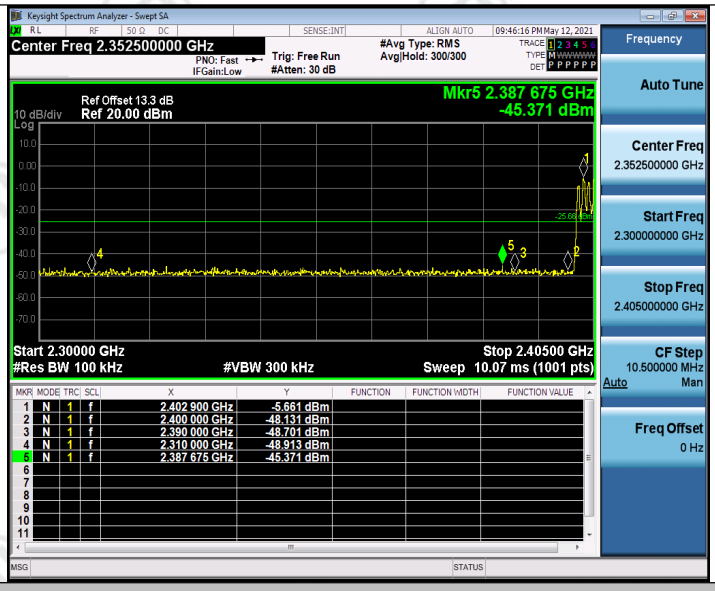
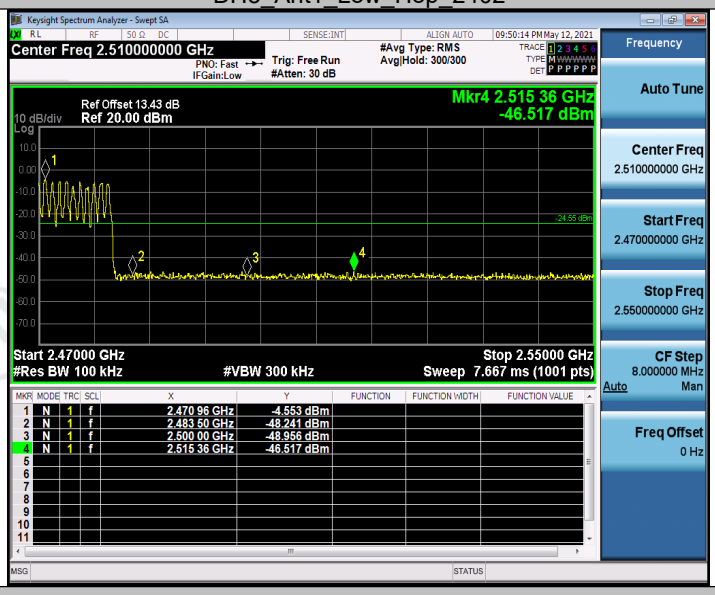
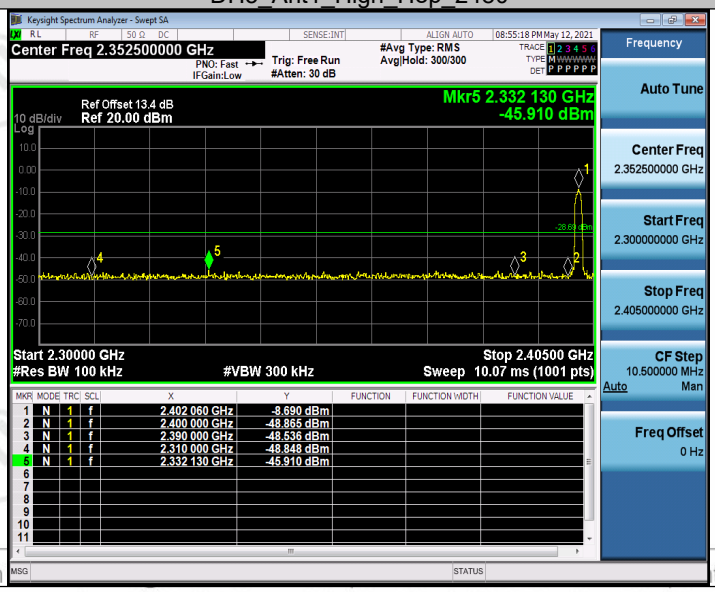


