


FCC PART 15.407 TEST REPORT

For

Billion Electric Co., Ltd.

8F, No.192, Sec. 2, Zhongxing Road, Xindian Dist., New Taipei City 231, Taiwan

FCC ID: QI3BIL-8700AXL

Report Type: Original Report	Product Name: Triple-WAN Wireless 1600Mbps VPN VDSL2/ADSL2+Firewall Router
Report Number:	RSC180228001-0D
Report Date:	2018-03-16
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Billion Electric Co., Ltd.**, model number: **BiPAC 8700AX-1600 (FCC ID: QI3BIL-8700AXL)** or the "EUT" as referred to in this report was one **Triple-WAN Wireless 1600Mbps VPN VDSL2/ADSL2+ Firewall Router**.

Mechanical Description of EUT

The EUT was measured approximately: 225mm (L) x 183 mm (W) x 72 mm (H).

Rated input voltage: DC 12V from adapter

Adapter Information

Manufacturer: SHENZHEN FRECOM ELECTRONICS CO., LTD

Model: F24W5-120200SPAU

Input: AC 100-240V; 50/60Hz

Output: DC 12V, 2A

Note: The products, test model: BiPAC 8700AX-1600, multiple models: BiPAC 8700AXL-1600, BEC 8700AXL. Their differences were presented in Product Difference Statement provided by the applicant. So we selected model BiPAC 8700AX-1600 to fully test.

**All measurement and test data in this report were gathered from final production sample, serial number: 180228001/01 (assigned by BACL). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2018-02-27, and EUT complied with test requirement.*

Objective

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

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

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: QI3BIL-8700AXL

Measurement Uncertainty

Item		Uncertainty	
AC power line conducted emission		2.71 dB	
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.57 dB
		V	4.81 dB
	200MHz-1GHz	H	5.69 dB
		V	6.07 dB
	1GHz-6GHz		5.49 dB
	6GHz-18GHz		5.57 dB
18GHz-40GHz		5.48 dB	
Conducted RF Power		±0.61dB	
Power Spectrum Density		±0.61dB	
Occupied Bandwidth		±5%	
Conducted Emission		±1.5dB	
Humidity		±5%	
Temperature		±1°C	

Test Methodology

All measurements contained in this report were conducted with:

1. ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
2. KDB789033 D02 UNII Meas Guidance v02r01.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Chengdu) to collect test data is located No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, 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. : 910975, the FCC Designation No. : CN1186.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062C-1.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

For 5150~5250 MHz band, channels are provided to test as follows:

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

For 802.11a, 802.11ac20, 802.11n-HT20: Channel 36, 40 and 48 were tested; for 802.11ac40, 802.11n-HT40: Channel 38, 46 were tested; for ac80: Channel 42 was tested.

For 5725~5850 MHz band, channels are provided to test as follows:

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

For 802.11a, 802.11ac20, 802.11n-HT20: Channel 149, 157 and 165 were tested.

For 802.11n-HT40, 802.11ac40: Channel 151, 159 were tested; for ac80: Channel 155 was tested.

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.

Note:

802.11a/ac/n supports SISO and MIMO mode, according to pretest, MIMO mode was worst. So, 802.11a/ac/n MIMO mode test data was recorded in the report.

EUT Exercise Software

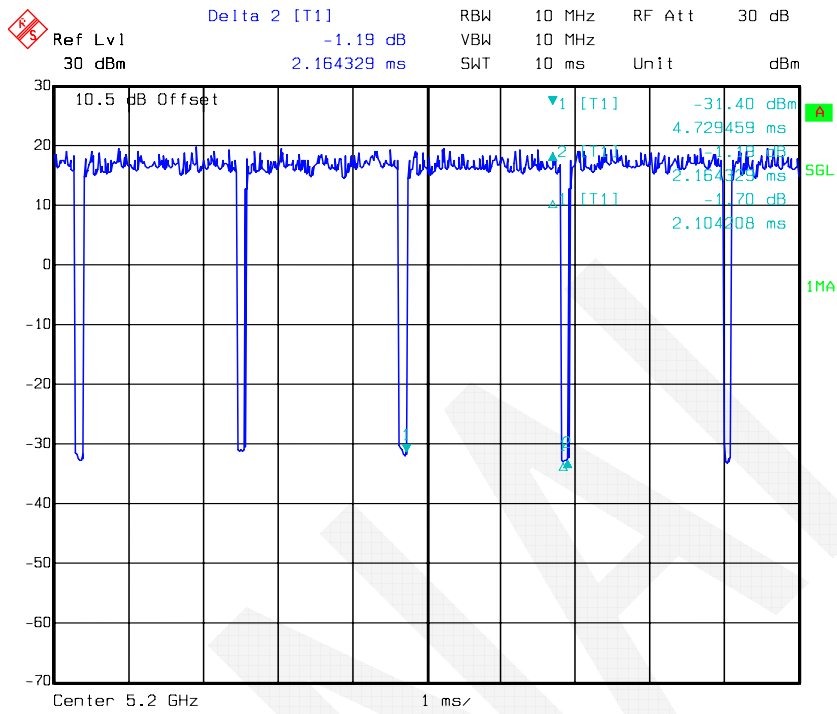
The software “access MTool 3.0.0.2” was used for testing, which was provided by manufacturer. The maximum power with maximum duty cycle was set as below:

Software				access MTool 3.0.0.2					
UNII Band	Mode	Channel	Frequency (MHz)	Data Rate (Mbps)			Power Level		
				Antenna 0	Antenna 1	Antenna 2	Antenna 0	Antenna 1	Antenna 2
5150-5250MHz	802.11a	Low	5180	6	6	6	30	30	30
		Middle	5200	6	6	6	30	30	30
		High	5240	6	6	6	30	30	30
	802.11n-HT20	Low	5180	MCS0	MCS0	MCS0	30	30	30
		Middle	5200	MCS0	MCS0	MCS0	30	30	30
		High	5240	MCS0	MCS0	MCS0	30	30	30
	802.11n-HT40	Low	5190	MCS0	MCS0	MCS0	30	30	30
		High	5230	MCS0	MCS0	MCS0	30	30	30
	802.11ac20	Low	5180	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30
		Middle	5200	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30
		High	5240	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30
	802.11ac40	Low	5190	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30
High		5230	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30	
802.11ac80	Middle	5210	MCS0NSS1	MCS0NSS1	MCS0NSS1	25	25	25	
5725-5850MHz	802.11a	Low	5745	6	6	6	30	30	30
		Middle	5785	6	6	6	30	30	30
		High	5825	6	6	6	30	30	30
	802.11n-HT20	Low	5745	MCS0	MCS0	MCS0	30	30	30
		Middle	5785	MCS0	MCS0	MCS0	30	30	30
		High	5825	MCS0	MCS0	MCS0	30	30	30
	802.11n-HT40	Low	5755	MCS0	MCS0	MCS0	30	30	30
		High	5795	MCS0	MCS0	MCS0	30	30	30
	802.11ac20	Low	5745	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30
		Middle	5785	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30
		High	5825	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30
	802.11ac40	Low	5755	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30
High		5795	MCS0NSS1	MCS0NSS1	MCS0NSS1	30	30	30	
802.11ac80	Middle	5775	MCS0NSS1	MCS0NSS1	MCS0NSS1	25	25	25	

Duty Cycle information is below:

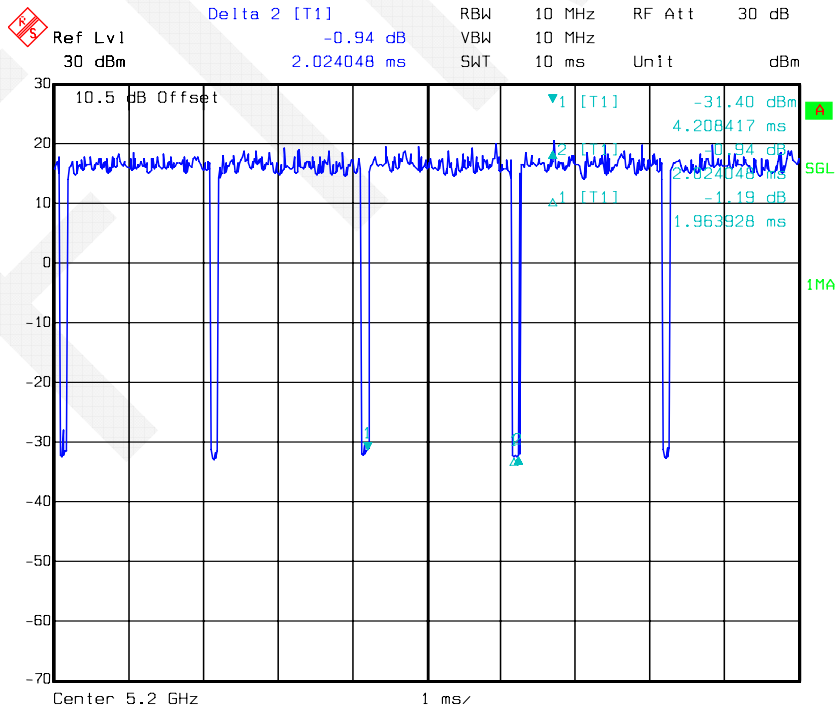
Mode	Ton (ms)	Ton+Toff (ms)	Duty cycle(%)
802.11a	2.10	2.16	97.22
802.11n-HT20	1.96	2.02	97.03
802.11n-HT40	0.98	1.04	94.23
802.11ac20	1.96	2.02	97.03
802.11ac40	0.98	1.04	94.23
802.11ac80	1.00	1.04	96.15

802.11a



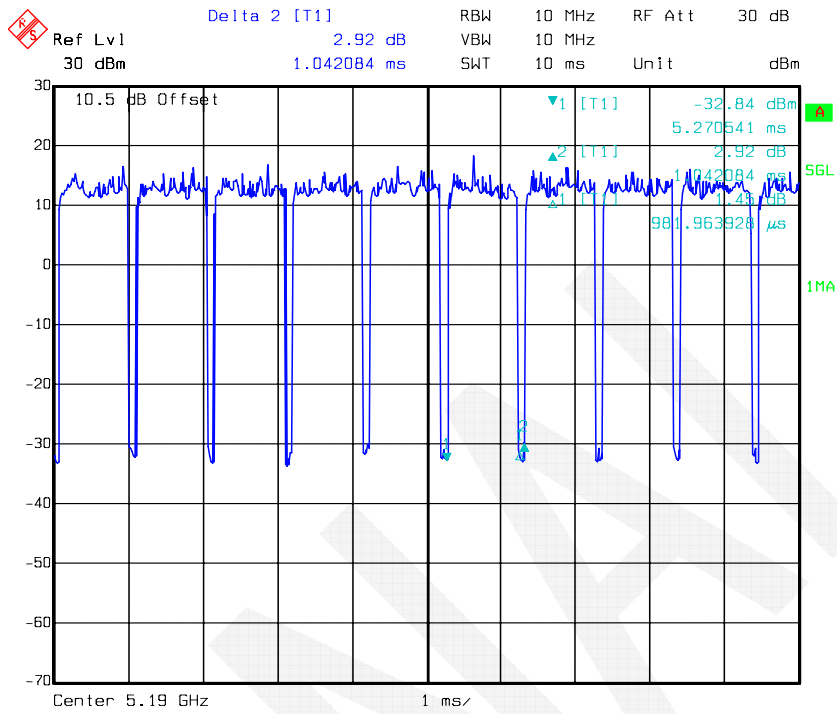
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802.11n- HT20



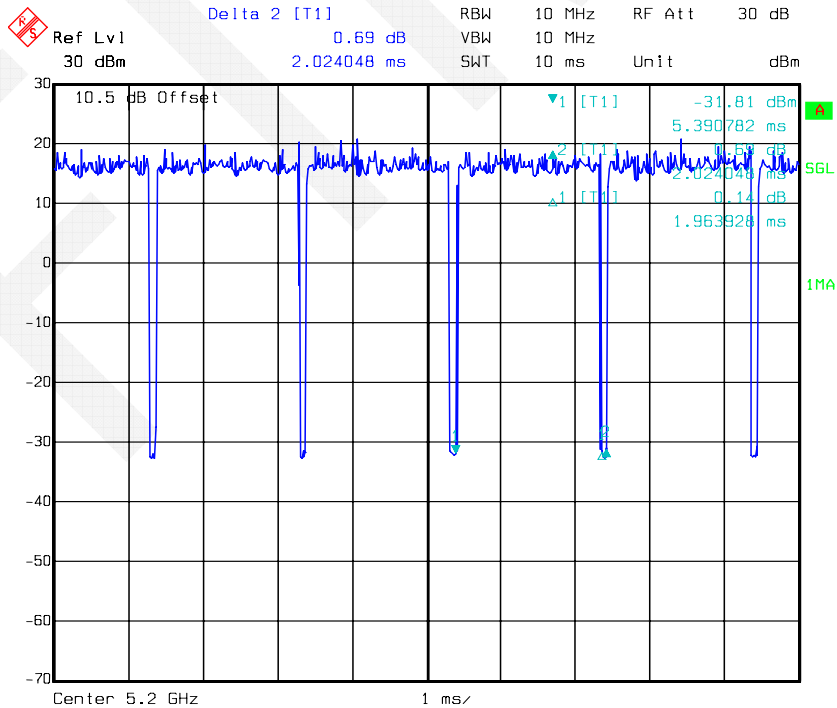
Date: 06.MAR.2018 15:06:12

802.11n- HT40



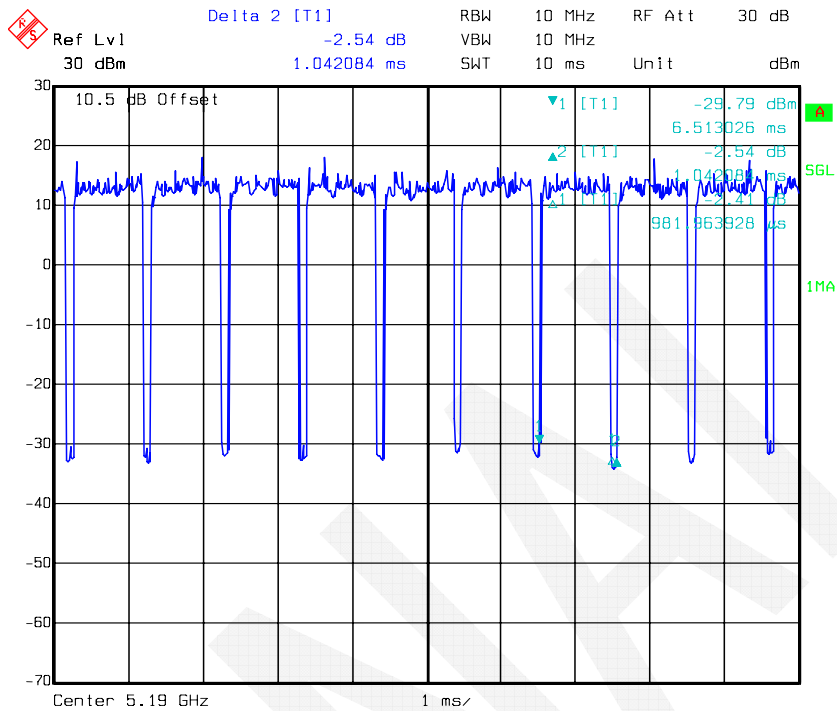
Date: 06.MAR.2018 15:12:02

802.11ac20



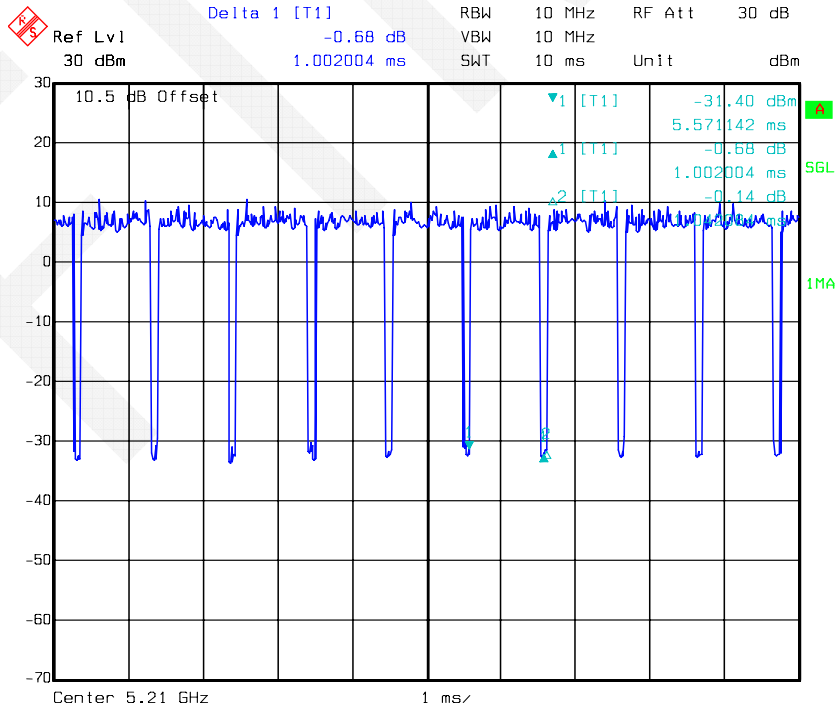
Date: 06.MAR.2018 15:10:56

802.11ac40



Date: 06.MAR.2018 15:15:19

802.11ac80



Date: 06.MAR.2018 15:18:06

Support Equipment List and Details

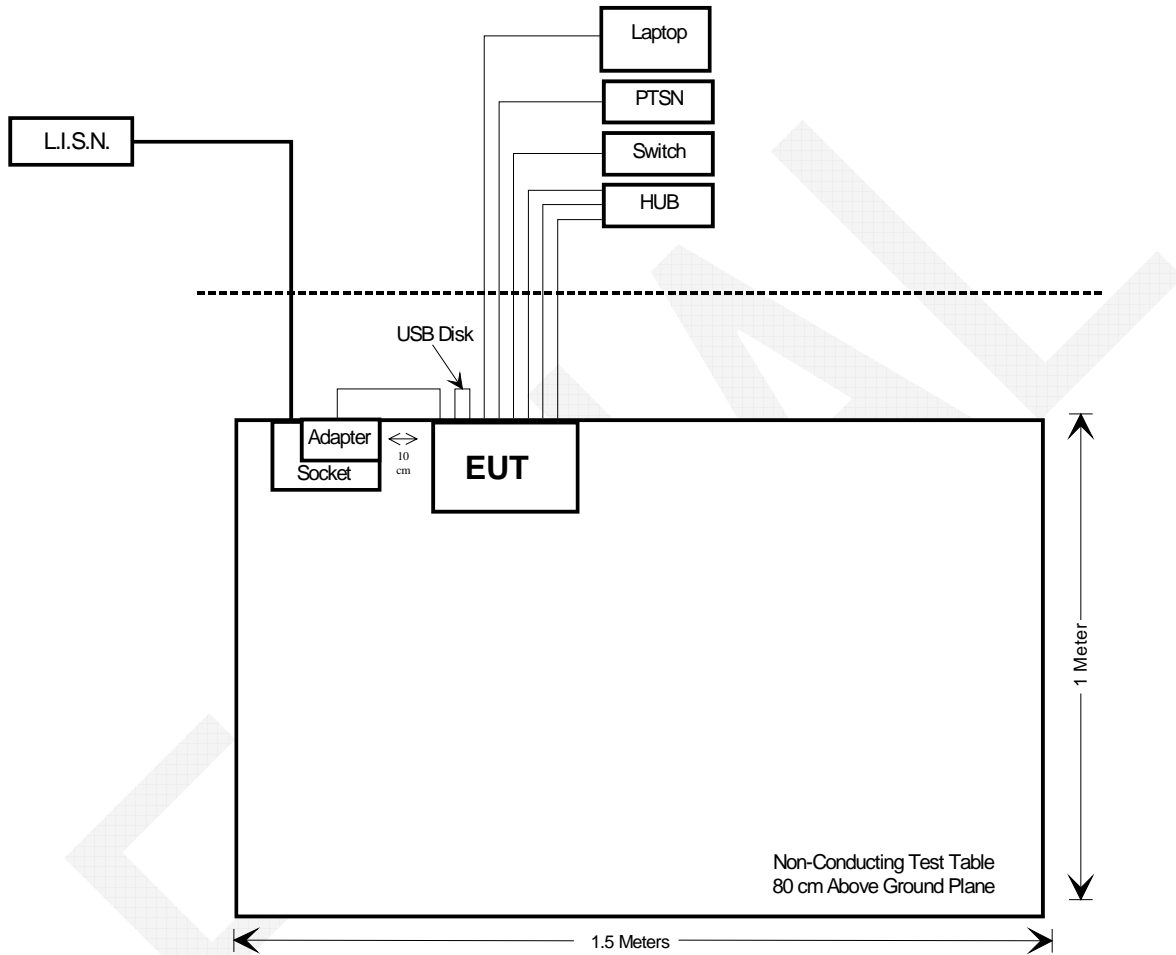
Manufacturer	Description	Model Number	Serial Number
DL	Switch	DL-S1005PM	None
Kingston	USB Disk	DTSE9G2	1337254
None	PTSN	None	None
D-Link	HUB	DES-1008D	DK9Q25A008177
DELL	Laptop	E6410	7480059229

External I/O Cable

Cable Description	Length (m)	From	To
Unshielded RJ11 Cable	10	EUT	PTSN
Unshielded RJ45 Cable	10	EUT	Laptop
Unshielded RJ45 Cable x3	10	EUT	HUB
Unshielded RJ45 Cable	10	EUT	Switch

Block Diagram of Test Setup

AC Power Lines Conducted Emissions Test



Test Equipments List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2017-12-02	2018-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	100018	2017-05-20	2018-05-19
EMCO	L.I.S.N.	3810/2BR	9509-1102	2017-12-02	2018-12-01
Rohde & Schwarz	RF Limiter	ESH3Z2	DE14781	2017-11-10	2018-11-09
N/A	Conducted Cable	L-E003	N/A	2017-11-10	2018-11-09
Rohde & Schwarz	EMC32	N/A	V 8.52.0	N/A	N/A
Radiated Emissions Test					
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2017-05-20	2018-05-19
Sunol Sciences	Broadband Antenna	JB3	A121808	2017-05-18	2020-05-17
Sonoma	Pre-Amplifier	310N	186684	2017-08-18	2018-08-17
INMET	Attenuator	18N-6dB	64671	2017-11-10	2018-11-09
Rohde & Schwarz	EMI Test Receiver	ESIB 40	100215	2017-09-12	2018-09-11
ETS	Horn Antenna	3115	003-6076	2017-05-19	2020-05-18
A.H.Systems,inc	Horn Antenna	SAS-574	505	2017-12-02	2018-12-01
Mini-circuits	Pre-Amplifier	ZVA-183-S+	771001215	2017-05-20	2018-05-19
EM Electronics Corporation	RF Pre-Amplifier	EM18G40	060725	2018-03-01	2019-02-28
N/A	RF Cable (below 1GHz)	L-E005	N/A	2017-11-10	2018-11-09
N/A	RF Cable (below 1GHz)	T-E128	N/A	2017-11-10	2018-11-09
N/A	RF Cable (below 1GHz)	T-E129	N/A	2017-11-10	2018-11-09
N/A	RF Cable (above 1GHz)	T-E069	N/A	2017-11-10	2018-11-09
ORIDA RF LABS	RF Cable (18-40GHz)	KMS-160A-72.0-KMS	1042	2017-11-10	2018-11-09
Micro-coax	RF Cable (18-40GHz)	UFA147A-1-2362-100100	MFR 64639 2310	2017-11-10	2018-11-09
Rohde & Schwarz	EMC32	N/A	V 8.52.0	N/A	N/A
RF Conducted Test					
Agilent	USB Wideband Power Sensor	U2021XA	MY53320008	2017-11-10	2018-11-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2017-05-18	2018-05-17
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2017-11-10	2018-11-09
N/A	RF Cable	NO.3	N/A	2017-11-09	2018-11-08
E-Microwave	DC Block	EMDCB-00036	OE01304225	Each Time	/
N/A	RF Cable	N/A	N/A	Each Time	/

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§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) (1), (4)(i), (6), (7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(b) (1), (4)(i)	Band Edge	Compliance
§15.407(a) (1),(3) & (e)	26dB & 6dB Bandwidth	Compliance
§15.407(a)(1),(3)	Conducted Transmitter Output Power	Compliance
§15.407 (a)(1),(3),(5)	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/f ²)	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.

Per 447498 D01 General RF Exposure Guidance v06, simultaneous transmission MPE test exclusion applies when the sum of the MPE for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.

Calculated Formulary:

Predication of MPE limit at a given distance

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

Where:

S = power density (in appropriate units, e.g. mW/cm²);

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:

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

The rated tune-up output power and antenna gain in the below table:

Calculated Data:

MPE evaluation for single transmission:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
WLAN	2412-2462	3.00	2.00	21.00	125.89	20	0.050	1.00
	5150-5250	5.00	3.16	17.50	56.23	20	0.035	1.00
	5725-5850	5.00	3.16	20.00	100.00	20	0.063	1.00

Note: The Wi-Fi(2.4G) and Wi-Fi(5G) can transmit simultaneously.

