



## **TEST REPORT**

Applicant Name : Address : Zeeva International Limited Suite 1007B, 10th Floor, Exchange Tower, 33 Wang Chiu Road, Kowloon Bay, Hong Kong RA221208-60240E-RF 2ADM5-SP-0205

Report Number : FCC ID:

**Test Standard (s)** FCC PART 15.247

#### Sample Description

Product Type: Test Model: Date Received: Date of Test: Report Date: BT LED EDGE HORT SPKR SP-0205, SP-0211 2022-12-08 2022-12-19 to 2022-12-26 2022-12-28

Test Result:

Pass\*

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

**Prepared and Checked By:** 

Roger, Ling

Roger.Ling EMC Engineer

**Approved By:** 

Candry . Cr

Candy Li EMC Engineer

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

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Shenzhen Accurate Technology Co., Ltd.	Report No.: RA221208-60240E-RF
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## **GENERAL INFORMATION**

Duradurat	DT LED EDCE HODT ODVD			
Product	BT LED EDGE HORT SPKR			
Tested Model	SP-0205			
Multiple Model	SP-0211			
SKU	BLACK - 7450039 BLUE - 7450040 RED - 7450041 GREEN - 7450042			
UPC	BLACK – 1922344100354 BLUE – 1922344100361 RED – 1922344100378 GREEN - 1922344100385			
Model difference	Please refer to DOS Letter			
Frequency Range	2402~2480MHz			
Maximum conducted Peak output power	1.90dBm			
Modulation Technique	BDR(GFSK)/EDR(π/4-DQPSK)/EDR(8DPSK)			
Antenna Specification*	Internal Antenna: -0.58dBi(provided by the applicant)			
Voltage Range	DC 3.7V from battery or DC 5V from USB port.			
RA221208-60240E-RF-S1 for model SP-0205Sample numberRA221208-60240E-RF-S2 for model SP-0211 (Assigned by ATC, Shenzhen)				
Sample/EUT Status	Good condition			
and SP-0205 has one more	identical schematic to model SP-0205, except for difference appearance LED driving circuit than SP-0211, please refer to EUT photo and DOS odels were test AC line conducted emission and radiated emission RF			

#### **Product Description for Equipment under Test (EUT)**

letter for detail. Both two models were test AC line conducted emission and radiated emission, RF conducted test only test model SP-0205.

#### Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 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**

Para	meter	Uncertainty
Occupied Char	nnel Bandwidth	5%
RF Fre	equency	$0.082*10^{-7}$
RF output pov	wer, conducted	0.73dB
Unwanted Emi	ssion, conducted	1.6dB
AC Power Lines C	onducted Emissions	2.72dB
	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
Emissions, Radiated	1GHz - 18GHz	4.98dB
Radiated	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
Temperature		1 °C
Hun	nidity	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 4297.01

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 5077A.

## SYSTEM TEST CONFIGURATION

#### **Description of Test Configuration**

The system was configured for testing in an engineering mode.

#### **EUT Exercise Software**

Software "FCC\_assist\_1.0.2.2"\* was used during testing and the power level was 10\*.

#### **Special Accessories**

N/A.

#### **Equipment Modifications**

No modification was made to the EUT tested.

#### **Support Equipment List and Details**

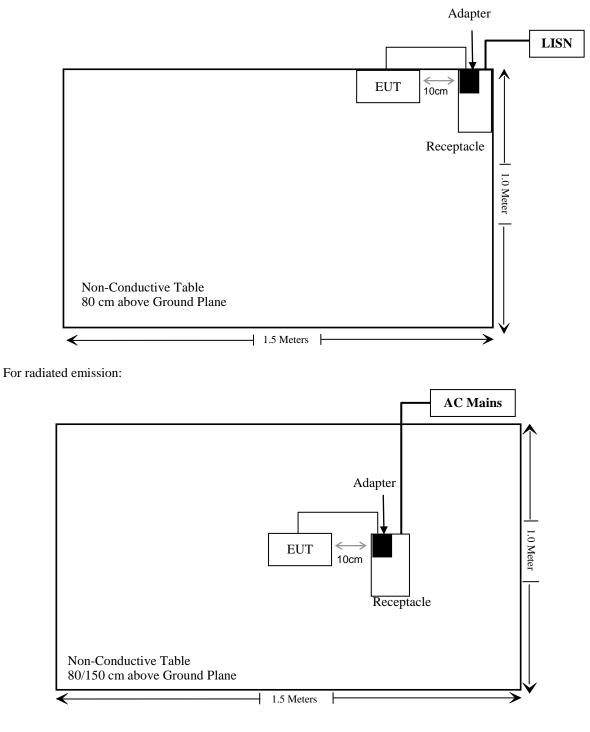
Manufacturer	Description	Model	Serial Number
HUAWEI	Adapter	HW-050100C01	H779KBK6V19398

External I/O Cable

Cable Description	Length (m)	From/Port	То
Un-shielding Detachable USB Cable	0.3	EUT	Adapter

## **Block Diagram of Test Setup**

For conducted emission:



## SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247(i), §1.1307(b)	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliant
§15.247(a)(1)	20 dB Emission Bandwidth & 99% Occupied Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges	Compliant

## TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date			
Conducted Emissions Test								
Rohde & Schwarz	EMI Test Receiver	ESCI	100784	2022/11/25	2023/11/24			
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2022/11/25	2023/11/24			
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2022/12/07	2023/12/06			
Unknown	RF Coaxial Cable	No.17	N0350	2022/11/25	2023/11/24			
	Conducted E	mission Test Soft	tware: e3 19821b (	V9)				
		Radiated Emissi	ons Test					
Rohde & Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24			
Rohde & Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24			
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07			
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07			
Quinstar	Amplifier	QLW-184055 36-J0	15964001002	2022/11/08	2023/11/07			
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			
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2022/11/25	2023/11/24			
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24			
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24			
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24			
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24			
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24			
Unknown	RF Coaxial Cable	No.15	N600	2022/11/25	2023/11/24			
Unknown	RF Coaxial Cable	No.16	N650	2022/11/25	2023/11/24			
	Radiated En	nission Test Soft	ware: e3 19821b (V	/9)				
		RF Conducted	d Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2022/11/25	2023/11/24			
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2022/11/25	2023/11/24			
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24			
Unknown	RF Coaxial Cable	No.33	RF-03	Each	time			

\* **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§15.247 (i), §1.1307 (b) – RF EXPOSURE

#### Applicable Standard

According to KDB 447498 D04 Interim General RF Exposure Guidance v01, clause 2.1.4 – MPE-Based Exemption:

An alternative to the SAR-based exemption is provided in § 1.1307(b)(3)(i)(C), for a much wider frequency range, from 300 kHz to 100 GHz, applicable for separation distances greater or equal to  $\lambda/2\pi$ , where  $\lambda$  is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the product of the maximum antenna gain and the delivered maximum time-averaged power. For this case, a RF source is an RF exempt device if its ERP (watts) is no more than a frequency-dependent value, as detailed tabular form in Appendix B. These limits have been derived based on the basic specifications on Maximum Permissible Exposure (MPE) considered for the FCC rules in § 1.1310(e)(1).

Table to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R <sup>2</sup> .
1.34-30	3,450 R <sup>2</sup> /f <sup>2</sup> .
30-300	3.83 R <sup>2</sup> .
300-1,500	0.0128 R <sup>2</sup> f.
1,500-100,000	19.2R <sup>2</sup> .

f = frequency in MHz;

R = minimum separation distance from the body of a nearby person (appropriate units, e.g., m);

#### **Test Result**

For worst case:

Mode	Frequency Range	Tune-up Output Power		Antenna Gain		ERP		Evaluation Distance	MPE-Based Exemption
Widde	(MHz)	(dBm)	( <b>mW</b> )	(dBi)	(dBd)	(dBm)	(mW)	(cm)	Threshold (mW)
BDR/EDR	2402-2480	2	1.58	-0.58	-2.73	-0.73	0.85	20	768

Note 1: The tune-up power was declared by the applicant. Note 2: 0dBd=2.15dBi.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

**Result:** Compliant.

## 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 arrangement, which was permanently attached and the antenna gain is -0.58dBi, fulfill the requirement of this section. Please refer to the EUT photos.

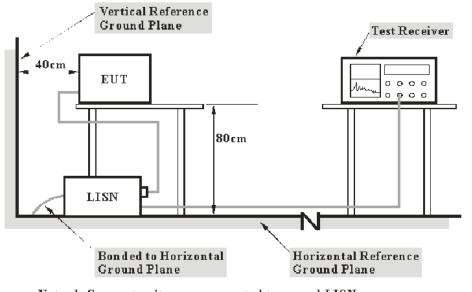
**Result:** Compliant.

## 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 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.

#### **Factor & Margin Calculation**

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

Factor = LISN VDF + 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 calculation is as follows:

Over Limit = Level – Limit Level = Read Level + Factor

#### **Test Data**

#### **Environmental Conditions**

Temperature:	18°C
<b>Relative Humidity:</b>	26 %
ATM Pressure:	101.0kPa

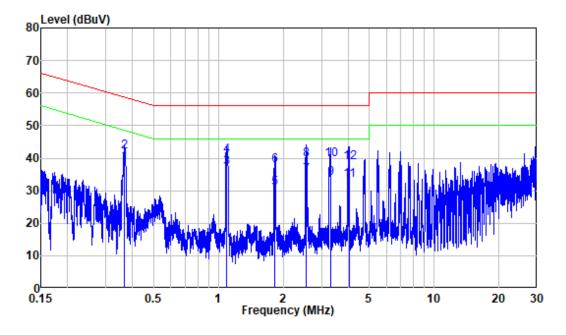
The testing was performed by Chen Jie on 2022-12-19.