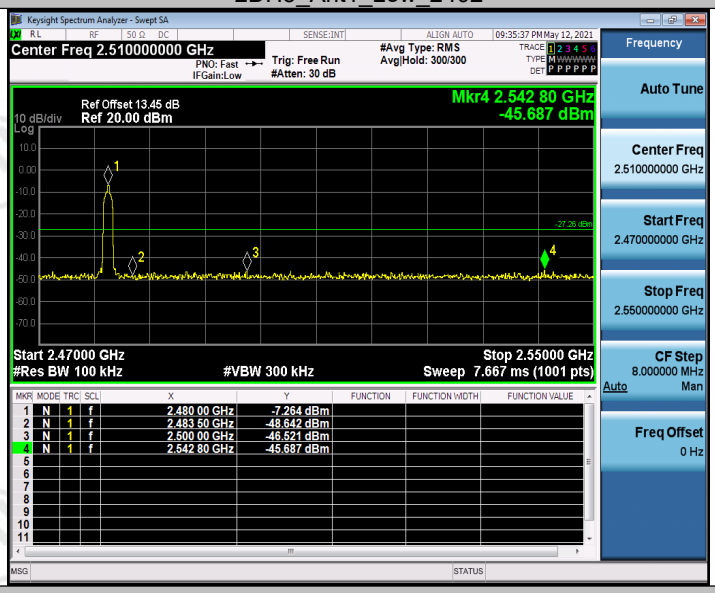
DH5_Ant1_Low_Hop_2402



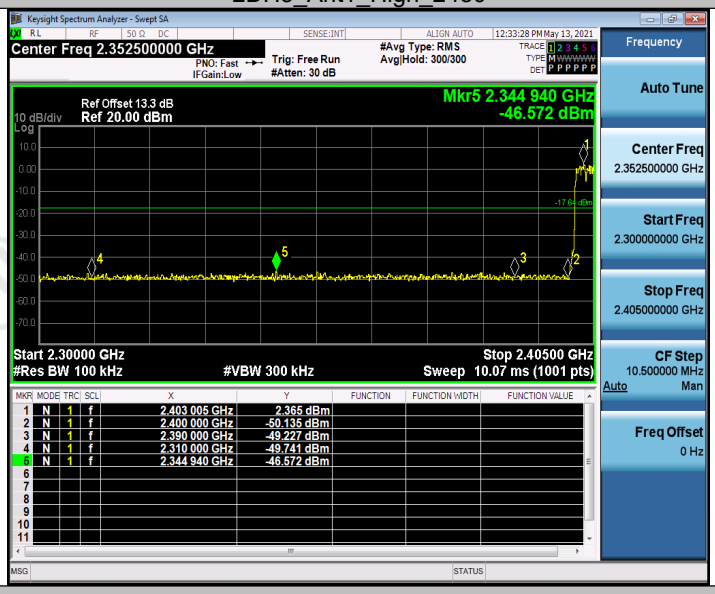
DH5_Ant1_High_Hop_2480



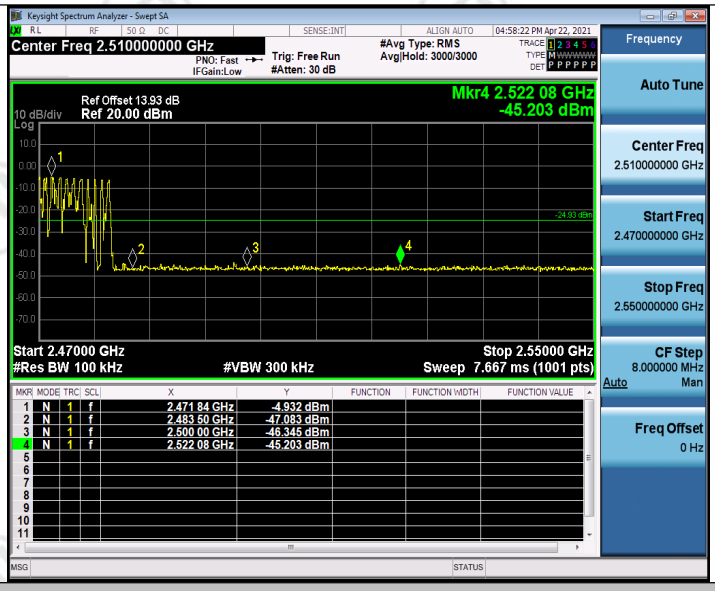
2DH5_Ant1_Low_2402



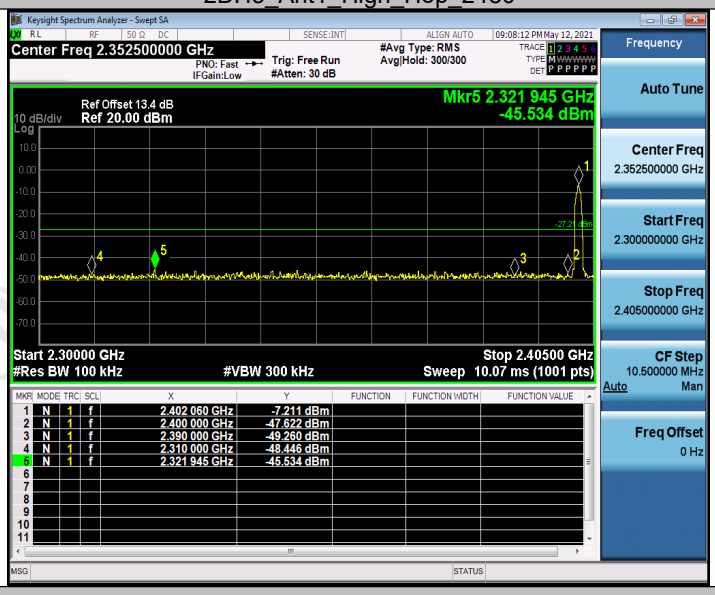
2DH5_Ant1_High_2480



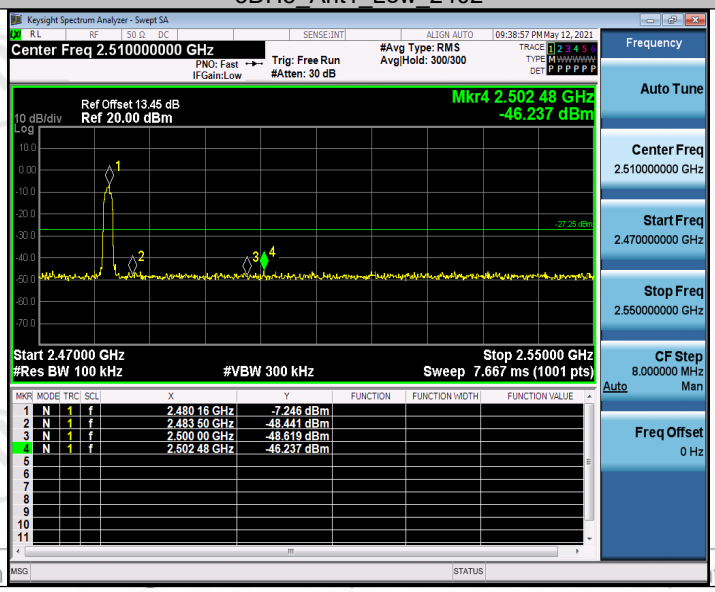
2DH5_Ant1_Low_Hop_2402



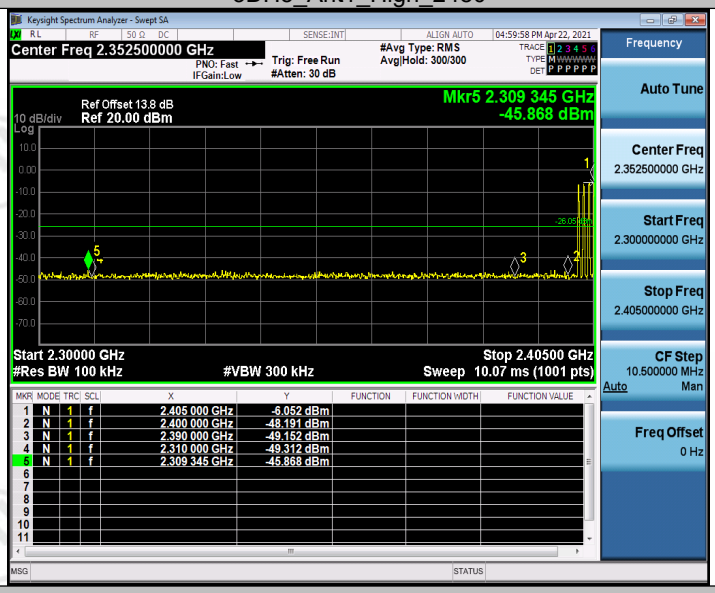
