



## FCC PART 15.247

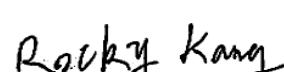
# TEST REPORT

For

Shenzhen Winext Technology Co., Ltd.

Rm 505, Building B50, Zhongchuang Industrial Park, Liuxian Rd, Taoyuan Street, Nanshan District, Shenzhen, China

**FCC ID: 2AFI2GW0001**

<b>Report Type:</b> Original Report	<b>Product Type:</b> LoRa Gateway
<b>Report Number:</b>	<u>RSZ180903003-00C</u>
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<b>Reviewed By:</b>	<u>RF Engineer</u> 
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**Note:** This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA\* or any agency of the Federal Government. \* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “\*”

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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The *Shenzhen Winext Technology Co., Ltd.*'s product, model number: *GW5000A (FCC ID: 2AFI2GW0001)* or the "EUT" in this report was a *LoRa Gateway*, which was measured approximately: 28.8 cm (L) \* 21.5 cm (W) \* 5.9 cm (H), rated with input voltage: DC 48 V POE.

*Notes: This series products model: GW5000B, GW5000C and GW5000A are identical; they have the same or similar appearance, structure, PCB, Material and function to the testing products. The difference between them are the model name. Model GW5000A was selected for fully testing, the detailed information can be referred to the attached declaration which was stated and guaranteed by the applicant.*

*\*All measurement and test data in this report was gathered from production sample serial number: 180903003 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-09-03.*

### Objective

This report is prepared on behalf of *Shenzhen Winext Technology Co., Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: 2AFI2GW0001.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

### Measurement Uncertainty

Parameter	Uncertainty	
Occupied Channel Bandwidth	±5%	
RF Output Power with Power meter	±0.5dB	
RF conducted test with spectrum	±1.5dB	
AC Power Lines Conducted Emissions	±1.95dB	
Emissions, Radiated	Below 1GHz Above 1GHz	±4.75dB ±4.88dB
Temperature	±3 °C	
Humidity	±6%	
Supply voltages	±0.4%	

### **Test Facility**

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 342867, the FCC Designation No. : CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer.

For LoRa mode, detailed Frequency as below:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	923.3	5	925.7
2	923.9	6	926.3
3	924.5	7	926.9
4	925.1	8	927.5

EUT was tested with Channel 1, 4 and 8.

### Equipment Modifications

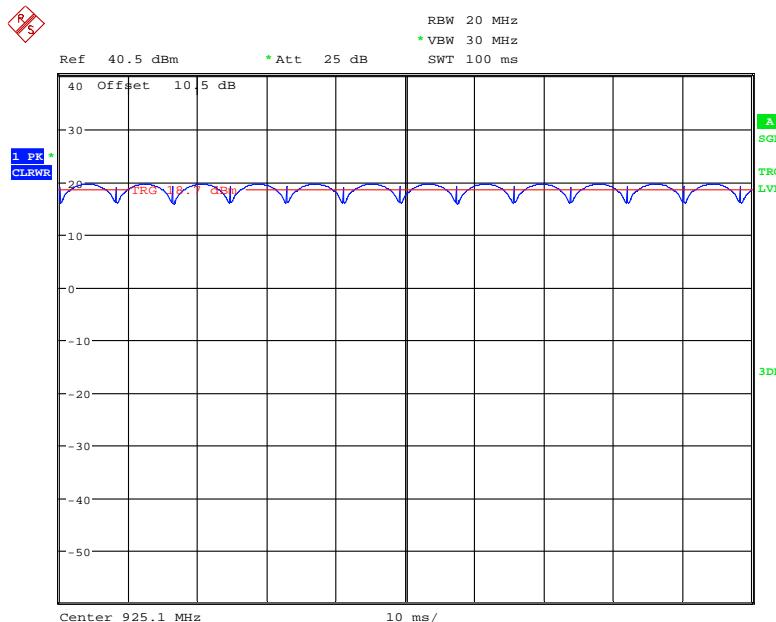
No modification was made to the EUT tested.

### EUT Exercise Software

Enter the webpage “192.168.3.1” to control EUT transmitting and power level is 12.

### Duty cycle

#### LoRa Mode



Date: 10.OCT.2018 14:54:11

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	10log(1/x)
LoRa	100	-	-	10Hz	-

## Support Equipment List and Details

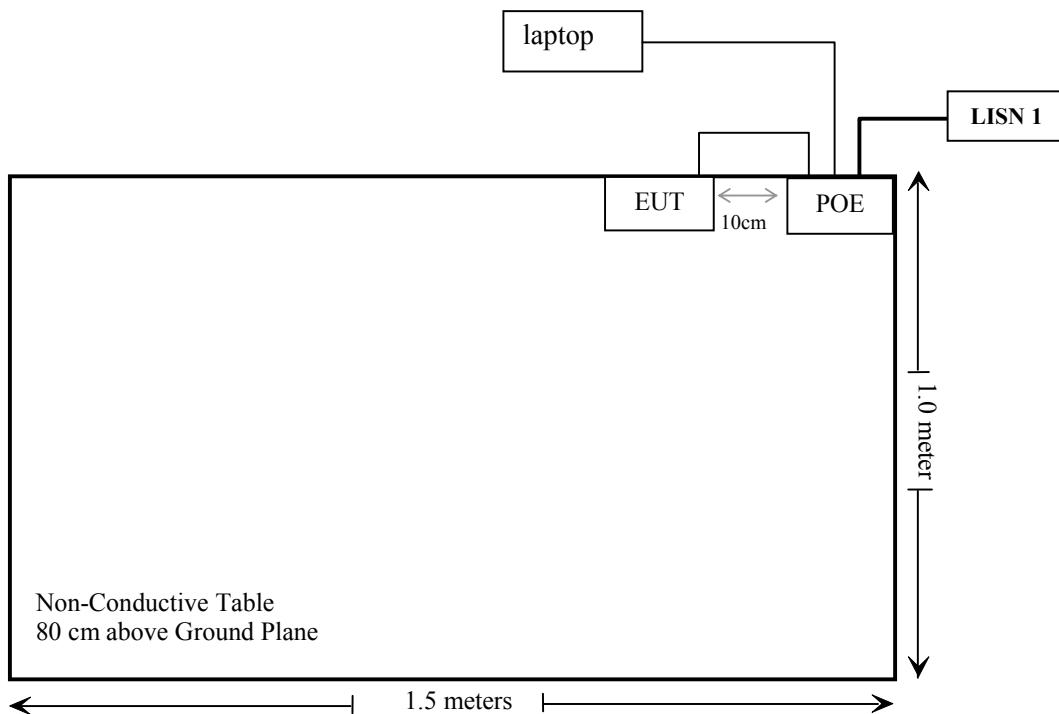
Manufacturer	Description	Model	Serial Number
DELL	Laptop	E6410	N/A

## External I/O Cable

Cable Description	Length (m)	From/Port	To
Un-Shielding Detachable RJ45 Cable	1.0	EUT	POE
Un-Shielding Detachable RJ45 Cable	3.0	Laptop	POE
Un-shielding detachable AC cable	1.4	LISN	POE

