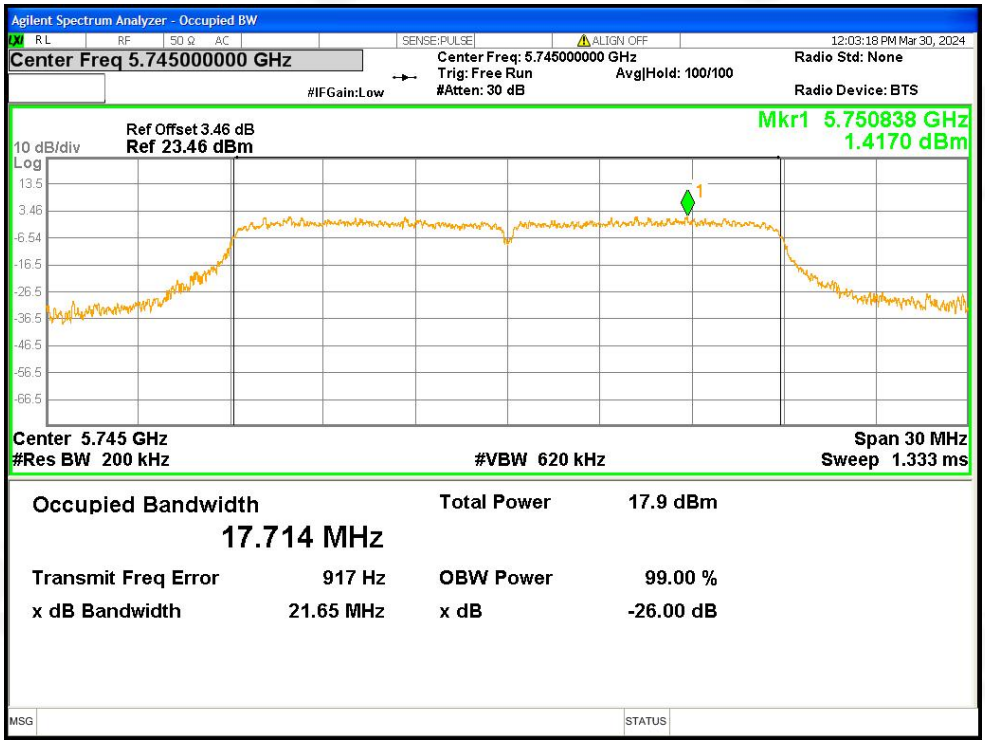
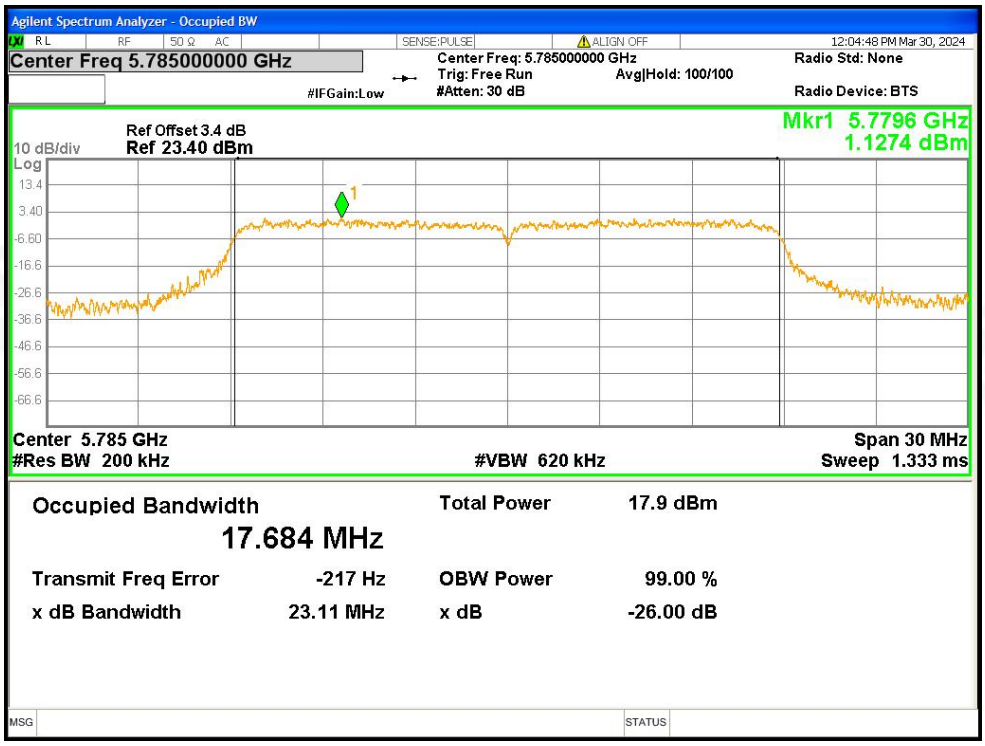


OBW NVNT n20 5745MHz Ant1



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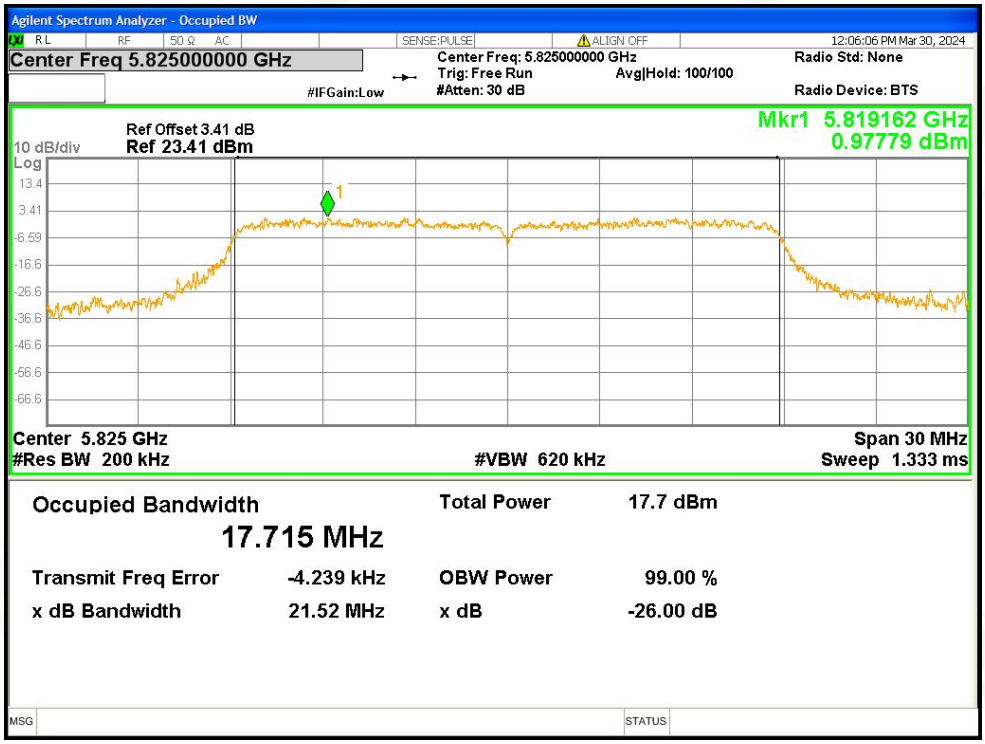

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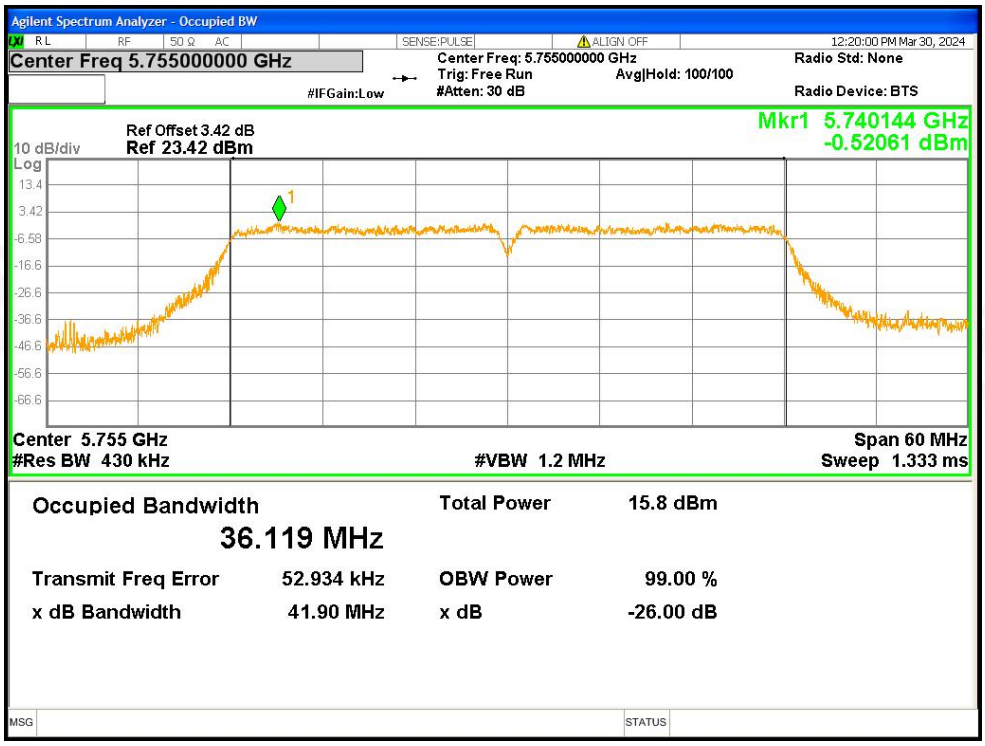
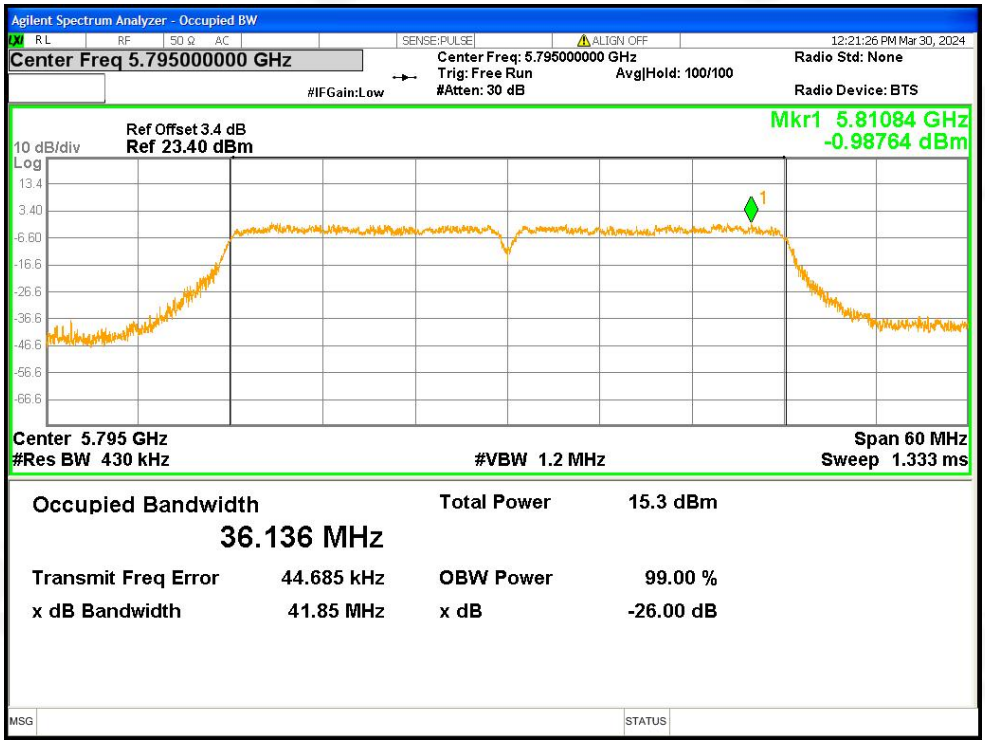


OBW NVNT n40 5755MHz Ant1



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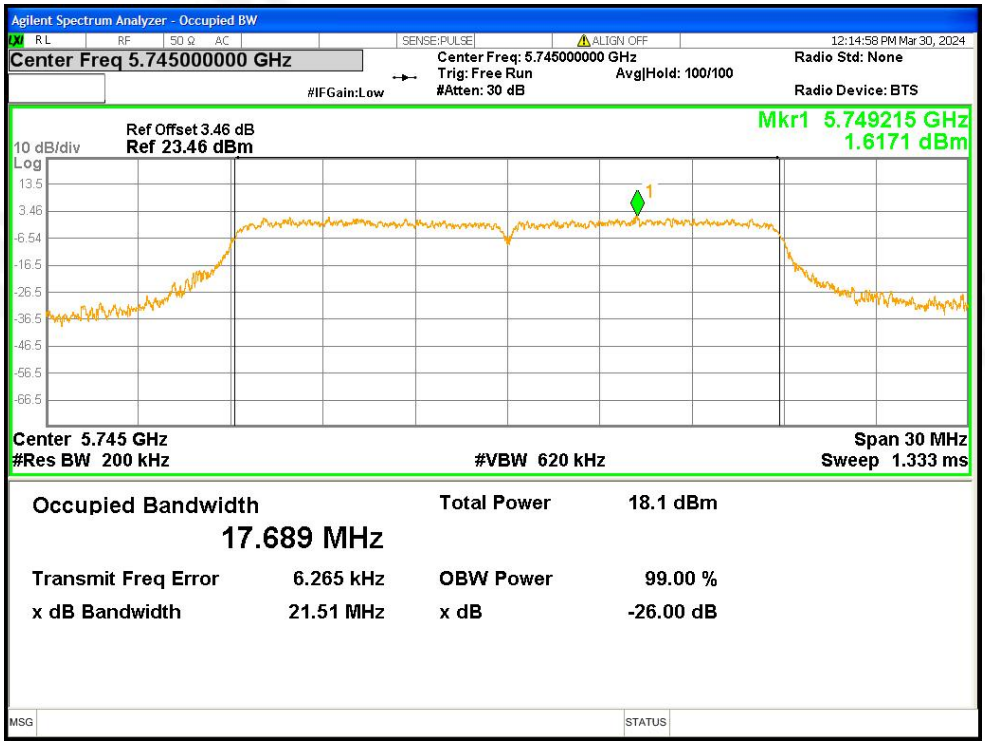
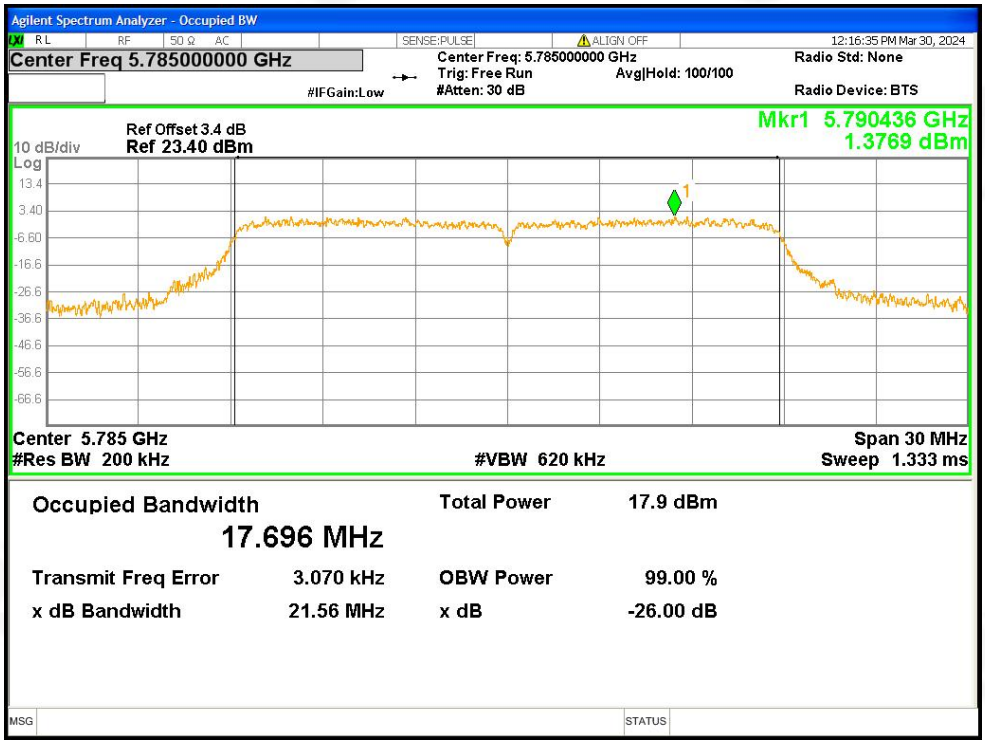


