

Report No.: SEWM2305000166RG03
 Rev.: 01
 Page: 1 of 140

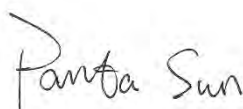
TEST REPORT

Application No.: SEWM2305000166RG
Applicant: vivo Mobile Communication Co., Ltd.
Address of Applicant: No.1, vivo Road, Chang'an, Dongguan,Guangdong,China
Manufacturer: vivo Mobile Communication Co., Ltd.
Address of Manufacturer: No.1, vivo Road, Chang'an, Dongguan,Guangdong,China
EUT Description: Mobile Phone
Model No.: V2250
Trade Mark: vivo
FCC ID: 2AUCY-V2250
Standards: FCC 47 CFR Part 2, Subpart J
 FCC 47 CFR Part 15, Subpart C
Date of Receipt: 2023/05/12
Date of Test: 2023/05/23 to 2023/06/05
Date of Issue: 2023/06/05

Test Result :	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:




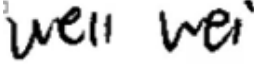
Panta Sun
 Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/06/05		Original

Prepared By		 <hr/> (Ives Cheng) / Test Engineer
Checked By		 <hr/> (Well Wei) / Reviewer



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2 Test Summary

Test Item	FCC Rule No.	Test Method	Test Result	Result
Antenna Requirement	15.203/15.247(b)	--	Clause 4.1	PASS
AC Power Line Conducted Emission	15.207	ANSI C63.10-2020 Section 6.2	Clause 4.3	PASS
Conducted Peak Output Power	15.247 (b)(1)	ANSI C63.10-2020 Section 11.9.1.2	Clause 4.4	PASS
20dB Emission Bandwidth & 99% Occupied Bandwidth	15.247 (a)(1)	ANSI C63.10-2020 Section 6.9.2/6.9.3	Clause 4.5	For Report Purpose
Carrier Frequencies Separation	15.247 (a)(1)	ANSI C63.10-2020 Section 7.8.2	Clause 4.6	PASS
Hopping Channel Number	15.247 (a)(1)	ANSI C63.10-2020 Section 7.8.3	Clause 4.7	PASS
Dwell Time	15.247 (a)(1)	ANSI C63.10-2020 Section 7.8.4	Clause 4.8	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10-2020 Section 7.8.7.2	Clause 4.9	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10-2020 Section 7.8.7.1	Clause 4.10	PASS
Radiated Spurious emissions	15.247(d); 15.205/15.209	ANSI C63.10-2020 Section 6.4 / 6.5 / 6.6	Clause 4.11	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d); 15.205/15.209	ANSI C63.10-2020 Section 6.10.5	Clause 4.12	PASS



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3 General Information

3.1 Details of Client

Applicant:	vivo Mobile Communication Co., Ltd.
Address of Applicant:	No.1, vivo Road, Chang'an, Dongguan,Guangdong,China
Manufacturer:	vivo Mobile Communication Co., Ltd.
Address of Manufacturer:	No.1, vivo Road, Chang'an, Dongguan,Guangdong,China

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Address:	South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone
Post code:	215000
Test engineer:	Ives Cheng, Tizzy Song

3.3 Test Facility

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

- **A2LA (Certificate No. 6336.01)**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0120.

IC#: 27594.

- **FCC –Designation Number: CN1312**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.

Designation Number: CN1312.

Test Firm Registration Number: 717327



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3.4 General Description of EUT

EUT Description:	Mobile Phone	
Model No.:	V2250	
Trade Mark:	vivo	
Hardware Version:	MP_0.1	
Software Version:	PD2283F_EX_A_13.0.6.14.W30	
IMEI:	RF Conducted	866242060182863
	RSE & AC power line	868007060199631
Operation Frequency:	2400MHz~2483.5MHz $f_c = 2402 \text{ MHz} + N * 1 \text{ MHz}$, where: - f_c = "Operating Frequency" in MHz, - N = "Channel Number" with the range from 0 to 78.	
Bluetooth version:	Bluetooth V5.2	
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)	
Modulation Type:	GFSK, $\pi/4$ DQPSK, 8DPSK	
Number of Channel:	79	
Hopping Channel Type:	Adaptive Frequency Hopping systems	
Antenna Type:	IFA Antenna	
Antenna Gain:	-0.91dBi (Ant22); -4.91dBi (Ant24)	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
RF Cable:	1.0dB	
Remark:	As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.	



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Operation Frequency of each 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		

Remark:

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(CH0)	2402MHz
The Middle channel(CH39)	2441MHz
The Highest channel(CH78)	2480MHz



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3.5 Test Environment

Environment Parameter	101.0 kPa Selected Values During Tests	
Relative Humidity	44-46 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~23	3.91
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

The EUT has been tested as an independent unit.



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(b)
<p>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.</p> <p>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.</p>	
<p>The antenna is IFA Antenna and no consideration of replacement. The best case gain of the antenna is -0.91dBi (Ant22); -4.91dBi (Ant24). *</p> <p><i>*Note:</i> <i>The antenna gain are derived from the gain information report provided by the manufacturer.</i></p> <p><i>Remark:</i> <i>As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.</i></p>	



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4.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

4.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

4.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals. Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudo random sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

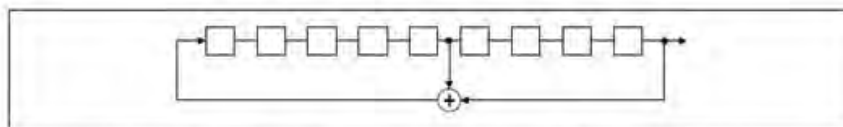
> Number of shift register stages: 9

> Length of pseudo-random sequence: $2^9 - 1 = 511$ bits

> Longest sequence of zeros: 8 (non-inverted signal)

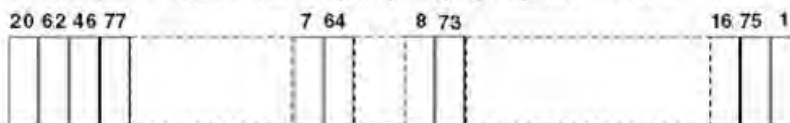
Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.



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According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the RF system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels. The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.



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4.3 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10-2020 Section 6.2		
Test Frequency Range:	150kHz to 30MHz		
Receiver Setup:	RBW = 9kHz, VBW = 30kHz		
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:	<ol style="list-style-type: none"> 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 C63.10-2020 on conducted measurement. 		



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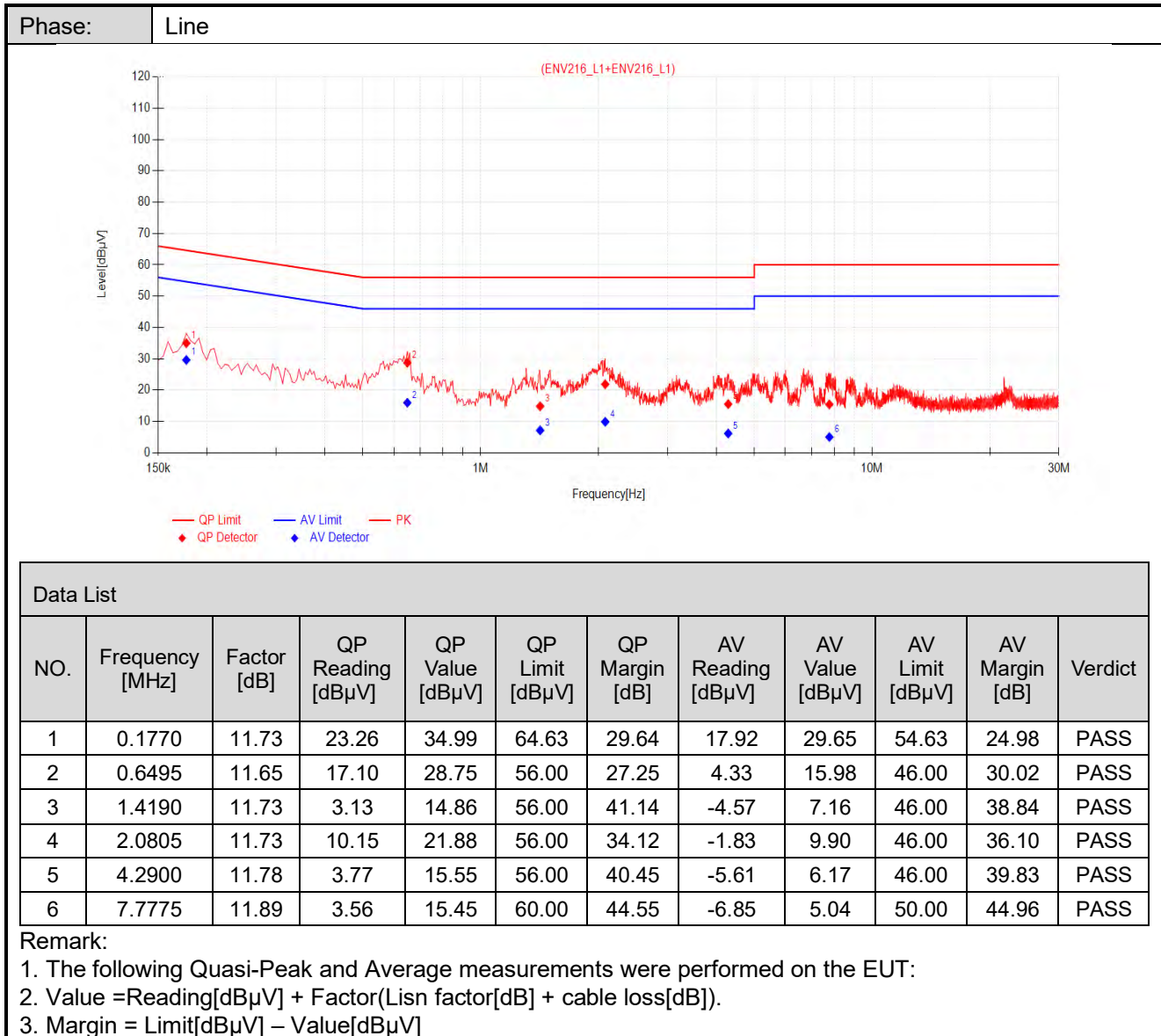
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<p>Test Setup:</p>	
<p>Test Mode:</p>	<p>Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel. Charge + Transmitting mode.</p>
<p>Final Test Mode:</p>	<p>Through Pre-scan, find the DH5 of data type and GFSK modulation at the lowest channel is the worst case. Charge + Transmitting mode Only the worst case is recorded in the report.</p>
<p>Instruments Used:</p>	<p>Refer to section 6 for details.</p>
<p>Test Results:</p>	<p>Pass</p>

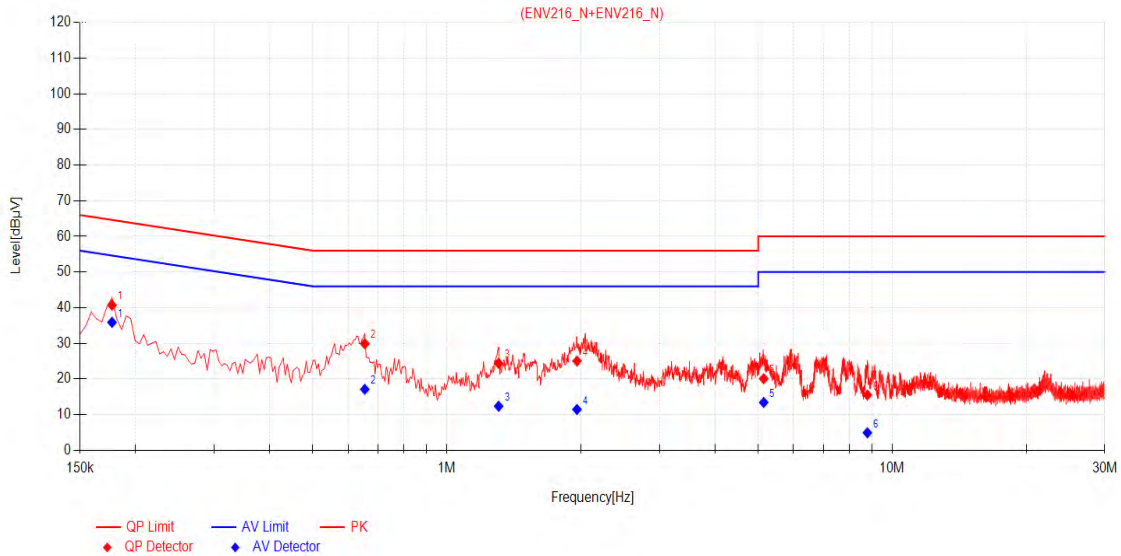


Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.



