

Optical Zonu

TEST REPORT FOR

**5 Band Antenna Extender
Models: A03-A15-5B and A03-E15-5B-55**

Tested to The Following Standard:

FCC Part 20.21 / 22H / 24E / 27 / 27D, 27L and 90S

Report No.: 104362-11

Date of issue: May 17, 2021



Test Certificate # 803.01

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Optical Zonu
7510 Hazeltine Ave
Van Nuys, CA 91405

Representative: Peter Dinnerstein
Customer Reference Number: 20-1001P3

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 104362

October 30, 2020

October 30, 2020, November 3-6, 2020 and May 12, 2021

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink that reads "Steve Behm". The signature is written in a cursive style and is positioned above a horizontal line.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.19
EMITest Immunity	5.03.10

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

SUMMARY OF RESULTS

Standard / Specification: FCC Part 20.21/22H/24E/27/27D/27L and 90S
Industrial and Non-Consumer Signal Booster, Repeater, and Amplifier Devices Measurement
Guidance KDB 935210 D05, v01r04, 04/03/2020

Correlation Matrix & Results					
Guidance Section	Guidance Description	FCC Section	FCC Rule Description	Mods	Results
3.3 a)-j)	Out of band rejection	20.21(c)	Frequency Bands	NA	Pass
3.4 a)-q)	Input-versus-output signal comparison	2.1049	Occupied Band Width	NA	Pass
3.5 a)-j)	Mean Output power and amplifier/ booster gain	2.1046	Power Limit	NA	Pass
3.6.2 a)-t)	Out of Band/out of block emission conducted emission	2.1051/20.21(c)	Out of Band Emission	NA	Pass
3.6.3 a)-r)	Conducted Spurious Emission	2.1051/22H/24/27/90S	Spurious emission	NA	Pass
3.7	Frequency Stability	NA	NA	NA	NA1
3.8	Radiated Spurious Emission	2.1053/22H/24E/27-90S	Spurious Emission	NA	Pass

NA = Not Applicable

NA1 = Not applicable because the device does not alter the input signal in any way.

ISO/IEC 17025 Decision Rule

The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
5 Band Antenna Extender	Optical Zonu	A03-A15-5B	201014609
5 Band Antenna Extender	Optical Zonu	A03-E15-5B-55	201014610

Support Equipment:

Device	Manufacturer	Model #	S/N
Signal Generator	Agilent	E4432B	MY41310665
Power Supply	HP	6038A	US36510255
Power Supply	Extech Instruments	382225	P99250026

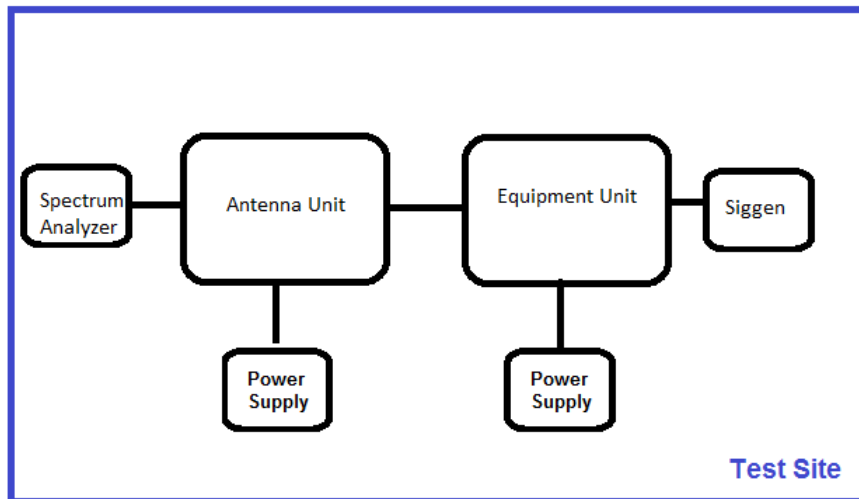
General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Transmission System:	Wideband Non-Consumer Booster/Antenna Extender
Operating Frequency Range(s):	See table below
Modulation Type(s):	0.3 GMSK (GSM) QPSK (CDMA) BPSK/QPSK (WCDMA) OFDM (LTE)
OBW and Emissions Type(s):	GXW (GSM) F9W(CDMA) F9W(WCDMA) W7D (LTE) See section 3.4 a) – q) below for OBW
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Type(s) and Gain:	NA
Beamforming Type:	NA
Antenna Connection Type:	External Connector, 50ohm N-Type
Nominal Input Voltage:	12Vdc/-48Vdc
Firmware used for Test:	FW B010

Band name	Lower 700	Upper700	ESMR	Cellular	Broadband PCS	AWS1	WCS
Rule part	27	27	90S	22H	24	27 L	27D
UL	698-716	776-787	817-824	824-849	1850-1915	1710-1755	2305-2315
DL*	728- 746	746-757	862-869	869-894	1930-1995	2100-2155	2350-2360
Protocol	GSM 1.25MHz CDMA 5MHzWCDME 1.4MHzLTE 5MHz LTE 10MHz LTE	GSM 1.25MHz CDMA 5MHzWCD ME 1.4MHzLTE 5MHz LTE 10MHz LTE	GSM 1.25MHz CDMA 5MHzWCD ME 1.4MHzLTE 5MHz LTE	GSM 1.25MHz CDMA 5MHzWCDME 1.4MHzLTE 5MHz LTE 10MHz LTE 20MHz LTE	GSM 1.25MHz CDMA 5MHzWCD ME 1.4MHzLTE 5MHz LTE 10MHz LTE 20MHz LTE	GSM 1.25MHz CDMA 5MHzWCD ME 1.4MHzLTE 5MHz LTE 10MHz LTE 20MHz LTE	GSM 1.25MHz CDMA 5MHzWCD ME 1.4MHzLTE 5MHz LTE 10MHz LTE

* Evaluation for UL only. DL port of the device is not intended to be connected to antenna for transmission.

Test Setup Block Diagram



FCC PART 20.21/22H/24E/27, 27D, 27L/90S

3.3 Out of Band Rejection

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen / Eddie Wong
Test Method:	KDB 935210 D05 Indus Booster Basic Meas v01r04, 04/03/2020	Test Date(s):	10/30/2020 and 5/12/2021
Configuration:	1		
Test Setup:	The EUTs (Antenna and Equipment units) are placed on test bench and connected to 12Vdc and 48Vdc external power supplies. Input port (BDA) is connected to a signal generator. Output port (Antenna) is connected a spectrum analyzer. Uplink (Equipment) unit and Downlink (Antenna) Unit are connected via an unshielded optical cable. The manufacturer declares that the Equipment Unit output port is only intended for BDA unit and is not connected to an antenna. All tests are performed only on the Antenna Unit output port. Note: This is a low gain device, the measured gain is listed in section 3.5, maximum gain is +3.1dB in the 1850-1915MHz band.		
Declaration:	None		

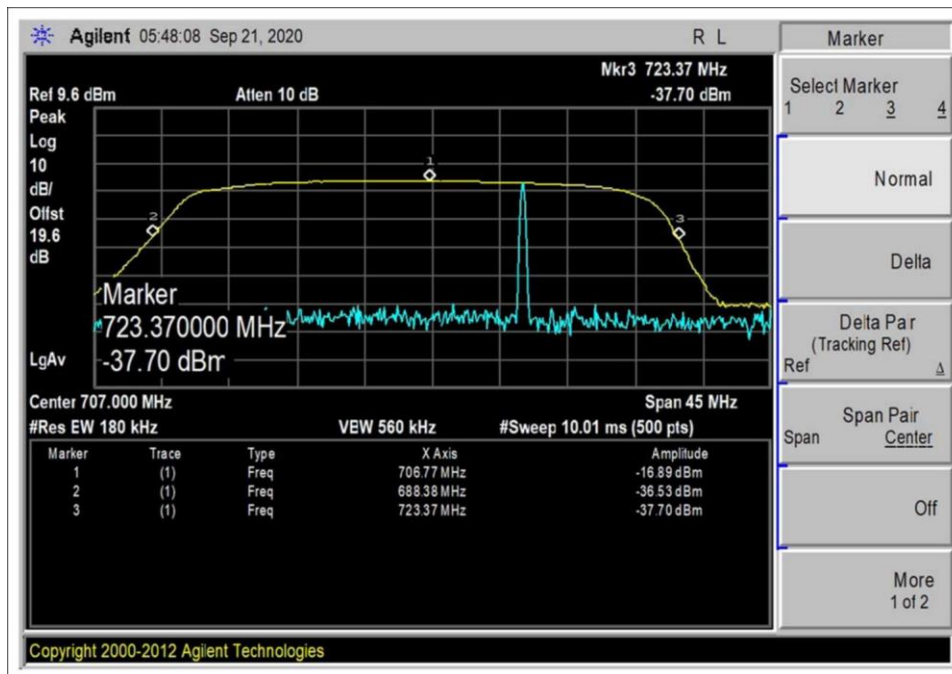
Environmental Conditions 10/30/2020			
Temperature (°C)	21.6	Relative Humidity (%):	39

Environmental Conditions 5/12/2021			
Temperature (°C)	22.3	Relative Humidity (%):	56

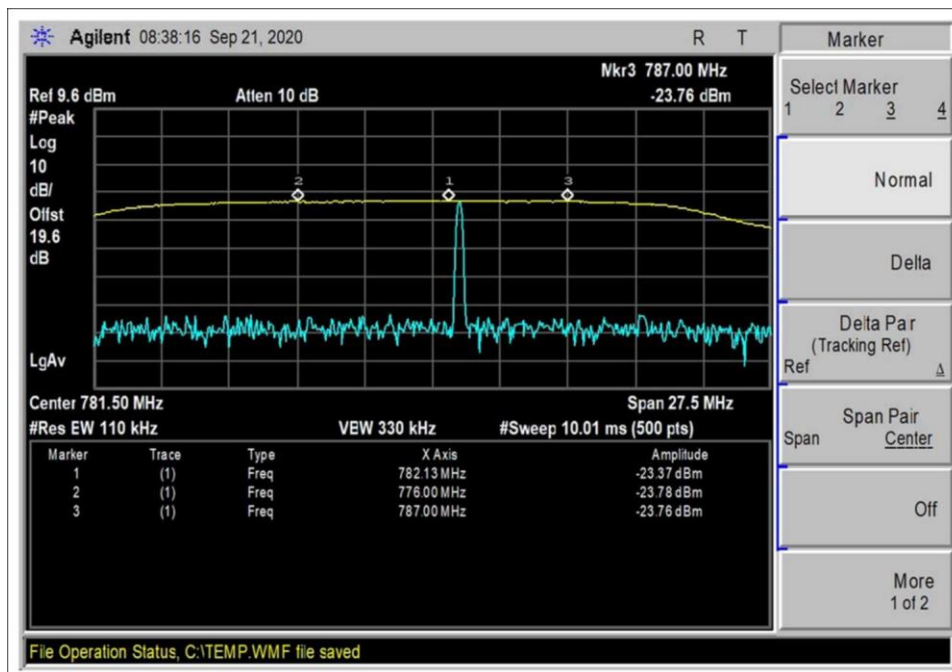
Test Equipment – 10/30/2020					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03643	Spectrum Analyzer	Agilent	E4440A	5/20/2020	5/20/2022
P06660	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022
P07243	Cable	H&S	32022-29094K- 29094K-24TC	5/29/2020	5/29/2022
03431	Attenuator	Aeroflex/Weinschel	89-20-21	12/20/2019	12/20/2021
P07037	Signal Generator	Agilent	E4432B	2/7/2019	2/7/2021

Test Equipment – 5/12/2021					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02672	Spectrum Analyzer	Agilent	E4446A	4/29/2020	4/29/2022
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	12/20/2019	12/20/2021
P07658	Cable	Astrolab, Inc.	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022
P07037	RF Signal Generator	Agilent	E4432B	4/20/2021	4/20/2023

