TESTING LABORATORY
CERTIFICATE # 4821.01

FCC PART 15.249

TEST REPORT

For

JM Manufacturing (HK) Ltd.

Unit G, 4/F Kaiser Estate, Phase 2,No. 47-53 Man Yue Street, Hung Hom, Kowloon, Hong Kong

FCC ID: 2AHGJJMS3060-27-1

Report Type:	**Product Type:**
Original Report	2.4G Radio control raptor helicopter remote controller

Report Number:	RSZ200722830-00
Report Date:	2020-08-05
Reviewed By:	Jimmy Xiao RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	2.4G Radio control raptor helicopter remote controller
Model	JMS-BJS1098
Frequency Range	2420-2465MHz
Maximum Field Strength	89.77dBuV/m @3m
Antenna Specification	0dBi
Voltage Range	DC 6*1.5V batteries
Date of Test	2020/07/28~2020/07/29
Sample serial number	RSZ200722830-RF-S1 (Assigned by BACL, Shenzhen)
Received date	2020/07/22
Sample/EUT Status	Good condition

Objective

This type approval report is prepared on behalf of *JM Manufacturing (HK) 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 Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

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 radiated and conducted 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		±0.73dB
RF conducted test with spectrum		±1.6dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1℃
Humidity		±6%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

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

Justification

The system was configured for testing by manufacturer.

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2420	23	2443
1	2421	24	2444
2	2422	25	2445
3	2423	26	2446
4	2424	27	2447
5	2425	28	2448
6	2426	29	2449
7	2427	30	2450
8	2428	31	2451
9	2429	32	2452
10	2430	33	2453
11	2431	34	2454
12	2432	35	2455
13	2433	36	2456
14	2434	37	2457
15	2435	38	2458
16	2436	39	2459
17	2437	40	2460
18	2438	41	2461
19	2439	42	2462
20	2440	43	2463
21	2441	44	2464
22	2442	45	2465

Channel 0, Channel 25 and Channel 45 were selected for testing.

EUT Exercise Software

No exercise software was used.

Equipment Modifications

No modifications were made to the unit tested.

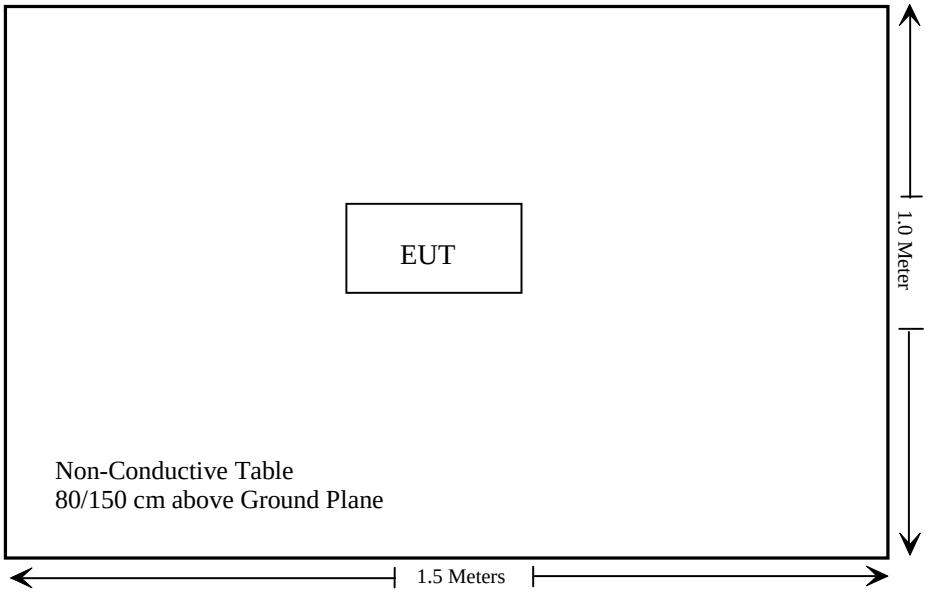
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

Support Cable Descriptions

Cable Description	Length (m)	From/Port	To
/	/	/	/

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	Not Applicable
15.205, §15.209, §15.249(d)	Radiated Emissions& Outside of Band Emission	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

Not Applicable: The device is powered by battery only.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102455	2020/7/9	2021/7/8
Sonoma instrument	Pre-amplifier	310 N	186238	2020/4/20	2021/4/19
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/7/22	2021/7/21
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2020/4/20	2021/4/19
Ducommun Technolagies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/6	2020/12/5

*** 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§15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has one internal antenna which was permanently attached and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC§15.205, §15.209 & §15.249(d) - 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.

As per FCC§15.249 (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.

Test Equipment Setup

The system was investigated from 30 MHz to 25 GHz.