MPE evaluation for simultaneous transmission:

2.4 G(Wi-Fi) and 5G(Wi-Fi) can transmit at the same time, MPE evaluation is as below formula:

$PD1/Limit1+PD2/Limit2+\dots < 1$, PD (Power Density)

MPE evaluation:

2.4 G(Wi-Fi) and 5G(Wi-Fi):

Max MPE of 2.4G(Wi-Fi) + Max MPE of 5G(Wi-Fi) = $0.050/1+0.063/1=0.113 < 1.0$

Result: MPE evaluation of single and simultaneous transmission meet the requirement of standard.

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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
 - b. Antenna must use a unique type of connector to attach to the EUT.
- Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

This device used two internal PIFA antennas for 2.4G band and three external Dipole antennas for 5G band. The maximum gain for 2.4G band is 3dBi and 5G band is 5dBi, which fulfill the requirement of this section, please refer to the EUT photos.

Antenna Information

Antenna Type	Manufacturer	Model Name	Connector Type	Max. Antenna Gain
2.4G WIFI	Signal Plus Technology Co., Ltd.	6022F00015	Integrated	3dBi
5G WIFI	Signal Plus Technology Co., Ltd.	6022F00061 6022F00063 6022F00074	SMA-K	5dBi

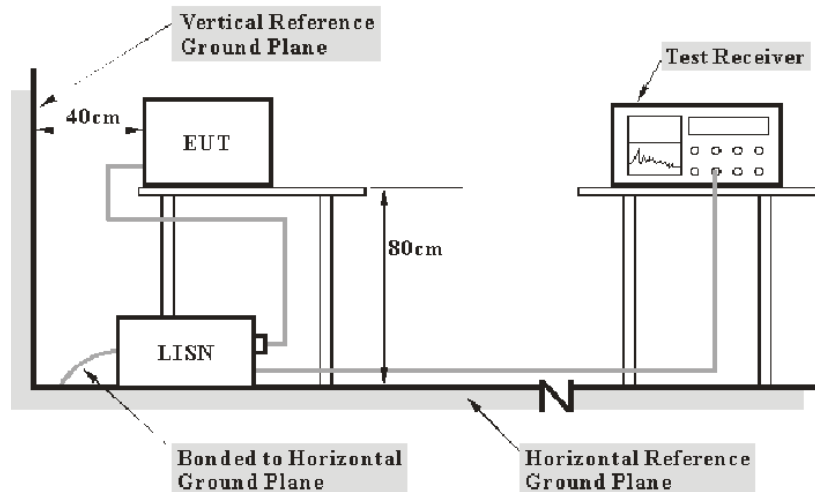
Result: Compliance.

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

Applicable Standard

FCC §15.207, §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 AC 120V/60Hz 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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Procedure

During the conducted emission test, the adapter was connected to the 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 Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

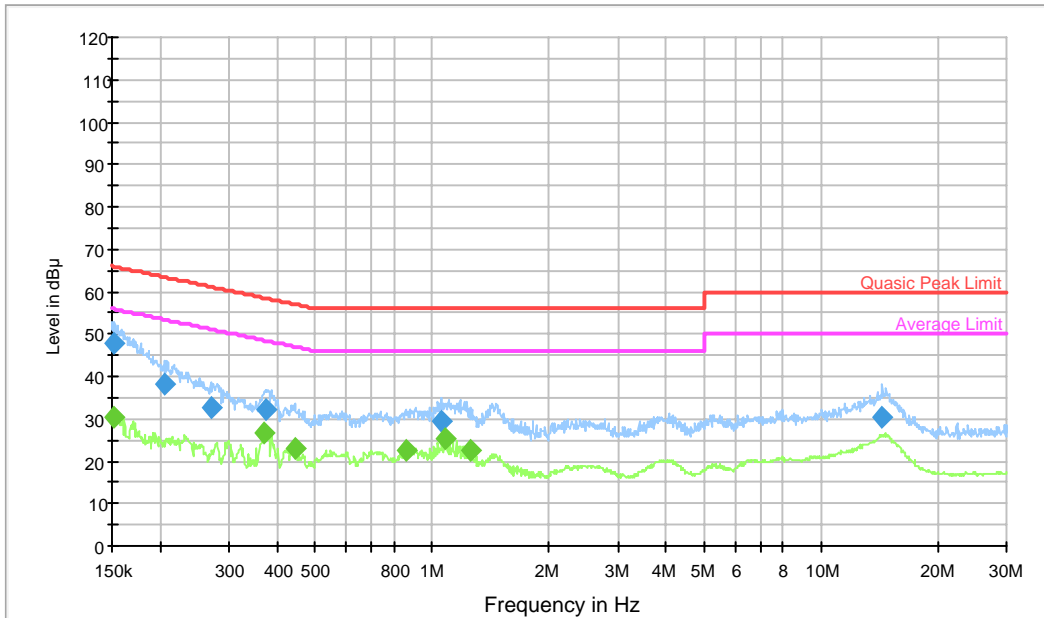
Environmental Conditions

Temperature:	20 °C
Relative Humidity:	42 %
ATM Pressure:	96.4 kPa

The testing was performed by Tom Tang on 2018-03-08.

Test Mode: Transmitting (Band 5150-5250MHz_802.11n-HT20_Middle channel)-worst case

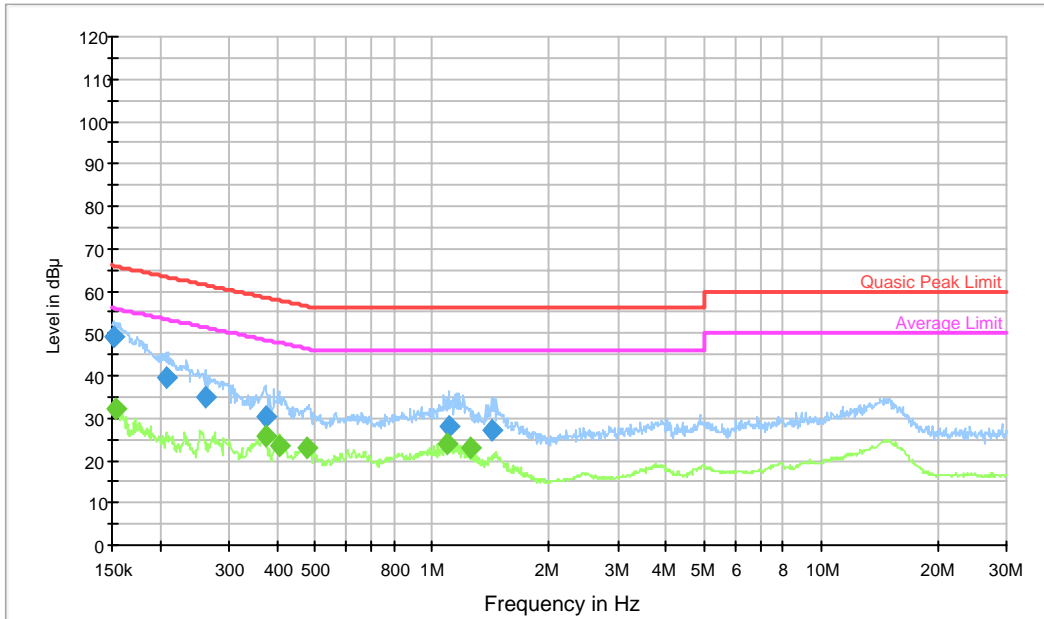
AC120V/60Hz, Line



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBμV)
0.152415	47.6	9.000	L1	19.6	18.3	65.9
0.204796	38.1	9.000	L1	19.7	25.3	63.4
0.269741	32.5	9.000	L1	19.7	28.6	61.1
0.374207	32.3	9.000	L1	19.7	26.1	58.4
1.056519	29.4	9.000	L1	19.7	26.6	56.0
14.378888	30.3	9.000	L1	20.1	29.7	60.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBμV)
0.151807	30.6	9.000	L1	19.6	25.3	55.9
0.369752	26.8	9.000	L1	19.7	21.7	48.5
0.442515	23.1	9.000	L1	19.8	23.9	47.0
0.855048	22.7	9.000	L1	19.7	23.3	46.0
1.082130	25.5	9.000	L1	19.7	20.5	46.0
1.249376	22.6	9.000	L1	19.7	23.4	46.0

AC120V/60Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.151807	49.1	9.000	N	19.5	16.8	65.9
0.206437	39.6	9.000	N	19.5	23.7	63.3
0.261263	34.8	9.000	N	19.5	26.6	61.4
0.371231	30.4	9.000	N	19.5	28.1	58.5
1.103946	28.2	9.000	N	19.5	27.8	56.0
1.419619	27.1	9.000	N	19.5	28.9	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.153636	32.2	9.000	N	19.5	23.6	55.8
0.371231	25.6	9.000	N	19.5	22.9	48.5
0.403694	23.5	9.000	N	19.5	24.3	47.8
0.477384	22.8	9.000	N	19.5	23.6	46.4
1.095167	23.8	9.000	N	19.5	22.2	46.0
1.249376	22.8	9.000	N	19.5	23.2	46.0

Note:

- 1) Corrected Amplitude = Reading + Correction Factor
- 2) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter
- 3) Margin = Limit – Corrected Amplitude

FCC §15.209, §15.205 & §15.407(b) (1) (4)(i) (6) (7) – UNDESIRABLE EMISSION, RESTRICTED BANDS

Applicable Standard

FCC §15.407 (b) (1) (4)(i), (6), (7); §15.209; §15.205

FCC 15.407 (b)

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band:
 - (i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.

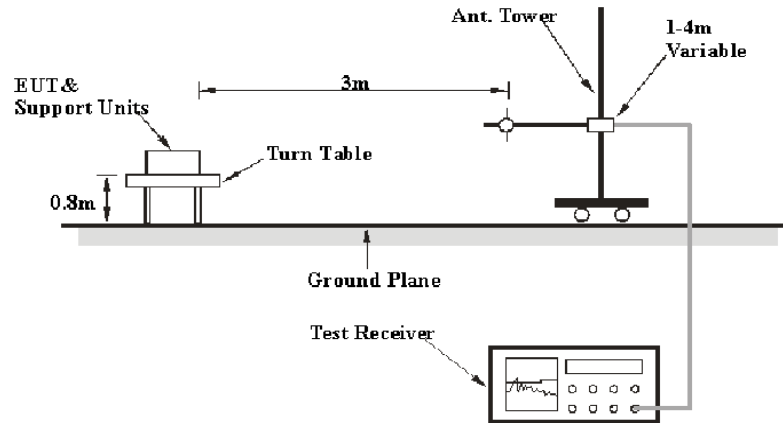
According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, emission shall be computed as:

$E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3$ meters.

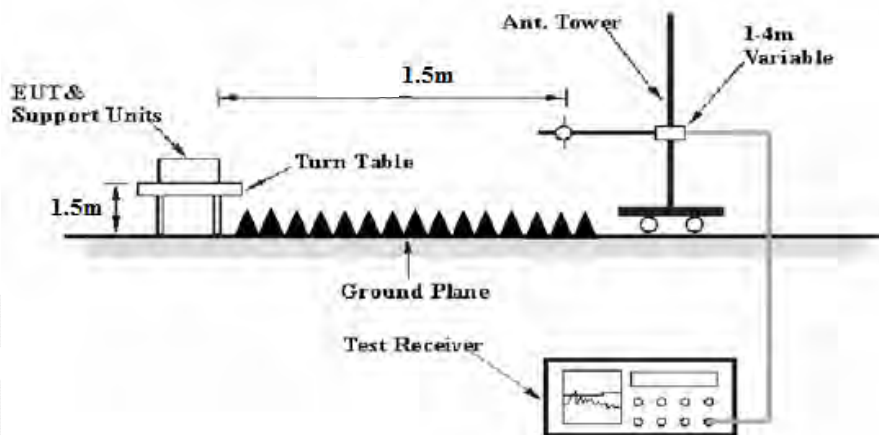
- 1) For 75 MHz above or below the band edge, a level of -27 dBm/MHz (68.2dB μ V/m) was applied.
- 2) For 25MHz-75 MHz above or below the band edge, a level of 10 dBm/MHz (105.2dB μ V/m) was applied.
- 3) For 5MHz-25 MHz above or below the band edge, a level of 15.6 dBm/MHz (110.8dB μ V/m) was applied.
- 4) For 0 MHz-5 MHz above or below the band edge, a level of 27 dBm/MHz (122.2dB μ V/m) was applied.

EUT Setup

Below 1GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters semi-anechoic chamber, 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.

The adapter was connected to AC 120V/60Hz power source.

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 Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

Frequency Range	RBW	Video B/W	Duty Cycle	Measurement
Above 1 GHz	1MHz	3 MHz	Any	PK
	1MHz	10Hz	>98%	AV
	1MHz	1/T	<98%	AV

Note: T is minimum transmission duration

Test Procedure

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

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

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, emission shall be computed as: $E [dB\mu V/m] = EIRP[dBm] + 95.2$, 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

Distance extrapolation factor = $20 \log(\text{specific distance [3m]}/\text{test distance [1.5m]})$ dB

Extrapolation result = Corrected Amplitude (dB μ V/m) - distance extrapolation factor (6dB)

Corrected Amplitude & Margin Calculation

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 = Receiver Reading + Cable loss + Antenna Factor – 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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, Section 15.205 and 15.209, Subpart E, Section 15.407.

Test Data

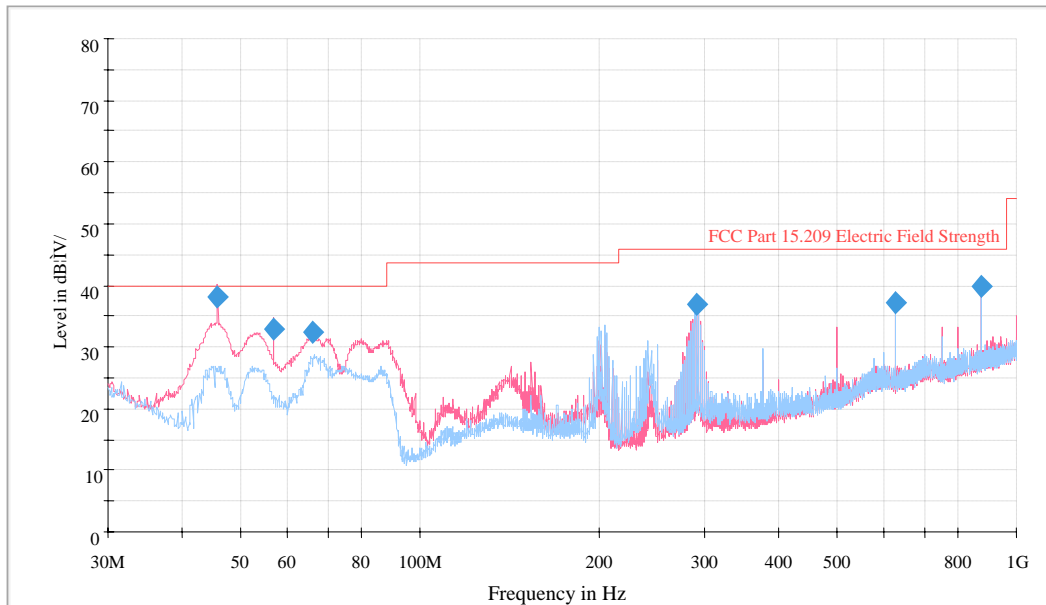
Environmental Conditions

Temperature:	22 °C
Relative Humidity:	50 %
ATM Pressure:	95.6 kPa

The testing was performed by Tom Tang on 2018-03-15.

Test mode: Transmitting

1) 30 MHz to 1 GHz: (Band 5150-5250MHz_802.11n-HT20_Middle channel)-worst case



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m)	Margin (dB)	Limit (dBµV/m)
45.883750	37.2	100.0	V	333.0	-14.7	*2.8	40.0
56.796250	32.8	150.0	V	61.0	-17.6	7.2	40.0
66.253750	31.0	100.0	V	23.0	-16.8	9.0	40.0
292.021250	35.1	150.0	V	223.0	-10.8	10.9	46.0
625.095000	35.3	100.0	V	208.0	-4.3	10.7	46.0
875.112500	39.0	100.0	V	186.0	-0.6	7.0	46.0

*Within measurement uncertainty!

2) 1GHz-40GHz

(Note: Above 1GHz was performed at distance 1.5m)

For 5150-5250 MHz:

For 802.11a mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5180 MHz										
5180	70.13	PK	H	34.51	5.21	0.00	109.85	103.85	N/A	N/A
5180	59.23	AV	H	34.51	5.21	0.00	98.95	92.95	N/A	N/A
5180	86.44	PK	V	34.51	5.21	0.00	126.16	120.16	N/A	N/A
5180	76.49	AV	V	34.51	5.21	0.00	116.21	110.21	N/A	N/A
5150	29.27	PK	V	34.49	5.18	0.00	68.94	62.94	74.00	11.06
5150	15.41	AV	V	34.49	5.18	0.00	55.08	49.08	54.00	*4.92
10360	35.43	PK	V	38.67	7.76	26.37	55.49	49.49	74.00	24.51
10360	23.02	AV	V	38.67	7.76	26.37	43.08	37.08	54.00	16.92
Frequency: 5200 MHz										
5200	70.14	PK	H	34.52	5.23	0.00	109.89	103.89	N/A	N/A
5200	59.81	AV	H	34.52	5.23	0.00	99.56	93.56	N/A	N/A
5200	86.30	PK	V	34.52	5.23	0.00	126.05	120.05	N/A	N/A
5200	76.70	AV	V	34.52	5.23	0.00	116.45	110.45	N/A	N/A
10400	36.04	PK	V	38.68	7.79	26.36	56.15	50.15	74.00	23.85
10400	23.12	AV	V	38.68	7.79	26.36	43.23	37.23	54.00	16.77
Frequency: 5240 MHz										
5240	70.11	PK	H	34.54	5.27	0.00	109.92	103.92	N/A	N/A
5240	60.32	AV	H	34.54	5.27	0.00	100.13	94.13	N/A	N/A
5240	86.06	PK	V	34.54	5.27	0.00	125.87	119.87	N/A	N/A
5240	76.55	AV	V	34.54	5.27	0.00	116.36	110.36	N/A	N/A
5350	29.21	PK	V	34.61	5.37	0.00	69.19	63.19	74.00	10.81
5350	17.02	AV	V	34.61	5.37	0.00	57.00	51.00	54.00	*3.00
10480	36.47	PK	V	38.70	7.84	26.35	56.66	50.66	74.00	23.34
10480	22.98	AV	V	38.70	7.84	26.35	43.17	37.17	54.00	16.83

**Within measurement uncertainty!*

For 802.11n-HT20 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5180 MHz										
5180	69.95	PK	H	34.51	5.21	0.00	109.67	103.67	N/A	N/A
5180	60.12	AV	H	34.51	5.21	0.00	99.84	93.84	N/A	N/A
5180	83.36	PK	V	34.51	5.21	0.00	123.08	117.08	N/A	N/A
5180	72.77	AV	V	34.51	5.21	0.00	112.49	106.49	N/A	N/A
5150	28.92	PK	V	34.49	5.18	0.00	68.59	62.59	74.00	11.41
5150	15.27	AV	V	34.49	5.18	0.00	54.94	48.94	54.00	*5.06
10360	35.18	PK	V	38.67	7.76	26.37	55.24	49.24	74.00	24.76
10360	22.97	AV	V	38.67	7.76	26.37	43.03	37.03	54.00	16.97
Frequency: 5200 MHz										
5200	69.75	PK	H	34.52	5.23	0.00	109.50	103.50	N/A	N/A
5200	60.10	AV	H	34.52	5.23	0.00	99.85	93.85	N/A	N/A
5200	84.01	PK	V	34.52	5.23	0.00	123.76	117.76	N/A	N/A
5200	73.73	AV	V	34.52	5.23	0.00	113.48	107.48	N/A	N/A
10400	36.07	PK	V	38.68	7.79	26.36	56.18	50.18	74.00	23.82
10400	23.51	AV	V	38.68	7.79	26.36	43.62	37.62	54.00	16.38
Frequency: 5240 MHz										
5240	69.32	PK	H	34.54	5.27	0.00	109.13	103.13	N/A	N/A
5240	59.61	AV	H	34.54	5.27	0.00	99.42	93.42	N/A	N/A
5240	84.22	PK	V	34.54	5.27	0.00	124.03	118.03	N/A	N/A
5240	74.14	AV	V	34.54	5.27	0.00	113.95	107.95	N/A	N/A
5350	29.96	PK	V	34.61	5.37	0.00	69.94	63.94	74.00	10.06
5350	17.08	AV	V	34.61	5.37	0.00	57.06	51.06	54.00	*2.94
10480	36.88	PK	V	38.70	7.84	26.35	57.07	51.07	74.00	22.93
10480	23.35	AV	V	38.70	7.84	26.35	43.54	37.54	54.00	16.46

**Within measurement uncertainty!*

For 802.11n-HT40 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5190 MHz										
5190	66.06	PK	H	34.51	5.22	0.00	105.79	99.79	N/A	N/A
5190	56.16	AV	H	34.51	5.22	0.00	95.89	89.89	N/A	N/A
5190	80.74	PK	V	34.51	5.22	0.00	120.47	114.47	N/A	N/A
5190	69.87	AV	V	34.51	5.22	0.00	109.60	103.60	N/A	N/A
5150	35.13	PK	V	34.49	5.18	0.00	74.80	68.80	74.00	*5.20
5150	18.79	AV	V	34.49	5.18	0.00	58.46	52.46	54.00	*1.54
10380	35.27	PK	V	38.68	7.78	26.37	55.36	49.36	74.00	24.64
10380	23.06	AV	V	38.68	7.78	26.37	43.15	37.15	54.00	16.85
Frequency: 5230 MHz										
5230	64.91	PK	H	34.54	5.26	0.00	104.71	98.71	N/A	N/A
5230	54.44	AV	H	34.54	5.26	0.00	94.24	88.24	N/A	N/A
5230	81.47	PK	V	34.54	5.26	0.00	121.27	115.27	N/A	N/A
5230	71.03	AV	V	34.54	5.26	0.00	110.83	104.83	N/A	N/A
5350	30.08	PK	V	34.61	5.37	0.00	70.06	64.06	74.00	9.94
5350	17.06	AV	V	34.61	5.37	0.00	57.04	51.04	54.00	*2.96
10460	36.03	PK	V	38.69	7.83	26.36	56.19	50.19	74.00	23.81
10460	22.85	AV	V	38.69	7.83	26.36	43.01	37.01	54.00	16.99

**Within measurement uncertainty!*

For 802.11ac20 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5180 MHz										
5180	69.64	PK	H	34.51	5.21	0.00	109.36	103.36	N/A	N/A
5180	60.33	AV	H	34.51	5.21	0.00	100.05	94.05	N/A	N/A
5180	85.83	PK	V	34.51	5.21	0.00	125.55	119.55	N/A	N/A
5180	73.04	AV	V	34.51	5.21	0.00	112.76	106.76	N/A	N/A
5150	30.26	PK	V	34.49	5.18	0.00	69.93	63.93	74.00	10.07
5150	15.56	AV	V	34.49	5.18	0.00	55.23	49.23	54.00	*4.77
10360	35.58	PK	V	38.67	7.76	26.37	55.64	49.64	74.00	24.36
10360	23.17	AV	V	38.67	7.76	26.37	43.23	37.23	54.00	16.77
Frequency: 5200 MHz										
5200	69.77	PK	H	34.52	5.23	0.00	109.52	103.52	N/A	N/A
5200	59.45	AV	H	34.52	5.23	0.00	99.20	93.20	N/A	N/A
5200	86.02	PK	V	34.52	5.23	0.00	125.77	119.77	N/A	N/A
5200	74.09	AV	V	34.52	5.23	0.00	113.84	107.84	N/A	N/A
10400	35.94	PK	V	38.68	7.79	26.36	56.05	50.05	74.00	23.95
10400	23.24	AV	V	38.68	7.79	26.36	43.35	37.35	54.00	16.65
Frequency: 5240 MHz										
5240	69.43	PK	H	34.54	5.27	0.00	109.24	103.24	N/A	N/A
5240	57.94	AV	H	34.54	5.27	0.00	97.75	91.75	N/A	N/A
5240	85.97	PK	V	34.54	5.27	0.00	125.78	119.78	N/A	N/A
5240	74.46	AV	V	34.54	5.27	0.00	114.27	108.27	N/A	N/A
5350	31.23	PK	V	34.61	5.37	0.00	71.21	65.21	74.00	8.79
5350	17.34	AV	V	34.61	5.37	0.00	57.32	51.32	54.00	*2.68
10480	36.11	PK	V	38.70	7.84	26.35	56.30	50.30	74.00	23.70
10480	23.07	AV	V	38.70	7.84	26.35	43.26	37.26	54.00	16.74

*Within measurement uncertainty!

