



FCC PART 15.249

TEST REPORT

For

SZ DJI TECHNOLOGY CO., LTD

14th floor, West Wing, Skyworth Semiconductor Design Building NO.18 Gaoxin South 4th Ave,
Nanshan, Shenzhen, Guangdong, China

FCC ID: SS3-RD2412R1712

Report Type: Original Report	Product Name: High-Precision Rotation Microwave Radar
Report Number:	RDG171213003-00B
Report Date:	2018-01-19
Reviewed By:	Jerry Zhang EMC Manager
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *SZ DJI TECHNOLOGY CO., LTD*'s product, model number: **RD2412R** (FCC ID: **SS3-RD2412R1712**) (the "EUT") in this report was a **High-Precision Rotation Microwave Radar**, which was measured approximately: 10.9 cm (D) x 15.2 cm (H), rated input voltage: DC12V.

**All measurement and test data in this report was gathered from production sample serial number: 171213003 (Assigned by BAACL, Dongguan). The EUT was received on 2017-12-13.*

Objective

This type approval report is prepared on behalf of *SZ DJI 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, 15.207, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

N/A

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 and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
Unwanted Emissions, radiated	30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, 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. : 897218,the FCC Designation No. : CN1220.

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

SYSTEM TEST CONFIGURATION

Justification

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

EUT Exercise Software

No software was used in test, the device was configured to engineer mode by manufacturer, test channel switched by keys.

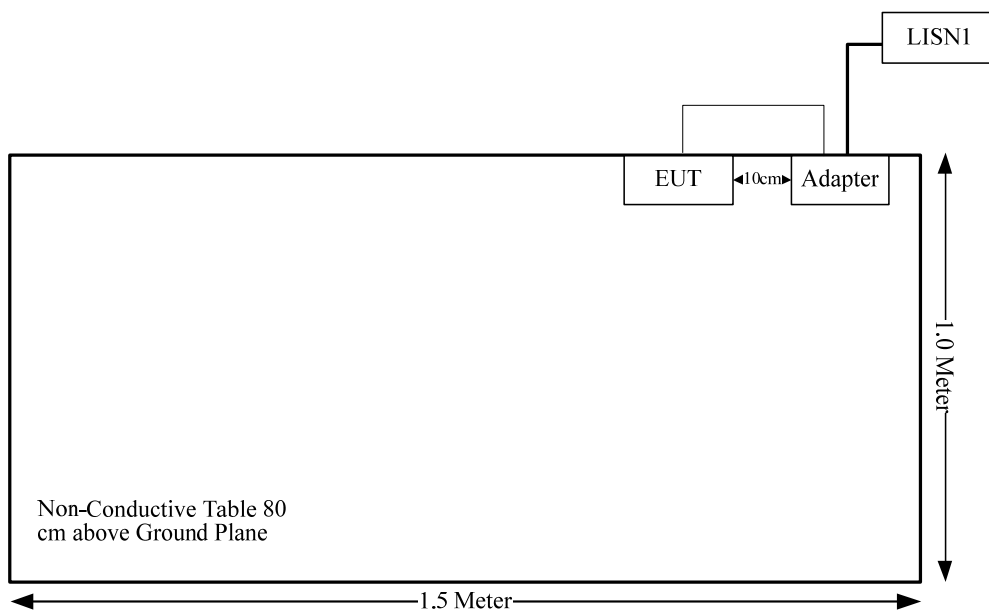
Equipment Modifications

No modifications were made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
TOTO LINK	adapter	DCP007B121500E	N/A

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§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

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 one internal antenna arrangement, and the antenna gain is 18.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

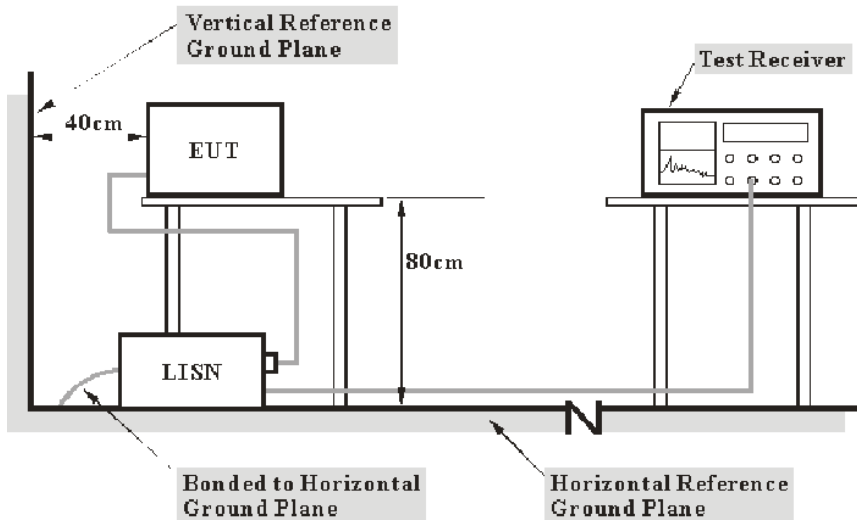
Result: Compliant.

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.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main LISN with a 120 V/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 adapter 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 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
R&S	EMI Test Receiver	ESCS 30	830245/006	2017/12/11	2018/12/11
R&S	L.I.S.N	ESH2-Z5	892107/021	2017/9/25	2018/9/25
R&S	Two-line V-network	ENV 216	101614	2017/12/8	2018/12/8
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
N/A	Coaxial Cable	C-NJNJ-50	C-0200-01	2017/9/5	2018/9/5

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

Test Data

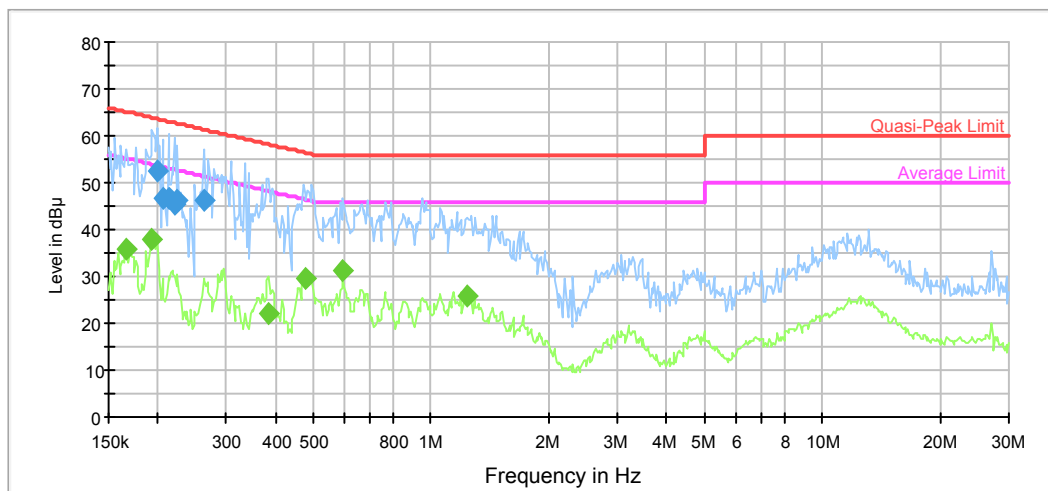
Environmental Conditions

Temperature:	25.9 °C
Relative Humidity:	37 %
ATM Pressure:	100.9 kPa

The testing was performed by Jim Zhang on 2018-01-02.

