FCC PART 15.247

TEST REPORT

For

Chengdu Vantron Technology, Ltd.

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

FCC ID: 2AAGEBTADE-PKR

Report Type:	**Product Name:**
Original Report	M2M Gateway

Report Number:	RSC180713001-0D
Report Date:	2018-08-08
Reviewed By:	Sula Huang Engineering Director
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)

The ***Chengdu Vantron Technology, Ltd.***'s product, model number: ***VT-M2M-BTA-DE-PKR*** **(FCC ID: 2AAGEBTADE-PKR)** or the "EUT" as referred to in this report was the ***M2M Gateway***.

Mechanical Description of EUT

The EUT was measured approximately: 176 mm (L) x 101 mm (W) x 52 mm (H).
Rated input voltage: DC9-36V (Typical: 12V) from adaptor.

Adaptor Information:
Manufacturer: Shenzhen Wentong Electronic Co., Ltd
Model: WT1205000
Input: AC 100-240V; 50/60Hz; 1.6A
Output: DC 12V, 5A

**All measurement and test data in this report was gathered from final production sample, serial number: 180713001/01 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2018-06-29, and EUT conformed to test requirement.*

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 15B JBC submissions with FCC ID: 2AAGEBTADE-PKR
FCC Part 15.247 DSS submissions with FCC ID: 2AAGEBTADE-PKR

Measurement Uncertainty

Item			Uncertainty
AC power line conducted emission			2.93 dB
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.63 dB
		V	4.88 dB
	200MHz-1GHz	H	5.02 dB
		V	6.06 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℃

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 v04.

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 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	-	-

For 802.11b, 802.11g, and 802.11n HT20 modes were tested with Channel 1, 6 and 11.

For 802.11n-HT40 mode, 7 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	7	2442
4	2427	8	2447
5	2432	9	2452
6	2437	-	-

802.11n HT40 was tested with Channel 3, 6 and 9.

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.

For 2-FSK mode, 3 channels are provided for testing:

Channel	Frequency (MHz)
0	902.9898
1	908.8693
2	914.7488

EUT was tested with channel 0, 1 and 2.

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	CCK 1M	CCK 1M	CCK 1M
	Power Level Setting Antenna	63	63	63
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	OFDM 6M	OFDM 6M	OFDM 6M
	Power Level Setting Antenna	63	63	63
802.11n-HT20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting Antenna	63	63	63
802.11n-HT40	Test Frequency	2422MHz	2437MHz	2452MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting Antenna	63	63	63

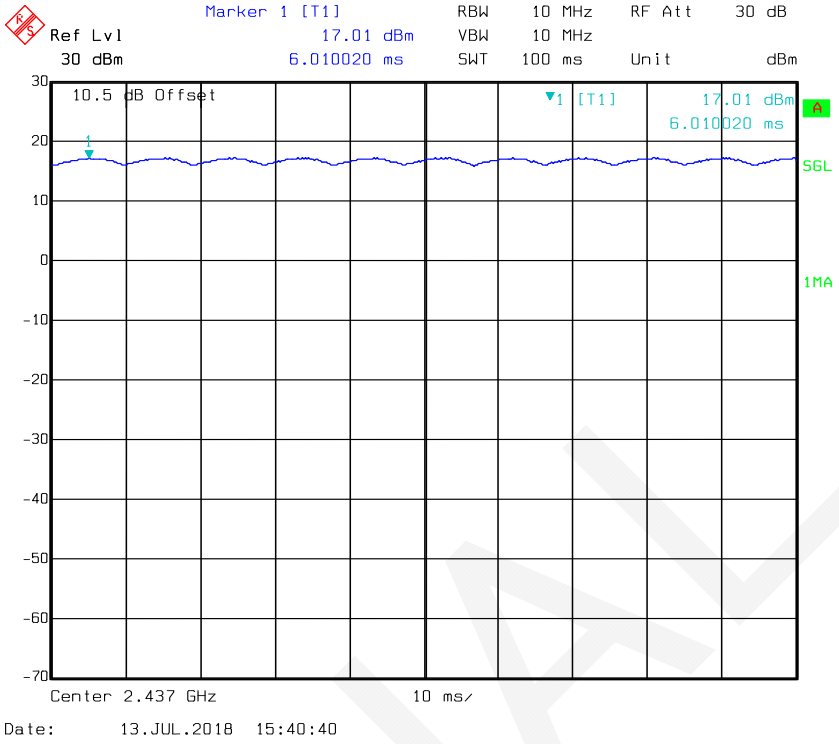
Test Mode	Test Software Version	SSCOM		
2-FSK	Test Frequency	902.9898	908.8693	914.7488
	Data Rate	Default	Default	Default
	Power Level Setting	Default	Default	Default

Test Mode	Test Software Version	CSR		
BLE	Test Frequency	2402MHz	2440MHz	2480MHz
	Data Rate	Default	Default	Default
	Power Level Setting	Default	Default	Default

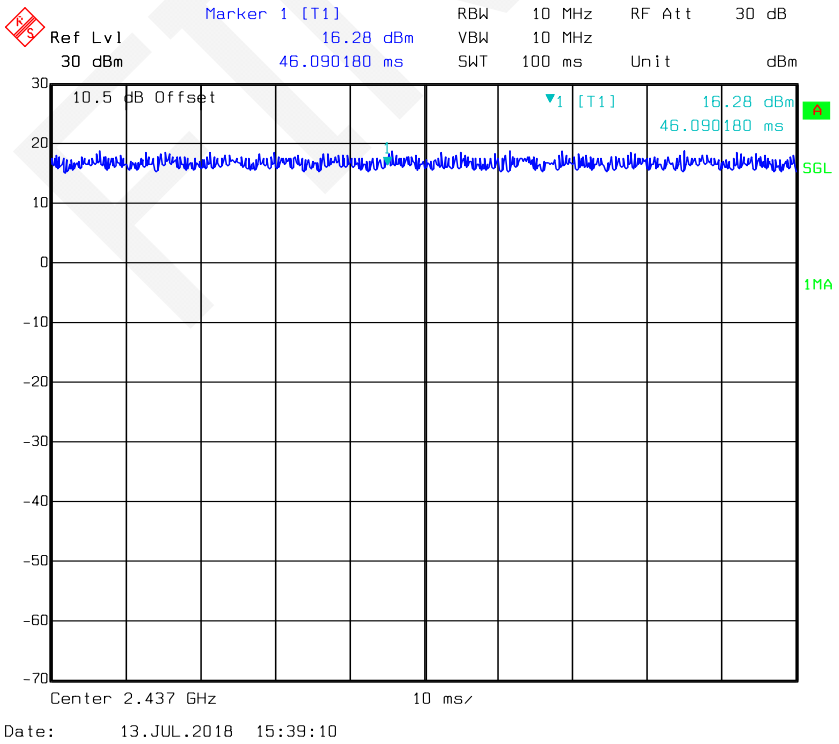
Duty Cycle information is below:

Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
802.11b	100	100	100
802.11g	100	100	100
802.11n-HT20	100	100	100
802.11n-HT40	100	100	100
BLE	100	100	100
2-FSK	100	100	100

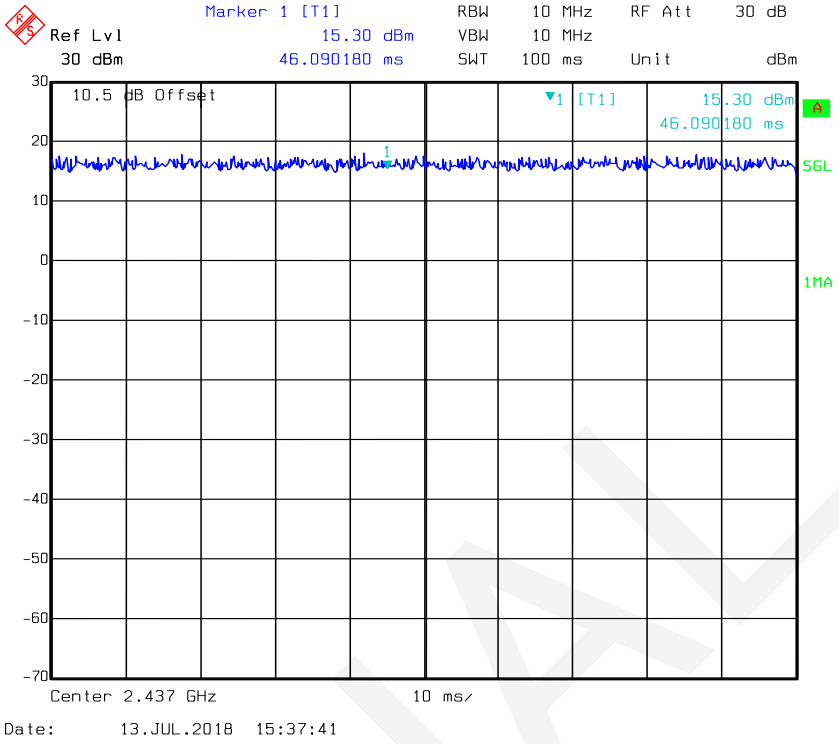
802.11b



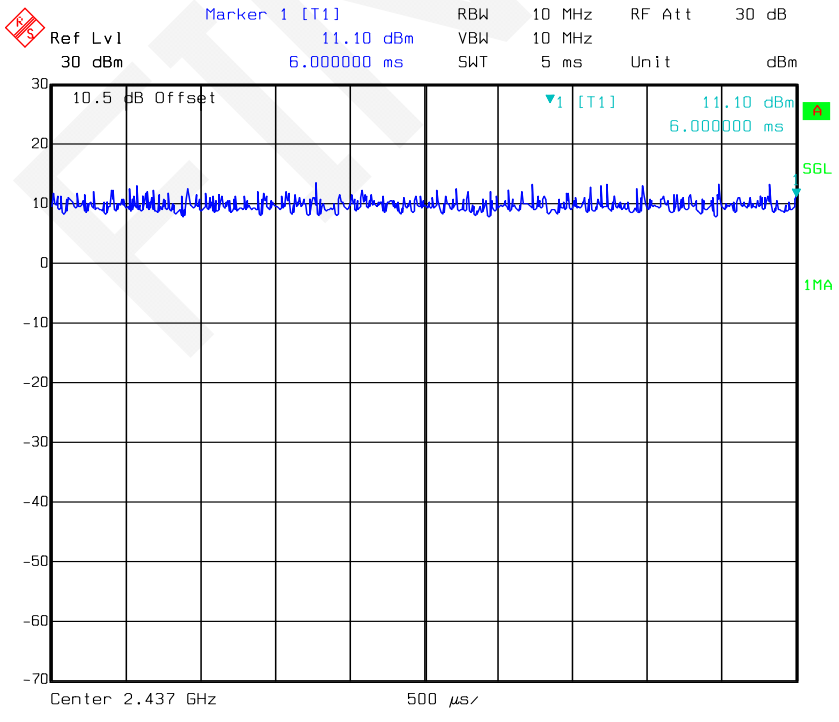
802.11g



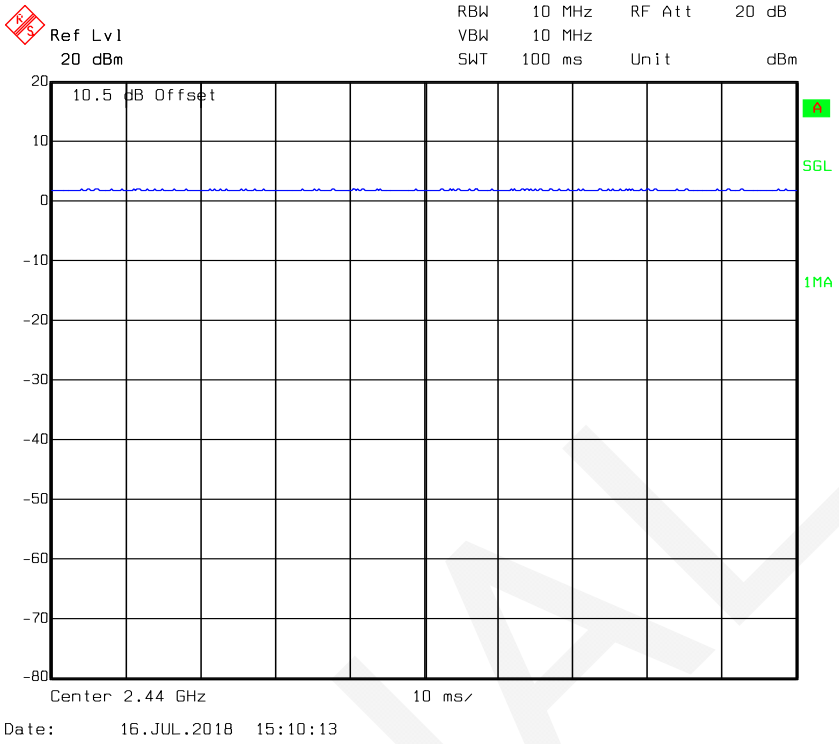
802.11n-HT20



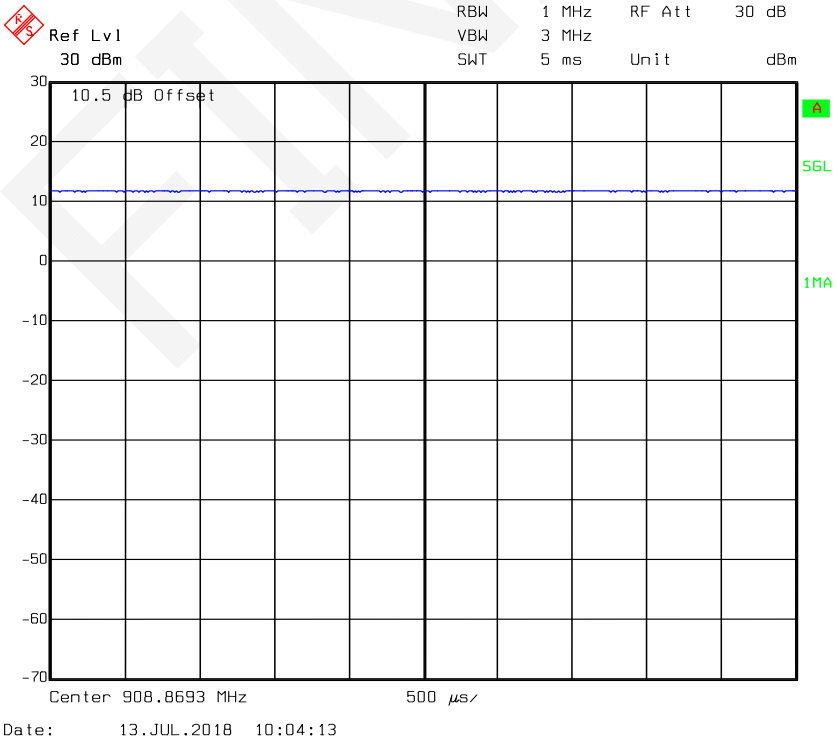
802.11n-HT40



Bluetooth LE mode



2-FSK



Support Equipment List and Details

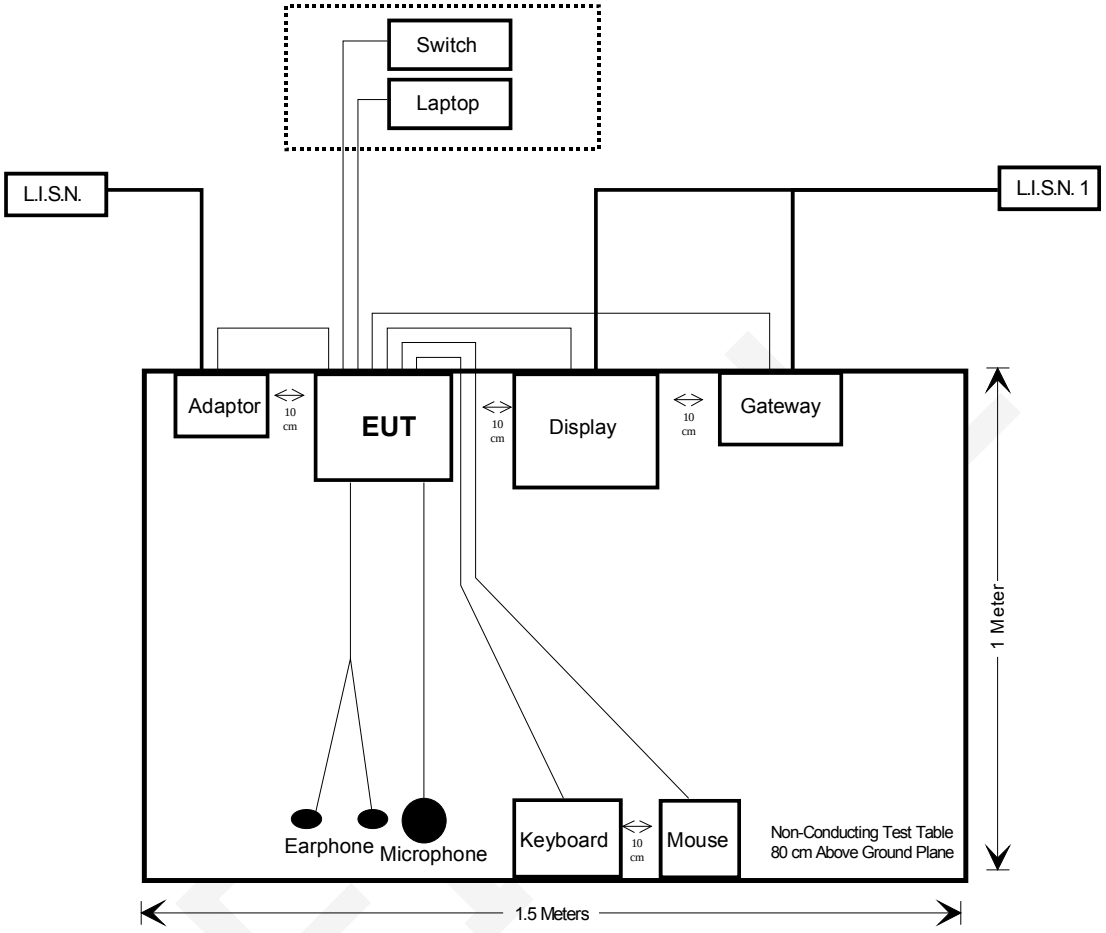
Manufacturer	Description	Model	Serial Number
Logitech	Mouse	M-U0004	810-001808
LAPOP	Keyboard	JT-505	JT5056UBD200312
DL	Switch	DL-S1005PM	None
HUAWEI	Earphone	P9	None
ANTER	Gateway	EGW802	0508350054-1B
DELL	Display	E157FPC	060229-11
NUBWO	Microphone	NO101	None
SONY	Laptop	SVF143A1QT	None

External I/O Cable

Cable Description	Length (m)	From	To
Unshielded DC Power Cable	1.0	Adaptor	EUT
Unshielded USB Cable	1.5	EUT	Mouse
Unshielded USB Cable	1.5	EUT	Keyboard
Unshielded Earphone Cable	1.0	EUT	Earphone
Unshielded Microphone Cable	1.5	EUT	Microphone
Unshielded RJ45 Cable x2	10	EUT	Switch
Unshielded RS232 Cable	1.8	EUT	Gateway
Unshielded VGA Cable	1.8	EUT	Display
Unshielded RJ45 Cable	10	EUT	Laptop

Block Diagram of Test Setup

Conducted Emissions



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

TEST EQUIPMENTS LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission					
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2018-04-18	2019-04-17
Rohde & Schwarz	L.I.S.N.	ENV216	100018	2018-04-18	2019-04-17
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 Emission					
EMCT	Semi-Anechoic Chamber	966	N/A	2017-05-18	2020-05-17
Sonoma	Pre-Amplifier	310N	186684	2017-08-18	2018-08-17
Rohde & Schwarz	EMI Test Receiver	ESIB 40	100215	2018-04-18	2019-04-17
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2018-04-18	2019-04-17
A.H. Systems, Inc	Amplifier	PAM-0118P	467	2017-08-10	2018-08-09
EM Electronics	RF Pre-Amplifier	EM18G40	060725	2018-03-28	2019-03-27
SUNOL SCIENCES	Broadband Antenna	JB3	A121808	2017-05-19	2020-05-18
ETS	Horn Antenna	3115	003-6076	2017-05-19	2020-05-18
A.H. Systems, Inc	Horn Antenna	SAS-574	510	2017-05-19	2020-05-18
INMET	Attenuator	18N-6dB	64671	2017-11-10	2018-11-09
Sinoscite.,Co Ltd	Reject Band Filter	BSF 2402-2480MN	0898-005	2017-11-10	2018-11-09
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
Micro-coax	RF Cable (above 1GHz)	T-E209	MFR 64639 2310	2018-03-14	2019-03-13
Rohde & Schwarz	EMC32	N/A	V 8.52.0	N/A	N/A

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2018-05-09	2019-05-08
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2017-11-10	2018-11-09
N/A	RF Cable	NO.3	N/A	2017-11-10	2018-11-09
E-Microwave	DC Block	EMDCB-00036	OE01304225	2017-12-09	2018-12-08
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).

FCC §15.247 & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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);

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

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

Calculated Data:

WiFi + Bluetooth + SRD + WCDMA/LTE module(FCC ID: RI7LE910NAV2)

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	3.0	2.00	17.0	50.12	20	0.020	1.0
BT 3.0	2402-2480	3.0	2.00	5.5	3.55	20	0.001	1.0
BLE	2402-2480	3.0	2.00	0.1	1.02	20	0.0004	1.0
SRD	902.9898-914.7488	3.0	2.00	12.0	15.85	20	0.006	0.60
WCDMA Band 5	826.4-846.6	3.0	2.00	24.5	281.84	20	0.112	0.55
LTE Band 5	824.7-848.3	3.0	2.00	24.0	251.19	20	0.100	0.55
WCDMA Band 2	1852.4-1907.6	5.0	3.16	24.5	281.84	20	0.177	1.0
LTE Band 2	1850.7-1909.3	5.0	3.16	24.0	251.19	20	0.158	1.0
LTE Band 4	1710.7-1754.3	5.0	3.16	24.0	251.19	20	0.158	1.0
LTE Band 12	699-716	3.0	2.00	24.0	251.19	20	0.100	0.47
LTE Band 13	777-787	3.0	2.00	24.0	251.19	20	0.100	0.52
LTE Band 17	704-715.9	3.0	2.00	24.0	251.19	20	0.100	0.47

MPE evaluation for simultaneous transmission:

Note: Wi-Fi & Bluetooth & SRD & WCDMA/LTE can transmit at the same time, MPE evaluation is as below formula:

PD1/Limit1+PD2/Limit2+……＜1, PD (Power Density)

The worst case is as below:

Max MPE of Wi-Fi + Max MPE of Bluetooth + Max MPE of SRD + Max MPE of LTE
= 0.02/1.0+0.001/1.0+0.006/0.60+0.10/0.47=0.244＜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

The EUT has five external antennas (one 2.4G Wi-Fi antenna, one Bluetooth antennas, one SRD antenna, one LTE main antenna and one LTE diversity antenna), fulfill the requirement of this section. Please refer to the EUT external photos.