*EUT operation mode: Charging + BT Transmitting* 

Report No.: RA221208-60240E-RF

#### For Model SP-0205:

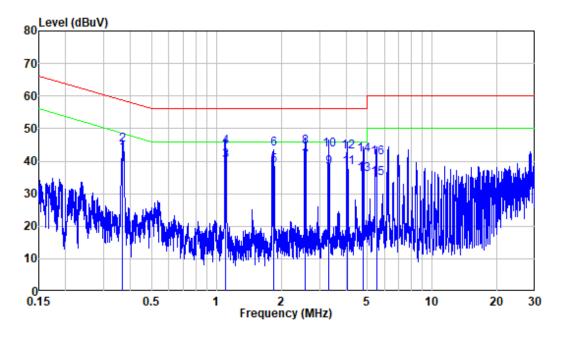
#### AC 120V/60 Hz, Line



Site :	Shielding Room						
Condition:	Line						
Job No. :	RA221208-60240E-RF						
Mode :	BT Transmitting						
Power :	AC 120V 60Hz						

		Read		Limit	0ver	
Freq	Factor	Level	Level	Line	Limit	Remark
MHz	dB	dBuV	dBuV	dBuV	dB	
0.366	9.80	28.74	38.54	48.58	-10.04	Average
0.366	9.80	32.19	41.99	58.58	-16.59	QP
1.094	9.81	27.22	37.03	46.00	-8.97	Average
1.094	9.81	31.02	40.83	56.00	-15.17	QP
1.824	9.82	20.91	30.73	46.00	-15.27	Average
1.824	9.82	27.93	37.75	56.00	-18.25	QP
2.560	9.83	24.82	34.65	46.00	-11.35	Average
2.560	9.83	29.84	39.67	56.00	-16.33	QP
3.304	9.83	23.94	33.77	46.00	-12.23	Average
3.304	9.83	29.77	39.60	56.00	-16.40	QP
4.041	9.84	23.26	33.10	46.00	-12.90	Average
4.041	9.84	28.74	38.58	56.00	-17.42	QP
29.960	10.10	18.70	28.80	50.00	-21.20	Average
29.960	10.10	24.51	34.61	60.00	-25.39	QP
	MHz 0.366 0.366 1.094 1.094 1.824 1.824 2.560 2.560 3.304 3.304 4.041 4.041 29.960	MHz         dB           0.366         9.80           0.366         9.80           1.094         9.81           1.094         9.81           1.824         9.82           1.824         9.82           1.824         9.82           3.304         9.83           3.304         9.83           4.041         9.84           29.960         10.10	Freq Factor         Level           MHz         dB         dBuV           0.366         9.80         28.74           0.366         9.80         32.19           1.094         9.81         27.22           1.094         9.81         31.02           1.824         9.82         20.91           1.824         9.82         27.93           2.560         9.83         24.82           2.560         9.83         29.84           3.304         9.83         29.77           4.041         9.84         23.26           4.041         9.84         28.74           29.960         10.10         18.70	Freq Factor         Level         Level           MHz         dB         dBuV         dBuV           0.366         9.80         28.74         38.54           0.366         9.80         32.19         41.99           1.094         9.81         27.22         37.03           1.094         9.81         31.02         40.83           1.824         9.82         20.91         30.73           1.824         9.82         27.93         37.75           2.560         9.83         24.82         34.65           2.560         9.83         29.84         39.67           3.304         9.83         23.94         33.77           3.304         9.83         29.77         39.60           4.041         9.84         23.26         33.10           4.041         9.84         28.74         38.58           29.960         10.10         18.70         28.80	Freq Factor         Level         Level         Line           MHz         dB         dBuV         dBuV         dBuV         dBuV           0.366         9.80         28.74         38.54         48.58           0.366         9.80         32.19         41.99         58.58           1.094         9.81         27.22         37.03         46.00           1.094         9.81         31.02         40.83         56.00           1.824         9.82         20.91         30.73         46.00           1.824         9.82         27.93         37.75         56.00           2.560         9.83         24.82         34.65         46.00           2.560         9.83         29.84         39.67         56.00           3.304         9.83         23.94         33.77         46.00           3.304         9.83         29.77         39.60         56.00           4.041         9.84         23.26         33.10         46.00           4.041         9.84         28.74         38.58         56.00           29.960         10.10         18.70         28.80         50.00	Freq Factor         Level         Level         Line         Limit           MHz         dB         dBuV         dBuV

### AC 120V/60 Hz, Neutral

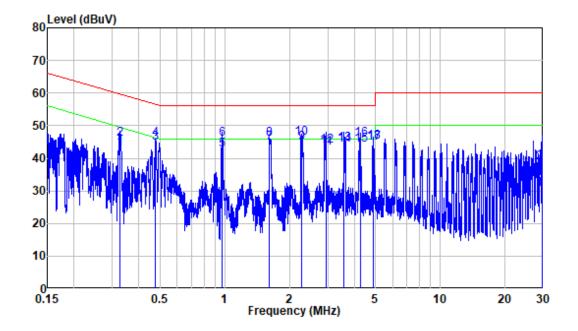


Site	:	Shielding Room
Condition	:	Neutral
Job No.	:	RA221208-60240E-RF
Mode	:	BT Transmitting
Power	:	AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.367	9.80	32.39	42.19	48.57	-6.38	Average
2	0.367	9.80	35.10	44.90	58.57	-13.67	QP
3	1.100	9.81	30.29	40.10	46.00	-5.90	Average
4	1.100	9.81	34.63	44.44	56.00	-11.56	QP
5	1.834	9.82	28.67	38.49	46.00	-7.51	Average
6	1.834	9.82	33.93	43.75	56.00	-12.25	QP
7	2.579	9.83	30.02	39.85	46.00	-6.15	Average
8	2.579	9.83	34.43	44.26	56.00	-11.74	QP
9	3.324	9.83	28.35	38.18	46.00	-7.82	Average
10	3.324	9.83	33.75	43.58	56.00	-12.42	QP
11	4.054	9.84	28.18	38.02	46.00	-7.98	Average
12	4.054	9.84	33.16	43.00	56.00	-13.00	QP
13	4.791	9.88	26.07	35.95	46.00	-10.05	Average
14	4.791	9.88	32.14	42.02	56.00	-13.98	QP
15	5.535	9.92	24.95	34.87	50.00	-15.13	Average
16	5.535	9.92	31.19	41.11	60.00	-18.89	QP

#### For Model SP-0211:

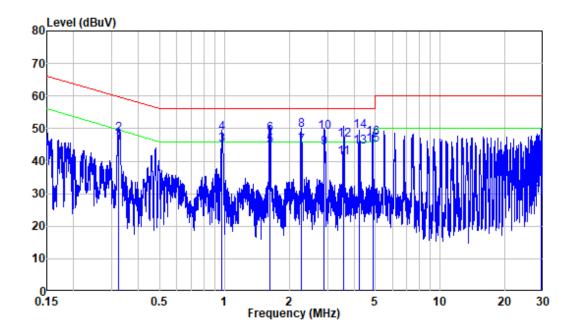
#### AC 120V/60 Hz, Line



Site :	Shielding Room				
Condition:	Line				
Job No. :	RA221208-60240E-RF				
Mode :	Transmitting				
Power :	AC 120V 60Hz				

	Freq	Factor		Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.326	9.80	32.97	42.77	49.56	-6.79	Average
2	0.326	9.80	36.07	45.87	59.56	-13.69	QP
3	0.477	9.80	34.97	44.77	46.40	-1.63	Average
4	0.477	9.80	36.11	45.91	56.40	-10.49	QP
5	0.974	9.81	32.82	42.63	46.00	-3.37	Average
6	0.974	9.81	35.94	45.75	56.00	-10.25	QP -
7	1.613	9.82	34.88	44.70	46.00	-1.30	Average
8	1.613	9.82	35.98	45.80	56.00	-10.20	QP -
9	2.261	9.82	34.96	44.78	46.00	-1.22	Average
10	2.261	9.82	36.35	46.17	56.00	-9.83	QP -
11	2.940	9.83	33.36	43.19	46.00	-2.81	Average
12	2.940	9.83	33.98	43.81	56.00	-12.19	QP
13	3.568	9.84	34.51	44.35	46.00	-1.65	Average
14	3.568	9.84	34.24	44.08	56.00	-11.92	QP -
15	4.264	9.84	34.18	44.02	46.00	-1.98	Average
16	4.264	9.84	36.17	46.01	56.00	-9.99	QP -
17	4,900	9,85	34.83	44.68	46.00	-1.32	Average
18	4.900	9.85				-10.99	-
19	29,586	10.10	20.27				Average
20	29.586	10.10	28.48	38.58		-21.42	-
							-

### AC 120V/60 Hz, Neutral



Site :	Shielding Room				
Condition:	Neutral				
Job No. :	RA221208-60240E-RF				
Mode :	Transmitting				
Power :	AC 120V 60Hz				

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
-	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.324	9.80	35.83	45.63	49.60	-3.97	Average
2	0.324	9.80	38.56	48.36	59.60 ·	-11.24	-
3	0.970	9.81	35.06	44.87	46.00	-1.13	Average
4	0.970	9.81	38.81	48.62	56.00	-7.38	QP -
5	1.627	9.82	34.94	44.76	46.00	-1.24	Average
6	1.627	9.82	38.40	48.22	56.00	-7.78	QP
7	2.271	9.82	34.86	44.68	46.00	-1.32	Average
8	2.271	9.82	39.83	49.65	56.00	-6.35	QP
9	2.894	9.83	34.37	44.20	46.00	-1.80	Average
10	2.894	9.83	38.94	48.77	56.00	-7.23	QP
11	3.558	9.84	31.28	41.12	46.00	-4.88	Average
12	3.558	9.84	36.77	46.61	56.00	-9.39	QP
13	4.224	9.85	34.68	44.53	46.00	-1.47	Average
14	4.224	9.85	39.23	49.08	56.00	-6.92	QP
15	4.861	9.88	34.97	44.85	46.00	-1.15	Average
16	4.861	9.88	37.30	47.18	56.00	-8.82	QP
17	29.235	10.19	19.04	29.23	50.00	-20.77	7 Average
18	29.235	10.19	25.03	35.22	60.00	-24.78	3 QP

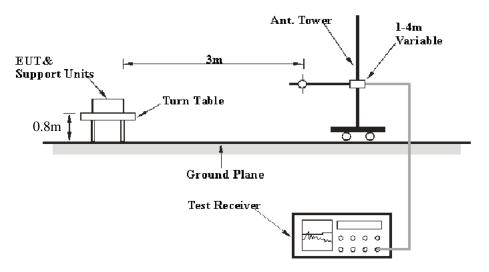
## FCC §15.205, §15.209 & §15.247(d) - RADIATED EMISSIONS

#### **Applicable Standard**

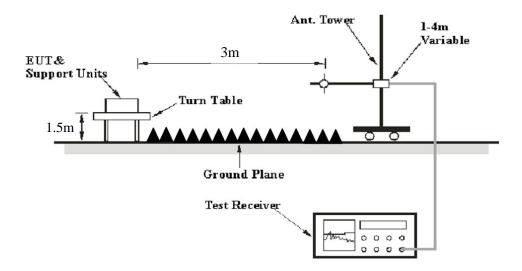
FCC §15.205; §15.209; §15.247(d)

#### **EUT Setup**

Below 1 GHz:



#### Above 1GHz:



The radiated emission performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.247 limits.

#### EMI Test Receiver & Spectrum Analyzer Setup

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	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	РК

For average measurement:

Use the duty cycle factor correction factor method per 15.35(c). Duty cycle=On time/100milliseconds, On time=N1\*L1+N2\*L2+...Nn-1\*Ln-1+Nn\*Ln, Where N1 is number of type 1 pulses, L1 is length of type 1 pulse, etc. Average Emission Level=Peak Emission Level+20\*log(Duty cycle)

#### **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.

If the maximized peak measured value complies with the limit, then it is unnecessary to perform an QP/Average measurement

#### Factor & Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss - 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 calculation is as follows:

Over Limit/Margin = Level / Corrected Amplitude – Limit Level / Corrected Amplitude = Read Level + Factor

#### **Test Data**

#### **Environmental Conditions**

Temperature:	23~24 °C
<b>Relative Humidity:</b>	56%
ATM Pressure:	101kPa

The testing was performed by Jason Liu from 2022-12-19 to 2022-12-26.

