



# FCC PART 15.249 TEST REPORT

For

## ShenZhen Rapoo Technology Co., Ltd

22,Jinxiu Road East,Pingshan District,Shenzhen,China

**FCC ID: PP203055B**

<b>Report Type:</b> Original Report	<b>Product Name:</b> 2.4G Nano Receiver
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<b>Report Number:</b> RDG170523002	
<b>Report Date:</b> 2017-07-18	
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## **GENERAL INFORMATION**

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

The **ShenZhen Rapoo Technology Co., Ltd**'s product, model number: **03055B (FCC ID: PP203055B)** (the "EUT") in this report was a **2.4G Nano Receiver**, which was measured approximately: 1.8 cm (L) x 1.2 cm (W) x 0.5 cm (H), rated input voltage: DC 5V from host.

*\*All measurement and test data in this report was gathered from final production sample, serial number: 170523002 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-06-05, and EUT conformed to test requirement.*

### **Objective**

This type approval report is prepared on behalf of **ShenZhen Rapoo Technology Co., Ltd** in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

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

Part of systems submissions with FCC ID: PP2M10

## Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

All of the measurements detailed in this Test Report were performed by Bay Area Compliance Laboratories Corp. (Chengdu).

The Bay Area Compliance Laboratories Corp. Chengdu's measurement Uncertainties (calculated for a k=2 Coverage Factor corresponding to approximately 95% Coverage) were as follows:

-For all of the AC Line Conducted Emissions Tests reported herein:  $\pm 3.17$  dB.

-For of all of the Direct Antenna Conducted Emissions Tests reported herein:  $\pm 0.56$  dB.

-For of all of the direct Radiated Emissions Tests reported herein are:

30 MHz to 200 MHz:  $\pm 4.7$  dB;

200 MHz to 1 GHz:  $\pm 6.0$  dB;

1 GHz to 6 GHz:  $\pm 5.13$ dB; and,

6 GHz to 40 GHz:  $\pm 5.47$ dB.

And the uncertainty will not be taken into consideration for all test data recorded in the report.

## Test Facility

The test site used by BACL to collect test data is located in the No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Justification

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

16 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	5	2425	9	2446	13	2471
2	2405	6	2428	10	2451	14	2474
3	2409	7	2431	11	2454	15	2477
4	2413	8	2434	12	2457	16	2479

EUT was tested with Channel 1, 9 and 16.

### EUT Exercise Software

Test software: 'EnteryLevelTool' was used in test, the maximum power was configured by system default setting, the software was used for change test modes and channels.

### Equipment Modifications

No modifications were made to the EUT.

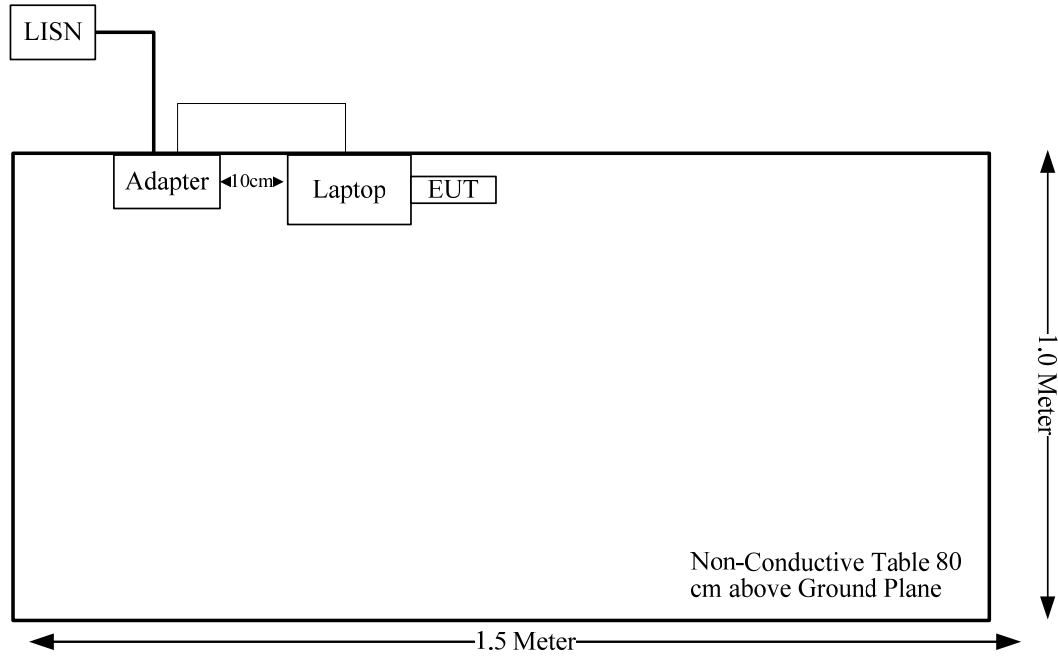
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	Ins15-7567-D1845B	X78591D8639

### Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Adapter Cable	yes	No	1.5	Adapter	Laptop

### Block Diagram of Test Setup



## **SUMMARY OF TEST RESULTS**

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<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

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

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### **Applicable Standard**

For intentional device, 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.

### **Antenna Connector Construction**

The EUT has an integrated antenna, the antenna gain is 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliant.

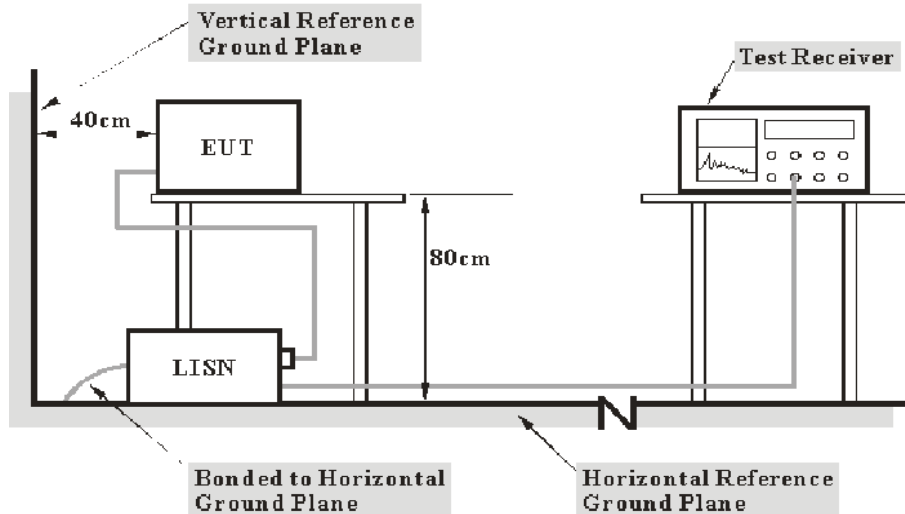


## FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC§15.207(a)

### 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.

The Adapter was connected to the main lisn with a 120V/60 Hz AC power source.

### 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 EUT was connected to the first LISN.

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

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

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

$V_C$  (cord. Reading): corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

VDF: voltage division factor of AMN

$C_f$ : Correction Factor

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

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

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2016-12-02	2017-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	100018	2016-12-02	2017-12-01
SOLAR ELECTRONICS	L.I.S.N.	9252-50-24-BNC	984413	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	DE14781	2016-10-31	2017-10-30
Unknown	Conducted Cable	Unknown	NO.5	2016-11-10	2017-11-09
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

## Test Data

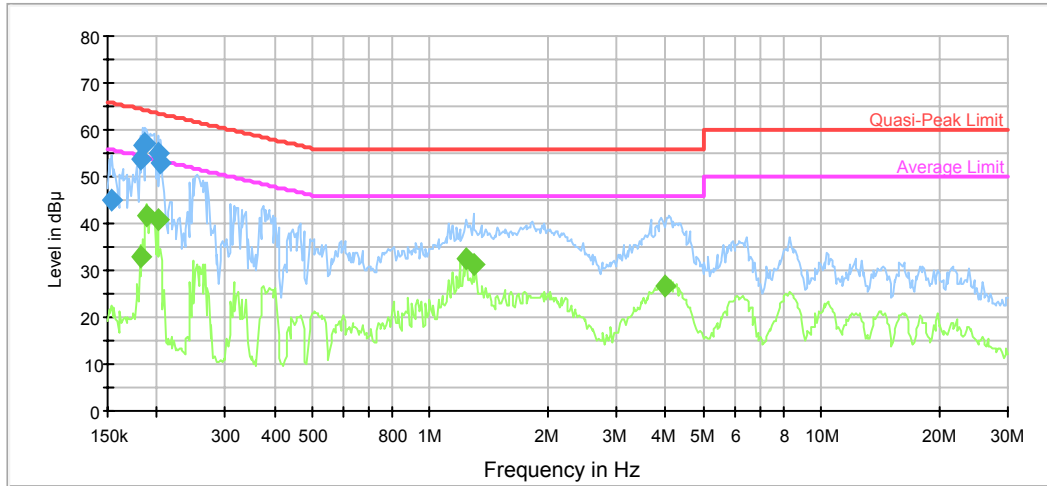
### Environmental Conditions

<b>Temperature:</b>	27.6°C
<b>Relative Humidity:</b>	55%
<b>ATM Pressure:</b>	100.3 kPa

