

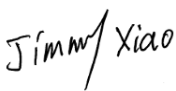
FCC PART 15.249 TEST REPORT

For

SANWA LIMITED

Room 1005, 10/F., Tower 2, Silvercord 30 Canton Road, Tsim Sha Tsui, Kowloon,
Hong Kong, China

FCC ID: 2AMSUWTB178BK

Report Type: Original Report	Product Type: 2.4GHz Wireless Trackball Mouse
Report Number: RSZ200715009-00	
Report Date: 2020-08-24	
Reviewed By: RF Engineer	Jimmy Xiao 
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	2.4GHz Wireless Trackball Mouse
Tested Model	GMAWTB178
Frequency	2405-2477MHz
Maximum Field Strength	86.22dBuV/m @3m
Antenna Specification	2.62 dBi
Voltage Range	DC 2*1.5V by batteries
Date of Test	2020-07-30 to 2020-08-01
Sample serial number	RSZ200715009-RF-S1 (Assigned by BACL, Shenzhen)
Received date	2020-07-15
Sample/EUT Status	Good condition

Objective

This type approval report is prepared on behalf of *SANWA LIMITED* 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.

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)
5	2405	40	2440
7	2407	41	2441
10	2410	42	2442
14	2414	49	2449
21	2421	55	2455
28	2428	67	2467
35	2435	68	2468
37	2437	77	2477

EUT was tested with Channel 5, 42 and 77.

EUT Exercise Software

No software was used.

Equipment Modifications

No modifications were made to the unit tested.

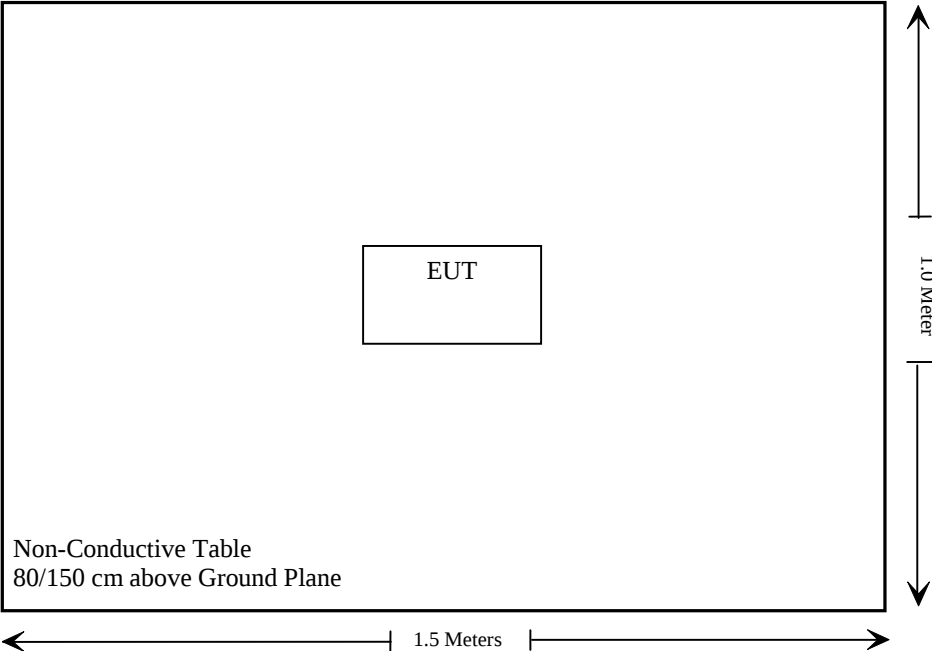
Support Equipment List and Details

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 EUT was powered by battery only.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2019/08/04	2020/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2019/08/04	2020/08/03
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	2019/08/04	2020/08/03
COM-POWER	Pre-amplifier	PA-122	181919	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	2020/04/20	2021/04/20
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/06	2020/12/05

* **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 2.62 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 spectrum analyzer or receiver is set as:

