NVLAP
Testing
NVLAP Lab Code 200087-0

ROGERS LABS, INC.
4405 West 259th Terrace
Louisburg, KS 66053
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Unlicensed National Information Infrastructure (U-NII) and License-Exempt Local Area Network (LE-LAN) Devices, 47 CFR, Part 15E (15.407) Industry Canada RSS-247 Issue 2

Application For Grant of Certification

Model: A03847

Frequency Range: 5180-5240, and 5745-5825 MHz
License-Exempt U-NII, Local Area Network equipment, U-NII-1 and U-NII-3 operation

FCC ID: IPH-03847
IC: 1792A-03847

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062

FCC Designation: US5305
ISED Registration: 3041A-1

Test Report Number: 191125

Test Date: November 25, 2019

Authorized Signatory: Scot D Rogers
Scot D. Rogers

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Revisions

Revision 1 Issued February 12, 2020

Foreword

The following information is submitted for consideration in obtaining Equipment Grants of Certification for License Exempt, Unlicensed National Information Infrastructure (U-NII) Intentional Radiator operating under 47 CFR Paragraph 15E (15.407), U-NII-1 and U-NII-3 new rules, 5180-5240, and 5745-5825 MHz bands, and Industry Canada RSS-GEN Issue 5, and RSS-247 Issue 2, LE-LAN transmitter.

Name of Applicant: Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062

M/N: A03847

FCC ID: IPH-03847 Industry Canada ID: 1792A-03847

Frequency Range: 5180-5240 MHz and 5745-5825 MHz (U-NII-1 and U-NII-3 under new rules 15.407, 802.11a/n (20 MHz), n (40 MHz) and ac (80 MHz) channels) and limited transmitter operations per regulations for operation in Canada

Mode	Channel width	Average Power (W)	99% OBW (kHz)
Mode 9, U-NII-1a	20 MHz mode	0.023	18,028.8
Mode 10, U-NII-1n	20 MHz mode	0.024	18,028.8
Mode 11, U-NII-1n40	40 MHz mode	0.015	36,859.0
Mode 12, U-NII-1ac	80 MHz mode	0.014	75,000.0
Mode 13, U-NII-3a	20 MHz mode	0.028	18,109.0
Mode 14, U-NII-3n	20 MHz mode	0.028	18,189.1
Mode 15, U-NII-3n	40 MHz mode	0.029	37,179.5
Mode 16, U-NII-3ac	80 MHz mode	0.027	76,282.1

This report addresses EUT Operations as U-NII transmitter using modulations defined above in modes 9 through 16.

Opinion / Interpretation of Results

Tests Performed	Margin (dB)	Results
Restricted Frequency Bands 15.205, RSS-GEN 8.10	-1.9	Complies
AC Line Conducted 15.207, RSS-GEN 7.2.4	-4.5	Complies
Radiated Emissions 15.209, RSS-GEN 7.2.5	-11.8	Complies
Harmonic Emissions per 15.407, RSS-247	-12.7	Complies
Power Spectral Density per 15.407, RS-247	-5.0	Complies

Equipment Tested

Equipment	Model / PN	Serial Number
EUT #1	A03847	3315409516
EUT #2	A03847	3315409596
DC Power cable	320-01404-00	N/A
Moto Mount	011-05088-00	N/A
CLA	320-00239-50	E17270002160
Auto Mount	011-05098-00	N/A
Interface cable	320-00541-01	N/A
Laptop Computer	Latitude 7480	HX91RN2
USB Printer	Dell 0N5819	5D1SL61
AC Adapter	362-00096-00	P183100862A1

Test results in this report relate only to the items tested. Worst-case configuration data recorded in this report.

Wireless communication modes

Mode	Transmitter Operation and Modulation
9	5180-5240 MHz, 802.11a (OFDM)
10	5180-5240 MHz, 802.11n (MCS)
11	5190-5243 MHz, 802.11n40 (MCS)
12	5210 MHz, 802.11ac (QAM)
13	5745-5825 MHz, 802.11a (OFDM)
14	5745-5825 MHz, 802.11n (MCS)
15	5755-5795 MHz, 802.11n40 (MCS)
16	5775 MHz, 802.11ac (QAM)

Software Version: 0.60, The software has no name as described by the manufacturer. The software does not provide ability to change power as it is hardcoded in manufacturer-controlled firmware. The manufacturer reported the following power level settings in the design.

- BT and BLE modulations +1 dBm power setting, 2.2-dBi integral Antenna
- ANT modulations +1 dBm power setting, 3-dBi integral Antenna
- 802.11 b/g/n/n40 +18dBm conducted power setting, 3-dBi integral Antenna
- U-N11 +13dBm conducted power setting, 3.9-dBi integral Antenna

The manufacturer reported the antenna characteristics were 50 ohms impedance with antenna gain as presented. The design may operate two or three transmitter functions at a time as collocated transmitters. The design offers wireless communication with compatible ANT, BT, BLE, and 802.11b/g/n/n40/a/ac. The modulation characteristics for these standards are defined in each related standard including the available bit and symbol rates.

Equipment Function

The EUT is a GPS receiver and digital display unit offering reception and display of location, navigation, and other information as Portable Navigational Device (PND). The design offers use as a hand-held, transportation mount or portable configuration for use in navigational applications. The design offers cabled and wireless interface capabilities for use with compatible equipment and installations. The EUT provides a single USB interface port for cabled communications and power for operation and internal battery recharge. The design incorporates transmitter circuitries operating in the 2402-2480 MHz, 5150-5250 MHz and 5725-5850 MHz bands. The transmitters designs provide low power operation across the 2402-2480 MHz band providing operating modes including ANT (GFSK), Bluetooth® Basic Rate (GFSK), 2EDR (π/4 DQPSK), 3EDR (8DPSK), and BLE (GMSK). The design provides wireless communication capability as Digital Transmission System with compatible 802.11b/g/n/n40 equipment operating across the 2412-2462 MHz band. The device also provides wireless communication capability with compatible 802.11a/n/n40/ac equipment operating across the 5180-5240 MHz (U-NII-1) and 5745-5825 MHz (U-NII-3) bands operating as Unlicensed National Information Infrastructure (U-NII) Local Area Network Transmission System. The product operates from internal rechargeable battery or external direct current power sources as documented in this report. The design offers no other interface options than those presented below in the configuration diagrams. The design utilizes internal fixed antenna systems and offers no provision for antenna replacement or modification. Two samples were provided for testing, one representative of production design, and the other modified for testing purposes replacing integral antennas with RF connection ports. The test samples were provided with test software (version 0.60) which enable transmitter functions on defined modes and channels with near 100% duty cycle. Production product will not operate at these high of duty cycles. The antenna modification provided the ability to connect test equipment to the temporary antenna ports for antenna port conducted emission testing. The EUT was arranged as described by the manufacturer emulating typical user configurations for testing purposes. For testing purposes, the EUT was powered from freshly charged internal battery or external power options and configured to operate in available modes. The equipment was tested for emissions compliance using the available configurations with the worst-case data presented. This report documents compliance testing and results for applicable product modes of operation. Test results in this report relate only to the products described in this report.

Equipment Configuration

320-01404-00 Ca Assy, Bare Wire, 5V, 1.5A, 2 pin, Moto Mount Cable
PCBA: 012-01779-16 Rev. C.

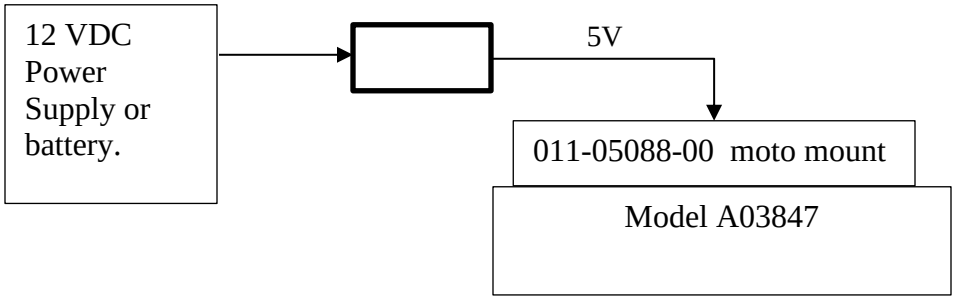


Fig. 1. Configuration 1. Motorcycle Mounting.

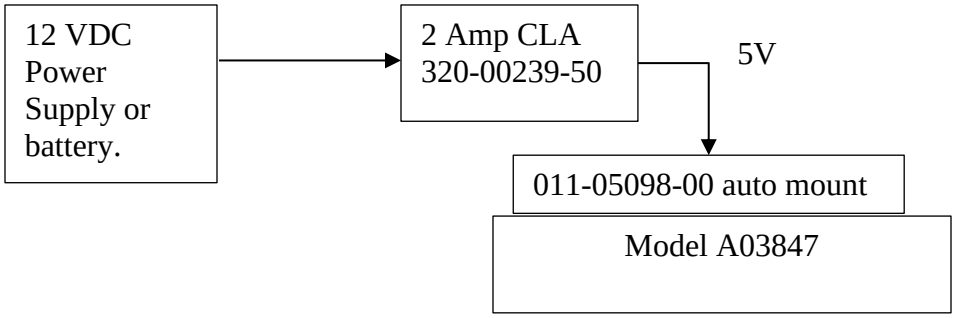


Fig. 2. Configuration 2. Automobile Mounting.

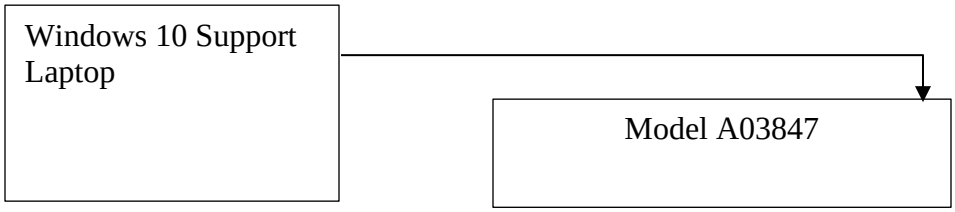


Fig. 3. Configuration 3. Data Configuration

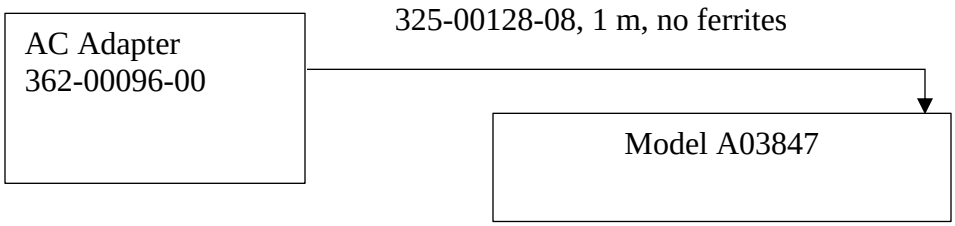


Fig. 4. Configuration 4. AC Charger Configuration

Applicant Company information

Applicants Company	Garmin International, Inc.
Applicants Address	1200 East 151st Street, Olathe, KS 66062
FCC Identifier	IPH-03847
Industry Canada Identifier	1792A-03847
Manufacturer Company	Garmin International, Inc.
Manufacturer Address	1200 East 151st Street, Olathe, KS 66062

Equipment information

Product Marketing Name (PMN): The PMN is the name or model number under which the product will be marketed/offered for sale in Canada. If the product has PMN, it must be provided.	A03847
Unique Product Number (UPN): The applicant made up of a maximum of 11 alphanumeric characters (A-Z, 0-9), assigns the UPN.	A03847
Hardware Version Identification Number (HVIN): The HVIN identifies hardware specifications of a product version. The HVIN replaces the ISED Model Number in the legacy E-filing System. An HVIN is required for all products for certification applications.	A03847
Host Marketing Name (HMN) (if applicable): The HMN is the name or model number of a final product, which contains a certified radio module.	
Brand Name	
Model Number	A03847
Test Rule Part(s)	47 CFR 15E, 15.407, RSS-247
Test Frequency Range	5.15-5.25 and 5.725-5.85 GHz
Project Number	191125
Submission Type	FCC: Certification, IC: Certification

Product Details

Items	Description
Product Type	Single chain 5 GHz U-NII-1 and U-NII-3
Radio Type	Transceiver
Power Type	Internal Rechargeable Battery or External AC or DC Supply
Frequency Range	5150-5250 MHz / 5725-5850 MHz
Channel Number	Channels 36, 40, 44,149, 157, and 165 for 802.11a/n 20MHz bandwidth; Channels 38, 46, 151. And 159 for 802.11n40 40MHz bandwidth; and Channels 42 and 155 for 802.11 a/c 80MHz bandwidth
Carrier Frequencies	Please refer to 802.11 Standard for Carrier Frequencies
Antenna	Integrated 3.9 dBi antenna PFIA
Communication Mode	Device provides 5 GHz, U-NII 1 and U-NII-3 operation
Beamforming Function	Without beamforming
Operating Mode	5150-5250 MHz (U-NII-1) and 5725-5825 MHz (U-NII-3)

Antenna and Bandwidth

Antenna	Number of TX chains		
Bandwidth Mode	20 MHz	40 MHz	80 MHz
IEEE 802.11a	Single Chain	N/A	N/A
IEEE 802.11n	Single Chain	Single Chain	N/A
IEEE 802.11ac	N/A	N/A	Single Chain

Application for Certification

(1) Manufacturer: Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062

(2) Identification: M/N: A03847
FCC ID: IPH-03847 IC: 1792A-03847

(3) Instruction Book:
Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:
Refer to Exhibit of Operational Description.

(5) Block Diagram with Frequencies:
Refer to Exhibit of Operational Description.

(6) Report of Measurements:
Report of measurements follows in this Report.

(7) Photographs: Construction, Component Placement, etc.:
Refer to Exhibit for photographs of equipment.

(8) List of Peripheral Equipment Necessary for operation. The equipment operates from internal battery or direct current power provided from compatible power sources. The EUT offers proprietary interface with mount and single USB interface port for power and communications or power as presented in this filing.

(9) Transition Provisions of 47 CFR 15.37 are not requested.

(10) Not Applicable. The unit is not a scanning receiver.

(11) Not Applicable. The EUT does not operate in the 59 – 64 GHz frequency band.

(12) The equipment is not software defined and this section is not applicable.

(13) Applications for certification of U-NII devices in the 5.15-5.35 GHz and the 5.47-5.85 GHz bands must include a high-level operational description of the security procedures that control the radio frequency operating parameters and ensure that unauthorized modifications cannot be made. The required information has been provided in Operational Description Exhibit filed with the application.

(14) Contain at least one drawing or photograph showing the test set-up for each of the required types of tests applicable to the device for which certification is requested. These drawings or photographs must show enough detail to confirm other information contained in the test report. Any photographs used must be focused originals without glare or dark spots and must clearly show the test configuration used. This information is provided in this report and Test Setup Exhibits provided with the application filing.

Applicable Standards & Test Procedures

The following information is submitted in accordance with e-CFR dated November 25, 2019, Part 2, Subpart J, Part 15, Subpart 15E, Industry Canada RSS-GEN Issue 5, and RSS-247 Issue 2. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in ANSI C63.10-2013, KDB 789033 D02 General UNII Test Procedures New Rules v02r01, KDB 926956 v02, RSS-247 Issue 2, and RSS-GEN Issue 5.

Testing Procedures

Testing for the AC line-conducted emissions was performed as defined in ANSI C63.10-2013. The test setup, including the EUT, was arranged in the test configurations as presented during testing. The test configuration was placed on a 1 x 1.5-meter bench, 0.8 meters high located in a screen room. The power lines of the system were isolated from the power source using a standard LISN with a 50-µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table. Refer to diagram one showing typical test arrangement and photographs in exhibits for EUT placement used during testing.

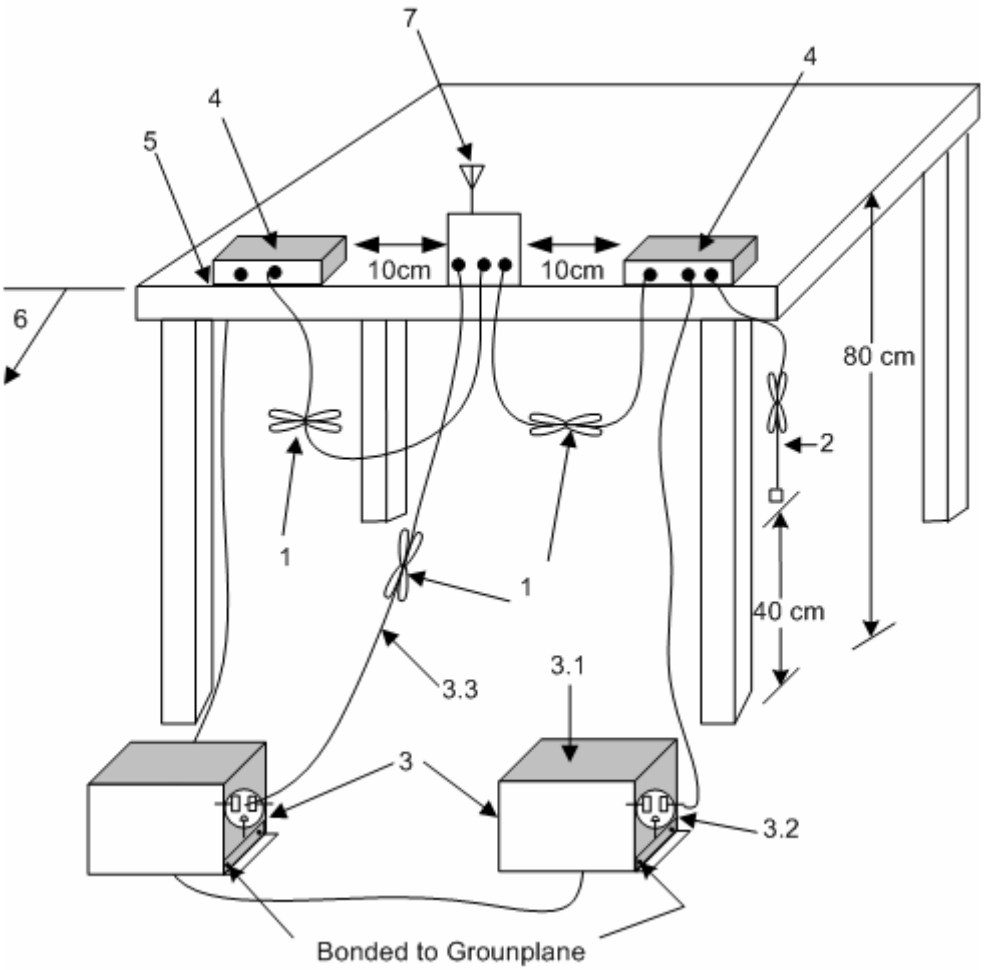
Radiated Emission Test Procedure

Radiated emissions testing was performed as required in 47 CFR 15C, RSS-247 Issue 2 and specified in ANSI C63.10-2013. The EUT was placed on a rotating 0.9 x 1.2-meter platform, elevated as required above the ground plane at a distance of 3 meters from the FSM antenna. EMI energy was maximized by equipment placement permitting orientation in three orthogonal axes, raising and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken and recorded. The frequency spectrum from 9 kHz to 25,000 MHz was searched for emissions during preliminary investigation. Refer to diagrams one and two showing typical test setup. Refer to photographs in the test setup exhibits for specific EUT placement during testing.

Antenna Port Conducted Emission Test Procedure

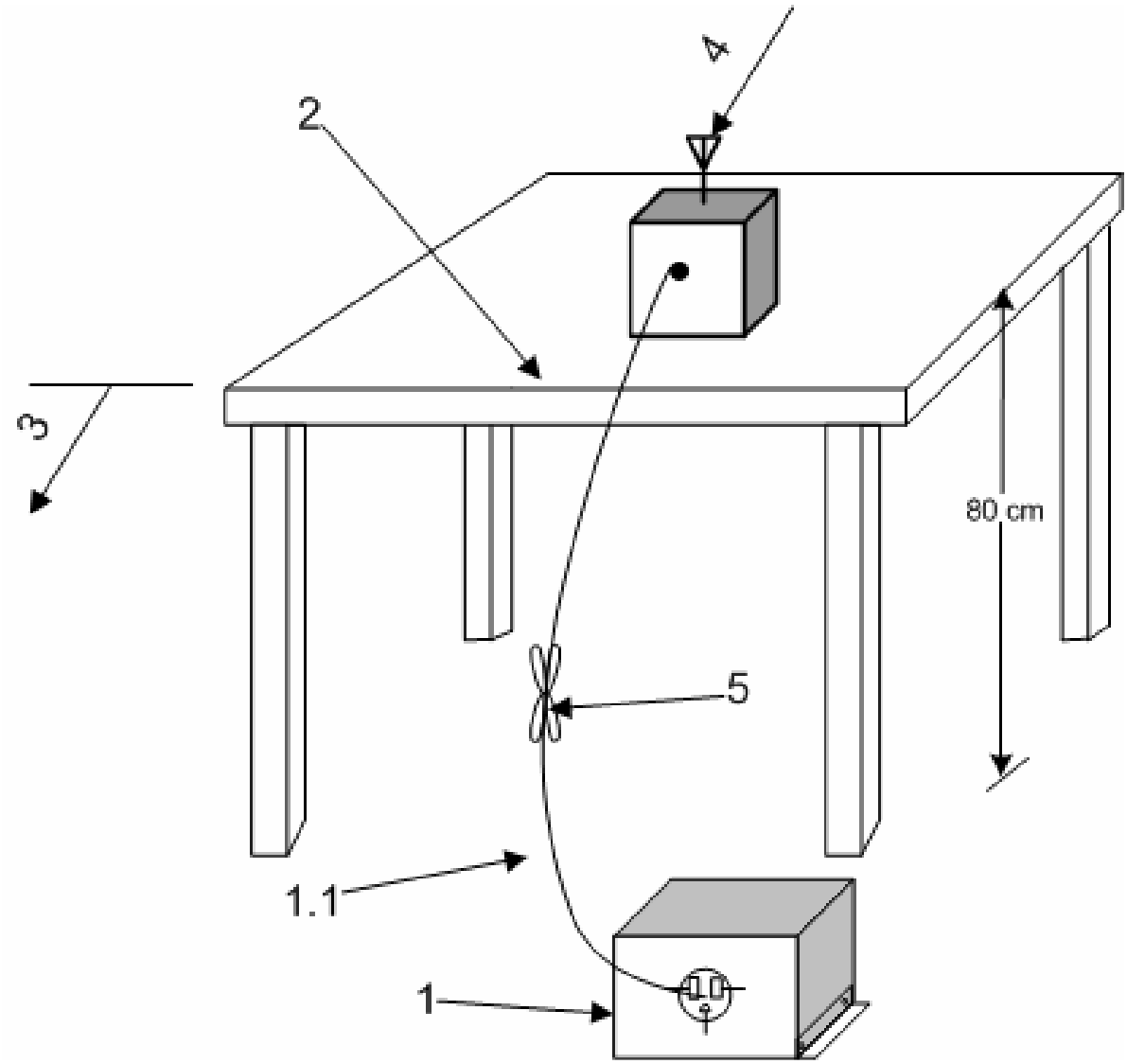
The EUT was assembled as required for operation placed on a benchtop. This configuration provided the ability to connect test equipment to the provided test antenna port Antenna Port

conducted emissions testing was performed presented in the regulations and specified in ANSI C63.10-2013. Testing was completed on a laboratory bench in a shielded room. The active antenna port of the device was connected to appropriate attenuation and the spectrum analyzer. Refer to diagram three showing typical test arrangement and photographs in the test setup exhibits for specific EUT placement during testing.



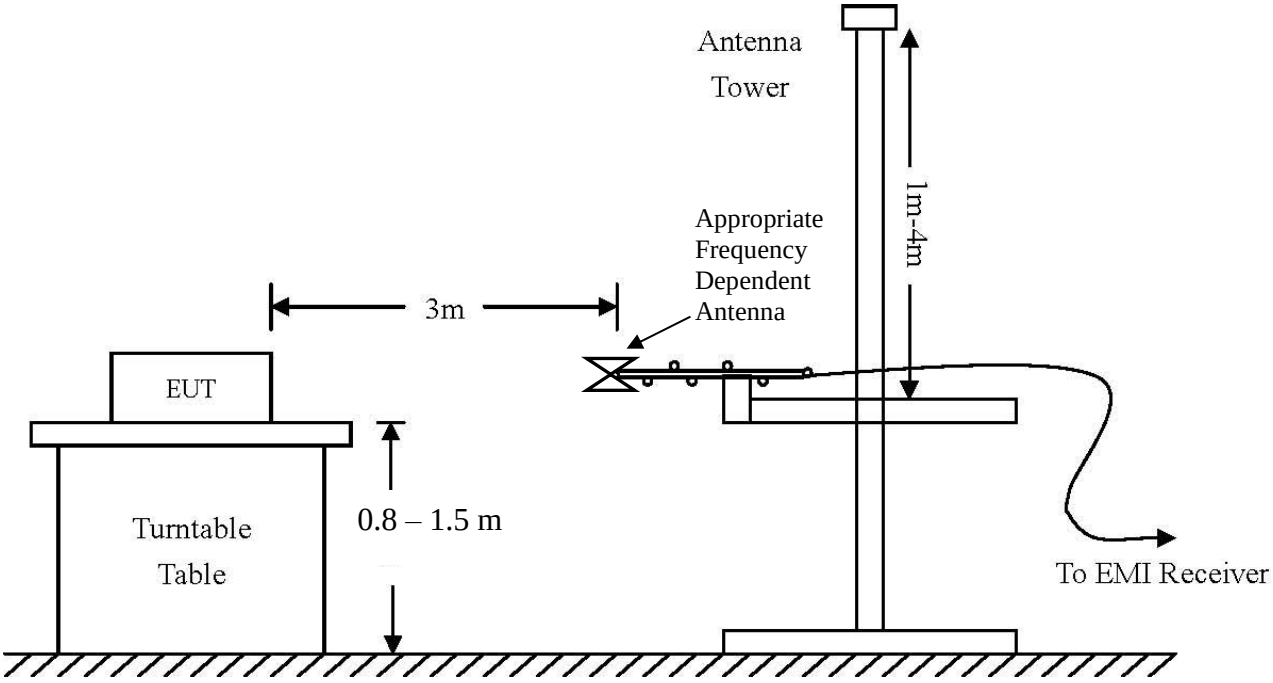
1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long see (see 6.2.3.1).
2. I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m (see 6.2.2).
3. EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. LISN can be placed on top of, or immediately beneath, reference ground plane (see 6.2.2 and 6.2.3).
   3.1 All other equipment powered from additional LISN(s).
   3.2 Multiple-outlet strip can be used for multiple power cords of non-EUT equipment.
   3.3 LISN at least 80 cm from nearest part of EUT chassis.
4. Non-EUT components of EUT system being tested.
5. Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop (see 6.2.3.1).
6. Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane (see 6.2.2 for options).
7. Antenna may be integral or detachable. If detachable, the antenna shall be attached for this test.

Diagram 1 Test arrangement for Conducted emissions



1—A LISN is optional for radiated measurements between 30 MHz and 1000 MHz but not allowed for measurements below 30 MHz and above 1000 MHz (see 6.3.1). If used, then connect EUT to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. The LISN may be placed on top of, or immediately beneath, the reference ground plane (see 6.2.2 and 6.2.3.2).
1.1—LISN spaced at least 80 cm from the nearest part of the EUT chassis.
2—Antenna can be integral or detachable, depending on the EUT (see 6.3.1).
3—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long (see 6.3.1).
4—For emission measurements at or below 1 GHz, the table height shall be 80 cm. For emission measurements above 1 GHz, the table height shall be 1.5 m for measurements, except as otherwise specified (see 6.3.1 and 6.6.3.1).

