TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.247

TEST REPORT

For

Hangzhou Tuya Information Technology Co., Ltd

Room701, Building3, More Center, No.87 GuDun Road, Hangzhou, Zhejiang, China

FCC ID: 2ANDL-TYAUXJ

Report Type:	**Product Type:**
Original Report	Wi-Fi Module

Test Engineer:	Max Min
Report Number:	RSHD190215003-00
Report Date:	2019-03-05
Reviewed By:	Oscar Ye RF Leader
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Hangzhou Tuya Information Technology Co., Ltd
Tested Model:	TYAUX_J
Product Type:	Wi-Fi Module
Dimension:	35.5mm(L)*19.5mm(W)*3.5mm(H)
Power Supply:	DC 12V
Type of Modulation:	DSSS,OFDM

**All measurement and test data in this report was gathered from production sample serial number: 20190215003. (Assigned by the BACL. The EUT supplied by the applicant was received on 2019-02-15.*

Objective

This report is prepared on behalf of Hangzhou Tuya Information Technology Co., Ltd in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions 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)

No related submittal/grant.

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 FCC 558074 D01 15.247 Meas Guidance v05r01.

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

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Test channel list is as below:

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

For 802.11n-HT40 mode, EUT was tested with Channel 3, 6 and 9.

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	/	/

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

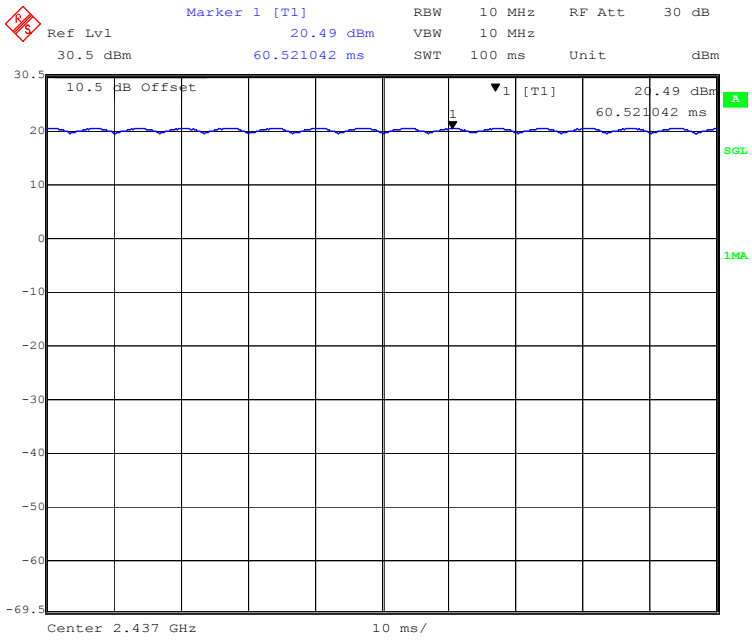
RF test tool: UI_mptool_1V16

Pre-scan with all the data rates, and the worst case was performed as below:

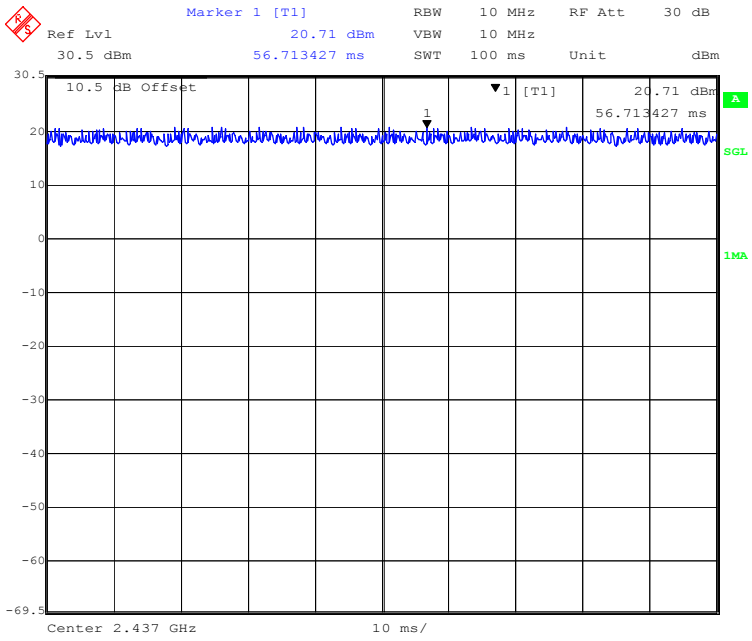
Mode	Data Rate	Power Level
802.11b	1 Mbps	41
802.11g	6 Mbps	41
802.11n-HT20	MCS0	39
802.11n-HT40	MCS0	39

Duty Cycle:

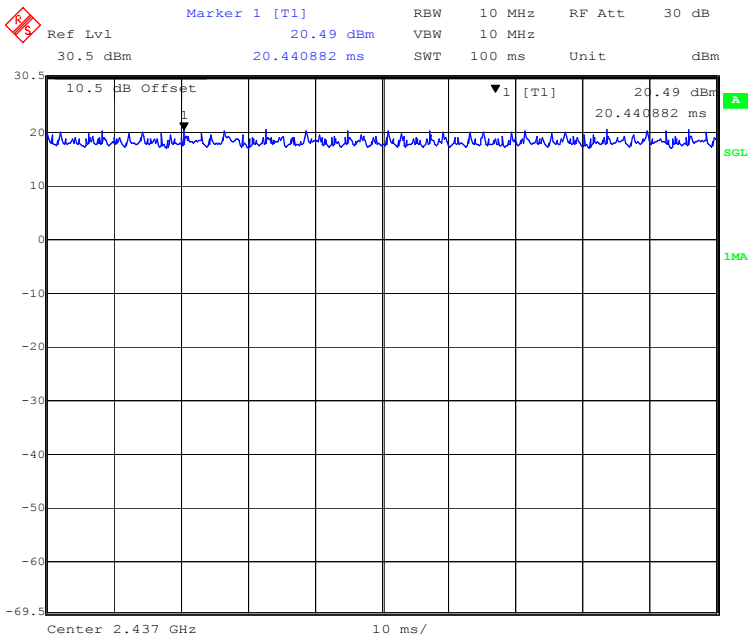
802.11b Mode Middle Channel



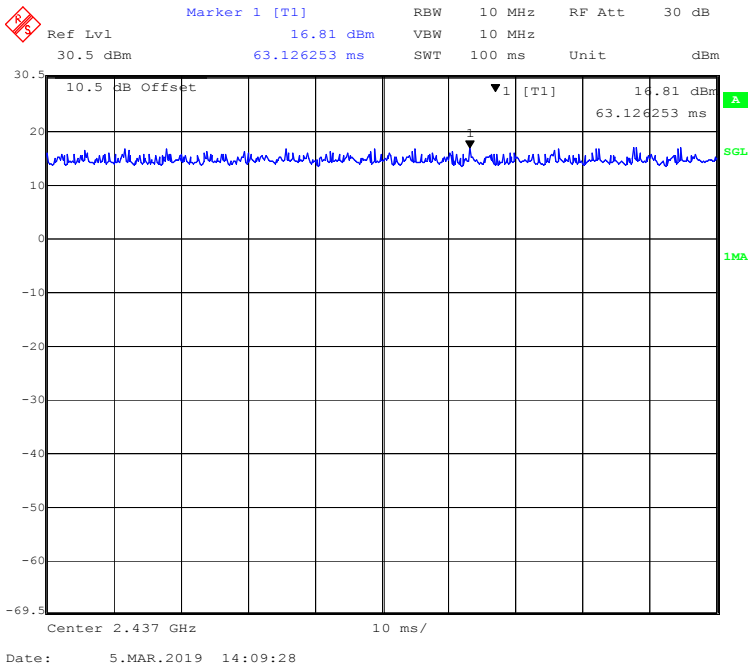
802.11g Mode Middle Channel



802.11n-HT20 Mode Middle Channel



802.11n-HT40 Mode Middle Channel



Mode	Duty Cycle (%)	T(ms)	1/T(kHz)	10log(1/x)
802.11b	100	/	/	0
802.11g	100	/	/	0
802.11n-HT20	100	/	/	0
802.11n-HT40	100	/	/	0

Note: "x" means the Duty Cycle.

Support Equipment List and Details

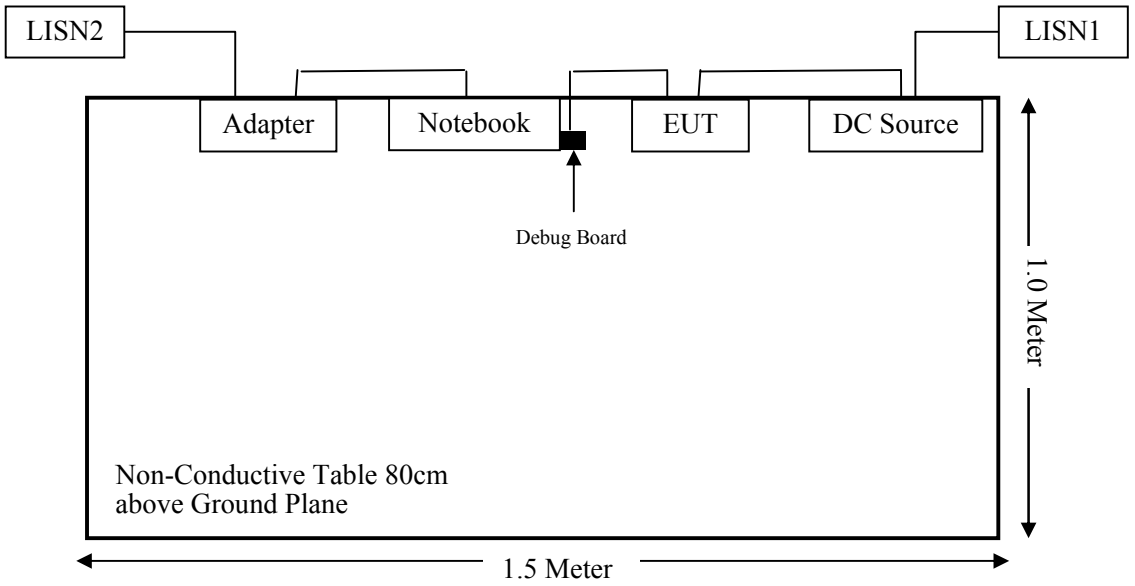
Manufacturer	Description	Model	Serial Number
DELL	Notebook	GX620	D65874152
DELL	Adapter	LA65NS0-00	DF263
TUYA	Debug Board	/	/

External I/O Cable

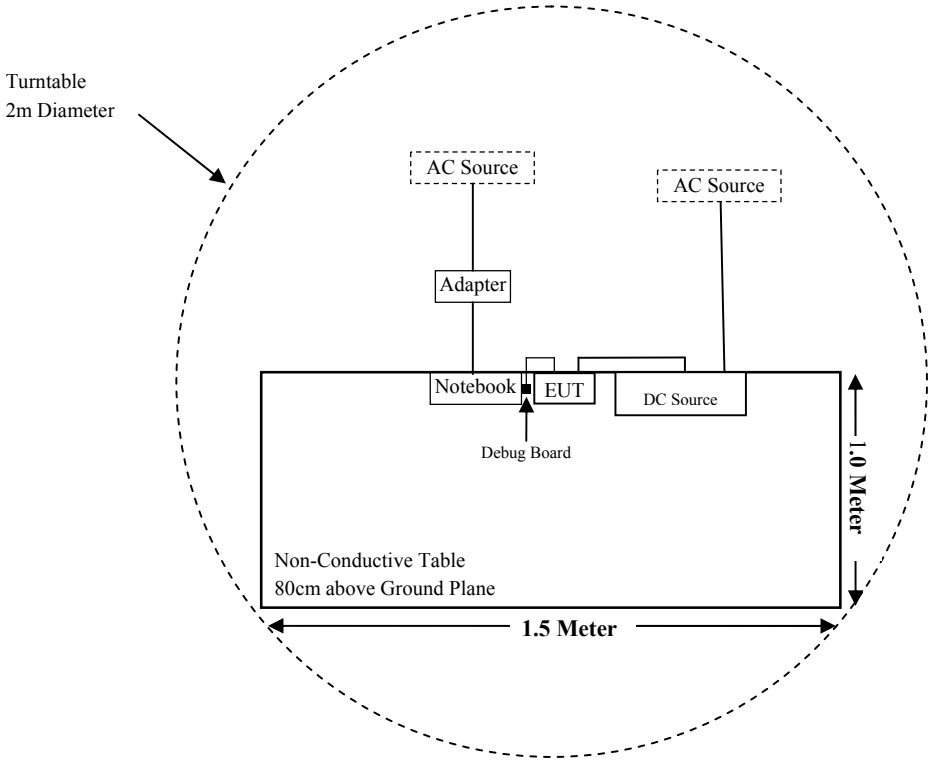
Cable Description	Length (m)	From Port	To
Power Cable	0.4	EUT	DC Source
Date Cable	0.2	EUT	Debug Board

Block Diagram of Test Setup

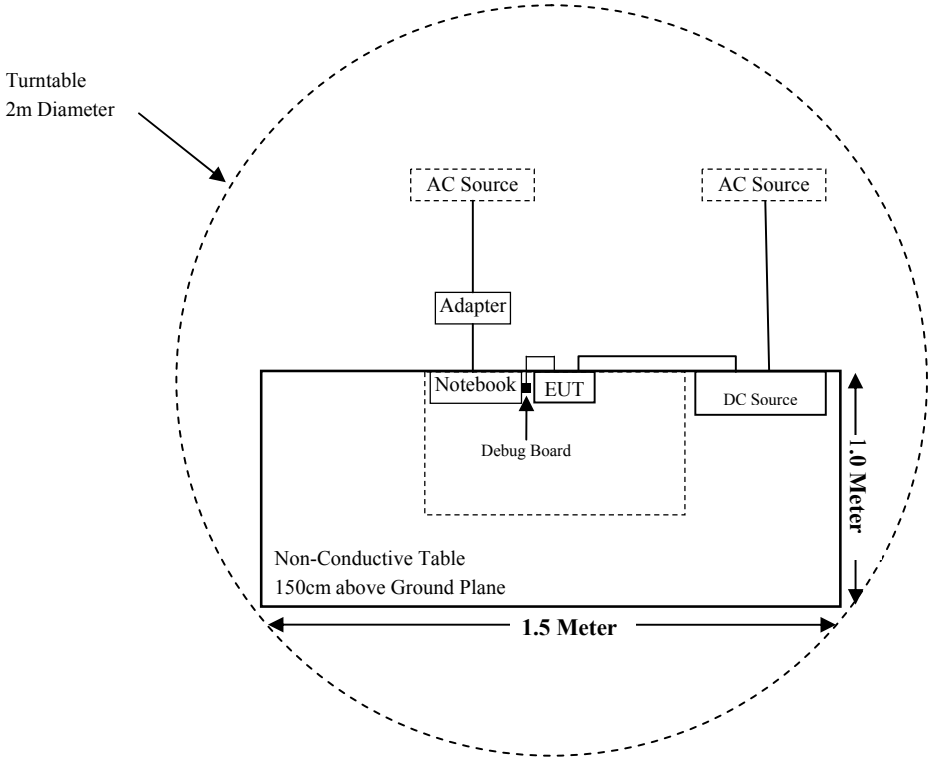
For Conducted Emissions:



