

FCC Test Report

FCC ID : 2AWUU6050001
Equipment : Wireless Alarm Hub
Model No. : BH61-HW
Brand Name : Verkada
Applicant : Verkada Inc.
Address : 405 E. 4th Ave. San Mateo CA 94401 United
States Of America (Excluding The States Of
Alaska)
Standard : 47 CFR FCC Part 15.247
Received Date : Oct. 05, 2021
Tested Date : Oct. 06 ~ Oct. 07, 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
FR1O0503	Rev. 01	Initial issue	Oct. 19, 2021

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 15.022MHz 44.15 (Margin -15.85dB) – QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 48.55MHz 36.77 (Margin -3.23dB) - PK	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 17.65	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. Freq. (MHz)	Modulation	Data Rate
915 ~ 916	915, 915.35, 915.70	DSSS-OQPSK	80Kbps

1.1.2 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)
1	PIFA	Murata connector	0.2

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	37-57Vdc from PoE
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Note: The above power supply is not bundled in market.

1.1.4 Accessories

Accessories		
No.	Equipment	Description
1	Install Kit	---

1.1.5 Channel List

Channel	MHz
0	915
10	915.35
20	915.70

1.1.6 Test Tool and Duty Cycle

Test Tool	Tera Term, Version: V4.94	
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)
	100.00%	0.00

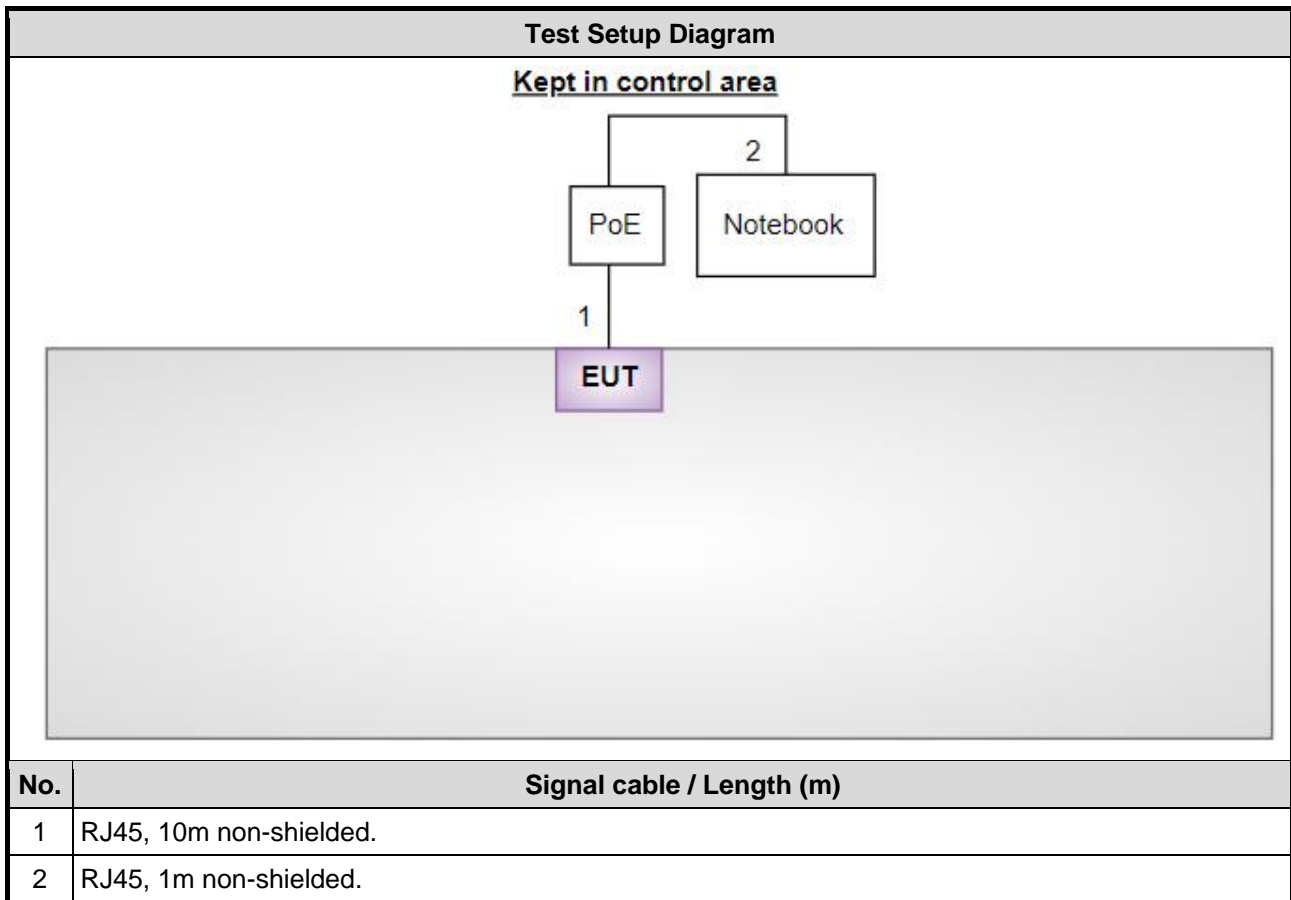
1.1.7 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)		
	915	915.35	915.70
DSSS-OQPSK	200	200	200

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E5470	DoC	---
2	POE	PowerDsine	PD-9601G/AC	---	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. 06, 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 chamber3 / (03CH03-WS)				
Tested Date	Oct. 06, 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	101499	Mar. 02, 2021	Mar. 01, 2022
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 17, 2020	Nov. 16, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	May 06, 2021	May 05, 2022
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 22, 2020	Dec. 21, 2021
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 06, 2020	Nov. 05, 2021
Preamplifier	EMC	EMC02325	980187	Jul. 26, 2021	Jul. 25, 2022
Preamplifier	Agilent	83017A	MY39501309	Sep. 06, 2021	Sep. 05, 2022
Preamplifier	EMC	EMC184045B	980192	Jul. 14, 2021	Jul. 13, 2022
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 05, 2021	Oct. 04, 2022
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Sep. 24, 2021	Sep. 23, 2022
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 24, 2021	Sep. 23, 2022
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Sep. 24, 2021	Sep. 23, 2022
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Sep. 24, 2021	Sep. 23, 2022
RF cable-8M	EMC	EMC104-SM-SM-8000	181107	Sep. 24, 2021	Sep. 23, 2022
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. 07, 2021				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2020	Dec. 03, 2021
Power Meter	Anritsu	ML2495A	1241002	Nov. 04, 2020	Nov. 03, 2021
Power Sensor	Anritsu	MA2411B	1207366	Nov. 04, 2020	Nov. 03, 2021
Measurement Software	Sporton	SENSE-15247_DTS	V5.10	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	± 3.96 dB
Radiated emission > 1 GHz	± 4.9 dB

2 Test Configuration

2.1 Testing Facility

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

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

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	DSSS-OQPSK	915 / 915.35 / 915.70	80Kbps	---
Radiated Emissions ≤1GHz Radiated Emissions >1GHz Maximum Output Power 6dB bandwidth Power spectral density	DSSS-OQPSK	915 / 915.35 / 915.70	80Kbps	---
NOTE:				
1. 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 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

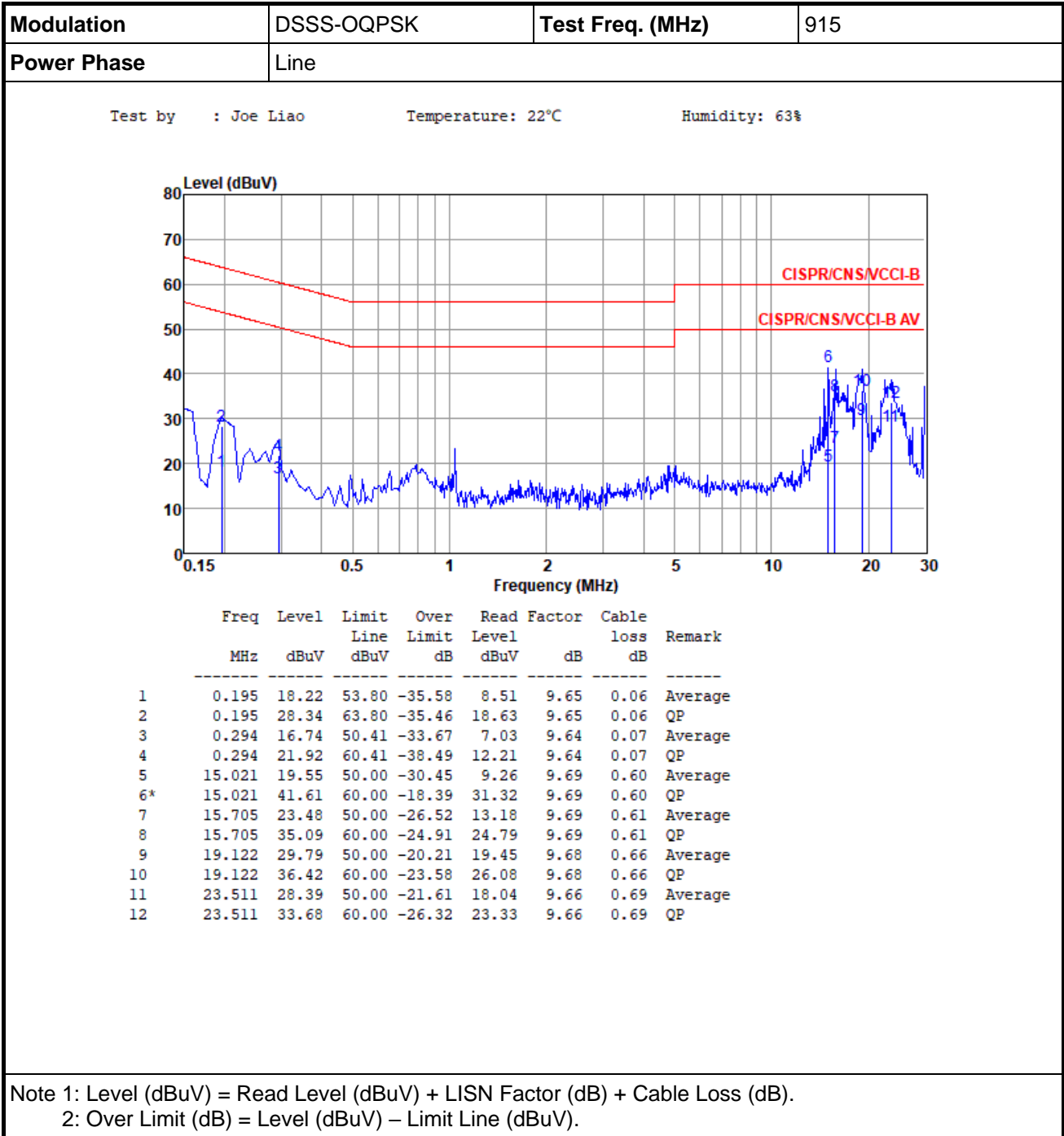
1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels 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



