

Test Report

Report No.: MTi230615006-05E2

Date of issue: 2023-08-04

Applicant: Shenzhen Teneth Technology Co., Ltd

Product: Cutting Plotter

Model(s): MINI140 PRO, MINI140

FCC ID: 2A33R-MINI140

Shenzhen Microtest Co., Ltd.

<http://www.mtitest.com>

The test report is only used for customer scientific research, teaching, internal quality control and other purposes, and is for internal reference only.



Instructions

1. This test report shall not be partially reproduced without the written consent of the laboratory.
2. The test results in this test report are only responsible for the samples submitted
3. This test report is invalid without the seal and signature of the laboratory.
4. This test report is invalid if transferred, altered, or tampered with in any form without authorization.
5. Any objection to this test report shall be submitted to the laboratory within 15 days from the date of receipt of the report.

Table of contents

1	General Description	5
1.1	Description of the EUT	5
1.2	Description of test modes	5
1.3	Environmental Conditions	7
1.4	Description of support units	7
1.5	Measurement uncertainty	7
2	Summary of Test Result	8
3	Test Facilities and accreditations	9
3.1	Test laboratory	9
4	List of test equipment.....	10
5	Evaluation Results (Evaluation).....	13
5.1	Antenna requirement	13
6	Radio Spectrum Matter Test Results (RF)	13
6.1	Conducted Emission at AC power line	13
6.2	Occupied Bandwidth	18
6.3	Maximum Conducted Output Power.....	19
6.4	Channel Separation	20
6.5	Number of Hopping Frequencies.....	21
6.6	Dwell Time	22
6.7	Emissions in non-restricted frequency bands	23
6.8	Band edge emissions (Radiated)	24
6.9	Emissions in restricted frequency bands (below 1GHz)	29
6.10	Emissions in restricted frequency bands (above 1GHz)	35
	Photographs of the test setup	42
	Photographs of the EUT.....	44
	Appendix A: 20dB Emission Bandwidth	46
	Appendix B: Maximum conducted output power.....	50
	Appendix C: Carrier frequency separation	54
	Appendix D: Time of occupancy	56
	Appendix E: Number of hopping channels.....	63
	Appendix F: Band edge measurements.....	65
	Appendix G: Conducted Spurious Emission.....	69

Test Result Certification	
Applicant:	Shenzhen Teneth Technology Co., Ltd
Address:	No.161, Pinghu street, Pinghu town, Longgang District, Shenzhen City, Guangdong Province, China
Manufacturer:	Shenzhen Teneth Technology Co., Ltd
Address:	No.161, Pinghu street, Pinghu town, Longgang District, Shenzhen City, Guangdong Province, China
Product description	
Product name:	Cutting Plotter
Trademark:	TENETH
Model name:	MINI140 PRO
Series Model:	MINI140
Standards:	47 CFR Part 15.247
Test Method:	ANSI C63.10 KDB 558074 D01 D15.247 Meas Guidance v05r02
Date of Test	
Date of test:	22023-07-19 to 2023-08-01
Test result:	Pass

Test Engineer	:	<i>Yanice Xie</i>
		(Yanice.Xie)
Reviewed By	:	<i>Leon Chen</i>
		(Leon Chen)
Approved By	:	<i>Tom Xue</i>
		(Tom Xue)

1 General Description

1.1 Description of the EUT

Product name:	Cutting Plotter
Model name:	MINI140 PRO
Series Model:	MINI140
Model difference:	All the models are the same circuit and module, except the model name, screen and RF function. MINI140 PRO is with screen and WIFI, MINI140 is without screen and WIFI.
Electrical rating:	Input:DC24V 1.75A
Accessories:	Adaptor: Model: GM42-240175-D INPUT: AC 100-240V 50/60Hz 1.5A OUTPUT: DC 24V 1.75A
Hardware version:	3.0
Software version:	2.6
Test sample(s) number:	MTi230615006-05S1001 MTi230615006-05S1002
RF specification	
Bluetooth version:	V4.2
Operating frequency range:	2402-2480
Channel number:	79
Modulation type:	GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna(s) type:	PCB Antenna
Antenna(s) gain:	0.1 dBi

1.2 Description of test modes

No.	Emission test modes
Mode1	TX-GFSK(CH00/CH39/CH78)
Mode2	TX- $\pi/4$ -DQPSK(CH00/CH39/CH78)
Mode3	TX-8DPSK(CH00/CH39/CH78)

1.2.1 Operation channel list

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468

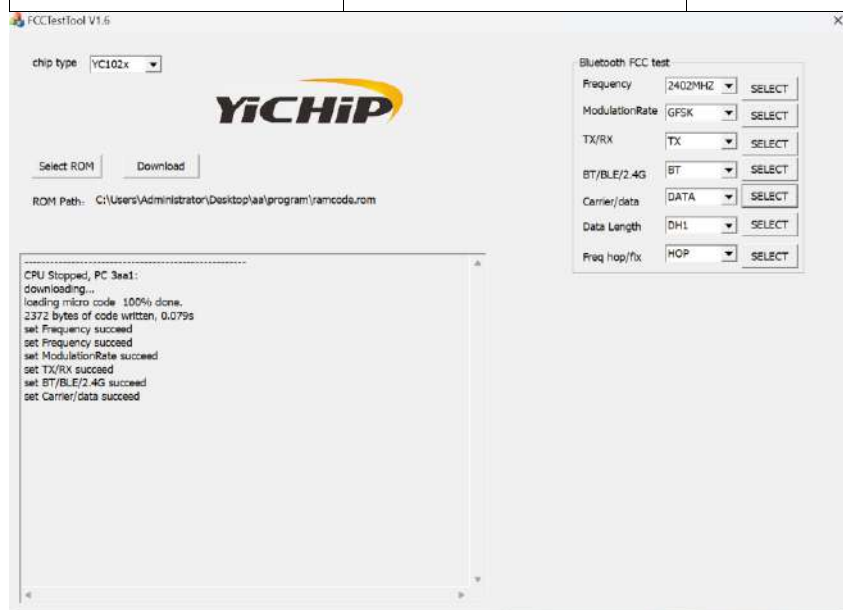
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	-	-

Note: The test software provided by manufacturer is used to control EUT for working in engineering mode, that enables selectable channel, and capable of continuous transmitting mode.

Test Software:

For power setting, refer to below table.

Test Software:	FCC Test Tool V1.6		
Mode	2402MHz	2441MHz	2480MHz
GFSK	22	22	22
$\pi/4$ -DQPSK	22	22	22
8DPSK	22	22	22



1.3 Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15°C ~ 35°C
Humidity:	20% RH ~ 75% RH
Atmospheric pressure:	98 kPa ~ 101 kPa

1.4 Description of support units

Support equipment list			
Description	Model	Serial No.	Manufacturer
/	/	/	/
Support cable list			
Description	Length (m)	From	To
/	/	/	/

1.5 Measurement uncertainty

Measurement	Uncertainty
Occupied channel bandwidth	±3 %
RF output power, conducted	±1 dB
Time	±1 %
Unwanted Emissions, conducted	±1 dB
Radiated spurious emissions (1GHz~25GHz)	5.3dB
Radiated spurious emissions (9kHz~30MHz)	4.3dB
Radiated spurious emissions (30MHz~1GHz)	4.7dB
Temperature	±1 °C
Humidity	± 5 %

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2 Summary of Test Result

No.	Item	Standard	Requirement	Result
1	Antenna requirement	47 CFR Part 15.247	47 CFR 15.203	Pass
2	Conducted Emission at AC power line	47 CFR Part 15.247	47 CFR 15.207(a)	Pass
3	Occupied Bandwidth	47 CFR Part 15.247	47 CFR 15.215(c)	Pass
4	Maximum Conducted Output Power	47 CFR Part 15.247	47 CFR 15.247(b)(1)	Pass
5	Channel Separation	47 CFR Part 15.247	47 CFR 15.247(a)(1)	Pass
6	Number of Hopping Frequencies	47 CFR Part 15.247	47 CFR 15.247(a)(1)(iii)	Pass
7	Dwell Time	47 CFR Part 15.247	47 CFR 15.247(a)(1)(iii)	Pass
8	Emissions in non-restricted frequency bands	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
9	Band edge emissions (Radiated)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
10	Emissions in restricted frequency bands (below 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass
11	Emissions in restricted frequency bands (above 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d)	Pass

3 Test Facilities and accreditations

3.1 Test laboratory

Test laboratory:	Shenzhen Microtest Co., Ltd.
Test site location:	101, No.7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	(86-755)88850135
Fax:	(86-755)88850136
CNAS Registration No.:	CNAS L5868
FCC Registration No.:	448573
IC Registration No.:	21760
CABID:	CN0093

4 List of test equipment

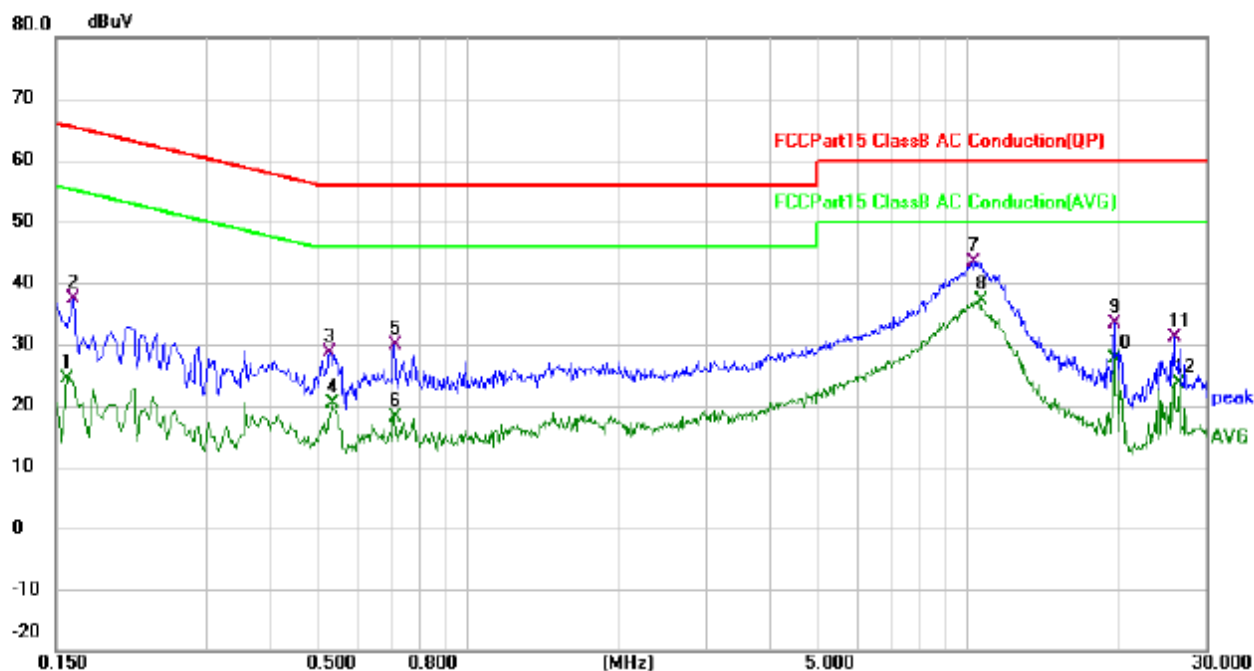
No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
Conducted Emission at AC power line						
1	EMI Test Receiver	Rohde&schwarz	ESCI3	101368	2023-04-26	2024-04-25
2	Artificial mains network	Schwarzbeck	NSLK 8127	183	2023-05-05	2024-05-04
3	Artificial Mains Network	Schwarzbeck	NSLK 8127	1001	2023-05-06	2024-05-05
Occupied Bandwidth						
1	Wideband Radio Communication Tester	Rohde&schwarz	CMW500	149155	2023-04-26	2024-04-25
2	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023-04-25	2024-04-24
3	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023-04-25	2024-04-24
4	Synthesized Sweeper	Agilent	83752A	3610A01957	2023-04-25	2024-04-24
5	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2023-04-26	2024-04-25
6	RF Control Unit	Tonscend	JS0806-1	19D8060152	2023-04-26	2024-04-25
7	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023-05-05	2024-05-04
8	ESG Vector Signal Generator	Agilent	N5182A	MY50143762	2023-04-25	2024-04-24
9	DC Power Supply	Agilent	E3632A	MY40027695	2023-05-05	2024-05-04
Maximum Conducted Output Power						
1	Wideband Radio Communication Tester	Rohde&schwarz	CMW500	149155	2023-04-26	2024-04-25
2	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023-04-25	2024-04-24
3	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023-04-25	2024-04-24
4	Synthesized Sweeper	Agilent	83752A	3610A01957	2023-04-25	2024-04-24
5	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2023-04-26	2024-04-25
6	RF Control Unit	Tonscend	JS0806-1	19D8060152	2023-04-26	2024-04-25
7	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023-05-05	2024-05-04
8	ESG Vector Signal Generator	Agilent	N5182A	MY50143762	2023-04-25	2024-04-24
9	DC Power Supply	Agilent	E3632A	MY40027695	2023-05-05	2024-05-04
Power Spectral Density						
1	Wideband Radio Communication Tester	Rohde&schwarz	CMW500	149155	2023-04-26	2024-04-25
2	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023-04-25	2024-04-24
3	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023-04-25	2024-04-24
4	Synthesized Sweeper	Agilent	83752A	3610A01957	2023-04-25	2024-04-24

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
5	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2023-04-26	2024-04-25
6	RF Control Unit	Tonscend	JS0806-1	19D8060152	2023-04-26	2024-04-25
7	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023-05-05	2024-05-04
8	ESG Vector Signal Generator	Agilent	N5182A	MY50143762	2023-04-25	2024-04-24
9	DC Power Supply	Agilent	E3632A	MY40027695	2023-05-05	2024-05-04
Emissions in non-restricted frequency bands						
1	Wideband Radio Communication Tester	Rohde&schwarz	CMW500	149155	2023-04-26	2024-04-25
2	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023-04-25	2024-04-24
3	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023-04-25	2024-04-24
4	Synthesized Sweeper	Agilent	83752A	3610A01957	2023-04-25	2024-04-24
5	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2023-04-26	2024-04-25
6	RF Control Unit	Tonscend	JS0806-1	19D8060152	2023-04-26	2024-04-25
7	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023-05-05	2024-05-04
8	ESG Vector Signal Generator	Agilent	N5182A	MY50143762	2023-04-25	2024-04-24
9	DC Power Supply	Agilent	E3632A	MY40027695	2023-05-05	2024-05-04
Band edge emissions (Radiated)						
1	EMI Test Receiver	Rohde&schwarz	ESCI7	101166	2023-04-26	2024-04-25
2	Double Ridged Broadband Horn Antenna	schwarabeck	BBHA 9120 D	2278	2023-05-26	2024-05-25
3	Amplifier	Agilent	8449B	3008A01120	2023-05-26	2024-05-25
4	Multi-device Controller	TuoPu	TPMDC	/	2023-05-04	2024-05-03
5	MXA signal analyzer	Agilent	N9020A	MY54440859	2023-05-05	2024-05-04
Emissions in restricted frequency bands (below 1GHz)						
1	EMI Test Receiver	Rohde&schwarz	ESCI7	101166	2023-04-26	2024-04-25
2	TRILOG Broadband Antenna	schwarabeck	VULB 9163	9163-1338	2023-06-11	2025-06-10
3	Amplifier	Hewlett-Packard	8447F	3113A06184	2023-04-26	2024-04-25
4	Multi-device Controller	TuoPu	TPMDC	/	2023-05-04	2024-05-03
Emissions in restricted frequency bands (above 1GHz)						
1	EMI Test Receiver	Rohde&schwarz	ESCI7	101166	2023-04-26	2024-04-25
2	Double Ridged Broadband Horn Antenna	schwarabeck	BBHA 9120 D	2278	2023-05-26	2024-05-25
3	Amplifier	Agilent	8449B	3008A01120	2023-05-26	2024-05-25

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
4	Multi-device Controller	TuoPu	TPMDC	/	2023-05-04	2024-05-03
5	MXA signal analyzer	Agilent	N9020A	MY54440859	2023-05-05	2024-05-04

