RF TEST REPORT

Applicant	Quectel Wireless Solutions Company Limited
FCC ID	XMR2024FCS960KNL
Product	Wi-Fi & Bluetooth Module
Brand	Quectel
Model	FCS960K-NL
Report No.	R2404A0429-R2V2
Issue Date	June 19, 2024

Eurofins TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15E (2023)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Prepared by: Xu Ying *Approved by: Xu Kai*

Eurofins TA Technology (Shanghai) Co., Ltd.

Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
TEL: +86-021-50791141/2/3
FAX: +86-021-50791141/2/3-8000

TABLE OF CONTENT

Version	Revision Description	Issue Date
Rev.0	Initial issue of report.	June 12, 2024
Rev.1	Updated data and information.	June 19, 2024
Rev.2	Updated data.	June 19, 2024
Note: This revised report (Report No.: R2404A0429-R2V2) supersedes and replaces the previously issued report (Report No.: R2404A0429-R2V1). Please discard or destroy the previously issued report and dispose of it accordingly.		

Summary of measurement results

Number	Test Case	Clause in FCC rules	Verdict
1	Average output power	15.407(a)	PASS
2	Occupied bandwidth	15.407(e)	PASS
3	Frequency stability	15.407(g)	PASS
4	Power spectral density	15.407(a)	PASS
5	Unwanted Emissions	15.407(b)	PASS
6	Conducted Emissions	15.207	NA
Date of Testing: April 25, 2024 ~ June 5, 2024 Date of Sample Received: April 18, 2024			
Note: NA = Not Applicable. PASS: The EUT complies with the essential requirements in the standard. FAIL: The EUT does not comply with the essential requirements in the standard. All indications of Pass/Fail in this report are opinions expressed by Eurofins TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

1. Test Laboratory

1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **Eurofins TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3. Testing Location

Company:	Eurofins TA Technology (Shanghai) Co., Ltd.
Address:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Xu Kai
Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	https://www.eurofins.com/electrical-and-electronics
E-mail:	Kain.Xu@cpt.eurofinscn.com

2. General Description of Equipment under Test

2.1. Applicant and Manufacturer Information

Applicant	Quectel Wireless Solutions Company Limited
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Manufacturer	Quectel Wireless Solutions Company Limited
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233

2.2. General information

EUT Description	
Model	FCS960K-NL
SN	Conducted: E1M24AR00000066
	Radiated: E1M24EF04000047
Hardware Version	R1.0
Software Version	FCS960KAAMD
Power Supply	External power supply
Antenna Type	External Antenna
Antenna Connector	RP SMA Male (meet with the standard FCC Part 15.203 requirement)
Antenna Gain	U-NII-1: -0.7 dBi U-NII-2A: -0.8 dBi U-NII-2C: -1.2 dBi U-NII-3: -1.5 dBi
Operating Frequency Range(s)	U-NII-1: 5150MHz-5250MHz U-NII-2A: 5250MHz -5350MHz U-NII-2C: 5470MHz-5725MHz U-NII-3: 5725MHz -5850MHz
Modulation Type	802.11a: OFDM 802.11n (HT20/HT40): OFDM 802.11ac (VHT20/VHT40): OFDM 802.11ax (HE20/ HE40): OFDMA (Only Support Full Ru)
Max. Output Power	17.10 dBm
Operating temperature range	-20 ° C to 80 ° C
Operating voltage range	3.0 V to 3.6 V
Testing temperature range	-30 ° C to 50° C
Testing voltage range	3.0 V – 3.3 V – 3.6 V

State DC voltage	3.3 V
EUT Accessory	
Mother board	Manufacturer: Quectel Wireless Solutions Co., Ltd. Model: /

Note:
1. The EUT is sent from the applicant to Eurofins TA and the information of the EUT is declared by the applicant.
2. This device support automatically discontinue transmission, while the device is not transmitting any information, the device can automatically discontinue transmission and become standby mode for power saving. The device can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.
3. (a) Manufacturers implements security features in any digitally modulated devices capable of operating in any of the U-NII bands, so that third parties are not able to reprogram the device to operate outside the parameters for which the device was certified. The software prevents the user from operating the transmitter with operating frequencies, output power, modulation types or other radio frequency parameters outside those that were approved for the device. Manufacturers uses means including, but not limited to the use of a private network that allows only authenticated users to download software, electronic signatures in software or coding in hardware that is decoded by software to verify that new software can be legally loaded into a device to meet these requirements and must describe the methods in their application for equipment authorization.
(b) Manufacturers take steps to ensure that DFS functionality cannot be disabled by the operator of the U-NII device.

3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:

FCC CFR47 Part 15E (2023) Unlicensed National Information Infrastructure Devices

ANSI C63.10-2013

Reference standard:

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

4. Test Configuration

Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (vertical), lie-down position (horizontal). The worst emission was found in stand-up position (vertical) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

Mode	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ax HE20	MCS0
802.11ax HE40	MCS0

Wireless Technology and Frequency Range

Wireless Technology		Bandwidth	Channel	Frequency
Wi-Fi	U-NII-1	20 MHz	36	5180MHz
			40	5200MHz
			44	5220MHz
			48	5240MHz
		40 MHz	38	5190MHz
			46	5230MHz
	U-NII-2A	20 MHz	52	5260MHz
			56	5280MHz
			60	5300MHz
			64	5320MHz
		40 MHz	54	5270MHz
			62	5310MHz
	U-NII-2C	20 MHz	100	5500MHz
			104	5520MHz
			108	5540MHz
			112	5560MHz
			116	5580MHz
			120	5600MHz
			124	5620MHz
			128	5640MHz
			132	5660MHz
			136	5680MHz
			140	5700MHz
			144	5720MHz
		40 MHz	102	5510MHz
			110	5550MHz
			118	5590MHz
			126	5630MHz
			134	5670MHz
			142	5710MHz
	U-NII-3	20 MHz	149	5745MHz
			153	5765MHz
			157	5785MHz
			161	5805MHz
			165	5825MHz
		40 MHz	151	5755MHz
			159	5795MHz
Does this device support TPC Function? ☐Yes ☒No				
Does this device support TDWR Band? ☒Yes ☐No				

5. Test Case Results

5.1. Occupied Bandwidth

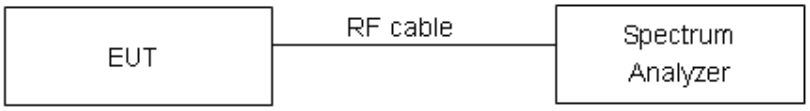
Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.
For U-NII-1/U-NII-2A/U-NII-2C, set RBW ≈1% OCB kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.
For U-NII-3, Set RBW = 100 kHz, VBW ≥ 3 × RBW, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.
Use the 99 % power bandwidth function of the instrument

Test Setup



Limits

For U-NII-1/U-NII-2A/U-NII-2C
No specific occupied bandwidth requirements in Part 15.407.
For U-NII-3
Rule FCC Part §15.407(e)
Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 936 Hz.

Test Results:

U-NII-1

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5180	16.961	25.021	PASS
	5200	16.896	25.623	PASS
	5240	16.978	25.492	PASS
802.11n HT20	5180	18.086	26.499	PASS
	5200	18.078	25.847	PASS
	5240	18.117	26.065	PASS
802.11n HT40	5190	36.689	48.026	PASS
	5230	36.612	46.941	PASS
802.11ac VHT20	5180	18.172	26.066	PASS
	5200	18.134	27.535	PASS
	5240	18.133	25.795	PASS
802.11ac VHT40	5190	36.580	47.768	PASS
	5230	36.699	47.047	PASS
802.11ax HE20	5180	19.146	24.350	PASS
	5200	19.104	26.226	PASS
	5240	19.167	25.698	PASS
802.11ax HE40	5190	37.999	46.490	PASS
	5230	37.971	43.970	PASS

U-NII-2A

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5260	17.037	26.258	PASS
	5300	16.955	28.516	PASS
	5320	16.945	25.639	PASS
802.11n HT20	5260	18.116	27.599	PASS
	5300	18.189	28.702	PASS
	5320	18.088	26.067	PASS
802.11n HT40	5270	36.658	50.707	PASS
	5310	36.684	47.809	PASS
802.11ac VHT20	5260	18.064	26.391	PASS
	5300	18.099	25.201	PASS
	5320	18.092	26.782	PASS
802.11ac VHT40	5270	36.567	47.223	PASS
	5310	36.639	59.225	PASS
802.11ax HE20	5260	19.134	26.131	PASS
	5300	19.146	24.814	PASS
	5320	19.081	25.780	PASS
802.11ax HE40	5270	37.961	45.198	PASS
	5310	37.968	45.001	PASS

U-NII-2C

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 26 dB bandwidth (MHz)	Conclusion
802.11a	5500	17.145	26.545	PASS
	5600	17.105	26.668	PASS
	5700	17.007	26.488	PASS
	5720	17.112	25.975	PASS
802.11n HT20	5500	18.269	28.293	PASS
	5600	18.361	28.020	PASS
	5700	18.272	30.484	PASS
	5720	18.226	27.388	PASS
802.11n HT40	5510	36.907	57.227	PASS
	5590	36.924	63.075	PASS
	5670	36.948	62.854	PASS
	5710	36.899	56.911	PASS
802.11ac VHT20	5500	18.300	32.801	PASS
	5600	18.276	26.442	PASS
	5700	18.321	28.869	PASS
	5720	18.294	28.120	PASS
802.11ac VHT40	5510	36.974	52.335	PASS
	5590	36.905	57.929	PASS
	5670	36.923	49.215	PASS
	5710	36.898	47.896	PASS
802.11ax HE20	5500	19.209	26.543	PASS
	5600	19.244	25.201	PASS
	5700	19.231	26.250	PASS
	5720	19.278	25.536	PASS
802.11ax HE40	5510	38.077	45.304	PASS
	5590	38.182	46.626	PASS
	5670	38.115	47.500	PASS
	5710	38.081	45.483	PASS

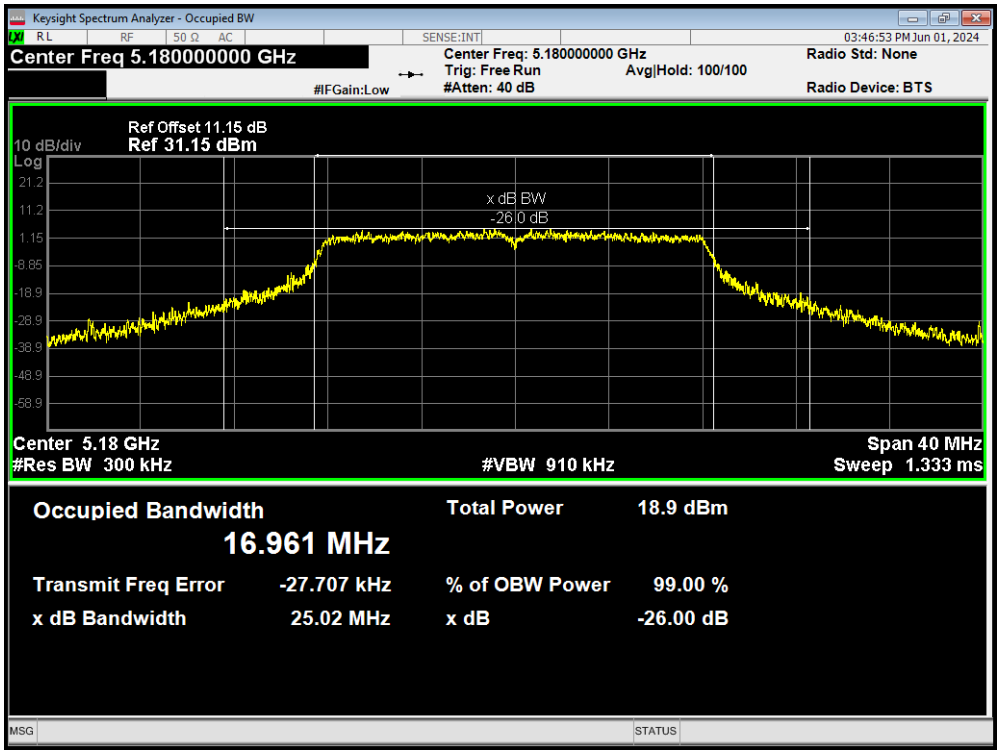
U-NII-3

Mode	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11a	5720	17.104	16.363	500	PASS
	5745	17.092	16.356	500	PASS
	5785	16.989	16.354	500	PASS
	5825	17.124	16.353	500	PASS
802.11n HT20	5720	18.300	17.596	500	PASS
	5745	18.237	17.581	500	PASS
	5785	18.278	17.595	500	PASS
	5825	18.280	17.601	500	PASS
802.11n HT40	5710	36.876	36.337	500	PASS
	5755	36.988	36.452	500	PASS
	5795	36.912	36.356	500	PASS
802.11ac VHT20	5720	18.268	17.581	500	PASS
	5745	18.321	17.618	500	PASS
	5785	18.269	17.622	500	PASS
	5825	18.292	17.608	500	PASS
802.11ac VHT40	5710	36.846	36.537	500	PASS
	5755	36.903	36.356	500	PASS
	5795	36.869	36.364	500	PASS
802.11ax HE20	5720	19.270	19.006	500	PASS
	5745	19.178	19.029	500	PASS
	5785	19.187	18.971	500	PASS
	5825	19.228	18.988	500	PASS
802.11ax HE40	5710	38.124	38.023	500	PASS
	5755	38.191	37.963	500	PASS
	5795	38.069	38.072	500	PASS

99% bandwidth

U-NII-1

OBW 802.11a 5180MHz



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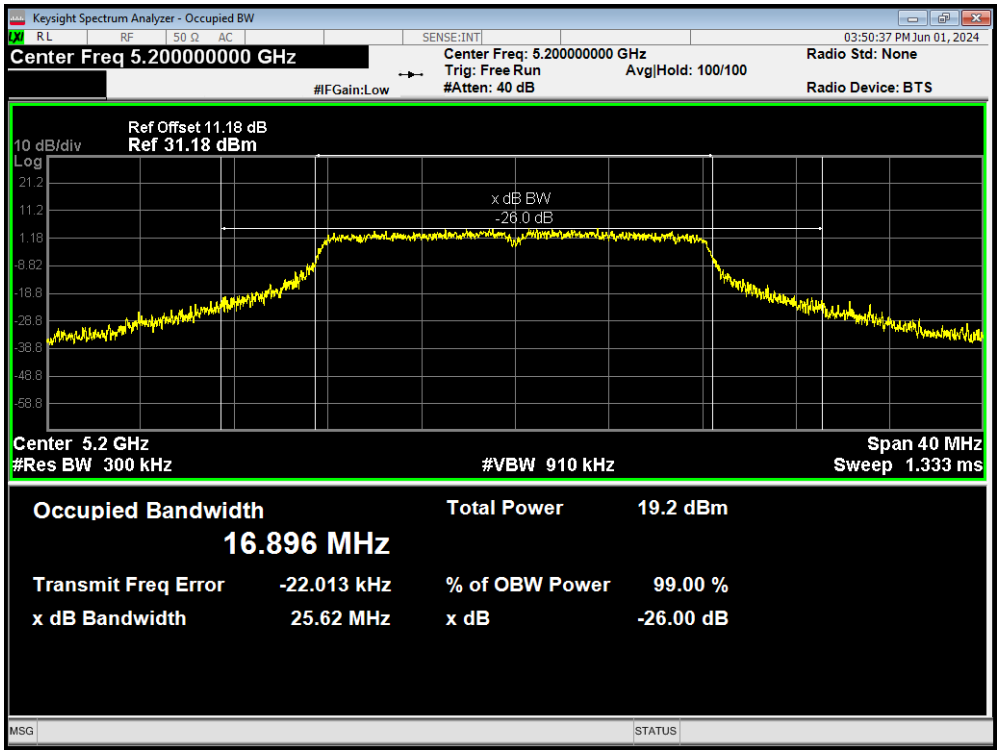

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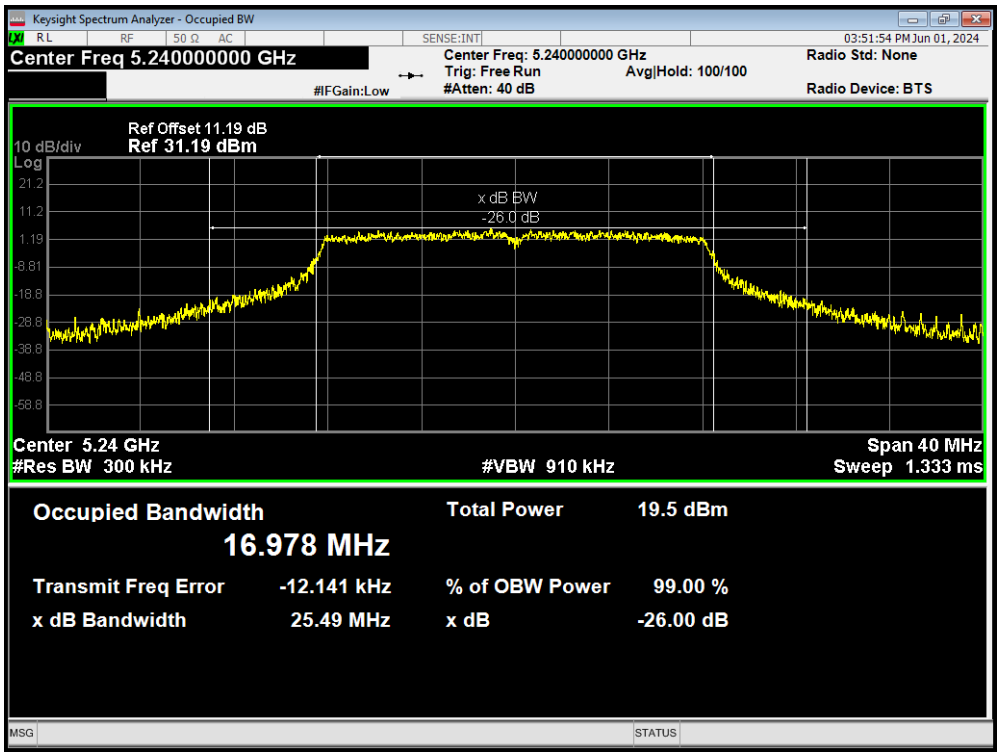

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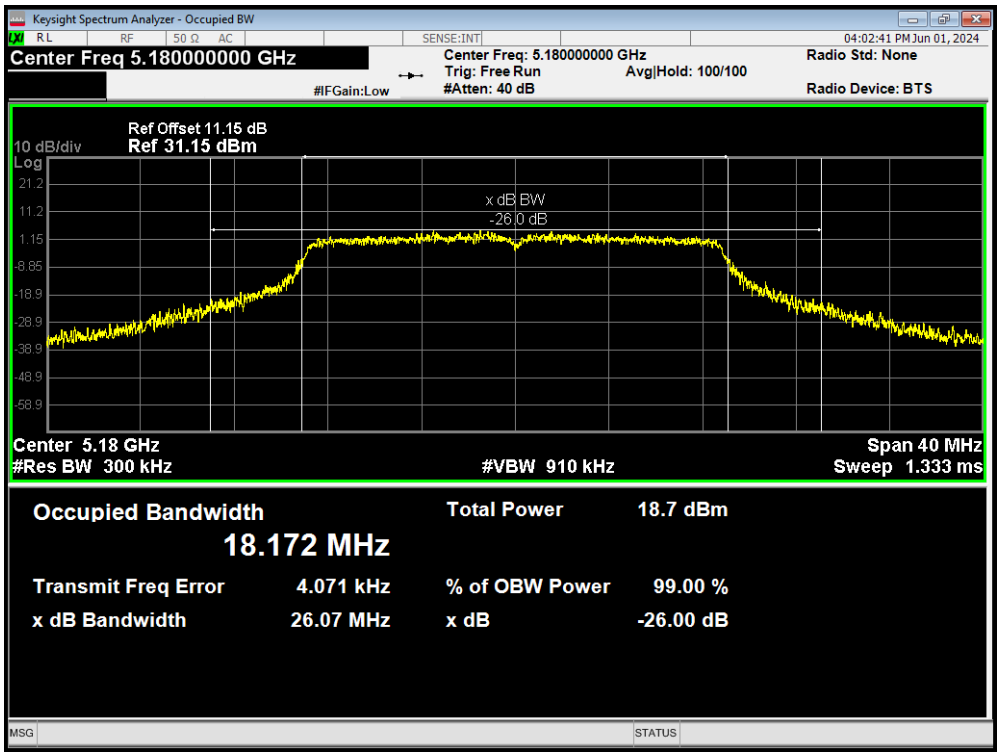

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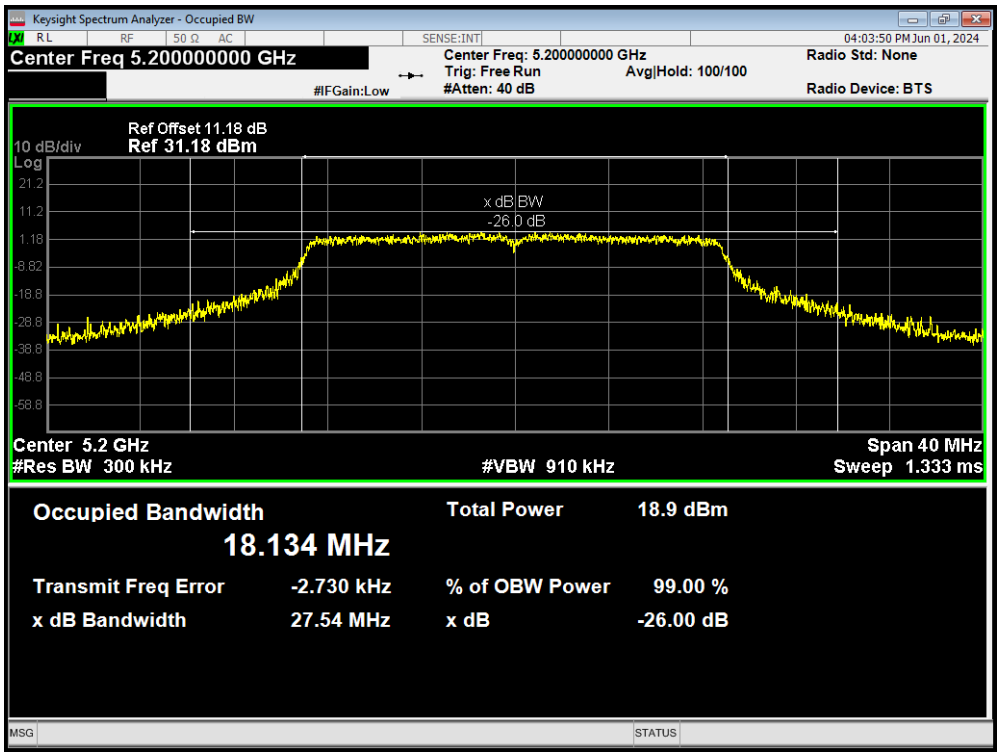

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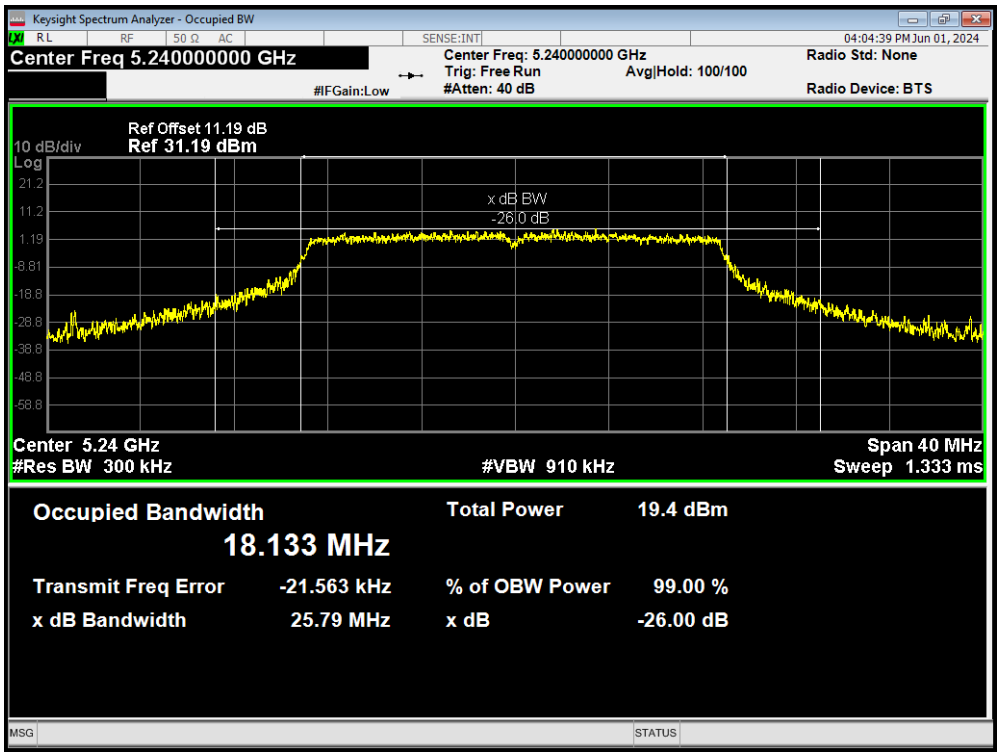

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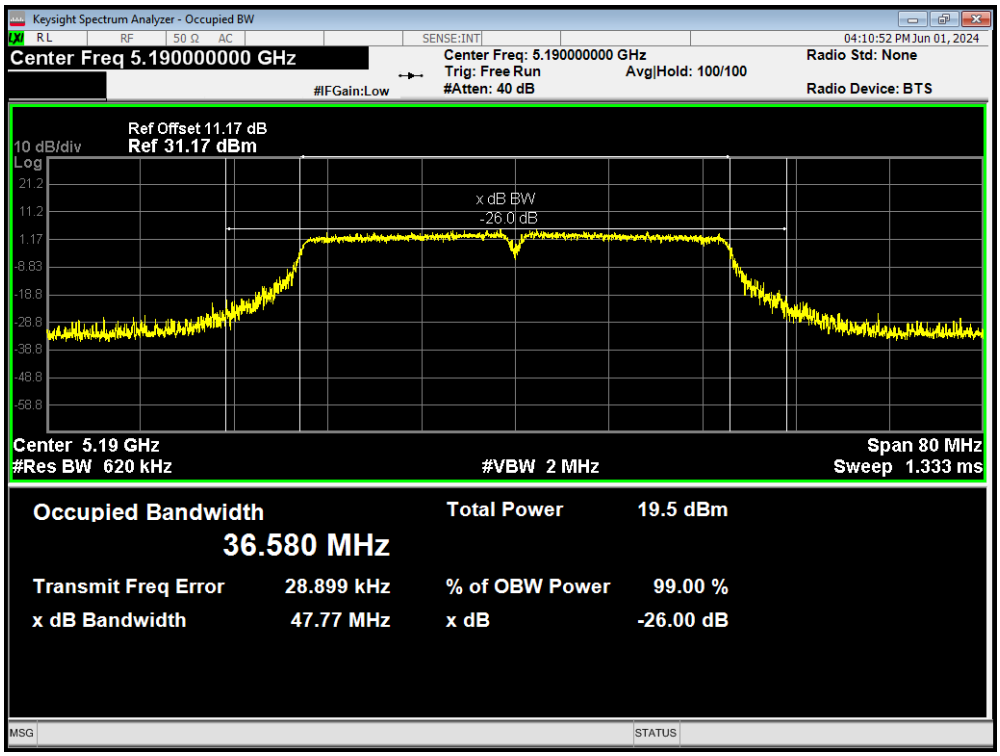

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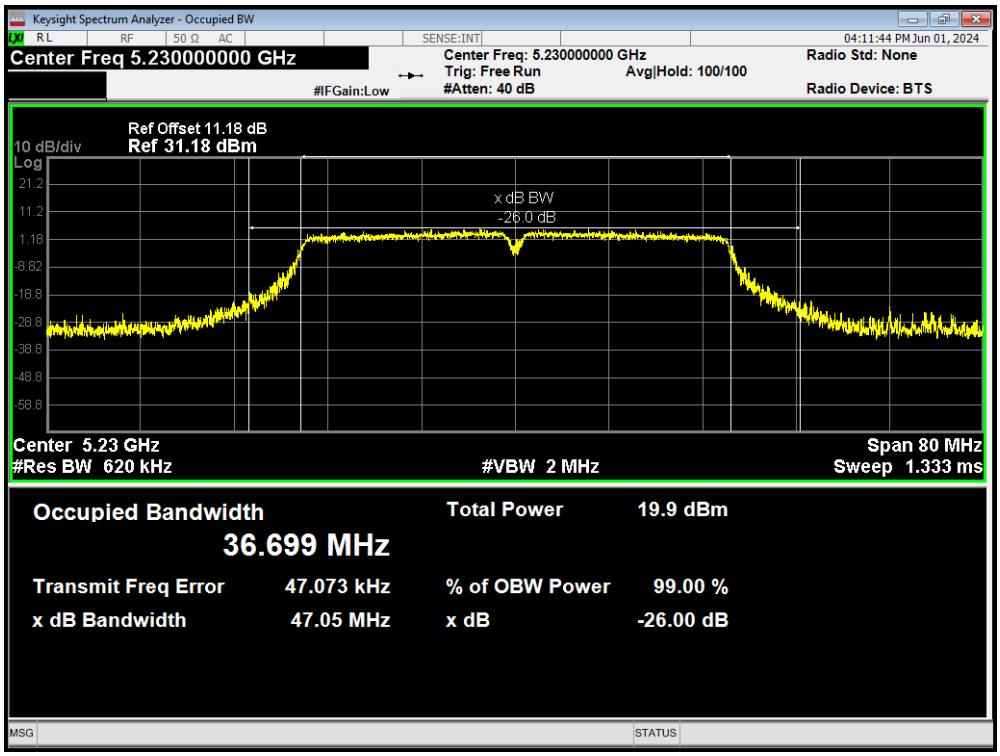

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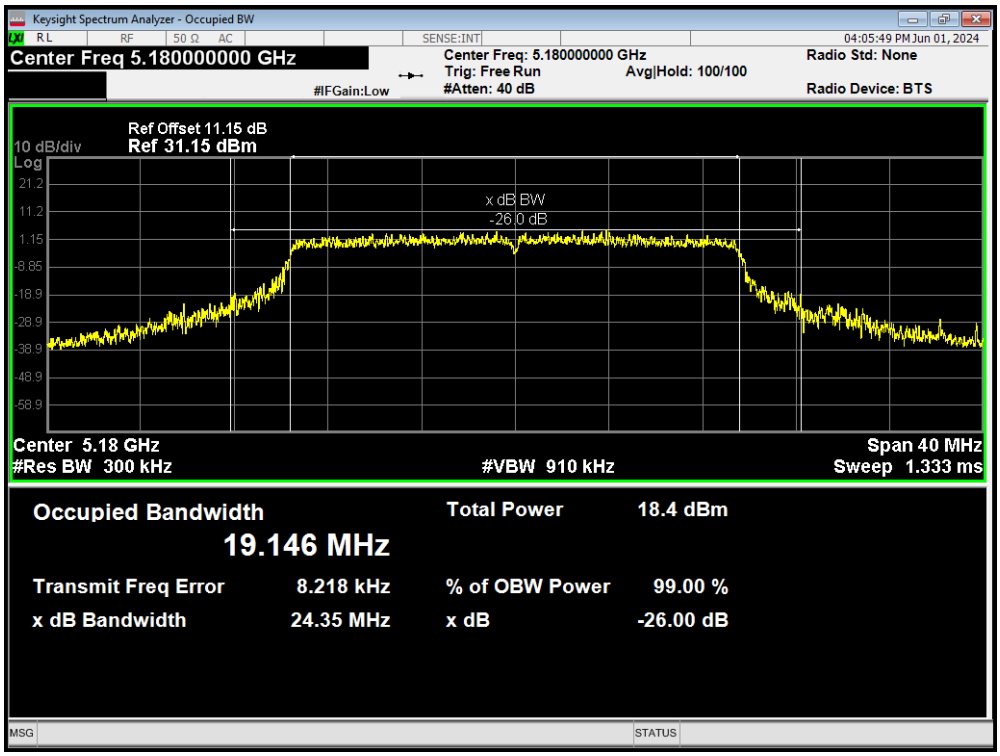

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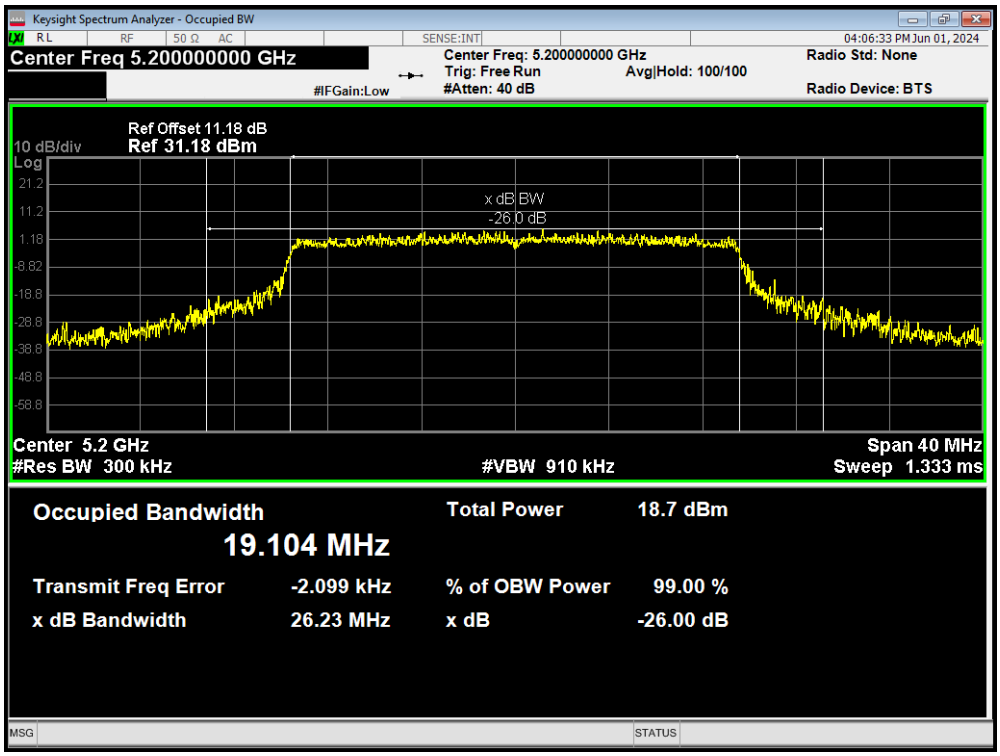

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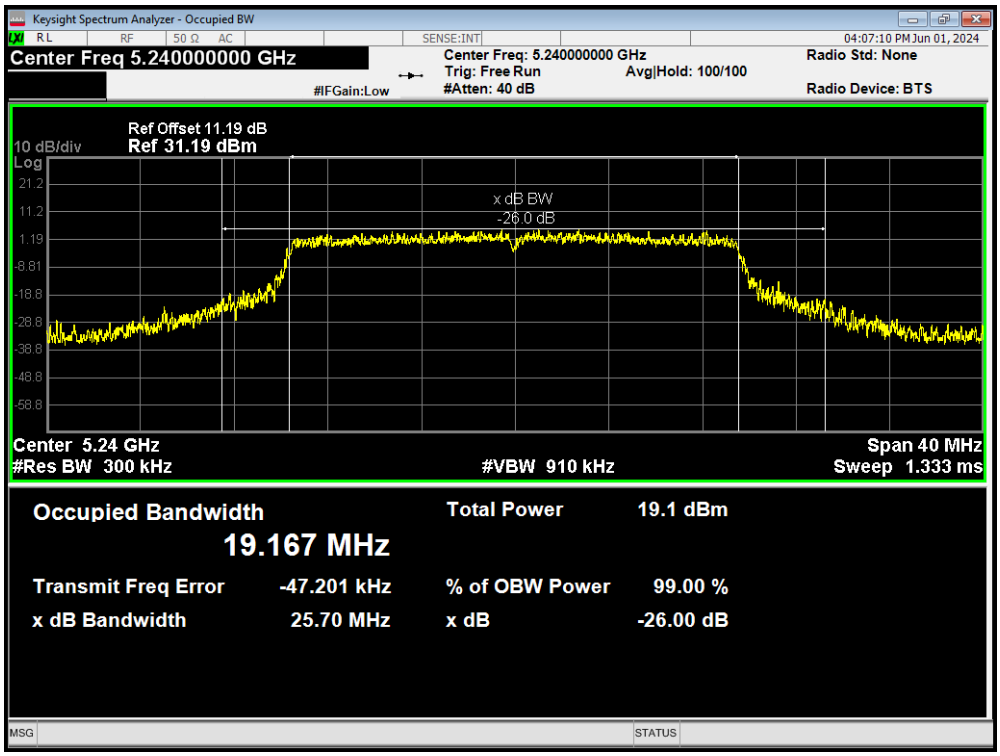