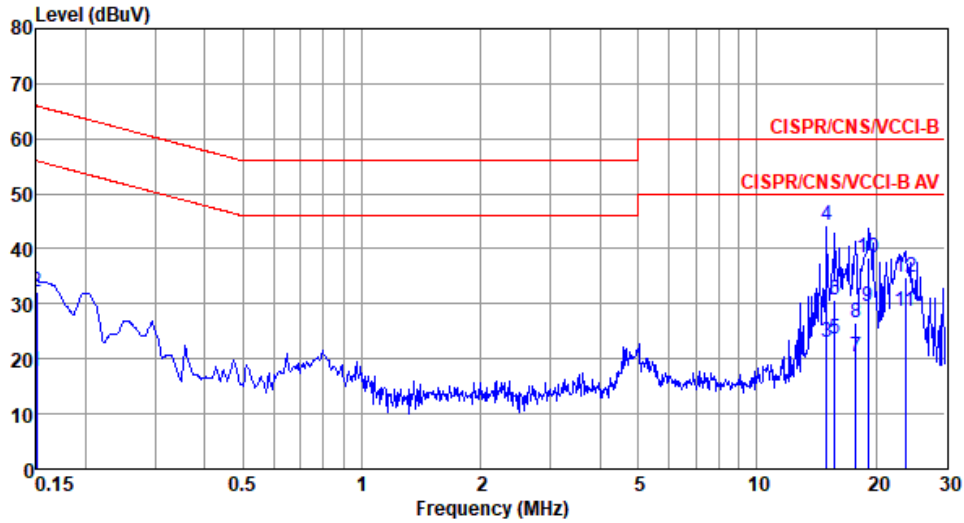
- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions



Modulation	DSSS-OQPSK	Test Freq. (MHz)	915
Power Phase	Neutral		

Test by : Joe Liao Temperature: 22°C Humidity: 63%

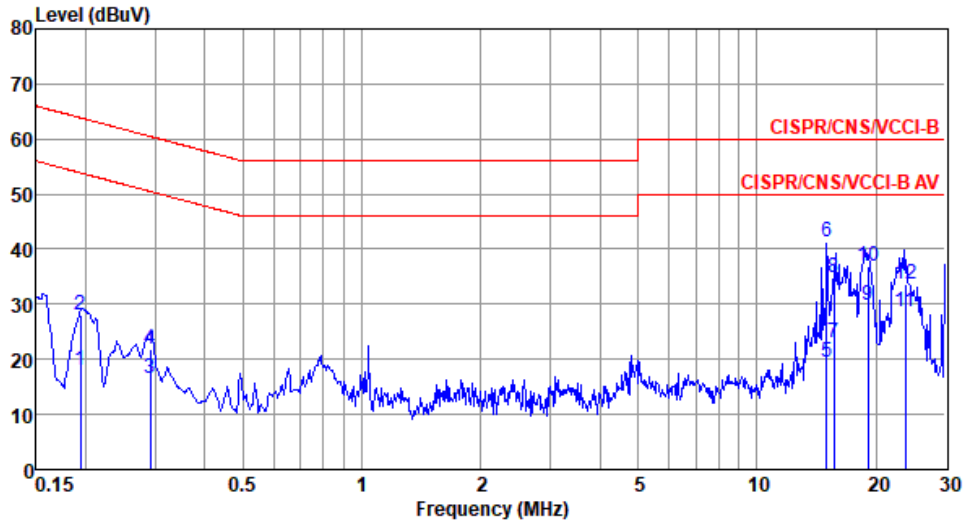


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.150	17.69	56.00	-38.31	7.95	9.69	0.05	Average
2	0.150	32.27	66.00	-33.73	22.53	9.69	0.05	QP
3	15.022	23.12	50.00	-26.88	12.71	9.81	0.60	Average
4*	15.022	44.15	60.00	-15.85	33.74	9.81	0.60	QP
5	15.718	23.50	50.00	-26.50	13.08	9.81	0.61	Average
6	15.718	30.56	60.00	-29.44	20.14	9.81	0.61	QP
7	17.755	20.39	50.00	-29.61	9.92	9.83	0.64	Average
8	17.755	26.49	60.00	-33.51	16.02	9.83	0.64	QP
9	19.122	29.38	50.00	-20.62	18.89	9.83	0.66	Average
10	19.122	38.35	60.00	-21.65	27.86	9.83	0.66	QP
11	23.762	28.75	50.00	-21.25	18.22	9.84	0.69	Average
12	23.762	34.86	60.00	-25.14	24.33	9.84	0.69	QP

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

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915.35
Power Phase	Line		

Test by : Joe Liao Temperature: 22°C Humidity: 63%

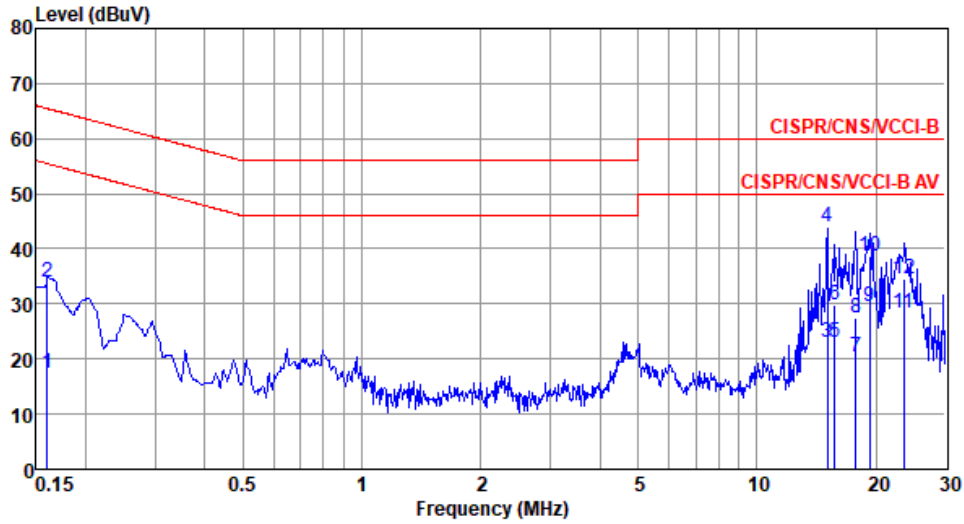


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.194	18.11	53.85	-35.74	8.40	9.65	0.06	Average
2	0.194	28.15	63.85	-35.70	18.44	9.65	0.06	QP
3	0.292	16.55	50.48	-33.93	6.84	9.64	0.07	Average
4	0.292	21.88	60.48	-38.60	12.17	9.64	0.07	QP
5	15.025	19.44	50.00	-30.56	9.15	9.69	0.60	Average
6*	15.025	41.42	60.00	-18.58	31.13	9.69	0.60	QP
7	15.663	23.11	50.00	-26.89	12.81	9.69	0.61	Average
8	15.663	34.88	60.00	-25.12	24.58	9.69	0.61	QP
9	19.147	29.88	50.00	-20.12	19.54	9.68	0.66	Average
10	19.147	36.85	60.00	-23.15	26.51	9.68	0.66	QP
11	23.720	28.55	50.00	-21.45	18.20	9.66	0.69	Average
12	23.720	33.77	60.00	-26.23	23.42	9.66	0.69	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	DSSS-OQPSK	Test Freq. (MHz)	915.35
Power Phase	Neutral		

