FCC PART 15.247

TEST REPORT

For

Power Idea Technology (Shenzhen) Co., Ltd.

4th Floor, A Section, Languang Science&technology Xinxi RD, Hi-Tech Industrial Park North, Nanshan, ShenZhen, China

FCC ID: ZLE-RG850

Report Type:	**Product Type:**
Original Report	LTE SMARTPHONE

Report Number: RSZ180710006-00C

Report Date: 2018-09-20

Reviewed By: Rocky Kang, RF Engineer

Prepared By: Bay Area Compliance Laboratories Corp. (Shenzhen)
6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China
Tel: +86-755-33320018
Fax: +86-755-33320008
www.baclcorp.com.cn

Note: This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government. * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*".

TABLE OF CONTENTS

GENERAL INFORMATION **4**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 4
OBJECTIVE 4
RELATED SUBMITTAL(S)/GRANT(S) 4
TEST METHODOLOGY 4
MEASUREMENT UNCERTAINTY 5
SYSTEM TEST CONFIGURATION **6**
DESCRIPTION OF TEST CONFIGURATION 6
EQUIPMENT MODIFICATIONS 7
EUT EXERCISE SOFTWARE 7
DUTY CYCLE 8
SUPPORT EQUIPMENT LIST AND DETAILS 10
EXTERNAL I/O CABLE 10
BLOCK DIAGRAM OF TEST SETUP 11
SUMMARY OF TEST RESULTS **12**
TEST EQUIPMENT LIST **13**
FCC§15.247 (i), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE **15**
APPLICABLE STANDARD 15
FCC §15.203 - ANTENNA REQUIREMENT **16**
APPLICABLE STANDARD 16
ANTENNA CONNECTOR CONSTRUCTION 16
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS **17**
APPLICABLE STANDARD 17
EUT SETUP 17
EMI TEST RECEIVER SETUP 17
TEST PROCEDURE 17
CORRECTED FACTOR & MARGIN CALCULATION 18
TEST RESULTS SUMMARY 18
TEST DATA 18
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS **27**
APPLICABLE STANDARD 27
EUT SETUP 27
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP 28
TEST PROCEDURE 28
CORRECTED AMPLITUDE & MARGIN CALCULATION 28
TEST RESULTS SUMMARY 28
TEST DATA 29
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH&99% OCCUPIED BANDWIDTH **43**
APPLICABLE STANDARD 43
TEST PROCEDURE 43
TEST DATA 43
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER **59**
APPLICABLE STANDARD 59

TEST PROCEDURE 59
TEST DATA 59

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....61

APPLICABLE STANDARD 61
TEST PROCEDURE 61
TEST DATA 61

FCC §15.247(e) - POWER SPECTRAL DENSITY 67

APPLICABLE STANDARD 67
TEST PROCEDURE 67
TEST DATA 67

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Power Idea Technology (Shenzhen) Co., Ltd.'s* product, model number: *RG850 (FCC ID: ZLE-RG850)* or the "EUT" in this report was a *LTE SMARTPHONE,* which was measured approximately: 16.2 cm (L) * 7.9 cm (W) *1.1 cm (H), rated with input voltage: DC 3.83 V battery or DC 5V from adapter.

White Adapter Information:
Model: HKC0115020-2B
Input: AC 100-240V, 50/60Hz, 0.5 A
Output: DC 5V, 2A

Black Adapter Information:
Model: HKC0115021-2D
Input: AC 100-240V, 50/60Hz, 0.5 A
Output: DC 5V, 2A

**All measurement and test data in this report was gathered from production sample serial number: 180710006 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-07-10.*

Objective

This report is prepared on behalf of *Power Idea Technology (Shenzhen) Co., Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

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

Related Submittal(s)/Grant(s)

FCC Part 15B JBP, Part 15.247 DSS and Part 22H&24E&27 PCE submissions with FCC ID: ZLE-RG850.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

And KDB 558074 D01 DTS Meas Guidance v04 .

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.5dB
RF conducted test with spectrum		±1.5dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±3℃
Humidity		±6%
Supply voltages		±0.4%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

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

For 802.11b, 802.11g, 802.11n-HT20 mode, EUT was tested with Channel 1, 6and 11

For 802.11n-HT40 mode, 9 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2422	6	2447
2	2427	7	2452
3	2432	/	/
4	2437	/	/
5	2442	/	/

EUT was tested with Channel 1, 4 and 7.

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	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

BLE & Wi-Fi test in the engineer mode.

“QRCT.exe” software was made to the EUT tested.

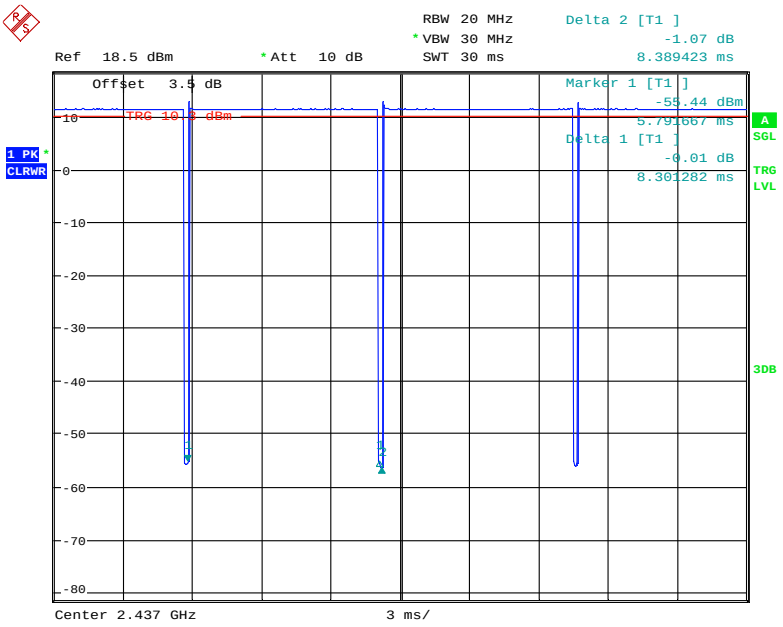
The device was tested with the worst case was performed as below:

Mode	Data rate	Power level		
		Low channel	Middle channel	High channel
802.11b	1 Mbps	13	13	13
802.11g	6 Mbps	11	11	12
802.11n-HT20	MCS0	11	11	11
802.11n-HT40	MCS0	12	12	9
BLE	/	Default	Default	Default

Pre-scan with all the data rates, the above data rate is the worst case for Wi-Fi test.

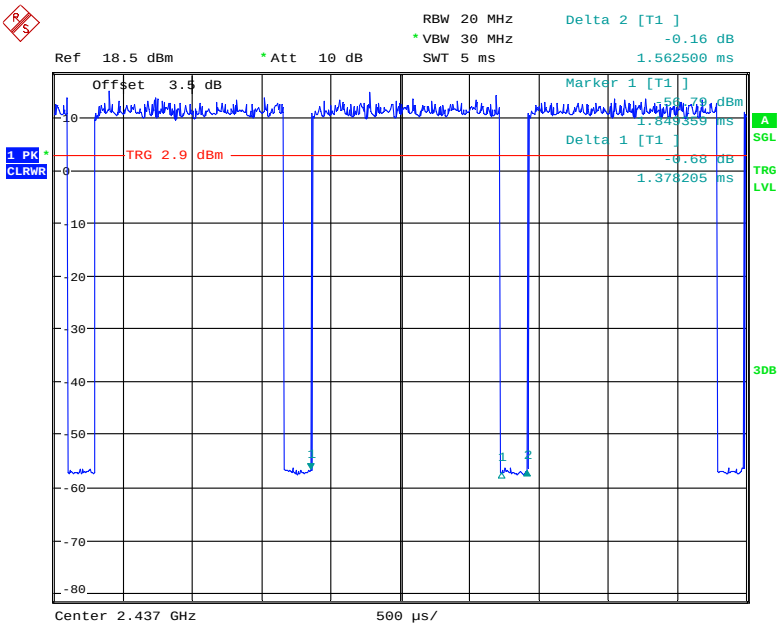
Duty cycle

802.11b mode



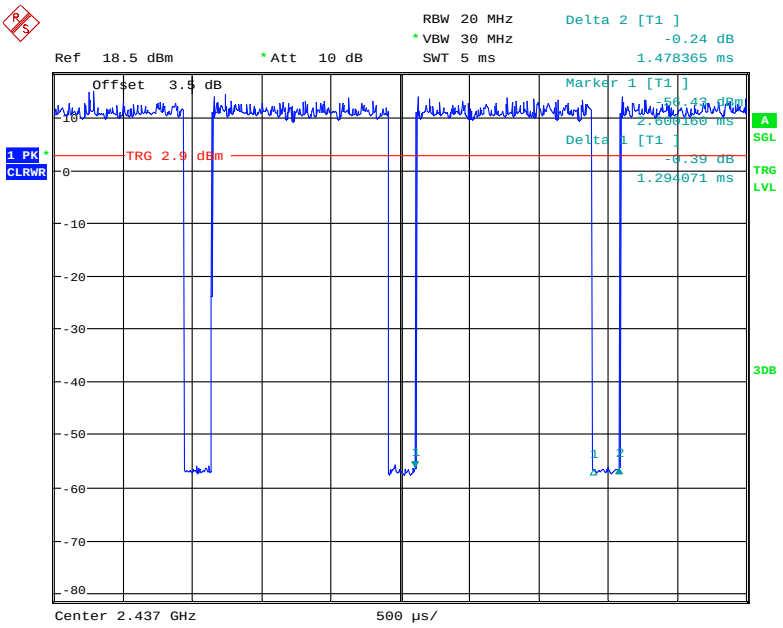
Date: 1.AUG.2018 16:29:50

802.11g mode



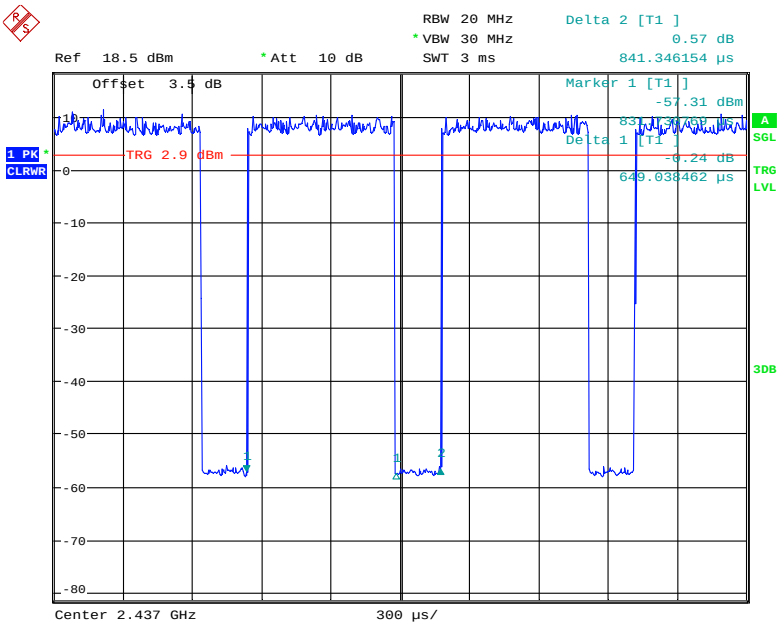
Date: 1.AUG.2018 16:27:19

802.11n-HT20 Mode



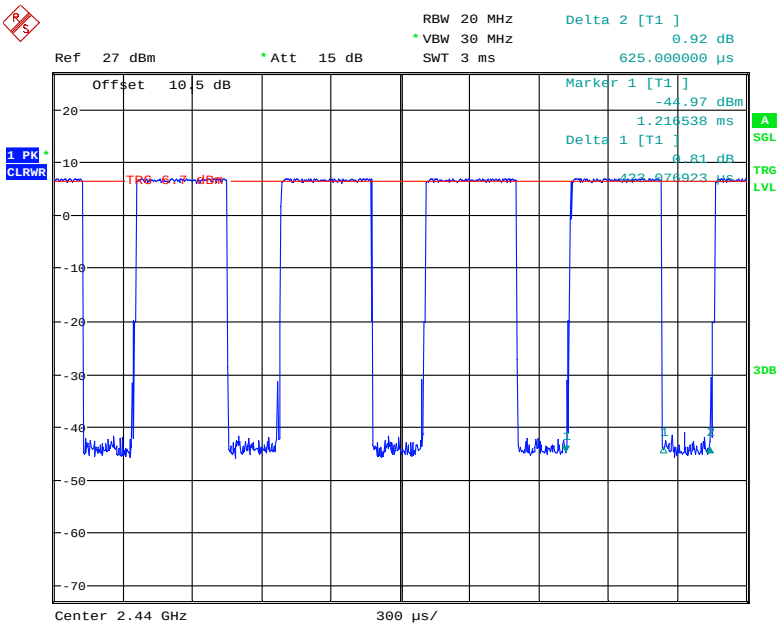
Date: 1.AUG.2018 16:23:55

802.11n-HT40 Mode



Date: 1.AUG.2018 16:26:02

BLE Mode



Date: 21.SEP.2018 17:21:23

Mode	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	10log(1/ Duty Cycle)
802.11b	99	-	-	10Hz	-
802.11g	88	1378	0.73	1kHz	0.56
802.11n-HT20	88	1294	0.77	1kHz	0.56
802.11n-HT40	77	649	1.54	3kHz	1.14
BLE	68	423	2.36	3kHz	1.67

Support Equipment List and Details

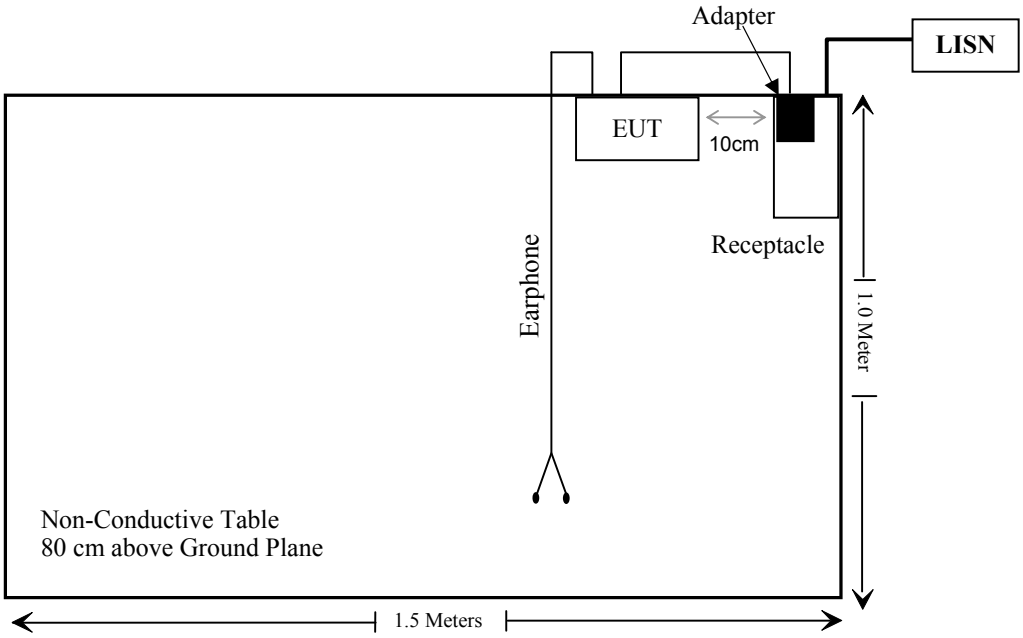
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	EUT	Adapter
Un-shielding Detachable Earphone Cable	1.2	EUT	Earphone

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1093	RF Exposure	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 EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2018-08-04	2019-08-04
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2017-12-21	2018-12-21
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2018-05-12	2018-11-21
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
N/A	Conducted Emission Cable	N/A	UF A210B-1-0720-504504	2018-05-12	2018-11-12
Radiated Emission Test					
A.H.System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-06-23	2019-06-23
COM-POWER	Pre-amplifier	PA-122	181919	2018-05-22	2018-11-22
Sonoma instrument	Amplifier	310N	186238	2018-05-12	2018-11-12
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-02-01	2018-08-01
Ducommun technologies	RF Cable	UFA147A-2362-100100	MFR64639 231029-003	2018-02-01	2018-08-01
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-21	2018-11-21
Ducommun technologies	RF Cable	RG-214	1	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	RG-214	2	2018-05-22	2018-11-22
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-04	2017-12-29	2020-12-28
Heatsink Required	Amplifier	QLW-18405536-J0	15964001002	2018-02-01	2018-08-01
Sinoscite	Notch Filter	BSF2402-2480MN-0898-001	N/A	2018-02-01	2018-08-01
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Agilent	USB windebond power meter	U2021XA	MY54250003	2018-06-23	2019-06-23
WEINSCHEL	10dB Attenuator	5324	AU 3842	Each Time	
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
Ducommun technologies	RF Cable	RG-214	3	Each Time	

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

FCC§15.247 (i), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Measurement Result

For worst case:

Mode	Frequency (MHz)	Max Tune-up Conducted Power (dBm)	Max Tune-up Conducted Power (mW)	Calculated Distance (mm)	Calculated value	Threshold (1-g SAR)	SAR Test Exclusion
BLE	2480	5.5	3.55	5	1.12	3.0	Yes

Result: No SAR test is required

For WIFI:

WIFI please refer to the report number: RSZ180710006-20A.

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.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has an internal antenna arrangement, which was permanently attached and the antenna gain is -2.8 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

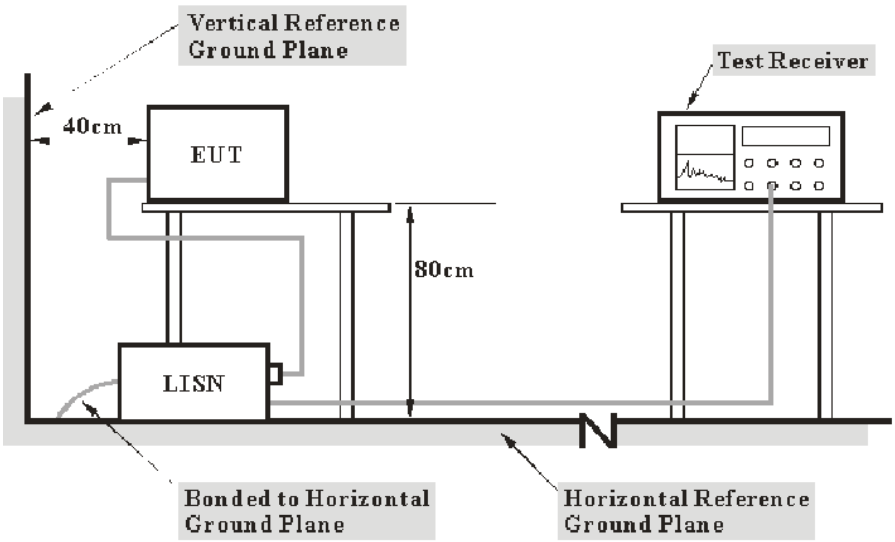
Result: Compliance.

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 outlet of the LISN.

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

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

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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

Margin = Limit – Corrected Amplitude

Test Results Summary

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

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

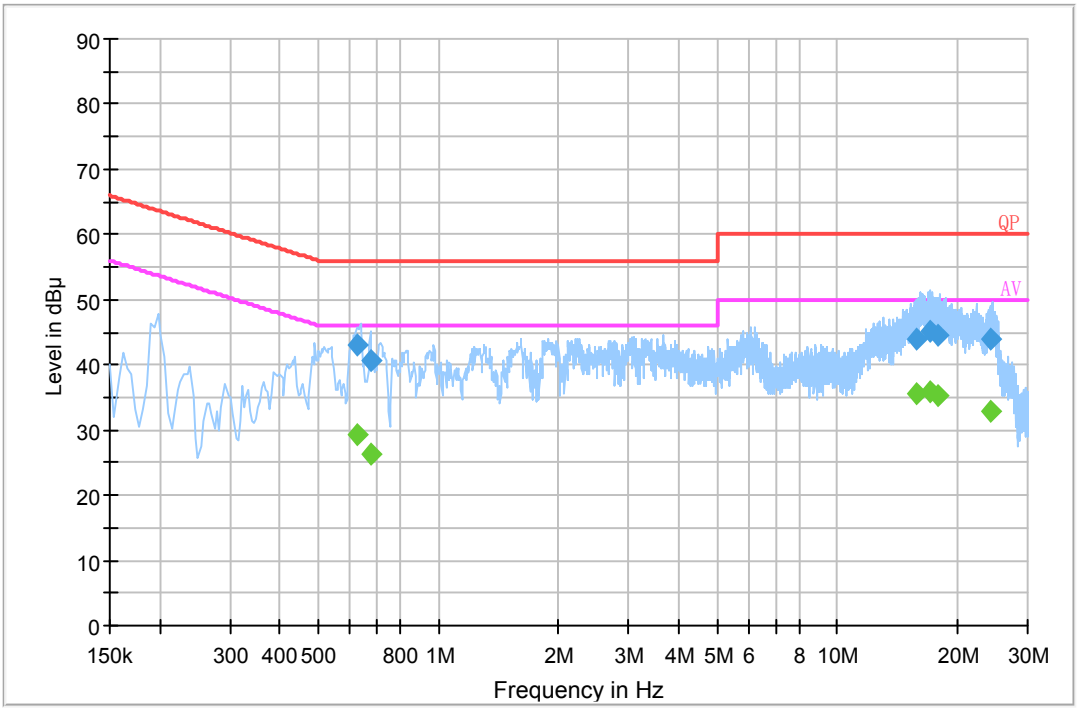
The testing was performed by Nancy Wang on 2018-08-22.