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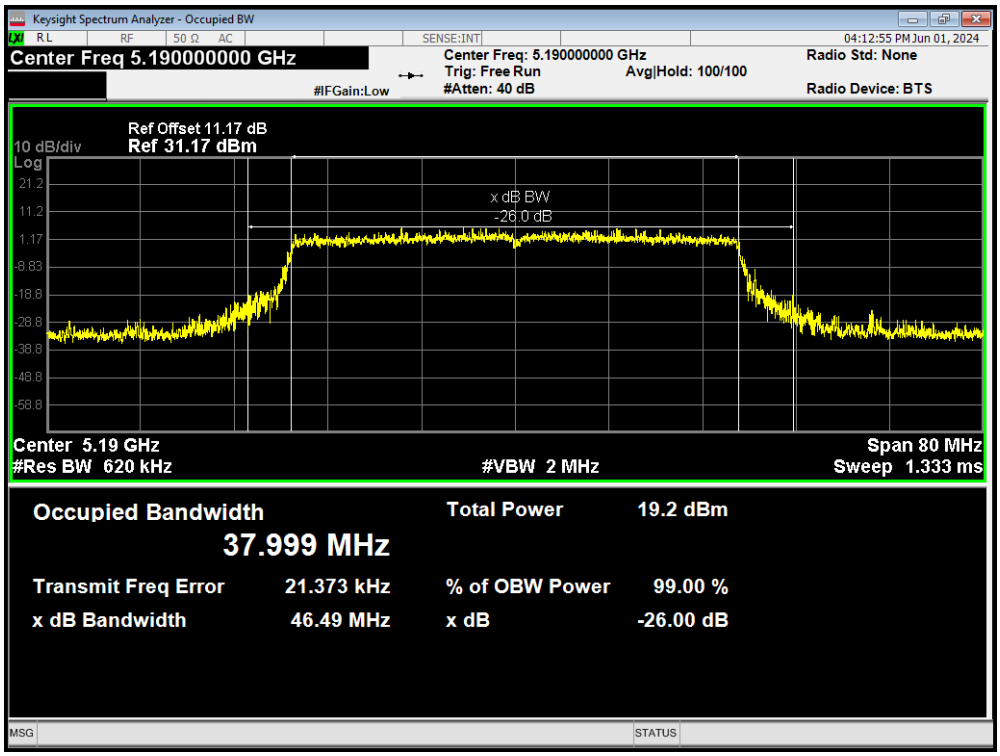

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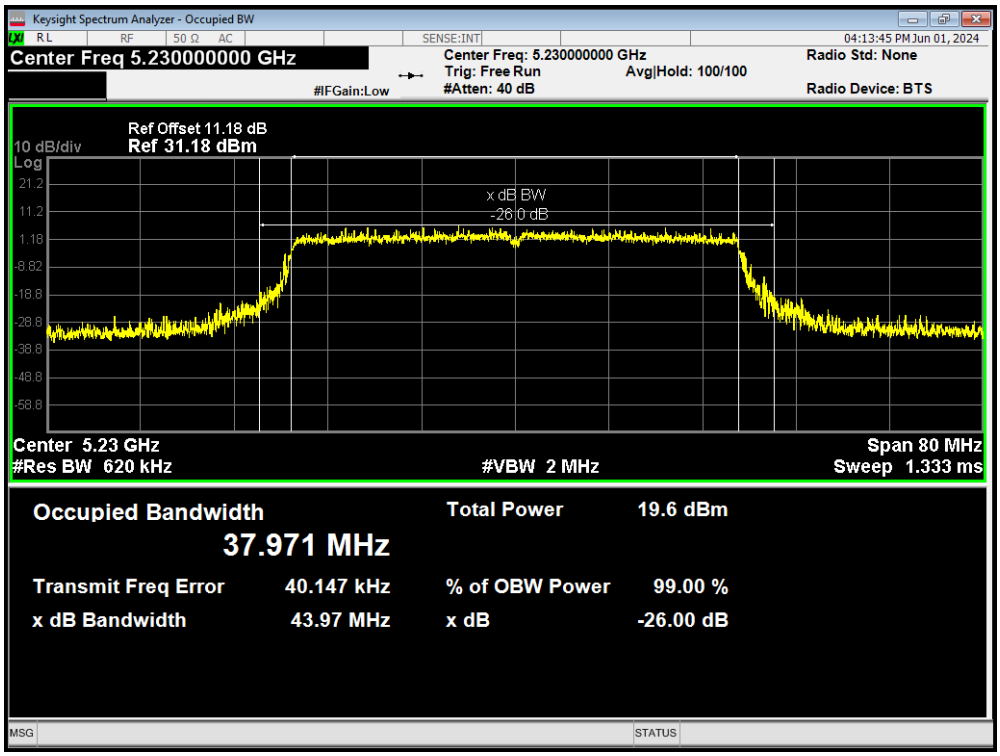
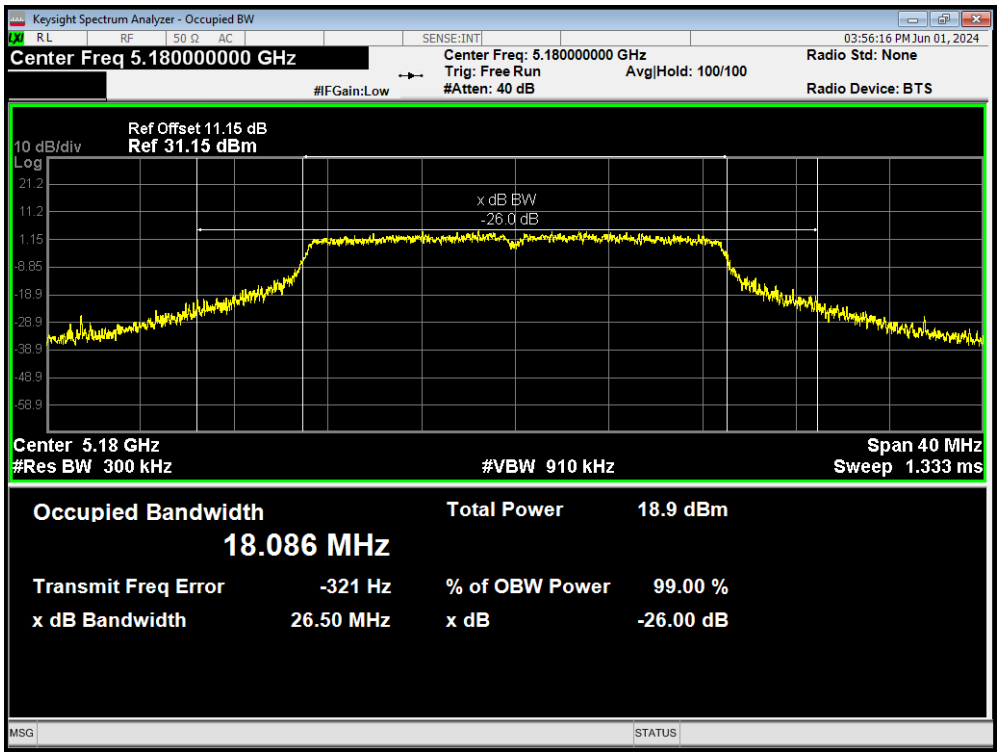


OBW 802.11n(HT20) 5180MHz



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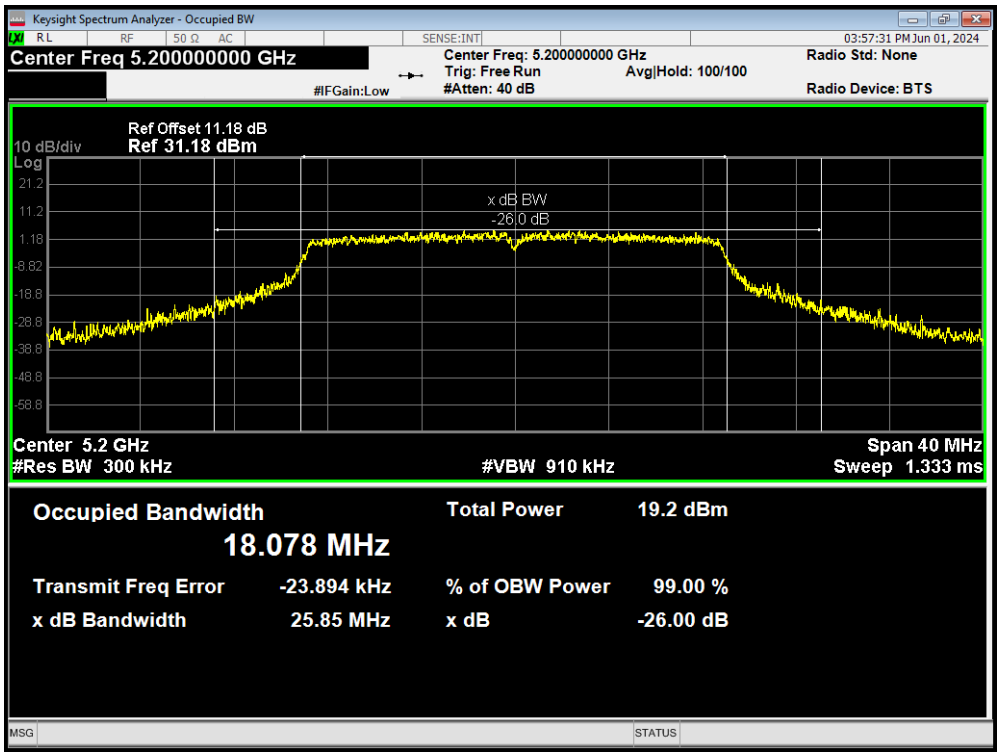

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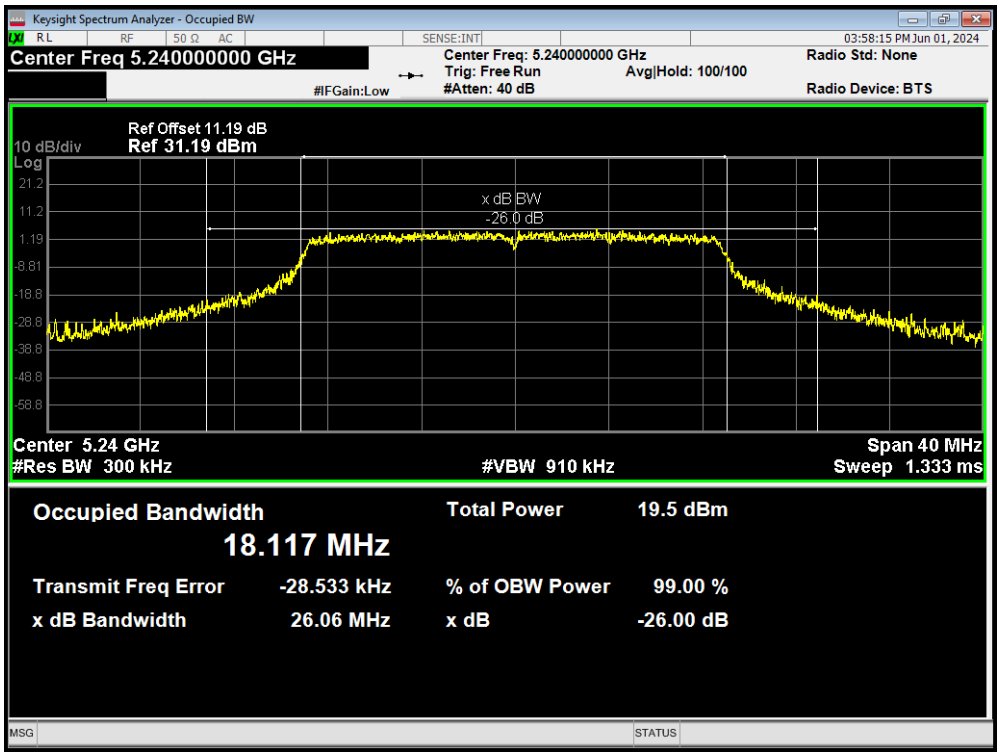

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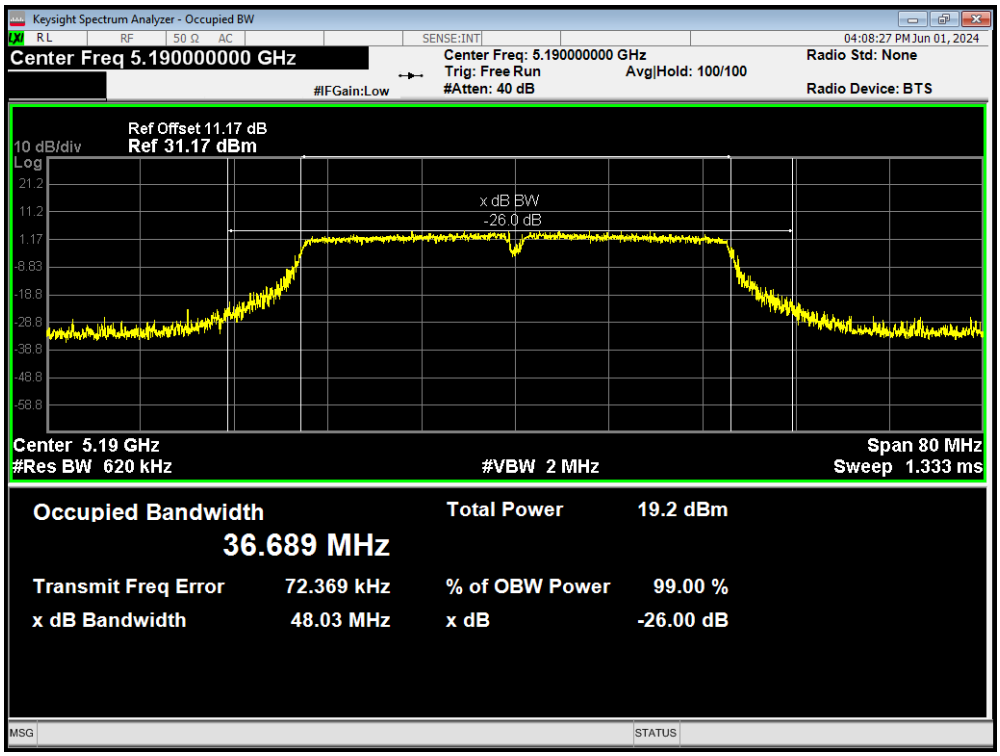

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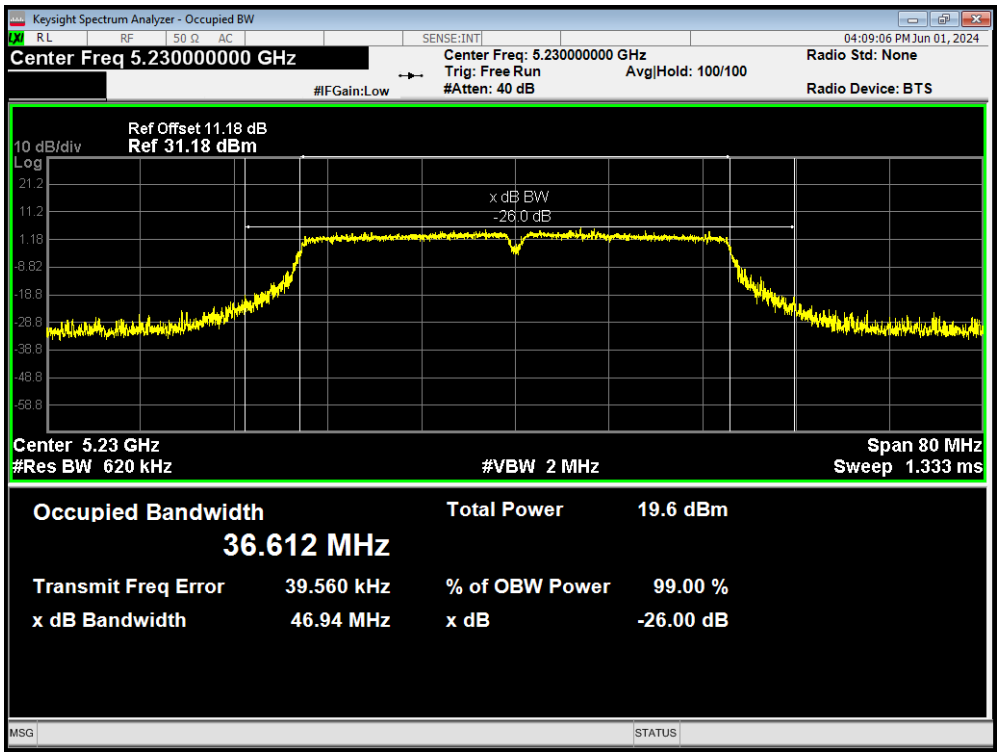

U-NII-2A

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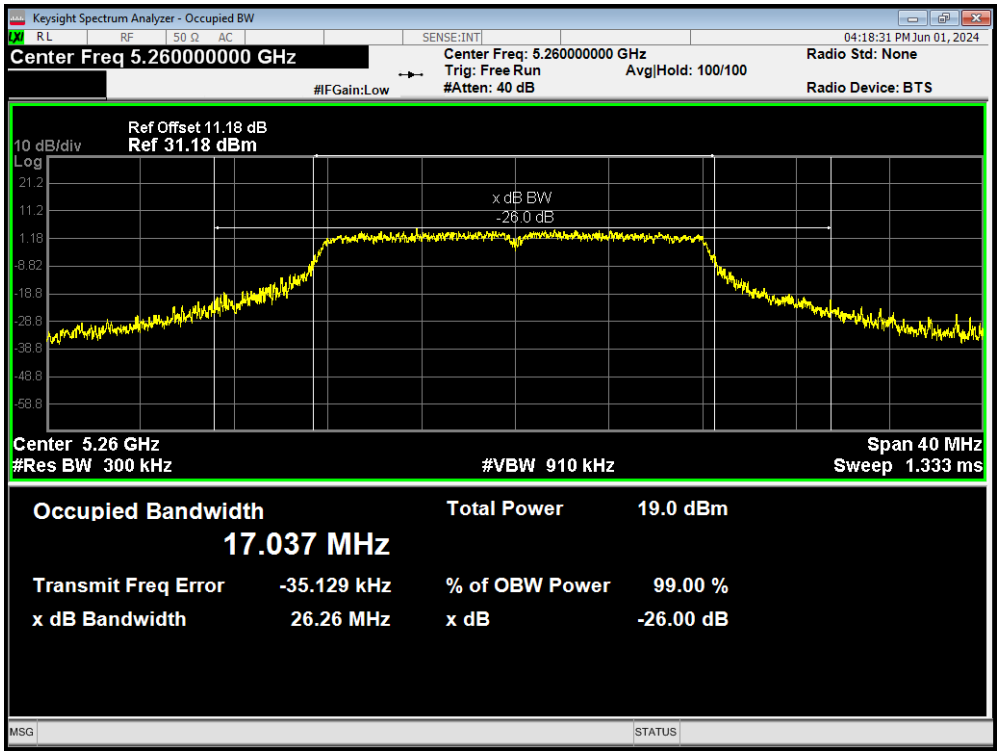

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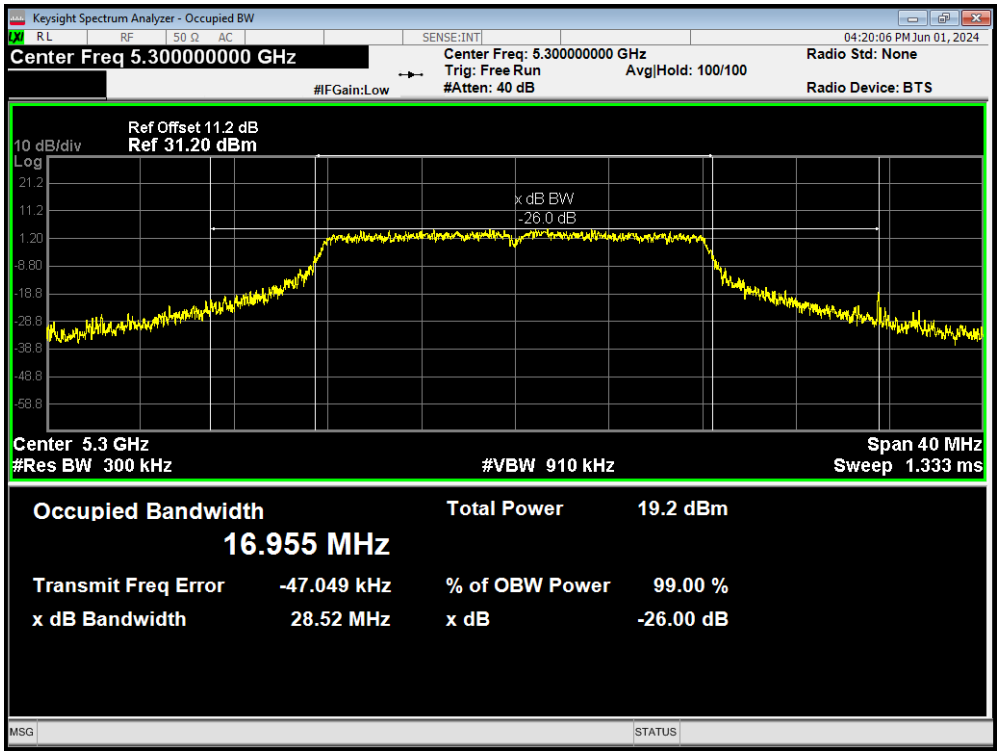

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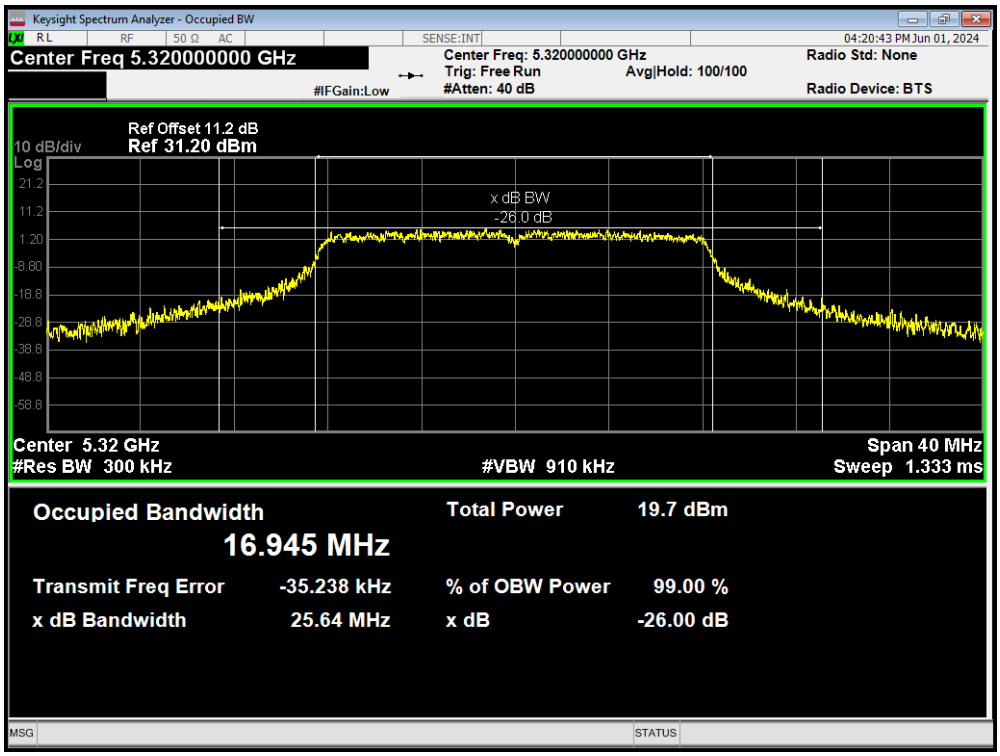
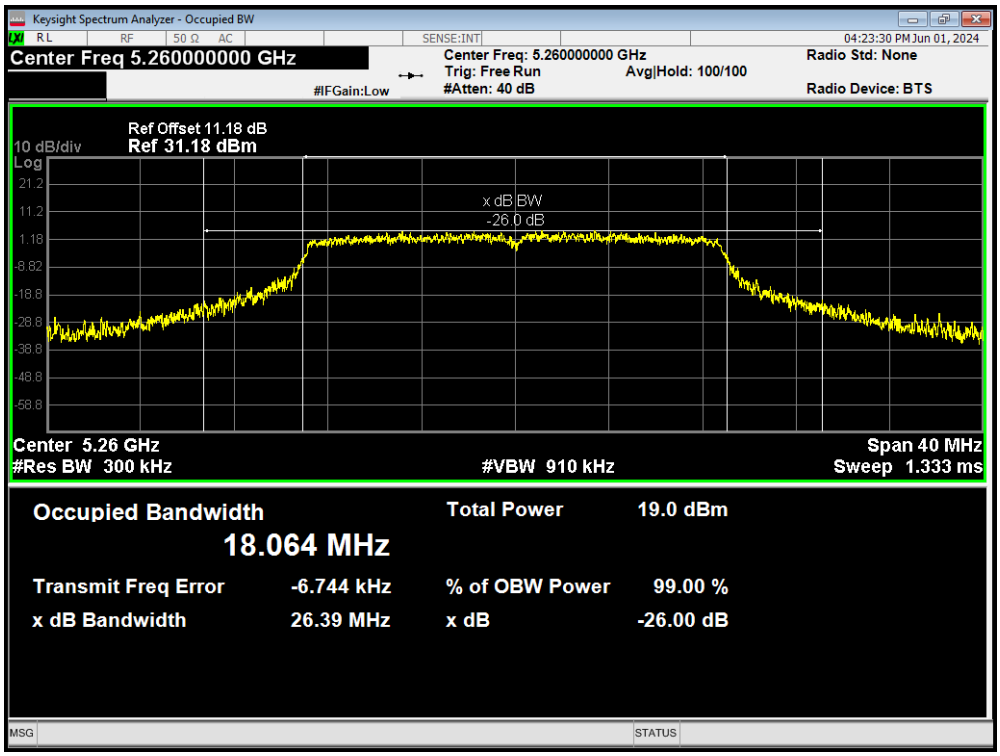
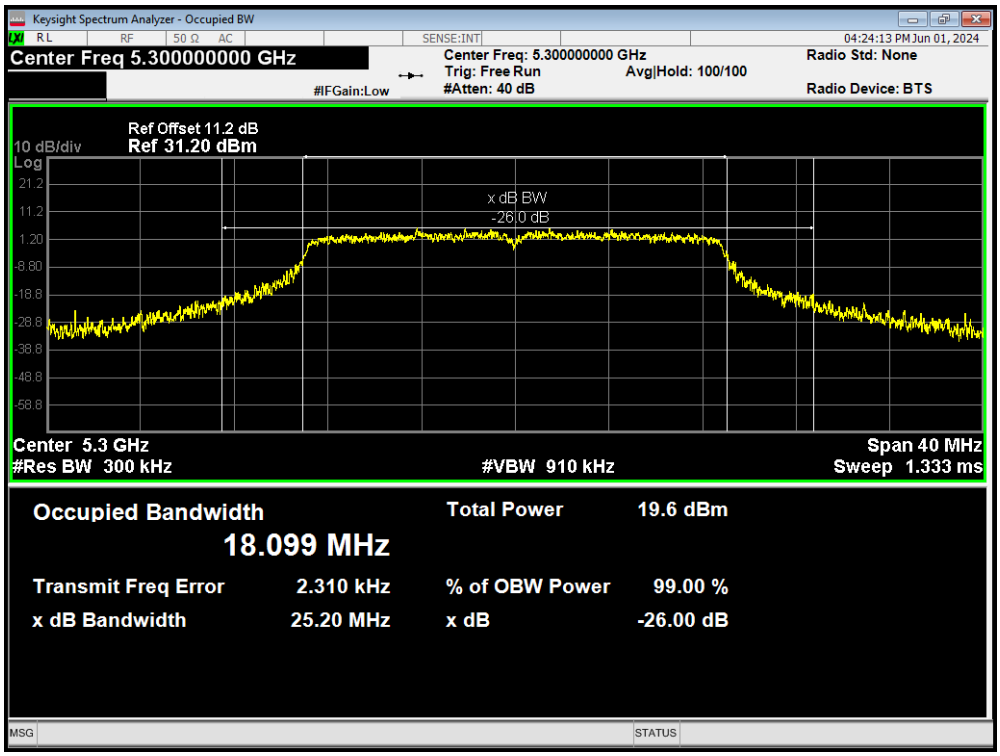