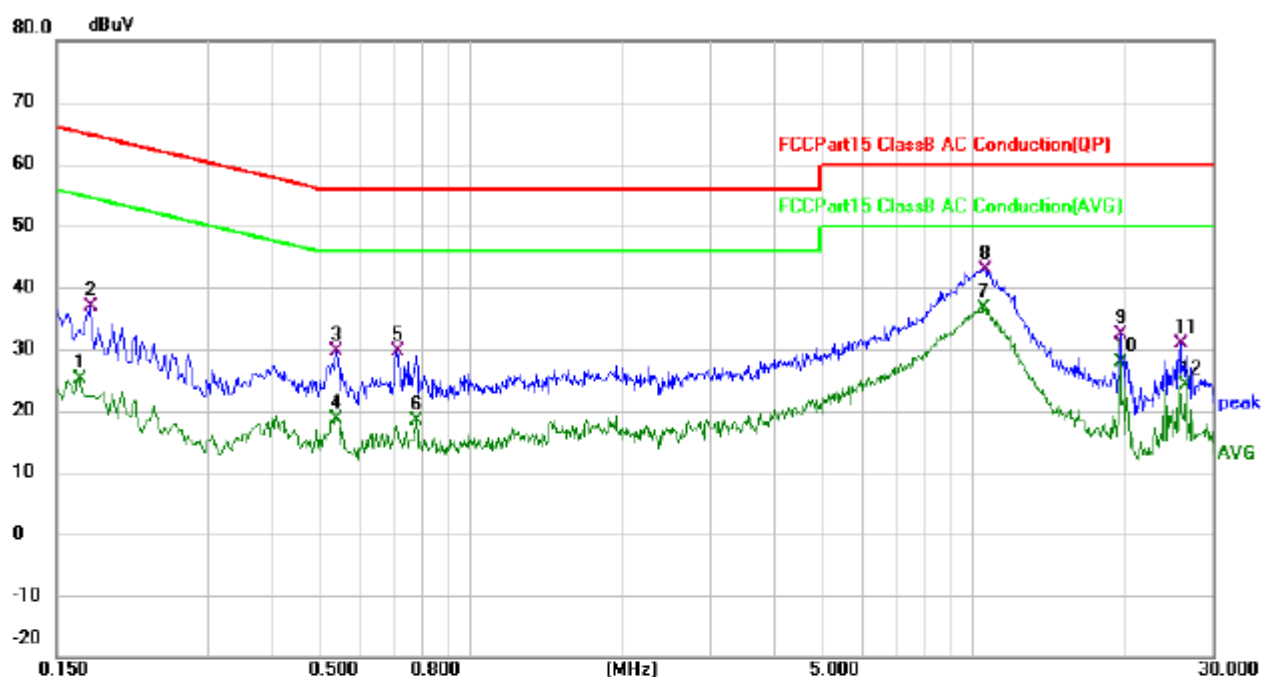
6.1.3 Test Data:

Mode1(AC120V/60Hz) / Line: Line / Band: 2.4G / BW: 1 / CH00



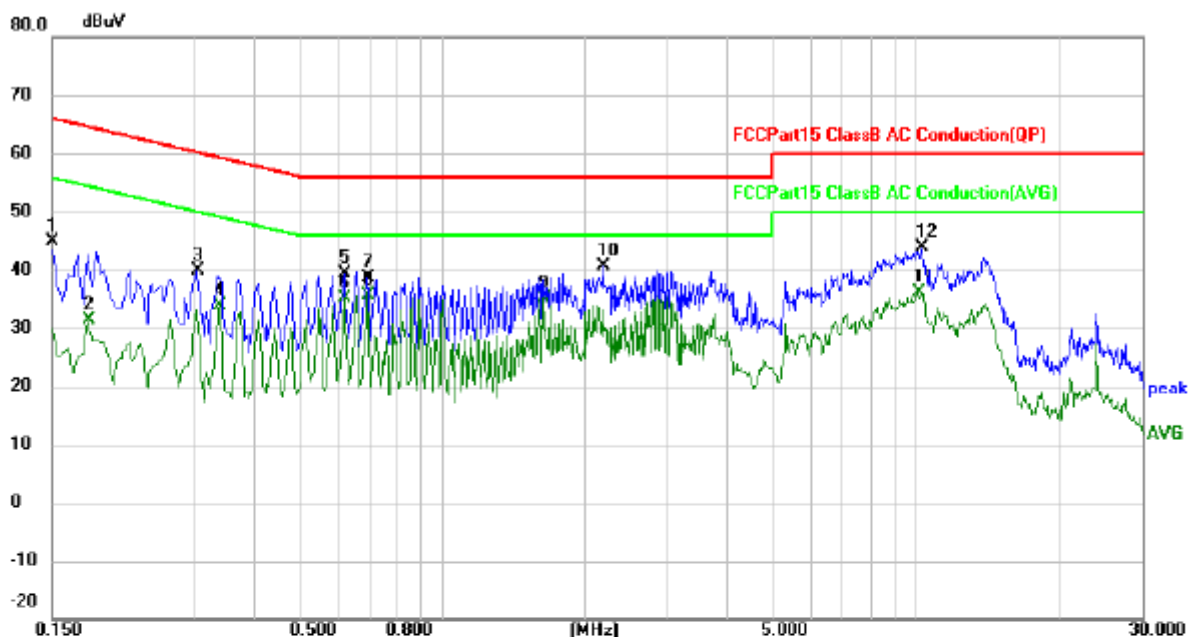
No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	dBuV	Factor	ment	dBuV	dB	Detector	Comment
1		0.1580	14.12	10.18	24.30	55.57	-31.27	AVG	
2		0.1620	27.12	10.18	37.30	65.36	-28.06	QP	
3		0.5299	18.31	10.24	28.55	56.00	-27.45	QP	
4		0.5340	10.04	10.23	20.27	46.00	-25.73	AVG	
5		0.7140	19.62	10.16	29.78	56.00	-26.22	QP	
6		0.7140	8.09	10.16	18.25	46.00	-27.75	AVG	
7		10.2620	32.60	10.75	43.35	60.00	-16.65	QP	
8	*	10.5860	26.31	10.74	37.05	50.00	-12.95	AVG	
9		19.7099	22.91	10.59	33.50	60.00	-26.50	QP	
10		19.7099	17.12	10.59	27.71	50.00	-22.29	AVG	
11		25.8779	20.44	10.70	31.14	60.00	-28.86	QP	
12		26.6100	12.85	10.71	23.56	50.00	-26.44	AVG	

Mode1(AC120V/60Hz) / Line: Neutral / Band: 2.4G / BW: 1 / CH00



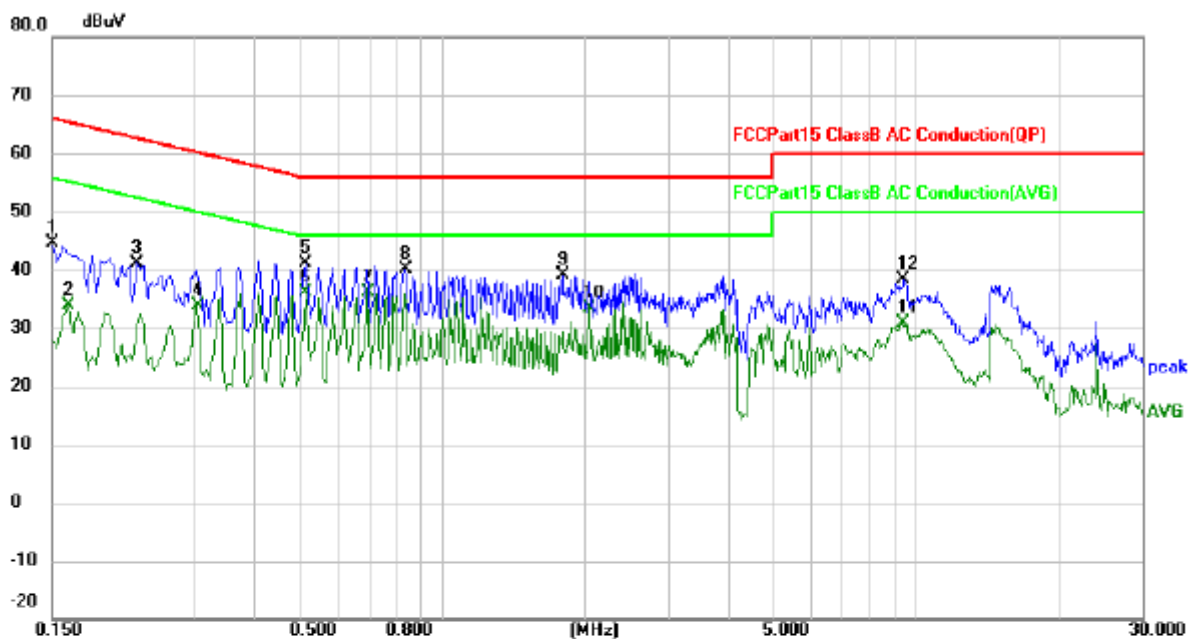
No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	dBuV	Factor	ment	dBuV	dB	Detector	Comment
1		0.1660	15.02	10.12	25.14	55.16	-30.02	AVG	
2		0.1740	26.65	10.11	36.76	64.77	-28.01	QP	
3		0.5420	19.60	10.07	29.67	56.00	-26.33	QP	
4		0.5420	8.63	10.07	18.70	46.00	-27.30	AVG	
5		0.7140	19.53	10.13	29.66	56.00	-26.34	QP	
6		0.7820	8.27	10.11	18.38	46.00	-27.62	AVG	
7	*	10.4740	25.91	10.72	36.63	50.00	-13.37	AVG	
8		10.5340	32.27	10.72	42.99	60.00	-17.01	QP	
9		19.7099	21.91	10.58	32.49	60.00	-27.51	QP	
10		19.7099	17.33	10.58	27.91	50.00	-22.09	AVG	
11		25.8779	20.14	10.68	30.82	60.00	-29.18	QP	
12		26.4860	13.48	10.69	24.17	50.00	-25.83	AVG	

Mode1(AC240V/60Hz) / Line: Line / Band: 2.4G / BW: 1 / CH00



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	dBuV	Factor	ment	dBuV	dB	Detector	Comment
1		0.1500	34.64	10.28	44.92	66.00	-21.08	peak	
2		0.1780	21.17	10.28	31.45	54.58	-23.13	AVG	
3		0.3020	28.93	10.87	39.80	60.19	-20.39	peak	
4		0.3379	22.87	10.96	33.83	49.25	-15.42	AVG	
5		0.6220	27.87	11.59	39.46	56.00	-16.54	peak	
6		0.6220	23.62	11.59	35.21	46.00	-10.79	AVG	
7		0.6940	26.93	11.75	38.68	56.00	-17.32	peak	
8	*	0.6940	23.99	11.75	35.74	46.00	-10.26	AVG	
9		1.6340	21.62	13.41	35.03	46.00	-10.97	AVG	
10		2.1860	30.61	10.05	40.66	56.00	-15.34	peak	
11		10.1020	25.76	10.41	36.17	50.00	-13.83	AVG	
12		10.2860	33.40	10.41	43.81	60.00	-16.19	peak	

Mode1(AC120V/60Hz) / Line: Neutral / Band: 2.4G / BW: 1 / CH00



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	34.38	10.28	44.66	66.00	-21.34	peak	
2		0.1620	23.49	10.28	33.77	55.36	-21.59	AVG	
3		0.2260	30.52	10.73	41.25	62.60	-21.35	peak	
4		0.3020	23.04	10.87	33.91	50.19	-16.28	AVG	
5		0.5140	29.84	11.34	41.18	56.00	-14.82	peak	
6	*	0.5140	24.85	11.34	36.19	46.00	-9.81	AVG	
7		0.6940	24.38	11.75	36.13	46.00	-9.87	AVG	
8		0.8340	28.03	12.05	40.08	56.00	-15.92	peak	
9		1.7940	25.35	13.67	39.02	56.00	-16.98	peak	
10		2.0420	23.34	10.01	33.35	46.00	-12.65	AVG	
11		9.3260	20.48	10.39	30.87	50.00	-19.13	AVG	
12		9.4500	28.03	10.38	38.41	60.00	-21.59	peak	

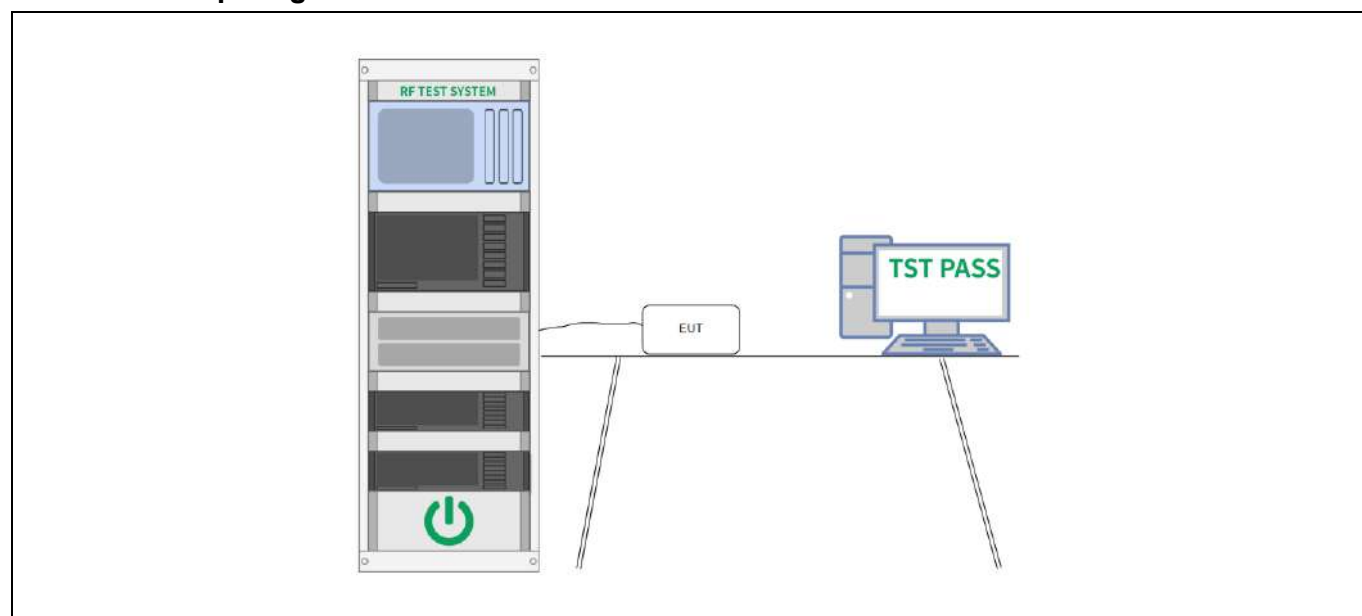
6.2 Occupied Bandwidth

Test Requirement:	47 CFR 15.215(c)
Test Limit:	Refer to 47 CFR 15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02

6.2.1 E.U.T. Operation:

Operating Environment:					
Temperature:	24.5 °C	Humidity:	44 %	Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3				

6.2.2 Test Setup Diagram:



6.2.3 Test Data:

Please Refer to Appendix for Details.

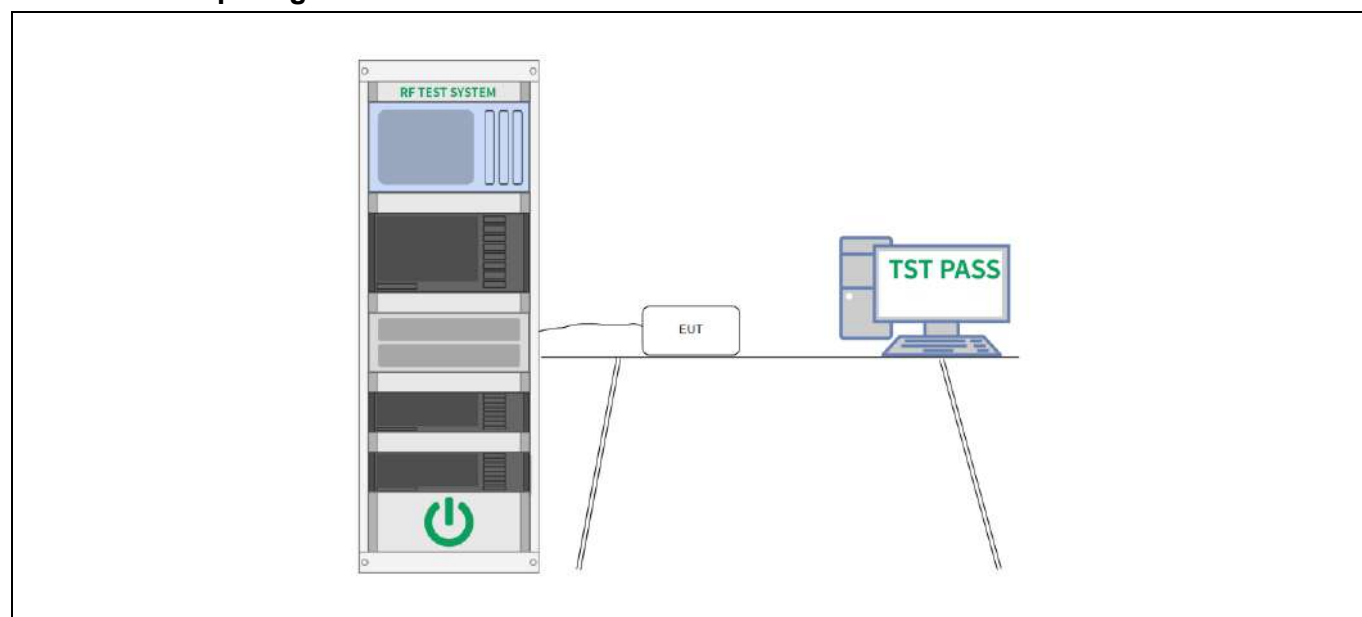
6.3 Maximum Conducted Output Power

Test Requirement:	47 CFR 15.247(b)(1)
Test Limit:	Refer to 47 CFR 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. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02

6.3.1 E.U.T. Operation:

Operating Environment:					
Temperature:	24.5 °C	Humidity:	44 %	Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3				

6.3.2 Test Setup Diagram:



6.3.3 Test Data:

Please Refer to Appendix for Details.