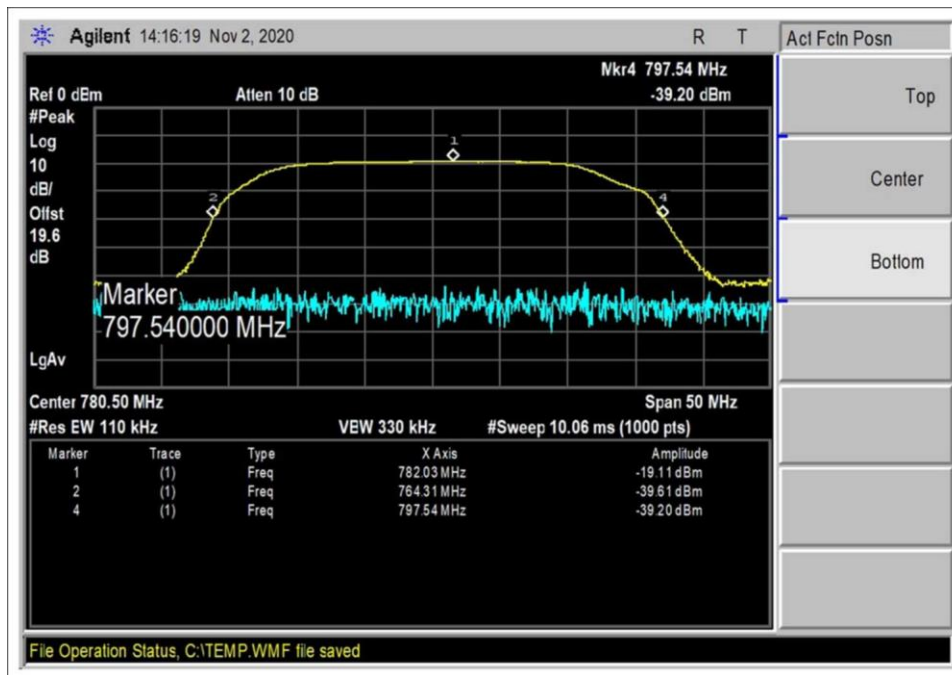
Plots



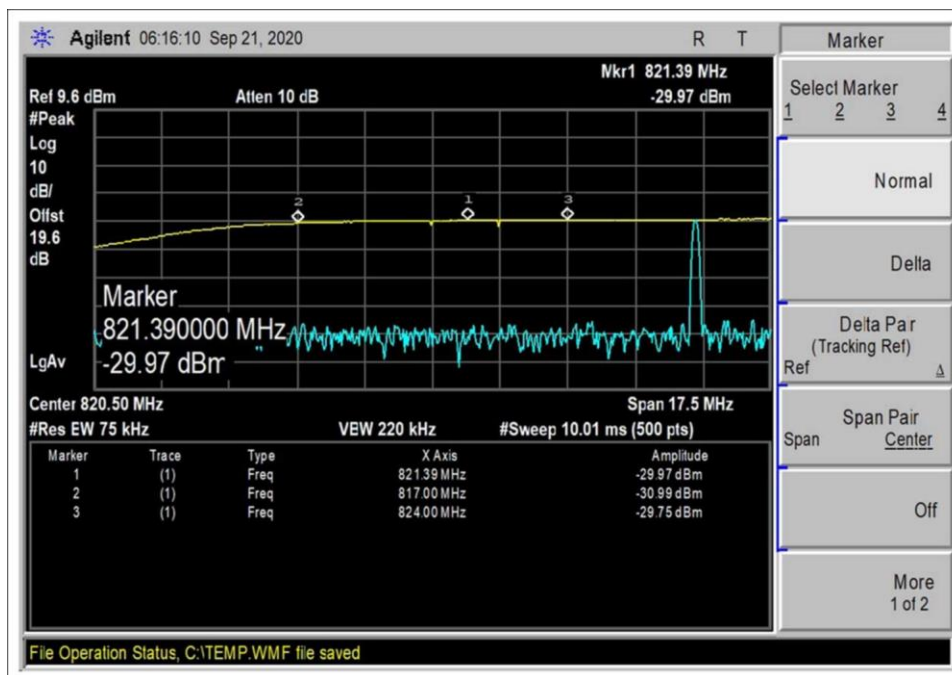
UL 698-716



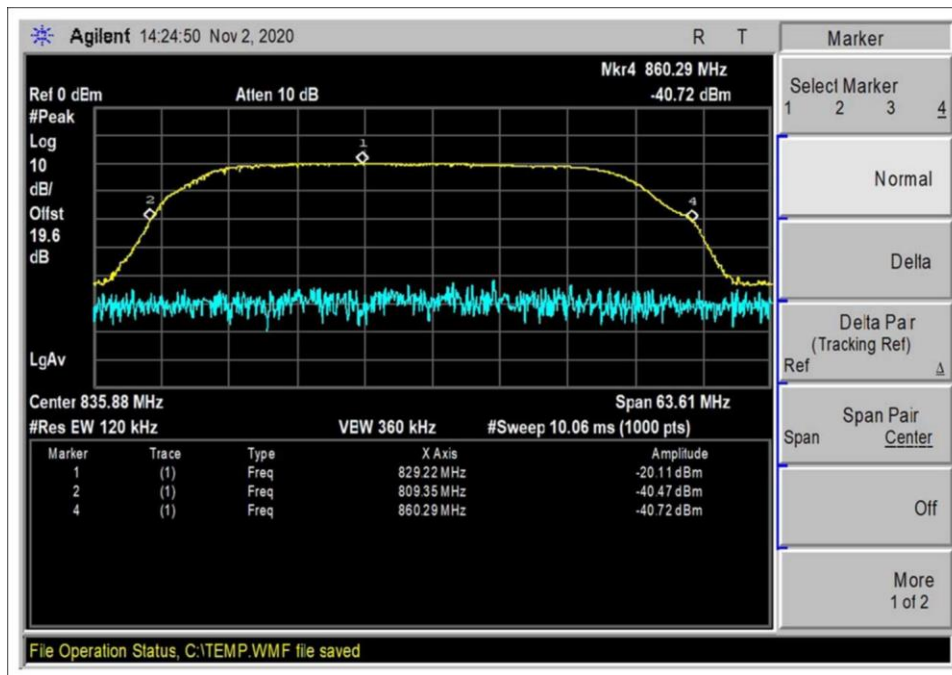
UL 776-787



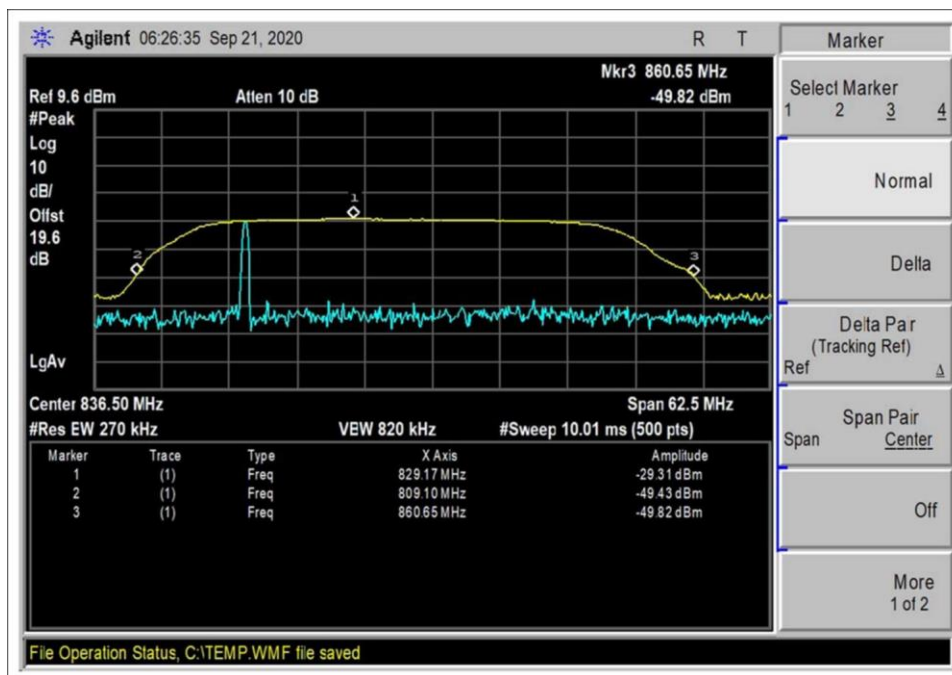
UL 776-787 zoom out



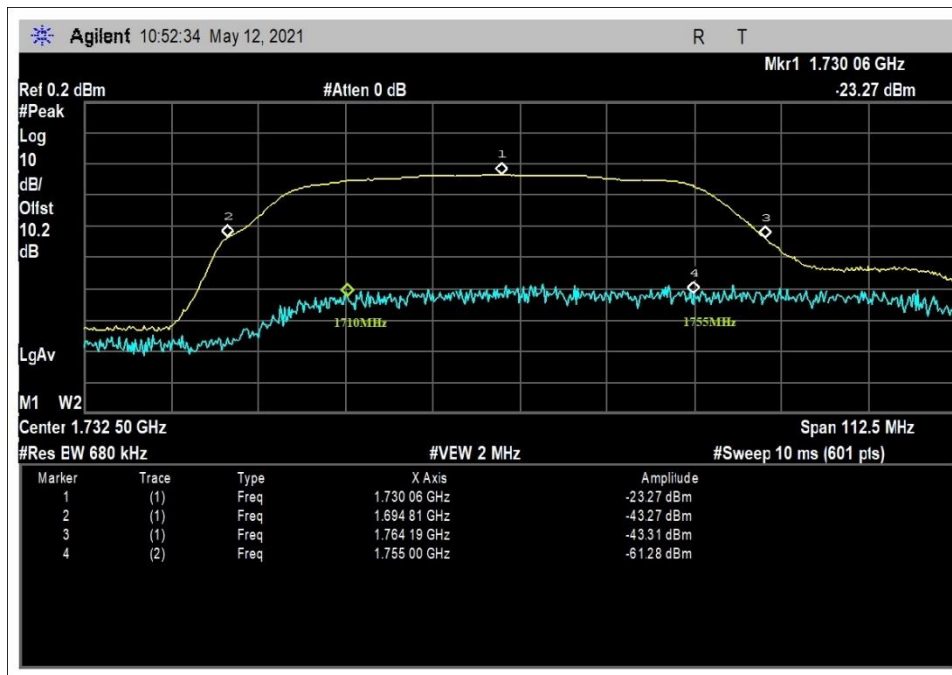
UL 817-824



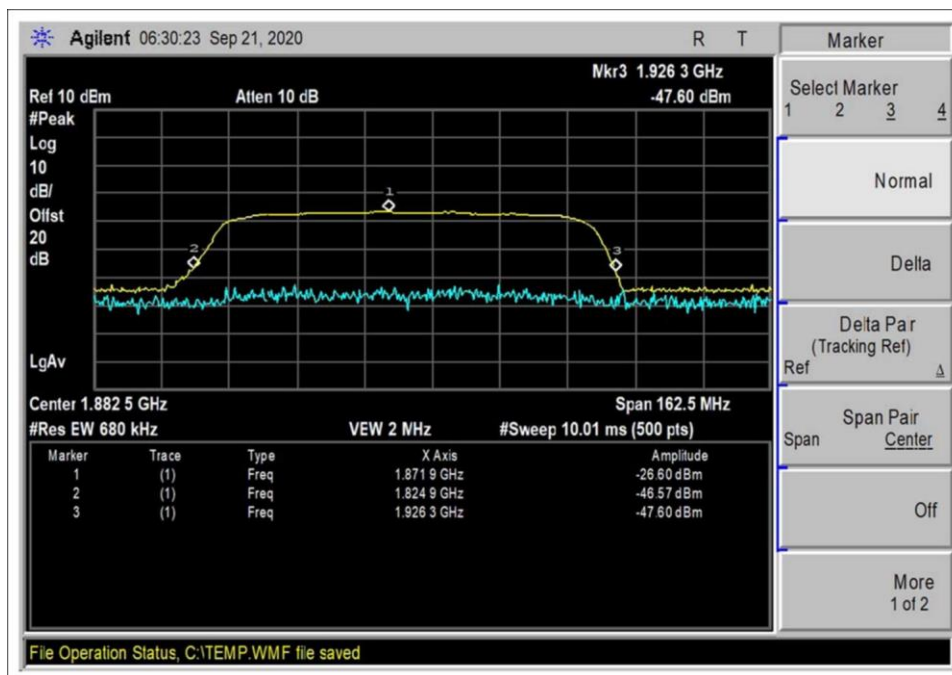
UL 817-824-849 zoom out



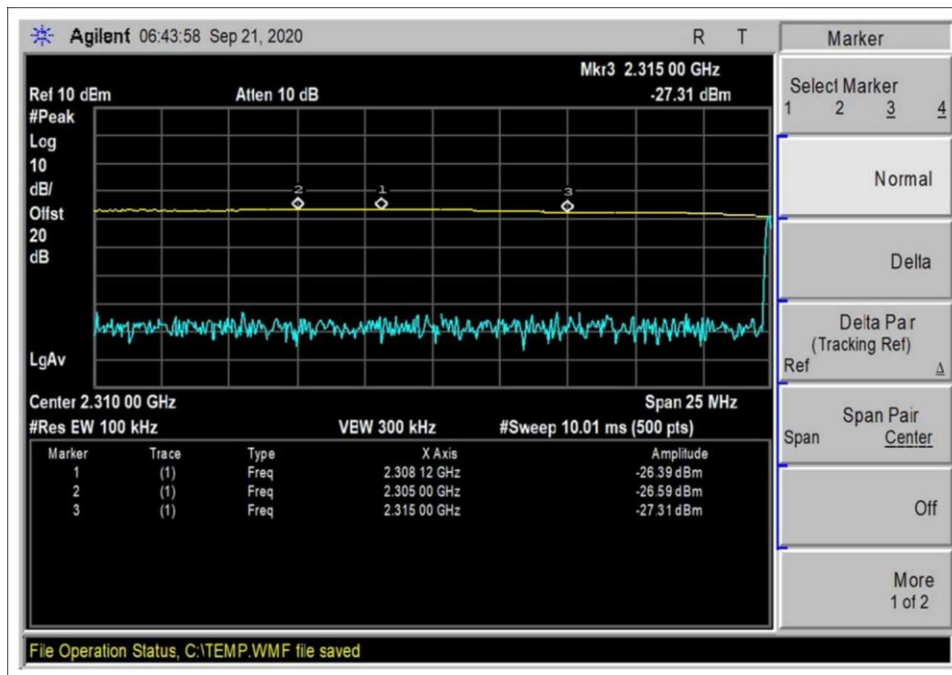
UL 824-849



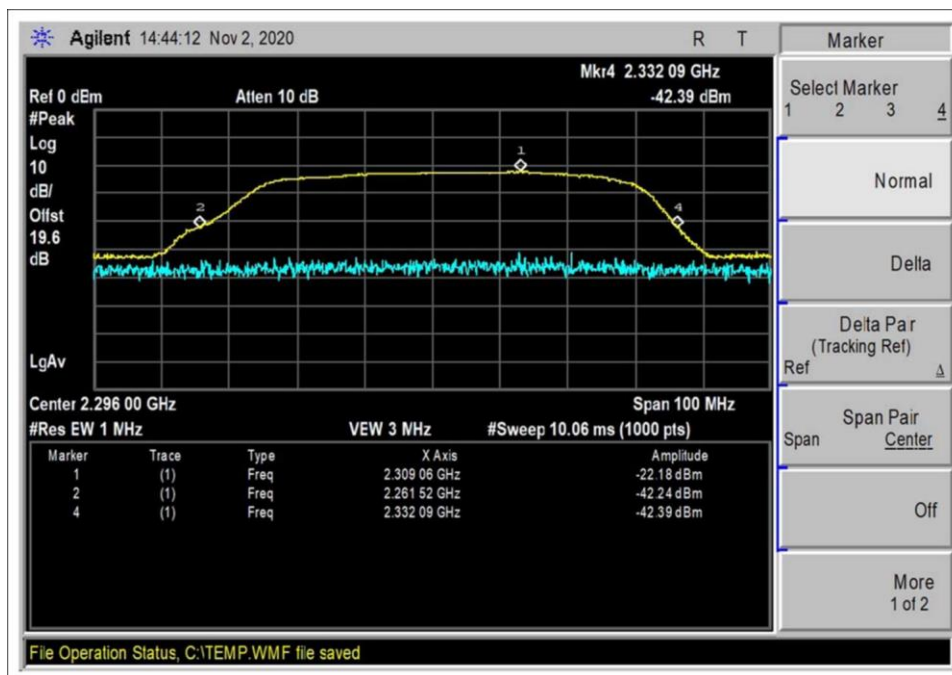
UL 1710-1755



UL 1850-1915



UL 2305-2315



UL 2305-2315 zoom out

3.4 Input-Versus-Output Signal Comparison

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	KDB 935210 D05 Indus Booster Basic Meas v01r04, 04/03/2020	Test Date(s):	10/30/2020
Configuration:	1		
Test Setup:	The EUTs (Antenna and Equipment units) are placed on test bench and connected to 12Vdc and 48Vdc external power supplies. Input port (BDA) is connected to a signal generator. Output port (Antenna) is connected a spectrum analyzer. Uplink (Equipment) unit and Downlink (Antenna) Unit are connected via an unshielded optical cable. The manufacturer declares that the Equipment Unit output port is only intended for BDA unit and is not connected to an antenna. All tests are performed only on the Antenna Unit output port.		
Declaration:	None		

