TESTING LABORATORY
CERTIFICATE #4820.01

# FCC PART 15.407

# TEST REPORT

For

## Xiamen Ursalink Technology Co., Ltd.

4/F,NO. 63-2 Wanghai Road, 2nd Software Park,Xiamen ,China

**FCC ID: 2AOSV-UR52-5**

| **Report Type:** | **Product Name:** |
|---|---|
| Original Report | Industrial Cellular Router |

| | |
|---|---|
| **Report Number:** | RDG180313053-00C |
| **Report Date:** | 2018-08-21 |
| **Reviewed By:** | Jerry Zhang<br>EMC Manager<br>Jerry Zhang |
| **Test Laboratory:** | Bay Area Compliance Laboratories Corp. (Dongguan)<br>No.69 Pulongcun, Puxinhu Industry Area,<br>Tangxia, Dongguan, Guangdong, China<br>Tel: +86-769-86858888<br>Fax: +86-769-86858891<br>www.baclcorp.com.cn |

**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan). This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government. * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*".

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# GENERAL INFORMATION

## Product Description for Equipment under Test (EUT)

| | | |
|---|---|---|
| **EUT Name:** | | Industrial Cellular Router |
| **EUT Model:** | | UR55 |
| **Multiple Models:** | | UR52 |
| **FCC ID:** | | 2AOSV-UR52-5 |
| **Rated Input Voltage:** | | DC 12V from adapter |
| **Adapter Information** | **Model:** | OH-1015A1201000U1-UL |
| | **Input:** | 100-240V~50/60Hz 350mA |
| | **Output:** | DC 12V 1A |
| **External Dimension:** | | 132mm(L)*103.8mm(W)*45mm(H) |
| **Serial Number:** | | 180313053-1(UR55)<br>180313053-2(UR52) |
| **EUT Received Date:** | | 2018.04.29 |

*Note: The series product, model UR52 is electrically identical with model UR55, we selected UR55 for fully testing, the differences details was explained in the declaration letter.*

## Objective

This type approval report is prepared on behalf of ***Xiamen Ursalink Technology Co., Ltd.***in accordance with Part 2-Subpart J, Part 15-Subparts A, and E of the Federal Communications Commission's rules.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart E, section 15.203, 15.205, 15.207, 15.209 and 15.407 rules.

## Related Submittal(s)/Grant(s)

FCC Part 15C DTS submissions with FCC ID: 2AOSV-UR52-5.
FCC Part 15B JBP submissions with FCC ID: 2AOSV-UR52-5.

## Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. And KDB 789033 D02 General U-NII Test Procedures New Rules v02r01.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

## Measurement Uncertainty

| Parameter | Measurement Uncertainty |
|---|---|
| Occupied Channel Bandwidth | ±5 % |
| RF output power, conducted | ±0.61dB |
| Power Spectral Density, conducted | ±0.61 dB |
| Unwanted Emissions, radiated | 30M~200MHz: 4.55 dB,200M~1GHz: 5.92 dB,1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 dB |
| Unwanted Emissions,conducted | ±1.5 dB |
| Temperature | ±1℃ |
| Humidity | ±5% |
| DC and low frequency voltages | ±0.4% |
| Duty Cycle | 1% |
| AC Power Lines Conducted Emission | 3.12 dB (150 kHz to 30 MHz) |

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218,the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

# SYSTEM TEST CONFIGURATION

## Description of Test Configuration

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

The system support 802.11a/n ht20/n ht40/ac vht20/ac vht40/ac vht80, the vh20/vht40 were reduced since the identical parameters with 802.11n ht20 and ht40.

For 5150~5250 MHz band, 7 channels are provided to testing:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|
| 36 | 5180 | 44 | 5220 |
| 38 | 5190 | 46 | 5230 |
| 40 | 5200 | 48 | 5240 |
| 42 | 5210 | / | / |

802.11a, 802.11n ht20 were tested with Channel 36, 40 and 48,
802.11n ht40 were tested with Channel 38 and 46.
802.11ac80 mode was tested with channel 42

For 5725~5850MHz band, 8 channels are provided to testing:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|
| 149 | 5745 | 157 | 5785 |
| 151 | 5755 | 159 | 5795 |
| 153 | 5765 | 161 | 5805 |
| 155 | 5775 | 165 | 5825 |

802.11a, 802.11n ht20 were tested with Channel 149, 157 and 165,
802.11n ht40 were tested with Channel 151 and 159.
802.11ac80 mode was tested with channel 155.

## EUT Exercise Software

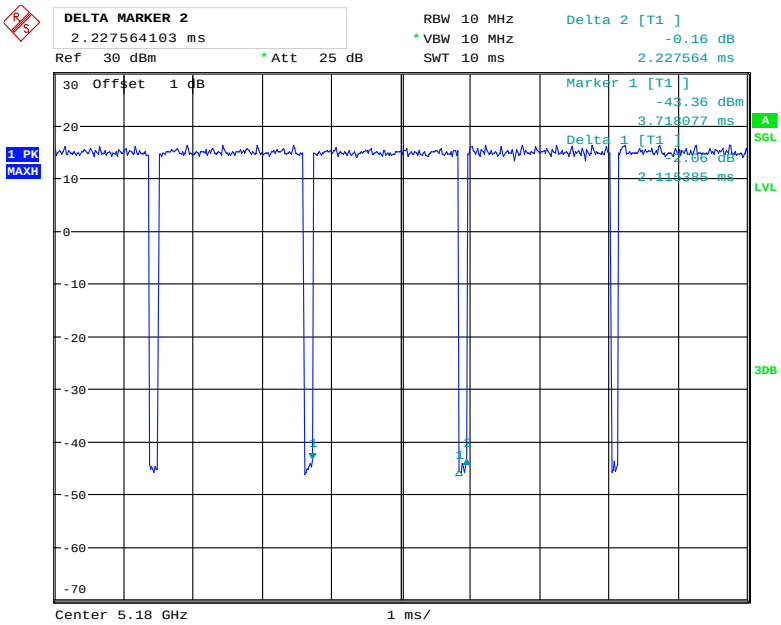
The software "QRCT Version3.0.265.0" was used for testing, which was provided by manufacturer. The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations. The maximum power was configured as below table, that provided by the manufacturer:

| Software and version | | | | QRCT Version3.0.265.0 | |
|---|---|---|---|---|---|
| **UNII Band** | **Mode** | **Channel** | **Frequency (MHz)** | **Data Rate (Mbps)** | **Power Level** |
| **5150-5250MHz** | **802.11a** | Low | 5180 | 6 | 9 |
| | | Middle | 5200 | 6 | 16 |
| | | High | 5240 | 6 | 16 |
| | **802.11n ht20** | Low | 5180 | MCS0 | 9 |
| | | Middle | 5200 | MCS0 | 17 |
| | | High | 5240 | MCS0 | 16 |
| | **802.11n ht40** | Low | 5190 | MCS0 | 8 |
| | | High | 5230 | MCS0 | 15 |
| | **802.11 ac80** | Middle | 5210 | MCS0 | 10 |
| **5725-5850MHz** | **802.11a** | Low | 5745 | 6 | 23 |
| | | Middle | 5785 | 6 | 23 |
| | | High | 5825 | 6 | 23 |
| | **802.11n ht20** | Low | 5745 | MCS0 | 23 |
| | | Middle | 5785 | MCS0 | 23 |
| | | High | 5825 | MCS0 | 24 |
| | **802.11n ht40** | Low | 5755 | MCS0 | 23 |
| | | High | 5795 | MCS0 | 23 |
| | **802.11 ac80** | Middle | 5775 | MCS0 | 17 |

The duty cycle as below:

| Mode | $T_{on}$ (ms) | $T_{on+off}$ (ms) | Duty Cycle (%) |
|---|---|---|---|
| 802.11 a | 2.115 | 2.228 | 94.9 |
| 802.11n ht20 | 1.971 | 2.019 | 97.6 |
| 802.11n ht40 | 0.964 | 1.077 | 89.5 |
| 802.11ac80 | 0.481 | 0.572 | 84.1 |

## 802.11a

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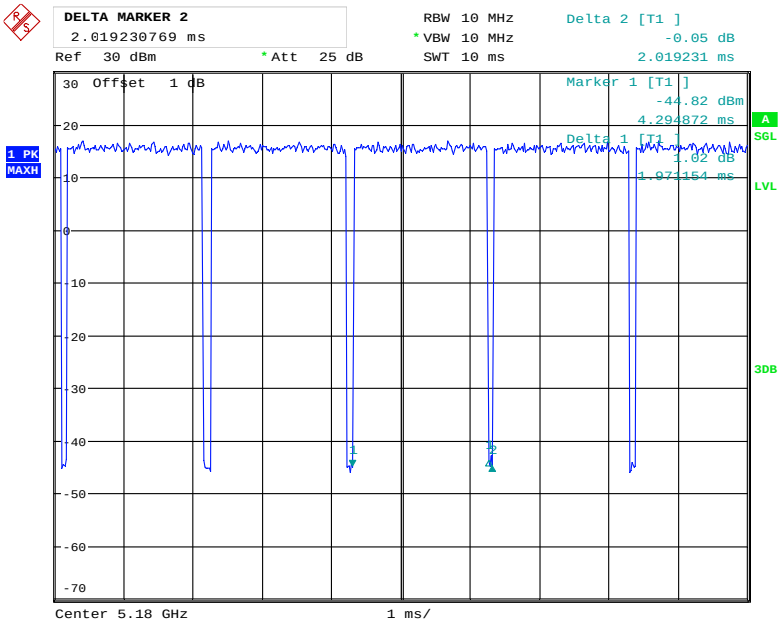
## 802.11n ht20

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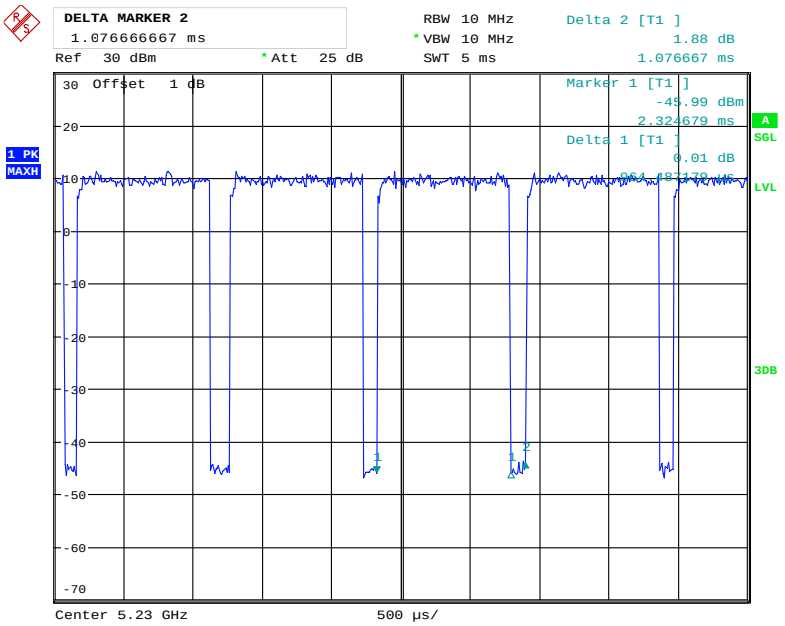
## 802.11n ht40

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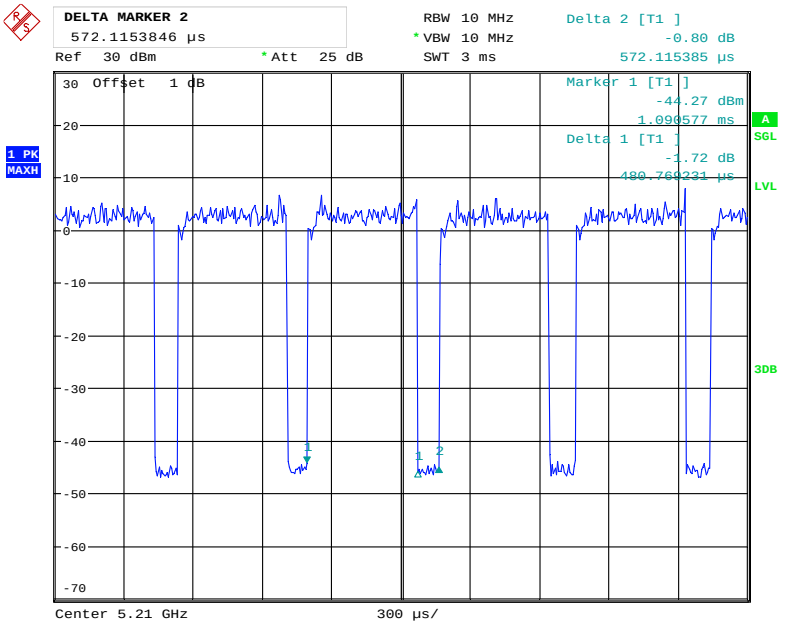
## 802.11 ac80

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## Equipment Modifications

No modification was made to the EUT.

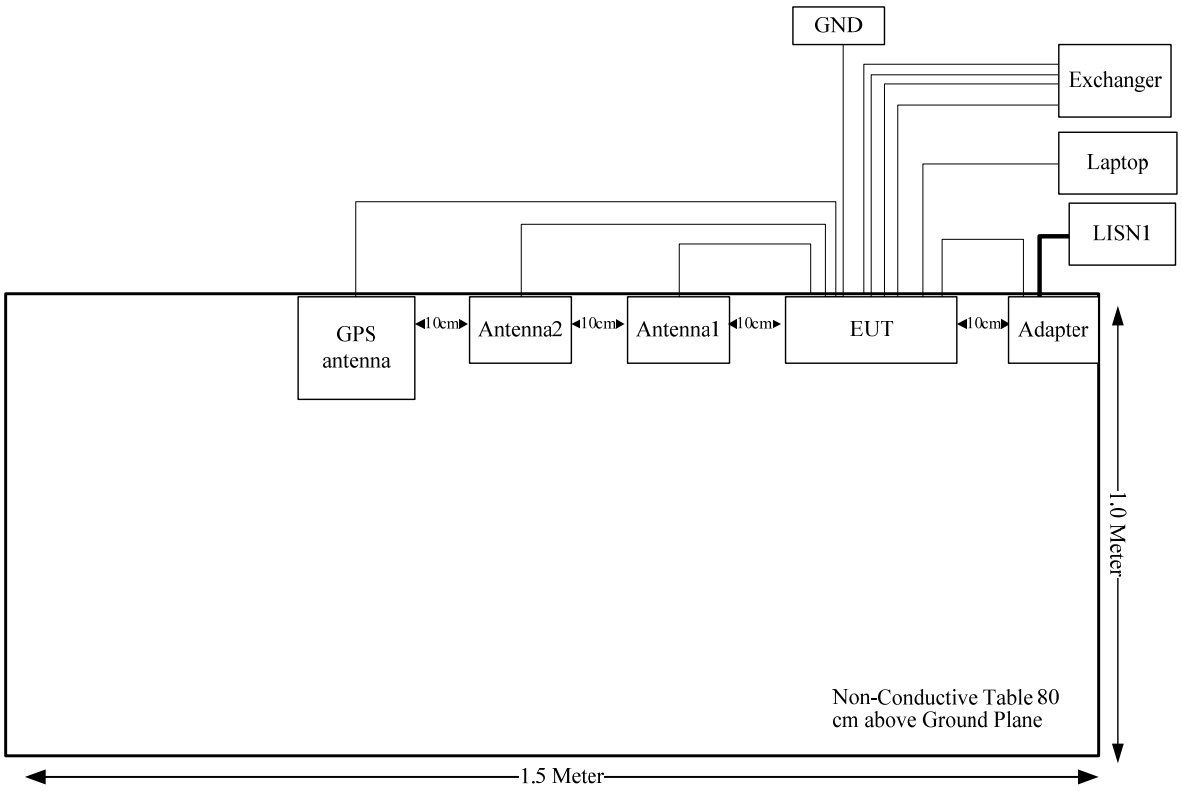
## Local Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| DELL | Laptop | PP11L | HLKYGB1 |
| TP-LINK | Exchanger | TL-SF1008P | 114A297001782 |

## Support Cable List and Details

| Cable Description | Shielding Type | Ferrite Core | Length (m) | From Port | To |
|---|---|---|---|---|---|
| RJ45 Cable | No | No | 5 | RJ45 Port of EUT | Laptop |
| RJ45 Cable | No | No | 5 | RJ45 Port of EUT | Exchanger |
| RJ45 Cable | No | No | 5 | RJ45 Port of EUT | Exchanger |
| RJ45 Cable | No | No | 5 | RJ45 Port of EUT | Exchanger |
| RJ45 Cable | No | No | 5 | RJ45 Port of EUT | Exchanger |
| Ground line | No | No | 1.5 | Gnd Port of EUT | ground |
| Antenna Cable | No | No | 1.5 | Antenna Port of EUT | Antenna 1 |
| Antenna Cable | No | No | 1.5 | Antenna Port of EUT | Antenna 2 |
| GPS antenna Cable | No | No | 3 | GPS Port of EUT | GPS antenna |
| Adapter Cable | No | Yes | 1.5 | Adapter | EUT |

## Block Diagram of Test Setup



# SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Result |
|---|---|---|
| FCC §15.407 (f) & §1.1310 & §2.1091 | Maximum Permissible Exposure (MPE) | Compliance |
| §15.203 | Antenna Requirement | Compliance |
| §15.407(b)(6)& §15.207(a) | Conducted Emissions | Compliance |
| §15.205& §15.209 &§15.407(b) | Undesirable Emission& Restricted Bands | Compliance |
| §15.407(b) | Out Of Band Emissions | Compliance |
| §15.407(a) (e) | Emission Bandwidth | Compliance |
| §15.407(g) | Frequency Stability | Compliance |
| §15.407(a) | Conducted Transmitter Output Power | Compliance |
| §15.407 (a) | Power Spectral Density | Compliance |

# FCC §15.407 (f) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

## Applicable Standard

According to subpart 15.407(f)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

| (B) 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)** |
| 0.3–1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34–30 | 824/f | 2.19/f | *(180/f²) | 30 |
| 30–300 | 27.5 | 0.073 | 0.2 | 30 |
| 300–1500 | / | / | f/1500 | 30 |
| 1500–100,000 | / | / | 1.0 | 30 |

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

According to §1.1310 and §2.1091 RF exposure is calculated.

**Calculation formula:**

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. $mW/cm^2$);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Calculated Data:**

| Frequency (MHz) | Antenna Gain | | Conducted output power including Tune-up Tolerance | | Evaluation Distance (cm) | Power Density ($mW/cm^2$) | $S_{limit}$ ($mW/cm^2$) | $S_i/S_{limit}$ |
|---|---|---|---|---|---|---|---|---|
| | (dBi) | (numeric) | (dBm) | (mW) | | | | |
| 5150-5250 & 5725-5850 | 5 | 3.16 | 14 | 25.12 | 20.00 | 0.02 | 1.0 | 0.20 |
| 824-849 | 2.5 | 1.78 | 23.5 | 223.87 | 20.00 | 0.08 | 0.55 | 0.14 |
| 1850-1910 | 3 | 2.00 | 24 | 251.19 | 20.00 | 0.10 | 1.00 | 0.10 |
| 1710-1755 | 3 | 2.00 | 24 | 251.19 | 20.00 | 0.10 | 1.00 | 0.10 |

The Wi-Fi function and LTE Module can transmit simultaneously.

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$=S_{Wi\text{-}Fi}/S_{Wi\text{-}Fi}+ S_{WAN}/S_{limit\ WAN}$

= 0.20+0.14=0.34<1

**Result:** The device meet FCC MPE at 20 cm distance

# FCC §15.203 – ANTENNA REQUIREMENT

## Applicable Standard

According to § 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 47 CFR section 15.407 (a)(1),if transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## Antenna Connector Construction

The EUT have one external antenna, and the antenna gain is 5dBi, the EUT requires professional installation. Please refer to the professional installation statement letter.

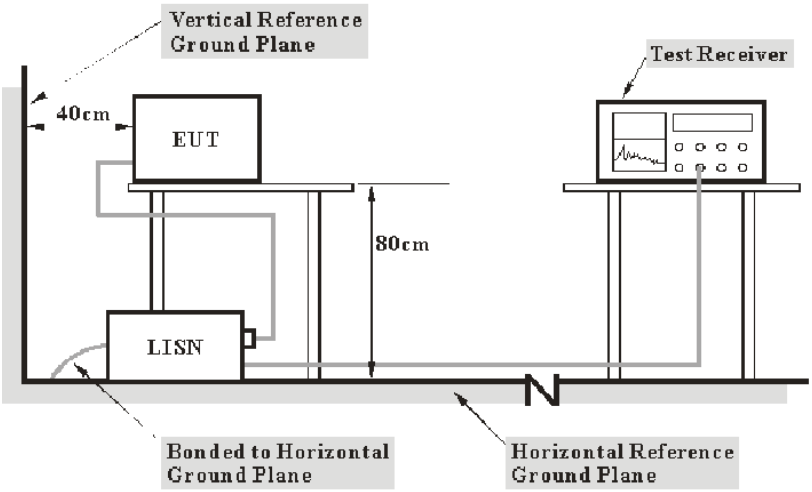
**Result:** Compliance.

# FCC §15.407 (b) (6) §15.207 (a) – CONDUCTED EMISSIONS

## Applicable Standard

FCC §15.207(a), §15.407(b) (6).

## EUT Setup




Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisn with a 120 V/60 Hz AC power source.

## EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range | IF B/W |
|---|---|
| 150 kHz – 30 MHz | 9 kHz |

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$
$C_f = A_C + VDF$

Herein,
$V_C$ (cord. Reading): corrected voltage amplitude
$V_R$: reading voltage amplitude
$A_c$: attenuation caused by cable loss
VDF: voltage division factor of AMN
$C_f$: Correction Factor

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

Margin = Limit – Corrected Amplitude

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Receiver | ESCS 30 | 830245/006 | 2017-12-11 | 2018-12-11 |
| R&S | L.I.S.N | ESH2-Z5 | 892107/021 | 2017-09-25 | 2018-09-25 |
| R&S | Two-line V-network | ENV 216 | 3560.6550.12 | 2017-12-08 | 2018-12-08 |
| R&S | Test Software | EMC32 | Version8.53.0 | N/A | N/A |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-0200-01 | 2017-09-05 | 2018-09-05 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Procedure

During the conducted emission test, the EUT was connected to the first LISN.

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

All data was recorded in the Quasi-peak and average detection mode.

## Test Data

### Environmental Conditions

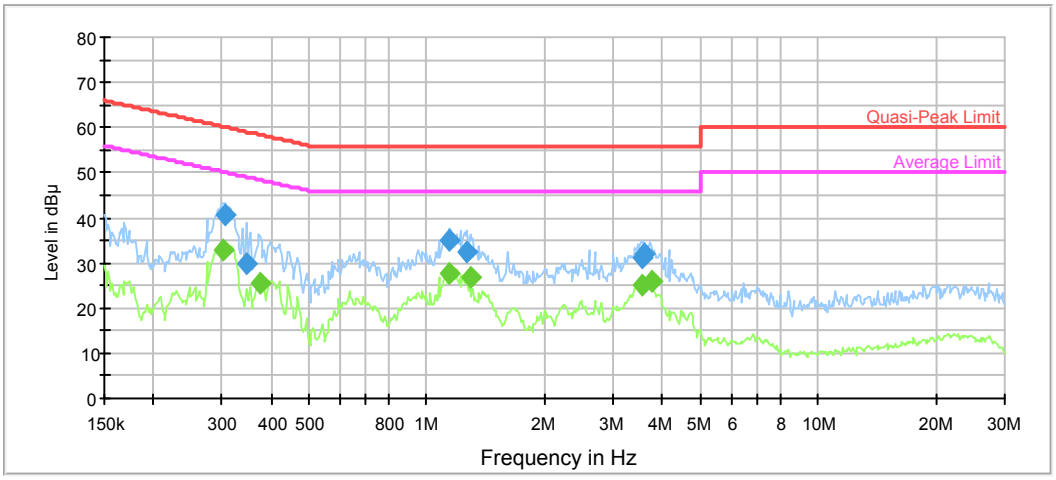
| | |
|---|---|
| **Temperature:** | 28.6 °C |
| **Relative Humidity:** | 58 % |
| **ATM Pressure:** | 100 kPa |

*The testing was performed by Alex You on 2018-07-13.*

*Test Mode: Transmitting*

*Model: UR55*

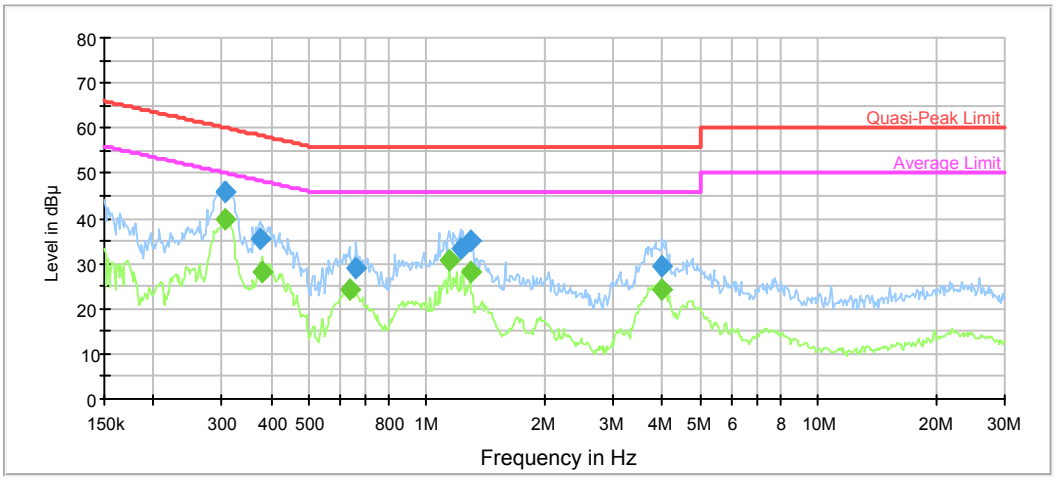
**AC120 V, 60 Hz, Line:**




| Frequency (MHz) | QuasiPeak (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.304845 | 40.5 | 9.000 | L1 | 10.1 | 19.6 | 60.1 | Compliance |
| 0.346296 | 29.9 | 9.000 | L1 | 10.0 | 29.2 | 59.1 | Compliance |
| 1.144267 | 35.0 | 9.000 | L1 | 9.8 | 21.0 | 56.0 | Compliance |
| 1.269154 | 32.6 | 9.000 | L1 | 9.8 | 23.4 | 56.0 | Compliance |
| 3.547503 | 31.1 | 9.000 | L1 | 9.8 | 24.9 | 56.0 | Compliance |
| 3.604490 | 31.9 | 9.000 | L1 | 9.8 | 24.1 | 56.0 | Compliance |

| Frequency (MHz) | Average (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.302425 | 32.8 | 9.000 | L1 | 10.1 | 17.4 | 50.2 | Compliance |
| 0.375019 | 25.7 | 9.000 | L1 | 10.0 | 22.7 | 48.4 | Compliance |
| 1.144267 | 27.6 | 9.000 | L1 | 9.8 | 18.4 | 46.0 | Compliance |
| 1.289541 | 27.0 | 9.000 | L1 | 9.8 | 19.0 | 46.0 | Compliance |
| 3.547503 | 25.2 | 9.000 | L1 | 9.8 | 20.8 | 46.0 | Compliance |
| 3.750995 | 26.1 | 9.000 | L1 | 9.8 | 19.9 | 46.0 | Compliance |

**AC120 V, 60 Hz, Neutral:**

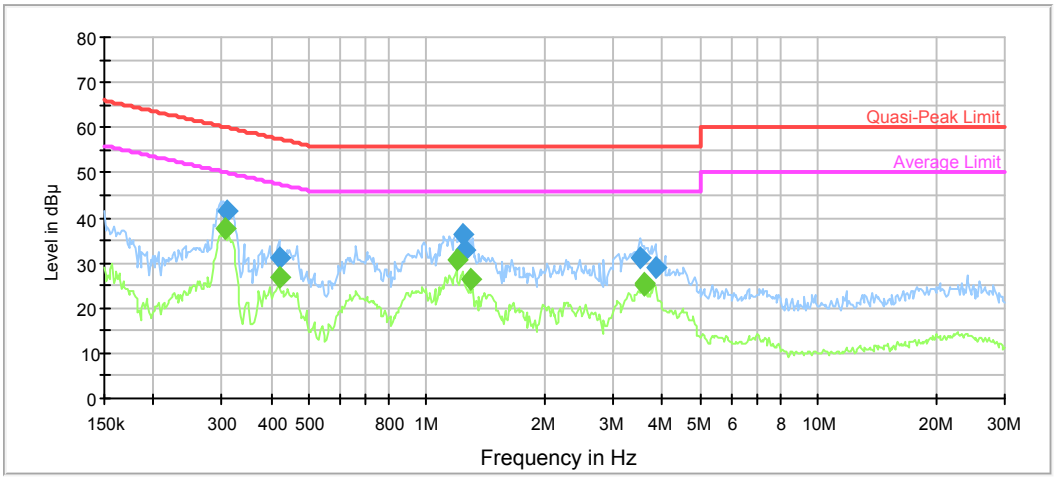



| Frequency (MHz) | QuasiPeak (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.304845 | 45.8 | 9.000 | N | 10.1 | 14.3 | 60.1 | Compliance |
| 0.375019 | 35.4 | 9.000 | N | 10.0 | 23.0 | 58.4 | Compliance |
| 0.660314 | 29.0 | 9.000 | N | 9.8 | 27.0 | 56.0 | Compliance |
| 1.219583 | 33.2 | 9.000 | N | 9.8 | 22.8 | 56.0 | Compliance |
| 1.289541 | 35.2 | 9.000 | N | 9.8 | 20.8 | 56.0 | Compliance |
| 3.997889 | 29.2 | 9.000 | N | 9.8 | 26.8 | 56.0 | Compliance |

| Frequency (MHz) | Average (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.304845 | 39.7 | 9.000 | N | 10.1 | 10.4 | 50.1 | Compliance |
| 0.381043 | 28.2 | 9.000 | N | 10.0 | 20.1 | 48.3 | Compliance |
| 0.634524 | 24.2 | 9.000 | N | 9.8 | 21.8 | 46.0 | Compliance |
| 1.144267 | 30.5 | 9.000 | N | 9.8 | 15.5 | 46.0 | Compliance |
| 1.289541 | 28.1 | 9.000 | N | 9.8 | 17.9 | 46.0 | Compliance |
| 3.997889 | 24.3 | 9.000 | N | 9.8 | 21.8 | 46.0 | Compliance |