Antenna	Manufacturer	Model	Antenna Gain (Max)	Antenna Connector
WLAN	Dongguan Guoxu Electronics Communication Co.,Ltd.	GX042S.100001.S01	3dBi (2400-2500MHz)	Reverse SMA(male)
Bluetooth	Dongguan Guoxu Electronics Communication Co.,Ltd.	GX042S.100001.S01	3dBi (2400-2500MHz)	Reverse SMA(male)
SRD	Pulse Electronics	W1063	3dBi (902-928MHz)	Reverse SMA(male)
LTE Main	Asian Creation	AC-Q7027-YZW	3dBi (698-960MHz) 5dBi (1710-2700MHz)	SMA(male)
LTE Diversity	Asian Creation	AC-Q7027-YZW	3dBi (698-960MHz) 5dBi (1710-2700MHz)	SMA(male)

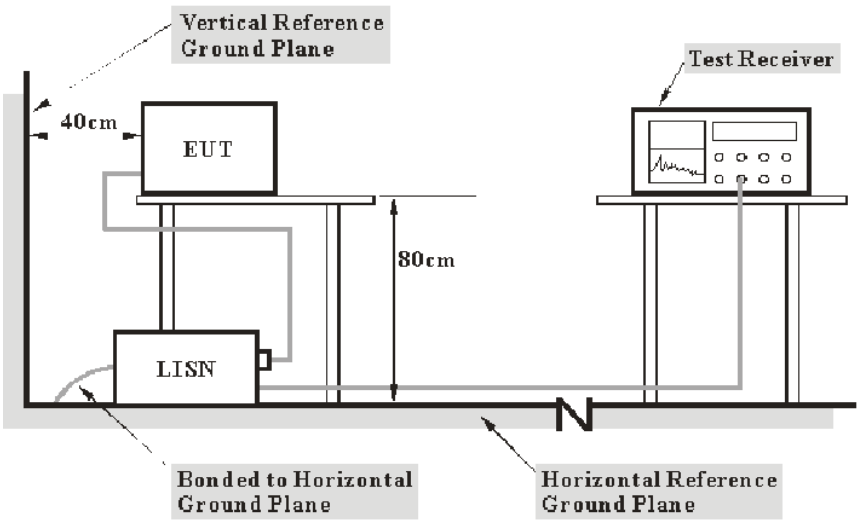
Result: Compliance

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.

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

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

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	60 %
ATM Pressure:	94.9 kPa

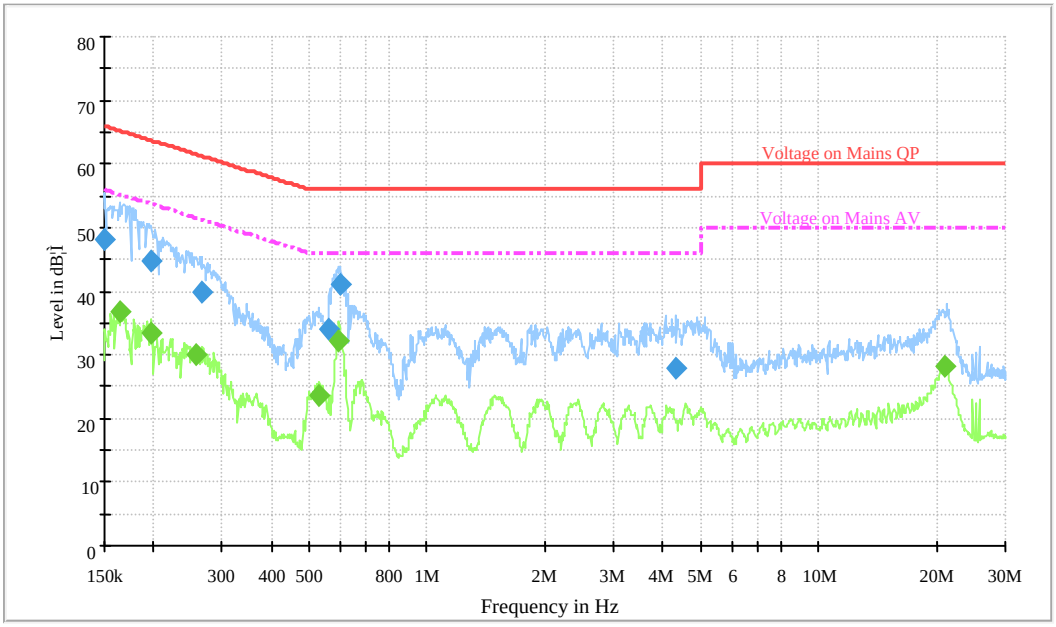
The testing was performed by Tom Tang on 2018-07-16.

Test Mode: Transmitting

Wi-Fi Mode

802.11n20-Low channel - Worst Case

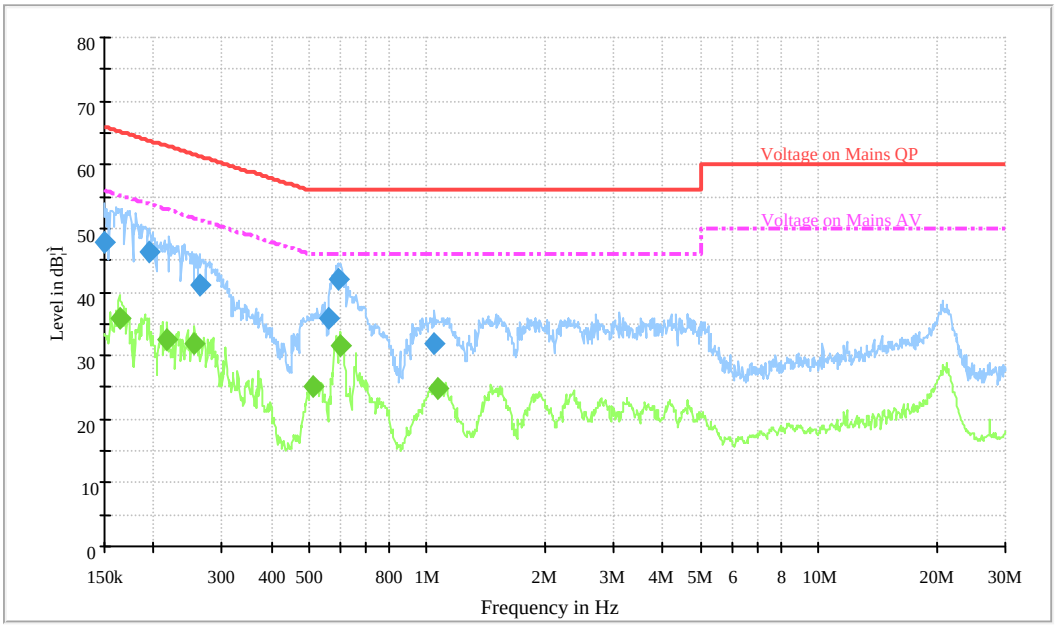
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.150600	48.2	9.000	L1	19.7	17.8	66.0
0.196781	44.8	9.000	L1	19.7	18.9	63.7
0.266530	39.9	9.000	L1	19.7	21.3	61.2
0.562277	33.9	9.000	L1	19.7	22.1	56.0
0.599363	41.1	9.000	L1	19.7	14.9	56.0
4.323921	28.0	9.000	L1	19.8	28.0	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.165082	36.8	9.000	L1	19.7	18.4	55.2
0.197569	33.3	9.000	L1	19.7	20.4	53.7
0.257124	30.0	9.000	L1	19.7	21.5	51.5
0.531715	23.7	9.000	L1	19.7	22.3	46.0
0.596975	32.1	9.000	L1	19.7	13.9	46.0
21.010095	28.1	9.000	L1	20.1	21.9	50.0

AC120 V, 60 Hz, Neutral:



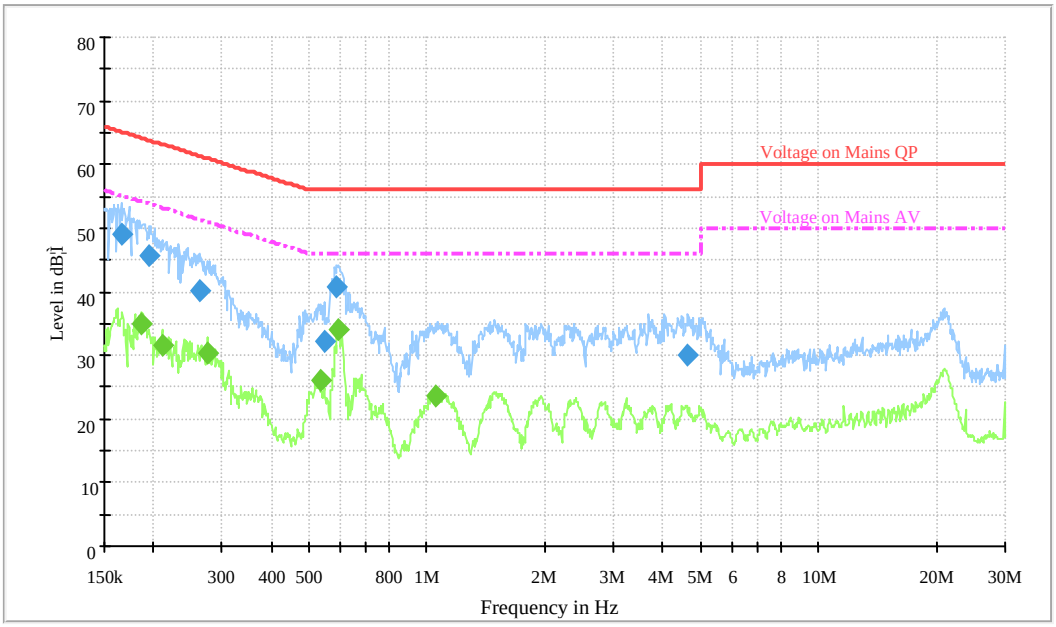
Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.150000	47.9	9.000	N	19.7	18.1	66.0
0.195997	46.2	9.000	N	19.7	17.6	63.8
0.262308	41.2	9.000	N	19.8	20.2	61.4
0.562277	36.0	9.000	N	19.8	20.0	56.0
0.594597	42.1	9.000	N	19.8	13.9	56.0
1.043941	31.9	9.000	N	19.7	24.1	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.163770	35.9	9.000	N	19.7	19.4	55.3
0.217434	32.4	9.000	N	19.7	20.5	52.9
0.255079	31.8	9.000	N	19.8	19.8	51.6
0.512950	25.0	9.000	N	19.8	21.0	46.0
0.601760	31.6	9.000	N	19.8	14.4	46.0
1.060745	25.0	9.000	N	19.7	21.0	46.0

BLE Mode

Low channel-worst case

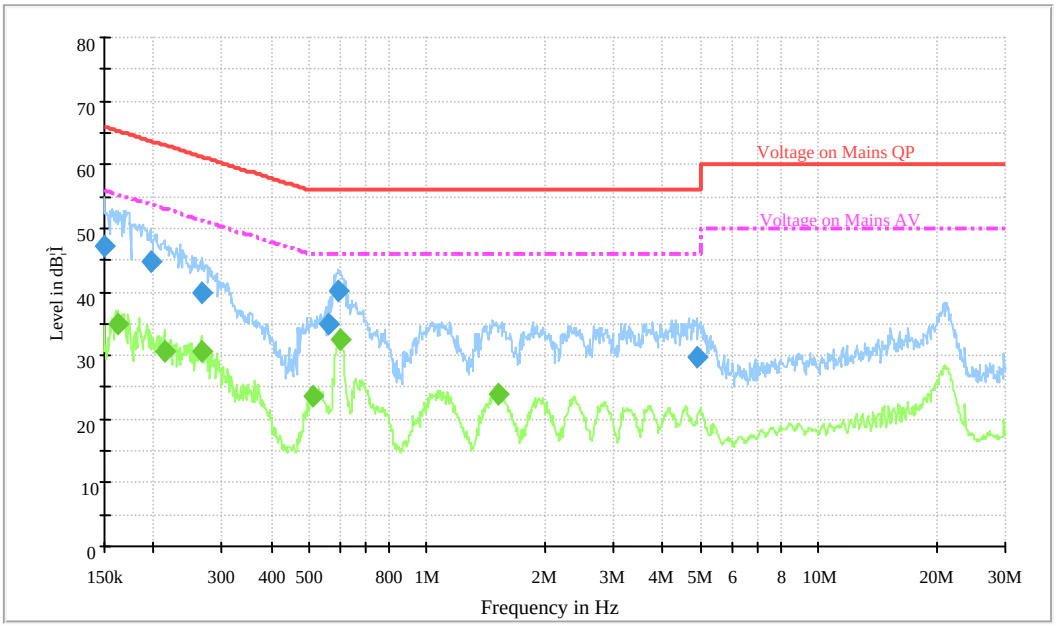
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.166406	49.2	9.000	L1	19.6	15.9	65.1
0.195997	45.8	9.000	L1	19.7	18.0	63.8
0.262308	40.3	9.000	L1	19.7	21.1	61.4
0.548969	32.3	9.000	L1	19.7	23.7	56.0
0.589868	40.7	9.000	L1	19.7	15.3	56.0
4.646057	30.2	9.000	L1	19.8	25.8	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.187577	34.9	9.000	L1	19.7	19.3	54.1
0.210599	31.5	9.000	L1	19.7	21.7	53.2
0.275179	30.3	9.000	L1	19.7	20.6	51.0
0.533841	26.2	9.000	L1	19.7	19.8	46.0
0.596975	33.9	9.000	L1	19.7	12.1	46.0
1.048117	23.7	9.000	L1	19.6	22.3	46.0

AC120 V, 60 Hz, Neutral:



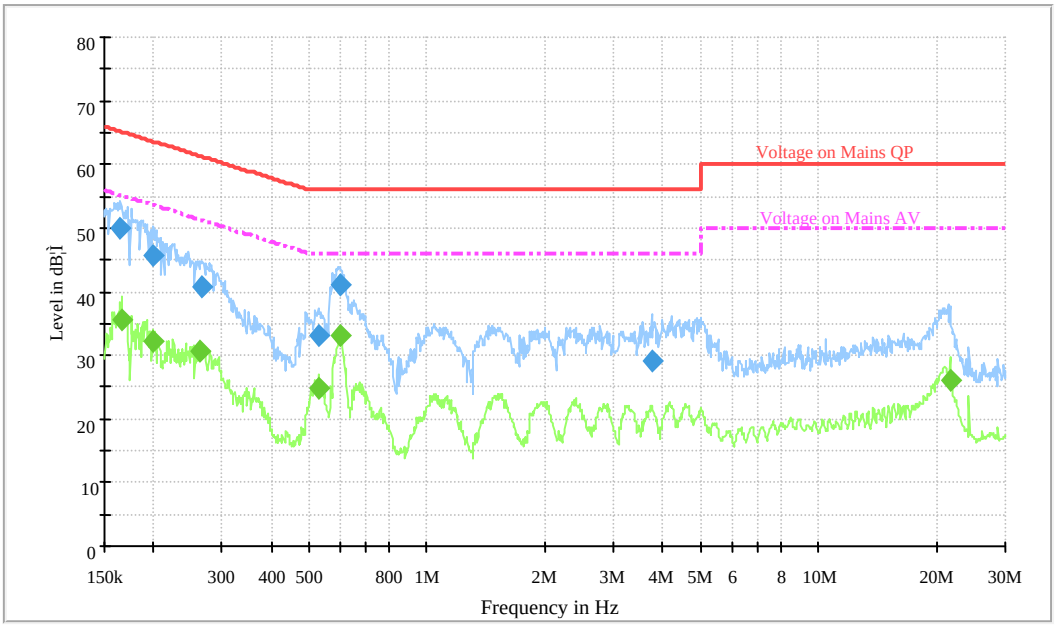
Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.150000	47.2	9.000	N	19.7	18.8	66.0
0.196781	44.7	9.000	N	19.7	19.0	63.7
0.267596	39.7	9.000	N	19.7	21.5	61.2
0.562277	35.0	9.000	N	19.8	21.0	56.0
0.594597	40.2	9.000	N	19.8	15.8	56.0
4.874040	29.8	9.000	N	19.9	26.2	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.161820	34.9	9.000	N	19.7	20.5	55.4
0.213137	30.5	9.000	N	19.7	22.6	53.1
0.265468	30.7	9.000	N	19.8	20.6	51.3
0.512950	23.6	9.000	N	19.8	22.4	46.0
0.601760	32.4	9.000	N	19.8	13.6	46.0
1.513252	24.0	9.000	N	19.8	22.0	46.0

2-FSK Mode

Low channel-worst case

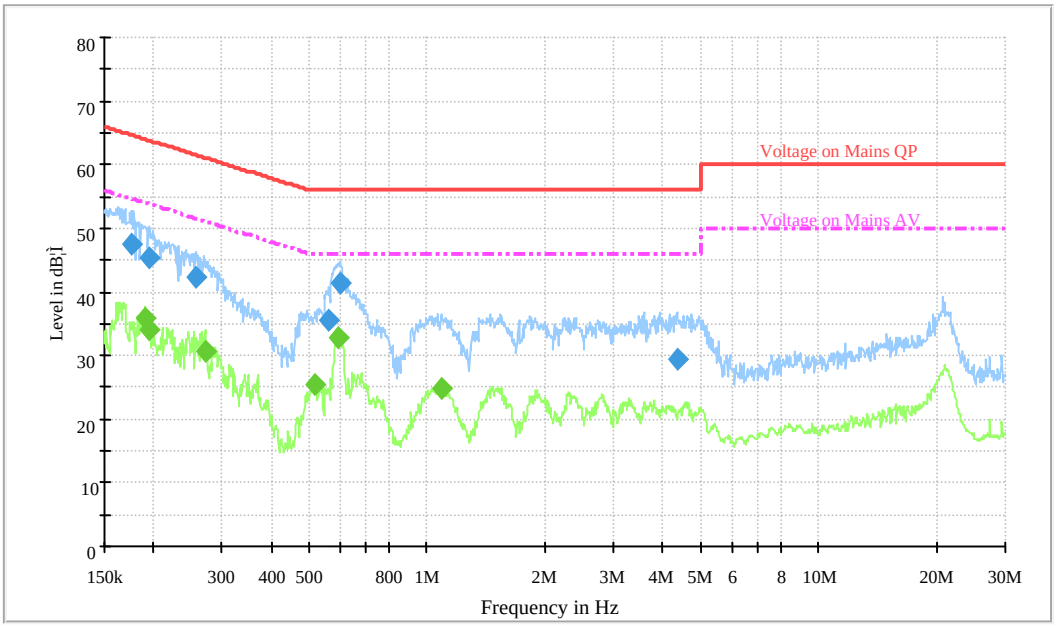
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.165082	50.0	9.000	L1	19.7	15.2	65.2
0.200749	45.6	9.000	L1	19.7	18.0	63.6
0.265468	40.7	9.000	L1	19.7	20.5	61.3
0.527486	33.0	9.000	L1	19.7	23.0	56.0
0.599363	41.0	9.000	L1	19.7	15.0	56.0
3.745106	29.0	9.000	L1	19.8	27.0	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.166406	35.6	9.000	L1	19.6	19.5	55.1
0.199949	32.3	9.000	L1	19.7	21.3	53.6
0.263357	30.7	9.000	L1	19.7	20.7	51.3
0.529596	24.9	9.000	L1	19.7	21.1	46.0
0.599363	33.2	9.000	L1	19.7	12.8	46.0
21.691906	25.9	9.000	L1	20.1	24.1	50.0

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.175971	47.7	9.000	N	19.7	17.0	64.7
0.195997	45.4	9.000	N	19.7	18.4	63.8
0.258153	42.3	9.000	N	19.8	19.2	61.5
0.562277	35.5	9.000	N	19.8	20.5	56.0
0.601760	41.4	9.000	N	19.8	14.6	56.0
4.358581	29.5	9.000	N	19.9	26.5	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.190596	35.9	9.000	N	19.7	18.1	54.0
0.195997	33.9	9.000	N	19.7	19.9	53.8
0.270820	30.8	9.000	N	19.7	20.3	51.1
0.515002	25.3	9.000	N	19.8	20.7	46.0
0.594597	32.9	9.000	N	19.8	13.1	46.0
1.090804	24.7	9.000	N	19.7	21.3	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

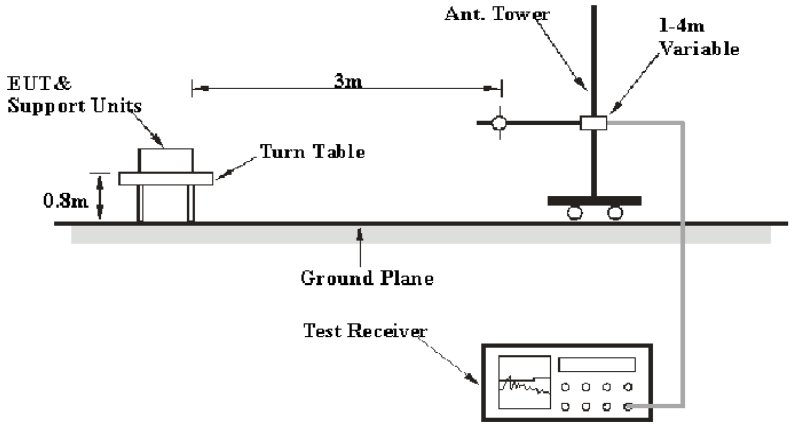
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

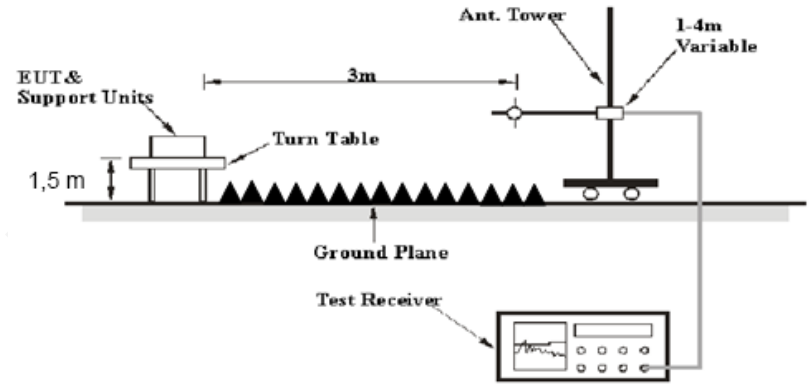
FCC §15.247 (d); §15.209; §15.205;

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.

