



## FCC PART 15.247 TEST REPORT

For

### TECNO MOBILE LIMITED

FLAT 39 8/F BLOCK D WAH LOK INDUSTRIAL CENTRE 31-35 SHAN MEI STREET  
FOTAN NT Hong Kong

**FCC ID: 2ADYY-KG6P**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Mobile Phone
<b>Report Number:</b> SZ1210901-45704E-RF-00A	
<b>Report Date:</b> 2021-10-25	
<b>Reviewed By:</b> RF Engineer	Candy Li <i>Candy Li</i>
<b>Prepared By:</b> Shenzhen Accurate Technology Co., Ltd. 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China Tel: (0755) 26503290 Fax: (0755) 26503396 <a href="http://www.atc-lab.com">Http://www.atc-lab.com</a>	

**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.

This report cannot be reproduced except in full, without prior written approval of the Company. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION.....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	4
OBJECTIVE .....	4
TEST METHODOLOGY .....	4
MEASUREMENT UNCERTAINTY .....	5
TEST FACILITY .....	5
<b>SYSTEM TEST CONFIGURATION .....</b>	<b>6</b>
DESCRIPTION OF TEST CONFIGURATION .....	6
EUT EXERCISE SOFTWARE .....	6
SPECIAL ACCESSORIES .....	6
EQUIPMENT MODIFICATIONS .....	6
SUPPORT EQUIPMENT LIST AND DETAILS .....	6
EXTERNAL I/O CABLE .....	6
BLOCK DIAGRAM OF TEST SETUP .....	7
<b>SUMMARY OF TEST RESULTS .....</b>	<b>8</b>
<b>TEST EQUIPMENT LIST .....</b>	<b>9</b>
<b>FCC§15.247 (i), §1.1307 (b) (1) &amp; §2.1093 – RF EXPOSURE .....</b>	<b>11</b>
APPLICABLE STANDARD .....	11
<b>FCC §15.203 – ANTENNA REQUIREMENT .....</b>	<b>12</b>
APPLICABLE STANDARD .....	12
ANTENNA CONNECTOR CONSTRUCTION .....	12
<b>FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS .....</b>	<b>13</b>
APPLICABLE STANDARD .....	13
EUT SETUP .....	13
EMI TEST RECEIVER SETUP .....	13
TEST PROCEDURE .....	13
TRANSD FACTOR & MARGIN CALCULATION .....	14
TEST DATA .....	14
<b>FCC §15.205, §15.209 &amp; §15.247(d) – RADIATED EMISSIONS .....</b>	<b>17</b>
APPLICABLE STANDARD .....	17
EUT SETUP .....	17
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP .....	18
TEST PROCEDURE .....	18
FACTOR & MARGIN CALCULATION .....	18
TEST DATA .....	18
<b>FCC §15.247(a) (1)-CHANNEL SEPARATION TEST .....</b>	<b>23</b>
APPLICABLE STANDARD .....	23
TEST PROCEDURE .....	23
TEST DATA .....	23
<b>FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH &amp; 99% OCCUPIED BANDWIDTH .....</b>	<b>24</b>
APPLICABLE STANDARD .....	24
TEST PROCEDURE .....	24
TEST DATA .....	25

<b>FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST .....</b>	<b>26</b>
APPLICABLE STANDARD .....	26
TEST PROCEDURE .....	26
TEST DATA .....	26
<b>FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME).....</b>	<b>27</b>
APPLICABLE STANDARD .....	27
TEST PROCEDURE .....	27
TEST DATA .....	27
<b>FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT .....</b>	<b>28</b>
APPLICABLE STANDARD .....	28
TEST PROCEDURE .....	28
TEST DATA .....	28
<b>FCC §15.247(d) - BAND EDGES TESTING .....</b>	<b>29</b>
APPLICABLE STANDARD .....	29
TEST PROCEDURE .....	29
TEST DATA .....	29
<b>APPENDIX .....</b>	<b>30</b>
APPENDIX A: 20dB EMISSION BANDWIDTH.....	30
APPENDIX B: OCCUPIED CHANNEL BANDWIDTH .....	34
APPENDIX C: MAXIMUM CONDUCTED PEAK OUTPUT POWER.....	38
APPENDIX D: CARRIER FREQUENCY SEPARATION .....	42
APPENDIX E: TIME OF OCCUPANCY .....	44
APPENDIX F: NUMBER OF HOPPING CHANNELS .....	51
APPENDIX G: BAND EDGE MEASUREMENTS .....	53

## GENERAL INFORMATION

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

Product	Mobile Phone
Tested Model	KG6p
Frequency Range	Bluetooth: 2402~2480MHz
Maximum conducted Peak output power	Bluetooth: 6.58dBm
Modulation Technique	Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna Specification*	1.2dBi (provided by the applicant)
Voltage Range	DC 3.85V From Battery or DC 5V From Adapter
Date of Test	2021-09-02 to 2021-10-23
Sample serial number	SZ1210901-45704E-RF-S1
Received date	2021-09-01
Sample/EUT Status	Good condition
Adapter information	Model: U100TSA Input: AC 100-240V ~ 50/60Hz, 0.3A Output: DC 5.0V, 2.0A

### 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.

Each test item follows test standards and with no deviation

## Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
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 4297.01.

Listed by Innovation, Science and Economic Development Canada (ISED), the Registration Number is 5077A-2.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in an engineering mode.

### EUT Exercise Software

EUT was test in engineering mode and the power level is default\*. The power level was provided by the applicant.

### Special Accessories

No special accessory.

### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

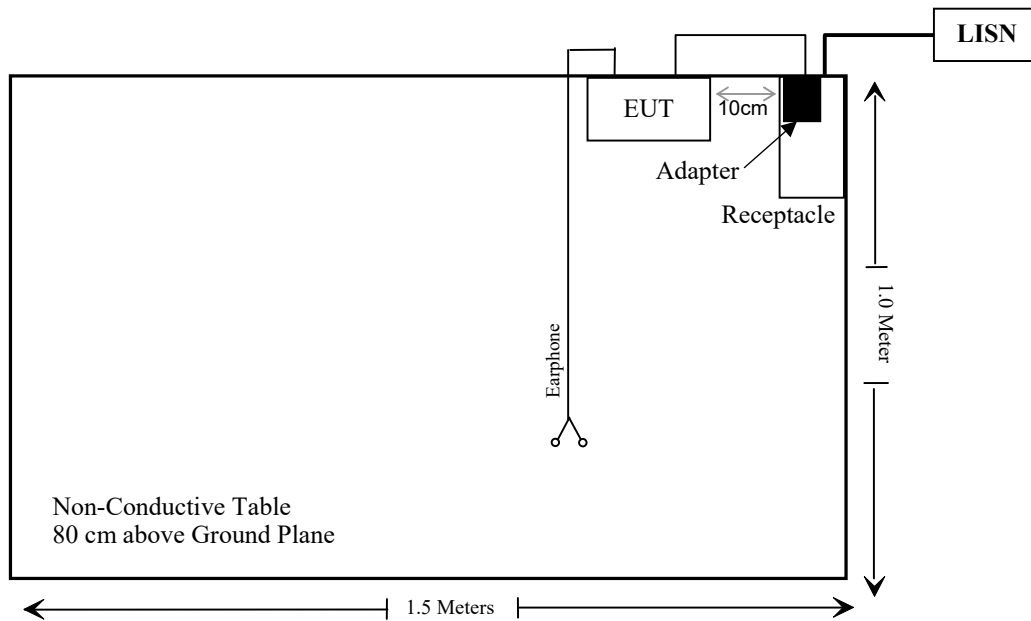
Manufacturer	Description	Model	Serial Number
/	/	/	/

### External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	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, §2.1093	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	Test Receiver	ESPI3	100396	2020/12/24	2021/12/23
R & S	L.I.S.N.	ENV216	101314	2020/12/25	2021/12/24
Anritsu Corp	50ΩCoaxial Switch	MP59B	6200506474	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-2m	No.2	2020/12/25	2021/12/24
Conducted Emission Test Software: ES-K1 V1.71					
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde&Schwarz	Spectrum Analyzer	FSV40	101495	2020/12/24	2021/12/23
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
Quinstar	Amplifier	QLW-184055 36-J0	15964001002	2020/11/28	2021/11/27
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2020/12/25	2021/12/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
OREGON SCIENTIFIC	Temperature & Humidity Meter	JB913R	GZ-WS004	2020/01/02	2023/01/01
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
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2020/12/25	2021/12/24
Radiated Emission Test Software: EZ_EMC V 1.1.4.2					

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2020/12/24	2021/12/23

\* **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) (1) & §2.1093 – RF EXPOSURE**

### **Applicable Standard**

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot$

$[\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

1.  $f(\text{GHz})$  is the RF channel transmit frequency in GHz.

2. Power and distance are rounded to the nearest mW and mm before calculation.

3. The result is rounded to one decimal place for comparison.

4. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test Exclusion.

**For worst case:**

Frequency (MHz)	Maximum Tune-up power		Calculated Distance (mm)	Calculated Value	Threshold (1-g SAR)	SAR Test Exclusion
	(dBm)	(mW)				
2402-2480	7.0	5.01	5	1.6	3.0	Yes

**Result: No Standalone SAR test is required**

## **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 maximum antenna gain is 1.2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

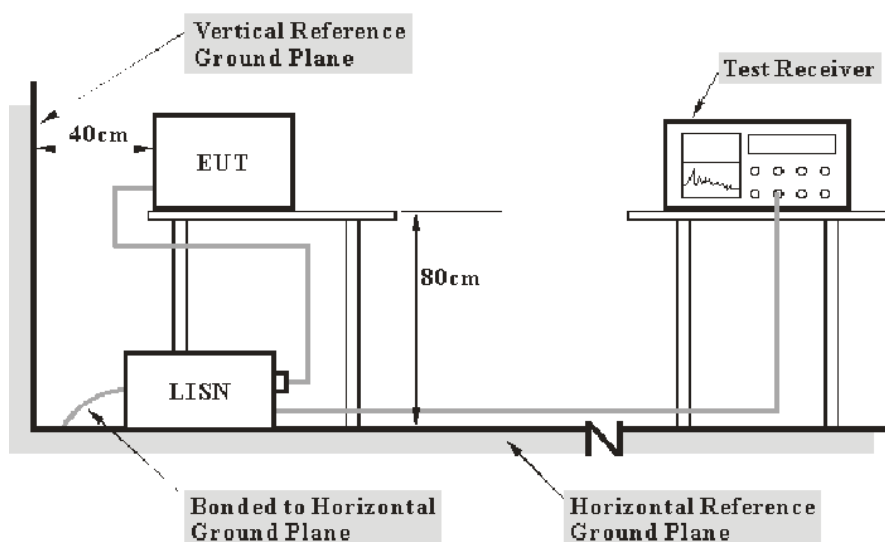
**Result:** Compliance.

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

$$\text{Margin} = \text{Limit} - \text{level}$$

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

## Test Data

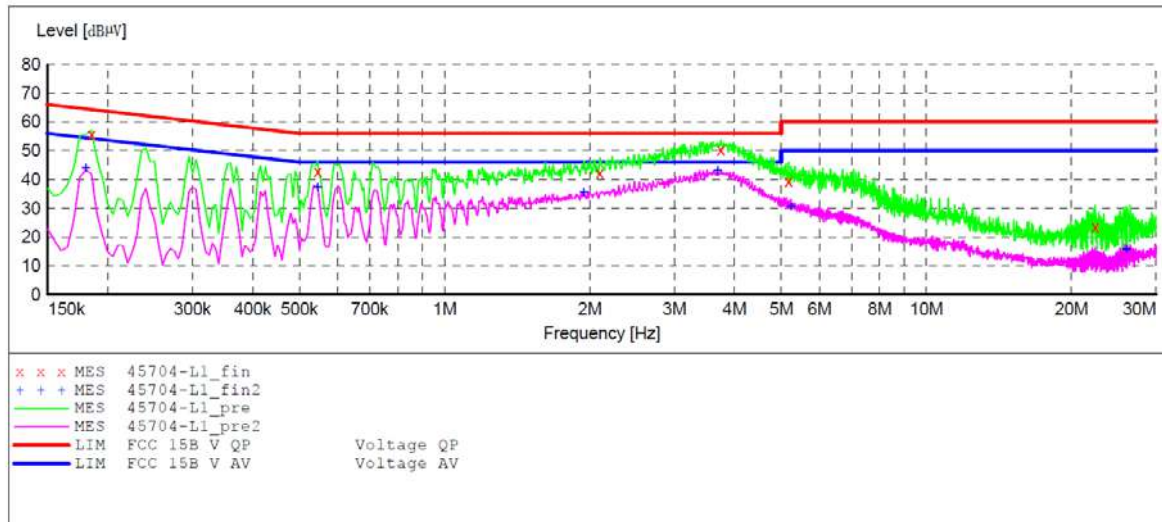
### Environmental Conditions

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Bin Deng on 2021-09-27.*

*EUT operation mode: Transmitting (the worst case is GFSK Mode, Middle channel)*

## AC 120V/60 Hz, Line



## MEASUREMENT RESULT: "45704-L1\_fin"

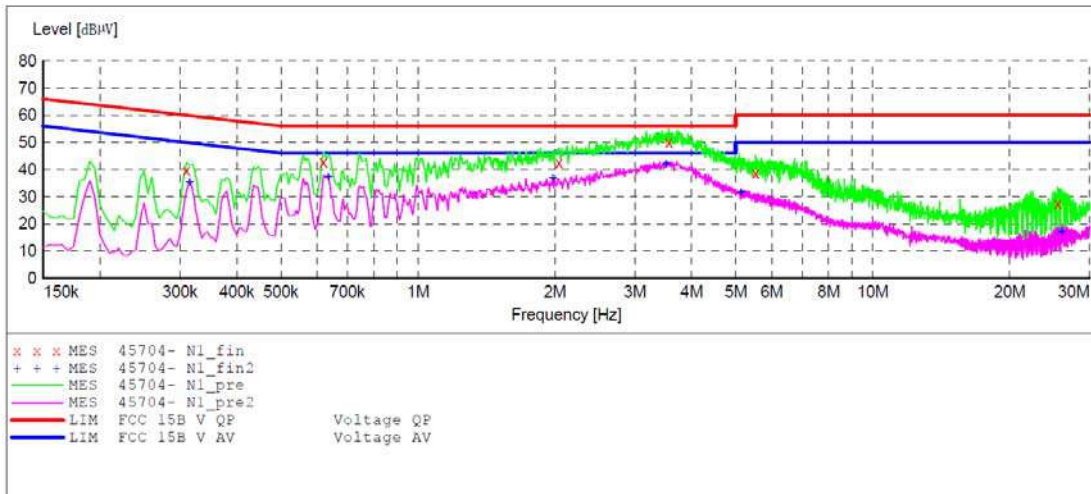
2021-9-27 09:39

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.185000	55.70	10.8	64	8.3	QP	L1	GND
0.545000	42.80	11.0	56	13.2	QP	L1	GND
2.100000	42.30	11.3	56	13.7	QP	L1	GND
3.750000	50.20	11.4	56	5.8	QP	L1	GND
5.180000	39.30	11.4	60	20.7	QP	L1	GND
22.425000	23.40	11.7	60	36.6	QP	L1	GND