EUT operation mode: Transmitting

BLE Mode:

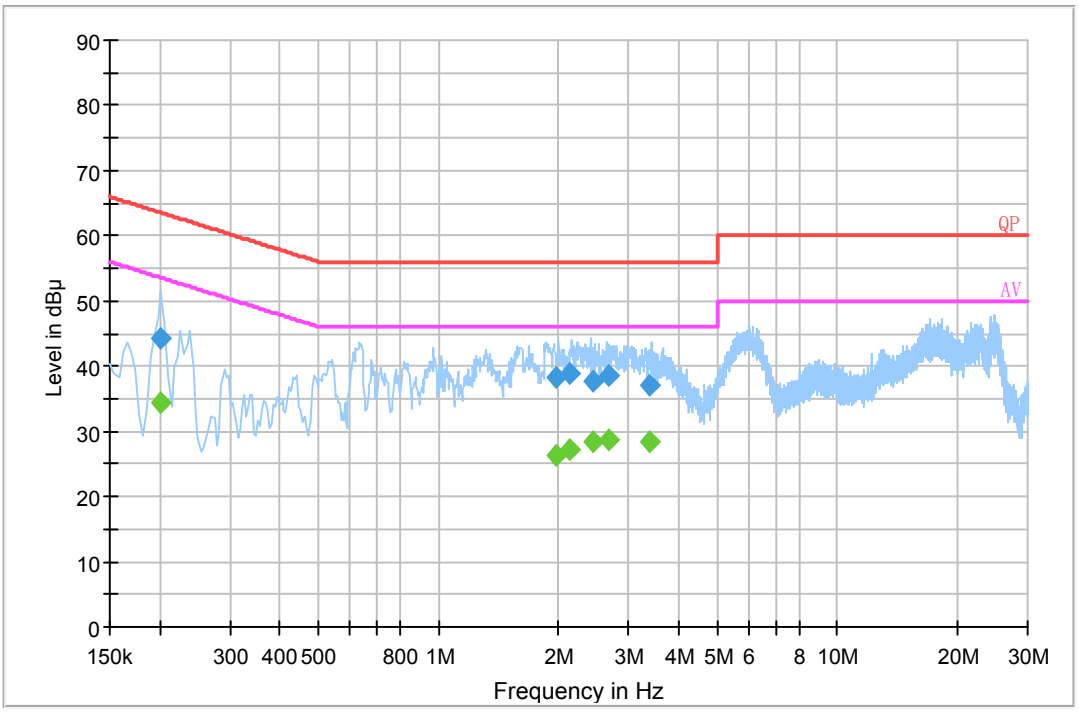
White Adapter

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.628430	43.1	19.7	56.0	12.9	QP
0.679890	40.6	19.7	56.0	15.4	QP
15.825810	44.0	20.2	60.0	16.0	QP
17.185230	45.2	20.2	60.0	14.8	QP
17.810770	44.5	20.2	60.0	15.5	QP
24.226470	43.9	20.4	60.0	16.1	QP
0.628430	29.4	19.7	46.0	16.6	Ave.
0.679890	26.4	19.7	46.0	19.6	Ave.
15.825810	35.5	20.2	50.0	14.5	Ave.
17.185230	35.9	20.2	50.0	14.1	Ave.
17.810770	35.2	20.2	50.0	14.8	Ave.
24.226470	32.8	20.4	50.0	17.2	Ave.

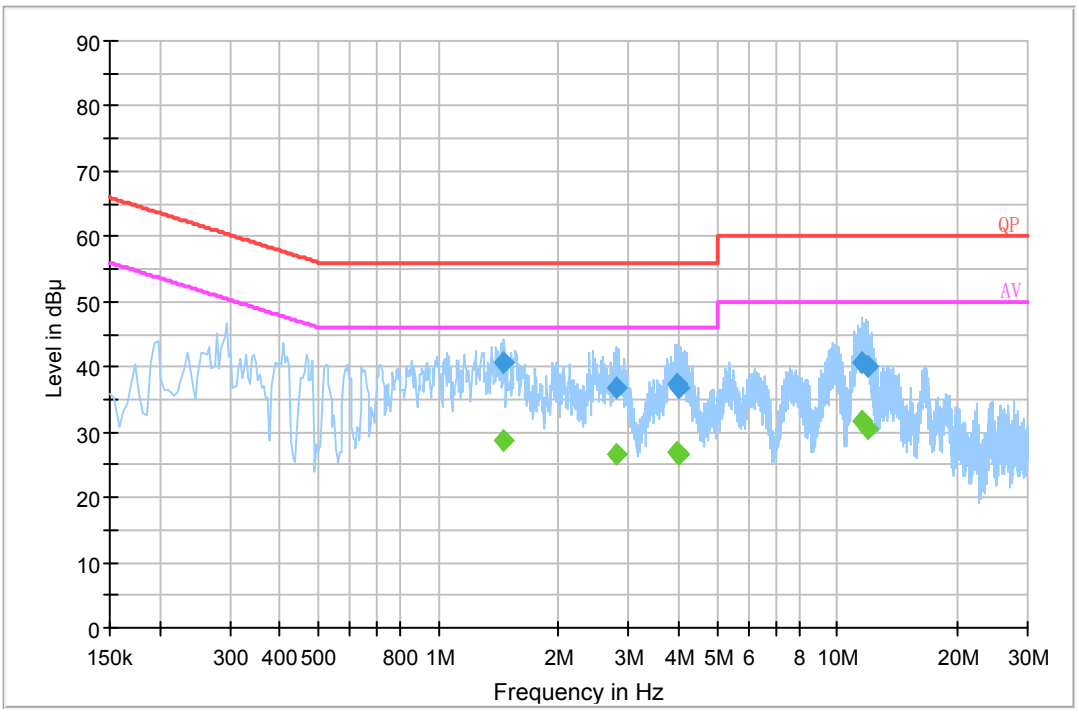
AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.201500	44.3	19.7	63.5	19.2	QP
1.975970	38.4	19.9	56.0	17.6	QP
2.141570	38.9	19.9	56.0	17.1	QP
2.429790	37.7	19.9	56.0	18.3	QP
2.670370	38.6	19.9	56.0	17.4	QP
3.370670	37.0	19.9	56.0	19.0	QP
0.201500	34.5	19.7	53.5	19.0	Ave.
1.975970	26.2	19.9	46.0	19.8	Ave.
2.141570	27.3	19.9	46.0	18.7	Ave.
2.429790	28.5	19.9	46.0	17.5	Ave.
2.670370	28.7	19.9	46.0	17.3	Ave.
3.370670	28.6	19.9	46.0	17.4	Ave.

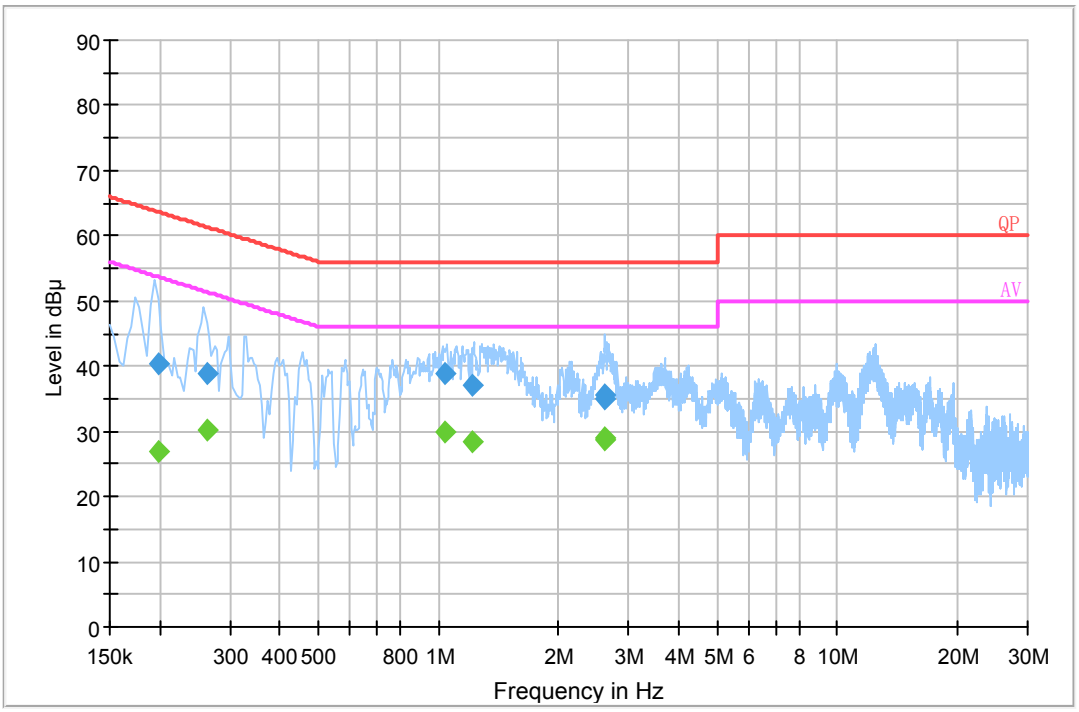
Black Adapter

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
1.460070	40.6	19.8	56.0	15.4	QP
2.792090	36.7	19.9	56.0	19.3	QP
3.963170	37.3	20.0	56.0	18.7	QP
4.009550	36.8	20.0	56.0	19.2	QP
11.585890	40.6	20.2	60.0	19.4	QP
11.861810	40.1	20.2	60.0	19.9	QP
1.460070	28.6	19.8	46.0	17.4	Ave.
2.792090	26.5	19.9	46.0	19.5	Ave.
3.963170	27.1	20.0	46.0	18.9	Ave.
4.009550	26.7	20.0	46.0	19.3	Ave.
11.585890	31.6	20.2	50.0	18.4	Ave.
11.861810	30.4	20.2	50.0	19.6	Ave.

AC 120V/60 Hz, Neutral

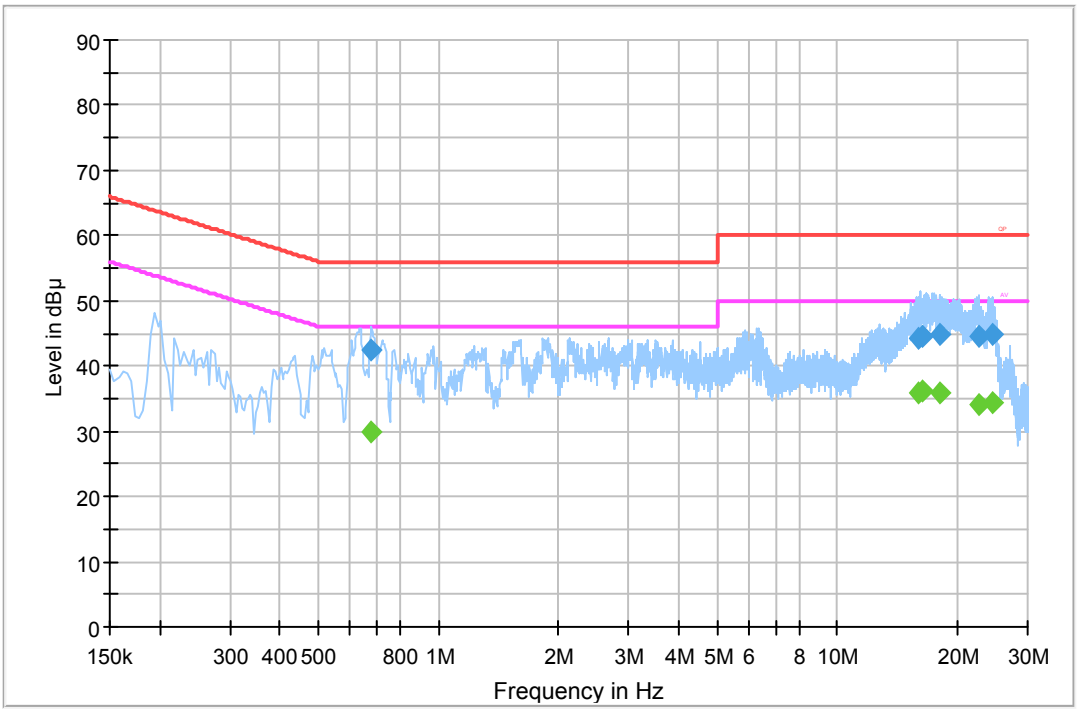


Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.198500	40.4	19.7	63.7	23.3	QP
0.262500	38.9	19.7	61.4	22.5	QP
1.042190	38.9	19.8	56.0	17.1	QP
1.215550	37.0	19.7	56.0	19.0	QP
2.606730	34.9	19.9	56.0	21.1	QP
2.626490	35.7	19.9	56.0	20.3	QP
0.198500	26.9	19.7	53.7	26.8	Ave.
0.262500	30.1	19.7	51.4	21.3	Ave.
1.042190	30.0	19.8	46.0	16.0	Ave.
1.215550	28.4	19.7	46.0	17.6	Ave.
2.606730	28.9	19.9	46.0	17.1	Ave.
2.626490	28.8	19.9	46.0	17.2	Ave.

Wi-Fi Mode:

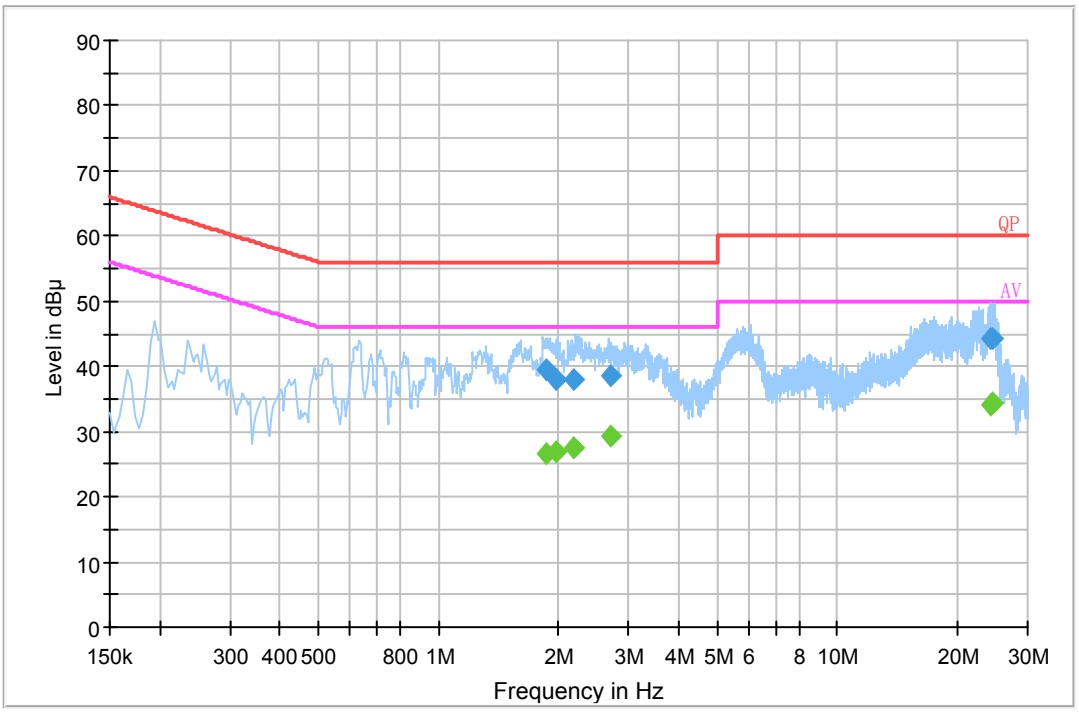
White adapter

AC 120 V/60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.675830	42.4	19.7	56.0	13.6	QP
15.953330	44.3	20.2	60.0	15.7	QP
16.415090	44.7	20.2	60.0	15.3	QP
18.025750	44.8	20.2	60.0	15.2	QP
22.735150	44.4	20.3	60.0	15.6	QP
24.396030	44.8	20.4	60.0	15.2	QP
0.675830	29.8	19.7	46.0	16.2	Ave.
15.953330	35.9	20.2	50.0	14.1	Ave.
16.415090	36.2	20.2	50.0	13.8	Ave.
18.025750	36.0	20.2	50.0	14.0	Ave.
22.735150	34.0	20.3	50.0	16.0	Ave.
24.396030	34.5	20.4	50.0	15.5	Ave.

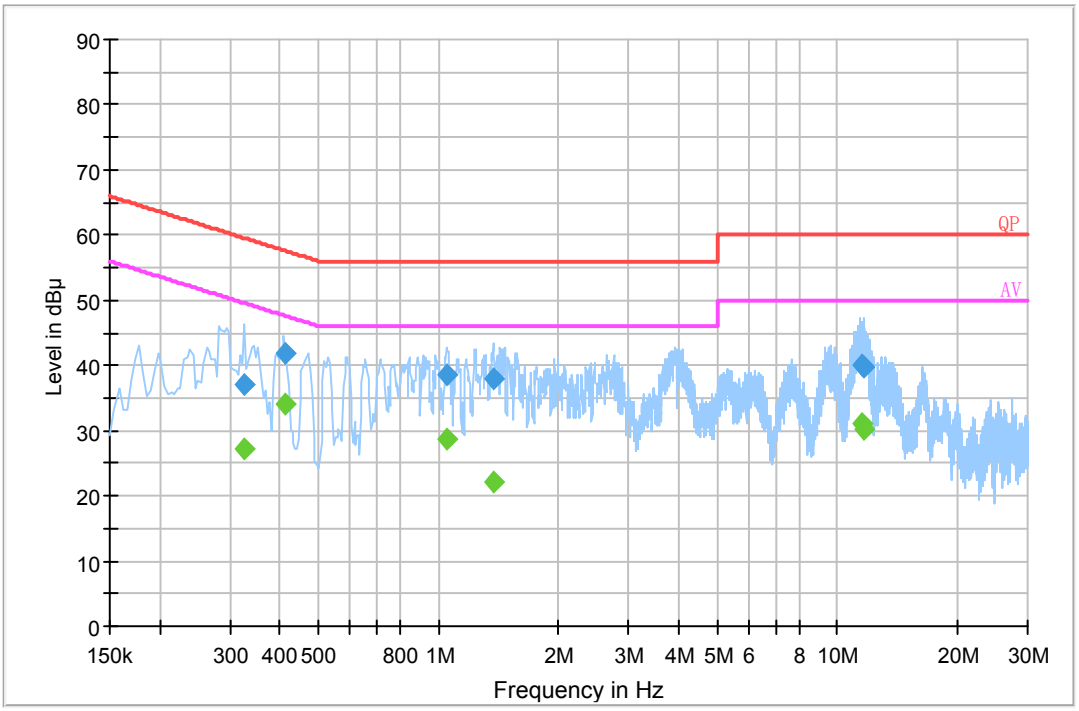
AC 120V/ 60 Hz, Neutral:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
1.857450	39.3	19.9	56.0	16.7	QP
1.980210	38.1	19.9	56.0	17.9	QP
2.184790	38.1	19.9	56.0	17.9	QP
2.693830	38.5	19.9	56.0	17.5	QP
24.317710	44.4	20.4	60.0	15.6	QP
24.395990	44.3	20.4	60.0	15.7	QP
1.857450	26.5	19.9	46.0	19.5	Ave.
1.980210	26.9	19.9	46.0	19.1	Ave.
2.184790	27.4	19.9	46.0	18.6	Ave.
2.693830	29.2	19.9	46.0	16.8	Ave.
24.317710	34.1	20.4	50.0	15.9	Ave.
24.395990	34.4	20.4	50.0	15.6	Ave.

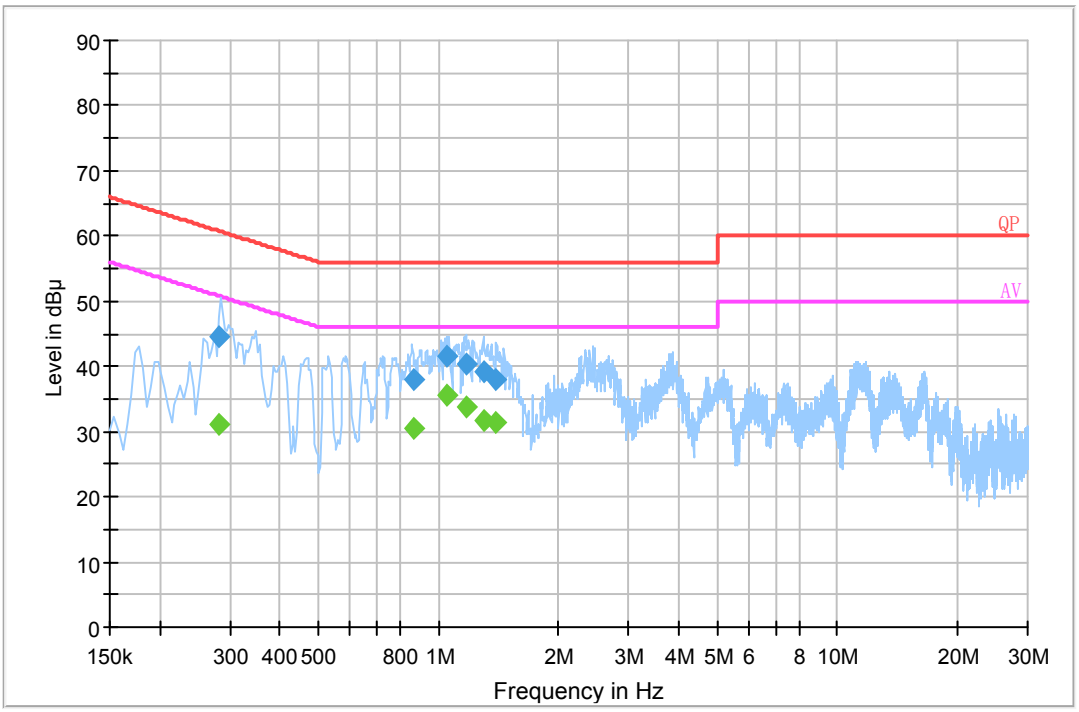
Black adapter

AC 120 V/60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.325110	37.2	19.8	59.6	22.4	QP
0.411850	41.8	19.7	57.6	15.8	QP
1.050310	38.6	19.8	56.0	17.4	QP
1.373390	38.0	19.8	56.0	18.0	QP
11.478670	40.2	20.2	60.0	19.8	QP
11.703070	39.6	20.2	60.0	20.4	QP
0.325110	27.3	19.8	49.6	22.3	Ave.
0.411850	34.1	19.7	47.6	13.5	Ave.
1.050310	28.7	19.8	46.0	17.3	Ave.
1.373390	22.2	19.8	46.0	23.8	Ave.
11.478670	31.2	20.2	50.0	18.8	Ave.
11.703070	30.3	20.2	50.0	19.7	Ave.

AC 120V/ 60 Hz, Neutral:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.281500	44.6	19.7	60.8	16.2	QP
0.869130	37.9	19.7	56.0	18.1	QP
1.054010	41.4	19.8	56.0	14.6	QP
1.172450	40.4	19.7	56.0	15.6	QP
1.306590	39.1	19.8	56.0	16.9	QP
1.393030	38.0	19.8	56.0	18.0	QP
0.281500	31.1	19.7	50.8	19.7	Ave.
0.869130	30.5	19.7	46.0	15.5	Ave.
1.054010	35.7	19.8	46.0	10.3	Ave.
1.172450	33.9	19.7	46.0	12.1	Ave.
1.306590	31.7	19.8	46.0	14.3	Ave.
1.393030	31.5	19.8	46.0	14.5	Ave.

