FCC PART 15.247

TEST REPORT

For

Beijing April Brother Technology Co.Ltd.

52 SOUTH STREET OF ZHONG GUAN CUN BEIJING CHINA

FCC ID: 2ACAL-WBGT01

Report Type:	**Product Name:**
Original Report	Wireless iBeacon Receiver

Test Engineer:	*Tom Tang*
Report Number:	RBJ170227050
Report Date:	2017-04-07
Reviewed By:	Henry Ding EMC Leader
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: 028-65523123, Fax: 028-65525125 www.baclcorp.com

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ***Beijing April Brother Technology Co.Ltd.*** 's product, model number: ***WB Gateway (FCC ID: 2ACAL-WBGT01)*** (the "EUT") in this report was a ***Wireless iBeacon Receiver,*** which was measured approximately: 5.4 cm (L) × 4.1 cm (W) × 1.05 cm (H), rated input voltage: DC5V from USB Port. The device built in two certified RF module, both module have increased the RF output power by software, the module information as below:

Wifi module:
Model: TA3200R1D-SA
FCC ID: VVJ-TA3200R1D-SA

BLE module:
Model: ILT254S
FCC ID: 2AAXH-ILT254

Note: The series product, model WB Gateway, T01 are electrically identical, the difference them is the color, weight and model name, we selected WB Gateway for fully testing, the details was explained in the attached declaration letter.

**All measurement and test data in this report was gathered from final production sample, serial number: 170227050 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-03-01, and EUT conformed to test requirement.*

Objective

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

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

Related Submittal(s)/Grant(s)

No related submittal(s)/grant(s).

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.

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

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.62dB
Unwanted Emissions, radiated	30M~200MHz: 4.7 dB for Horizontal, 4.7 dB for Vertical 200M~1GHz:6.0 dB for Horizontal, 6.0 for Vertical 1G~6GHz: 5.13 dB, 6G~18GHz: 5.47 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.17 dB (150 kHz to 30 MHz)

Test Facility

The test site used by BACL to collect test data is located in the No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer.
For 2.4GHz band, 11 channels are provided to testing:

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

For 802.11b, 802.11g, and 802.11n ht20 modes were tested with channel 1, 6 and 11.

The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations.

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

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

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

The worst condition (maximum power) was setting by the Engineer Mode as following table:

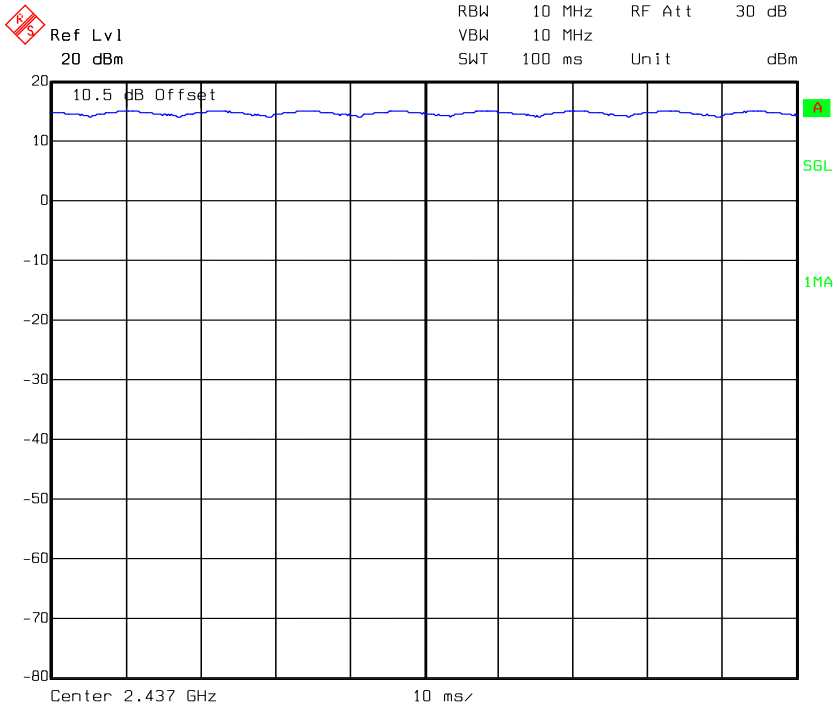
Test Mode	Test Software Version	Engineer Mode		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting	0	0	0
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level Setting	0	0	0
802.11n ht20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting	0	0	0

Note: BLE mode configured as maximum power by the system default setting.

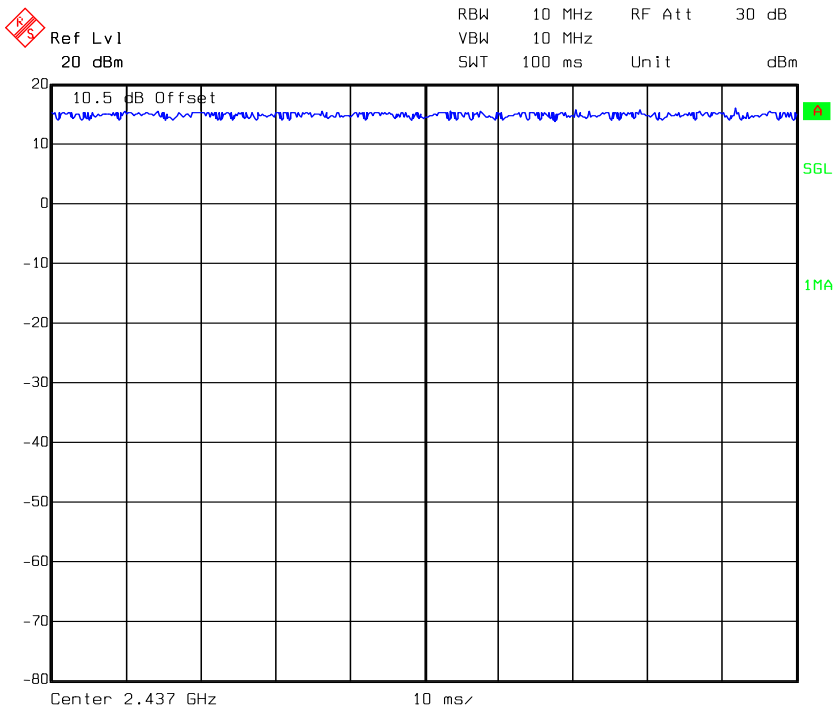
The maximum duty cycle as following table:

Test mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
802.11b	100	100	100%
802.11g	100	100	100%
802.11n ht20	100	100	100%
BLE	0.461	0.651	71%