## MEASUREMENT RESULT: "45704-L1\_fin2"

2021-9-27 09:37

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.180000	44.00	10.8	55	11.0	AV	L1	GND
0.545000	37.20	11.0	46	8.8	AV	L1	GND
1.945000	35.60	11.3	46	10.4	AV	L1	GND
3.690000	43.00	11.4	46	3.0	AV	L1	GND
5.240000	30.50	11.4	50	19.5	AV	L1	GND
26.000000	15.50	11.8	50	34.5	AV	L1	GND

**AC 120V/60 Hz, Neutral****MEASUREMENT RESULT: "45704- N1\_fin"**

2021-9-27 10:21

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.310000	39.70	10.9	60	20.3	QP	N	GND
0.620000	42.90	11.0	56	13.1	QP	N	GND
2.040000	42.60	11.3	56	13.4	QP	N	GND
3.560000	50.00	11.4	56	6.0	QP	N	GND
5.530000	38.50	11.5	60	21.5	QP	N	GND
25.550000	27.50	11.7	60	32.5	QP	N	GND

**MEASUREMENT RESULT: "45704- N1\_fin2"**

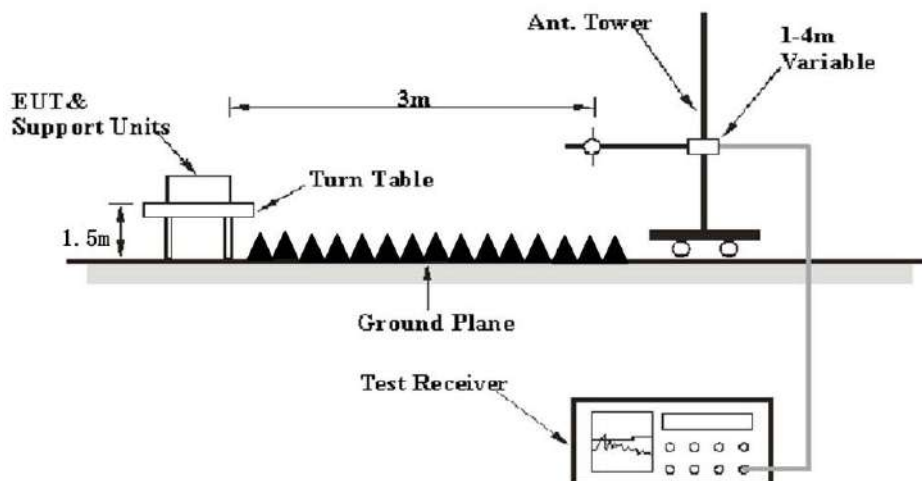
2021-9-27 10:21

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.315000	35.30	10.9	50	14.7	AV	N	GND
0.635000	37.20	11.0	46	8.8	AV	N	GND
1.980000	36.50	11.3	46	9.5	AV	N	GND
3.520000	41.90	11.4	46	4.1	AV	N	GND
5.130000	31.50	11.4	50	18.5	AV	N	GND
26.000000	17.10	11.8	50	32.9	AV	N	GND



**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 tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and 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	/	PK
	1 MHz	10 Hz	/	Average

## Test Procedure

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

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

## Factor & Margin Calculation

The Factor 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:

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

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

$$\begin{aligned} \text{Margin} &= \text{Result} - \text{Limit} \\ \text{Result} &= \text{Reading} + \text{Factor} \end{aligned}$$

## Test Data

### Environmental Conditions

Temperature:	23~27.3 °C
Relative Humidity:	48~54 %
ATM Pressure:	101.0~101.2 kPa

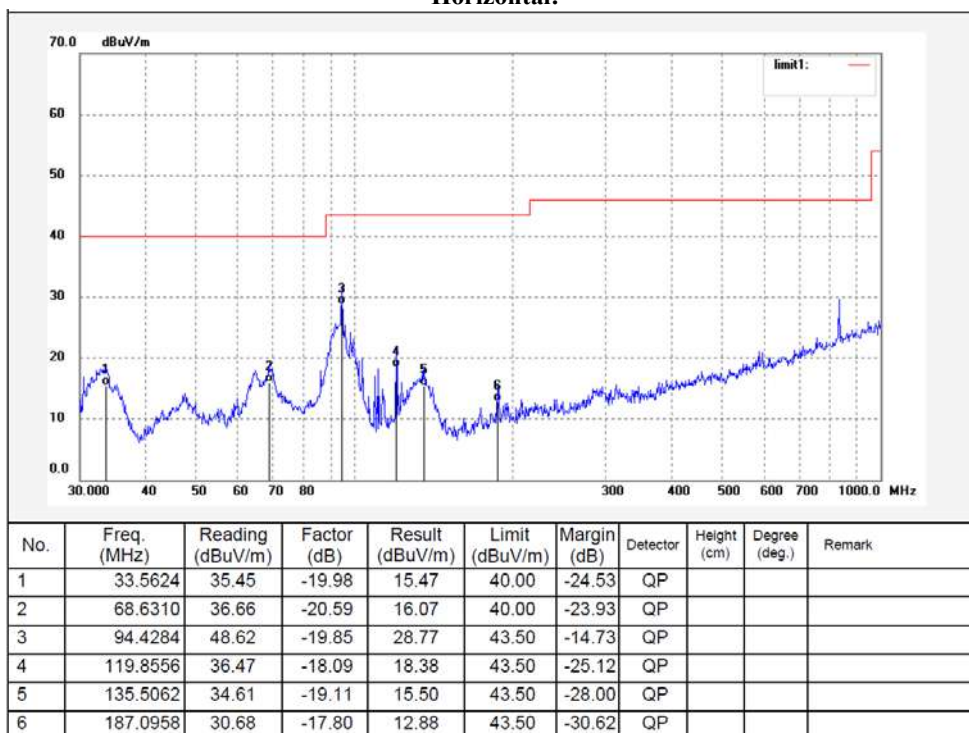
The testing was performed by Caro hu on 2021-09-10 and 2021-10-23.

EUT operation mode: Transmitting

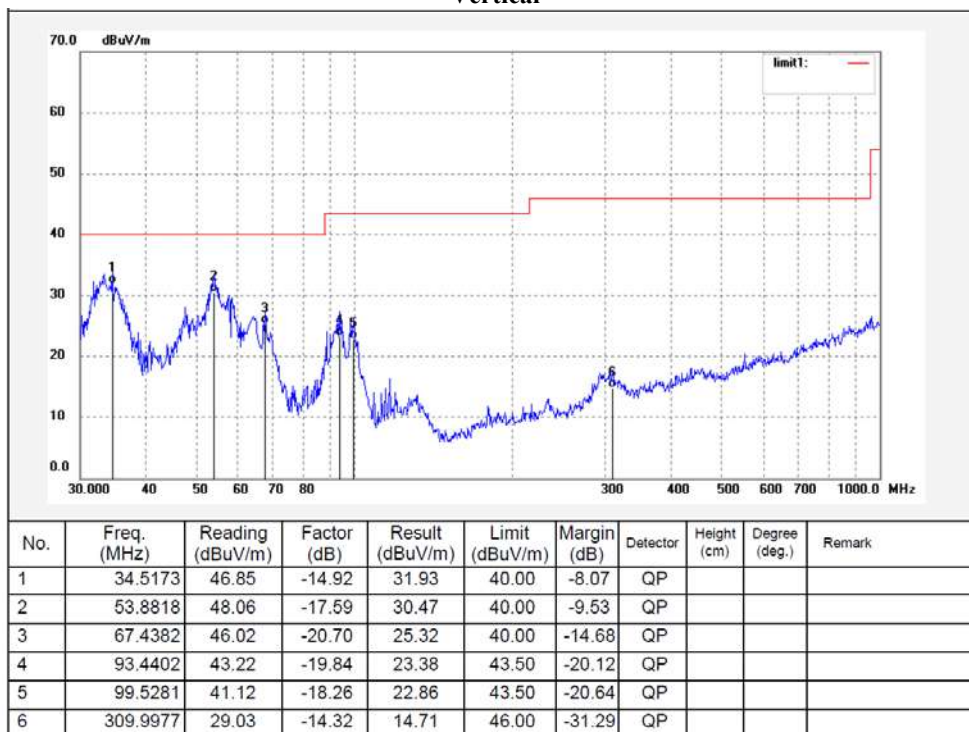
(Scan with GFSK,  $\pi/4$ -DQPSK, 8DPSK mode, the worst case is 8DPSK Mode)

**30MHz-1GHz:** (worst case is 8DPSK Mode, Middle channel)

**Horizontal:**



**Vertical**



**Above 1GHz:**

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2402 MHz)									
2310	67.05	PK	356	1.1	H	-6.84	60.21	74	-13.79
2310	52.51	Ave	356	1.1	H	-6.84	45.67	54	-8.33
2310	65.15	PK	332	1.3	V	-6.84	58.31	74	-15.69
2310	50.43	Ave	332	1.3	V	-6.84	43.59	54	-10.41
2390	67.76	PK	71	1.2	H	-6.44	61.32	74	-12.68
2390	52.67	Ave	71	1.2	H	-6.44	46.23	54	-7.77
2390	66.06	PK	342	1.5	V	-6.44	59.62	74	-14.38
2390	50.98	Ave	342	1.5	V	-6.44	44.54	54	-9.46
4804	50.89	PK	86	2.2	H	2.81	53.70	74	-20.30
4804	48.54	PK	73	2.0	V	2.81	51.35	74	-22.65
Middle Channel (2441 MHz)									
4880	49.05	PK	29	1.4	H	3.04	52.09	74	-21.91
4880	47.12	PK	78	1.5	V	3.04	50.16	74	-23.84
High Channel (2480 MHz)									
2483.5	66.99	PK	249	1.5	H	-5.96	61.03	74	-12.97
2483.5	51.62	Ave	249	1.5	H	-5.96	45.66	54	-8.34
2483.5	65.33	PK	336	2	V	-5.96	59.37	74	-14.63
2483.5	49.38	Ave	336	2	V	-5.96	43.42	54	-10.58
2500	67.17	PK	3	1.4	H	-5.88	61.29	74	-12.71
2500	52.13	Ave	3	1.4	H	-5.88	46.25	54	-7.75
2500	65.36	PK	40	1.8	V	-5.88	59.48	74	-14.52
2500	50.20	Ave	40	1.8	V	-5.88	44.32	54	-9.68
4960	50.22	PK	218	1.7	H	3.29	53.51	74	-20.49
4960	48.04	PK	157	1.6	V	3.29	51.33	74	-22.67

**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 in the noise floor level was not recorded.

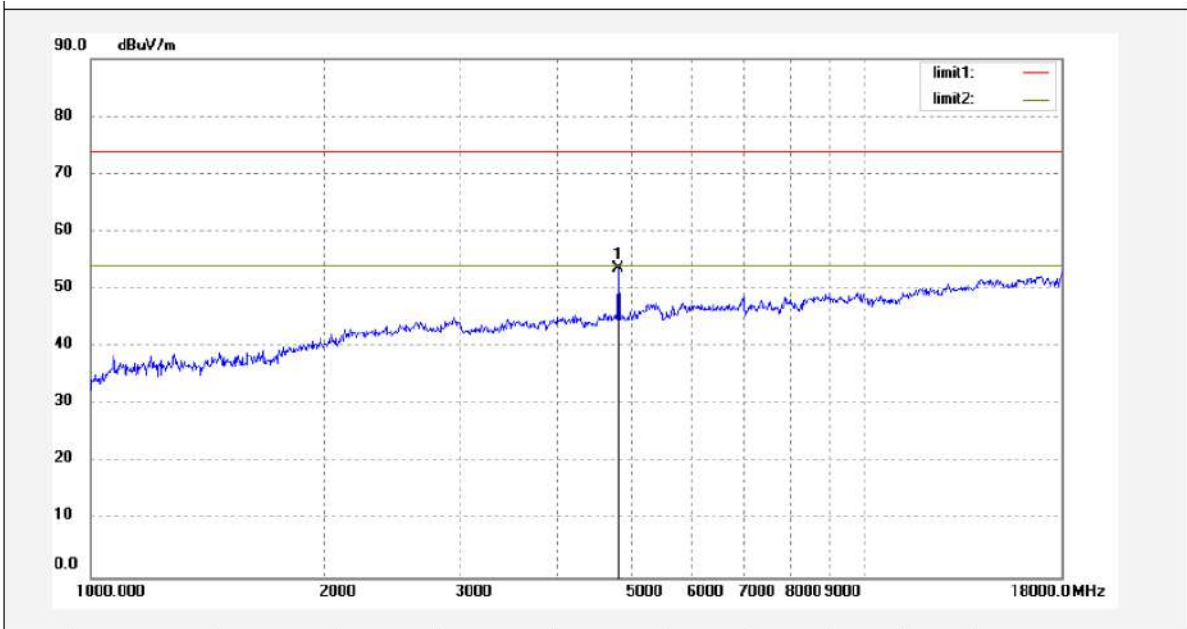
The test result of peak was less than the limit of average, so just peak value were recorded.