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

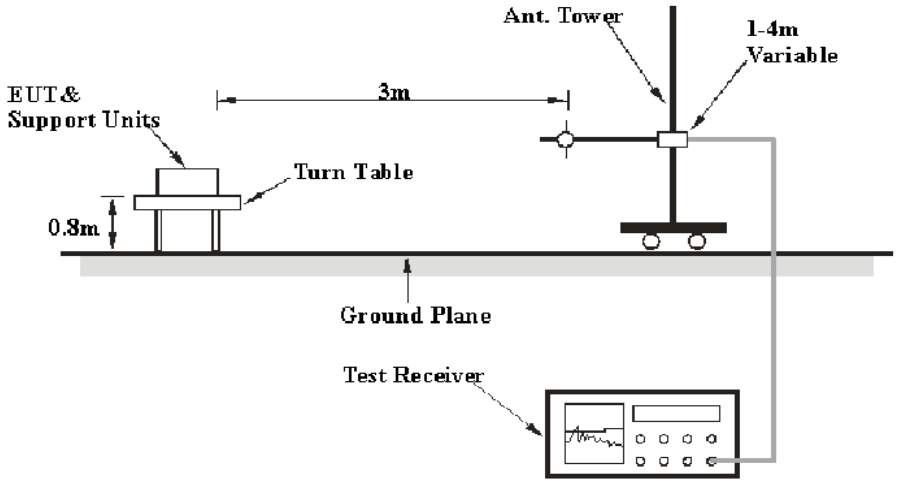
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

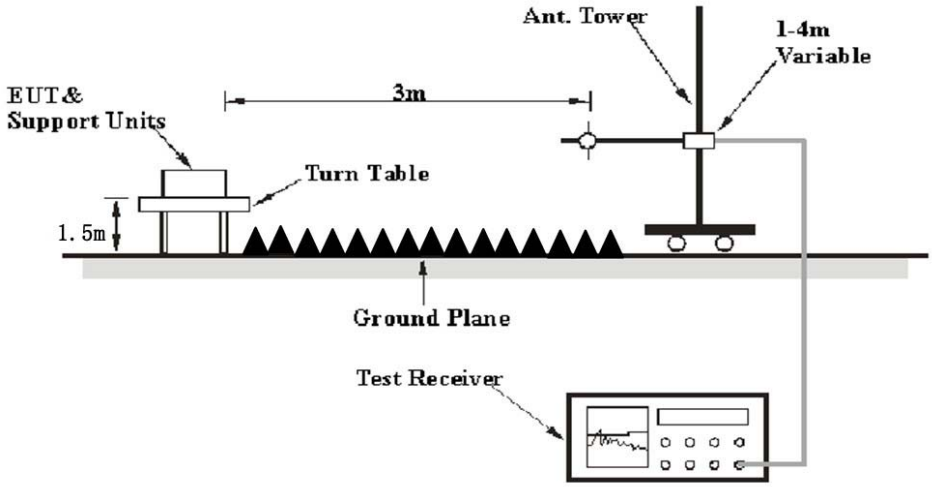
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters 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.

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 & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Average
	1MHz	＞1/T Note 2	/	Average

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

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 Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

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

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

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

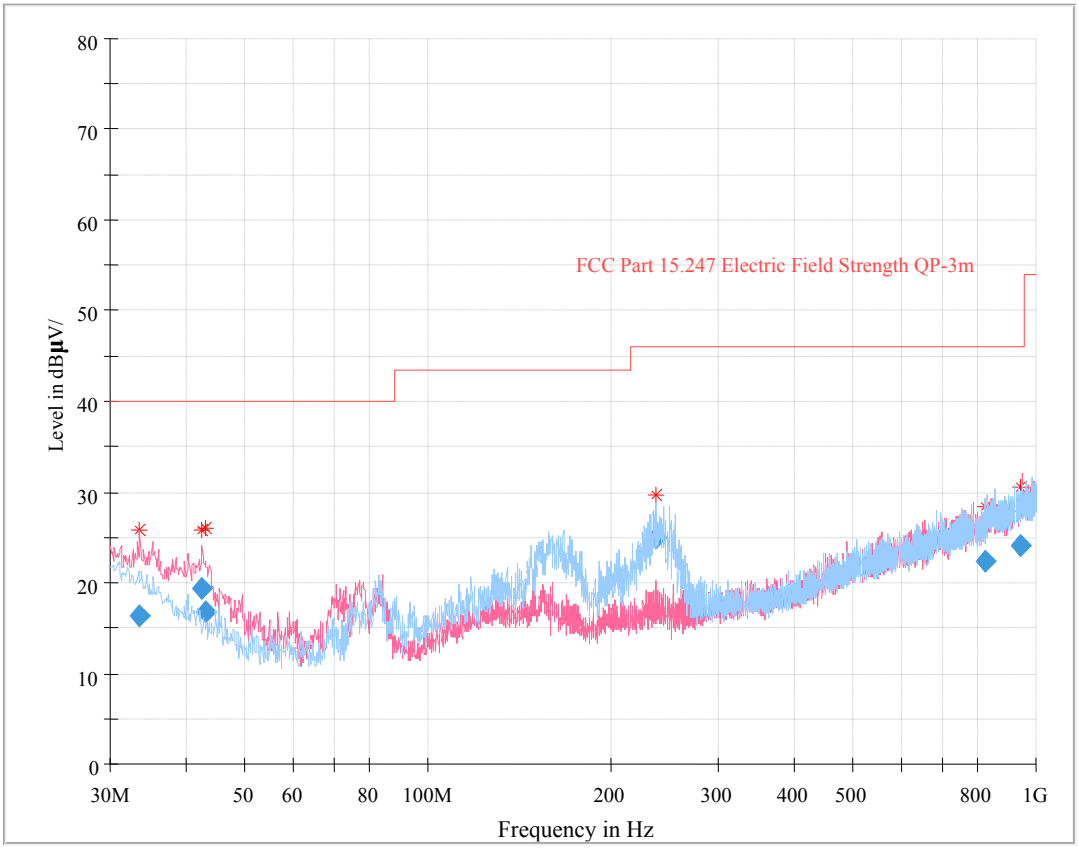
The testing was performed by Nancy Wang on 2018-07-26.

EUT operation mode: Transmitting

BLE Mode:

White adapter

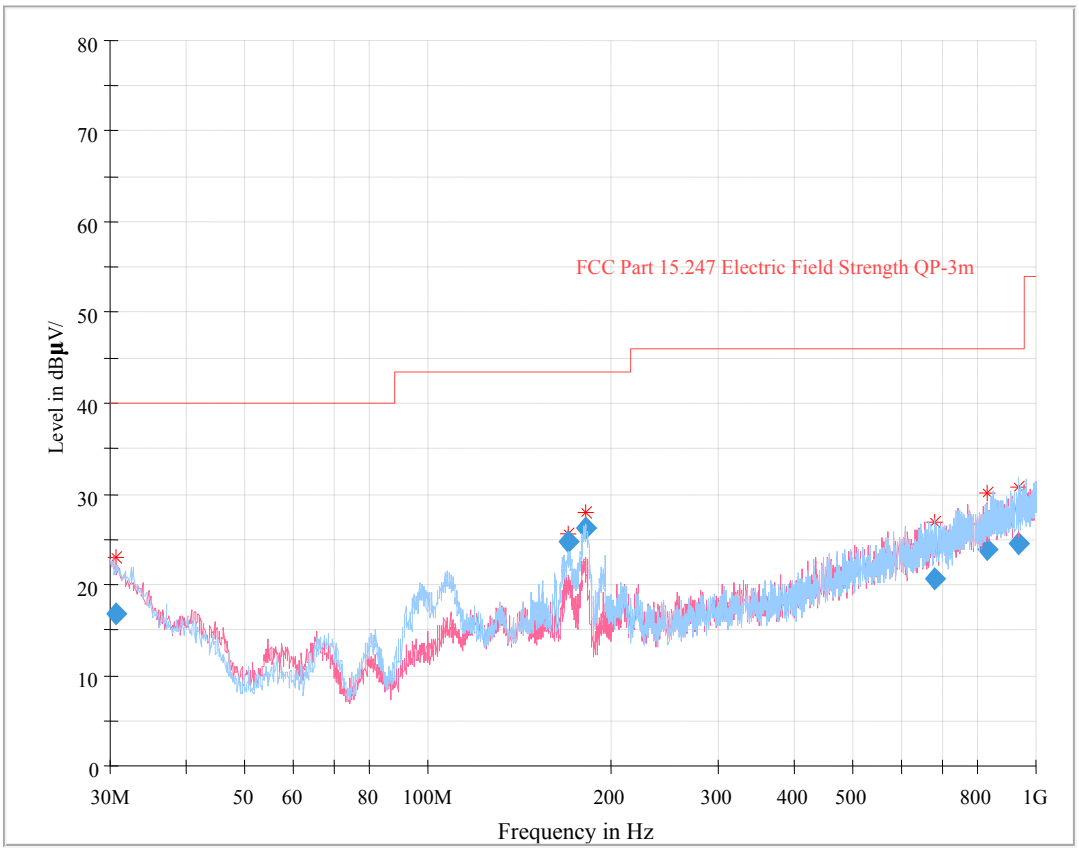
30 MHz~1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
33.492750	16.28	133.0	V	188.0	-6.8	40.00	23.72
42.596250	19.40	100.0	V	163.0	-12.5	40.00	20.60
42.946875	16.67	116.0	V	79.0	-12.7	40.00	23.33
237.503250	25.00	128.0	H	90.0	-10.6	46.00	21.00
828.374875	22.33	100.0	H	207.0	-0.1	46.00	23.67
946.123250	24.19	112.0	V	89.0	1.9	46.00	21.81

Black adapter

30 MHz~1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.560682	16.83	320.0	V	149.0	-5.0	40.00	23.17
170.586375	24.71	165.0	H	233.0	-11.6	43.50	18.79
181.310000	26.30	124.0	H	226.0	-12.2	43.50	17.20
681.181000	20.72	152.0	V	97.0	-2.3	46.00	25.28
834.494750	23.83	109.0	V	292.0	0.1	46.00	22.17
934.922250	24.58	102.0	H	184.0	1.5	46.00	21.42

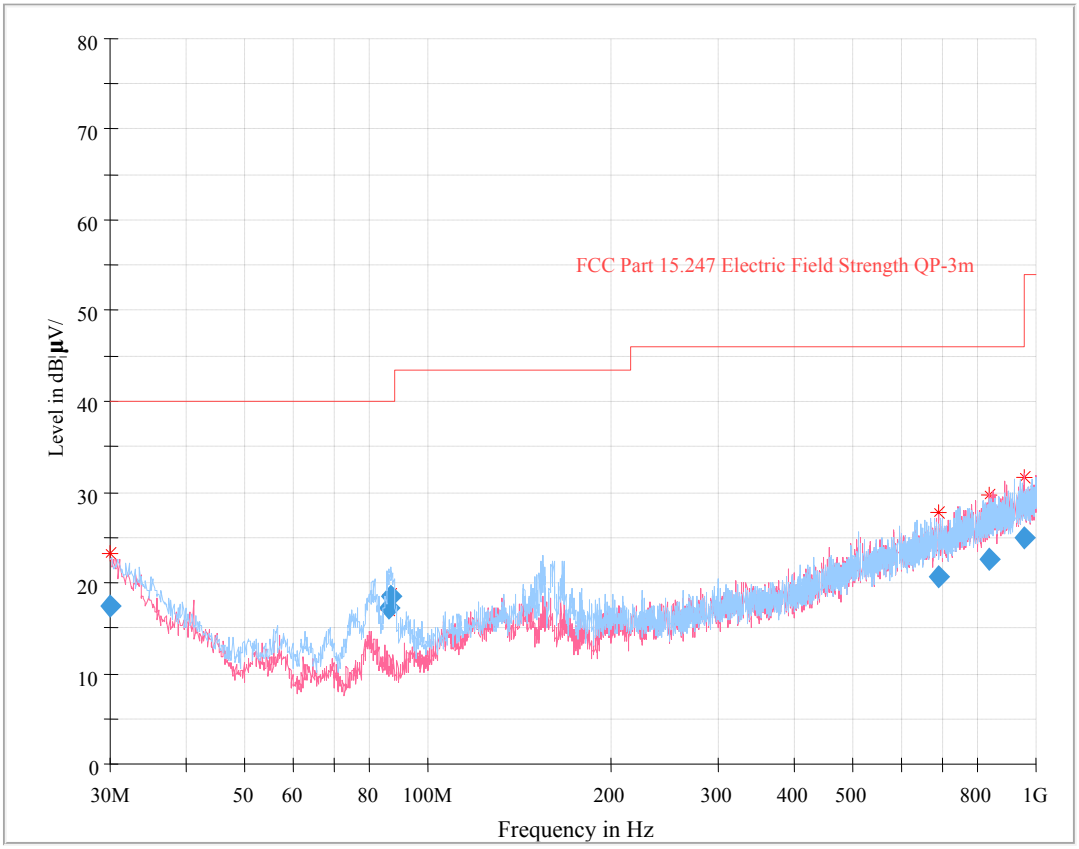
1 GHz-25 GHz(BLE):

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2402 MHz)									
2402.00	61.51	PK	168	1.6	H	33.00	94.51	/	/
2402.00	55.42	Ave.	168	1.6	H	33.00	88.42	/	/
2402.00	65.64	PK	73	1.3	V	33.00	98.64	/	/
2402.00	59.33	Ave.	73	1.3	V	33.00	92.33	/	/
2372.56	27.52	PK	357	1.1	V	33.00	60.52	74	13.48
2372.56	14.11	Ave.	357	1.1	V	33.00	47.11	54	6.89
2488.51	27.14	PK	39	1.0	V	33.20	60.34	74	13.66
2488.51	13.67	Ave.	39	1.0	V	33.20	46.87	54	7.13
4804.00	47.25	PK	88	2.1	V	7.88	55.13	74	18.87
4804.00	33.24	Ave.	88	2.1	V	7.88	41.12	54	12.88
Middle Channel (2440 MHz)									
2440.00	61.32	PK	188	1.3	H	33.10	94.42	/	/
2440.00	55.18	Ave.	188	1.3	H	33.10	88.28	/	/
2440.00	65.87	PK	241	1.4	V	33.10	98.97	/	/
2440.00	60.23	Ave.	241	1.4	V	33.10	93.33	/	/
4880.00	47.38	PK	251	1.8	V	9.21	56.59	74	17.41
4880.00	32.39	Ave.	251	1.8	V	9.21	41.60	54	12.40
High Channel (2480 MHz)									
2480.00	59.34	PK	318	1.0	H	33.20	92.54	/	/
2480.00	53.14	Ave.	318	1.0	H	33.20	86.34	/	/
2480.00	63.21	PK	343	1.8	V	33.20	96.41	/	/
2480.00	58.52	Ave.	343	1.8	V	33.20	91.72	/	/
2324.51	27.62	PK	323	1.7	V	32.97	60.59	74	13.41
2324.51	14.51	Ave.	323	1.7	V	32.97	47.48	54	6.52
2486.72	28.32	PK	187	1.1	V	33.20	61.52	74	12.48
2486.72	14.83	Ave.	187	1.1	V	33.20	48.03	54	5.97
4960.00	47.29	PK	149	2.0	V	9.07	56.36	74	17.64
4960.00	31.54	Ave.	149	2.0	V	9.07	40.61	54	13.39

Wi-Fi Mode:

White adapter

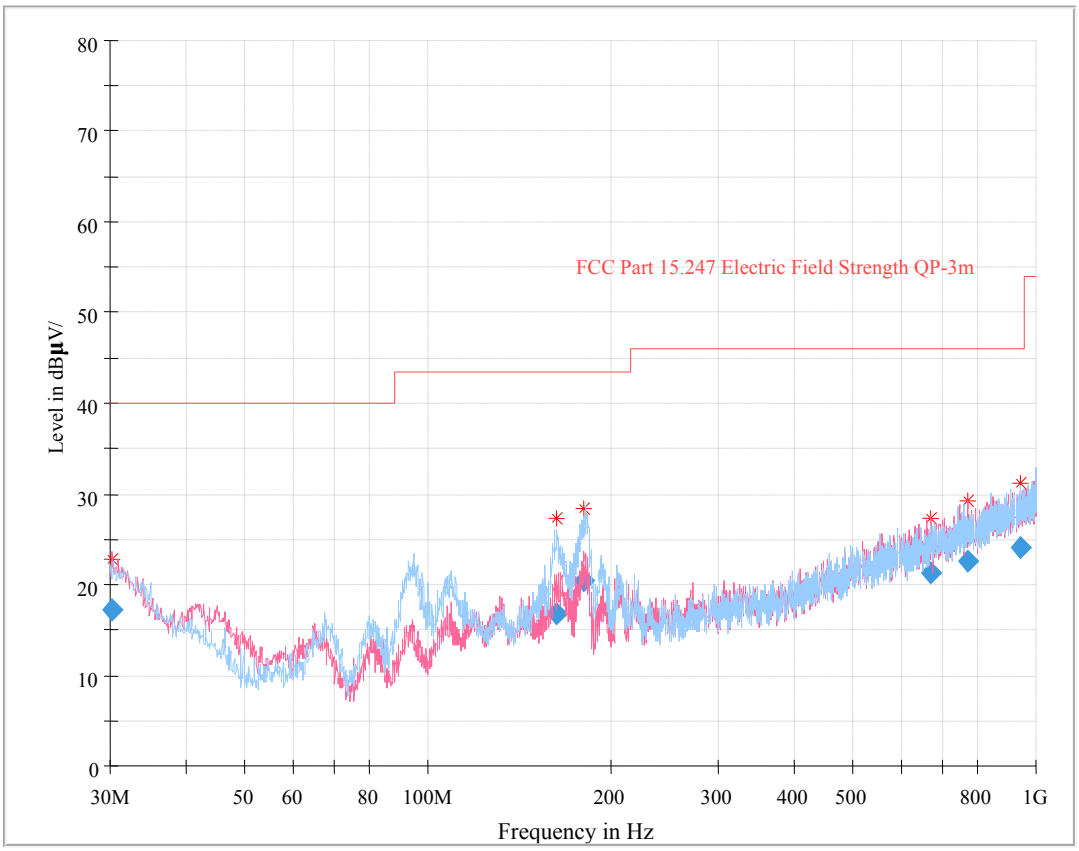
30 MHz~1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.055524	17.34	326.0	H	26.0	-4.7	40.00	22.66
86.231500	17.24	220.0	H	92.0	-16.1	40.00	22.76
86.701250	18.46	400.0	H	92.0	-16.1	40.00	21.54
690.387000	20.58	261.0	V	317.0	-1.9	46.00	25.42
835.085375	22.68	180.0	V	264.0	0.1	46.00	23.32
957.118750	24.89	112.0	V	212.0	2.3	46.00	21.11

Black adapter

30 MHz~1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.284656	17.13	308.0	V	279.0	-4.9	40.00	22.87
162.225125	16.74	281.0	H	264.0	-11.2	43.50	26.76
180.925625	20.38	139.0	H	210.0	-12.2	43.50	23.12
670.819750	21.21	116.0	V	357.0	-2.4	46.00	24.79
770.186375	22.65	106.0	V	121.0	-1.0	46.00	23.35
945.912875	24.07	400.0	H	217.0	1.9	46.00	21.93

1 GHz-25 GHz(WIFI):

802.11b Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2412 MHz)									
2412.00	67.96	PK	226	2.3	H	33.92	101.88	/	/
2412.00	62.46	Ave.	226	2.3	H	33.92	96.38	/	/
2412.00	61.48	PK	135	2.3	V	33.92	95.40	/	/
2412.00	55.40	Ave.	135	2.3	V	33.92	89.32	/	/
2366.59	29.18	PK	352	1.2	H	33.92	63.10	74	10.90
2366.59	14.23	Ave.	352	1.2	H	33.92	48.15	54	5.85
2485.55	27.18	PK	181	1.1	H	34.08	61.26	74	12.74
2485.55	13.40	Ave.	181	1.1	H	34.08	47.48	54	6.52
4824.00	43.44	PK	302	1.8	H	5.84	49.28	74	24.72
4824.00	28.42	Ave.	302	1.8	H	5.84	34.26	54	19.74
Middle Channel (2437MHz)									
2437.00	71.23	PK	8	1.3	H	33.92	105.15	/	/
2437.00	65.33	Ave.	8	1.3	H	33.92	99.25	/	/
2437.00	66.52	PK	73	2.2	V	33.92	100.44	/	/
2437.00	60.49	Ave.	73	2.2	V	33.92	94.41	/	/
4874.00	43.36	PK	244	2.3	H	6.21	49.57	74	24.43
4874.00	28.77	Ave.	244	2.3	H	6.21	34.98	54	19.02
High Channel (2462 MHz)									
2462.00	69.44	PK	45	2.0	H	34.08	103.52	/	/
2462.00	63.54	Ave.	45	2.0	H	34.08	97.62	/	/
2462.00	63.64	PK	285	2.2	V	34.08	97.72	/	/
2462.00	58.08	Ave.	285	2.2	V	34.08	92.16	/	/
2357.29	28.26	PK	256	1.9	H	33.92	62.18	74	11.82
2357.29	13.97	Ave.	256	1.9	H	33.92	47.89	54	6.11
2487.27	27.64	PK	82	1.7	H	34.08	61.72	74	12.28
2487.27	13.56	Ave.	82	1.7	H	34.08	47.64	54	6.36
4924.00	42.68	PK	21	1.9	H	6.21	48.89	74	25.11
4924.00	27.84	Ave.	21	1.9	H	6.21	34.05	54	19.95

802.11g Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2412 MHz)									
2412.00	69.26	PK	21	1.6	H	33.92	103.18	/	/
2412.00	51.37	Ave.	21	1.6	H	33.92	85.29	/	/
2412.00	65.48	PK	28	2.3	V	33.92	99.40	/	/
2412.00	47.97	Ave.	28	2.3	V	33.92	81.89	/	/
2389.52	27.53	PK	130	1.3	H	33.92	61.45	74	12.55
2389.52	13.66	Ave.	130	1.3	H	33.92	47.58	54	6.42
2484.03	27.00	PK	266	1.7	H	34.08	61.08	74	12.92
2484.03	13.54	Ave.	266	1.7	H	34.08	47.62	54	6.38
4824.00	41.84	PK	250	1.2	H	5.84	47.68	74	26.32
4824.00	27.07	Ave.	250	1.2	H	5.84	32.91	54	21.09
Middle Channel (2437MHz)									
2437.00	69.77	PK	188	1.2	H	33.92	103.69	/	/
2437.00	51.96	Ave.	188	1.2	H	33.92	85.88	/	/
2437.00	66.31	PK	164	2.3	V	33.92	100.23	/	/
2437.00	49.56	Ave.	164	2.3	V	33.92	83.48	/	/
4874.00	42.27	PK	193	2.2	H	6.21	48.48	74	25.52
4874.00	27.81	Ave.	193	2.2	H	6.21	34.02	54	19.98
High Channel (2462 MHz)									
2462.00	72.64	PK	235	2.4	H	34.08	106.72	/	/
2462.00	54.83	Ave.	235	2.4	H	34.08	88.91	/	/
2462.00	63.74	PK	200	1.6	V	34.08	97.82	/	/
2462.00	46.57	Ave.	200	1.6	V	34.08	80.65	/	/
2382.46	28.29	PK	93	1.7	H	33.92	62.21	74	11.79
2382.46	14.13	Ave.	93	1.7	H	33.92	48.05	54	5.95
2493.04	27.15	PK	331	2.4	H	34.08	61.23	74	12.77
2493.04	13.56	Ave.	331	2.4	H	34.08	47.64	54	6.36
4924.00	41.09	PK	344	1.2	H	6.21	47.30	74	26.70
4924.00	26.74	Ave.	344	1.2	H	6.21	32.95	54	21.05