*The testing was performed by Kevin Hu on 2017-6-27.*

Test Mode: Transmitting

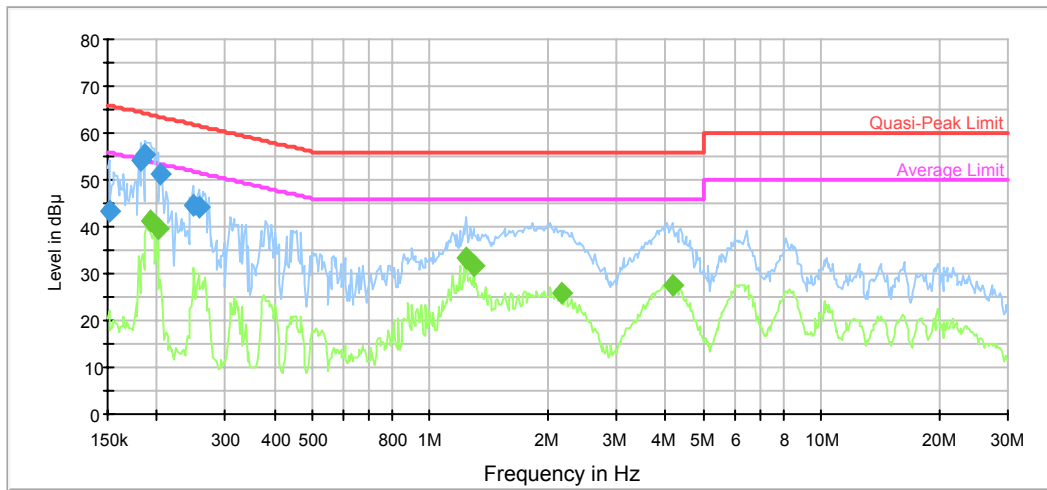
AC120 V, Line:



Frequency (MHz)	Quasi Peak (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.153629	45.0	9.000	L1	19.7	20.8	65.8	Compliance
0.181612	54.0	9.000	L1	19.7	10.4	64.4	Compliance
0.184529	56.9	9.000	L1	19.7	7.4	64.3	Compliance
0.187494	57.1	9.000	L1	19.7	7.0	64.1	Compliance
0.201433	55.0	9.000	L1	19.7	8.6	63.6	Compliance
0.204669	53.0	9.000	L1	19.7	10.4	63.4	Compliance

Frequency (MHz)	Average (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.181612	33.1	9.000	L1	19.7	21.3	54.4	Compliance
0.188994	41.6	9.000	L1	19.7	12.5	54.1	Compliance
0.201433	40.8	9.000	L1	19.7	12.8	53.6	Compliance
1.239175	32.3	9.000	L1	19.7	13.7	46.0	Compliance
1.289541	31.2	9.000	L1	19.7	14.8	46.0	Compliance
3.997889	26.6	9.000	L1	19.7	19.4	46.0	Compliance

**AC120V, Neutral:**



Frequency (MHz)	Quasi Peak (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.151200	43.4	9.000	N	19.7	22.5	65.9	Compliance
0.183065	54.1	9.000	N	19.6	10.2	64.3	Compliance
0.187494	55.4	9.000	N	19.6	8.7	64.1	Compliance
0.204669	51.4	9.000	N	19.6	12.0	63.4	Compliance
0.247802	44.7	9.000	N	19.6	17.1	61.8	Compliance
0.255827	44.1	9.000	N	19.6	17.5	61.6	Compliance

Frequency (MHz)	Average (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.192030	41.2	9.000	N	19.6	12.7	53.9	Compliance
0.201433	39.7	9.000	N	19.6	13.9	53.6	Compliance
1.239175	33.4	9.000	N	19.6	12.6	46.0	Compliance
1.289541	31.6	9.000	N	19.6	14.4	46.0	Compliance
2.164561	25.6	9.000	N	19.7	20.4	46.0	Compliance
4.193667	27.6	9.000	N	19.7	18.4	46.0	Compliance

## FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS

### Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

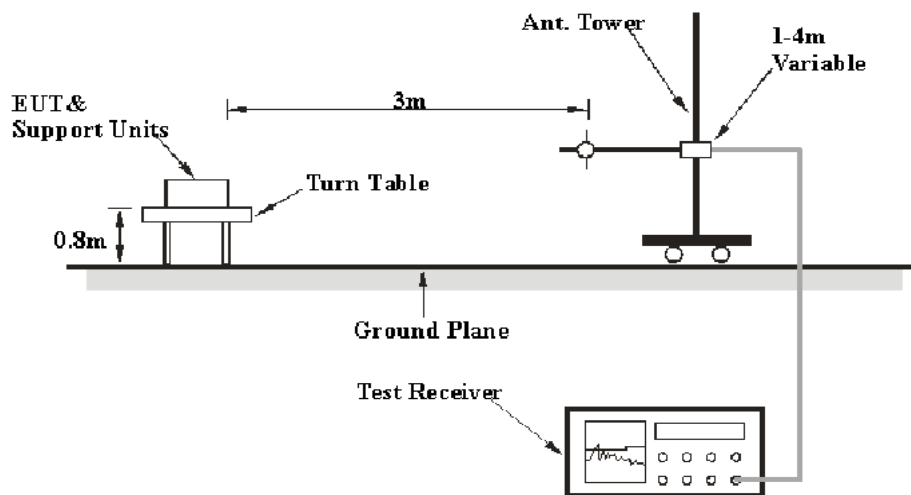
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

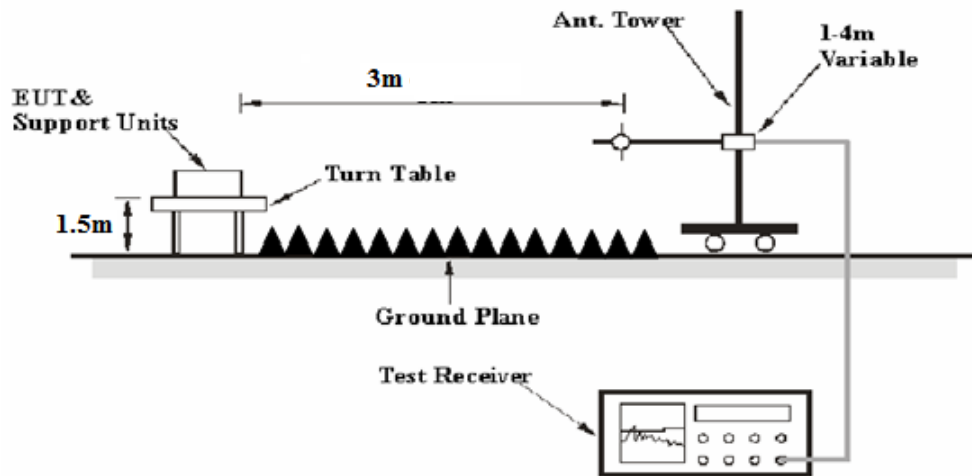
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013 The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

### Test Equipment Setup

The system was investigated from 30 MHz to 25 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	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

### Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1GHz, peak and average detection mode 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A121808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2017-05-20	2018-05-19
EMCT	Semi-Anechoic Chamber	966	966-1	2015-04-24	2018-04-23
Unknown	RF Cable (below 1GHz)	Unknown	NO.1	2016-11-10	2017-11-09
Unknown	RF Cable (below 1GHz)	Unknown	NO.4	2016-11-10	2017-11-09
Unknown	RF Cable (above 1GHz)	Unknown	NO.2	2016-11-10	2017-11-09
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-011312	2016-08-18	2017-08-18
Quinstar	Amplifier	QLW-18405536-JO	15964001032	2016-08-18	2017-08-18
Agilent	Spectrum Analyzer	8564E	5943A01752	2016-08-18	2017-08-18

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.