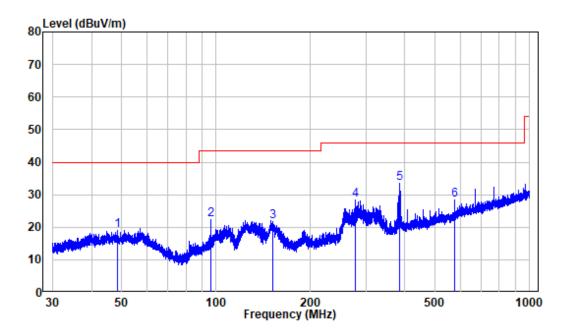
EUT operation mode: Transmitting

(Scan with GFSK,  $\pi/4$ -DQPSK, 8DPSK mode at X axis, Y axis, Z axis, the worst case is 8DPSK Mode at Y axis)

#### Below 1GHz: 8DPSK, High Channel:

#### For Model SP-0205:

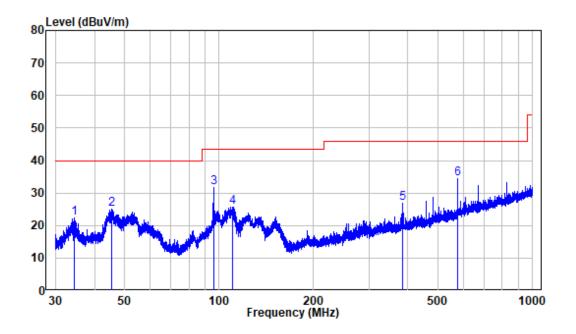
#### Horizontal



chamber
3m HORIZONTAL
RA221208-60240E-RF
BT transmitting

	Freq	Factor			Limit Line		Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	48.332	-9.98	28.94	18.96	40.00	-21.04	Peak
2	95.972	-12.31	34.54	22.23	43.50	-21.27	Peak
3	151.930	-15.16	36.76	21.60	43.50	-21.90	Peak
4	277.945	-9.71	38.09	28.38	46.00	-17.62	Peak
5	384.100	-7.08	40.52	33.44	46.00	-12.56	Peak
6	576.139	-3.70	31.96	28.26	46.00	-17.74	Peak

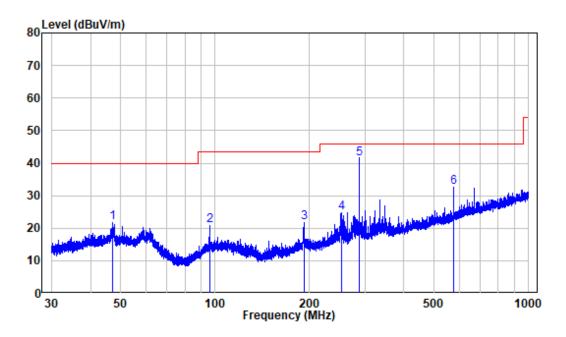




Site :	chamber
Condition:	3m VERTICAL
Job No. :	RA221208-60240E-RF
Test Mode:	BT transmitting

	Freq	Factor			Limit Line		Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.578	-11.68	34.00	22.32	40.00	-17.68	Peak
2	45.475	-9.96	35.09	25.13	40.00	-14.87	Peak
3	96.014	-12.30	43.88	31.58	43.50	-11.92	Peak
4	110.230	-11.99	37.78	25.79	43.50	-17.71	Peak
5	384.100	-7.08	34.02	26.94	46.00	-19.06	Peak
6	576.139	-3.70	38.03	34.33	46.00	-11.67	Peak

#### For Model SP-0211:

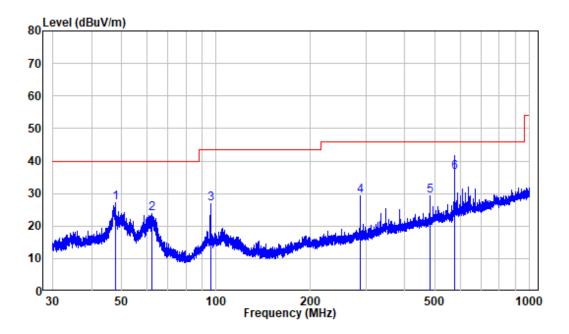


Horizontal

Site :	chamber
Condition:	3m HORIZONTAL
Job No. :	RA221208-60240E-RF
Test Mode:	BT transmitting

	Freq	Factor			Limit Line		Remark
-	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	47.057	-10.00	31.72	21.72	40.00	-18.28	Peak
2	95.972	-12.31	33.11	20.80	43.50	-22.70	Peak
3	191.997	-11.25	33.10	21.85	43.50	-21.65	Peak
4	253.614	-10.65	35.52	24.87	46.00	-21.13	Peak
5	287.990	-9.36	50.80	41.44	46.00	-4.56	QP
6	576.139	-3.70	36.37	32.67	46.00	-13.33	Peak





Site :	chamber
Condition:	3m VERTICAL
Job No. :	RA221208-60240E-RF
Test Mode:	BT transmitting

	Freq	Factor			Limit Line		Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	47.805	-10.00	37.07	27.07	40.00	-12.93	Peak
	62.186	-11.50	35.42	23.92	40.00	-16.08	Peak
3	95.972	-12.31	39.25	26.94	43.50	-16.56	Peak
4	287.990	-9.36	38.70	29.34	46.00	-16.66	Peak
5	480.107	-5.00	34.39	29.39	46.00	-16.61	Peak
6	576.139	-3.70	40.20	36.50	46.00	-9.50	QP

### Above 1GHz (worst case for 8DPSK):

#### Model SP-0205

Frequency	Receiver		Turntable	Rx An	itenna	Factor	Absolute	Limit	Margin
(MHz)	Reading (dBuV)	PK/Ave	Angle Degree	Height (m)	Polar (H/V)	(dB/m)	Level (dBuV/m)	(dBuV/m)	( <b>dB</b> )
				Low Ch	annel				
2310	46.84	РК	257	1.3	Н	-7.23	39.61	74	-34.39
2310	49.61	PK	198	1.4	V	-7.23	42.38	74	-31.62
2390	54.85	PK	34	1.3	Н	-7.21	47.64	74	-26.36
2390	51.54	PK	348	2.0	V	-7.21	44.33	74	-29.67
4804	59.66	PK	222	2.0	Н	-3.52	56.14	74	-17.86
4804	59.53	PK	145	1.6	V	-3.52	56.01	74	-17.99
				Middle C	hannel				
4882	55.7	PK	154	1.9	Н	-3.37	52.33	74	-21.67
4882	55.99	PK	32	1.2	V	-3.37	52.62	74	-21.38
	•			High Ch	annel				
2483.5	61.99	PK	306	1.3	Н	-7.2	54.79	74	-19.21
2483.5	52.45	PK	323	1.6	V	-7.2	45.25	74	-28.75
2500	55.36	PK	26	2.2	Н	-7.18	48.18	74	-25.82
2500	49.04	PK	199	1.4	V	-7.18	41.86	74	-32.14
4960	59.68	PK	237	1.3	Н	-3.01	56.67	74	-17.33
4960	58.34	PK	147	2.2	V	-3.01	55.33	74	-18.67

#### Model SP-0211

Frequency	Receiver		Turntable	Rx An	itenna	Factor	Absolute	Limit	Margin
(MHz)	Reading (dBuV)	PK/Ave	Angle Degree	Height (m)	Polar (H/V)	(dB/m)	Level (dBuV/m)	(dBuV/m)	(dB)
				Low Ch	annel				
2310	48.39	PK	289	1.5	Н	-7.23	41.16	74	-32.84
2310	50.76	PK	180	2.0	V	-7.23	43.53	74	-30.47
2390	54.2	PK	303	1.5	Н	-7.21	46.99	74	-27.01
2390	52.72	PK	17	1.4	V	-7.21	45.51	74	-28.49
4804	57.38	PK	4	1.8	Н	-3.52	53.86	74	-20.14
4804	57.41	PK	93	2.1	V	-3.52	53.89	74	-20.11
				Middle C	hannel				
4882	55.79	PK	241	2.0	Н	-3.37	52.42	74	-21.58
4882	56.03	PK	67	1.2	V	-3.37	52.66	74	-21.34
				High Ch	annel				
2483.5	52.03	PK	20	1.9	Н	-7.2	44.83	74	-29.17
2483.5	52.74	PK	277	1.9	V	-7.2	45.54	74	-28.46
2500	54.61	РК	44	1.9	Н	-7.18	47.43	74	-26.57
2500	55.82	PK	251	1.9	V	-7.18	48.64	74	-25.36
4960	57.17	PK	202	1.9	Н	-3.01	54.16	74	-19.84
4960	58.42	РК	97	1.7	V	-3.01	55.41	74	-18.59

#### Model SP-0205:

		I	Field Strength	of Average			Field Strength of Average											
Peak Duty Cycle Corrected Par																		
Frequency (MHz)	Measurement @3m (dBµV/m)	Polar (H/V)	Correction Factor (dB)	Ampitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comment											
			Low Cha	nnel														
2310	39.61	Н	-23.91	15.7	54	-38.3	Band edge											
2310	42.38	V	-23.91	18.47	54	-35.53	Band edge											
2390	47.64	Н	-23.91	23.73	54	-30.27	Band edge											
2390	44.33	V	-23.91	20.42	54	-33.58	Band edge											
4804	56.14	Н	-23.91	32.23	54	-21.77	Harmonic											
4804	56.01	V	-23.91	32.1	54	-21.9	Harmonic											
			Middle Ch	annel														
4882	52.33	Н	-23.91	28.42	54	-25.58	Harmonic											
4882	52.62	V	-23.91	28.71	54	-25.29	Harmonic											
			High Cha	nnel														
2483.5	54.79	Н	-23.91	30.88	54	-23.12	Band edge											
2483.5	45.25	V	-23.91	21.34	54	-32.66	Band edge											
2500	48.18	Н	-23.91	24.27	54	-29.73	Band edge											
2500	41.86	V	-23.91	17.95	54	-36.05	Band edge											
4960	56.67	Н	-23.91	32.76	54	-21.24	Harmonic											
4960	55.33	V	-23.91	31.42	54	-22.58	Harmonic											

#### Model SP-0211:

	Field Strength of Average										
	Peak	Р	art 15.247								
Frequency (MHz)	Measurement @3m (dBµV/m)	Polar (H/V)	Correction Factor (dB)	Corrected Ampitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comment				
			Low Cha	nnel							
2310	41.16	Н	-23.91	17.25	54	-36.75	Band edge				
2310	43.53	V	-23.91	19.62	54	-34.38	Band edge				
2390	46.99	Н	-23.91	23.08	54	-30.92	Band edge				
2390	45.51	V	-23.91	21.6	54	-32.4	Band edge				
4804	53.86	Н	-23.91	29.95	54	-24.05	Harmonic				
4804	53.89	V	-23.91	29.98	54	-24.02	Harmonic				
			Middle Ch	annel							
4882	52.42	Н	-23.91	28.51	54	-25.49	Harmonic				
4882	52.66	V	-23.91	28.75	54	-25.25	Harmonic				
			High Cha	nnel							
2483.5	44.83	Н	-23.91	20.92	54	-33.08	Band edge				
2483.5	45.54	V	-23.91	21.63	54	-32.37	Band edge				
2500	47.43	Н	-23.91	23.52	54	-30.48	Band edge				
2500	48.64	V	-23.91	24.73	54	-29.27	Band edge				
4960	54.16	Н	-23.91	30.25	54	-23.75	Harmonic				
4960	55.41	V	-23.91	31.5	54	-22.5	Harmonic				

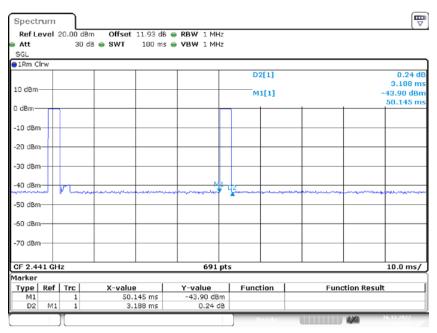
#### Note:

Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor Absolute Level (Corrected Amplitude) = Factor + Reading Margin = Absolute Level (Corrected Amplitude) – Limit The other spurious emission which is in the noise floor level was not recorded.