Phase: Neutral



Data List											
NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1770	11.73	28.98	40.71	64.63	23.92	24.16	35.89	54.63	18.74	PASS
2	0.6540	11.66	18.24	29.90	56.00	26.10	5.45	17.11	46.00	28.89	PASS
3	1.3065	11.73	12.65	24.38	56.00	31.62	0.63	12.36	46.00	33.64	PASS
4	1.9590	11.74	13.30	25.04	56.00	30.96	-0.28	11.46	46.00	34.54	PASS
5	5.1450	11.82	8.26	20.08	60.00	39.92	1.61	13.43	50.00	36.57	PASS
6	8.7945	11.88	3.63	15.51	60.00	44.49	-6.96	4.92	50.00	45.08	PASS

Remark:

- The following Quasi-Peak and Average measurements were performed on the EUT:
- Value = Reading[dBµV] + Factor(Lisn factor[dB] + cable loss[dB]).
- Margin = Limit[dBµV] – Value[dBµV]



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4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)&15.247 (b)(1)
Test Method:	ANSI C63.10-2020 Section 11.9.1.2
Test Setup:	<p>* Test with power meter (Detector function: Peak)</p>
Test Instruments:	Refer to section 6 for details
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 $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Limit:	0.125 watts
Test Results:	Pass
The detailed test data see: Appendix	



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4.5 20dB Emission Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10-2020 Section 6.9.2 and 6.9.3
Test Setup:	
Instruments Used:	Refer to section 6 for details
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 $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Limit:	NA
Test Results:	Pass
The detailed test data see: Appendix	



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4.6 Carrier Frequencies Separation

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10-2020 Section 7.8.2
Test Setup:	
Test Instruments:	Refer to section 6 for details
Exploratory Test Mode:	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 $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Limit:	2/3 of the 20dB bandwidth Remark: the transmission power is less than 0.125W.
Test Results:	Pass
The detailed test data see: Appendix	



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4.7 Hopping Channel Number

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10-2020 Section 7.8.3
Test Setup:	
Instruments Used:	Refer to section 6 for details
Test Mode:	Hopping transmitting with all kind of modulation
Limit:	At least 15 channels
Test Results:	Pass
The detailed test data see: Appendix	



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4.8 Dwell Time

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10-2020 Section 7.8.4
Test Setup:	
Instruments Used:	Refer to section 6 for details
Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Limit:	0.4 Second
Test Results:	Pass
The detailed test data see: Appendix	



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4.9 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2020 Section 7.8.7.2
Test Setup:	
Instruments Used:	Refer to section 6 for details
Exploratory Test Mode:	Hopping and 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 $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
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.
Test Results:	Pass
The detailed test data see: Appendix	



4.10 Spurious RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2020 Section 7.8.7.1
Test Setup:	
Instruments Used:	Refer to section 6 for details
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 $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
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.
Test Results:	Pass
The detailed test data see: Appendix	



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4.11 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10-2020 Section 6.4 / 6.5 / 6.6				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Test Frequency:	9kHz ~ 25GHz				
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					

Test Setup:

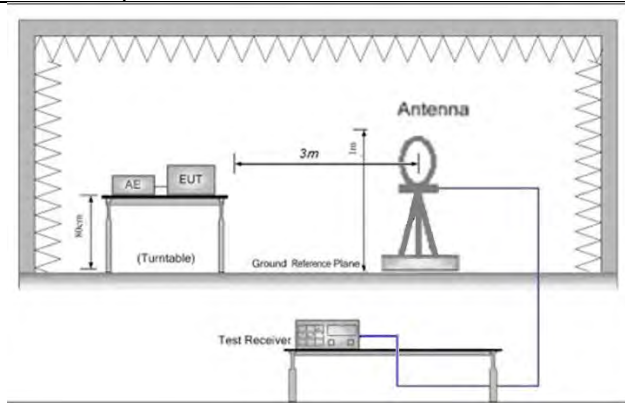


Figure 1. Below 30MHz

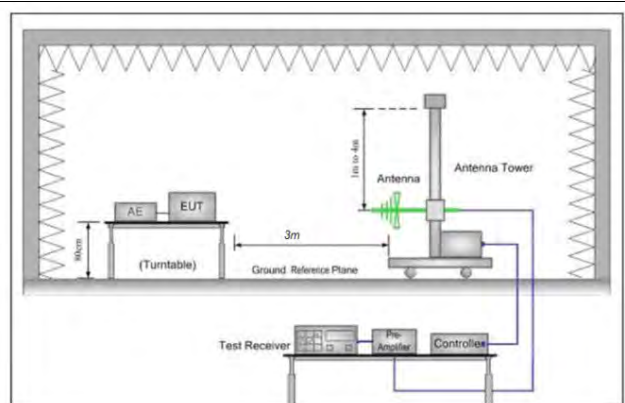


Figure 2. 30MHz to 1GHz



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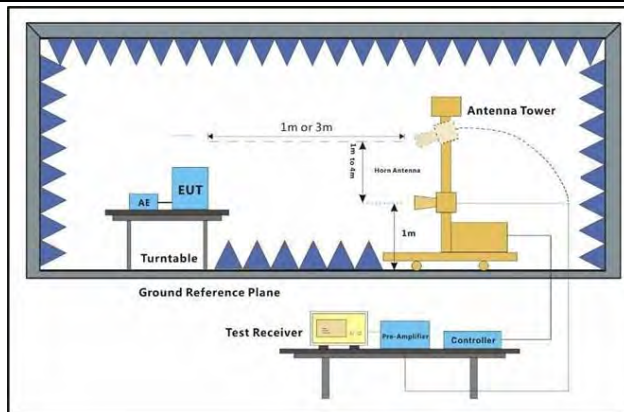


Figure 3. Above 1 GHz

<p>Test Procedure:</p>	<ol style="list-style-type: none"> For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation (Distance from antenna to EUT is 1m for measurements >18GHz). The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. Test the EUT in the lowest channel, the middle channel, the Highest channel. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case. Repeat above procedures until all frequencies measured was complete. The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported The disturbance above 18GHz was very low, and the harmonics were the highest point could be found when testing, so only the harmonics had been displayed. At a measurement distance of 1 meter the limit line was increased by $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$.
<p>Test Configuration:</p>	<p>Measurements below 30MHz</p> <ul style="list-style-type: none"> RBW = 10 kHz VBW = 30 kHz Detector = Peak & Average & Quasi-peak Trace mode = max hold <p>Measurements Below 1000MHz</p>



	<ul style="list-style-type: none"> • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold <p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW ≥ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold <p>Average Measurements Above 1000MHz</p> <p>Use duty cycle correction factor method per 15.35(c).</p> <p>Duty cycle = On time / 100 milliseconds</p> <p>On time = $N_1 * L_1 + N_2 * L_2 \dots + N_{N-1} * L_{N-1} + N_N * L_N$</p> <p>Where N_1 is number of type 1 pulse, L_1 is length of type 1 pulses, etc.</p> <p>Average Value = Peak Value + 20*log(Duty cycle).</p>
Exploratory Test Mode:	<p>Non-hopping transmitting mode with all kind of modulation and all kind of data type</p> <p>Charge + Transmitting mode.</p>
Final Test Mode:	<p>Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case.</p> <p>Pretest the EUT at Charge + Transmitting mode</p> <p>For below 1GHz part, through pre-scan, the worst case is the lowest channel.</p> <p>Only the worst case is recorded in the report.</p>
Instruments Used:	Refer to section 6 for details
Test Results:	Pass
The detailed test data see: Appendix	



4.12 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10-2020 Section 6.10.5		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test Setup:

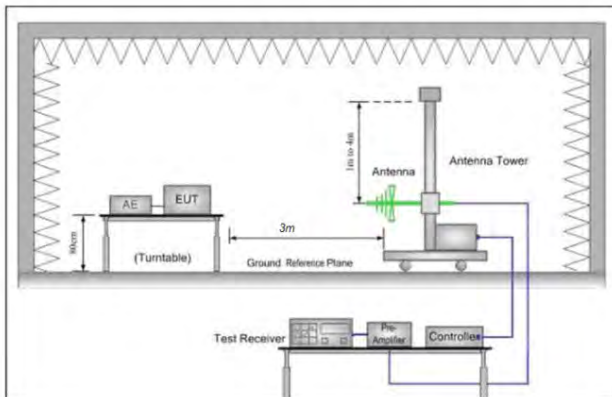


Figure 1. 30MHz to 1GHz

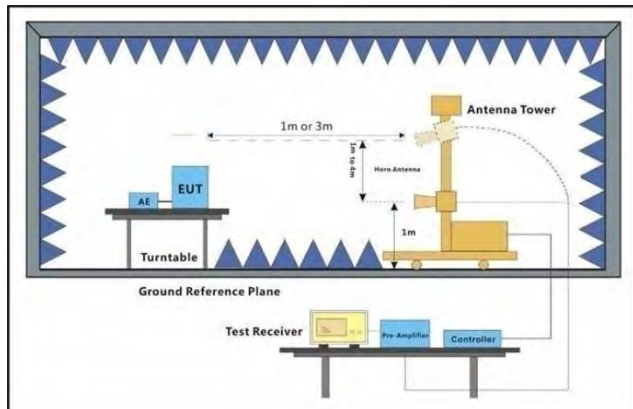


Figure 2. Above 1 GHz

Test Procedure:

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- Place a marker at the end of the restricted band closest to the transmit



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	<p>frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel</p> <p>h. Test the EUT in the lowest channel , the Highest channel</p> <p>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p>
Test Configuration:	<p>Measurements Below 1000MHz</p> <ul style="list-style-type: none"> • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold <p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW ≥ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold <p>Average Measurements Above 1000MHz</p> <p>Use duty cycle correction factor method per 15.35(c).</p> <p>Duty cycle = On time / 100 milliseconds</p> <p>On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{N-1} * L_{N-1} + N_N * L_N$</p> <p>Where N_1 is number of type 1 pulse, L_1 is length of type 1 pulses, etc.</p> <p>Average Value = Peak Value + 20*log(Duty cycle).</p>
Exploratory Test Mode:	<p>Non-hopping transmitting mode with all kind of modulation and all kind of data type</p> <p>Charge + Transmitting mode.</p>
Final Test Mode:	<p>Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case.</p> <p>Pretest the EUT at Charge + Transmitting mode,</p> <p>Only the worst case is recorded in the report.</p>
Instruments Used:	Refer to section 6 for details
Test Results:	Pass
The detailed test data see: Appendix	



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5 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.54dB
2	RF power density, conducted	±1.03dB
3	Spurious emissions, conducted	±0.54dB
4	Radio Frequency	±1.0 %
5	Duty Cycle	±0.37%
6	Occupied Bandwidth	±1.0 %
7	Conduction Emission	± 2.90dB (150kHz to 30MHz)
8	Radiated Emission	± 3.13dB (9k to 30MHz)
		± 4.88dB (30M to 1GHz)
		± 4.75dB (1GHz to 18GHz)
		± 4.77dB (Above 18GHz)

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{CISPR/ETSI}$ (CISPR/ETSI Uncertainty), so the test results
 – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
 – non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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6 Equipment List