## Test Data

### Environmental Conditions

<b>Temperature:</b>	26 °C
<b>Relative Humidity:</b>	38%
<b>ATM Pressure:</b>	100.1 kPa

*The testing was performed by Kevin Hu on 2017-06-15.*

Test Mode: Transmitting

30MHz-25GHz

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector	Polar (H/V)	Factor (dB(1/m))					
Low Channel: 2402 MHz									
2402	60.84	PK	H	23.53	3.00	0.00	87.37	114	26.63
2402	46.48	AV	H	23.53	3.00	0.00	73.01	94	20.99
2402	60.75	PK	V	23.53	3.00	0.00	87.28	114	26.72
2402	47.29	AV	V	23.53	3.00	0.00	73.82	94	20.18
2400	31.90	PK	H	23.54	3.00	0.00	58.44	74	15.56
2400	17.88	AV	H	23.54	3.00	0.00	44.42	54	9.58
4780	38.91	PK	H	30.70	5.14	26.87	47.88	74	26.12
4780	29.84	AV	H	30.70	5.14	26.87	38.81	54	15.19
7206	36.65	PK	H	34.71	6.16	26.35	51.17	74	22.83
7206	26.94	AV	H	34.71	6.16	26.35	41.46	54	12.54
2459	43.28	PK	H	23.34	2.99	26.88	42.73	74	31.27
2459	33.96	AV	H	23.34	2.99	26.88	33.41	54	20.59
44.55	50.33	QP	H	11.82	0.34	28.51	33.98	40	6.02
173.56	46.49	QP	H	11.52	0.92	27.96	30.97	43.5	12.53
Middle Channel: 2446 MHz									
2446	61.11	PK	H	23.38	3.00	0.00	87.49	114	26.51
2446	47.39	AV	H	23.38	3.00	0.00	73.77	94	20.23
2446	59.62	PK	V	23.38	3.00	0.00	86	114	28
2446	47.02	AV	V	23.38	3.00	0.00	73.4	94	20.6
4892	38.13	PK	H	31.05	5.08	26.87	47.39	74	26.61
4892	27.74	AV	H	31.05	5.08	26.87	37	54	17
7338	30.30	PK	H	34.98	6.23	26.41	45.1	74	28.9
7338	19.51	AV	H	34.98	6.23	26.41	34.31	54	19.69
1529	40.17	PK	H	24.15	2.69	26.36	40.65	74	33.35
1529	30.00	AV	H	24.15	2.69	26.36	30.48	54	23.52
2457	44.02	PK	H	23.35	3.00	26.88	43.49	74	30.51
2457	35.78	AV	H	23.35	3.00	26.88	35.25	54	18.75
44.55	50.60	QP	H	11.82	0.34	28.51	34.25	40	5.75
173.56	46.63	QP	H	11.52	0.92	27.96	31.11	43.5	12.39
High Channel: 2479 MHz									
2479	58.92	PK	H	23.27	2.99	0.00	85.18	114	28.82
2479	46.90	AV	H	23.27	2.99	0.00	73.16	94	20.84
2479	57.61	PK	V	23.27	2.99	0.00	83.87	114	30.13
2479	47.66	AV	V	23.27	2.99	0.00	73.92	94	20.08
2483.5	31.49	PK	H	23.26	2.99	0.00	57.74	74	16.26
2483.5	18.99	AV	H	23.26	2.99	0.00	45.24	54	8.76
4958	36.68	PK	H	31.27	5.05	26.88	46.12	74	27.88
4958	26.40	AV	H	31.27	5.05	26.88	35.84	54	18.16
7437	29.47	PK	H	35.17	6.27	26.45	44.46	74	29.54
7437	19.33	AV	H	35.17	6.27	26.45	34.32	54	19.68
1513	41.90	PK	H	24.12	2.68	26.34	42.36	74	31.64
1513	33.26	AV	H	24.12	2.68	26.34	33.72	54	20.28
44.55	51.44	QP	H	11.82	0.34	28.51	35.09	40	4.91
173.56	47.05	QP	H	11.52	0.92	27.96	31.53	43.5	11.97

## FCC §15.215(c) – 20 dB BANDWIDTH TESTING

### Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
3. Repeat above procedures until all frequencies measured were complete.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
Unknown	RF Cable	Unknown	C-5	Each Time	/

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B "Implementation of traceability policy in accredited laboratories".