Diagram 2 Test arrangement for radiated emissions of tabletop equipment



AC Line Conducted Emissions (0.150 -30 MHz)		
RBW	AVG. BW	Detector Function
9 kHz	30 kHz	Peak / Quasi Peak
Emissions (30-1000 MHz)		
RBW	AVG. BW	Detector Function
120 kHz	300 kHz	Peak / Quasi Peak
Emissions (Above 1000 MHz)		
RBW	Video BW	Detector Function
100 kHz	100 kHz	Peak
1 MHz	1 MHz	Peak / Average

Diagram 3 Test arrangement for radiated emissions tested on Open Area Test Site (OATS)

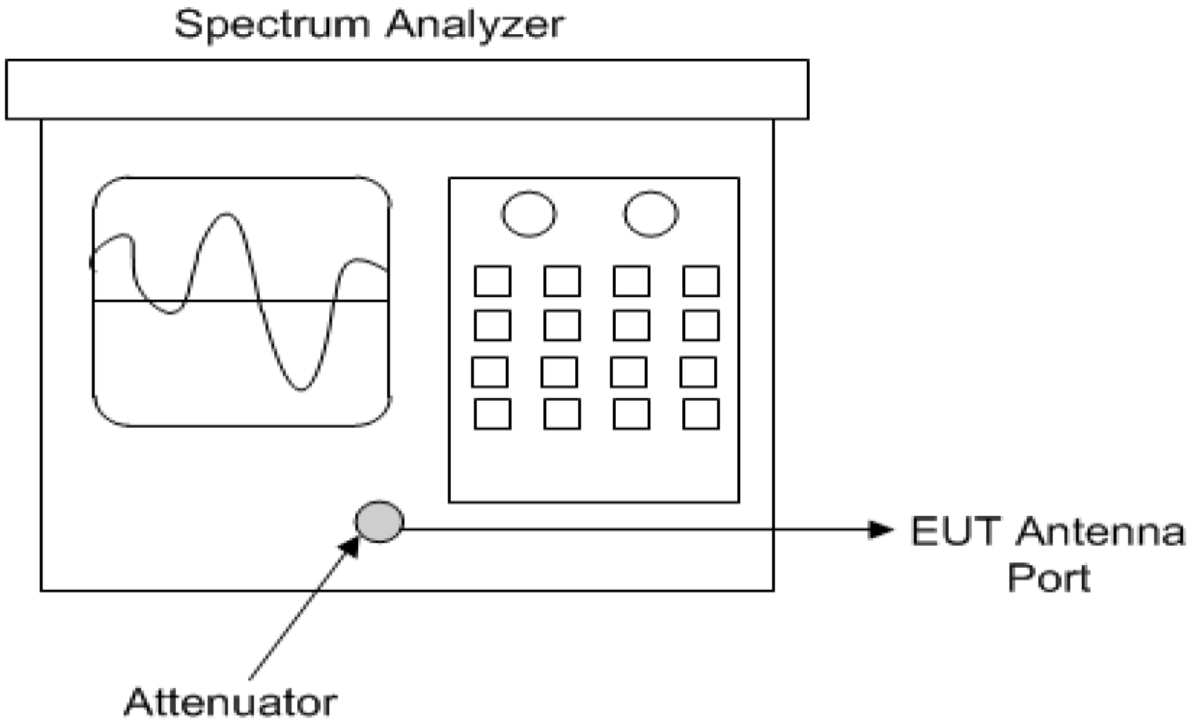


Diagram 4 Test arrangement for Antenna Port Conducted emissions

Test Site Locations

Conducted EMI	AC line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 West 259th Terrace, Louisburg, KS
Antenna port	Antenna port conducted emissions testing was performed in a shielded screen room located at Rogers Labs, Inc., 4405 West 259th Terrace, Louisburg, KS
Radiated EMI	The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 West 259th Terrace, Louisburg, KS
Registered Site information:	FCC Site: US5305, ISED: 3041A, CAB Identifier: US0096
NVLAP Accreditation	Lab code 200087-0

List of Test Equipment

Equipment	Manufacturer	Model (SN)	Band	Cal Date(m/d/y)	Due
☒ LISN	FCC	FCC-LISN-50-25-10(1PA) (160611)	.15-30MHz	4/18/2019	4/18/2020
☒ LISN	Compliance Design	FCC-LISN-2.Mod.cd,(126)	.15-30MHz	10/14/2019	10/14/2020
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L10M)(303073)	9kHz-40 GHz	10/14/2019	10/14/2020
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303069)	9kHz-40 GHz	10/14/2019	10/14/2020
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303071)	9kHz-40 GHz	10/14/2019	10/14/2020
☒ Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	10/14/2019	10/14/2020
☒ Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	10/14/2019	10/14/2020
☒ Antenna	Com Power	AL-130 (121055)	.001-30 MHz	10/14/2019	10/14/2020
☐ Antenna:	EMCO	6509	.001-30 MHz	10/16/2018	10/16/2020
☐ Antenna	ARA	BCD-235-B (169)	20-350MHz	10/14/2019	10/14/2020
☐ Antenna:	Schwarzbeck Model:	BBA 9106/VHBB 9124 (9124-627)		4/18/2019	4/18/2021
☒ Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	10/14/2019	10/14/2020
☐ Antenna	ETS-Lindgren	3147 (40582)	200-1000MHz	10/14/2019	10/14/2020
☐ Antenna:	Schwarzbeck Model:	VULP 9118 A (VULP 9118 A-534)		4/18/2019	4/18/2021
☒ Antenna	ETS-Lindgren	3117 (200389)	1-18 GHz	5/02/2019	5/2/2020
☐ Antenna	Com Power	AH-118 (10110)	1-18 GHz	10/14/2019	10/14/2020
☒ Antenna	Com Power	AH-840 (101046)	18-40 GHz	4/18/2019	4/18/2021
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	4/18/2019	4/18/2020
☒ Analyzer	Rohde & Schwarz	ESW44 (101534)	20Hz-44GHz	1/31/2019	1/31/2020
☐ Analyzer	Rohde & Schwarz	FS-Z60, 90, 140, and 220	40GHz-220GHz	12/22/2017	12/22/2027
☒ Amplifier	Com-Power	PA-010 (171003)	100Hz-30MHz	10/14/2019	10/14/2020
☒ Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	10/14/2019	10/14/2020
☒ Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	10/14/2019	10/14/2020
☒ Amplifier	Com-Power	PAM-840A (461328)	18-40 GHz	10/14/2019	10/14/2020
☒ Power Meter	Agilent	N1911A with N1921A	0.05-40 GHz	4/18/2019	4/18/2020
☐ Generator	Rohde & Schwarz	SMB100A6 (100150)	20Hz-6 GHz	4/18/2019	4/18/2020
☐ Generator	Rohde & Schwarz	SMBV100A6 (260771)	20Hz-6 GHz	4/18/2019	4/18/2020
☐ RF Filter	Micro-Tronics	BRC50722 (009).9G notch	30-18000 MHz	4/18/2019	4/18/2020
☐ RF Filter	Micro-Tronics	HPM50114 (017)1.5G HPF	30-18000 MHz	4/18/2019	4/18/2020
☐ RF Filter	Micro-Tronics	HPM50117 (063) 3G HPF	30-18000 MHz	4/18/2019	4/18/2020
☐ RF Filter	Micro-Tronics	HPM50105 (059) 6G HPF	30-18000 MHz	4/18/2019	4/18/2020
☐ RF Filter	Micro-Tronics	BRM50702 (172) 2G notch	30-18000 MHz	4/18/2019	4/18/2020
☐ RF Filter	Micro-Tronics	BRC50703 (G102) 5G notch	30-18000 MHz	4/18/2019	4/18/2020
☐ RF Filter	Micro-Tronics	BRC50705 (024) 5G notch	30-18000 MHz	4/18/2019	4/18/2020
☐ Attenuator	Fairview	SA6NFNF100W-40 (1625)	30-18000 MHz	4/18/2019	4/18/2020
☒ Attenuator	Mini-Circuits	VAT-3W2+ (1436)	30-6000 MHz	4/18/2019	4/18/2020
☐ Attenuator	Mini-Circuits	VAT-3W2+ (1445)	30-6000 MHz	4/18/2019	4/18/2020
☐ Attenuator	Mini-Circuits	VAT-3W2+ (1735)	30-6000 MHz	4/18/2019	4/18/2020
☐ Attenuator	Mini-Circuits	VAT-6W2+ (1438)	30-6000 MHz	4/18/2019	4/18/2020
☐ Attenuator	Mini-Circuits	VAT-6W2+ (1736)	30-6000 MHz	4/18/2019	4/18/2020
☒ Weather station	Davis	6312 (A81120N075)		11/4/2019	11/4/2020

Units of Measurements

Conducted EMI Data presented in dBµV; dB referenced to one microvolt

Antenna port Conducted Data is in dBm; dB referenced to one milliwatt

Radiated EMI Data presented in dBµV/m; dB referenced to one microvolt per meter

Note: Radiated limit may be expressed for measurement in dBµV/m when the measurement is taken at a distance of 3 or 10 meters. Data taken for this report was taken at distance of 3 meters. Sample calculation demonstrates corrected field strength reading for Open Area Test Site using the measurement reading and correcting for receive antenna factor, cable losses, and amplifier gains.

Sample Calculation:

RFS = Radiated Field Strength, FSM = Field Strength Measured

A.F. = Receive antenna factor, Losses = attenuators/cable losses, Gain = amplification gains

RFS (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB/m) + Losses (dB) - Gain (dB)

Environmental Conditions

Ambient Temperature 20.7° C

Relative Humidity 33 %

Atmospheric Pressure 1006.0 mb

Statement of Modifications and Deviations

No modifications to the EUT were required for the unit to demonstrate compliance with the 47 CFR Part 15C, RSS-Gen, and RSS-247 Issue 2, and RSS-GEN Issue 5 emission requirements. There were no deviations to the specifications.

Intentional Radiators

The following information is submitted in support demonstration of compliance with the requirements of 47 CFR, Subpart C, paragraph 15.247 and Industry Canada RSS-247 and RSS-Gen the following information is submitted.

Antenna Requirements

The EUT incorporates integral antenna system and offers no provision for connection to alternate antenna system. The antenna connection point complies with the unique antenna connection requirements. There are no deviations or exceptions to the specification.

Restricted Bands of Operation

Spurious emissions falling in the restricted frequency bands of operation were measured at the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were investigated at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and a spectrum analyzer. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. Test procedures of ANSI C63.10-2013 were used during testing. No other significant emission was observed which fell into the restricted bands of operation. Computed emission values consider the received radiated field strength, receive antenna correction factor, amplifier gain stage, and test system cable losses.

Table 1 Harmonic Radiated Emissions in Restricted Bands Data Mode 9 (802.11a)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
U-NII-1 Operation Worst-case							
5150.0	60.2	42.5	65.7	46.5	54.0	-11.5	-7.5
5350.0	56.1	43.0	60.5	47.1	54.0	-11.0	-6.9
15540.0	62.0	48.8	61.5	48.8	54.0	-5.2	-5.2
15600.0	62.7	48.5	62.6	49.1	54.0	-5.5	-4.9
15720.0	63.3	50.3	63.2	50.0	54.0	-3.7	-4.0
20720.0	63.4	50.4	64.5	50.5	54.0	-3.6	-3.5
20800.0	63.5	50.9	64.0	50.9	54.0	-3.1	-3.1
20960.0	64.2	50.9	63.7	51.0	54.0	-3.1	-3.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 2 Harmonic Radiated Emissions in Restricted Bands Data Mode 10 (802.11n)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
U-NII-1 Operation Worst-case							
5150.0	60.7	42.3	63.9	44.0	54.0	-11.7	-10.0
5350.0	53.5	41.0	54.3	41.3	54.0	-13.0	-12.7
15540.0	62.2	49.0	61.7	49.0	54.0	-5.1	-5.1
15600.0	62.9	48.7	62.8	49.3	54.0	-5.4	-4.8
15720.0	63.5	50.5	63.4	50.2	54.0	-3.6	-3.9
20720.0	63.5	50.5	64.6	50.6	54.0	-3.5	-3.4
20800.0	63.6	51.0	64.1	51.0	54.0	-3.0	-3.0
20960.0	64.3	51.0	63.8	51.1	54.0	-3.0	-2.9

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 3 Harmonic Radiated Emissions in Restricted Bands Data Mode 11 (802.11n40)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
U-NII-1 Operation Worst-case							
5150.0	65.2	48.5	71.7	51.6	54.0	-5.5	-2.4
5350.0	56.1	43.1	60.5	47.1	54.0	-10.9	-6.9
15570.0	62.6	49.9	63.3	50.1	54.0	-4.1	-3.9
15690.0	63.4	49.7	63.0	49.7	54.0	-4.3	-4.3
20760.0	62.7	49.7	63.1	49.9	54.0	-4.3	-4.1
20920.0	63.1	50.3	63.7	50.2	54.0	-3.7	-3.8

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 4 Harmonic Radiated Emissions in Restricted Bands Data Mode 12 (802.11ac)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
U-NII-1 Operation Worst-case							
5150.0	65.7	48.4	70.3	52.1	54.0	-5.6	-1.9
5350.0	60.0	46.9	60.2	47.1	54.0	-7.1	-6.9
15630.0	62.4	48.8	61.9	48.9	54.0	-5.2	-5.1
20840.0	63.4	50.2	64.0	50.3	54.0	-3.8	-3.7

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 5 Harmonic Radiated Emissions in Restricted Bands Data Mode 13 (802.11a)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
U-NII-3 Operation Worst-case							
11490.0	57.7	44.6	58.0	44.5	54.0	-9.4	-9.5
11570.0	57.3	44.6	57.6	44.6	54.0	-9.4	-9.4
11650.0	58.0	44.7	57.4	44.6	54.0	-9.3	-9.4
22980.0	64.2	51.3	64.5	50.7	54.0	-2.7	-3.3

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 6 Harmonic Radiated Emissions in Restricted Bands Data Mode 14 (802.11n)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
U-NII-3 Operation Worst-case							
11490.0	57.8	44.7	58.1	44.6	54.0	-9.3	-9.4
11570.0	57.4	44.7	57.7	44.7	54.0	-9.3	-9.3
11650.0	58.1	44.8	57.5	44.7	54.0	-9.2	-9.3
22980.0	64.3	51.4	64.6	50.8	54.0	-2.6	-3.2

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 7 Harmonic Radiated Emissions in Restricted Bands Data Mode 15 (802.11n40)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
U-NII-3 Operation Worst-case							
11510.0	57.8	44.7	58.1	44.8	54.0	-9.3	-9.2
11590.0	57.7	44.9	57.6	44.9	54.0	-9.1	-9.1
23020.0	64.7	51.1	64.1	51.0	54.0	-2.9	-3.0

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 8 Harmonic Radiated Emissions in Restricted Bands Data Mode 16 (802.11ac)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
U-NII-3 Operation Worst-case							
11550.0	57.8	44.9	57.5	45.0	54.0	-9.1	-9.0
23100.0	64.1	51.1	64.0	51.1	54.0	-2.9	-2.9

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Summary of Results for Radiated Emissions in Restricted Bands

The EUT demonstrated compliance with the emissions requirements of 47 CFR 15.205, RSS-GEN Issue 5, and RSS-247 Issue 2. The EUT provided a worst-case minimum margin of -1.9 dB below the emissions requirements in restricted frequency bands. Peak, Quasi-peak, and average amplitudes were checked for compliance with the regulations. Worst-case emissions are reported with other emissions found in the restricted frequency bands at least 20 dB below the requirements.

AC Line Conducted EMI Procedure

The EUT was arranged in typical equipment configurations as offered by manufacturer and presented above in equipment configuration. AC Line Conducted emission testing was performed with the EUT placed on a 1 x 1.5-meter bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room. The LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. Testing for the AC line-conducted emissions followed the procedures of ANSI C63.10-2013. The EUT was configured as presented in the AC Line conducted configurations as directed by the manufacture and presented above in equipment configuration. The AC adapter for the EUT was connected to the LISN for AC line-conducted emissions testing. A second LISN was positioned on the floor of the screen room 80-cm from the rear of the supporting equipment of the test configuration. All power cords except the EUT were then powered from the second LISN. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor, internal to the LISN. Power line conducted emissions testing was carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer, and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequencies of each of the emissions, which demonstrated the highest amplitudes. The cables were repositioned to obtain maximum amplitude of measured EMI level. Once the worst-case configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz and data recorded.

Refer to figures one and two showing plots of the AC Adapter configuration worst-case line conducted emissions. Refer to figures three and four for plots of the EUT – USB Computer interface AC Line conducted emissions.

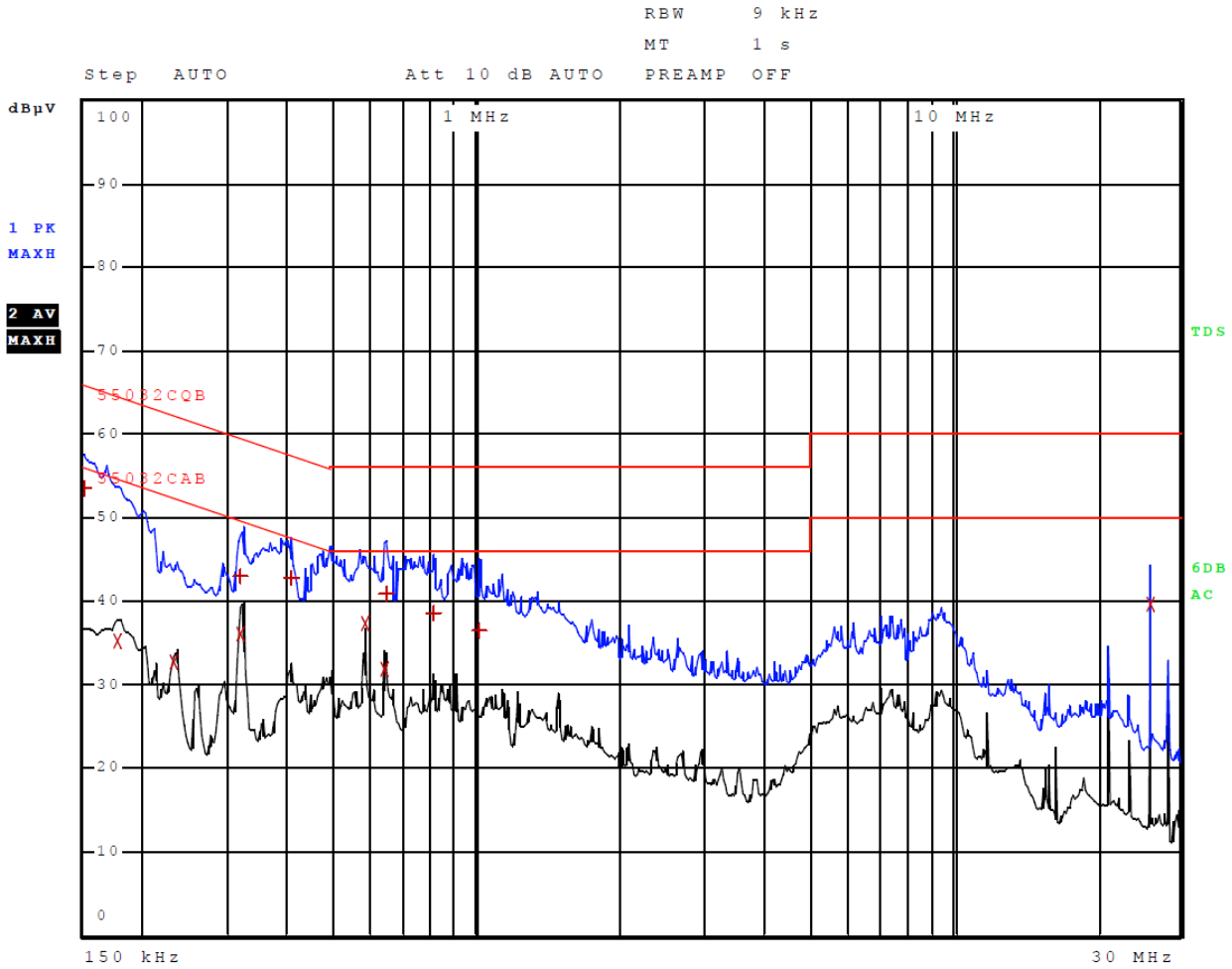


Figure 1 AC Line Conducted emissions of EUT line 1 Configuration #3

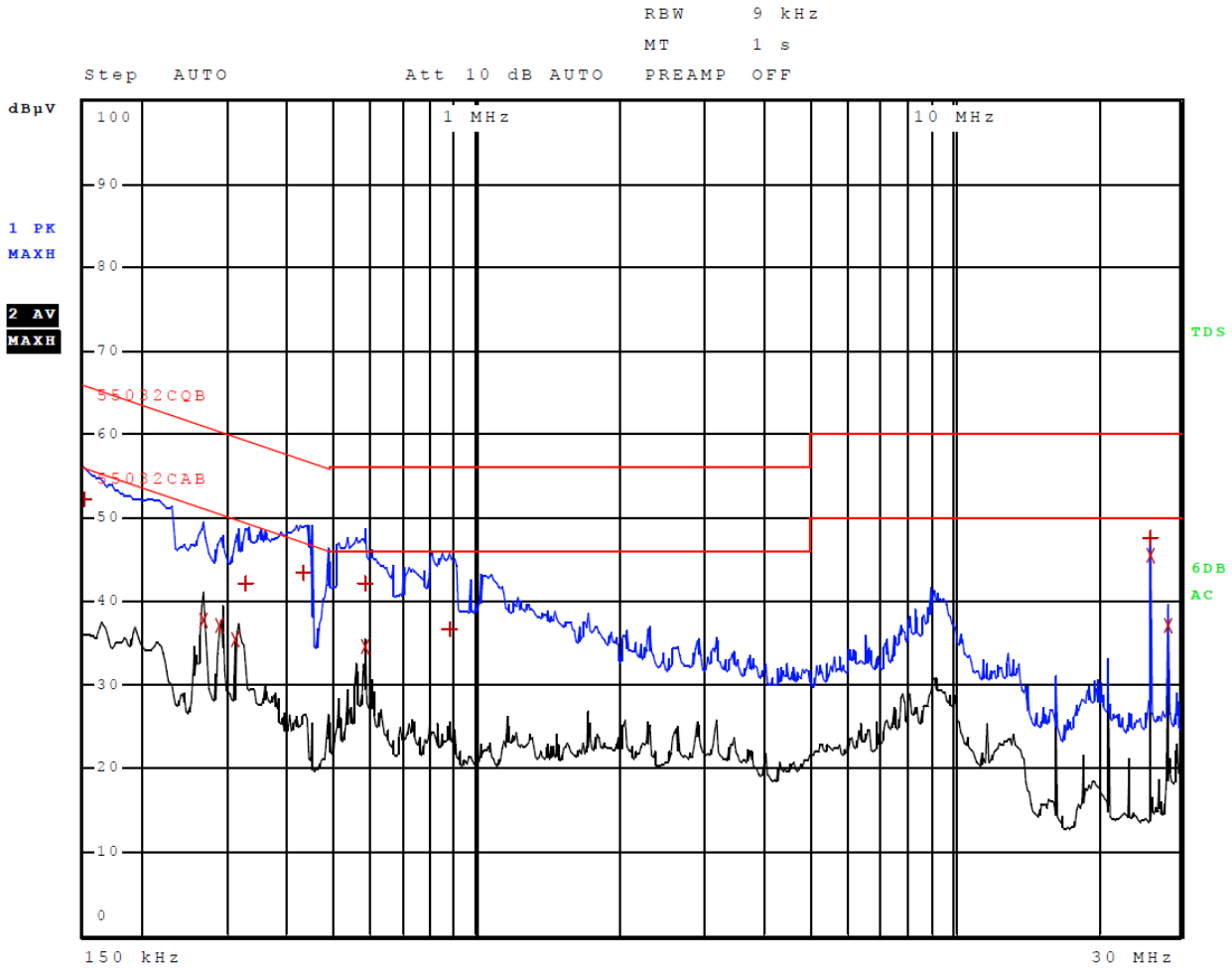


Figure 2 AC Line Conducted emissions of EUT line 2 Configuration #3

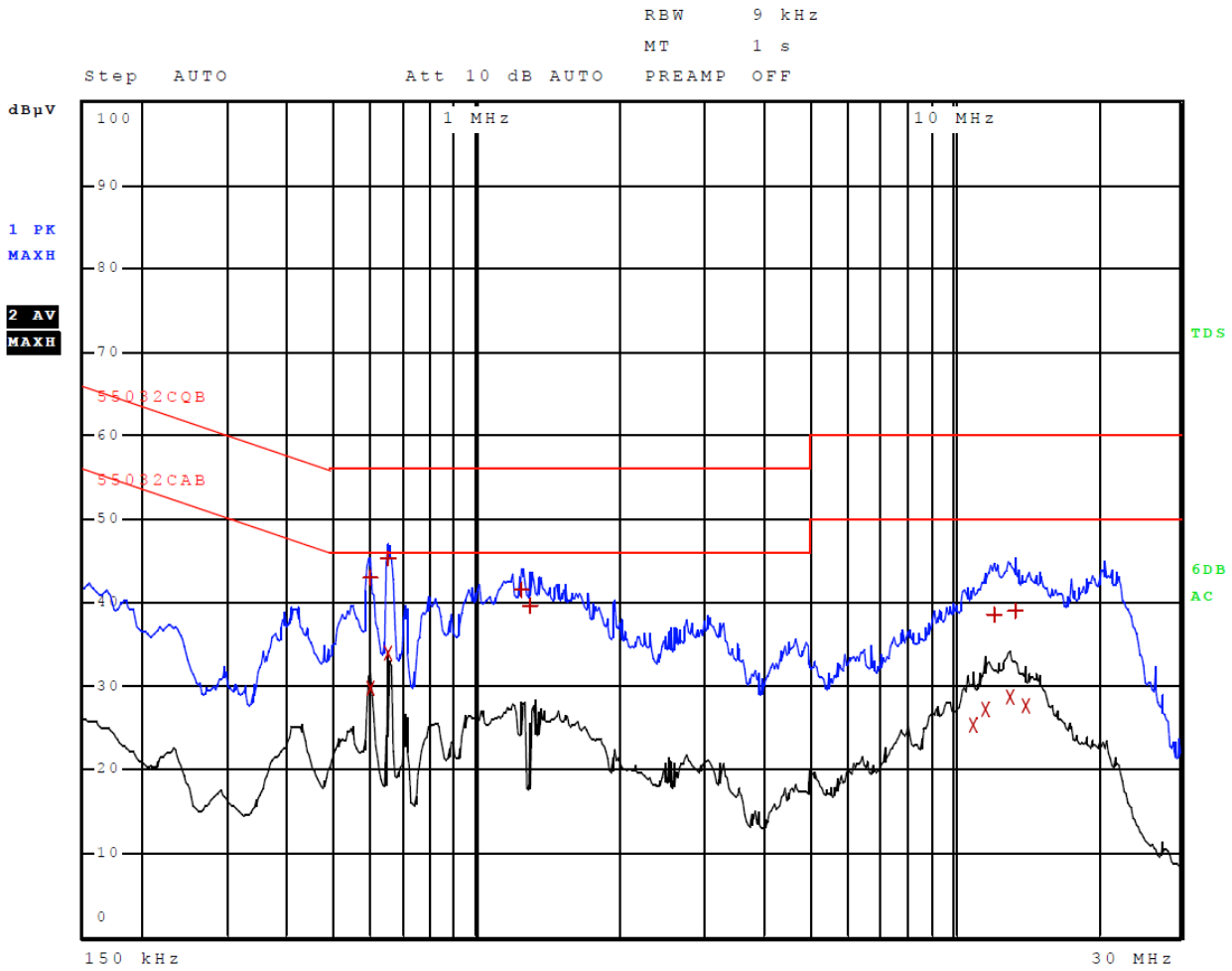


Figure 3 AC Line Conducted emissions of EUT line 1 Configuration #4

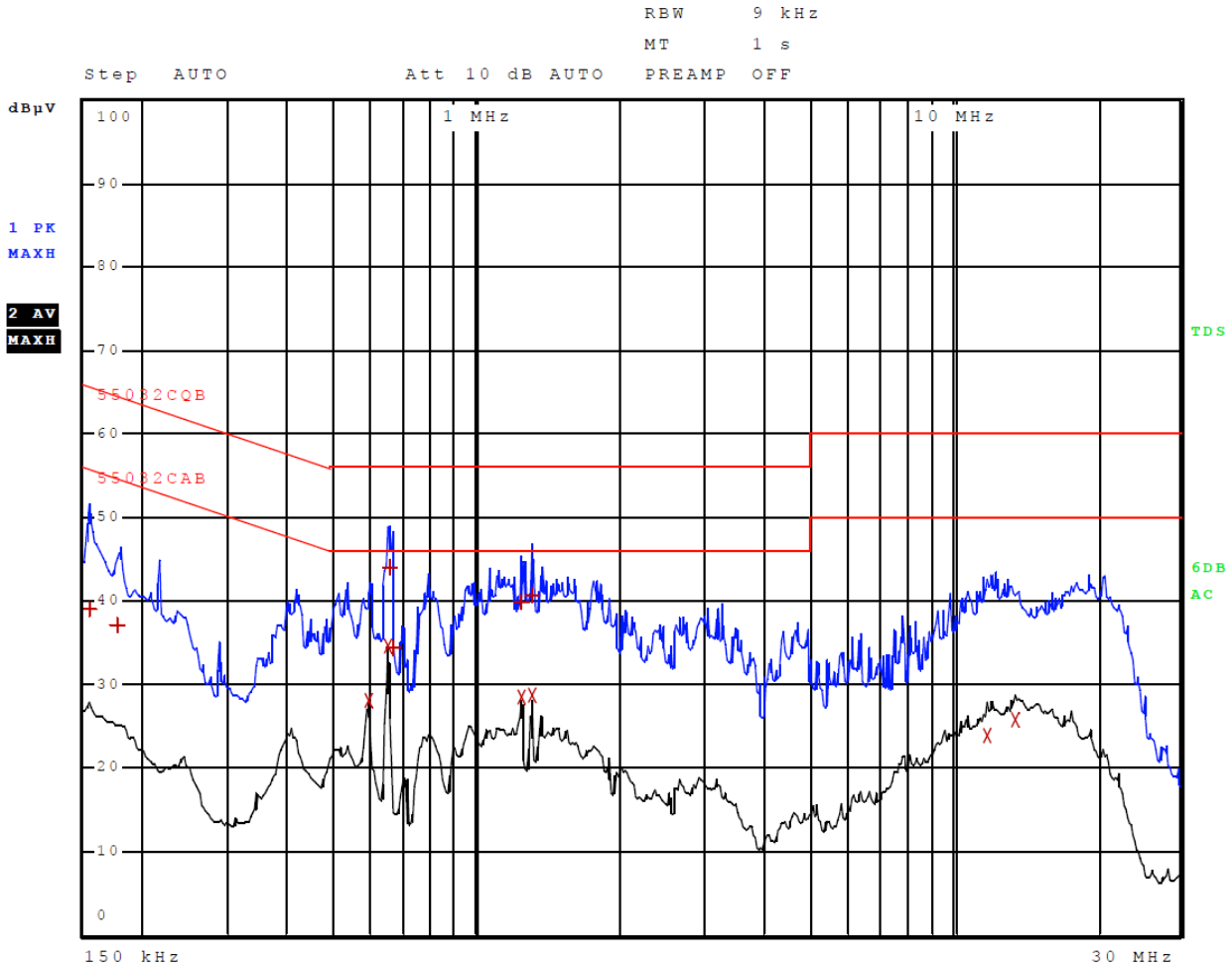


Figure 4 AC Line Conducted emissions of EUT line 2 Configuration #4

Table 9 AC Line Conducted Emissions Data L1 Configuration #3

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	53.56	Quasi Peak	-12.44
2	178.000000000 kHz	35.20	Average	-19.38
2	234.000000000 kHz	32.69	Average	-19.61
1	322.000000000 kHz	42.87	Quasi Peak	-16.79
2	322.000000000 kHz	36.03	Average	-13.63
1	406.000000000 kHz	42.82	Quasi Peak	-14.91
2	578.000000000 kHz	37.25	Average	-8.75
2	638.000000000 kHz	31.83	Average	-14.17
1	642.000000000 kHz	40.89	Quasi Peak	-15.11
1	810.000000000 kHz	38.57	Quasi Peak	-17.43
1	1.006000000 MHz	36.55	Quasi Peak	-19.45
2	25.872000000 MHz	39.51	Average	-10.49

Other emissions present had amplitudes at least 20 dB below the limit.