RF Test Equipment					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	SUWI-04-01-06	2021/05/08	2024/05/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-07	2023/02/06	2024/02/05
Measurement Software	Tonscend	JS1120-3 Test System V3.1.55	SUWI-02-09-09	NCR	NCR
Signal Analyzer	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2023/05/11	2024/05/10
Wideband Radio Communication Tester	ROHDE&SCHWARZ	CMW500	SUWI-01-16-05	2023/02/06	2024/02/05
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2023/02/06	2024/02/05
Power meter	Anritsu	ML2495A	SUWI-01-31-01	2022/11/23	2023/11/22
Pulse power sensor	Anritsu	MA2411B	SUWI-01-32-01	2022/11/23	2023/11/22
MXG Vector signal genitor	KEYSIGHT	N5182B	SUWI-01-38-01	2023/02/06	2024/02/05
Temperature Chamber	ESPEC	SU-242	SUWI-01-13-01	2023/02/06	2024/02/05
Signal Generator	ROHDE&SCHWARZ	SMM100A	SUWI-01-07-04	2023/02/22	2024/02/21
Signal Analyzer	KEYSIGHT	N9020A	SUWI-01-02-05	2022/11/23	2023/11/22

Conduction Test Equipment					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	SUWI-04-03-01	2021/05/08	2024/05/07
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2023/02/08	2024/02/07
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2023/02/06	2024/02/05
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-06	2023/02/07	2024/02/06
Artificial network	ROHDE&SCHWARZ	ENV216	SUWI-01-19-03	2023/02/08	2024/02/07
Artificial network	ROHDE&SCHWARZ	ENV216	SUWI-01-19-04	2023/02/08	2024/02/07
Measurement Software	Tonscend	JS32-CE V4.0.0.2	SUWI-02-09-05	NCR	NCR



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RSE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Semi-Anechoic Chamber	Brilliant-emc	N/A	SUWI-04-02-02	2021/11/25	2024/11/24
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-13	2023/02/07	2024/02/06
Signal Analyzer	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2023/05/11	2024/05/10
Signal Analyzer	KEYSIGHT	N9020A	SUWI-01-02-06	2022/11/23	2023/11/22
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2023/02/08	2024/02/07
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	VULB 9168	SUWI-01-11-04	2021/12/05	2023/12/04
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9120D	SUWI-01-11-05	2021/12/05	2023/12/04
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9170	SUWI-01-11-03	2023/05/12	2024/05/11
Active Loop Antenna	SCHWRZBECK MESS-ELEKTRONIK	FMZB 1519B	SUWI-01-21-01	2021/06/10	2023/06/09
Amplifier	Tonscend	TAP9K3G32	SUWI-01-14-06	2022/11/23	2023/11/22
Amplifier	Tonscend	TAP01018050	SUWI-01-14-04	2022/11/23	2023/11/22
Amplifier	Tonscend	TAP30M7G30	SUWI-01-14-05	2022/11/23	2023/11/22
Measurement Software	Tonscend	JS32-RE V4.0.0.0	SUWI-02-09-04	NCR	NCR



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7 Photographs - Setup Photos

Refer to Appendix A.2 WLAN Setup Photos.



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Appendix



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**20dB Emission Bandwidth
Test Result**

TestMode	Antenna	Frequency[MHz]	20dB EBW[MHz]	FL[MHz]	FH[MHz]	Verdict
DH5	Ant22	2402	0.942	2401.544	2402.486	For Report Purpose
	Ant24	2402	0.933	2401.544	2402.477	
	Ant22	2441	0.939	2440.544	2441.483	
	Ant24	2441	0.939	2440.544	2441.483	
	Ant22	2480	0.936	2479.547	2480.483	
	Ant24	2480	0.936	2479.547	2480.483	
2DH5	Ant22	2402	1.341	2401.328	2402.669	
	Ant24	2402	1.338	2401.328	2402.666	
	Ant22	2441	1.335	2440.328	2441.663	
	Ant24	2441	1.362	2440.322	2441.684	
	Ant22	2480	1.356	2479.325	2480.681	
	Ant24	2480	1.371	2479.316	2480.687	
3DH5	Ant22	2402	1.317	2401.346	2402.663	
	Ant24	2402	1.323	2401.343	2402.666	
	Ant22	2441	1.353	2440.322	2441.675	
	Ant24	2441	1.284	2440.355	2441.639	
	Ant22	2480	1.302	2479.349	2480.651	
	Ant24	2480	1.302	2479.349	2480.651	



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Test Graphs



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DH5 Ant22_2441



DH5 Ant24_2441



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Occupied Channel Bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
DH5	Ant22	2402	0.83471	2401.5845	2402.4192	For Report Purpose
	Ant24	2402	0.84046	2401.5798	2402.4203	
	Ant22	2441	0.84803	2440.5750	2441.4230	
	Ant24	2441	0.83094	2440.5835	2441.4144	
	Ant22	2480	0.83188	2479.5857	2480.4176	
	Ant24	2480	0.83758	2479.5821	2480.4196	
2DH5	Ant22	2402	1.1904	2401.4063	2402.5967	
	Ant24	2402	1.1858	2401.4086	2402.5944	
	Ant22	2441	1.1862	2440.4087	2441.5949	
	Ant24	2441	1.1840	2440.4067	2441.5907	
	Ant22	2480	1.1866	2479.4092	2480.5958	
	Ant24	2480	1.1821	2479.4063	2480.5884	
3DH5	Ant22	2402	1.1772	2401.4177	2402.5949	
	Ant24	2402	1.1925	2401.4039	2402.5964	
	Ant22	2441	1.1862	2440.4095	2441.5957	
	Ant24	2441	1.1892	2440.4078	2441.5970	
	Ant22	2480	1.1889	2479.4043	2480.5932	
	Ant24	2480	1.1885	2479.4061	2480.5946	



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Test Graphs



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DH5 Ant22_2441



DH5 Ant24_2441



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2DH5_Ant24_2441



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2DH5_Ant22_2480



2DH5_Ant24_2480



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3DH5_Ant22_2402



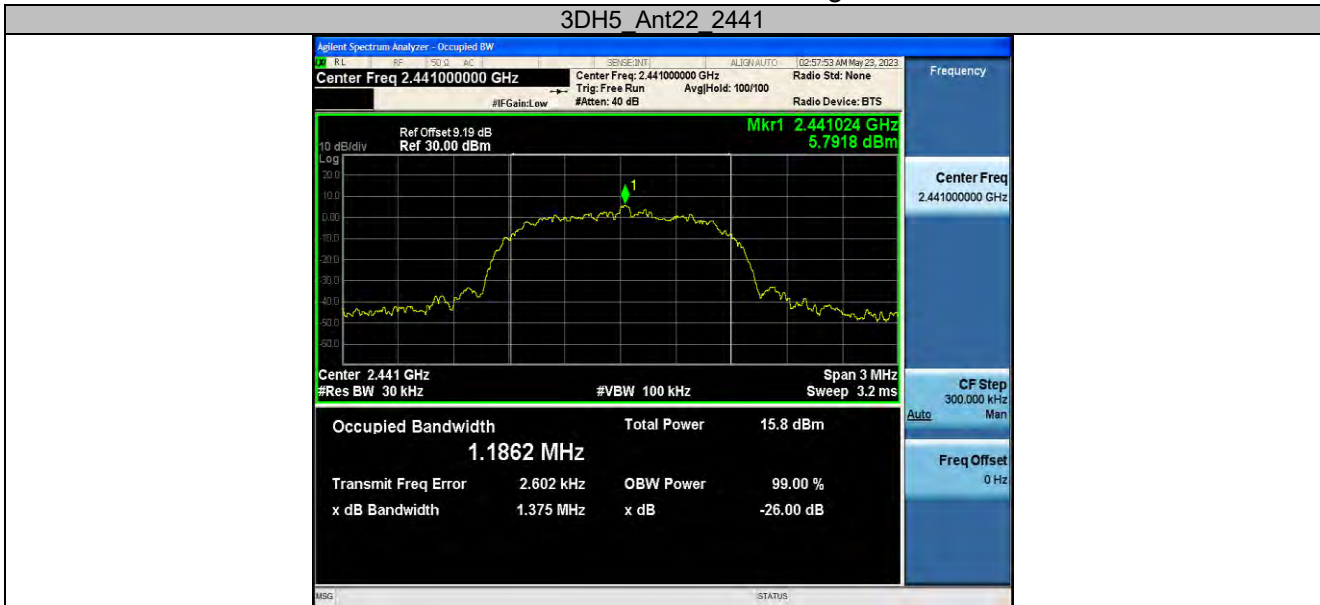
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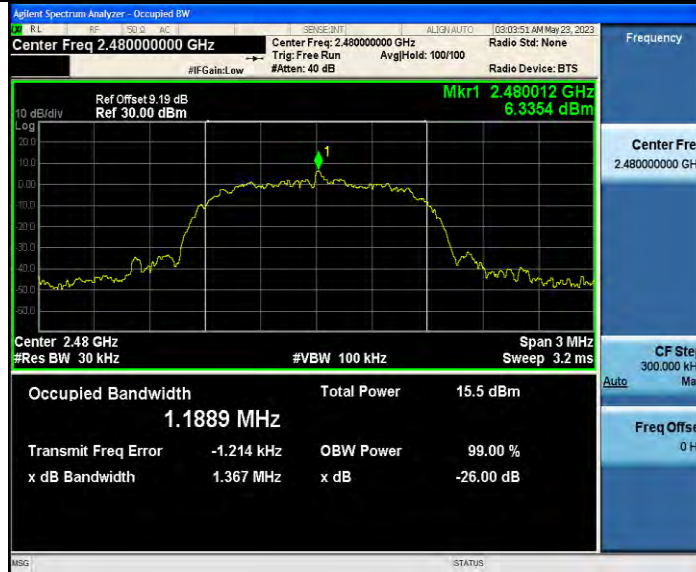
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**Maximum conducted output power
Test Result**

Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	Verdict
DH5	Ant22	2402	9.01	≤20.97	PASS
	Ant24	2402	9.62	≤20.97	PASS
	Ant22	2441	9.70	≤20.97	PASS
	Ant24	2441	10.95	≤20.97	PASS
	Ant22	2480	8.70	≤20.97	PASS
	Ant24	2480	9.75	≤20.97	PASS
2DH5	Ant22	2402	10.82	≤20.97	PASS
	Ant24	2402	11.34	≤20.97	PASS
	Ant22	2441	11.38	≤20.97	PASS
	Ant24	2441	12.61	≤20.97	PASS
	Ant22	2480	10.45	≤20.97	PASS
	Ant24	2480	11.52	≤20.97	PASS
3DH5	Ant22	2402	11.11	≤20.97	PASS
	Ant24	2402	11.63	≤20.97	PASS
	Ant22	2441	11.77	≤20.97	PASS
	Ant24	2441	12.94	≤20.97	PASS
	Ant22	2480	10.78	≤20.97	PASS
	Ant24	2480	11.85	≤20.97	PASS



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Carrier frequency separation Test Result

TestMode	Antenna	Hop/No-Hop	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant22	Hop	0.692	≥0.628	PASS
	Ant24	Hop	0.862	≥0.628	PASS
2DH5	Ant22	Hop	0.962	≥0.904	PASS
	Ant24	Hop	0.992	≥0.904	PASS
3DH5	Ant22	Hop	1.018	≥0.902	PASS
	Ant24	Hop	1.068	≥0.902	PASS



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Test Graphs



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2DH5_Ant22_Hop



2DH5_Ant24_Hop



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**Time of occupancy
Test Result**

TestMode	Antenna	Hop/No-Hop	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH5	Ant22	Hop	2.884	106.67	0.308	≤0.4	PASS
	Ant24	Hop	2.884	106.67	0.308	≤0.4	PASS
2DH5	Ant22	Hop	2.887	106.67	0.308	≤0.4	PASS
	Ant24	Hop	2.885	106.67	0.308	≤0.4	PASS
3DH5	Ant22	Hop	2.888	106.67	0.308	≤0.4	PASS
	Ant24	Hop	2.888	106.67	0.308	≤0.4	PASS

