TEST REPORT

Report No.:	BCTC2205933622-2E
Applicant:	FIREWALLA INC
Product Name:	Firewalla Wi-Fi SD
Model/Type reference:	Firewalla Wi-Fi SD
Tested Date:	2022-05-26 to 2022-05-31
Issued Date:	2022-05-31

Shenzhen BCTC Testing Co., Ltd.

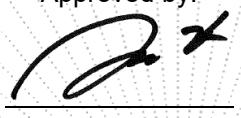
FCC ID:2A2QB-WIFISD

Product Name:	Firewalla Wi-Fi SD
Trademark:	FIREWALLA
Model/Type reference:	Firewalla Wi-Fi SD
Prepared For:	FIREWALLA INC
Address:	19630 Allendale Ave #2217 Saratoga, CA 95070 United States
Manufacturer:	Firewalla INC
Address:	19630 Allendale Ave #2217 Saratoga, CA 95070 United States
Prepared By:	Shenzhen BCTC Testing Co., Ltd.
Address:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Sample Received Date:	2022-05-26
Sample tested Date:	2022-05-26 to 2022-05-31
Issue Date:	2022-05-31
Report No.:	BCTC2205933622-2E
Test Standards:	FCC Part15 15.407 ANSI C63.10-2013 KDB 662911 D01 v02r01 KDB 789033 D02 v02r01
Test Results:	PASS
Remark:	This is WIFI-5GHz band radio test report.

Tested by:

Brave Zeng/ Project Handler

Approved by:



Zero Zhou/Reviewer

The test report is effective only with both signature and specialized stamp.This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen BCTC Testing Co., Ltd, this report can't be reproduced except in full.The tested sample(s) and the sample information are provided by the client.

Table Of Content

(Note: N/A Means Not Applicable)

1. Version

Report No.	Issue Date	Description	Approved
BCTC2205933622-2E	2022-05-31	Original	Valid

2. Test Summary

The Product has been tested according to the following specifications:

1	Test Parameter	Clause No.	Results
1	Spurious Radiated Emissions	15.209(a), 15.407 (b)(1) 15.407 (b)(4) 15.407 (b)(8)	PASS
2	Conducted Emission	15.207	PASS
3	26 dB and 99% Emission Bandwidth	15.407 (a)(12) 15.1049	PASS
4	Minimum 6 dB bandwidth	15.407(e)	PASS
5	Maximum Conducted Output Power	15.407 (a)(1) 15.407 (a)(3)	PASS
6	Band Edge	2.1051, 15.407(b)(1) 15.407(b)(4)	PASS
7	Power Spectral Density	15.407 (a)(1) 15.407 (a)(3)	PASS
8	Spurious Emissions at Antenna Terminals	2.1051, 15.407(b)	PASS
9	Antenna Requirement	15.203	PASS

3. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Uncertainty
1	3m chamber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
2	3m chamber Radiated spurious emission(9KHz-30MHz)	U=3.7dB
3	3m chamber Radiated spurious emission(1GHz-18GHz)	U=4.5dB
4	3m chamber Radiated spurious emission(18GHz-40GHz)	U=3.34dB
5	Conducted Emission (150kHz-30MHz)	U=3.20dB
6	Conducted Adjacent channel power	U=1.38dB
7	Conducted output power uncertainty Above 1G	U=1.576dB
8	Conducted output power uncertainty below 1G	U=1.28dB
9	humidity uncertainty	U=5.3%
10	Temperature uncertainty	U=0.59℃

4. Product Information And Test Setup

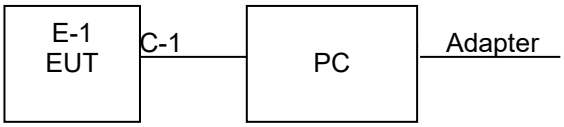
4.1 Product Information

Model/Type reference:	Firewalla Wi-Fi SD
Model differences:	N/A
IEEE 802.11 WLAN Mode Supported:	802.11a/n/ac(20MHz channel bandwidth) 802.11n/ac(40MHz channel bandwidth) 802.11ac(80MHz channel bandwidth)
Operation Frequency:	5745-5825 MHz for 802.11a/n(HT20)/ac20; 5755-5795 MHz for 802.11a/n(HT40)/ac40; 5775MHz for 802.11 ac80;
Data Rate:	802.11a: 6,9,12,18,24,36,48,54Mbps; 802.11n(HT20/HT40):MCS0-MCS15; 802.11ac(VHT20): NSS1, MCS0-MCS8 802.11ac(VHT40/VHT80):NSS1, MCS0-MCS
Type of Modulation:	OFDM with BPSK/QPSK/16QAM/64QAM/256QAM for 802.11a/n/ac;
Number Of Channel:	5 channels for 802.11a/n20 in the 5745-5825MHz band ; 2 channels for 802.11 n40 in the 5755-5795MHz band ; 1 channels for 802.11 ac80 in the 5775MHz band ;
Antenna installation:	External antenna
Antenna Gain:	5 dBi
Ratings:	DC 5V From PC

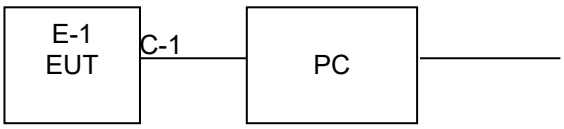
4.2 Test Setup Configuration

See test photographs attached in *EUT TEST SETUP PHOTOGRAPHS* for the actual connections between Product and support equipment.

Conducted Emission:



Radiated Spurious Emission



4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
E-1	PC	N/A	BCTC-PC	N/A	Auxiliary

Item	Shielded Type	Ferrite Core	Length	Note
C-1	N/A	N/A	1M	DC cable unshielded

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

Frequency and Channel list for 802.11a/n /ac (5745-5825MHz):

802.11a/n/ac(20MHz) Carrier Frequency Channel							
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
149	5745	153	5765	157	5785	161	5805
165	5825	-	-	-	-	-	-

802.11n/ac(40MHz) Carrier Frequency Channel							
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
151	5755	159	5795	-	-	-	-

802.11ac (80MHz) Carrier Frequency Channel							
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
155	5775	-	-	-	-	-	-

4.5 Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	802.11a /n/ ac 20 CH149/ CH157/ CH 165
Mode 2	802.11n/ ac40 CH 151 / CH 159
Mode 3	802.11 ac80 CH 155
Mode 4	Link Mode

Note: The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

4.6 Table Of Parameters Of Text Software Setting

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters

Test software Version	CMD		
Parameters	DEF	DEF	DEF

5. Test Facility And Test Instrument Used

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Shenzhen BCTC Testing Co., Ltd. Address:1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.
FCC Test Firm Registration Number: 712850
IC Registered No.: 23583

5.2 Test Instrument Used

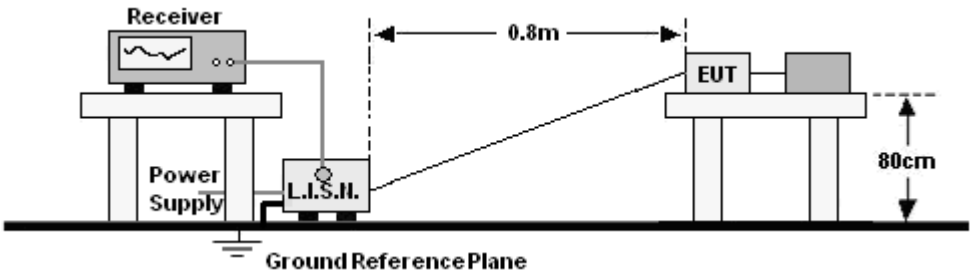
Conducted Emissions Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Receiver	R&S	ESR3	102075	May 24, 2022	May 23, 2023
LISN	R&S	ENV216	101375	May 24, 2022	May 23, 2023
Software	Frad	EZ-EMC	EMC-CON 3A1	\	\
Attenuator	\	10dB C-6GHz	1650	May 24, 2022	May 23, 2023

RF Conducted Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Power Metter	Keysight	E4419	\	May 24, 2022	May 23, 2023
Power Sensor (AV)	Keysight	E9300A	\	May 24, 2022	May 23, 2023
Signal Analyzer 20kHz-26.5GHz	Keysight	N9020A	MY49100060	May 24, 2022	May 23, 2023
Spectrum Analyzer 9kHz-40GHz	R&S	FSP 40	\	May 24, 2022	May 23, 2023

Radiated Emissions Test (966 Chamber)					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
966 chamber	ChengYu	966 Room	966	Jun. 06. 2020	Jun. 05, 2023
Receiver	R&S	ESR3	102075	May 24, 2022	May 23, 2023
Receiver	R&S	ESRP	101154	May 24, 2022	May 23, 2023
Amplifier	SKET	LAPA_01G18G-45dB	\	May 24, 2022	May 23, 2023
Amplifier	Schwarzbeck	BBV9744	9744-0037	May 24, 2022	May 23, 2023
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	942	May 26, 2022	May 25, 2023
Horn Antenna	Schwarzbeck	BBHA9120D	1541	May 24, 2022	May 23, 2023
Horn Antenn (18GHz-40GHz)	Schwarzbeck	BBHA9170	00822	Jun. 15, 2021	Jun. 14, 2022
Amplifier (18GHz-40GHz)	MITEQ	TTA1840-35-HG	2034381	May 26, 2022	May 25, 2023
Loop Antenna (9KHz-30MHz)	Schwarzbeck	FMZB1519B	00014	May 26, 2022	May 25, 2023
RF cables1 (9kHz-30MHz)	Huber+Suhnar	9kHz-30MHz	B1702988-0008	May 26, 2022	May 25, 2023
RF cables2 (30MHz-1GHz)	Huber+Suhnar	30MHz-1GHz	1486150	May 26, 2022	May 25, 2023
RF cables3 (1GHz-40GHz)	Huber+Suhnar	1GHz-40GHz	1607106	May 28, 2021	May 27, 2022
Power Metter	Keysight	E4419	\	May 26, 2022	May 25, 2023
Power Sensor (AV)	Keysight	E9300A	\	May 26, 2022	May 25, 2023
Signal Analyzer 20kHz-26.5GHz	Keysight	N9020A	MY49100060	May 26, 2022	May 25, 2023
Spectrum Analyzer 9kHz-40GHz	R&S	FSP 40	\	May 26, 2022	May 25, 2023
Software	Frad	EZ-EMC	FA-03A2 RE	\	\

6. Conducted Emissions

6.1 Block Diagram Of Test Setup



6.2 Limit

Frequency (MHz)	Limit (dBuV)	
	Quas-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00
Notes: 1. *Decreasing linearly with logarithm of frequency. 2. The lower limit shall apply at the transition frequencies.		

6.3 Test procedure

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

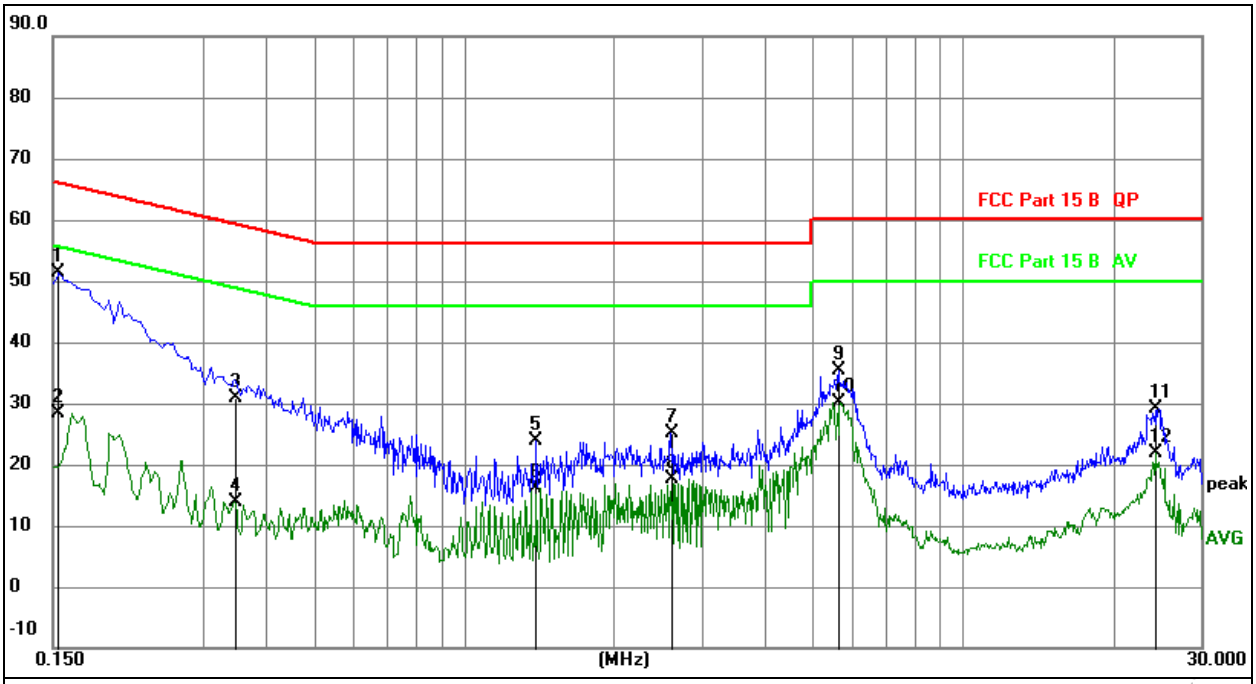
a. The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
b. The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
c. For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

6.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.
We pretest AC 120V and AC 240V, the worst voltage was AC 120V and the data recording in the report.

6.5 Test Result

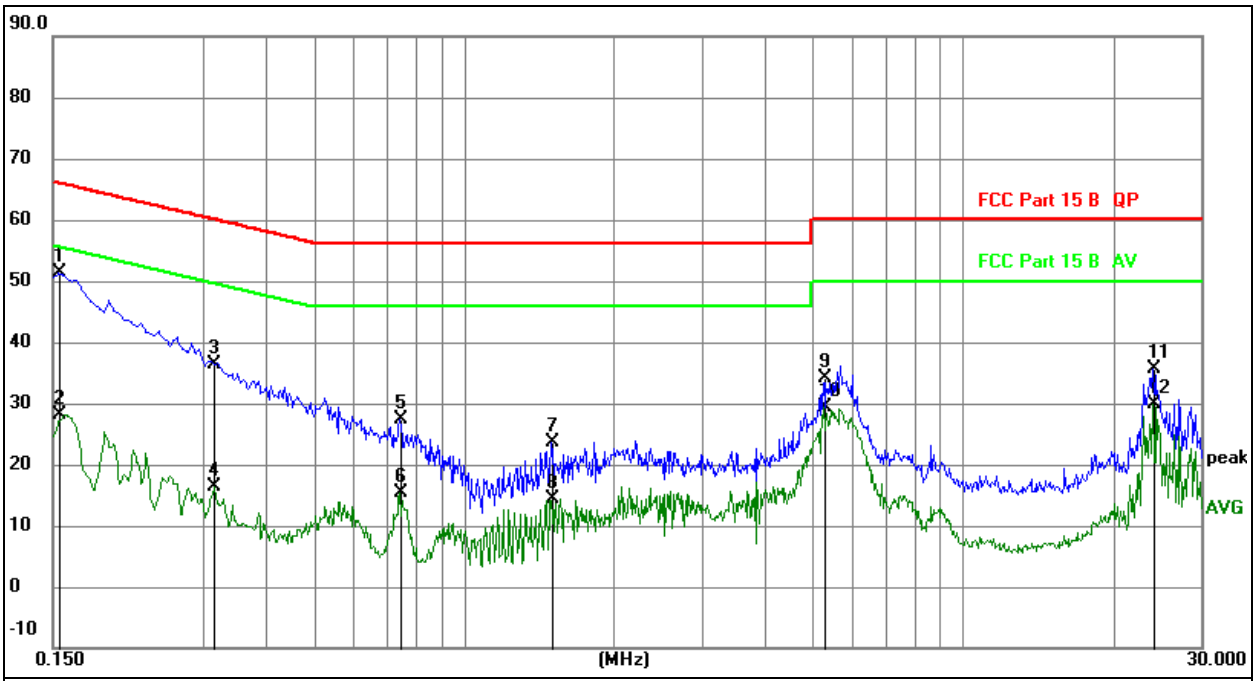
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	DC 5V
Test Mode:	Mode 4	Polarization :	L



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. Measurement = Reading Level + Correct Factor
4. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1	*	0.1539	31.71	19.60	51.31	65.79	-14.48	QP
2		0.1539	8.68	19.60	28.28	55.79	-27.51	AVG
3		0.3465	11.38	19.61	30.99	59.05	-28.06	QP
4		0.3465	-5.71	19.61	13.90	49.05	-35.15	AVG
5		1.3958	4.25	19.62	23.87	56.00	-32.13	QP
6		1.3958	-3.58	19.62	16.04	46.00	-29.96	AVG
7		2.5945	5.38	19.64	25.02	56.00	-30.98	QP
8		2.5945	-1.93	19.64	17.71	46.00	-28.29	AVG
9		5.6234	15.71	19.71	35.42	60.00	-24.58	QP
10		5.6234	10.52	19.71	30.23	50.00	-19.77	AVG
11		24.2706	9.28	19.73	29.01	60.00	-30.99	QP
12		24.2706	2.11	19.73	21.84	50.00	-28.16	AVG

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	DC 5V
Test Mode:	Mode 4	Polarization :	N



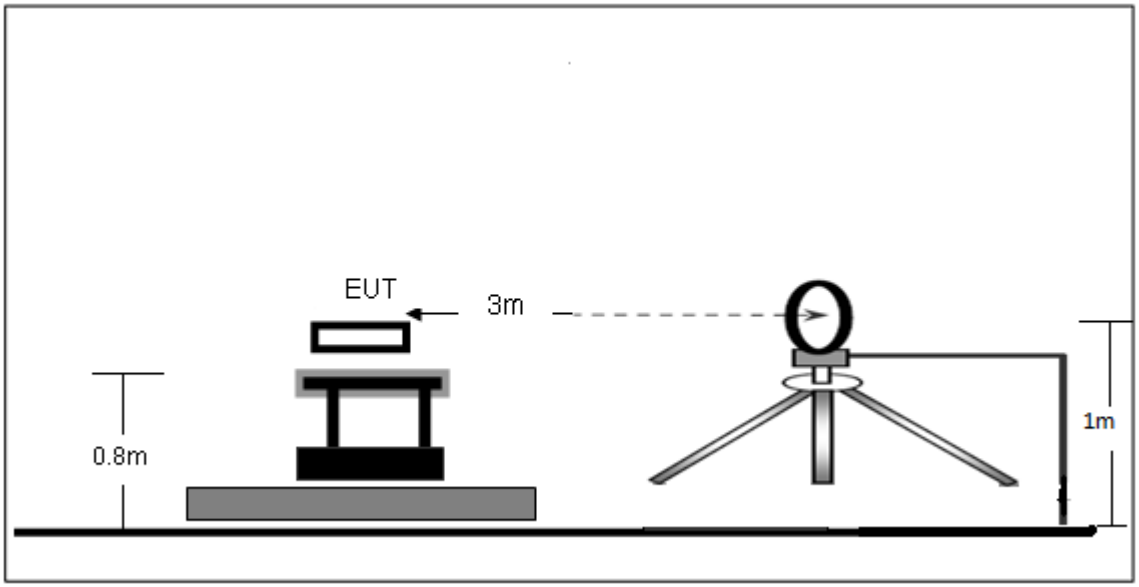
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. Measurement = Reading Level + Correct Factor
4. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1	*	0.1545	31.75	19.60	51.35	65.75	-14.40	QP
2		0.1545	8.63	19.60	28.23	55.75	-27.52	AVG
3		0.3165	16.89	19.61	36.50	59.80	-23.30	QP
4		0.3165	-3.35	19.61	16.26	49.80	-33.54	AVG
5		0.7440	7.75	19.61	27.36	56.00	-28.64	QP
6		0.7440	-4.22	19.61	15.39	46.00	-30.61	AVG
7		1.4955	3.95	19.62	23.57	56.00	-32.43	QP
8		1.4955	-5.33	19.62	14.29	46.00	-31.71	AVG
9		5.2710	14.31	19.70	34.01	60.00	-25.99	QP
10		5.2710	9.68	19.70	29.38	50.00	-20.62	AVG
11		24.0450	15.82	19.73	35.55	60.00	-24.45	QP
12		24.0450	10.03	19.73	29.76	50.00	-20.24	AVG

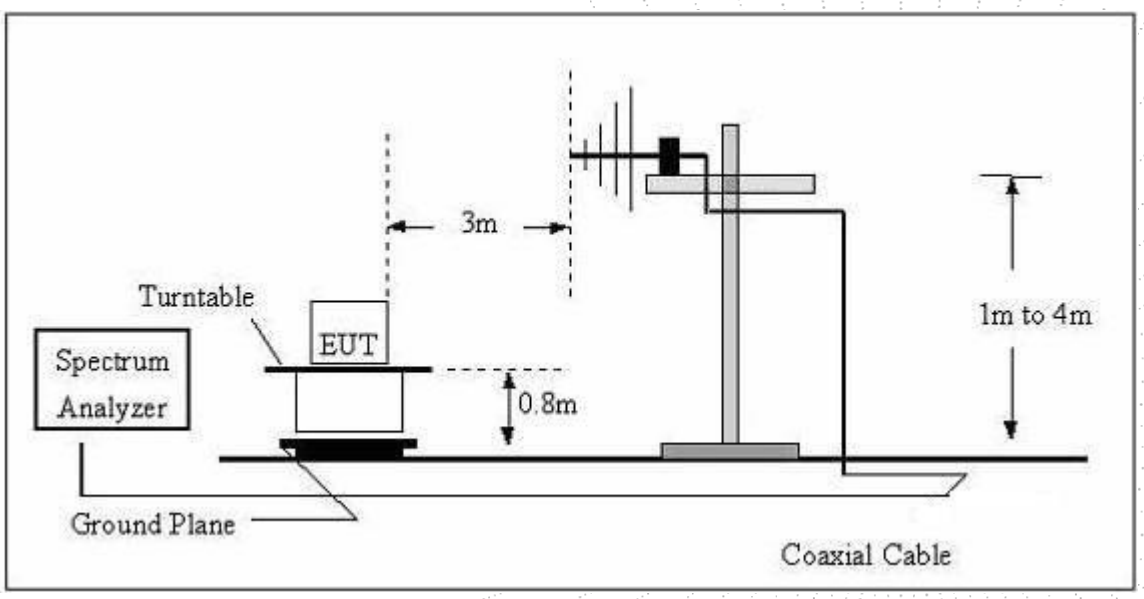
7. Radiated Emissions

7.1 Block Diagram Of Test Setup

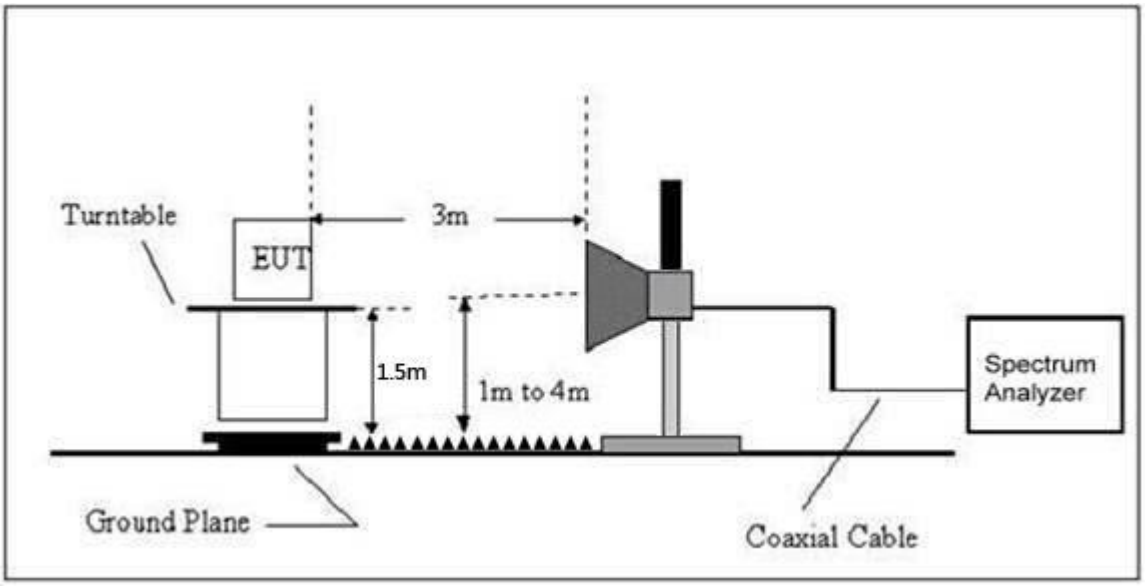
（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz



7.2 Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency	Field Strength	Distance	Field Strength Limit at 3m Distance	
(MHz)	uV/m	(m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))}$ + 80
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))}$ + 40
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)}$ + 40
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Limits Of Radiated Emission Measurement (Above 1000MHz)

Frequency (MHz)	Limit (dBuV/m) (at 3M)	
	Peak	Average
Above 1000	74	54

Notes:
(1)The limit for radiated test was performed according to FCC PART 15C.
(2)The tighter limit applies at the band edges.
(3) Emission level (dBuV/m)=20log Emission level (uV/m).