802.11n-HT20 Mode:

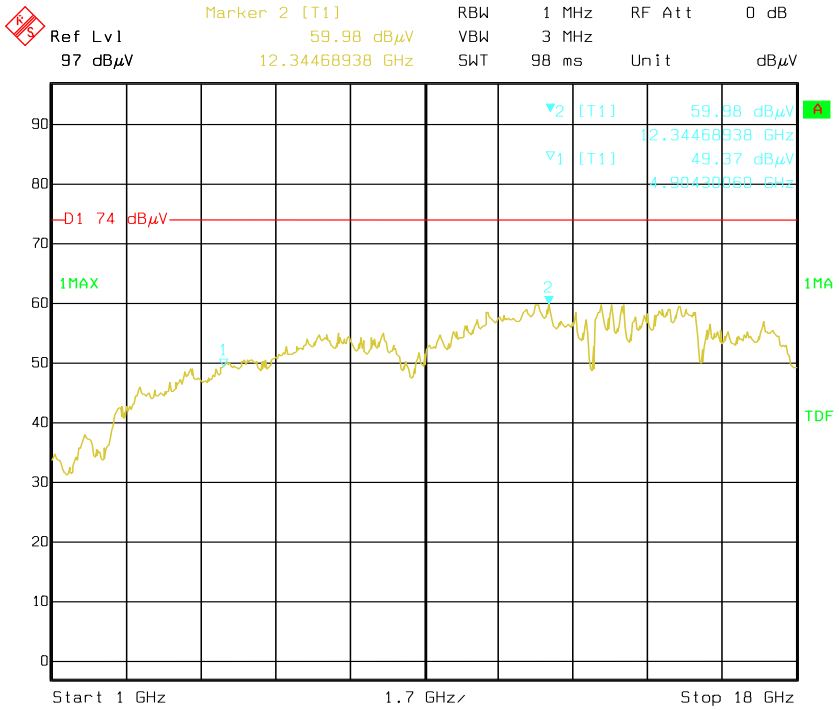
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2412 MHz)									
2412.00	69.68	PK	44	1.9	H	33.92	103.60	/	/
2412.00	51.96	Ave.	44	1.9	H	33.92	85.88	/	/
2412.00	64.77	PK	170	1.5	V	33.92	98.69	/	/
2412.00	47.77	Ave.	170	1.5	V	33.92	81.69	/	/
2369.80	27.89	PK	42	1.5	H	33.92	61.81	74	12.19
2369.80	13.66	Ave.	42	1.5	H	33.92	47.58	54	6.42
2484.02	26.65	PK	187	1.2	H	34.08	60.73	74	13.27
2484.02	13.38	Ave.	187	1.2	H	34.08	47.46	54	6.54
4824.00	42.15	PK	123	1.9	H	5.84	47.99	74	26.01
4824.00	27.27	Ave.	123	1.9	H	5.84	33.11	54	20.89
Middle Channel (2437MHz)									
2437.00	70.06	PK	40	2.2	H	33.92	103.98	/	/
2437.00	52.97	Ave.	40	2.2	H	33.92	86.89	/	/
2437.00	66.40	PK	324	1.6	V	33.92	100.32	/	/
2437.00	49.18	Ave.	324	1.6	V	33.92	83.10	/	/
4874.00	41.72	PK	105	1.2	H	6.21	47.93	74	26.07
4874.00	27.60	Ave.	105	1.2	H	6.21	33.81	54	20.19
High Channel (2462 MHz)									
2462.00	69.65	PK	246	2.1	H	34.08	103.73	/	/
2462.00	50.69	Ave.	246	2.1	H	34.08	84.77	/	/
2462.00	61.71	PK	303	1.7	V	34.08	95.79	/	/
2462.00	43.92	Ave.	303	1.7	V	34.08	78.00	/	/
2346.23	27.41	PK	5	1.9	H	33.83	61.24	92	30.76
2346.23	13.38	Ave.	5	1.9	H	33.83	47.21	60	12.79
2486.18	27.55	PK	38	1.4	V	34.08	61.63	92	30.37
2486.18	13.51	Ave.	38	1.4	V	34.08	47.59	60	12.41
4924.00	42.05	PK	285	1.7	H	6.21	48.26	74	25.74
4924.00	27.30	Ave.	285	1.7	H	6.21	33.51	54	20.49

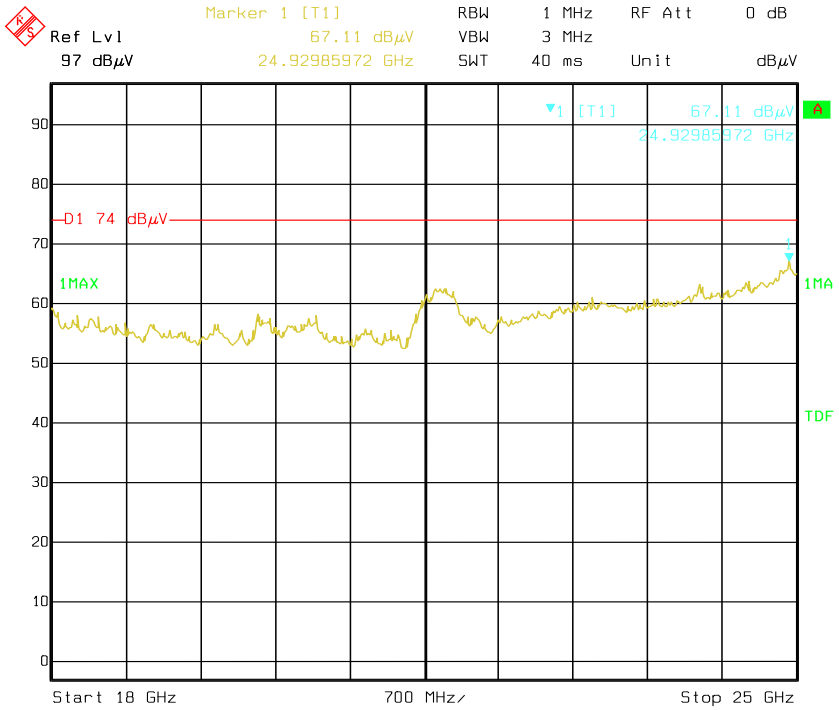
802.11n-HT40 Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2422 MHz)									
2422.00	65.77	PK	357	1.4	H	33.92	99.69	/	/
2422.00	53.75	Ave.	357	1.4	H	33.92	87.67	/	/
2422.00	60.62	PK	35	1.7	V	33.92	94.54	/	/
2422.00	47.84	Ave.	35	1.7	V	33.92	81.76	/	/
2390.00	31.43	PK	354	2.4	H	33.92	65.35	92	26.65
2390.00	16.34	Ave.	354	2.4	H	33.92	50.26	60	9.74
2488.56	26.85	PK	100	2.3	V	34.08	60.93	92	31.07
2488.56	13.45	Ave.	100	2.3	V	34.08	47.53	60	12.47
4844.00	42.84	PK	340	1.3	H	5.84	48.68	74	25.32
4844.00	28.58	Ave.	340	1.3	H	5.84	34.42	54	19.58
Middle Channel (2437MHz)									
2437.00	67.37	PK	281	2.4	H	33.92	101.29	/	/
2437.00	55.53	Ave.	281	2.4	H	33.92	89.45	/	/
2437.00	62.80	PK	116	2.2	V	33.92	96.72	/	/
2437.00	46.30	Ave.	116	2.2	V	33.92	80.22	/	/
4874.00	42.22	PK	112	1.9	H	5.34	47.56	74	26.44
4874.00	28.81	Ave.	112	1.9	H	5.34	34.15	54	19.85
High Channel (2452 MHz)									
2452.00	63.17	PK	126	1.3	H	34.08	97.25	/	/
2452.00	50.98	Ave.	126	1.3	H	34.08	85.06	/	/
2452.00	59.10	PK	321	1.7	V	34.08	93.18	/	/
2452.00	45.93	Ave.	321	1.7	V	34.08	80.01	/	/
2348.80	26.66	PK	95	1.3	H	33.83	60.49	74	13.51
2348.80	13.28	Ave.	95	1.3	H	33.83	47.11	54	6.89
2498.12	26.81	PK	265	2.5	H	34.08	60.89	74	13.11
2498.12	13.40	Ave.	265	2.5	H	34.08	47.48	54	6.52
4904.00	43.76	PK	311	1.3	H	6.21	49.97	74	24.03
4904.00	28.94	Ave.	311	1.3	H	6.21	35.15	54	18.85

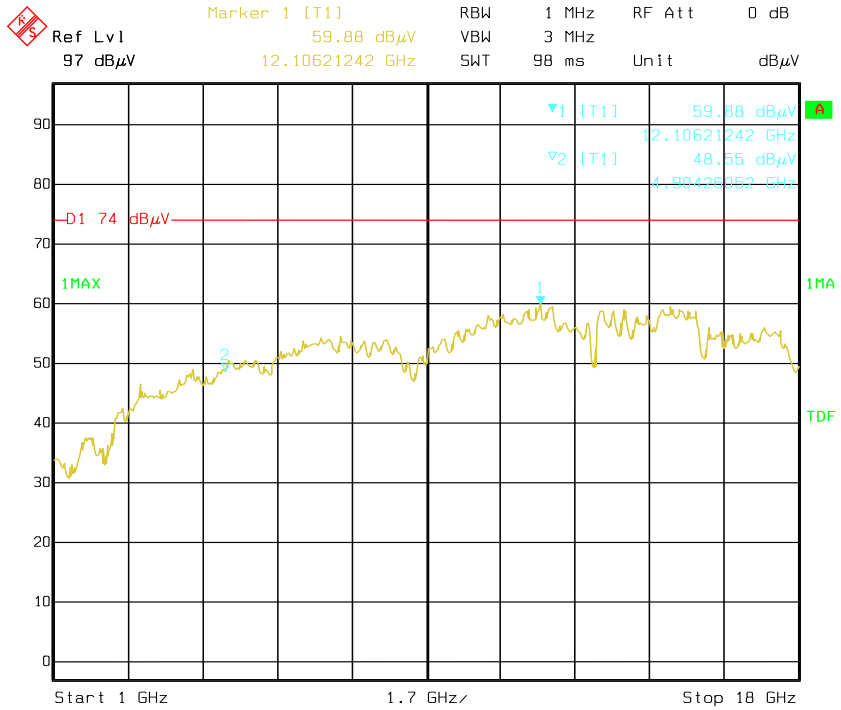
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.
And for the pre-scan is performed with the 2400-2483.5MHz band filter.

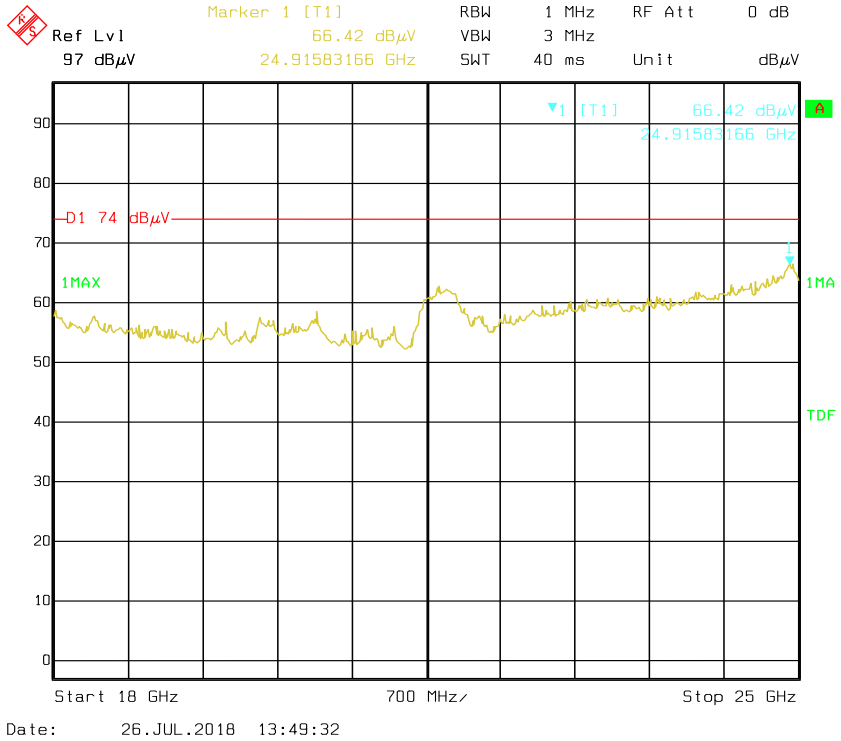
Pre-scan with 802.11n-HT40 Mode, High channel
Horizontal



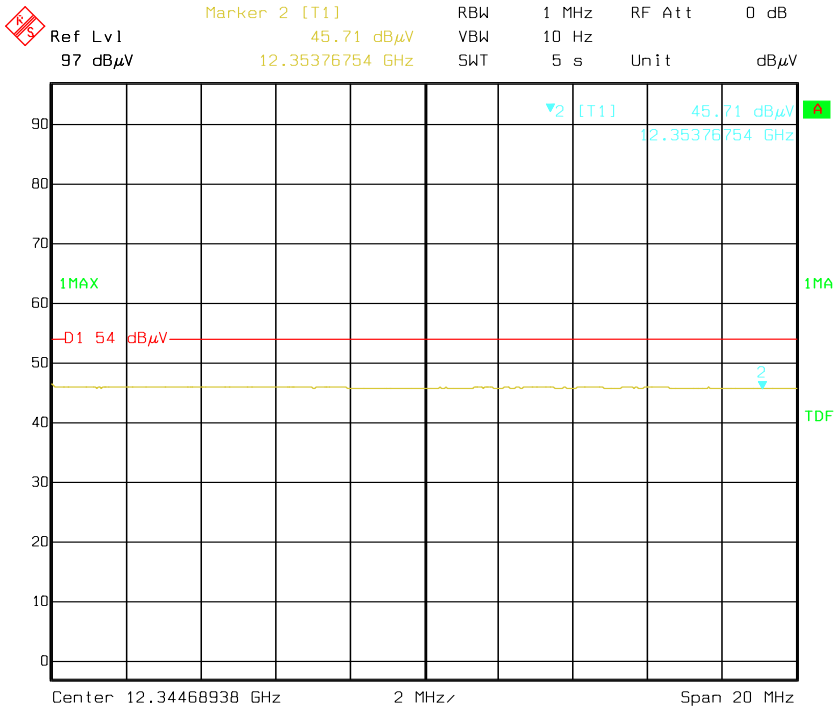


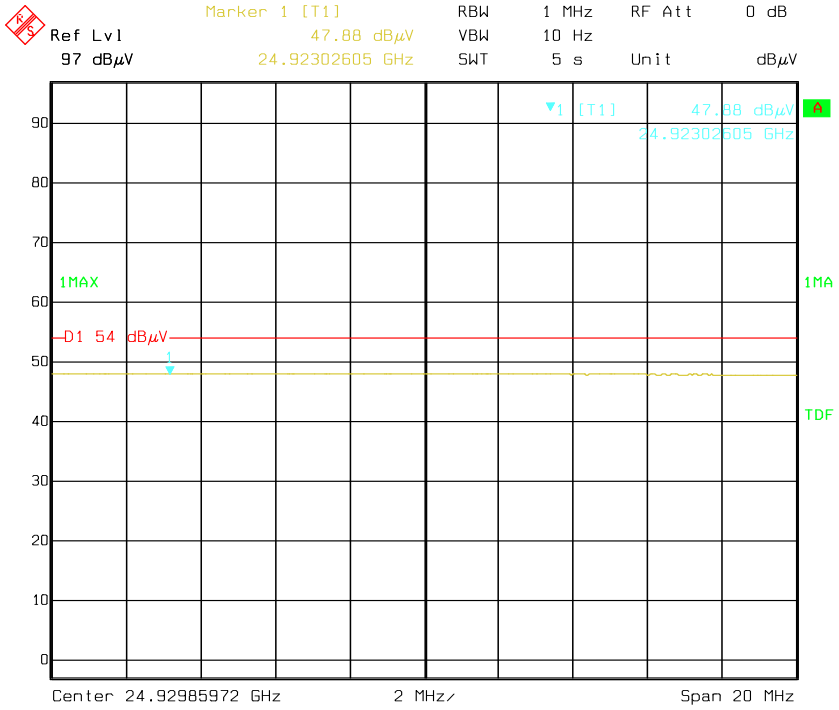
Vertical


Marker 1 [T1]
59.88 dBµV
12.10621242 GHz
RBW 1 MHz
VBW 3 MHz
SWT 98 ms
RF Att 0 dB
Unit dBµV
Ref Lvl
97 dBµV
▼1 [T1] 59.88 dBµV
12.10621242 GHz
▽2 [T1] 48.55 dBµV
4.99439253 GHz
D1 74 dBµV
1MAX
1MA
TDF
Start 1 GHz
1.7 GHz/
Stop 18 GHz
Date: 26.JUL.2018 13:17:12

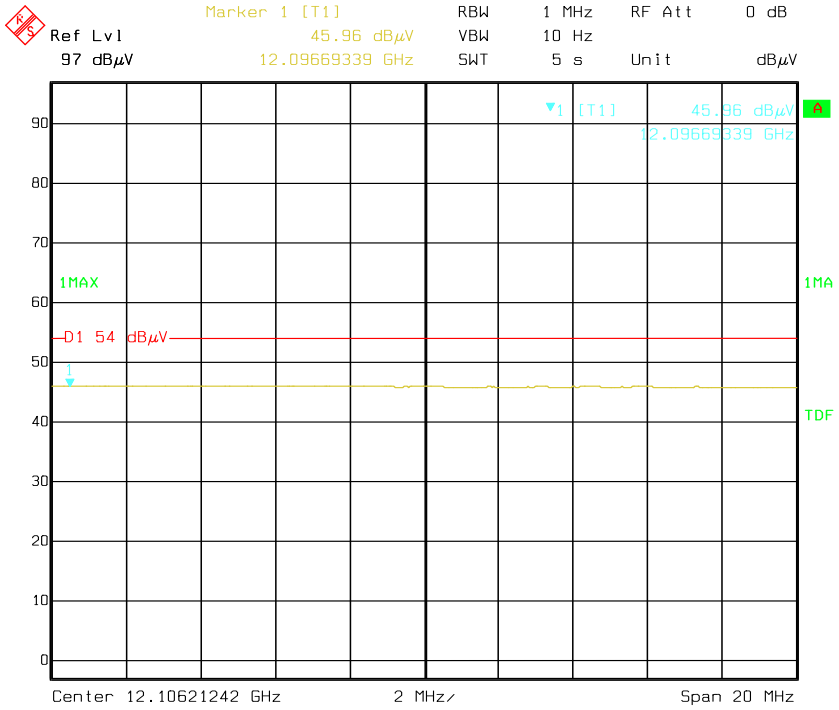

Marker 1 [T1]
66.42 dBµV
24.91583166 GHz
RBW 1 MHz
VBW 3 MHz
SWT 40 ms
RF Att 0 dB
Unit dBµV
Ref Lvl
97 dBµV
▼1 [T1] 66.42 dBµV
24.91583166 GHz
D1 74 dBµV
1MAX
1MA
TDF
Start 18 GHz
700 MHz/
Stop 25 GHz
Date: 26.JUL.2018 13:49:32

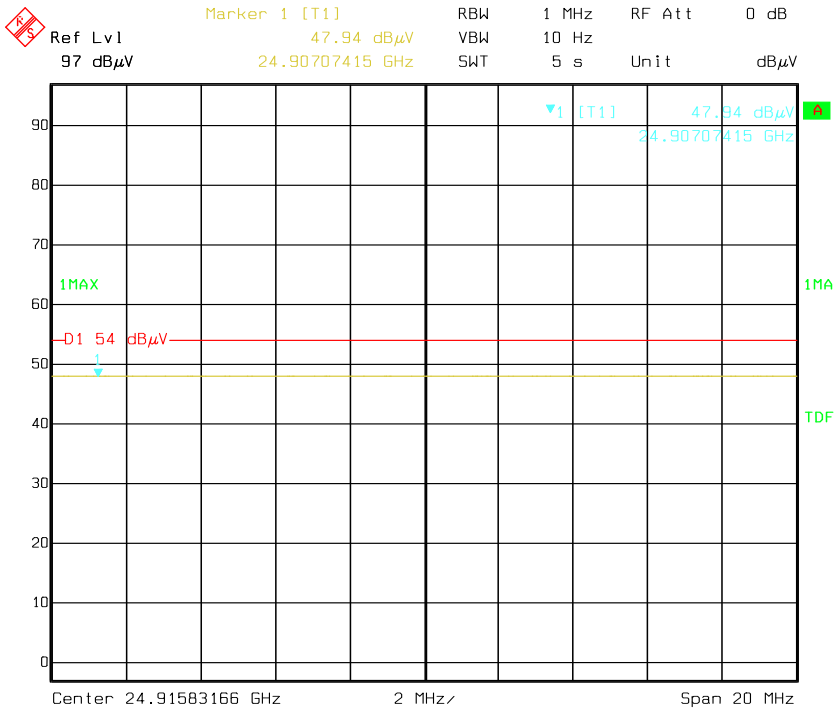
Pre-scan for Average
Horizontal





Vertical


Marker 1 [T1]
Ref Lvl
97 dBµV
45.96 dBµV
12.09669339 GHz
RBW 1 MHz
VBW 10 Hz
SWT 5 s
RF Att 0 dB
Unit dBµV
1 [T1] 45.96 dBµV
12.09669339 GHz
1MAX
1MA
D1 54 dBµV
TDF
Center 12.10621242 GHz
2 MHz/
Span 20 MHz
Date: 26.JUL.2018 13:19:29


Marker 1 [T1]
Ref Lvl
97 dBµV
47.94 dBµV
24.90707415 GHz
RBW 1 MHz
VBW 10 Hz
SWT 5 s
RF Att 0 dB
Unit dBµV
1 [T1] 47.94 dBµV
24.90707415 GHz
1MAX
1MA
D1 54 dBµV
TDF
Center 24.91583166 GHz
2 MHz/
Span 20 MHz
Date: 26.JUL.2018 13:51:06

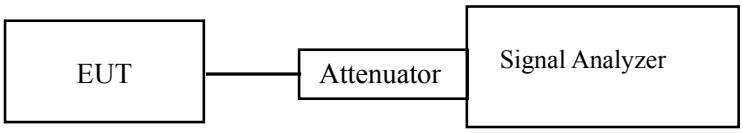
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH&99% OCCUPIED BANDWIDTH

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

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 it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-08-01 and 2018-08-07.