For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2018-11-12	2019-11-11
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sonoma Instrument	Pre-amplifier	310N	171205	2018-08-15	2019-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	N/A	N/A
MICRO-COAX	Coaxial Cable	Cable-8	008	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2018-08-15	2019-08-14
Radiated Emission Test（Chamber 2#）					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2018-08-27	2019-08-26
ETS-LINDGREN	Horn Antenna	3115	6229	2019-01-11	2022-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
A.H.Systems, inc	Amplifier	2641-1	466	2018-09-11	2019-09-10
EM Electronics Corporation	Amplifier	EM18G40G	060726	2018-03-22	2019-03-21
MICRO-TRONICS	Band Reject Filter	BRM50702	G024	2018-08-05	2019-08-04
Narda	Attenuator	10dB	010	2018-08-15	2019-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	N/A	N/A
MICRO-COAX	Coaxial Cable	Cable-6	006	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2018-08-15	2019-08-14
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2018-09-21	2019-09-20
Agilent	Power Meter	N1912A	MY5000492	2018-11-18	2019-11-17
Agilent	Power Sensor	N1921A	MY54210024	2018-11-18	2019-11-17
Narda	Attenuator	10dB	010	2018-08-15	2019-08-14
Hangzhou Tuya	RF Cable	TuyaC01	C01	Each Time	/
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2018-11-12	2019-11-11
Rohde & Schwarz	LISN	ENV216	3560655016	2018-11-12	2019-11-11
BACL	Auto test Software	BACL-EMC	CE001	N/A	N/A
Narda	Attenuator/6dB	10690812-2	26850-6	2019-01-10	2020-01-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2018-08-15	2019-08-14

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

FCC §1.1310 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 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.

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

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Target Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412~2462	2.50	1.78	22.00	158.49	20	0.0561	1.0
802.11g		2.50	1.78	22.50	177.83	20	0.0630	1.0
802.11 n-HT20		2.50	1.78	21.50	141.25	20	0.0500	1.0
802.11 n-HT40	2422~2452	2.50	1.78	21.50	141.25	20	0.0500	1.0

Note: The target output power was declared by the manufacturer.

Conclusion: The device meets FCC MPE at 20 cm distance.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the 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 a PCB antenna for Wi-Fi and the antenna gain is 2.5dBi, which was permanently attached, fulfill the requirement of this section. Please refer to the EUT photos.

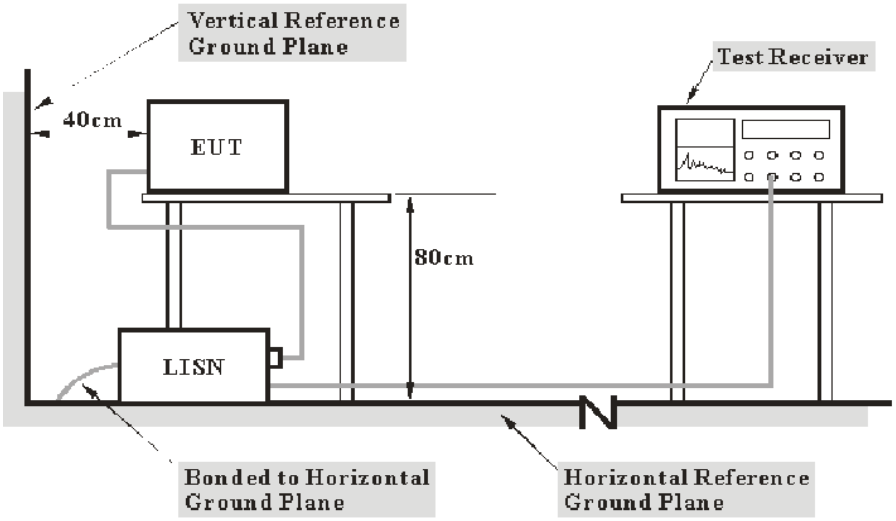
Result: Compliance.

FCC §15.207 (a) - AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

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 measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

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

ANSI C63.10-2013 clause 6.2

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:

Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)

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 (dB) = Limit (dBμV) – Corrected Amplitude (dBμV)

Test Results Summary

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

Test Data

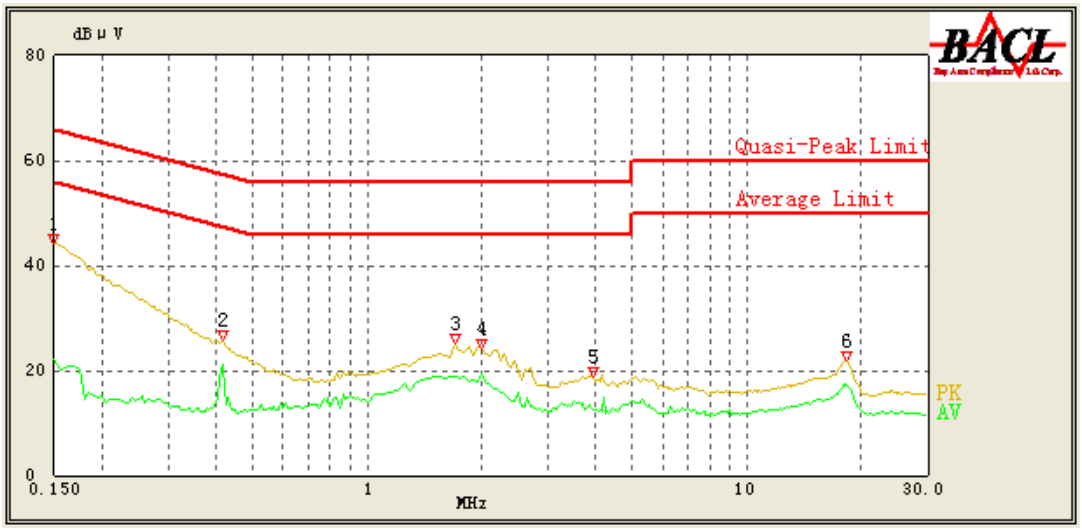
Environmental Conditions

Temperature:	20.2 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by Max Min on 2019-02-22.

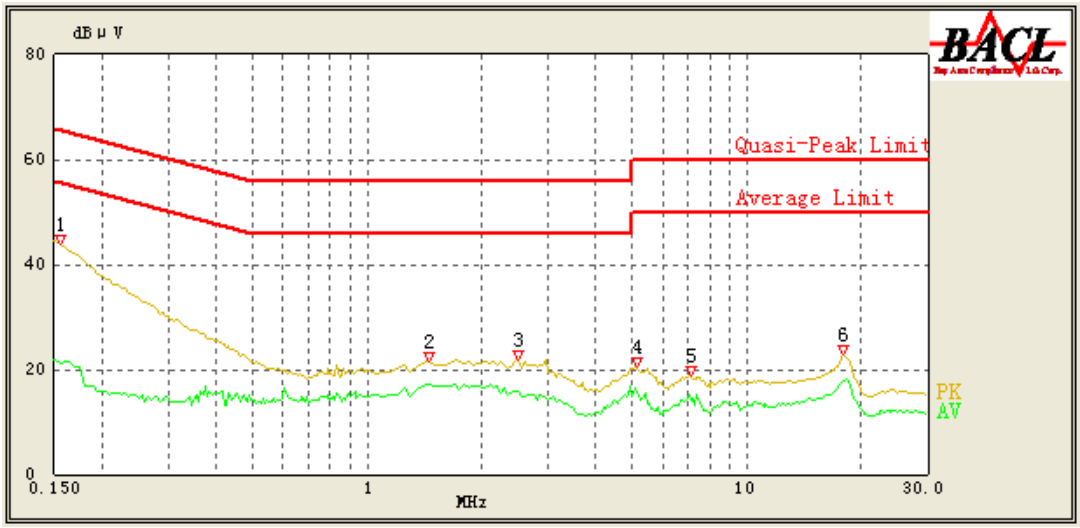
EUT operation mode: Transmitting in 802.11g mode high channel (worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.150	44.50	QP	9.000	L1	16.06	66.00	21.50	Compliance
0.150	22.52	AV	9.000	L1	16.06	56.00	33.48	Compliance
0.415	25.80	QP	9.000	L1	16.06	57.55	31.75	Compliance
0.415	21.22	AV	9.000	L1	16.06	47.55	26.33	Compliance
1.700	25.05	QP	9.000	L1	15.86	56.00	30.95	Compliance
1.700	18.97	AV	9.000	L1	15.86	46.00	27.03	Compliance
2.000	24.23	QP	9.000	L1	15.85	56.00	31.77	Compliance
2.000	19.46	AV	9.000	L1	15.85	46.00	26.54	Compliance
3.950	18.98	QP	9.000	L1	15.85	56.00	37.02	Compliance
3.950	12.48	AV	9.000	L1	15.85	46.00	33.52	Compliance
18.250	21.88	QP	9.000	L1	16.36	60.00	38.12	Compliance
18.150	17.31	AV	9.000	L1	16.35	50.00	32.69	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.155	43.25	QP	9.000	N	16.06	65.86	22.61	Compliance
0.155	21.24	AV	9.000	N	16.06	55.86	34.62	Compliance
1.450	21.38	QP	9.000	N	15.93	56.00	34.62	Compliance
1.450	17.03	AV	9.000	N	15.93	46.00	28.97	Compliance
2.500	21.87	QP	9.000	N	15.90	56.00	34.13	Compliance
2.500	15.74	AV	9.000	N	15.90	46.00	30.26	Compliance
5.150	20.53	QP	9.000	N	15.87	60.00	39.47	Compliance
5.100	16.41	AV	9.000	N	15.87	50.00	33.59	Compliance
7.100	18.70	QP	9.000	N	15.92	60.00	41.30	Compliance
7.100	14.13	AV	9.000	N	15.92	50.00	35.87	Compliance
18.000	22.78	QP	9.000	N	16.10	60.00	37.22	Compliance
18.000	17.96	AV	9.000	N	16.10	50.00	32.04	Compliance

Note:
1) Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Margin (dB) = Limit (dBµV) – Corrected Amplitude (dBµV)

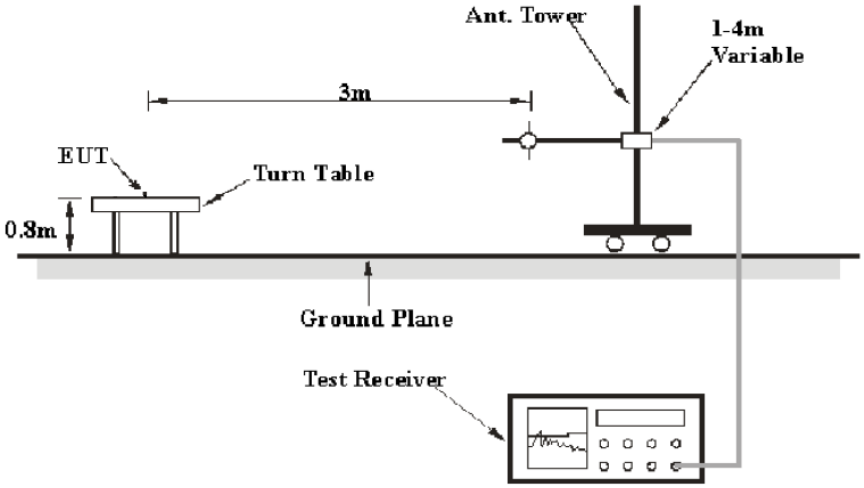
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

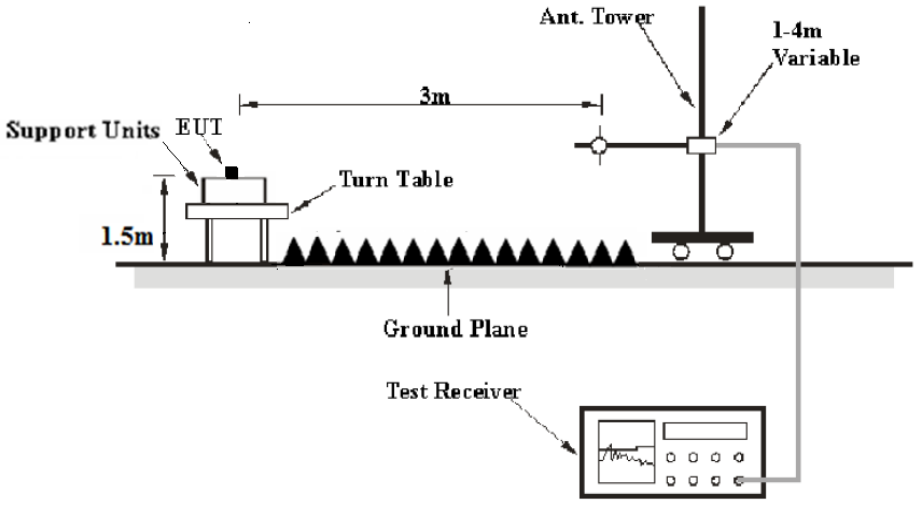
FCC §15.247 (d); §15.209; §15.205;

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 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	/	Ave.

Test Procedure

According to ANSI C63.10-2013 clause 6.5, 6.6 and 6.7.

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 30MHz - 1GHz, peak and Average detection mode 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 (dBμV /m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

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 (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

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.