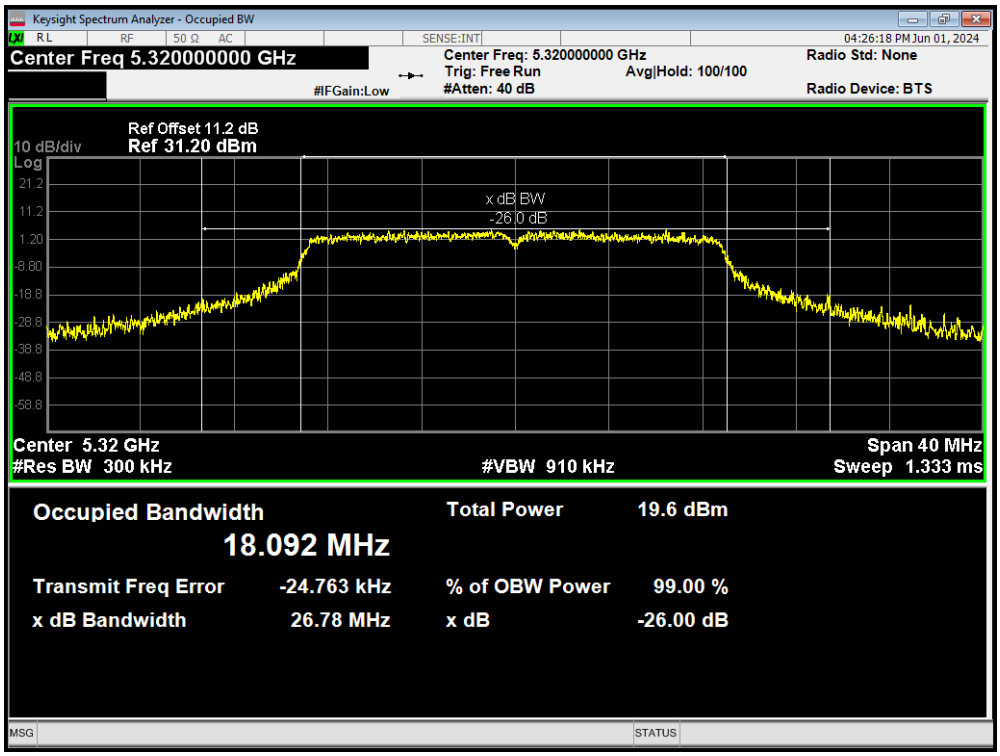
OBW 802.11ac(VHT20) 5260MHz



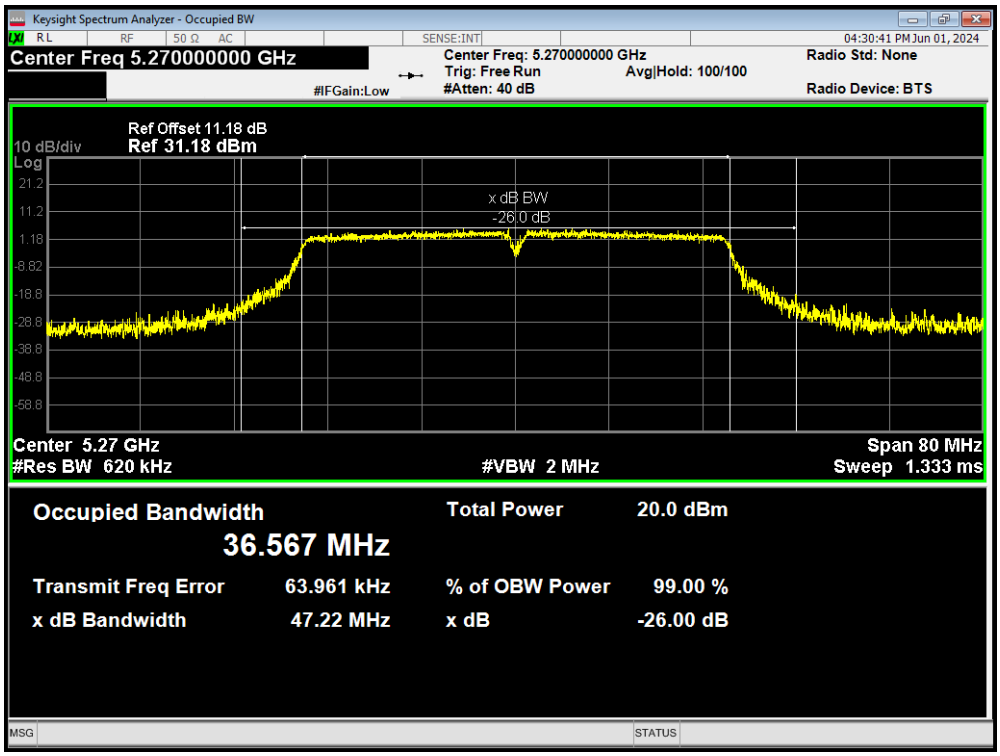
OBW 802.11ac(VHT20) 5300MHz



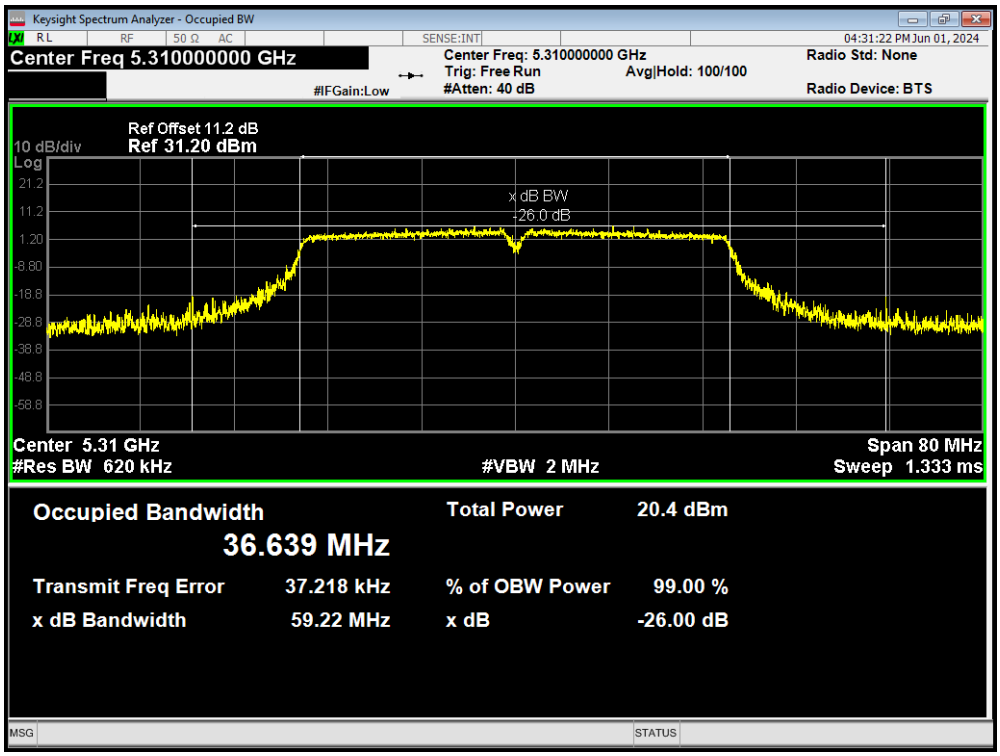
OBW 802.11ac(VHT20) 5320MHz



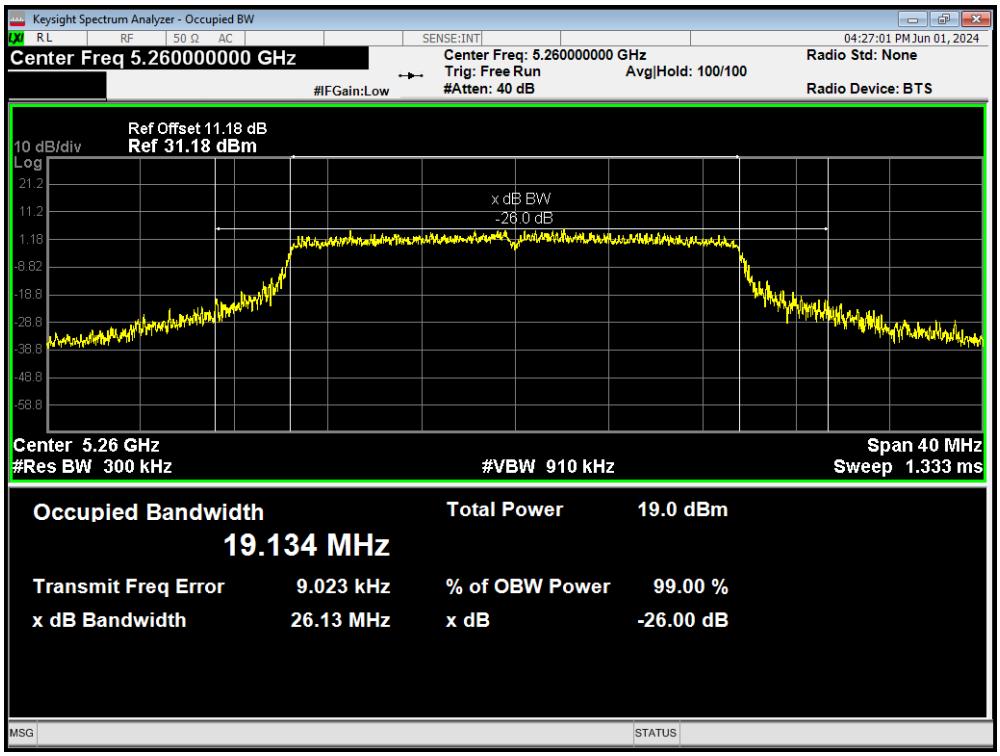
OBW 802.11ac(VHT40) 5270MHz



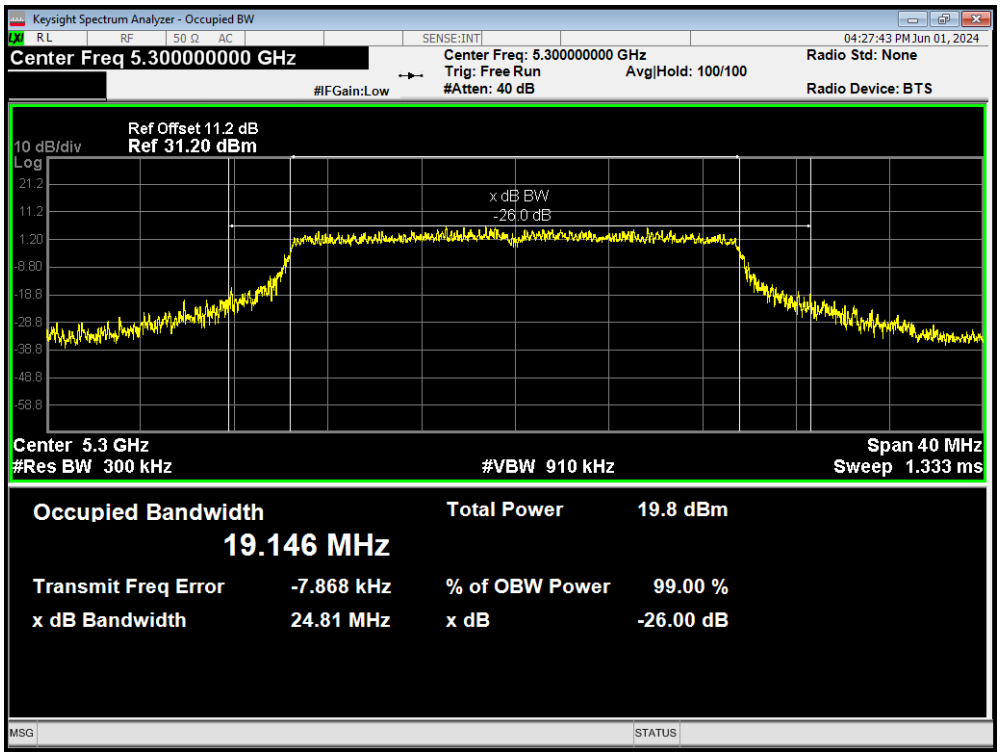
OBW 802.11ac(VHT40) 5310MHz



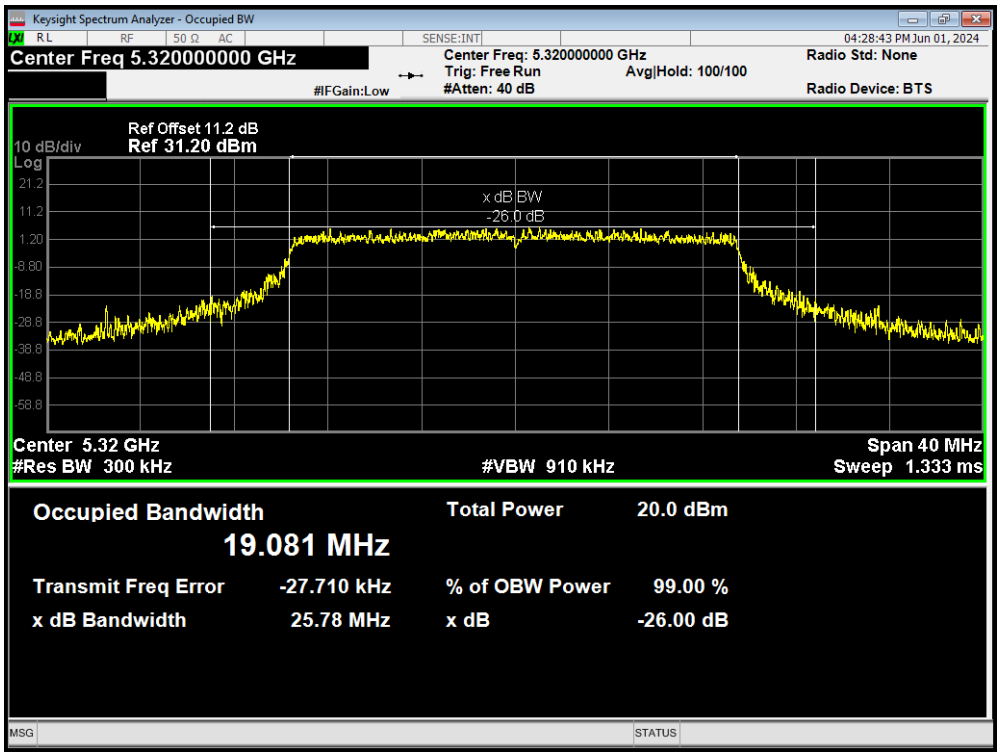
OBW 802.11ax(HE20) 5260MHz



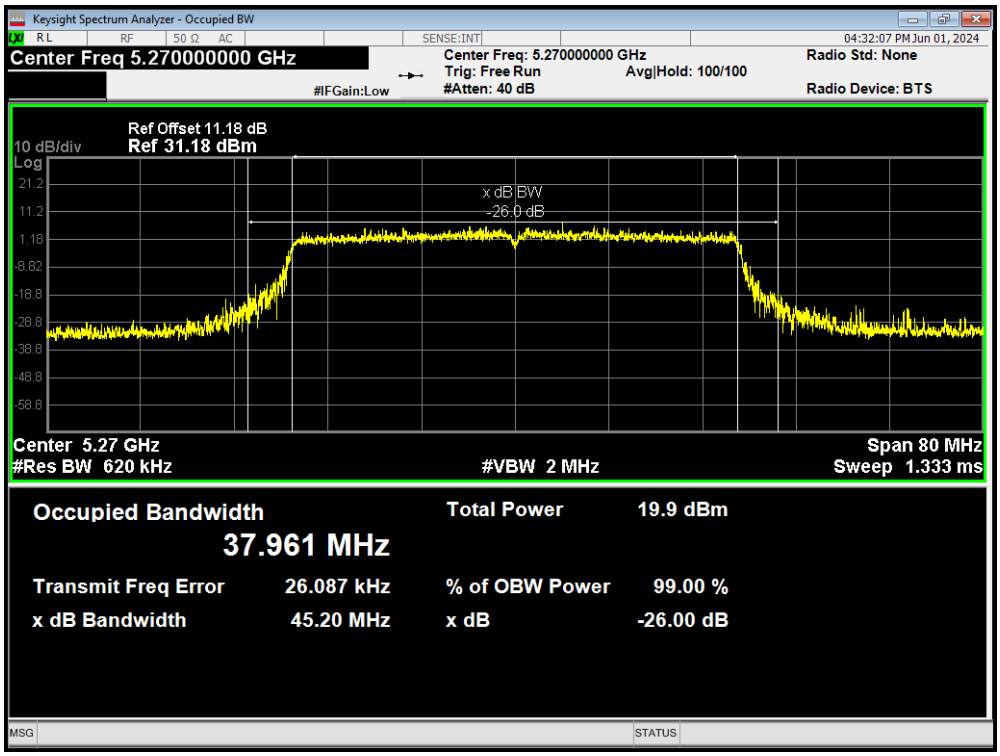
OBW 802.11ax(HE20) 5300MHz



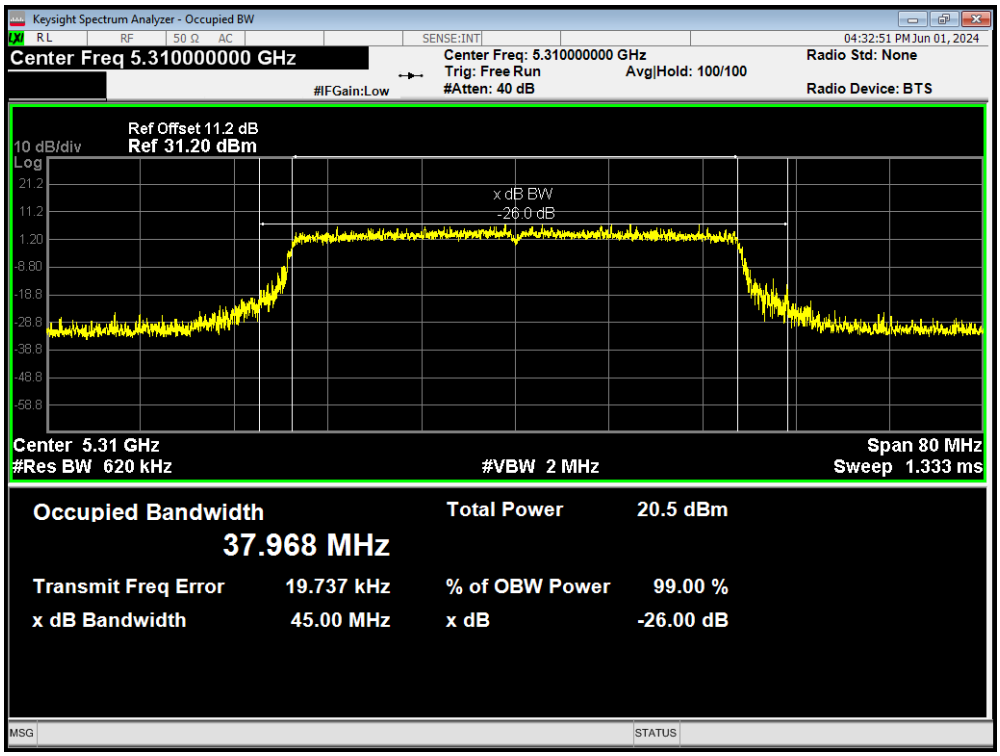
OBW 802.11ax(HE20) 5320MHz



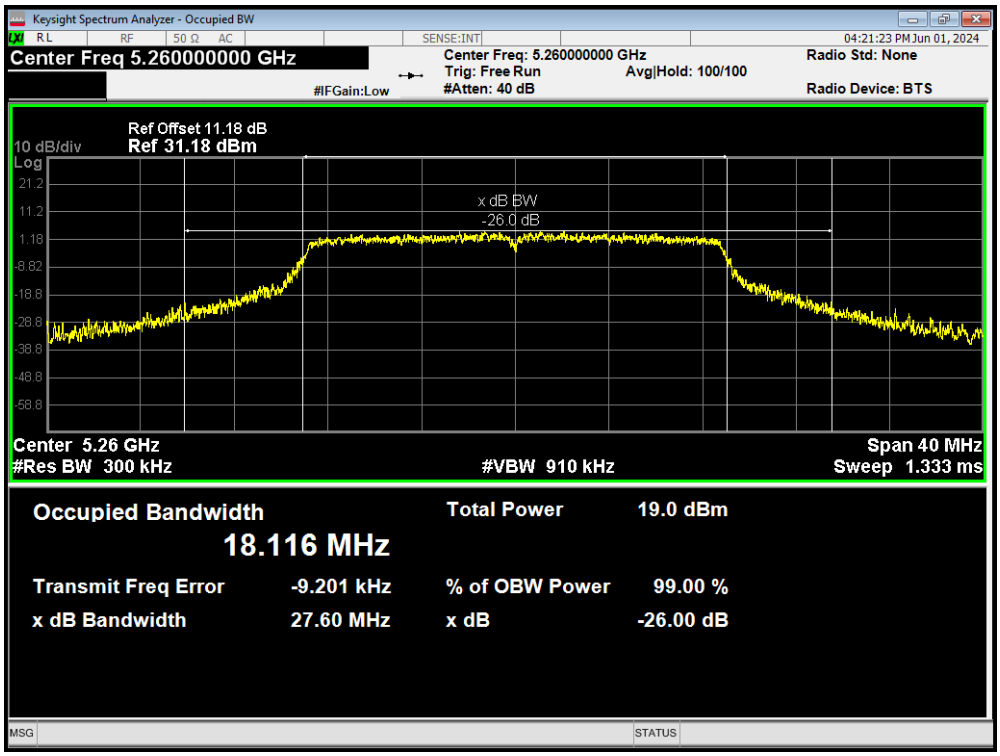
OBW 802.11ax(HE40) 5270MHz



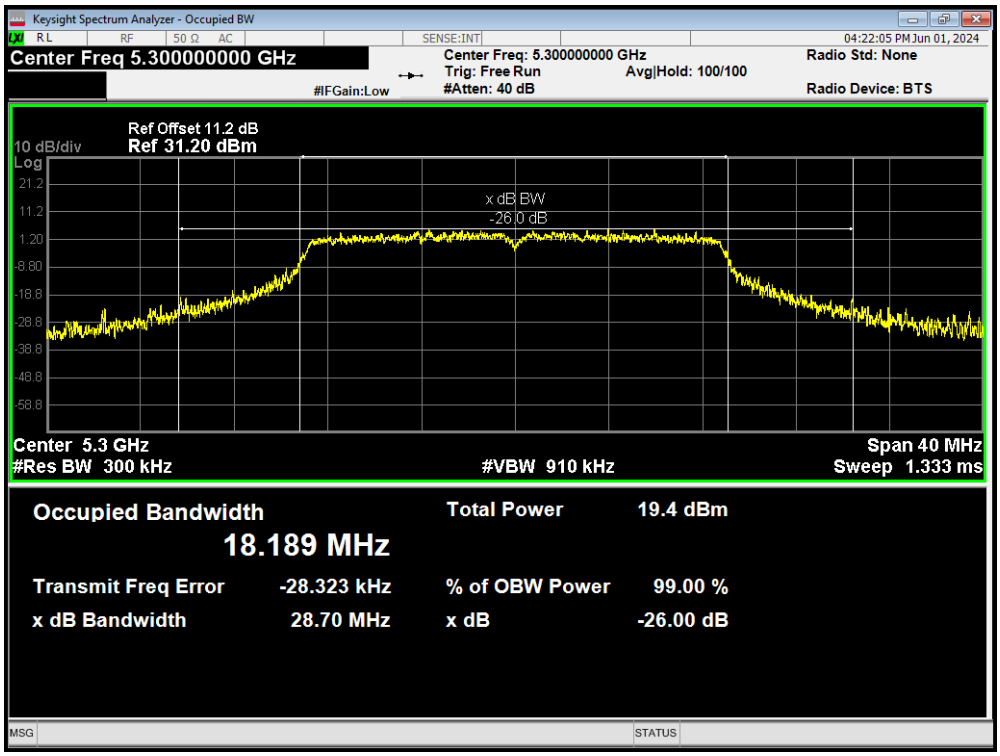
OBW 802.11ax(HE40) 5310MHz



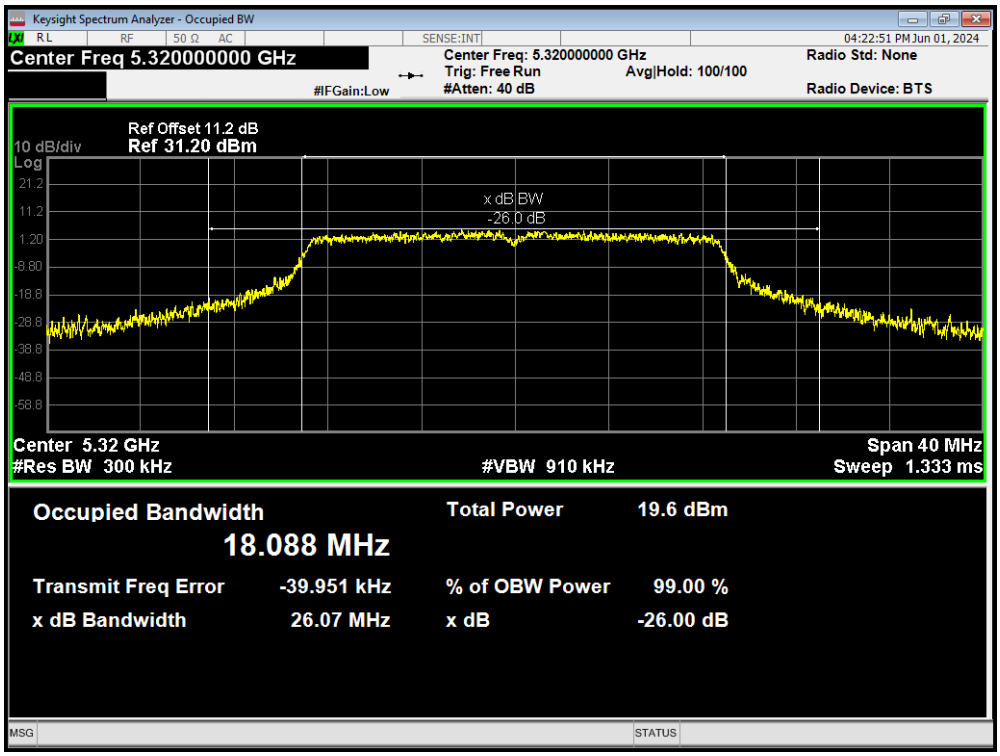
OBW 802.11n(HT20) 5260MHz



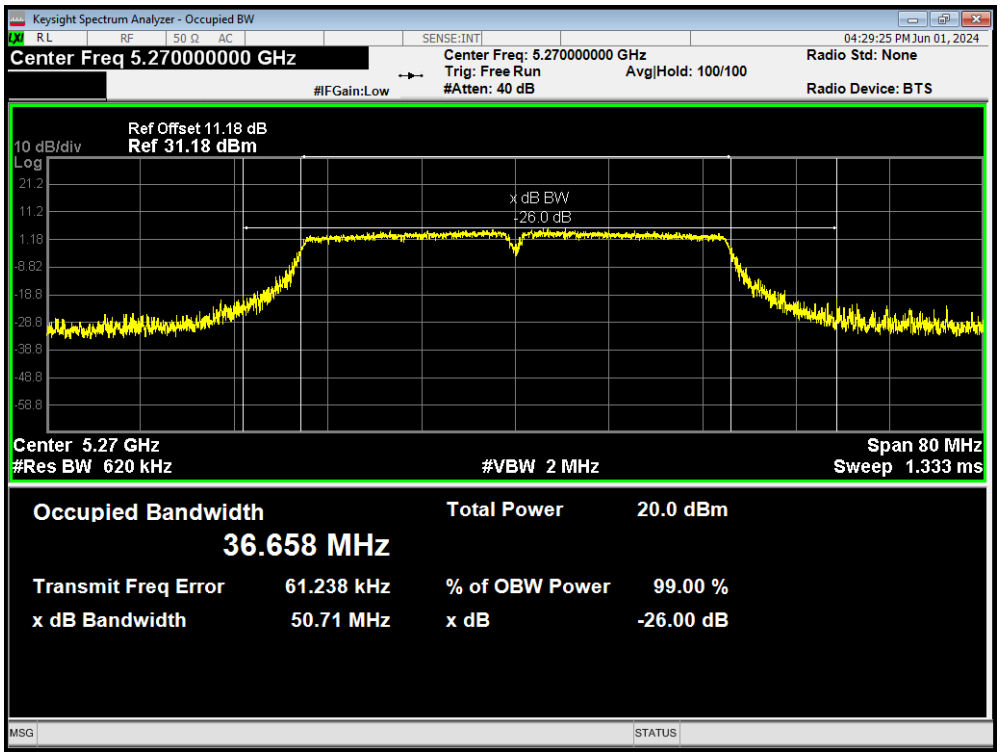
OBW 802.11n(HT20) 5300MHz



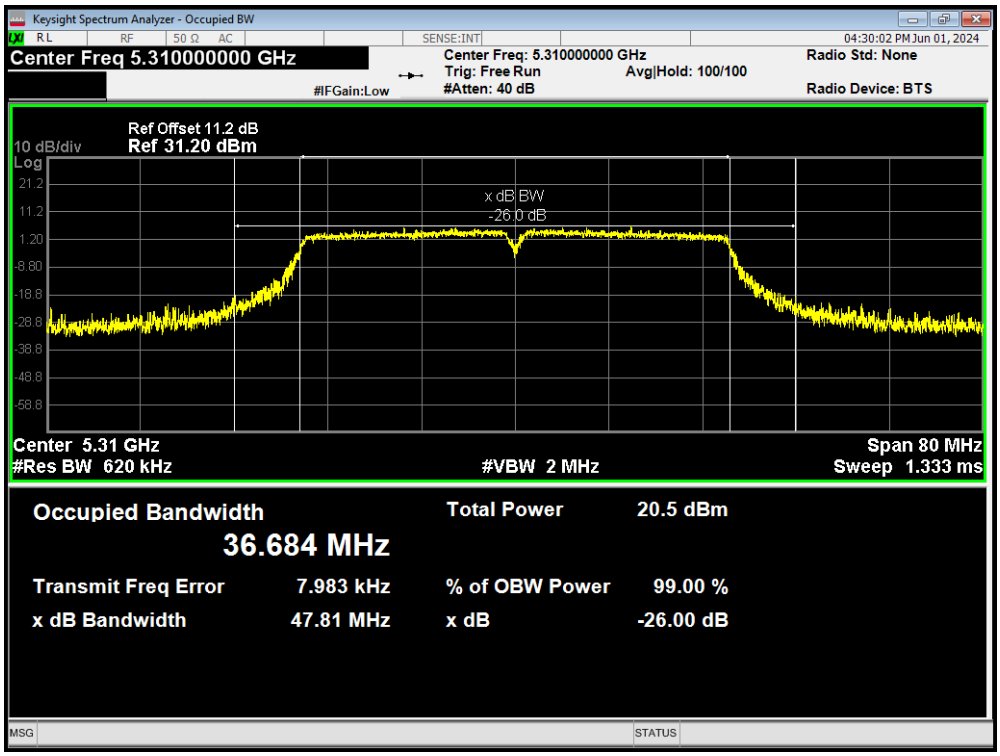
OBW 802.11n(HT20) 5320MHz



OBW 802.11n(HT40) 5270MHz

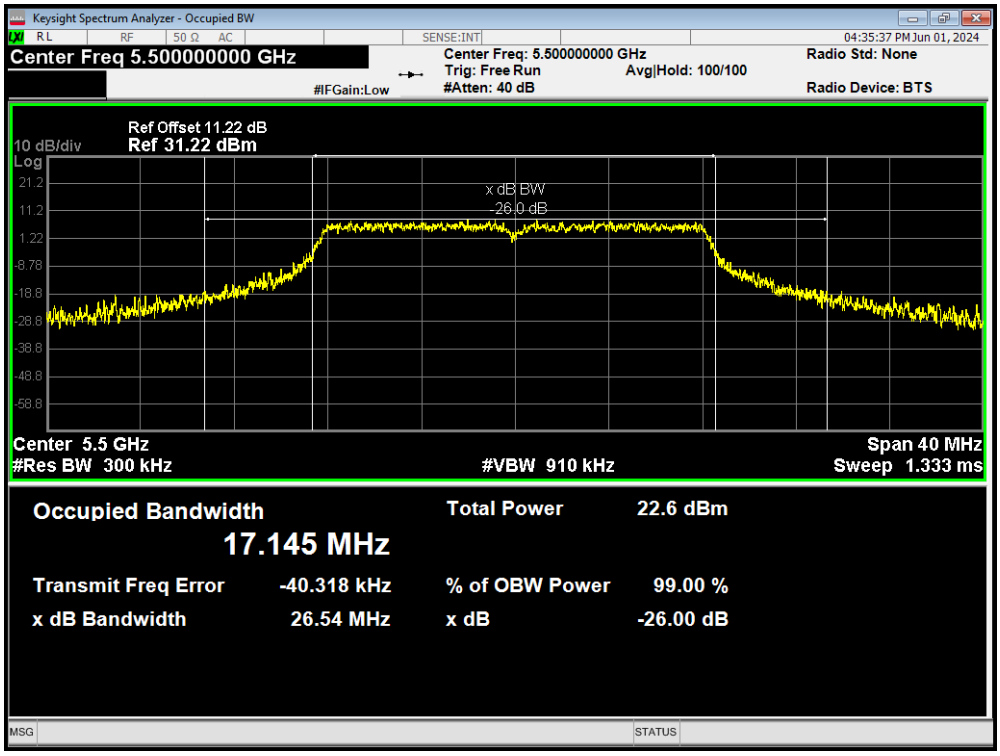


OBW 802.11n(HT40) 5310MHz

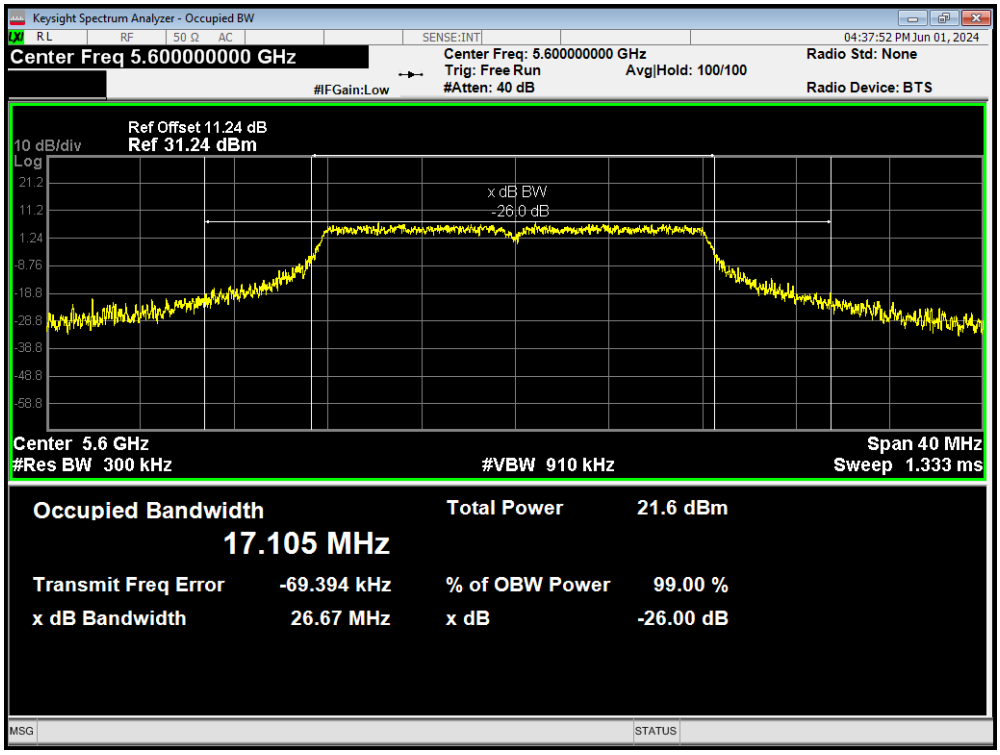


U-NII-2C

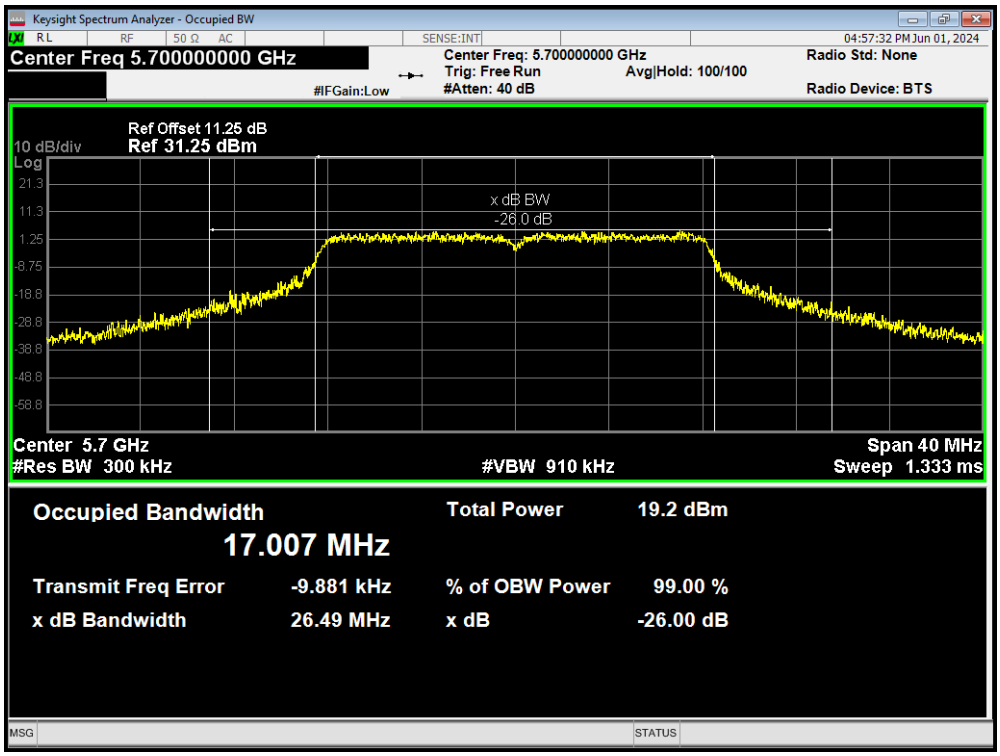
OBW 802.11a 5500MHz