Average level= Peak level+ Duty Cycle Corrected Factor

The worst case duty cycle as below: Duty cycle = Ton/100ms = (3.188\*2)/100=0.06376Duty Cycle Corrected Factor = 20\*lg (Duty cycle) = 20\*lg(0.06376) = -23.91

### Duty Cycle



Date: 16.DEC.2022 16:02:38

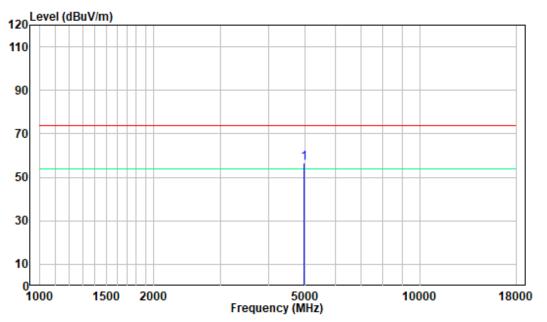
Report No.: RA221208-60240E-RF

#### 1 GHz - 18 GHz: (Pre-Scan plots)

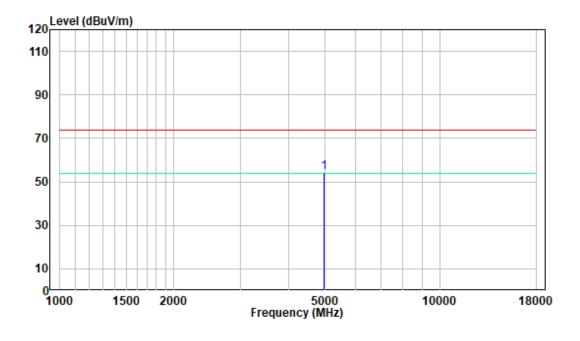
Worst case for High Channel:

Model SP-0205

Horizontal



Model SP-0211

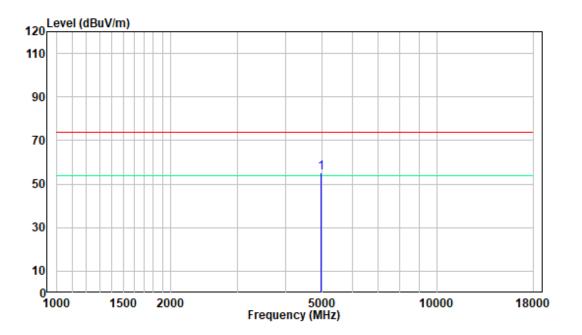




#### 150 200 1500 200 1500 200 Frequency (MHz)

#### Model SP-0205



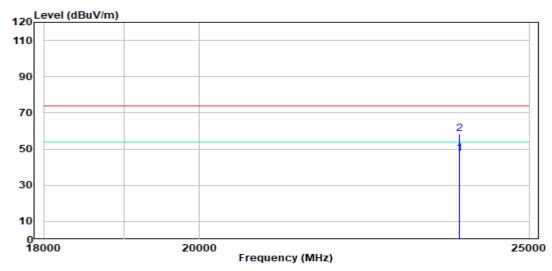


18-25GHz: (Pre-Scan plots)

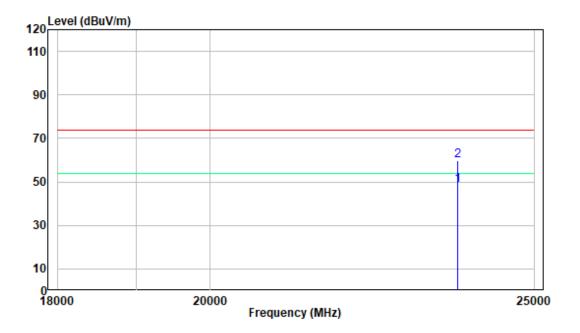
Worst case for High Channel:

#### Model SP-0205

Horizontal

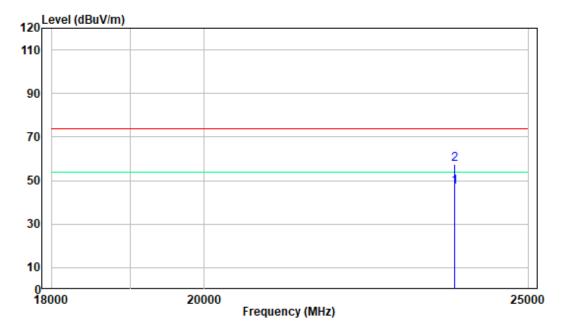


Model SP-0211

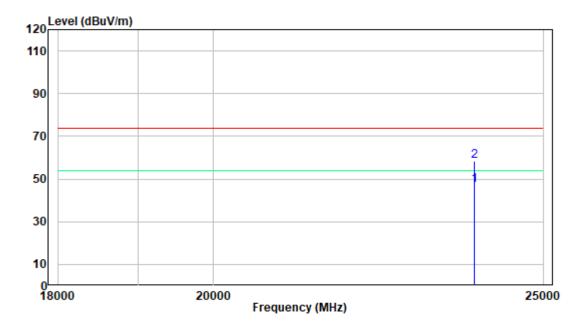




#### Model SP-0205







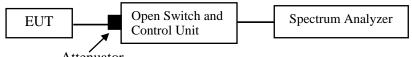
## FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

#### **Applicable Standard**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

#### **Test Procedure**

- 1. Set the EUT in TX mode, maxhold the channel.
- 2. Set the adjacent channel of the EUT and maxhold another trace.
- 3. Measure the channel separation.



Attenuator

#### Test Data

#### **Environmental Conditions**

Temperature:	22°C
Relative Humidity:	56%
ATM Pressure:	101kPa

The testing was performed by Glenn Jiang on 2022-12-16.

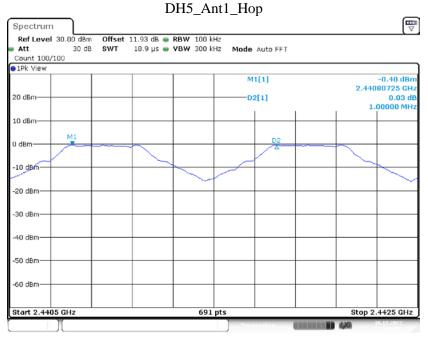
EUT operation mode: Transmitting

Test Result: Compliant.

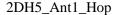
Test Mode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Нор	1	>=0.712	PASS
2DH5	Ant1	Нор	1.003	>=0.900	PASS
3DH5	Ant1	Нор	1.003	>=0.866	PASS

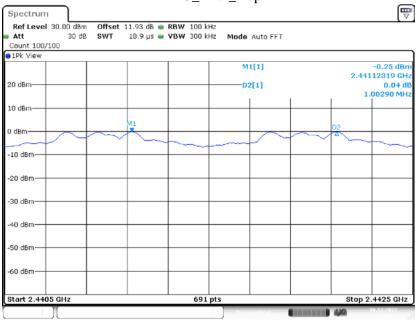
Note: The limit = (2/3) \* 20dB bandwidth

Please refer to the below plots:



Date: 16.DEC.2022 15:13:27





Date: 16.DEC.2022 15:38:27

dBm		M1[1] D2[1]				-0.29 dBm 2.44080435 GHz 0.03 dB 1.00290 MHz		
M1	$\sim$			D2	$\sim$			
		~ ~	~ -					
	M1						D2[1]	

#### 3DH5\_Ant1\_Hop

Date: 16.DEC.2022 15:47:46

# FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH & 99% OCCUPIED BANDWIDTH

#### **Applicable Standard**

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### **Test Procedure**

The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

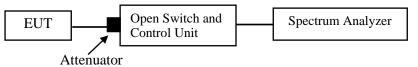
• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / 20 dB bandwidth if the device is not TX continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / 20 dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).



Attenuator

### **Test Data**

#### **Environmental Conditions**

Temperature:	22°C
<b>Relative Humidity:</b>	56%
ATM Pressure:	101kPa

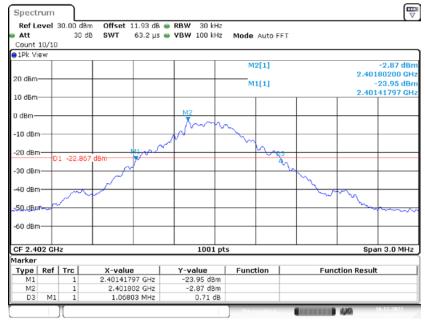
The testing was performed by Glenn Jiang on 2022-12-16.

EUT operation mode: Transmitting

Test Result: Compliant.

TestMode	Antenna	Channel	20db EBW[MHz]	99% OCCUPIED BANDWIDTH[MHz]	Verdict
DH5	Ant1	2402	1.068	0.944	PASS
		2441	1.058	0.953	PASS
		2480	1.068	0.968	PASS
2DH5	Ant1	2402	1.335	1.214	PASS
		2441	1.338	1.226	PASS
		2480	1.350	1.241	PASS
3DH5	Ant1	2402	1.299	1.211	PASS
		2441	1.296	1.217	PASS
		2480	1.293	1.22	PASS

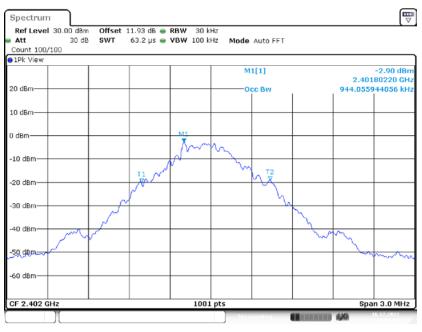
Please refer to the below plots:



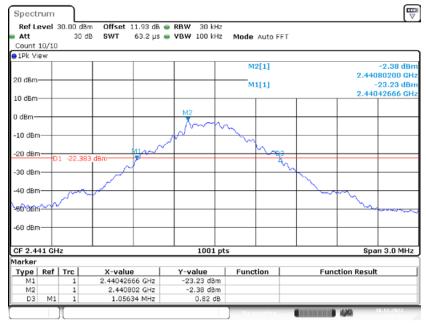
#### 20 dB EMISSION BANDWIDTH\_DH5\_Ant1\_2402