Environmental Conditions			
Temperature (°C)	21.6	Relative Humidity (%):	39

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03643	Spectrum Analyzer	Agilent	E4440A	5/20/2020	5/20/2022
P06664	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022
P06660	Cable	Gore	PHASEFLEX FJR01N01036.0	3/27/2020	3/27/2022
P07243	Cable	H&S	32022-29094K- 29094K-24TC	5/29/2020	5/29/2022
03431	Attenuator	Aeroflex/Weinschel	89-20-21	12/20/2019	12/20/2021
P07037	Signal Generator	Agilent	E4432B	2/7/2019	2/7/2021
03420	Signal Generator	Agilent	E4438C	4/17/2019	4/17/2021
00786	Preamplifier	HP	83017A	5/20/2020	5/20/2022

99% OBW preAGC Input (Hz)								
Frequency Range (MHz)	AWGN	GSM	CDMA	WCDMA	LTE 1.4MHz	LTE 5MHz	LTE 10MHz	LTE 20MHz
UL 698-716	4118421	245821	1257863	4149932	1100190	4477236	9004428	NA
UL 776-787	4105720	250598	1259023	4120435	1099347	4458624	9001679	NA
UL 817-824	4110024	250108	1251434	4150036	1100304	4471952	NA	NA
UL 824-849	4113135	246821	1254275	4140067	1100401	4467725	9009856	17899250
UL 1850-1915	4153865	248330	1277654	4149854	1100219	4471864	9006984	17933060
UL 1710-1755	4175863	248690	1281154	4148364	1100324	4472014	9012204	17902750
UL 2305-2315	4217835	245190	1315545	4169842	1101300	4474535	9013685	NA

99% OBW preAGC Output (Hz)								
Frequency Range (MHz)	AWGN	GSM	CDMA	WCDMA	LTE 1.4MHz	LTE 5MHz	LTE 10MHz	LTE 20MHz
UL 698-716	4096757	247106	1254101	4137679	1098372	4464323	8995590	NA
UL 776-787	4102836	249100	1255203	4135907	1100827	4460283	8997437	NA
UL 817-824	4103592	249377	1257306	4134503	1100320	4464476	NA	NA
UL 824-849	4101898	249334	1254376	4139695	1100799	4459963	9000208	17889660
UL 1850-1915	4144732	248469	1270757	4135612	1100551	4472439	9014802	17884910
UL 1710-1755	4158101	248251	1284113	4149329	1101170	4480592	9025148	17899270
UL 2305-2315	4120991	249659	1270588	4181878	1105176	4486135	9051003	NA

Input vs Output Difference preAGC								
Frequency Range (MHz)	AWGN	GSM	CDMA	WCDMA	LTE 1.4 MHz	LTE 5MHz	LTE 10MHz	LTE 20MHz
UL 698-716	0.53%	0.52%	0.30%	0.30%	0.17%	0.29%	0.10%	NA
UL 776-787	0.07%	0.60%	0.30%	0.38%	0.13%	0.04%	0.05%	NA
UL 817-824	0.16%	0.29%	0.47%	0.37%	0.00%	0.17%	NA	NA
UL 824-849	0.27%	1.02%	0.01%	0.01%	0.04%	0.17%	0.11%	0.05%
UL 1850-1915	0.22%	0.06%	0.54%	0.34%	0.03%	0.01%	0.09%	0.27%
UL 1710-1755	0.43%	0.18%	0.23%	0.02%	0.08%	0.19%	0.14%	0.02%
UL 2305-2315	2.30%	1.82%	3.42%	0.29%	0.35%	0.26%	0.41%	NA

99% OBW AGC+3dB Input (Hz)								
Frequency Range (MHz)	AWGN	GSM	CDMA	WCDMA	LTE 1.4MHz	LTE 5MHz	LTE 10MHz	LTE 20MHz
UL 698-716	4125353	247513	1257771	4139727	1100676	4485423	9014649	NA
UL 776-787	4108232	246287	1257435	4143384	1099867	4484132	9015373	NA
UL 817-824	4112381	247447	1253486	4139549	1099416	4483367	NA	NA
UL 824-849	4121856	246336	1260365	4152717	1101292	4486675	9003175	17947250
UL 1850-1915	4193248	245602	1282719	4176016	1099535	4581736	9015080	17921690
UL 1710-1755	4161786	248254	1281185	4152570	1101734	4521769	9019767	17937260
UL 2305-2315	4135251	249114	1272516	4148450	1099998	4458134	9015439	NA

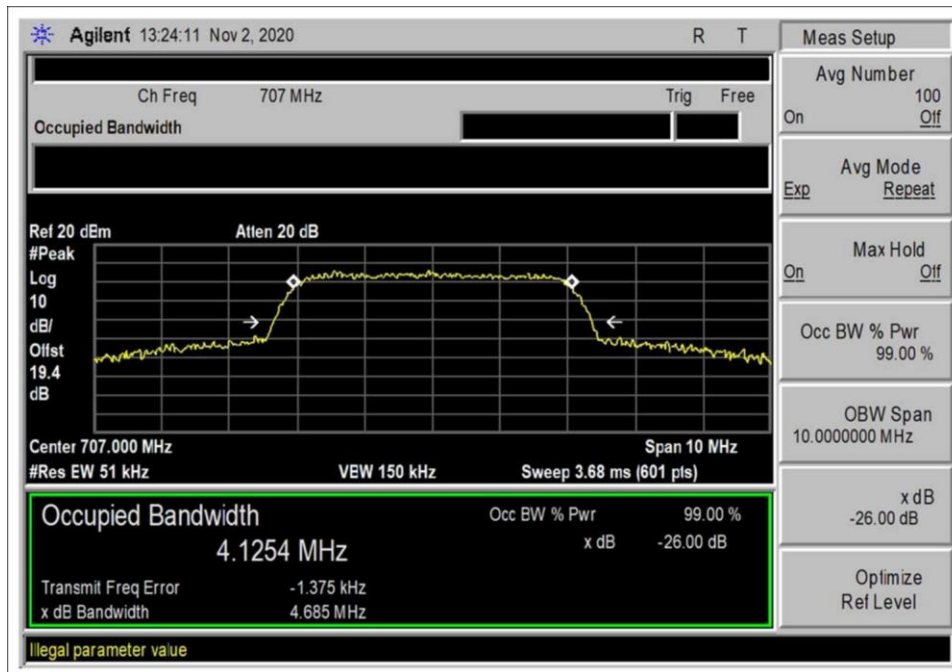
99% OBW AGC+3dB Output (Hz)								
Frequency Range (MHz)	AWGN	GSM	CDMA	WCDMA	LTE 1.4MHz	LTE 5MHz	LTE 10MHz	LTE 20MHz
UL 698-716	4135193	246988	1255960	4136424	1100828	4462391	9004012	NA
UL 776-787	4126106	250615	1259639	4155255	1100170	4488841	8999713	NA
UL 817-824	4142631	246248	1257651	4133235	1100585	4480935	NA	NA
UL 824-849	4139133	246979	1258729	4153037	1099047	4480550	9013366	17879690
UL 1850-1915	4263356	246601	1277624	4188867	1101715	4502367	9017625	17909850
UL 1710-1755	4195934	248991	1300425	4222997	1101298	4477658	9020524	17911780
UL 2305-2315	4259745	247687	1298764	4236024	1115819	4489826	9091998	NA

Input vs Output Difference AGC+3dB								
Frequency Range (MHz)	AWGN	GSM	CDMA	WCDMA	LTE 1.4MHz	LTE 5MHz	LTE 10MHz	LTE 20MHz
UL 698-716	0.24%	0.21%	0.14%	0.08%	0.01%	0.51%	0.12%	NA
UL 776-787	0.44%	1.76%	0.18%	0.29%	0.03%	0.11%	0.17%	NA
UL 817-824	0.74%	0.48%	0.33%	0.15%	0.11%	0.05%	NA	NA
UL 824-849	0.42%	0.26%	0.13%	0.01%	0.20%	0.14%	0.11%	0.38%
UL 1850-1915	1.67%	0.41%	0.40%	0.31%	0.20%	1.73%	0.03%	0.07%
UL 1710-1755	0.82%	0.30%	1.50%	1.70%	0.04%	0.98%	0.01%	0.14%
UL 2305-2315	3.01%	0.57%	2.06%	2.11%	1.44%	0.71%	0.85%	NA

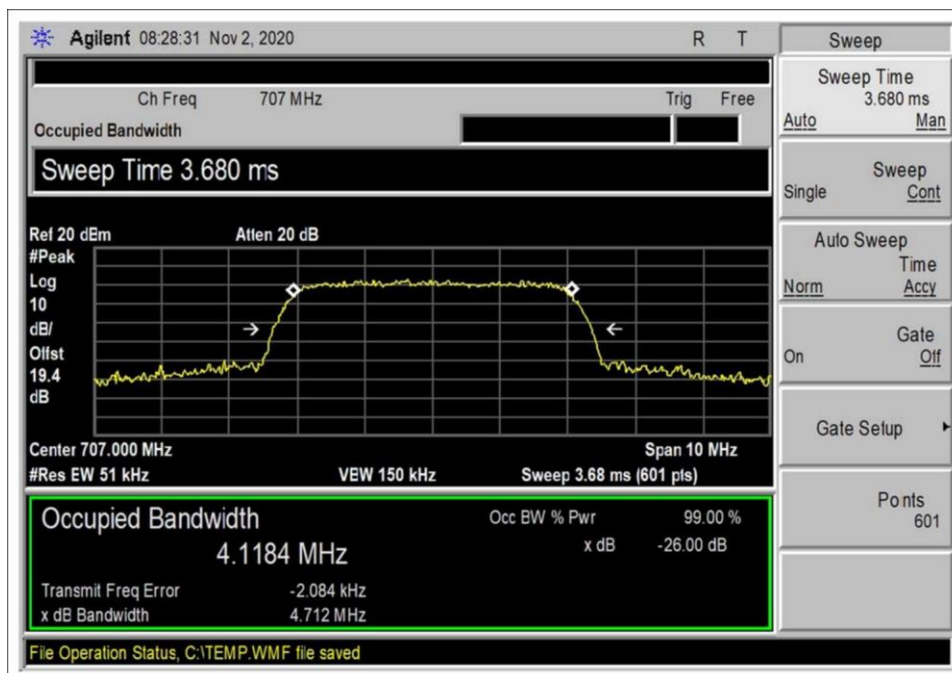
NA: Signal protocol does not fit within passband.

