

## **RADIATED TEST REPORT**



**Title:** Mikrotiks SIA (MikroTik) RB4011iGS+5HacQ2HnD-IN-US  
**To:** FCC CFR 47 Part 15 Subpart E 15.407  
**Serial #:** MIKO93-U2\_Radiated Draft

## Table of Contents

<b>1. TEST RESULTS</b> .....	<b>3</b>
1.1. TX Spurious & Restricted Band Emissions.....	3
1.2. Restricted Edge & Band-Edge .....	7

# 1. TEST RESULTS

## 1.1. TX Spurious & Restricted Band Emissions

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions (Restricted Bands)			
<b>Standard:</b>	FCC CFR 47 Part 15 Subpart C 15.247 (DTS)	<b>Ambient Temp. (°C):</b>	20.0 - 24.5
<b>Test Heading:</b>	Radiated Spurious and Band-Edge Emissions	<b>Rel. Humidity (%):</b>	32 - 45
<b>Standard Section(s):</b>	15.205, 15.209	<b>Pressure (mBars):</b>	999 - 1001
<b>Reference Document(s):</b>	See Normative References		

**Test Procedure for Radiated Spurious and Band-Edge Emissions (Restricted Bands)**  
 Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

Test configuration and setup for Radiated Spurious and Band-Edge Measurement were per the Radiated Test Set-up specified in this document.

Limits for **Restricted Bands**  
 Peak emission: 74 dBuV/m  
 Average emission: 54 dBuV/m

**Field Strength Calculation**  
 The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.  
 $FS = R + AF + CORR - FO$

where:  
 FS = Field Strength  
 R = Measured Spectrum analyzer Input Amplitude  
 AF = Antenna Factor  
 CORR = Correction Factor = CL – AG + NFL  
 CL = Cable Loss  
 AG = Amplifier Gain  
 FO = Distance Falloff Factor  
 NFL = Notch Filter Loss or Waveguide Loss

**Example:**  
 Given receiver input reading of 51.5 dBmV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength (FS) of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dBmV/m}$$

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are as follows:  
 Level (dBmV/m) = 20 \* Log (level (mV/m))

40 dBmV/m = 100 mV/m  
 48 dBmV/m = 250 mV/m

**Restricted Bands of Operation (15.205)**

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

--

Frequency Band			
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

- (1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.
- (2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.
- (3) Cable locating equipment operated pursuant to §15.213.
- (4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.
- (5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.
- (6) Transmitters operating under the provisions of subparts D or F of this part.
- (7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.
- (8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).
- (9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

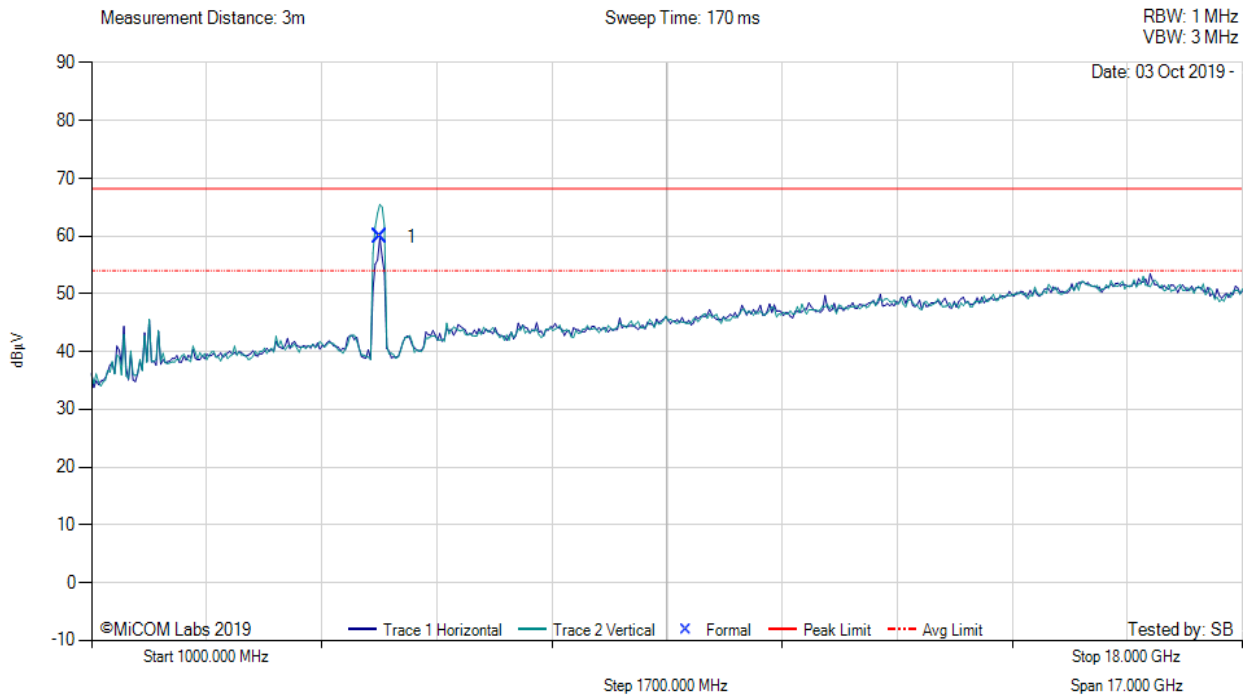
**Equipment Configuration for Restricted Band Spurious Emissions**