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	Unknown	PK
	1 MHz	10 Hz	Unknown	Average

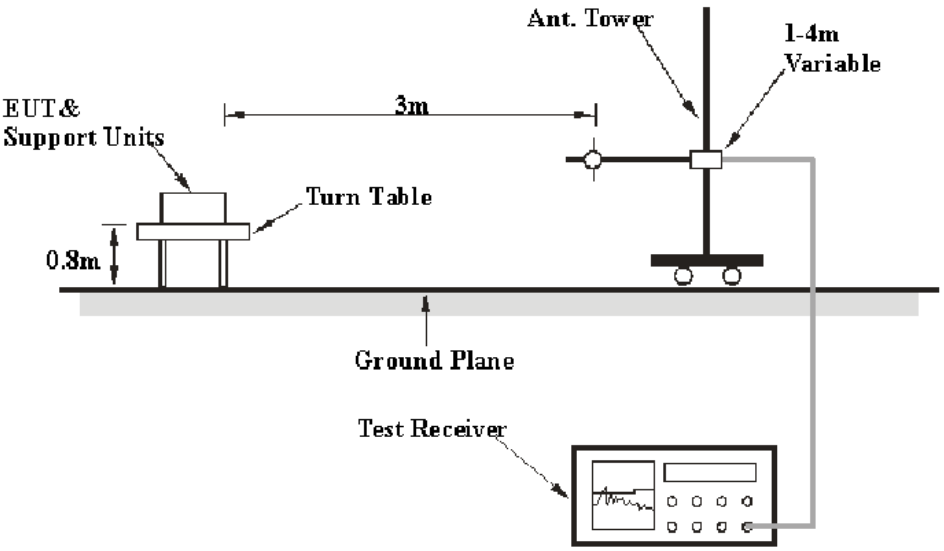
Test Procedure

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

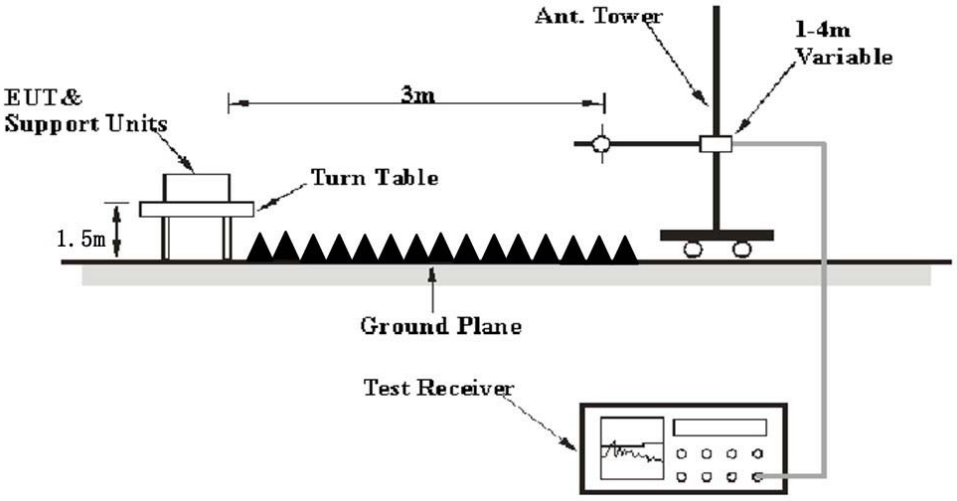
All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

EUT Setup

Below 1GHz:



Above 1GHz:



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 Procedure

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

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 mete, and the EUT is placed on a turntable, which is 0.8 meter above ground plane for below 1GHz or 1.5 meter for above 1GHz, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – Corrected Amplitude

