FCC PART 15.407

TEST REPORT

For

Roku, Inc.

1155 Coleman Ave,
San Jose, CA 95110, USA

FCC ID: TC2-R1036

Report Type:	Model:
Class II Permissive Change	4800X

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Report Number:	R2104214-NII	
Report Date:	2021-08-27	
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ACCREDITED
CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2104214-NII	Original Report	2021-08-27

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test report was prepared on behalf of *Roku, Inc.*, and their product model: *4800X*, FCC ID: TC2-R1036, or the "EUT" as referred to in this report. It is a Set-top-box.

1.2 Objective

This report was prepared on behalf of Roku, Inc in accordance with FCC CFR47 §15.407 Issue 2, February 2017.

The objective was to determine compliance with FCC Part 15.407 rules for Output Power, Antenna Requirements, AC Line Conducted Emissions, Emission Bandwidth, Power spectral density, Conducted and Radiated Spurious Emissions.

This project is a Permissive Change II submission for the purpose of adding 40 MHz and 80 MHz bandwidth to device capability (Model: 4800X).

1.3 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment DTS with FCC ID: TC2-R1036

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz, and FCC KDB 789033 D02 General UNII Test Procedure New Rules v02r01.

1.5 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 ^{o} C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.6 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices,

Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
  - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  - 3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  - 1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  - 2 All Scope 2-Licensed Personal Mobile Radio Services;
  - 3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime & Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
  - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case data rates are determined by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The test software used was Teraterm. The software is compliant with the standard requirements being tested against.

Please refer to the following power setting table.

Modulation	Frequency (MHz)	Power Setting	
		Ant A	Ant B
802.11n40	5190	78	78
	5230	87	87
	5755	100	100
	5795	104	104
802.11ac40	5190	78	78
	5230	87	87
	5755	100	100
	5795	104	104
802.11ac80	5210	76	76
	5775	91	91

*Data rates tested:
802.11n HT40 mode: MCS0
802.11ac VHT40 mode: MCS0
802.11ac VHT80 mode: MCS0

2.3 Duty Cycle Correction Factor

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 section B:

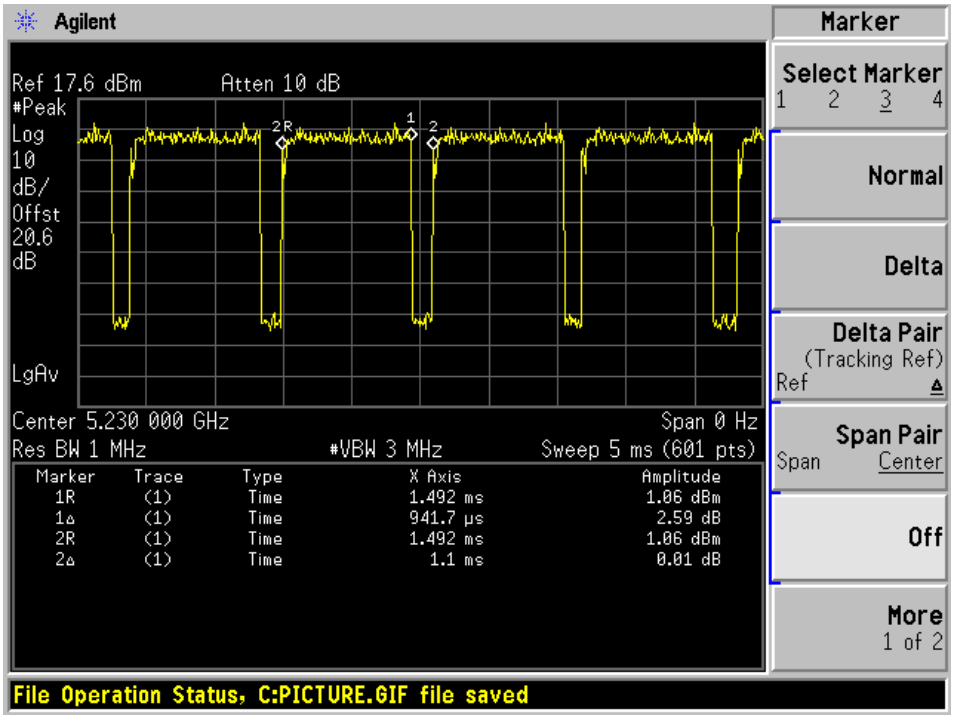
All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum-power transmission duration, T, are required for each tested mode of operation.

Radio Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11n40	0.94	1.10	85.5	0.68
802.11ac40	0.95	1.15	82.6	0.83
802.11ac80	0.46	0.60	76.7	1.15

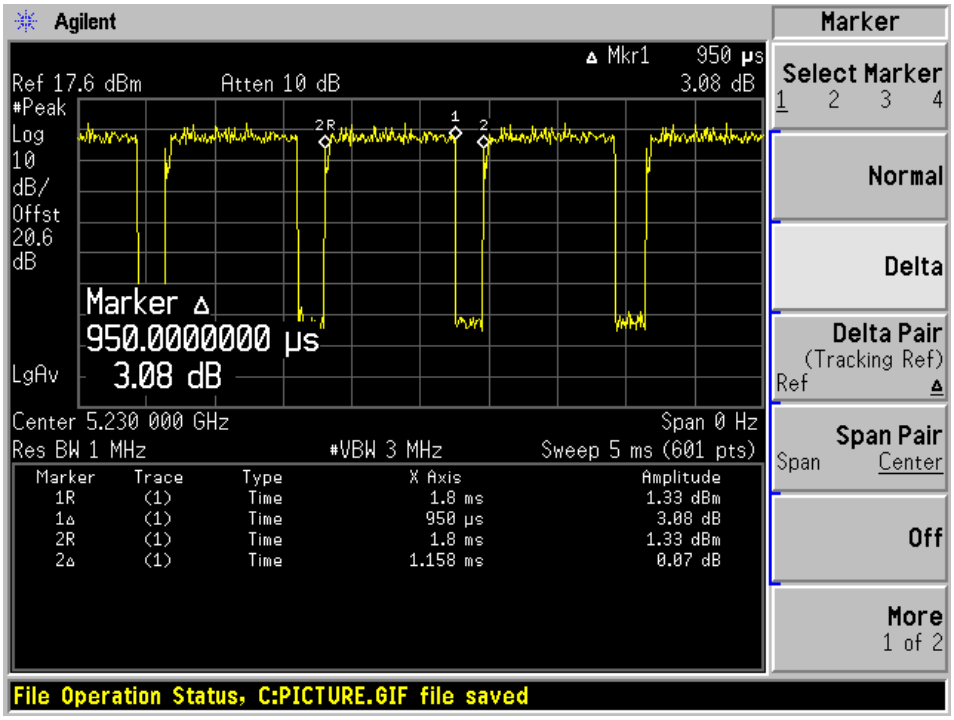
Note: Duty Cycle Correction Factor = 10*log(1/duty cycle)

Please refer to the following plots.

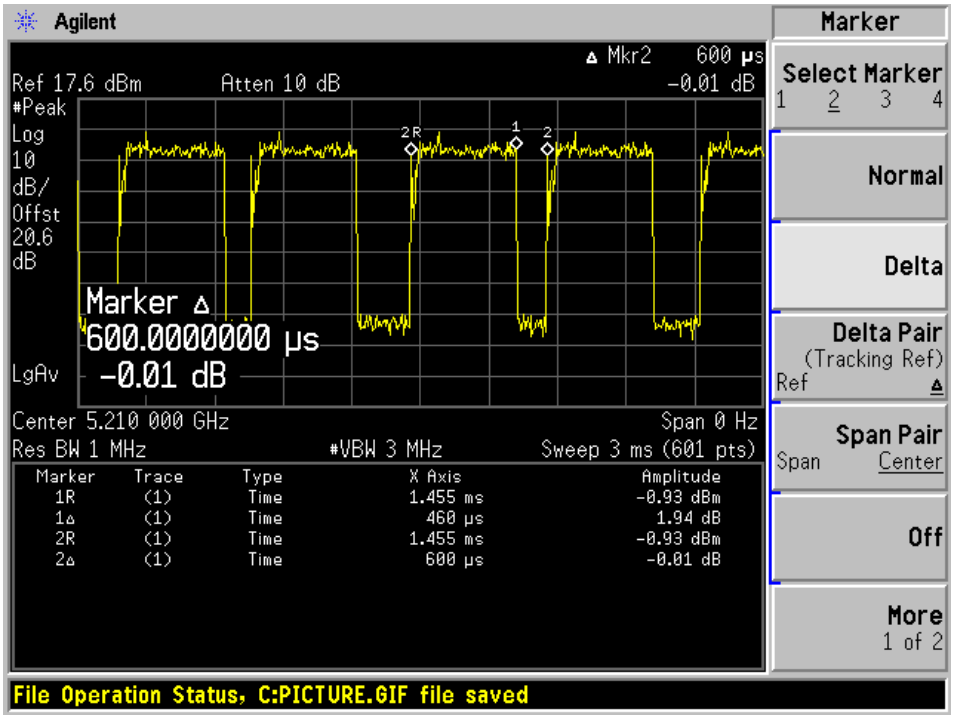
802.11n40 mode



802.11ac40 mode



802.11ac80 mode



2.4 Equipment Modifications

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E6410

2.6 Support Equipment

Manufacturer	Description	Model
Roku, Inc.	Debug Board	-

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	< 1 m	Laptop	EUT
RF Cable	< 1 m	EUT	PSA

3 Summary of Test Results

FCC Rules	Description of Test	Result
FCC §2.1091, §15.407(f)	RF Exposure	Compliant
FCC §15.203	Antenna Requirement	Compliant
FCC §15.207	AC Power Line Conducted Emissions	Compliant
FCC §2.1053, §15.205, §15.209, 15.407(b)	Spurious Radiated Emissions	Compliant
FCC §15.407(e)	Emission Bandwidth	Compliant
FCC §15.407(a)	Output Power	Compliant
FCC §2.1051, §15.407(b)	Band Edges	Compliant
FCC §15.407(a)	Power Spectral Density	Compliant
FCC §2.1051, §15.407(b)	Spurious Emissions at Antenna Terminals	Compliant

4 FCC §2.1091, §15.407(f) - RF Exposure

4.1 Applicable Standards

According to FCC §2.1091 and §15.407(f), Radio frequency devices operating under the provisions of this part are subject to the radio frequency radiation exposure requirements specified in §§1.1307(b), 1.1310, 2.1091, and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements. Technical information showing the basis for this statement must be submitted to the Commission upon request.

According to KDB 447498 Section (7.2), "simultaneous transmission of MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum *test separation distance* required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Where: f = frequency in MHz
* = Plane-wave equivalent power density

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field.

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 MPE Results

5 GHz WiFi

Worst Case: 802.11ac40, 5795 MHz

Maximum output power at antenna input terminal (dBm):	24.25
Maximum output power at antenna input terminal (mW):	266
Prediction distance (cm):	20
Prediction frequency (MHz):	5795
Maximum Directional Antenna Gain, typical (dBi):	7.61
Maximum Antenna Gain (numeric):	5.768
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.305
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.305 mW/cm^2. Limit is 1.0 mW/cm^2.

Radio Co-location

2.4 GHz Wi-Fi and 5 GHz Wi-Fi simultaneous transmission is not supported.

Worst case colocation 5 GHz Wi-Fi and 2.4 GHz Classic Bluetooth:

Frequency Band	Max Conducted Power(dBm)	Evaluated Distance (cm)	Worst-Case MPE (mW/cm^2)	MPE Limit (mW/cm^2)	Worst-Case MPE Ratios	Sum of MPE Ratios	Limit
Worst Case							
5 GHz Wi-Fi	24.25	20	0.305	1.0	30.5%	31.6%	1
2.4 GHz Classic BT	14.58	20	0.011	1.0	1.1%		

5 FCC §15.203 - Antenna Requirements

5.1 Applicable Standards

According to FCC §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2 Antenna List

The antennas used by the EUT are permanent attached antennas.

Antenna usage	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Bluetooth Metal Antenna	2400-2483.5	2.7
2.4GHz Wi-Fi Metal Antenna (Ant A)	2400-2483.5	2.4
2.4GHz Wi-Fi PCB Antenna (Ant B)	2400-2483.5	3.9
5GHz Wi-Fi Metal Antenna (Ant A)	5150-5850	4.7
5GHz Wi-Fi PCB Antenna (Ant B)	5150-5850	4.5

Antenna info provided by customer.

6 FCC §15.207 - AC Power Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note1	56 to 46 Note2
0.5-5	56	46
5-30	60	50

Note1: Decreases with the logarithm of the frequency.
Note2: A linear average detector is required

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used was FCC §15.207 limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.
The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

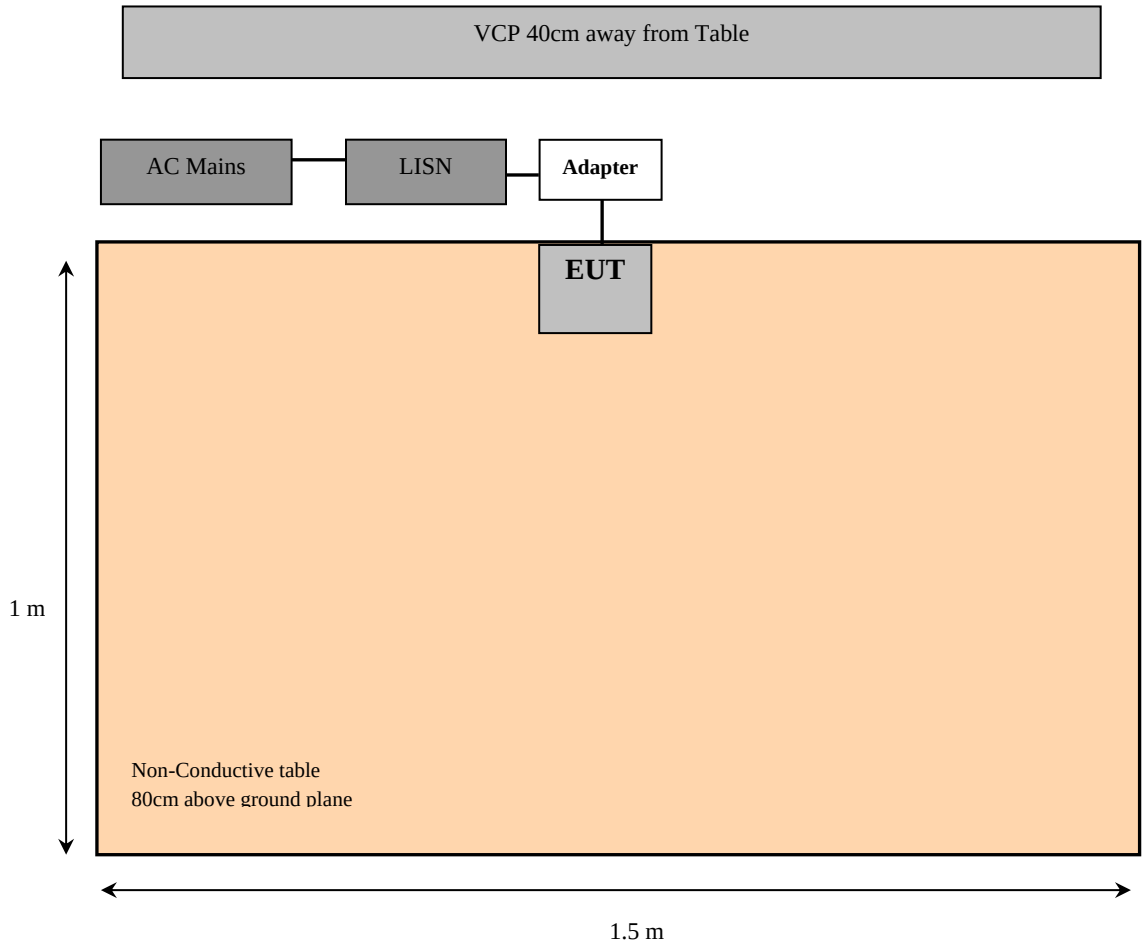
6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cords of support equipment were connected to LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak, quasi-peak, and average detection mode. Quasi-Peak readings are distinguished with a “QP.” Average readings are distinguished with an “Ave”.

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude and Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Correction Factor (CF) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CF

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Correction Factor (13.7 dB)

The Correction Factor is calculated by adding Cable loss (CL), LISN calibration factor, and attenuation of the impulse limiter and the high pass filter. The basic equation is as follows:

CF= CL + LISN calibration factor + Attenuation

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.5 dB) + LISN calibration factor (0.2 dB) + Attenuator (10 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2020-03-17	1.5 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2020-07-01	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150203	2021-03-02	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2020-10-13	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

6.7 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	101.31 kPa

The testing was performed by Christian McCaig on 2021-05-14 in the Ground Plane test site.

6.8 Summary of Test Results

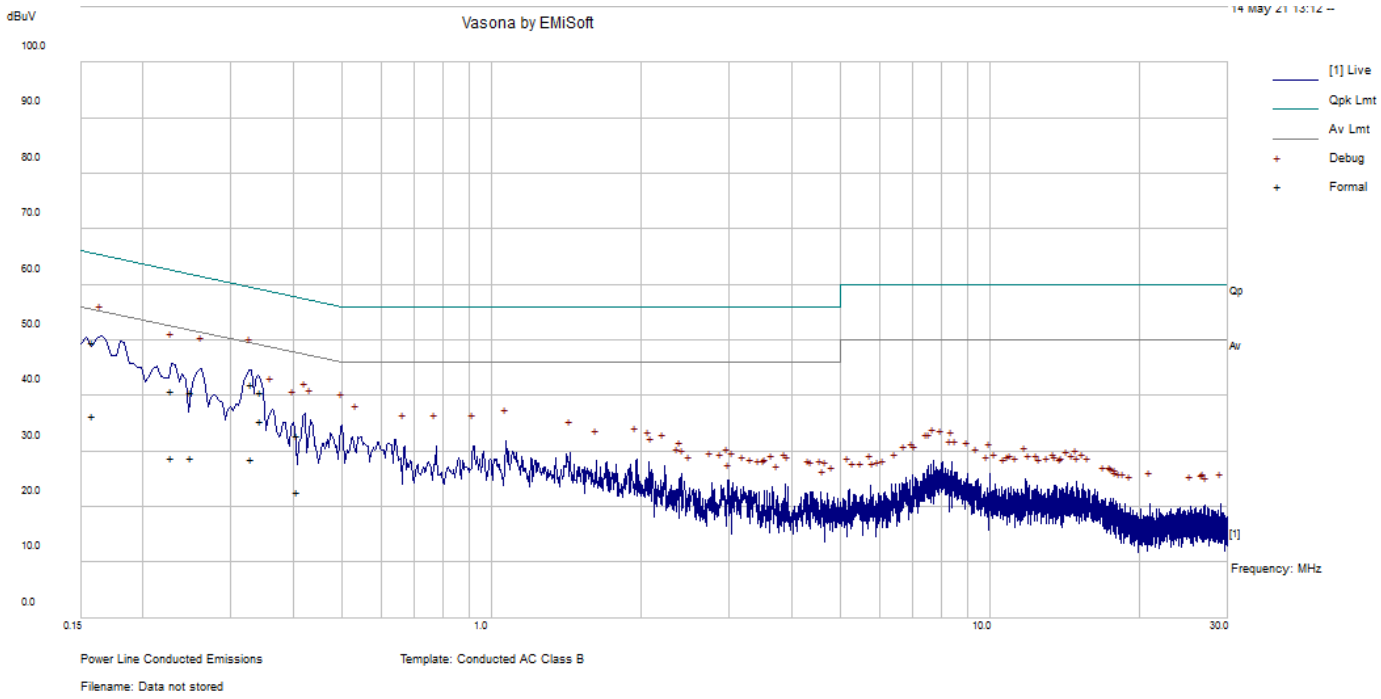
According to the recorded data in following table, the EUT complied with the FCC Part 15 standards'conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-13.54	0.345668	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

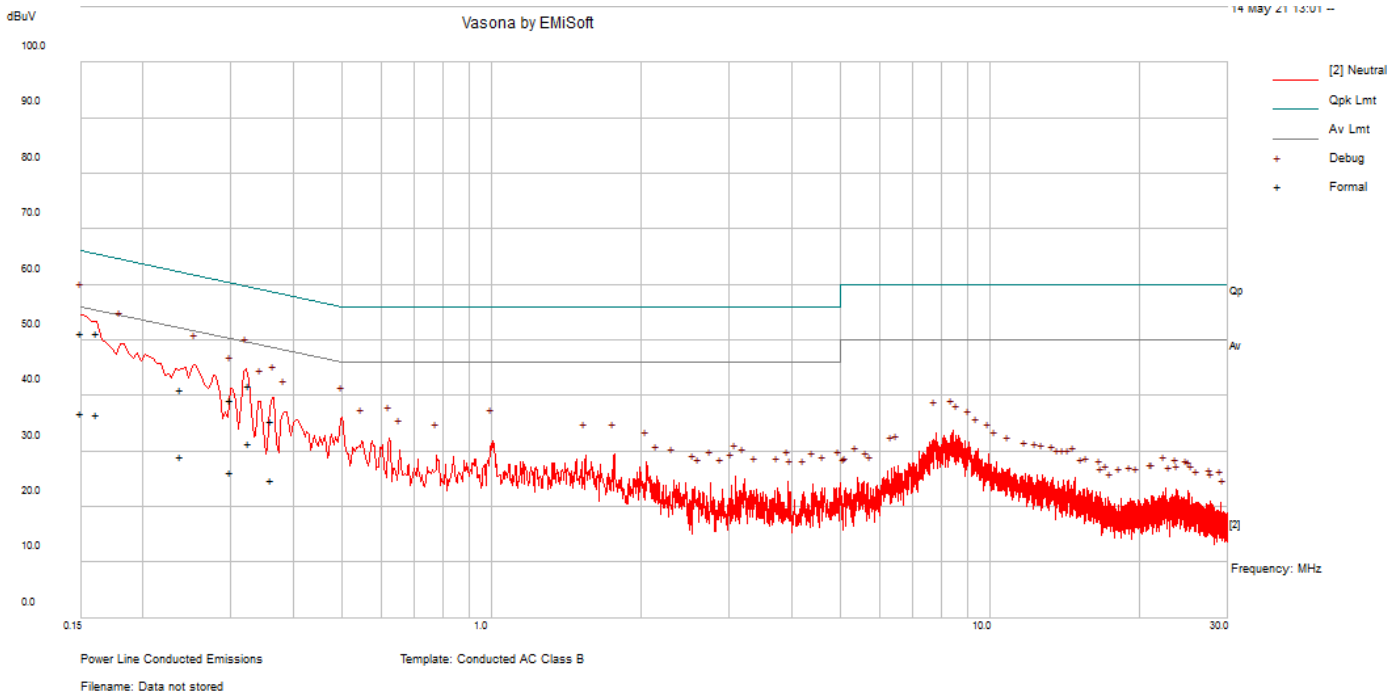
Worst Case: 802.11ac40 mode – 5795MHz

120 V, 60 Hz – Live



Frequency (MHz)	Ai. Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.159094	38.92	10.73	49.65	65.51	-15.86	QP
0.330606	31.47	10.52	41.99	59.44	-17.45	QP
0.249975	29.92	10.62	40.54	61.76	-21.22	QP
0.228524	30.17	10.65	40.82	62.5	-21.68	QP
0.409458	22.47	10.43	32.9	57.66	-24.76	QP
0.345668	30.25	10.5	40.75	59.07	-18.32	QP
0.159094	25.78	10.73	36.51	55.51	-19	Ave
0.330606	18.15	10.52	28.67	49.44	-20.77	Ave
0.249975	18.16	10.62	28.78	51.76	-22.98	Ave
0.228524	18.19	10.65	28.84	52.5	-23.66	Ave
0.409458	12.19	10.43	22.62	47.66	-25.03	Ave
0.345668	**25.03**	**10.5**	**35.53**	**49.07**	**-13.54**	**Ave**

120 V, 60 Hz – Neutral



Frequency (MHz)	Ai. Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.15025	40.58	10.75	51.33	65.99	-14.66	QP
0.325627	31.34	10.52	41.86	59.56	-17.7	QP
0.161852	40.57	10.74	51.31	65.37	-14.06	QP
0.238768	30.58	10.64	41.22	62.14	-20.92	QP
0.362503	25.09	10.48	35.57	58.67	-23.1	QP
0.299188	28.57	10.55	39.12	60.27	-21.14	QP
0.15025	26.16	10.74	36.9	55.99	-19.09	Ave
0.325627	20.96	10.52	31.48	49.56	-18.08	Ave
0.161852	25.9	10.73	36.63	55.37	-18.74	Ave
0.238768	18.44	10.64	29.08	52.14	-23.06	Ave
0.362503	14.45	10.48	24.93	48.67	-23.74	Ave
0.299188	15.67	10.55	26.22	50.27	-24.04	Ave

7 FCC §15.209, §15.407(b) - Spurious Radiated Emissions

7.1 Applicable Standard

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.209: The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 Note 1	3
88 - 216	150 Note 1	3
216 - 960	200 Note 1	3
Above 960	500	3

Note 1: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC Part 15.407 (b)

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

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

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

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

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

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15.407 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

7.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords were connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter or 1.5 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 3MHz / Sweep = 100ms
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

7.4 Corrected Amplitude and Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

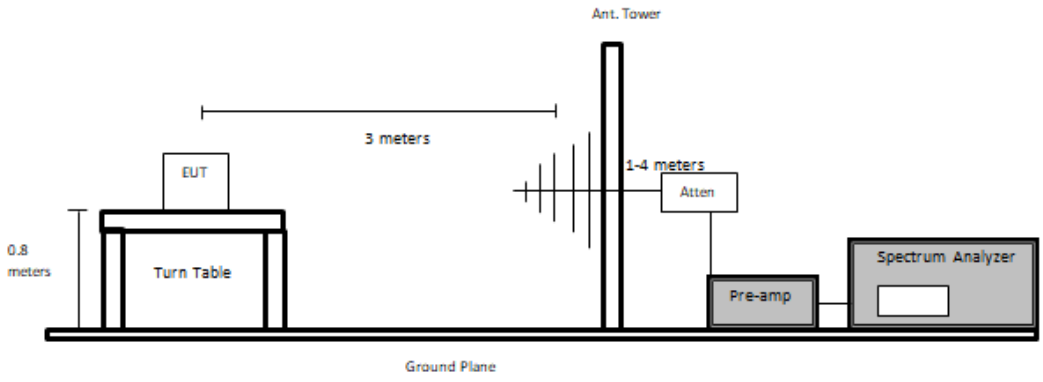
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit for Class A. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

