Shenzhen Huaxia Testing Technology Co., Ltd.

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

Telephone: +86-755-26648640
Fax: +86-755-26648637
Website: www.cqa-cert.com

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

Test Report

Report No. :	CQASZ20250200396E-02
Applicant:	Shenzhen Thinkmak Technology Co., Ltd.
Address of Applicant:	Rm 8630, 6th Floor,No. 3012 Banxuegang Avenue,Longgang District,Shenzhen ,China

Equipment Under Test (EUT):

Product:	Speaker
Model No.:	WS-598, WS-1955, WS-1967, WS-300SL, WS-596, WS-1968, WS-X65, WS-1969,WS-1965, WS-691, WS-1966, WS-1957，AN-A7
Test Model No.:	WS-598
Brand Name:	WSTER
FCC ID:	2BN2D2537
Standards:	47 CFR Part 15, Subpart C KDB558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013
Date of Receipt:	2025-2-28
Date of Test:	2025-2-28 to 2025-3-17
Date of Issue:	2025-3-27
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:

(Jack Ai)

SHENZHEN HUAXIA TESTING TECHNOLOGY CO., LTD. 华夏准测 APPROVED

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20250200396E-02	Rev.01	Initial report	2025-3-27

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

Page

1 VERSION 2

2 TEST SUMMARY 3

3 CONTENTS 4

4 GENERAL INFORMATION 5

4.1 CLIENT INFORMATION 5
4.2 GENERAL DESCRIPTION OF EUT 5
4.3 ADDITIONAL INSTRUCTIONS 7
4.4 TEST ENVIRONMENT 8
4.5 DESCRIPTION OF SUPPORT UNITS 8
4.6 STATEMENT OF THE MEASUREMENT UNCERTAINTY 9
4.7 TEST LOCATION 10
4.8 TEST FACILITY 10
4.9 ABNORMALITIES FROM STANDARD CONDITIONS 10
4.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER 10
4.11 EQUIPMENT LIST 11

5 TEST RESULTS AND MEASUREMENT DATA 12

5.1 ANTENNA REQUIREMENT 12
5.2 CONDUCTED EMISSIONS 13
5.3 CONDUCTED PEAK OUTPUT POWER 17
5.4 20DB OCCUPIED BANDWIDTH 22
5.5 CARRIER FREQUENCIES SEPARATION 26
5.6 HOPPING CHANNEL NUMBER 29
5.7 DWELL TIME 31
5.8 BAND-EDGE FOR RF CONDUCTED EMISSIONS 38
5.9 SPURIOUS RF CONDUCTED EMISSIONS 46
5.10 OTHER REQUIREMENTS FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM 54
5.11 RADIATED SPURIOUS EMISSION & RESTRICTED BANDS 56
5.11.1 Radiated Emission below 1GHz *59*
5.11.2 Transmitter Emission above 1GHz *61*

6 PHOTOGRAPHS - EUT TEST SETUP 63

6.1 RADIATED EMISSION 63
6.2 CONDUCTED EMISSION 64

7 PHOTOGRAPHS - EUT CONSTRUCTIONAL DETAILS 65

4 General Information

4.1 Client Information

Applicant:	Shenzhen Thinkmak Technology Co., Ltd.
Address of Applicant:	Rm 8630, 6th Floor,No. 3012 Banxuegang Avenue,Longgang District,Shenzhen ,China
Manufacturer:	Dongguan Aierpu Electronics Science&technology Co.,LTD
Address of Manufacturer:	Building 3, 20th Xiegang Xinxing Rd, Xiegang Town,Dongguan City,Guangdong Province,China
Factory:	Dongguan Aierpu Electronics Science&technology Co.,LTD
Address of Factory:	Building 3, 20th Xiegang Xinxing Rd, Xiegang Town,Dongguan City,Guangdong Province,China

4.2 General Description of EUT

Product Name:	Speaker
Model No.:	WS-598, WS-1955, WS-1967, WS-300SL, WS-596, WS-1968, WS-X65, WS-1969,WS-1965, WS-691, WS-1966, WS-1957，AN-A7
Test Model No.:	WS-598
Trade Mark:	WSTER
Software Version:	sdk_ab560x_s865_20220513
Hardware Version:	WS-598-AB5605B-T2.0
Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	V5.0
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK
Transfer Rate:	1Mbps/2Mbps
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Product Type:	☐ Mobile ☒ Portable ☐ Fix Location
Test Software of EUT:	BlueTest3
Antenna Type:	PCB antenna
Antenna Gain:	2.21dBi
Power Supply:	lithium battery : 3.7V 1500mAh, Charge by DC 5V for adapter
Simultaneous Transmission	☐ Simultaneous TX is supported and evaluated in this report. ☒ Simultaneous TX is not supported.

Note:

Model No.: WS-598, WS-1955, WS-1967, WS-300SL, WS-596, WS-1968, WS-X65, WS-1969,WS-1965, WS-691, WS-1966, WS-1957, AN-A7

Only the model WS-598 was tested, Their electrical circuit design, layout, components used and internal wiring are identical. Only the model name and color is different.

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

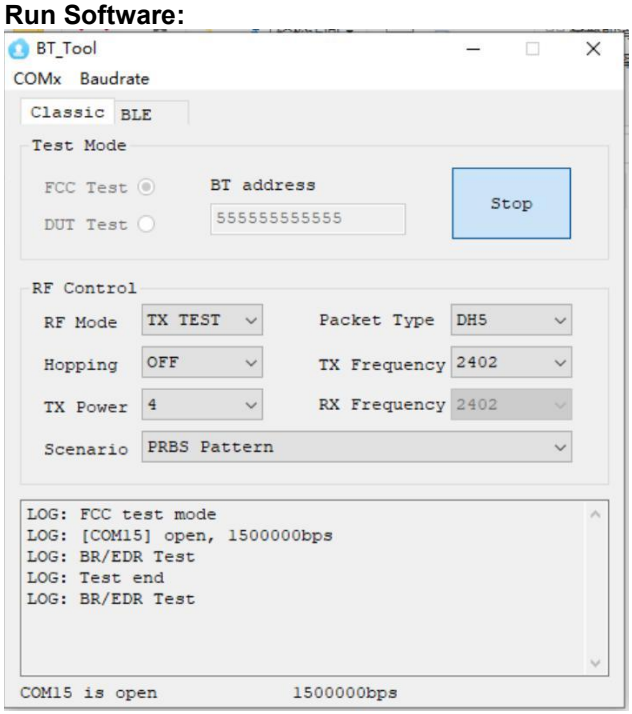
4.3 Additional Instructions

EUT Test Software Settings:	
Mode:	☒ Special software is used. ☐ Through engineering command into the engineering mode. engineering command: *#*#3646633#*#*
EUT Power level:	(Power level is built-in set parameters and cannot be changed and selected)

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

Test software:

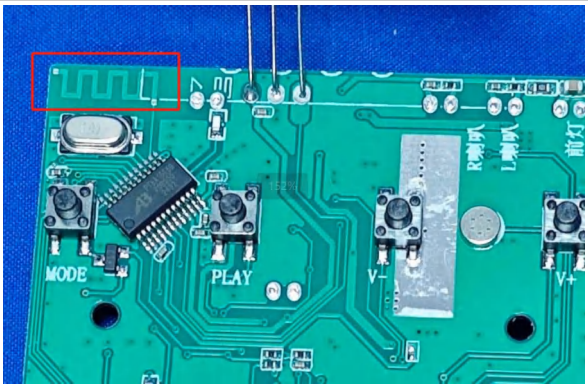
	Manufacturer	Software brand	Software version
Radiated Emissions test software	Tonscend	JS1120-3	Version:8
Conducted Emissions test software	Audix	e3	Version:9
RF Conducted test software	Audix	e3	V3.5.39

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:	

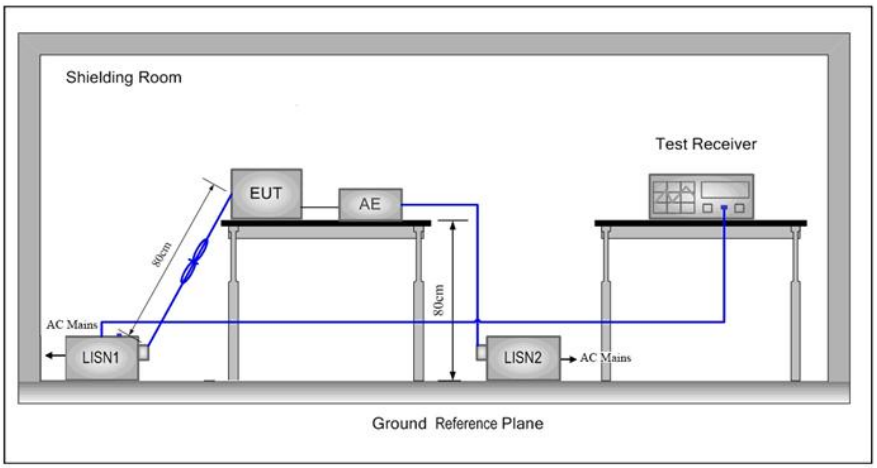
Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* 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.