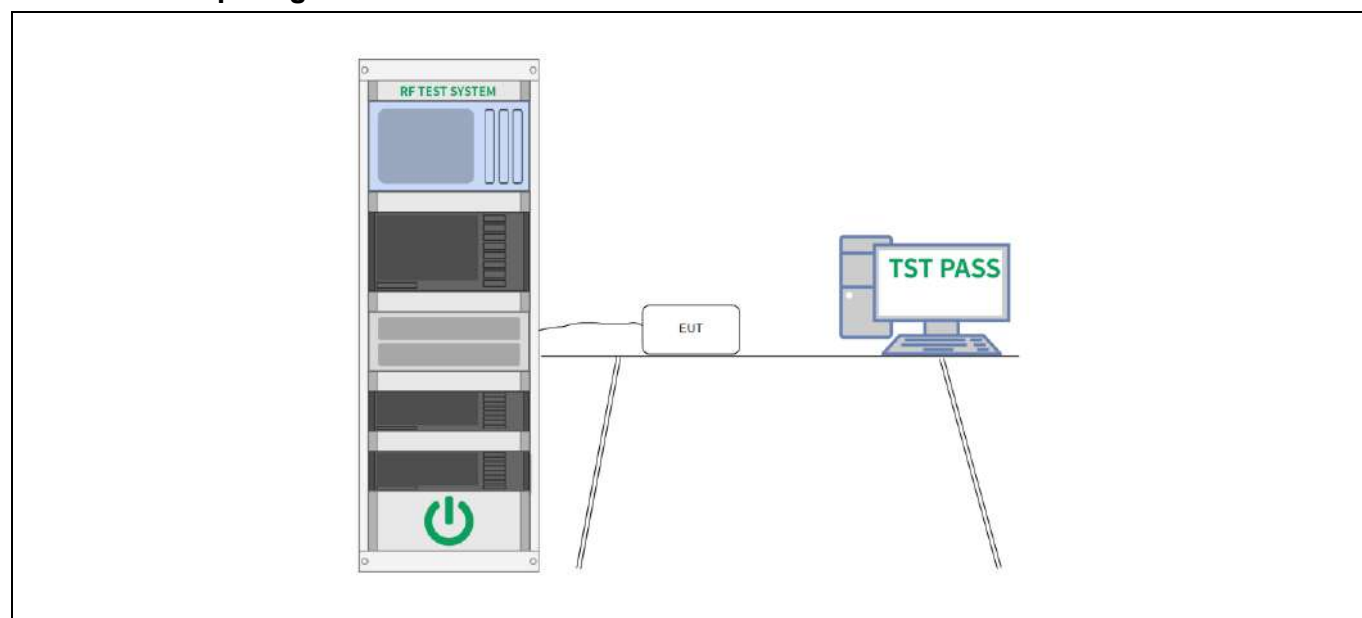
6.4 Channel Separation

Test Requirement:	47 CFR 15.247(a)(1)
Test Limit:	Refer to 47 CFR 15.247(a)(1), 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.
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02

6.4.1 E.U.T. Operation:

Operating Environment:					
Temperature:	24.5 °C	Humidity:	44 %	Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3				

6.4.2 Test Setup Diagram:



6.4.3 Test Data:

Please Refer to Appendix for Details.

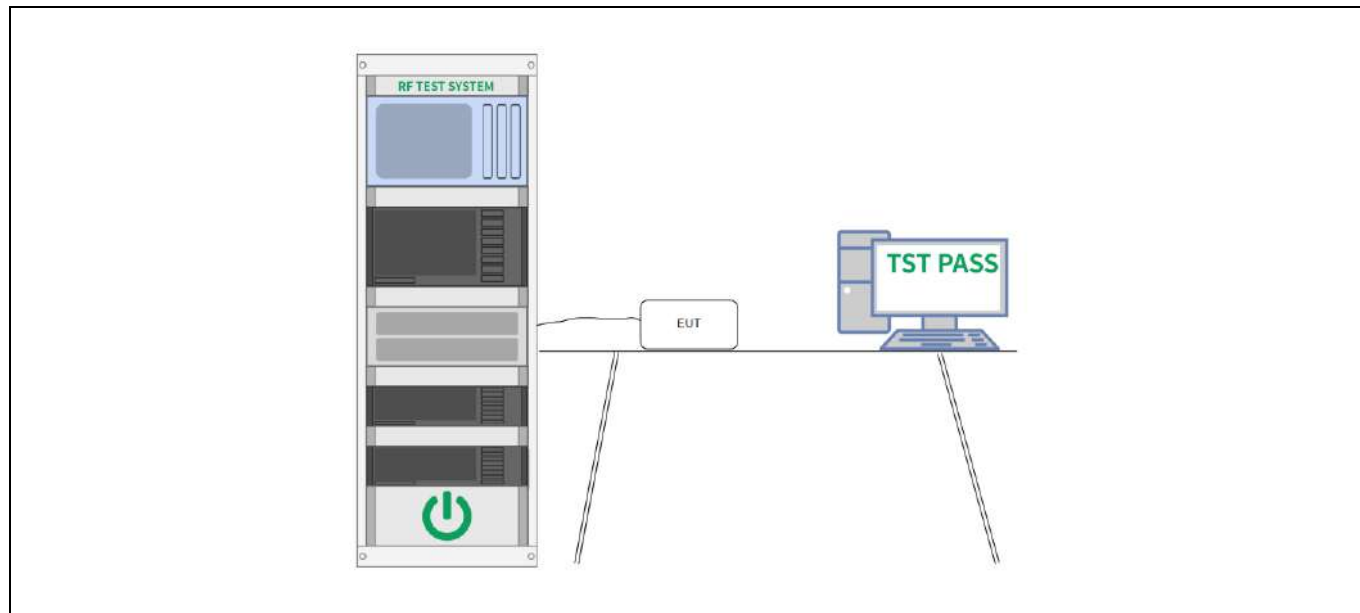
6.5 Number of Hopping Frequencies

Test Requirement:	47 CFR 15.247(a)(1)(iii)
Test Limit:	Refer to 47 CFR 15.247(a)(1)(iii), 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 Method:	KDB 558074 D01 15.247 Meas Guidance v05r02

6.5.1 E.U.T. Operation:

Operating Environment:					
Temperature:	24.5 °C	Humidity:	44 %	Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3				

6.5.2 Test Setup Diagram:



6.5.3 Test Data:

Please Refer to Appendix for Details.

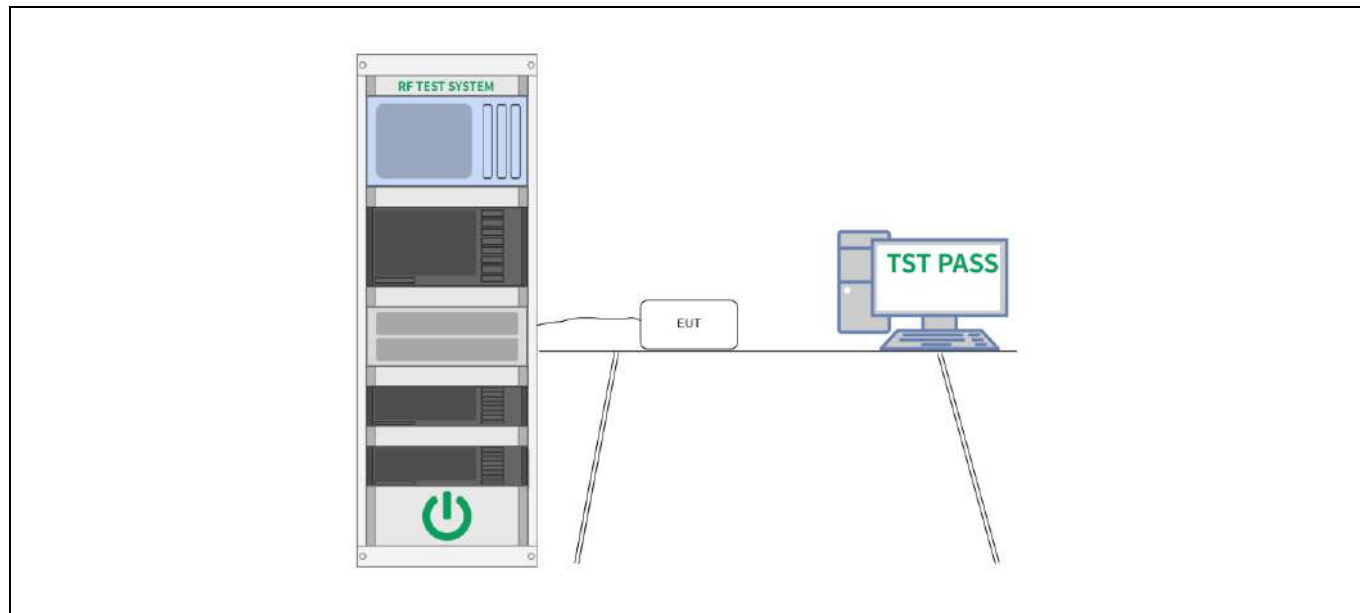
6.6 Dwell Time

Test Requirement:	47 CFR 15.247(a)(1)(iii)
Test Limit:	Refer to 47 CFR 15.247(a)(1)(iii), 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 Method:	KDB 558074 D01 15.247 Meas Guidance v05r02

6.6.1 E.U.T. Operation:

Operating Environment:					
Temperature:	24.5 °C	Humidity:	44 %	Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3				

6.6.2 Test Setup Diagram:



6.6.3 Test Data:

Please Refer to Appendix for Details.

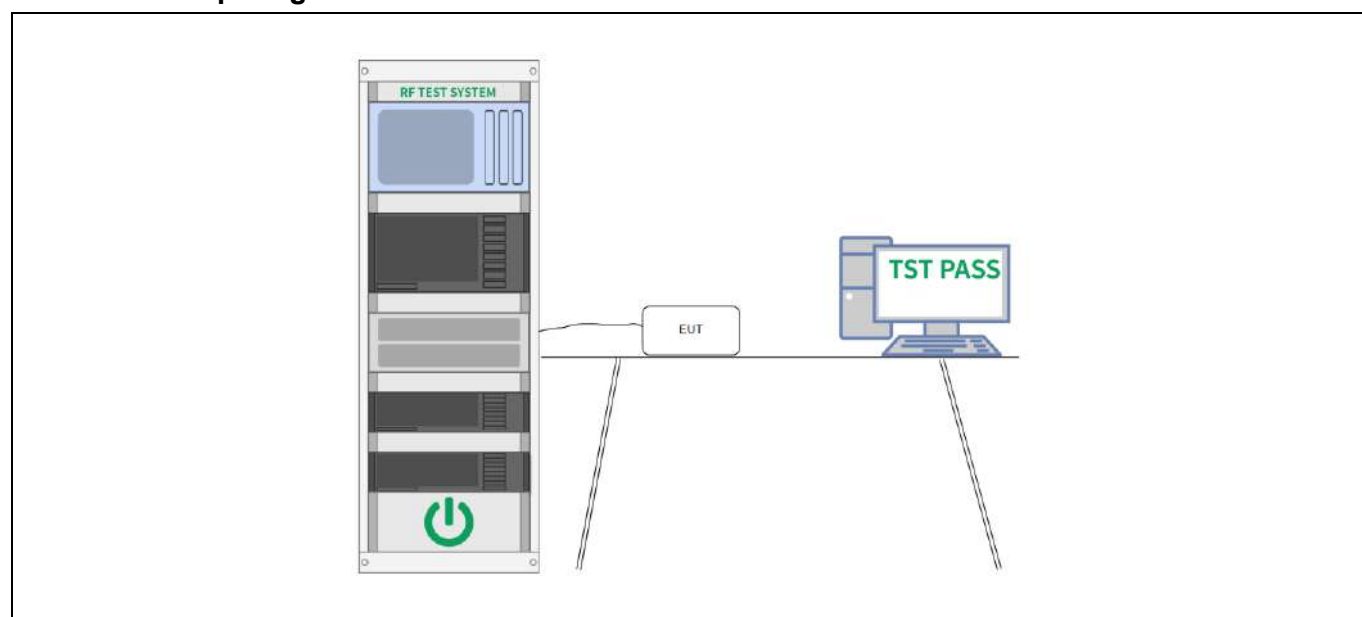
6.7 Emissions in non-restricted frequency bands

Test Requirement:	47 CFR 15.247(d)
Test Limit:	Refer to 47 CFR 15.247(d), 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.
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02

6.7.1 E.U.T. Operation:

Operating Environment:					
Temperature:	24.5 °C	Humidity:	44 %	Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3				

6.7.2 Test Setup Diagram:



6.7.3 Test Data:

Please Refer to Appendix for Details.

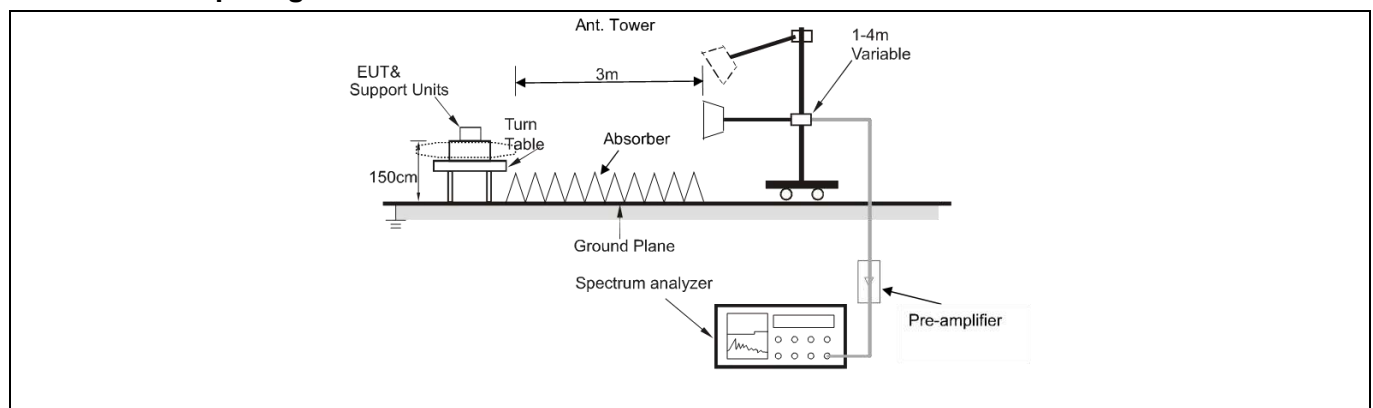
6.8 Band edge emissions (Radiated)

Test Requirement:	Refer to 47 CFR 15.247(d), 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 Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.			
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02		

6.8.1 E.U.T. Operation:

Operating Environment:			
Temperature:	24.9 °C	Humidity:	45 %
		Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3		
Final test mode:	All of the listed pre-test mode were tested, only the data of the worst mode (Mode1) is recorded in the report		
Note:	All other emissions are attenuated 20dB below the limit, so does not recorded.		

6.8.2 Test Setup Diagram:



6.8.3 Test Data:

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH00

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		2310.000	47.48	-8.08	39.40	74.00	-34.60	peak
2		2310.000	37.47	-8.08	29.39	54.00	-24.61	AVG
3		2390.000	52.86	-7.71	45.15	74.00	-28.85	peak
4	*	2390.000	38.16	-7.71	30.45	54.00	-23.55	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH00

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2310.000	47.66	-8.08	39.58	74.00	-34.42	peak
2		2310.000	37.37	-8.08	29.29	54.00	-24.71	AVG
3		2390.000	47.89	-7.71	40.18	74.00	-33.82	peak
4	*	2390.000	37.61	-7.71	29.90	54.00	-24.10	AVG

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH78

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	2483.500	62.46	-7.24	55.22	74.00	-18.78	peak
2		2483.500	41.98	-7.24	34.74	54.00	-19.26	AVG
3		2500.000	47.76	-7.17	40.59	74.00	-33.41	peak
4		2500.000	37.85	-7.17	30.68	54.00	-23.32	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH78

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	57.97	-7.24	50.73	74.00	-23.27	peak
2	*	2483.500	39.80	-7.24	32.56	54.00	-21.44	AVG
3		2500.000	48.23	-7.17	41.06	74.00	-32.94	peak
4		2500.000	37.89	-7.17	30.72	54.00	-23.28	AVG

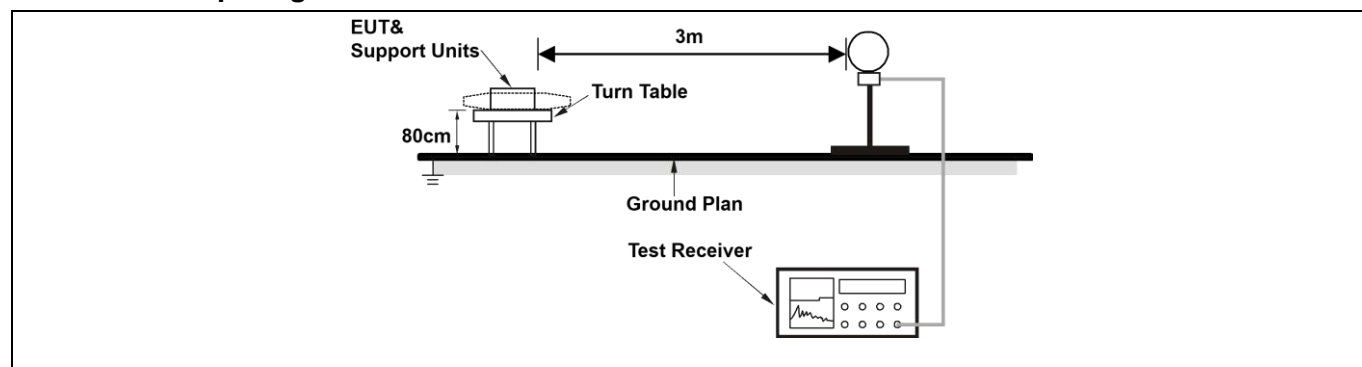
6.9 Emissions in restricted frequency bands (below 1GHz)