*Model: UR52*

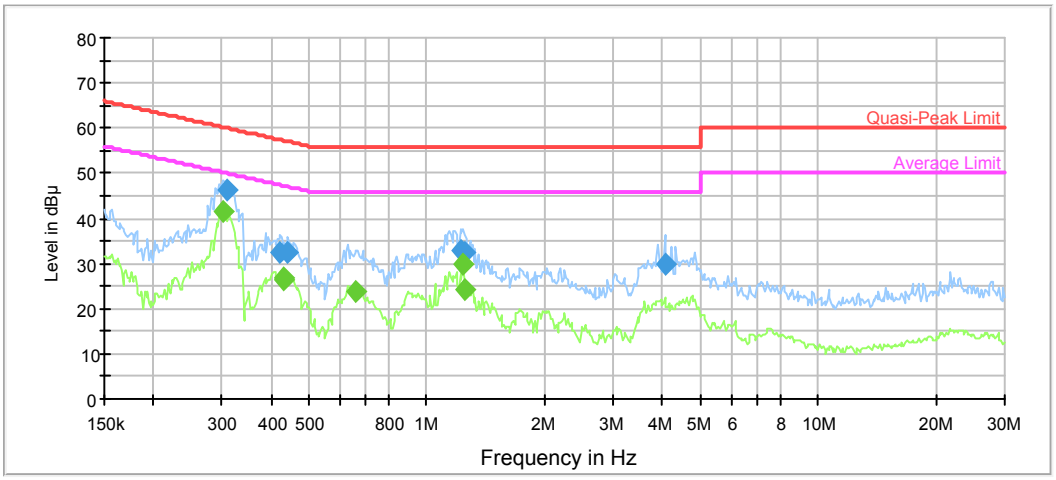
**AC120 V, 60 Hz, Line:**




| Frequency (MHz) | QuasiPeak (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.309742 | 41.4 | 9.000 | L1 | 10.1 | 18.5 | 60.0 | Compliance |
| 0.419276 | 31.0 | 9.000 | L1 | 10.0 | 26.5 | 57.5 | Compliance |
| 1.239175 | 36.1 | 9.000 | L1 | 9.8 | 19.9 | 56.0 | Compliance |
| 1.249088 | 32.9 | 9.000 | L1 | 9.8 | 23.1 | 56.0 | Compliance |
| 3.519348 | 31.0 | 9.000 | L1 | 9.8 | 25.0 | 56.0 | Compliance |
| 3.841741 | 29.2 | 9.000 | L1 | 9.8 | 26.8 | 56.0 | Compliance |

| Frequency (MHz) | Average (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.304845 | 37.6 | 9.000 | L1 | 10.1 | 12.5 | 50.1 | Compliance |
| 0.419276 | 26.9 | 9.000 | L1 | 10.0 | 20.6 | 47.5 | Compliance |
| 1.190776 | 30.6 | 9.000 | L1 | 9.8 | 15.4 | 46.0 | Compliance |
| 1.289541 | 26.3 | 9.000 | L1 | 9.8 | 19.7 | 46.0 | Compliance |
| 3.575883 | 25.3 | 9.000 | L1 | 9.8 | 20.7 | 46.0 | Compliance |
| 3.604490 | 25.7 | 9.000 | L1 | 9.8 | 20.3 | 46.0 | Compliance |

**AC120 V, 60 Hz, Neutral:**




| requency (MHz) | QuasiPeak (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.307284 | 46.3 | 9.000 | N | 10.1 | 13.7 | 60.0 | Compliance |
| 0.422630 | 32.5 | 9.000 | N | 9.9 | 24.9 | 57.4 | Compliance |
| 0.443327 | 32.5 | 9.000 | N | 9.9 | 24.5 | 57.0 | Compliance |
| 1.219583 | 33.0 | 9.000 | N | 9.8 | 23.0 | 56.0 | Compliance |
| 1.249088 | 32.5 | 9.000 | N | 9.8 | 23.5 | 56.0 | Compliance |
| 4.062112 | 30.0 | 9.000 | N | 9.8 | 26.0 | 56.0 | Compliance |

| Frequency (MHz) | Average (dBµV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|
| 0.302425 | 41.6 | 9.000 | N | 10.1 | 8.6 | 50.2 | Compliance |
| 0.429420 | 26.9 | 9.000 | N | 9.9 | 20.4 | 47.3 | Compliance |
| 0.432855 | 26.5 | 9.000 | N | 9.9 | 20.7 | 47.2 | Compliance |
| 0.660314 | 24.0 | 9.000 | N | 9.8 | 22.0 | 46.0 | Compliance |
| 1.239175 | 29.7 | 9.000 | N | 9.8 | 16.3 | 46.0 | Compliance |
| 1.249088 | 24.2 | 9.000 | N | 9.8 | 21.8 | 46.0 | Compliance |

# FCC §15.209, §15.205 & §15.407(b) –UNWANTED EMISSION

## Applicable Standard

FCC §15.407; §15.209; §15.205;

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(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.

(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.

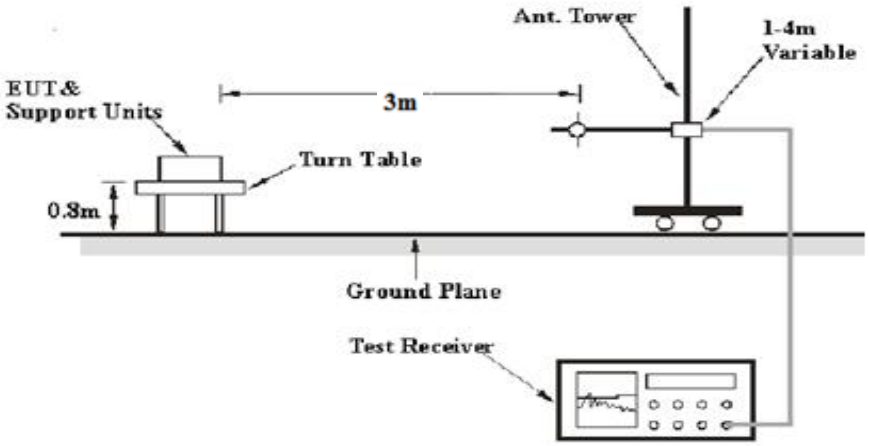
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) 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.

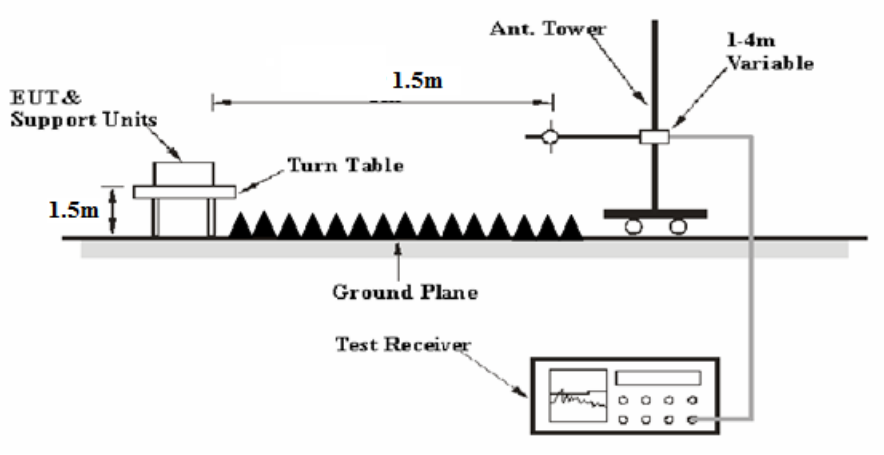
(7) The provisions of §15.205 apply to intentional radiators operating under this section.

## EUT Setup

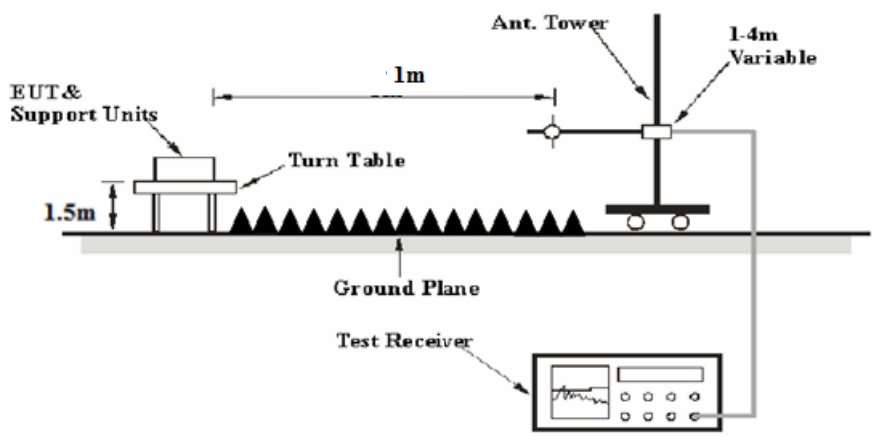
**Below 1 GHz:**




**1-26.5 GHz:**




**26.5-40 GHz:**



The radiated emission Below 1GHz tests were performed in the 10 meters chamber, above 1GHz tests were performed in the 3/1.5/1 meters chamber test site B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.407 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30-1000MHz:

| Measurement | RBW | Video B/W | IF B/W |
|---|---|---|---|
| QP | 120 kHz | 300 kHz | 120kHz |

1GHz- 40GHz:

| Measurement | Duty cycle | RBW | Video B/W |
|---|---|---|---|
| PK | Any | 1MHz | 3 MHz |
| Ave. | >98% | 1MHz | 10 Hz |
| | <98% | 1MHz | 1/T |

Note: T is minimum transmission duration

## Test Procedure

During the radiated emission test, the adapter was connected to the first AC floor outlet.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz, peak and Average detection modes for frequencies above 1GHz.

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, emission shall be computed as: E [dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

According to C63.10, the above 1G test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1.5m or 1m
Distance extrapolation factor =20 log (specific distance [3m]/test distance [1.5m]) dB= 6.02 dB
or
Distance extrapolation factor =20 log (specific distance [3m]/test distance [1m]) dB= 9.54 dB

All emissions under the average limit and under the noise floor have not recorded in the report.

## Corrected Amplitude & Margin Calculation

For the range 30MHz-1GHz, the Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

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

Margin = Limit - Corrected Amplitude

For the range 1GHz-40GHz, Test performed at 1.5m or 1m, the Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading and the Distance extrapolation factor. The basic equation is as follows:

Corrected Amplitude
= Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain-Distance extrapolation factor

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

Margin = Limit- Corrected Amplitude

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Receiver | ESCI | 100035 | 2017-08-04 | 2018-08-04 |
| Farad | Test Software | EZ-EMC | V1.1.4.2 | N/A | N/A |
| Sunol Sciences | Antenna | JB3 | A060611-3 | 2017-07-21 | 2019-07-21 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-0400-02 | 2017-09-05 | 2018-09-05 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-0075-02 | 2017-09-05 | 2018-09-05 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-2200-01 | 2017-09-05 | 2018-09-05 |
| HP | Amplifier | 8447F | 2443A01912 | 2017-09-05 | 2018-09-05 |
| Agilent | Spectrum Analyzer | E4440A | SG43360054 | 2018-01-04 | 2019-01-04 |
| R&S | Spectrum Analyzer | FSP 38 | 100478 | 2017-12-08 | 2018-12-08 |
| Farad | Test Software | EZ-EMC | V1.1.4.2 | N/A | N/A |
| ETS-Lindgren | Horn Antenna | 3115 | 000 527 35 | 2016-01-05 | 2019-01-04 |
| Ducommun Technolagies | Horn Antenna | ARH-4223-02 | 1007726-01 1304 | 2016-11-18 | 2019-11-18 |
| Ducommun Technolagies | Horn Antenna | ARH-2823-02 | 1007726-01 1302 | 2016-11-18 | 2019-11-18 |
| Unknown | Coaxial Cable | C-SJSJ-50 | C-0800-01 | 2017-09-05 | 2018-09-05 |
| Unknown | Coaxial Cable | C-2.4J2.4J-50 | C-0700-02 | 2018-06-27 | 2019-06-27 |
| MITEQ | Amplifier | AFS42-00101800-25-S-42 | 2001271 | 2017-09-05 | 2018-09-05 |
| Quinstar | Amplifier | QLW-18405536-JO | 15964001001 | 2018-06-27 | 2019-06-27 |
| Sinoscite | Bandstop Filters | BSF5150-5850MN-0899-003 | 0899003 | 2018-05-06 | 2019-05-06 |
| Mini Circuits | High Pass Filter | VHF-6010+ | 31118 | 2018-06-16 | 2019-06-16 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26.1~26.7 °C |
| **Relative Humidity:** | 39~58 % |
| **ATM Pressure:** | 100.1~101.1 kPa |

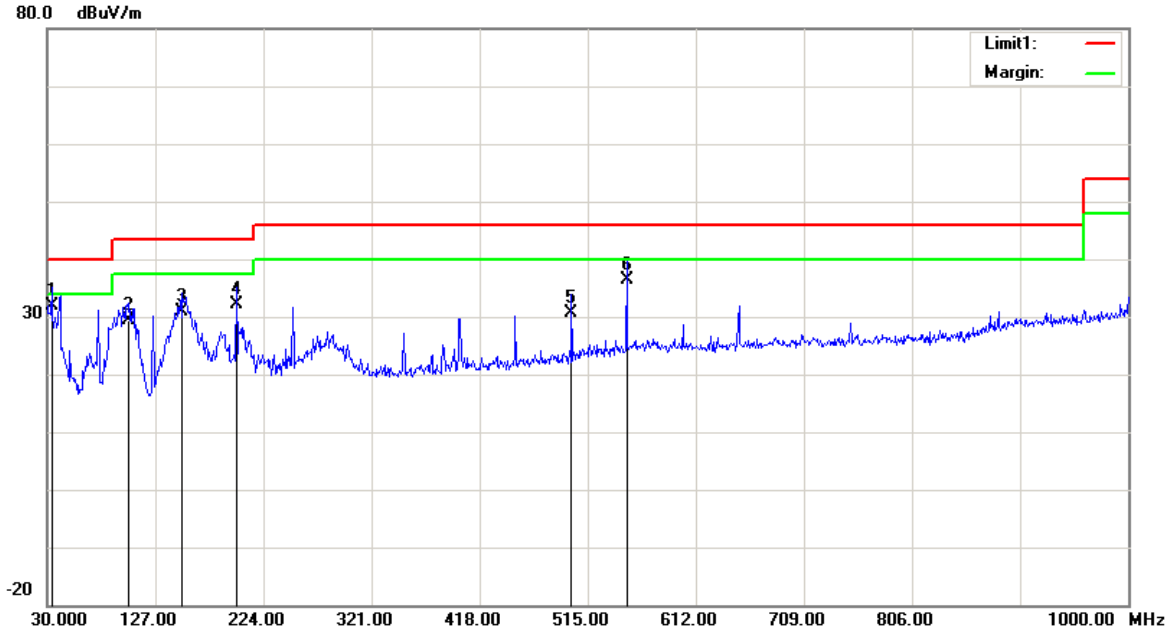
** The testing was performed by Vito Chen & Tyler Pan from 2018-07-17 to 2018-07-19.*

*Test Mode: Transmitting*

**1) Below 1GHz**(802.11 a 5785 MHz was the worst):

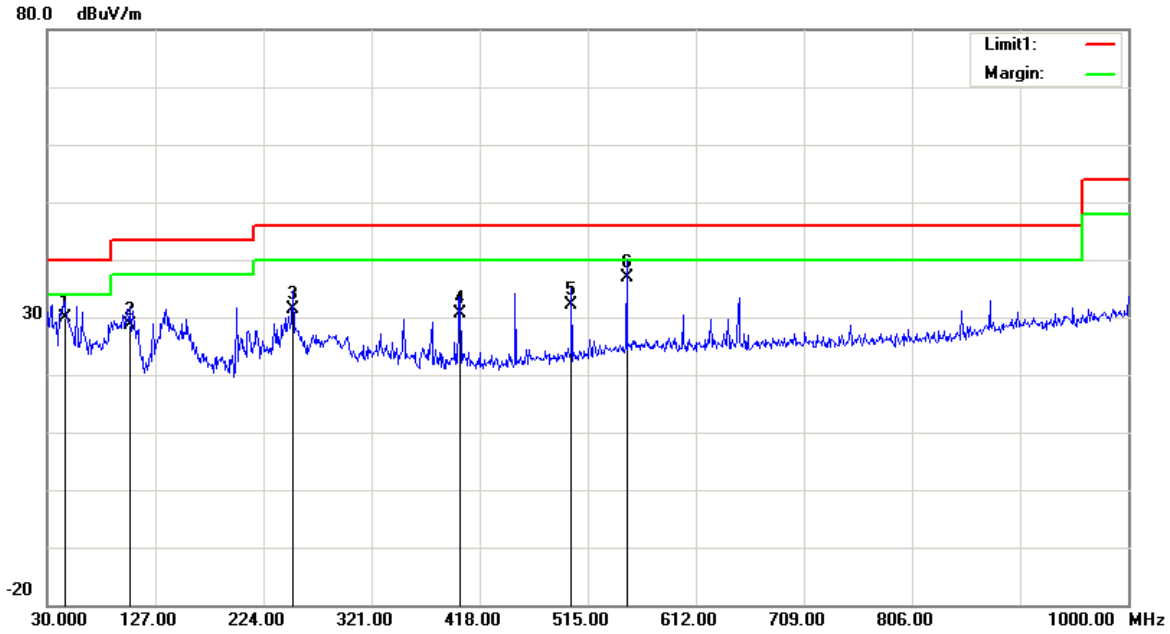
*Model: UR55*

**Horizontal**




| Frequency (MHz) | Receiver Reading (dBµV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 33.8800 | 35.88 | QP | -3.88 | 32.00 | 40.00 | 8.00 |
| 102.7500 | 40.78 | QP | -11.48 | 29.30 | 43.50 | 14.20 |
| 151.2500 | 37.91 | QP | -6.91 | 31.00 | 43.50 | 12.50 |
| 199.7500 | 39.06 | QP | -6.86 | 32.20 | 43.50 | 11.30 |
| 500.4500 | 30.85 | QP | -0.15 | 30.70 | 46.00 | 15.30 |
| 549.9200 | 34.74 | QP | 1.76 | 36.50 | 46.00 | 9.50 |

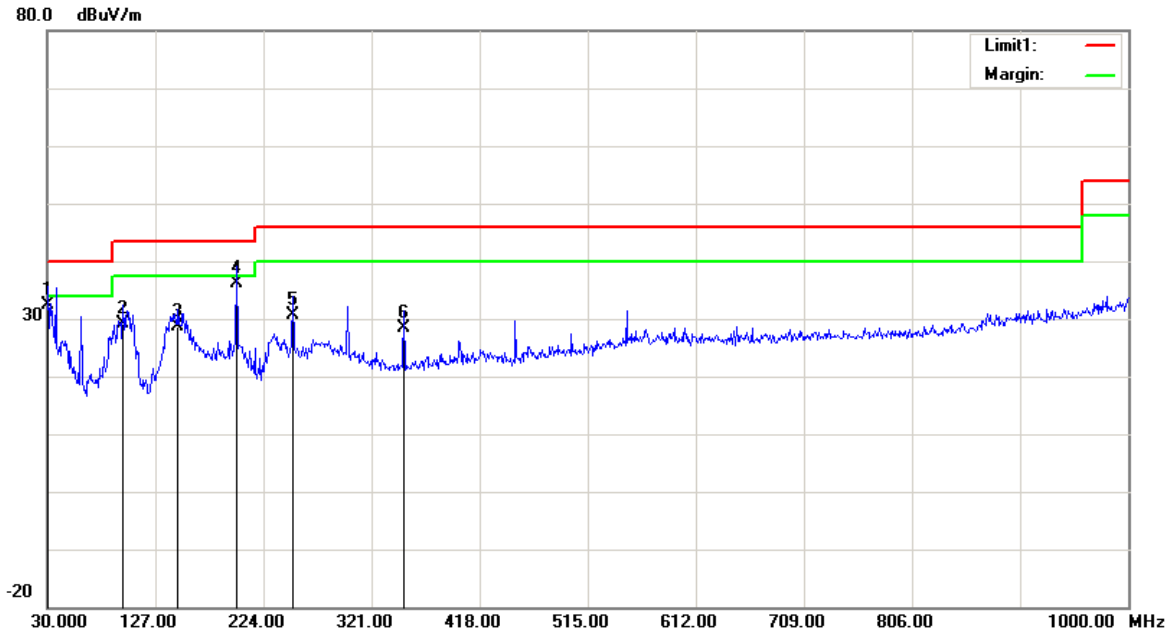
**Vertical**




| Frequency (MHz) | Receiver Reading (dBµV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 45.5200 | 40.13 | QP | -10.33 | 29.80 | 40.00 | 10.20 |
| 104.6900 | 40.06 | QP | -11.36 | 28.70 | 43.50 | 14.80 |
| 250.1900 | 39.09 | QP | -7.59 | 31.50 | 46.00 | 14.50 |
| 400.5400 | 32.89 | QP | -2.29 | 30.60 | 46.00 | 15.40 |
| 500.4500 | 32.25 | QP | -0.15 | 32.10 | 46.00 | 13.90 |
| 549.9200 | 35.14 | QP | 1.76 | 36.90 | 46.00 | 9.10 |

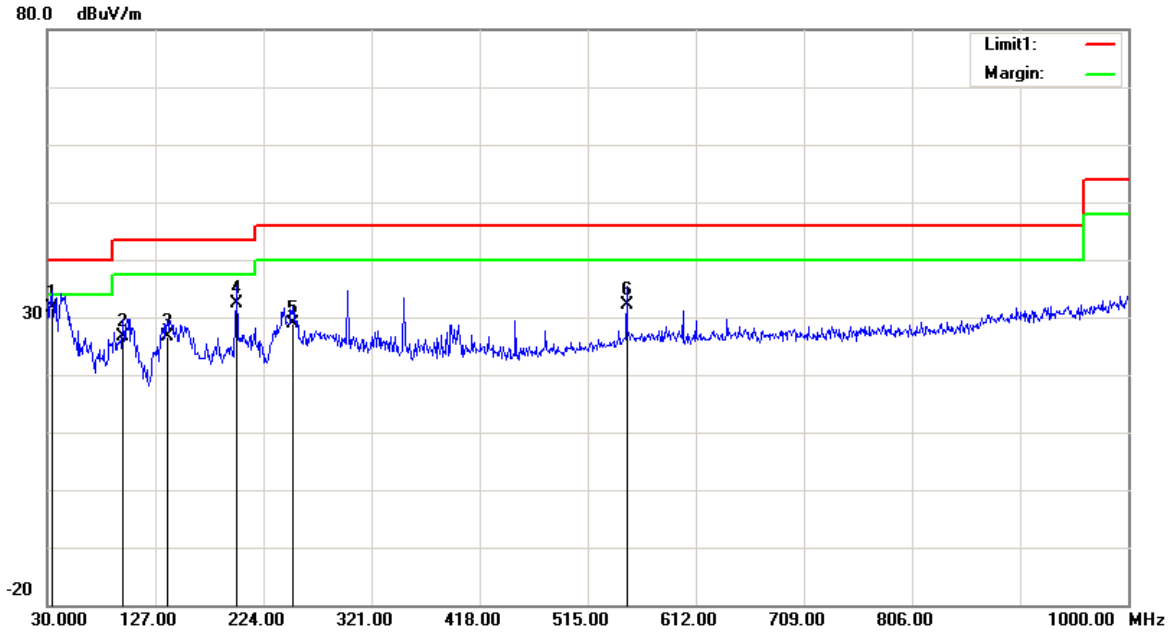
*Model: UR52*

**Horizontal**




| Frequency (MHz) | Receiver Reading (dBµV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 30.9700 | 34.97 | QP | -2.47 | 32.50 | 40.00 | 7.50 |
| 97.9000 | 41.08 | QP | -11.88 | 29.20 | 43.50 | 14.30 |
| 147.3700 | 35.47 | QP | -6.87 | 28.60 | 43.50 | 14.90 |
| 199.7500 | 43.06 | QP | -6.86 | 36.20 | 43.50 | 7.30 |
| 250.1900 | 38.29 | QP | -7.59 | 30.70 | 46.00 | 15.30 |
| 350.1000 | 31.89 | QP | -3.59 | 28.30 | 46.00 | 17.70 |

**Vertical**




| Frequency (MHz) | Receiver Reading (dBµV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 34.8500 | 36.06 | QP | -4.36 | 31.70 | 40.00 | 8.30 |
| 97.9000 | 38.58 | QP | -11.88 | 26.70 | 43.50 | 16.80 |
| 137.6700 | 33.48 | QP | -6.88 | 26.60 | 43.50 | 16.90 |
| 199.7500 | 39.16 | QP | -6.86 | 32.30 | 43.50 | 11.20 |
| 250.1900 | 36.49 | QP | -7.59 | 28.90 | 46.00 | 17.10 |
| 549.9200 | 30.44 | QP | 1.76 | 32.20 | 46.00 | 13.80 |

**2) 1GHz-40GHz:**

*UR55 was the worst case*

**5150-5250MHz**

**802.11a**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Measurement | Polar (H/V) | Factor (dB/m) | | | | | | |
| Low Channel: 5180 MHz | | | | | | | | | | |
| 5180.00 | 57.03 | PK | H | 33.59 | 3.58 | 0.00 | 94.20 | 88.18 | N/A | N/A |
| 5180.00 | 47.67 | AV | H | 33.59 | 3.58 | 0.00 | 84.84 | 78.82 | N/A | N/A |
| 5180.00 | 72.31 | PK | V | 33.59 | 3.58 | 0.00 | 109.48 | 103.46 | N/A | N/A |
| 5180.00 | 62.91 | AV | V | 33.59 | 3.58 | 0.00 | 100.08 | 94.06 | N/A | N/A |
| 5150.00 | 36.18 | PK | V | 33.54 | 3.56 | 0.00 | 73.28 | 67.26 | 74.00 | 6.74 |
| 5150.00 | 14.41 | AV | V | 33.54 | 3.56 | 0.00 | 51.51 | 45.49 | 54.00 | 8.51 |
| 10360.00 | 46.68 | PK | V | 38.17 | 6.29 | 36.85 | 54.29 | 48.27 | 74.00 | 25.73 |
| 10360.00 | 34.16 | AV | V | 38.17 | 6.29 | 36.85 | 41.77 | 35.75 | 54.00 | 18.25 |
| 15540.00 | 46.52 | PK | V | 38.06 | 8.85 | 39.04 | 54.39 | 48.37 | 74.00 | 25.63 |
| 15540.00 | 34.09 | AV | V | 38.06 | 8.85 | 39.04 | 41.96 | 35.94 | 54.00 | 18.06 |
| Middle Channel: 5200 MHz | | | | | | | | | | |
| 5200.00 | 64.65 | PK | H | 33.62 | 3.60 | 0.00 | 101.87 | 95.85 | N/A | N/A |
| 5200.00 | 55.06 | AV | H | 33.62 | 3.60 | 0.00 | 92.28 | 86.26 | N/A | N/A |
| 5200.00 | 79.04 | PK | V | 33.62 | 3.60 | 0.00 | 116.26 | 110.24 | N/A | N/A |
| 5200.00 | 69.47 | AV | V | 33.62 | 3.60 | 0.00 | 106.69 | 100.67 | N/A | N/A |
| 10400.00 | 47.22 | PK | V | 38.18 | 6.32 | 36.86 | 54.86 | 48.84 | 74.00 | 25.16 |
| 10400.00 | 34.69 | AV | V | 38.18 | 6.32 | 36.86 | 42.33 | 36.31 | 54.00 | 17.69 |
| 15600.00 | 46.38 | PK | V | 38.00 | 8.83 | 39.09 | 54.12 | 48.1 | 74.00 | 25.90 |
| 15600.00 | 33.96 | AV | V | 38.00 | 8.83 | 39.09 | 41.70 | 35.68 | 54.00 | 18.32 |
| High Channel: 5240 MHz | | | | | | | | | | |
| 5240.00 | 64.24 | PK | H | 33.68 | 3.52 | 0.00 | 101.44 | 95.42 | N/A | N/A |
| 5240.00 | 54.89 | AV | H | 33.68 | 3.52 | 0.00 | 92.09 | 86.07 | N/A | N/A |
| 5240.00 | 78.48 | PK | V | 33.68 | 3.52 | 0.00 | 115.68 | 109.66 | N/A | N/A |
| 5240.00 | 69.25 | AV | V | 33.68 | 3.52 | 0.00 | 106.45 | 100.43 | N/A | N/A |
| 5350.00 | 24.67 | PK | V | 33.86 | 3.52 | 0.00 | 62.05 | 56.03 | 74.00 | 17.97 |
| 5350.00 | 14.94 | AV | V | 33.86 | 3.52 | 0.00 | 52.32 | 46.3 | 54.00 | 7.70 |
| 10480.00 | 46.28 | PK | V | 38.20 | 6.37 | 36.88 | 53.97 | 47.95 | 74.00 | 26.05 |
| 10480.00 | 33.71 | AV | V | 38.20 | 6.37 | 36.88 | 41.40 | 35.38 | 54.00 | 18.62 |
| 15720.00 | 45.84 | PK | V | 37.88 | 8.79 | 39.18 | 53.33 | 47.31 | 74.00 | 26.69 |
| 15720.00 | 33.47 | AV | V | 37.88 | 8.79 | 39.18 | 40.96 | 34.94 | 54.00 | 19.06 |