Test Mode: Transmitting

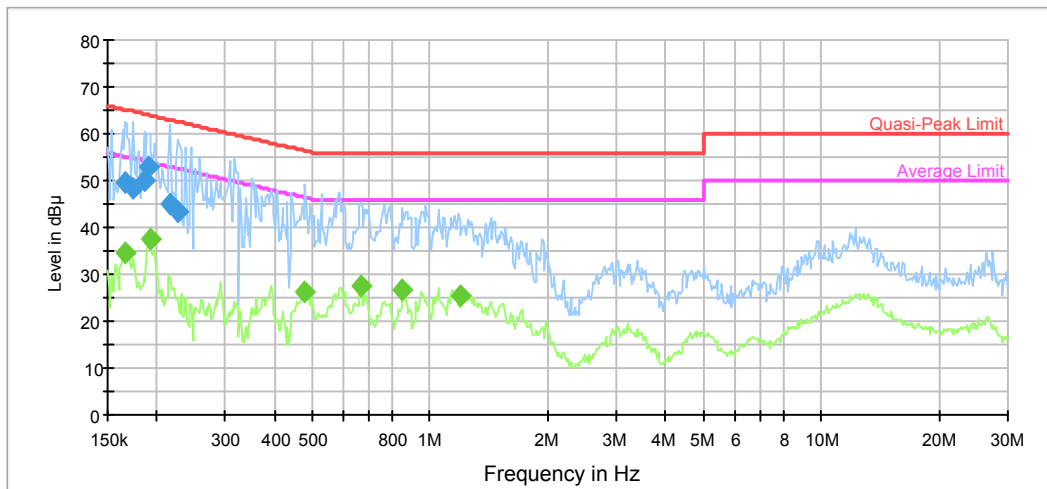
AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.199835	52.5	9.000	L1	10.6	11.1	63.6	Compliance
0.206306	46.6	9.000	L1	10.6	16.7	63.4	Compliance
0.212988	46.7	9.000	L1	10.5	16.4	63.1	Compliance
0.221645	45.5	9.000	L1	10.5	17.3	62.8	Compliance
0.225205	46.4	9.000	L1	10.5	16.2	62.6	Compliance
0.262017	46.2	9.000	L1	10.3	15.1	61.4	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.166371	35.8	9.000	L1	11.0	19.3	55.1	Compliance
0.193566	37.8	9.000	L1	10.7	16.1	53.9	Compliance
0.384091	22.3	9.000	L1	10.0	25.9	48.2	Compliance
0.476287	29.4	9.000	L1	9.9	17.0	46.4	Compliance
0.595338	31.1	9.000	L1	9.8	14.9	46.0	Compliance
1.239175	26.0	9.000	L1	9.8	20.0	46.0	Compliance

AC120V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.166371	49.7	9.000	N	10.9	15.4	65.1	Compliance
0.174519	48.5	9.000	N	10.9	16.3	64.7	Compliance
0.186006	49.8	9.000	N	10.7	14.4	64.2	Compliance
0.190505	52.8	9.000	N	10.7	11.2	64.0	Compliance
0.216409	45.1	9.000	N	10.5	17.9	63.0	Compliance
0.227007	43.2	9.000	N	10.5	19.4	62.6	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.166371	34.8	9.000	N	10.9	20.4	55.1	Compliance
0.192030	37.5	9.000	N	10.7	16.4	53.9	Compliance
0.476287	26.3	9.000	N	9.9	20.1	46.4	Compliance
0.665597	27.4	9.000	N	9.8	18.6	46.0	Compliance
0.852094	26.6	9.000	N	9.8	19.4	46.0	Compliance
1.190776	25.6	9.000	N	9.8	20.4	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:

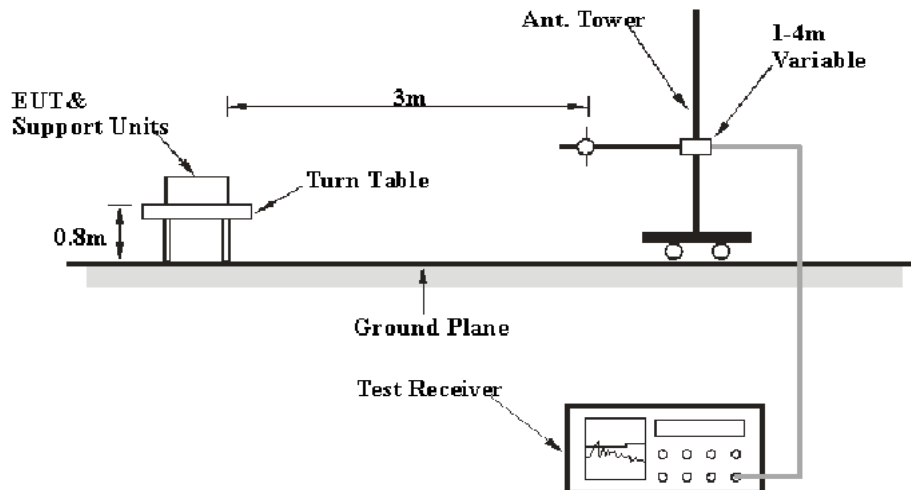
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

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

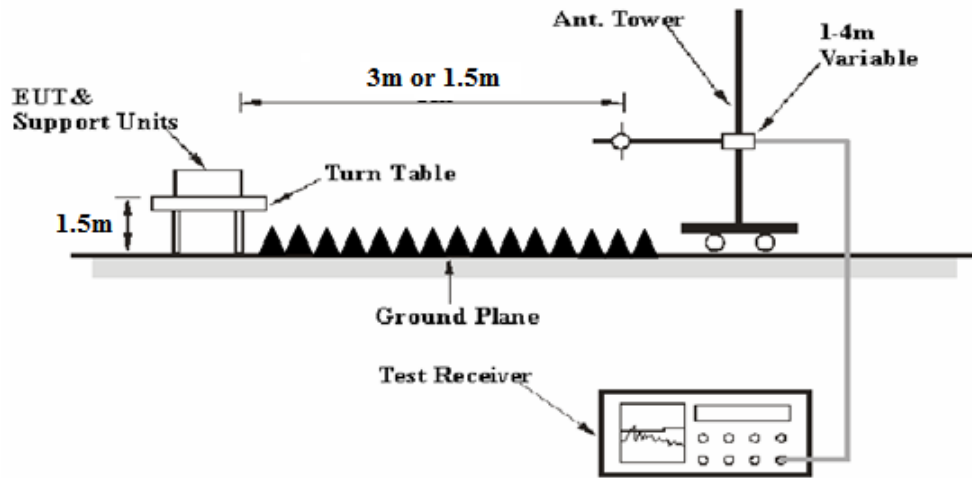
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters distance, 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.