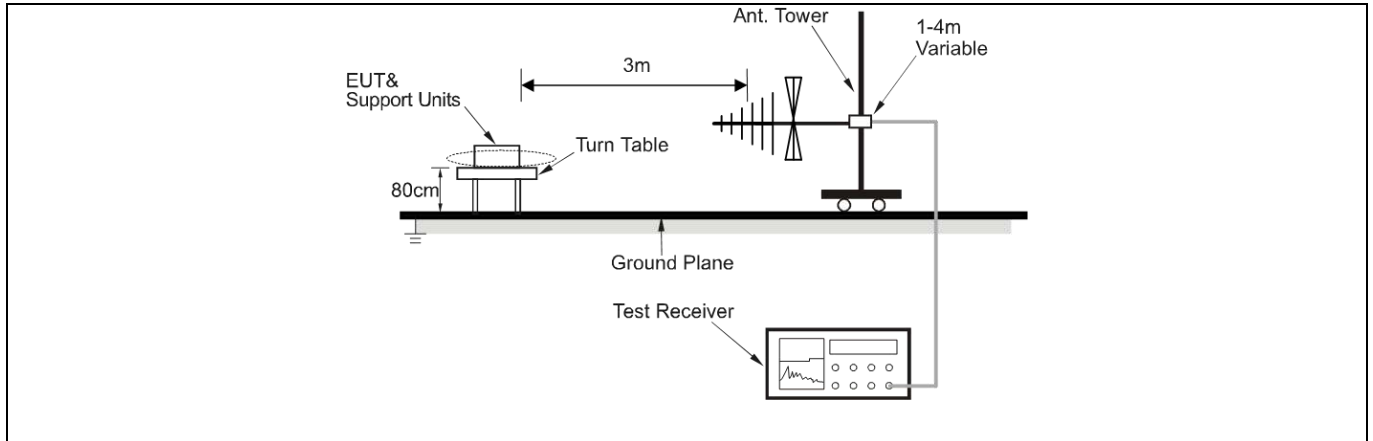
Test Requirement:	Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`		
Test Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.			
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02		

6.9.1 E.U.T. Operation:

Operating Environment:					
Temperature:	24.9 °C	Humidity:	55 %	Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3				
Final test mode:	All of the listed pre-test mode were tested, only the data of the worst mode (Mode1) is recorded in the report				
Note: The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported. All modes of operation of the EUT were investigated, and only the worst-case results are reported. There were no emissions found below 30MHz within 20dB of the limit.					

6.9.2 Test Setup Diagram:

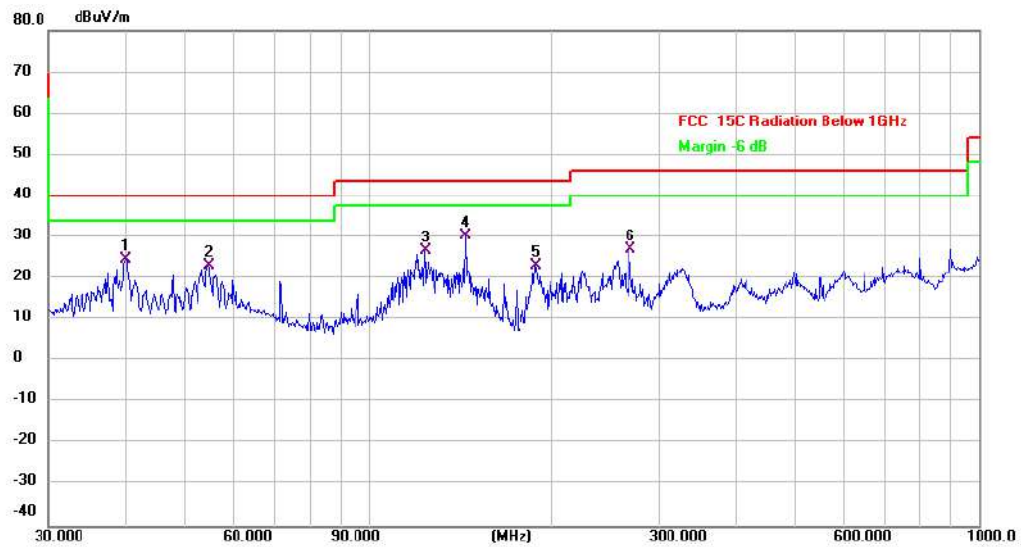




Test Data:

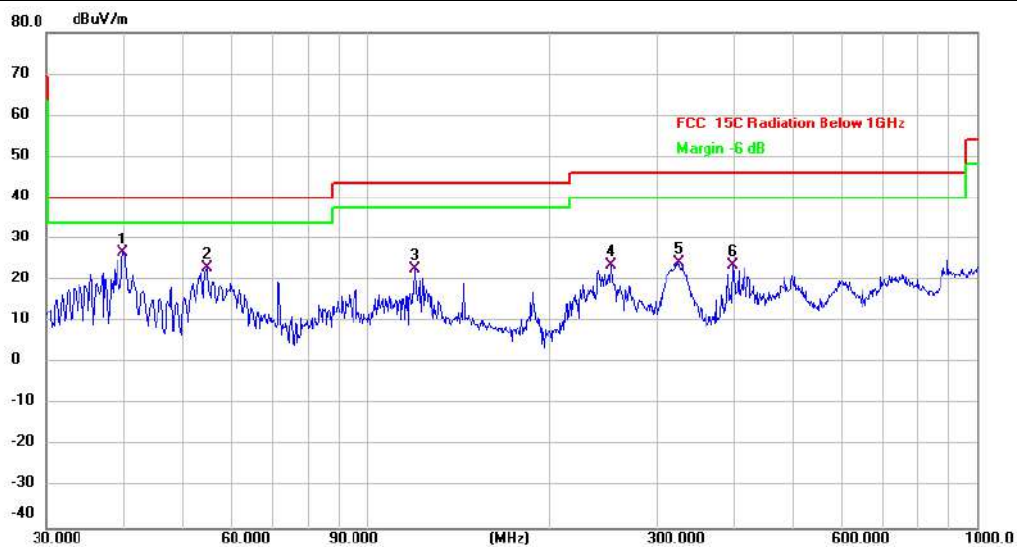
MINI140 PRO:

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH78



No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	40.1347	37.82	-13.29	24.53	40.00	-15.47	QP	
2	54.6429	35.92	-12.63	23.29	40.00	-16.71	QP	
3	123.2655	42.37	-15.74	26.63	43.50	-16.87	QP	
4 *	143.8295	43.93	-13.64	30.29	43.50	-13.21	QP	
5	187.7530	40.76	-17.61	23.15	43.50	-20.35	QP	
6	268.4853	41.89	-14.76	27.13	46.00	-18.87	QP	

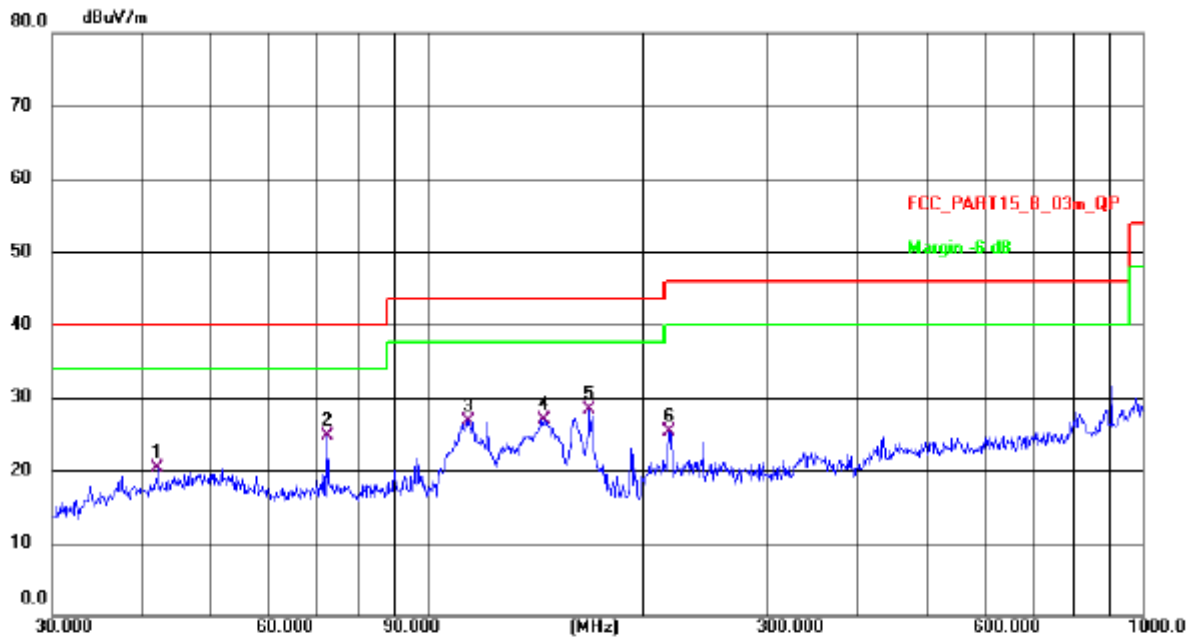
Mode1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH78



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	39.9942	40.01	-13.34	26.67	40.00	-13.33	QP	
2		54.8348	35.73	-12.60	23.13	40.00	-16.87	QP	
3		119.8556	38.10	-15.24	22.86	43.50	-20.64	QP	
4		252.0627	38.68	-14.88	23.80	46.00	-22.20	QP	
5		324.4561	34.77	-10.47	24.30	46.00	-21.70	QP	
6		399.0302	35.35	-11.48	23.87	46.00	-22.13	QP	

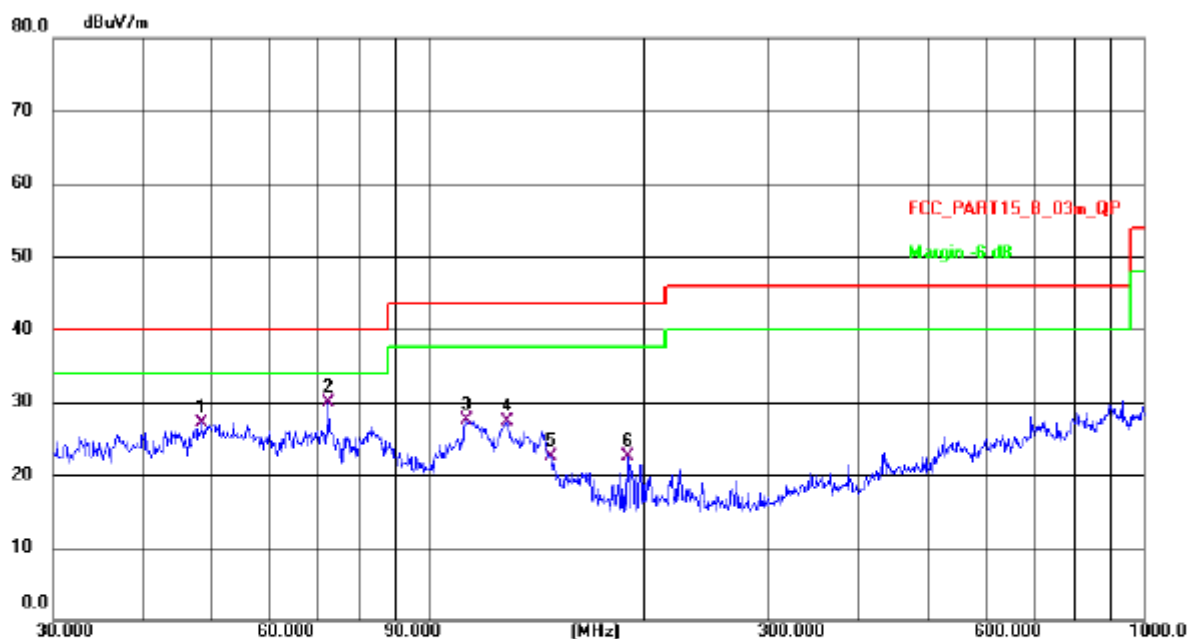
MINI140:

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH78



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		42.1540	29.14	-8.78	20.36	40.00	-19.64	QP	
2		72.8465	36.63	-12.01	24.62	40.00	-15.38	QP	
3		114.5146	37.16	-10.45	26.71	43.50	-16.79	QP	
4		145.8608	40.17	-13.18	26.99	43.50	-16.51	QP	
5	*	169.0053	40.46	-12.13	28.33	43.50	-15.17	QP	
6		218.3084	34.39	-9.04	25.35	46.00	-20.65	QP	

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH78



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		48.5015	35.20	-8.11	27.09	40.00	-12.91	QP	
2	*	72.8465	41.86	-12.01	29.85	40.00	-10.15	QP	
3		113.3161	37.72	-10.24	27.48	43.50	-16.02	QP	
4		129.0141	39.92	-12.70	27.22	43.50	-16.28	QP	
5		148.4410	35.65	-13.06	22.59	43.50	-20.91	QP	
6		190.4050	32.96	-10.43	22.53	43.50	-20.97	QP	

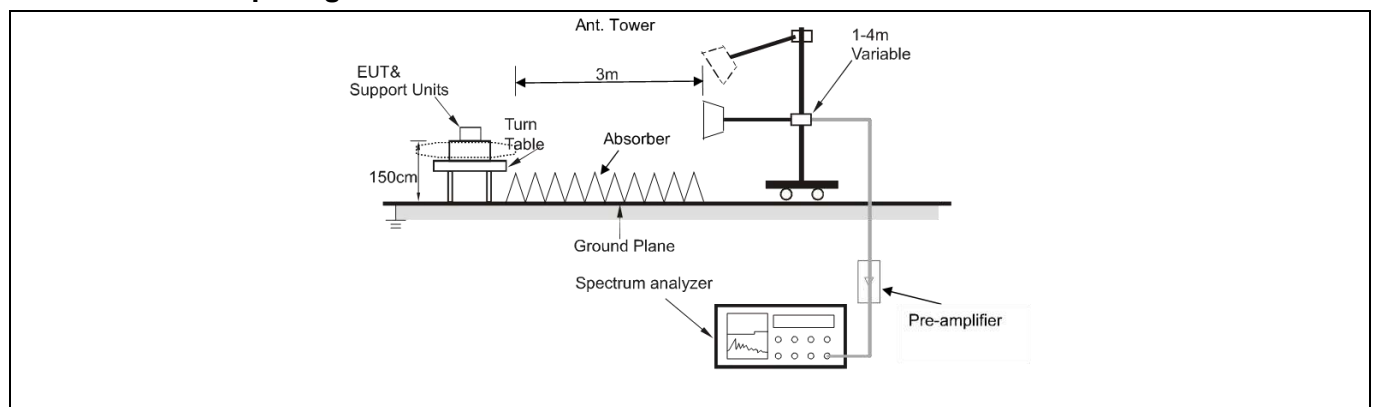
6.10 Emissions in restricted frequency bands (above 1GHz)

Test Requirement:	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 Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.			
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02		

6.10.1 E.U.T. Operation:

Operating Environment:					
Temperature:	21.9 °C	Humidity:	61.9 %	Atmospheric Pressure:	100 kPa
Test mode:	Mode1, Mode2, Mode3				
Final test mode:	All of the listed pre-test mode were tested, only the data of the worst mode (Mode1) is recorded in the report				
Note: Test frequency are from 1GHz to 25GHz, the amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported. All modes of operation of the EUT were investigated, and only the worst-case results are reported.					