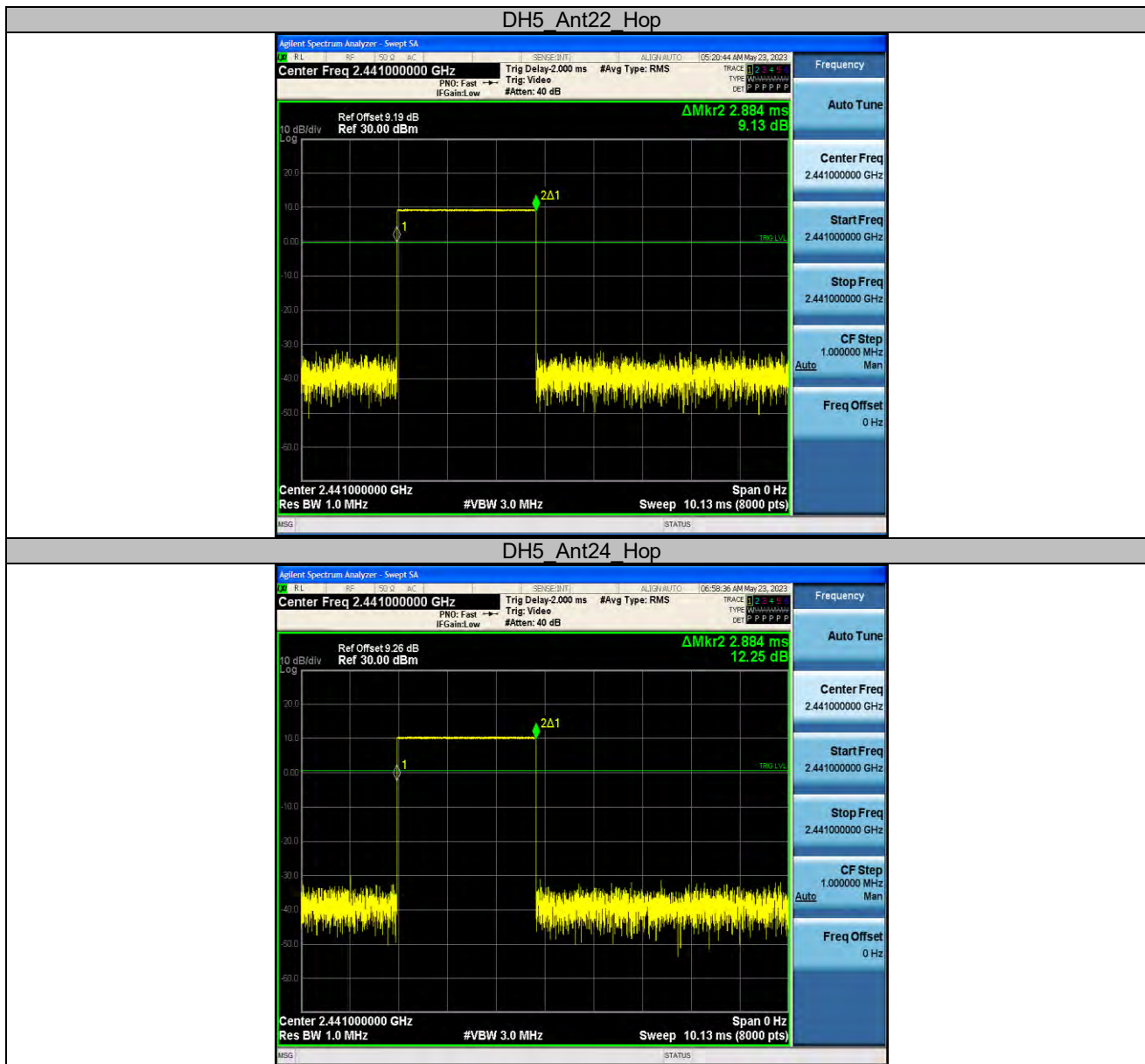


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Test Graphs

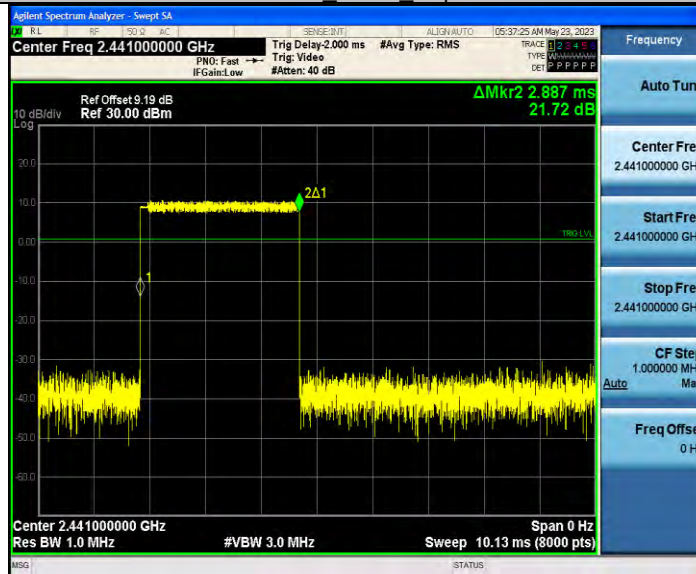


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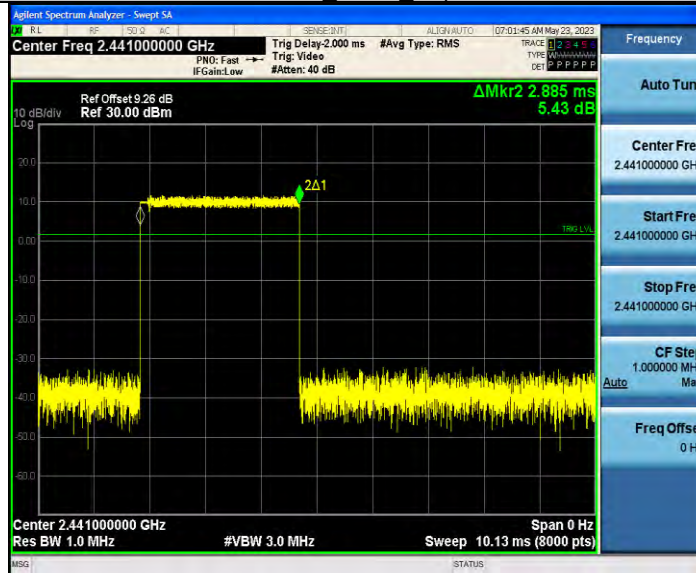
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2DH5_Ant24_Hop



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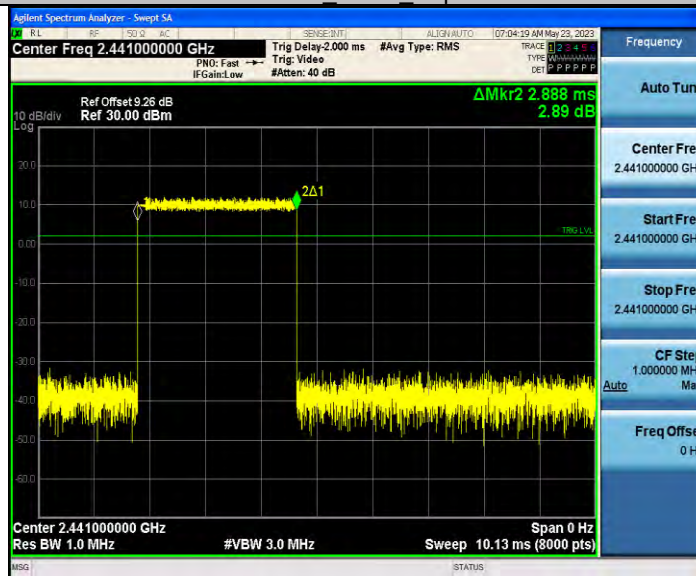
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Number of hopping channels Test Result

TestMode	Antenna	Hop/No-Hop	Result[Num]	Limit[Num]	Verdict
DH5	Ant22	Hop	79	≥15	PASS
	Ant24	Hop	79	≥15	PASS
2DH5	Ant22	Hop	79	≥15	PASS
	Ant24	Hop	79	≥15	PASS
3DH5	Ant22	Hop	79	≥15	PASS
	Ant24	Hop	79	≥15	PASS



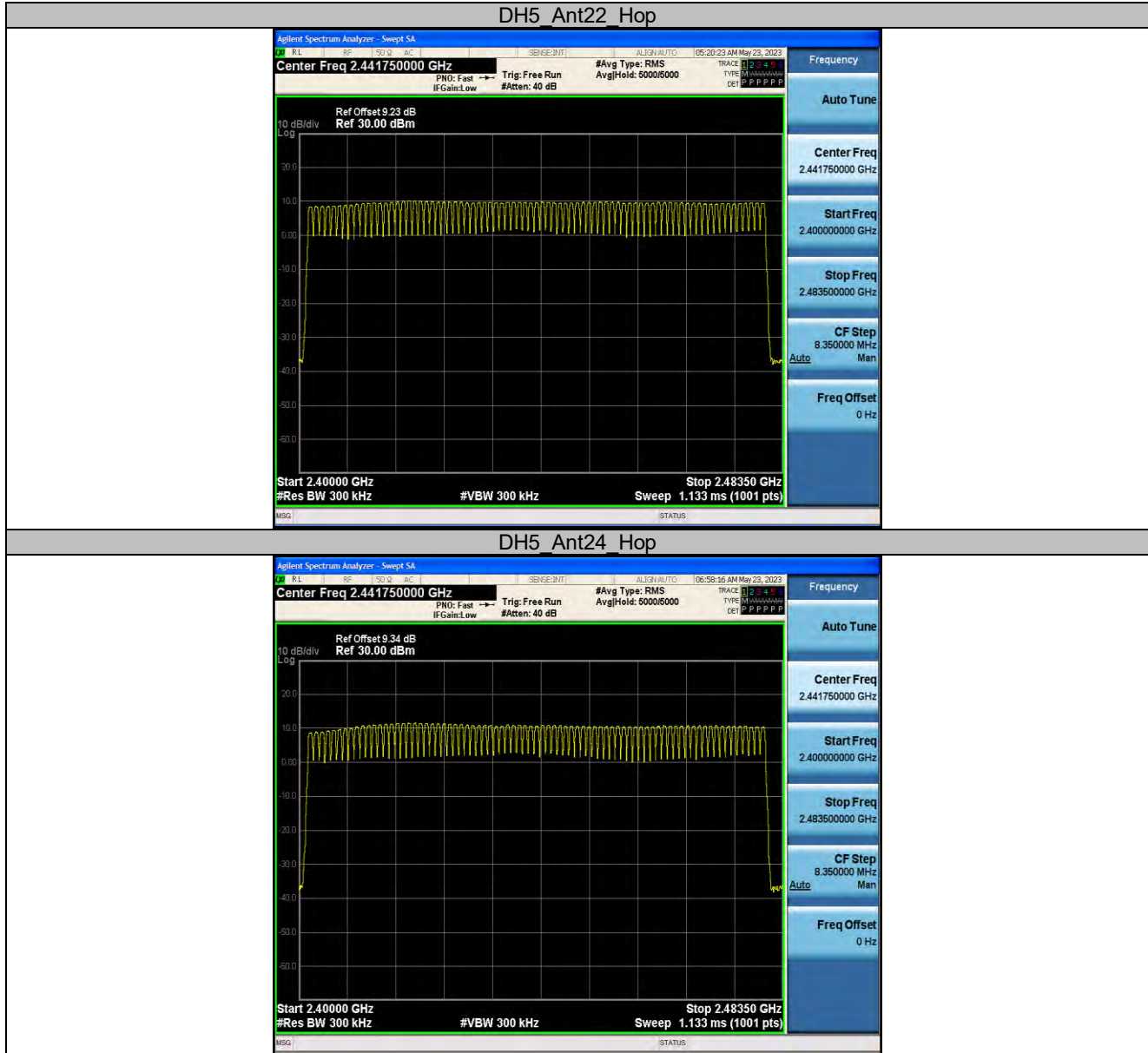
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Test Graphs