For 802.11ac40 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5190 MHz										
5190	66.51	PK	H	34.51	5.22	0.00	106.24	100.24	N/A	N/A
5190	56.73	AV	H	34.51	5.22	0.00	96.46	90.46	N/A	N/A
5190	81.01	PK	V	34.51	5.22	0.00	120.74	114.74	N/A	N/A
5190	70.39	AV	V	34.51	5.22	0.00	110.12	104.12	N/A	N/A
5150	35.24	PK	V	34.49	5.18	0.00	74.91	68.91	74.00	*5.09
5150	18.63	AV	V	34.49	5.18	0.00	58.30	52.30	54.00	*1.70
10380	35.09	PK	V	38.68	7.78	26.37	55.18	49.18	74.00	24.82
10380	22.95	AV	V	38.68	7.78	26.37	43.04	37.04	54.00	16.96
Frequency: 5230 MHz										
5230	65.51	PK	H	34.54	5.26	0.00	105.31	99.31	N/A	N/A
5230	55.02	AV	H	34.54	5.26	0.00	94.82	88.82	N/A	N/A
5230	81.98	PK	V	34.54	5.26	0.00	121.78	115.78	N/A	N/A
5230	71.55	AV	V	34.54	5.26	0.00	111.35	105.35	N/A	N/A
5350	30.28	PK	V	34.61	5.37	0.00	70.26	64.26	74.00	9.74
5350	17.11	AV	V	34.61	5.37	0.00	57.09	51.09	54.00	*2.91
10460	35.97	PK	V	38.69	7.83	26.36	56.13	50.13	74.00	23.87
10460	23.26	AV	V	38.69	7.83	26.36	43.42	37.42	54.00	16.58

*Within measurement uncertainty!

For 802.11ac80 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5210 MHz										
5210	61.47	PK	H	34.53	5.24	0.00	101.24	95.24	N/A	N/A
5210	51.06	AV	H	34.53	5.24	0.00	90.83	84.83	N/A	N/A
5210	76.05	PK	V	34.53	5.24	0.00	115.82	109.82	N/A	N/A
5210	64.73	AV	V	34.53	5.24	0.00	104.50	98.50	N/A	N/A
5150	34.74	PK	V	34.49	5.18	0.00	74.41	68.41	74.00	5.59
5150	18.34	AV	V	34.49	5.18	0.00	58.01	52.01	54.00	*1.99
5350	30.57	PK	V	34.61	5.37	0.00	70.55	64.55	74.00	9.45
5350	17.01	AV	V	34.61	5.37	0.00	56.99	50.99	54.00	*3.01
10420	34.82	PK	V	38.68	7.80	26.36	54.94	48.94	74.00	25.06
10420	22.74	AV	V	38.68	7.80	26.36	42.86	36.86	54.00	17.14

*Within measurement uncertainty!

Note:

Corrected Amplitude = Corrected Factor + Reading

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Margin = Limit- Corr. Amplitude

Spurious emissions more than 20 dB below the limit were not reported.

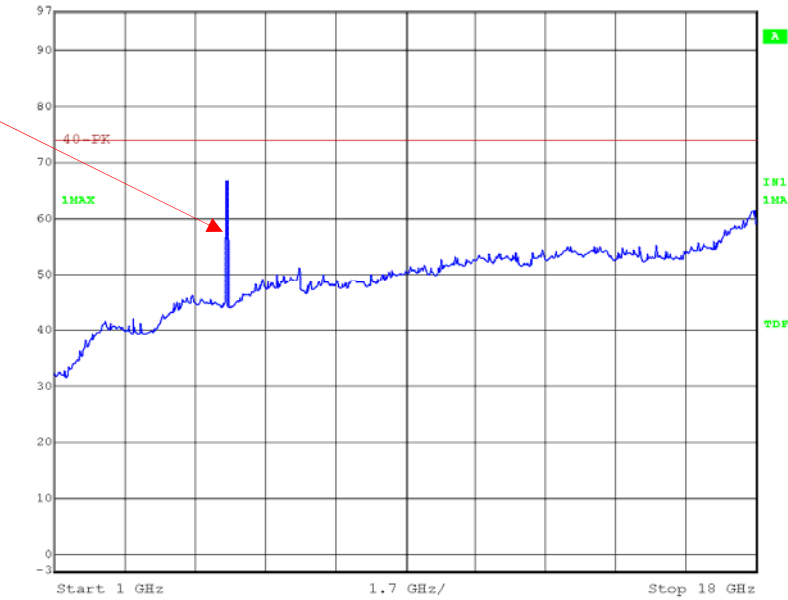
Please refer to the below pre-scan plot of worst case:

Note: The test distance is 1.5m and distance factor add to the total factor.

802.11n-HT40 Mode: Low Channel_Horizontal_1GHz-18GHz

Ref Lvl 97 dBµV
RBW 1 MHz RF Att 0 dB
VBW 3 MHz
SWT 170 ms Unit dBµV

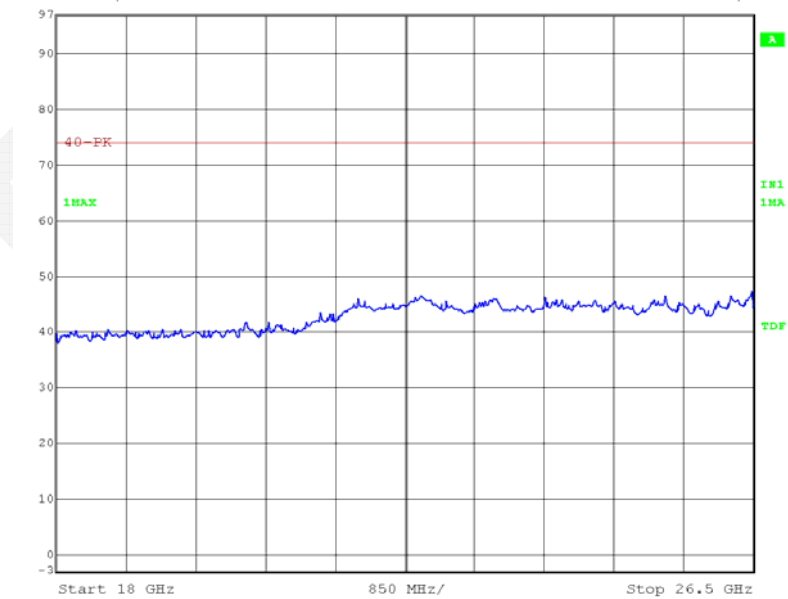
Fundamental with Reject Band Filter



Date: 15.MAR.2018 13:48:00

802.11n-HT40 Mode: Low Channel_Horizontal_18GHz-26.5GHz

Ref Lvl 97 dBµV
RBW 1 MHz RF Att 0 dB
VBW 3 MHz
SWT 86 ms Unit dBµV



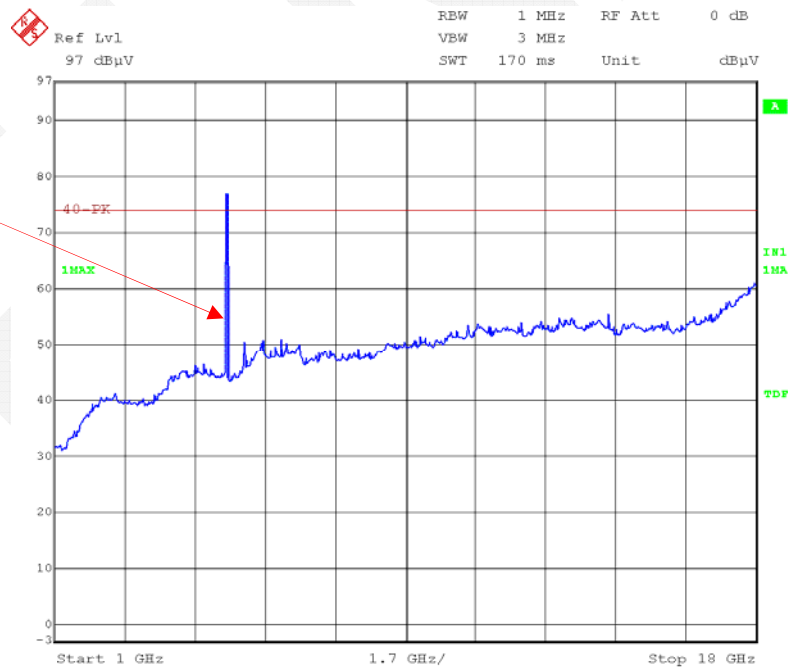
Date: 15.MAR.2018 13:50:29

802.11n-HT40 Mode: Low Channel_Horizontal_26.5GHz-40GHz



Date: 15.MAR.2018 13:55:26

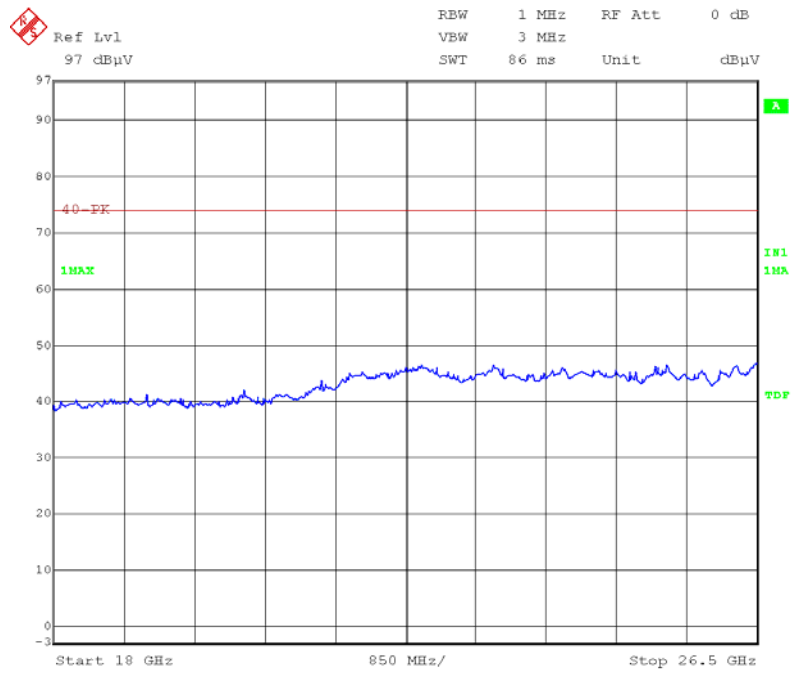
802.11n-HT40 Mode: Low Channel_Vertical_1GHz-18GHz



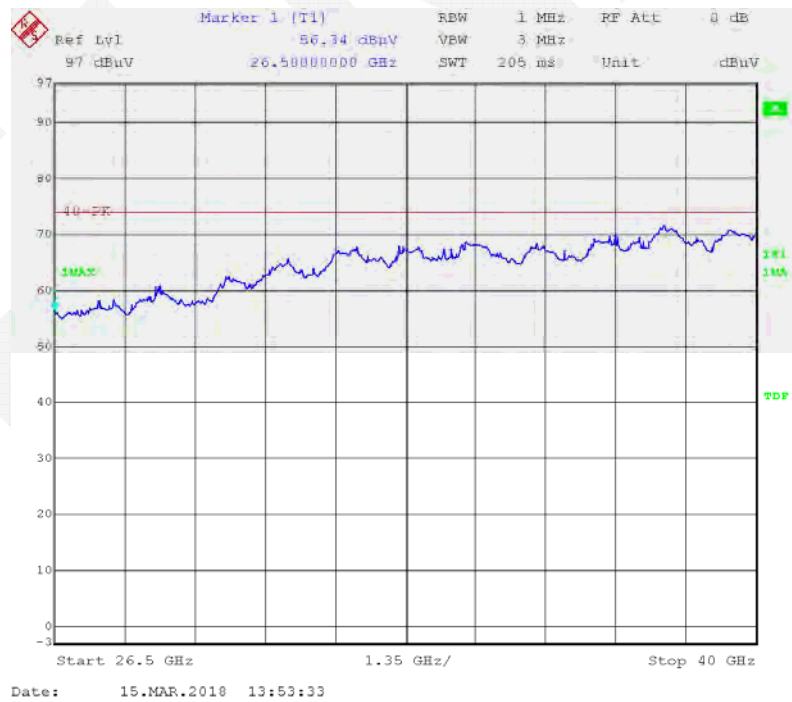
Fundamental with
Reject Band Filter

Date: 15.MAR.2018 13:47:04

802.11n-HT40 Mode: Low Channel_Vertical_18GHz-26.5GHz



802.11n-HT40 Mode: Low Channel_Vertical_26.5GHz-40GHz



For 5725-5850 MHz

For 802.11a mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5745 MHz										
5745	70.61	PK	H	34.75	5.74	0.00	111.10	105.10	N/A	N/A
5745	59.88	AV	H	34.75	5.74	0.00	100.37	94.37	N/A	N/A
5745	84.01	PK	V	34.75	5.74	0.00	124.50	118.50	N/A	N/A
5745	73.99	AV	V	34.75	5.74	0.00	114.48	108.48	N/A	N/A
5650	31.21	PK	V	34.73	5.65	0.00	71.59	65.59	68.20	*2.61
5700	31.63	PK	V	34.74	5.70	0.00	72.07	66.07	105.20	39.13
5720	31.82	PK	V	34.74	5.71	0.00	72.27	66.27	110.80	44.53
5725	35.03	PK	V	34.75	5.72	0.00	75.50	69.50	122.20	52.70
11490	44.24	PK	V	38.90	8.22	26.02	65.34	59.34	74.00	14.66
11490	27.42	AV	V	38.90	8.22	26.02	48.52	42.52	54.00	11.48
Frequency: 5785 MHz										
5785	71.02	PK	H	34.76	5.77	0.00	111.55	105.55	N/A	N/A
5785	60.58	AV	H	34.76	5.77	0.00	101.11	95.11	N/A	N/A
5785	83.86	PK	V	34.76	5.77	0.00	124.39	118.39	N/A	N/A
5785	73.97	AV	V	34.76	5.77	0.00	114.50	108.50	N/A	N/A
11570	43.89	PK	V	38.91	8.21	26.00	65.01	59.01	74.00	14.99
11570	27.03	AV	V	38.91	8.21	26.00	48.15	42.15	54.00	11.85
Frequency: 5825 MHz										
5825	71.31	PK	H	34.77	5.81	0.00	111.89	105.89	N/A	N/A
5825	61.09	AV	H	34.77	5.81	0.00	101.67	95.67	N/A	N/A
5825	83.59	PK	V	34.77	5.81	0.00	124.17	118.17	N/A	N/A
5825	73.74	AV	V	34.77	5.81	0.00	114.32	108.32	N/A	N/A
5850	31.67	PK	V	34.77	5.83	0.00	72.27	66.27	122.20	55.93
5855	31.47	PK	V	34.77	5.83	0.00	72.07	66.07	110.80	44.73
5875	31.49	PK	V	34.78	5.85	0.00	72.12	66.12	105.20	39.08
5925	31.55	PK	V	34.79	5.89	0.00	72.23	66.23	68.20	*1.97
11650	43.15	PK	V	38.93	8.20	25.98	64.30	58.30	74.00	15.70
11650	26.57	AV	V	38.93	8.20	25.98	47.72	41.72	54.00	12.28

**Within measurement uncertainty!*

For 802.11n-HT20 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5745 MHz										
5745	69.36	PK	H	34.75	5.74	0.00	109.85	103.85	N/A	N/A
5745	59.11	AV	H	34.75	5.74	0.00	99.60	93.60	N/A	N/A
5745	82.95	PK	V	34.75	5.74	0.00	123.44	117.44	N/A	N/A
5745	72.81	AV	V	34.75	5.74	0.00	113.30	107.30	N/A	N/A
5650	31.58	PK	V	34.73	5.65	0.00	71.96	65.96	68.20	*2.24
5700	32.05	PK	V	34.74	5.70	0.00	72.49	66.49	105.20	38.71
5720	31.43	PK	V	34.74	5.71	0.00	71.88	65.88	110.80	44.92
5725	42.41	PK	V	34.75	5.72	0.00	82.88	76.88	122.20	45.32
11490	43.66	PK	V	38.90	8.22	26.02	64.76	58.76	74.00	15.24
11490	26.96	AV	V	38.90	8.22	26.02	48.06	42.06	54.00	11.94
Frequency: 5785 MHz										
5785	70.45	PK	H	34.76	5.77	0.00	110.98	104.98	N/A	N/A
5785	60.05	AV	H	34.76	5.77	0.00	100.58	94.58	N/A	N/A
5785	83.23	PK	V	34.76	5.77	0.00	123.76	117.76	N/A	N/A
5785	73.16	AV	V	34.76	5.77	0.00	113.69	107.69	N/A	N/A
11570	43.53	PK	V	38.91	8.21	26.00	64.65	58.65	74.00	15.35
11570	26.85	AV	V	38.91	8.21	26.00	47.97	41.97	54.00	12.03
Frequency: 5825 MHz										
5825	71.43	PK	H	34.77	5.81	0.00	112.01	106.01	N/A	N/A
5825	60.74	AV	H	34.77	5.81	0.00	101.32	95.32	N/A	N/A
5825	83.03	PK	V	34.77	5.81	0.00	123.61	117.61	N/A	N/A
5825	73.24	AV	V	34.77	5.81	0.00	113.82	107.82	N/A	N/A
5850	31.11	PK	V	34.77	5.83	0.00	71.71	65.71	122.20	56.49
5855	31.16	PK	V	34.77	5.83	0.00	71.76	65.76	110.80	45.04
5875	31.28	PK	V	34.78	5.85	0.00	71.91	65.91	105.20	39.29
5925	32.21	PK	V	34.79	5.89	0.00	72.89	66.89	68.20	*1.31
11650	43.04	PK	V	38.93	8.20	25.98	64.19	58.19	74.00	15.81
11650	26.59	AV	V	38.93	8.20	25.98	47.74	41.74	54.00	12.26

*Within measurement uncertainty!

For 802.11n-HT40 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5755 MHz										
5755	65.15	PK	H	34.75	5.74	0.00	105.64	99.64	N/A	N/A
5755	55.02	AV	H	34.75	5.74	0.00	95.51	89.51	N/A	N/A
5755	79.47	PK	V	34.75	5.74	0.00	119.96	113.96	N/A	N/A
5755	69.08	AV	V	34.75	5.74	0.00	109.57	103.57	N/A	N/A
5650	30.35	PK	V	34.73	5.65	0.00	70.73	64.73	68.20	*3.47
5700	30.81	PK	V	34.74	5.70	0.00	71.25	65.25	105.20	39.95
5720	36.84	PK	V	34.74	5.71	0.00	77.29	71.29	110.80	39.51
5725	36.38	PK	V	34.75	5.72	0.00	76.85	70.85	122.20	51.35
11510	43.02	PK	V	38.90	8.22	26.02	64.12	58.12	74.00	15.88
11510	26.89	AV	V	38.90	8.22	26.02	47.99	41.99	54.00	12.01
Frequency: 5795 MHz										
5795	66.53	PK	H	34.76	5.78	0.00	107.07	101.07	N/A	N/A
5795	56.38	AV	H	34.76	5.78	0.00	96.92	90.92	N/A	N/A
5795	78.91	PK	V	34.76	5.78	0.00	119.45	113.45	N/A	N/A
5795	68.14	AV	V	34.76	5.78	0.00	108.68	102.68	N/A	N/A
5850	31.81	PK	V	34.77	5.83	0.00	72.41	66.41	122.20	55.79
5855	30.64	PK	V	34.77	5.83	0.00	71.24	65.24	110.80	45.56
5875	31.11	PK	V	34.78	5.85	0.00	71.74	65.74	105.20	39.46
5925	30.87	PK	V	34.79	5.89	0.00	71.55	65.55	68.20	*2.65
11590	41.97	PK	V	38.92	8.21	25.99	63.11	57.11	74.00	16.89
11590	26.54	AV	V	38.92	8.21	25.99	47.68	41.68	54.00	12.32

*Within measurement uncertainty!

For 802.11ac20 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5745 MHz										
5745	70.15	PK	H	34.75	5.74	0.00	110.64	104.64	N/A	N/A
5745	59.41	AV	H	34.75	5.74	0.00	99.90	93.90	N/A	N/A
5745	82.63	PK	V	34.75	5.74	0.00	123.12	117.12	N/A	N/A
5745	73.23	AV	V	34.75	5.74	0.00	113.72	107.72	N/A	N/A
5650	31.65	PK	V	34.73	5.65	0.00	72.03	66.03	68.20	*2.17
5700	30.45	PK	V	34.74	5.70	0.00	70.89	64.89	105.20	40.31
5720	30.48	PK	V	34.74	5.71	0.00	70.93	64.93	110.80	45.87
5725	32.63	PK	V	34.75	5.72	0.00	73.10	67.10	122.20	55.10
11490	43.78	PK	V	38.90	8.22	26.02	64.88	58.88	74.00	15.12
11490	27.06	AV	V	38.90	8.22	26.02	48.16	42.16	54.00	11.84
Frequency: 5785 MHz										
5785	70.96	PK	H	34.76	5.77	0.00	111.49	105.49	N/A	N/A
5785	60.34	AV	H	34.76	5.77	0.00	100.87	94.87	N/A	N/A
5785	82.92	PK	V	34.76	5.77	0.00	123.45	117.45	N/A	N/A
5785	73.60	AV	V	34.76	5.77	0.00	114.13	108.13	N/A	N/A
11570	43.50	PK	V	38.91	8.21	26.00	64.62	58.62	74.00	15.38
11570	26.83	AV	V	38.91	8.21	26.00	47.95	41.95	54.00	12.05
Frequency: 5825 MHz										
5825	71.52	PK	H	34.77	5.81	0.00	112.10	106.10	N/A	N/A
5825	60.78	AV	H	34.77	5.81	0.00	101.36	95.36	N/A	N/A
5825	83.21	PK	V	34.77	5.81	0.00	123.79	117.79	N/A	N/A
5825	73.51	AV	V	34.77	5.81	0.00	114.09	108.09	N/A	N/A
5850	30.96	PK	V	34.77	5.83	0.00	71.56	65.56	122.20	56.64
5855	30.93	PK	V	34.77	5.83	0.00	71.53	65.53	110.80	45.27
5875	31.85	PK	V	34.78	5.85	0.00	72.48	66.48	105.20	38.72
5925	32.01	PK	V	34.79	5.89	0.00	72.69	66.69	68.20	*1.51
11650	42.89	PK	V	38.93	8.20	25.98	64.04	58.04	74.00	15.96
11650	26.47	AV	V	38.93	8.20	25.98	47.62	41.62	54.00	12.38

*Within measurement uncertainty!

Bay Area Compliance Laboratories Corp. (Chengdu)

For 802.11ac40 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5755 MHz										
5755	66.41	PK	H	34.75	5.74	0.00	106.90	100.90	N/A	N/A
5755	55.69	AV	H	34.75	5.74	0.00	96.18	90.18	N/A	N/A
5755	80.07	PK	V	34.75	5.74	0.00	120.56	114.56	N/A	N/A
5755	69.61	AV	V	34.75	5.74	0.00	110.10	104.10	N/A	N/A
5650	30.11	PK	V	34.73	5.65	0.00	70.49	64.49	68.20	*3.71
5700	30.68	PK	V	34.74	5.70	0.00	71.12	65.12	105.20	40.08
5720	36.41	PK	V	34.74	5.71	0.00	76.86	70.86	110.80	39.94
5725	33.73	PK	V	34.75	5.72	0.00	74.20	68.20	122.20	54.00
11510	43.81	PK	V	38.90	8.22	26.02	64.91	58.91	74.00	15.09
11510	27.68	AV	V	38.90	8.22	26.02	48.78	42.78	54.00	11.22
Frequency: 5795 MHz										
5795	67.04	PK	H	34.76	5.78	0.00	107.58	101.58	N/A	N/A
5795	56.91	AV	H	34.76	5.78	0.00	97.45	91.45	N/A	N/A
5795	79.06	PK	V	34.76	5.78	0.00	119.60	113.60	N/A	N/A
5795	68.71	AV	V	34.76	5.78	0.00	109.25	103.25	N/A	N/A
5850	31.25	PK	V	34.77	5.83	0.00	71.85	65.85	122.20	56.35
5855	30.83	PK	V	34.77	5.83	0.00	71.43	65.43	110.80	45.37
5875	31.87	PK	V	34.78	5.85	0.00	72.50	66.50	105.20	38.70
5925	31.53	PK	V	34.79	5.89	0.00	72.21	66.21	68.20	*1.99
11590	42.46	PK	V	38.92	8.21	25.99	63.60	57.60	74.00	16.40
11590	27.15	AV	V	38.92	8.21	25.99	48.29	42.29	54.00	11.71

*Within measurement uncertainty!