Test by : Joe Liao Temperature: 22°C Humidity: 63%

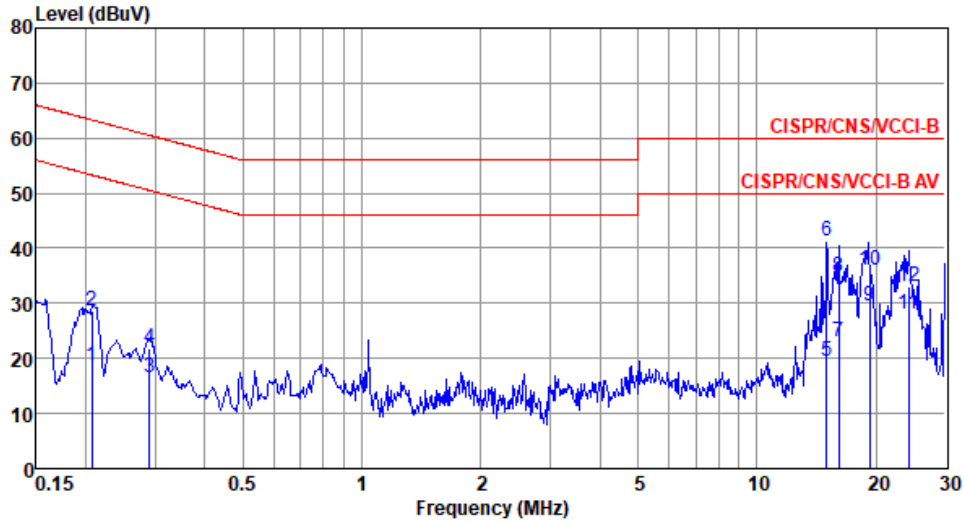


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.160	17.55	55.47	-37.92	7.81	9.69	0.05	Average
2	0.160	33.88	65.47	-31.59	24.14	9.69	0.05	QP
3	15.050	22.88	50.00	-27.12	12.47	9.81	0.60	Average
4*	15.050	44.04	60.00	-15.96	33.63	9.81	0.60	QP
5	15.770	22.95	50.00	-27.05	12.53	9.81	0.61	Average
6	15.770	29.89	60.00	-30.11	19.47	9.81	0.61	QP
7	17.800	20.44	50.00	-29.56	9.97	9.83	0.64	Average
8	17.800	27.55	60.00	-32.45	17.08	9.83	0.64	QP
9	19.330	29.55	50.00	-20.45	19.05	9.84	0.66	Average
10	19.330	38.66	60.00	-21.34	28.16	9.84	0.66	QP
11	23.540	28.44	50.00	-21.56	17.91	9.84	0.69	Average
12	23.540	34.47	60.00	-25.53	23.94	9.84	0.69	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	DSSS-OQPSK	Test Freq. (MHz)	915.70
Power Phase	Line		

Test by : Joe Liao Temperature: 22°C Humidity: 63%

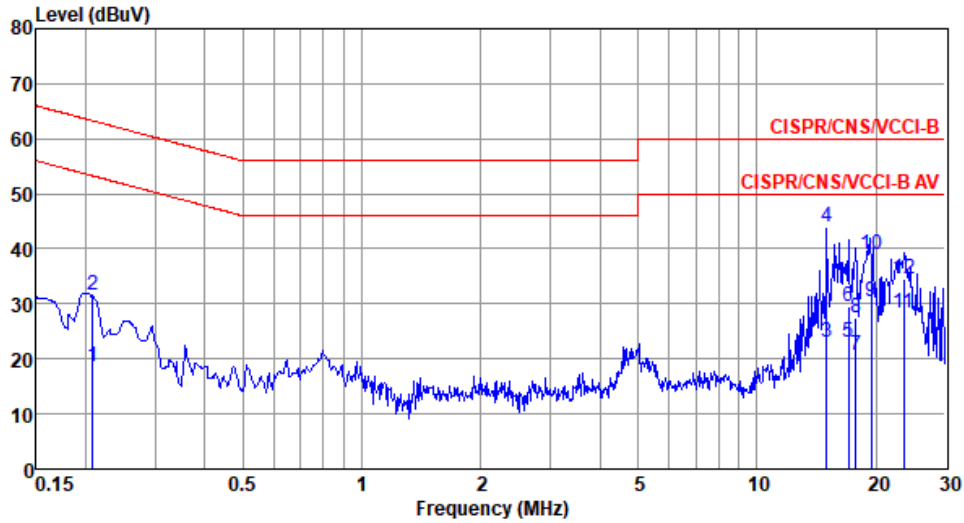


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.207	18.55	53.32	-34.77	8.84	9.65	0.06	Average
2	0.207	28.66	63.32	-34.66	18.95	9.65	0.06	QP
3	0.290	16.55	50.52	-33.97	6.84	9.64	0.07	Average
4	0.290	21.88	60.52	-38.64	12.17	9.64	0.07	QP
5	15.025	19.42	50.00	-30.58	9.13	9.69	0.60	Average
6*	15.025	41.42	60.00	-18.58	31.13	9.69	0.60	QP
7	16.140	22.95	50.00	-27.05	12.64	9.69	0.62	Average
8	16.140	34.88	60.00	-25.12	24.57	9.69	0.62	QP
9	19.290	29.42	50.00	-20.58	19.08	9.68	0.66	Average
10	19.290	35.88	60.00	-24.12	25.54	9.68	0.66	QP
11	24.210	28.10	50.00	-21.90	17.74	9.66	0.70	Average
12	24.210	32.95	60.00	-27.05	22.59	9.66	0.70	QP

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

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915.70
Power Phase	Neutral		

Test by : Joe Liao Temperature: 22°C Humidity: 63%



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.208	18.55	53.28	-34.73	8.81	9.68	0.06	Average
2	0.208	31.66	63.28	-31.62	21.92	9.68	0.06	QP
3	15.022	22.95	50.00	-27.05	12.54	9.81	0.60	Average
4*	15.022	44.05	60.00	-15.95	33.64	9.81	0.60	QP
5	17.020	22.88	50.00	-27.12	12.43	9.82	0.63	Average
6	17.020	29.45	60.00	-30.55	19.00	9.82	0.63	QP
7	17.800	20.55	50.00	-29.45	10.08	9.83	0.64	Average
8	17.800	27.56	60.00	-32.44	17.09	9.83	0.64	QP
9	19.450	30.33	50.00	-19.67	19.83	9.84	0.66	Average
10	19.450	39.11	60.00	-20.89	28.61	9.84	0.66	QP
11	23.550	28.45	50.00	-21.55	17.92	9.84	0.69	Average
12	23.550	34.54	60.00	-25.46	24.01	9.84	0.69	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

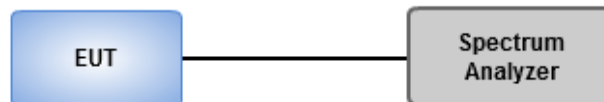
6dB Bandwidth

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 / 66%	Tested By	Brad Wu
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Summary

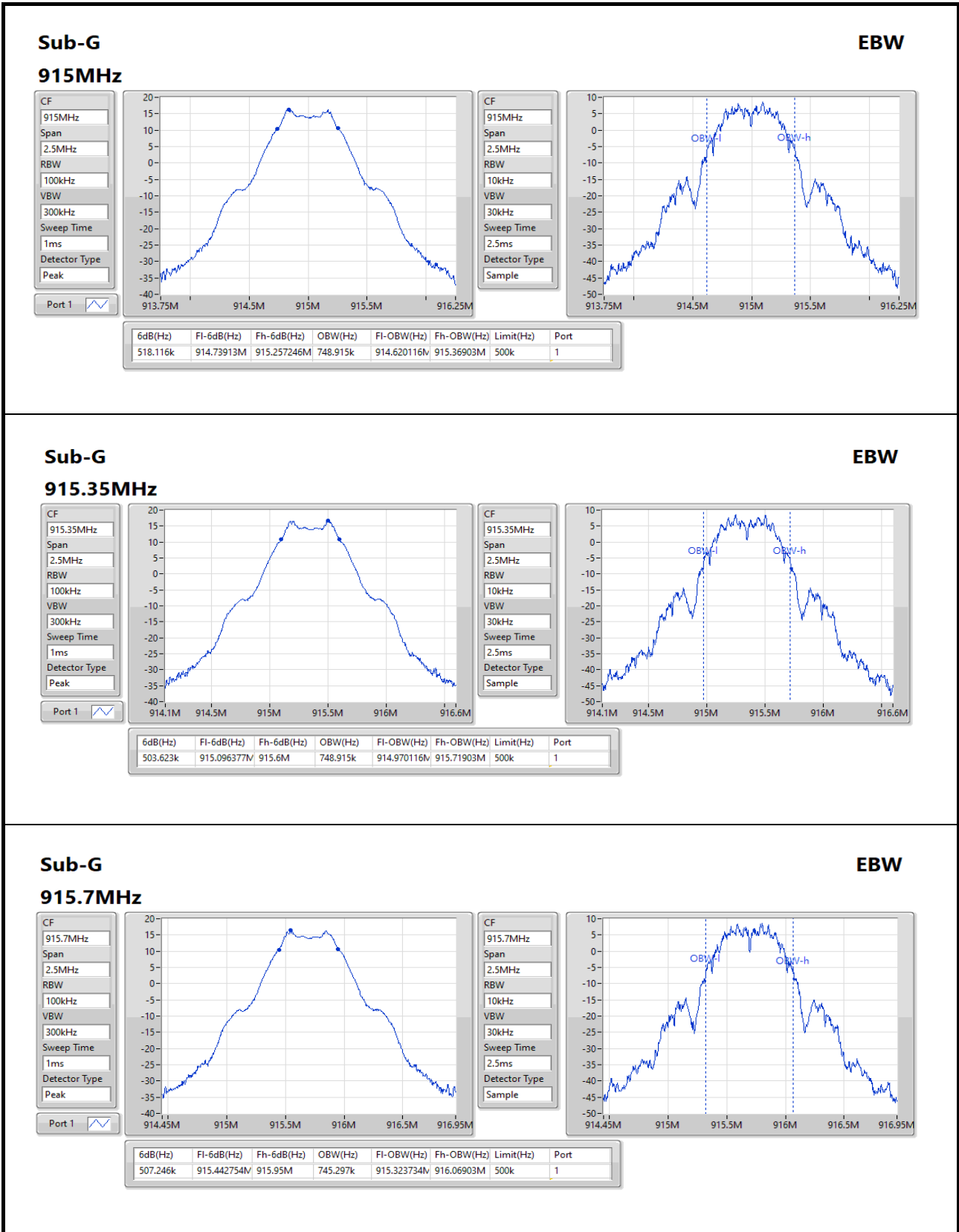
Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
902-928MHz	-	-	-	-	-
Sub-G	518.116k	748.915k	749KD1D	503.623k	745.297k

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)
Sub-G	-	-	-	-
915MHz	Pass	500k	518.116k	748.915k
915.35MHz	Pass	500k	503.623k	748.915k
915.7MHz	Pass	500k	507.246k	745.297k

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



3.3 RF Output Power

3.3.1 Limit of RF Output Power

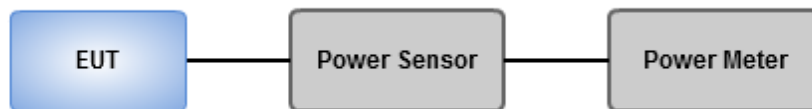
Conducted power shall not exceed 1Watt.

