

**ATC**

## TEST REPORT

Applicant Name :

Shenzhen Duomei Industry Co.,Ltd.

Address :

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Report Number :

SZNS220402-12260E-RF-00

FCC ID:

2AU9ZDMS214

**Test Standard (s)**

FCC PART 15.249

**Sample Description**

Product: US Standard Smart Touch Switch

Tested Model: DMS214

Multiple Model(s) No.: DMS111, DMS112, DMS113, DMS114, DMS211, DMS212, DMS213, DMS311, DMS312, DMS313, DMS314, DMS411, DMS412, DMS413, DMS414, DMS1E1, DMS1E2, DMS1E3, DMS1E4, DMS2E1, DMS2E2, DMS2E3, DMS2E4, DMS3E1, DMS3E2, DMS3E3, DMS3E4, DMS4E1, DMS4E2, DMS4E3, DMS4E4, DMS191, DMS291, DMS391, DMS491, DMS192, DMS292, DMS392, DMS492, DMS131, DMS132, DMS133, DMS231, DMS232, DMS233, DMS331, DMS332, DMS333, DMS431, DMS432, DMS433, DMS1B1, DMS2B1, DMS3B1, DMS4B1, DMS1Q1, DMS2Q1, DMS3Q1, DMS4Q1, DMS1R1, DMS2R1, DMS3R1, DMS4R1, DMS1AK, DMS2AK, DMS3AK, DMS4AK, DMS1AL, DMS2AL, DMS3AL, DMS4AL (Please refer to DOS for Model difference)

Trade mark: N/A

Date Received: 2022/04/02

Report Date: 2022/06/20

Test Result:	Pass*
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\* In the configuration tested, the EUT complied with the standards above.

**Prepared and Checked By:**

Ting Lü

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	2405-2480MHz
Maximum E-field strength	84.29dBuV/m@3m
Modulation Technique	O-QPSK
Antenna Specification*	2.5dBi (provided by the applicant)
Voltage Range	AC 120V/60Hz
Sample serial number	RE&CE: SZNS220402-12260E-RF-S1 ; RF: SZNS220402-12260E-RF-S2 (assigned by ATC)
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 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
	1GHz- 18GHz
	18GHz- 26.5GHz
	26.5GHz- 40GHz
Temperature	1 °C
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 (ISED), the Registration Number is 5077A.

## SYSTEM TEST CONFIGURATION

### Justification

The system was configured for testing by manufacturer.

For Zigbee mode, 16 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

EUT was tested with Channel 11, 19 and 26.

### EUT Exercise Software

“EMI\_Test\_Tool\_V1.8”\* software was used during test and power level is Default\*. The software and power level was provided by applicant.

### Equipment Modifications

No modifications were made to the unit tested.

### Support Equipment List and Details

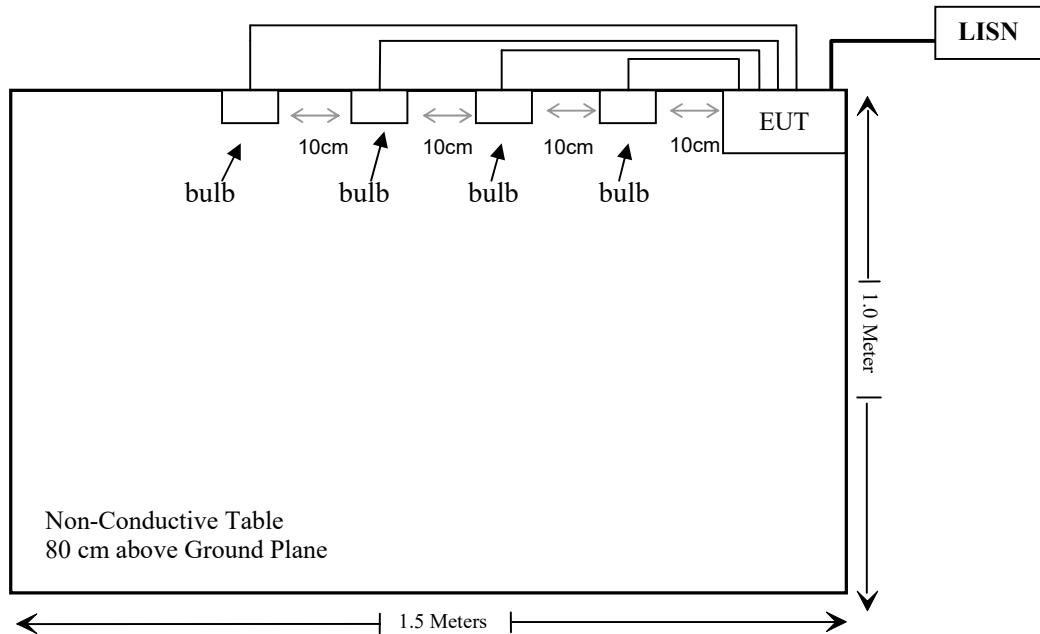
Manufacturer	Description	Model	Serial Number
Unknown	Bulb*4	Unknown	Bulb 1~ Bulb 4