7.3 Test procedure

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10-2013. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.
This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205.
It must be performed with the highest gain of each type of antenna proposed for use with the EUT.
Use the following spectrum analyzer settings:

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

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

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

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

Note: for the frequency ranges below 30 MHz, a narrower RBW is used for these ranges but the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] =10*lg(100 [kHz]/narrower RBW [kHz]). , the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the
narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

7.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

7.5 Test Result

Below 30MHz

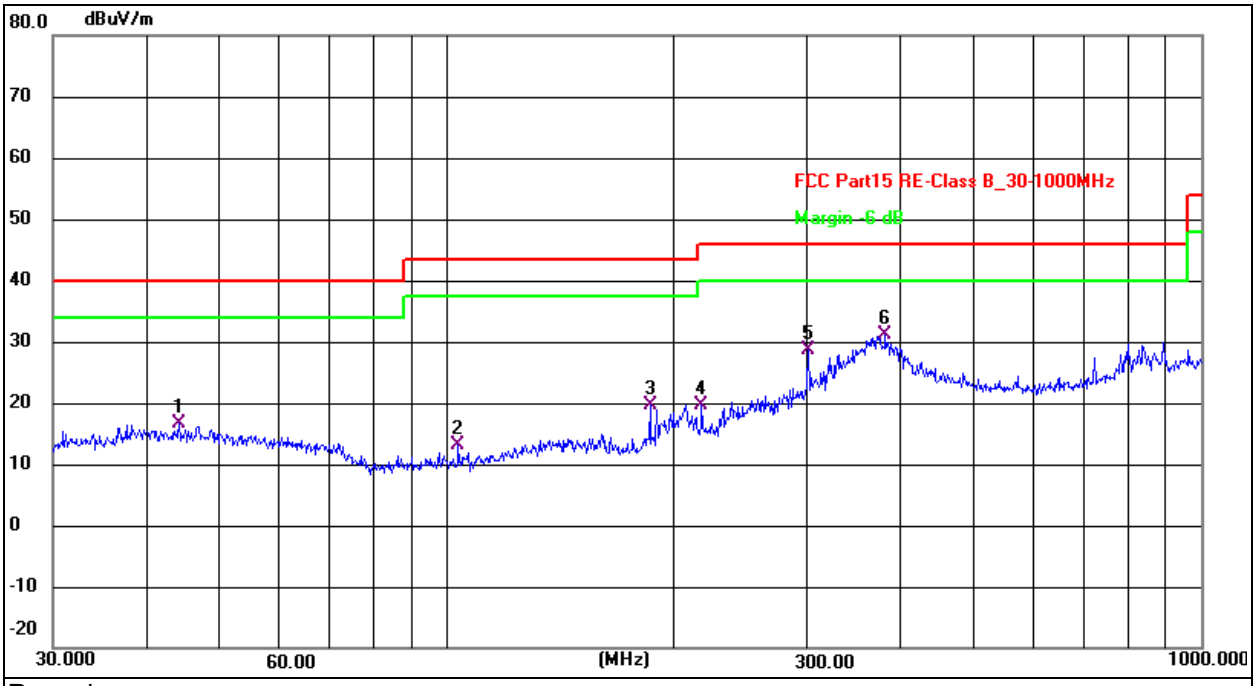
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	DC 5V
Test Mode:	Mode 4	Polarization :	---

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

Note:
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

Between 30MHz – 1GHz

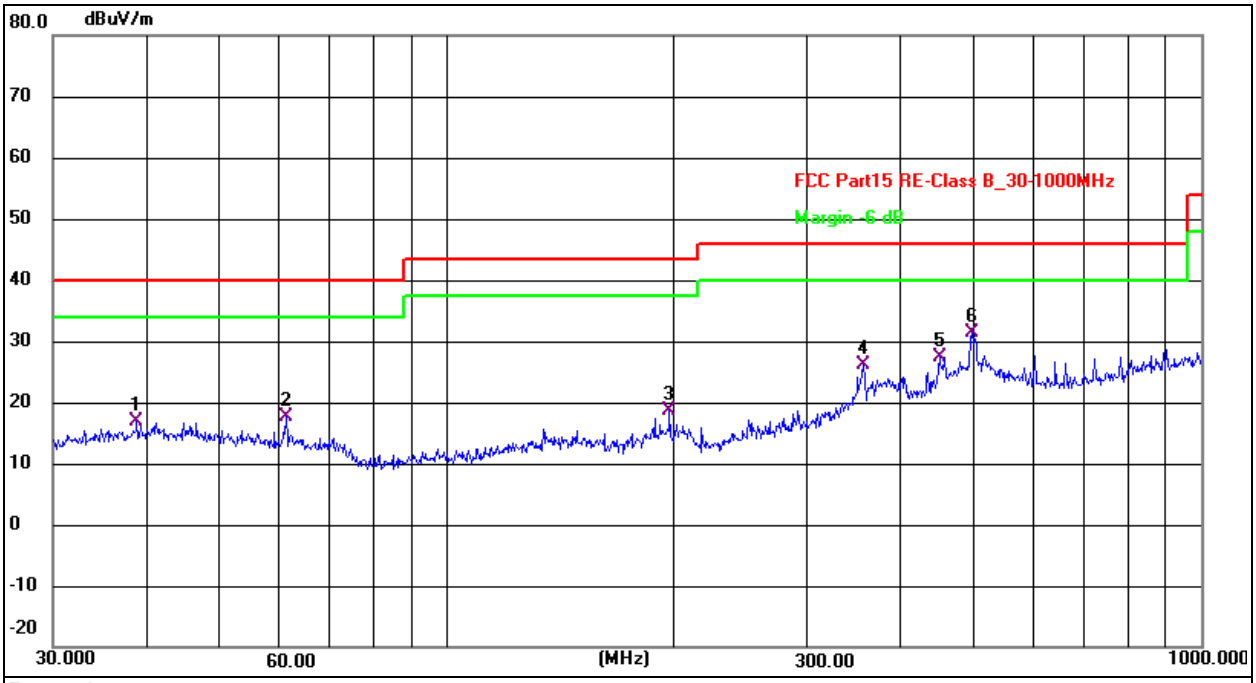
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	DC 5V
Test Mode:	Mode 4	Polarization :	Horizontal



Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Measurement = Reading Level + Correct Factor
3. Over = Measurement - Limit

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	44.1202	27.80	-11.10	16.70	40.00	-23.30	QP
2	103.4421	28.24	-15.17	13.07	43.50	-30.43	QP
3	185.7882	33.42	-13.74	19.68	43.50	-23.82	QP
4	217.5443	33.20	-13.49	19.71	46.00	-26.29	QP
5	301.4224	38.74	-10.15	28.59	46.00	-17.41	QP
6 *	381.2487	39.27	-8.21	31.06	46.00	-14.94	QP

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage ：	DC 5V
Test Mode:	Mode 4	Polarization :	Vertical



Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Measurement = Reading Level + Correct Factor
3. Over = Measurement - Limit

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	38.7518	27.93	-11.08	16.85	40.00	-23.15	QP
2	61.1316	30.28	-12.56	17.72	40.00	-22.28	QP
3	197.2001	32.60	-14.08	18.52	43.50	-24.98	QP
4	356.6758	34.92	-8.81	26.11	46.00	-19.89	QP
5	449.5558	32.96	-5.48	27.48	46.00	-18.52	QP
6 *	497.6765	34.69	-3.26	31.43	46.00	-14.57	QP

Between 1GHz – 40GHz

Test Mode:	TX(5.8G) - 802.11a

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Cable loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel (5745 MHz)-Above 1G									
V	4679.122	59.42	5.94	35.40	44.00	56.76	74	-17.24	PK
V	4679.122	43.72	5.94	35.40	44.00	41.06	54	-12.94	AV
V	11490.199	57.42	8.46	39.75	44.50	61.13	68.2	-7.07	PK
V	11490.199	43.54	8.46	39.75	44.50	47.25	54	-6.75	AV
V	17235.183	58.03	10.12	38.80	44.10	62.85	68.2	-5.35	PK
V	17235.183	43.10	10.12	38.80	42.70	49.32	54	-4.68	AV
H	4679.100	58.62	5.94	35.18	44.00	55.74	74	-18.26	PK
H	4679.100	43.01	5.94	35.18	44.00	40.13	54	-13.87	AV
H	11490.023	53.13	8.46	38.71	44.50	55.80	68.2	-12.40	PK
H	11490.023	43.95	8.46	38.71	44.50	46.62	54	-7.38	AV
H	17235.149	50.74	10.12	38.38	44.10	55.14	68.2	-13.06	PK
H	17235.149	41.36	10.12	38.38	44.10	45.76	54	-8.24	AV
Middle Channel (5785 MHz)-Above 1G									
V	4592.145	54.89	6.48	36.35	44.05	53.67	74	-20.33	PK
V	4592.145	43.98	6.48	36.35	44.05	42.76	54	-11.24	AV
V	11570.042	55.67	8.47	37.88	44.51	57.51	68.2	-10.69	PK
V	11570.042	43.53	8.47	37.88	44.51	45.37	54	-8.63	AV
V	17355.083	57.93	10.12	38.80	44.10	62.75	68.2	-5.45	PK
V	17355.083	39.34	10.12	38.80	42.70	45.56	54	-8.44	AV
H	4592.114	57.99	6.48	36.37	44.05	56.79	74	-17.21	PK
H	4592.114	43.74	6.48	36.37	44.05	42.54	54	-11.46	AV
H	11570.108	54.68	8.47	38.64	44.50	57.29	68.2	-10.91	PK
H	11570.108	44.93	8.47	38.64	44.50	47.54	54	-6.46	AV
H	17355.175	53.42	10.12	38.38	44.10	57.82	68.2	-10.38	PK
H	17355.175	40.40	10.12	38.38	44.10	44.80	54	-9.20	AV
High Channel (5825 MHz)-Above 1G									
V	6039.007	59.21	7.10	37.24	43.50	60.05	68.2	-8.15	PK
V	6039.007	43.15	7.10	37.24	43.50	43.99	54	-10.01	AV
V	11650.160	62.86	8.46	37.68	44.50	64.50	74	-9.50	PK
V	11650.160	43.56	8.46	37.68	44.50	45.20	54	-8.80	AV
V	17475.176	53.22	10.12	38.80	44.10	58.04	68.2	-10.16	PK
V	17475.176	43.85	10.12	38.80	42.70	50.07	54	-3.93	AV
H	6039.034	55.80	7.10	37.24	43.50	56.64	68.2	-11.56	PK
H	6039.034	43.27	7.10	37.24	43.50	44.11	54	-9.89	AV
H	11650.074	50.52	8.46	38.57	44.50	53.05	74	-20.95	PK
H	11650.074	40.91	8.46	38.57	44.50	43.44	54	-10.56	AV
H	17475.122	52.96	10.12	38.38	44.10	57.36	68.2	-10.84	PK
H	17475.122	43.83	10.12	38.38	44.10	48.23	54	-5.77	AV

Note: PK value is lower than the Average value limit, So average didn't record.
The 26.5-40G amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Mode:	TX(5.8G) - 802.11n-HT20

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Cable loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel (5745 MHz)-Above 1G									
V	4679.050	60.10	5.94	35.40	44.00	57.44	74	-16.56	PK
V	4679.050	43.76	5.94	35.40	44.00	41.10	54	-12.90	AV
V	11490.059	55.46	8.46	39.75	44.50	59.17	68.2	-9.03	PK
V	11490.059	43.52	8.46	39.75	44.50	47.23	54	-6.77	AV
V	17235.104	58.06	10.12	38.80	44.10	62.88	68.2	-5.32	PK
V	17235.104	43.59	10.12	38.80	42.70	49.81	54	-4.19	AV
H	4679.149	57.94	5.94	35.18	44.00	55.06	74	-18.94	PK
H	4679.149	43.64	5.94	35.18	44.00	40.76	54	-13.24	AV
H	11490.012	47.05	8.46	38.71	44.50	49.72	68.2	-18.48	PK
H	11490.012	40.14	8.46	38.71	44.50	42.81	54	-11.19	AV
H	17235.142	51.10	10.12	38.38	44.10	55.50	68.2	-12.70	PK
H	17235.142	44.81	10.12	38.38	44.10	49.21	54	-4.79	AV
Middle Channel (5785 MHz)-Above 1G									
V	4592.046	58.33	6.48	36.35	44.05	57.11	74	-16.89	PK
V	4592.046	43.10	6.48	36.35	44.05	41.88	54	-12.12	AV
V	11570.015	57.98	8.47	37.88	44.51	59.82	68.2	-8.38	PK
V	11570.015	43.25	8.47	37.88	44.51	45.09	54	-8.91	AV
V	17355.094	59.43	10.12	38.80	44.10	64.25	68.2	-3.95	PK
V	17355.094	43.55	10.12	38.80	42.70	49.77	54	-4.23	AV
H	4592.053	58.86	6.48	36.37	44.05	57.66	74	-16.34	PK
H	4592.053	43.81	6.48	36.37	44.05	42.61	54	-11.39	AV
H	11570.163	53.24	8.47	38.64	44.50	55.85	68.2	-12.35	PK
H	11570.163	40.65	8.47	38.64	44.50	43.26	54	-10.74	AV
H	17355.125	54.66	10.12	38.38	44.10	59.06	68.2	-9.14	PK
H	17355.125	40.08	10.12	38.38	44.10	44.48	54	-9.52	AV
High Channel (5825 MHz)-Above 1G									
V	6039.174	58.90	7.10	37.24	43.50	59.74	68.2	-8.46	PK
V	6039.174	43.79	7.10	37.24	43.50	44.63	54	-9.37	AV
V	11650.076	56.43	8.46	37.68	44.50	58.07	74	-15.93	PK
V	11650.076	43.08	8.46	37.68	44.50	44.72	54	-9.28	AV
V	17475.063	58.96	10.12	38.80	44.10	63.78	68.2	-4.42	PK
V	17475.063	43.95	10.12	38.80	42.70	50.17	54	-3.83	AV
H	6039.193	58.81	7.10	37.24	43.50	59.65	68.2	-8.55	PK
H	6039.193	43.82	7.10	37.24	43.50	44.66	54	-9.34	AV
H	11650.085	50.19	8.46	38.57	44.50	52.72	74	-21.28	PK
H	11650.085	44.30	8.46	38.57	44.50	46.83	54	-7.17	AV
H	17475.063	52.07	10.12	38.38	44.10	56.47	68.2	-11.73	PK
H	17475.063	42.46	10.12	38.38	44.10	46.86	54	-7.14	AV

Note: PK value is lower than the Average value limit, So average didn't record.
The 26.5-40G amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Mode:	TX(5.8G) - 802.11n-HT40

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Cable loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel (5755 MHz)-Above 1G									
V	4679.076	59.18	5.94	35.40	44.00	56.52	74	-17.48	PK
V	4679.076	43.12	5.94	35.40	44.00	40.46	54	-13.54	AV
V	11510.054	56.29	8.46	39.75	44.50	60.00	74	-14.00	PK
V	11510.054	43.73	8.46	39.75	44.50	47.44	54	-6.56	AV
V	17265.069	58.13	10.12	38.80	44.10	62.95	68.2	-5.25	PK
V	17265.069	2.00	10.12	38.80	42.70	8.22	54	-45.78	AV
H	4679.147	59.91	5.94	35.18	44.00	57.03	74	-16.97	PK
H	4679.147	43.78	5.94	35.18	44.00	40.90	54	-13.10	AV
H	11510.106	53.88	8.46	38.71	44.50	56.55	74	-17.45	PK
H	11510.106	41.10	8.46	38.71	44.50	43.77	54	-10.23	AV
H	17265.004	52.07	10.12	38.38	44.10	56.47	68.2	-11.73	PK
H	17265.004	43.51	10.12	38.38	44.10	47.91	54	-6.09	AV
High Channel (5795 MHz)-Above 1G									
V	6039.125	59.45	6.48	36.35	44.05	58.23	68.2	-9.97	PK
V	6039.125	43.22	6.48	36.35	44.05	42.00	54	-12.00	AV
V	11590.136	56.39	8.47	37.88	44.51	58.23	74	-15.77	PK
V	11590.136	43.40	8.47	37.88	44.51	45.24	54	-8.76	AV
V	17385.112	55.78	10.12	38.80	44.10	60.60	68.2	-7.60	PK
V	17385.112	41.60	10.12	38.80	42.70	47.82	54	-6.18	AV
H	6039.199	60.39	6.48	36.37	44.05	59.19	68.2	-9.01	PK
H	6039.199	43.80	6.48	36.37	44.05	42.60	54	-11.40	AV
H	11590.132	53.39	8.47	38.64	44.50	56.00	74	-18.00	PK
H	11590.132	41.05	8.47	38.64	44.50	43.66	54	-10.34	AV
H	17385.089	53.00	10.12	38.38	44.10	57.40	68.2	-10.80	PK
H	17385.089	42.15	10.12	38.38	44.10	46.55	54	-7.45	AV

Note: PK value is lower than the Average value limit, So average didn't record.
The 26.5-40G amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Mode:	TX(5.8G) - 802.11ac-HT20

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Cable loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel (5745 MHz)-Above 1G									
V	4679.084	57.07	5.94	35.40	44.00	54.41	74	-19.59	PK
V	4679.084	43.39	5.94	35.40	44.00	40.73	54	-13.27	AV
V	11490.088	56.30	8.46	39.75	44.50	60.01	68.2	-8.19	PK
V	11490.088	43.88	8.46	39.75	44.50	47.59	54	-6.41	AV
V	17235.063	59.22	10.12	38.80	44.10	64.04	68.2	-4.16	PK
V	17235.063	43.80	10.12	38.80	42.70	50.02	54	-3.98	AV
H	4679.076	60.49	5.94	35.18	44.00	57.61	74	-16.39	PK
H	4679.076	43.68	5.94	35.18	44.00	40.80	54	-13.20	AV
H	11490.086	50.51	8.46	38.71	44.50	53.18	68.2	-15.02	PK
H	11490.086	40.09	8.46	38.71	44.50	42.76	54	-11.24	AV
H	17235.088	52.74	10.12	38.38	44.10	57.14	68.2	-11.06	PK
H	17235.088	44.39	10.12	38.38	44.10	48.79	54	-5.21	AV
Middle Channel (5785 MHz)-Above 1G									
V	4592.003	62.69	6.48	36.35	44.05	61.47	74	-12.53	PK
V	4592.003	43.93	6.48	36.35	44.05	42.71	54	-11.29	AV
V	11570.124	58.21	8.47	37.88	44.51	60.05	68.2	-8.15	PK
V	11570.124	43.58	8.47	37.88	44.51	45.42	54	-8.58	AV
V	17355.061	59.03	10.12	38.80	44.10	63.85	68.2	-4.35	PK
V	17355.061	43.21	10.12	38.80	42.70	49.43	54	-4.57	AV
H	4592.131	59.38	6.48	36.37	44.05	58.18	74	-15.82	PK
H	4592.131	43.12	6.48	36.37	44.05	41.92	54	-12.08	AV
H	11570.032	52.08	8.47	38.64	44.50	54.69	68.2	-13.51	PK
H	11570.032	42.70	8.47	38.64	44.50	45.31	54	-8.69	AV
H	17355.135	54.22	10.12	38.38	44.10	58.62	68.2	-9.58	PK
H	17355.135	41.68	10.12	38.38	44.10	46.08	54	-7.92	AV
High Channel (5825 MHz)-Above 1G									
V	6039.107	58.04	7.10	37.24	43.50	58.88	68.2	-9.32	PK
V	6039.107	43.05	7.10	37.24	43.50	43.89	54	-10.11	AV
V	11650.183	60.92	8.46	37.68	44.50	62.56	74	-11.44	PK
V	11650.183	43.68	8.46	37.68	44.50	45.32	54	-8.68	AV
V	17475.129	58.17	10.12	38.80	44.10	62.99	68.2	-5.21	PK
V	17475.129	43.39	10.12	38.80	42.70	49.61	54	-4.39	AV
H	6039.132	57.18	7.10	37.24	43.50	58.02	68.2	-10.18	PK
H	6039.132	43.89	7.10	37.24	43.50	44.73	54	-9.27	AV
H	11650.014	50.35	8.46	38.57	44.50	52.88	74	-21.12	PK
H	11650.014	43.00	8.46	38.57	44.50	45.53	54	-8.47	AV
H	17475.010	54.79	10.12	38.38	44.10	59.19	68.2	-9.01	PK
H	17475.010	40.85	10.12	38.38	44.10	45.25	54	-8.75	AV

Note: PK value is lower than the Average value limit, So average didn't record.
The 26.5-40G amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Test Mode:	TX(5.8G) - 802.11ac-HT40

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Cable loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel (5755 MHz)-Above 1G									
V	4679.065	59.39	5.94	35.40	44.00	56.73	74	-17.27	PK
V	4679.065	43.16	5.94	35.40	44.00	40.50	54	-13.50	AV
V	11510.116	56.03	8.46	39.75	44.50	59.74	74	-14.26	PK
V	11510.116	43.93	8.46	39.75	44.50	47.64	54	-6.36	AV
V	17265.059	55.81	10.12	38.80	44.10	60.63	68.2	-7.57	PK
V	17265.059	2.00	10.12	38.80	42.70	8.22	54	-45.78	AV
H	4679.032	56.22	5.94	35.18	44.00	53.34	74	-20.66	PK
H	4679.032	43.42	5.94	35.18	44.00	40.54	54	-13.46	AV
H	11510.068	53.55	8.46	38.71	44.50	56.22	74	-17.78	PK
H	11510.068	42.26	8.46	38.71	44.50	44.93	54	-9.07	AV
H	17265.176	51.41	10.12	38.38	44.10	55.81	68.2	-12.39	PK
H	17265.176	45.00	10.12	38.38	44.10	49.40	54	-4.60	AV
High Channel (5795 MHz)-Above 1G									
V	6039.168	60.23	6.48	36.35	44.05	59.01	68.2	-9.19	PK
V	6039.168	43.48	6.48	36.35	44.05	42.26	54	-11.74	AV
V	11590.199	58.44	8.47	37.88	44.51	60.28	74	-13.72	PK
V	11590.199	43.75	8.47	37.88	44.51	45.59	54	-8.41	AV
V	17385.051	55.71	10.12	38.80	44.10	60.53	68.2	-7.67	PK
V	17385.051	41.48	10.12	38.80	42.70	47.70	54	-6.30	AV
H	6039.191	60.71	6.48	36.37	44.05	59.51	68.2	-8.69	PK
H	6039.191	43.67	6.48	36.37	44.05	42.47	54	-11.53	AV
H	11590.191	53.02	8.47	38.64	44.50	55.63	74	-18.37	PK
H	11590.191	40.62	8.47	38.64	44.50	43.23	54	-10.77	AV
H	17385.131	54.89	10.12	38.38	44.10	59.29	68.2	-8.91	PK
H	17385.131	43.09	10.12	38.38	44.10	47.49	54	-6.51	AV

Note: PK value is lower than the Average value limit, So average didn't record.
The 26.5-40G amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

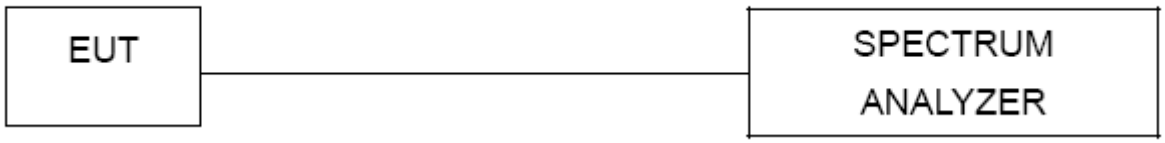
Test Mode:	TX(5.8G) - 802.11ac-HT80

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Cable loss (dB)	Antenna Factor dB/m	Preamp Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
(5775 MHz)-Above 1G									
V	4679.009	57.41	5.94	35.40	44.00	54.75	74	-19.25	PK
V	4679.009	43.63	5.94	35.40	44.00	40.97	54	-13.03	AV
V	11550.167	55.44	8.46	39.75	44.50	59.15	74	-14.85	PK
V	11550.167	42.14	8.46	39.75	44.50	45.85	54	-8.15	AV
V	17325.131	57.50	10.12	38.80	44.10	62.32	68.2	-5.88	PK
V	17325.131	41.63	10.12	38.80	42.70	47.85	54	-6.15	AV
H	4679.033	55.36	5.94	35.18	44.00	52.48	74	-21.52	PK
H	4679.033	43.75	5.94	35.18	44.00	40.87	54	-13.13	AV
H	11550.033	50.95	8.46	38.71	44.50	53.62	74	-20.38	PK
H	11550.033	43.10	8.46	38.71	44.50	45.77	54	-8.23	AV
H	17325.032	54.27	10.12	38.38	44.10	58.67	68.2	-9.53	PK
H	17325.032	42.43	10.12	38.38	44.10	46.83	54	-7.17	AV

Note: PK value is lower than the Average value limit, So average didn't record.
The 26.5-40G amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.
Emission level (dBuV/m) = 20 log Emission level (uV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

8. Power Spectral Density Test

8.1 Block Diagram Of Test Setup



8.2 Limit

For the band 5.15-5.25 GHz,
(i)For an outdoor Wifi Repeater operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor Wifi Repeater operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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.

(iii) For fixed point-to-point Wifi Repeaters operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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.
For the band 5.725-5.85 GHz

(3)For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. 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.

8.3 Test procedure

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:
a) Set RBW ≥ 1/T, where T is defined in section II.B.I.a).
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

8.4 EUT operating Conditions

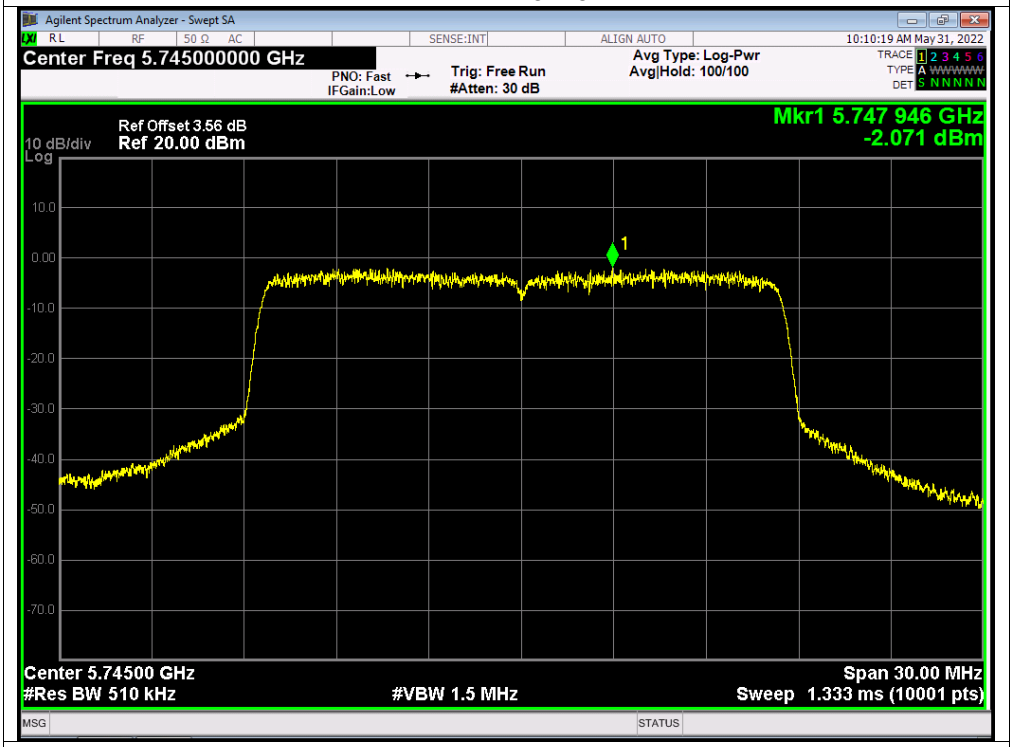
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

8.5 Test Result

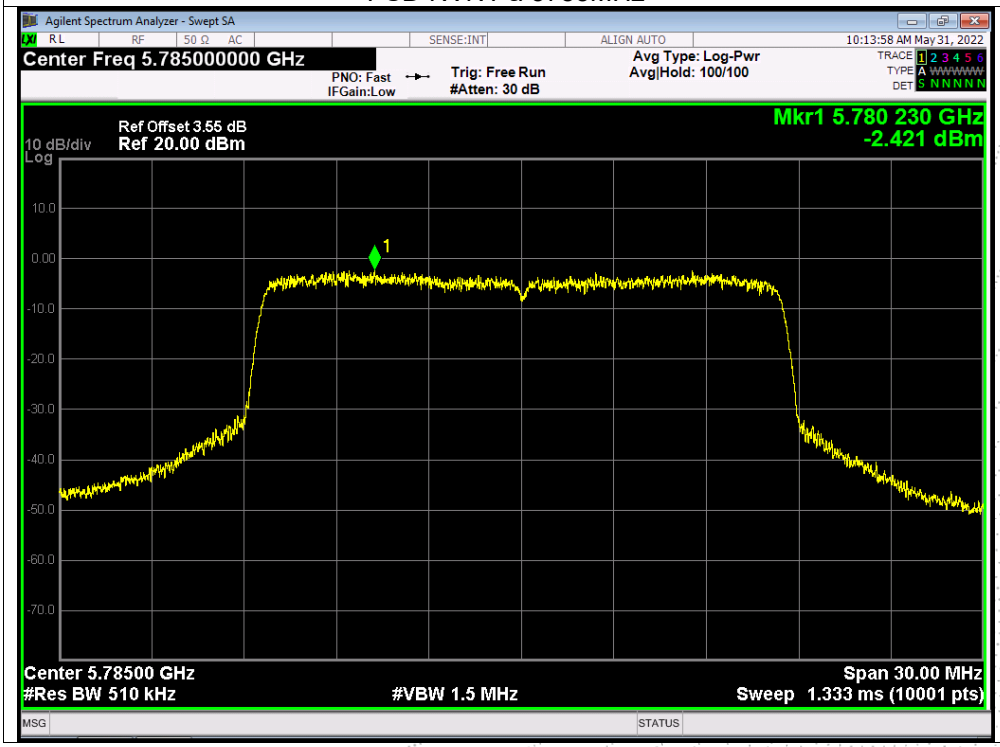
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage:	DC 5V
Test Mode:	(5745-5825MHz)		

Condition	Mode	Frequency (MHz)	Conducted PSD (dBm)	Limit (dBm)	Verdict
NVNT	a	5745	-2.07	30	Pass
NVNT	a	5785	-2.42	30	Pass
NVNT	a	5825	-2.83	30	Pass
NVNT	n20	5745	-3.50	30	Pass
NVNT	n20	5785	-3.03	30	Pass
NVNT	n20	5825	-3.95	30	Pass
NVNT	n40	5755	-7.69	30	Pass
NVNT	n40	5795	-8.44	30	Pass
NVNT	ac20	5745	-3.63	30	Pass
NVNT	ac20	5785	-3.48	30	Pass
NVNT	ac20	5825	-4.29	30	Pass
NVNT	ac40	5755	-7.90	30	Pass
NVNT	ac40	5795	-7.87	30	Pass
NVNT	ac80	5775	-11.30	30	Pass