1-18GHz

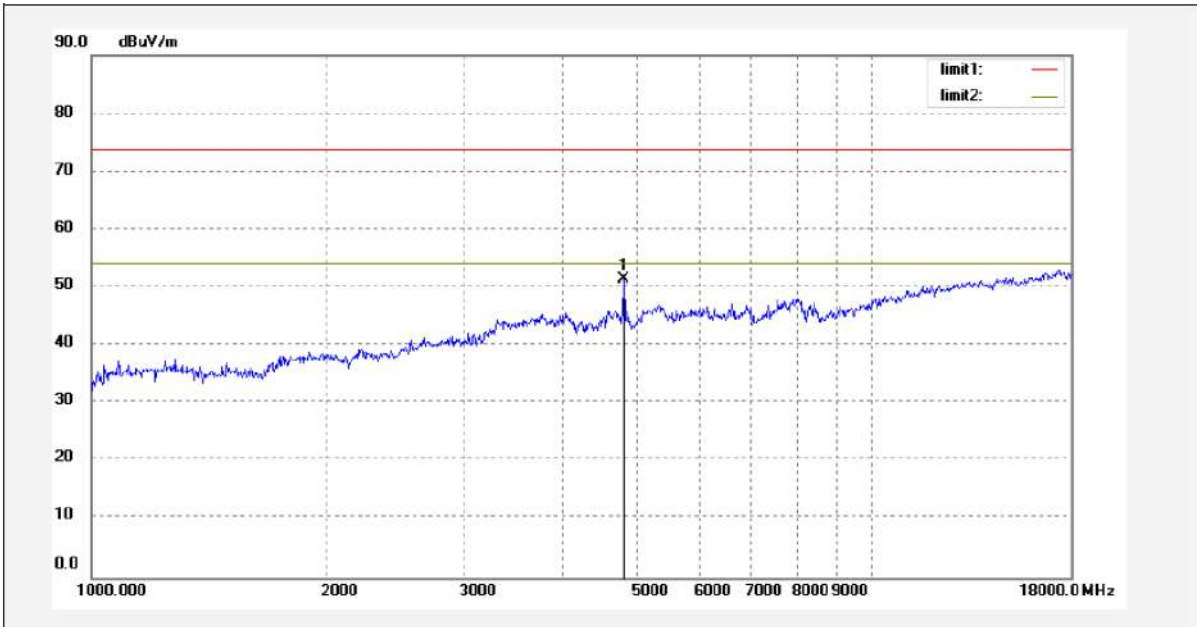
Pre-scan for Peak

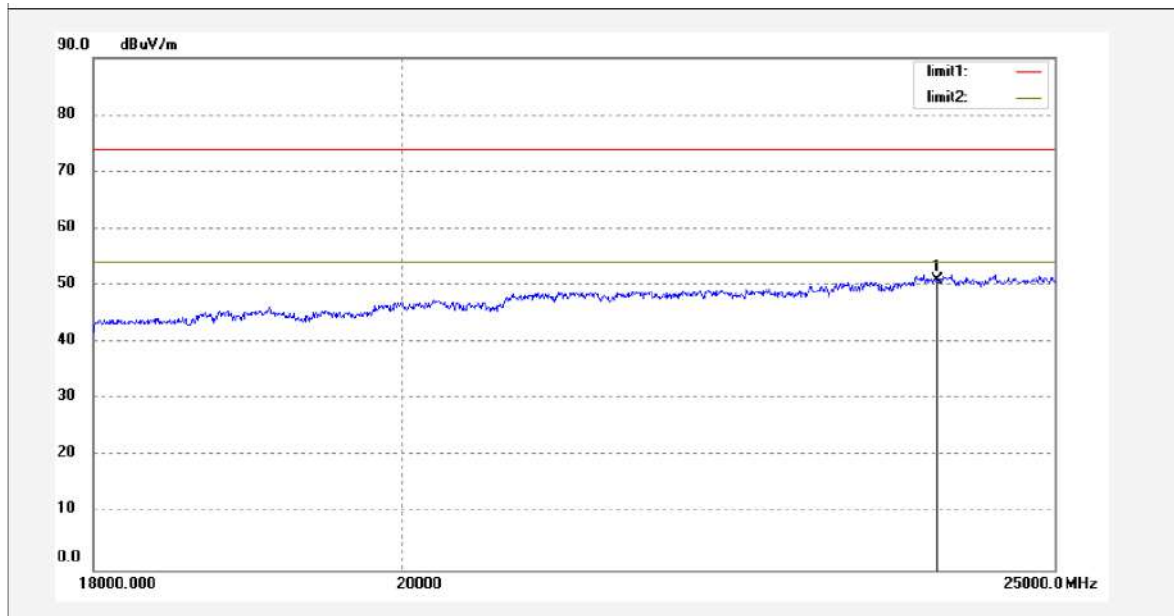
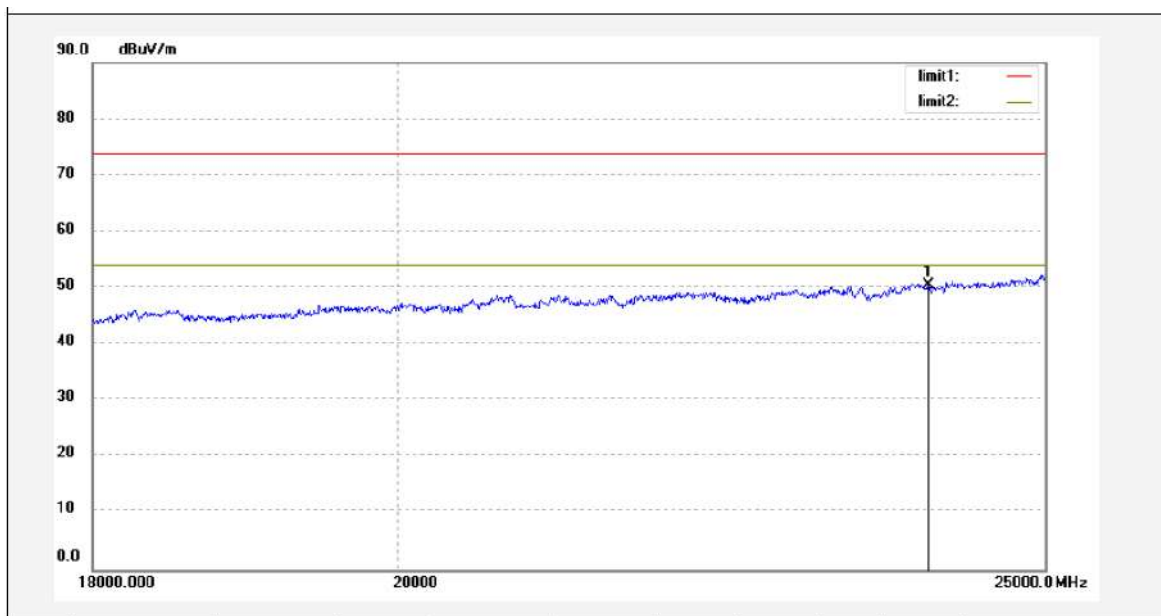
Low Channel

Horizontal:



Vertical:



**18-25GHz****Pre-scan for Peak****Low Channel****Horizontal:****Vertical:**

## 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 transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.

### Test Data

#### Environmental Conditions

Temperature:	24 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

*The testing was performed by Paul liu on 2021-09-02.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*

## 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.

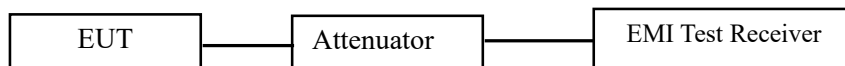
### Test Procedure

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 transmitting 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).





**Test Data****Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Paul liu on 2021-09-02.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*

**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.

**Test Data****Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Paul liu on 2021-09-02.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*

**FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWEELL 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  $\geq 3 \times$  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

**Test Data****Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Paul liu on 2021-09-02.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*

## **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 transmitting 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**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Paul liu on 2021-09-02.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*

## 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 transmitting 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:	24 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

*The testing was performed by Paul liu on 2021-09-02.*

*EUT operation mode: Transmitting*

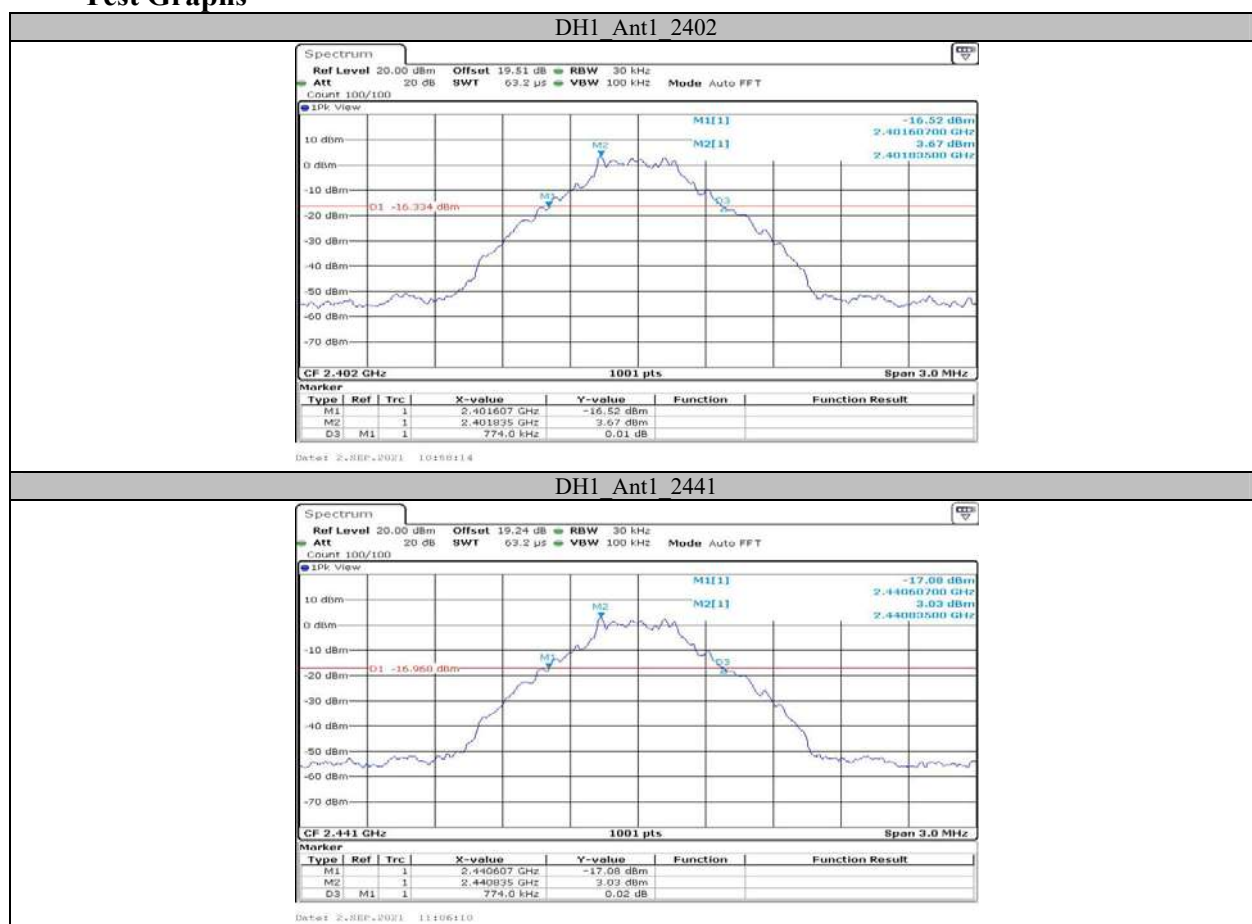
*Test Result: Compliant. Please refer to the Appendix.*

## APPENDIX

### Appendix A: 20dB Emission Bandwidth Test Result

Test Mode	Antenna	Channel	20db EBW[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	0.774	---	PASS
		2441	0.774	---	PASS
		2480	0.780	---	PASS
2DH1	Ant1	2402	1.212	---	PASS
		2441	1.215	---	PASS
		2480	1.218	---	PASS
3DH1	Ant1	2402	1.218	---	PASS
		2441	1.218	---	PASS
		2480	1.221	---	PASS