For 802.11ac80 mode

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 (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5775 MHz										
5775	60.88	PK	H	34.76	5.76	0.00	101.40	95.40	N/A	N/A
5775	50.51	AV	H	34.76	5.76	0.00	91.03	85.03	N/A	N/A
5775	75.23	PK	V	34.76	5.76	0.00	115.75	109.75	N/A	N/A
5775	64.17	AV	V	34.76	5.76	0.00	104.69	98.69	N/A	N/A
5650	30.99	PK	V	34.73	5.65	0.00	71.37	65.37	68.20	*2.83
5700	32.48	PK	V	34.74	5.70	0.00	72.92	66.92	105.20	38.28
5720	34.45	PK	V	34.74	5.71	0.00	74.90	68.90	110.80	41.90
5725	34.58	PK	V	34.75	5.72	0.00	75.05	69.05	122.20	53.15
5850	30.97	PK	V	34.77	5.83	0.00	71.57	65.57	122.20	56.63
5855	31.63	PK	V	34.77	5.83	0.00	72.23	66.23	110.80	44.57
5875	31.68	PK	V	34.78	5.85	0.00	72.31	66.31	105.20	38.89
5925	31.35	PK	V	34.79	5.89	0.00	72.03	66.03	68.20	*2.17
11550	42.86	PK	V	38.91	8.21	26.01	63.97	57.97	74.00	16.03
11550	26.54	AV	V	38.91	8.21	26.01	47.65	41.65	54.00	12.35

*Within measurement uncertainty!

Note:

Corrected Amplitude = Corrected Factor + Reading

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Margin = Limit- Corr. Amplitude

Spurious emissions more than 20 dB below the limit were not reported.

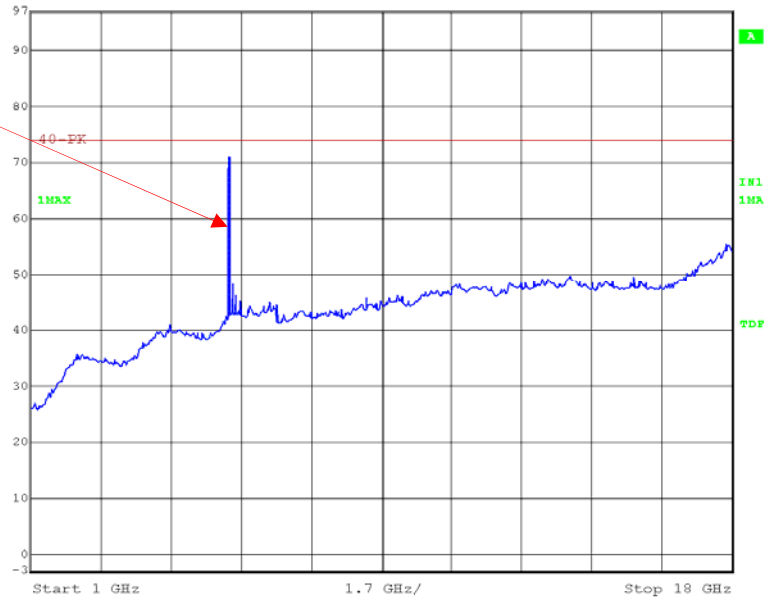
Please refer to the below pre-scan plot of worst case:

Note: The test distance is 1.5m and distance factor add to the total factor.

802.11n-HT20 Mode: High Channel_Horizontal_1GHz-18GHz

Ref Lvl 97 dBµV
RBW 1 MHz RF Att 0 dB
VBW 3 MHz
SWT 170 ms Unit dBµV

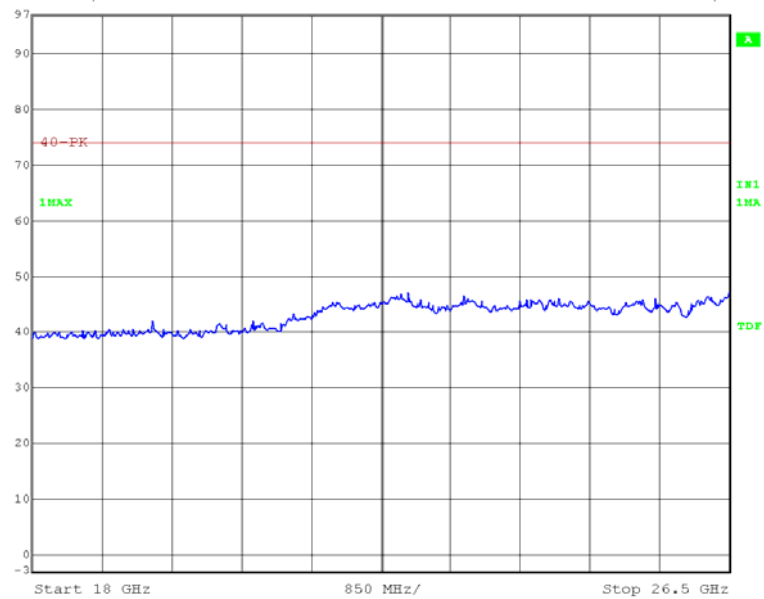
Fundamental with Reject Band Filter



Date: 15.MAR.2018 13:28:50

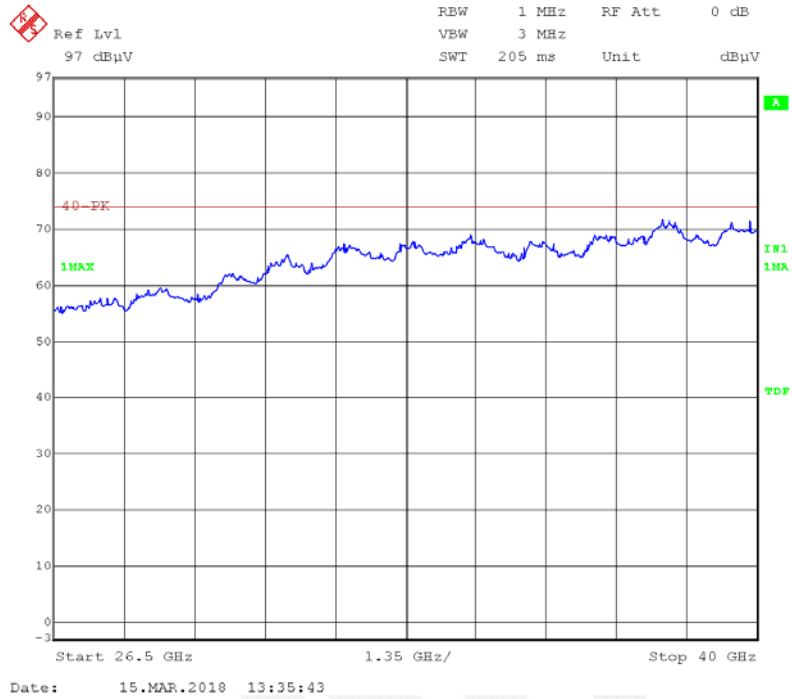
802.11n-HT20 Mode: High Channel_Horizontal_18GHz-26.5GHz

Ref Lvl 97 dBµV
RBW 1 MHz RF Att 0 dB
VBW 3 MHz
SWT 86 ms Unit dBµV

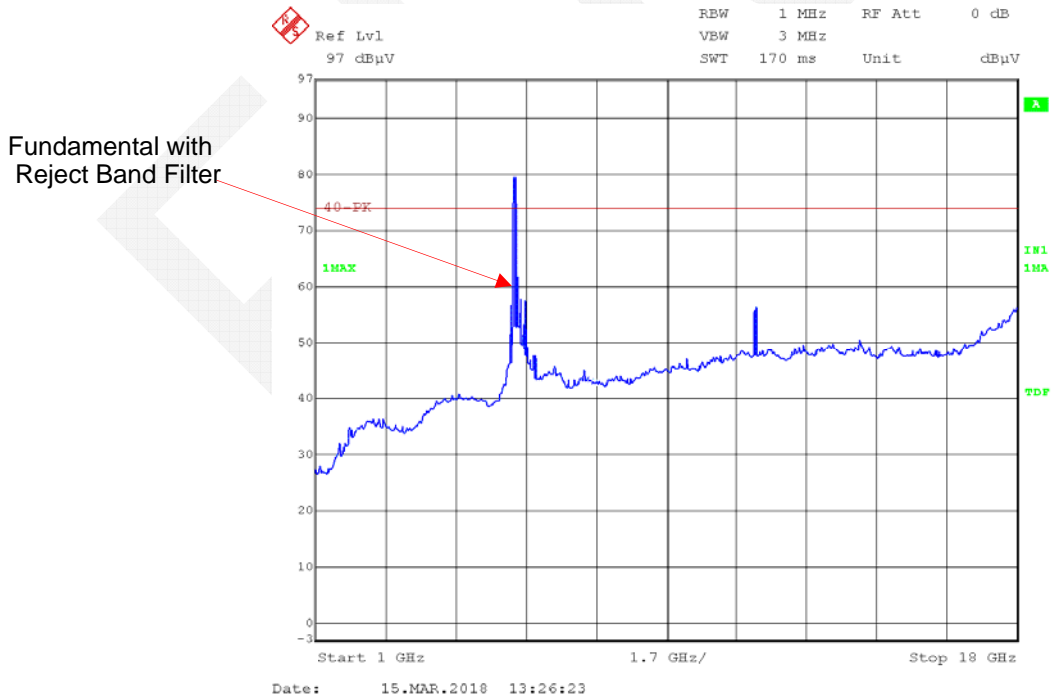


Date: 15.MAR.2018 13:33:01

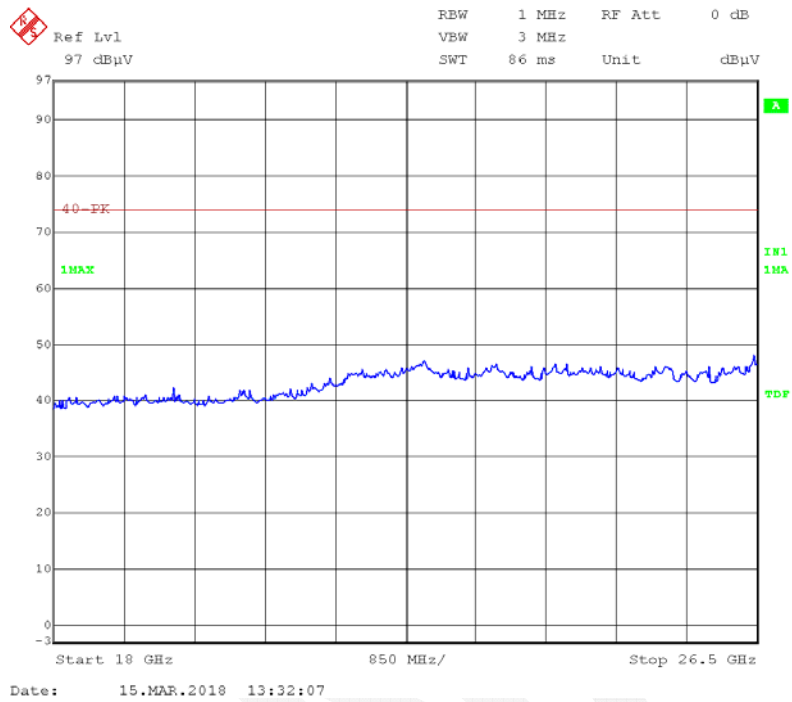
802.11n-HT20 Mode: High Channel_Horizontal_26.5GHz-40GHz



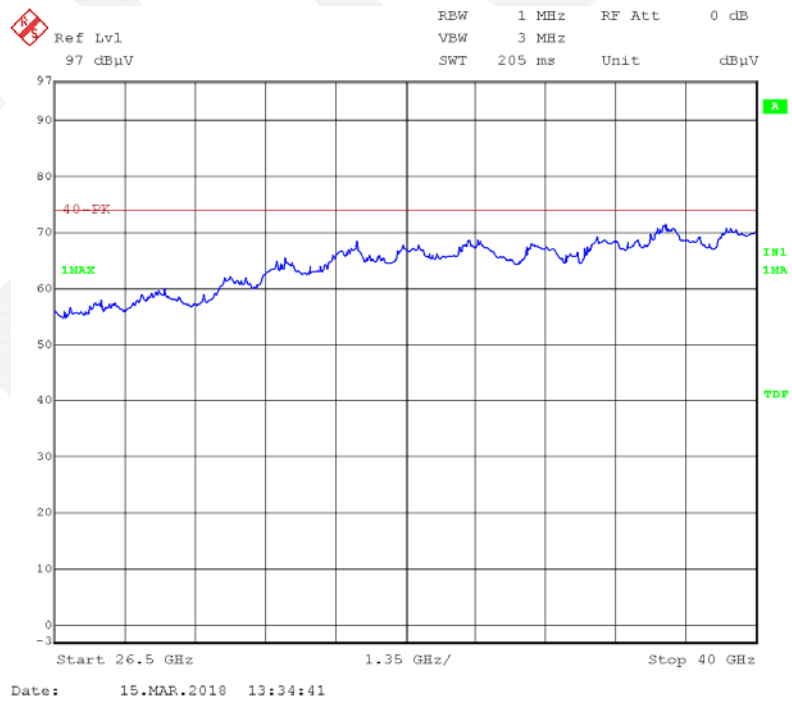
802.11n-HT20 Mode: High Channel_Vertical_1GHz-18GHz



802.11n-HT20 Mode: High Channel_Vertical_18GHz-26.5GHz



802.11n-HT20 Mode: High Channel_Vertical_26.5GHz-40GHz



FCC §15.407(b) (1), (4) (i) – BAND EDGE

Applicable Standard

FCC §15.407(b) (1), (4) (i)

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band:
 - (i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibration or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 1 MHz and VBW to 3 MHz of spectrum analyzer. Offset the antenna gain and cable loss.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

Temperature:	18 ~ 20 °C
Relative Humidity:	45 ~ 56 %
ATM Pressure:	95.2 ~ 96.2 kPa

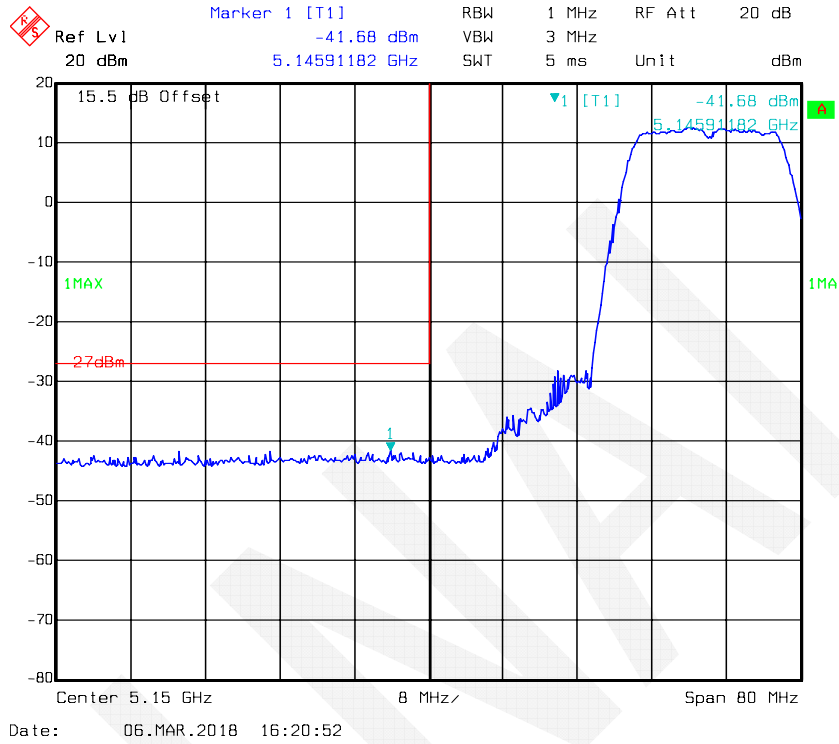
* The testing was performed by Tom Tang on 2018-03-06 ~ 2018-03-07.

Test mode: Transmitting

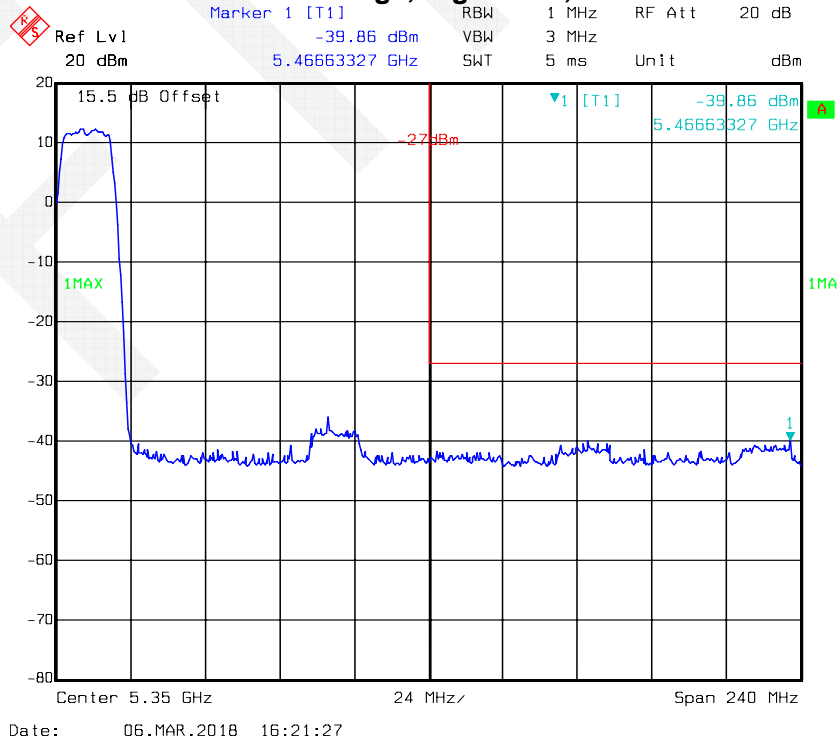
Test Result: Compliance. Please refer to following table and plots.

For 5150-5250 MHz (Note: The antenna gain was set in the offset, all emissions under limit more than 5dBc, so MIMO mode also comply the requirement.)

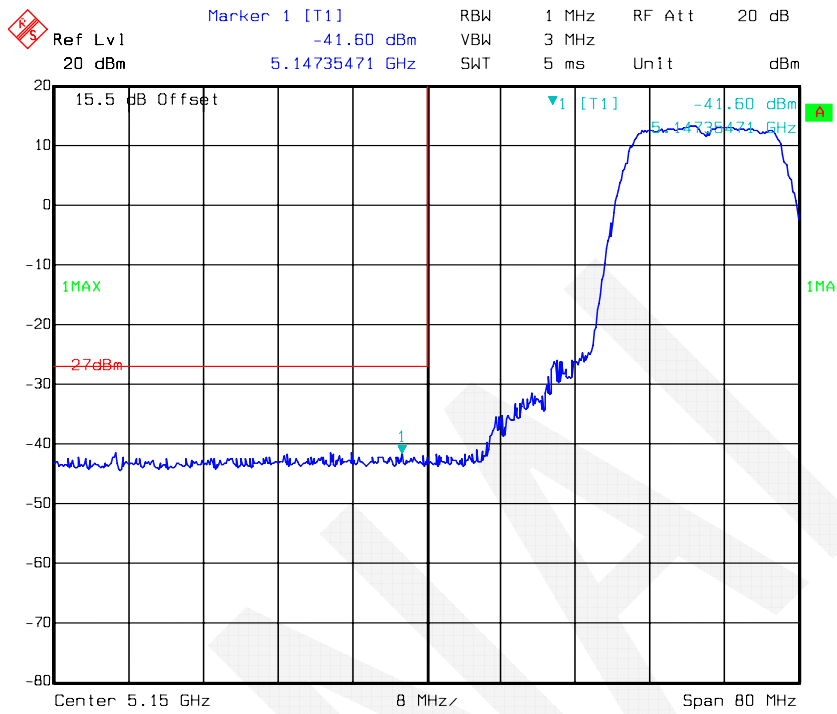
802.11a: Band Edge, Left Side, Antenna 0