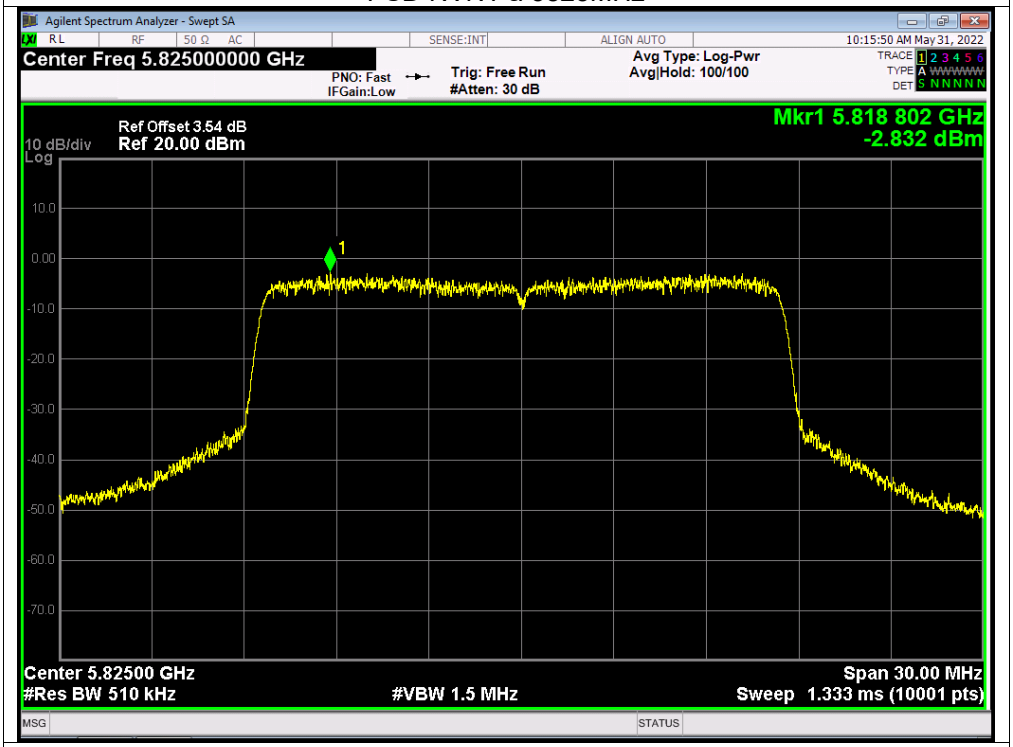
Test Graphs
PSD NVNT a 5745MHz



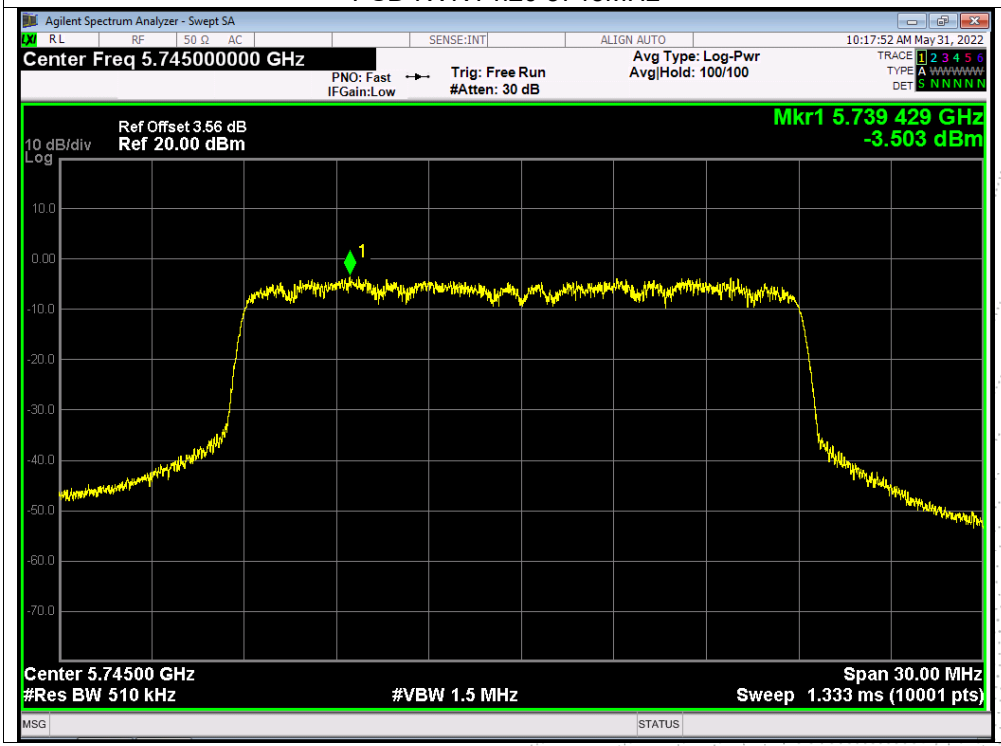
PSD NVNT a 5785MHz



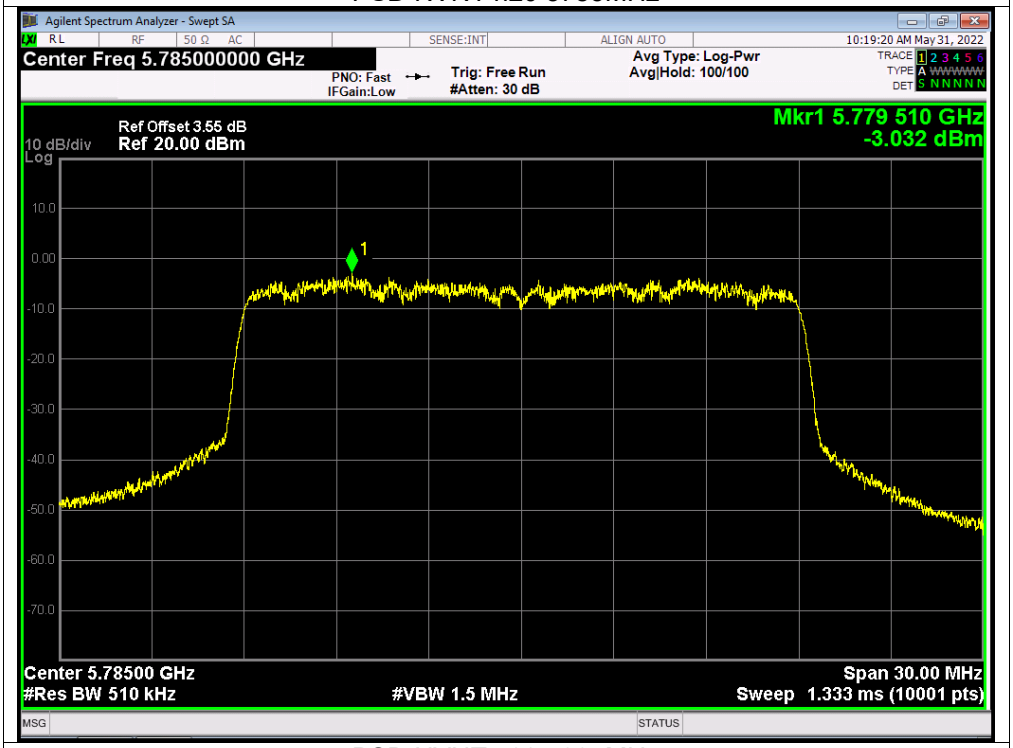
PSD NVNT a 5825MHz



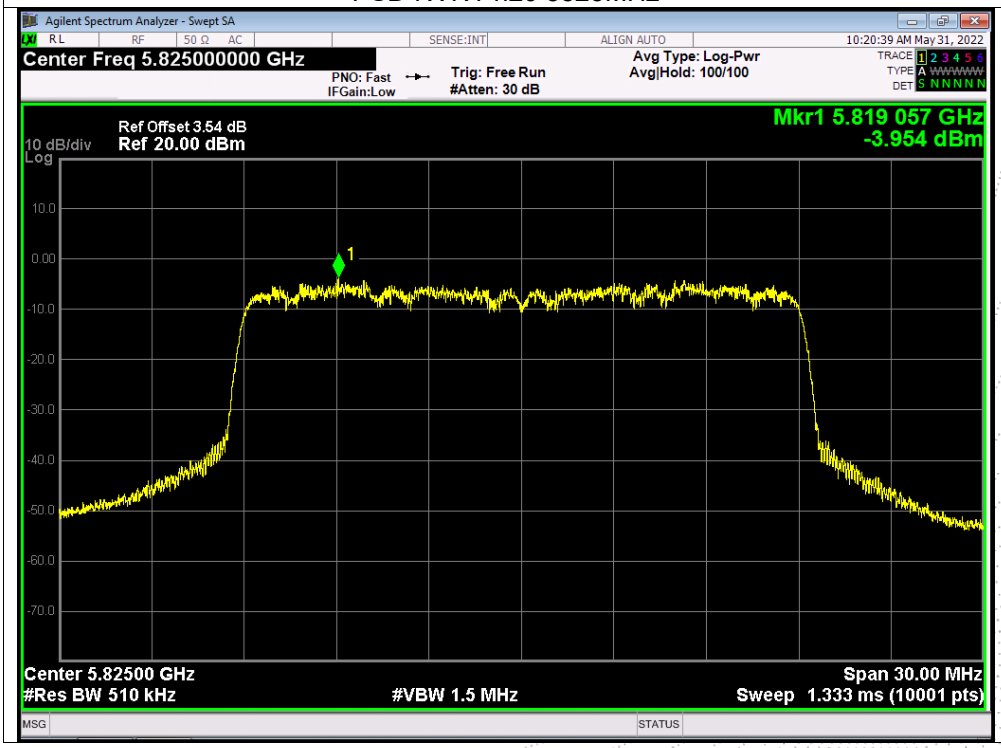
PSD NVNT n20 5745MHz



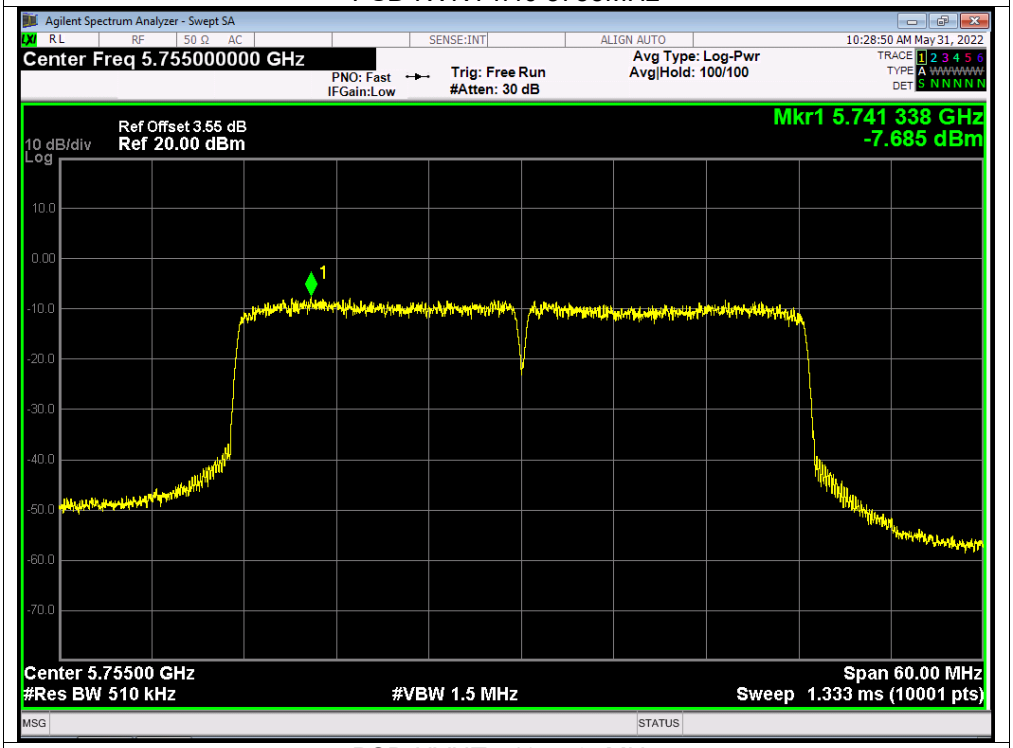
PSD NVNT n20 5785MHz



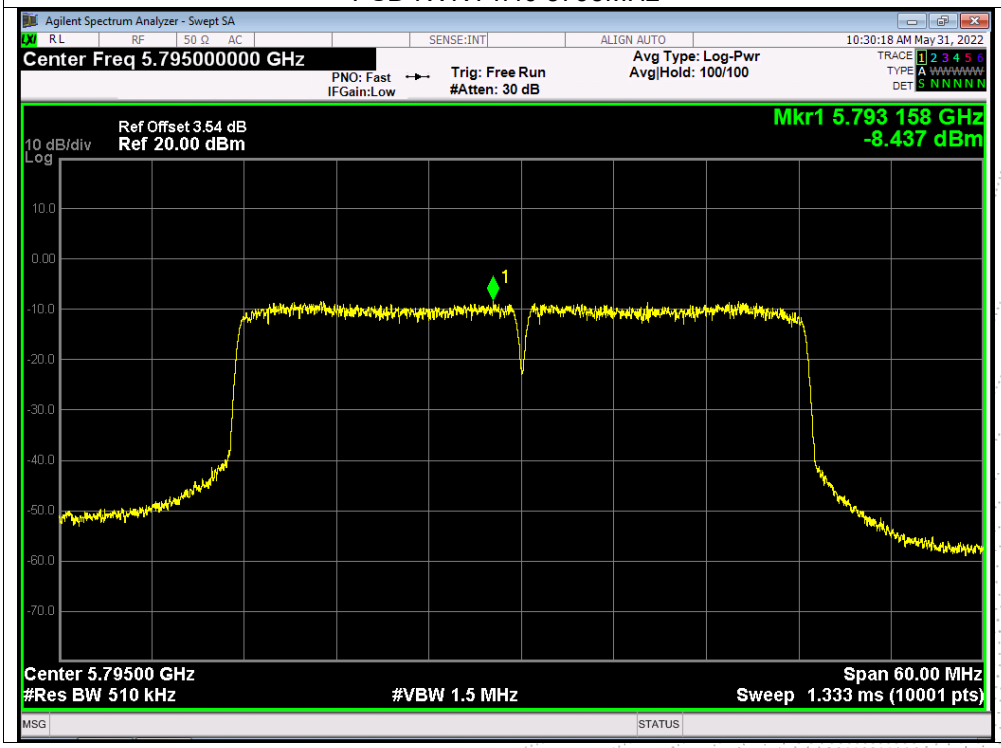
PSD NVNT n20 5825MHz



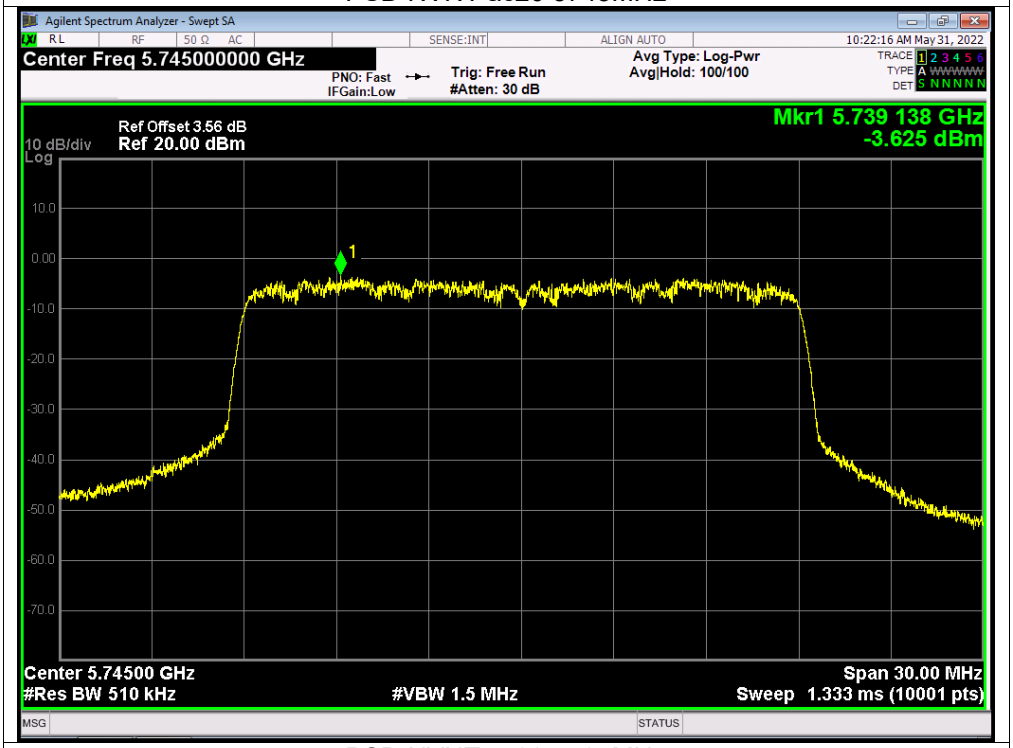
PSD NVNT n40 5755MHz



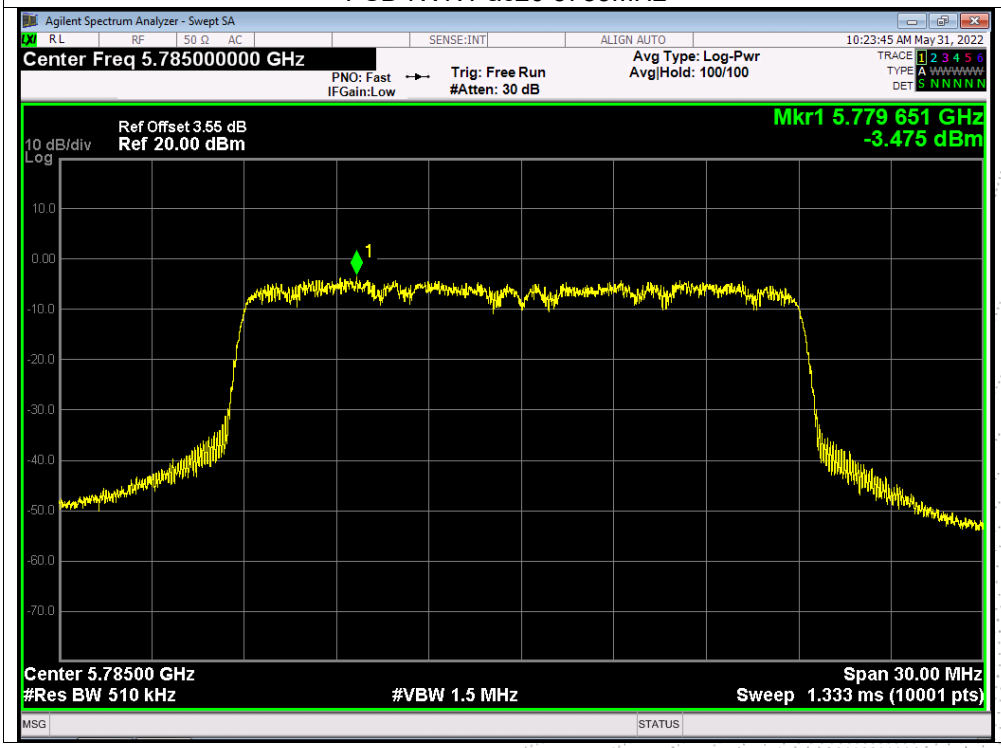
PSD NVNT n40 5795MHz



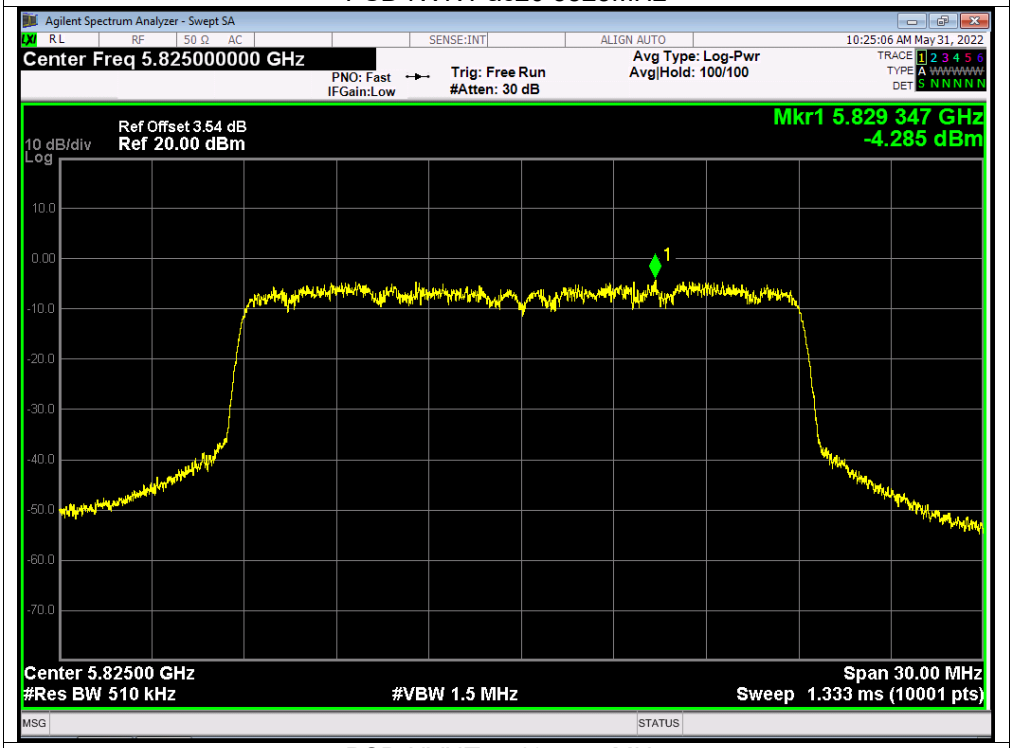
PSD NVNT ac20 5745MHz



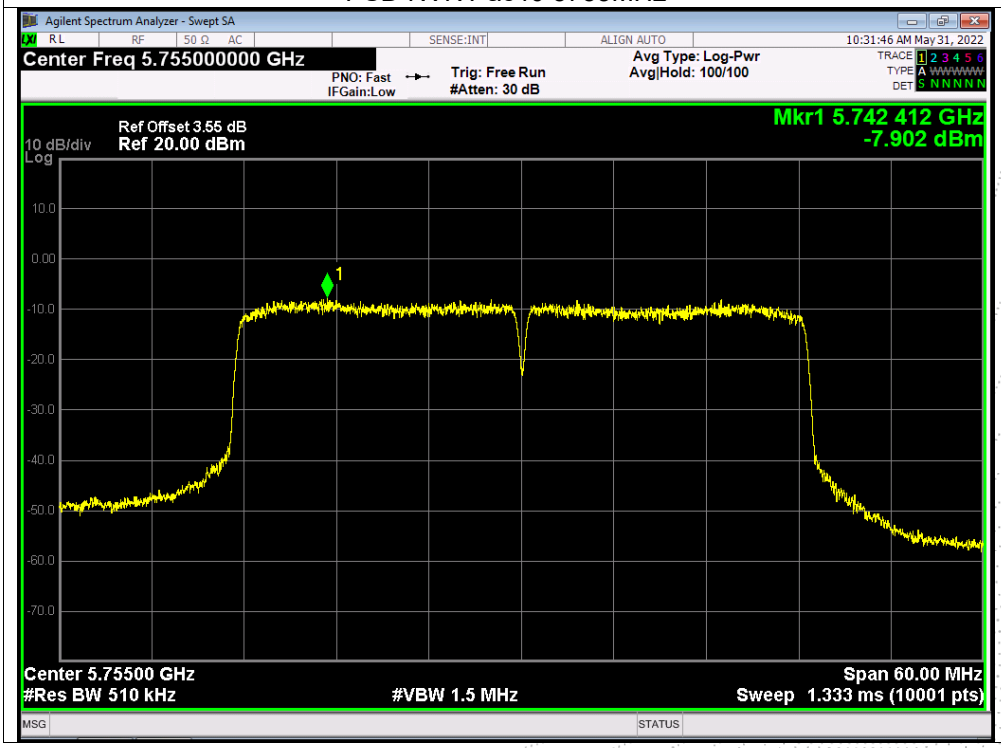
PSD NVNT ac20 5785MHz



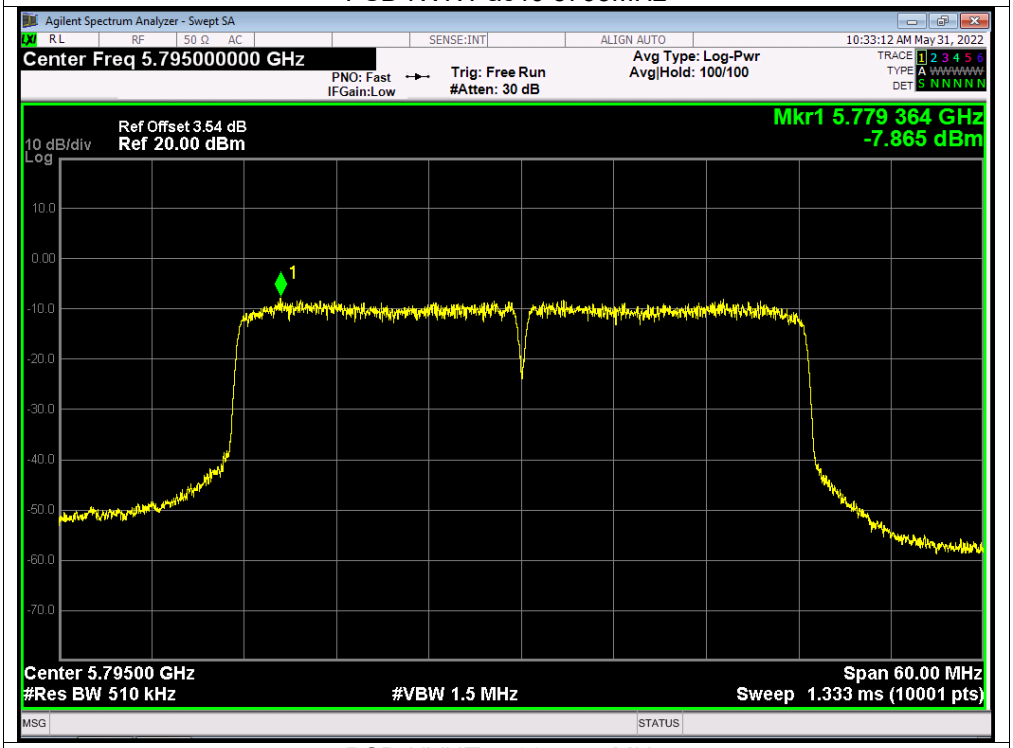
PSD NVNT ac20 5825MHz



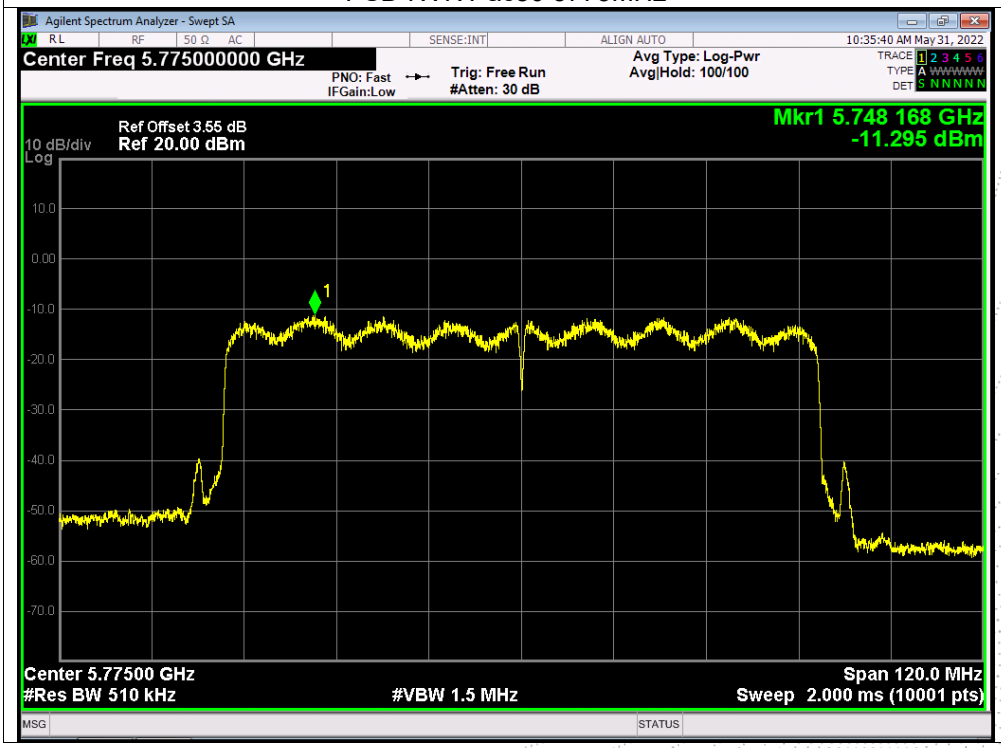
PSD NVNT ac40 5755MHz



PSD NVNT ac40 5795MHz

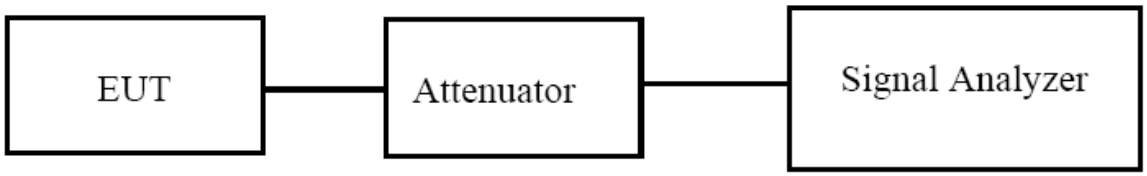


PSD NVNT ac80 5775MHz



9. 26dB & 6dB & 99% Emission Bandwidth

9.1 Block Diagram Of Test Setup



9.2 Limit

The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power
is integrated over the full reference bandwidth.