**802.11n ht20**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Measurement | Polar (H/V) | Factor (dB/m) | | | | | | |
| Low Channel: 5180 MHz | | | | | | | | | | |
| 5180.00 | 58.85 | PK | H | 33.59 | 3.58 | 0.00 | 96.02 | 90 | N/A | N/A |
| 5180.00 | 49.64 | AV | H | 33.59 | 3.58 | 0.00 | 86.81 | 80.79 | N/A | N/A |
| 5180.00 | 72.18 | PK | V | 33.59 | 3.58 | 0.00 | 109.35 | 103.33 | N/A | N/A |
| 5180.00 | 63.17 | AV | V | 33.59 | 3.58 | 0.00 | 100.34 | 94.32 | N/A | N/A |
| 5150.00 | 34.93 | PK | V | 33.54 | 3.56 | 0.00 | 72.03 | 66.01 | 74.00 | 7.99 |
| 5150.00 | 16.48 | AV | V | 33.54 | 3.56 | 0.00 | 53.58 | 47.56 | 54.00 | 6.44 |
| 10360.00 | 46.10 | PK | V | 38.17 | 6.29 | 36.85 | 53.71 | 47.69 | 74.00 | 26.31 |
| 10360.00 | 33.57 | AV | V | 38.17 | 6.29 | 36.85 | 41.18 | 35.16 | 54.00 | 18.84 |
| 15540.00 | 45.88 | PK | V | 38.06 | 8.85 | 39.04 | 53.75 | 47.73 | 74.00 | 26.27 |
| 15540.00 | 33.46 | AV | V | 38.06 | 8.85 | 39.04 | 41.33 | 35.31 | 54.00 | 18.69 |
| Middle Channel: 5200 MHz | | | | | | | | | | |
| 5200.00 | 65.59 | PK | H | 33.62 | 3.60 | 0.00 | 102.81 | 96.79 | N/A | N/A |
| 5200.00 | 56.35 | AV | H | 33.62 | 3.60 | 0.00 | 93.57 | 87.55 | N/A | N/A |
| 5200.00 | 78.68 | PK | V | 33.62 | 3.60 | 0.00 | 115.90 | 109.88 | N/A | N/A |
| 5200.00 | 69.55 | AV | V | 33.62 | 3.60 | 0.00 | 106.77 | 100.75 | N/A | N/A |
| 10400.00 | 48.95 | PK | V | 38.18 | 6.32 | 36.86 | 56.59 | 50.57 | 74.00 | 23.43 |
| 10400.00 | 36.38 | AV | V | 38.18 | 6.32 | 36.86 | 44.02 | 38 | 54.00 | 16.00 |
| 15600.00 | 48.36 | PK | V | 38.00 | 8.83 | 39.09 | 56.10 | 50.08 | 74.00 | 23.92 |
| 15600.00 | 35.88 | AV | V | 38.00 | 8.83 | 39.09 | 43.62 | 37.6 | 54.00 | 16.40 |
| High Channel: 5240 MHz | | | | | | | | | | |
| 5240.00 | 64.46 | PK | H | 33.68 | 3.52 | 0.00 | 101.66 | 95.64 | N/A | N/A |
| 5240.00 | 55.54 | AV | H | 33.68 | 3.52 | 0.00 | 92.74 | 86.72 | N/A | N/A |
| 5240.00 | 77.62 | PK | V | 33.68 | 3.52 | 0.00 | 114.82 | 108.8 | N/A | N/A |
| 5240.00 | 68.81 | AV | V | 33.68 | 3.52 | 0.00 | 106.01 | 99.99 | N/A | N/A |
| 5350.00 | 25.72 | PK | V | 33.86 | 3.52 | 0.00 | 63.10 | 57.08 | 74.00 | 16.92 |
| 5350.00 | 15.36 | AV | V | 33.86 | 3.52 | 0.00 | 52.74 | 46.72 | 54.00 | 7.28 |
| 10480.00 | 48.10 | PK | V | 38.20 | 6.37 | 36.88 | 55.79 | 49.77 | 74.00 | 24.23 |
| 10480.00 | 35.62 | AV | V | 38.20 | 6.37 | 36.88 | 43.31 | 37.29 | 54.00 | 16.71 |
| 15720.00 | 47.35 | PK | V | 37.88 | 8.79 | 39.18 | 54.84 | 48.82 | 74.00 | 25.18 |
| 15720.00 | 35.02 | AV | V | 37.88 | 8.79 | 39.18 | 42.51 | 36.49 | 54.00 | 17.51 |

**802.11n ht40**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Measurement | Polar (H/V) | Factor (dB/m) | | | | | | |
| Low Channel: 5190 MHz | | | | | | | | | | |
| 5190.00 | 54.67 | PK | H | 33.60 | 3.59 | 0.00 | 91.86 | 85.84 | N/A | N/A |
| 5190.00 | 44.66 | AV | H | 33.60 | 3.59 | 0.00 | 81.85 | 75.83 | N/A | N/A |
| 5190.00 | 68.22 | PK | V | 33.60 | 3.59 | 0.00 | 105.41 | 99.39 | N/A | N/A |
| 5190.00 | 58.33 | AV | V | 33.60 | 3.59 | 0.00 | 95.52 | 89.5 | N/A | N/A |
| 5150.00 | 36.48 | PK | V | 33.54 | 3.56 | 0.00 | 73.58 | 67.56 | 74.00 | 6.44 |
| 5150.00 | 15.66 | AV | V | 33.54 | 3.56 | 0.00 | 52.76 | 46.74 | 54.00 | 7.26 |
| 10380.00 | 45.54 | PK | V | 38.18 | 6.31 | 36.85 | 53.18 | 47.16 | 74.00 | 26.84 |
| 10380.00 | 33.05 | AV | V | 38.18 | 6.31 | 36.85 | 40.69 | 34.67 | 54.00 | 19.33 |
| 15570.00 | 46.38 | PK | V | 38.03 | 8.84 | 39.06 | 54.19 | 48.17 | 74.00 | 25.83 |
| 15570.00 | 33.75 | AV | V | 38.03 | 8.84 | 39.06 | 41.56 | 35.54 | 54.00 | 18.46 |
| High Channel: 5230 MHz | | | | | | | | | | |
| 5230.00 | 60.95 | PK | H | 33.67 | 3.54 | 0.00 | 98.16 | 92.14 | N/A | N/A |
| 5230.00 | 51.32 | AV | H | 33.67 | 3.54 | 0.00 | 88.53 | 82.51 | N/A | N/A |
| 5230.00 | 74.21 | PK | V | 33.67 | 3.54 | 0.00 | 111.42 | 105.4 | N/A | N/A |
| 5230.00 | 64.11 | AV | V | 33.67 | 3.54 | 0.00 | 101.32 | 95.3 | N/A | N/A |
| 5350.00 | 27.45 | PK | V | 33.86 | 3.52 | 0.00 | 64.83 | 58.81 | 74.00 | 15.19 |
| 5350.00 | 14.68 | AV | V | 33.86 | 3.52 | 0.00 | 52.06 | 46.04 | 54.00 | 7.96 |
| 10460.00 | 46.00 | PK | V | 38.19 | 6.36 | 36.87 | 53.68 | 47.66 | 74.00 | 26.34 |
| 10460.00 | 33.56 | AV | V | 38.19 | 6.36 | 36.87 | 41.24 | 35.22 | 54.00 | 18.78 |
| 15690.00 | 45.77 | PK | V | 37.91 | 8.80 | 39.15 | 53.33 | 47.31 | 74.00 | 26.69 |
| 15690.00 | 33.26 | AV | V | 37.91 | 8.80 | 39.15 | 40.82 | 34.8 | 54.00 | 19.20 |

**802.11 ac80**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Measurement | Polar (H/V) | Factor (dB/m) | | | | | | |
| Middle Channel: 5210 MHz | | | | | | | | | | |
| 5210.00 | 56.44 | PK | H | 33.64 | 3.58 | 0.00 | 93.66 | 87.64 | N/A | N/A |
| 5210.00 | 43.09 | AV | H | 33.64 | 3.58 | 0.00 | 80.31 | 74.29 | N/A | N/A |
| 5210.00 | 69.86 | PK | V | 33.64 | 3.58 | 0.00 | 107.08 | 101.06 | N/A | N/A |
| 5210.00 | 56.99 | AV | V | 33.64 | 3.58 | 0.00 | 94.21 | 88.19 | N/A | N/A |
| 5150.00 | 35.26 | PK | V | 33.54 | 3.56 | 0.00 | 72.36 | 66.34 | 74.00 | 7.66 |
| 5150.00 | 19.45 | AV | V | 33.54 | 3.56 | 0.00 | 56.55 | 50.53 | 54.00 | 3.47 |
| 5350.00 | 26.02 | PK | V | 33.86 | 3.52 | 0.00 | 63.40 | 57.38 | 74.00 | 16.62 |
| 5350.00 | 14.77 | AV | V | 33.86 | 3.52 | 0.00 | 52.15 | 46.13 | 54.00 | 7.87 |
| 10420.00 | 45.50 | PK | V | 38.18 | 6.33 | 36.86 | 53.15 | 47.13 | 74.00 | 26.87 |
| 10420.00 | 32.76 | AV | V | 38.18 | 6.33 | 36.86 | 40.41 | 34.39 | 54.00 | 19.61 |
| 15630.00 | 46.10 | PK | V | 37.97 | 8.82 | 39.11 | 53.78 | 47.76 | 74.00 | 26.24 |
| 15630.00 | 33.58 | AV | V | 37.97 | 8.82 | 39.11 | 41.26 | 35.24 | 54.00 | 18.76 |

**5725-5850MHz**

**802.11a**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Measurement | Polar (H/V) | Factor (dB/m) | | | | | | |
| Low Channel: 5745MHz | | | | | | | | | | |
| 5745.00 | 63.88 | PK | H | 34.20 | 3.69 | 0.00 | 101.77 | 95.75 | N/A | N/A |
| 5745.00 | 54.10 | AV | H | 34.20 | 3.69 | 0.00 | 91.99 | 85.97 | N/A | N/A |
| 5745.00 | 80.17 | PK | V | 34.20 | 3.69 | 0.00 | 118.06 | 112.04 | N/A | N/A |
| 5745.00 | 70.85 | AV | V | 34.20 | 3.69 | 0.00 | 108.74 | 102.72 | N/A | N/A |
| 5725.00 | 56.15 | PK | V | 34.19 | 3.69 | 0.00 | 94.03 | 88.01 | 122.20 | 34.19 |
| 5720.00 | 46.54 | PK | V | 34.19 | 3.69 | 0.00 | 84.42 | 78.4 | 110.80 | 32.40 |
| 5700.00 | 37.14 | PK | V | 34.18 | 3.68 | 0.00 | 75.00 | 68.98 | 105.20 | 36.22 |
| 5650.00 | 27.58 | PK | V | 34.16 | 3.63 | 0.00 | 65.37 | 59.35 | 68.20 | 8.85 |
| 11490.00 | 45.71 | PK | V | 38.99 | 6.59 | 37.35 | 53.94 | 47.92 | 74.00 | 26.08 |
| 11490.00 | 33.49 | AV | V | 38.99 | 6.59 | 37.35 | 41.72 | 35.7 | 54.00 | 18.30 |
| 17235.00 | 45.94 | PK | V | 41.56 | 8.78 | 38.61 | 57.67 | 51.65 | 74.00 | 22.35 |
| 17235.00 | 33.66 | AV | V | 41.56 | 8.78 | 38.61 | 45.39 | 39.37 | 54.00 | 14.63 |
| Middle Channel: 5785 MHz | | | | | | | | | | |
| 5785.00 | 63.32 | PK | H | 34.21 | 3.71 | 0.00 | 101.24 | 95.22 | N/A | N/A |
| 5785.00 | 54.01 | AV | H | 34.21 | 3.71 | 0.00 | 91.93 | 85.91 | N/A | N/A |
| 5785.00 | 80.12 | PK | V | 34.21 | 3.71 | 0.00 | 118.04 | 112.02 | N/A | N/A |
| 5785.00 | 70.53 | AV | V | 34.21 | 3.71 | 0.00 | 108.45 | 102.43 | N/A | N/A |
| 11570.00 | 46.33 | PK | V | 39.00 | 6.61 | 37.44 | 54.50 | 48.48 | 74.00 | 25.52 |
| 11570.00 | 33.77 | AV | V | 39.00 | 6.61 | 37.44 | 41.94 | 35.92 | 54.00 | 18.08 |
| 17355.00 | 46.10 | PK | V | 42.26 | 8.81 | 38.52 | 58.65 | 52.63 | 74.00 | 21.37 |
| 17355.00 | 33.67 | AV | V | 42.26 | 8.81 | 38.52 | 46.22 | 40.2 | 54.00 | 13.80 |
| High Channel: 5825 MHz | | | | | | | | | | |
| 5825.00 | 63.31 | PK | H | 34.23 | 3.73 | 0.00 | 101.27 | 95.25 | N/A | N/A |
| 5825.00 | 53.91 | AV | H | 34.23 | 3.73 | 0.00 | 91.87 | 85.85 | N/A | N/A |
| 5825.00 | 80.14 | PK | V | 34.23 | 3.73 | 0.00 | 118.10 | 112.08 | N/A | N/A |
| 5825.00 | 70.72 | AV | V | 34.23 | 3.73 | 0.00 | 108.68 | 102.66 | N/A | N/A |
| 5850.00 | 47.16 | PK | V | 34.24 | 3.75 | 0.00 | 85.15 | 79.13 | 122.20 | 43.07 |
| 5855.00 | 43.61 | PK | V | 34.24 | 3.75 | 0.00 | 81.60 | 75.58 | 110.80 | 35.22 |
| 5875.00 | 34.05 | PK | V | 34.25 | 3.77 | 0.00 | 72.07 | 66.05 | 105.20 | 39.15 |
| 5925.00 | 26.99 | PK | V | 34.27 | 3.80 | 0.00 | 65.06 | 59.04 | 68.20 | 9.16 |
| 11650.00 | 47.22 | PK | V | 39.00 | 6.64 | 37.53 | 55.33 | 49.31 | 74.00 | 24.69 |
| 11650.00 | 35.10 | AV | V | 39.00 | 6.64 | 37.53 | 43.21 | 37.19 | 54.00 | 16.81 |
| 17475.00 | 46.31 | PK | V | 42.96 | 8.84 | 38.44 | 59.67 | 53.65 | 74.00 | 20.35 |
| 17475.00 | 34.84 | AV | V | 42.96 | 8.84 | 38.44 | 48.20 | 42.18 | 54.00 | 11.82 |

**802.11n ht20**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Measurement | Polar (H/V) | Factor (dB/m) | | | | | | |
| Low Channel: 5745MHz | | | | | | | | | | |
| 5745.00 | 62.01 | PK | H | 34.20 | 3.69 | 0.00 | 99.90 | 93.88 | N/A | N/A |
| 5745.00 | 52.43 | AV | H | 34.20 | 3.69 | 0.00 | 90.32 | 84.3 | N/A | N/A |
| 5745.00 | 79.21 | PK | V | 34.20 | 3.69 | 0.00 | 117.10 | 111.08 | N/A | N/A |
| 5745.00 | 69.92 | AV | V | 34.20 | 3.69 | 0.00 | 107.81 | 101.79 | N/A | N/A |
| 5725.00 | 55.97 | PK | V | 34.19 | 3.69 | 0.00 | 93.85 | 87.83 | 122.20 | 34.37 |
| 5720.00 | 47.21 | PK | V | 34.19 | 3.69 | 0.00 | 85.09 | 79.07 | 110.80 | 31.73 |
| 5700.00 | 36.87 | PK | V | 34.18 | 3.68 | 0.00 | 74.73 | 68.71 | 105.20 | 36.49 |
| 5650.00 | 26.86 | PK | V | 34.16 | 3.63 | 0.00 | 64.65 | 58.63 | 68.20 | 9.57 |
| 11490.00 | 46.28 | PK | V | 38.99 | 6.59 | 37.35 | 54.51 | 48.49 | 74.00 | 25.51 |
| 11490.00 | 33.88 | AV | V | 38.99 | 6.59 | 37.35 | 42.11 | 36.09 | 54.00 | 17.91 |
| 17235.00 | 45.76 | PK | V | 41.56 | 8.78 | 38.61 | 57.49 | 51.47 | 74.00 | 22.53 |
| 17235.00 | 33.37 | AV | V | 41.56 | 8.78 | 38.61 | 45.10 | 39.08 | 54.00 | 14.92 |
| Middle Channel: 5785 MHz | | | | | | | | | | |
| 5785.00 | 62.12 | PK | H | 34.21 | 3.71 | 0.00 | 100.04 | 94.02 | N/A | N/A |
| 5785.00 | 53.56 | AV | H | 34.21 | 3.71 | 0.00 | 91.48 | 85.46 | N/A | N/A |
| 5785.00 | 78.61 | PK | V | 34.21 | 3.71 | 0.00 | 116.53 | 110.51 | N/A | N/A |
| 5785.00 | 69.02 | AV | V | 34.21 | 3.71 | 0.00 | 106.94 | 100.92 | N/A | N/A |
| 11570.00 | 46.58 | PK | V | 39.00 | 6.61 | 37.44 | 54.75 | 48.73 | 74.00 | 25.27 |
| 11570.00 | 34.10 | AV | V | 39.00 | 6.61 | 37.44 | 42.27 | 36.25 | 54.00 | 17.75 |
| 17355.00 | 46.02 | PK | V | 42.26 | 8.81 | 38.52 | 58.57 | 52.55 | 74.00 | 21.45 |
| 17355.00 | 33.55 | AV | V | 42.26 | 8.81 | 38.52 | 46.10 | 40.08 | 54.00 | 13.92 |
| High Channel: 5825 MHz | | | | | | | | | | |
| 5825.00 | 62.54 | PK | H | 34.23 | 3.73 | 0.00 | 100.50 | 94.48 | N/A | N/A |
| 5825.00 | 53.04 | AV | H | 34.23 | 3.73 | 0.00 | 91.00 | 84.98 | N/A | N/A |
| 5825.00 | 79.23 | PK | V | 34.23 | 3.73 | 0.00 | 117.19 | 111.17 | N/A | N/A |
| 5825.00 | 69.50 | AV | V | 34.23 | 3.73 | 0.00 | 107.46 | 101.44 | N/A | N/A |
| 5850.00 | 46.78 | PK | V | 34.24 | 3.75 | 0.00 | 84.77 | 78.75 | 122.20 | 43.45 |
| 5855.00 | 44.23 | PK | V | 34.24 | 3.75 | 0.00 | 82.22 | 76.2 | 110.80 | 34.60 |
| 5875.00 | 33.15 | PK | V | 34.25 | 3.77 | 0.00 | 71.17 | 65.15 | 105.20 | 40.05 |
| 5925.00 | 27.53 | PK | V | 34.27 | 3.80 | 0.00 | 65.60 | 59.58 | 68.20 | 8.62 |
| 11650.00 | 47.10 | PK | V | 39.00 | 6.64 | 37.53 | 55.21 | 49.19 | 74.00 | 24.81 |
| 11650.00 | 34.42 | AV | V | 39.00 | 6.64 | 37.53 | 42.53 | 36.51 | 54.00 | 17.49 |
| 17475.00 | 46.57 | PK | V | 42.96 | 8.84 | 38.44 | 59.93 | 53.91 | 74.00 | 20.09 |
| 17475.00 | 34.05 | AV | V | 42.96 | 8.84 | 38.44 | 47.41 | 41.39 | 54.00 | 12.61 |

**802.11n ht40**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Measurement | Polar (H/V) | Factor (dB/m) | | | | | | |
| Low Channel: 5755MHz | | | | | | | | | | |
| 5755.00 | 60.22 | PK | H | 34.20 | 3.70 | 0.00 | 98.12 | 92.1 | N/A | N/A |
| 5755.00 | 50.57 | AV | H | 34.20 | 3.70 | 0.00 | 88.47 | 82.45 | N/A | N/A |
| 5755.00 | 76.59 | PK | V | 34.20 | 3.70 | 0.00 | 114.49 | 108.47 | N/A | N/A |
| 5755.00 | 66.93 | AV | V | 34.20 | 3.70 | 0.00 | 104.83 | 98.81 | N/A | N/A |
| 5725.00 | 56.27 | PK | V | 34.19 | 3.69 | 0.00 | 94.15 | 88.13 | 122.20 | 34.07 |
| 5720.00 | 53.53 | PK | V | 34.19 | 3.69 | 0.00 | 91.41 | 85.39 | 110.80 | 25.41 |
| 5700.00 | 39.39 | PK | V | 34.18 | 3.68 | 0.00 | 77.25 | 71.23 | 105.20 | 33.97 |
| 5650.00 | 30.95 | PK | V | 34.16 | 3.63 | 0.00 | 68.74 | 62.72 | 68.20 | 5.48 |
| 11510.00 | 46.10 | PK | V | 39.00 | 6.59 | 37.37 | 54.32 | 48.3 | 74.00 | 25.70 |
| 11510.00 | 33.68 | AV | V | 39.00 | 6.59 | 37.37 | 41.90 | 35.88 | 54.00 | 18.12 |
| 17265.00 | 46.25 | PK | V | 41.74 | 8.79 | 38.58 | 58.20 | 52.18 | 74.00 | 21.82 |
| 17265.00 | 33.85 | AV | V | 41.74 | 8.79 | 38.58 | 45.80 | 39.78 | 54.00 | 14.22 |
| High Channel: 5795 MHz | | | | | | | | | | |
| 5795.00 | 59.80 | PK | H | 34.22 | 3.71 | 0.00 | 97.73 | 91.71 | N/A | N/A |
| 5795.00 | 49.59 | AV | H | 34.22 | 3.71 | 0.00 | 87.52 | 81.5 | N/A | N/A |
| 5795.00 | 77.45 | PK | V | 34.22 | 3.71 | 0.00 | 115.38 | 109.36 | N/A | N/A |
| 5795.00 | 67.51 | AV | V | 34.22 | 3.71 | 0.00 | 105.44 | 99.42 | N/A | N/A |
| 5850.00 | 46.77 | PK | V | 34.24 | 3.75 | 0.00 | 84.76 | 78.74 | 122.20 | 43.46 |
| 5855.00 | 44.72 | PK | V | 34.24 | 3.75 | 0.00 | 82.71 | 76.69 | 110.80 | 34.11 |
| 5875.00 | 37.78 | PK | V | 34.25 | 3.77 | 0.00 | 75.80 | 69.78 | 105.20 | 35.42 |
| 5925.00 | 27.19 | PK | V | 34.27 | 3.80 | 0.00 | 65.26 | 59.24 | 68.20 | 8.96 |
| 11590.00 | 48.11 | PK | V | 39.00 | 6.62 | 37.46 | 56.27 | 50.25 | 74.00 | 23.75 |
| 11590.00 | 36.10 | AV | V | 39.00 | 6.62 | 37.46 | 44.26 | 38.24 | 54.00 | 15.76 |
| 17385.00 | 46.28 | PK | V | 42.43 | 8.82 | 38.50 | 59.03 | 53.01 | 74.00 | 20.99 |
| 17385.00 | 33.78 | AV | V | 42.43 | 8.82 | 38.50 | 46.53 | 40.51 | 54.00 | 13.49 |

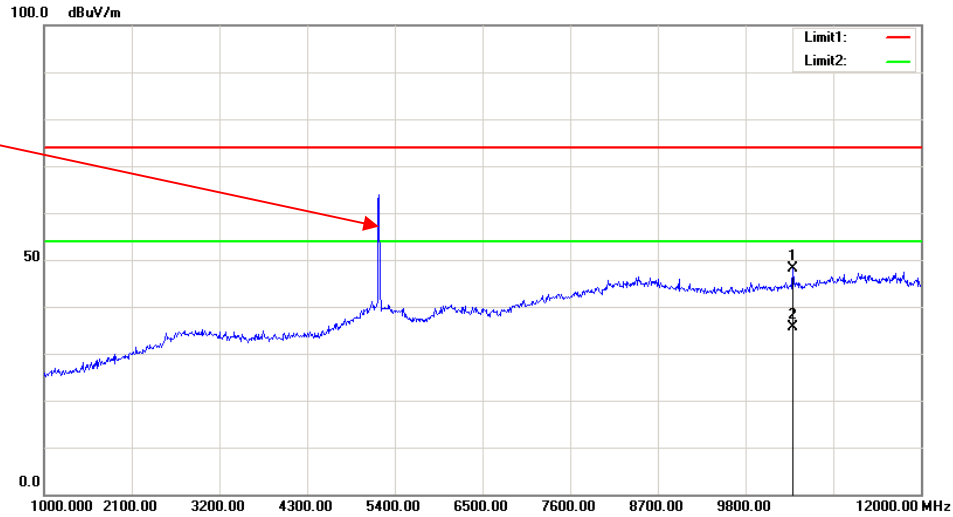
**802.11 ac80**

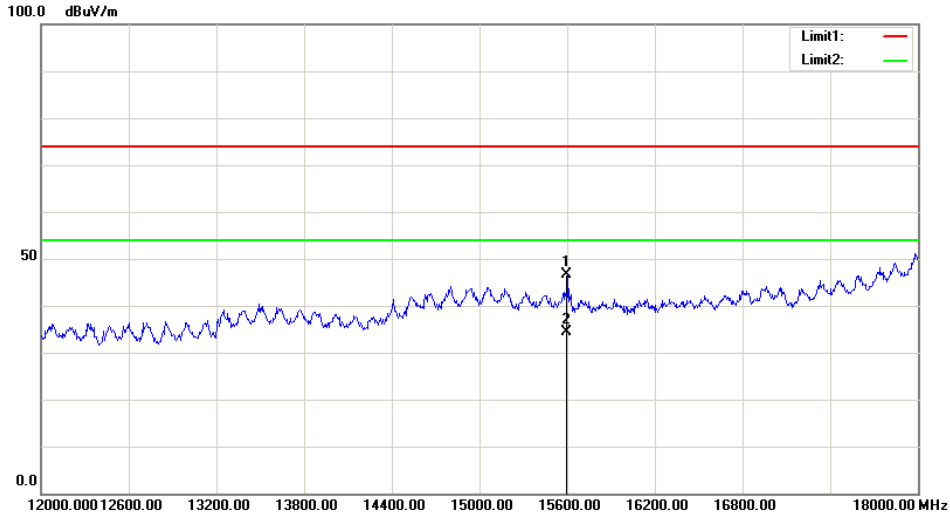
| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBµV/m) | Extrapolation result (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBµV) | Measurement | Polar (H/V) | Factor (dB/m) | | | | | | |
| Middle Channel: 5775 MHz | | | | | | | | | | |
| 5775.00 | 56.06 | PK | H | 34.21 | 3.70 | 0.00 | 93.97 | 87.95 | N/A | N/A |
| 5775.00 | 66.21 | AV | H | 34.21 | 3.70 | 0.00 | 104.12 | 98.1 | N/A | N/A |
| 5775.00 | 72.51 | PK | V | 34.21 | 3.70 | 0.00 | 110.42 | 104.4 | N/A | N/A |
| 5775.00 | 62.89 | AV | V | 34.21 | 3.70 | 0.00 | 100.80 | 94.78 | N/A | N/A |
| 5725.00 | 52.66 | PK | V | 34.19 | 3.69 | 0.00 | 90.54 | 84.52 | 122.20 | 37.68 |
| 5720.00 | 51.06 | PK | V | 34.19 | 3.69 | 0.00 | 88.94 | 82.92 | 110.80 | 27.88 |
| 5700.00 | 40.58 | PK | V | 34.18 | 3.68 | 0.00 | 78.44 | 72.42 | 105.20 | 32.78 |
| 5650.00 | 34.43 | PK | V | 34.16 | 3.63 | 0.00 | 72.22 | 66.2 | 68.20 | 2.00 |
| 5850.00 | 38.30 | PK | V | 34.24 | 3.75 | 0.00 | 76.29 | 70.27 | 122.20 | 51.93 |
| 5855.00 | 35.73 | PK | V | 34.24 | 3.75 | 0.00 | 73.72 | 67.7 | 110.80 | 43.10 |
| 5875.00 | 28.69 | PK | V | 34.25 | 3.77 | 0.00 | 66.71 | 60.69 | 105.20 | 44.51 |
| 5925.00 | 29.01 | PK | V | 34.27 | 3.80 | 0.00 | 67.08 | 61.06 | 68.20 | 7.14 |
| 11550.00 | 48.52 | PK | V | 39.00 | 6.61 | 37.42 | 56.71 | 50.69 | 74.00 | 23.31 |
| 11550.00 | 36.05 | AV | V | 39.00 | 6.61 | 37.42 | 44.24 | 38.22 | 54.00 | 15.78 |
| 17325.00 | 45.98 | PK | V | 42.09 | 8.80 | 38.54 | 58.33 | 52.31 | 74.00 | 21.69 |
| 17325.00 | 33.44 | AV | V | 42.09 | 8.80 | 38.54 | 45.79 | 39.77 | 54.00 | 14.23 |

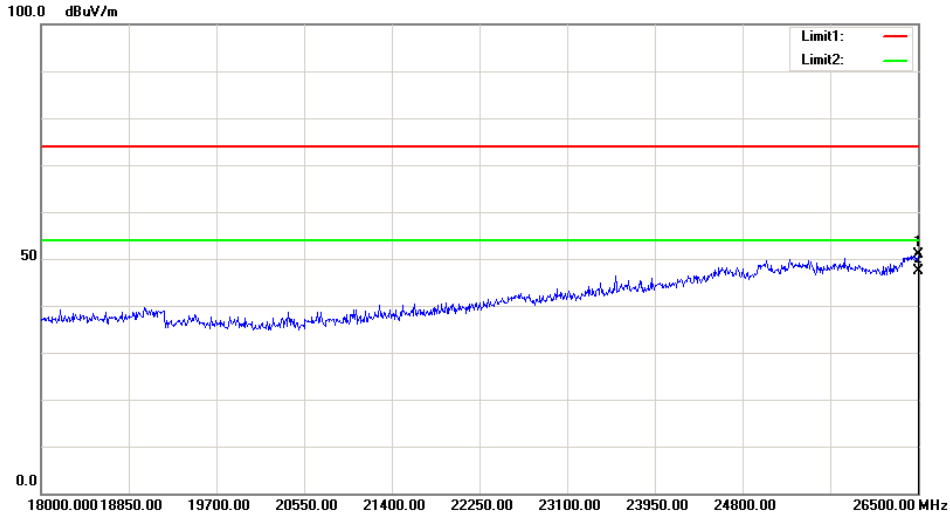
**Test Plots(For worst mode 802.11n ht20 5200MHz)**