Plots

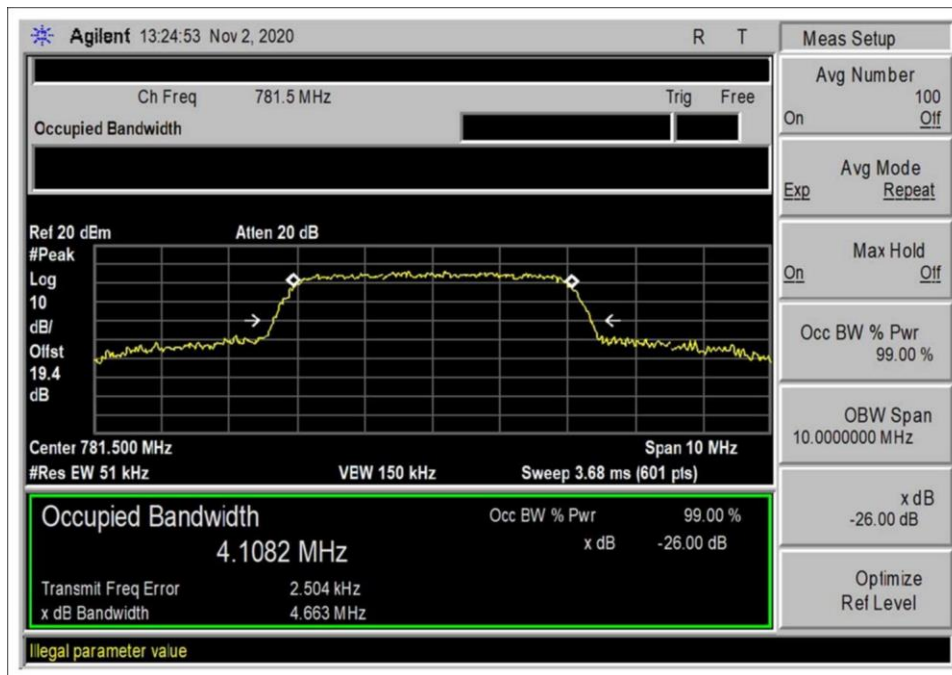
AWGN Input



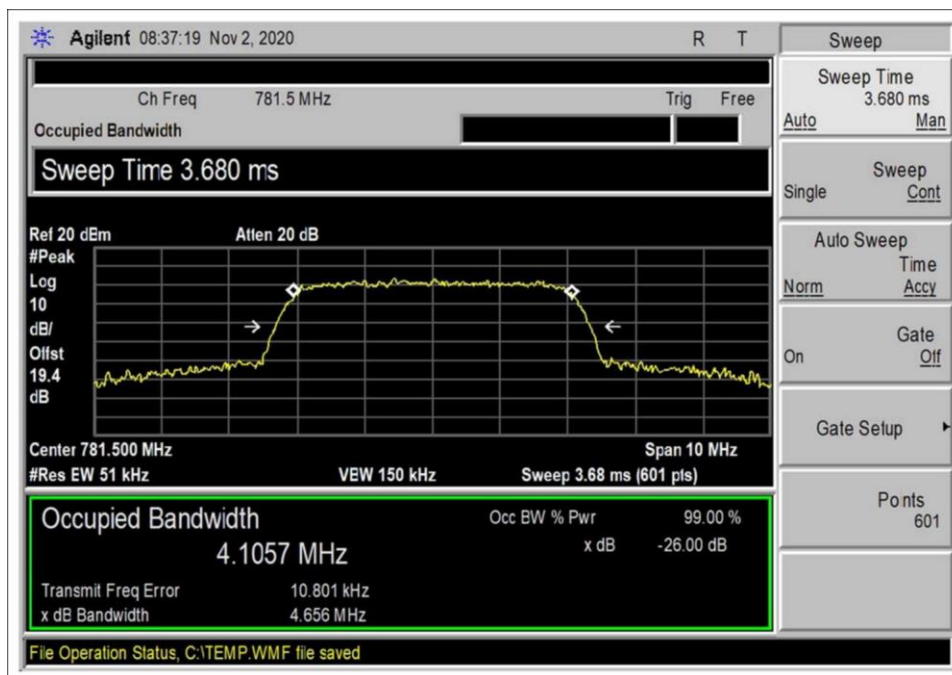
UL 698-716 AGC+3dB



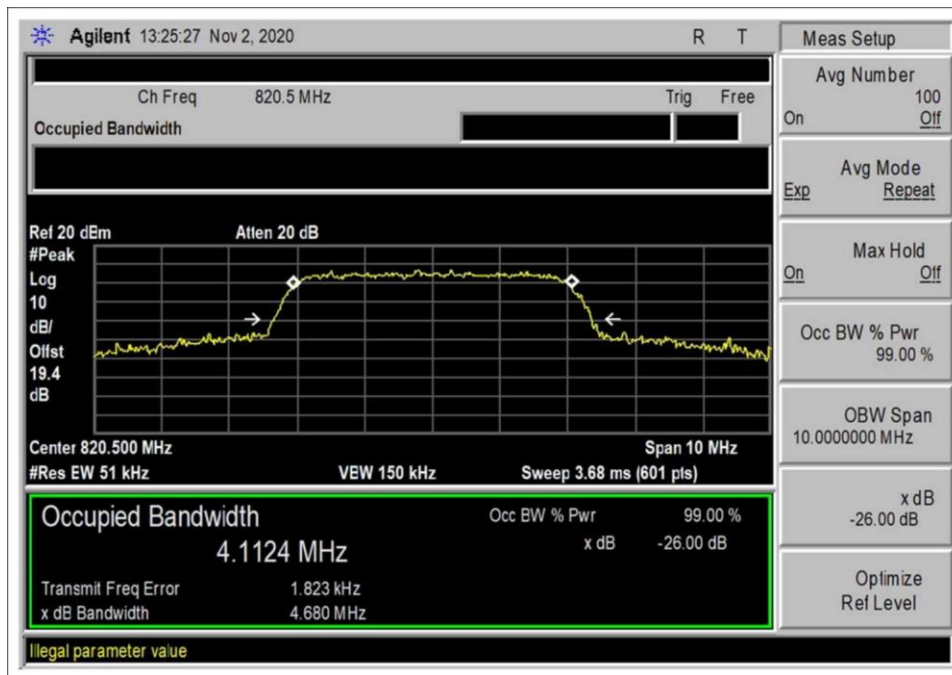
UL 698-716 preAGC



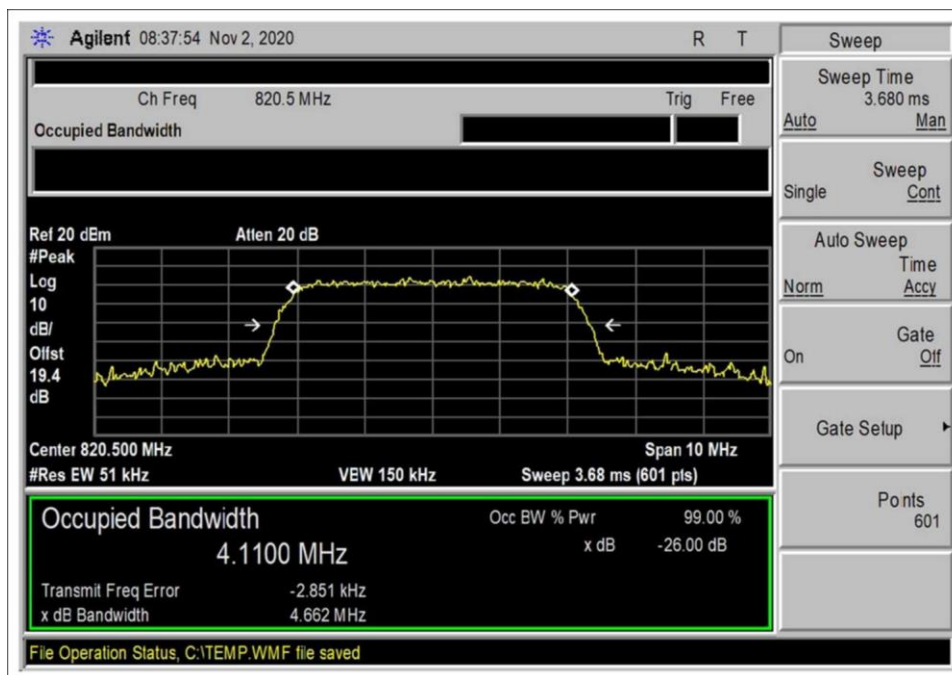
UL 776-787 AGC+3dB



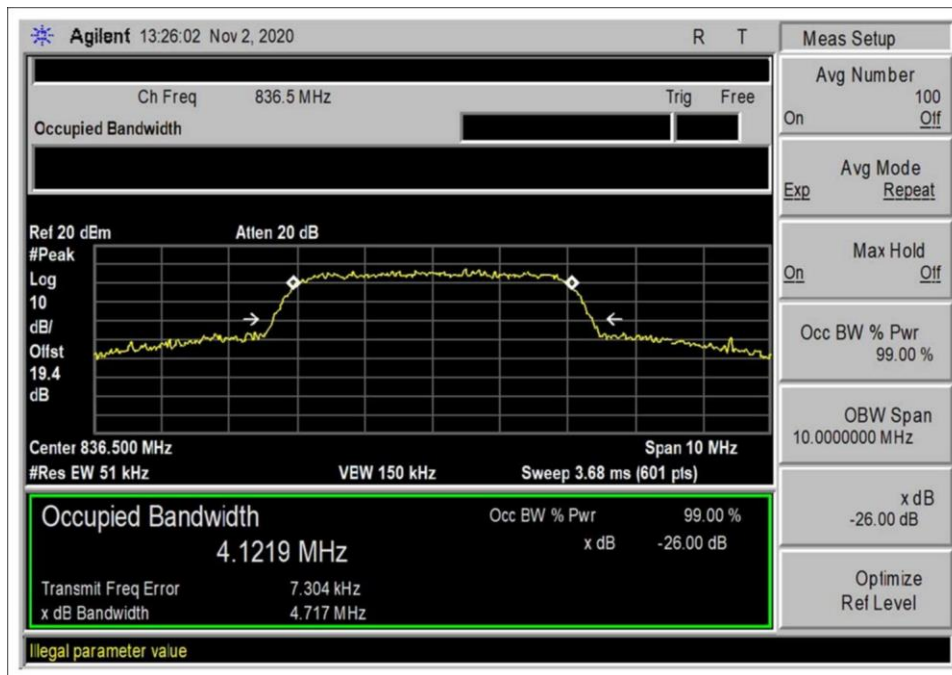
UL 776-787 preAGC



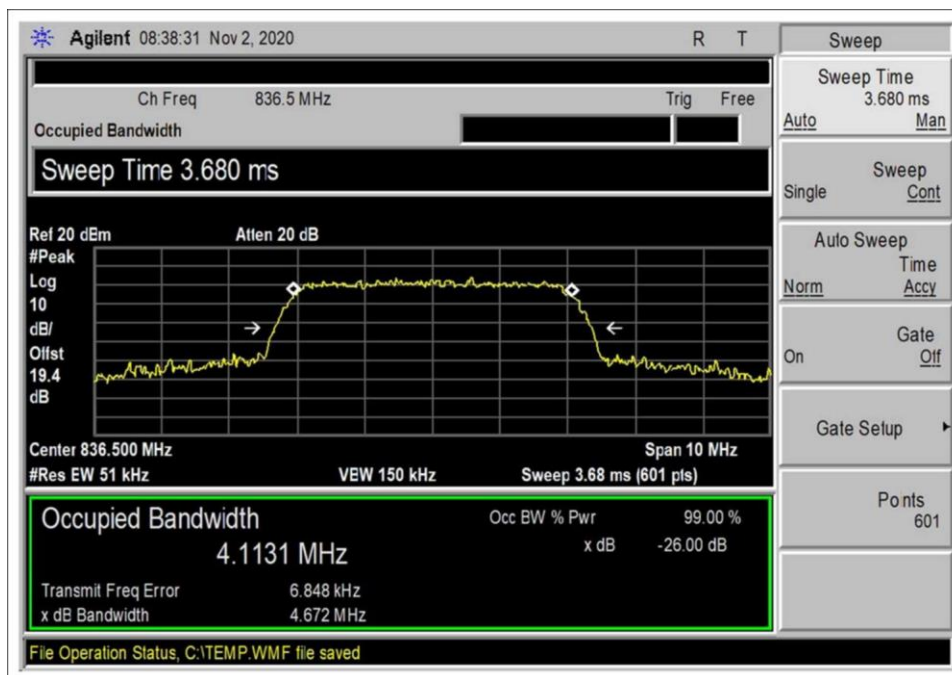
UL 817-824 AGC+3dB



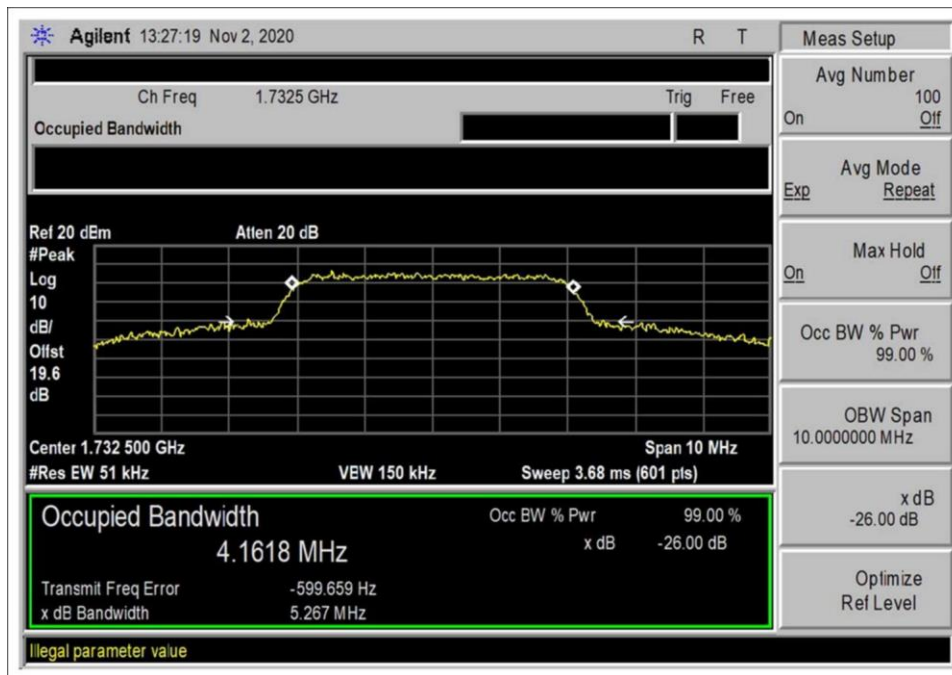
UL 817-824 preAGC



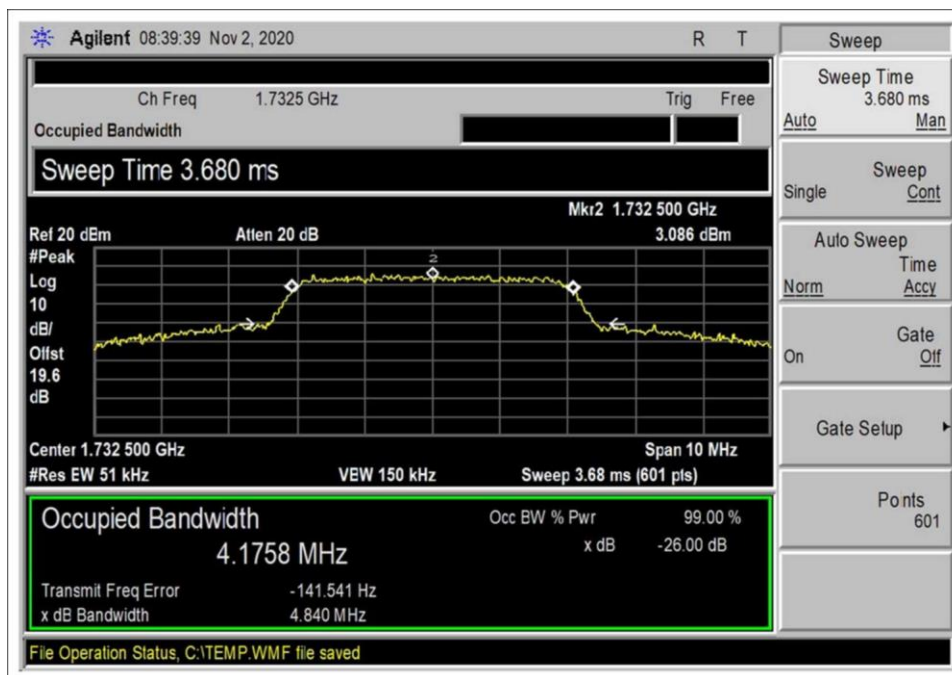