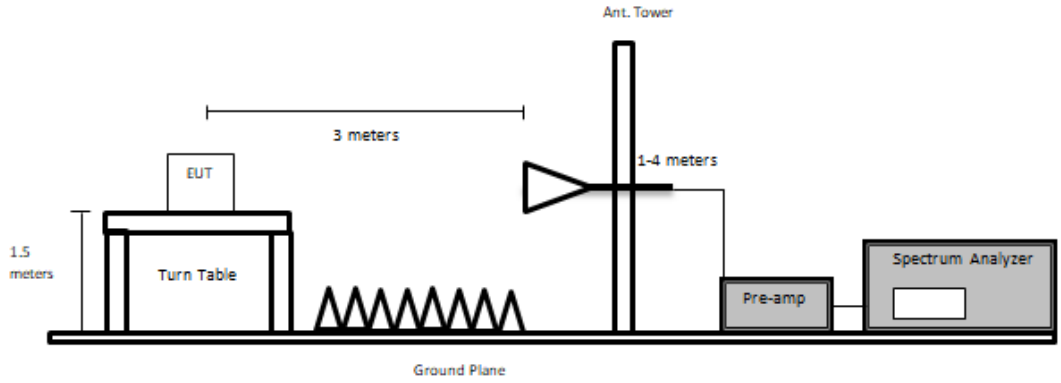
7.5 Test Setup Block Diagram

Below 1GHz:

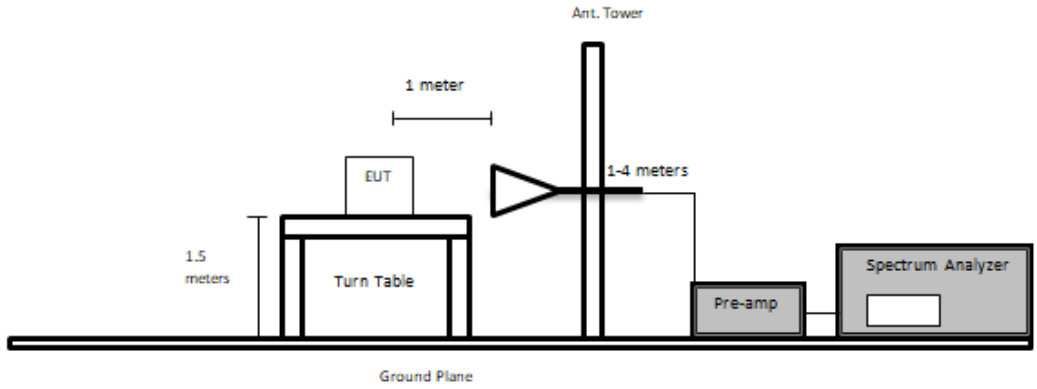


Above 1GHz:

At 3 meters:



At 1 meter:



7.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2020-10-26	2 years
Agilent	Spectrum Analyzer	E4446A	US44300386	2020-04-27	18 months
Sunol Science Corp	System Controller	SC110V	122303-1	N/R	N/A
HP	Pre-Amplifier	8447D	2944A07030	2020-08-17	1 year
HP	Pre-Amplifier	8449B	3147A00400	2021-03-02	1 year
AH Systems	Pre-Amplifier	PAM 1840 VH	170	2020-11-09	1 year
Wisewave	Horn Antenna	ARH-4223-02	10555-02	2020-02-05	2 years
ETS Lindgren	Horn Antenna	3117	00218973	2019-02-13	2.5 years
Sunol Sciences	Biconilog Antenna	JB3	A020106-2	2019-11-20	2 years
-	RF cable	-	-	Each time[1]	N/A
-	Notch Filter	-	-	Each time[1]	N/A
IW Incorporated	157 Series 2.92 SM (x2) Armored 33 ft. Cable	KPS-1571AN-3960-KPS	DC 1917	2021-03-03	1 year
MDP Digital	Times Microwave LMR 400 UltraFex Coaxial Cable 35\'	LMR400UF	BACL1904161	2020-05-20	1 year
IW Incorporated	157 Series Cable Armored with 2.92mm Male Plugs	KPS-1571AN-2400	DC 1922	2020-06-06	1 year
BACL	5m3 Sensitivity Box	1	2	2020-10-27	1 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2020-02-05	2 years

Note[1]: cables and attenuators included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

7.7 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Rita Yang from 2021-05-04 to 2021-05-13 in 5m chamber 3.

7.8 Summary of Test Results

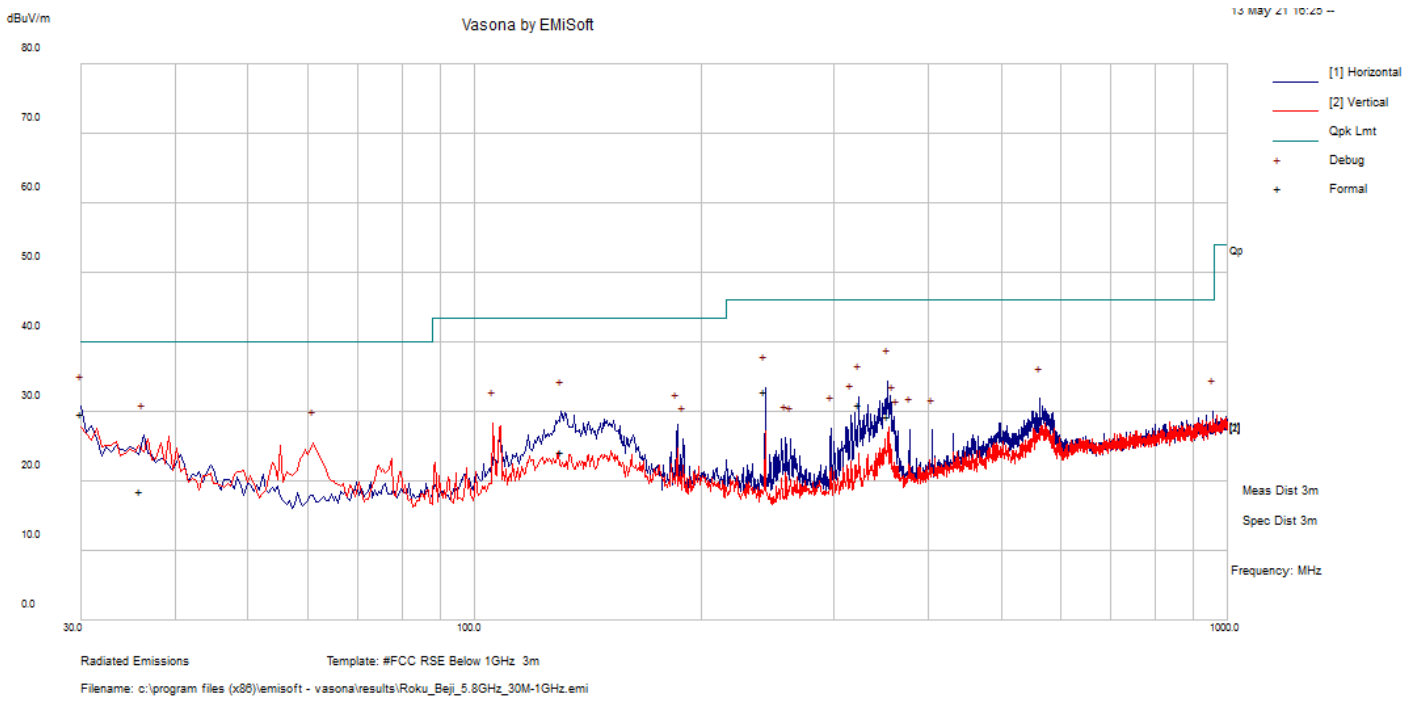
According to the data hereinafter, the EUT complied with the FCC Part 15.407 standards' radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-0.52	5625-5650	H	AC40, 5755 MHz

7.9 Radiated Emissions Test Result Data

1) 30 MHz – 1 GHz at 3 meters

Worst Case: ac40 mode, 5795 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
30.01703	27.26	2.44	29.7	105	H	232	40	-10.3	Pass
353.58225	32.82	-3.42	29.4	114	H	118	46	-16.6	Pass
242.99475	39.37	-6.4	32.97	122	H	279	46	-13.03	Pass
35.93925	20.66	-2.06	18.6	196	V	159	40	-21.4	Pass
130.369	28.45	-4.32	24.13	289	H	352	43.5	-19.37	Pass
324.01575	35	-4.01	30.99	108	H	164	46	-15.01	Pass

2) 1–40 GHz Bandedge and Harmonic Measurements

5150 - 5250 MHz

5150 - 5250 MHz Band Edges measured at 3 meters, Harmonics measured at 1 meter

802.11n40 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5190 MHz											
5150	50.55	310	292	V	35.50	9.20	35.20	60.05	74	-13.95	Peak
5150	58.53	315	100	H	35.50	9.20	35.20	68.03	74	-5.97	Peak
5150	36.57	305	235	V	35.50	9.20	35.20	46.07	54	-7.93	Ave
5150	43.28	315	100	H	35.50	9.20	35.20	52.78	54	-1.22	Ave
10380	38.91	0	100	V	38.10	15.20	35.74	56.47	78	-21.53	Peak
10380	38.52	0	100	H	38.10	15.20	35.74	56.08	78	-21.92	Peak
15570	42.89	0	100	V	40.5	16.28	33.87	65.8	84	-18.2	Peak
15570	42.26	0	100	H	40.5	16.28	33.87	65.17	84	-18.83	Peak
15570	31.88	0	100	V	40.5	16.28	33.87	54.79	64	-9.21	Ave
15570	32.05	0	100	H	40.5	16.28	33.87	54.96	64	-9.04	Ave
High Channel 5230 MHz											
10460	43.57	0	100	V	38.20	15.95	35.49	62.23	78	-15.77	Peak
10460	42.72	0	100	H	38.20	15.95	35.49	61.38	78	-16.62	Peak
15690	44.89	0	100	V	40.70	13.86	33.87	65.58	84	-18.42	Peak
15690	43.85	0	100	H	40.70	13.86	33.87	64.54	84	-19.46	Peak
15690	32.73	0	100	V	40.70	13.86	33.87	53.42	64	-10.58	Ave
15690	32.76	0	100	H	40.70	13.86	33.87	53.45	64	-10.55	Ave

5150 - 5250 MHz

802.11ac40 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5190 MHz											
5150	50.41	315	302	V	35.50	9.20	35.20	59.91	74	-14.09	Peak
5150	57.13	315	100	H	35.50	9.20	35.20	66.63	74	-7.37	Peak
5150	37.56	315	302	V	35.50	9.20	35.20	47.06	54	-6.94	Ave
5150	43.42	315	100	H	35.50	9.20	35.20	52.92	54	-1.08	Ave
10380	43.32	0	100	V	38.10	15.20	35.74	60.88	78	-17.12	Peak
10380	44.36	0	100	H	38.10	15.20	35.74	61.92	78	-16.08	Peak
15570	43.07	0	100	V	40.50	16.28	33.87	65.98	84	-18.02	Peak
15570	41.83	0	100	H	40.50	16.28	33.87	64.74	84	-19.26	Peak
15570	31.71	0	100	V	40.50	16.28	33.87	54.62	64	-9.38	Ave
15570	31.33	0	100	H	40.50	16.28	33.87	54.24	64	-9.76	Ave
High Channel 5230 MHz											
10460	40.16	0	100	V	38.20	15.95	35.49	58.82	78	-19.18	Peak
10460	38.60	0	100	H	38.20	15.95	35.49	57.26	78	-20.74	Peak
15690	45.02	0	100	V	40.70	13.86	33.87	65.71	84	-18.29	Peak
15690	44.40	0	100	H	40.70	13.86	33.87	65.09	84	-18.91	Peak
15690	32.79	0	100	V	40.70	13.86	33.87	53.49	64	-10.52	Ave
15690	32.99	0	100	H	40.70	13.86	33.87	53.68	64	-10.32	Ave

5150 - 5250 MHz

802.11ac80 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
5210 MHz											
5150	50.47	310	295	V	35.50	9.20	35.20	59.97	74	-14.03	Peak
5150	58.04	315	110	H	35.50	9.20	35.20	67.54	74	-6.46	Peak
5150	35.91	310	295	V	35.50	9.20	35.20	45.41	54	-8.59	Ave
5150	43.41	315	110	H	35.50	9.20	35.20	52.91	54	-1.09	Ave
10420	44.72	0	100	V	38.10	15.13	35.74	62.21	78	-15.79	Peak
10420	43.69	0	100	H	38.10	15.13	35.74	61.18	78	-16.82	Peak
15630	42.73	0	100	V	40.50	16.09	33.70	65.62	84	-18.38	Peak
15630	43.20	0	100	H	40.50	16.09	33.70	66.09	84	-17.91	Peak
15630	31.82	0	100	V	40.50	16.09	33.70	54.70	64	-9.30	Ave
15630	31.87	0	100	H	40.50	16.09	33.70	54.76	64	-9.24	Ave

5725 - 5850 MHz

5725 - 5850 MHz measured at 1 meter

802.11n40 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5755 MHz											
5625-5650	61.07	330	110	V	35.30	9.89	34.85	71.41	78.20	-6.79	Peak
5650-5700	77.73	330	110	V	35.30	9.89	34.85	88.07	114.31	-26.24	Peak
5700-5720	91.12	330	110	V	35.30	9.89	34.85	101.46	120.63	-19.17	Peak
5720-5725	92.62	330	110	V	35.30	9.89	34.85	102.96	130.16	-27.20	Peak
5625-5650	66.95	260	100	H	35.30	9.89	34.85	77.29	78.20	-0.91	Peak
5650-5700	82.37	260	100	H	35.30	9.89	34.85	92.71	113.44	-20.73	Peak
5700-5720	93.91	260	100	H	35.30	9.89	34.85	104.25	120.66	-16.41	Peak
5720-5725	96.41	260	100	H	35.30	9.89	34.85	106.75	125.20	-18.45	Peak
11510	42.14	0	100	V	38.70	18.18	34.47	64.55	84.00	-19.45	Peak
11510	42.46	0	100	H	38.70	18.18	34.47	64.87	84.00	-19.13	Peak
11510	31.255	0	100	V	38.70	18.18	34.47	53.67	64.00	-10.34	Ave
11510	31.366	0	100	H	38.70	18.18	34.47	53.78	64.00	-10.22	Ave
17265	50.26	11	108	V	41.80	14.83	32.84	74.05	78.00	-3.95	Peak
17265	50.92	40	125	H	41.80	14.83	32.84	74.71	78.00	-3.29	Peak
High Channel 5795 MHz											
5850-5855	81.58	340	110	V	35.60	10.28	35.05	92.41	125.37	-32.96	Peak
5855-5875	79.79	340	110	V	35.60	10.28	35.05	90.62	120.29	-29.67	Peak
5875-5925	72.05	340	110	V	35.60	10.28	35.05	82.88	114.49	-31.61	Peak
5925-5950	59.68	340	110	V	35.80	10.28	35.05	70.71	78.20	-7.49	Peak
5850-5855	89.15	320	135	H	35.60	10.28	35.05	99.98	126.00	-26.02	Peak
5855-5875	87.22	320	135	H	35.60	10.28	35.05	98.05	120.24	-22.19	Peak
5875-5925	79.11	320	135	H	35.60	10.28	35.05	89.94	114.55	-24.61	Peak
5925-5950	66.24	320	135	H	35.80	10.28	35.05	77.27	78.20	-0.93	Peak
11590	42.51	0	100	V	39.00	17.77	35.35	63.93	84.00	-20.07	Peak
11590	42.68	0	100	H	39.00	17.77	35.35	64.10	84.00	-19.90	Peak
11590	31.348	0	100	V	39.00	17.77	35.35	52.77	64.00	-11.23	Ave
11590	32.109	0	100	H	39.00	17.77	35.35	53.53	64.00	-10.47	Ave
17385	51.56	30	107	V	41.90	14.80	33.05	75.21	78.00	-2.79	Peak
17385	51.67	43	100	H	41.90	14.80	33.05	75.32	78.00	-2.68	Peak

5725 - 5850 MHz

802.11ac40 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5755 MHz											
5625-5650	60.05	325	170	V	35.30	9.89	34.85	70.39	78.20	-7.81	Peak
5650-5700	74.02	325	170	V	35.30	9.89	34.85	84.36	114.36	-30.00	Peak
5700-5720	90.63	325	170	V	35.30	9.89	34.85	100.97	120.82	-19.85	Peak
5720-5725	92.92	325	170	V	35.30	9.89	34.85	103.26	125.90	-22.64	Peak
5625-5650	**67.34**	**325**	**150**	**H**	**35.30**	**9.89**	**34.85**	**77.68**	**78.20**	**-0.52**	**Peak**
5650-5700	81.78	325	150	H	35.30	9.89	34.85	92.12	112.95	-20.83	Peak
5700-5720	95.12	325	150	H	35.30	9.89	34.85	105.46	120.82	-15.36	Peak
5720-5725	95.95	325	150	H	35.30	9.89	34.85	106.29	129.55	-23.26	Peak
11510	42.57	0	100	V	38.70	18.18	34.47	64.98	84.00	-19.02	Peak
11510	42.93	0	100	H	38.70	18.18	34.47	65.34	84.00	-18.66	Peak
11510	31.591	0	100	V	38.70	18.18	34.47	54.00	64.00	-10.00	Ave
11510	31.826	0	100	H	38.70	18.18	34.47	54.24	64.00	-9.76	Ave
17265	49.02	14	119	V	41.80	18.18	32.84	76.16	78.00	-1.84	Peak
17265	48.42	45	120	H	41.80	18.18	32.84	75.56	78.00	-2.44	Peak
High Channel 5795 MHz											
5850-5855	84.46	210	170	V	35.60	10.28	35.05	95.29	130.50	-35.21	Peak
5855-5875	81.59	210	170	V	35.60	10.28	35.05	92.42	120.66	-28.24	Peak
5875-5925	73.42	210	170	V	35.60	10.28	35.05	84.25	114.55	-30.30	Peak
5925-5950	61.52	210	170	V	35.60	10.28	35.05	72.35	78.20	-5.85	Peak
5850-5855	88.23	315	140	H	35.60	10.28	35.05	99.06	126.09	-27.03	Peak
5855-5875	85.98	315	140	H	35.60	10.28	35.05	96.81	120.71	-23.90	Peak
5875-5925	77.71	315	140	H	35.60	10.28	35.05	88.54	114.31	-25.77	Peak
5925-5950	66.68	315	140	H	35.60	10.28	35.05	77.51	78.20	-0.69	Peak
11590	42.66	0	100	V	39.00	17.77	35.35	64.08	84.00	-19.92	Peak
11590	42.84	0	100	H	39.00	17.77	35.35	64.26	84.00	-19.74	Peak
11590	31.654	0	100	V	39.00	17.77	35.35	53.07	64.00	-10.93	Ave
11590	32.182	0	100	H	39.00	17.77	35.35	53.60	64.00	-10.40	Ave
17385	50.29	29	120	V	41.90	14.80	33.05	73.94	78.00	-4.06	Peak
17385	52.91	40	108	H	41.90	14.80	33.05	76.56	78.00	-1.44	Peak

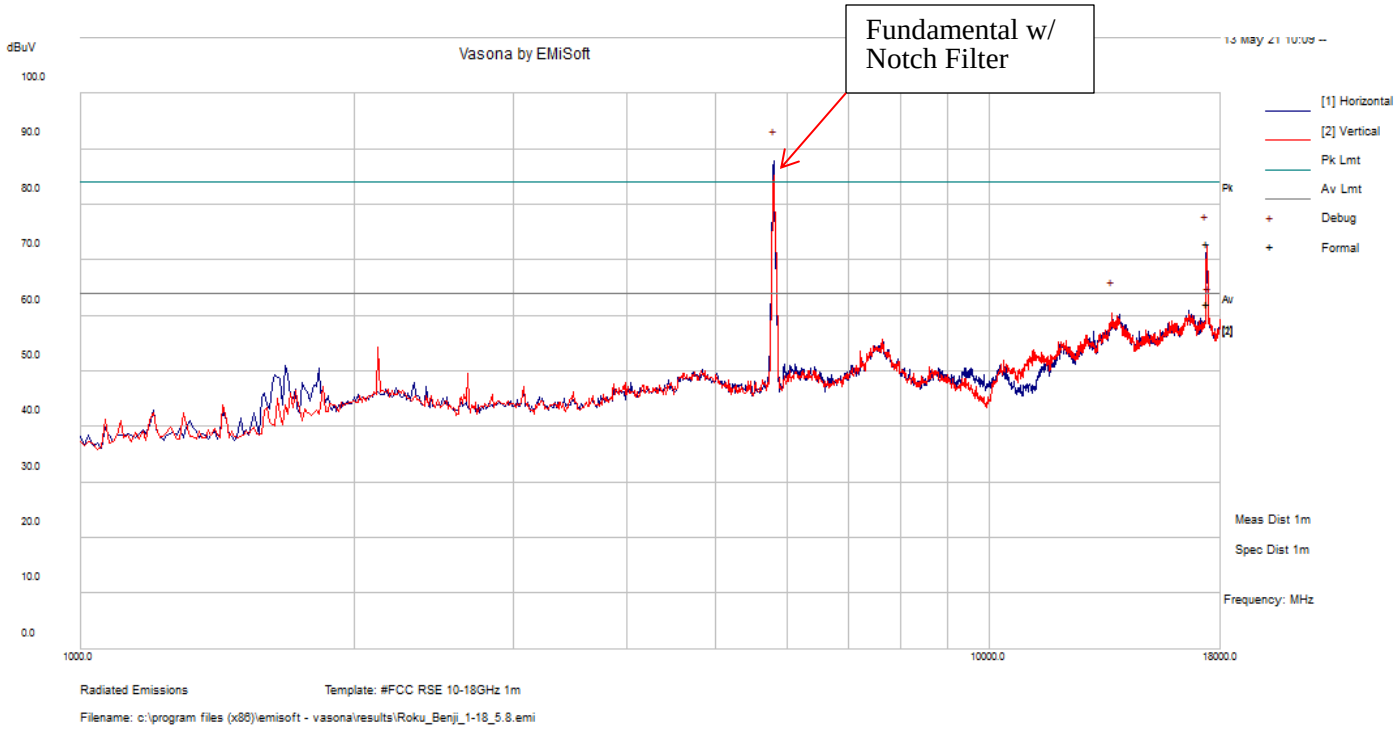
5725 - 5850 MHz

802.11ac80 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
5775 MHz											
5625-5650	60.02	332	120	V	35.30	9.89	34.85	70.36	78.20	-7.84	Peak
5650-5700	77.11	332	120	V	35.30	9.89	34.85	87.45	104.87	-17.42	Peak
5700-5720	81.68	332	120	V	35.30	9.89	34.85	92.02	119.41	-27.39	Peak
5720-5725	82.56	332	120	V	35.30	9.89	34.85	92.90	125.94	-33.04	Peak
5625-5650	67.02	315	125	H	35.30	9.89	34.85	77.36	78.20	-0.84	Peak
5650-5700	82.95	315	125	H	35.30	9.89	34.85	93.29	104.50	-11.21	Peak
5700-5720	86.53	315	125	H	35.30	9.89	34.85	96.87	120.47	-23.60	Peak
5720-5725	86.58	315	125	H	35.30	9.89	34.85	96.92	125.98	-29.06	Peak
5850-5855	79.88	210	170	V	35.60	10.28	35.05	90.71	132.12	-41.41	Peak
5855-5875	79.12	210	170	V	35.60	10.28	35.05	89.95	120.66	-30.71	Peak
5875-5925	71.56	210	170	V	35.60	10.28	35.05	82.39	97.04	-14.65	Peak
5925-5950	60.22	210	170	V	35.60	10.28	35.05	71.05	78.20	-7.15	Peak
5850-5855	83.76	315	140	H	35.60	10.28	35.05	94.59	131.82	-37.23	Peak
5855-5875	81.92	315	140	H	35.60	10.28	35.05	92.75	120.70	-27.95	Peak
5875-5925	76.24	315	140	H	35.60	10.28	35.05	87.07	96.49	-9.42	Peak
5925-5950	63.07	315	140	H	35.60	10.28	35.05	73.90	78.20	-4.30	Peak
11550	41.97	0	100	V	38.70	18.18	34.47	64.38	84.00	-19.62	Peak
11550	42.28	0	100	H	38.70	18.18	34.47	64.69	84.00	-19.31	Peak
11550	31.084	0	100	V	38.70	18.18	34.47	53.49	64.00	-10.51	Ave
11550	31.337	0	100	H	38.70	18.18	34.47	53.75	64.00	-10.25	Ave
17325	44.42	0	100	V	41.80	18.18	32.84	71.56	78.00	-6.44	Peak
17325	44.32	0	100	H	41.80	18.18	32.84	71.46	78.00	-6.54	Peak

1 GHz – 18 GHz Worst Case Scan at 1 Meter

Worst Case: ac40 mode, 5795 MHz

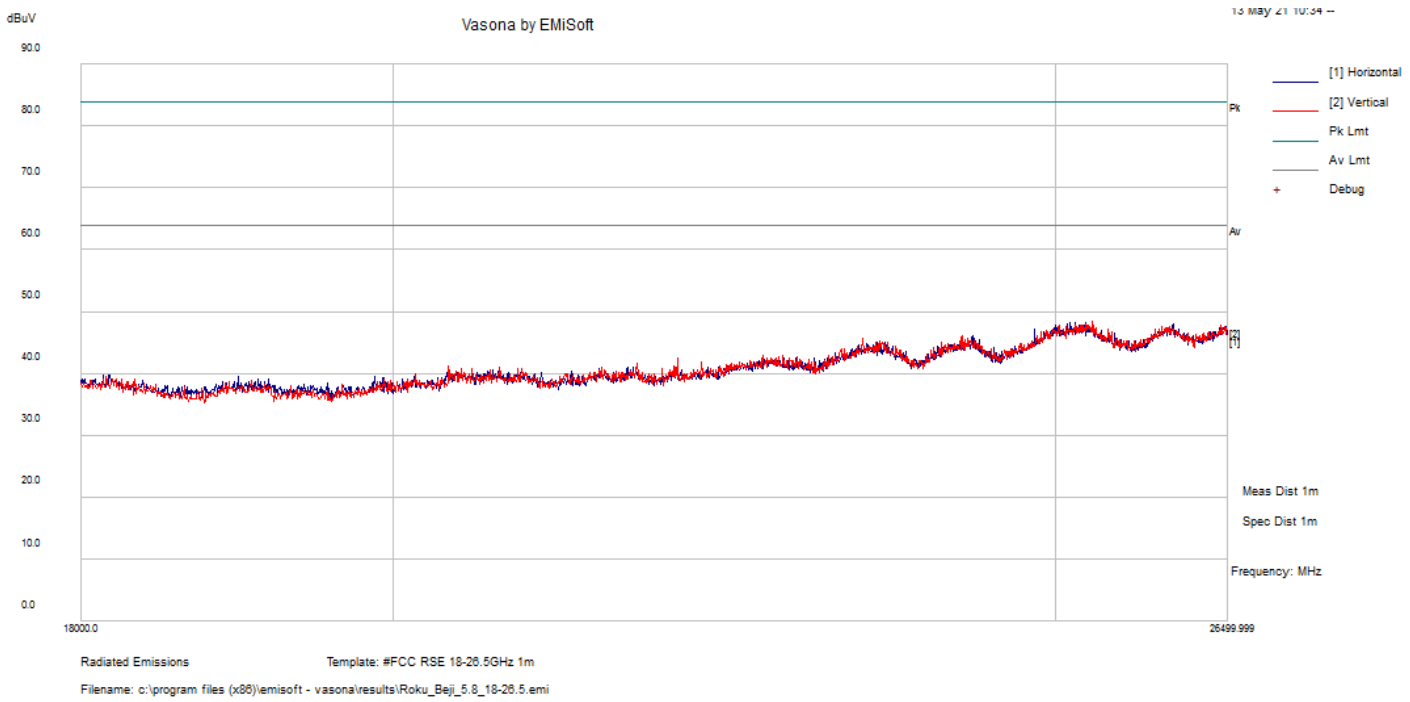


Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment[1]
17384.12	48.85	24.24	73.09	129	H	28	78	-4.91	PK

Note[1]: Emission is outside of restricted bands, therefore 15.407 Spurious Emission limit was applied.