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

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 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	Detector
30 MHz–1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	AV

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

Environmental Conditions

Temperature:	28 ~ 29 °C
Relative Humidity:	59 ~ 62 %
ATM Pressure:	94.9 ~ 95.1 kPa

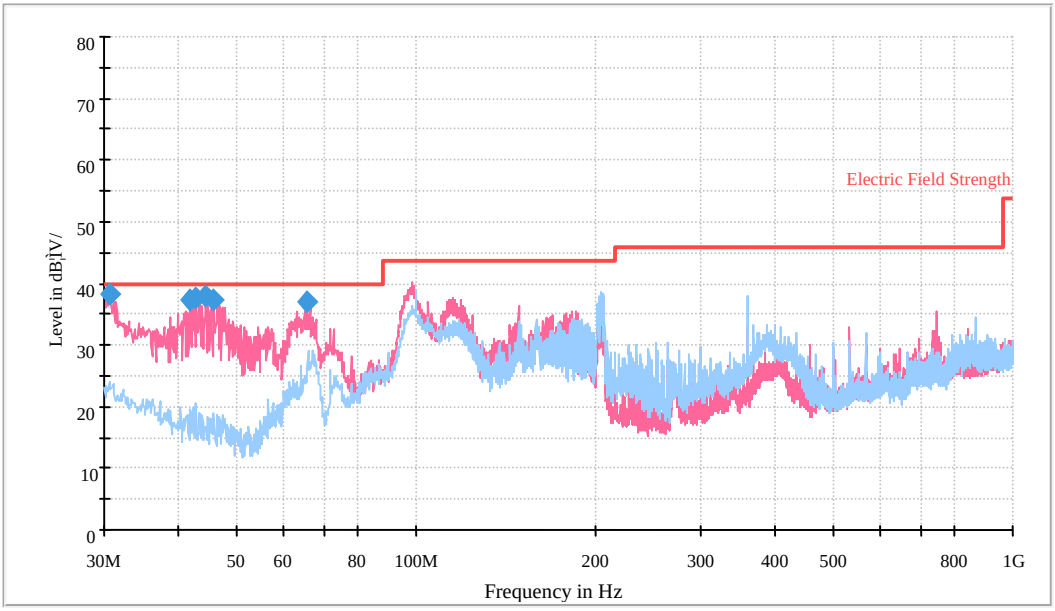
** The testing was performed by Tom Tang on 2018-08-01 to 2018-08-03.*

Test Mode: Transmitting

Wi-Fi Mode

30 MHz to 1 GHz

802.11n20-Low channel - Worst Case



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m)	Margin (dB)	Limit (dBµV/m)
30.606250	38.4	100.0	V	341.0	-5.2	*1.6	40.0
41.882500	37.3	100.0	V	121.0	-12.4	*2.7	40.0
42.852500	37.5	100.0	V	0.0	-13.0	*2.5	40.0
44.428750	38.1	100.0	V	91.0	-13.9	*1.9	40.0
45.883750	37.5	100.0	V	76.0	-14.7	*2.5	40.0
65.768750	36.9	100.0	V	267.0	-16.9	*3.1	40.0

**Within measurement uncertainty!*

Above 1 GHz

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/m)	dB	dB	dBµV/m	dBµV/m	dB
Frequency: 2412MHz									
2412	69.93	PK	H	28.74	3.07	0.00	101.74	N/A	N/A
2412	65.55	AV	H	28.74	3.07	0.00	97.36	N/A	N/A
2412	77.88	PK	V	28.74	3.07	0.00	109.69	N/A	N/A
2412	73.53	AV	V	28.74	3.07	0.00	105.34	N/A	N/A
2390	28.99	PK	V	28.67	3.06	0.00	60.72	74.00	13.28
2390	16.95	AV	V	28.67	3.06	0.00	48.68	54.00	5.32
4824	49.77	PK	V	33.91	4.36	44.72	43.32	74.00	30.68
4824	36.53	AV	V	33.91	4.36	44.72	30.08	54.00	23.92
7236	46.36	PK	V	36.43	5.42	44.00	44.21	74.00	29.79
7236	33.35	AV	V	36.43	5.42	44.00	31.20	54.00	22.80
Frequency: 2437MHz									
2437	70.09	PK	H	28.81	3.09	0.00	101.99	N/A	N/A
2437	65.73	AV	H	28.81	3.09	0.00	97.63	N/A	N/A
2437	77.02	PK	V	28.81	3.09	0.00	108.92	N/A	N/A
2437	72.70	AV	V	28.81	3.09	0.00	104.60	N/A	N/A
4874	48.90	PK	V	34.05	4.39	44.72	42.62	74.00	31.39
4874	35.87	AV	V	34.05	4.39	44.72	29.59	54.00	24.41
7311	45.67	PK	V	36.54	5.44	44.20	43.45	74.00	30.56
7311	33.11	AV	V	36.54	5.44	44.20	30.89	54.00	23.12
Frequency: 2462MHz									
2462	70.25	PK	H	28.89	3.10	0.00	102.24	N/A	N/A
2462	65.91	AV	H	28.89	3.10	0.00	97.90	N/A	N/A
2462	76.15	PK	V	28.89	3.10	0.00	108.14	N/A	N/A
2462	71.87	AV	V	28.89	3.10	0.00	103.86	N/A	N/A
2483.5	30.18	PK	V	28.95	3.12	0.00	62.25	74.00	11.75
2483.5	17.26	AV	V	28.95	3.12	0.00	49.33	54.00	4.67
4924	48.02	PK	V	34.19	4.42	44.71	41.92	74.00	32.08
4924	35.21	AV	V	34.19	4.42	44.71	29.11	54.00	24.89
7386	44.97	PK	V	36.64	5.46	44.40	42.67	74.00	31.33
7386	32.86	AV	V	36.64	5.46	44.40	30.56	54.00	23.44

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/m)	dB	dB	dBµV/m	dBµV/m	dB
Frequency: 2412MHz									
2412	68.46	PK	H	28.74	3.07	0.00	100.27	N/A	N/A
2412	58.53	AV	H	28.74	3.07	0.00	90.34	N/A	N/A
2412	75.43	PK	V	28.74	3.07	0.00	107.24	N/A	N/A
2412	65.71	AV	V	28.74	3.07	0.00	97.52	N/A	N/A
2390	31.26	PK	V	28.67	3.06	0.00	62.99	74.00	11.01
2390	17.25	AV	V	28.67	3.06	0.00	48.98	54.00	5.02
4824	48.99	PK	V	33.91	4.36	44.72	42.54	74.00	31.46
4824	36.21	AV	V	33.91	4.36	44.72	29.76	54.00	24.24
7236	46.02	PK	V	36.43	5.42	44.00	43.87	74.00	30.13
7236	32.94	AV	V	36.43	5.42	44.00	30.79	54.00	23.21
Frequency: 2437MHz									
2437	68.60	PK	H	28.81	3.09	0.00	100.50	N/A	N/A
2437	58.87	AV	H	28.81	3.09	0.00	90.77	N/A	N/A
2437	75.00	PK	V	28.81	3.09	0.00	106.90	N/A	N/A
2437	65.60	AV	V	28.81	3.09	0.00	97.50	N/A	N/A
4874	48.81	PK	V	34.05	4.39	44.72	42.53	74.00	31.47
4874	36.22	AV	V	34.05	4.39	44.72	29.94	54.00	24.06
7311	45.92	PK	V	36.54	5.44	44.20	43.70	74.00	30.30
7311	32.57	AV	V	36.54	5.44	44.20	30.35	54.00	23.65
Frequency: 2462MHz									
2462	68.57	PK	H	28.89	3.10	0.00	100.56	N/A	N/A
2462	58.87	AV	H	28.89	3.10	0.00	90.86	N/A	N/A
2462	74.43	PK	V	28.89	3.10	0.00	106.42	N/A	N/A
2462	65.03	AV	V	28.89	3.10	0.00	97.02	N/A	N/A
2483.5	33.15	PK	V	28.95	3.12	0.00	65.22	74.00	8.78
2483.5	18.66	AV	V	28.95	3.12	0.00	50.73	54.00	*3.27
4924	48.24	PK	V	34.19	4.42	44.71	42.14	74.00	31.86
4924	35.84	AV	V	34.19	4.42	44.71	29.74	54.00	24.26
7386	45.21	PK	V	36.64	5.46	44.40	42.91	74.00	31.09
7386	32.15	AV	V	36.64	5.46	44.40	29.85	54.00	24.15

**Within measurement uncertainty!*

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/m)	dB	dB	dBµV/m	dBµV/m	dB
Frequency: 2412MHz									
2412	67.41	PK	H	28.74	3.07	0.00	99.22	N/A	N/A
2412	57.42	AV	H	28.74	3.07	0.00	89.23	N/A	N/A
2412	74.73	PK	V	28.74	3.07	0.00	106.54	N/A	N/A
2412	64.75	AV	V	28.74	3.07	0.00	96.56	N/A	N/A
2390	33.93	PK	V	28.67	3.06	0.00	65.66	74.00	8.34
2390	17.53	AV	V	28.67	3.06	0.00	49.26	54.00	4.74
4824	48.06	PK	V	33.91	4.36	44.72	41.61	74.00	32.39
4824	35.81	AV	V	33.91	4.36	44.72	29.36	54.00	24.64
7236	45.64	PK	V	36.43	5.42	44.00	43.49	74.00	30.51
7236	32.34	AV	V	36.43	5.42	44.00	30.19	54.00	23.81
Frequency: 2437MHz									
2437	67.84	PK	H	28.81	3.09	0.00	99.74	N/A	N/A
2437	57.94	AV	H	28.81	3.09	0.00	89.84	N/A	N/A
2437	74.34	PK	V	28.81	3.09	0.00	106.24	N/A	N/A
2437	64.84	AV	V	28.81	3.09	0.00	96.74	N/A	N/A
4874	48.26	PK	V	34.05	4.39	44.72	41.98	74.00	32.02
4874	35.84	AV	V	34.05	4.39	44.72	29.56	54.00	24.44
7311	45.16	PK	V	36.54	5.44	44.20	42.94	74.00	31.06
7311	32.01	AV	V	36.54	5.44	44.20	29.79	54.00	24.21
Frequency: 2462MHz									
2462	68.49	PK	H	28.89	3.10	0.00	100.48	N/A	N/A
2462	58.88	AV	H	28.89	3.10	0.00	90.87	N/A	N/A
2462	74.38	PK	V	28.89	3.10	0.00	106.37	N/A	N/A
2462	65.01	AV	V	28.89	3.10	0.00	97.00	N/A	N/A
2483.5	33.41	PK	V	28.95	3.12	0.00	65.48	74.00	8.52
2483.5	18.73	AV	V	28.95	3.12	0.00	50.80	54.00	*3.20
4924	48.56	PK	V	34.19	4.42	44.71	42.46	74.00	31.54
4924	36.04	AV	V	34.19	4.42	44.71	29.94	54.00	24.06
7386	45.18	PK	V	36.64	5.46	44.40	42.88	74.00	31.12
7386	32.06	AV	V	36.64	5.46	44.40	29.76	54.00	24.24

**Within measurement uncertainty!*

802.11n-HT40 Mode

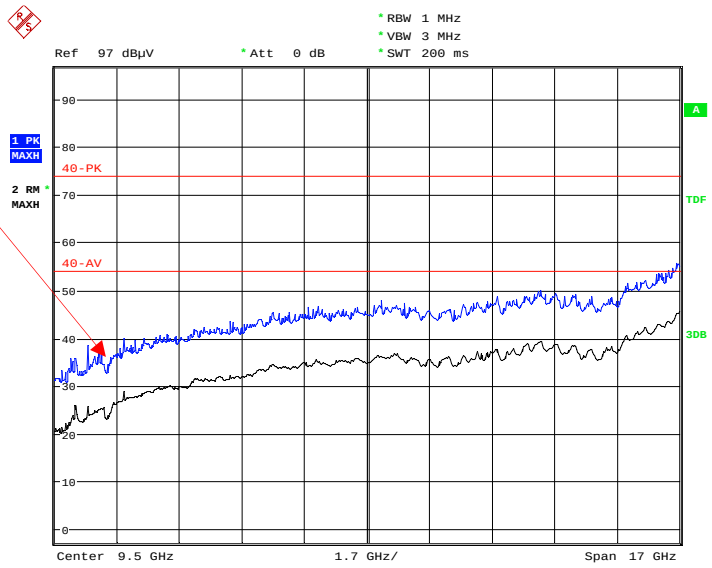
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	(dB/m)	dB	dB	dBμV/m	dBμV/m	dB
Frequency: 2422MHz									
2422	64.58	PK	H	28.77	3.08	0.00	96.43	N/A	N/A
2422	55.06	AV	H	28.77	3.08	0.00	86.91	N/A	N/A
2422	71.31	PK	V	28.77	3.08	0.00	103.16	N/A	N/A
2422	61.33	AV	V	28.77	3.08	0.00	93.18	N/A	N/A
2390	31.56	PK	V	28.67	3.06	0.00	63.29	74.00	10.71
2390	18.43	AV	V	28.67	3.06	0.00	50.16	54.00	*3.84
4844	49.76	PK	V	33.96	4.38	44.72	43.38	74.00	30.62
4844	35.56	AV	V	33.96	4.38	44.72	29.18	54.00	24.82
7266	47.62	PK	V	36.47	5.43	44.08	45.44	74.00	28.56
7266	33.29	AV	V	36.47	5.43	44.08	31.11	54.00	22.89
Frequency: 2437MHz									
2437	64.70	PK	H	28.81	3.09	0.00	96.60	N/A	N/A
2437	55.24	AV	H	28.81	3.09	0.00	87.14	N/A	N/A
2437	70.66	PK	V	28.81	3.09	0.00	102.56	N/A	N/A
2437	60.75	AV	V	28.81	3.09	0.00	92.65	N/A	N/A
4874	49.03	PK	V	34.05	4.39	44.72	42.75	74.00	31.25
4874	35.18	AV	V	34.05	4.39	44.72	28.90	54.00	25.10
7311	47.28	PK	V	36.54	5.44	44.20	45.06	74.00	28.94
7311	32.98	AV	V	36.54	5.44	44.20	30.76	54.00	23.24
Frequency: 2452MHz									
2452	65.18	PK	H	28.86	3.10	0.00	97.14	N/A	N/A
2452	55.62	AV	H	28.86	3.10	0.00	87.58	N/A	N/A
2452	70.16	PK	V	28.86	3.10	0.00	102.12	N/A	N/A
2452	60.29	AV	V	28.86	3.10	0.00	92.25	N/A	N/A
2483.5	32.91	PK	V	28.95	3.12	0.00	64.98	74.00	9.02
2483.5	19.16	AV	V	28.95	3.12	0.00	51.23	54.00	*2.77
4904	48.32	PK	V	34.13	4.41	44.71	42.15	74.00	31.85
4904	34.97	AV	V	34.13	4.41	44.71	28.80	54.00	25.20
7356	47.01	PK	V	36.60	5.45	44.32	44.74	74.00	29.26
7356	32.98	AV	V	36.60	5.45	44.32	30.71	54.00	23.29

**Within measurement uncertainty!*

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

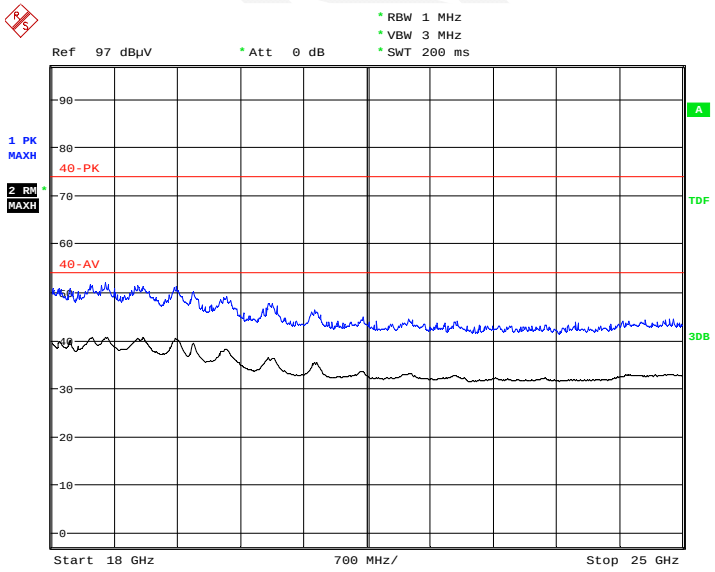
802.11g Mode: High Channel_Horizontal_1GHz-18GHz

Fundamental with Reject Band Filter



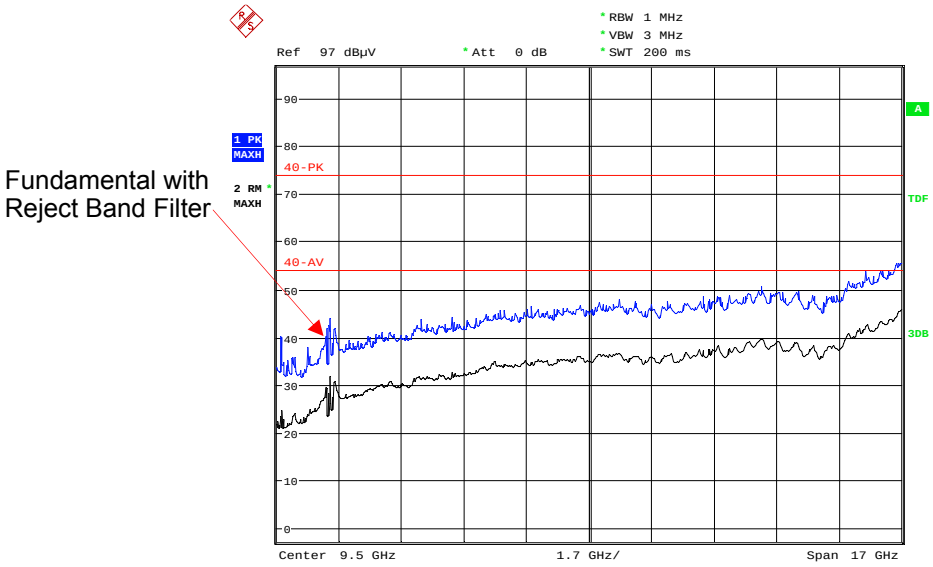
Date: 1.AUG.2018 13:53:24

802.11g Mode: High Channel_Horizontal_18GHz-25GHz



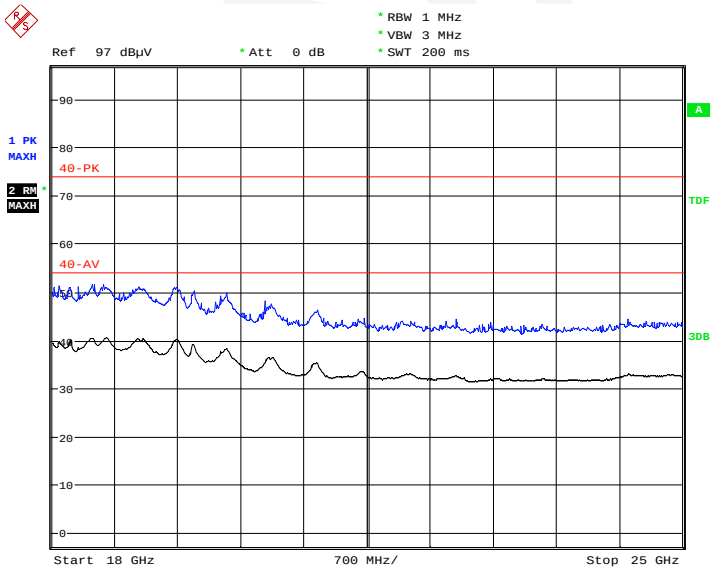
Date: 1.AUG.2018 13:56:09

802.11g Mode: High Channel_Vertical_1GHz-18GHz



Date: 1.AUG.2018 13:52:25

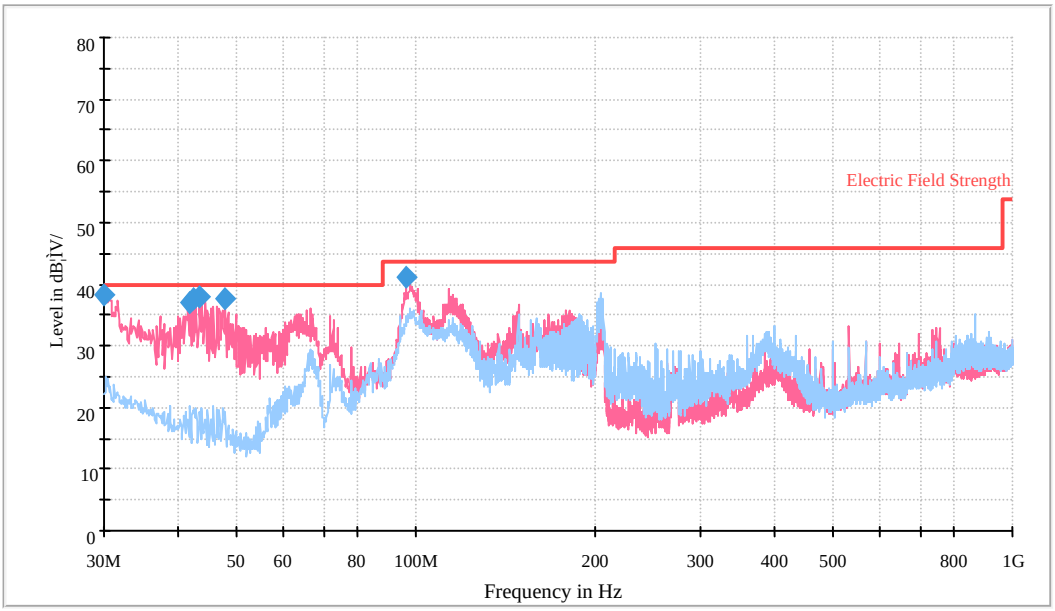
802.11g Mode: High Channel_Vertical_18GHz-25GHz



Date: 1.AUG.2018 13:55:20

BLE Mode

30 MHz to 1 GHz
Low channel-worst case



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m)	Margin (dB)	Limit (dBµV/m)
30.000000	38.2	100.0	V	0.0	-4.8	*1.8	40.0
41.882500	37.0	100.0	V	311.0	-12.4	*3.0	40.0
42.367500	37.7	100.0	V	333.0	-12.7	*2.3	40.0
43.337500	37.9	100.0	V	355.0	-13.3	*2.1	40.0
47.823750	37.5	100.0	V	8.0	-15.8	*2.5	40.0
96.202500	41.0	100.0	V	39.0	-16.4	*2.5	43.5