According to C63.10, the above 40GHz test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 0.5m

Distance extrapolation factor = $20 \log(\text{specific distance [3m]}/\text{test distance [0.5m]})$ dB

Extrapolation result = Corrected Amplitude (dB μ V/m) - distance extrapolation factor (15.56dB)

For above 40GHz, external harmonic mixers are utilized. The antenna is scanned around the entire perimeter surface of the EUT, in both horizontal and vertical polarizations, at the distance of 0.5m from the EUT. The Mixers and it's RF cables is compose a system for calibration, the conversion factor was added into the test Spectrum Analyzer in testing.

Test Equipment Setup

The system was investigated from 30 MHz to 100 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	Measurement
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
Sunol Sciences	Antenna	JB3	A060611-1	2017/11/10	2020/11/10
HP	Amplifier	8447D	2727A05902	2017/9/5	2018/9/5
R&S	EMI Test Receiver	ESCI	100224	2017/9/1	2018/9/1
Agilent	Spectrum Analyzer	E4440A	SG43360054	2017/12/08	2018/12/08
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016/1/5	2019/1/5
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017/9/5	2018/9/5
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2016/11/18	2019/11/18
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2017/6/27	2018/6/27
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-01 1302	2016/11/18	2019/11/18
N/A	Coaxial Cable	C-NJNJ-50	C-0400-01	2017/9/5	2018/9/5
N/A	Coaxial Cable	C-NJNJ-50	C-0075-01	2017/9/5	2018/9/5
N/A	Coaxial Cable	C-NJNJ-50	C-1000-01	2017/9/5	2018/9/5
N/A	Coaxial Cable	C-SJSJ-50	C-0800-01	2017/9/5	2018/9/5
R&S	Spectrum Analyzer	8564E	3943A01781	2017/1/6	2018/1/6
Agilent	Harmonic Mixer	11970U	2332A00853	2017/08/16	2019/08/15
Flann Microwave	Horn Antenna	24245-AB	26	N/A	N/A
Agilent	Harmonic Mixer	11970V	2521A011767	2017/08/16	2019/08/15
Alpha Industries	Horn Antenna	861V/385	736	N/A	N/A
Agilent	Harmonic Mixer	11970W	2521A00597	2017/08/16	2018/08/15
Alpha Industries	Horn Antenna	861W/387	355	N/A	N/A
Agilent	Coaxial Cable	1m	N/A	2017/05/06	2018/05/06
Agilent	Coaxial Cable	1m	N/A	2017/05/06	2018/05/06

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

Test Data

Environmental Conditions

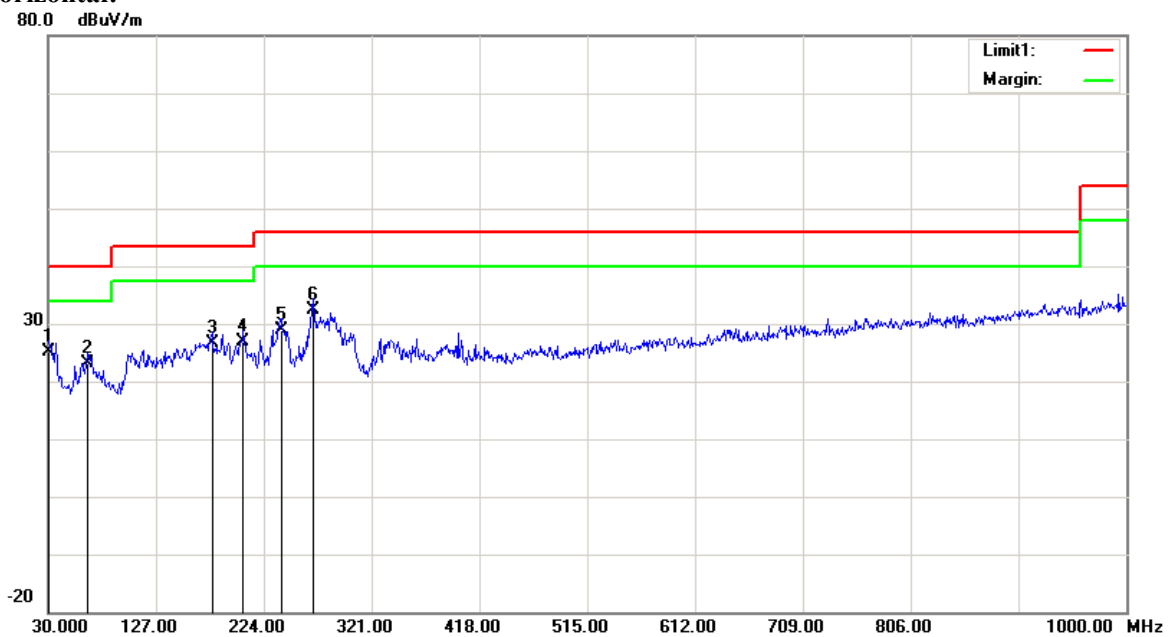
Temperature:	22.4~25.5 °C
Relative Humidity:	30.6~35 %
ATM Pressure:	101.6~102.7 kPa

The testing was performed by Steven Zuo from 2017-12-21 to 2017-12-26.

Test Mode: Transmitting

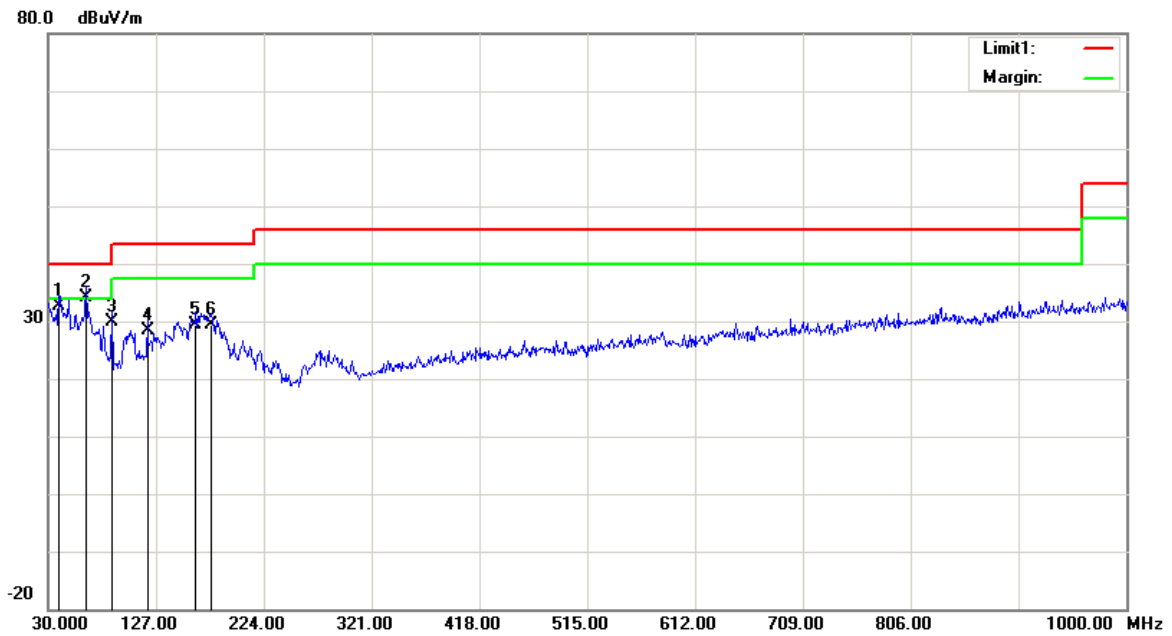
1) 30MHz-1GHz:

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	24.75	QP	0.35	25.10	40.00	14.90
64.9200	34.97	QP	-11.87	23.10	40.00	16.90
177.4400	34.35	QP	-7.75	26.60	43.50	16.90
205.5700	33.85	QP	-7.05	26.80	43.50	16.70
239.5200	35.12	QP	-6.22	28.90	46.00	17.10
268.6200	36.55	QP	-4.15	32.40	46.00	13.60

Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
39.7000	38.79	QP	-6.09	32.70	40.00	7.30
63.9500	46.15	QP	-11.95	34.20	40.00	5.80
87.2300	40.95	QP	-11.15	29.80	40.00	10.20
119.2400	33.33	QP	-4.93	28.40	43.50	15.10
162.8900	36.35	QP	-6.85	29.50	43.50	14.00
176.4700	37.23	QP	-7.73	29.50	43.50	14.00

2) 1GHz-40GHz

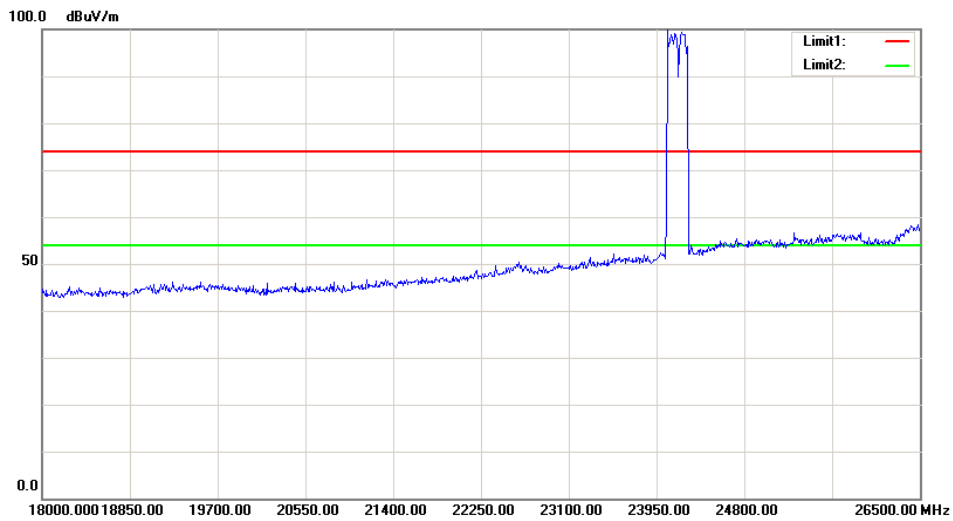
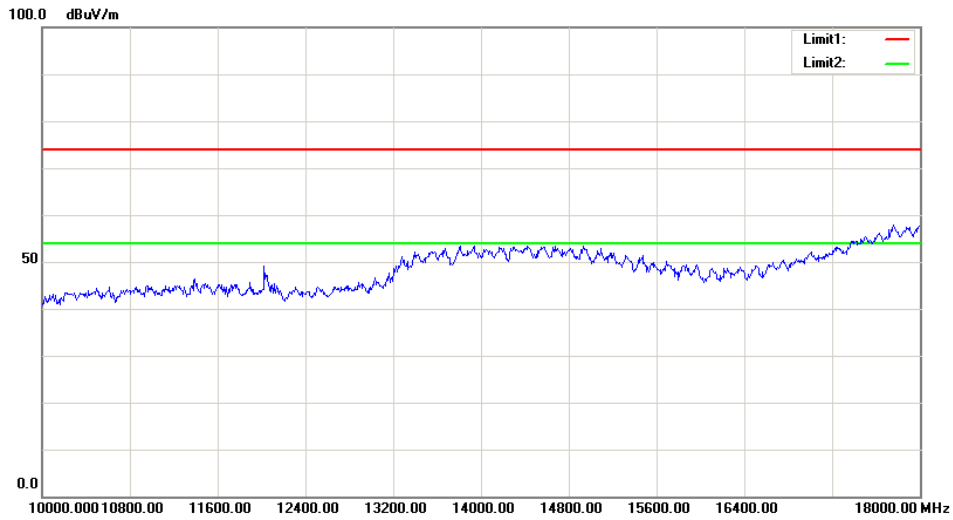
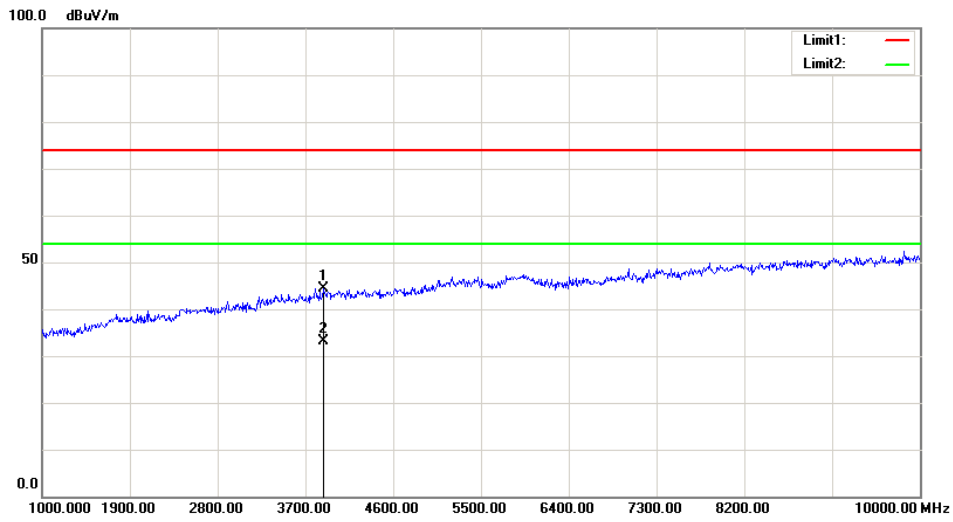
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
	Reading (dB μ V)	Detector	Polar (H/V)	Factor (dB(1/m))					
24150	91.36	PK	H	35.41	20.19	37.12	109.84	127.96	18.12
24150	89.28	AV	H	35.41	20.19	37.12	107.76	107.96	0.20
24150	66.95	PK	V	35.41	20.19	37.12	85.43	127.96	42.53
24150	65.89	AV	V	35.41	20.19	37.12	84.37	107.96	23.59
24000	43.07	PK	H	35.35	19.96	37.40	60.98	74.00	13.02
24000	19.84	AV	H	35.35	19.96	37.40	37.75	54.00	16.25
24250	38.17	PK	H	35.45	20.33	36.94	57.01	74.00	16.99
24250	18.42	AV	H	35.45	20.33	36.94	37.26	54.00	16.74
24328	32.64	PK	H	35.47	20.45	36.79	51.77	74.00	22.23
24328	18.57	AV	H	35.47	20.45	36.79	37.70	54.00	16.30
25143	32.26	PK	V	35.76	20.76	36.23	52.55	74.00	21.45
25143	18.49	AV	V	35.76	20.76	36.23	38.78	54.00	15.22