Test Result: Pass.

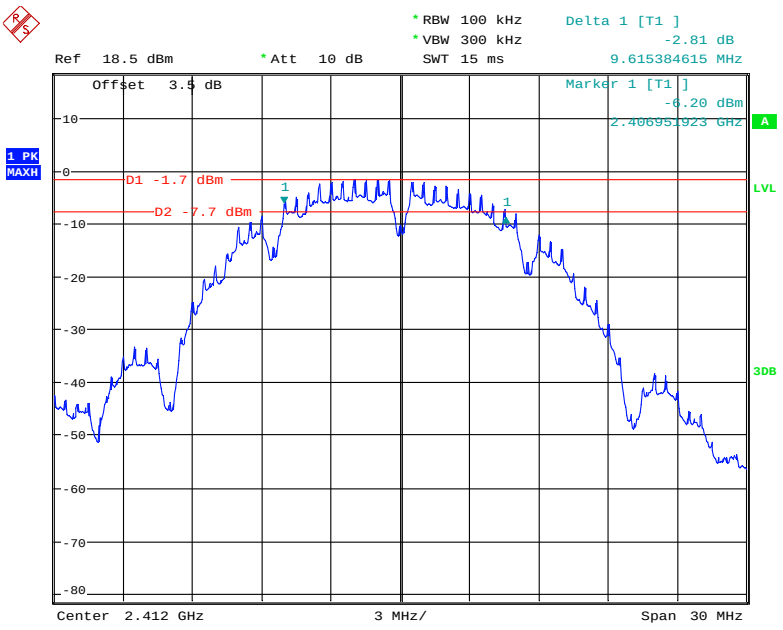
Please refer to the following table and plots.

EUT operation mode: Transmitting

Channel	Frequency (MHz)	6dB bandwidth (MHz)	99% OBW (MHz)	Limit (kHz)
802.11b mode				
Low	2412	9.62	14.36	≥500
Middle	2437	9.13	13.91	≥500
High	2462	9.62	14.49	≥500
802.11g mode				
Low	2412	15.87	17.63	≥500
Middle	2437	15.77	17.18	≥500
High	2462	15.87	17.76	≥500
802.11n-HT20 mode				
Low	2412	15.82	17.63	≥500
Middle	2437	15.77	17.12	≥500
High	2462	15.87	17.56	≥500
802.11n-HT40 mode				
Low	2422	36.25	37.44	≥500
Middle	2437	32.69	35.90	≥500
High	2452	23.85	35.77	≥500

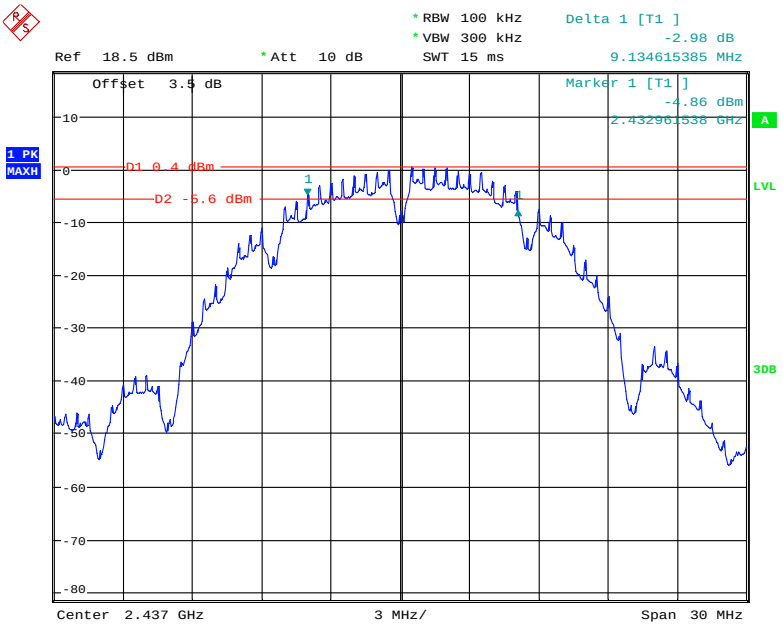
Channel	Frequency (MHz)	6 dB Emission Bandwidth(MHz)	Limit (kHz)
Low	2402	0.676	≥500
Middle	2440	0.667	≥500
High	2480	0.679	≥500