**Within measurement uncertainty!*

Above 1 GHz

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	(dB/m)	dB	dB	dBμV/m	dBμV/m	dB
frequency: 2402MHz									
2402	48.22	PK	H	28.71	3.06	0.00	79.99	N/A	N/A
2402	42.32	AV	H	28.71	3.06	0.00	74.09	N/A	N/A
2402	58.94	PK	V	28.71	3.06	0.00	90.71	N/A	N/A
2402	53.41	AV	V	28.71	3.06	0.00	85.18	N/A	N/A
2390	27.23	PK	V	28.67	3.06	0.00	58.96	74.00	15.04
2390	16.04	AV	V	28.67	3.06	0.00	47.77	54.00	6.23
4804	54.24	PK	V	33.85	4.35	44.73	47.71	74.00	26.29
4804	45.49	AV	V	33.85	4.35	44.73	38.96	54.00	15.04
7206	47.08	PK	V	36.39	5.41	43.92	44.96	74.00	29.04
7206	34.42	AV	V	36.39	5.41	43.92	32.30	54.00	21.70
frequency: 2440MHz									
2440	49.82	PK	H	28.82	3.09	0.00	81.73	N/A	N/A
2440	43.78	AV	H	28.82	3.09	0.00	75.69	N/A	N/A
2440	61.67	PK	V	28.82	3.09	0.00	93.58	N/A	N/A
2440	56.29	AV	V	28.82	3.09	0.00	88.20	N/A	N/A
4880	58.19	PK	V	34.06	4.40	44.72	51.93	74.00	22.07
4880	50.01	AV	V	34.06	4.40	44.72	43.75	54.00	10.25
7320	47.18	PK	V	36.55	5.44	44.22	44.95	74.00	29.05
7320	34.14	AV	V	36.55	5.44	44.22	31.91	54.00	22.09
frequency: 2480MHz									
2480	53.49	PK	H	28.94	3.12	0.00	85.55	N/A	N/A
2480	48.14	AV	H	28.94	3.12	0.00	80.20	N/A	N/A
2480	65.01	PK	V	28.94	3.12	0.00	97.07	N/A	N/A
2480	59.99	AV	V	28.94	3.12	0.00	92.05	N/A	N/A
2483.5	29.99	PK	V	28.95	3.12	0.00	62.06	74.00	11.94
2483.5	19.83	AV	V	28.95	3.12	0.00	51.90	54.00	*2.10
4960	62.11	PK	V	34.29	4.44	44.71	56.13	74.00	17.87
4960	54.36	AV	V	34.29	4.44	44.71	48.38	54.00	5.62
7440	46.95	PK	V	36.72	5.48	44.54	44.61	74.00	29.39
7440	33.84	AV	V	36.72	5.48	44.54	31.50	54.00	22.50

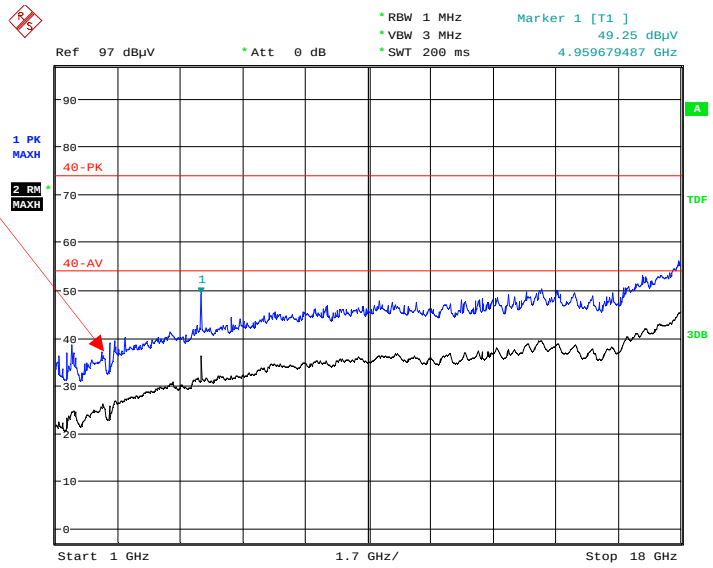
**Within measurement uncertainty!*

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:

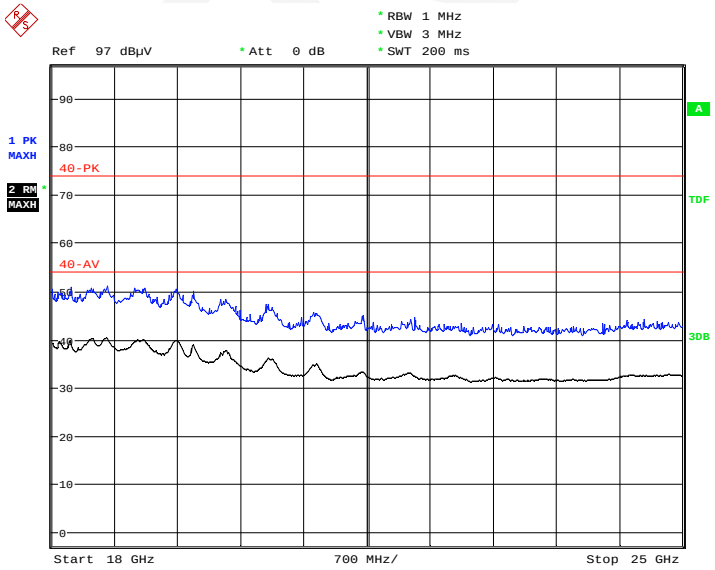
High Channel_Horizontal_1GHz-18GHz

Fundamental with Reject Band Filter



Date: 1.AUG.2018 14:21:46

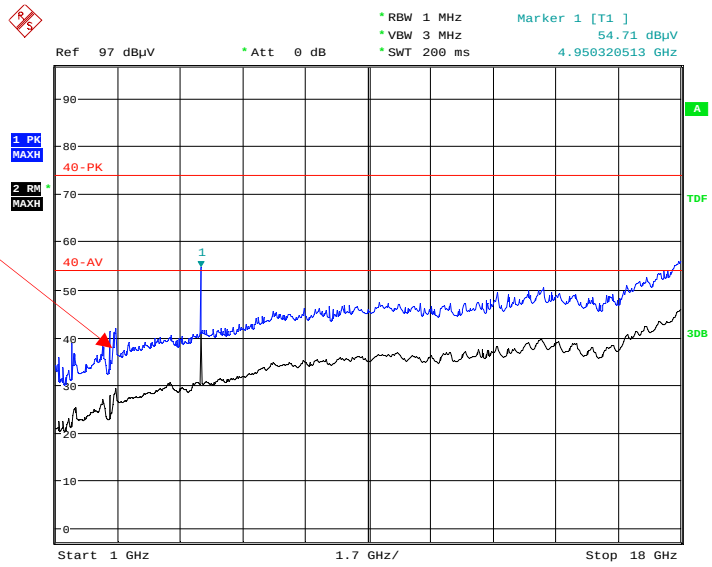
High Channel_Horizontal_18GHz-25GHz



Date: 1.AUG.2018 14:24:55

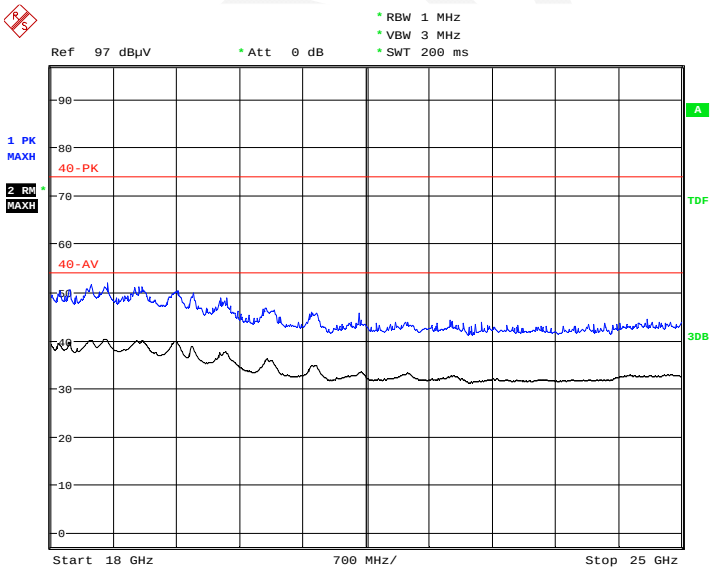
High Channel_Vertical_1GHz-18GHz

Fundamental with Reject Band Filter



Date: 1.AUG.2018 14:17:02

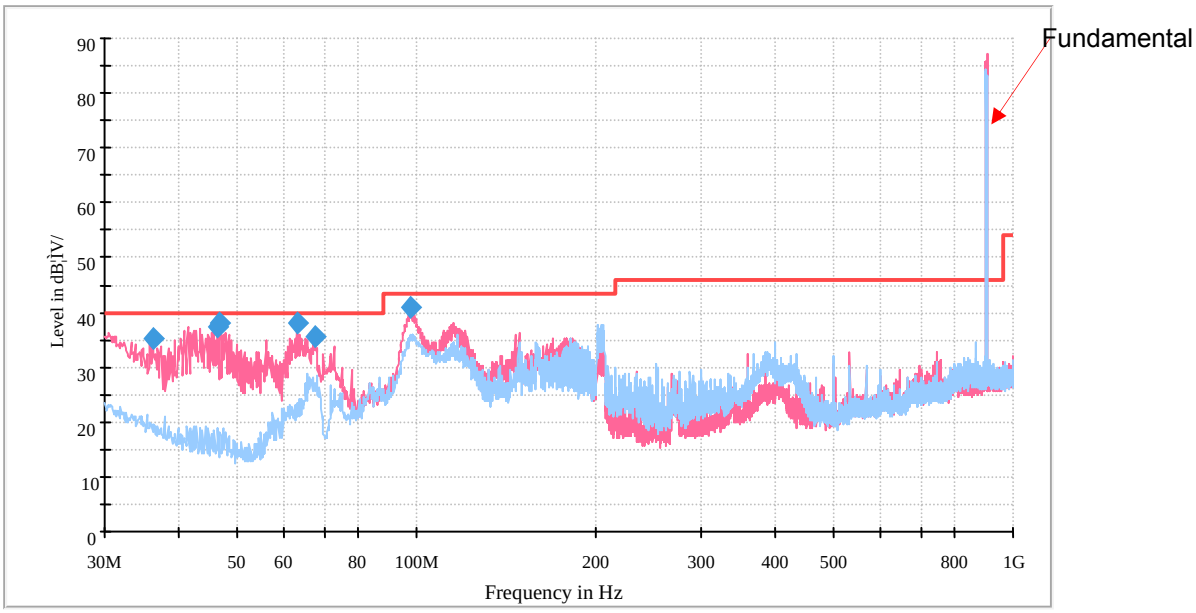
High Channel_Vertical_18GHz-25GHz



Date: 1.AUG.2018 14:23:03

2-FSK Mode

30 MHz to 1 GHz
Low channel-worst case



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m)	Margin (dB)	Limit (dBµV/m)
36.183750	35.3	100.0	V	85.0	-8.9	*4.7	40.0
46.368750	37.4	100.0	V	69.0	-15.0	*2.6	40.0
46.853750	38.2	100.0	V	128.0	-15.3	*1.8	40.0
62.980000	38.0	100.0	V	281.0	-17.4	*2.0	40.0
67.587500	35.5	100.0	V	295.0	-16.8	*4.5	40.0
97.536250	40.8	100.0	V	348.0	-16.1	*2.7	43.5

**Within measurement uncertainty!*

Fundamental and Above 1 GHz

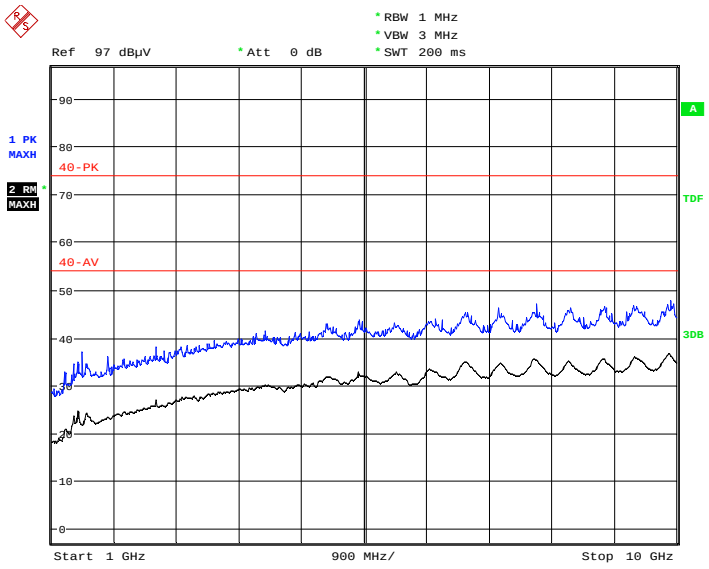
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBµV	PK/QP/AV	H/V	(dB/m)	dB	dB	dBµV/m	dBµV/m	dB
frequency: 902.9898MHz									
902.9898	74.81	QP	H	22.84	2.40	0.00	100.05	N/A	N/A
902.9898	79.16	QP	V	22.84	2.40	0.00	104.40	N/A	N/A
902.0000	35.18	QP	V	22.82	2.40	0.00	60.40	84.00	23.60
1805.9796	57.38	PK	V	26.53	2.65	43.63	42.93	74.00	31.07
1805.9796	52.88	AV	V	26.53	2.65	43.63	38.43	54.00	15.57
2708.9694	52.36	PK	V	29.67	3.25	44.13	41.15	74.00	32.85
2708.9694	41.62	AV	V	29.67	3.25	44.13	30.41	54.00	23.59
frequency: 908.8693MHz									
908.8693	75.31	QP	H	22.91	2.42	0.00	100.64	N/A	N/A
908.8693	78.91	QP	V	22.91	2.42	0.00	104.24	N/A	N/A
1817.7386	56.31	PK	V	26.59	2.66	43.63	41.93	74.00	32.07
1817.7386	50.36	AV	V	26.59	2.66	43.63	35.98	54.00	18.02
2726.6079	51.57	PK	V	29.73	3.26	44.14	40.42	74.00	33.58
2726.6079	41.16	AV	V	29.73	3.26	44.14	30.01	54.00	23.99
frequency: 914.7488MHz									
914.7488	75.49	QP	H	22.98	2.45	0.00	100.92	N/A	N/A
914.7488	78.24	QP	V	22.98	2.45	0.00	103.67	N/A	N/A
928.0000	23.49	QP	V	23.14	2.50	0.00	49.13	83.67	34.54
1829.4976	55.25	PK	V	26.65	2.67	43.63	40.94	74.00	33.06
1829.4976	49.36	AV	V	26.65	2.67	43.63	35.05	54.00	18.95
2744.2464	51.62	PK	V	29.78	3.27	44.15	40.52	74.00	33.48
2744.2464	41.86	AV	V	29.78	3.27	44.15	30.76	54.00	23.24

**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.

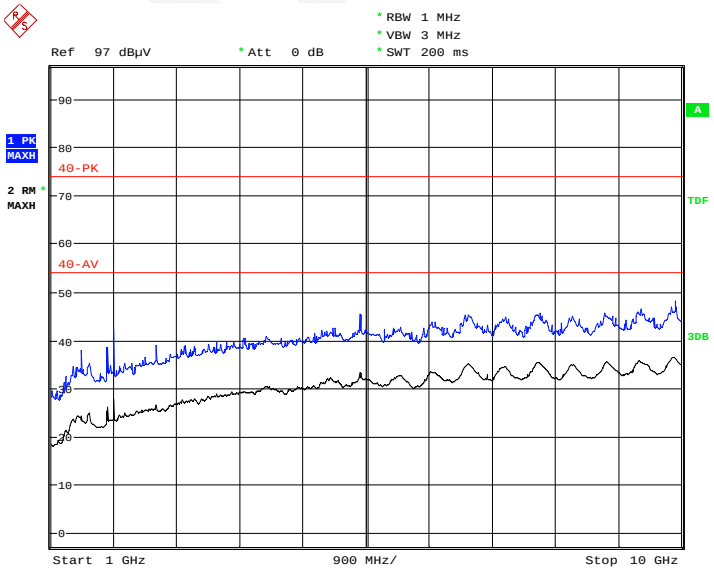
Please refer to the below pre-scan plot of worst case:

Low Channel_Horizontal_1GHz-10GHz



Date: 3.AUG.2018 15:40:34

Low Channel_Vertical_1GHz-10GHz



Date: 3.AUG.2018 15:39:10

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:	26 ~ 28 °C
Relative Humidity:	56 ~ 58 %
ATM Pressure:	94.8 ~ 95.0 kPa

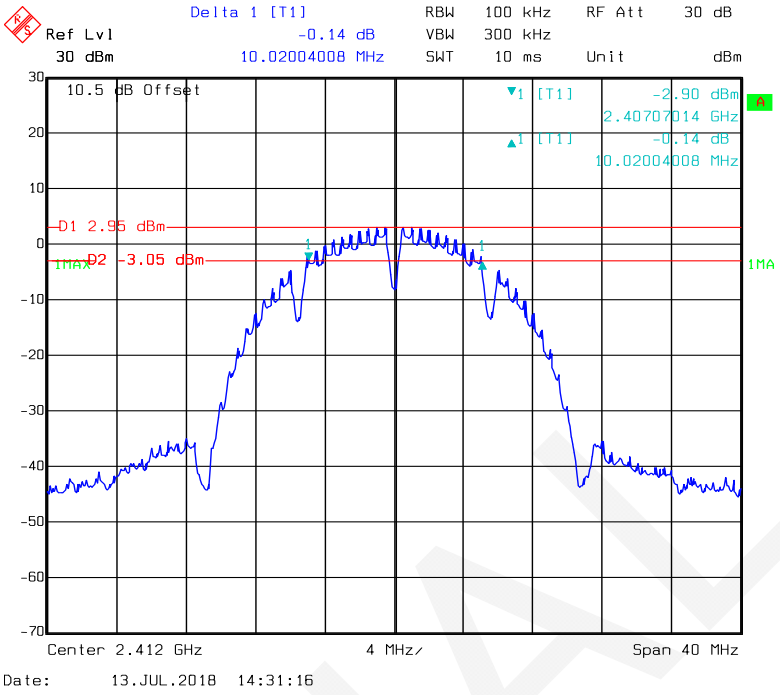
** The testing was performed by Tom Tang on 2018-07-13 and 2018-07-16.*

Test Mode: Transmitting

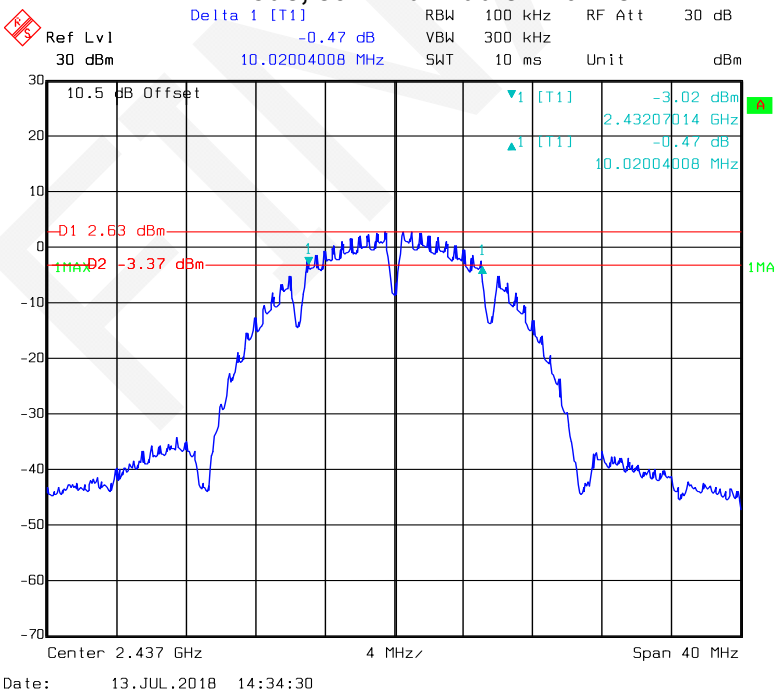
Test Result: Compliance. Please refer to the following table and plots.

Mode	Channel	Frequency (MHz)	6dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	10.02	≥0.50
	Middle	2437	10.02	≥0.50
	High	2462	10.02	≥0.50
802.11g	Low	2412	16.59	≥0.50
	Middle	2437	16.59	≥0.50
	High	2462	16.59	≥0.50
802.11n-HT20	Low	2412	17.80	≥0.50
	Middle	2437	17.80	≥0.50
	High	2462	17.80	≥0.50
802.11n-HT40	Low	2422	36.39	≥0.50
	Middle	2437	36.39	≥0.50
	High	2452	36.39	≥0.50
BLE	Low	2402	0.74	≥0.50
	Middle	2440	0.74	≥0.50
	High	2480	0.73	≥0.50
2-FSK	Low	902.9898	0.57	≥0.50
	Middle	908.8693	0.57	≥0.50
	High	914.7488	0.57	≥0.50