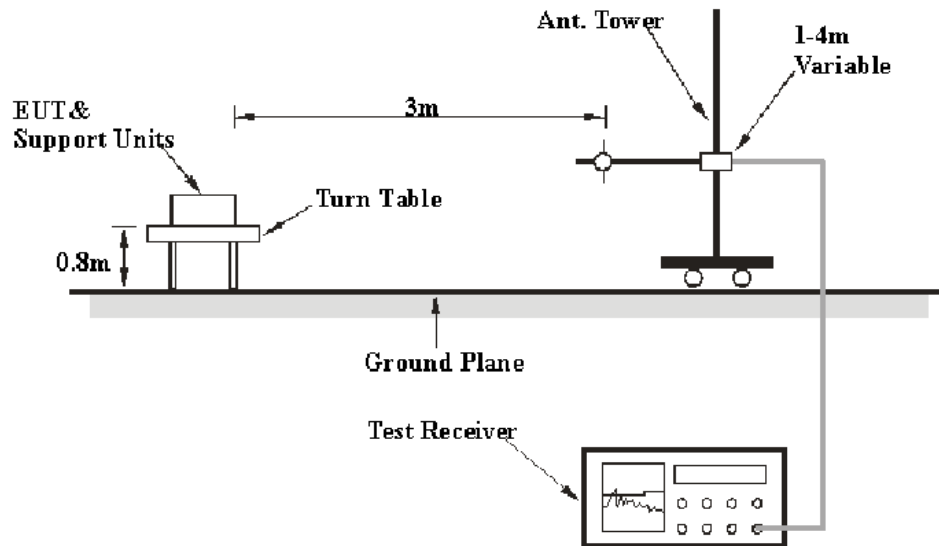
Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP/PK
Above 1 GHz	1 MHz	3 MHz	/	PK

Test Procedure

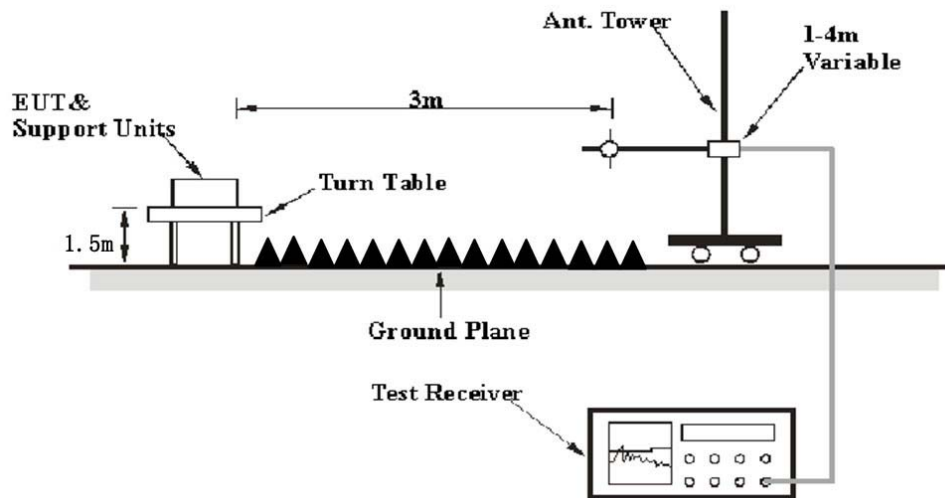
Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

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 meter, 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:

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

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 Data

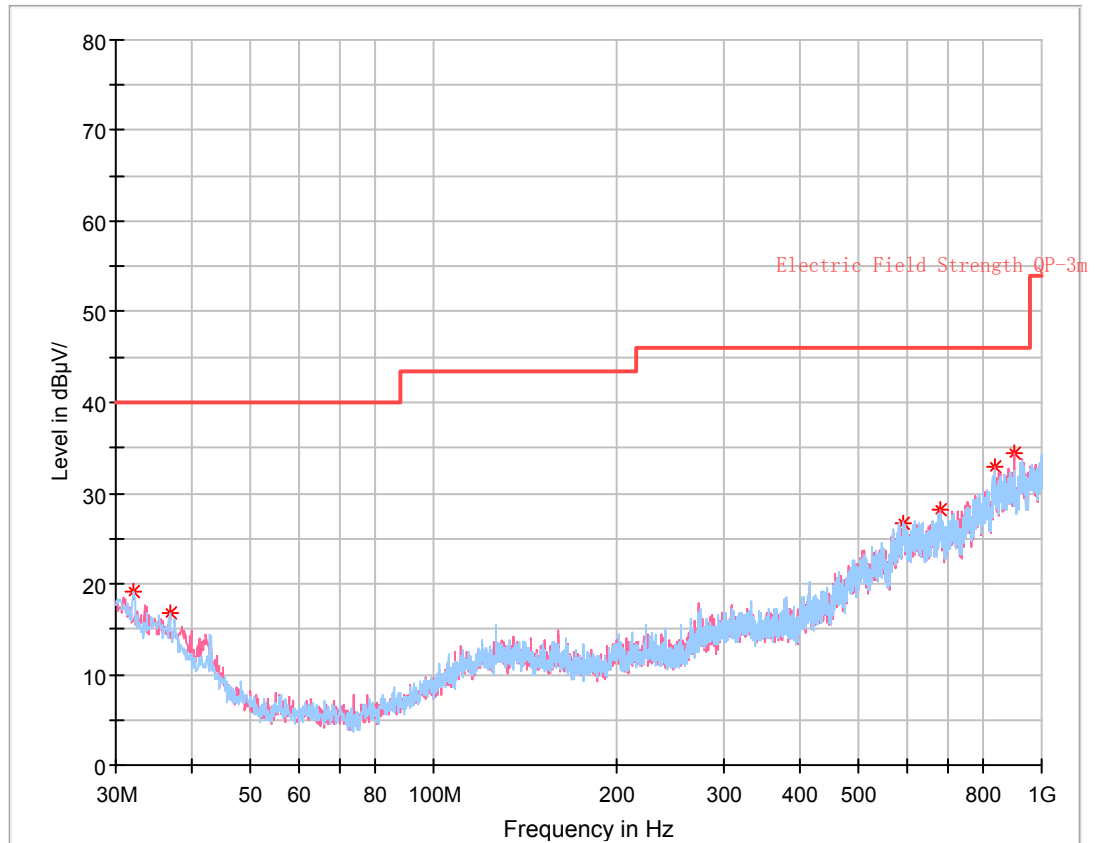
Environmental Conditions

Temperature:	25~29 °C
Relative Humidity:	53~60 %
ATM Pressure:	100.9~101.0 kPa

The testing was performed by Holland Yang on 2020-07-30 for below 1GHz, by Charlie Cha on 2020-07-31 and 2020-08-01 for above 1GHz and by Leven Gan on 2020-07-31 for duty cycle.

Test Mode: Transmitting (Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was record)

30MHz – 1 GHz: (Low channel was worst case)



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
32.061250	19.17	105.0	H	345.0	-8.9	40.00	20.83
36.790000	16.71	205.0	H	151.0	-11.7	40.00	23.29
590.175000	26.67	390.0	H	262.0	-2.1	46.00	19.33
678.808750	28.09	105.0	V	343.0	-1.4	46.00	17.91
837.161250	32.84	390.0	V	180.0	2.7	46.00	13.16
901.302500	34.45	105.0	V	191.0	4.2	46.00	11.55

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(2405 MHz)									
2405.00	86.58	PK	299	1.5	H	-0.36	86.22	114	27.78
2405.00	84.15	PK	108	1.2	V	-0.36	83.79	114	30.21
2368.95	28.75	PK	338	2.4	H	31.87	60.62	74	13.38
2488.65	28.81	PK	261	2.0	H	32.13	60.94	74	13.06
4810.00	48.61	PK	187	1.7	H	5.24	53.85	74	20.15
Middle Channel(2442 MHz)									
2442.00	84.90	PK	162	1.9	H	-0.26	84.64	114	29.36
2442.00	83.63	PK	247	1.8	V	-0.26	83.37	114	30.63
4884.00	47.89	PK	113	2.1	H	5.46	53.35	74	20.65
High Channel(2477 MHz)									
2477.00	83.88	PK	337	1.9	H	-0.15	83.73	114	30.27
2477.00	83.21	PK	114	2.4	V	-0.15	83.06	114	30.94
2333.82	28.74	PK	20	2.1	H	31.64	60.38	74	13.62
2489.15	28.93	PK	253	1.8	H	32.13	61.06	74	12.94
4954.00	47.79	PK	98	1.6	H	5.37	53.16	74	20.84