2DH5_Ant1_High_Hop_2480



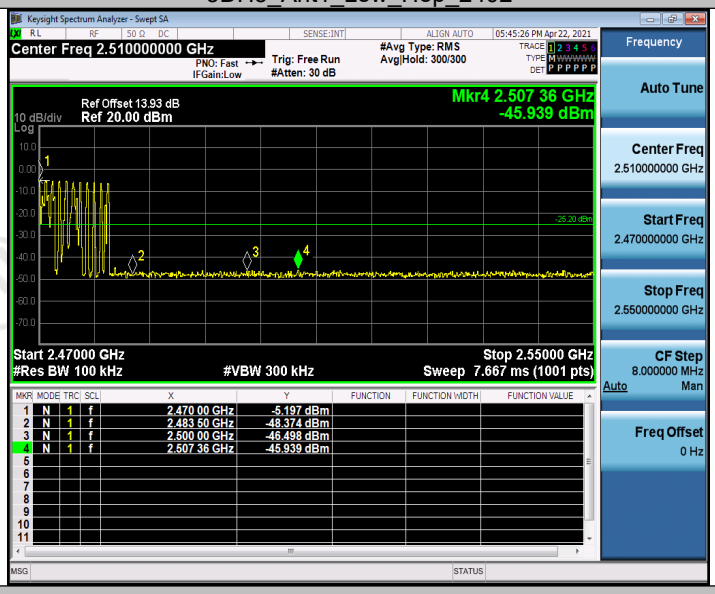
3DH5_Ant1_Low_2402



3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



3DH5_Ant1_High_Hop_2480

Appendix G): RF Conducted Spurious Emissions

Test Limit

According to §15.247(d),

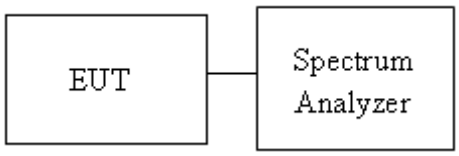
Limit	-20 dBc

Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.