6.10.2 Test Setup Diagram:



6.10.3 Test Data:

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH00

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4804.000	42.85	0.74	43.59	74.00	-30.41	peak
2		4804.000	36.55	0.74	37.29	54.00	-16.71	AVG
3		7206.000	40.56	6.02	46.58	74.00	-27.42	peak
4		7206.000	34.20	6.02	40.22	54.00	-13.78	AVG
5		9608.000	40.96	5.88	46.84	74.00	-27.16	peak
6	*	9608.000	34.60	5.88	40.48	54.00	-13.52	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH00

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4804.000	41.09	0.74	41.83	74.00	-32.17	peak
2		4804.000	34.59	0.74	35.33	54.00	-18.67	AVG
3		7206.000	40.54	6.02	46.56	74.00	-27.44	peak
4		7206.000	34.39	6.02	40.41	54.00	-13.59	AVG
5		9608.000	41.65	5.88	47.53	74.00	-26.47	peak
6	*	9608.000	35.41	5.88	41.29	54.00	-12.71	AVG

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH39

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4882.000	41.05	1.05	42.10	74.00	-31.90	peak
2		4882.000	35.00	1.05	36.05	54.00	-17.95	AVG
3		7323.000	39.55	5.94	45.49	74.00	-28.51	peak
4		7323.000	33.28	5.94	39.22	54.00	-14.78	AVG
5		9764.000	40.47	6.55	47.02	74.00	-26.98	peak
6	*	9764.000	33.93	6.55	40.48	54.00	-13.52	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH39

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4882.000	40.46	1.05	41.51	74.00	-32.49	peak
2		4882.000	34.21	1.05	35.26	54.00	-18.74	AVG
3		7323.000	40.74	5.94	46.68	74.00	-27.32	peak
4		7323.000	34.39	5.94	40.33	54.00	-13.67	AVG
5		9764.000	41.46	6.55	48.01	74.00	-25.99	peak
6	*	9764.000	35.04	6.55	41.59	54.00	-12.41	AVG

Mode1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH78

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4960.000	40.99	1.50	42.49	74.00	-31.51	peak
2		4960.000	34.72	1.50	36.22	54.00	-17.78	AVG
3		7440.000	40.17	5.61	45.78	74.00	-28.22	peak
4		7440.000	33.73	5.61	39.34	54.00	-14.66	AVG
5		9920.000	40.73	6.10	46.83	74.00	-27.17	peak
6	*	9920.000	34.31	6.10	40.41	54.00	-13.59	AVG

Mode1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH78

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4960.000	41.32	1.50	42.82	74.00	-31.18	peak
2		4960.000	34.73	1.50	36.23	54.00	-17.77	AVG
3		7440.000	39.95	5.61	45.56	74.00	-28.44	peak
4		7440.000	33.80	5.61	39.41	54.00	-14.59	AVG
5		9920.000	41.06	6.10	47.16	74.00	-26.84	peak
6	*	9920.000	35.01	6.10	41.11	54.00	-12.89	AVG

Photographs of the test setup

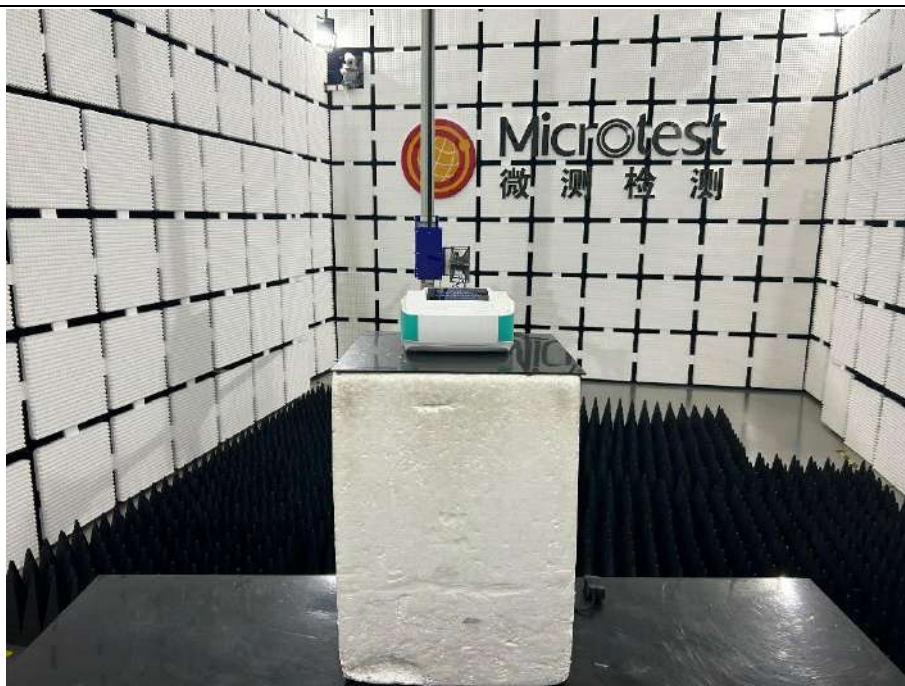
Conducted Emission at AC power line



Receiver spurious emissions (30MHz to 1GHz)



Receiver spurious emissions (above 1GHz)



Photographs of the EUT

Refer to Appendix - EUT Photos

Appendix

Appendix A: 20dB Emission Bandwidth

Test Result

Test Mode	Antenna	Frequency [MHz]	20db EBW [MHz]
DH5	Ant1	2402	0.864
		2441	0.867
		2480	0.813
2DH5	Ant1	2402	1.215
		2441	1.227
		2480	1.242
3DH5	Ant1	2402	1.233
		2441	1.242
		2480	1.245

Test Graphs





2DH5 Ant1_2441



2DH5 Ant1_2480



3DH5 Ant1_2402



3DH5 Ant1_2441



3DH5 Ant1_2480

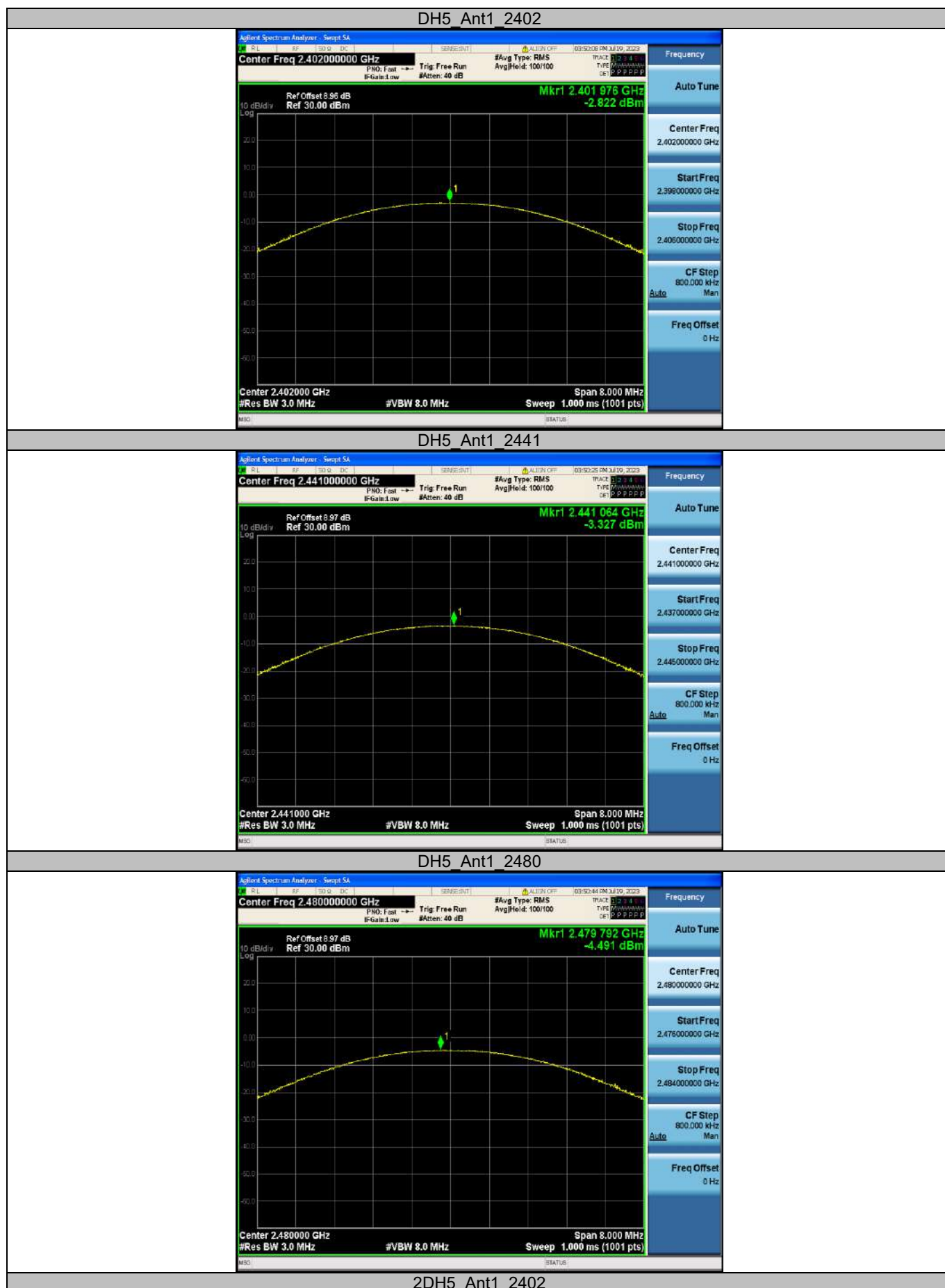


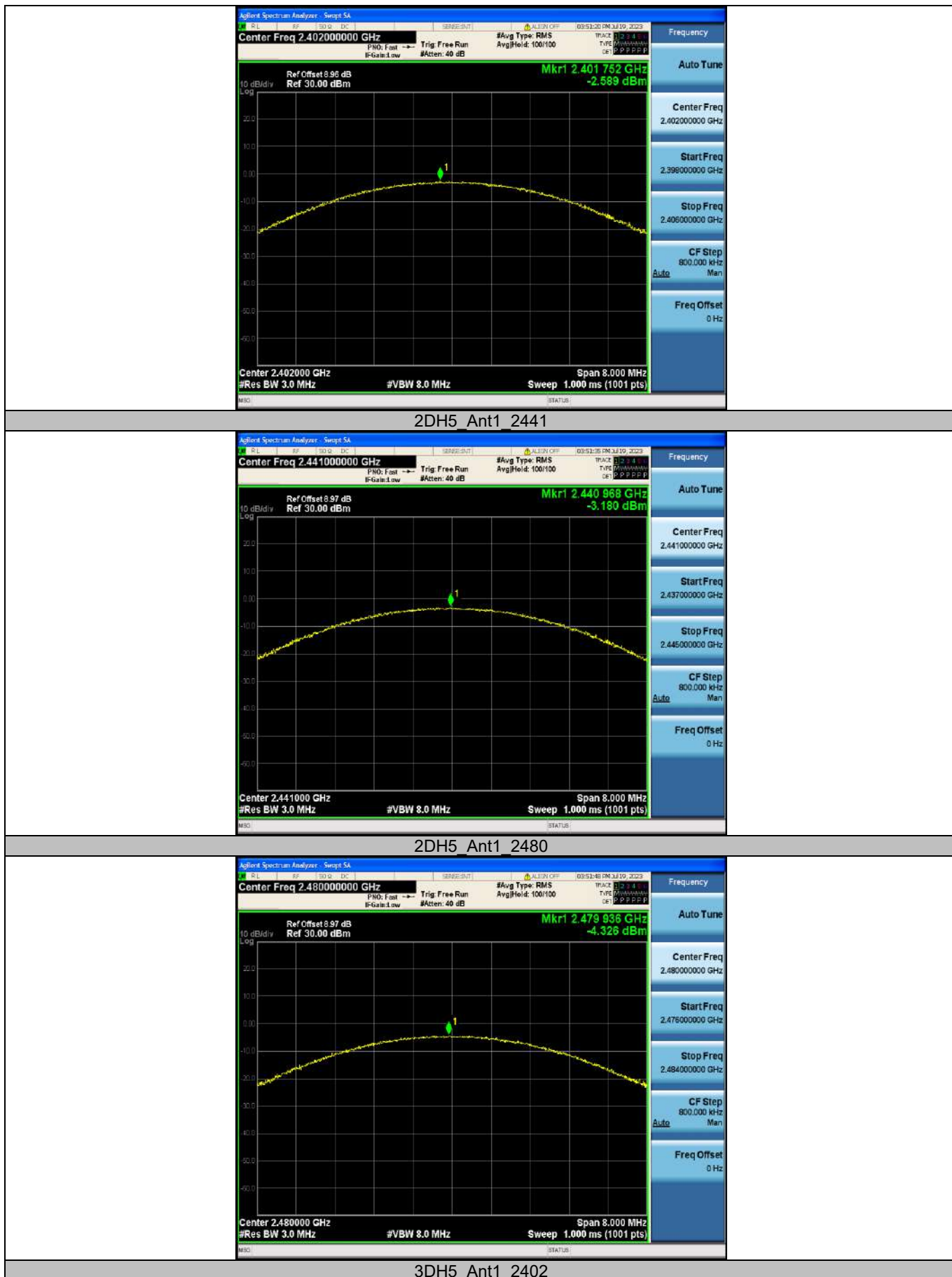
Appendix B: Maximum conducted output power

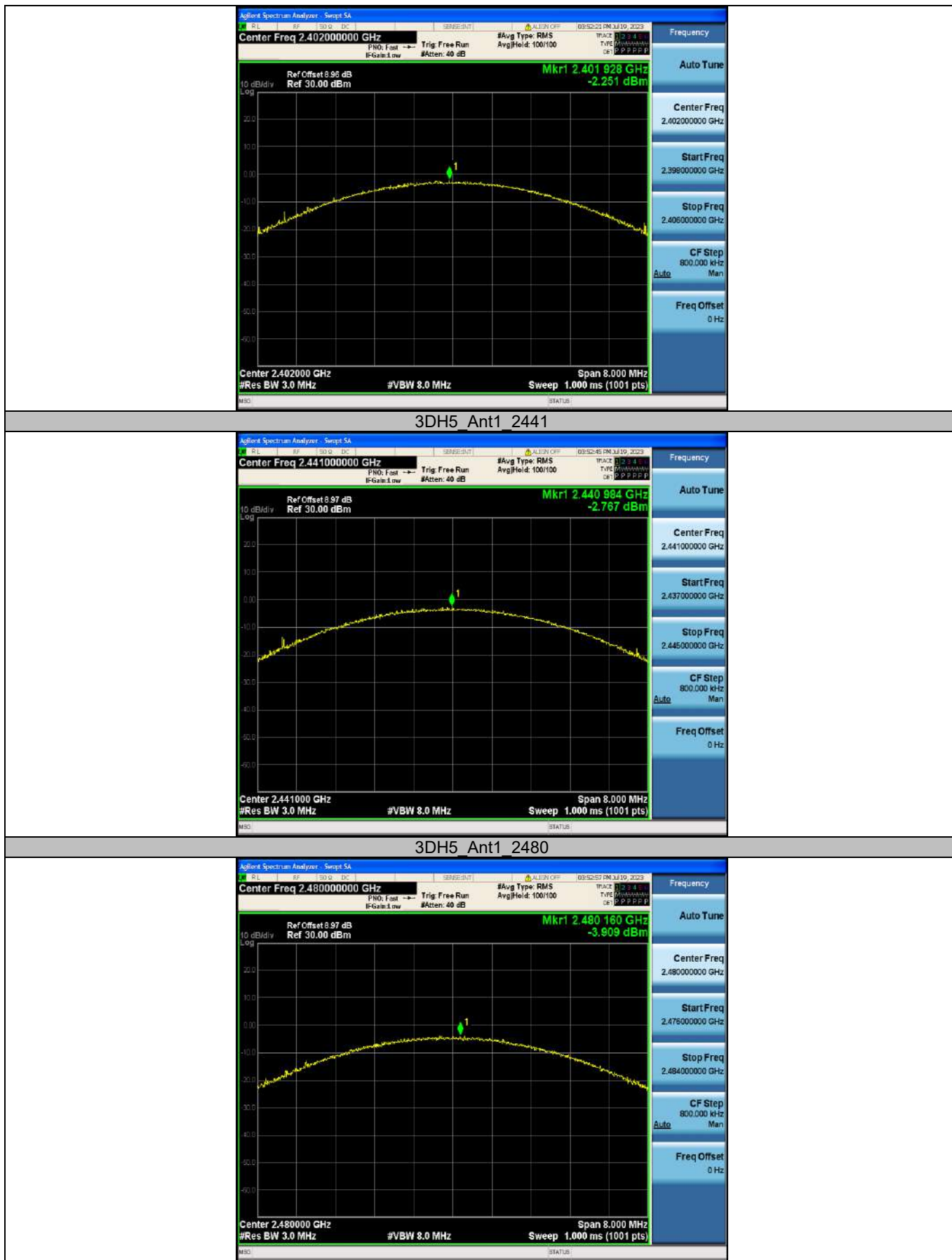
Test Result Peak

Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	-2.82	≤30	PASS
		2441	-3.33	≤30	PASS
		2480	-4.49	≤30	PASS
2DH5	Ant1	2402	-2.59	≤20.97	PASS
		2441	-3.18	≤20.97	PASS
		2480	-4.33	≤20.97	PASS
3DH5	Ant1	2402	-2.25	≤20.97	PASS
		2441	-2.77	≤20.97	PASS
		2480	-3.91	≤20.97	PASS

Test Graphs







Appendix C: Carrier frequency separation

Test Result

Test Mode	Antenna	Frequency [MHz]	Result [MHz]	Limit [MHz]	Verdict
DH5	Ant1	Hop	0.998	≥ 0.867	PASS
2DH5	Ant1	Hop	1	≥ 0.828	PASS
3DH5	Ant1	Hop	1	≥ 0.830	PASS