Date: 16.DEC.2022 14:55:54

#### 99% OCCUPIED BANDWIDTH\_DH5 \_Ant1\_2402



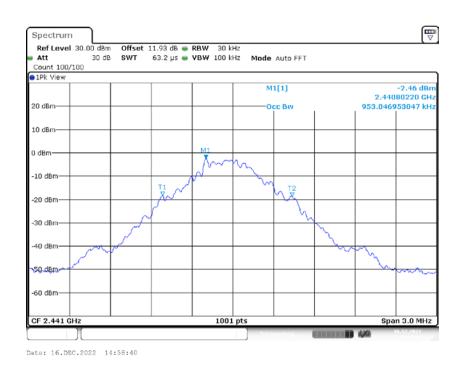
Date: 16.DEC.2022 14:56:11



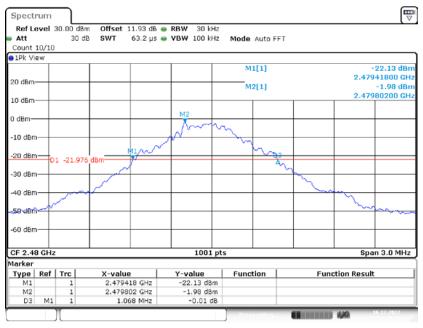
# 20 dB EMISSION BANDWIDTH\_DH5 \_Ant1\_2441

Date: 16.DEC.2022 14:58:24

# 99% OCCUPIED BANDWIDTH\_DH5 \_Ant1\_2441



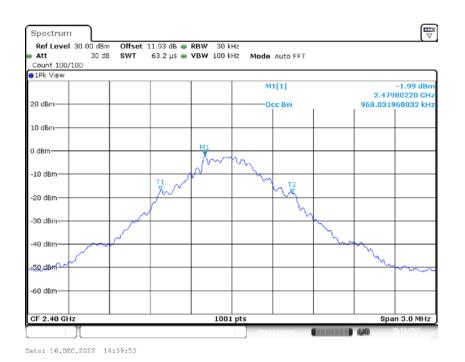
Version 11: 2021-11-09

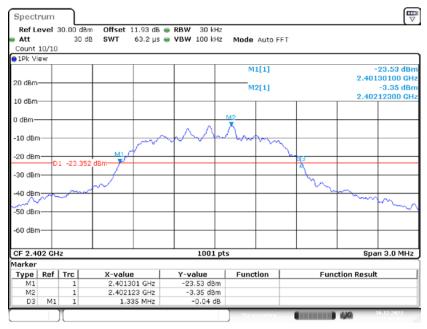


# 20 dB EMISSION BANDWIDTH\_DH5 \_Ant1\_2480

Date: 16.DEC.2022 14:59:36

# 99% OCCUPIED BANDWIDTH\_DH5 \_Ant1\_2480

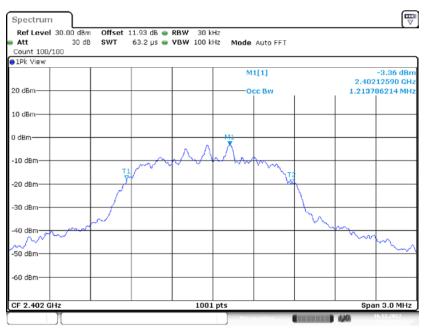




### 20 dB EMISSION BANDWIDTH\_2DH5 \_Ant1\_2402

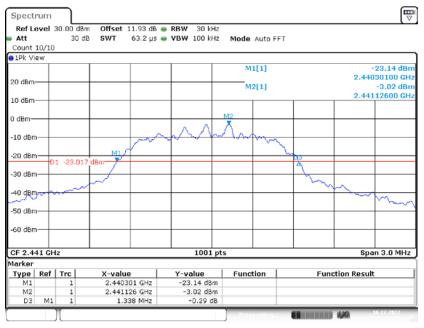
Date: 16.DEC.2022 15:01:03

# 99% OCCUPIED BANDWIDTH\_2DH5 \_Ant1\_2402



Date: 16.DEC.2022 15:01:20

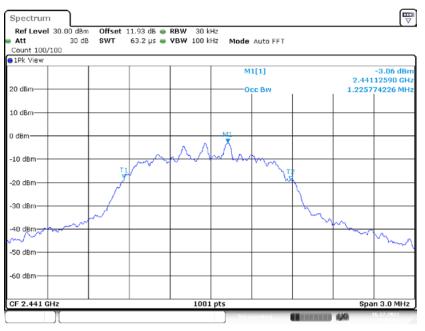
Version 11: 2021-11-09



# 20 dB EMISSION BANDWIDTH\_2DH5 \_Ant1\_2441

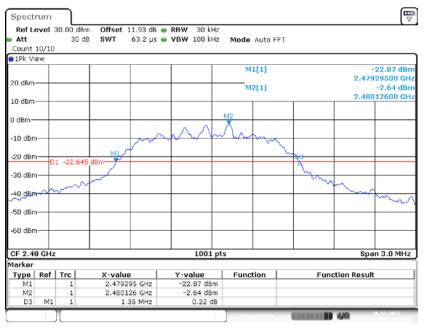
Date: 16.DEC.2022 15:02:17

# 99% OCCUPIED BANDWIDTH\_2DH5 \_Ant1\_2441



Date: 16.DEC.2022 15:02:34

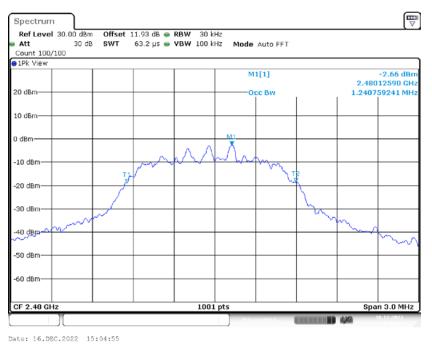
Version 11: 2021-11-09

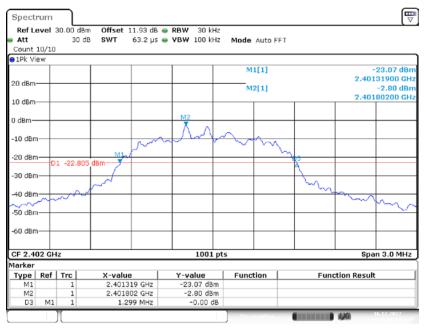


# 20 dB EMISSION BANDWIDTH \_2DH5\_Ant1\_2480

Date: 16.DEC.2022 15:04:38

# 99% OCCUPIED BANDWIDTH \_2DH5\_Ant1\_2480

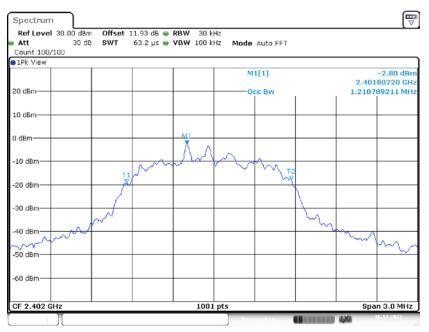




# 20 dB EMISSION BANDWIDTH\_3DH5\_Ant1\_2402

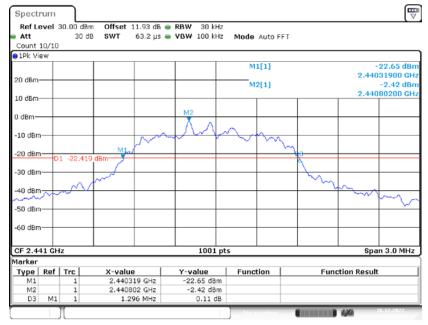
Date: 16.DEC.2022 15:05:56

# 99% OCCUPIED BANDWIDTH\_3DH5 \_Ant1\_2402



Date: 16.DEC.2022 15:06:12

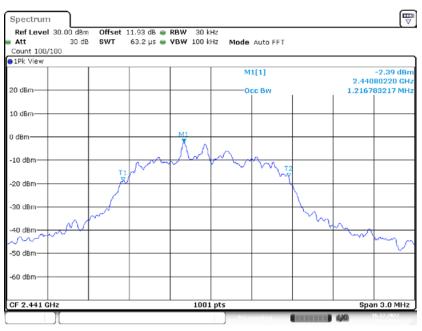
Version 11: 2021-11-09



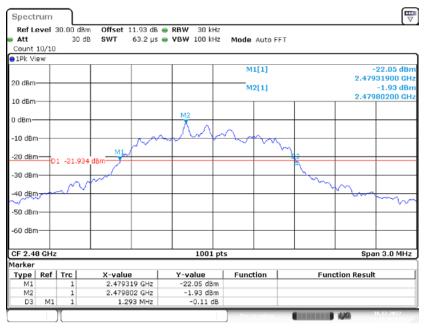
# 20 dB EMISSION BANDWIDTH\_3DH5 \_Ant1\_2441

Date: 16.DEC.2022 15:07:06

# 99% OCCUPIED BANDWIDTH\_3DH5 \_Ant1\_2441



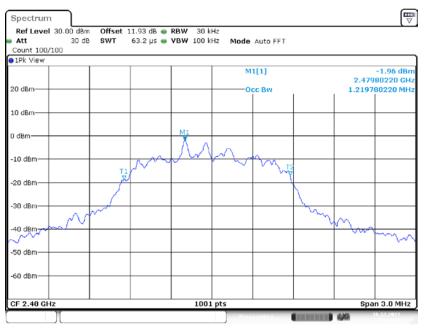
Date: 16.DEC.2022 15:07:23



# 20 dB EMISSION BANDWIDTH\_3DH5 \_Ant1\_2480

Date: 16.DEC.2022 15:08:04

# 99% OCCUPIED BANDWIDTH\_3DH5 \_Ant1\_2480



Date: 16.DEC.2022 15:08:21

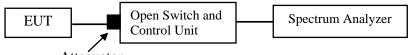
# FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST

## **Applicable Standard**

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

# **Test Procedure**

- 1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- 2. Set the EUT in hopping mode from first channel to last.
- 3. By using the max-hold function record the quantity of the channel.



Attenuator

## **Test Data**

### **Environmental Conditions**

Temperature:	22°C
Relative Humidity:	56%
ATM Pressure:	101kPa

The testing was performed by Glenn Jiang on 2022-12-16.

EUT operation mode: Transmitting

Test Result: Compliant.