Table 10 AC Line Conducted Emissions Data L2 Configuration #3

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	150.000000000 kHz	52.12	Quasi Peak	-13.88
2	266.000000000 kHz	37.80	Average	-13.44
2	290.000000000 kHz	37.17	Average	-13.36
2	314.000000000 kHz	35.45	Average	-14.41
1	330.000000000 kHz	42.10	Quasi Peak	-17.35
1	430.000000000 kHz	43.32	Quasi Peak	-13.94
2	578.000000000 kHz	34.58	Average	-11.42
1	582.000000000 kHz	42.14	Quasi Peak	-13.86
1	870.000000000 kHz	36.61	Quasi Peak	-19.39
2	25.872000000 MHz	45.46	Average	-4.54
1	25.872000000 MHz	47.59	Quasi Peak	-12.41
2	28.224000000 MHz	37.01	Average	-12.99

Other emissions present had amplitudes at least 20 dB below the limit.

Table 11 AC Line Conducted Emissions Data L1 Configuration #4

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	594.000000000 kHz	29.72	Average	-16.28
1	594.000000000 kHz	42.89	Quasi Peak	-13.11
2	650.000000000 kHz	33.92	Average	-12.08
1	650.000000000 kHz	45.35	Quasi Peak	-10.65
1	1.242000000 MHz	41.50	Quasi Peak	-14.50
1	1.294000000 MHz	39.62	Quasi Peak	-16.38
2	11.040000000 MHz	25.22	Average	-24.78
2	11.728000000 MHz	27.23	Average	-22.77
1	12.148000000 MHz	38.61	Quasi Peak	-21.39
2	13.116000000 MHz	28.74	Average	-21.26
1	13.468000000 MHz	38.90	Quasi Peak	-21.10
2	14.156000000 MHz	27.62	Average	-22.38

Other emissions present had amplitudes at least 20 dB below the limit.

Table 12 AC Line Conducted Emissions Data L2 Configuration #4

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	154.000000000 kHz	38.96	Quasi Peak	-26.82
1	178.000000000 kHz	37.00	Quasi Peak	-27.58
2	590.000000000 kHz	28.09	Average	-17.91
2	650.000000000 kHz	34.55	Average	-11.45
1	654.000000000 kHz	43.93	Quasi Peak	-12.07
1	662.000000000 kHz	34.27	Quasi Peak	-21.73
2	1.242000000 MHz	28.49	Average	-17.51
1	1.242000000 MHz	39.74	Quasi Peak	-16.26
2	1.302000000 MHz	28.75	Average	-17.25
1	1.306000000 MHz	40.75	Quasi Peak	-15.25
2	11.808000000 MHz	23.88	Average	-26.12
2	13.524000000 MHz	25.69	Average	-24.31

Other emissions present had amplitudes at least 20 dB below the limit.

Summary of Results for AC Line Conducted Emissions

The EUT demonstrated compliance with the AC Line Conducted Emissions requirements of 47 CFR Part 15C, RSS-247 and RSS-Gen. The EUT configuration #3 configuration demonstrated a minimum margin of -4.5 dB below the requirement. The EUT configuration #4 demonstrated a minimum margin of -10.6 dB below the requirement. Other emissions were present with amplitudes at least 20 dB below the limit and worst-case amplitudes recorded.

General Radiated Emissions Procedure

The EUT was arranged in a typical equipment configuration and operated through all available mode during testing. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies, which produced the highest emissions. Each radiated emission was then maximized at the OATS location before final radiated measurements were performed. Final data was taken with the EUT located on the OATS at 3 meters distance between the EUT and the receiving antenna. The frequency spectrum from 9 kHz to 60,000 MHz was searched for general radiated emissions. Measured emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna position between horizontal and vertical polarization. Antennas used were Loop from 9 kHz to 30 MHz, Broadband Biconical from 30 to 200 MHz, Biconilog from 30 to 1000 MHz, Log Periodic from 200 MHz to 1 GHz and or double Ridge or pyramidal horns and mixers above 1 GHz, notch filters and appropriate amplifiers and external mixers were utilized.

Table 13 General Radiated Emissions Data

Frequency (MHz)	Horizontal Peak (dBµV/m)	Horizontal Quasi-Peak (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Quasi-Peak (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
38.0	26.5	20.8	48.7	28.2	40.0	-19.2	-11.8
51.8	23.9	18.6	33.4	28.1	40.0	-21.4	-11.9
65.6	24.4	17.5	29.1	24.4	40.0	-22.5	-15.6
368.3	23.4	16.9	21.5	16.1	47.0	-30.1	-30.9
421.2	25.1	19.1	22.6	17.0	47.0	-27.9	-30.0
844.2	36.9	24.7	39.2	33.2	47.0	-22.3	-13.8
897.1	30.8	24.9	30.8	24.8	47.0	-22.1	-22.2

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Summary of Results for General Radiated Emissions

The EUT demonstrated compliance with the radiated emissions requirements of 47 CFR part 15 and Industry Canada RSS-247 Issue 2 Intentional Radiators. The EUT demonstrated a minimum margin of -11.8 dB below the requirements. Other emissions were present with amplitudes at least 20 dB below the Limits.

Operation in the 5150-5250 and 5725-5850 MHz Frequency U-NII-1 and U-NII-3 Bands

Testing followed FCC 789033 D02 General U-NII Test Procedures New Rules v02r01.
The manufacturer provided a second test sample which provided direct connection to the antenna port. A power meter was used to measure fundamental transmitter output power. A spectrum analyzer / receiver was used to produce plots and make other antenna port conducted measurements for compliance testing. Test software was provided to operate the transmitter. This software provided the ability to set test channel, operational mode, and modulation scheme. The antenna port was connected to coaxial cable with 50-ohm attenuator and receiver, spectrum analyzer, or power meter during testing. The design was also tested for radiated emissions using sample #1 representative of production equipment. Radiated emissions testing was performed on the Open Area Test Site (OATS) with the transmitter operating. The test sample was placed on a turntable elevated as required above the ground plane as required at a 3 meters distance from the FSM antenna located on the OATS for testing radiated emissions. The peak and quasi-peak amplitude of the frequencies below 1000 MHz were measured using a spectrum analyzer. The peak and average amplitude of emissions above 1000 MHz were measured using a spectrum analyzer. Emissions data was recorded from the measurement results. Data presented reflects measurement result corrected to account for measurement system gains and losses. Plots were made of transmitter performance for reference and demonstration of compliance. In addition, all Manufacturers of U-NII devices are responsible for ensuring frequency stability such that the emissions are maintained within the band of operation under all conditions of normal operation as specified in the user's manual. The manufacturer has attested the equipment operates within the required frequency spectrum under normal operational conditions. This report documents emissions governed under the U-NII-1 and U-NII-3 bands operating in the 5180-5240 and 5745-5825 MHz frequency bands.

Per **15.407 Technical Requirements**

(a) power limitations

(1) For the Band 5.15-5.25 GHz

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1-megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

Per **RSS-247 Issue 2**

6. Technical requirements for license-exempt local area network devices and digital transmission systems operating in the 5 GHz band

This section provides standards for License-Exempt Local Area Network (LE-LAN) devices operating in the bands 5150-5250 MHz, 5250-5350 MHz, 5470-5600 MHz, 5650-5725 MHz and 5725-5850 MHz and for DTSs operating in the band 5725-5850 MHz that employ digital modulation technology but are not designed for LE-LAN operation.

Devices with occupied bandwidths which overlap different bands shall comply with all operational requirements for each band.

6.2.1 Frequency band 5150-5250 MHz

LE-LAN devices are restricted to indoor operation only in the band 5150-5250 MHz. However, original equipment manufacturer (OEM) devices, which are installed in vehicles by vehicles manufacturers, are permitted.

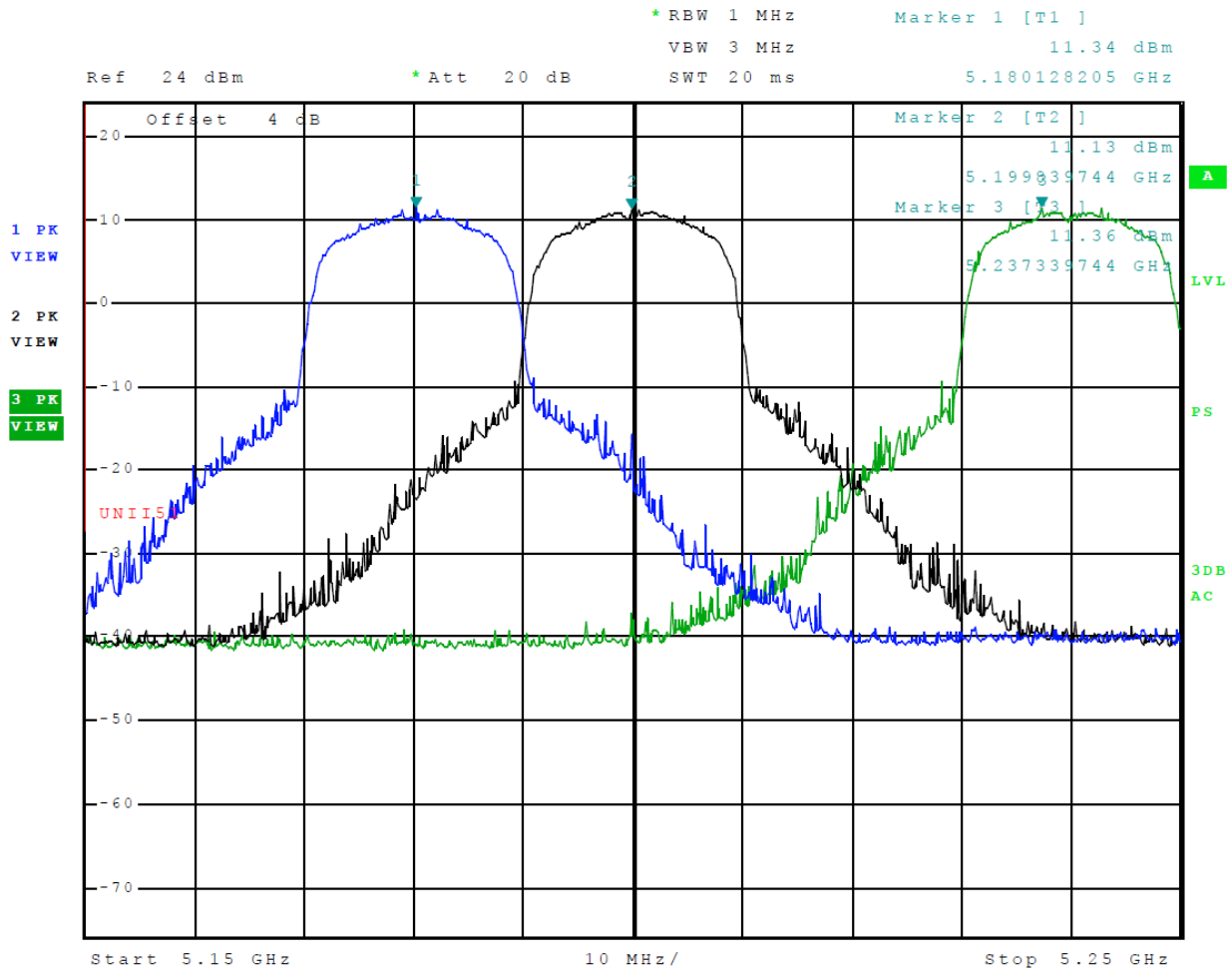


Figure 5 Plot of Transmitter Emissions Across 5150-5250 MHz Band, Mode 9 (802.11a)

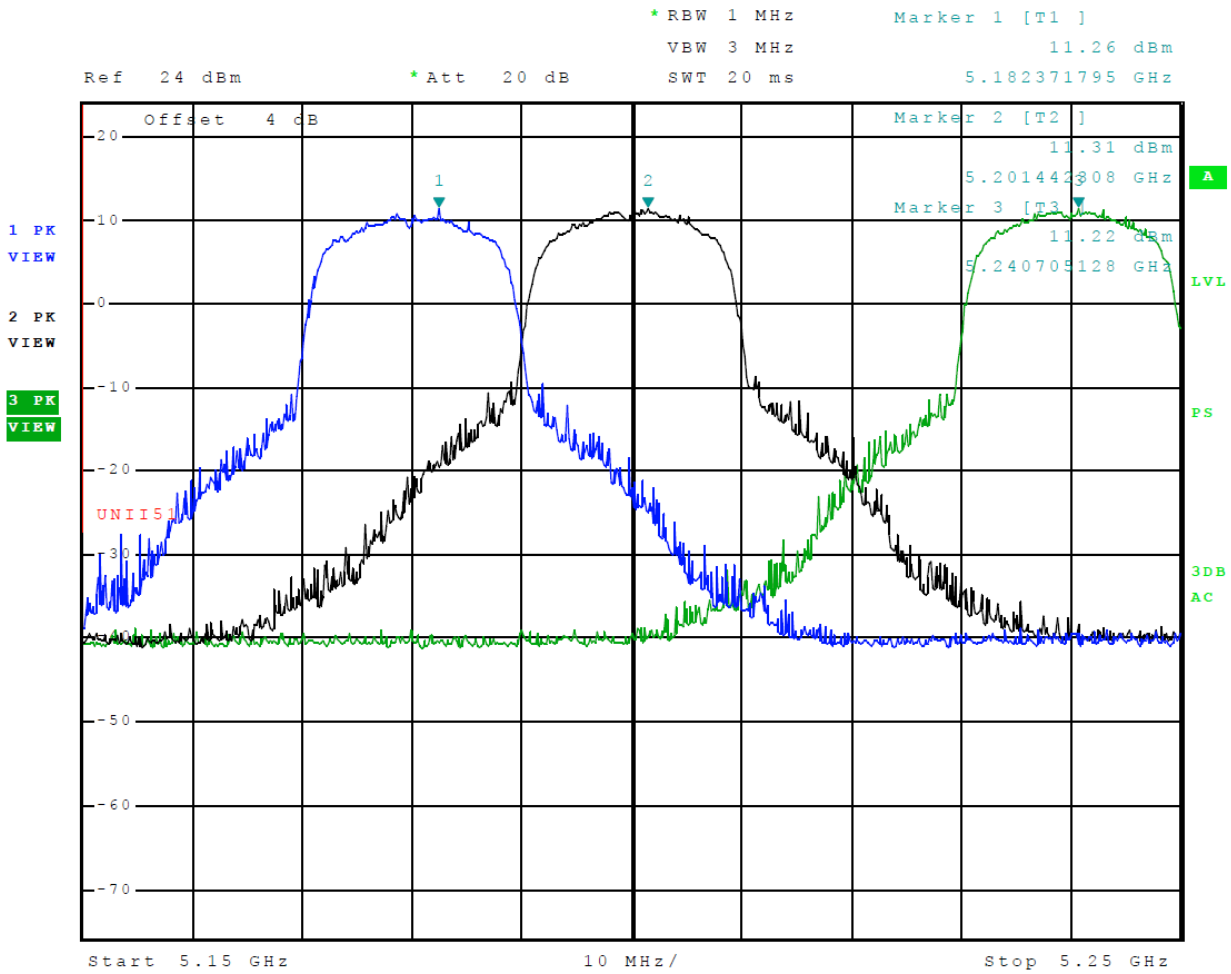


Figure 6 Plot of Transmitter Emissions Across 5150-5250 MHz Band, Mode 10 (802.11n)

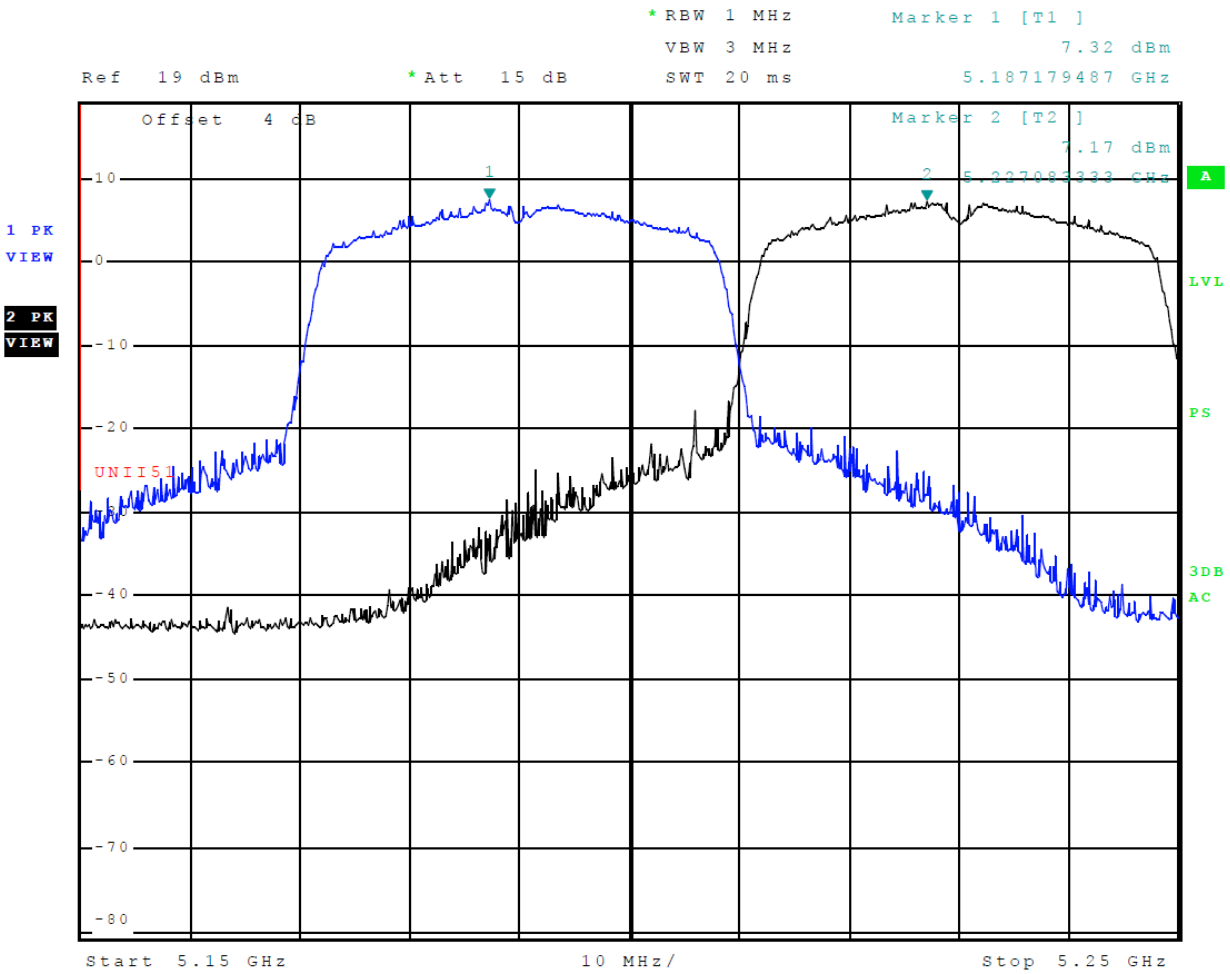


Figure 7 Plot of Transmitter Emissions Across 5150-5250 MHz Band, Mode 11 (802.11n40)

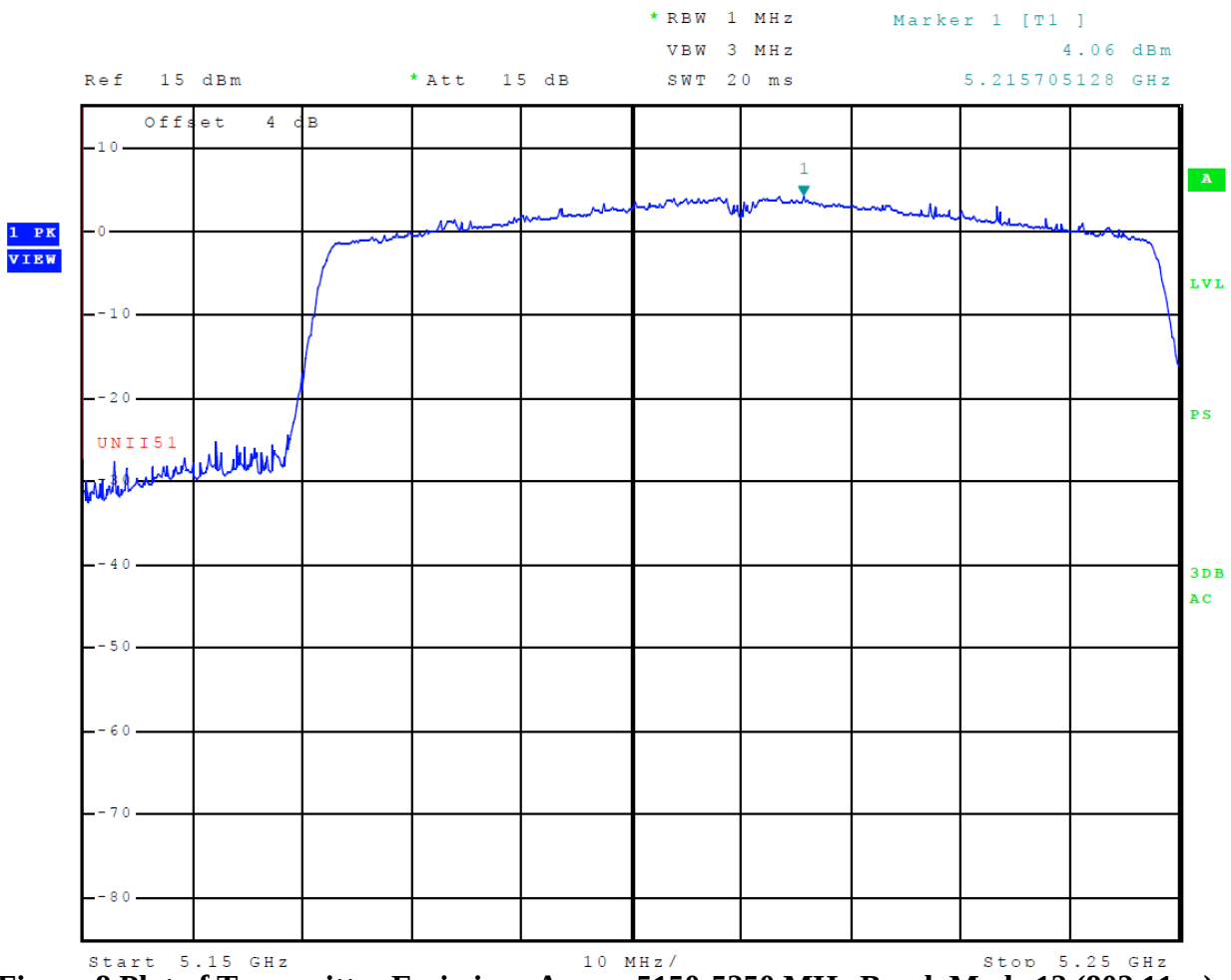


Figure 8 Plot of Transmitter Emissions Across 5150-5250 MHz Band, Mode 12 (802.11ac)

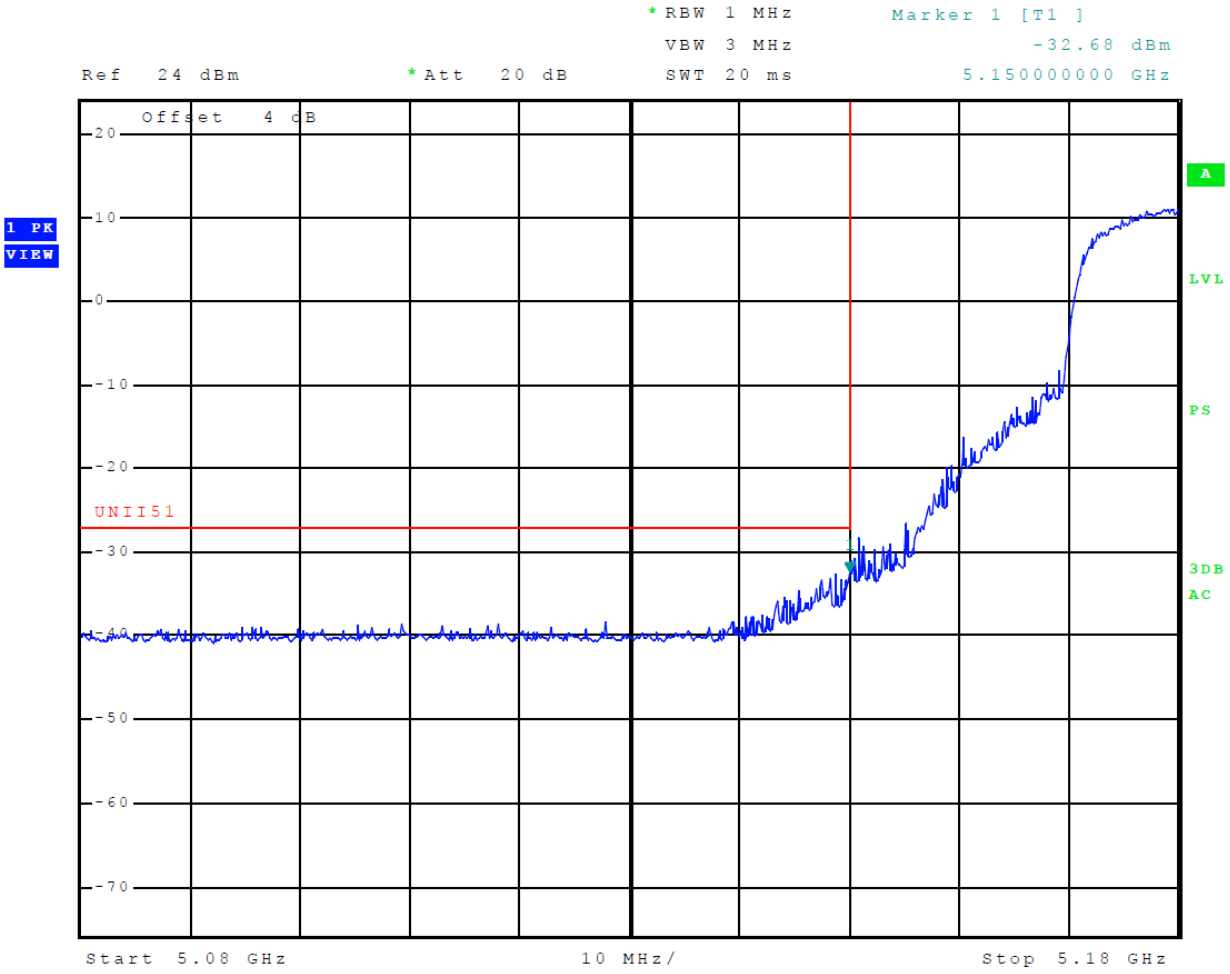


Figure 9 Plot of Lower Band Edge Across 5150-5250 MHz Band, Mode 9 (802.11a)

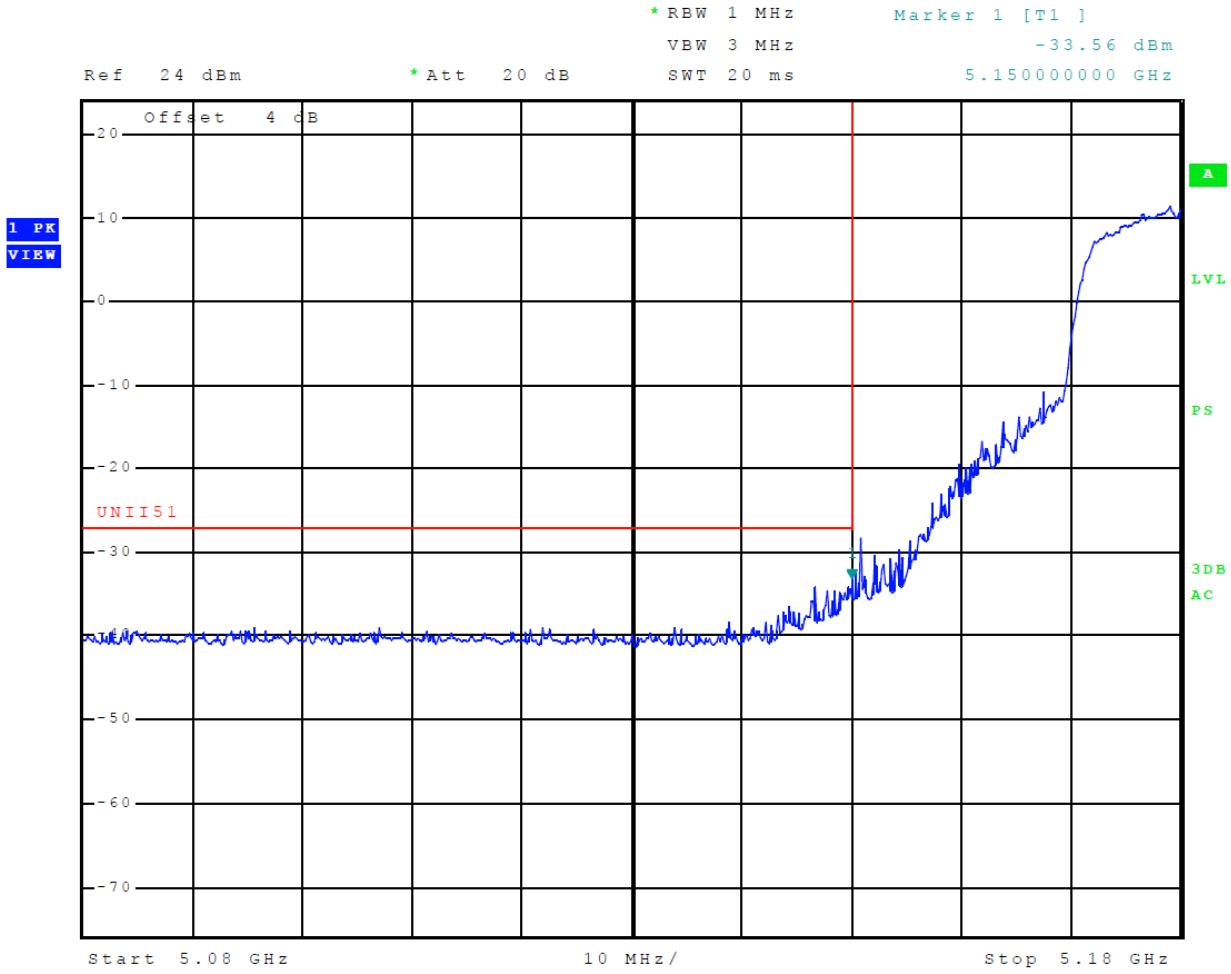


Figure 10 Plot of Lower Band Edge Across 5150-5250 MHz Band, Mode 10 (802.11n)