Test Data

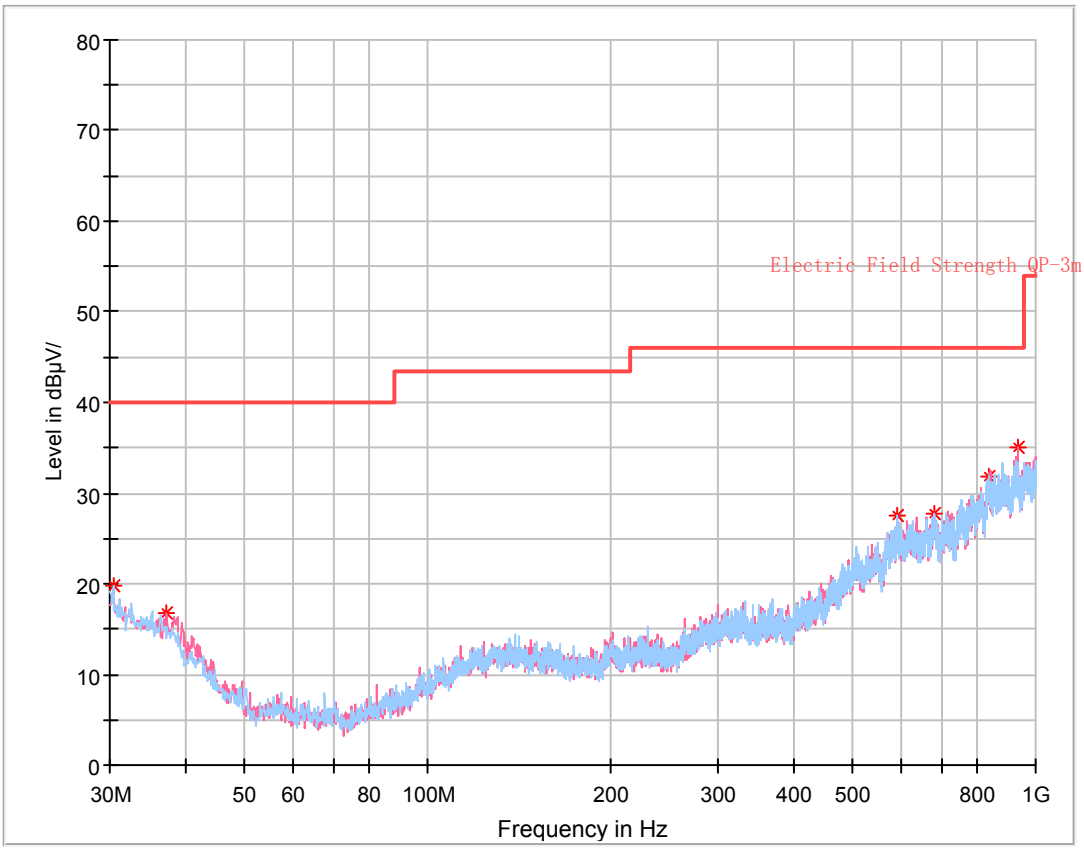
Environmental Conditions

Temperature:	28 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Holland Yang on 2020-07-29 for below 1GHz and by Leo Huang on 2020-07-28 for above 1GHz.

Test Mode: Transmitting

30MHz – 1 GHz (worst case is middle channel):



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.363750	19.79	205.0	H	183.0	-7.9	40.00	20.21
37.275000	16.87	305.0	V	120.0	-12.0	40.00	23.13
590.538750	27.46	390.0	H	61.0	-2.1	46.00	18.54
680.142500	27.83	390.0	H	105.0	-1.4	46.00	18.17
835.342500	31.80	105.0	H	126.0	2.7	46.00	14.20
933.918750	34.95	305.0	V	45.0	4.8	46.00	11.05

Above 1 GHz:

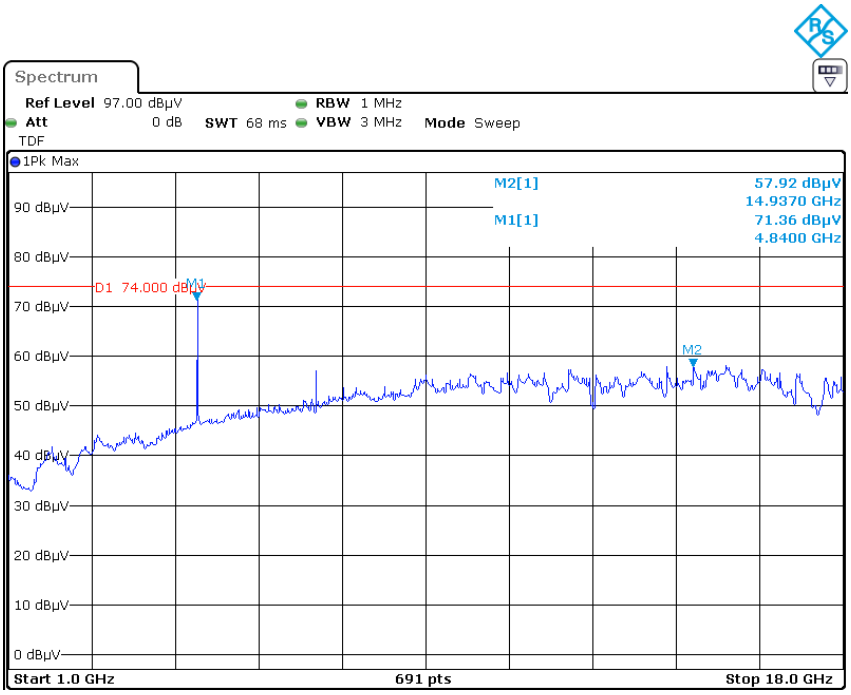
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.249&15.209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2420 MHz)									
2420.00	57.22	PK	294	1.1	H	31.97	89.19	114	24.81
2420.00	48.11	Ave.	294	1.1	H	31.97	80.08	94	13.92
2420.00	50.97	PK	49	2.0	V	31.97	82.94	114	31.06
2420.00	41.26	Ave.	49	2.0	V	31.97	73.23	94	20.77
2343.86	27.79	PK	313	2.3	H	31.64	59.43	74	14.57
2343.86	13.55	Ave.	313	2.3	H	31.64	45.19	54	8.81
2400.00	27.36	PK	2	1.2	H	31.87	59.23	74	14.77
2400.00	13.43	Ave.	2	1.2	H	31.87	45.30	54	8.70
2483.69	27.36	PK	101	1.7	H	32.13	59.49	74	14.51
2483.69	13.42	Ave.	101	1.7	H	32.13	45.55	54	8.45
4840.00	66.50	PK	25	1.6	H	6.28	72.78	74	1.22
4840.00	32.77	Ave.	25	1.6	H	6.28	39.05	54	14.95
7260.00	48.61	PK	240	1.1	H	11.56	60.17	74	13.83
7260.00	28.08	Ave.	240	1.1	H	11.56	39.64	54	14.36
Middle Channel (2445 MHz)									
2445.00	57.80	PK	342	2.0	H	31.97	89.77	114	24.23
2445.00	48.61	Ave.	342	2.0	H	31.97	80.58	94	13.42
2445.00	51.13	PK	320	2.1	V	31.97	83.10	114	30.90
2445.00	42.36	Ave.	320	2.1	V	31.97	74.33	94	19.67
4890.00	64.19	PK	313	2.3	H	6.76	70.95	74	3.05
4890.00	32.28	Ave.	313	2.3	H	6.76	39.04	54	14.96
7335.00	47.78	PK	334	1.4	H	11.66	59.44	74	14.56
7335.00	29.12	Ave.	334	1.4	H	11.66	40.78	54	13.22