### Test Graphs

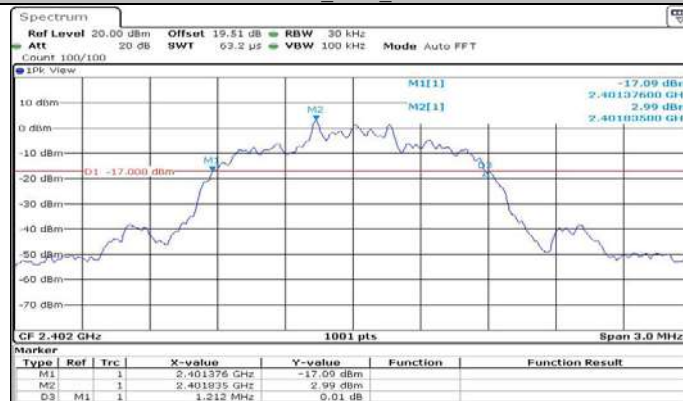


## DH1 Ant1 2480



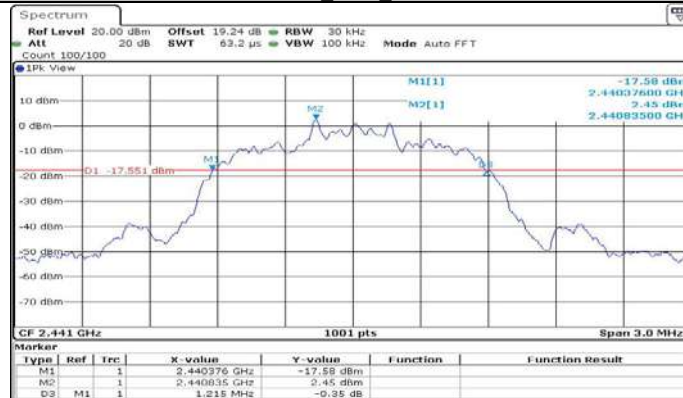
Date: 2,SEP,2021 11:07:08

## 2DH1 Ant1 2402



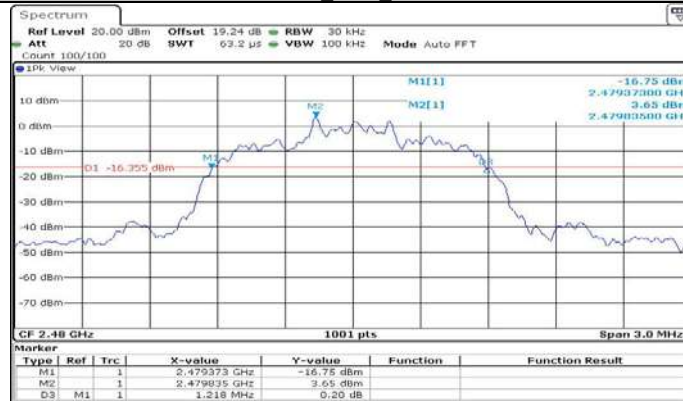
Date: 2,SEP,2021 11:08:24

## 2DH1 Ant1 2441



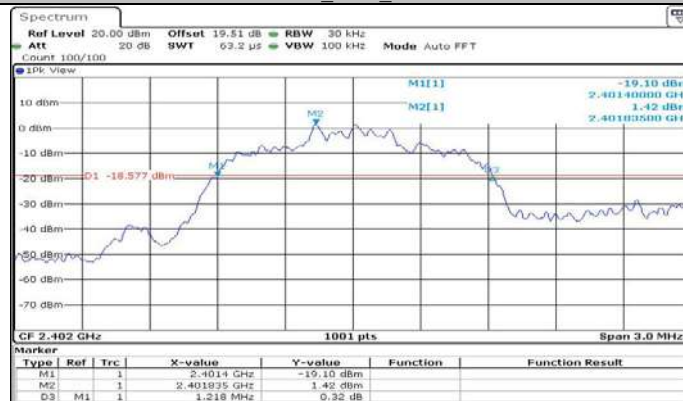
Date: 2,SEP,2021 11:09:37

## 2DH1 Ant1 2480



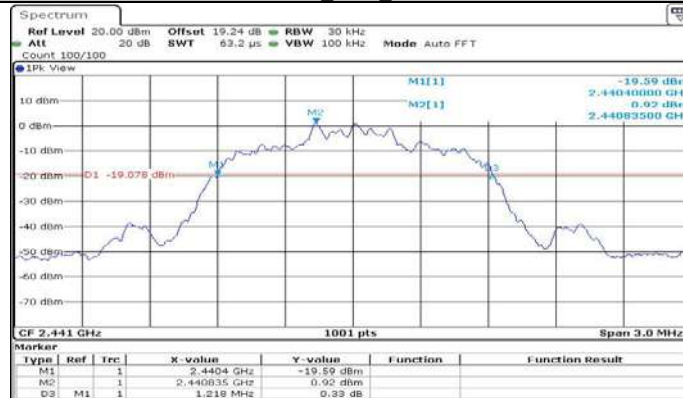
Date: 2, SEP, 2021 11:10:38

## 3DH1 Ant1 2402



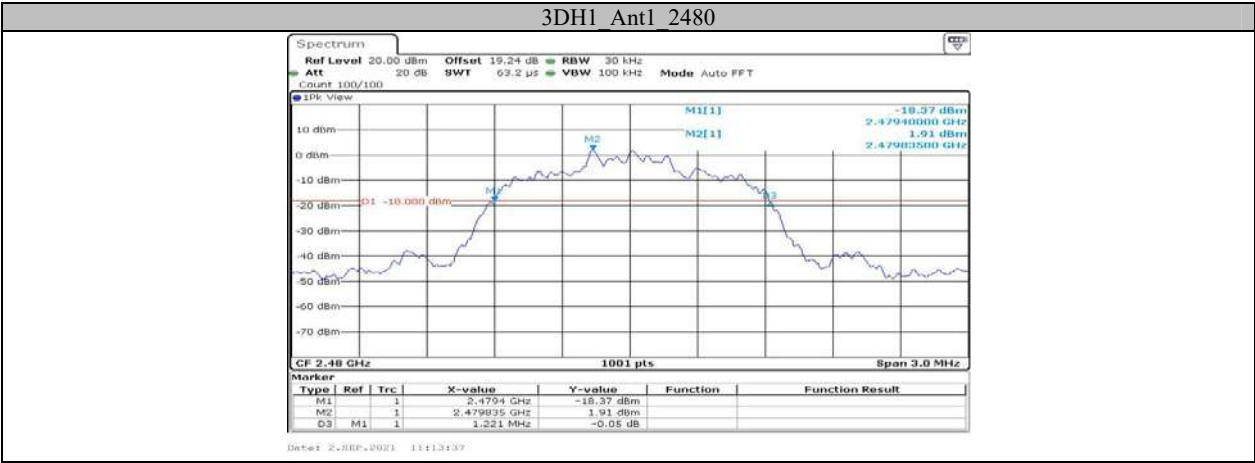
Date: 2, SEP, 2021 11:11:46

## 3DH1 Ant1 2441



Date: 2, SEP, 2021 11:12:45



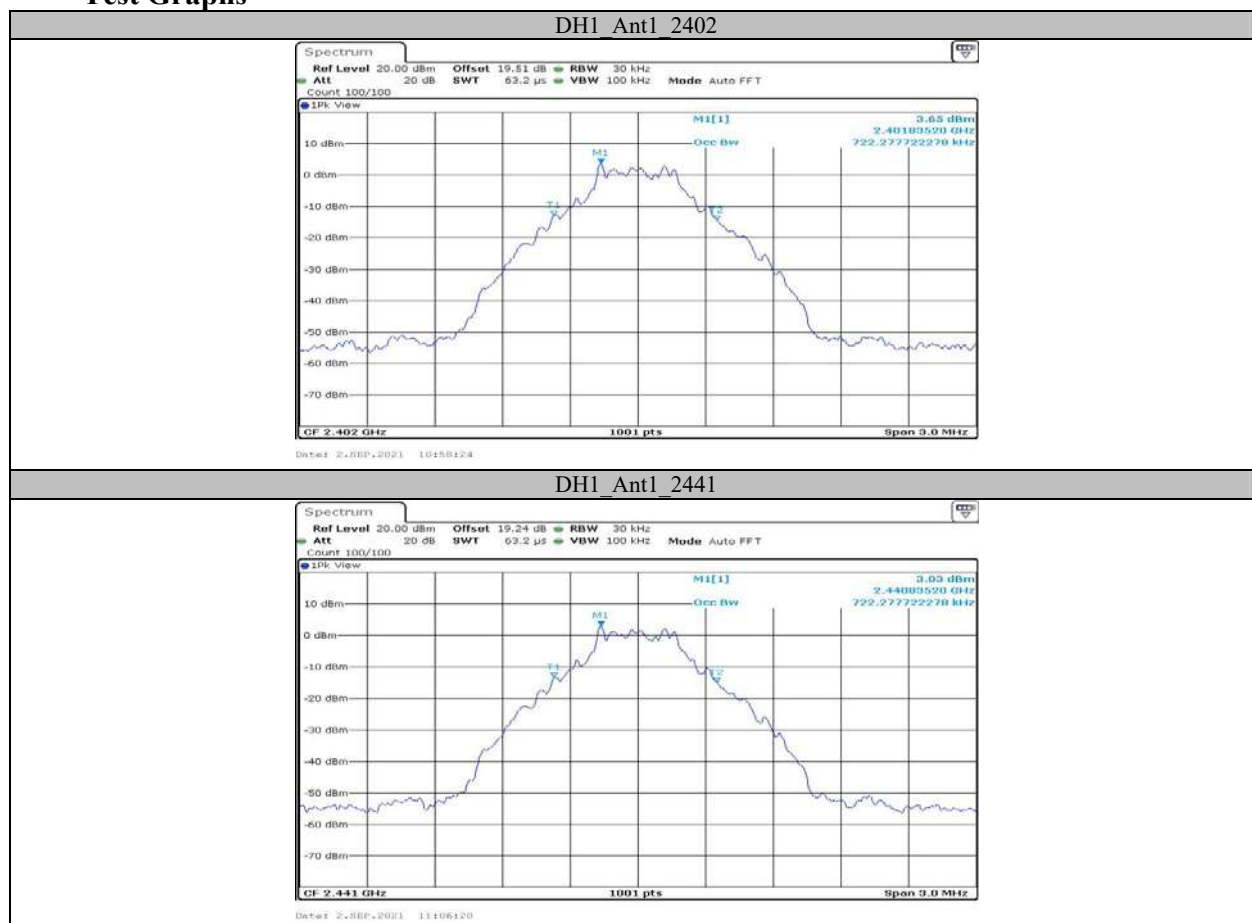


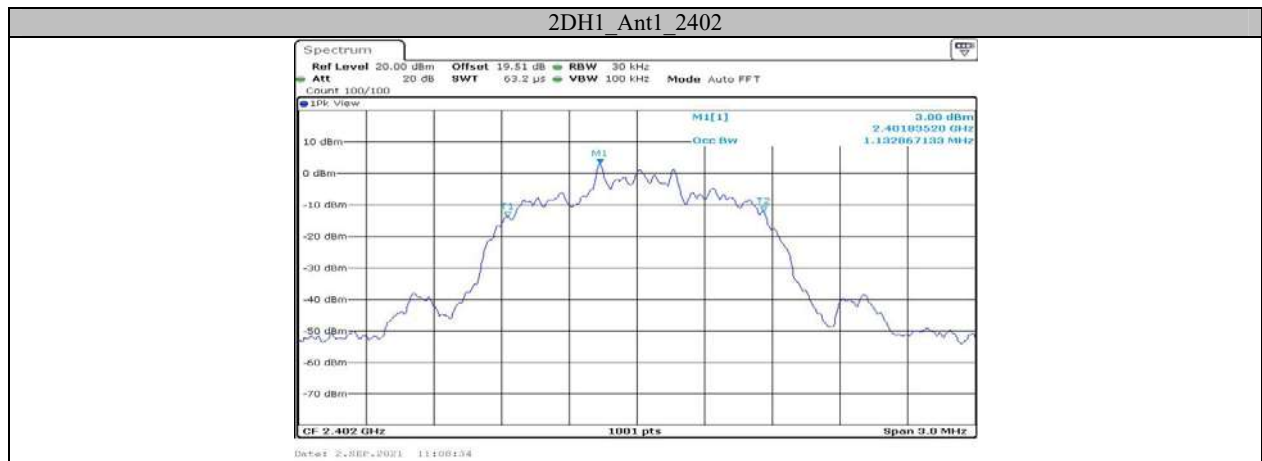
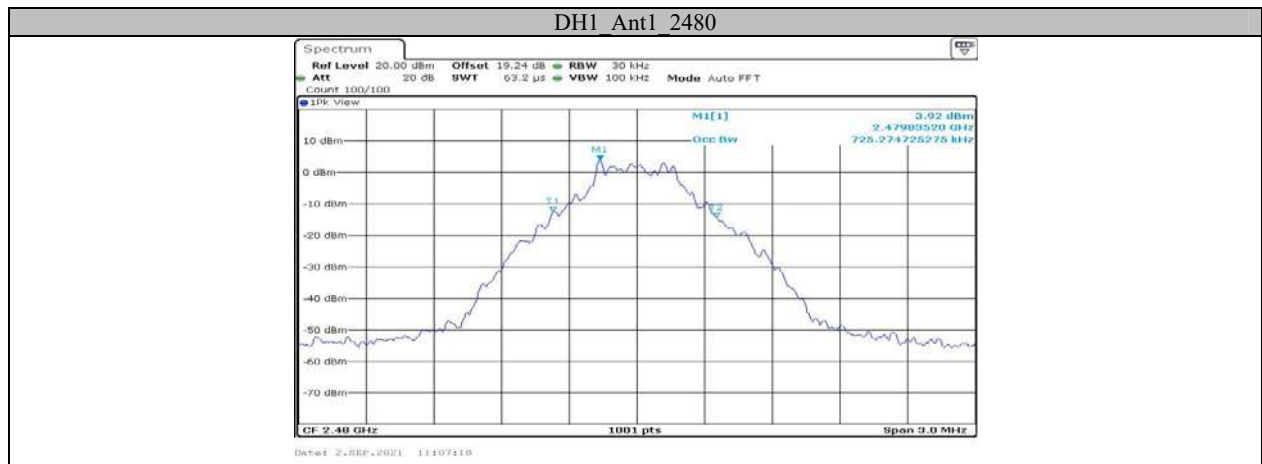
## Appendix B: Occupied Channel Bandwidth

### Test Result

Test Mode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	0.722	---	PASS
		2441	0.722	---	PASS
		2480	0.725	---	PASS
2DH1	Ant1	2402	1.133	---	PASS
		2441	1.133	---	PASS
		2480	1.139	---	PASS
3DH1	Ant1	2402	1.127	---	PASS
		2441	1.127	---	PASS
		2480	1.13	---	PASS