2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

Test Setup

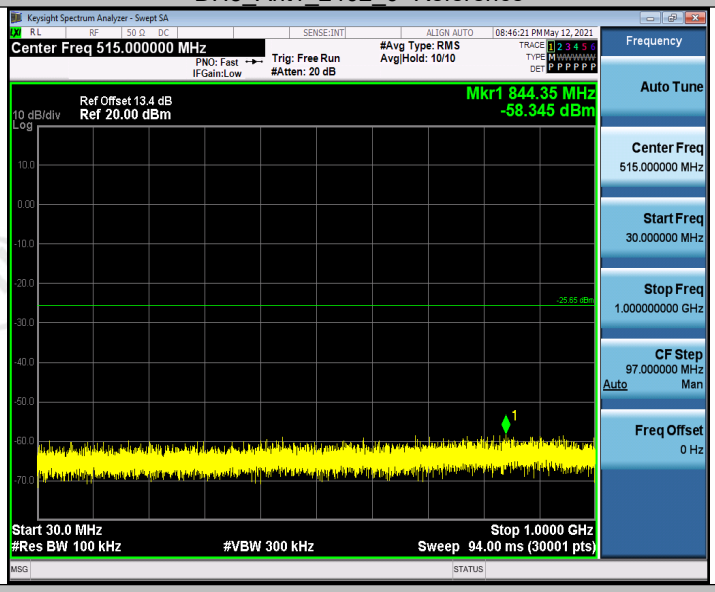


Result Table

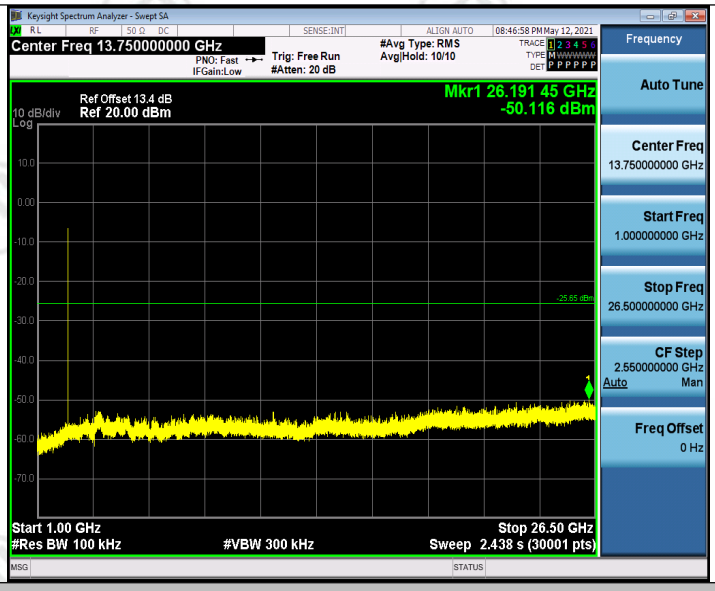
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	-5.65	-5.65	---	PASS
			30~1000	---	-58.345	<=-25.654	PASS
			1000~26500	---	-50.116	<=-25.654	PASS
		2441	Reference	-3.88	-3.88	---	PASS
			30~1000	---	-58.346	<=-23.877	PASS
			1000~26500	---	-49.305	<=-23.877	PASS
		2480	Reference	-5.21	-5.21	---	PASS
			30~1000	---	-57.222	<=-25.212	PASS
			1000~26500	---	-49.056	<=-25.212	PASS
2DH5	Ant1	2402	Reference	-7.32	-7.32	---	PASS
			30~1000	---	-57.678	<=-27.323	PASS
			1000~26500	---	-49.501	<=-27.323	PASS
		2441	Reference	-6.41	-6.41	---	PASS
			30~1000	---	-56.325	<=-26.406	PASS
			1000~26500	---	-49.461	<=-26.406	PASS
		2480	Reference	-7.44	-7.44	---	PASS
			30~1000	---	-57.24	<=-27.435	PASS
			1000~26500	---	-49.787	<=-27.435	PASS
3DH5	Ant1	2402	Reference	-7.68	-7.68	---	PASS
			30~1000	---	-57.713	<=-27.675	PASS
			1000~26500	---	-49.653	<=-27.675	PASS
		2441	Reference	-5.37	-5.37	---	PASS
			30~1000	---	-57.621	<=-25.373	PASS
			1000~26500	---	-49.76	<=-25.373	PASS
		2480	Reference	-7.27	-7.27	---	PASS
			30~1000	---	-58.051	<=-27.272	PASS
			1000~26500	---	-49.676	<=-27.272	PASS

