Shenzhen Huaxia Testing Technology Co., Ltd.

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Report Template Version: V05
Report Template Revision Date: 2021-11-03

Test Report

Report No. :	CQASZ20241002229E-01
Applicant:	Shenzhen Kingstar Industrial Co.,Ltd.
Address of Applicant:	Room 211, Min Le technology Bullding Meiban Road, LongHua District, Shenzhen, China
Equipment Under Test (EUT):	
Product:	LIVE TWS EARBUDS WITH POWER DISPLAY
Model No.:	941454
Test Model No.:	941454
Brand Name:	N/A
FCC ID:	2AO47-KS941454
Standards:	47 CFR Part 15, Subpart C
	KDB558074 D01 15.247 Meas Guidance v05r02
	ANSI C63.10:2013
Date of Receipt:	2024-10-18
Date of Test:	2024-10-18 to 2024-10-28
Date of Issue:	2024-11-21
Test Result :	**PASS***

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

Tested By: lewis zhou
(Lewis Zhou)

Reviewed By: Timo Lei
(Timo Lei)

Approved By: Alex
(Alex Wang)

1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20241002229E-01	Rev.01	Initial report	2024-11-21

2 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15.203	/	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15.247	ANSI C63.10-2013	PASS
20dB Occupied Bandwidth	47 CFR Part 15.247	ANSI C63.10-2013	PASS
Carrier Frequencies Separation	47 CFR Part 15.247	ANSI C63.10-2013	PASS
Hopping Channel Number	47 CFR Part 15.247	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15.247	ANSI C63.10-2013	PASS
Pseudorandom Frequency Hopping Sequence	47 CFR Part 15.247	ANSI C63.10-2013	PASS
Band-edge for RF Conducted Emissions	47 CFR Part 15.247	ANSI C63.10-2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15.247	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15.209	ANSI C63.10-2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15.205/15.209	ANSI C63.10-2013	PASS

Remark:

The tested sample(s) and the sample information are provided by the client.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

Volt: In this whole report Volt means Voltage.

Temp: In this whole report Temp means Temperature.

Humid: In this whole report Humid means humidity.

Press: In this whole report Press means Pressure.

N/A: In this whole report not application

3 Contents

4 General Information

4.1 Client Information

Applicant:	Shenzhen Kingstar Industrial Co.,Ltd.
Address of Applicant:	Room 211, Min Le technology Bullding Meiban Road, LongHua District, Shenzhen, China
Manufacturer:	Shenzhen Kingstar Industrial Co.,Ltd.
Address of Manufacturer:	Room 211, Min Le technology Bullding Meiban Road, LongHua District, Shenzhen, China
Factory:	Shenzhen Kingstar Industrial Co.,Ltd.
Address of Factory:	Room 211, Min Le technology Bullding Meiban Road, LongHua District, Shenzhen, China

4.2 General Description of EUT

Product Name:	LIVE TWS EARBUDS WITH POWER DISPLAY
Model No.:	941454
Test Model No.:	941454
Trade Mark:	N/A
Software Version:	V5.3
Hardware Version:	V5.3
Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	V5.3
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Transfer Rate:	1Mbps/2Mbps/3Mbps
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Product Type:	☐ Mobile ☒ Portable
Test Software of EUT:	FCC_assist_1.0.2.2
Antenna Type:	Chip antenna
Antenna Gain:	2.6dBi
Power Supply:	Li-ion battery DC 3.7V 30mAh, Charge by DC 5V for Charge box
Simultaneous Transmission	☐ Simultaneous TX is supported and evaluated in this report. ☒ Simultaneous TX is not supported.

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
6	2408MHz	26	2428MHz	46	2448MHz	66	2468MHz
7	2409MHz	27	2429MHz	47	2449MHz	67	2469MHz
8	2410MHz	28	2430MHz	48	2450MHz	68	2470MHz
9	2411MHz	29	2431MHz	49	2451MHz	69	2471MHz
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
12	2414MHz	32	2434MHz	52	2454MHz	72	2474MHz
13	2415MHz	33	2435MHz	53	2455MHz	73	2475MHz
14	2416MHz	34	2436MHz	54	2456MHz	74	2476MHz
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel	2402MHz
The Middle channel	2441MHz
The Highest channel	2480MHz

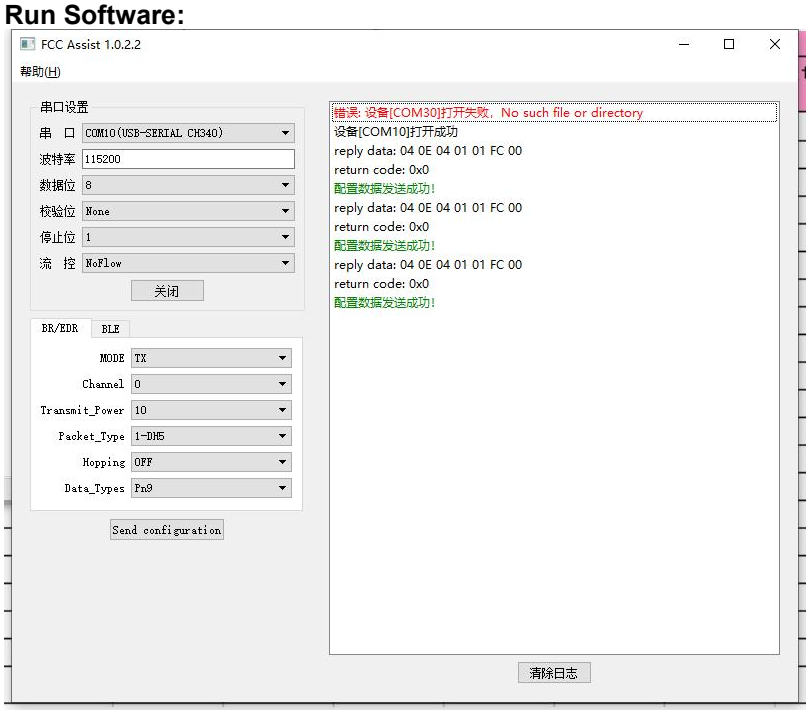
4.3 Additional Instructions

EUT Test Software Settings:	
Mode:	☒ Special software is used. ☐ Through engineering command into the engineering mode. engineering command: *#*#3646633#*#*
EUT Power level:	Class 10

Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT.

Mode	Channel	Frequency(MHz)
DH1/DH3/DH5	CH0	2402
	CH39	2441
	CH78	2480
2DH1/2DH3/2DH5	CH0	2402
	CH39	2441
	CH78	2480
3DH1/3DH3/3DH5	CH0	2402
	CH39	2441
	CH78	2480

Run Software:



4.4 Test Environment

Operating Environment:	
Temperature:	25 °C
Humidity:	54% RH
Atmospheric Pressure:	1009mbar
Test Mode:	Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT.

4.5 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Remark	Supplied
Adapter	MI	/	/	CQA

4.6 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia Testing Technology Co., Ltd.** quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CQA laboratory is reported:

No.	Item	Uncertainty
1	Radiated Emission (Below 1GHz)	5.12dB
2	Radiated Emission (Above 1GHz)	4.60dB
3	Conducted Disturbance (0.15~30MHz)	3.34dB
4	Radio Frequency	3×10^{-8}
5	Duty cycle	0.6 %
6	Occupied Bandwidth	1.1%
7	RF conducted power	0.86dB
8	RF power density	0.74
9	Conducted Spurious emissions	0.86dB
10	Temperature test	0.8℃
11	Humidity test	2.0%
12	Supply voltages	0.5 %
13	Frequency Error	5.5 Hz

4.7 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

4.8 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:
IC Registration No.: 22984-1
The 3m Semi-anechoic chamber of Shenzhen Huaxia Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L5785)**

CNAS has accredited Shenzhen Huaxia Testing Technology Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 4742.01)**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

- **FCC Registration No.: 522263**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.:522263

4.9 Abnormalities from Standard Conditions

None.

4.10 Other Information Requested by the Customer

None.

4.11 Equipment List

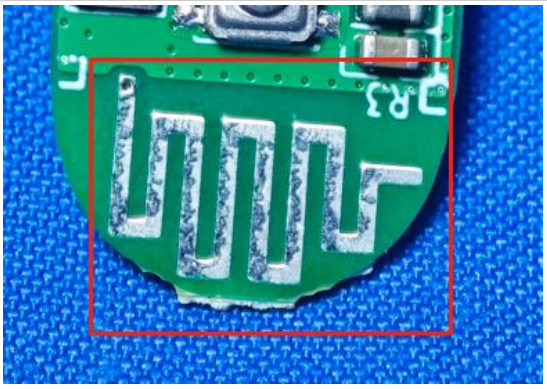
Test Equipment	Manufacturer	Model No.	Instrument No.	Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESR7	CQA-005	2024/9/2	2025/9/1
Spectrum analyzer	R&S	FSU26	CQA-038	2024/9/2	2025/9/1
Spectrum analyzer	R&S	FSU40	CQA-075	2024/9/2	2025/9/1
Preamplifier	MITEQ	AFS4-00010300-18-10P-4	CQA-035	2024/9/2	2025/9/1
Preamplifier	MITEQ	AMF-6D-02001800-29-20P	CQA-036	2024/9/2	2025/9/1
Preamplifier	EMCI	EMC184055SE	CQA-089	2024/9/2	2025/9/1
Loop antenna	Schwarzbeck	FMZB1516	CQA-060	2023/9/8	2026/9/7
Bilog Antenna	R&S	HL562	CQA-011	2023/11/01	2026/10/31
Horn Antenna	R&S	HF906	CQA-012	2023/11/01	2026/10/31
Horn Antenna	Schwarzbeck	BBHA 9170	CQA-088	2023/9/7	2026/9/6
Coaxial Cable (Above 1GHz)	CQA	N/A	C007	2024/9/2	2025/9/1
Coaxial Cable (Below 1GHz)	CQA	N/A	C013	2024/9/2	2025/9/1
Antenna Connector	CQA	RFC-01	CQA-080	2024/9/2	2025/9/1
RF cable(9KHz~40GHz)	CQA	RF-01	CQA-079	2024/9/2	2025/9/1
Power meter	R&S	NRVD	CQA-029	2024/9/2	2025/9/1
Power divider	MIDWEST	PWD-2533-02-SMA-79	CQA-067	2024/9/2	2025/9/1
EMI Test Receiver	R&S	ESR7	CQA-005	2024/9/2	2025/9/1
LISN	R&S	ENV216	CQA-003	2024/9/2	2025/9/1
Coaxial cable	CQA	N/A	CQA-C009	2024/9/2	2025/9/1
DC power	KEYSIGHT	E3631A	CQA-028	2024/9/2	2025/9/1

Note:

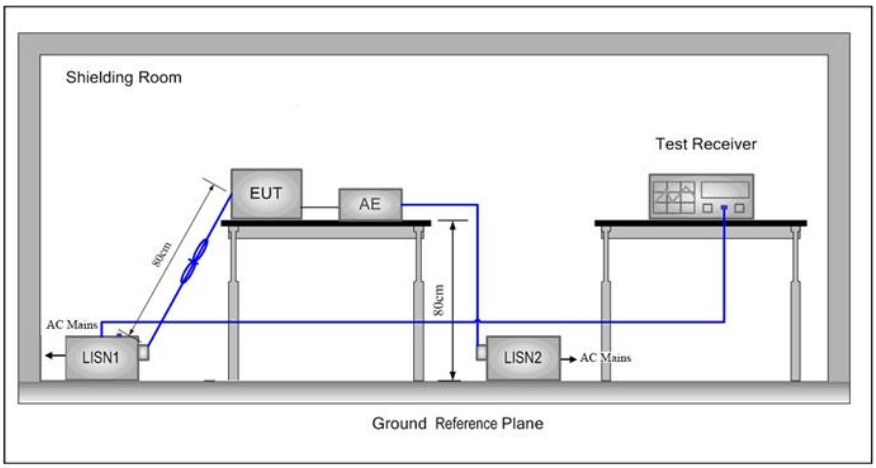
The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

5 Test results and Measurement Data

5.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
15.203 requirement: 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, 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. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	
The antenna is PCB antenna. **The connection/connection type between the antenna to the EUT's antenna port is: permanently attachment.** **This is either permanently attachment or a unique coupling that satisfies the requirement.**	

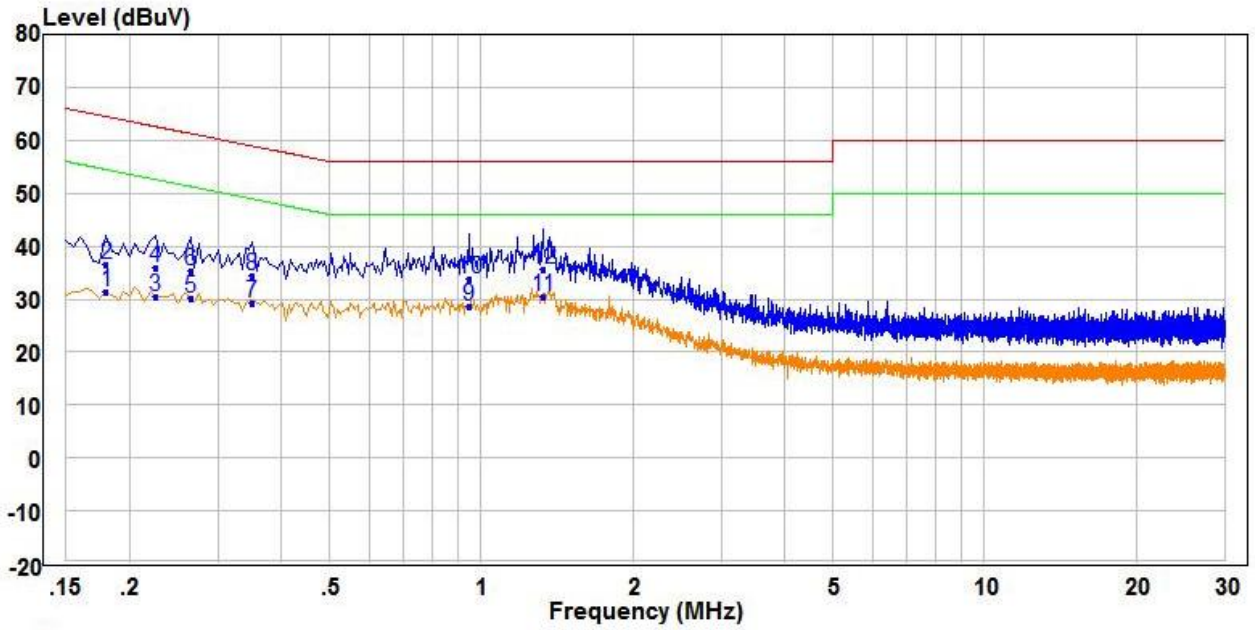
5.2 Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207
Test Method:	ANSI C63.10: 2013
Test Frequency Range:	150kHz to 30MHz
Limit:	Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 * Decreases with the logarithm of the frequency.
Test Procedure:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.
Test Setup:	

Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel.
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation at the lowest channel is the worst case. Only the worst case is recorded in the report.
Test Voltage:	AC 120V/60Hz
Test Results:	Pass

Measurement Data

Live line:



		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.180	21.75	9.64	31.39	54.49	-23.10	Average	Line
2		0.180	26.76	9.64	36.40	64.49	-28.09	QP	Line
3		0.225	20.87	9.58	30.45	52.63	-22.18	Average	Line
4		0.225	26.25	9.58	35.83	62.63	-26.80	QP	Line
5		0.265	20.64	9.53	30.17	51.27	-21.10	Average	Line
6		0.265	25.84	9.53	35.37	61.27	-25.90	QP	Line
7		0.350	19.66	9.55	29.21	48.96	-19.75	Average	Line
8		0.350	24.96	9.55	34.51	58.96	-24.45	QP	Line
9		0.945	19.01	9.74	28.75	46.00	-17.25	Average	Line
10		0.945	24.09	9.74	33.83	56.00	-22.17	QP	Line
11	PP	1.325	19.95	10.49	30.44	46.00	-15.56	Average	Line
12	QP	1.325	25.11	10.49	35.60	56.00	-20.40	QP	Line

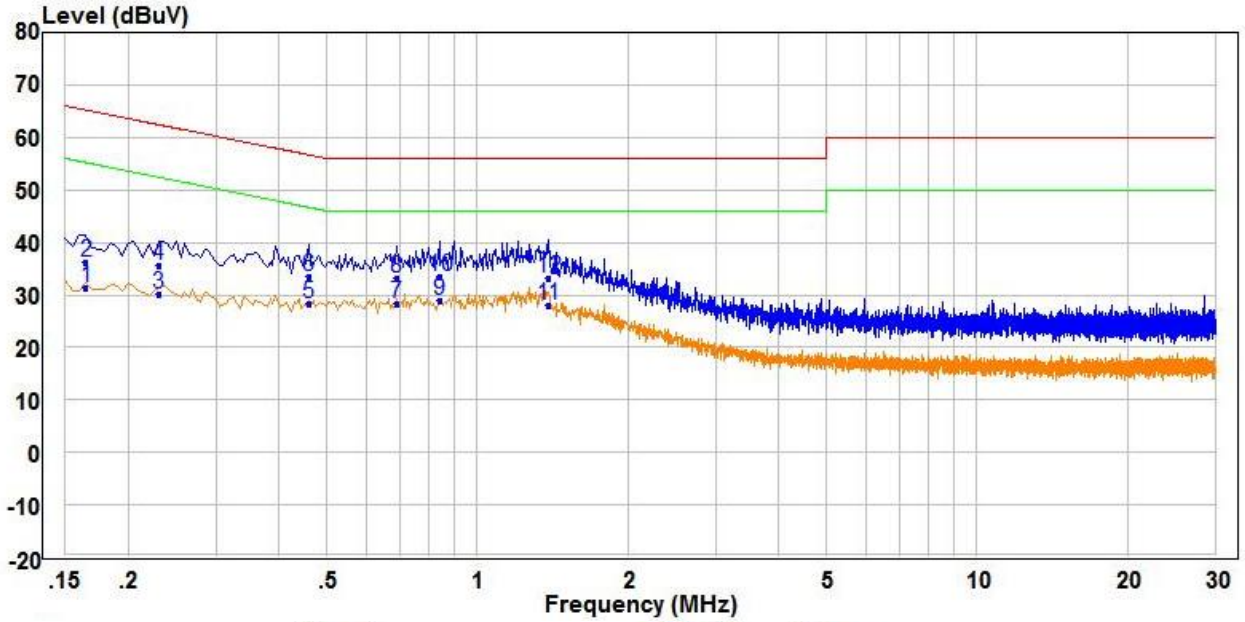
Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

3. If the Peak value under Average limit, the Average value is not recorded in the report.

Neutral line:



		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.165	21.67	9.67	31.34	55.21	-23.87	Average	Neutral
2		0.165	26.70	9.67	36.37	65.21	-28.84	QP	Neutral
3		0.230	20.65	9.56	30.21	52.45	-22.24	Average	Neutral
4		0.230	26.05	9.56	35.61	62.45	-26.84	QP	Neutral
5		0.460	18.64	9.66	28.30	46.69	-18.39	Average	Neutral
6		0.460	23.73	9.66	33.39	56.69	-23.30	QP	Neutral
7		0.690	18.54	9.89	28.43	46.00	-17.57	Average	Neutral
8		0.690	23.44	9.89	33.33	56.00	-22.67	QP	Neutral
9	PP	0.840	19.01	9.81	28.82	46.00	-17.18	Average	Neutral
10	QP	0.840	23.70	9.81	33.51	56.00	-22.49	QP	Neutral
11		1.385	18.25	9.72	27.97	46.00	-18.03	Average	Neutral
12		1.385	23.36	9.72	33.08	56.00	-22.92	QP	Neutral

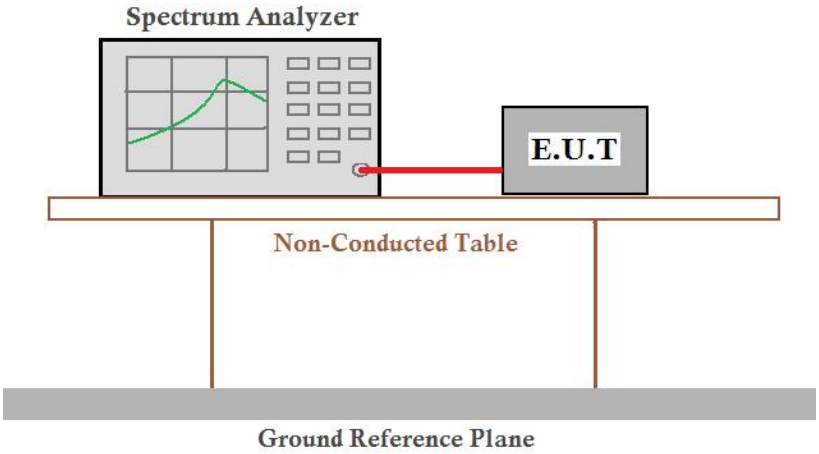
Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

3. If the Peak value under Average limit, the Average value is not recorded in the report.

5.3 Conducted Peak Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	***Setup for Power meter measurement method***  ***Setup for Spectrum analyser measurement method***  *Remark: Offset=Cable loss+ attenuation factor.*
Limit:	21dBm
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Only the worst case is recorded in the report.
Test Results:	Pass

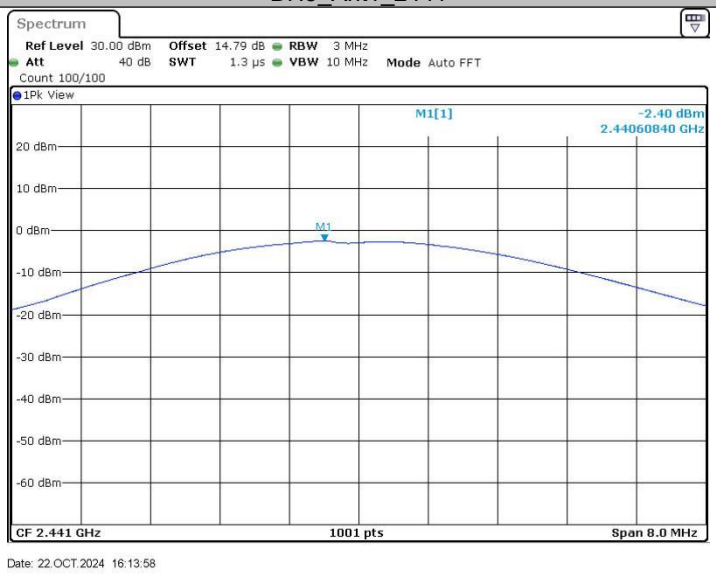
Measurement Data

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-2.03	21.00	Pass
Middle	-2.4	21.00	Pass
Highest	-0.73	21.00	Pass
π/4DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-2.47	21.00	Pass
Middle	-2.04	21.00	Pass
Highest	-0.6	21.00	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-1.91	21.00	Pass
Middle	-2.31	21.00	Pass
Highest	-0.88	21.00	Pass

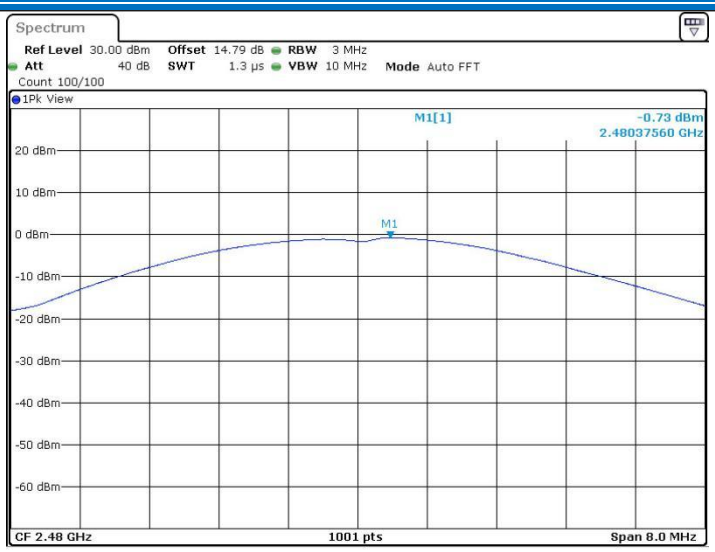
Test plot as follows:

DH5_Ant1_2402

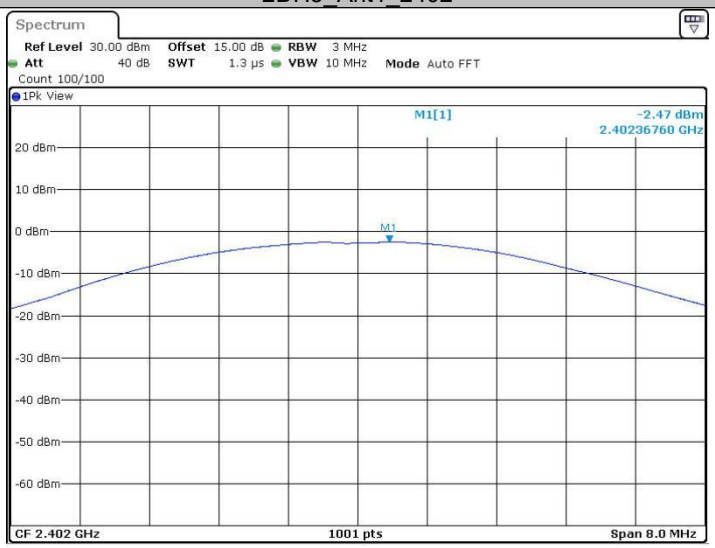
DH5_Ant1_2441



DH5_Ant1_2480



2DH5_Ant1_2402



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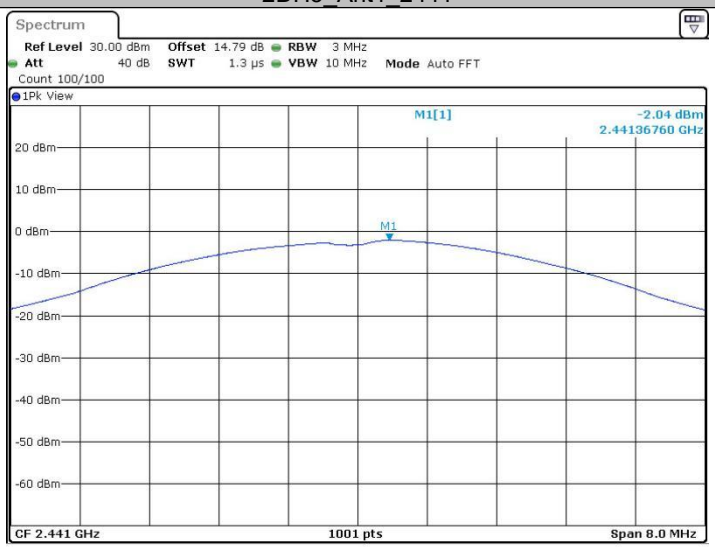
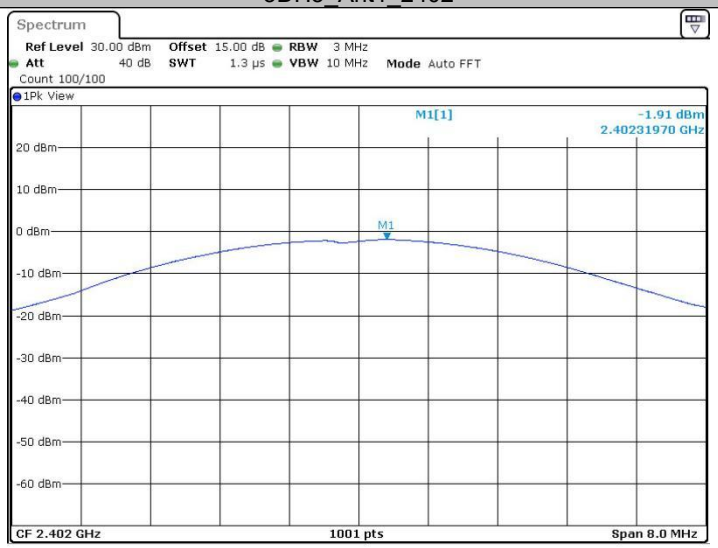
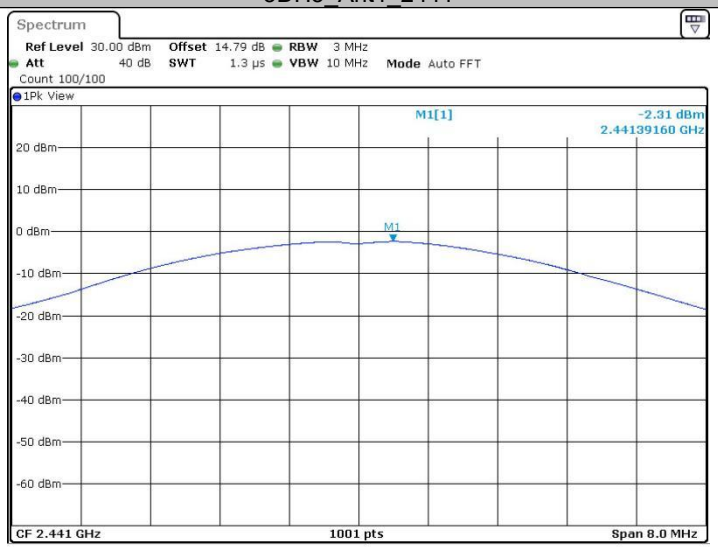


2DH5_Ant1_2480

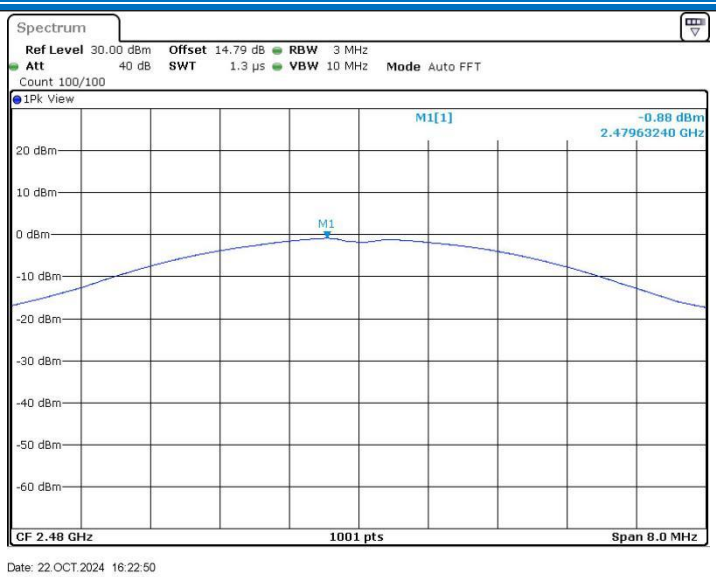
3DH5_Ant1_2402



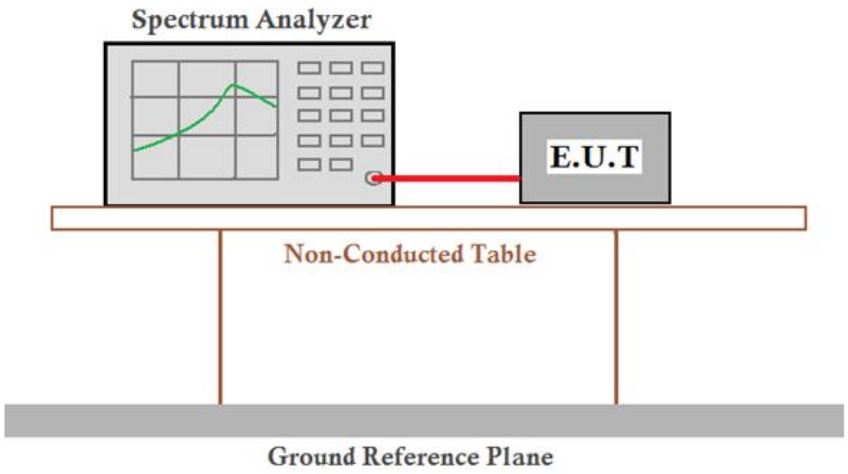
3DH5_Ant1_2441



3DH5_Ant1_2480


Spectrum
Ref Level 30.00 dBm Offset 14.79 dB RBW 3 MHz
Att 40 dB SWT 1.3 µs VBW 10 MHz Mode Auto FFT
Count 100/100
1Pk View
M1[1]
-0.88 dBm
2.47963240 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
CF 2.48 GHz
1001 pts
Span 8.0 MHz
Date: 22.OCT.2024 16:22:50

5.4 20dB Occupied Bandwidth

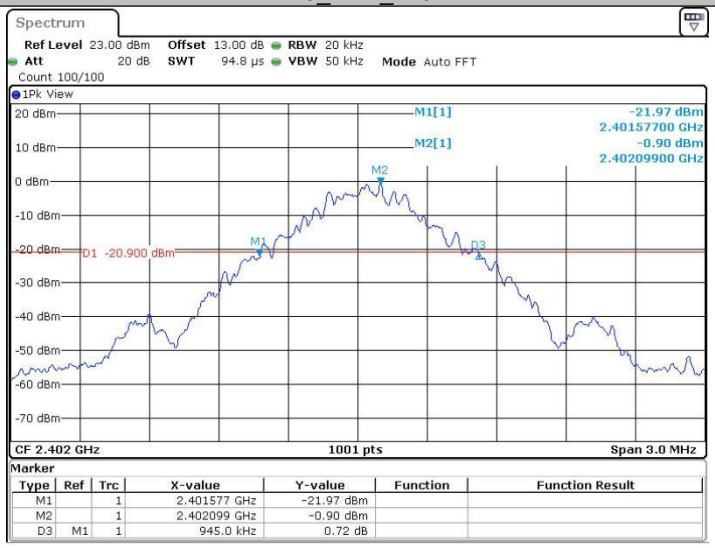
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 Remark: Offset=Cable loss+ attenuation factor.
Limit:	NA
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Only the worst case is recorded in the report.
Test Results:	Pass

Measurement Data

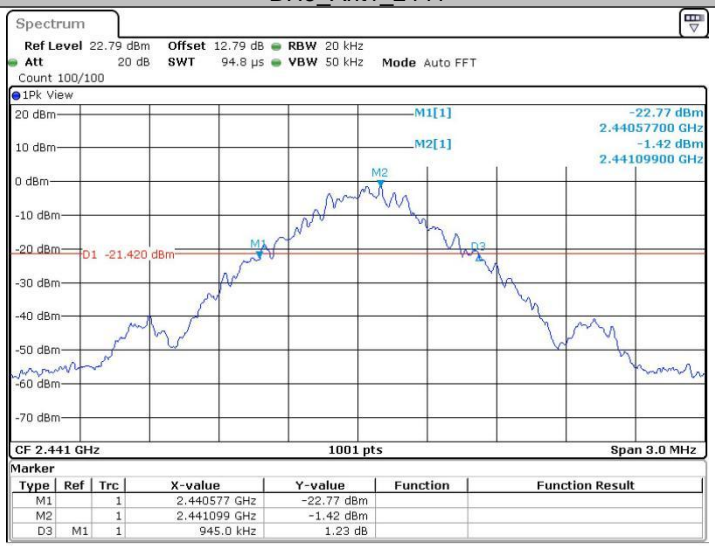
Test channel	20dB Occupy Bandwidth (MHz)		
	GFSK	π/4DQPSK	8DPSK
Lowest	0.94	1.29	1.26
Middle	0.94	1.29	1.26
Highest	0.94	1.29	1.26

Test plot as follows:

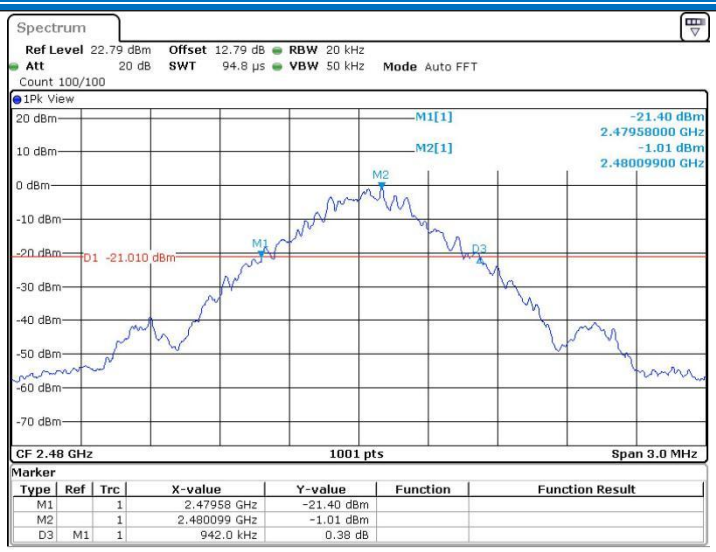
DH5_Ant1_2402



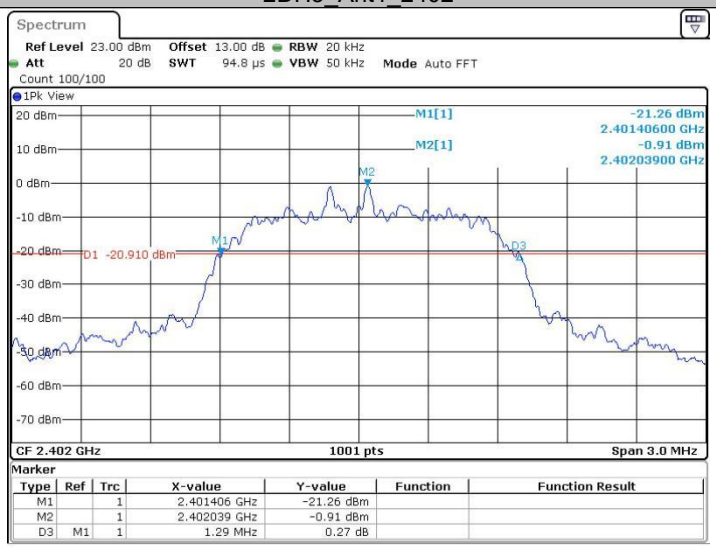
DH5_Ant1_2441



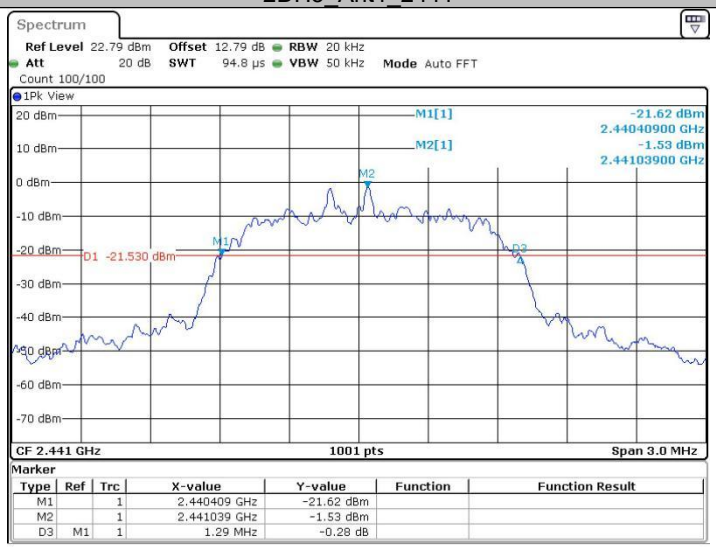
DH5_Ant1_2480



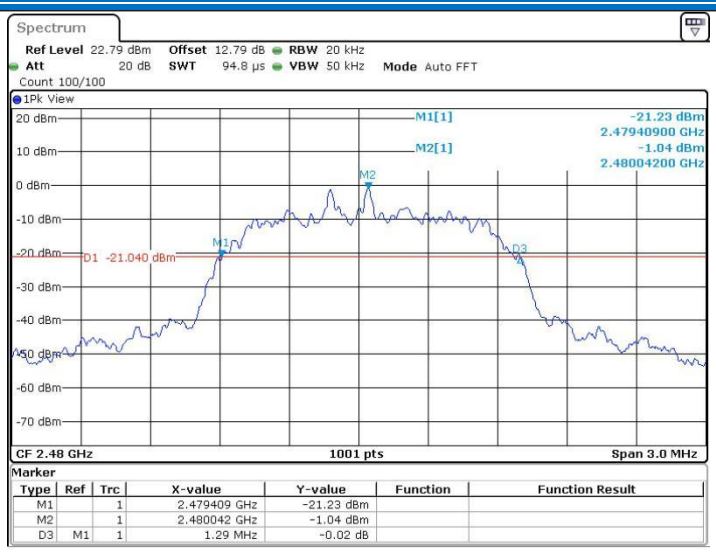
2DH5_Ant1_2402



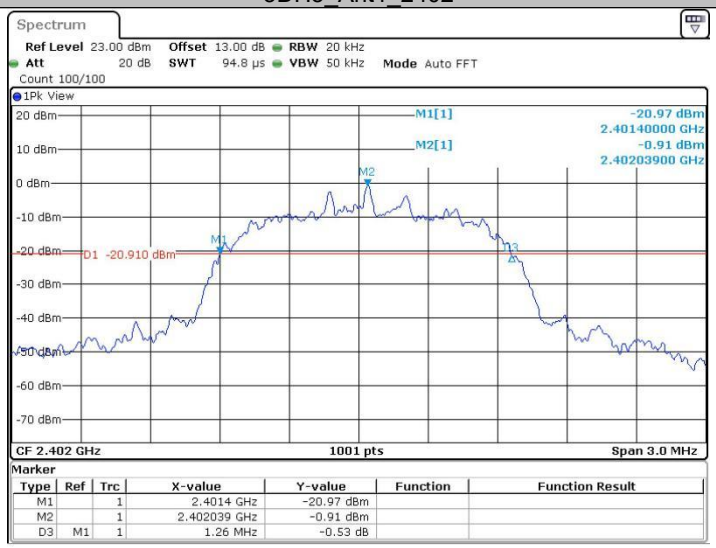
2DH5_Ant1_2441



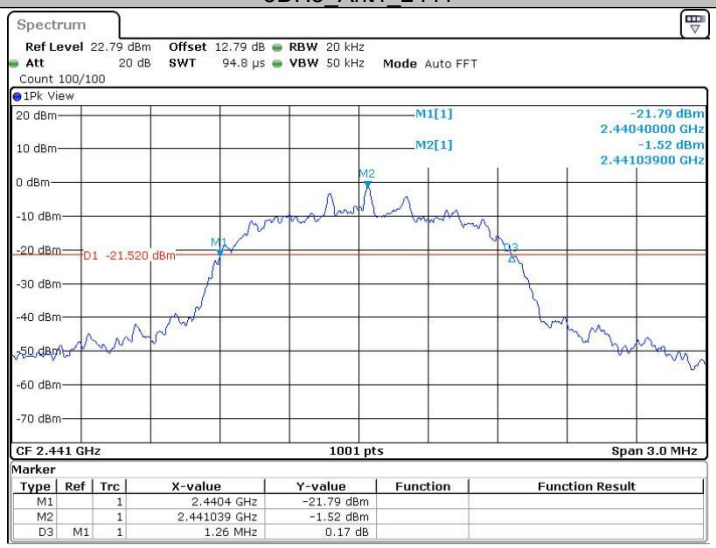
2DH5_Ant1_2480



3DH5_Ant1_2402



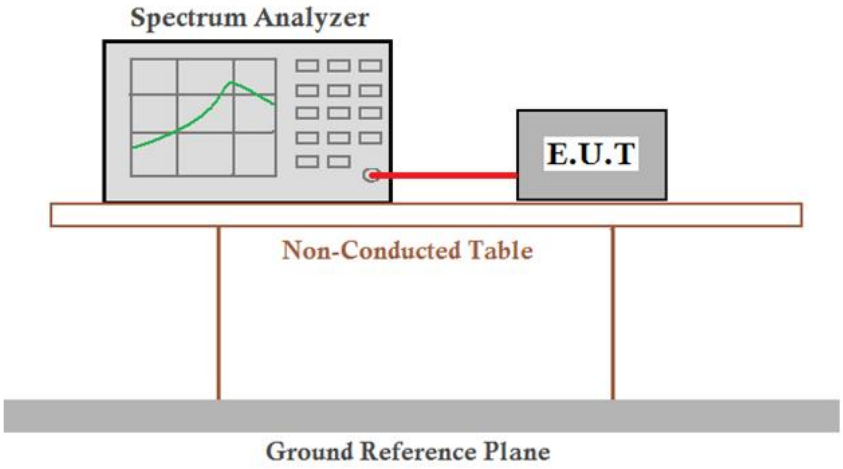
3DH5_Ant1_2441



3DH5_Ant1_2480


Spectrum
Ref Level 22.79 dBm Offset 12.79 dB RBW 20 kHz
Att 20 dB SWT 94.8 µs VBW 50 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -21.40 dBm
2.47940000 GHz
M2[1] -1.12 dBm
2.48004200 GHz
D1 -21.120 dBm
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4794 GHz -21.40 dBm
M2 1 2.480042 GHz -1.12 dBm
D3 M1 1 1.263 MHz -0.20 dB
Date: 21.OCT.2024 15:27:33

5.5 Carrier Frequencies Separation

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 Remark: Offset=Cable loss+ attenuation factor.
Limit:	2/3 of the 20dB bandwidth
	Remark: the transmission power is less than 0.125W.
Exploratory Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Only the worst case is recorded in the report.
Test Results:	Pass

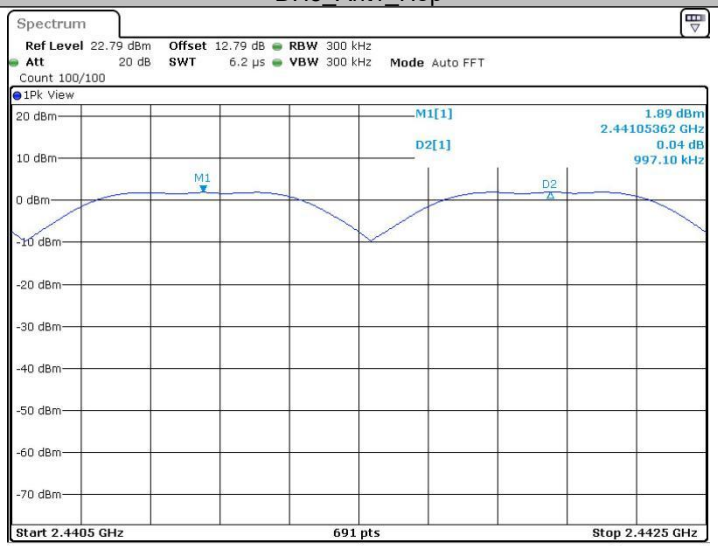
Measurement Data

TestMode	Freq(MHz)	Result[MHz]	Limit[MHz]	Verdict
DH5	Hop	0.997	≥0.627	PASS
2DH5	Hop	1.009	≥0.860	PASS
3DH5	Hop	1.017	≥0.840	PASS

Mode	20dB bandwidth (MHz) (worse case)	Limit (MHz) (Carrier Frequencies Separation)
GFSK	0.94	≥0.627
π/4DQPSK	1.29	≥0.860
8DPSK	1.26	≥0.840

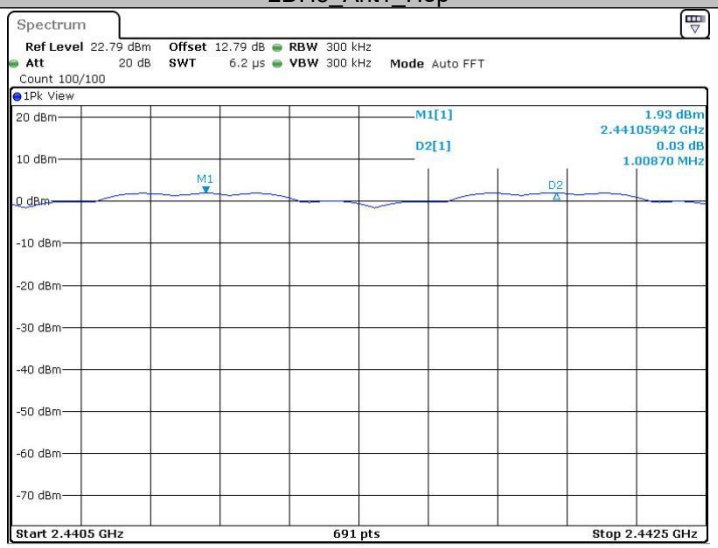
Test plot as follows:

DH5_Ant1_Hop



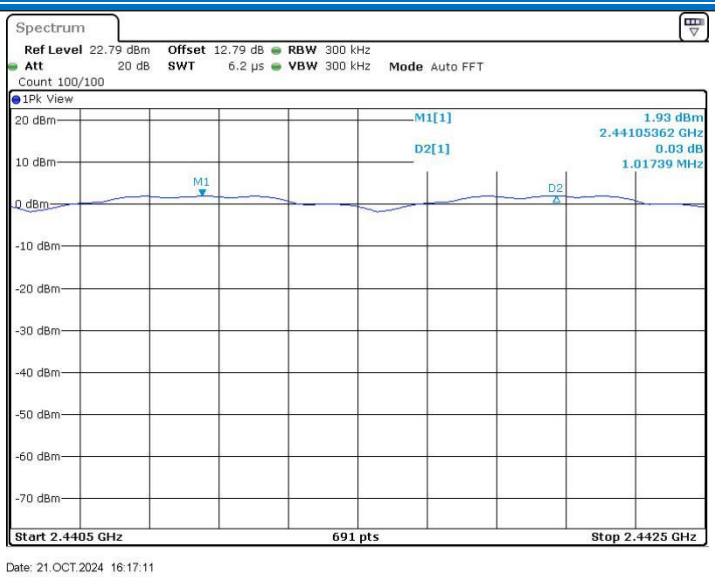
Date: 21.OCT.2024 15:32:37

2DH5_Ant1_Hop

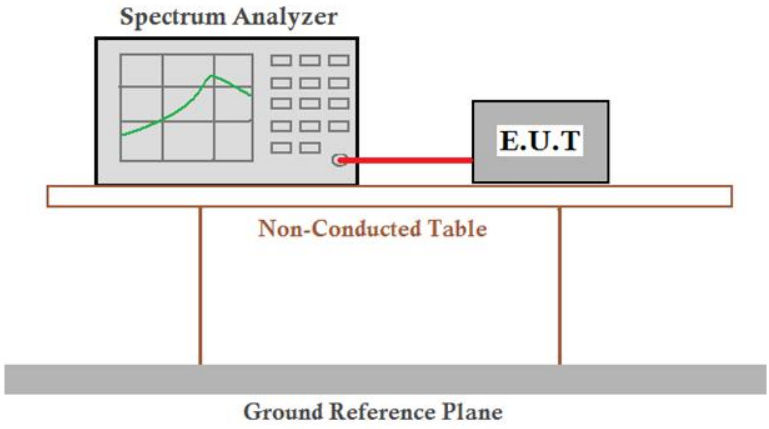


Date: 21.OCT.2024 16:06:08

3DH5_Ant1_Hop


Spectrum
Ref Level 22.79 dBm Offset 12.79 dB RBW 300 kHz
Att 20 dB SWT 6.2 µs VBW 300 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] 1.93 dBm
2.44105362 GHz
D2[1] 0.03 dB
1.01739 MHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
D2
Start 2.4405 GHz
691 pts
Stop 2.4425 GHz
Date: 21.OCT.2024 16:17:11

5.6 Hopping Channel Number

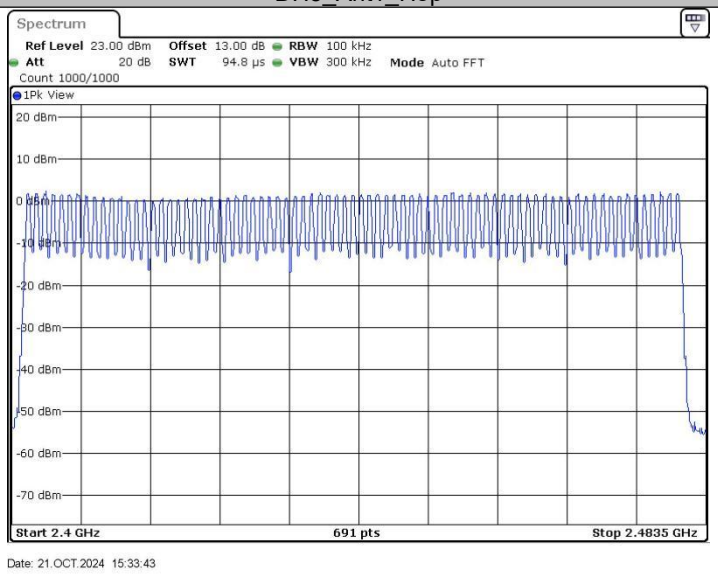
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 *Remark: Offset=Cable loss+ attenuation factor.*
Limit:	At least 15 channels
Exploratory Test Mode:	hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Only the worst case is recorded in the report.
Test Results:	Pass

Measurement Data

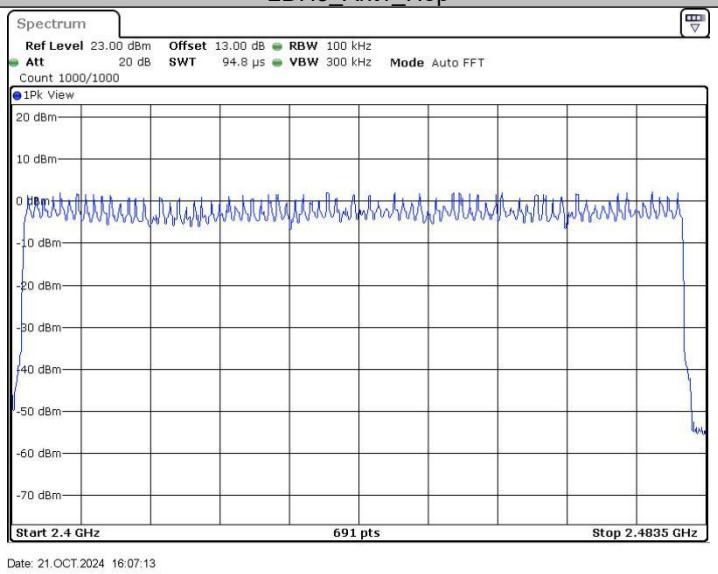
Mode	Hopping channel numbers	Limit
GFSK	79	≥15
π/4DQPSK	79	≥15
8DPSK	79	≥15

Test plot as follows:

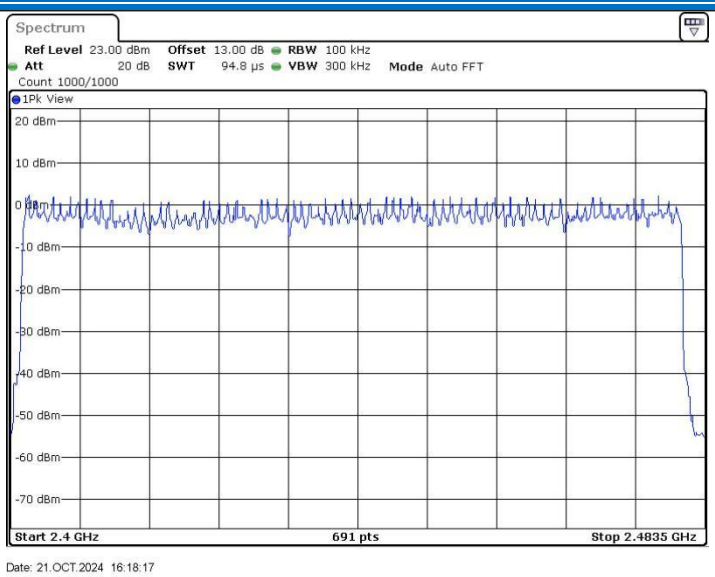
DH5_Ant1_Hop



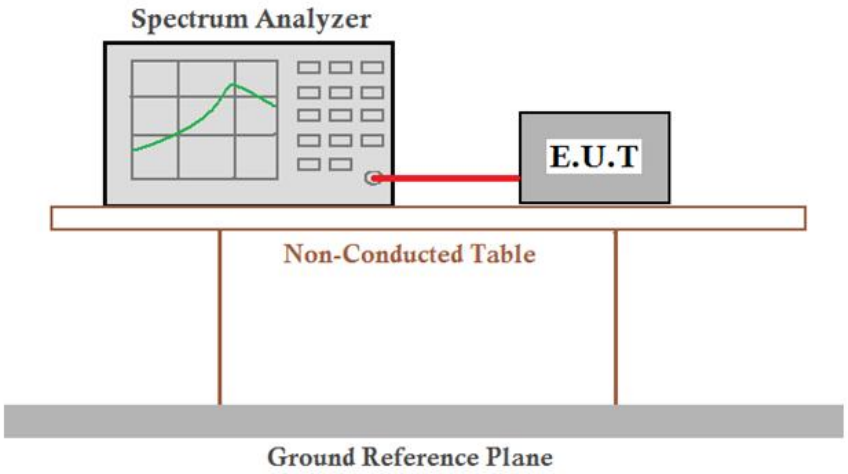
2DH5_Ant1_Hop



3DH5_Ant1_Hop


Spectrum
Ref Level 23.00 dBm Offset 13.00 dB RBW 100 kHz
Att 20 dB SWT 94.8 µs VBW 300 kHz Mode Auto FFT
Count 1000/1000
1Pk View
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.4 GHz
691 pts
Stop 2.4835 GHz
Date: 21.OCT.2024 16:18:17

5.7 Dwell Time

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 *Remark: Offset=Cable loss+ attenuation factor.*
Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Limit:	0.4 Second
Test Results:	Pass

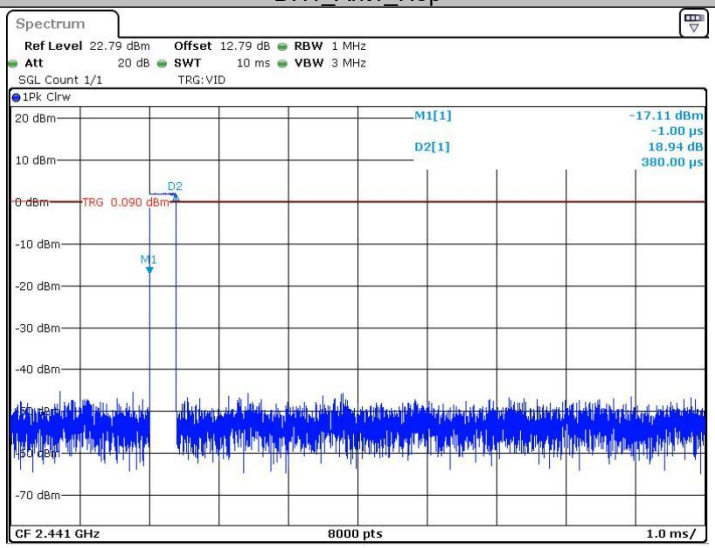
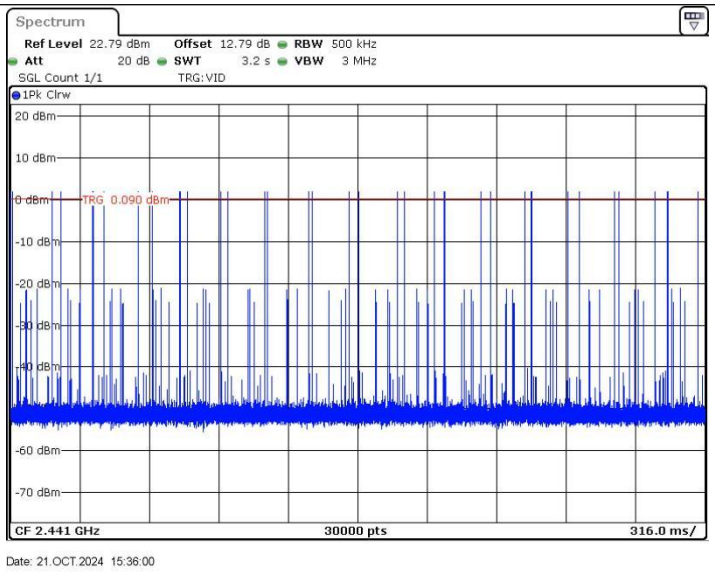
Measurement Data

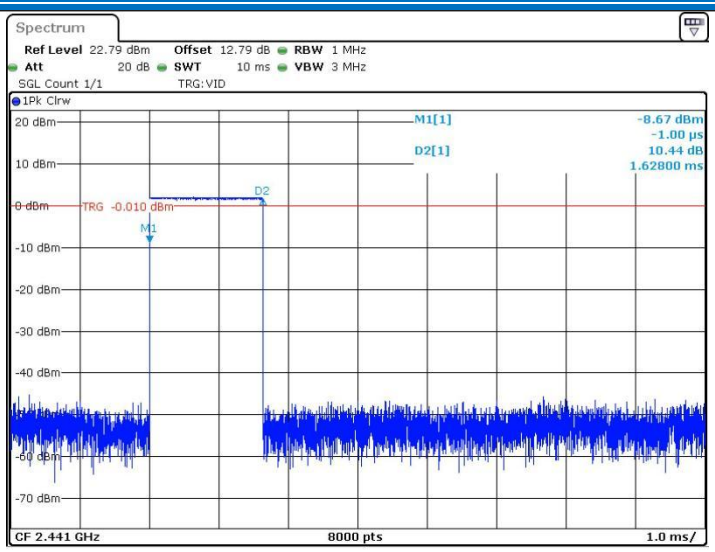
TestMode	Freq(MHz)	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Hop	0.380	330	0.125	≤0.4	PASS
DH3	Hop	1.628	190	0.309	≤0.4	PASS
DH5	Hop	2.868	90	0.258	≤0.4	PASS
2DH1	Hop	0.389	330	0.128	≤0.4	PASS
2DH3	Hop	1.631	160	0.261	≤0.4	PASS
2DH5	Hop	2.899	90	0.261	≤0.4	PASS
3DH1	Hop	0.388	330	0.128	≤0.4	PASS
3DH3	Hop	1.631	180	0.294	≤0.4	PASS
3DH5	Hop	2.875	110	0.316	≤0.4	PASS

Remark:

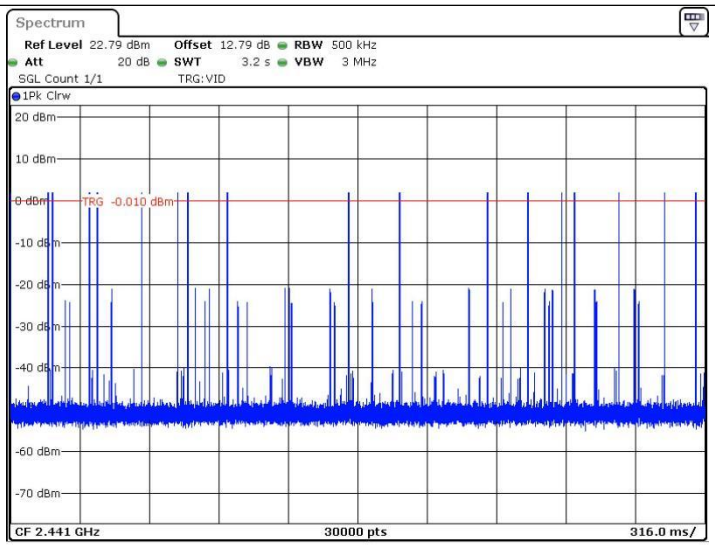
The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test plot as follows:

DH1_Ant1_Hop


DH3_Ant1_Hop

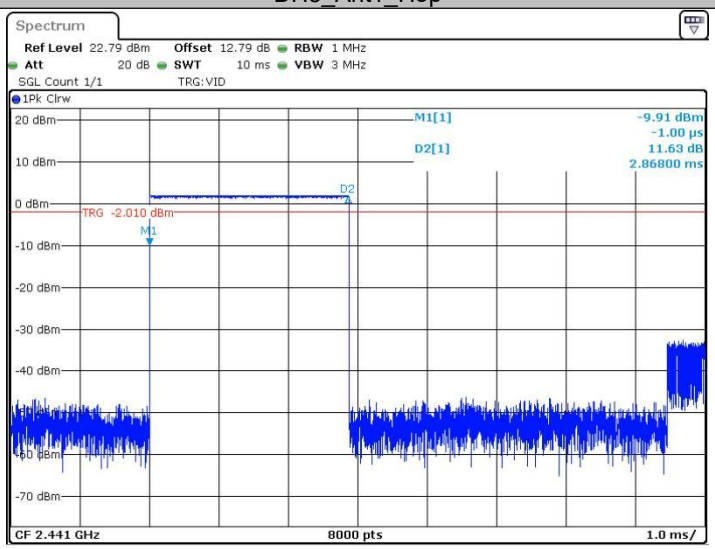


Date: 21.OCT.2024 15:38:41

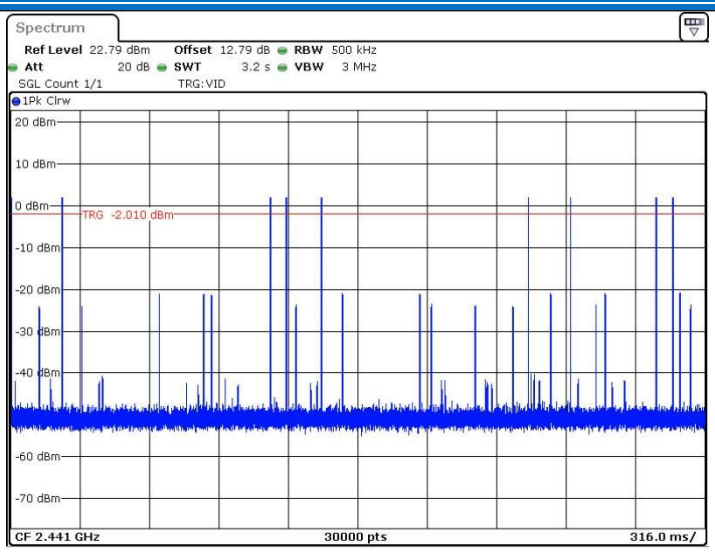


Date: 21.OCT.2024 15:38:47

DH5_Ant1_Hop

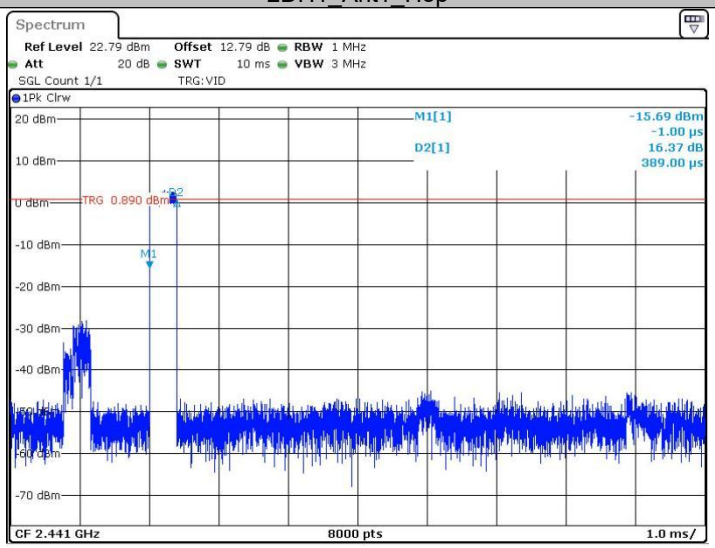


Date: 21.OCT.2024 15:34:00

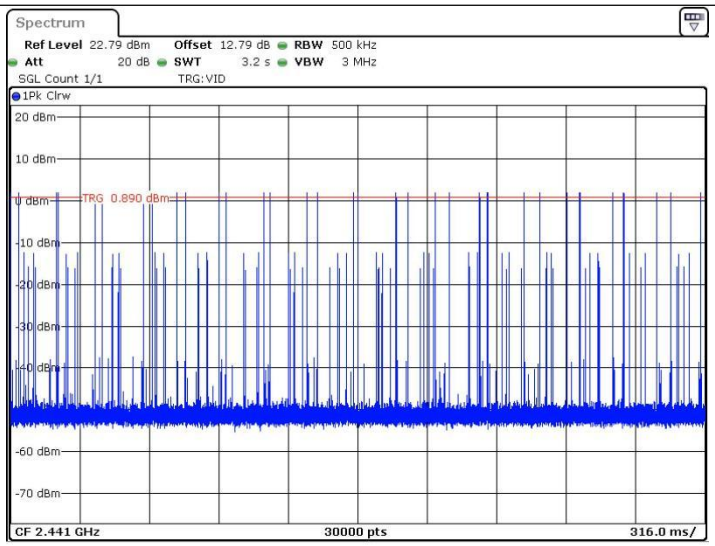


Date: 21.OCT.2024 15:34:05

2DH1_Ant1_Hop

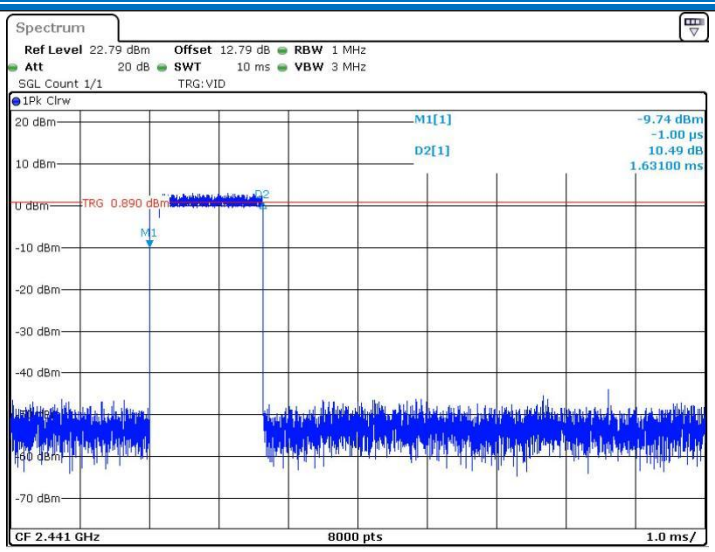


Date: 21.OCT.2024 16:11:08

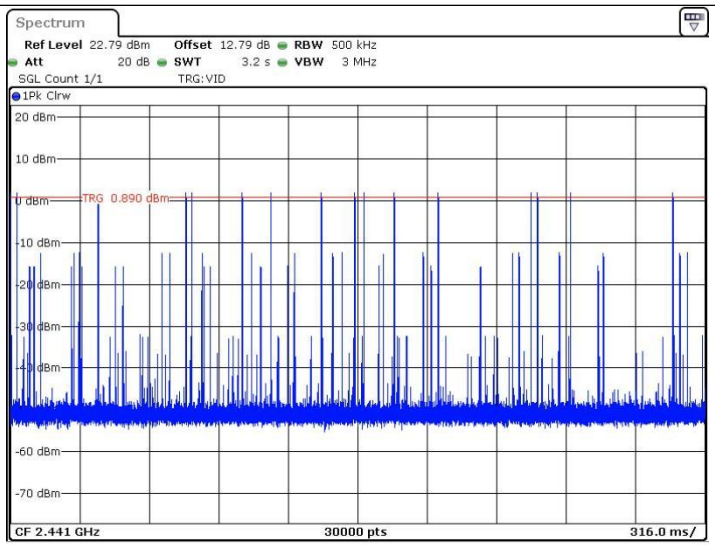


Date: 21.OCT.2024 16:11:14

2DH3_Ant1_Hop

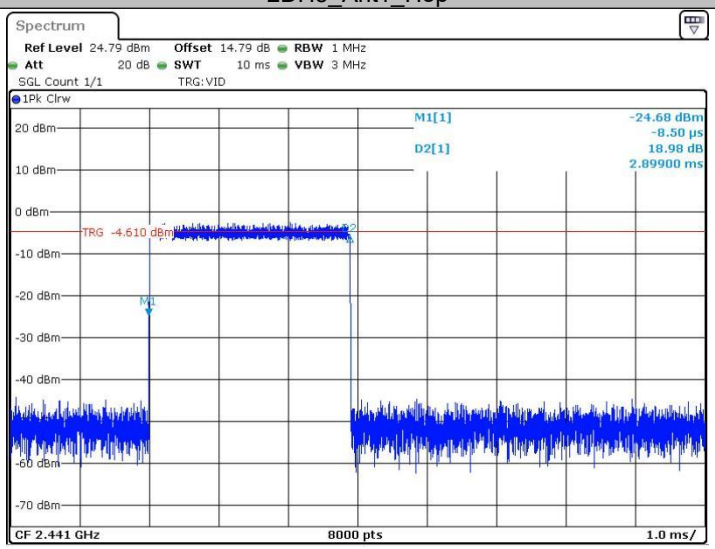


Date: 21.OCT.2024 16:11:39

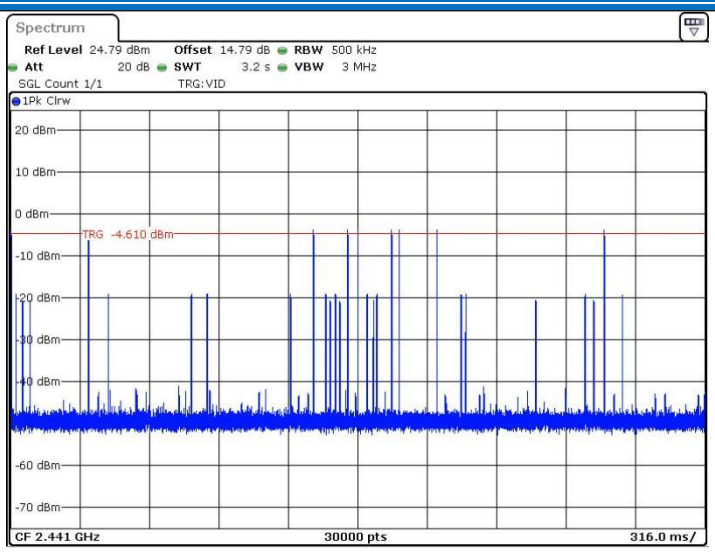


Date: 21.OCT.2024 16:11:45

2DH5_Ant1_Hop

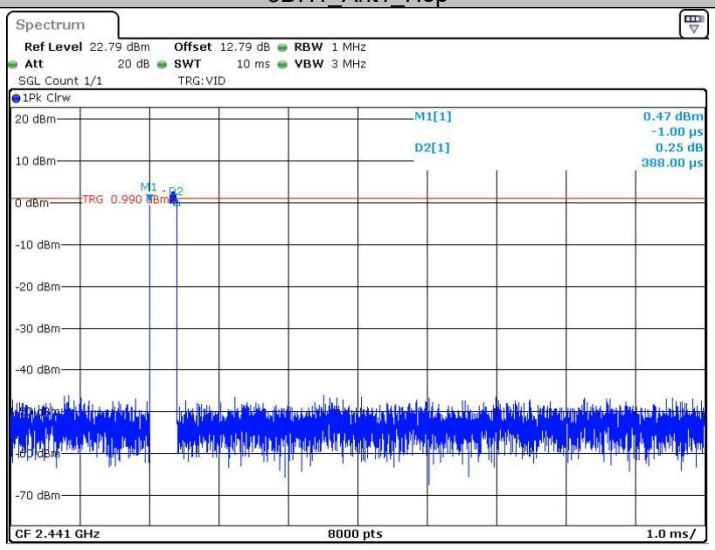


Date: 22.OCT.2024 15:26:10

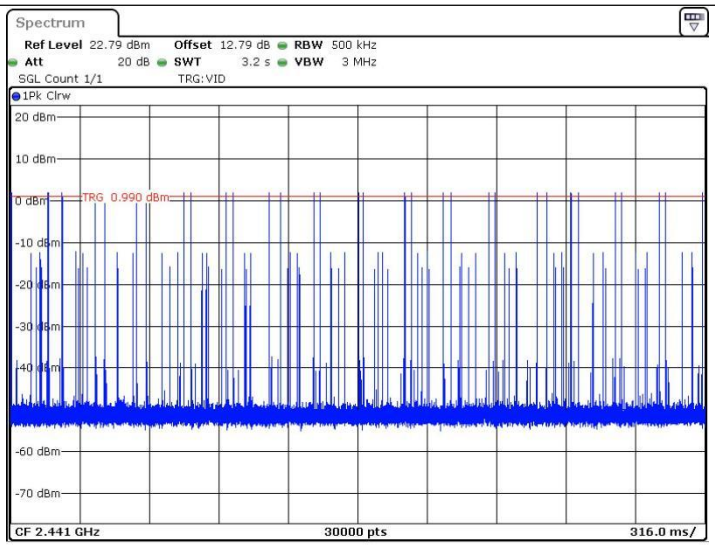


Date: 22.OCT.2024 15:26:16

3DH1_Ant1_Hop

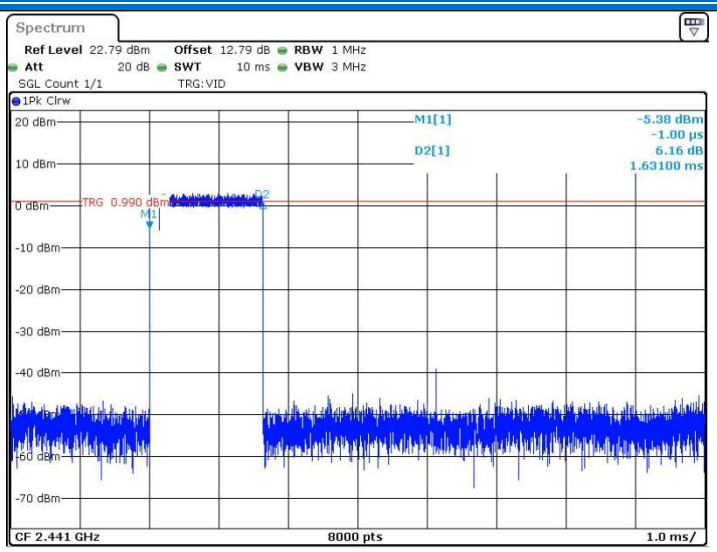


Date: 21.OCT.2024 16:22:10

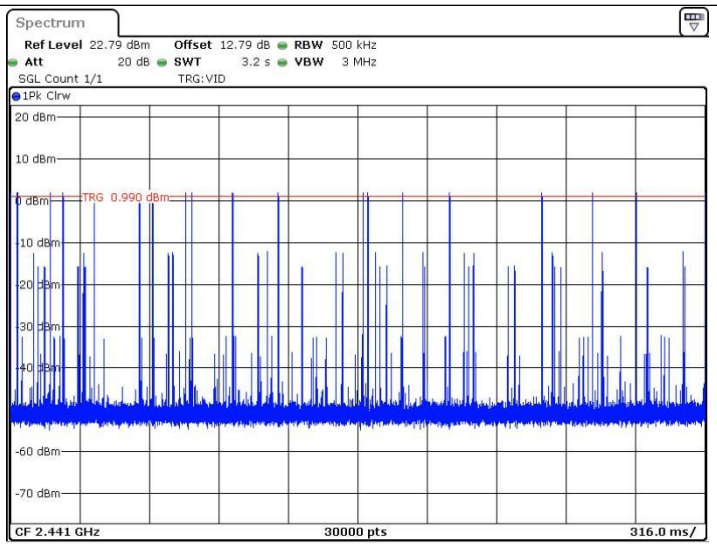


Date: 21.OCT.2024 16:22:16

3DH3_Ant1_Hop

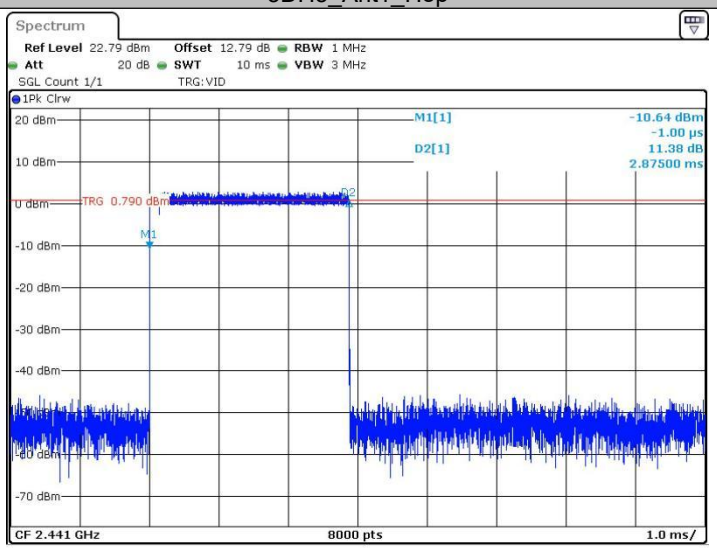


Date: 21.OCT.2024 16:23:50

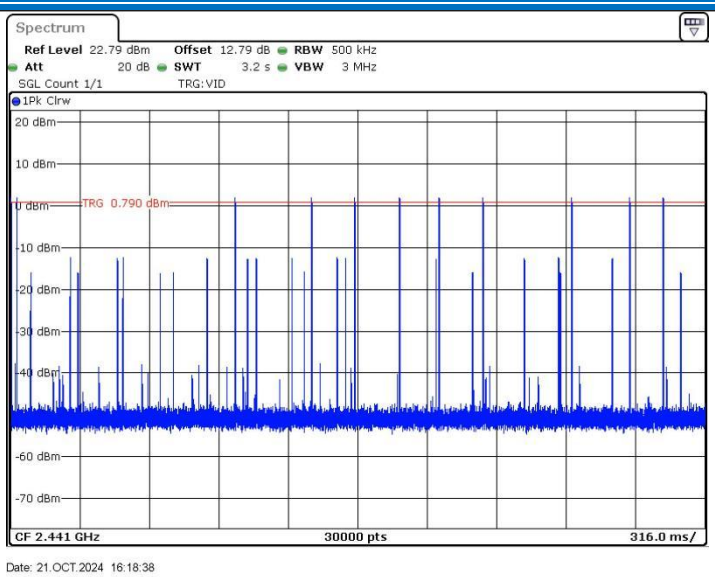


Date: 21.OCT.2024 16:23:56

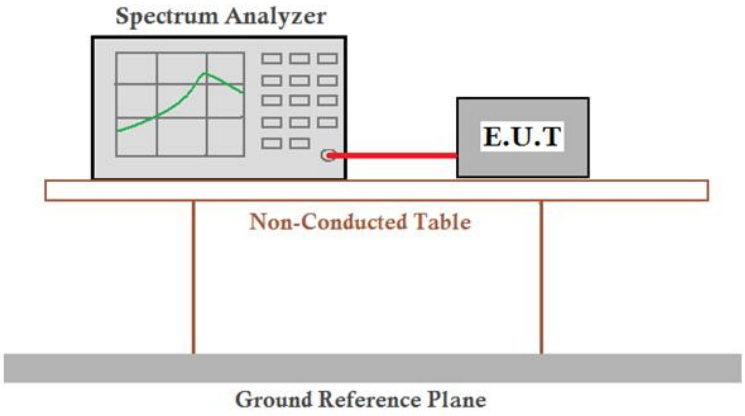
3DH5_Ant1_Hop



Date: 21.OCT.2024 16:18:33


Spectrum
Ref Level 22.79 dBm Offset 12.79 dB RBW 500 kHz
Att 20 dB SWT 3.2 s VBW 3 MHz
SGL Count 1/1 TRG:VID
1Pk Clrw
20 dBm
10 dBm
0 dBm
TRG 0.790 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-60 dBm
-70 dBm
CF 2.441 GHz
30000 pts
316.0 ms/
Date: 21.OCT.2024 16:18:38