### Test Graphs



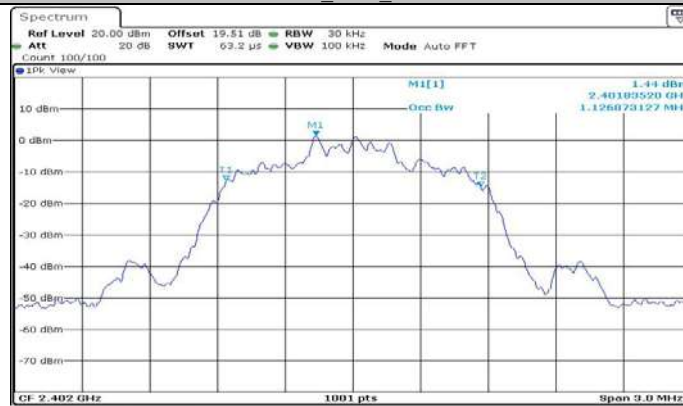


## 2DH1\_Ant1\_2480



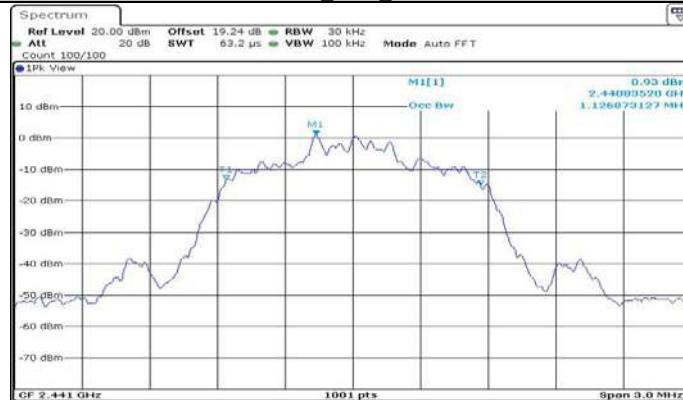
Date: 2,SEP,2021 11:10:47

## 3DH1\_Ant1\_2402



Date: 2,SEP,2021 11:11:56

## 3DH1\_Ant1\_2441



Date: 2,SEP,2021 11:12:54

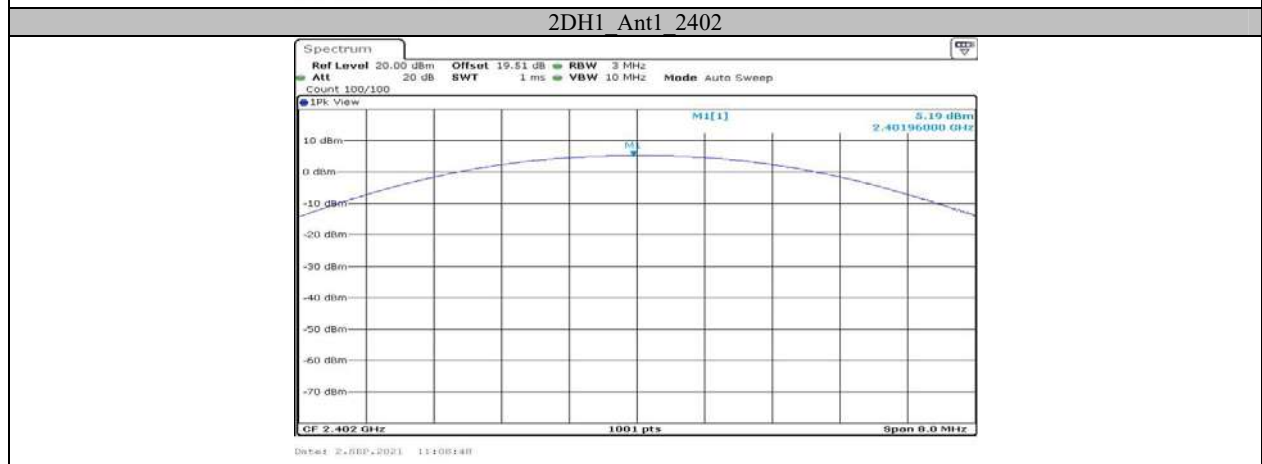
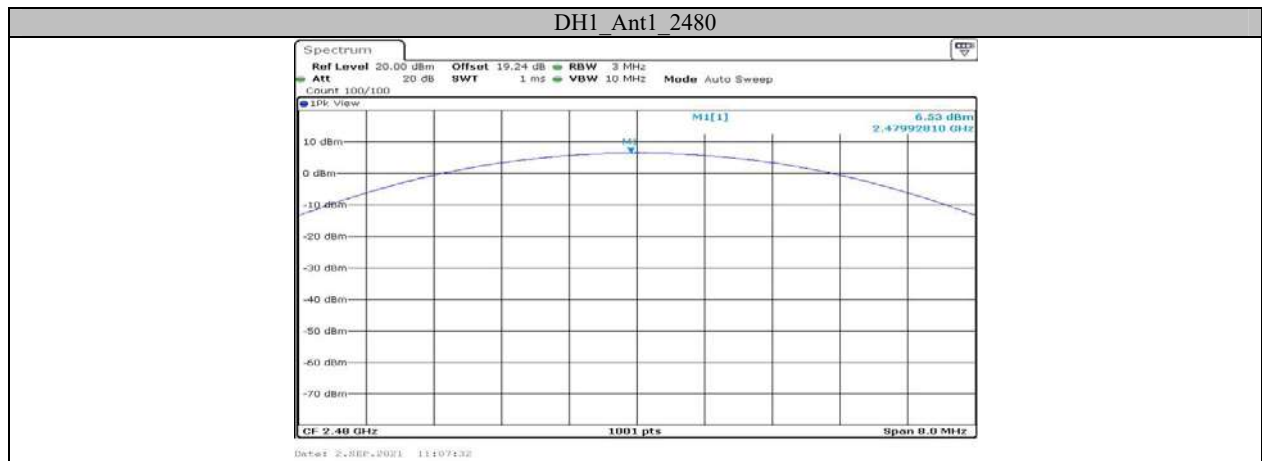
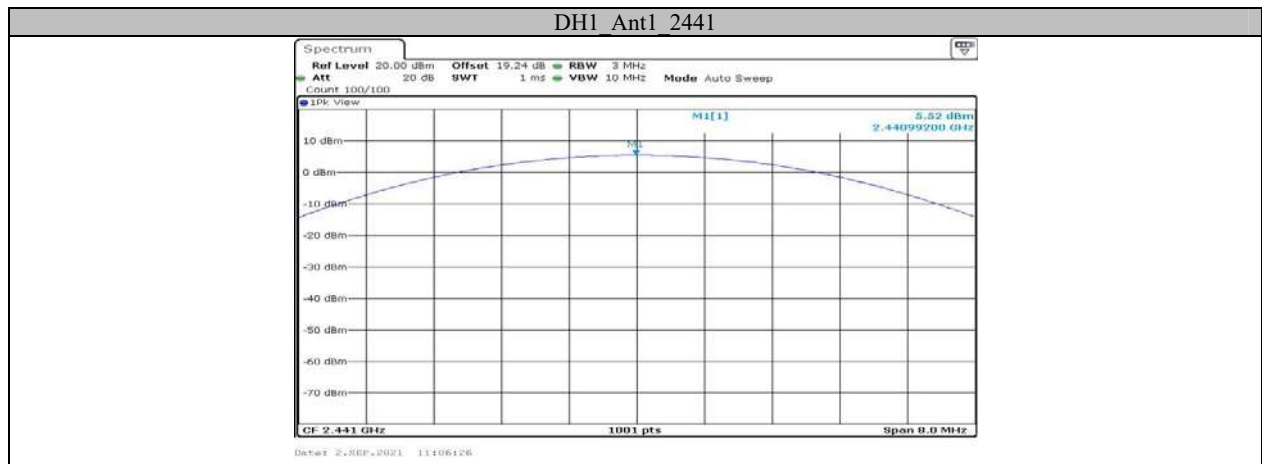


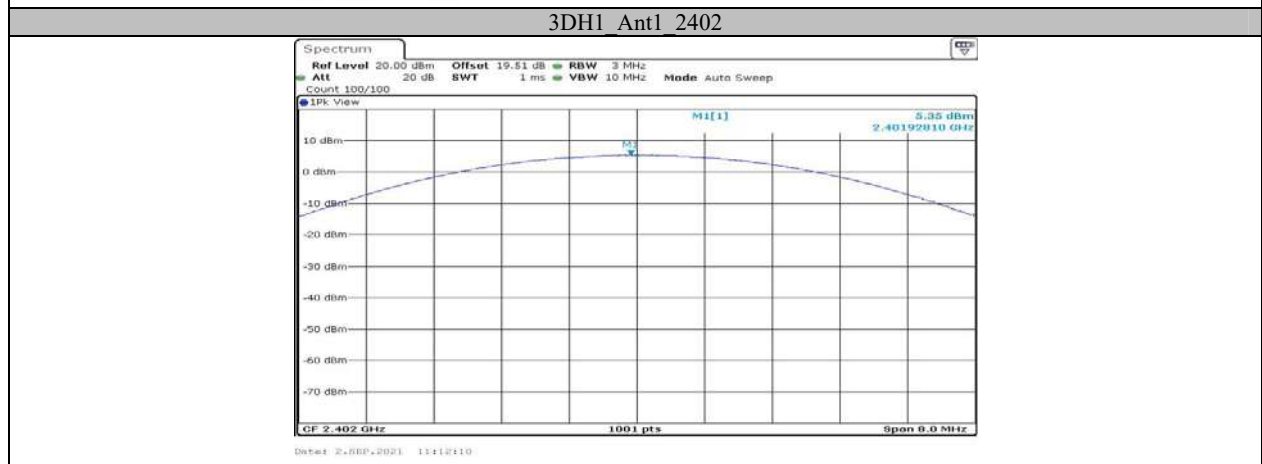
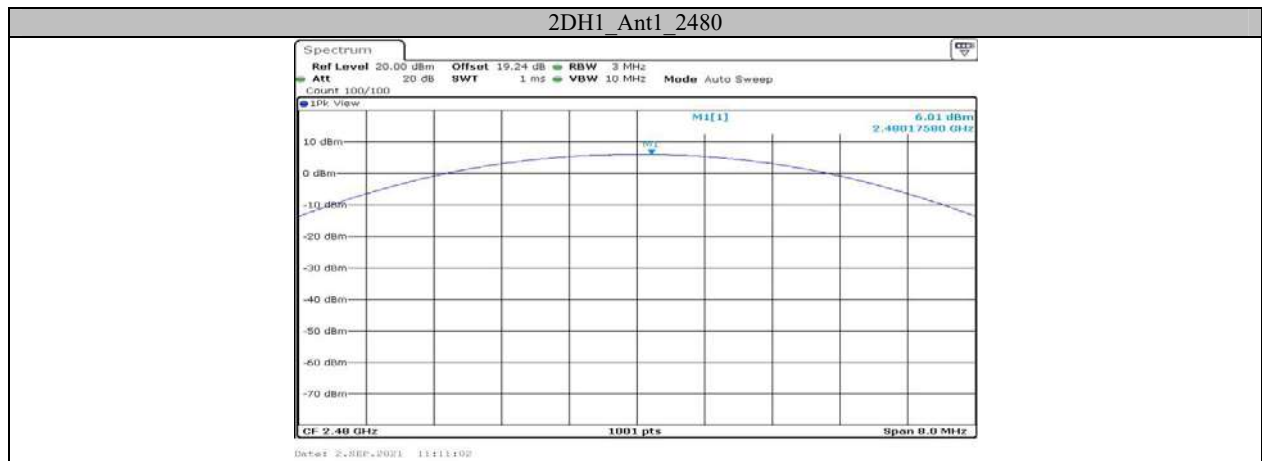
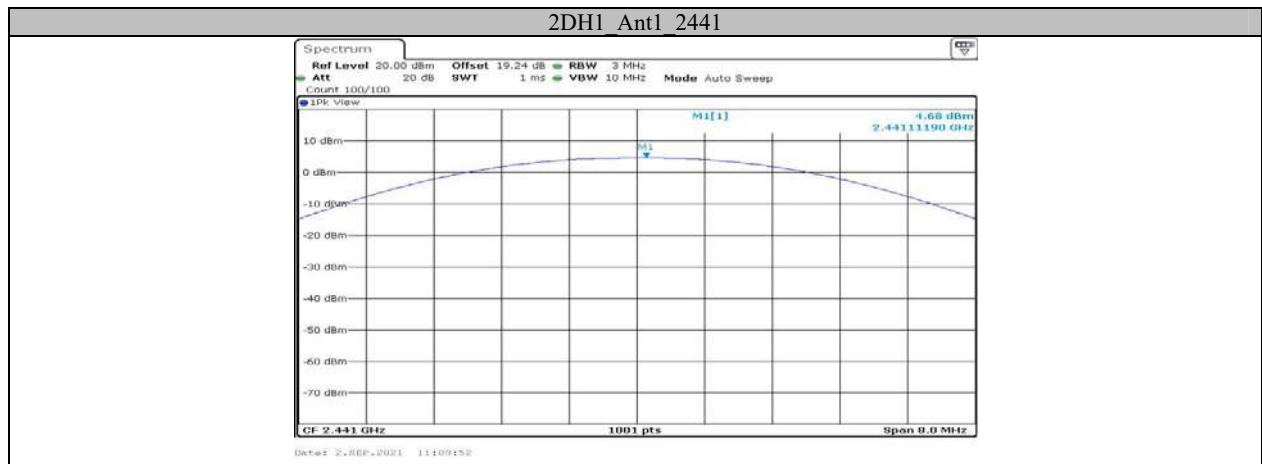
### Appendix C: Maximum conducted Peak output power Test Result

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH1	Ant1	2402	6.09	≤20.97	PASS
		2405	6.58	≤20.97	PASS
		2441	5.52	≤20.97	PASS
		2480	6.53	≤20.97	PASS
2DH1	Ant1	2402	5.19	≤20.97	PASS
		2441	4.68	≤20.97	PASS
		2480	6.01	≤20.97	PASS
3DH1	Ant1	2402	5.35	≤20.97	PASS
		2441	4.86	≤20.97	PASS
		2480	5.88	≤20.97	PASS

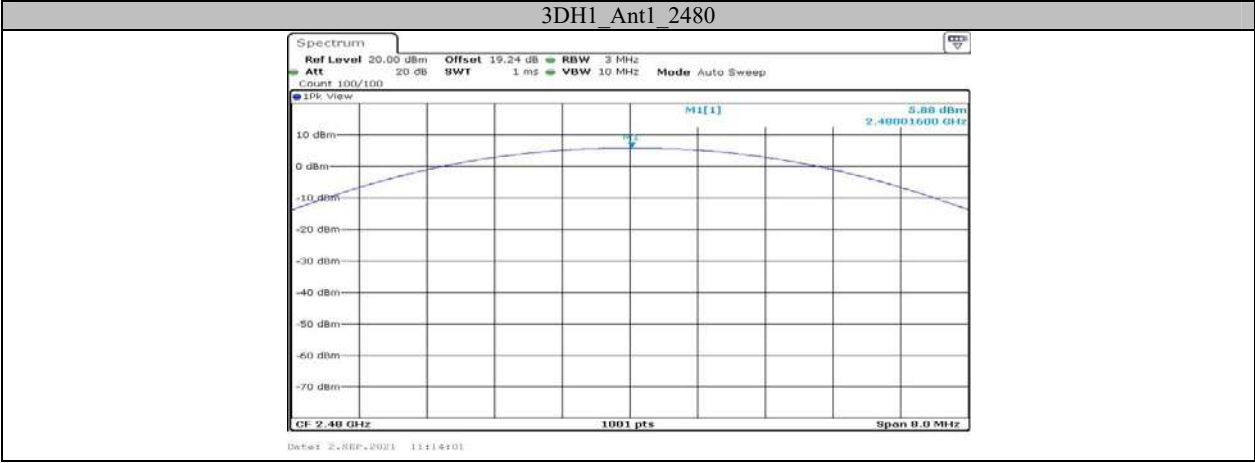
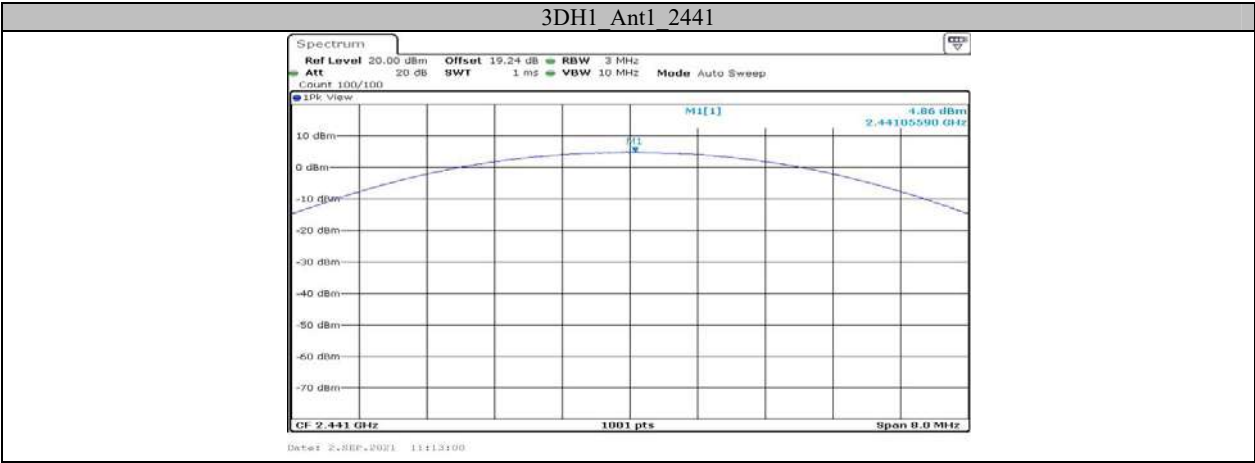
### Test Graphs











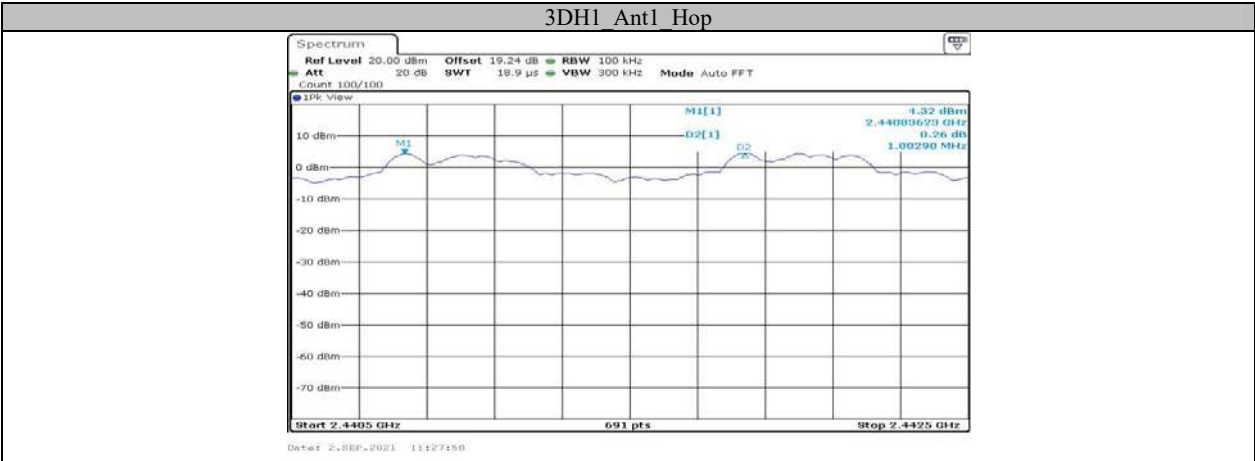
## Appendix D: Carrier frequency separation