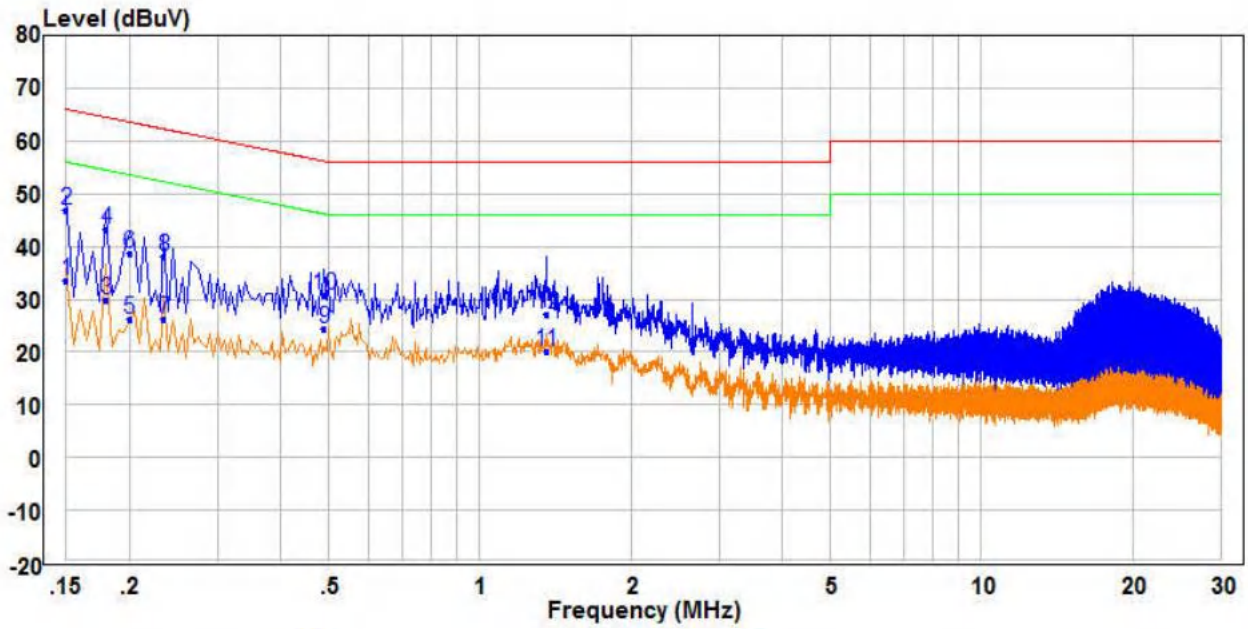
Test Setup:



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:

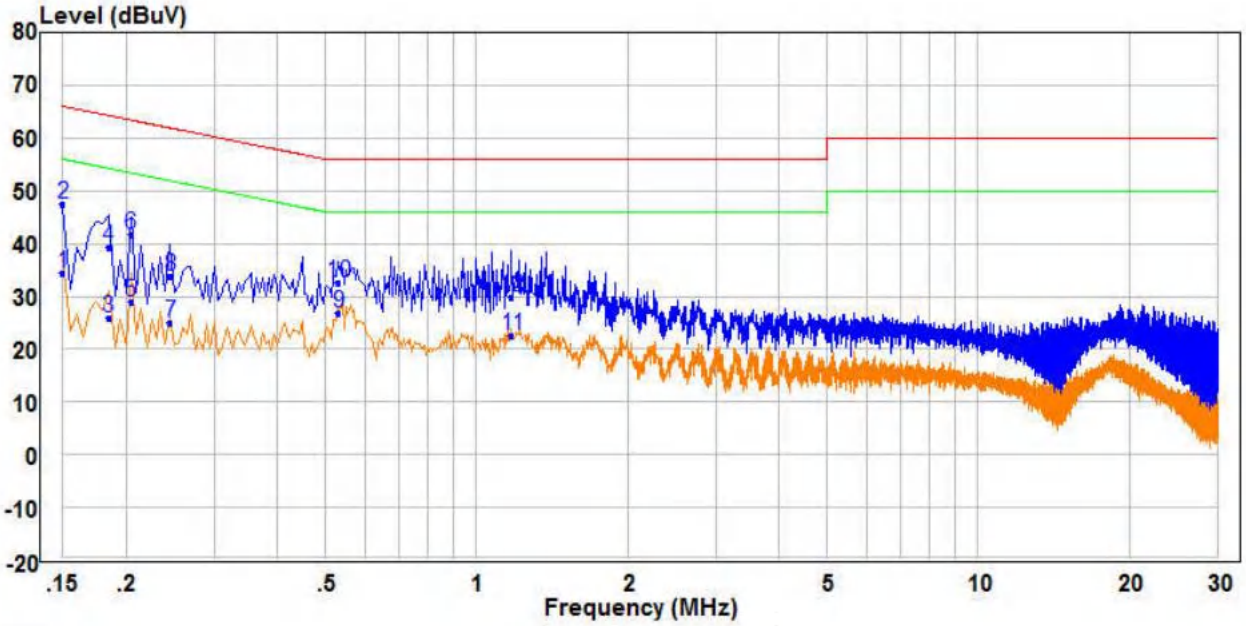


		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.150	23.70	9.70	33.40	56.00	-22.60	Average	Line
2	PP	0.150	37.25	9.70	46.95	66.00	-19.05	QP	Line
3		0.180	20.26	9.64	29.90	54.49	-24.59	Average	Line
4		0.180	33.45	9.64	43.09	64.49	-21.40	QP	Line
5		0.200	16.47	9.61	26.08	53.61	-27.53	Average	Line
6		0.200	29.19	9.61	38.80	63.61	-24.81	QP	Line
7		0.235	16.59	9.56	26.15	52.27	-26.12	Average	Line
8		0.235	28.56	9.56	38.12	62.27	-24.15	QP	Line
9	AV	0.490	14.56	9.69	24.25	46.17	-21.92	Average	Line
10		0.490	20.96	9.69	30.65	56.17	-25.52	QP	Line
11		1.355	9.44	10.55	19.99	46.00	-26.01	Average	Line
12		1.355	16.46	10.55	27.01	56.00	-28.99	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:

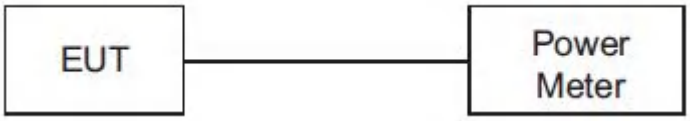
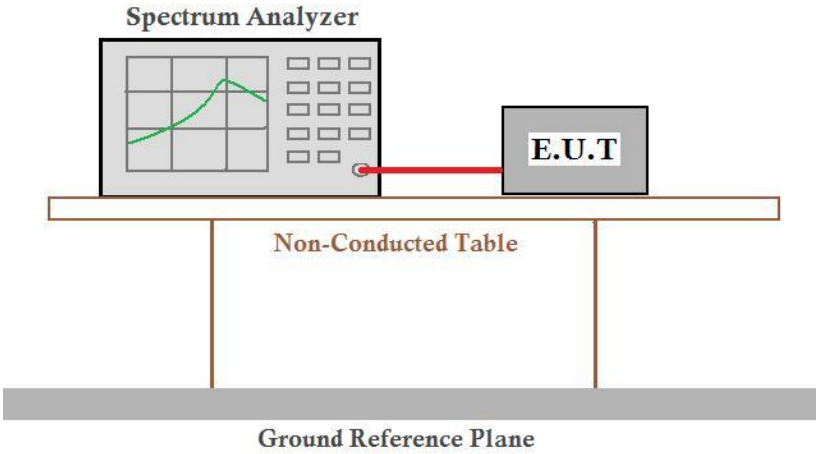