9.3 Test procedure

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
The following procedure shall be used for measuring (99 %) power bandwidth:
1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 · RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

9.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

9.5 Test Result

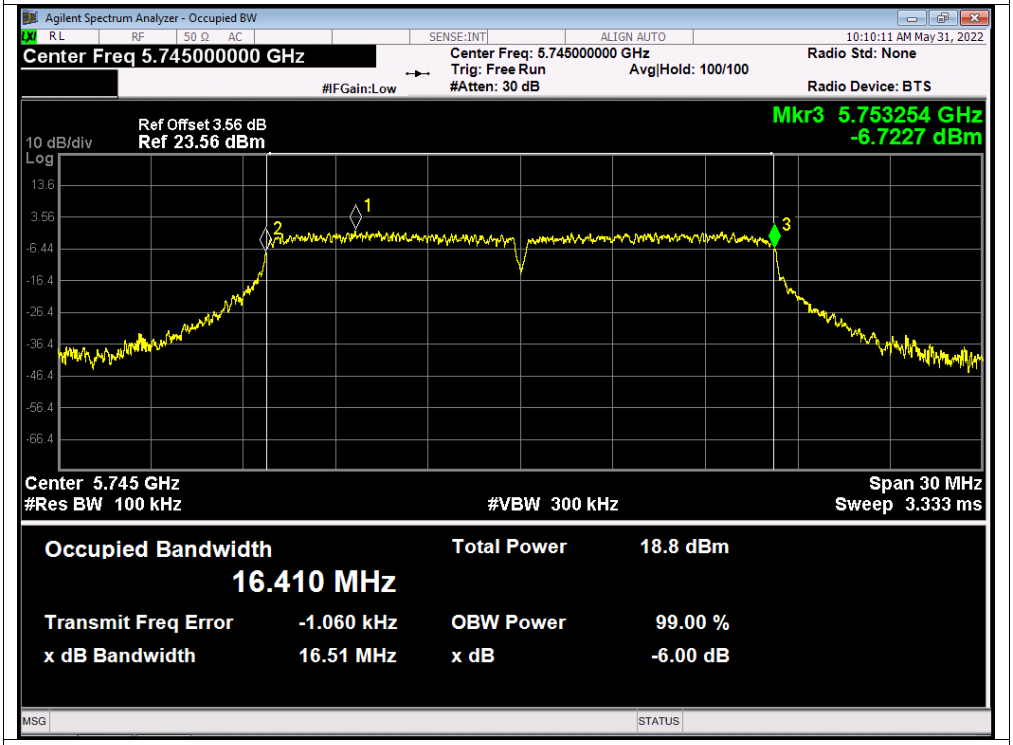
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage:	DC 5V
Test Mode:	(5745-5825MHz)		

Condition	Mode	Frequency (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	a	5745	16.510	0.5	Pass
NVNT	a	5785	16.484	0.5	Pass
NVNT	a	5825	16.514	0.5	Pass
NVNT	n20	5745	17.642	0.5	Pass
NVNT	n20	5785	17.645	0.5	Pass
NVNT	n20	5825	17.655	0.5	Pass
NVNT	n40	5755	36.427	0.5	Pass
NVNT	n40	5795	36.402	0.5	Pass
NVNT	ac20	5745	17.595	0.5	Pass
NVNT	ac20	5785	17.619	0.5	Pass
NVNT	ac20	5825	17.756	0.5	Pass
NVNT	ac40	5755	36.395	0.5	Pass
NVNT	ac40	5795	36.392	0.5	Pass
NVNT	ac80	5775	75.930	0.5	Pass

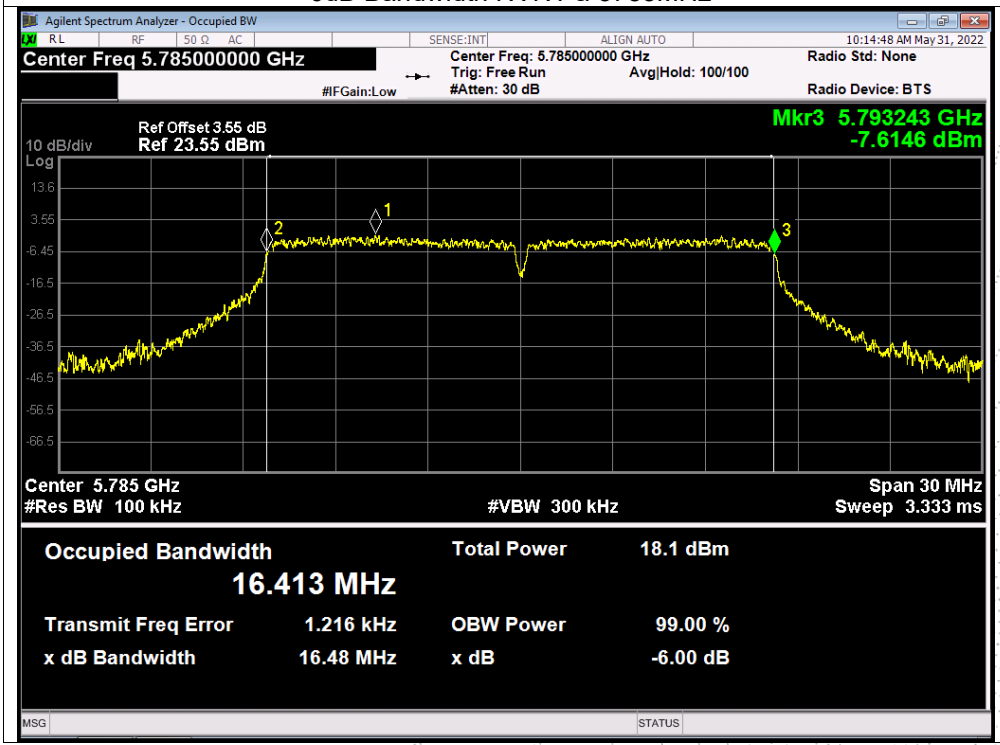
Condition	Mode	Frequency (MHz)	99% OBW (MHz)
NVNT	a	5745	16.485
NVNT	a	5785	16.492
NVNT	a	5825	16.510
NVNT	n20	5745	17.600
NVNT	n20	5785	17.615
NVNT	n20	5825	17.646
NVNT	n40	5755	36.143
NVNT	n40	5795	36.129
NVNT	ac20	5745	17.616
NVNT	ac20	5785	17.640
NVNT	ac20	5825	17.679
NVNT	ac40	5755	36.117
NVNT	ac40	5795	36.129
NVNT	ac80	5775	75.322