5.8 Band-edge for RF Conducted Emissions

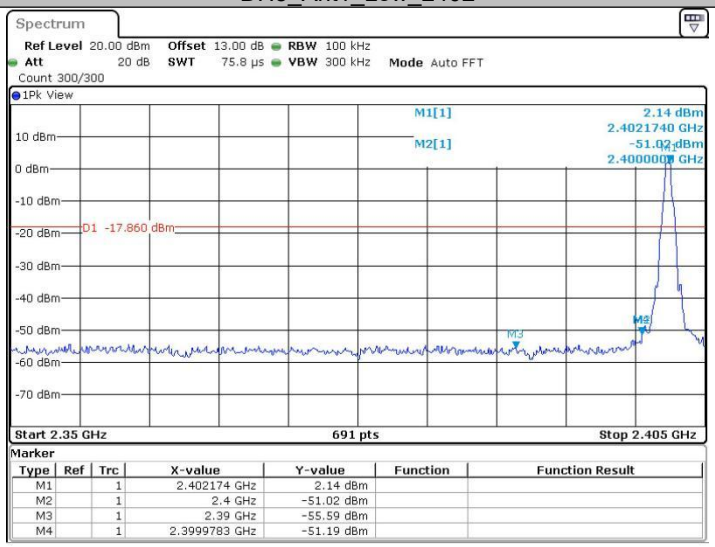
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Test Setup:	 *Remark: Offset=cable loss+ attenuation factor.*
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is 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.
Exploratory Test Mode:	Hopping and Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Only the worst case is recorded in the report.
Test Results:	Pass

Measurement Data

TestMode	ChName	Freq(MHz)	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Low	2402	2.14	-51.19	≤-17.86	PASS
	High	2480	2.21	-52.6	≤-17.79	PASS
	Low	Hop_2402	2.18	-52.67	≤-17.82	PASS
	High	Hop_2480	1.29	-51.04	≤-18.71	PASS
2DH5	Low	2402	2.39	-52.44	≤-17.61	PASS
	High	2480	2.22	-53.24	≤-17.78	PASS
	Low	Hop_2402	2.50	-52.16	≤-17.5	PASS
	High	Hop_2480	1.89	-52.26	≤-18.11	PASS
3DH5	Low	2402	2.44	-48.44	≤-17.56	PASS
	High	2480	2.29	-52.12	≤-17.71	PASS
	Low	Hop_2402	-0.02	-52.98	≤-20.02	PASS
	High	Hop_2480	2.20	-52.26	≤-17.8	PASS

Test plot as follows:

DH5_Ant1_Low_2402



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402174 GHz	2.14 dBm		
M2		1	2.4 GHz	-51.02 dBm		
M3		1	2.39 GHz	-55.59 dBm		
M4		1	2.3999783 GHz	-51.19 dBm		

Date: 21.OCT.2024 15:04:06

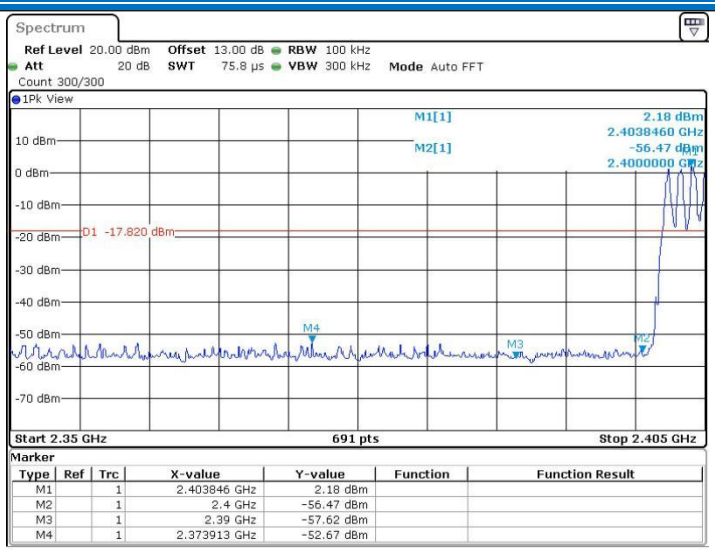
DH5_Ant1_High_2480

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48025 GHz	2.21 dBm		
M2		1	2.4835 GHz	-55.79 dBm		
M3		1	2.5 GHz	-57.09 dBm		
M4		1	2.512667 GHz	-52.60 dBm		

Date: 21.OCT.2024 15:09:44

DH5_Ant1_Low_Hop_2402



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403846 GHz	2.18 dBm		
M2		1	2.4 GHz	-56.47 dBm		
M3		1	2.39 GHz	-57.62 dBm		
M4		1	2.373913 GHz	-52.67 dBm		

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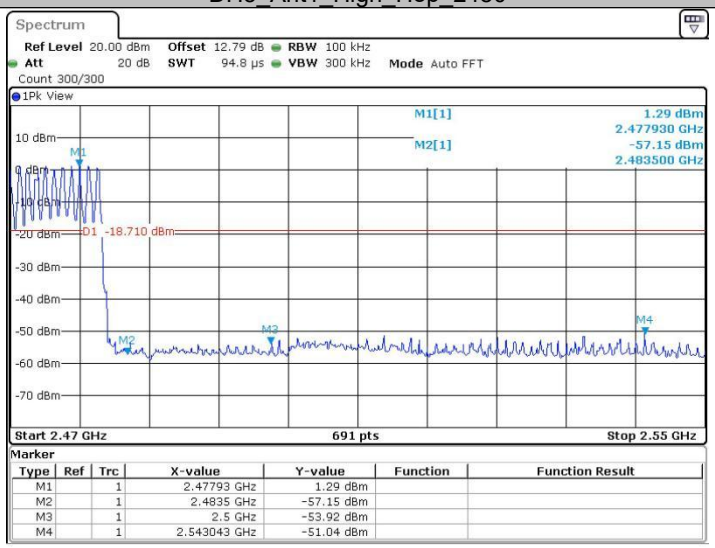
DH5_Ant1_High_Hop_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47793 GHz	1.29 dBm		
M2		1	2.4835 GHz	-57.15 dBm		
M3		1	2.5 GHz	-53.92 dBm		
M4		1	2.543043 GHz	-51.04 dBm		

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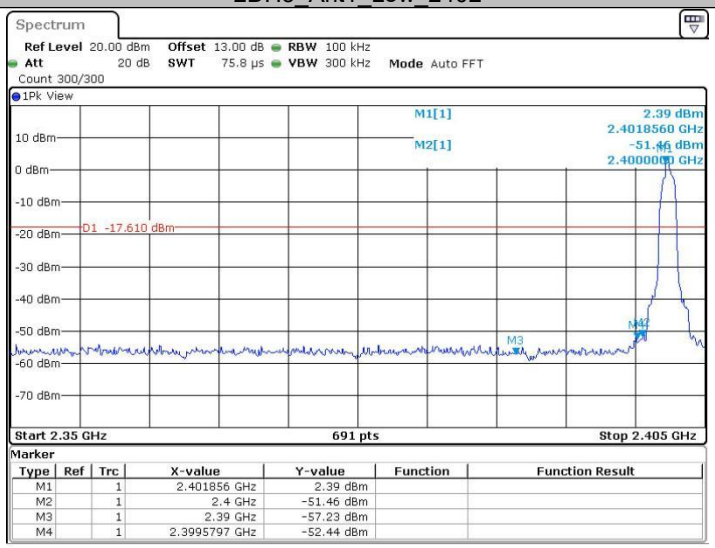
2DH5_Ant1_Low_2402



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401856 GHz	2.39 dBm		
M2		1	2.4 GHz	-51.46 dBm		
M3		1	2.39 GHz	-57.23 dBm		
M4		1	2.3995797 GHz	-52.44 dBm		

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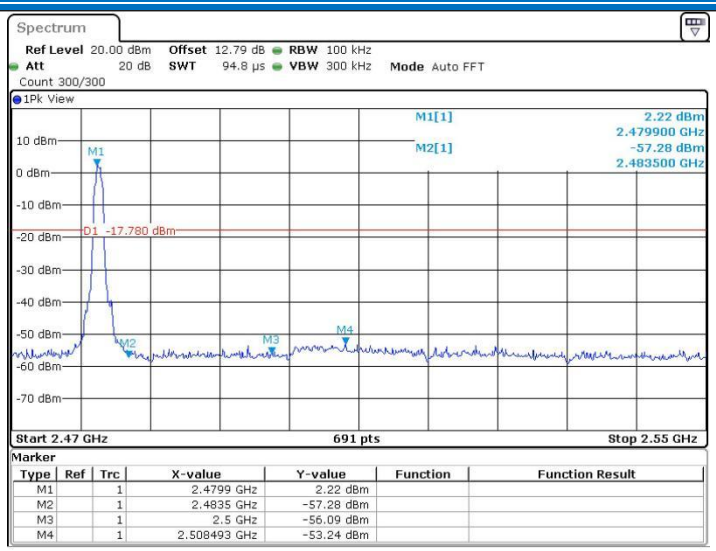
2DH5_Ant1_High_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799 GHz	2.22 dBm		
M2		1	2.4835 GHz	-57.28 dBm		
M3		1	2.5 GHz	-56.09 dBm		
M4		1	2.508493 GHz	-53.24 dBm		

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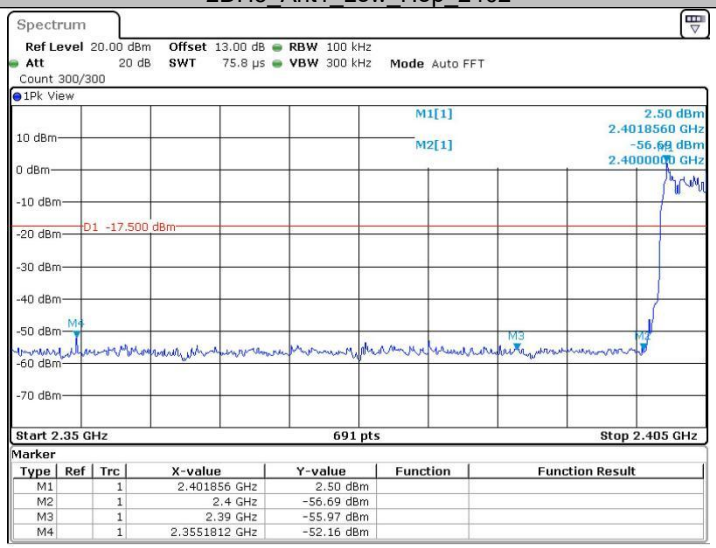
2DH5_Ant1_Low_Hop_2402



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401856 GHz	2.50 dBm		
M2		1	2.4 GHz	-56.69 dBm		
M3		1	2.39 GHz	-55.97 dBm		
M4		1	2.3551812 GHz	-52.16 dBm		

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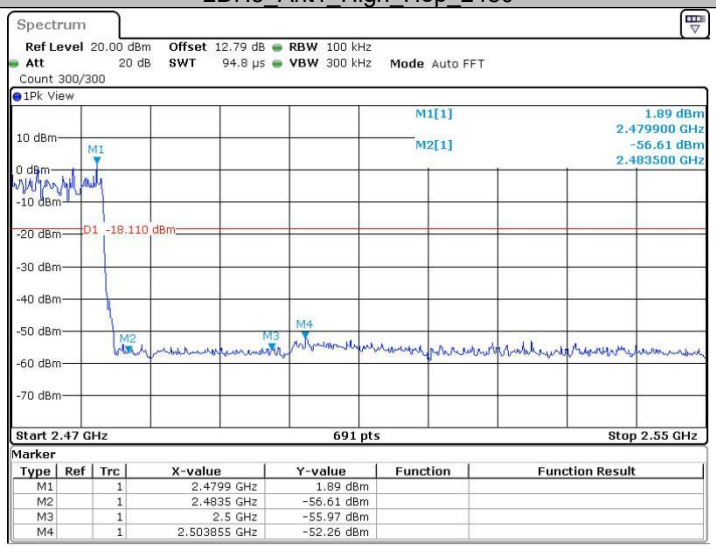
2DH5_Ant1_High_Hop_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799 GHz	1.89 dBm		
M2		1	2.4835 GHz	-56.61 dBm		
M3		1	2.5 GHz	-55.97 dBm		
M4		1	2.503855 GHz	-52.26 dBm		

