TEST REPORT

Applicant Name :	Shenzhen Loyal Electronics Co., Ltd.
Address :	No.5, First Industry Park, Shanmen Songgang, Baoan, Shenzhen, Guangdong, China
Report Number :	SZNS210601-55081E-RF-00
FCC ID:	2AAVD-G1357E6

Test Standard (s)

FCC PART 15.249

Sample Description

Product Type:	Wireless mouse
Model No.:	G1357E6
Multiple Model(s) No.:	G1316E4,G1123E6,G1053E6,G1056E6,G1068E4,G1068E6, G1168E4,G1168E6,G1081E4,G1303E6,G1317E6,M503, G1060E4, G1060E6
Trade Mark:	N/A
Date Received:	2021/06/01
Date of Test:	2021/08/16~2021/11/05
Report Date:	2021/11/10

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Black Ding

EMC Engineer

Approved By:

Candy Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★ ".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	2402-2480MHz
Modulation Type	GFSK
Maximum E-Field Strength	84.98dBuV/m@3m
Antenna Specification*	-0.61dBi(It is provided by the applicant)
Voltage Range	DC 1.5V from battery
Sample serial number	SZNS210601-55081E-RF-S1(Assigned by ATC, Shenzhen)
Sample/EUT Status	Good condition

Objective

This test report is 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, 15.215 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 emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz- 18GHz	4.98dB
	18GHz- 26.5GHz	5.06dB
	26.5GHz- 40GHz	4.72dB
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 Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. 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.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing by manufacturer.

Frequency List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

EUT was test in channel 0, 19, 39.

EUT Exercise Software

No software was used, EUT was configured in testing mode by manufacturer

Equipment Modifications

No modifications were made to the unit tested.

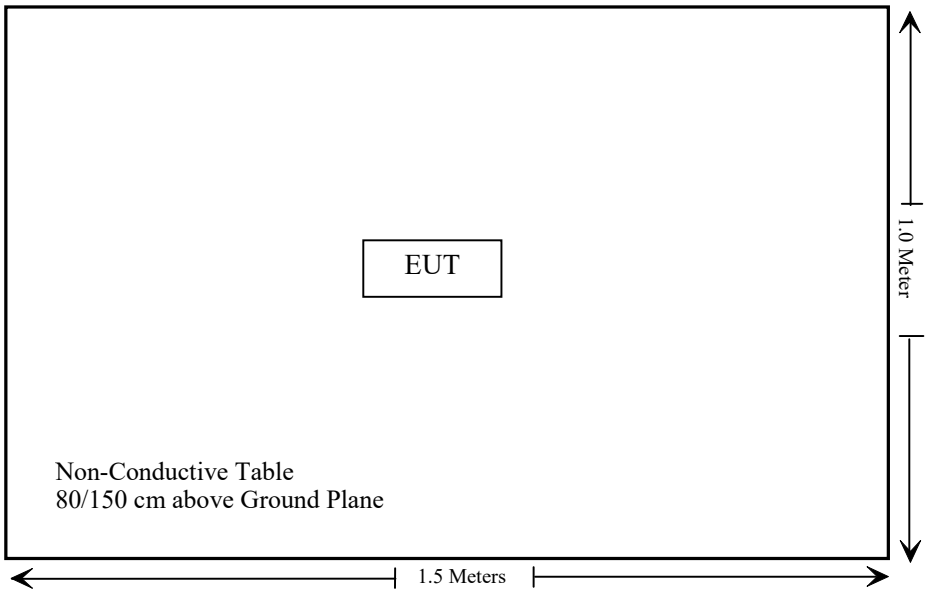
Support Equipment List and Details

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

Not Applicable: The EUT was powered by battery only.

Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emissions Test					
Rohde&Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/04	2023/01/03
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.3	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.4	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.6	2020/12/25	2021/12/24
Radiated Emission Test Software: e3 19821G (V9)					

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. 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 -0.61dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

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:

Below 1000MHz:

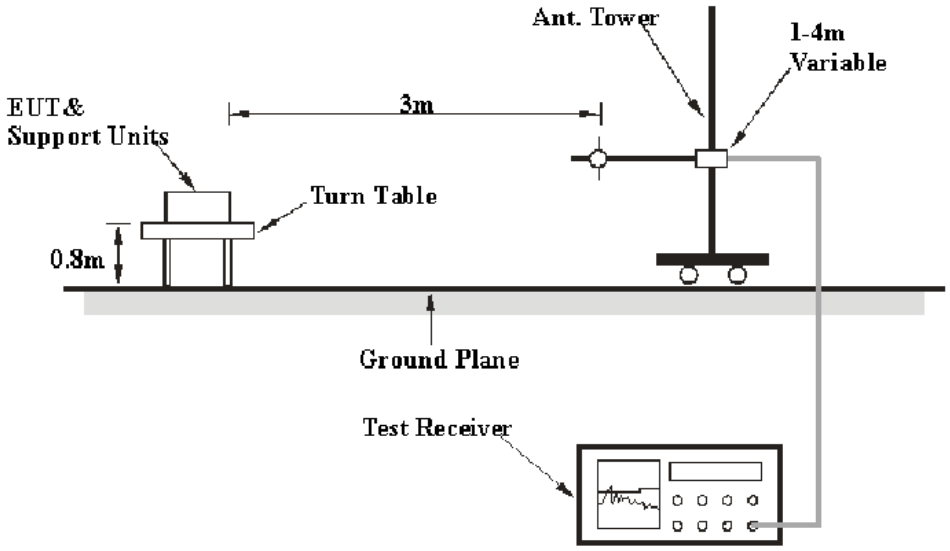
RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

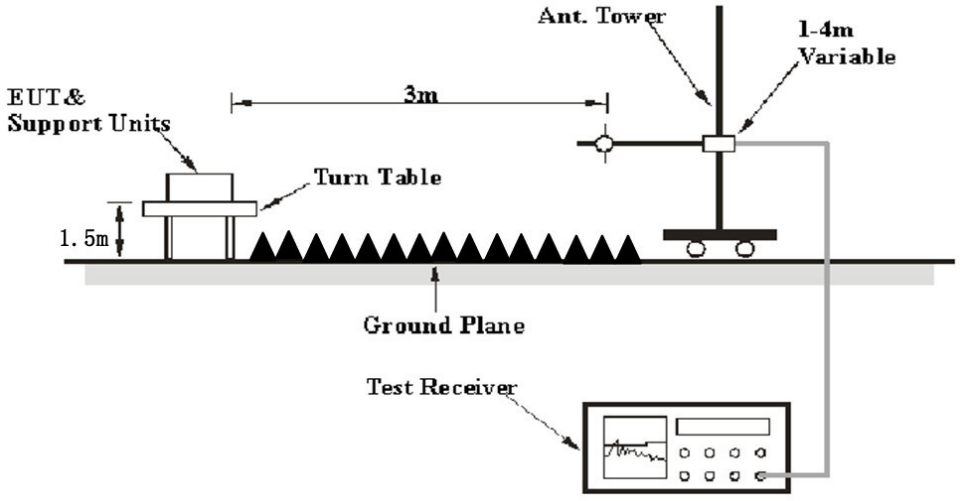
Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

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:

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/Over limit = Corrected Amplitude - Limit