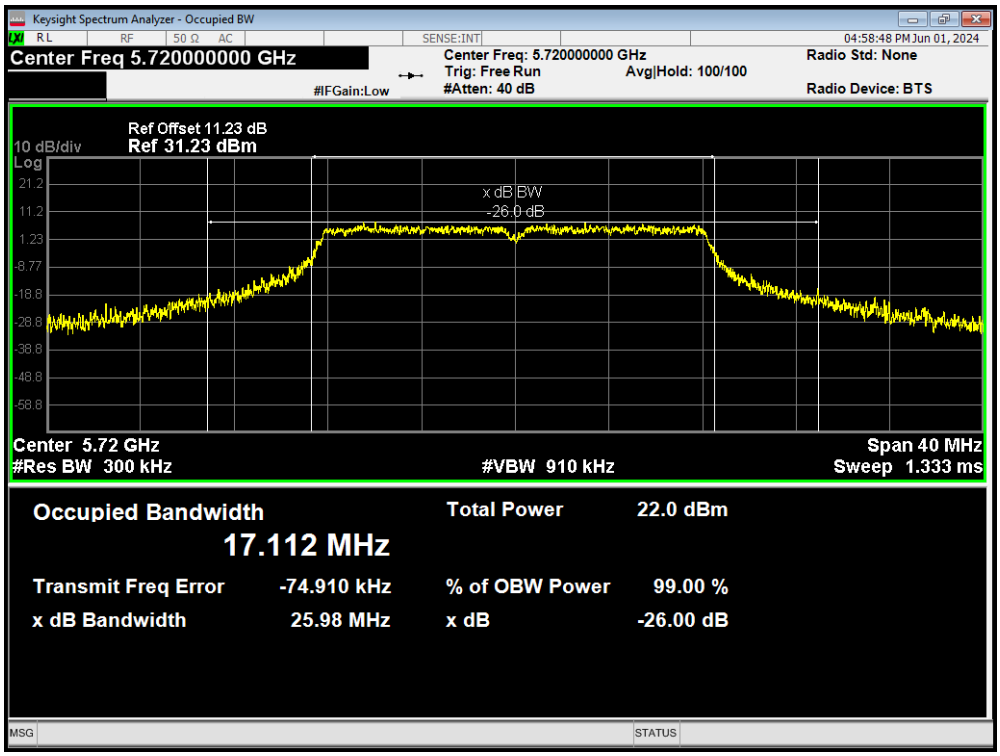
OBW 802.11a 5600MHz



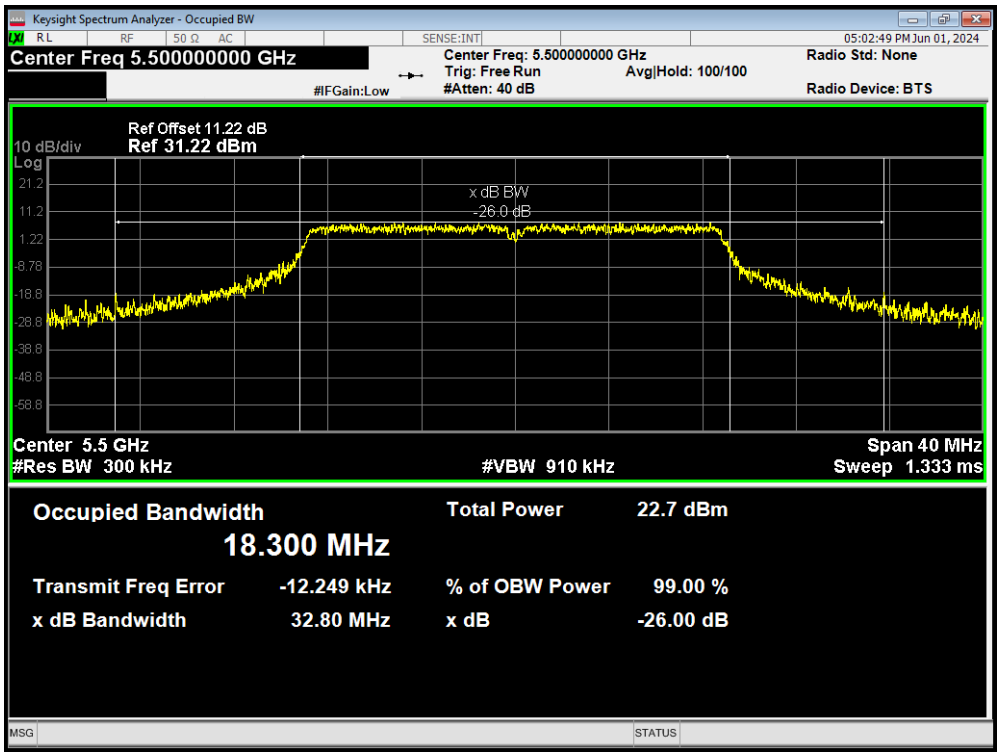
OBW 802.11a 5700MHz



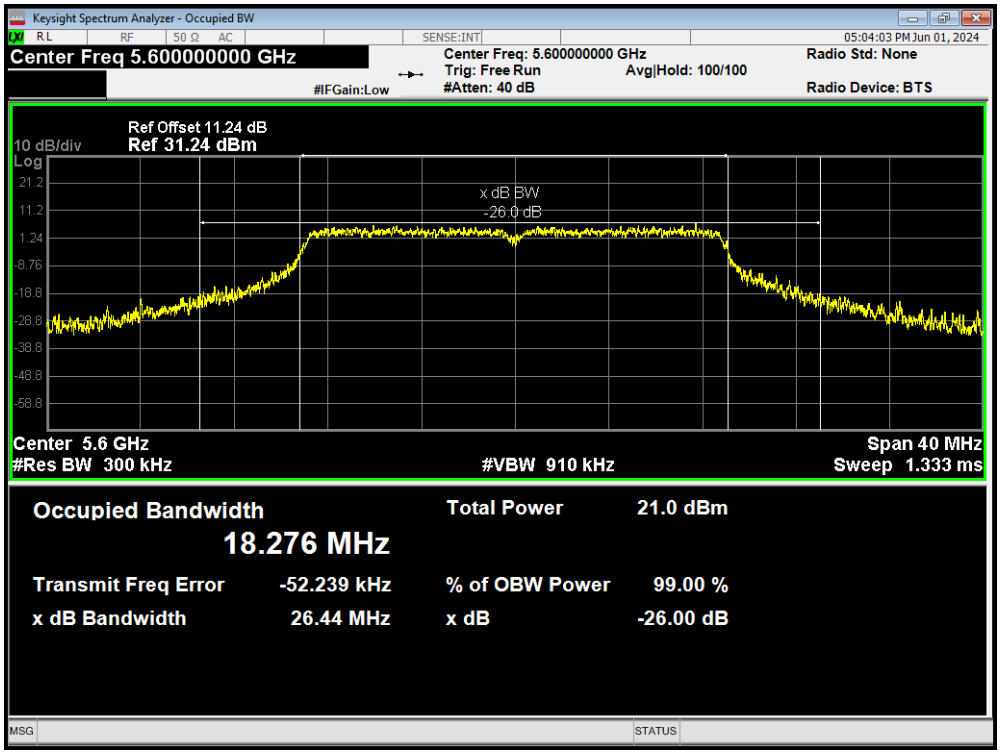
OBW 802.11a 5720MHz



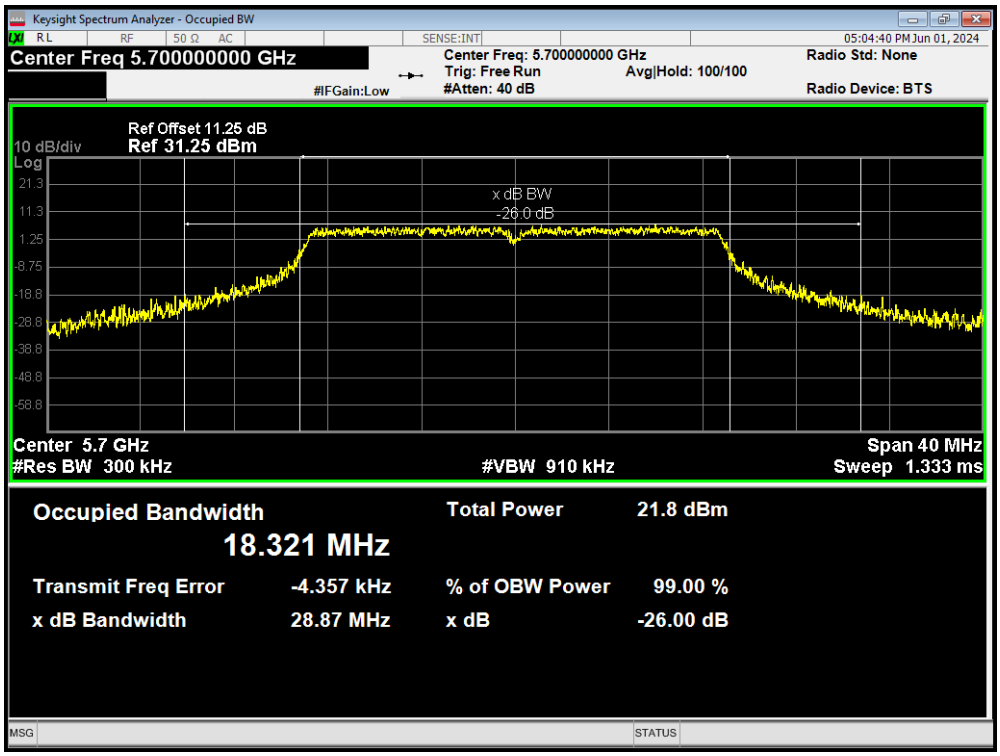
OBW 802.11ac(VHT20) 5500MHz



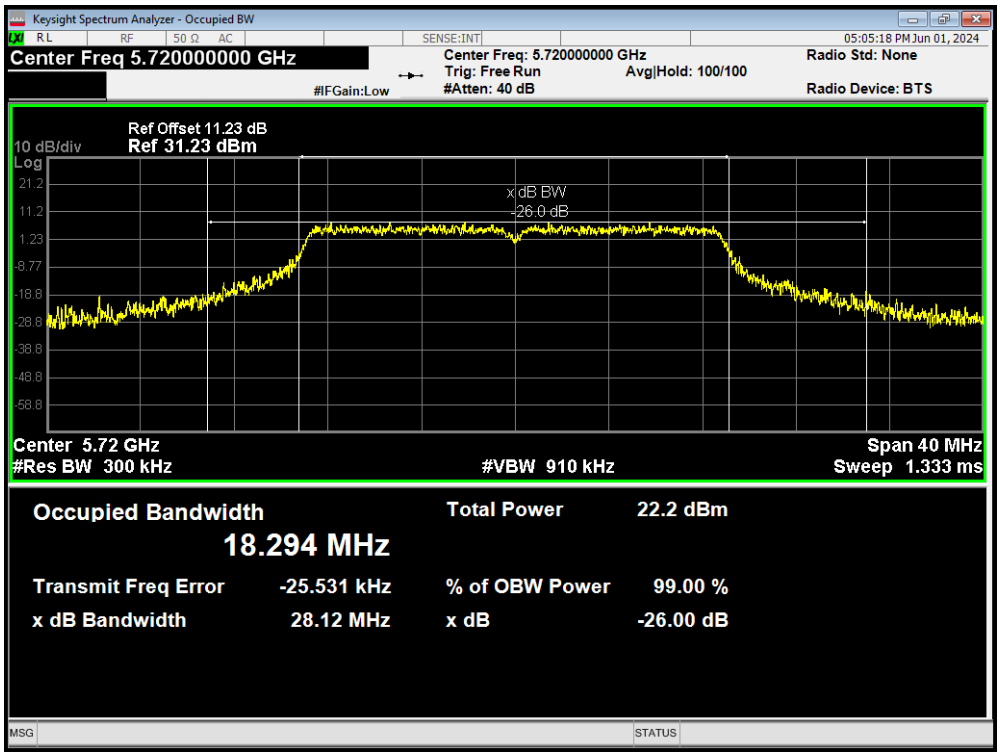
OBW 802.11ac(VHT20) 5600MHz



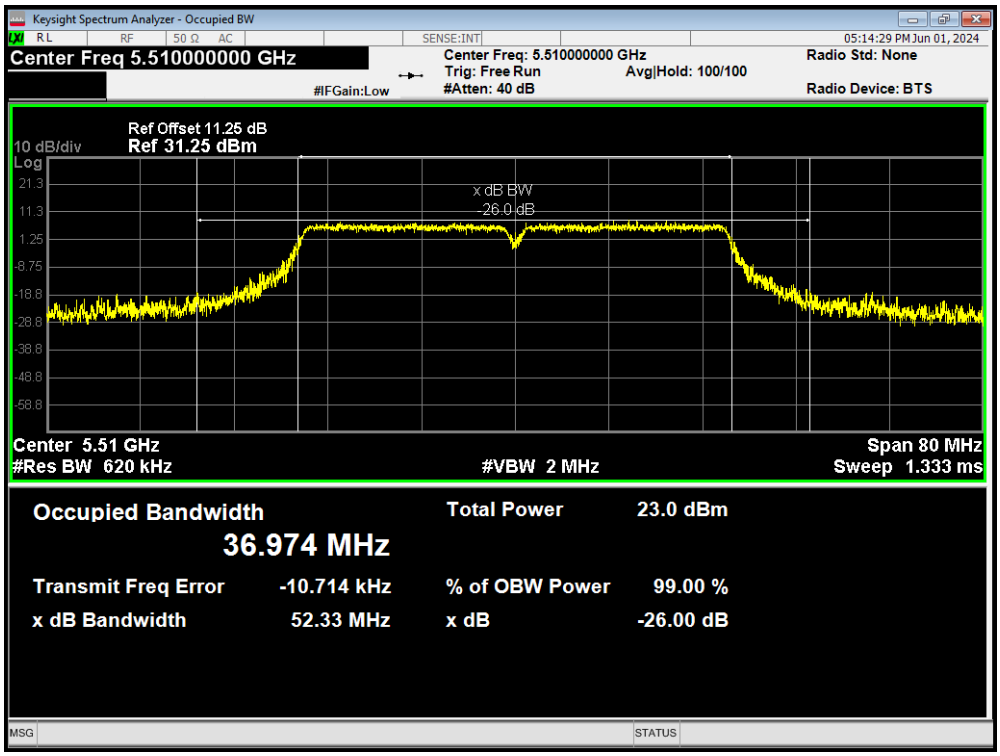
OBW 802.11ac(VHT20) 5700MHz



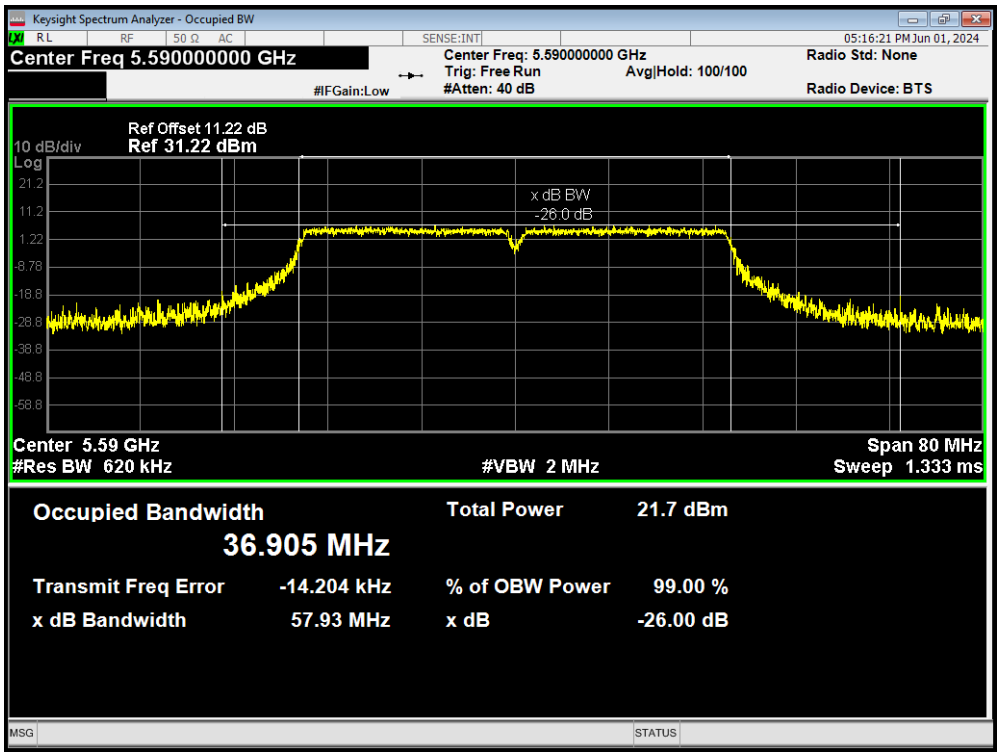
OBW 802.11ac(VHT20) 5720MHz



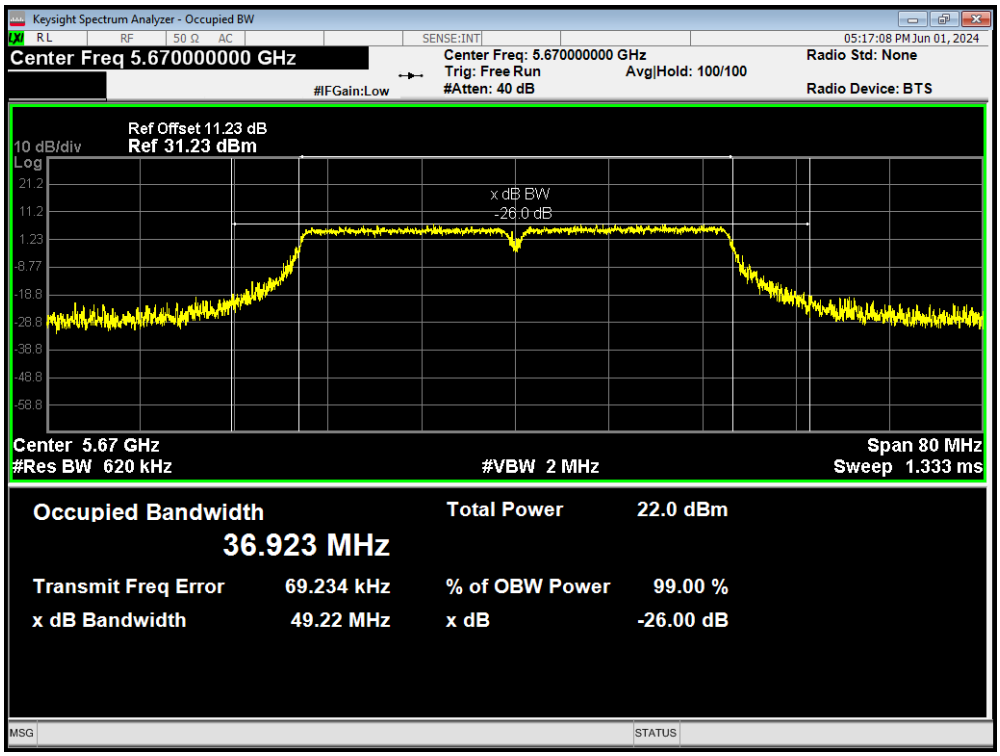
OBW 802.11ac(VHT40) 5510MHz



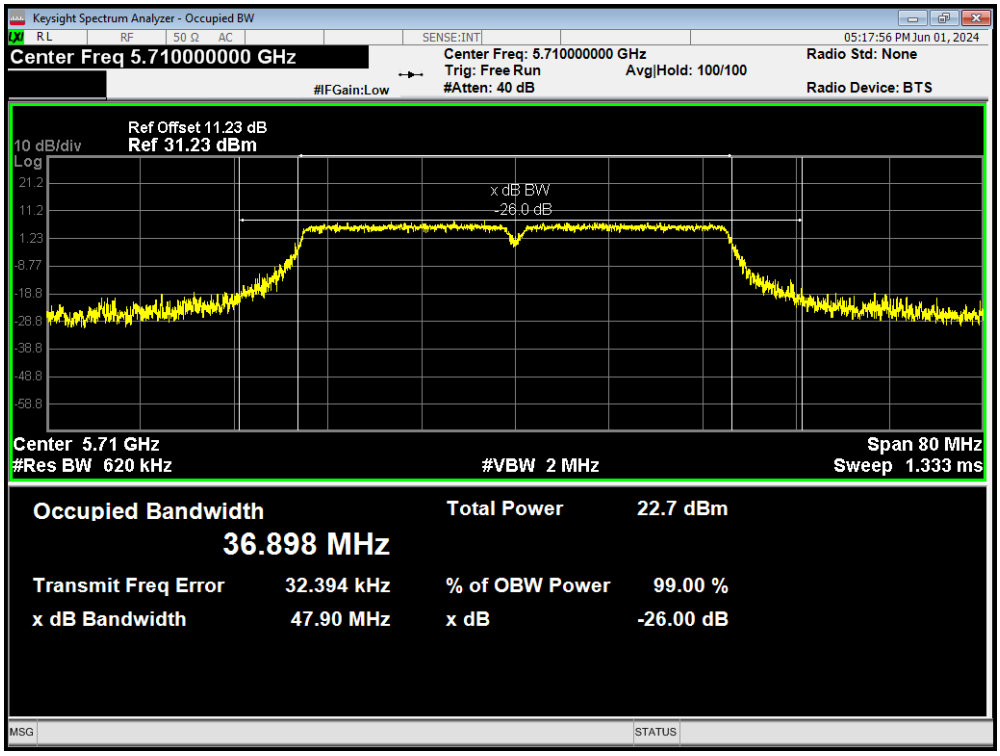
OBW 802.11ac(VHT40) 5590MHz



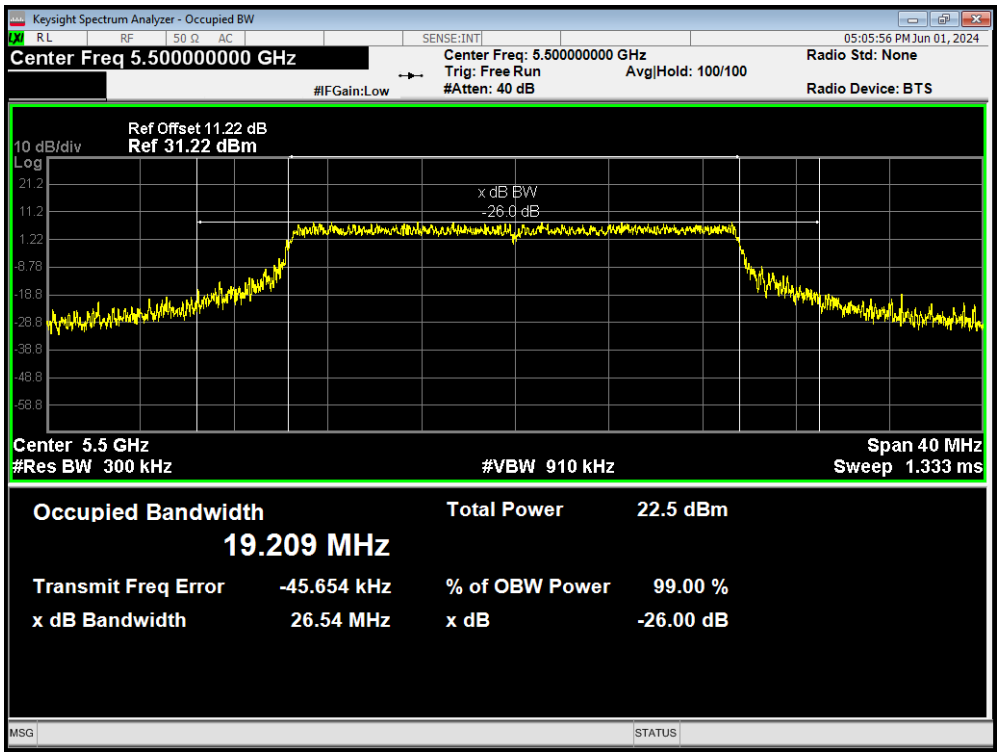
OBW 802.11ac(VHT40) 5670MHz



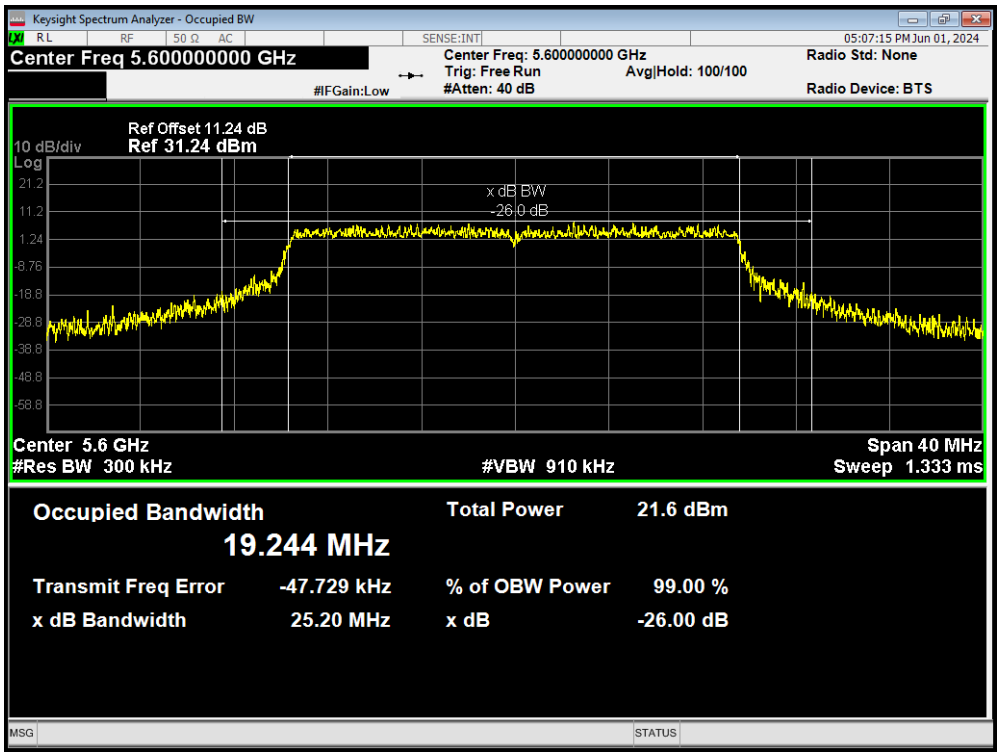
OBW 802.11ac(VHT40) 5710MHz



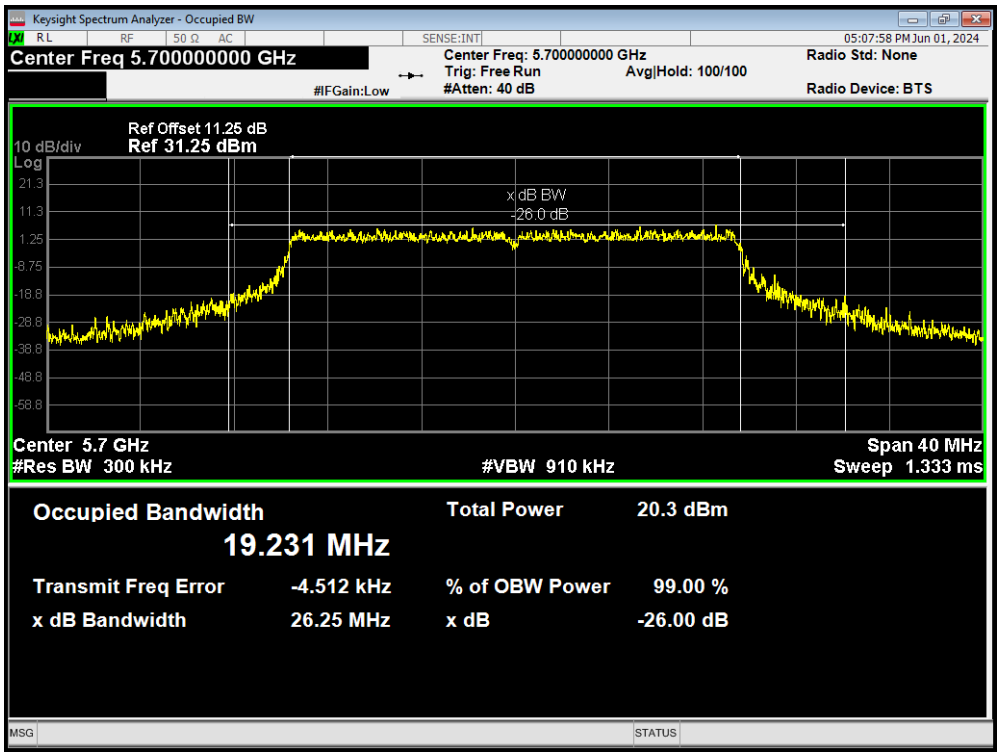
OBW 802.11ax(HE20) 5500MHz



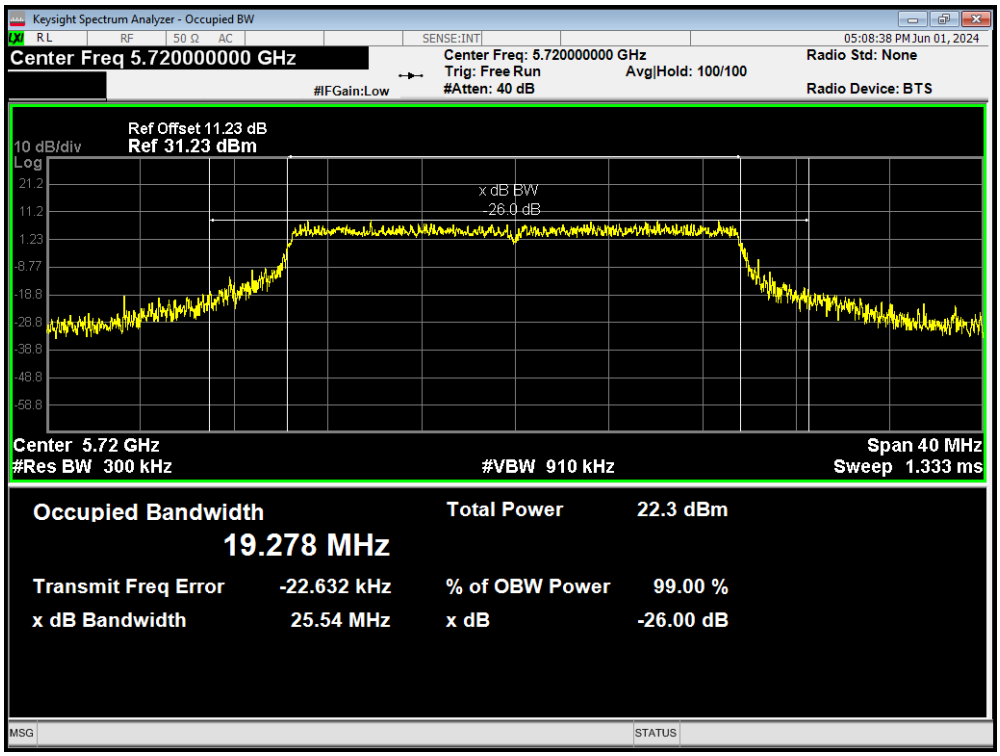
OBW 802.11ax(HE20) 5600MHz



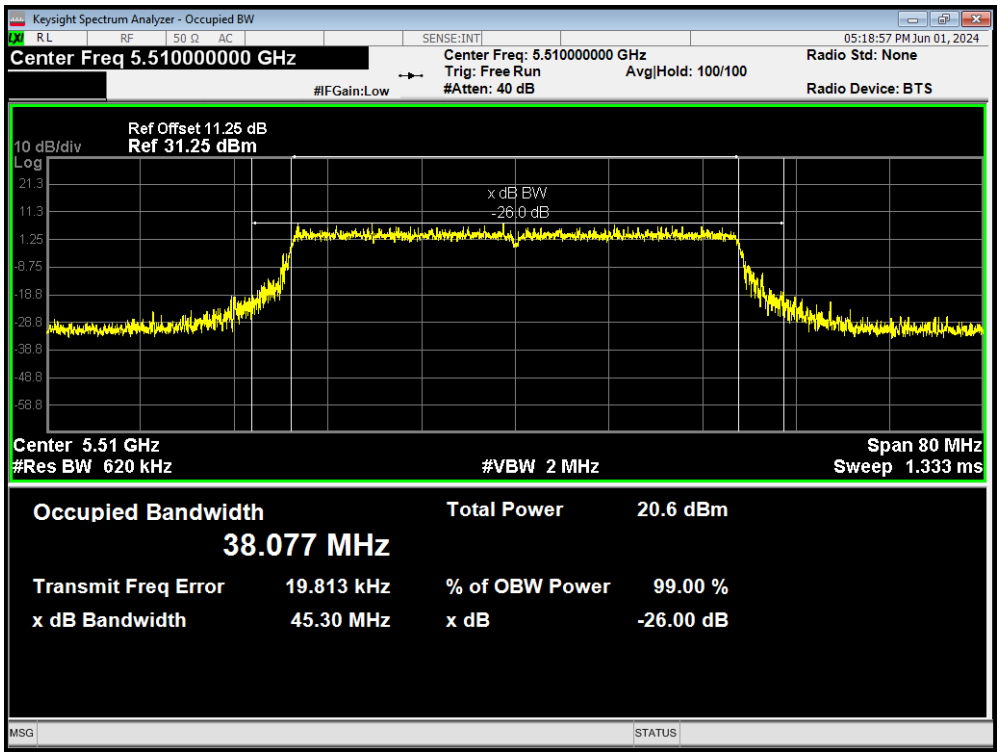
OBW 802.11ax(HE20) 5700MHz



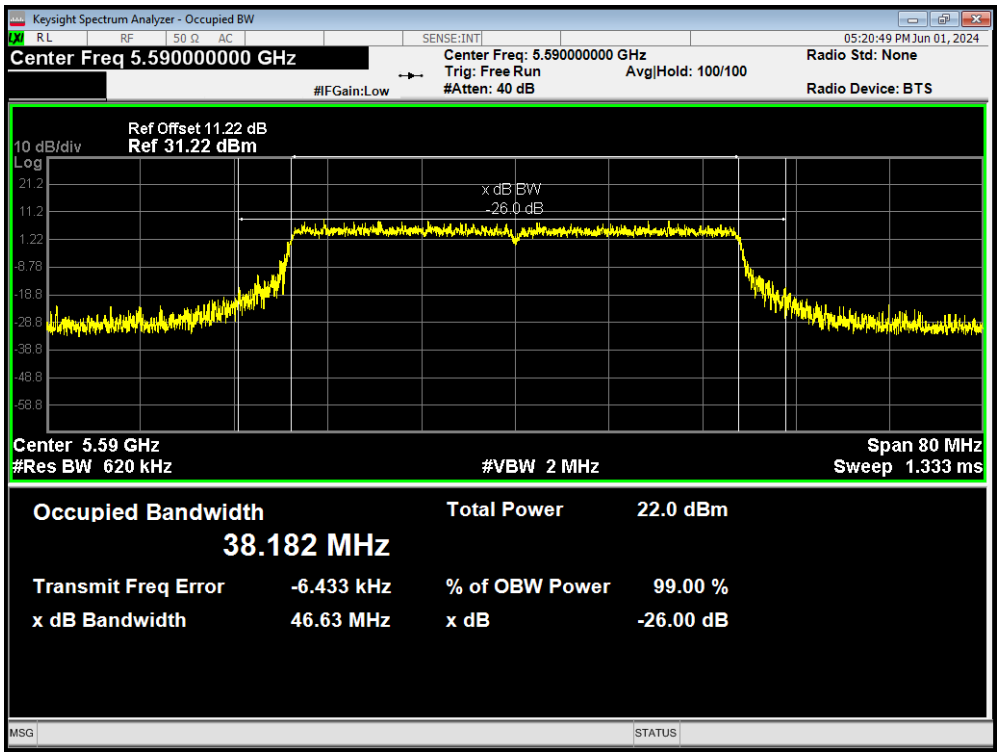
OBW 802.11ax(HE20) 5720MHz



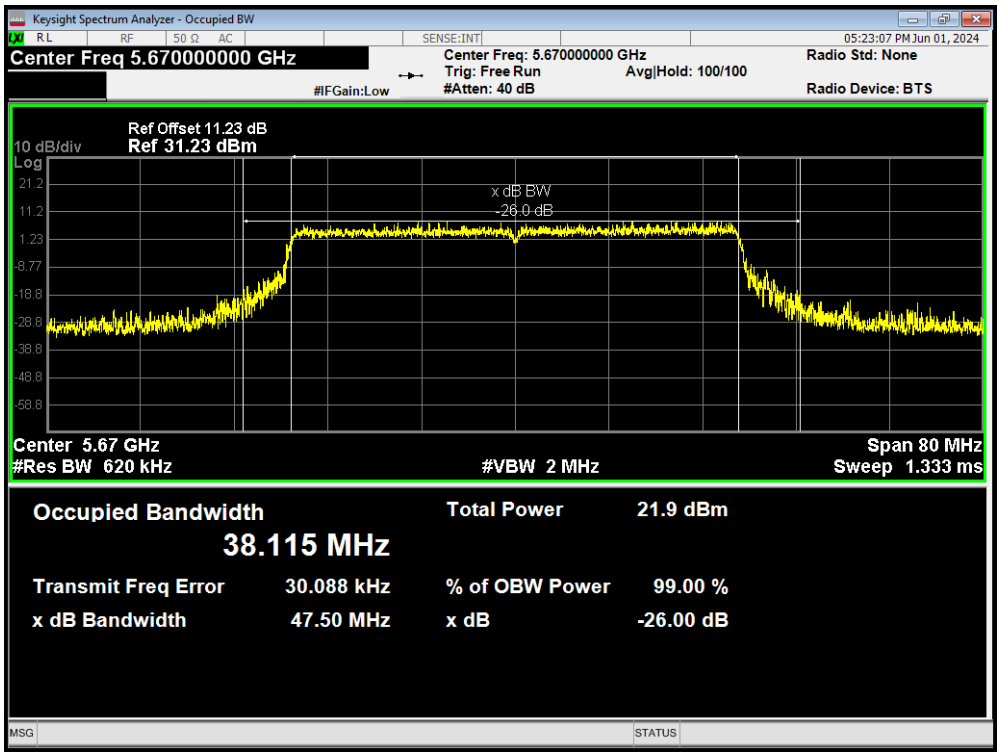
OBW 802.11ax(HE40) 5510MHz



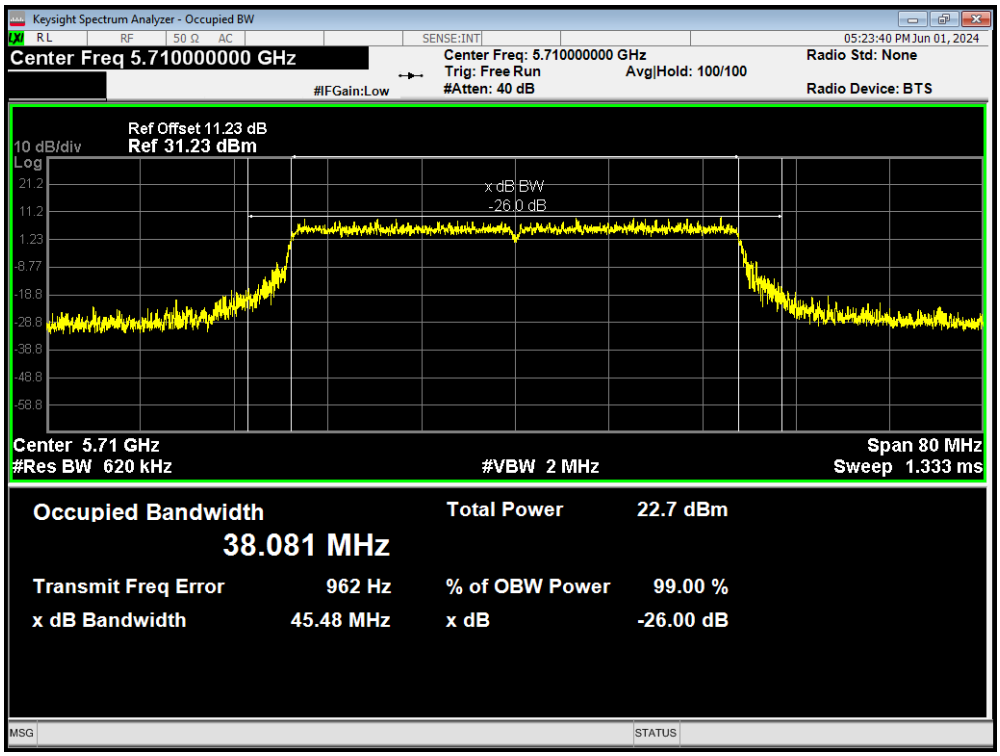