Test Graphs



Appendix D: Time of occupancy

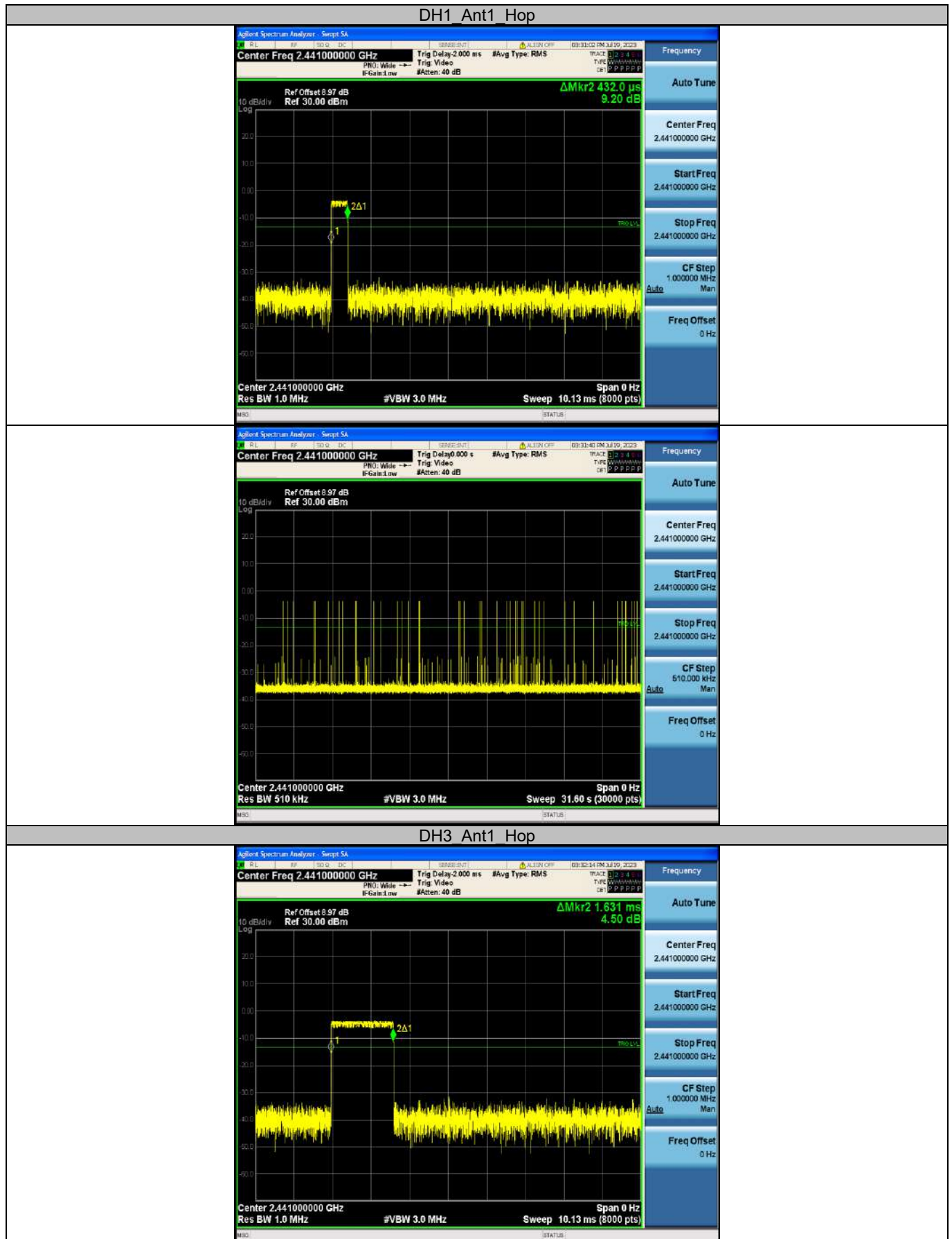
Test Result

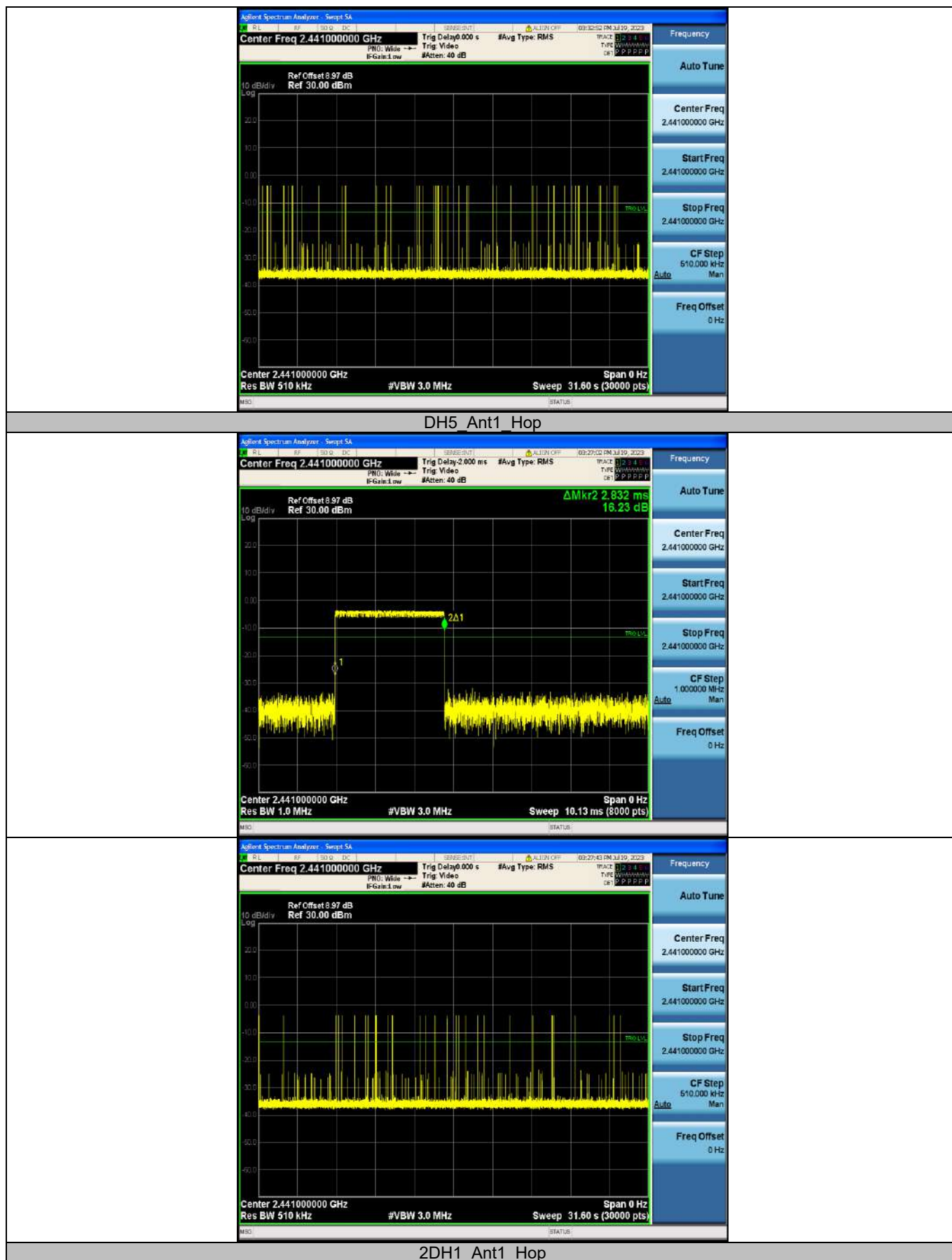
Test Mode	Antenna	Frequency [MHz]	BurstWidth [ms]	Hops in 31.6s [Num]	Result [s]	Limit [s]	Verdict
DH1	Ant1	Hop	0.432	43	0.019	≤0.4	PASS
DH3	Ant1	Hop	1.631	53	0.086	≤0.4	PASS
DH5	Ant1	Hop	2.832	31	0.088	≤0.4	PASS
2DH1	Ant1	Hop	0.491	45	0.022	≤0.4	PASS
2DH3	Ant1	Hop	1.691	39	0.066	≤0.4	PASS
2DH5	Ant1	Hop	2.892	42	0.121	≤0.4	PASS
3DH1	Ant1	Hop	0.418	56	0.023	≤0.4	PASS
3DH3	Ant1	Hop	1.671	42	0.07	≤0.4	PASS
3DH5	Ant1	Hop	2.764	39	0.108	≤0.4	PASS

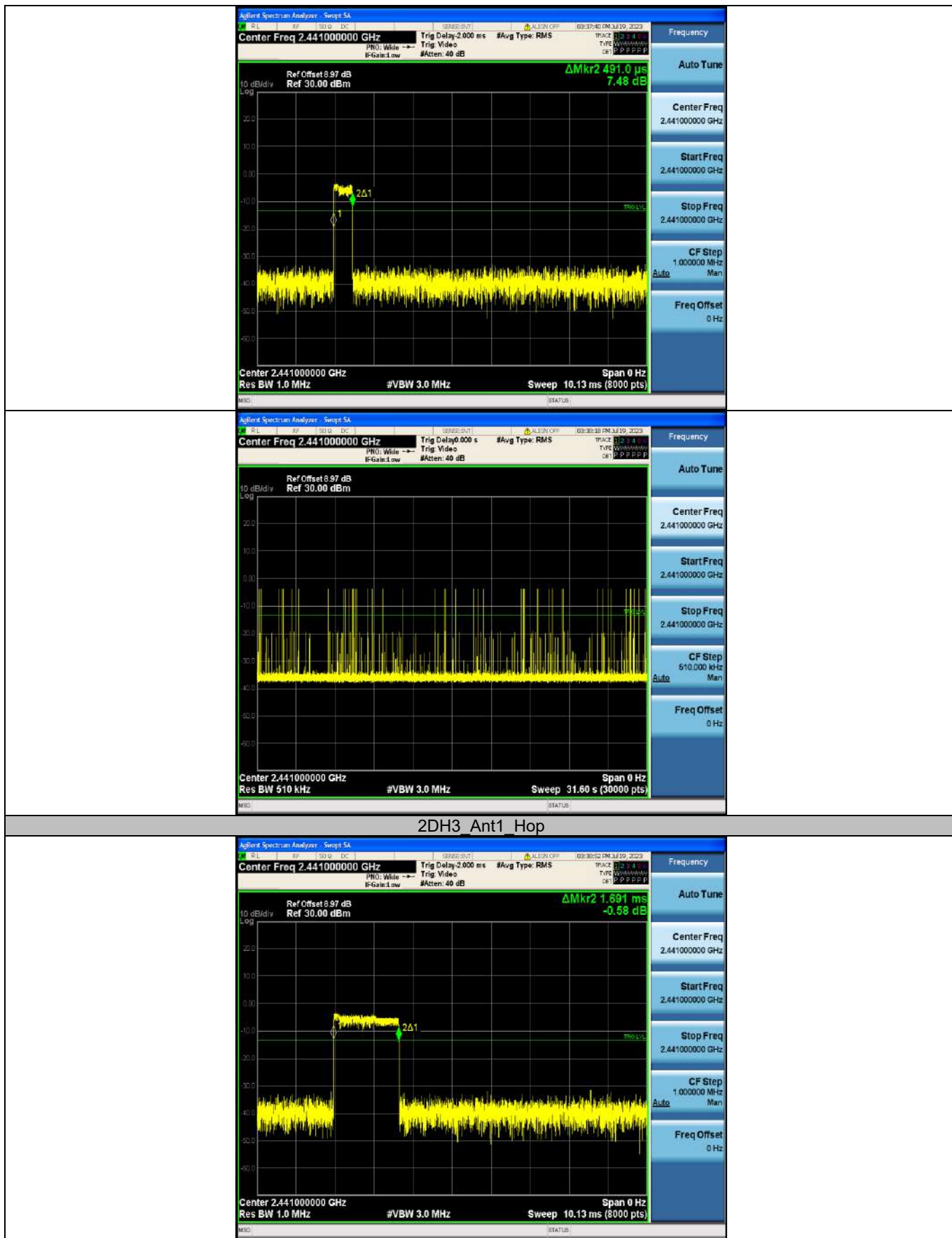
Notes:

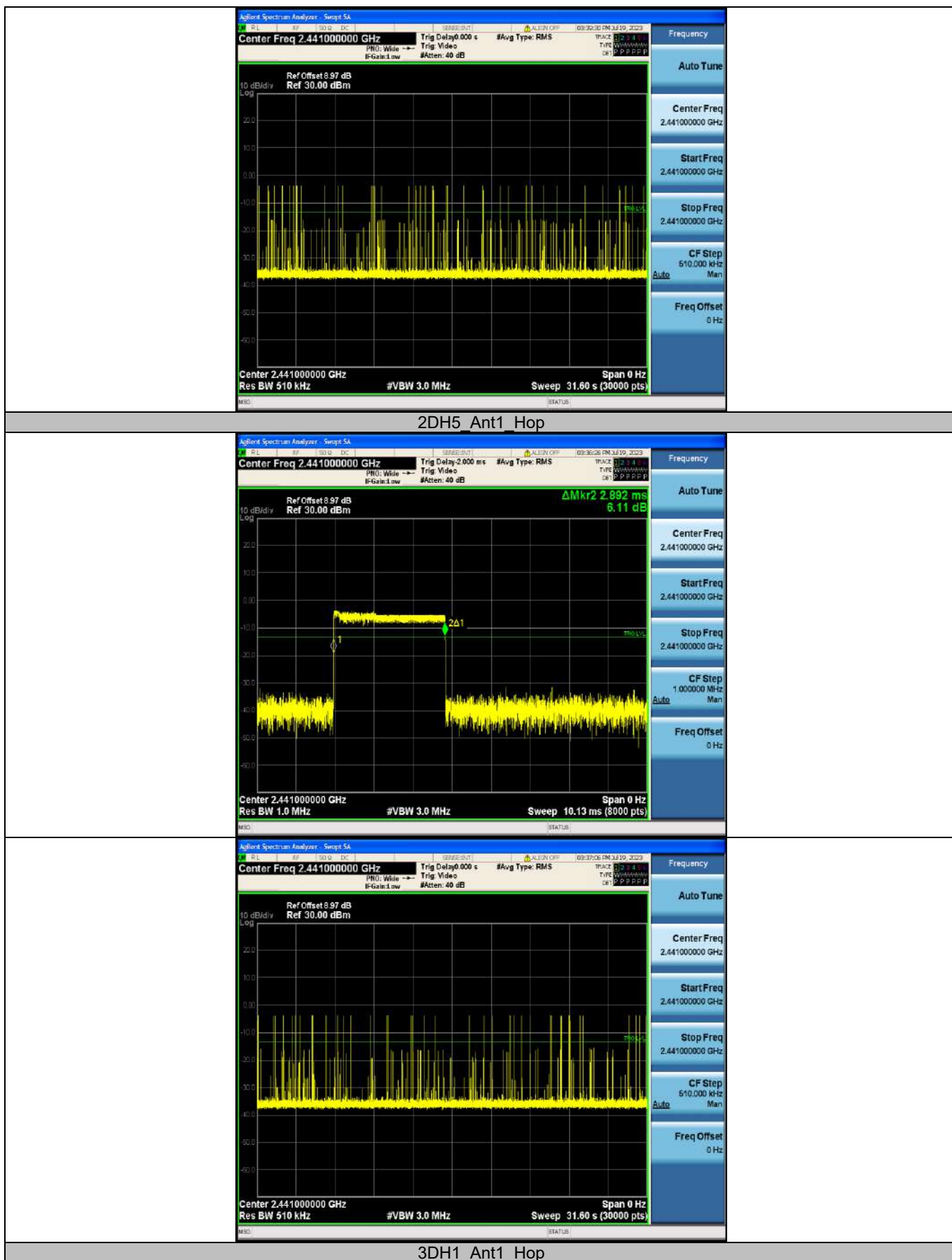
1. Period time = 0.4s * 79 = 31.6s
2. Result (Time of occupancy) = BurstWidth[ms] * Hops in 31.6s [Num]