## Block Diagram of Test Setup

For conducted emission



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.247 (i) & §1.1310 & §2.1091	Maximum Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

## TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Conducted Emissions Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2018-07-11	2019-07-11
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2017-12-21	2018-12-21
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2018-05-12	2018-11-21
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
/	Conducted Emission Cable	/	UF A210B-1-0720-504504	2018-05-12	2018-11-12
<b>Radiated Emission Test</b>					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017-12-22	2020-12-21
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-06-23	2019-06-23
COM-POWER	Pre-amplifier	PA-122	181919	2018-05-22	2018-11-22
Sonoma instrument	Amplifier	310N	186238	2018-05-12	2018-11-12
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
Ducommun technologies	RF Cable	UFA147A-2362-100100	MFR64639 231029-003	2017-12-29	2020-12-28
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-21	2018-11-21
Ducommun technologies	RF Cable	RG-214	1	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	RG-214	2	2018-05-22	2018-11-22
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
<b>RF Conducted Test</b>					
Agilent	USB Wideband Power meter	U2021XA	MY54250003	2018-06-23	2019-06-23
WEINSCHEL	10dB Attenuator	5324	AU 3842	Each Time	
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
Ducommun technologies	RF Cable	RG-214	3	Each Time	

**\* Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

## FCC §15.247 (I) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### Applicable Standard

According to subpart 15.247(i) and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; \* = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

### Calculated Formulary:

Predication of MPE limit at a given distance

S = PG/4πR<sup>2</sup> = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Calculated Data:****The worst case as below:**

Mode	Frequency (MHz)	Antenna Gain		Max Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
LoRa	923.3-927.5	5.0	3.16	11	12.59	20	0.008	0.616
WiFi	2412-2462	2.0	1.58	13	19.95	20	0.006	1.0
WCDMA B2	1850-1910	0.5	1.12	23.5	223.87	20	0.050	1.0
WCDMA B5	824-849	-1.1	0.78	23.5	223.87	20	0.035	0.549
LTE B2	1850-1910	0.5	1.12	24	251.19	20	0.056	1.0
LTE B4	1710-1755	0.1	1.02	24	251.19	20	0.051	1.0
LTE B12	699-716	-1.4	0.72	24	251.19	20	0.036	0.466

The power data of WCDMA and LTE refer to FCC ID: XMR201605EC25A

Simultaneous transmitting consideration:

For LoRa + WiFi + WCDMA:

The ratio = MPE/limit<sub>LoRa</sub>+MPE/limit<sub>WiFi</sub>+MPE/limit<sub>WCDMA</sub>=0.008/0.616+0.006/1+0.035/0.549=0.08<1.0,

For LoRa + WiFi + LTE:

The ratio = MPE/limit<sub>LoRa</sub>+MPE/limit<sub>WiFi</sub>+MPE/limit<sub>LTE</sub>=0.008/0.616+0.006/1+0.036/0.466=0.10<1.0,

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons..

**Result: Compliance**

## **FCC §15.203 - ANTENNA REQUIREMENT**

### **Applicable Standard**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **Antenna Connector Construction**

The EUT has an external antenna which the maximum antenna gain is 5.0 dBi, this antenna need be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed. fulfill the requirement of this section. Please refer to the EUT photos.

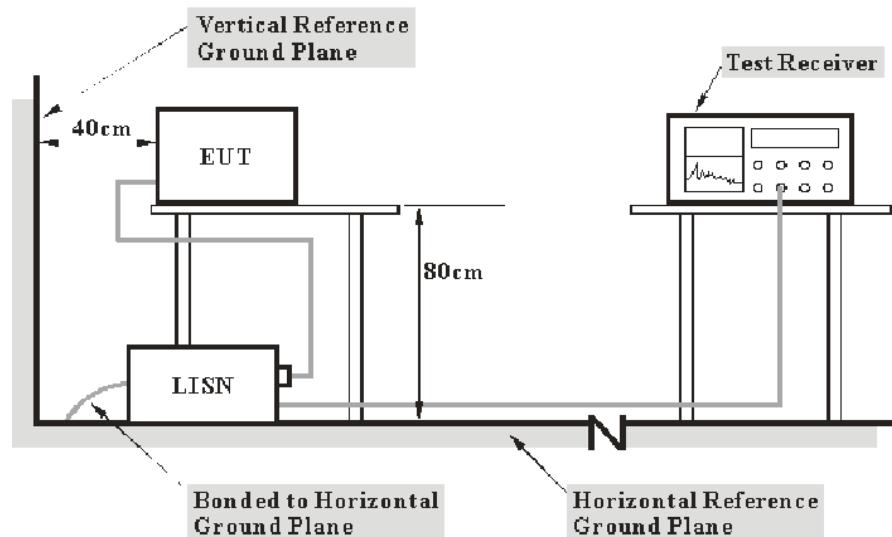
**Result:** Compliance.

## FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC§15.207

### EUT Setup



**Note:**

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

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

### Test Procedure

During the conducted emission test, the POE was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

## Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207,

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cisp}$$

In BACL,  $U_{(Lm)}$  is less than  $U_{cisp}$ , if  $L_m$  is less than  $L_{lim}$ , it implies that the EUT complies with the limit.