OBW 802.11ax(HE40) 5590MHz



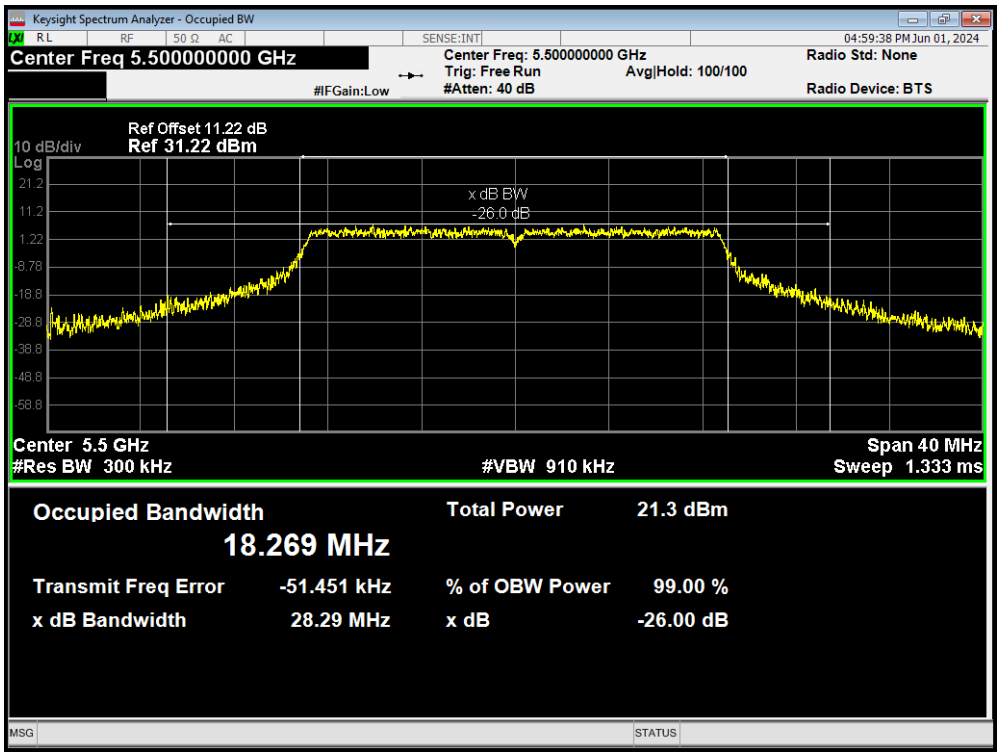
OBW 802.11ax(HE40) 5670MHz



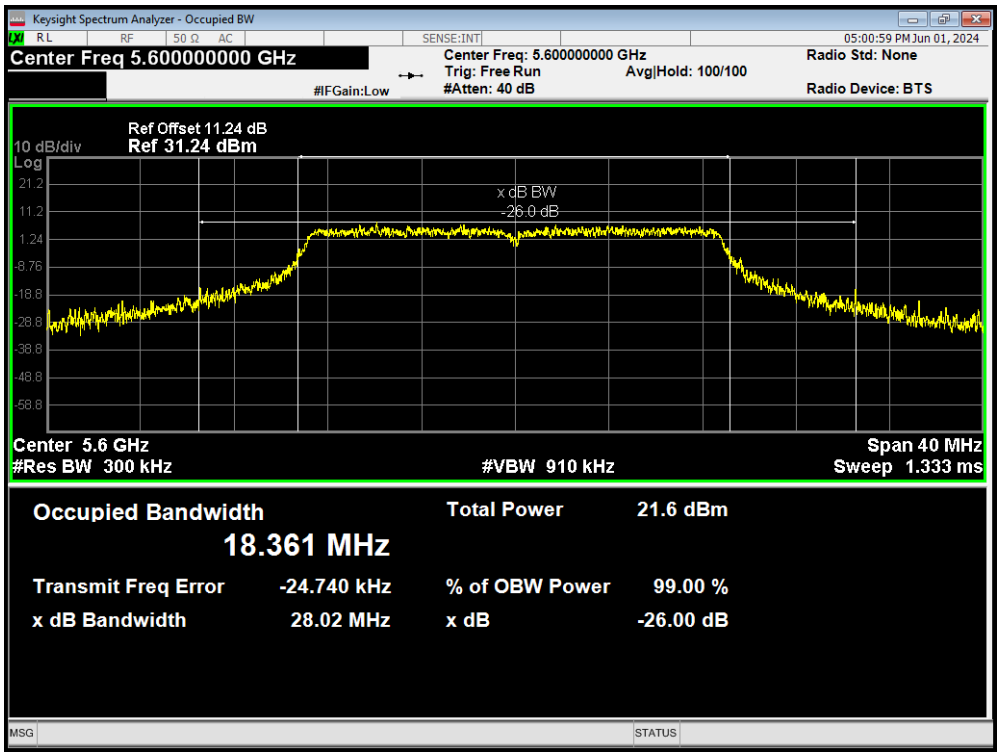
OBW 802.11ax(HE40) 5710MHz



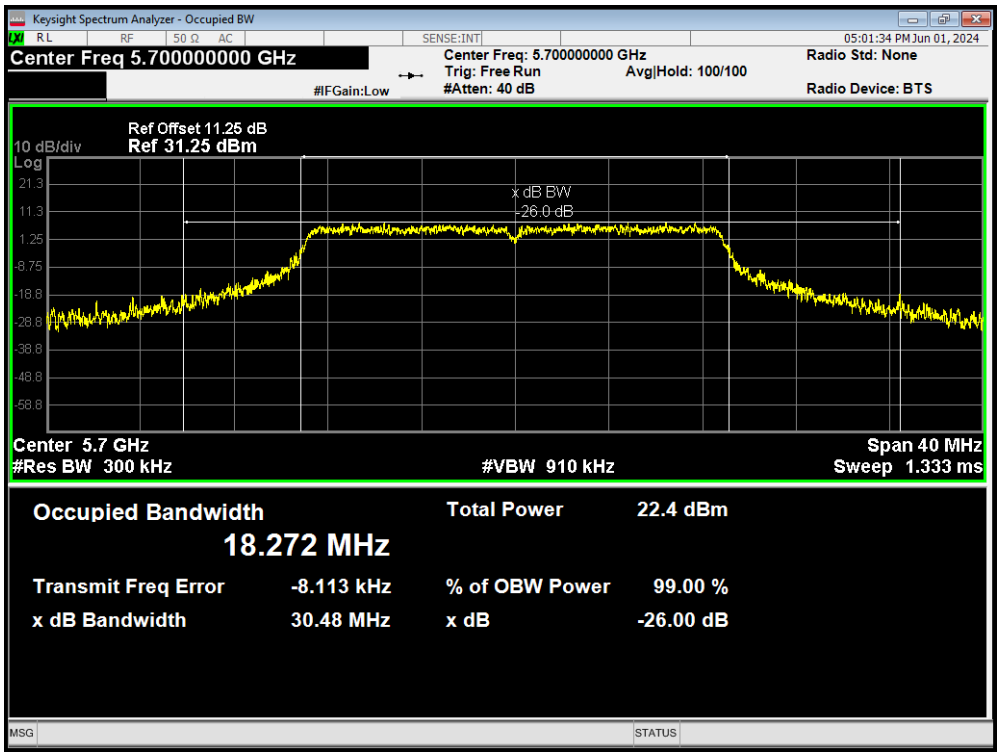
OBW 802.11n(HT20) 5500MHz



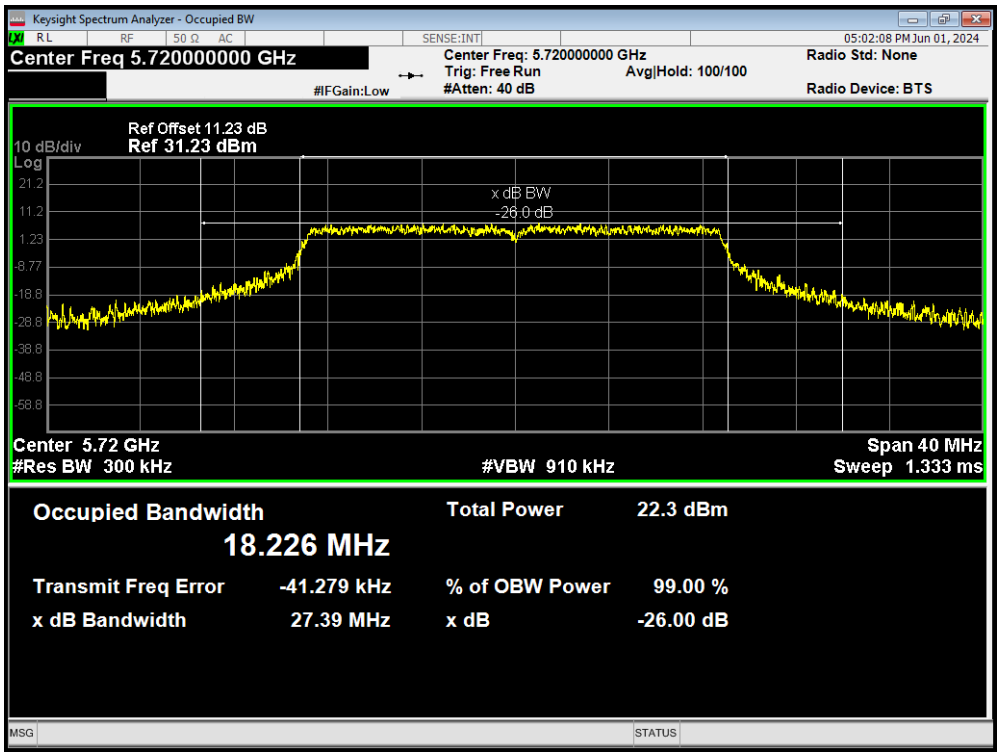
OBW 802.11n(HT20) 5600MHz



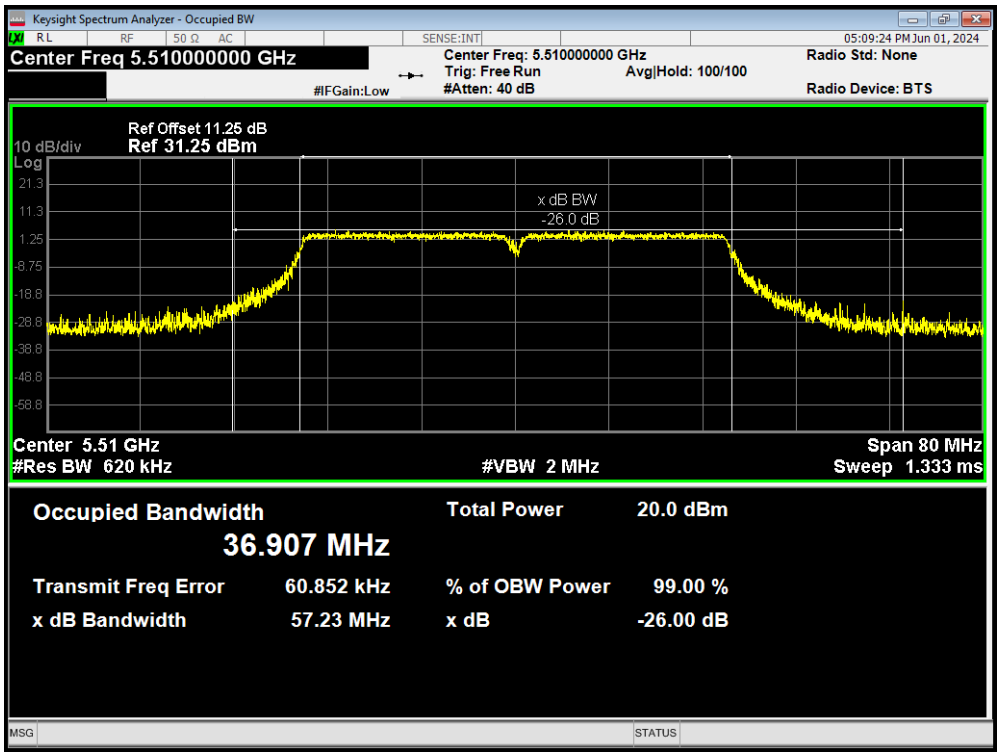
OBW 802.11n(HT20) 5700MHz



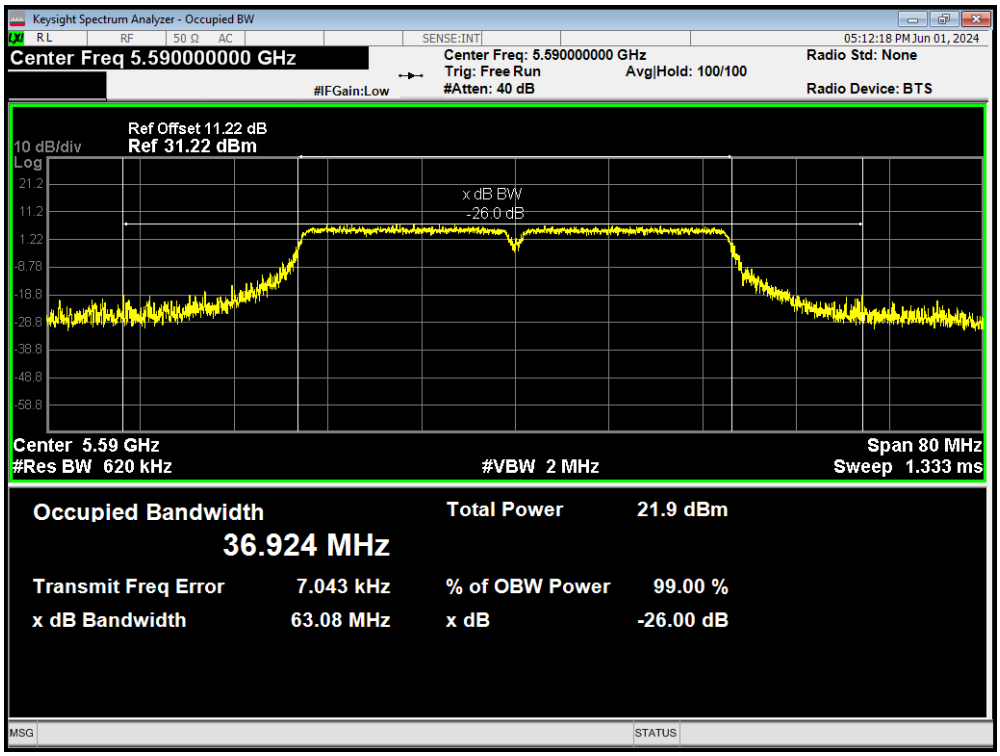
OBW 802.11n(HT20) 5720MHz



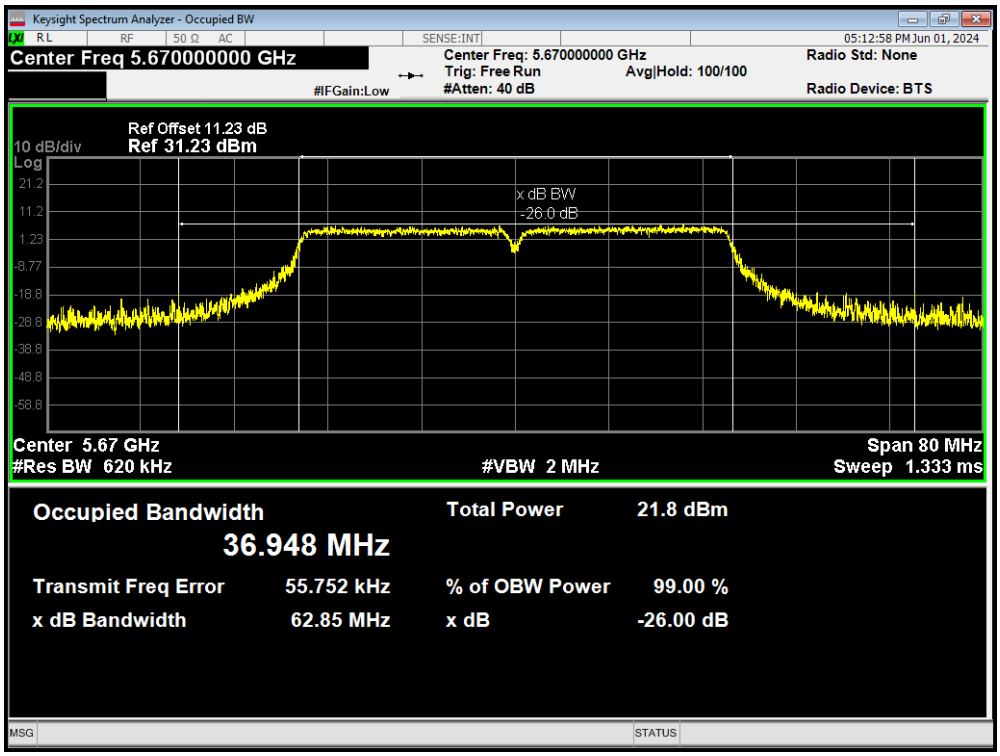
OBW 802.11n(HT40) 5510MHz



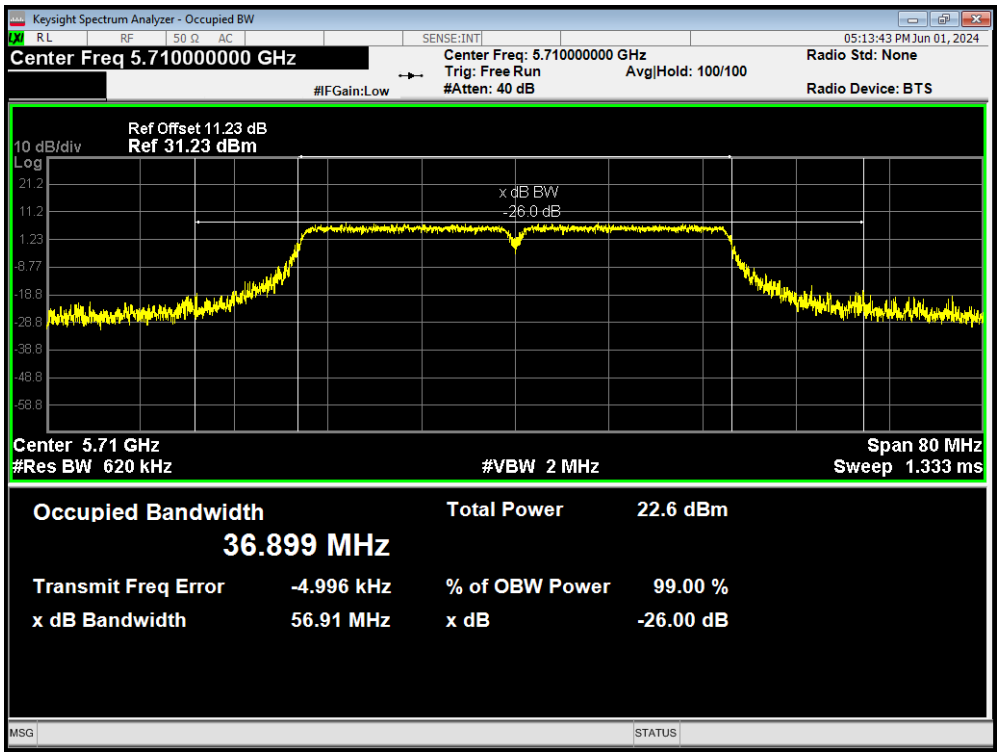
OBW 802.11n(HT40) 5590MHz



OBW 802.11n(HT40) 5670MHz

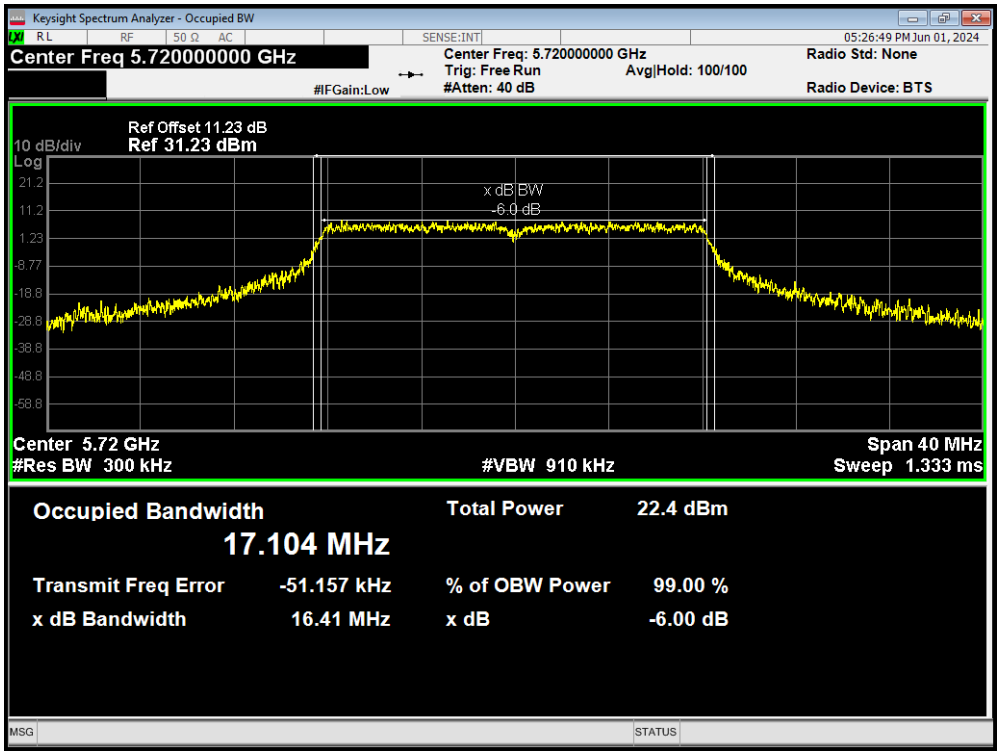


OBW 802.11n(HT40) 5710MHz

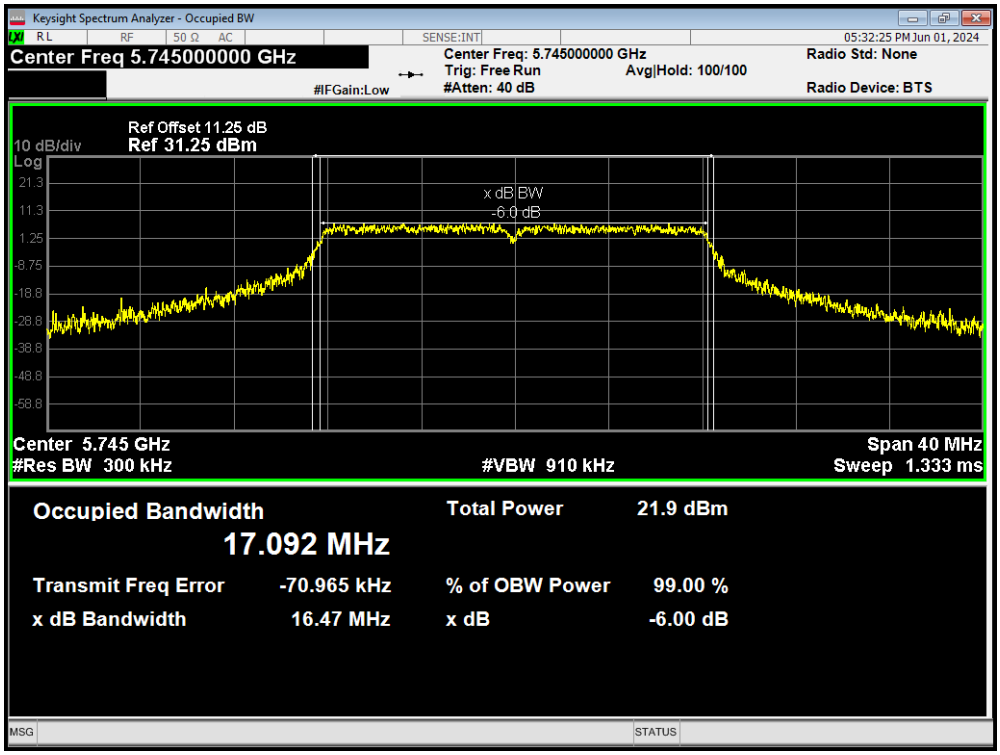


U-NII-3

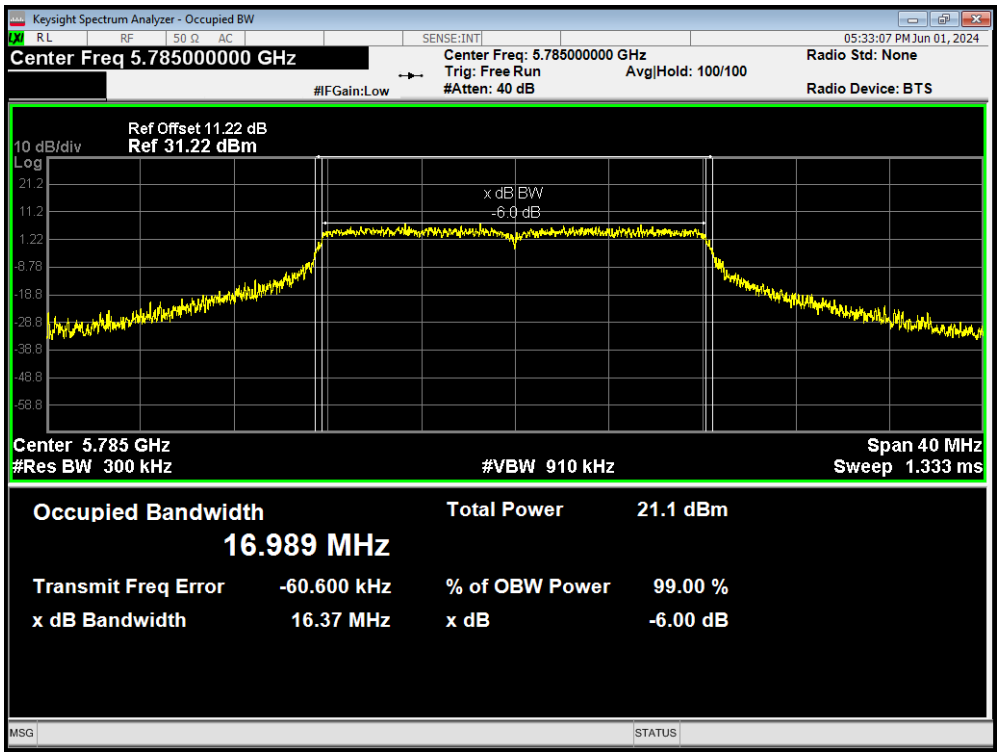
OBW 802.11a 5720MHz



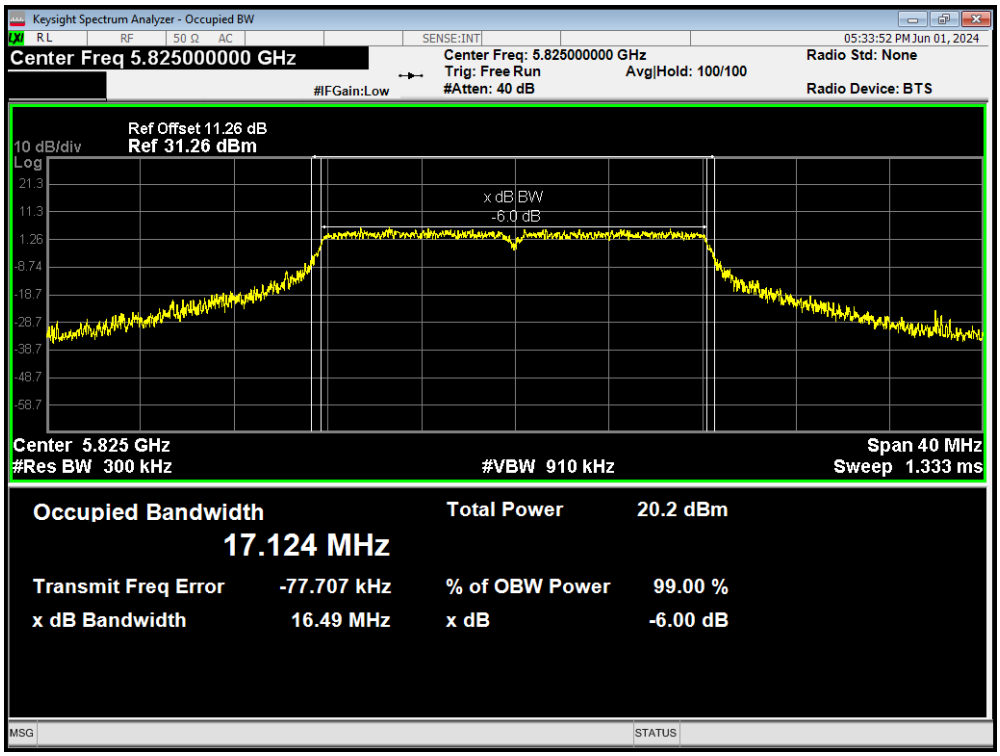
OBW 802.11a 5745MHz



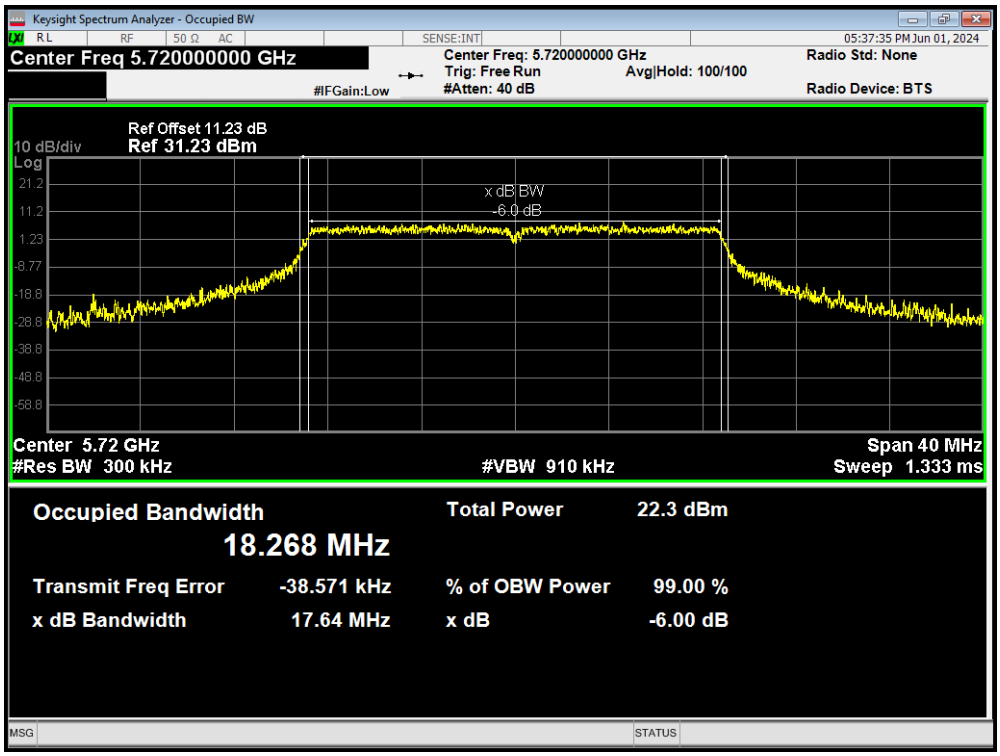
OBW 802.11a 5785MHz



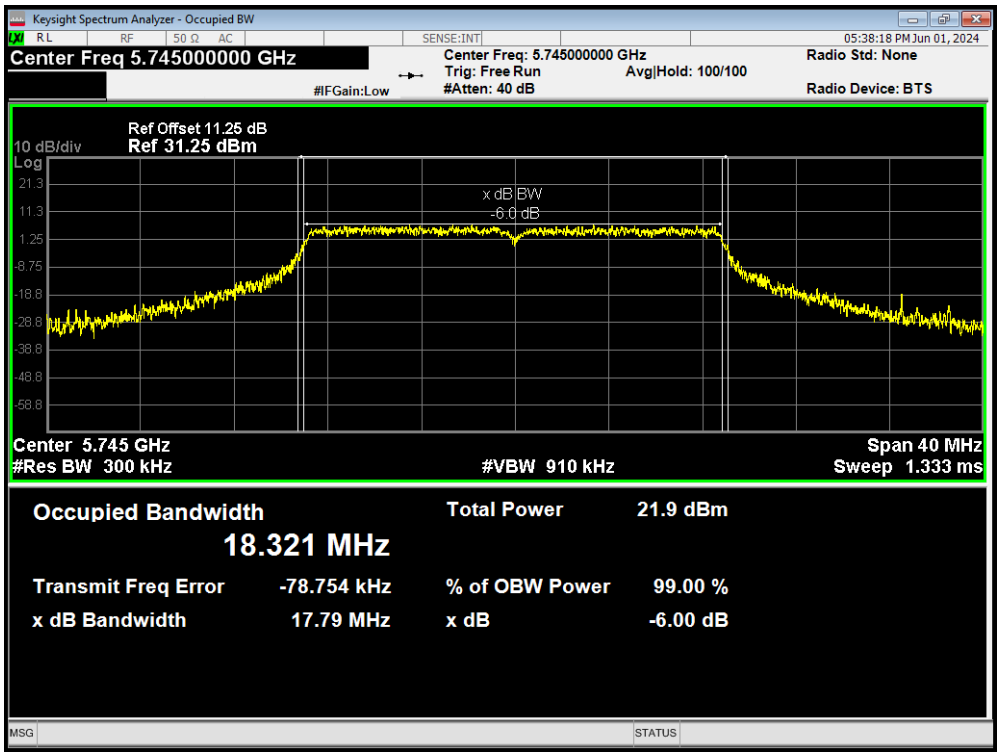
OBW 802.11a 5825MHz



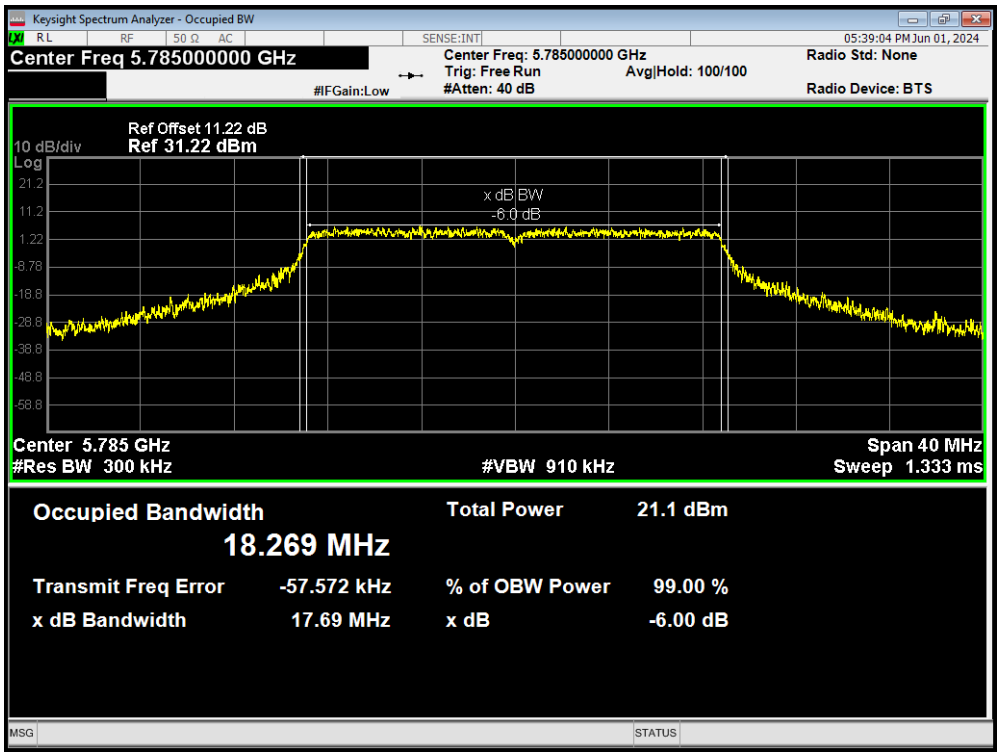
OBW 802.11ac(VHT20) 5720MHz



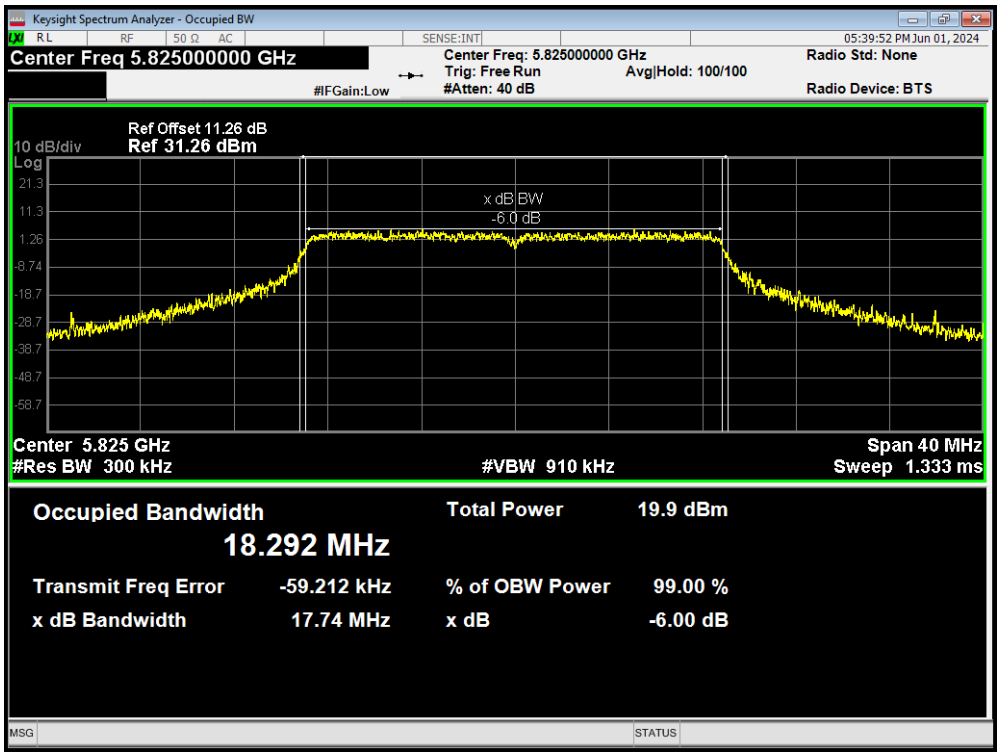
OBW 802.11ac(VHT20) 5745MHz