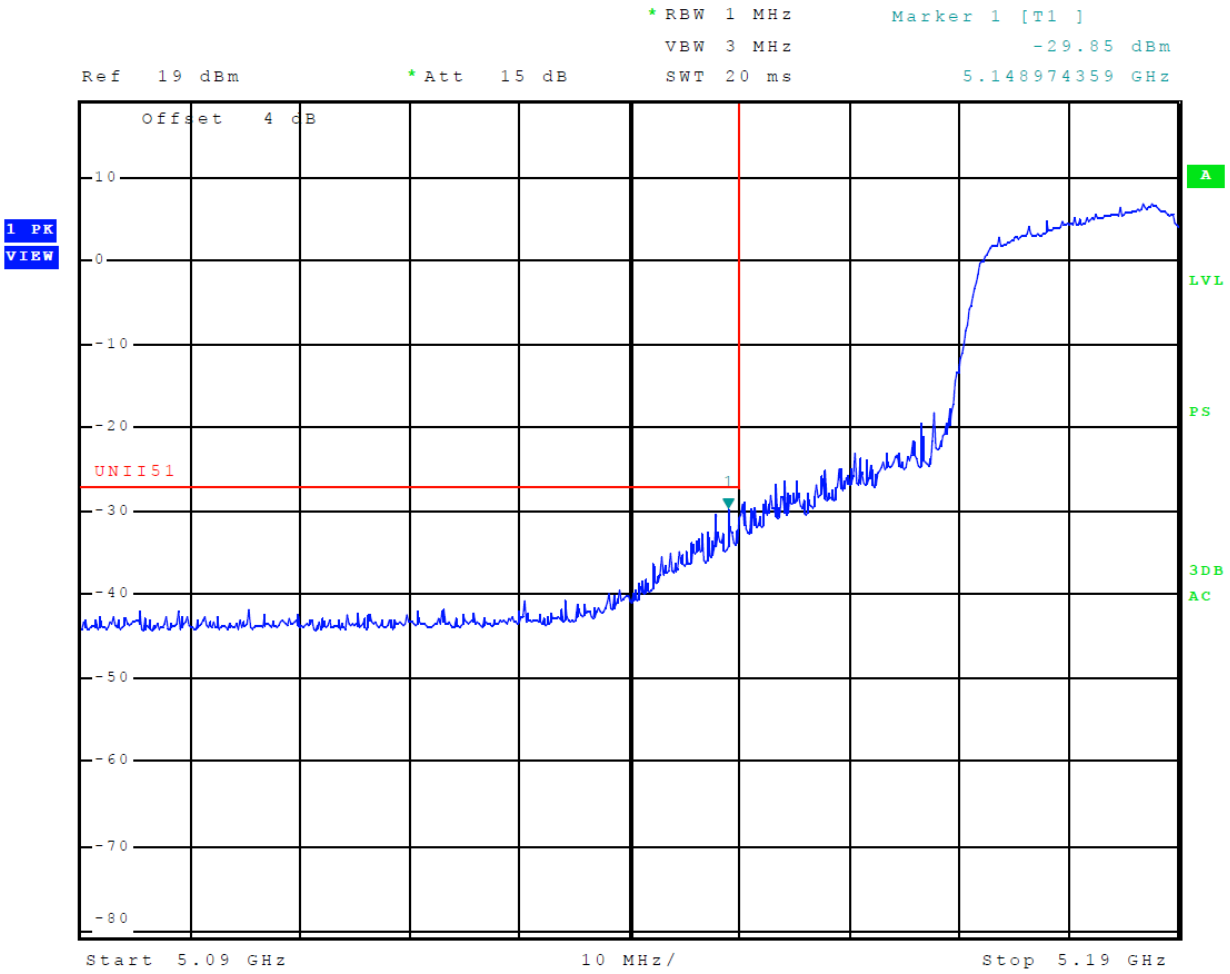


Figure 11 Plot of Lower Band Edge Across 5150-5250 MHz Band, Mode 11 (802.11n40)

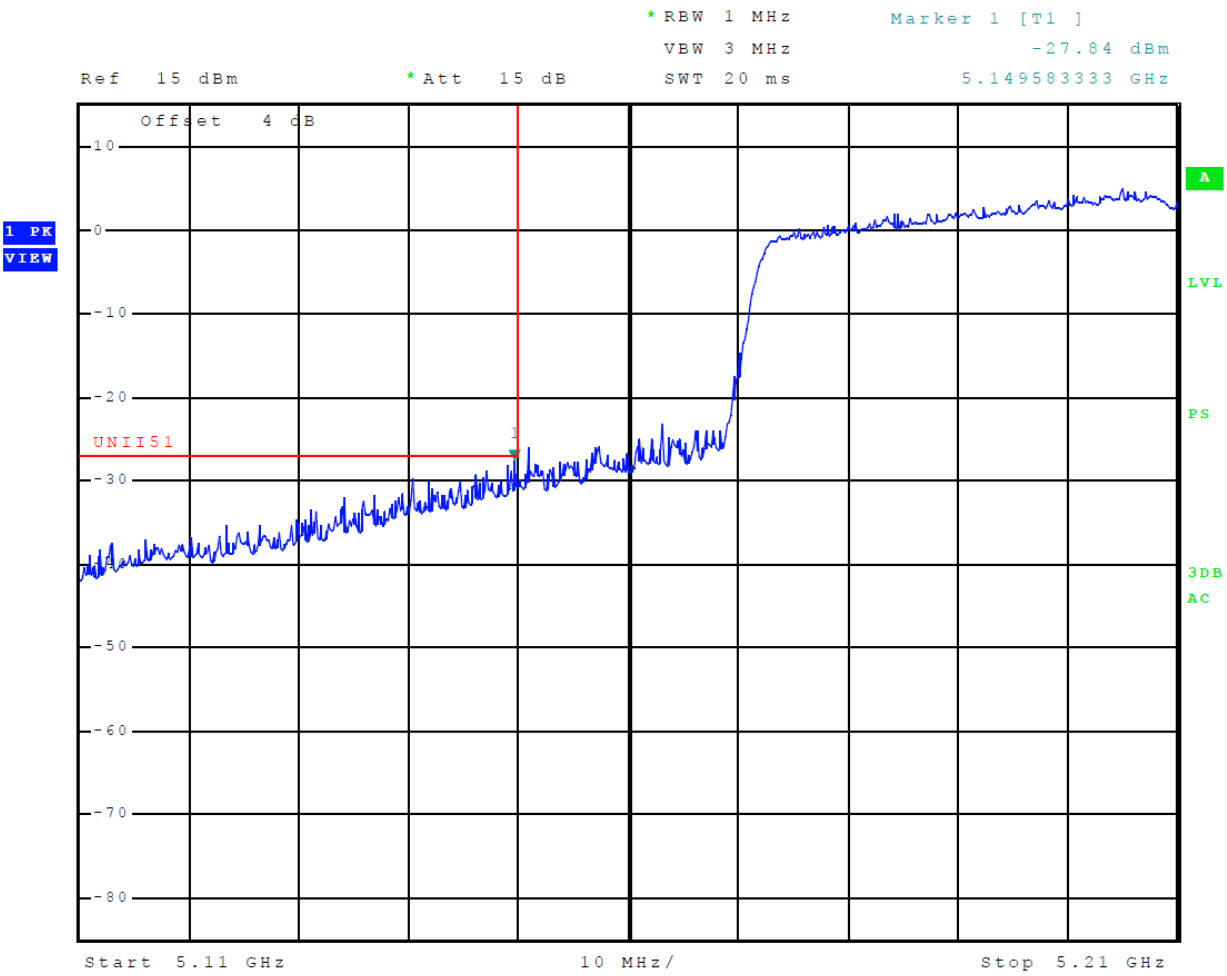


Figure 12 Plot of Lower Band Edge Across 5150-5250 MHz Band, Mode 12 (802.11ac)

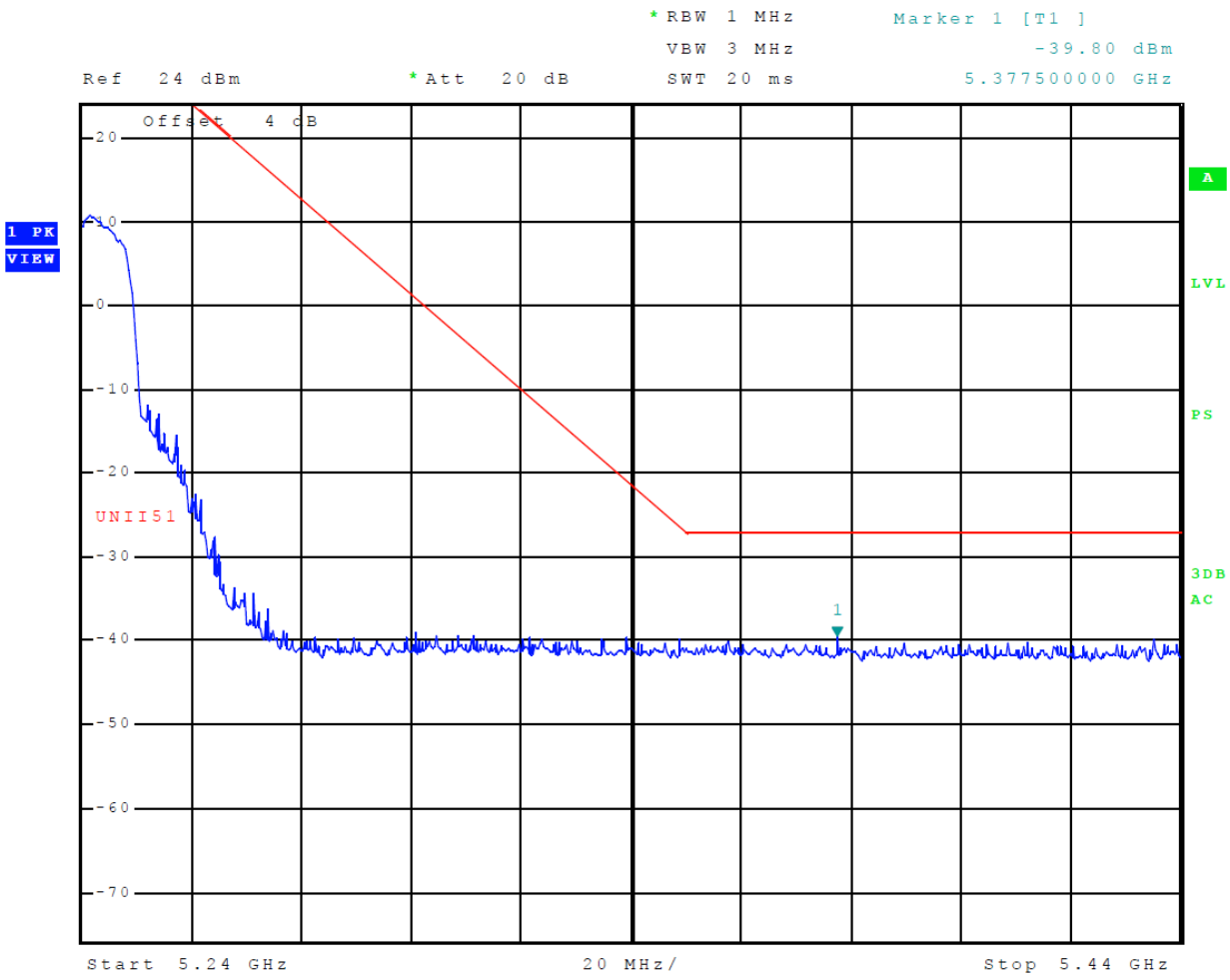


Figure 13 Plot of Upper Band Edge (Across 5150-5250 MHz Band, Mode 9 (802.11a)

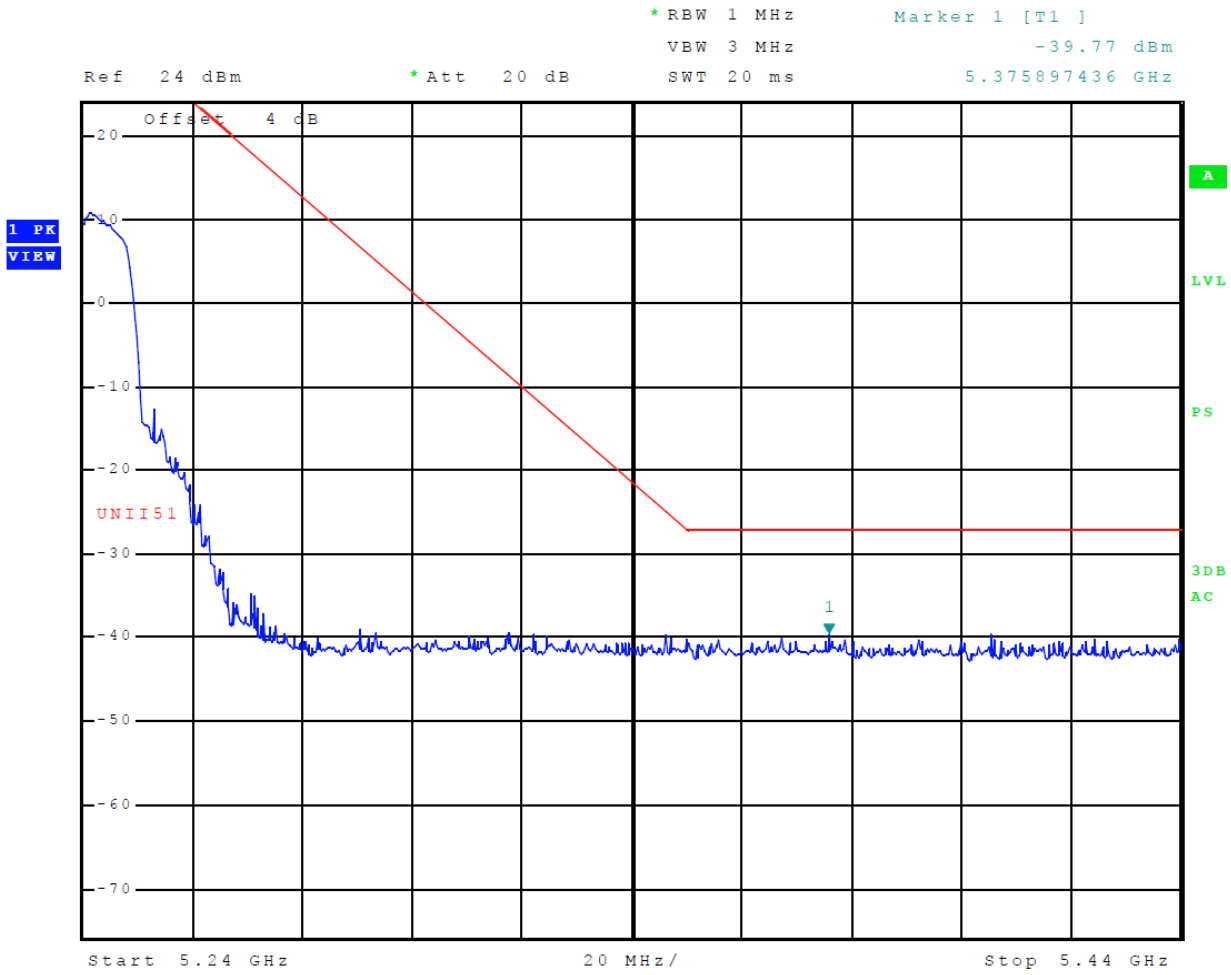


Figure 14 Plot of Upper Band Edge (Across 5150-5250 MHz Band, Mode 10 (802.11n)

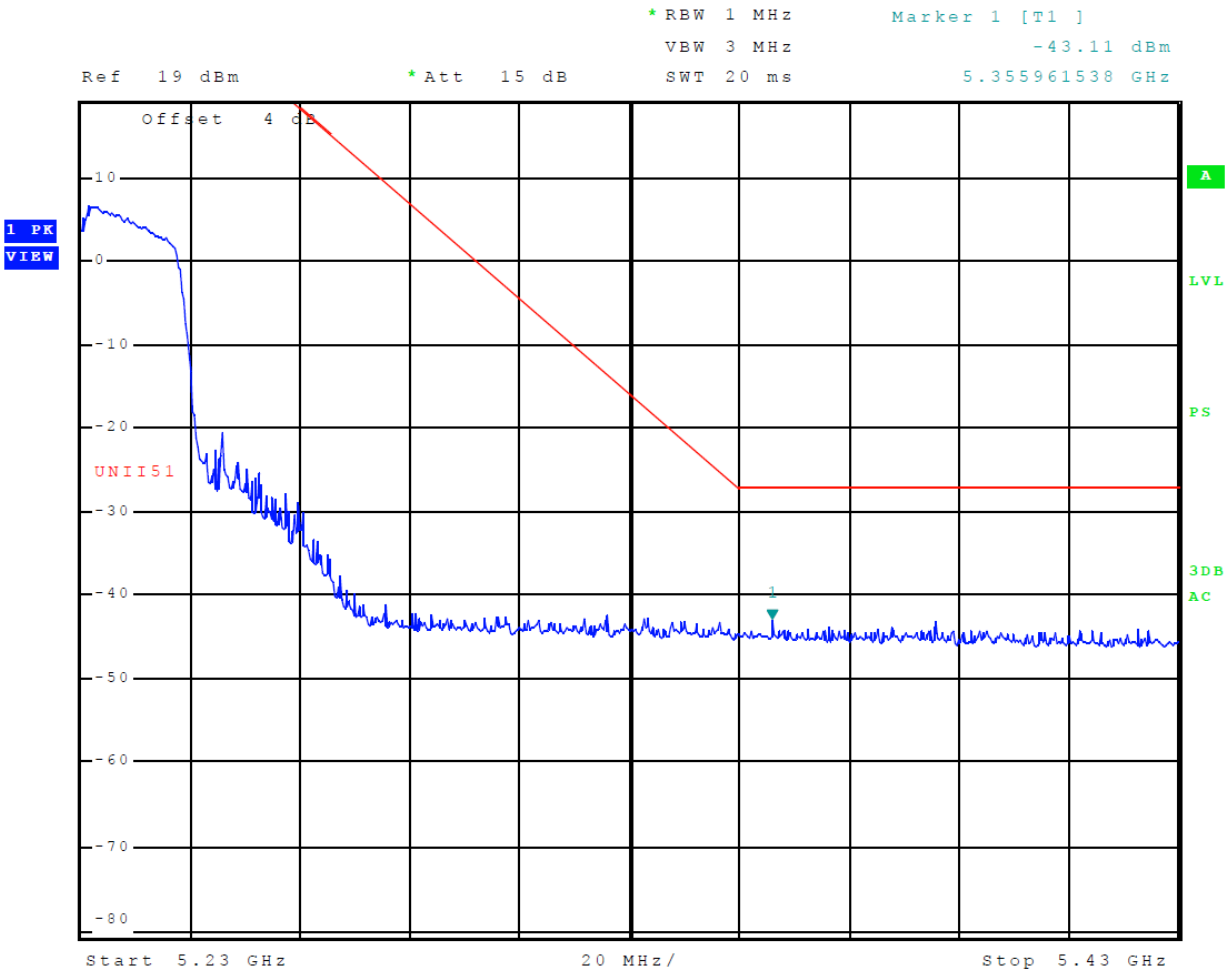


Figure 15 Plot of Upper Band Edge (Across 5150-5250 MHz Band, Mode 11 (802.11n40)

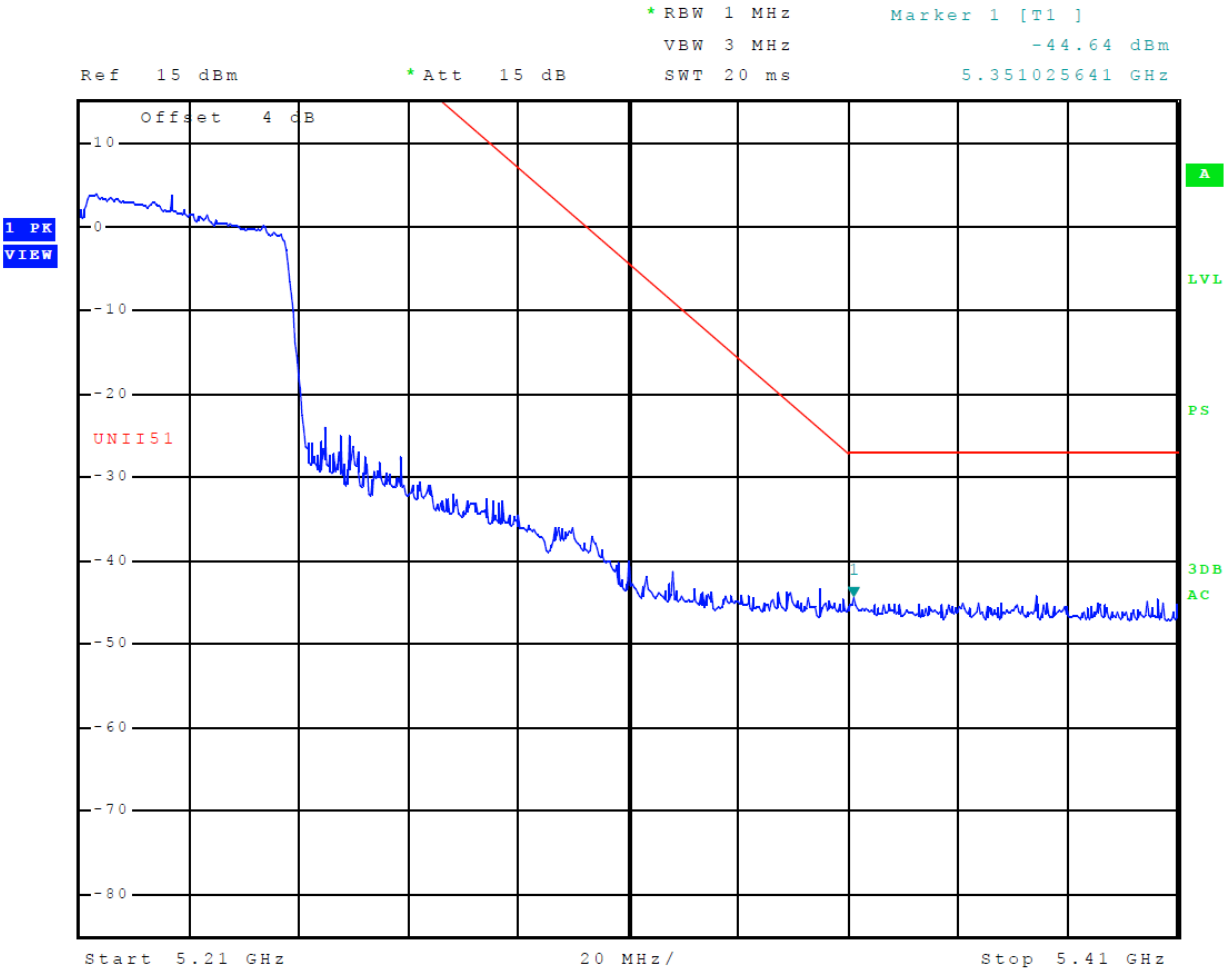


Figure 16 Plot of Upper Band Edge (Across 5150-5250 MHz Band, Mode 12 (802.11ac)

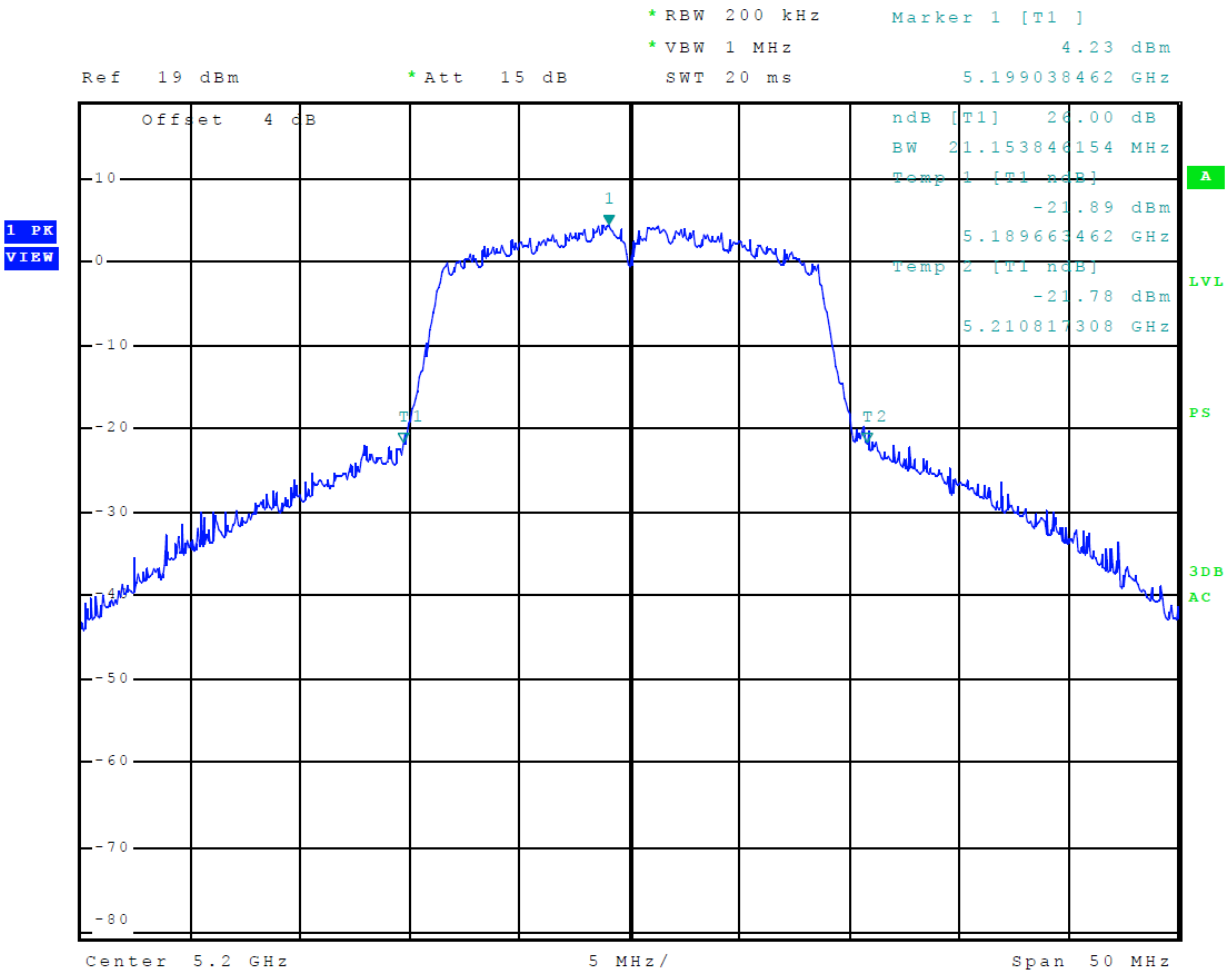


Figure 17 Plot of Transmitter 26-dB Occupied Bandwidth (5150-5250 MHz Mode 9 (802.11a)