802.11a: Band Edge, Right Side, Antenna 0

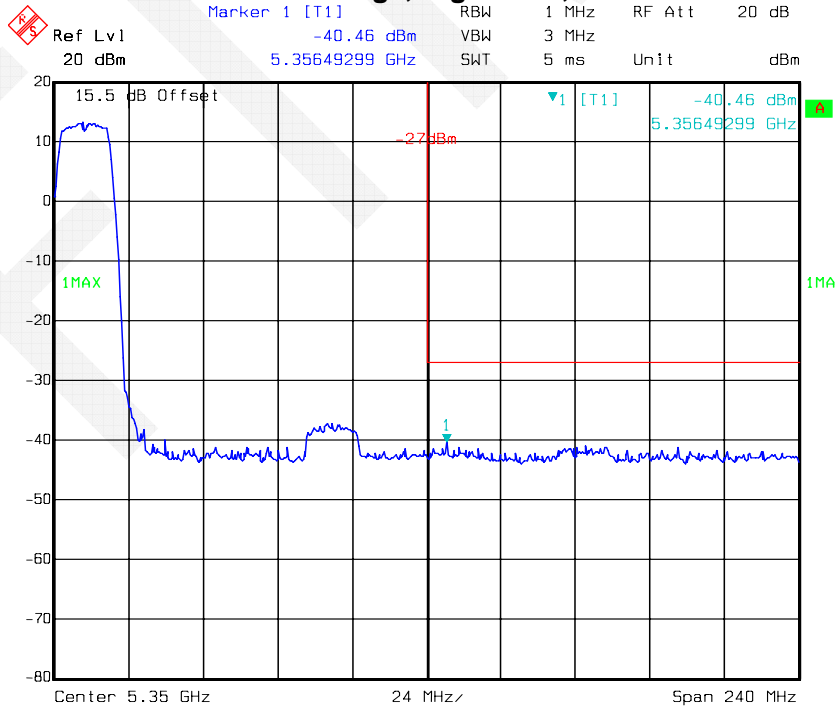


802.11a: Band Edge, Left Side, Antenna 1



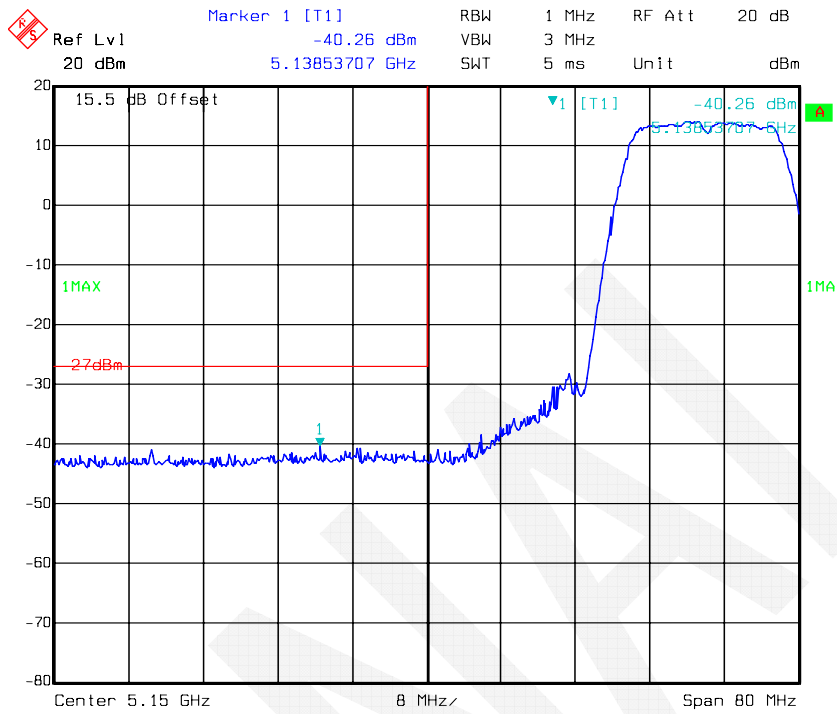
Date: 06.MAR.2018 16:39:41

802.11a: Band Edge, Right Side, Antenna 1



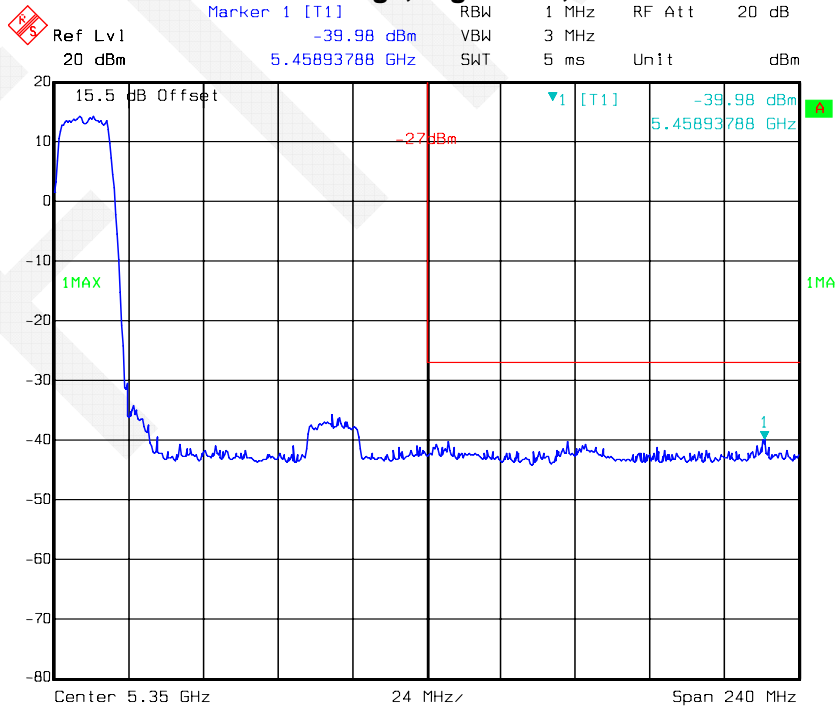
Date: 06.MAR.2018 16:40:28

802.11a: Band Edge, Left Side, Antenna 2



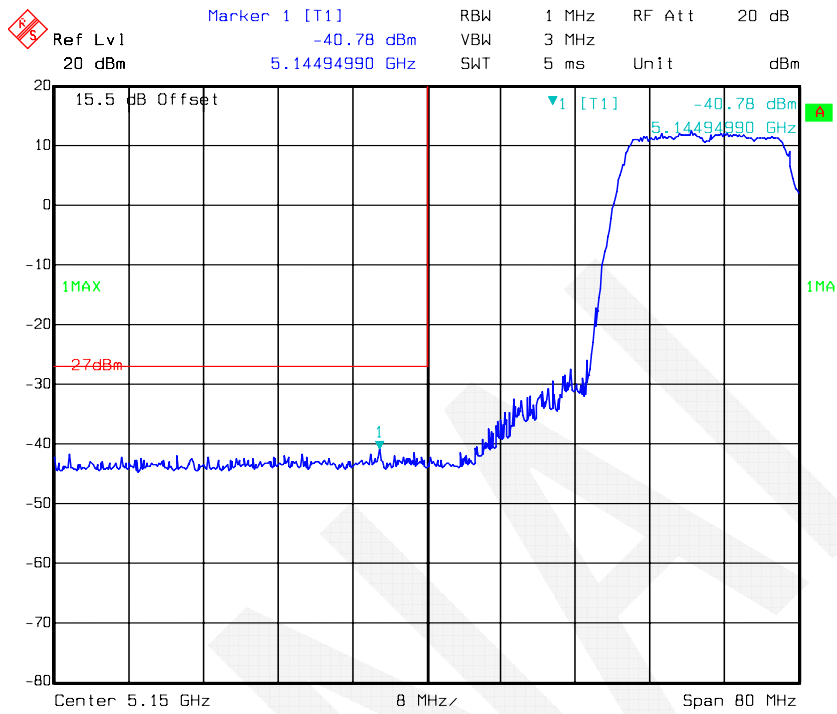
Date: 06.MAR.2018 17:59:05

802.11a: Band Edge, Right Side, Antenna 2



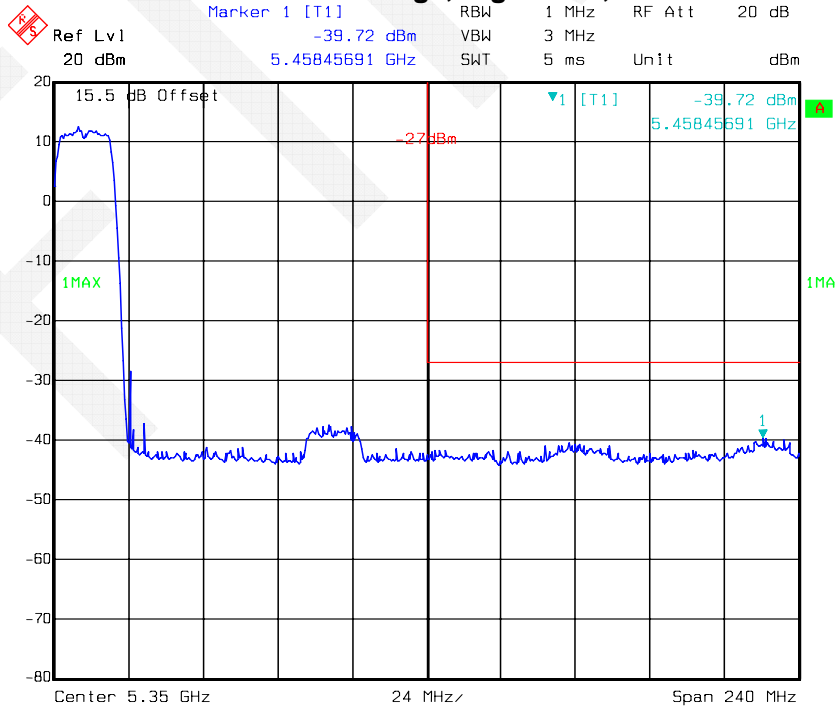
Date: 06.MAR.2018 17:59:40

802.11n-HT20: Band Edge, Left Side, Antenna 0



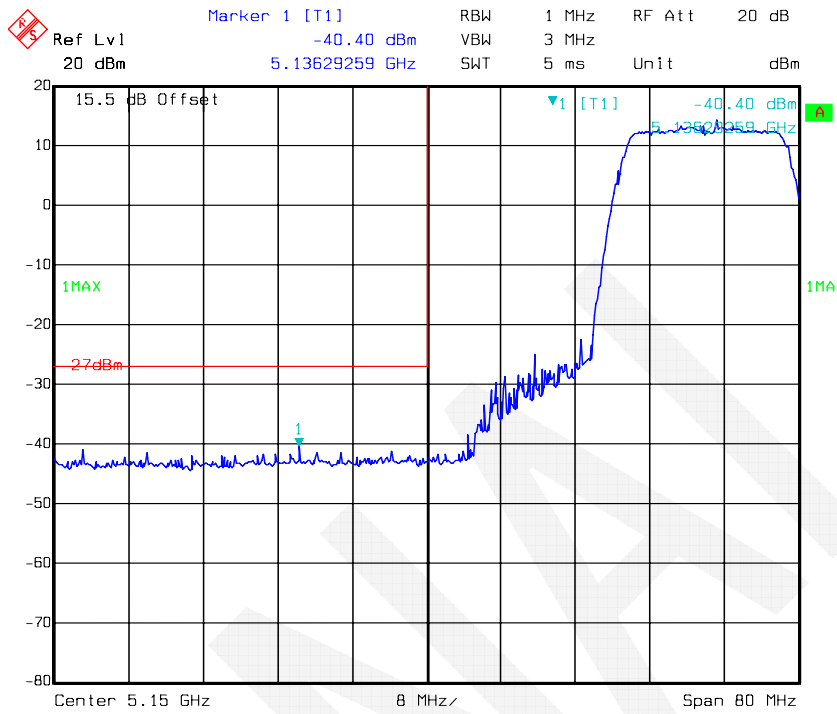
Date: 06.MAR.2018 16:22:11

802.11n-HT20: Band Edge, Right Side, Antenna 0

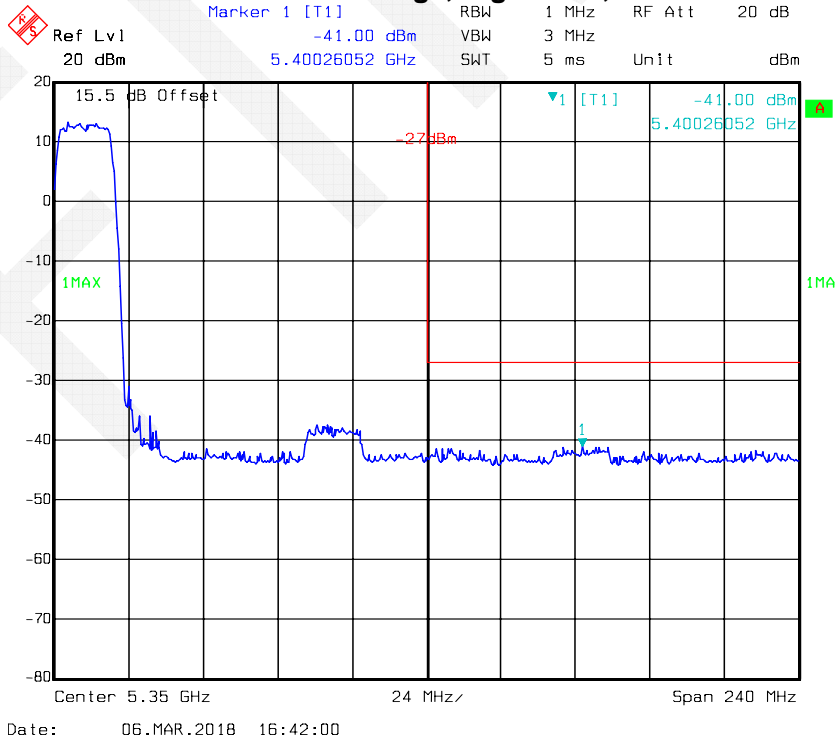


Date: 06.MAR.2018 16:22:49

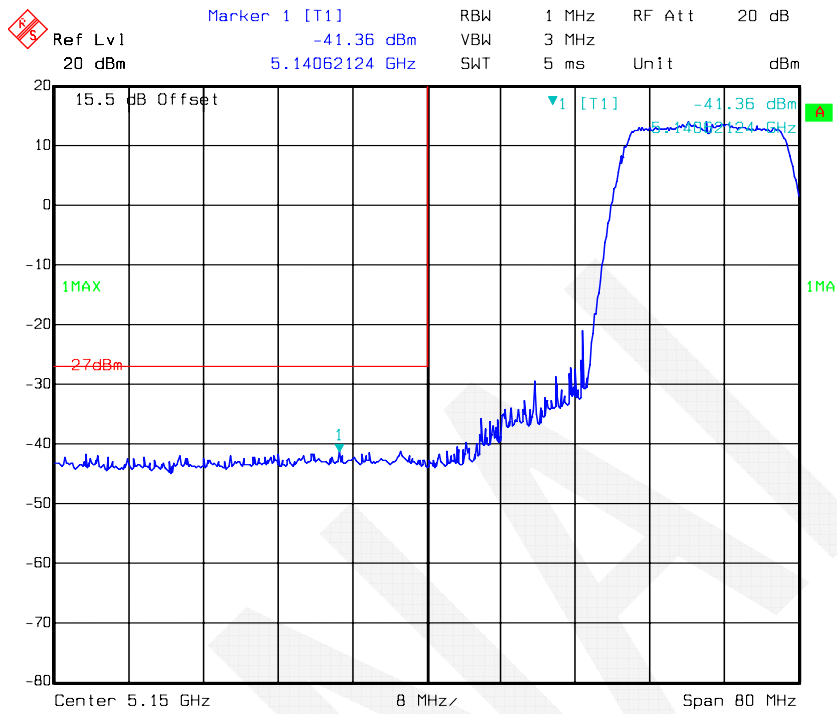
802.11n-HT20: Band Edge, Left Side, Antenna 1