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 / 66%	Tested By	Brad Wu
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Summary of Peak Conducted Output Power

Mode	Total Power (dBm)	Total Power (W)
902-928MHz	-	-
Sub-G	17.65	0.05821

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
Sub-G	-	-	-	-	-	-	-
915MHz	Pass	0.20	17.64	17.64	30.00	17.84	36.00
915.35MHz	Pass	0.20	17.65	17.65	30.00	17.85	36.00
915.7MHz	Pass	0.20	17.63	17.63	30.00	17.83	36.00

DG = Directional Gain; **Port X** = Port X output power

Summary of Conducted (Average) Output Power

Mode	Total Power (dBm)	Total Power (W)
902-928MHz	-	-
Sub-G	17.57	0.05715

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
Sub-G	-	-	-	-	-	-	-
915MHz	Pass	0.20	17.56	17.56	-	17.76	-
915.35MHz	Pass	0.20	17.57	17.57	-	17.77	-
915.7MHz	Pass	0.20	17.55	17.55	-	17.75	-

DG = Directional Gain; **Port X** = Port X output power

Note : Conducted average output power is for reference only

3.4 Power Spectral Density

3.4.1 Limit of Power Spectral Density

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

3.4.2 Test Procedures

Peak PSD

1. Set the RBW = 3 kHz, VBW = 10 kHz.
2. Detector = Peak, Sweep time = auto couple.
3. Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

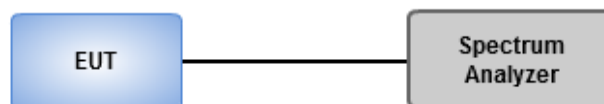
Average PSD, duty cycle $\geq 98\%$

1. Set the RBW = 30 kHz, VBW = 100 kHz.
2. Detector = RMS, Sweep time = auto couple.
3. Sweep time = auto couple.
4. Employ trace averaging (RMS) mode over a minimum of 100 traces.
5. Use the peak marker function to determine the maximum amplitude level.

Average PSD, duty cycle $< 98\%$

1. Set the RBW = 30 kHz, VBW = 100 kHz. Detector = RMS.
2. Set the sweep time to: ≥ 10 (number of measurement points in sweep) x (total on/off period of the transmitted signal).
3. Perform the measurement over a single sweep.
4. Use the peak marker function to determine the maximum amplitude level.
5. Add $10 \log (1/x)$, where x is the duty cycle.

3.4.3 Test Setup



3.4.4 Test Result of Power Spectral Density

Ambient Condition	24°C / 66%	Tested By	Brad Wu
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Summary

Mode	PD (dBm/3kHz)
902-928MHz	-
Sub-G	4.81

Result

Mode	Result	DG (dBi)	Port 1 (dBm/3kHz)	PD (dBm/3kHz)	PD Limit (dBm/3kHz)
Sub-G	-	-	-	-	-
915MHz	Pass	0.20	4.23	4.23	8.00
915.35MHz	Pass	0.20	4.81	4.81	8.00
915.7MHz	Pass	0.20	4.64	4.64	8.00

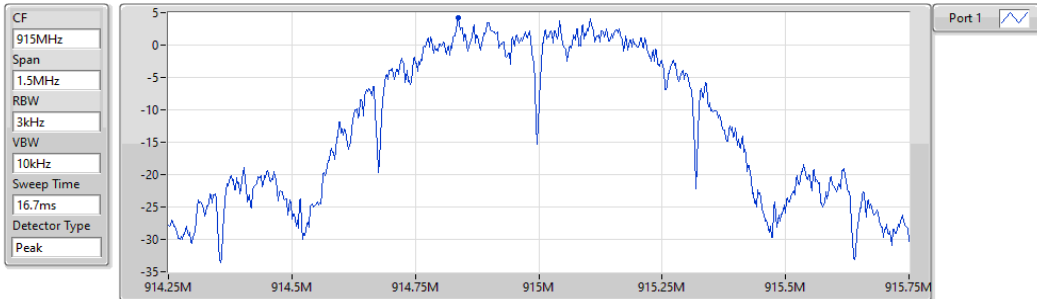
DG = Directional Gain;

PD = Maximum power density; **Port X** = Port X power density;

Sub-G

PSD

915MHz

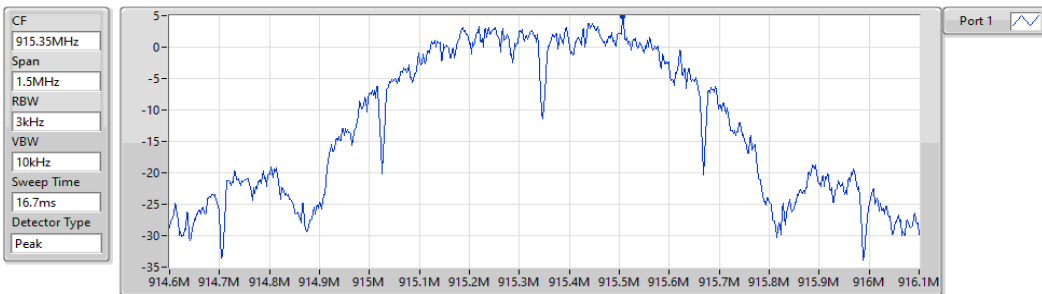


Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
4.23	4.23	4.23

Sub-G

PSD

915.35MHz

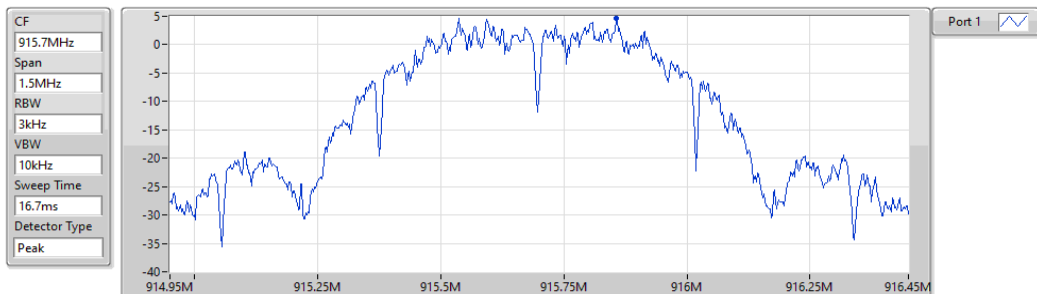


Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
4.81	4.81	4.81

Sub-G

PSD

915.7MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
4.64	4.64	4.64

3.5 Unwanted Emissions into Restricted Frequency Bands

3.5.1 Limit of Unwanted Emissions into Restricted Frequency Bands

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

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

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

3.5.2 Test Procedures

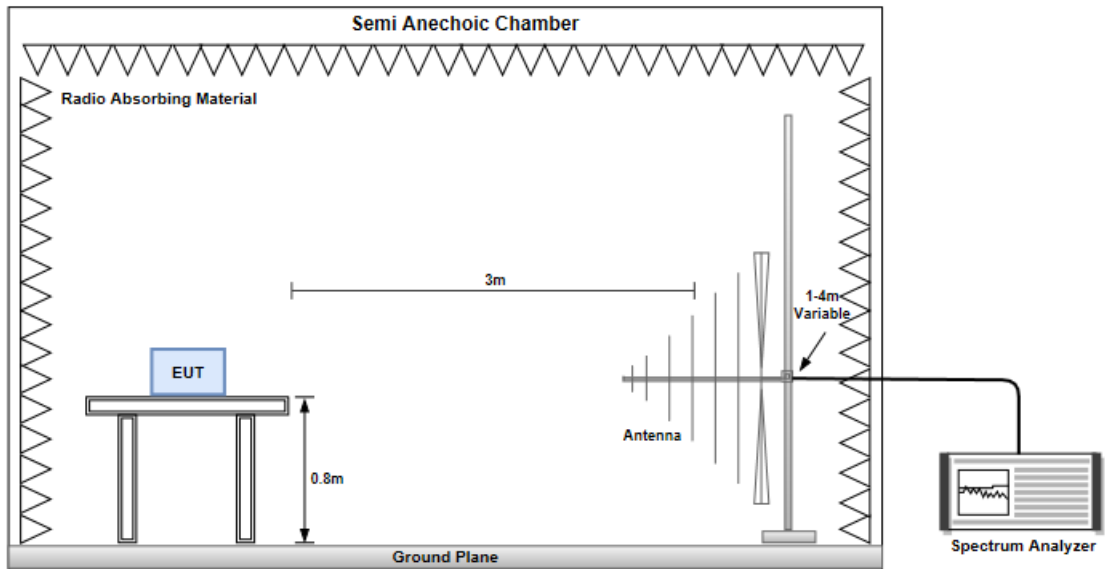
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