Frequency (MHz)	Peak value@3m	Rx Antenna	Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249&15.209	
		Polar (H / V)			Limit (dBμV/m)	Margin (dB)
Average						
Low Channel(2405MHz)						
2405.00	86.22	H	-16.9	69.32	94	24.68
2405.00	83.79	V	-16.9	66.89	94	27.11
2368.95	60.62	H	-16.9	43.72	54	10.28
2488.65	60.94	H	-16.9	44.04	54	9.96
4810.00	53.85	H	-16.9	36.95	54	17.05
Middle Channel(2442MHz)						
2442.00	84.64	H	-16.9	67.74	94	26.26
2442.00	83.37	V	-16.9	66.47	94	27.53
4884.00	53.35	H	-16.9	36.45	54	17.55
High Channel(2477 MHz)						
2477.00	83.73	H	-16.9	66.83	94	27.17
2477.00	83.06	V	-16.9	66.16	94	27.84
2333.82	60.38	H	-16.9	43.48	54	10.52
2489.15	61.06	H	-16.9	44.16	54	9.84
4954.00	53.16	H	-16.9	36.26	54	17.74

Note:

Corrected Amplitude = Corrected Factor + Reading

Corrected Factor=Antenna factor (RX) +cable loss – amplifier factor

Margin = Limit- Corr. Amplitude

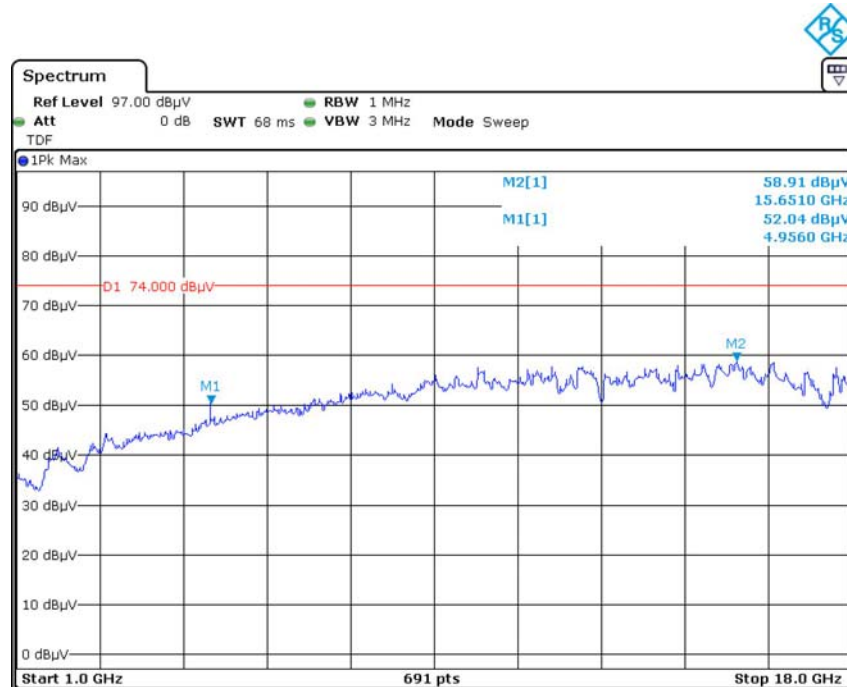
Duty Cycle = Ton/Tp*100%, Ton =143.48us, Tp= 1.00435ms

Duty Cycle Factor = 20lg(Duty Cycle) = -16.9

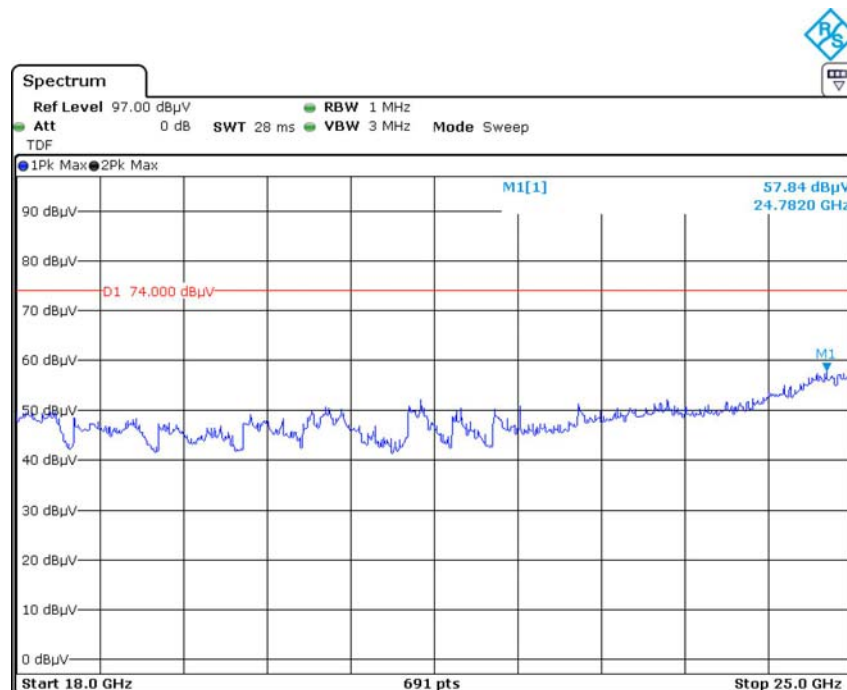
AV=PK+20*lg(Duty Cycle)

The emission more than20dB below the limit was not required to be recorded.