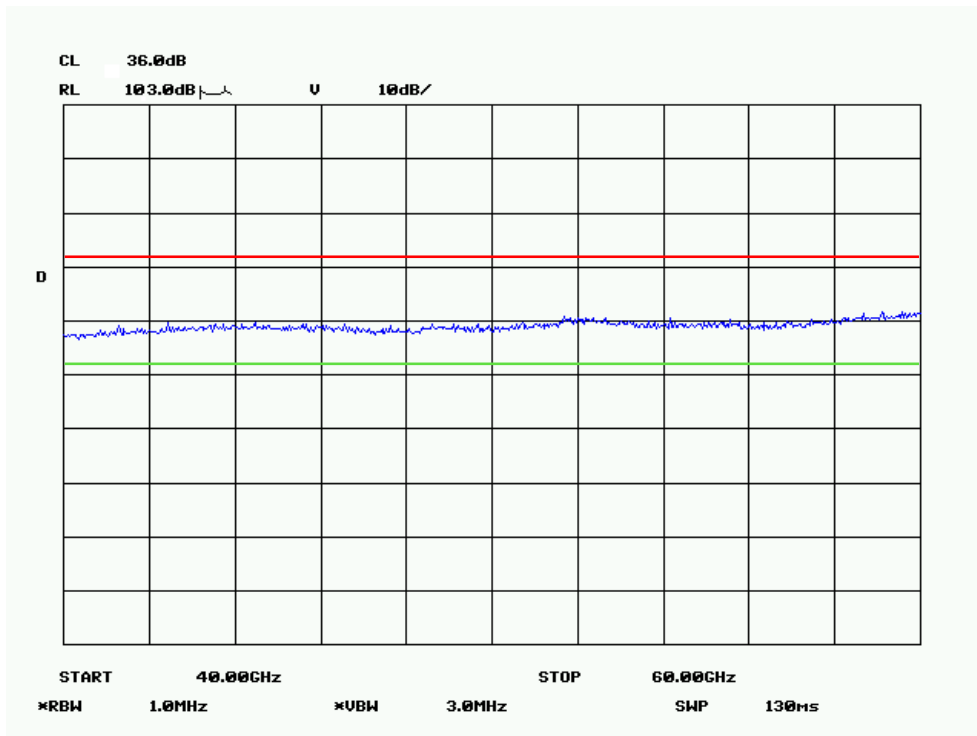
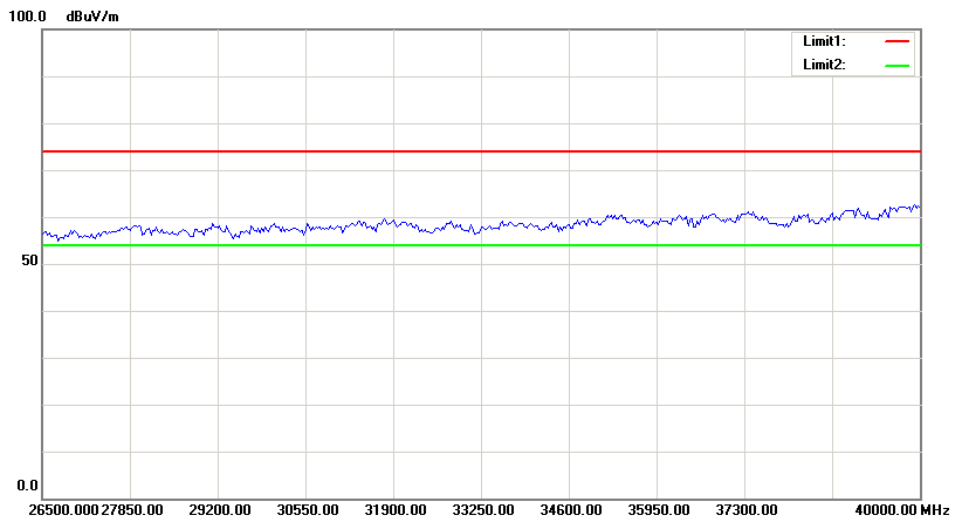
40GHz-100GHz