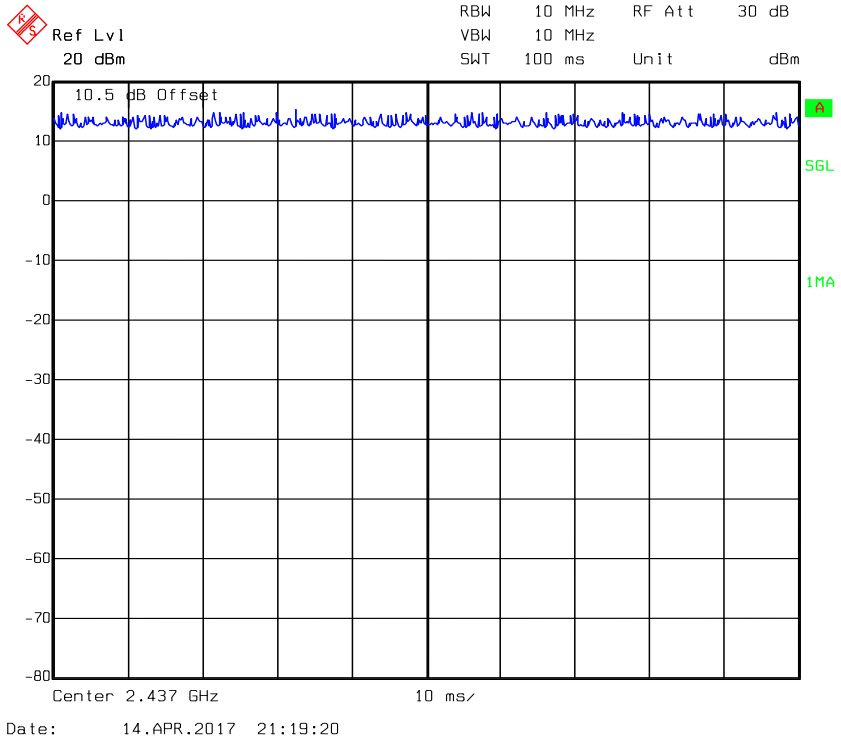
802.11b



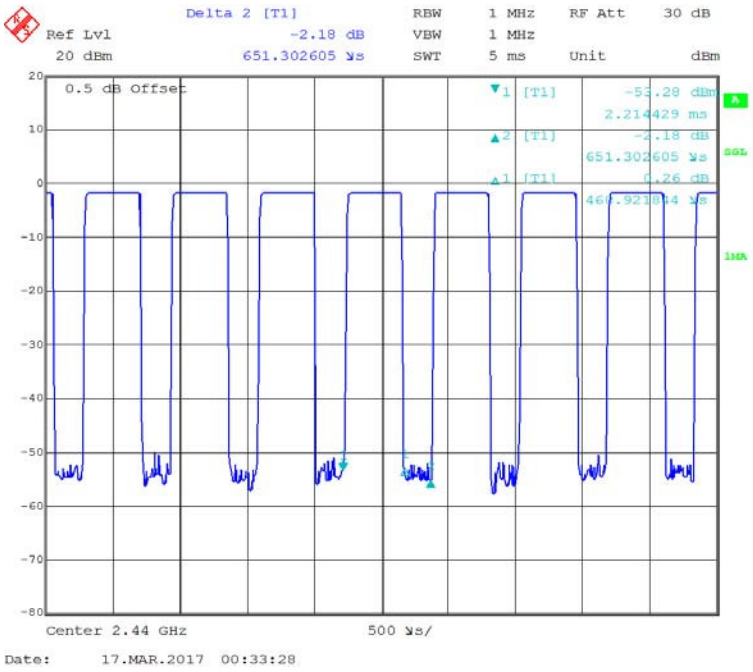
802.11g



802.11n ht20



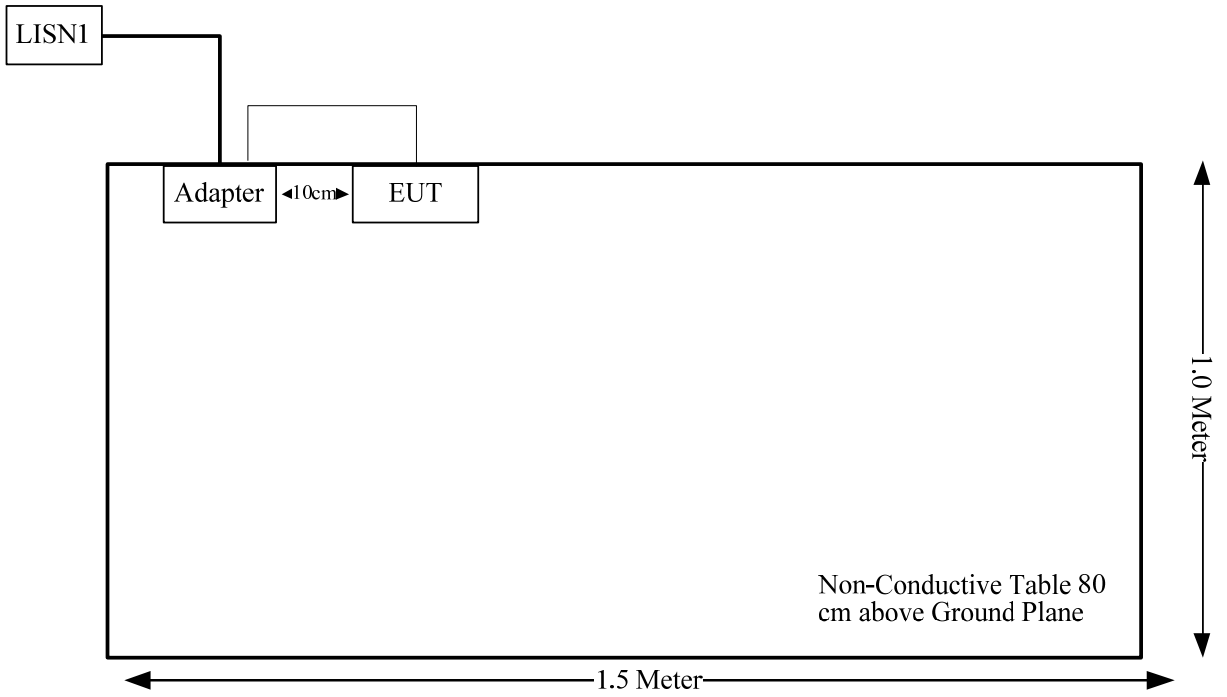
BLE



External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB Cable	No	No	1.0	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissable Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.247(d)	Spurious Emissions at Antenna Port	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

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

Applicable Standard

According to subpart 15.247(i)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);

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

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

Calculated Data:

Operation Mode	Frequency (MHz)	Antenna Gain		Tune-up Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi	2412-2462	0	1.00	21	125.89	20.00	0.0251	1.0
BLE	2402-2480	2	1.58	-2	0.63	20.00	0.0002	1.0

The Wi-Fi and BLE can transmit simultaneously:

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

$=S_{WI\text{-}FI}/S_{limit\text{-}WI\text{-}FI} + S_{BLE}/S_{limit\text{-}BLE}$

=0.0251/1+0.0002/1

=0.0253

< 1.0

Result: The device meet 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.

Antenna Connector Construction

The EUT has one internal antenna arrangement for Wifi, the antenna gain is 0 dBi, and one RP-SMA antenna for Bluetooth, the antenna gain is 2dBi, 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

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

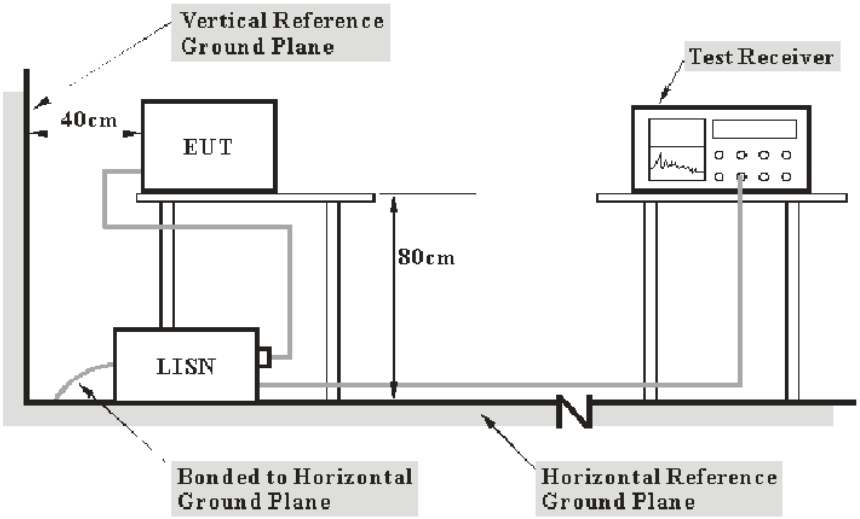
If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of Table 1, then:
–compliance is deemed to occur if no measured disturbance level, increased by (U_{lab} − U_{cispr}), exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} − U_{cispr}), exceeds the disturbance limit.

Based on CISPR 16-4-2:2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Chengdu) is ±3.17 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

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

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the first LISN.

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

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

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$
$C_f = A_C + VDF$

Herein,
V_C (cord. Reading): corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN
C_f: Correction Factor

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

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2016-12-02	2017-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	100018	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	DE14781	2016-10-31	2017-10-30
N/A	Conducted Cable	NO.5	N/A	2016-11-10	2017-11-09
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

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

Test Data

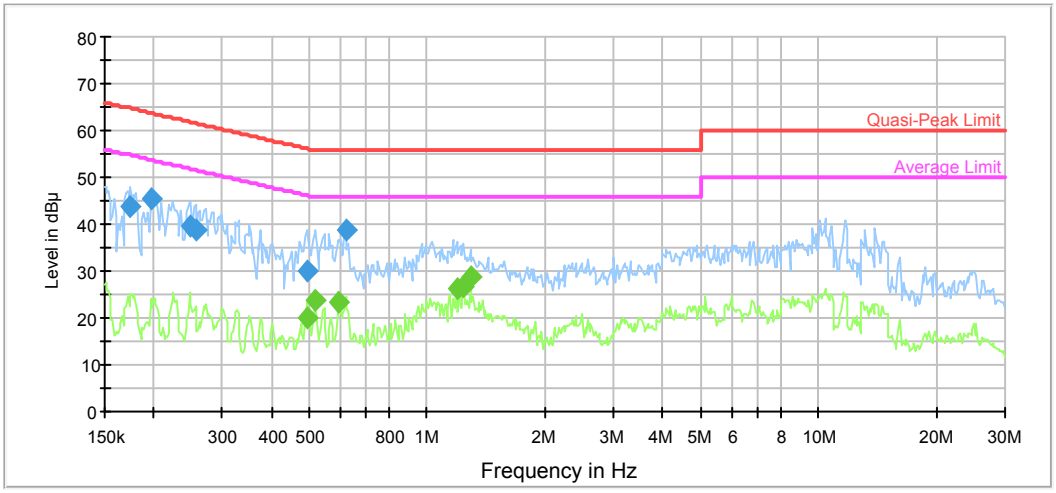
Environmental Conditions

Temperature:	18.0°C
Relative Humidity:	58.0 %
ATM Pressure:	96.0 kPa

The testing was performed by Tom Tang on 2017-03-14.

Test Mode: Transmitting (Wi-Fi+BLE)

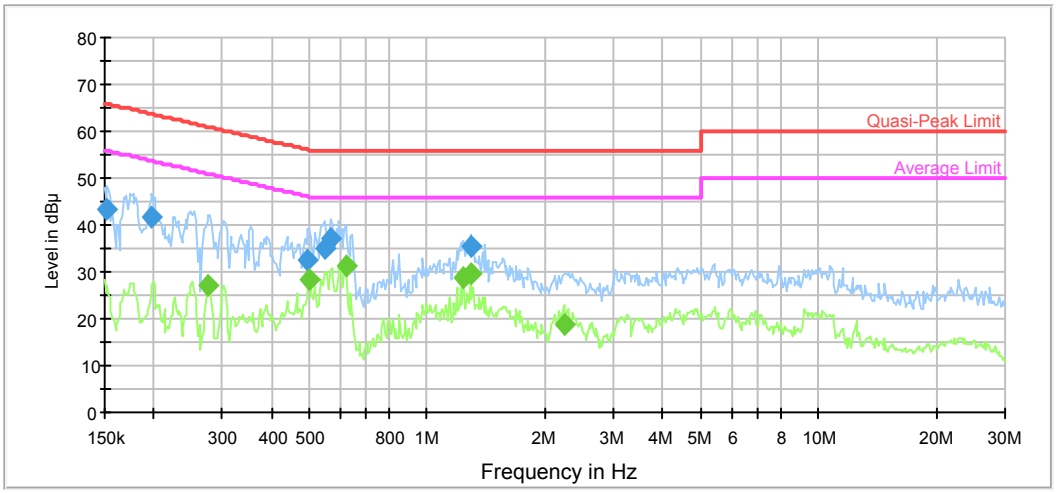
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.174519	43.6	9.000	L1	19.7	21.1	64.7	Compliance
0.196675	45.3	9.000	L1	19.7	18.4	63.7	Compliance
0.247802	39.8	9.000	L1	19.7	22.0	61.8	Compliance
0.255827	38.7	9.000	L1	19.7	22.9	61.6	Compliance
0.491712	29.9	9.000	L1	19.7	26.2	56.1	Compliance
0.619536	38.9	9.000	L1	19.7	17.1	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.491712	20.0	9.000	L1	19.7	26.1	46.1	Compliance
0.515791	23.6	9.000	L1	19.7	22.4	46.0	Compliance
0.595338	23.5	9.000	L1	19.8	22.5	46.0	Compliance
1.190776	26.2	9.000	L1	19.7	19.8	46.0	Compliance
1.239175	26.7	9.000	L1	19.7	19.3	46.0	Compliance
1.289541	28.9	9.000	L1	19.7	17.1	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.152410	43.5	9.000	N	19.7	22.4	65.9	Compliance
0.198249	41.9	9.000	N	19.6	21.8	63.7	Compliance
0.495646	32.3	9.000	N	19.6	23.8	56.1	Compliance
0.545378	35.1	9.000	N	19.6	20.9	56.0	Compliance
0.567545	37.2	9.000	N	19.6	18.8	56.0	Compliance
1.289541	35.4	9.000	N	19.6	20.6	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.277046	26.9	9.000	N	19.6	24.0	50.9	Compliance
0.499611	28.1	9.000	N	19.6	17.9	46.0	Compliance
0.619536	31.3	9.000	N	19.6	14.7	46.0	Compliance
1.239175	28.6	9.000	N	19.6	17.4	46.0	Compliance
1.289541	29.4	9.000	N	19.6	16.6	46.0	Compliance
2.234662	18.6	9.000	N	19.7	27.4	46.0	Compliance

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 2, then:
–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of Table 2, then:
–compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