## Test Data

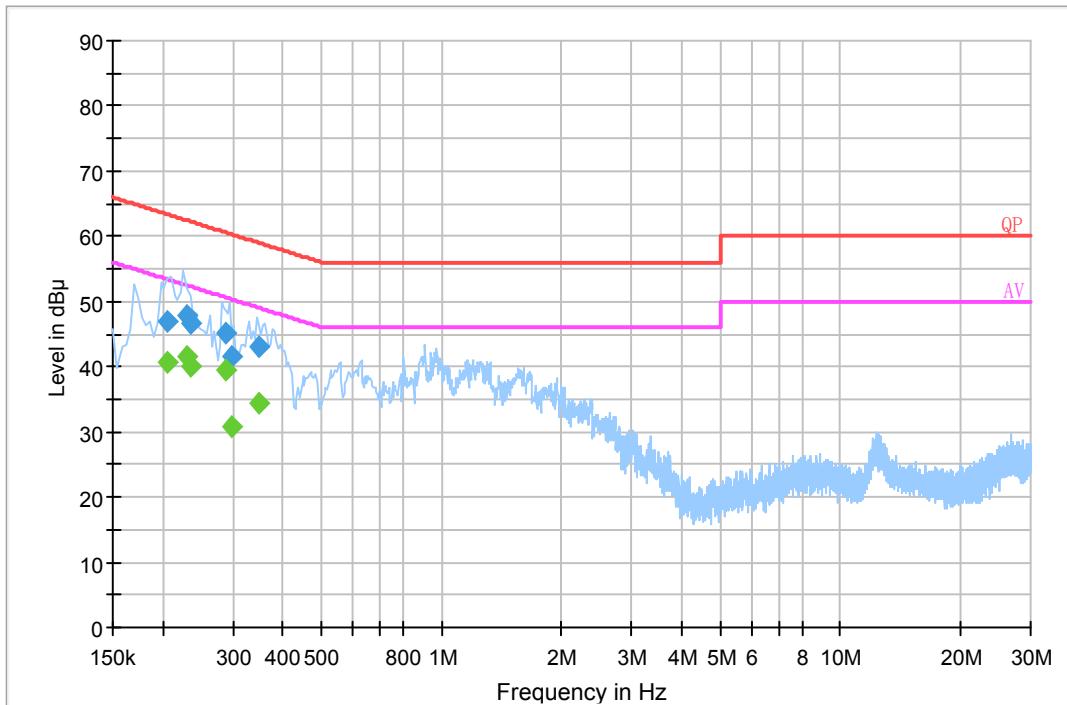
### Environmental Conditions

Temperature:	24 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

*The testing was performed by Kiki Kong on 2018-10-15.*

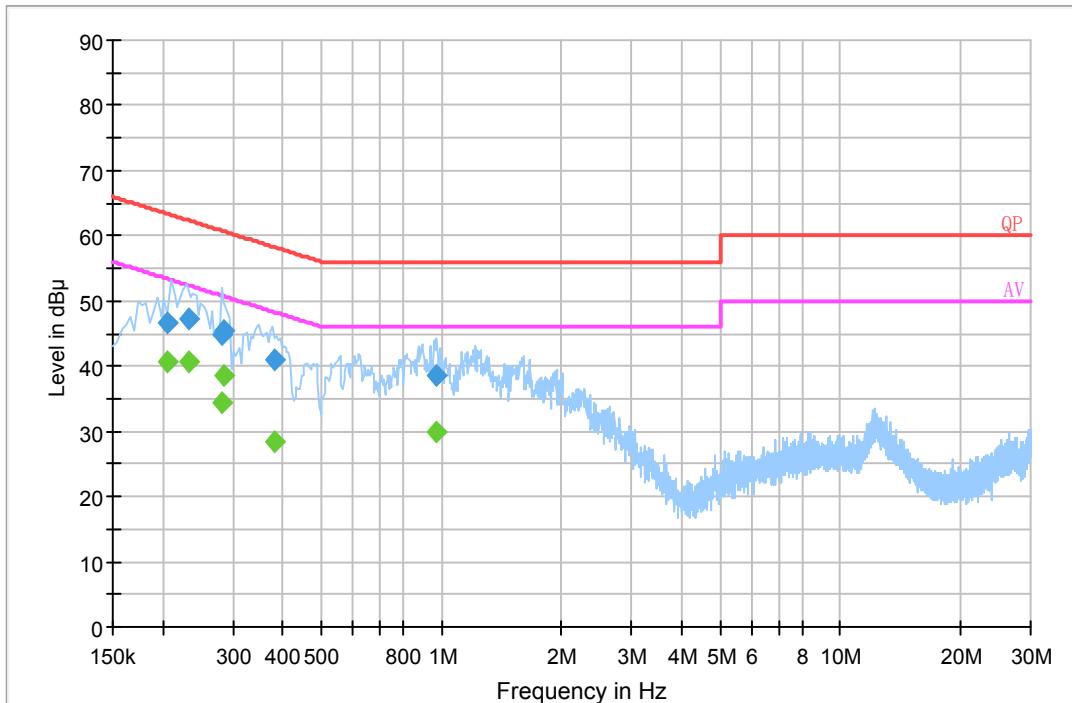
*EUT operation mode: Transmitting*

## AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dB $\mu$ V)	Correction Factor (dB)	Limit (dB $\mu$ V)	Margin (dB)	Detector (PK/Ave./QP)
0.205500	46.8	19.7	63.4	16.6	QP
0.229500	47.9	19.7	62.5	14.6	QP
0.234500	46.8	19.7	62.3	15.5	QP
0.286500	45.0	19.8	60.6	15.6	QP
0.297500	41.5	19.8	60.3	18.8	QP
0.348810	43.2	19.7	59.0	15.8	QP
0.205500	40.8	19.7	53.4	12.6	Ave.
0.229500	41.5	19.7	52.5	11.0	Ave.
0.234500	40.1	19.7	52.3	12.2	Ave.
0.286500	39.4	19.8	50.6	11.2	Ave.
0.297500	30.8	19.8	50.3	19.5	Ave.
0.348810	34.4	19.7	49.0	14.6	Ave.

## AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dB $\mu$ V)	Correction Factor (dB)	Limit (dB $\mu$ V)	Margin (dB)	Detector (PK/Ave./QP)
0.205500	46.6	19.7	63.4	16.8	QP
0.233500	47.1	19.7	62.3	15.2	QP
0.281500	45.0	19.7	60.8	15.8	QP
0.285500	45.3	19.8	60.7	15.4	QP
0.383670	41.0	19.7	58.2	17.2	QP
0.967390	38.5	19.8	56.0	17.5	QP
0.205500	40.5	19.7	53.4	12.9	Ave.
0.233500	40.7	19.7	52.3	11.6	Ave.
0.281500	34.3	19.7	50.8	16.5	Ave.
0.285500	38.4	19.8	50.7	12.3	Ave.
0.383670	28.3	19.7	48.2	19.9	Ave.
0.967390	29.9	19.8	46.0	16.1	Ave.

**Note:**

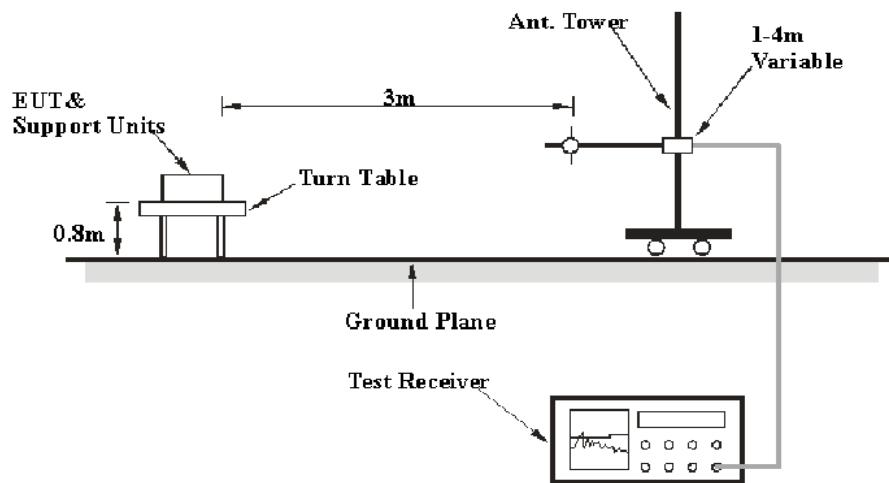
- 1) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

**FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS****Applicable Standard**

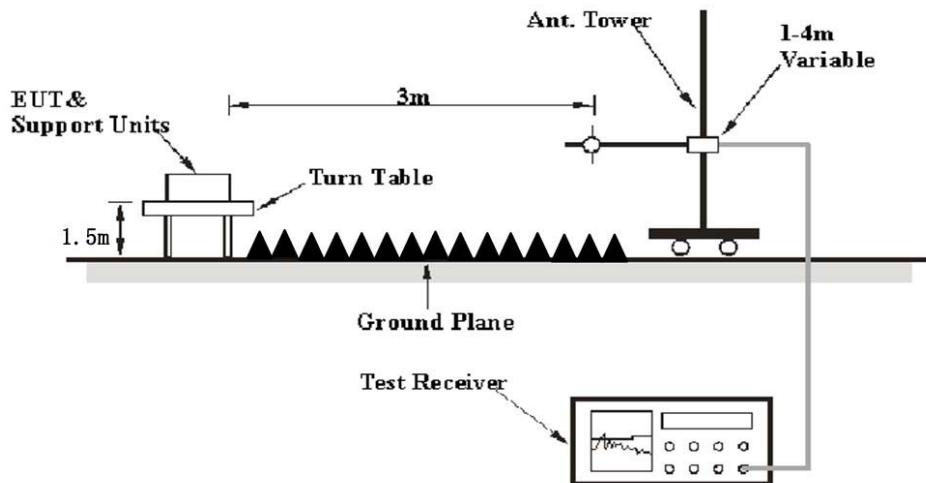
FCC §15.247 (d); §15.209; §15.205;

**EUT Setup**

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 10 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurements
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz <sup>Note 1</sup>	/	Average
	1MHz	>1/T <sup>Note 2</sup>	/	Average

Note 1: when duty cycle is no less than 98%

Note 2: when duty cycle is less than 98%

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{\text{lim}} + U_{\text{cisp}}$$

In BACL,  $U_{(Lm)}$  is less than  $U_{\text{cisp}}$ , if  $L_m$  is less than  $L_{\text{lim}}$ , it implies that the EUT complies with the limit.

## Test Data

### Environmental Conditions

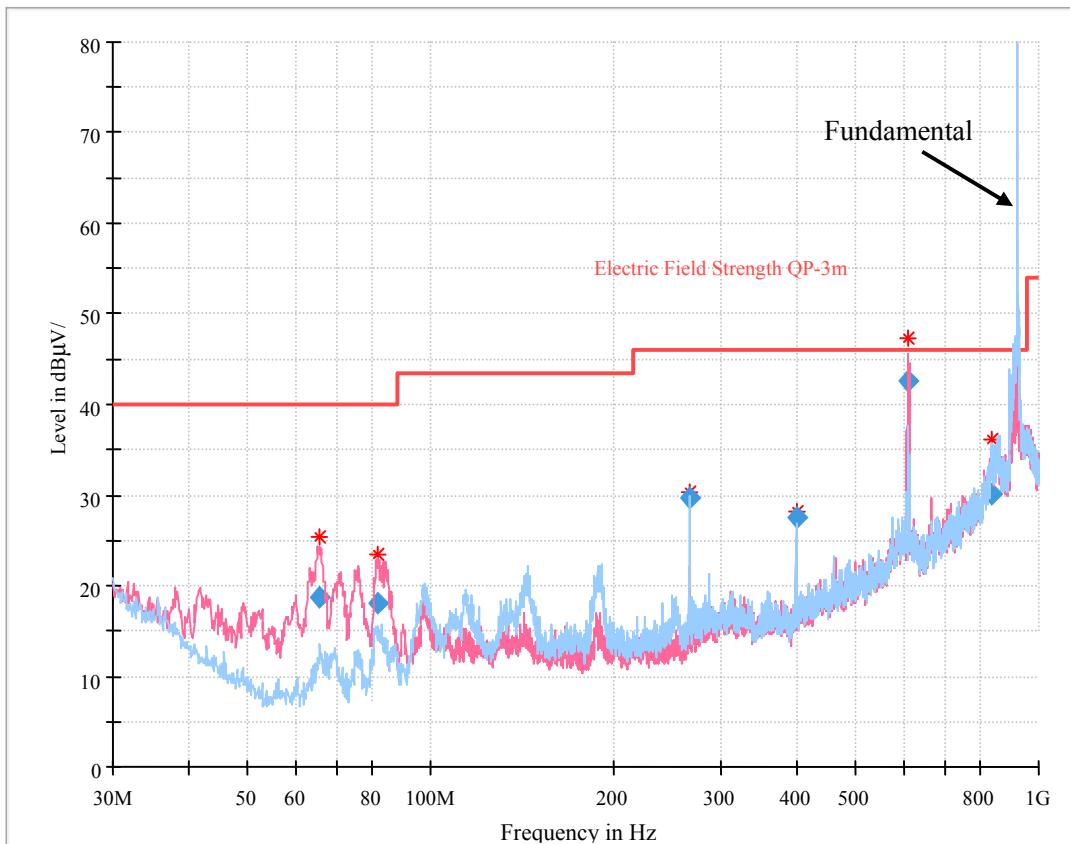
Temperature:	24 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Kiki Kong on 2018-10-12.

EUT operation mode: Transmitting

Test frequency range: 30MHz – 10GHz, please refer to the following tables and plots.

(Worst case at Low channel)



Frequency (MHz)	Corrected Amplitude (dB $\mu$ V/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dB $\mu$ V/m)	Margin (dB)
65.689750	18.78	116.0	V	166.0	-20.4	40.00	21.22
81.852250	18.12	107.0	V	91.0	-19.8	40.00	21.88
265.997125	29.72	117.0	H	219.0	-13.0	46.00	16.28
398.998000	27.54	163.0	V	253.0	-10.3	46.00	18.46
611.569500	42.52	108.0	V	283.0	-2.0	46.00	3.48
839.486875	30.06	351.0	H	305.0	5.9	46.00	15.94

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dB $\mu$ V/m)	FCC Part 15.247/205/209	
	Reading (dB $\mu$ V)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dB $\mu$ V/m)	Margin (dB)
<b>Low Channel (923.3 MHz)</b>									
923.3	76.6	PK	342	2.0	H	6.7	83.3	/	/
923.3	67.5	Ave.	342	2.0	H	6.7	74.6	/	/
923.3	77.5	PK	292	1.4	V	6.9	84.4	/	/
923.3	68.5	Ave.	292	1.4	V	6.9	75.4	/	/
902	21.5	PK	292	1.4	V	4.4	25.9	64.4	38.5
1846.60	46.64	PK	99	2.2	V	-1.41	45.23	74	28.77
1846.60	41.25	Ave.	99	2.2	V	-1.41	39.84	54	14.16
2769.90	44.57	PK	111	1.6	V	3.02	47.59	74	26.41
2769.90	29.81	Ave.	111	1.6	V	3.02	32.83	54	21.17
3693.20	43.54	PK	106	1.3	V	3.56	47.10	74	26.90
3693.20	37.09	Ave.	254	1.6	V	4.06	41.15	54	12.85
4874.00	60.36	PK	267	1.8	V	8.88	69.24	74	4.76
4874.00	32.79	Ave.	267	1.8	V	8.88	41.67	54	12.33