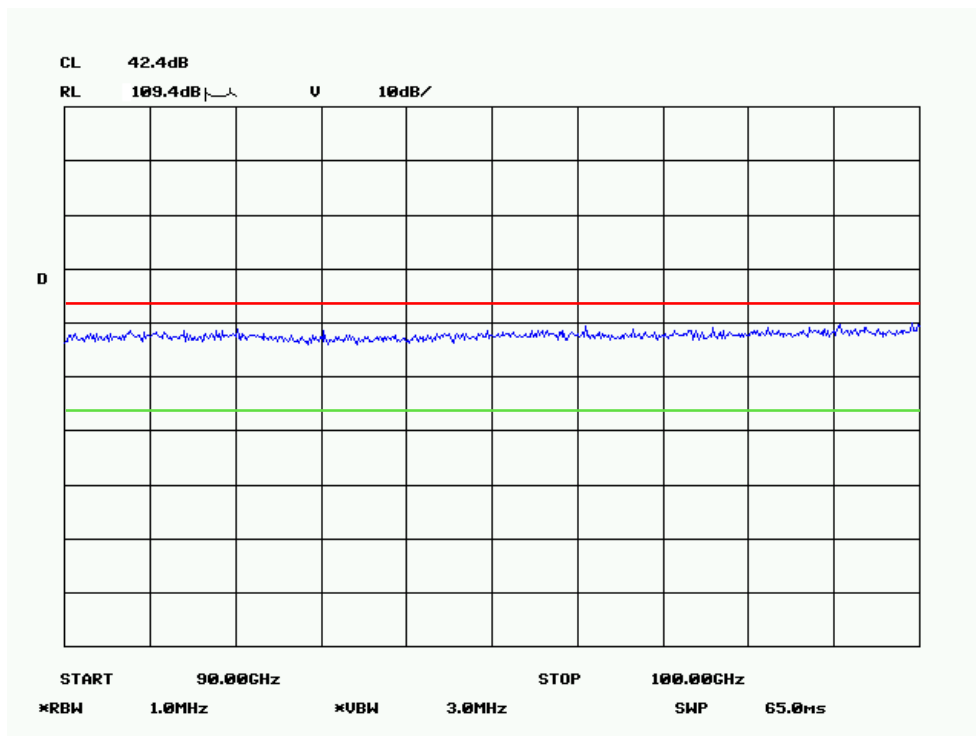
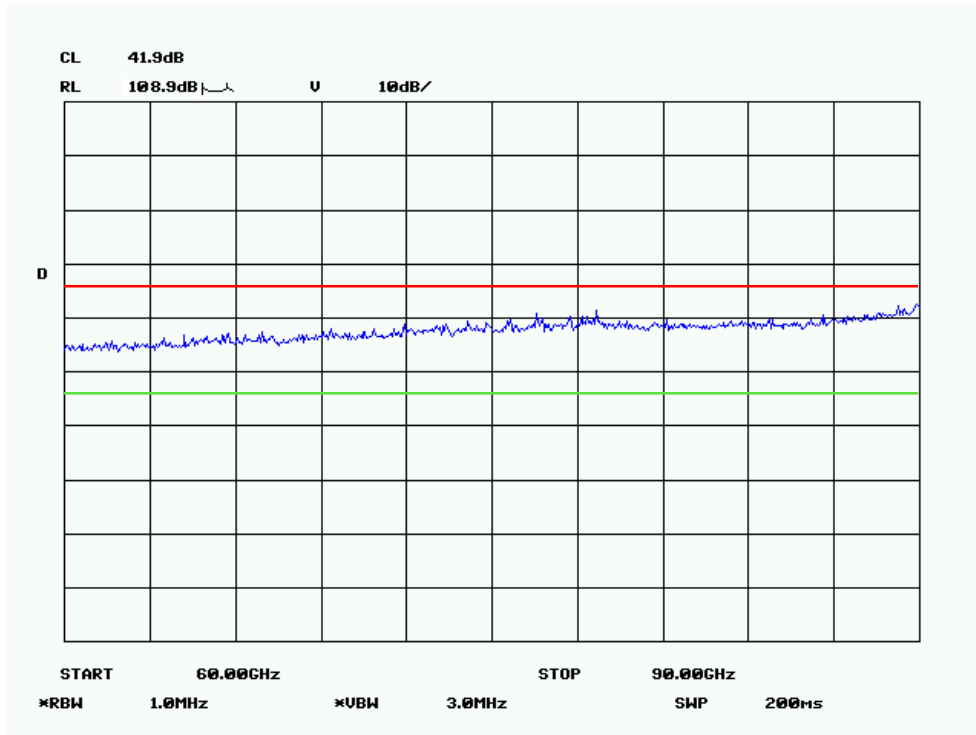
Frequency (GHz)	Receiver		Rx Antenna		Corrected Amplitude (dB μ V/m)	Extrapolation result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
	Reading (dB μ V)	Detector	Polar (H/V)	Factor (dB(1/m))				
48.25	36.55	PK	H	40.40	76.95	61.39	74.00	12.61
48.25	17.74	AV	H	40.40	58.14	42.58	54.00	11.42
72.45	37.47	PK	H	44.92	82.39	66.83	74.00	7.17
72.45	17.08	AV	H	44.92	62.00	46.44	54.00	7.56
96.48	39.86	PK	H	49.41	89.27	73.71	74.00	0.29
96.48	18.42	AV	H	49.41	67.83	52.27	54.00	1.73

Note: 1. for the range 40-100GHz, the test performed at the distance 0.5m.

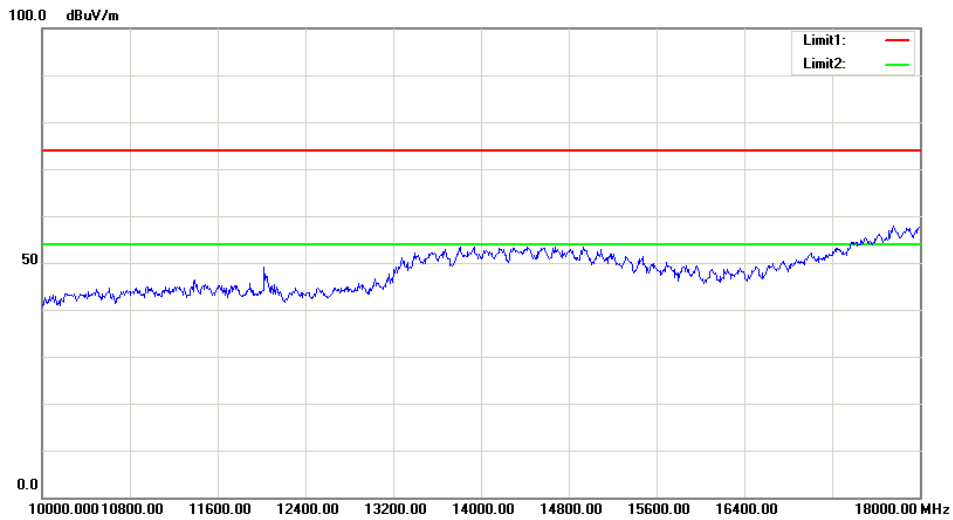
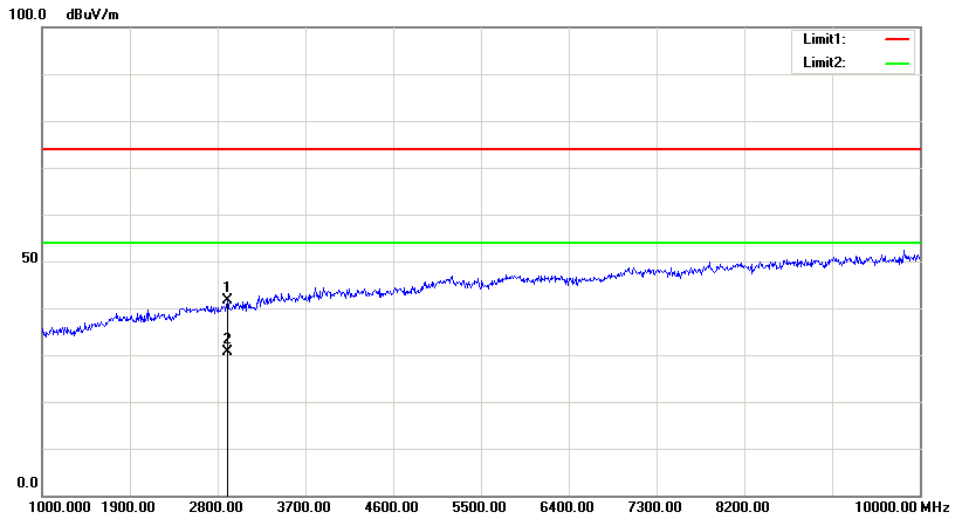
Test plots Horizontal