6dB Bandwidth, 802.11b Low Channel



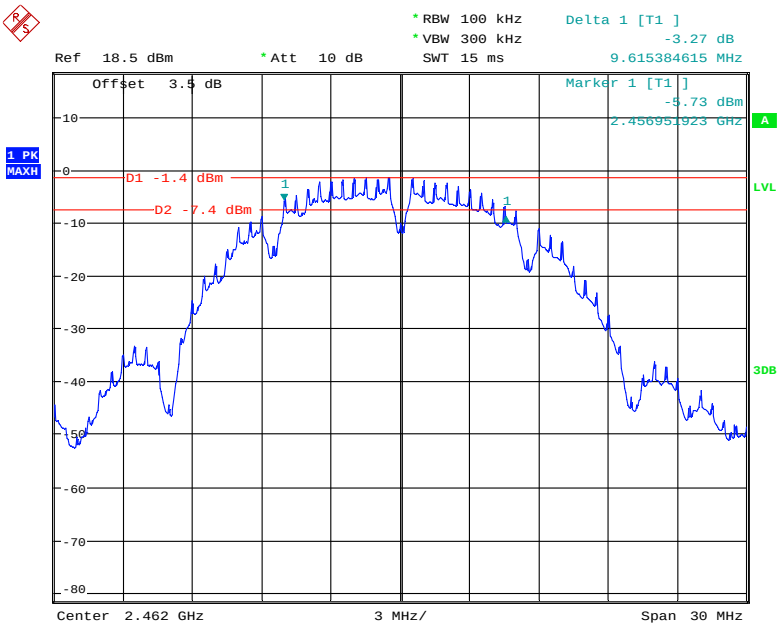
Date: 1.AUG.2018 11:58:52

6dB Bandwidth, 802.11b Middle Channel



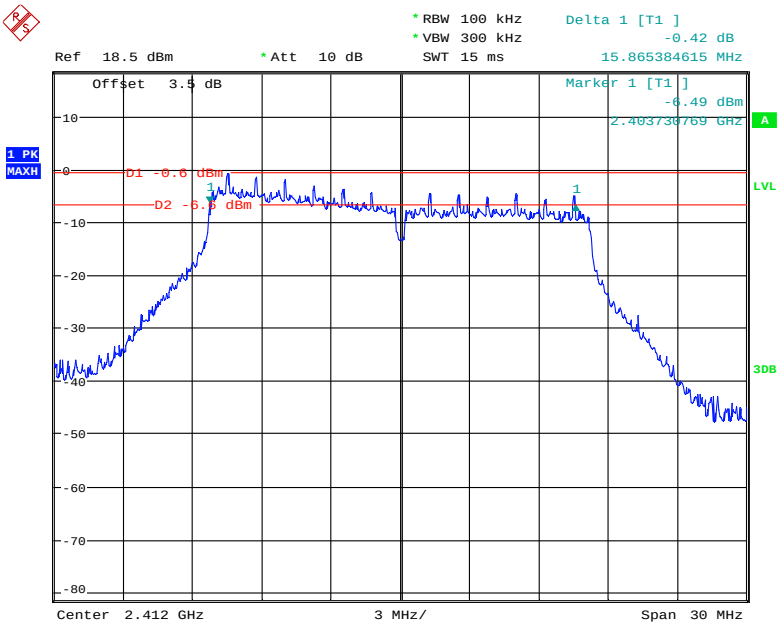
Date: 1.AUG.2018 11:57:39

6dB Bandwidth, 802.11b High Channel



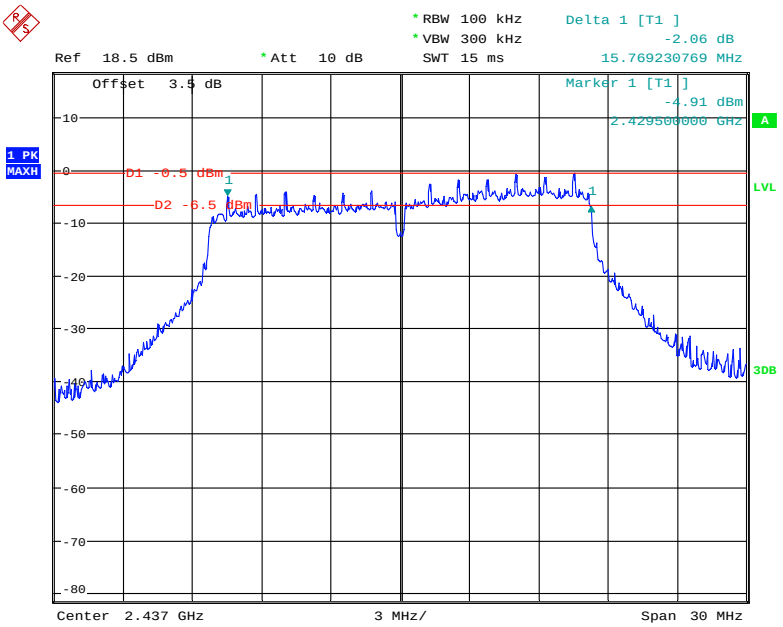
Date: 1.AUG.2018 11:55:05

6dB Bandwidth, 802.11g Low Channel



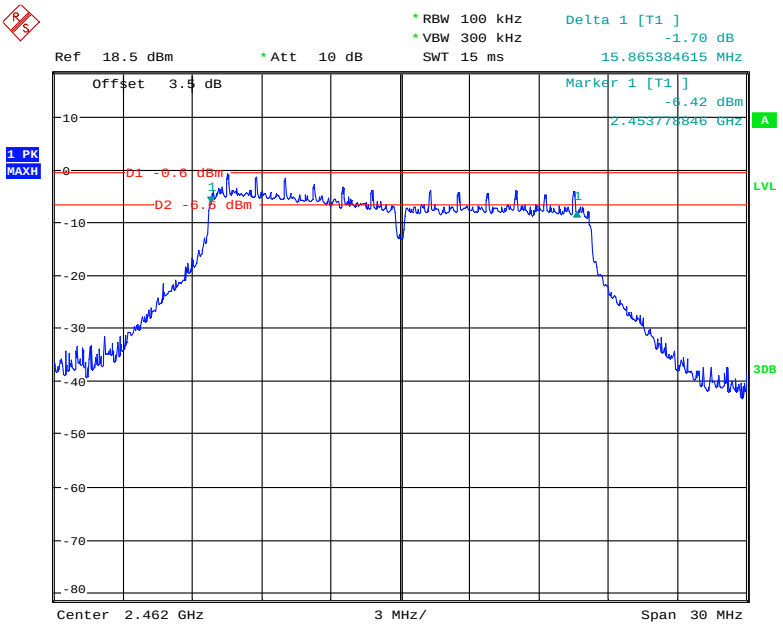
Date: 1.AUG.2018 13:13:10

6dB Bandwidth, 802.11g Middle Channel



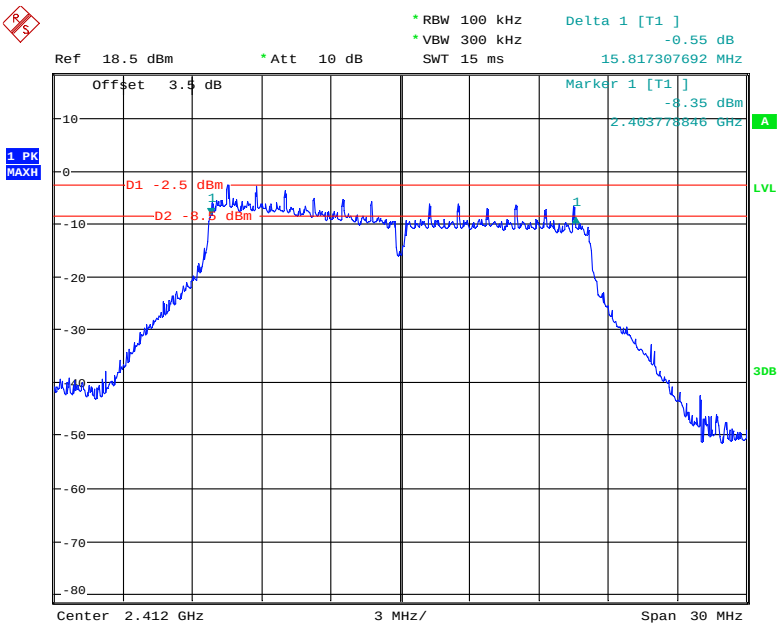
Date: 1.AUG.2018 13:14:44

6dB Bandwidth, 802.11g High Channel



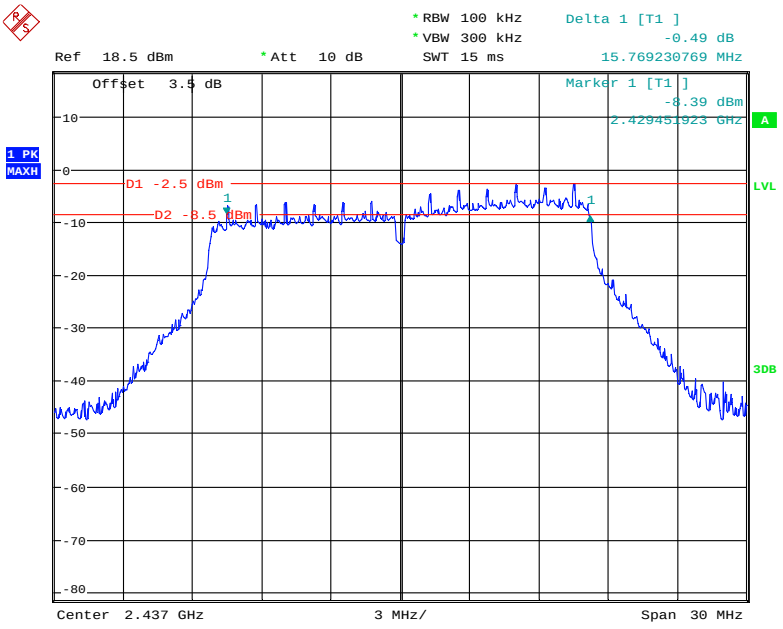
Date: 1.AUG.2018 13:19:01

6dB Bandwidth, 802.11n-HT20 Low Channel



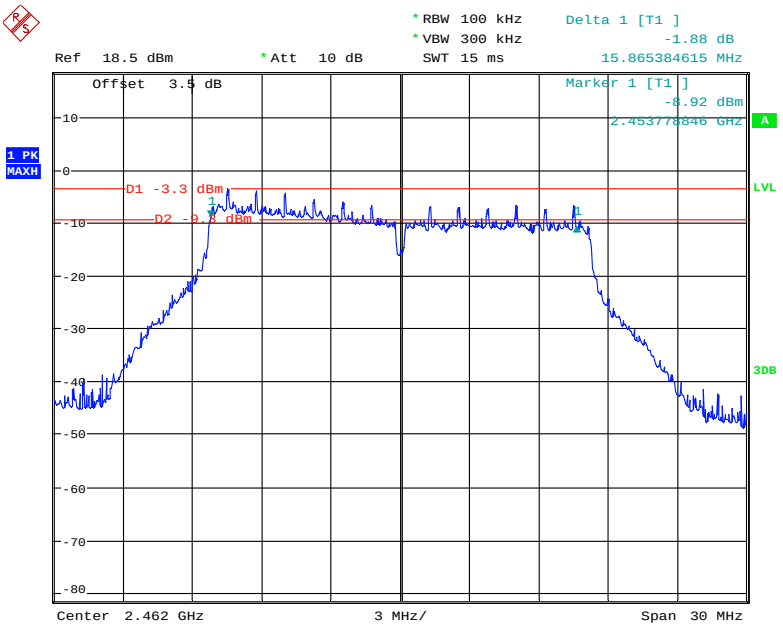
Date: 1.AUG.2018 13:35:15

6dB Bandwidth, 802.11n-HT20 Middle Channel



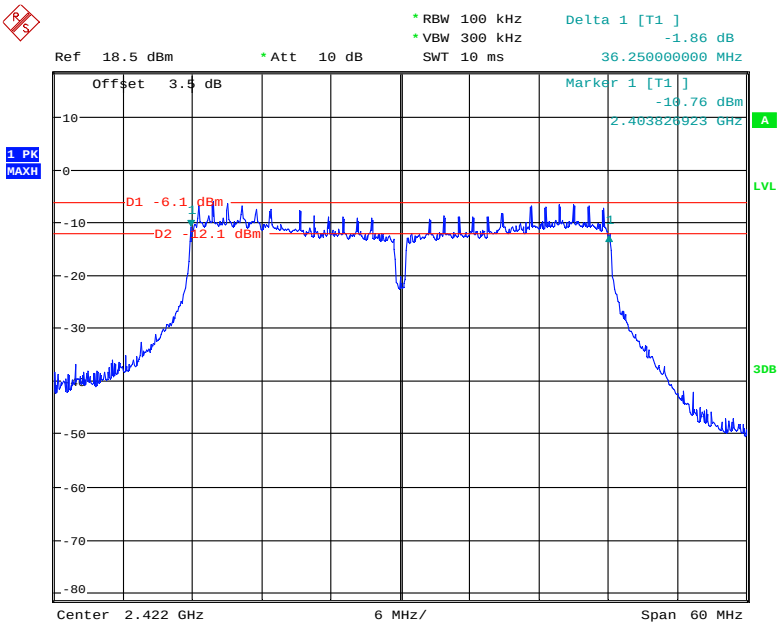
Date: 1.AUG.2018 13:34:17

6dB Bandwidth, 802.11n-HT20 High Channel



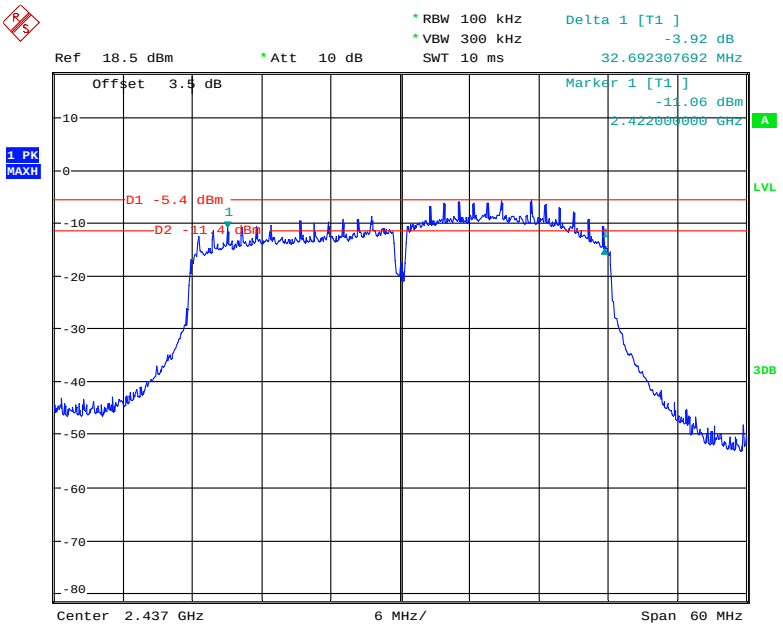
Date: 1.AUG.2018 13:32:52

6dB Bandwidth, 802.11n-HT40 Low Channel



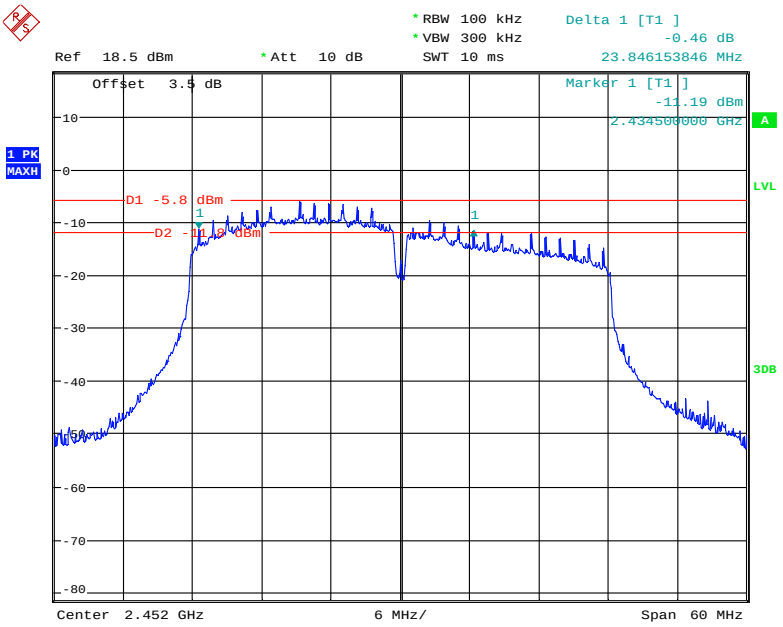
Date: 1.AUG.2018 11:19:58

6dB Bandwidth, 802.11n-HT40 Middle Channel



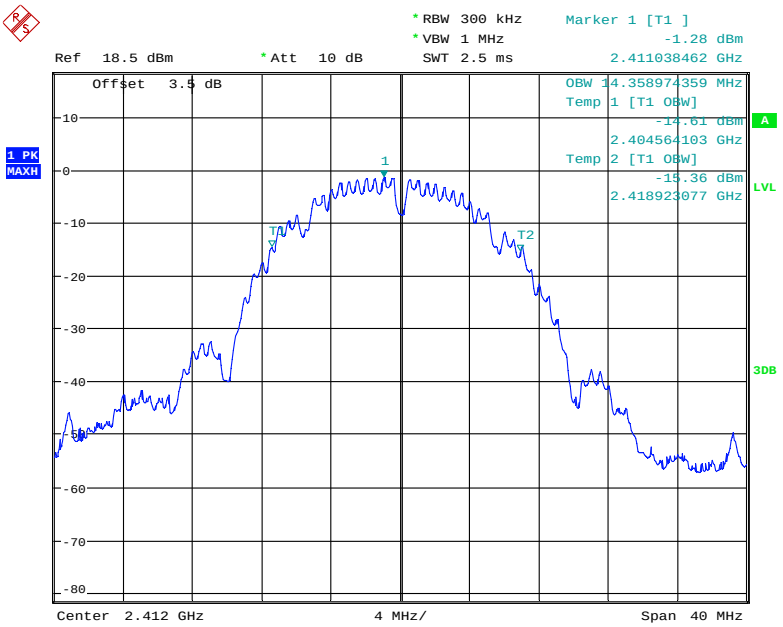
Date: 1.AUG.2018 11:17:16

6dB Bandwidth, 802.11n-HT40 High Channel



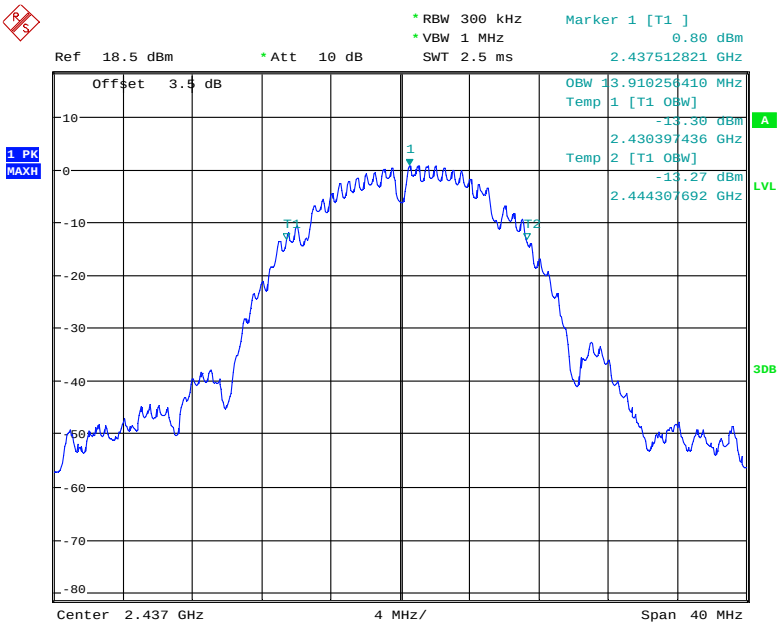
Date: 1.AUG.2018 10:50:11

99% Occupied Bandwidth, 802.11b Low Channel



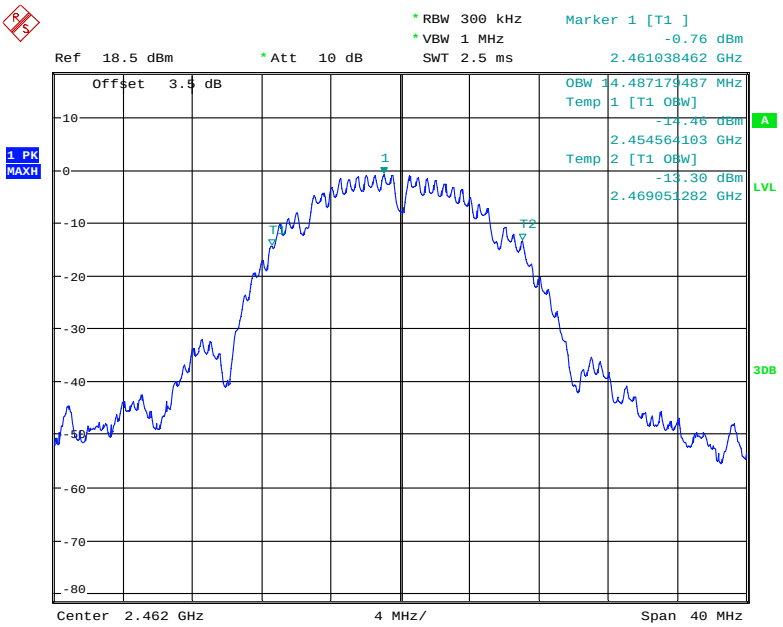
Date: 1.AUG.2018 11:47:40

99% Occupied Bandwidth, 802.11b Middle Channel



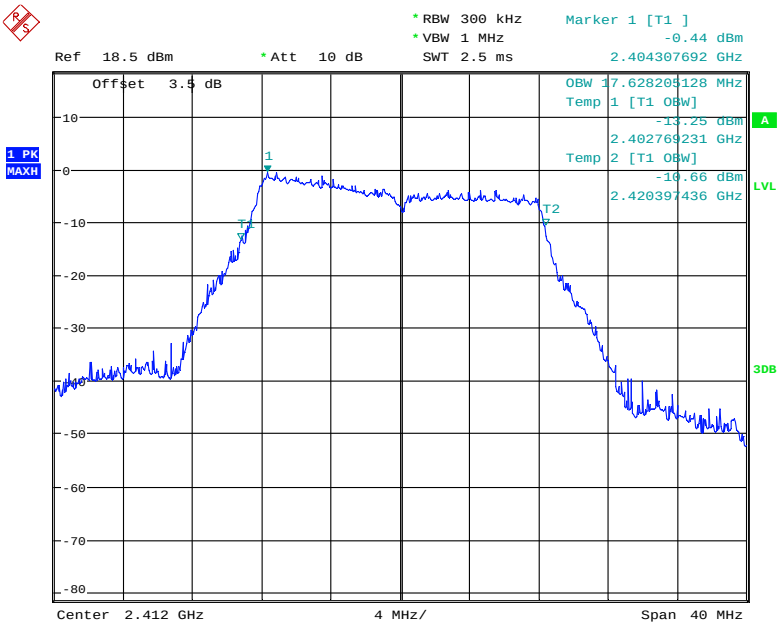
Date: 1.AUG.2018 11:49:14

99% Occupied Bandwidth, 802.11b High Channel



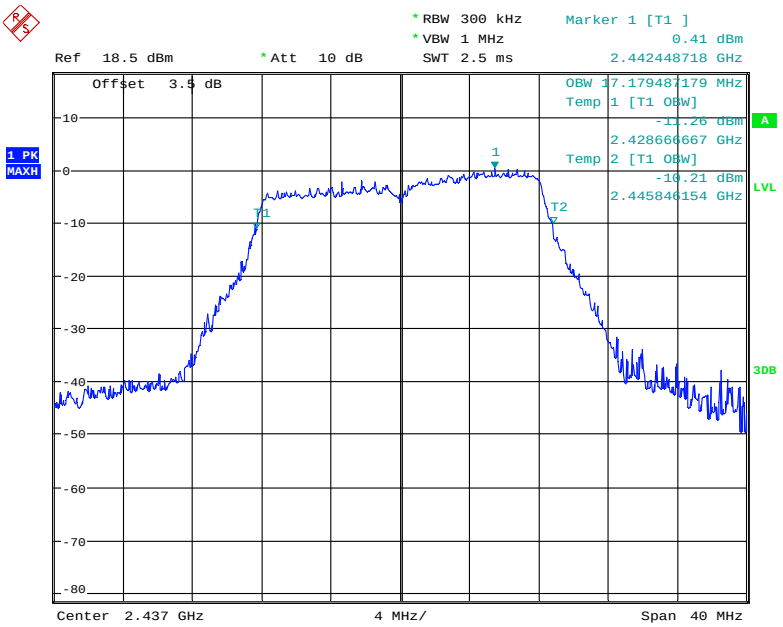
Date: 1.AUG.2018 11:50:05

99% Occupied Bandwidth, 802.11g Low Channel



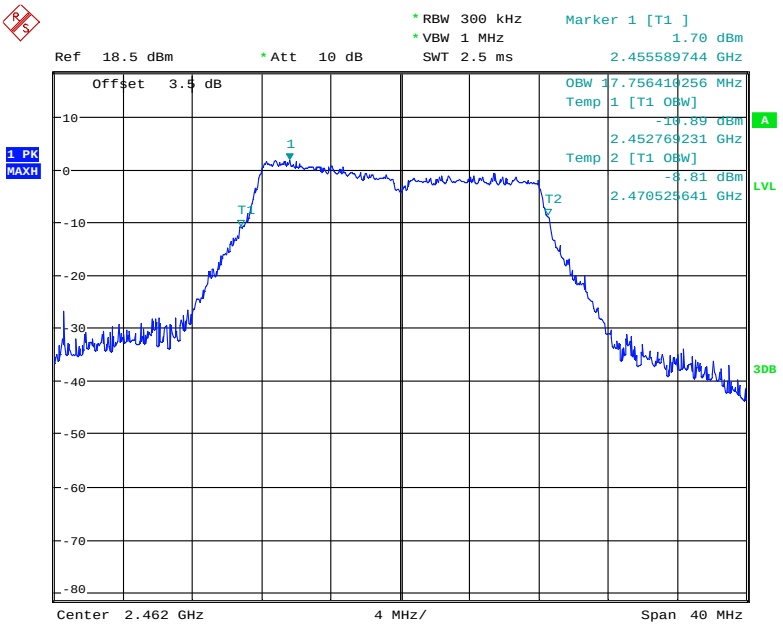
Date: 1.AUG.2018 13:24:57

99% Occupied Bandwidth, 802.11g Middle Channel



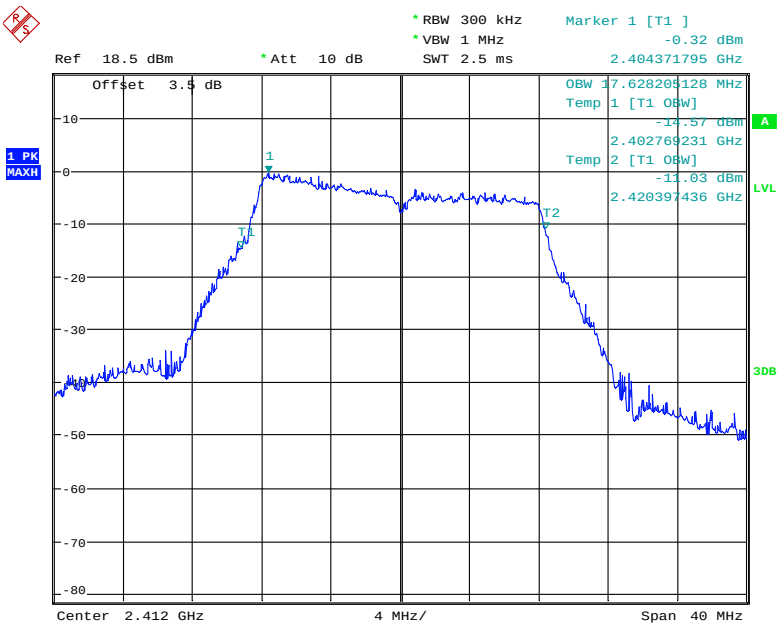
Date: 1.AUG.2018 13:24:17

99% Occupied Bandwidth, 802.11g High Channel



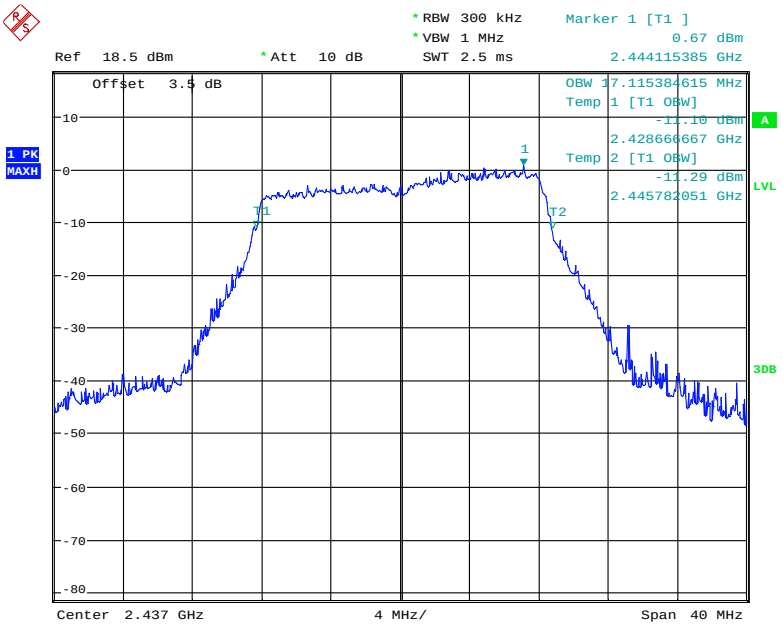
Date: 1.AUG.2018 13:23:29

99% Occupied Bandwidth, 802.11n-HT20 Low Channel



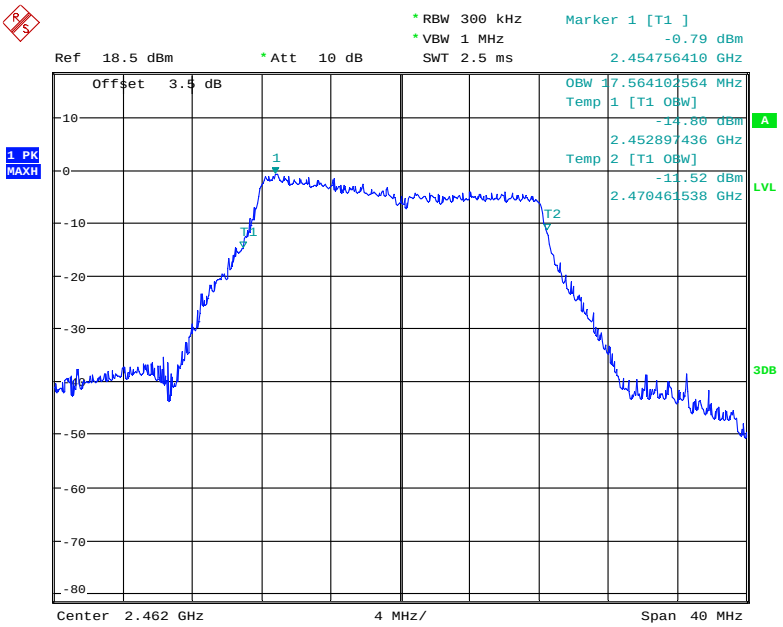
Date: 1.AUG.2018 13:27:25

99% Occupied Bandwidth, 802.11n-HT20 Middle Channel



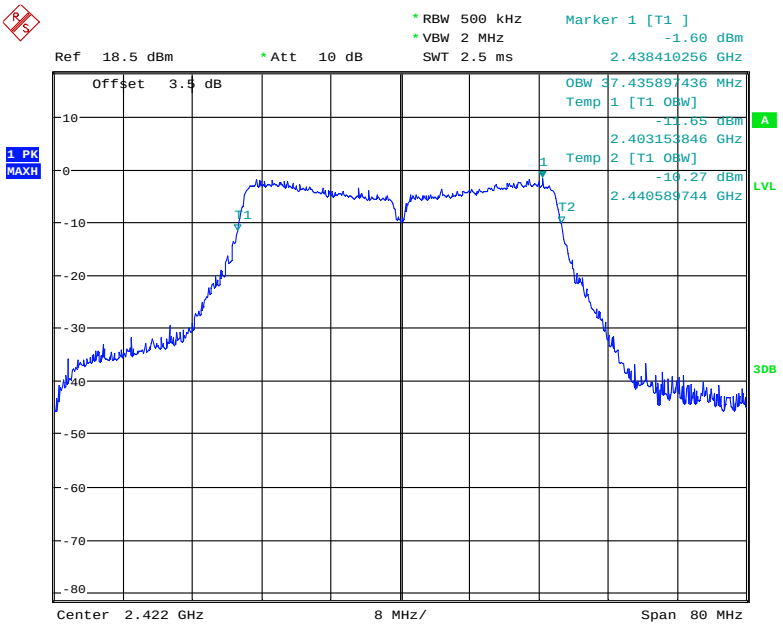
Date: 1.AUG.2018 13:28:22

99% Occupied Bandwidth, 802.11n-HT20 High Channel



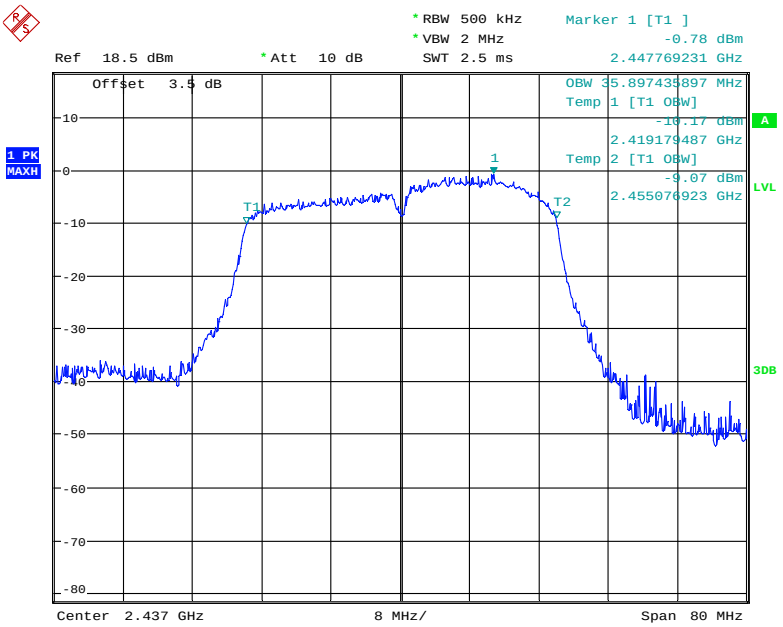
Date: 1.AUG.2018 13:29:21

99% Occupied Bandwidth, 802.11n-HT40 Low Channel



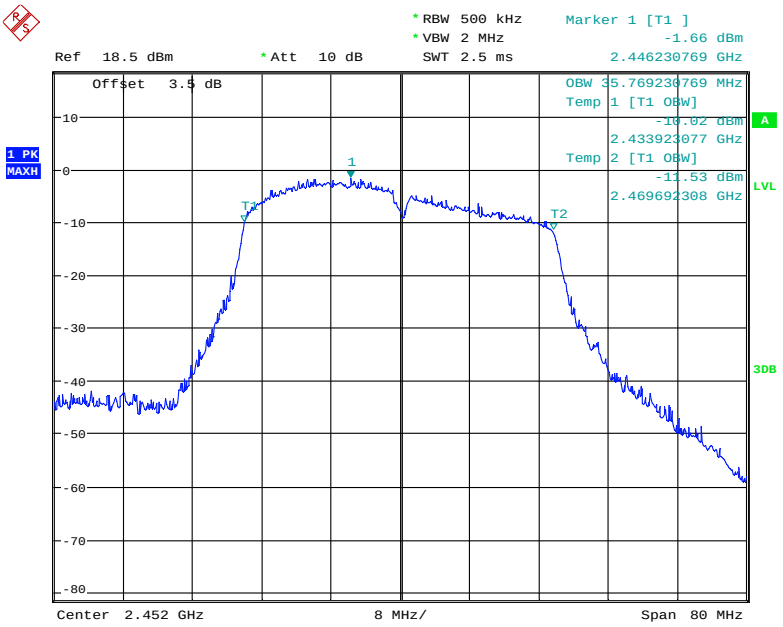
Date: 1.AUG.2018 11:31:20

99% Occupied Bandwidth, 802.11n-HT40 Middle Channe



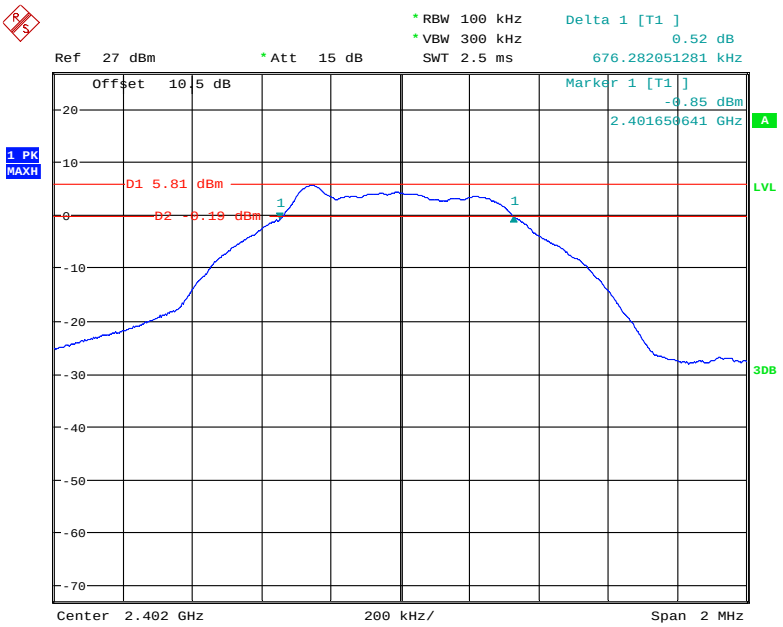
Date: 1.AUG.2018 11:33:03

99% Occupied Bandwidth, 802.11n-HT40 High Channel



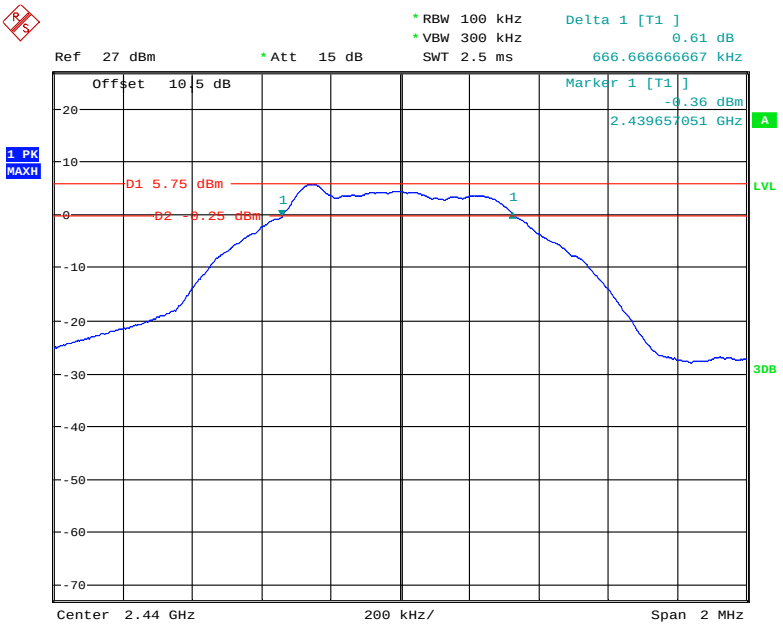
Date: 1.AUG.2018 11:34:41

BLE Low Channel



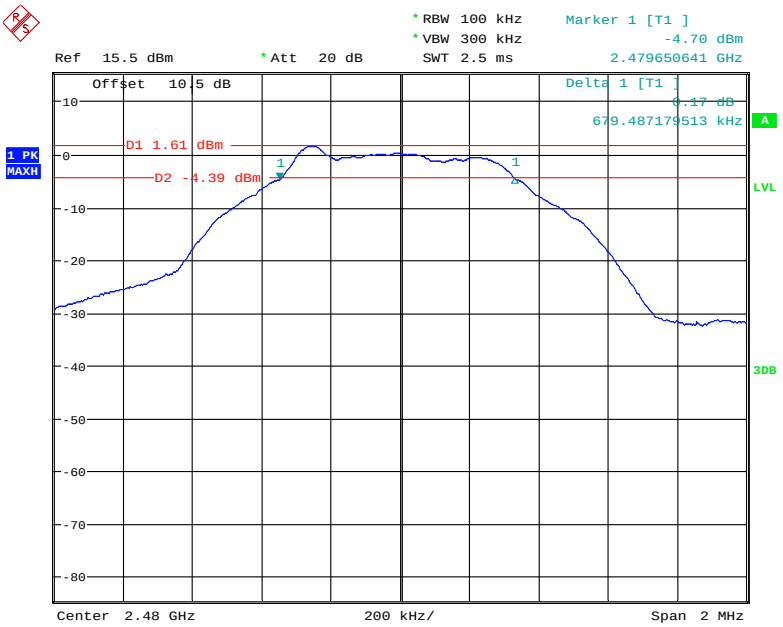
Date: 7.AUG.2018 13:29:55

BLE Middle Channel



Date: 7.AUG.2018 13:32:37

BLE High Channel



Date: 7.AUG.2018 22:18:48

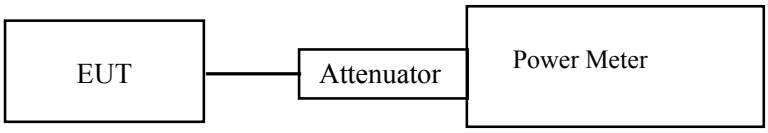
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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 one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-08-07.