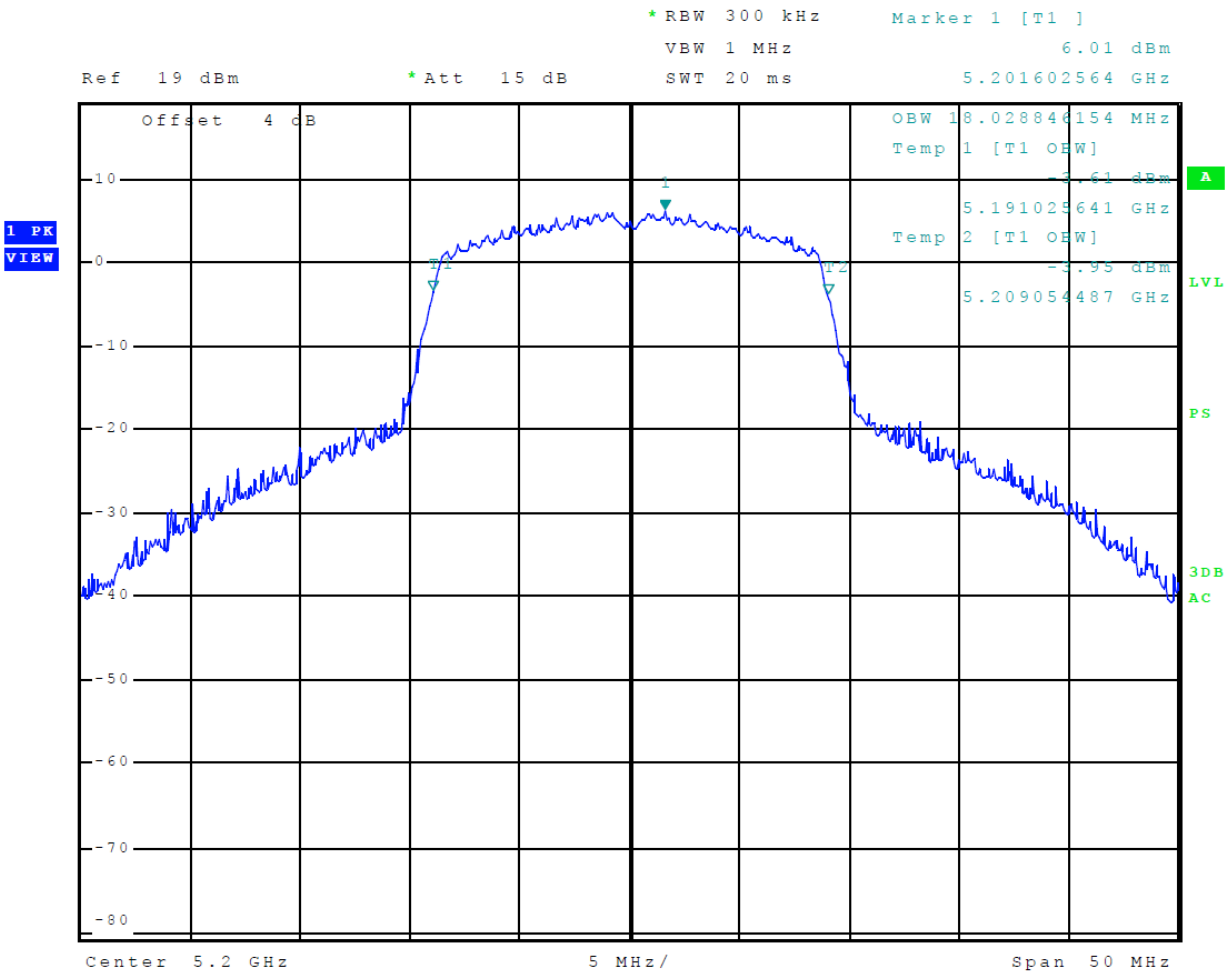


Figure 18 Plot of Transmitter 99% Occupied Bandwidth (5150-5250 MHz Mode 9 (802.11a)

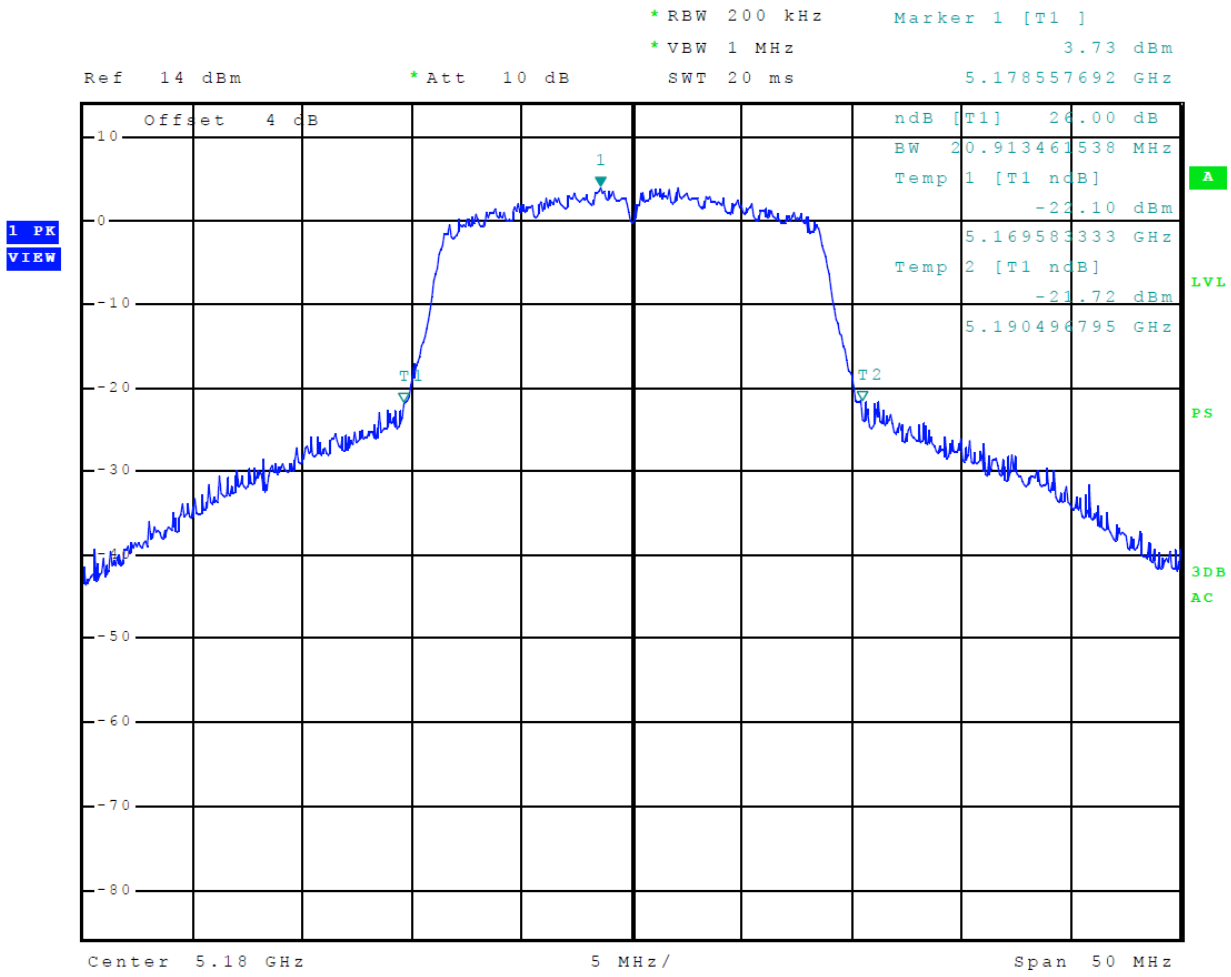


Figure 19 Plot of Transmitter 26-dB Occupied Bandwidth (5150-5250 MHz Mode 10 (802.11n)

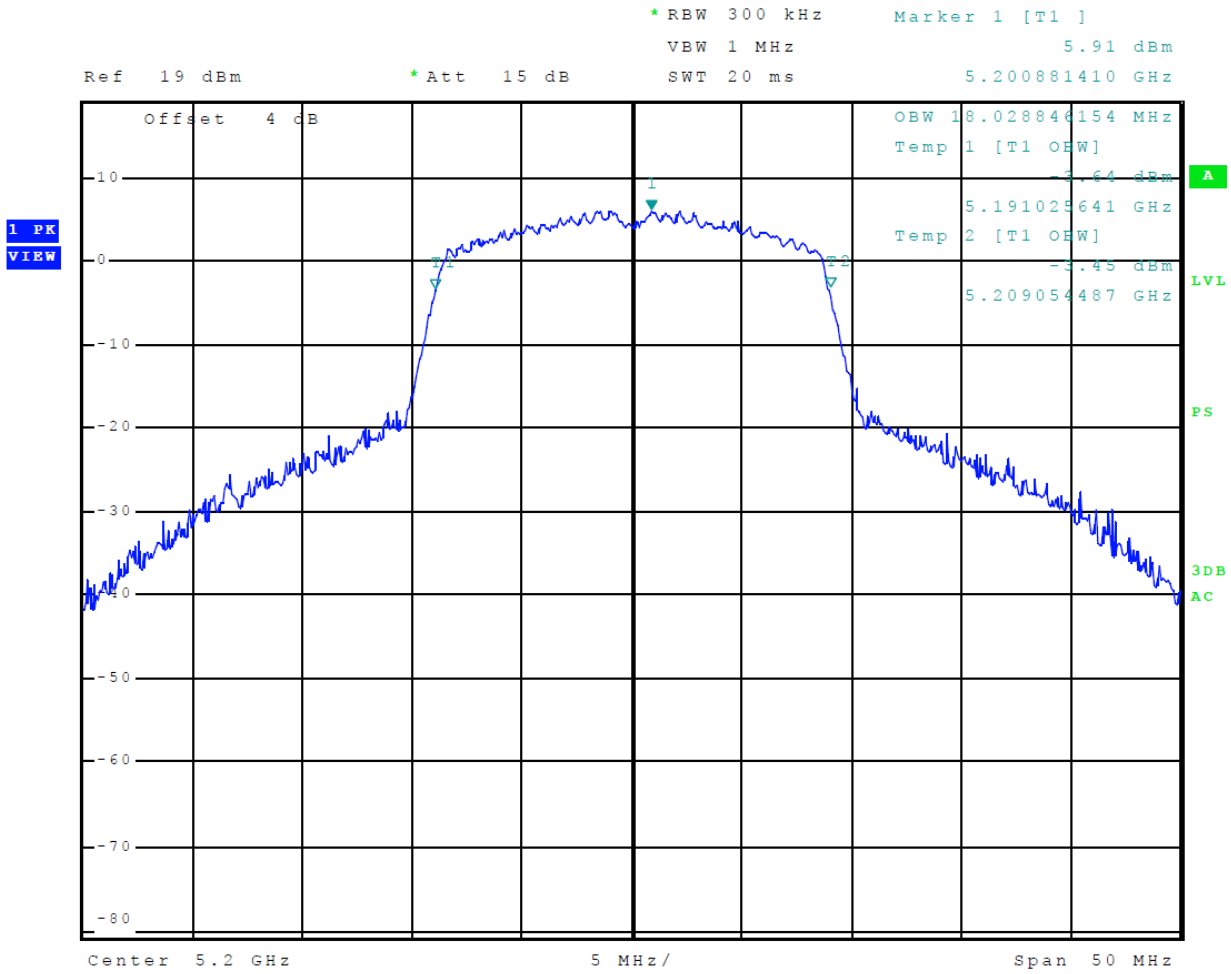


Figure 20 Plot of Transmitter 99% Occupied Bandwidth (5150-5250 MHz Mode 10 (802.11n)

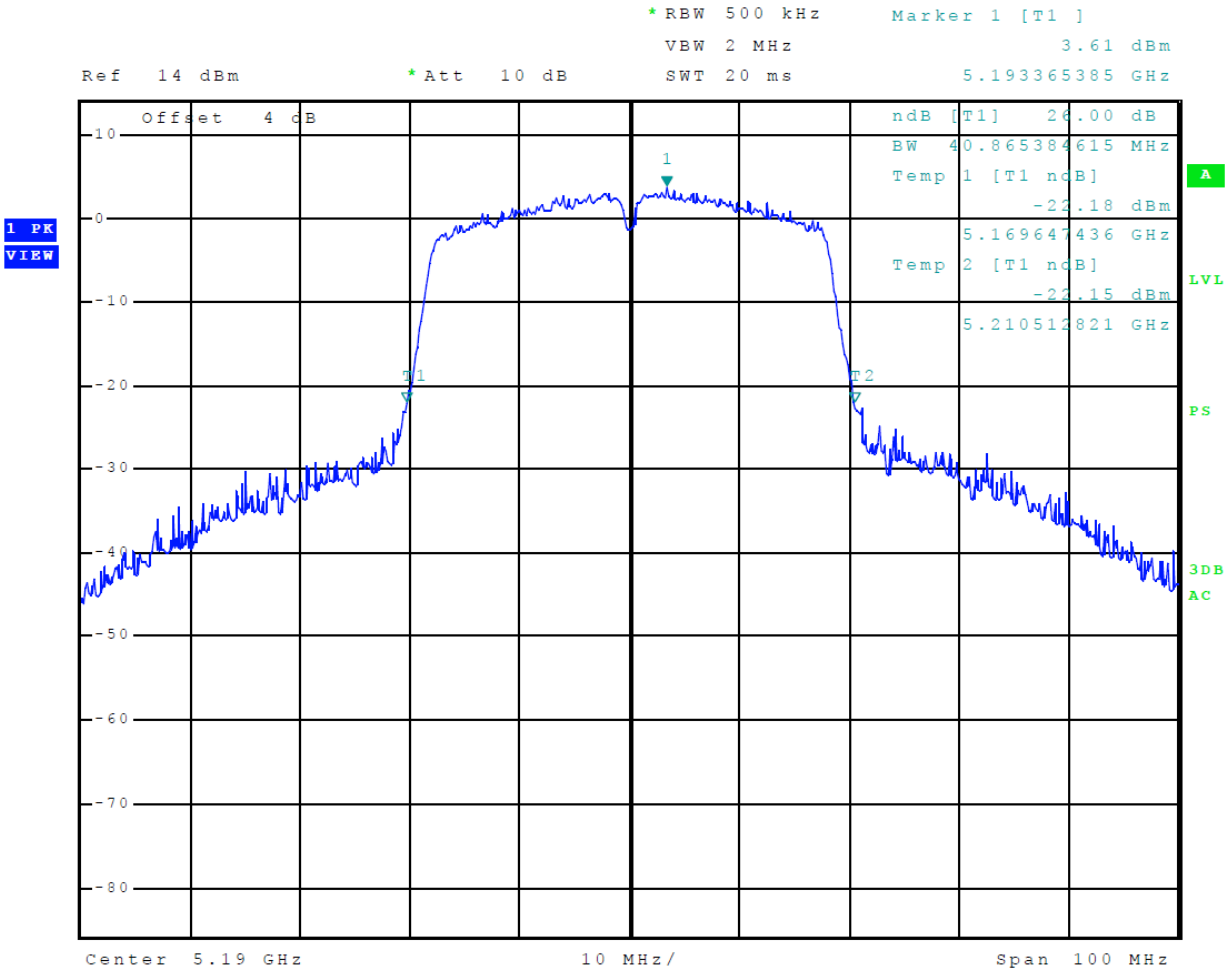


Figure 21 Plot of Transmitter 26-dB Occupied Bandwidth (5150-5250 MHz Mode 11 (802.11n40)

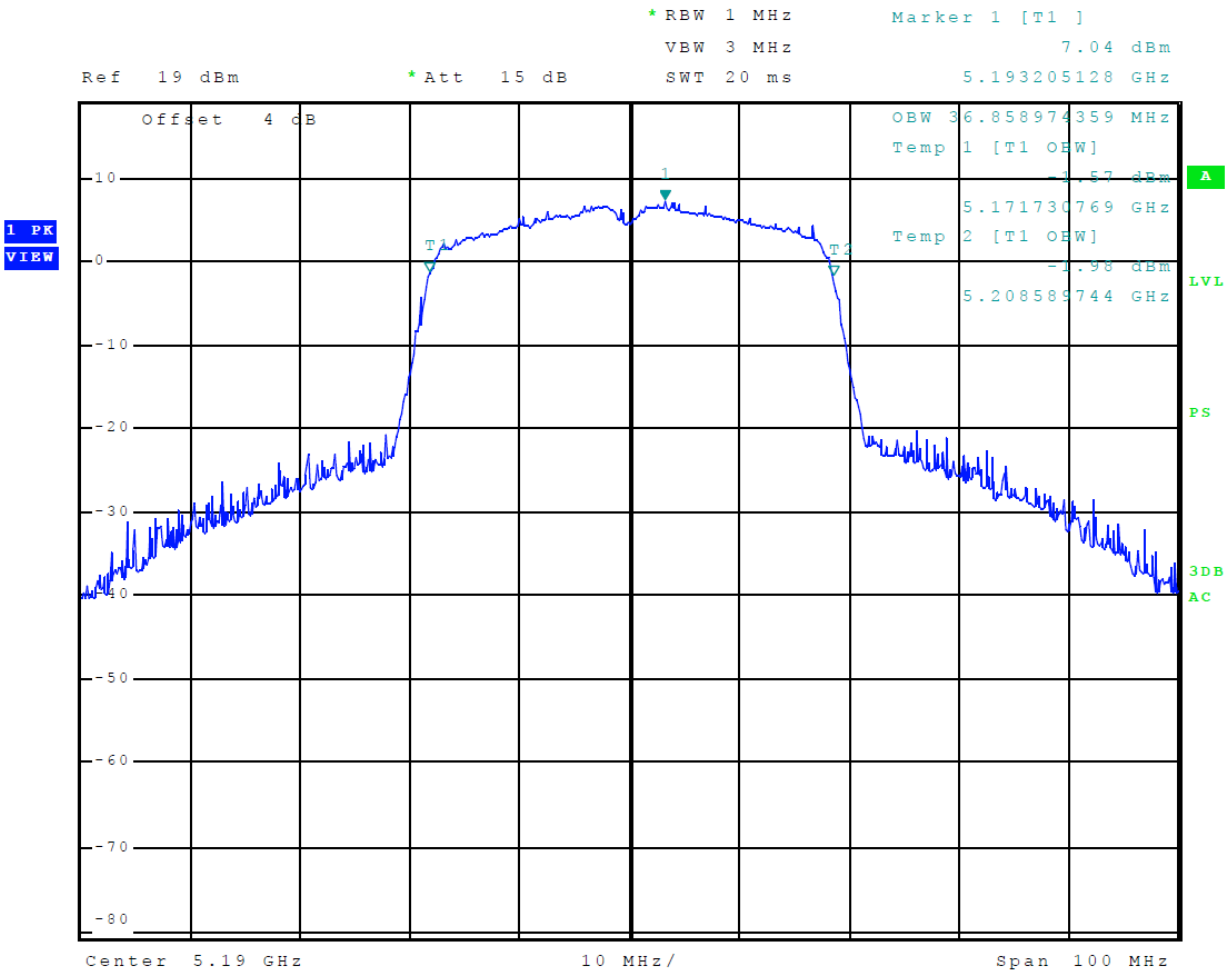


Figure 22 Plot of Transmitter 99% Occupied Bandwidth (5150-5250 MHz Mode 11 (802.11n40)

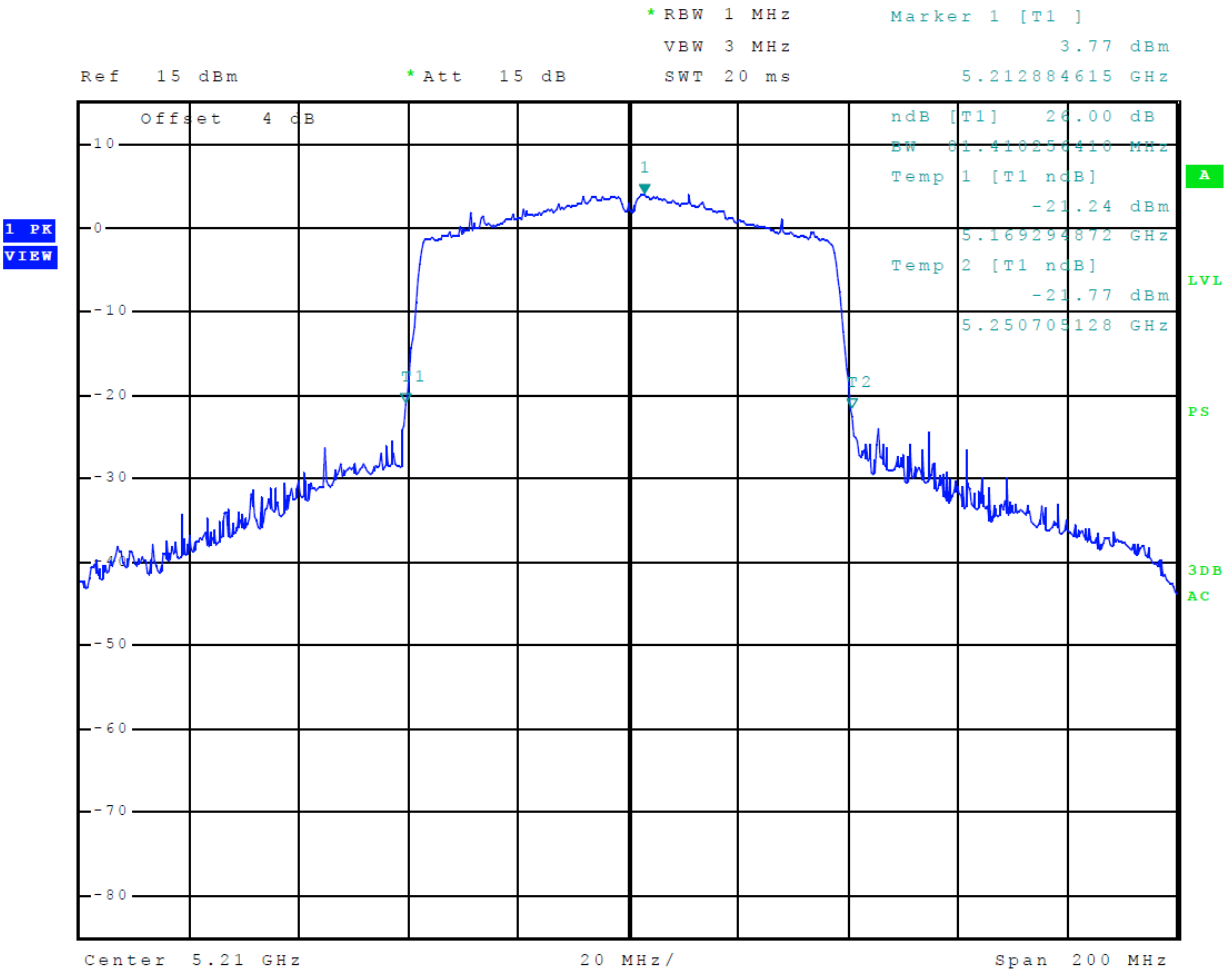


Figure 23 Plot of Transmitter 26-dB Occupied Bandwidth (5150-5250 MHz Mode 12 (802.11ac)

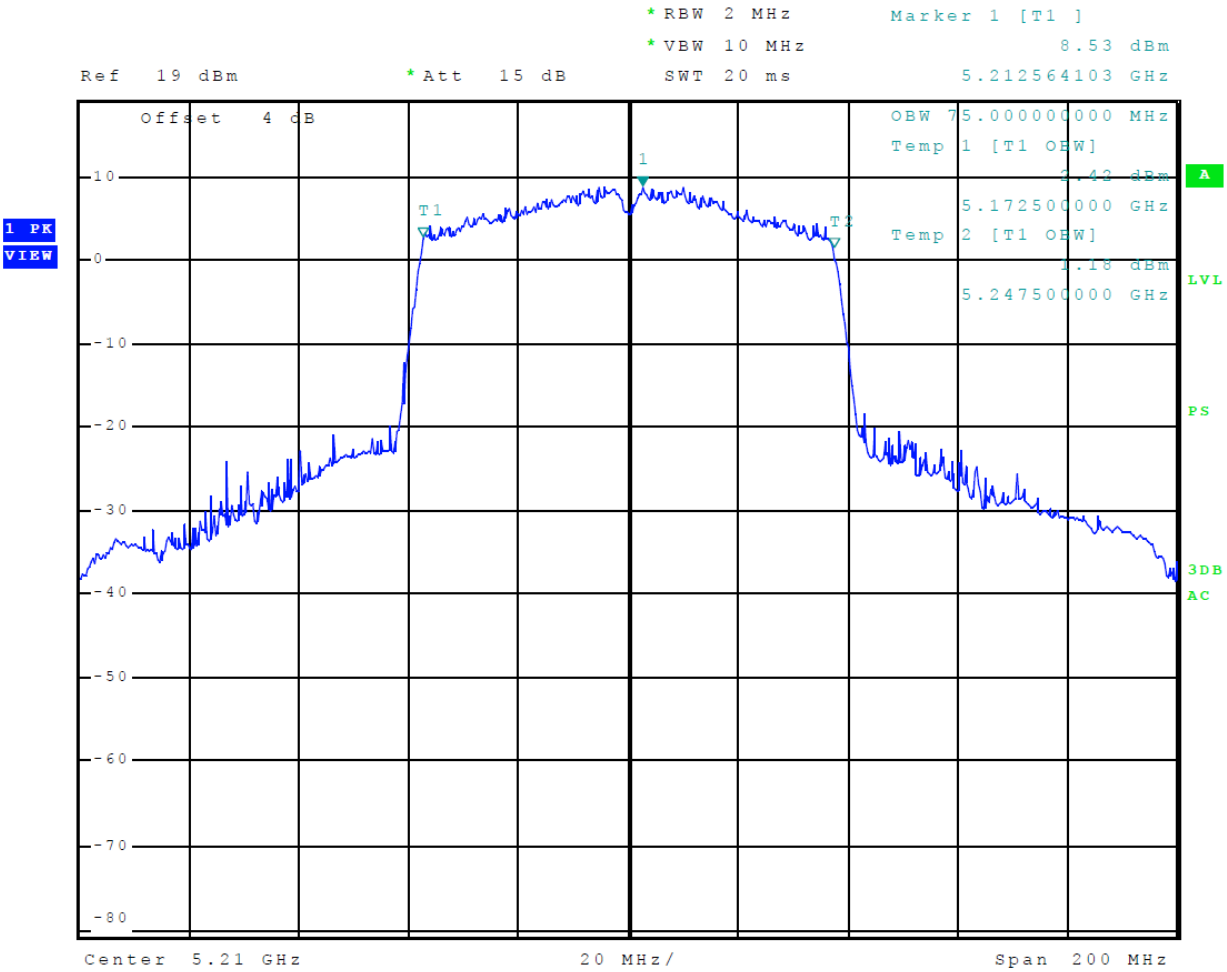


Figure 24 Plot of Transmitter 99% Occupied Bandwidth (5150-5250 MHz Mode 12 (802.11ac)

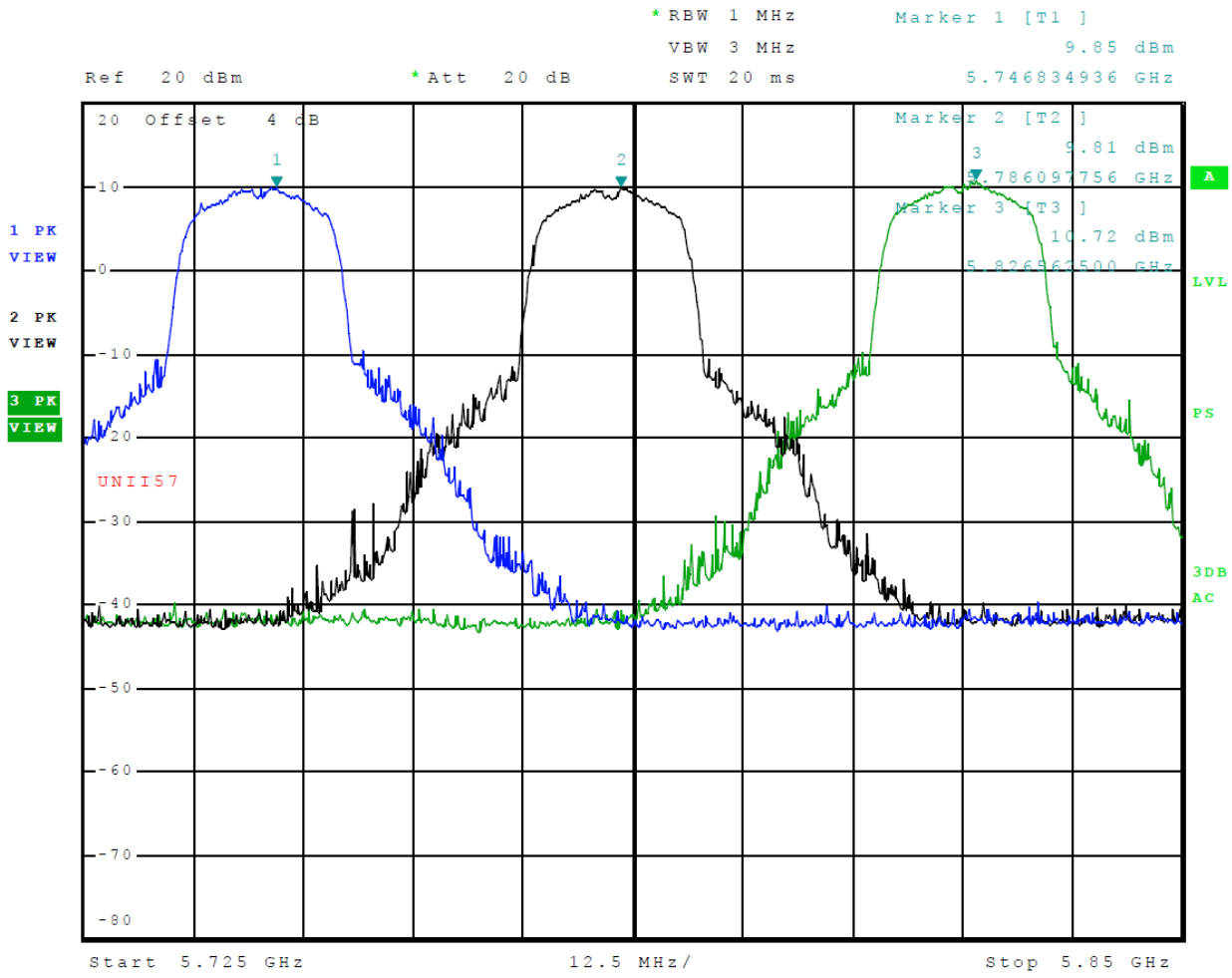


Figure 25 Plot of Transmitter Emissions (Across 5725-5850 MHz Band, Mode 13 (802.11a)