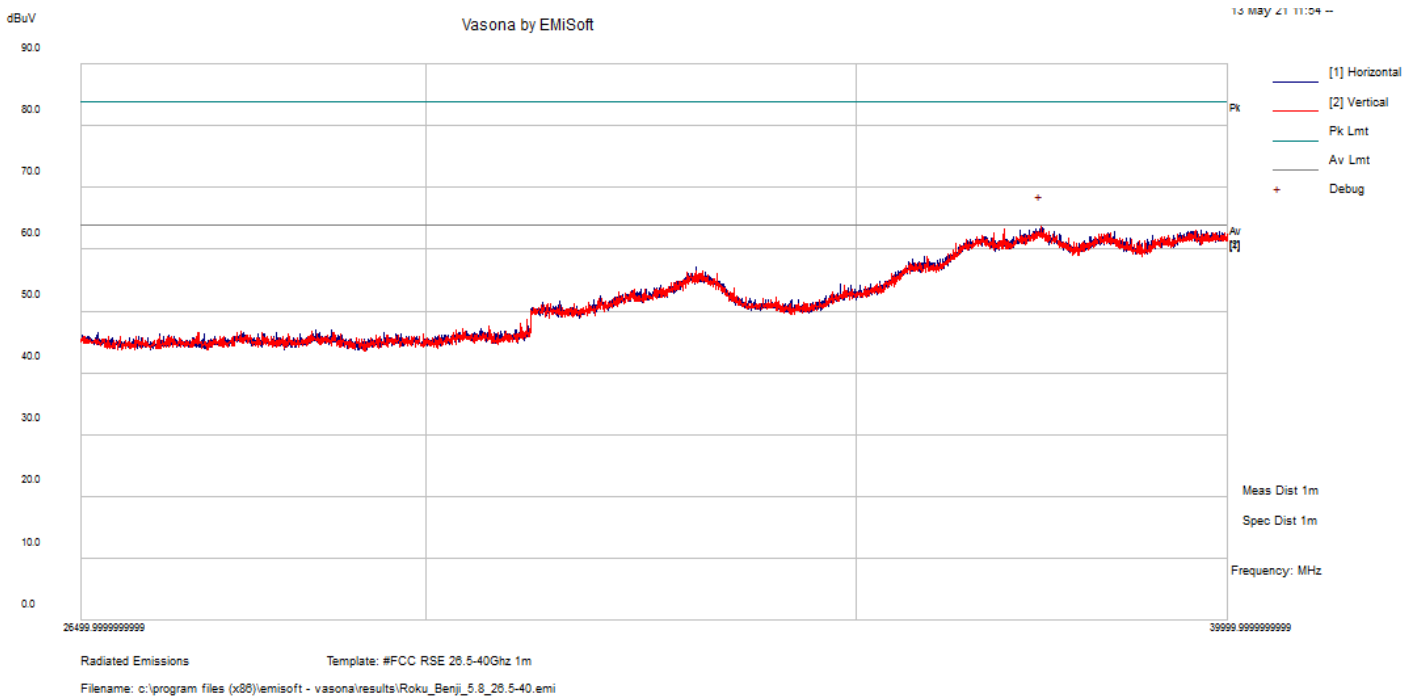
18 GHz – 26.5 GHz Worst Case Scan at 1 Meter

Worst Case: ac40 mode, 5795 MHz



26.5 GHz – 40 GHz Worst Case Scan at 1 Meter

Worst Case: ac40 mode, 5795 MHz



8 FCC §15.407(e) - 6 dB, 26 dB, & 99% - Occupied Bandwidth

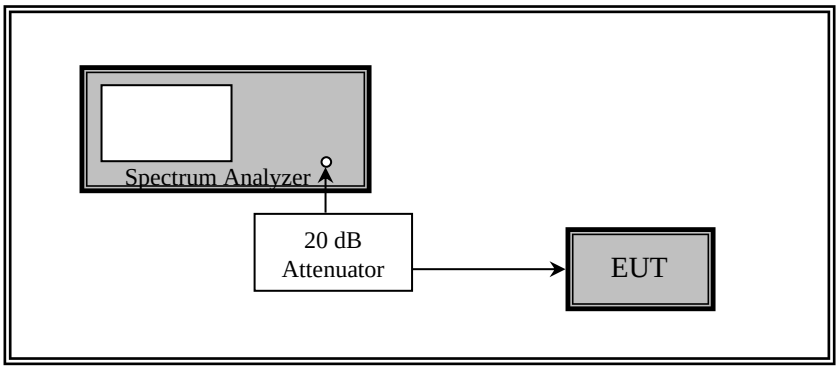
8.1 Applicable Standards

As per FCC §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.

8.2 Measurement 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 it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 or 26 dB from the reference level. Record the frequency difference as the minimum emission or emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

8.3 Test Setup Block Diagram



8.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2020-04-24	18 months
Rohde & Schwarz	Spectrum Analyzer	FSQ26	200749	2019-11-07	2 years
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

8.5 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Rita Yang on 2021-05-11 and Allen Huang on 2021-05-12 and 2021-05-14 at RF test site.

8.6 Test Results

Please refer to the following tables and plots.

5150 - 5250 MHz

Ant A

Channel	Frequency (MHz)	99% OBW (MHz)	26 dB OBW (MHz)
802.11n40 mode			
38	5190	37.1229	42
46	5230	36.7761	43.9
802.11ac40 mode			
38	5190	36.9113	41.7
46	5230	36.2892	44
802.11ac80 mode			
42	5210	74.7614	81.8

Ant B

Channel	Frequency (MHz)	99% OBW (MHz)	26 dB OBW (MHz)
802.11n40 mode			
38	5190	36.4183	42
46	5230	36.4956	46.1
802.11ac40 mode			
38	5190	36.6315	42.1
46	5230	36.5021	47.2
802.11ac80 mode			
42	5210	74.9551	84.2

5725 - 5850 MHz

Ant A

Channel	Frequency (MHz)	99% OBW (MHz)	26 dB OBW (MHz)
802.11n40 mode			
151	5755	56.7639	89
159	5795	69.0894	57
802.11ac40 mode			
151	5755	55.1536	89
159	5795	66.6593	56
802.11ac80 mode			
155	5775	76.6378	110.5

Ant B

Channel	Frequency (MHz)	99% OBW (MHz)	26 dB OBW (MHz)
802.11n40 mode			
151	5755	53.5334	87.4
159	5795	67.6508	56.4
802.11ac40 mode			
151	5755	51.9222	86
159	5795	63.9394	57
802.11ac80 mode			
155	5775	76.2226	101.4

5725 - 5850 MHz

Ant A

Channel	Frequency (MHz)	6 dB OBW (MHz)	6 dB OBW limit (kHz)
802.11n40 mode			
151	5755	33.5	≥500
159	5795	34.5	≥500
802.11ac40 mode			
151	5755	35.3	≥500
159	5795	30.9	≥500
802.11ac80 mode			
155	5775	58.7	≥500

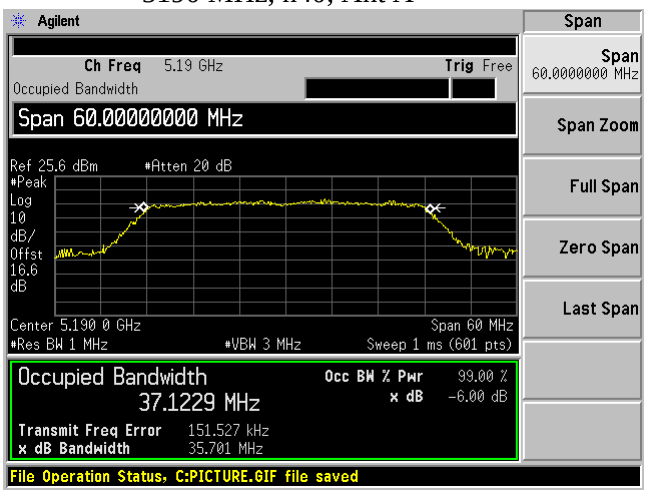
Ant B

Channel	Frequency (MHz)	6 dB OBW (MHz)	6 dB OBW limit (kHz)
802.11n40 mode			
151	5755	33.5	≥500
159	5795	33.8	≥500
802.11ac40 mode			
151	5755	34.1	≥500
159	5795	33.3	≥500
802.11ac80 mode			
155	5775	64.8	≥500

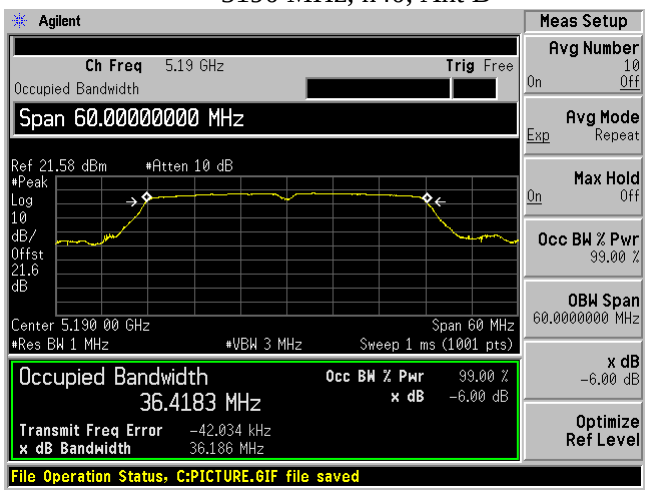
Please refer to the following plots:

99% OBW

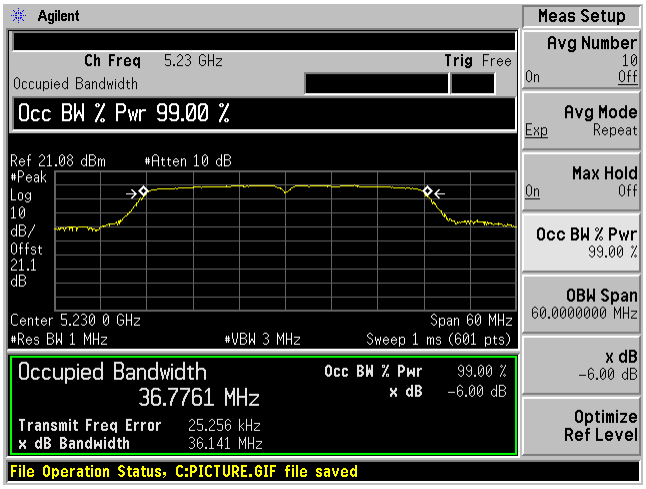
5190 MHz, n40, Ant A



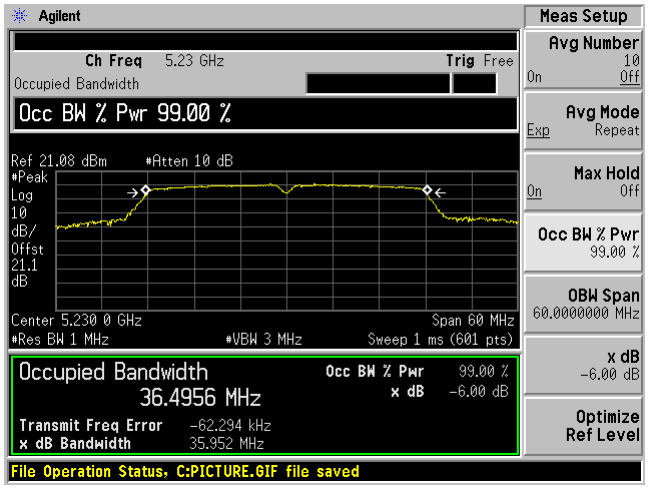
5190 MHz, n40, Ant B



5230 MHz, n40, Ant A

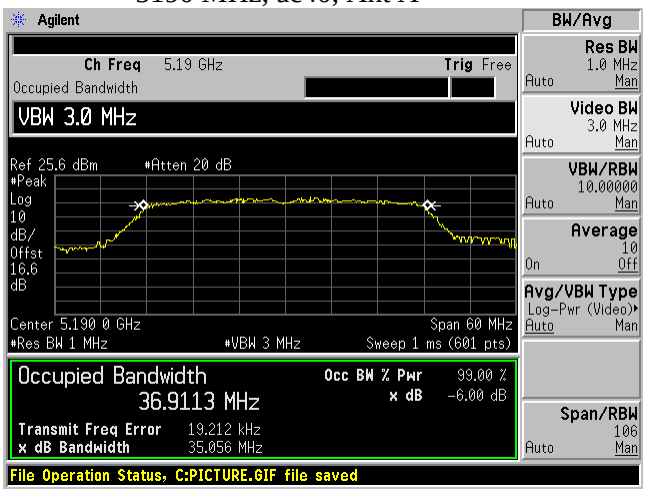


5230 MHz, n40, Ant B

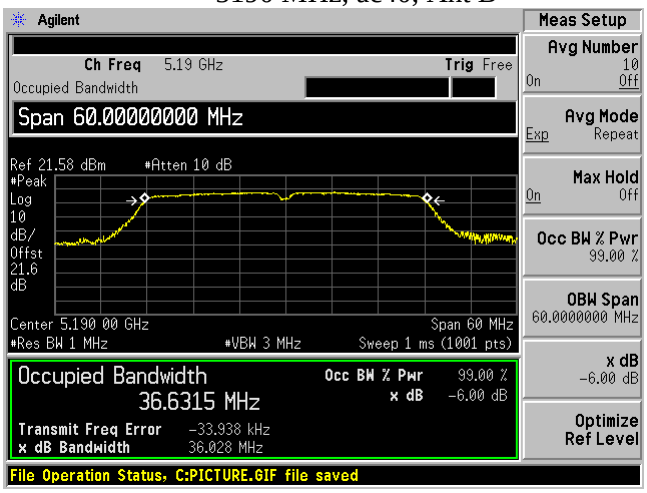


99% OBW

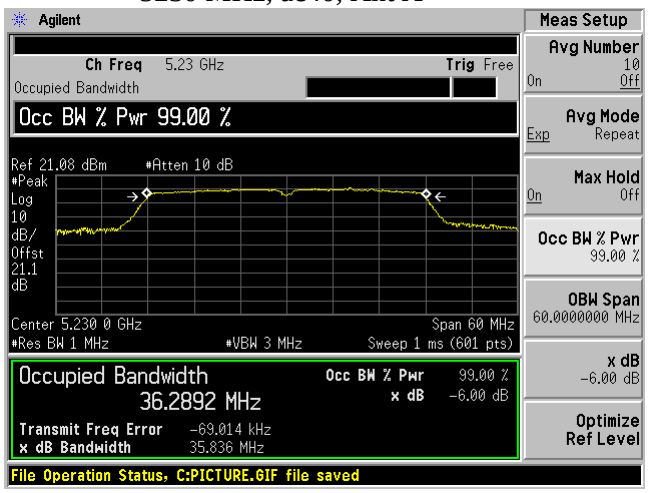
5190 MHz, ac40, Ant A



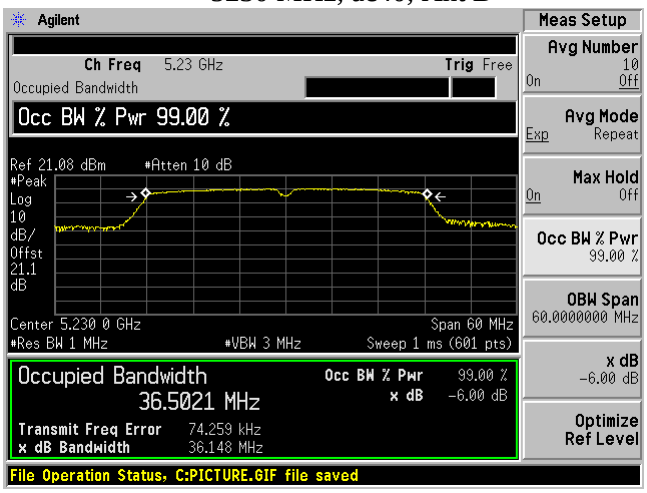
5190 MHz, ac40, Ant B



5230 MHz, ac40, Ant A

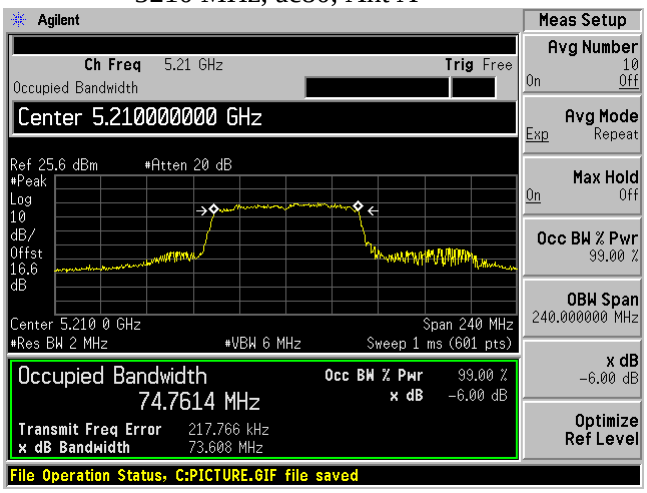


5230 MHz, ac40, Ant B

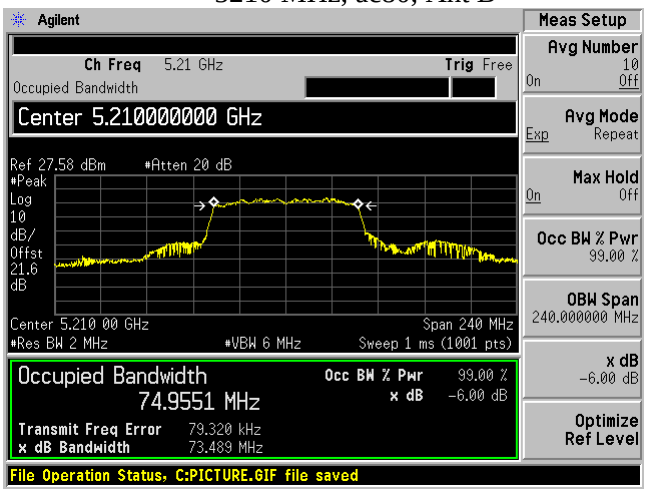


99% OBW

5210 MHz, ac80, Ant A

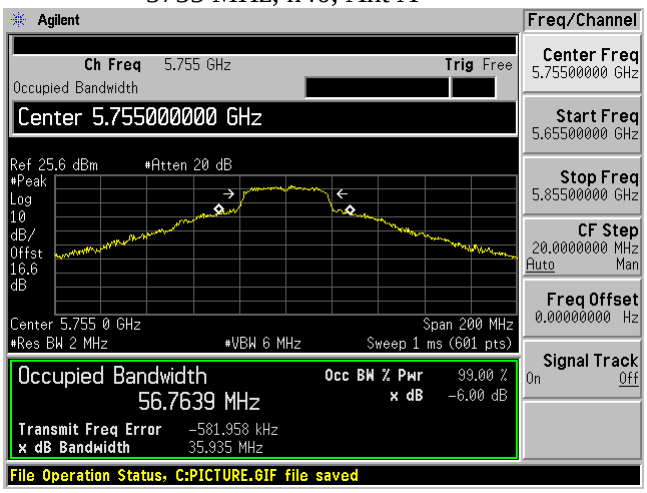


5210 MHz, ac80, Ant B

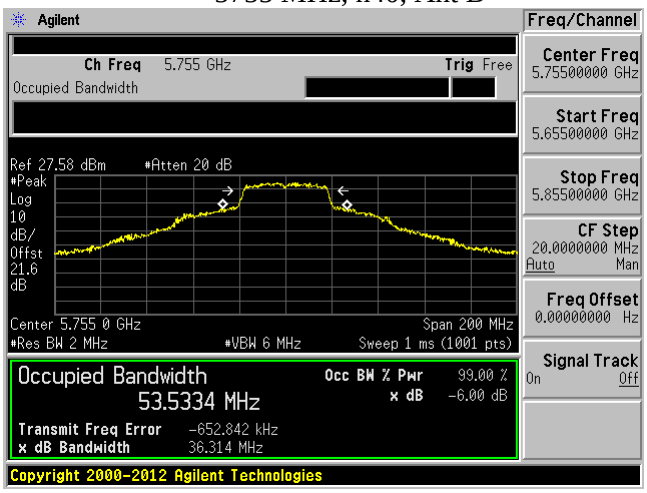


99% OBW

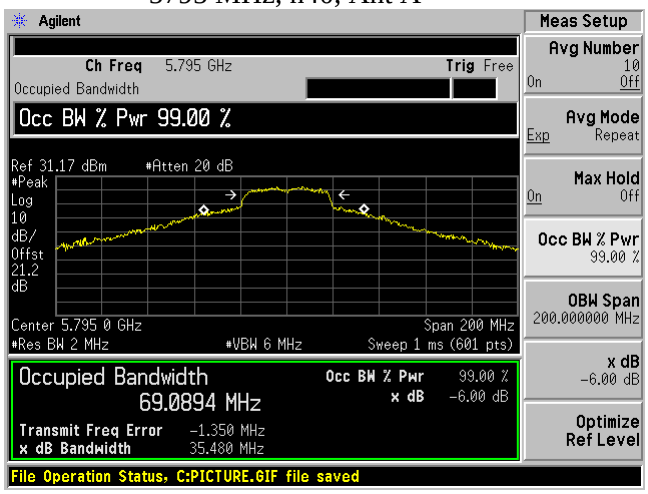
5755 MHz, n40, Ant A



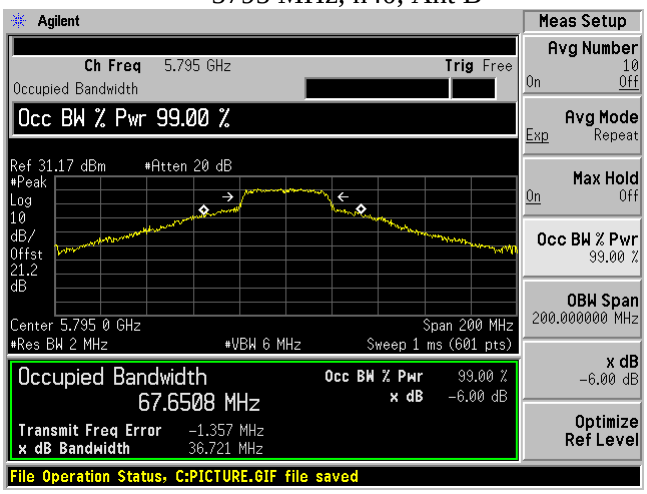
5755 MHz, n40, Ant B



5795 MHz, n40, Ant A

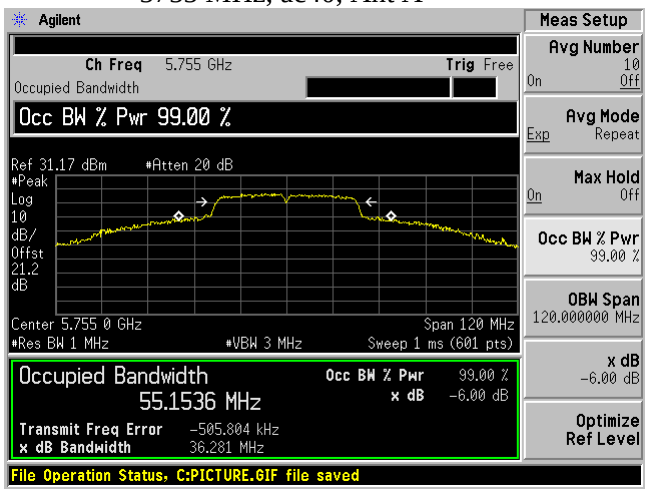


5795 MHz, n40, Ant B

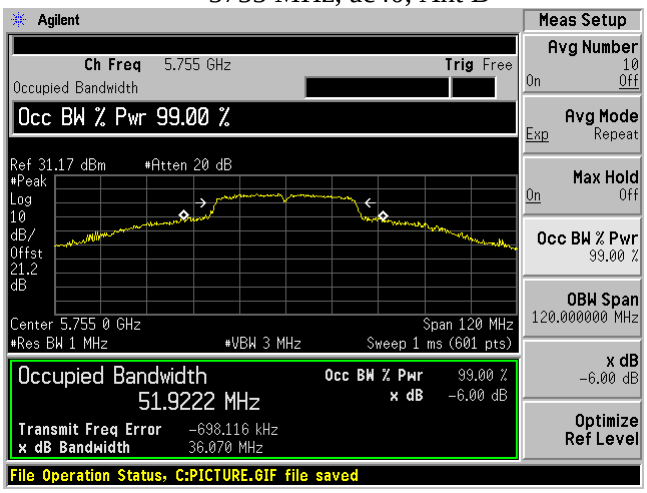


99% OBW

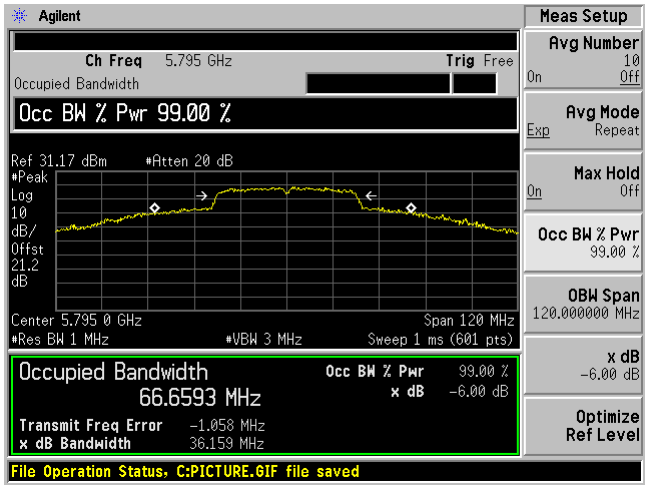
5755 MHz, ac40, Ant A



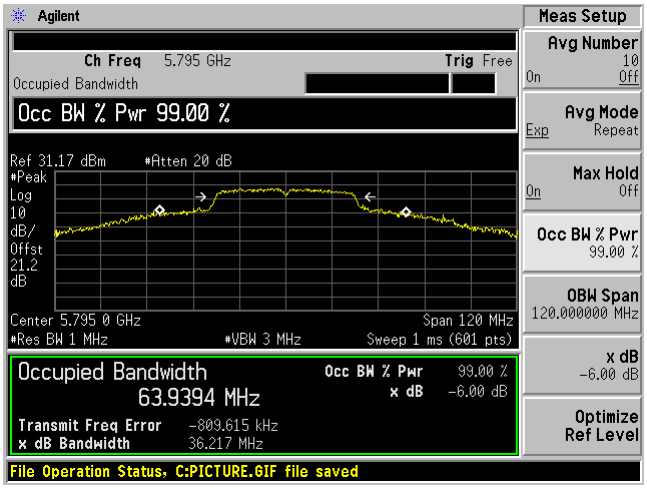
5755 MHz, ac40, Ant B



5795 MHz, ac40, Ant A

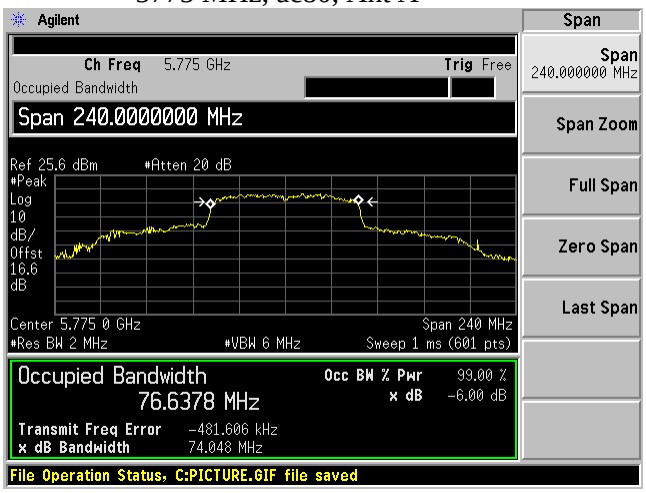


5795 MHz, ac40, Ant B

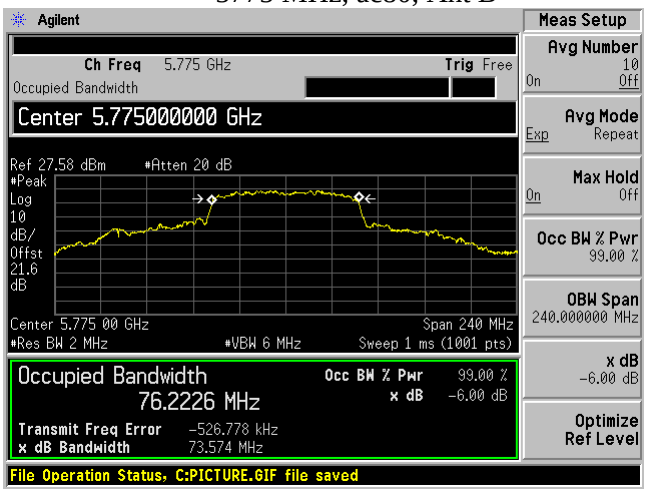


99% OBW

5775 MHz, ac80, Ant A

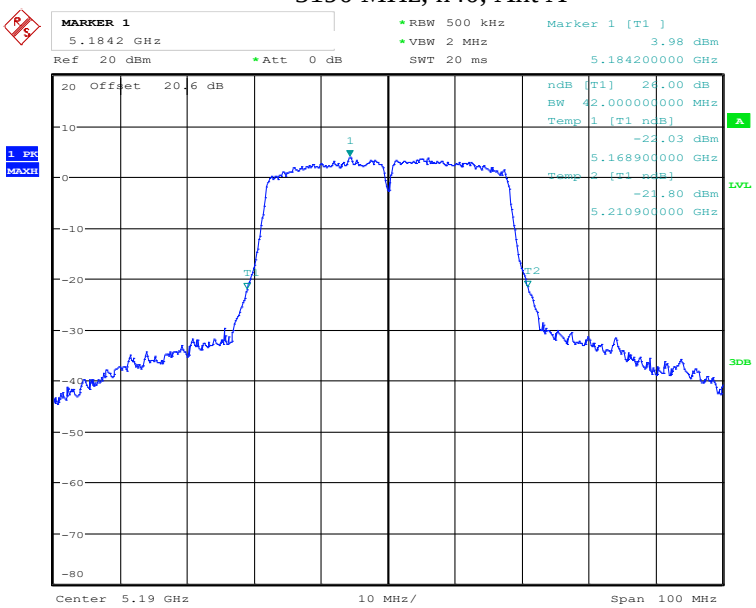


5775 MHz, ac80, Ant B



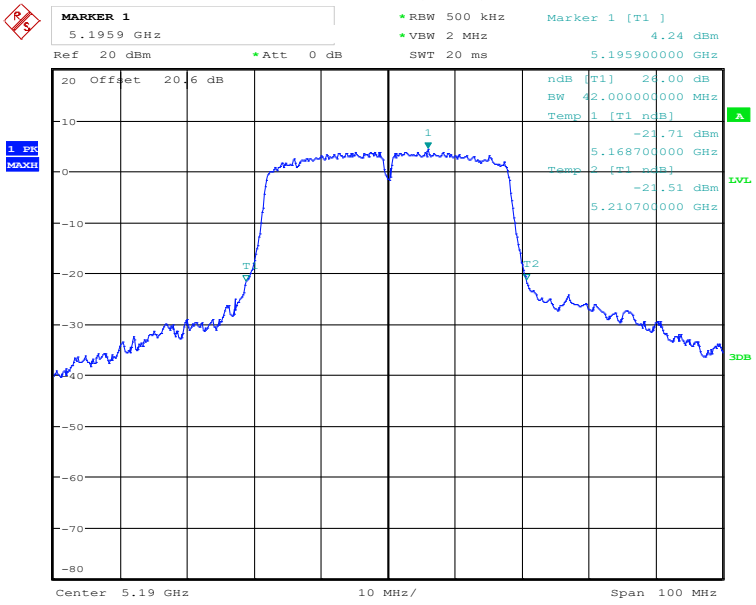
26 dB BW

5190 MHz, n40, Ant A



Date: 12.MAY.2021 10:23:00

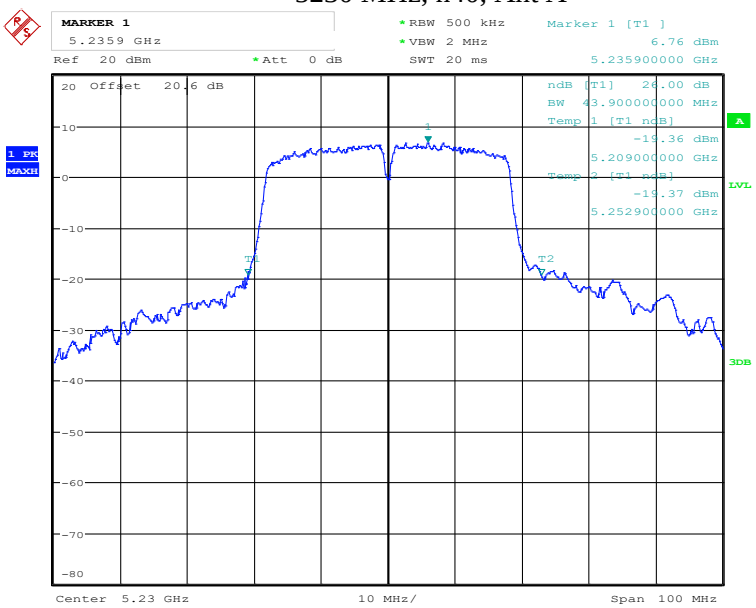
5190 MHz, n40, Ant B



Date: 12.MAY.2021 10:27:22

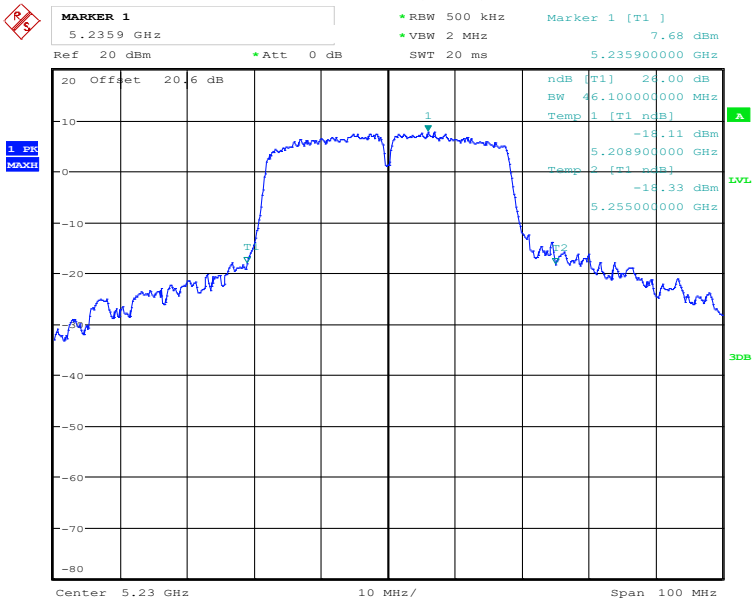
26 dB BW

5230 MHz, n40, Ant A



Date: 12.MAY.2021 10:34:11

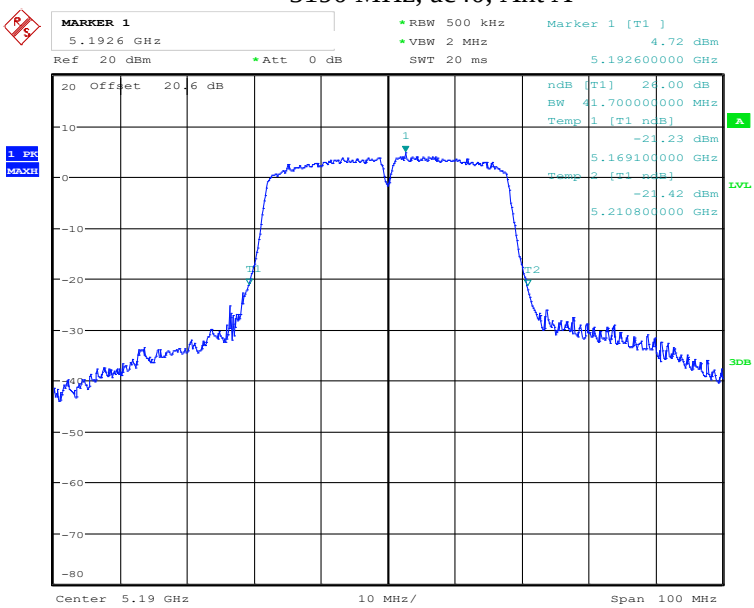
5230 MHz, n40, Ant B



Date: 12.MAY.2021 10:31:06

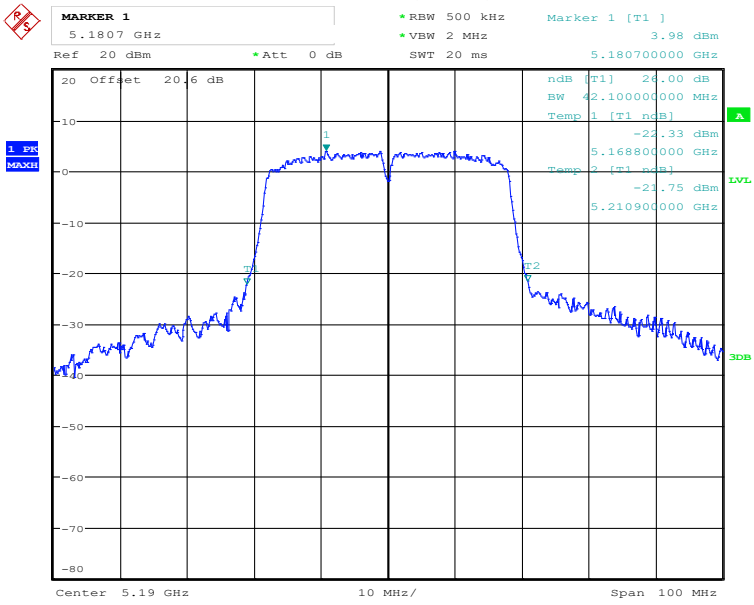
26 dB BW

5190 MHz, ac40, Ant A



Date: 12.MAY.2021 10:47:55

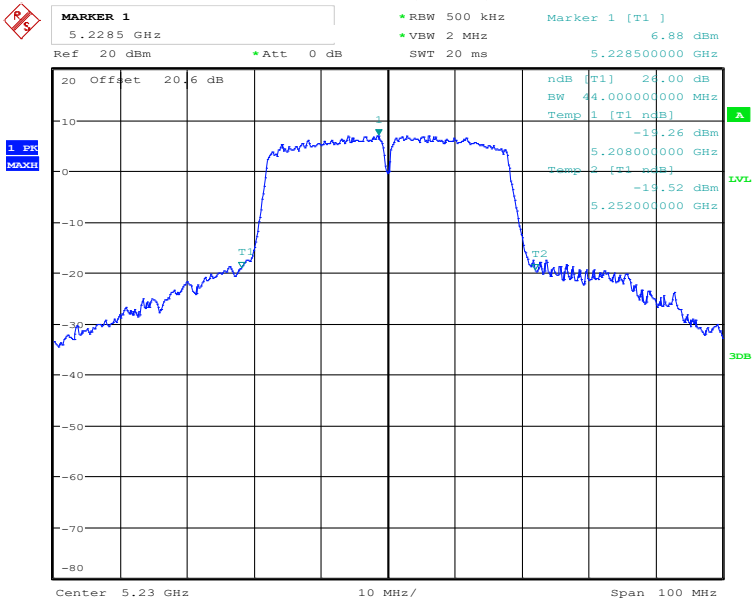
5190 MHz, ac40, Ant B



Date: 12.MAY.2021 10:52:54

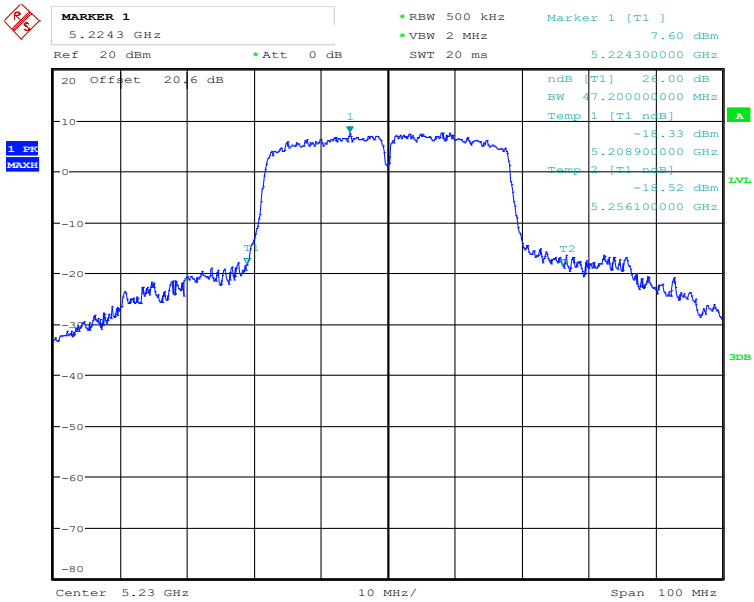
26 dB BW

5230 MHz, ac40, Ant A



Date: 12.MAY.2021 10:56:16

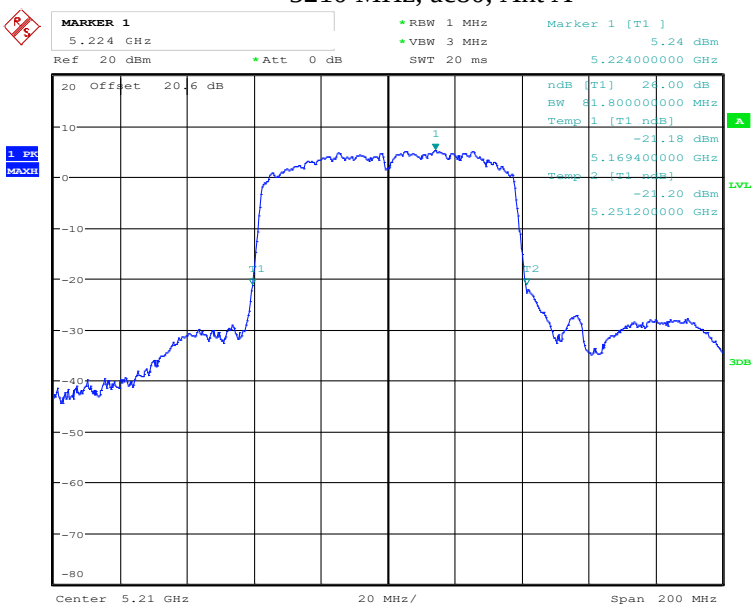
5230 MHz, ac40, Ant B



Date: 12.MAY.2021 10:58:38

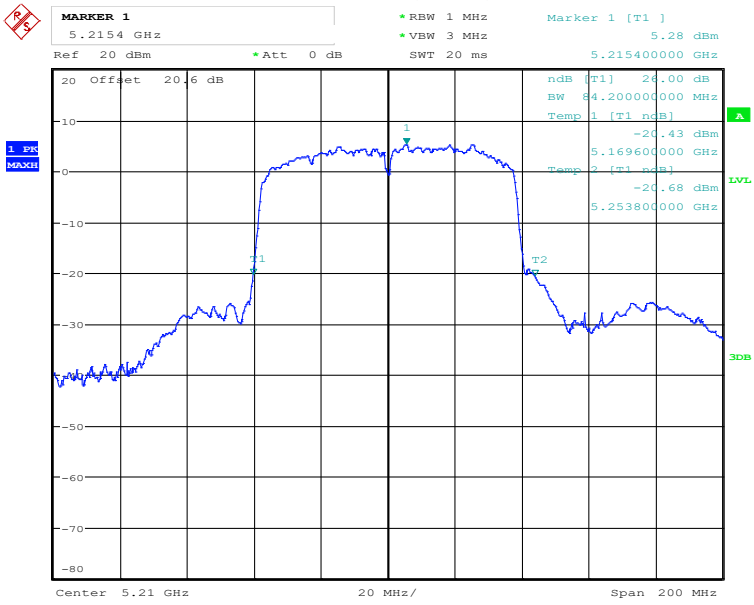
26 dB BW

5210 MHz, ac80, Ant A



Date: 12.MAY.2021 11:07:30

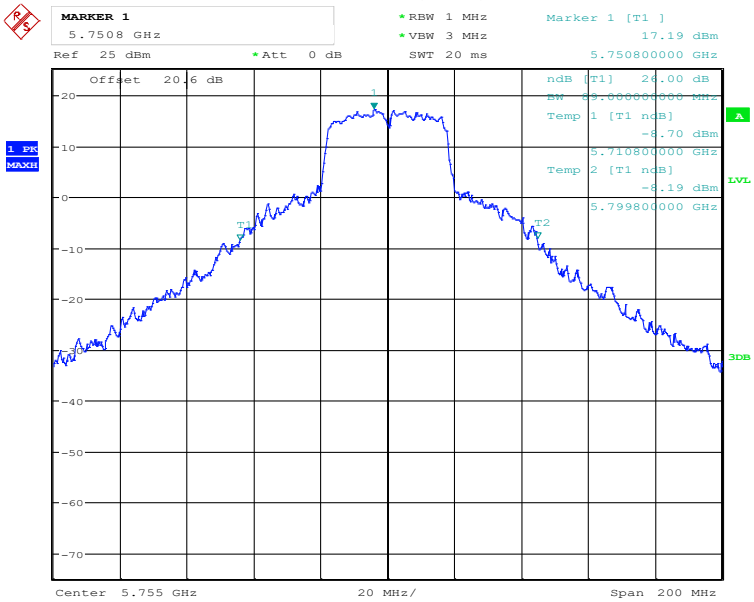
5210 MHz, ac80, Ant B



Date: 12.MAY.2021 11:04:19