Test Data

Environmental Conditions

Temperature:	24.2 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

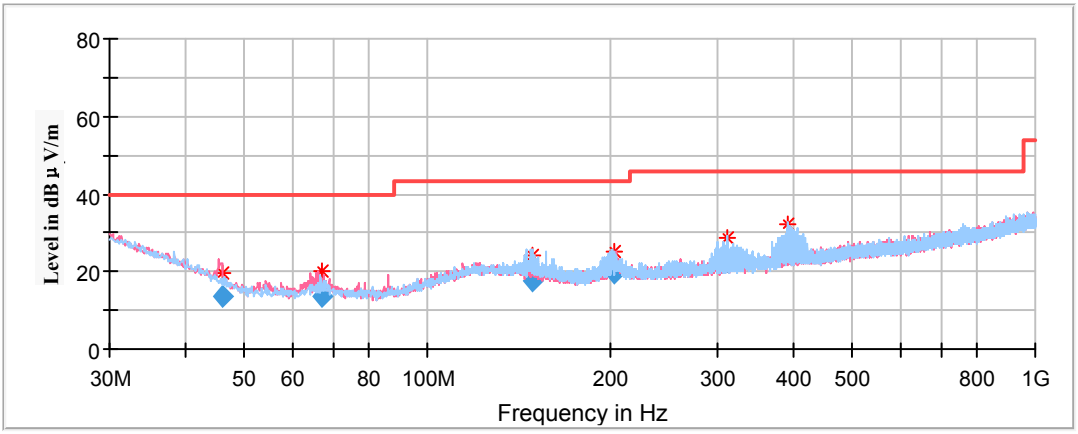
The testing was performed by Max Min on 2019-02-22.

EUT operation mode: Transmitting

Spurious Emission Test:

30MHz-1GHz:

Pre-scan with 802.11b, 802.11g, 802.11n-HT20 and 802.11n-HT40 modes of operation in the X,Y and Z axes of orientation, the worst case ***high channel of 802.11b mode in X-axis of orientation*** *was recorded*



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	QuasiPeak (dBµV/m)	Height (cm)	Polar (H/V)				
45.944750	13.37	101.0	V	59.0	-14.8	40.00	26.63
66.932350	13.76	101.0	V	90.0	-17.5	40.00	26.24
149.281350	17.49	199.0	H	180.0	-12.3	43.50	26.01
202.717000	19.63	199.0	H	149.0	-12.3	43.50	23.87
311.828100	22.86	101.0	H	38.0	-10.2	46.00	23.14
390.353800	26.50	101.0	H	0.0	-8.3	46.00	19.50

1GHz-25GHz:

802.11b Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2412.00MHz)									
2412	93.58	PK	176	236	V	12.60	106.18	\	\
2412	90.76	Ave	176	236	V	12.60	103.36	\	\
2412	90.04	PK	250	202	H	12.60	102.64	\	\
2412	87.09	Ave	250	202	H	12.60	99.69	\	\
2390	42.71	PK	120	226	V	12.60	55.31	74	18.69
2390	32.24	Ave	120	226	V	12.60	44.84	54	9.16
4824	39.31	PK	269	219	V	10.60	49.91	74	24.09
4824	29.81	Ave	269	219	V	10.60	40.41	54	13.59
7236	38.74	PK	134	188	V	16.80	55.54	74	18.46
7236	29.97	Ave	134	188	V	16.80	46.77	54	7.23
Middle Channel: (2437.00MHz)									
2437	93.55	PK	72	239	V	12.70	106.25	\	\
2437	90.81	Ave	72	239	V	12.70	103.51	\	\
2437	89.38	PK	180	205	H	12.70	102.08	\	\
2437	86.23	Ave	180	205	H	12.70	98.93	\	\
4874	37.08	PK	131	237	V	10.70	47.78	74	26.22
4874	27.98	Ave	131	237	V	10.70	38.68	54	15.32
7311	38.05	PK	99	146	V	17.00	55.05	74	18.95
7311	29.94	Ave	99	146	V	17.00	46.94	54	7.06
High Channel: (2462.00MHz)									
2462	92.70	PK	29	158	V	12.80	105.50	\	\
2462	89.52	Ave	29	158	V	12.80	102.32	\	\
2462	87.36	PK	104	170	H	12.80	100.16	\	\
2462	85.28	Ave	104	170	H	12.80	98.08	\	\
2483.5	40.99	PK	189	217	V	13.00	53.99	74	20.01
2483.5	31.31	Ave	189	217	V	13.00	44.31	54	9.69
4924	37.95	PK	116	230	V	10.80	48.75	74	25.25
4924	28.89	Ave	116	230	V	10.80	39.69	54	14.31
7386	41.18	PK	121	178	H	17.00	58.18	74	15.82
7386	32.13	Ave	121	178	H	17.00	49.13	54	4.87

802.11g Mode:

*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2412.00MHz)									
2412	94.66	PK	334	216	V	12.60	107.26	\	\
2412	87.43	Ave	334	216	V	12.60	100.03	\	\
2412	91.03	PK	340	131	H	12.60	103.63	\	\
2412	82.17	Ave	340	131	H	12.60	94.77	\	\
2390	46.32	PK	151	240	V	12.60	58.92	74	15.08
2390	36.69	Ave	151	240	V	12.60	49.29	54	4.71
4824	37.24	PK	70	163	V	10.60	47.84	74	26.16
4824	27.89	Ave	70	163	V	10.60	38.49	54	15.51
7236	38.21	PK	162	230	V	16.80	55.01	74	18.99
7236	27.79	Ave	162	230	V	16.80	44.59	54	9.41
Middle Channel: (2437.00MHz)									
2437	94.17	PK	343	244	V	12.70	106.87	\	\
2437	86.31	Ave	343	244	V	12.70	99.01	\	\
2437	89.53	PK	101	220	H	12.70	102.23	\	\
2437	81.71	Ave	101	220	H	12.70	94.41	\	\
4874	37.73	PK	224	182	H	10.70	48.43	74	25.57
4874	27.82	Ave	224	182	H	10.70	38.52	54	15.48
7311	37.23	PK	348	224	H	17.00	54.23	74	19.77
7311	28.28	Ave	348	224	H	17.00	45.28	54	8.72
High Channel: (2462.00MHz)									
2462	94.08	PK	132	129	V	12.80	106.88	\	\
2462	87.18	Ave	132	129	V	12.80	99.98	\	\
2462	89.54	PK	57	232	H	12.80	102.34	\	\
2462	81.78	Ave	57	232	H	12.80	94.58	\	\
2483.5	48.19	PK	140	200	V	13.00	61.19	74	12.81
2483.5	36.65	Ave	140	200	V	13.00	49.65	54	4.35
4924	37.48	PK	267	113	H	10.80	48.28	74	25.72
4924	26.97	Ave	267	113	H	10.80	37.77	54	16.23
7386	37.86	PK	283	199	H	17.00	54.86	74	19.14
7386	28.09	Ave	283	199	H	17.00	45.09	54	8.91

802.11n-HT20 Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

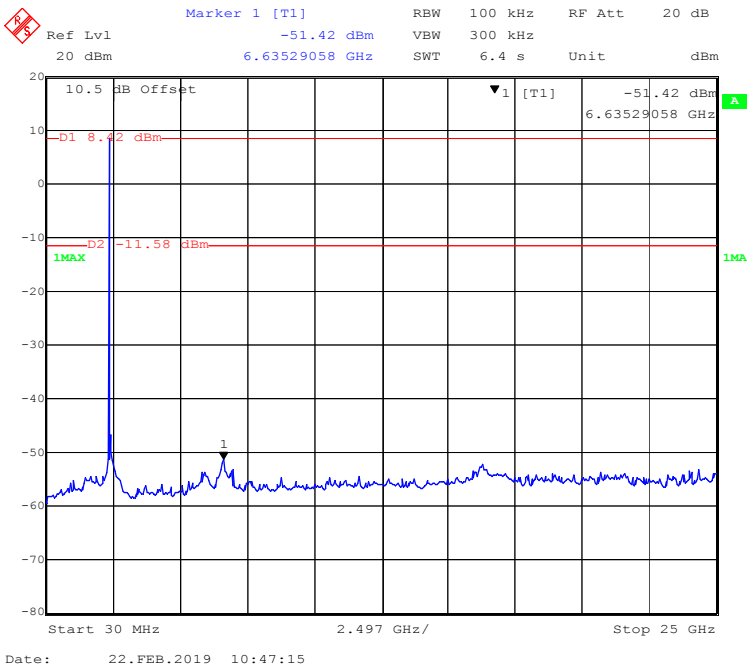
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2412.00MHz)									
2412	94.32	PK	282	210	V	12.60	106.92	\	\
2412	87.35	Ave	282	210	V	12.60	99.95	\	\
2412	89.46	PK	103	125	H	12.60	102.06	\	\
2412	82.22	Ave	103	125	H	12.60	94.82	\	\
2390	48.63	PK	160	161	V	12.60	61.23	74	12.77
2390	36.89	Ave	160	161	V	12.60	49.49	54	4.51
4824	37.38	PK	21	139	H	10.60	47.98	74	26.02
4824	27.67	Ave	21	139	H	10.60	38.27	54	15.73
7236	36.94	PK	271	153	H	16.80	53.74	74	20.26
7236	27.34	Ave	271	153	H	16.80	44.14	54	9.86
Middle Channel: (2437.00MHz)									
2437	94.17	PK	6	235	V	12.70	106.87	\	\
2437	87.05	Ave	6	235	V	12.70	99.75	\	\
2437	90.16	PK	57	231	H	12.70	102.86	\	\
2437	83.02	Ave	57	231	H	12.70	95.72	\	\
4874	37.16	PK	53	134	V	10.70	47.86	74	26.14
4874	27.38	Ave	53	134	V	10.70	38.08	54	15.92
7311	37.42	PK	99	164	H	17.00	54.42	74	19.58
7311	26.85	Ave	99	164	H	17.00	43.85	54	10.15
High Channel: (2462.00MHz)									
2462	93.65	PK	293	219	V	12.80	106.45	\	\
2462	86.68	Ave	293	219	V	12.80	99.48	\	\
2462	88.24	PK	205	223	H	12.80	101.04	\	\
2462	82.60	Ave	205	223	H	12.80	95.40	\	\
2483.5	49.57	PK	346	168	V	13.00	62.57	74	11.43
2483.5	36.78	Ave	346	168	V	13.00	49.78	54	4.22
4924	38.05	PK	299	234	V	10.80	48.85	74	25.15
4924	27.90	Ave	299	234	V	10.80	38.70	54	15.30
7386	39.64	PK	76	135	V	17.00	56.64	74	17.36
7386	28.94	Ave	76	135	V	17.00	45.94	54	8.06

802.11n-HT40 Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

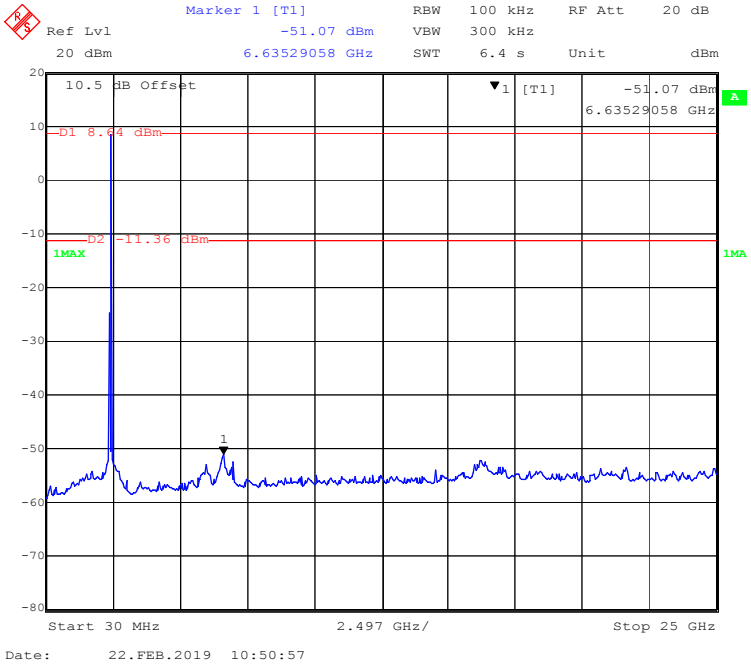
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2422.00MHz)									
2422	89.93	PK	319	206	V	12.70	102.63	\	\
2422	82.23	Ave	319	206	V	12.70	94.93	\	\
2422	86.15	PK	198	122	H	12.70	98.85	\	\
2422	77.18	Ave	198	122	H	12.70	89.88	\	\
2390	48.85	PK	143	196	V	12.60	61.45	74	12.55
2390	37.84	Ave	143	196	V	12.60	50.44	54	3.56
4844	38.31	PK	228	100	H	10.60	48.91	74	25.09
4844	27.67	Ave	228	100	H	10.60	38.27	54	15.73
7266	36.77	PK	294	245	H	17.30	54.07	74	19.93
7266	26.45	Ave	294	245	H	17.30	43.75	54	10.25
Middle Channel: (2437.00MHz)									
2437	89.86	PK	15	112	V	12.70	102.56	\	\
2437	82.34	Ave	15	112	V	12.70	95.04	\	\
2437	85.91	PK	130	229	H	12.70	98.61	\	\
2437	77.00	Ave	130	229	H	12.70	89.70	\	\
4874	37.95	PK	70	186	V	10.70	48.65	74	25.35
4874	27.93	Ave	70	186	V	10.70	38.63	54	15.37
7311	37.19	PK	163	147	V	17.00	54.19	74	19.81
7311	26.44	Ave	163	147	V	17.00	43.44	54	10.56
High Channel: (2452.00MHz)									
2452	89.94	PK	224	215	V	12.80	102.74	\	\
2452	82.45	Ave	224	215	V	12.80	95.25	\	\
2452	85.68	PK	129	163	H	12.80	98.48	\	\
2452	77.33	Ave	129	163	H	12.80	90.13	\	\
2483.5	47.06	PK	135	110	V	13.00	60.06	74	13.94
2483.5	36.92	Ave	135	110	V	13.00	49.92	54	4.08
4904	37.36	PK	64	166	V	10.70	48.06	74	25.94
4904	27.76	Ave	64	166	V	10.70	38.46	54	15.54
7356	36.77	PK	238	218	H	17.40	54.17	74	19.83
7356	26.36	Ave	238	218	H	17.40	43.76	54	10.24