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.249&15.209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2465 MHz)									
2465.00	57.56	PK	35	2.1	H	32.03	89.59	114	24.41
2465.00	48.58	Ave.	35	2.1	H	32.03	80.61	94	13.39
2465.00	51.36	PK	309	1.0	V	32.03	83.39	114	30.61
2465.00	42.73	Ave.	309	1.0	V	32.03	74.76	94	19.24
2327.89	27.83	PK	136	1.6	H	31.64	59.47	74	14.53
2327.89	13.56	Ave.	136	1.6	H	31.64	45.20	54	8.80
2488.05	27.79	PK	65	1.6	H	32.13	59.92	74	14.08
2488.05	13.62	Ave.	65	1.6	H	32.13	45.75	54	8.25
4930.00	63.27	PK	321	2.1	H	6.76	70.03	74	3.97
4930.00	32.25	Ave.	321	2.1	H	6.76	39.01	54	14.99
7395.00	46.25	PK	104	1.1	H	12.39	58.64	74	15.36
7395.00	28.35	Ave.	104	1.1	H	12.39	40.74	54	13.26

Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) +cable loss – amplifier factor
Margin = Limit- Corr. Amplitude
The emission more than4dB below the limit was not required to be recorded.

Pre-scan with Low channel Peak

Horizontal



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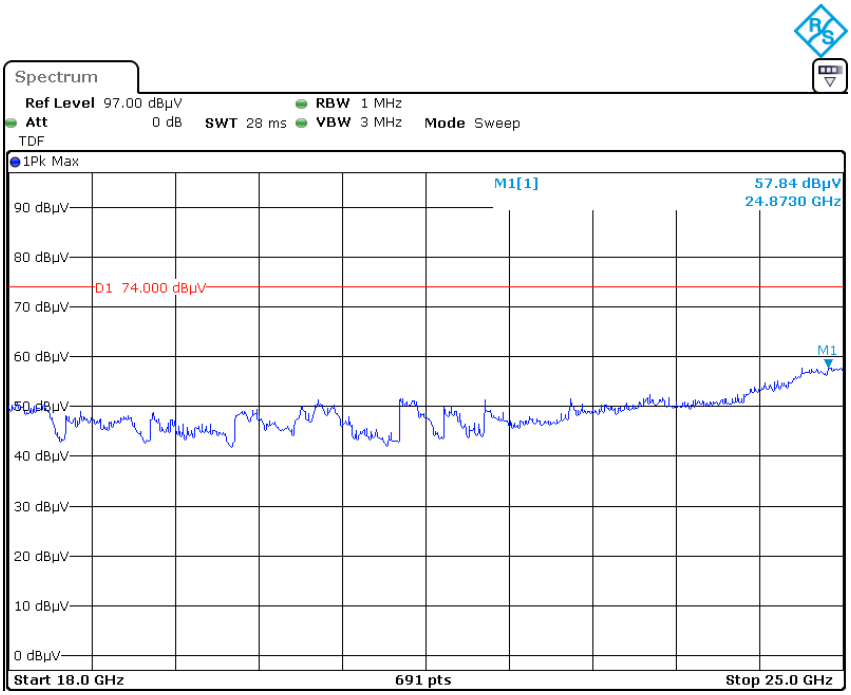