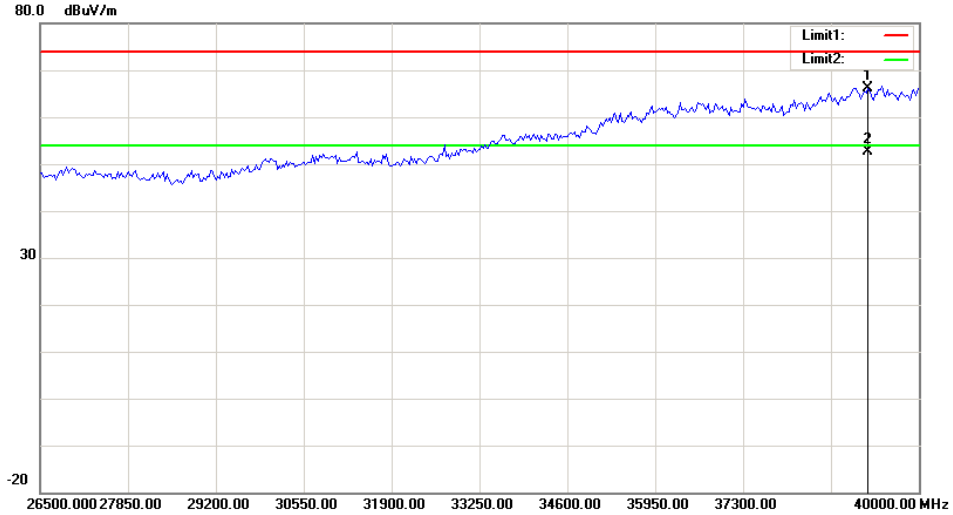
**Horizontal**

Fundamental Test with Band Rejection Filter



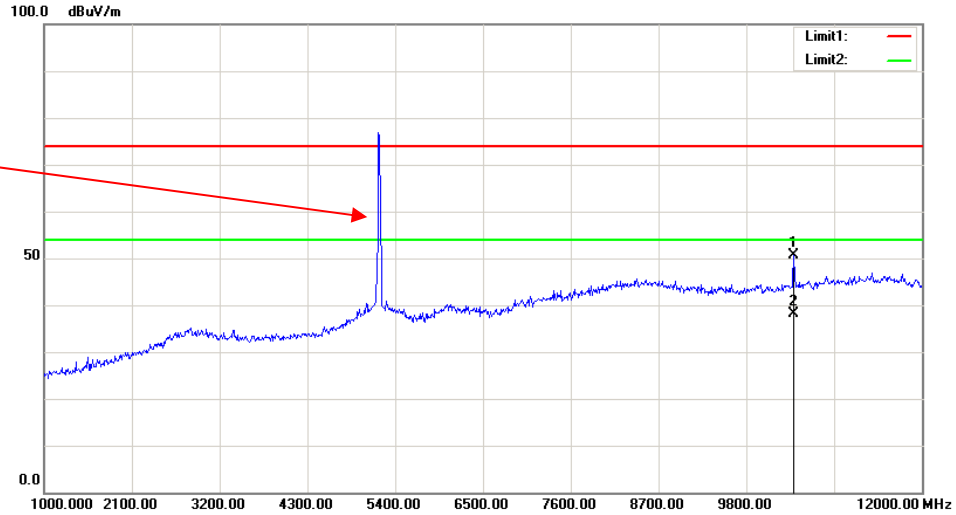



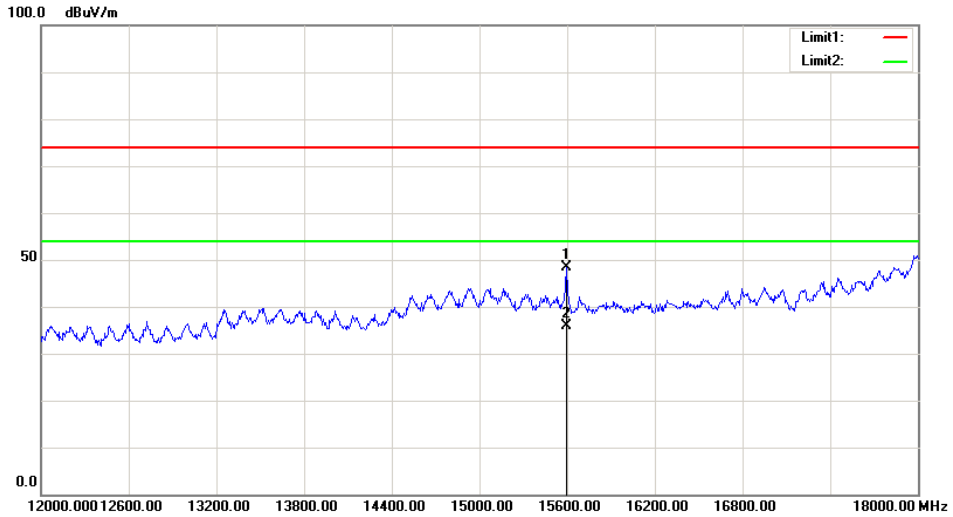



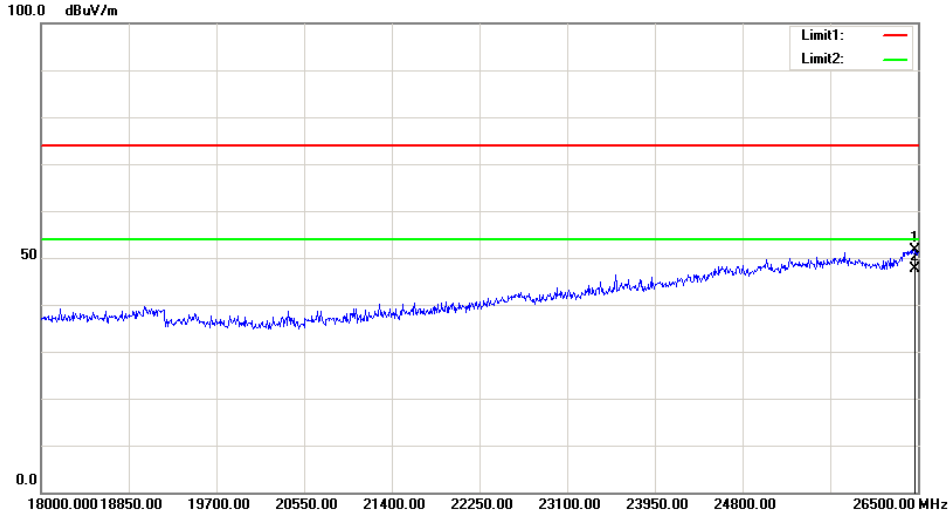


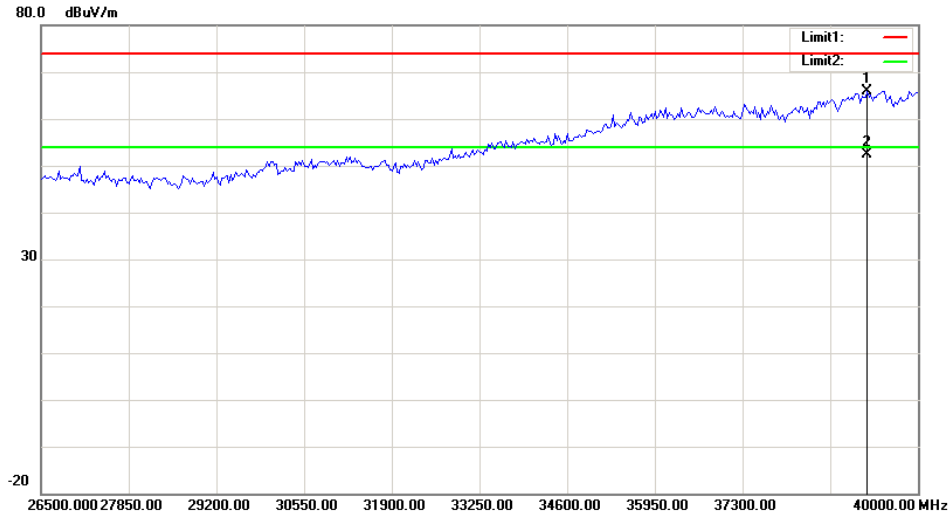

**Vertical**

Fundamental Test with Band Rejection Filter




100.0 dBuV/m
Limit1:
Limit2:
50
0.0
18000.000 18850.00 19700.00 20550.00 21400.00 22250.00 23100.00 23950.00 24800.00 26500.00 MHz


80.0 dBuV/m
Limit1:
Limit2:
30
-20
26500.000 27850.00 29200.00 30550.00 31900.00 33250.00 34600.00 35950.00 37300.00 40000.00 MHz

# FCC §15.407(b)–OUT- OF-BAND EMISSIONS

## Applicable Standard

FCC §15.407

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(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.

(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.

(5) 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.

## Test Procedure

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

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 831929/005 | 2017-08-31 | 2018-08-31 |
| yzjingcheng | Coaxial Cable | KTRFBU-141-50 | 41005011 | 2017-09-05 | 2018-09-05 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each time | N/A |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 28.1~28.8°C |
| **Relative Humidity:** | 58~61 % |
| **ATM Pressure:** | 99.8~99.9 kPa |

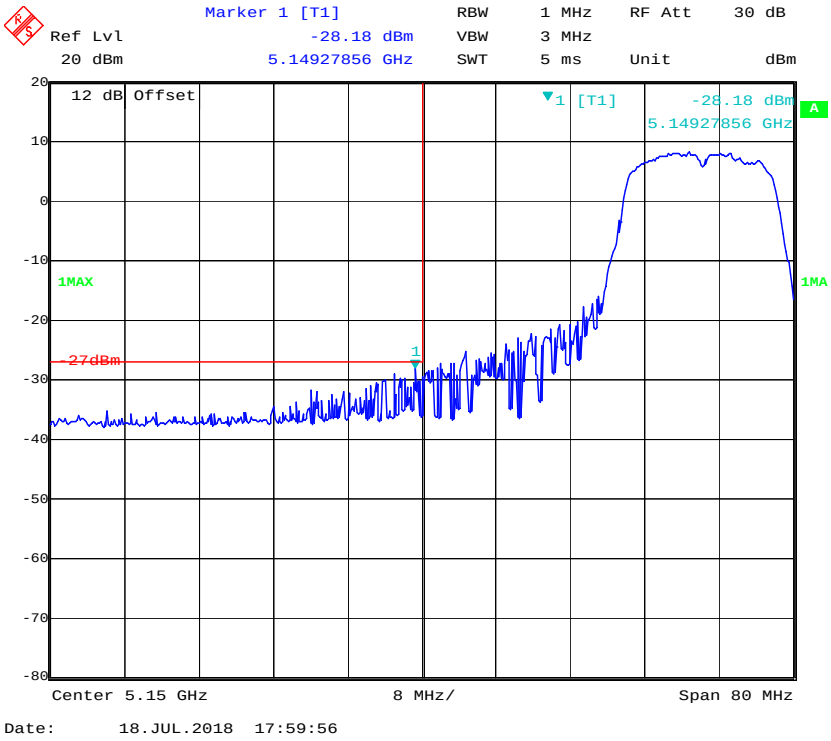
*The testing was performed by Tiago Huang on 2018-07-18, 2018-08-17.*

**Test Result:** Pass.

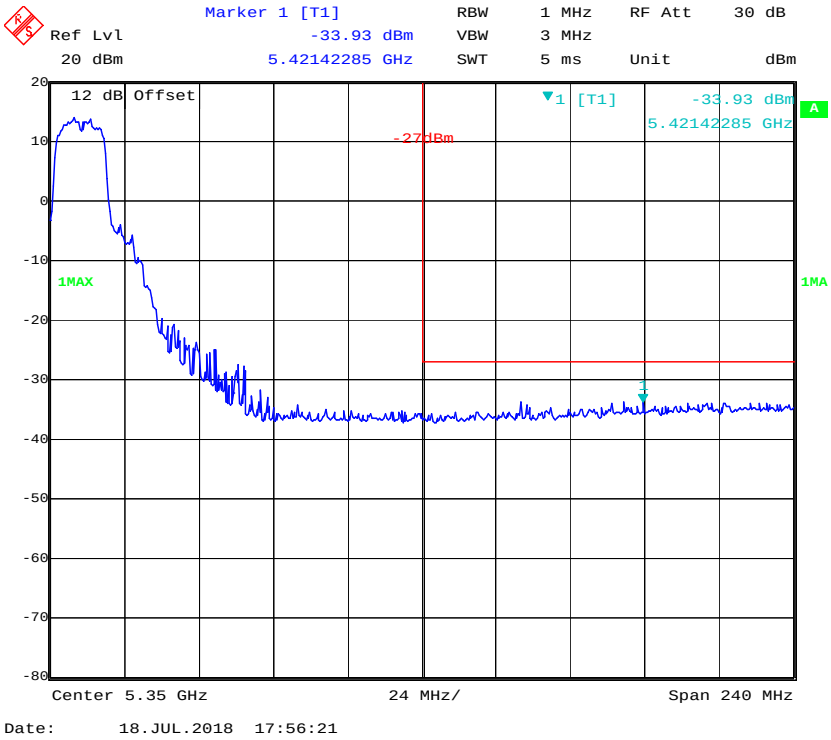
Please refer to the following plots.