Note:

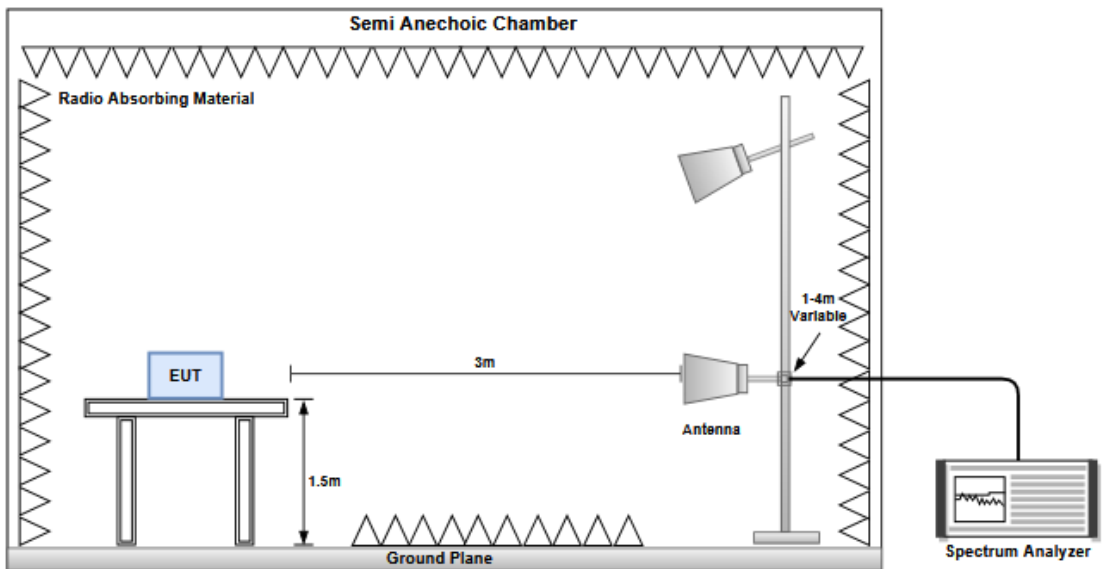
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

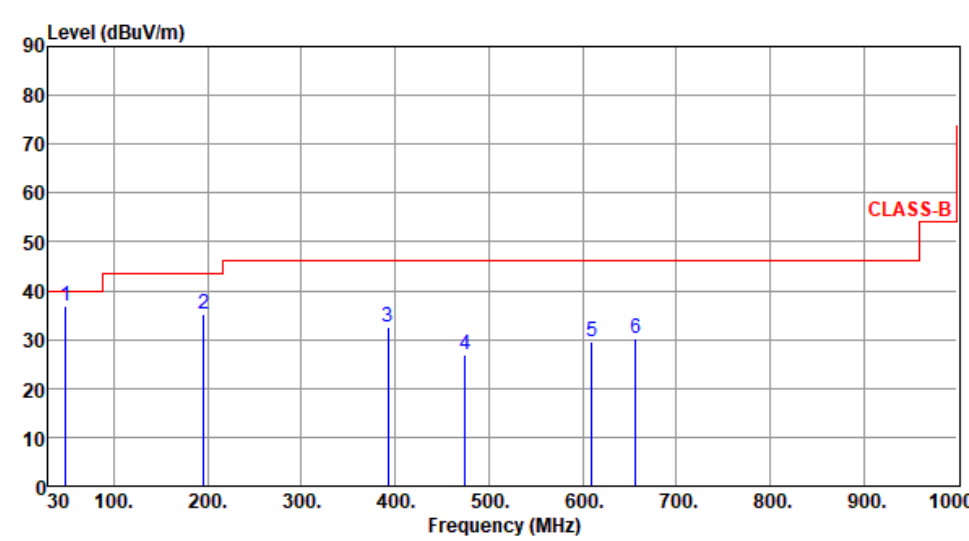
Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



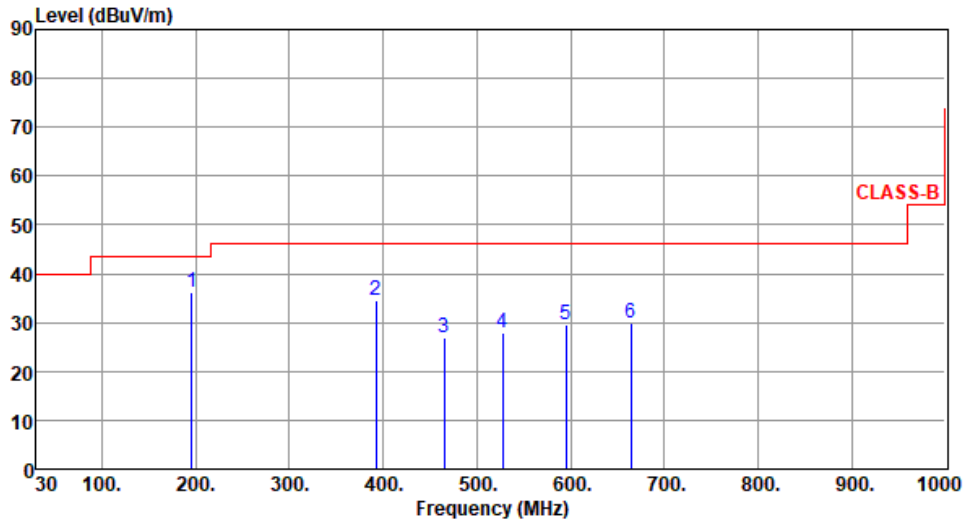
3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915						
Polarization	Horizontal								
Test By : Akun Chung Temperature(°C):24 Humidity(%):63									
									
	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	48.55	36.77	40.00	-3.23	45.71	-8.94	Peak	---	---
2	196.00	35.14	43.50	-8.36	46.88	-11.74	Peak	---	---
3	392.80	32.49	46.00	-13.51	38.15	-5.66	Peak	---	---
4	474.40	27.05	46.00	-18.95	30.21	-3.16	Peak	---	---
5	609.60	29.50	46.00	-16.50	29.25	0.25	Peak	---	---
6	656.80	30.08	46.00	-15.92	29.29	0.79	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	DSSS-OQPSK	Test Freq. (MHz)	915
Polarization	Vertical		

Test By :Akun Chung Temperature(°C):24 Humidity(%):63



	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	196.21	36.33	43.50	-7.17	48.06	-11.73	Peak	---	---
2	392.80	34.69	46.00	-11.31	40.35	-5.66	Peak	---	---
3	465.60	26.84	46.00	-19.16	30.16	-3.32	Peak	---	---
4	527.20	27.99	46.00	-18.01	30.09	-2.10	Peak	---	---
5	595.20	29.53	46.00	-16.47	29.82	-0.29	Peak	---	---
6	664.00	29.96	46.00	-16.04	29.19	0.77	Peak	---	---

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

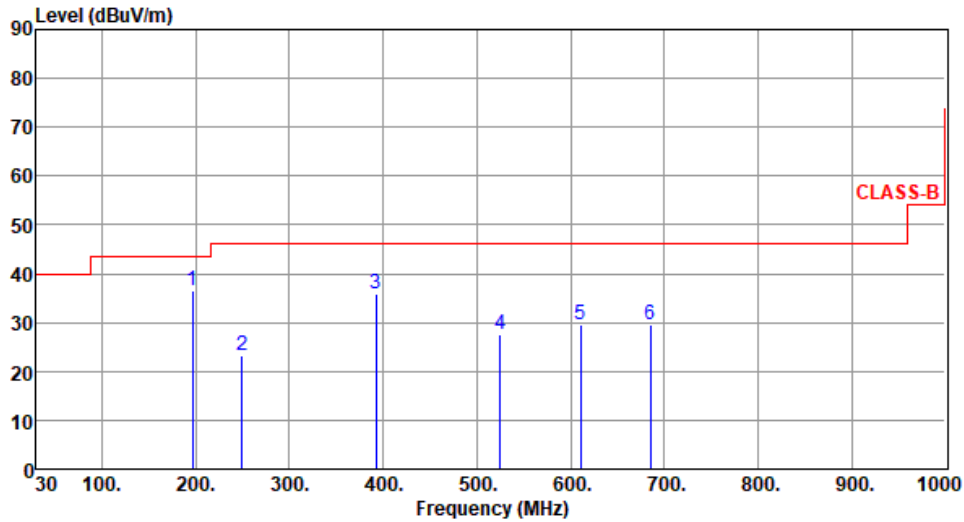
*Factor includes antenna factor , cable loss and amplifier gain

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	DSSS-OQPSK	Test Freq. (MHz)	915.35
Polarization	Horizontal		

Test By :Akun Chung Temperature(°C):24 Humidity(%):63



	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	196.57	36.57	43.50	-6.93	48.30	-11.73	Peak	---	---
2	249.60	23.13	46.00	-22.87	32.92	-9.79	Peak	---	---
3	392.80	36.02	46.00	-9.98	41.68	-5.66	Peak	---	---
4	524.80	27.44	46.00	-18.56	29.59	-2.15	Peak	---	---
5	610.40	29.47	46.00	-16.53	29.22	0.25	Peak	---	---
6	684.80	29.68	46.00	-16.32	28.59	1.09	Peak	---	---