Test Data

Environmental Conditions

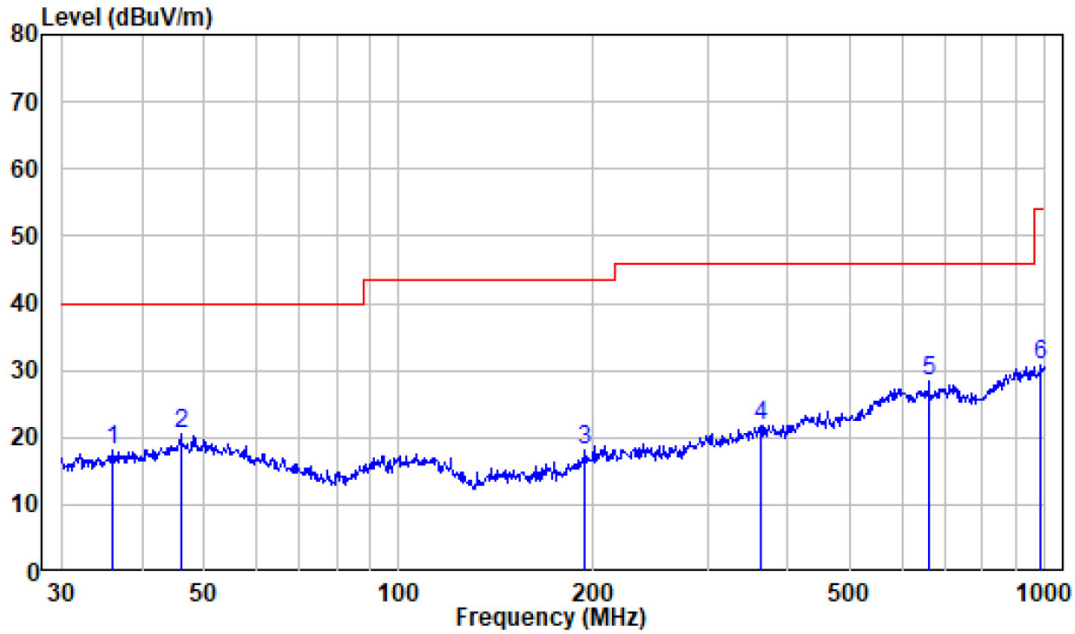
Temperature:	25~27.3 ℃
Relative Humidity:	56~64 %
ATM Pressure:	101.0 kPa

The testing was performed by Chao Mo on 2021-11-05 for below 1GHz and Bin Deng on 2021-08-16 for above 1GHz.

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

30MHz-1GHz: (Worst case)

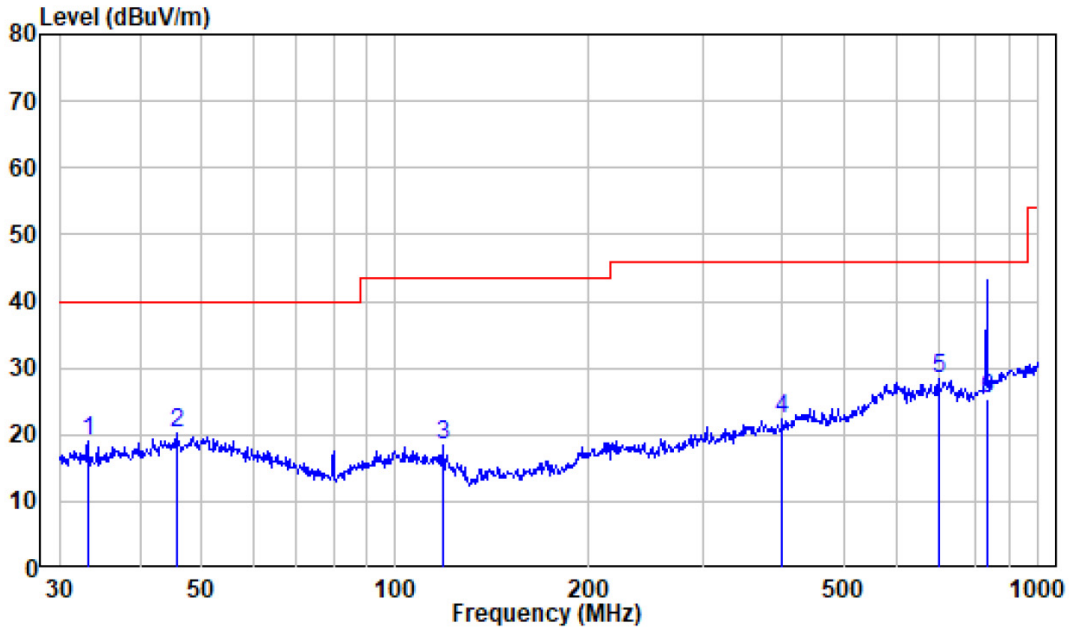
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job NO : SZNS210601-55081E-RF
Mode : TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Result
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	36.13	-19.27	37.25	17.98	40.00	-22.02	
2	46.02	-17.40	38.04	20.64	40.00	-19.36	
3	193.77	-19.74	37.81	18.07	43.50	-25.43	
4	364.26	-15.86	37.64	21.78	46.00	-24.22	
5	661.15	-11.40	39.86	28.46	46.00	-17.54	
6	986.07	-7.65	38.31	30.66	54.00	-23.34	