OBW NVNT ac20 5745MHz Ant1



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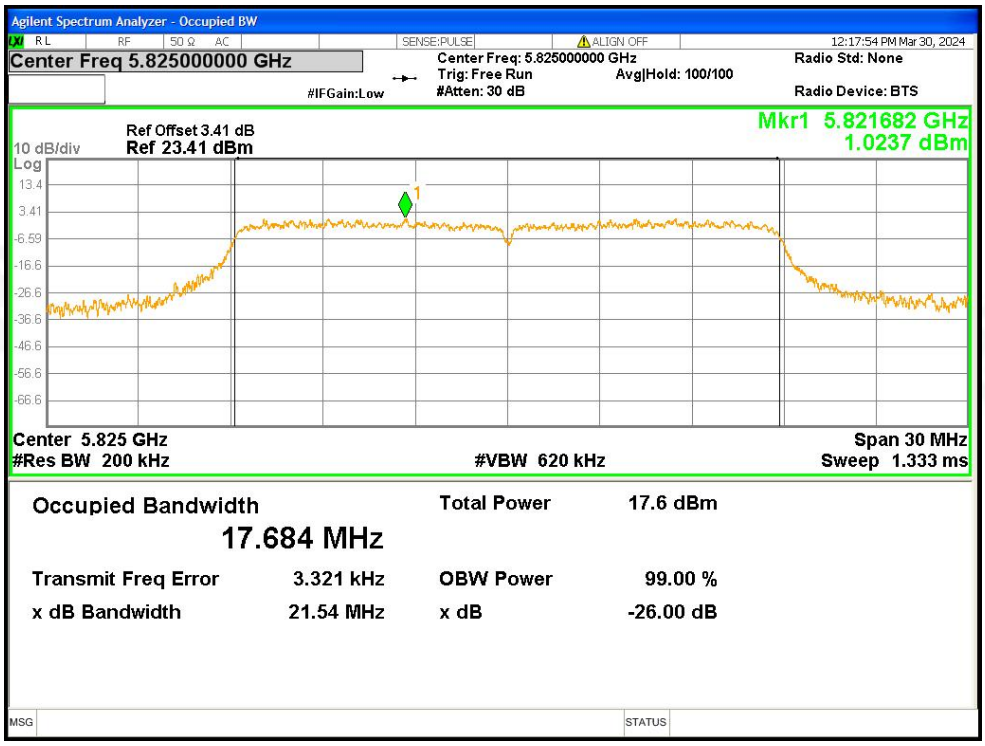

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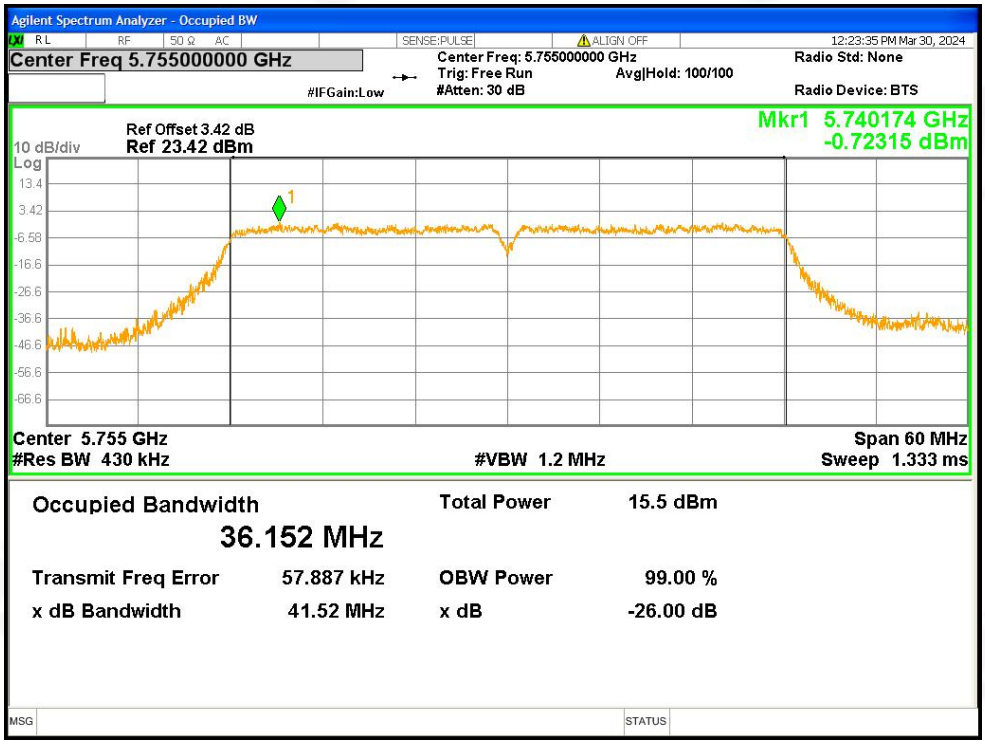
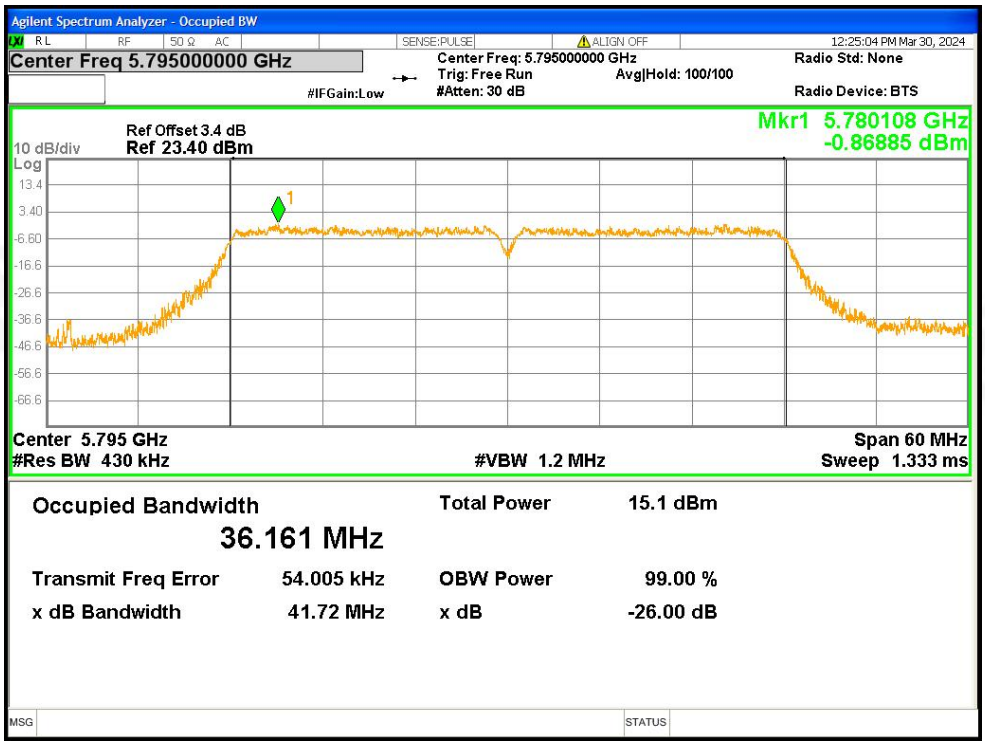
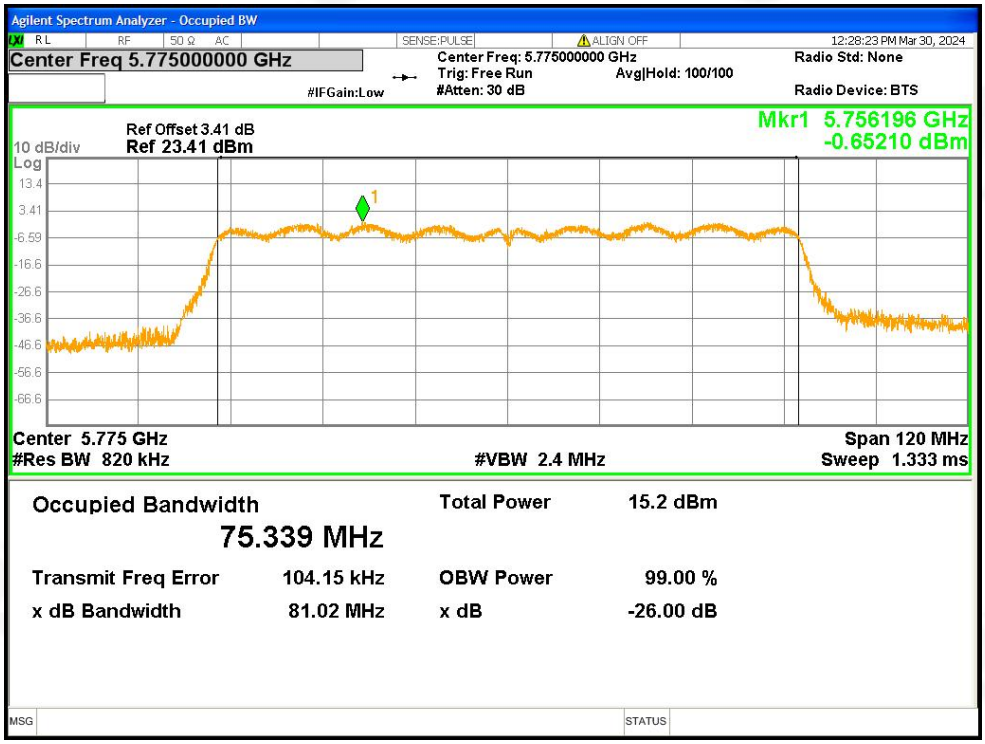