Pre-scan with Peak, High Channel Horizontal

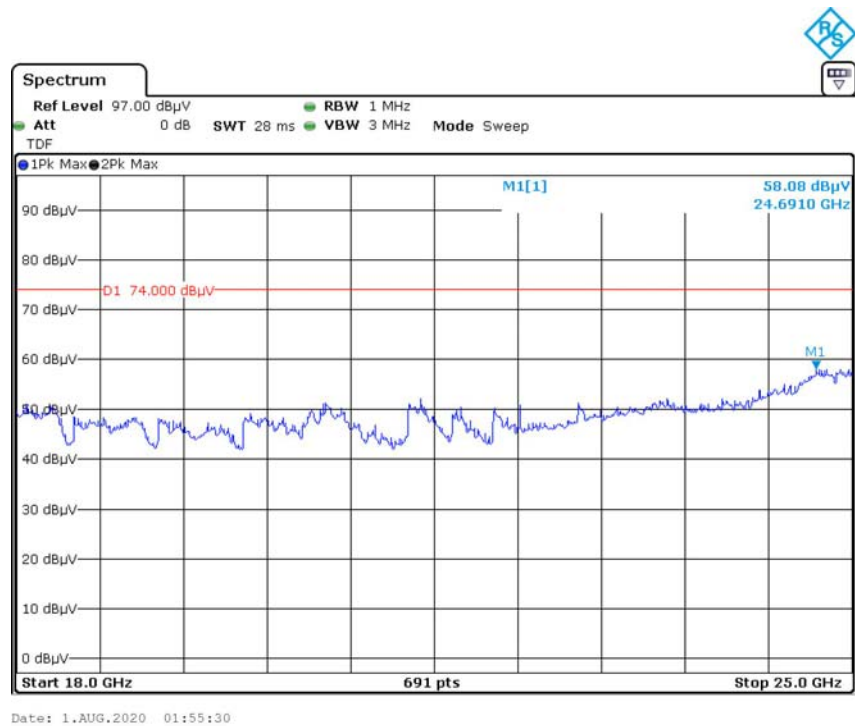
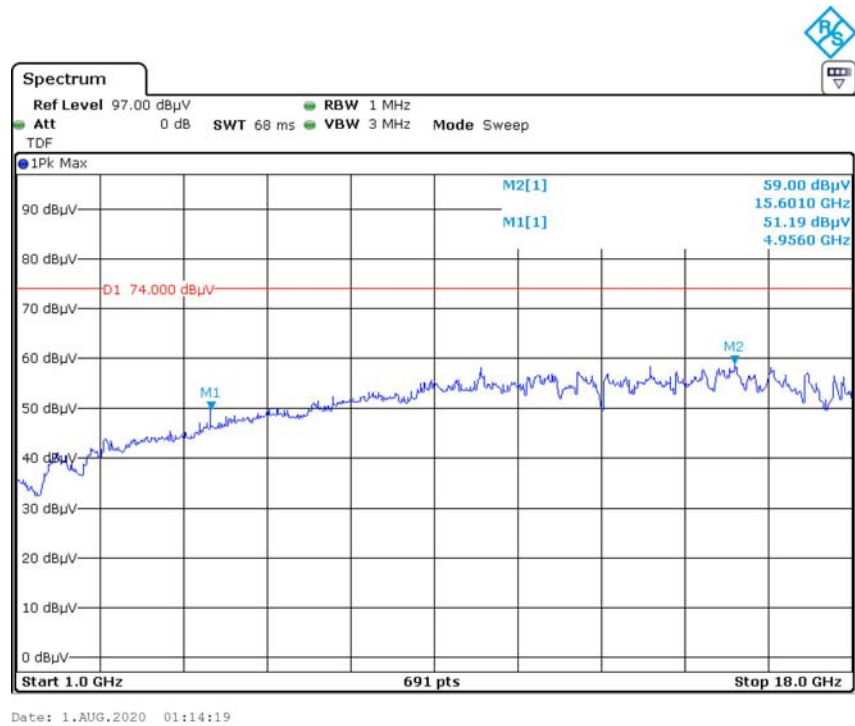