		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.150	24.65	9.70	34.35	56.00	-21.65	Average	Neutral
2	PP	0.150	37.68	9.70	47.38	66.00	-18.62	QP	Neutral
3		0.185	16.41	9.63	26.04	54.26	-28.22	Average	Neutral
4		0.185	29.78	9.63	39.41	64.26	-24.85	QP	Neutral
5		0.205	19.31	9.60	28.91	53.41	-24.50	Average	Neutral
6		0.205	32.21	9.60	41.81	63.41	-21.60	QP	Neutral
7		0.245	15.49	9.54	25.03	51.92	-26.89	Average	Neutral
8		0.245	24.31	9.54	33.85	61.92	-28.07	QP	Neutral
9	AV	0.530	17.11	9.73	26.84	46.00	-19.16	Average	Neutral
10		0.530	22.88	9.73	32.61	56.00	-23.39	QP	Neutral
11		1.175	12.86	9.71	22.57	46.00	-23.43	Average	Neutral
12		1.175	20.17	9.71	29.88	56.00	-26.12	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

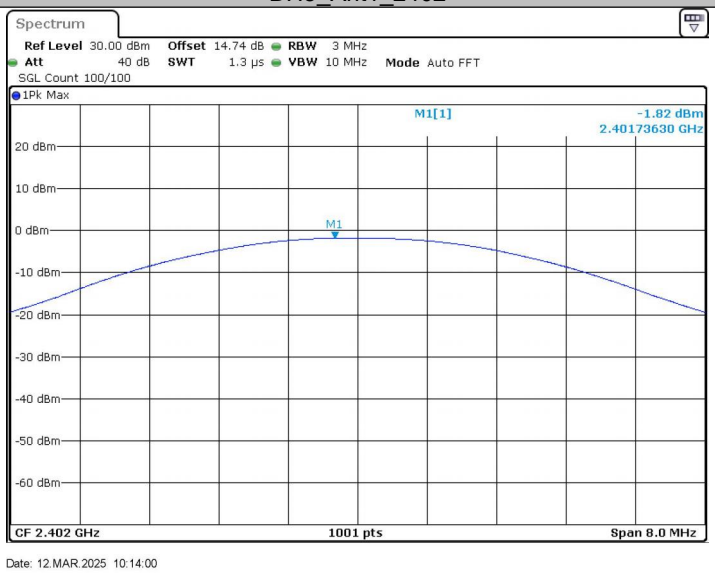
Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	***Setup for Power meter measurement method***  ***Setup for Spectrum analyser measurement method***  *Remark: Offset=Cable loss+ attenuation factor.*
Limit:	21dBm
Exploratory Test Mode:	Non-hopping transmitting 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

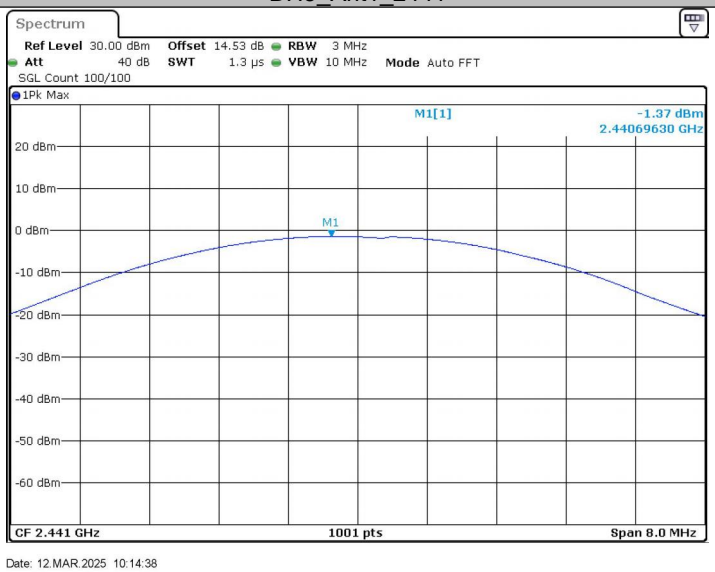
Test Mode	Antenna	Freq (MHz)	Conducted Peak Powert [dBm]	Conducted Limit [dBm]	Gain	EIRP [dBm]	EIRP Limit [dBm]	Verdict
DH5	Ant1	2402	-1.82	≤30	2.21	0.39	≤36	PASS
		2441	-1.37	≤30	2.21	0.84	≤36	PASS
		2480	-0.43	≤30	2.21	1.78	≤36	PASS
2DH5	Ant1	2402	-1.40	≤30	2.21	0.81	≤36	PASS
		2441	-1.73	≤30	2.21	0.48	≤36	PASS
		2480	-0.41	≤30	2.21	1.80	≤36	PASS

Test plot as follows:

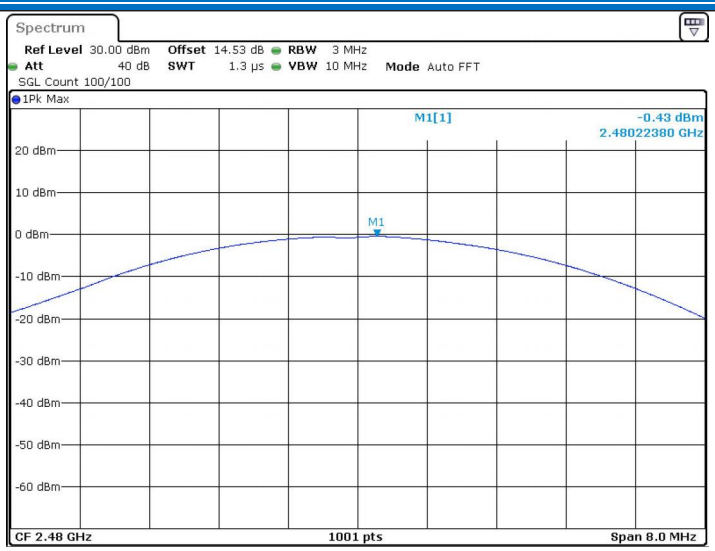
DH5_Ant1_2402



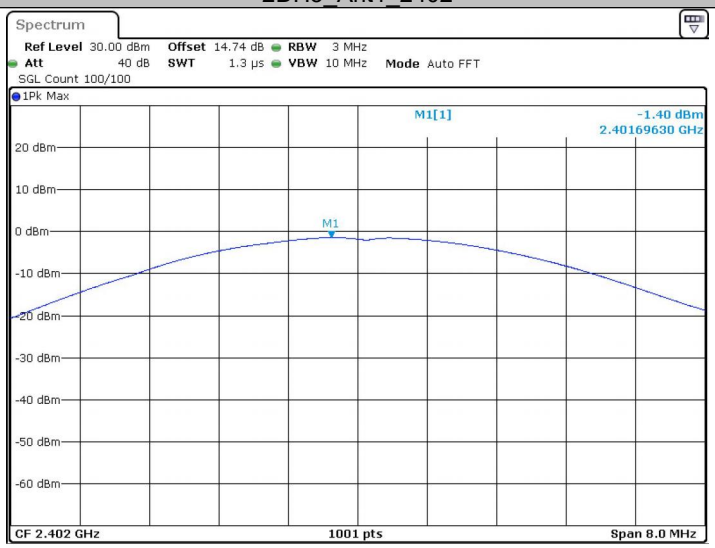
DH5_Ant1_2441



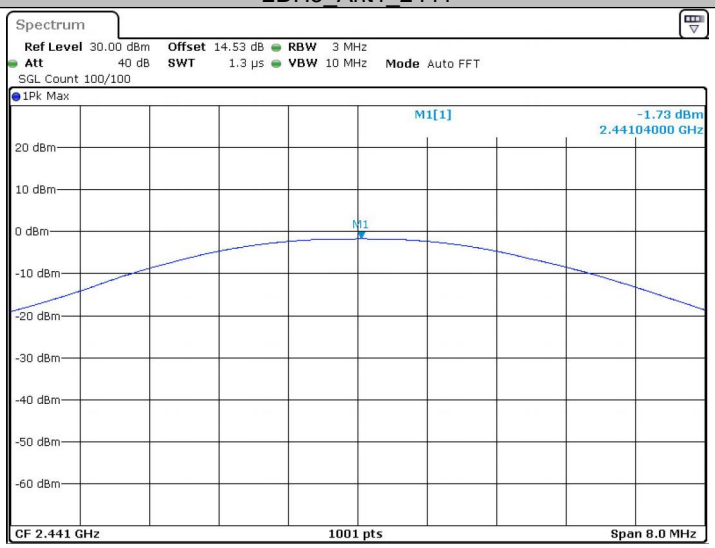
DH5_Ant1_2480



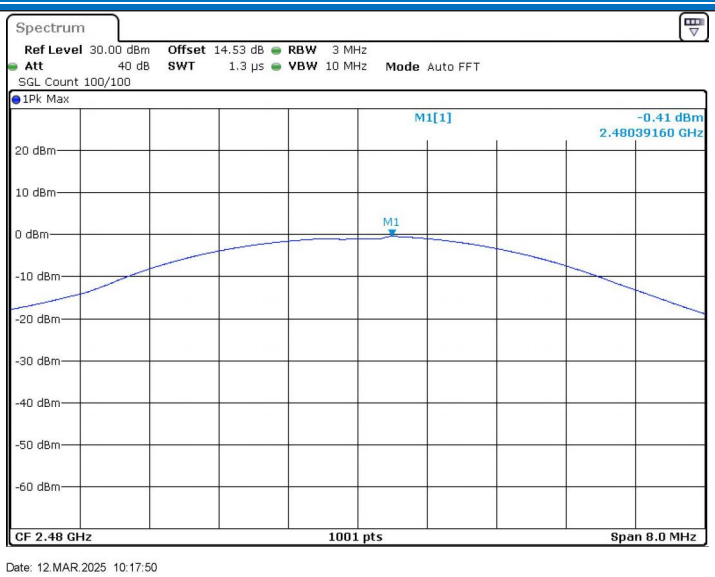
2DH5_Ant1_2402



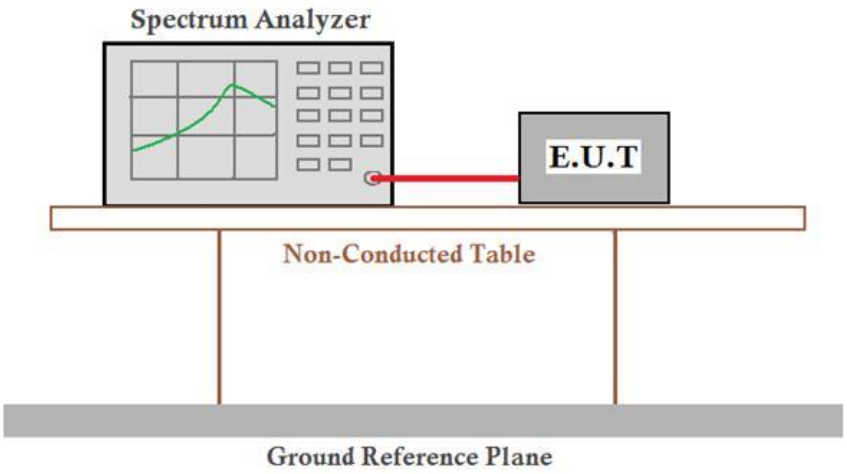
2DH5_Ant1_2441



2DH5_Ant1_2480


Spectrum
Ref Level 30.00 dBm Offset 14.53 dB RBW 3 MHz
Att 40 dB SWT 1.3 µs VBW 10 MHz Mode Auto FFT
SGL Count 100/100
1Pk Max
M1[1] -0.41 dBm
2.48039160 GHz
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.48 GHz
1001 pts
Span 8.0 MHz
Date: 12.MAR.2025 10:17:50

5.4 20dB Occupied Bandwidth

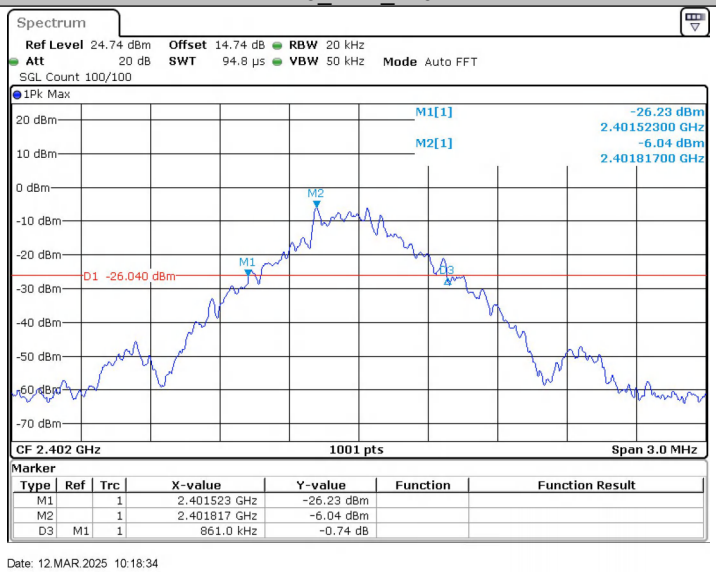
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 Remark: Offset=Cable loss+ attenuation factor.
Limit:	NA
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Only the worst case is recorded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

Measurement Data

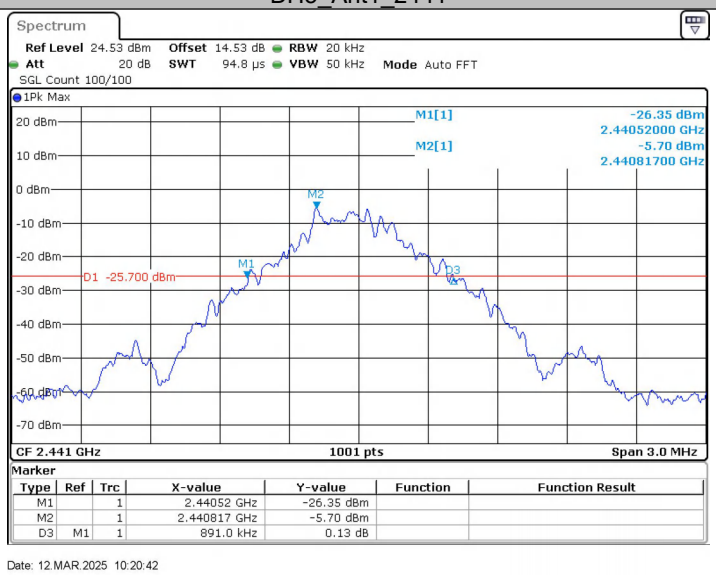
TestMode	Antenna	Freq(MHz)	20dB EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.86	2401.52	2402.38	---	---
		2441	0.89	2440.52	2441.41	---	---
		2480	0.93	2479.52	2480.46	---	---
2DH5	Ant1	2402	1.32	2401.32	2402.64	---	---
		2441	1.32	2440.32	2441.64	---	---
		2480	1.31	2479.32	2480.64	---	---

Test plot as follows:

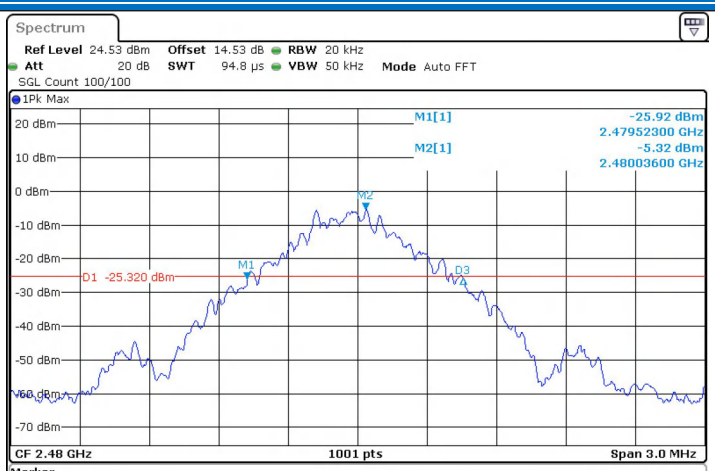
DH5_Ant1_2402



DH5_Ant1_2441



DH5_Ant1_2480

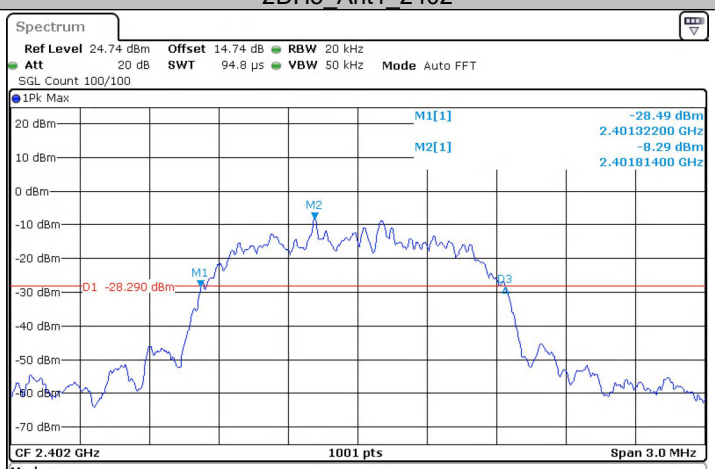


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479523 GHz	-25.92 dBm		
M2		1	2.480036 GHz	-5.32 dBm		
D3	M1	1	933.0 kHz	0.32 dB		