### Test Result

Test Mode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH1	Ant1	Hop	1.003	$\geq 0.516$	PASS
2DH1	Ant1	Hop	1.003	$\geq 0.810$	PASS
3DH1	Ant1	Hop	1.003	$\geq 0.812$	PASS

### Test Graphs





## Appendix E: Time of occupancy Test Result

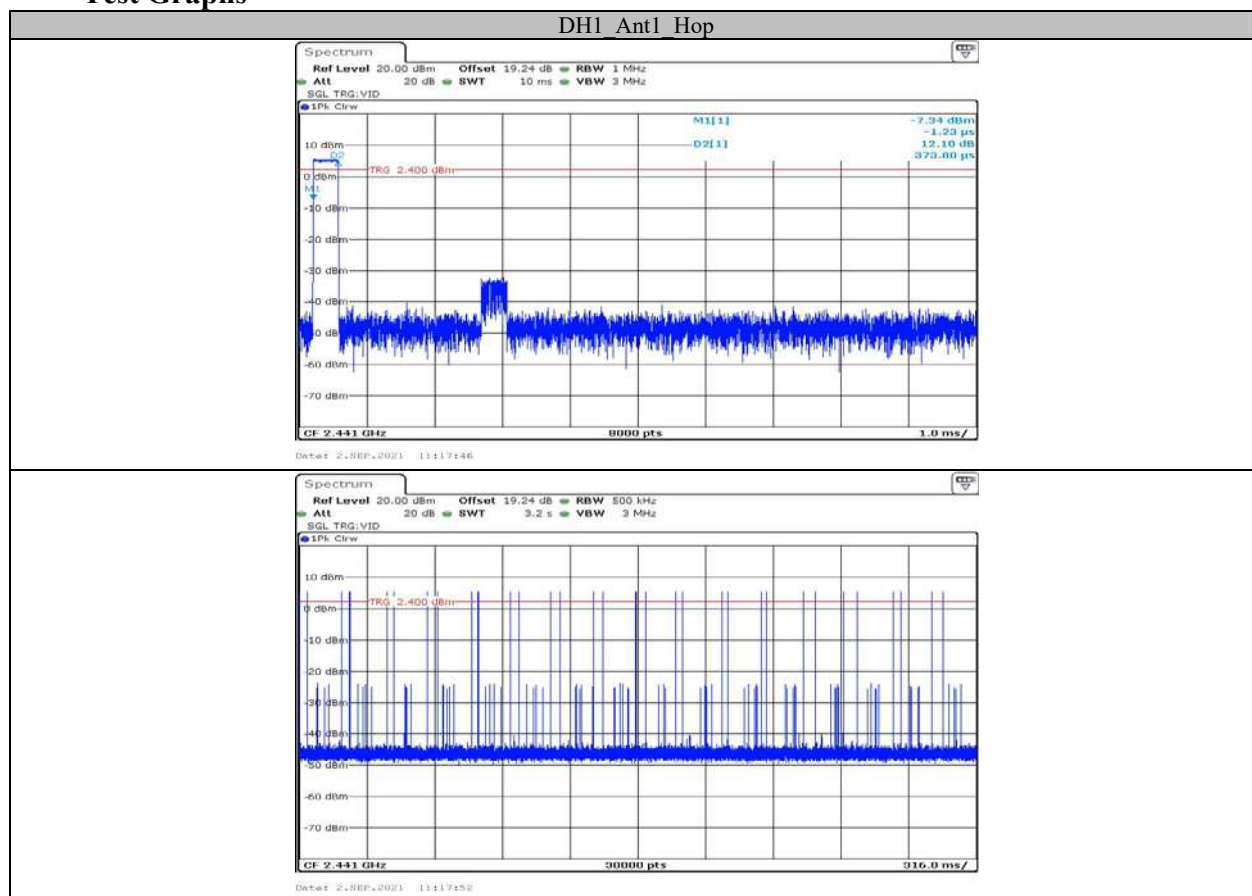
Test Mode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.37	320	0.120	≤0.4	PASS
DH3	Ant1	Hop	1.62	170	0.276	≤0.4	PASS
DH5	Ant1	Hop	2.86	110	0.315	≤0.4	PASS
2DH1	Ant1	Hop	0.38	320	0.122	≤0.4	PASS
2DH3	Ant1	Hop	1.63	170	0.276	≤0.4	PASS
2DH5	Ant1	Hop	2.87	130	0.373	≤0.4	PASS
3DH1	Ant1	Hop	0.38	320	0.122	≤0.4	PASS
3DH3	Ant1	Hop	1.63	170	0.276	≤0.4	PASS
3DH5	Ant1	Hop	2.87	110	0.315	≤0.4	PASS

Note 1: A period time=0.4\*79=31.6(S), Result=BurstWidth\*Totalhops

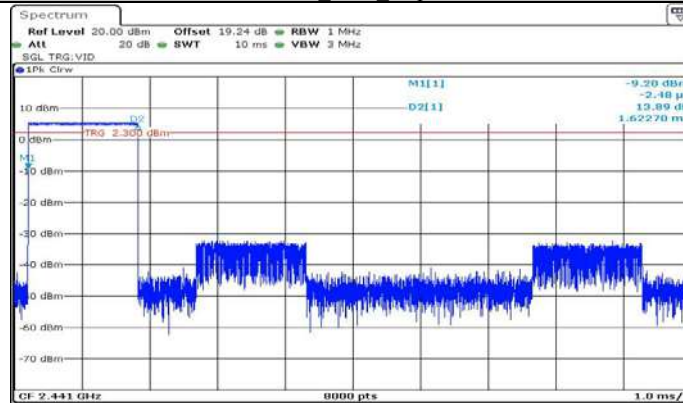
Note 2: Totalhops=Hopping Number in 3.16s\*10

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

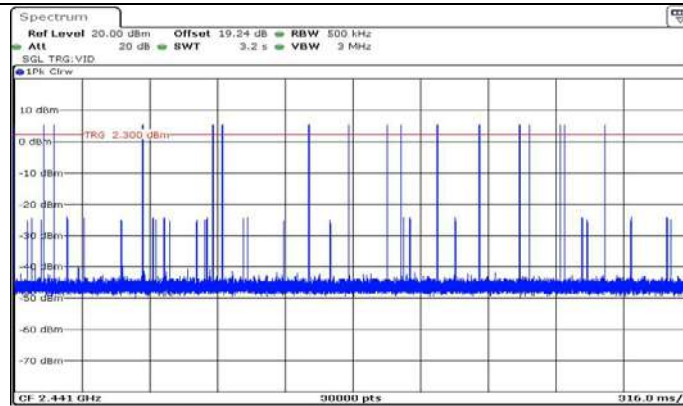
## Test Graphs



## DH3 Ant1 Hop

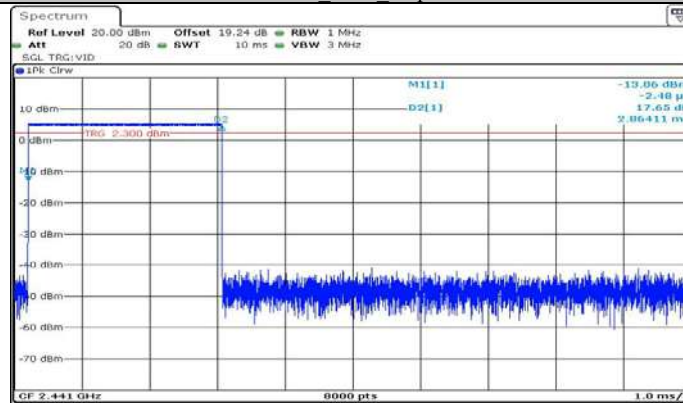


Date: 2,SEP,2021 11:18:29

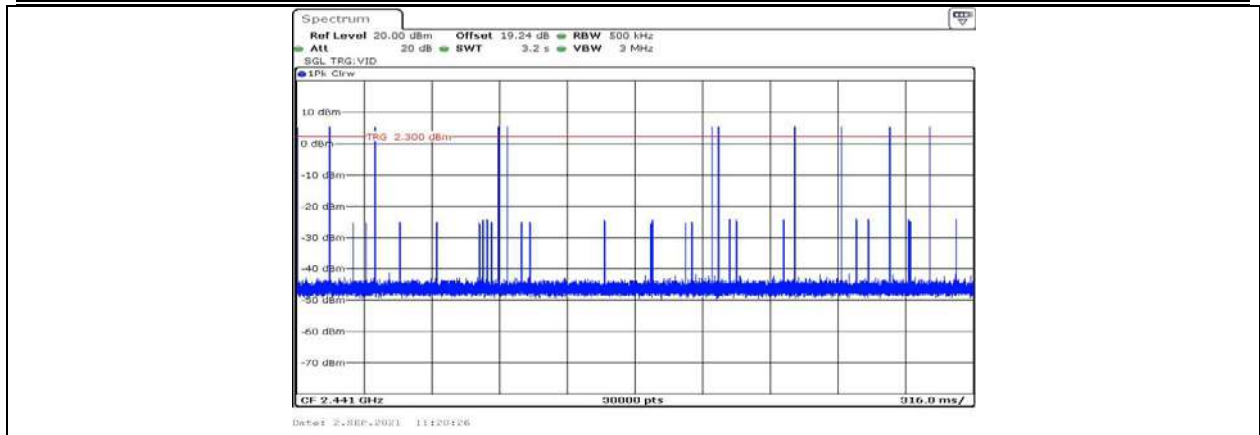


Date: 2,SEP,2021 11:18:30

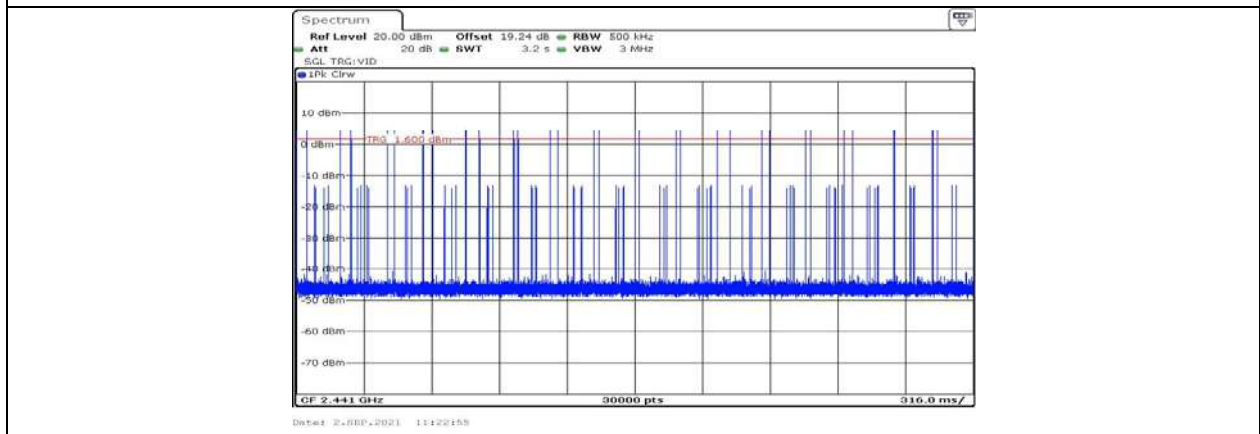
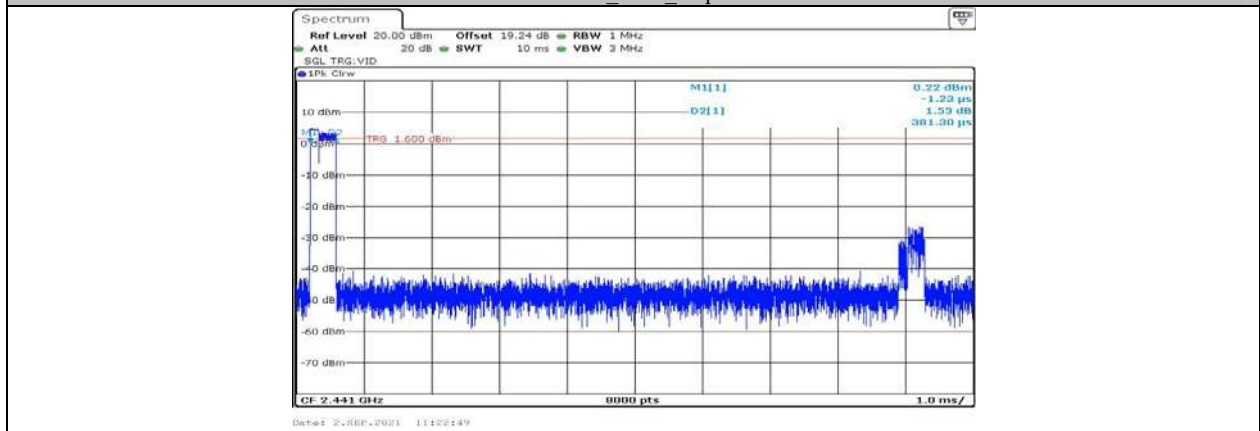
## DH5 Ant1 Hop