802.11n-HT20: Band Edge, Right Side, Antenna 1

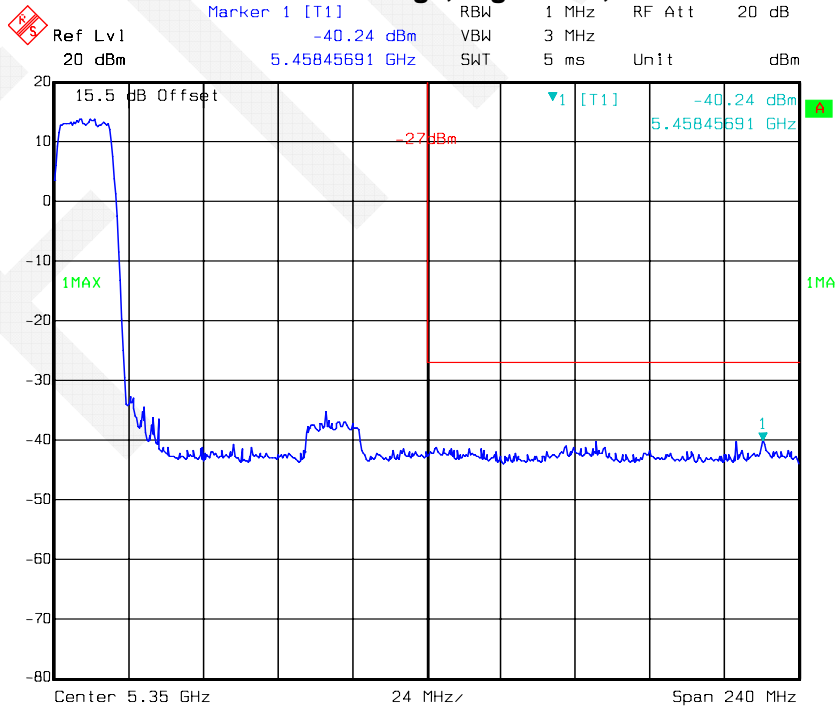


802.11n-HT20: Band Edge, Left Side, Antenna 2



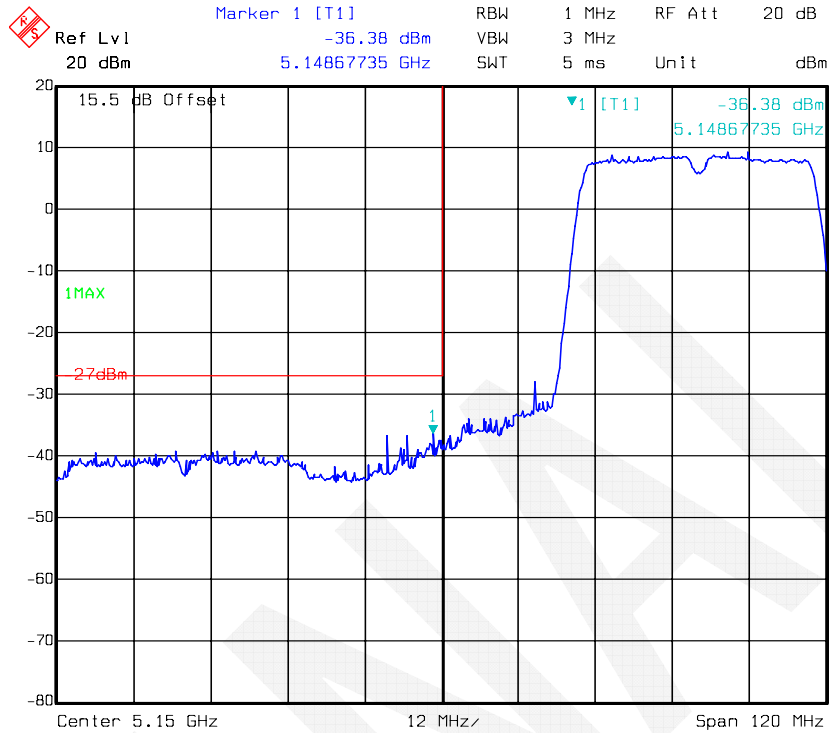
Date: 06.MAR.2018 18:05:37

802.11n-HT20: Band Edge, Right Side, Antenna 2



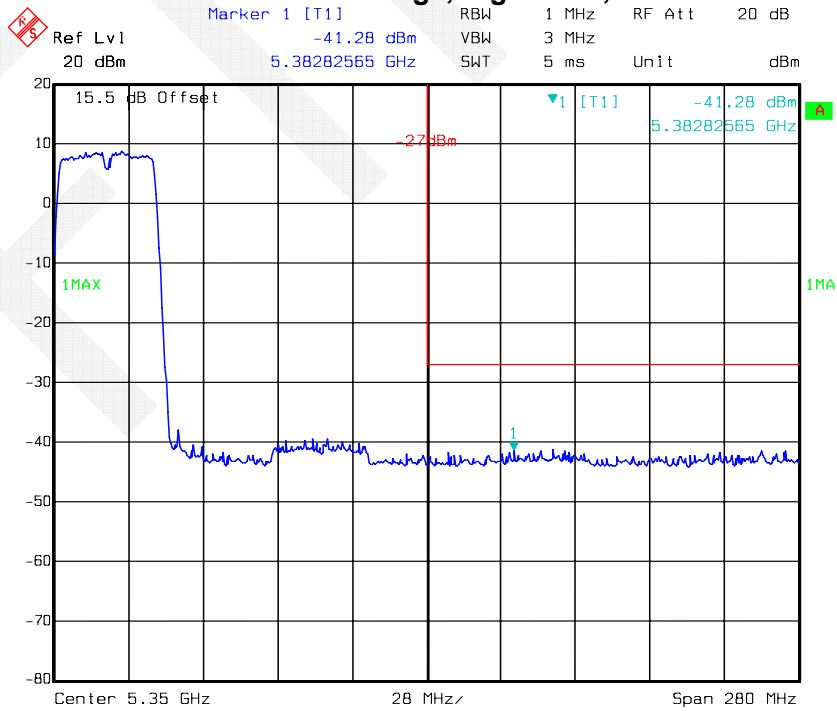
Date: 06.MAR.2018 18:01:06

802.11n-HT40: Band Edge, Left Side, Antenna 0



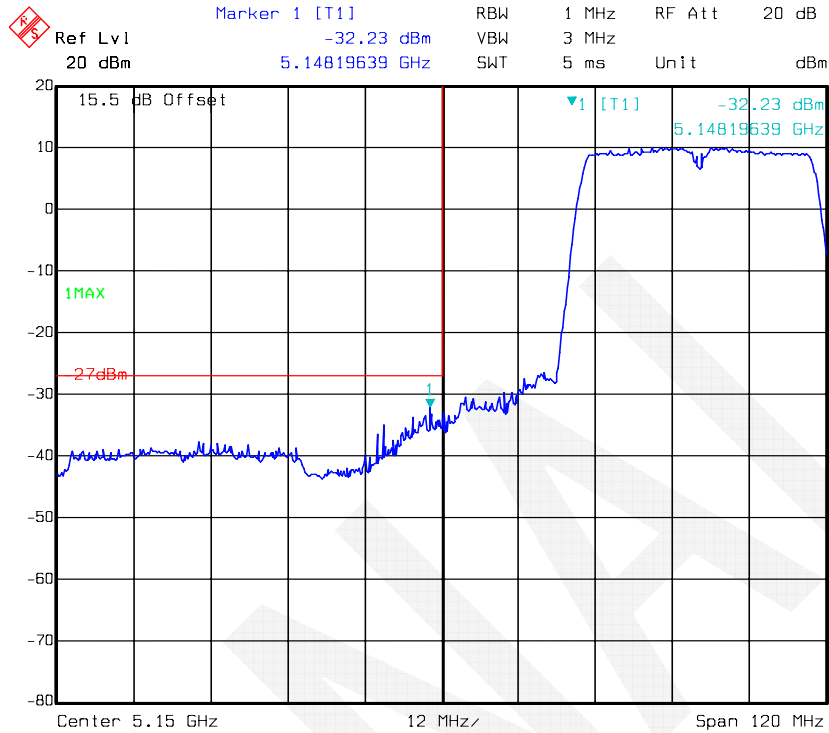
Date: 06.MAR.2018 16:25:02

802.11n-HT40: Band Edge, Right Side, Antenna 0



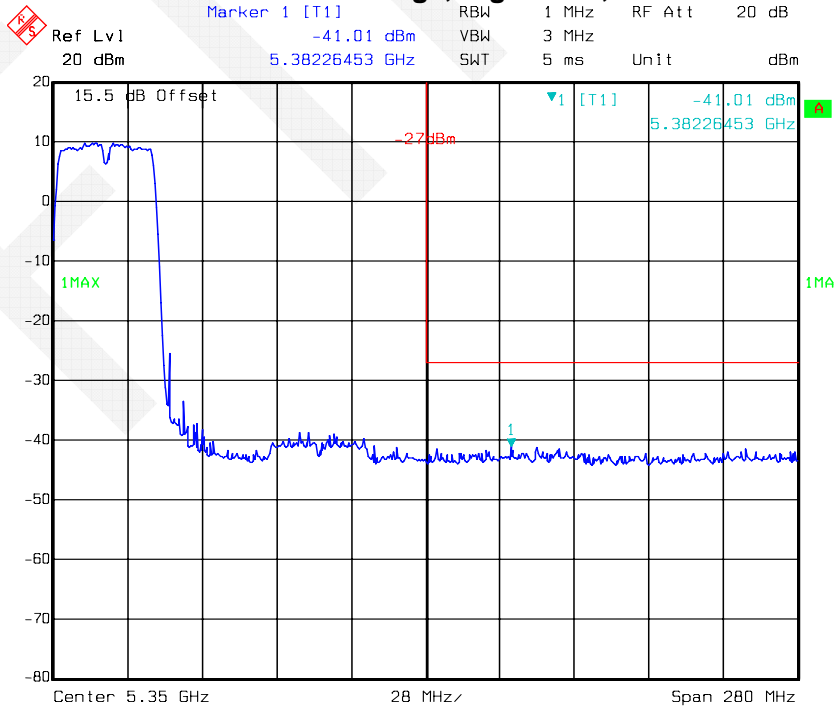
Date: 06.MAR.2018 16:25:37

802.11n-HT40: Band Edge, Left Side, Antenna 1



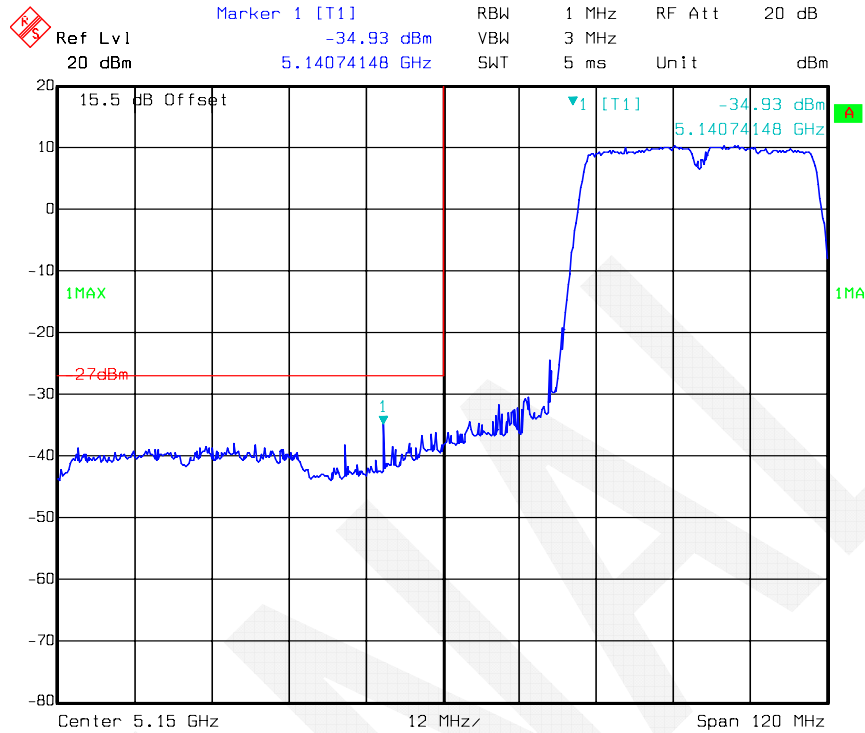
Date: 06.MAR.2018 16:44:51

802.11n-HT40: Band Edge, Right Side, Antenna 1



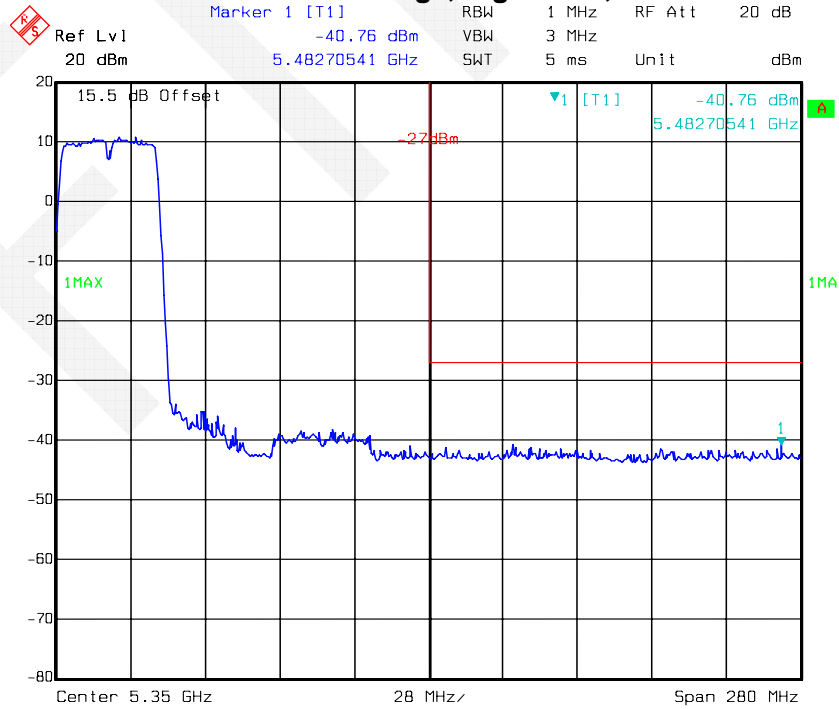
Date: 06.MAR.2018 16:45:55

802.11n-HT40: Band Edge, Left Side, Antenna 2



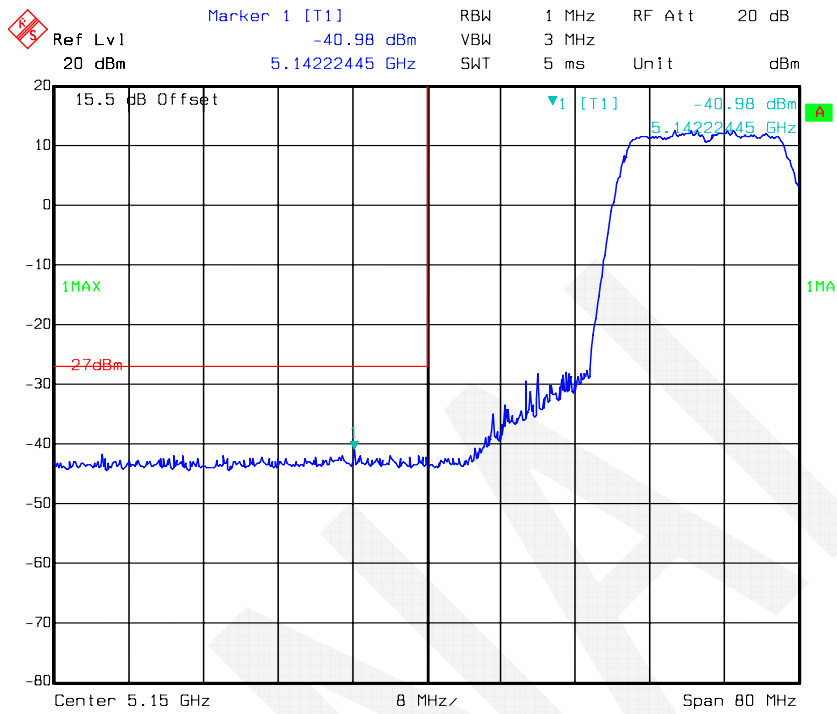
Date: 06.MAR.2018 18:06:44

802.11n-HT40: Band Edge, Right Side, Antenna 2



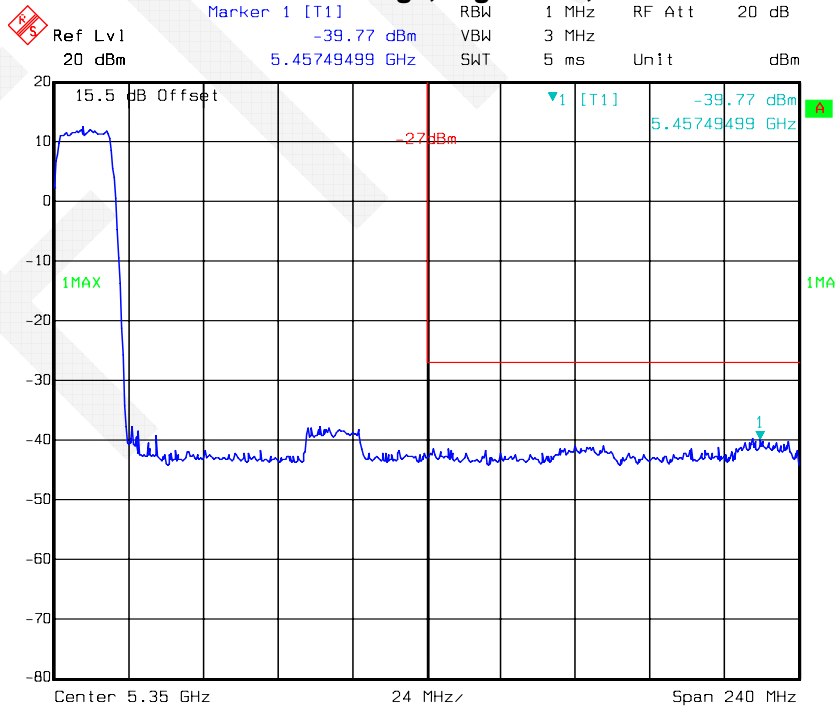
Date: 06.MAR.2018 18:07:25

802.11ac20: Band Edge, Left Side, Antenna 0



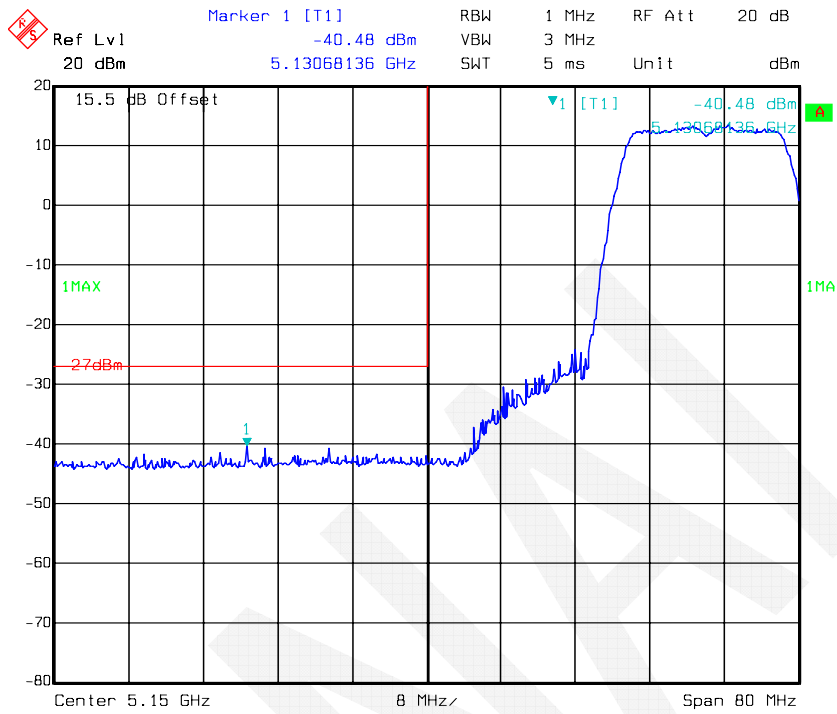
Date: 06.MAR.2018 16:23:35

802.11ac20: Band Edge, Right Side, Antenna 0



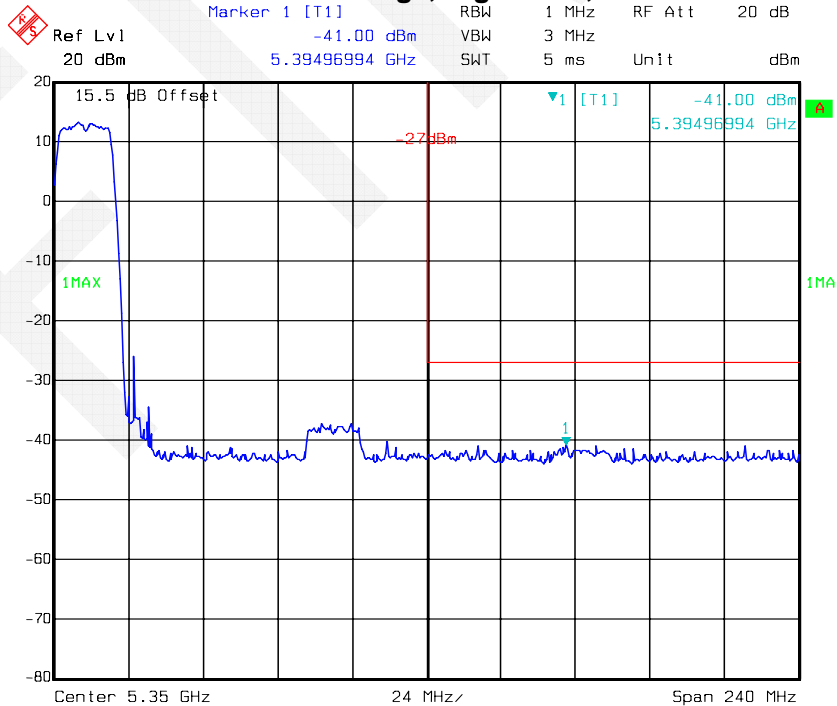
Date: 06.MAR.2018 16:24:14

802.11ac20: Band Edge, Left Side, Antenna 1



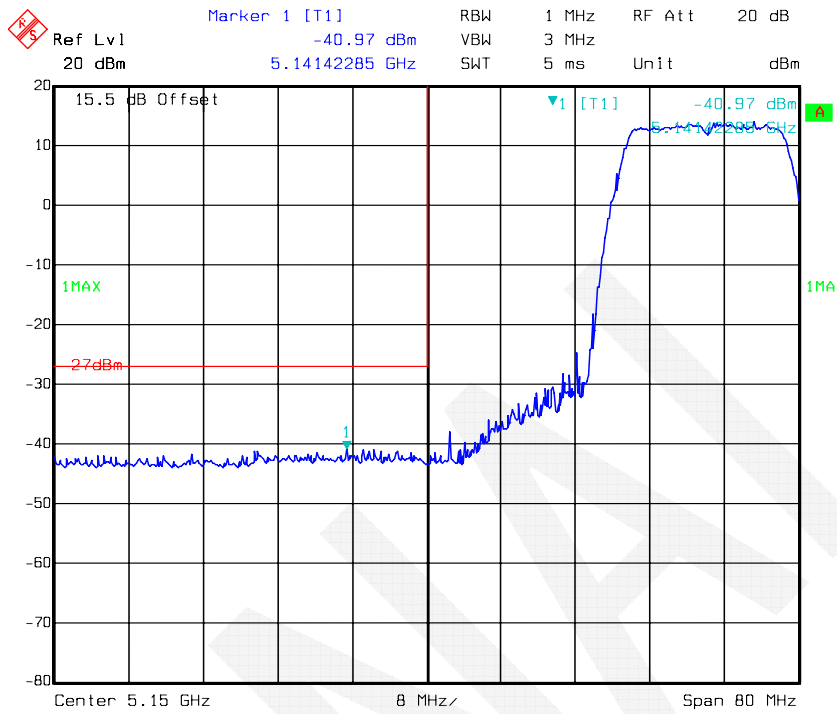
Date: 06.MAR.2018 16:42:53

802.11ac20: Band Edge, Right Side, Antenna 1



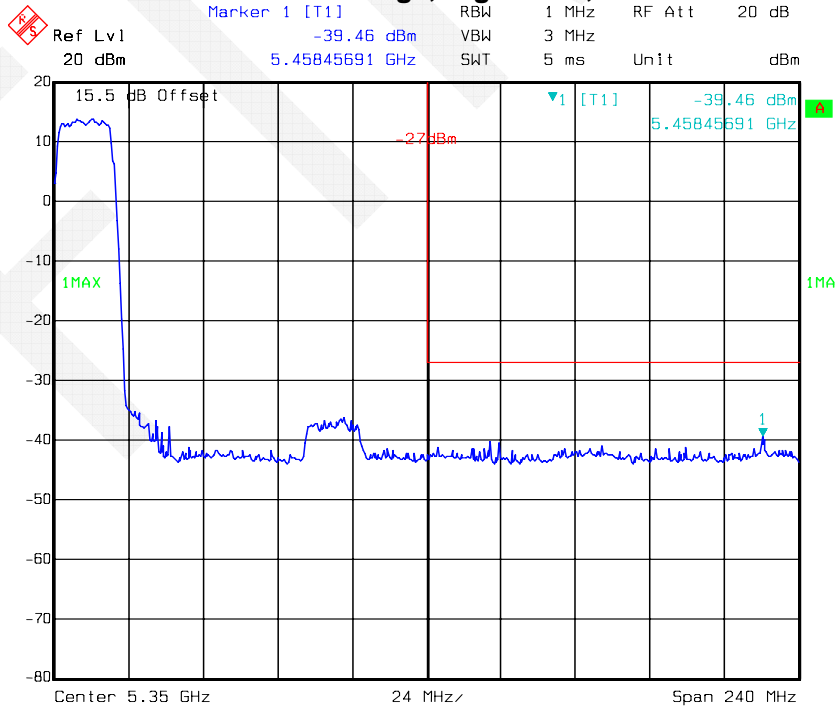
Date: 06.MAR.2018 16:43:30