Test Graphs

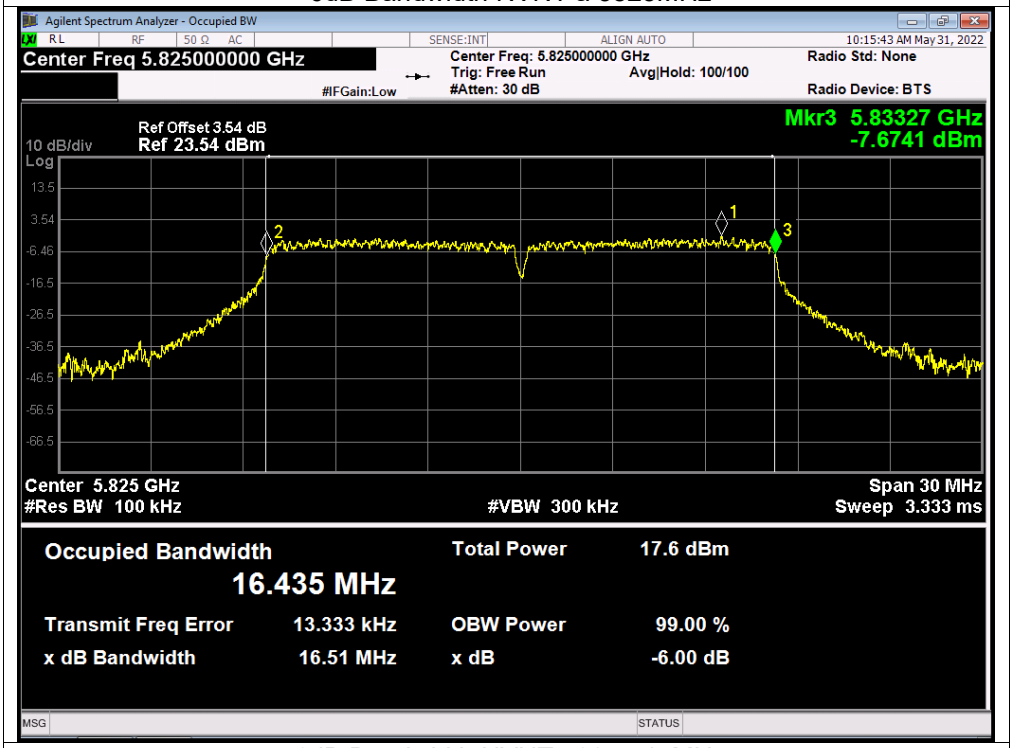
-6dB Bandwidth NVNT a 5745MHz



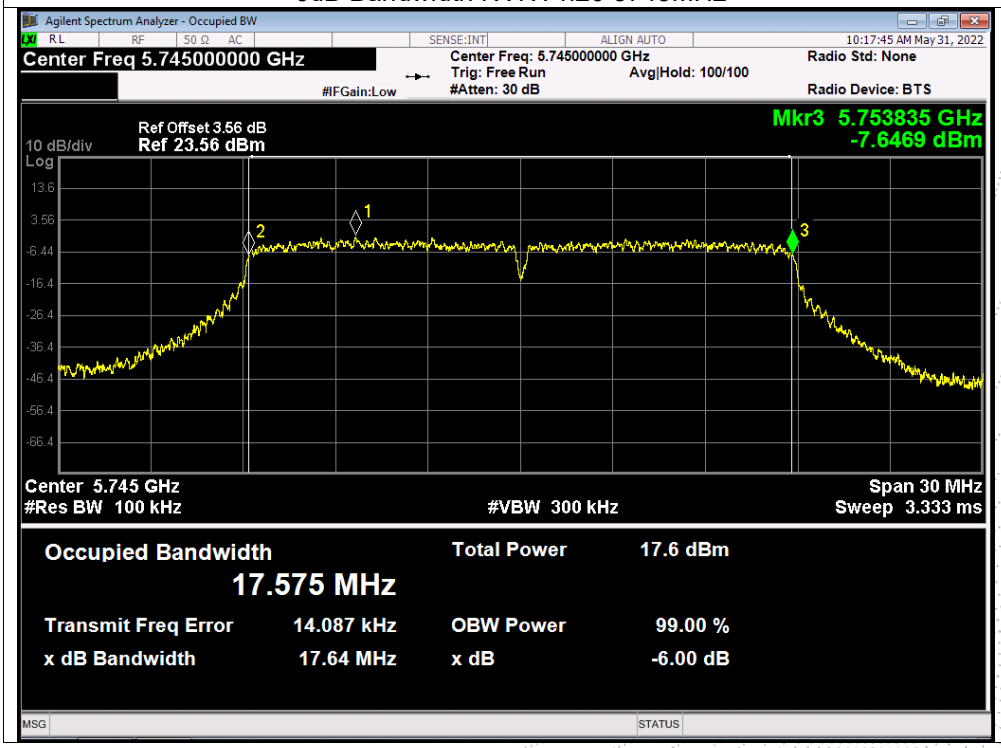
-6dB Bandwidth NVNT a 5785MHz



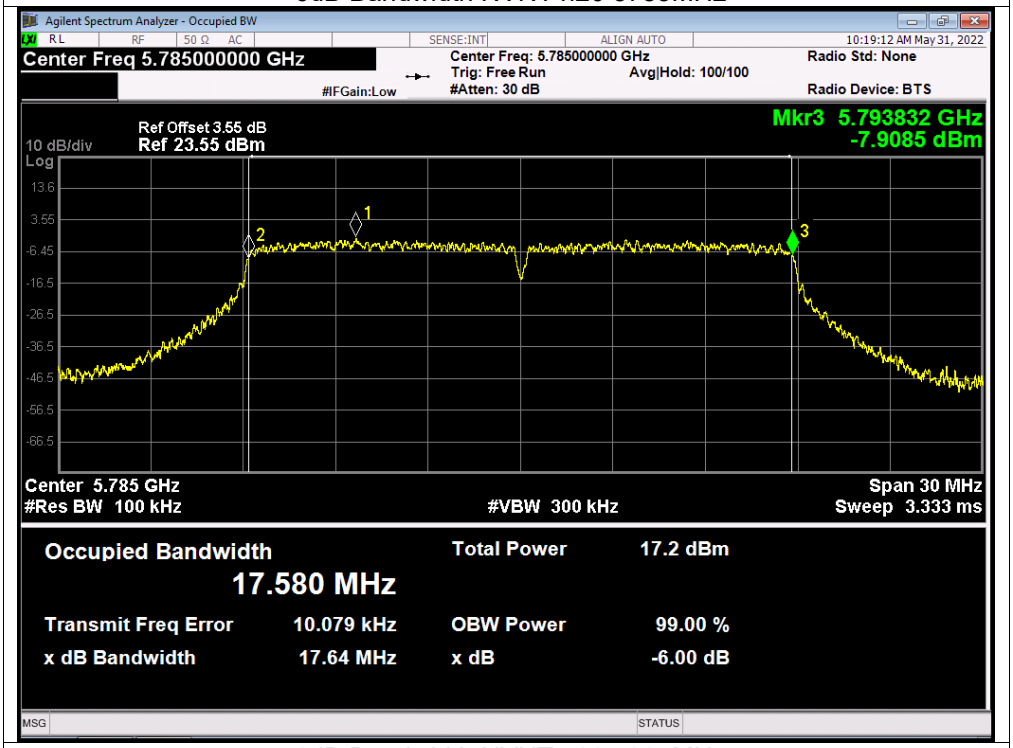
-6dB Bandwidth NVNT a 5825MHz



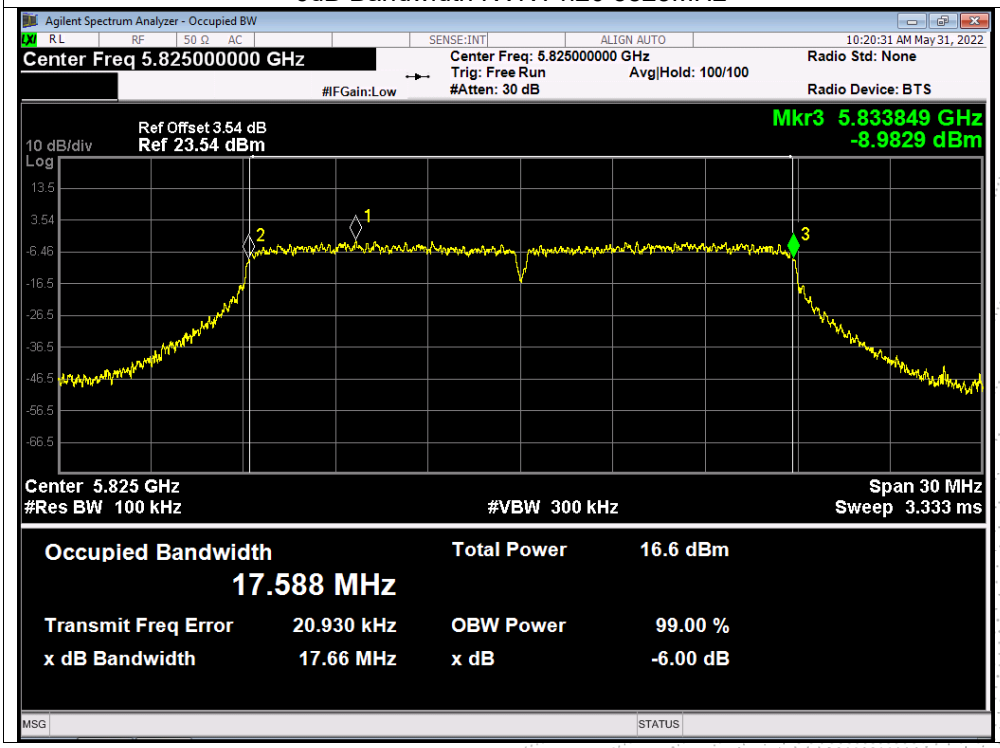
-6dB Bandwidth NVNT n20 5745MHz



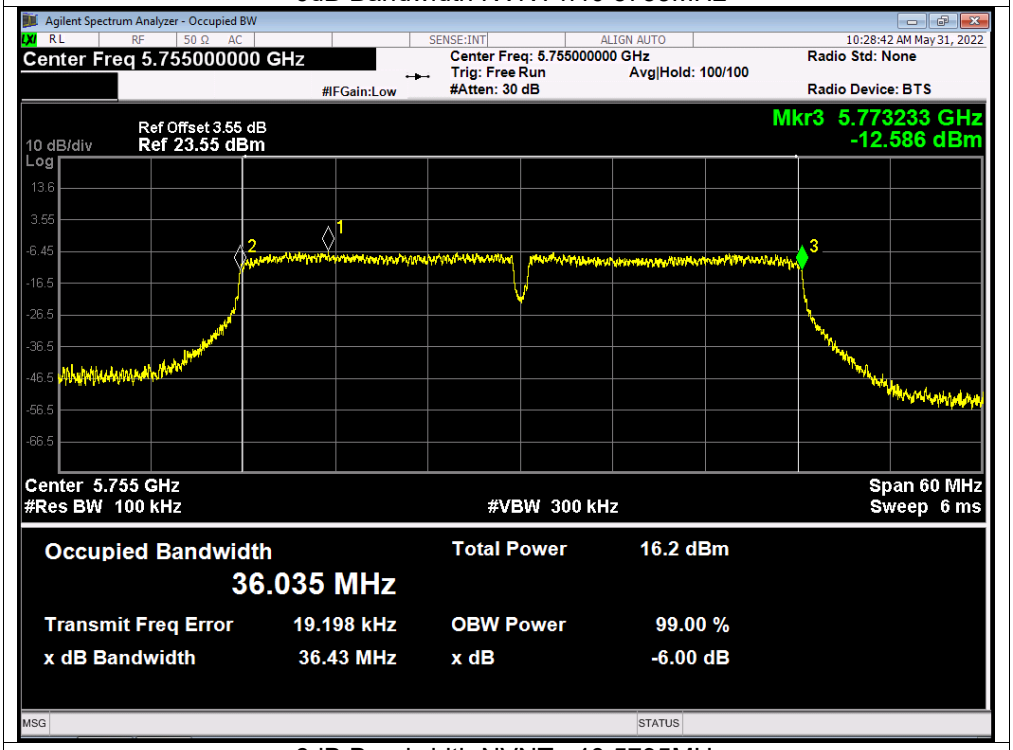
-6dB Bandwidth NVNT n20 5785MHz



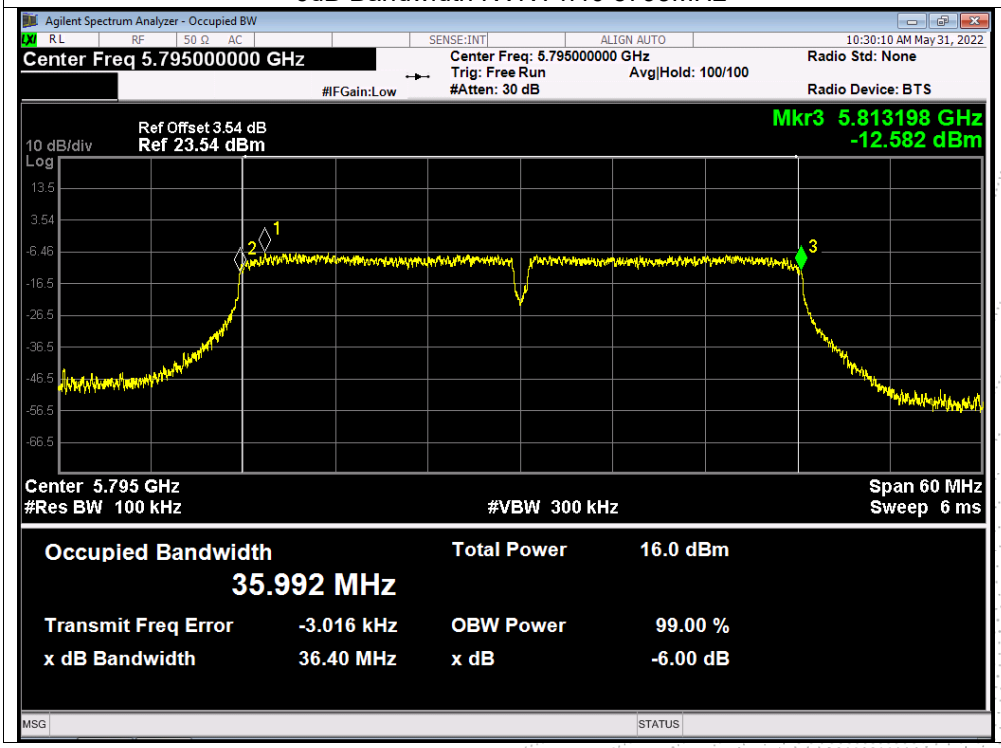
-6dB Bandwidth NVNT n20 5825MHz



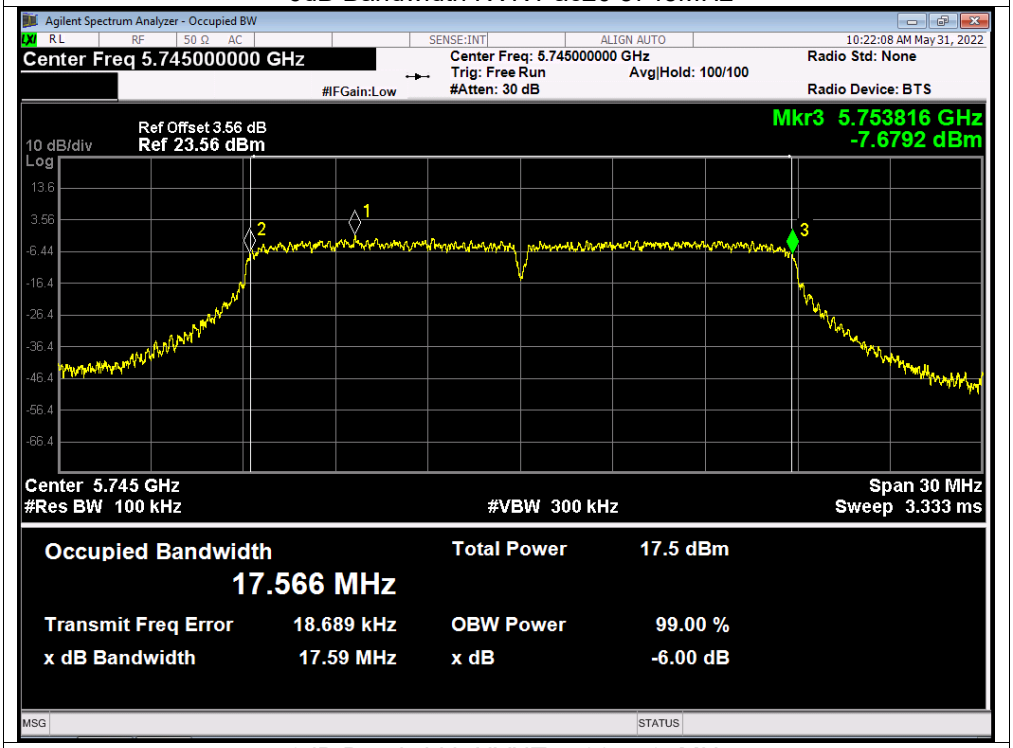
-6dB Bandwidth NVNT n40 5755MHz



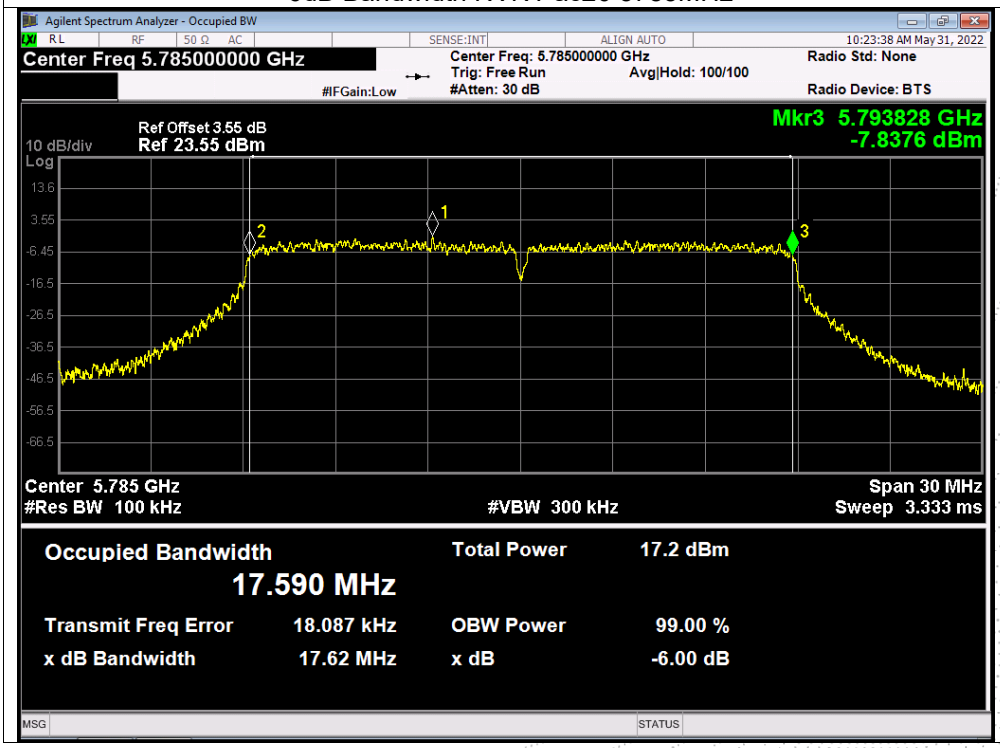
-6dB Bandwidth NVNT n40 5795MHz



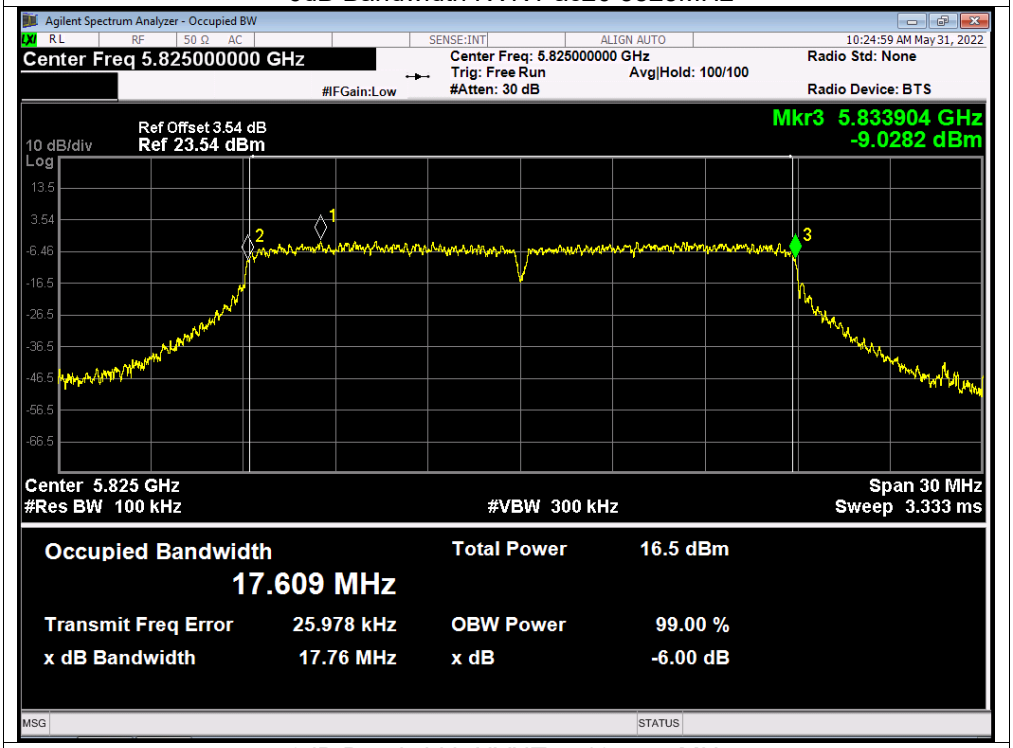
-6dB Bandwidth NVNT ac20 5745MHz



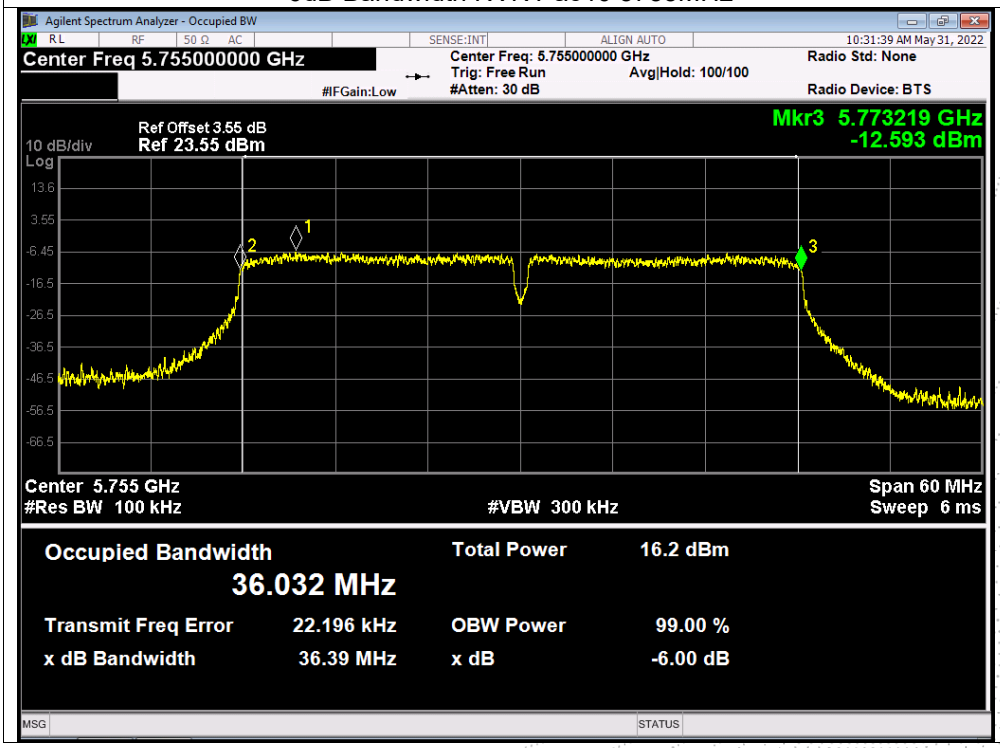
-6dB Bandwidth NVNT ac20 5785MHz



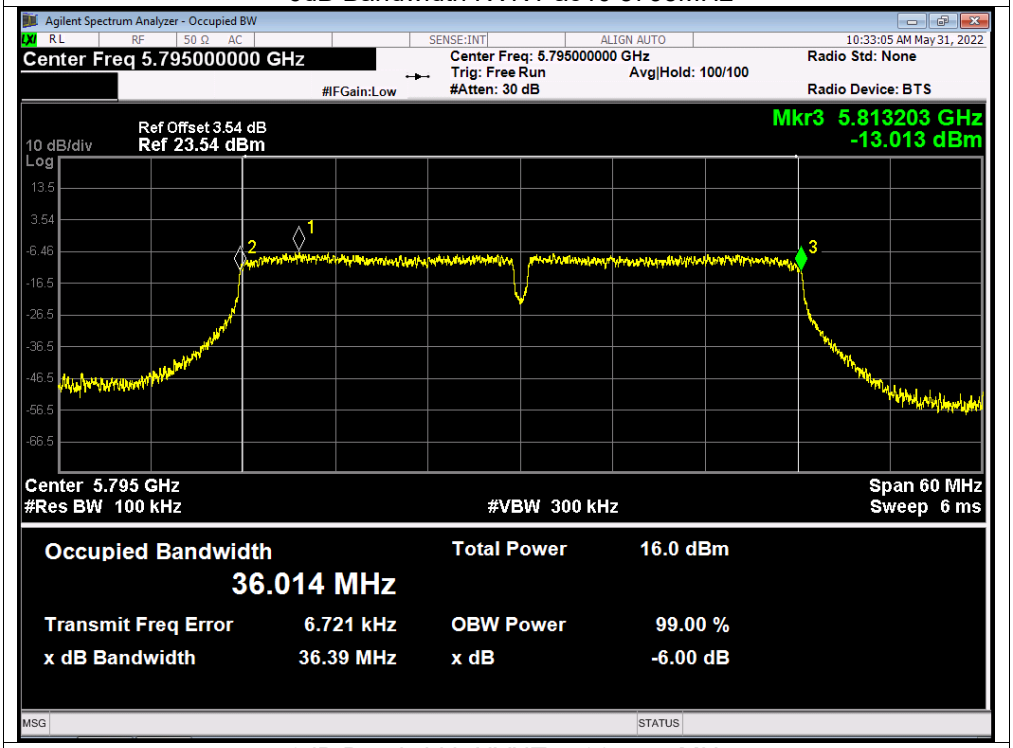
-6dB Bandwidth NVNT ac20 5825MHz



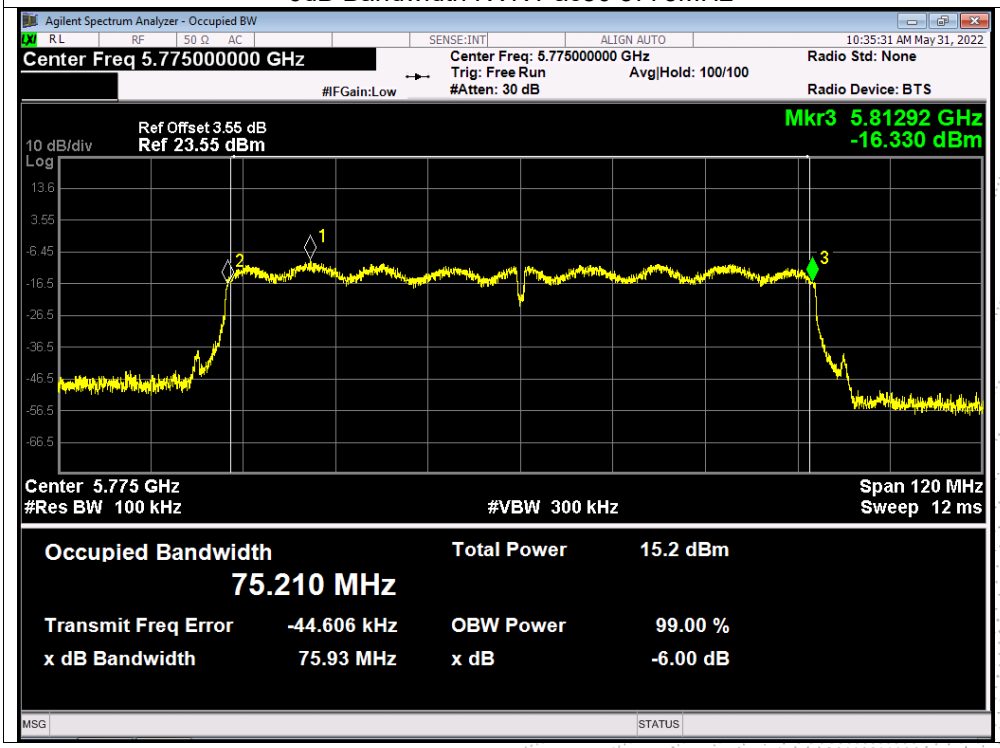
-6dB Bandwidth NVNT ac40 5755MHz



-6dB Bandwidth NVNT ac40 5795MHz

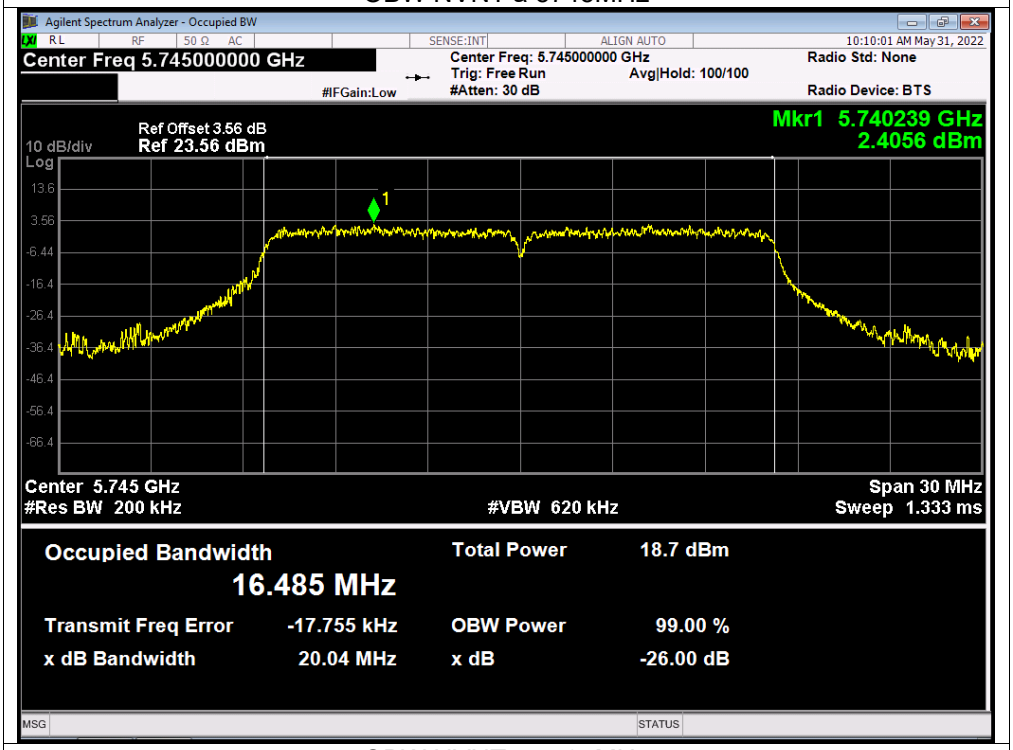


-6dB Bandwidth NVNT ac80 5775MHz

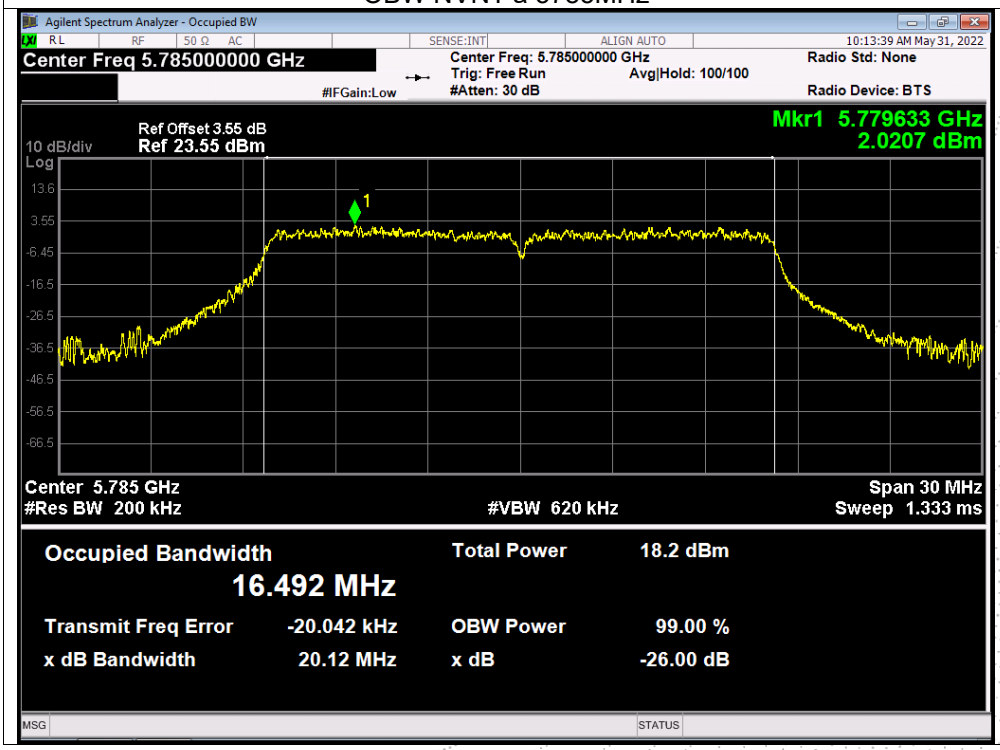


Test Graphs

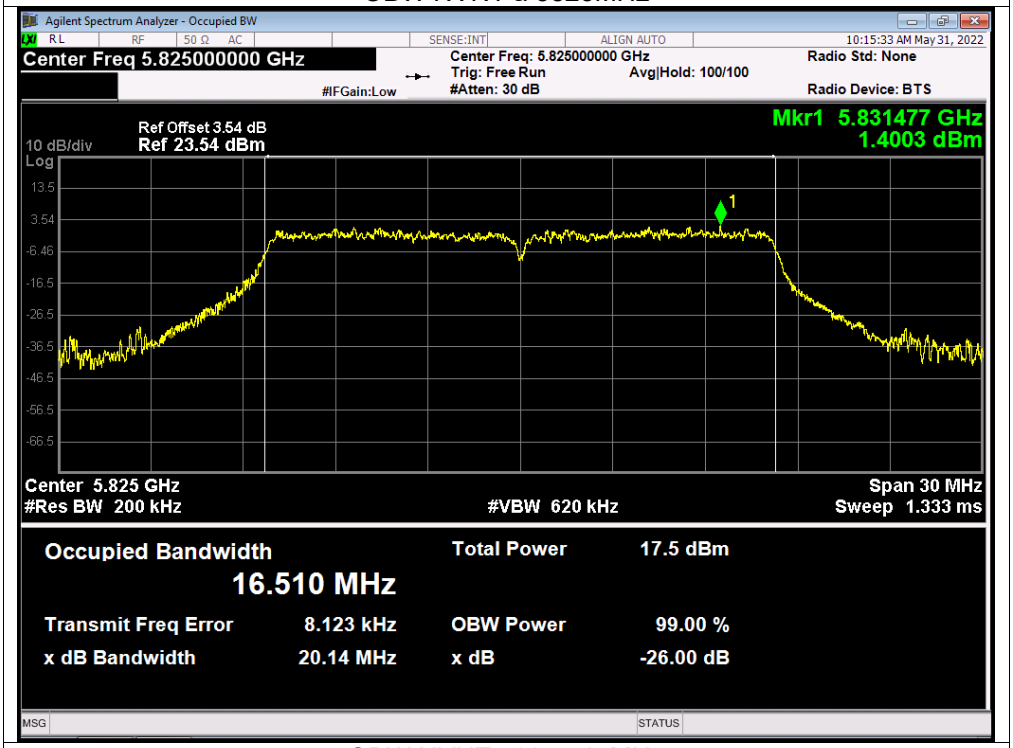
OBW NVNT a 5745MHz



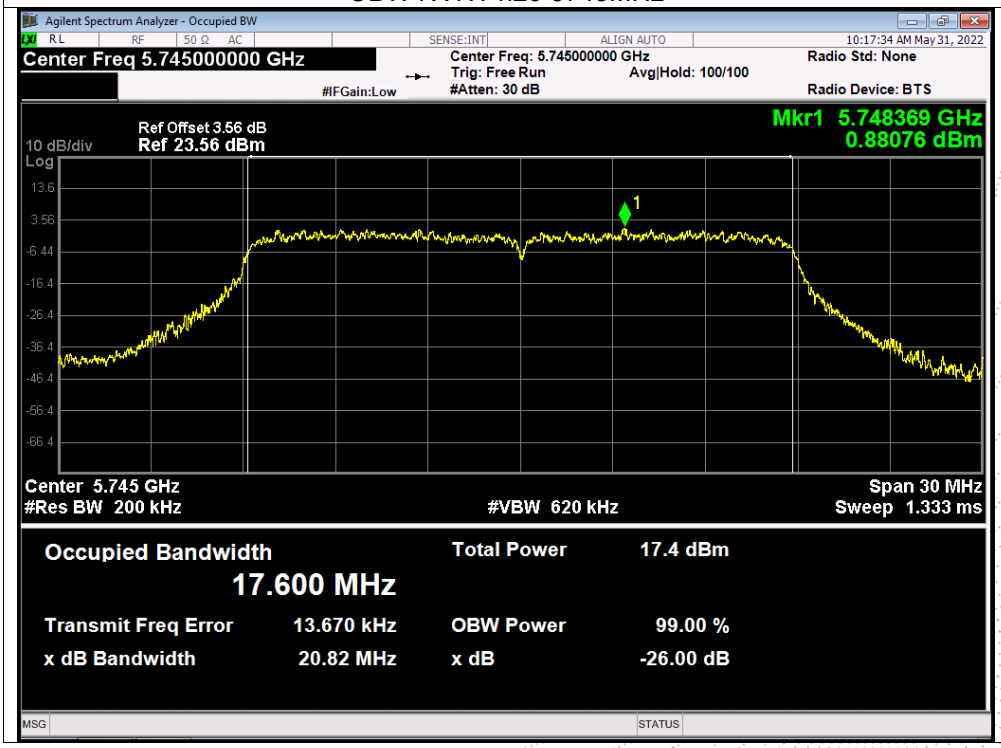
OBW NVNT a 5785MHz



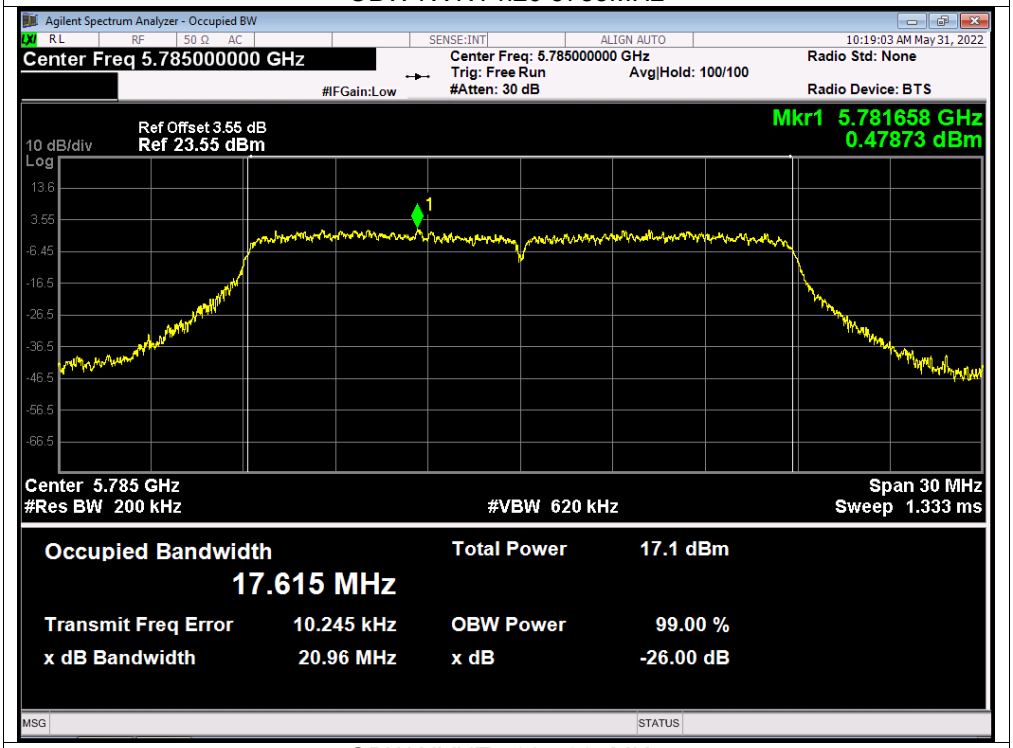
OBW NVNT a 5825MHz



OBW NVNT n20 5745MHz



OBW NVNT n20 5785MHz



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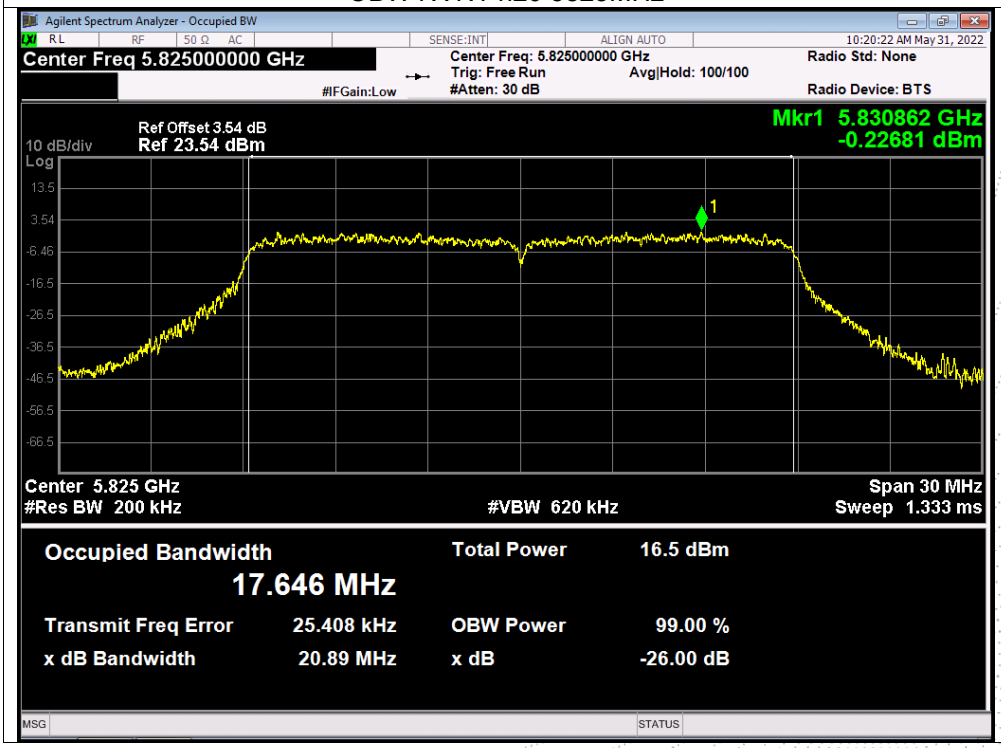
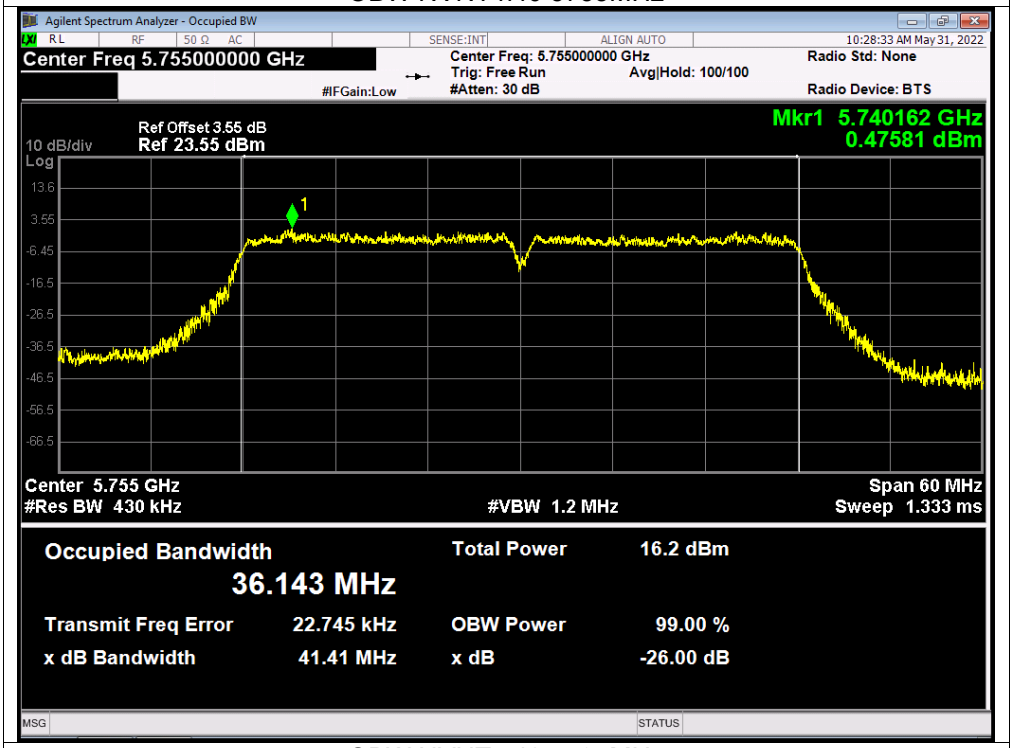
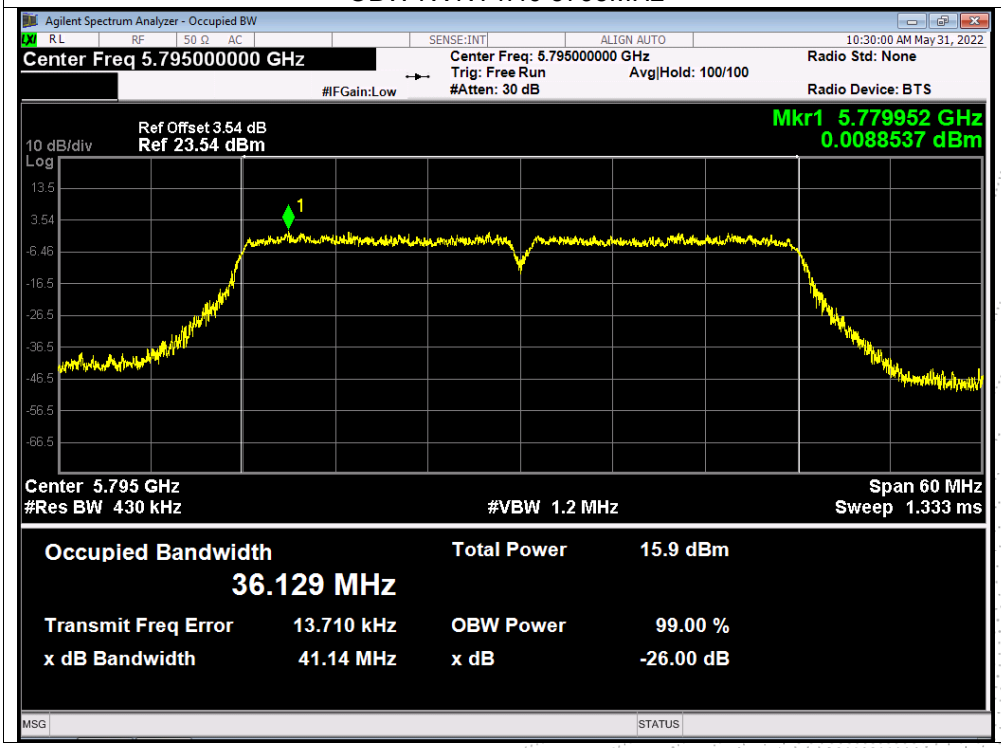