**5150-5250MHz**(the antenna gain was offset in the display):

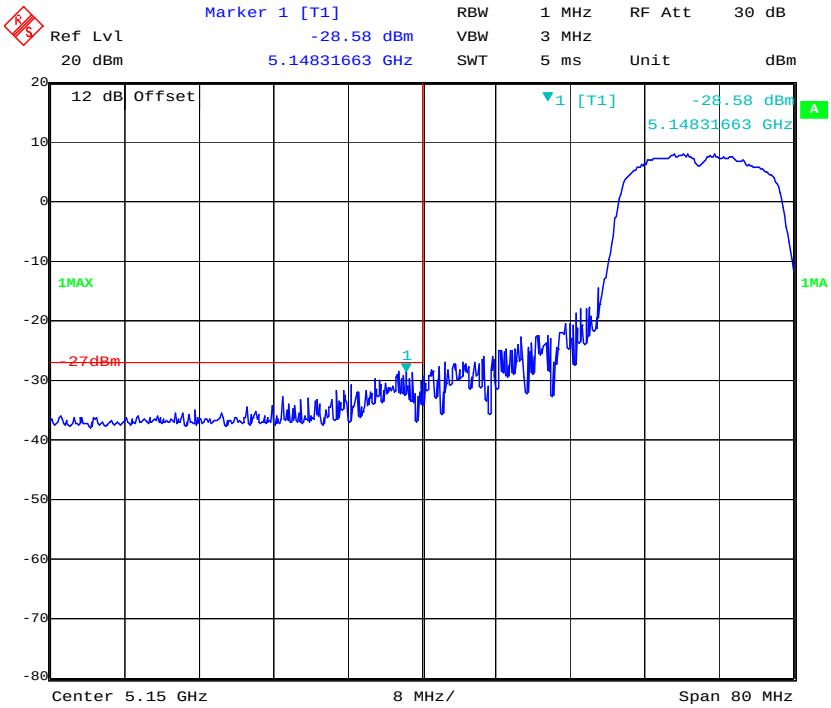
**802.11a Low Channel**




**802.11a High Channel**

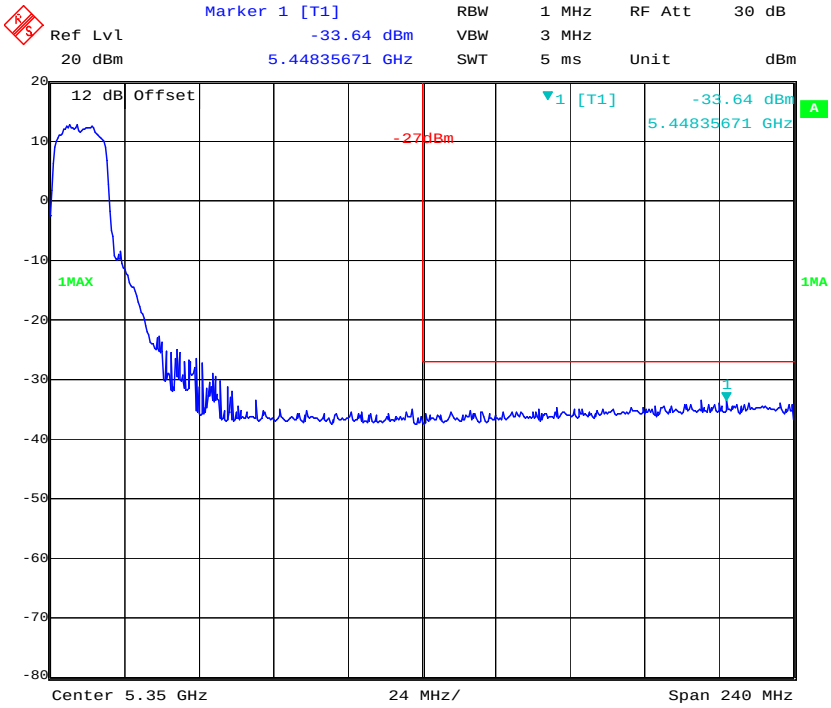


## 802.11n ht20 Low Channel



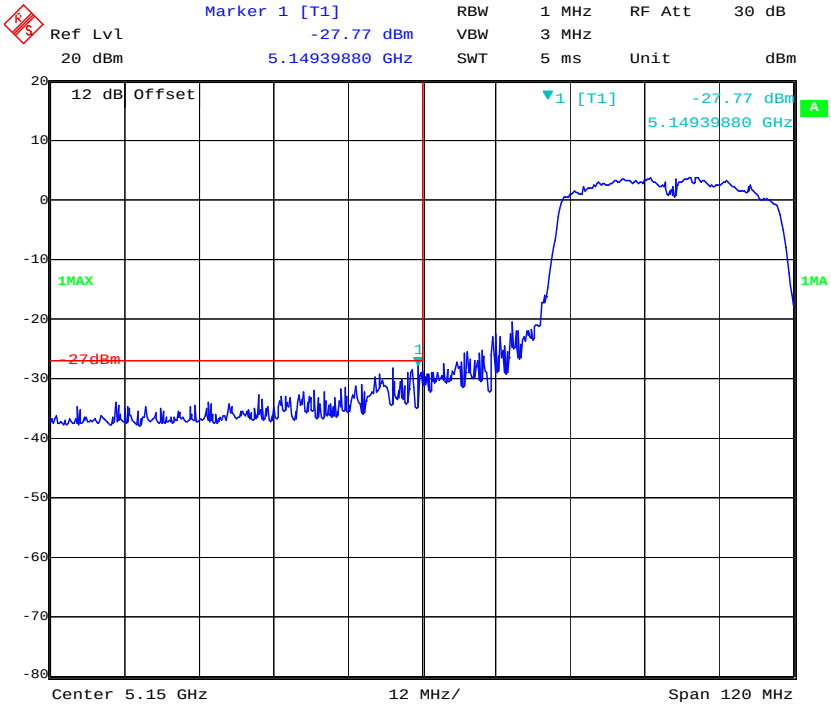

Date: 18.JUL.2018 17:54:52

## 802.11n ht20 High Channel



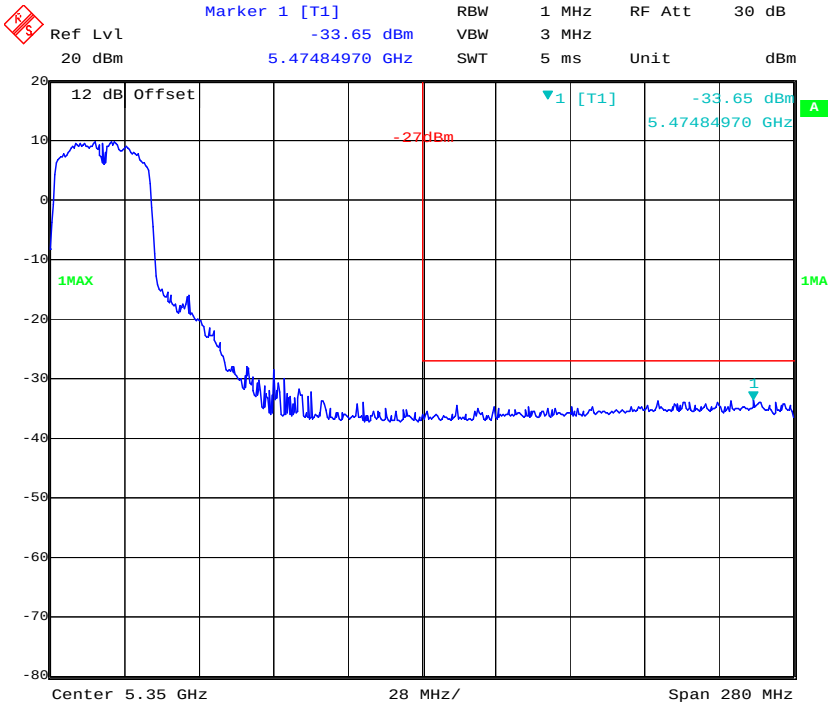

Date: 18.JUL.2018 17:52:40

## 802.11n ht40 Low Channel



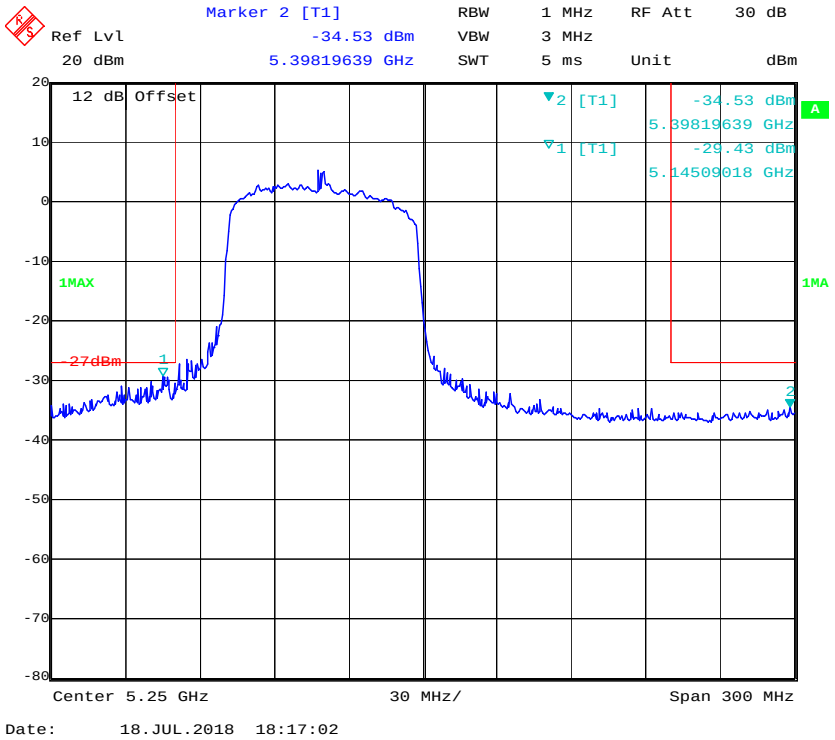

Date: 18.JUL.2018 18:08:37

## 802.11n ht40 High Channel



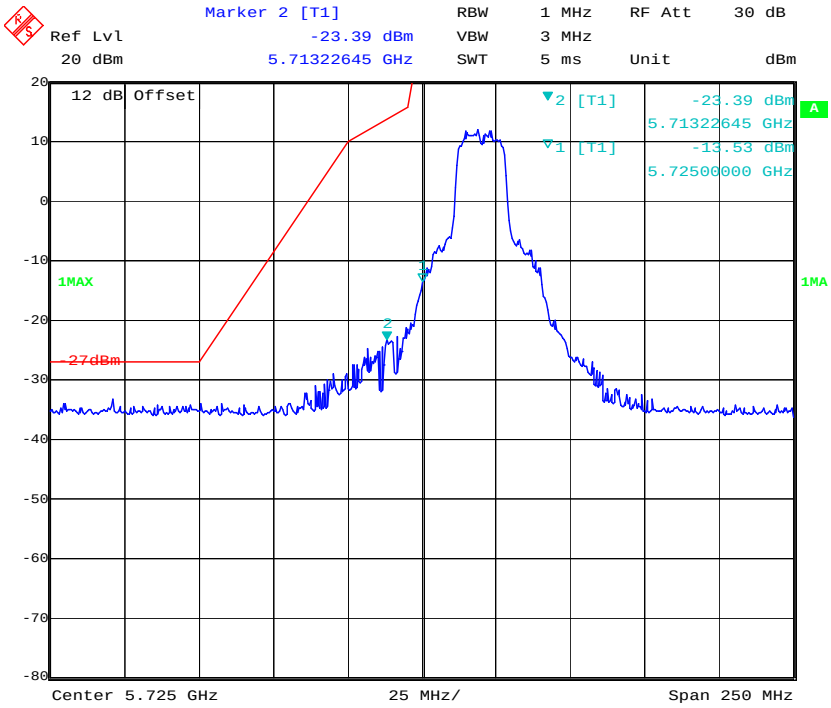

Date: 18.JUL.2018 18:10:44

## 802.11 ac80 Middle Channel

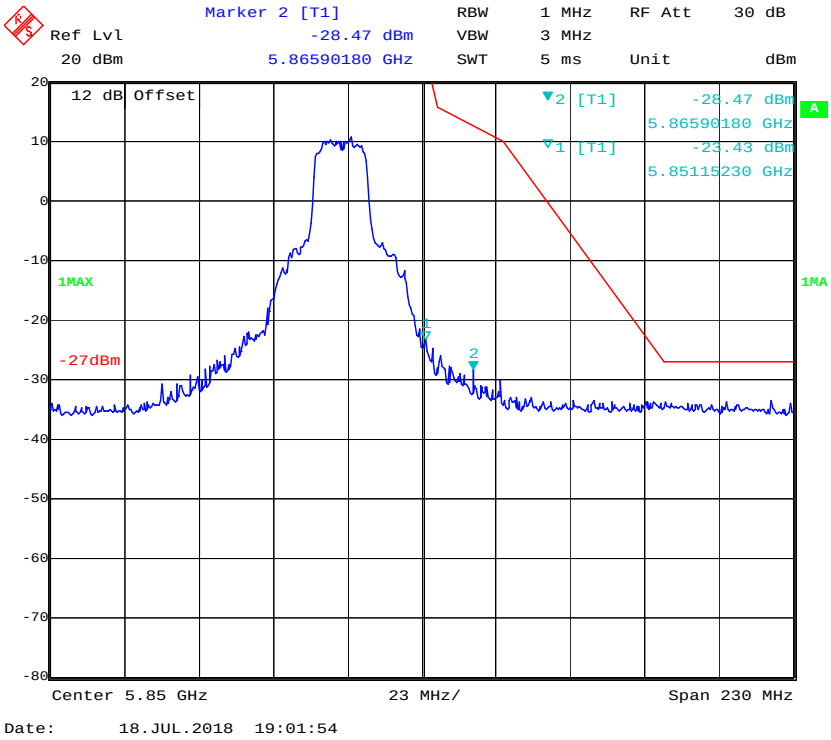


**5725-5850MHz**(the antenna gain was offset in the display)

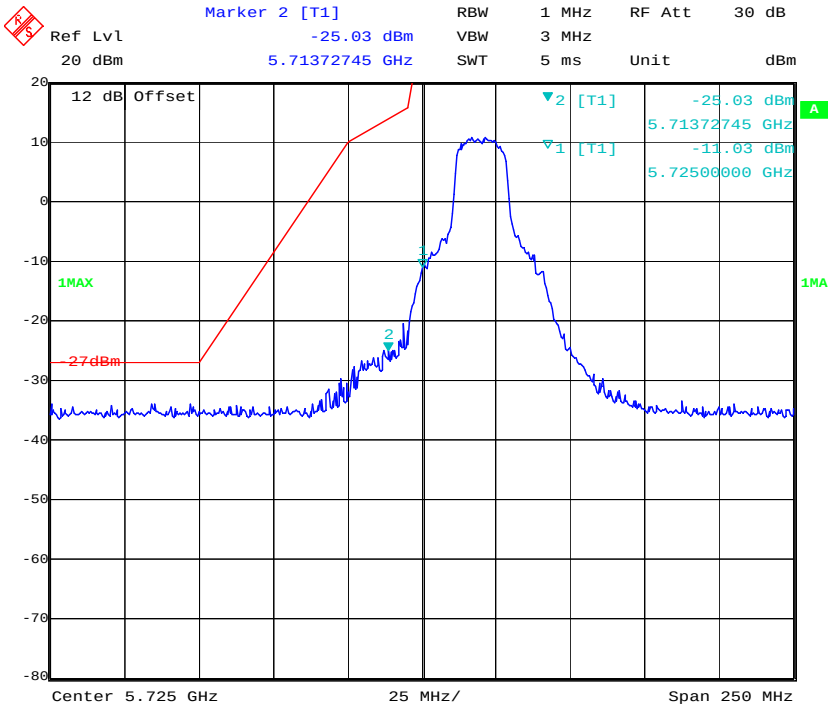
## 802.11a Low Channel




## 802.11a High Channel

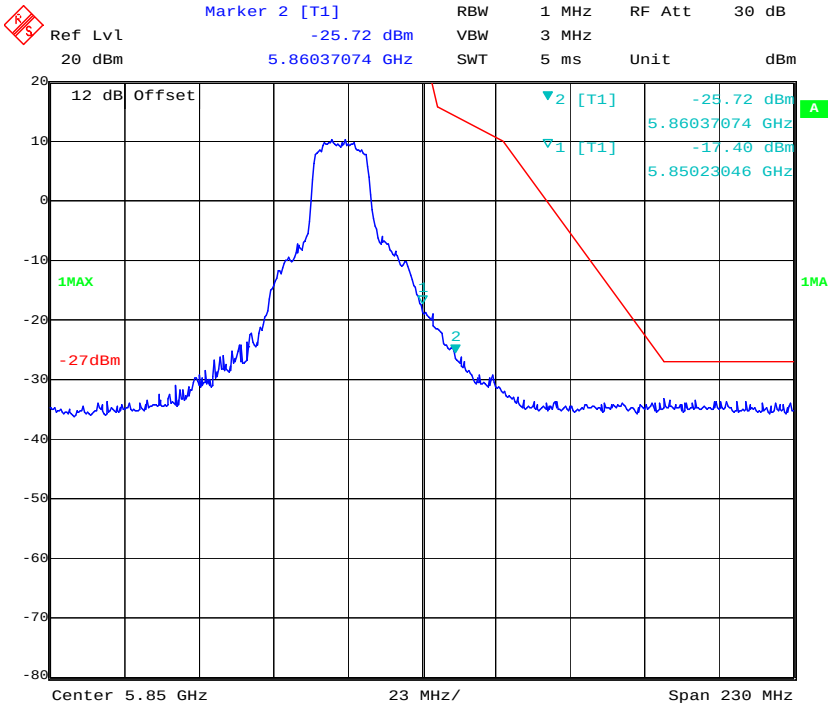


## 802.11n ht20 Low Channel



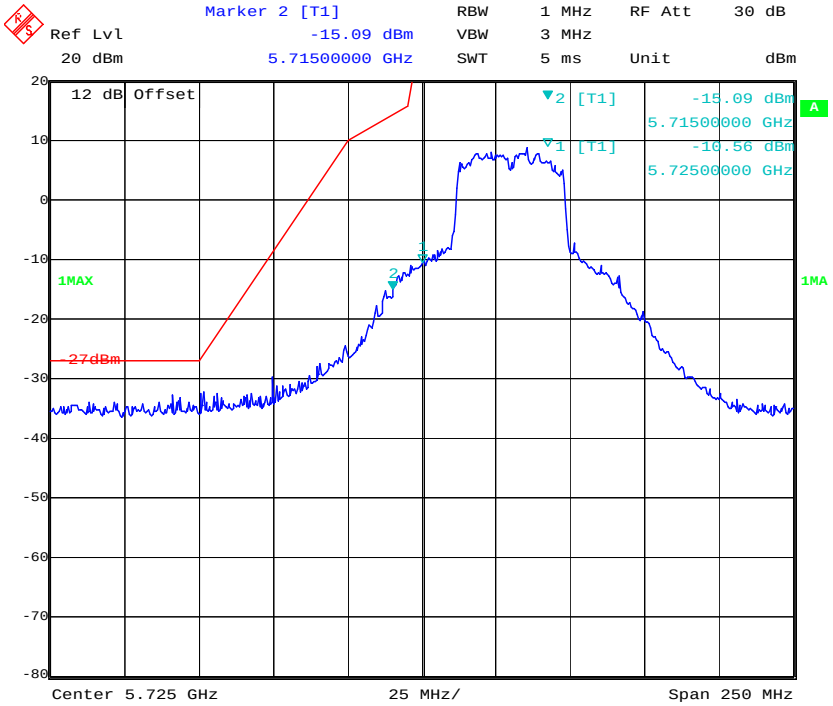

Date: 18.JUL.2018 18:46:52

## 802.11n ht20 High Channel



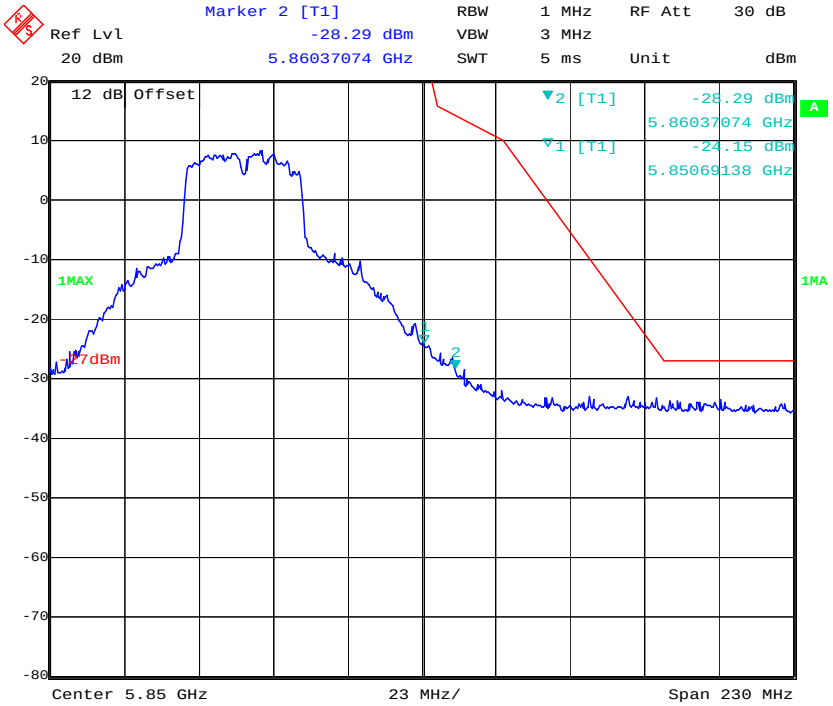

Date: 18.JUL.2018 18:51:39

## 802.11n ht40 Low Channel



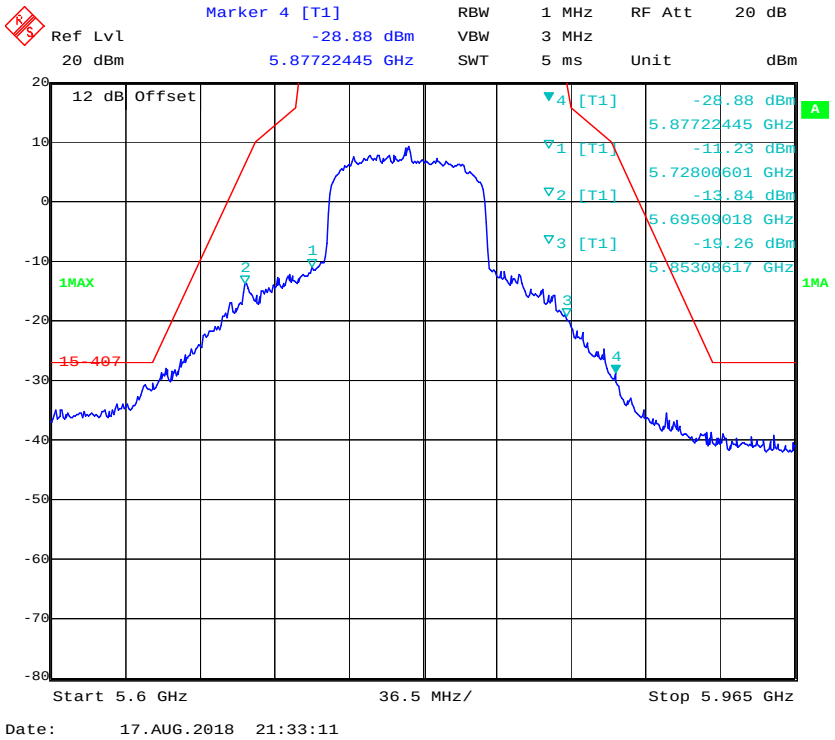

Date: 18.JUL.2018 19:04:47

## 802.11n ht40 High Channel




Date: 18.JUL.2018 19:06:50

## 802.11 ac80 Middle Channel



# FCC §15.407(a)(e) –EMISSION BANDWIDTH AND OCCUPIED BANDWIDTH

## Applicable Standard

15.407(a) (e)

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 831929/005 | 2017-08-31 | 2018-08-31 |
| yzjingcheng | Coaxial Cable | KTRFBU-141-50 | 41005011 | 2017-09-05 | 2018-09-05 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each time | N/A |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Procedure

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

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 28.1~28.8°C |
| **Relative Humidity:** | 58~61 % |
| **ATM Pressure:** | 99.8~99.9 kPa |

*The testing was performed by Tiago Huang on 2018-07-18, 2018-08-17.*

**Test Result:** Pass.

Please refer to the following tables and plots.

*Test mode: Transmitting*

***5150-5250MHz:***

| Mode | Channel | Frequency (MHz) | 26 dB Emission Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|---|---|---|
| 802.11 a | Low | 5180 | 19.80 | 16.43 |
| | Middle | 5200 | 23.81 | 16.67 |
| | High | 5240 | 23.97 | 16.83 |
| 802.11n ht20 | Low | 5180 | 20.84 | 17.47 |
| | Middle | 5200 | 31.18 | 18.12 |
| | High | 5240 | 27.09 | 17.88 |
| 802.11n ht40 | Low | 5190 | 40.72 | 36.39 |
| | High | 5230 | 46.97 | 36.55 |
| 802.11ac80 | Middle | 5210 | 81.76 | 75.03 |

Note: the 99% Occupied Bandwidth have not fall into the band 5250-5350MHz, please refer to the test plots of 99% Occupied Bandwidth.

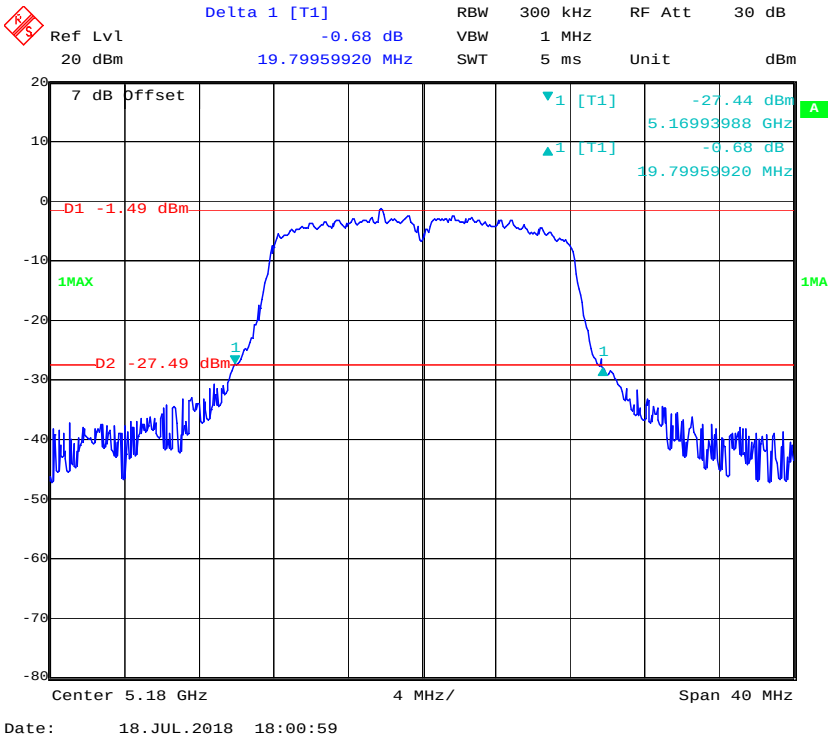
***5725-5850MHz:***

| Mode | Channel | Frequency (MHz) | 6 dB Emission Bandwidth (MHz) | 6 dB Emission Bandwidth Limits (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|---|---|---|---|
| 802.11 a | Low | 5745 | 15.31 | ≥0.5 | 23.89 |
| | Middle | 5785 | 15.31 | ≥0.5 | 25.97 |
| | High | 5825 | 15.39 | ≥0.5 | 25.17 |
| 802.11n ht20 | Low | 5745 | 15.55 | ≥0.5 | 25.81 |
| | Middle | 5785 | 15.31 | ≥0.5 | 20.76 |
| | High | 5825 | 15.47 | ≥0.5 | 26.53 |
| 802.11n ht40 | Low | 5755 | 34.15 | ≥0.5 | 50.50 |
| | High | 5795 | 34.31 | ≥0.5 | 51.94 |
| 802.11ac80 | Middle | 5775 | 72.79 | ≥0.5 | 103.25 |

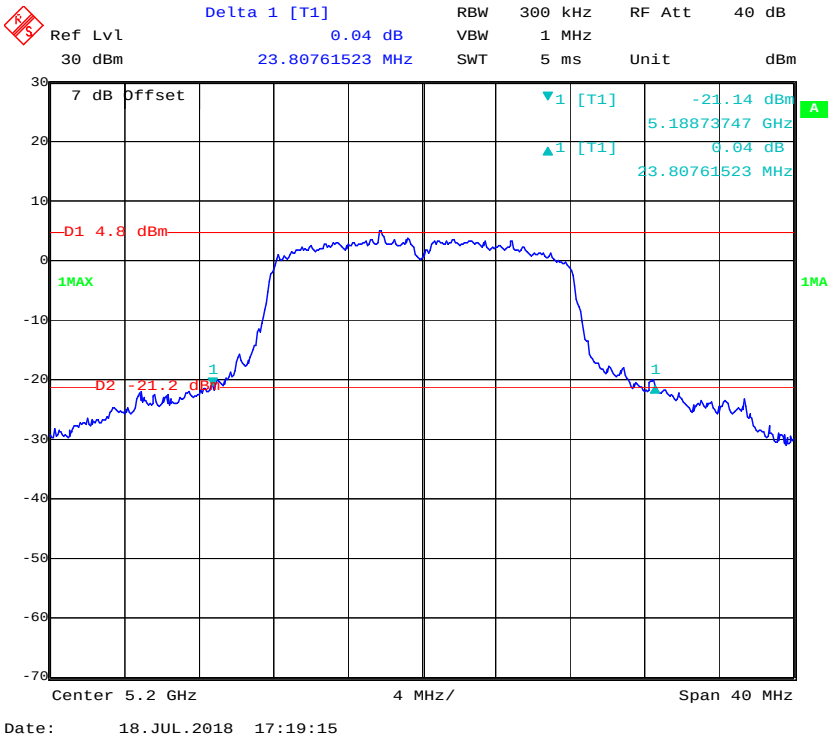
Note: For 5725-5850MHz band, the 99% Occupied Bandwidth have not fall into the band 5470-5725MHz.