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dB $\mu$ V/m)	FCC Part 15.247/205/209	
	Reading (dB $\mu$ V)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dB $\mu$ V/m)	Margin (dB)
<b>Middle Channel(925.1MHz)</b>									
925.1	74.5	PK	281	1.5	H	7.1	81.6	/	/
925.1	65.4	Ave.	281	1.5	H	7.1	72.5	/	/
925.1	76.8	PK	342	2.3	V	7.1	83.9	/	/
925.1	67.8	Ave.	342	2.3	V	7.1	74.9	/	/
1850.20	45.61	PK	14	1.9	V	-1.34	44.27	74	29.73
1850.20	43.66	Ave.	14	1.9	V	-1.34	42.32	54	11.68
2775.30	43.78	PK	283	1.3	V	3.02	46.80	74	27.20
2775.30	29.63	Ave.	283	1.3	V	3.02	32.65	54	21.35
3700.40	45.05	PK	102	1.6	V	4.06	49.11	74	24.89
3700.40	29.39	Ave.	102	1.6	V	4.06	33.45	54	20.55
4874.00	59.84	PK	125	1.5	V	9.39	69.23	74	4.77
4874.00	32.24	Ave.	125	1.5	V	9.39	41.63	54	12.37
<b>High Channel(927.5 MHz)</b>									
927.5	73.1	PK	288	1.5	H	7.3	80.4	/	/
927.5	64.0	Ave.	288	1.5	H	7.3	71.3	/	/
927.5	75.1	PK	347	2.0	V	7.3	82.4	/	/
927.5	66.0	Ave.	347	2.0	V	7.3	73.3	/	/
928	28.1	PK	288	2.0	V	7.4	35.5	62.4	26.9
1855.00	52.61	PK	223	1.5	V	-1.24	51.37	74	22.63
1855.00	29.65	Ave.	223	1.5	V	-1.24	28.41	54	25.59
2782.50	43.78	PK	345	2.2	V	3.02	46.80	74	27.20
2782.50	29.83	Ave.	345	2.2	V	3.02	32.85	54	21.15
3710.00	46.71	PK	358	2.3	V	4.06	50.77	74	23.23
3710.00	37.12	Ave.	358	2.3	V	4.06	41.18	54	12.82
4874.00	59.84	PK	45	1.9	V	9.39	69.23	74	4.77
4874.00	32.99	Ave.	45	1.9	V	9.39	42.38	54	11.62

**Note:**

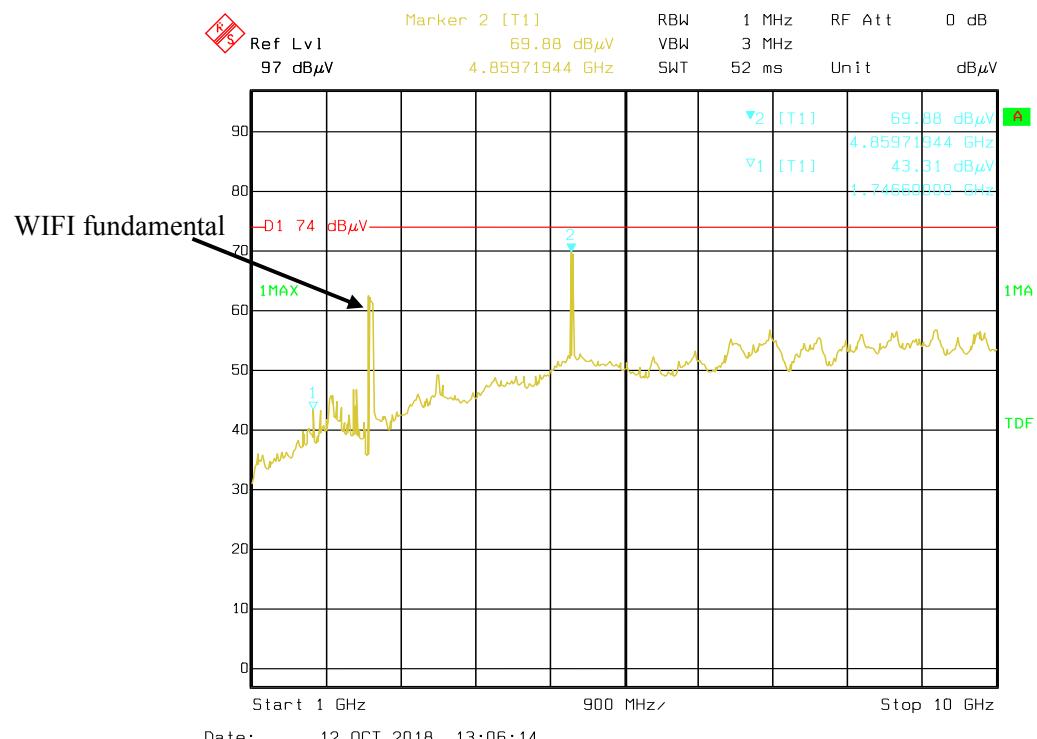
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