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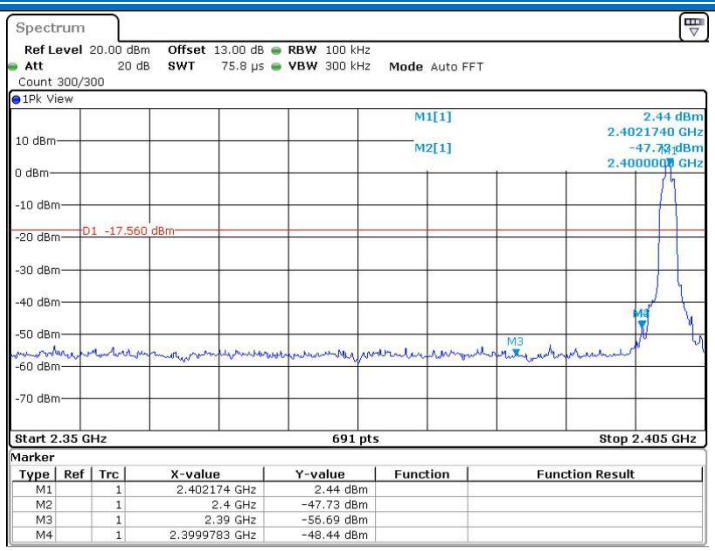
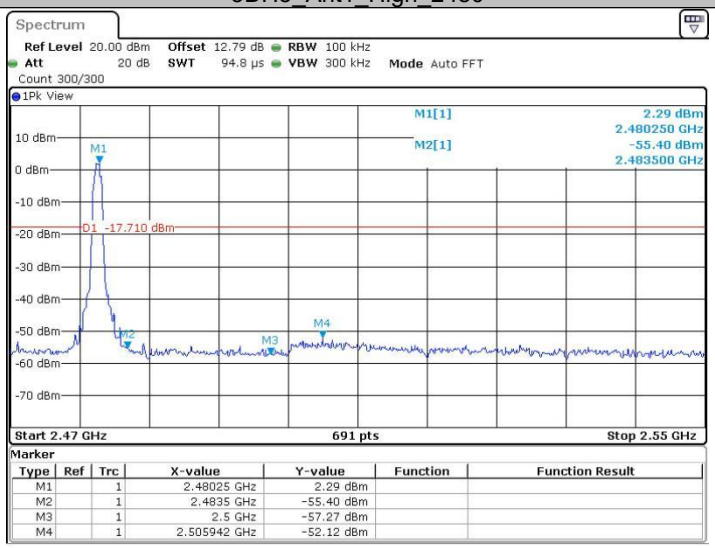
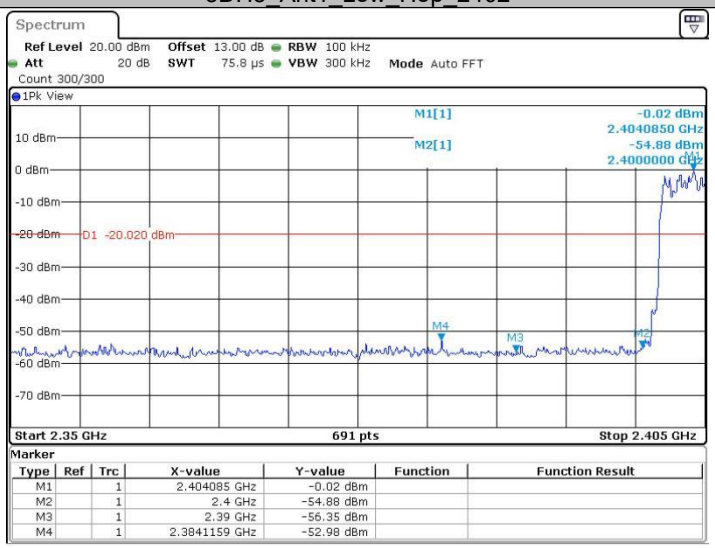
3DH5_Ant1_Low_2402



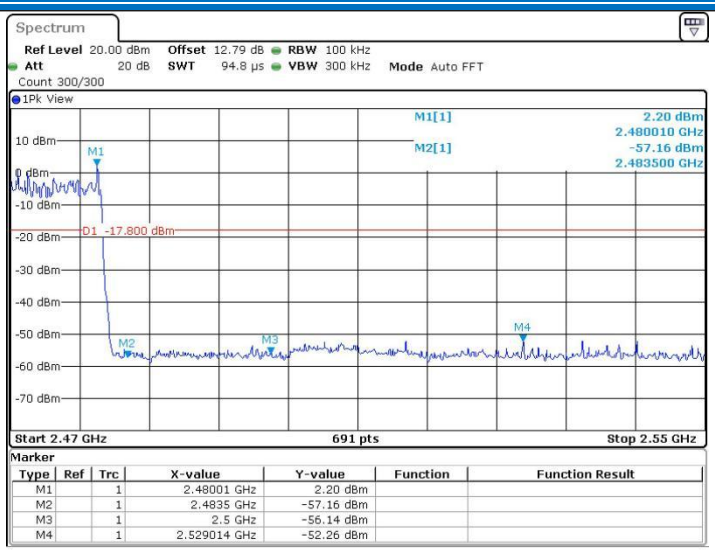
3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



3DH5_Ant1_High_Hop_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48001 GHz	2.20 dBm		
M2		1	2.4835 GHz	-57.16 dBm		
M3		1	2.5 GHz	-56.14 dBm		
M4		1	2.529014 GHz	-52.26 dBm		

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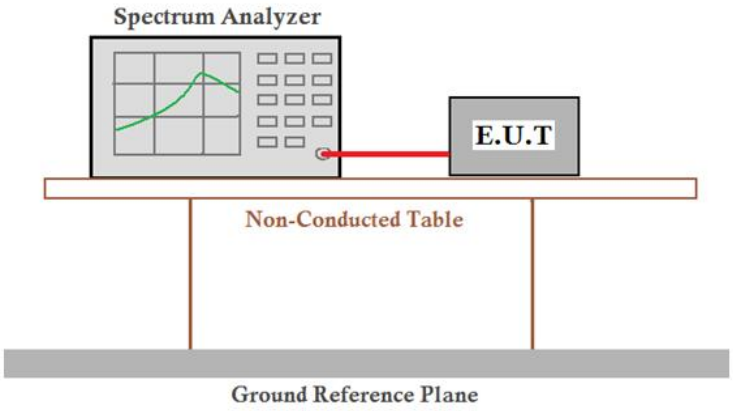
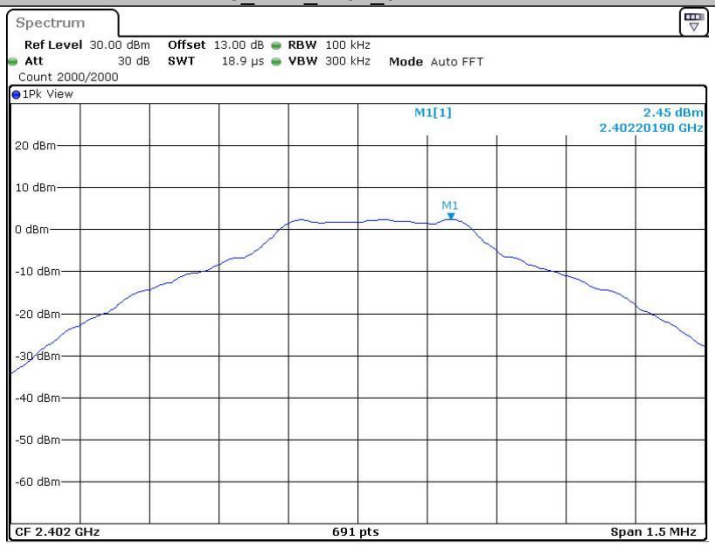
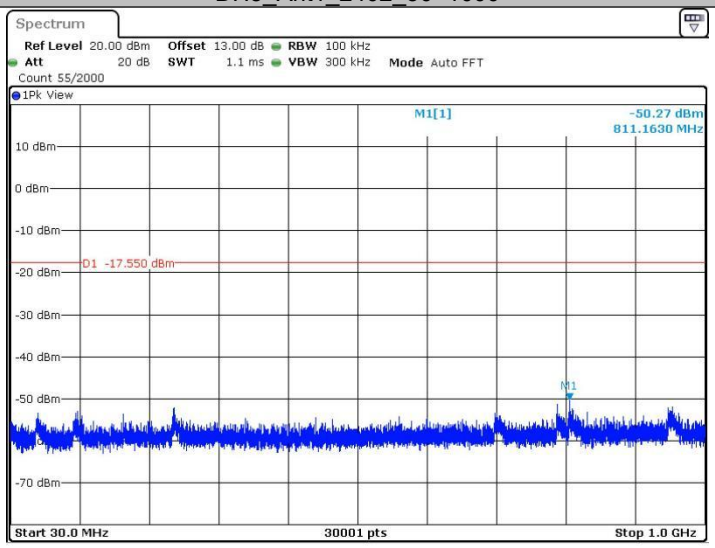
5.9 Spurious RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Test Setup:	 *Remark: Offset=cable loss+ attenuation factor.*
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of π/4DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Test Results:	Pass

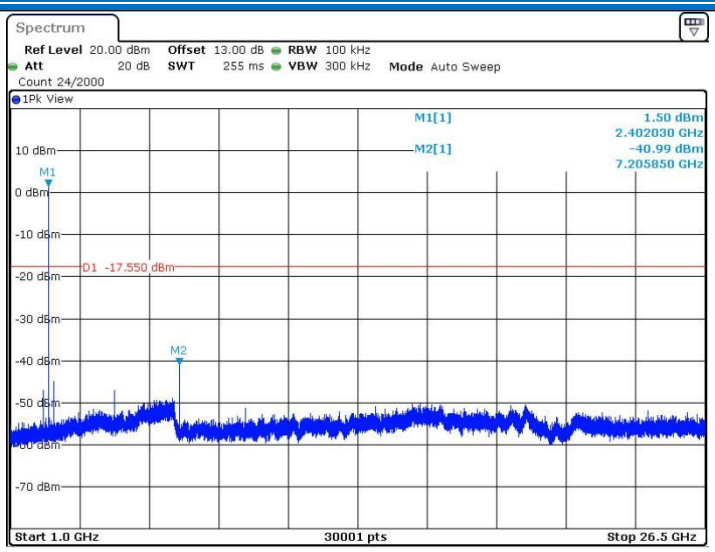
DH5_Ant1_2402_0~Reference



DH5_Ant1_2402_30~1000



DH5_Ant1_2402_1000~26500



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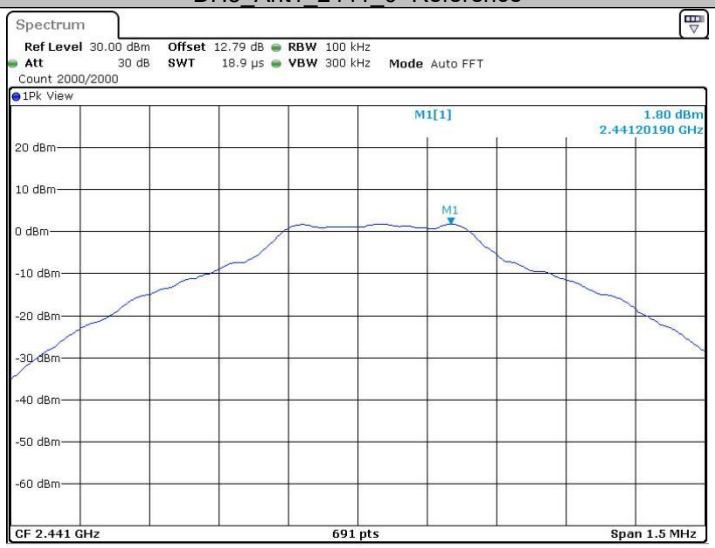
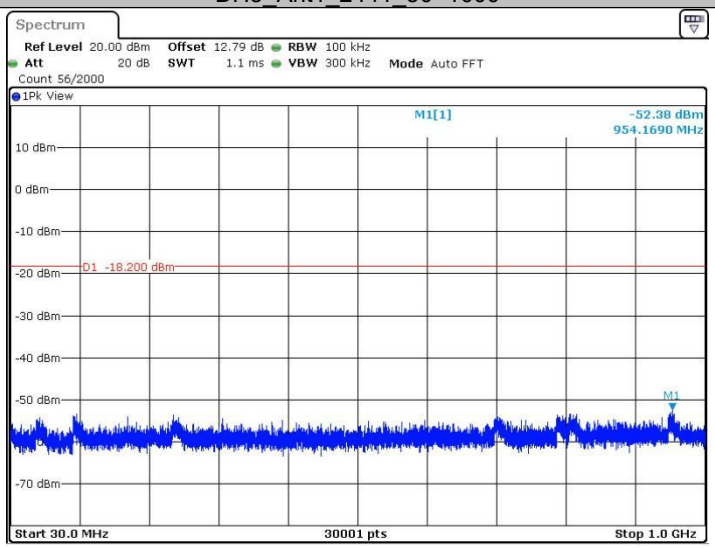
DH5_Ant1_2441_0~Reference



Date: 21.OCT.2024 15:07:46

DH5_Ant1_2441_30~1000



Date: 21.OCT.2024 15:07:52

DH5_Ant1_2441_1000~26500