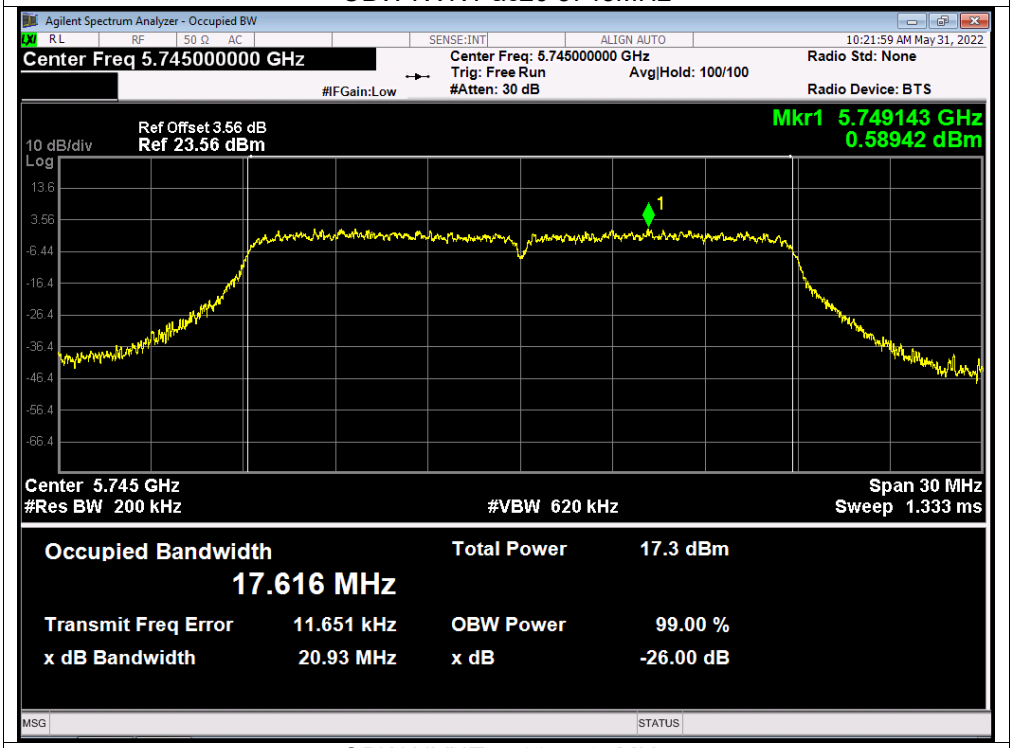
OBW NVNT n40 5755MHz



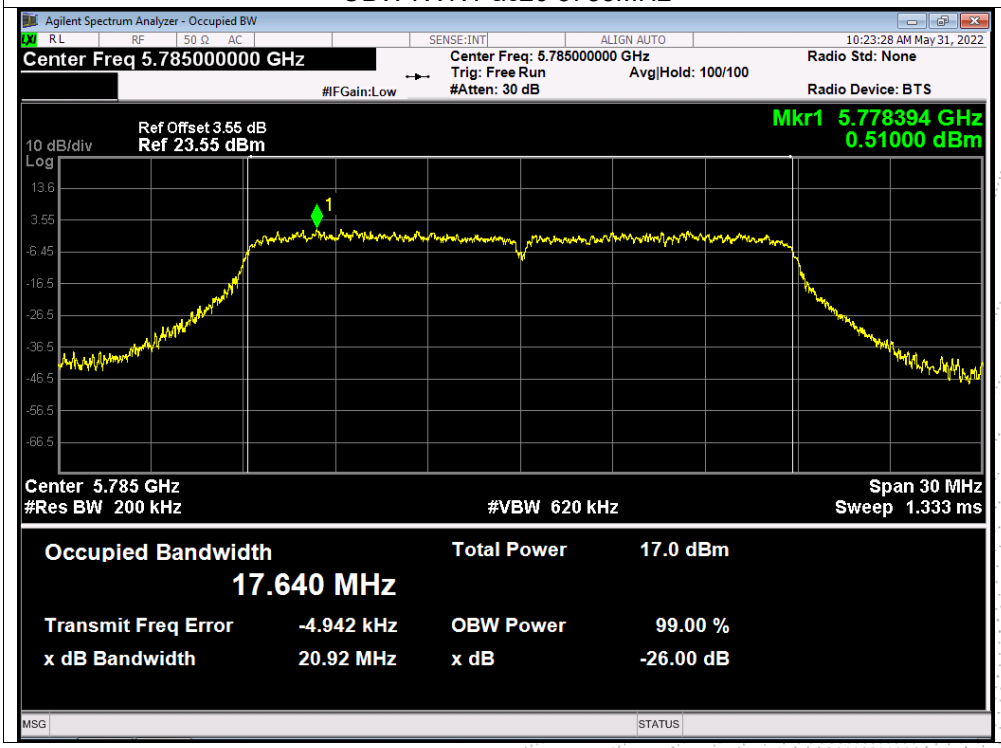
OBW NVNT n40 5795MHz



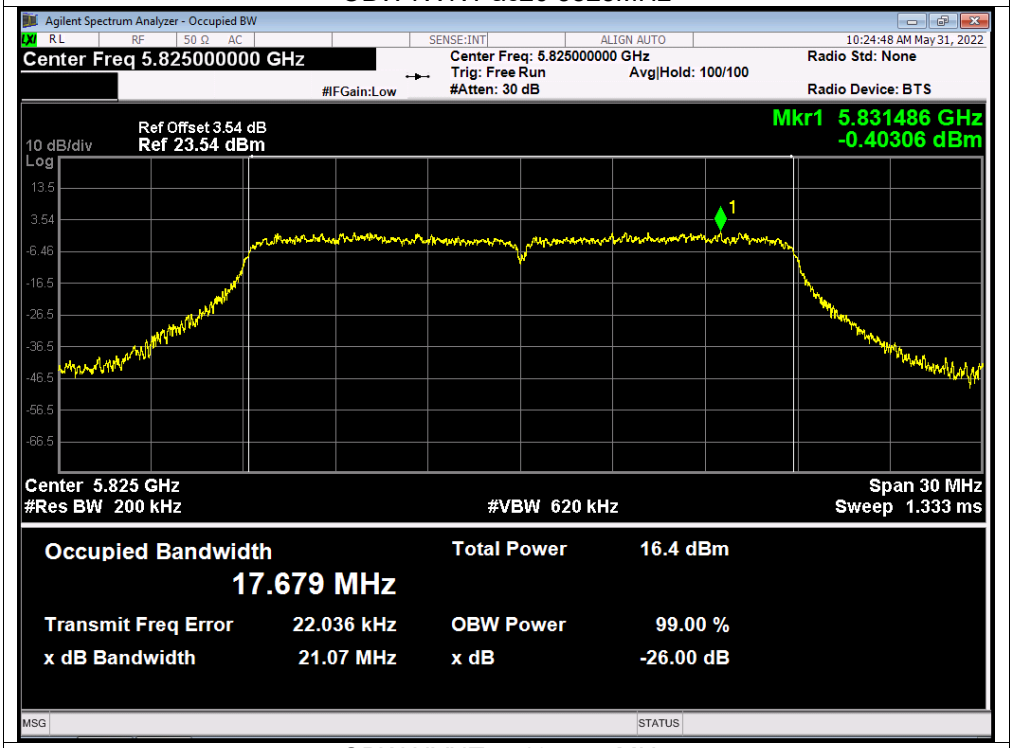
OBW NVNT ac20 5745MHz



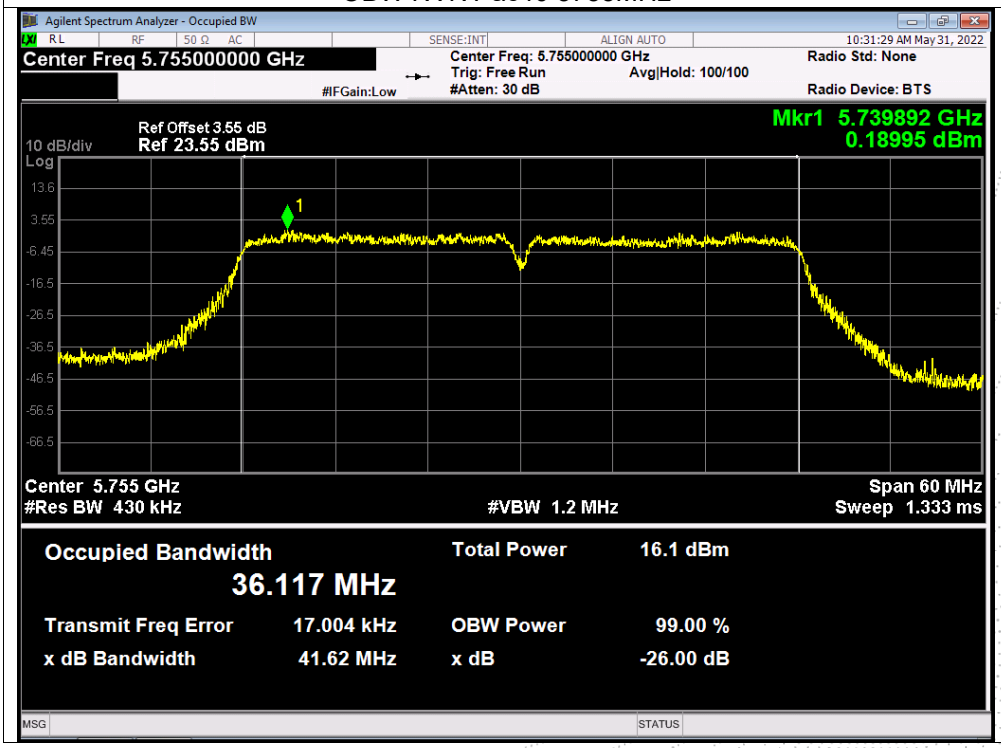
OBW NVNT ac20 5785MHz



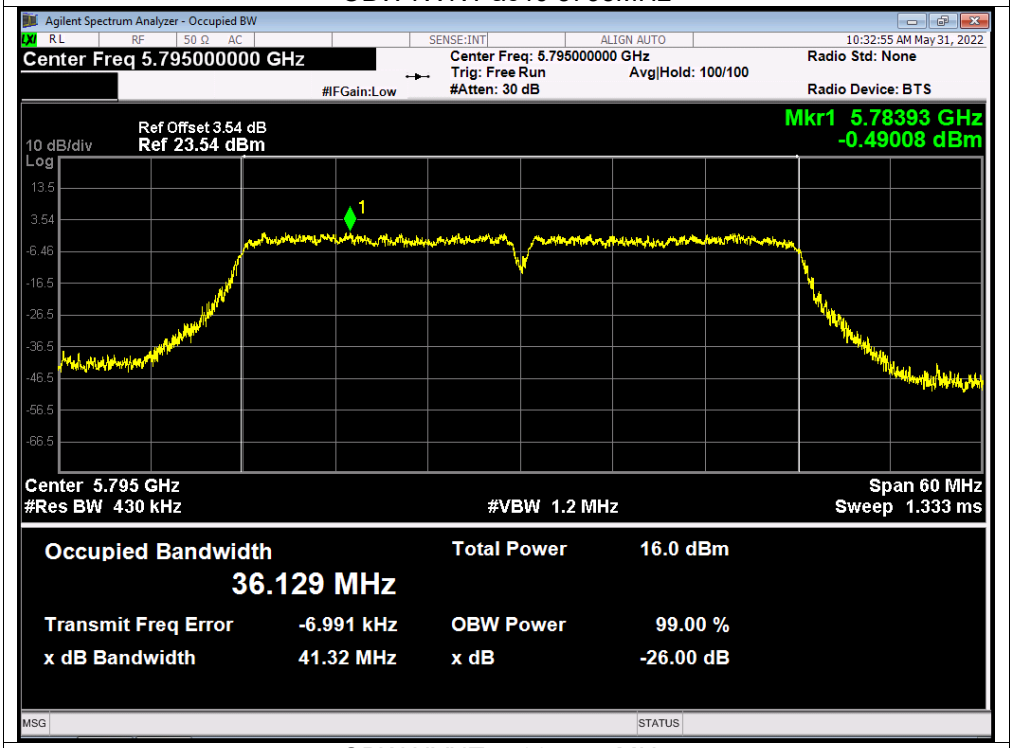
OBW NVNT ac20 5825MHz



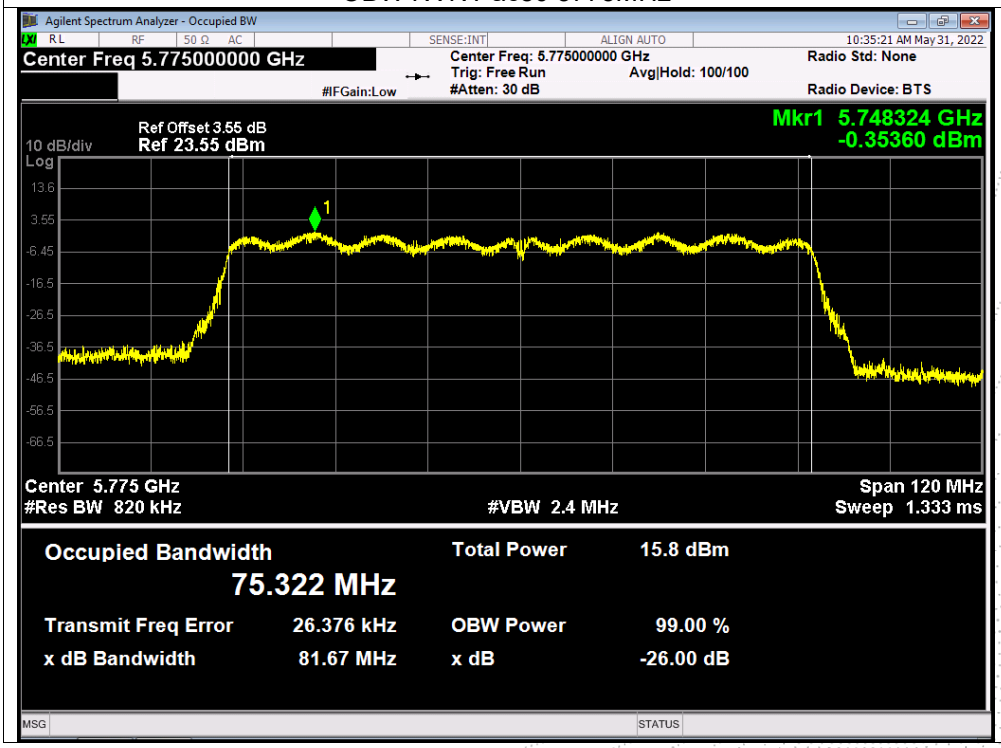
OBW NVNT ac40 5755MHz



OBW NVNT ac40 5795MHz

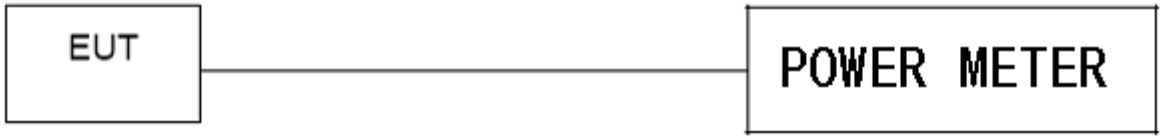


OBW NVNT ac80 5775MHz



10. Maximum Conducted Output Power

10.1 Block Diagram Of Test Setup



10.2 Limit

According to FCC §15.407
The maximum conduced output power should not exceed:

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

10.3 Test procedure

Maximum conducted output power may be measured using a spectrum analyzer/EMI receiver or an RF 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

10.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

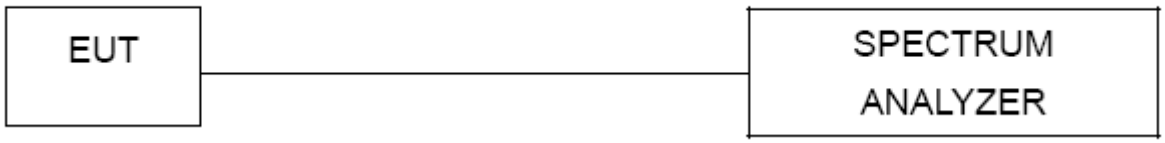
10.5 Test Result

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage:	DC 5V
Test Mode:	(5745-5825MHz)		

Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	a	5745	13.74	30	Pass
NVNT	a	5785	12.91	30	Pass
NVNT	a	5825	12.24	30	Pass
NVNT	n20	5745	12.13	30	Pass
NVNT	n20	5785	11.84	30	Pass
NVNT	n20	5825	11.22	30	Pass
NVNT	n40	5755	10.78	30	Pass
NVNT	n40	5795	10.62	30	Pass
NVNT	ac20	5745	12.16	30	Pass
NVNT	ac20	5785	11.83	30	Pass
NVNT	ac20	5825	11.20	30	Pass
NVNT	ac40	5755	10.77	30	Pass
NVNT	ac40	5795	10.58	30	Pass
NVNT	ac80	5775	9.98	30	Pass

11. Out Of Band Emissions

11.1 Block Diagram Of Test Setup



11.2 Limit

According to FCC §15.407(b)
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) 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.

11.3 Test procedure

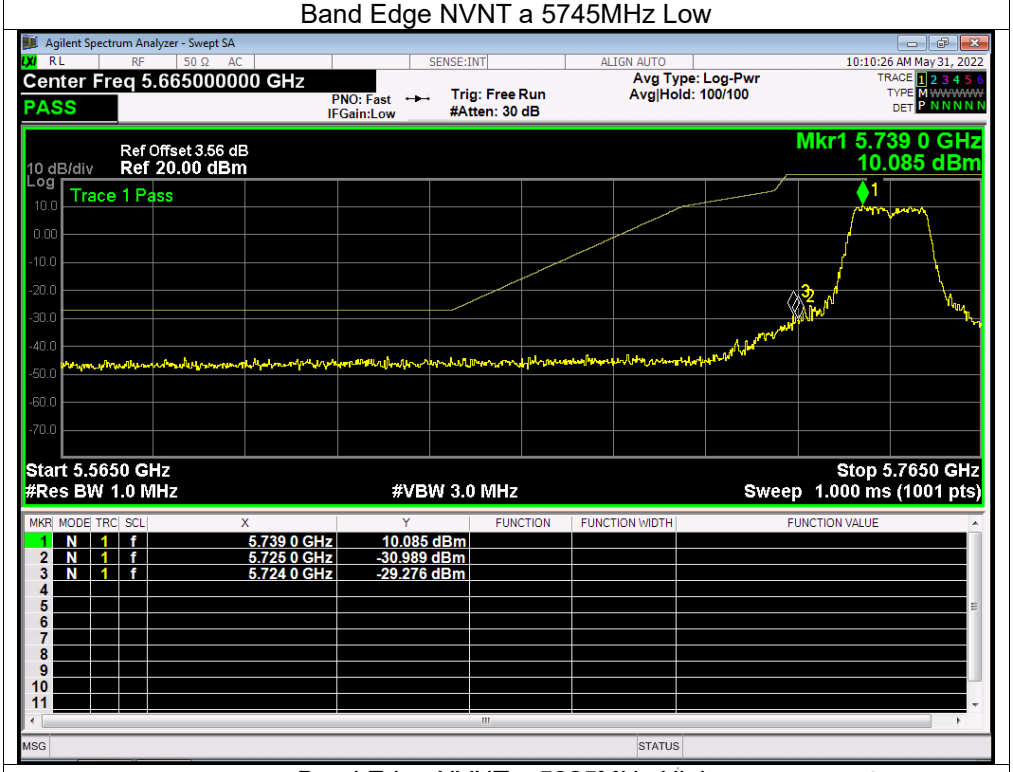
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

11.4 EUT operating Conditions

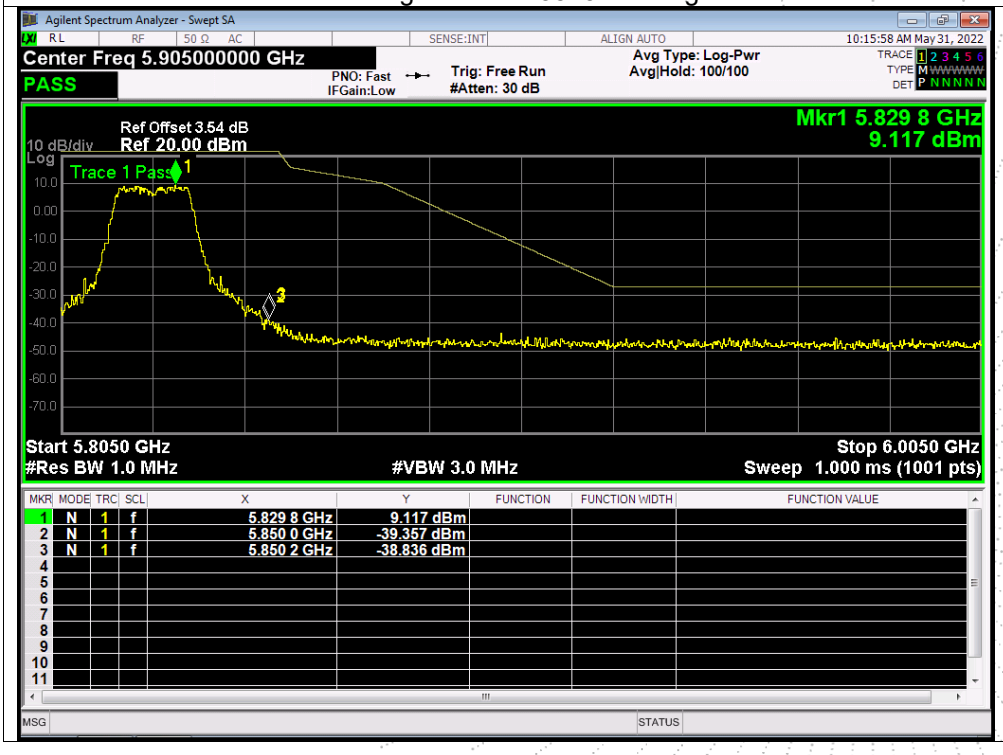
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data

11.5 Test Result

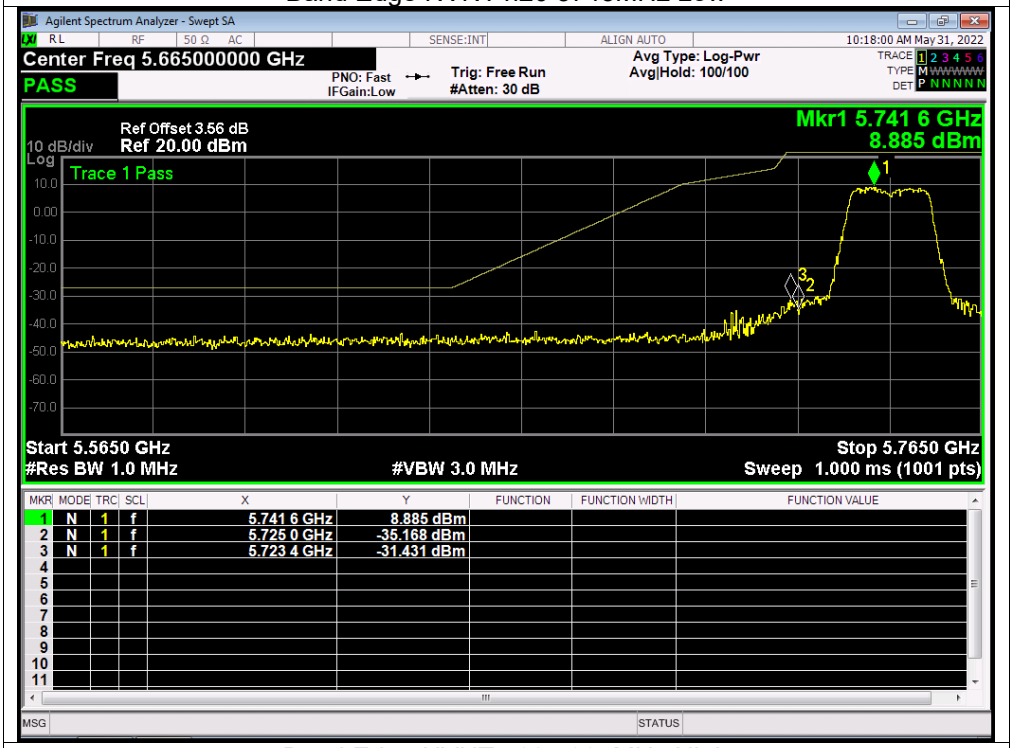
Test Graphs
Band Edge NVNT a 5745MHz Low