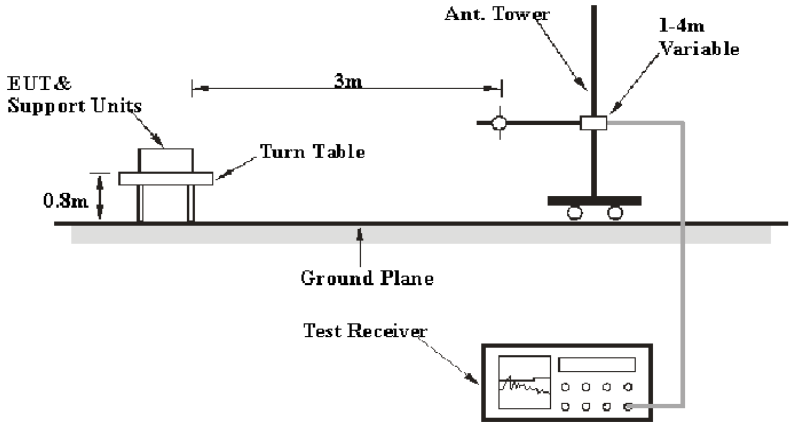
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:
30M~200MHz: ±4.7 dB ;
200M~1GHz: ±6.0 dB ;
1G~6GHz: ±5.13dB;
6G~25GHz: ±5.47 dB;

Table 2 – Values of U_{cispr}

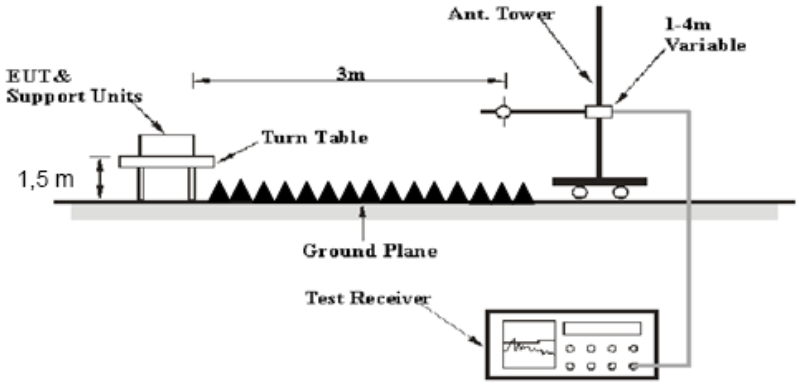
Measurement		U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC)	(30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR)	(1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR)	(6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

Detector	RBW	Video B/W	IF B/W
QP	120 kHz	300 kHz	120kHz

1GHz- 25GHz:

Detector	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
Ave.	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

Test Procedure

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

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

Corrected Amplitude & Margin Calculation

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

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

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

Margin = Limit –Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A121808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
EMCT	Semi-Anechoic Chamber	966	966-1	2015-04-24	2018-04-23
Unknown	RF Cable (below 1GHz)	Unknown	NO.1	2016-11-10	2017-11-09
Unknown	RF Cable (below 1GHz)	Unknown	NO.4	2016-11-10	2017-11-09
Unknown	RF Cable (above 1GHz)	Unknown	NO.2	2016-11-10	2017-11-09
Ducommun Technolagies	Horn Antenna	ARH-2823-02	1007726-01 1312	2016-08-18	2017-08-18
Quinstar	Amplifier	QLW-18405536-JO	15964001032	2016-08-18	2017-08-18
Agilent	Spectrum Analyzer	8564E	5943A01752	2016-08-18	2017-08-18

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

Test Data

Environmental Conditions

Temperature:	20.0 °C
Relative Humidity:	56 %
ATM Pressure:	96.1 kPa

** The testing was performed by Tom Tang on 2017-03-27.*

Test Mode: Transmitting

1) 30MHz-25GHz:

802.11b Mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	73.96	PK	H	23.50	3.00	0.00	100.46	N/A	N/A
2412	69.71	AV	H	23.50	3.00	0.00	96.21	N/A	N/A
2412	64.93	PK	V	23.50	3.00	0.00	91.43	N/A	N/A
2412	60.25	AV	V	23.50	3.00	0.00	86.75	N/A	N/A
2390	30.79	PK	H	23.57	3.00	0.00	57.36	74	16.64
2390	17.56	AV	H	23.57	3.00	0.00	44.13	54	9.87
4824	37.74	PK	H	30.84	5.11	26.87	46.82	74	27.18
4824	26.42	AV	H	30.84	5.11	26.87	35.5	54	18.5
7236	34.83	PK	H	34.77	6.18	26.36	49.42	74	24.58
7236	23.96	AV	H	34.77	6.18	26.36	38.55	54	15.45
4060	50.70	PK	H	29.10	4.96	26.59	58.17	74	15.83
4060	39.47	AV	H	29.10	4.96	26.59	46.94	54	7.06
184.3	43.26	QP	V	11.50	0.90	27.87	27.79	43.5	15.71
Middle Channel: 2437 MHz									
2437	73.68	PK	H	23.41	3.00	0.00	100.09	N/A	N/A
2437	69.29	AV	H	23.41	3.00	0.00	95.7	N/A	N/A
2437	65.51	PK	V	23.41	3.00	0.00	91.92	N/A	N/A
2437	61.12	AV	V	23.41	3.00	0.00	87.53	N/A	N/A
4874	37.66	PK	H	31.00	5.09	26.87	46.88	74	27.12
4874	26.24	AV	H	31.00	5.09	26.87	35.46	54	18.54
7311	34.52	PK	H	34.92	6.21	26.40	49.25	74	24.75
7311	23.71	AV	H	34.92	6.21	26.40	38.44	54	15.56
2263	49.38	PK	H	24.01	3.02	26.86	49.55	74	24.45
2263	38.20	AV	H	24.01	3.02	26.86	38.37	54	15.63
4095	37.49	PK	H	29.15	4.99	26.61	45.02	74	28.98
4095	26.43	AV	H	29.15	4.99	26.61	33.96	54	20.04
184.3	42.98	QP	V	11.50	0.90	27.87	27.51	43.5	15.99
High Channel: 2462 MHz									
2462	73.91	PK	H	23.33	2.99	0.00	100.23	N/A	N/A
2462	69.84	AV	H	23.33	2.99	0.00	96.16	N/A	N/A
2462	64.97	PK	V	23.33	2.99	0.00	91.29	N/A	N/A
2462	60.83	AV	V	23.33	2.99	0.00	87.15	N/A	N/A
2483.5	32.19	PK	H	23.26	2.99	0.00	58.44	74	15.56
2483.5	18.73	AV	H	23.26	2.99	0.00	44.98	54	9.02
4924	38.11	PK	H	31.16	5.07	26.88	47.46	74	26.54
4924	26.49	AV	H	31.16	5.07	26.88	35.84	54	18.16
7386	35.56	PK	H	35.07	6.25	26.43	50.45	74	23.55
7386	24.35	AV	H	35.07	6.25	26.43	39.24	54	14.76
4126	49.07	PK	H	29.20	5.01	26.63	56.65	74	17.35
4126	38.46	AV	H	29.20	5.01	26.63	46.04	54	7.96
184.3	43.46	QP	V	11.50	0.90	27.87	27.99	43.5	15.51

802.11g Mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	74.23	PK	H	23.50	3.00	0.00	100.73	N/A	N/A
2412	62.52	AV	H	23.50	3.00	0.00	89.02	N/A	N/A
2412	66.25	PK	V	23.50	3.00	0.00	92.75	N/A	N/A
2412	54.63	AV	V	23.50	3.00	0.00	81.13	N/A	N/A
2390	35.05	PK	H	23.57	3.00	0.00	61.62	74	12.38
2390	19.82	AV	H	23.57	3.00	0.00	46.39	54	7.61
4824	38.32	PK	H	30.84	5.11	26.87	47.4	74	26.6
4824	26.41	AV	H	30.84	5.11	26.87	35.49	54	18.51
7236	35.17	PK	H	34.77	6.18	26.36	49.76	74	24.24
7236	24.26	AV	H	34.77	6.18	26.36	38.85	54	15.15
4060	50.80	PK	H	29.10	4.96	26.59	58.27	74	15.73
4060	39.65	AV	H	29.10	4.96	26.59	47.12	54	6.88
184.4	43.25	QP	V	11.51	0.90	27.87	27.79	43.50	15.71
Middle Channel: 2437 MHz									
2437	74.22	PK	H	23.41	3.00	0.00	100.63	N/A	N/A
2437	62.59	AV	H	23.41	3.00	0.00	89	N/A	N/A
2437	65.46	PK	V	23.41	3.00	0.00	91.87	N/A	N/A
2437	54.87	AV	V	23.41	3.00	0.00	81.28	N/A	N/A
4874	38.23	PK	H	31.00	5.09	26.87	47.45	74	26.55
4874	27.31	AV	H	31.00	5.09	26.87	36.53	54	17.47
7311	34.99	PK	H	34.92	6.21	26.40	49.72	74	24.28
7311	23.83	AV	H	34.92	6.21	26.40	38.56	54	15.44
2263	49.74	PK	H	24.01	3.02	26.86	49.91	74	24.09
2263	38.33	AV	H	24.01	3.02	26.86	38.5	54	15.5
4095	36.73	PK	H	29.15	4.99	26.61	44.26	74	29.74
4095	25.47	AV	H	29.15	4.99	26.61	33	54	21
184.4	43.52	QP	V	11.51	0.90	27.87	28.06	43.50	15.44
High Channel: 2462 MHz									
2462	73.84	PK	H	23.33	2.99	0.00	100.16	N/A	N/A
2462	62.31	AV	H	23.33	2.99	0.00	88.63	N/A	N/A
2462	65.22	PK	V	23.33	2.99	0.00	91.54	N/A	N/A
2462	53.96	AV	V	23.33	2.99	0.00	80.28	N/A	N/A
2483.5	37.66	PK	H	23.26	2.99	0.00	63.91	74	10.09
2483.5	20.24	AV	H	23.26	2.99	0.00	46.49	54	7.51
4924	39.29	PK	H	31.16	5.07	26.88	48.64	74	25.36
4924	28.07	AV	H	31.16	5.07	26.88	37.42	54	16.58
7386	35.89	PK	H	35.07	6.25	26.43	50.78	74	23.22
7386	24.43	AV	H	35.07	6.25	26.43	39.32	54	14.68
4126	50.36	PK	H	29.20	5.01	26.63	57.94	74	16.06
4126	38.98	AV	H	29.20	5.01	26.63	46.56	54	7.44
184.4	44.36	QP	V	11.51	0.90	27.87	28.90	43.50	14.60