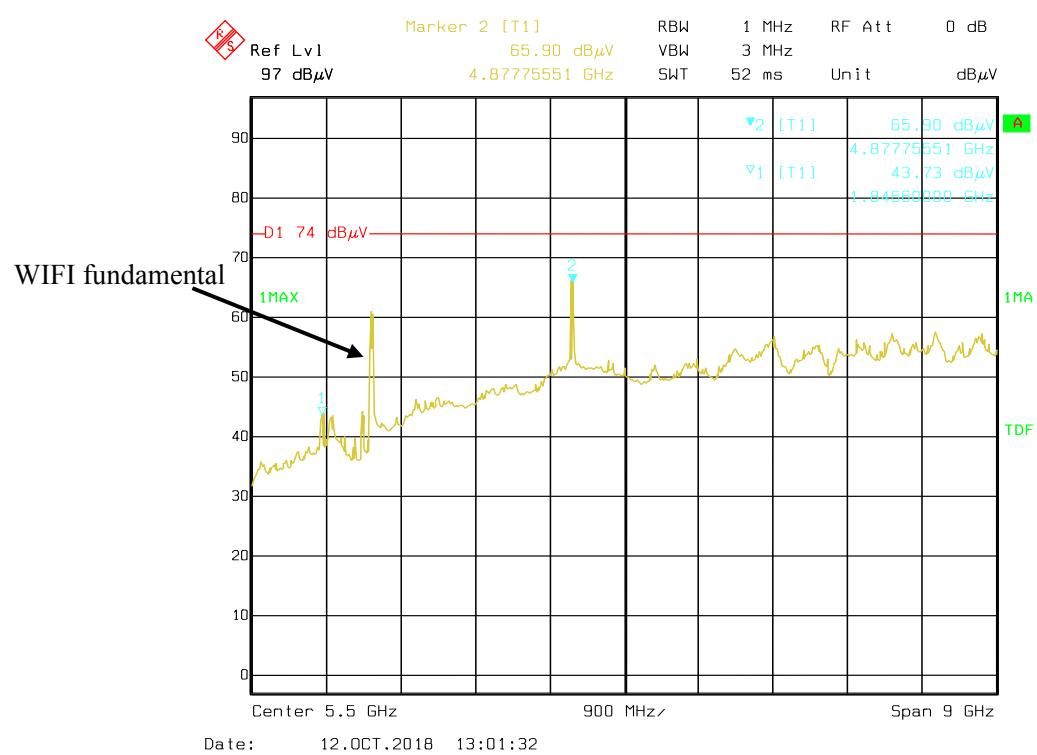
Margin = Limit - Corrected. Amplitude

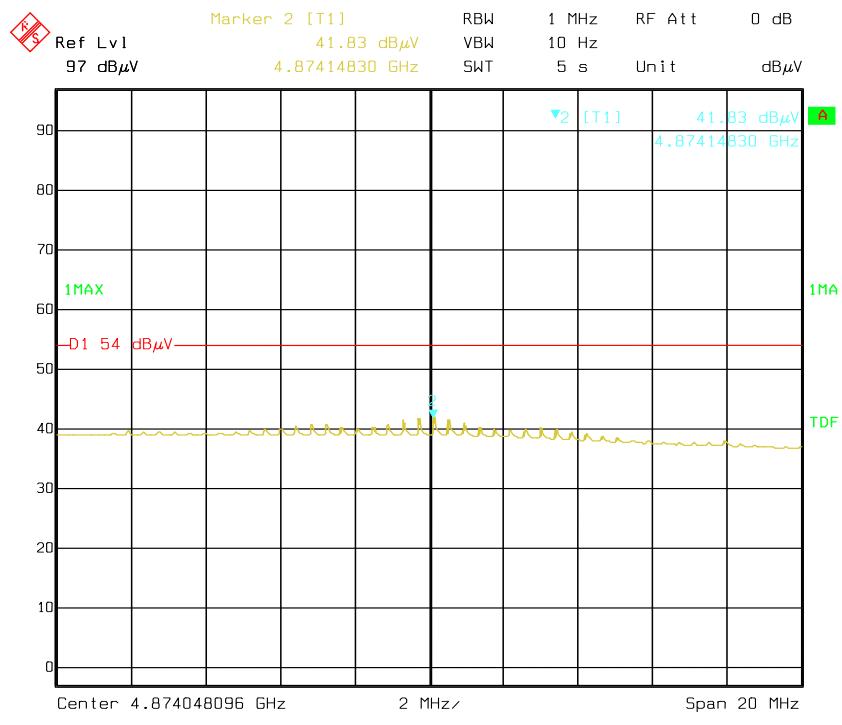
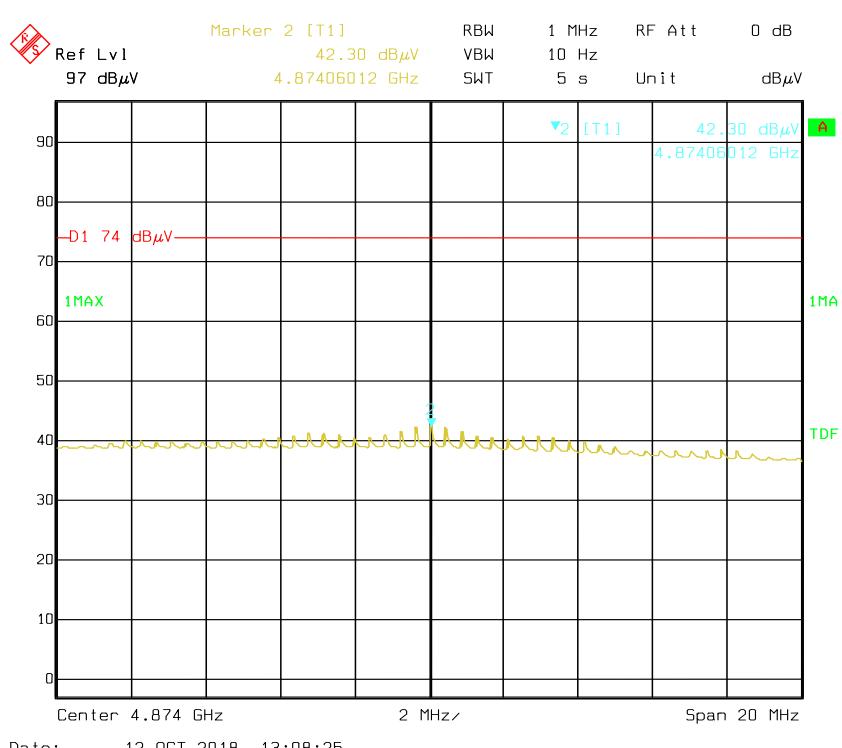
The other spurious emission which is 20dB to the limit was not recorded.

### Pre-scan with High channel for Peak Horizontal



### Vertical



**Pre-scan for Average  
Horizontal****Vertical**

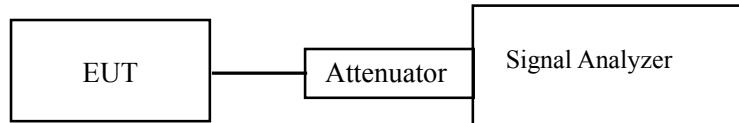
## FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

### Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



### Test Data

#### Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

*The testing was performed by Kiki Kong on 2018-10-16.*

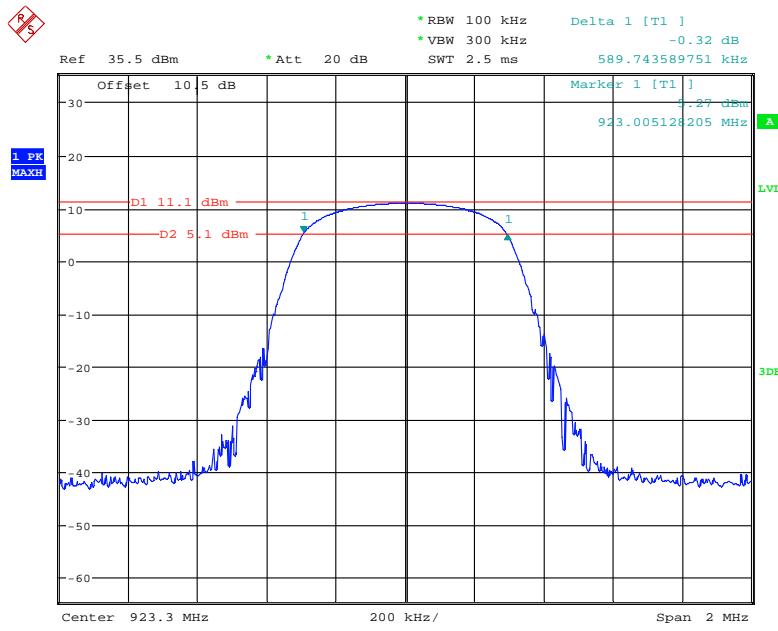
**Test Result:** Pass.

Please refer to the following table and plots.