Vertical



Site : chamber
Condition: 3m VERTICAL
Job NO : SZNS210601-55081E-RF
Mode : TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Result
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	33.21	-19.84	38.95	19.11	40.00	-20.89	
2	45.69	-17.41	37.56	20.15	40.00	-19.85	
3	118.19	-20.18	38.72	18.54	43.50	-24.96	
4	399.03	-15.82	38.21	22.39	46.00	-23.61	
5	699.30	-11.38	39.76	28.38	46.00	-17.62	
6	830.40	-9.80	35.11	25.31	46.00	-20.69	

1-25 GHz:

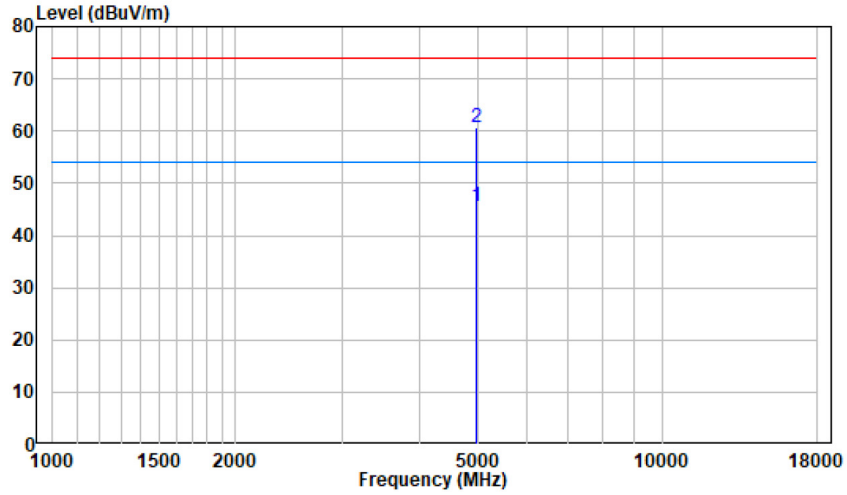
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel(2402MHz)									
2402	91.35	PK	298	2.1	H	-6.37	84.98	94	-9.02
2402	90.33	PK	328	1.6	V	-6.37	83.96	94	-10.04
2310	66.78	PK	287	2.2	H	-6.84	59.94	74	-14.06
2310	52.74	Ave.	287	2.2	H	-6.84	45.90	54	-8.10
2310	65.36	PK	49	1.9	V	-6.84	58.52	74	-15.48
2310	51.31	Ave.	49	1.9	V	-6.84	44.47	54	-9.53
2390	66.90	PK	73	1.7	H	-6.44	60.46	74	-13.54
2390	52.63	Ave.	73	1.7	H	-6.44	46.19	54	-7.81
2390	65.75	PK	133	1.9	V	-6.44	59.31	74	-14.69
2390	51.69	Ave.	133	1.9	V	-6.44	45.25	54	-8.75
2400	74.63	PK	283	2.5	H	-6.39	68.24	74	-5.76
2400	52.28	Ave.	283	2.5	H	-6.39	45.89	54	-8.11
2400	73.47	PK	340	2.5	V	-6.39	67.08	74	-6.92
2400	51.01	Ave.	340	2.5	V	-6.39	44.62	54	-9.38
4804	58.60	PK	89	2	H	2.81	61.41	74	-12.59
4804	32.22	Ave.	89	2	H	2.81	35.03	54	-18.97
4804	57.45	PK	147	2.2	V	2.81	60.26	74	-13.74
4804	30.98	Ave.	147	2.2	V	2.81	33.79	54	-20.21
Middle Channel(2440MHz)									
2440	90.47	PK	145	1.5	H	-6.21	84.26	94	-9.74
2440	89.84	PK	175	1.2	V	-6.21	83.63	94	-10.37
4880	58.22	PK	202	1.7	H	3.04	61.26	74	-12.74
4880	31.93	Ave.	202	1.7	H	3.04	34.97	54	-19.03
4880	57.01	PK	79	1.6	V	3.04	60.05	74	-13.95
4880	30.60	Ave.	79	1.6	V	3.04	33.64	54	-20.36