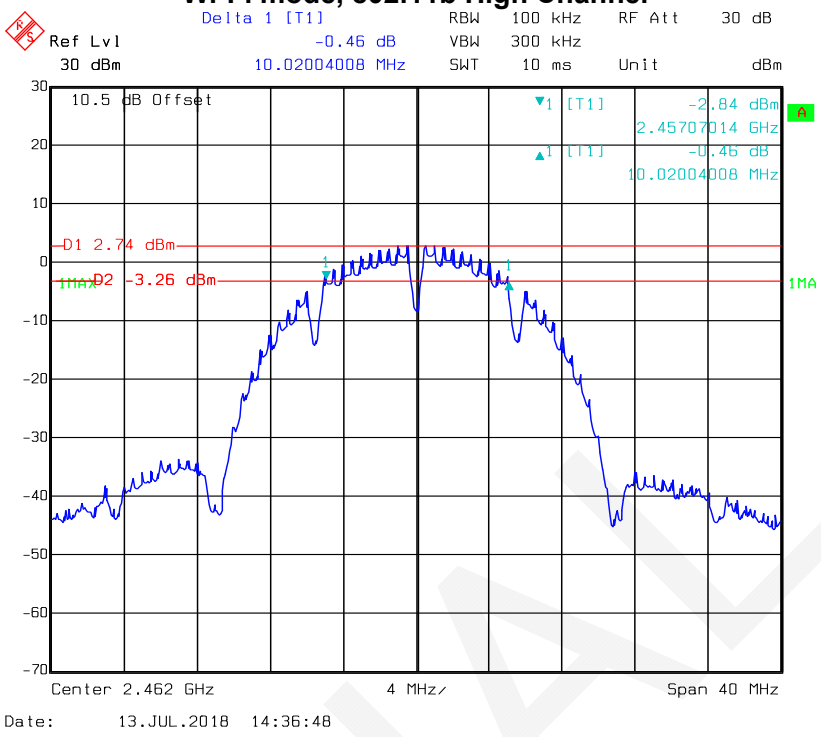
Wi-Fi mode, 802.11b Low Channel



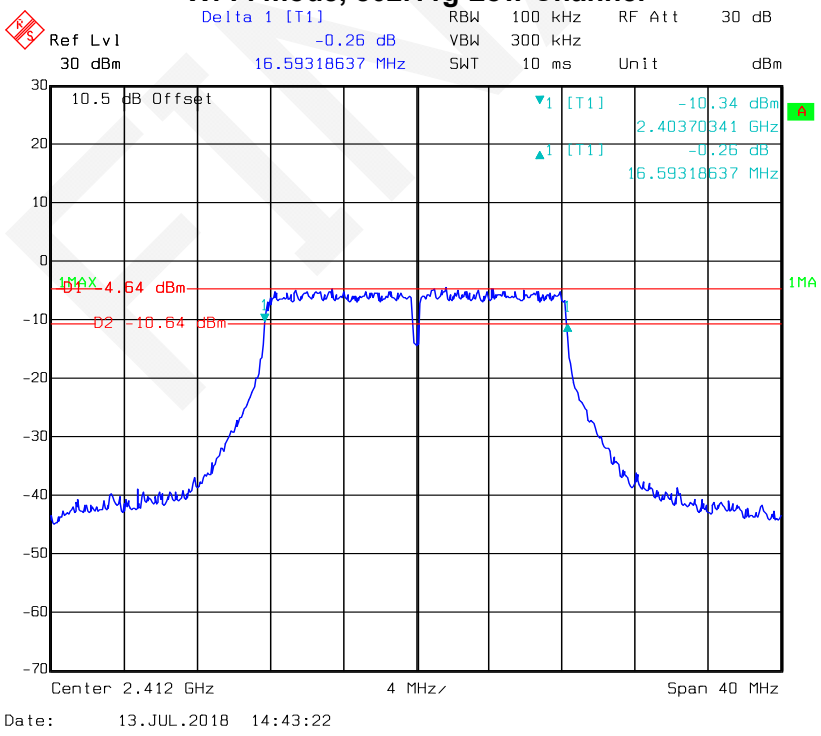
Wi-Fi mode, 802.11b Middle Channel



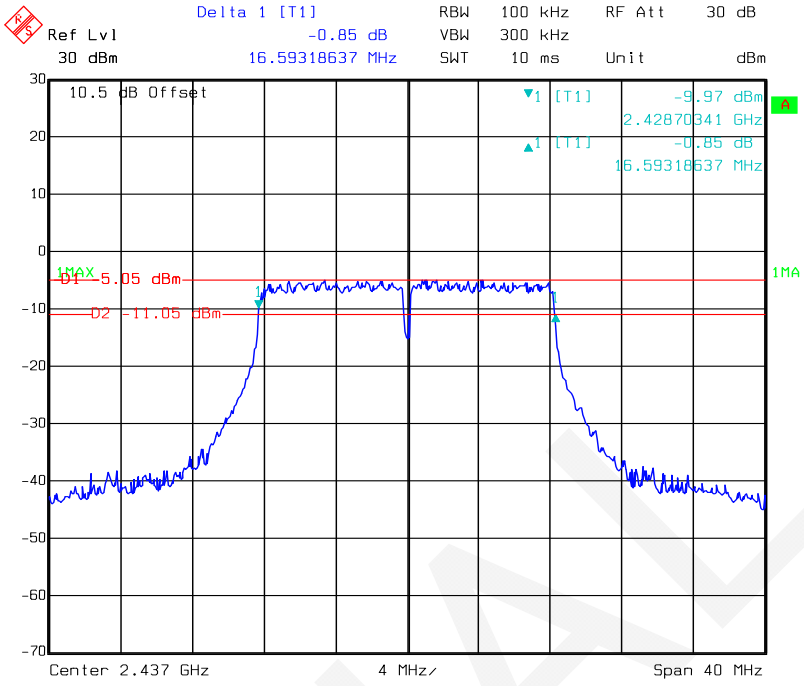
Wi-Fi mode, 802.11b High Channel



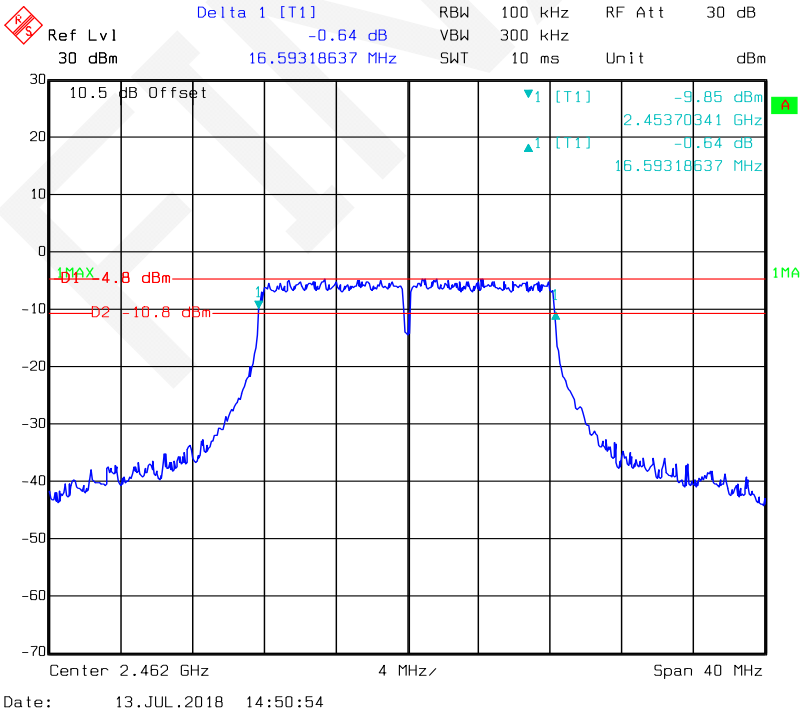
Wi-Fi mode, 802.11g Low Channel



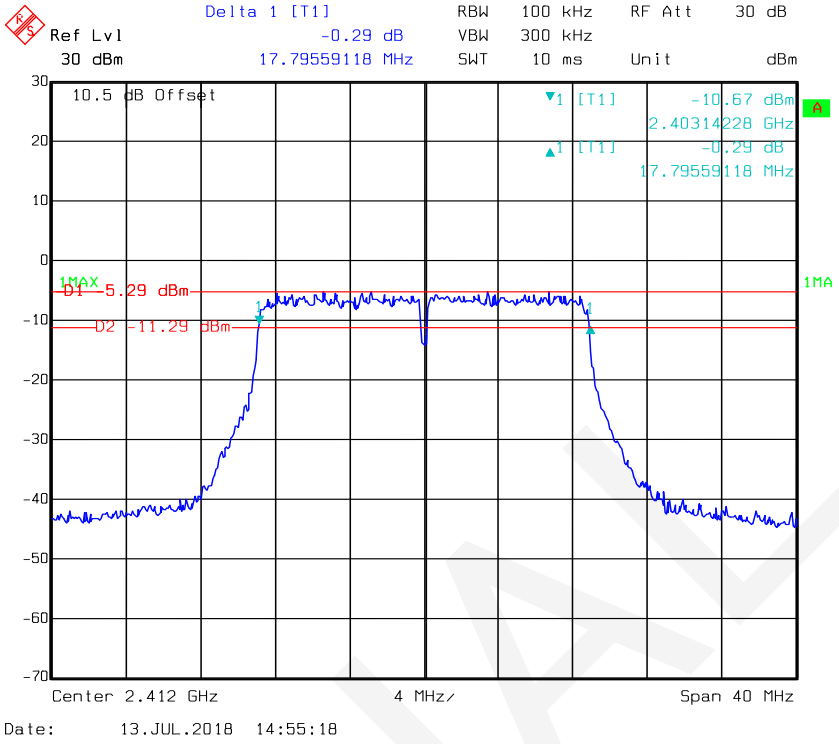
Wi-Fi mode, 802.11g Middle Channel



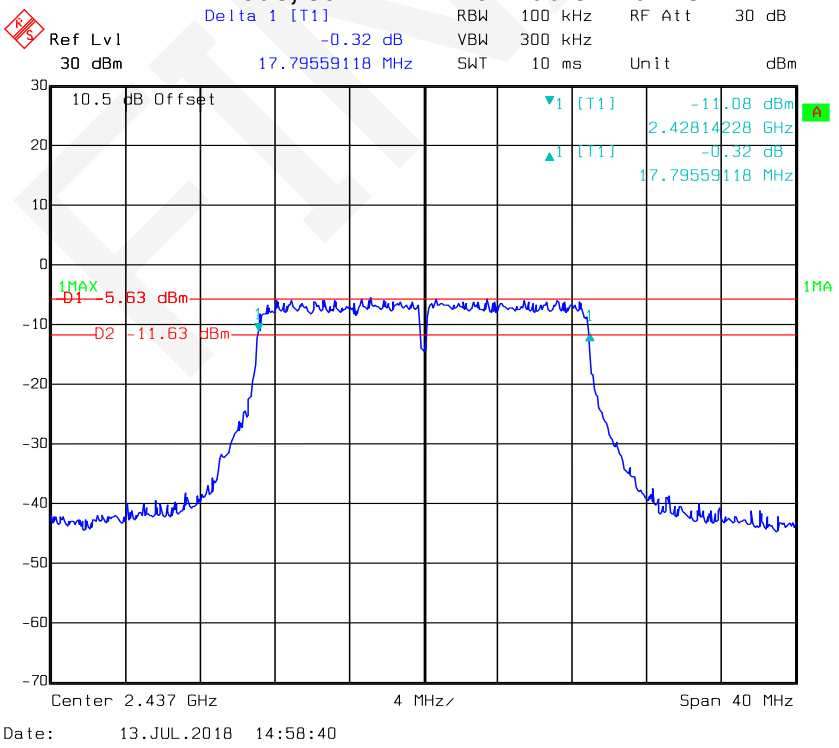
Wi-Fi mode, 802.11g High Channel



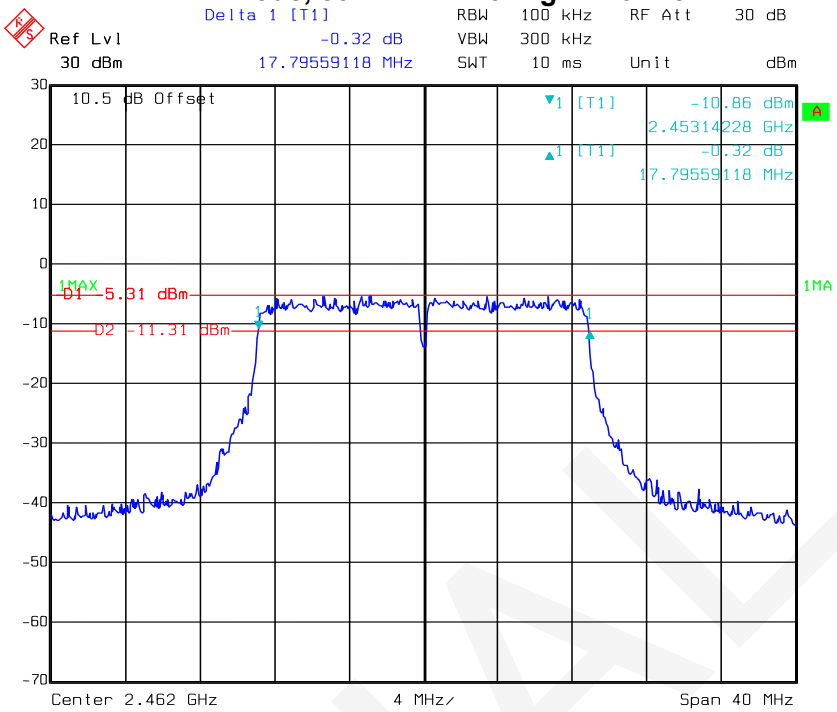
Wi-Fi mode, 802.11n-HT20 Low Channel



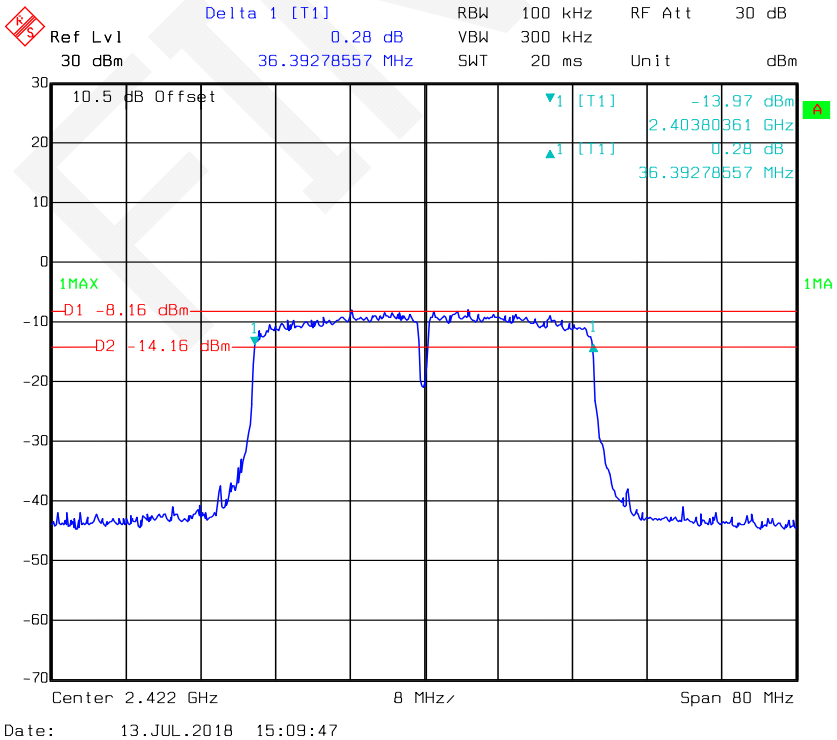
Wi-Fi mode, 802.11n-HT20 Middle Channel



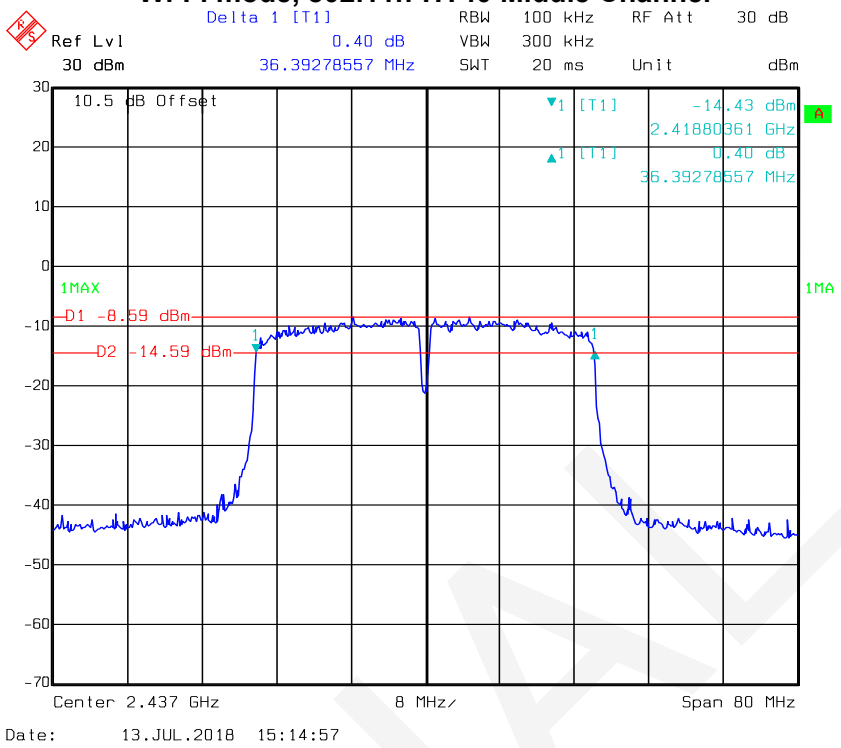
Wi-Fi mode, 802.11n-HT20 High Channel



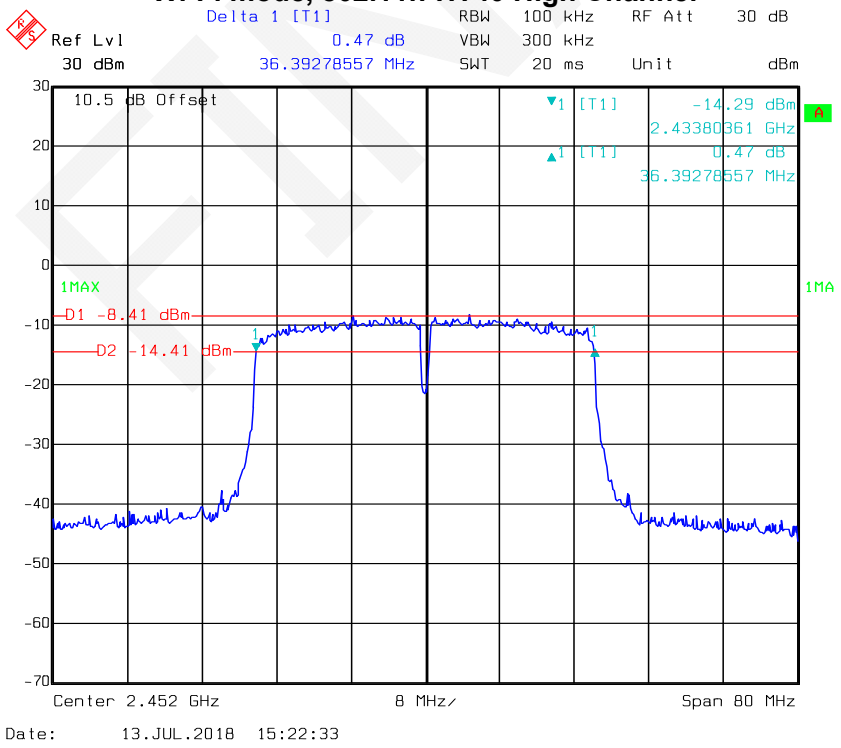
Wi-Fi mode, 802.11n-HT40 Low Channel



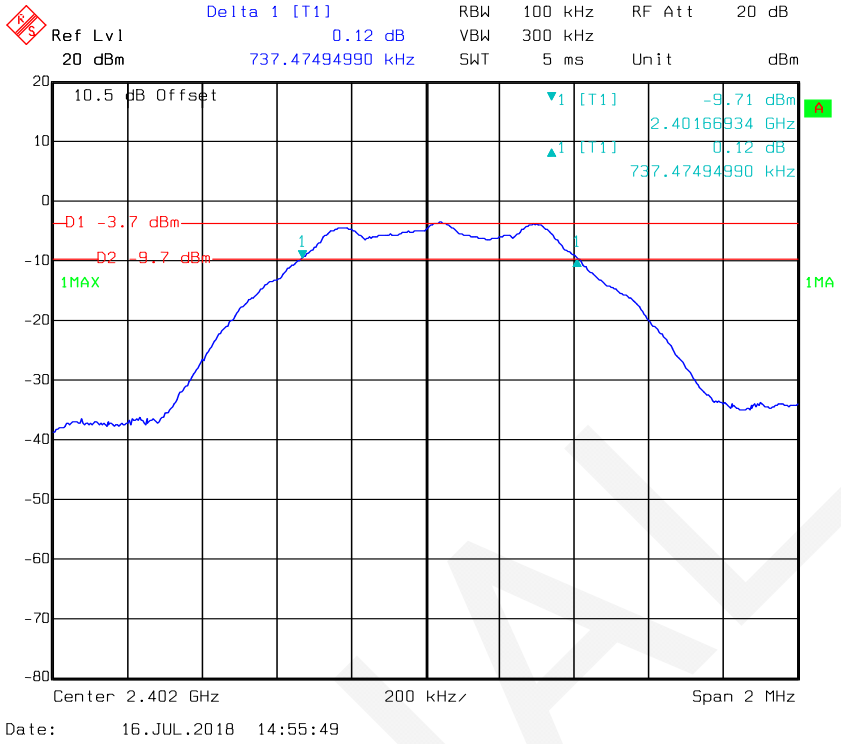
Wi-Fi mode, 802.11n-HT40 Middle Channel



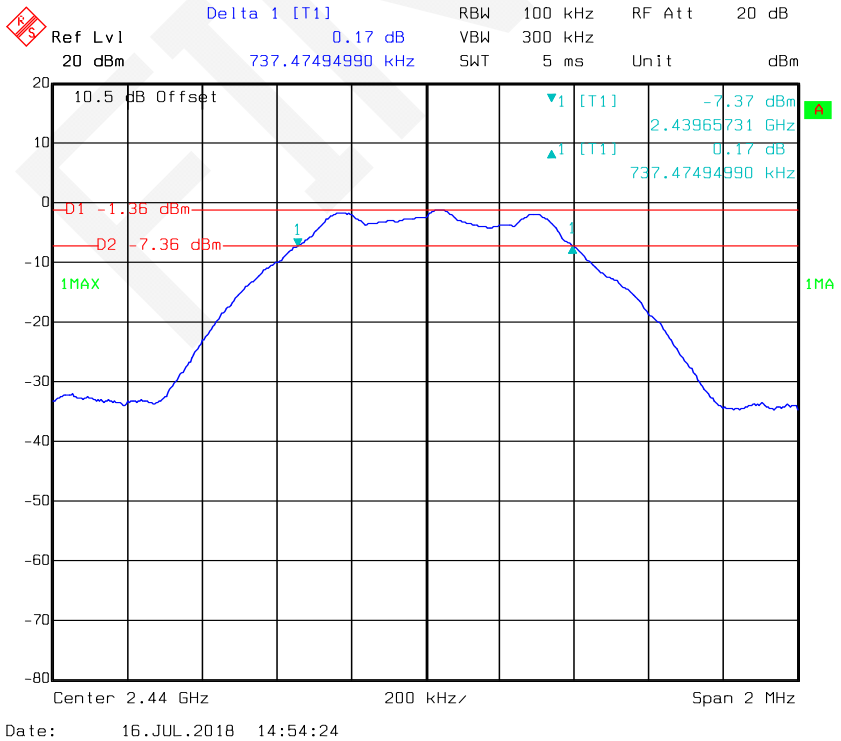
Wi-Fi mode, 802.11n-HT40 High Channel



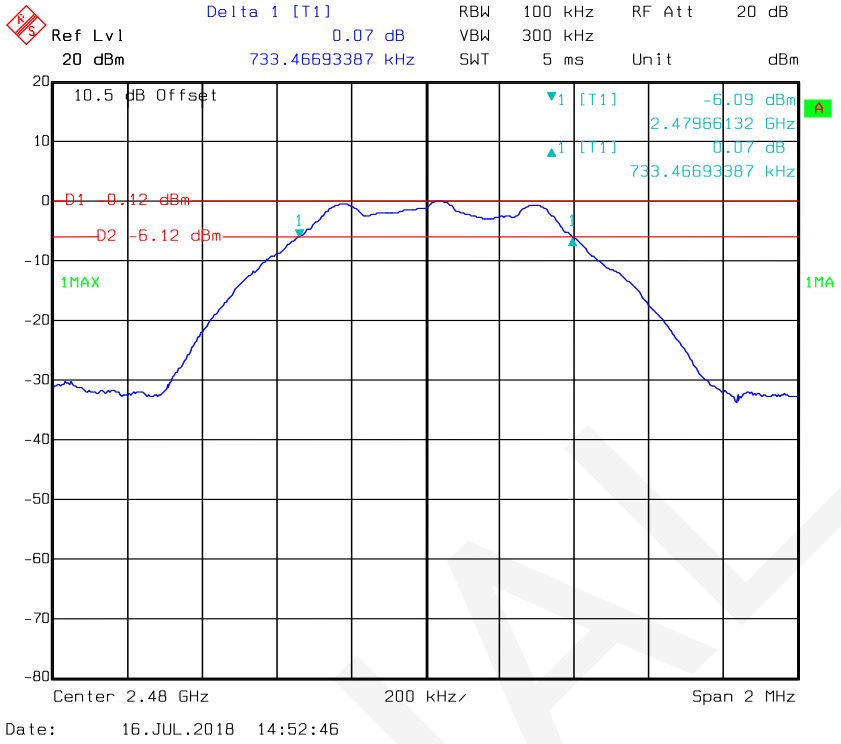
BLE mode, Low Channel



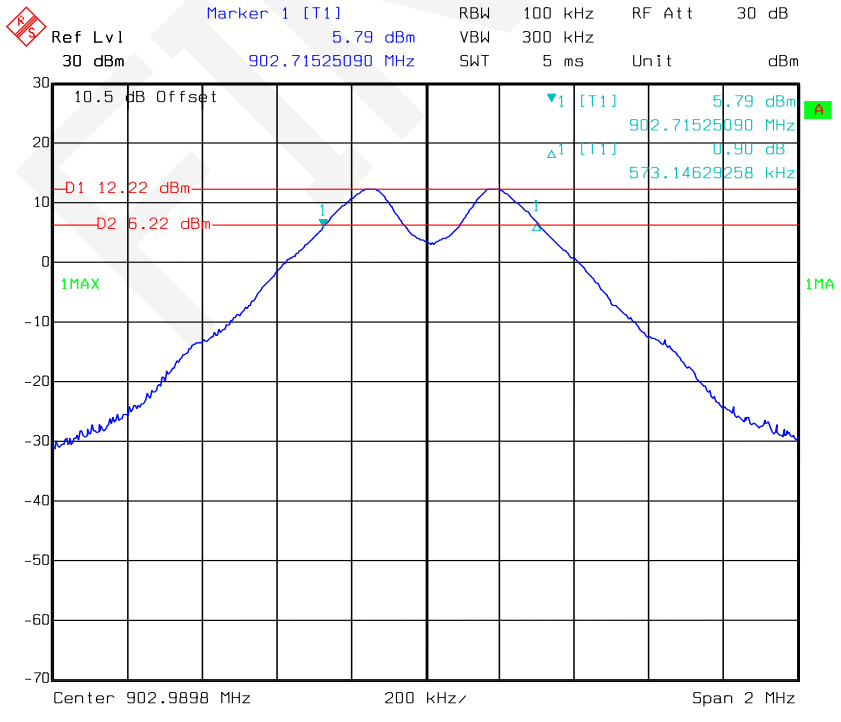
BLE mode, Middle Channel



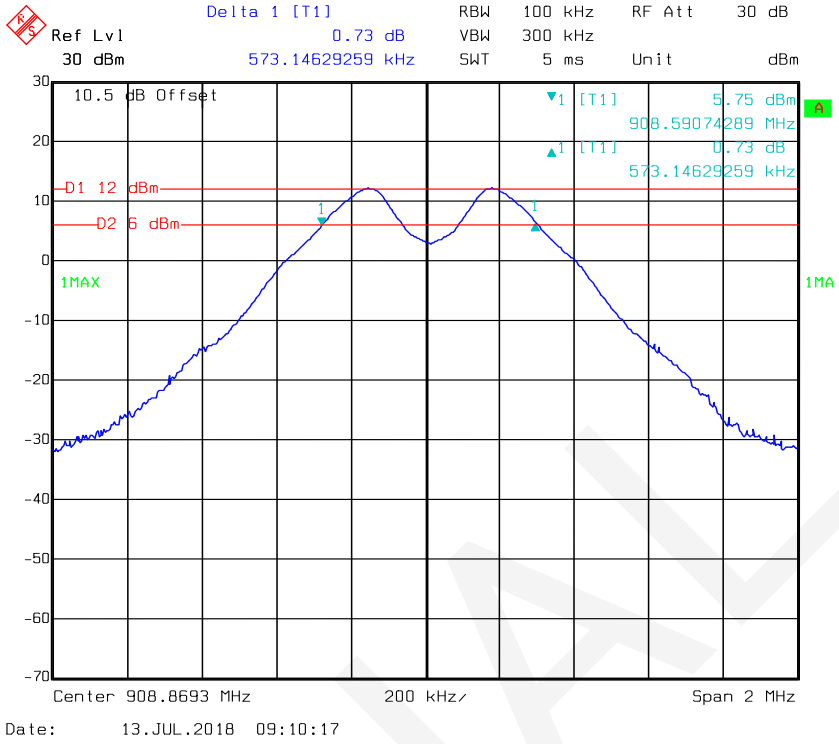
BLE mode, High Channel



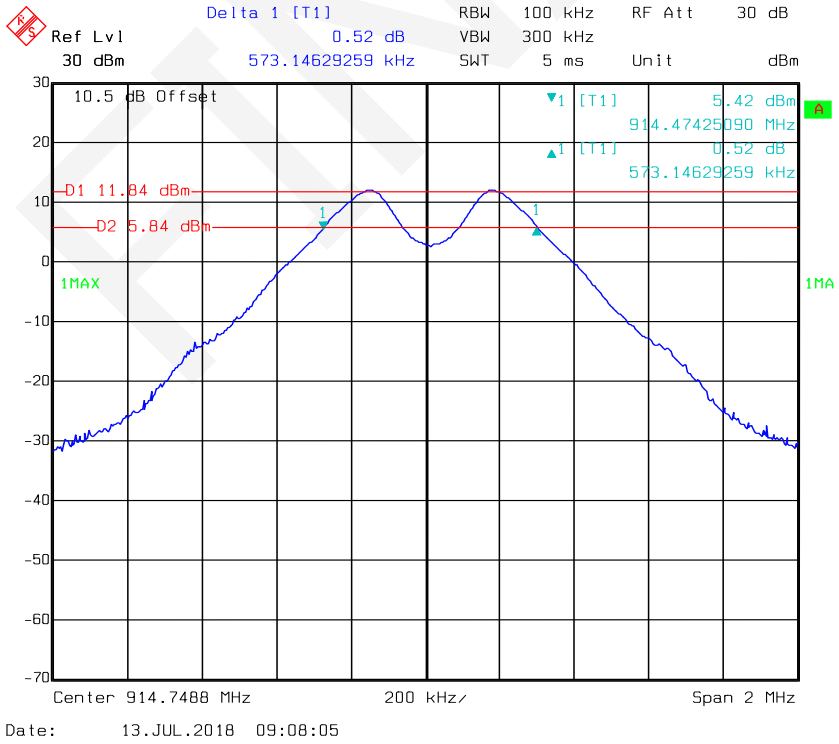
2-FSK mode, Low Channel



2-FSK mode, Middle Channel



2-FSK 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:	28 °C