OBW NVNT ac40 5755MHz Ant1

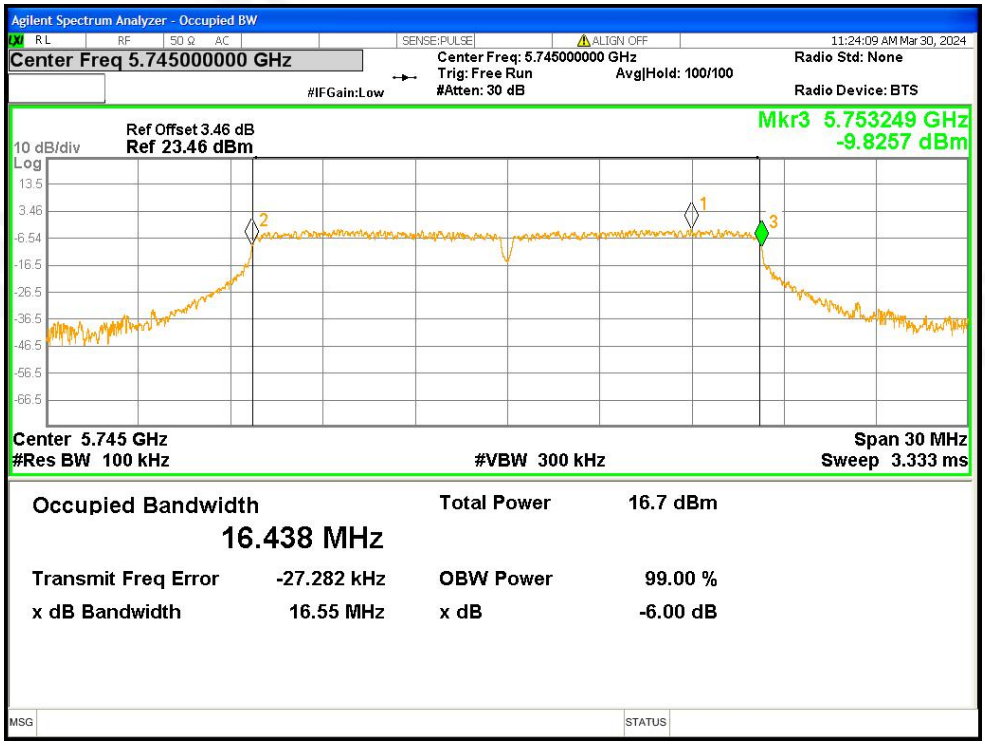


OBW NVNT ac40 5795MHz Ant1

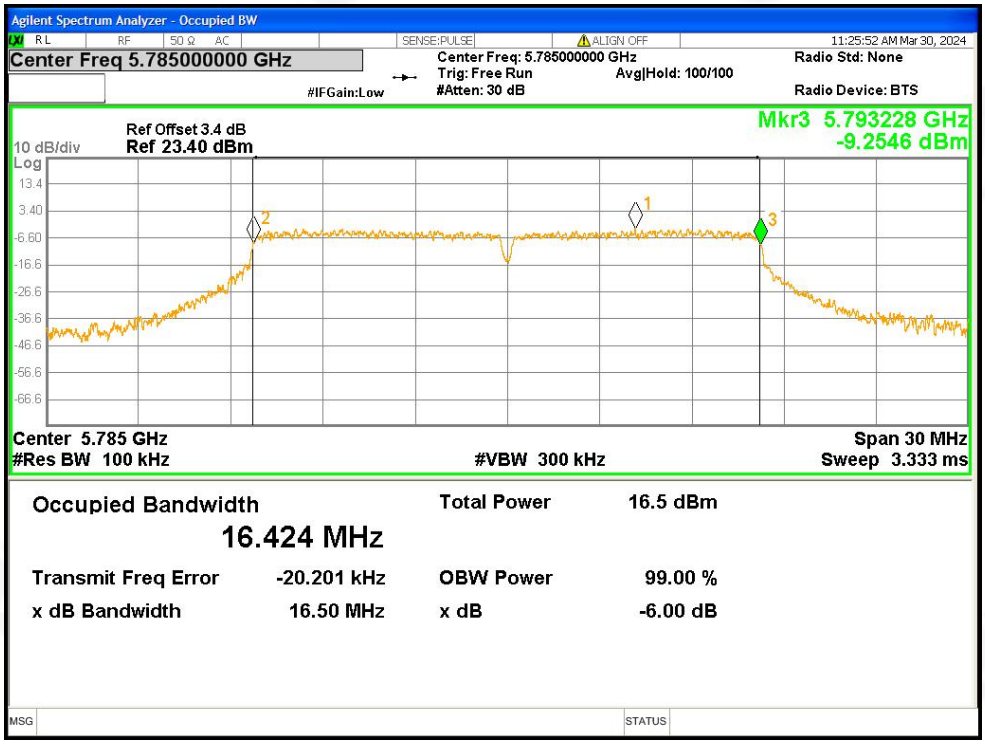


OBW NVNT ac80 5775MHz Ant1

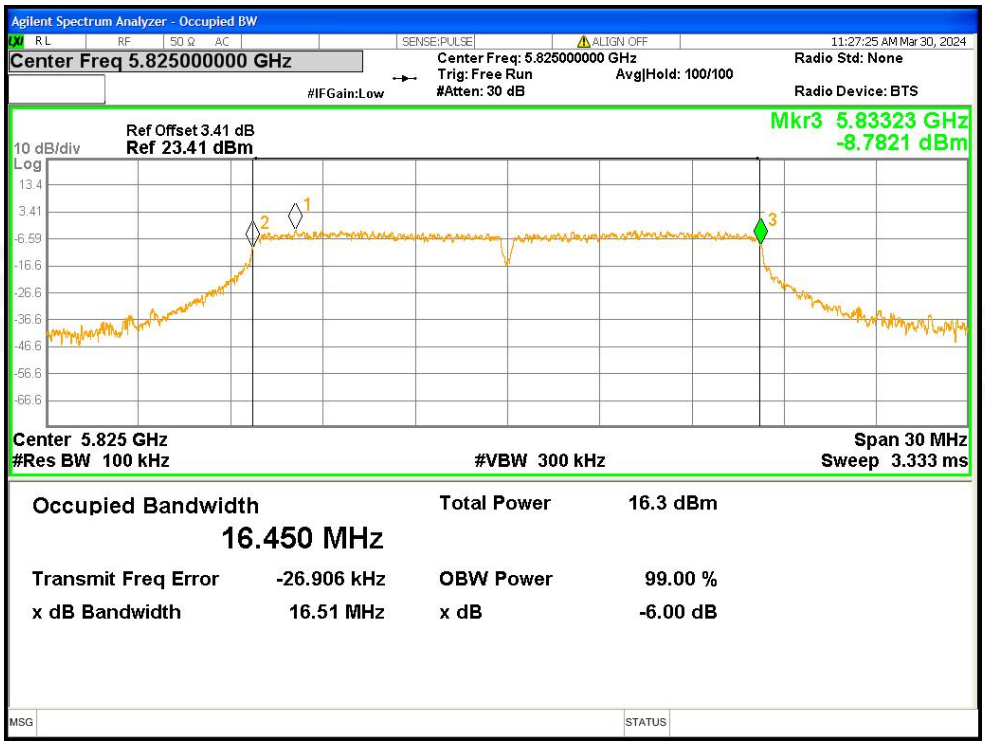
Ant0



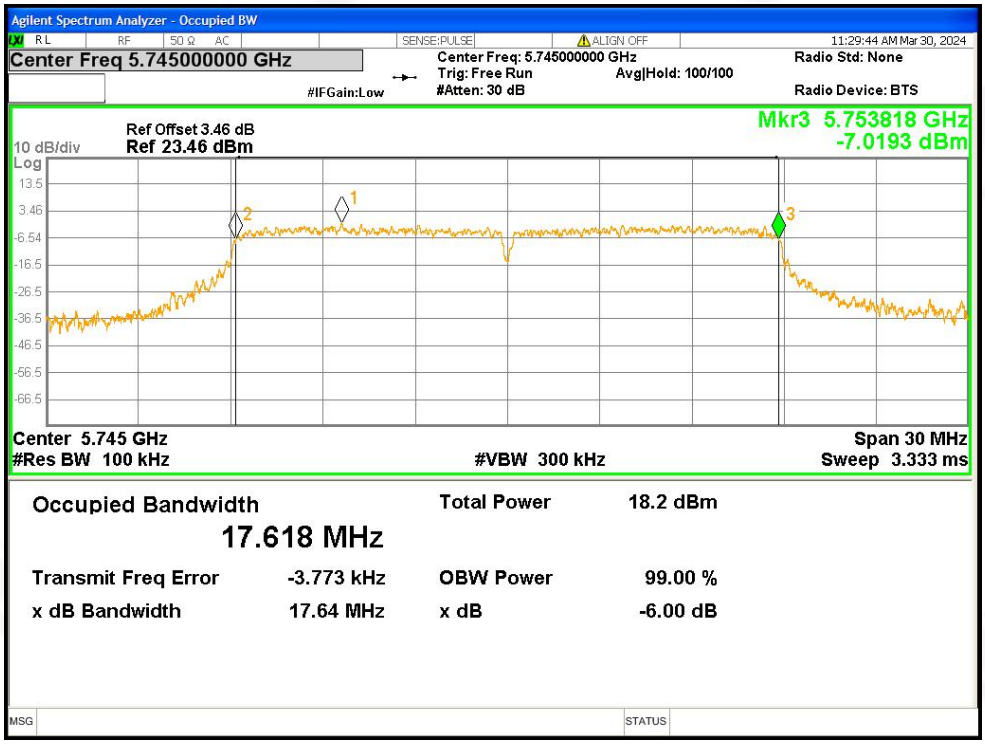
-6dB Bandwidth NVNT a 5745MHz



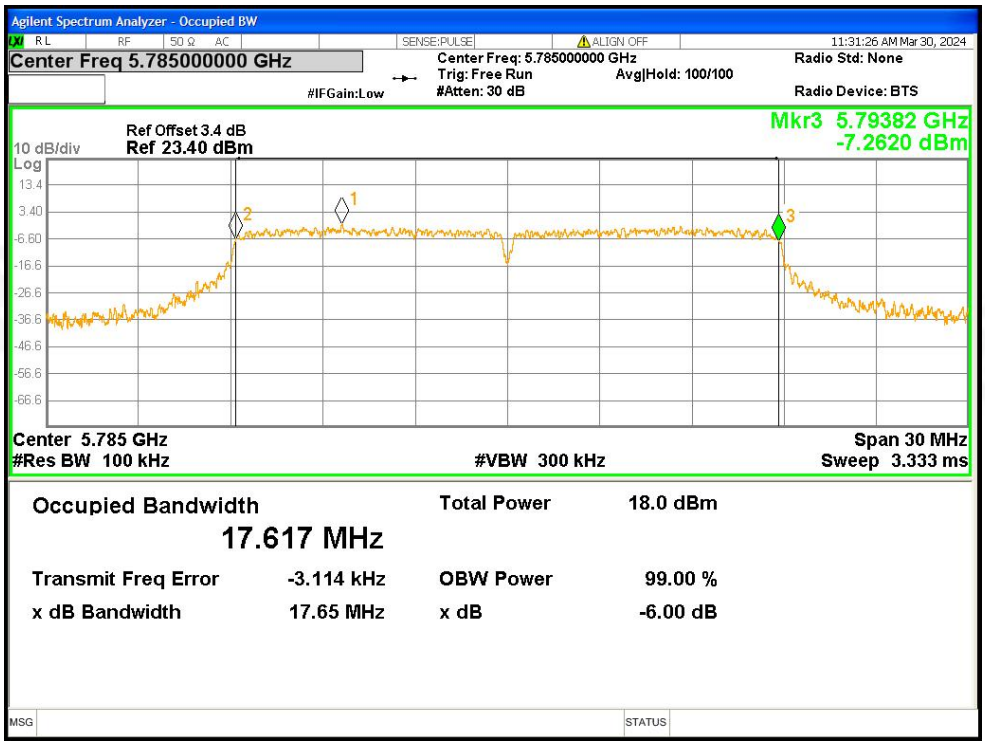
-6dB Bandwidth NVNT a 5785MHz



-6dB Bandwidth NVNT a 5825MHz



-6dB Bandwidth NVNT n20 5745MHz



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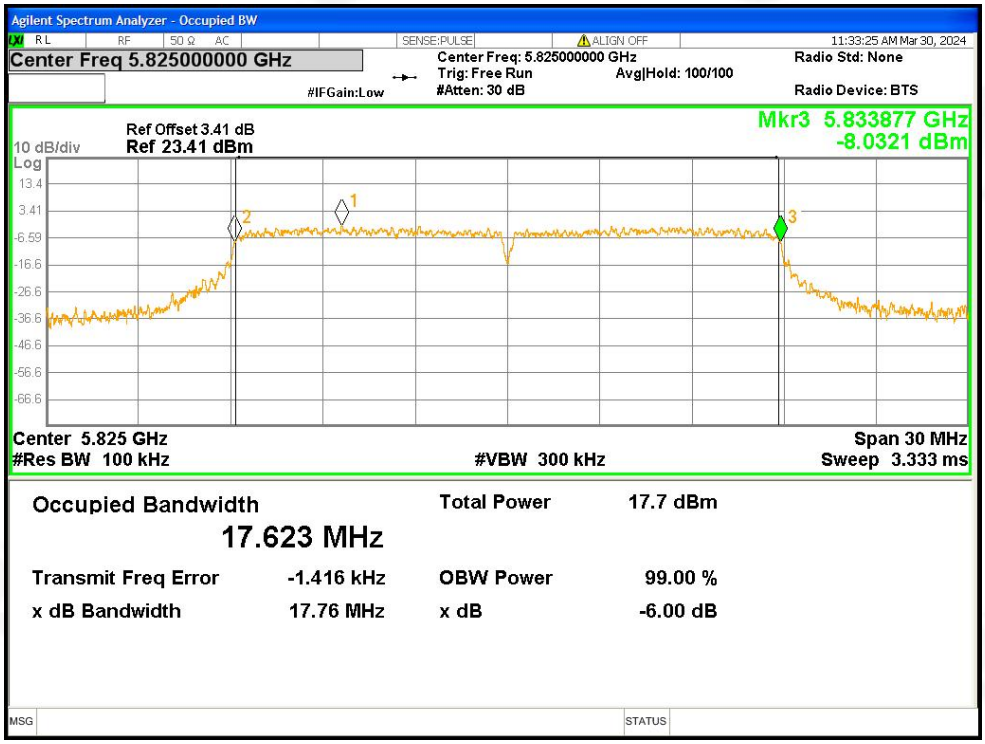
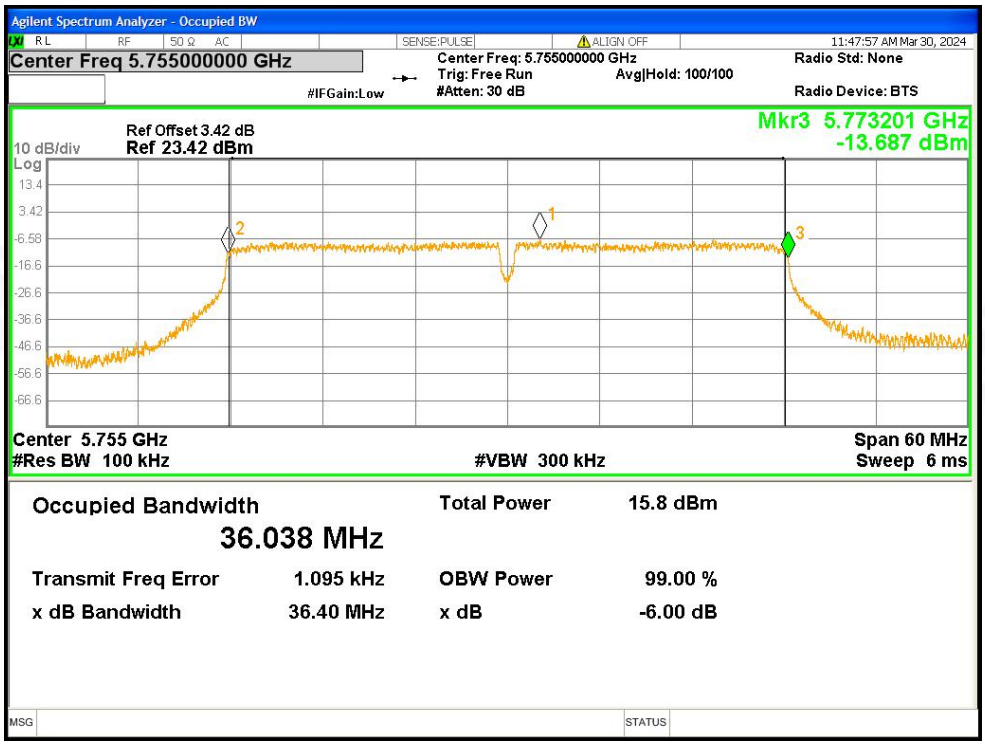
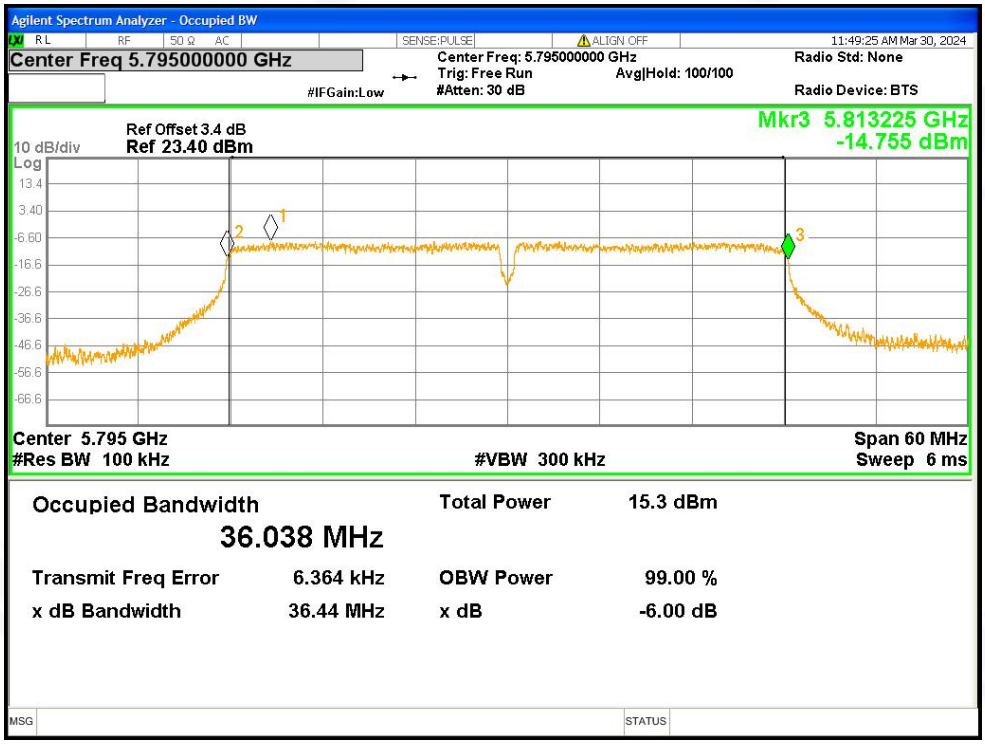