<b>Antenna:</b>	RF21C03277A	<b>Variant:</b>	802.11ac-160
<b>Antenna Gain (dBi):</b>	4.00	<b>Modulation:</b>	OFDM
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	5250.00	<b>Data Rate:</b>	58.60 MBit/s
<b>Power Setting:</b>	21	<b>Tested By:</b>	SB

**Test Measurement Results**



Variant: OFDM, Test Freq: 5290.00 MHz, Power Setting: Max, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5266.95	69.23	2.91	-12.21	59.93	Peak (NRB)	Vertical	100	0	--	--	Pass

**Equipment Configuration for TX Spurious & Restricted Band Emissions**

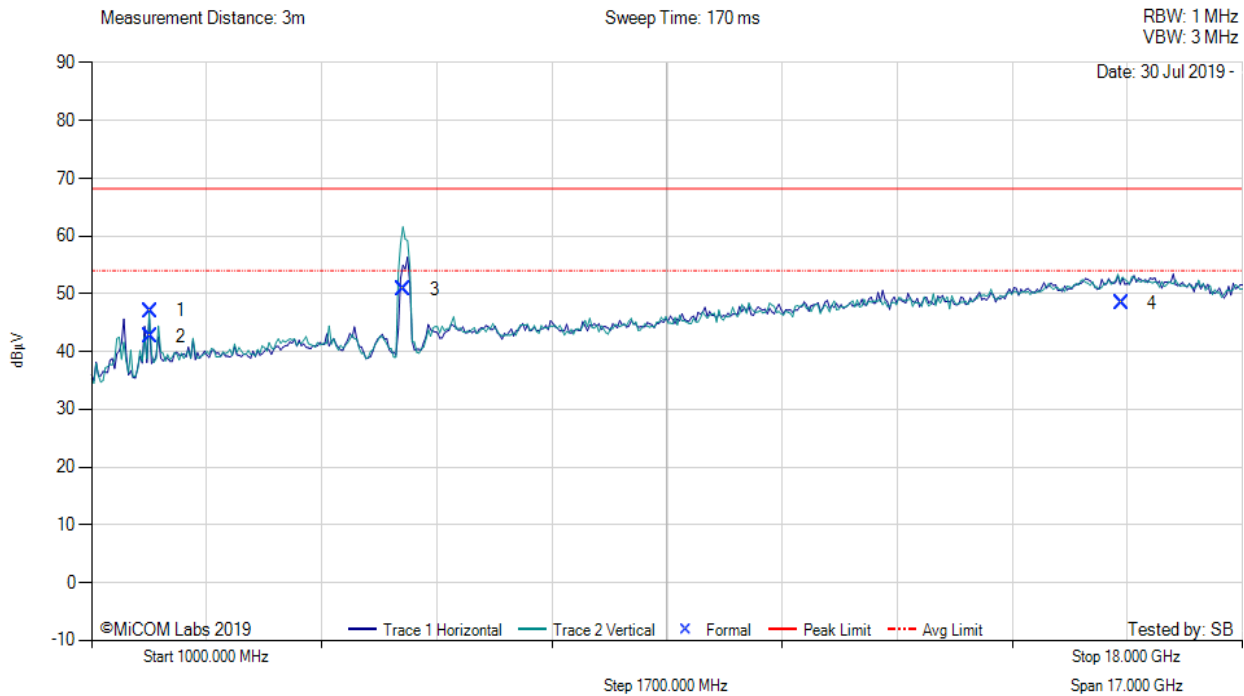
<b>Antenna:</b>	RF21C03277A	<b>Variant:</b>	802.11ac-160
<b>Antenna Gain (dBi):</b>	4.00	<b>Modulation:</b>	OFDM
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	5570.00	<b>Data Rate:</b>	58.60 MBit/s
<b>Power Setting:</b>	21	<b>Tested By:</b>	SB