### External I/O Cable

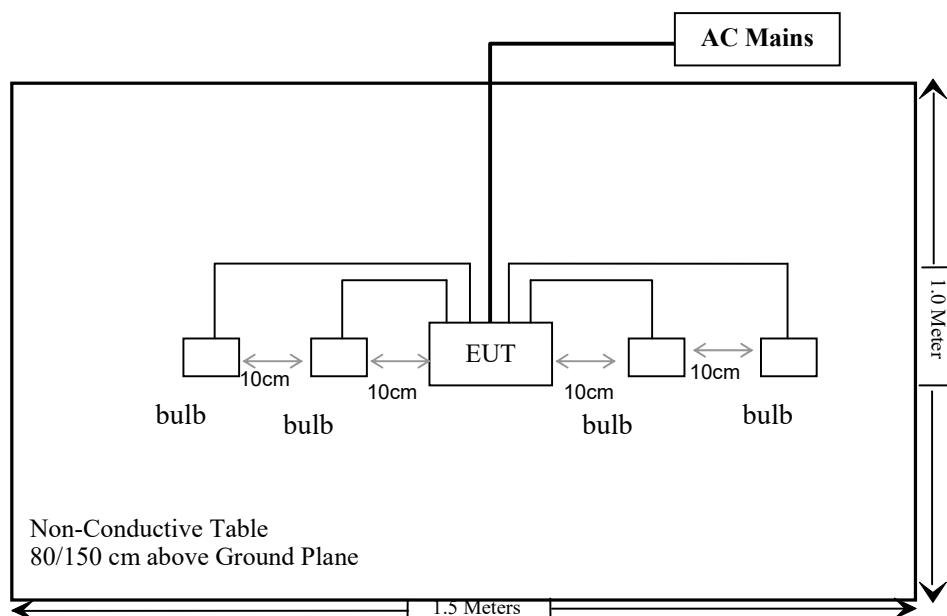
Cable Description	Length (m)	From Port	To
Un-shielding Detachable AC Cable	1.5	EUT	LISN
Un-shielding Detachable AC Cable*4	1.0	EUT	Bulb

## Block Diagram of Test Setup

For conducted emission:



For radiated emission:



## SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207(a)	Conduction Emissions	Compliant
15.205, §15.209, §15.249(d)	Radiated Emissions& Outside of Band Emission	Compliant
§15.215 (c)	20 dB Bandwidth	Compliant

## Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Conducted Emissions Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	100784	2021/12/13	2022/12/12
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2021/12/13	2022/12/12
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.17	N0350	2021/12/14	2022/12/13
Conducted Emission Test Software: e3 19821b (V9)					
<b>Radiated Emissions Test</b>					
Rohde & Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde & Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2021/11/11	2022/11/10
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.15	N600	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.16	N650	2021/12/14	2022/12/13
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2021/12/14	2022/12/13

**\* 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 PCB Antenna which was permanently attached and the antenna gain is 2.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

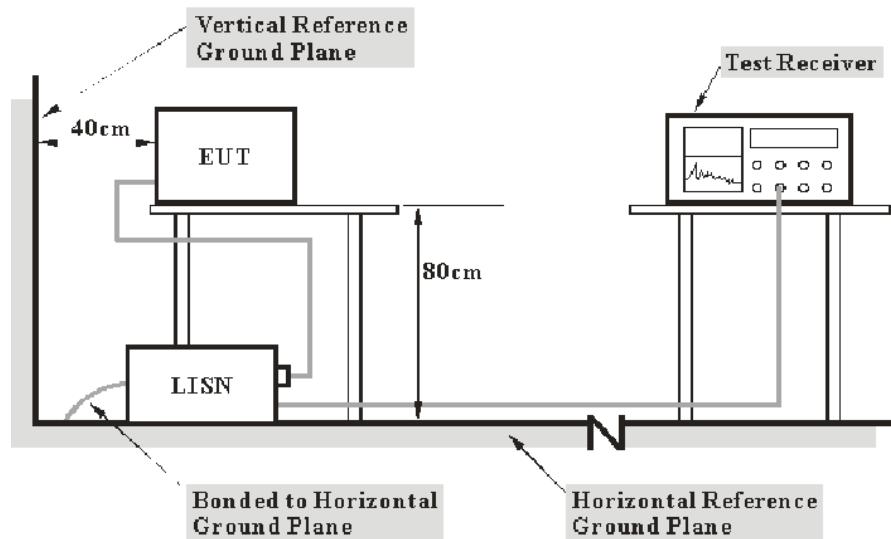
**Result:** Compliance.

## 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 measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

### 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 outlet of the LISN.

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

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

## Transd Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Transd Factor} = \text{LISN VDF} + \text{Cable Loss}$$

The “Over limit” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over limit of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Over Limit} = \text{Level} - \text{Limit}$$