### Test Data

#### Environmental Conditions

Temperature:	25.4 °C
Relative Humidity:	35 %
ATM Pressure:	101.7 kPa

*The testing was performed by Kevin Hu on 2017-06-13.*

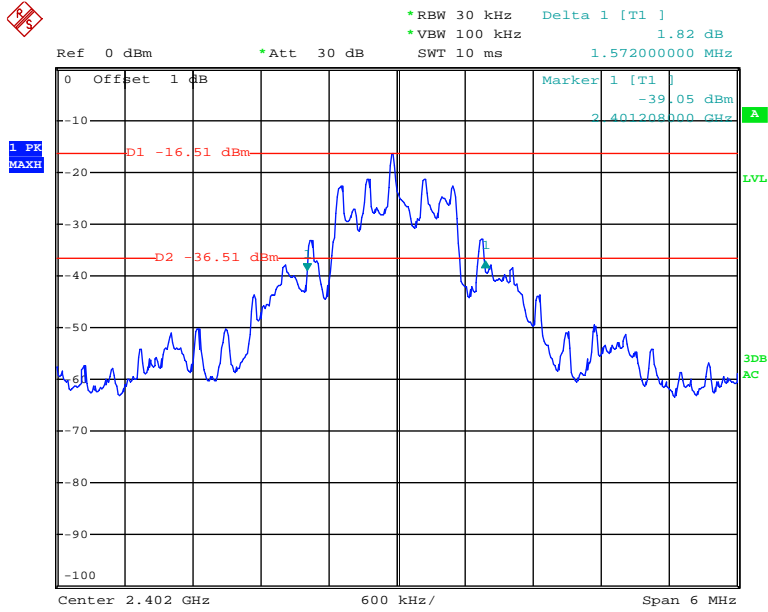
**Test Result:** Compliant.

Please refer to following tables and plots

Test Mode: Transmitting

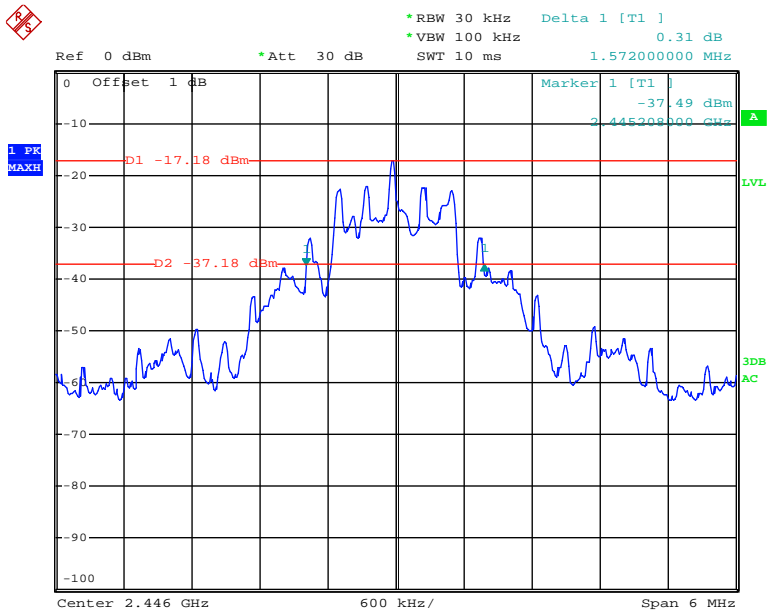
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2402	1.57
Middle	2446	1.57
High	2479	1.57

### Low Channel



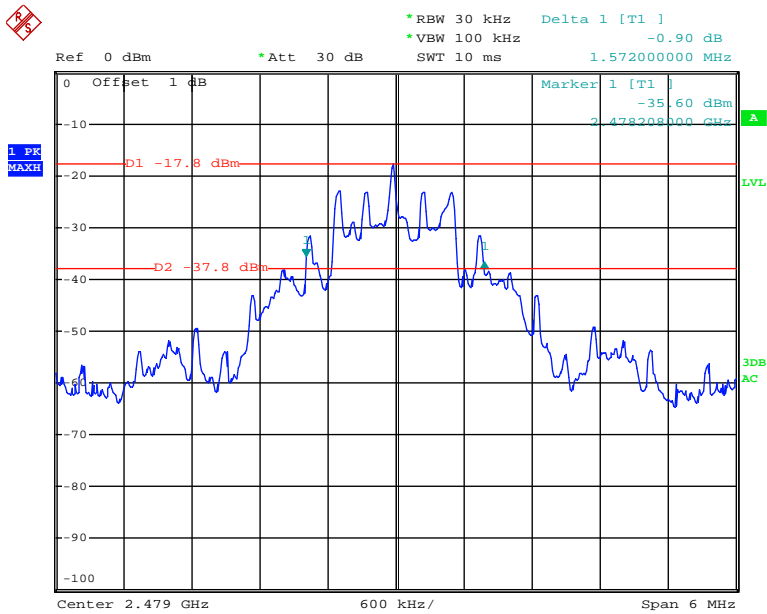
Date: 13.JUN.2017 16:03:28

### Middle Channel



Date: 13.JUN.2017 16:08:01

### High Channel



Date: 13.JUN.2017 16:12:10

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