**Test Measurement Results**



**TX SPURIOUS & RESTRICTED BAND EMISSIONS**

Variant: 802.11ac-160, Test Freq: 5570.00 MHz, Antenna: RF21C03277A, Power Setting: 21, Duty Cycle (%): 99



**1000.00 - 18000.00 MHz**

Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	1875.36	62.35	-1.58	-13.70	47.07	Max Peak	Vertical	98	32	68.2	-21.2	Pass
2	1875.36	57.87	-1.58	-13.70	42.59	Max Avg	Vertical	98	32	54.0	-11.4	Pass
3	5614.39	64.78	-2.74	-11.28	50.76	Peak (NRB)	Vertical	100	0	--	--	Pass
4	16214.27	53.13	-4.85	0.10	48.38	Peak (NRB)	Vertical	100	0	--	--	Pass

## 1.2. Restricted Edge & Band-Edge

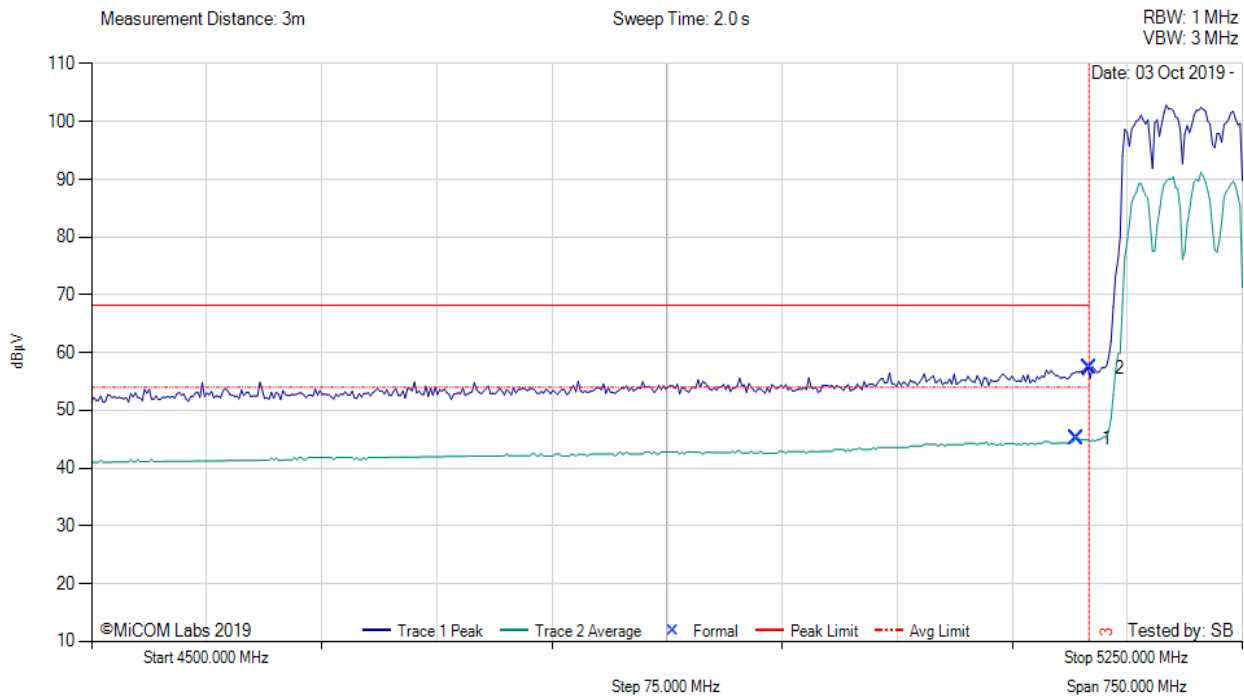
### Equipment Configuration for 5150 MHz Radiated Band-Edge Emissions

<b>Antenna:</b>	RF21C03277A	<b>Variant:</b>	802.11ac-160
<b>Antenna Gain (dBi):</b>	4.00	<b>Modulation:</b>	OFDM
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	5250.00	<b>Data Rate:</b>	58.60 MBit/s
<b>Power Setting:</b>	21	<b>Tested By:</b>	SB