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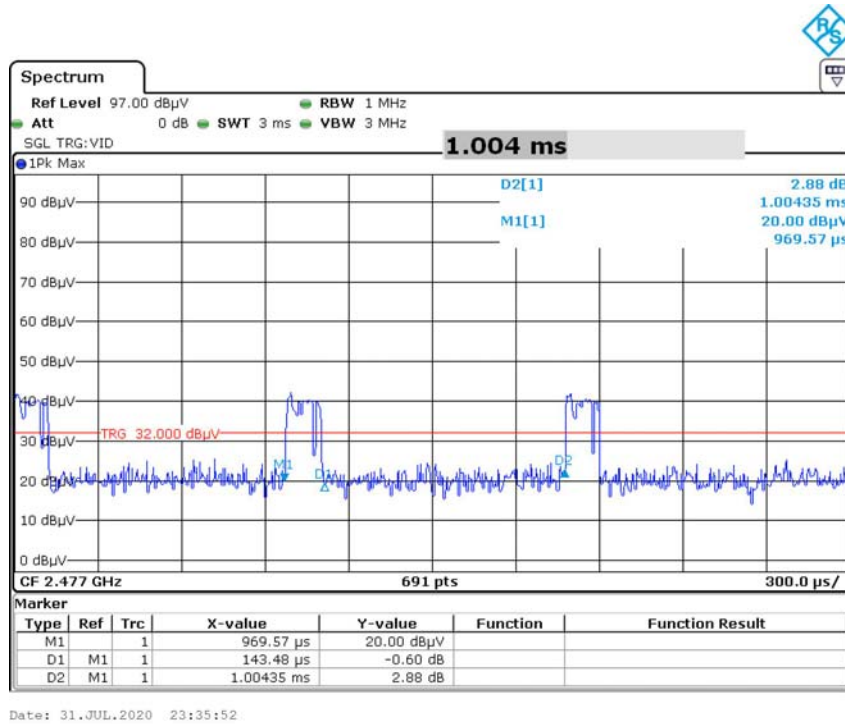


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Vertical



Duty Cycle



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**

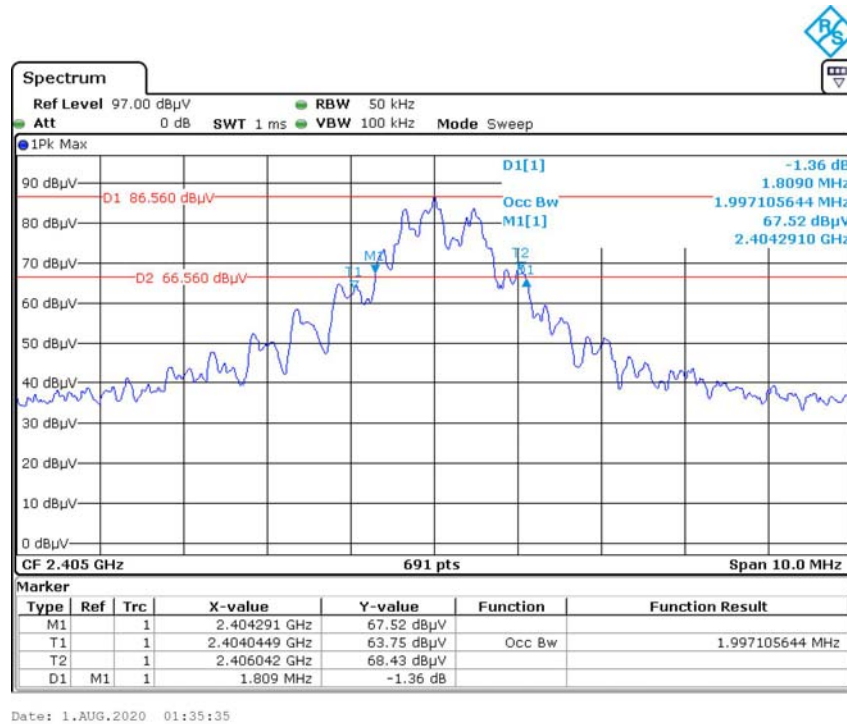
Temperature:	27 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Leven Gan on 2020-08-01.