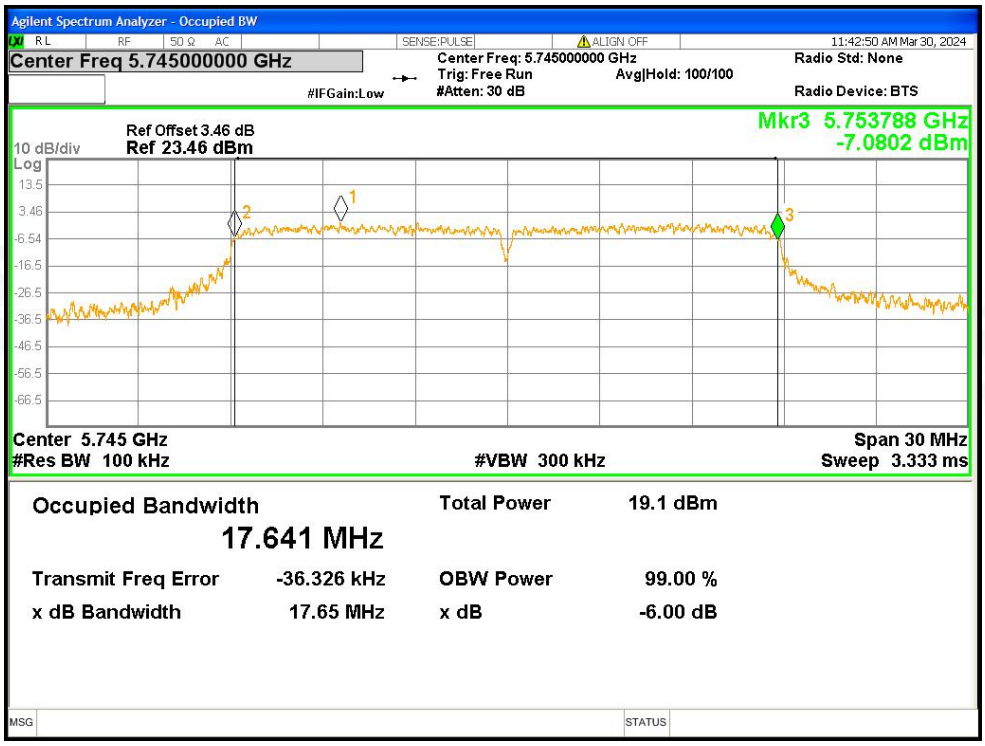
-6dB Bandwidth NVNT n20 5825MHz



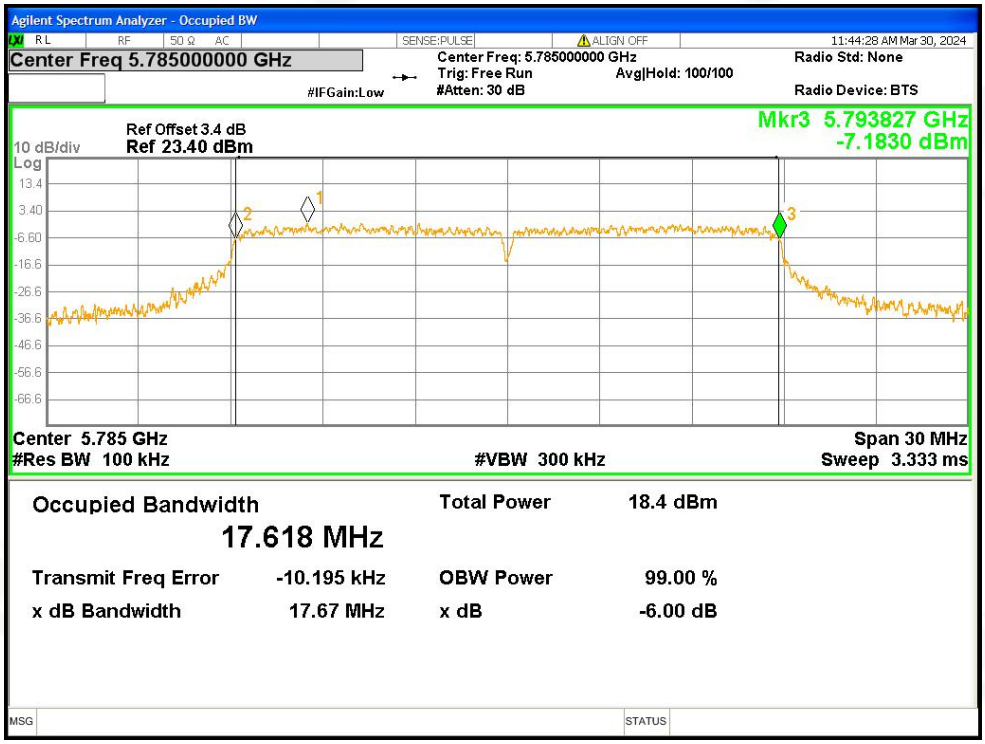
-6dB Bandwidth NVNT n40 5755MHz



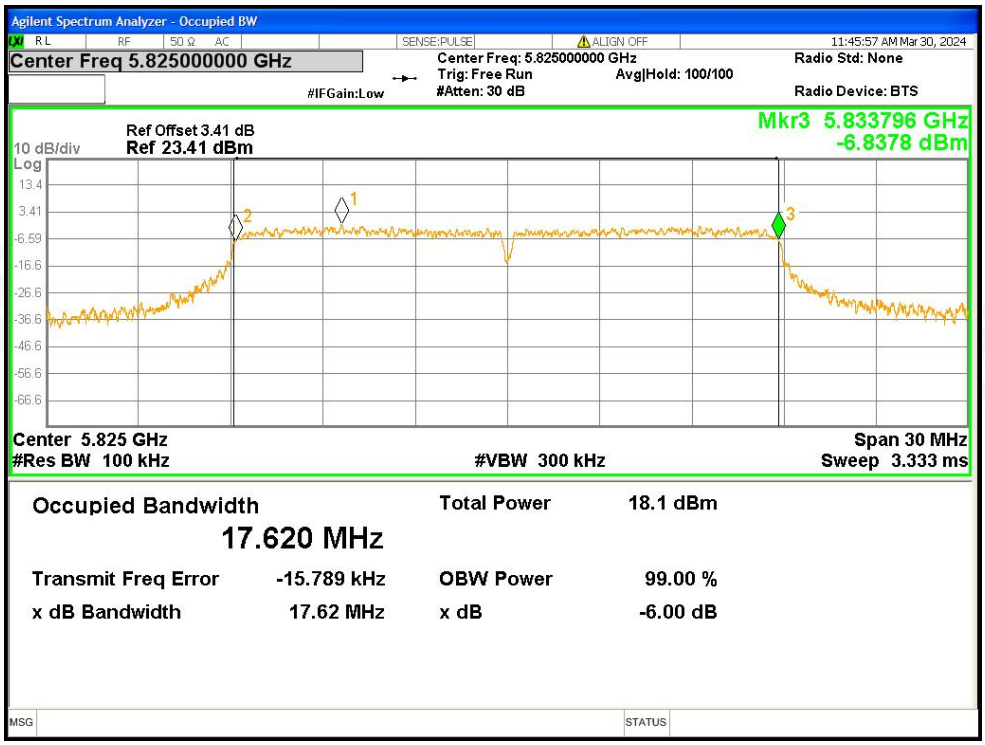
-6dB Bandwidth NVNT n40 5795MHz



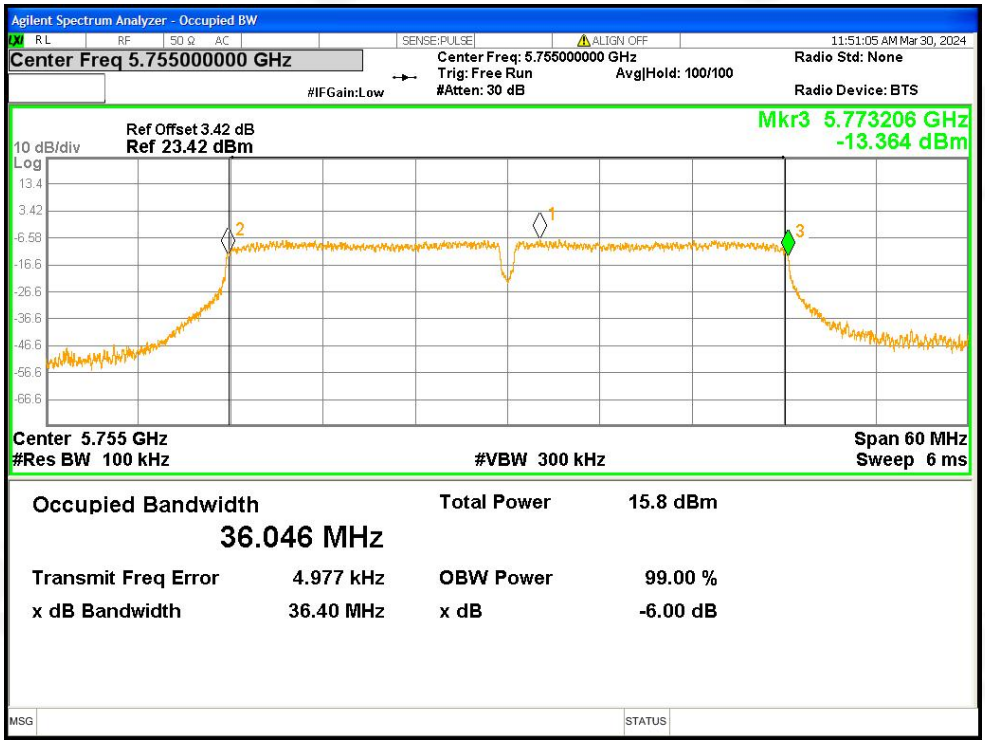
-6dB Bandwidth NVNT ac20 5745MHz



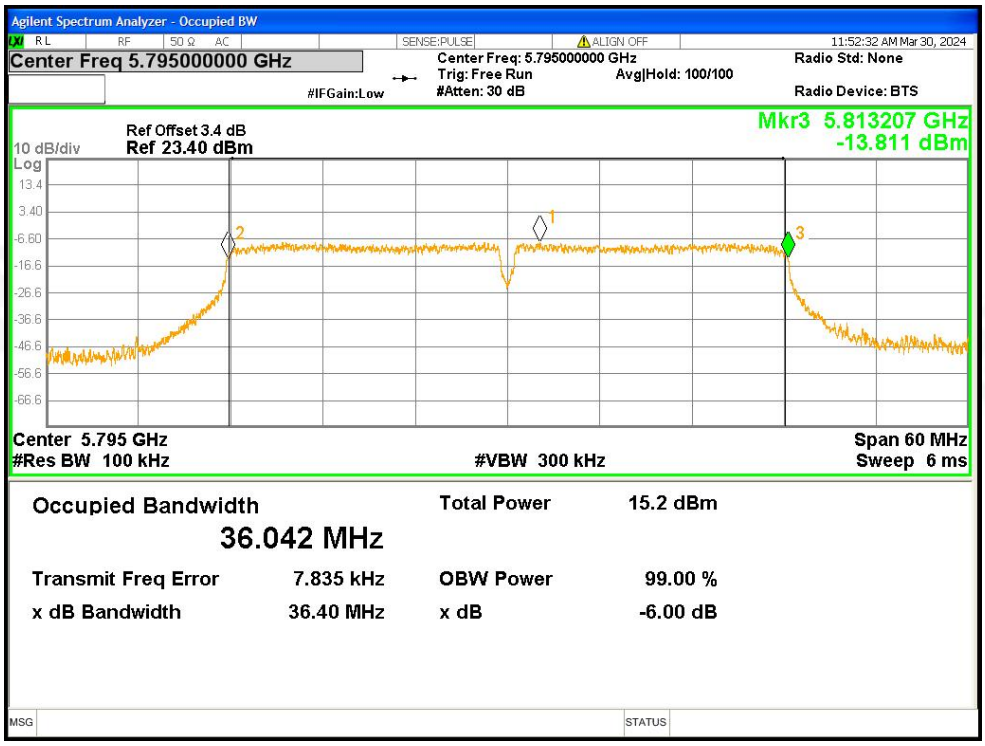
-6dB Bandwidth NVNT ac20 5785MHz



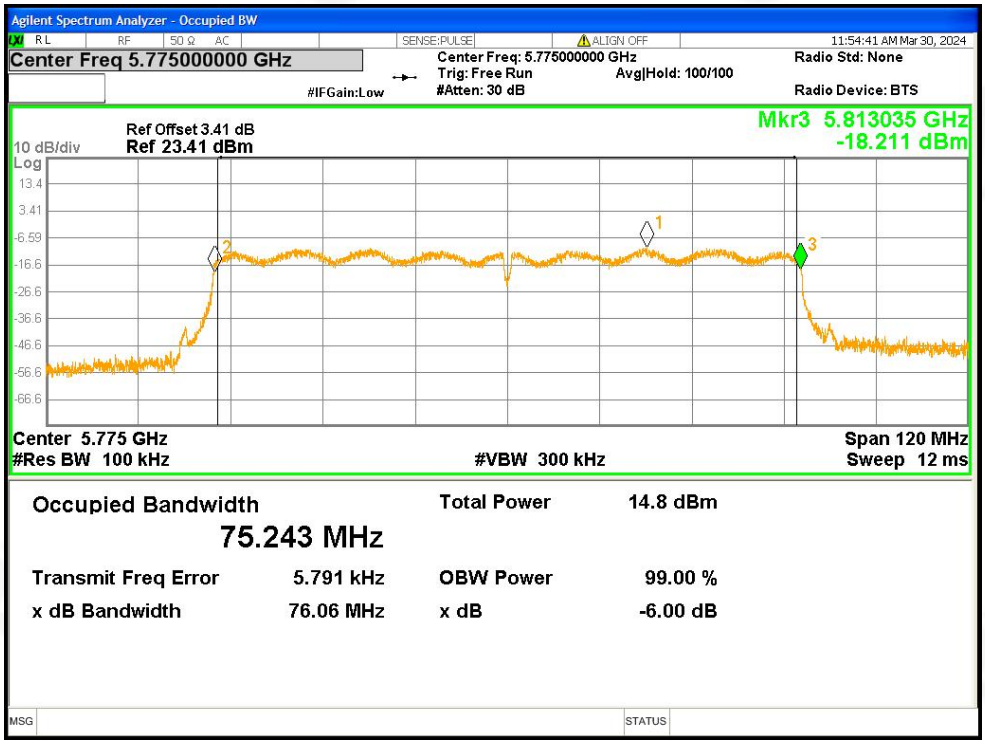
-6dB Bandwidth NVNT ac20 5825MHz



-6dB Bandwidth NVNT ac40 5755MHz

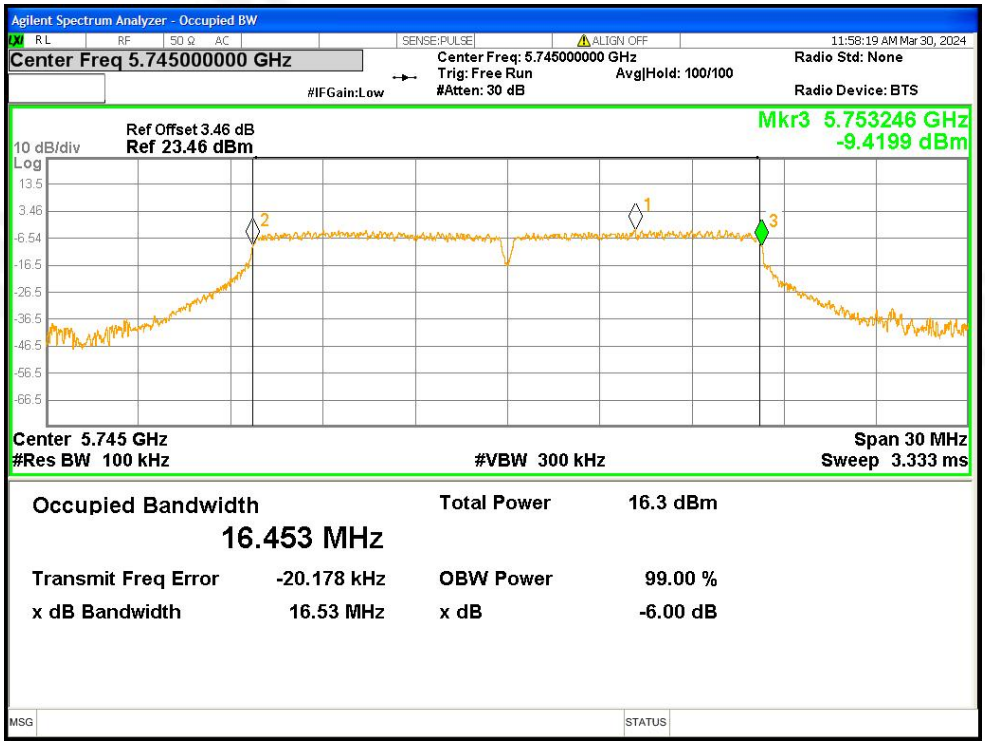


-6dB Bandwidth NVNT ac40 5795MHz

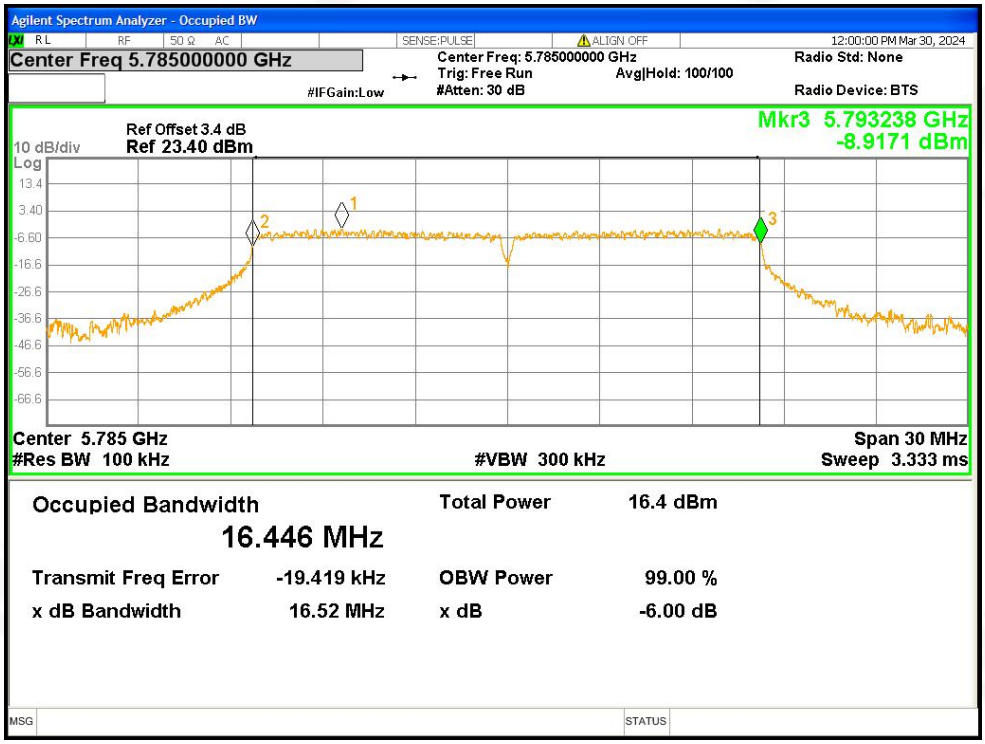


-6dB Bandwidth NVNT ac80 5775MHz

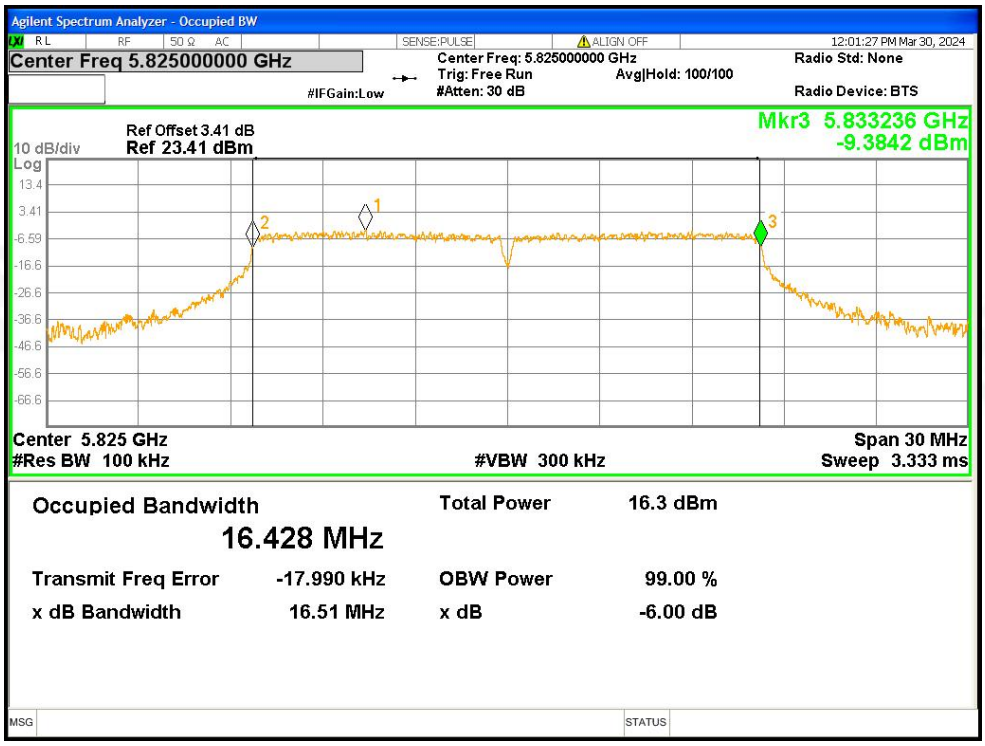