802.11ac20: Band Edge, Left Side, Antenna 2



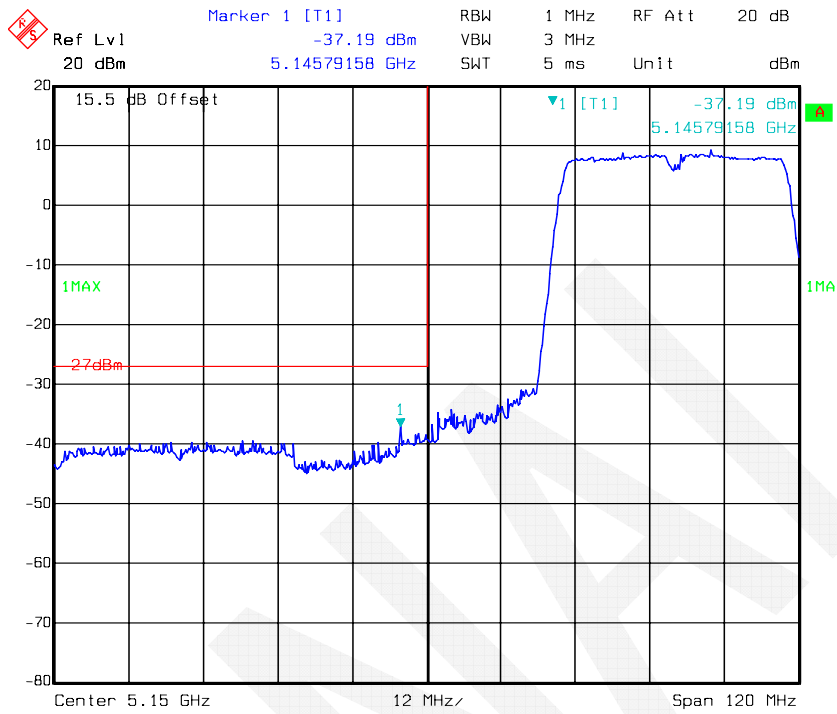
Date: 06.MAR.2018 18:02:05

802.11ac20: Band Edge, Right Side, Antenna 2



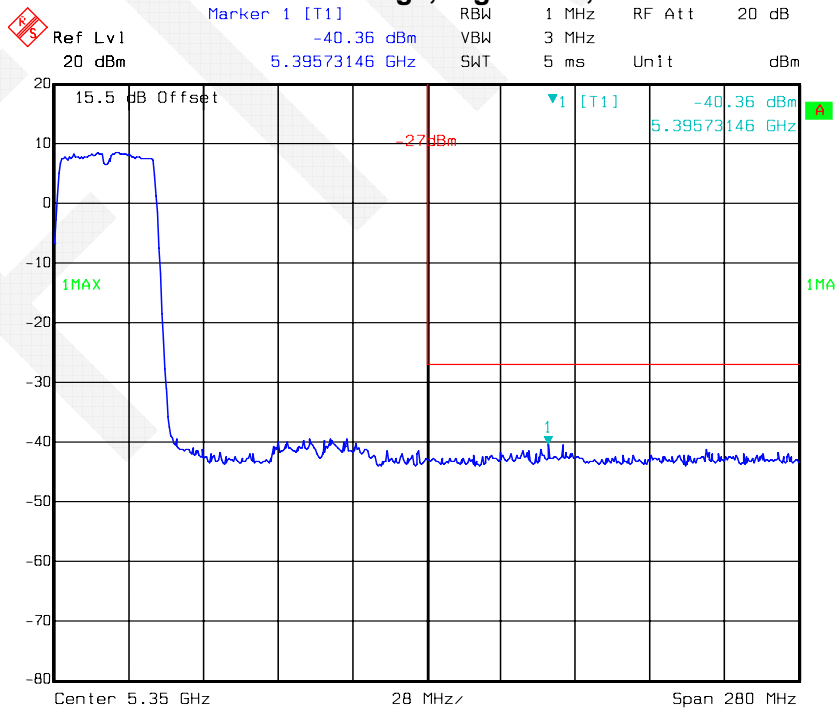
Date: 06.MAR.2018 18:02:45

802.11ac40: Band Edge, Left Side, Antenna 0



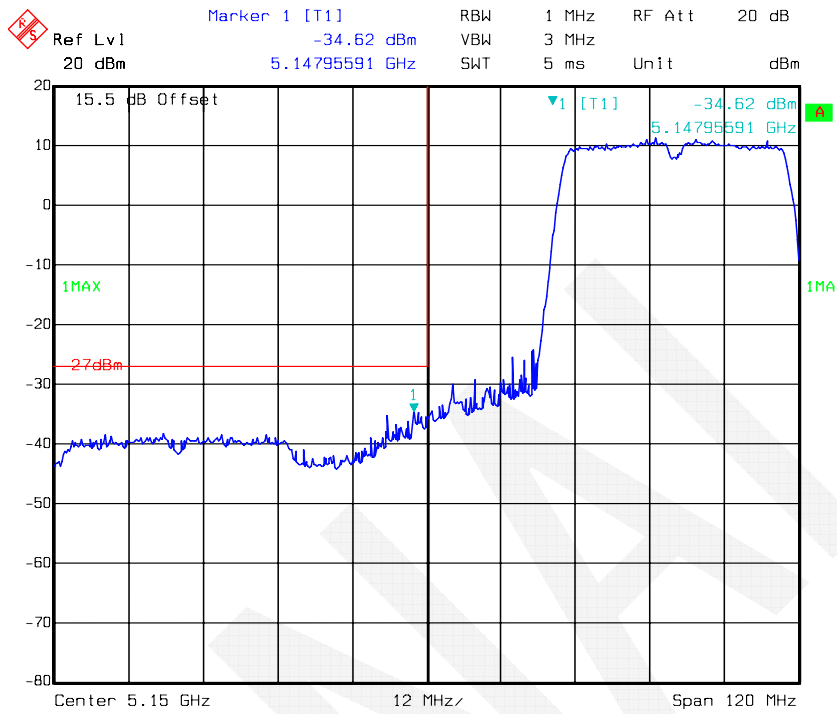
Date: 06.MAR.2018 16:31:50

802.11ac40: Band Edge, Right Side, Antenna 0



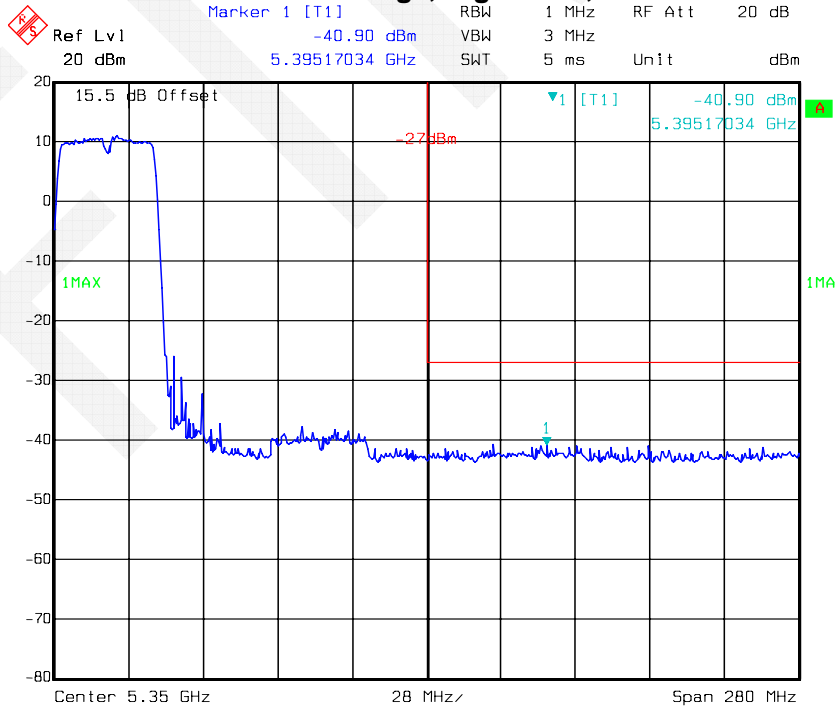
Date: 06.MAR.2018 16:32:28

802.11ac40: Band Edge, Left Side, Antenna 1



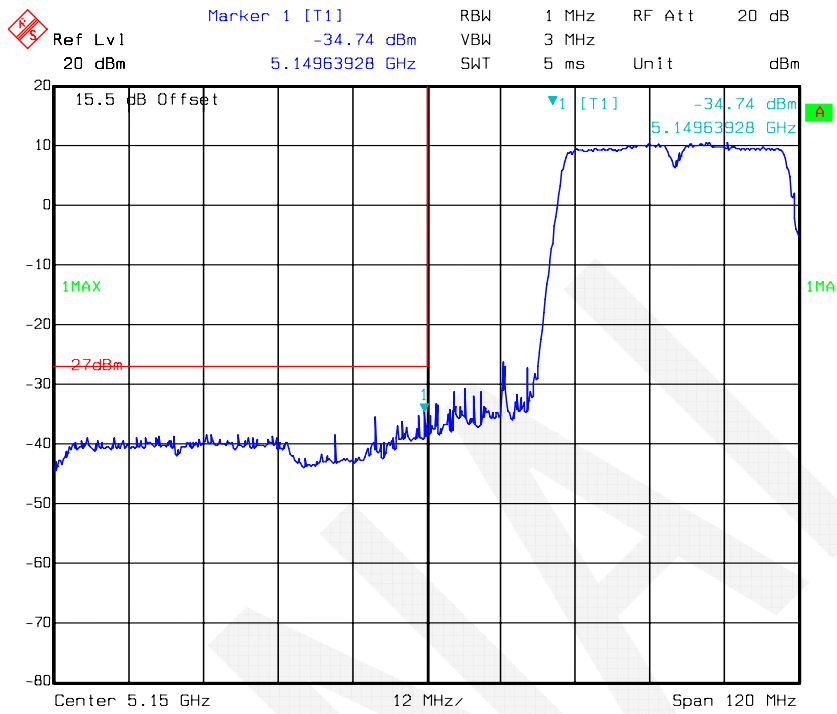
Date: 06.MAR.2018 17:54:07

802.11ac40: Band Edge, Right Side, Antenna 1



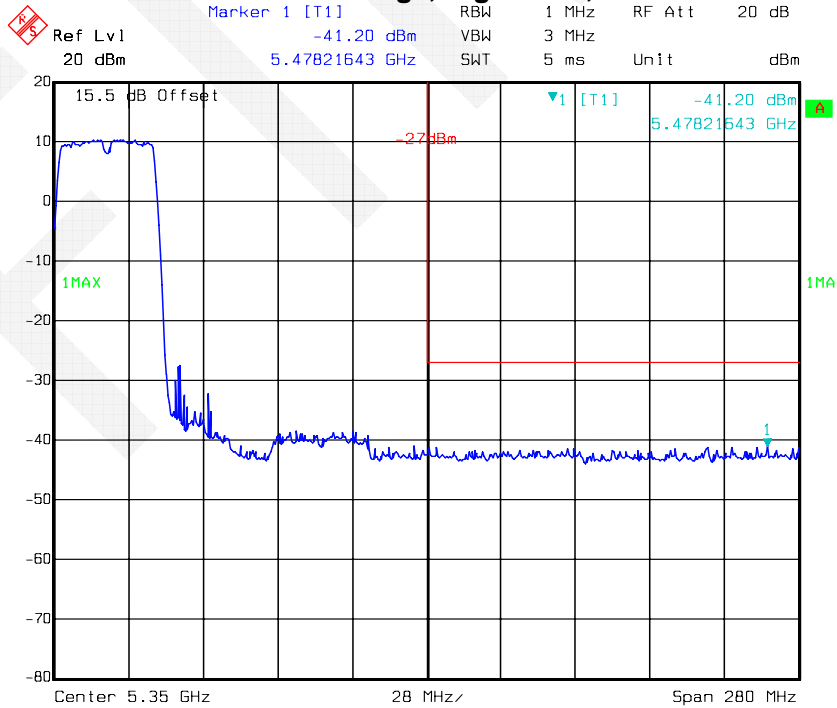
Date: 06.MAR.2018 17:54:48

802.11ac40: Band Edge, Left Side, Antenna 2



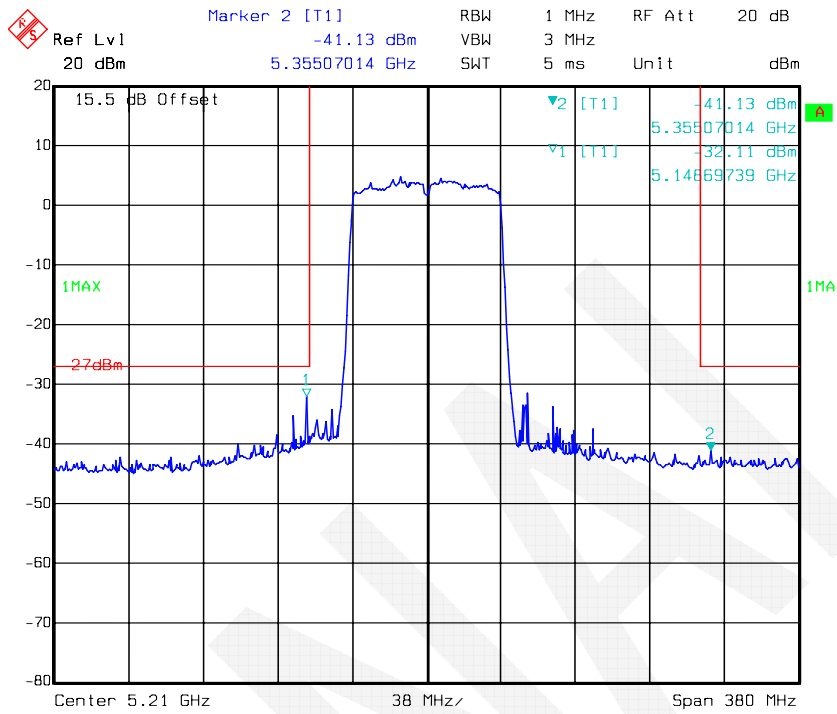
Date: 06.MAR.2018 18:11:09

802.11ac40: Band Edge, Right Side, Antenna 2



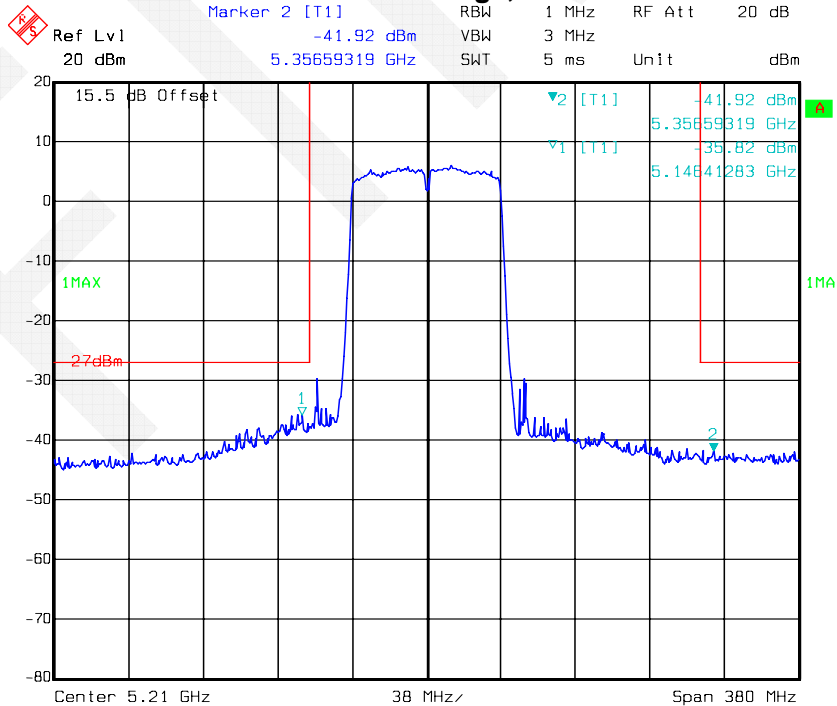
Date: 06.MAR.2018 18:11:45

802.11ac80: Band Edge, Antenna 0



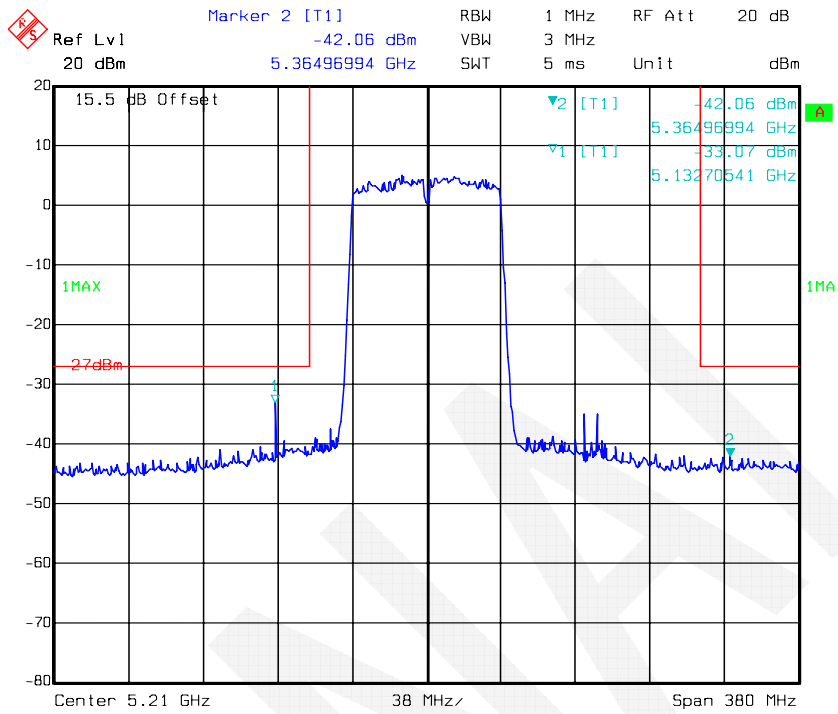
Date: 06.MAR.2018 16:33:13

802.11ac80: Band Edge, Antenna 1



Date: 06.MAR.2018 17:56:08

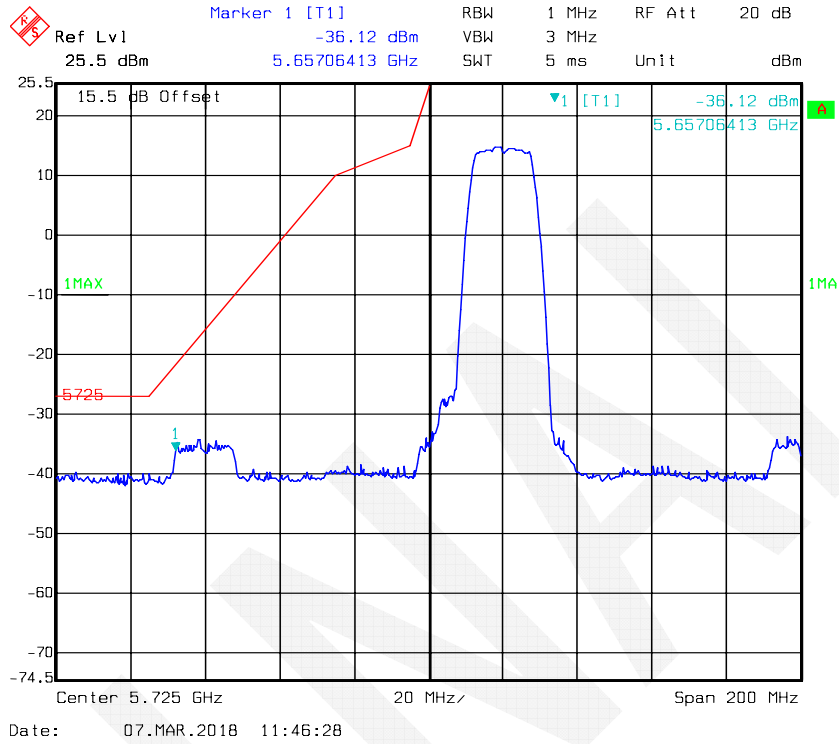
802.11ac80: Band Edge, Antenna 2



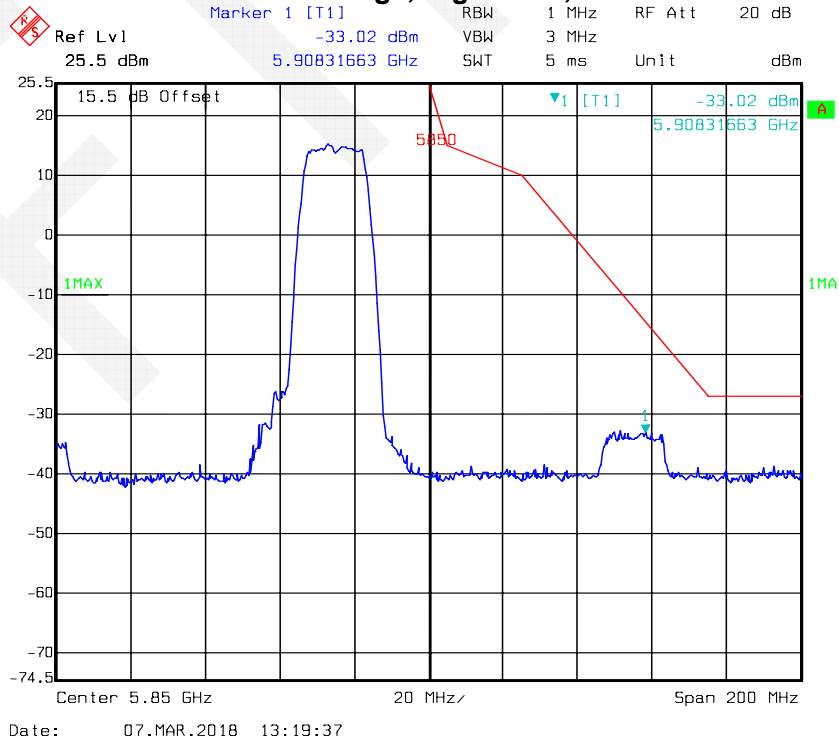
Date: 06.MAR.2018 18:15:11

For 5725-5850 MHz: (Note: The antenna gain was set in the offset, all emissions under limit more than 5dBc, so MIMO mode also comply the requirement.)

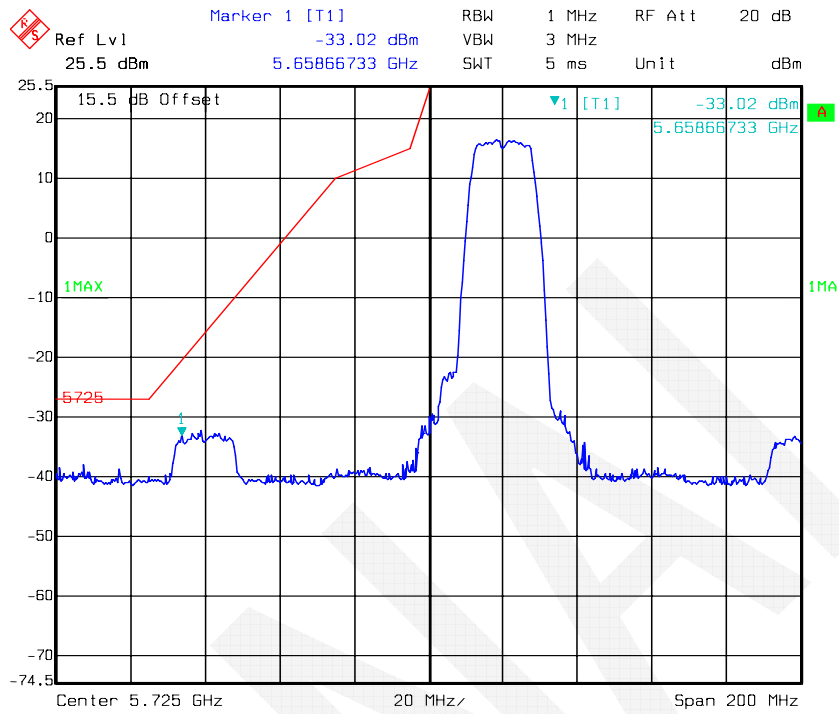
802.11a: Band Edge, Left Side, Antenna 0