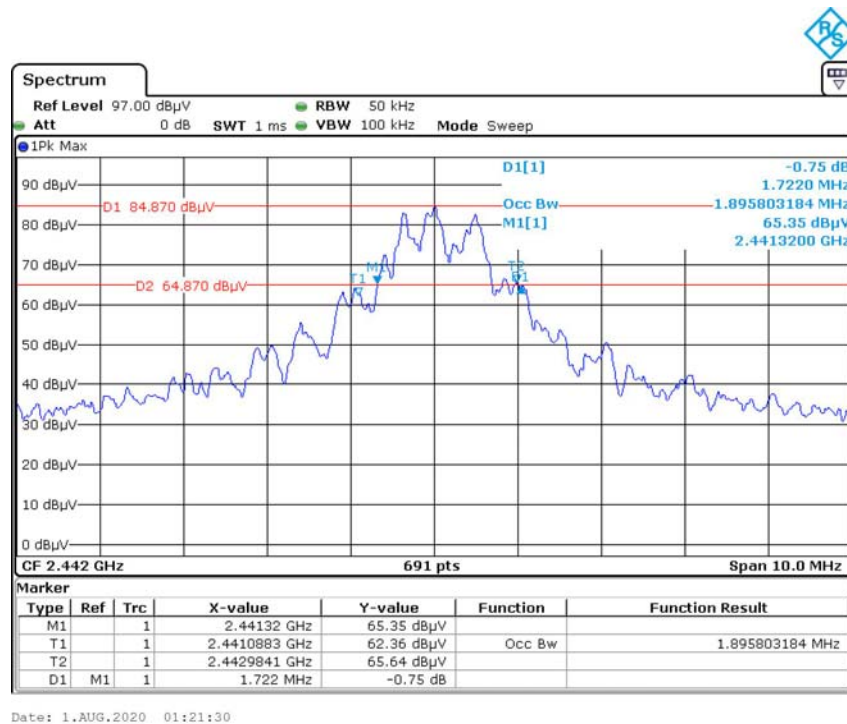
Test Mode: Transmitting

Channel	Frequency (MHz)	20dB bandwidth (MHz)
Low	2405	1.809
Middle	2442	1.722
High	2477	1.737

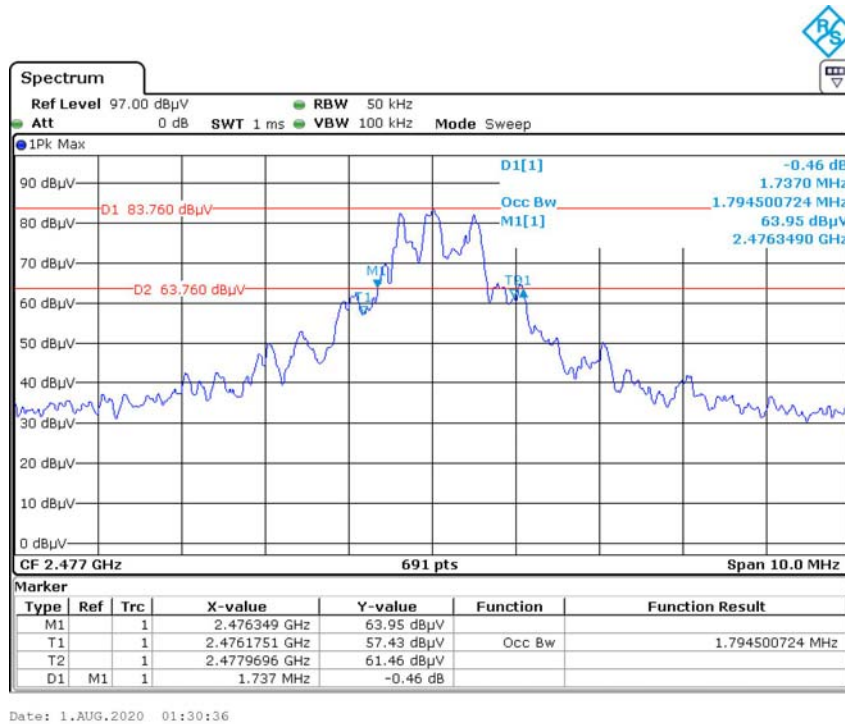
Low Channel



Middle Channel



High Channel



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