EUT operation mode: Transmitting

Wi-Fi mode

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Max Conducted Average Output Power (dBm)	Limit (dBm)
802.11b				
Low	2412	12.14	7.39	30
Middle	2437	11.49	9.29	30
High	2462	11.60	8.02	30
802.11g				
Low	2412	14.53	7.66	30
Middle	2437	14.83	8.98	30
High	2462	14.82	8.98	30
802.11n HT20				
Low	2412	14.56	7.86	30
Middle	2437	15.01	9.00	30
High	2462	14.99	8.20	30
802.11n HT40				
Low	2422	15.31	8.94	30
Middle	2437	15.15	8.46	30
High	2452	14.92	7.55	30

BLE mode

Channel	Frequency (MHz)	Max Peak Output Power (dBm)	Limit (dBm)	Result
Low	2402	5.39	30	Pass
Middle	2440	5.44	30	Pass
High	2480	2.19	30	Pass

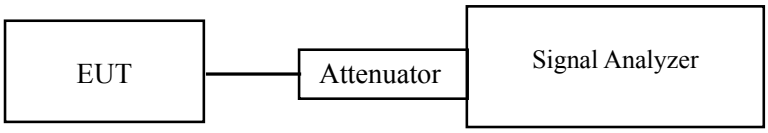
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

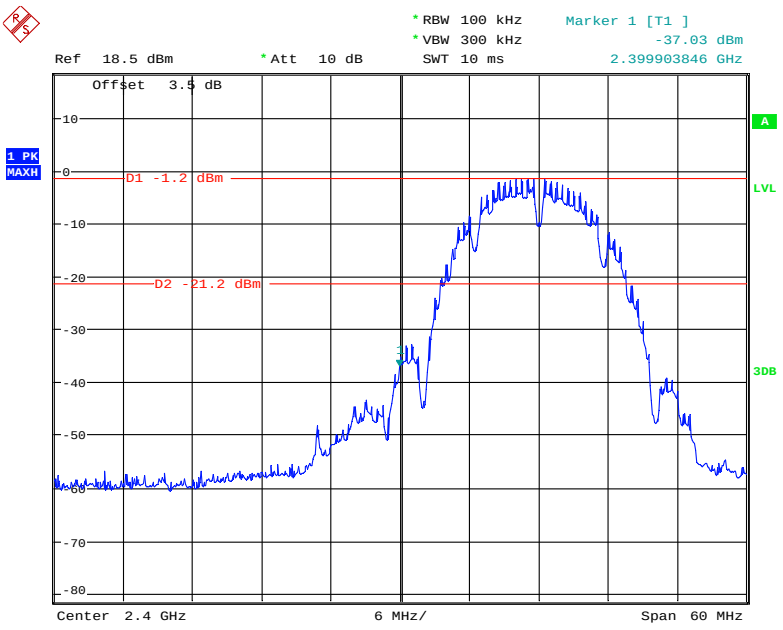
The testing was performed by Nancy Wang on 2018-08-01 and 2018-08-07.

EUT operation mode: Transmitting

Test Result: Compliance

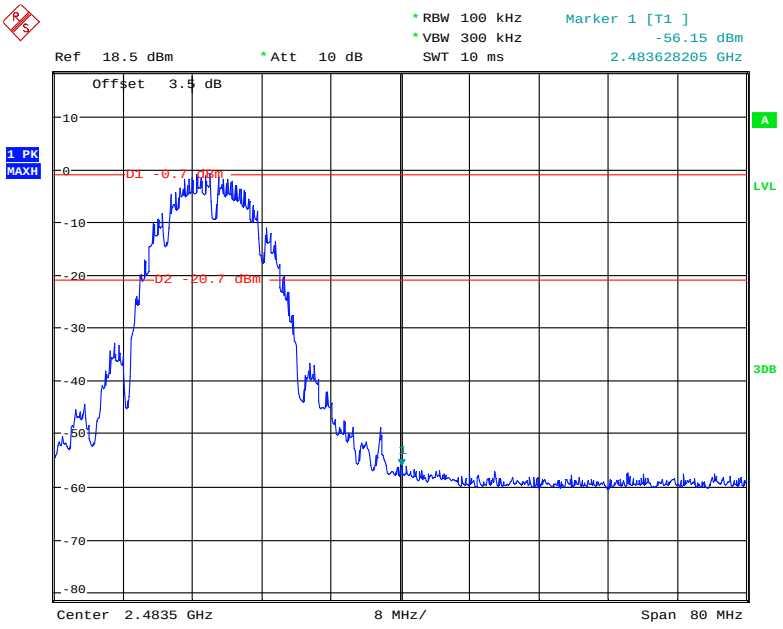
Please refer to the following plots.

802.11b: Band Edge, Left Side



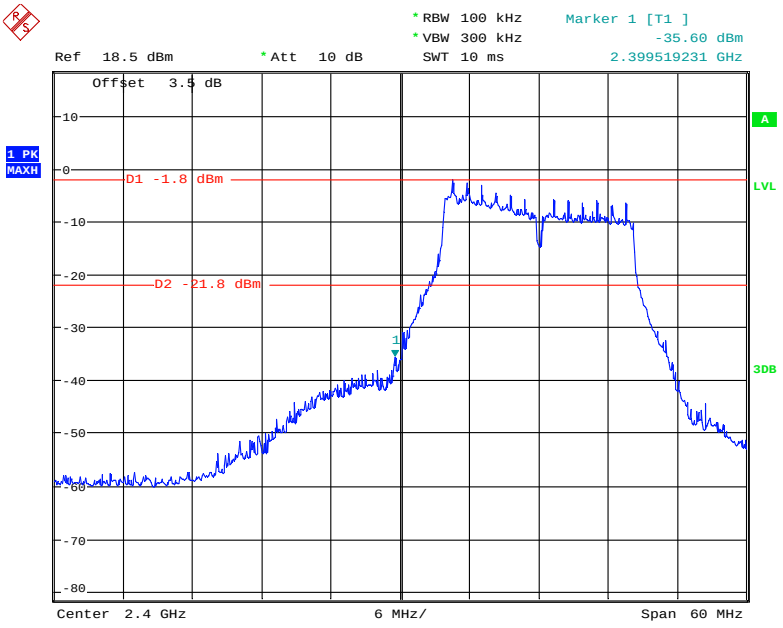
Date: 1.AUG.2018 16:32:17

802.11b: Band Edge, Right Side



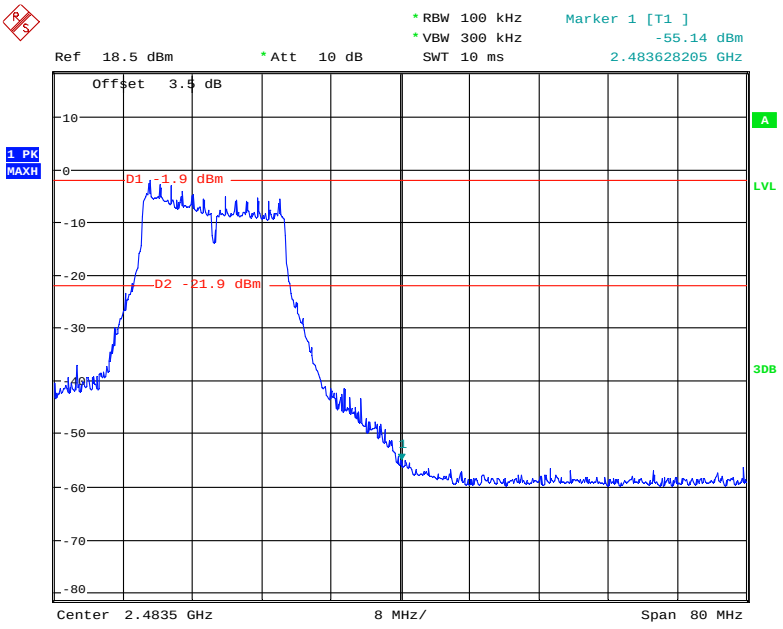
Date: 1.AUG.2018 16:33:36

802.11g: Band Edge, Left Side



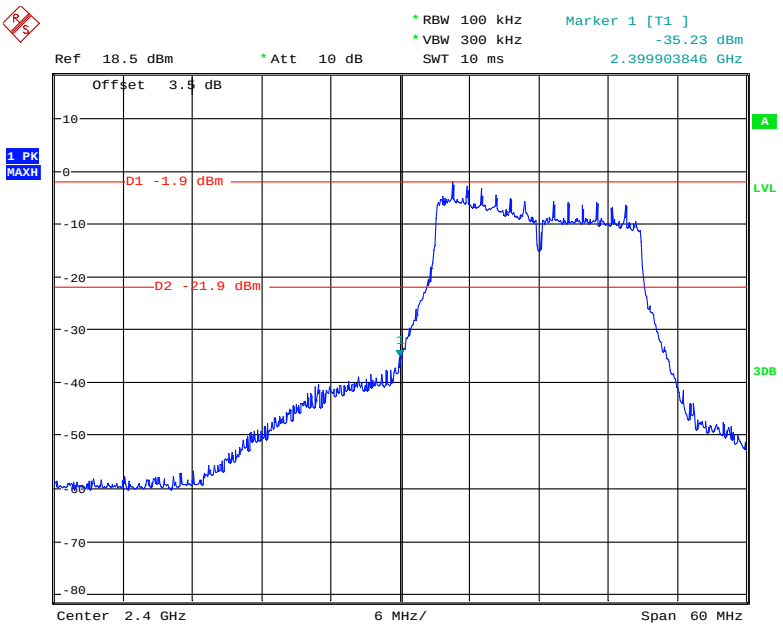
Date: 1.AUG.2018 16:37:49

802.11g: Band Edge, Right Side



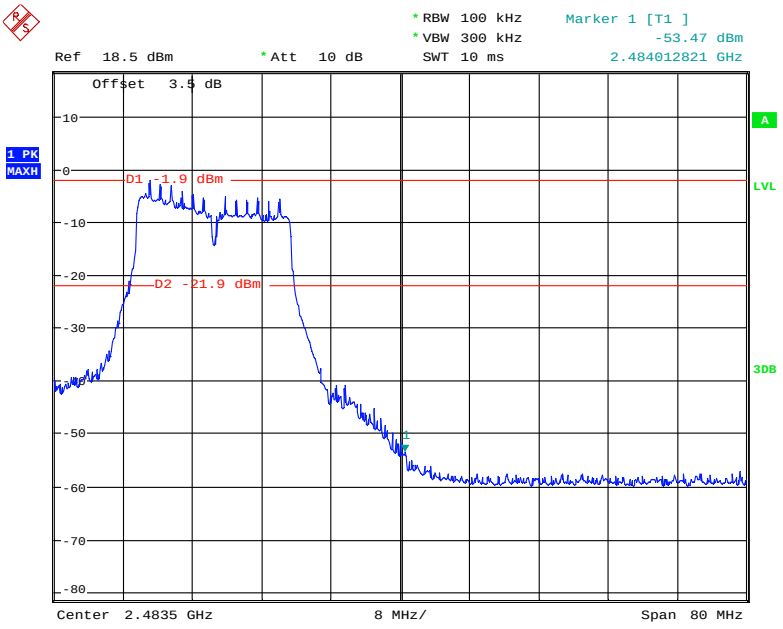
Date: 1.AUG.2018 16:36:06

802.11n-HT20: Band Edge, Left Side



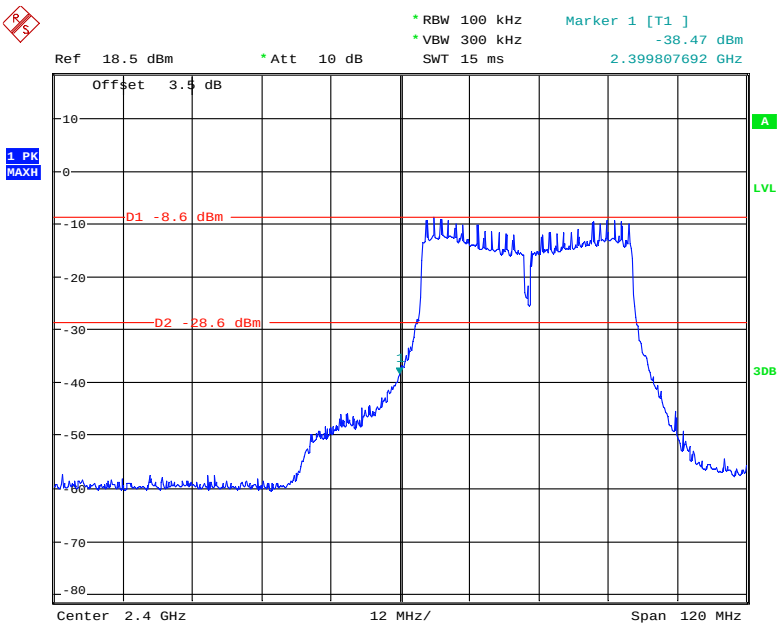
Date: 1.AUG.2018 16:38:51

802.11n-HT20: Band Edge, Right Side



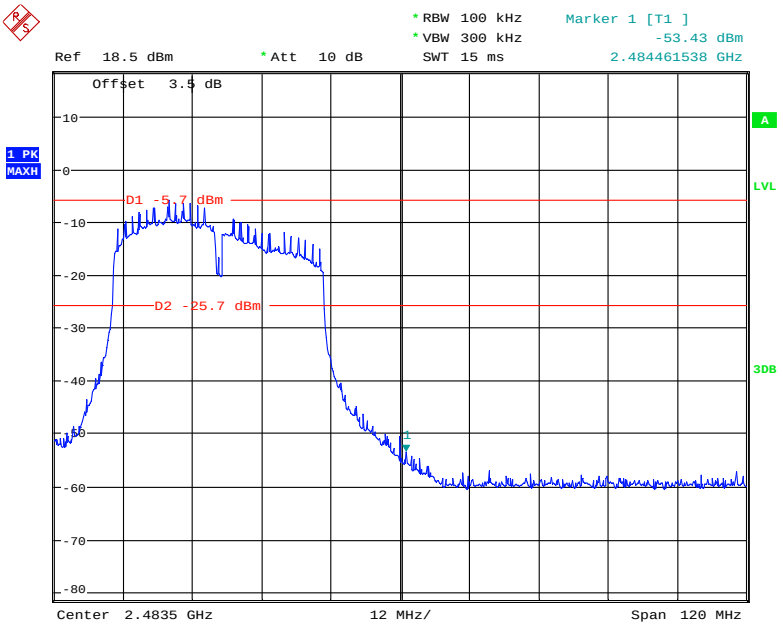
Date: 1.AUG.2018 16:40:36

802.11n-HT40: Band Edge, Left Side



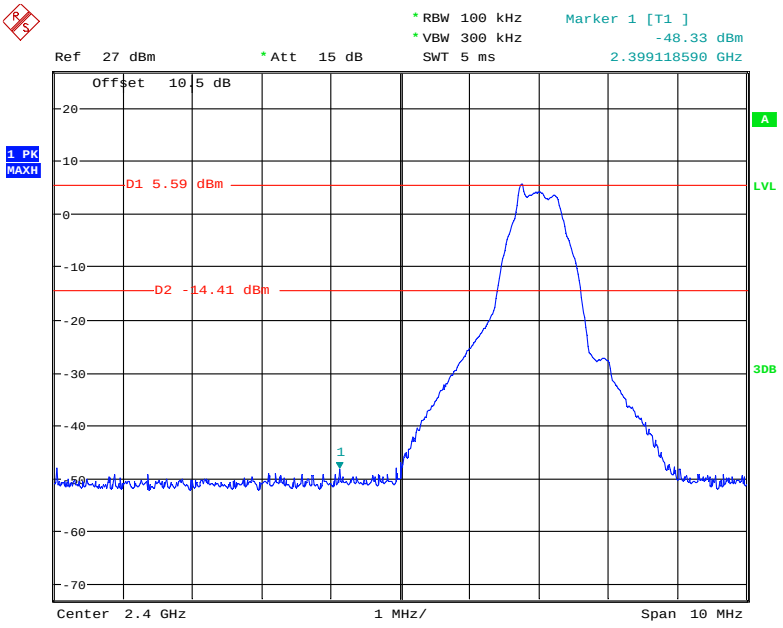
Date: 1.AUG.2018 16:42:55

802.11n-HT40: Band Edge, Right Side



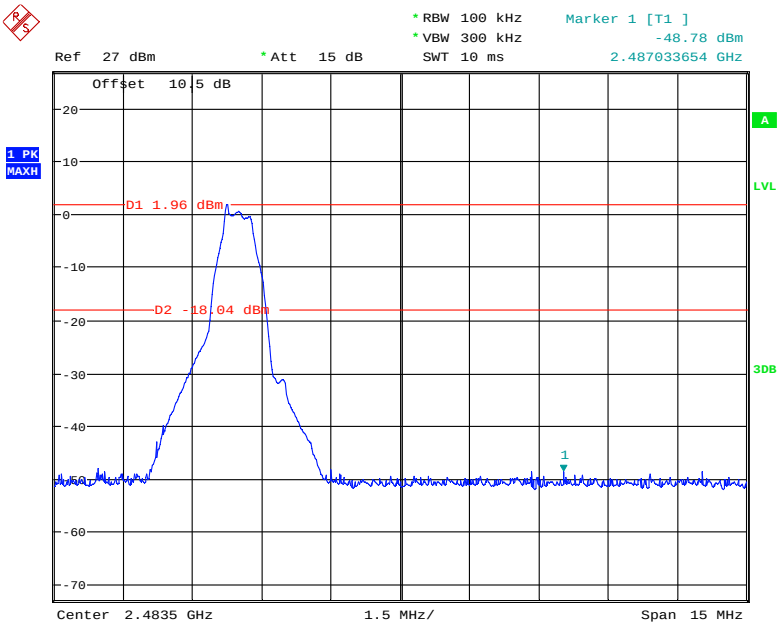
Date: 1.AUG.2018 16:42:06

BLE: Band Edge, Left Side



Date: 7.AUG.2018 13:38:13

BLE: Band Edge, Right Side



Date: 7.AUG.2018 13:39:19

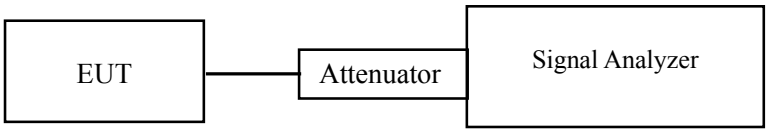
FCC §15.247(e) - POWER SPECTRAL DENSITY

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

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

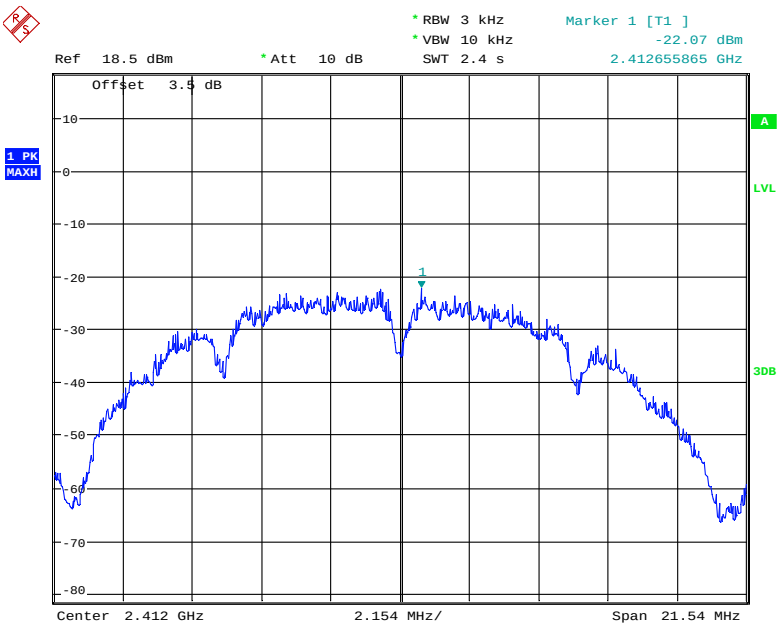
The testing was performed by Nancy Wang on 2018-08-01 and 2018-08-07.