$$\text{Level} = \text{reading level} + \text{Transd Factor}$$

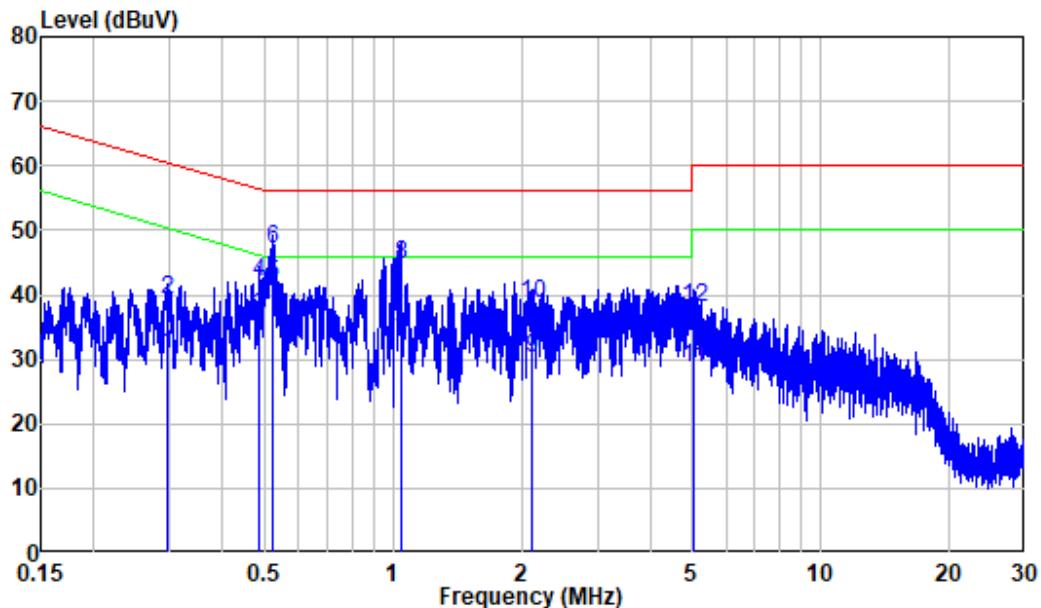
## Test Data

### Environmental Conditions

<b>Temperature:</b>	23 °C
<b>Relative Humidity:</b>	59 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Jason on 2022-05-10.*

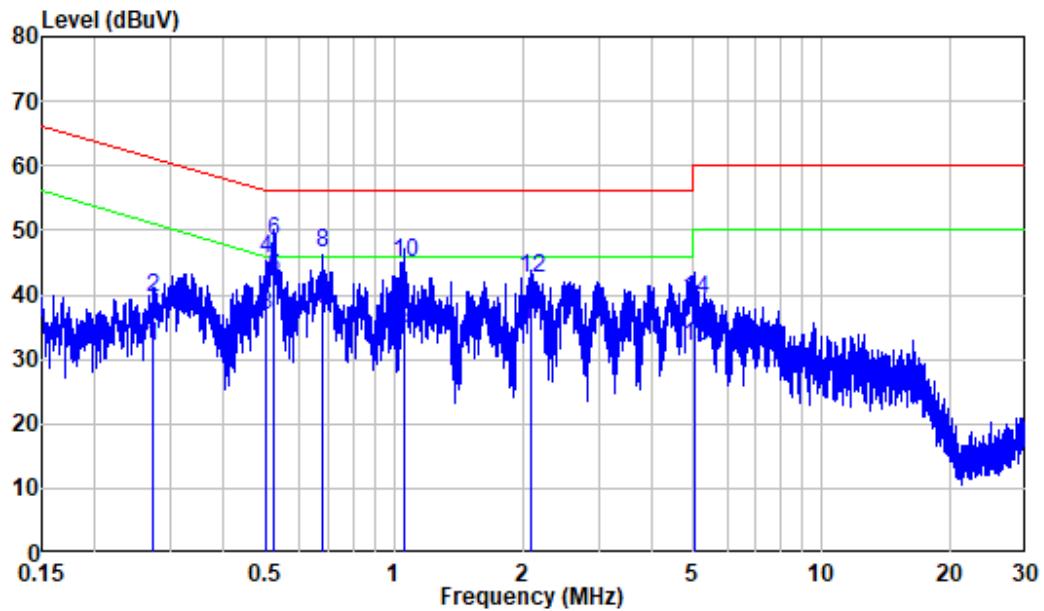
*EUT operation mode: Transmitting (worst case is low channel)*

**AC 120V/60 Hz, Line**

Site : Shielding Room  
Condition: Line  
Job No. : SZNS220402-12260E-RF  
Mode : Transmitting  
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Limit Level	Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.298	9.80	20.85	30.65	50.31	-19.66	Average
2	0.298	9.80	29.47	39.27	60.31	-21.04	QP
3	0.486	9.80	26.87	36.67	46.24	-9.57	Average
4	0.486	9.80	32.16	41.96	56.24	-14.28	QP
5	0.523	9.81	31.72	41.53	46.00	-4.47	Average
6	0.523	9.81	37.28	47.09	56.00	-8.91	QP
7	1.040	9.81	22.85	32.66	46.00	-13.34	Average
8	1.040	9.81	34.74	44.55	56.00	-11.45	QP
9	2.117	9.82	20.48	30.30	46.00	-15.70	Average
10	2.117	9.82	28.96	38.78	56.00	-17.22	QP
11	5.038	9.85	18.71	28.56	50.00	-21.44	Average
12	5.038	9.85	28.25	38.10	60.00	-21.90	QP

## AC 120V/60 Hz, Neutral



Site : Shielding Room  
Condition: Neutral  
Job No. : SZNS220402-12260E-RF  
Mode : Transmitting  
Power : AC 120V 60Hz

Freq	Factor	Read		Limit	Over	Remark
		MHz	dB	dBuV	dBuV	dB
1	0.274	9.80	22.20	32.00	50.99	-18.99 Average
2	0.274	9.80	29.81	39.61	60.99	-21.38 QP
3	0.499	9.80	26.99	36.79	46.02	-9.23 Average
4	0.499	9.80	35.77	45.57	56.02	-10.45 QP
5	0.524	9.81	32.77	42.58	46.00	-3.42 Average
6	0.524	9.81	38.43	48.24	56.00	-7.76 QP
7	0.683	9.81	28.06	37.87	46.00	-8.13 Average
8	0.683	9.81	36.67	46.48	56.00	-9.52 QP
9	1.051	9.81	24.91	34.72	46.00	-11.28 Average
10	1.051	9.81	35.16	44.97	56.00	-11.03 QP
11	2.098	9.82	25.43	35.25	46.00	-10.75 Average
12	2.098	9.82	32.60	42.42	56.00	-13.58 QP
13	5.035	9.89	22.17	32.06	50.00	-17.94 Average
14	5.035	9.89	29.22	39.11	60.00	-20.89 QP