Relative Humidity:	58 %
ATM Pressure:	94.8 kPa

** The testing was performed by Tom Tang on 2018-07-13.*

Test Mode: Transmitting

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

Wi-Fi mode

Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Max Average Conducted Output Power (dBm)	Limit (dBm)
802.11b	Low	2412	15.60	12.38	30
	Middle	2437	15.17	11.98	30
	High	2462	15.24	12.03	30
802.11g	Low	2412	16.93	8.93	30
	Middle	2437	16.61	8.67	30
	High	2462	16.73	8.80	30
802.11n-HT20	Low	2412	16.70	8.42	30
	Middle	2437	16.33	8.08	30
	High	2462	16.42	8.21	30
802.11n-HT40	Low	2422	16.16	7.96	30
	Middle	2437	15.77	7.56	30
	High	2452	15.82	7.63	30

BLE mode

Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
BLE	Low	2402	-3.40	30
	Middle	2440	-1.04	30
	High	2480	0.09	30

2-FSK mode

Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
2-FSK	Low	902.9898	11.99	30
	Middle	908.8693	11.74	30
	High	914.7488	11.61	30

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:	26 ~ 28 °C
Relative Humidity:	56 ~ 58 %
ATM Pressure:	94.8 ~ 95.0 kPa

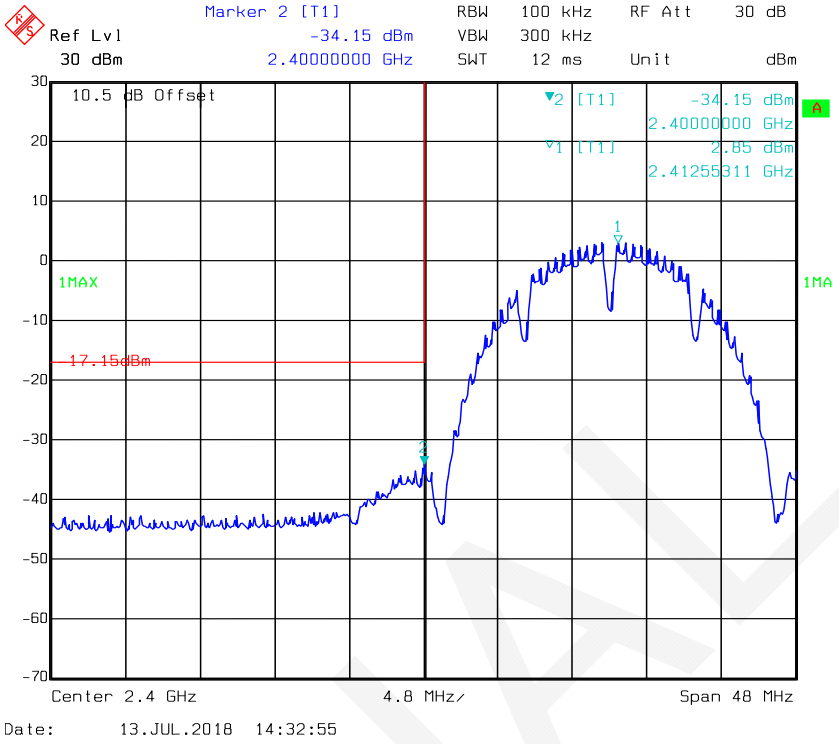
** The testing was performed by Tom Tang on 2018-07-13 and 2018-07-16.*

Test mode: Transmitting

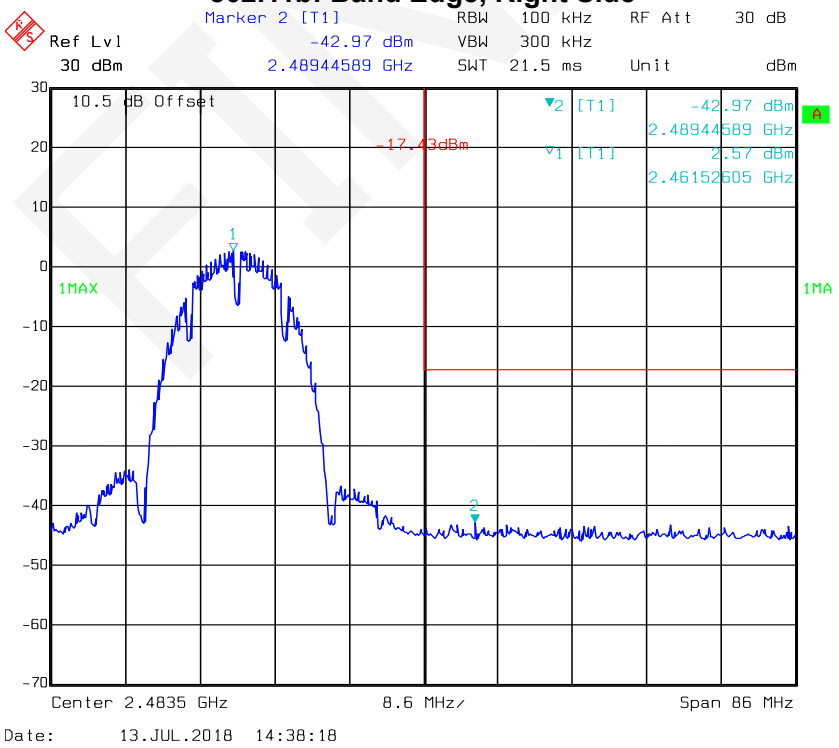
Test Result: Compliance. Please refer to following plots.