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
High Channel(2480 MHz)									
2480	90.64	PK	281	2	H	-5.92	84.72	94	-9.28
2480	90.34	PK	41	2.2	V	-5.92	84.42	94	-9.58
2483.5	69.46	PK	285	2.2	H	-5.96	63.5	74	-10.50
2483.5	52.14	Ave.	285	2.2	H	-5.96	46.18	54	-7.82
2483.5	68.10	PK	117	2	V	-5.96	62.14	74	-11.86
2483.5	50.92	Ave.	117	2	V	-5.96	44.96	54	-9.04
2500	65.74	PK	218	2.5	H	-5.88	59.86	74	-14.14
2500	51.53	Ave.	218	2.5	H	-5.88	45.65	54	-8.35
2500	64.51	PK	276	1.2	V	-5.88	58.63	74	-15.37
2500	50.33	Ave.	276	1.2	V	-5.88	44.45	54	-9.55
4960	57.70	PK	325	2.4	H	3.29	60.99	74	-13.01
4960	42.43	Ave.	325	2.4	H	3.29	45.72	54	-8.28
4960	56.33	PK	254	1.9	V	3.29	59.62	74	-14.38
4960	41.04	Ave.	254	1.9	V	3.29	44.33	54	-9.67

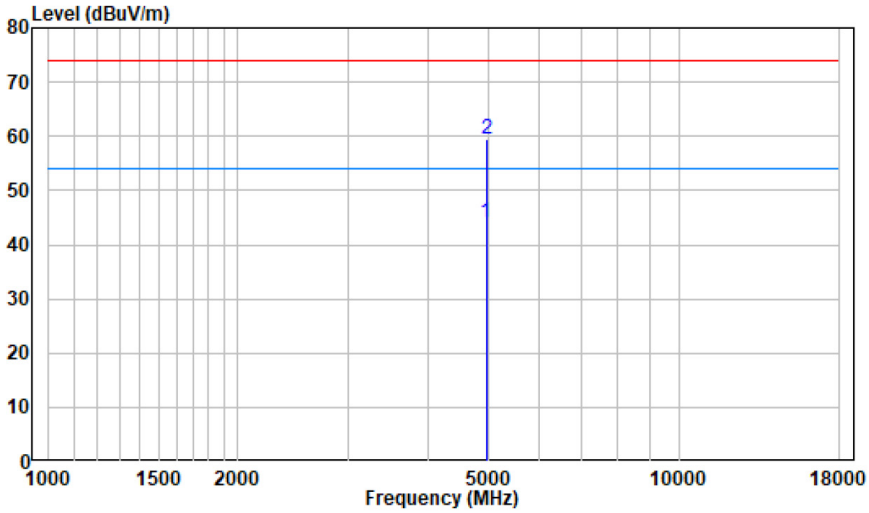
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
The other spurious emission which is 20dB to the limit was not recorded.
For fundamental, Peak value meet the average limit.