Conducted Spurious Emissions at Antenna Port

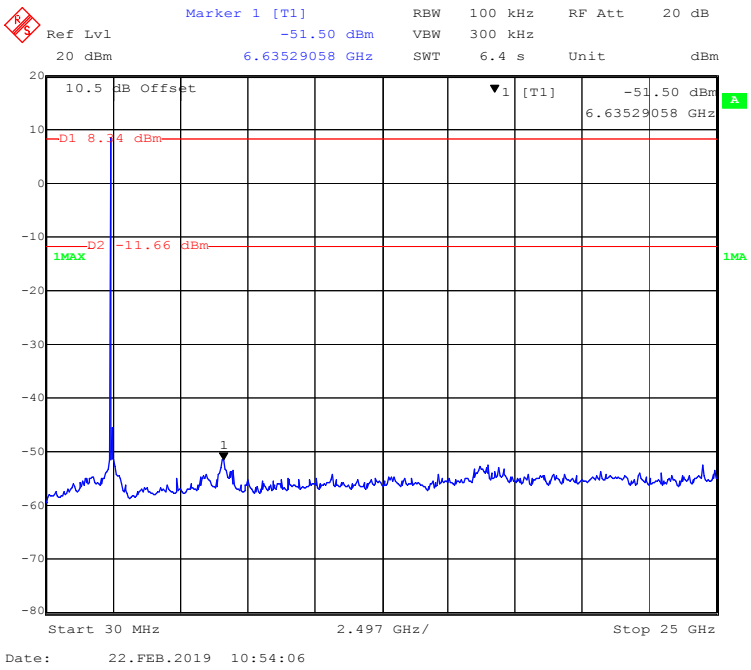
802.11b Mode Low Channel



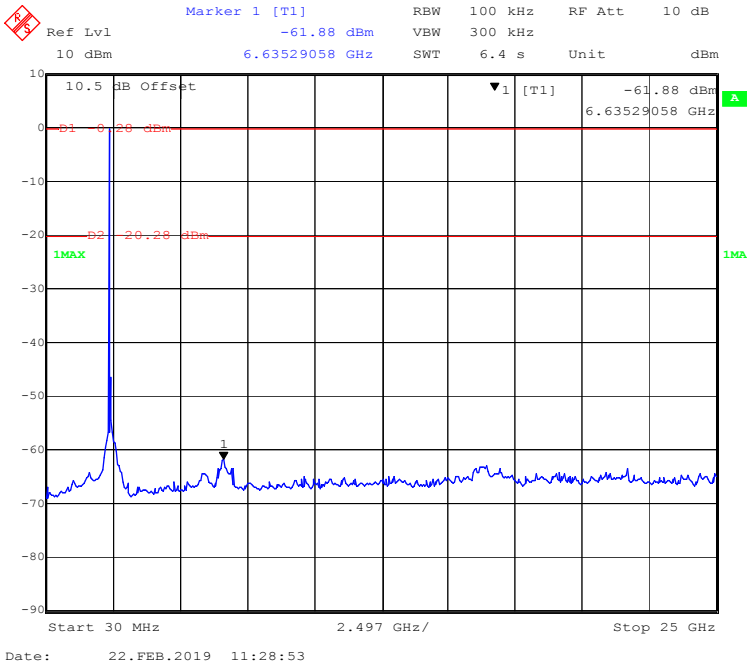
802.11b Mode Middle Channel



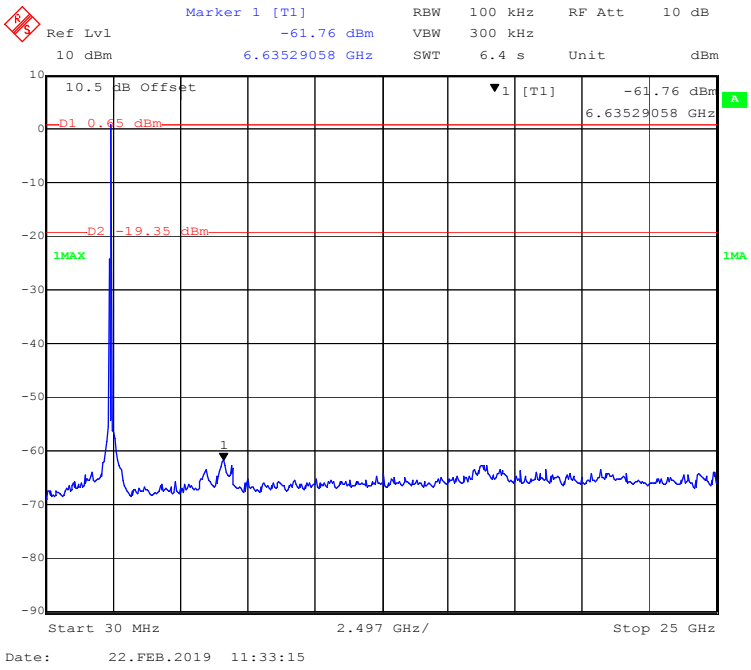
802.11b Mode High Channel



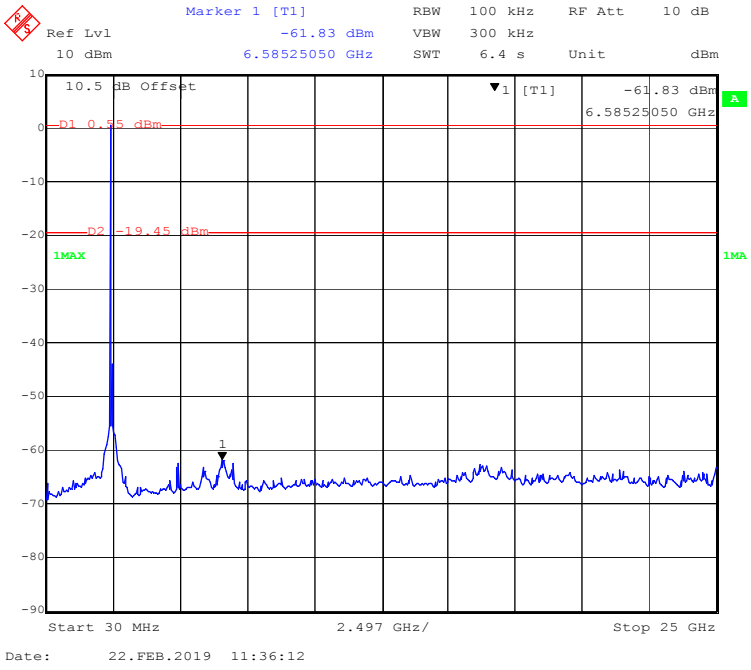
802.11g Mode Low Channel



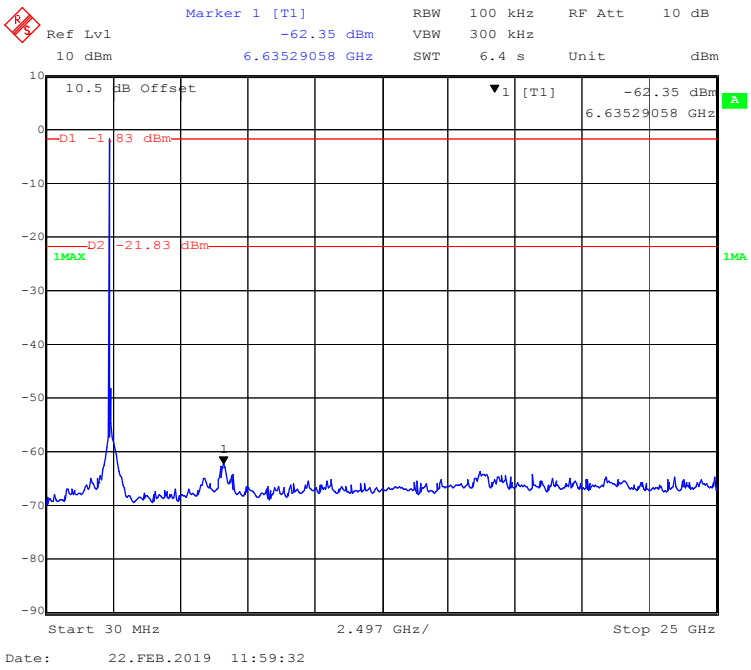
802.11g Mode Middle Channel



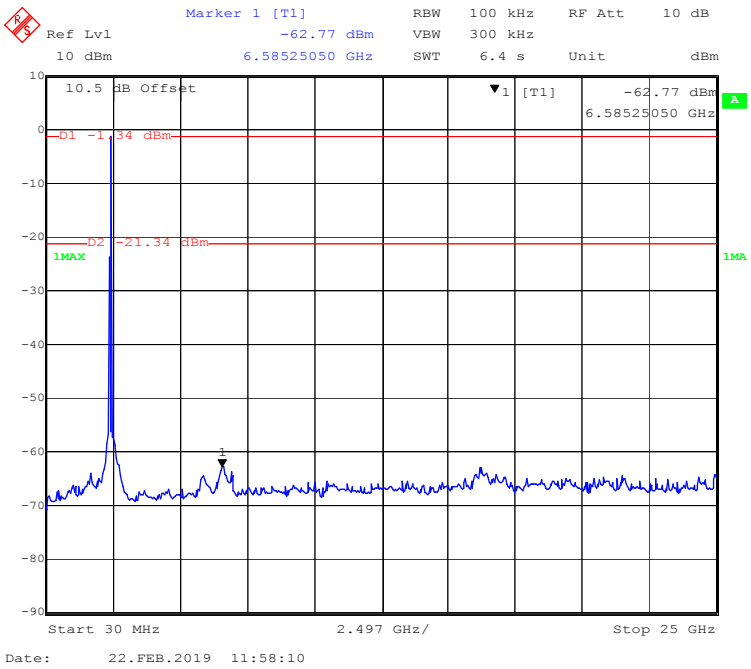
802.11g Mode High Channel



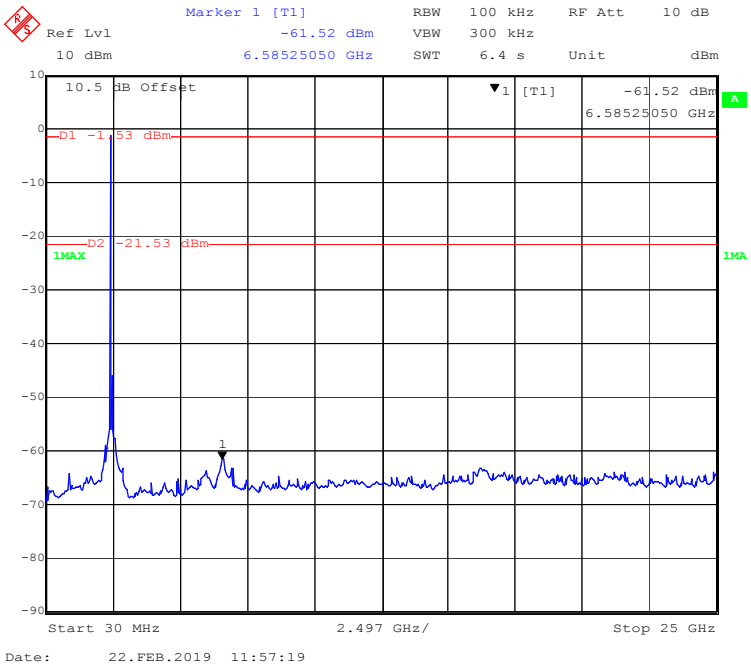
802.11n-HT20 Mode Low Channel



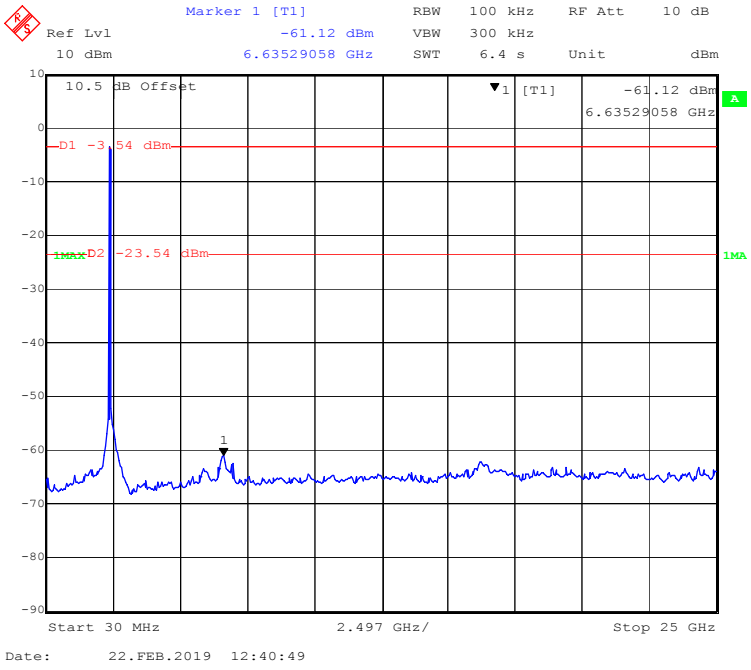
802.11n-HT20 Mode Middle Channel



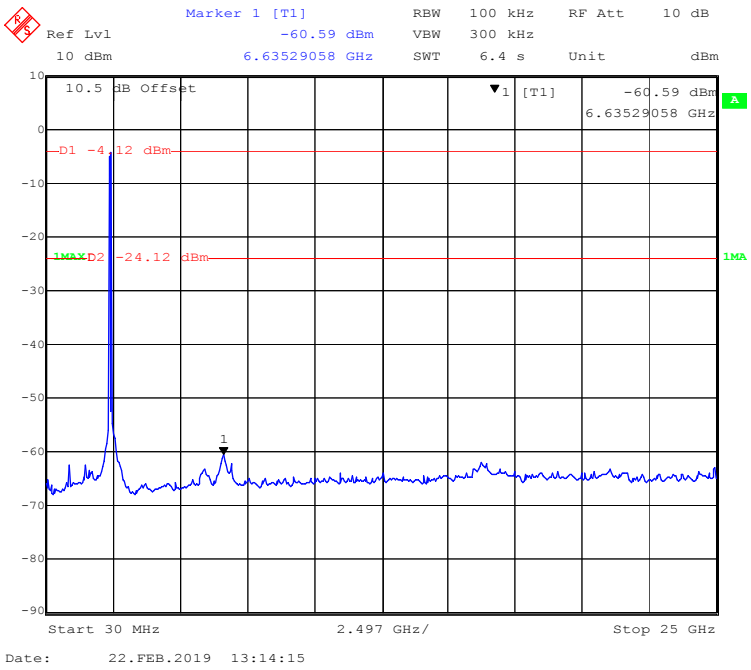
802.11n-HT20 Mode High Channel



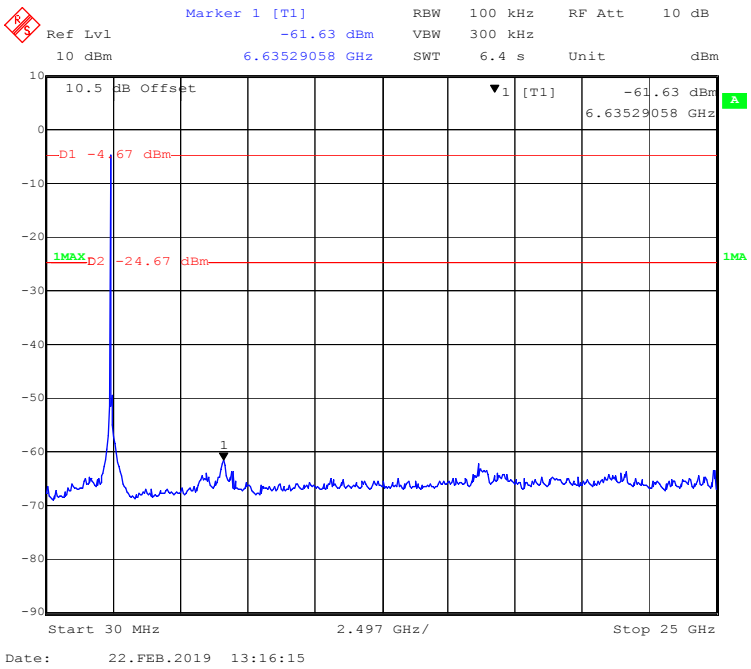
802.11n-HT40 Mode Low Channel



802.11n-HT40 Mode Middle Channel



802.11n-HT40 Mode High Channel



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

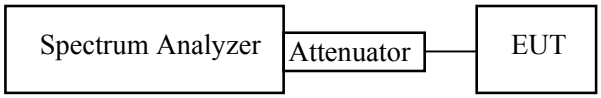