Wi-Fi mode

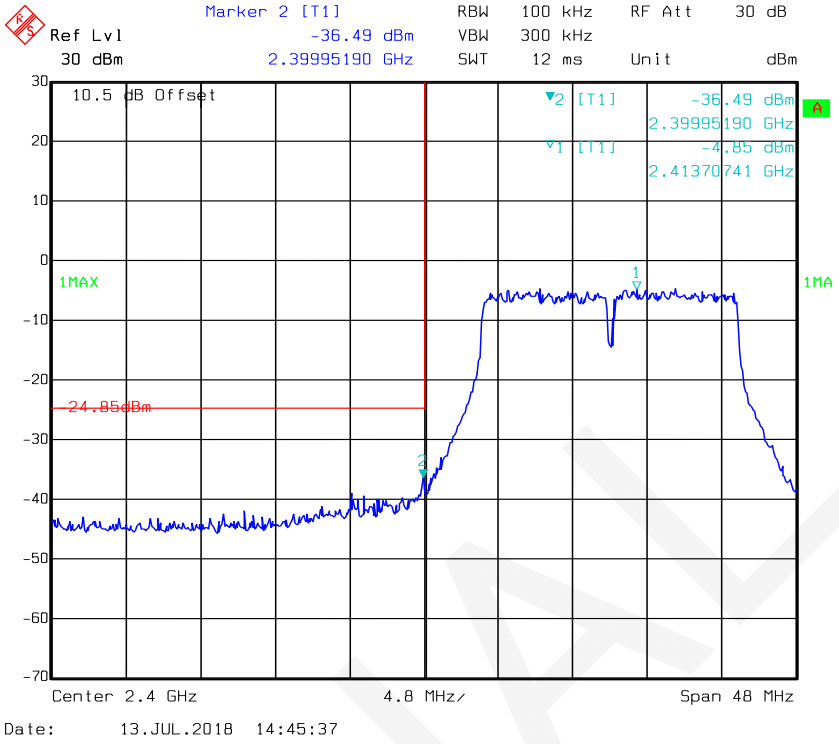
802.11b: Band Edge, Left Side



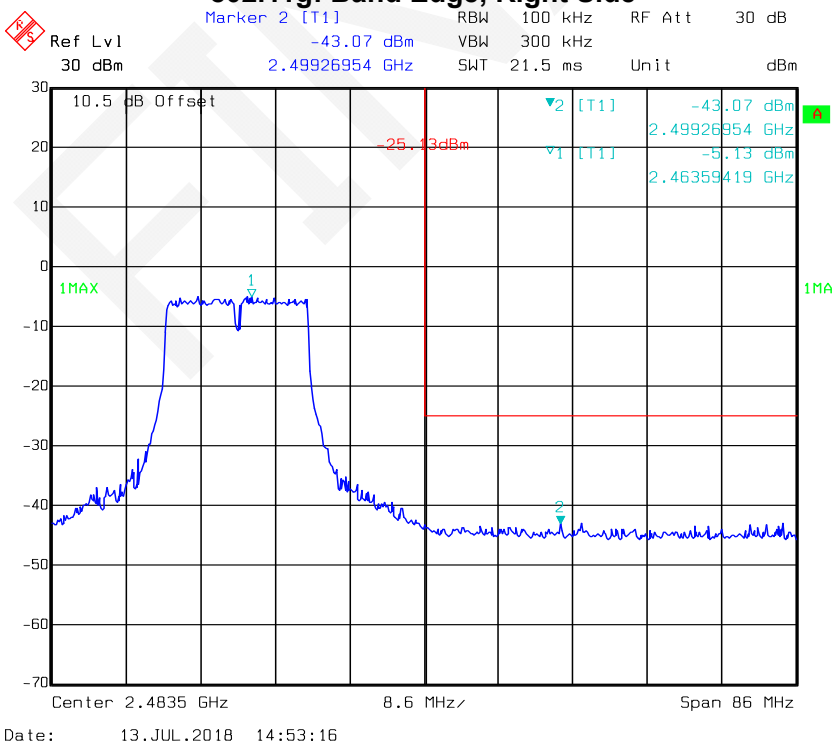
802.11b: Band Edge, Right Side



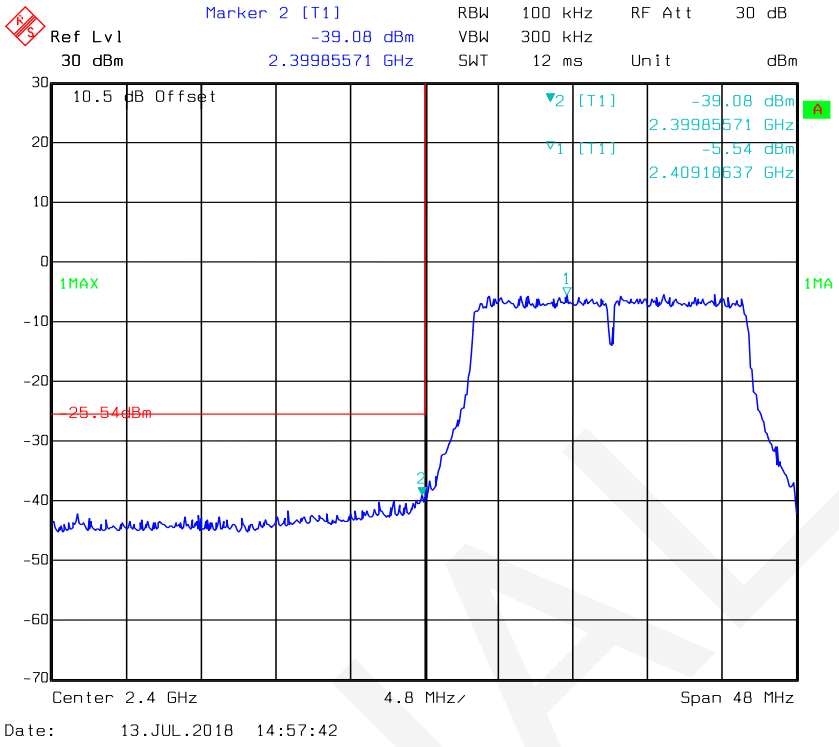
802.11g: Band Edge, Left Side



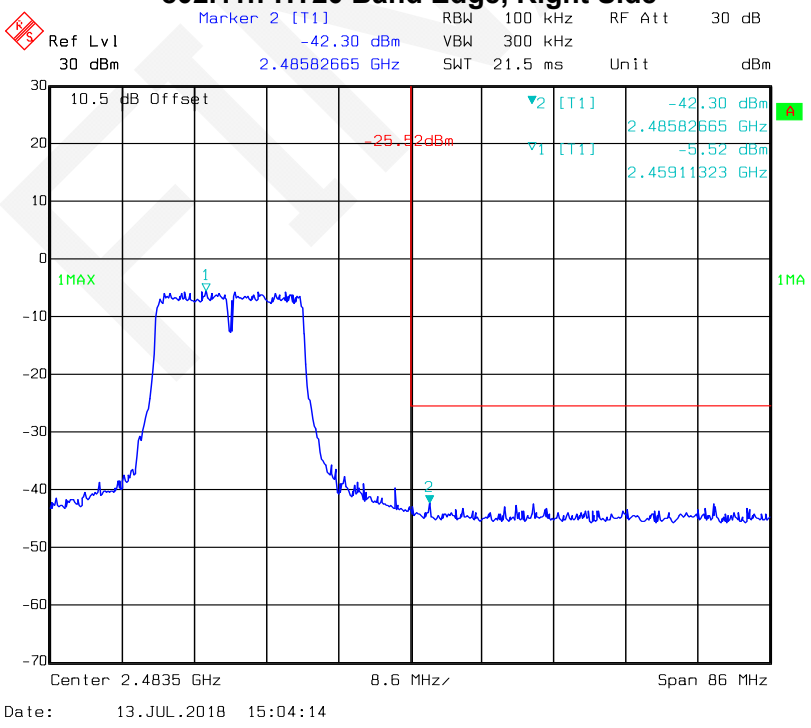
802.11g: Band Edge, Right Side



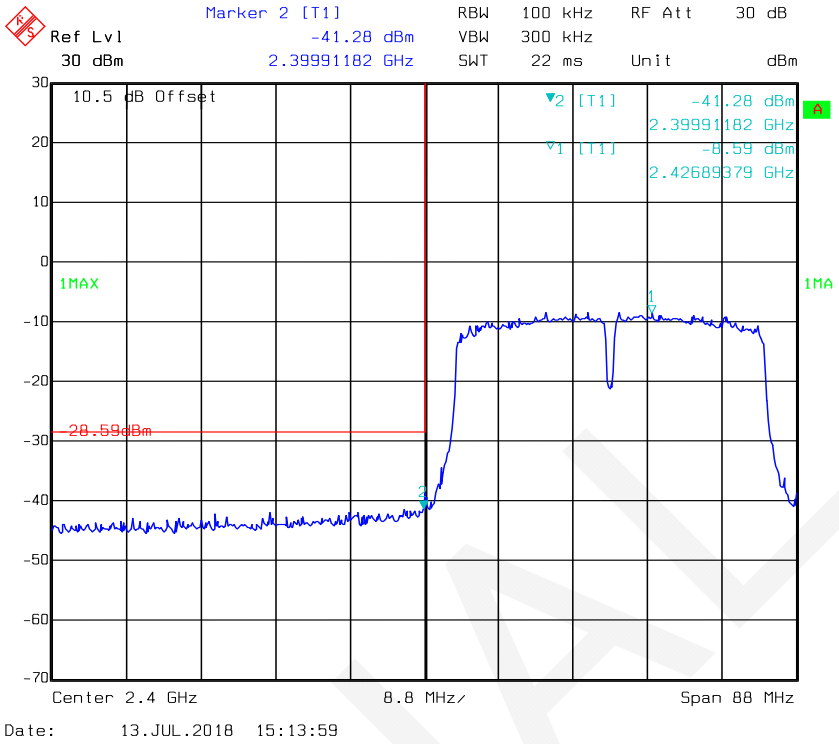
802.11n-HT20 Band Edge, Left Side



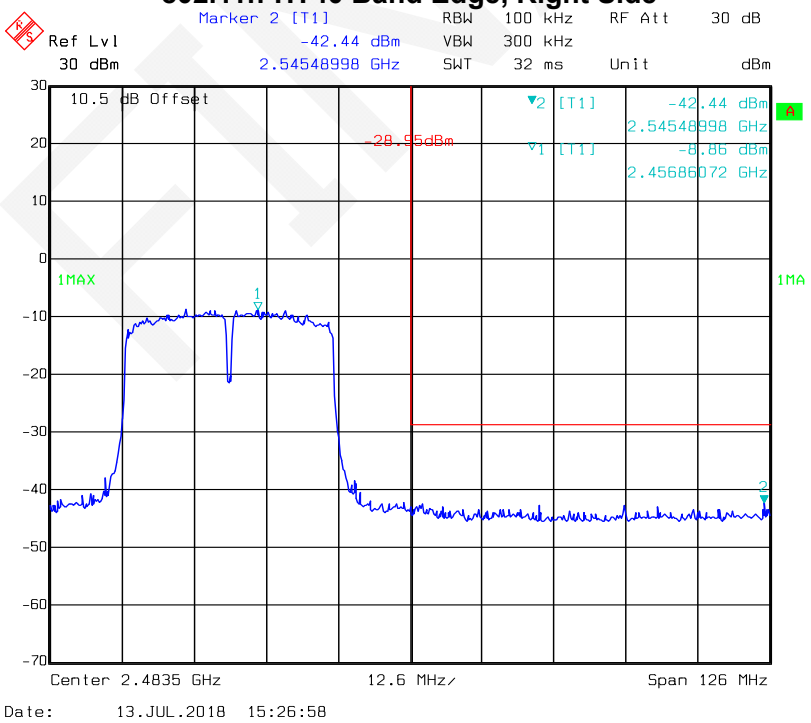
802.11n-HT20 Band Edge, Right Side



802.11n-HT40 Band Edge, Left Side

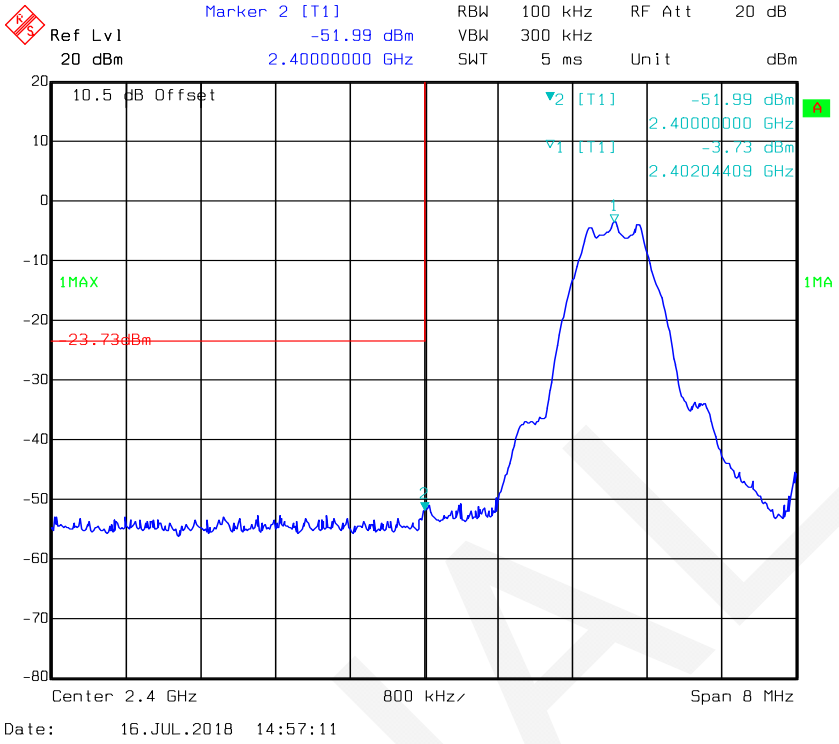


802.11n-HT40 Band Edge, Right Side

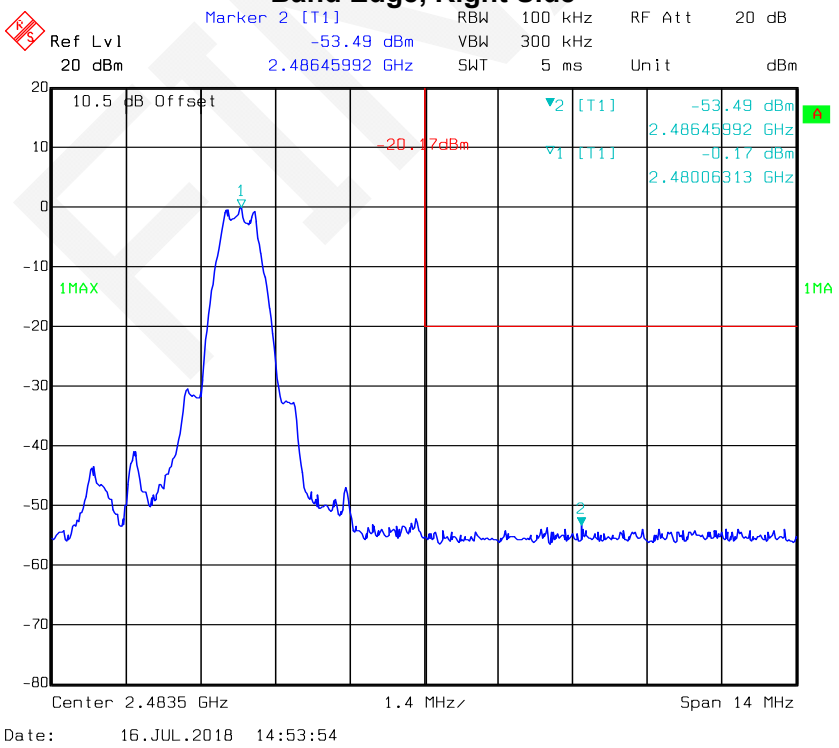


BLE mode

Band Edge, Left Side

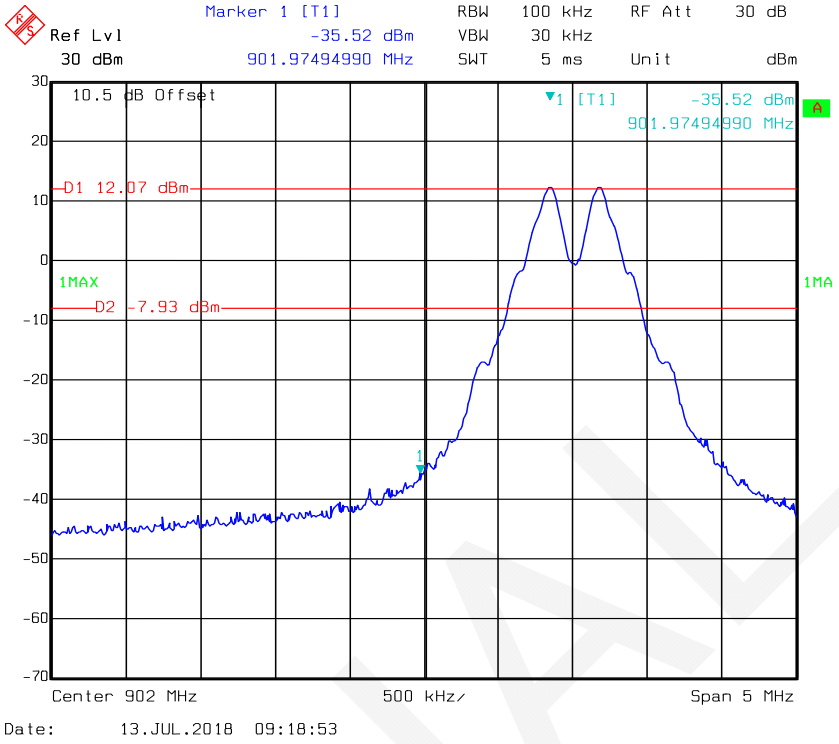


Band Edge, Right Side

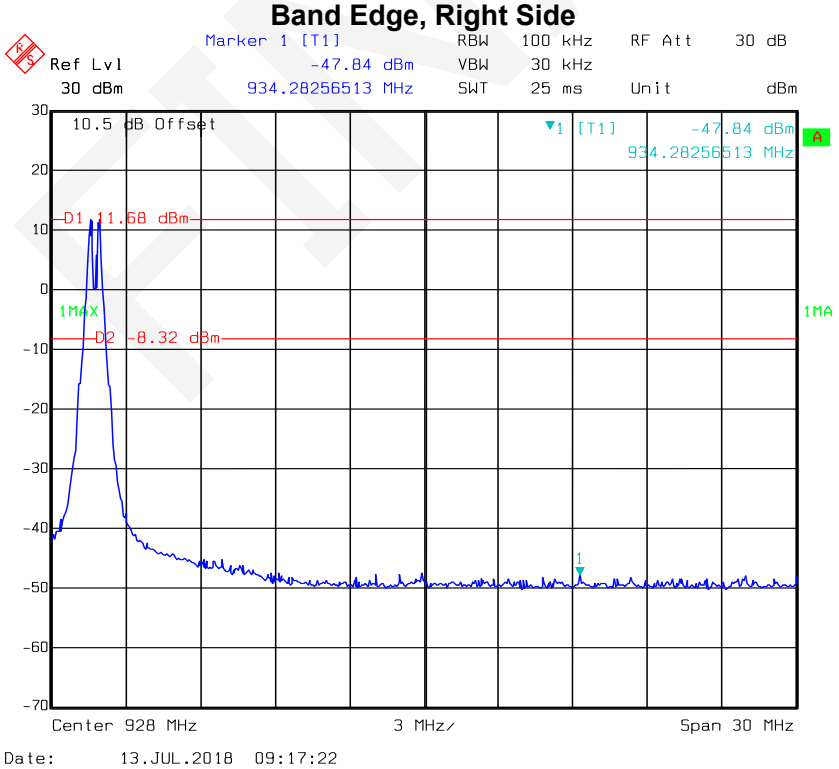


2-FSK mode

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:	26 ~ 28 °C
Relative Humidity:	56 ~ 58 %
ATM Pressure:	94.8 ~ 95.0 kPa

** The testing was performed by Tom Tang on 2018-07-13 and 2018-07-16.*

Test Mode: Transmitting

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

Wi-Fi mode

Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-16.31	8
	Middle	2437	-16.65	8
	High	2462	-16.59	8
802.11g	Low	2412	-19.14	8
	Middle	2437	-19.53	8
	High	2462	-19.31	8
802.11n-HT20	Low	2412	-18.92	8
	Middle	2437	-19.35	8
	High	2462	-19.16	8
802.11n-HT40	Low	2422	-19.77	8
	Middle	2437	-20.04	8
	High	2452	-19.91	8

BLE mode

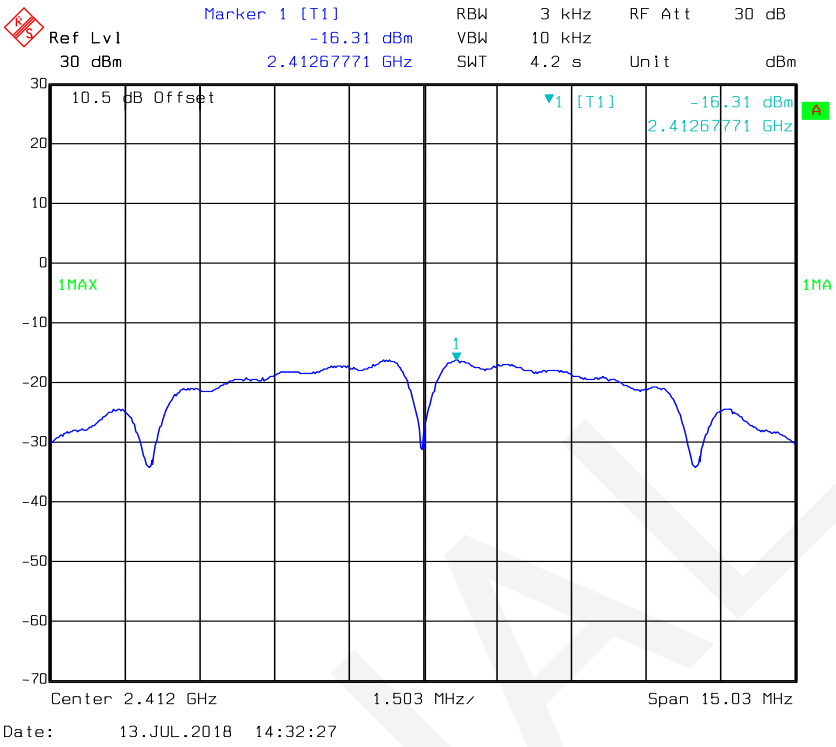
Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
BLE	Low	2402	-18.89	8
	Middle	2440	-16.56	8
	High	2480	-15.41	8

2-FSK mode

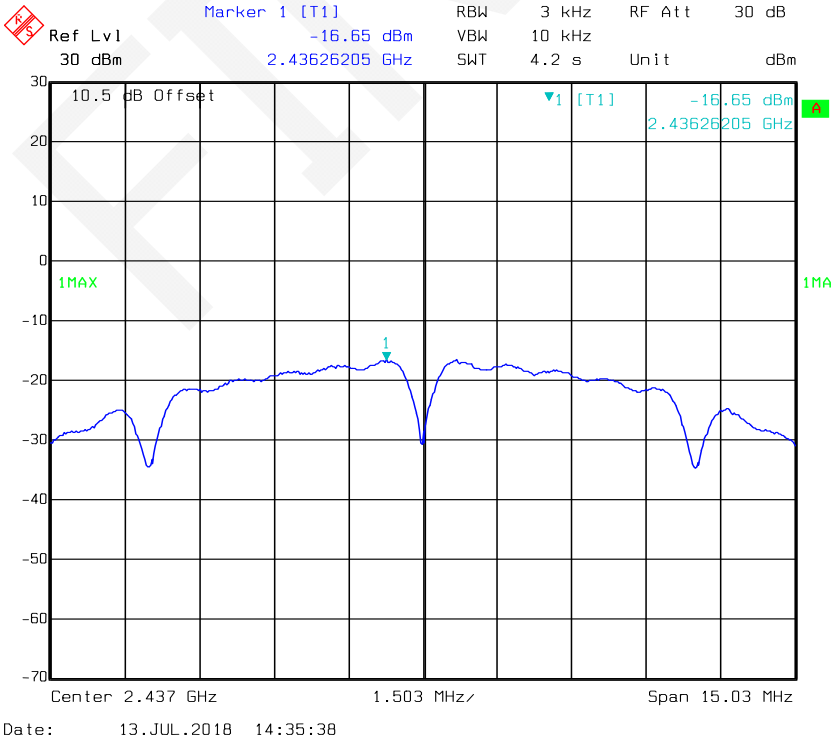
Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
2-FSK	Low	902.9898	3.88	8
	Middle	908.8693	3.80	8
	High	914.7488	3.54	8

Wi-Fi mode

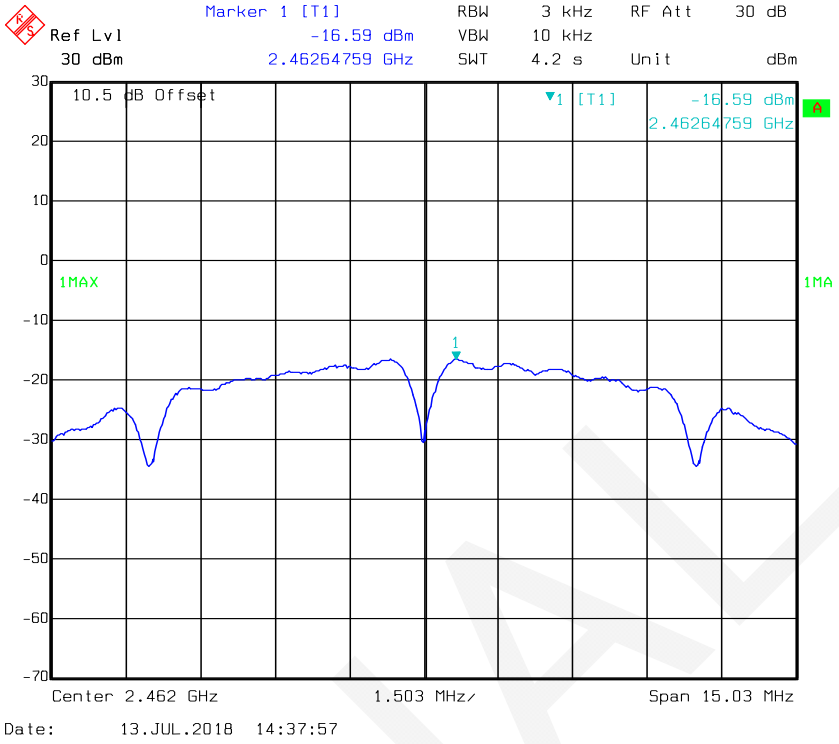
Power Spectral Density, 802.11b Low Channel



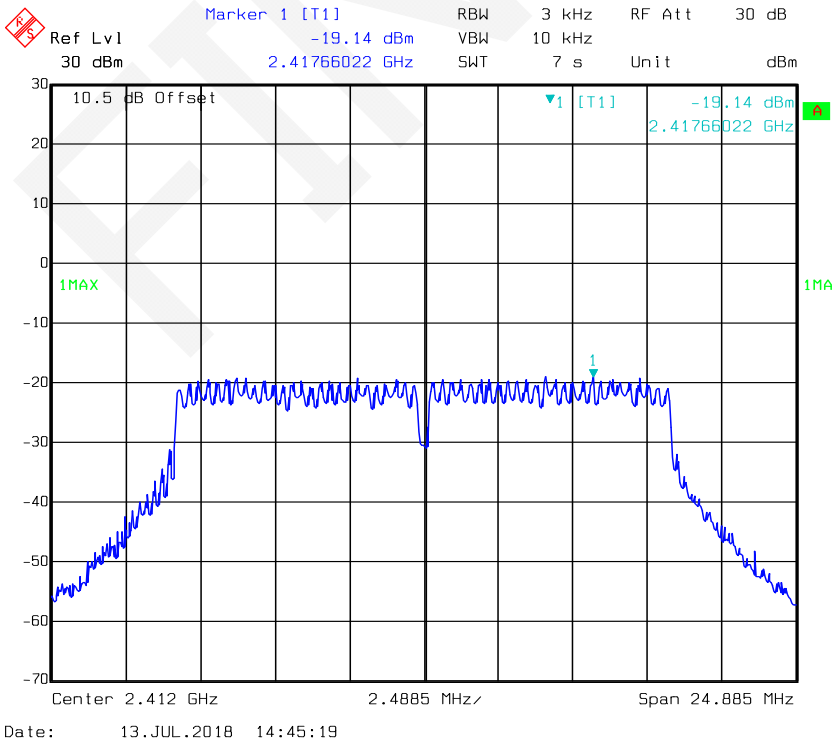
Power Spectral Density, 802.11b Middle Channel



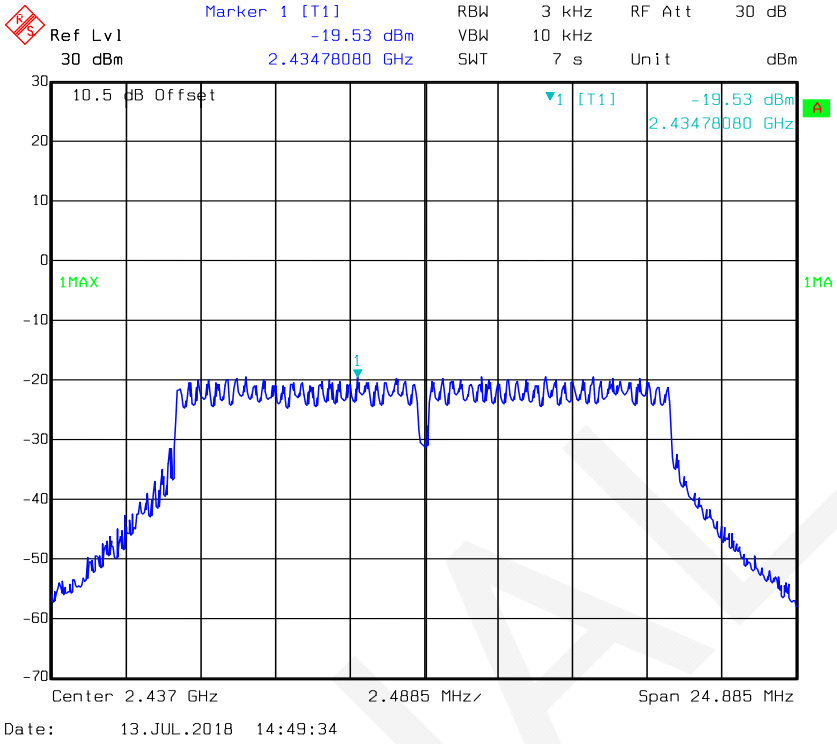
Power Spectral Density, 802.11b High Channel



Power Spectral Density, 802.11g Low Channel



Power Spectral Density, 802.11g Middle Channel



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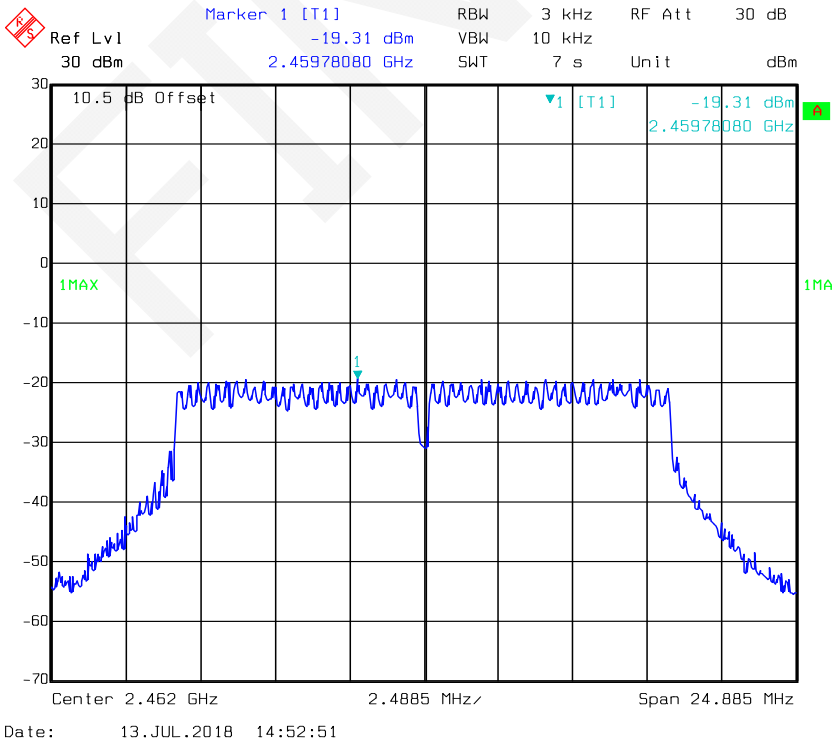
Power Spectral Density, 802.11g High Channel