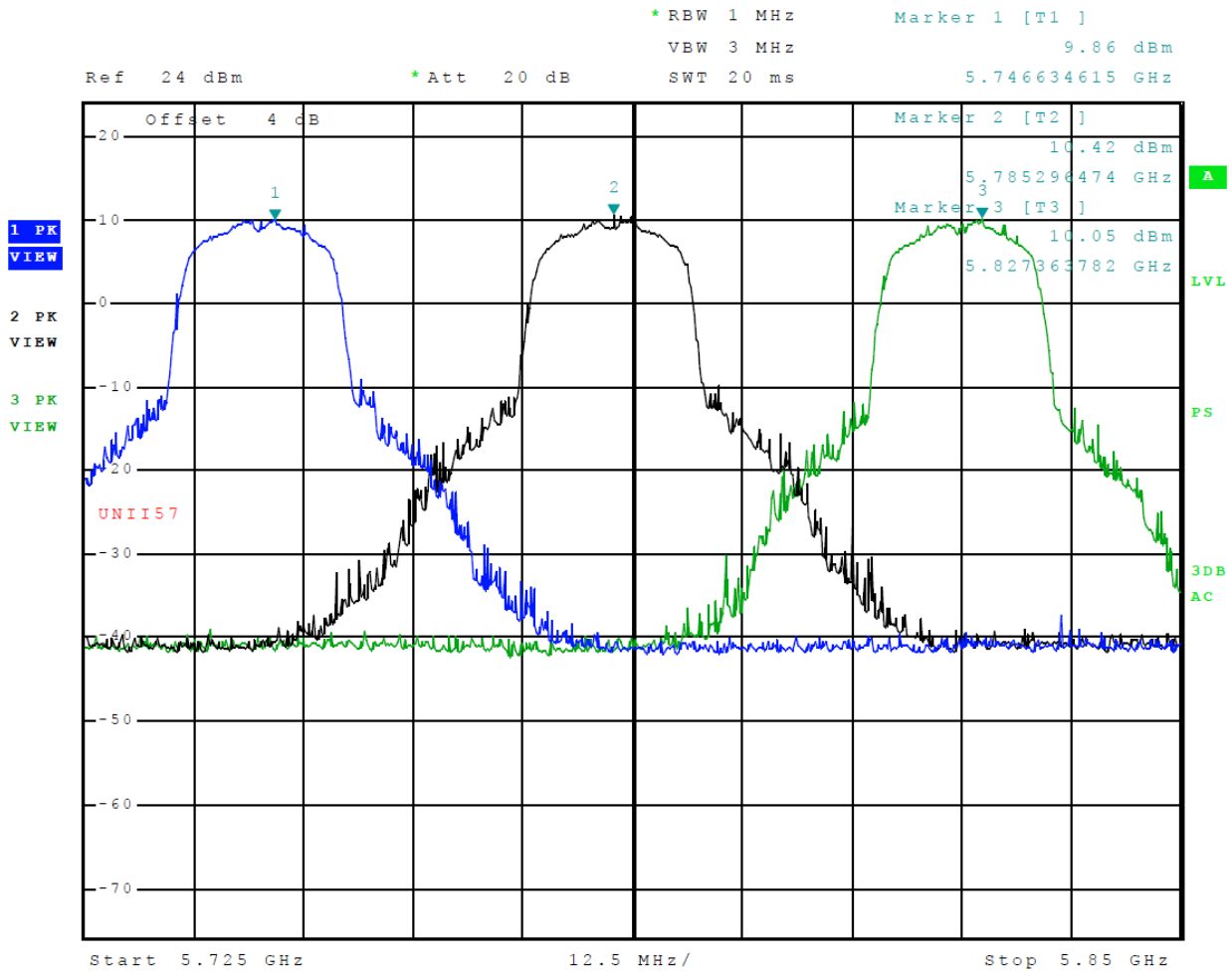


Figure 26 Plot of Transmitter Emissions (Across 5725-5850 MHz Band, Mode 14 (802.11n)

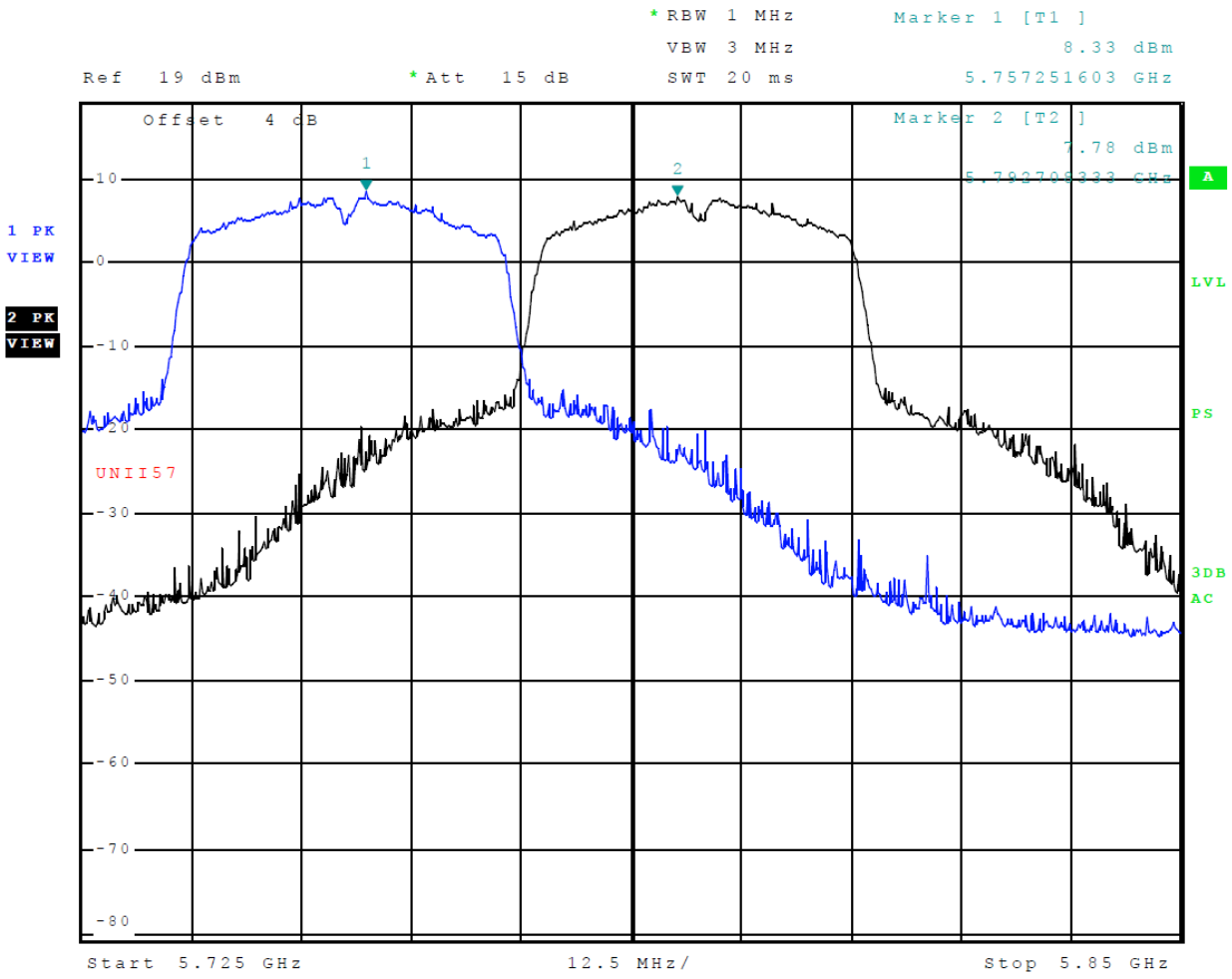


Figure 27 Plot of Transmitter Emissions (Across 5725-5850 MHz Band, Mode 15 (802.11n40)

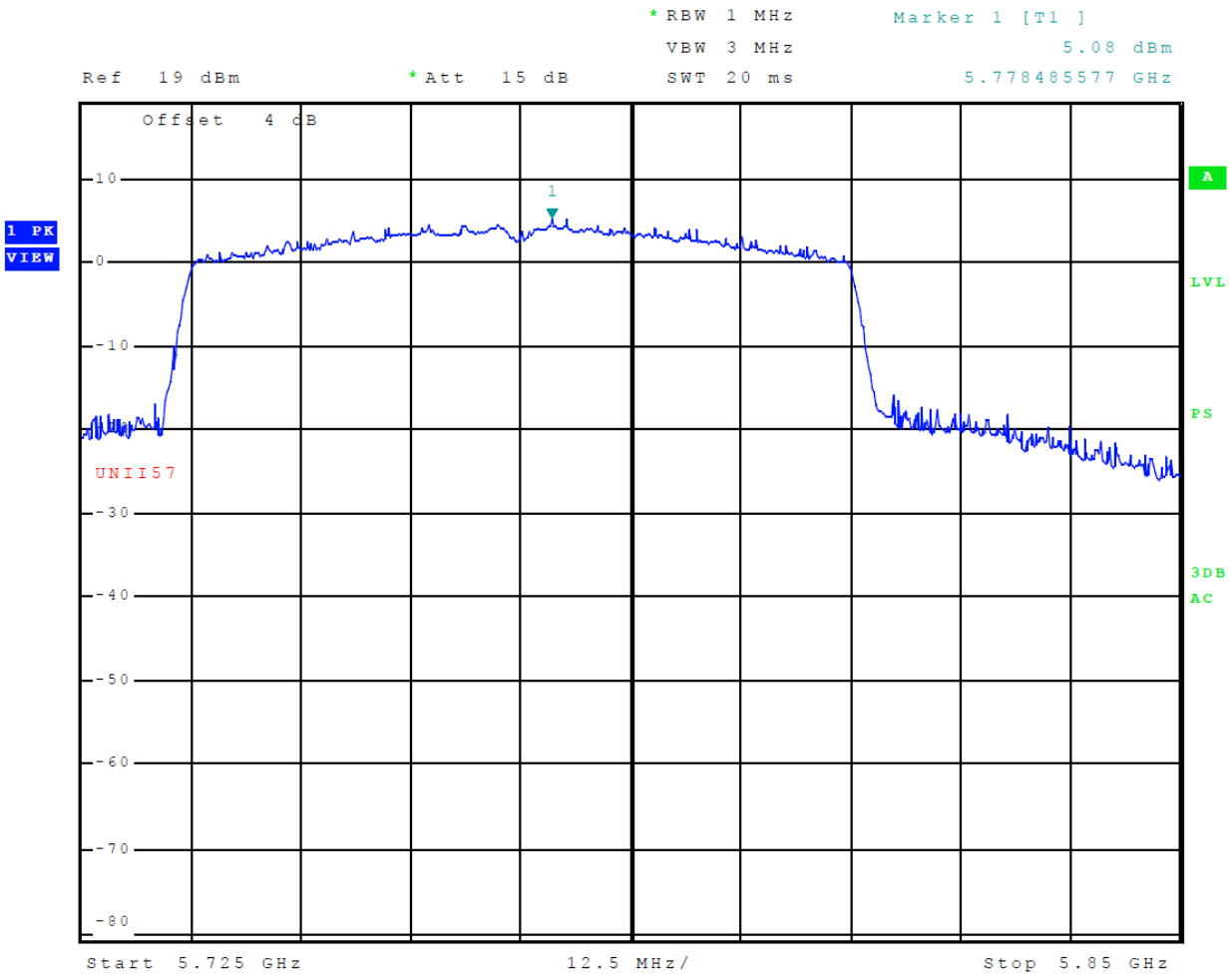


Figure 28 Plot of Transmitter Emissions (Across 5725-5850 MHz Band, Mode 16 (802.11ac)

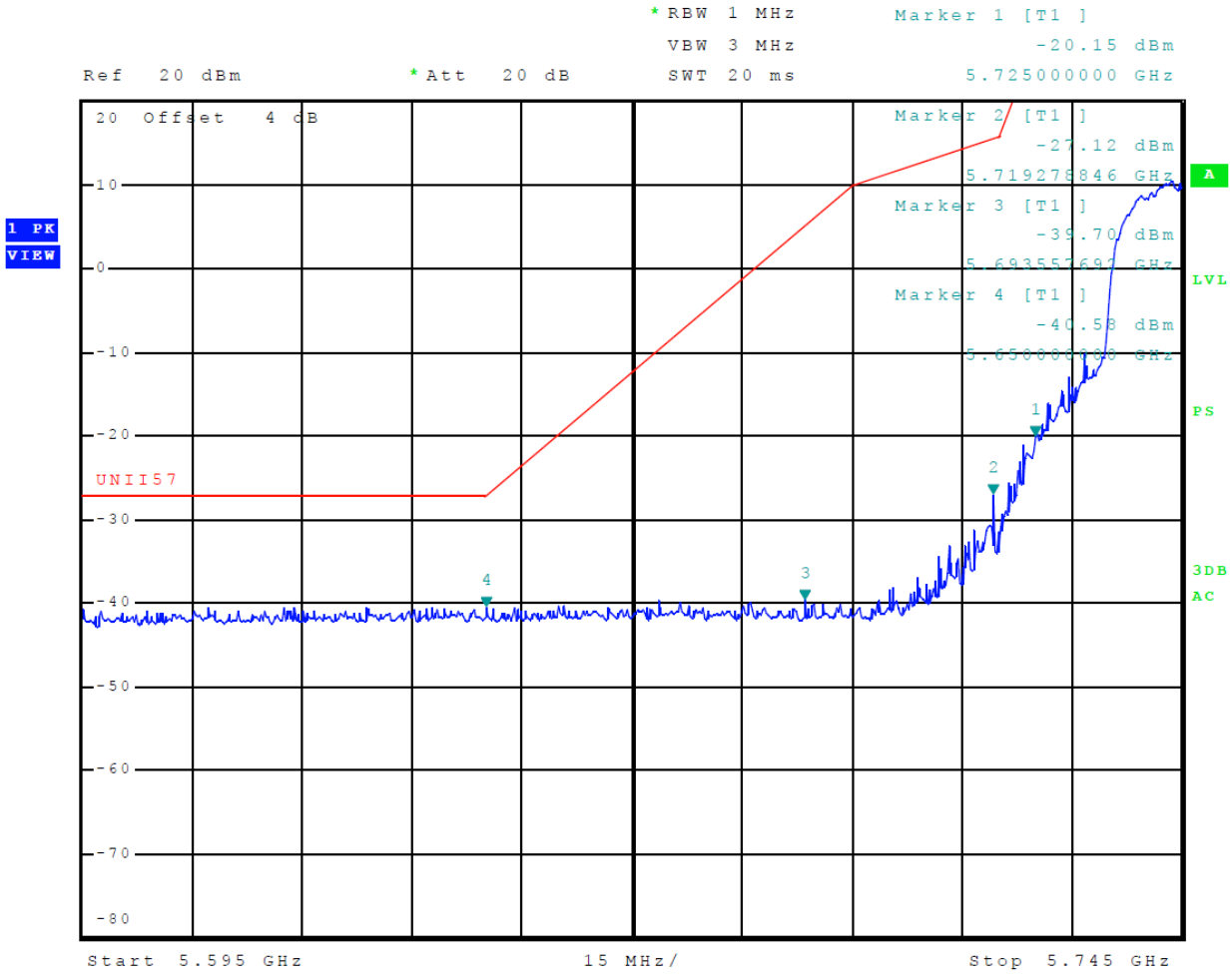


Figure 29 Plot of Lower Band Edge (Across 5725-5850 MHz Band, Mode 13 (802.11a)

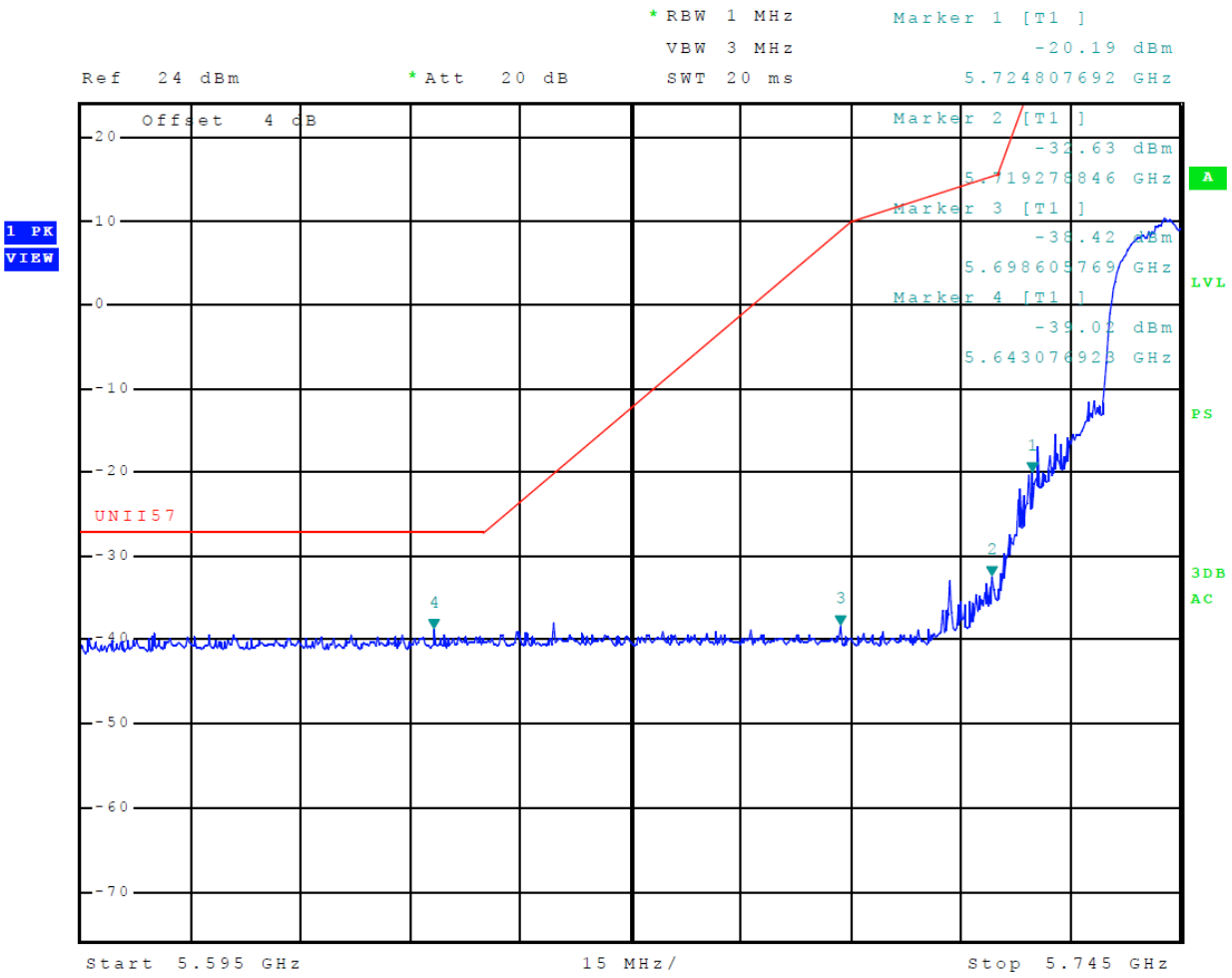


Figure 30 Plot of Lower Band Edge (Across 5725-5850 MHz Band, Mode 14 (802.11n)

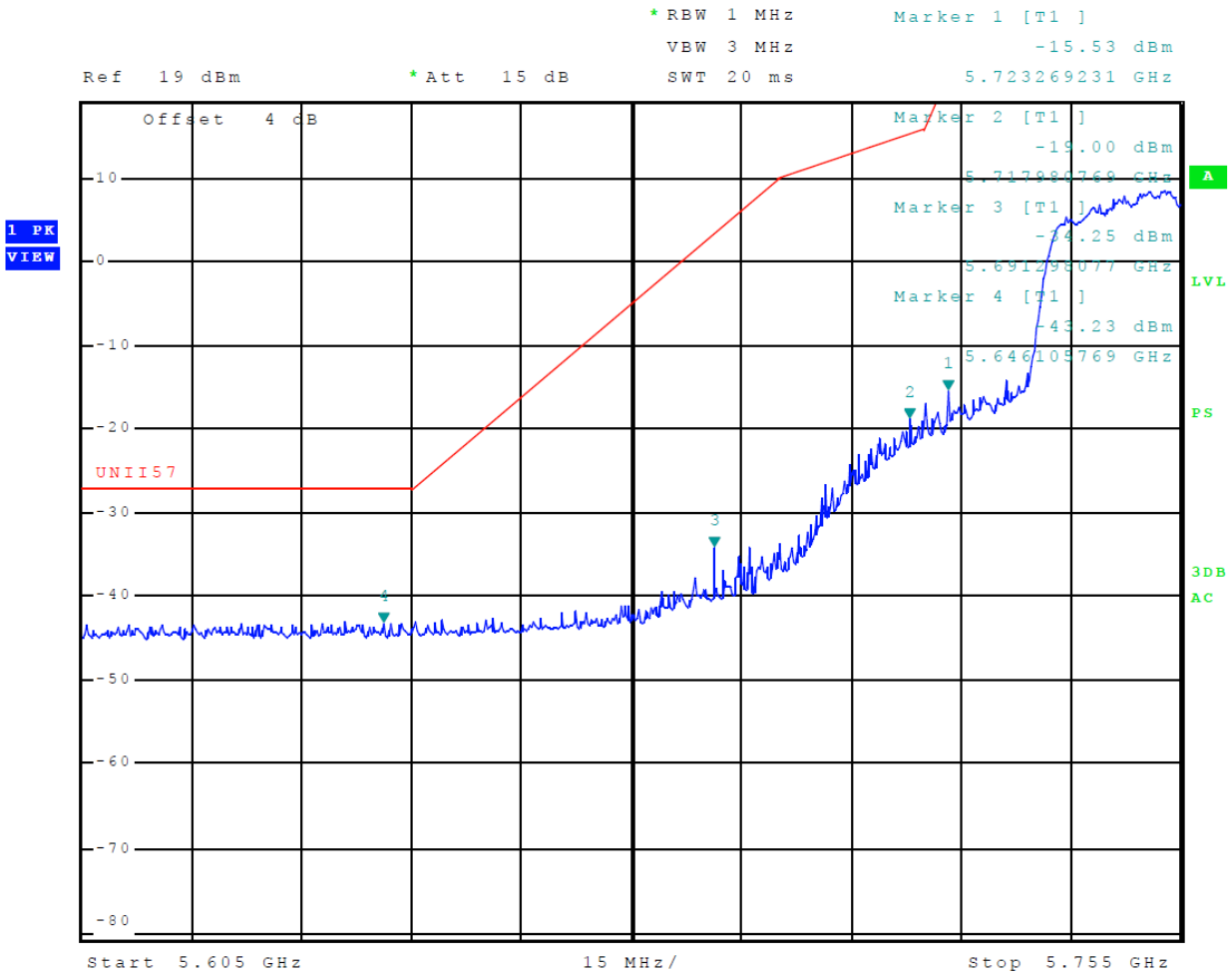


Figure 31 Plot of Lower Band Edge (Across 5725-5850 MHz Band, Mode 15 (802.11n40)

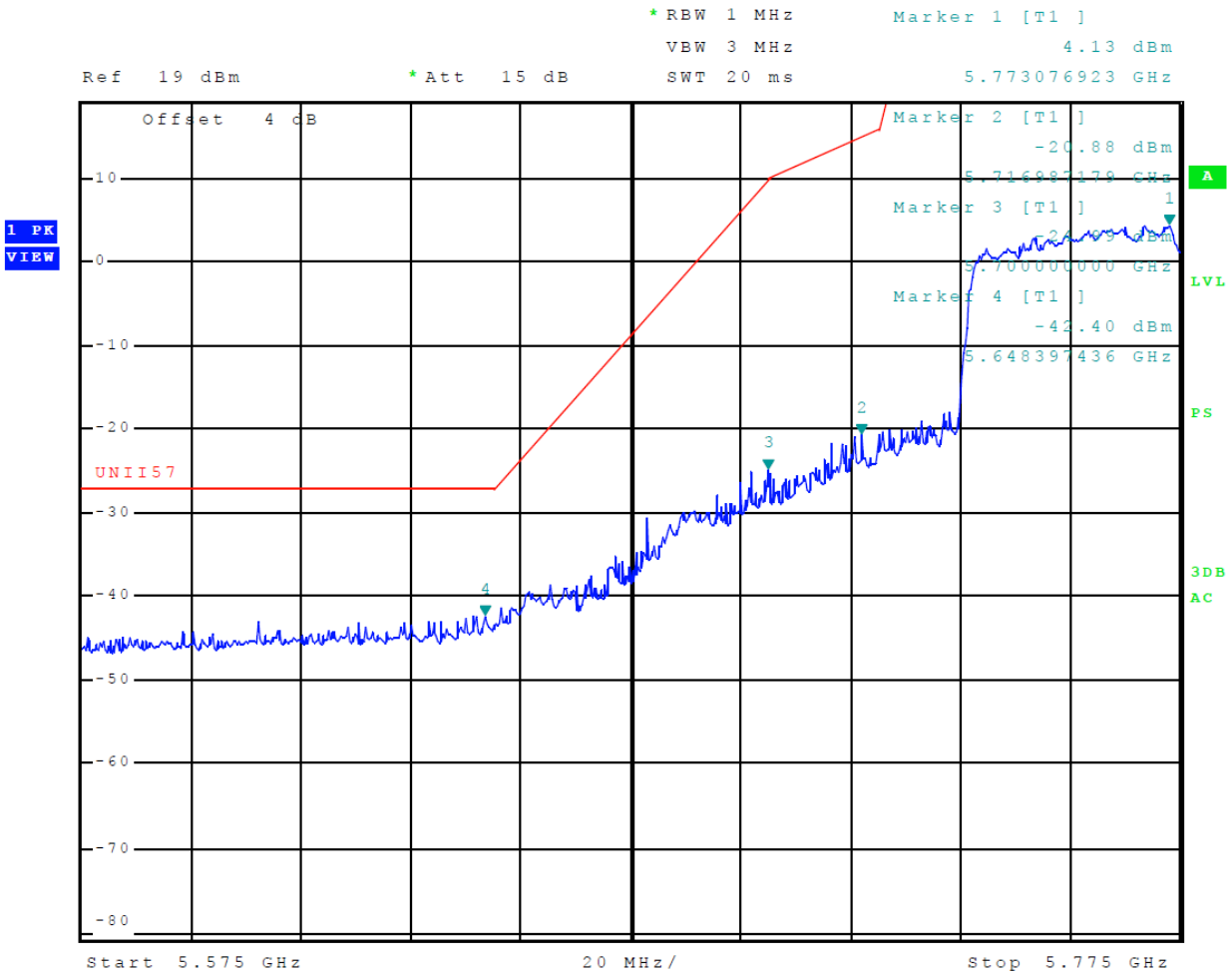


Figure 32 Plot of Lower Band Edge (Across 5725-5850 MHz Band, Mode 16 (802.11ac)

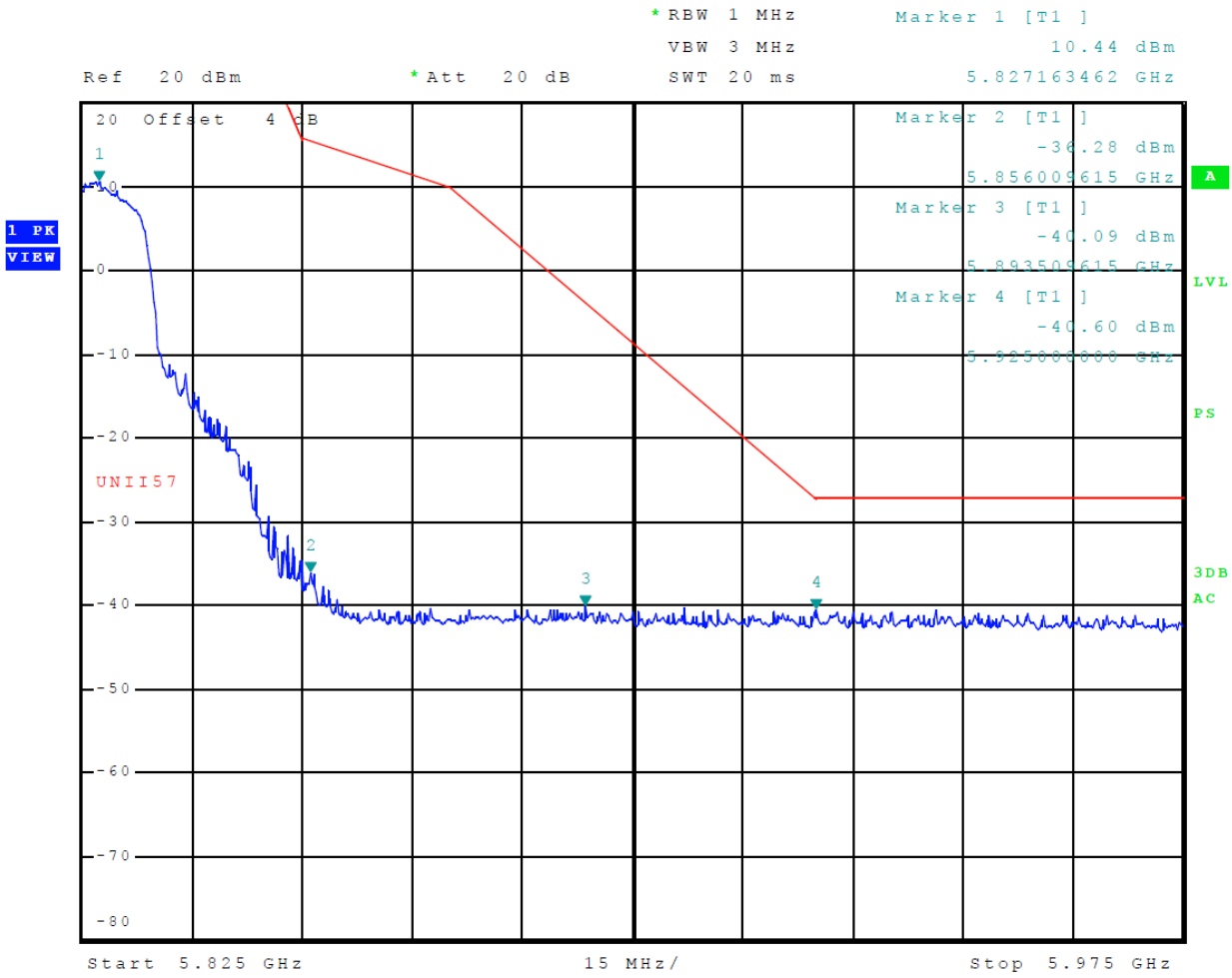


Figure 33 Plot of Upper Band Edge (Across 5725-5850 MHz Band, Mode 13 (802.11a)