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

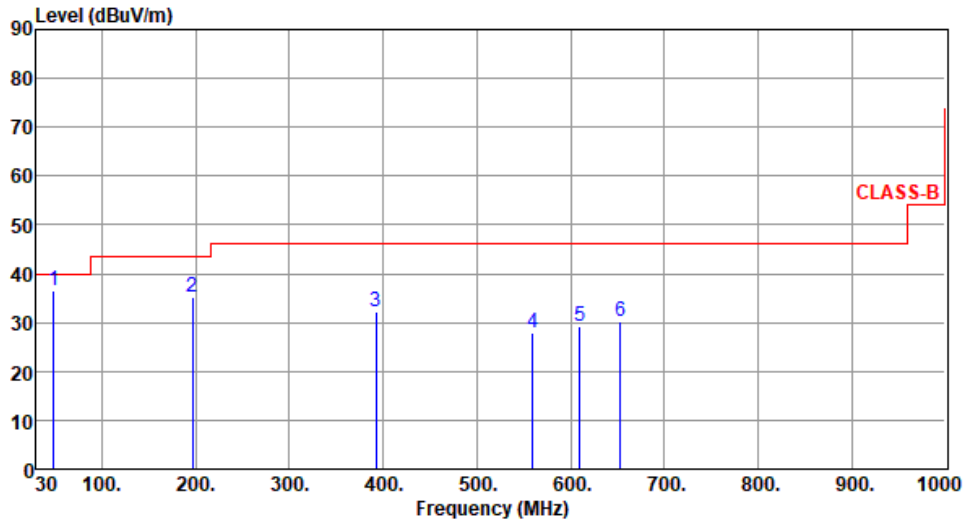
*Factor includes antenna factor , cable loss and amplifier gain

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	DSSS-OQPSK	Test Freq. (MHz)	915.35
Polarization	Vertical		

Test By : Akun Chung Temperature(°C): 24 Humidity(%): 63



	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	48.45	36.45	40.00	-3.55	45.38	-8.93	Peak	---	---
2	196.33	35.23	43.50	-8.27	46.96	-11.73	Peak	---	---
3	392.80	32.18	46.00	-13.82	37.84	-5.66	Peak	---	---
4	559.20	27.84	46.00	-18.16	29.45	-1.61	Peak	---	---
5	609.60	29.36	46.00	-16.64	29.11	0.25	Peak	---	---
6	653.60	30.16	46.00	-15.84	29.35	0.81	Peak	---	---

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

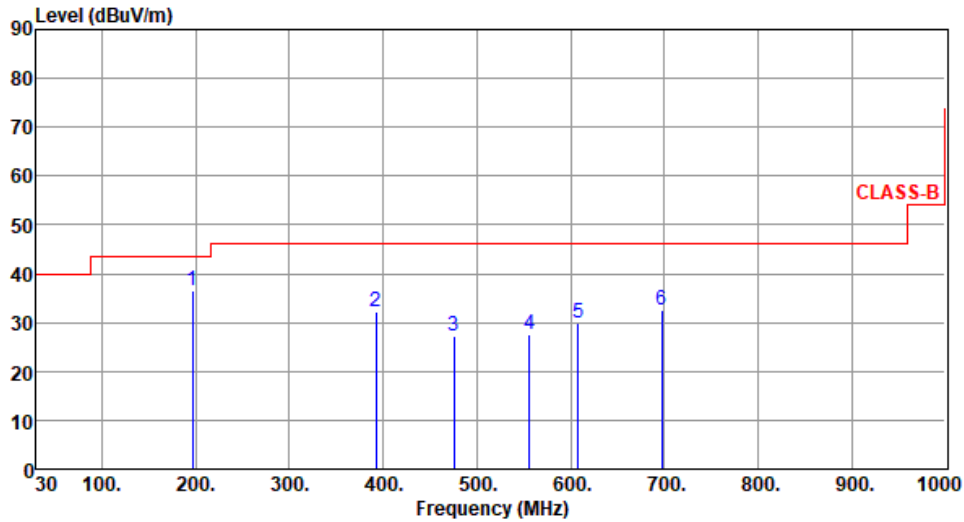
*Factor includes antenna factor , cable loss and amplifier gain

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.

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915.70
Polarization	Horizontal		

Test By :Akun Chung Temperature(°C):24 Humidity(%):63



	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	196.77	36.57	43.50	-6.93	48.30	-11.73	Peak	---	---
2	392.80	32.06	46.00	-13.94	37.72	-5.66	Peak	---	---
3	476.00	27.08	46.00	-18.92	30.22	-3.14	Peak	---	---
4	556.00	27.49	46.00	-18.51	29.11	-1.62	Peak	---	---
5	608.00	29.86	46.00	-16.14	29.65	0.21	Peak	---	---
6	697.60	32.47	46.00	-13.53	31.05	1.42	Peak	---	---

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

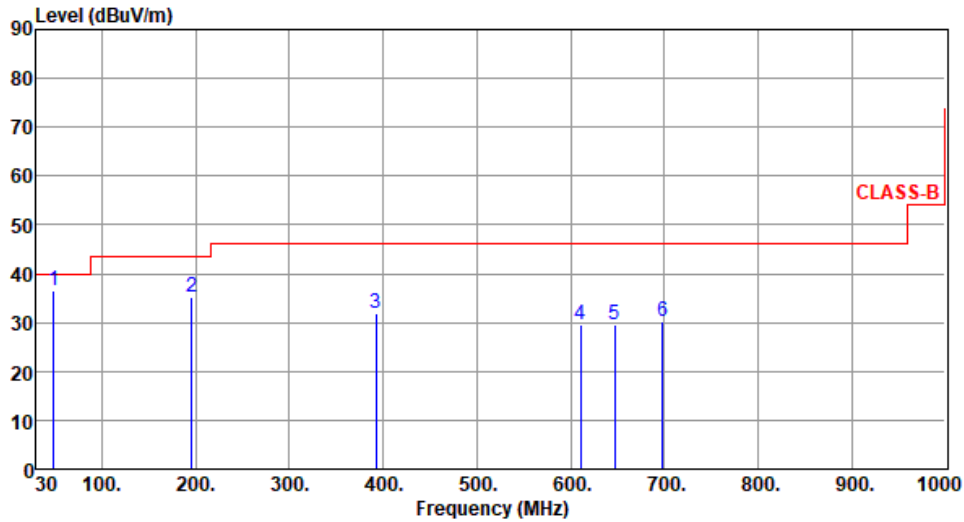
*Factor includes antenna factor , cable loss and amplifier gain

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	DSSS-OQPSK	Test Freq. (MHz)	915.70
Polarization	Vertical		

Test By : Akun Chung Temperature(°C): 24 Humidity(%): 63



	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	48.41	36.50	40.00	-3.50	45.42	-8.92	Peak	---	---
2	195.88	35.32	43.50	-8.18	47.05	-11.73	Peak	---	---
3	392.80	31.95	46.00	-14.05	37.61	-5.66	Peak	---	---
4	610.40	29.62	46.00	-16.38	29.37	0.25	Peak	---	---
5	647.20	29.66	46.00	-16.34	28.94	0.72	Peak	---	---
6	698.40	30.14	46.00	-15.86	28.70	1.44	Peak	---	---

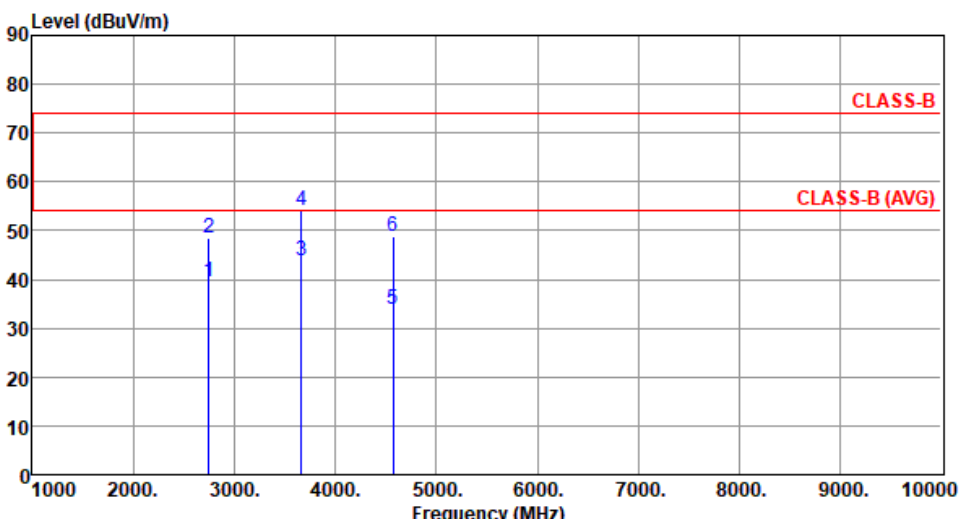
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