UL 824-849 AGC+3dB



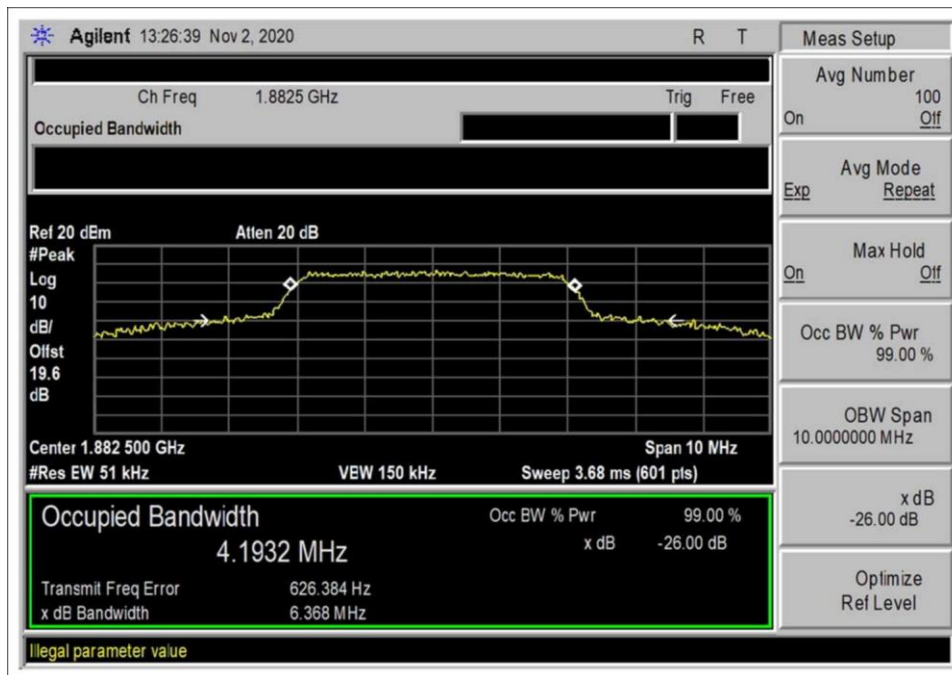
UL 824-849 preAGC



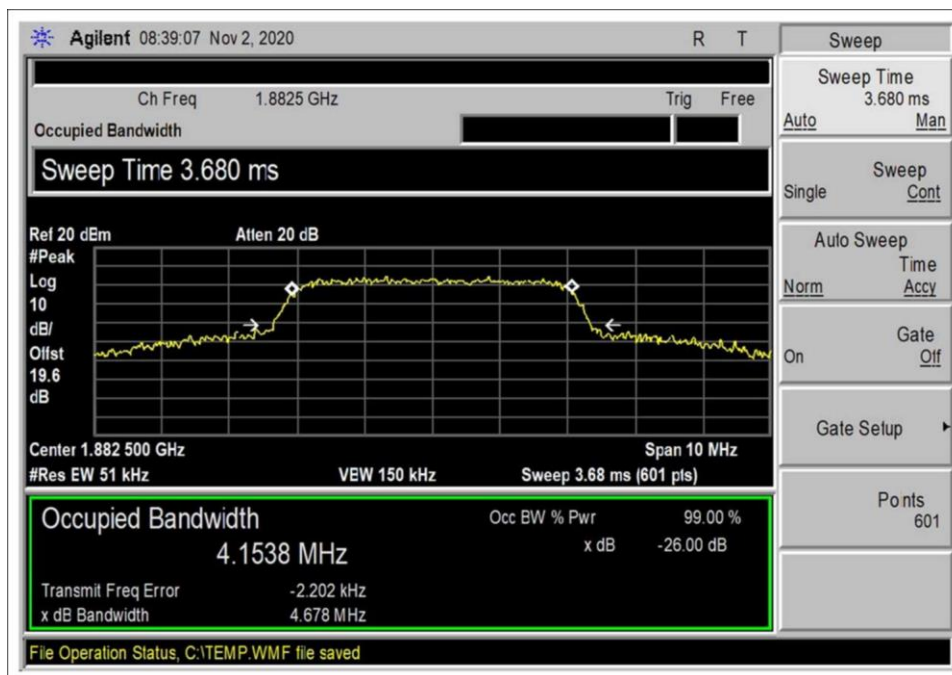
UL 1710-1755 AGC+3dB



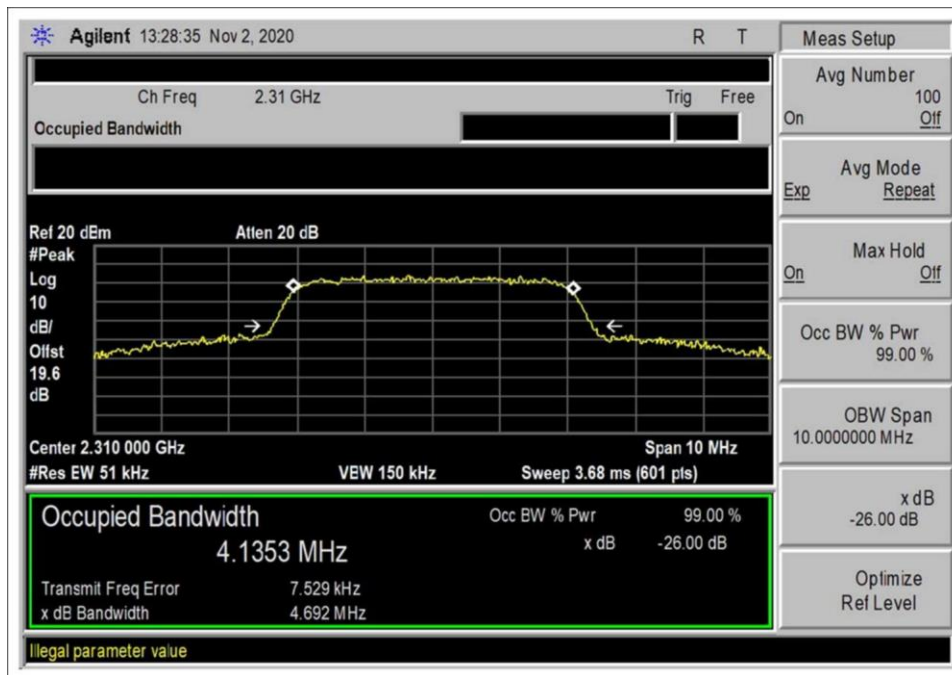
UL 1710-1755 preAGC



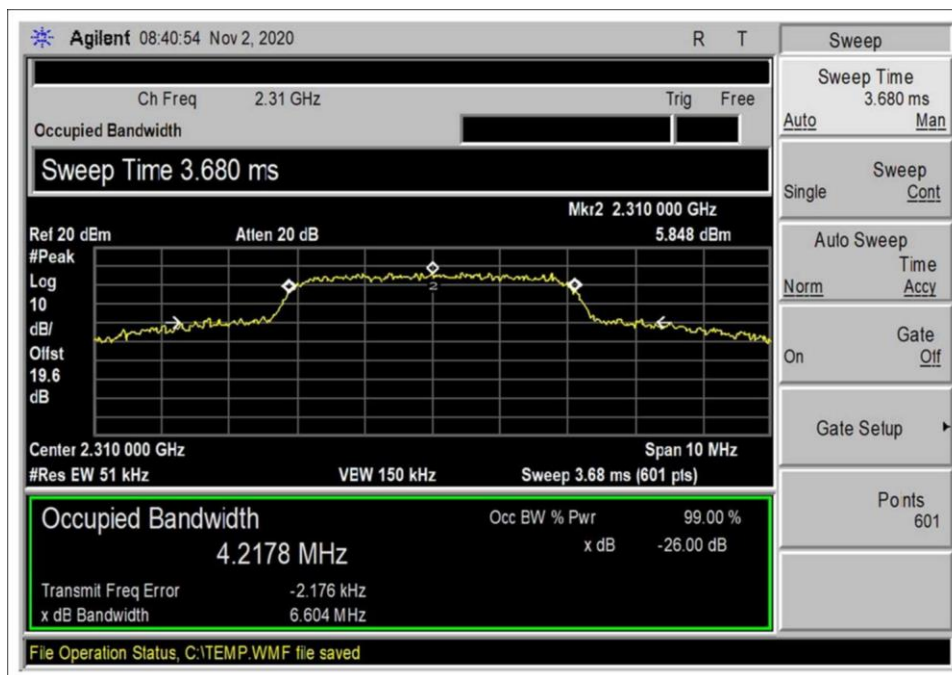
UL 1850-1915 AGC+3dB



UL 1850-1915 preAGC

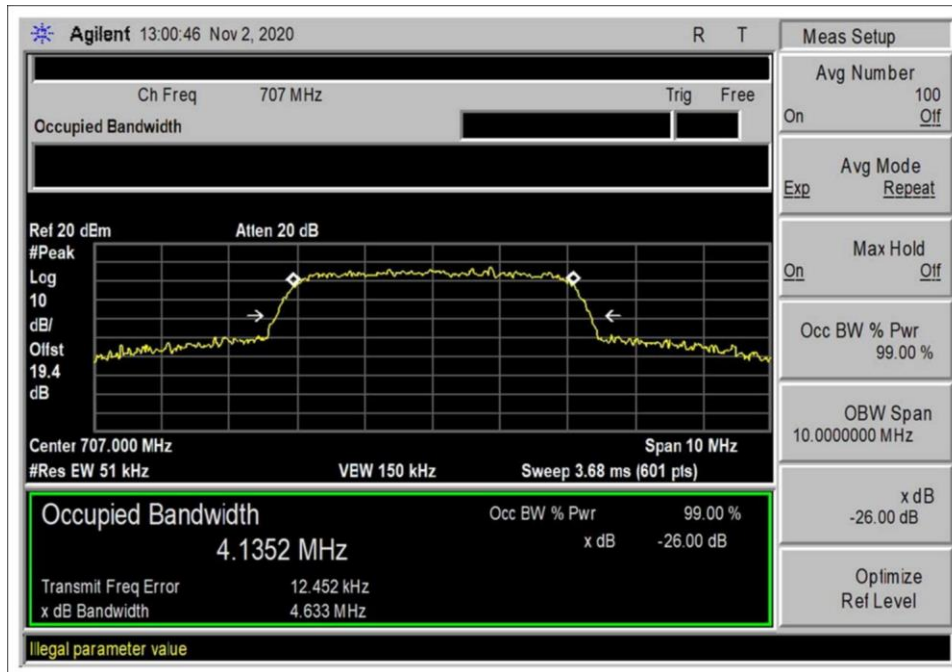


UL 2305-2315 AGC+3dB

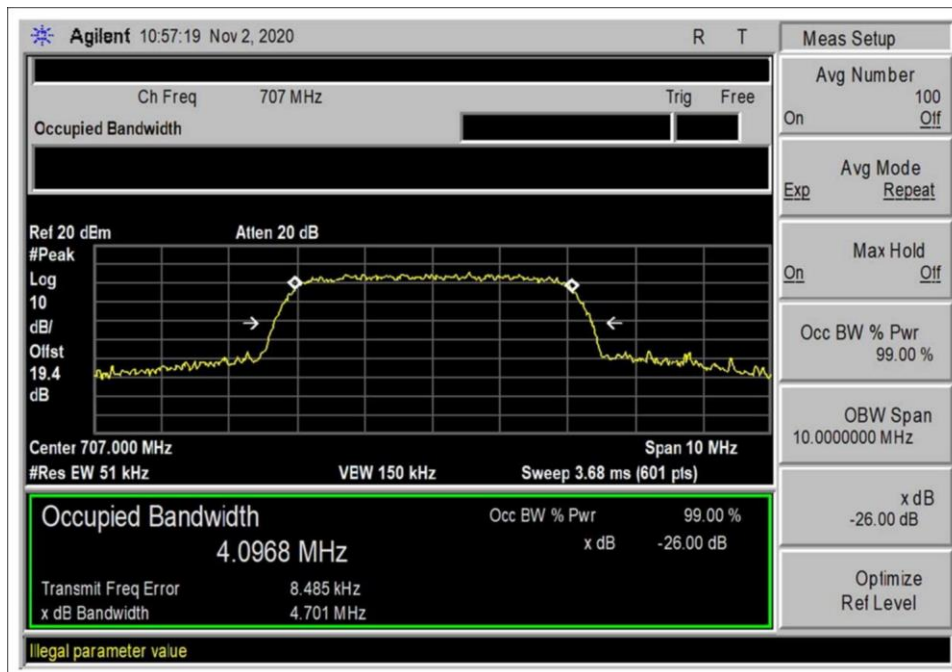


UL 2305-2315 preAGC

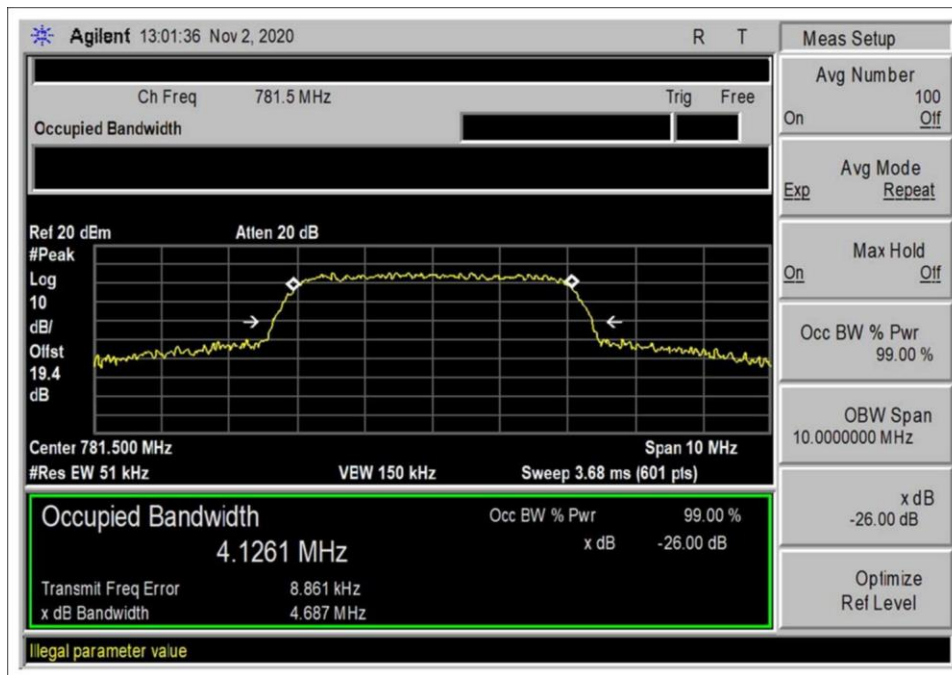