### Test Measurement Results



Variant: 802.11ac-160, Test Freq: 5250.00 MHz, Antenna: RF21C03277A, Power Setting: 21, Duty Cycle (%): 99



### 4500.00 - 5250.00 MHz

Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	5141.78	7.99	2.95	34.20	45.14	Max Avg	Vertical	157	16	54.0	-8.9	Pass
2	5150.00	20.23	2.93	34.21	57.37	Max Peak	Vertical	157	16	68.2	-10.9	Pass
3	5150.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--

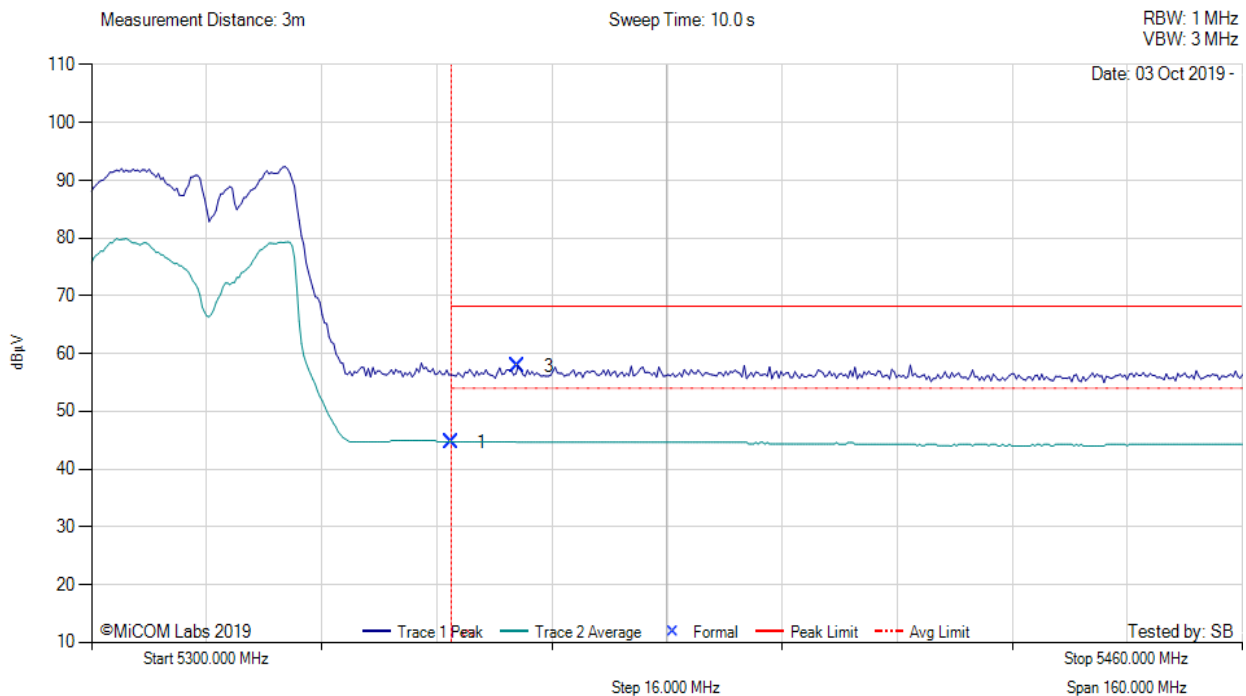
**Equipment Configuration for 5350 MHz Radiated Band-Edge Emissions**

<b>Antenna:</b>	RF21C03277A	<b>Variant:</b>	802.11ac-160
<b>Antenna Gain (dBi):</b>	4.00	<b>Modulation:</b>	OFDM
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	5250.00	<b>Data Rate:</b>	58.60 MBit/s
<b>Power Setting:</b>	21	<b>Tested By:</b>	SB

**Test Measurement Results**



Variant: 802.11ac-160, Test Freq: 5250.00 MHz, Antenna: RF21C03277A, Power Setting: 21, Duty Cycle (%): 99



**5300.00 - 5460.00 MHz**

Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5350.00	7.18	3.06	34.46	44.70	Max Avg	Horizontal	157	16	54.0	-9.3	Pass
3	5359.30	20.37	3.04	34.47	57.88	Max Peak	Horizontal	157	16	68.2	-10.4	Pass
2	5350.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--