EUT operation mode: Transmitting

Test Result: Pass

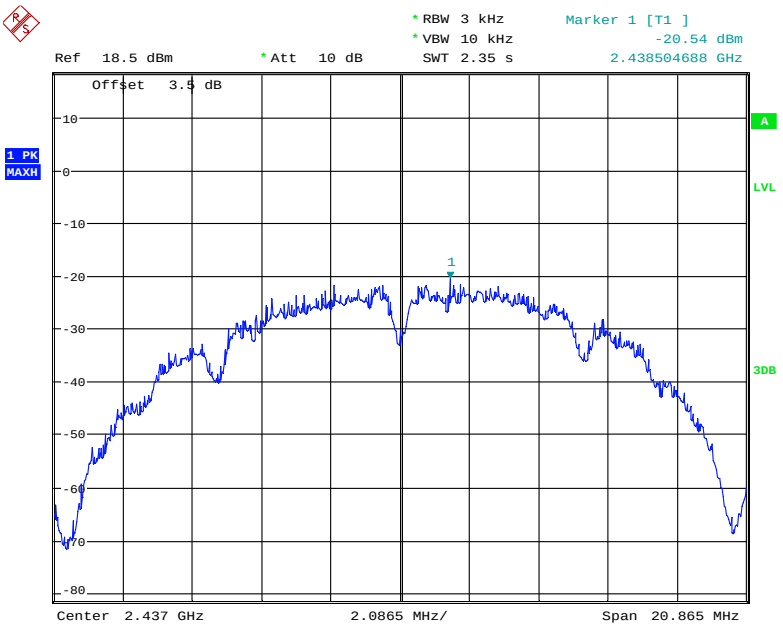
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-22.07	≤8
Middle	2437	-20.54	≤8
High	2462	-24.51	≤8
802.11g mode			
Low	2412	-22.37	≤8
Middle	2437	-21.38	≤8
High	2462	-23.88	≤8
802.11n-HT20 mode			
Low	2412	-22.02	≤8
Middle	2437	-21.66	≤8
High	2462	-23.28	≤8
802.11n-HT40 mode			
Low	2422	-25.27	≤8
Middle	2437	-24.76	≤8
High	2452	-20.74	≤8
BLE mode			
Low	2402	-9.00	≤8
Middle	2440	-9.54	≤8
High	2480	-13.54	≤8

Power Spectral Density, 802.11b Low Channel



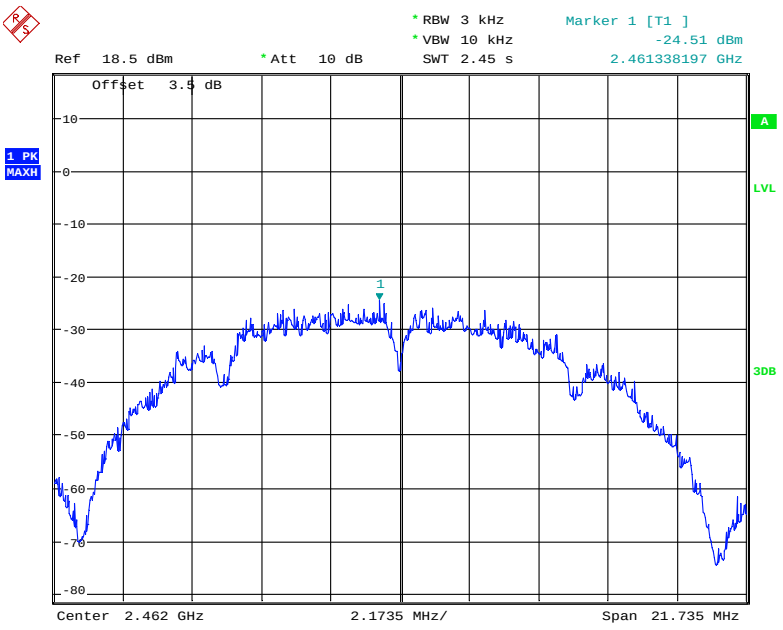
Date: 1.AUG.2018 15:43:28

Power Spectral Density, 802.11b Middle Channel



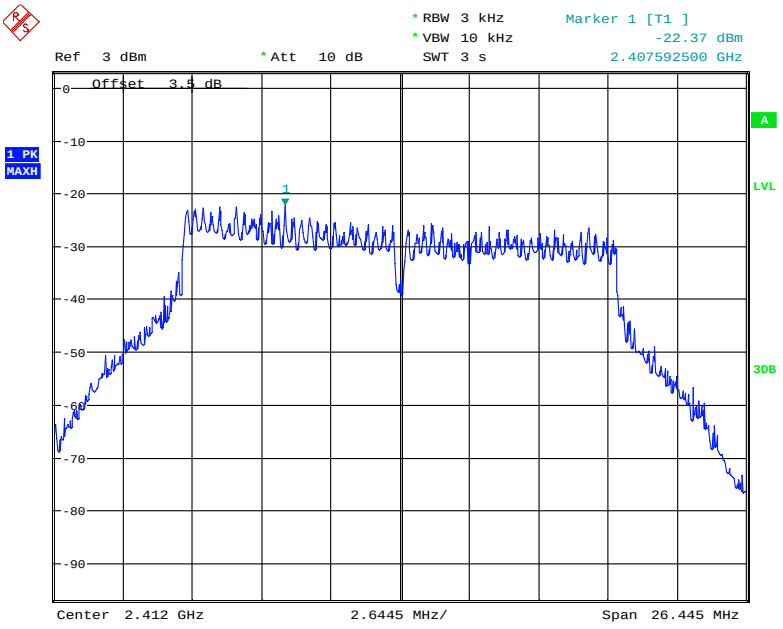
Date: 1.AUG.2018 15:45:42

Power Spectral Density, 802.11b High Channel



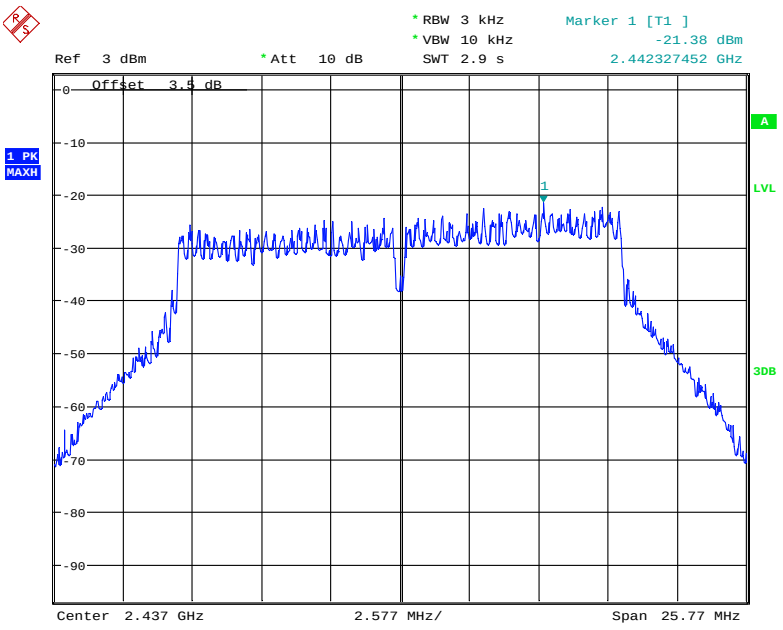
Date: 1.AUG.2018 15:46:48

Power Spectral Density, 802.11g Low Channel



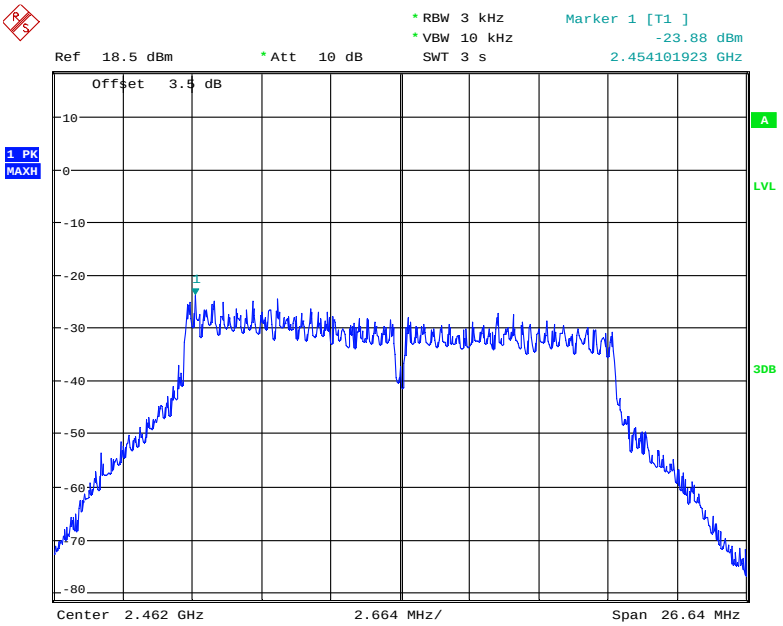
Date: 1.AUG.2018 15:51:29

Power Spectral Density, 802.11g Middle Channel



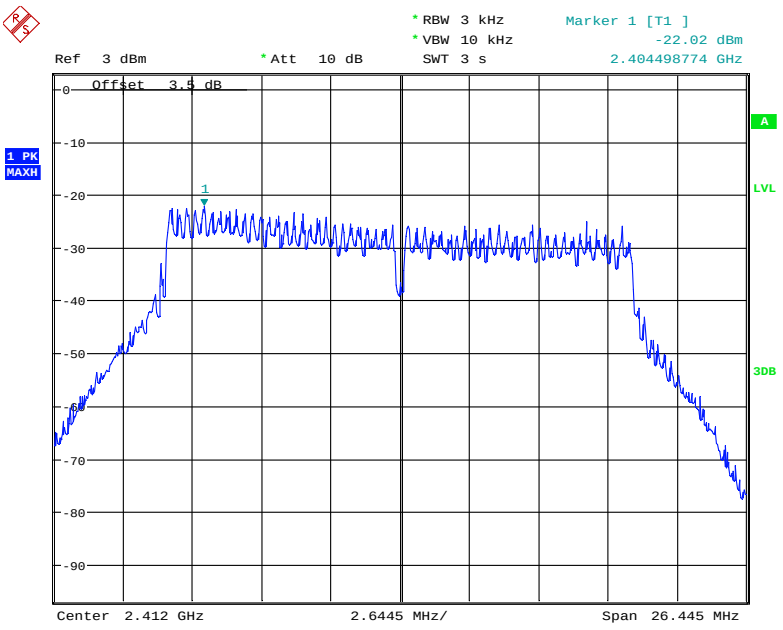
Date: 1.AUG.2018 15:50:16

Power Spectral Density, 802.11g High Channel



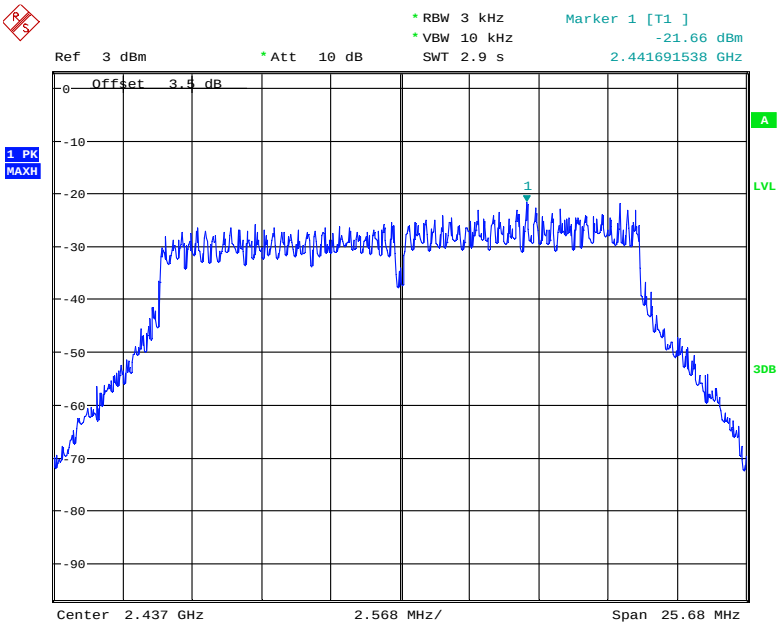
Date: 1.AUG.2018 15:48:51

Power Spectral Density, 802.11n-HT20 Low Channel



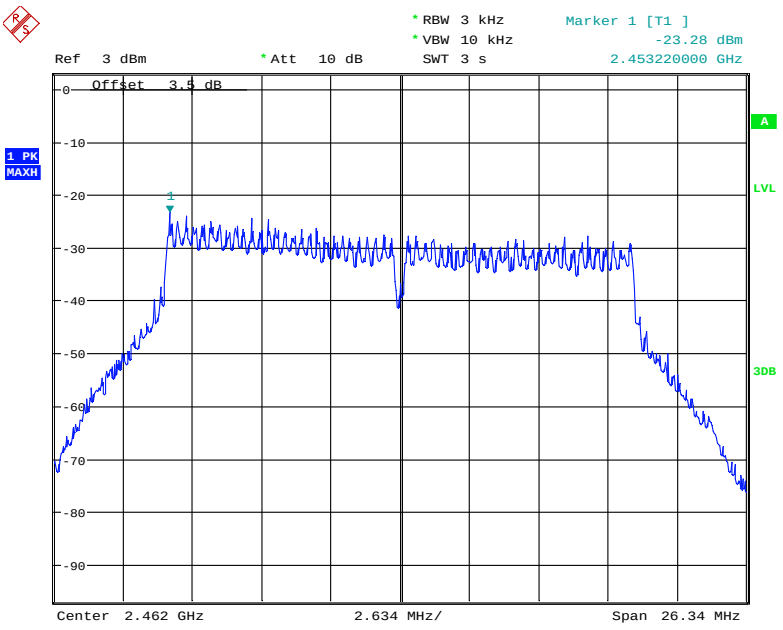
Date: 1.AUG.2018 15:52:37

Power Spectral Density, 802.11n-HT20 Middle Channel



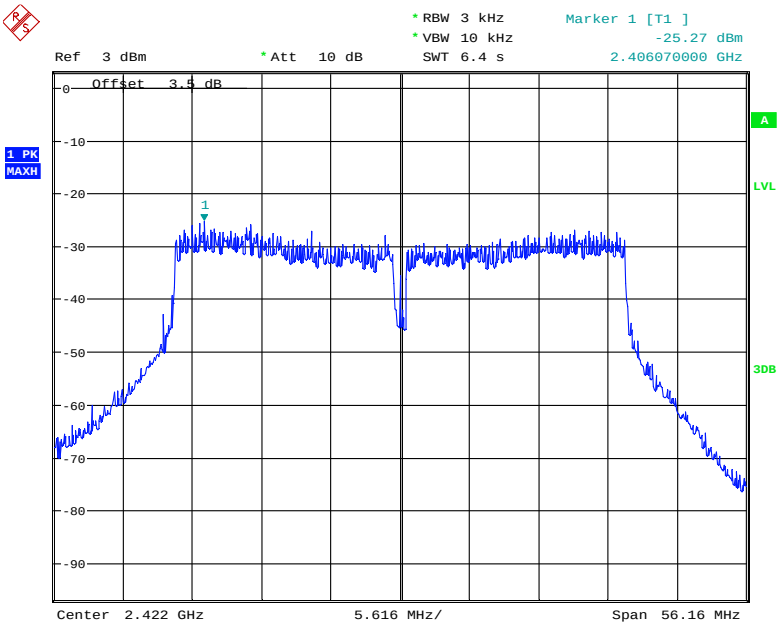
Date: 1.AUG.2018 15:53:45

Power Spectral Density, 802.11n-HT20 High Channel



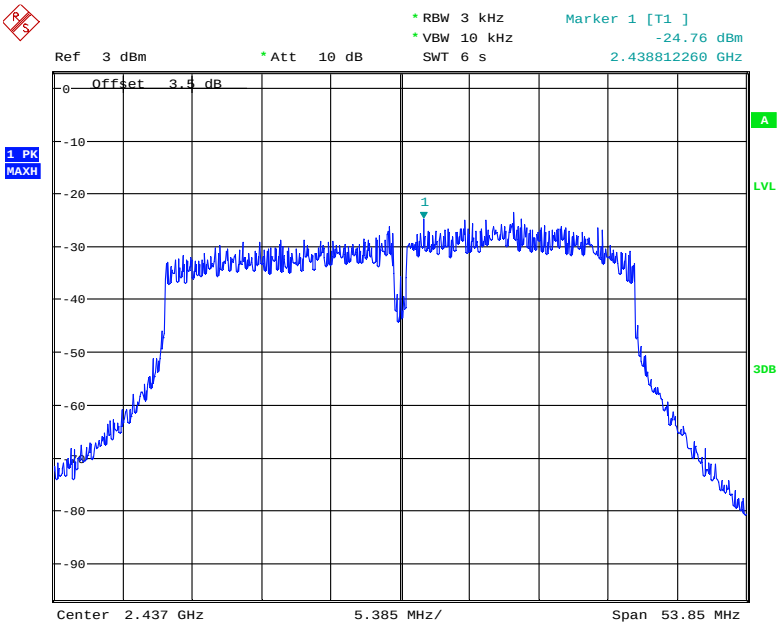
Date: 1.AUG.2018 15:54:47

Power Spectral Density, 802.11n-HT40 Low Channel



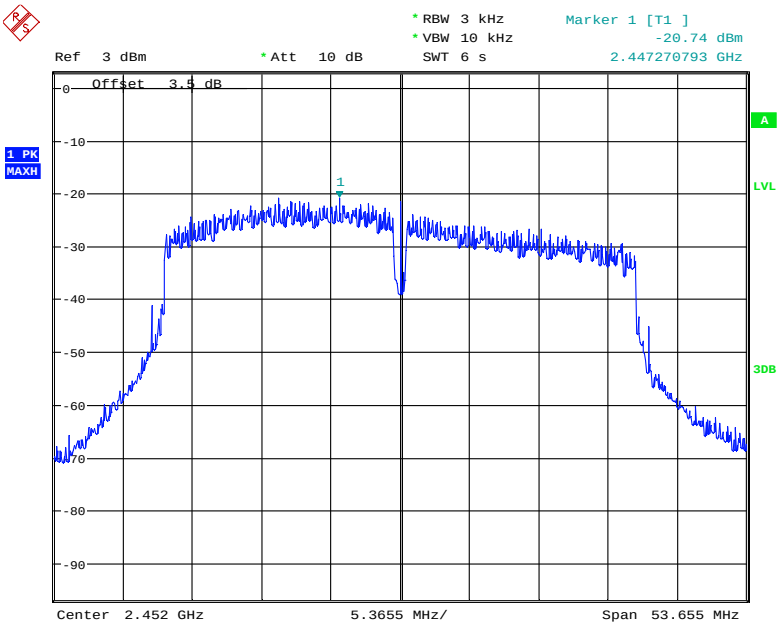
Date: 1.AUG.2018 15:58:58

Power Spectral Density, 802.11n-HT40 Middle Channel



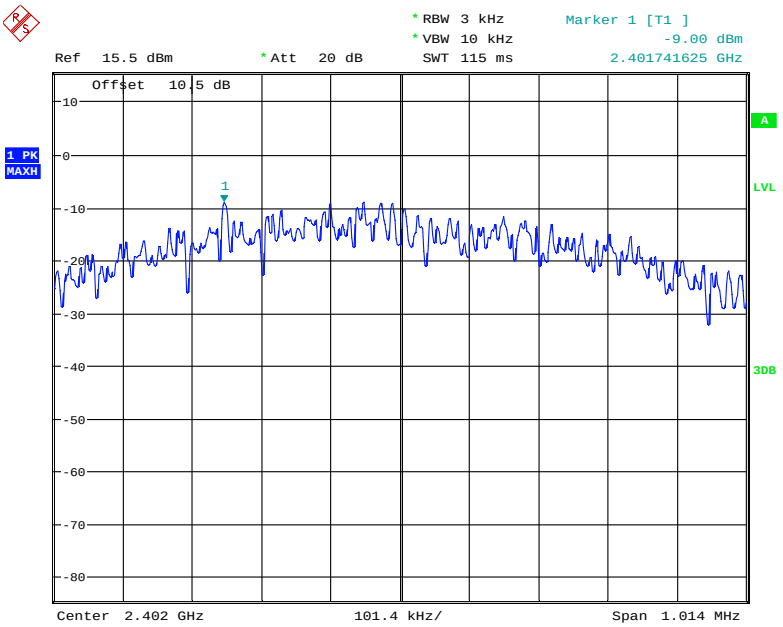
Date: 1.AUG.2018 16:00:12

Power Spectral Density, 802.11n-HT40 High Channel



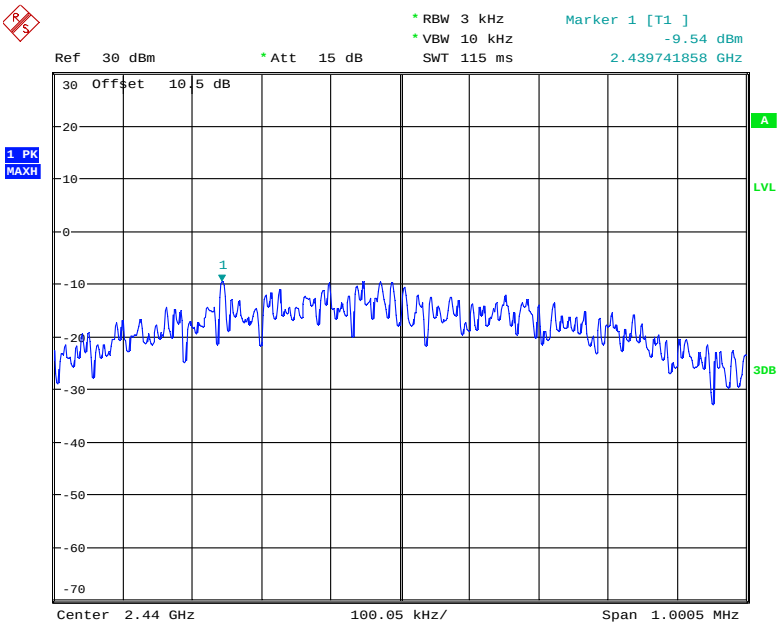
Date: 1.AUG.2018 16:18:08

Power Spectral Density, BLE Low Channel



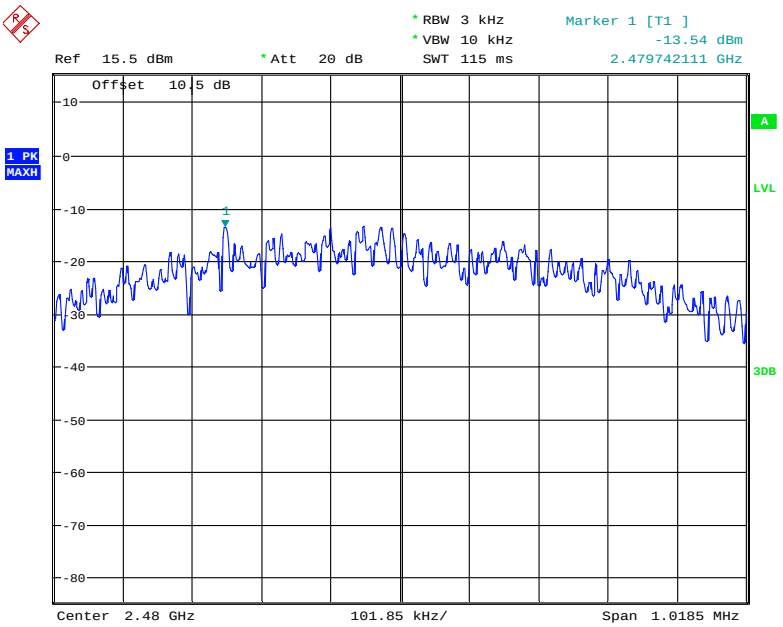
Date: 7.AUG.2018 22:21:15

Power Spectral Density, BLE Middle Channel



Date: 7.AUG.2018 13:47:34

Power Spectral Density, BLE High Channel



Date: 7.AUG.2018 22:20:36

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