Pre-scan with high channel
1-18GHz

Horizontal

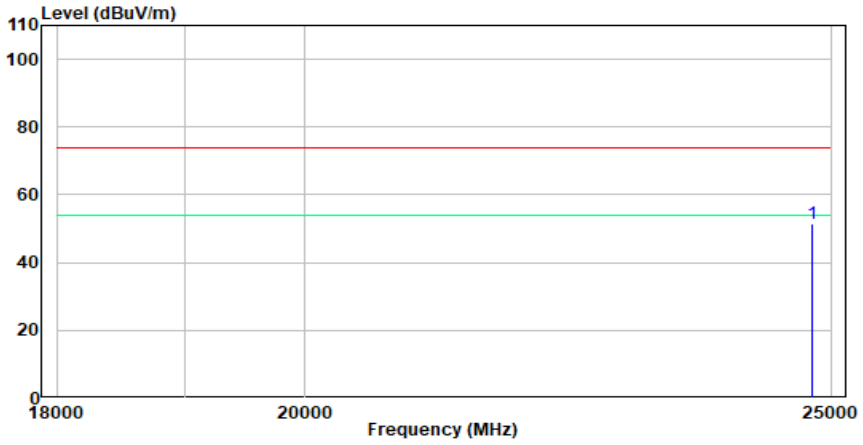


Vertical



18-25GHz

Horizontal



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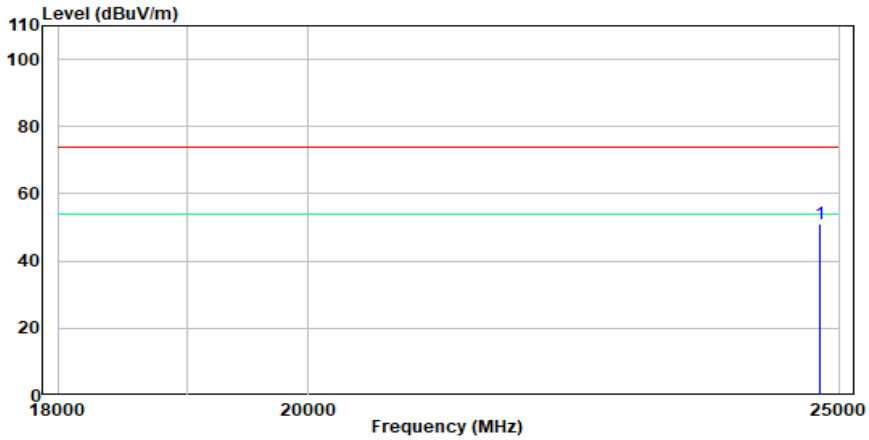


FCC§15.215(c) - 20dB EMISSION BANDWIDTH

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

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 indicated 20dB bandwidth.

4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	27.3 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

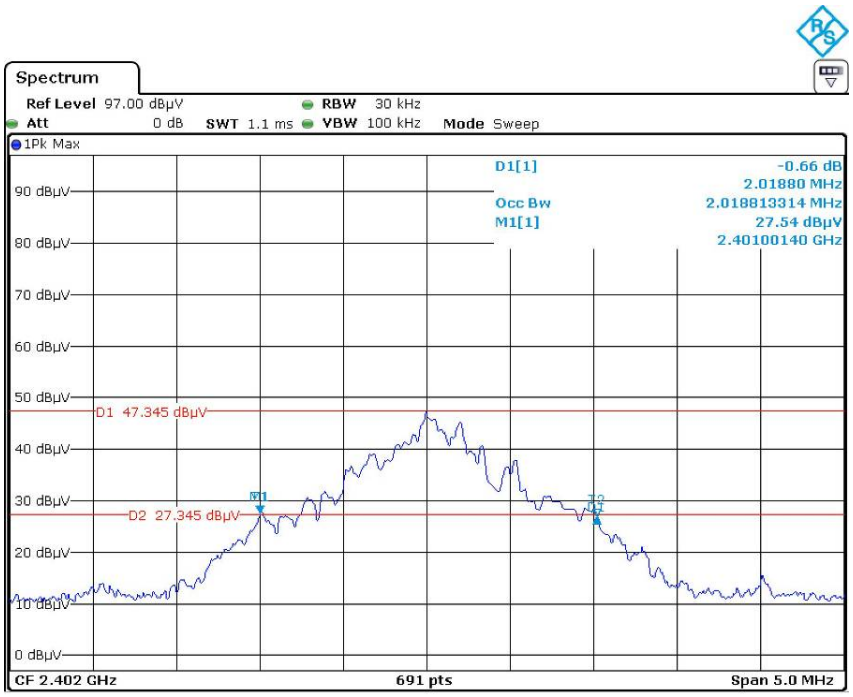
The testing was performed by Bin Deng on 2021-08-16.

Test Mode: Transmitting

Please refer to the following table and plots.

