FCC PART 15.247

TEST REPORT

For

Chengdu Vantron Technology, Ltd.

No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, P.R. China 610045

Tested Model: VT-HMI-156-TEL
FCC ID: 2AAGE156TEL

Report Type:	**Product Name:**
Original Report	15.6-inch Computer

Report Number:	RSC191209001-0C
Date of Report Issue:	2019-12-24
Reviewed By:	Sula Huang
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: +86-28-65525123 Fax: +86-28-65525125 www.baclcorp.com

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Chengdu Vantron Technology, Ltd.
Product	15.6-inch Computer
Tested Model	VT-HMI-156-TEL
FCC ID	2AAGE156TEL
Voltage Range	DC 12V from adapter, DC 48V from POE
Measure approximately	395 mm (L) x 250 mm (W) x 35 mm (H)
Frequency	2.4G WiFi: 2412-2462MHz (802.11b/g/n20) Bluetooth LE: 2402-2480MHz
Modulation Type:	802.11b: DSSS 802.11g/n20: OFDM Bluetooth LE: GFSK
Sample serial number	191209001/01 (assigned by the BACL, Chengdu)
Sample/EUT Status	The test sample was in good condition and received:2019-12-09

Note: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Objective

This report is prepared on behalf of **Chengdu Vantron Technology, Ltd.** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the compliance of the EUT with FCC Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15C DSS submissions with FCC ID: 2AAGE156TEL
FCC Part 15E NII submissions with FCC ID: 2AAGE156TEL

Measurement Uncertainty

Item			Uncertainty
AC power line conducted emission			2.24 dB
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.47 dB
		V	4.73 dB
	200MHz-1GHz	H	4.87 dB
		V	5.93 dB
	1GHz-6GHz		4.51 dB
	6GHz-18GHz		4.49 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℃

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the corresponding inclusion factor K when the inclusion probability is about 95%.

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. KDB558074 D01 DTS Meas Guidance v05r02.

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.

Bay Area Compliance Laboratories Corp. (Chengdu) lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4324.01) and the FCC designation No. CN1186 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured in testing mode, which was provided by manufacturer.

For Wi-Fi mode, 802.11b, 802.11g, and 802.11n-HT20 mode, 11 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	-	-

EUT were tested with Channel 1, 6 and 11.

For Bluetooth LE mode, 40 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
..	…	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

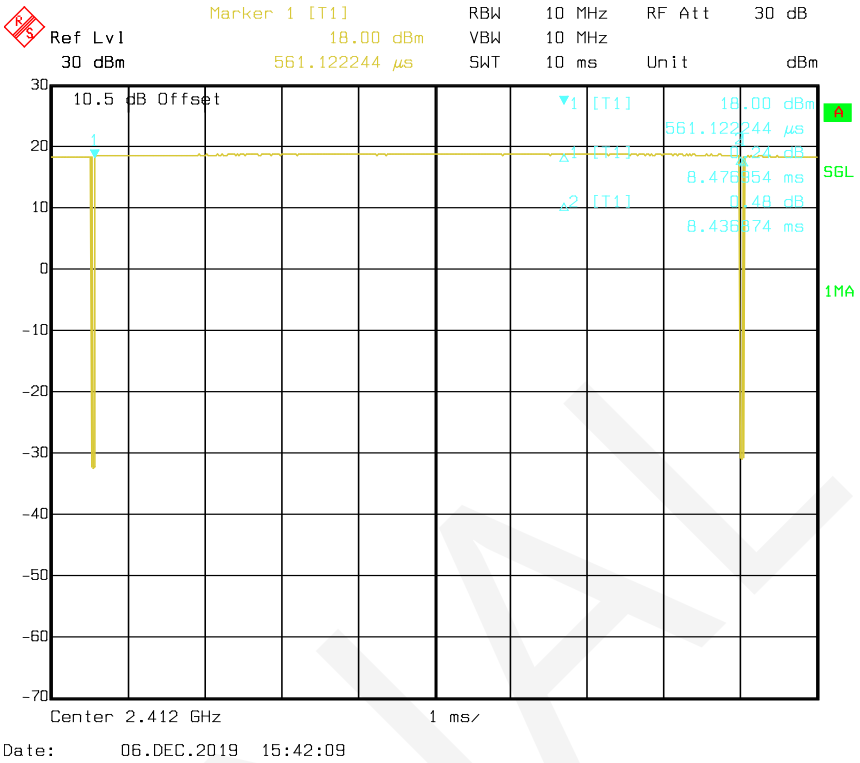
The worst condition (maximum power with maximum duty cycle) was setting by the software as following table:

Test Mode	Test Software Version	RF test tool		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level	Default	Default	Default
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level	Default	Default	Default
802.11n-HT20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level	Default	Default	Default
BLE	Test Frequency	2402MHz	2440MHz	2480MHz
	Data Rate	Default	Default	Default
	Power Level Setting	Default	Default	Default

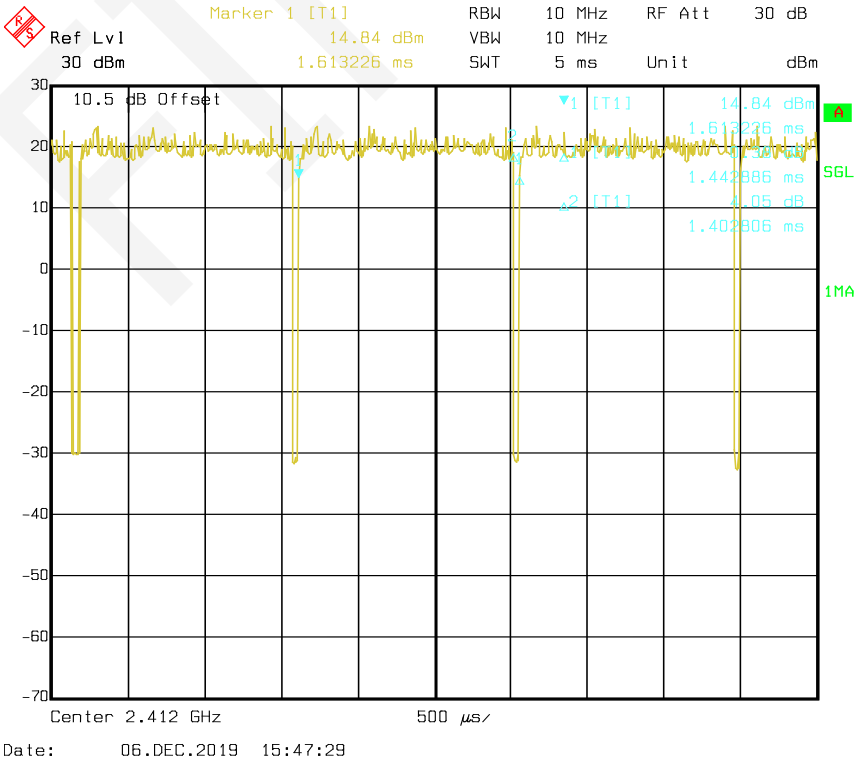
Duty Cycle information is below:

Mode	T_{on} (ms)	T_p (ms)	Duty Cycle (%)	Duty Cycle Factor(dB)
802.11b	0.84	0.85	99.53	0.02
802.11g	1.40	1.44	97.23	0.12
802.11n-HT20	1.31	1.35	97.04	0.13
BLE	0.39	0.63	62.08	2.07

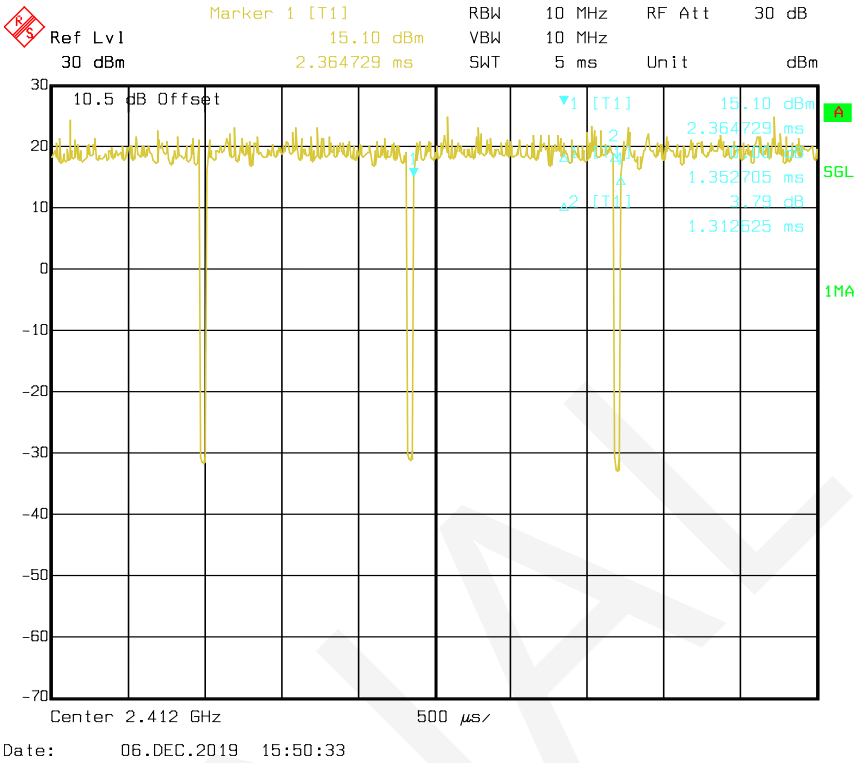
802.11b



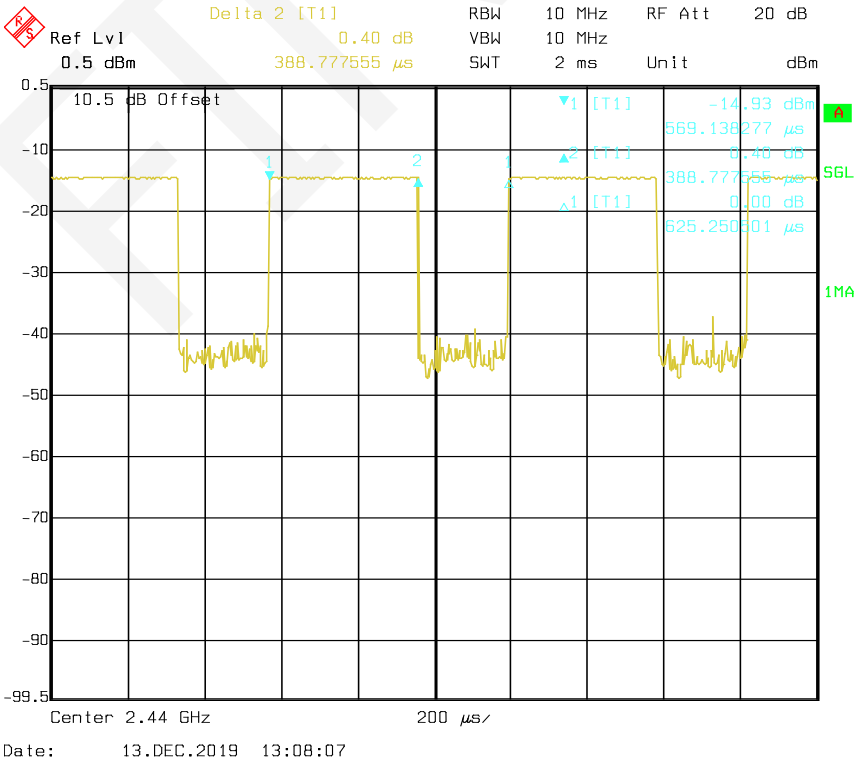
802.11g



802.11n-HT20



BLE mode



Support Equipment List and Details

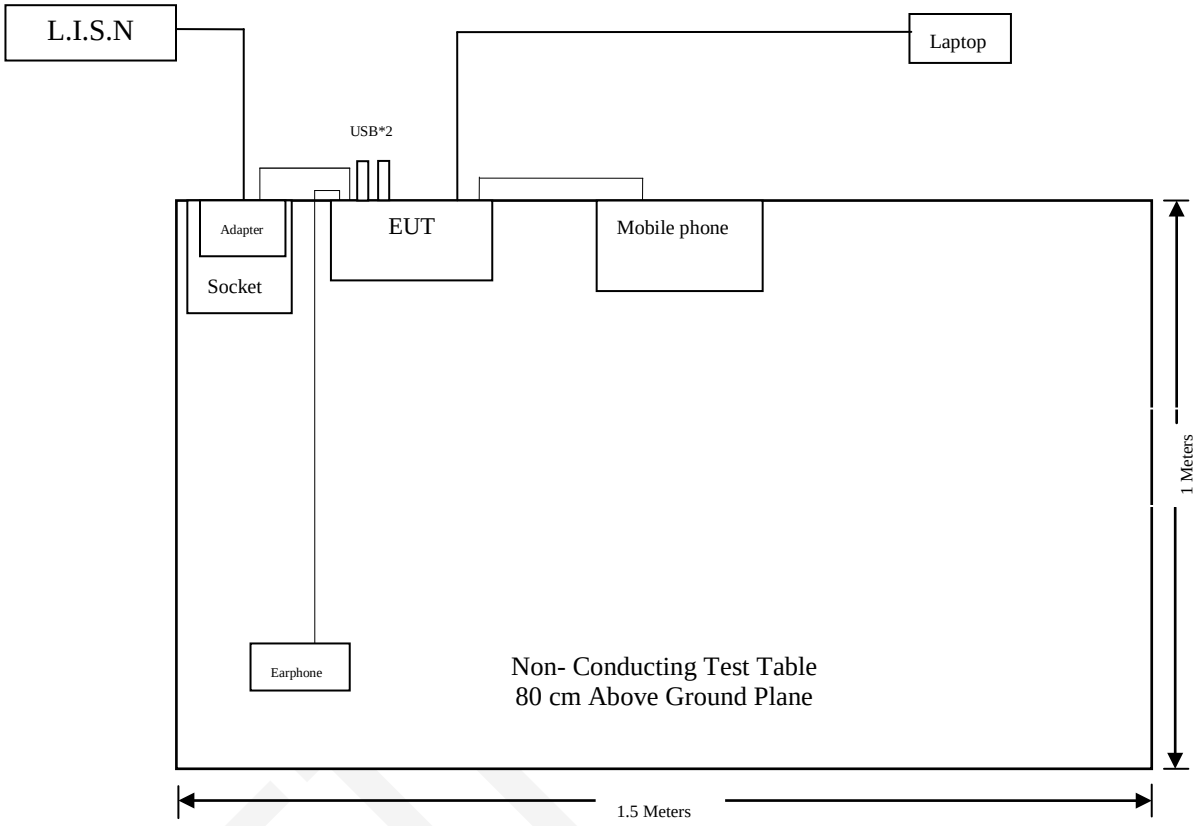
Manufacturer	Description	Model	Serial Number
Kingston*2	USB Disk	DTSE9G2	Unknown
Huawei	Mobile phone	V10	Unknown
Unknown	Earphone	N/A	Unknown
DELL	Laptop	E75	PCOR364L
XinSPower	Adapter	A241-12020001	Unknown
Ubiquiti	POE	GP-H480-050G	1538-0029503

External I/O Cable

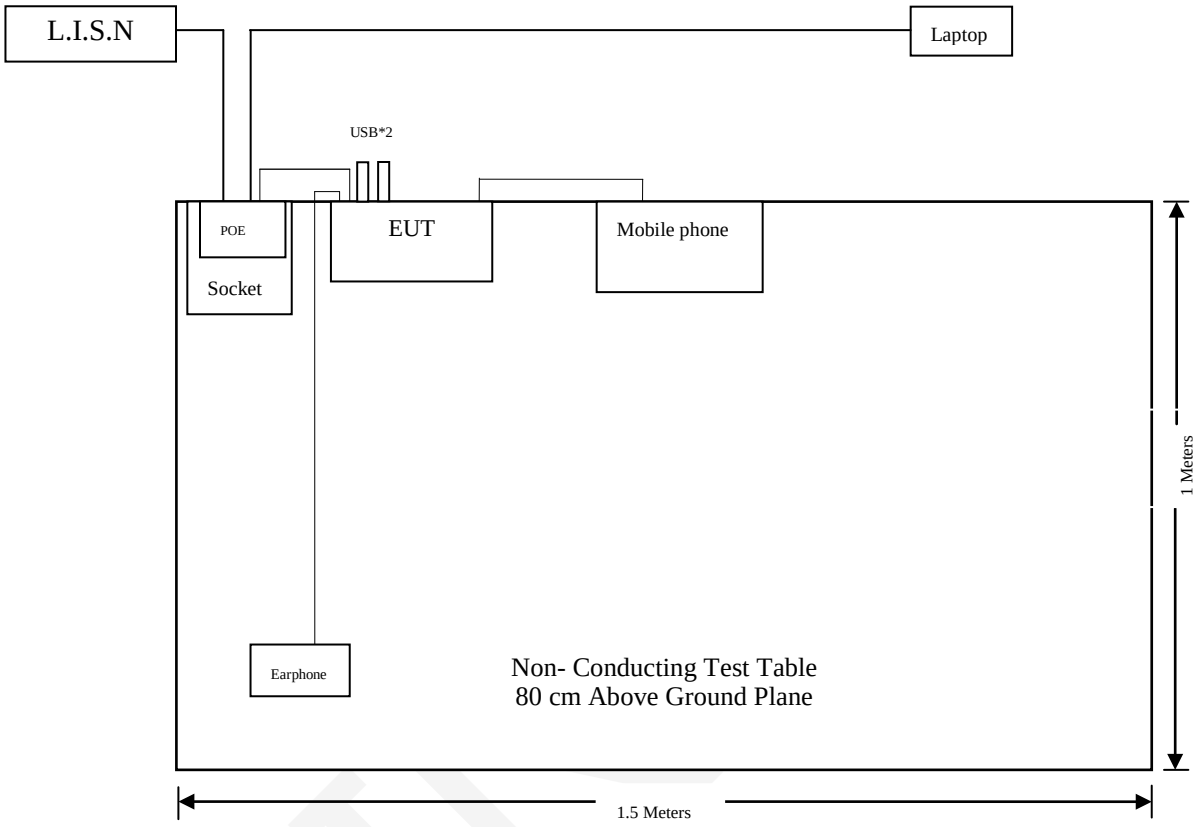
Cable Description	Length (m)	From	To
Shielded USB Cable	1.2m	Mobile phone	EUT
DC Power Cable	1.2m	Adapter	EUT
Unshielded Earphone Cable	1.2m	Earphone	EUT
Unshielded RJ45 Cable	8.0m	Laptop	EUT
Unshielded RJ45 Cable	1.2m	POE	EUT
Unshielded RJ45 Cable	8.0m	POE	Laptop

Block Diagram of Test Setup

Powered by Adapter



Powered by POE



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 & §1.1310 & §2.1091	Maximum Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum conducted output power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

TEST EQUIPMENTS LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission					
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2019-04-15	2020-04-14
ROHDE&SCHWARZ	L.I.S.N.	ENV216	3560.6550.16	2019-02-25	2020-02-24
HP	RF Limiter	11947A	3107A01270	2019-10-18	2020-10-17
Unknown	Conducted Cable	L-E003	000003	2019-08-05	2020-08-04
Rohde & Schwarz	EMC32	EMC32	V 8.52.0	NCR	NCR
Radiated Emission					
EMCT	Semi-Anechoic Chamber	966	001	2017-05-18	2020-05-17
SONOMA INSTRUMENT	Amplifier	310 N	186684	2019-09-06	2020-09-05
SUNOL SCIENCES	Broadband Antenna	JB3	A121808	2017-05-19	2020-05-18
INMET	Attenuator	18N-6dB	N/A	2019-10-17	2020-10-16
Rohde & Schwarz	EMI Test Receiver	ESR3	102456	2019-04-15	2020-04-14
Rohde & Schwarz	Spectrum Analyzer	FSU26	200835	2019-04-15	2020-04-14
EMCO	Horn Antenna	3115	2192	2019-09-25	2021-09-24
Mini-circuits	Pre-Amplifier	ZVA-183-S+	771001215	2019-07-24	2020-07-23
EM Electronics	RF Pre-Amplifier	EM18G40	060725	2019-07-24	2020-07-23
Rohde & Schwarz	EMI Test Receiver	ESIB 40	100215	2019-04-15	2020-04-14
A.H. Systems, Inc	Horn Antenna	SAS-574	510	2019-09-02	2021-09-01
Sinoscite.,Co Ltd	Reject Band Filter	BSF 2402-2480MN	0898-005	2019-11-10	2020-11-09
MICRO-TRONICS	High Pass Filter	HPM50111	G216	2019-11-10	2020-11-09
Unknown	RF Cable (Below 1GHz)	L-E005	000005	2019-09-06	2020-09-05
Unknown	RF Cable (Below 1GHz)	T-E128	000128	2019-10-17	2020-10-16
MICRO-COAX	Flexible microwave cable	T-E237	233522-001	2019-07-19	2020-07-18
Unknown	RF Cable (Above 1GHz)	T-E069	000069	2019-07-24	2020-07-23
Micro-coax	RF Cable (Above 1GHz)	T-E209	MFR 64639 2310	2019-07-19	2020-07-18
Rohde & Schwarz	EMC32	EMC32	V9.10.00	NCR	NCR

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2019-04-15	2020-04-14
WEINSCHEL ENGINEERING	Attenuator	1A 10dB	AB1165	2019-08-05	2020-08-04
E-Microwave	DC Block	EMDCB-00036	OE01304225	2019-08-05	2020-08-04
Agilent	USB Wideband Power Sensor	U2021XA	MY53320008	2019-01-17	2020-01-16
Unknown	RF Cable	Unknown	000007	Each Time	Each Time

FCC §15.247 & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE

Applicable Standard

According to subpart 15.247 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.