Ant1



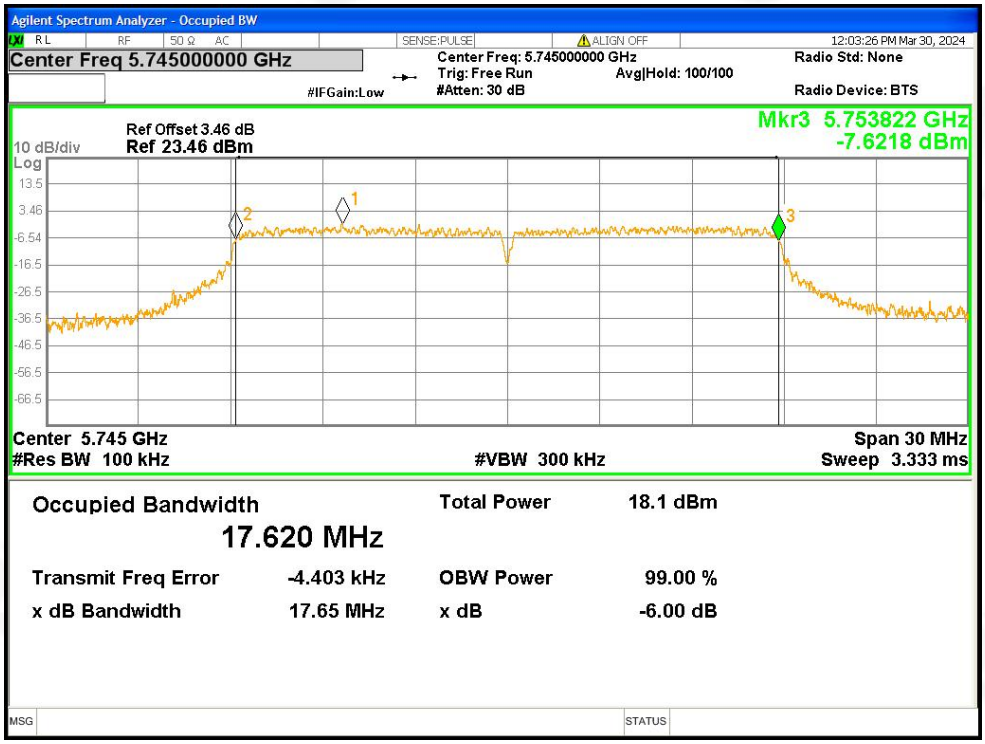
-6dB Bandwidth NVNT a 5745MHz Ant1



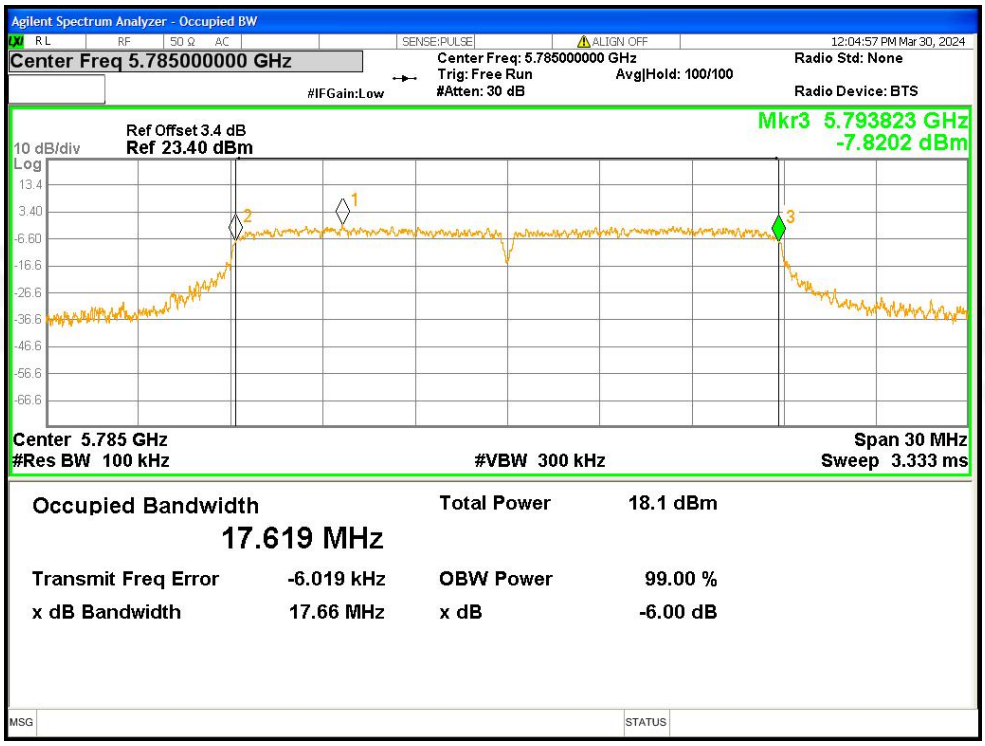
-6dB Bandwidth NVNT a 5785MHz Ant1



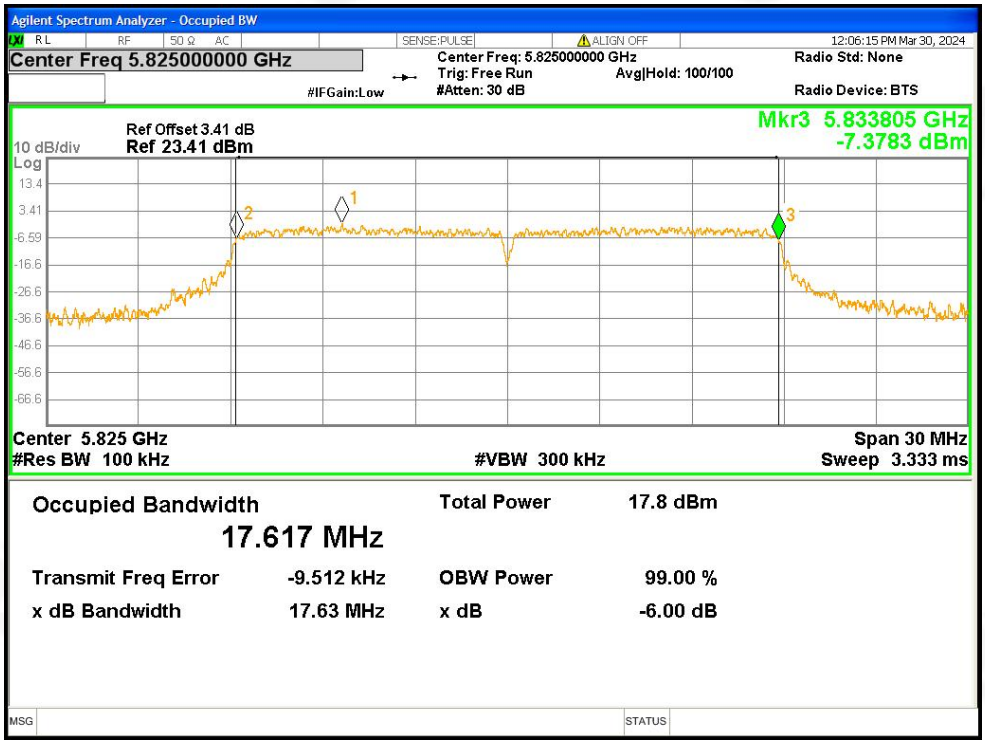
-6dB Bandwidth NVNT a 5825MHz Ant1



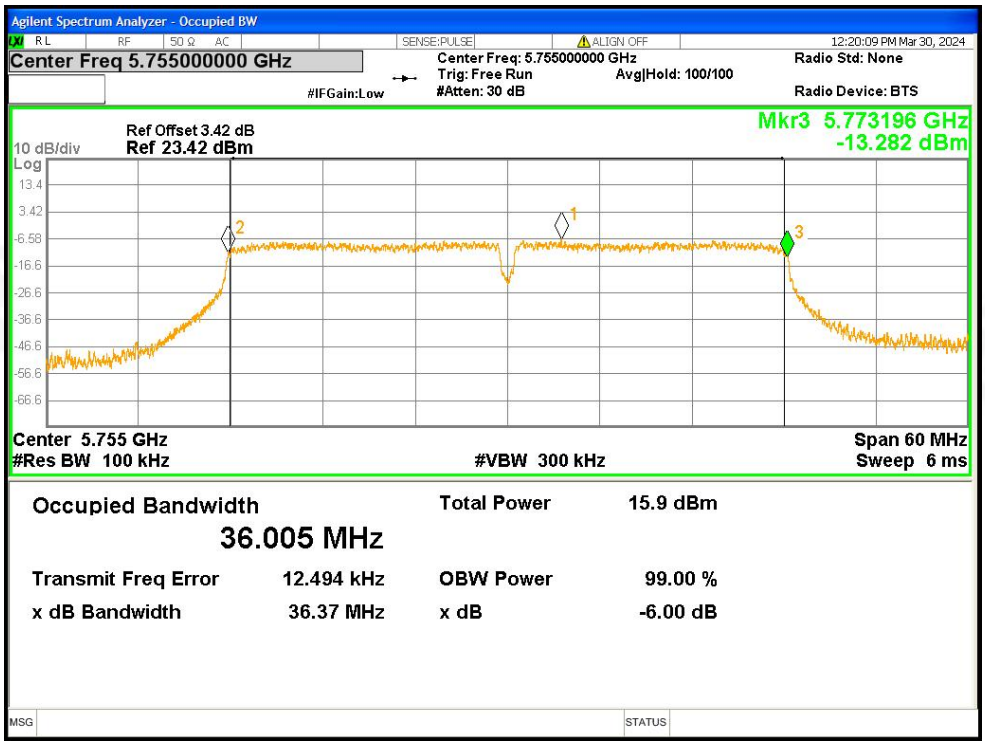
-6dB Bandwidth NVNT n20 5745MHz Ant1



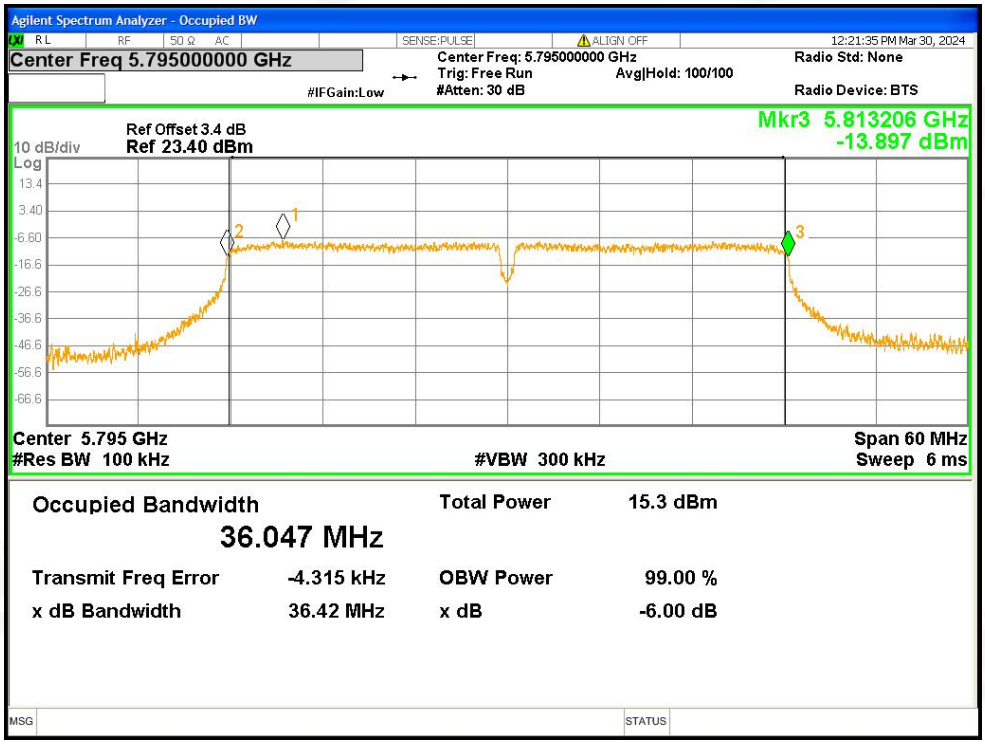
-6dB Bandwidth NVNT n20 5785MHz Ant1



-6dB Bandwidth NVNT n20 5825MHz Ant1



-6dB Bandwidth NVNT n40 5755MHz Ant1



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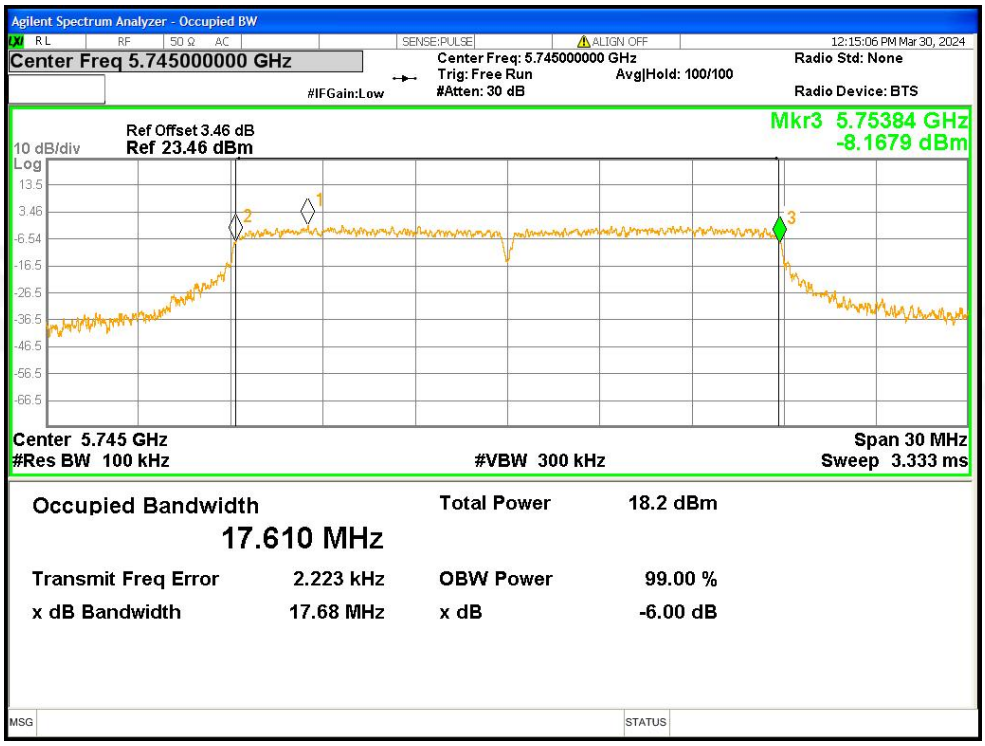
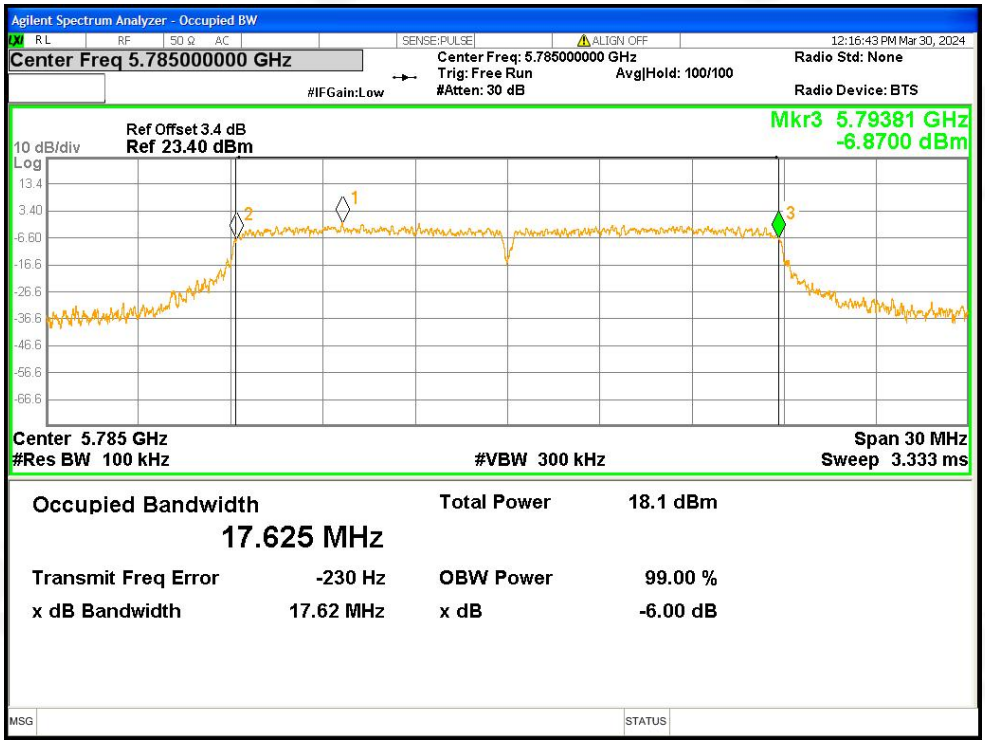
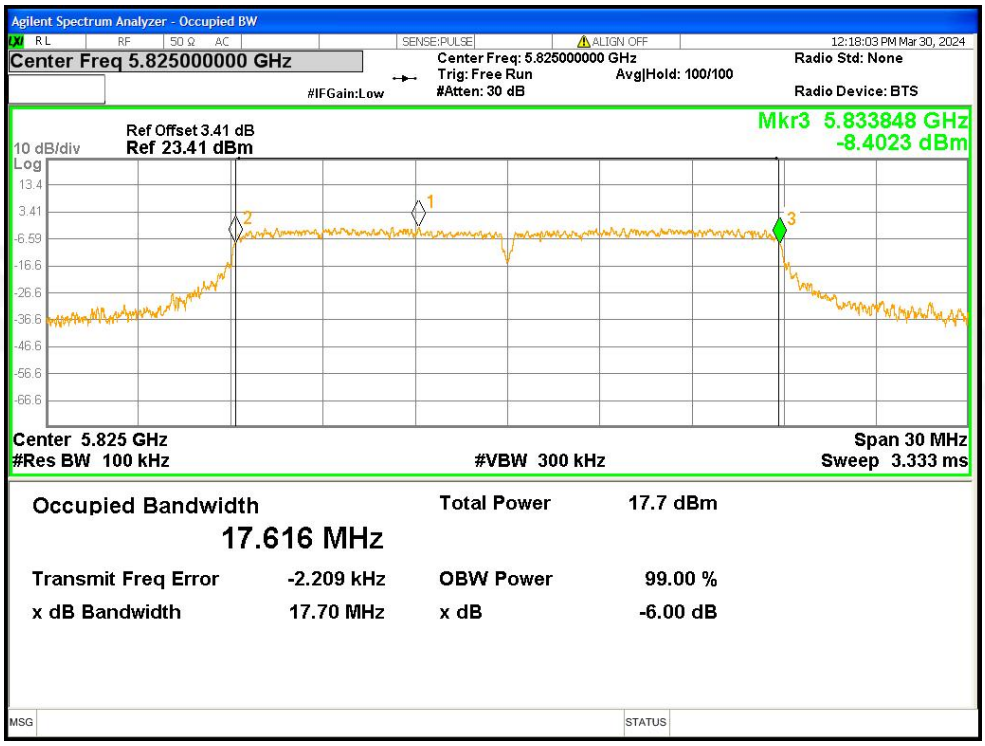