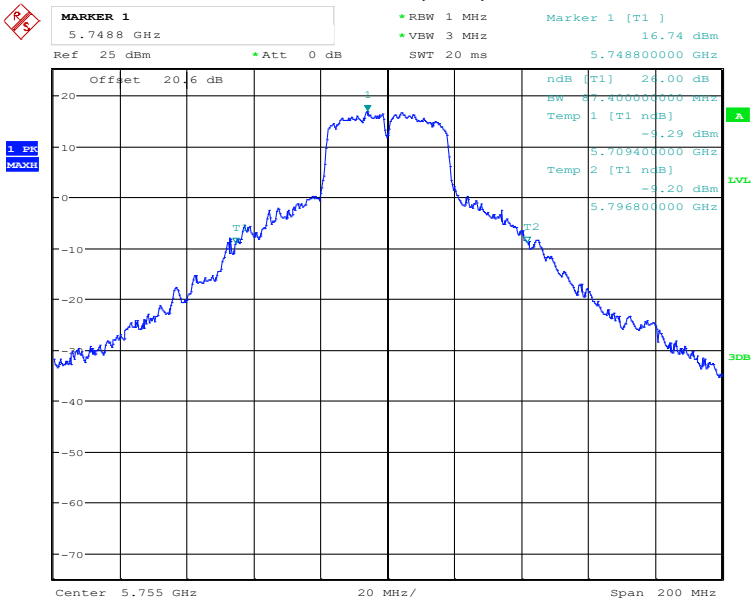
26 dB BW

5755 MHz, n40, Ant A



Date: 12.MAY.2021 11:16:46

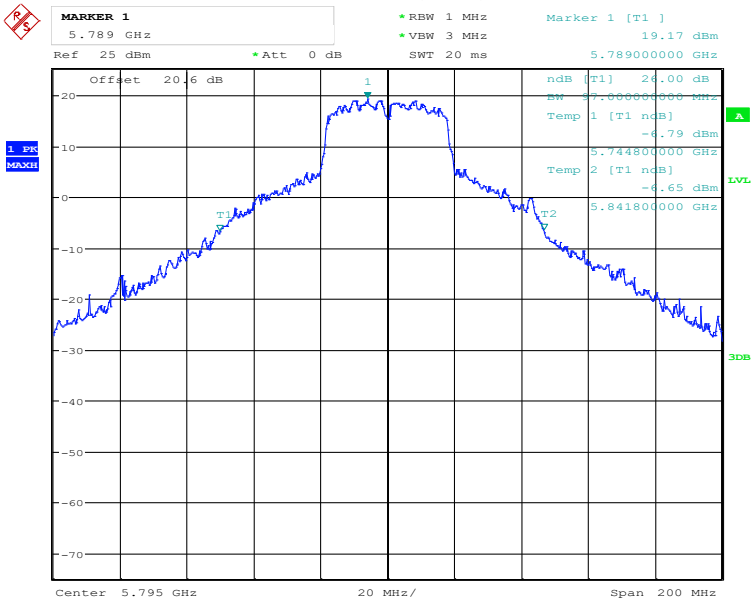
5755 MHz, n40, Ant B



Date: 12.MAY.2021 11:20:11

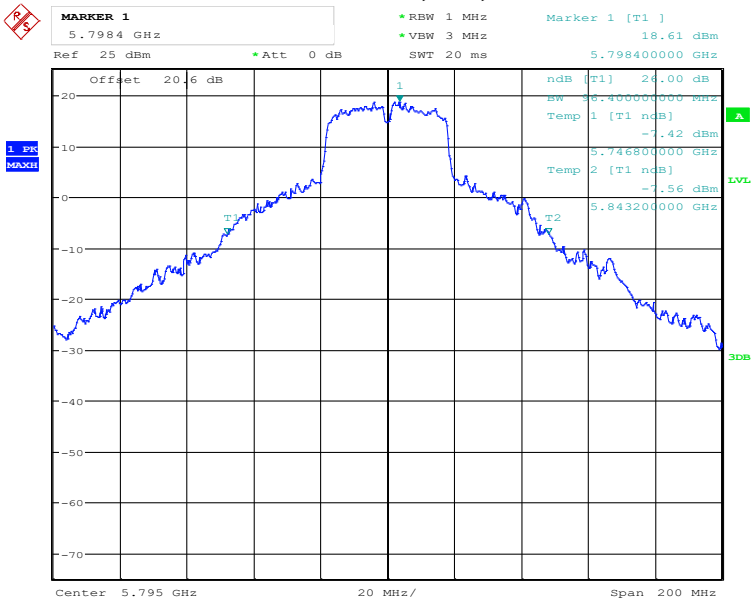
26 dB BW

5795 MHz, n40, Ant A



Date: 12.MAY.2021 11:25:31

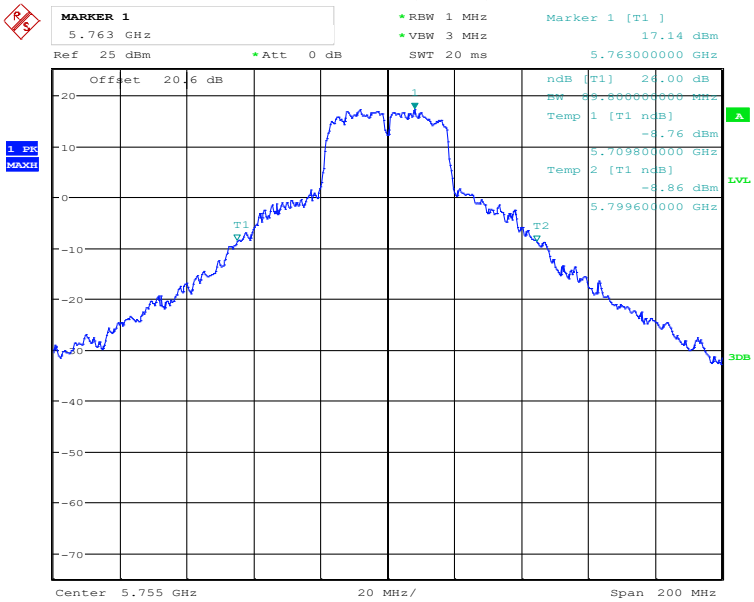
5795 MHz, n40, Ant B



Date: 12.MAY.2021 11:23:04

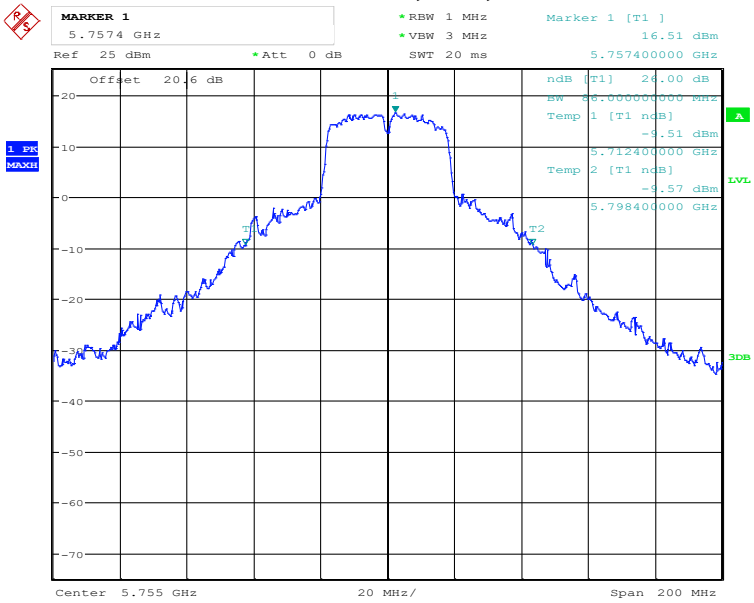
26 dB BW

5755 MHz, ac40, Ant A



Date: 12.MAY.2021 11:29:13

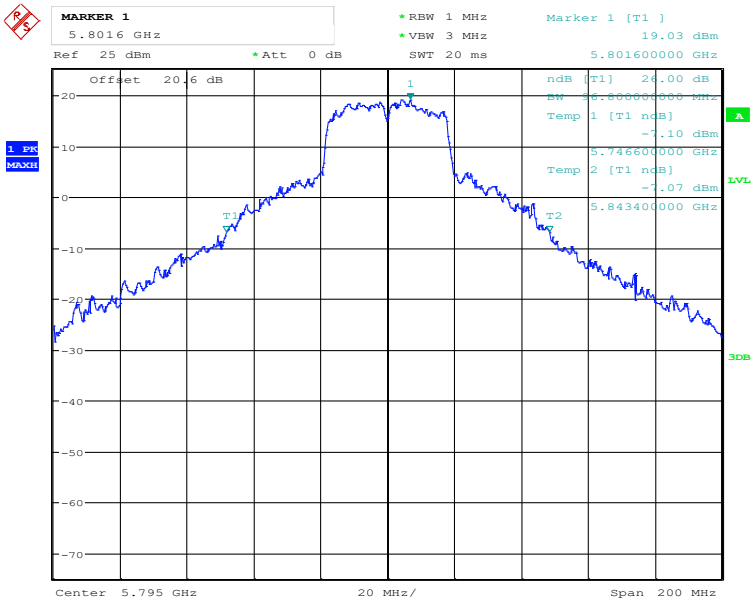
5755 MHz, ac40, Ant B



Date: 12.MAY.2021 11:46:48

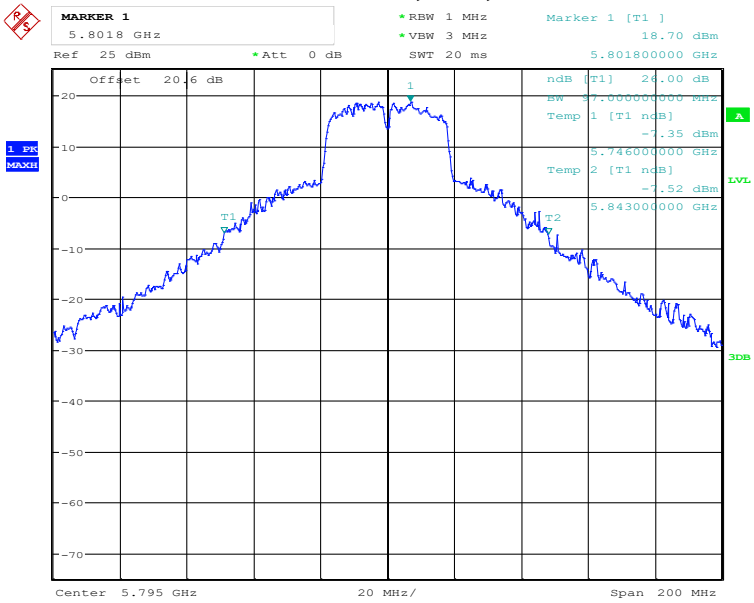
26 dB BW

5795 MHz, ac40, Ant A



Date: 12.MAY.2021 11:51:34

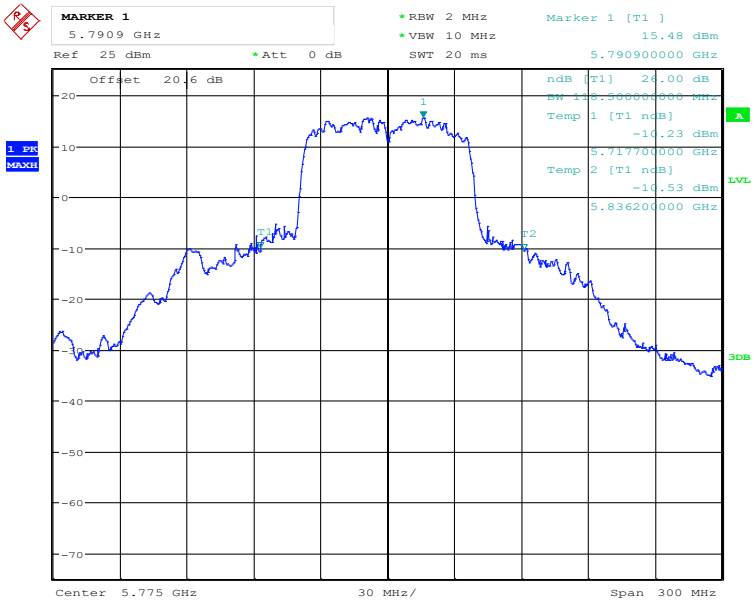
5795 MHz, ac40, Ant B



Date: 12.MAY.2021 11:49:46

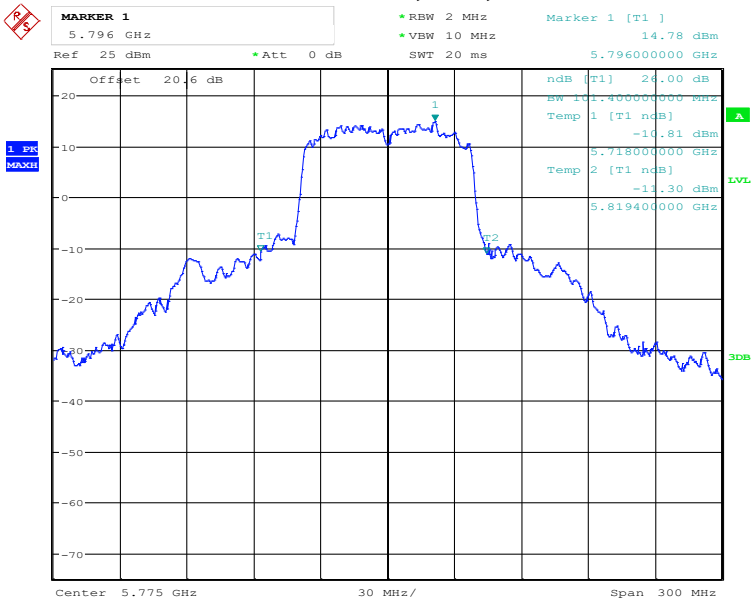
26 dB BW

5775 MHz, ac80, Ant A



Date: 12.MAY.2021 11:40:43

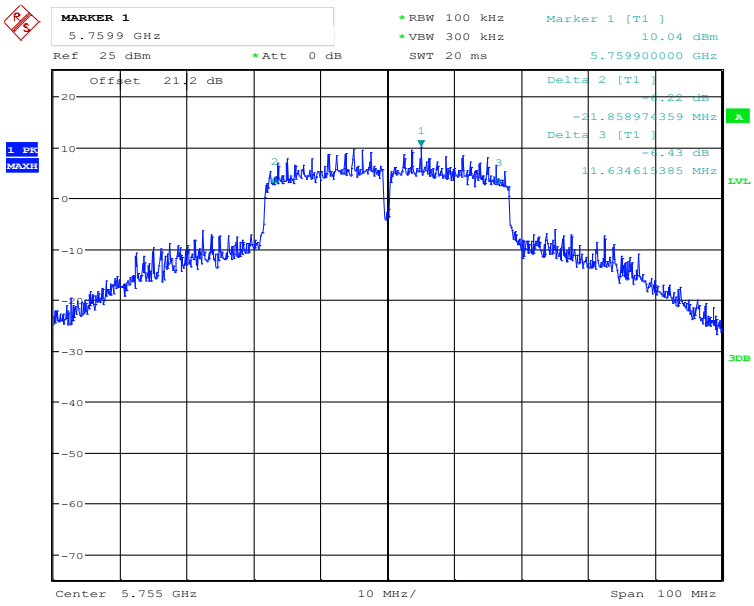
5775 MHz, ac80, Ant B



Date: 12.MAY.2021 11:43:36

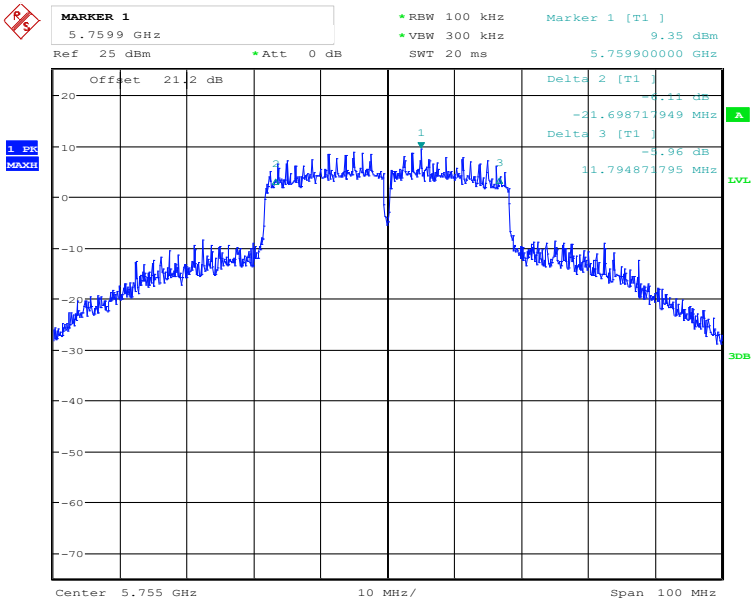
6 dB BW

5755 MHz, n40, Ant A



Date: 14.MAY.2021 09:08:23

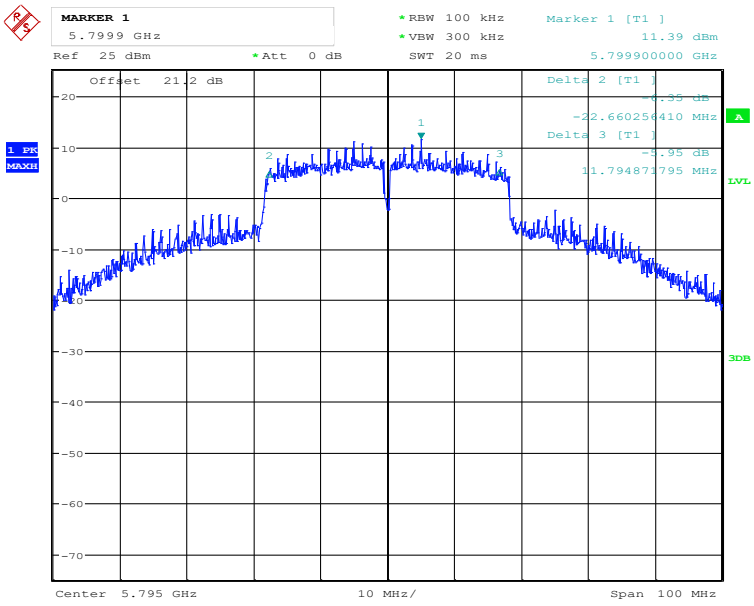
5755 MHz, n40, Ant B



Date: 14.MAY.2021 09:12:00

6 dB BW

5795 MHz, n40, Ant A



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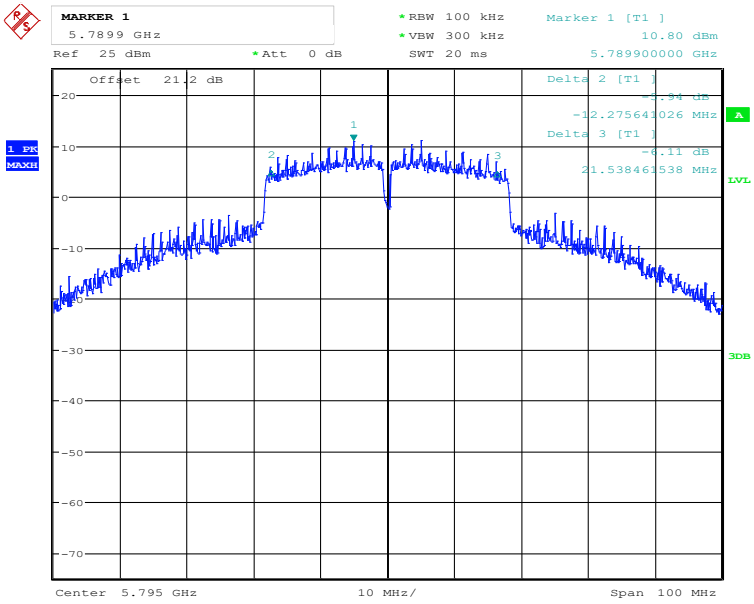
5795 MHz, n40, Ant B



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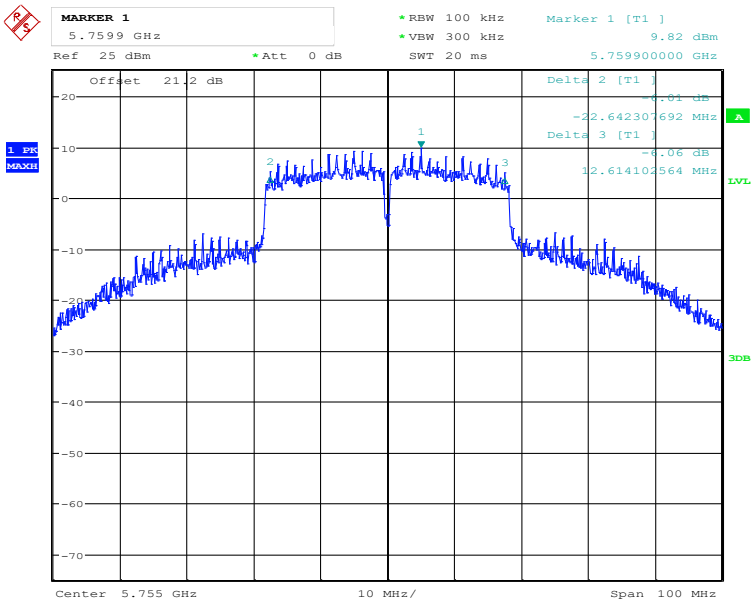
6 dB BW

5755 MHz, ac40, Ant A



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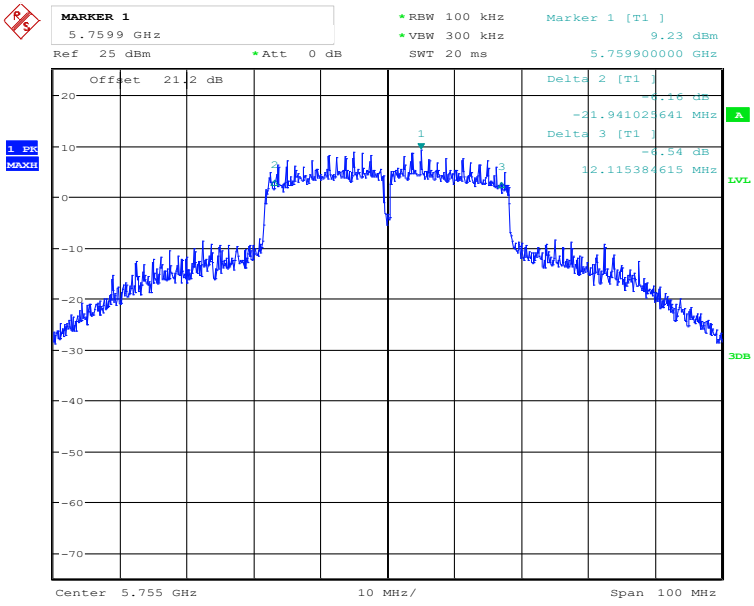
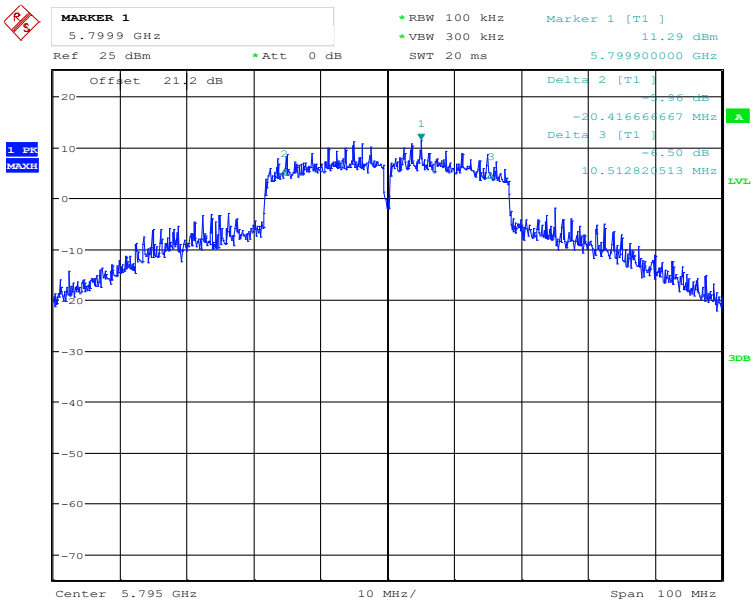
5755 MHz, ac40, Ant B



Date: 14.MAY.2021 09:23:46

6 dB BW

5795 MHz, ac40, Ant A



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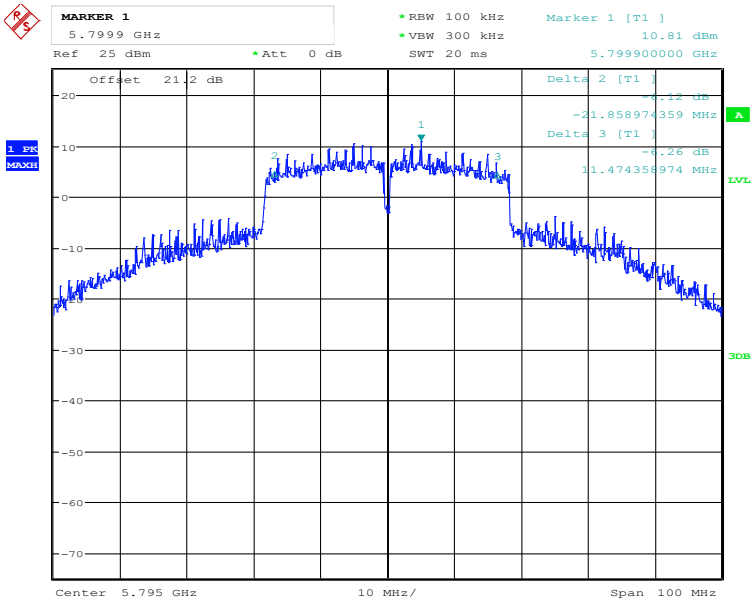
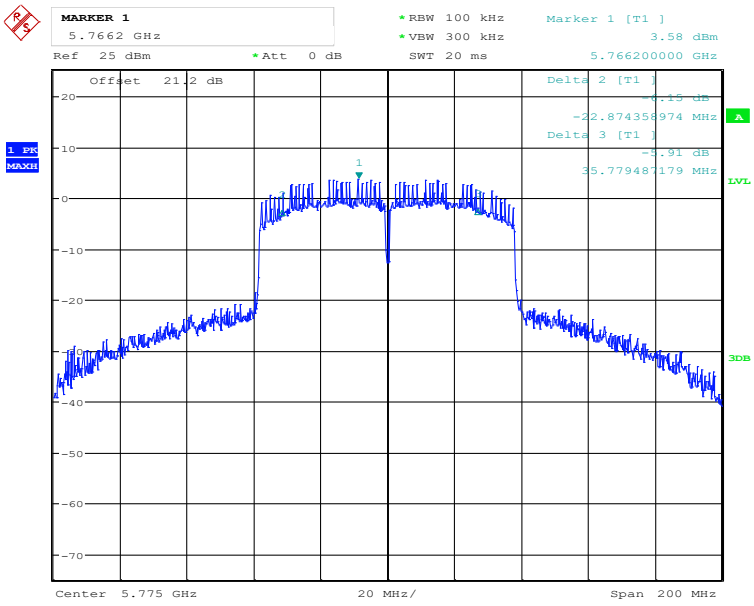
5795 MHz, ac40, Ant B



Date: 14.MAY.2021 09:26:25

6 dB BW

5775 MHz, ac80, Ant A



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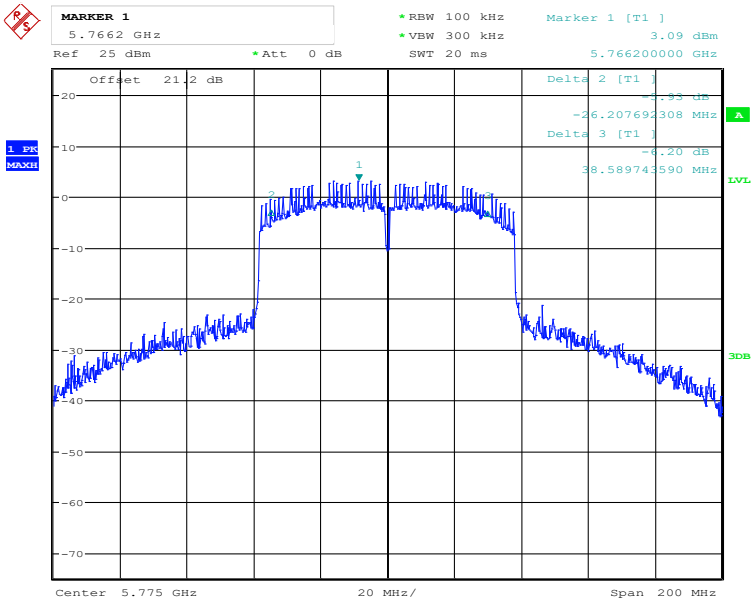
5775 MHz, ac80, Ant B



Date: 14.MAY.2021 09:34:26

9 FCC §15.407(a) - Output Power

9.1 Applicable Standards

According to FCC §15.407(a):

(a) Power limits:

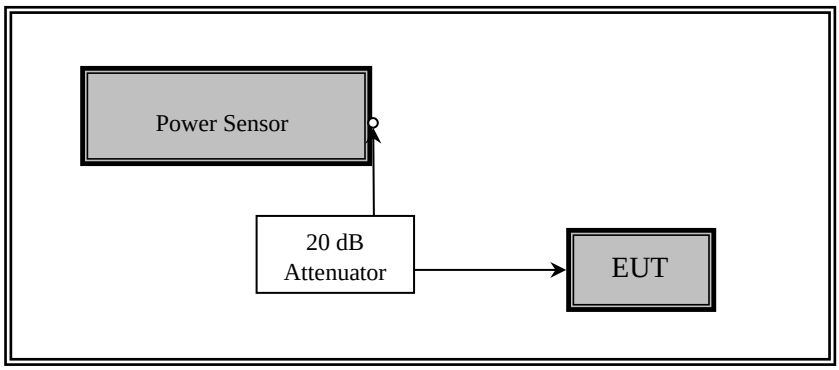
(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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.