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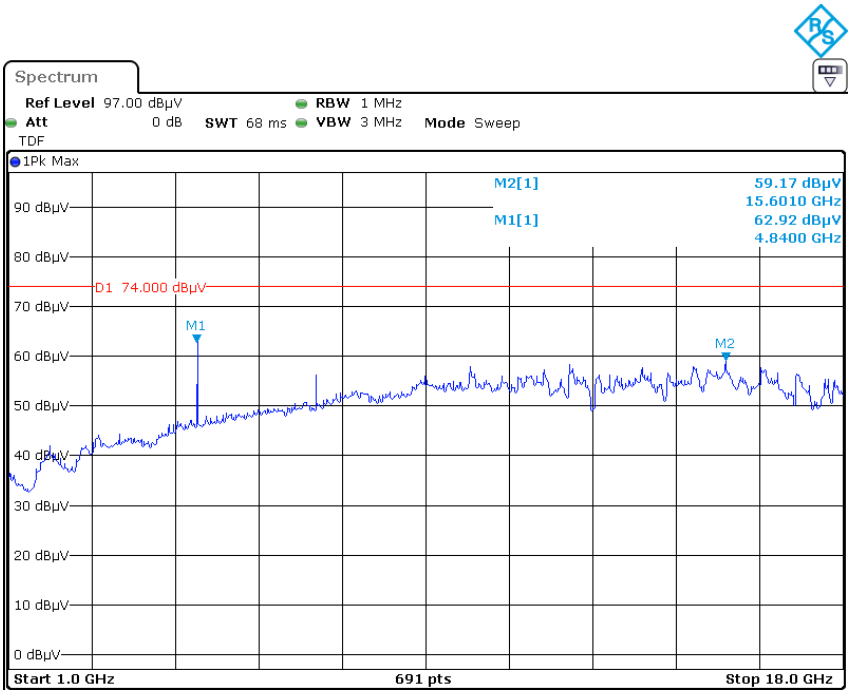
Vertical



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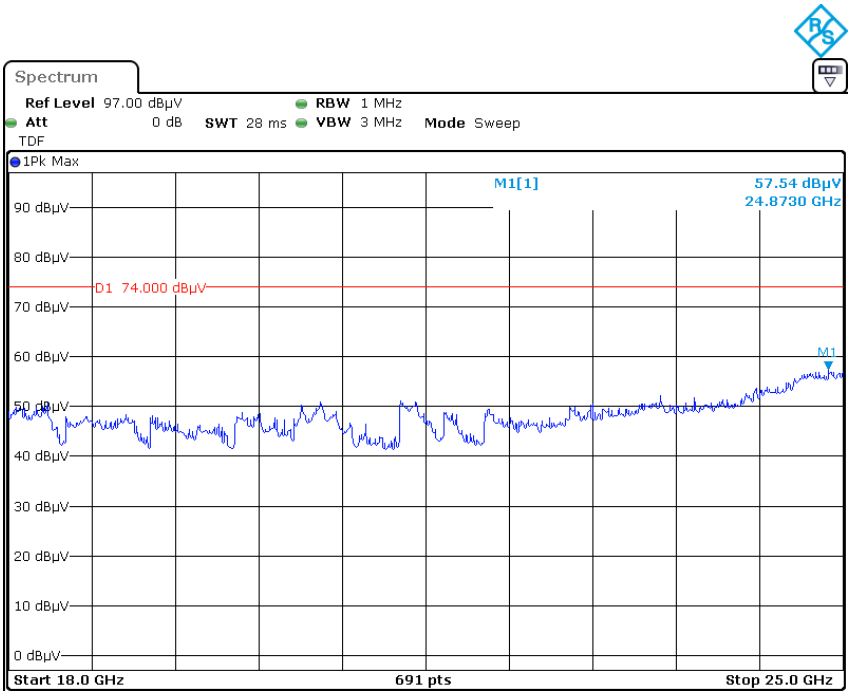