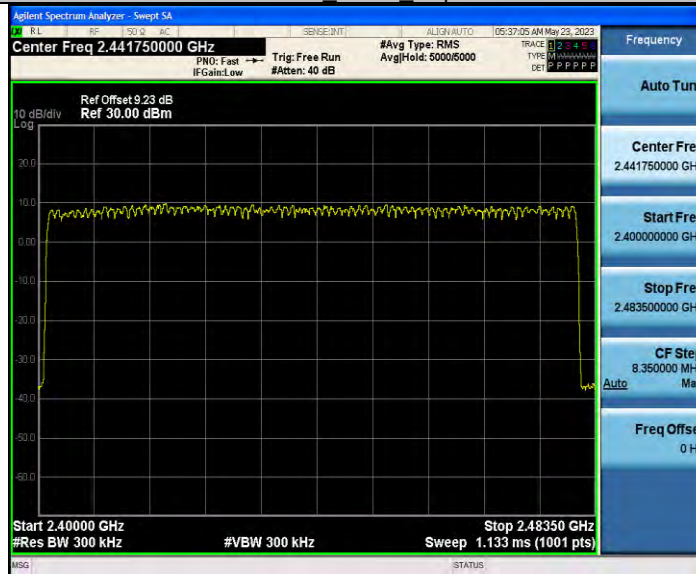


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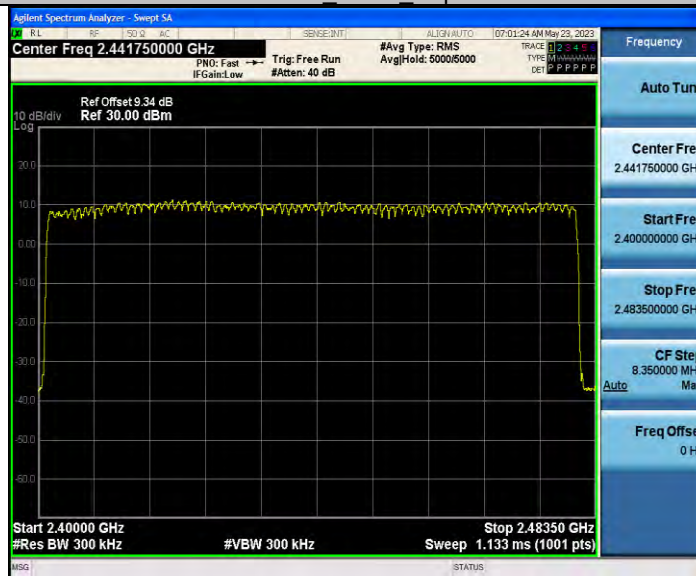
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2DH5_Ant22_Hop



2DH5_Ant24_Hop

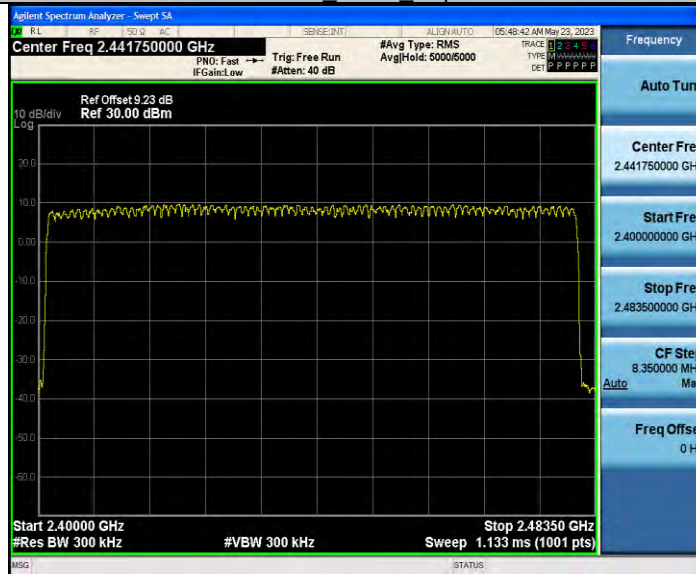


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3DH5_Ant22_Hop



3DH5_Ant24_Hop



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Band edge measurements
Test Result

TestMode	Antenna	Channel	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant22	Low	2402	8.08	-50.44	≤-11.92	PASS
	Ant24	Low	2402	8.13	-49.58	≤-11.87	PASS
	Ant22	High	2480	8.96	-49.94	≤-11.04	PASS
	Ant24	High	2480	9.57	-50.23	≤-10.43	PASS
	Ant22	Low	Hop_2402	7.55	-50.38	≤-12.45	PASS
	Ant24	Low	Hop_2402	8.27	-50.28	≤-11.73	PASS
	Ant22	High	Hop_2480	8.83	-50.21	≤-11.17	PASS
	Ant24	High	Hop_2480	10.20	-49.16	≤-9.8	PASS
2DH5	Ant22	Low	2402	7.77	-50.4	≤-12.23	PASS
	Ant24	Low	2402	6.10	-50.27	≤-13.9	PASS
	Ant22	High	2480	8.60	-50.03	≤-11.4	PASS
	Ant24	High	2480	8.55	-49.81	≤-11.45	PASS
	Ant22	Low	Hop_2402	4.97	-49.67	≤-15.03	PASS
	Ant24	Low	Hop_2402	5.53	-50.65	≤-14.47	PASS
	Ant22	High	Hop_2480	6.31	-50.31	≤-13.7	PASS
	Ant24	High	Hop_2480	10.00	-48.86	≤-10	PASS
3DH5	Ant22	Low	2402	5.15	-50.3	≤-14.85	PASS
	Ant24	Low	2402	8.29	-49.55	≤-11.71	PASS
	Ant22	High	2480	8.19	-49.52	≤-11.81	PASS
	Ant24	High	2480	8.86	-50.02	≤-11.15	PASS
	Ant22	Low	Hop_2402	6.95	-50.06	≤-13.05	PASS
	Ant24	Low	Hop_2402	7.06	-50.55	≤-12.94	PASS
	Ant22	High	Hop_2480	6.64	-50.06	≤-13.36	PASS
	Ant24	High	Hop_2480	9.65	-50.09	≤-10.35	PASS