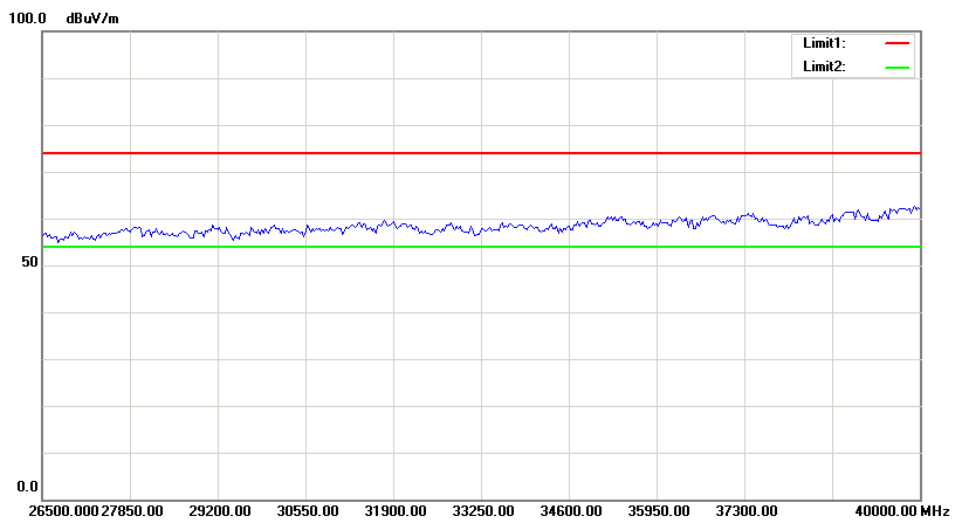
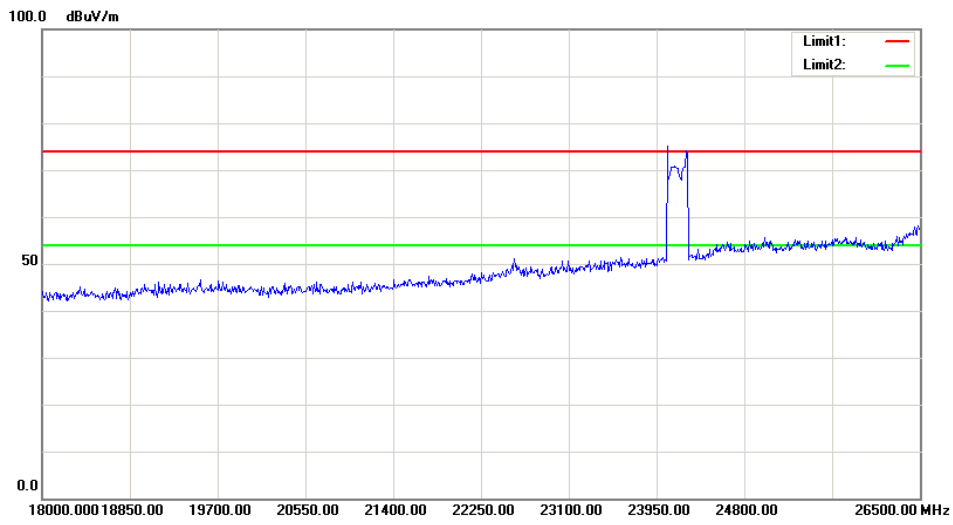


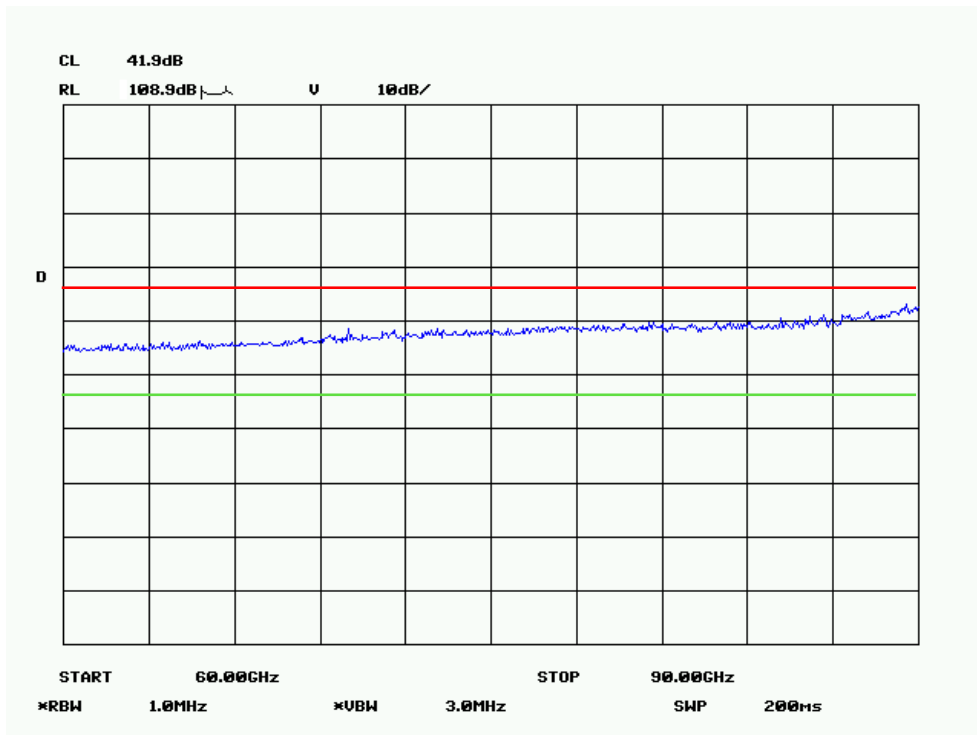
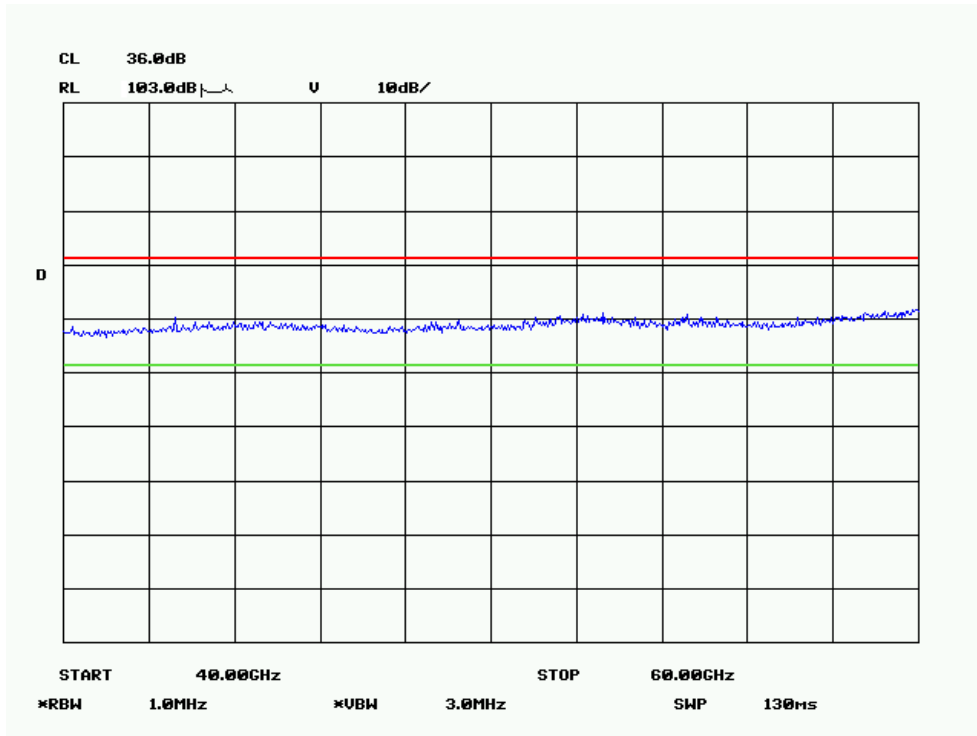