(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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. 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.

9.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a power meter.

9.3 Test Setup Block Diagram



9.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A
ETS-LINDGREN	Power Sensor	7002-006	160097	2021-02-12	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

9.5 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Rita Yang on 2021-05-11and 2021-09-14 in RF site.

9.6 Test Results

5150 - 5250 MHz

Channel	Frequency (MHz)	Conducted Output Power (dBm)		Combined Total (dBm)	Limit (dBm)
		ANT A	ANT B		
802.11n40 mode					
38	5190	15.30	15.58	18.45	22.39
46	5230	16.92	17.89	20.44	22.39
802.11ac40 mode					
38	5190	15.15	15.69	18.44	22.39
46	5230	16.75	17.50	20.15	22.39
802.11ac80 mode					
42	5210	14.23	14.85	17.56	22.39

5725 - 5850 MHz

Channel	Frequency (MHz)	Conducted Output Power (dBm)		Combined Total (dBm)	Limit (dBm)
		ANT A	ANT B		
802.11n40 mode					
151	5755	21.35	21.06	24.22	28.39
159	5795	21.20	20.85	24.04	28.39
802.11ac40 mode					
151	5755	21.30	20.91	24.12	28.39
159	5795	21.35	21.12	24.25	28.39
802.11ac80 mode					
155	5775	20.12	19.35	22.76	28.39

Note: When the directional gain is greater than 6dBi, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The directional antenna gain is 7.61 dBi calculated based on method specified in KDB 662911 D01.

Note: Duty cycle correction factor has already been added to the measurements.
Note: Combined Total is the sum of the two Antenna port measurements.

10 FCC §15.407(a) - Power Spectral Density

10.1 Applicable Standards

According to FCC §15.407(a):

(1)(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.

(12) Power spectral density measurement. The maximum power spectral density is measured as either a conducted emission by direct connection of a calibrated test instrument to the equipment under test or a radiated measurement. 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 all other 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.

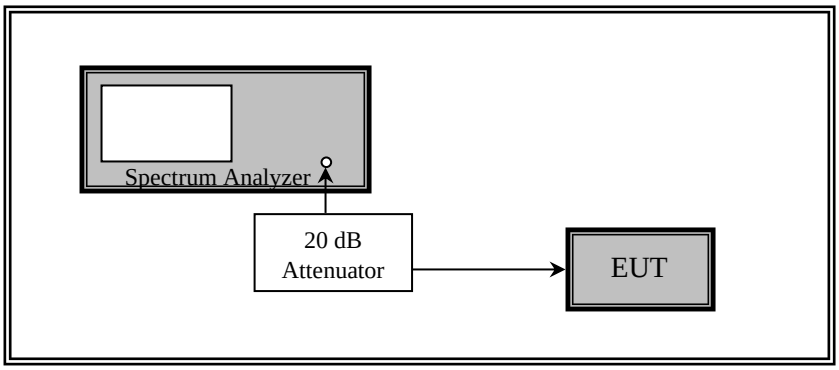
According to FCC KDB 789033 D02(F)(5):

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz, reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz.

10.2 Measurement Procedure

(i) Set span to encompass the entire emission bandwidth (EBW) of the signal.
(ii) Set RBW = 1 MHz(for 5.15-5.25GHz band), 500kHz(for 5.725-5.85GHz band)
(iii) Set VBW ≥ 3 RBW
(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 26 dB EBW of the signal using the spectrum analyzer’s band power measurement function with band limits set equal to the EBW band edges. If the spectrum analyzer does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW of the spectrum.

10.3 Test Setup Block Diagram



10.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2020-04-24	18 months
Rohde & Schwarz	Spectrum Analyzer	FSQ26	200749	2019-11-07	2 years
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

10.5 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Rita Yang on 2021-05-07 and Allen Huang from 2021-05-12 to 2021-05-14 and 2021-09-14at RF test site.

10.6 Test Results

5150 - 5250 MHz

Channel	Frequency (MHz)	PSD (dBm/MHz)		Total PSD (dBm/MHz)	Limit (dBm/MHz)
		ANT A	ANT B		
801.11n40 mode					
38	5190	0.241	0.825	3.55	9.39
46	5230	2.92	4.09	6.55	9.39
801.11ac40 mode					
38	5190	0.644	1.028	3.85	9.39
46	5230	2.69	3.71	6.24	9.39
801.11ac80 mode					
42	5210	-2.849	-2.091	0.56	9.39

PSD is with Duty Cycle Correction Factor considered.
Total PSD (dBm/MHz) is the sum of measurements from both antenna ports.

Note: When the directional gain is greater than 6dBi, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The directional antenna gain for is 7.61 dBi calculated based on method specified in KDB 662911 D01.

5725 - 5850 MHz

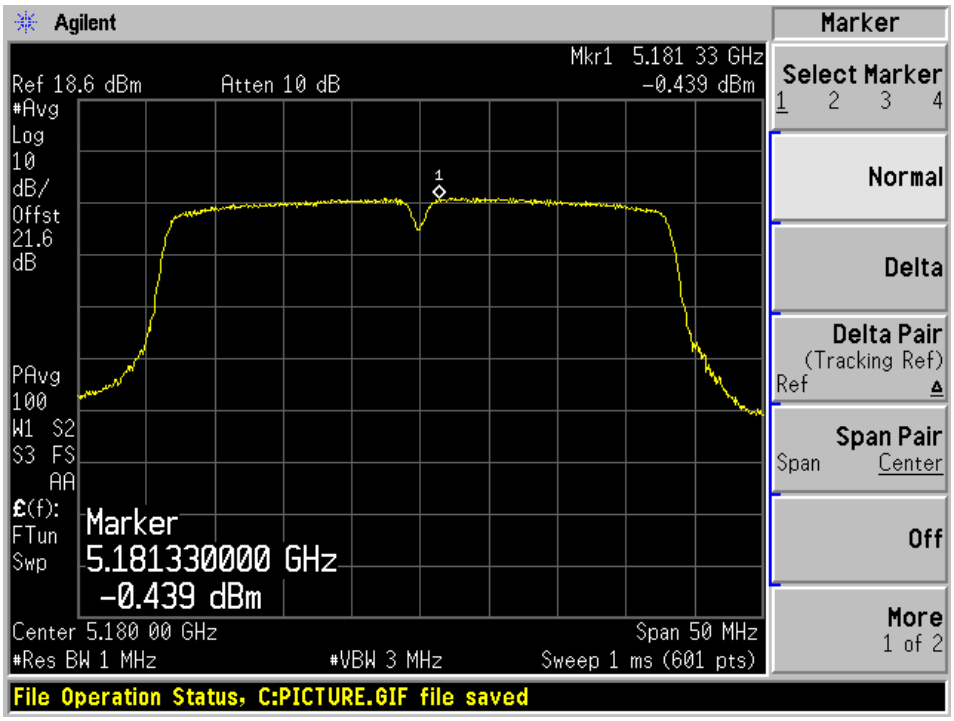
Channel	Frequency (MHz)	PSD (dBm/500kHz)		Total PSD (dBm/500kHz)	Limit (dBm/500kHz)
		ANT A	ANT B		
801.11n40 mode					
151	5755	2.24	2.12	5.19	28.39
159	5795	1.83	2.36	5.11	28.39
801.11ac40 mode					
151	5755	3.39	2.96	6.19	28.39
159	5795	1.66	1.07	4.38	28.39
801.11ac80 mode					
155	5775	-3.33	-2.33	0.21	28.39

PSD is with Duty Cycle Correction Factor considered.
Total PSD (dBm/500kHz) is the sum of measurements from both antenna ports.

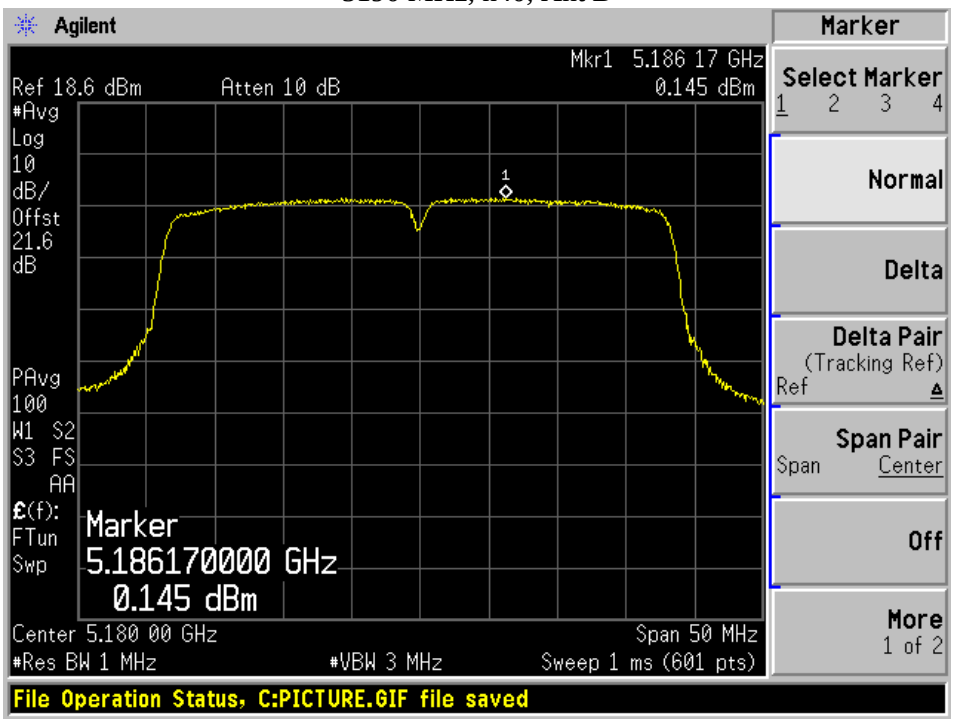
Note: When the directional gain is greater than 6dBi, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The directional antenna gain is 7.61 dBi calculated based on method specified in KDB 662911 D01.

Please refer to the following plots.