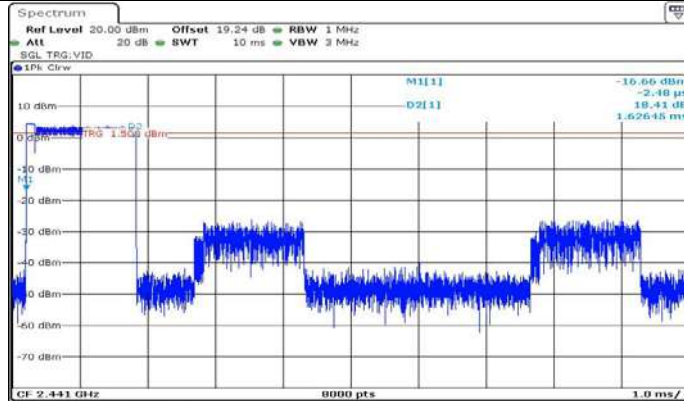
Date: 2,SEP,2021 11:20:20



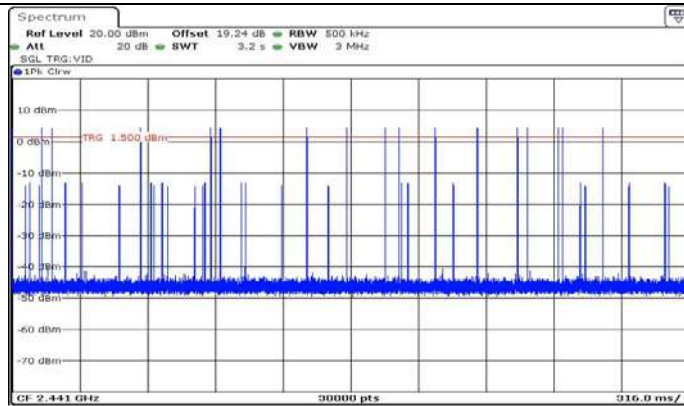
## 2DH1 Ant1 Hop



## 2DH3 Ant1 Hop

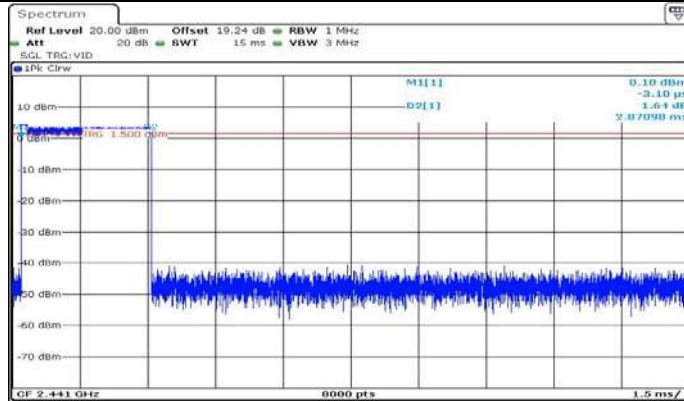


Date: 2, SEP, 2021 11:23:33

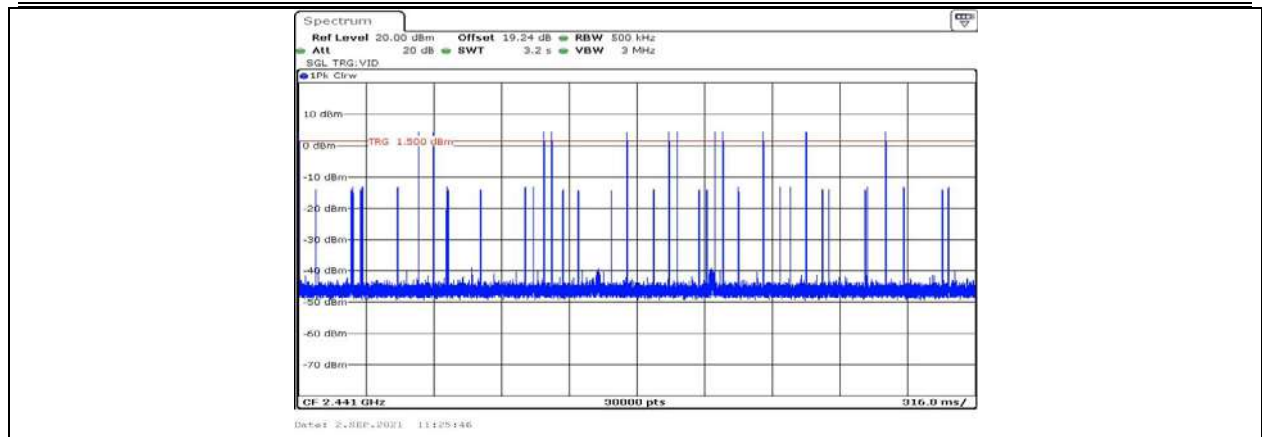


Date: 2, SEP, 2021 11:23:38

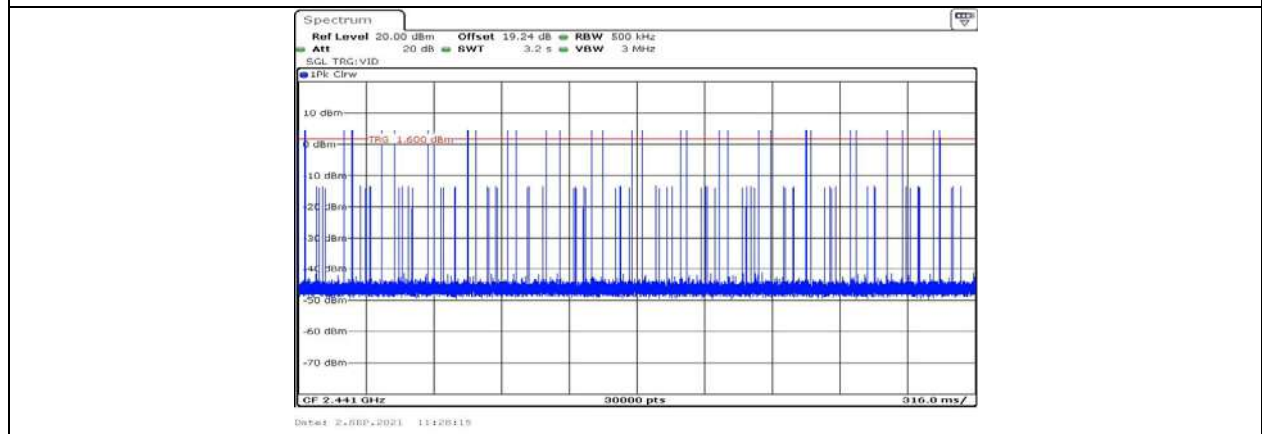
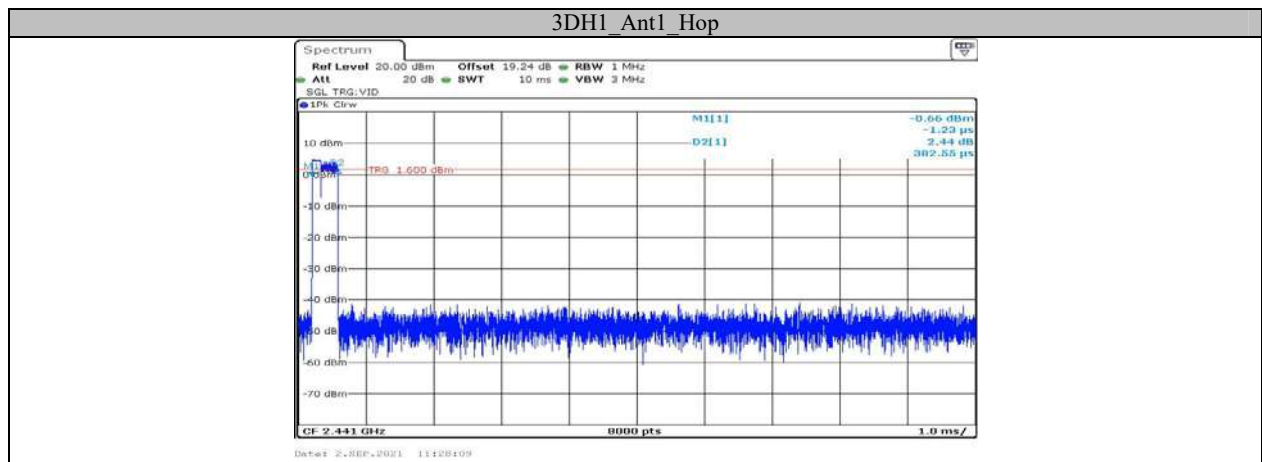
## 2DH5 Ant1 Hop