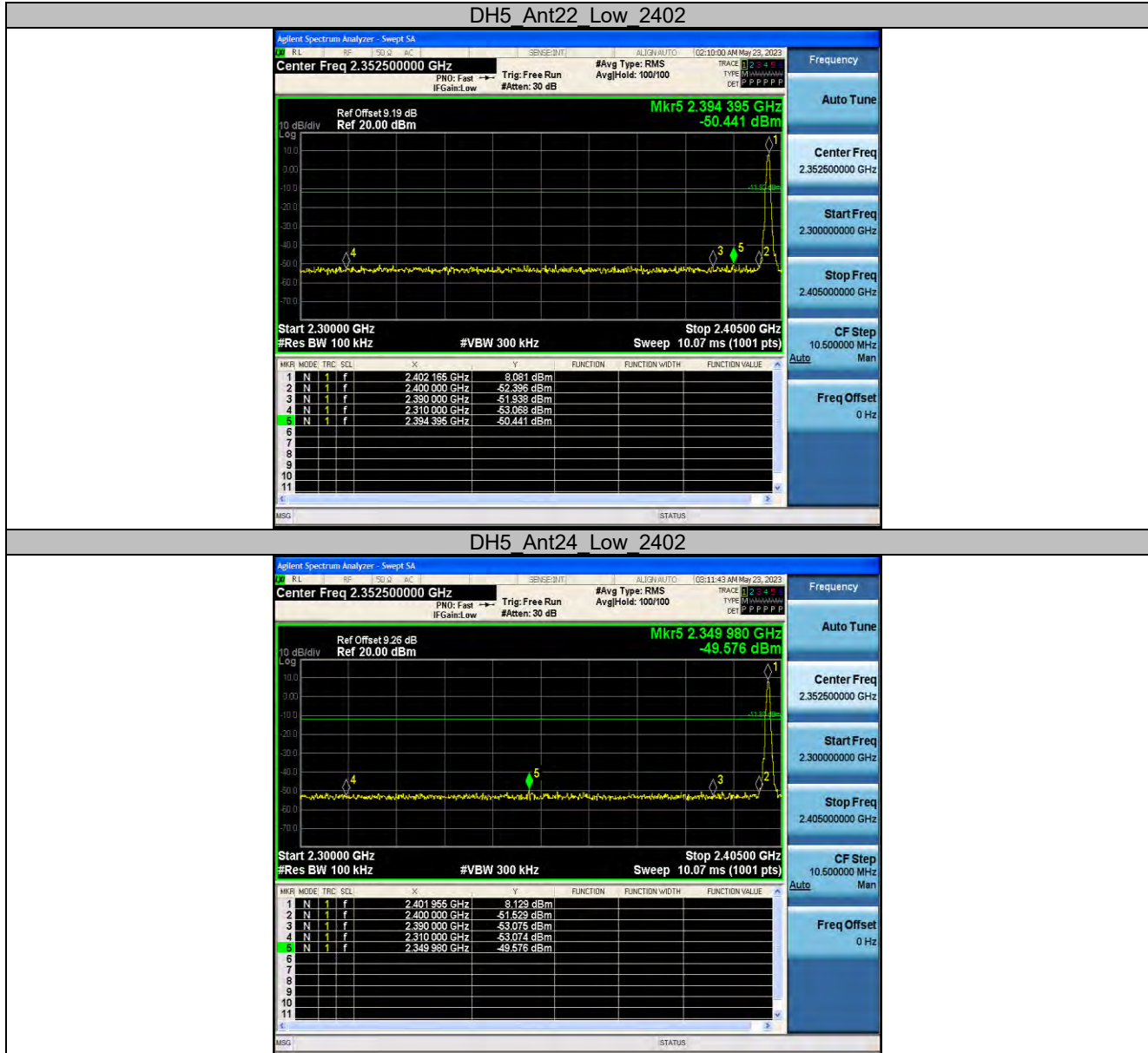


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Test Graphs

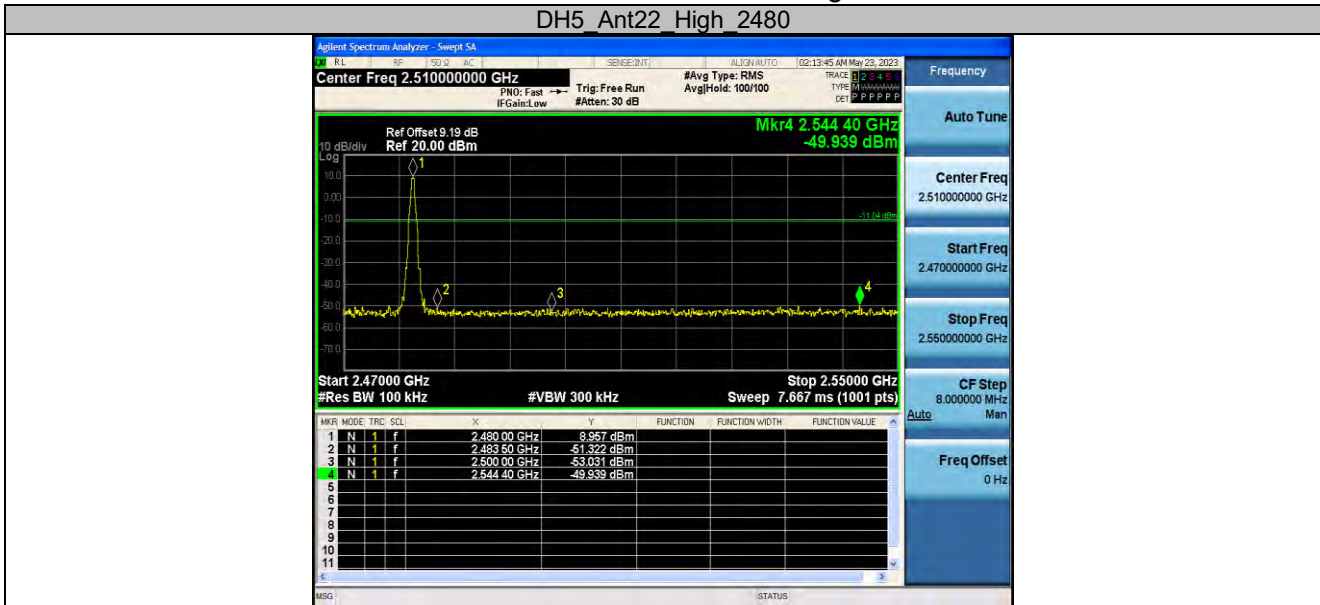


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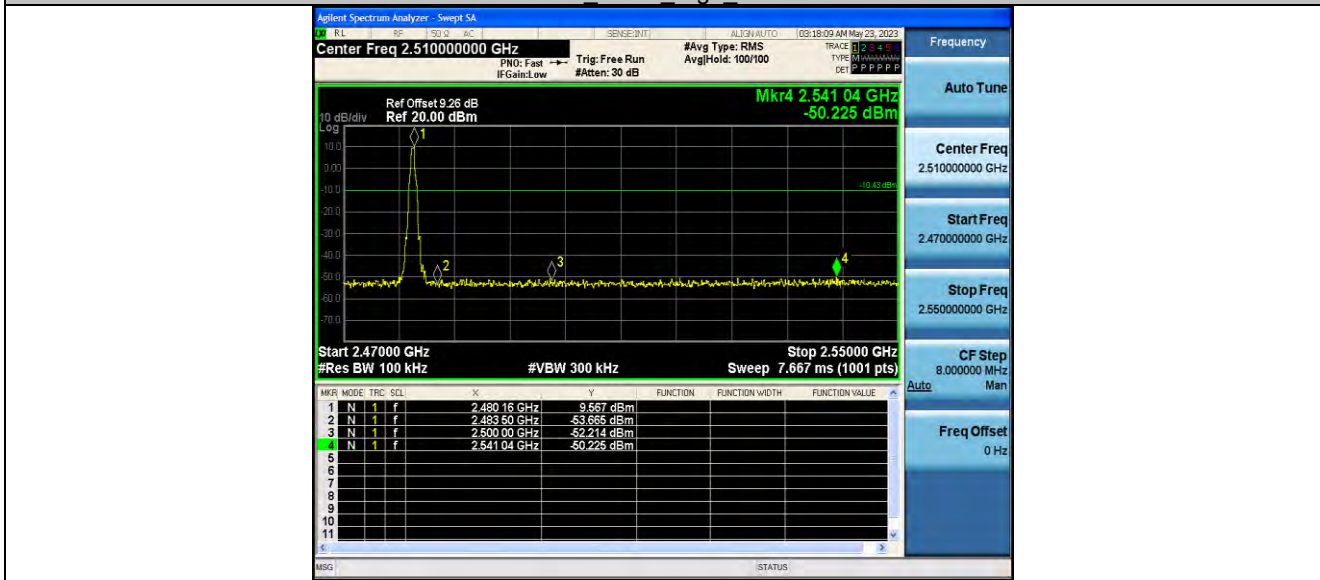
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DH5 Ant22_High_2480



DH5 Ant24_High_2480

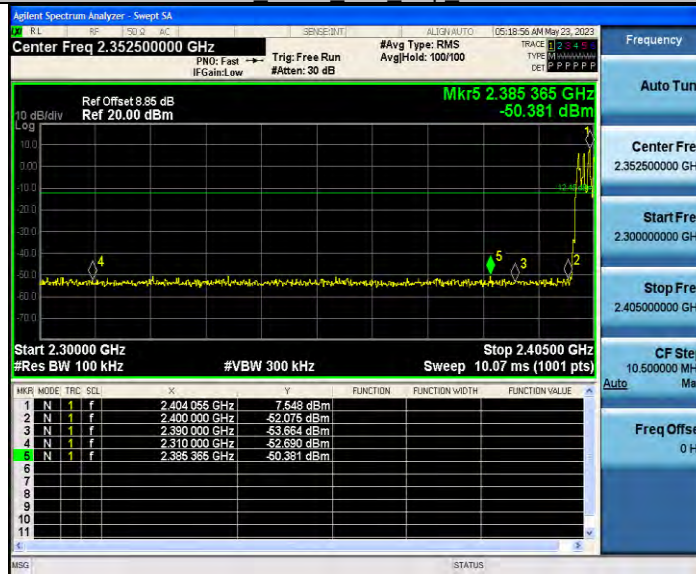


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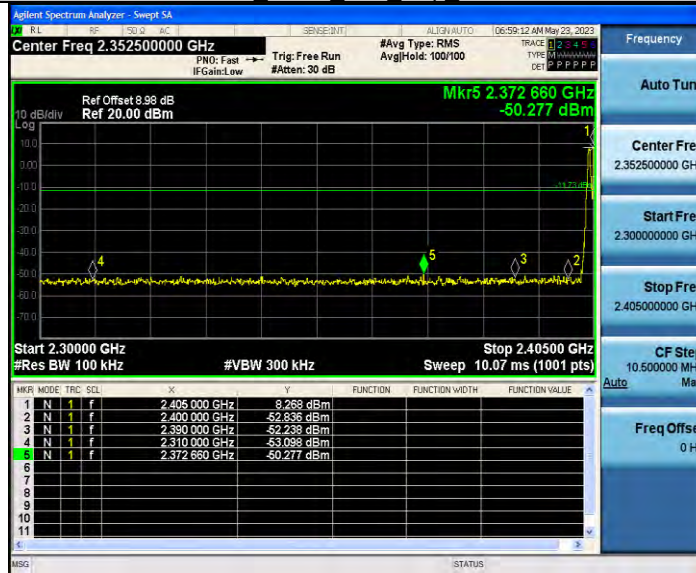
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DH5 Ant22 Low Hop 2402



DH5 Ant24 Low Hop 2402

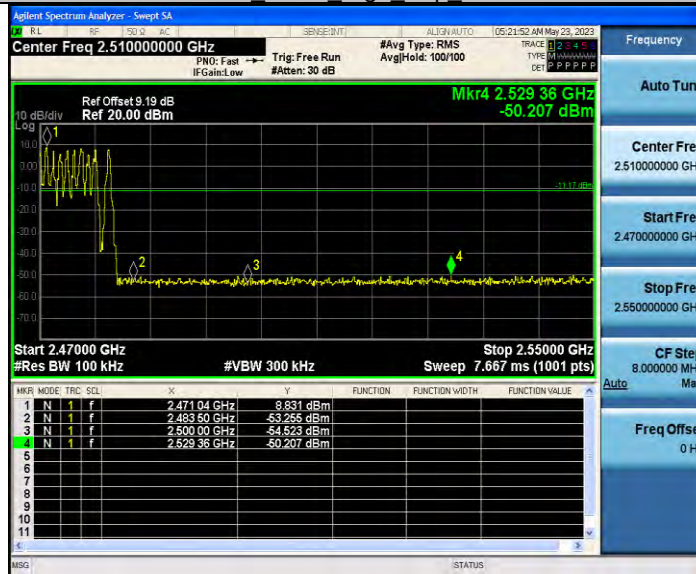


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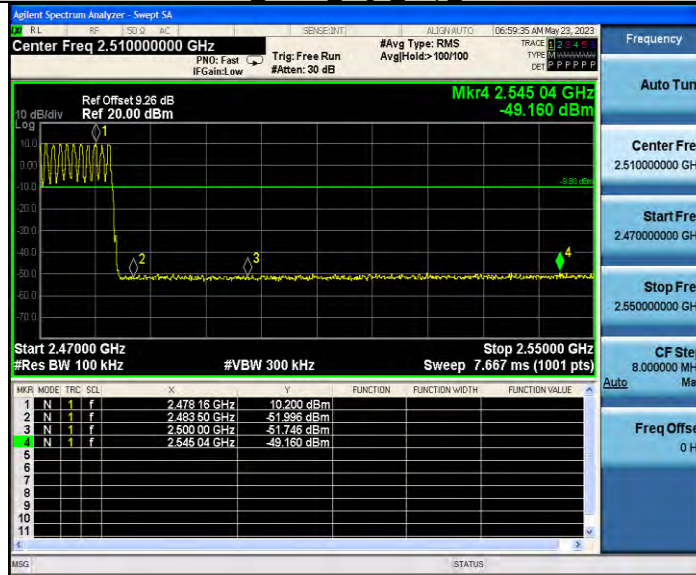
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DH5 Ant22 High Hop 2480



DH5 Ant24 High Hop 2480

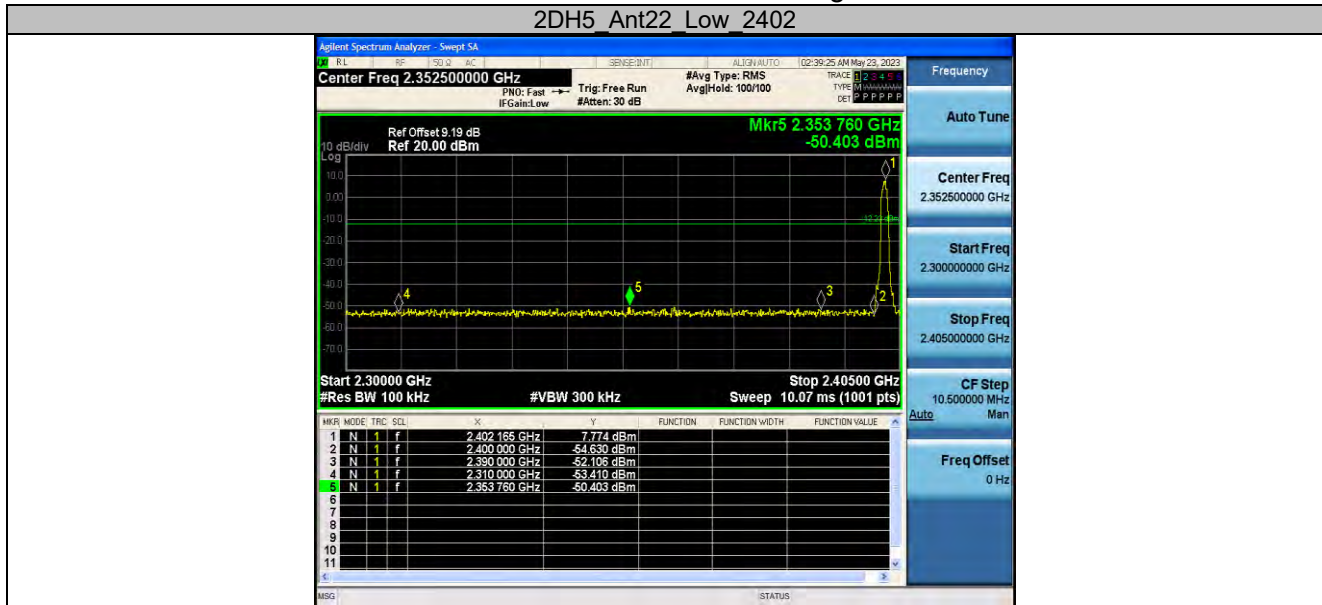


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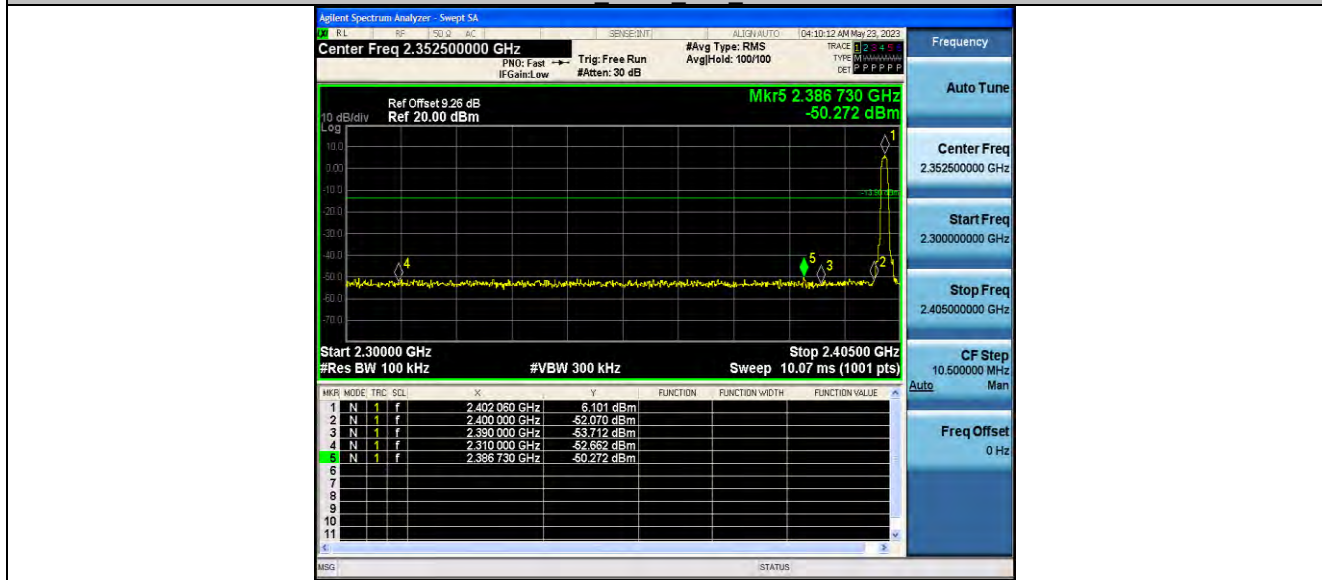
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2DH5_Ant22_Low_2402