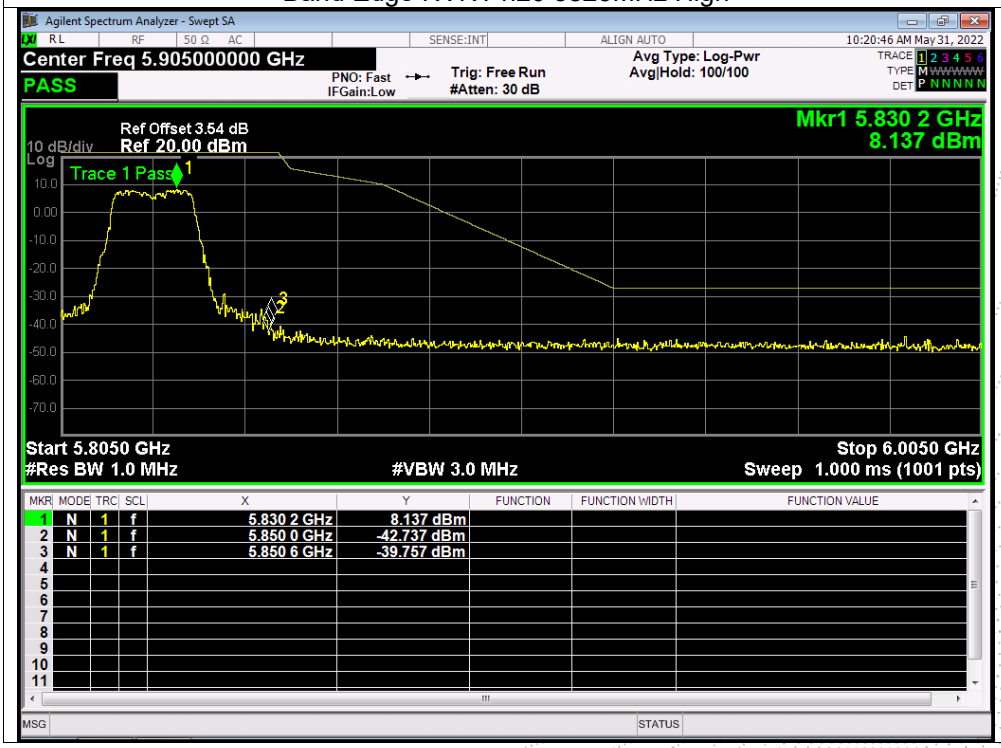
Band Edge NVNT a 5825MHz High



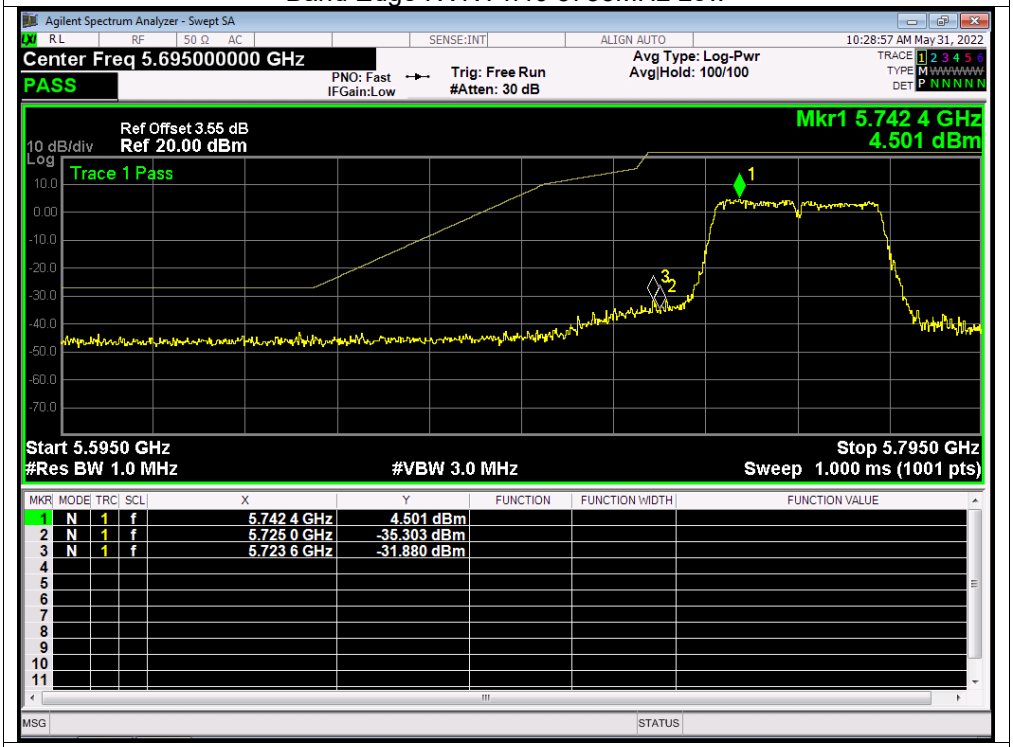
Band Edge NVNT n20 5745MHz Low



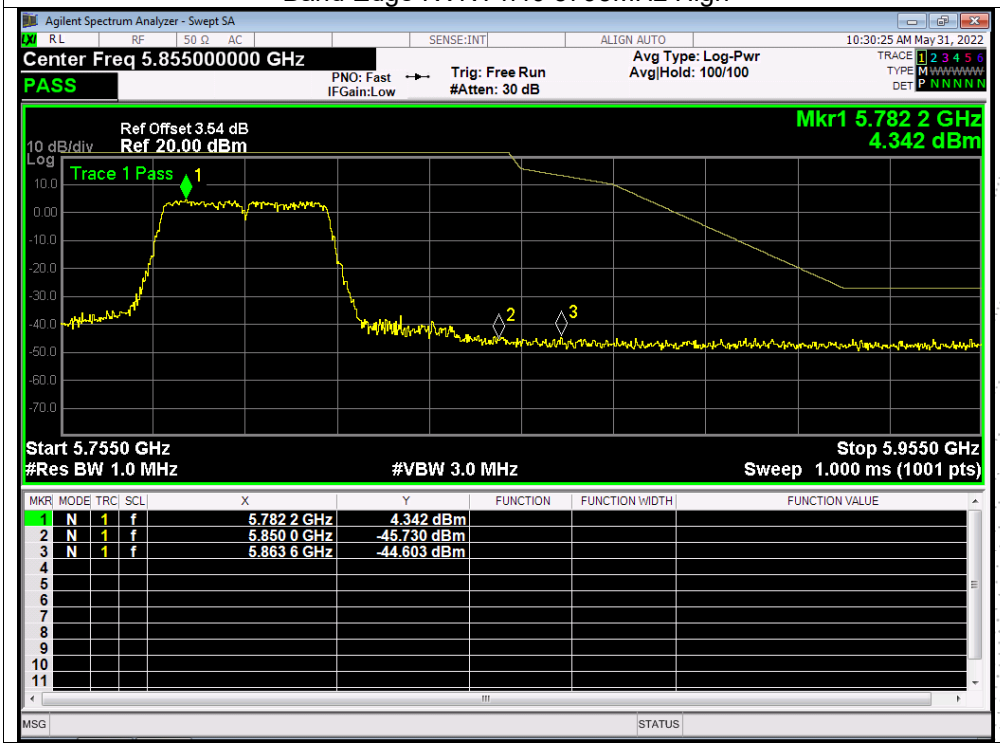
Band Edge NVNT n20 5825MHz High



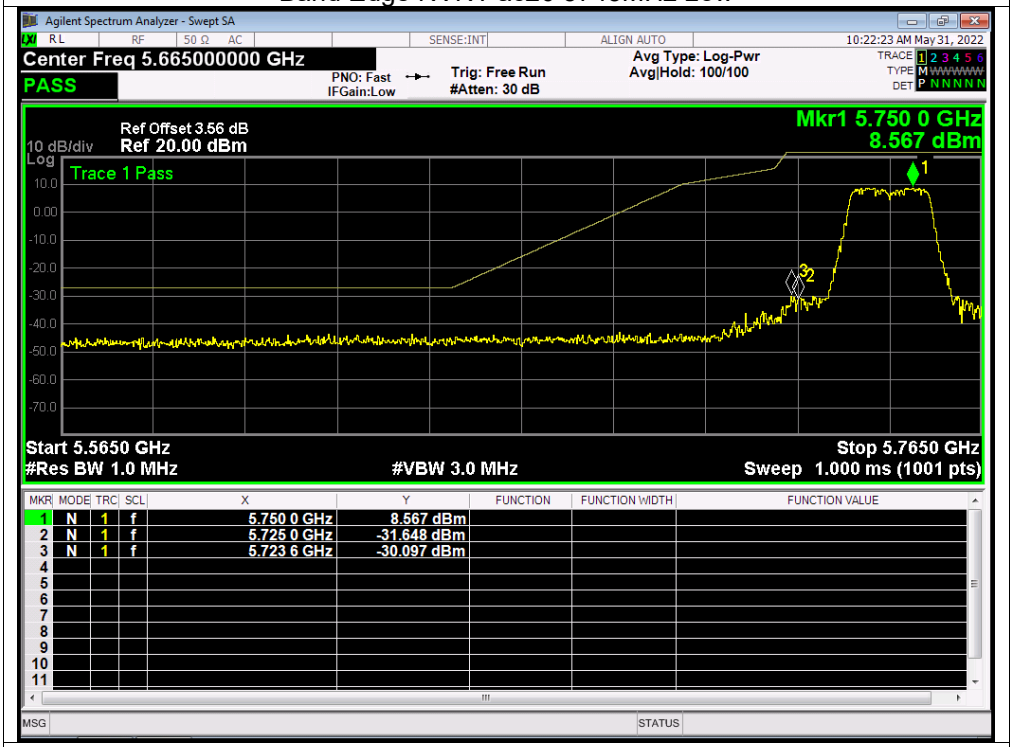
Band Edge NVNT n40 5755MHz Low



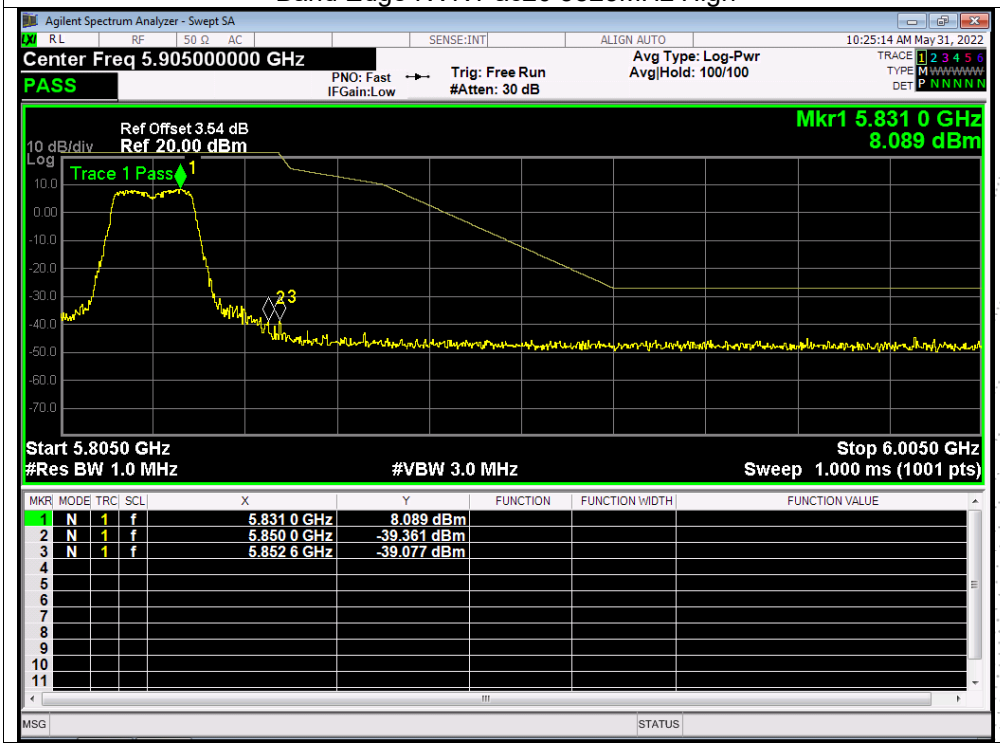
Band Edge NVNT n40 5795MHz High



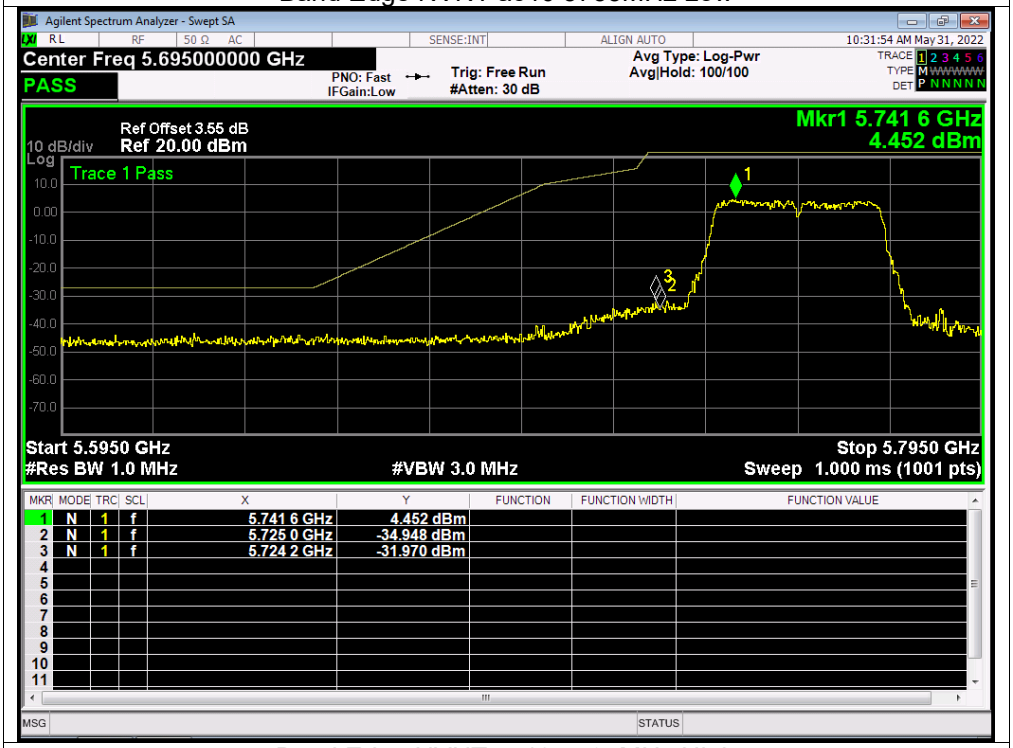
Band Edge NVNT ac20 5745MHz Low



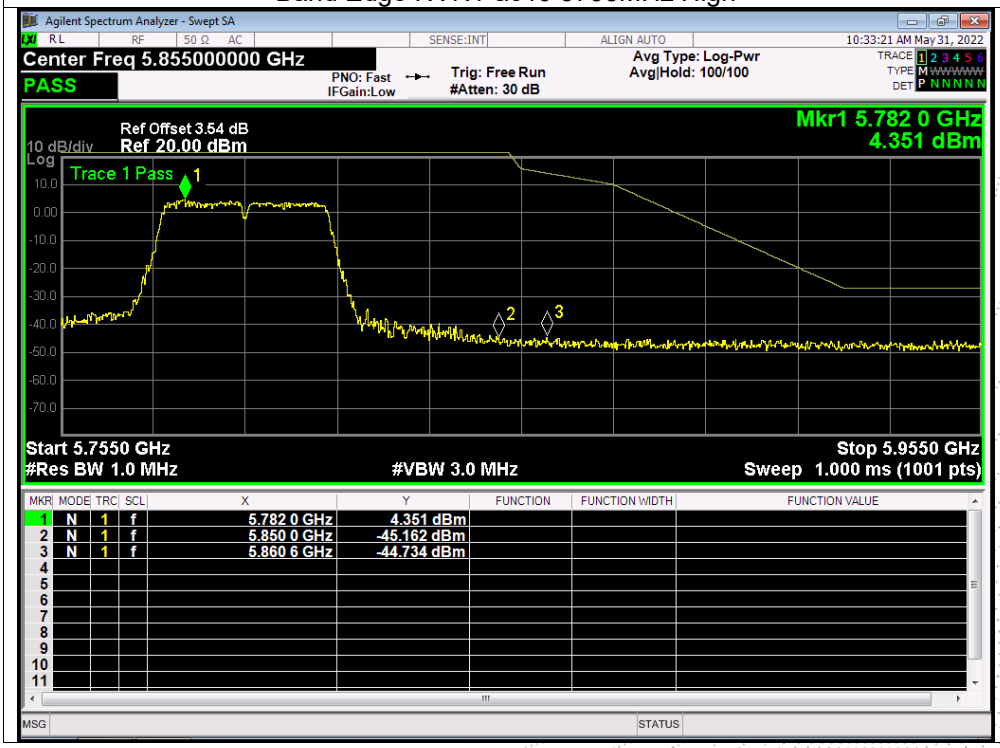
Band Edge NVNT ac20 5825MHz High



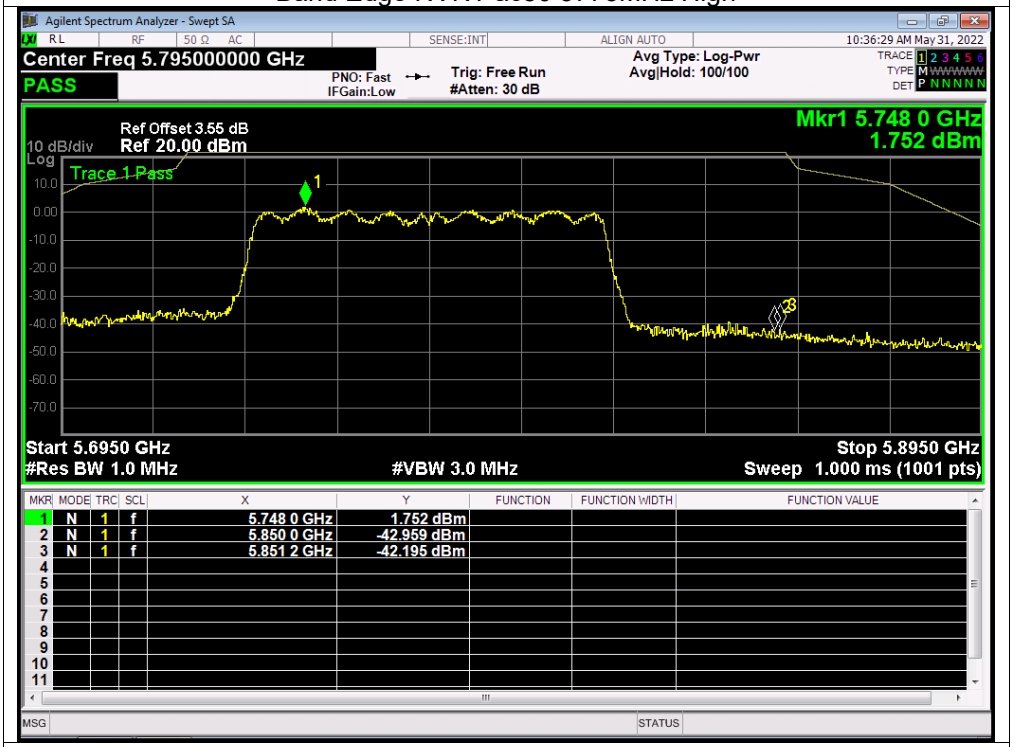
Band Edge NVNT ac40 5755MHz Low



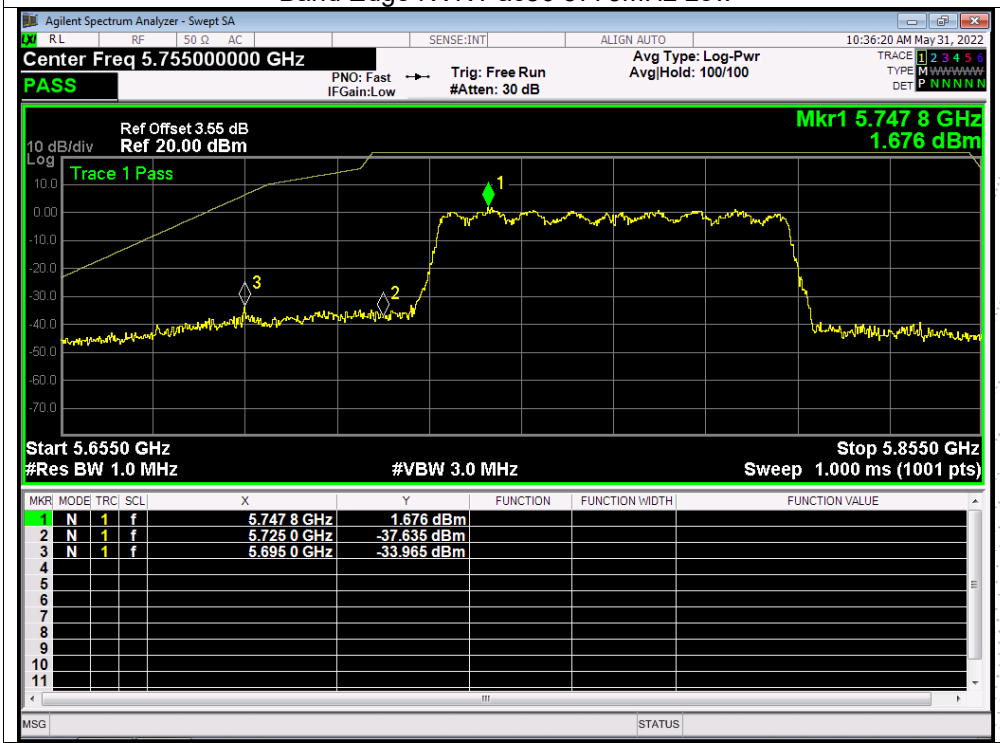
Band Edge NVNT ac40 5795MHz High



Band Edge NVNT ac80 5775MHz High

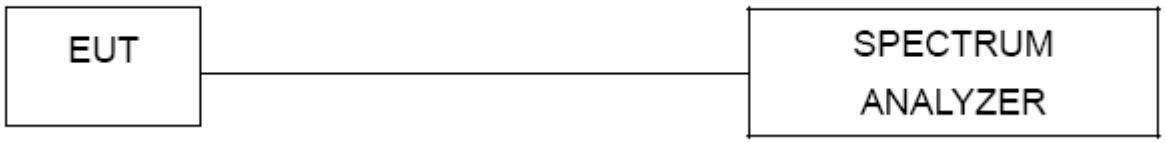


Band Edge NVNT ac80 5775MHz Low



12. Spurious RF Conducted Emissions

12.1 Block Diagram Of Test Setup



12.2 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 5.725-5.85 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.

12.3 Test procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

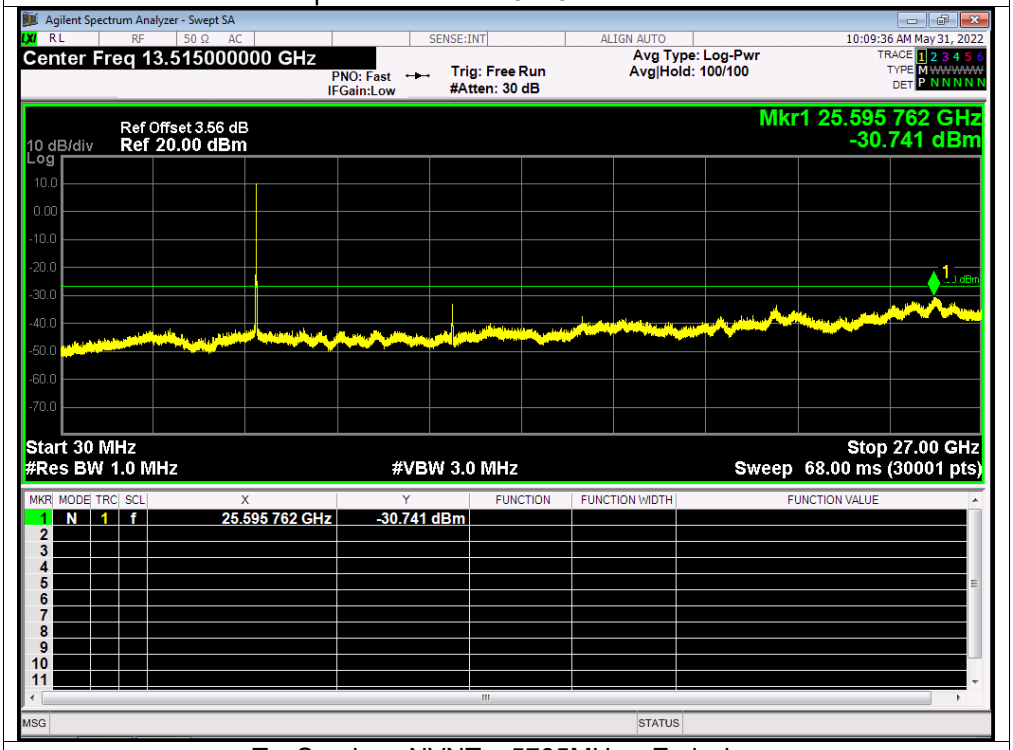
12.4 Test Result

Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

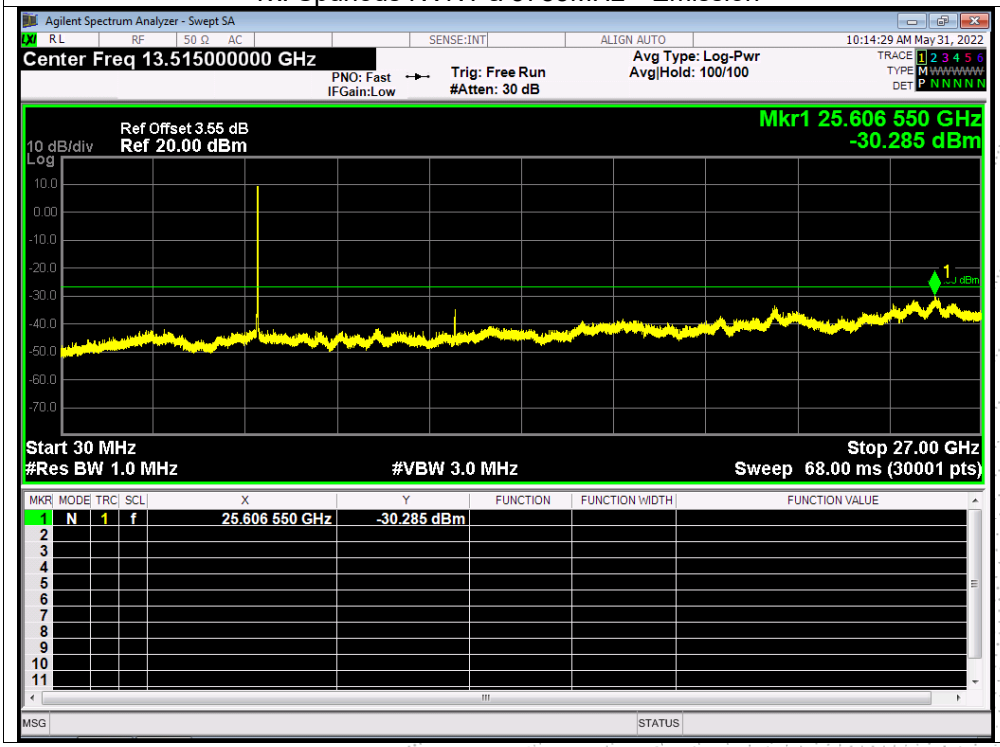
About:26.5GHz-40GHz, The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B, only shown Antenna B Plot.