Applicable Standard

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

According to ANSI C63.10-2013 sub-clause 11.8.1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 * RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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:	24 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

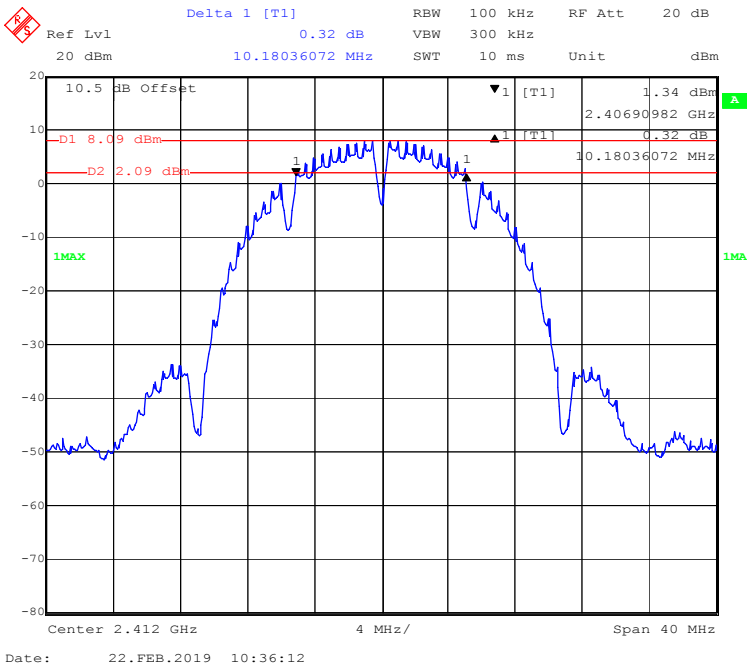
The testing was performed by Max Min on 2019-02-22.

EUT operation mode: Transmitting

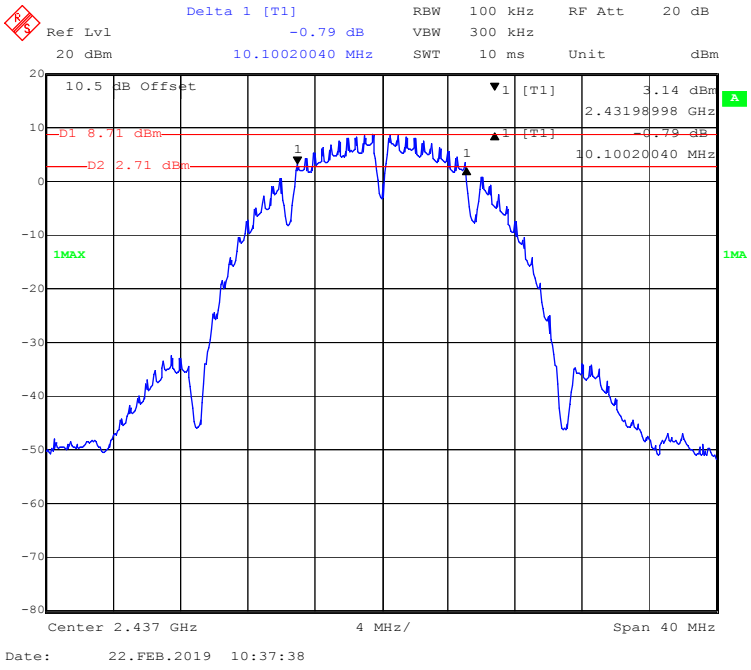
Test Result: Pass

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b Mode			
Low	2412	10.180	≥ 0.5
Middle	2437	10.100	≥ 0.5
High	2462	10.100	≥ 0.5
802.11g Mode			
Low	2412	16.593	≥ 0.5
Middle	2437	16.593	≥ 0.5
High	2462	16.603	≥ 0.5
802.11n-HT20 Mode			
Low	2412	17.796	≥ 0.5
Middle	2437	17.796	≥ 0.5
High	2462	17.796	≥ 0.5
802.11n-HT40 Mode			
Low	2422	36.313	≥ 0.5
Middle	2437	36.463	≥ 0.5
High	2452	36.493	≥ 0.5