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/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);

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	2.0	1.58	23.0	199.53	20	0.063	1.0
	5180-5240	3.0	2.00	9.5	8.91	20	0.004	1.0
	5745-5825	3.0	2.00	14.0	25.12	20	0.010	1.0
BT 3.0	2402-2480	2.0	1.58	9.0	7.94	20	0.002	1.0
BLE	2402-2480	2.0	1.58	5.0	3.16	20	0.001	1.0

Note: Wi-Fi & Bluetooth can't transmit simultaneously.
Result: The device meets MPE at distance ⩾20cm.

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.

The EUT has one external WiFi/Bluetooth antenna, which uses a reverse SMA male connector and fulfill the requirement of this section. Please refer to the table below and EUT

Manufacturer	Model Number	Maximum Gain	Antenna Type	Antenna Connector
Asian Creation antenna factory	AC-Q2458-24W	2.4G WiFi: 2.0dBi 5G WiFi: 3.0dBi Bluetooth: 2.0dBi	Monopole	Reverse SMA male

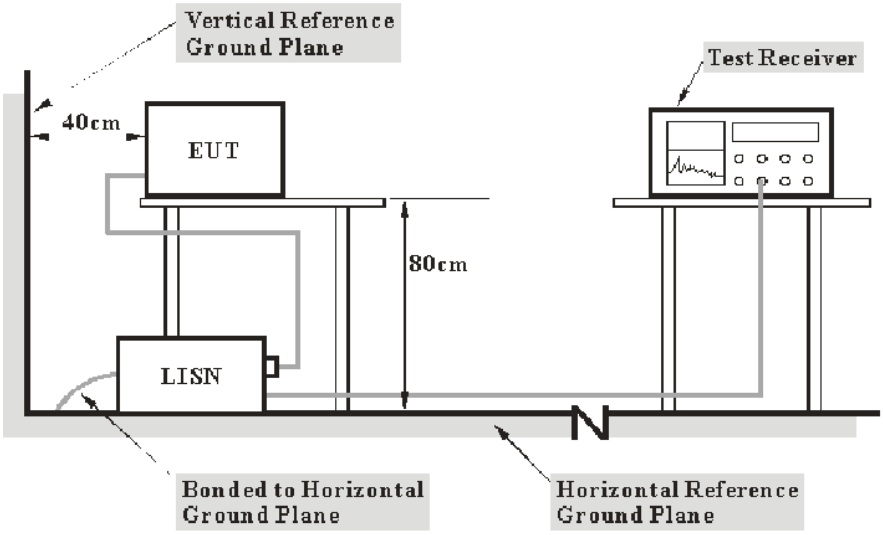
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

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.

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

Test Procedure

During the conducted emission test, the adapter was connected to the first L.I.S.N.

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.

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 Data

Test Environment Conditions

Temperature:	21 °C
Relative Humidity:	63 %
ATM Pressure:	95.9 kPa

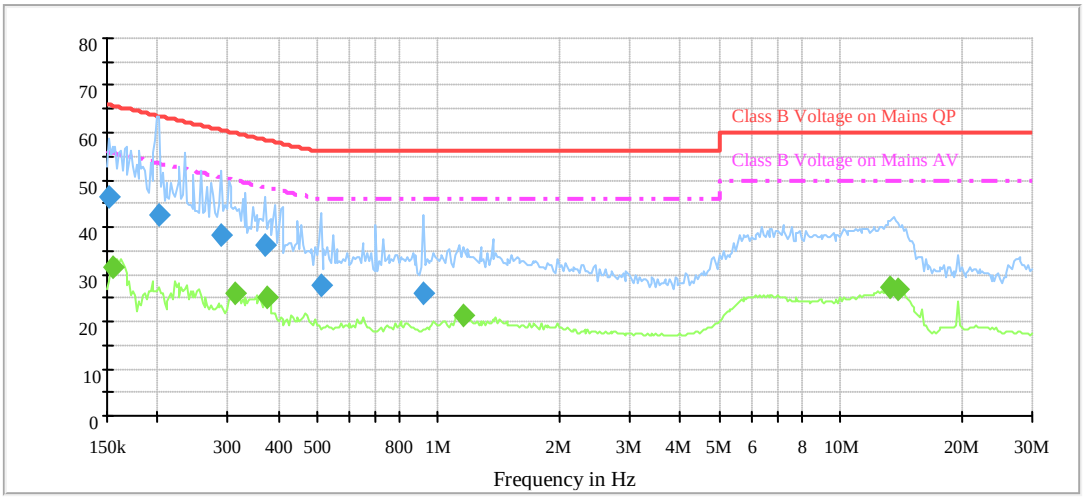
The testing was performed by Eric Xiao on 2019-12-17.

Test Mode: Transmitting

Wi-Fi Mode: (802.11b)-Worst Case

Powered by adapter

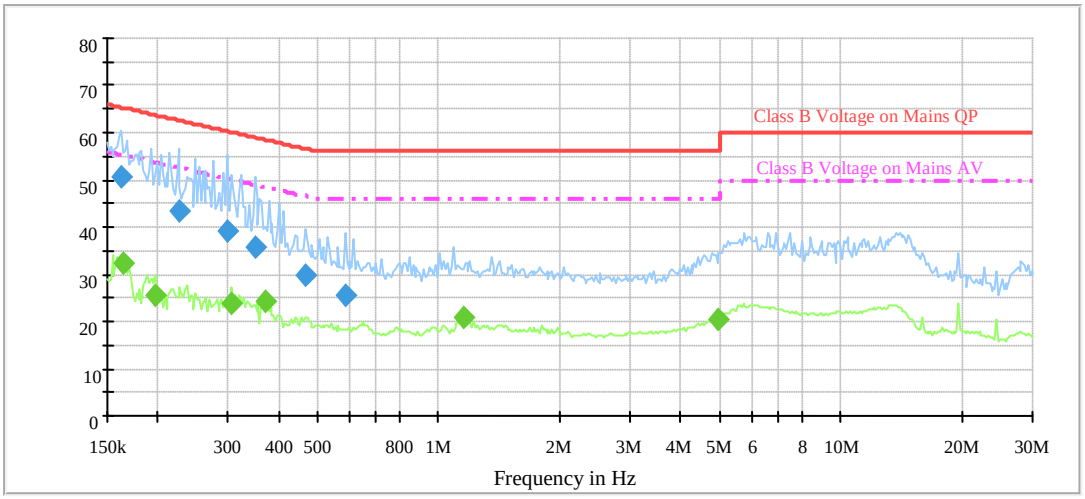
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.151500	46.2	200.0	9.000	L1	19.6	19.7	65.9
0.202177	42.6	200.0	9.000	L1	19.6	20.9	63.5
0.289269	38.2	200.0	9.000	L1	19.6	22.3	60.5
0.370968	36.4	200.0	9.000	L1	19.6	22.1	58.5
0.510059	27.5	200.0	9.000	L1	19.6	28.5	56.0
0.917448	26.0	200.0	9.000	L1	19.6	30.0	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.156091	31.6	200.0	9.000	L1	19.6	24.1	55.7
0.313237	26.0	200.0	9.000	L1	19.6	23.8	49.9
0.374678	25.1	200.0	9.000	L1	19.6	23.3	48.4
1.153382	21.4	200.0	9.000	L1	19.6	24.6	46.0
13.336170	27.1	200.0	9.000	L1	19.9	22.9	50.0
13.877672	26.9	200.0	9.000	L1	19.9	23.1	50.0

AC120 V, 60 Hz, Neutral:

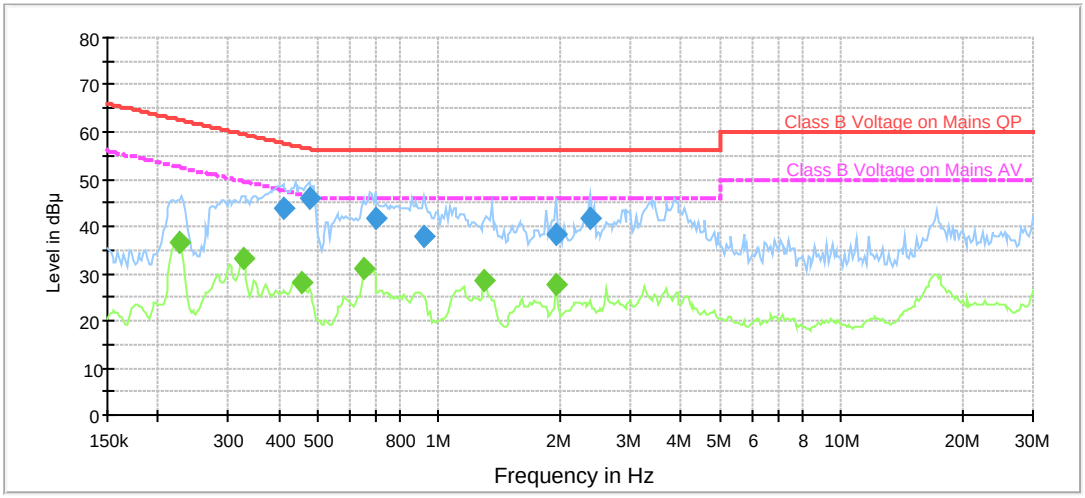


Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.162429	50.8	200.0	9.000	Off	N	19.6	14.6	65.3
0.225563	43.5	200.0	9.000	Off	N	19.6	19.2	62.6
0.298034	39.3	200.0	9.000	Off	N	19.6	21.0	60.3
0.349469	35.6	200.0	9.000	Off	N	19.6	23.4	59.0
0.466367	29.7	200.0	9.000	Off	N	19.6	26.9	56.6
0.586300	25.6	200.0	9.000	Off	N	19.6	30.4	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.164053	32.5	200.0	9.000	Off	N	19.6	22.8	55.3
0.198194	25.4	200.0	9.000	Off	N	19.6	28.3	53.7
0.307065	23.8	200.0	9.000	Off	N	19.6	26.3	50.0
0.370968	24.1	200.0	9.000	Off	N	19.6	24.4	48.5
1.153382	20.9	200.0	9.000	Off	N	19.7	25.1	46.0
4.979837	20.6	200.0	9.000	Off	N	19.7	25.4	46.0

Powered by POE

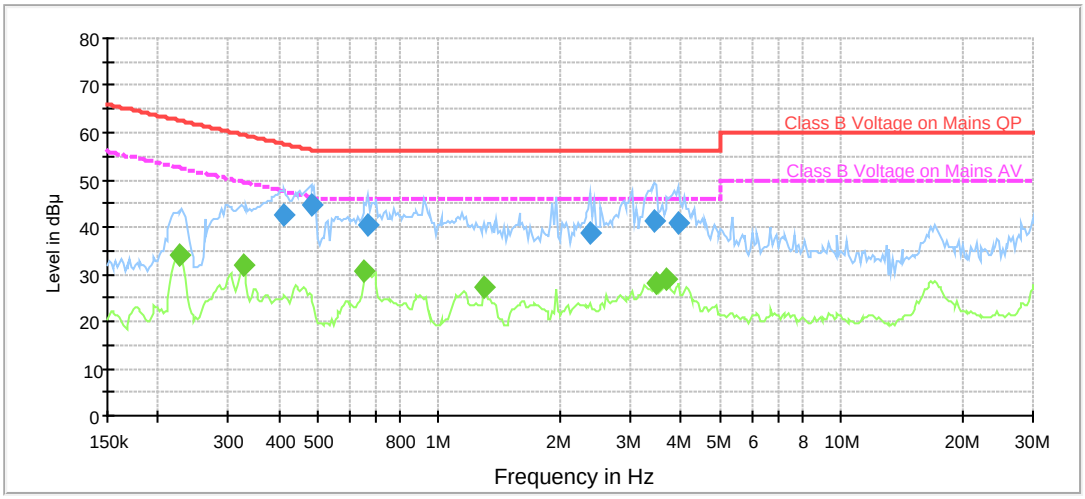
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.409780	43.8	200.0	9.000	L1	19.6	13.8	57.7
0.475741	45.9	200.0	9.000	L1	19.6	10.6	56.4
0.694357	41.6	200.0	9.000	L1	19.6	14.4	56.0
0.917448	38.1	200.0	9.000	L1	19.6	17.9	56.0
1.954366	38.1	200.0	9.000	L1	19.6	17.9	56.0
2.384698	41.5	200.0	9.000	L1	19.6	14.5	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.225563	36.4	200.0	9.000	L1	19.6	16.2	52.6
0.325956	33.0	200.0	9.000	L1	19.6	16.6	49.6
0.457178	28.0	200.0	9.000	L1	19.6	18.7	46.7
0.654116	31.0	200.0	9.000	L1	19.6	15.0	46.0
1.299660	28.6	200.0	9.000	L1	19.6	17.4	46.0
1.954366	27.8	200.0	9.000	L1	19.6	18.2	46.0

AC120 V, 60 Hz, Neutral:



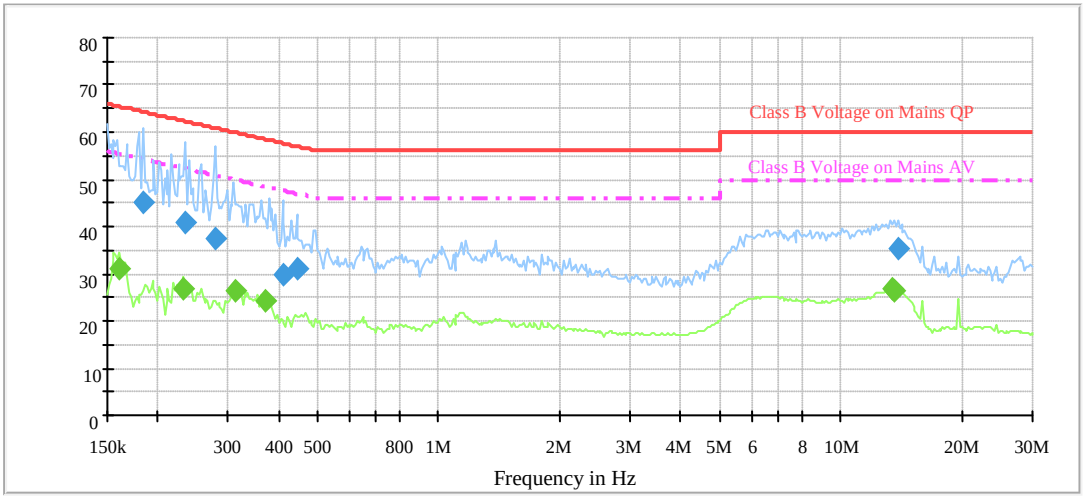
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.413877	42.4	200.0	9.000	N	19.6	15.2	57.6
0.480499	44.6	200.0	9.000	N	19.6	11.7	56.3
0.667264	40.5	200.0	9.000	N	19.7	15.5	56.0
2.384698	38.5	200.0	9.000	N	19.6	17.5	56.0
3.446072	41.5	200.0	9.000	N	19.7	14.5	56.0
3.961170	41.0	200.0	9.000	N	19.7	15.0	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.225563	34.0	200.0	9.000	N	19.6	18.6	52.6
0.325956	31.8	200.0	9.000	N	19.6	17.8	49.6
0.654116	30.5	200.0	9.000	N	19.6	15.5	46.0
1.299660	27.3	200.0	9.000	N	19.7	18.7	46.0
3.480532	28.1	200.0	9.000	N	19.7	17.9	46.0
3.694655	29.1	200.0	9.000	N	19.7	16.9	46.0

BLE Mode: (Low channel)-worst case

Powered by Adapter

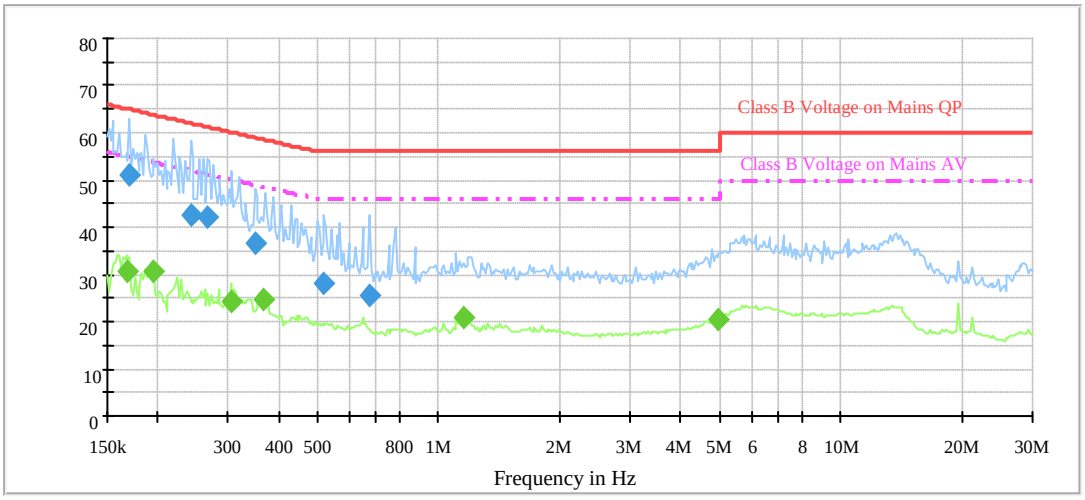
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.184859	45.0	200.0	9.000	L1	19.6	19.3	64.3
0.234722	40.9	200.0	9.000	L1	19.6	21.4	62.3
0.277982	37.6	200.0	9.000	L1	19.6	23.3	60.9
0.409780	29.9	200.0	9.000	L1	19.6	27.8	57.7
0.443733	31.1	200.0	9.000	L1	19.6	25.9	57.0
13.877672	35.2	200.0	9.000	L1	19.9	24.8	60.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.160820	31.3	200.0	9.000	L1	19.6	24.1	55.4
0.232398	27.0	200.0	9.000	L1	19.6	25.4	52.4
0.313237	26.5	200.0	9.000	L1	19.6	23.3	49.9
0.370968	24.1	200.0	9.000	L1	19.6	24.3	48.5
13.469532	26.8	200.0	9.000	L1	19.9	23.2	50.0
13.604227	26.5	200.0	9.000	L1	19.9	23.5	50.0

AC120 V, 60 Hz, Neutral:

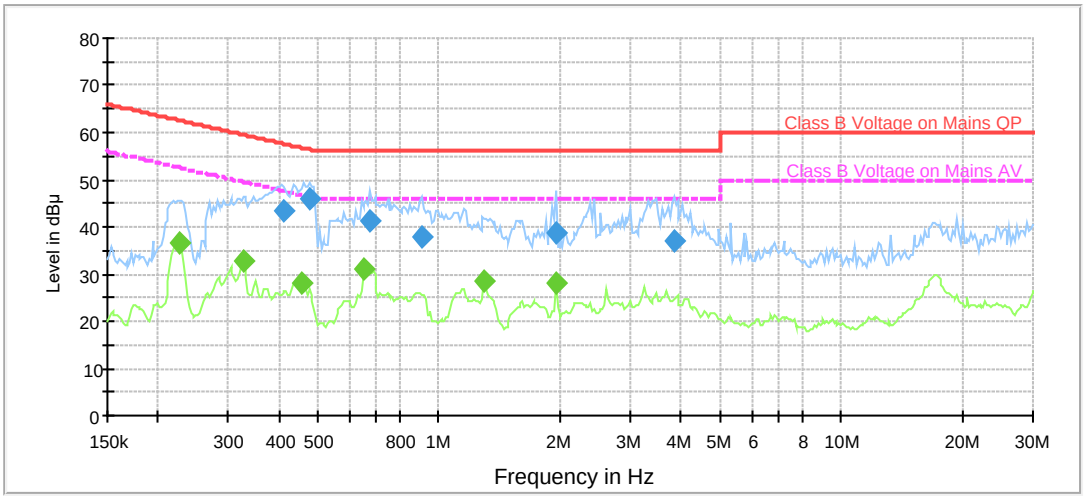


Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.170714	50.9	200.0	9.000	N	19.6	14.0	64.9
0.241834	42.4	200.0	9.000	N	19.6	19.6	62.0
0.267135	42.3	200.0	9.000	N	19.6	18.9	61.2
0.349469	36.7	200.0	9.000	N	19.6	22.3	59.0
0.520311	28.1	200.0	9.000	N	19.6	27.9	56.0
0.673937	25.7	200.0	9.000	N	19.7	30.3	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.167350	30.7	200.0	9.000	N	19.6	24.4	55.1
0.196231	30.6	200.0	9.000	N	19.6	23.2	53.8
0.304025	24.4	200.0	9.000	N	19.6	25.7	50.1
0.367295	24.8	200.0	9.000	N	19.6	23.8	48.6
1.153382	21.0	200.0	9.000	N	19.7	25.0	46.0
4.979837	20.6	200.0	9.000	N	19.7	25.4	46.0

Powered by POE

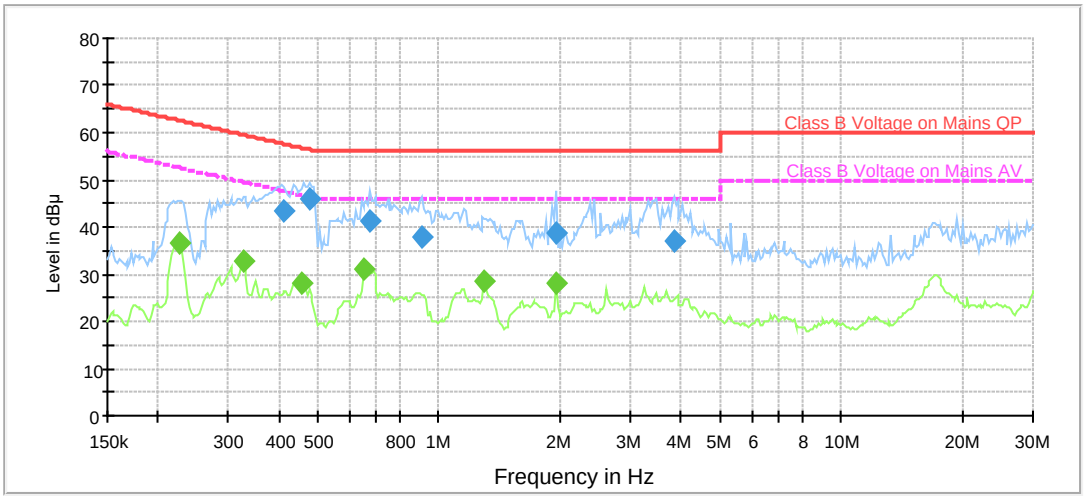
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.413877	43.2	200.0	9.000	L1	19.6	14.4	57.6
0.475741	45.8	200.0	9.000	L1	19.6	10.6	56.4
0.673937	41.5	200.0	9.000	L1	19.6	14.5	56.0
0.908365	37.7	200.0	9.000	L1	19.6	18.3	56.0
1.954366	38.9	200.0	9.000	L1	19.6	17.1	56.0
3.844673	36.9	200.0	9.000	L1	19.6	19.1	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.225563	36.5	200.0	9.000	L1	19.6	16.1	52.6
0.325956	32.8	200.0	9.000	L1	19.6	16.8	49.6
0.457178	27.9	200.0	9.000	L1	19.6	18.9	46.7
0.654116	31.0	200.0	9.000	L1	19.6	15.0	46.0
1.299660	28.6	200.0	9.000	L1	19.6	17.4	46.0
1.954366	28.0	200.0	9.000	L1	19.6	18.0	46.0

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.409780	42.6	200.0	9.000	N	19.6	15.0	57.7
0.480499	45.2	200.0	9.000	N	19.6	11.2	56.3
0.687483	40.5	200.0	9.000	N	19.7	15.5	56.0
2.456957	35.9	200.0	9.000	N	19.6	20.1	56.0
3.411952	41.5	200.0	9.000	N	19.7	14.5	56.0
3.961170	40.5	200.0	9.000	N	19.7	15.5	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.227819	33.9	200.0	9.000	N	19.6	18.6	52.5
0.325956	31.8	200.0	9.000	N	19.6	17.8	49.6
0.654116	30.1	200.0	9.000	N	19.6	15.9	46.0
1.299660	27.2	200.0	9.000	N	19.7	18.8	46.0
3.246355	27.6	200.0	9.000	N	19.7	18.4	46.0
3.694655	29.1	200.0	9.000	N	19.7	16.9	46.0

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
The corrected factor has been input into the transducer of the test software.
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

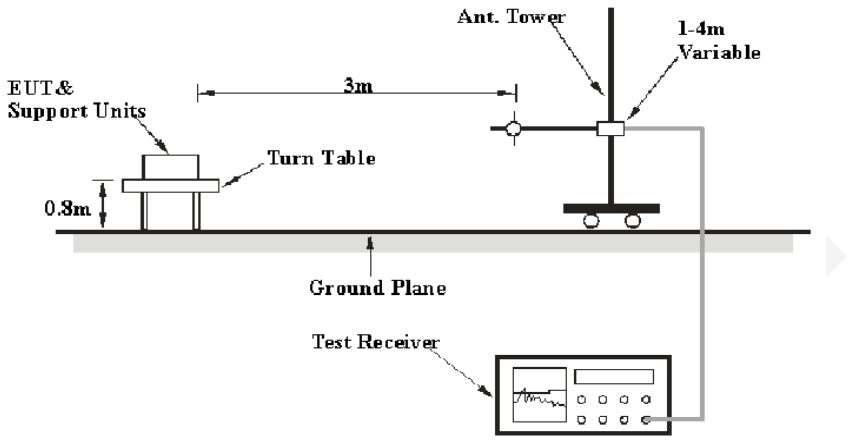
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

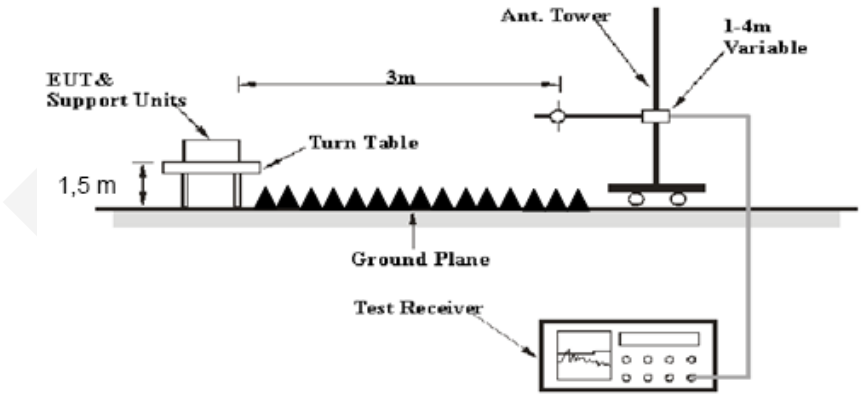
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 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 26.5 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	3 MHz	>98%	AV
	1MHz	1/T	<98%	AV

Note: T is Transmission Duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

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-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Loss + 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

Test Data

Test Environment Conditions

Temperature:	20°C
Relative Humidity:	55 %
ATM Pressure:	96.1 kPa

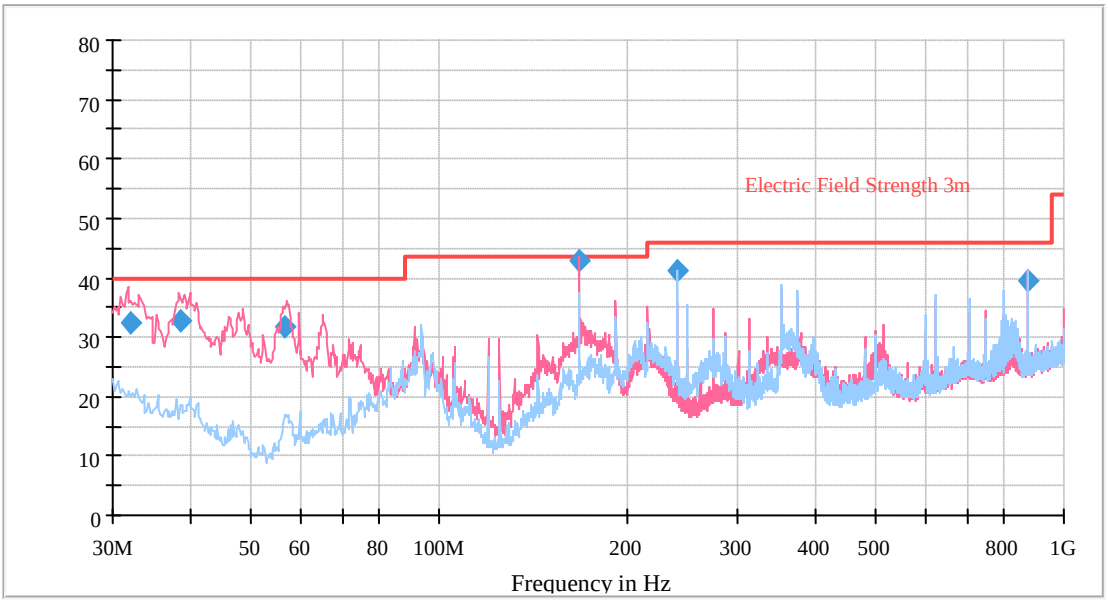
The testing was performed by Eric Xiao on 2019-12-19

Test Mode: Transmitting

Wi-Fi Mode

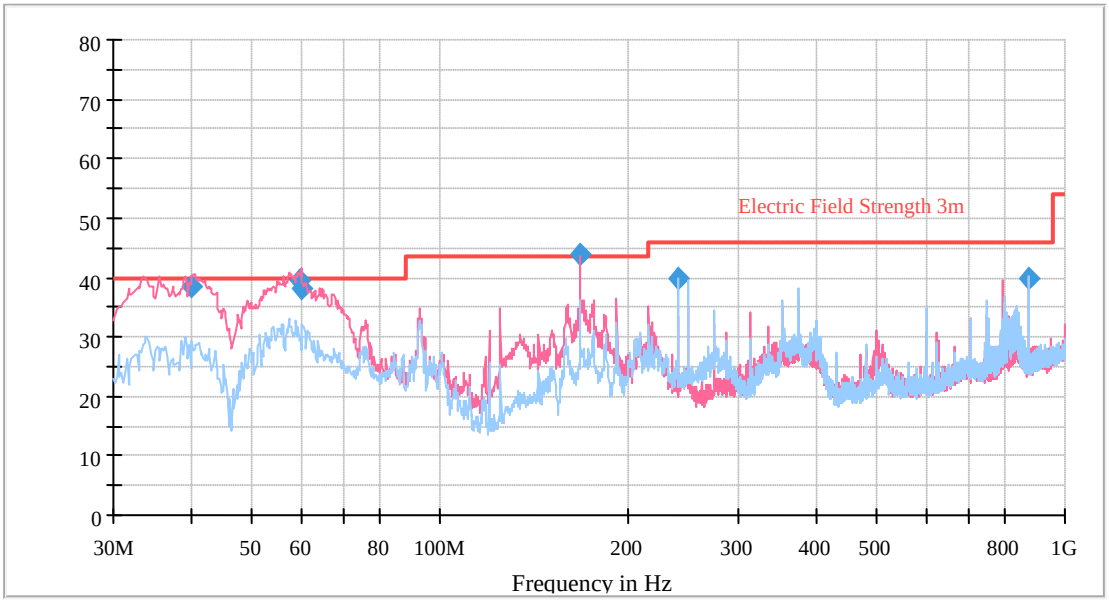
30 MHz to 1 GHz: 802.11b_Middle Channel

Powered by Adapter



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.013900	32.40	40.00	7.60	200.0	120.000	113.0	V	92.0	-6.6
38.468900	32.62	40.00	7.38	200.0	120.000	156.0	V	99.0	-10.0
56.794300	31.73	40.00	8.27	200.0	120.000	113.0	V	21.0	-17.2
168.015000	42.99	43.50	0.51	200.0	120.000	117.0	V	33.0	-12.0
239.997400	41.18	46.00	4.82	200.0	120.000	117.0	H	343.0	-12.4
875.005200	39.41	46.00	6.59	200.0	120.000	115.0	V	102.0	-1.4

Powered by POE



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.073800	38.64	40.00	1.36	200.0	120.000	102.0	V	1.0	-10.9
59.625900	39.38	40.00	0.62	200.0	120.000	131.0	V	256.0	-17.3
60.085000	38.08	40.00	1.92	200.0	120.000	127.0	V	303.0	-17.3
167.999700	43.19	43.50	0.31	200.0	120.000	104.0	V	62.0	-12.0
240.008800	39.83	46.00	6.17	200.0	120.000	106.0	H	341.0	-12.4
875.038500	39.79	46.00	6.21	200.0	120.000	147.0	H	22.0	-1.4

Above 1GHz -Powered by adapter

802.11b Mode

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBµV	PK/AV	H/V	dB(1/m)	dB	dB	dBµV/m	dBµV/m	dB
frequency:2412 MHz									
2412	74.75	PK	V	29.12	3.55	0.00	107.42	N/A	N/A
2412	68.97	AV	V	29.12	3.55	0.00	101.64	N/A	N/A
2390	27.66	PK	V	29.15	3.54	0.00	60.35	74.00	13.65
2390	16.08	AV	V	29.15	3.54	0.00	48.77	54.00	5.23
5400	39.62	PK	V	34.06	5.46	27.19	51.95	74.00	22.05
5400	29.73	AV	V	34.06	5.46	27.19	42.06	54.00	11.94
8100	34.16	PK	V	36.94	6.68	27.17	50.61	74.00	23.39
8100	25.13	AV	V	36.94	6.68	27.17	41.58	54.00	12.42
4824	30.87	PK	V	33.04	5.06	27.27	41.70	74.00	32.30
4824	20.10	AV	V	33.04	5.06	27.27	30.93	54.00	23.07
7236	28.19	PK	V	35.82	6.44	27.10	43.35	74.00	30.65
7236	23.70	AV	V	35.82	6.44	27.10	38.86	54.00	15.14
frequency:2437MHz									
2437	74.84	PK	V	29.09	3.57	0.00	107.50	N/A	N/A
2437	69.02	AV	V	29.09	3.57	0.00	101.68	N/A	N/A
5400	39.41	PK	V	34.06	5.46	27.19	51.74	74.00	22.26
5400	29.95	AV	V	34.06	5.46	27.19	42.28	54.00	11.72
8100	33.50	PK	V	36.94	6.68	27.17	49.95	74.00	24.05
8100	25.13	AV	V	36.94	6.68	27.17	41.58	54.00	12.42
4874	30.28	PK	V	33.17	5.09	27.26	41.28	74.00	32.72
4874	21.01	AV	V	33.17	5.09	27.26	32.01	54.00	21.99
7311	26.96	PK	V	35.98	6.48	27.11	42.31	74.00	31.69
7311	23.39	AV	V	35.98	6.48	27.11	38.74	54.00	15.26
frequency:2462 MHz									
2462	73.74	PK	V	29.05	3.59	0.00	106.38	N/A	N/A
2462	68.90	AV	V	29.05	3.59	0.00	101.54	N/A	N/A
2483.5	28.35	PK	V	29.02	3.61	0.00	60.98	74.00	13.02
2483.5	16.82	AV	V	29.02	3.61	0.00	49.45	54.00	4.55
5400	39.00	PK	V	34.06	5.46	27.19	51.33	74.00	22.67
5400	30.27	AV	V	34.06	5.46	27.19	42.60	54.00	11.40
8100	34.00	PK	V	36.94	6.68	27.17	50.45	74.00	23.55
8100	25.04	AV	V	36.94	6.68	27.17	41.49	54.00	12.51
4924	30.54	PK	V	33.30	5.12	27.25	41.71	74.00	32.29
4924	20.64	AV	V	33.30	5.12	27.25	31.81	54.00	22.19
7386	27.67	PK	V	36.15	6.52	27.12	43.22	74.00	30.78
7386	24.20	AV	V	36.15	6.52	27.12	39.75	54.00	14.25