Test Mode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Нор	79	>=15	PASS
2DH5	Ant1	Нор	79	>=15	PASS
3DH5	Ant1	Нор	79	>=15	PASS

Please refer to the below plots:

Att 1Pk View	30 dB	SWT	1 ms 👄	VBW 300 k	Hz Mode	Auto Swee	p		
1PK VIEW									
20 dBm									
10 dBm									
	MANA	MANDA	IONDAN	MAMA	) MAANAA		ANNAA	MMM	
-10 38m	<b>INNIN</b> N	10110111	<del>arrea</del> t.	<u>  }                                  </u>	<u> </u>	01880880	<u> Akolâko</u> l	<u>{}∪}</u>	NAILI
30 dBm									
40 dBm—									h
50 dBm									
-60 dBm									
Start 2.4 0	GHz			691	pts			Stop 2	.4835 GHz

DH5\_Ant1\_Hop

Date: 16.DEC.2022 15:15:19

2DH5\_Ant1\_Hop

Spectrum Ref Level	30.00 dBm	Offset	11.93 dB	RBW	100 ki	Ηz				[
Att	30 dB	SWT	1 m s 🗧	VBW	300 ki	Iz Mode	Auto Swee	р		
1Pk View										
20 dBm										
10 dBm										
MAN	MMM	MMW	www	1M	MM	WWW	umm	MMM	www	MM
10 dBm										
-20 dBm										
30 dBm										
40 dBm										
-50 dBm										
-60 dBm										
Start 2.4 GI	Hz				691	pts	I		Stop 2	.4835 GH

Date: 16.DEC.2022 15:39:29

Att 30 dB S	WT 1 ms 👄	VBW 300 ki	Iz Mode	Auto Swee	0		
1Pk View							
20 dBm							
10 dBm							
Mannana Marina	mmm	MMMM.	MMM	umun	mm	WWW	uwu
10 dBm							
20 dBm							
30 dBm							
30 dBm							
30 dBm							h
30 dBm							L
20 dBm 30 dBm 40 dBm 50 dBm 60 dBm							

3DH5\_Ant1\_Hop

Date: 16.DEC.2022 15:48:53

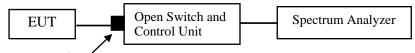
# FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

### **Applicable Standard**

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **Test Procedure**

- 1. The EUT was worked in channel hopping.
- 2. Set the RBW to: 1MHz.
- 3. Set the VBW  $\geq$  3×RBW.
- 4. Set the span to 0Hz.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Recorded the time of single pulses



Attenuator

## **Test Data**

### **Environmental Conditions**

Temperature:	22°C
Relative Humidity:	56%
ATM Pressure:	101kPa

The testing was performed by Glenn Jiang on 2022-12-16.

#### EUT operation mode: Transmitting

Test Result: Compliant.

Test Mode	Antenna	Channel	Burst Width [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Нор	0.37	320	0.119	<=0.4	PASS
DH3	Ant1	Нор	1.62	160	0.259	<=0.4	PASS
DH5	Ant1	Нор	2.86	120	0.343	<=0.4	PASS
2DH1	Ant1	Нор	0.38	330	0.126	<=0.4	PASS
2DH3	Ant1	Нор	1.63	170	0.276	<=0.4	PASS
2DH5	Ant1	Нор	2.87	110	0.315	<=0.4	PASS
3DH1	Ant1	Нор	0.38	320	0.122	<=0.4	PASS
3DH3	Ant1	Нор	1.63	160	0.26	<=0.4	PASS
3DH5	Ant1	Нор	2.87	130	0.373	<=0.4	PASS

Note 1: A period time=0.4\*79=31.6(s), Result=Burst Width\*Total Hops

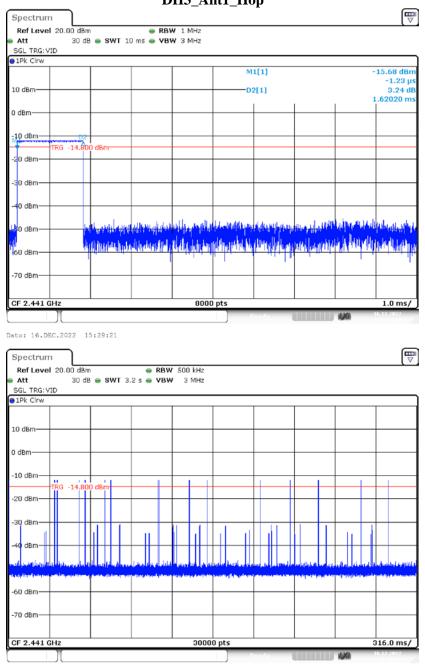
Note 2: Total Hops =Hopping Number in 3.16s\*10

Note 3: Hoping Number in 3.16s=Total of highest signals in 3.16s (Second high signals were other channel)

₽ Spectrum Ref Level 20.00 dBm RBW 1 MHz 30 dB 🖶 SWT 10 ms 🖶 VBW 3 MHz Att SGL TRG: VID ⊖1Pk Clrw M1[1] -13.27 dBr 25 n 1.12 di 10 dBm· D2[1] 371.30 µ 0 dBm-410 dBm-TRG -14.800 dD. -20 dB 0 dB 0 dB اسا ال Julation 1 0 de to ashe of paliticity and the plant of the plate of the second plant of the second plate of t ч 1 -70 dBm-CF 2.441 GHz 8000 pts 1.0 ms/ 110 Date: 16.DEC.2022 15:32:04 P Spectrum Ref Level 20.00 dBm 👄 RBW 500 kHz Att 30 dB 👄 SWT 3.2 s 👄 VBW 3 MHz SGL TRG: VID ⊖1Pk Clrw 10 dBm· 0 dBm--10 dBm -14.800 dBm -20 dBr 30.df -60 dBm -70 dBm-316.0 ms/ CF 2.441 GHz 30000 pts

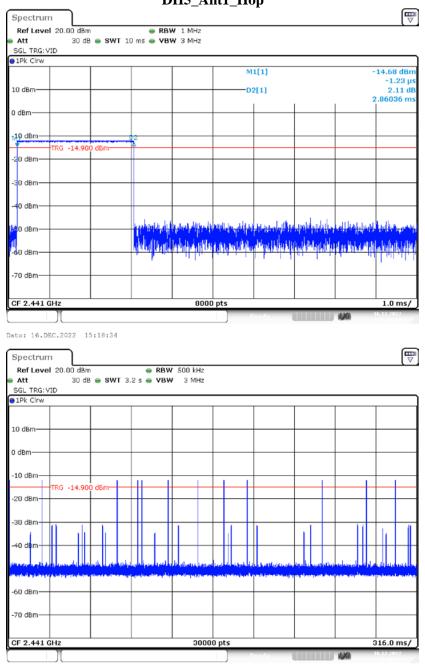
DH1\_Ant1\_Hop

Date: 16.DEC.2022 15:32:09



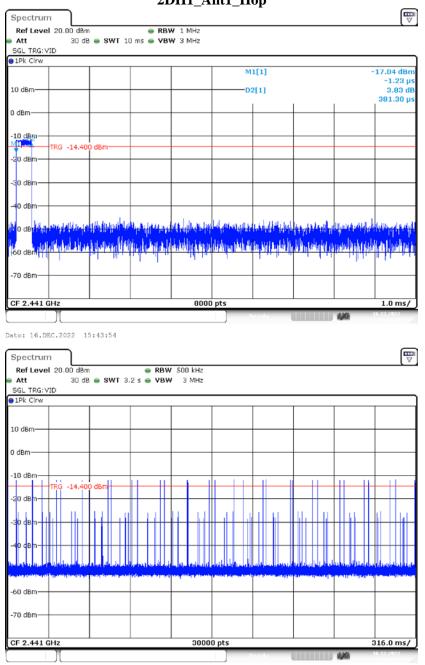
DH3\_Ant1\_Hop

Date: 16.DEC.2022 15:29:27



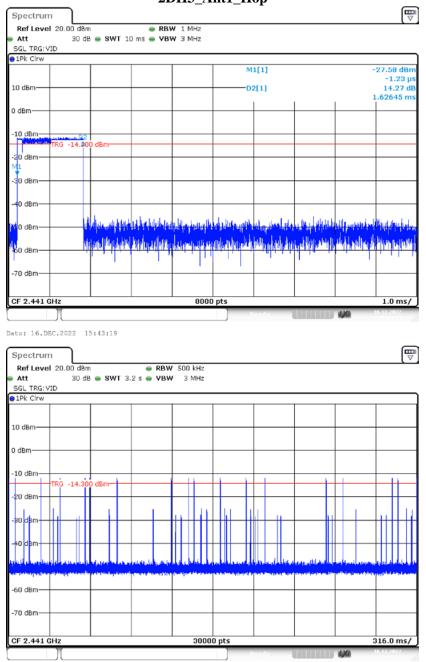


Date: 16.DEC.2022 15:18:40



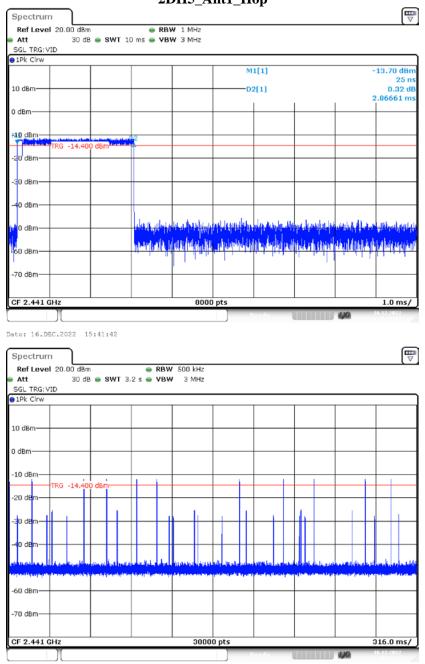


Date: 16.DEC.2022 15:43:59



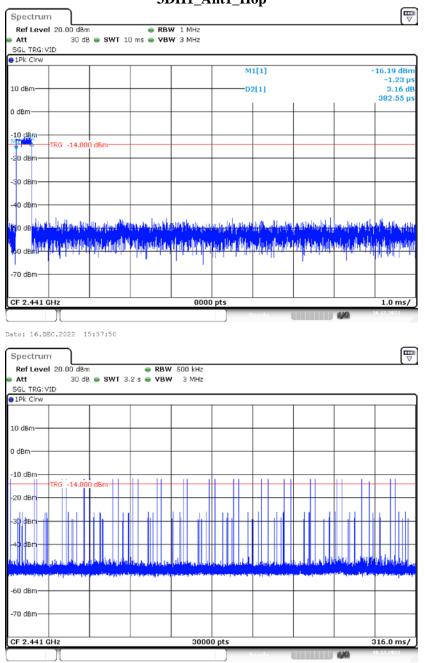
### 2DH3\_Ant1\_Hop

Date: 16.DEC.2022 15:43:25



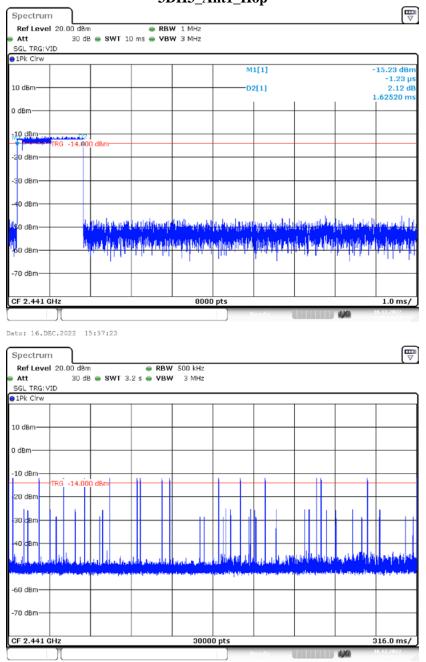
2DH5\_Ant1\_Hop

Date: 16.DEC.2022 15:41:47



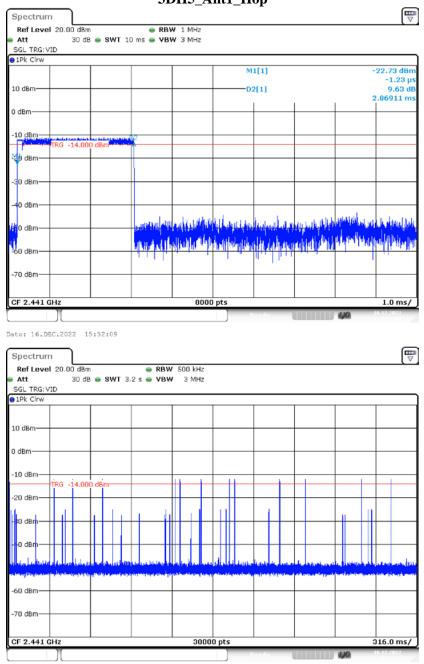
### 3DH1\_Ant1\_Hop

Date: 16.DEC.2022 15:57:56



### 3DH3\_Ant1\_Hop

Date: 16.DEC.2022 15:57:28



3DH5\_Ant1\_Hop

Date: 16.DEC.2022 15:52:15

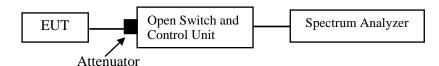
# FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

## **Applicable Standard**

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

# **Test Procedure**

- 1. Place the EUT on a bench and set in TX mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
- 3. Add a correction factor to the display.