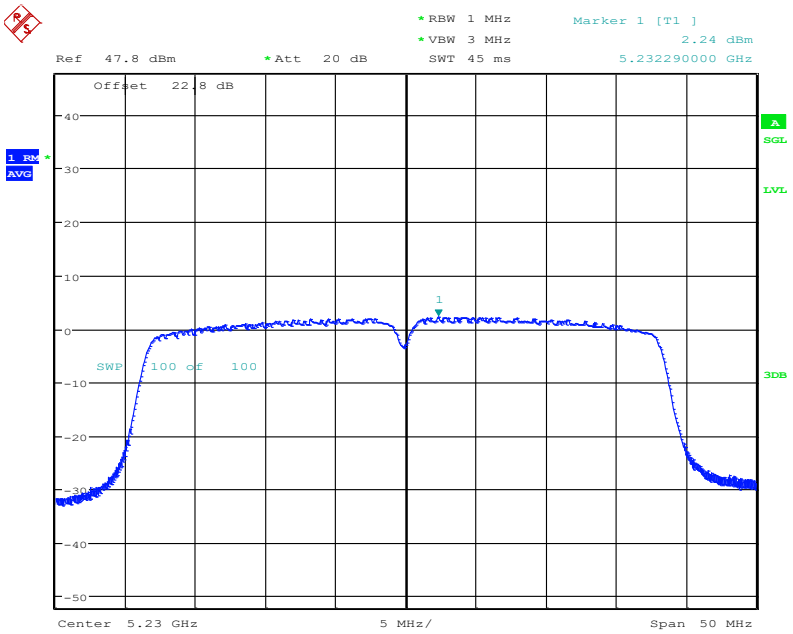
5190 MHz, n40, Ant A



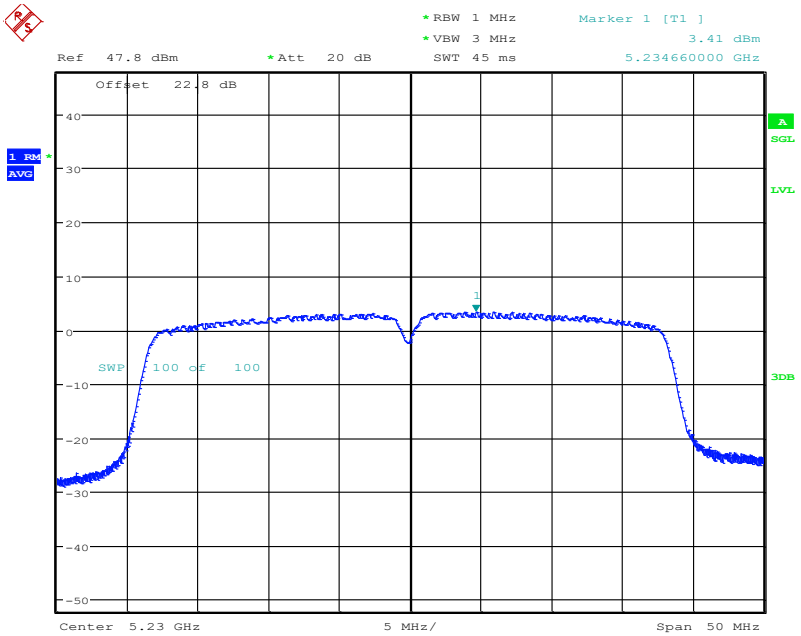
5190 MHz, n40, Ant B



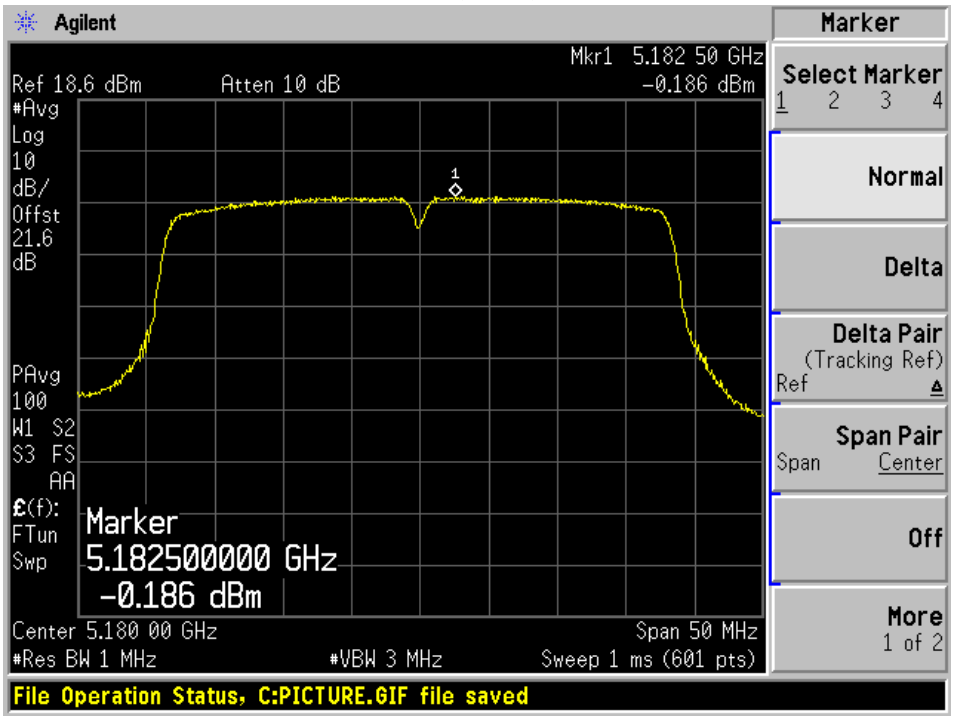
5230 MHz, n40, Ant A



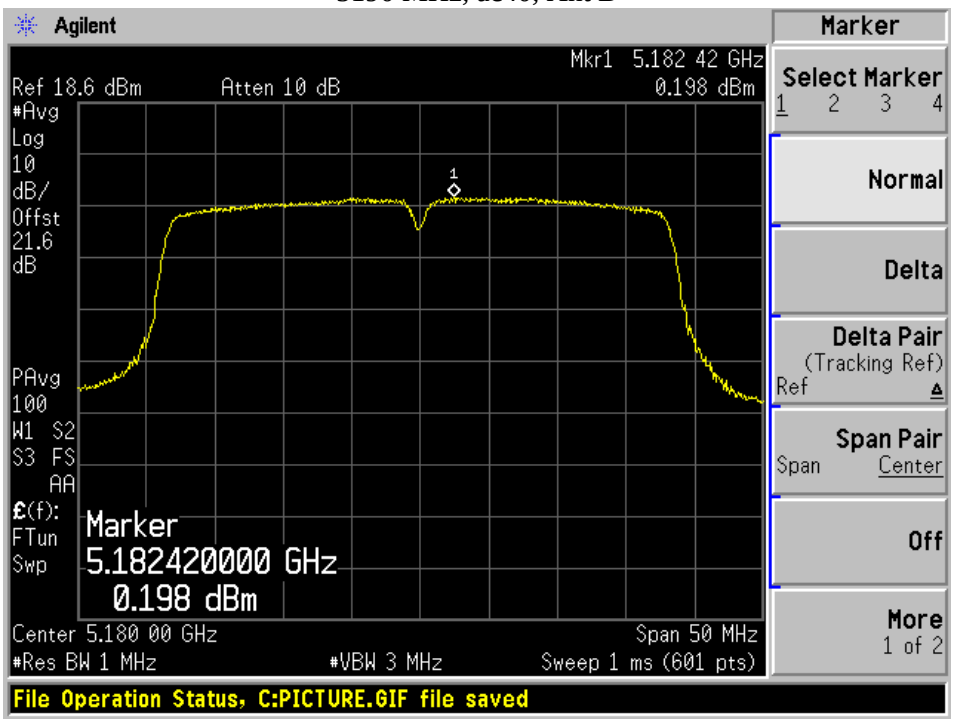
5230 MHz, n40, Ant B



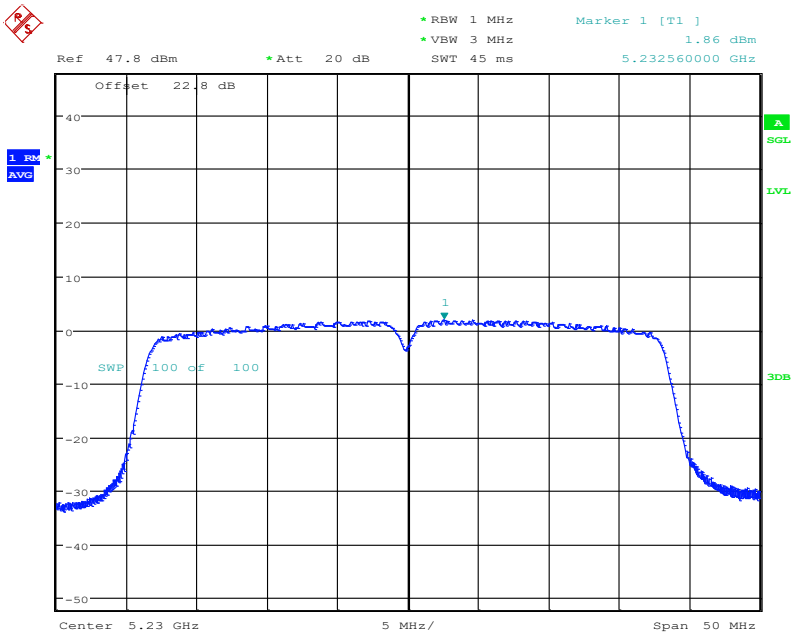
5190 MHz, ac40, Ant A



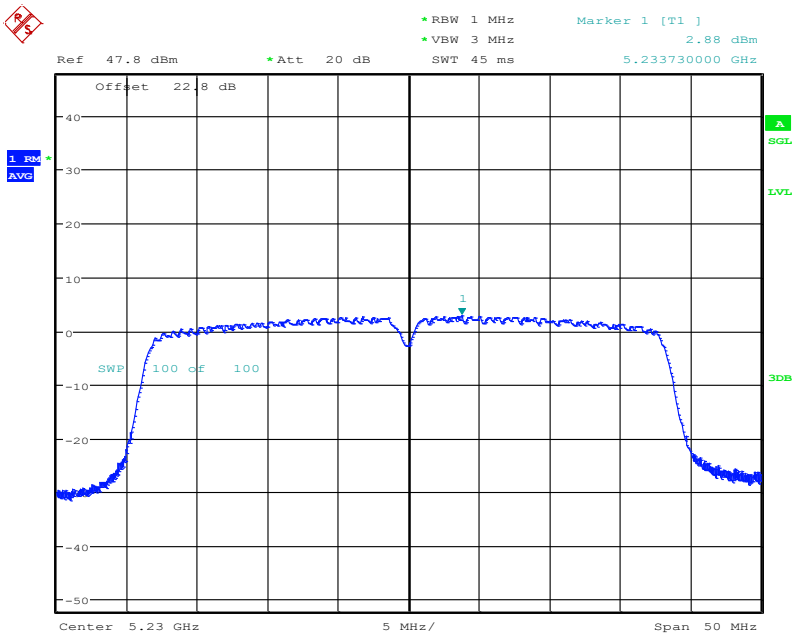
5190 MHz, ac40, Ant B



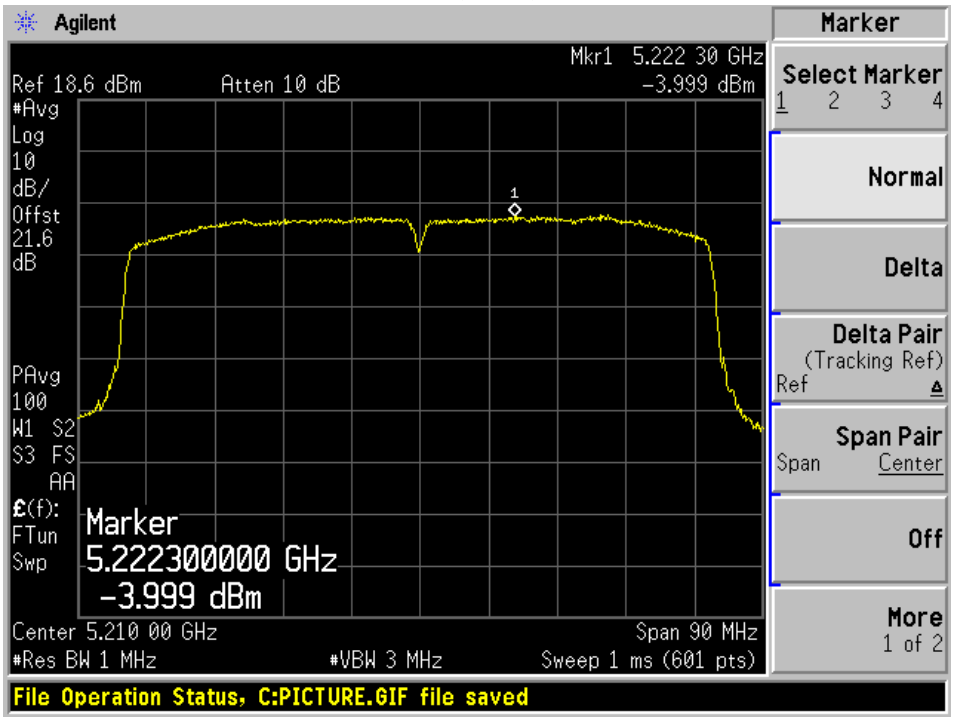
5230 MHz, ac40, Ant A



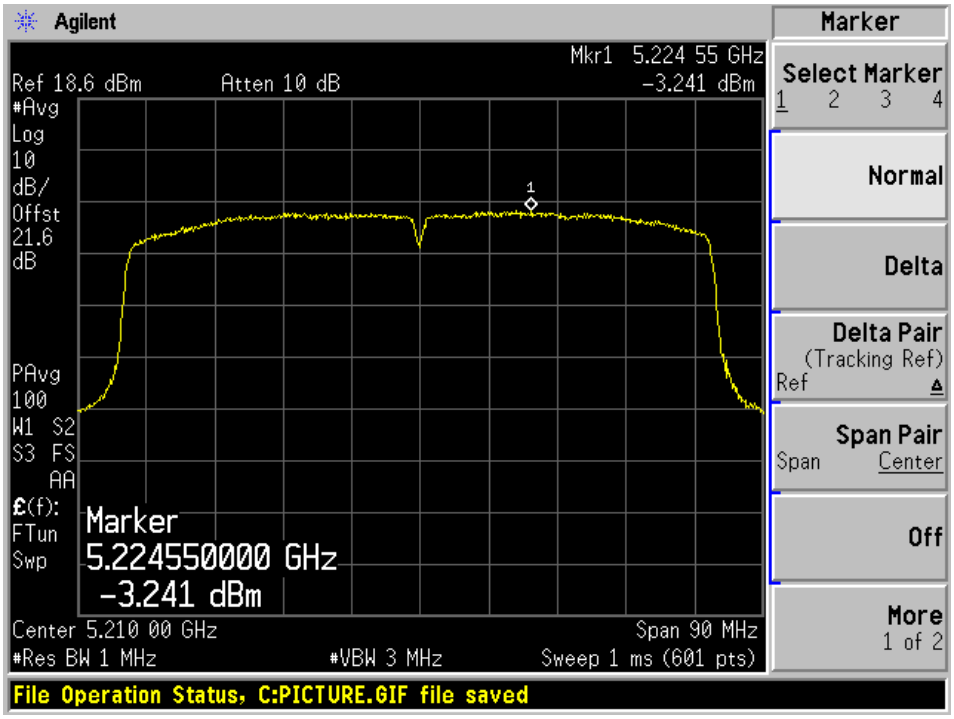
5230 MHz, ac40, Ant B



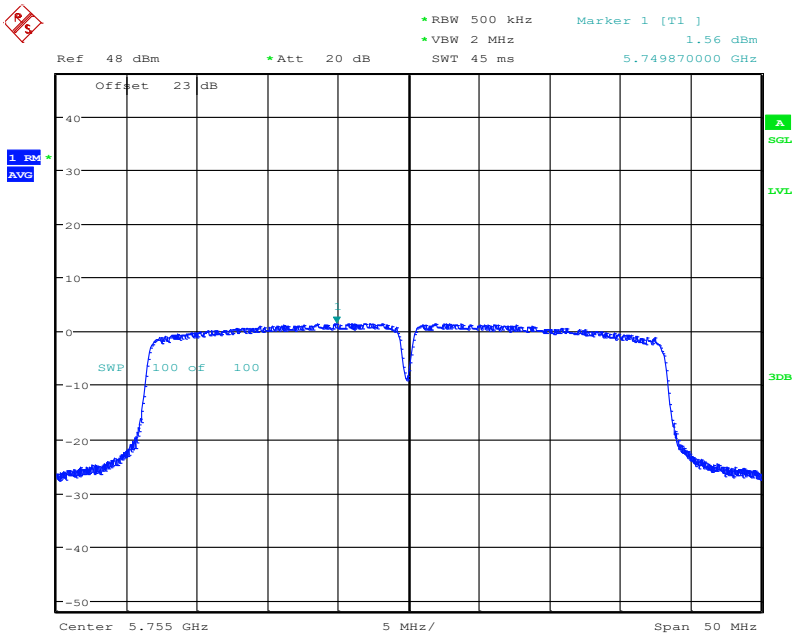
5210 MHz, ac80, Ant A



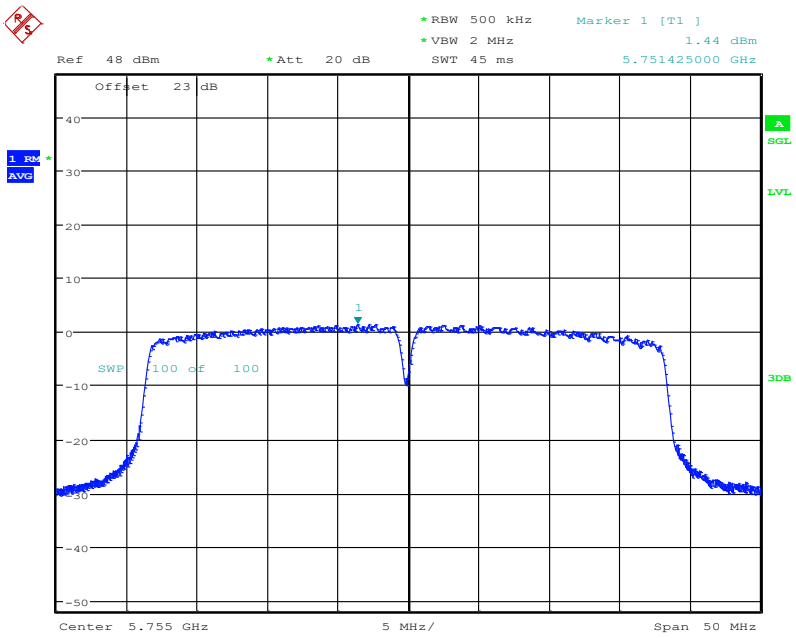
5210 MHz, ac80, Ant B



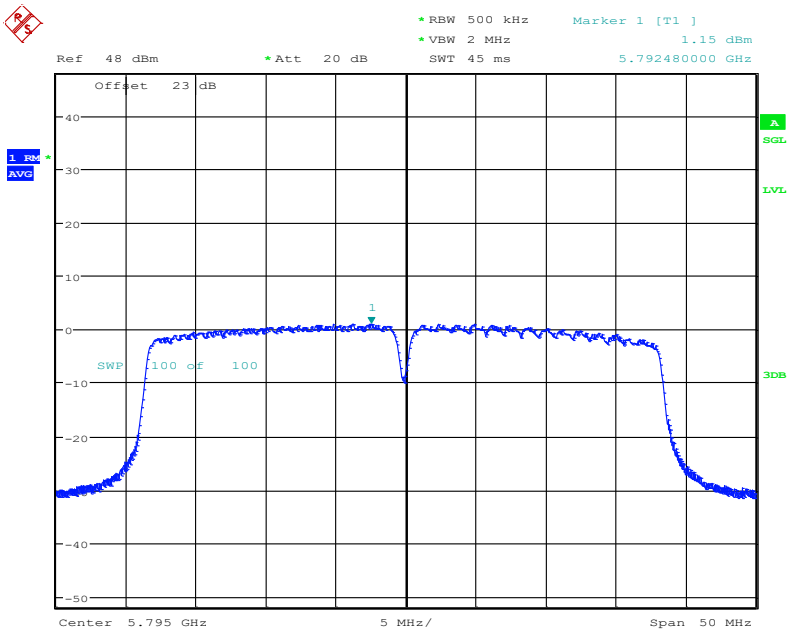
5755 MHz, n40, Ant A



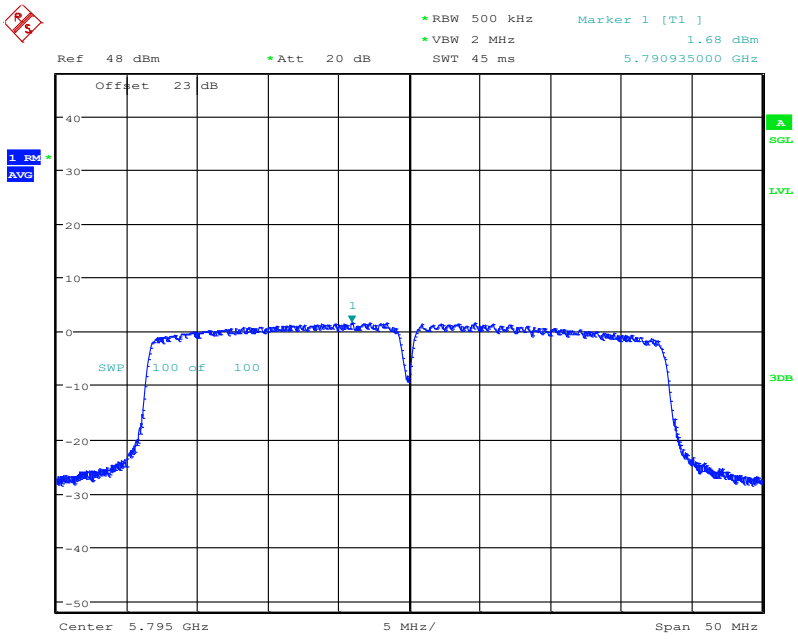
5755 MHz, n40, Ant B



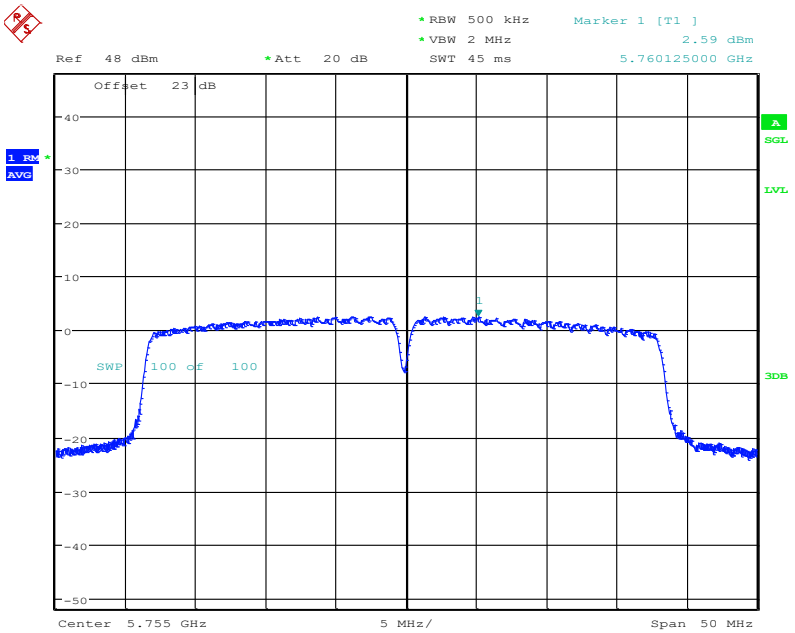
5795 MHz, n40, Ant A



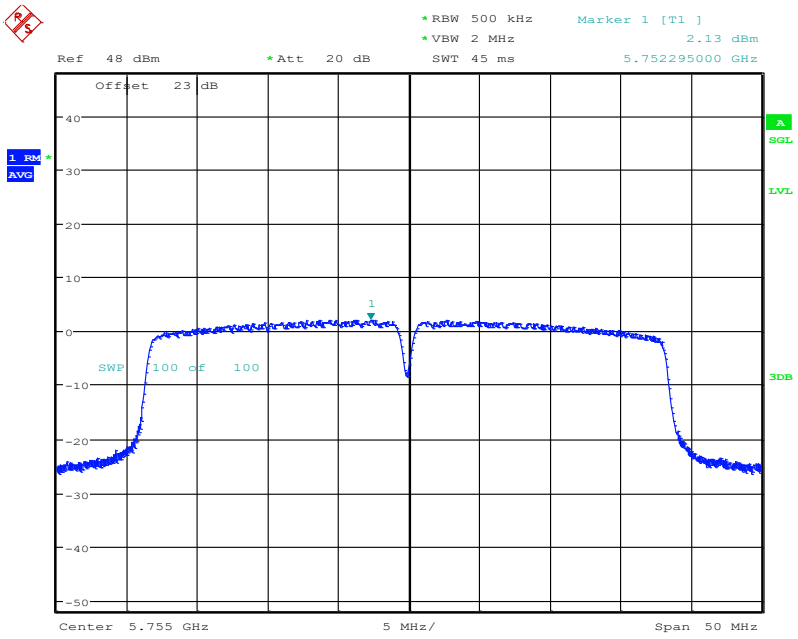
5795 MHz, n40, Ant B



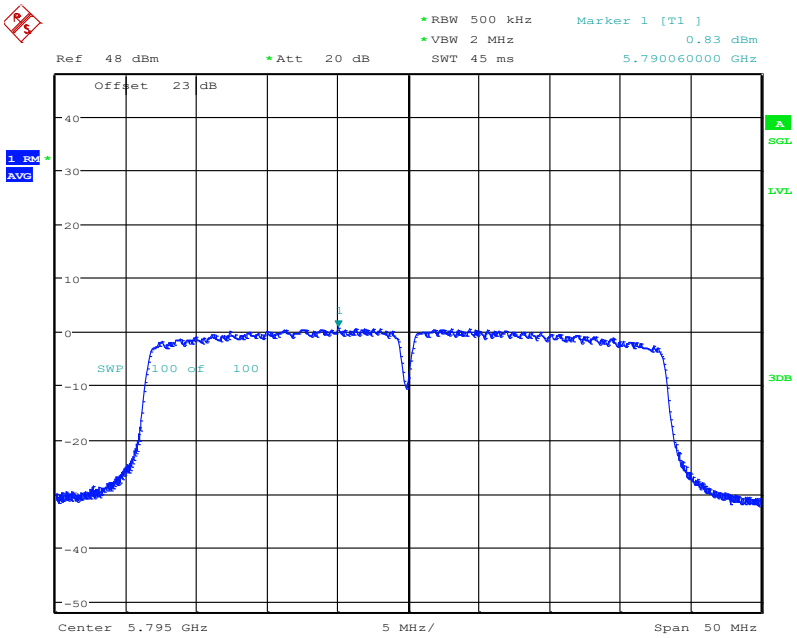
5755 MHz, ac40, Ant A



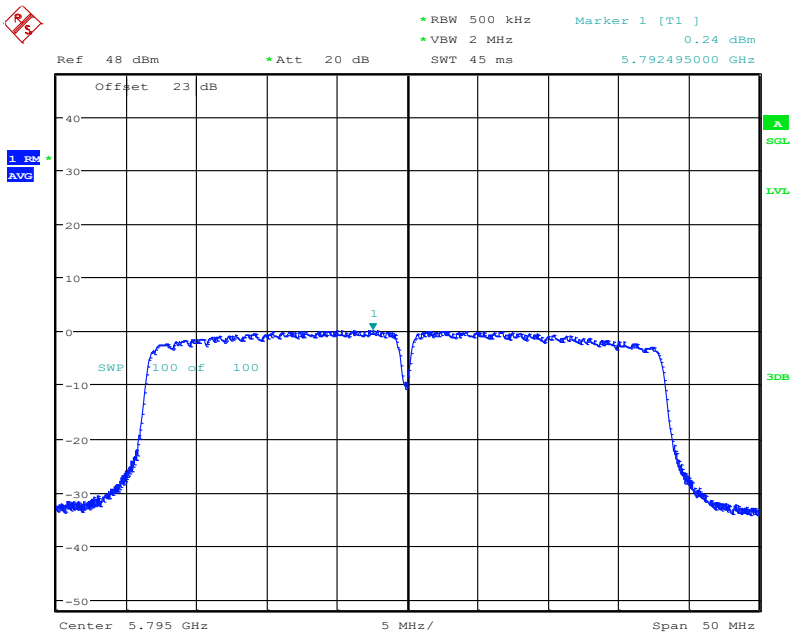
5755 MHz, ac40, Ant B



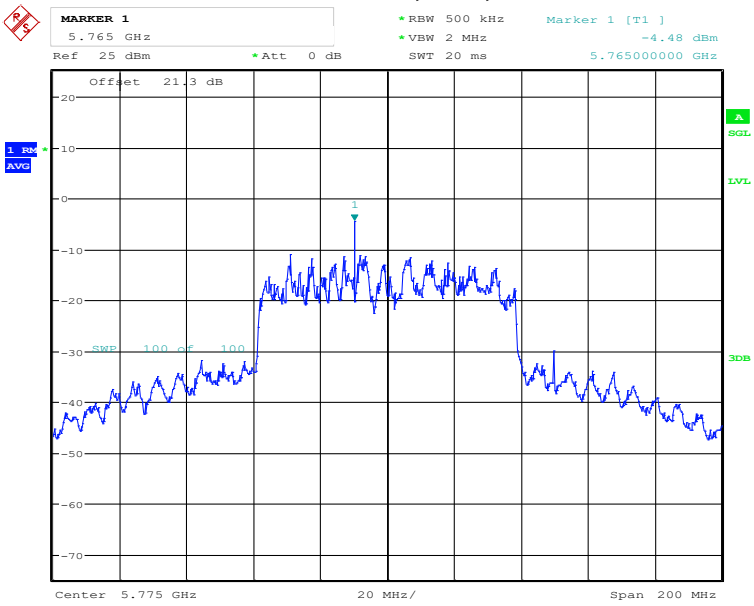
5795 MHz, ac40, Ant A



5795 MHz, ac40, Ant B

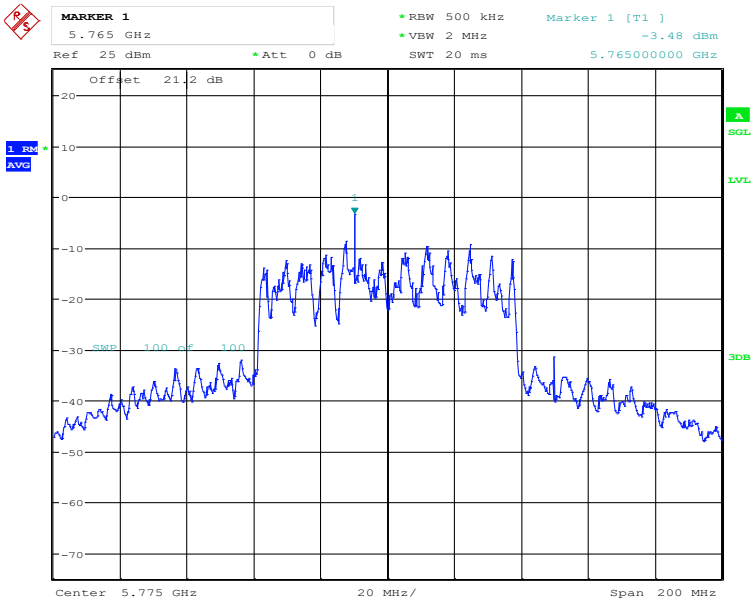


5775 MHz, ac80, Ant A



Date: 12.MAY.2021 14:59:34

5775 MHz, ac80, Ant B



Date: 14.MAY.2021 08:55:55

11 FCC §15.407(b) - Out of Band Emissions

11.1 Applicable Standards

According to FCC §15.407(b):

(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.

(4) For transmitters operating in the 5.725-5.85 GHz band:
(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

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

(7) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(8) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(9) The provisions of §15.205 apply to intentional radiators operating under this section.

11.2 Measurement Procedure

Add a correction factor (antenna gain+ MIMO factor of "10*log(Number of Antennas) dB" + Attenuator loss+cable loss) to the offset of the spectrum analyzer.

Unwanted Emission Measurement:

Maximum emission levels are measured by setting the analyzer as follows:

i. RBW = 1 MHz
ii. VBW ≥ 3 MHz
iii. Detector = Peak
iv. Sweep time = auto
v. Trace mode = max hold

Integration Method:

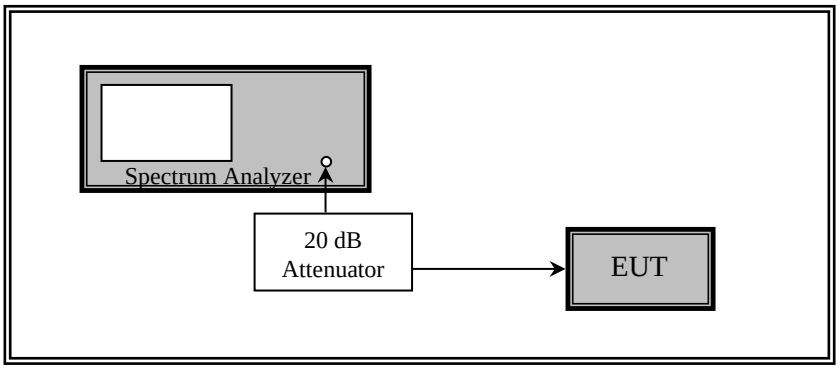
1. For peak emissions measurements, follow the procedures described in section H)5), "Procedures for Peak Unwanted Emissions Measurements above 1000 MHz", except for the following changes:

- Set RBW = 100 kHz
- Set VBW = 3RBW
- Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI receiver is set for peak-detection and max-hold for this measurement.

2. For average emissions measurements, follow the procedures described in section H)6), "Procedures for Average Unwanted Emissions Measurements above 1000 MHz", except for the following changes:

- Set RBW = 100 kHz
- Set VBW = 3RBW
- Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.

11.3 Test Setup Block Diagram



11.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2021-02-12	18 Months
Rohde & Schwarz	Spectrum Analyzer	FSQ26	200749	2019-11-07	2 Years
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

11.5 Test Environmental Conditions

Temperature:	22-24º C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Allen Huang from 2021-05-13 to 2021-05-14 in RF site.

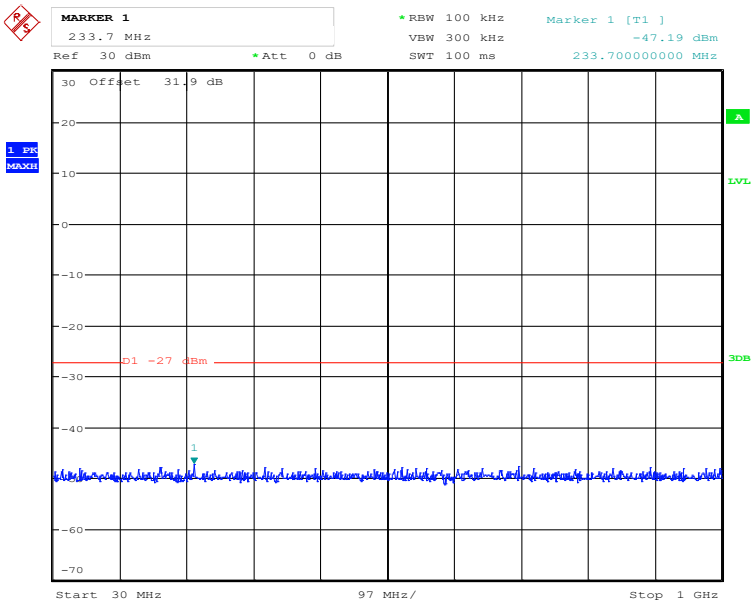
11.6 Test Results

Please refer to the following plots

Spurious Emissions:

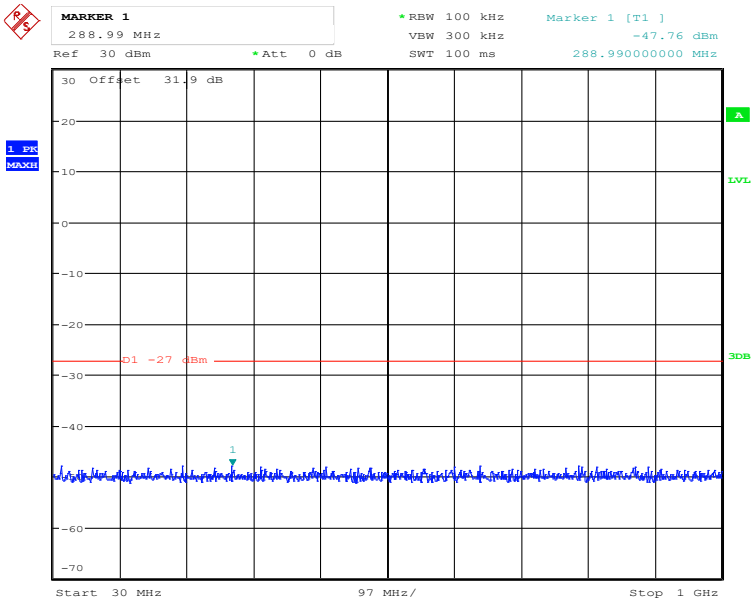
5150 - 5250 MHz, 802.11n40 Mode, ANTENNA A

Low Channel 5190 MHz , 30MHz – 1GHz



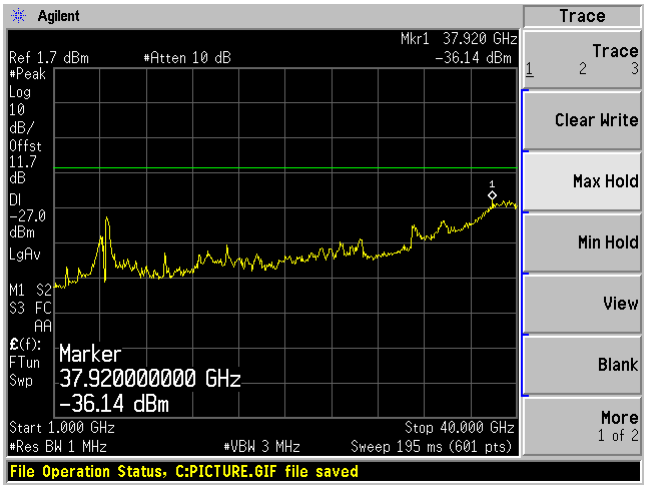
Date: 12.MAY.2021 15:34:32

High Channel 5230 MHz, 30MHz – 1GHz

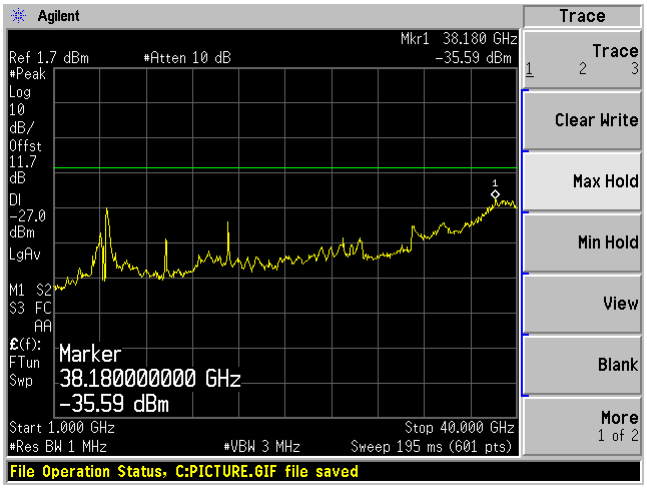


Date: 12.MAY.2021 15:42:05

Low Channel 5190 MHz , 1GHz – 40GHz

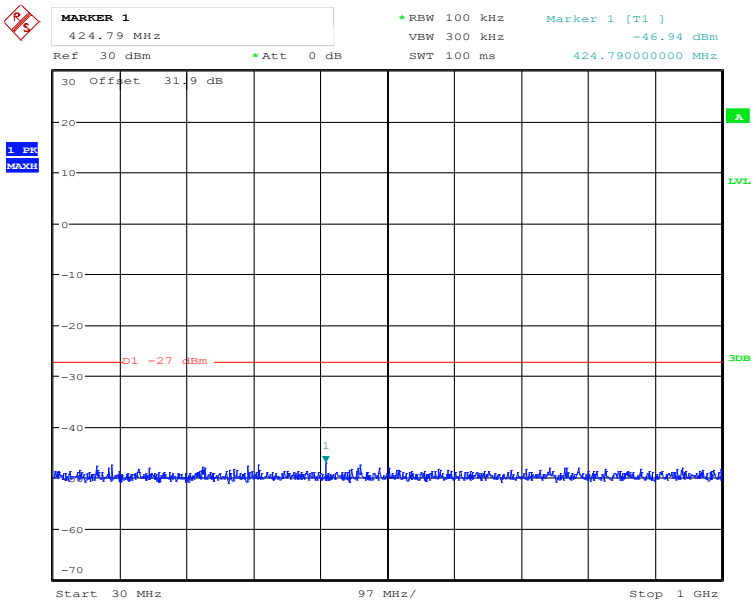


High Channel 5230 MHz, 1GHz – 40GHz



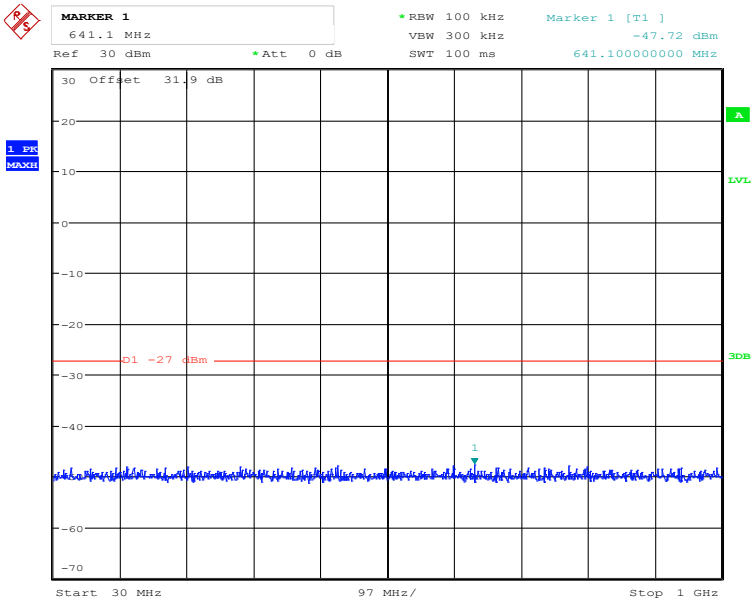
5150 - 5250 MHz, 802.11n40 Mode, ANTENNA B