2DH5_Ant24_Low_2402

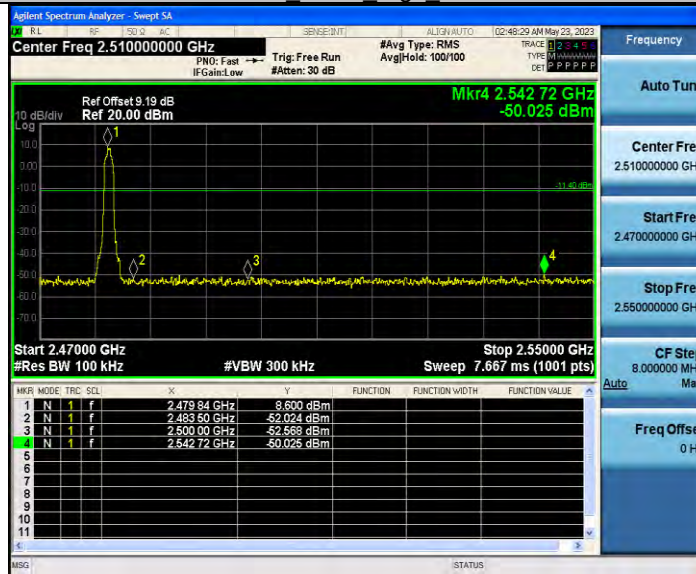


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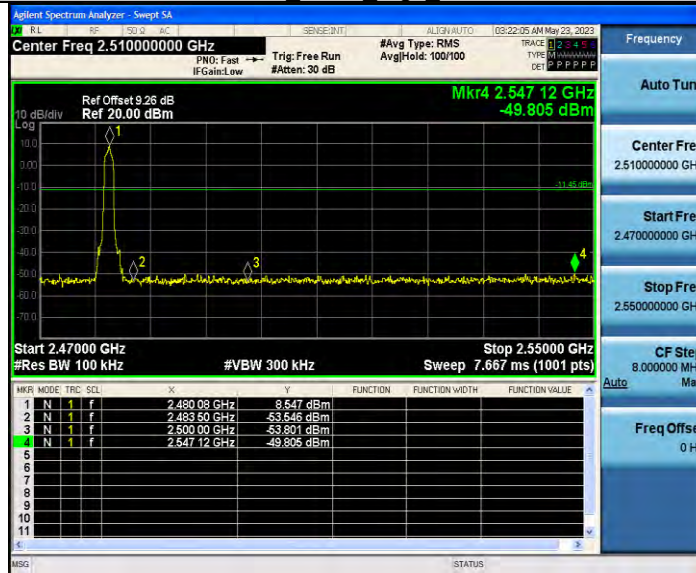
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2DH5 Ant22 High 2480



2DH5 Ant24 High 2480

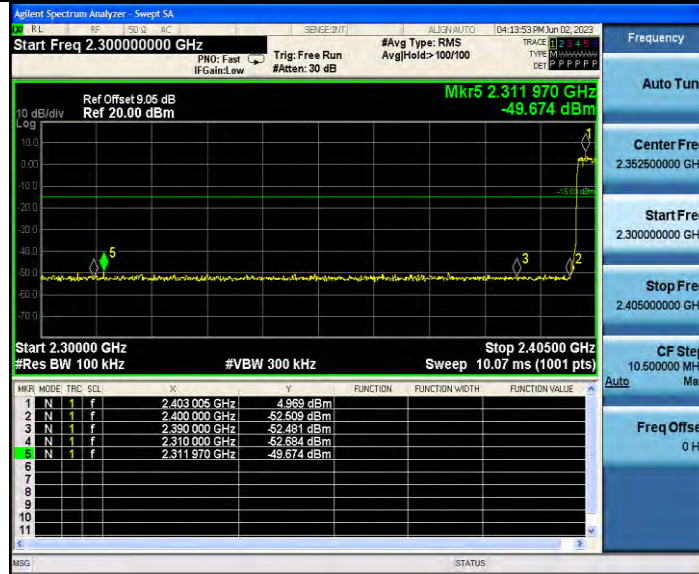


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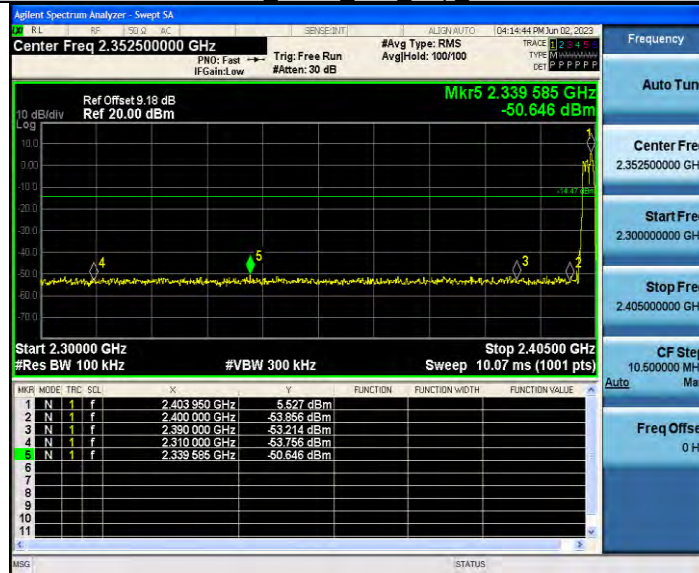
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2DH5_Ant22_Low Hop_2402



2DH5_Ant24_Low Hop_2402

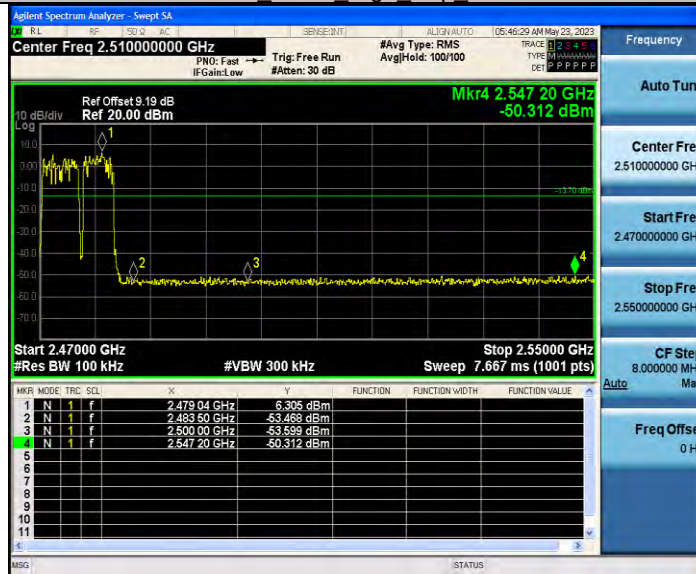


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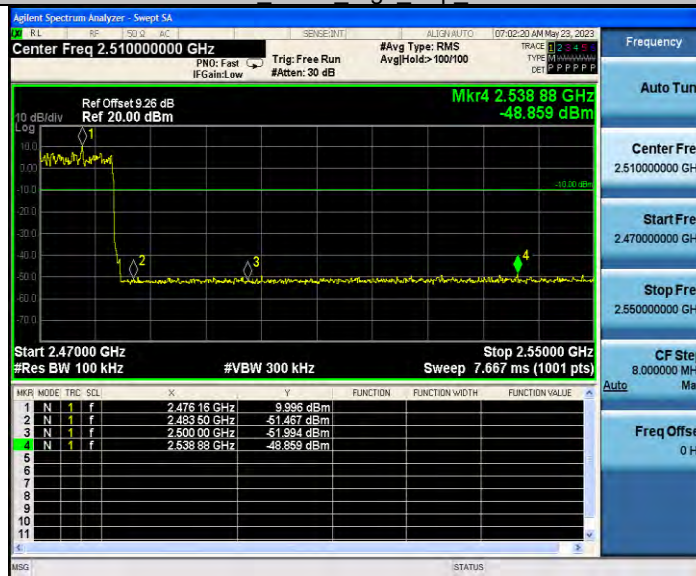
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2DH5 Ant22 High Hop 2480



2DH5 Ant24 High Hop 2480

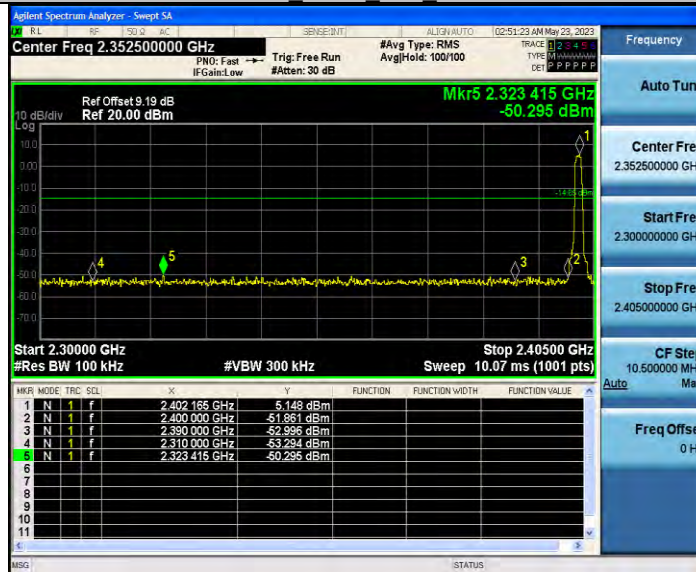


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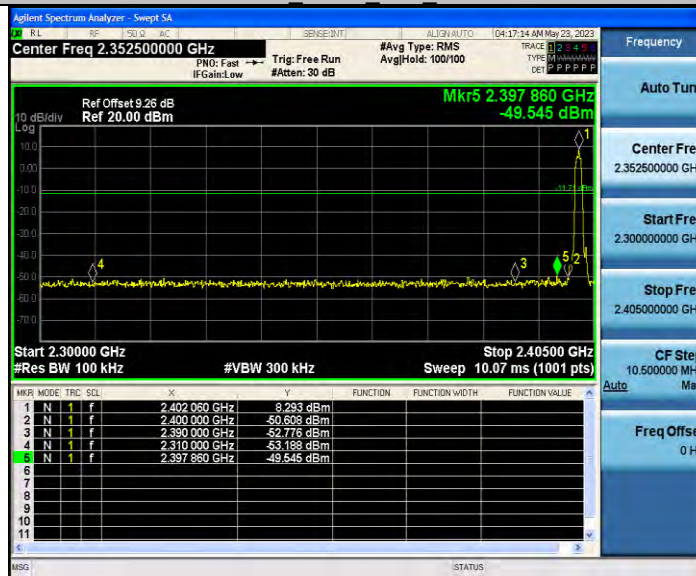
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3DH5_Ant22_Low_2402