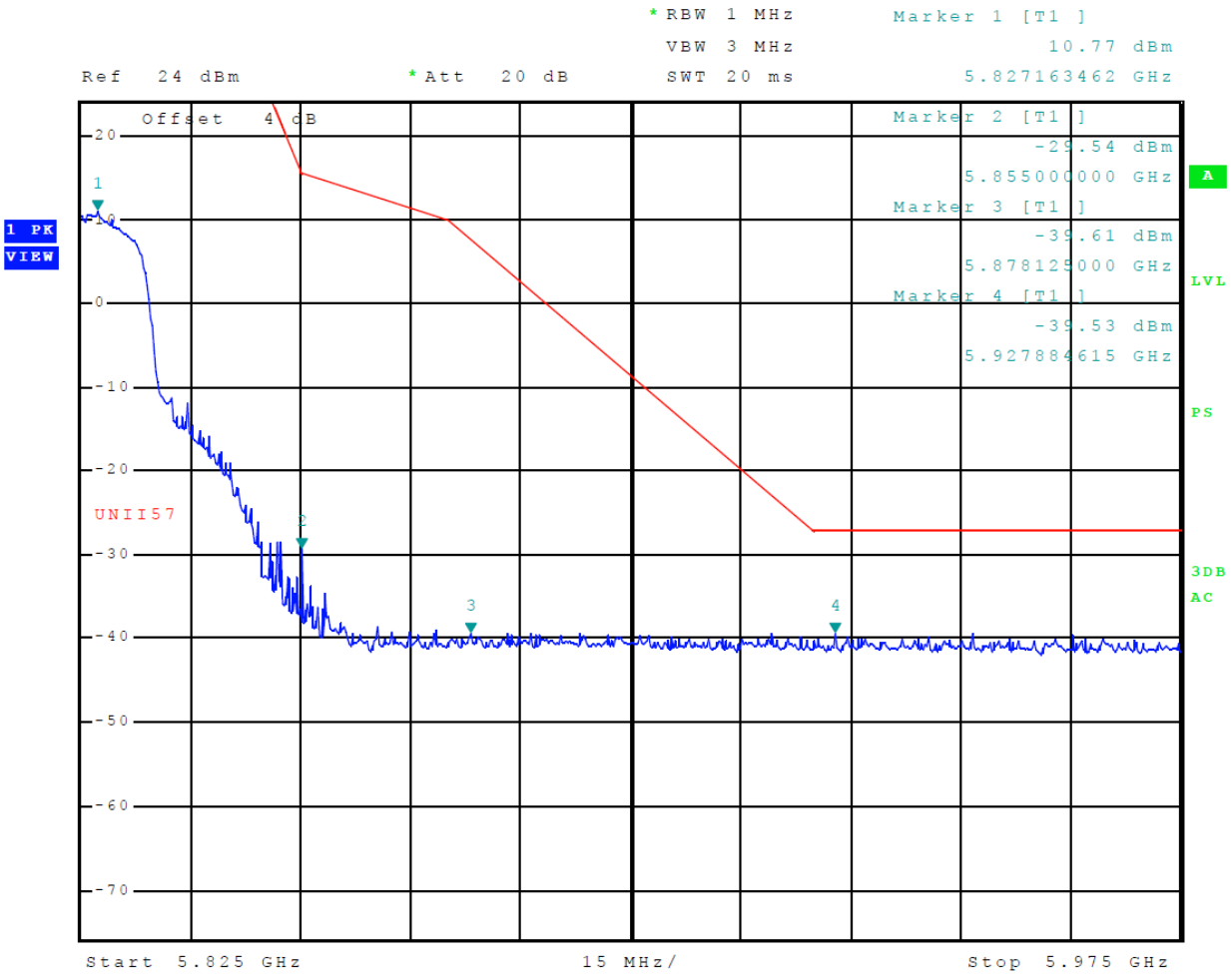


Figure 34 Plot of Upper Band Edge (Across 5725-5850 MHz Band, Mode 14 (802.11n)

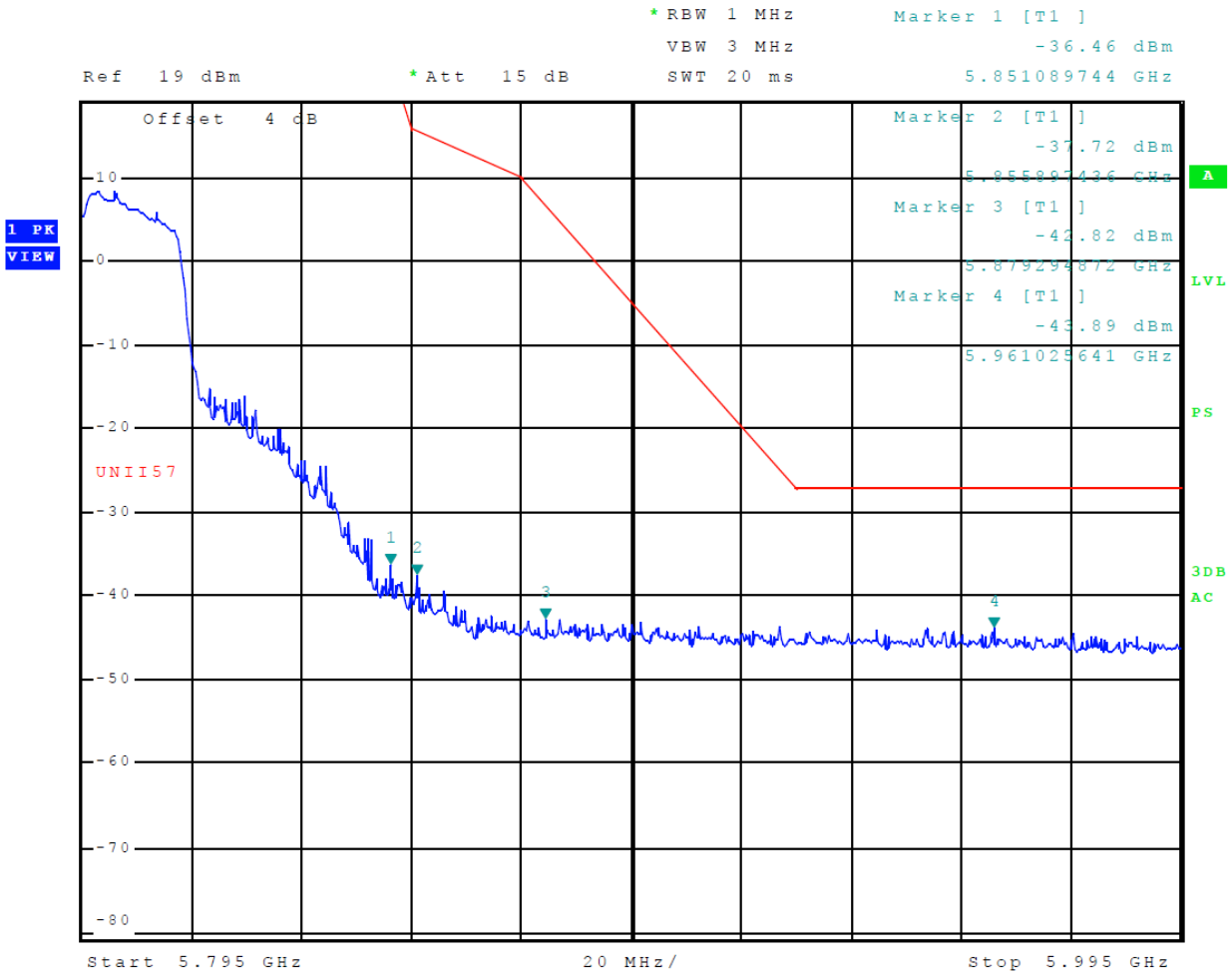


Figure 35 Plot of Upper Band Edge (Across 5725-5850 MHz Band, Mode 15 (802.11n40)

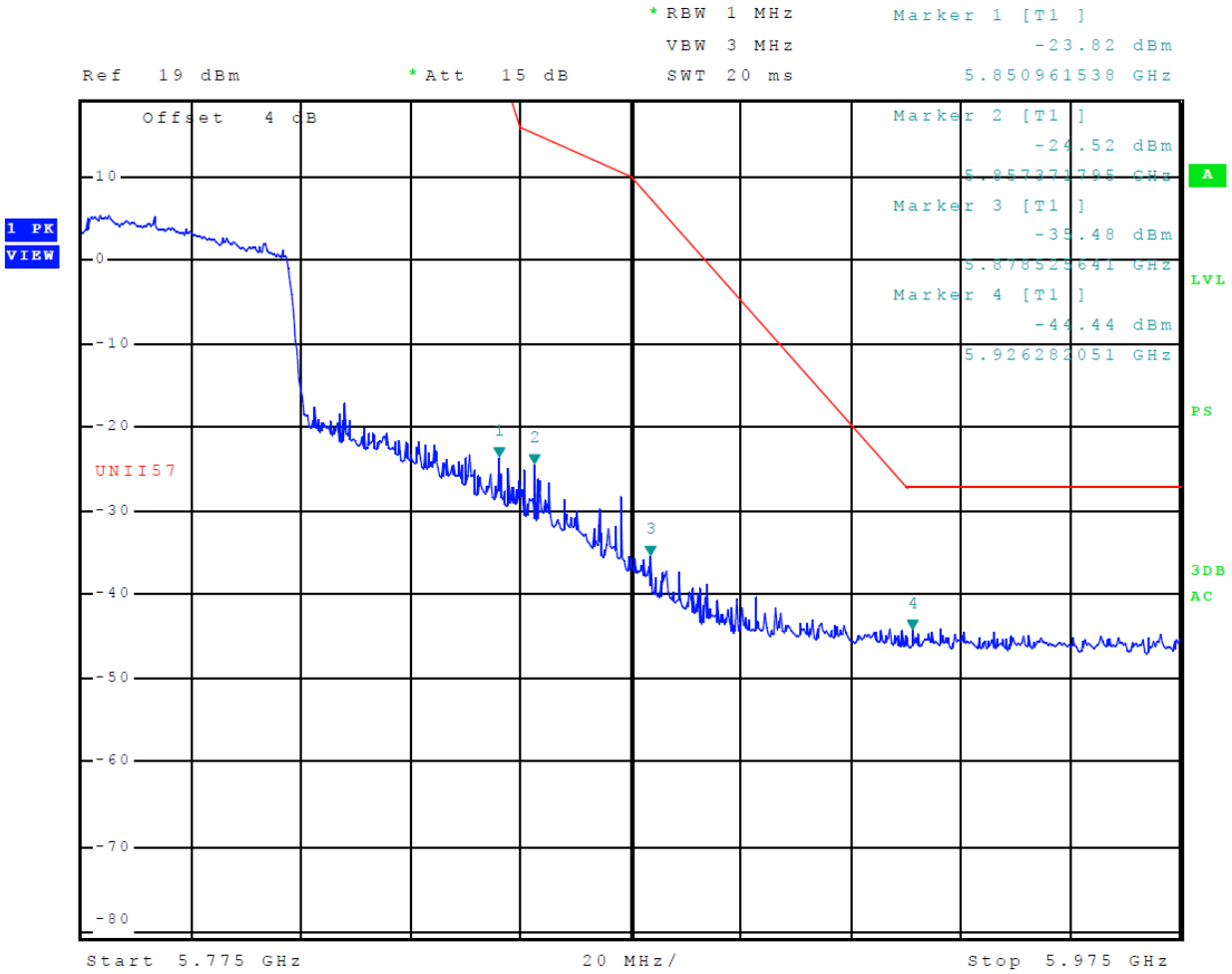


Figure 36 Plot of Upper Band Edge (Across 5725-5850 MHz Band, Mode 16 (802.11ac)

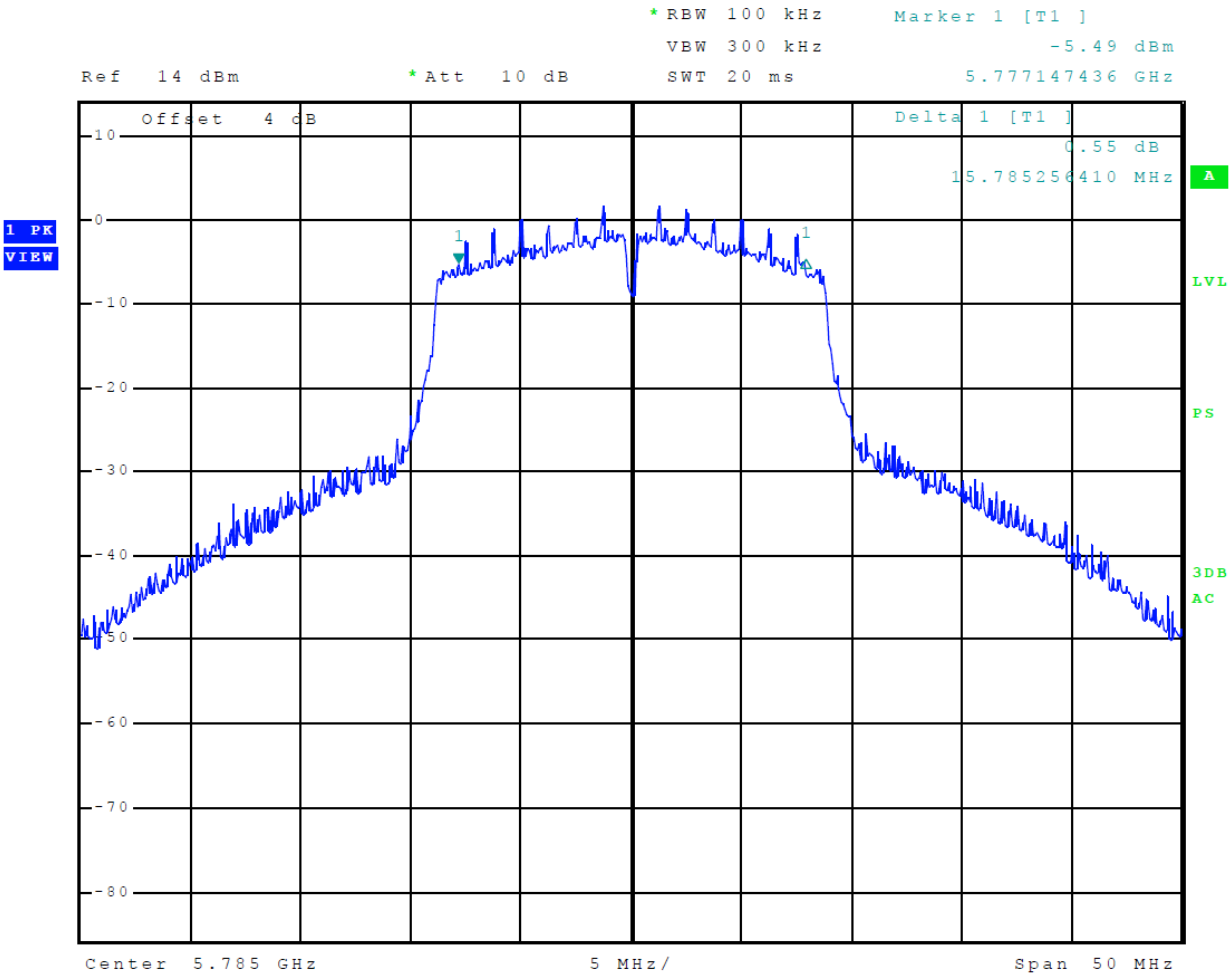


Figure 37 Plot of Transmitter 6-dB Occupied Bandwidth (5725-5850 MHz Mode 13 (802.11a)

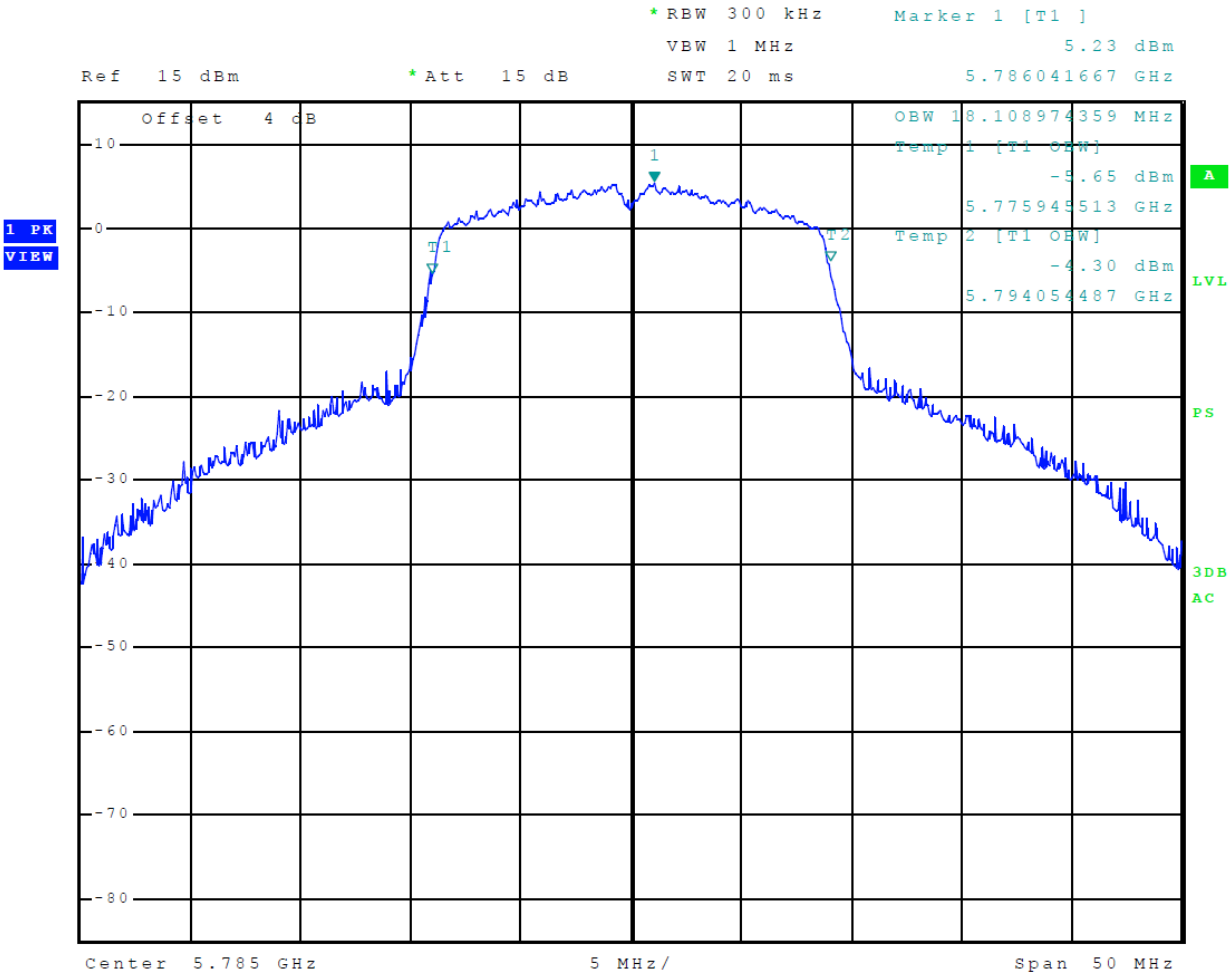


Figure 38 Plot of Transmitter 99% Occupied Bandwidth (5725-5850 MHz Mode 13 (802.11a)

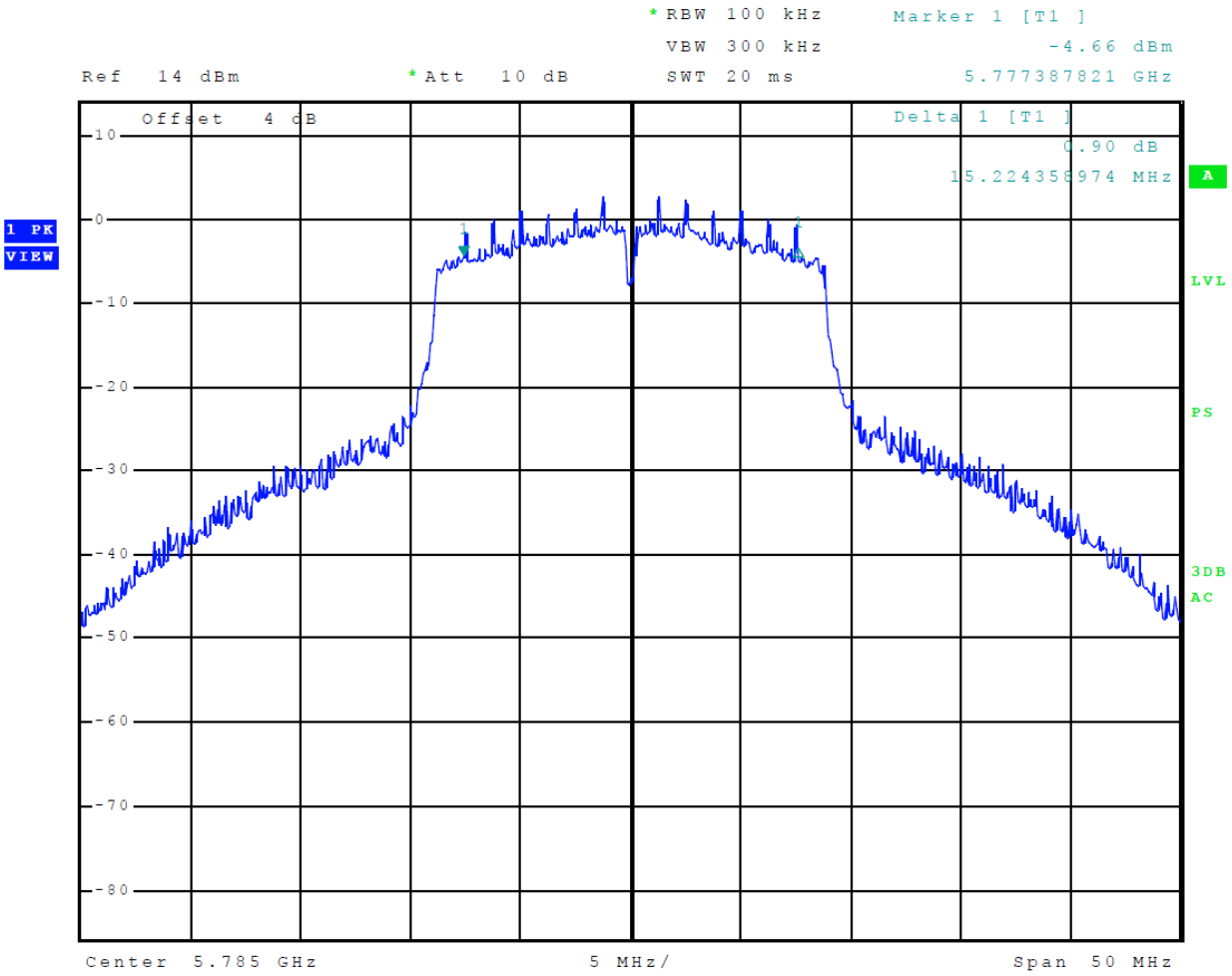


Figure 39 Plot of Transmitter 6-dB Occupied Bandwidth (5725-5850 MHz Mode 14 (802.11n)

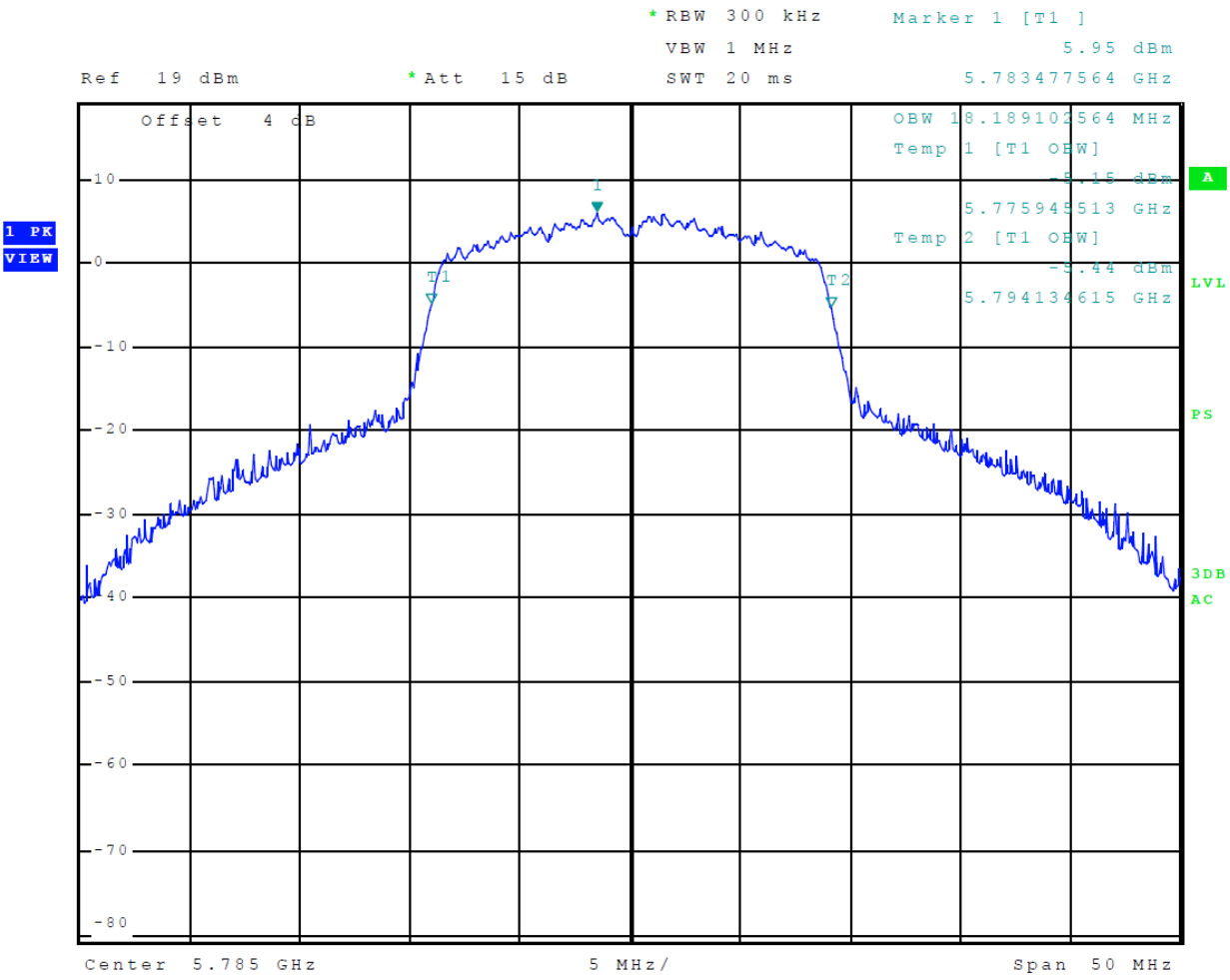


Figure 40 Plot of Transmitter 99% Occupied Bandwidth (5725-5850 MHz Mode 14 (802.11n)

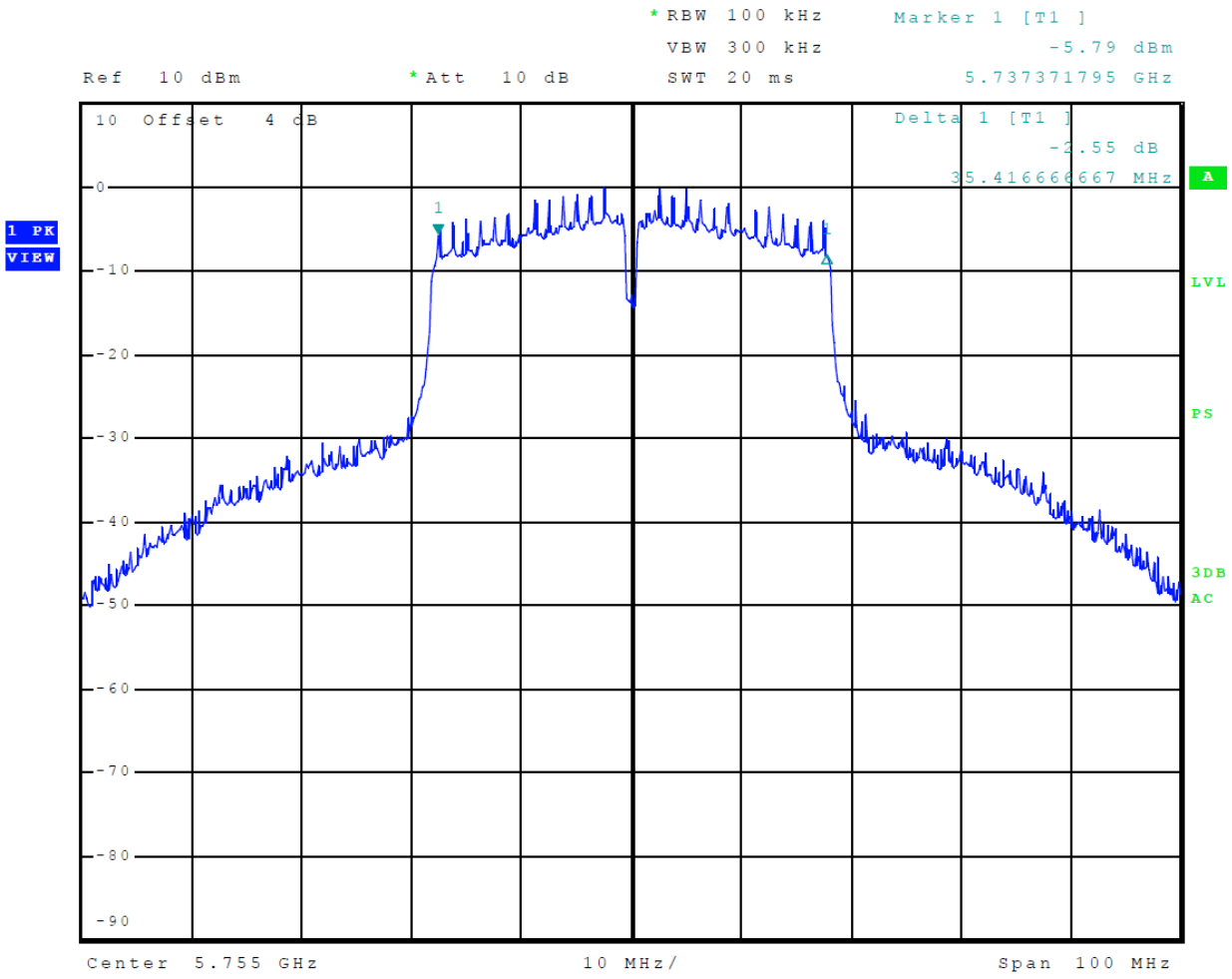


Figure 41 Plot of Transmitter 6-dB Occupied Bandwidth (5725-5850 MHz Mode 15 (802.11n40)