**Equipment Configuration for Restricted Lower Band-Edge Emissions**

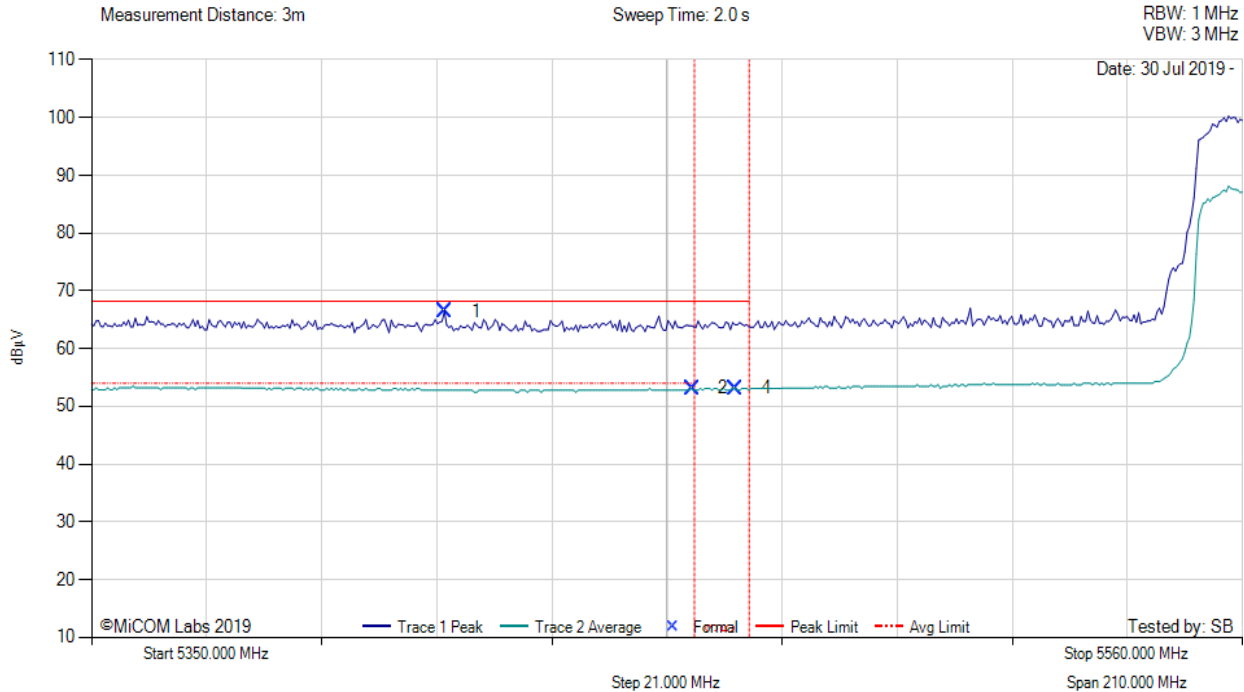
<b>Antenna:</b>	RF21C03277A	<b>Variant:</b>	802.11ac-160
<b>Antenna Gain (dBi):</b>	4.00	<b>Modulation:</b>	OFDM
<b>Beam Forming Gain (Y):</b>	Not Applicable	<b>Duty Cycle (%):</b>	99
<b>Channel Frequency (MHz):</b>	5570.00	<b>Data Rate:</b>	58.60 MBit/s
<b>Power Setting:</b>	21	<b>Tested By:</b>	SB

**Test Measurement Results**



**RESTRICTED LOWER BAND-EDGE EMISSIONS**

Variant: 802.11ac-160, Test Freq: 5570.00 MHz, Antenna: RF21C03277A, Power Setting: 21, Duty Cycle (%): 99



**5350.00 - 5560.00 MHz**

Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5414.55	34.68	-2.69	34.52	66.51	Max Peak	Vertical	150	342	68.2	-1.7	Pass
2	5459.58	21.29	-2.69	34.53	53.13	Max Avg	Vertical	150	342	54.0	-0.9	Pass
4	5467.58	21.27	-2.68	34.55	53.14	Max Avg	Vertical	150	342	68.2	-15.1	Pass
3	5460.00	--	--	--	--	Restricted-Band	--	--	--	--	--	--
5	5470.00	--	--	--	--	Band-Edge	--	--	--	--	--	--



575 Boulder Court  
Pleasanton, California 94566, USA  
Tel: +1 (925) 462 0304  
Fax: +1 (925) 462 0306  
[www.micomlabs.com](http://www.micomlabs.com)