### **Test Data**

# **Environmental Conditions**

Temperature:	22°C
<b>Relative Humidity:</b>	56%
ATM Pressure:	101kPa

The testing was performed by Glenn Jiang on 2022-12-16.

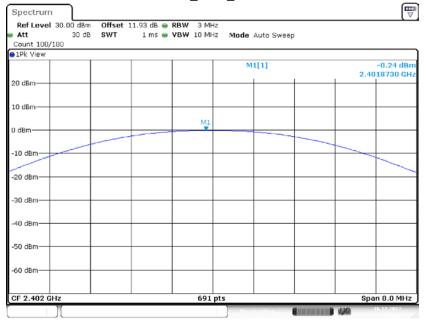
#### EUT operation mode: Transmitting

Test Result: Compliant.

Test Mode	Antenna	Channel	Conducted peak output power [dBm]	Limit[dBm]	Verdict
		2402	-0.24	<=20.97	PASS
DH5	Ant1	2441	0.28	<=20.97	PASS
		2480	0.73	<=20.97	PASS
		2402	0.54	<=20.97	PASS
2DH5	Ant1	2441	1.04	<=20.97	PASS
		2480	1.47	<=20.97	PASS
		2402	0.90	<=20.97	PASS
3DH5	Ant1	2441	1.42	<=20.97	PASS
		2480	1.90	<=20.97	PASS

Please refer to the below plots:

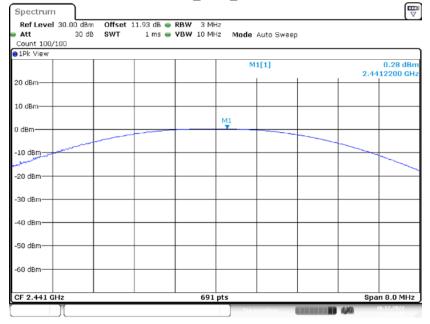
Report No.: RA221208-60240E-RF



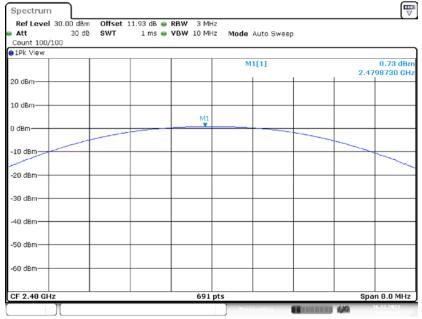
DH5\_Ant1\_2402

Date: 16.DEC.2022 14:50:22

#### DH5\_Ant1\_2441



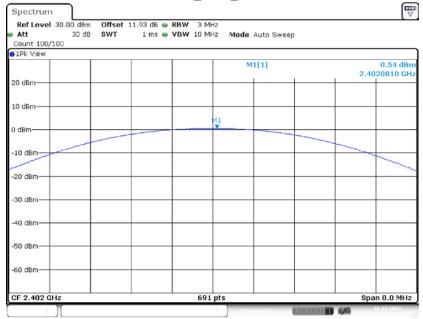
Date: 16.DEC.2022 14:50:45



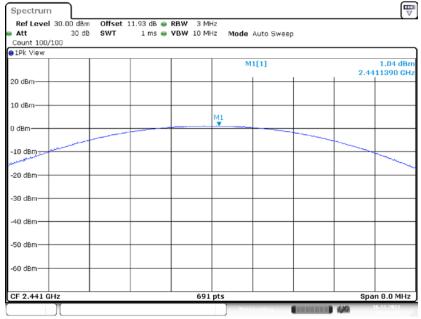
DH5\_Ant1\_2480

Date: 16.DEC.2022 14:51:13

2DH5\_Ant1\_2402



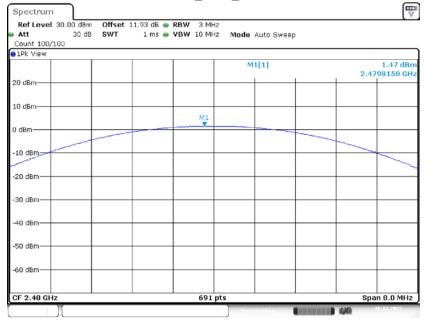
Date: 16.DEC.2022 14:51:52



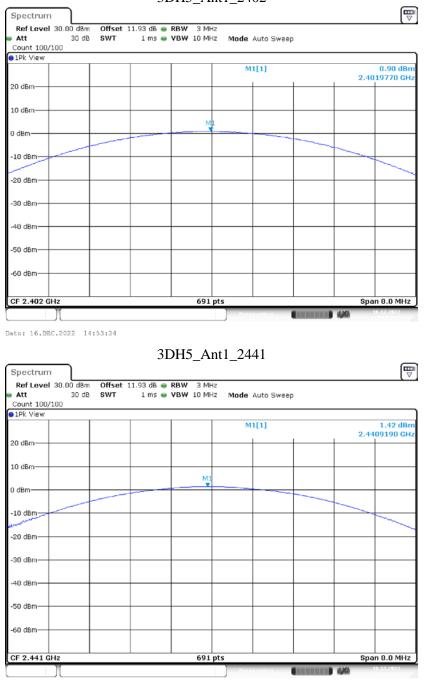
2DH5\_Ant1\_2441

Date: 16.DEC.2022 14:52:19

2DH5\_Ant1\_2480



Date: 16.DEC.2022 14:52:39



## 3DH5\_Ant1\_2402

Date: 16.DEC.2022 14:54:04

### Report No.: RA221208-60240E-RF

Ref Level 30.00 dBm	Offset 11.93		3 MHz			
Att 30 dB Count 100/100	SWT 1	ms 👄 VBW 🗄	10 MHz Mode	Auto Sweep		
1Pk View						
			N	11[1]	2.47	1.90 dBr 99540 GH
20 dBm						
10 dBm			M1			
0 dBm						
-10 dBm						
-20 dBm						
-30 dBm						
-40 dBm						
-50 dBm						
-60 dBm						
CF 2.48 GHz			691 pts			n 8.0 MHz

# 3DH5\_Ant1\_2480

Date: 16.DEC.2022 14:54:28

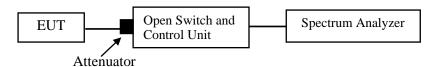
# FCC §15.247(d) - BAND EDGES TESTING

# **Applicable Standard**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

# **Test Procedure**

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in TX mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
- 3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- 5. Repeat above procedures until all measured frequencies were complete.



# **Test Data**

### **Environmental Conditions**

Temperature:	22°C
<b>Relative Humidity:</b>	56%
ATM Pressure:	101kPa

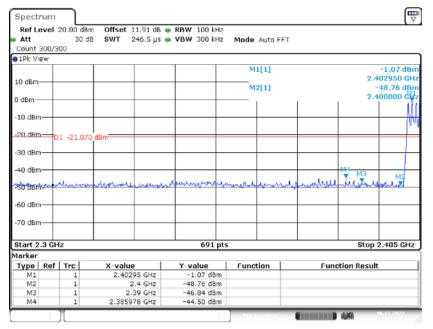
The testing was performed by Glenn Jiang on 2022-12-16.

EUT operation mode: Transmitting

Test Result: Compliant

Please refer to the below plots:

### DH5: Band Edge-Left Side Hopping



Date: 16.DEC.2022 15:09:52

### Single

Ref Le	evel	20.00 dB	m Offset 11.93 dB	RBW 100 kHz			
Att		30 d	B SWT 246.5 µs	VBW 300 kHz	Mode Auto F	FT	
Count 3	300/3	00					
●1Pk Vi	ew						
					M1[1]		-1.04 dB
10 dBm-							2.401880 GF
10 00111					M2[1]		-48.43 dB
0 dBm-	_				<u> </u>		2.400000
-10 dBm	-+						
-20 dBm	⊫	1 -21.04	0 dBm				
-30 dBm							
-30 UBII	-						
-40 dBm				_		M1	
							M3 Ma
45e dên	reso	مهات المربسة التحريد	-	an weather the	- And the agendant	Mary and the second	Mary Marked Marken T
-60 dBm	-						
-70 dBm							
-70 UBI	' T						
Start 2		1.2		691 pt			Stop 2.405 GHz
Marker	.5 GF	2		091 pc	\$		atop 2.403 GHz
Type	0-6		X-value	Y-value	Function	. <b>.</b>	ction Result
M1	Ref	1	2.40188 GHz	-1.04 dBm	Function	Fun	ction Result
M2		1	2.4 GHz	-48.43 dBm			
M3		1	2.39 GHz	-49.18 dBm			
M4		1	2.378065 GHz	-44.68 dBm			

Date: 16.DEC.2022 14:56:26

Att		20.00 dBn 30 dB		<b>VBW</b> 300 kHz	Mode Auto S	ween	
Count	300/3				Mode Addo 5	Noop	
1Pk Vi	ew						
					M1[1]		-0.22 dBn
10 dBm	$\rightarrow$						2.474920 GH
M					M2[1]		-44.40 dBn
የ ଶନ୍ଧଳ	40.04	۸.				1	2.483500 GH
NYAA	ШMA	h –					
-10 dBn	1 <b>4 6 1</b> 1	1					
20 d8m	$\rightarrow$	1 -20.220	dam				
		1					
-30 dBm		_					
		MO	M	M4			
-40 dBm	ν <del>- </del> -		unewahrender		munu	and and an and a	men and and all the read
-50 dBm						• • • • •	
-50 UBI	' T						
-60 dBm							
-70 dBm	<b>⊢</b> ⊢						
Start 2	.47 G	Hz		691 pts			Stop 2.55 GHz
1arker							
Type	Ref	Trc	X-value	Y-value	Function	Fun	ction Result
M1		1	2.47492 GHz	-0.22 dBm			
M2		1	2.4835 GHz	-44.40 dBm			
MЗ		1	2.5 GHz	-42.03 dBm			
M4		1	2.507913 GHz	-39.81 dBm			