802.11g Mode

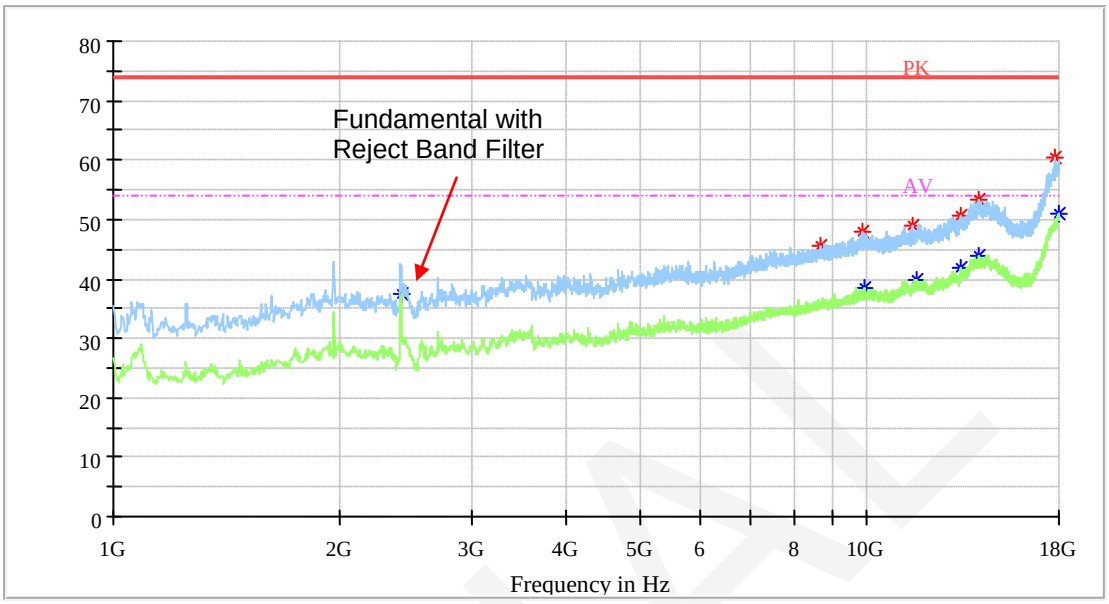
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBµV	PK/AV	H/V	dB(1/m)	dB	dB	dBµV/m	dBµV/m	dB
frequency:2412 MHz									
2412	80.53	PK	V	29.12	3.55	0.00	113.20	N/A	N/A
2412	69.31	AV	V	29.12	3.55	0.00	101.98	N/A	N/A
2390	27.41	PK	V	29.15	3.54	0.00	60.10	74.00	13.90
2390	16.38	AV	V	29.15	3.54	0.00	49.07	54.00	4.93
5400	39.21	PK	V	34.06	5.46	27.19	51.54	74.00	22.46
5400	28.94	AV	V	34.06	5.46	27.19	41.27	54.00	12.73
8100	33.8	PK	V	36.94	6.68	27.17	50.25	74.00	23.75
8100	24.23	AV	V	36.94	6.68	27.17	40.68	54.00	13.32
4824	31.17	PK	V	33.04	5.06	27.27	42.00	74.00	32.00
4824	21.98	AV	V	33.04	5.06	27.27	32.81	54.00	21.19
7236	28.33	PK	V	35.82	6.44	27.10	43.49	74.00	30.51
7236	23.12	AV	V	35.82	6.44	27.10	38.28	54.00	15.72
frequency:2437 MHz									
2437	80.68	PK	V	29.09	3.57	0.00	113.34	N/A	N/A
2437	69.34	AV	V	29.09	3.57	0.00	102.00	N/A	N/A
5400	39.55	PK	V	34.06	5.46	27.19	51.88	74.00	22.12
5400	30.52	AV	V	34.06	5.46	27.19	42.85	54.00	11.15
8100	33.69	PK	V	36.94	6.68	27.17	50.14	74.00	23.86
8100	25.89	AV	V	36.94	6.68	27.17	42.34	54.00	11.66
4874	30.67	PK	V	33.17	5.09	27.26	41.67	74.00	32.33
4874	21.08	AV	V	33.17	5.09	27.26	32.08	54.00	21.92
7311	27.43	PK	V	35.98	6.48	27.11	42.78	74.00	31.22
7311	23.88	AV	V	35.98	6.48	27.11	39.23	54.00	14.77
frequency:2462 MHz									
2462	80.96	PK	V	29.05	3.59	0.00	113.60	N/A	N/A
2462	69.84	AV	V	29.05	3.59	0.00	102.48	N/A	N/A
2483.5	27.34	PK	V	29.02	3.61	0.00	59.97	74.00	14.03
2483.5	17.52	AV	V	29.02	3.61	0.00	50.15	54.00	3.85
5400	39.84	PK	V	34.06	5.46	27.19	52.17	74.00	21.83
5400	29.46	AV	V	34.06	5.46	27.19	41.79	54.00	12.21
8100	34.58	PK	V	36.94	6.68	27.17	51.03	74.00	22.97
8100	25.59	AV	V	36.94	6.68	27.17	42.04	54.00	11.96
4924	29.85	PK	V	33.30	5.12	27.25	41.02	74.00	32.98
4924	20.39	AV	V	33.30	5.12	27.25	31.56	54.00	22.44
7386	26.88	PK	V	36.15	6.52	27.12	42.43	74.00	31.57
7386	24.4	AV	V	36.15	6.52	27.12	39.95	54.00	14.05

802.11n-HT20 Mode

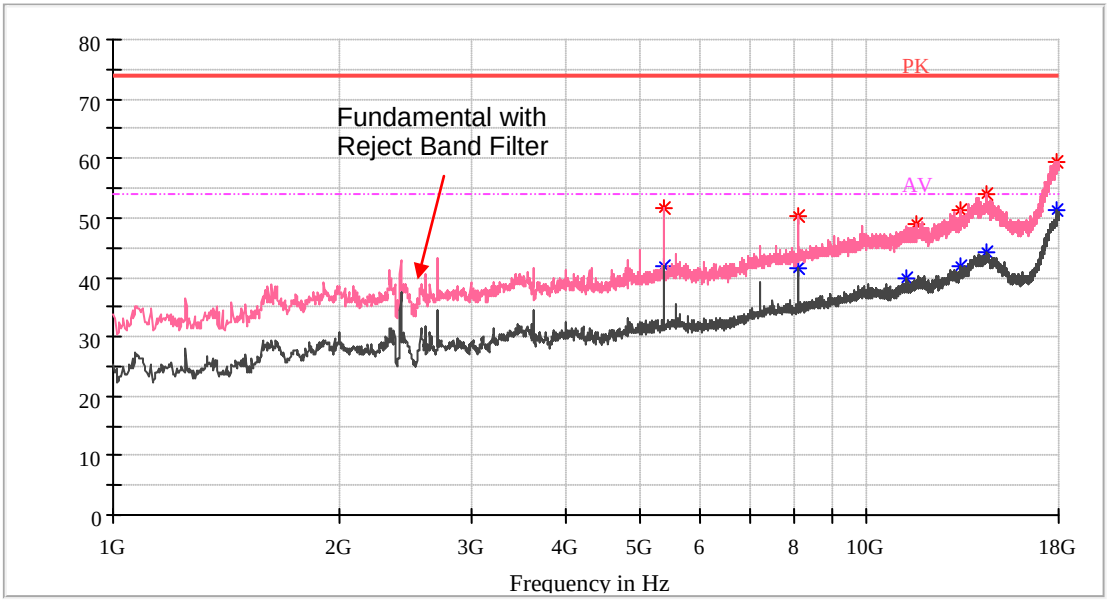
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBµV	PK/AV	H/V	dB(1/m)	dB	dB	dBµV/m	dBµV/m	dB
frequency:2412 MHz									
2412	80.15	PK	V	29.12	3.55	0.00	112.82	N/A	N/A
2412	69.52	AV	V	29.12	3.55	0.00	102.19	N/A	N/A
2390	27.36	PK	V	29.15	3.54	0.00	60.05	74.00	13.95
2390	16.43	AV	V	29.15	3.54	0.00	49.12	54.00	4.88
5400	39.48	PK	V	34.06	5.46	27.19	51.81	74.00	22.19
5400	30.49	AV	V	34.06	5.46	27.19	42.82	54.00	11.18
8100	34.3	PK	V	36.94	6.68	27.17	50.75	74.00	23.25
8100	24.44	AV	V	36.94	6.68	27.17	40.89	54.00	13.11
4824	29.78	PK	V	33.04	5.06	27.27	40.61	74.00	33.39
4824	20.3	AV	V	33.04	5.06	27.27	31.13	54.00	22.87
7236	26.83	PK	V	35.82	6.44	27.10	41.99	74.00	32.01
7236	24.43	AV	V	35.82	6.44	27.10	39.59	54.00	14.41
frequency:2437 MHz									
2437	80.38	PK	V	29.09	3.57	0.00	113.04	N/A	N/A
2437	68.41	AV	V	29.09	3.57	0.00	101.07	N/A	N/A
5400	40.43	PK	V	34.06	5.46	27.19	52.76	74.00	21.24
5400	29.91	AV	V	34.06	5.46	27.19	42.24	54.00	11.76
8100	34.90	PK	V	36.94	6.68	27.17	51.35	74.00	22.65
8100	25.42	AV	V	36.94	6.68	27.17	41.87	54.00	12.13
4874	31.18	PK	V	33.17	5.09	27.26	42.18	74.00	31.82
4874	20.6	AV	V	33.17	5.09	27.26	31.60	54.00	22.40
7311	28.10	PK	V	35.98	6.48	27.11	43.45	74.00	30.55
7311	24.97	AV	V	35.98	6.48	27.11	40.32	54.00	13.68
frequency:2462 MHz									
2462	78.36	PK	V	29.05	3.59	0.00	111.00	N/A	N/A
2462	67.12	AV	V	29.05	3.59	0.00	99.76	N/A	N/A
2483.5	27.14	PK	V	29.02	3.61	0.00	59.77	74.00	14.23
2483.5	16.03	AV	V	29.02	3.61	0.00	48.66	54.00	5.34
5400	39.29	PK	V	34.06	5.46	27.19	51.62	74.00	22.38
5400	29.5	AV	V	34.06	5.46	27.19	41.83	54.00	12.17
8100	34.46	PK	V	36.94	6.68	27.17	50.91	74.00	23.09
8100	24.29	AV	V	36.94	6.68	27.17	40.74	54.00	13.26
4924	31.38	PK	V	33.30	5.12	27.25	42.55	74.00	31.45
4924	20.66	AV	V	33.30	5.12	27.25	31.83	54.00	22.17
7386	27.98	PK	V	36.15	6.52	27.12	43.53	74.00	30.47
7386	23.74	AV	V	36.15	6.52	27.12	39.29	54.00	14.71

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

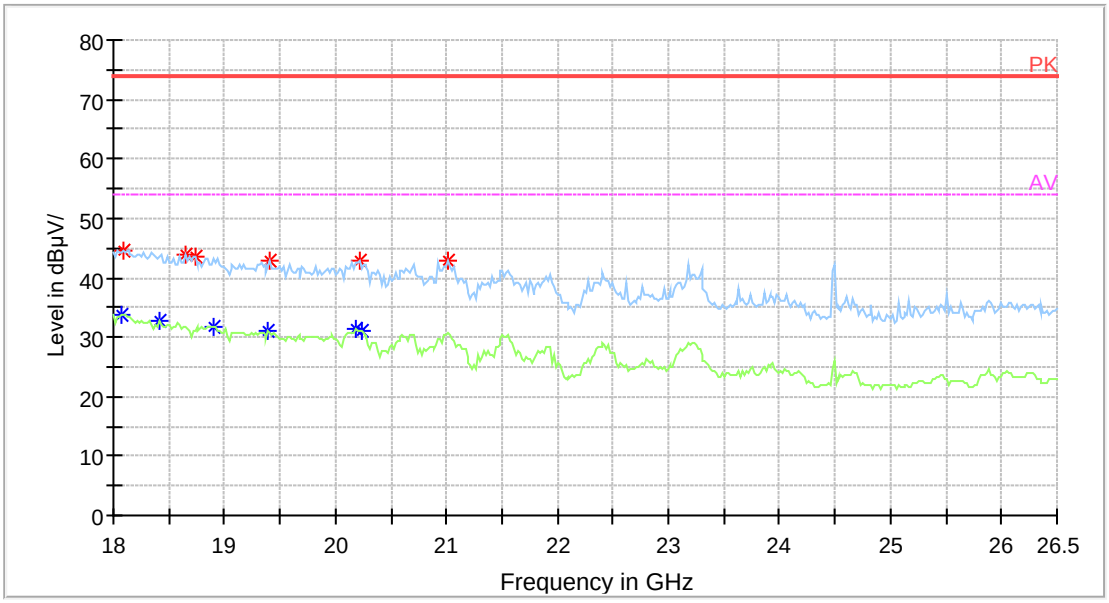
802.11g Mode: High Channel_Horizontal_1GHz-18GHz



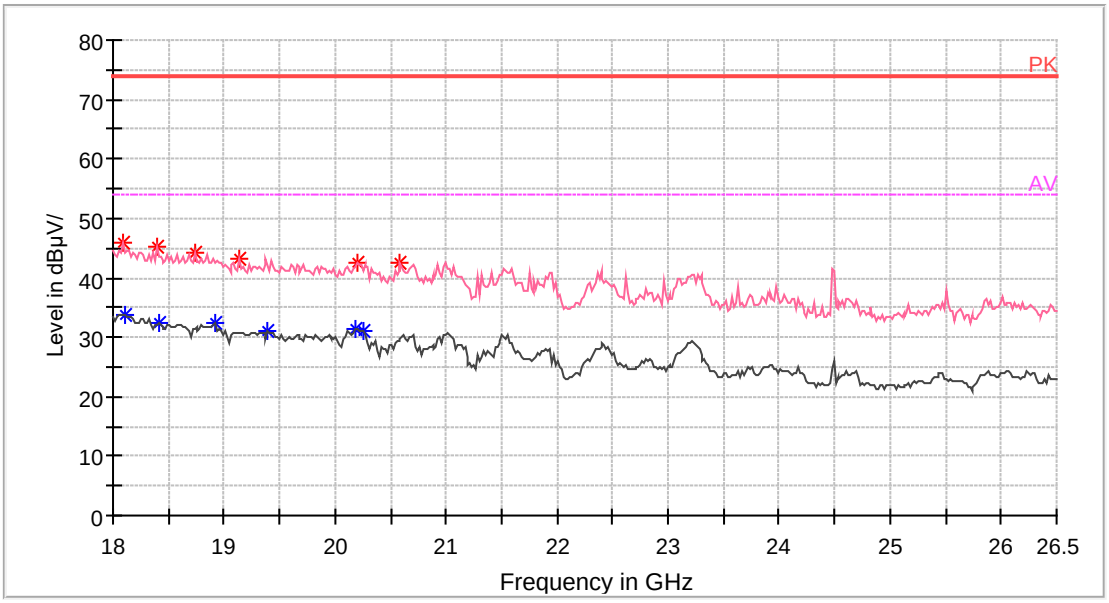
802.11g Mode: High Channel_Vertical_1GHz-18GHz



802.11g Mode: High Channel_Horizontal_18 GHz-26.5 GHz



802.11g Mode: High Channel_Vertical_18GHz-26.5GHz

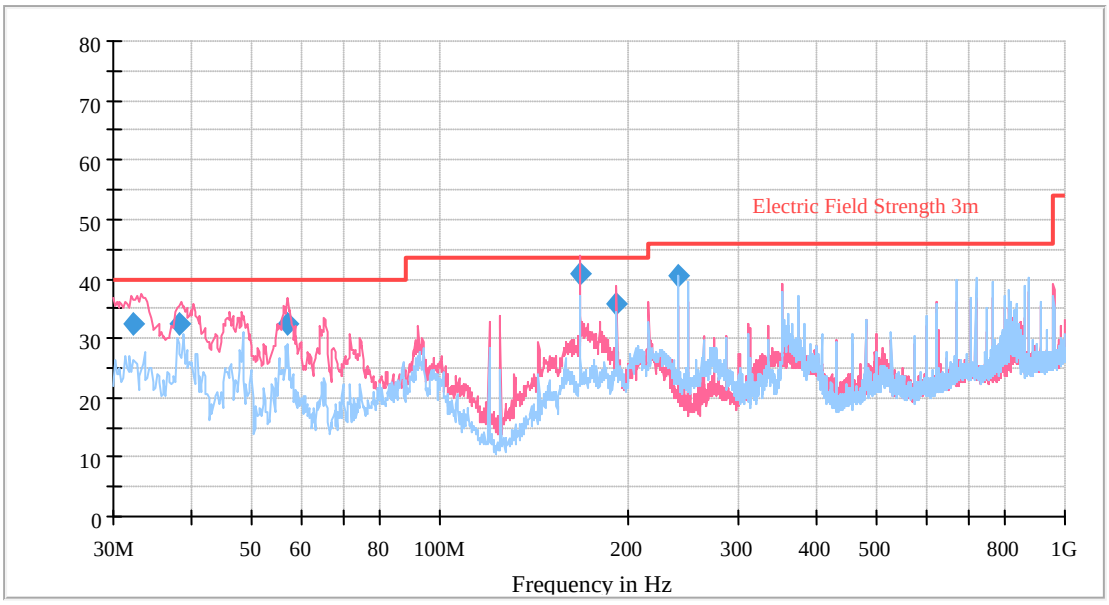


Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude
Spurious emissions more than 20 dB below the limit were not reported.

BLE Mode

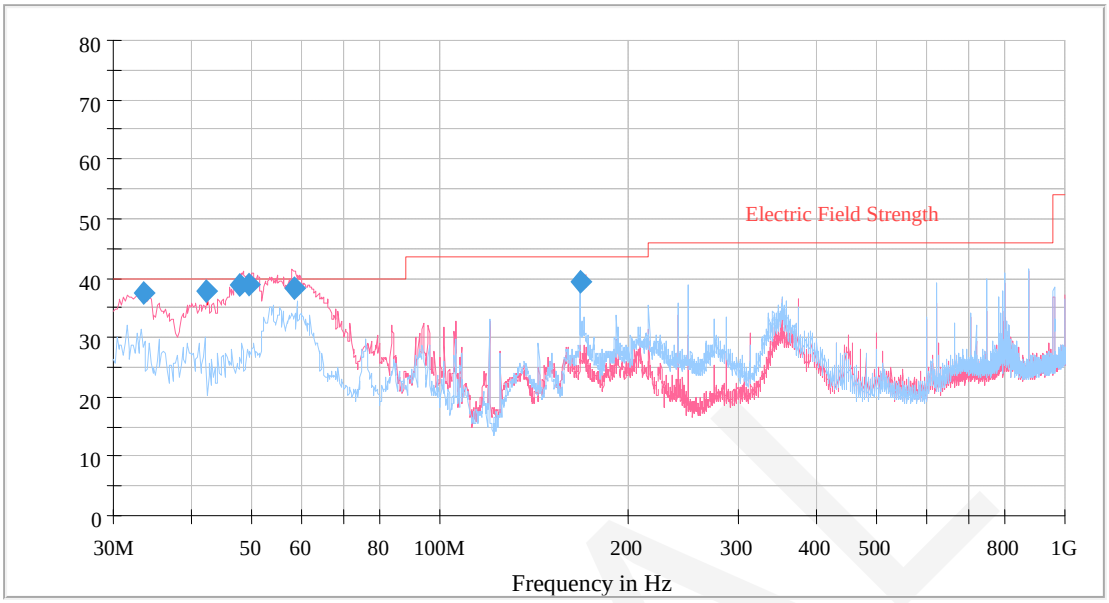
30 MHz to 1 GHz-Middle channel-worst case

Powered by adapter



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.179600	32.38	40.00	7.62	200.0	120.000	133.0	V	133.0	-6.7
38.284600	32.24	40.00	7.76	200.0	120.000	133.0	V	245.0	-9.9
57.080500	32.56	40.00	7.44	200.0	120.000	114.0	V	9.0	-17.2
168.003300	40.97	43.50	2.53	200.0	120.000	110.0	V	42.0	-12.0
192.016700	35.85	43.50	7.65	200.0	120.000	115.0	V	101.0	-12.7
239.992300	40.42	46.00	5.58	200.0	120.000	120.0	H	356.0	-12.4

Powered by POE



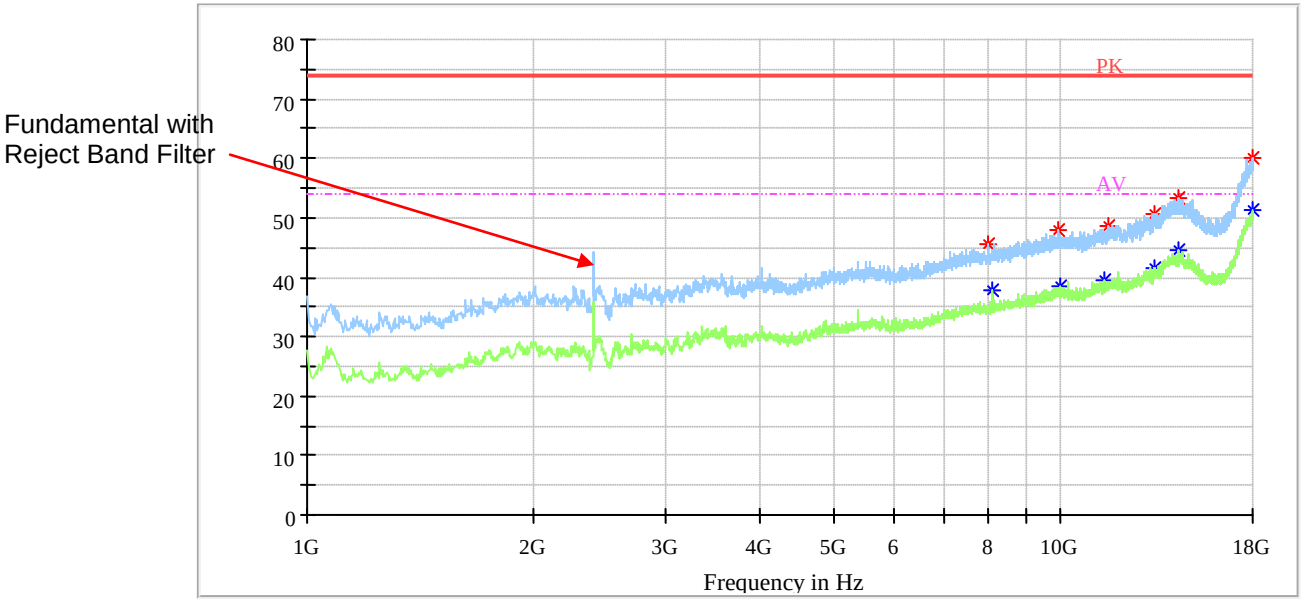
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.492000	38.23	40.00	1.77	100.0	V	306.0	-7.4
42.416000	37.69	40.00	2.31	100.0	V	10.0	-12.3
48.430000	38.50	40.00	1.50	100.0	V	10.0	-16.0
57.936000	38.70	40.00	1.30	100.0	V	349.0	-17.3
60.652000	38.59	40.00	1.41	100.0	V	338.0	-17.3
167.934000	39.37	43.50	4.13	100.0	H	230.0	-12.1