Test Graphs

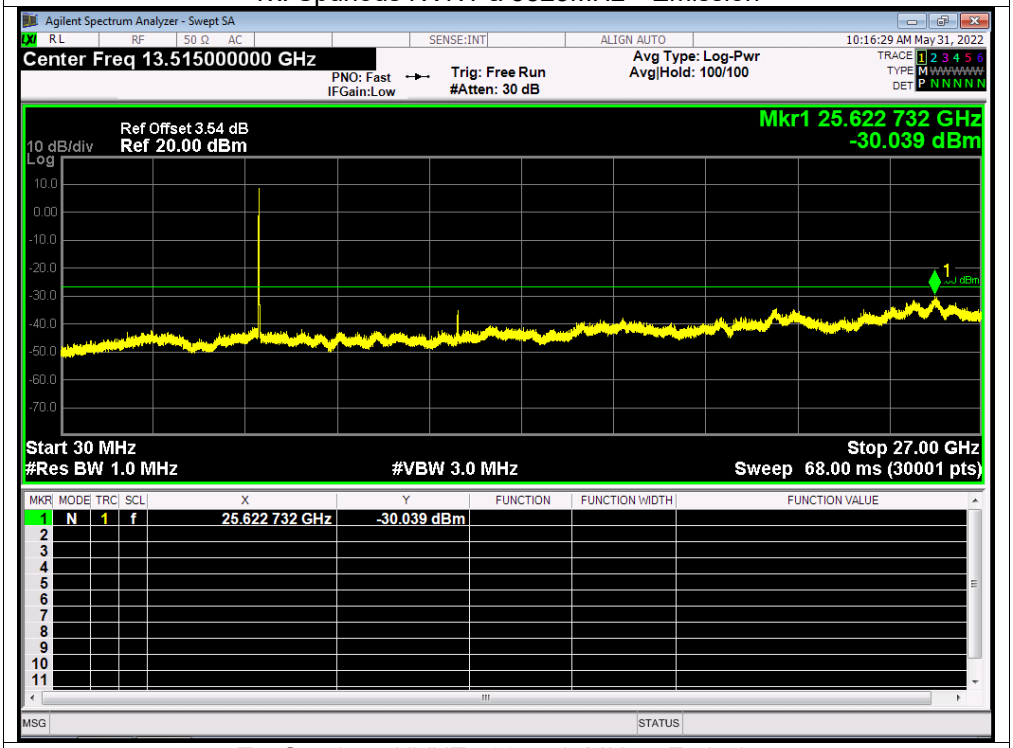
Tx. Spurious NVNT a 5745MHz Emission



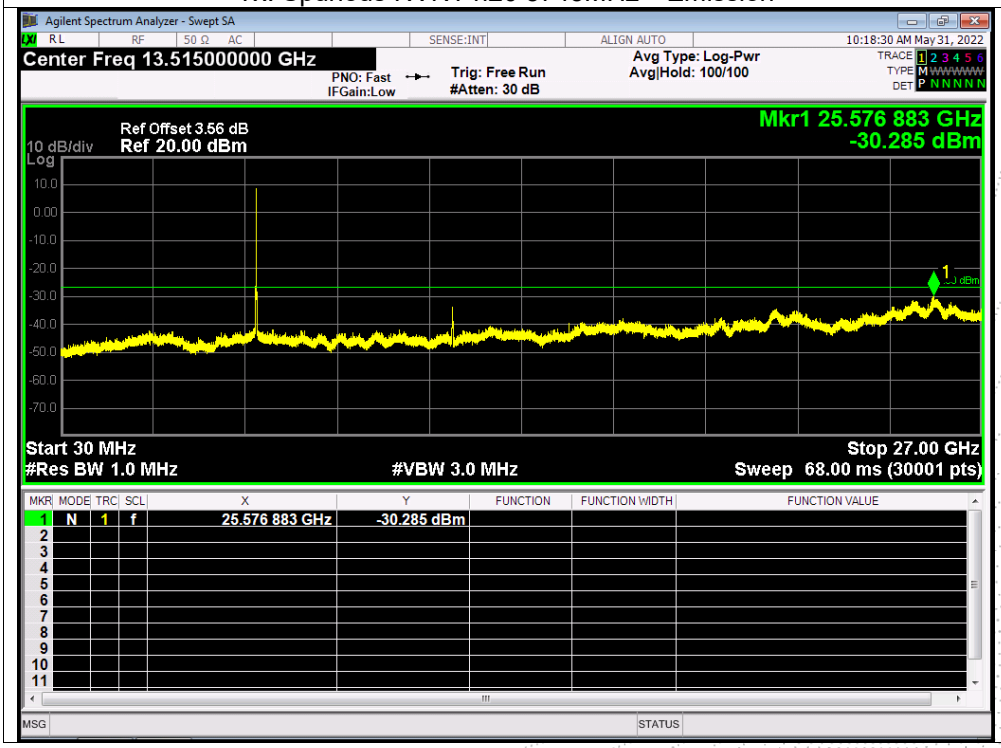
Tx. Spurious NVNT a 5785MHz Emission



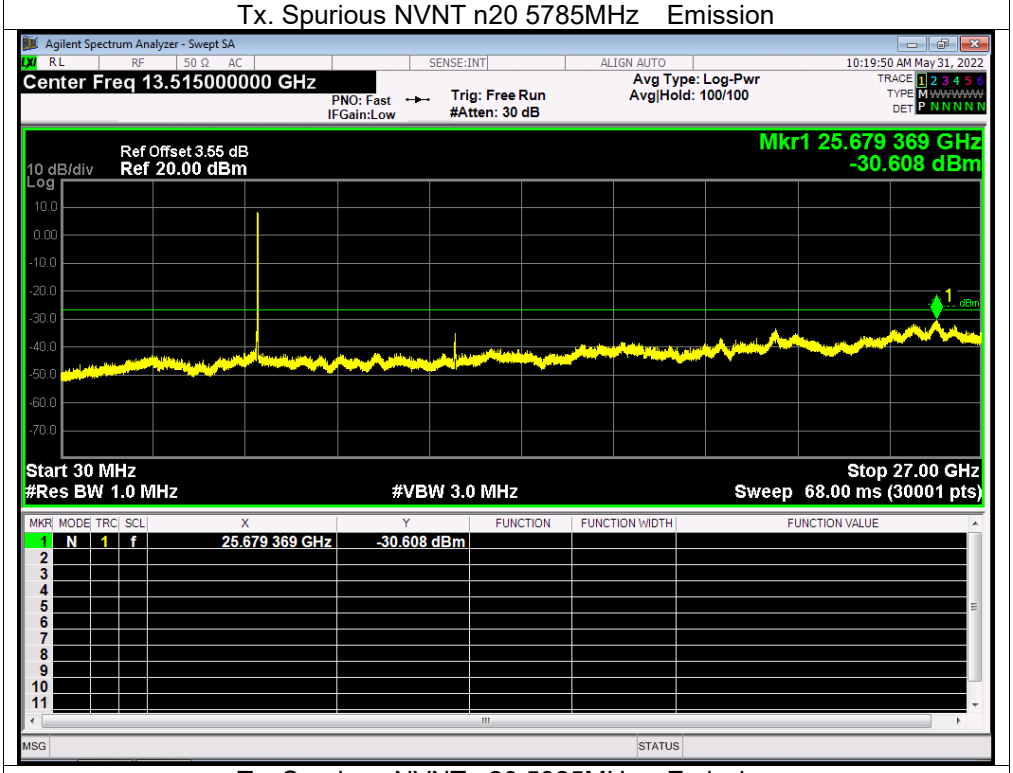
Tx. Spurious NVNT a 5825MHz Emission



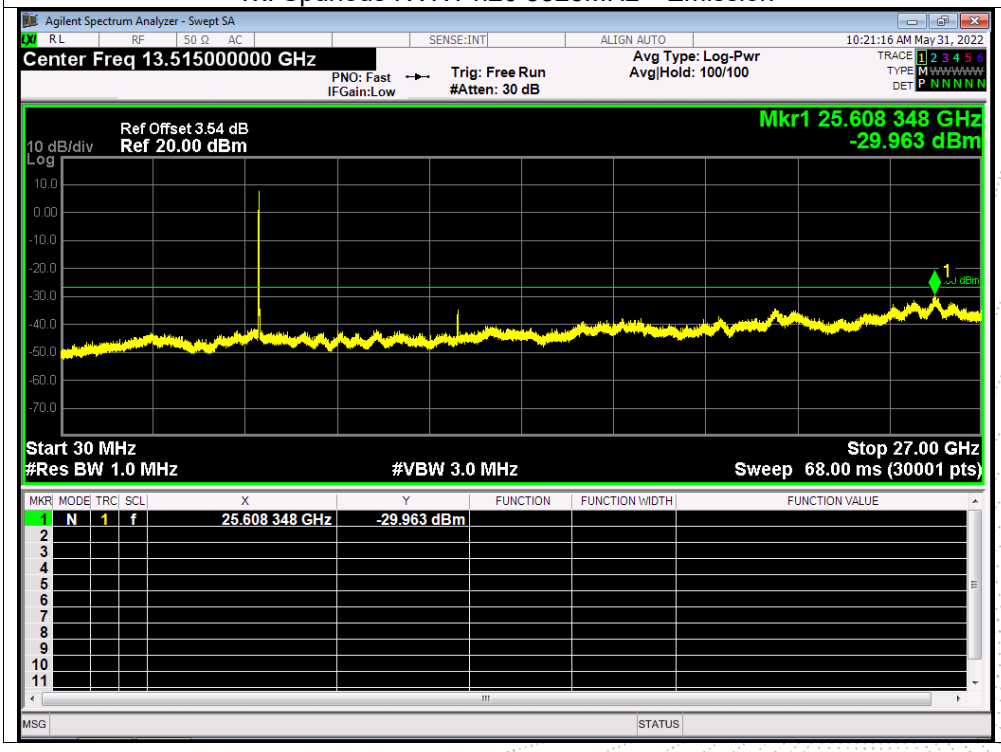
Tx. Spurious NVNT n20 5745MHz Emission



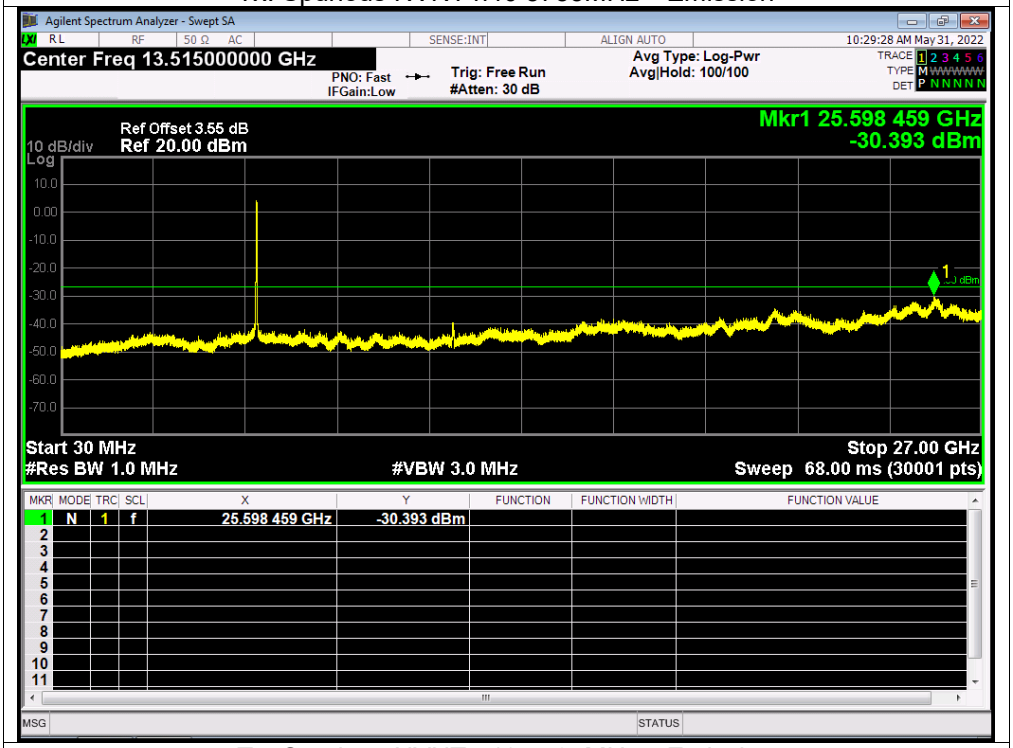
Tx. Spurious NVNT n20 5785MHz Emission



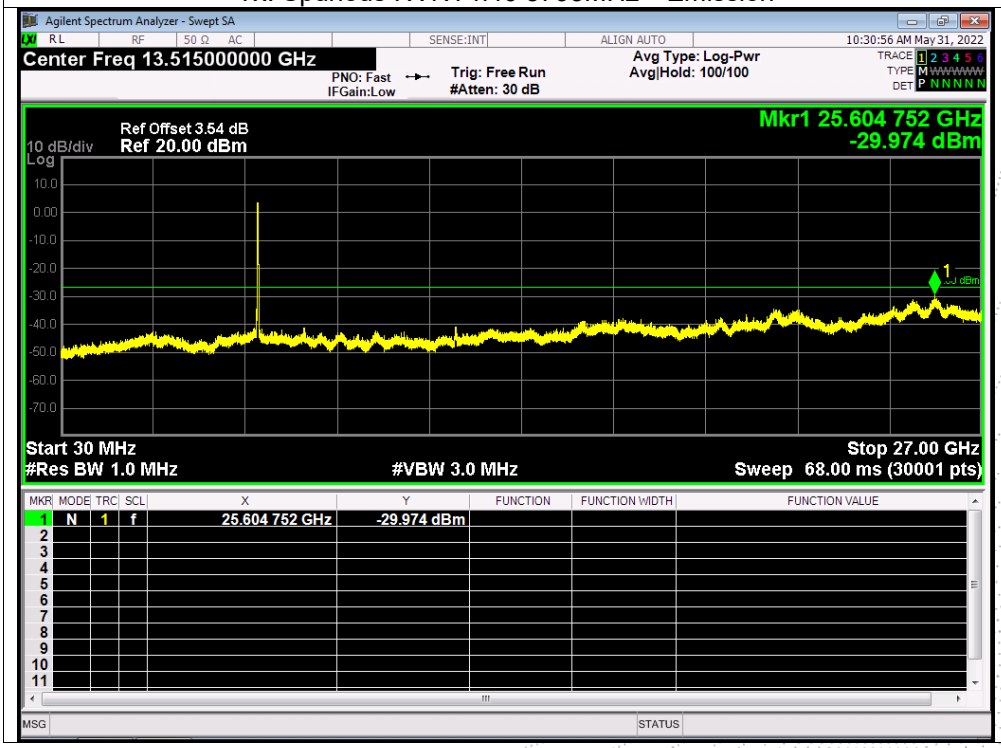
Tx. Spurious NVNT n20 5825MHz Emission



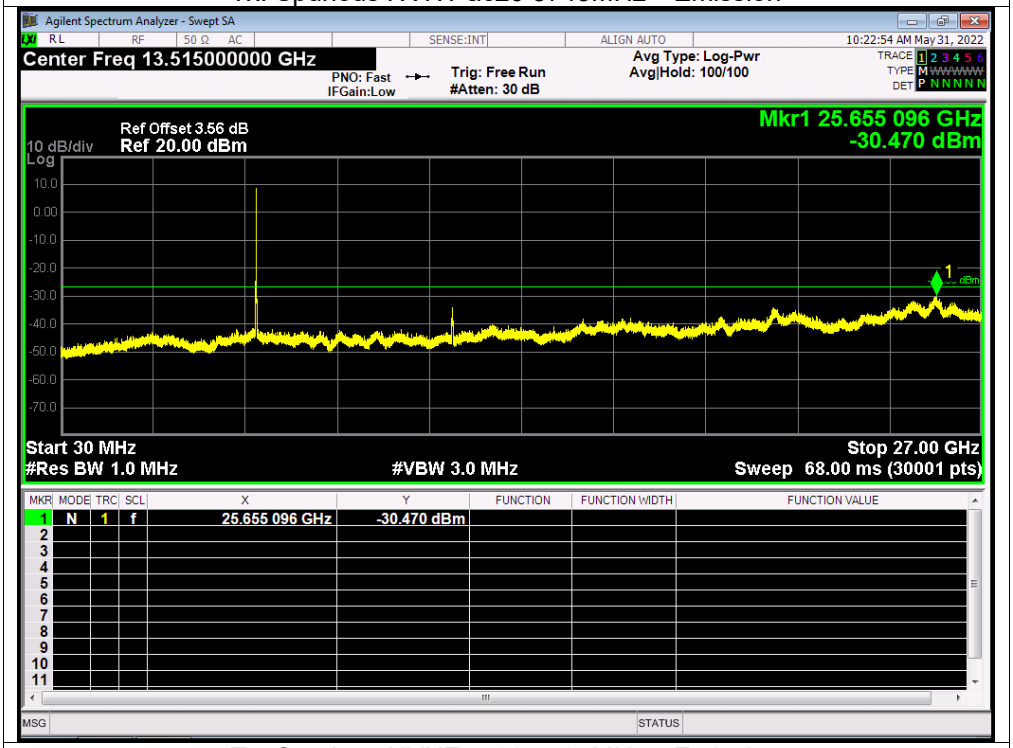
Tx. Spurious NVNT n40 5755MHz Emission



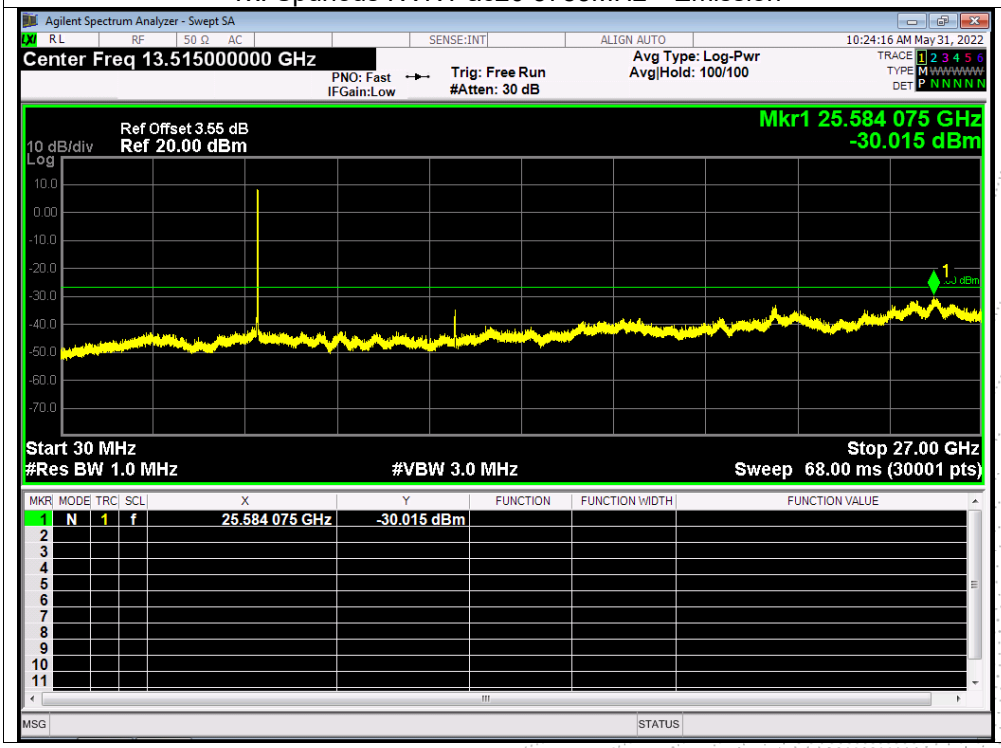
Tx. Spurious NVNT n40 5795MHz Emission



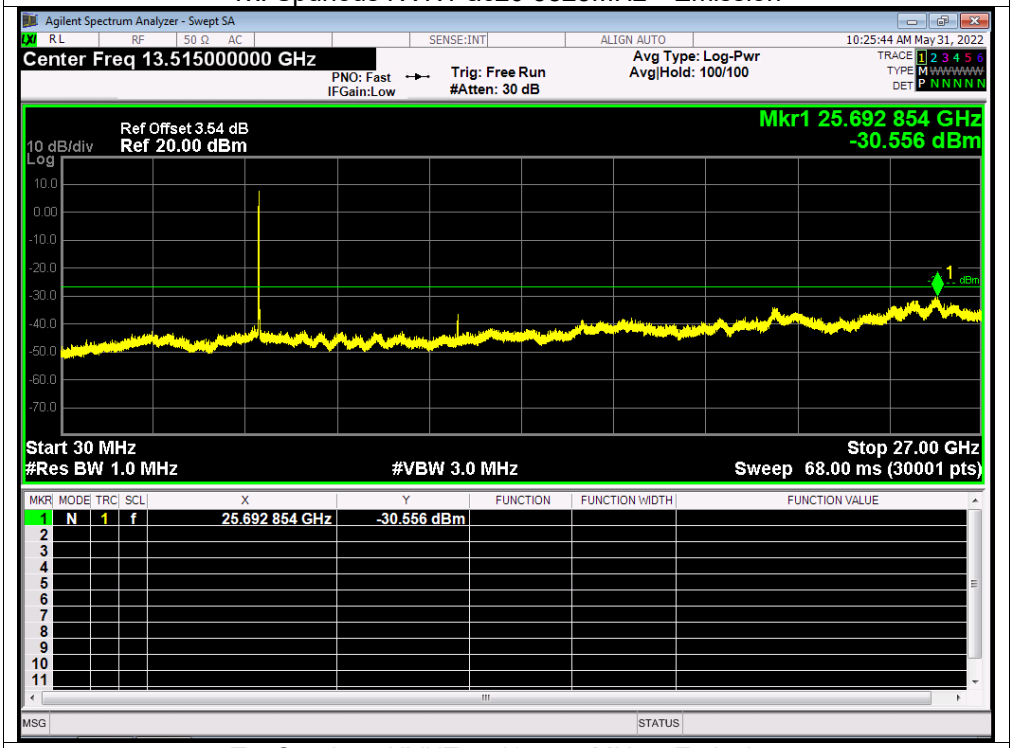
Tx. Spurious NVNT ac20 5745MHz Emission



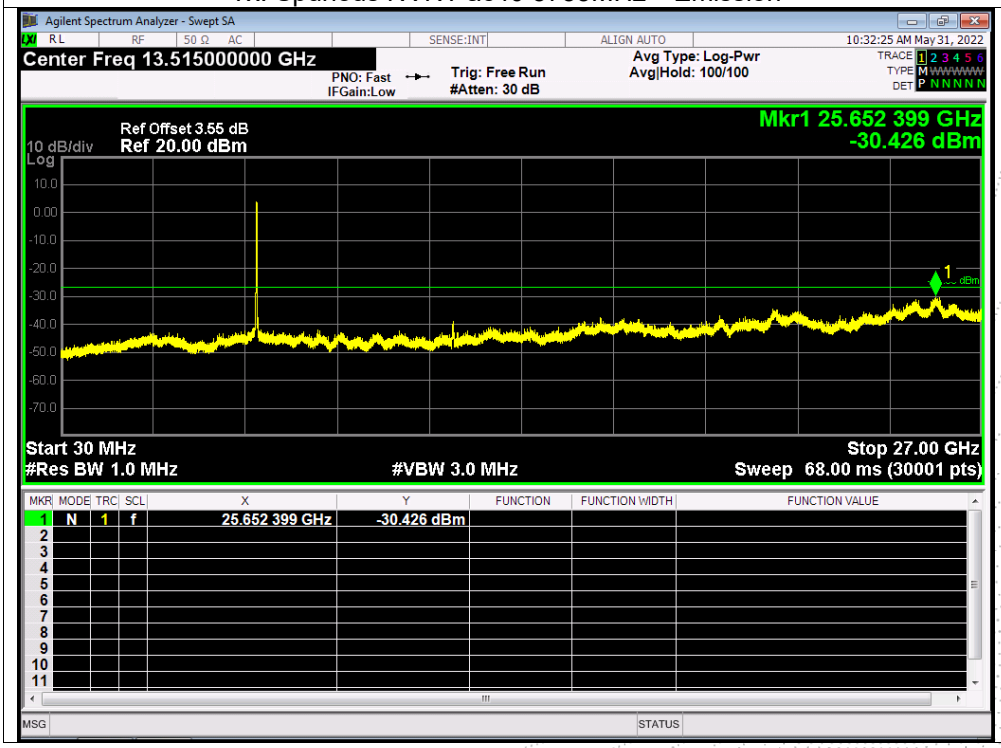
Tx. Spurious NVNT ac20 5785MHz Emission



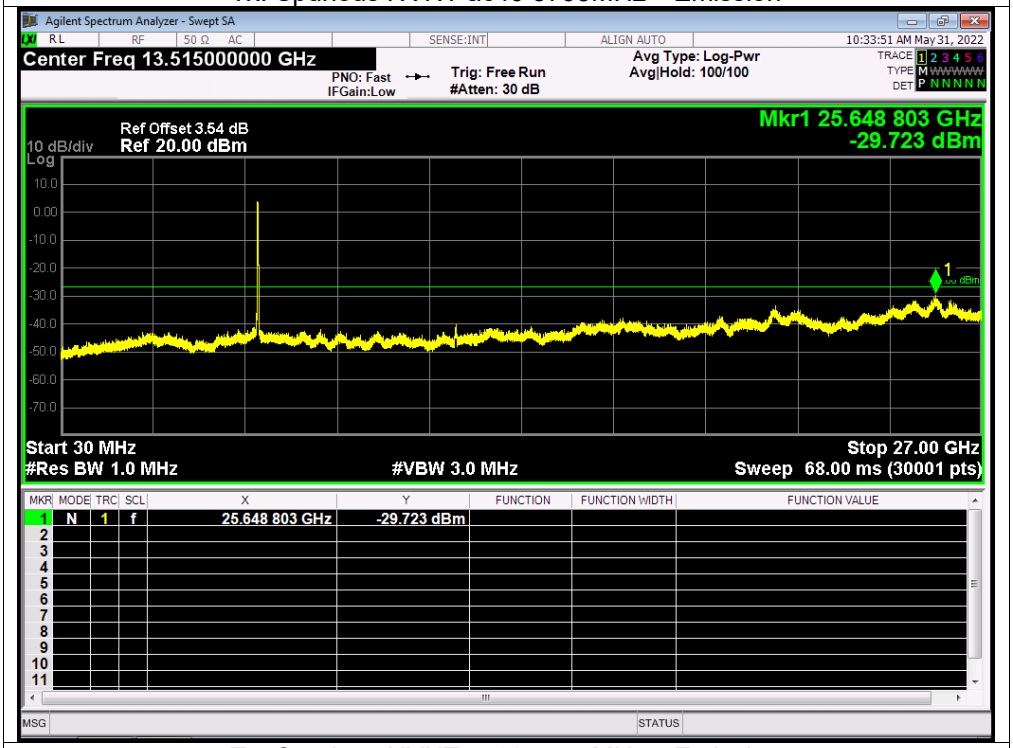
Tx. Spurious NVNT ac20 5825MHz Emission



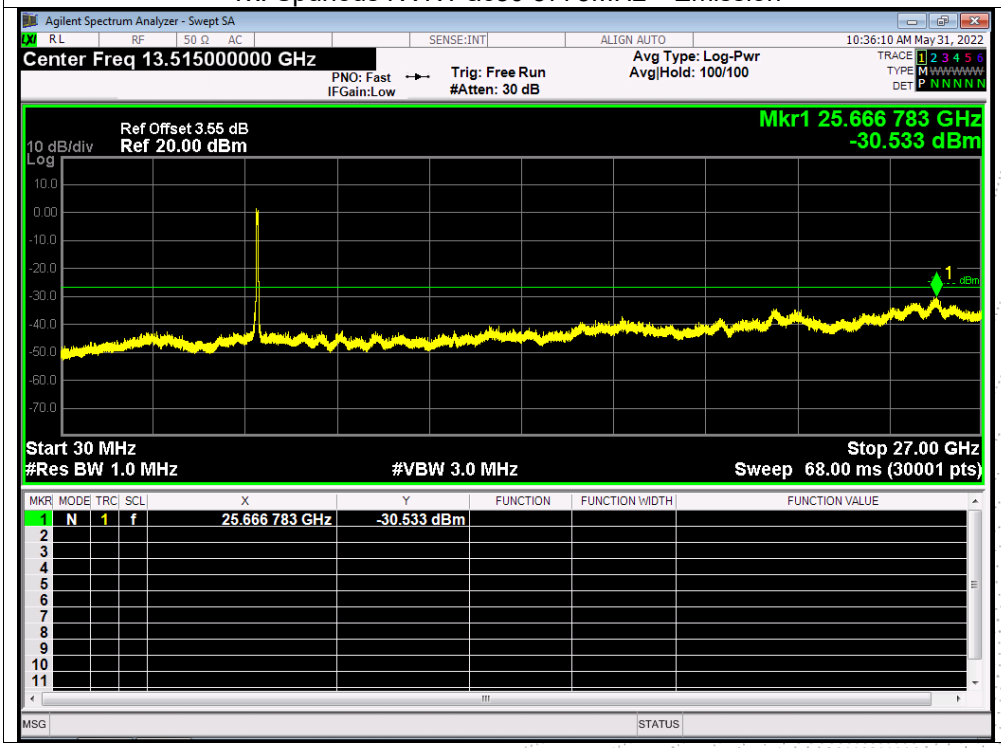
Tx. Spurious NVNT ac40 5755MHz Emission



Tx. Spurious NVNT ac40 5795MHz Emission



Tx. Spurious NVNT ac80 5775MHz Emission



13. Frequency Stability Measurement

13.1 Block Diagram Of Test Setup

13.2 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).

13.3 Test procedure

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 maxhold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 106 ppm and he 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.

13.4 Test Result

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage:	DC 5V
Test Mode:	TX (5.8G) Mode Frequency U-NII-3 (5745-5825MHz)		

Voltage vs. Frequency Stabilit

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5745.00614	5745	0.00614	1.0696
		V max (V)	6.25	5745.00982	5745	0.00982	1.7088
		V min (V)	4.25	5745.01011	5745	0.01011	1.7594
Limits				5725-5850 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5745.00755	5745	0.00755	1.3140
		T (°C)	-10	5745.01230	5745	0.01230	2.1418
		T (°C)	0	5745.00215	5745	0.00215	0.3747
		T (°C)	10	5745.01211	5745	0.01211	2.1076
		T (°C)	20	5745.00375	5745	0.00375	0.6526
		T (°C)	30	5745.00297	5745	0.00297	0.5176
		T (°C)	40	5745.00728	5745	0.00728	1.2668
		T (°C)	50	5745.00925	5745	0.00925	1.6103
		T (°C)	60	5745.00766	5745	0.00766	1.3329
		T (°C)	70	5745.00863	5745	0.00863	1.5023
Limits				5725-5850 MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency : 5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5785.01038	5785	0.01038	1.7944
		V max (V)	6.25	5785.00767	5785	0.00767	1.3261
		V min (V)	4.25	5785.00081	5785	0.00081	0.1402
Limits				5725-5850 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency : 5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5785.00829	5785	0.00829	1.4324
		T (°C)	-10	5785.00431	5785	0.00431	0.7448
		T (°C)	0	5785.00406	5785	0.00406	0.7012
		T (°C)	10	5785.00654	5785	0.00654	1.1303
		T (°C)	20	5785.00724	5785	0.00724	1.2510
		T (°C)	30	5785.00279	5785	0.00279	0.4826
		T (°C)	40	5785.01165	5785	0.01165	2.0130
		T (°C)	50	5785.00389	5785	0.00389	0.6723
		T (°C)	60	5785.00697	5785	0.00697	1.2049
		T (°C)	70	5785.01096	5785	0.01096	1.8937
Limits				5725-5850 MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency : 5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5825.00605	5825	0.00605	1.0381
		V max (V)	6.25	5825.00918	5825	0.00918	1.5751
		V min (V)	4.25	5825.00627	5825	0.00627	1.0762
Limits				5725-5850 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency : 5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5825.00647	5825	0.00647	1.1101
		T (°C)	-10	5825.00702	5825	0.00702	1.2047
		T (°C)	0	5825.00142	5825	0.00142	0.2446
		T (°C)	10	5825.00262	5825	0.00262	0.4490
		T (°C)	20	5825.00816	5825	0.00816	1.4011
		T (°C)	30	5825.00927	5825	0.00927	1.5918
		T (°C)	40	5825.00261	5825	0.00261	0.4479
		T (°C)	50	5825.00664	5825	0.00664	1.1393
		T (°C)	60	5825.00420	5825	0.00420	0.7204
		T (°C)	70	5825.00501	5825	0.00501	0.8599
Limits				5725-5850 MHz			
Result				Complies			

14. Antenna Requirement

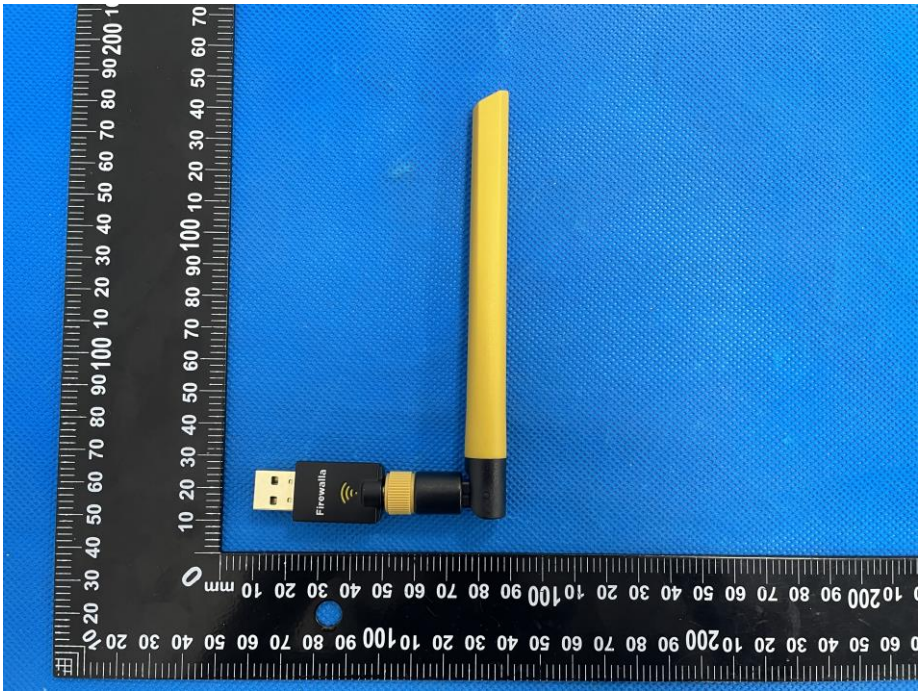
14.1 Limit

15.203 requirement: For intentional device, according to 15.203: 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.

14.2 Test Antenna

The EUT antenna is External antenna. It comply with the standard requirement.

15. EUT Photographs

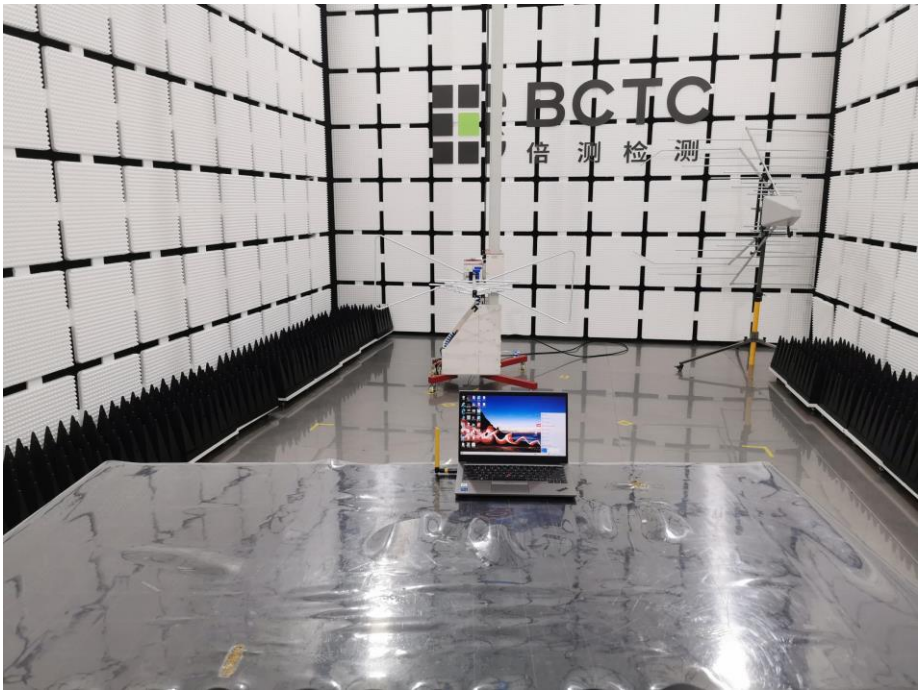


NOTE: Appendix-Photographs Of EUT Constructional Details

16. EUT Test Setup Photographs

Conducted emissions

Radiated Measurement Photos



STATEMENT

1.The equipment lists are traceable to the national reference standards.

2.The test report can not be partially copied unless prior written approval is issued from our lab.

3.The test report is invalid without stamp of laboratory.

4.The test report is invalid without signature of person(s) testing and authorizing.

5.The test process and test result is only related to the Unit Under Test.

6.The quality system of our laboratory is in accordance with ISO/IEC17025.

7.If there is any objection to report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

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※※※※※ **END** ※※※※※