**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

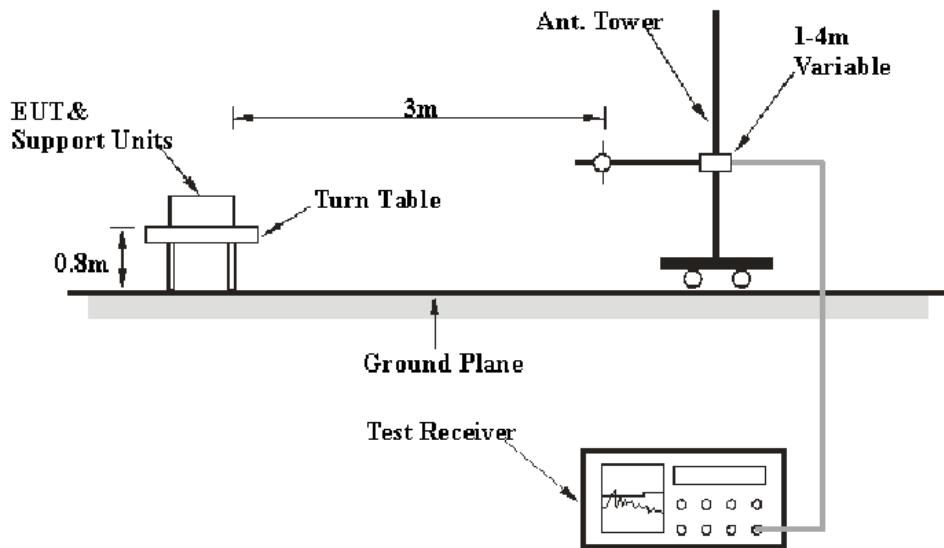
Above 1000MHz:

Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto

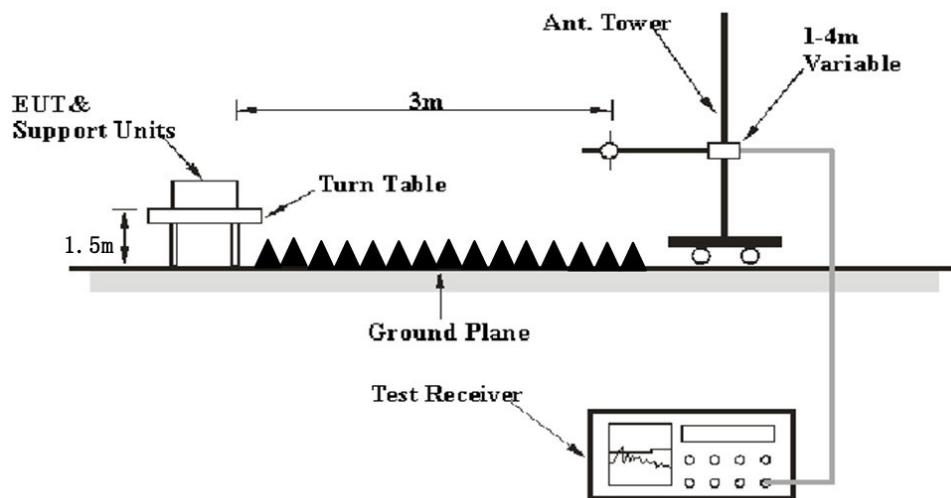
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

## 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:

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

The “**Over Limit/Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Over Limit/Margin} = \text{Level} / \text{Corrected Amplitude} - \text{Limit}$$

## Test Results Summary

According to the EUT complied with the FCC Part 15.205, 15.209 & §15.249

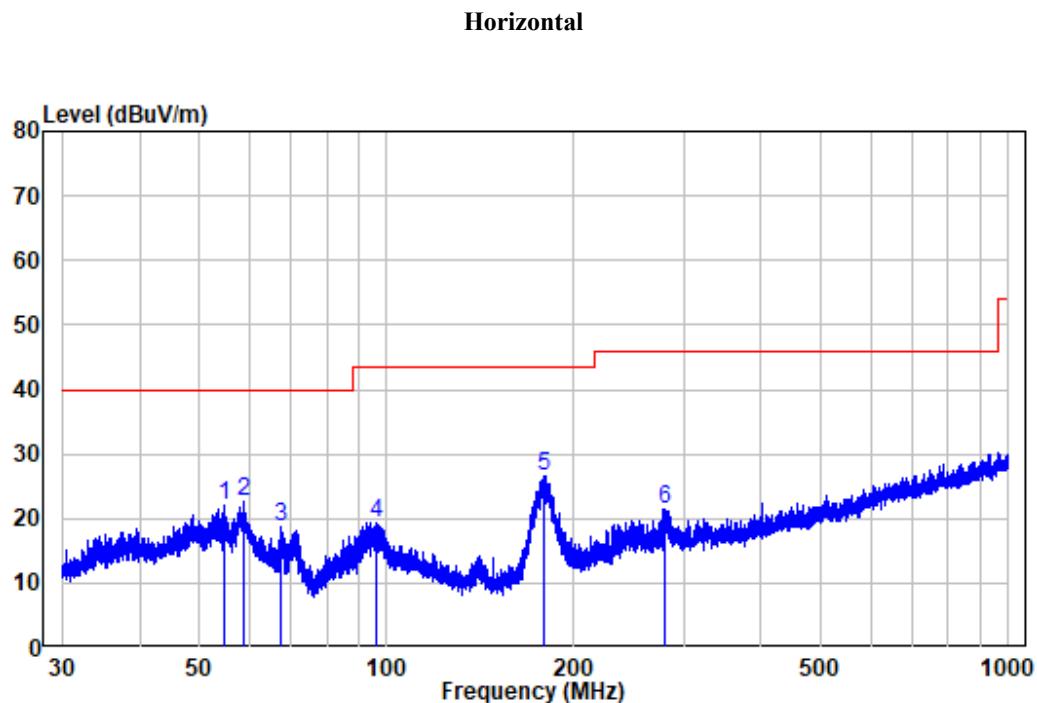
## Test Data

### Environmental Conditions

<b>Temperature:</b>	24~28.1 °C
<b>Relative Humidity:</b>	44~70 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Leo on 2022-05-11 for below 1GHz, Level from 2022-05-05 to 2022-05-16 for above 1GHz*