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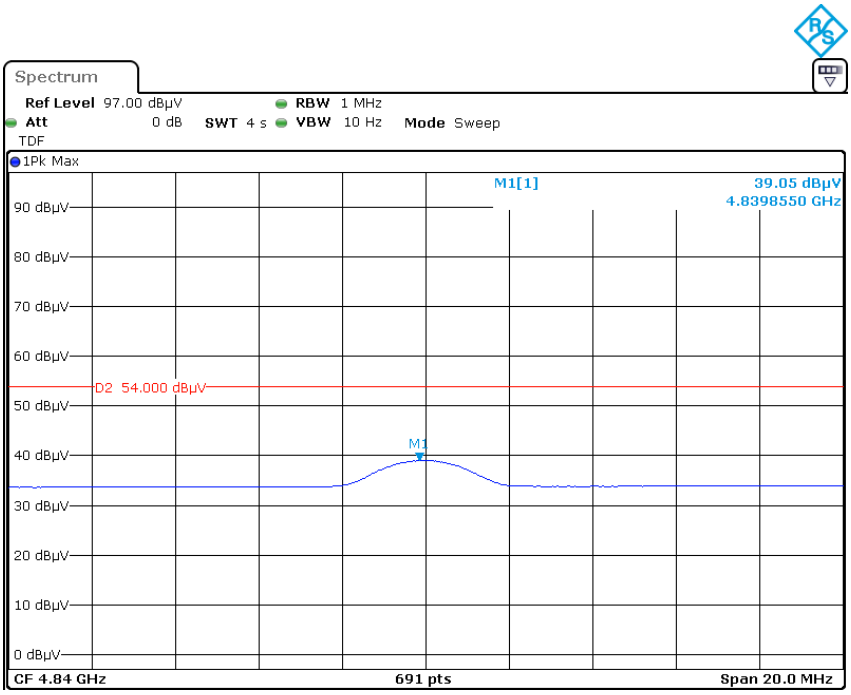
Average

Horizontal



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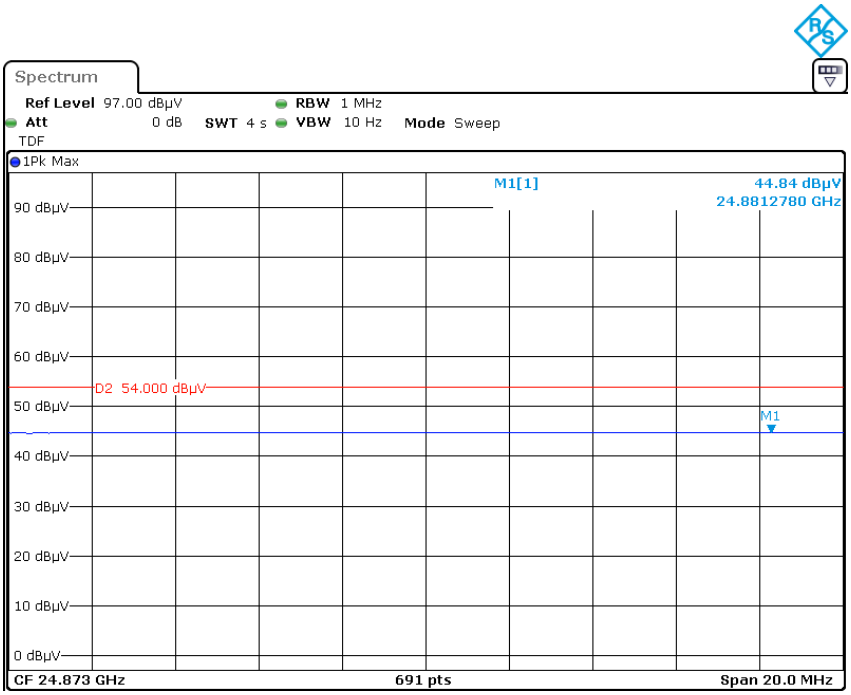

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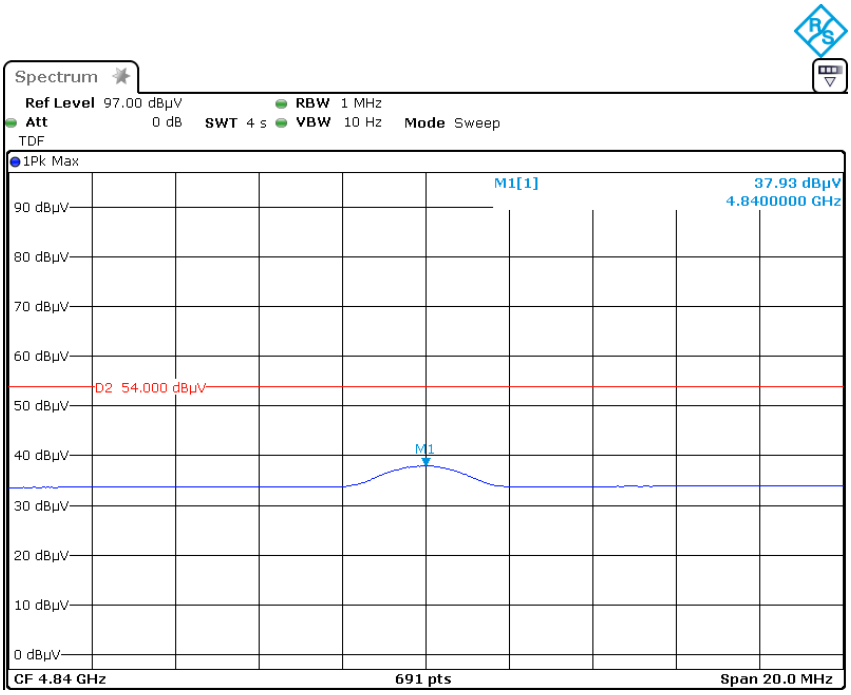