EUT operation mode: Transmitting

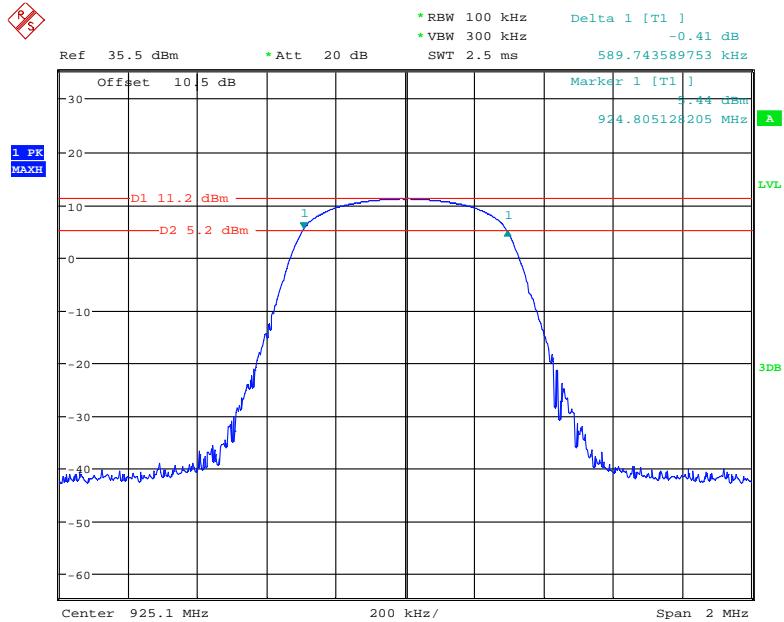
Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	Limit (kHz)
Low	923.3	589.7	≥500
Middle	925.1	589.7	≥ 500
High	927.5	589.7	≥500

### Low Channel



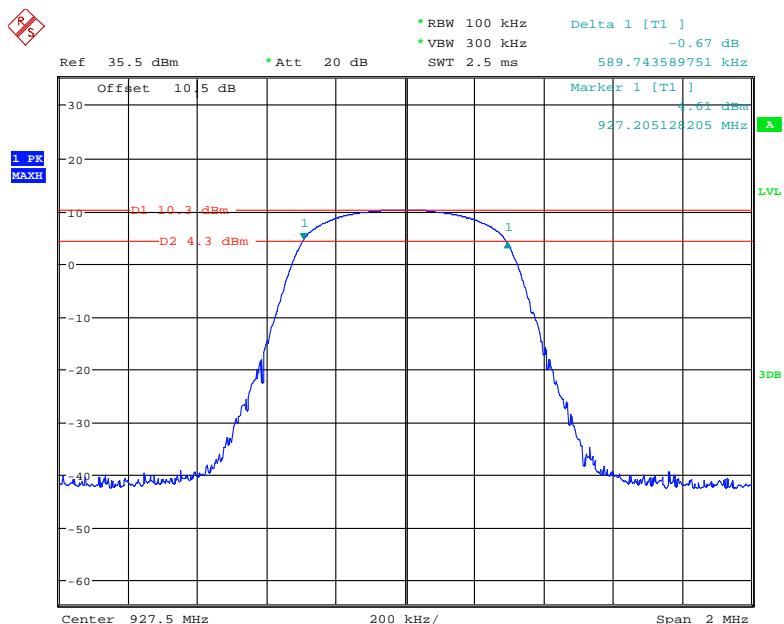
Date: 16.OCT.2018 13:32:25

## Middle Channel



Date: 16.OCT.2018 13:34:34

## High Channel



Date: 16.OCT.2018 13:41:02

## FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

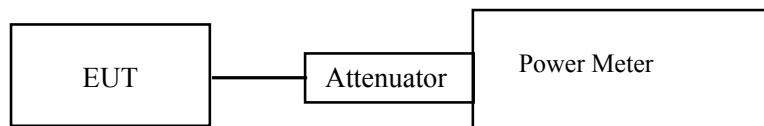
### Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

### Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



### Test Data

#### Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

*The testing was performed by Kiki Kong on 2018-10-16.*

*EUT operation mode: Transmitting*

Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
Low	923.3	10.86	30
Middle	925.1	10.98	30
High	927.5	10.25	30

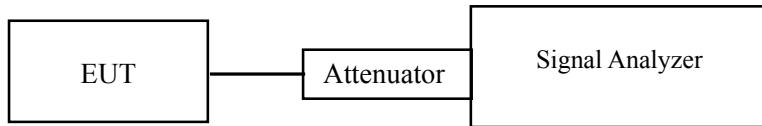
## FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

### Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



### Test Data

#### Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

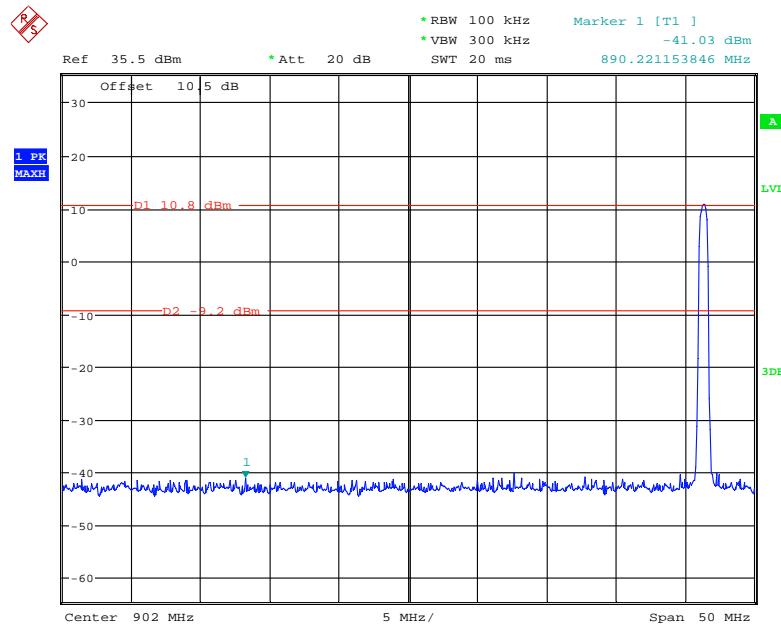
*The testing was performed by Kiki Kong on 2018-10-16.*

*EUT operation mode: Transmitting*

**Test Result:** Compliance

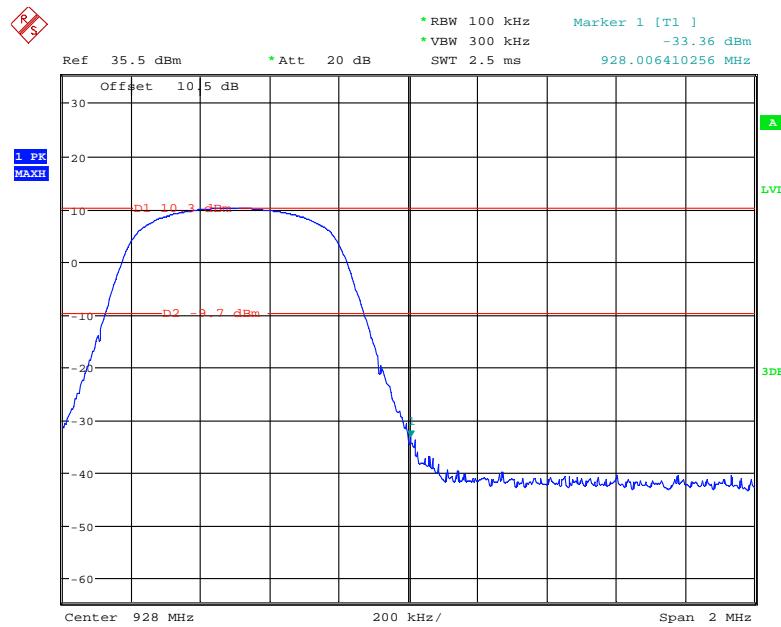
Please refer to the following plots.