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

**30MHz-1GHz: (worst case is low channel)**

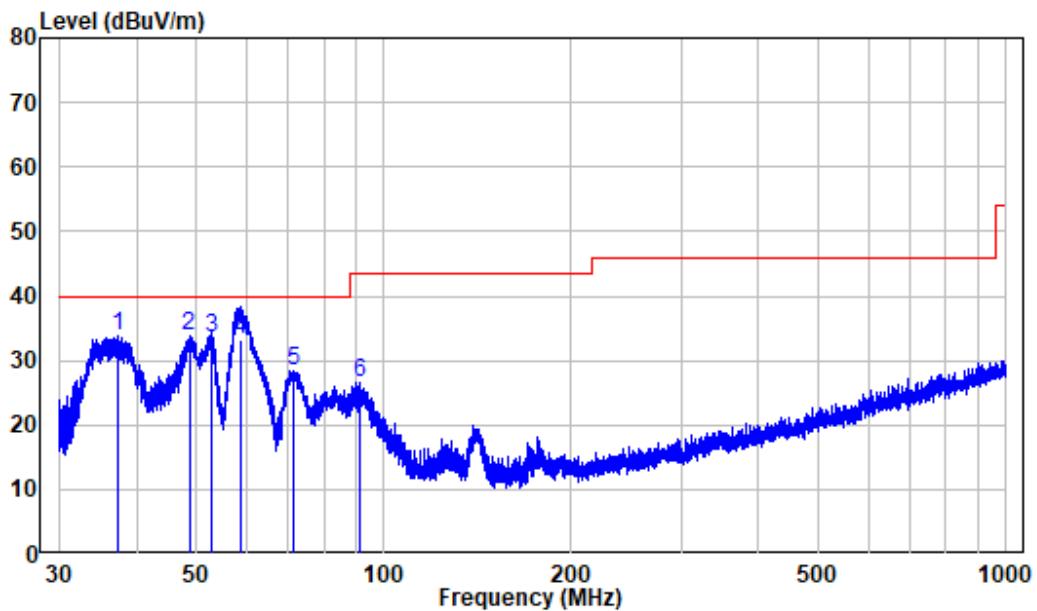
Site : chamber

Condition: 3m HORIZONTAL

Job No. : SZNS220402-12260E-RF

Freq	Factor	Read		Limit		Over	Remark
		MHz	dB/m	dBuV	dBuV/m	dBuV/m	
1	54.715	-10.30	32.42	22.12	40.00	-17.88	Peak
2	58.741	-10.18	32.88	22.70	40.00	-17.30	Peak
3	67.527	-13.62	32.21	18.59	40.00	-21.41	Peak
4	96.099	-12.30	31.57	19.27	43.50	-24.23	Peak
5	178.994	-12.87	39.33	26.46	43.50	-17.04	Peak
6	280.884	-9.56	31.06	21.50	46.00	-24.50	Peak

## Vertical



Site : chamber

Condition: 3m VERTICAL

Job No. : SZNS220402-12260E-RF

	Freq	Factor	Read Level	Limit Level	Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	37.285	-10.96	44.89	33.93	40.00	-6.07	Peak
2	48.608	-9.97	43.71	33.74	40.00	-6.26	Peak
3	52.737	-10.12	43.48	33.36	40.00	-6.64	Peak
4	58.741	-10.18	43.51	33.33	40.00	-6.67	QP
5	71.361	-15.35	43.82	28.47	40.00	-11.53	Peak
6	91.495	-13.49	39.94	26.45	43.50	-17.05	Peak

## 1-25 GHz:

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel									
2405	90.72	PK	238	1.5	H	-7.23	83.49	114	-30.51
2405	87.78	AV	238	1.5	H	-7.23	80.55	94	-13.45
2405	87.21	PK	37	1.5	V	-7.23	79.98	114	-34.02
2405	83.38	AV	37	1.5	V	-7.23	76.15	94	-17.85
2310	67.43	PK	266	2.3	H	-7.24	60.19	74	-13.81
2310	52.79	AV	266	2.3	H	-7.24	45.55	54	-8.45
2310	68.33	PK	141	2.4	V	-7.24	61.09	74	-12.91
2310	53.73	AV	141	2.4	V	-7.24	46.49	54	-7.51
2390	68.03	PK	185	2	H	-7.22	60.81	74	-13.19
2390	53.93	AV	185	2	H	-7.22	46.71	54	-7.29
2390	68.64	PK	348	1.9	V	-7.22	61.42	74	-12.58
2390	53.34	AV	348	1.9	V	-7.22	46.12	54	-7.88
2400	68.32	PK	281	2.4	H	-7.23	61.09	74	-12.91
2400	54.09	AV	281	2.4	H	-7.23	46.86	54	-7.14
2400	68.14	PK	264	1.4	V	-7.23	60.91	74	-13.09
2400	53.88	AV	264	1.4	V	-7.23	46.65	54	-7.35
4810	55.14	PK	185	1.5	H	-3.52	51.62	74	-22.38
4810	54.92	PK	290	2.3	V	-3.52	51.40	74	-22.60
Middle Channel									
2445	91.53	PK	244	1	H	-7.24	84.29	114	-29.71
2445	88.86	AV	244	1	H	-7.24	81.62	94	-12.38
2445	89.36	PK	229	1.2	V	-7.24	82.12	114	-31.88
2445	88.57	AV	229	1.2	V	-7.24	81.33	94	-12.67
4890	55.16	PK	249	1.9	H	-3.33	51.83	74	-22.17
4890	55.06	PK	248	1.7	V	-3.33	51.73	74	-22.27