## 5150-5250MHz: 26dB Emission Bandwidth:

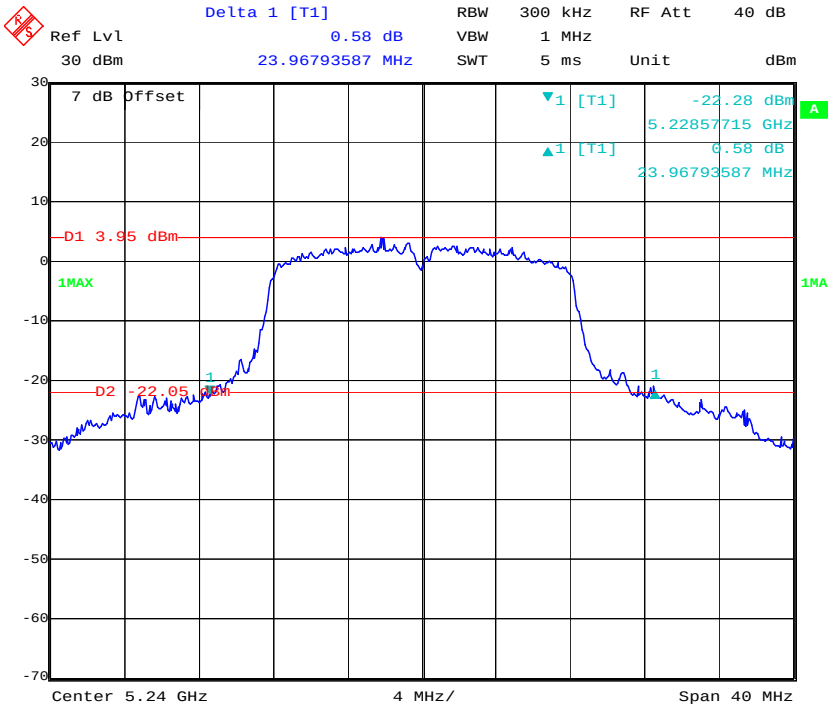
### 802.11a Low Channel




### 802.11a Middle Channel

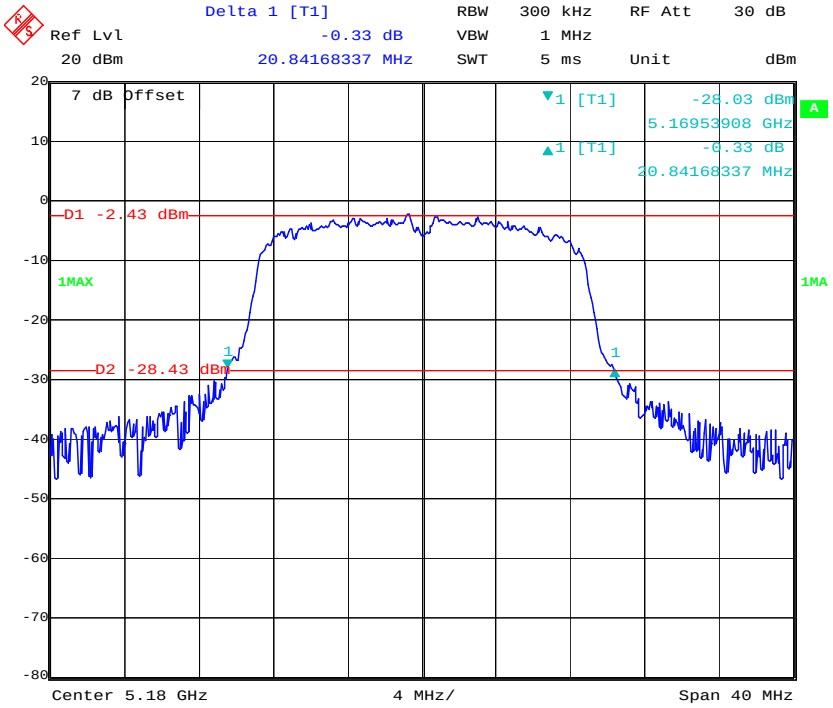


## 802.11a High Channel



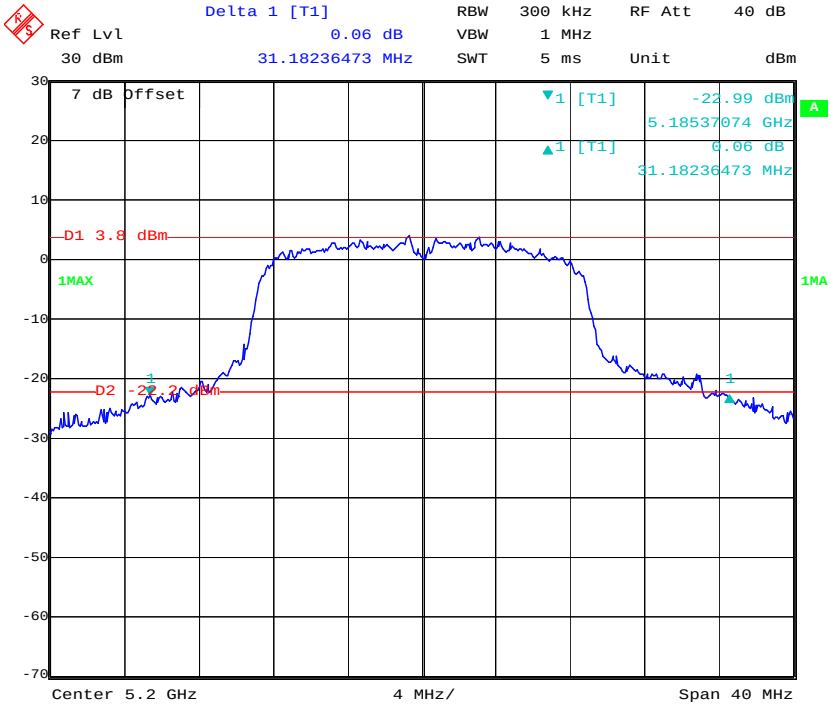

Date: 18.JUL.2018 17:21:27

## 802.11n ht20 Low Channel



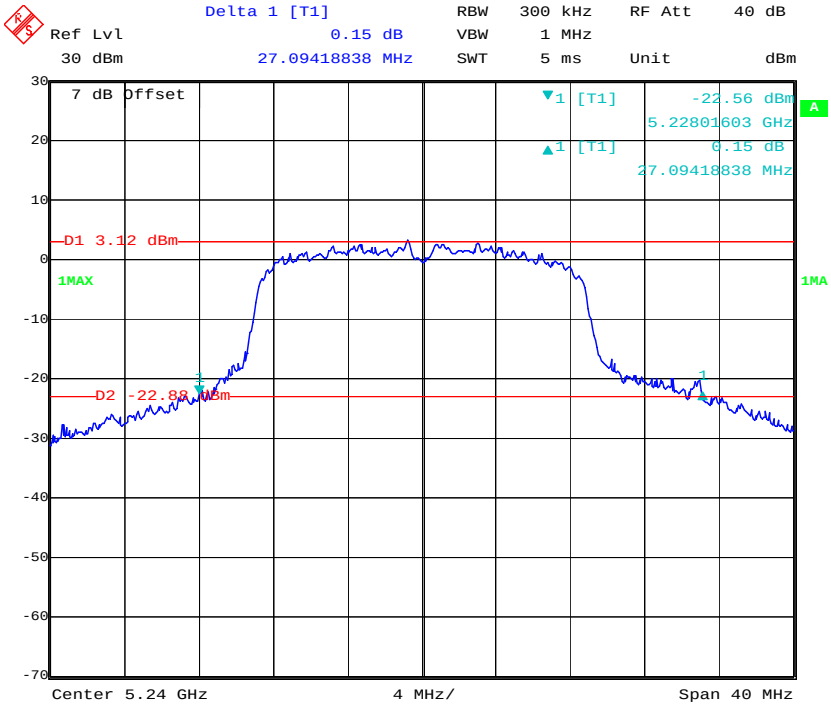

Date: 18.JUL.2018 17:49:24

## 802.11n ht20 Middle Channel



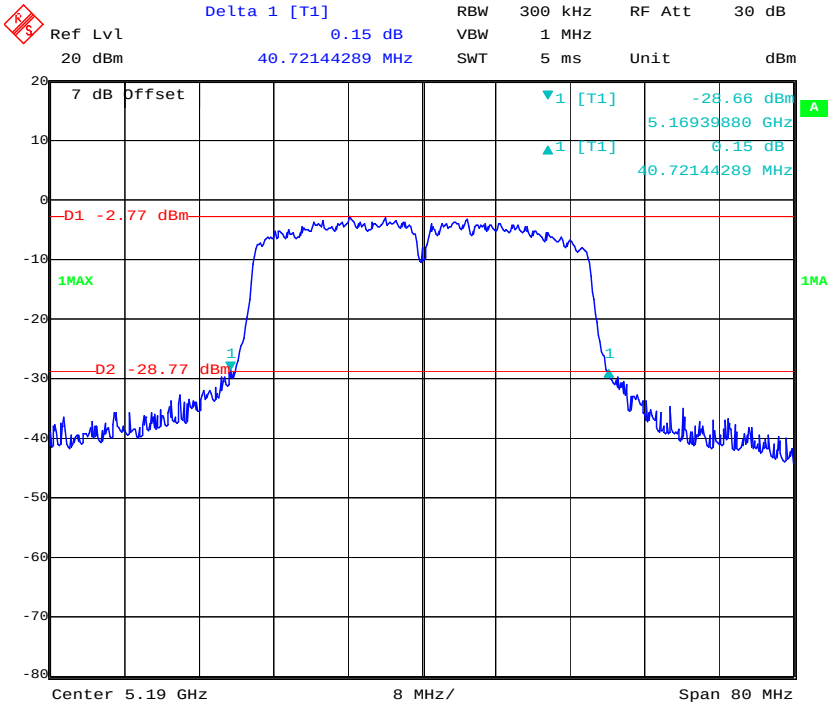

Date: 17.AUG.2018 21:14:12

## 802.11n ht20 High Channel



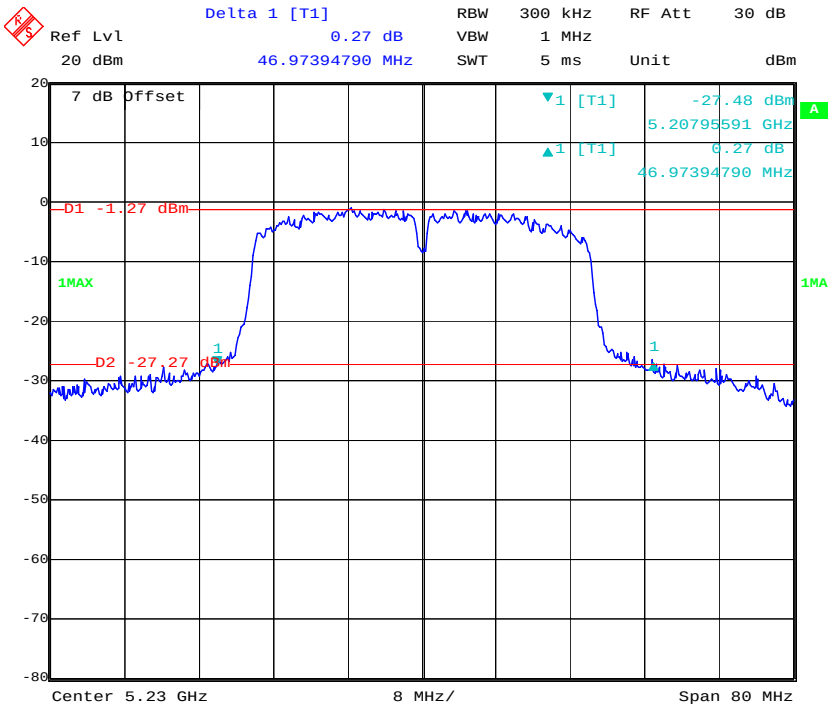

Date: 18.JUL.2018 17:24:10

## 802.11n ht40 Low Channel



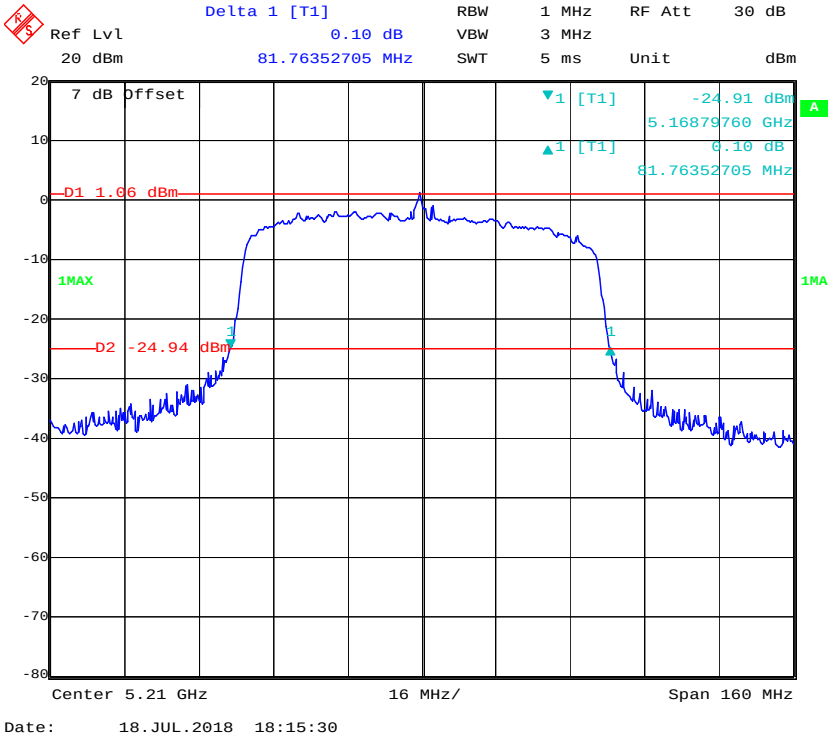

Date: 18.JUL.2018 18:03:36

## 802.11n ht40 High Channel



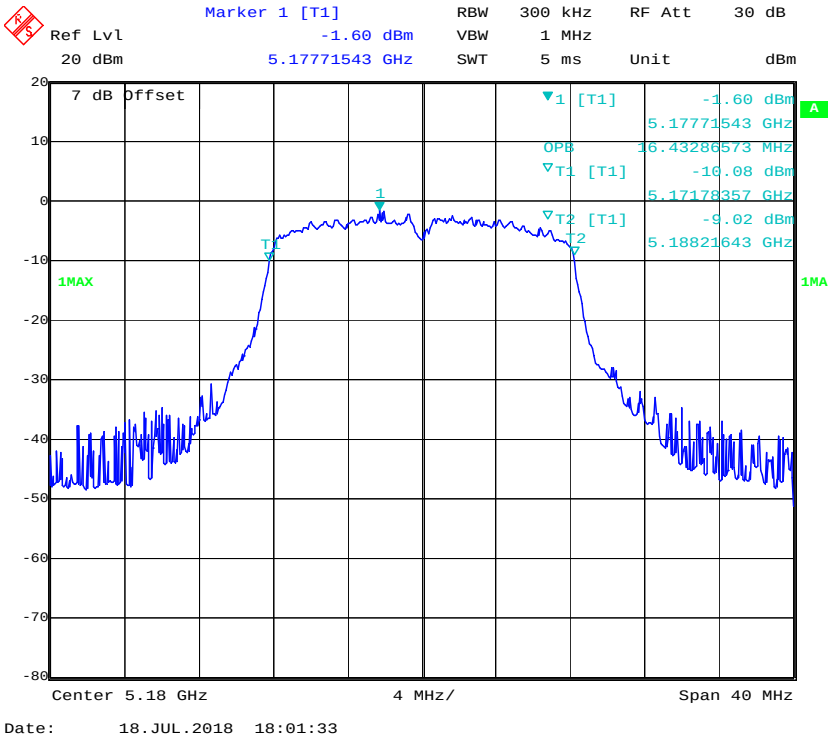

Date: 18.JUL.2018 18:09:39

**802.11ac80 Middle Channel**

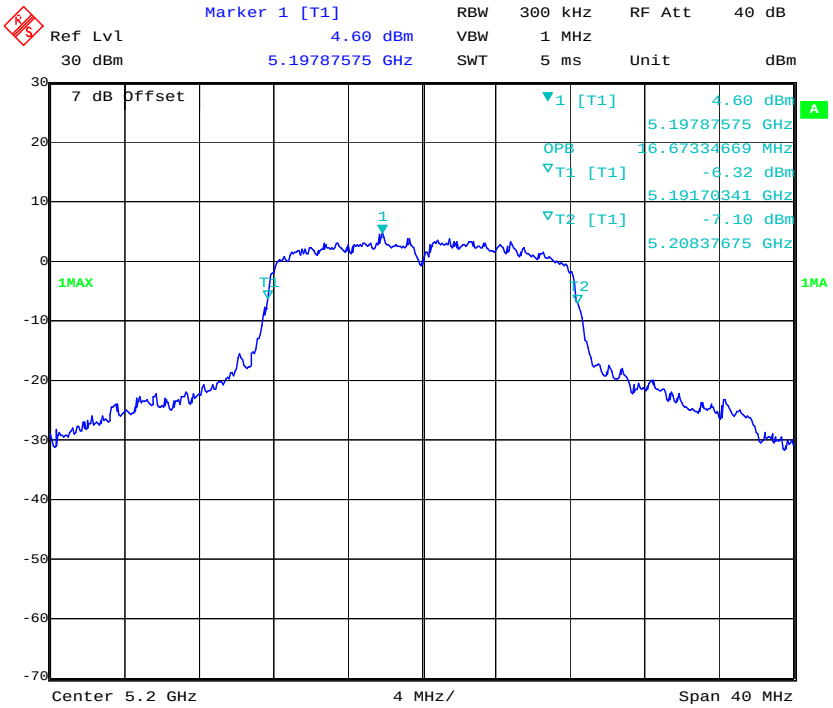



**99% Occupied Bandwidth:**

**802.11a Low Channel**

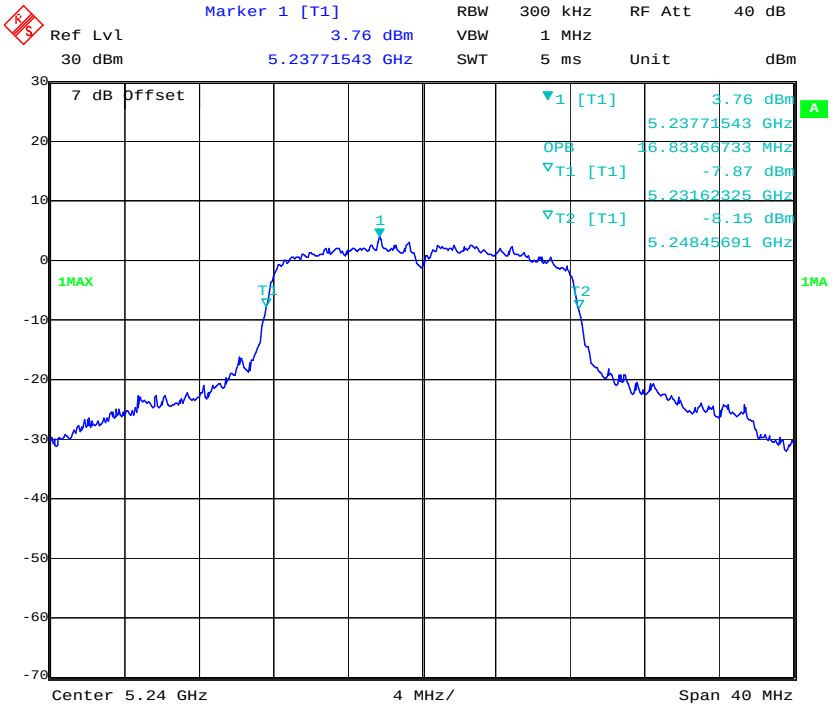


## 802.11a Middle Channel



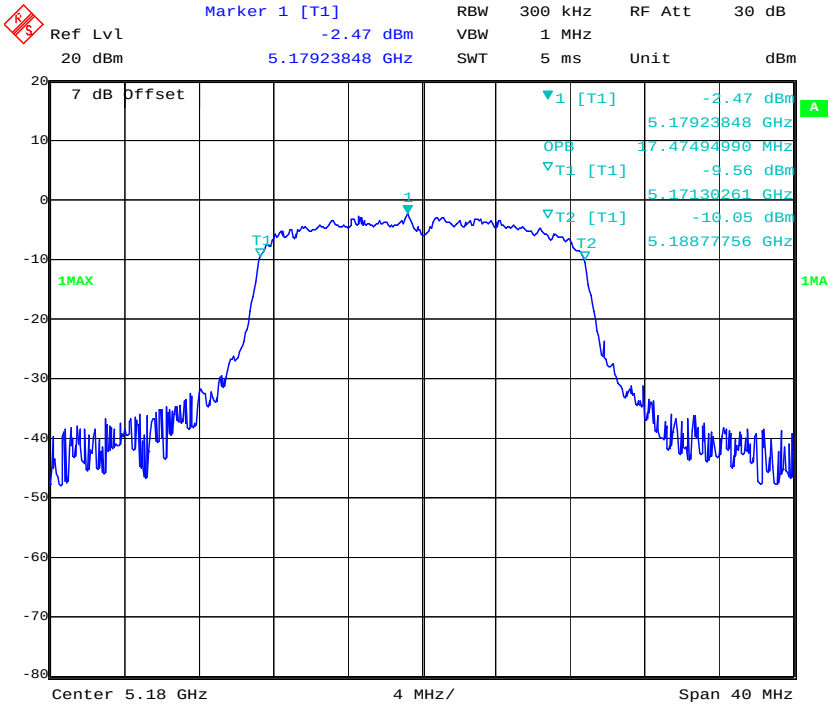

Date: 18.JUL.2018 17:19:36

## 802.11a High Channel



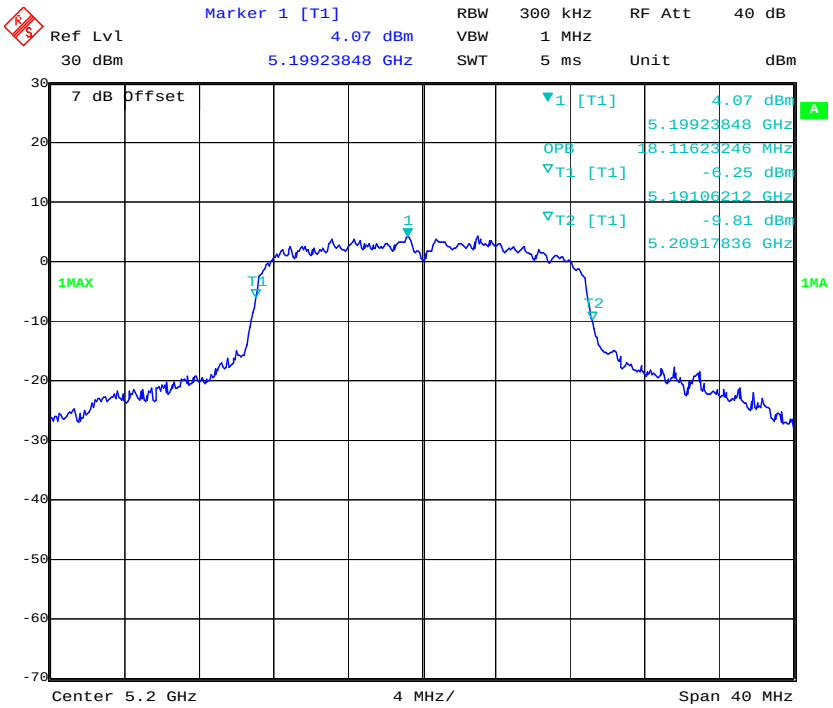

Date: 18.JUL.2018 17:22:00

## 802.11n ht20 Low Channel



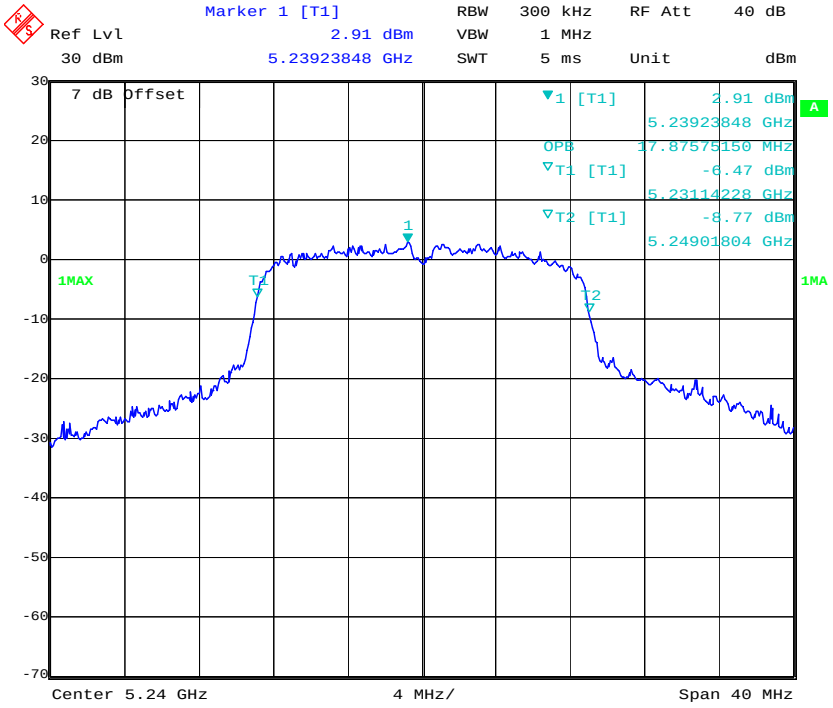

Date: 18.JUL.2018 17:50:25

## 802.11n ht20 Middle Channel



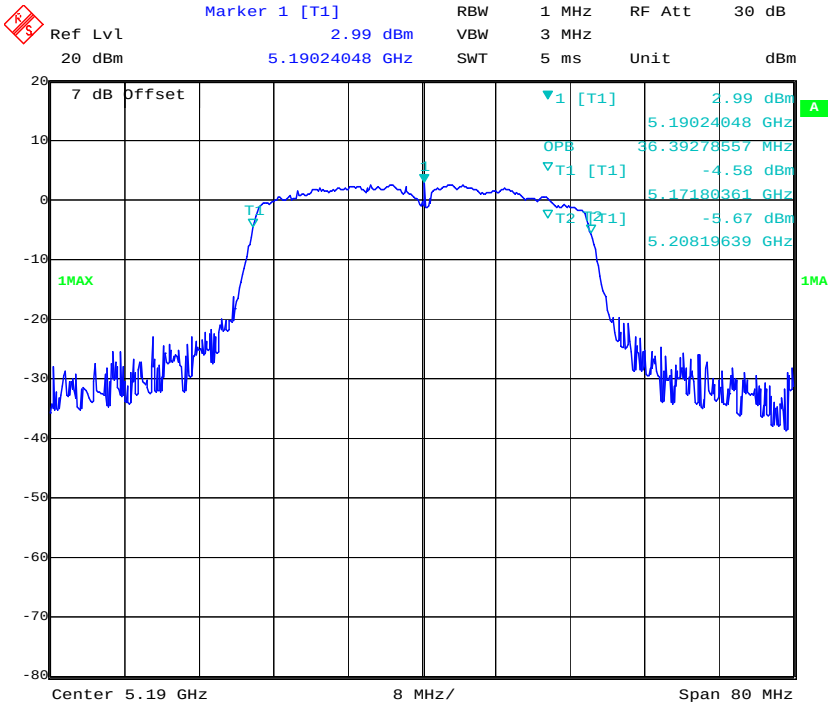

Date: 18.JUL.2018 17:27:39

## 802.11n ht20 High Channel



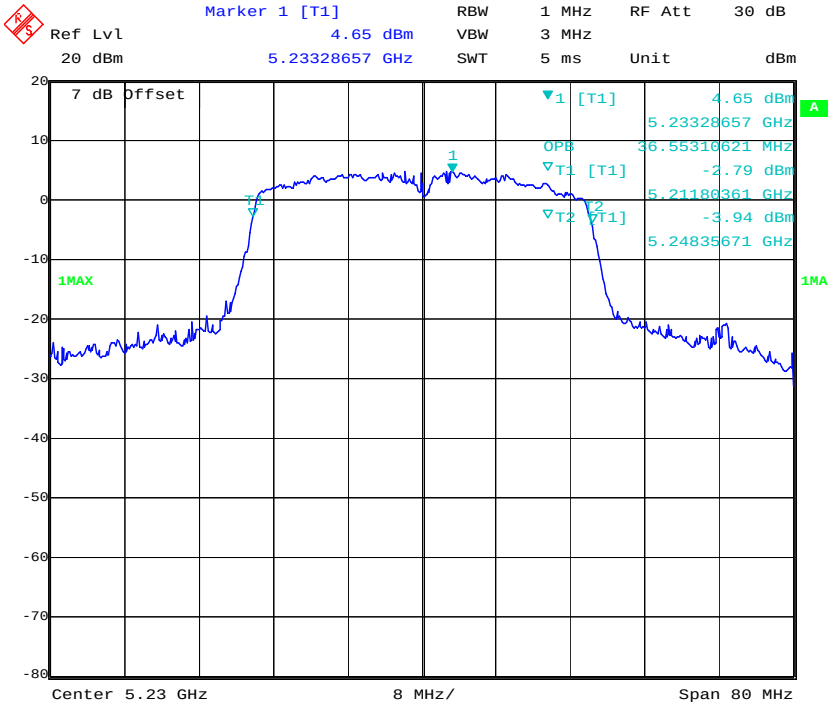

Date: 18.JUL.2018 17:24:39

## 802.11n ht40 Low Channel



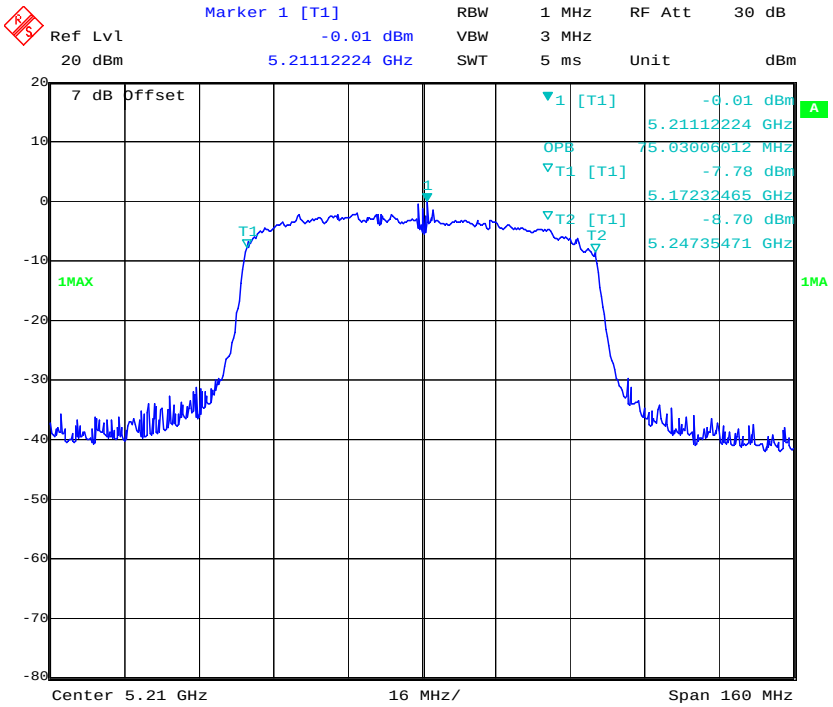

Date: 18.JUL.2018 18:04:25

## 802.11n ht40 High Channel




Date: 18.JUL.2018 18:10:01

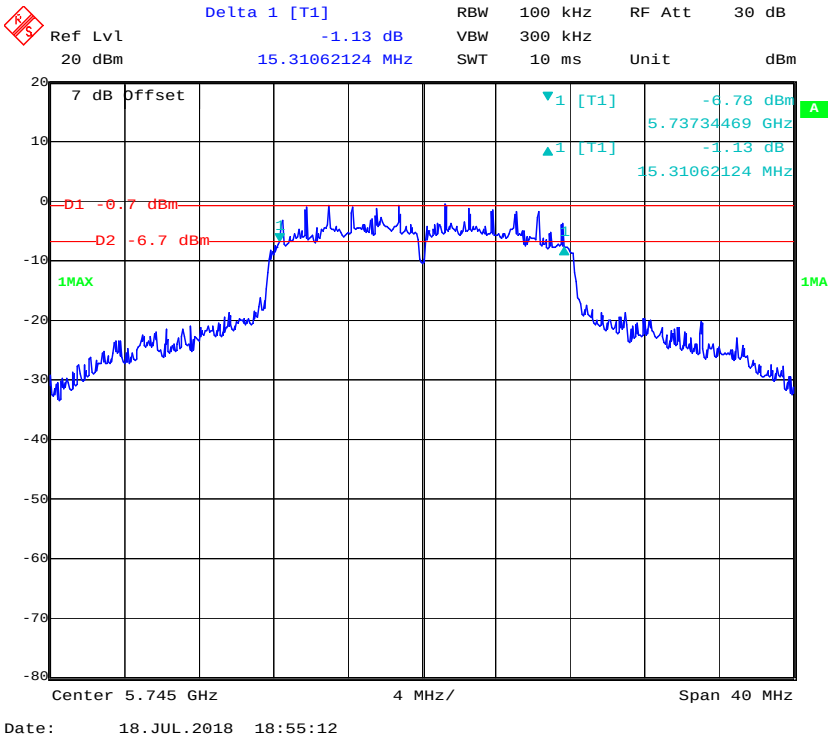
## 802.11 ac80 Middle Channel




Date: 18.JUL.2018 18:15:58

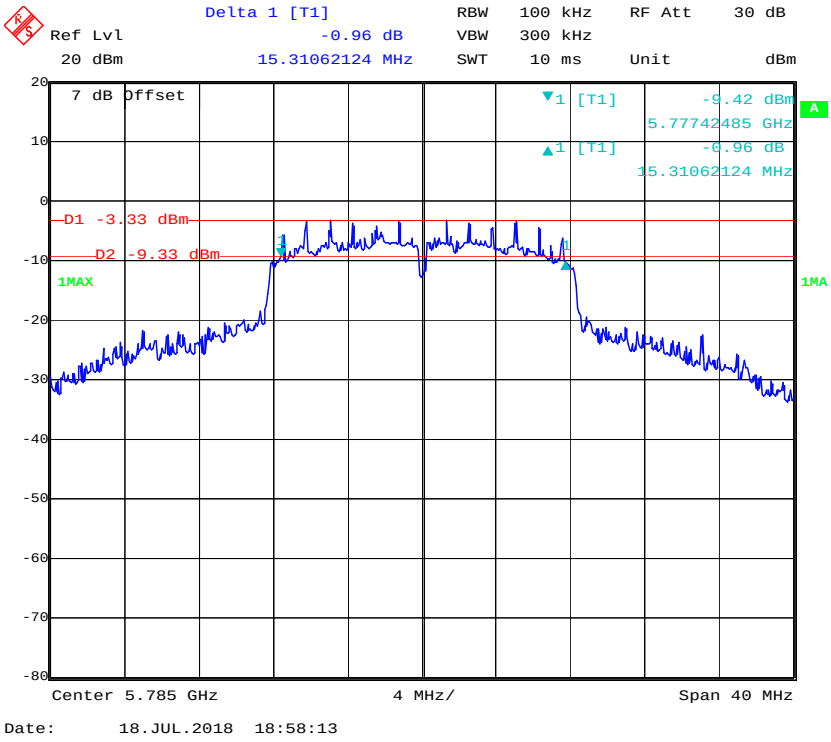
**5725-5850MHz:**
**6dB Bandwidth:**

**802.11a Low Channel**



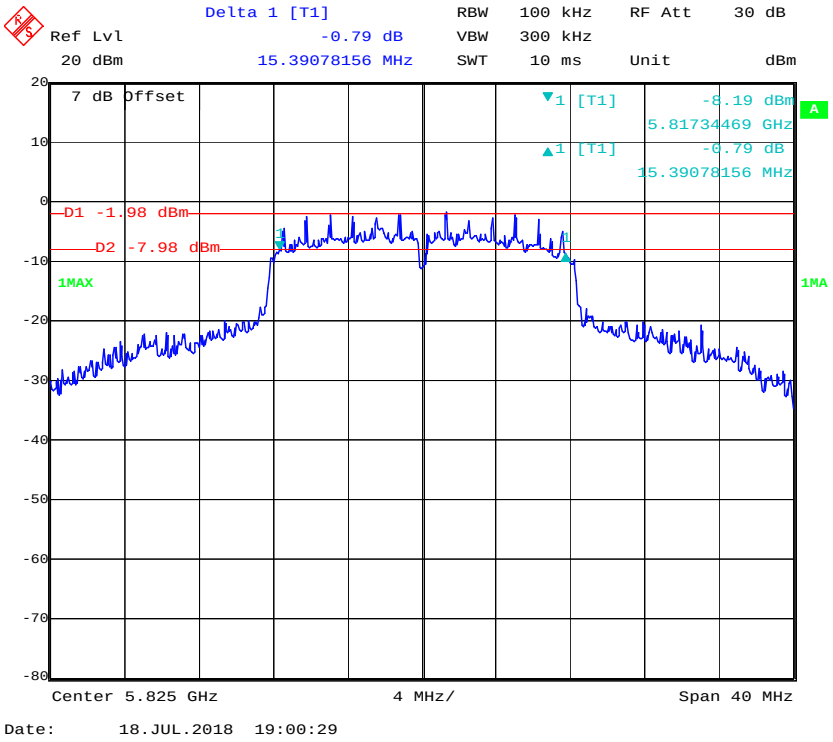

Date: 18.JUL.2018 18:55:12

**802.11a Middle Channel**

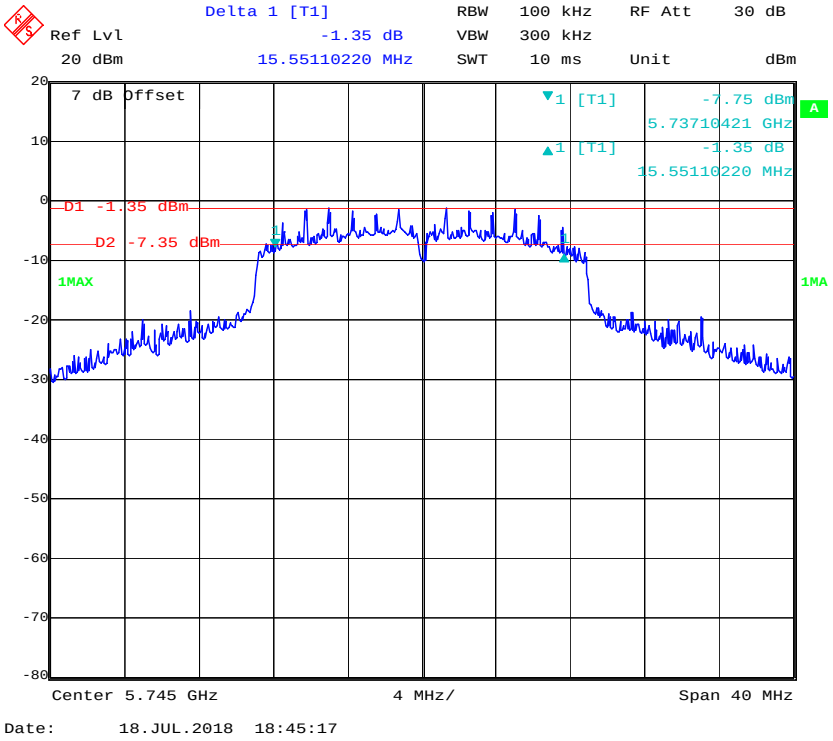



Date: 18.JUL.2018 18:58:13

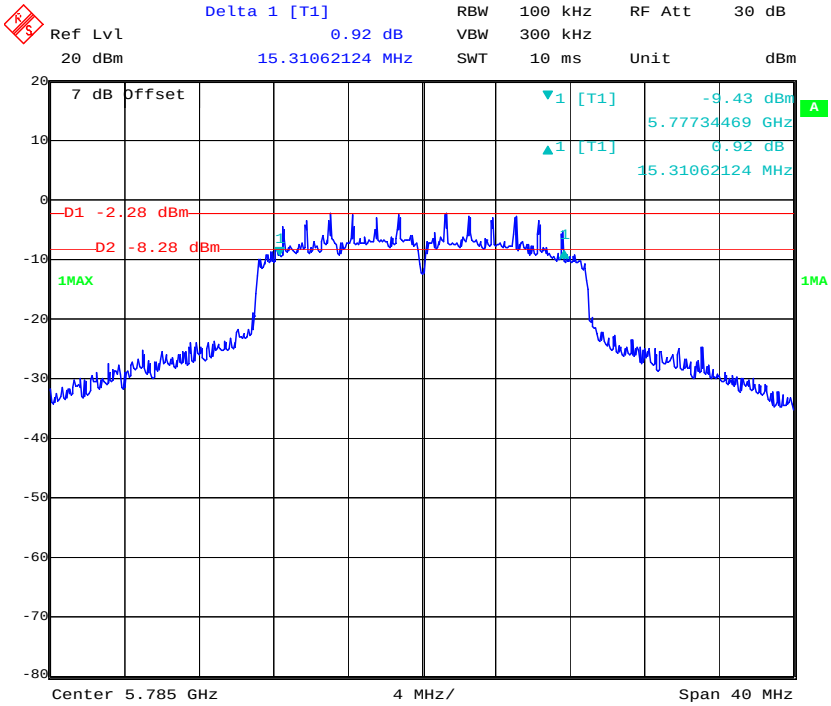
## 802.11a High Channel




## 802.11n ht20 Low Channel

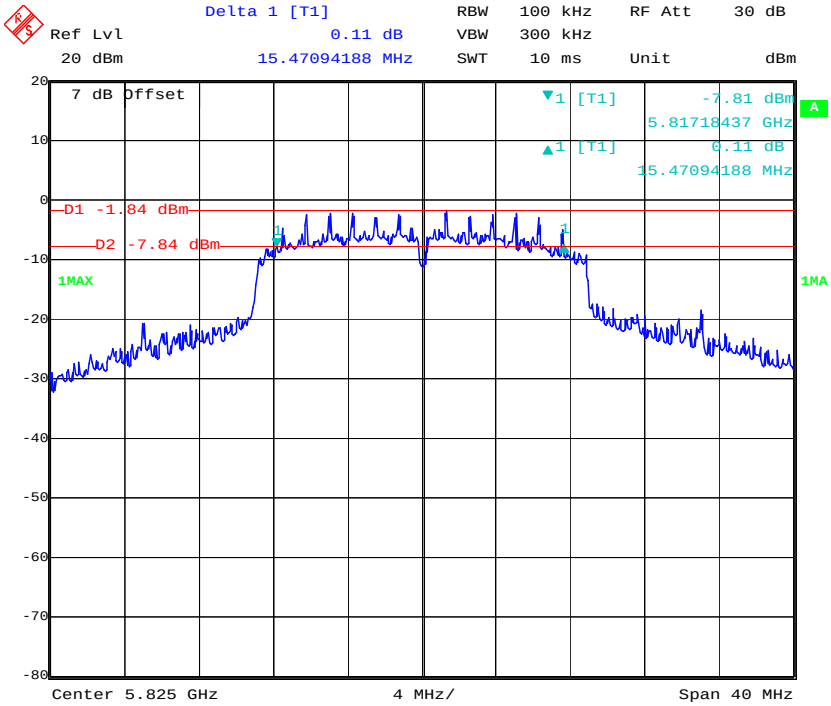


## 802.11n ht20 Middle Channel



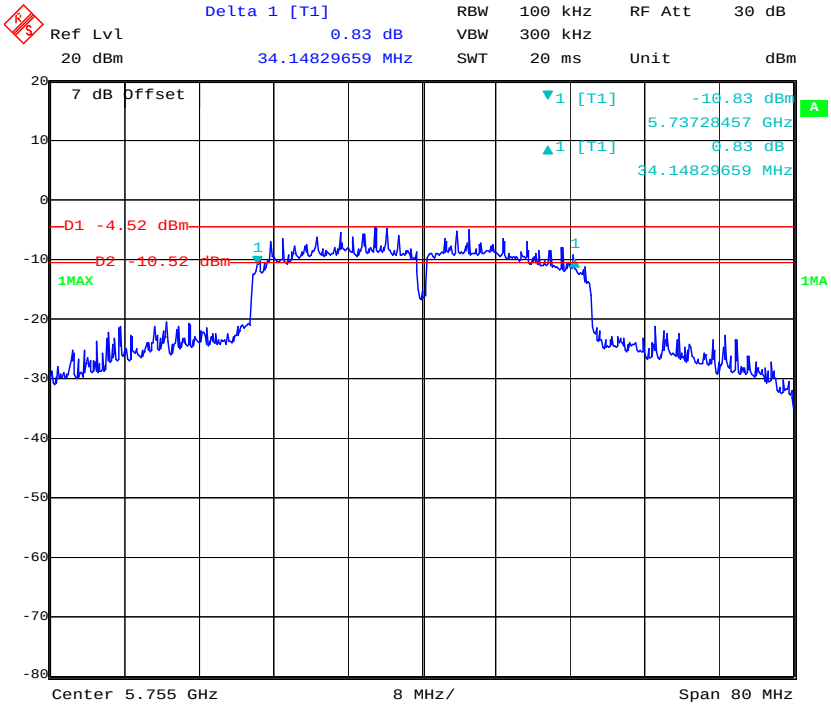

Date: 18.JUL.2018 18:47:38

## 802.11n ht20 High Channel



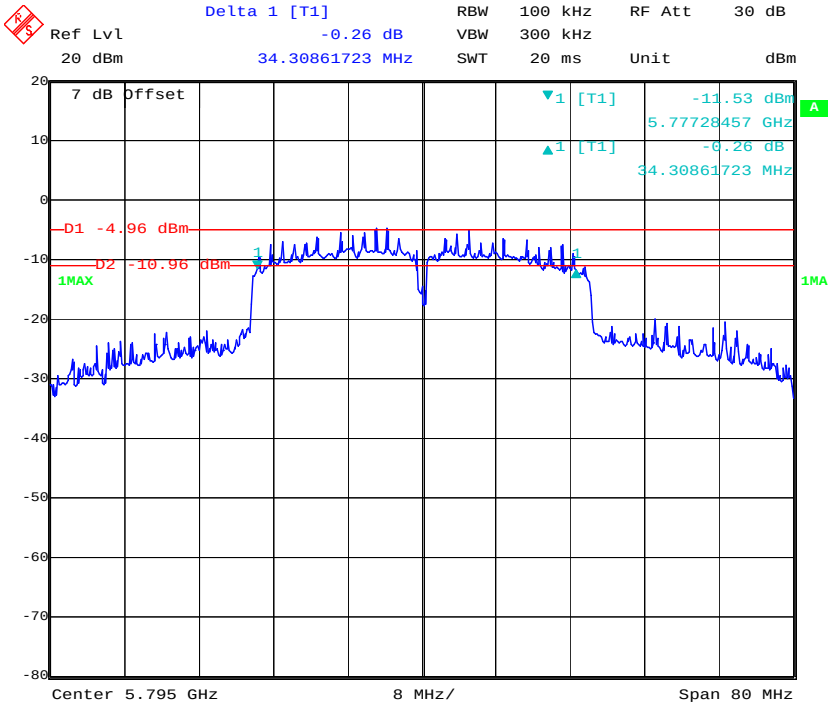

Date: 18.JUL.2018 18:50:14

## 802.11n ht40 Low Channel



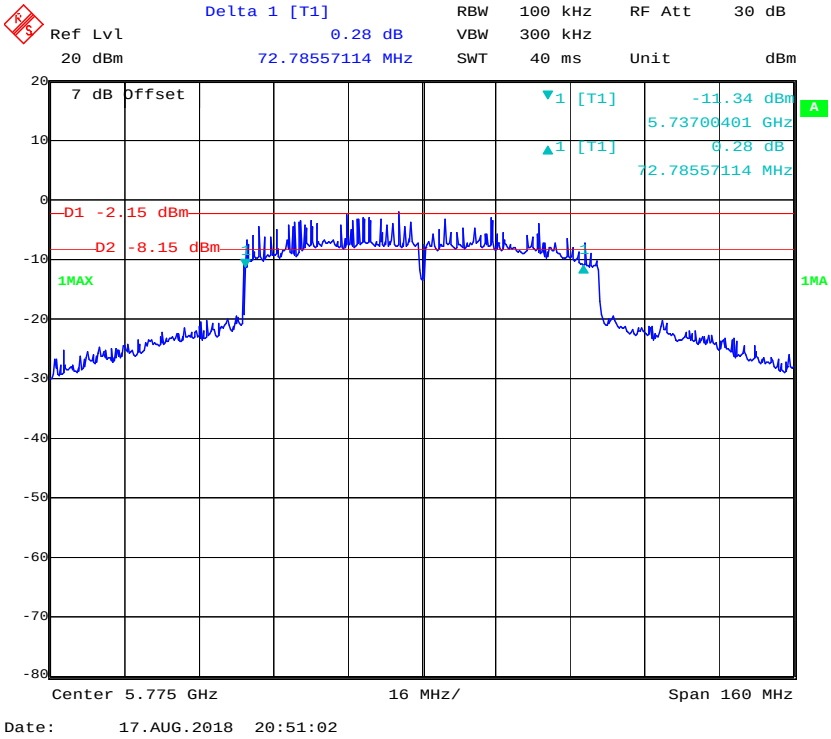

Date: 18.JUL.2018 19:03:24

## 802.11n ht40 High Channel



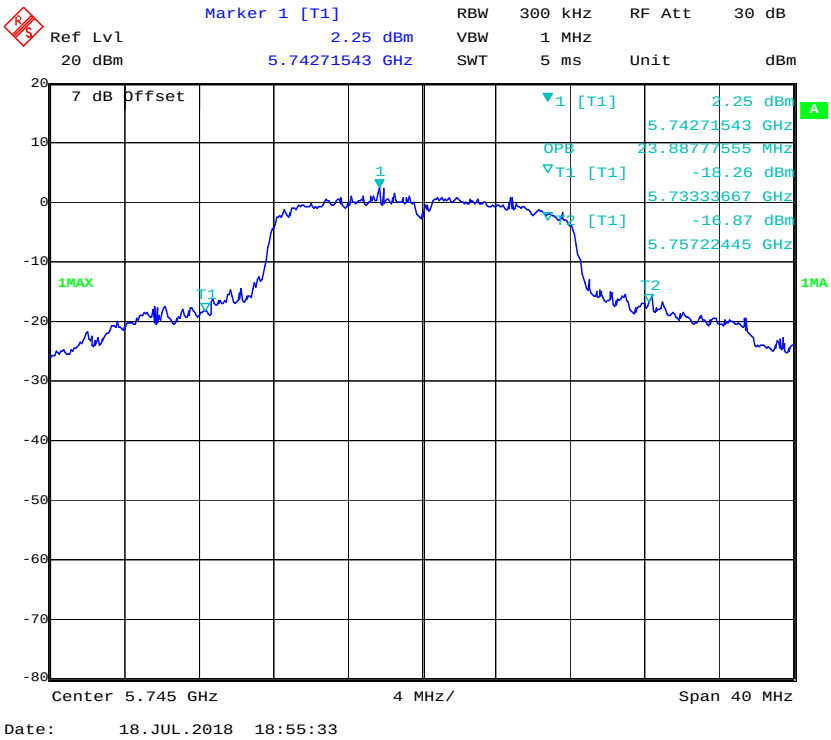

Date: 18.JUL.2018 19:05:32

## 802.11ac80 Middle Channel

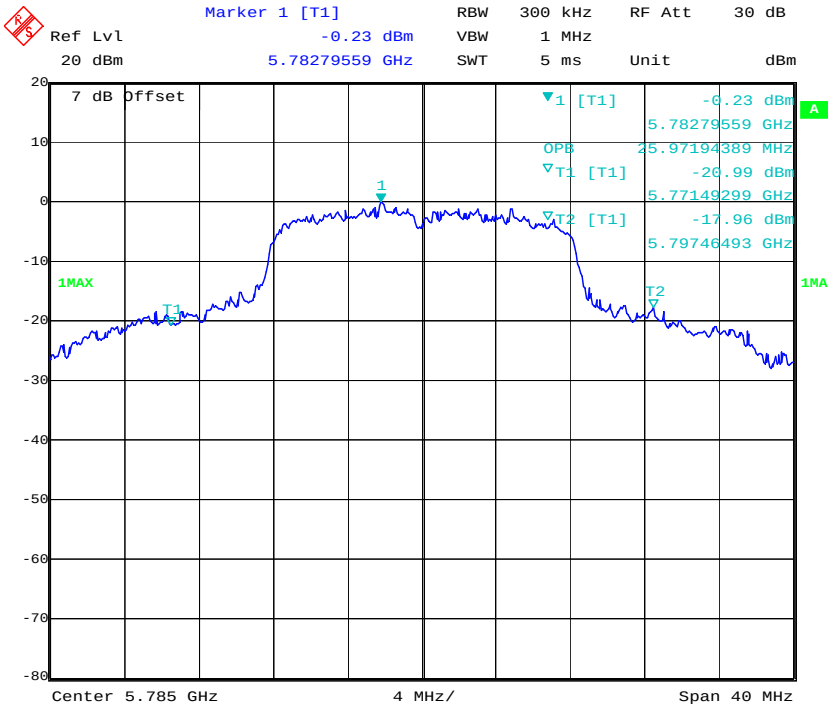



## 99% Occupied Bandwidth:

## 802.11a Low Channel

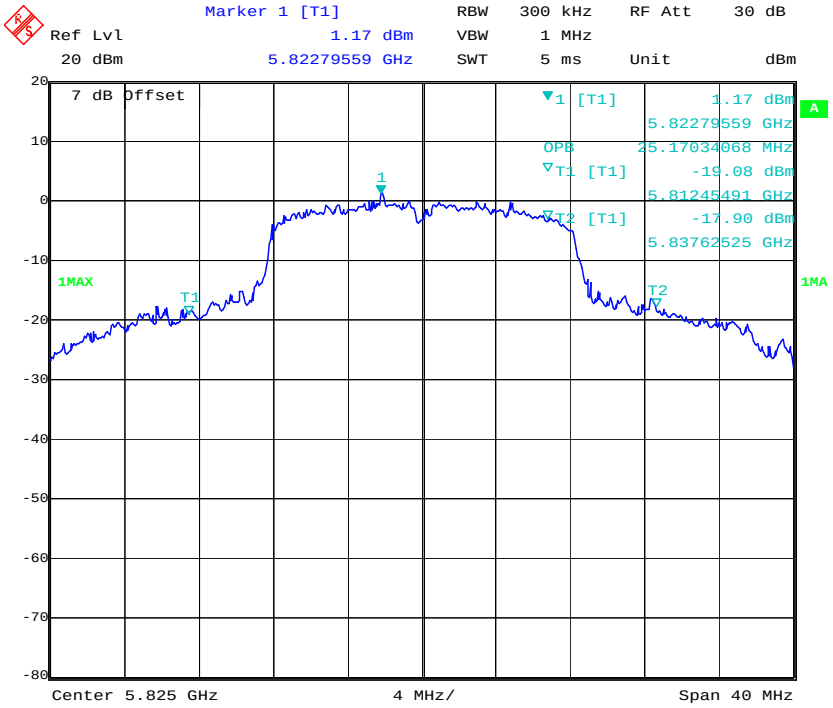


## 802.11a Middle Channel



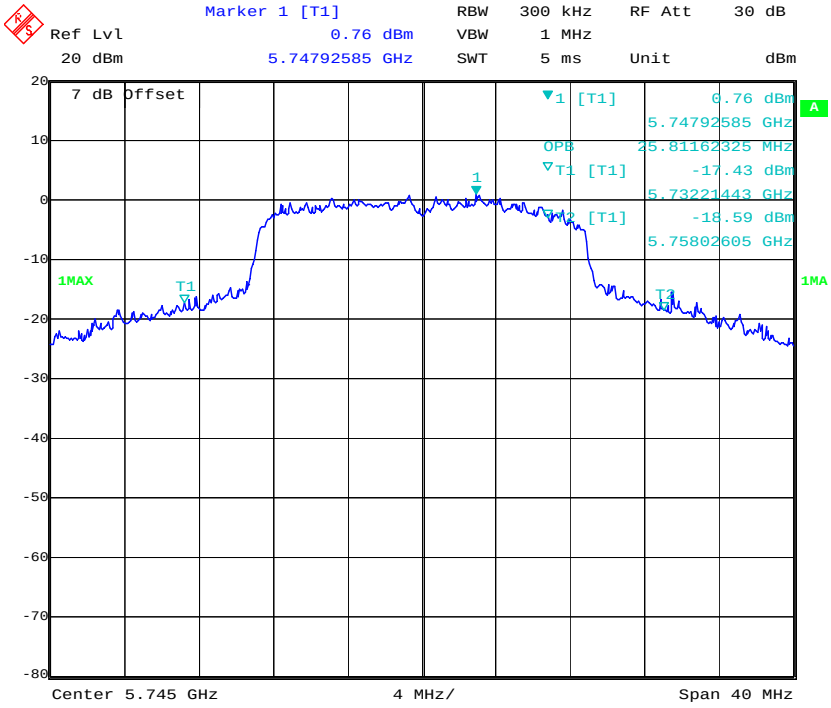

Date: 18.JUL.2018 18:58:37

## 802.11a High Channel



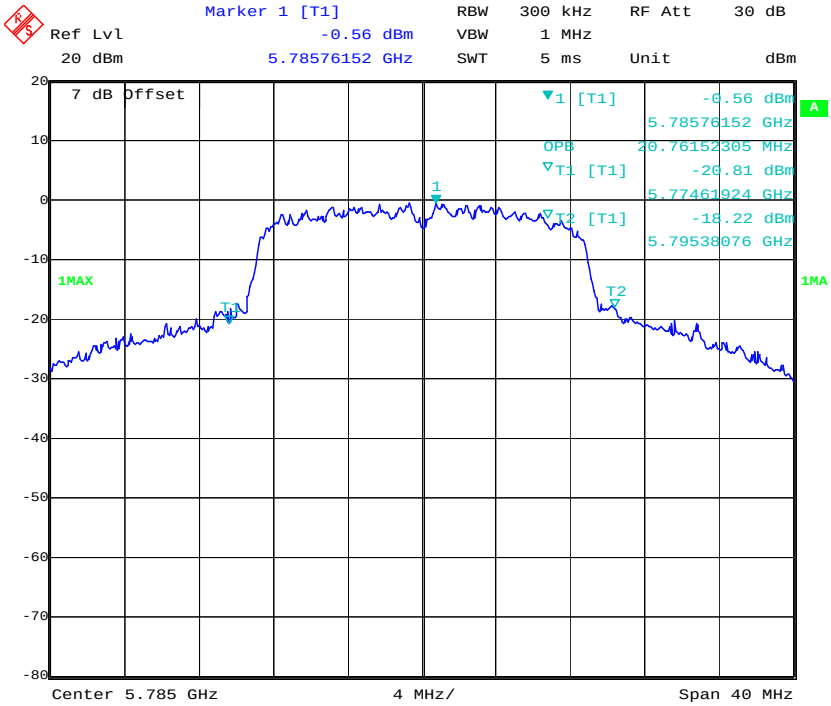

Date: 18.JUL.2018 19:00:50

## 802.11n ht20 Low Channel



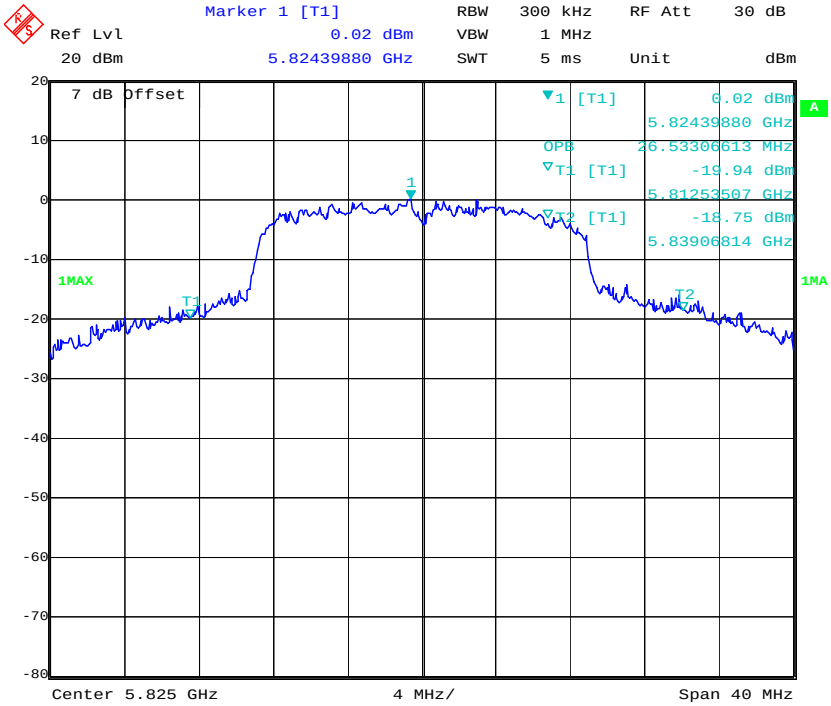

Date: 18.JUL.2018 18:45:41

## 802.11n ht20 Middle Channel



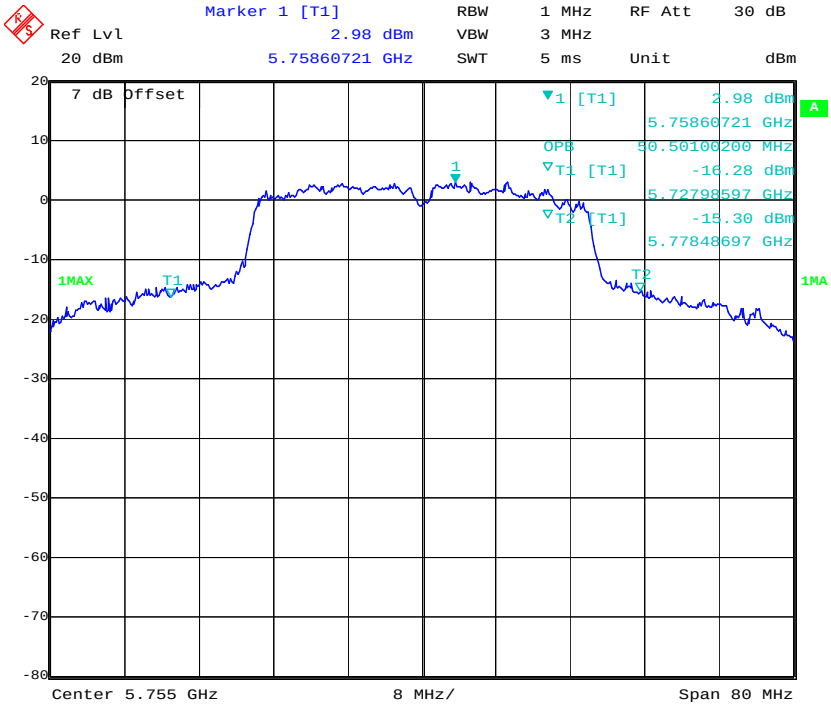

Date: 18.JUL.2018 18:48:08

## 802.11n ht20 High Channel



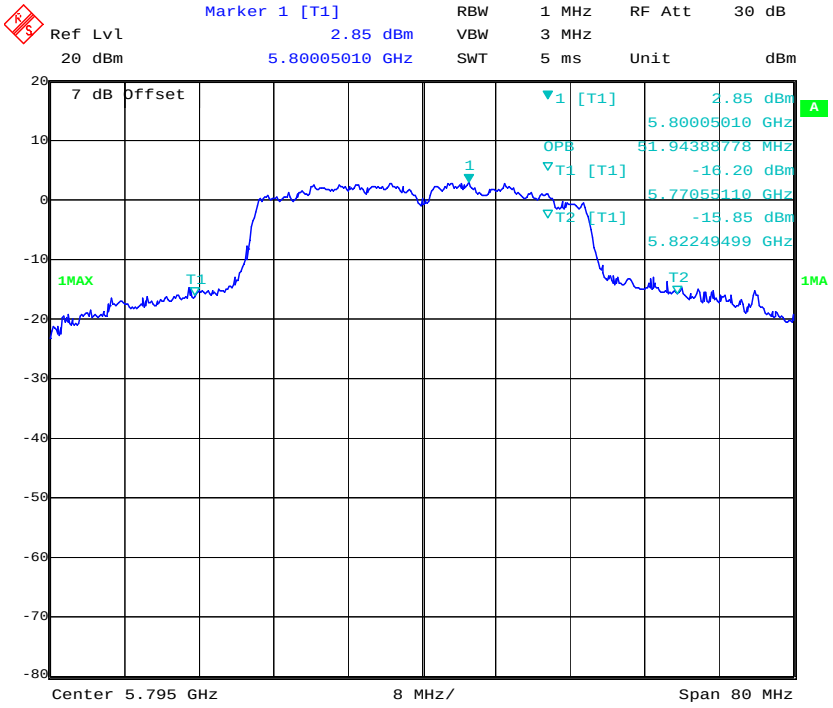

Date: 18.JUL.2018 18:50:35

## 802.11n ht40 Low Channel



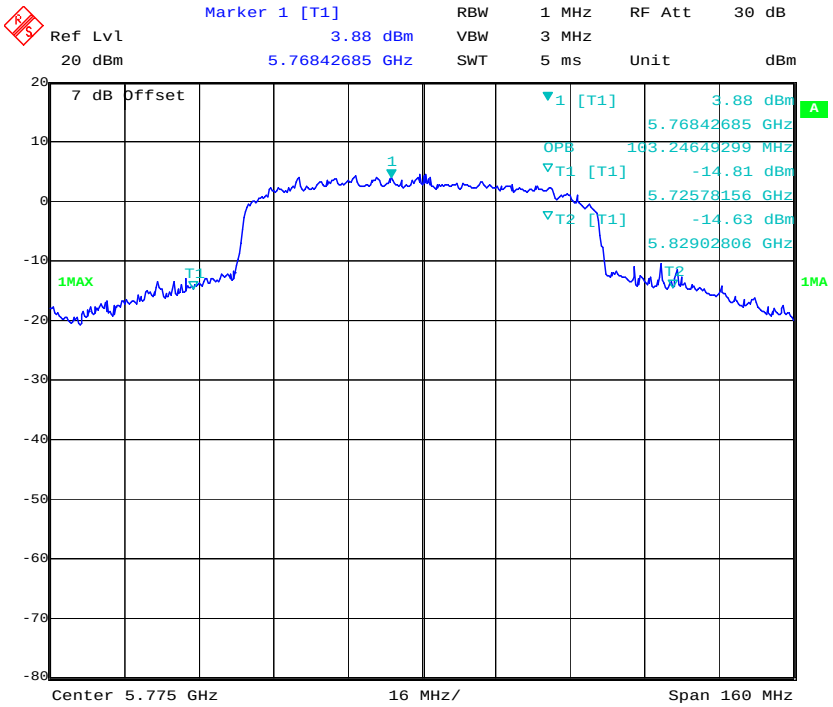

Date: 18.JUL.2018 19:03:45

## 802.11n ht40 High Channel




Date: 18.JUL.2018 19:05:49

## 802.11ac80 Middle Channel




Date: 17.AUG.2018 20:32:43

# FCC §15.407(a) –MAXIMUM CONDUCTED OUTPUT POWER

## Applicable Standard

(a) Power limits:

(1) For the band 5.15-5.25 GHz.