## Band Edge, Left Side



Date: 16.OCT.2018 13:44:01

## Band Edge, Right Side



Date: 16.OCT.2018 13:45:31

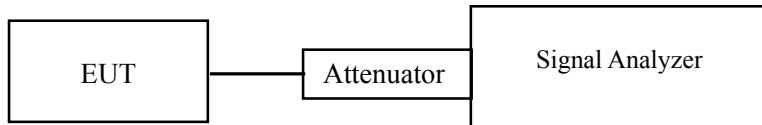
## FCC §15.247(e) - POWER SPECTRAL DENSITY

### Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to:  $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$ .
3. Set the VBW  $\geq 3 \times \text{RBW}$ .
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



### Test Data

#### Environmental Conditions

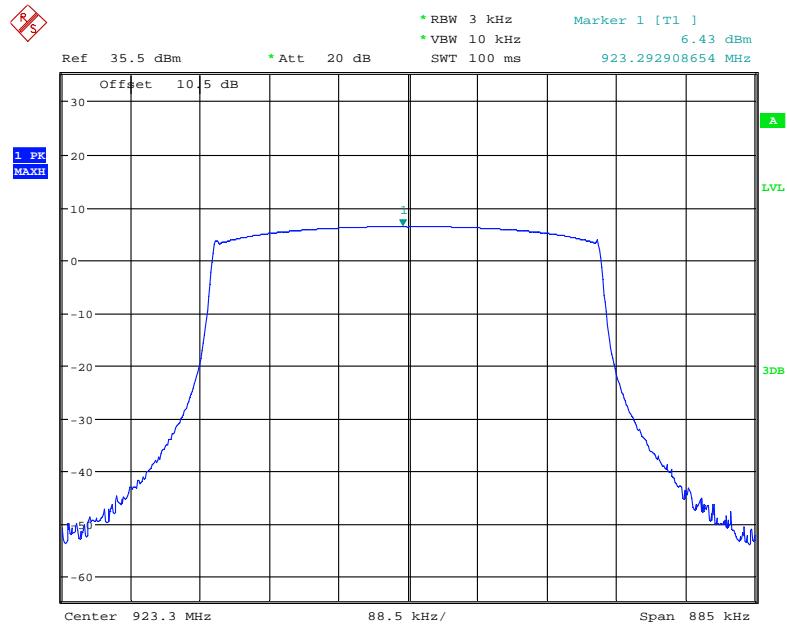
Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Kiki Kong on 2018-10-16.

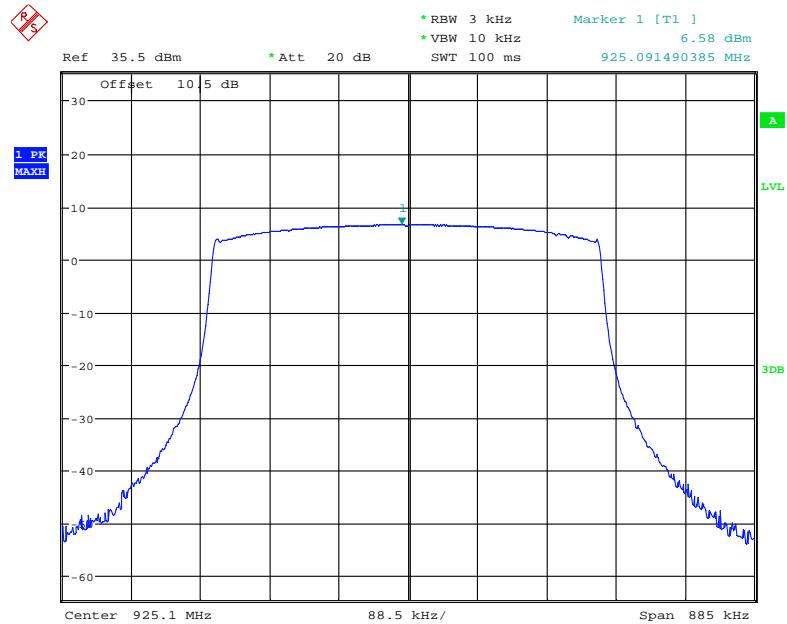
EUT operation mode: Transmitting

Test Result: Pass

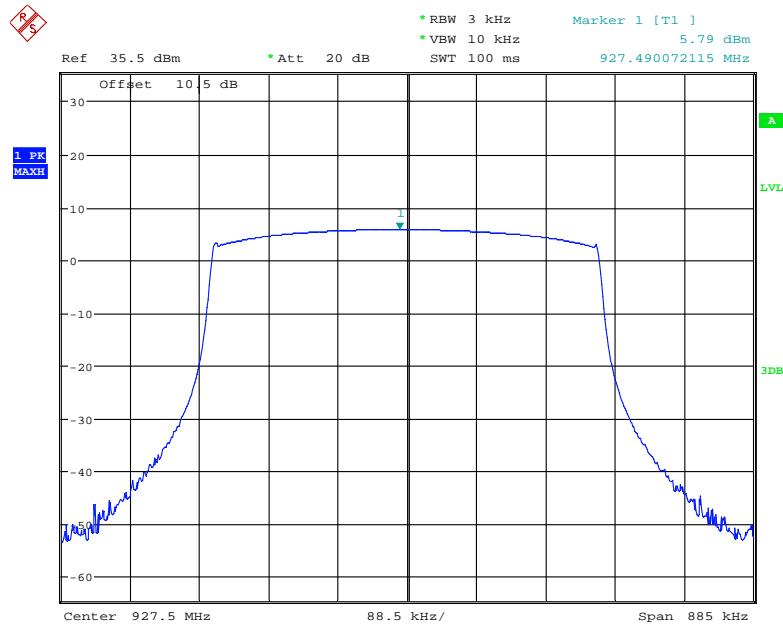
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	923.3	6.43	≤8
Middle	925.1	6.58	≤8
High	927.5	5.79	≤8

**Power Spectral Density, Low Channel**

Date: 16.OCT.2018 13:49:06

**Power Spectral Density, Middle Channel**

Date: 16.OCT.2018 13:48:18

**Power Spectral Density, High Channel**

Date: 16.OCT.2018 13:47:32

**\*\*\*\*\* END OF REPORT \*\*\*\*\***