802.11a: Band Edge, Right Side, Antenna 0

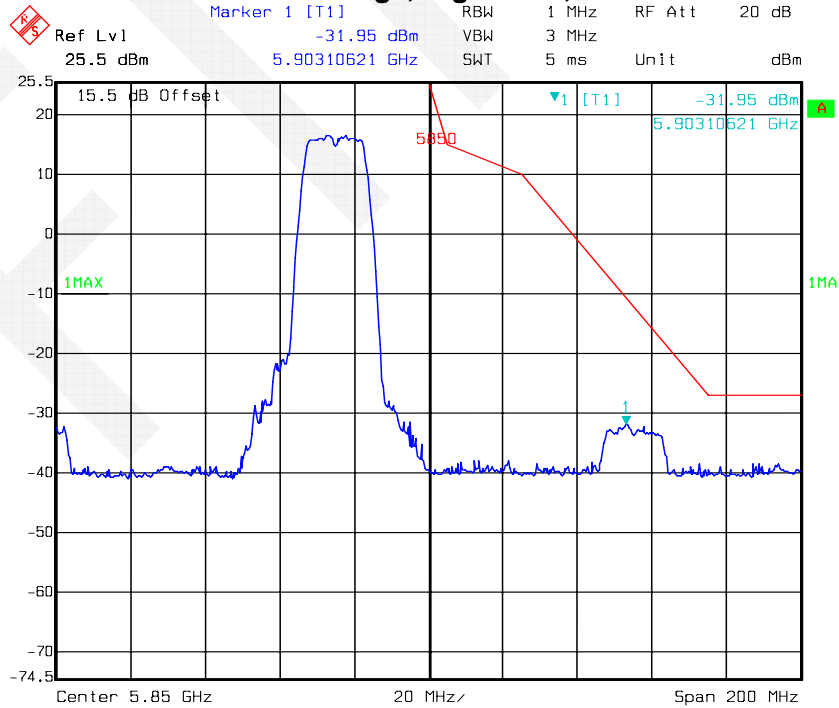


802.11a: Band Edge, Left Side, Antenna 1



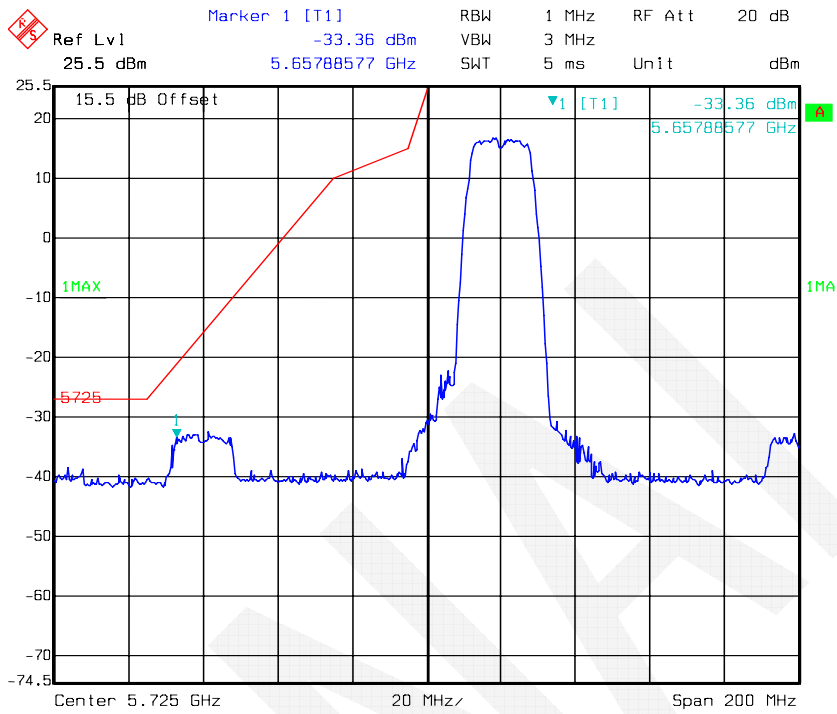
Date: 07.MAR.2018 13:39:27

802.11a: Band Edge, Right Side, Antenna 1



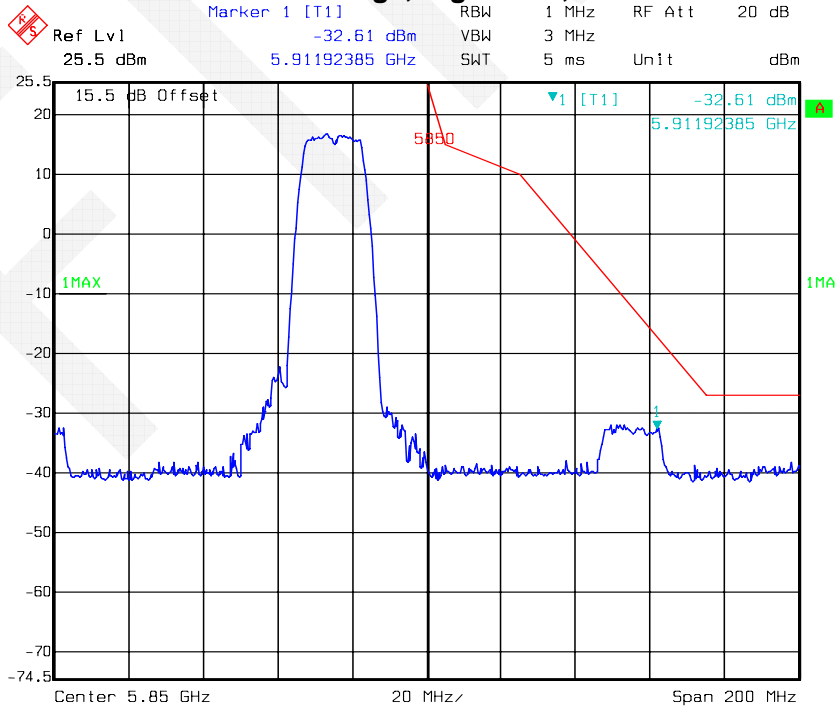
Date: 07.MAR.2018 13:48:15

802.11a: Band Edge, Left Side, Antenna 2



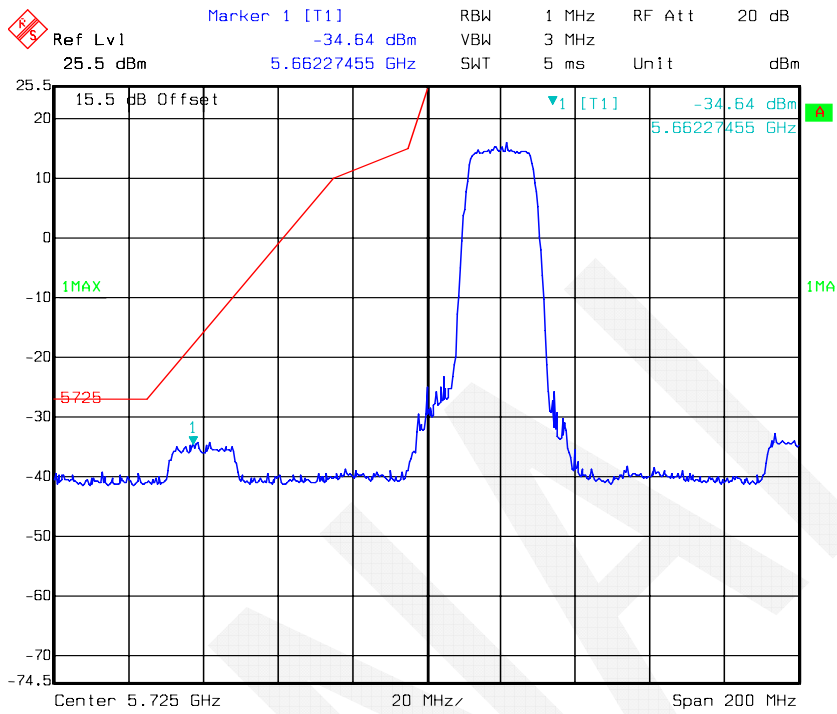
Date: 07.MAR.2018 14:07:02

802.11a: Band Edge, Right Side, Antenna 2



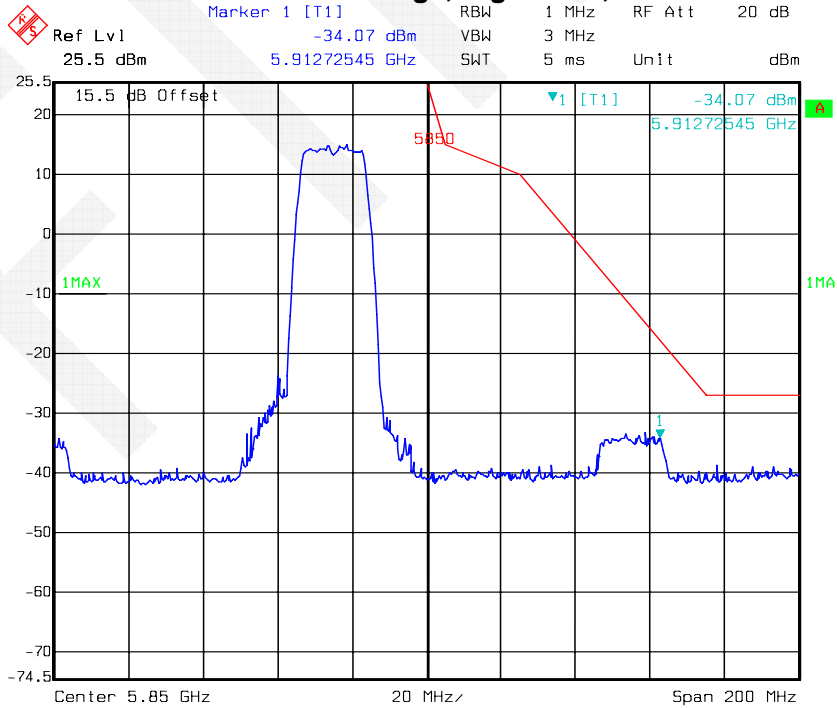
Date: 07.MAR.2018 14:13:10

802.11n-HT20: Band Edge, Left Side, Antenna 0



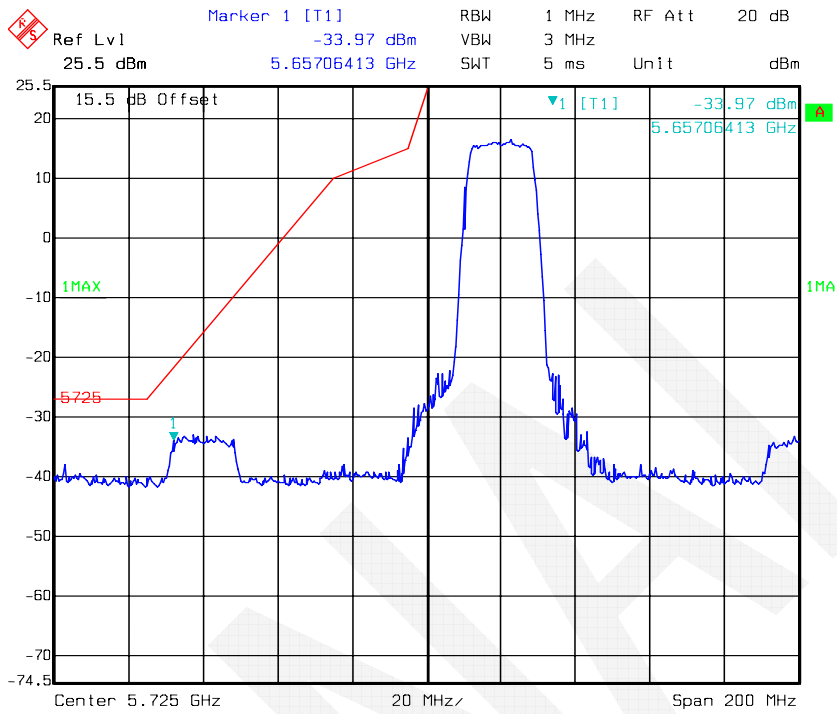
Date: 07.MAR.2018 13:12:10

802.11n-HT20: Band Edge, Right Side, Antenna 0



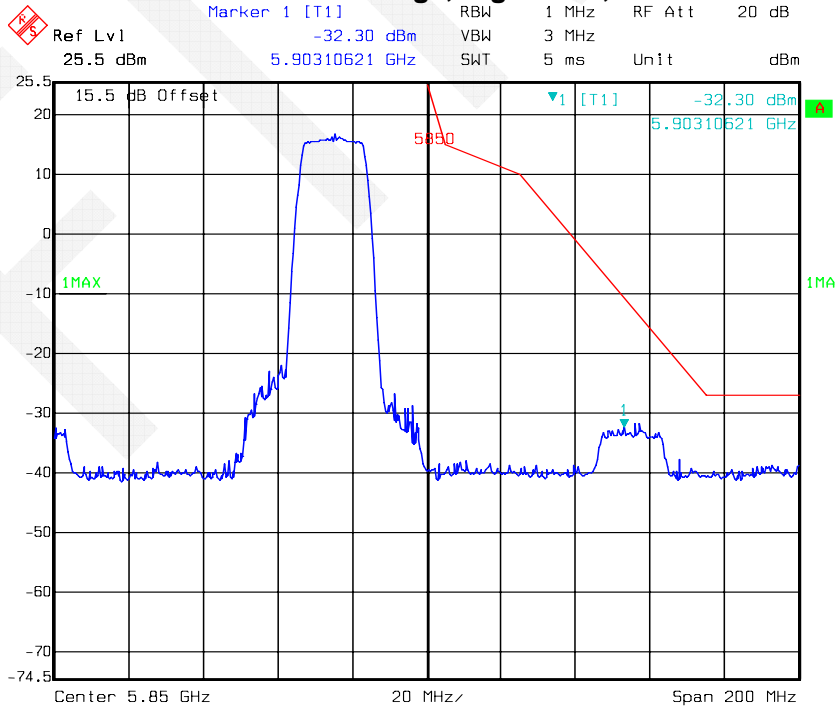
Date: 07.MAR.2018 13:20:34

802.11n-HT20: Band Edge, Left Side, Antenna 1



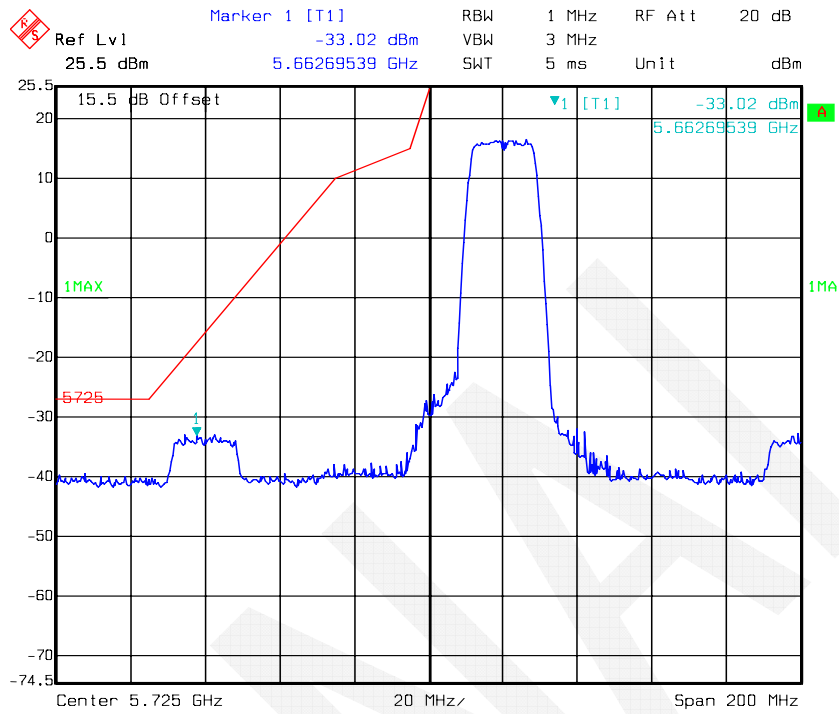
Date: 07.MAR.2018 13:40:33

802.11n-HT20: Band Edge, Right Side, Antenna 1



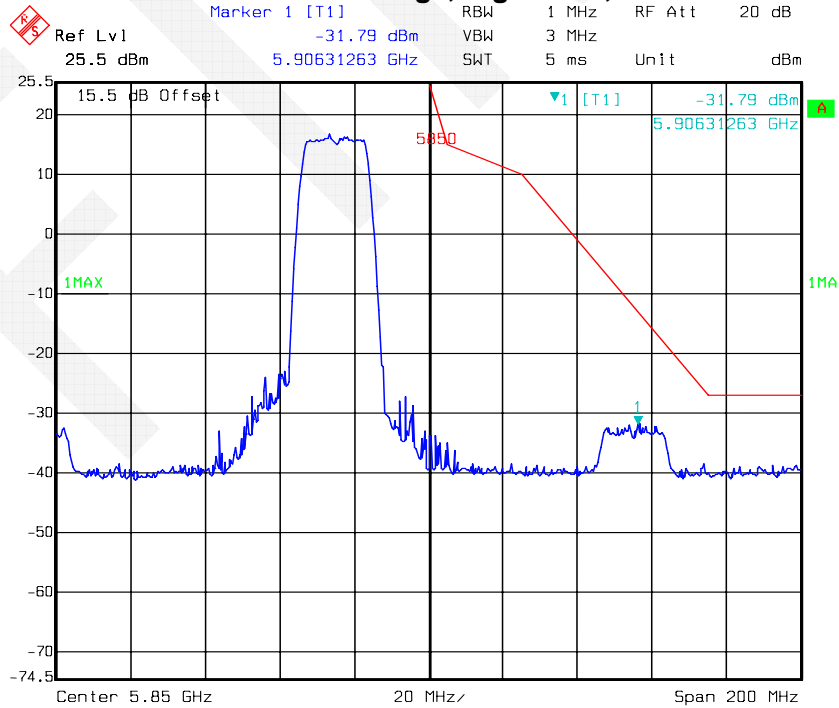
Date: 07.MAR.2018 13:49:02

802.11n-HT20: Band Edge, Left Side, Antenna 2



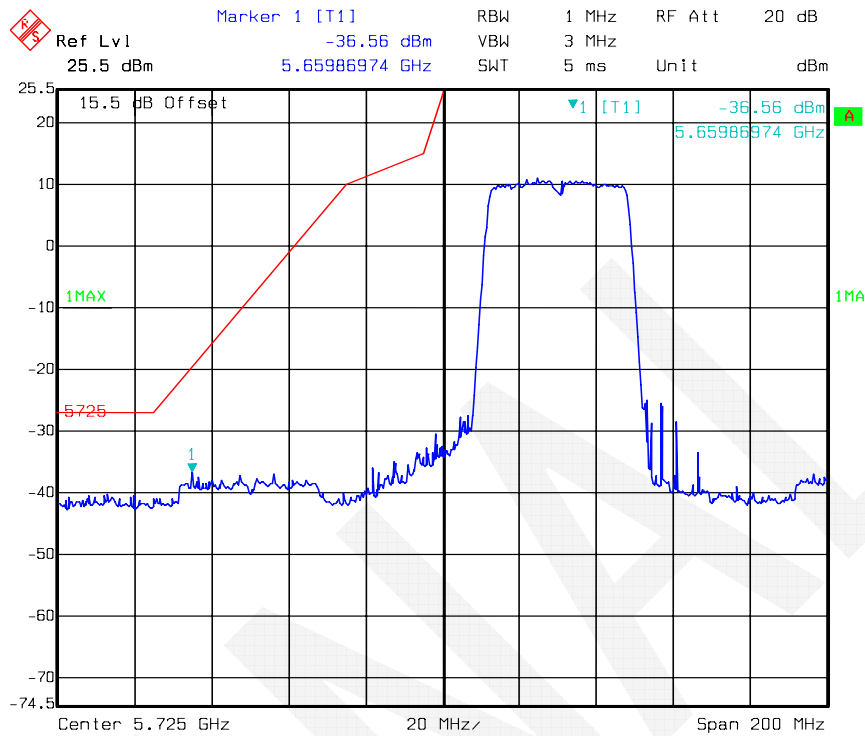
Date: 07.MAR.2018 14:07:50

802.11n-HT20: Band Edge, Right Side, Antenna 2



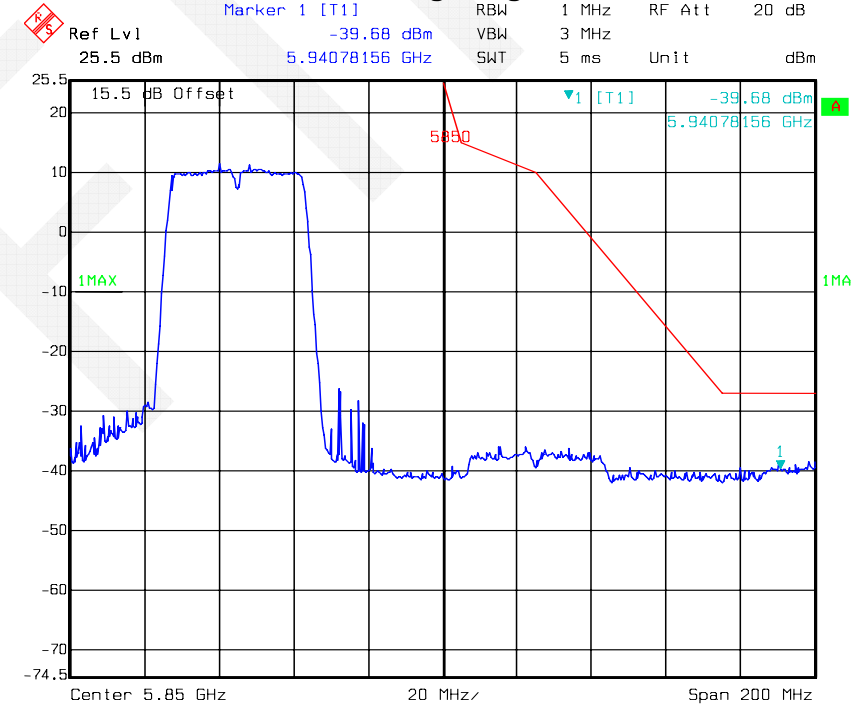
Date: 07.MAR.2018 14:12:22

802.11n-HT40: Band Edge, Left Side, Antenna 0



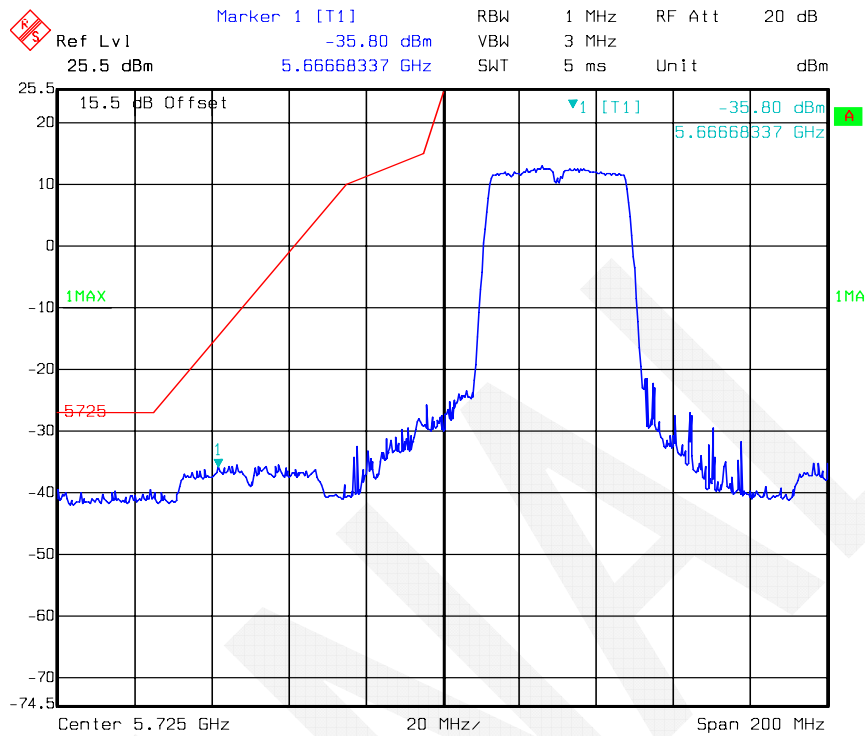
Date: 07.MAR.2018 13:14:18

802.11n-HT40: Band Edge, Right Side, Antenna 0



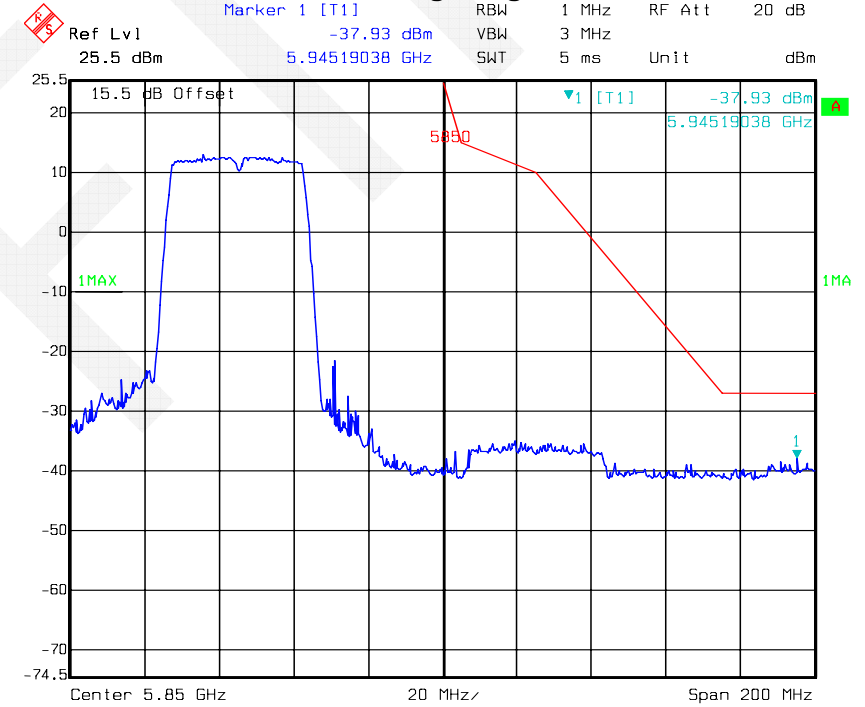
Date: 07.MAR.2018 13:22:35

802.11n-HT40: Band Edge, Left Side, Antenna 1



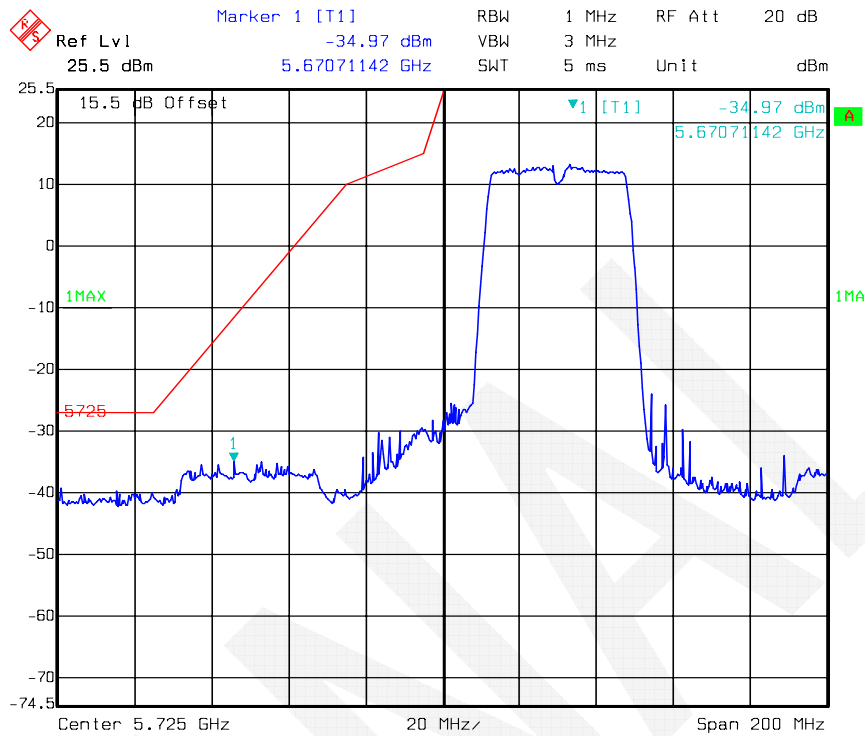
Date: 07.MAR.2018 13:42:19

802.11n-HT40: Band Edge, Right Side, Antenna 1



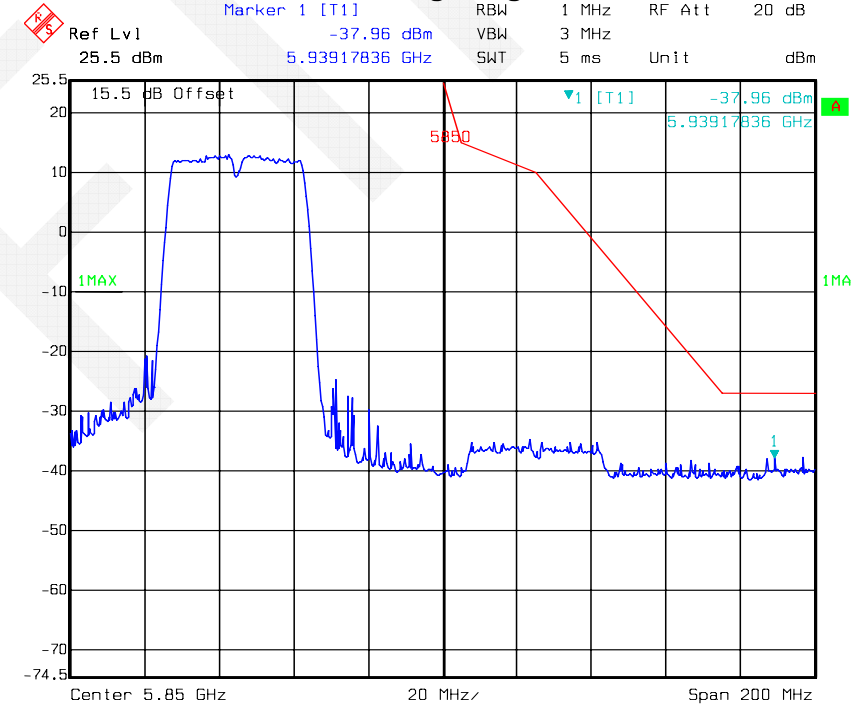
Date: 07.MAR.2018 13:50:27

802.11n-HT40: Band Edge, Left Side, Antenna 2



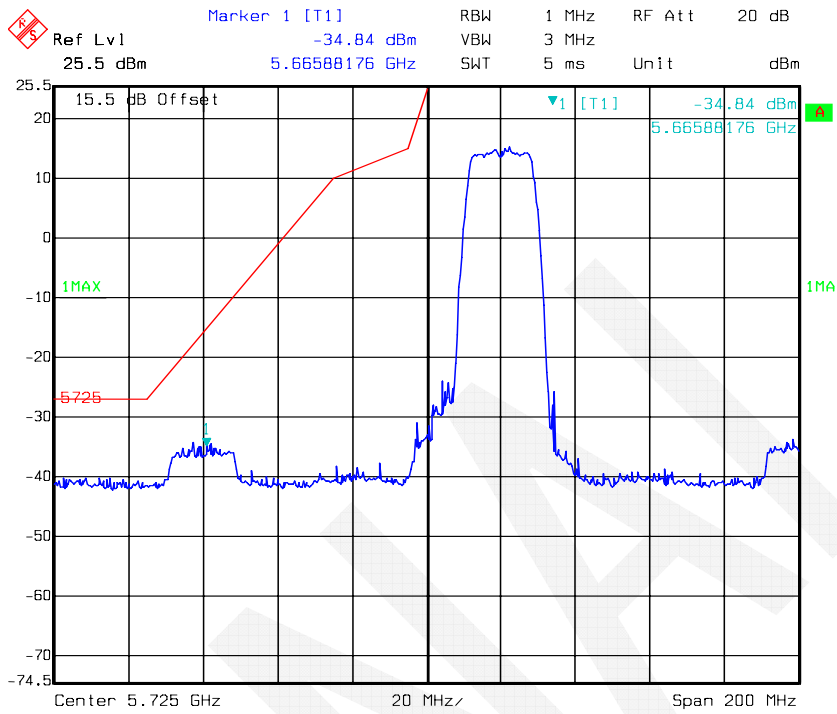
Date: 07.MAR.2018 14:09:04

802.11n-HT40: Band Edge, Right Side, Antenna 2



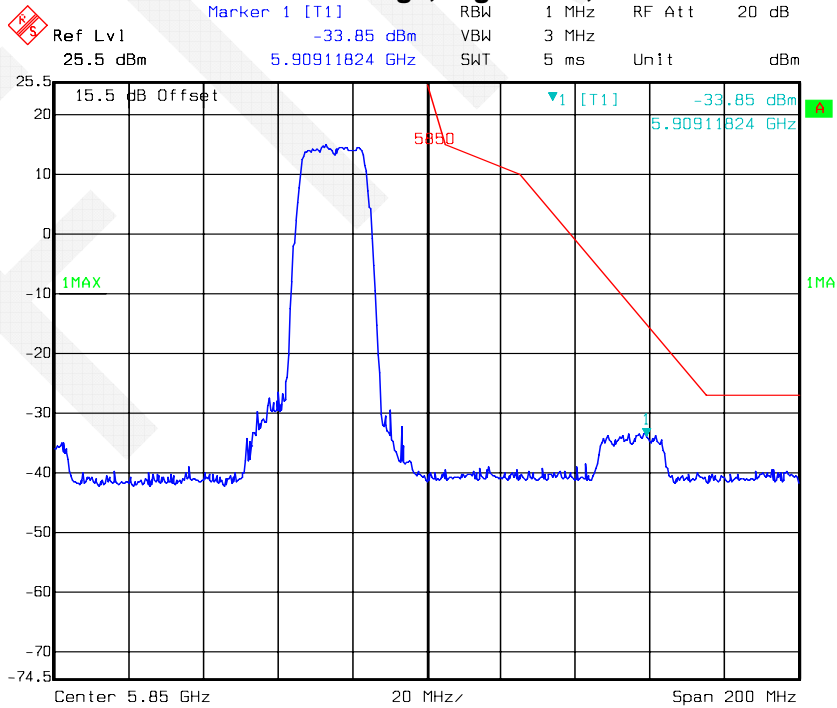
Date: 07.MAR.2018 14:15:04

802.11ac20: Band Edge, Left Side, Antenna 0



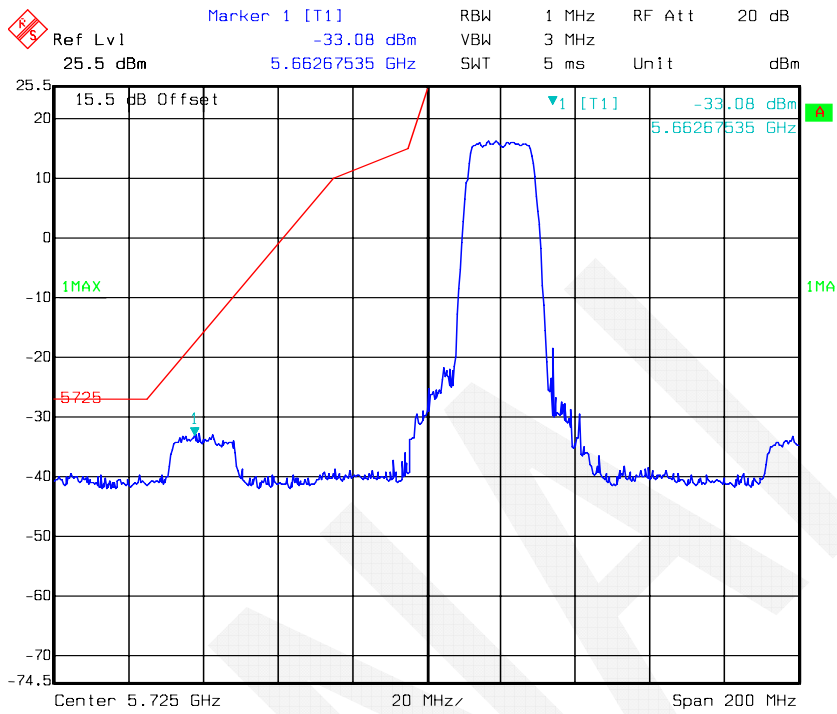
Date: 07.MAR.2018 13:13:14

802.11ac20: Band Edge, Right Side, Antenna 0



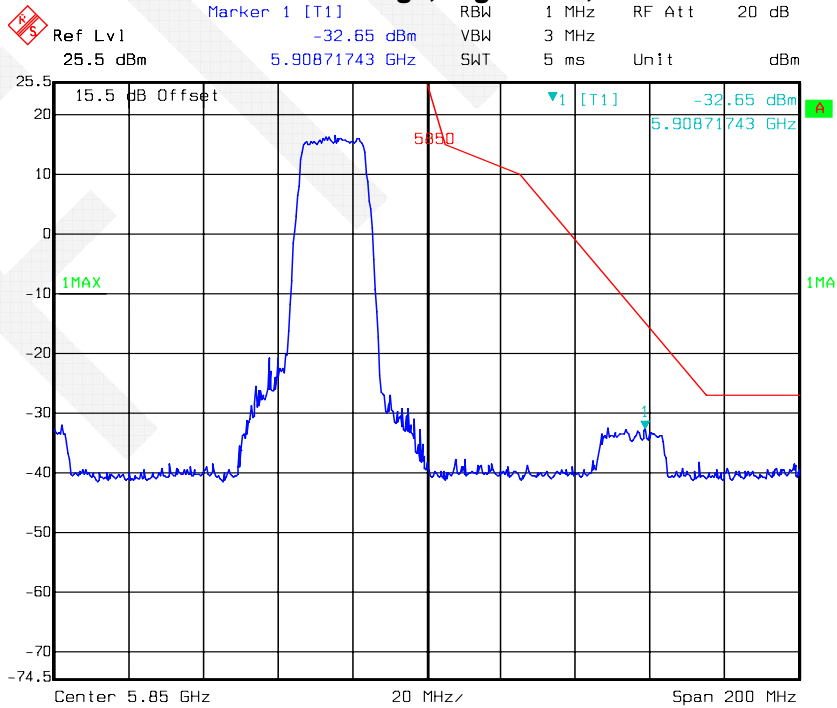
Date: 07.MAR.2018 13:21:41

802.11ac20: Band Edge, Left Side, Antenna 1



Date: 07.MAR.2018 13:41:37

802.11ac20: Band Edge, Right Side, Antenna 1



Date: 07.MAR.2018 13:49:35