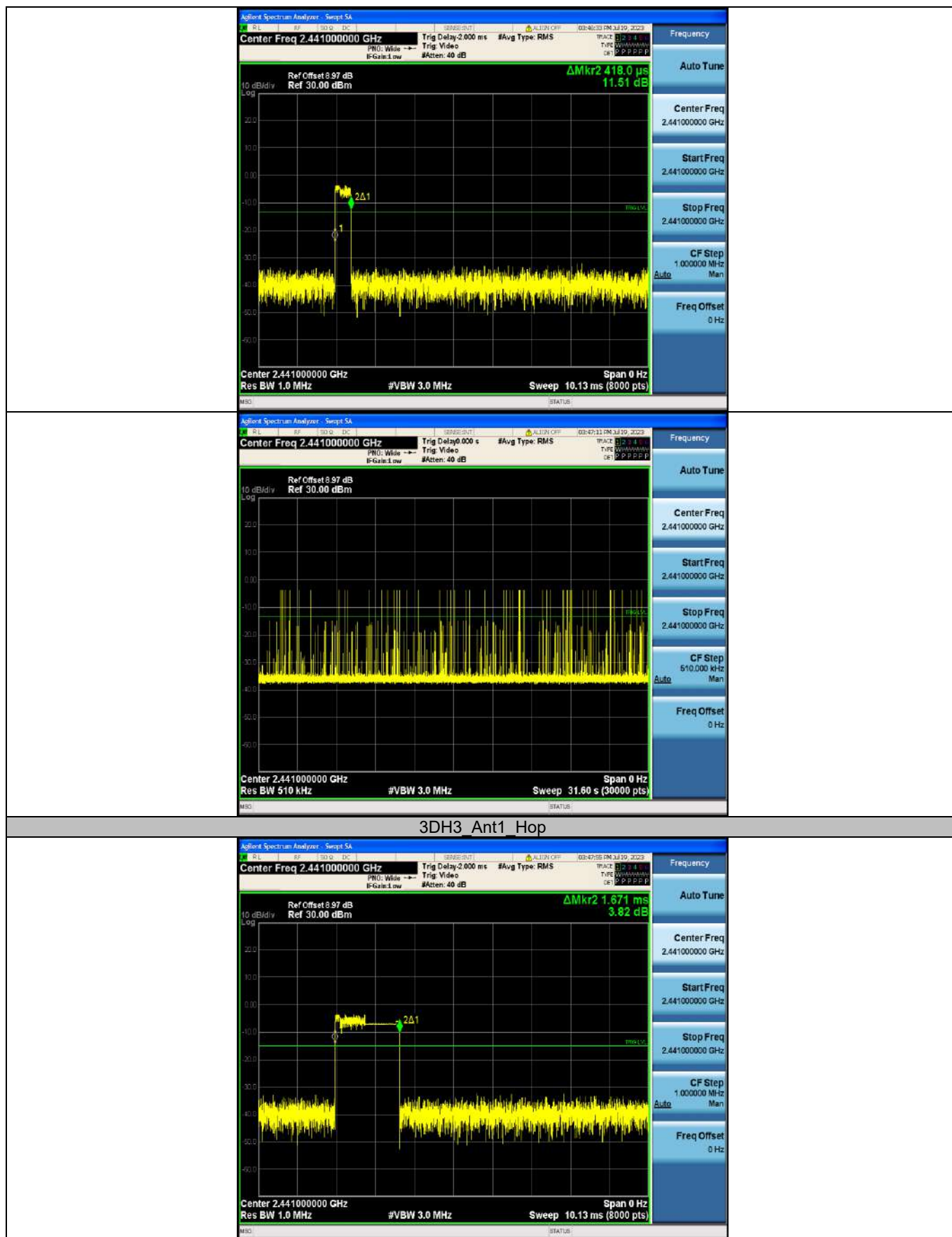
Test Graphs

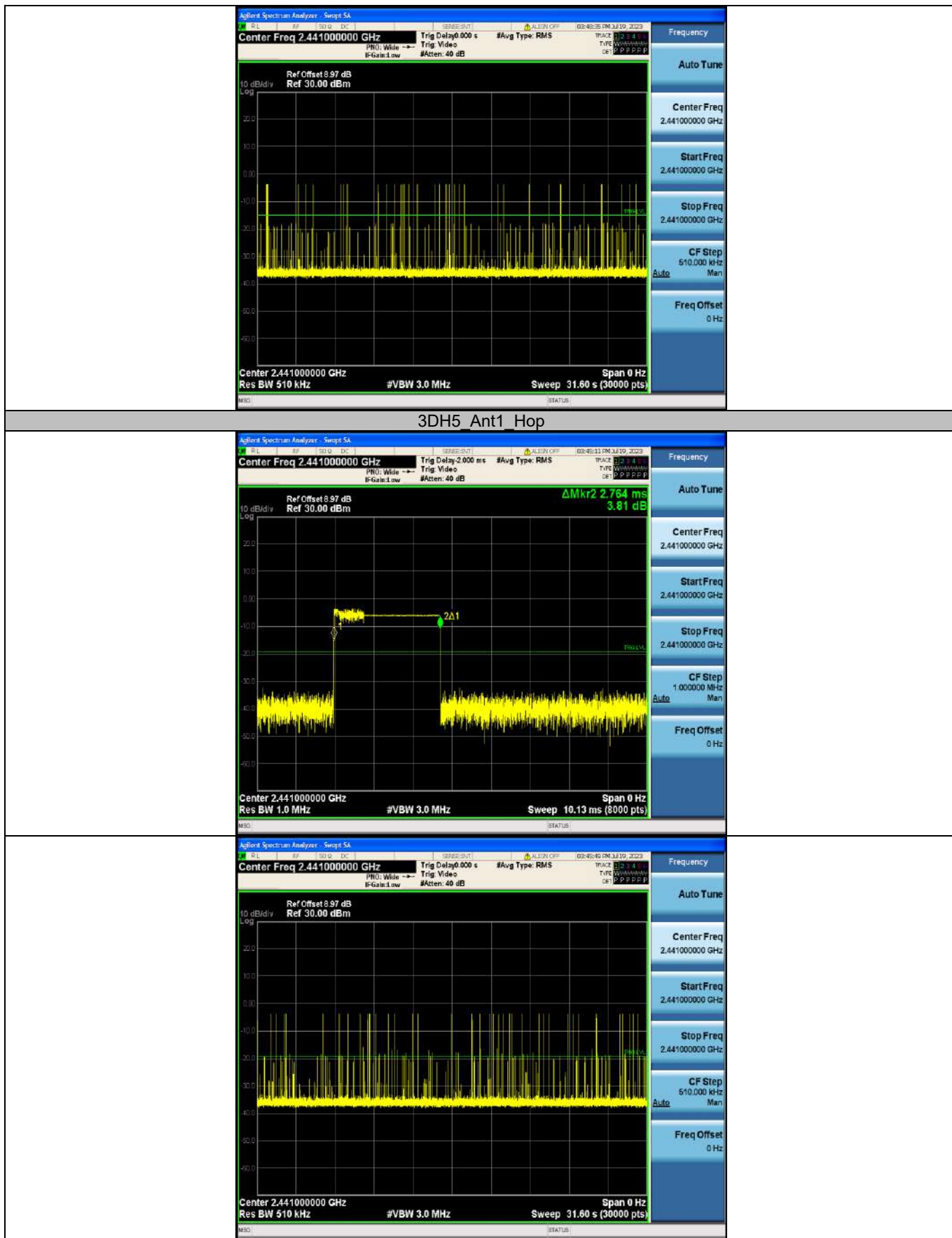










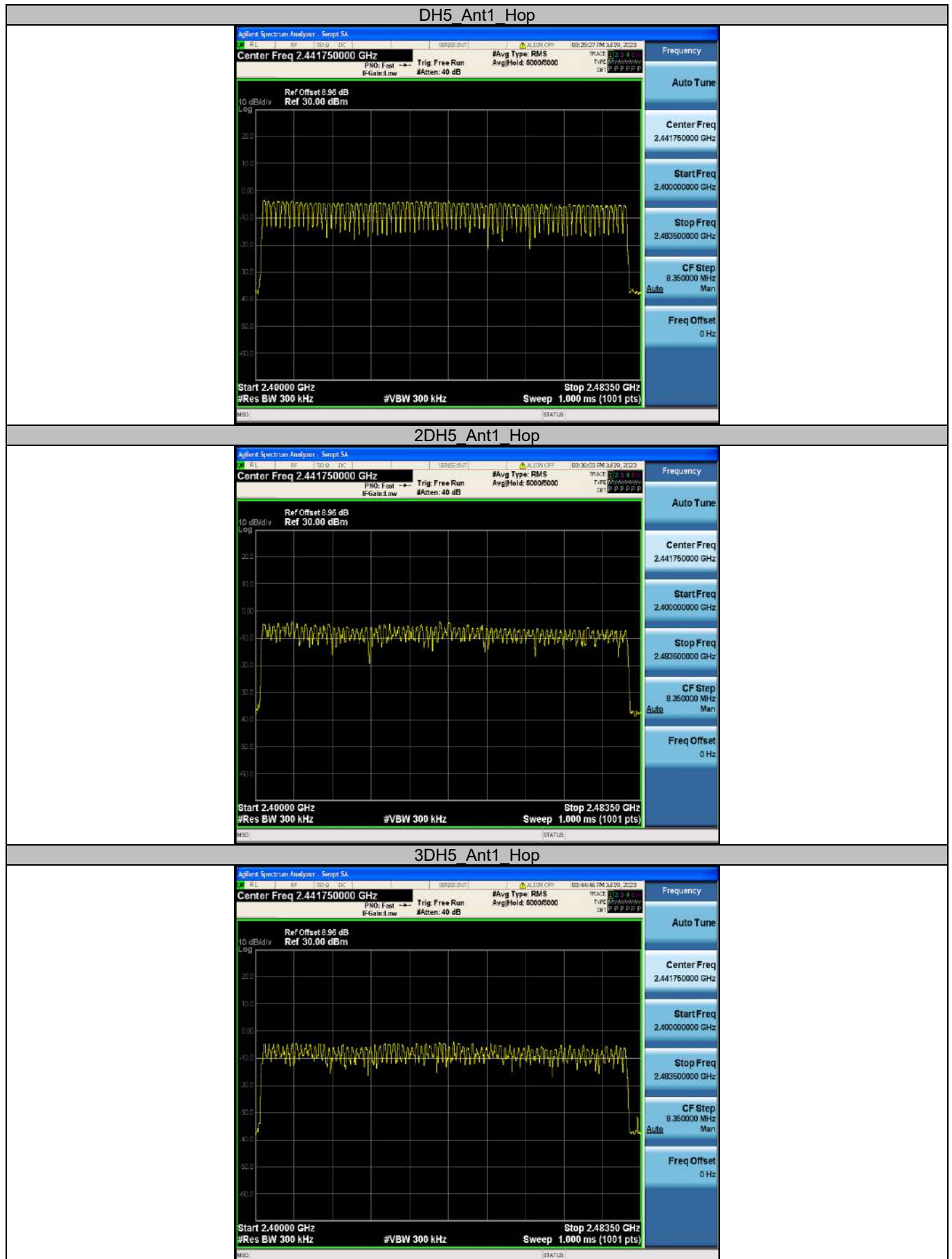


Appendix E: Number of hopping channels

Test Result

Test Mode	Antenna	Frequency [MHz]	Result [Num]	Limit [Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	Ant1	Hop	79	≥15	PASS