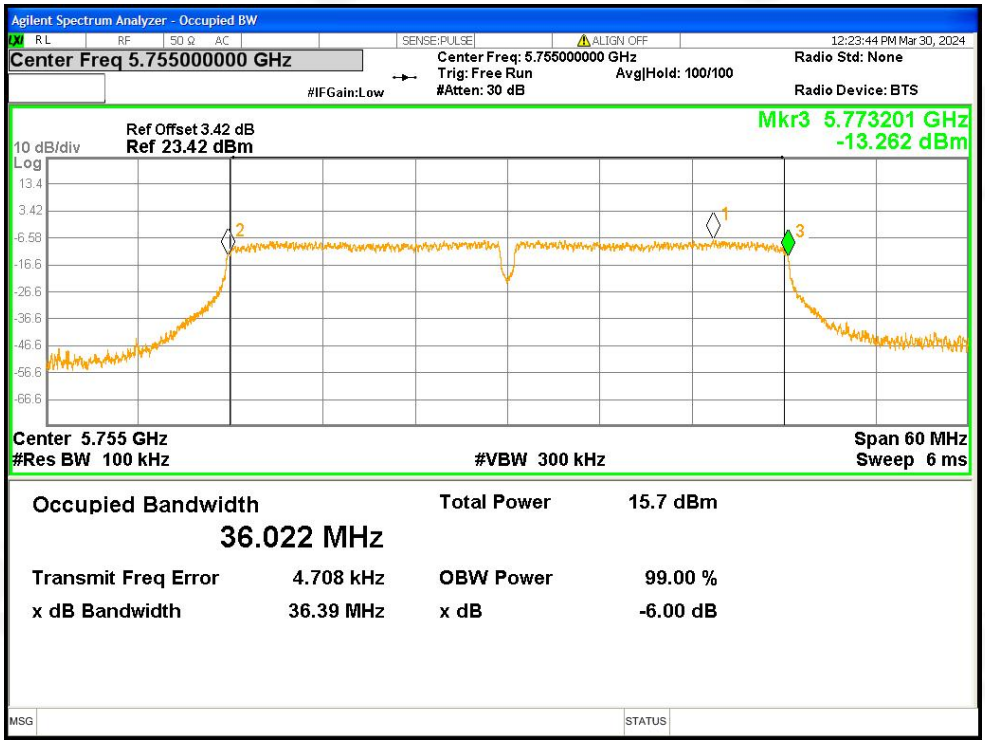
-6dB Bandwidth NVNT ac20 5745MHz Ant1



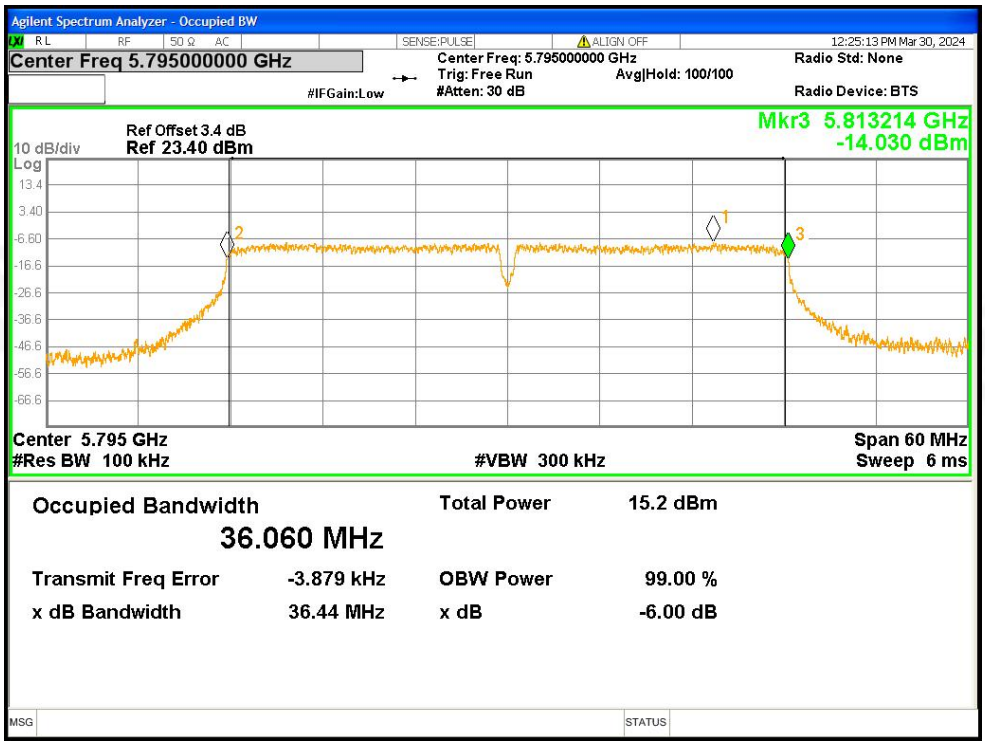
-6dB Bandwidth NVNT ac20 5785MHz Ant1



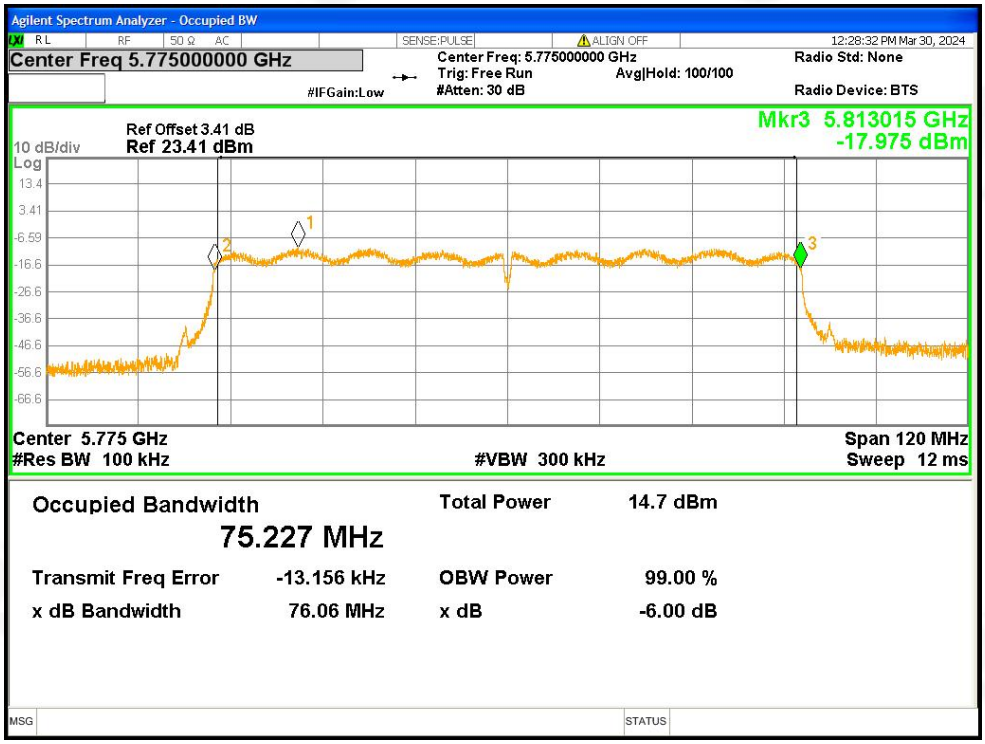
-6dB Bandwidth NVNT ac20 5825MHz Ant1



-6dB Bandwidth NVNT ac40 5755MHz Ant1



-6dB Bandwidth NVNT ac40 5795MHz Ant1



-6dB Bandwidth NVNT ac80 5775MHz Ant1

7.MAXIMUM CONDUCTED OUTPUT POWER

7.1 PPLIED PROCEDURES / LIMIT

According to FCC §15.407&RSS 247 section 6.2.1.1/6.2.4.1
The maximum conduced output power should not exceed:

Frequency Band(MHz)	Limit
5150~5250	250mW
5725-5850	1W

IC Limit(5150~5250Mhz): For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz.

7.2 TEST PROCEDURE

The EUT was directly connected to the Power meter

1. Device Configuration
If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).
a) The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.
b) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

2. Measurement using a Spectrum Analyzer or EMI Receiver (SA)
Measurement of maximum conducted output power using a spectrum analyzer requires integrating the spectrum across a frequency span that encompasses, at a minimum, either the EBW or the 99-percent occupied bandwidth of the signal.1 However, the EBW must be used to determine bandwidth dependent limits on maximum conducted output power in accordance with § 15.407(a).
a) The test method shall be selected as follows: (i) Method SA-1 or SA-1 Alternative (averaging with the EUT transmitting at full power throughout each sweep) shall be applied if either of the following conditions can be satisfied:
• The EUT transmits continuously (or with a duty cycle ≥ 98 percent).
• Sweep triggering or gating can be implemented in a way that the device transmits at the maximum power control level throughout the duration of each of the instrument sweeps to be averaged. This condition can generally be achieved by triggering the instrument's sweep if the duration of the sweep (with the analyzer configured as in Method SA-1, below) is equal to or shorter than the duration T of each transmission from the EUT and if those transmissions exhibit full power throughout their durations.
(ii) Method SA-2 or SA-2 Alternative (averaging across on and off times of the EUT transmissions, followed by duty cycle correction) shall be applied if the conditions of (i) cannot be achieved and the transmissions exhibit a constant duty cycle during the measurement duration. Duty cycle will be considered to be constant if variations are less than ± 2 percent.
(iii) Method SA-3 (RMS detection with max hold) or SA-3 Alternative (reduced VBW with max hold) shall be applied if the conditions of (i) and (ii) cannot be achieved.
b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep): (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.
(ii) Set RBW = 1 MHz.
(iii) Set VBW ≥ 3 MHz.
(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
(v) Sweep time = auto.
(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each

transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.

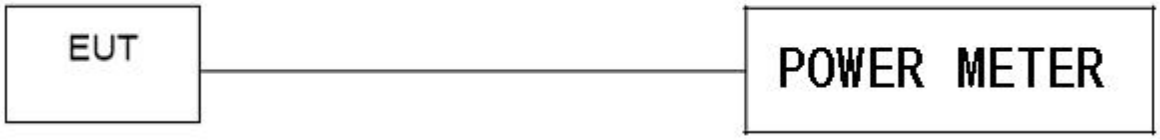
(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

7.6 TEST RESULTS

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	1012 hPa	Test Voltage :	AC 120V/60Hz
Test Mode :	TX		

Band	Operation mode	CH	Conducted Output Power (dBm)		Conducted Output Power (dBm)MIMO	Limit
			Ant0	Ant1	/	28.34
U-NII-3	802.11a	Low	11.46	10.92	/	28.34
		Middle	11.3	11.16	/	28.34
		High	11.04	10.95	/	28.34
	802.11n(HT20)	Low	12.86	12.76	15.82	25.33
		Middle	12.64	12.84	15.75	25.33
		High	12.42	12.57	15.51	25.33
	802.11n(HT40)	Low	10.47	10.24	13.37	25.33
		High	9.97	9.84	12.92	25.33
	802.11ac(HT20)	Low	**14.25**	**12.88**	**16.63**	25.33
		Middle	13.16	12.75	15.97	25.33
		High	12.86	12.41	15.65	25.33
	802.11ac(HT40)	Low	10.21	10	13.12	25.33
		High	9.88	9.7	12.80	25.33
	802.11ac(HT80)	Low	9.17	8.91	12.05	25.33

Directional Gain Calculations for In-Band Measurements

EUT suppots MIMO mode for 802.11n/ac mode, Direction Gain=antenna gain+10*log(X)=7.66+3.01=10.67(X is the number of antennas, it is should be 2)

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.OUT OF BAND EMISSIONS

8.1 APPLICABLE STANDARD

According to FCC §15.407(b) FCC §15.407&RSS 247 section 6.2.1.2/6.2.4.2

For FCC Limit

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

For IC Limit

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27dBm/MHz.

For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350MHz shall not exceed -27 dBm/MHz e.i.r.p. Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;

b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;

c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and

d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

8.2 TEST PROCEDURE

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

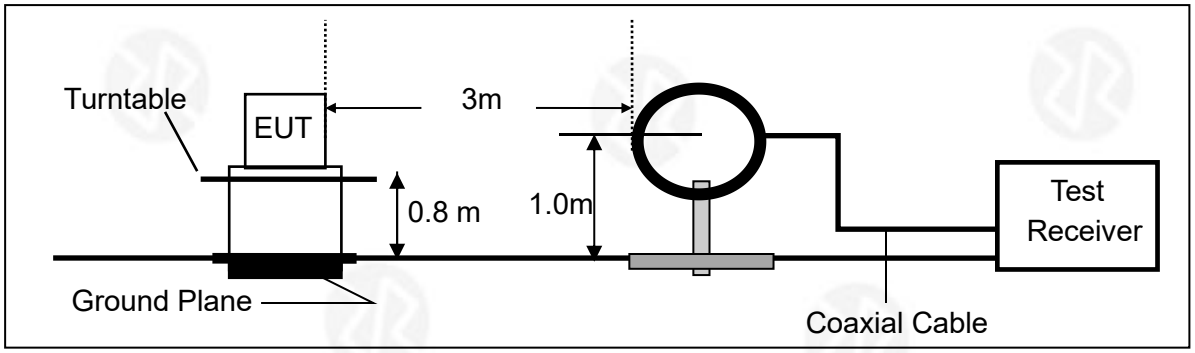
Note:

Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

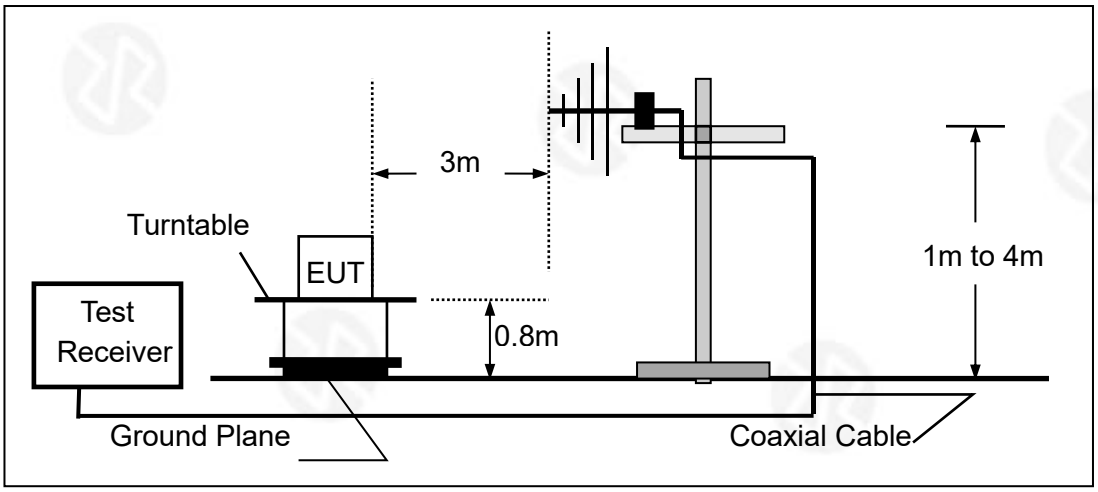
8.3 DEVIATION FROM STANDARD

No deviation.