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
High Channel									
2480	91.43	PK	127	1.7	H	-7.20	84.23	114	-29.77
2480	88.35	AV	127	1.7	H	-7.20	81.15	94	-12.85
2480	87.67	PK	243	1.5	V	-7.20	80.47	114	-33.53
2480	84.42	AV	243	1.5	V	-7.20	77.22	94	-16.78
2483.5	69.88	PK	90	2.5	H	-7.20	62.68	74	-11.32
2483.5	54.69	AV	90	2.5	H	-7.20	47.49	54	-6.51
2483.5	69.89	PK	10	1.1	V	-7.20	62.69	74	-11.31
2483.5	54.69	AV	10	1.1	V	-7.20	47.49	54	-6.51
2500	69.03	PK	197	2.2	H	-7.18	61.85	74	-12.15
2500	54.04	AV	197	2.2	H	-7.18	46.86	54	-7.14
2500	69.05	PK	91	2.4	V	-7.18	61.87	74	-12.13
2500	54.06	AV	91	2.4	V	-7.18	46.88	54	-7.12
4960	53.83	PK	213	2.4	H	-3.01	50.82	74	-23.18
4960	53.55	PK	187	1.5	V	-3.01	50.54	74	-23.46

**Note:**

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

Margin = Corrected. Amplitude - Limit

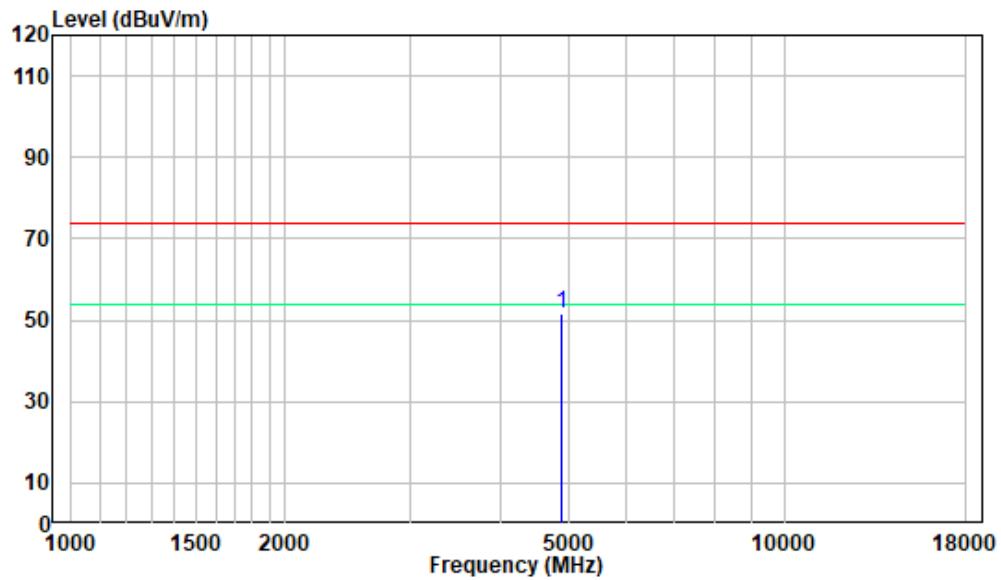
The other spurious emission which is 20dB to the limit or in noise floor level was not recorded.

The test result of Peak was less than the limit of average, just the Peak value was recorded.