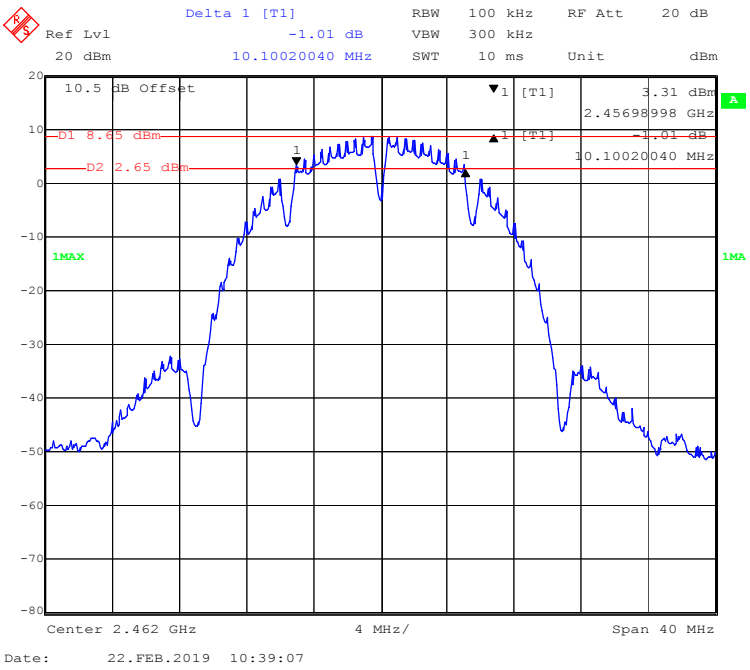
802.11b Mode Low Channel



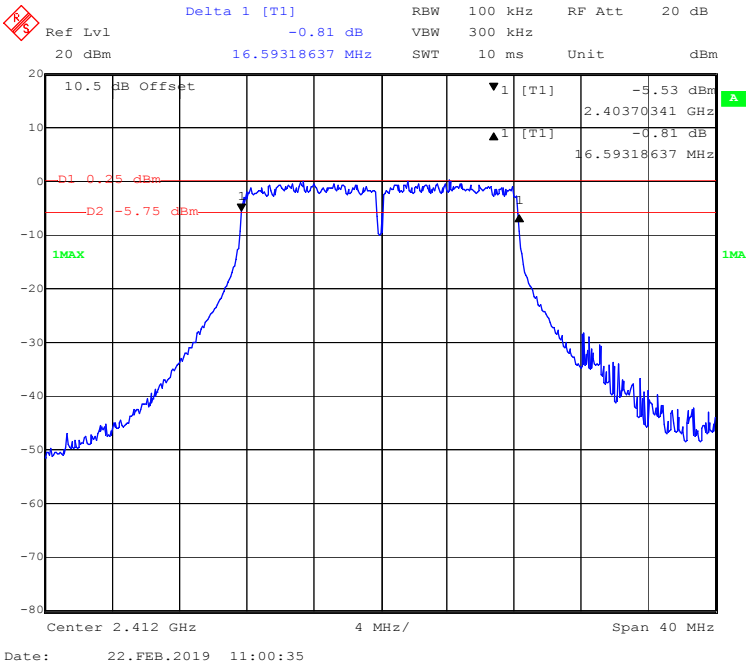
802.11b Mode Middle Channel



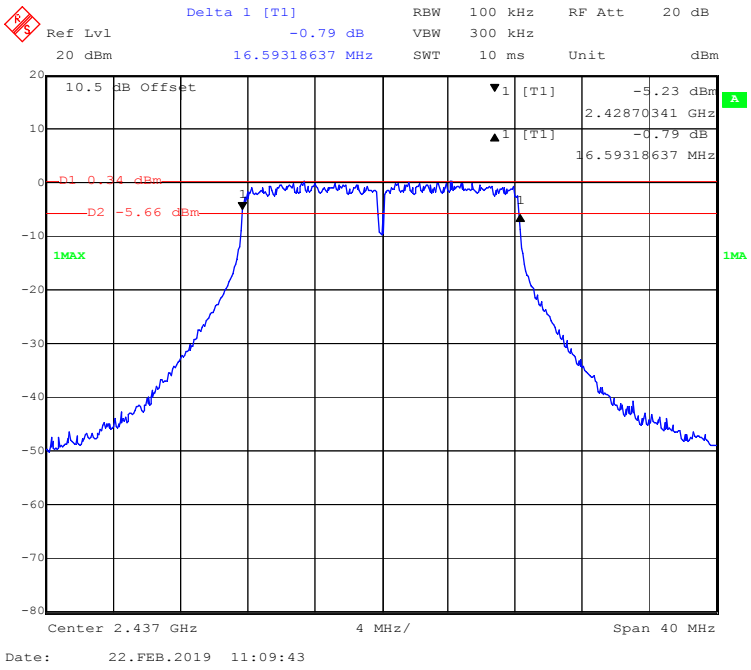
802.11b Mode High Channel



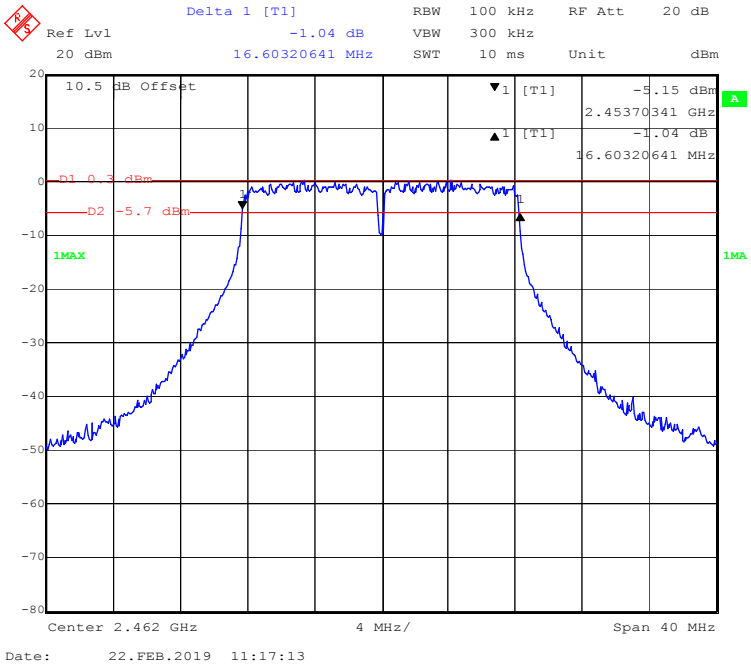
802.11g Mode Low Channel



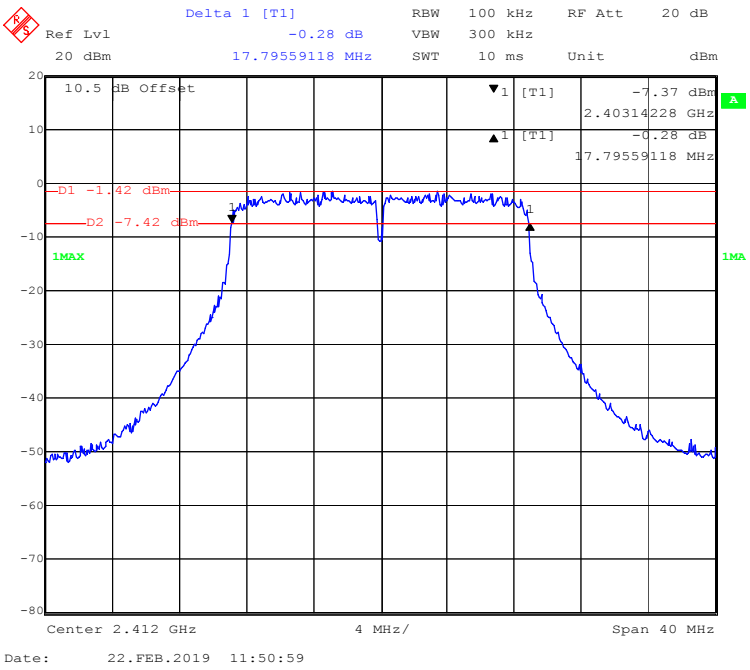
802.11g Mode Middle Channel



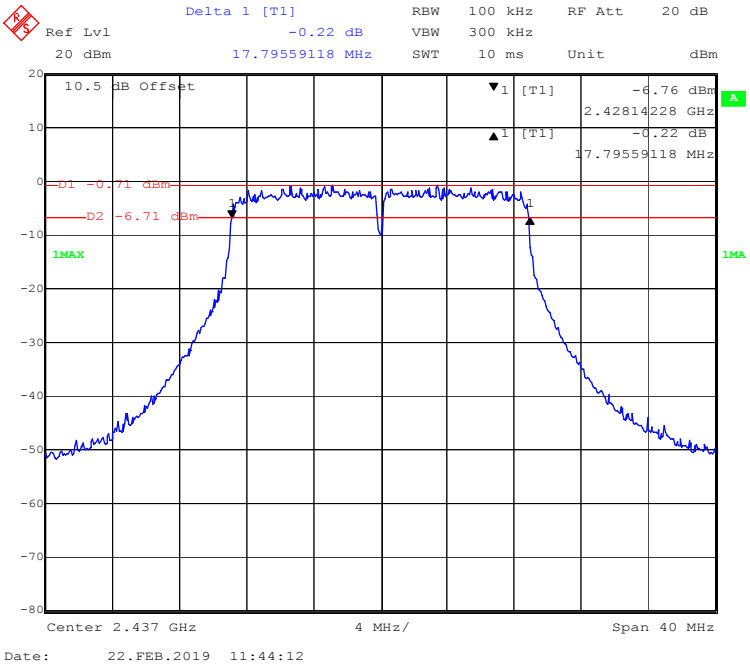
802.11g Mode High Channel



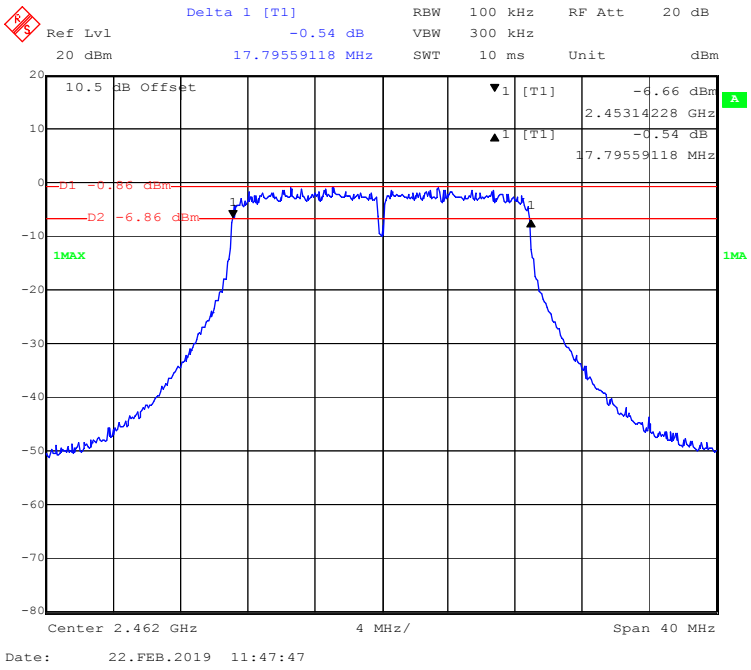
802.11n-HT20 Mode Low Channel



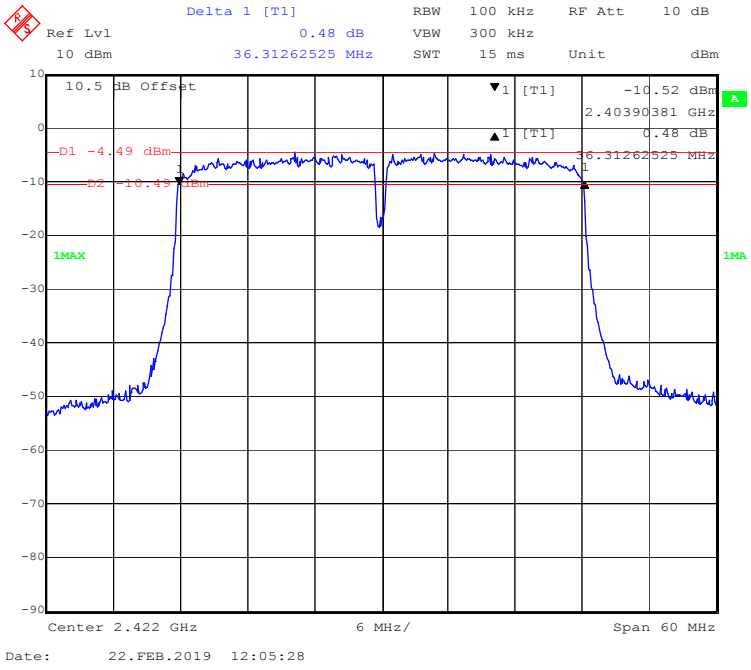
802.11n-HT20 Mode Middle Channel



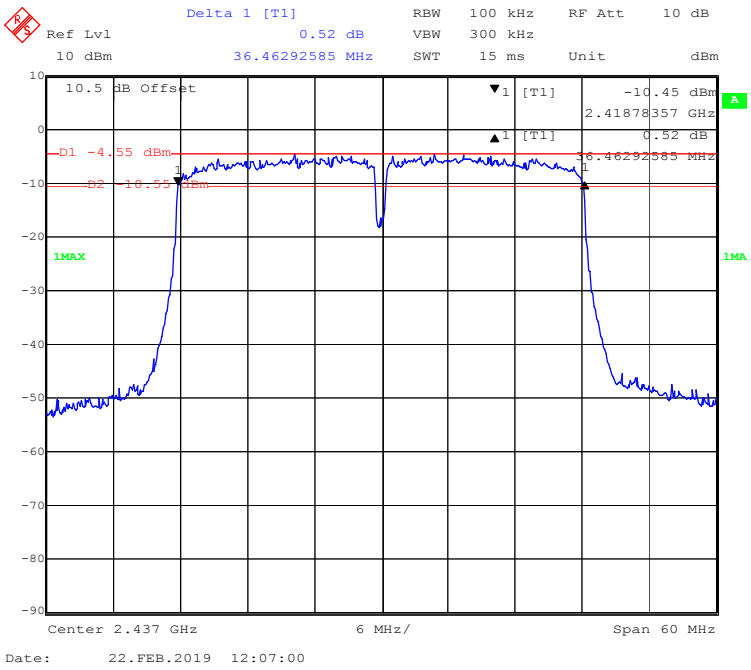
802.11n-HT20 Mode High Channel



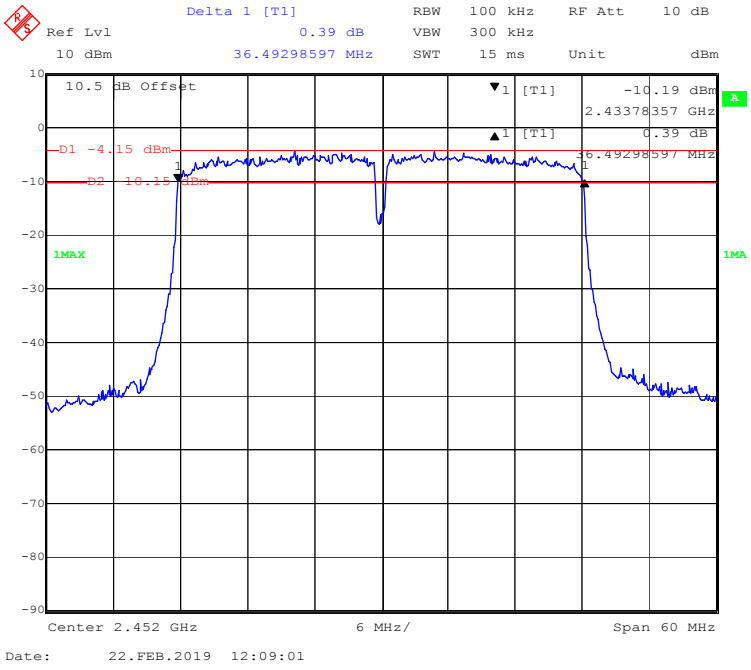
802.11n-HT40 Mode Low Channel



802.11n-HT40 Mode Middle Channel



802.11n-HT40 Mode High Channel



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

Applicable Standard

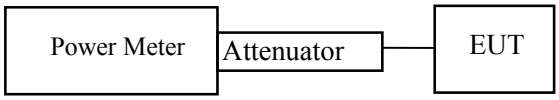
According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, Compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted 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

According to ANSI C63.10-2013 sub-clause 11.9.1.3

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

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:	23.8℃
Relative Humidity:	54 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2019-02-22.

EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
802.11b Mode				
Low	2412	21.20	30	Pass
Middle	2437	21.84	30	Pass
High	2462	21.89	30	Pass
802.11g Mode				
Low	2412	21.71	30	Pass
Middle	2437	22.15	30	Pass
High	2462	22.05	30	Pass
802.11n-HT20 Mode				
Low	2412	21.02	30	Pass
Middle	2437	21.15	30	Pass
High	2462	21.27	30	Pass
802.11n-HT40 Mode				
Low	2422	20.78	30	Pass
Middle	2437	20.79	30	Pass
High	2452	21.03	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

According to ANSI C63.10-2013 sub-clause 6.10.

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

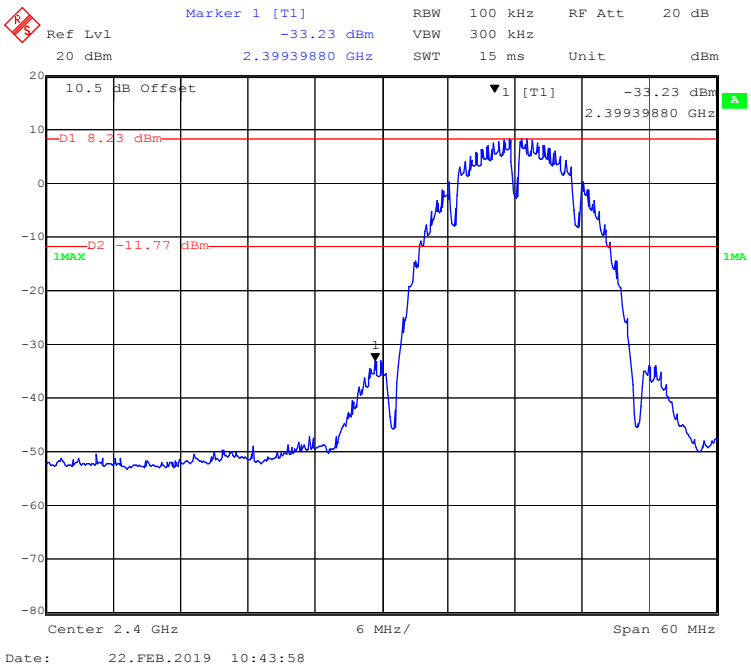
Temperature:	24.3 ℃
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

The testing was performed by Max Min on 2019-02-22.