Above 1 GHz (Powered by adapter)-Worst case

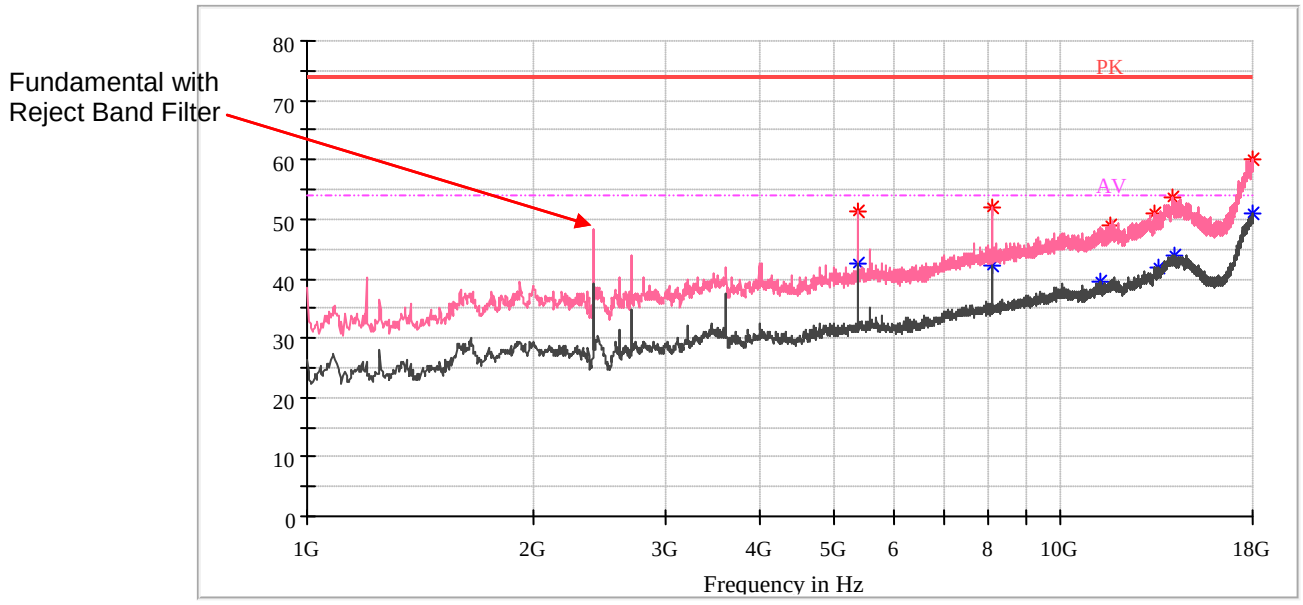
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBµV	PK/AV	H/V	dB(1/m)	dB	dB	dBµV/m	dBµV/m	dB
frequency:2402 MHz									
2390	30.94	PK	V	28.67	3.54	0.00	63.15	74.00	10.85
2390	15.69	AV	V	28.67	3.54	0.00	47.90	54.00	6.10
5400	39.40	PK	V	34.64	5.46	27.19	52.31	74.00	21.69
5400	29.45	AV	V	34.64	5.46	27.19	42.36	54.00	11.64
8100	34.79	PK	V	37.04	6.68	27.17	51.34	74.00	22.66
8100	25.43	AV	V	37.04	6.68	27.17	41.98	54.00	12.02
4804	30.29	PK	V	33.85	5.05	27.27	41.92	74.00	32.08
4804	21.81	AV	V	33.85	5.05	27.27	33.44	54.00	20.56
7206	28.17	PK	V	36.39	6.43	27.10	43.89	74.00	30.11
7206	19.42	AV	V	36.39	6.43	27.10	35.14	54.00	18.86
frequency:2440 MHz									
5400	39.86	PK	V	34.64	5.46	27.19	52.77	74.00	21.23
5400	29.65	AV	V	34.64	5.46	27.19	42.56	54.00	11.44
8100	34.77	PK	V	37.04	6.68	27.17	51.32	74.00	22.68
8100	26.83	AV	V	37.04	6.68	27.17	43.38	54.00	10.62
4880	29.36	PK	V	34.06	5.09	27.26	41.25	74.00	32.75
4880	21.98	AV	V	34.06	5.09	27.26	33.87	54.00	20.13
7320	26.74	PK	V	36.55	6.49	27.11	42.67	74.00	31.33
7320	18.63	AV	V	36.55	6.49	27.11	34.56	54.00	19.44
frequency:2480 MHz									
2483.5	27.64	PK	V	28.95	3.61	0.00	60.20	74.00	13.80
2483.5	16.57	AV	V	28.95	3.61	0.00	49.13	54.00	4.87
5400	39.25	PK	V	34.64	5.46	27.19	52.16	74.00	21.84
5400	30.49	AV	V	34.64	5.46	27.19	43.40	54.00	10.60
8100	35.51	PK	V	37.04	6.68	27.17	52.06	74.00	21.94
8100	25.68	AV	V	37.04	6.68	27.17	42.23	54.00	11.77
4960	28.82	PK	V	34.29	5.14	27.24	41.01	74.00	32.99
4960	21.56	AV	V	34.29	5.14	27.24	33.75	54.00	20.25
7440	27.99	PK	V	36.72	6.55	27.13	44.13	74.00	29.87
7440	19.39	AV	V	36.72	6.55	27.13	35.53	54.00	18.47

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

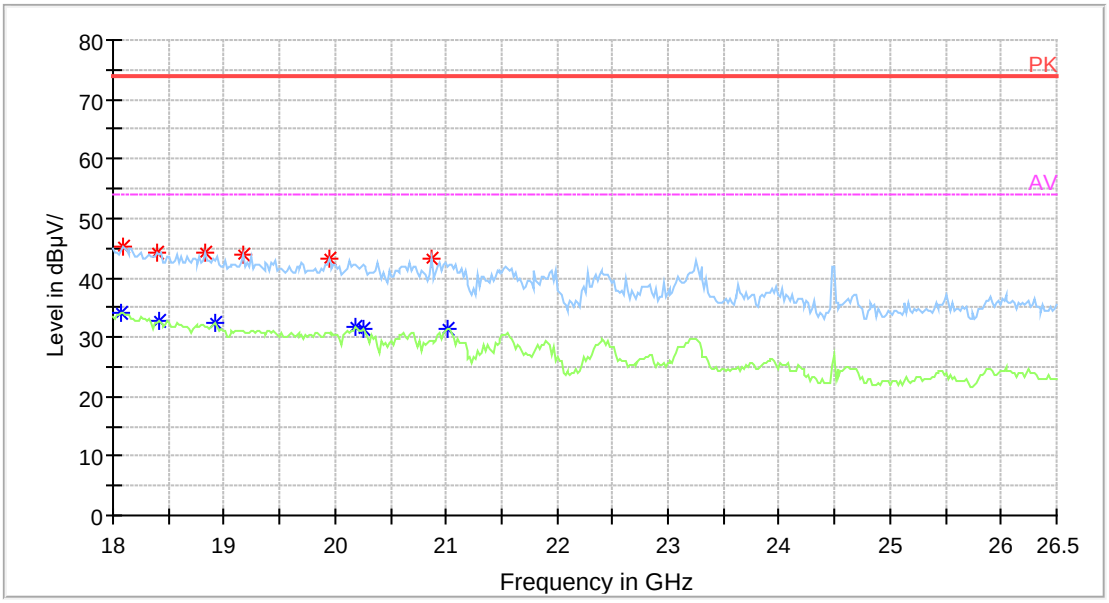
High Channel_Horizontal_1GHz-18GHz



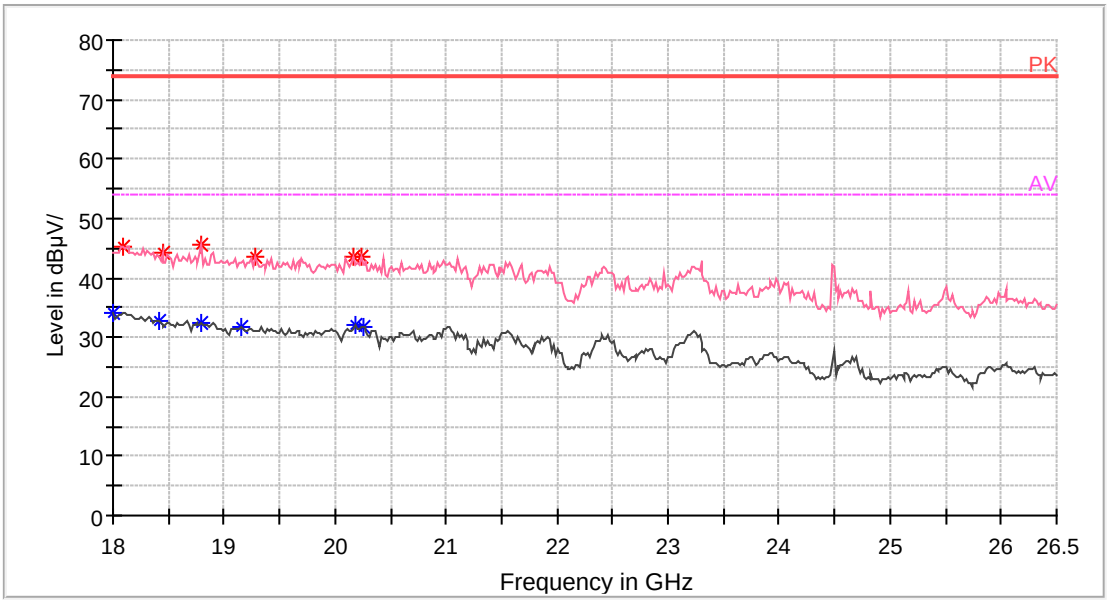
High Channel_Vertical_1GHz-18GHz



High Channel_Horizontal_18GHz-26.5GHz



High Channel_Vertical_18GHz-26.5GHz



Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude

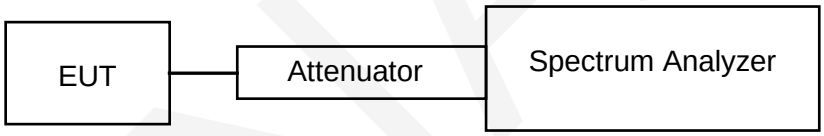
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



Test Data

Environmental Conditions

Temperature:	19 °C	20°C
Relative Humidity:	58 %	59 %
ATM Pressure:	95.7 kPa	95.8 kPa

The testing was performed by Eric Xiao on 2019-12-06 and 2019-12-13.

Test Mode: Transmitting

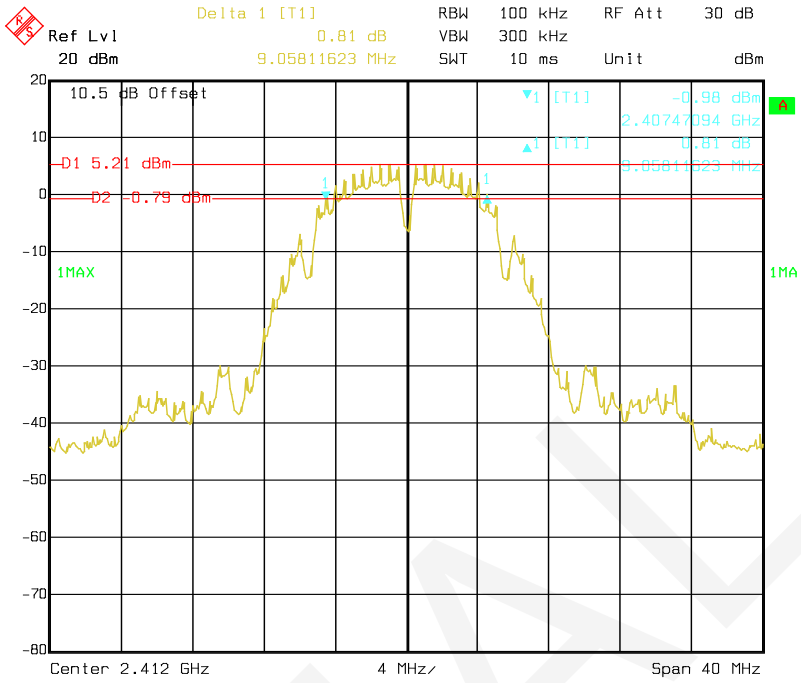
Test Result: Compliance. Please refer to the following table and plots.

WiFi:

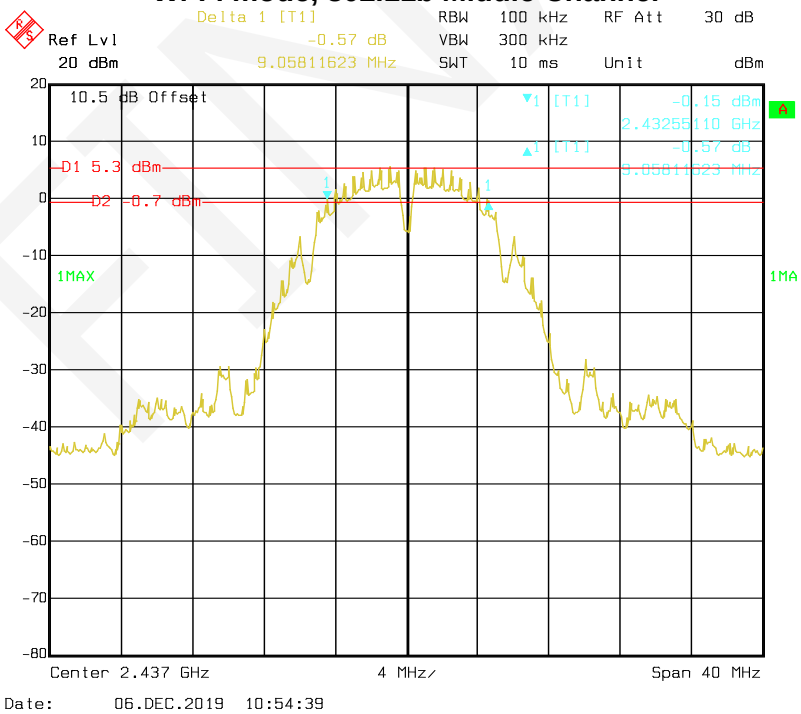
Mode	Channel	Frequency(MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	9.06	≥0.50
	Middle	2437	9.06	≥0.50
	High	2462	9.06	≥0.50
802.11g	Low	2412	16.35	≥0.50
	Middle	2437	16.35	≥0.50
	High	2462	16.35	≥0.50
802.11-HT20	Low	2412	17.64	≥0.50
	Middle	2437	17.56	≥0.50
	High	2462	17.64	≥0.50

Mode	Channel	Frequency(MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
BLE	Low	2402	0.74	≥0.50
	Middle	2440	0.75	≥0.50
	High	2480	0.75	≥0.50