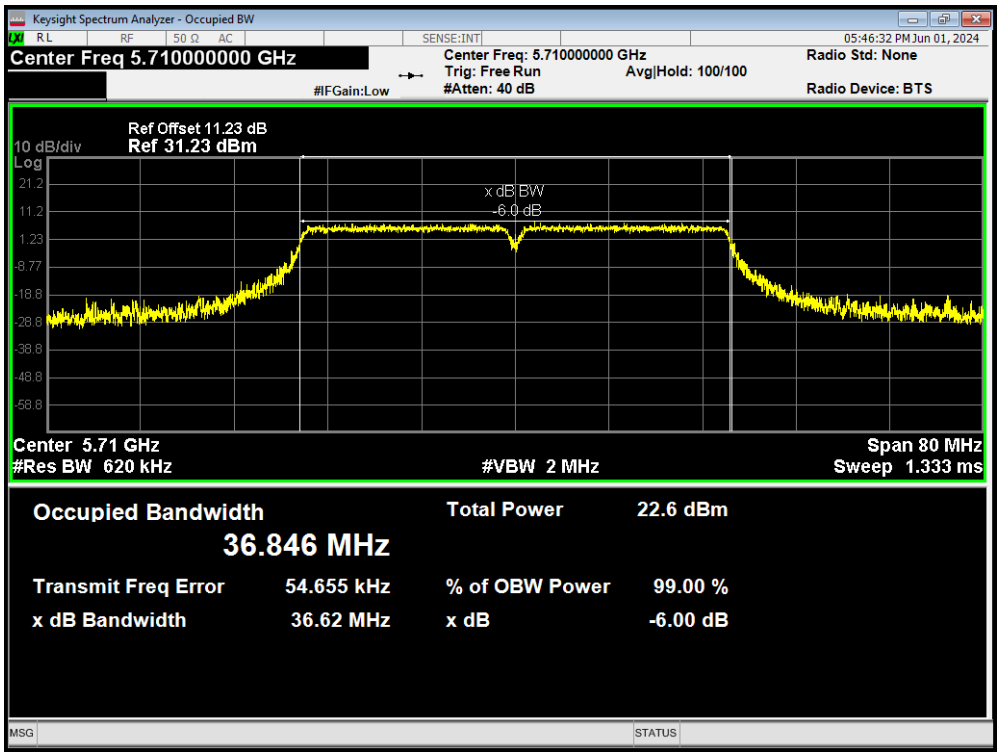
OBW 802.11ac(VHT20) 5785MHz



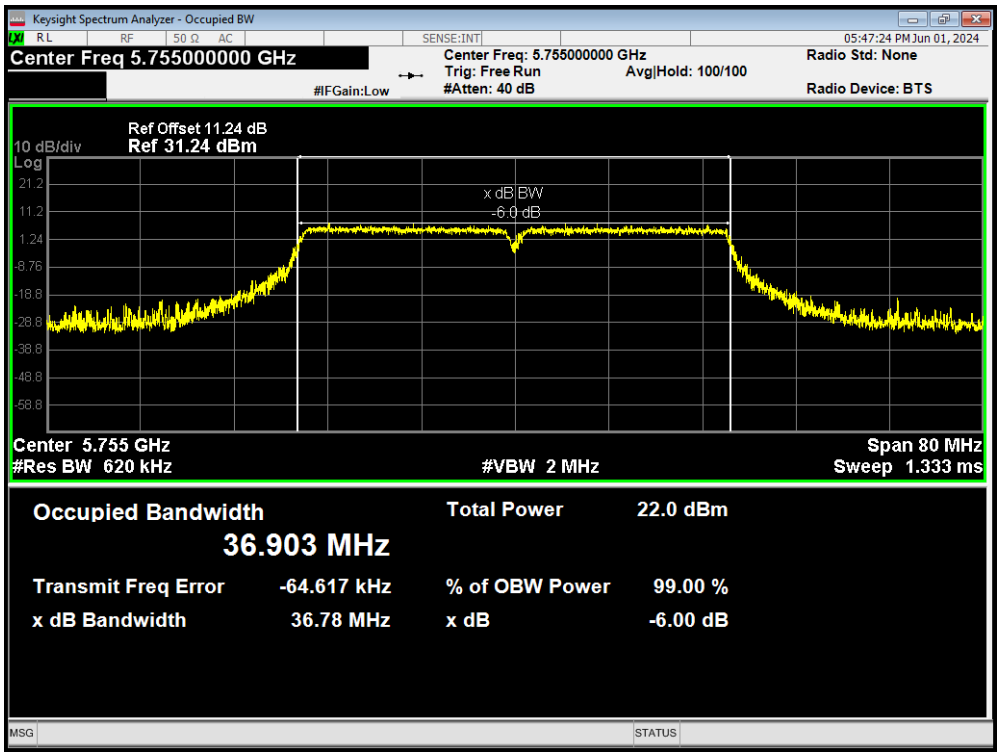
OBW 802.11ac(VHT20) 5825MHz



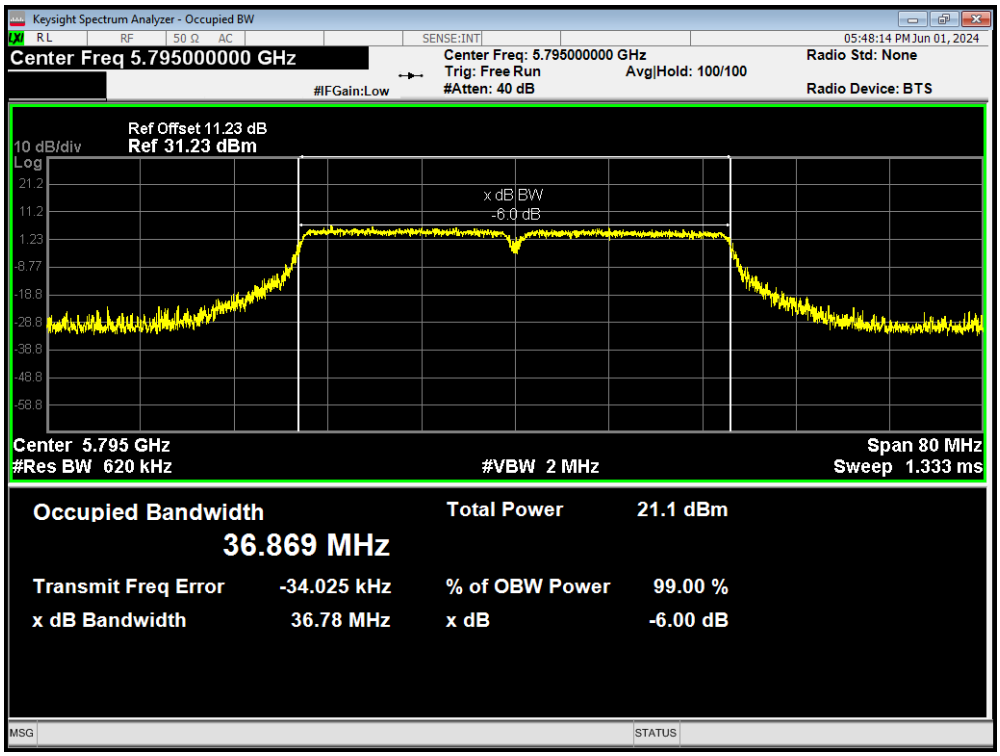
OBW 802.11ac(VHT40) 5710MHz



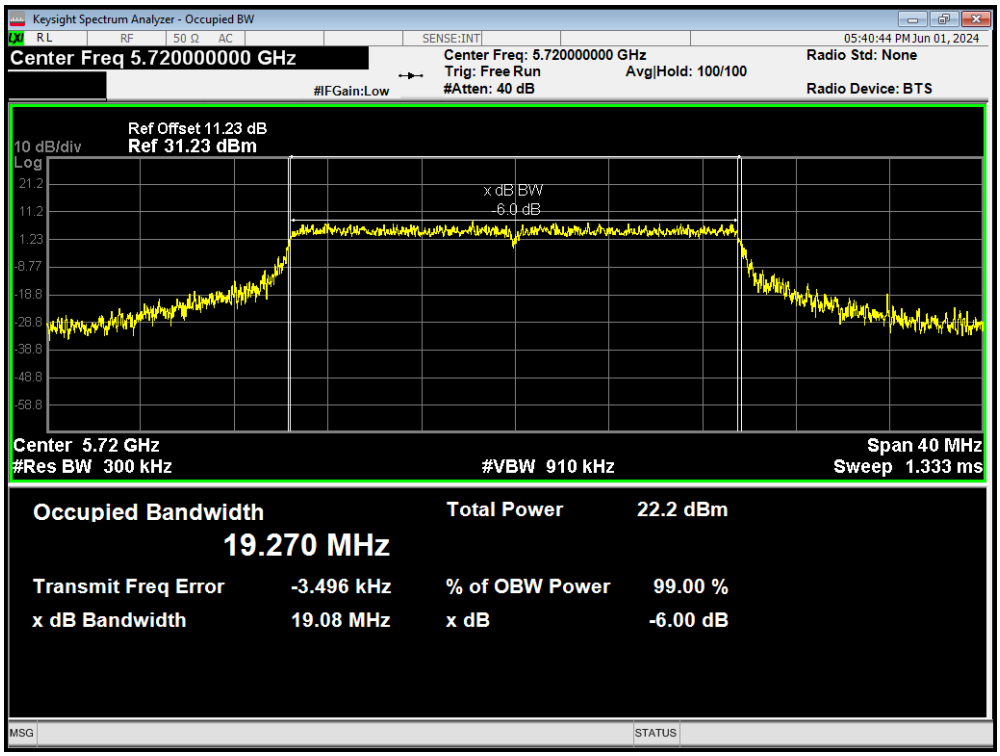
OBW 802.11ac(VHT40) 5755MHz



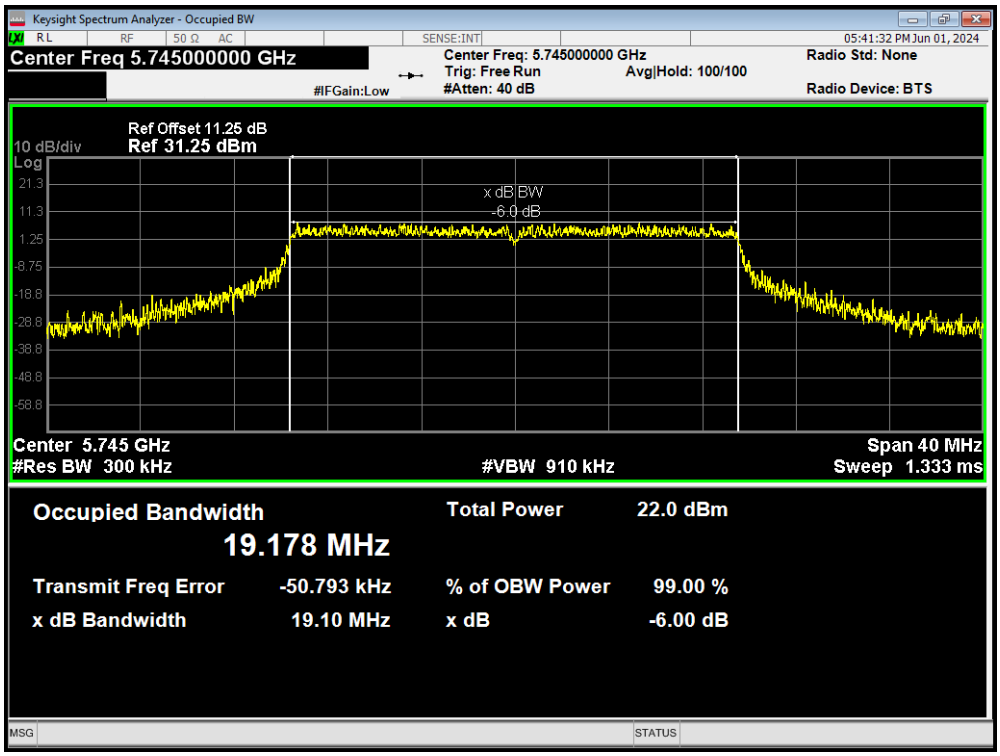
OBW 802.11ac(VHT40) 5795MHz



OBW 802.11ax(HE20) 5720MHz



OBW 802.11ax(HE20) 5745MHz



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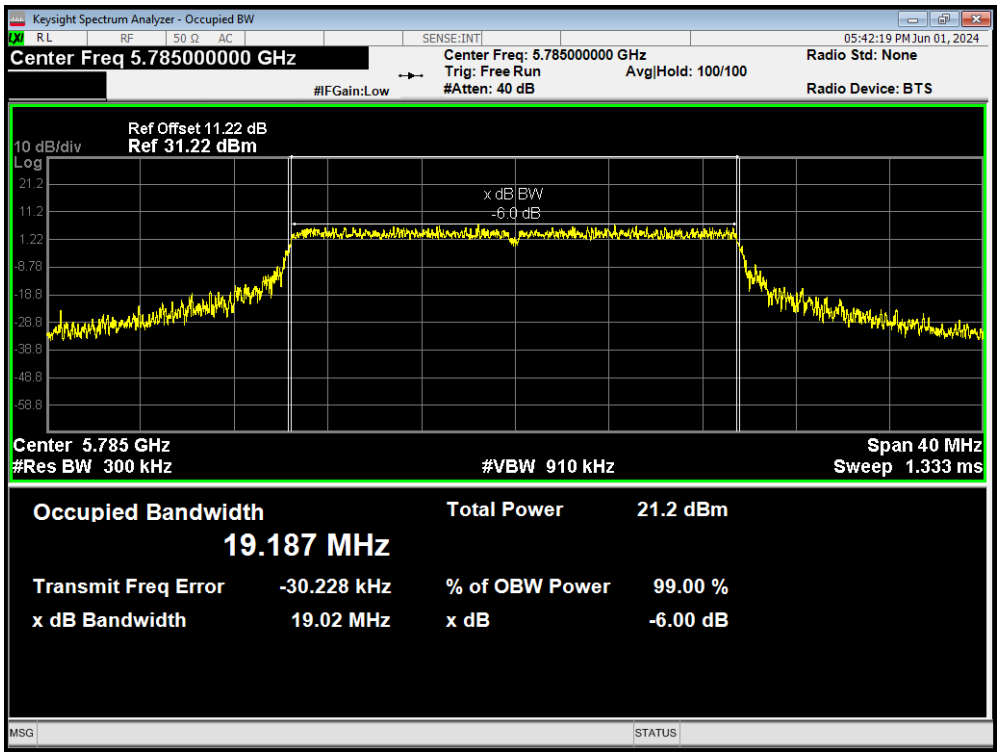
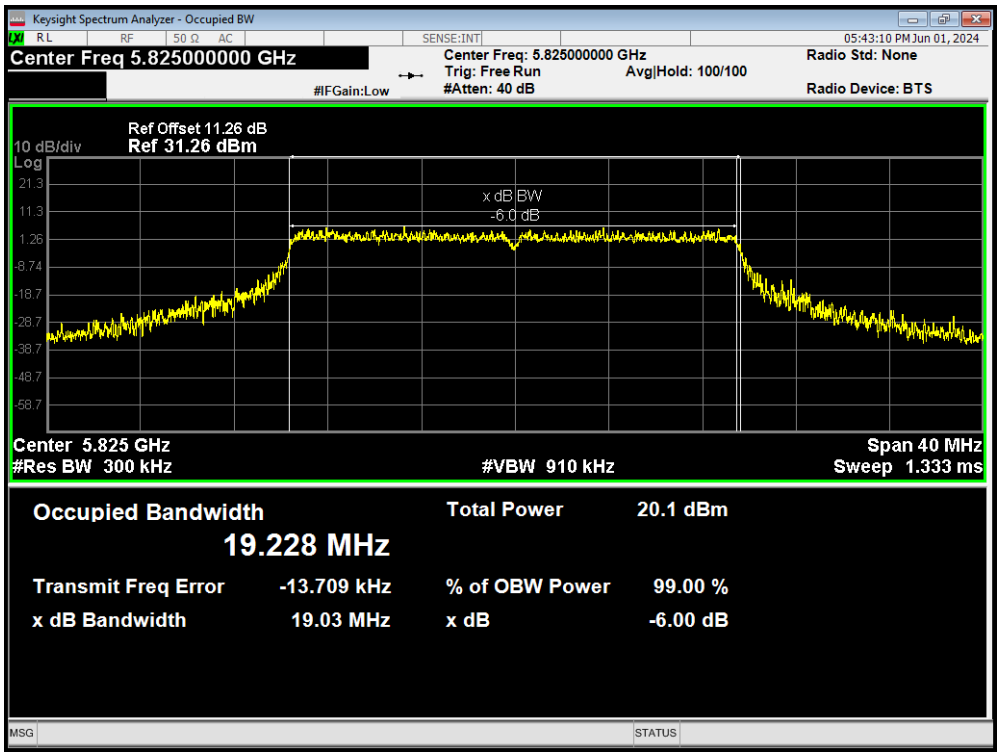


OBW 802.11ax(HE20) 5825MHz



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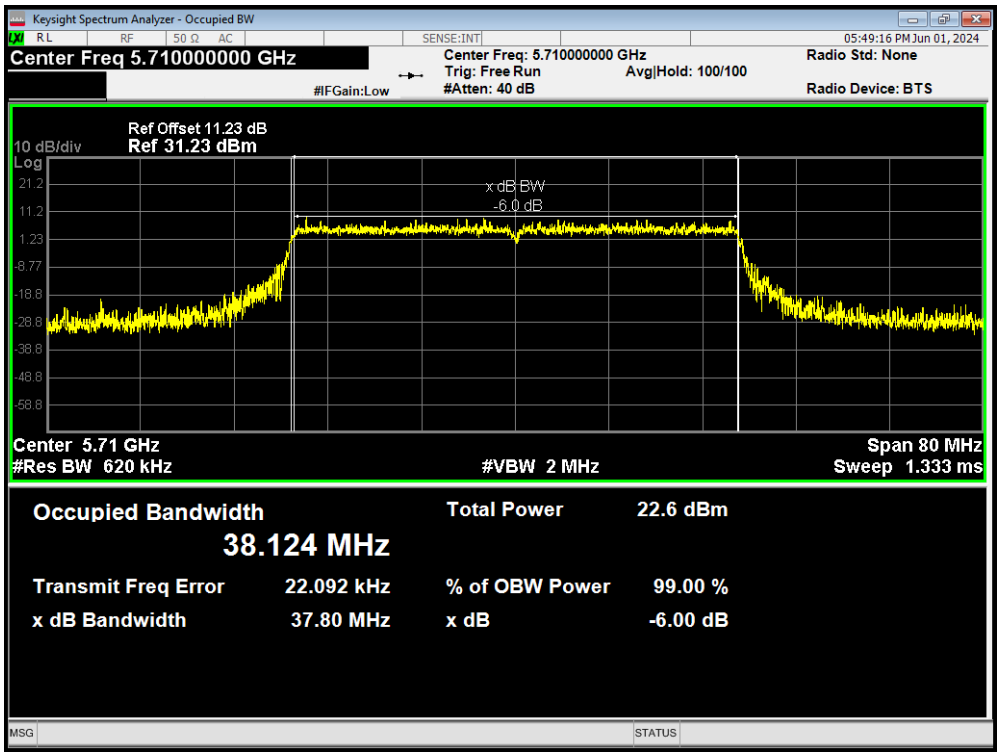
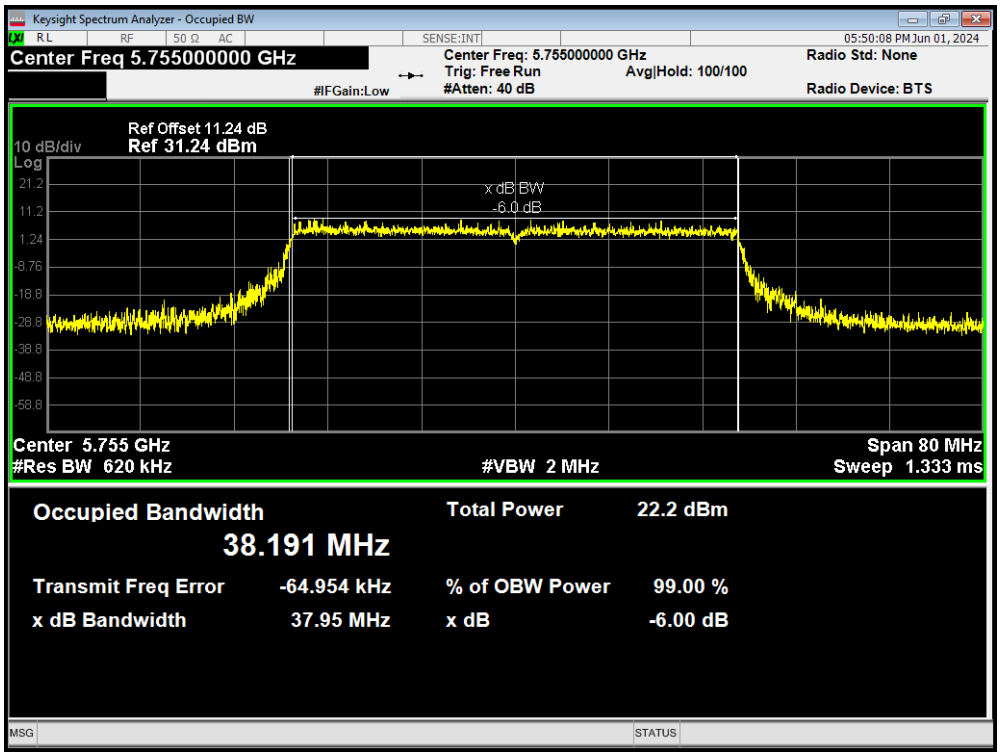


OBW 802.11ax(HE40) 5755MHz



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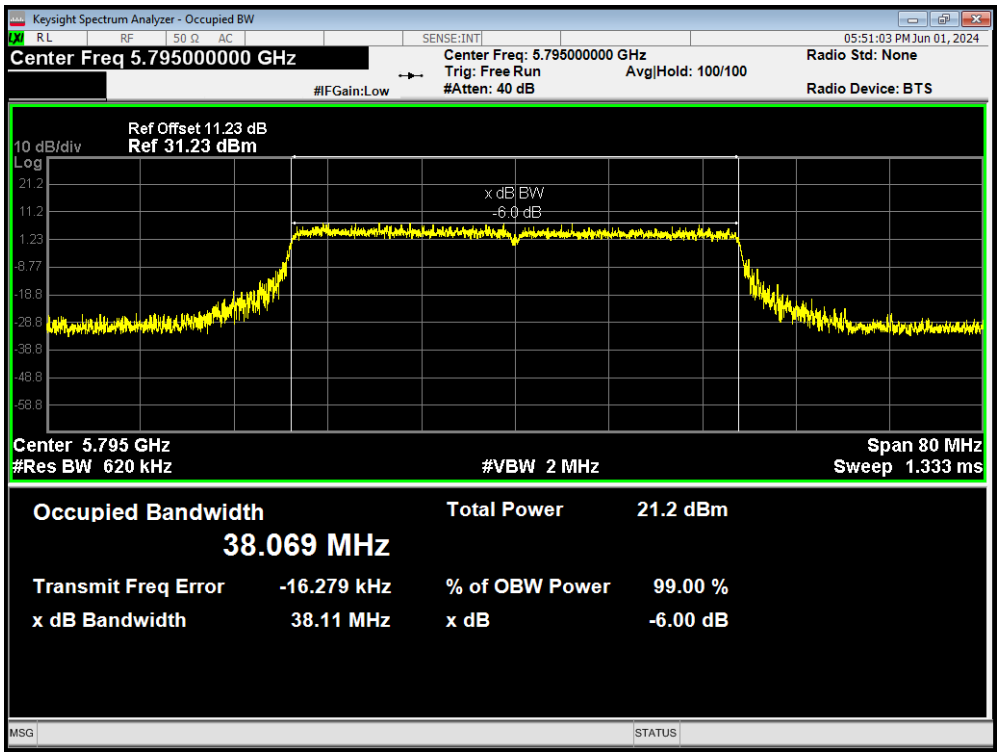
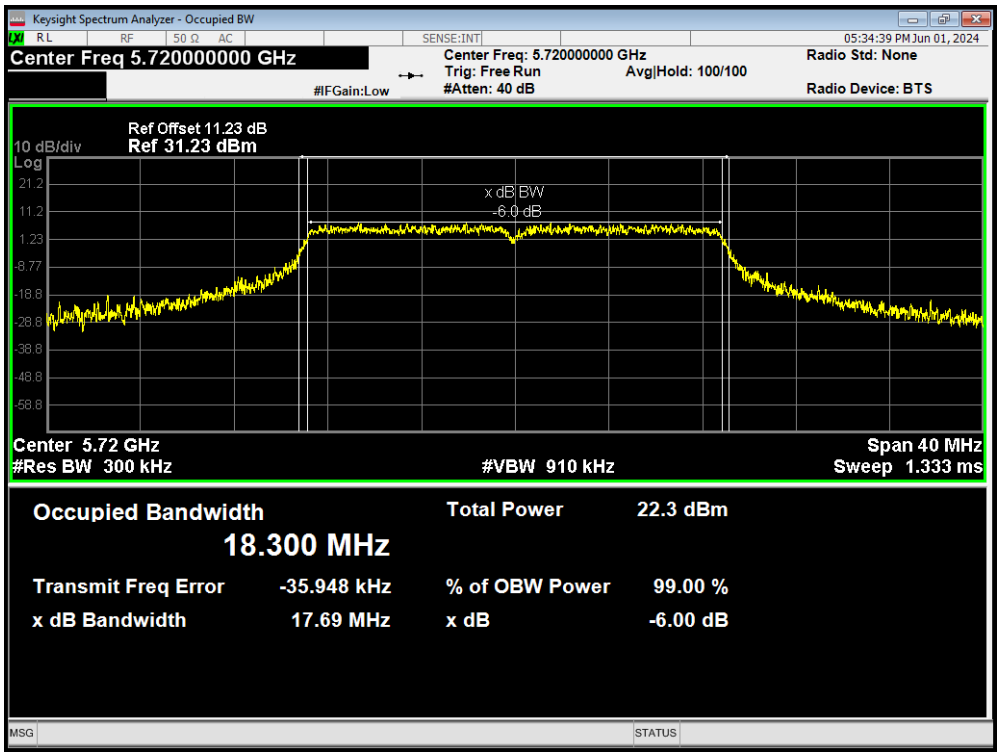
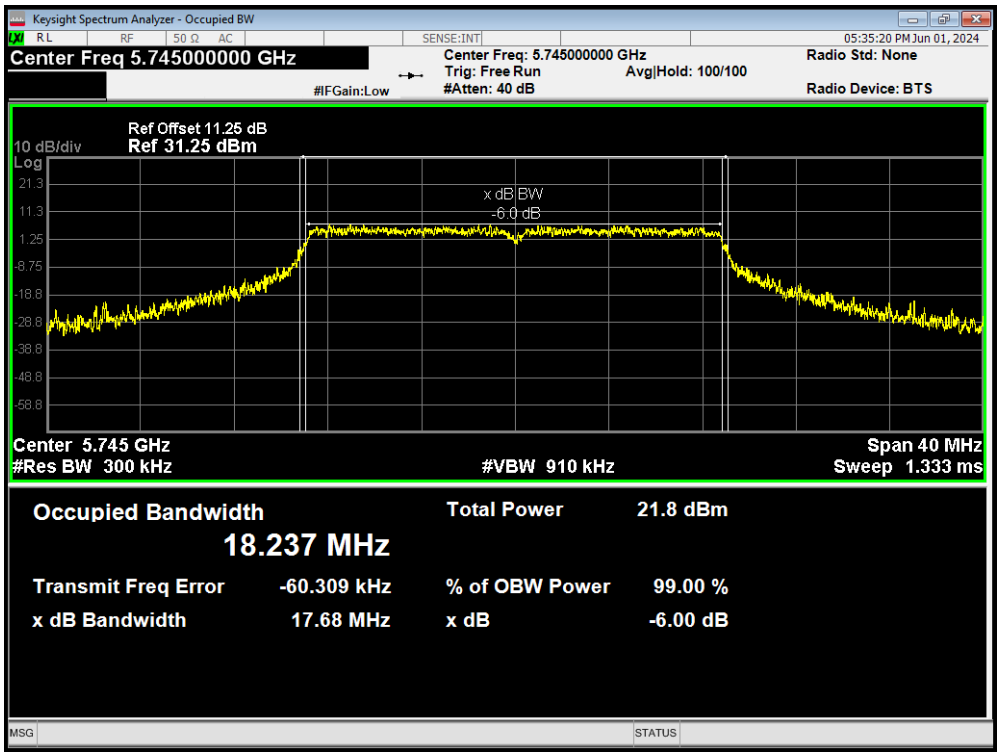


OBW 802.11n(HT20) 5720MHz



OBW 802.11n(HT20) 5745MHz



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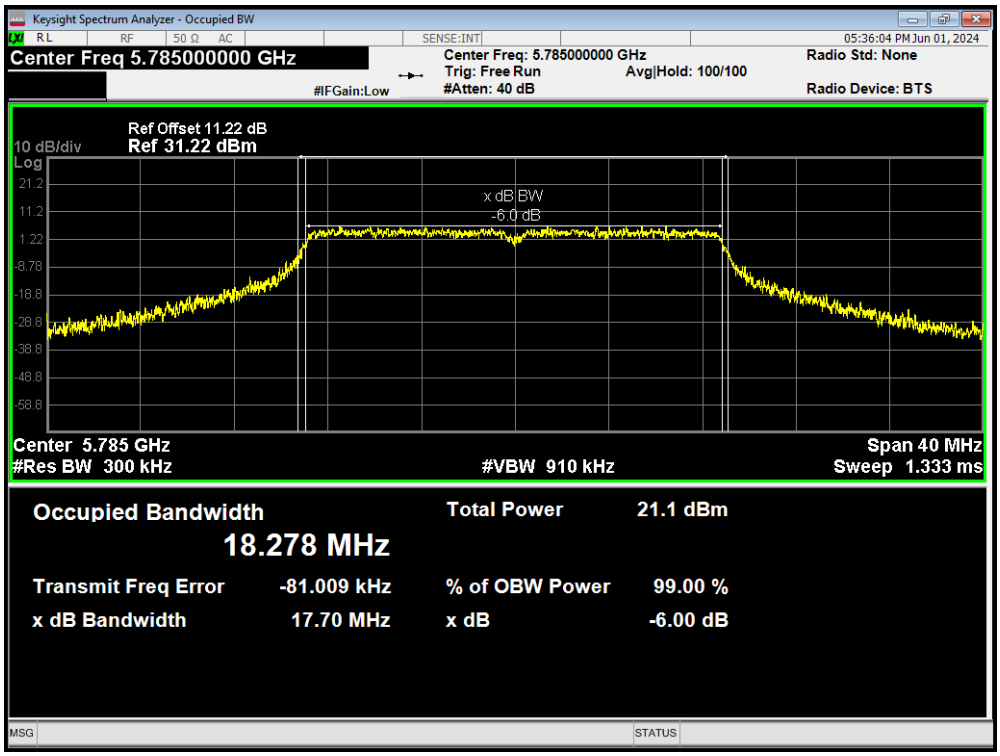
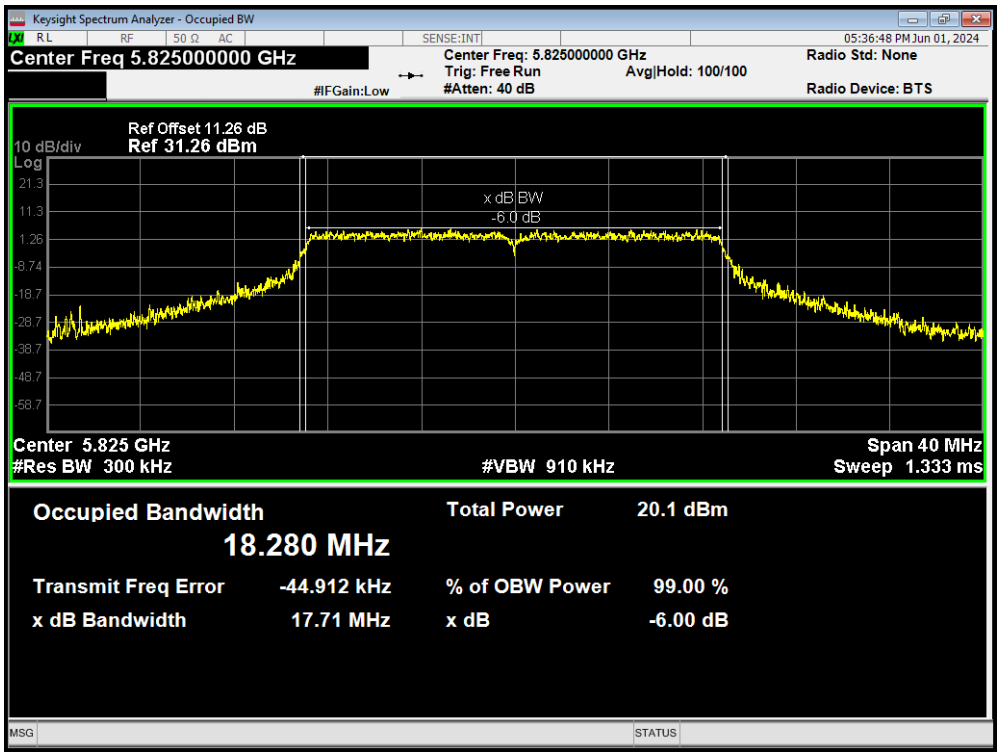
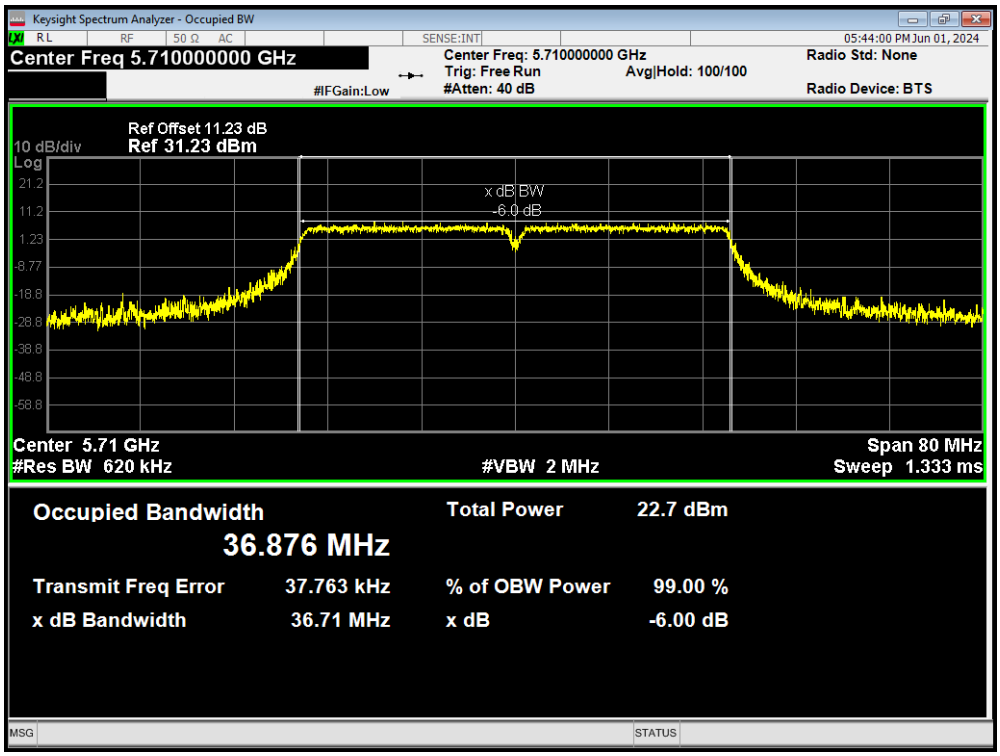