802.11 n ht20 Mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	71.85	PK	H	23.50	3.00	0.00	98.35	N/A	N/A
2412	59.70	AV	H	23.50	3.00	0.00	86.2	N/A	N/A
2412	61.63	PK	V	23.50	3.00	0.00	88.13	N/A	N/A
2412	49.97	AV	V	23.50	3.00	0.00	76.47	N/A	N/A
2390	36.01	PK	H	23.57	3.00	0.00	62.58	74	11.42
2390	19.37	AV	H	23.57	3.00	0.00	45.94	54	8.06
4824	38.51	PK	H	30.84	5.11	26.87	47.59	74	26.41
4824	26.15	AV	H	30.84	5.11	26.87	35.23	54	18.77
7236	34.66	PK	H	34.77	6.18	26.36	49.25	74	24.75
7236	23.54	AV	H	34.77	6.18	26.36	38.13	54	15.87
2950	52.99	PK	H	24.10	3.39	26.46	54.02	74	19.98
2950	41.44	AV	H	24.10	3.39	26.46	42.47	54	11.53
184.4	43.89	QP	V	11.51	0.90	27.87	28.43	43.50	15.07
Middle Channel: 2437 MHz									
2437	72.17	PK	H	23.41	3.00	0.00	98.58	N/A	N/A
2437	60.26	AV	H	23.41	3.00	0.00	86.67	N/A	N/A
2437	62.11	PK	V	23.41	3.00	0.00	88.52	N/A	N/A
2437	50.39	AV	V	23.41	3.00	0.00	76.8	N/A	N/A
4874	37.55	PK	H	31.00	5.09	26.87	46.77	74	27.23
4874	25.63	AV	H	31.00	5.09	26.87	34.85	54	19.15
7311	34.43	PK	H	34.92	6.21	26.40	49.16	74	24.84
7311	24.00	AV	H	34.92	6.21	26.40	38.73	54	15.27
2263	49.52	PK	H	24.01	3.02	26.86	49.69	74	24.31
2263	37.97	AV	H	24.01	3.02	26.86	38.14	54	15.86
4095	37.54	PK	H	29.15	4.99	26.61	45.07	74	28.93
4095	26.69	AV	H	29.15	4.99	26.61	34.22	54	19.78
184.4	43.42	QP	V	11.51	0.90	27.87	27.96	43.50	15.54
High Channel: 2462 MHz									
2462	72.03	PK	H	23.33	2.99	0.00	98.35	N/A	N/A
2462	60.19	AV	H	23.33	2.99	0.00	86.51	N/A	N/A
2462	61.96	PK	V	23.33	2.99	0.00	88.28	N/A	N/A
2462	50.12	AV	V	23.33	2.99	0.00	76.44	N/A	N/A
2483.5	37.12	PK	H	23.26	2.99	0.00	63.37	74	10.63
2483.5	20.97	AV	H	23.26	2.99	0.00	47.22	54	6.78
4924	39.16	PK	H	31.16	5.07	26.88	48.51	74	25.49
4924	27.09	AV	H	31.16	5.07	26.88	36.44	54	17.56
7386	35.70	PK	H	35.07	6.25	26.43	50.59	74	23.41
7386	24.02	AV	H	35.07	6.25	26.43	38.91	54	15.09
4126	50.13	PK	H	29.20	5.01	26.63	57.71	74	16.29
4126	38.66	AV	H	29.20	5.01	26.63	46.24	54	7.76
184.4	43.52	QP	V	11.51	0.90	27.87	28.06	43.50	15.44

BLE Mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)					
Low Channel: 2402 MHz									
2402	69.48	PK	H	23.53	3.00	0.00	96.01	N/A	N/A
2402	67.10	AV	H	23.53	3.00	0.00	93.63	N/A	N/A
2402	60.87	PK	V	23.53	3.00	0.00	87.4	N/A	N/A
2402	57.51	AV	V	23.53	3.00	0.00	84.04	N/A	N/A
2390	27.82	PK	H	23.57	3.00	0.00	54.39	74	19.61
2390	15.37	AV	H	23.57	3.00	0.00	41.94	54	12.06
4804	36.45	PK	H	30.77	5.12	26.87	45.47	74	28.53
4804	25.70	AV	H	30.77	5.12	26.87	34.72	54	19.28
7206	33.28	PK	H	34.71	6.16	26.35	47.8	74	26.2
7206	22.55	AV	H	34.71	6.16	26.35	37.07	54	16.93
1435	32.57	PK	H	23.93	2.58	26.39	32.69	74	41.31
1435	21.73	AV	H	23.93	2.58	26.39	21.85	54	32.15
184.4	42.52	QP	V	11.51	0.90	27.87	27.06	43.5	16.44
Middle Channel: 2440 MHz									
2440	69.99	PK	H	23.40	3.00	0.00	96.39	N/A	N/A
2440	67.03	AV	H	23.40	3.00	0.00	93.43	N/A	N/A
2440	60.84	PK	V	23.40	3.00	0.00	87.24	N/A	N/A
2440	58.19	AV	V	23.40	3.00	0.00	84.59	N/A	N/A
4880	36.61	PK	H	31.02	5.09	26.87	45.85	74	28.15
4880	25.70	AV	H	31.02	5.09	26.87	34.94	54	19.06
7320	33.73	PK	H	34.94	6.22	26.40	48.49	74	25.51
7320	23.18	AV	H	34.94	6.22	26.40	37.94	54	16.06
1468	32.85	PK	H	24.02	2.63	26.36	33.14	74	40.86
1468	22.11	AV	H	24.02	2.63	26.36	22.4	54	31.6
3065	39.62	PK	H	24.56	3.53	26.43	41.28	74	32.72
3065	29.07	AV	H	24.56	3.53	26.43	30.73	54	23.27
184.4	42.55	QP	V	11.51	0.90	27.87	27.09	43.5	16.41
High Channel: 2480 MHz									
2480	70.64	PK	H	23.27	2.99	0.00	96.9	N/A	N/A
2480	68.15	AV	H	23.27	2.99	0.00	94.41	N/A	N/A
2480	61.22	PK	V	23.27	2.99	0.00	87.48	N/A	N/A
2480	57.43	AV	V	23.27	2.99	0.00	83.69	N/A	N/A
2483.5	29.08	PK	H	23.26	2.99	0.00	55.33	74	18.67
2483.5	16.39	AV	H	23.26	2.99	0.00	42.64	54	11.36
4960	37.34	PK	H	31.27	5.05	26.88	46.78	74	27.22
4960	25.75	AV	H	31.27	5.05	26.88	35.19	54	18.81
7440	34.03	PK	H	35.18	6.27	26.45	49.03	74	24.97
7440	23.20	AV	H	35.18	6.27	26.45	38.2	54	15.8
1503	32.43	PK	H	24.10	2.67	26.33	32.87	74	41.13
1503	21.51	AV	H	24.10	2.67	26.33	21.95	54	32.05
184.4	42.44	QP	V	11.51	0.90	27.87	26.98	43.5	16.52

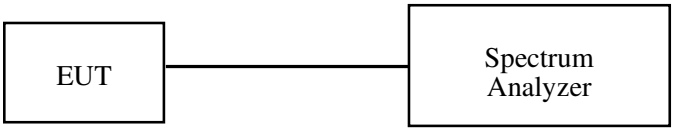
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

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

Test Procedure

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



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	18.0~20.0 °C
Relative Humidity:	54~60 %
ATM Pressure:	95.5~96.0 kPa

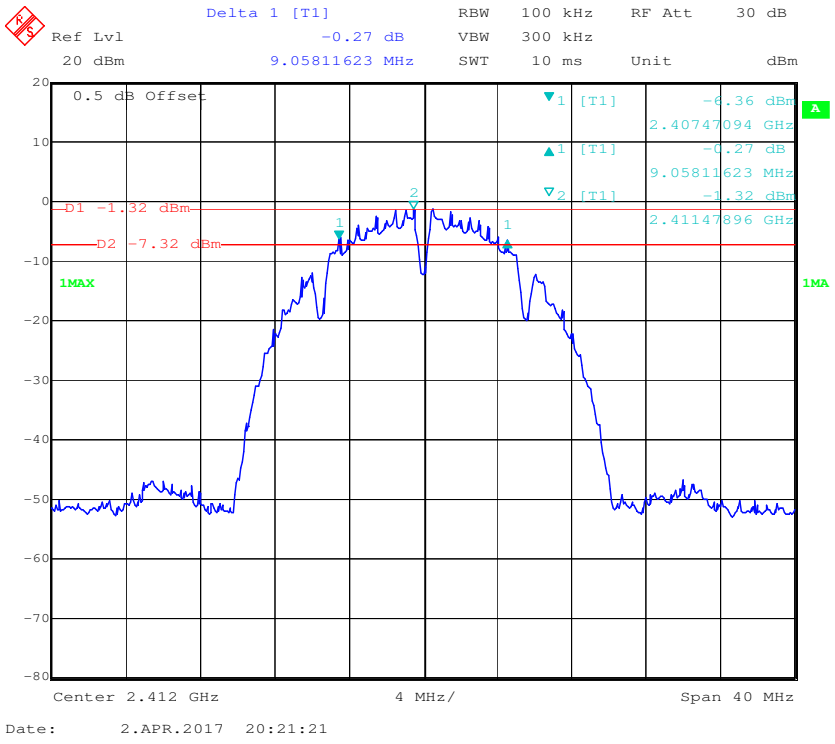
** The testing was performed by Tom Tang from 2017-03-17 to 2017-04-02.*

Test Mode: Transmitting

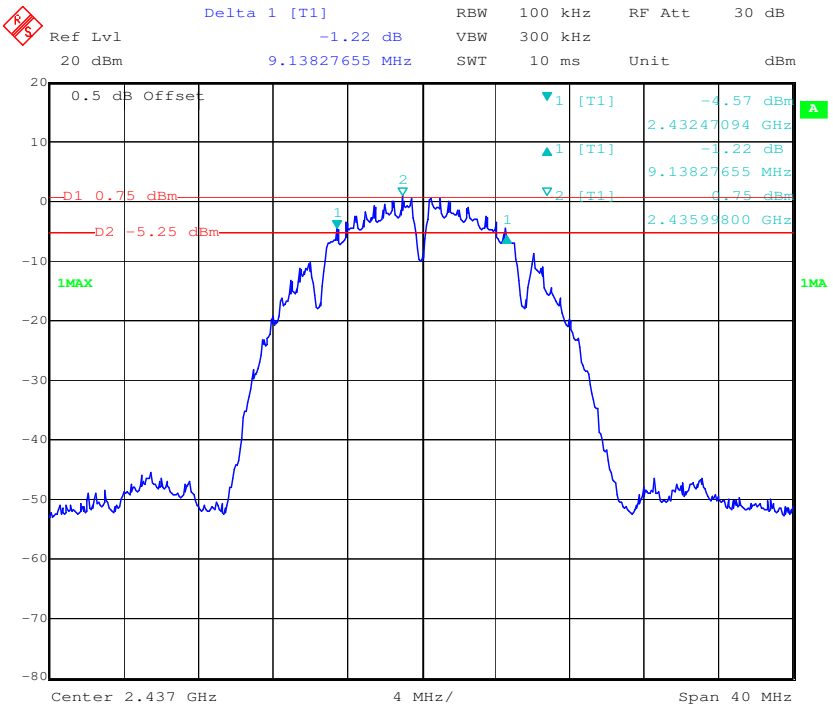
Test Result: Compliant. Please refer to the following table and plots.

Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	9.06	≥0.5
	Middle	2437	9.14	≥0.5
	High	2462	9.22	≥0.5
802.11g	Low	2412	15.15	≥0.5
	Middle	2437	15.15	≥0.5
	High	2462	15.15	≥0.5
802.11n20	Low	2412	15.15	≥0.5
	Middle	2437	15.15	≥0.5
	High	2462	15.15	≥0.5
BLE	Low	2402	0.68	≥0.5
	Middle	2440	0.73	≥0.5
	High	2480	0.72	≥0.5

802.11b Low Channel

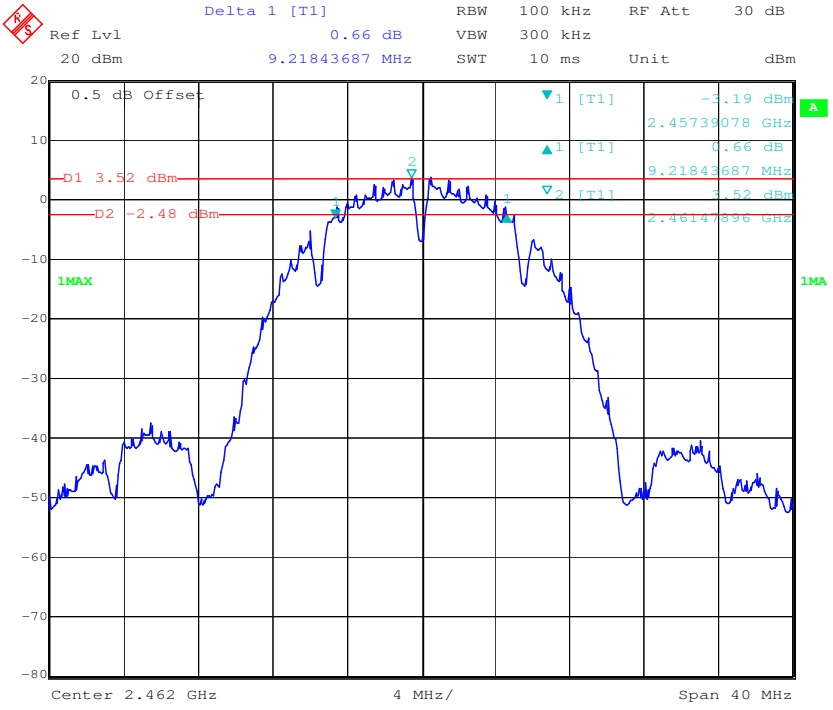


802.11b Middle Channel



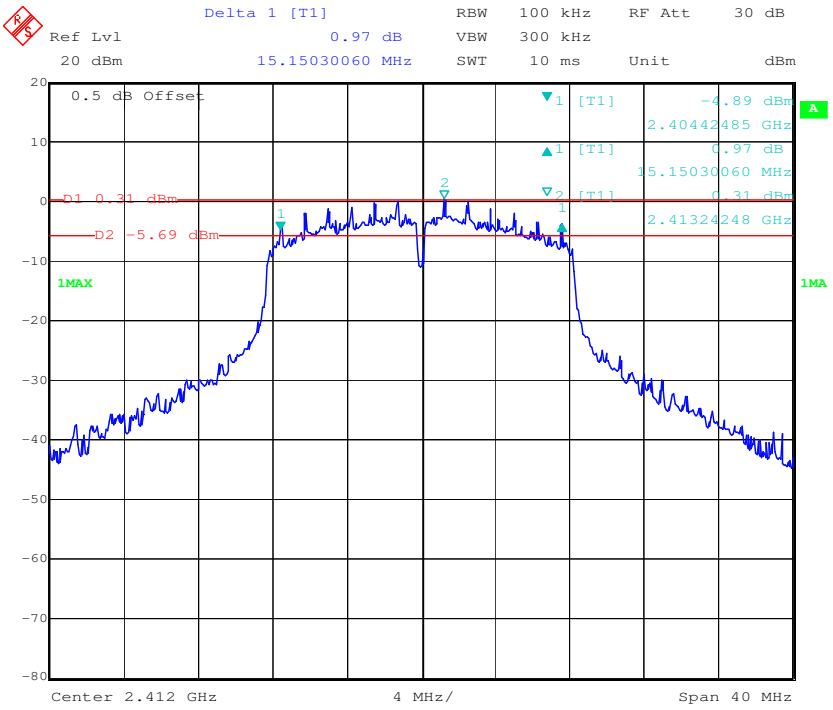
Date: 2.APR.2017 20:24:13

802.11b High Channel



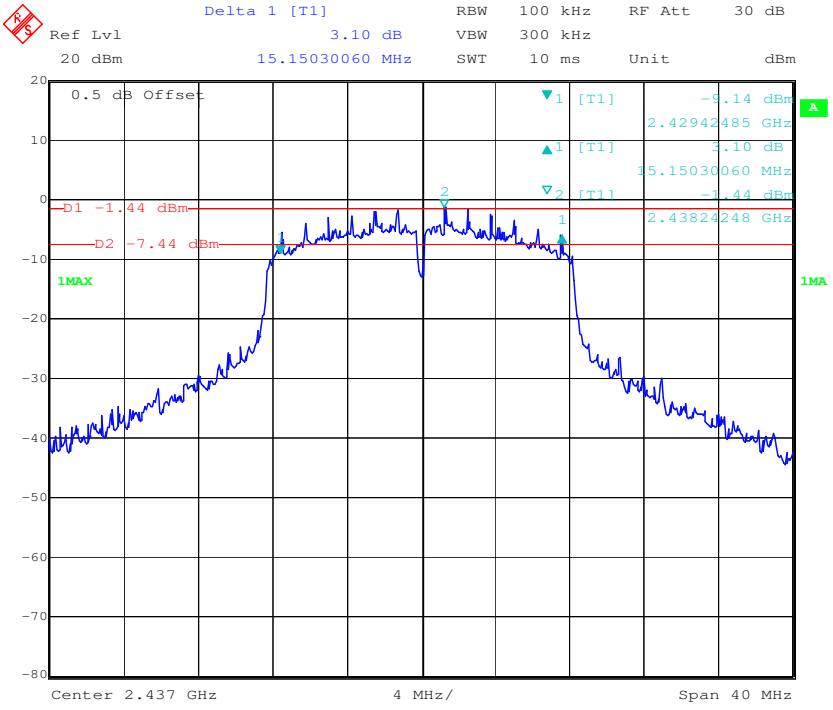
Date: 2.APR.2017 20:25:53

802.11g Low Channel



Date: 2.APR.2017 22:10:54

802.11g Middle Channel



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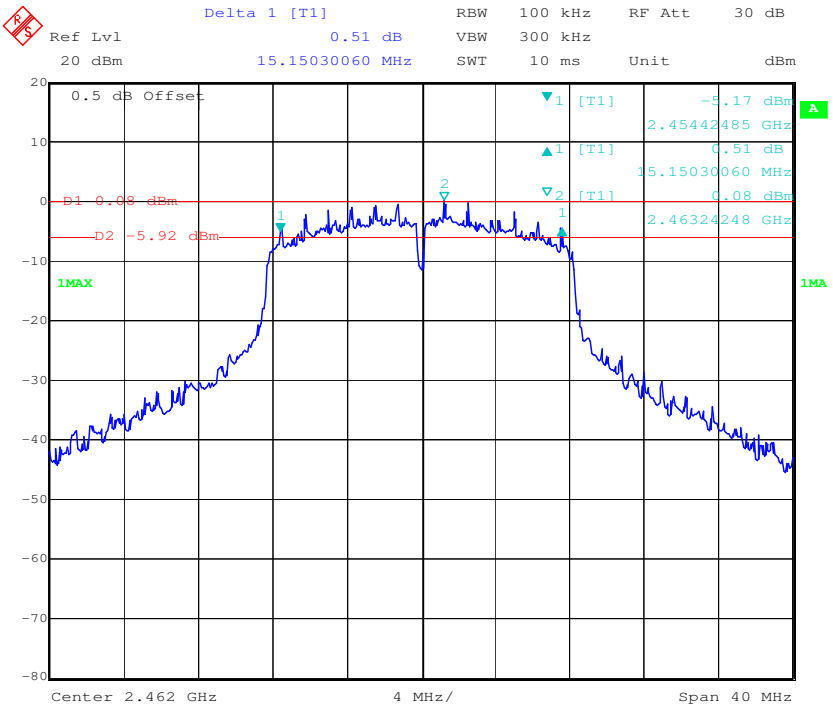
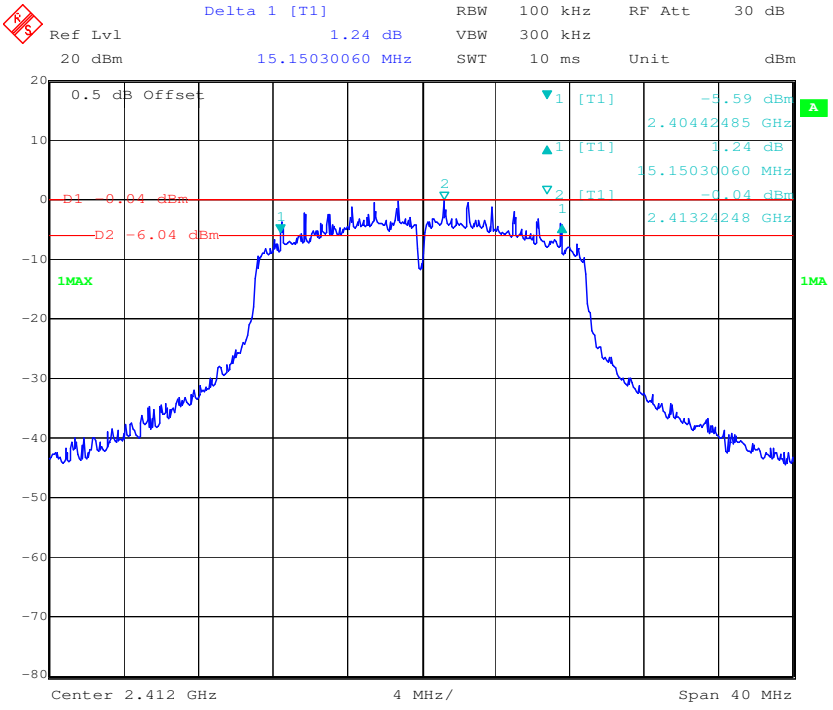
802.11g High Channel