Date: 12.MAR.2025 10:21:19

2DH5_Ant1_2402

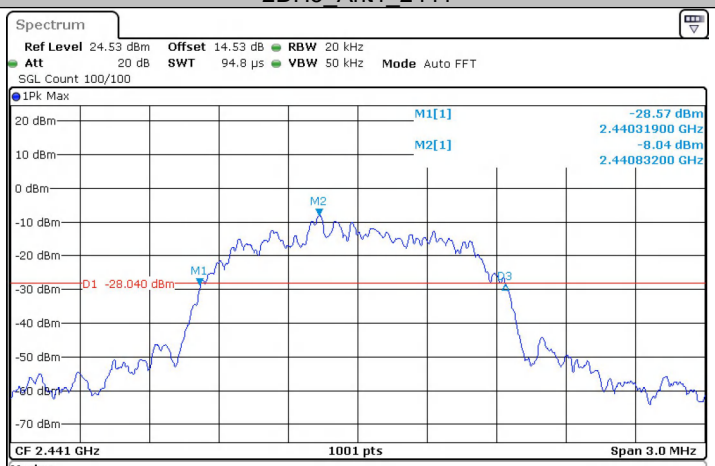


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401322 GHz	-28.49 dBm		
M2		1	2.401814 GHz	-8.29 dBm		
D3	M1	1	1.317 MHz	0.11 dB		

Date: 12.MAR.2025 10:24:32

2DH5_Ant1_2441



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.440319 GHz	-28.57 dBm		
M2		1	2.440832 GHz	-8.04 dBm		
D3	M1	1	1.32 MHz	0.32 dB		

Date: 12.MAR.2025 10:26:33

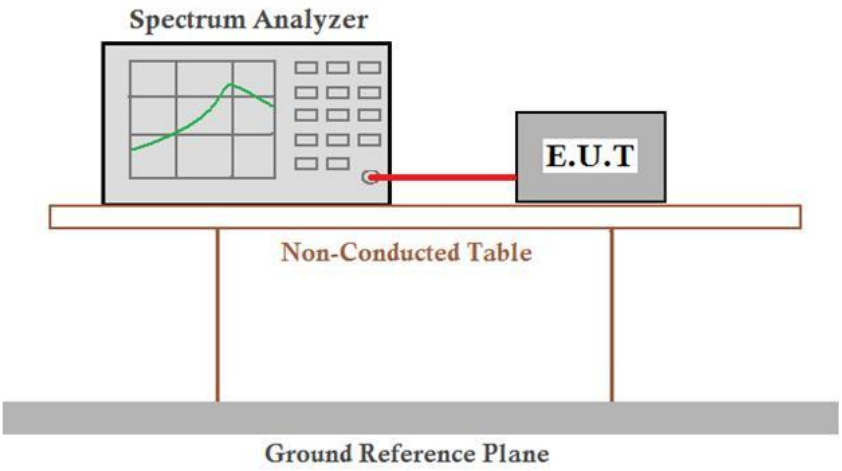
2DH5_Ant1_2480

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479322 GHz	-26.52 dBm		
M2		1	2.47991 GHz	-6.42 dBm		
D3	M1	1	1.314 MHz	-0.27 dB		

Date: 12.MAR.2025 10:29:35

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

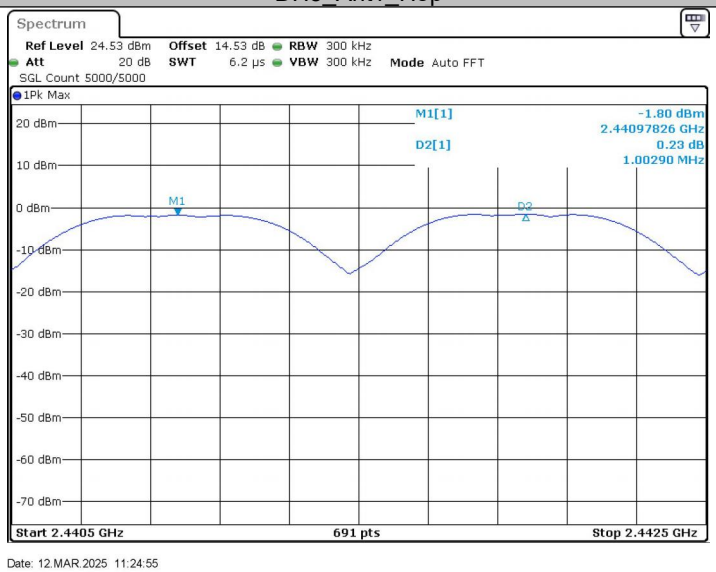
Measurement Data

TestMode	Freq(MHz)	Result[MHz]	Limit[MHz]	Verdict
DH5	Hop	1.003	≥0.62	PASS
2DH5	Hop	0.951	≥0.880	PASS

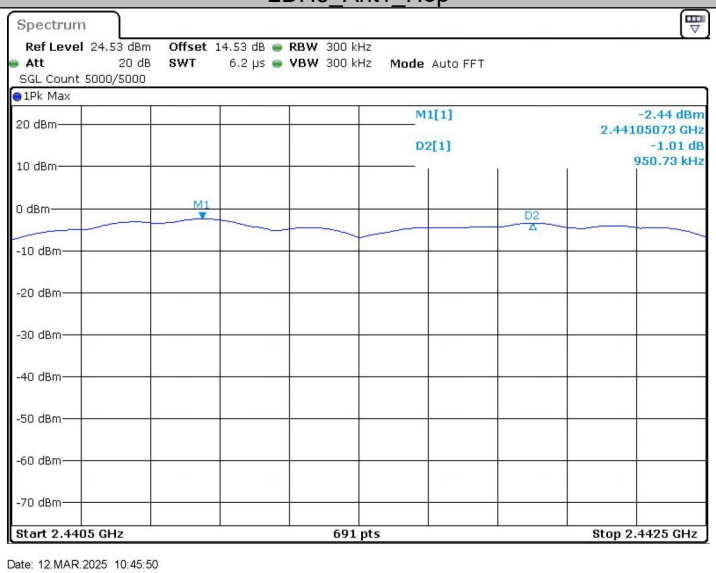
Mode	20dB bandwidth (MHz) (worse case)	Limit (MHz) (Carrier Frequencies Separation)
GFSK	0.93	0.62
π/4DQPSK	1.32	0.880

Test plot as follows:

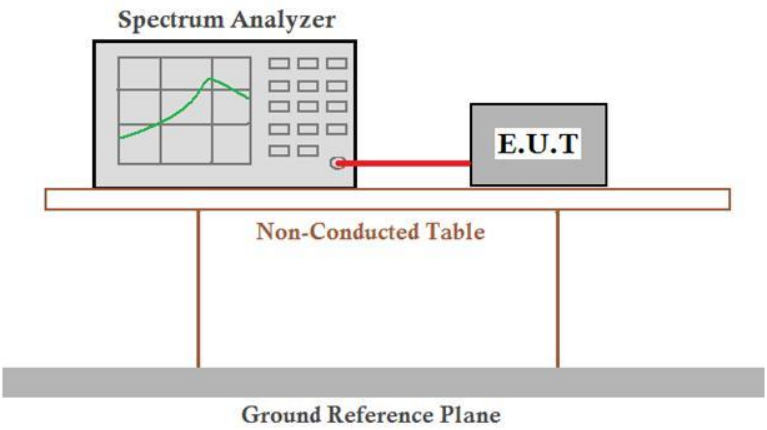
DH5_Ant1_Hop



2DH5_Ant1_Hop



5.6 Hopping Channel Number

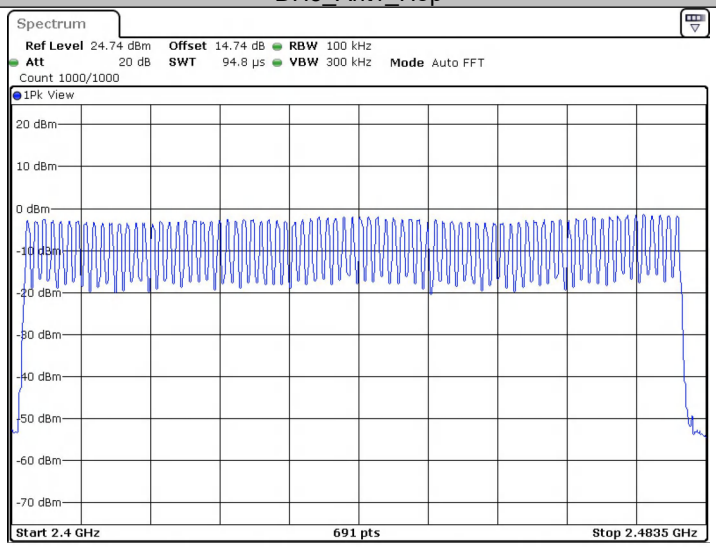
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 *Remark: Offset=Cable loss+ attenuation factor.*
Limit:	At least 15 channels
Exploratory Test Mode:	hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Only the worst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