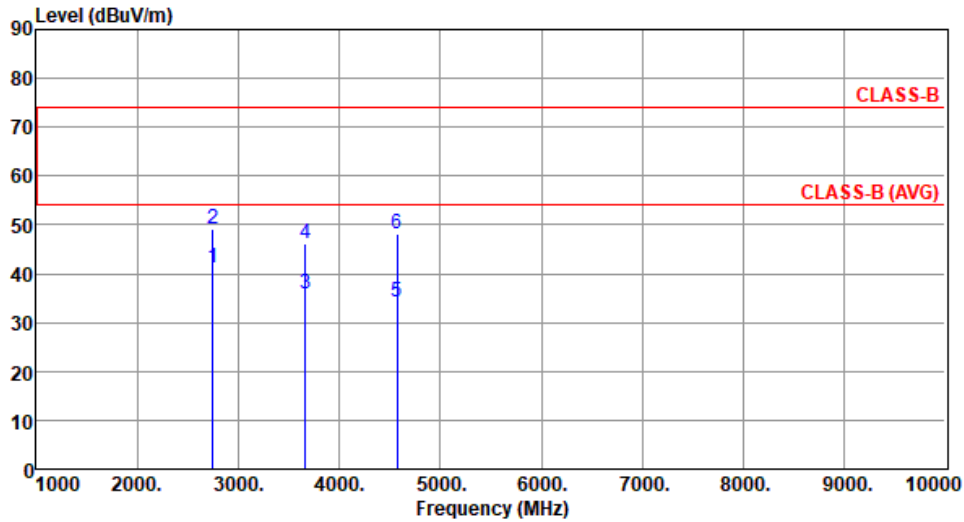
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915						
Polarization	Horizontal								
Test By :Akun Chung Temperature(°C):24 Humidity(%):63									
									
	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	2745.00	39.44	54.00	-14.56	40.44	-1.00	Average	175	333
2	2745.00	48.54	74.00	-25.46	49.54	-1.00	Peak	175	333
3	3660.00	43.71	54.00	-10.29	41.77	1.94	Average	100	23
4	3660.00	54.09	74.00	-19.91	52.15	1.94	Peak	100	23
5	4575.00	34.04	54.00	-19.96	29.41	4.63	Average	198	34
6	4575.00	48.96	74.00	-25.04	44.33	4.63	Peak	198	34
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	DSSS-OQPSK	Test Freq. (MHz)	915
Polarization	Vertical		

Test By :Akun Chung Temperature(°C):24 Humidity(%):63



	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	2745.00	41.11	54.00	-12.89	42.11	-1.00	Average	100	11
2	2745.00	49.22	74.00	-24.78	50.22	-1.00	Peak	100	11
3	3660.00	35.99	54.00	-18.01	34.05	1.94	Average	102	349
4	3660.00	46.05	74.00	-27.95	44.11	1.94	Peak	102	349
5	4575.00	34.07	54.00	-19.93	29.44	4.63	Average	100	303
6	4575.00	48.29	74.00	-25.71	43.66	4.63	Peak	100	303

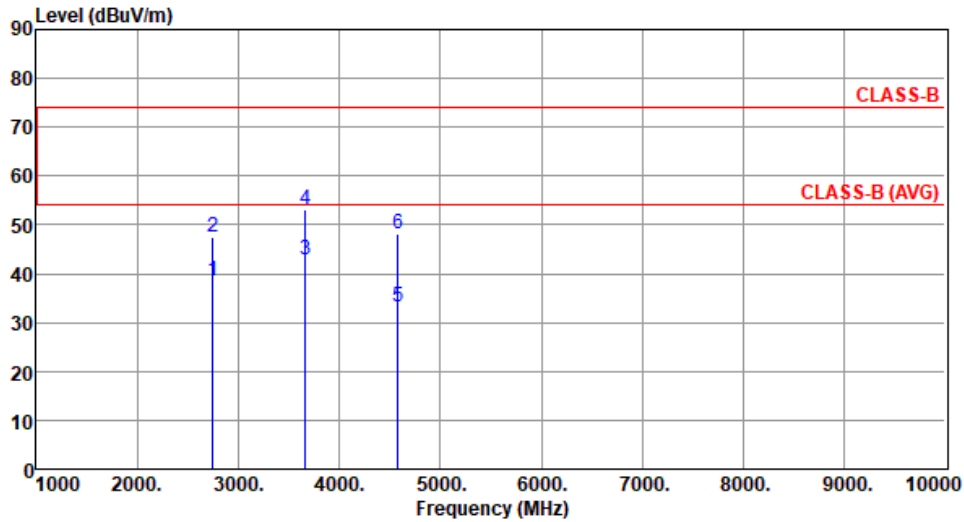
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915.35
Polarization	Horizontal		

Test By :Akun Chung Temperature(°C):24 Humidity(%):63



	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	2746.05	38.59	54.00	-15.41	39.59	-1.00	Average	172	329
2	2746.05	47.64	74.00	-26.36	48.64	-1.00	Peak	172	329
3	3661.40	42.79	54.00	-11.21	40.85	1.94	Average	101	21
4	3661.40	53.15	74.00	-20.85	51.21	1.94	Peak	101	21
5	4576.75	33.18	54.00	-20.82	28.55	4.63	Average	200	35
6	4576.75	48.17	74.00	-25.83	43.54	4.63	Peak	200	35

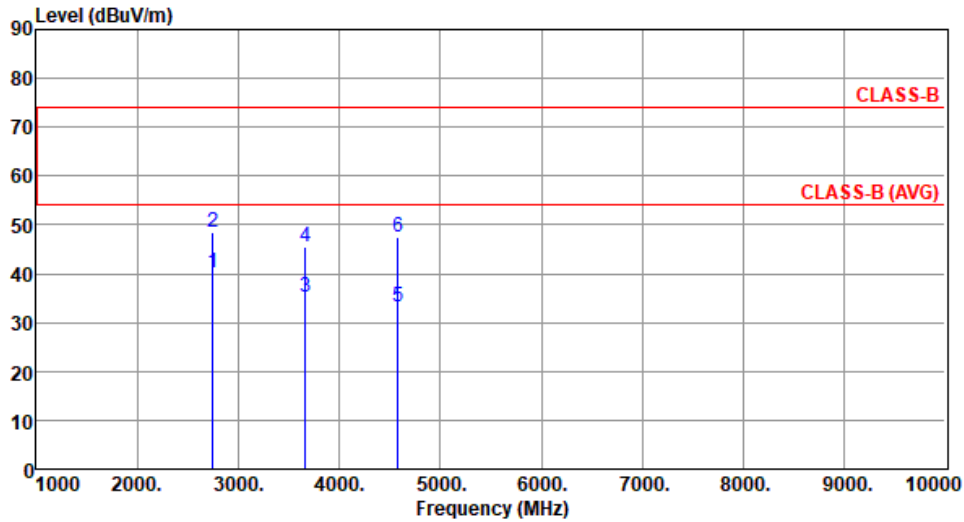
Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915.35
Polarization	Vertical		

Test By :Akun Chung Temperature(°C):24 Humidity(%):63



	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	2746.05	40.28	54.00	-13.72	41.28	-1.00	Average	102	12
2	2746.05	48.40	74.00	-25.60	49.40	-1.00	Peak	102	12
3	3661.40	35.06	54.00	-18.94	33.12	1.94	Average	104	355
4	3661.40	45.52	74.00	-28.48	43.58	1.94	Peak	104	355
5	4576.75	33.29	54.00	-20.71	28.66	4.63	Average	100	305
6	4576.75	47.50	74.00	-26.50	42.87	4.63	Peak	100	305

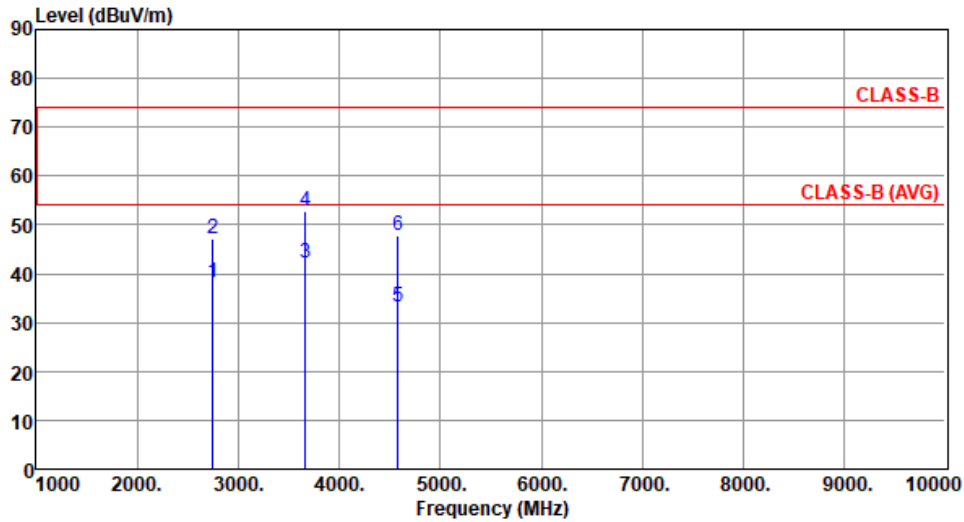
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915.70
Polarization	Horizontal		

Test By :Akun Chung Temperature(°C):24 Humidity(%):63



	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	2747.10	38.12	54.00	-15.88	39.11	-0.99	Average	169	323
2	2747.10	47.07	74.00	-26.93	48.06	-0.99	Peak	169	323
3	3662.80	42.20	54.00	-11.80	40.26	1.94	Average	100	25
4	3662.80	52.70	74.00	-21.30	50.76	1.94	Peak	100	25
5	4578.50	33.08	54.00	-20.92	28.44	4.64	Average	100	40
6	4578.50	47.90	74.00	-26.10	43.26	4.64	Peak	100	40