AWGN Output



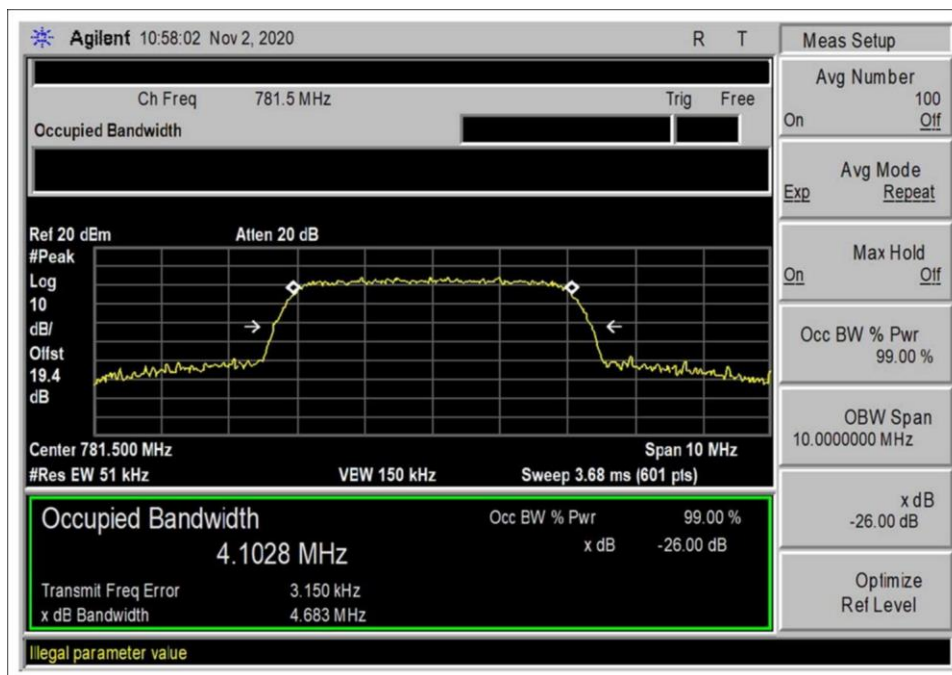
UL 698-716 AGC+3dB



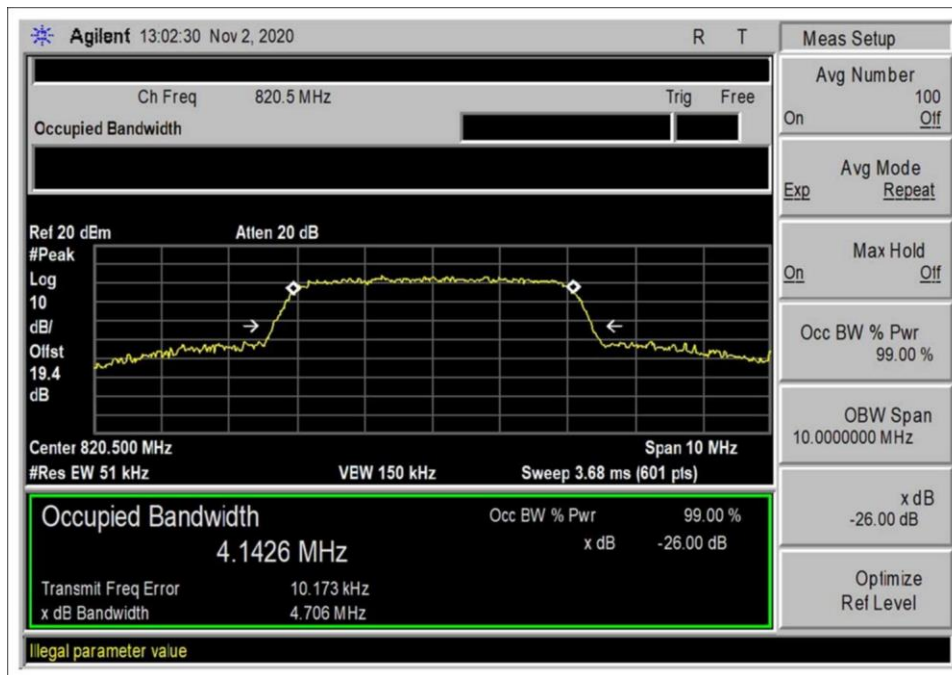
UL 698-716 preAGC



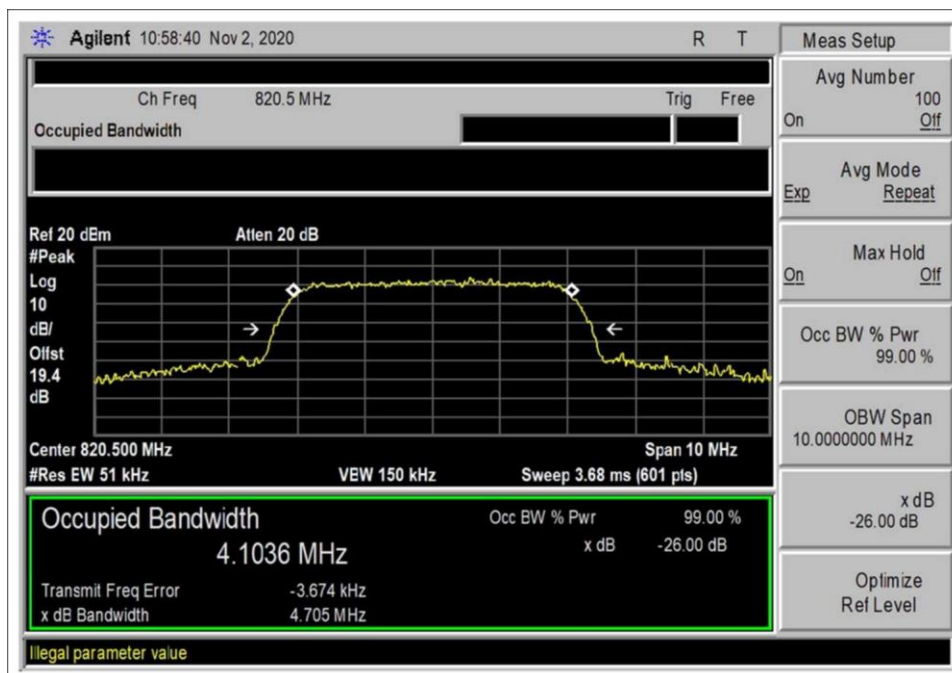
UL 776-787 AGC+3dB



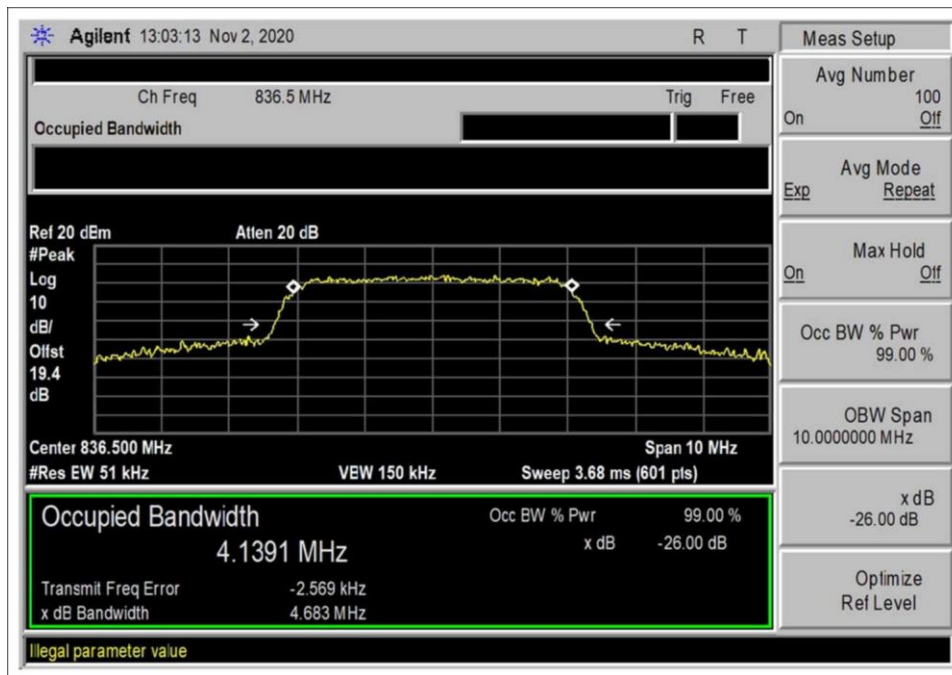
UL 776-787 preAGC



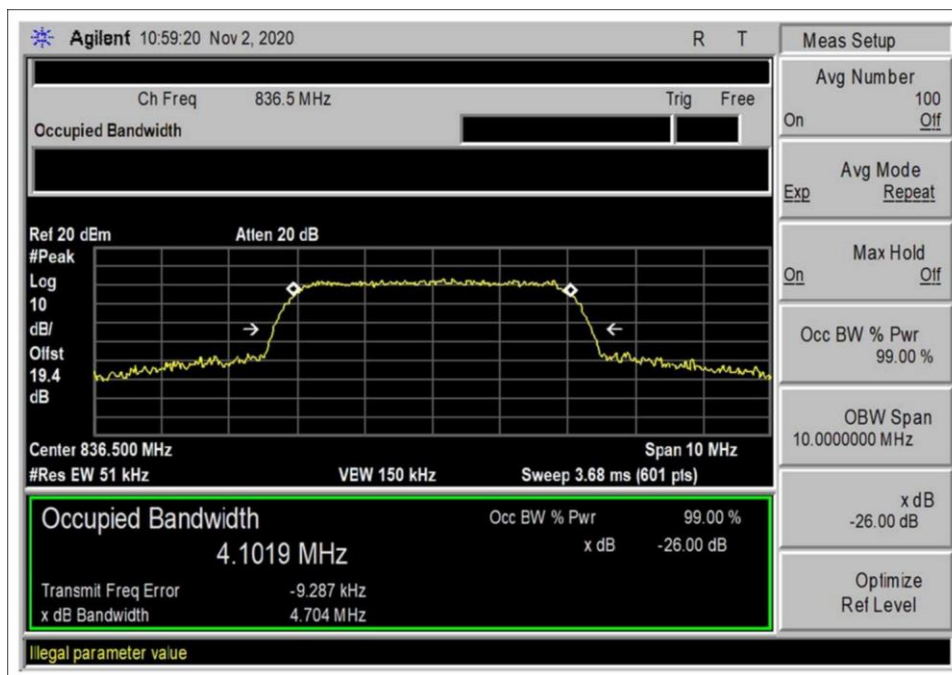
UL 817-824 AGC+3dB



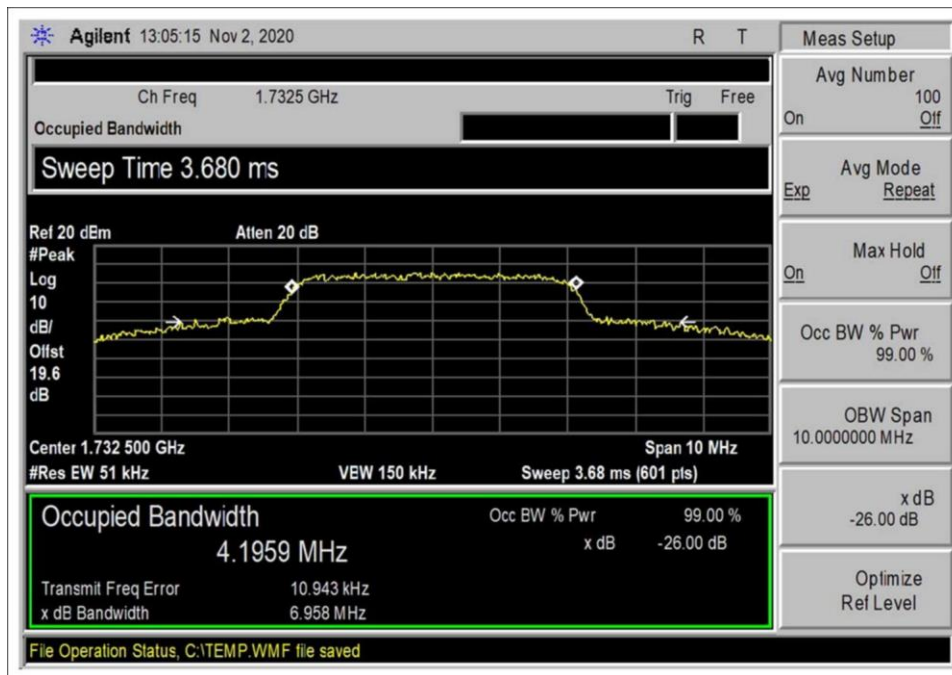
UL 817-824 preAGC



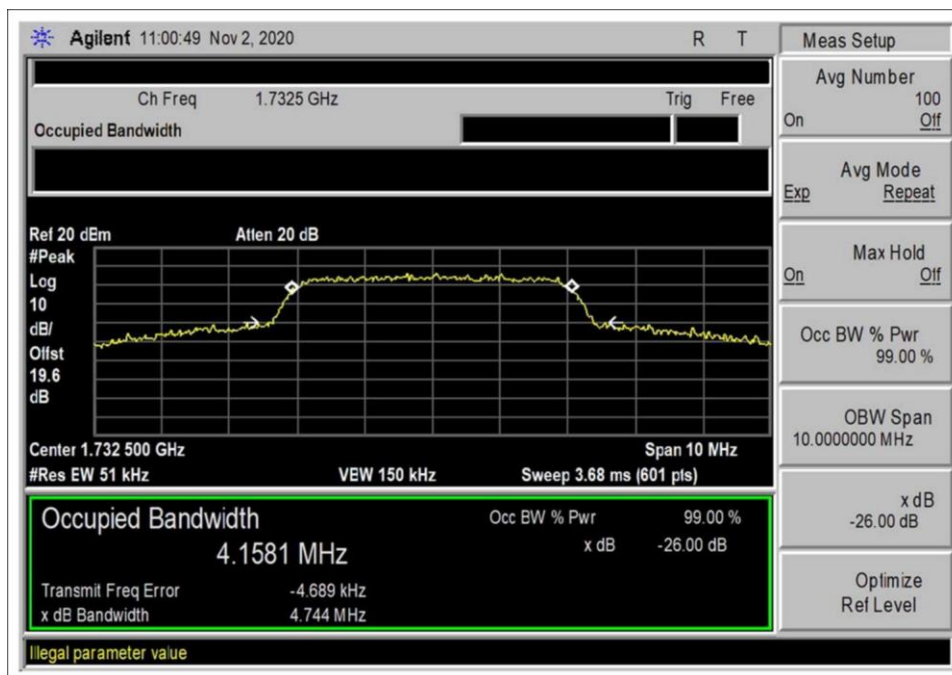
UL 824-849 AGC+3dB