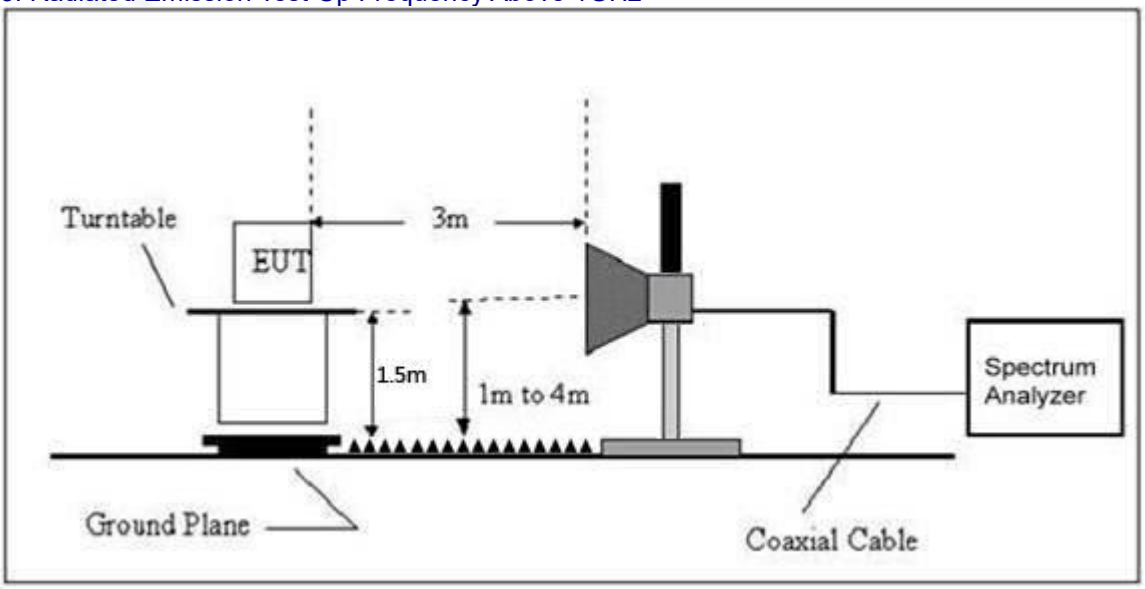
8.4 TEST SETUP



2.For radiated emissions from 30MHz to 1000MHz



3. Radiated Emission Test-Up Frequency Above 1GHz

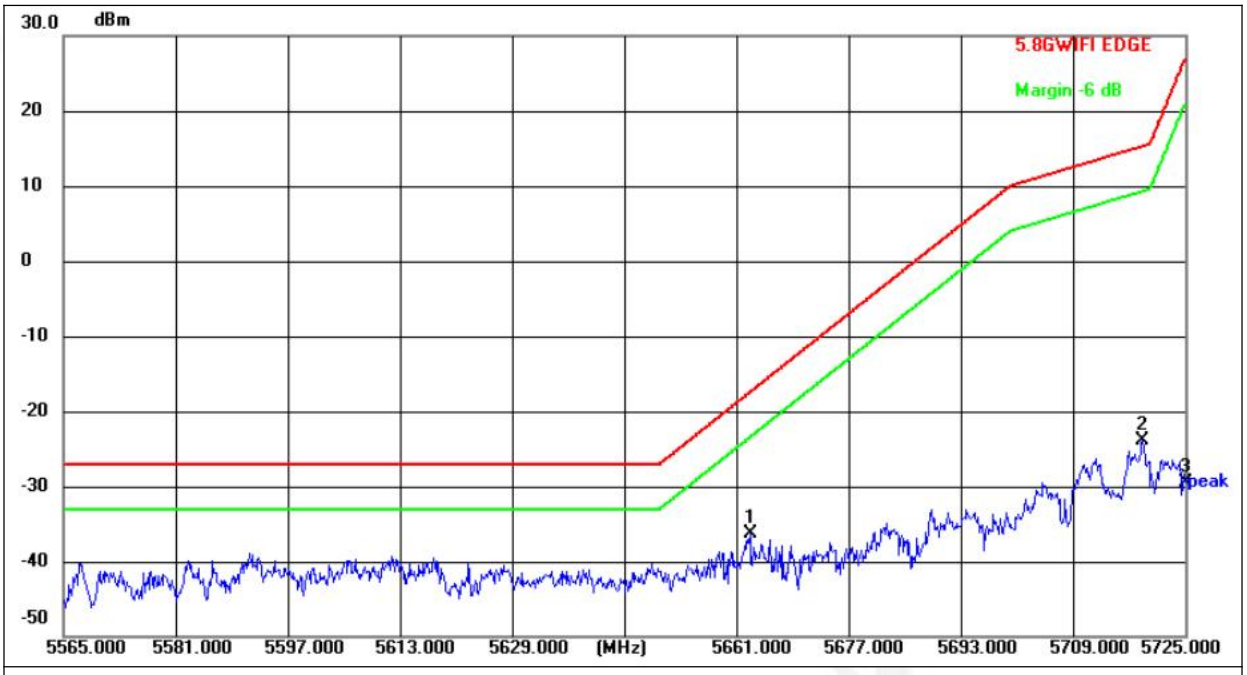


8.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

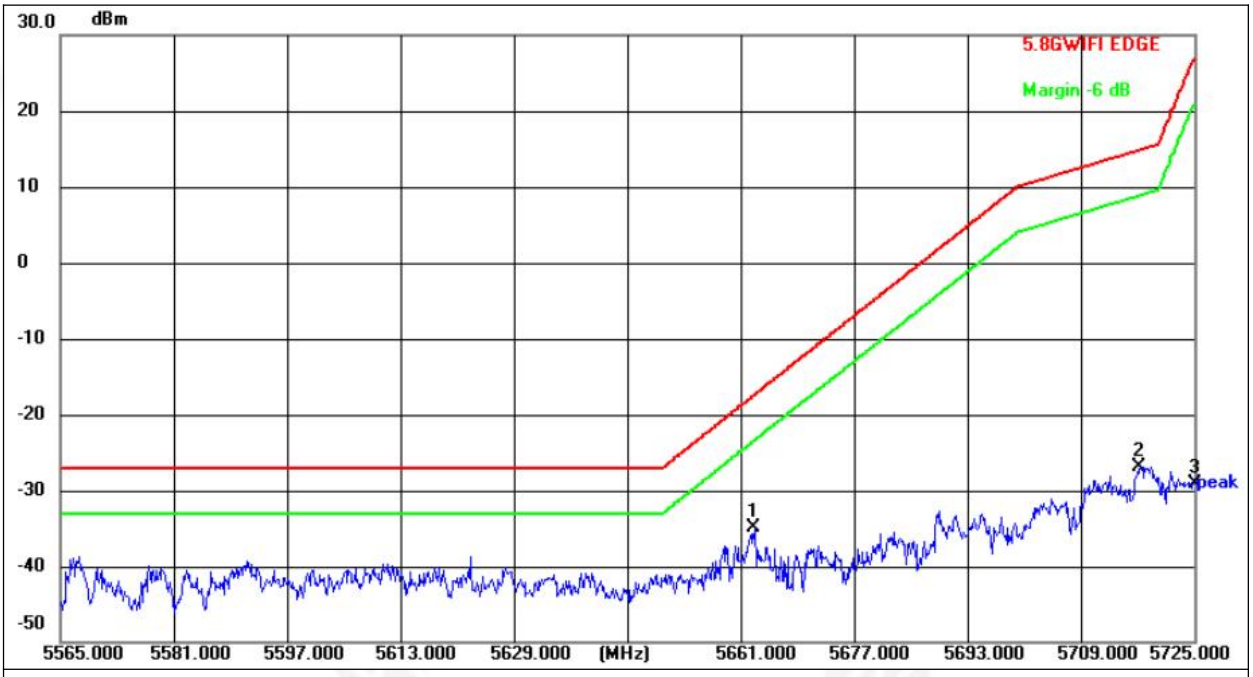
8.6 TEST RESULTS

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 12V	Test Mode	802.11a 5745MHz TX (Worst case ant0)



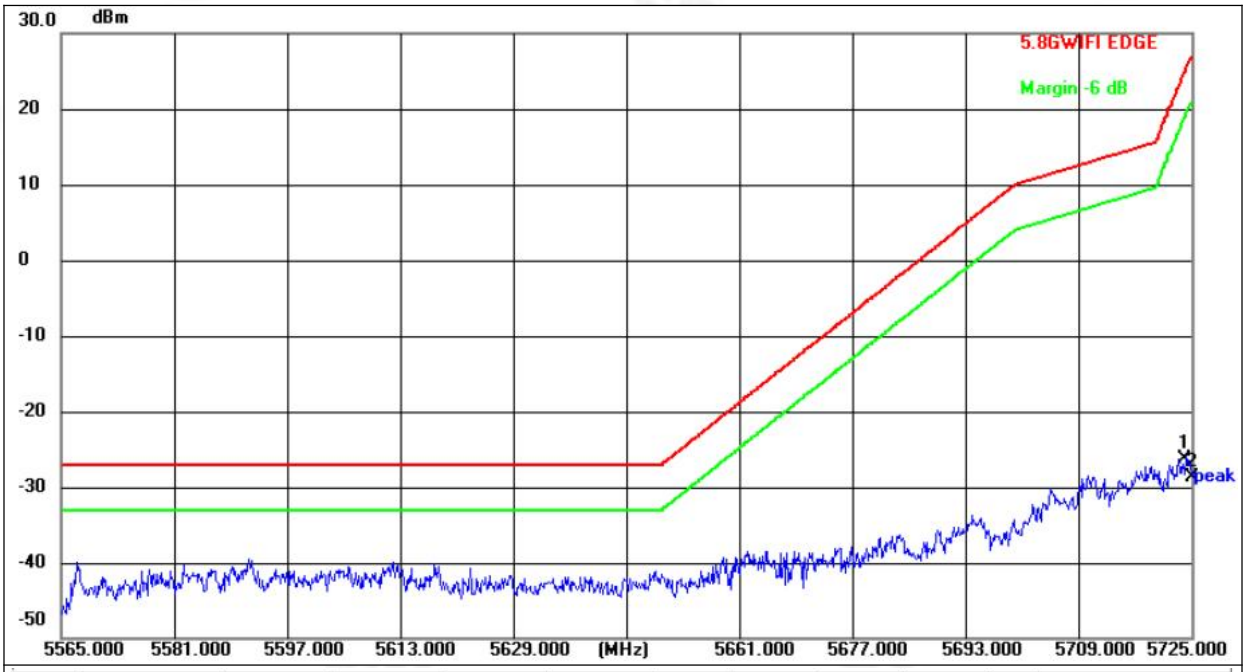
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5662.920	-40.75	4.43	-36.32	-17.41	-18.91	peak			P	
2	5718.920	-28.52	4.60	-23.92	15.30	-39.22	peak			P	
3	5725.000	-34.03	4.62	-29.41	27.00	-56.41	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	DC 12V	Test Mode	802.11a 5745MHz TX (Worst case ant0)



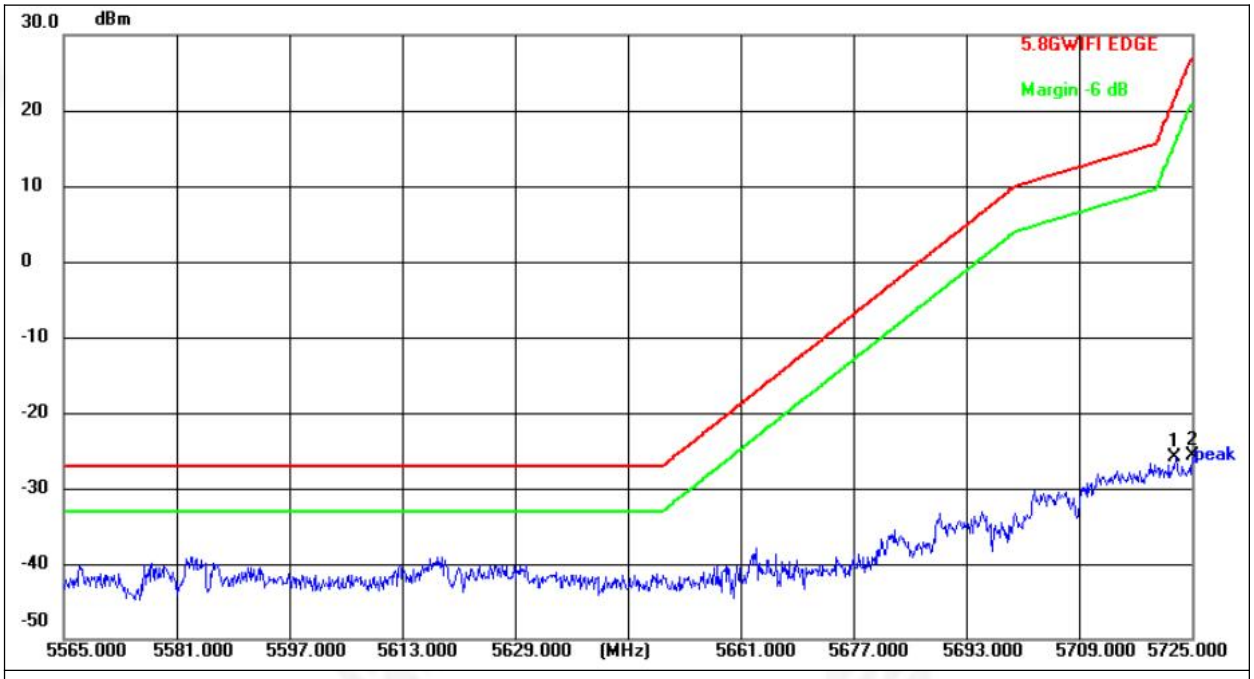
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5663.018	-38.75	3.80	-34.95	-17.34	-17.61	peak			P	
2	5717.472	-30.78	3.95	-26.83	14.89	-41.72	peak			P	
3	5725.000	-33.00	3.97	-29.03	27.00	-56.03	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 12V	Test Mode	802.11n40 5755MHz TX (Worst case is MIMO)



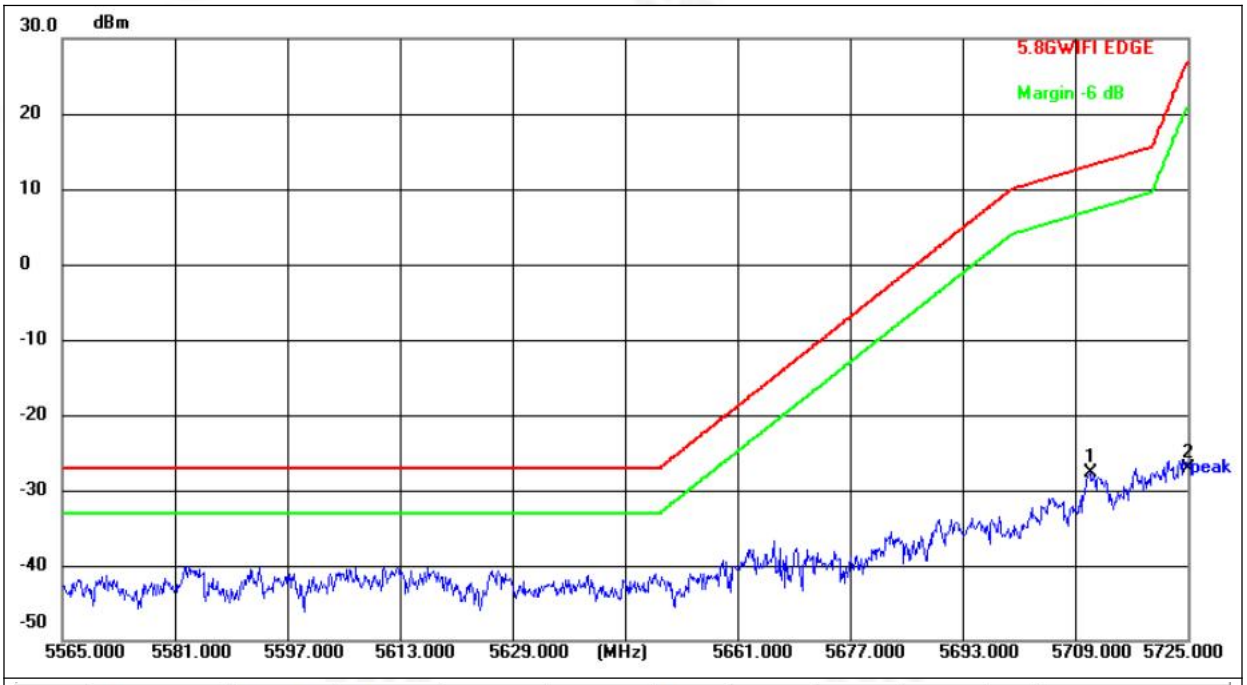
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5724.198	-30.17	3.97	-26.20	25.17	-51.37	peak			P	
2	5725.000	-32.71	3.97	-28.74	27.00	-55.74	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	DC 12V	Test Mode	802.11n40 5755MHz TX (Worst case is MIMO)



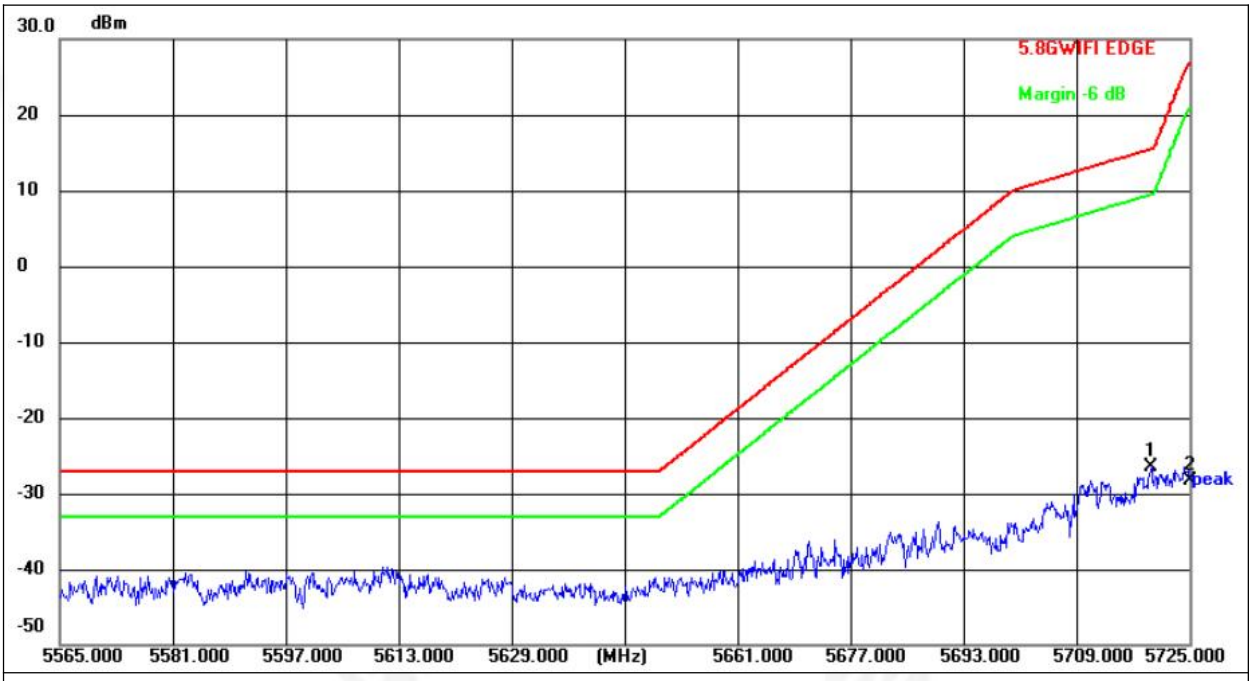
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5722.753	-29.77	3.97	-25.80	21.88	-47.68	peak			P	
2	5725.000	-29.66	3.97	-25.69	27.00	-52.69	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 12V	Test Mode	802.11ac80 5775MHz TX (Worst case is MIMO)