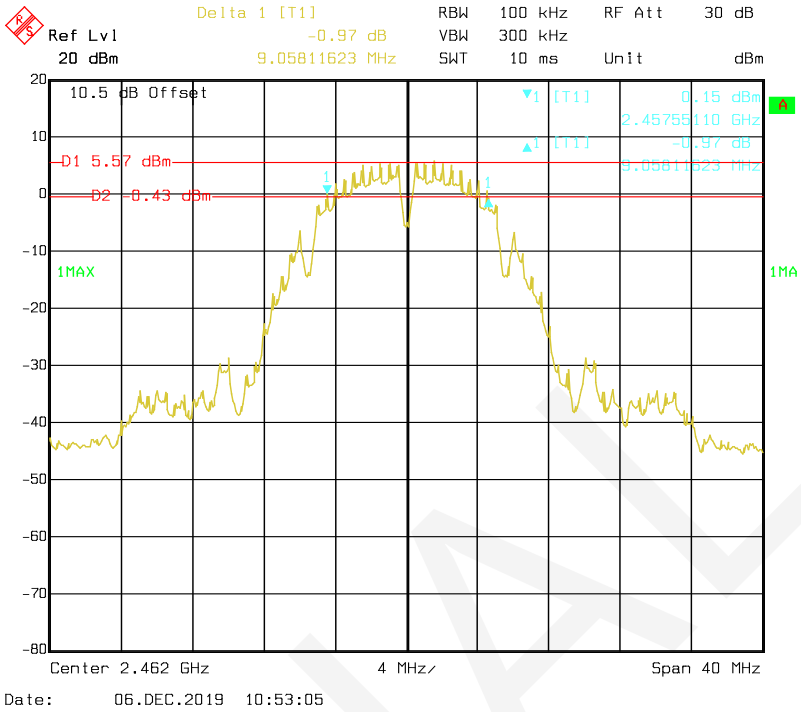
Wi-Fi mode, 802.11b Low Channel



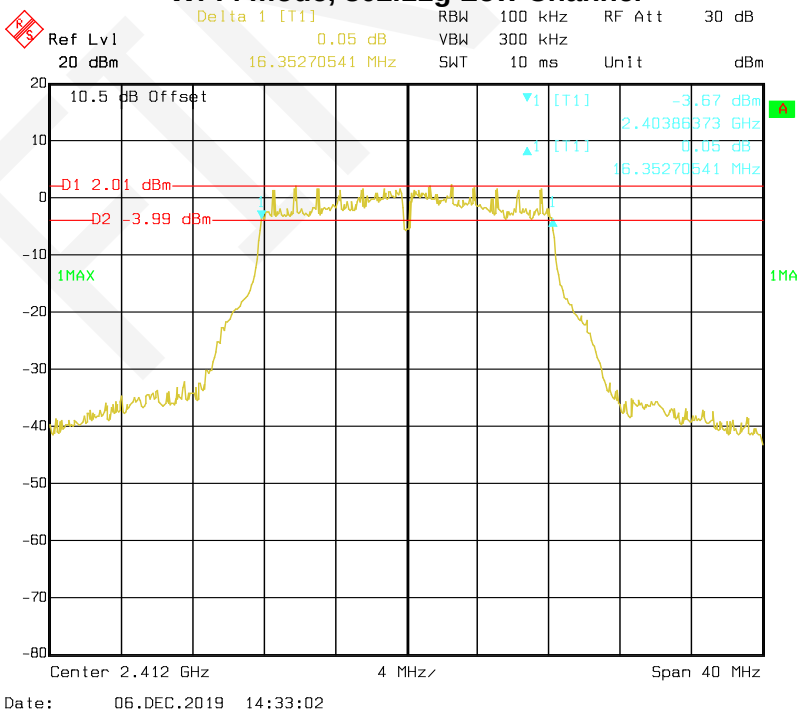
Wi-Fi mode, 802.11b Middle Channel



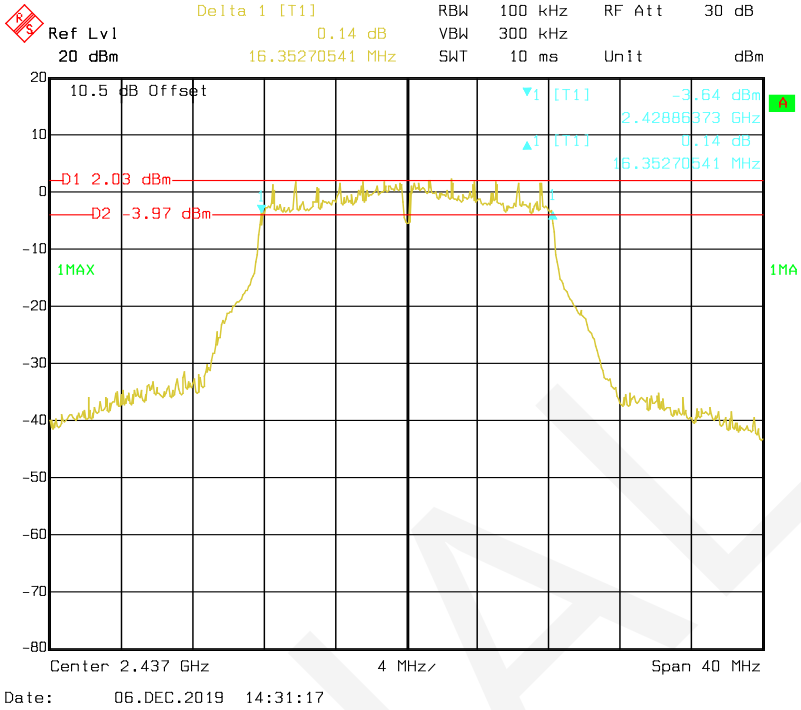
Wi-Fi mode, 802.11b High Channel



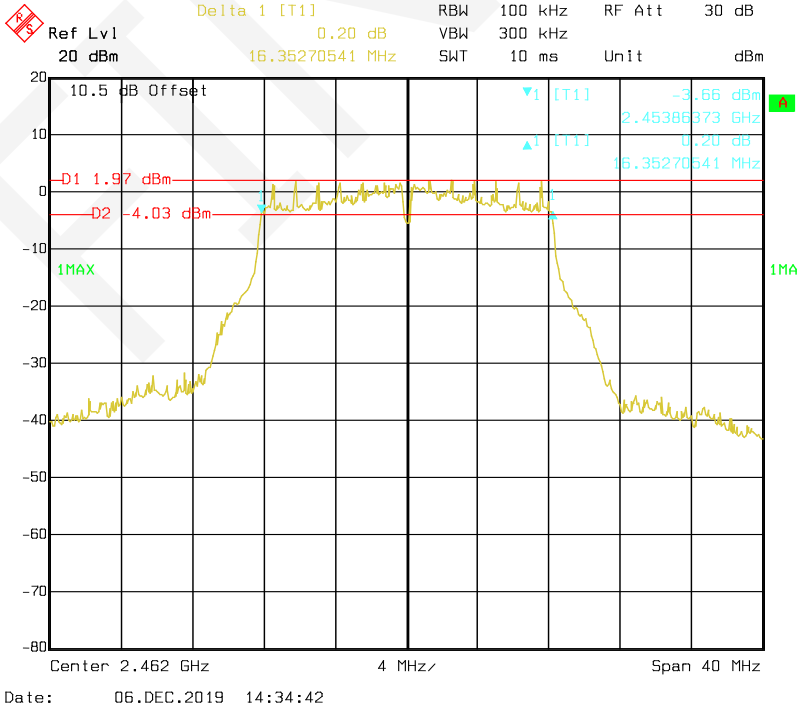
Wi-Fi mode, 802.11g Low Channel



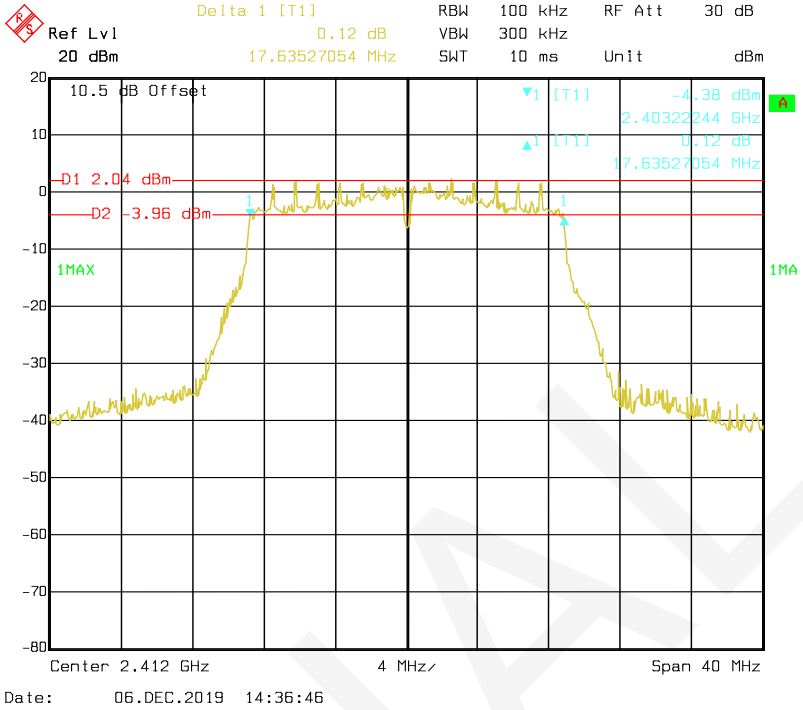
Wi-Fi mode, 802.11g Middle Channel



Wi-Fi mode, 802.11g High Channel

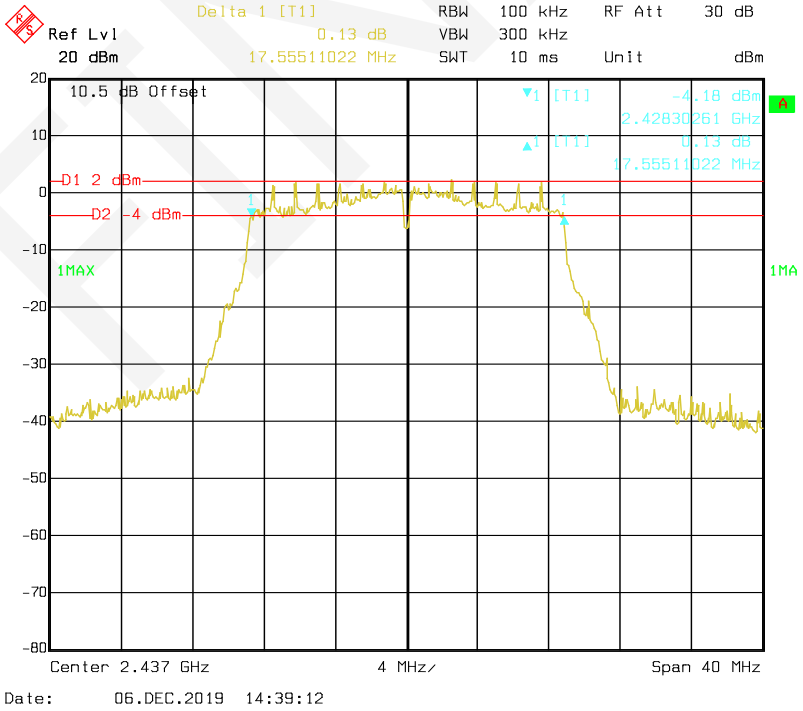


Wi-Fi mode, 802.11n-HT20 Low Channel



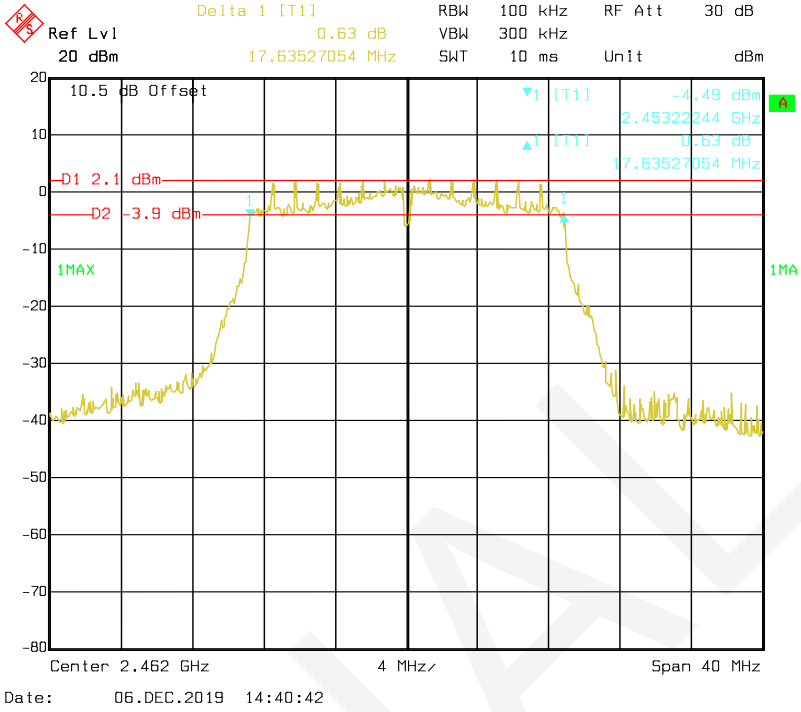
Date: 06.DEC.2019 14:36:46

Wi-Fi mode, 802.11n-HT20 Middle Channel

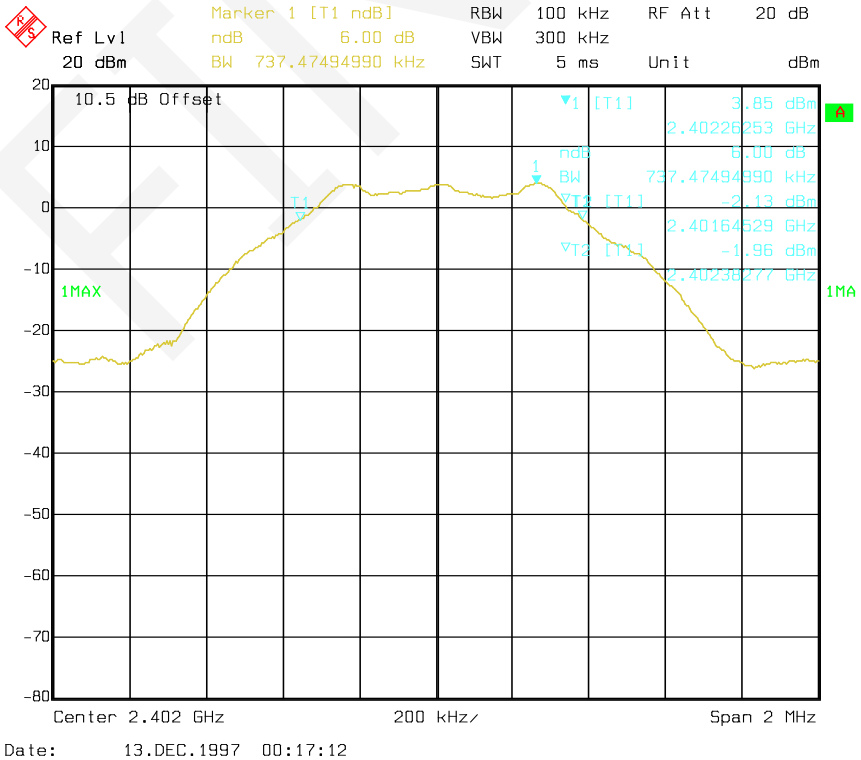


Date: 06.DEC.2019 14:39:12

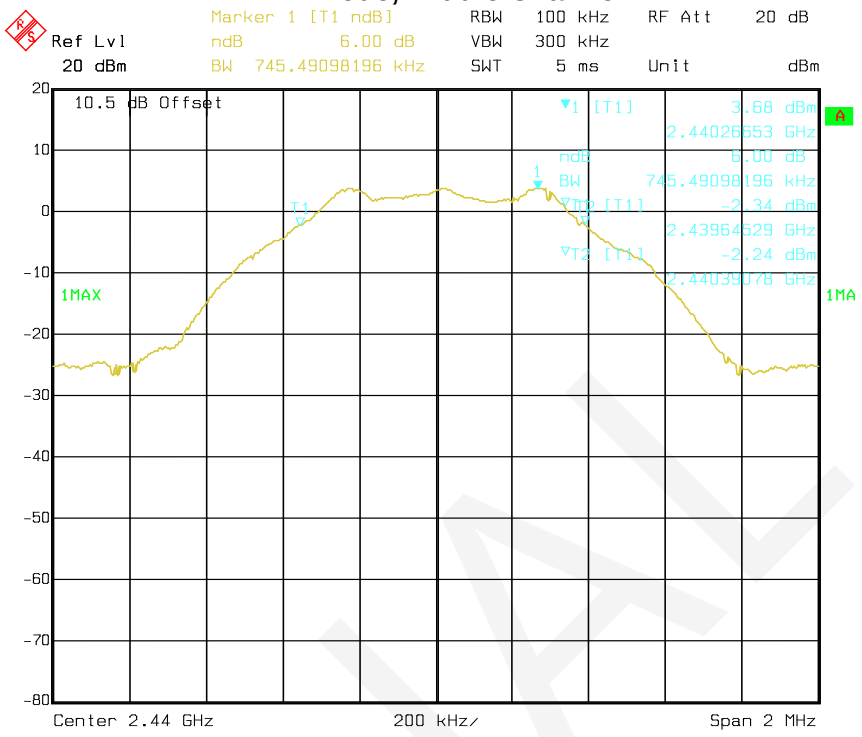
Wi-Fi mode, 802.11n-HT20 High Channel



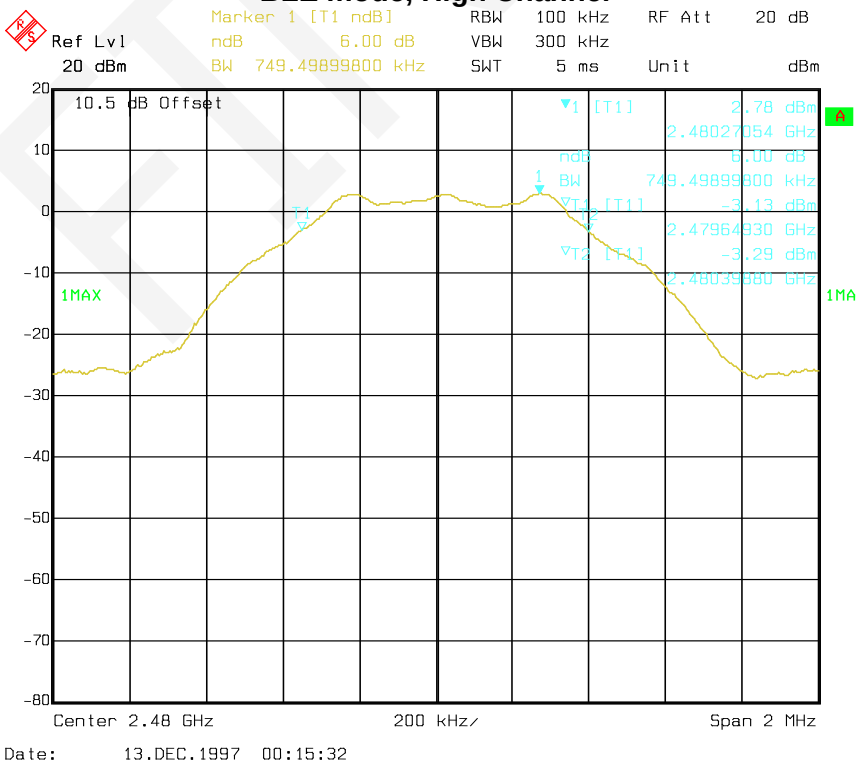
BLE mode, Low Channel



BLE mode, Middle Channel



BLE mode, High Channel



FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.

Test Data

Environmental Conditions

Temperature:	22 °C
Relative Humidity:	58 %
ATM Pressure:	95.5 kPa

The testing was performed by Eric Xiao on 2019-12-13.

Test Mode: Transmitting

Test Result: Compliance. Please refer to the following table.

WIFI:

Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Max Average Conducted Output Power (dBm)	Limit (dBm)
802.11b	Low	2412	16.17	13.28	30
	Middle	2437	16.50	13.26	30
	High	2462	16.66	13.40	30
802.11g	Low	2412	22.11	12.55	30
	Middle	2437	22.34	12.71	30
	High	2462	22.51	12.85	30
802.11n-HT20	Low	2412	21.40	12.18	30
	Middle	2437	21.83	12.43	30
	High	2462	22.04	12.45	30

Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
BLE	Low	2402	4.05	30
	Middle	2440	4.57	30
	High	2480	3.29	30

Note: The duty cycle factor was calculated in result.

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect 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 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
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:	19 °C	20°C
Relative Humidity:	58 %	58 %
ATM Pressure:	95.7 kPa	95.8 kPa

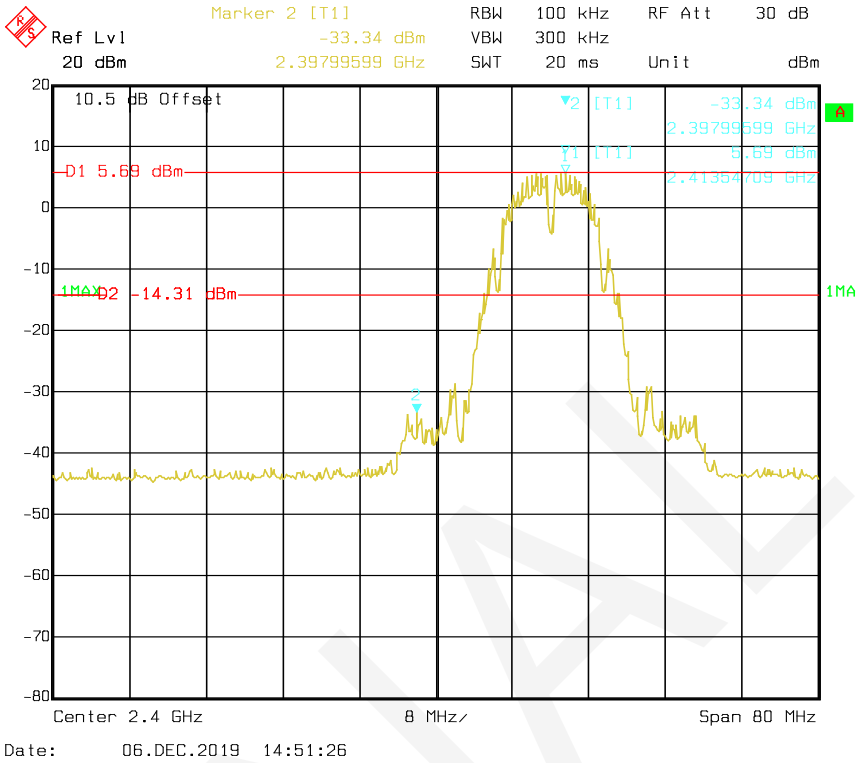
The testing was performed by Eric Xiao on 2019-12-06 and 2019-12-13.

Test mode: Transmitting

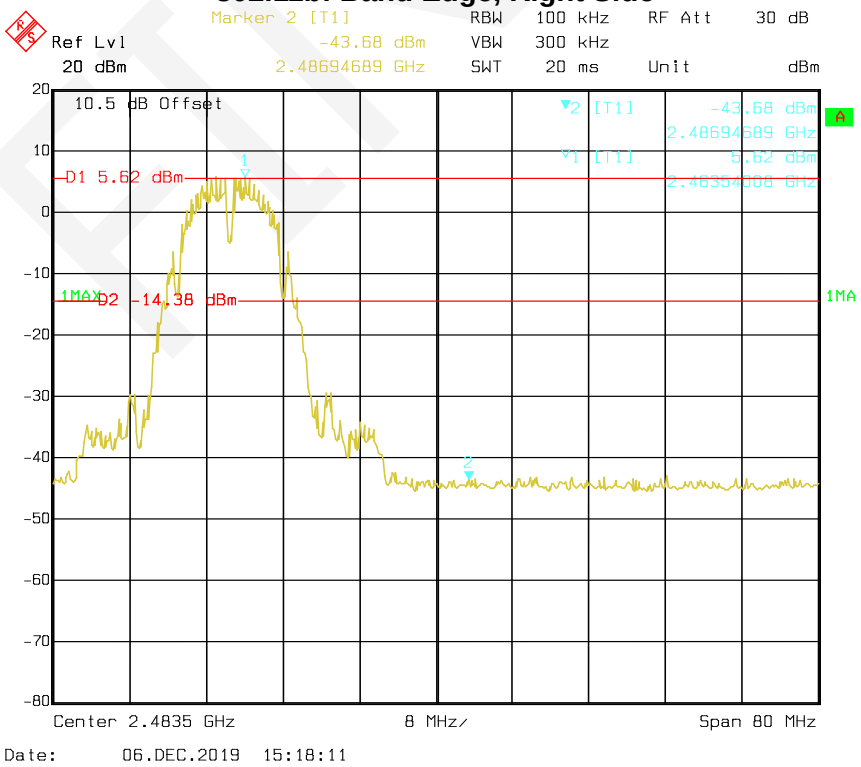
Test Result: Compliance. Please refer to following plots.