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

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. 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.

(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | EMI Test Receiver | ESPI | 100120 | 2017-12-11 | 2018-12-11 |
| Agilent | USB Wideband Power Sensor | U2022XA | MY5417006 | 2017-12-11 | 2018-12-11 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each time | N/A |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Procedure

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

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 28.8°C |
| **Relative Humidity:** | 61 % |
| **ATM Pressure:** | 99.8 kPa |

*The testing was performed by Tiago Huang on 2018-07-18.*

*Test Mode: Transmitting*

| UNII Band | Mode | Frequency (MHz) | Conducted Average Output Power(dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| 5150-5250 MHz | 802.11 a | 5180 | 6.06 | 30 | PASS |
| | | 5200 | 13.02 | 30 | PASS |
| | | 5240 | 12.93 | 30 | PASS |
| | 802.11n ht20 | 5180 | 5.75 | 30 | PASS |
| | | 5200 | 13.39 | 30 | PASS |
| | | 5240 | 12.79 | 30 | PASS |
| | 802.11n ht40 | 5190 | 4.63 | 30 | PASS |
| | | 5230 | 11.79 | 30 | PASS |
| | 802.11 ac80 | 5210 | 6.49 | 30 | PASS |
| 5725-5850 MHz | 802.11 a | 5745 | 13.76 | 30 | PASS |
| | | 5785 | 12.22 | 30 | PASS |
| | | 5825 | 12.95 | 30 | PASS |
| | 802.11n ht20 | 5745 | 13.57 | 30 | PASS |
| | | 5785 | 12.14 | 30 | PASS |
| | | 5825 | 12.68 | 30 | PASS |
| | 802.11n ht40 | 5755 | 13.63 | 30 | PASS |
| | | 5795 | 13.36 | 30 | PASS |
| | 802.11 ac80 | 5775 | 11.64 | 30 | PASS |

# FCC §15.407(a) - POWER SPECTRAL DENSITY

## Applicable Standard

(a) Power limits:

(1) For the band 5.15-5.25 GHz.

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

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output

power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. 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.

## Test Procedure

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

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 831929/005 | 2017-08-31 | 2018-08-31 |
| yzjingcheng | Coaxial Cable | KTRFBU-141-50 | 41005011 | 2017-09-05 | 2018-09-05 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/02 | Each time | N/A |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 28.5~28.8°C |
| **Relative Humidity:** | 56~61 % |
| **ATM Pressure:** | 99.8~100.1 kPa |

*The testing was performed by Tiago Huang on 2018-07-18, 2018-08-18.*

*Test Mode: Transmitting*

*Test Result:Compliance.Please refer to the following table and plot.*

**5150-5250MHz**

| Mode | Frequency (MHz) | Power Spectral Density (dBm/MHz) | Limit (dBm/MHz) |
|---|---|---|---|
| 802.11 a | 5180 | -3.89 | 17 |
| | 5200 | 2.56 | 17 |
| | 5240 | 1.54 | 17 |
| 802.11n ht20 | 5180 | -3.57 | 17 |
| | 5200 | 3.21 | 17 |
| | 5240 | 1.71 | 17 |
| 802.11n ht40 | 5190 | -4.67 | 17 |
| | 5230 | -2.53 | 17 |
| 802.11 ac80 | 5210 | -8.98 | 17 |

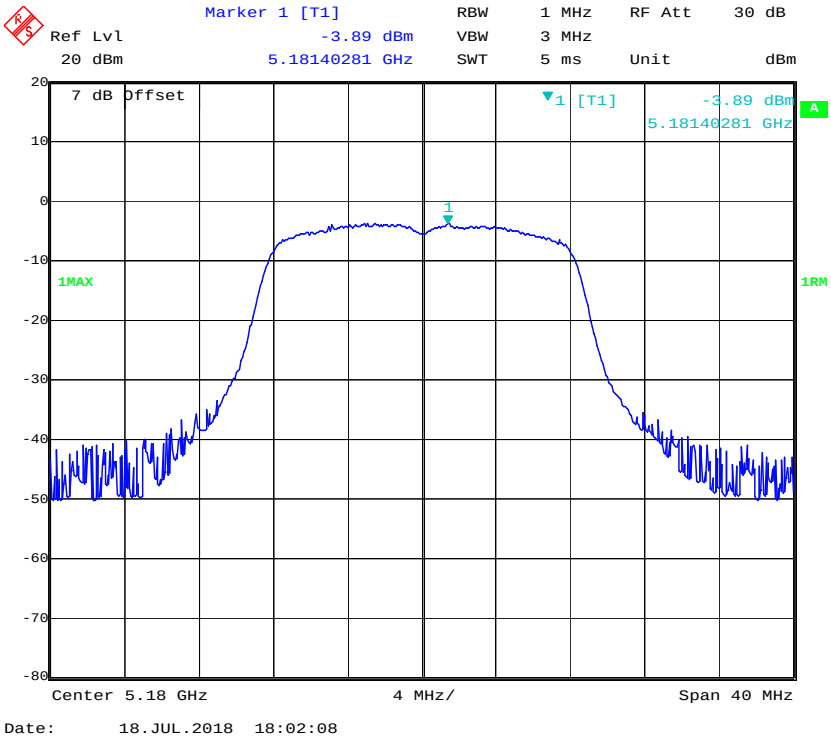
**5725-5850MHz**

| Mode | Frequency (MHz) | Reading (dBm/300kHz) | Power Spectral Density (dBm/500kHz) | Limit (dBm/500kHz) |
|---|---|---|---|---|
| 802.11 a | 5745 | -1.16 | 1.06 | 30 |
| | 5785 | -3.93 | -1.71 | 30 |
| | 5825 | -2.18 | 0.04 | 30 |
| 802.11n ht20 | 5745 | -1.57 | 0.65 | 30 |
| | 5785 | -2.74 | -0.52 | 30 |
| | 5825 | -2.54 | -0.32 | 30 |
| 802.11n ht40 | 5755 | -6.09 | -3.87 | 30 |
| | 5795 | -6.16 | -3.94 | 30 |
| 802.11 ac80 | 5775 | -4.75 | -2.53 | 30 |

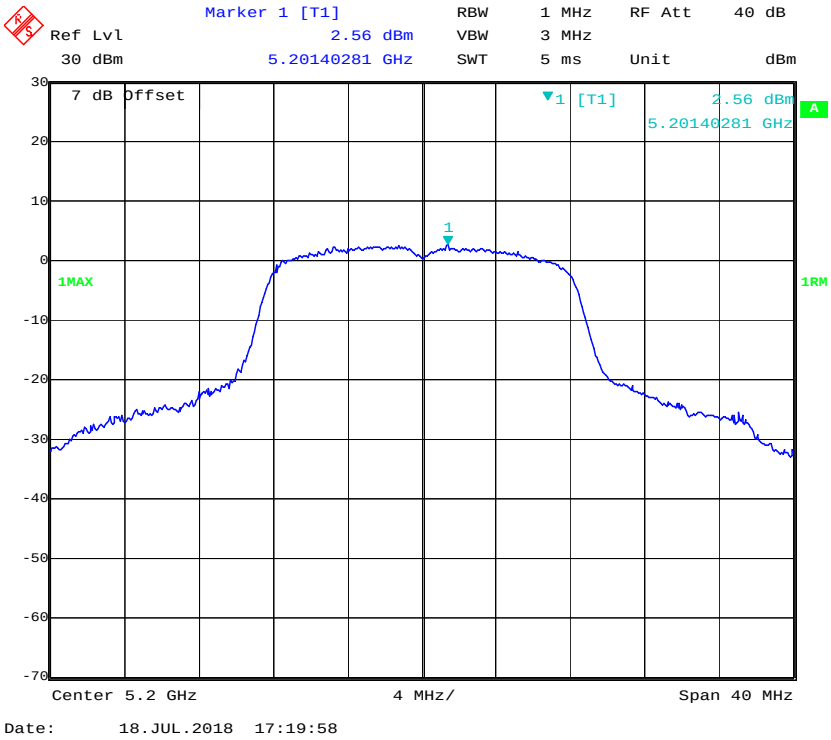
Note 2: For 5.8GHz band, If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