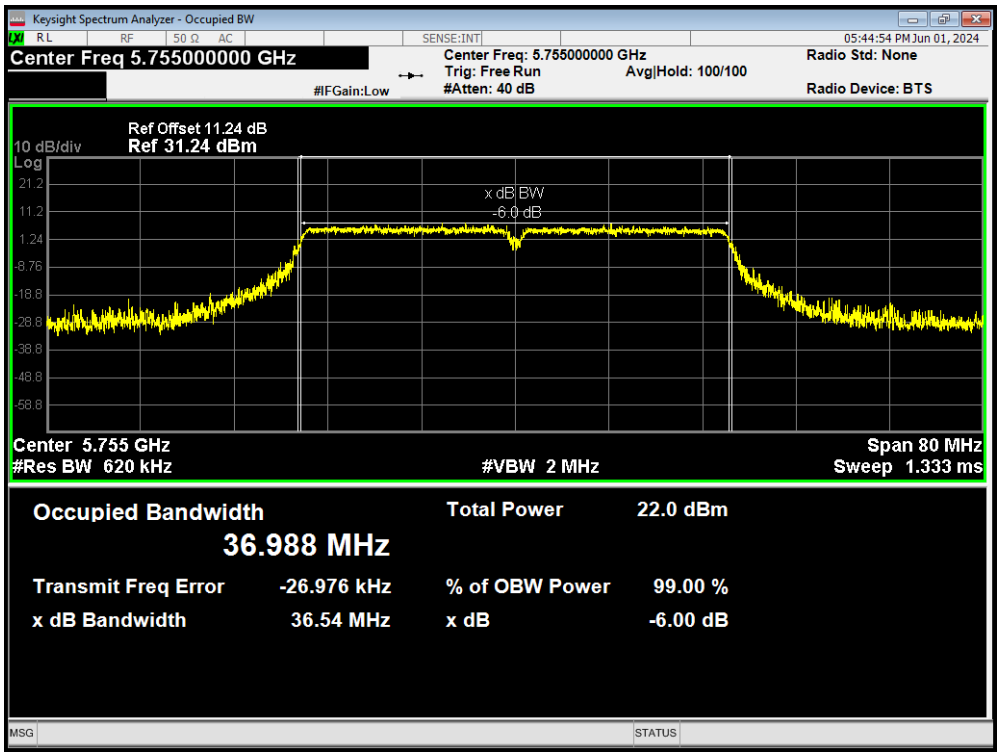
OBW 802.11n(HT20) 5825MHz



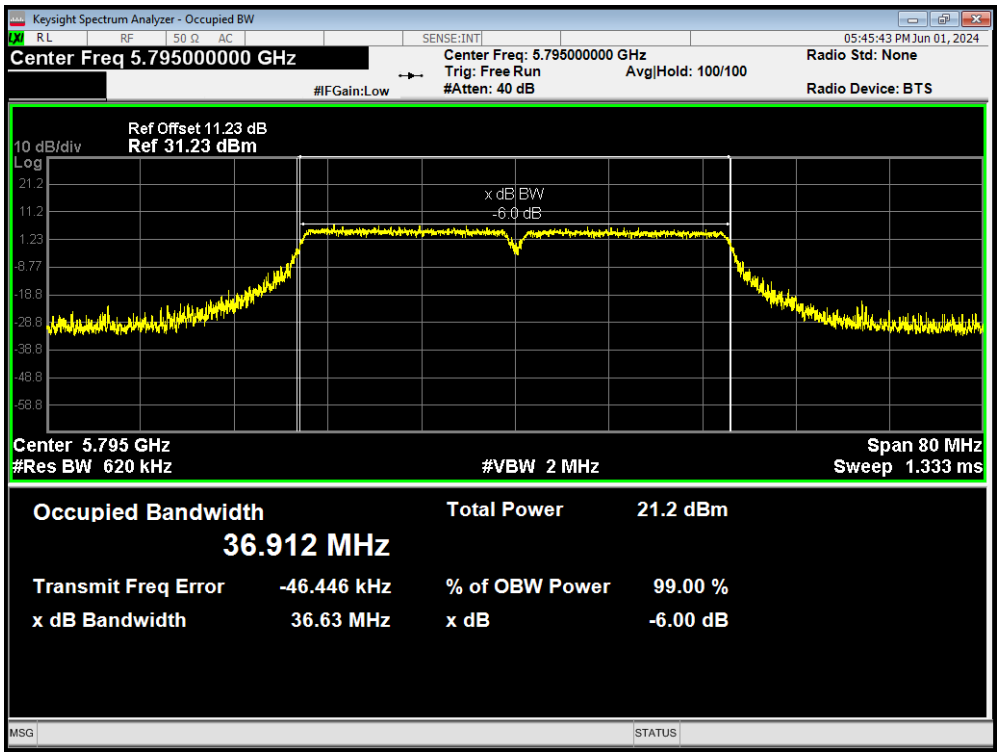
OBW 802.11n(HT40) 5710MHz



OBW 802.11n(HT40) 5755MHz



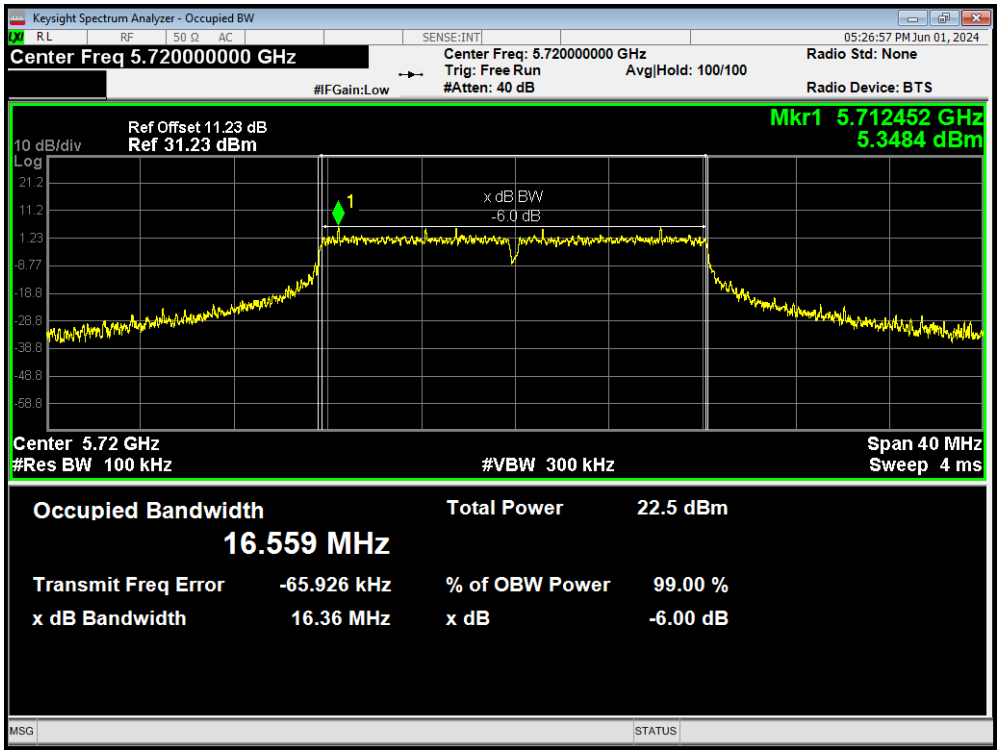
OBW 802.11n(HT40) 5795MHz



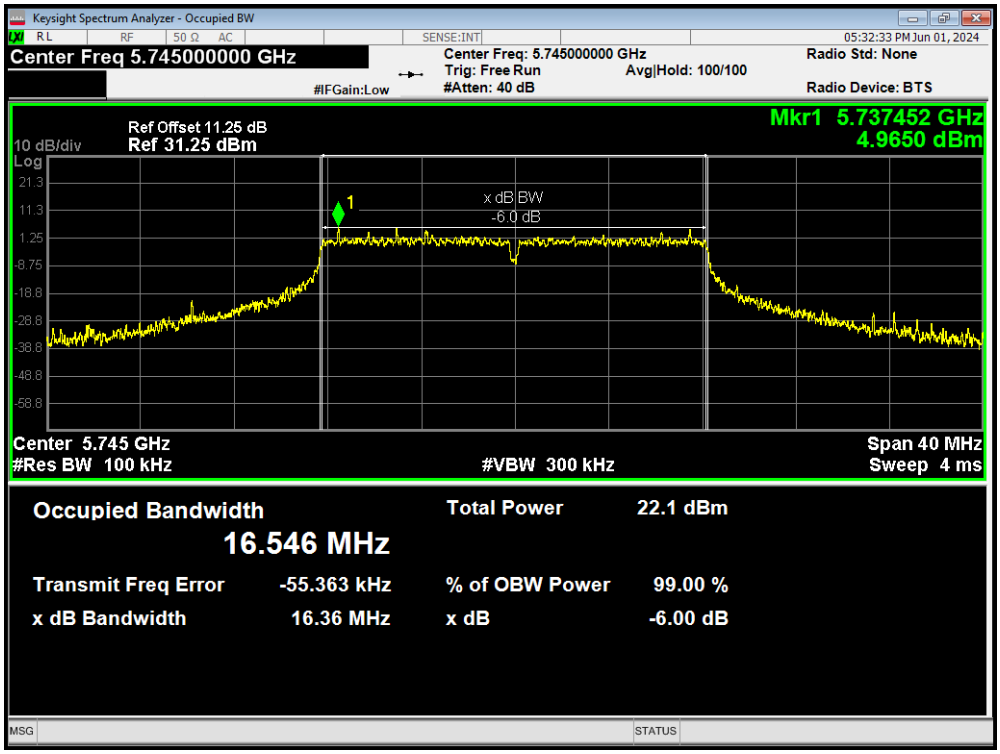
Minimum 6 dB bandwidth

U-NII-3

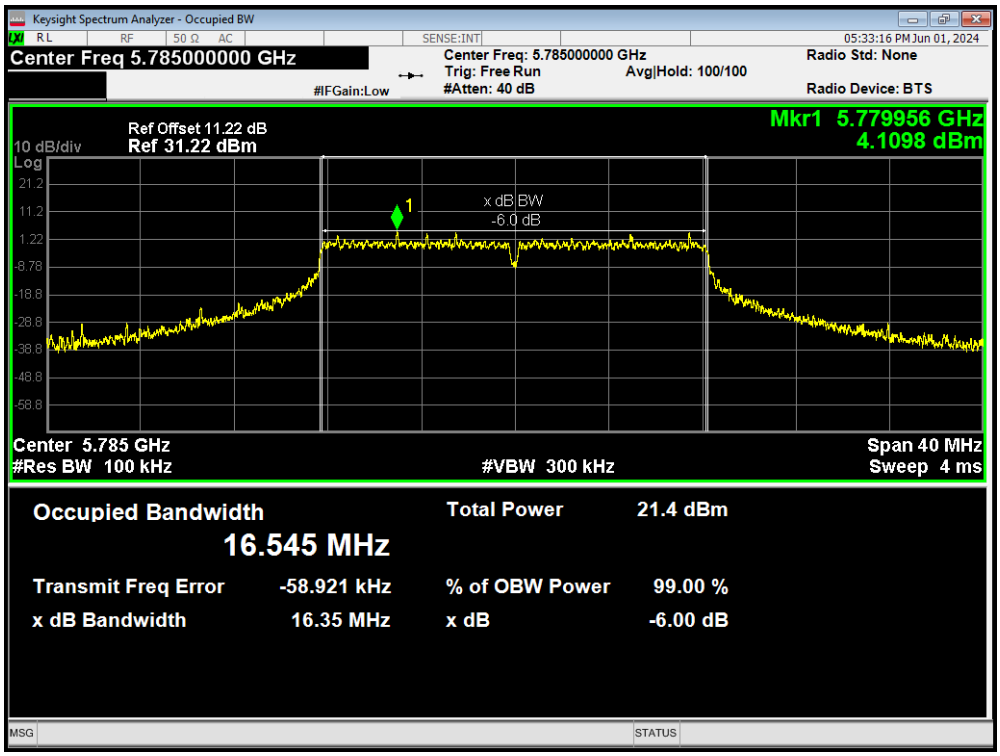
-6dB Bandwidth 802.11a 5720MHz



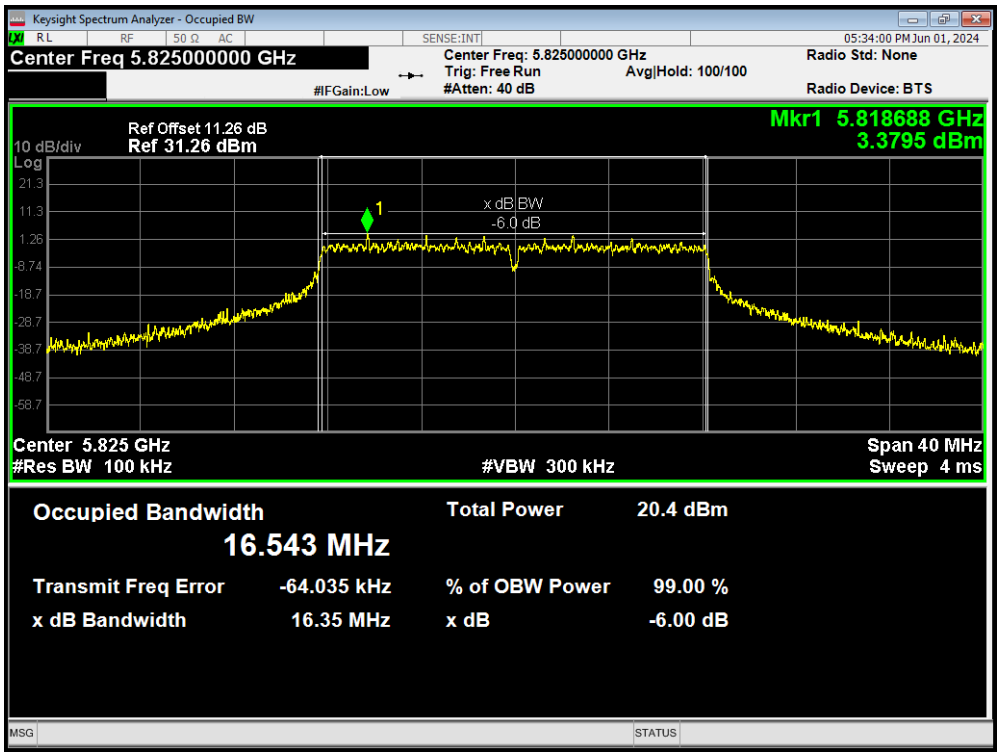
-6dB Bandwidth 802.11a 5745MHz



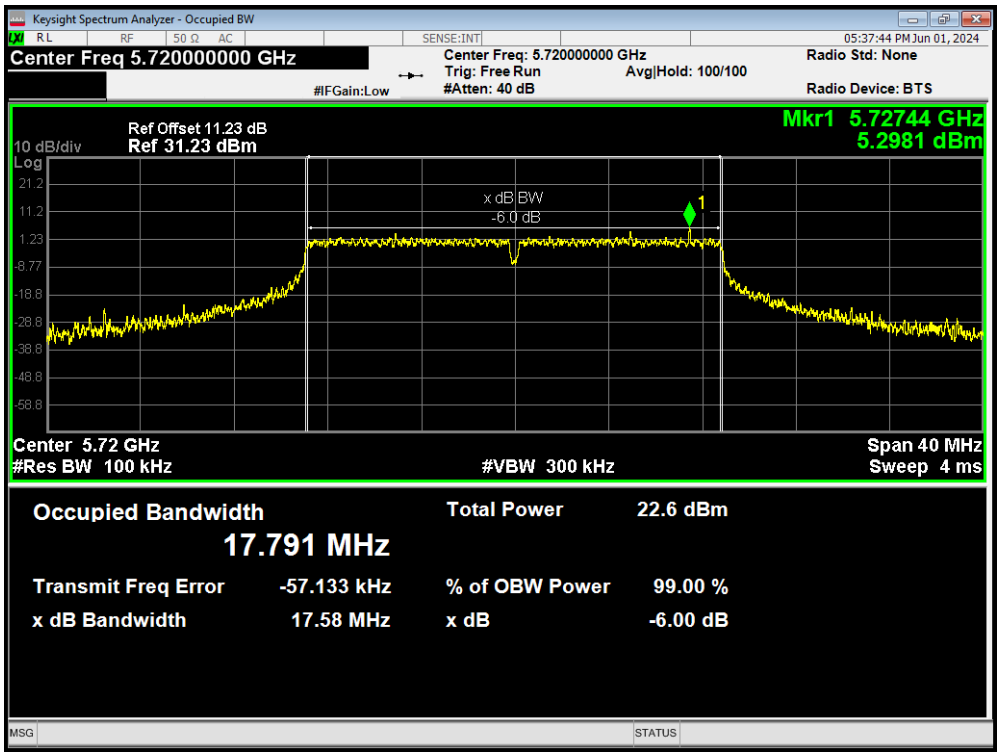
-6dB Bandwidth 802.11a 5785MHz



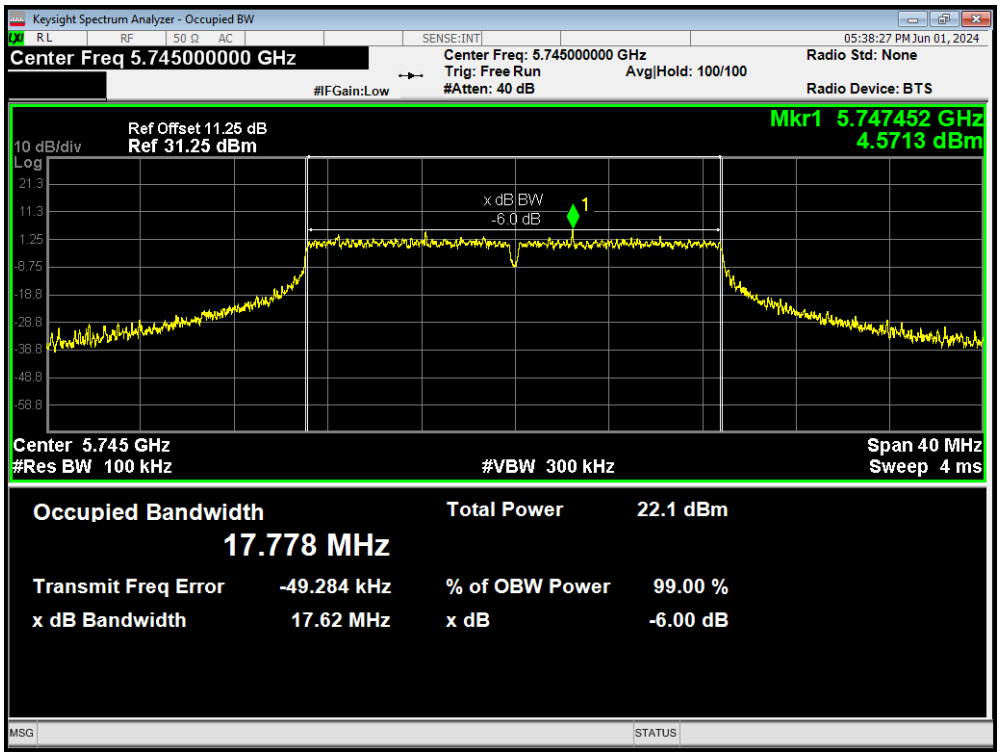
-6dB Bandwidth 802.11a 5825MHz



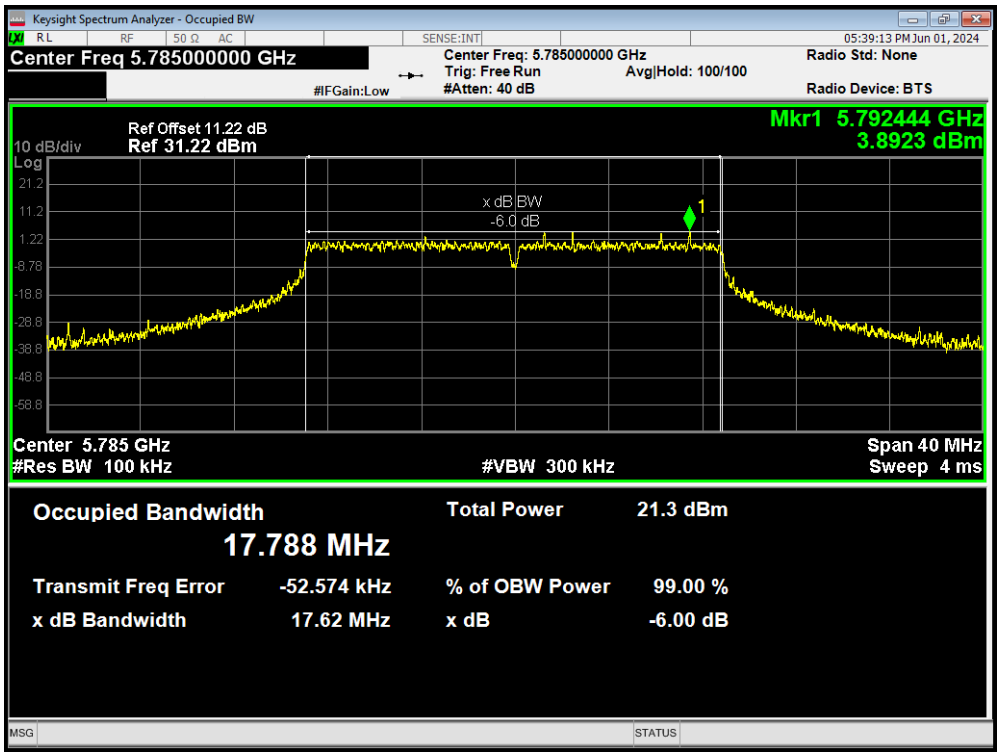
-6dB Bandwidth 802.11ac(VHT20) 5720MHz



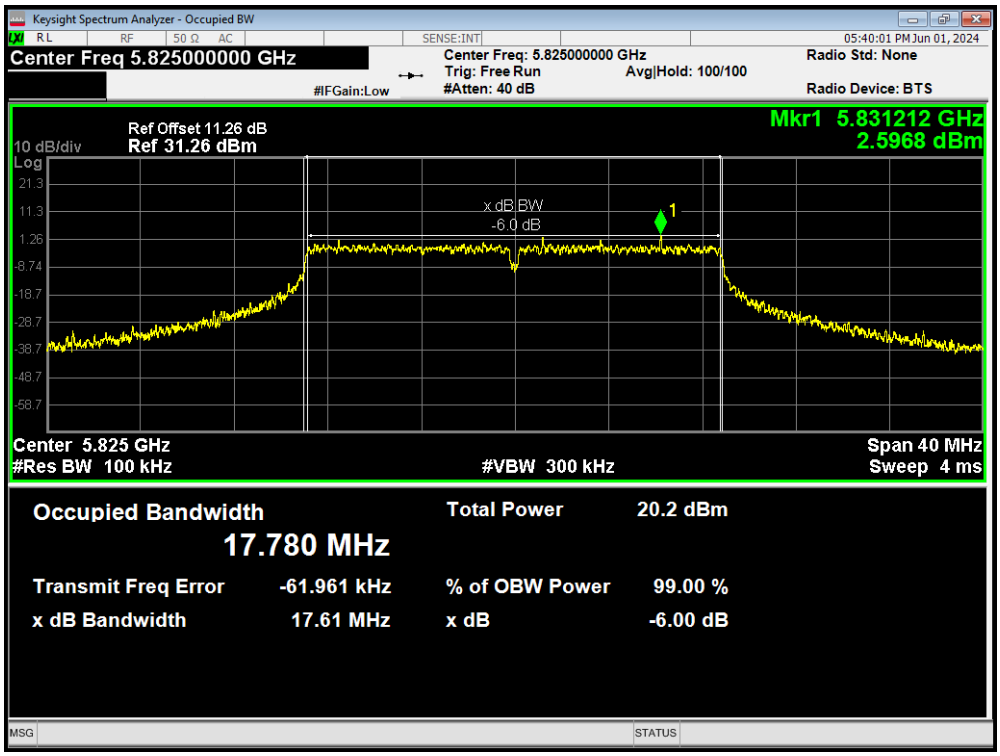
-6dB Bandwidth 802.11ac(VHT20) 5745MHz



-6dB Bandwidth 802.11ac(VHT20) 5785MHz



-6dB Bandwidth 802.11ac(VHT20) 5825MHz



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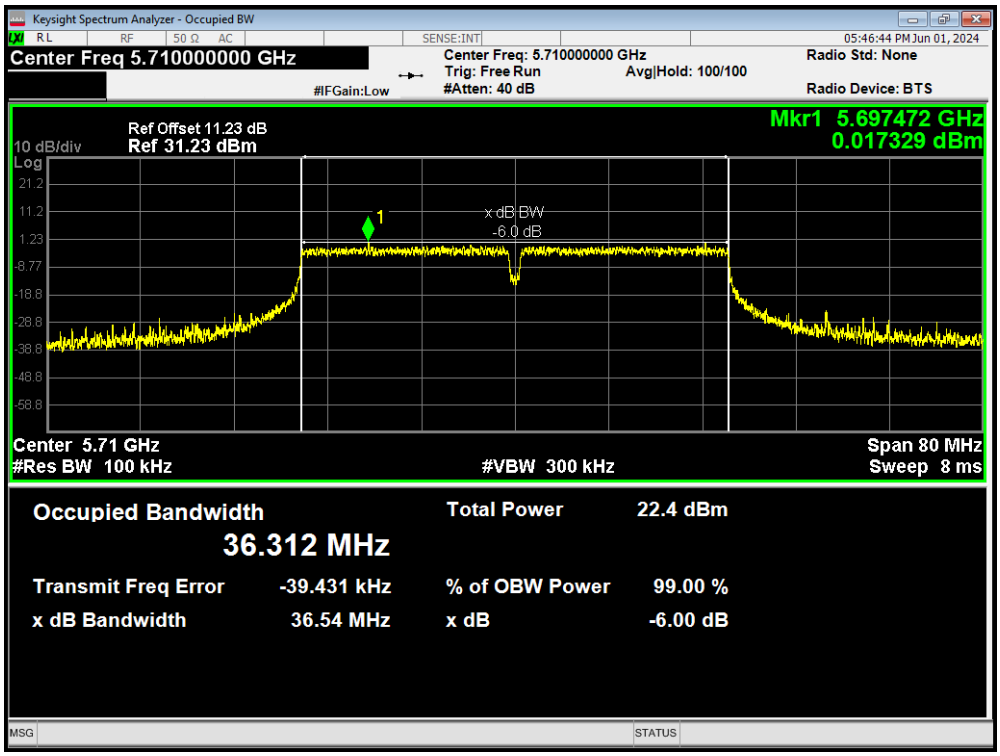
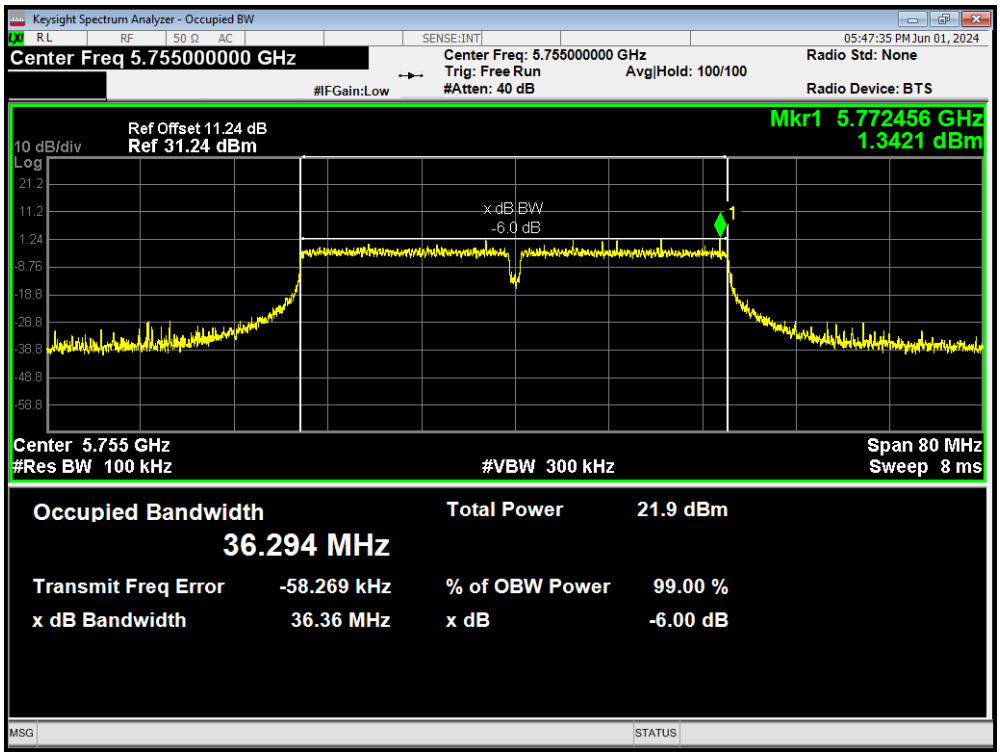
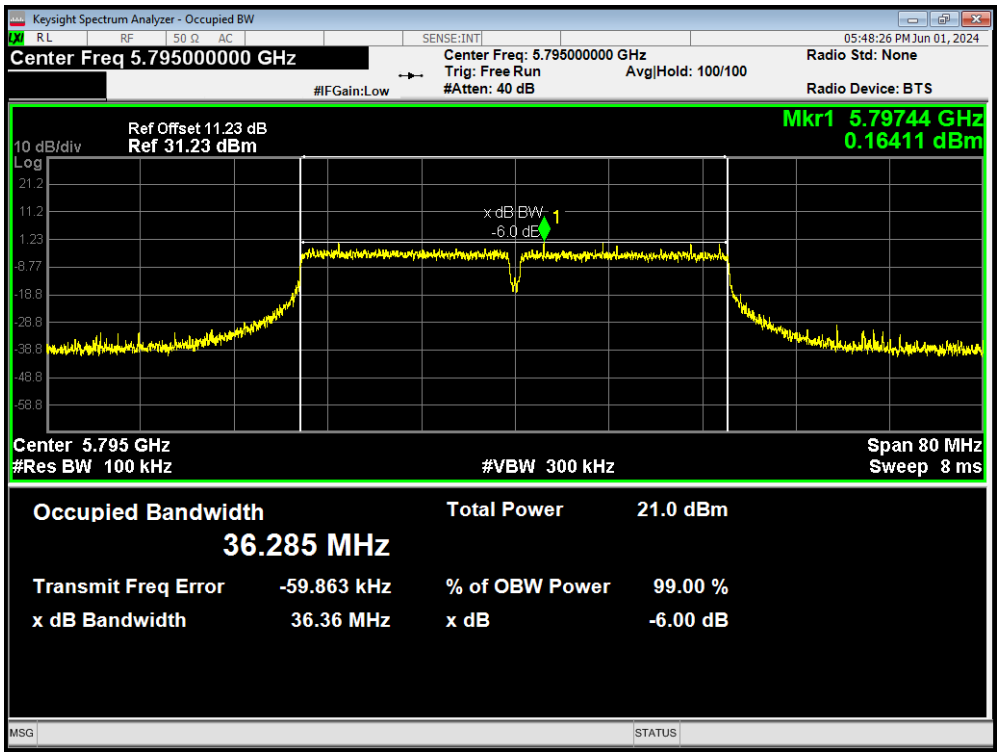