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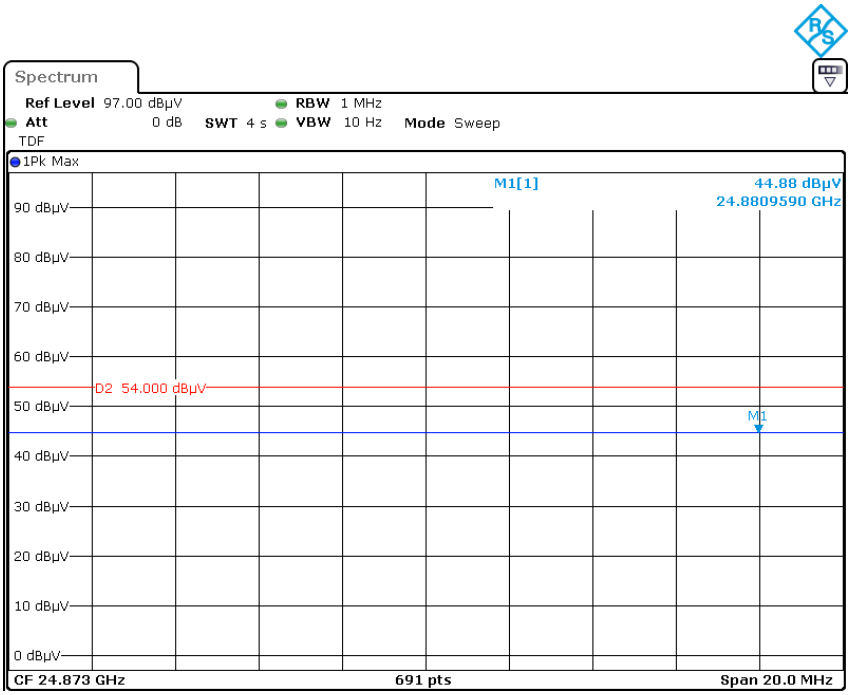

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FCC§15.215(c) - 20DB EMISSION BANDWIDTH

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

Per ANSI C63.10-2013 §6.9

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

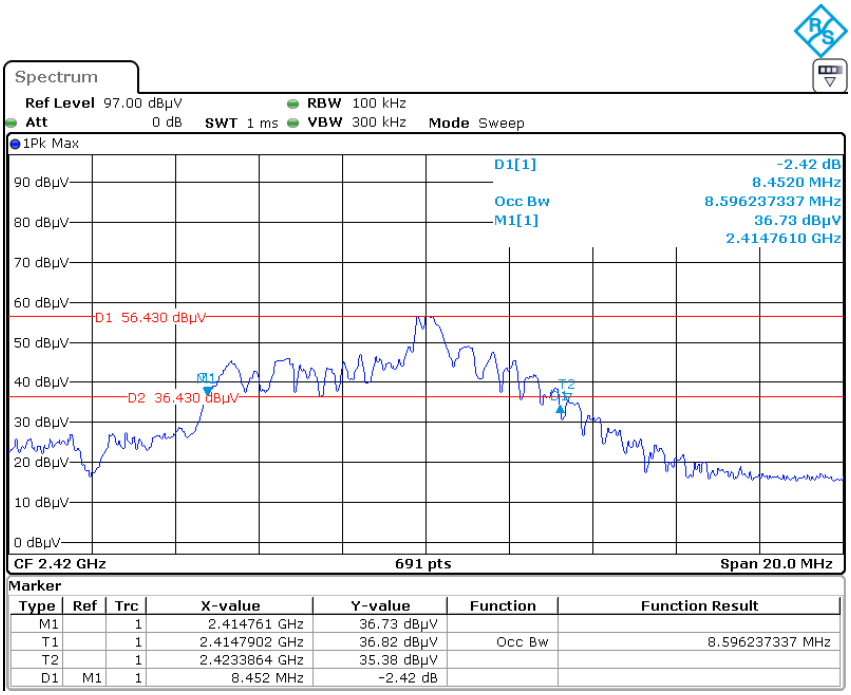
The testing was performed by Leo Huang on 2020-07-28.