UL 824-849 preAGC



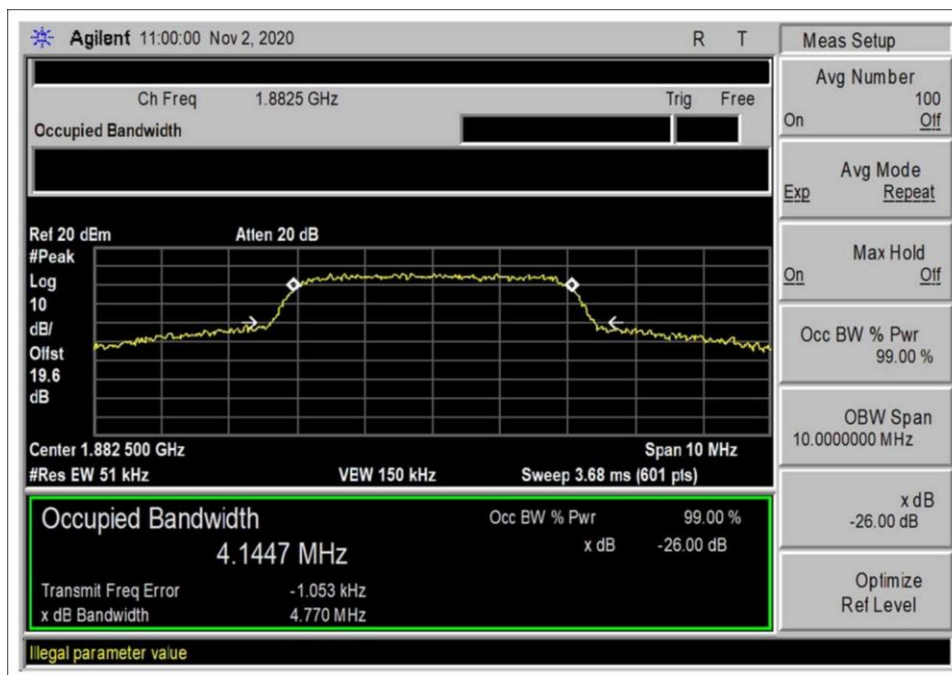
UL 1710-1755 AGC+3dB



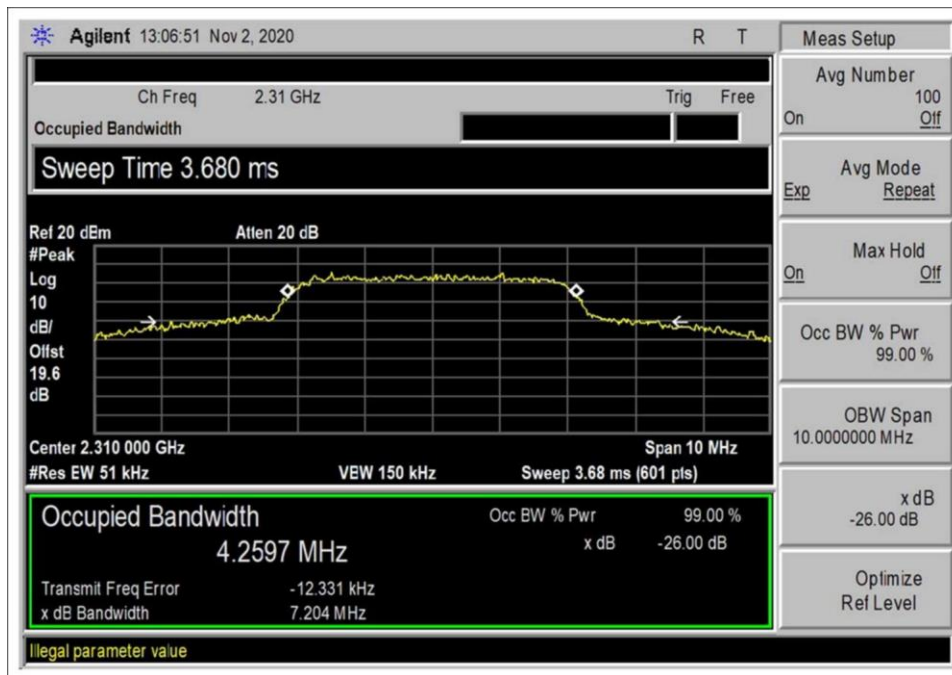
UL 1710-1755 preAGC



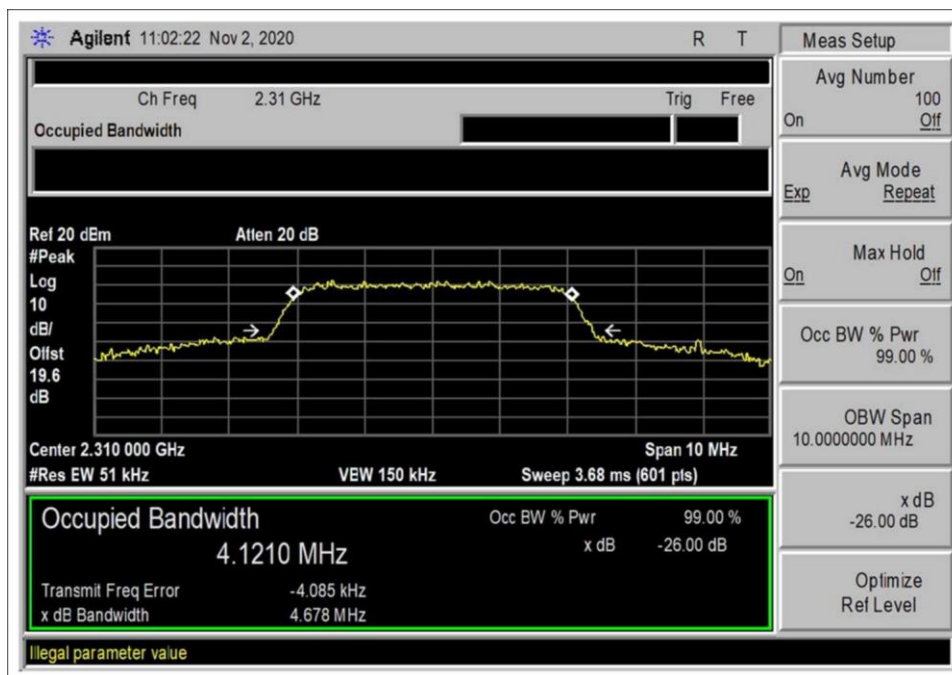
UL 1850-1915 AGC+3dB



UL 1850-1915 preAGC



UL 2305-2315 AGC+3dB

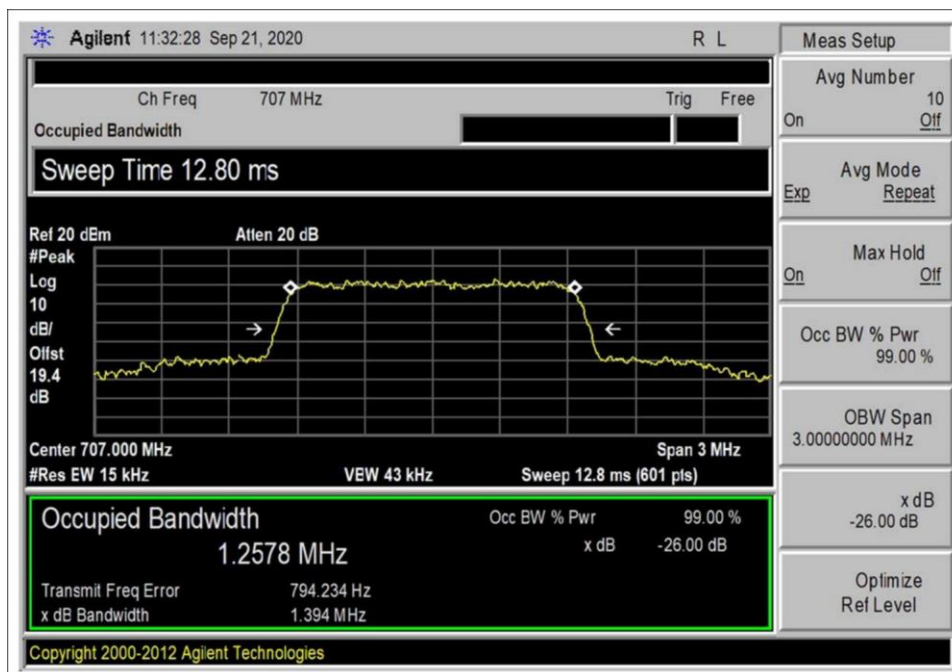


UL 2305-2315 preAGC

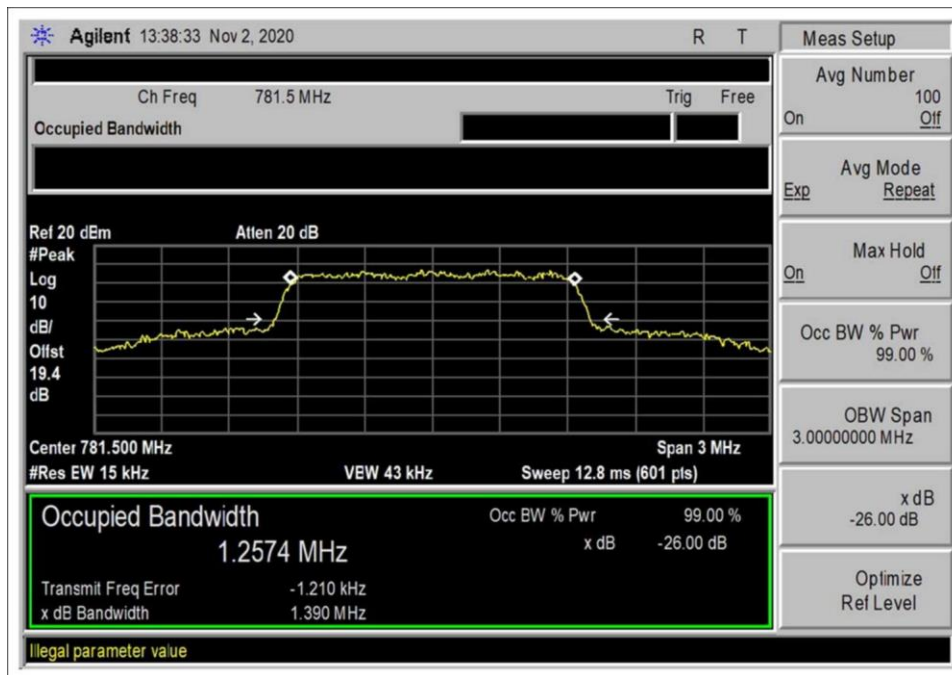
CDMA Input



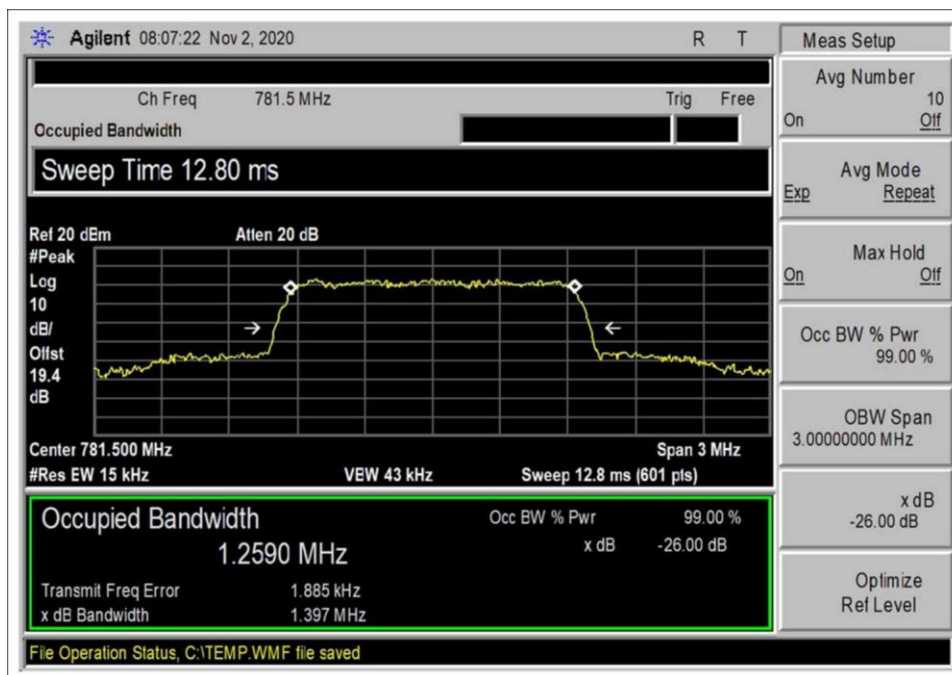
UL 698-716 AGC+3dB