Low Channel 5190 MHz , 30MHz – 1GHz



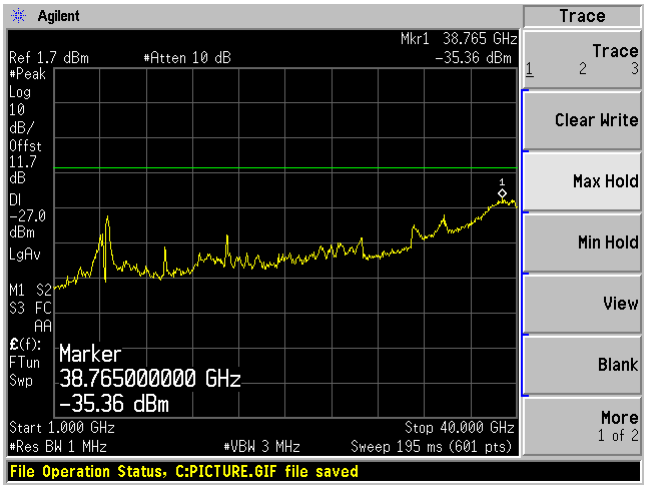
Date: 12.MAY.2021 15:36:58

High Channel 5230 MHz, 30MHz – 1GHz

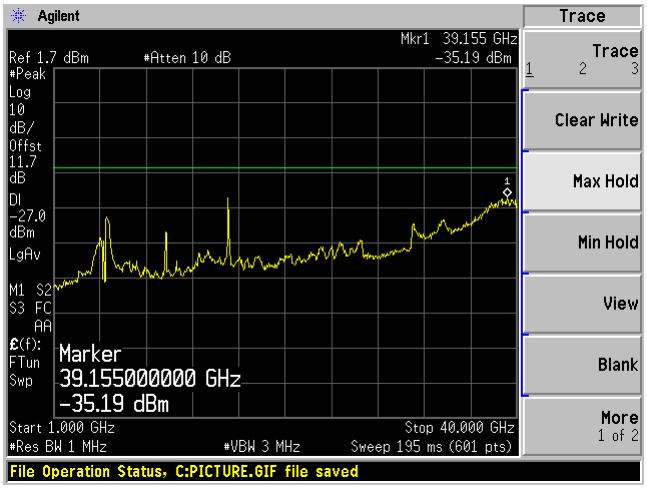


Date: 12.MAY.2021 15:39:52

Low Channel 5190 MHz , 1GHz – 40GHz

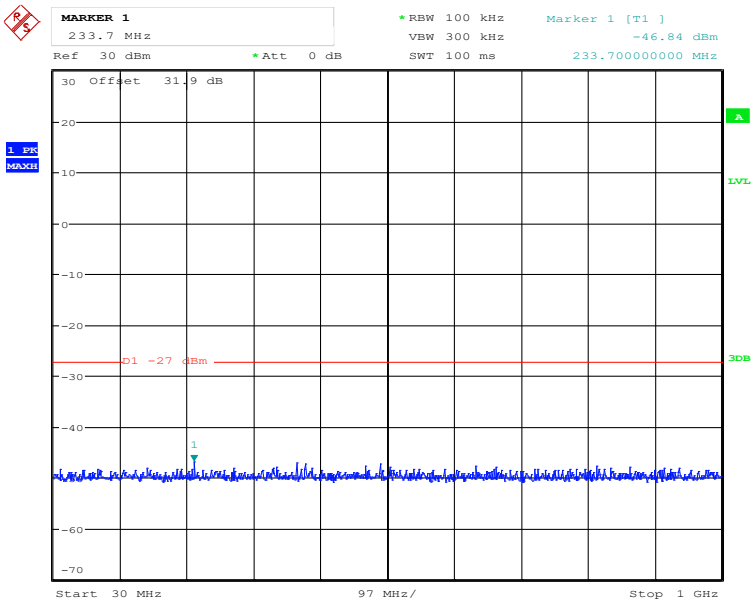


High Channel 5230 MHz, 1GHz – 40GHz



5150 - 5250 MHz, 802.11ac40 Mode, ANTENNA A

Low Channel 5190 MHz , 30MHz – 1GHz



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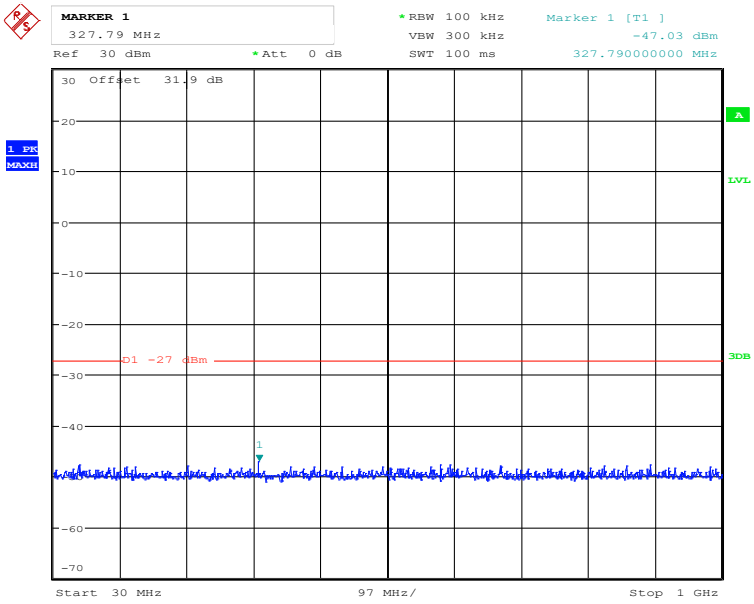
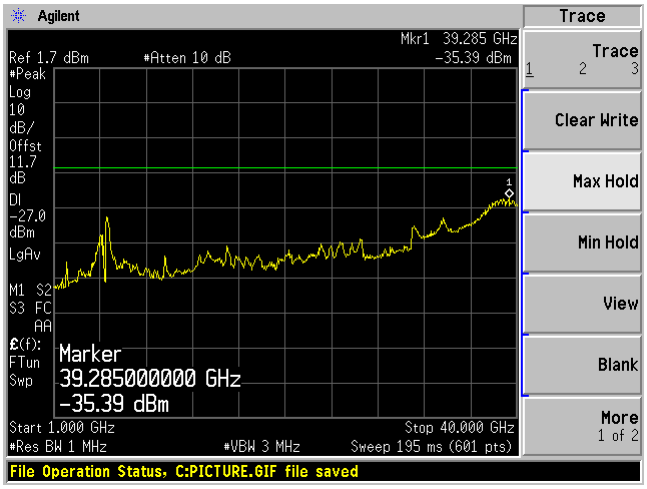
High Channel 5230 MHz, 30MHz – 1GHz

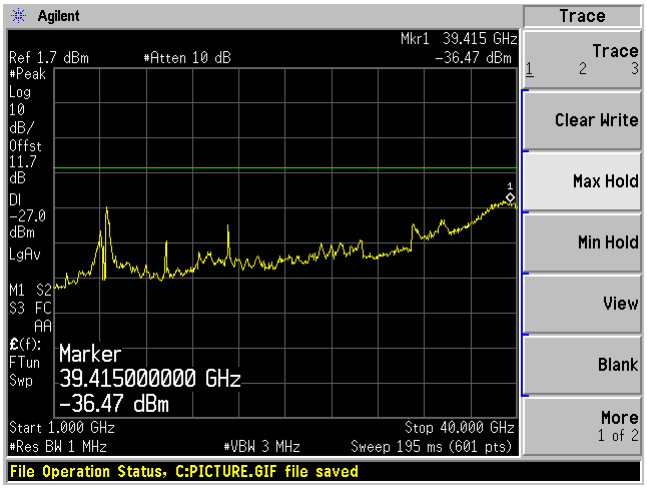


Date: 12.MAY.2021 16:00:34

Low Channel 5190 MHz , 1GHz – 40GHz

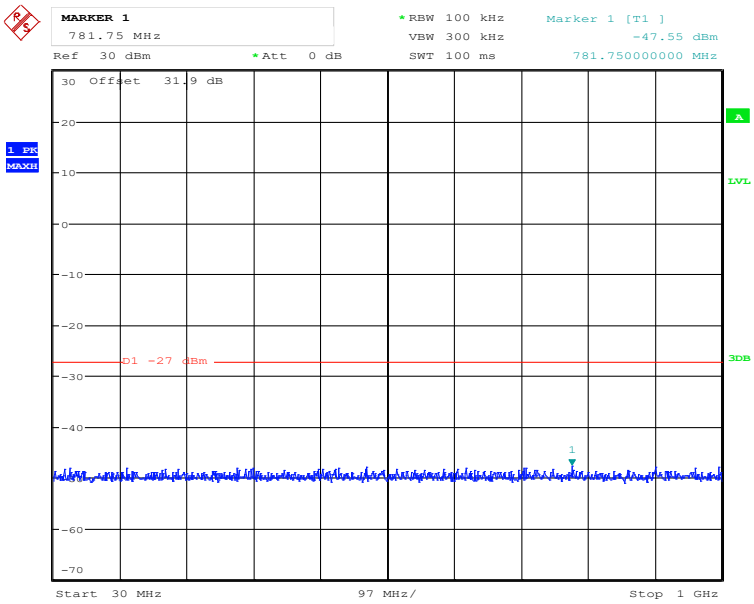


High Channel 5230 MHz, 1GHz – 40GHz



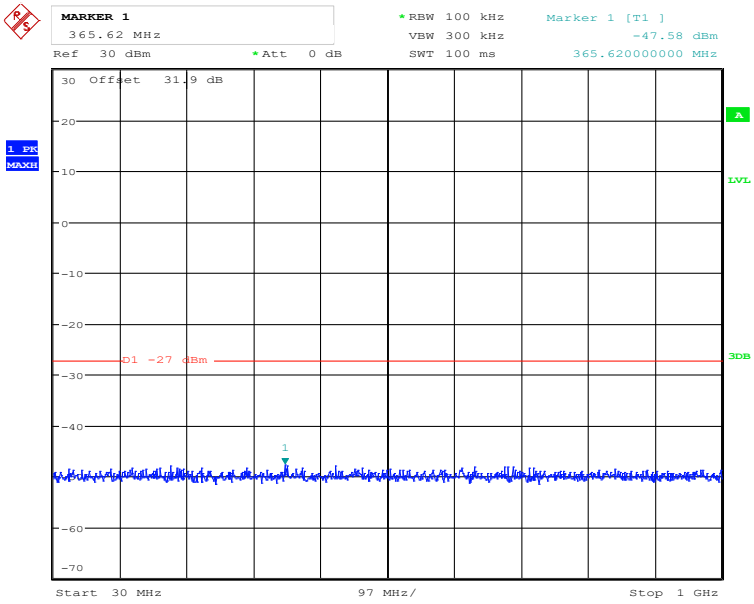
5150 - 5250 MHz, 802.11ac40 Mode, ANTENNA B

Low Channel 5190 MHz , 30MHz – 1GHz



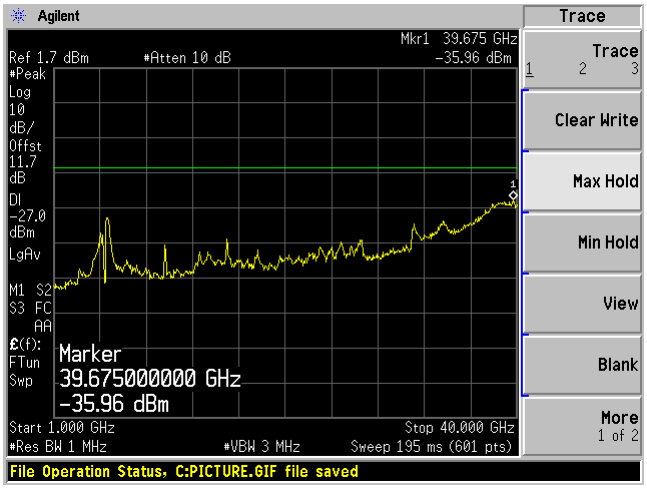
Date: 12.MAY.2021 15:57:18

High Channel 5230 MHz, 30MHz – 1GHz

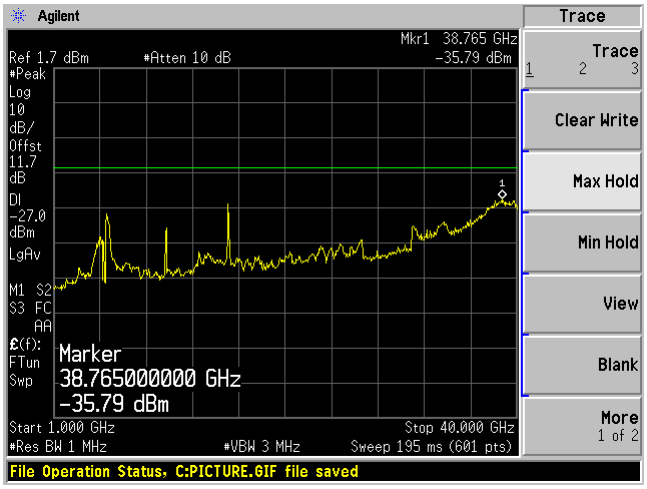


Date: 12.MAY.2021 15:58:51

Low Channel 5190 MHz , 1GHz – 40GHz

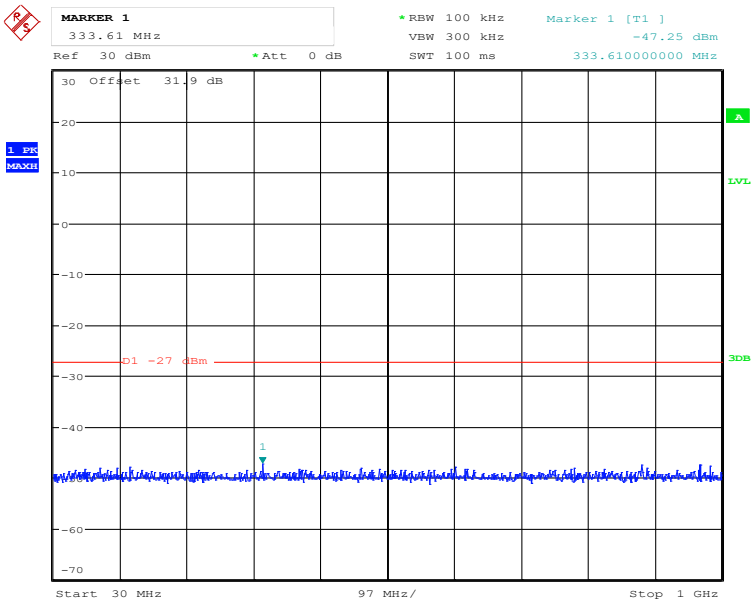


High Channel 5230 MHz, 1GHz – 40GHz



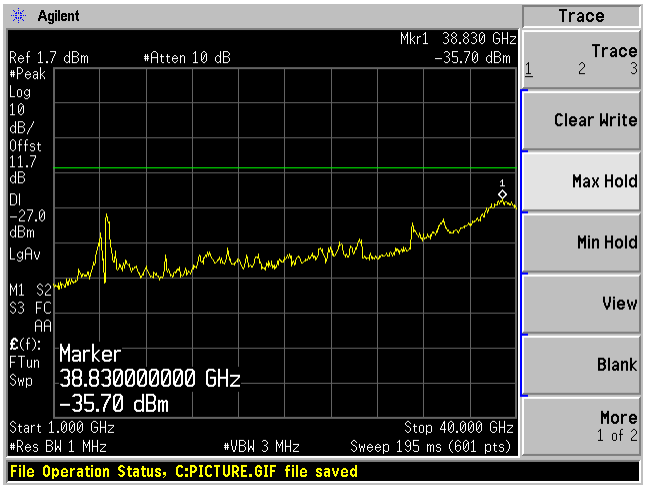
5150 - 5250 MHz, 802.11ac80 Mode, ANTENNA A

5210 MHz , 30MHz – 1GHz



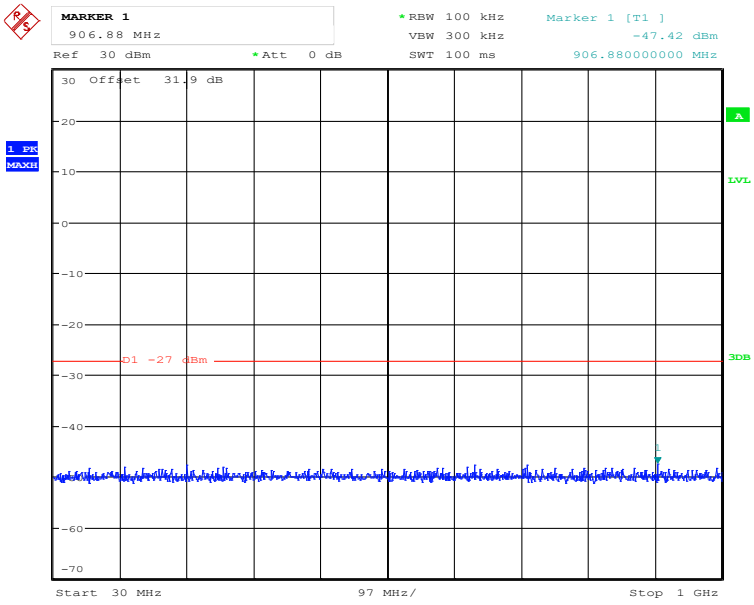
Date: 12.MAY.2021 16:02:22

5210 MHz, 1GHz – 40GHz



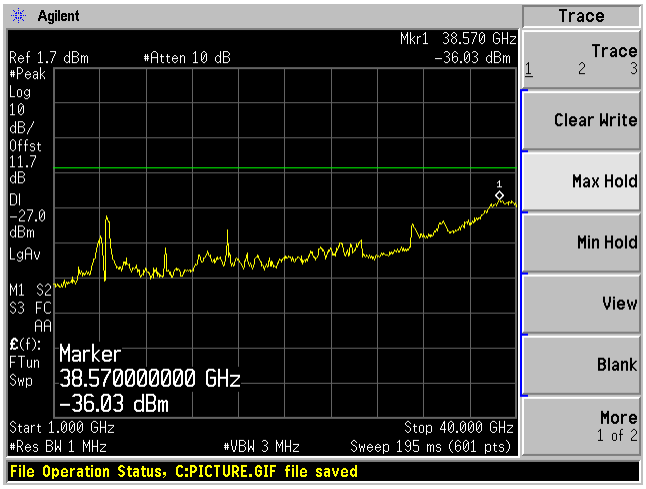
5150 - 5250 MHz, 802.11ac80 Mode, ANTENNA B

5210 MHz , 30MHz – 1GHz



Date: 12.MAY.2021 16:04:33

5210 MHz, 1GHz – 40GHz

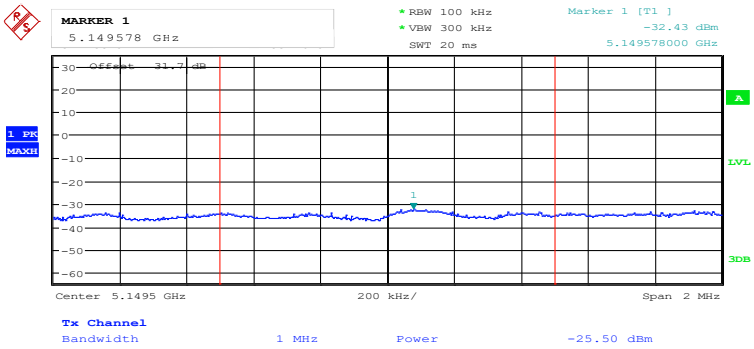


Note: Applicable antenna gain (7.61 dBi calculated based on method specified in KDB 662911 D01) and added MIMO factor of "10*log(Number of Antennas) dB"(3dB calculated based on method specified in KDB 662911 D01) were added to offset.
Note: A notch filter was used for spurious emissions measured over 1 GHz.
Note: 5.8 GHz spurious emissions were evaluated in the radiated spurious emissions section.

Band Edge Emissions

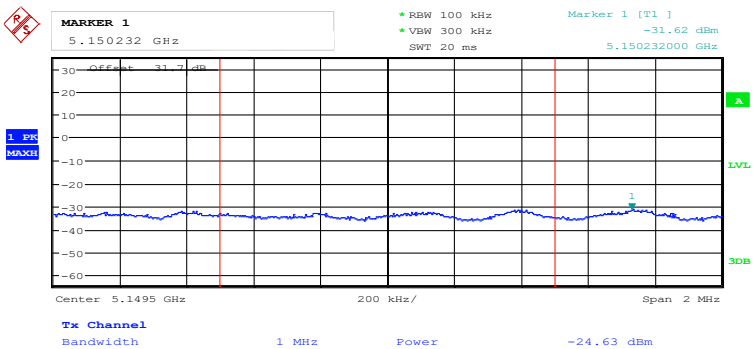
5150 - 5250 MHz, 802.11n40 Mode

Ant A, Low Channel



Date: 14.MAY.2021 11:57:50

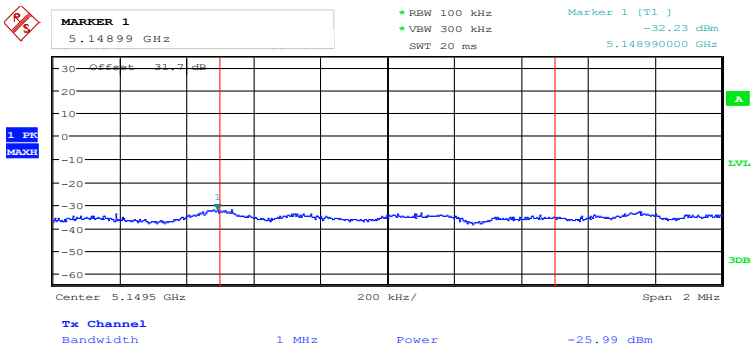
Ant B, Low Channel



Date: 14.MAY.2021 12:03:23

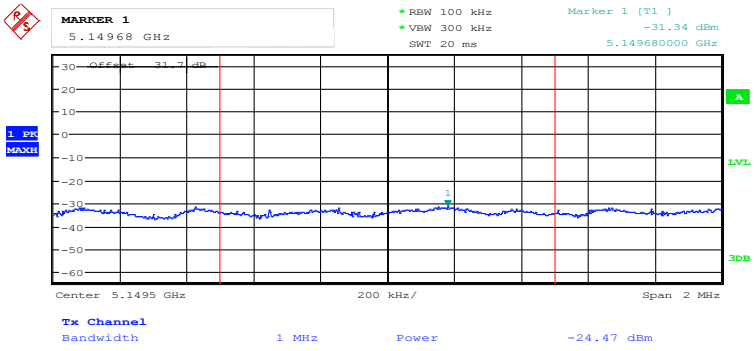
5150 - 5250 MHz, 802.11ac40 Mode

Ant A, Low Channel



Date: 14.MAY.2021 12:07:27

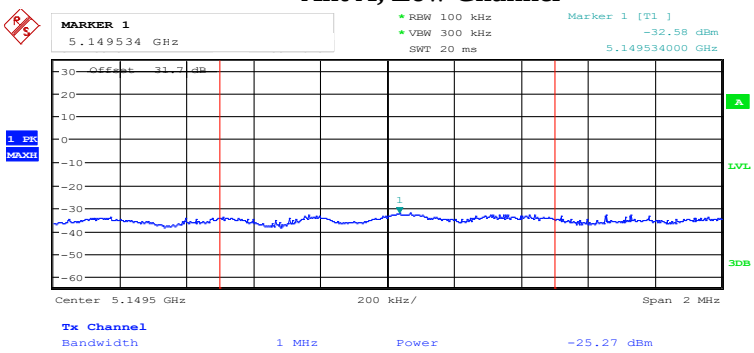
Ant B, Low Channel



Date: 14.MAY.2021 12:05:45

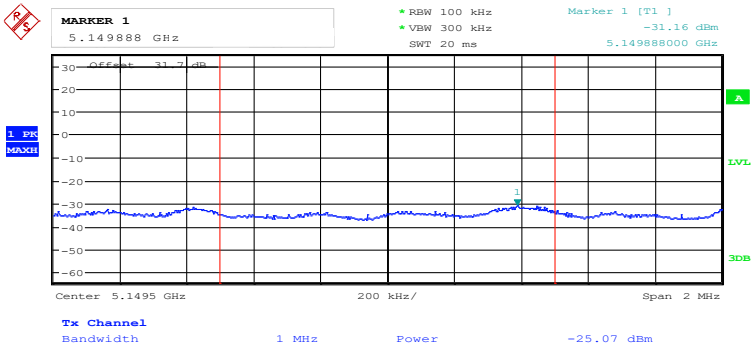
5150 - 5250 MHz, 802.11ac80 Mode

Ant A, Low Channel



Date: 14.MAY.2021 12:09:14

Ant B, Low Channel



Date: 14.MAY.2021 12:10:59

Note: Applicable antenna gain (7.61 dBi calculated based on method specified in KDB 662911 D01) and added MIMO factor of "10*log(Number of Antennas) dB"(3dB calculated based on method specified in KDB 662911 D01) were added to offset.
Note: 5.8 GHz Emission Mask was evaluated in the radiated spurious emissions section.

12 Annex A (Normative) – EUT Test Setup Photographs

Please refer to the attachment.

13 Annex B (Normative) – EUT External Photographs

Please refer to the attachment.

14 Annex C (Normative) – EUT Internal Photographs

Please refer to the attachment.

15 Annex D (Normative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets A2LA *R222 - Specific Requirements EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 10th day of March 2021.

Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2022

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

Please follow the web link below for a full ISO 17025 scope

https://www.a2la.org/scopepdf/3297-02.pdf

--- END OF REPORT ---