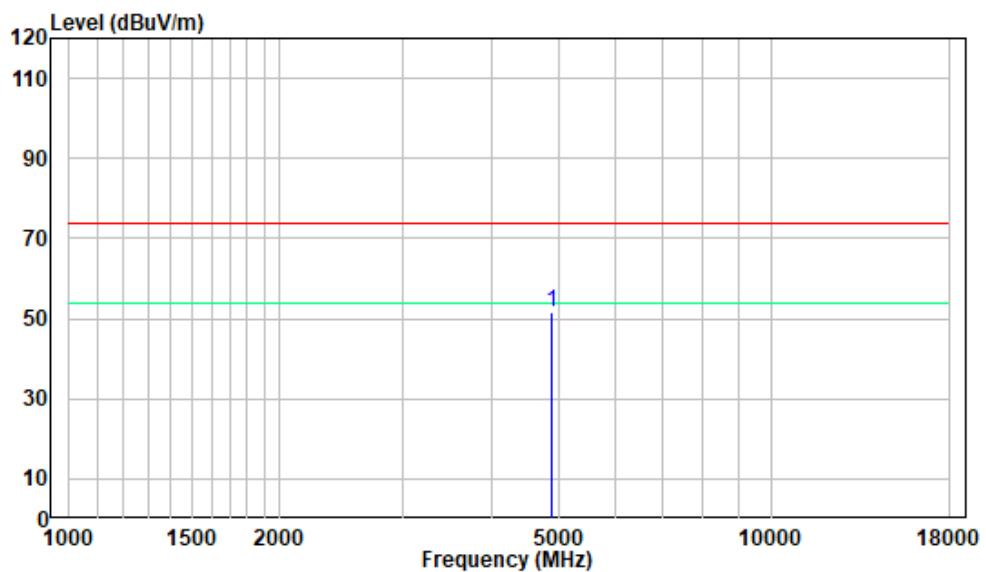
**Pre-scan with Middle channel Peak**

**1-18GHz**

**Horizontal**

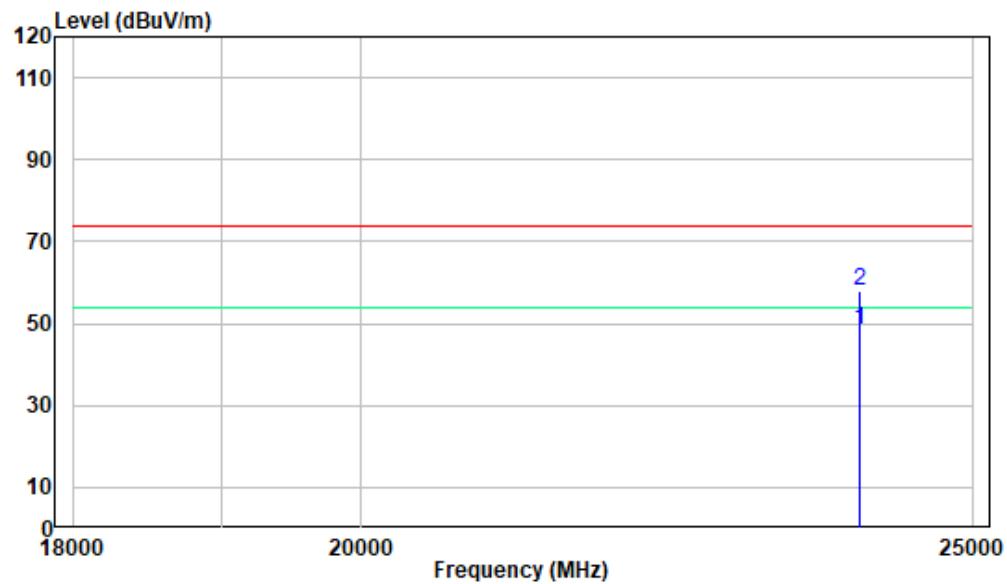


**Vertical**

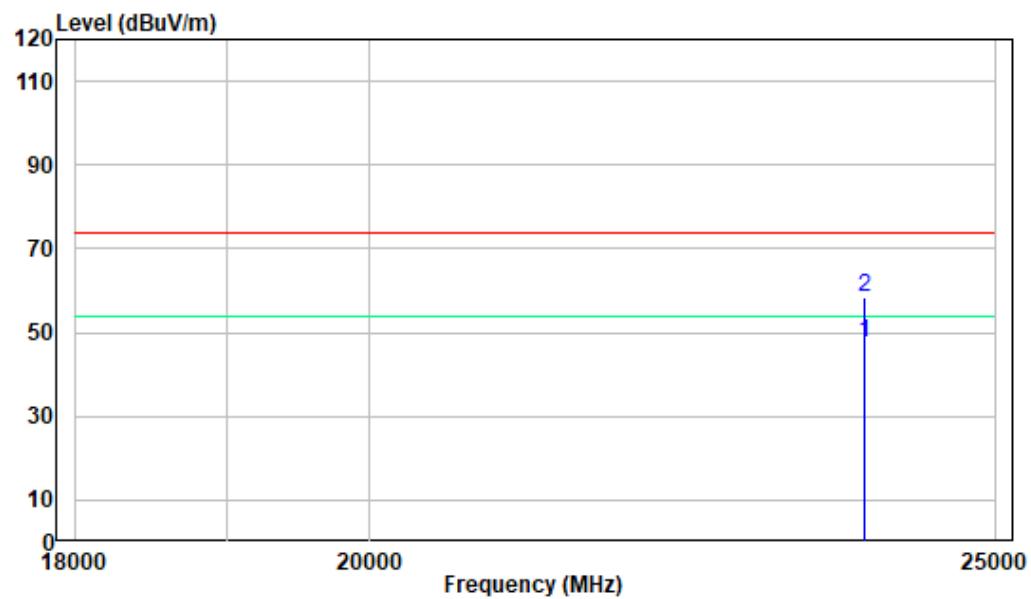


**18-25GHz**

**Horizontal**



**Vertical**



## **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**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	70 %
<b>ATM Pressure:</b>	101.0 kPa