Test Graphs

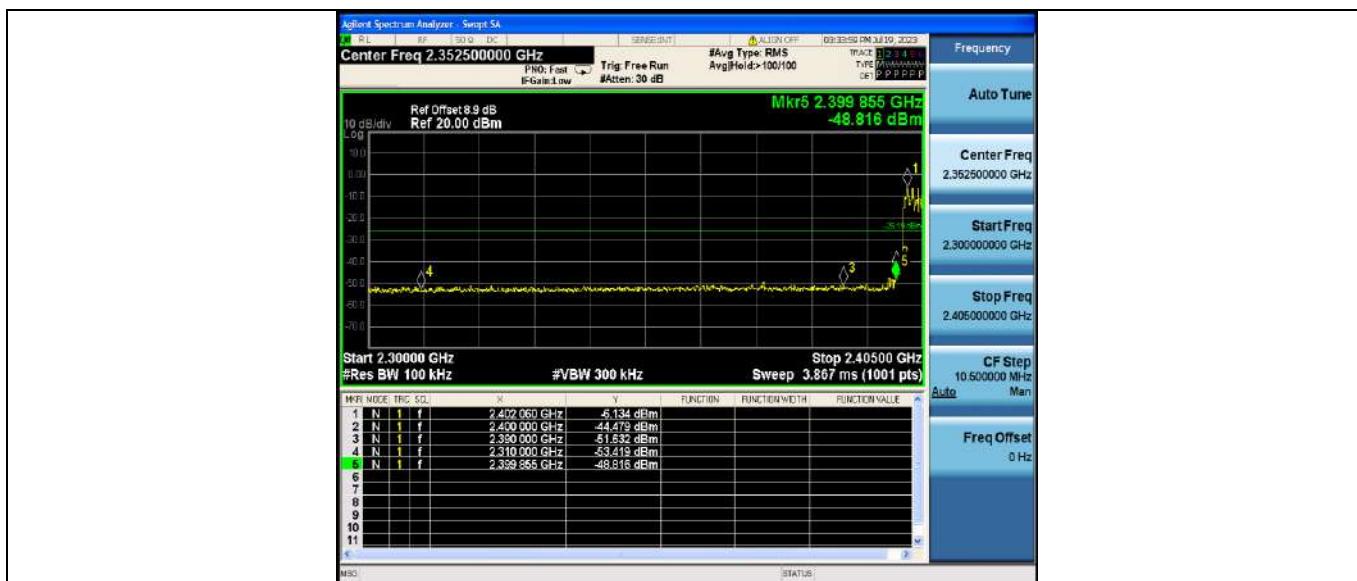


Appendix F: Band edge measurements

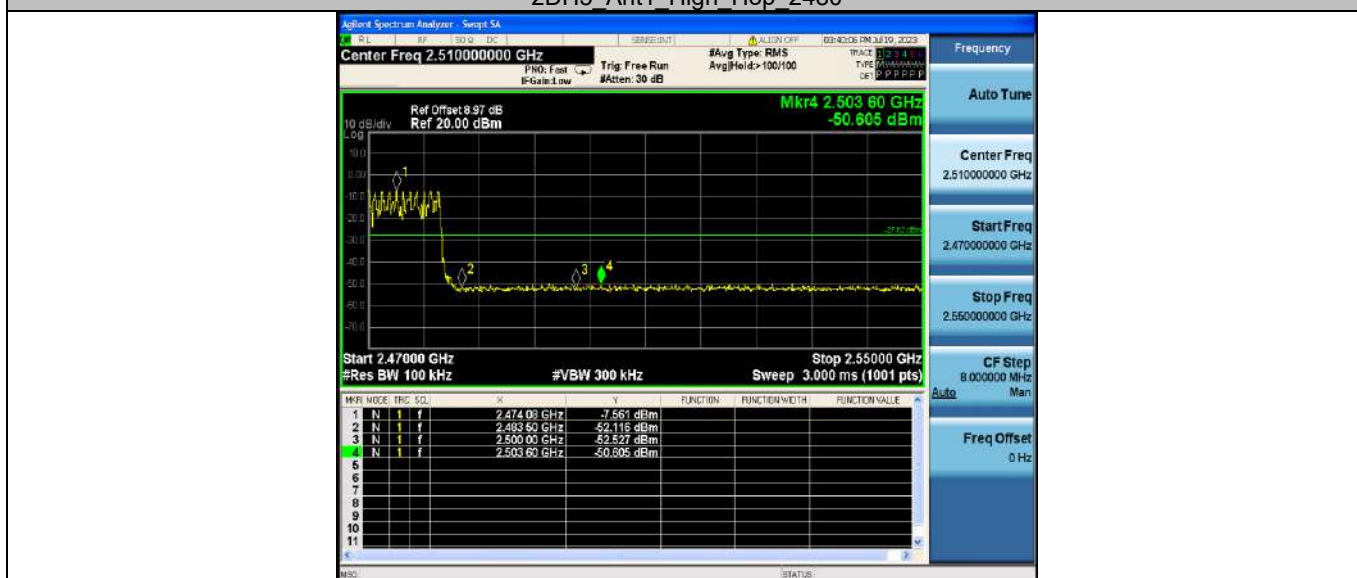
Test Graphs



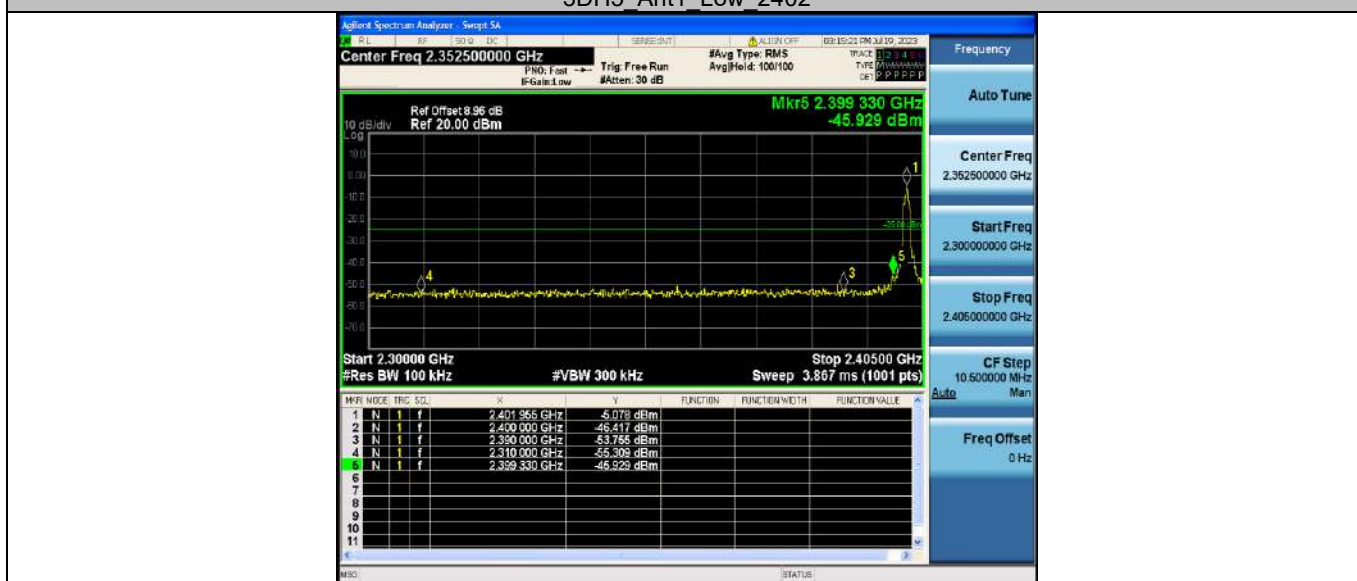




2DH5 Ant1 High Hop 2480



3DH5 Ant1 Low 2402



3DH5 Ant1 High 2480



Appendix G: Conducted Spurious Emission

Test Graphs





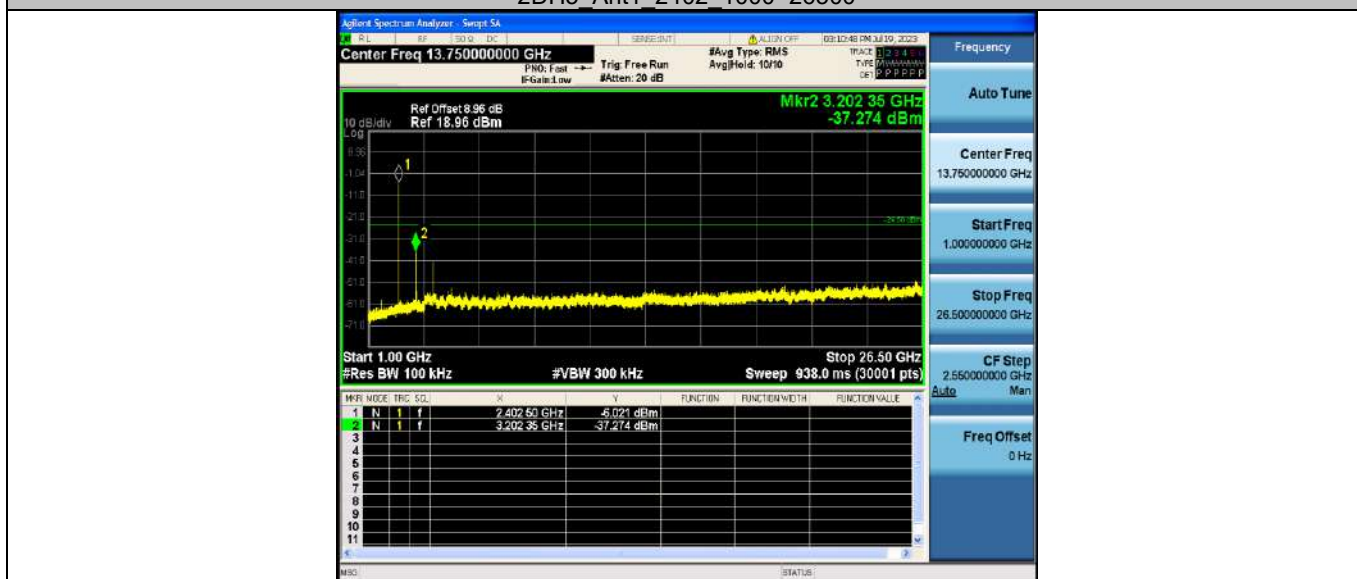




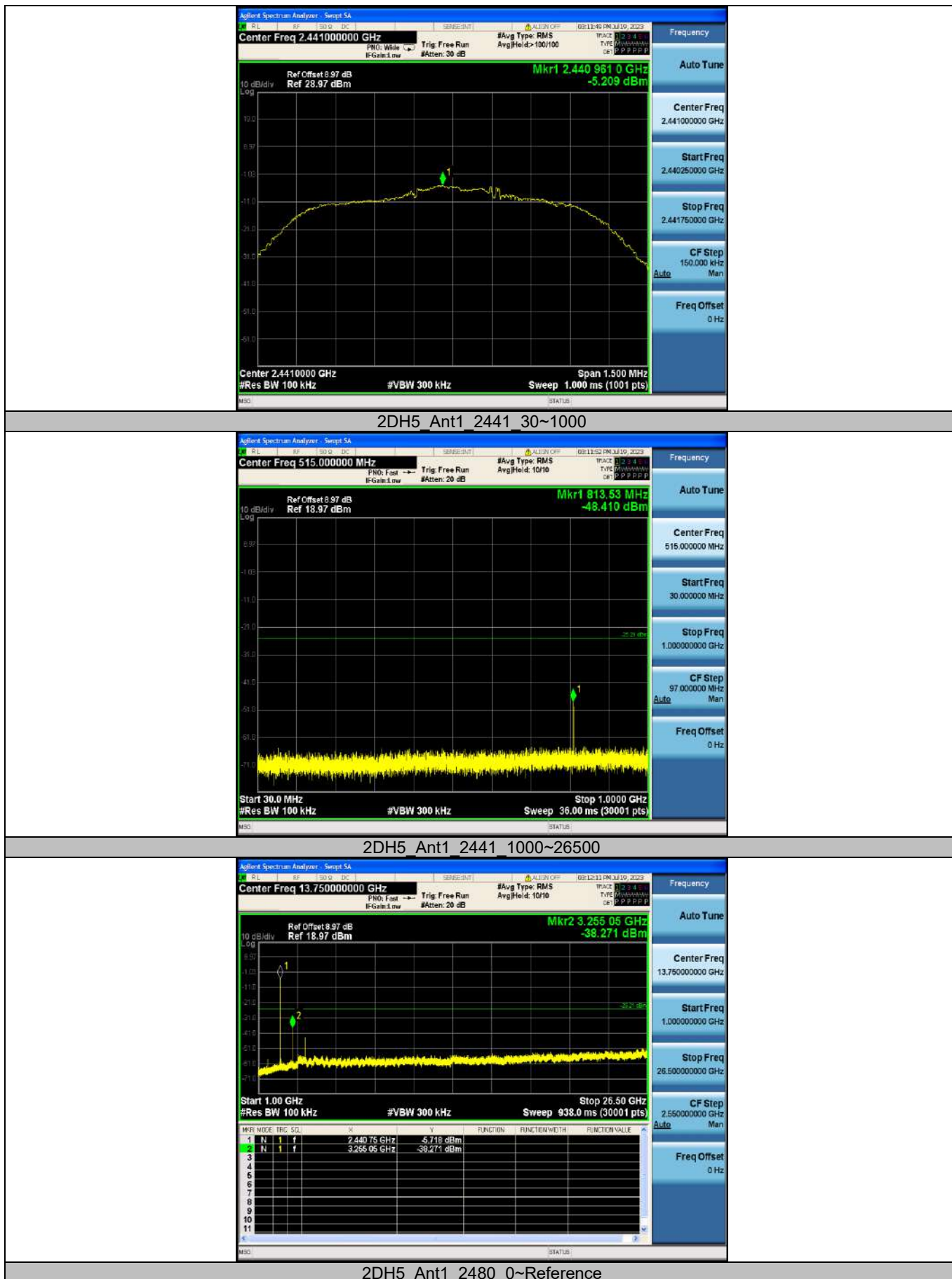
2DH5_Ant1_2402_30~1000

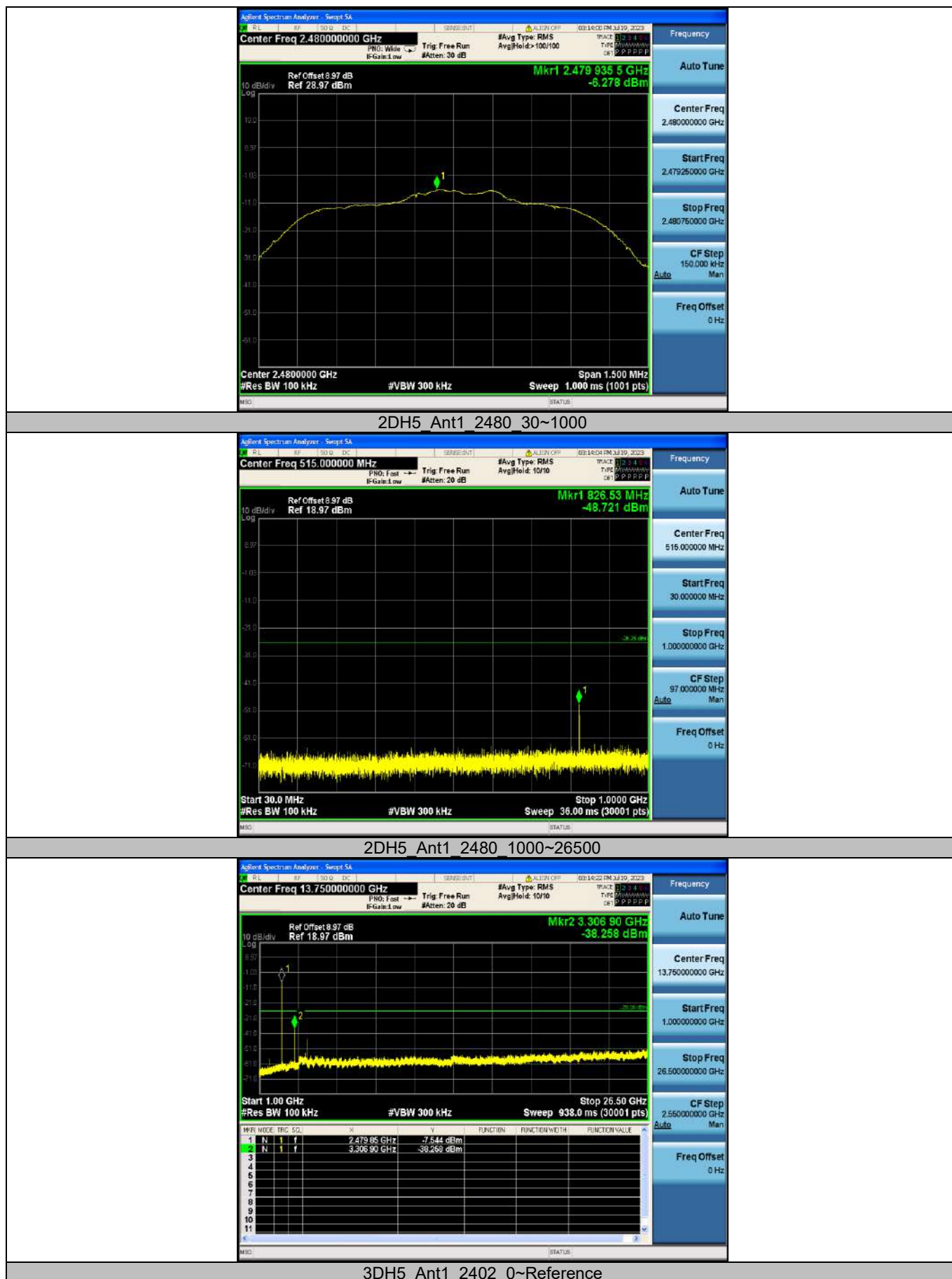


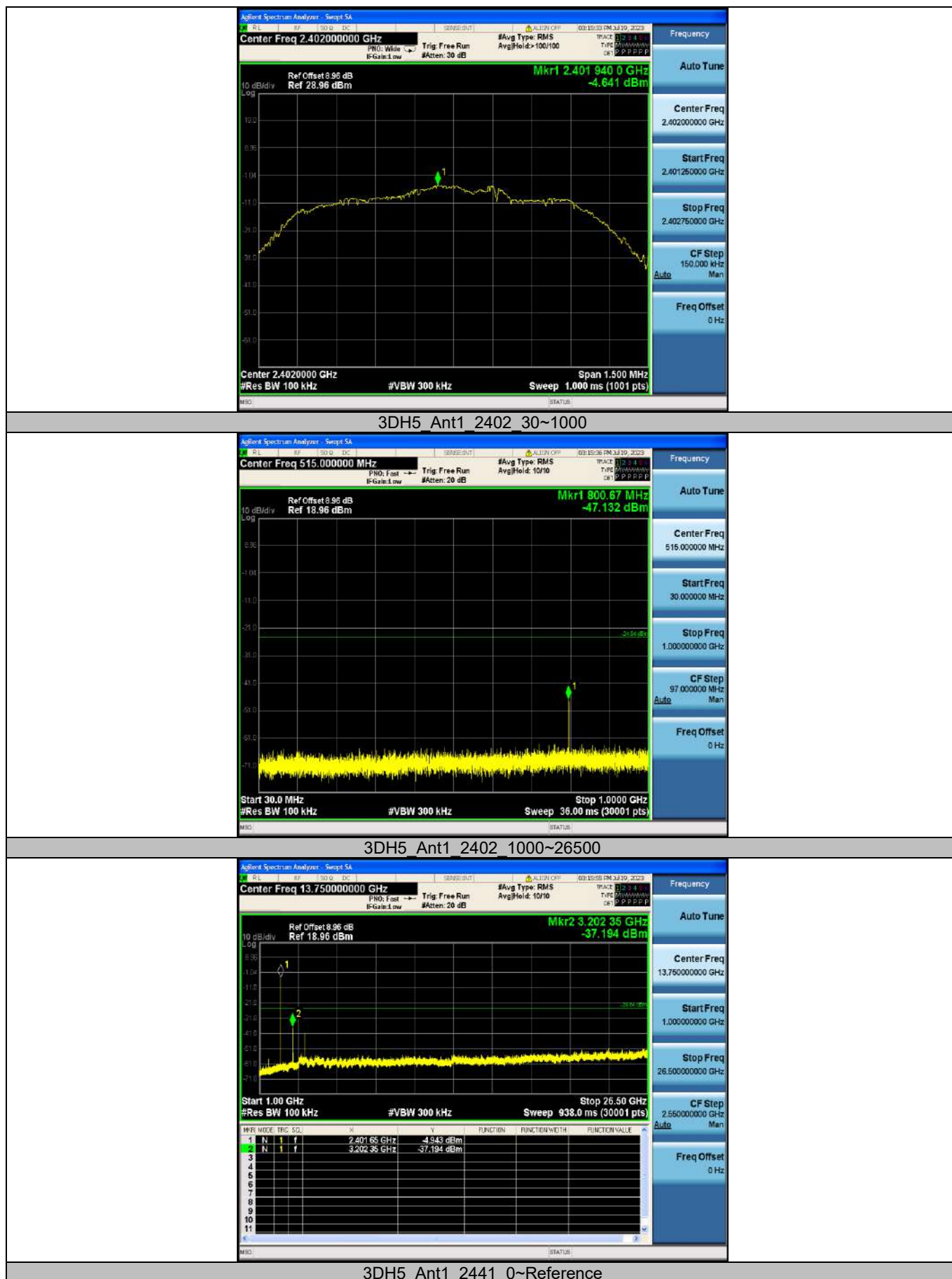
2DH5_Ant1_2402_1000~26500

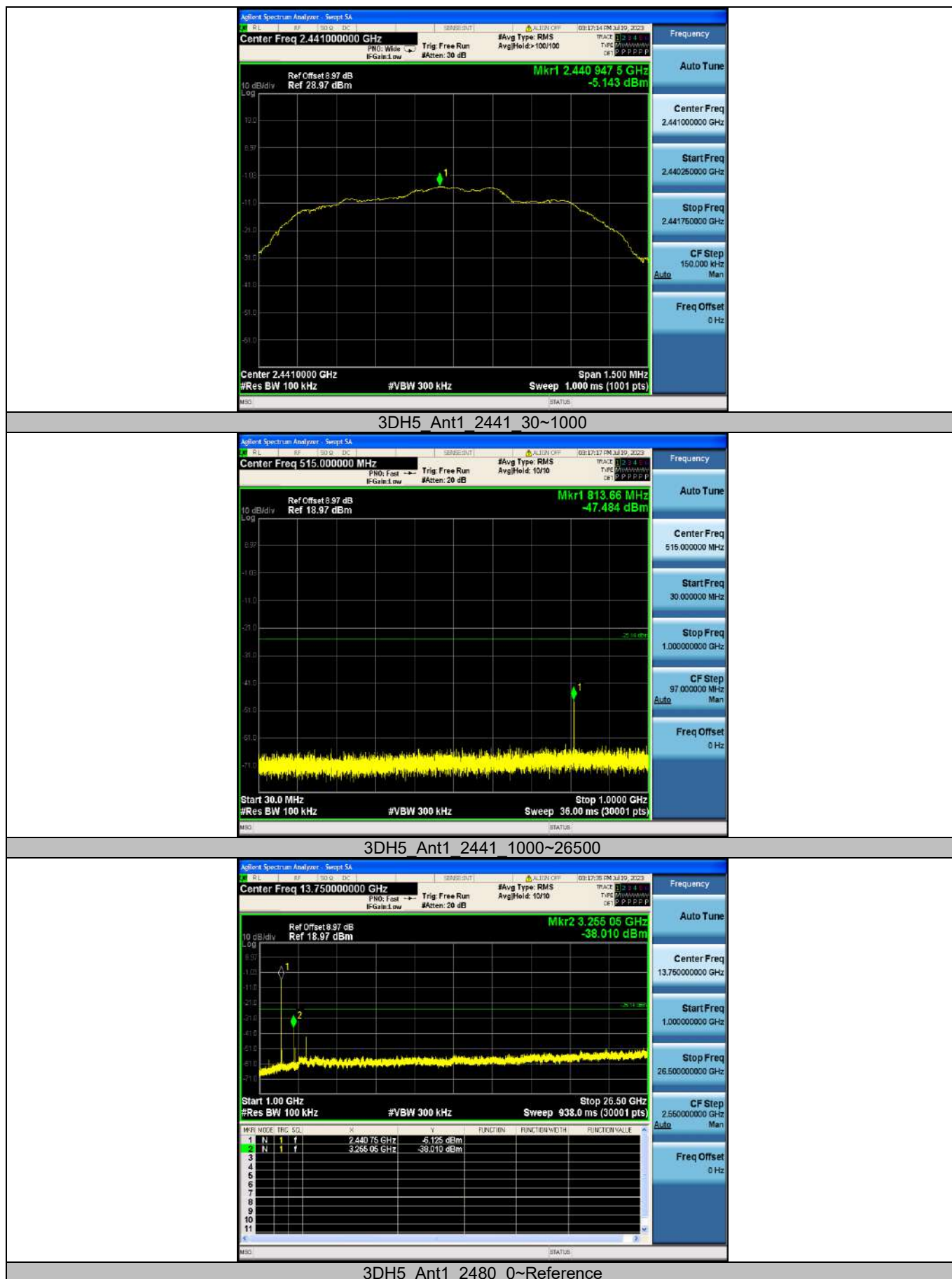


2DH5_Ant1_2441_0~Reference











----End of Report----