Test Mode: Transmitting

Please refer to the following table and plots.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2420	8.452
Middle	2445	8.249
High	2465	8.741

Low Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.414761 GHz	36.73 dBµV		
T1		1	2.4147902 GHz	36.82 dBµV	Occ Bw	8.596237337 MHz
T2		1	2.4233864 GHz	35.38 dBµV		
D1	M1	1	8.452 MHz	-2.42 dB		

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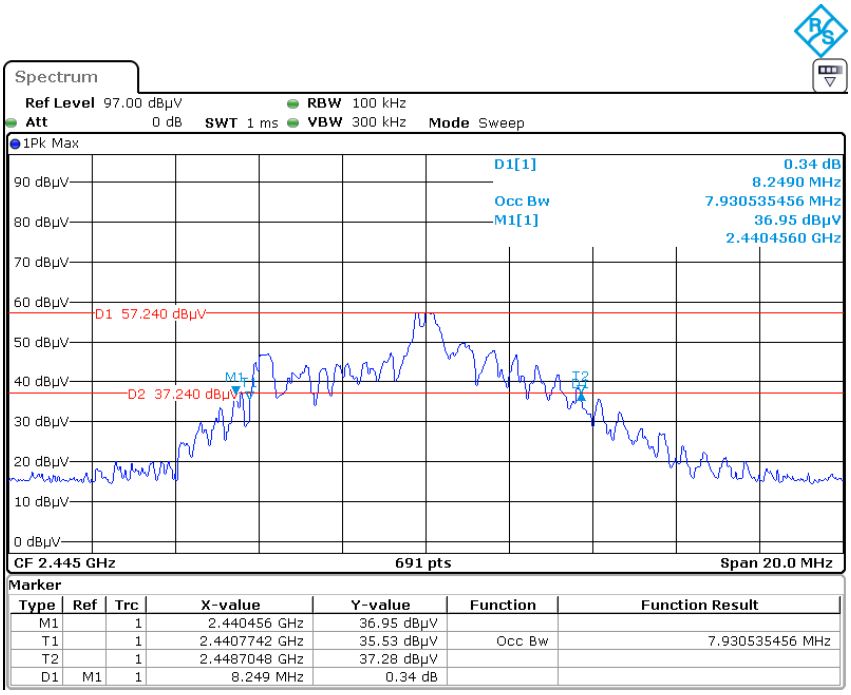
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.440456 GHz	36.95 dBµV		
T1		1	2.4407742 GHz	35.53 dBµV	Occ Bw	7.930535456 MHz
T2		1	2.4487048 GHz	37.28 dBµV		
D1	M1	1	8.249 MHz	0.34 dB		

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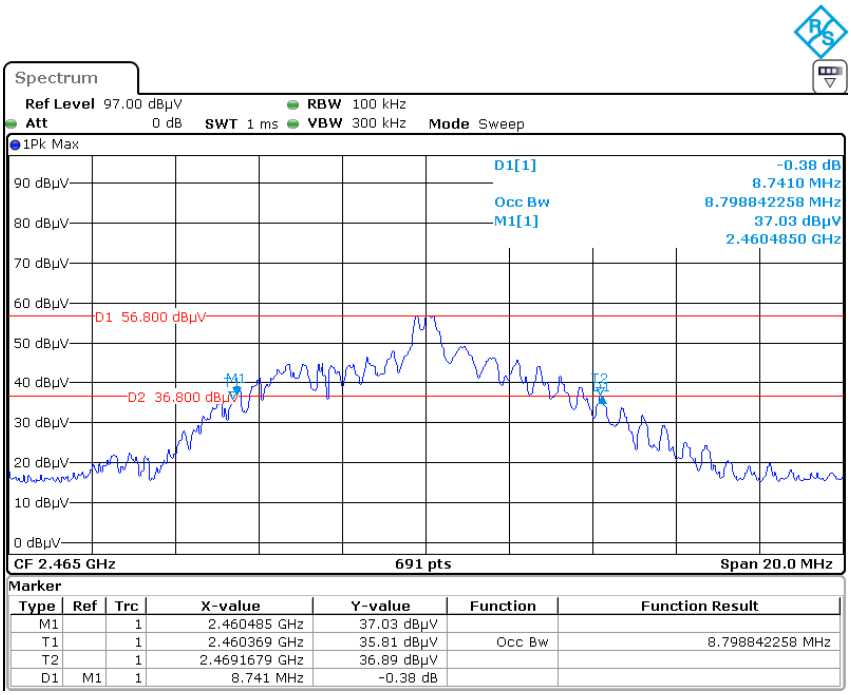
High Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.460485 GHz	37.03 dBµV		
T1		1	2.460369 GHz	35.81 dBµV	Occ Bw	8.798842258 MHz
T2		1	2.4691679 GHz	36.89 dBµV		
D1	M1	1	8.741 MHz	-0.38 dB		

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