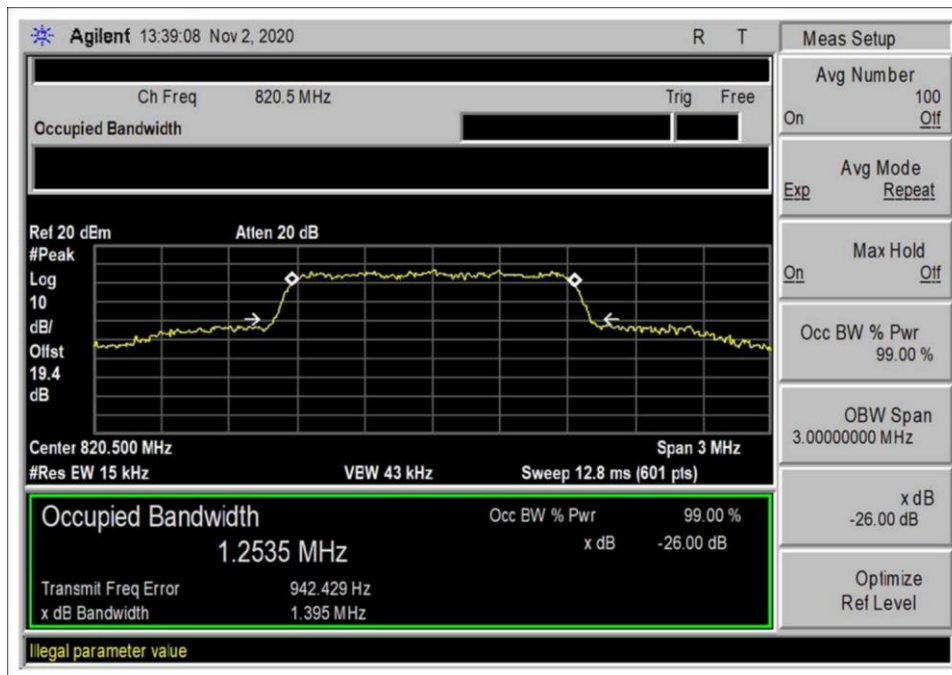
UL 698-716 preAGC



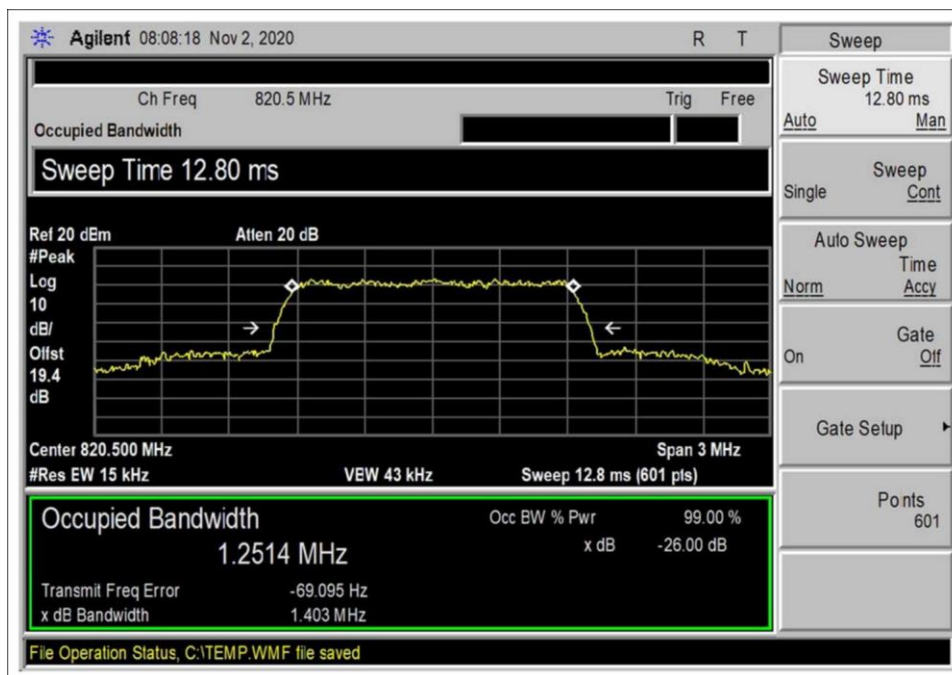
UL 776-787 AGC+3dB



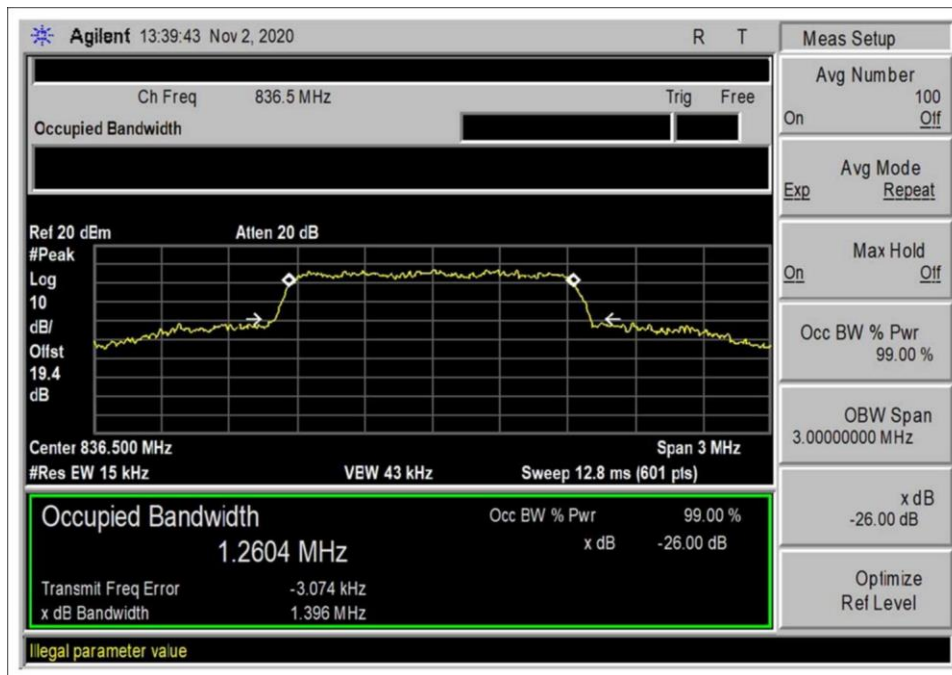
UL 776-787 preAGC



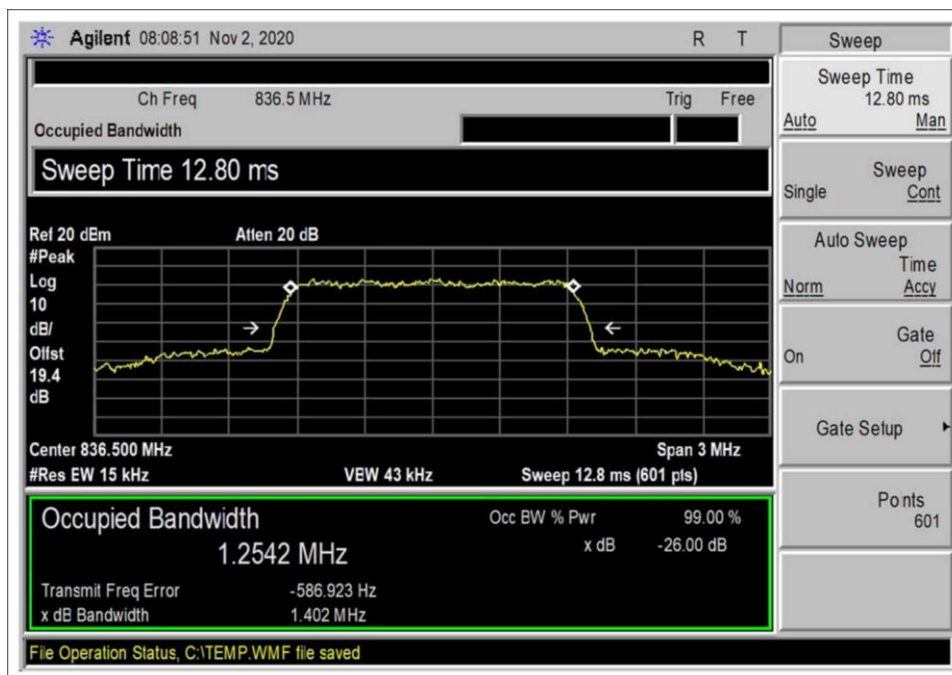
UL 817-824 AGC+3dB



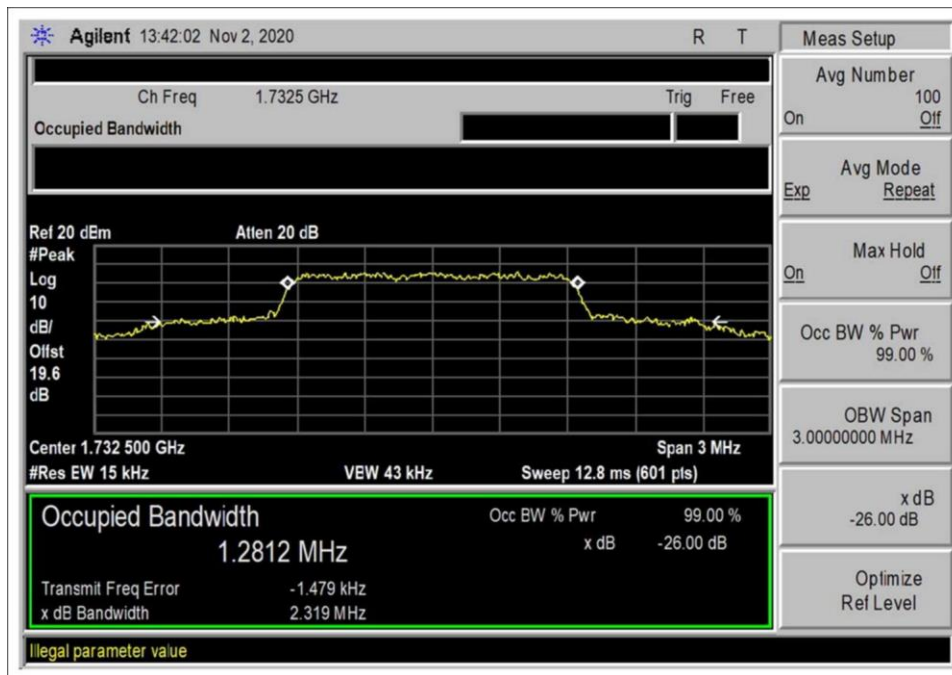
UL 817-824 preAGC



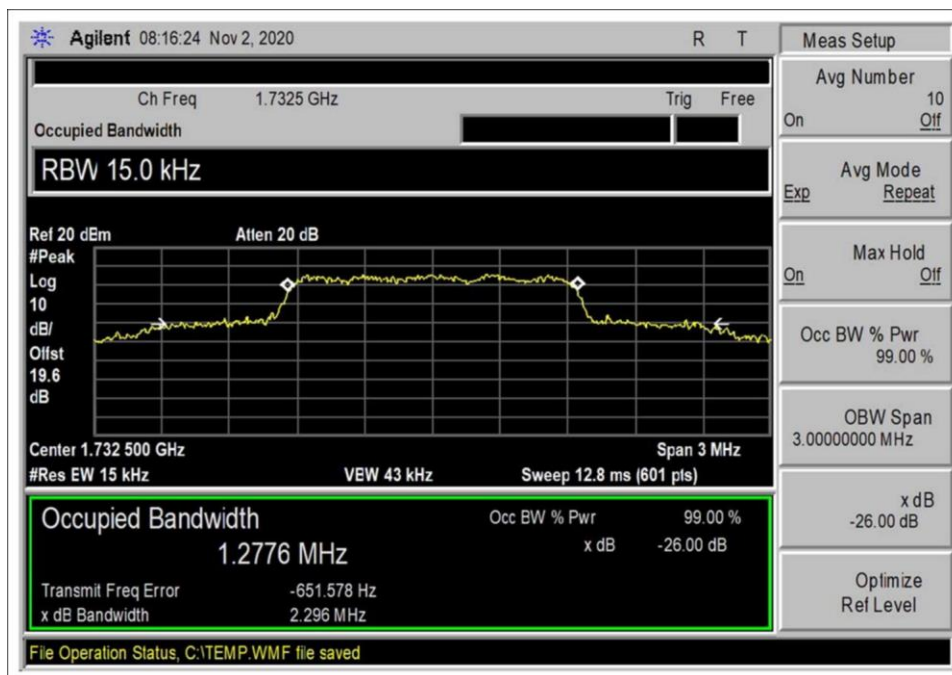
UL 824-849 AGC+3dB



UL 824-849 preAGC



UL 1710-1755 AGC+3dB



UL 1710-1755 preAGC



UL 1850-1915 AGC+3dB



UL 1850-1915 preAGC