Date: 2.APR.2017 22:14:07

802.11n ht20 Low Channel



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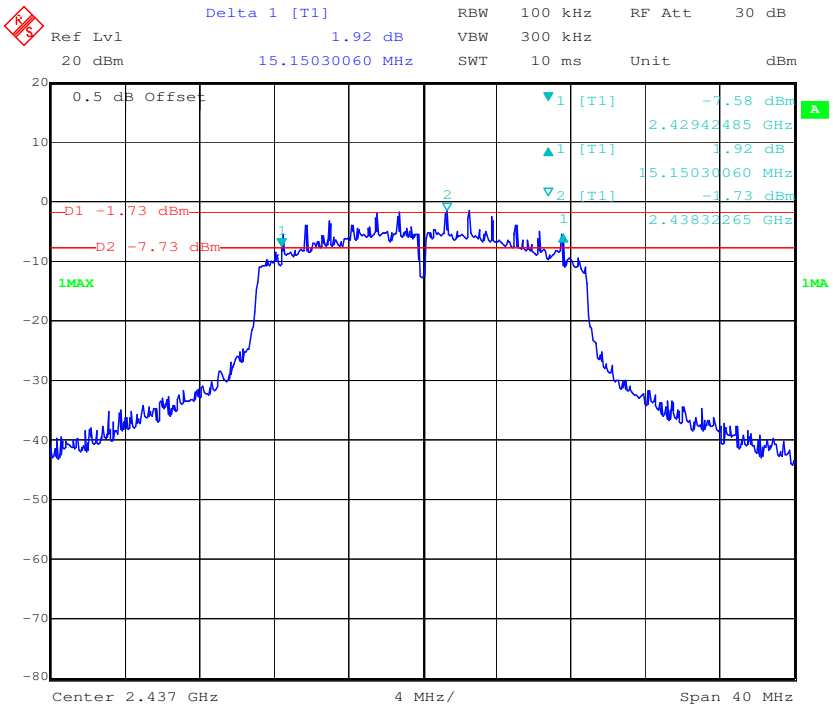
802.11n ht20 Middle Channel



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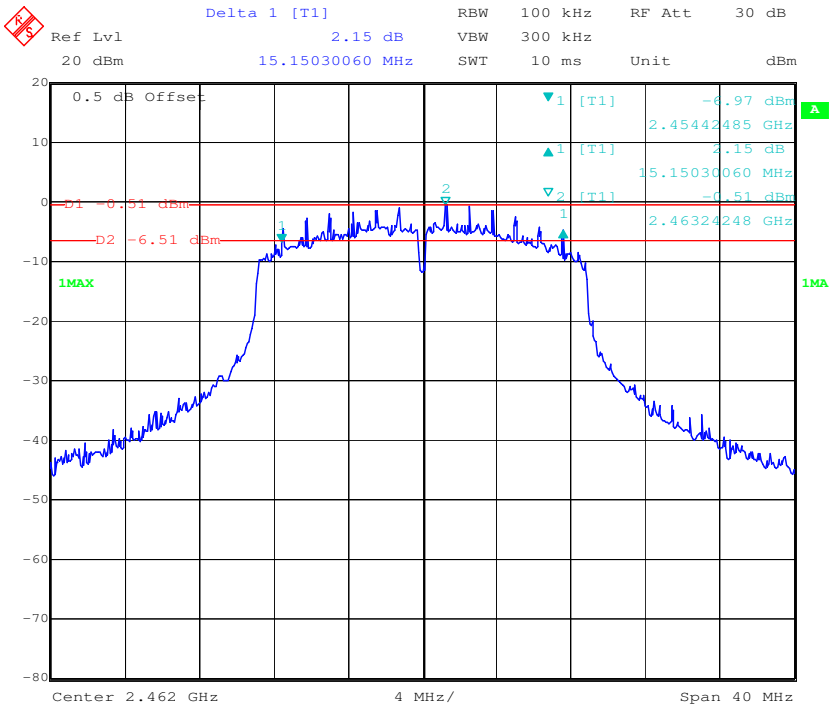
802.11n ht20 High Channel



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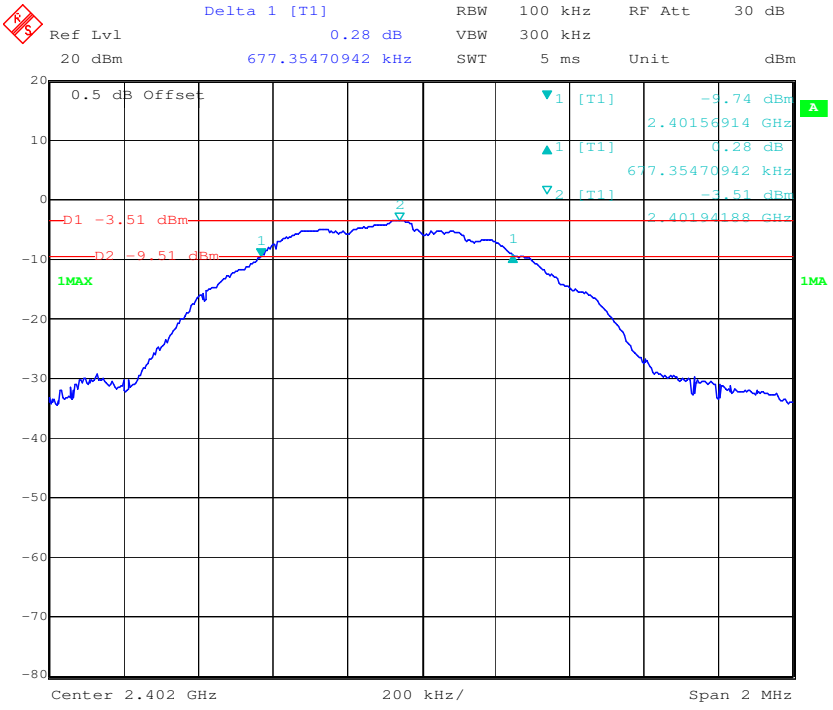
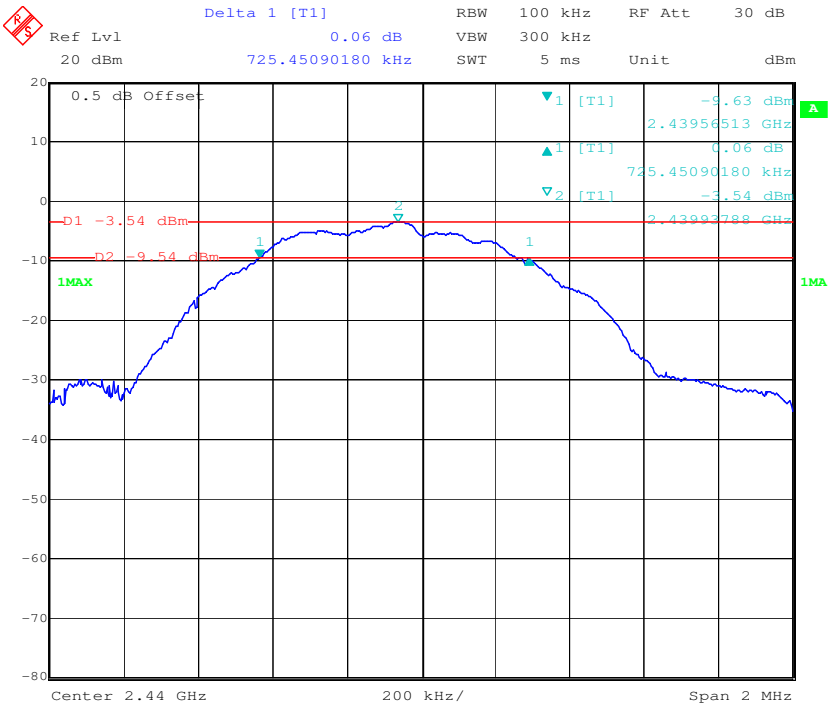
BLE Low Channel



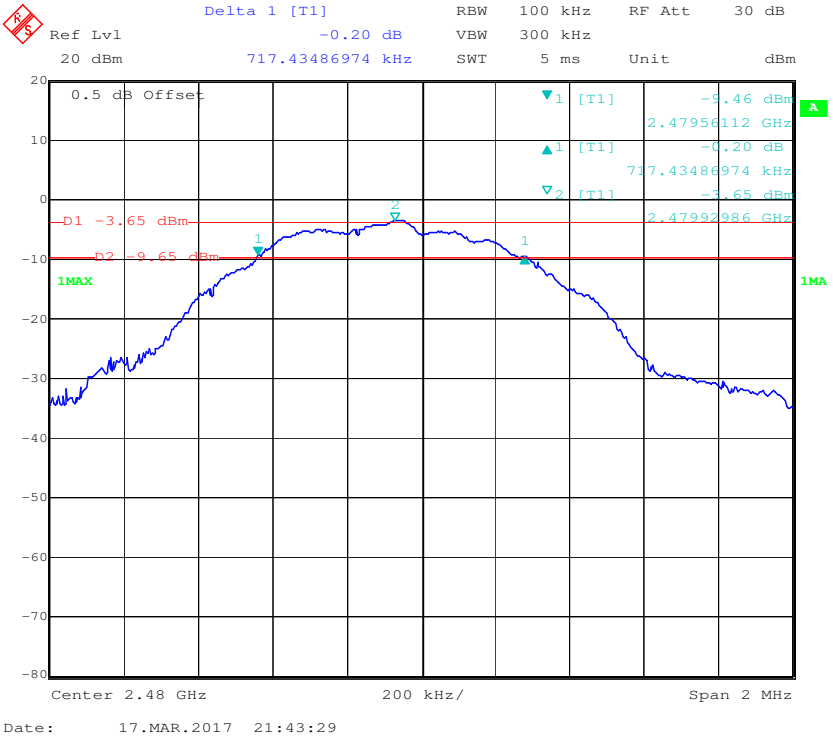
Date: 17.MAR.2017 21:40:19

BLE Middle Channel



Date: 17.MAR.2017 21:36:47

BLE High Channel



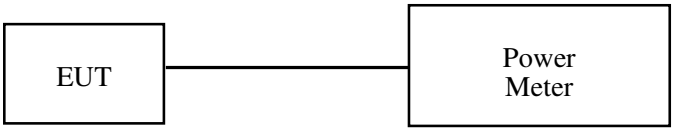
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

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

Test Procedure

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



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54170074	2017-01-03	2018-01-02
Agilent	P-Series Power Meter	N1912A	MY5000798	2017-01-03	2018-01-02
N/A	RF Cable	N/A	N/A	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	18.0 °C
Relative Humidity:	60 %
ATM Pressure:	95.5 kPa