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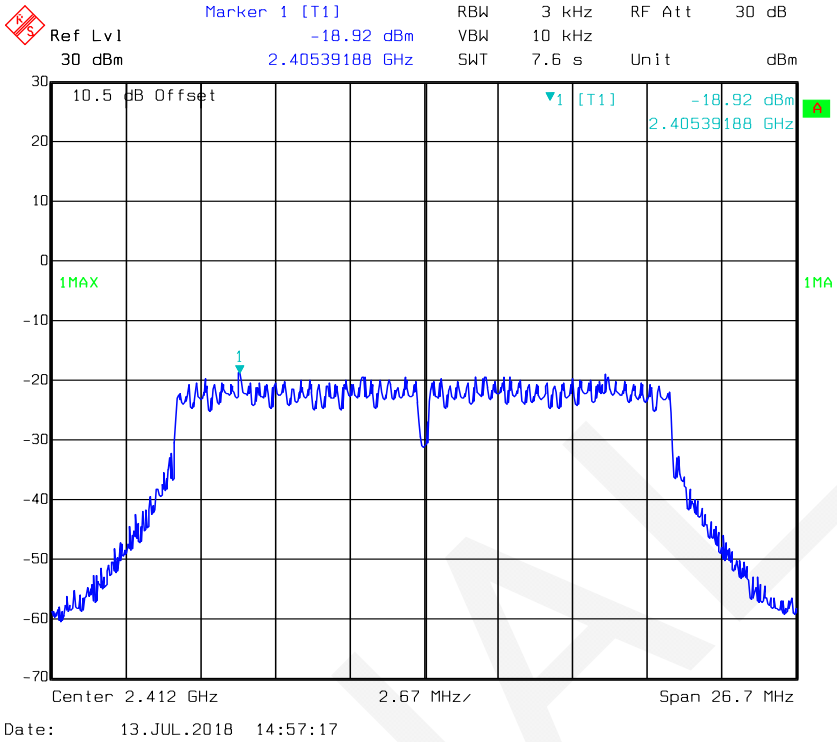
Power Spectral Density, 802.11n-HT20 Low Channel



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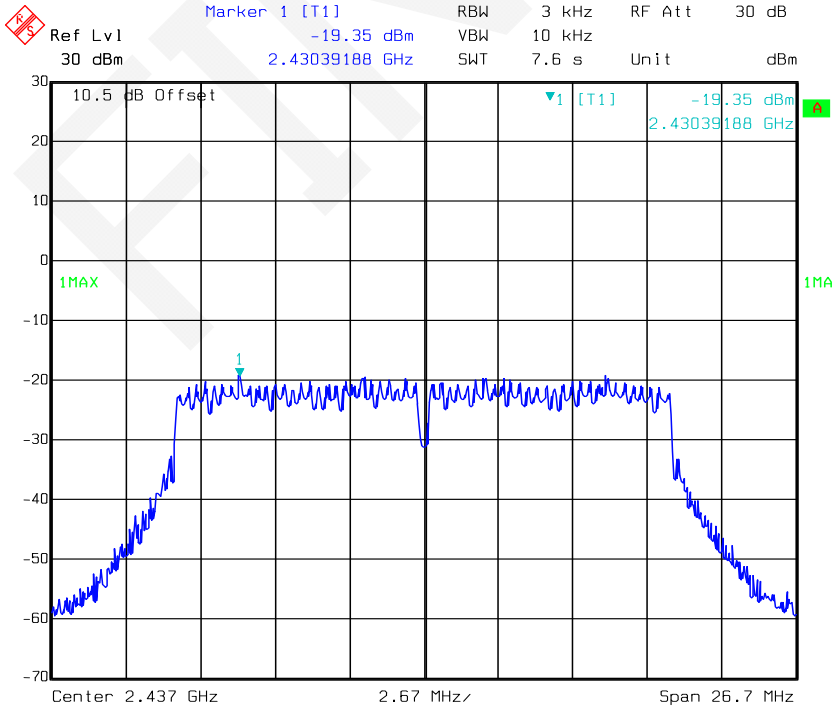
Power Spectral Density, 802.11n-HT20 Middle Channel



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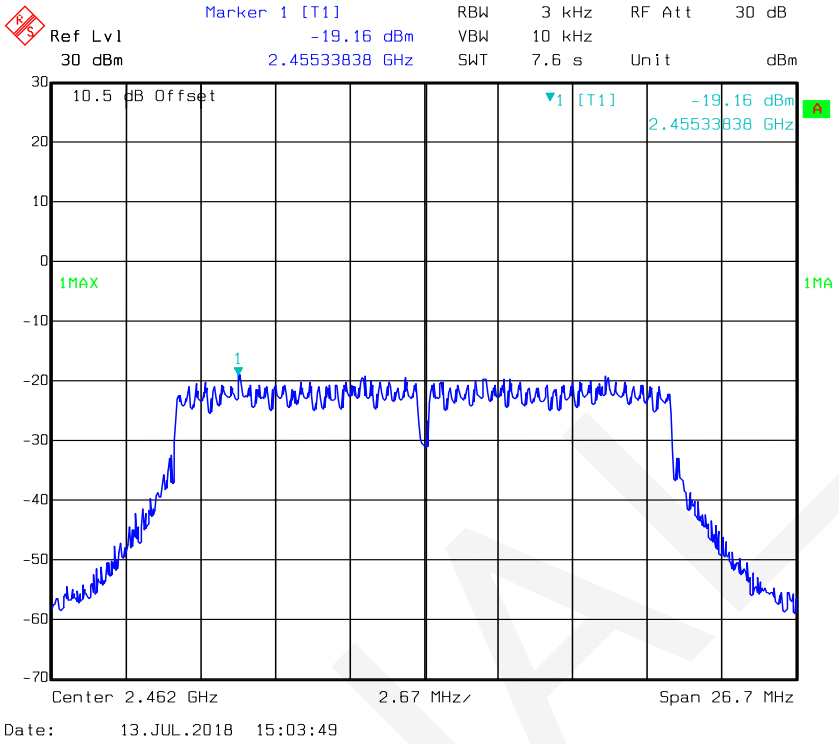
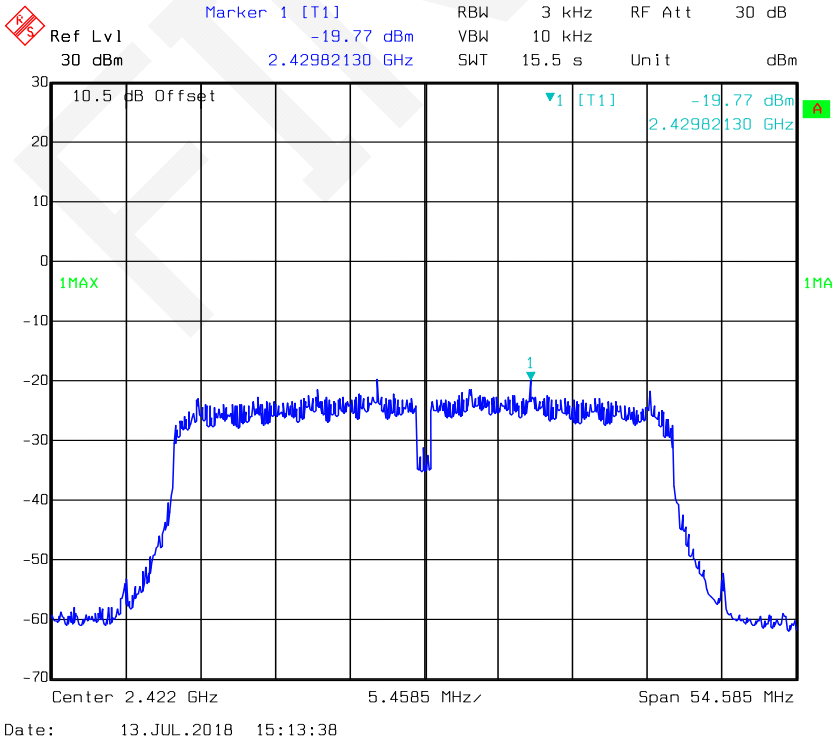
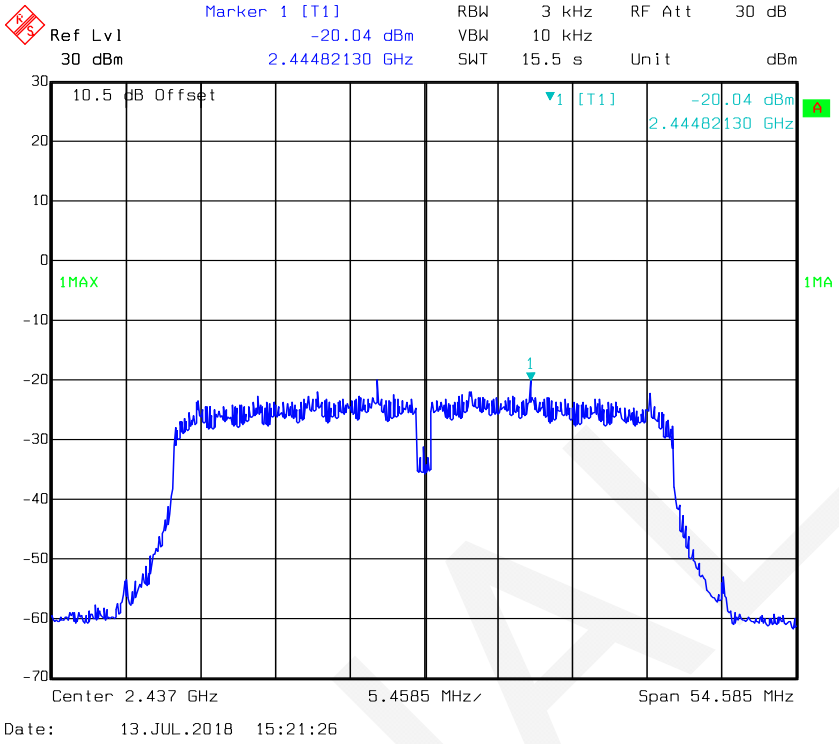
Power Spectral Density, 802.11n-HT20 High Channel



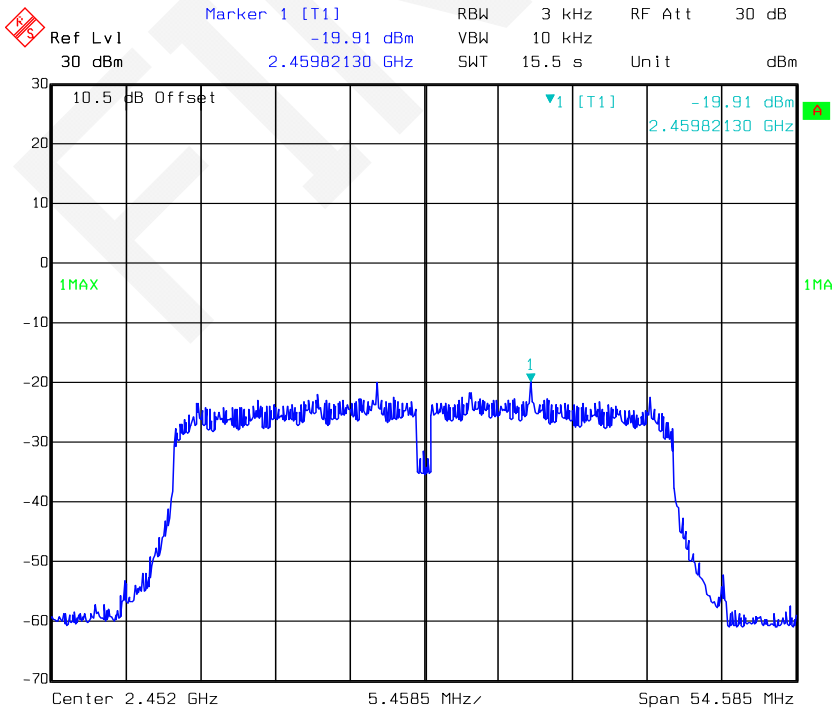
Power Spectral Density, 802.11n-HT40 Low Channel



Power Spectral Density, 802.11n-HT40 Middle Channel

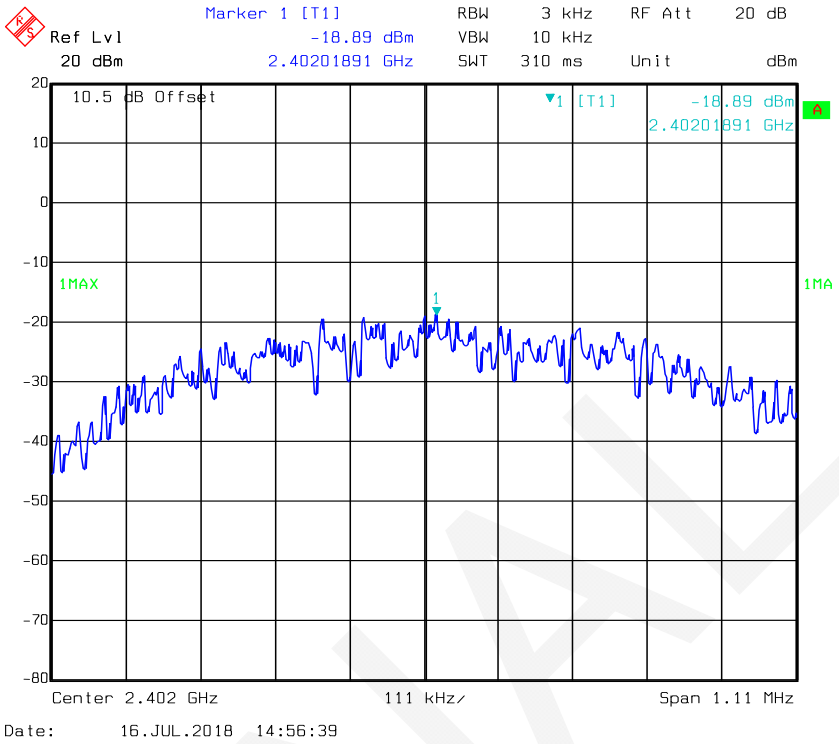


Power Spectral Density, 802.11n-HT40 High Channel

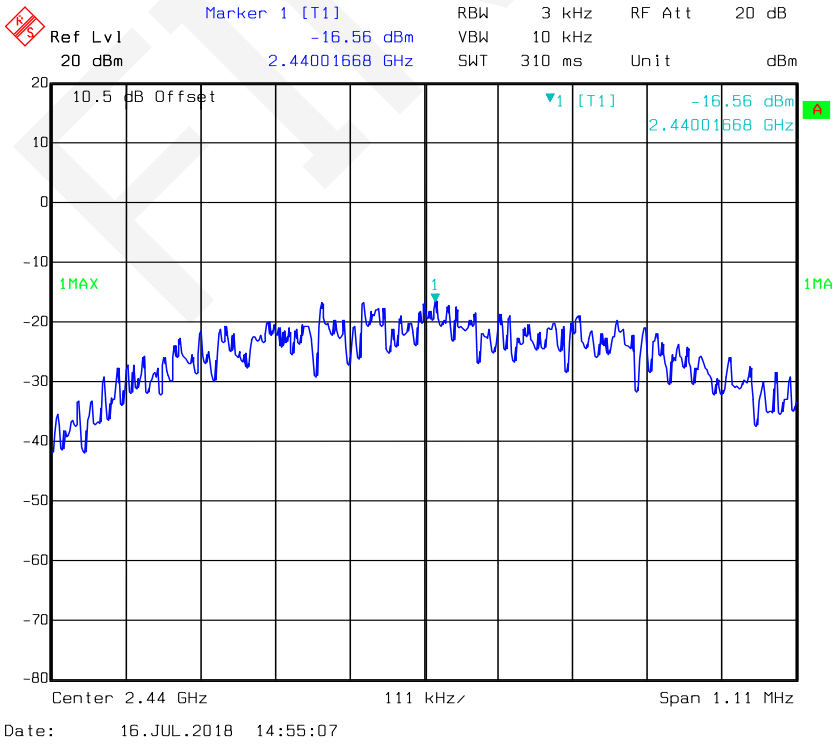


BLE mode

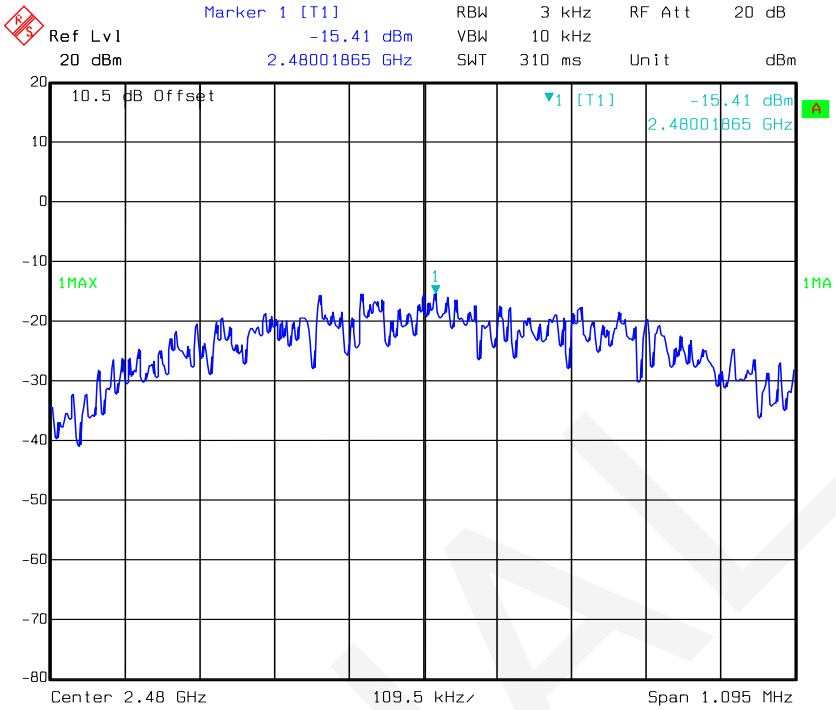
Power Spectral Density, Low Channel



Power Spectral Density, Middle Channel

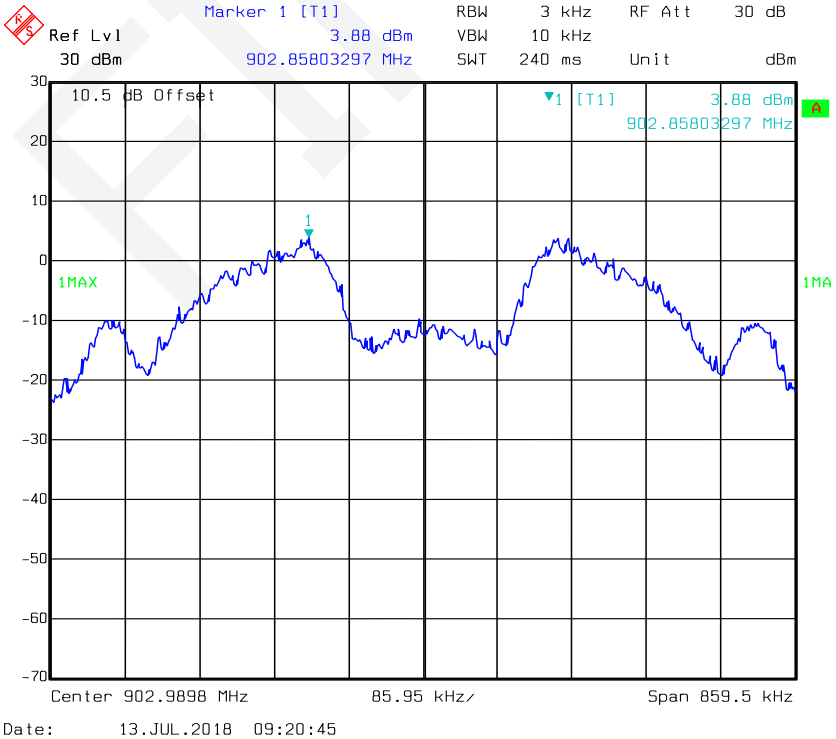


Power Spectral Density, High Channel

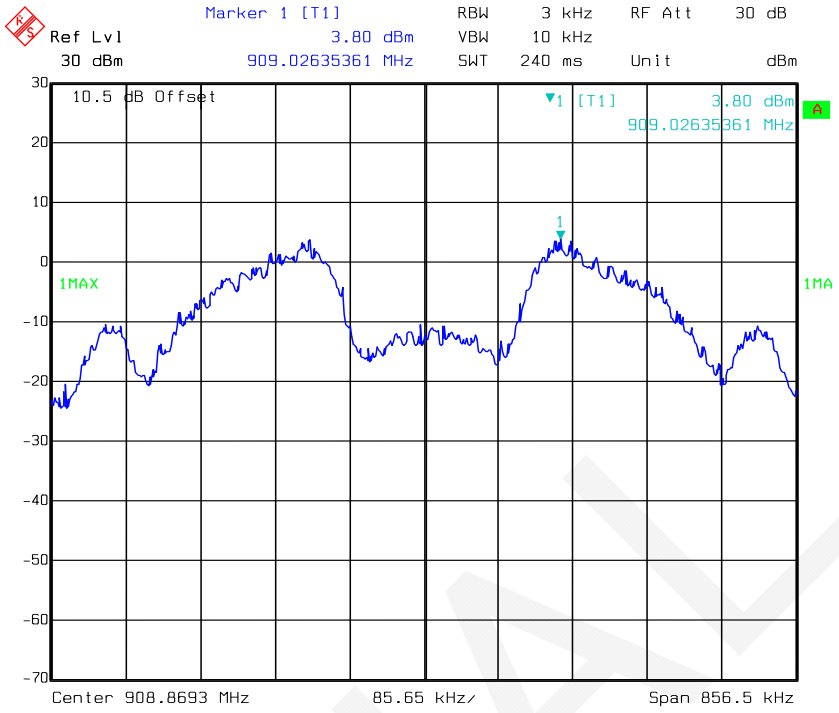


2-FSK mode

Power Spectral Density, Low Channel



Power Spectral Density, Middle Channel



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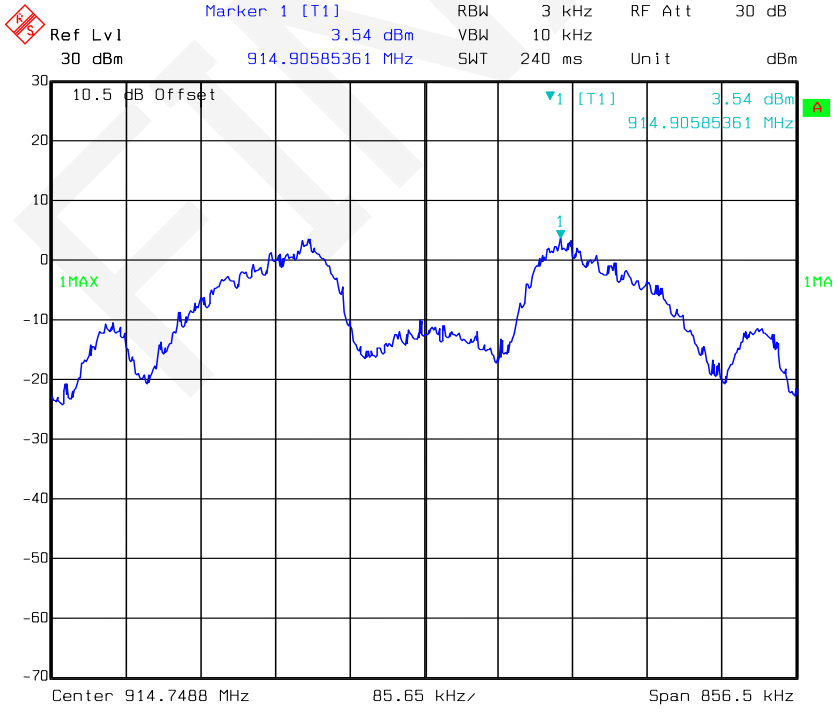
Power Spectral Density, High Channel



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