Test Graph

DH5_Ant1_2402_0~Reference

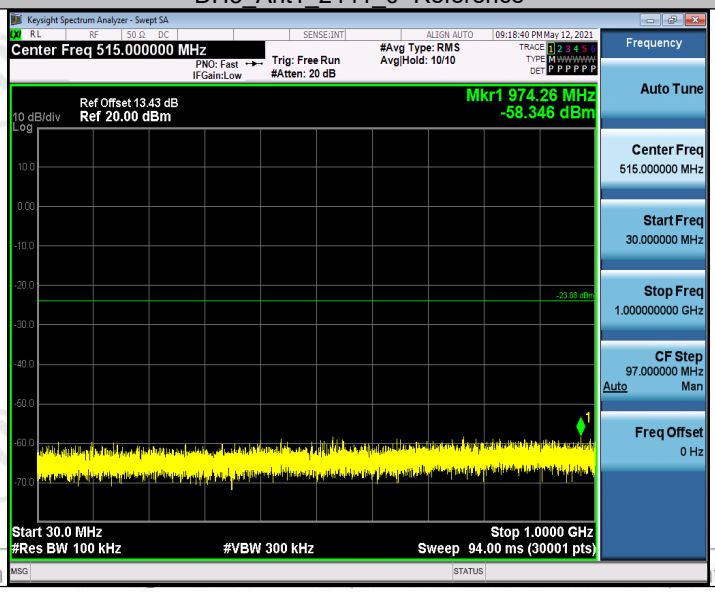


DH5_Ant1_2402_30~1000



DH5_Ant1_2402_1000~26500

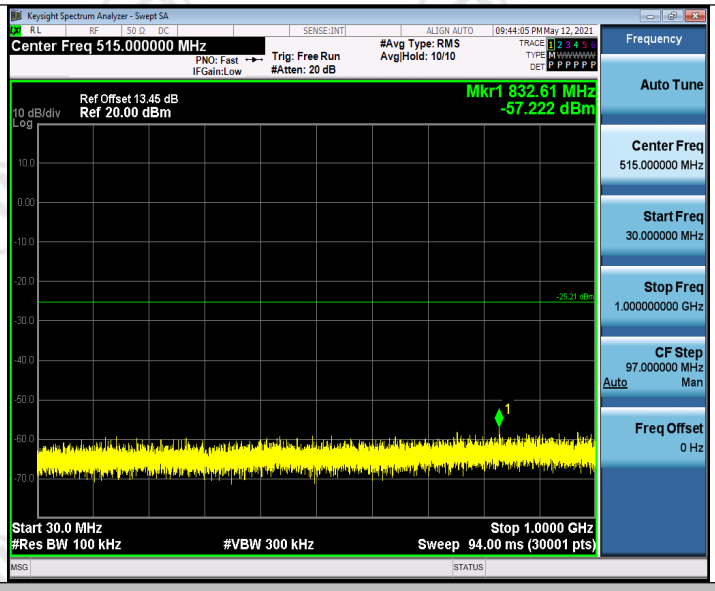
DH5_Ant1_2441_0~Reference



DH5_Ant1_2441_30~1000

DH5_Ant1_2441_1000~26500

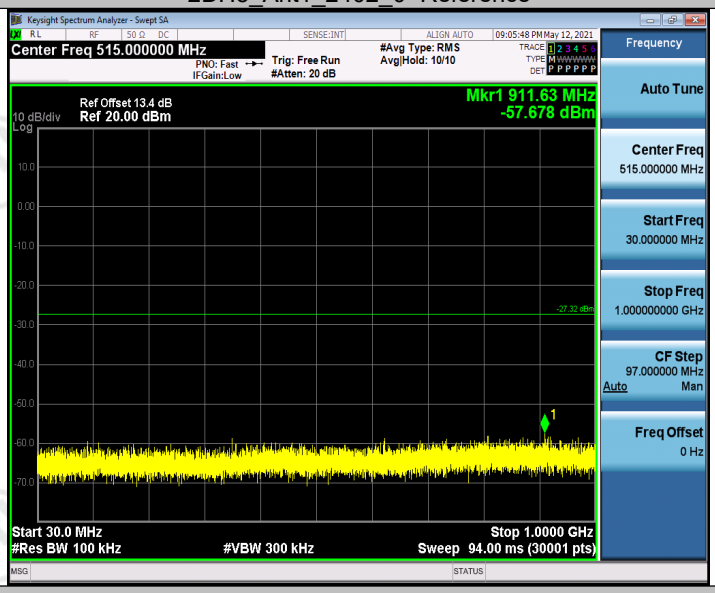
DH5_Ant1_2480_0~Reference



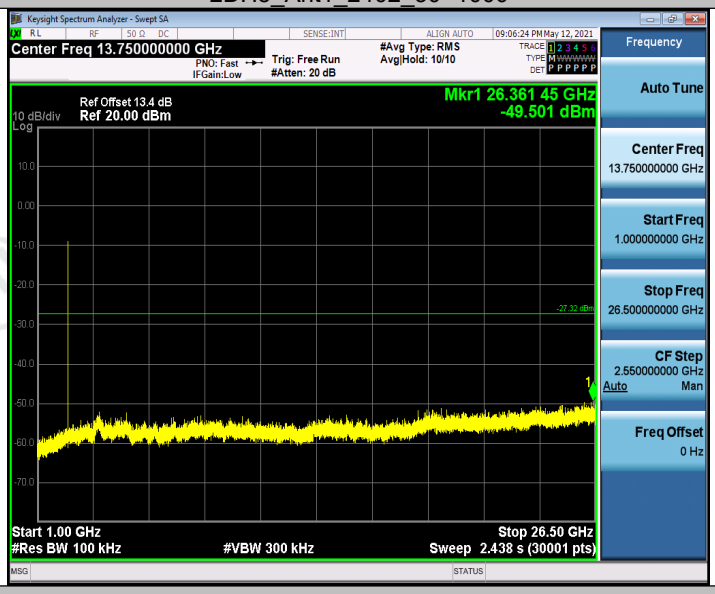
DH5_Ant1_2480_30~1000

DH5_Ant1_2480_1000~26500

2DH5_Ant1_2402_0~Reference

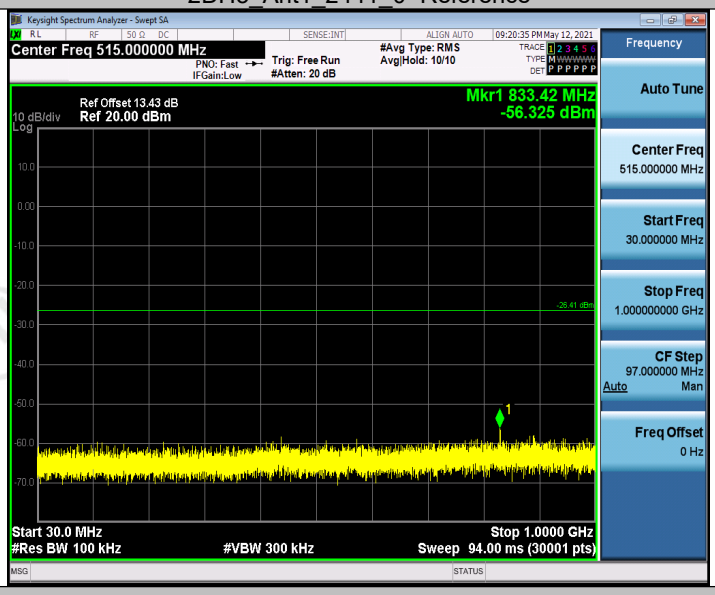


2DH5_Ant1_2402_30~1000



2DH5_Ant1_2402_1000~26500

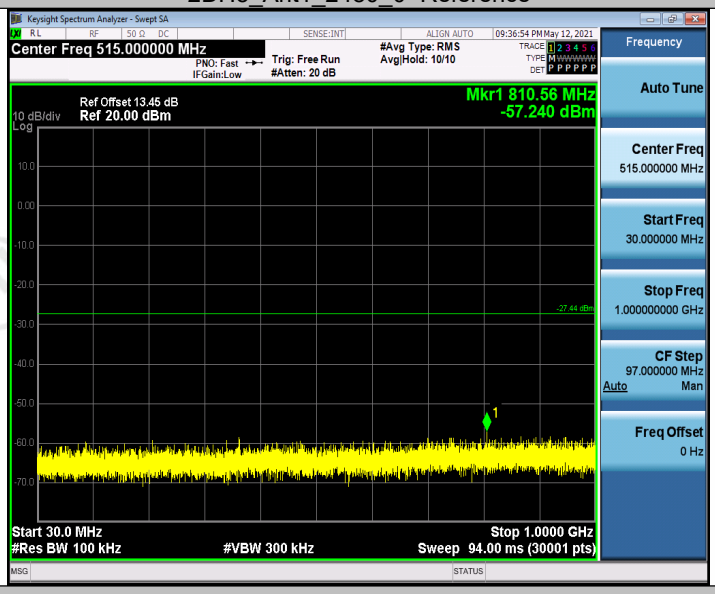