** The testing was performed by Tom Tang on 2017-03-17.*

Test Mode: Transmitting

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

Test mode	Channel	Frequency	Max Peak Conducted Output Power	Max Conducted Average Output Power	Limit
		(MHz)	(dBm)	(dBm)	(dBm)
802.11b	Low	2412	13.96	10.53	30
	Middle	2437	15.91	11.81	30
	High	2462	12.8	10.39	30
802.11g	Low	2412	18.22	10.15	30
	Middle	2437	20.32	12.2	30
	High	2462	17.76	9.03	30
802.11n20	Low	2412	17.43	8.98	30
	Middle	2437	20.46	11.23	30
	High	2462	17.54	9.32	30
BLE	Low	2402	-2.86	/	30
	Middle	2440	-2.86	/	30
	High	2480	-2.98	/	30

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

Applicable Standard

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

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

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

Test Data

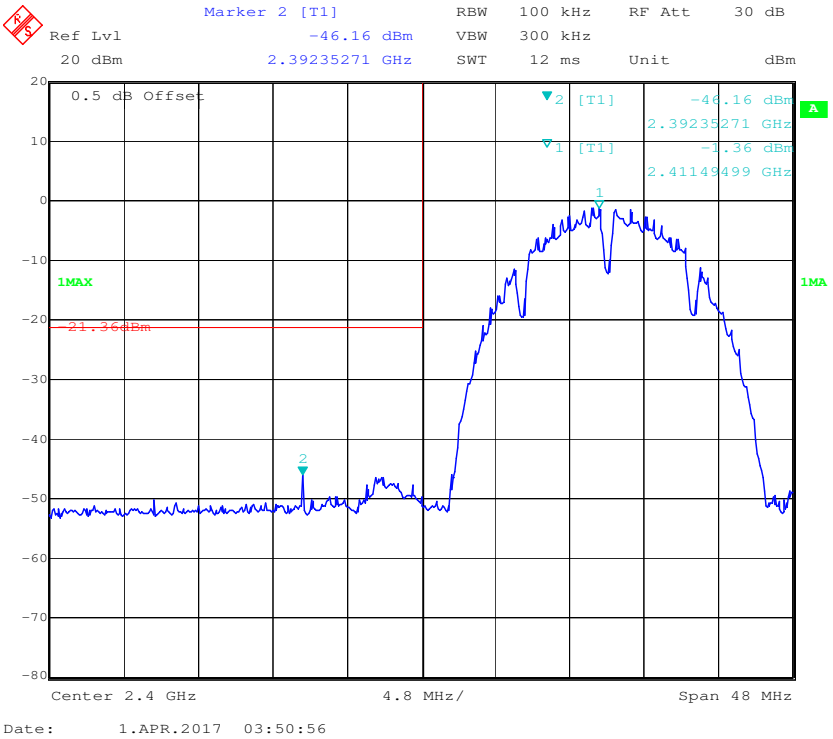
Environmental Conditions

Temperature:	18.0~20.0 °C
Relative Humidity:	54~60 %
ATM Pressure:	95.5~96.0 kPa

** The testing was performed by Tom Tang from 2017-03-17 to 2017-04-02.*
Test mode: Transmitting

Test Result: Compliant. Please refer to following plots.

802.11b: Band Edge, Left Side



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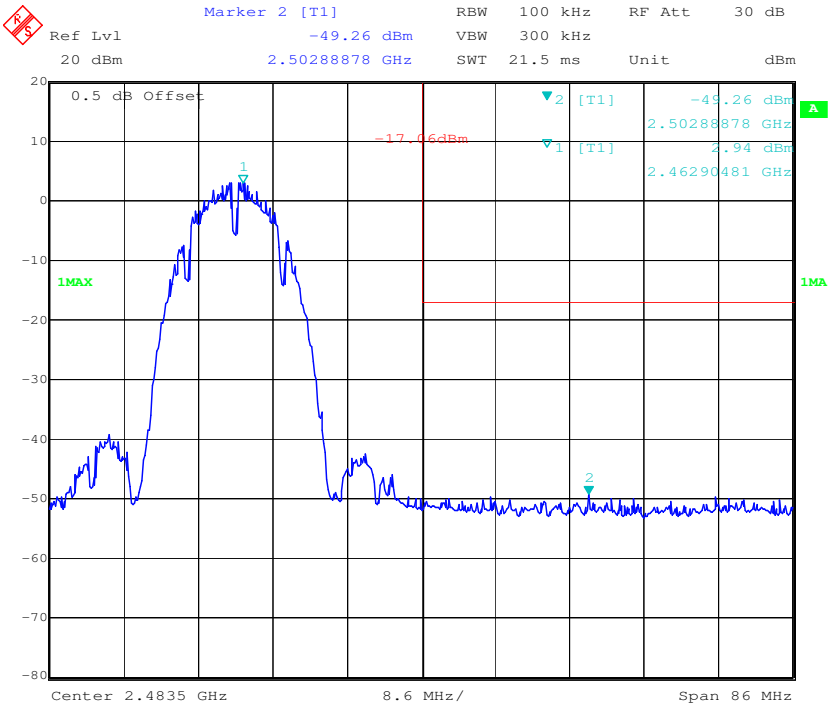
802.11b: Band Edge, Right Side



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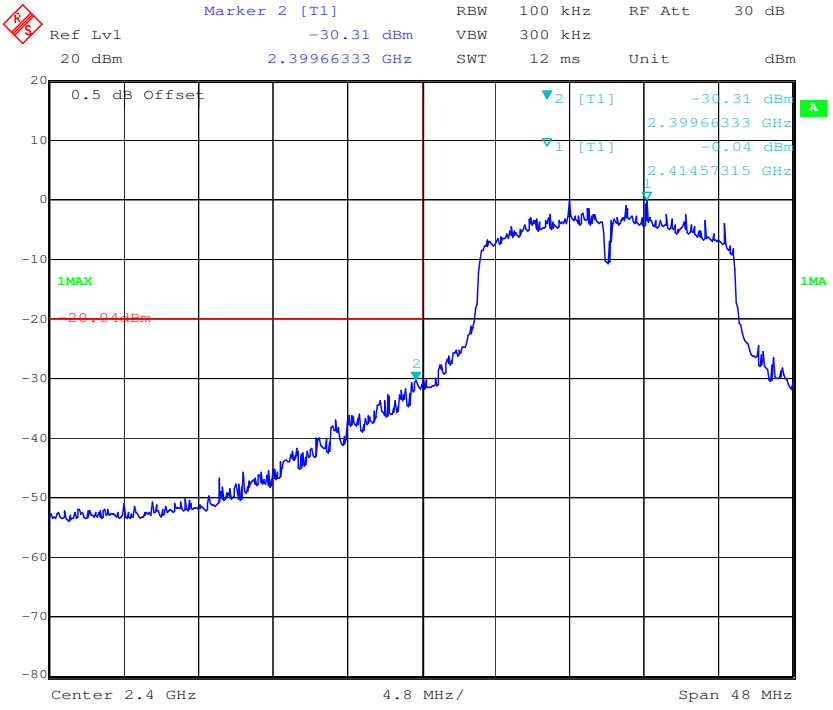
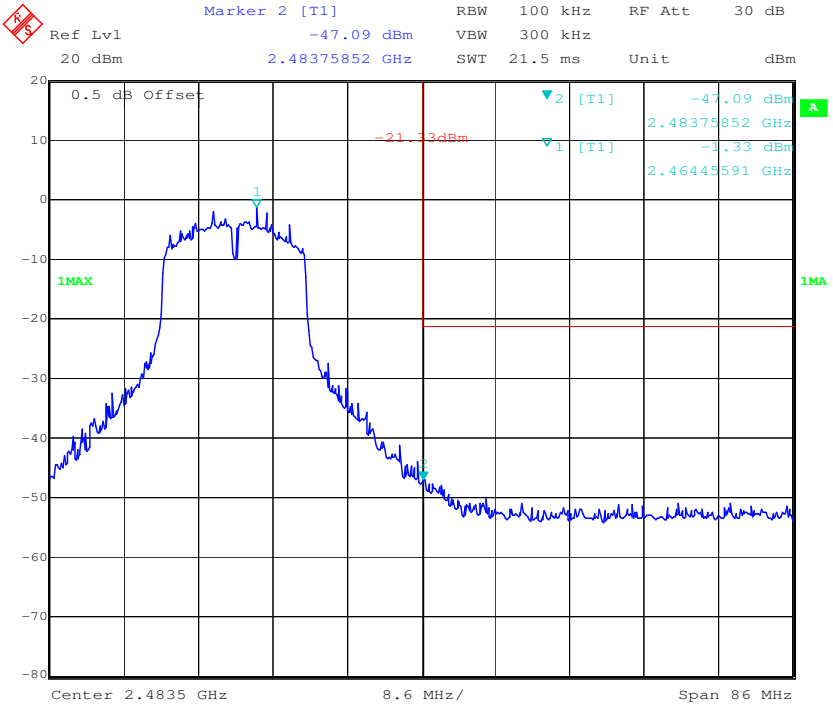
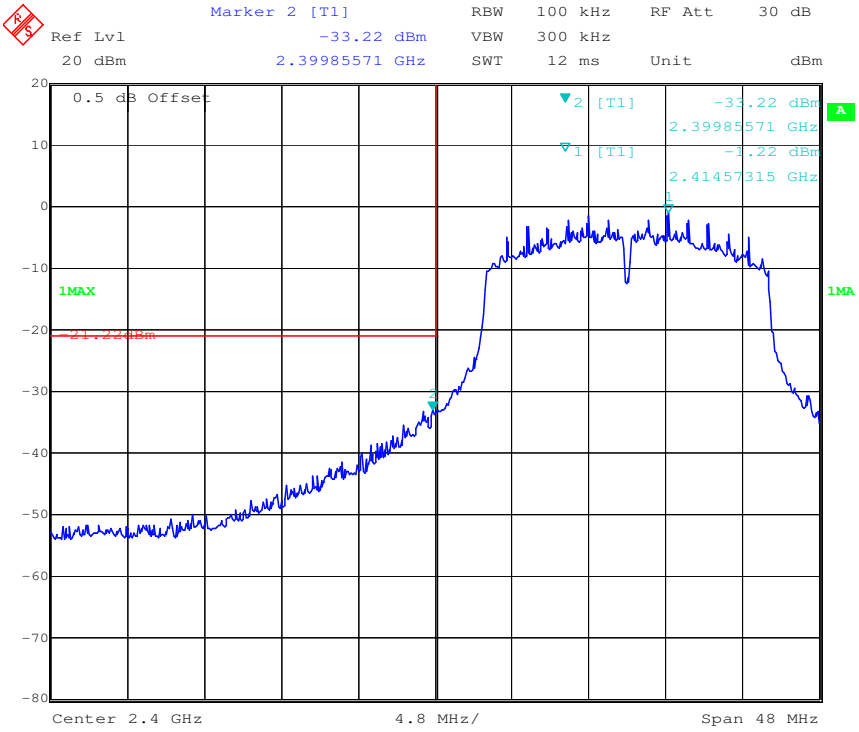
802.11g: Band Edge, Left Side