Measurement Data

TestMode	Freq(MHz)	Result[Num]	Limit[Num]	Verdict
DH5	Hop	79	≥15	PASS
2DH5	Hop	79	≥15	PASS

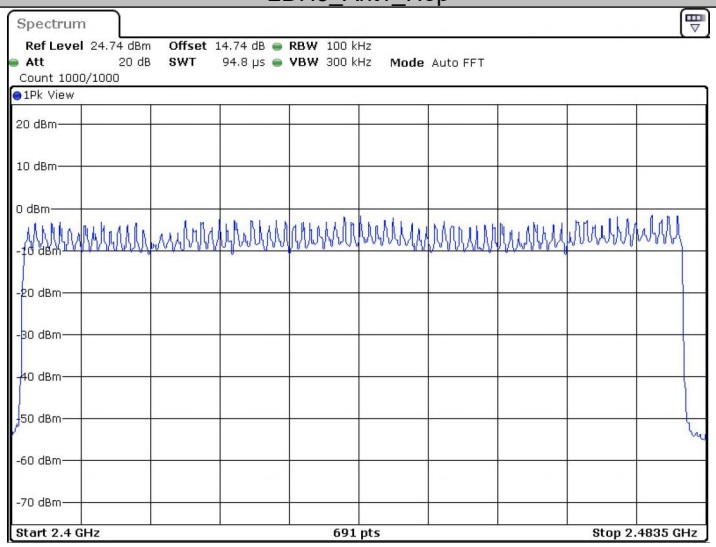
Test plot as follows:

DH5_Ant1_Hop



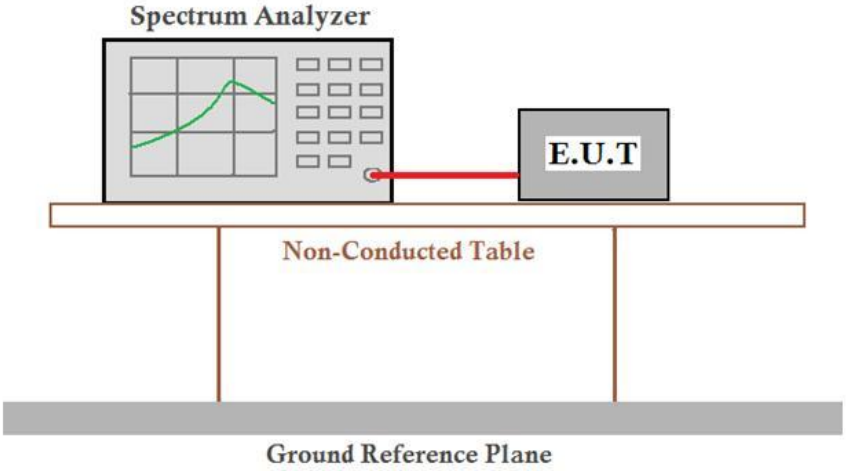
Date: 12.MAR.2025 10:33:54

2DH5_Ant1_Hop



Date: 12.MAR.2025 10:46:56

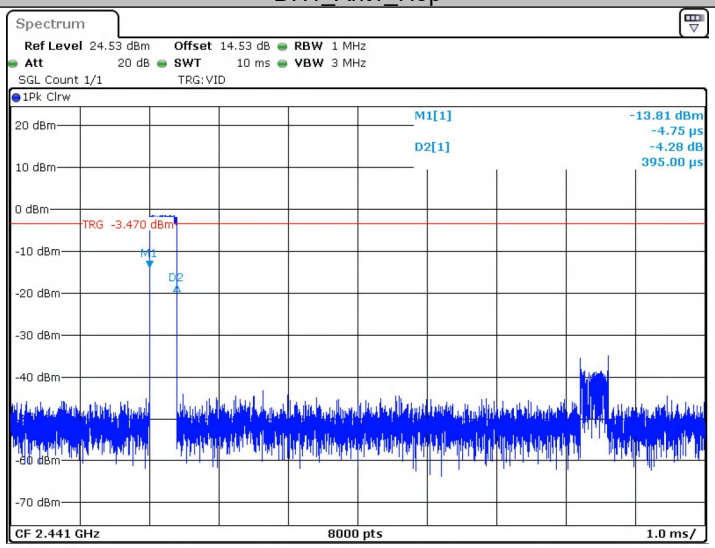
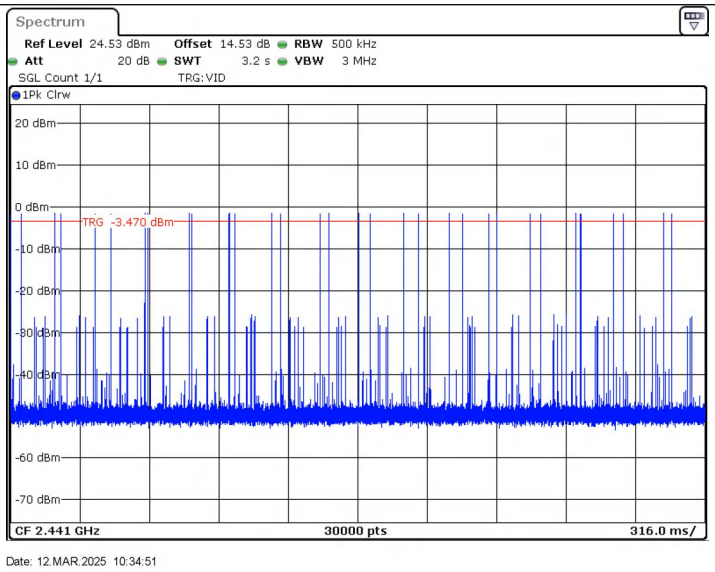
5.7 Dwell Time

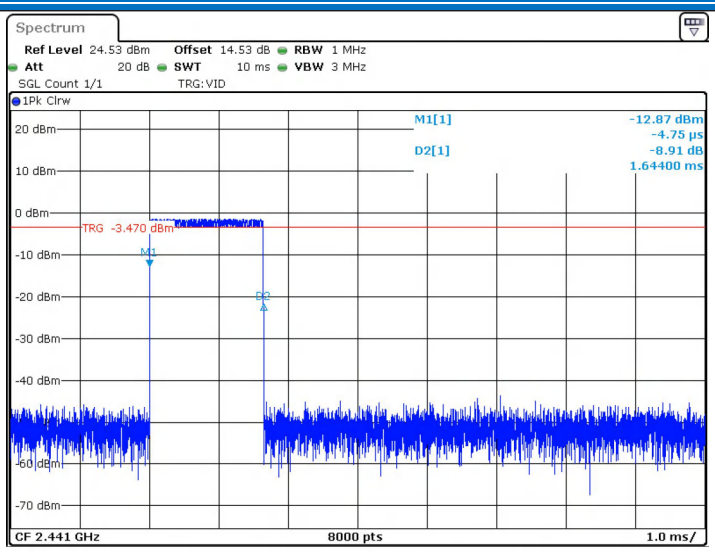
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 *Remark: Offset=Cable loss+ attenuation factor.*
Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Limit:	0.4 Second
Test Results:	Pass