2DH5_Ant1_2441_0~Reference



2DH5_Ant1_2441_30~1000

2DH5_Ant1_2441_1000~26500

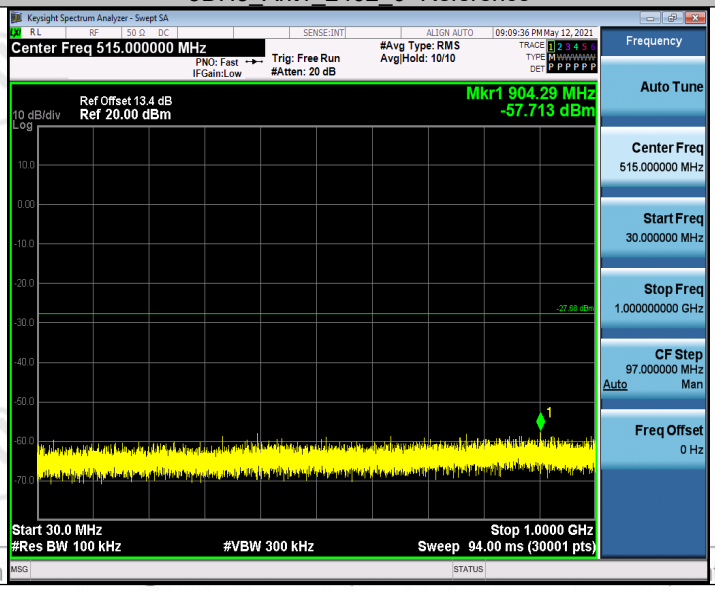
2DH5_Ant1_2480_0~Reference



2DH5_Ant1_2480_30~1000

2DH5_Ant1_2480_1000~26500

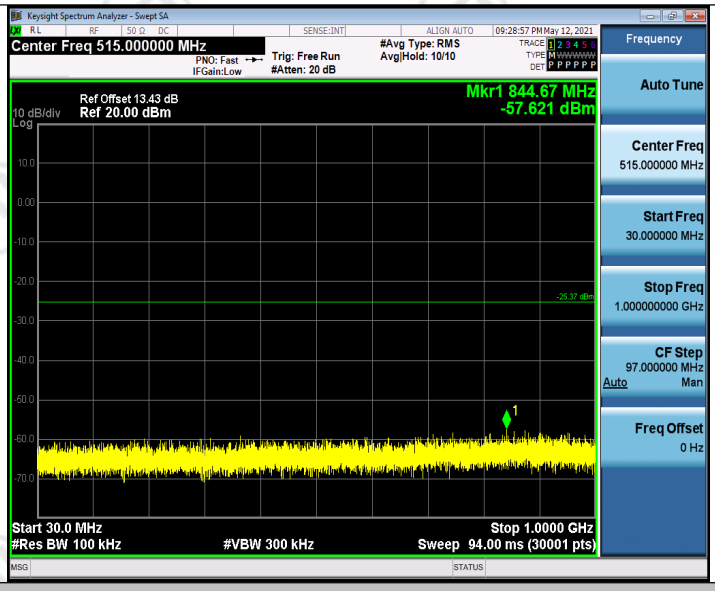
3DH5_Ant1_2402_0~Reference



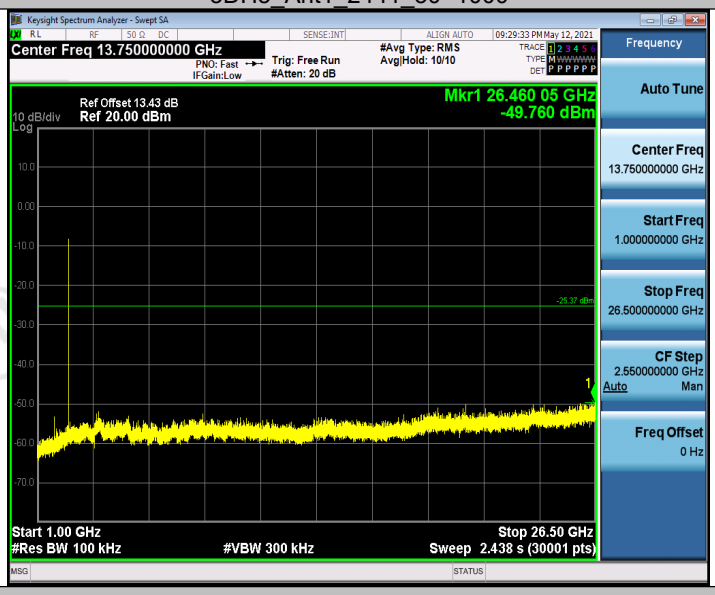
3DH5_Ant1_2402_30~1000

3DH5_Ant1_2402_1000~26500

3DH5_Ant1_2441_0~Reference

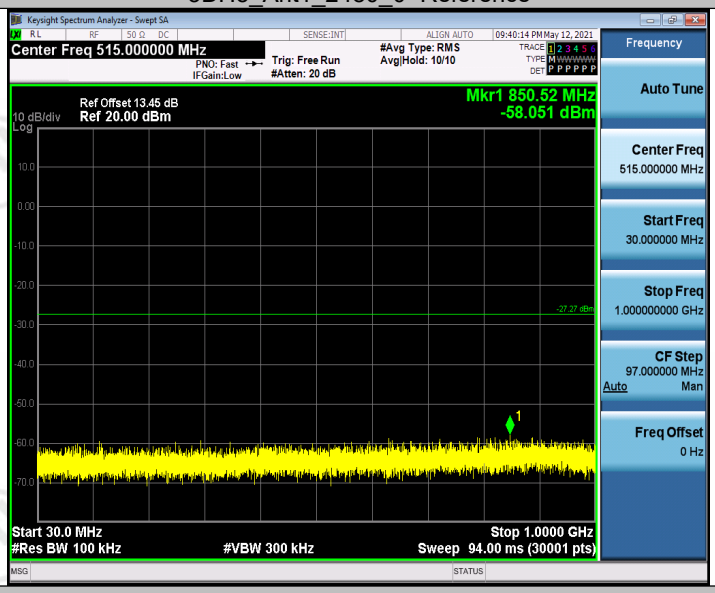


3DH5_Ant1_2441_30~1000

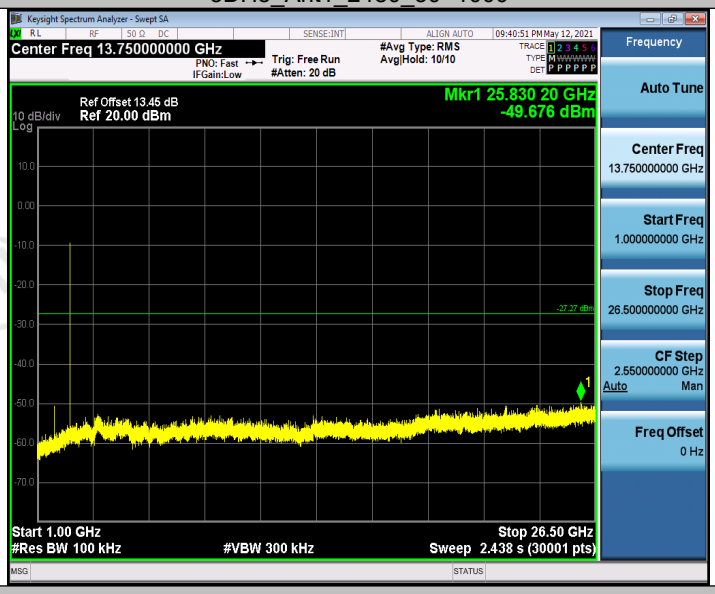


3DH5_Ant1_2441_1000~26500

3DH5_Ant1_2480_0~Reference