**5150-5250MHz**

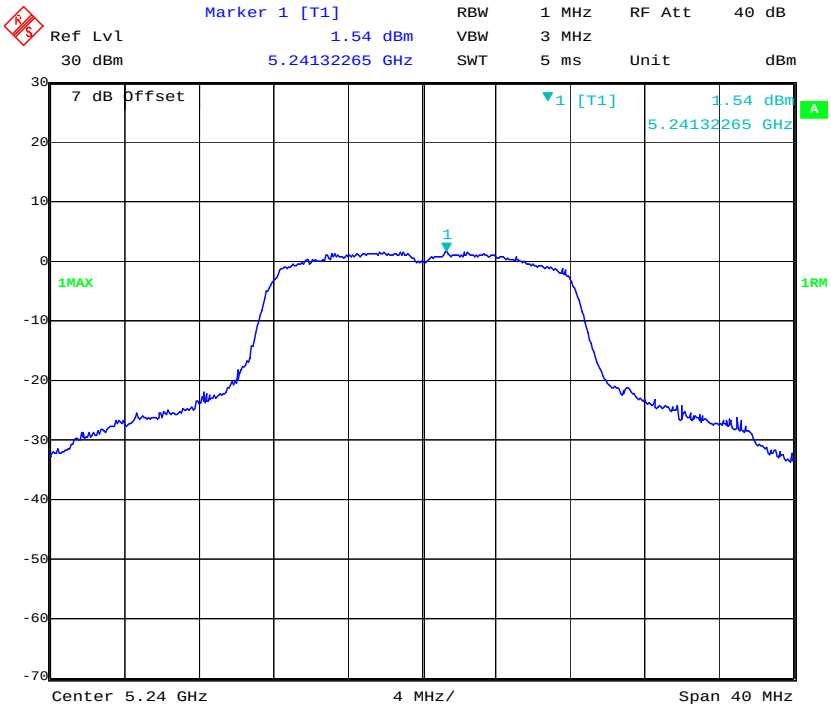
**802.11a Low Channel**




**802.11a Middle Channel**

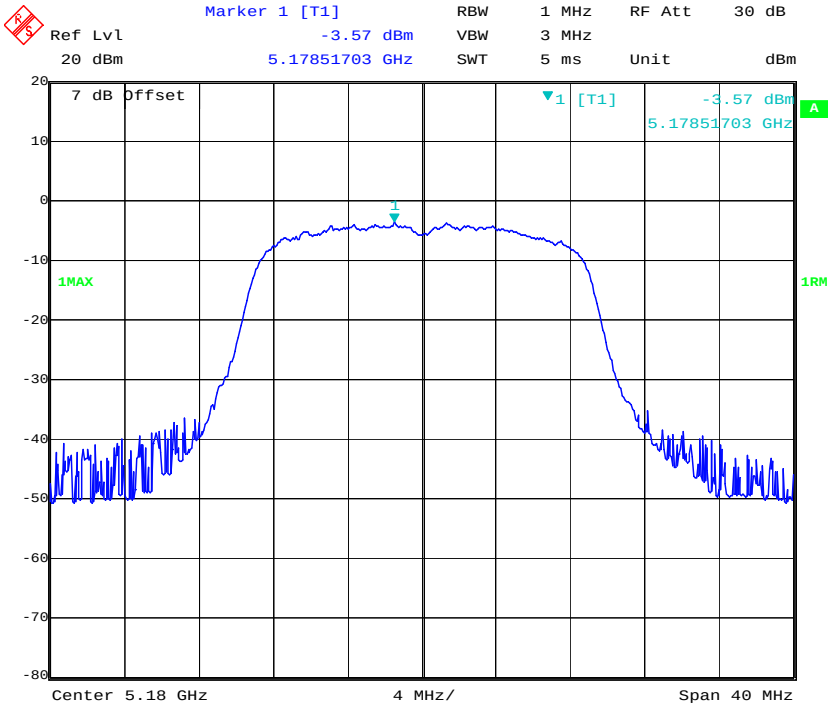


## 802.11a High Channel



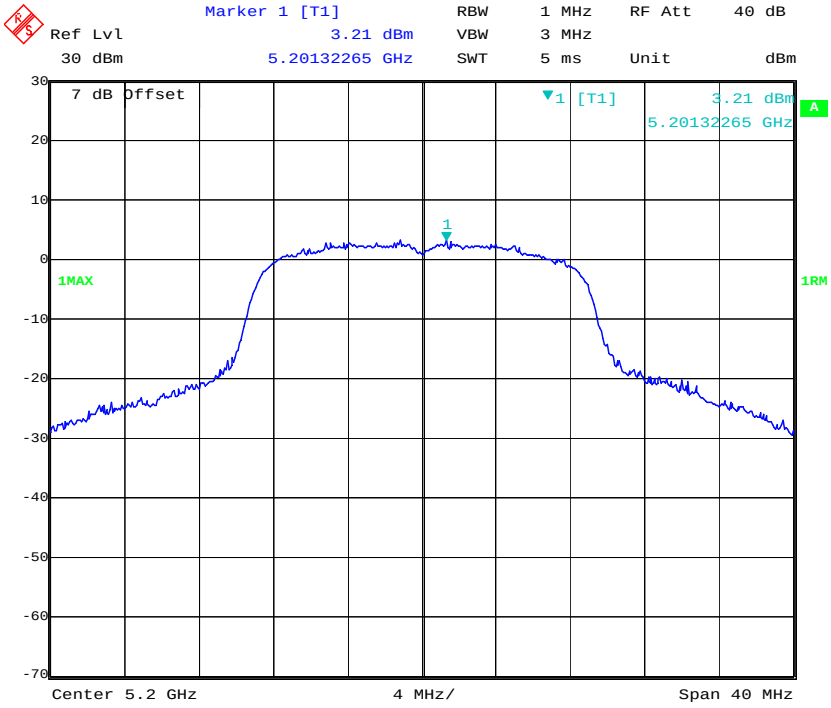

Date: 18.JUL.2018 17:22:23

## 802.11n ht20 Low Channel



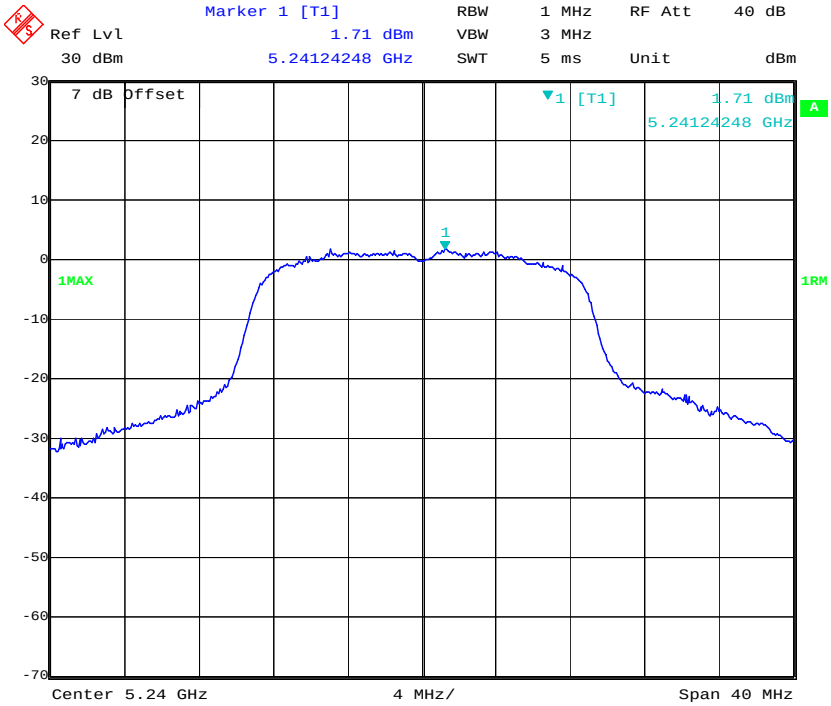

Date: 18.JUL.2018 17:50:54

## 802.11n ht20 Middle Channel



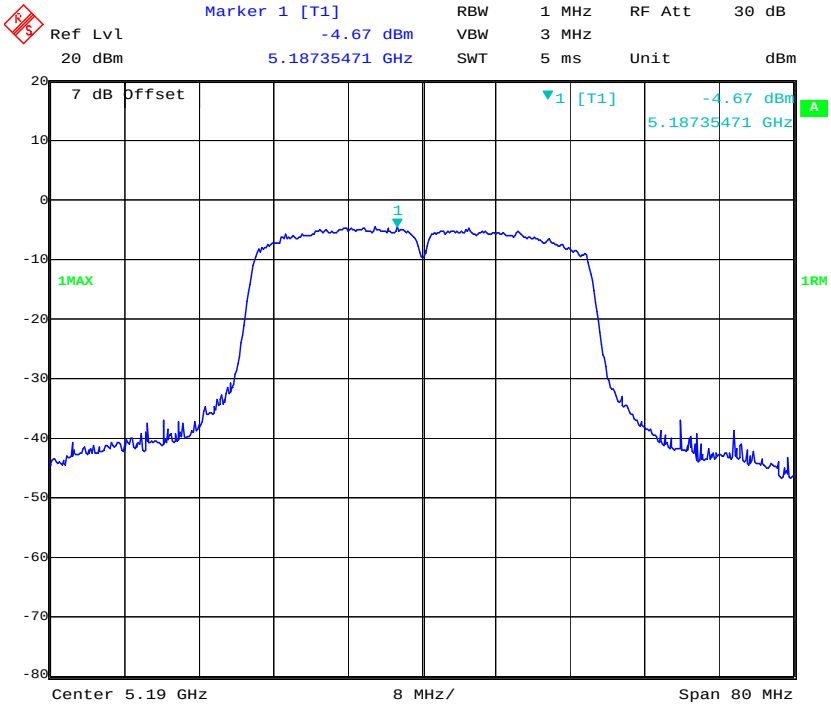

Date: 18.JUL.2018 17:27:55

## 802.11n ht20 High Channel



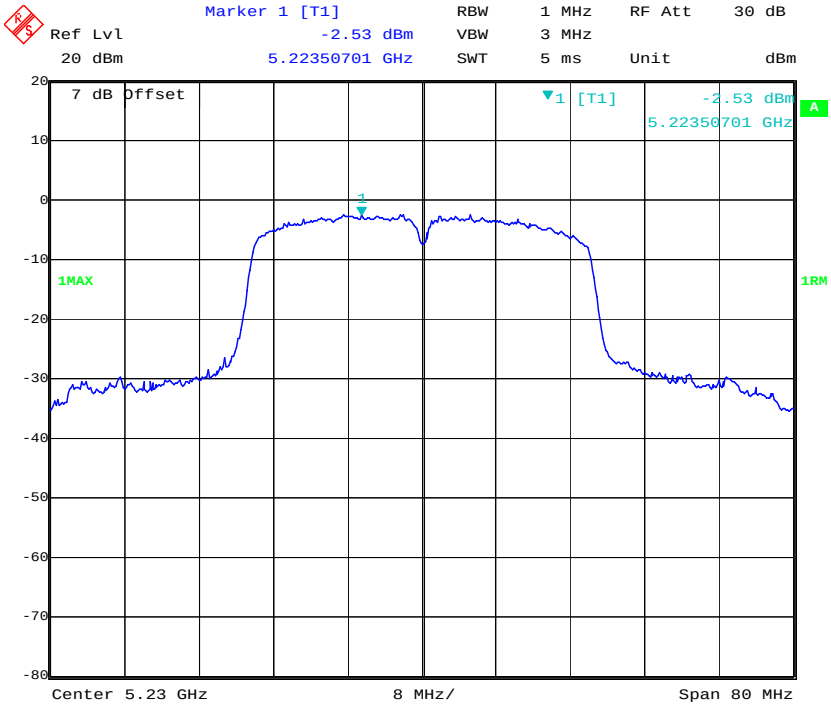

Date: 18.JUL.2018 17:25:04

## 802.11n ht40 Low Channel



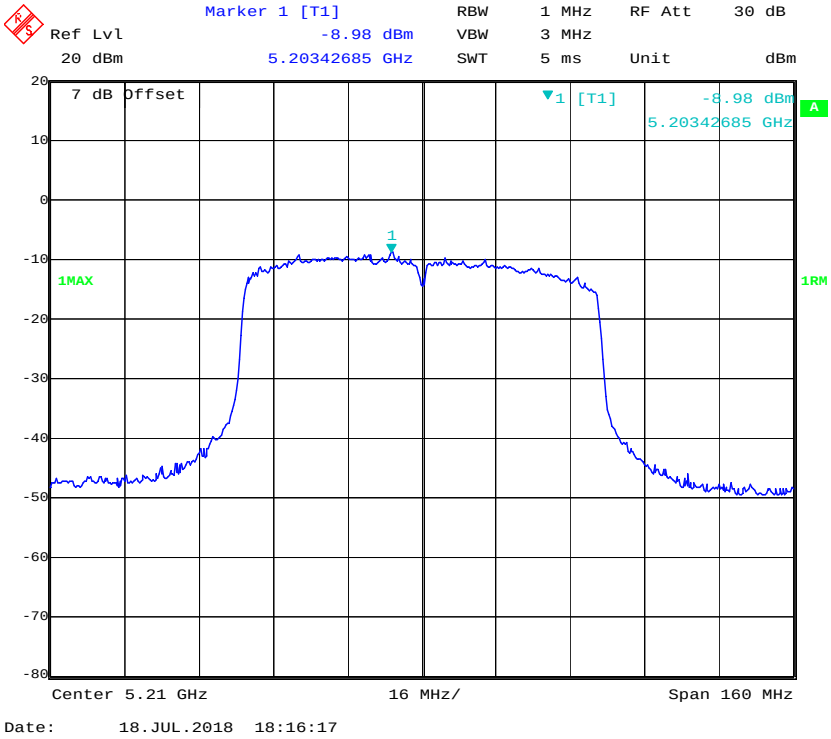

Date: 18.JUL.2018 18:04:48

## 802.11n ht40 High Channel



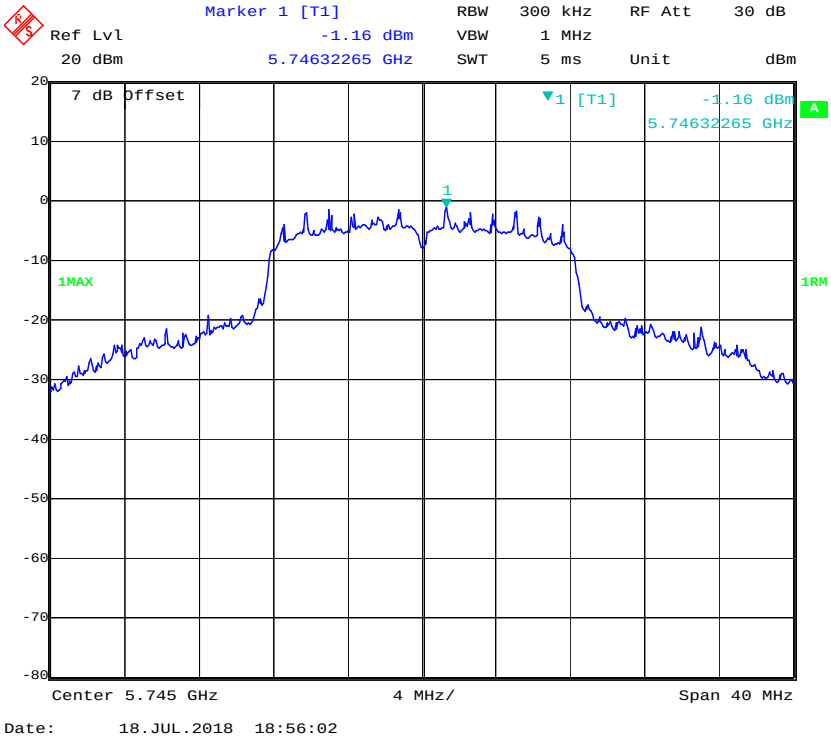

Date: 18.JUL.2018 18:10:20

## 802.11ac80 Middle Channel

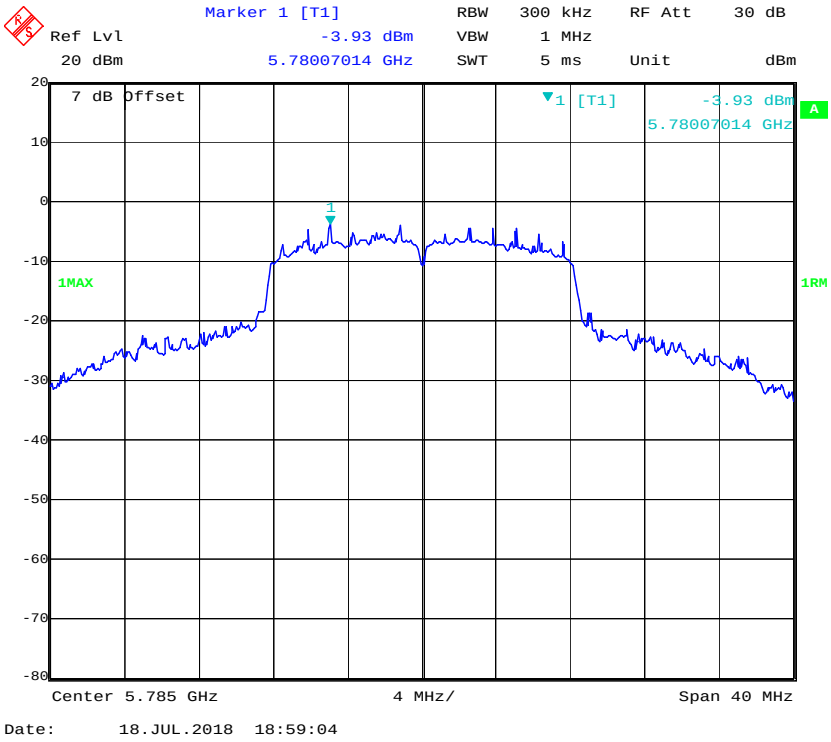



## 5725-5850MHz

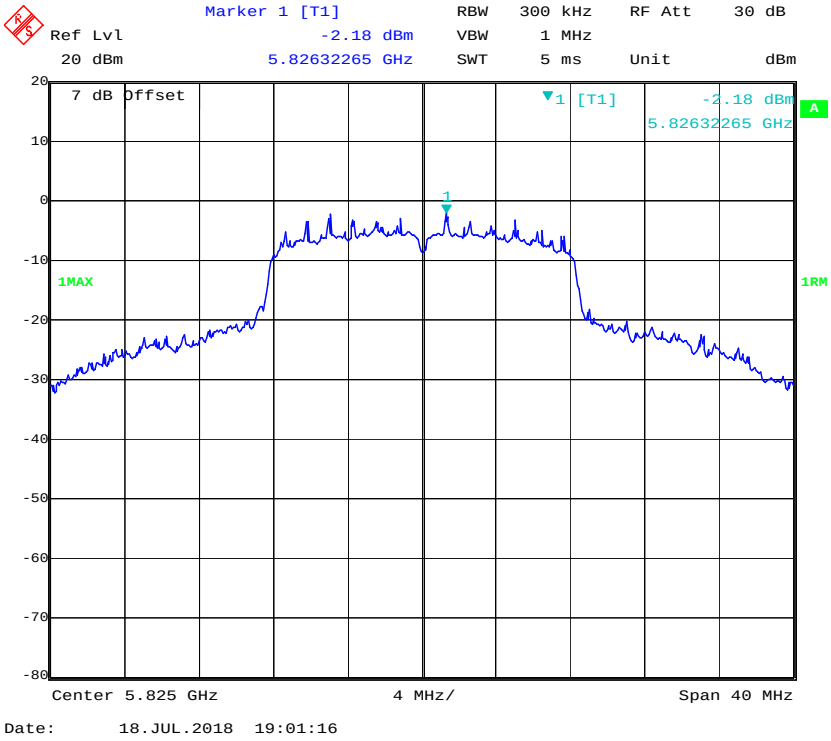
## 802.11a Low Channel



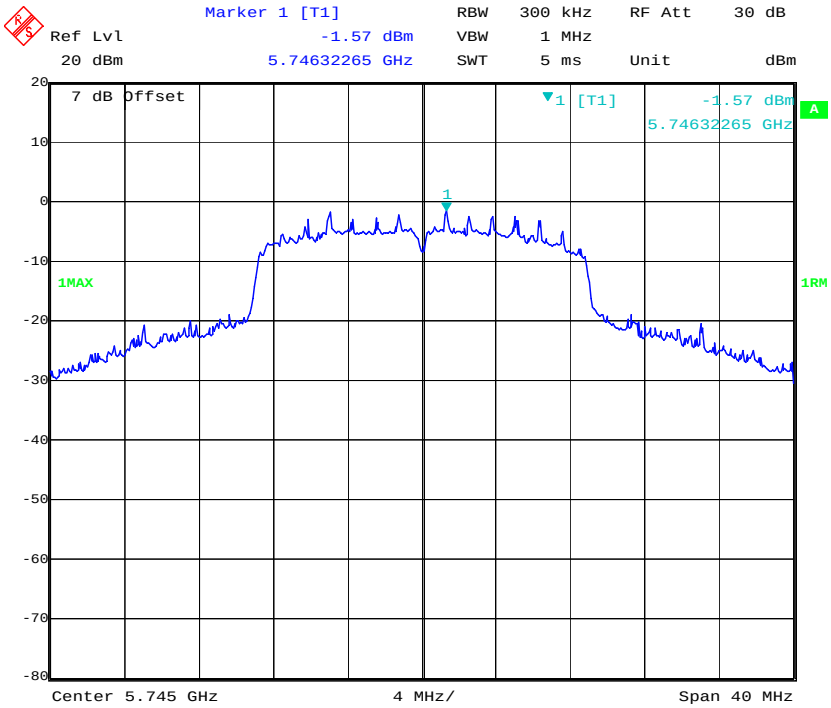
## 802.11a Middle Channel




## 802.11a High Channel

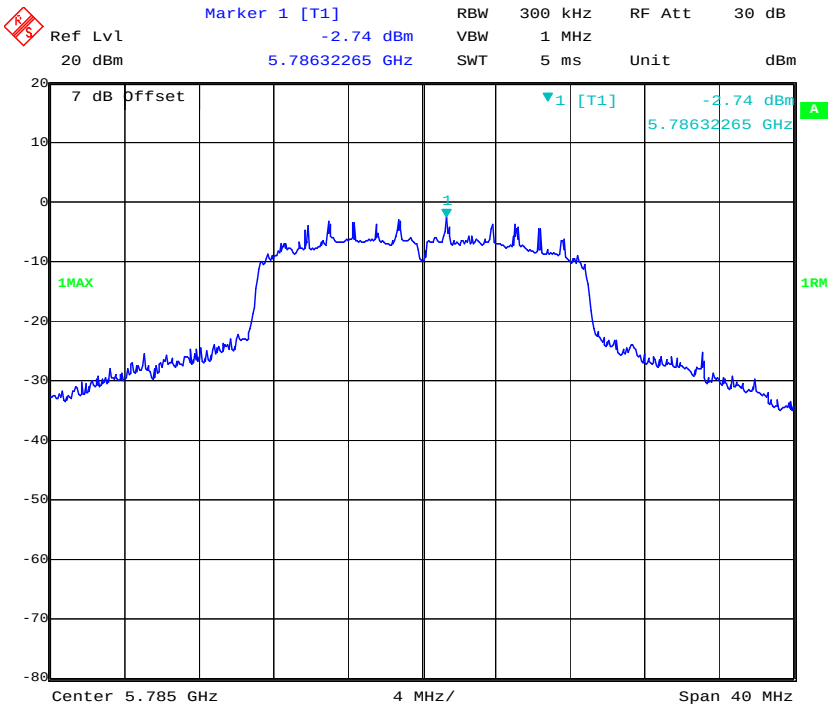


## 802.11n ht20 Low Channel



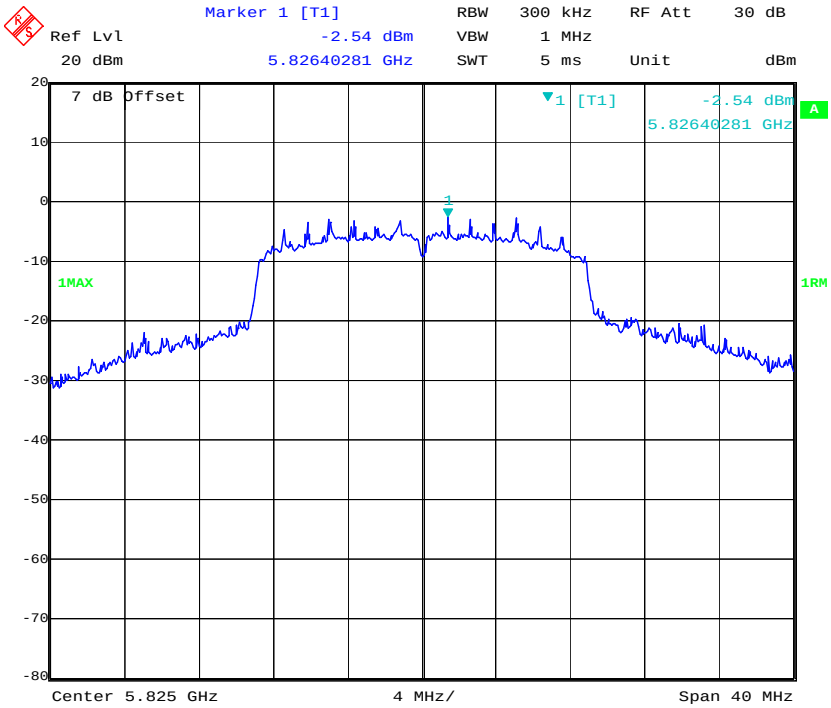

Date: 18.JUL.2018 18:46:12

## 802.11n ht20 Middle Channel



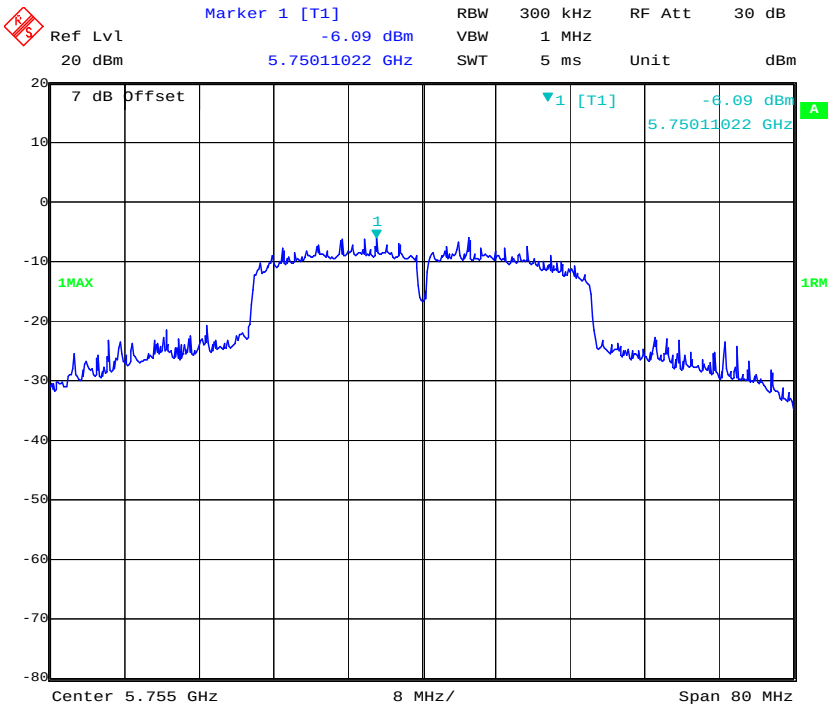

Date: 18.JUL.2018 18:48:31

## 802.11n ht20 High Channel



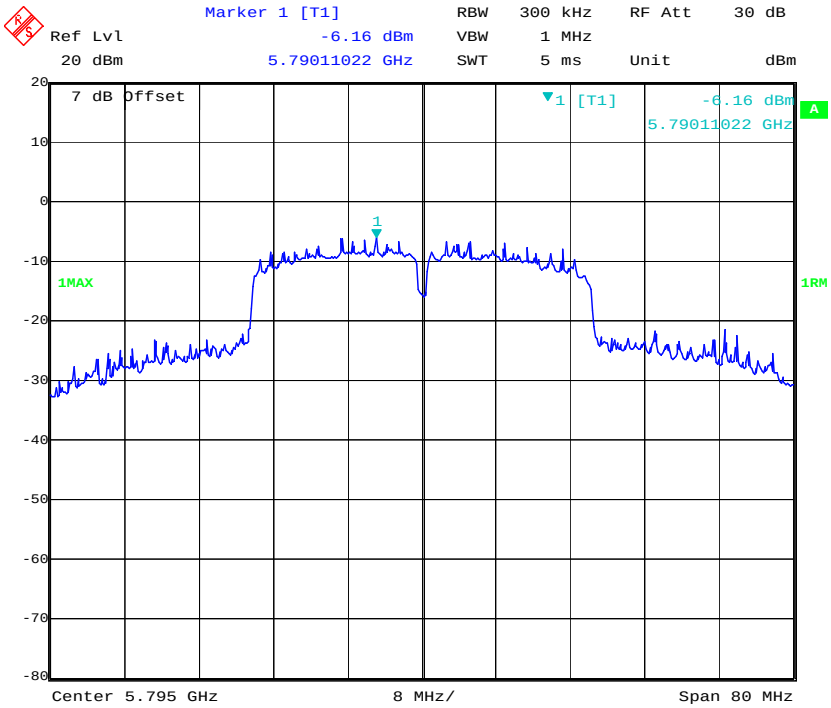

Date: 18.JUL.2018 18:50:57

## 802.11n ht40 Low Channel



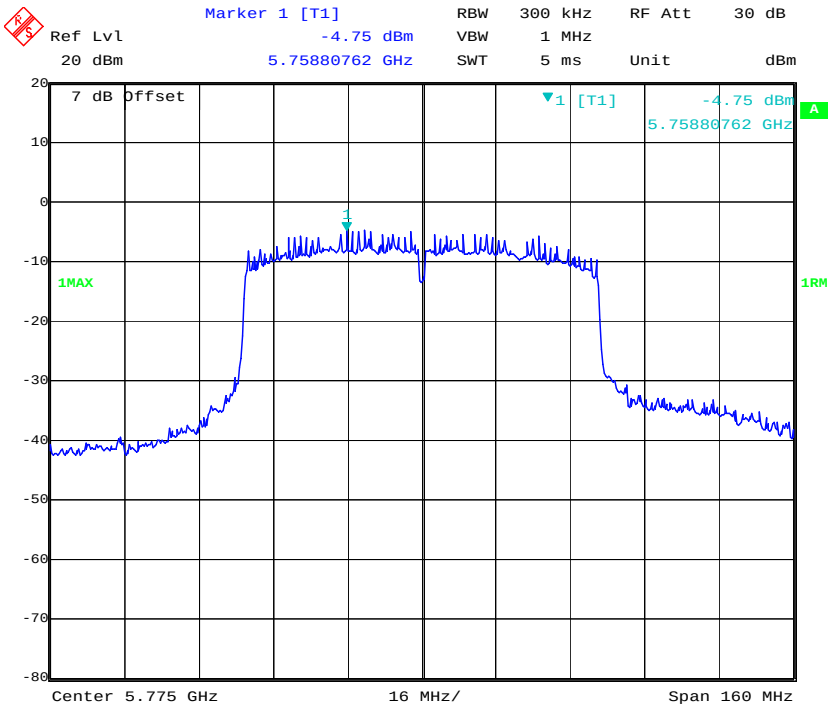

Date: 18.JUL.2018 19:04:08

## 802.11n ht40 High Channel




Date: 18.JUL.2018 19:06:15

## 802.11ac80 Middle Channel




Date: 18.AUG.2018 00:05:06

***** END OF REPORT *****