# DH5: Band Edge- Right Side Hopping

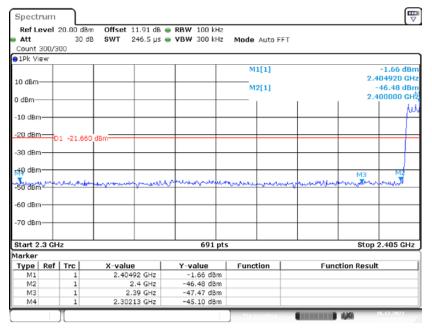
Date: 16.DEC.2022 15:34:55

# Single

Ref Lo	evel	20.00 dBr	m Offset 11.93 dB	RBW 100 kHz			
Att		30 d	B SWT 1.1 ms	🖶 VBW 300 kHz	Mode Auto S	Sweep	
Count	300/3	00				-	
●1Pk Vi	ew						
					M1[1]		0.00 dB
10 dBm							2.479780 GF
20 000		41			M2[1]		-43.86 dB
0 dBm-		Y.			<u> </u>		2.483500 GF
		N					
-10 dBm		11					
		n –					
-20 dBm	⊢–lo	1 -20.000	) dBm				
		11					
-30 dBm	р <u>—</u>			M4			
-40 dBm		M2	M				
4 mores		Lux	nour advantante	hundrenwork	an is more thank	windham	presenter more more
-50 dBm	<b>⊢</b> ⊢						
-60 dBrr				+			
-70 dBm	<u>+</u>			+			
Start 2	.47 G	Hz	· · ·	691 pt:	s		Stop 2.55 GHz
Marker							
Type	Ref	Trc	X-value	Y-value	Function	Fun	ction Result
M1		1	2.47978 GHz	0.00 dBm			
M2		1	2.4835 GHz	-43.86 dBm			
MЗ		1	2.5 GHz	-43.67 dBm			
M4		1	2.503971 GHz	-39.85 dBm			

Date: 16.DEC.2022 15:00:08

### 2DH5: Band Edge-Left Side Hopping



Date: 16.DEC.2022 15:36:23

### Single

Ref Le	vel :	20.00 dBi	m Offset 11.93 dB	RBW 100 kHz			
Att		30 d	B SWT 246.5 µs	VBW 300 kHz	Mode Auto F	FT	
Count	300/3	00					
🔵 1Pk Vi	ЭW						
					M1[1]		-0.84 dBi
10 dBm-							2.401730 GH
					M2[1]		-48.60 dBi
0 dBm-							2.400000 CH
-10 dBm	-						
-20 dBm							
-20 061		1 -20.84	0 dBm				
-30 dBm							
-40 dBm	-			-		M4	M3 M2
New Jackson		and a chief	a waybe ward of an Manual	this have and	الراجين المسع المعان	land in Allow	
-50 dBm		he will be that the second second	and the second she was a		he was a second	and the second s	and the second
-60 dBm							
00 001							
-70 dBm							
Start 2	.3 GH	z		691 pts	5		Stop 2.405 GHz
Marker							
Type	Ref	Trc	X-value	Y-value	Function	Fun	ction Result
M1		1	2.40173 GHz	-0.84 dBm			
M2		1	2.4 GHz	-48.60 dBm			
MЗ		1	2.39 GHz	-48.02 dBm			
M4		1	2.377913 GHz	-44.87 dBm			

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Version 11: 2021-11-09

# 2DH5: Band Edge- Right Side Hopping

1 20.00 dB 30 c /300	IB SWT 1.1 ms	RBW 100 kHz     VBW 300 kHz	Mode Auto S	Sweep		0.01 dBn 2.477120 GH: -42.65 dBn 2.483500 GH:
M -D1 -19.99	0 dBm					2.477120 GH -42.65 dBr
D1 -19.99	0 dBm					2.477120 GH -42.65 dBn
-D1 -19.99	0 dBm		M2[1]			-42.65 dBr
-D1 -19.99	0.dBm					
-D1 -19.99	0.dBm					1
D1 -19.99	0_dBm					
D1 -19.99	0_dBm					
D1 -19.99	0 dBm					
						_
M2	M	814				
Line	Autor Manager	blashermore	usuboranium	Margan and Market	much	mound
					_	
GHz		691 pt	s		5	Stop 2.55 GHz
f   Trc	X-value	Y-value	Function	F	unction Re	sult
1	2.47712 GHz	0.01 dBm				
1	2.4835 GHz	-42.65 dBm				
1	2.501188 GHz	-41.01 dBm				
	GHz f Trc	GHz Trc X-value 1 2.47712 GHz 1 2.4835 GHz 1 2.5 GHz	GHz         G91 pt:           1         2.47712 GHz         0.01 dBm           1         2.4835 GHz         -42.65 dBm           1         2.5 GHz         -42.65 dBm	GHz         G91 pts           1         2.47712 GHz         0.01 dBm           1         2.4835 GHz         -42.65 dBm           1         2.5 GHz         -42.65 dBm	Image: Second	GHz         691 pts         S           1         2.47712 GHz         0.01 dBm         1           1         2.4935 GHz         -42.65 dBm         1

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# Single

	1 20.00 dBr					
Att Count 300	30 d /300	B SWT 1.1 ms	VBW 300 kHz	Mode Auto S	Sweep	
1Pk View						
				M1[1]		0.06 dBi
10 dBm						2.480130 GH
	M1			M2[1]		-44.15 dBi 2.483500 GF
0 dBm	1 T				1 1	2.463300 GH
-10 dBm-						
10 0011						
-20 dBm	D1 -19.94	0_dBm			_	
-30 dBm—	H \					
-40 dBm	M2	м	3		M4	
	high	mound	aneman	withurnow	warmen his work	monorman
-50 dBm						
-60 dBm—						
-70 dBm						
-70 UBIII						
Start 2.47	CH2		691 pt			Stop 2.55 GHz
larker	din.		051 pt.	,		0100 2100 0112
	f   Trc	X-value	Y-value	Function	Funct	ion Result
M1	1	2.48013 GHz	0.06 dBm			
M2	1	2.4835 GHz	-44.15 dBm			
MЗ	1	2.5 GHz	-43.11 dBm			
M4	1	2.528203 GHz	-40.62 dBm			

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# 3DH5: Band Edge-Left Side Hopping

Pofle	- Iou	20.00 dB	0ffcet	11.01.d8 #	<b>RBW</b> 100 kH	2				
Att	sver .	20.00 Q2 30 (			VBW 300 kH		Auto E	ET		
Count	300/3		300	240.5 µ5	• • • • • • • • • • • • • • • • • • •	<sup>12</sup> Moue	AULU P	FI		
1Pk Vi	, -	00								
			1		1	м	1[1]			-0.49 dBr
					1 1		-1-1		2.	403860 GH
10 dBm						M	2[1]			-48.34 dB
0 dBm—									2.	400000 GH
) ubin								1		I M
-10 dBm					++					+
					1 1					
20 dBm		1 -20.49	0 dBm							
30 dBm					1 1					
-зо авп	-									
-40 dBm								1914		
		munde		and souther	munon	man	unda	<b>y</b>	M3	MÉ
-50 dBm	June	- and a second	work		1 accelle	- Anna	~~~~	angun the	and here	-
					1 1					
-60 dBrr										
-70 dBm										
10 000	.				1 1					
Start 2	.3 GH	z			691 p	ots			Stop	2.405 GHz
1arker										
Туре	Ref	Trc	X-valu	e	Y-value	Func	tion	Fun	ction Resu	lt
M1		1		386 GHz	-0.49 dBn	n				
M2		1		2.4 GHz	-48.34 dBn					
MЗ		1		.39 GHz	-47.91 dBn -45.22 dBn					
M4										

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# Single

Refli	rum evel :	20.00 di	Bm Offset	11.93 dB	<b>RBW</b> 100 k	Hz				( v
Att		20.00 G			<b>VBW</b> 300 k		Auto F	FT		
Count	300/3					inoue	Hator			
1Pk Vi	ew									
						N	11[1]			-0.86 dBr
10 dBm	-+		_							402190 GH
						N	12[1]			-47.49 dBr
0 dBm—	+					<u> </u>		1	2.4	100000 GH
										1 A
-10 dBr	·+-								1	
-20 dBm		1 -20.8	(0, d0 m							
	٣	1 -20.8	bu ubm							
-30 dBm	-		_							
										I - IA
-40 dBm	·+-·							M4	M3	MÉ
shuke	Lune	ممدهد	marin rulan	mallin	manyour	malante	ميصيطي	mentalland	more Tulio	1 de partes
-60 dBrr	-+								+	
-70 dBm	' <b>-</b>								+	
Start 2	.3 GH	z			691	pts			Stop	2.405 GHz
larker						1 -		-		
Type M1	Ref	1	X-valu 2 402	19 GHz	<u>Y-value</u> -0.86 d8		tion	Fur	nction Result	τ
M1 M2		1		19 GHZ 2.4 GHZ	-47.49 de					
M3		1		39 GHz	-48.55 de					
M4		1		17 GHz	-45.46 de					

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## 3DH5: Band Edge- Right Side Hopping

Count		00			Mode Auto S		
⊖1Pk Vi	ew				M1[1]		0.07 dBi
10 dBm							2.480010 GH
10 0011	1	41			M2[1]		-42.69 dB
RARA	ww	X				1	2.483500 GH
-10 dBm		1					
10 001							
-20 dBn	⊢-p	1 -19.930	D dBm				
-30 dBm							
-30 aBn	' <del></del>				M4		
-40 dBm		M2	- unine and the most of the second	M3	holimaner		and letter and a market and
-50 dBm							
-30 UBI	'						
-60 dBr	-						
70.40-							
-70 dBr	·——						
Start 2	47.0	H2		691 pt	<u>ــــــــــــــــــــــــــــــــــــ</u>		Stop 2.55 GHz
Marker	.47 0	112		091 pc	3		3100 2.35 412
Type	Ref	Trc	X-value	Y-value	Function	Fun	ction Result
M1		1	2.48001 GHz	0.07 dBm			
M2		1	2.4835 GHz	-42.69 dBm			
M3		1	2.5 GHz	-42.51 dBm			

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# Single

Refle	vel 2	20.00 dBn	Offset 11.93 dB	RBW 100 kHz			
Att		30 di		VBW 300 kHz	Mode Auto S	Sween	
Count 3	300/30	10 00			nous note t	shoop	
1Pk Vie							
					M1[1]		-0.04 dB
10 dBm-							2.480130 GF
TO OBM-		41			M2[1]		-44.54 dB
0 dBm—	'	<b>V</b>					2.483500 GF
o abiii		4					
-10 dBm	$\rightarrow$						
-20 dBm	D:	1 -20.040	dBm				
	- 11						
-30 dBm							
-40 dBm	_/	luo	M	3 <sup>M4</sup>			
pha when		Low	mounder	bortmanen	marken	and march	monumber
-50 dBm	$\rightarrow$						
-60 dBm	+						
-70 dBm							
Start 2	.47 GI	lz		691 pts	5		Stop 2.55 GH
Marker							
	Ref		X-value	Y-value	Function	Fund	tion Result
M1		1	2.48013 GHz	-0.04 dBm			
M2 M3		1	2.4835 GHz 2.5 GHz	-44.54 dBm -42.95 dBm			
		1	2.5 GHz 2.504203 GHz	-42.95 dBm			

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