Wi-Fi mode

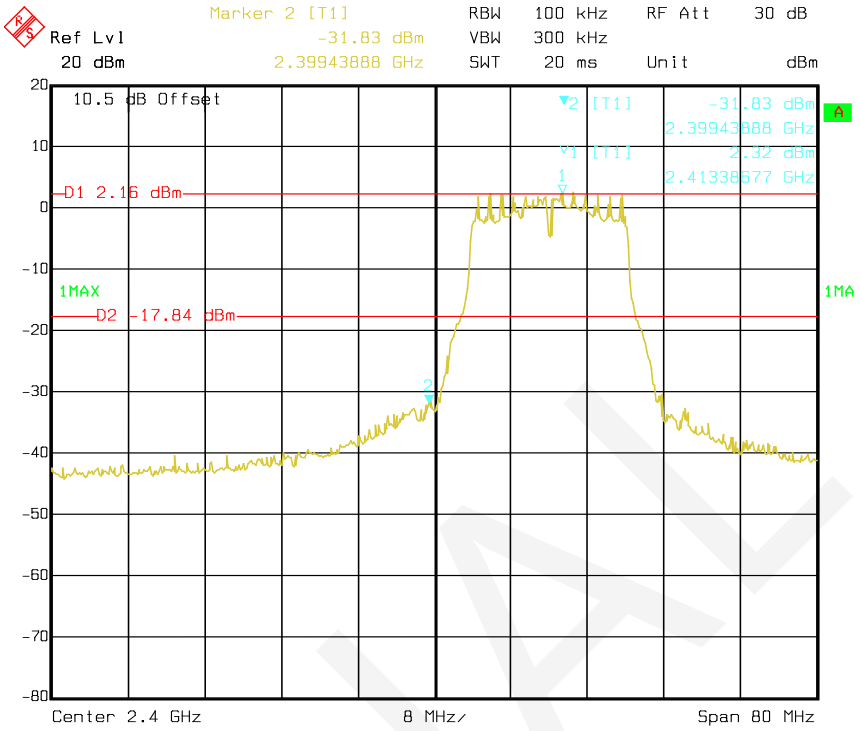
802.11b: Band Edge, Left Side



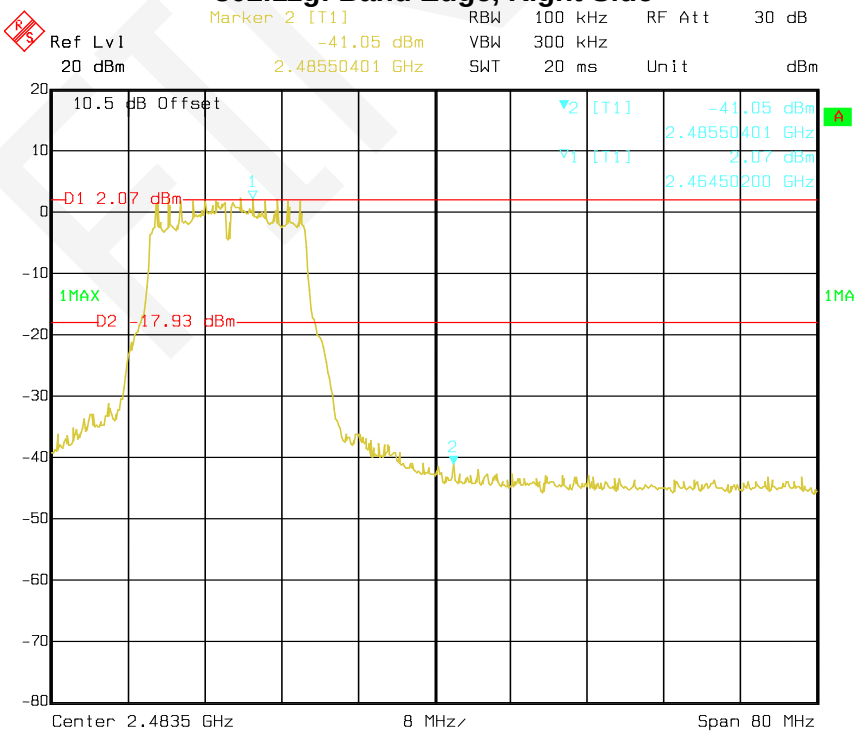
802.11b: Band Edge, Right Side



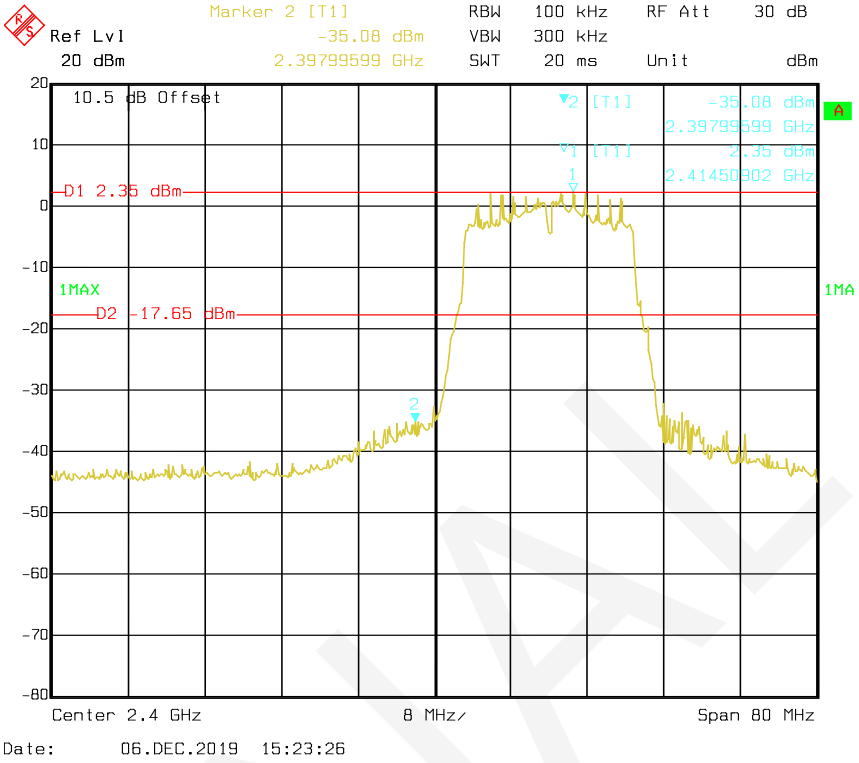
802.11g: Band Edge, Left Side



802.11g: Band Edge, Right Side

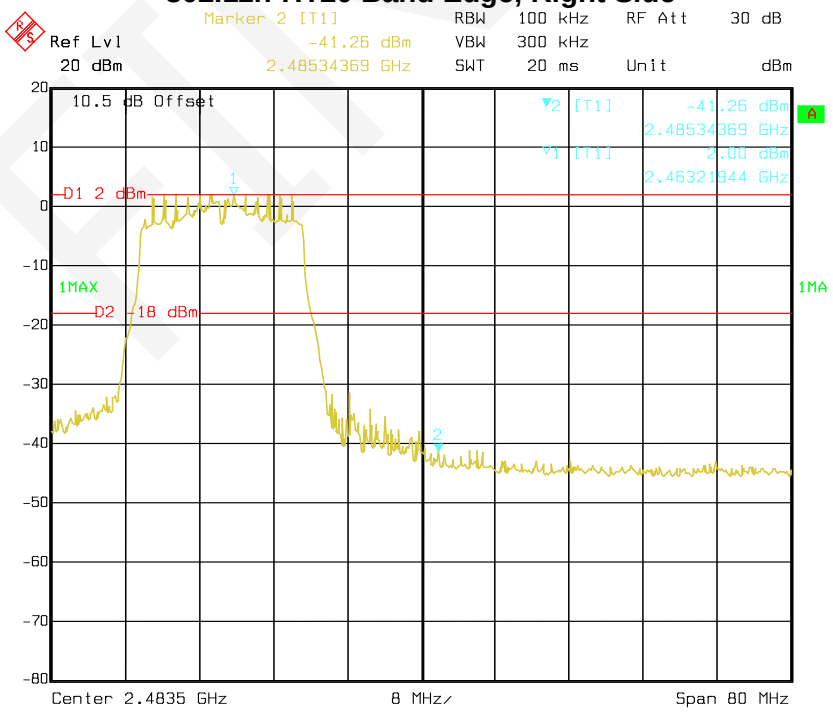


802.11n-HT20 Band Edge, Left Side



Date: 06.DEC.2019 15:23:26

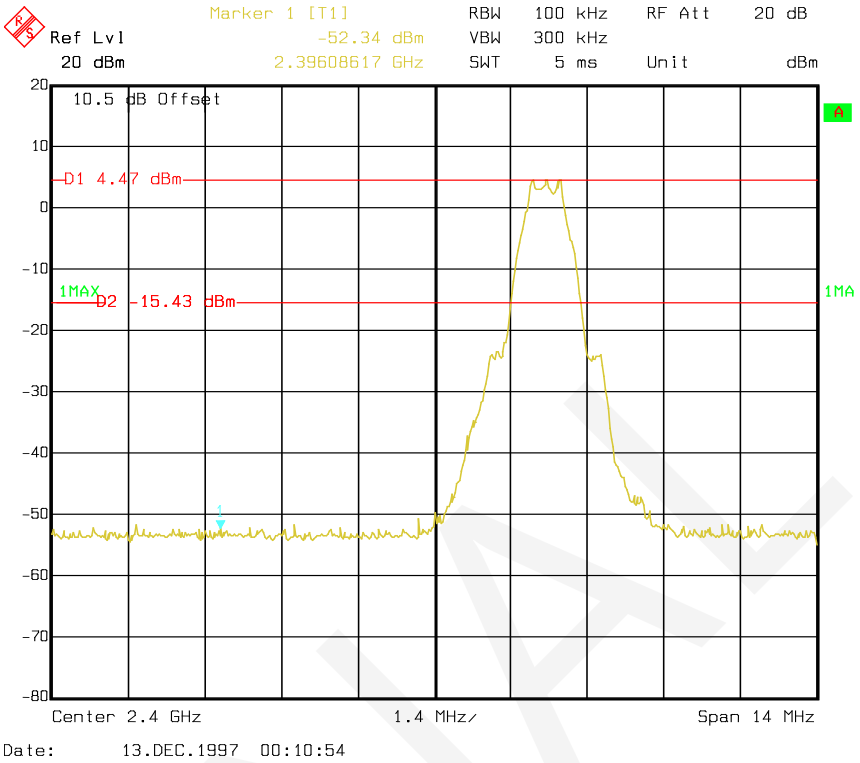
802.11n-HT20 Band Edge, Right Side



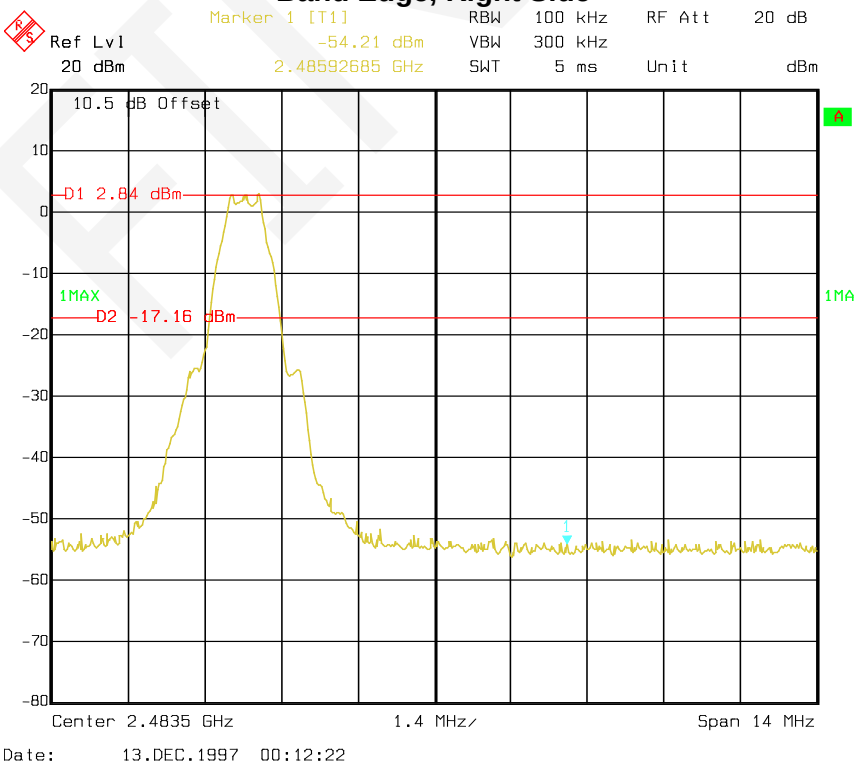
Date: 06.DEC.2019 15:25:46

BLE mode

Band Edge, Left Side



Band Edge, Right Side



FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3×RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Data

Environmental Conditions

Temperature:	19 °C	20°C
Relative Humidity:	58 %	58 %
ATM Pressure:	95.7 kPa	95.8 kPa

The testing was performed by Eric Xiao on 2019-12-06 and 2019-12-13.

Test Mode: Transmitting

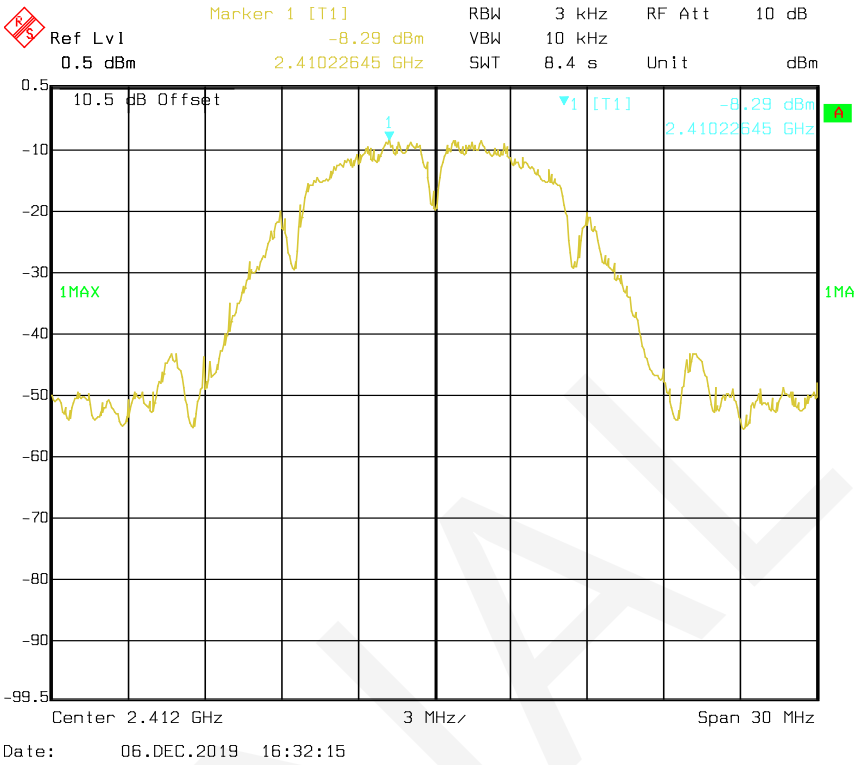
Test Result: Compliance. Please refer to the following table and plots

Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-8.29	8
	Middle	2437	-8.57	8
	High	2462	-9.16	8
802.11g	Low	2412	-10.12	8
	Middle	2437	-10.93	8
	High	2462	-10.22	8
802.11n-HT20	Low	2412	-11.47	8
	Middle	2437	-10.21	8
	High	2462	-11.98	8

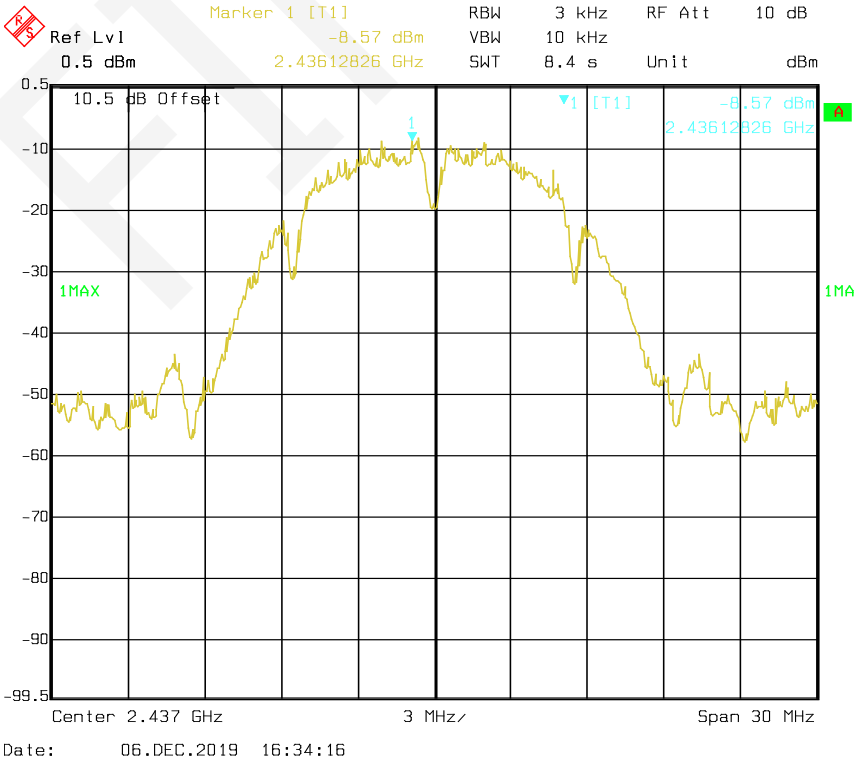
Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
BLE	Low	2402.00	-10.40	8
	Middle	2440.00	-10.02	8
	High	2480.00	-11.37	8

Wi-Fi mode

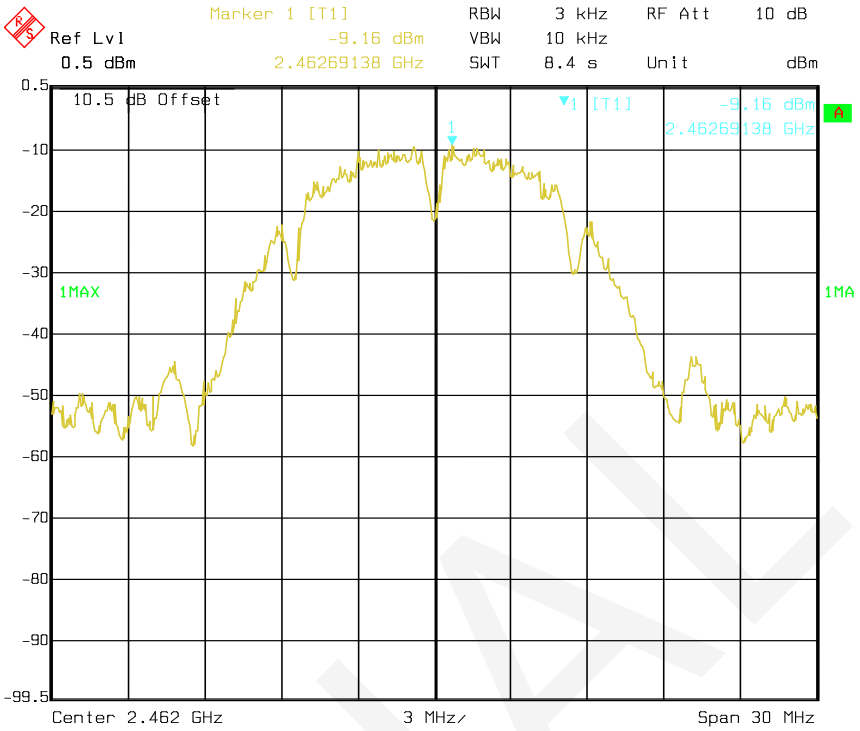
Power Spectral Density, 802.11b Low Channel