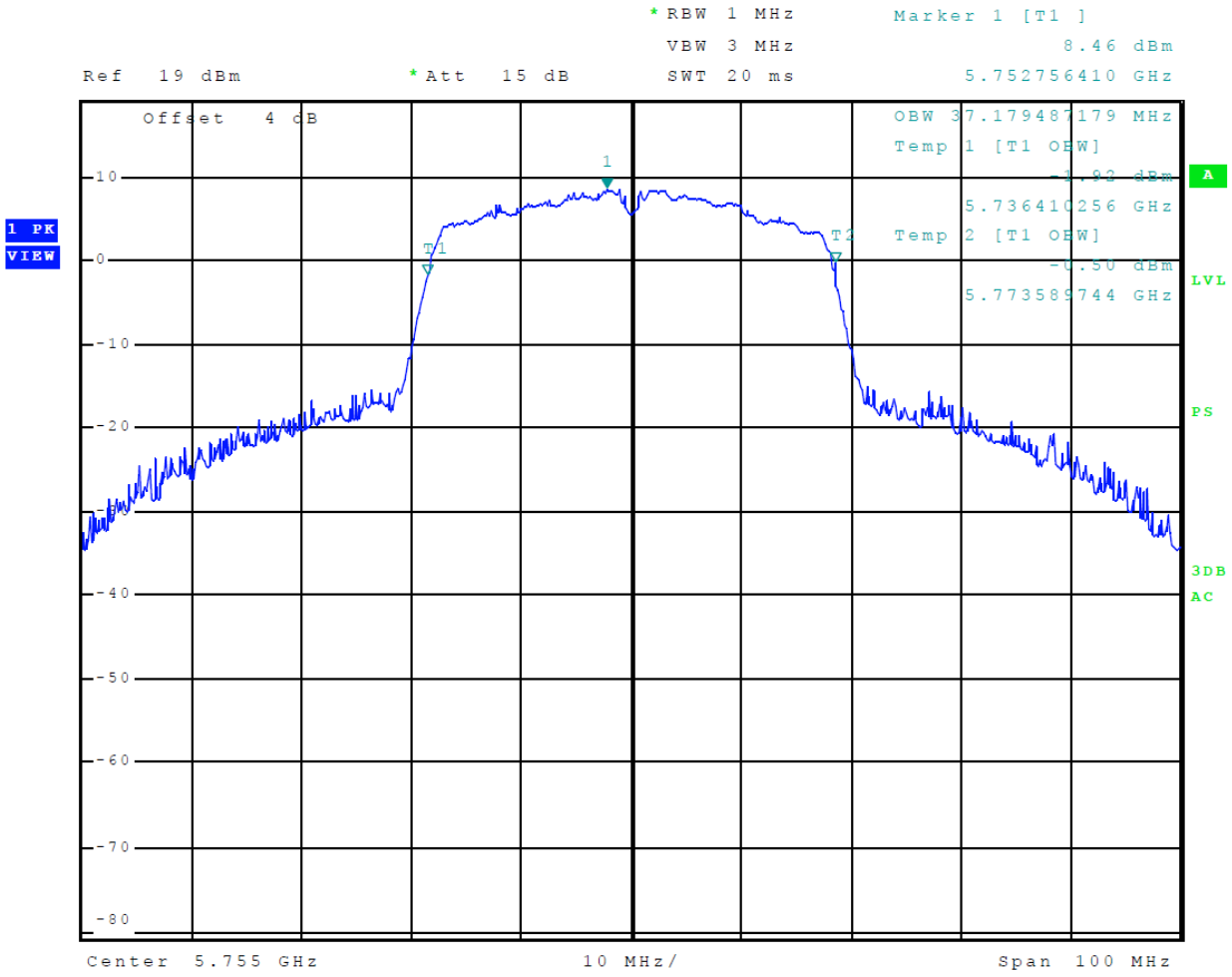


Figure 42 Plot of Transmitter 99% Occupied Bandwidth (5725-5850 MHz Mode 15 (802.11n40)

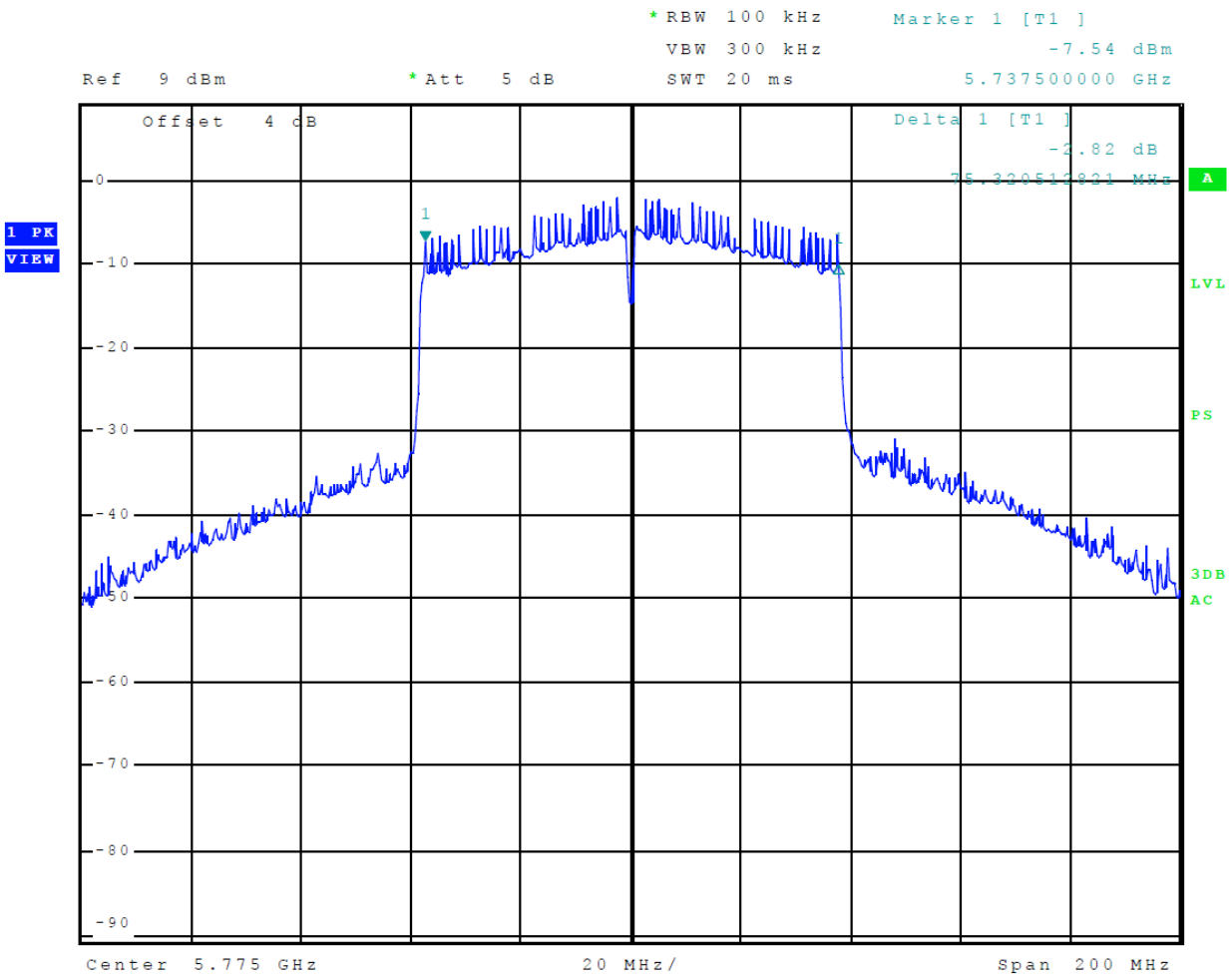


Figure 43 Plot of Transmitter 6-dB Occupied Bandwidth (5725-5850 MHz Mode 16 (802.11ac)

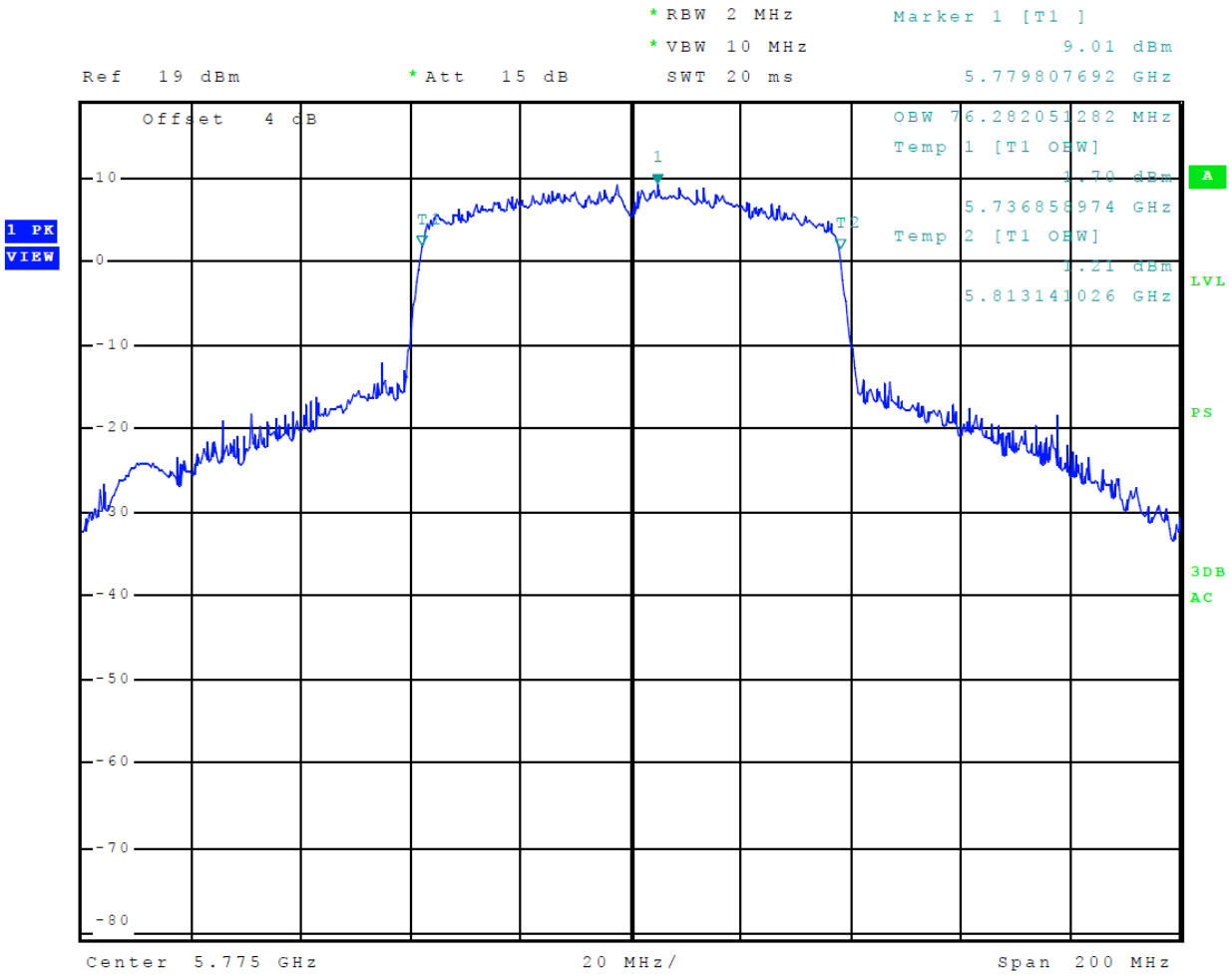


Figure 44 Plot of Transmitter 99% Occupied Bandwidth (5725-5850 MHz Mode 16 (802.11ac)

Transmitter Emissions Data

Table 14 Transmitter Radiated Emission 5150-5250 MHz Band, Mode 9 (802.11a)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
20 MHz Channel							
5180.0	--	--	--	--	--	--	--
10360.0	56.2	43.2	56.4	43.1	68.3	-25.1	-25.2
15540.0	62.0	48.8	61.5	48.8	68.3	-19.5	-19.5
20720.0	63.4	50.4	64.5	50.5	68.3	-17.9	-17.8
25900.0	66.8	53.7	66.7	53.8	68.3	-14.6	-14.5
5200.0	--	--	--	--	--	--	--
10400.0	56.4	43.2	56.6	43.6	68.3	-25.1	-24.7
15600.0	62.7	48.5	62.6	49.1	68.3	-19.8	-19.2
20800.0	63.5	50.9	64.0	50.9	68.3	-17.4	-17.4
26000.0	66.3	53.8	66.7	53.8	68.3	-14.5	-14.5
5240.0	--	--	--	--	--	--	--
10480.0	57.6	44.1	56.9	44.3	68.3	-24.2	-24.0
15720.0	63.3	50.3	63.2	50.0	68.3	-18.0	-18.3
20960.0	64.2	50.9	63.7	51.0	68.3	-17.4	-17.3
26200.0	66.7	53.6	66.3	53.5	68.3	-14.7	-14.8
Band Edges							
5150.0	60.2	42.5	65.7	46.5	54.0	-11.5	-7.5
5350.0	56.1	43.0	60.5	47.1	54.0	-11.0	-6.9

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 15 Transmitter Radiated Emission 5150-5250 MHz Band, Mode 10 (802.11n)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
20 MHz Channel							
5180.0	--	--	--	--	--	--	--
10360.0	56.3	43.3	56.5	43.2	68.3	-25.0	-25.1
15540.0	62.2	49.0	61.7	49.0	68.3	-19.4	-19.4
20720.0	63.5	50.5	64.6	50.6	68.3	-17.8	-17.7
25900.0	67.0	53.9	66.9	54.0	68.3	-14.4	-14.3
5200.0	--	--	--	--	--	--	--
10400.0	56.5	43.3	56.7	43.7	68.3	-25.0	-24.6
15600.0	62.9	48.7	62.8	49.3	68.3	-19.7	-19.1
20800.0	63.6	51.0	64.1	51.0	68.3	-17.3	-17.3
26000.0	66.5	54.0	66.9	54.0	68.3	-14.3	-14.3
5240.0	--	--	--	--	--	--	--
10480.0	57.7	44.2	57.0	44.4	68.3	-24.1	-23.9
15720.0	63.5	50.5	63.4	50.2	68.3	-17.9	-18.2
20960.0	64.3	51.0	63.8	51.1	68.3	-17.3	-17.2
26200.0	66.9	53.8	66.5	53.7	68.3	-14.5	-14.6
Band Edges							
5150.0	60.7	42.3	63.9	44.0	54.0	-11.7	-10.0
5350.0	53.5	41.0	54.3	41.3	54.0	-13.0	-12.7

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 16 Transmitter Radiated Emission 5150-5250 MHz Band, Mode 11 (802.11n40)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
40 MHz Channel							
5190.0	--	--	--	--	--	--	--
10380.0	56.7	43.8	56.9	44.1	68.3	-24.5	-24.2
15570.0	62.6	49.9	63.3	50.1	68.3	-18.4	-18.2
20760.0	62.7	49.7	63.1	49.9	68.3	-18.6	-18.4
25950.0	66.4	53.2	66.9	53.2	68.3	-15.1	-15.1
5230.0	--	--	--	--	--	--	--
10460.0	57.9	44.7	57.4	44.8	68.3	-23.6	-23.5
15690.0	63.4	49.7	63.0	49.7	68.3	-18.6	-18.6
20920.0	63.1	50.3	63.7	50.2	68.3	-18.0	-18.1
26150.0	65.6	52.6	65.5	52.5	68.3	-15.7	-15.8
Band Edges							
5150.0	65.2	48.5	71.7	51.6	54.0	-5.5	-2.4
5350.0	56.1	43.1	60.5	47.1	54.0	-10.9	-6.9

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 17 Transmitter Radiated Emission 5150-5250 MHz Band, Mode 12 (802.11ac)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
80 MHz Channel							
5210.0	--	--	--	--	--	--	--
10420.0	57.8	45.0	58.2	45.1	68.3	-23.3	-23.2
15630.0	62.4	48.8	61.9	48.9	68.3	-19.5	-19.4
20840.0	63.4	50.2	64.0	50.3	68.3	-18.1	-18.0
26050.0	66.1	53.0	66.2	53.0	68.3	-15.3	-15.3
Band Edges							
5150.0	65.7	48.4	70.3	52.1	54.0	-5.6	-1.9
5350.0	60.0	46.9	60.2	47.1	54.0	-7.1	-6.9

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 18 Transmitter Radiated Emission 5725-5850 MHz Band, Mode 13 (802.11a)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
20 MHz Channel							
5745.0	--	--	--	--	--	--	--
11490.0	57.7	44.6	58.0	44.5	68.3	-23.7	-23.8
17235.0	62.9	49.9	62.8	49.8	68.3	-18.4	-18.5
22980.0	64.2	51.3	64.5	50.7	68.3	-17.0	-17.6
28725.0	67.9	55.1	68.8	55.1	68.3	-13.2	-13.2
5785.0	--	--	--	--	--	--	--
11570.0	57.3	44.6	57.6	44.6	68.3	-23.7	-23.7
17355.0	63.3	50.0	63.0	49.9	68.3	-18.3	-18.4
23140.0	64.7	51.3	64.8	51.1	68.3	-17.0	-17.2
28925.0	68.7	55.0	68.8	55.2	68.3	-13.3	-13.1
5825.0	--	--	--	--	--	--	--
11650.0	58.0	44.7	57.4	44.6	68.3	-23.6	-23.7
17475.0	63.9	50.7	64.1	50.7	68.3	-17.6	-17.6
23300.0	64.2	51.4	64.7	51.2	68.3	-16.9	-17.1
29125.0	69.1	55.4	68.7	55.4	68.3	-12.9	-12.9
Band Edges							
5725.0	71.2	47.9	74.3	51.7	78.2	-30.3	-26.5
5850.0	59.4	42.1	65.9	46.1	78.2	-36.1	-32.1

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 19 Transmitter Radiated Emission 5725-5850 MHz Band, Mode 14 (802.11n)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
20 MHz Channel							
5745.0	--	--	--	--	--	--	--
11490.0	57.8	44.7	58.1	44.6	68.3	-23.6	-23.7
17235.0	63.1	50.1	63.0	50.0	68.3	-18.3	-18.4
22980.0	64.3	51.4	64.6	50.8	68.3	-16.9	-17.5
28725.0	68.1	55.3	69.0	55.3	68.3	-13.1	-13.1
5785.0	--	--	--	--	--	--	--
11570.0	57.4	44.7	57.7	44.7	68.3	-23.6	-23.6
17355.0	63.5	50.2	63.2	50.1	68.3	-18.2	-18.3
23140.0	65.8	52.4	65.9	52.2	68.3	-15.9	-16.1
28925.0	68.9	55.2	69.0	55.4	68.3	-13.2	-13.0
5825.0	--	--	--	--	--	--	--
11650.0	58.1	44.8	57.5	44.7	68.3	-23.5	-23.6
17475.0	64.1	50.9	64.3	50.9	68.3	-17.4	-17.4
23300.0	65.3	52.5	65.8	52.3	68.3	-15.8	-16.0
29125.0	69.3	55.6	68.9	55.6	68.3	-12.7	-12.7
Band Edges							
5725.0	72.9	50.6	69.7	47.6	78.2	-27.6	-30.6
5850.0	60.9	43.3	60.3	44.0	78.2	-34.9	-34.2

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 20 Transmitter Radiated Emission 5725-5850 MHz Band, Mode 15 (802.11n40)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
40 MHz Channel							
5755.0	--	--	--	--	--	--	--
11510.0	57.8	44.7	58.1	44.8	68.3	-23.6	-23.5
17265.0	63.8	50.6	63.6	50.7	68.3	-17.7	-17.6
23020.0	64.7	51.1	64.1	51.0	68.3	-17.2	-17.3
28775.0	68.4	55.3	69.0	55.3	68.3	-13.0	-13.0
5795.0	--	--	--	--	--	--	--
11590.0	57.7	44.9	57.6	44.9	68.3	-23.4	-23.4
17385.0	63.7	50.7	63.4	50.6	68.3	-17.6	-17.7
23180.0	65.1	52.1	65.2	52.0	68.3	-16.2	-16.3
28975.0	68.4	55.4	68.4	55.4	68.3	-12.9	-12.9
Band Edges							
5725.0	71.5	52.4	73.4	54.3	78.2	-25.8	-23.9
5850.0	57.7	43.6	62.4	44.6	78.2	-34.6	-33.6

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 21 Transmitter Radiated Emission 5725-5850 MHz Band, Mode 16 (802.11ac)

Frequency in MHz	Horizontal Peak (dBµV/m)	Horizontal Average (dBµV/m)	Vertical Peak (dBµV/m)	Vertical Average (dBµV/m)	Limit @ 3m (dBµV/m)	Horizontal Margin (dB)	Vertical Margin (dB)
80 MHz Channel							
5775.0	--	--	--	--	--	--	--
11550.0	57.8	44.9	57.5	45.0	68.3	-23.4	-23.3
17325.0	64.5	51.4	64.6	51.6	68.3	-16.9	-16.7
23100.0	64.1	51.1	64.0	51.1	68.3	-17.2	-17.2
28875.0	67.9	55.1	68.6	55.1	68.3	-13.2	-13.2
Band Edges							
5725.0	71.7	51.0	75.8	53.6	78.2	-27.2	-24.6
5850.0	62.8	45.5	70.1	50.6	78.2	-32.7	-27.6

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

Table 22 Transmitter Antenna Port Data (U-NII-1)

Frequency MHz	Conducted Antenna Port Average Output Power (Watts)	99% Occupied Bandwidth (kHz)	Peak Power Spectral Density (dBm/MHz)
20 MHz Mode 9 (802.11a)			
5180	0.023	18,028.8	11.9
5200	0.023	18,028.8	11.8
5240	0.023	17,948.7	11.8
20 MHz Mode 10 (802.11n)			
5180	0.023	18,028.8	11.8
5200	0.023	18,028.8	12.1
5240	0.024	17,948.7	12.0
40 MHz Mode 11 (802.11n40)			
5190	0.015	36,859.0	7.3
5230	0.015	36,859.0	7.4
80 MHz Mode 12 (802.11ac)			
5210	0.014	75,000.0	4.8

Table 23 Transmitter Antenna Port Data (U-NII-3)

Frequency MHz	Conducted Antenna Port Average Output Power (Watts)	99% Occupied Bandwidth (kHz)	6-dB Occupied Bandwidth (kHz)	Peak Power Spectral Density (dBm/500kHz)
20 MHz Mode 13 (802.11a)				
5745	0.027	18,028.8	15,224.4	6.4
5785	0.027	18,109.0	15,785.3	8.1
5825	0.028	18,109.0	15,464.7	7.7
20 MHz Mode 14 (802.11n)				
5745	0.027	18,109.0	15,224.4	7.2
5785	0.028	18,189.1	15,224.4	8.0
5825	0.027	18,109.0	15,224.4	7.6
40 MHz Mode 15 (802.11n40)				
5755	0.028	37,179.5	35,416.7	4.9
5795	0.029	37,179.5	35,416.7	5.1
80 MHz Mode 16 (802.11ac)				
5775	0.027	76,282.1	75,320.5	1.5

Summary of Results for Transmitter Radiated Emissions of Intentional Radiator

The EUT demonstrated compliance with the radiated emissions requirements of 47 CFR Part 15.407 and Industry Canada RSS-247 Issue 2. The maximum average conducted power delivered to antenna was 0.024-Watts in the U-NII-1 Band and 0.029-Watts in the U-NII-3 Band. The radiated harmonic emissions provided a minimum margin of -12.7 dB below requirements. The Power Spectral Density provided a minimum margin of -5.0 dB below requirements. There were no other significantly measurable emissions in the restricted bands other than those presented in this report. Other emissions were present with amplitudes at least 20 dB below the requirements. There were no other deviations or exceptions to the requirements.

Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Additional Test Equipment
- Annex C Rogers Qualifications
- Annex D Rogers Labs Certificate of Accreditation

Annex A Measurement Uncertainty Calculations

The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4. Result of measurement uncertainty calculations are recorded below. Component and process variability of production devices similar to those tested may result in additional deviations. The manufacturer has the sole responsibility of continued compliance.

Measurement	Expanded Measurement Uncertainty $U_{(lab)}$
3 Meter Horizontal 0.009-1000 MHz Measurements	4.16
3 Meter Vertical 0.009-1000 MHz Measurements	4.33
3 Meter Measurements 1-18 GHz	5.14
3 Meter Measurements 18-40 GHz	5.16
10 Meter Horizontal Measurements 0.009-1000 MHz	4.15
10 Meter Vertical Measurements 0.009-1000 MHz	4.32
AC Line Conducted	1.75
Antenna Port Conducted power	1.17
Frequency Stability	1.00E-11
Temperature	1.6˚C
Humidity	3%

Annex B Additional Test Equipment

List of Test Equipment				Calibration	Date (m/d/y)	Due
☐ Frequency Counter: Leader LDC-825 (8060153					4/18/2019	4/18/2021
☐ LISN: Com-Power Model LI-220A					10/14/2019	10/14/2020
☐ LISN: Com-Power Model LI-550C					10/14/2019	10/14/2020
☐ LISN: Compliance Eng. Model 240/20					4/18/2019	4/18/2020
☐ LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08					4/18/2019	4/18/2020
☐ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303070)	9kHz-40 GHz		10/14/2019	10/14/2020
☐ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303072)	9kHz-40 GHz		10/14/2019	10/14/2020
☐ Cable	Huber & Suhner Inc.	Sucoflex102ea(L4M)(281184)	9kHz-40 GHz		10/14/2019	10/14/2020
☐ Cable	Huber & Suhner Inc.	Sucoflex102ea(L10M)(317546)	9kHz-40 GHz		10/14/2019	10/14/2020
☐ Cable	Time Microwave	4M-750HF290-750 (4M)	9kHz-24 GHz		10/14/2019	10/14/2020
☐ RF Filter	Micro-Tronics	BRC17663 (001) 9.3-9.5 notch	30-1800 MHz		4/18/2019	4/18/2020
☐ RF Filter	Micro-Tronics	BRC19565 (001) 9.2-9.6 notch	30-1800 MHz		10/16/2018	4/18/2020
☐ Attenuator	Mini-Circuits	VAT-3W2+ (1735)	30-6000 MHz		4/18/2019	4/18/2020
☐ Analyzer	HP	8562A (3051A05950)	9kHz-125GHz		4/18/2019	4/18/2020
☐ Analyzer	HP External Mixers	11571, 11970	25GHz-110GHz		4/18/2015	4/18/2025
☐ Analyzer	HP	8591EM (3628A00871)			5/2/2018	5/2/2020
☐ Antenna: Solar 9229-1 & 9230-1					2/22/2019	2/22/2020
☐ R.F. Generator: SMB100A6 s/n 100623					4/18/2019	4/18/2020
☐ R.F. Generator: SBMBV100A s/n: 260771					4/18/2019	4/18/2020
☐ CDN: Com-Power Model CDN325E					10/14/2019	10/14/2020
☐ Injection Clamp Luthi Model EM101					10/14/2019	10/14/2020
☐ R.F. Power Amp ACS 230-50W					10/14/2019	10/14/20200
☐ R.F. Power Amp EIN Model: A301					2/22/2019	2/22/2020
☐ R.F. Power Amp A.R. Model: 10W 1010M7					2/22/2019	2/22/2020
☐ Oscilloscope Scope: Tektronix MDO 4104					2/22/2019	2/22/2020
☐ EMC Transient Generator HVT TR 3000					2/22/2019	2/22/2020
☐ AC Power Source (Ametech, California Instruments)					2/22/2019	2/22/2020
☐ Field Intensity Meter: EFM-018					2/22/2019	2/22/2020
☐ ESD Simulator: MZ-15					2/22/2019	2/22/2020

☒ Shielded Room not required

Annex C Rogers Qualifications

Scot D. Rogers, Engineer

Rogers Labs, Inc.

Mr. Rogers has approximately 32 years' experience in the field of electronics. Work experience includes working in the automated controls industry, design, development and testing of radio communications and electronic equipment.

Positions Held:

Systems Engineer:	A/C Controls Mfg. Co., Inc.	6 Years
Electrical Engineer:	Rogers Consulting Labs, Inc.	5 Years
Electrical Engineer:	Rogers Labs, Inc.	Current

Educational Background:

1) Bachelor of Science Degree in Electrical Engineering from Kansas State University

2) Bachelor of Science Degree in Business Administration Kansas State University

3) Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming.

Annex D Laboratory Certificate of Accreditation

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 200087-0

Rogers Labs, Inc.
Louisburg, KS

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2019-11-07 through 2020-03-31
Effective Dates

For the National Voluntary Laboratory Accreditation Program