Measurement Data

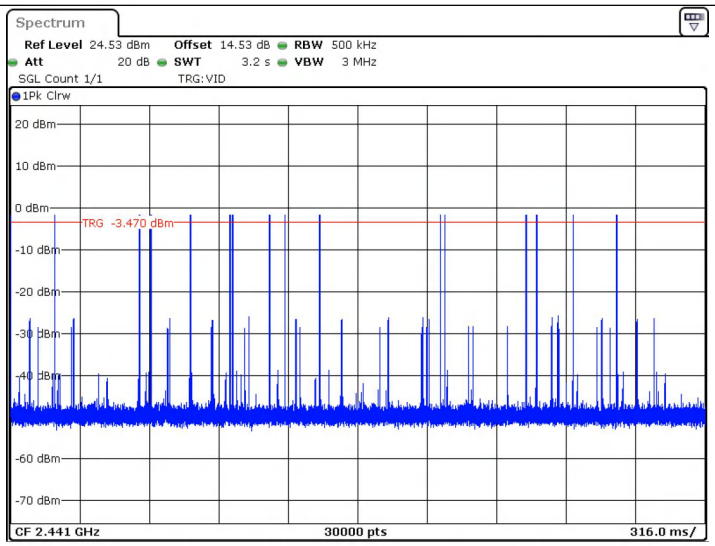
TestMode	Freq(MHz)	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Hop	0.395	320	0.126	≤0.4	PASS
DH3	Hop	1.644	160	0.263	≤0.4	PASS
DH5	Hop	2.884	110	0.317	≤0.4	PASS
2DH1	Hop	0.406	320	0.13	≤0.4	PASS
2DH3	Hop	1.650	160	0.264	≤0.4	PASS
2DH5	Hop	2.890	120	0.347	≤0.4	PASS

Test plot as follows:

DH1_Ant1_Hop


DH3_Ant1_Hop

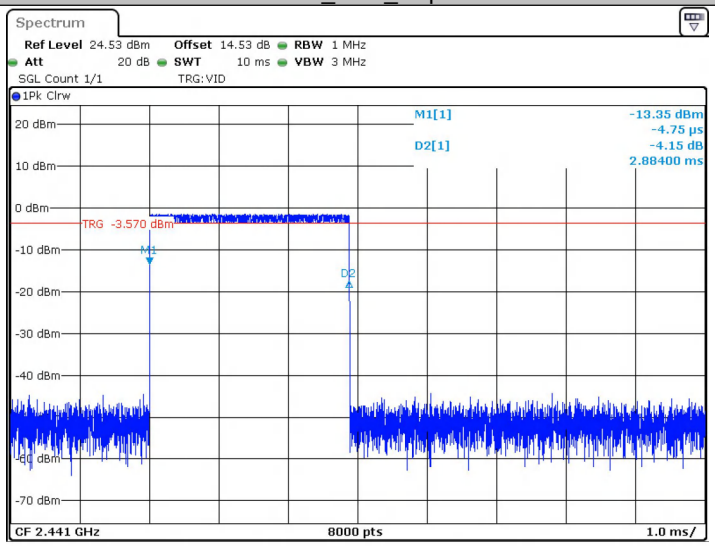


Date: 12.MAR.2025 10:36:21

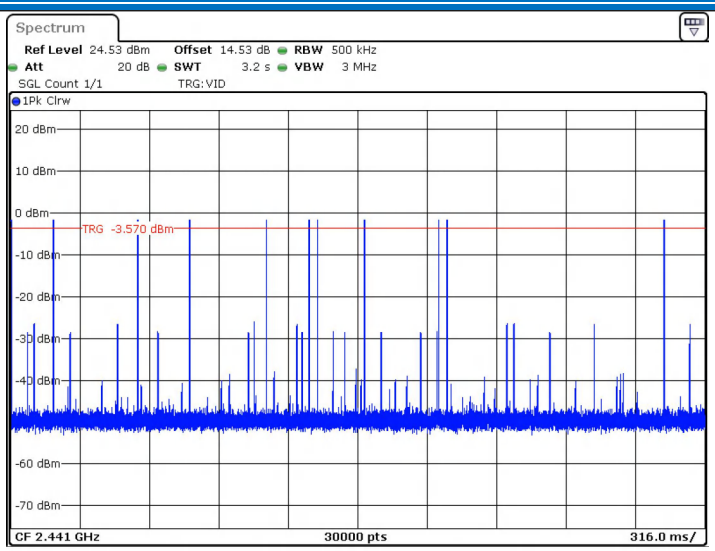


Date: 12.MAR.2025 10:36:26

DH5_Ant1_Hop

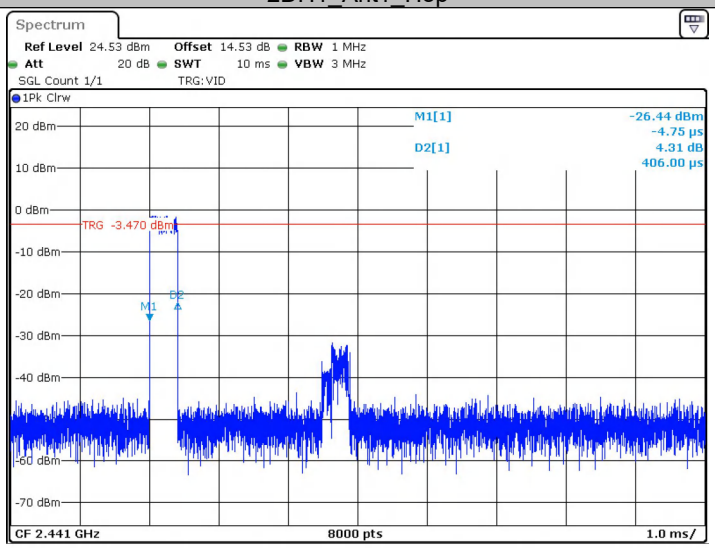


Date: 12.MAR.2025 10:34:09

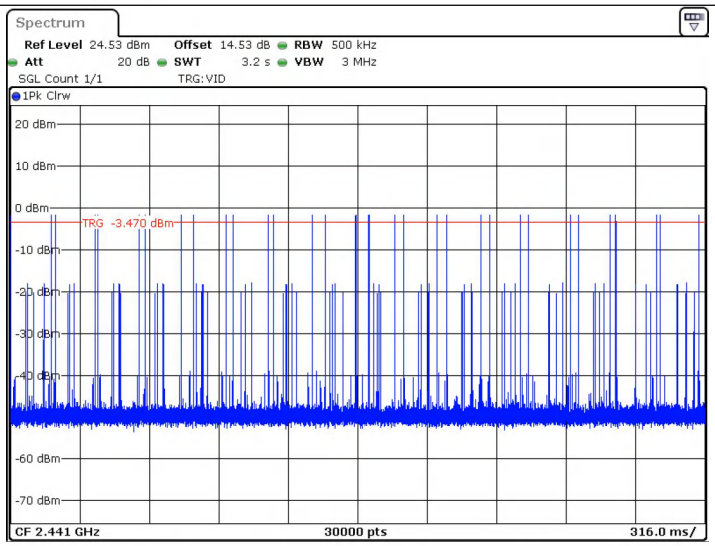


Date: 12.MAR.2025 10:34:14

2DH1_Ant1_Hop

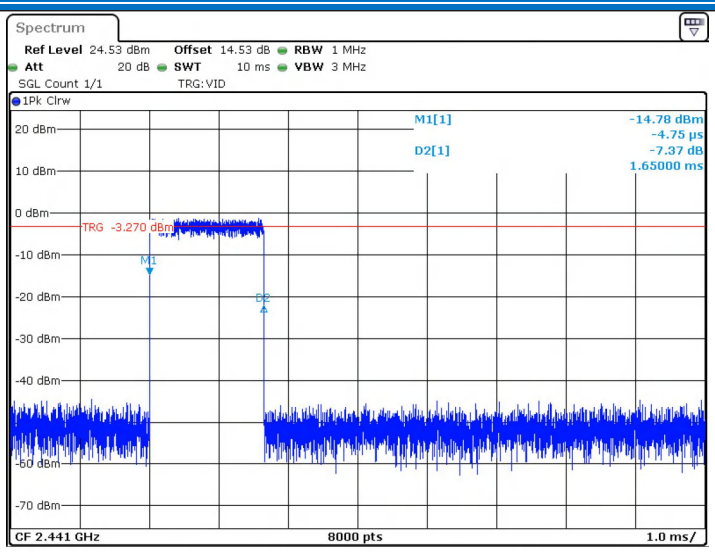


Date: 12.MAR.2025 10:50:49

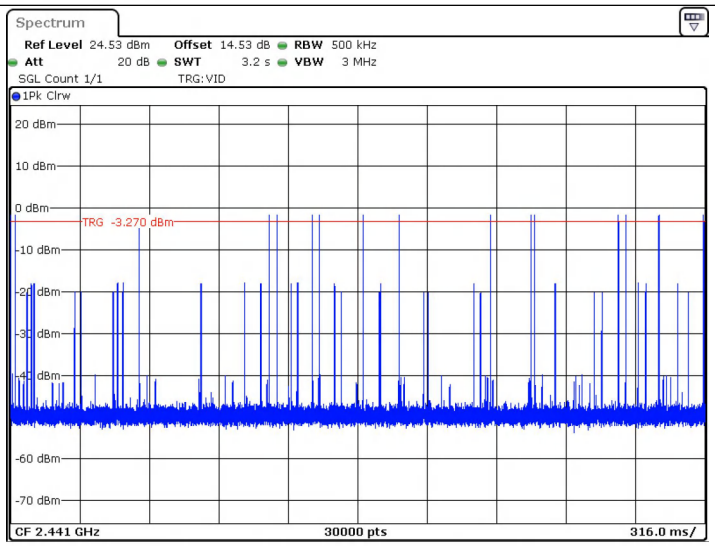


Date: 12.MAR.2025 10:50:55

2DH3_Ant1_Hop

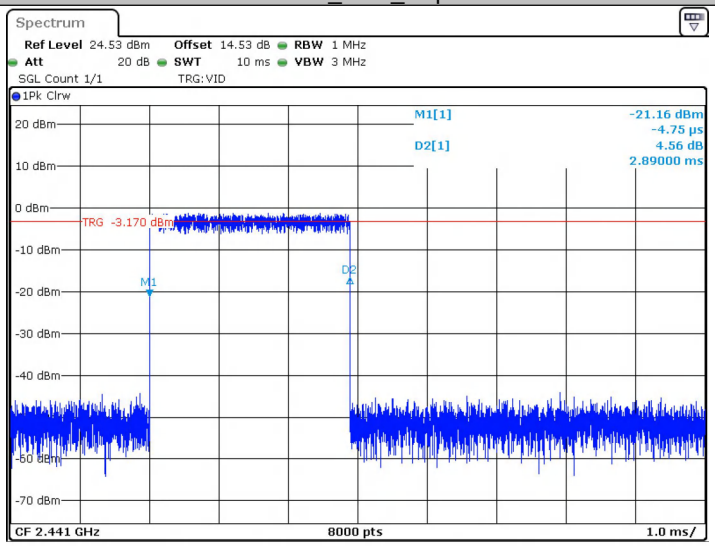


Date: 12.MAR.2025 10:51:25

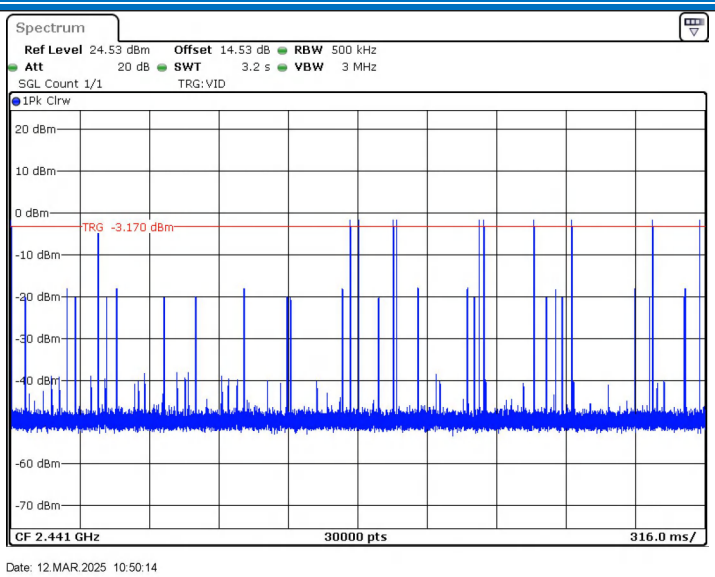


Date: 12.MAR.2025 10:51:30

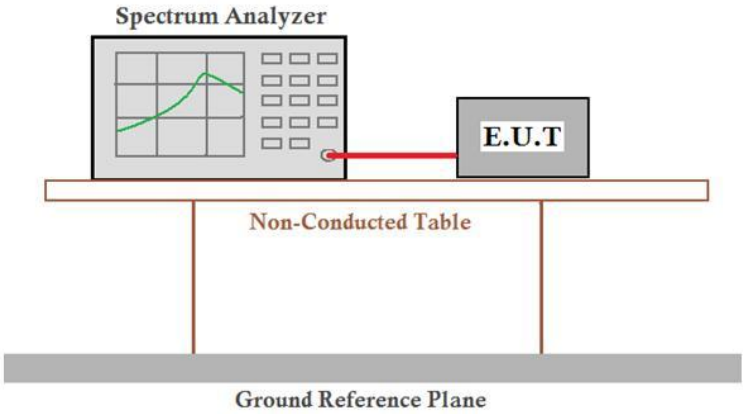
2DH5_Ant1_Hop



Date: 12.MAR.2025 10:50:08


Spectrum
Ref Level 24.53 dBm Offset 14.53 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 -3.170 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-60 dBm
-70 dBm
CF 2.441 GHz
30000 pts
316.0 ms/
Date: 12.MAR.2025 10:50:14

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

ChName	Freq(MHz)	Detector	Freq [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/m]	Limit [dBuV/m]	Verdict
Low	2402	AV	2310.000	-53.81	≤-41.20	41.39	≤54	PASS
		AV	2340.935	-51.44	≤-41.20	43.76	≤54	PASS
		AV	2390.000	-54.07	≤-41.20	41.13	≤54	PASS
		Peak	2310.000	-44.66	≤-21.20	50.54	≤74	PASS
		Peak	2346.870	-40.38	≤-21.20	54.82	≤74	PASS
		Peak	2390.000	-44.39	≤-21.20	50.81	≤74	PASS
High	2480	AV	2483.500	-53.03	≤-41.20	42.17	≤54	PASS
		AV	2483.681	-52.87	≤-41.20	42.33	≤54	PASS
		AV	2500.000	-54.12	≤-41.20	41.08	≤54	PASS
		Peak	2483.500	-46.39	≤-21.20	48.81	≤74	PASS
		Peak	2484.493	-43.03	≤-21.20	52.17	≤74	PASS
		Peak	2500.000	-44.7	≤-21.20	50.50	≤74	PASS
Low	Hop_2402	Peak	2310.000	-44.45	≤-21.20	50.75	≤74	PASS
		Peak	2346.261	-41.26	≤-21.20	53.94	≤74	PASS
		Peak	2390.000	-44.8	≤-21.20	50.40	≤74	PASS
High	Hop_2480	Peak	2483.500	-47.24	≤-21.20	47.96	≤74	PASS
		Peak	2485.420	-42.41	≤-21.20	52.79	≤74	PASS
		Peak	2500.000	-45.37	≤-21.20	49.83	≤74	PASS
Low	2402	AV	2310.000	-53.85	≤-41.20	41.35	≤54	PASS
		AV	2341.239	-51.48	≤-41.20	43.72	≤54	PASS
		AV	2390.000	-54.07	≤-41.20	41.13	≤54	PASS
		Peak	2310.000	-44.83	≤-21.20	50.37	≤74	PASS
		Peak	2368.478	-41.05	≤-21.20	54.15	≤74	PASS
		Peak	2390.000	-43.06	≤-21.20	52.14	≤74	PASS
High	2480	AV	2483.500	-53.27	≤-41.20	41.93	≤54	PASS
		AV	2483.797	-53.15	≤-41.20	42.05	≤54	PASS
		AV	2500.000	-54.15	≤-41.20	41.05	≤54	PASS
		Peak	2483.500	-46.92	≤-21.20	48.28	≤74	PASS
		Peak	2486.464	-42.31	≤-21.20	52.89	≤74	PASS
		Peak	2500.000	-43.91	≤-21.20	51.29	≤74	PASS
Low	Hop_2402	Peak	2310.000	-45.85	≤-21.20	49.35	≤74	PASS
		Peak	2342.000	-39.76	≤-21.20	55.44	≤74	PASS
		Peak	2390.000	-45.29	≤-21.20	49.91	≤74	PASS
High	Hop_2480	Peak	2483.500	-46.13	≤-21.20	49.07	≤74	PASS
		Peak	2497.478	-43.31	≤-21.20	51.89	≤74	PASS

		Peak	2500.000	-44.76	≤-21.20	50.44	≤74	PASS