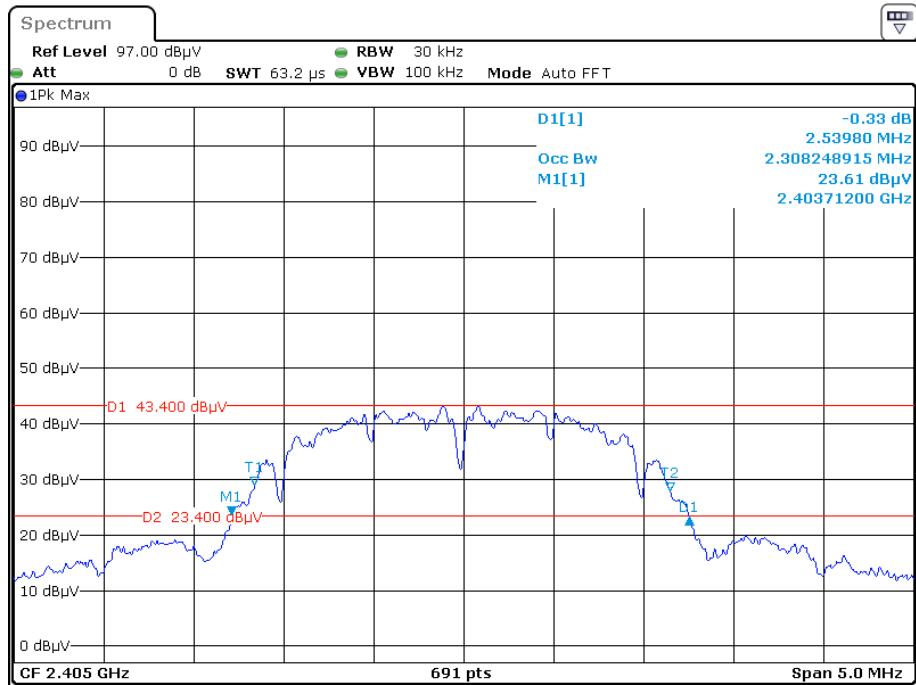
*The testing was performed by Ting Lu on 2022-06-20.*

*EUT operation mode: Transmitting*

*Please refer to the following table and plots.*

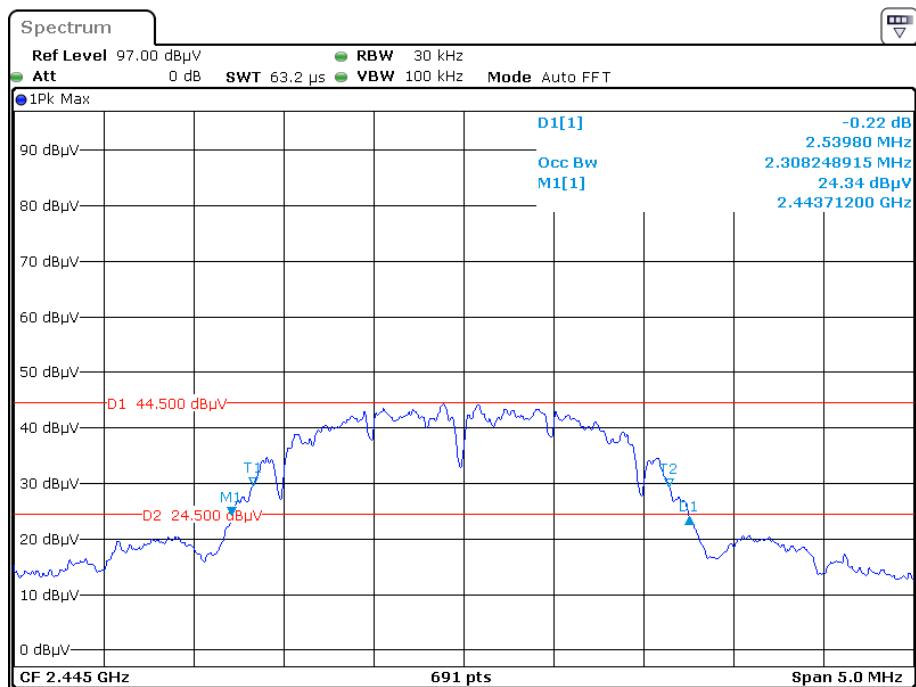
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2405	2.540
Middle	2445	2.540
High	2480	2.540

### Low Channel

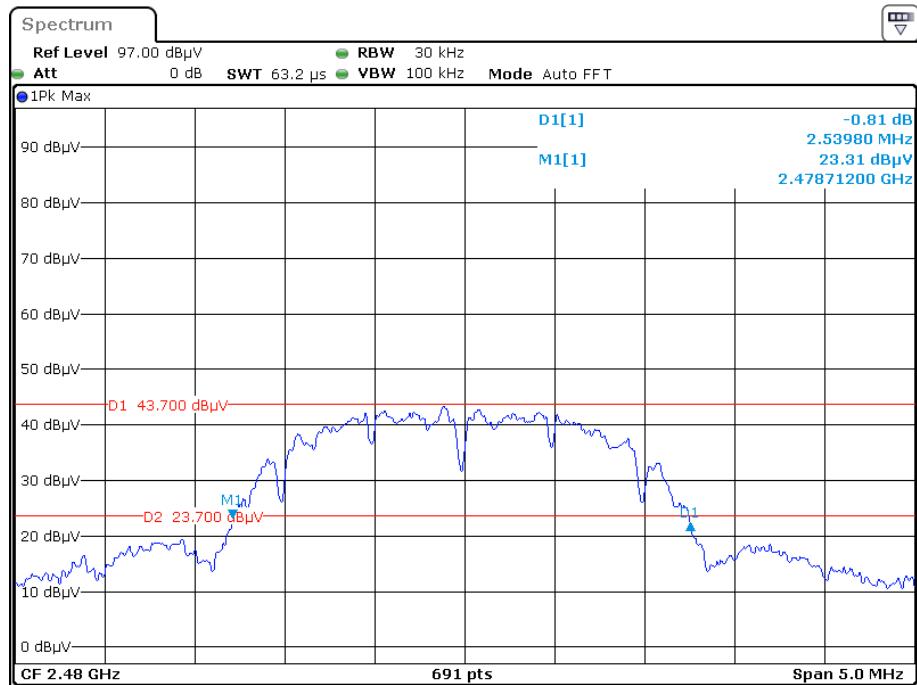


Date: 20.JUN.2022 15:17:20

### Middle Channel



Date: 20.JUN.2022 15:26:56

**High Channel**

Date: 20.JUN.2022 15:31:53

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