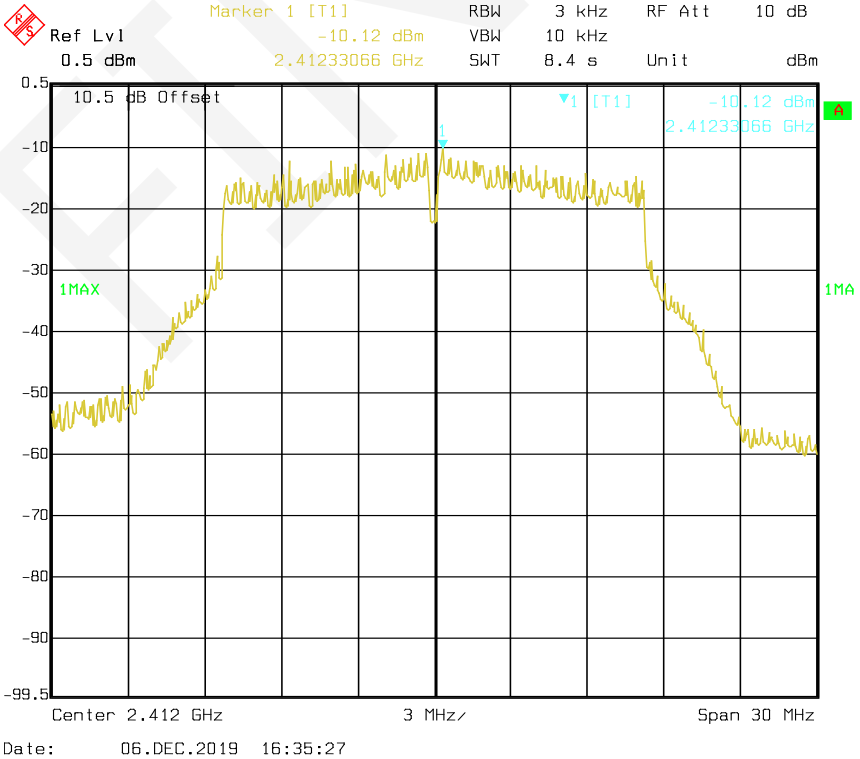
Power Spectral Density, 802.11b Middle Channel



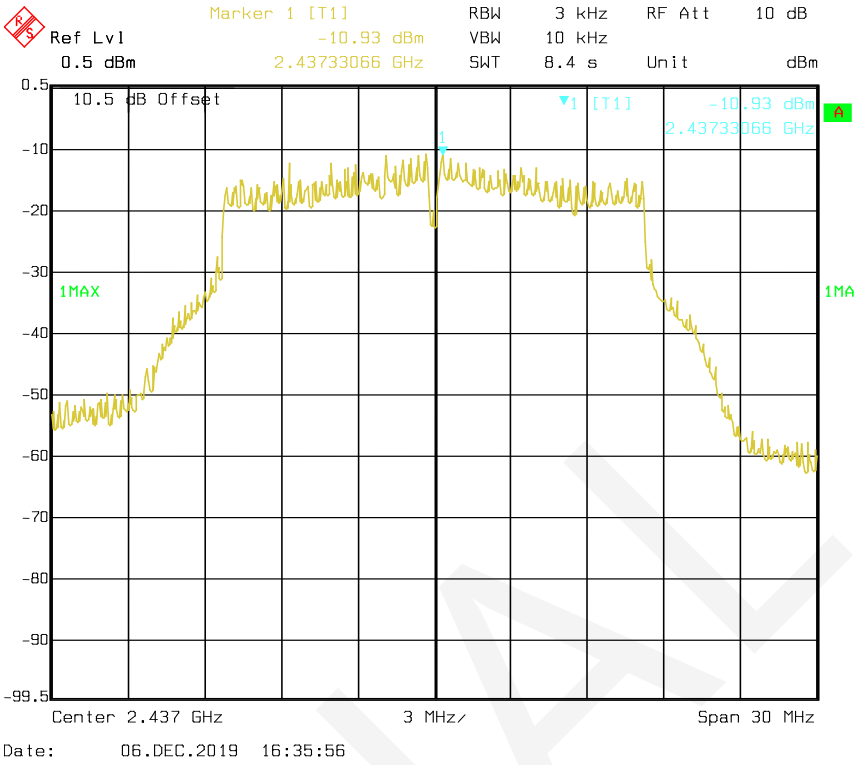
Power Spectral Density, 802.11b High Channel



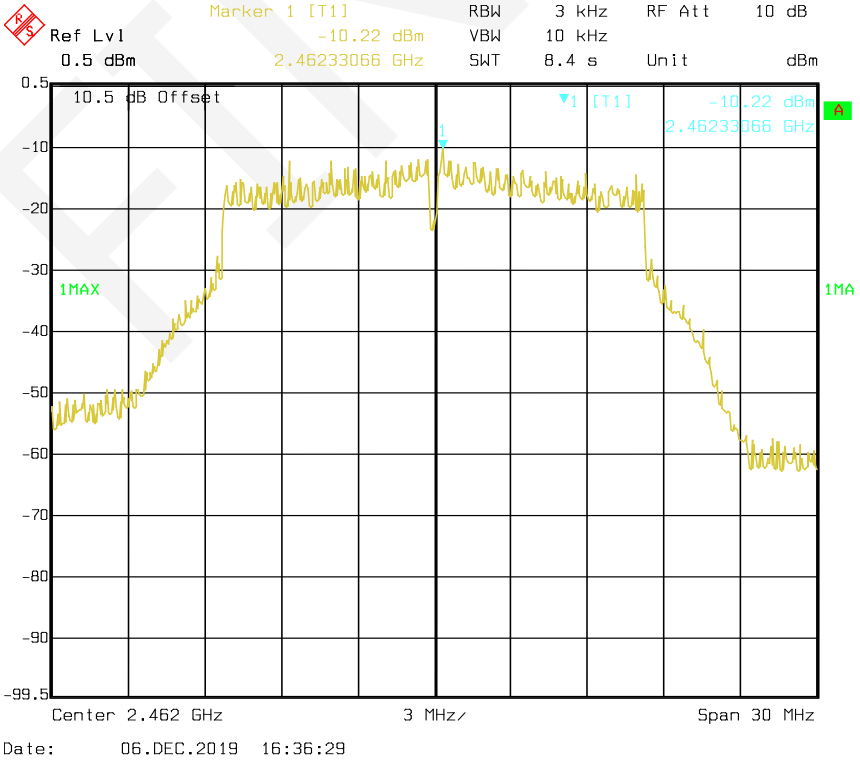
Power Spectral Density, 802.11g Low Channel



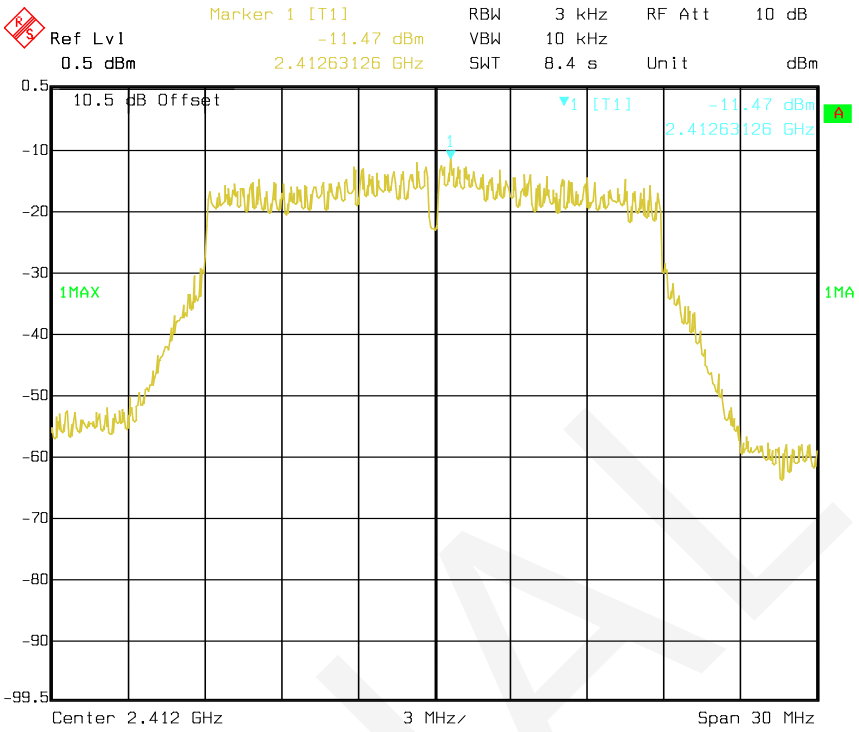
Power Spectral Density, 802.11g Middle Channel



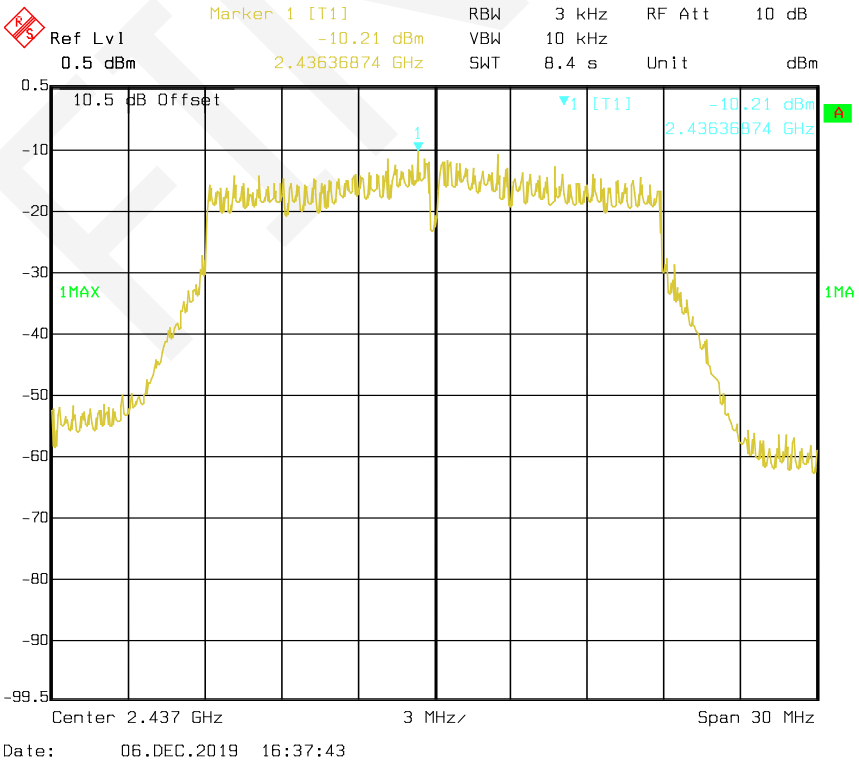
Power Spectral Density, 802.11g High Channel



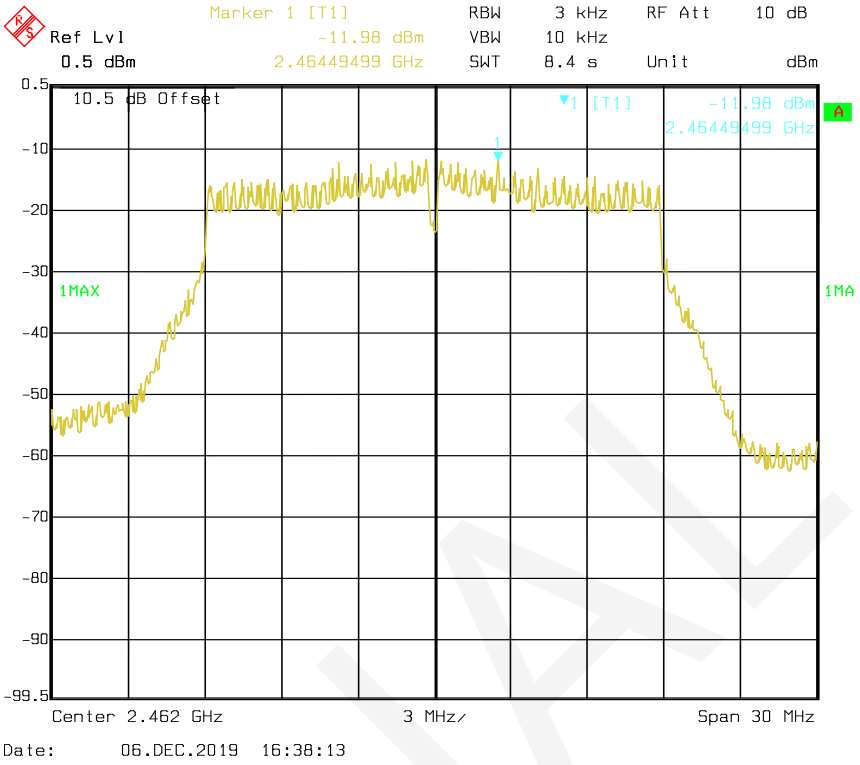
Power Spectral Density, 802.11n-HT20 Low Channel



Power Spectral Density, 802.11n-HT20 Middle Channel

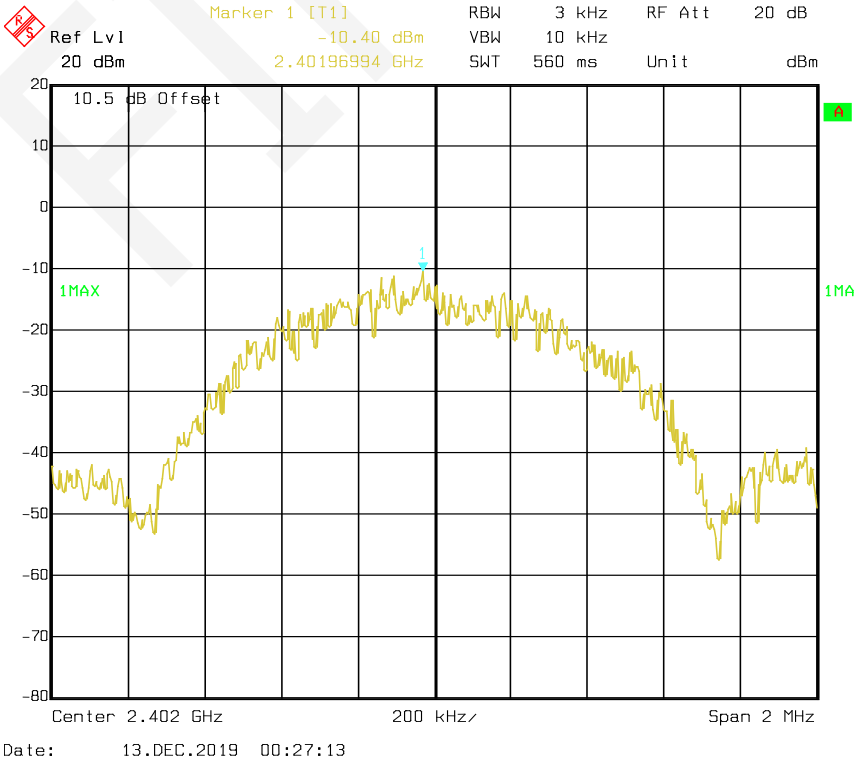


Power Spectral Density, 802.11n-HT20 High Channel

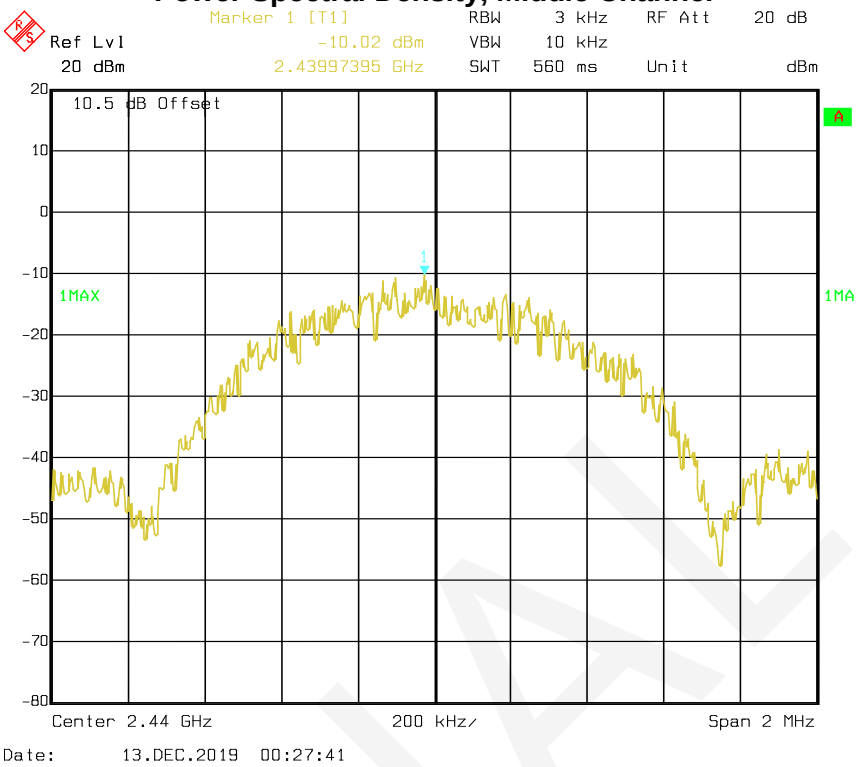


BLE mode

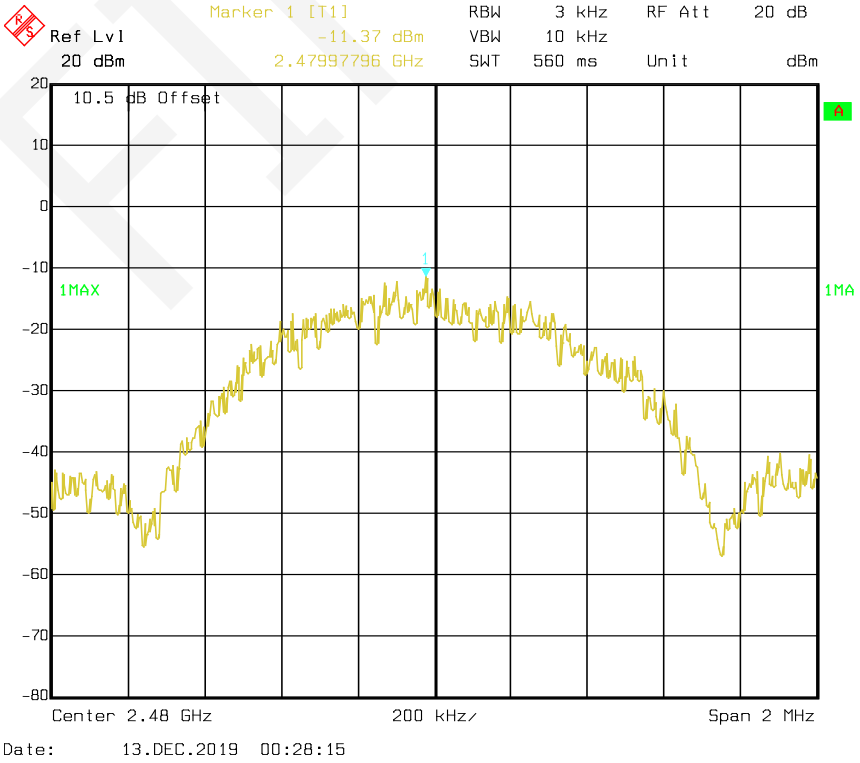
Power Spectral Density, Low Channel



Power Spectral Density, Middle Channel



Power Spectral Density, High Channel



END OF REPORT