3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500

Appendix H) Pseudorandom Frequency Hopping Sequence

Test Requirement:	47 CFR Part 15**C Section 15.247 (a)(1) requirement:**

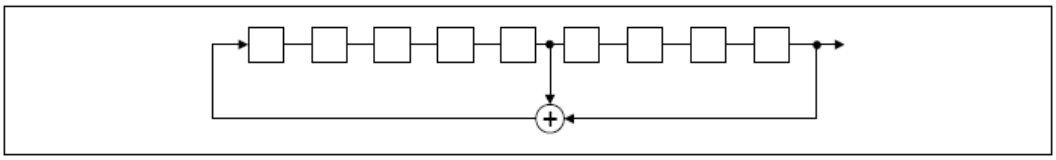
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom 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.

EUT Pseudorandom Frequency Hopping Sequence

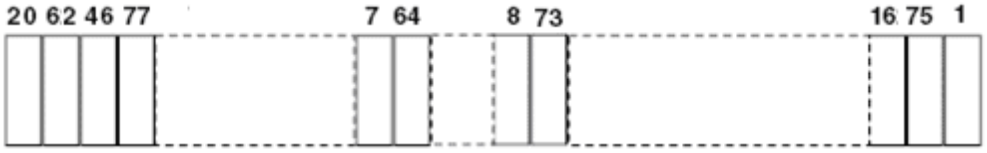
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized 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:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