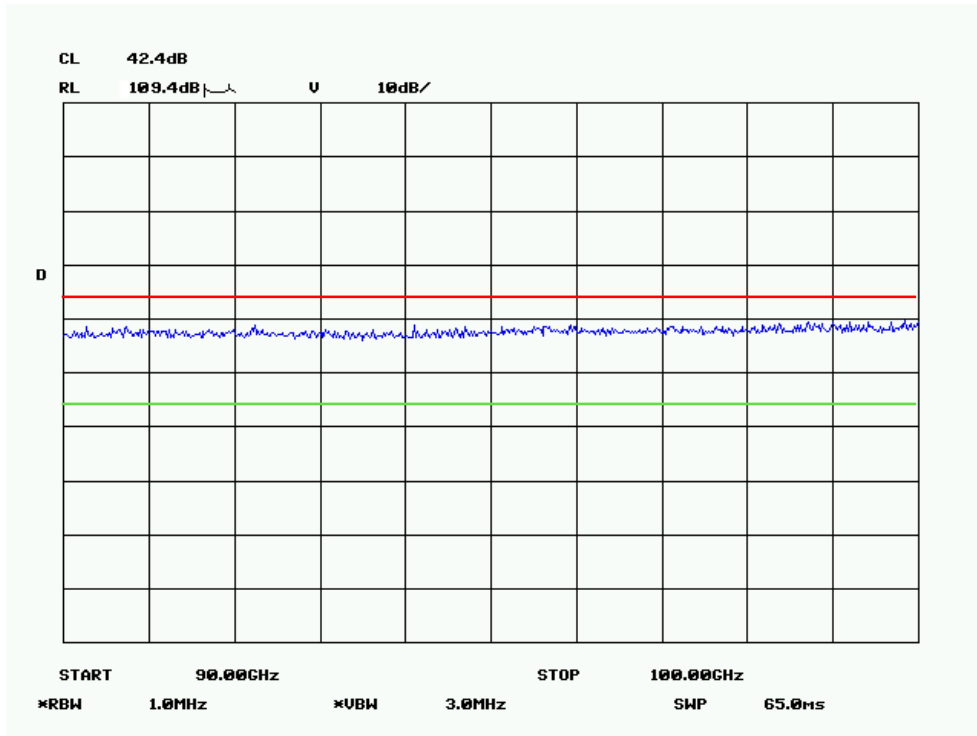


Vertical









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
R&S	Spectrum Analyzer	FSIQ 26	831929/005	2017/8/31	2018/8/31
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2016/11/18	2019/11/18
Quinstar	Amplifier	QLW- 18405536-JO	15964001001	2017/6/27	2018/6/27
N/A	Coaxial Cable	C-SJSJ-50	C-0800-01	2017/9/5	2018/9/5

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

Test Data

Environmental Conditions

Temperature:	24.3 °C
Relative Humidity:	39 %
ATM Pressure:	101.6 kPa

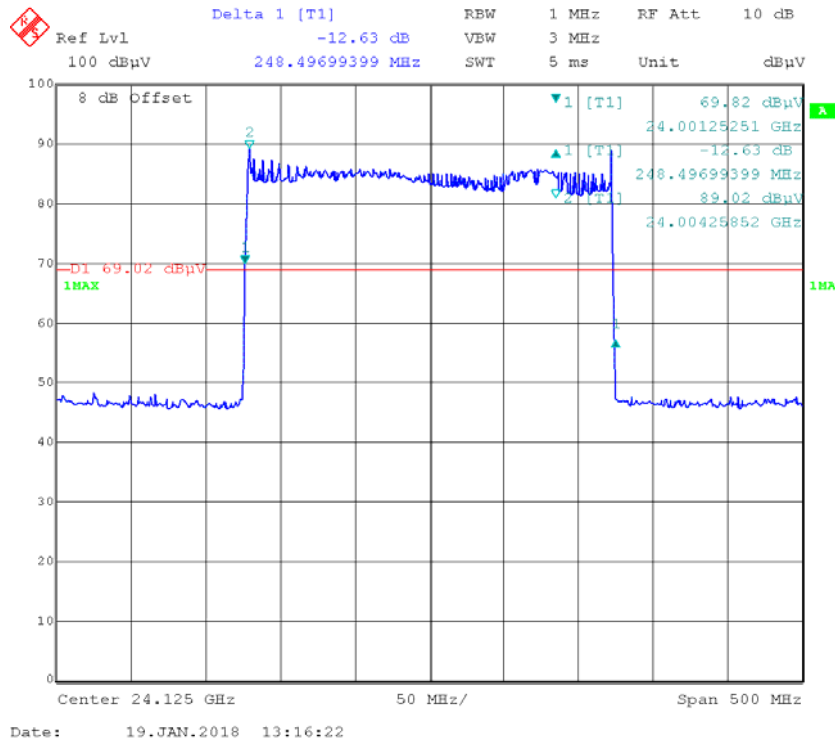
The testing was performed by Emily Wang on 2018-01-19.

Test Result: Compliant.

Please refer to following tables and plots

Test Mode: Transmitting

Frequency (MHz)	20 dB Bandwidth (MHz)
24000-24250	248.497



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