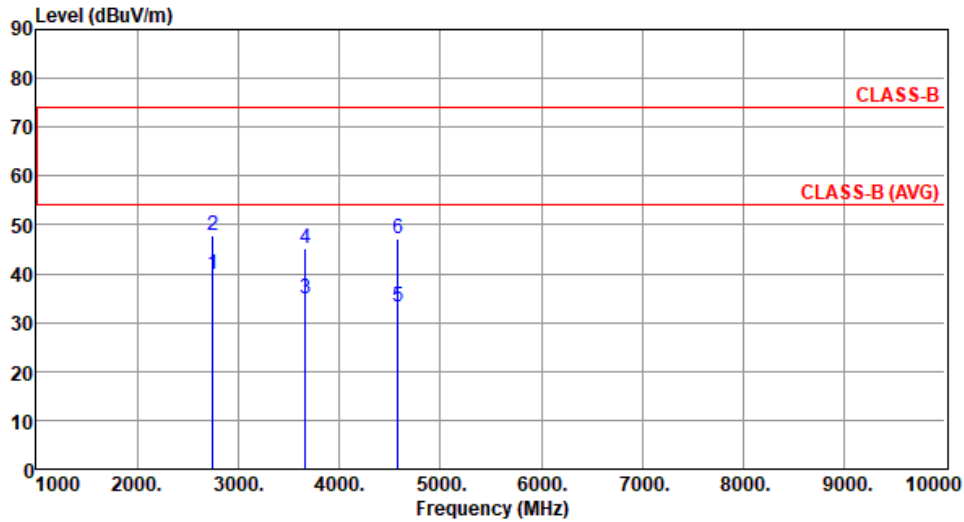
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	DSSS-OQPSK	Test Freq. (MHz)	915.70
Polarization	Vertical		

Test By :Akun Chung Temperature(°C):24 Humidity(%):63



	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	2747.10	39.76	54.00	-14.24	40.75	-0.99	Average	100	15
2	2747.10	47.96	74.00	-26.04	48.95	-0.99	Peak	100	15
3	3662.80	34.82	54.00	-19.18	32.88	1.94	Average	102	350
4	3662.80	45.17	74.00	-28.83	43.23	1.94	Peak	102	350
5	4578.50	33.19	54.00	-20.81	28.55	4.64	Average	100	304
6	4578.50	47.29	74.00	-26.71	42.65	4.64	Peak	100	304

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

*Factor includes antenna factor , cable loss and amplifier gain

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

3.6 Emissions in Non-Restricted Frequency Bands

3.6.1 Emissions in Non-Restricted Frequency Bands Limit

Peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.6.2 Test Procedures

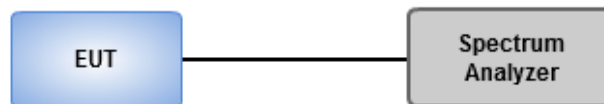
Reference level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Use the peak marker function to determine the maximum PSD level

Emission level measurement

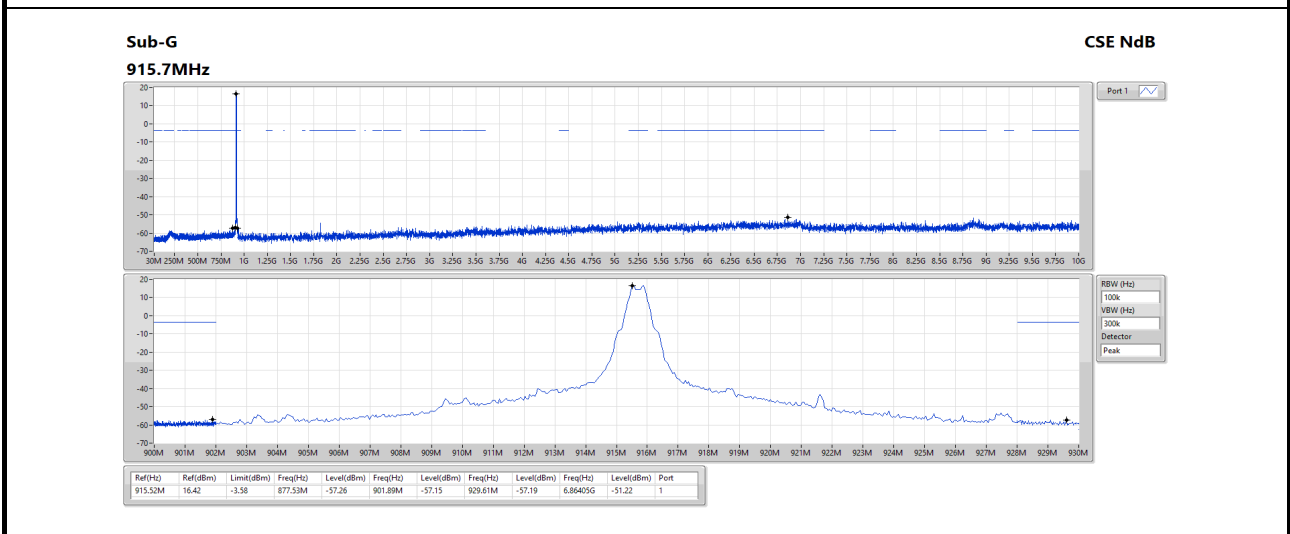
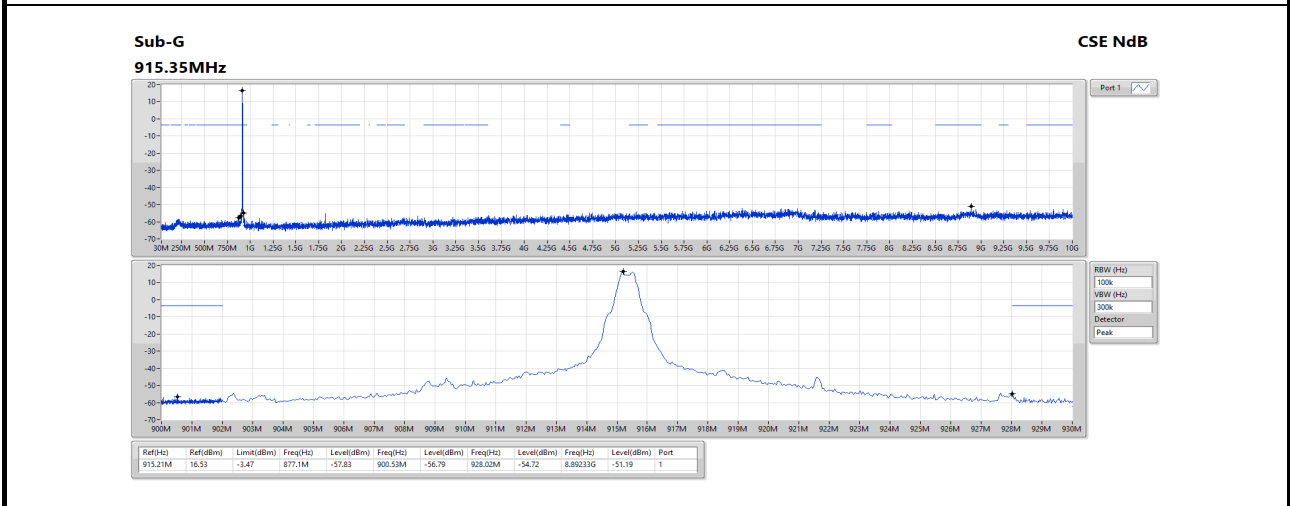
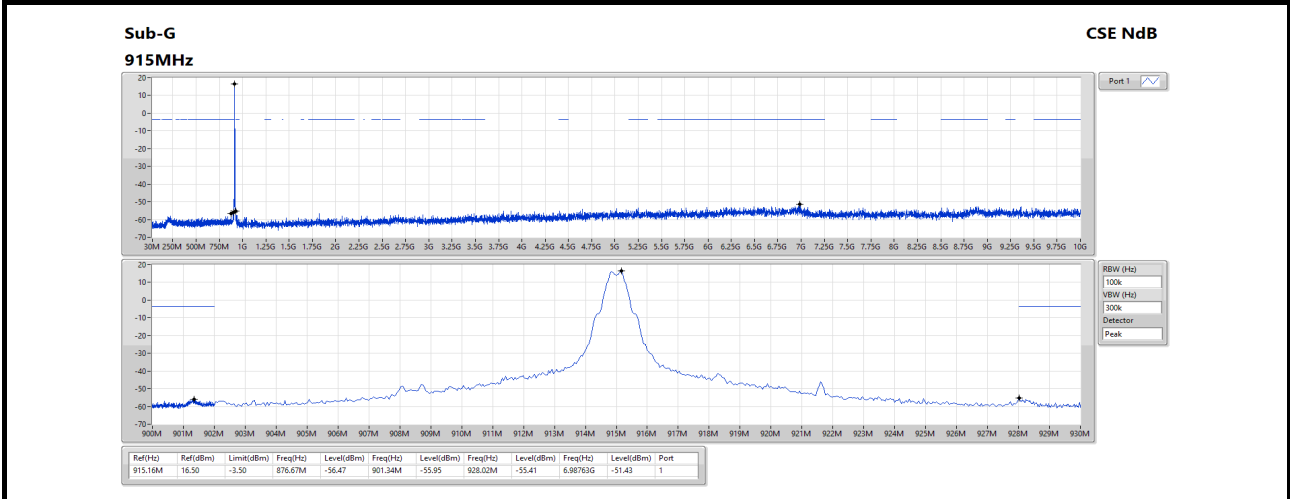
1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 25GHz
4. Use the peak marker function to determine the maximum amplitude level

3.6.3 Test Setup



3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands

Ambient Condition	24°C / 66%	Tested By	Brad Wu
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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.

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