Date: 2, SEP, 2021 11:25:40

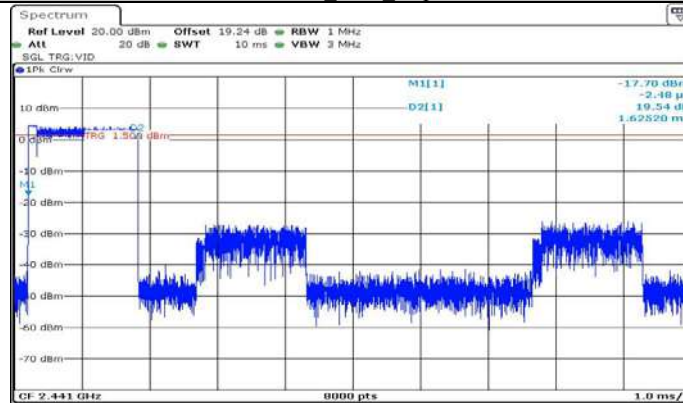


## 3DH1 Ant1 Hop

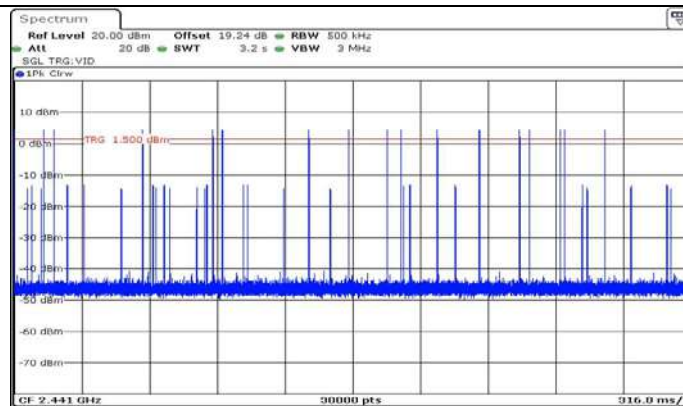




## 3DH3 Ant1 Hop

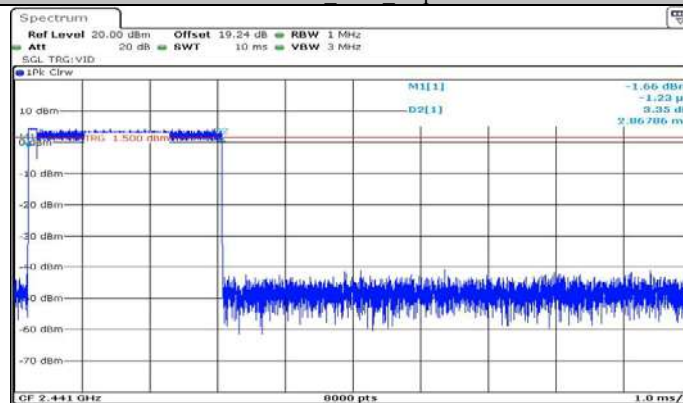


Date: 2,SEP,2021 11:12:09

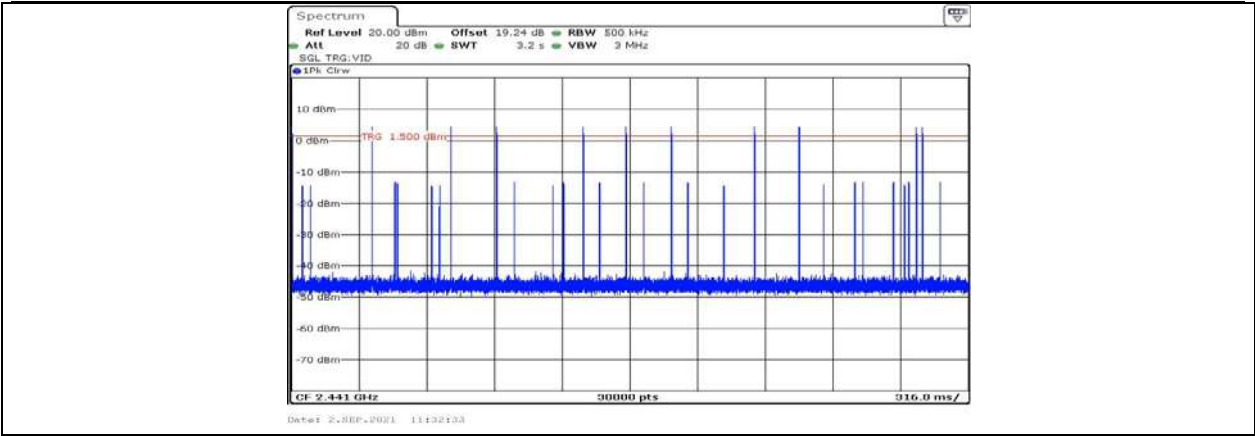


Date: 2,SEP,2021 11:12:06

## 3DH5 Ant1 Hop

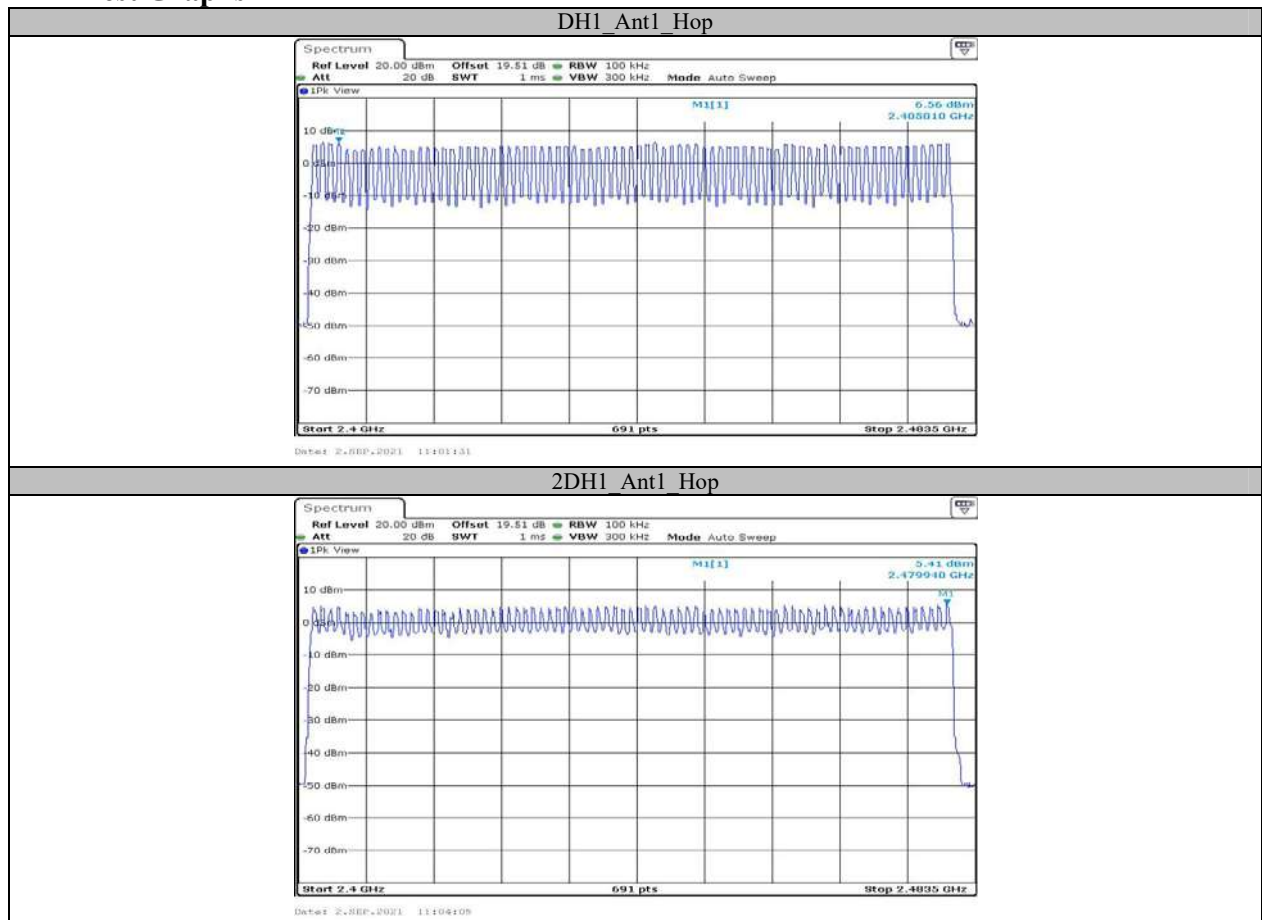


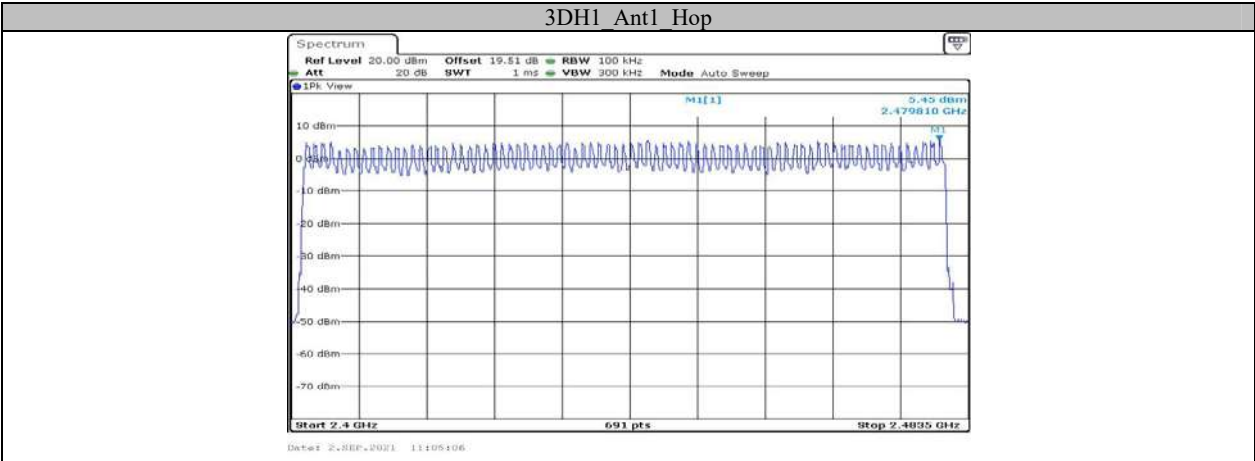
Date: 2,SEP,2021 11:12:10



**Appendix F: Number of hopping channels****Test Result**

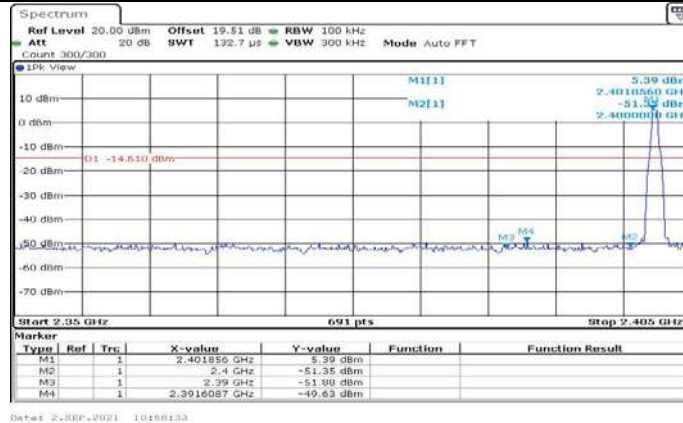
Test Mode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH1	Ant1	Hop	79	≥15	PASS
2DH1	Ant1	Hop	79	≥15	PASS
3DH1	Ant1	Hop	79	≥15	PASS

**Test Graphs**

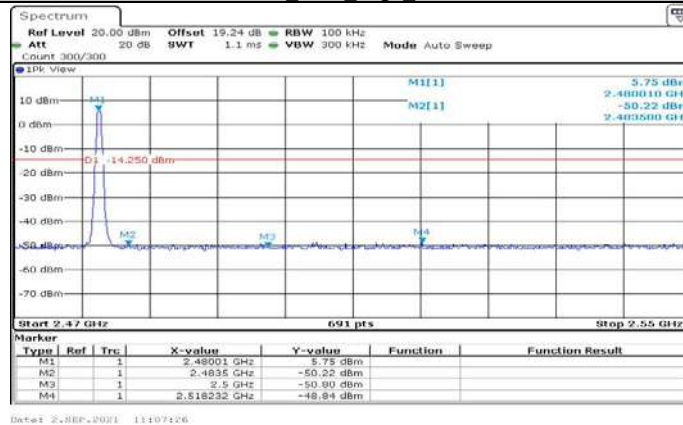


## Appendix G: Band edge measurements Test Graphs

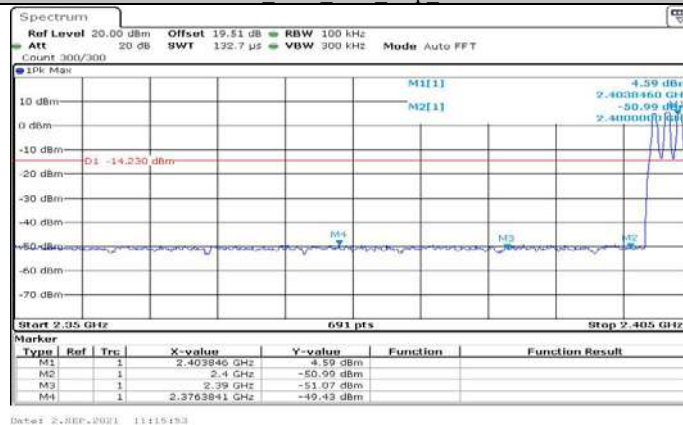
DH1 Ant1 Low 2402



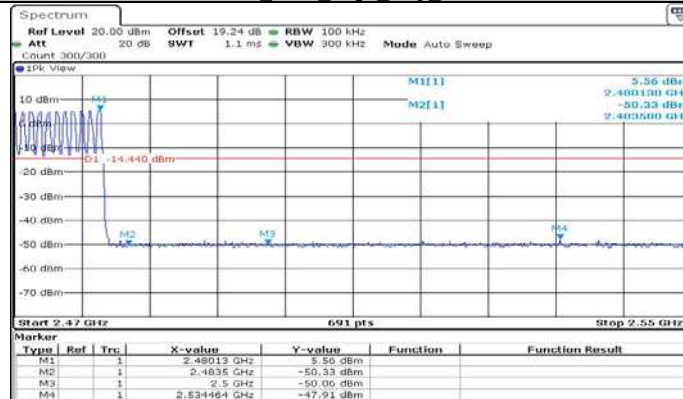
DH1 Ant1 High 2480



DH1 Ant1 Low Hop 2402

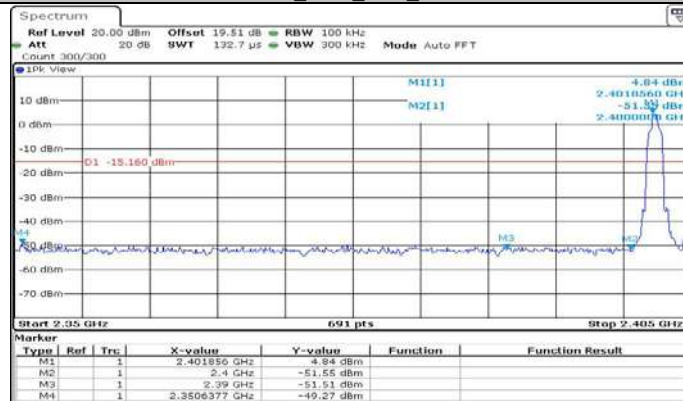


## DH1 Ant1 High Hop 2480



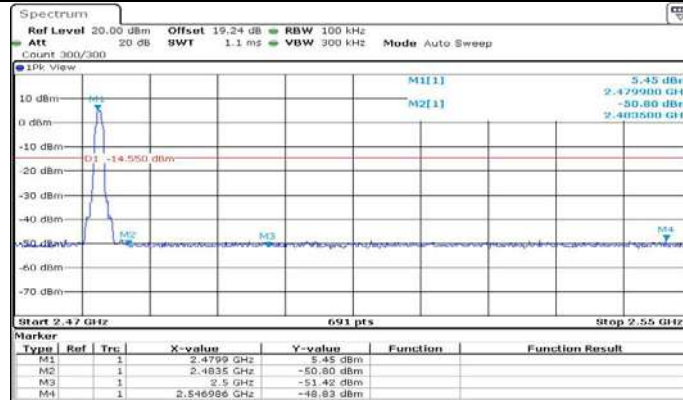
Date: 2-SEP-2021 11:12:13

## 2DH1 Ant1 Low 2402



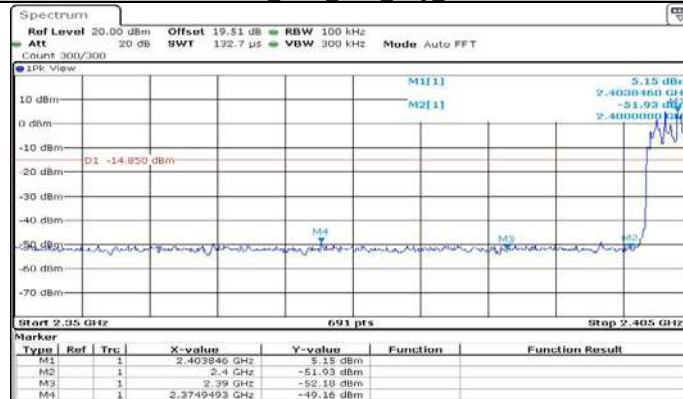
Date: 2-SEP-2021 11:10:42

## 2DH1 Ant1 High 2480



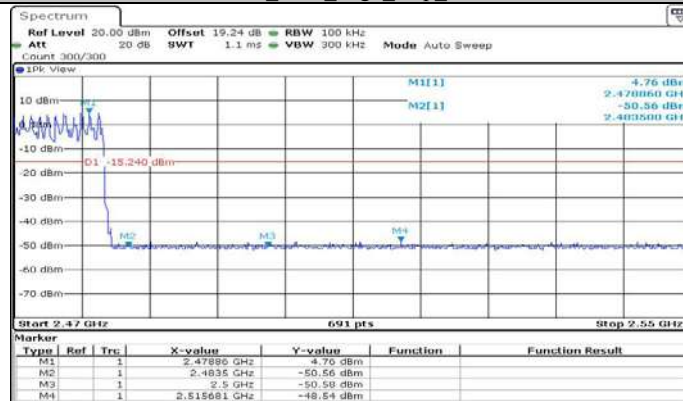
Date: 2-SEP-2021 11:10:56

## 2DH1 Ant1 Low Hop 2402



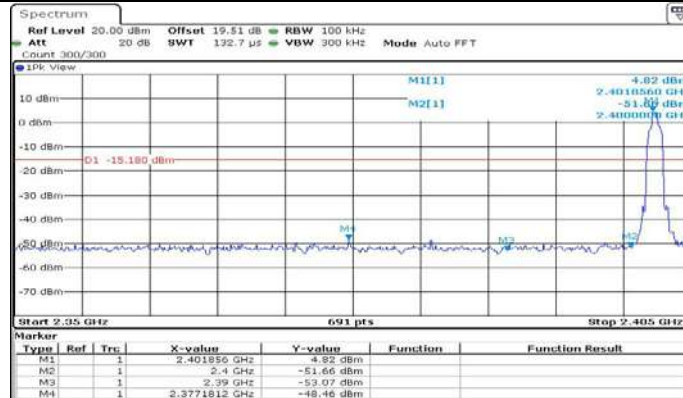
Date: 2-SEP-2021 11:22:06

## 2DH1 Ant1 High Hop 2480



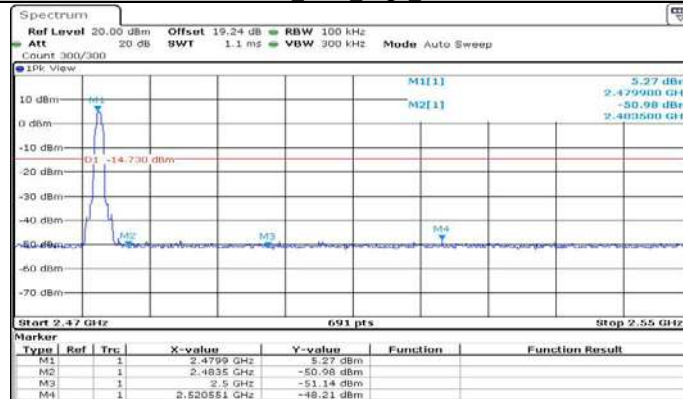
Date: 2-SEP-2021 11:26:17

## 3DH1 Ant1 Low 2402



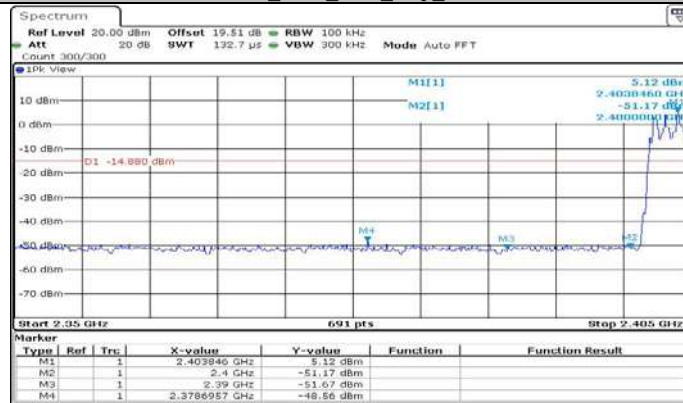
Date: 2-SEP-2021 11:12:04

## 3DH1 Ant1 High 2480



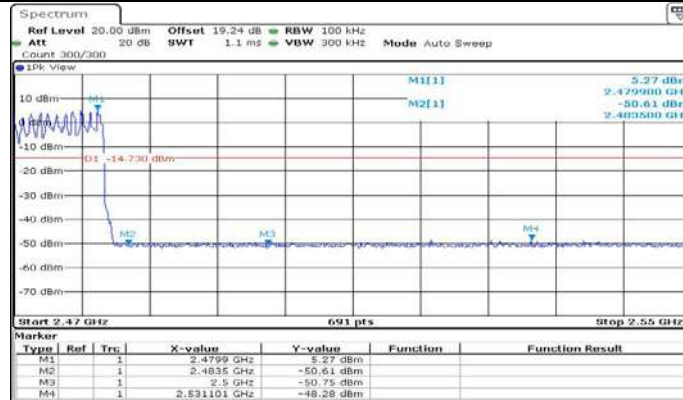
Date: 2-SEP-2021 11:13:59

## 3DH1 Ant1 Low Hop 2402



Date: 2-SEP-2021 11:12:10

## 3DH1 Ant1 High Hop 2480



Date: 2-SEP-2021 11:10:45

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