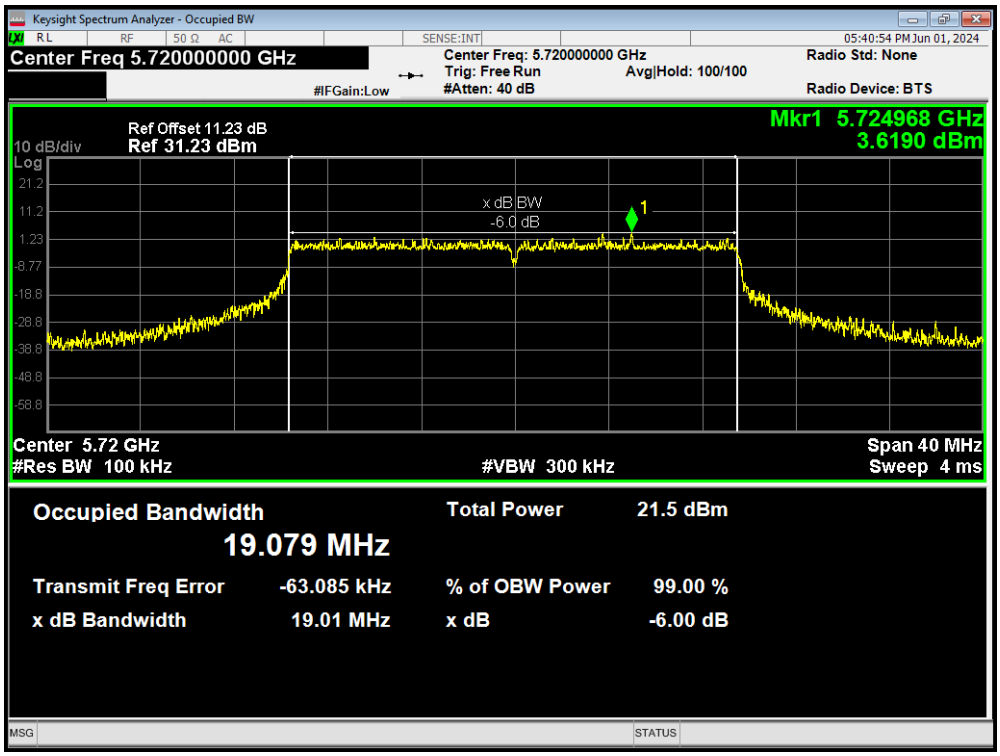
-6dB Bandwidth 802.11ac(VHT40) 5755MHz



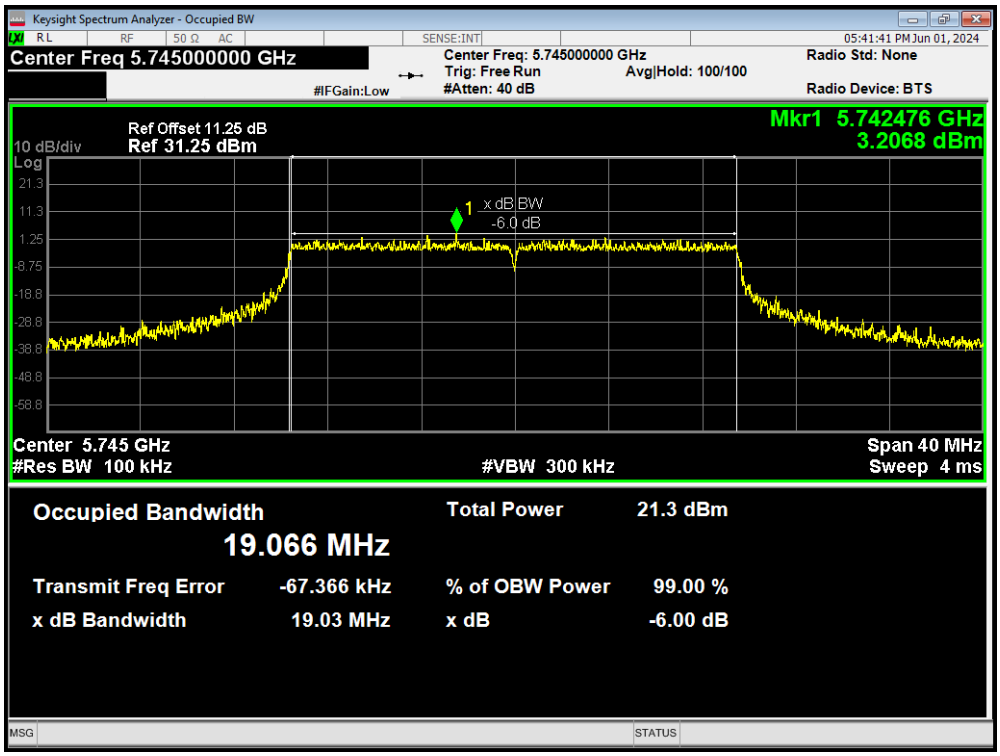
-6dB Bandwidth 802.11ac(VHT40) 5795MHz



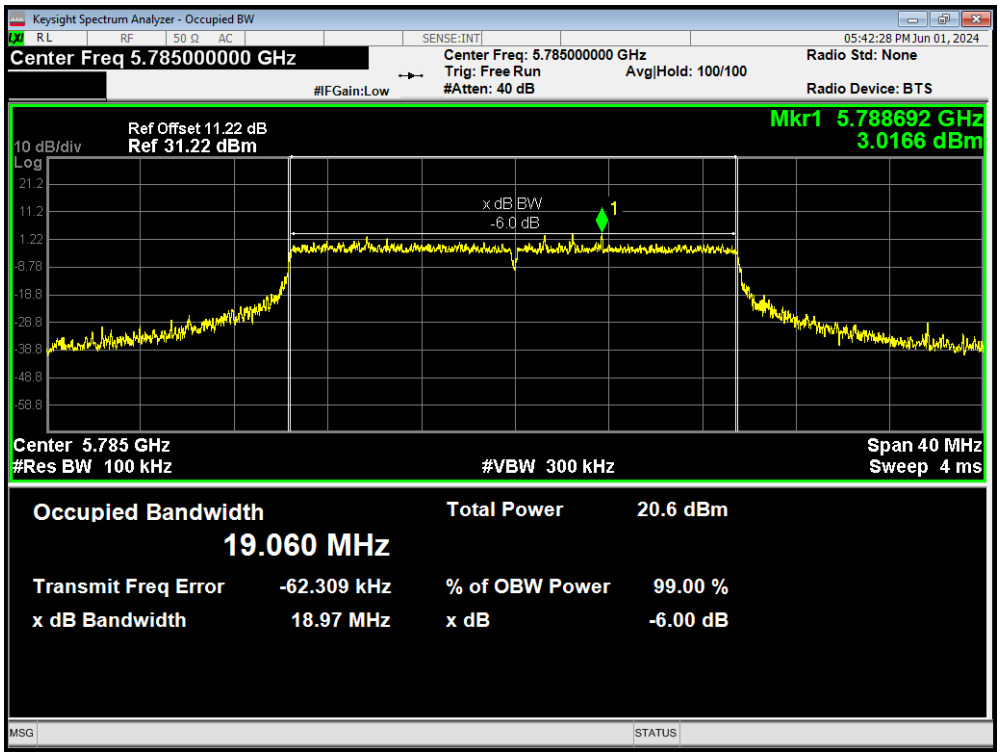
-6dB Bandwidth 802.11ax(HE20) 5720MHz



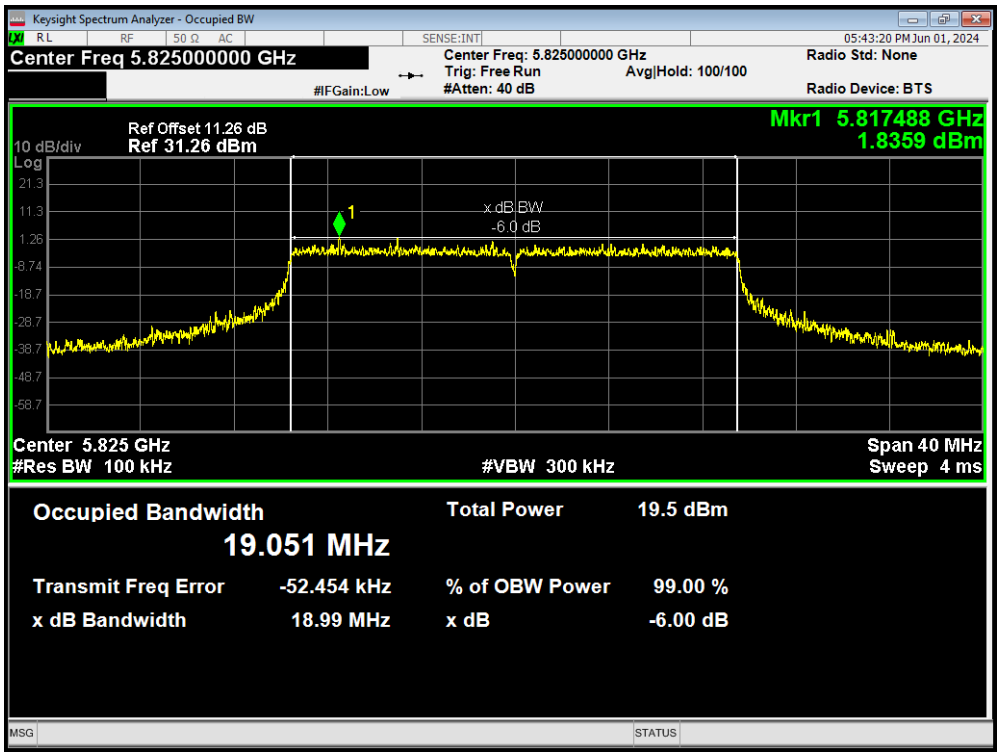
-6dB Bandwidth 802.11ax(HE20) 5745MHz



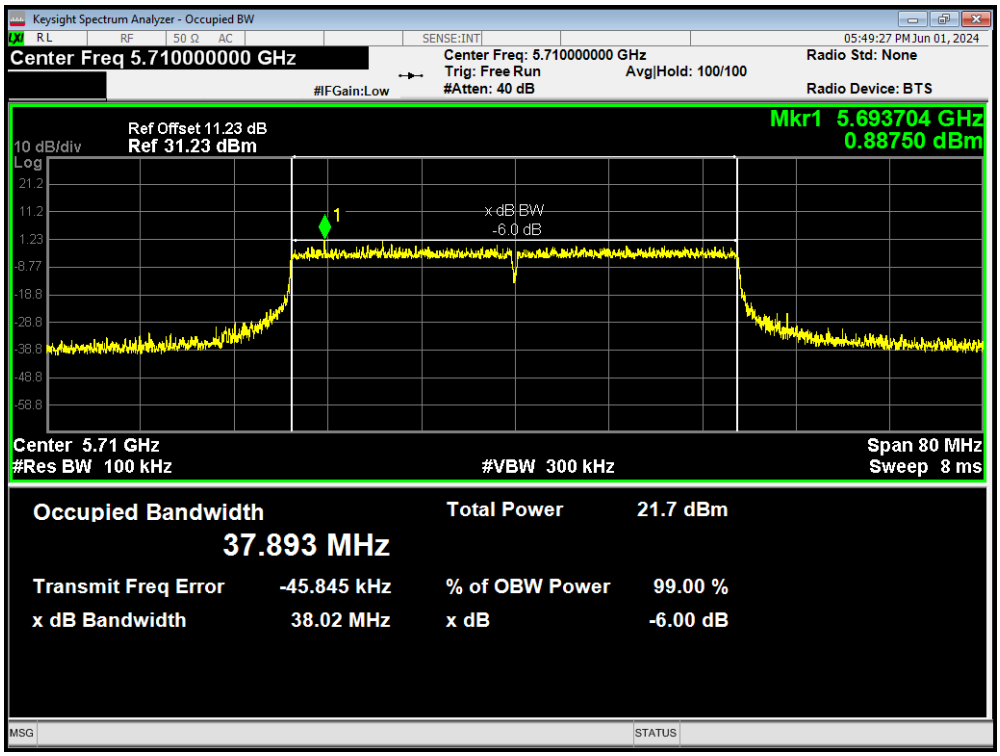
-6dB Bandwidth 802.11ax(HE20) 5785MHz



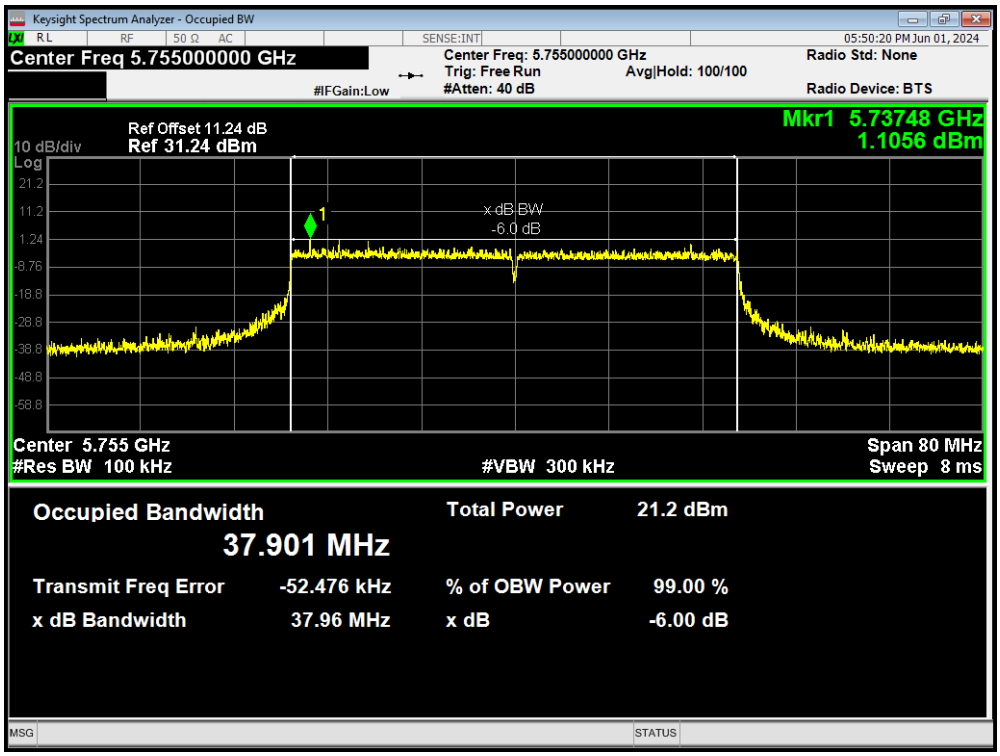
-6dB Bandwidth 802.11ax(HE20) 5825MHz



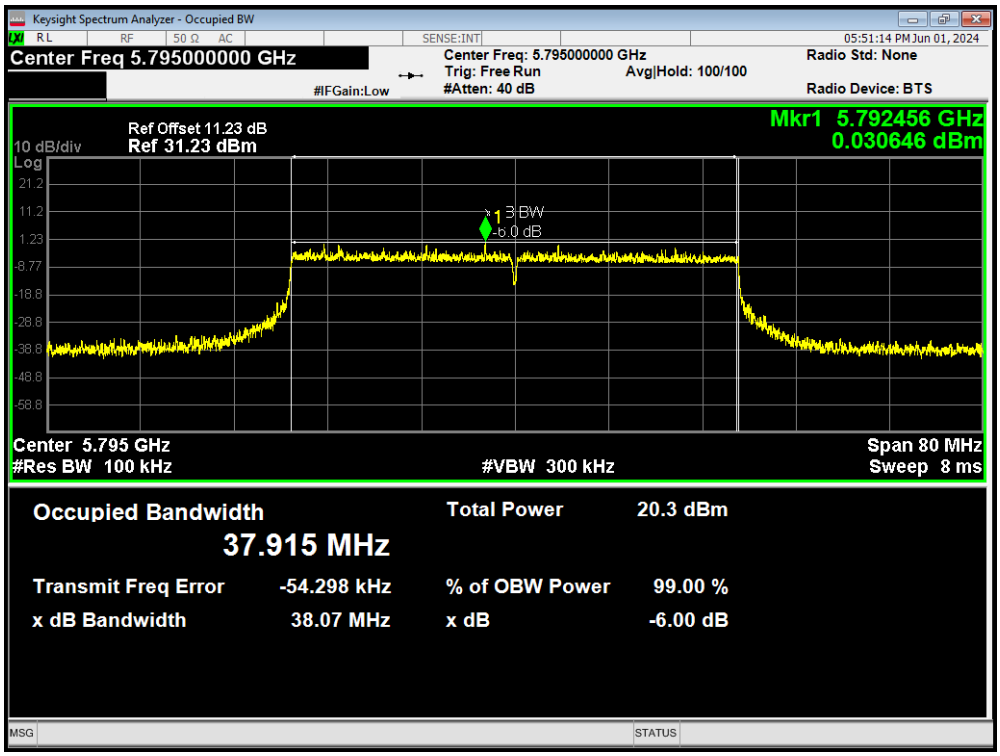
-6dB Bandwidth 802.11ax(HE40) 5710MHz



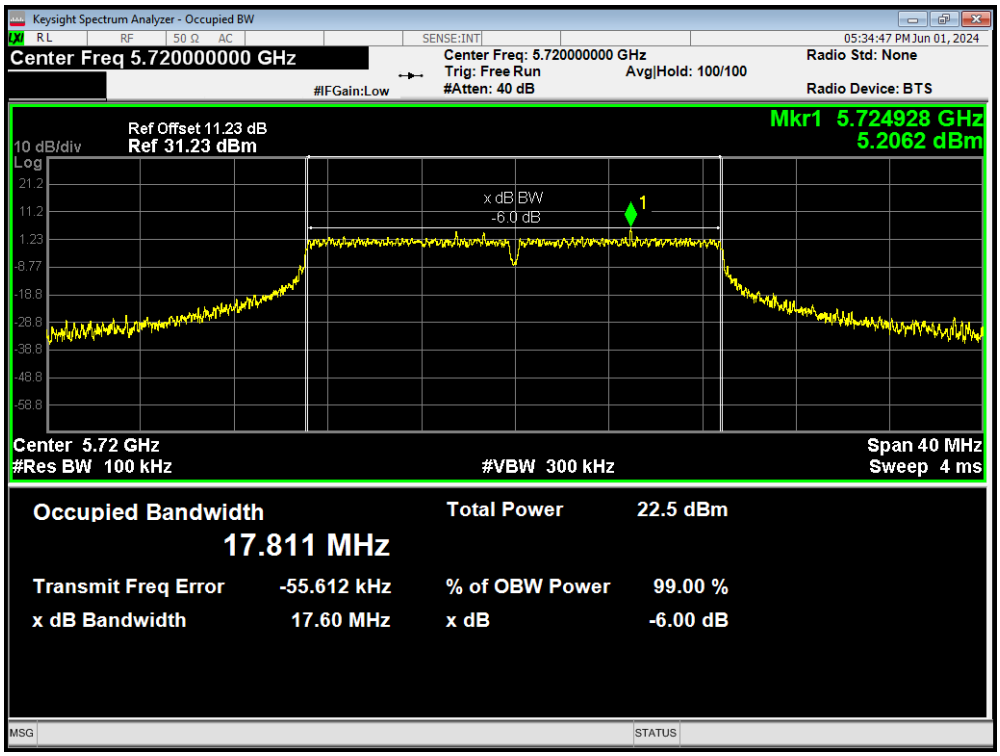
-6dB Bandwidth 802.11ax(HE40) 5755MHz



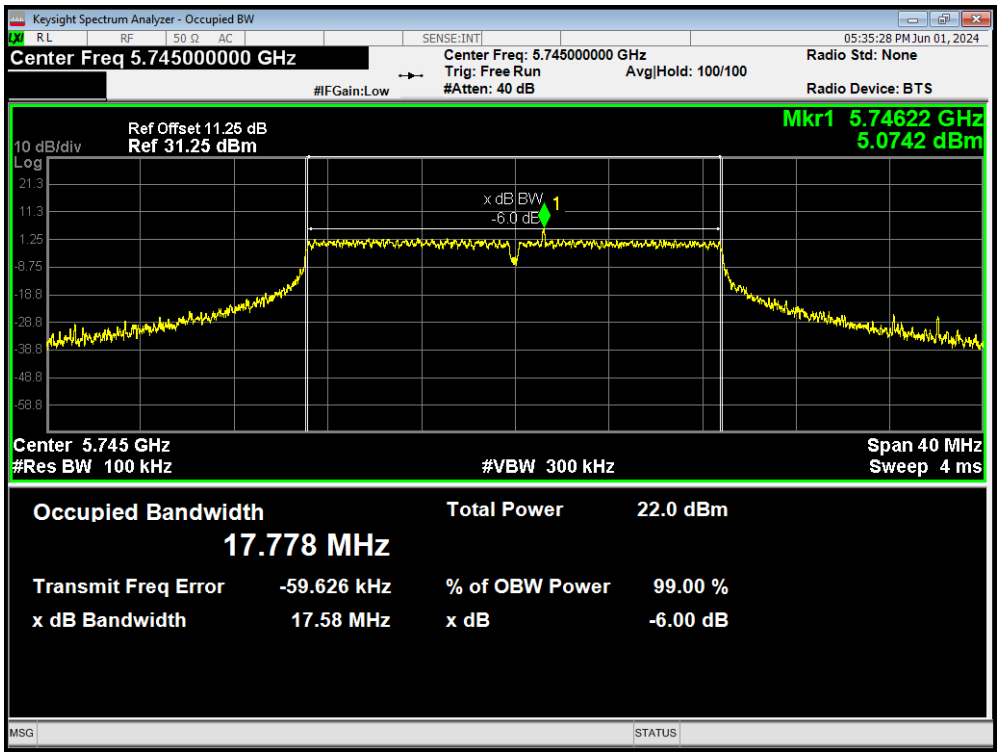
-6dB Bandwidth 802.11ax(HE40) 5795MHz



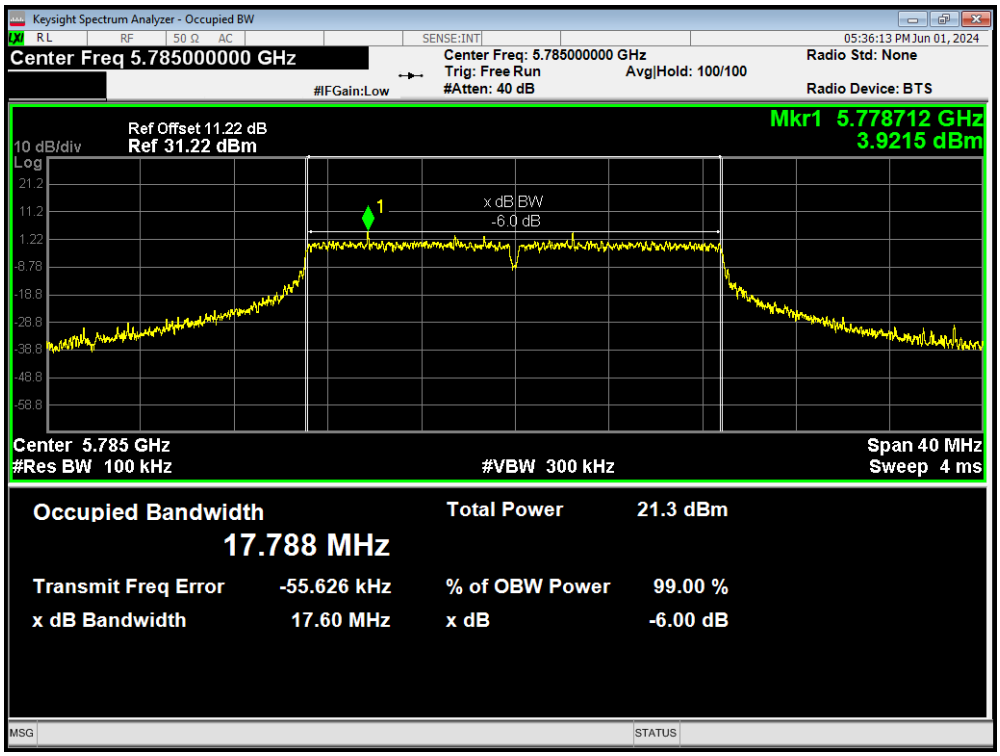
-6dB Bandwidth 802.11n(HT20) 5720MHz



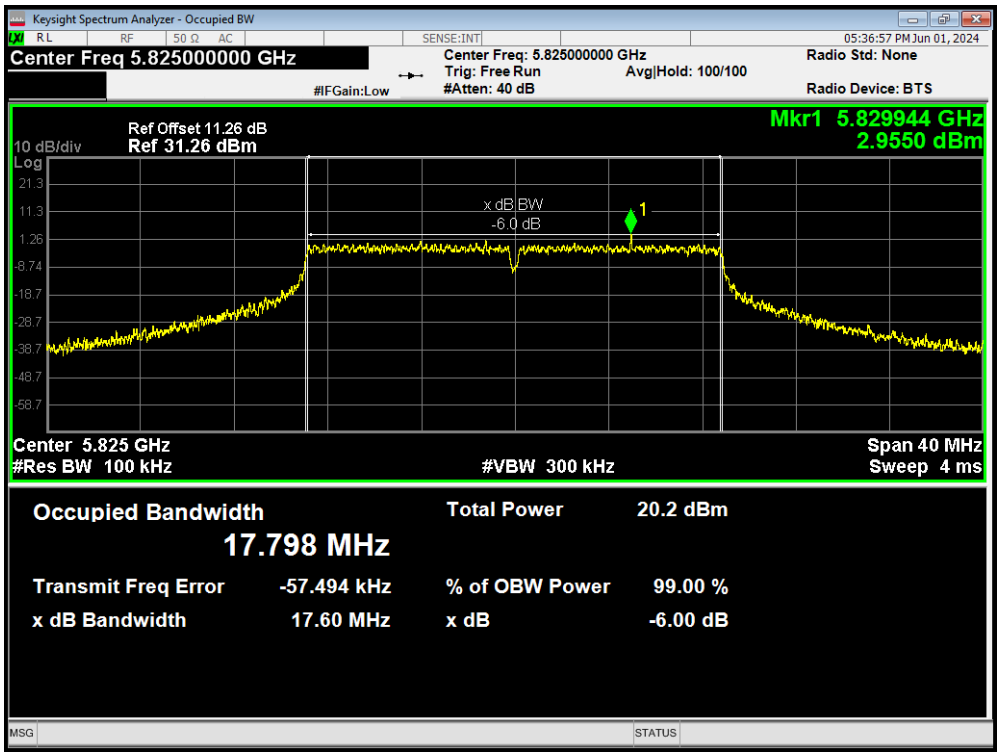
-6dB Bandwidth 802.11n(HT20) 5745MHz



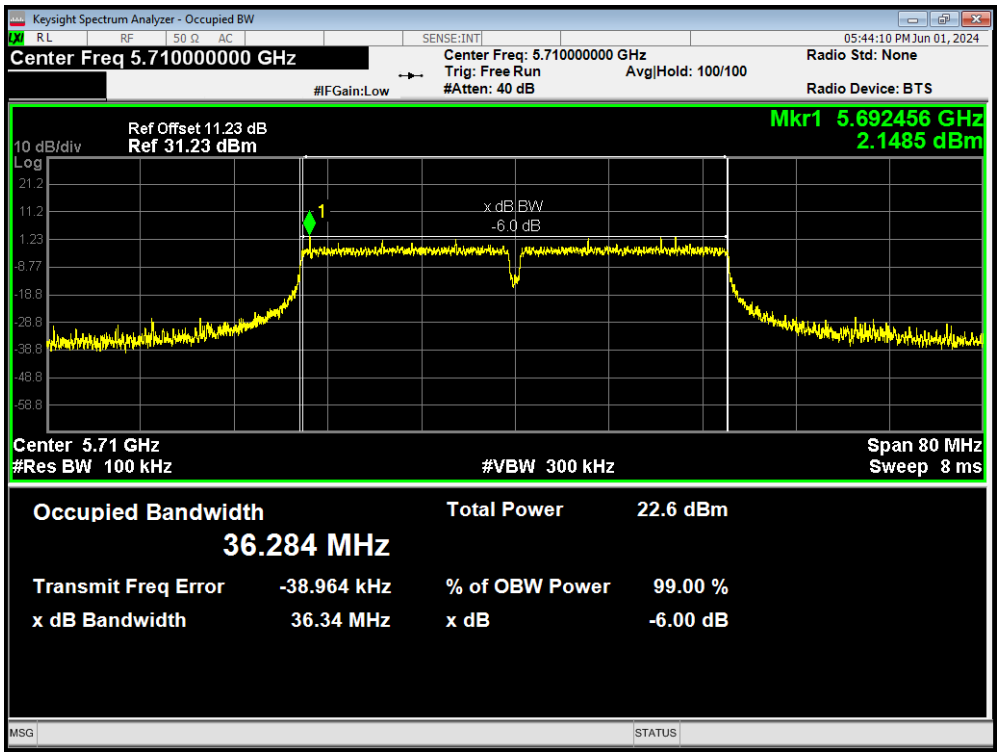
-6dB Bandwidth 802.11n(HT20) 5785MHz



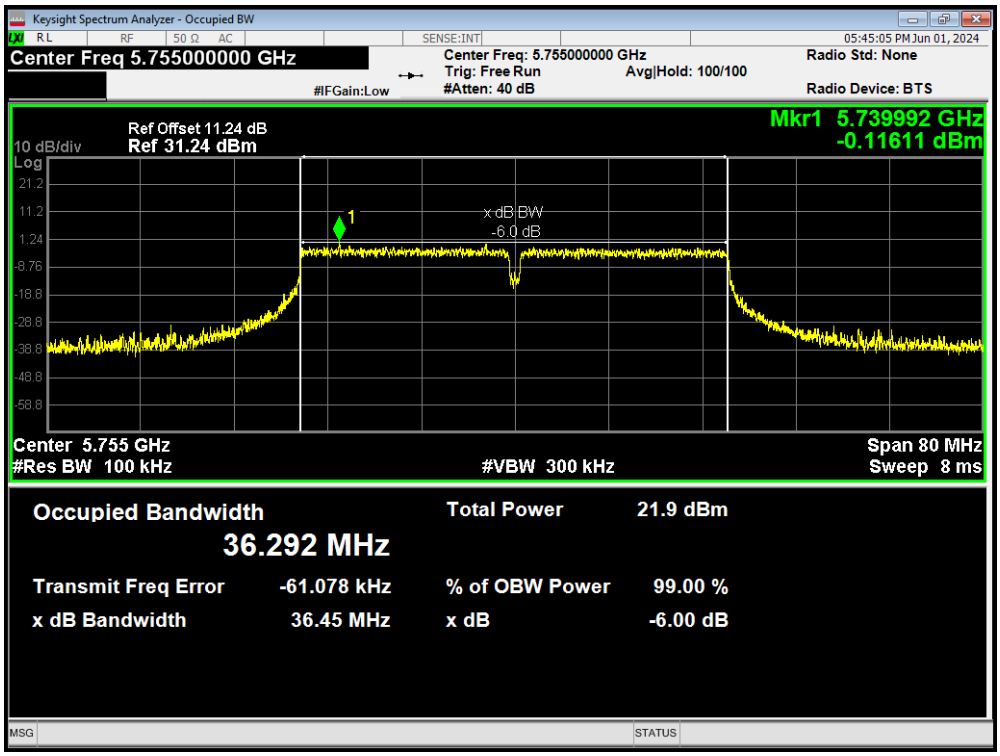
-6dB Bandwidth 802.11n(HT20) 5825MHz



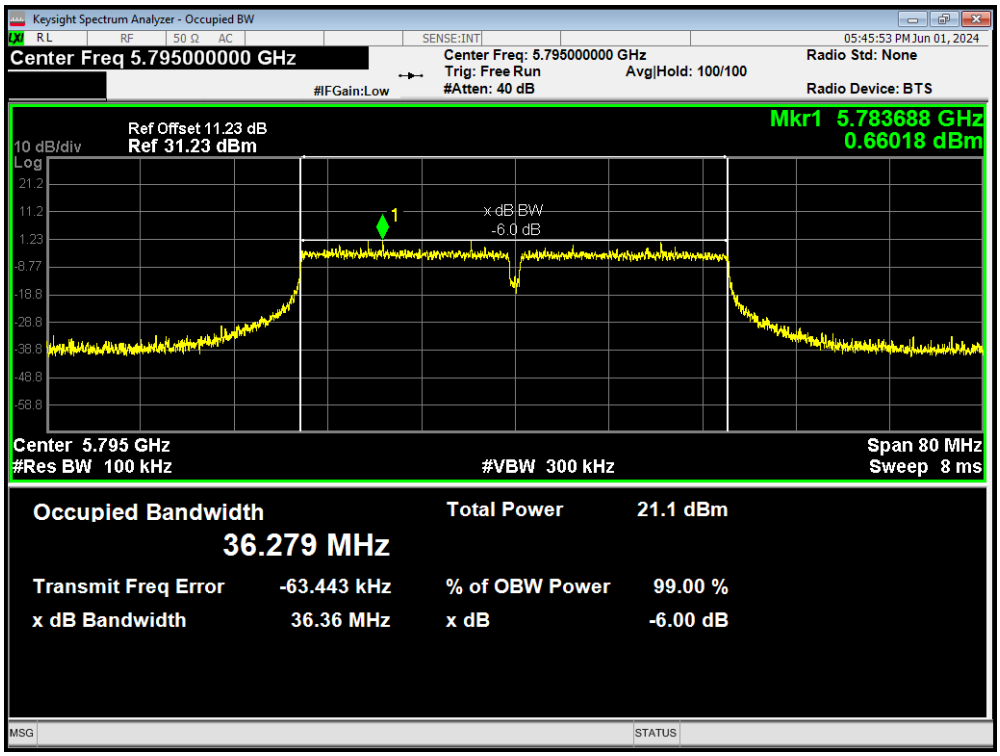
-6dB Bandwidth 802.11n(HT40) 5710MHz



-6dB Bandwidth 802.11n(HT40) 5755MHz



-6dB Bandwidth 802.11n(HT40) 5795MHz



5.2. Average Power Output

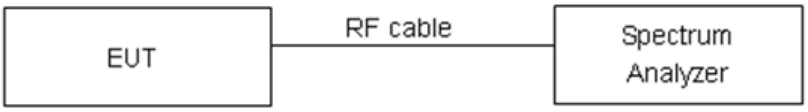
Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the Spectrum Analyzer through an external attenuator and a known loss cable. The EUT is max power transmission with proper modulation. We use the Method in FCC KDB 789033 Clause E 2 d) Method SA-2

Test Setup



Limits

Rule FCC Part 15.407(a)(1) / FCC Part 15.407(a) (2) / FCC Part 15.407(a) (3)
(1) For the band 5.15-5.25 GHz.
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, 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 access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, 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 access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, 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 conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, 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.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, 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.
(3)For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, 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.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.44 dB.

Test Results

Mode	Duty cycle	Duty cycle correction Factor (dB)
802.11a	0.894	0.49
802.11n HT20	0.968	0.14
802.11n HT40	0.964	0.16
802.11ac VHT20	0.962	0.17
802.11ac VHT40	0.968	0.14
802.11ax HE20	0.955	0.20
802.11ax HE40	0.958	0.18
Note: when Duty cycle⩾0.98, Duty cycle correction Factor not required.		

Power Index								
Channel	802.11a	802.11n HT20	802.11ac VHT20	802.11ax HE20	Channel	802.11n HT40	802.11ac VHT40	802.11ax HE40
CH36	17	17	17	16	CH38	17	17	16
CH40	17	17	17	16	CH46	17	17	16
CH48	17	17	17	16	/	/	/	/
CH52	17	17	17	16	CH54	17	17	16
CH60	17	17	17	16	CH62	17	17	16
CH64	17	17	17	16	/	/	/	/
CH100	17	16	17	16	CH102	14	17	14
CH120	17	17	17	16	CH118	17	17	16
CH140	14	17	17	14	CH134	17	17	16
CH144	17	17	17	16	CH142	17	17	16
CH149	17	17	17	16	CH151	17	17	16
CH157	17	17	17	16	CH159	17	17	16
CH165	17	17	17	16	/	/	/	/

Test Mode		Channel/ Frequency (MHz)	B=26 dB bandwidth (MHz)	Limit 11 dBm + 10 log B (dBm)	Final Limit (dBm)
U-NII-2A	802.11a	52/5260	26.26	25.19>24	24.00
		60/5300	28.52	25.55>24	24.00
		64/5320	25.64	25.09>24	24.00
	802.11n HT20	52/5260	27.60	25.41>24	24.00
		60/5300	28.70	25.58>24	24.00
		64/5320	26.07	25.16>24	24.00
	802.11n HT40	54/5270	50.71	28.05>24	24.00
		62/5310	47.81	27.80>24	24.00
	802.11ac VHT20	52/5260	26.39	25.21>24	24.00
		60/5300	25.20	25.01>24	24.00
		64/5320	26.78	25.28>24	24.00
	802.11ac VHT40	54/5270	47.22	27.74>24	24.00
		62/5310	59.23	28.73>24	24.00
	802.11ax HE20	52/5260	26.13	25.17>24	24.00
		60/5300	24.81	24.95>24	24.00
		64/5320	25.78	25.11>24	24.00
	802.11ax HE40	54/5270	45.20	27.55>24	24.00
		62/5310	45.00	27.53>24	24.00
U-NII-2C	802.11a	100/5500	26.545	25.24>24	24.00
		120/5600	26.668	25.26>24	24.00
		140/5700	26.488	25.23>24	24.00
		144/5720	25.975	25.15>24	24.00
	802.11n HT20	100/5500	28.293	25.52>24	24.00
		120/5600	28.020	25.47>24	24.00
		140/5700	30.484	25.84>24	24.00
		144/5720	27.388	25.38>24	24.00
	802.11n HT40	102/5510	57.227	28.58>24	24.00
		118/5590	63.075	29.00>24	24.00
		134/5670	62.854	28.98>24	24.00
		142/5710	56.911	28.55>24	24.00
	802.11ac VHT20	100/5500	32.801	26.16>24	24.00
		120/5600	26.442	25.22>24	24.00
		140/5700	28.869	25.60>24	24.00
		144/5720	28.120	25.49>24	24.00
	802.11ac VHT40	102/5510	52.335	28.19>24	24.00
		118/5590	57.929	28.63>24	24.00

		134/5670	49.215	27.92>24	24.00
		142/5710	47.896	27.80>24	24.00
	802.11ax HE20	100/5500	26.543	25.24>24	24.00
		120/5600	25.201	25.01>24	24.00
		140/5700	26.250	25.19>24	24.00
		144/5720	25.536	25.07>24	24.00
	802.11ax HE40	102/5510	45.304	27.56>24	24.00
		118/5590	46.626	27.69>24	24.00
		134/5670	47.500	27.77>24	24.00
		142/5710	45.483	27.58>24	24.00
Note: 250mW=24dBm					

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Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	36/5180	12.82	13.31	24	PASS
	40/5200	13.19	13.68	24	PASS
	48/5240	13.66	14.15	24	PASS
802.11n HT20	36/5180	13.23	13.37	24	PASS
	40/5200	12.93	13.07	24	PASS
	48/5240	13.83	13.97	24	PASS
802.11n HT40	38/5190	13.13	13.29	24	PASS
	46/5230	13.56	13.72	24	PASS
802.11ac VHT20	36/5180	13.12	13.29	24	PASS
	40/5200	13.15	13.32	24	PASS
	48/5240	13.61	13.78	24	PASS
802.11ac VHT40	38/5190	13.17	13.31	24	PASS
	46/5230	13.45	13.59	24	PASS
802.11ax HE20	36/5180	11.81	12.01	24	PASS
	40/5200	12.06	12.26	24	PASS
	48/5240	12.42	12.62	24	PASS
802.11ax HE40	38/5190	12.09	12.27	24	PASS
	46/5230	12.15	12.33	24	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-2A

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	52/5260	13.00	13.49	24.00	PASS
	60/5300	13.19	13.68	24.00	PASS
	64/5320	13.65	14.14	24.00	PASS
802.11n HT20	52/5260	13.21	13.35	24.00	PASS
	60/5300	13.77	13.91	24.00	PASS
	64/5320	13.32	13.46	24.00	PASS
802.11n HT40	54/5270	13.99	14.15	24.00	PASS
	62/5310	13.82	13.98	24.00	PASS
802.11ac VHT20	52/5260	13.19	13.36	24.00	PASS
	60/5300	14.02	14.19	24.00	PASS
	64/5320	13.84	14.01	24.00	PASS
802.11ac VHT40	54/5270	13.95	14.09	24.00	PASS
	62/5310	13.85	13.99	24.00	PASS
802.11ax HE20	52/5260	12.17	12.37	24.00	PASS
	60/5300	12.58	12.78	24.00	PASS
	64/5320	13.27	13.47	24.00	PASS
802.11ax HE40	54/5270	12.97	13.15	24.00	PASS
	62/5310	12.82	13.00	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-2C

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	100/5500	16.61	17.10	23.34	PASS
	120/5600	15.35	15.84	23.33	PASS
	140/5700	15.52	16.01	23.31	PASS
	144/5720	13.05	13.54	23.33	PASS
802.11n HT20	100/5500	14.91	15.05	23.62	PASS
	120/5600	15.48	15.62	23.64	PASS
	140/5700	16.04	16.18	23.62	PASS
	144/5720	15.46	15.60	23.61	PASS
802.11n HT40	102/5510	13.84	14.00	24.00	PASS
	118/5590	15.86	16.02	24.00	PASS
	134/5670	15.25	15.41	24.00	PASS
	142/5710	15.69	15.85	24.00	PASS
802.11ac VHT20	100/5500	16.46	16.63	23.62	PASS
	120/5600	15.32	15.49	23.62	PASS
	140/5700	16.08	16.25	23.63	PASS
	144/5720	15.43	15.60	23.62	PASS
802.11ac VHT40	102/5510	16.90	17.04	24.00	PASS
	118/5590	15.69	15.83	24.00	PASS
	134/5670	15.46	15.60	24.00	PASS
	142/5710	16.25	16.39	24.00	PASS
802.11ax HE20	100/5500	15.42	15.62	23.84	PASS
	120/5600	14.35	14.55	23.84	PASS
	140/5700	13.48	13.68	23.84	PASS
	144/5720	14.31	14.51	23.85	PASS
802.11ax HE40	102/5510	13.56	13.74	24.00	PASS
	118/5590	14.84	15.02	24.00	PASS
	134/5670	14.78	14.96	24.00	PASS
	142/5710	15.17	15.35	24.00	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

U-NII-3

Test Mode	Channel/ Frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11a	144/5720	9.34	9.83	30	PASS
	149/5745	15.89	16.38	30	PASS
	157/5785	15.18	15.67	30	PASS
	165/5825	14.13	14.62	30	PASS
802.11n HT20	144/5720	9.57	9.71	30	PASS
	149/5745	16.00	16.14	30	PASS
	157/5785	15.45	15.59	30	PASS
	165/5825	14.35	14.49	30	PASS
802.11n HT40	142/5710	6.13	6.29	30	PASS
	151/5755	15.61	15.77	30	PASS
	159/5795	14.76	14.92	30	PASS
802.11ac VHT20	144/5720	10.02	10.19	30	PASS
	149/5745	16.11	16.28	30	PASS
	157/5785	15.26	15.43	30	PASS
	165/5825	14.31	14.48	30	PASS
802.11ac VHT40	142/5710	6.23	6.37	30	PASS
	151/5755	16.00	16.14	30	PASS
	159/5795	15.07	15.21	30	PASS
802.11ax HE20	144/5720	9.49	9.69	30	PASS
	149/5745	15.37	15.57	30	PASS
	157/5785	14.51	14.71	30	PASS
	165/5825	13.39	13.59	30	PASS
802.11ax HE40	142/5710	6.06	6.24	30	PASS
	151/5755	14.63	14.81	30	PASS
	159/5795	14.23	14.41	30	PASS
Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor					

5.3. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

Method of Measurement

1. Frequency stability with respect to ambient temperature

a) Supply the EUT with a nominal ac voltage or install a new or fully charged battery in the EUT. If possible, a dummy load shall be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, then the EUT shall be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn ON the EUT and tune it to one of the number of frequencies shown in 5.6.

b) Couple the unlicensed wireless device output to the measuring instrument by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away), or by connecting a dummy load to the measuring instrument, through an attenuator if necessary.

c) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).

d) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.

e) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.

f) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

g) Measure the frequency at each of frequencies specified in 5.6.

h) Switch OFF the EUT but do not switch OFF the oscillator heater.

i) Lower the chamber temperature by not more that 10°C, and allow the temperature inside the chamber to stabilize.

j) Repeat step f) through step i) down to the lowest specified temperature.

2. Frequency stability when varying supply voltage

Unless otherwise specified, these tests shall be made at ambient room temperature (+15°C to +25 °C). An antenna shall be connected to the antenna output terminals of the EUT if possible. If the EUT is equipped with or uses an adjustable-length antenna, then it shall be fully extended.

a) Supply the EUT with nominal voltage or install a new or fully charged battery in the EUT. Turn ON the EUT and couple its output to a frequency counter or other frequency-measuring instrument.

b) Tune the EUT to one of the number of frequencies required in 5.6. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).
c) Measure the frequency at each of the frequencies specified in 5.6.
d) Repeat the above procedure at 85% and 115% of the nominal supply voltage.

Limit

Manufacturers 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 users manual.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 936Hz

Test Results

Voltage (V)	Temperature (°C)	U-NII-1 Test Results			
		5200MHz			
		1min	2min	5min	10min
3.3	-30	5199.997928	5199.997133	5199.997131	5199.993649
3.3	-20	5199.998598	5199.994414	5199.984971	5199.981660
3.3	-10	5199.999697	5199.993656	5199.975540	5199.975995
3.3	0	5199.993516	5199.985282	5199.966380	5199.967984
3.3	10	5199.984805	5199.979180	5199.964272	5199.961247
3.3	20	5199.979541	5199.970734	5199.962523	5199.960062
3.3	30	5199.970492	5199.968722	5199.957438	5199.958532
3.3	40	5199.965750	5199.962753	5199.951469	5199.953868
3.3	50	5199.957464	5199.959688	5199.949602	5199.952922
3	20	5199.953080	5199.954870	5199.941958	5199.952736
3.6	20	5199.945721	5199.950920	5199.932474	5199.947556
Max. ΔMHz		-0.054279	-0.049080	-0.067526	-0.052444
PPM		-10.438211	-9.438476	-12.985840	-10.085445

Voltage (V)	Temperature (°C)	U-NII-2A Test Results			
		5300MHz			
		1min	2min	5min	10min
3.3	-30	5299.990007	5299.984344	5299.977537	5299.968435
3.3	-20	5299.993660	5299.983984	5299.976998	5299.968102
3.3	-10	5299.986577	5299.976140	5299.971711	5299.967363
3.3	0	5299.977768	5299.969058	5299.963375	5299.960136
3.3	10	5299.969758	5299.965686	5299.956590	5299.958093
3.3	20	5299.961048	5299.960015	5299.949369	5299.951947
3.3	30	5299.958179	5299.950620	5299.948038	5299.948850
3.3	40	5299.957664	5299.948011	5299.941389	5299.939630
3.3	50	5299.956588	5299.943685	5299.939543	5299.929631
3	20	5299.948416	5299.938633	5299.936454	5299.923601
3.6	20	5299.939866	5299.929499	5299.936329	5299.923279
Max. ΔMHz		-0.060134	-0.070501	-0.063671	-0.076721
PPM		-11.346016	-13.302056	-12.013308	-14.475675

Voltage (V)	Temperature (°C)	U-NII-2C Test Results			
		5580MHz			
		1min	2min	5min	10min
3.3	-30	5580.000024	5579.990163	5579.985608	5579.984943
3.3	-20	5579.994177	5579.987517	5579.983118	5579.975834
3.3	-10	5579.986203	5579.984302	5579.982359	5579.972061
3.3	0	5579.980933	5579.978357	5579.978590	5579.968391
3.3	10	5579.979064	5579.972027	5579.976550	5579.965239
3.3	20	5579.969122	5579.971732	5579.976541	5579.963470
3.3	30	5579.963093	5579.963985	5579.975470	5579.959149
3.3	40	5579.953966	5579.959687	5579.968363	5579.950014
3.3	50	5579.947447	5579.955035	5579.967183	5579.946323
3	20	5579.938725	5579.949503	5579.959826	5579.942864
3.6	20	5579.933762	5579.942723	5579.950079	5579.942372
Max. ΔMHz		-0.066238	-0.057277	-0.049921	-0.057628
PPM		-11.870567	-10.264676	-8.946451	-10.327516

Voltage (V)	Temperature (°C)	U-NII-3 Test Results			
		5785MHz			
		1min	2min	5min	10min
3.3	-30	5784.993945	5784.987617	5784.979564	5784.978881
3.3	-20	5785.009053	5785.002862	5784.996705	5784.995278
3.3	-10	5785.000288	5784.994225	5784.995225	5784.985916
3.3	0	5784.992481	5784.990086	5784.988574	5784.981359
3.3	10	5784.987663	5784.980151	5784.980163	5784.980243
3.3	20	5784.981460	5784.973991	5784.972744	5784.974726
3.3	30	5784.981365	5784.971381	5784.971865	5784.969934
3.3	40	5784.980771	5784.964307	5784.970085	5784.966573
3.3	50	5784.980250	5784.958542	5784.964759	5784.957334
3	20	5784.977169	5784.951446	5784.962513	5784.950120
3.6	20	5784.967438	5784.946323	5784.961626	5784.946160
Max. ΔMHz		-0.032562	-0.053677	-0.038374	-0.053840
PPM		-5.628755	-9.278591	-6.633280	-9.306897

5.4. Power Spectral Density

Ambient condition

Temperature	Relative humidity	Pressure
15°C ~ 35°C	20% ~ 80%	86 kPa ~ 106 kPa

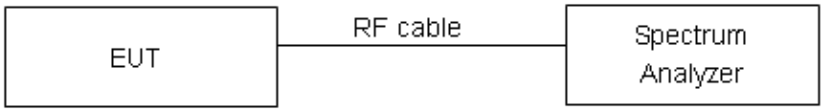
Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

Set RBW = 1MHz, VBW =3MHz for the band 5.150-5.250GHz, 5.250-5.350GHz, 5.470-5.725GHz.
Set RBW = 470kHz, VBW =1.5MHz for the band 5.725-5.850GHz

The conducted PSD is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test setup



Limits

Rule FCC Part 15.407(a)(1)/ FCC Part 15.407(a)(2) / FCC Part 15.407(a)(3)
For an indoor access point 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.
For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, 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 5.25-5.35 GHz and 5.47-5.725 GHz bands, 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, the maximum power spectral density shall not exceed 30 dBm in any 500kHz band. If transmittingantennas 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.

Frequency Bands/GHz	Limits
5.15-5.25	11dBm/MHz
5.25-5.35 and 5.47-5.725	11dBm/MHz
5.725-5.85	30dBm/500kHz

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.75dB.