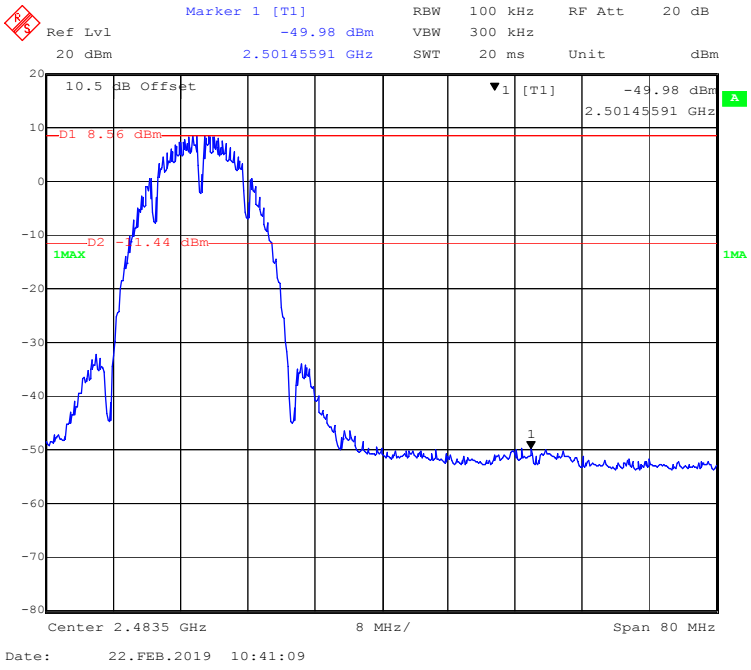
EUT operation mode: Transmitting

Test Result: Compliance

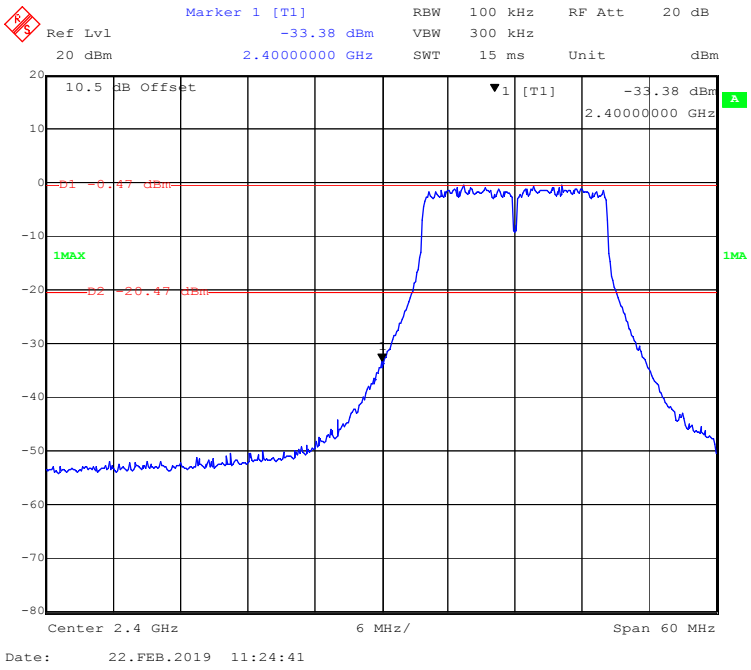
802.11b Mode Left Side



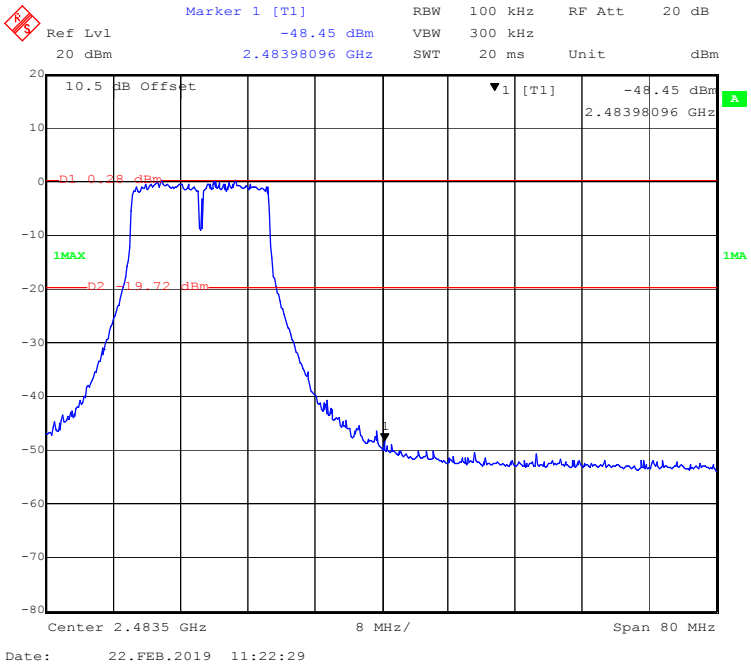
802.11b Mode Right Side



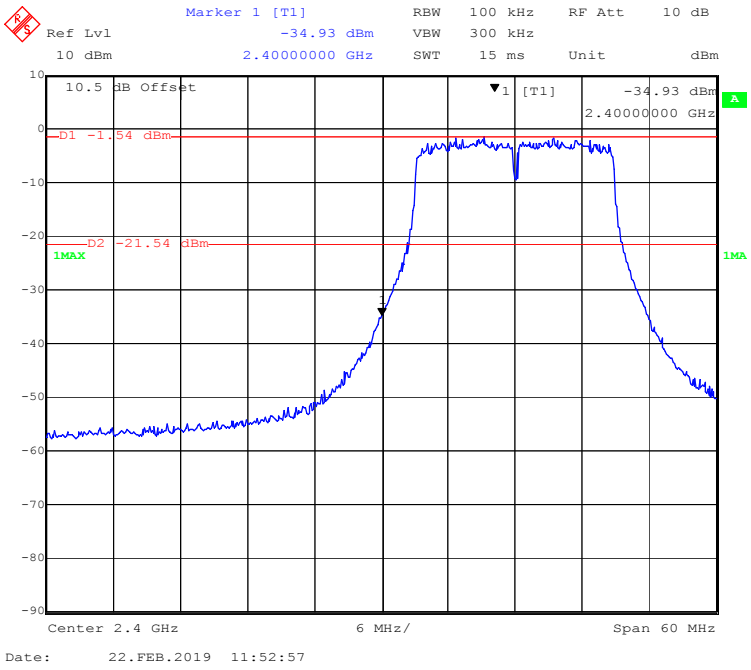
802.11g Mode Left Side



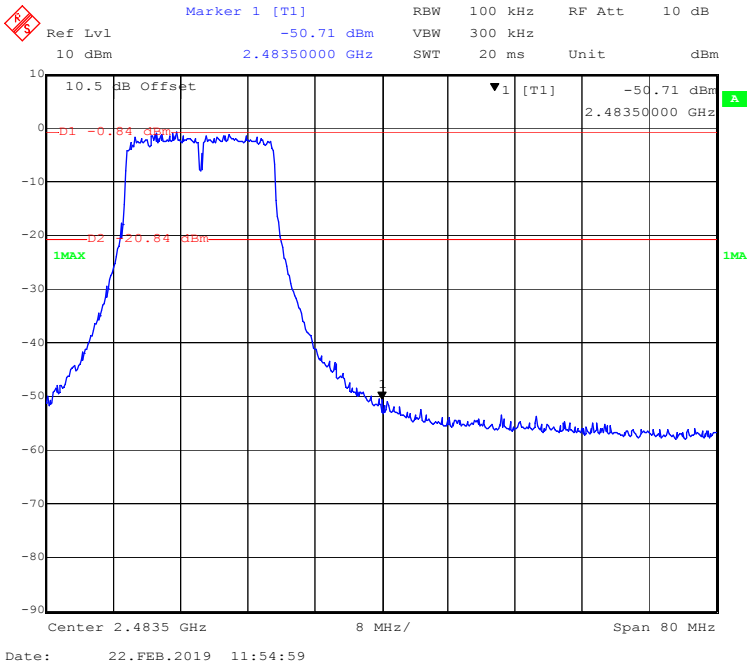
802.11g Mode Right Side



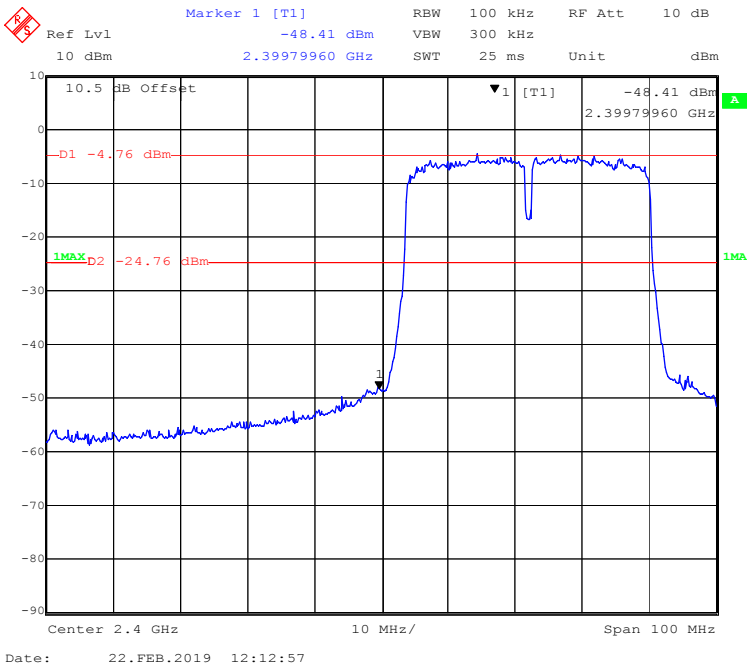
802.11n-HT20 Mode Left Side



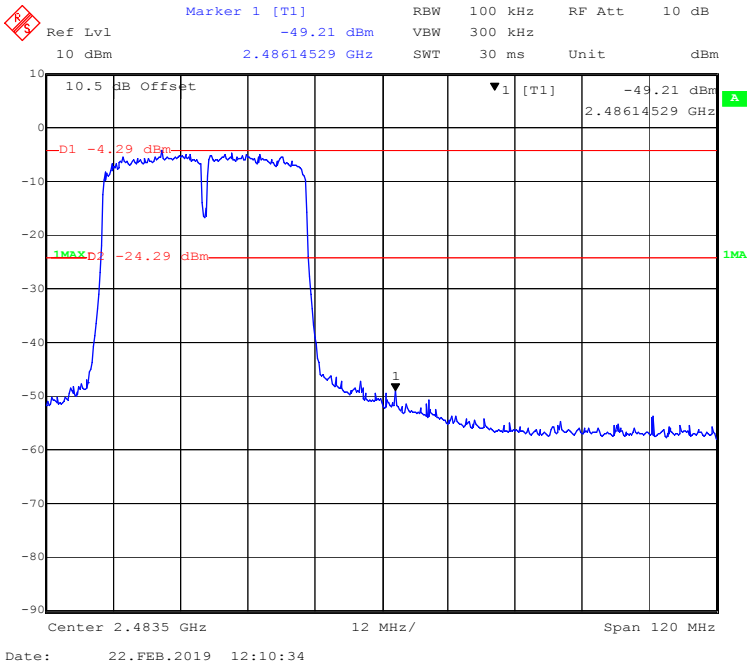
802.11n-HT20 Mode Right Side



802.11n-HT40 Mode Left Side



802.11n-HT40 Mode 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

According to ANSI C63.10-2013 sub-clause 11.10.2

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

1. Set the RBW to: 3kHz≤ RBW≤100 kHz.
2. Set the VBW ≥ 3xRBW.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.
9. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	50%
ATM Pressure:	101.3 kPa

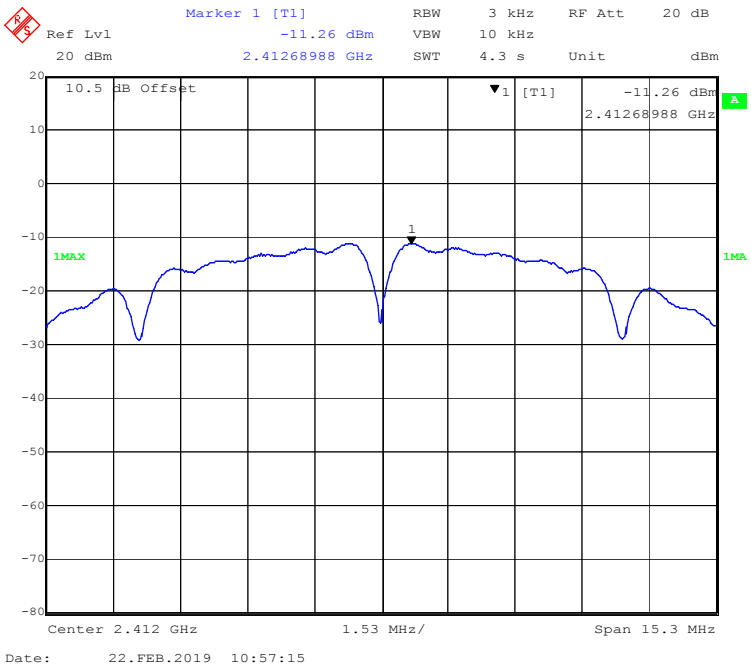
The testing was performed by Max Min on 2019-02-22.

EUT operation mode: Transmitting

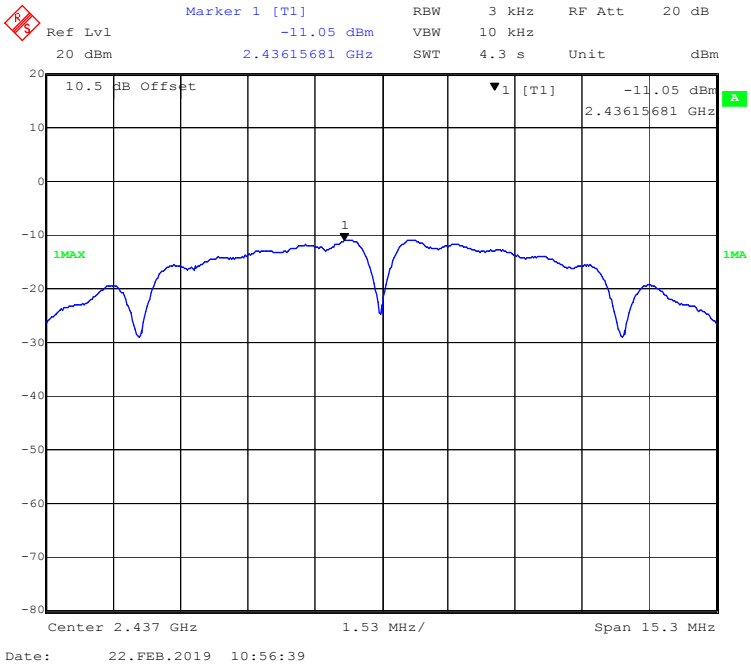
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b Mode			
Low	2412	-11.26	≤ 8
Middle	2437	-11.05	≤ 8
High	2462	-10.79	≤ 8
802.11g Mode			
Low	2412	-14.68	≤ 8
Middle	2437	-14.37	≤ 8
High	2462	-14.46	≤ 8
802.11n-HT20 mode			
Low	2412	-16.08	≤ 8
Middle	2437	-15.69	≤ 8
High	2462	-15.56	≤ 8
802.11n-HT40 Mode			
Low	2422	-15.93	≤ 8
Middle	2437	-15.91	≤ 8
High	2452	-15.45	≤ 8