Appendix I) Antenna Requirement

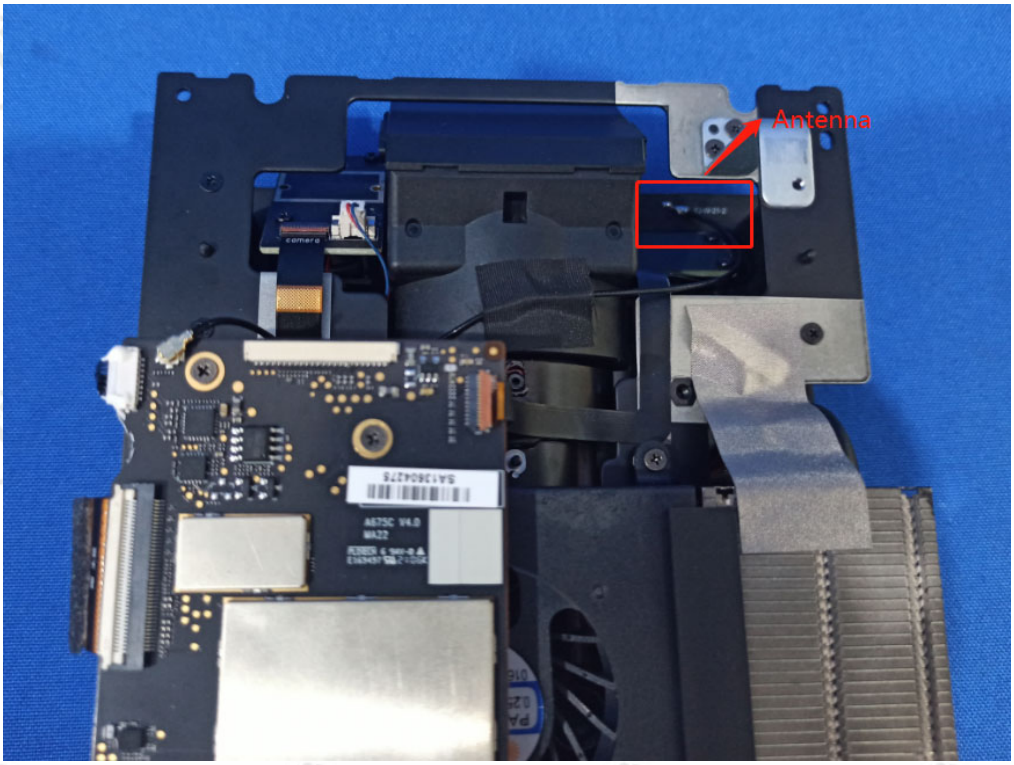
15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:



The antenna is integrated on the main FPC and no consideration of replacement. The best case gain of the antenna is 3.4 dBi.

Appendix J) AC Power Line Conducted Emission

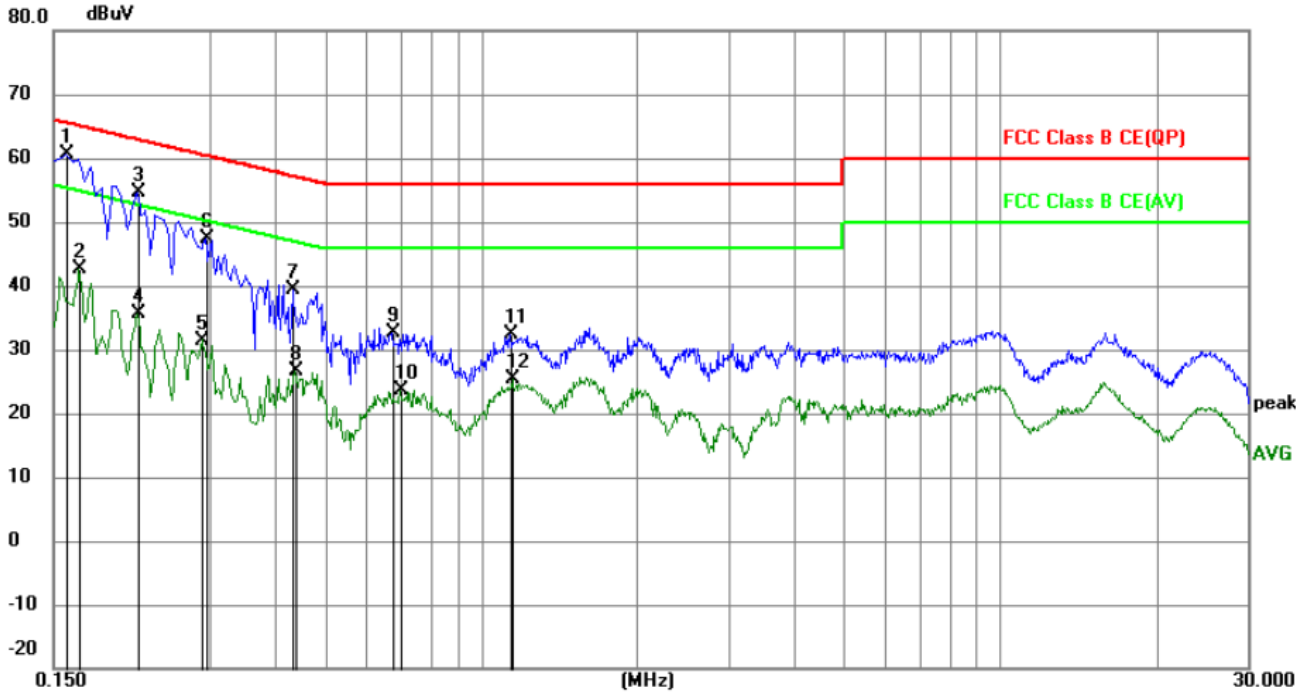
<table>
<tr><td>Test Procedure:</td><td>Test frequency range :150KHz-30MHz
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. 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 on conducted measurement.</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.
NOTE : The lower limit is applicable at the transition frequency</td></tr>
</table>

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.

Live line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1590	50.69	9.87	60.56	65.52	-4.96	QP	
2		0.1680	32.69	9.87	42.56	55.06	-12.50	AVG	
3		0.2175	44.83	9.90	54.73	62.91	-8.18	QP	
4		0.2175	25.83	9.90	35.73	52.91	-17.18	AVG	
5		0.2895	21.45	10.05	31.50	50.54	-19.04	AVG	
6		0.2940	37.32	10.06	47.38	60.41	-13.03	QP	
7		0.4335	29.44	9.96	39.40	57.19	-17.79	QP	
8		0.4380	16.75	9.96	26.71	47.10	-20.39	AVG	
9		0.6720	22.72	9.93	32.65	56.00	-23.35	QP	
10		0.6990	13.81	9.88	23.69	46.00	-22.31	AVG	
11		1.1400	22.44	9.82	32.26	56.00	-23.74	QP	
12		1.1490	15.45	9.82	25.27	46.00	-20.73	AVG	