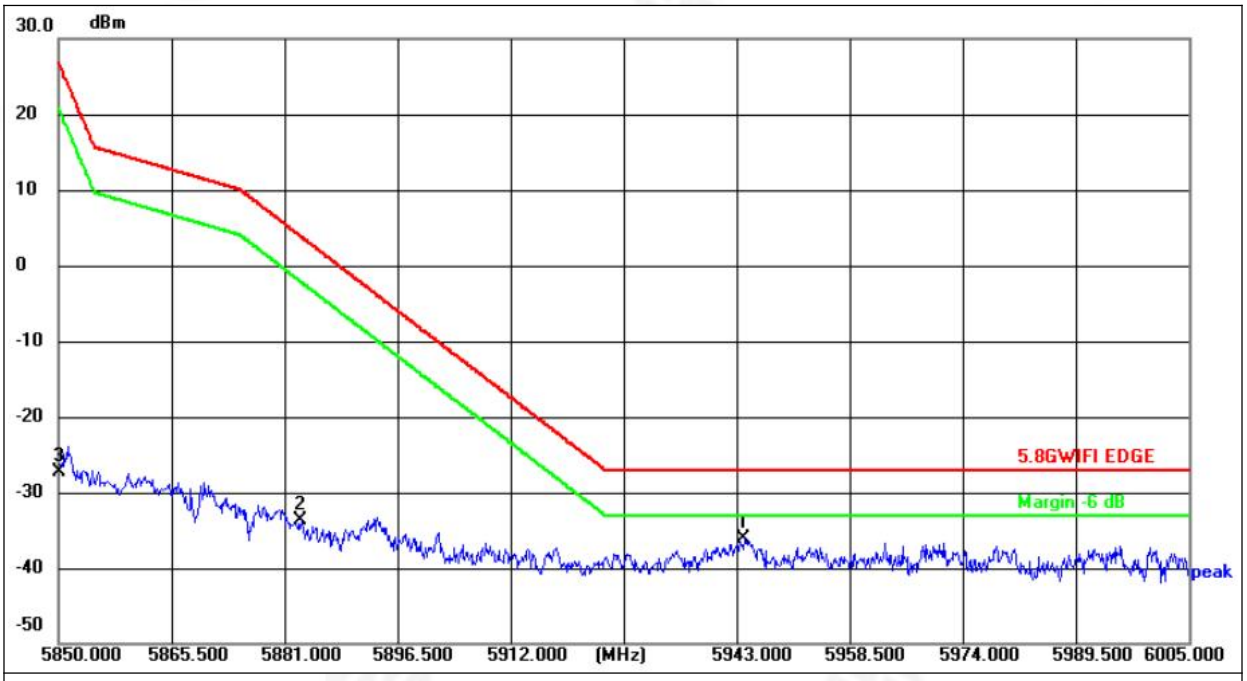
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5711.185	-31.70	3.94	-27.76	13.13	-40.89	peak			P	
2	5725.000	-30.98	3.97	-27.01	27.00	-54.01	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	DC 12V	Test Mode	802.11ac80 5775MHz TX (Worst case is MIMO)



No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5719.693	-30.52	3.96	-26.56	15.51	-42.07	peak			P	
2	5725.000	-32.27	3.97	-28.30	27.00	-55.30	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 12V	Test Mode	802.11a 5825MHz TX (Worst case ant0)

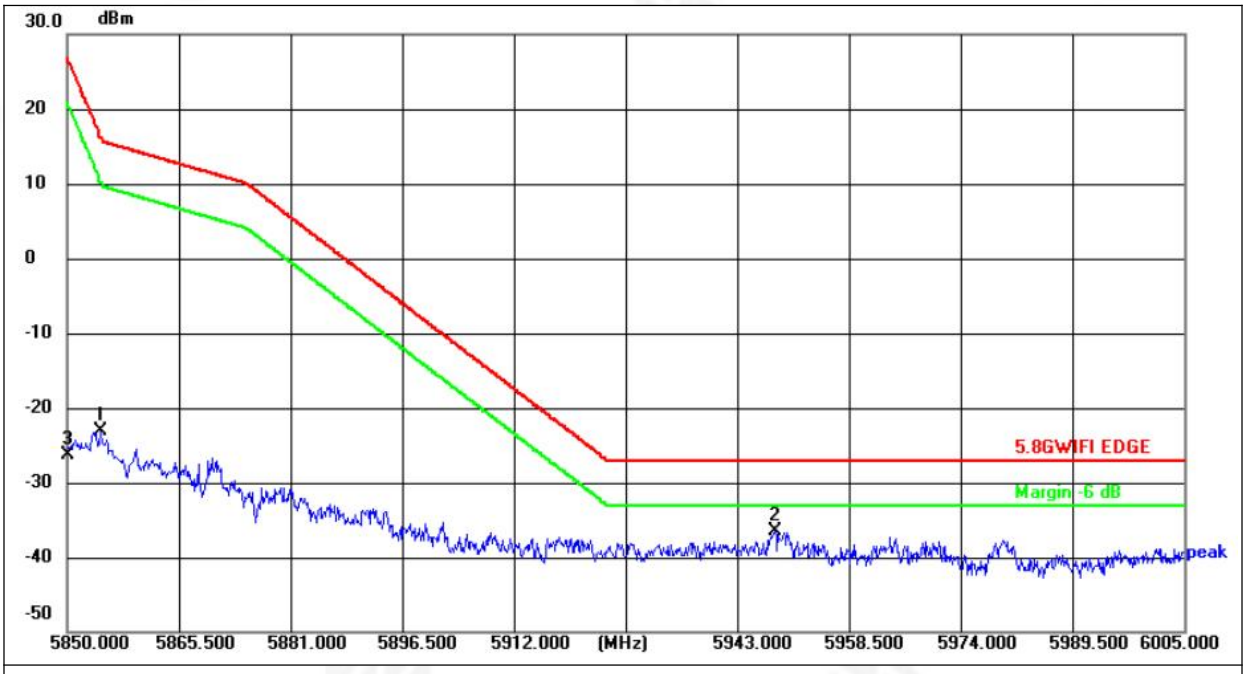


No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5944.085	-40.77	4.58	-36.19	-27.00	-9.19	peak			P	
2	5883.325	-38.04	4.41	-33.63	3.82	-37.45	peak			P	
3	5850.000	-31.71	4.32	-27.39	27.00	-54.39	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	DC 12V	Test Mode	802.11a 5825MHz TX (Worst case ant0)

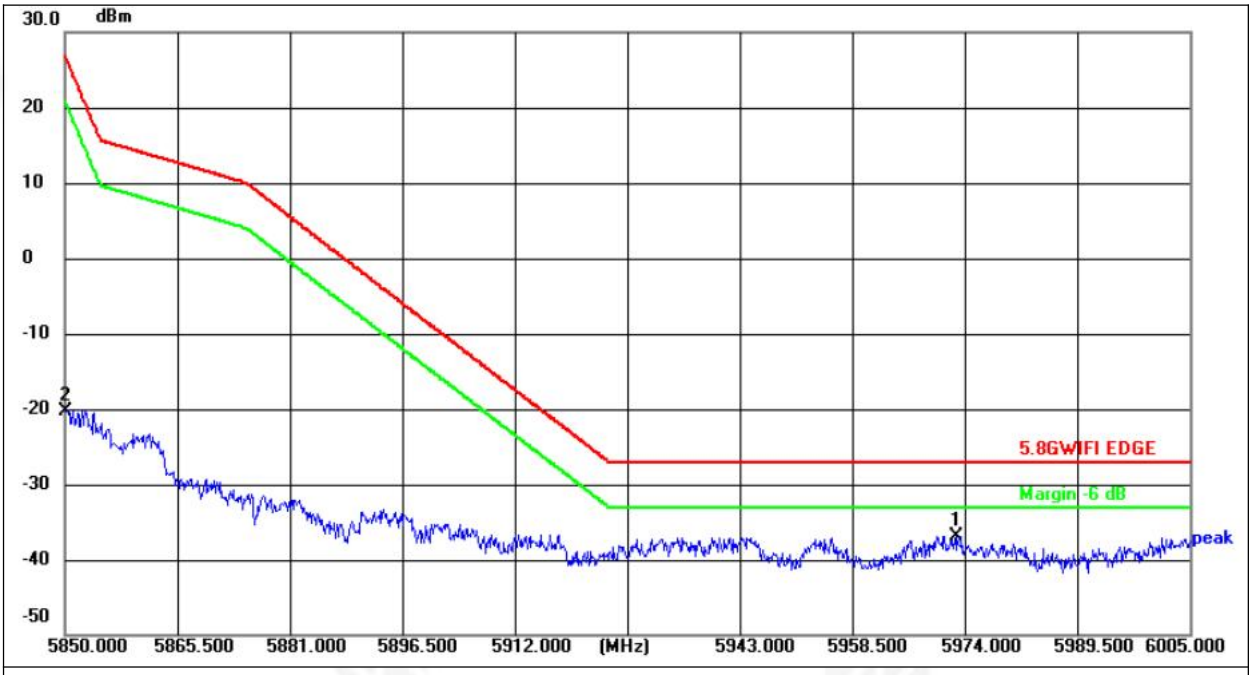
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5965.862	-40.68	4.64	-36.04	-27.00	-9.04	peak			P	
2	5893.021	-36.64	4.43	-32.21	-3.37	-28.84	peak			P	
3	5850.000	-26.71	4.32	-22.39	27.00	-49.39	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 12V	Test Mode	802.11n40 5795MHz TX (Worst case is MIMO)



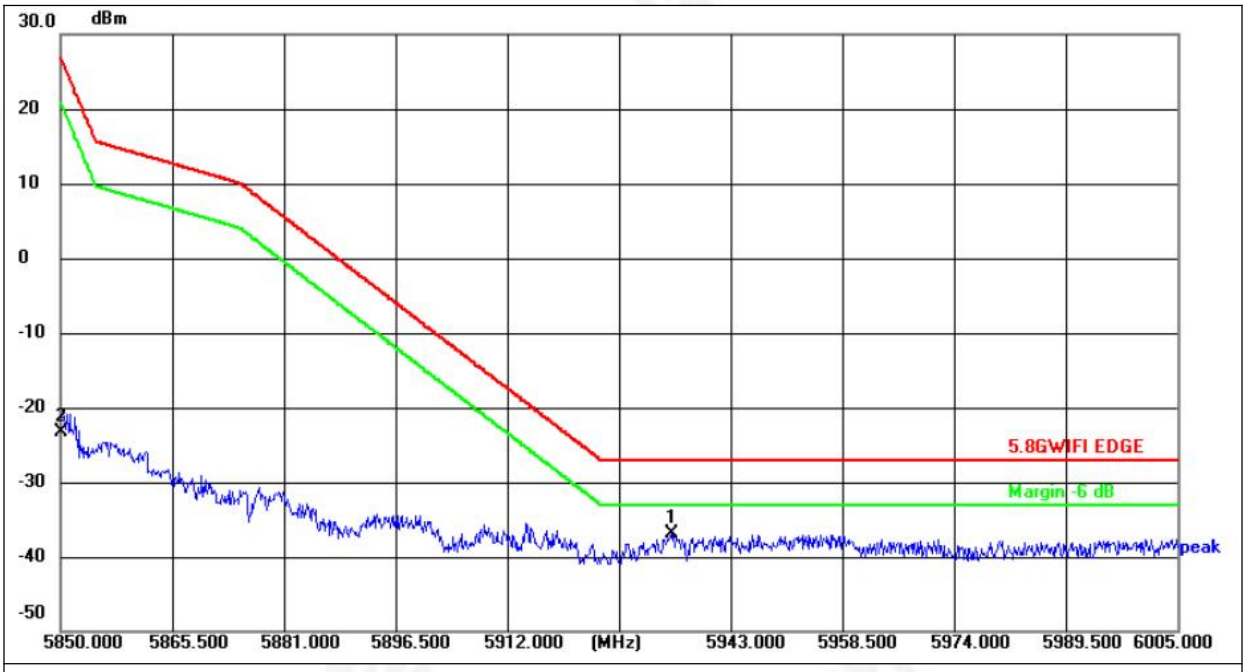
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	5854.664	-27.40	4.33	-23.07	16.37	-39.44	peak			P	
2 *	5948.255	-41.17	4.59	-36.58	-27.00	-9.58	peak			P	
3	5850.000	-30.71	4.32	-26.39	27.00	-53.39	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	DC 12V	Test Mode	802.11n40 5795MHz TX (Worst case is MIMO)



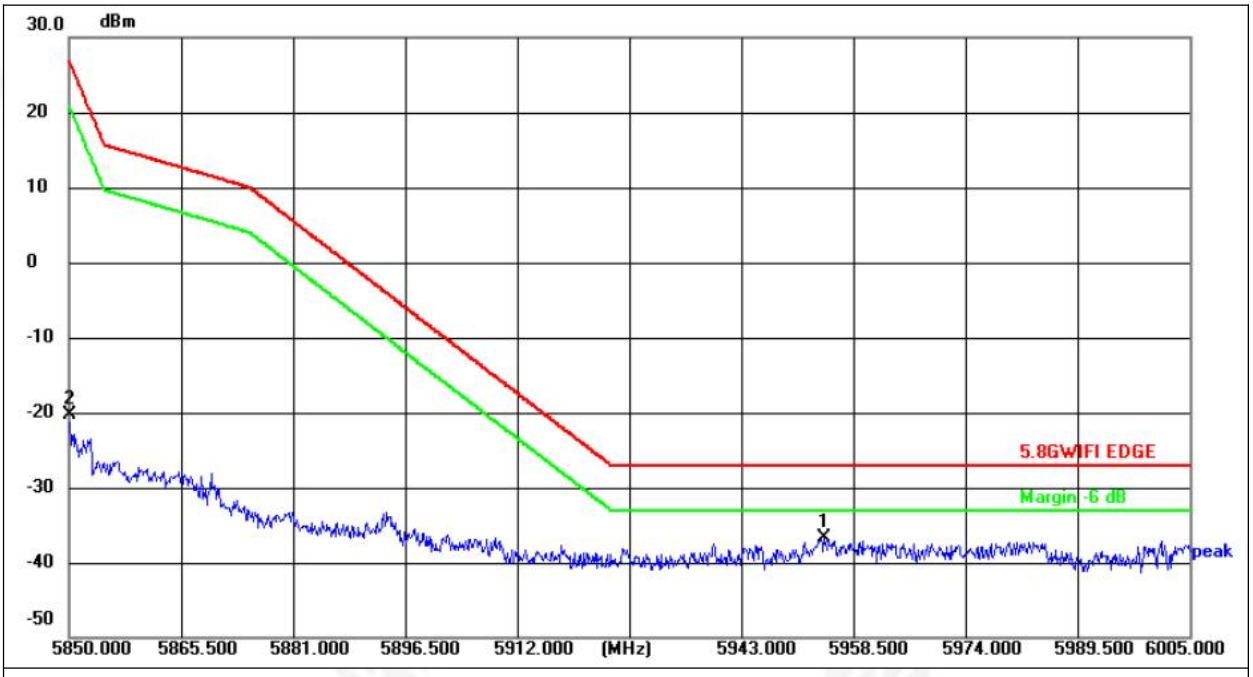
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5972.942	-41.47	4.66	-36.81	-27.00	-9.81	peak			P	
2	5850.000	-24.71	4.32	-20.39	27.00	-47.39	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 12V	Test Mode	802.11ac80 5775MHz TX (Worst case is MIMO)



No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5934.899	-41.49	4.56	-36.93	-27.00	-9.93	peak			P	
2	5850.000	-27.71	4.32	-23.39	27.00	-50.39	peak			P	

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	DC 12V	Test Mode	802.11ac80 5775MHz TX (Worst case is MIMO)



No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	5954.477	-41.34	4.60	-36.74	-27.00	-9.74	peak			P	
2	5850.000	-24.71	4.32	-20.39	27.00	-47.39	peak			P	

Remarks:
1.Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2.The emission levels of other frequencies are very lower than the limit and not show in test report.
3.The test data shows only the worst case mode

10.Frequency Stability Measurement

10.1 LIMIT

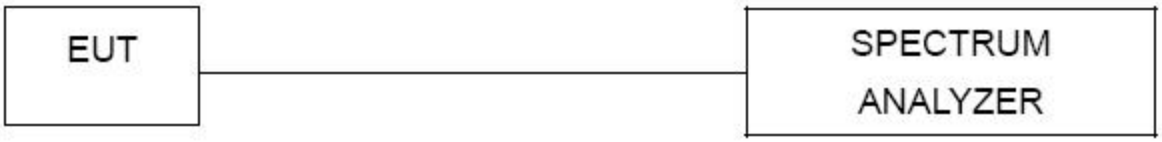
Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification).

10.2 TEST PROCEDURES

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and max hold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 106 ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is -20°C~70°C.

10.3 TEST SETUP LAYOUT



10.4 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously un-modulation transmitting mode.

10.5 TEST RESULTS

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	1012 hPa	Test Voltage :	AC 120V/60Hz
Test Mode :	TX		

5.8G

802.11a20

Reference Frequency(Middle Channel): 5725MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	12	21	0.00361
40	12	24	0.00417
30	12	32	0.00552
20	12	22	0.00381
10	12	12	0.00206
0	12	32	0.00551
-10	12	24	0.00413
-20	12	22	0.00382
-30	12	12	0.00201

802.11n_HT20

Reference Frequency(Middle Channel): 5725MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	12	13	0.00223
40	12	21	0.00364
30	12	32	0.00552
20	12	55	0.00953
10	12	42	0.00723
0	12	32	0.00552
-10	12	24	0.00414
-20	12	22	0.00383
-30	12	12	0.00231

So, Frequency Stability Versus Input Voltage is:

802.11a20

Reference Frequency(Middle Channel): 5725 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	12	44	0.00757
	7.75	43	0.00745
	10.49	42	0.00724

802.11n_HT20

Reference Frequency(Middle Channel): 5725 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	12	21	0.00365
	7.75	43	0.00745
	10.49	55	0.00952

11. DUTY CYCLE

Test Requirement:	47 CFR Part 15E 15.407 KDB789033 D02 General U-NII Test Procedures New Rules v02r01, Section (B)
Test Method:	ANSI C63.10: 2013
Test Limit:	N/A
Test Result:	PASS
Remark:	Through Pre-scan, The duty cycle set for channel low, middle and high are same, and the duty cycle test is performed at channel low only, The report only records the test data of antenna 1

Test Result:

Mode	Frequency (MHz)	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
a	5745	100	0	0
a	5785	100	0	0
a	5825	100	0	0
n20	5745	100	0	0
n20	5785	100	0	0
n20	5825	100	0	0
n40	5755	100	0	0
n40	5795	100	0	0
ac20	5745	100	0	0
ac20	5785	100	0	0
ac20	5825	100	0	0
ac40	5755	100	0	0
ac40	5795	100	0	0
ac80	5775	100	0	0