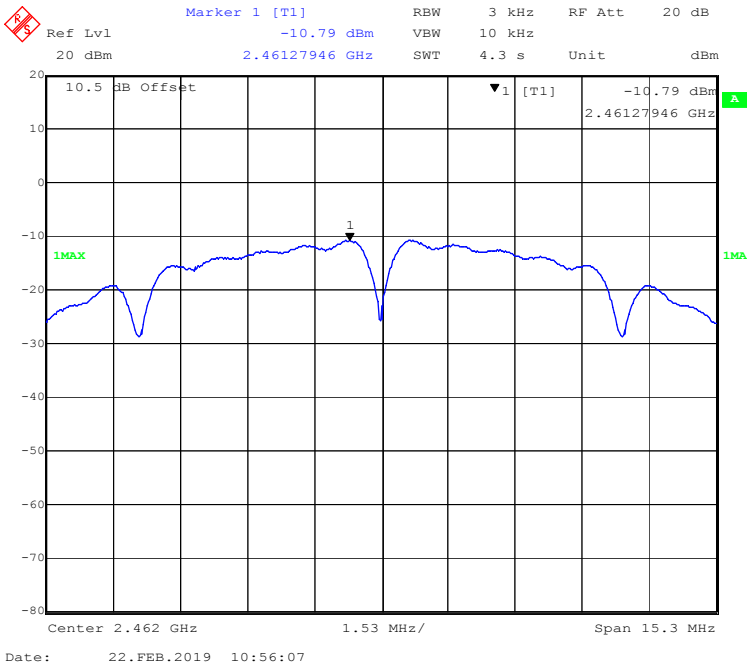
802.11b Mode Low Channel



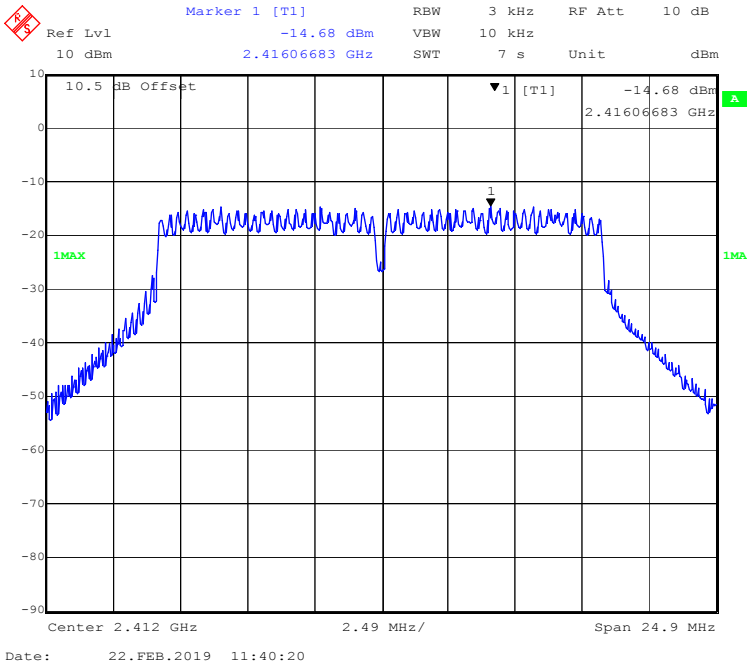
802.11b Mode Middle Channel



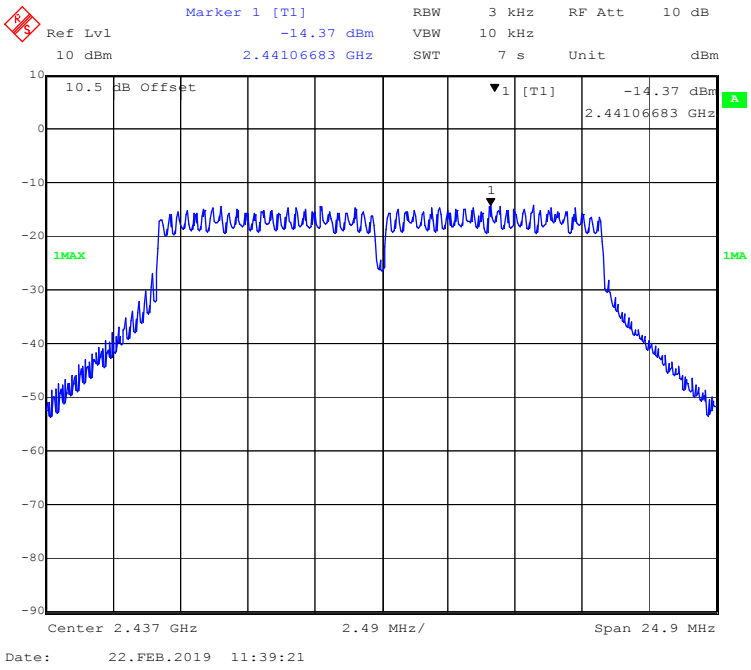
802.11b Mode High Channel



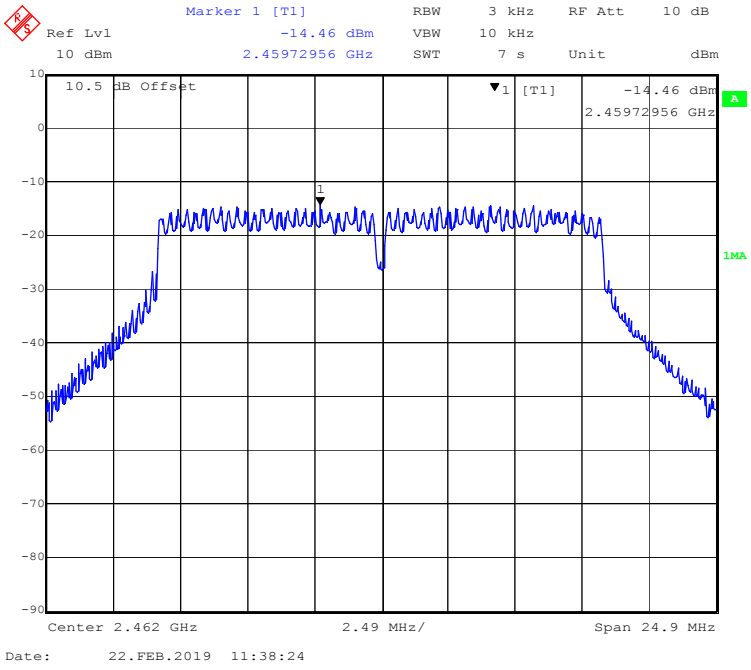
802.11g Mode Low Channel



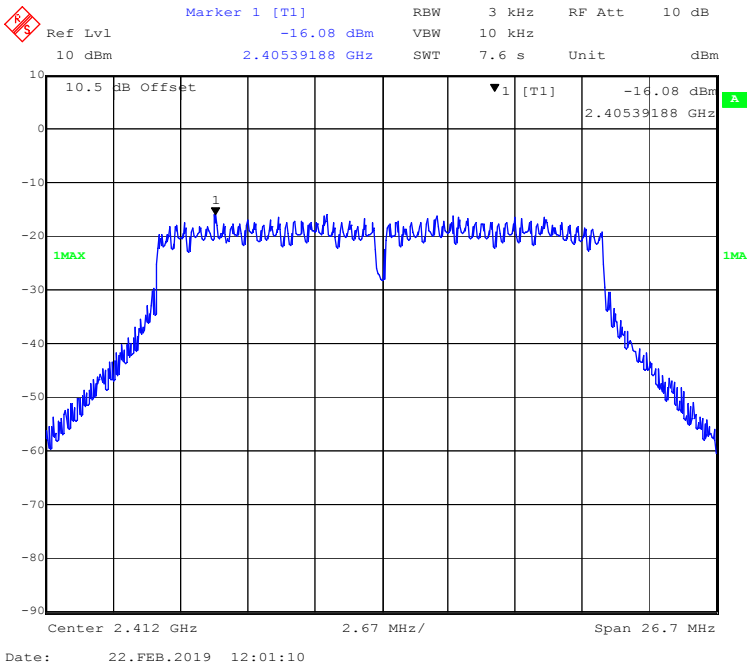
802.11g Mode Middle Channel



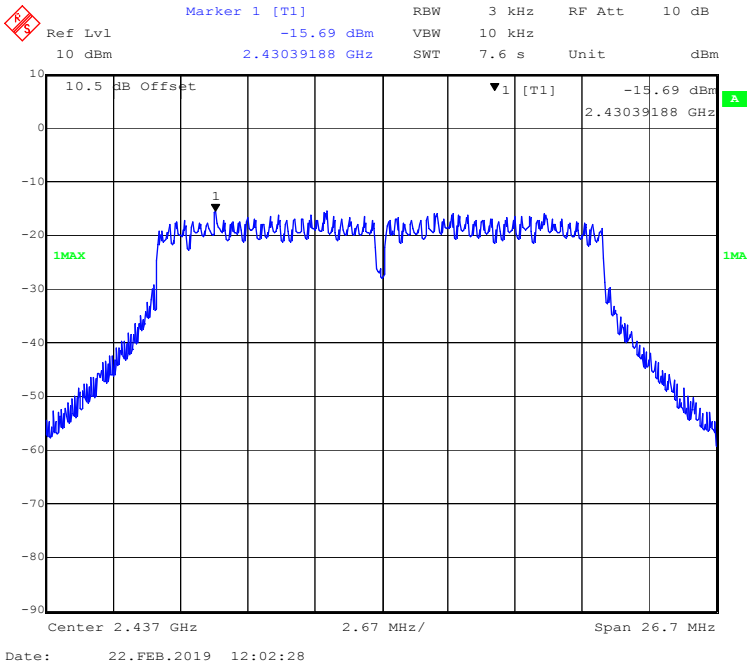
802.11g Mode High Channel



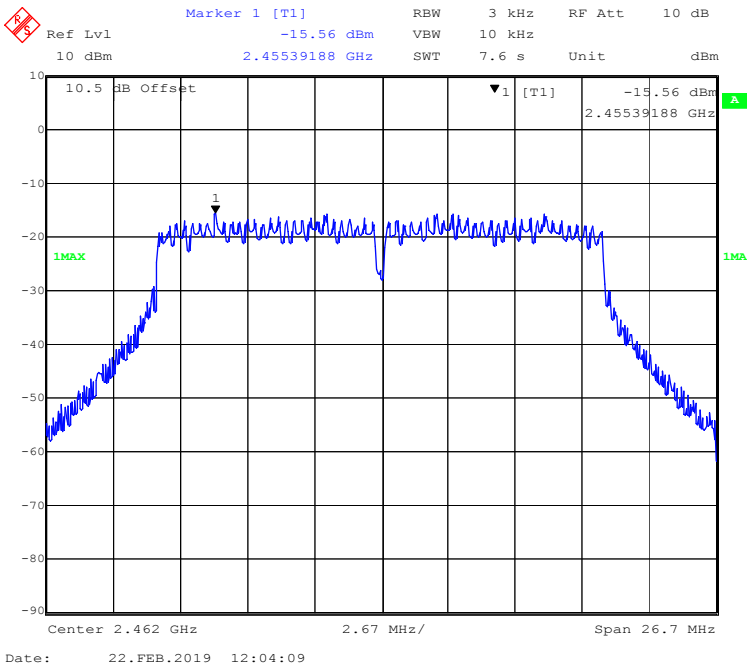
802.11n-HT20 Mode Low Channel



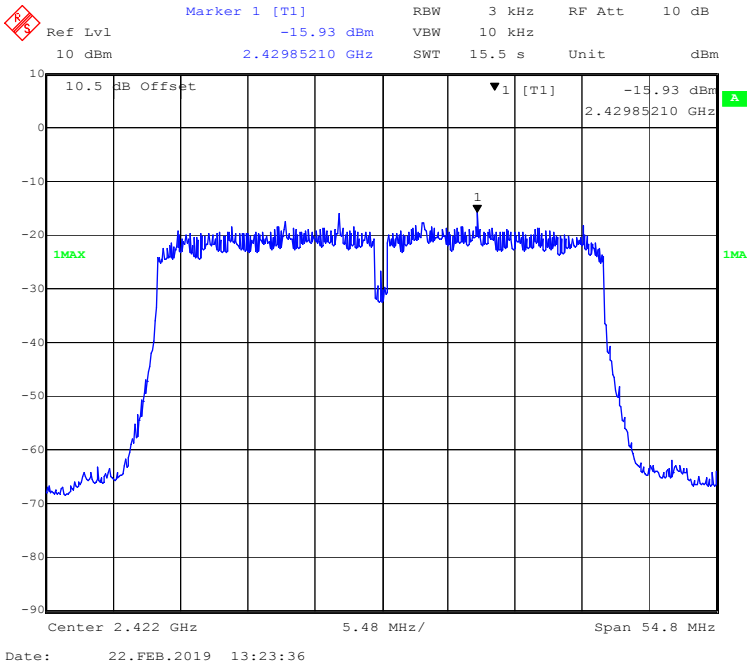
802.11n-HT20 Mode Middle Channel



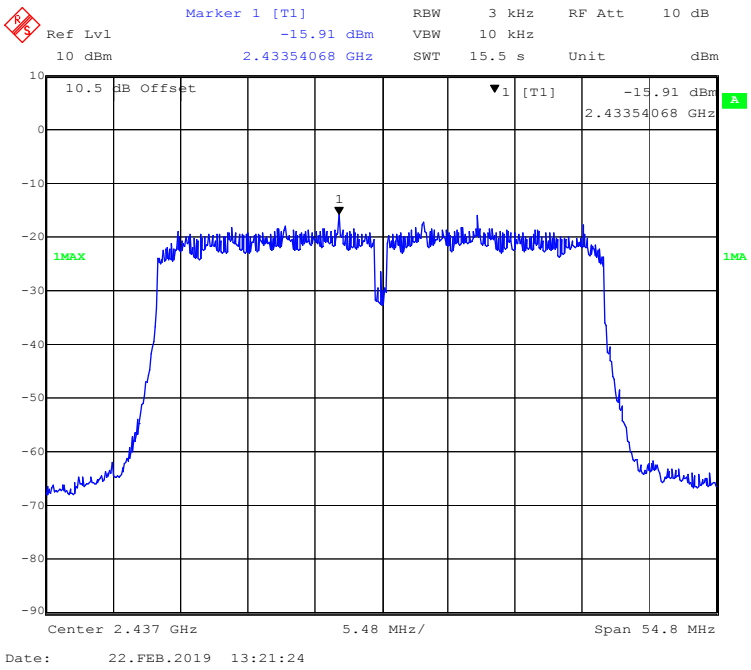
802.11n-HT20 Mode High Channel



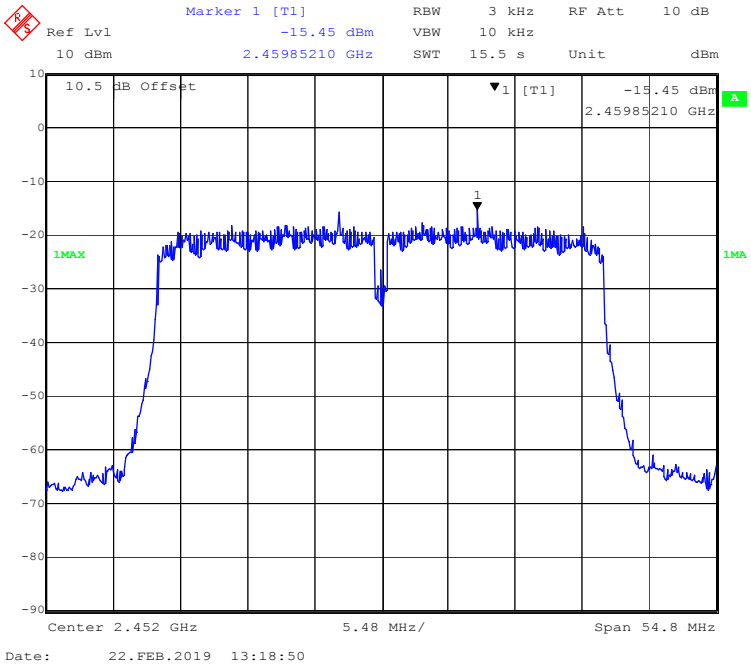
802.11n-HT40 Mode Low Channel



802.11n-HT40 Mode Middle Channel



802.11n-HT40 Mode High Channel



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