Channel	Frequency(MHz)	20dB Bandwidth (MHz)
Low	2402	2.02
Middle	2440	2.03
High	2480	2.05

Low Channel



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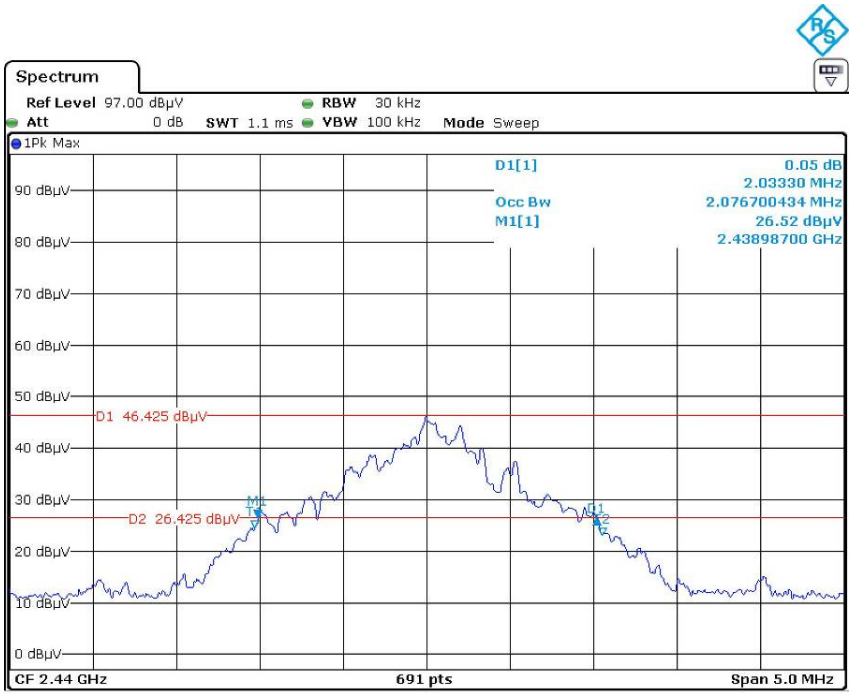
Middle Channel



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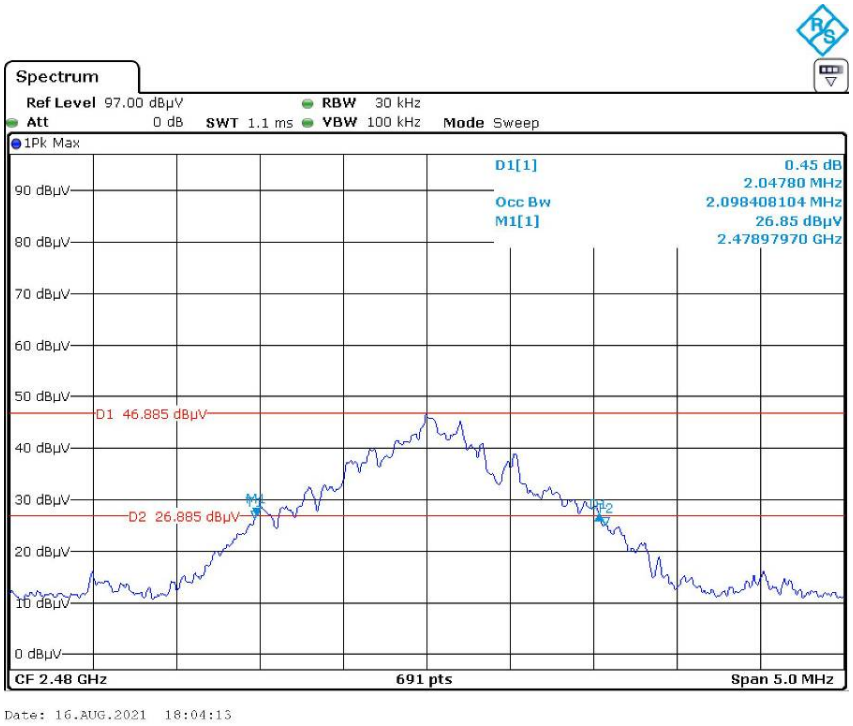
High Channel



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