3DH5_Ant24_Low_2402

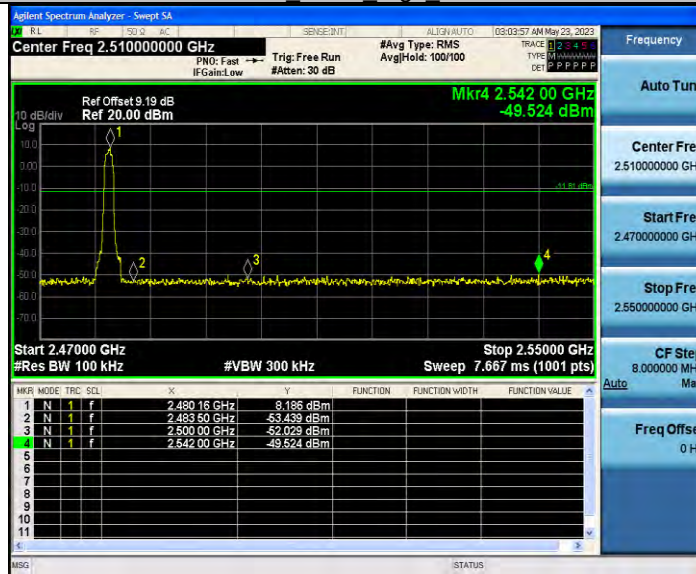


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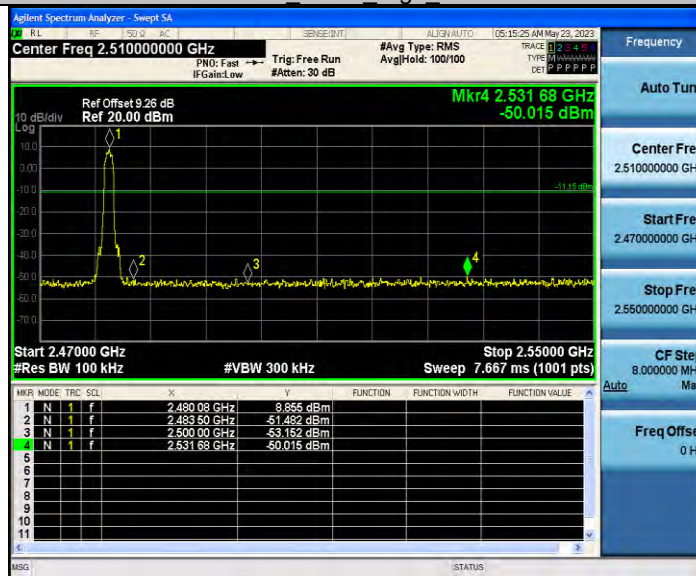
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3DH5 Ant22 High 2480



3DH5 Ant24 High 2480



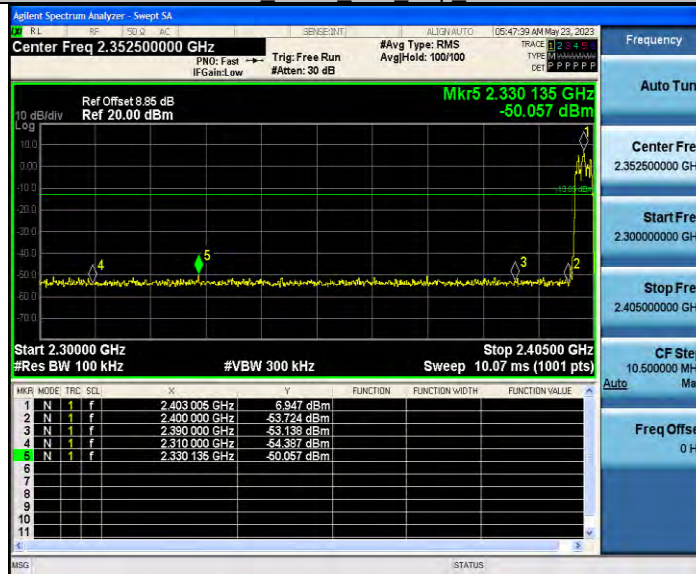
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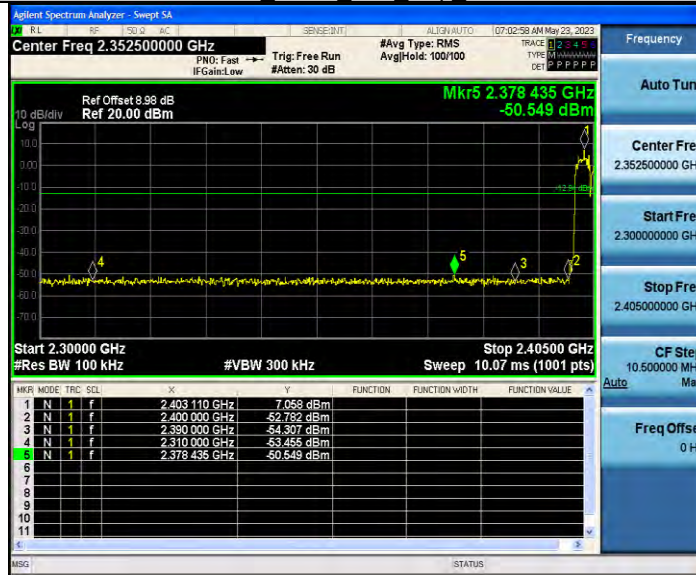
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3DH5_Ant22_Low_Hop_2402



3DH5_Ant24_Low_Hop_2402

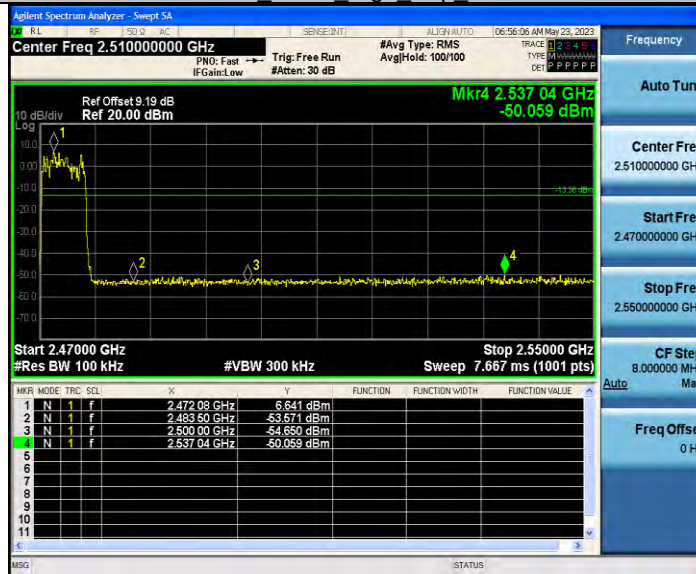


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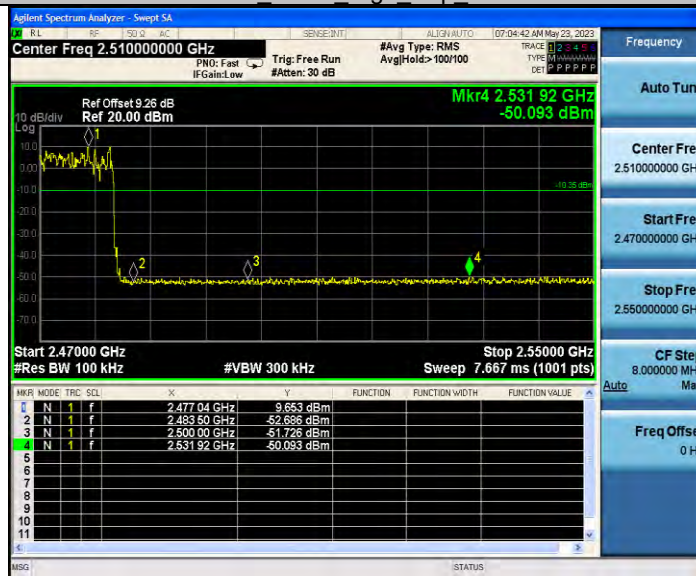
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3DH5 Ant22 High Hop 2480



3DH5 Ant24 High Hop 2480



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Conducted Spurious Emission Test Result

TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict	
DH5	Ant22	2402	Reference	7.52	7.52	---	PASS	
			30~1000	7.52	-60.35	≤-12.48	PASS	
			1000~26500	7.52	-45.31	≤-12.48	PASS	
	Ant24	2402	Reference	8.24	8.24	---	PASS	
			30~1000	8.24	-59.71	≤-11.76	PASS	
			1000~26500	8.24	-45.73	≤-11.76	PASS	
	Ant22	2441	Reference	8.49	8.49	---	PASS	
			30~1000	8.49	-59.72	≤-11.51	PASS	
			1000~26500	8.49	-45.72	≤-11.51	PASS	
	Ant24	2441	Reference	9.65	9.65	---	PASS	
			30~1000	9.65	-60.27	≤-10.35	PASS	
			1000~26500	9.65	-44.67	≤-10.35	PASS	
	Ant22	2480	Reference	8.49	8.49	---	PASS	
			30~1000	8.49	-60	≤-11.51	PASS	
			1000~26500	8.49	-45.87	≤-11.51	PASS	
	Ant24	2480	Reference	9.14	9.14	---	PASS	
			30~1000	9.14	-60.2	≤-10.86	PASS	
			1000~26500	9.14	-45.91	≤-10.86	PASS	
	2DH5	Ant22	2402	Reference	4.84	4.84	---	PASS
				30~1000	4.84	-60.38	≤-15.16	PASS
				1000~26500	4.84	-45.95	≤-15.16	PASS
		Ant24	2402	Reference	6.86	6.86	---	PASS
				30~1000	6.86	-59.19	≤-13.14	PASS
				1000~26500	6.86	-45.43	≤-13.14	PASS
Ant22		2441	Reference	5.94	5.94	---	PASS	
			30~1000	5.94	-60.97	≤-14.06	PASS	
			1000~26500	5.94	-45.77	≤-14.06	PASS	
Ant24		2441	Reference	7.94	7.94	---	PASS	
			30~1000	7.94	-60.43	≤-12.06	PASS	
			1000~26500	7.94	-45.58	≤-12.06	PASS	
Ant22		2480	Reference	5.53	5.53	---	PASS	
			30~1000	5.53	-60.08	≤-14.47	PASS	
			1000~26500	5.53	-45.06	≤-14.47	PASS	
Ant24		2480	Reference	6.71	6.71	---	PASS	
			30~1000	6.71	-60.05	≤-13.29	PASS	
			1000~26500	6.71	-45.4	≤-13.29	PASS	
3DH5		Ant22	2402	Reference	5.21	5.21	---	PASS
				30~1000	5.21	-60.12	≤-14.79	PASS
				1000~26500	5.21	-45.38	≤-14.79	PASS
		Ant24	2402	Reference	5.00	5.00	---	PASS
				30~1000	5.00	-60.79	≤-15	PASS
				1000~26500	5.00	-45.85	≤-15	PASS
	Ant22	2441	Reference	5.88	5.88	---	PASS	
			30~1000	5.88	-60.62	≤-14.12	PASS	
			1000~26500	5.88	-44.8	≤-14.12	PASS	
	Ant24	2441	Reference	7.17	7.17	---	PASS	
			30~1000	7.17	-60.43	≤-12.83	PASS	
			1000~26500	7.17	-45.16	≤-12.83	PASS	
	Ant22	2480	Reference	6.40	6.40	---	PASS	
			30~1000	6.40	-60.31	≤-13.6	PASS	



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			1000~26500	6.40	-46.1	≤-13.6	PASS
			Reference	6.99	6.99	---	PASS
	Ant24	2480	30~1000	6.99	-60.04	≤-13.01	PASS
			1000~26500	6.99	-45.74	≤-13.01	PASS



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