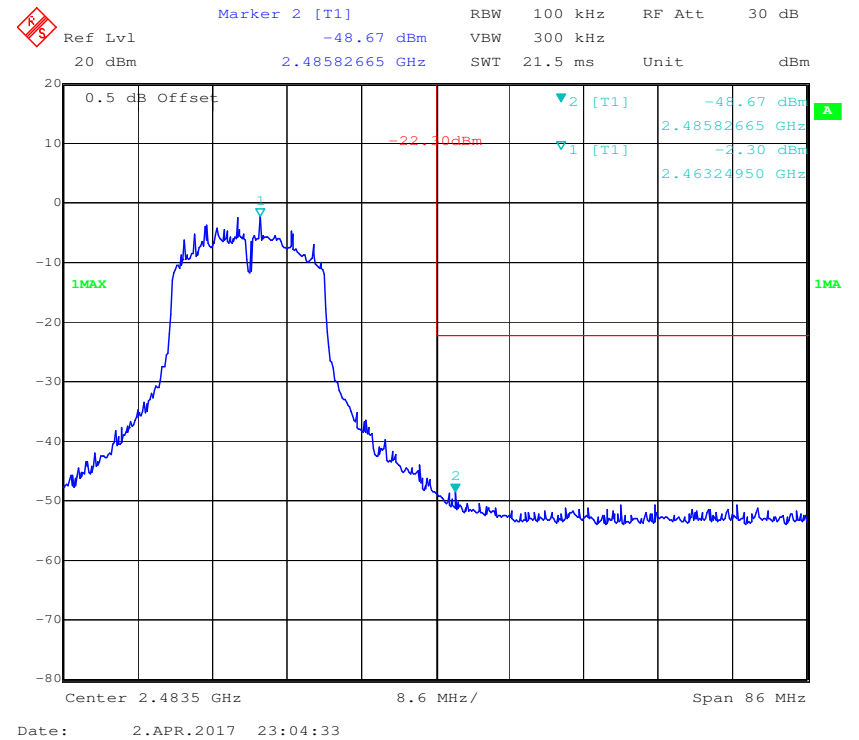
802.11g: Band Edge, Right Side



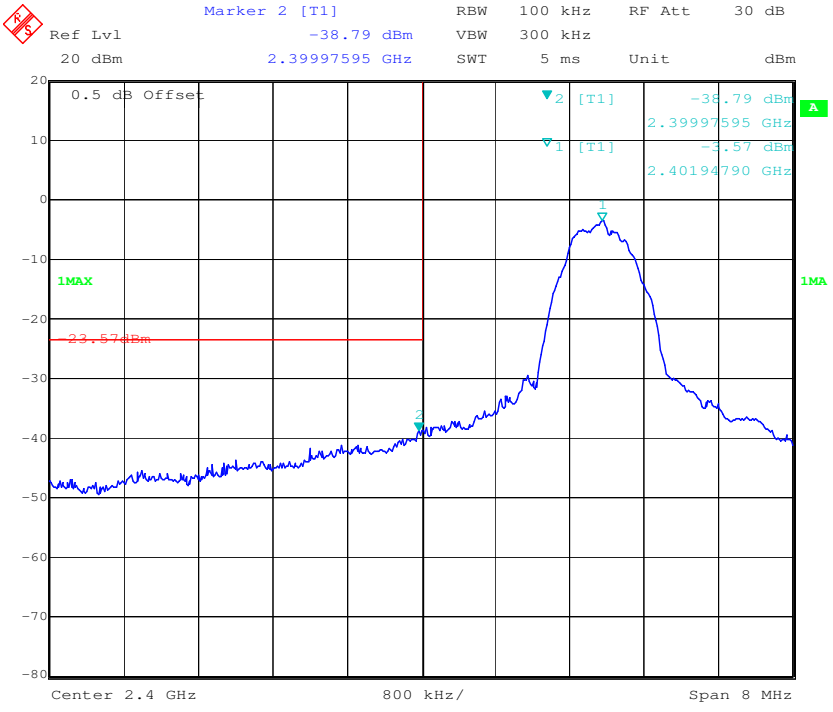
802.11n ht20 Band Edge, Left Side



802.11n ht20 Band Edge, Right Side



BLE Band Edge， Left Side



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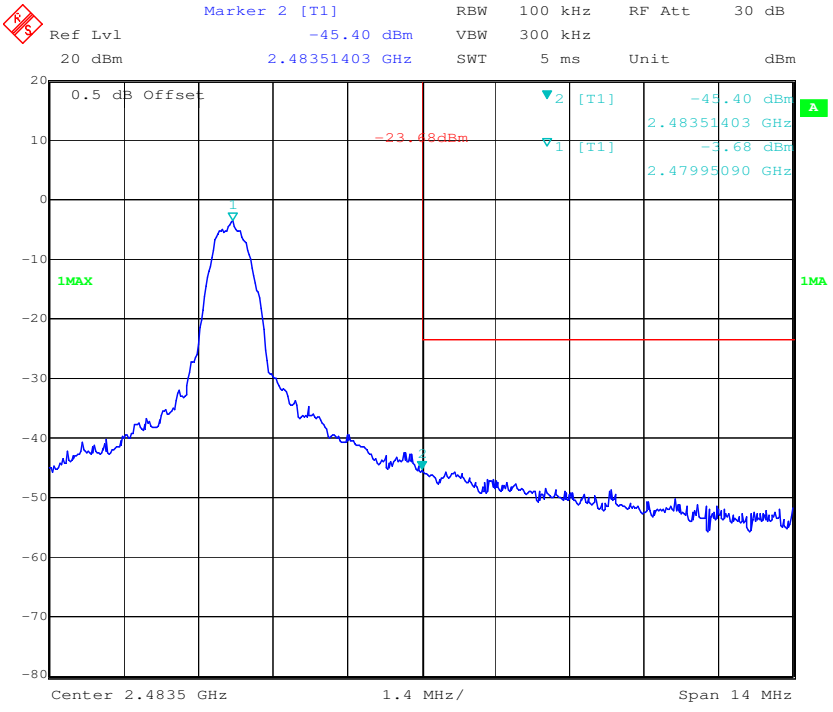
BLE Band Edge, Right Side



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FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	18.0~20.0 °C
Relative Humidity:	54~60 %
ATM Pressure:	95.5~96.0 kPa

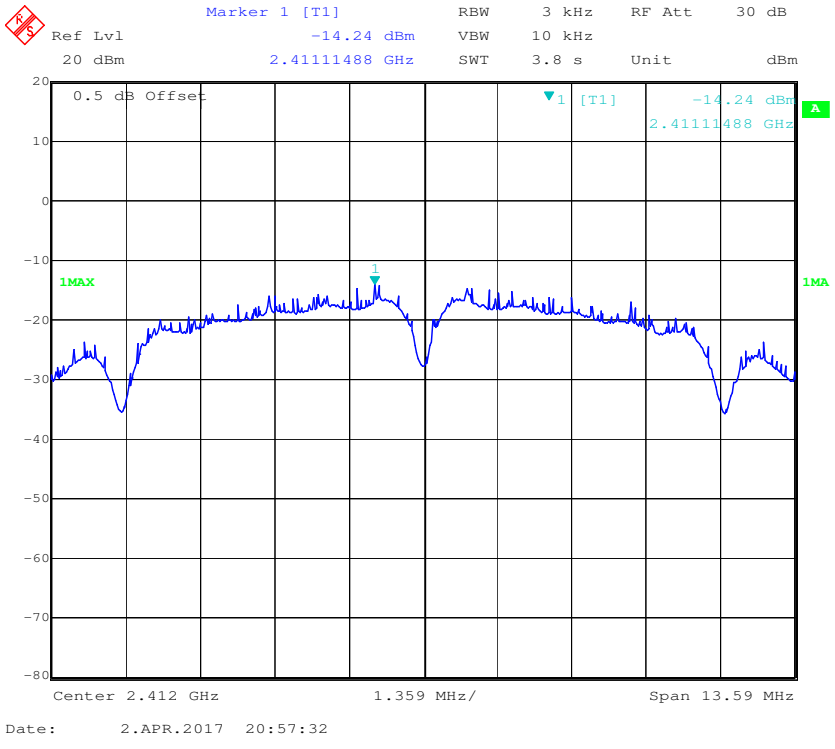
** The testing was performed by Tom Tang from 2017-03-17 to 2017-04-02.*

Test Mode: Transmitting

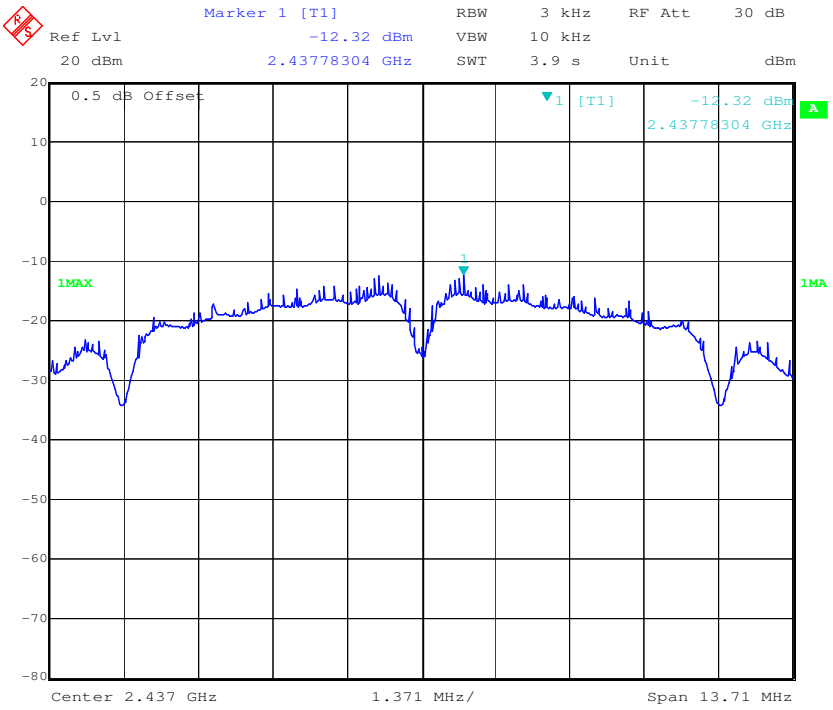
Test Result: Compliant. Please refer to the following table and plots

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-14.24	≤8
	Middle	2437	-12.32	≤8
	High	2462	-12.99	≤8
802.11g	Low	2412	-17.12	≤8
	Middle	2437	-13.61	≤8
	High	2462	-17.6	≤8
802.11n20	Low	2412	-16.65	≤8
	Middle	2437	-13.46	≤8
	High	2462	-16.87	≤8
BLE	Low	2402	-10.1	≤8
	Middle	2440	-10.05	≤8
	High	2480	-10.27	≤8

Power Spectral Density, 802.11b Low Channel



Power Spectral Density, 802.11b Middle Channel



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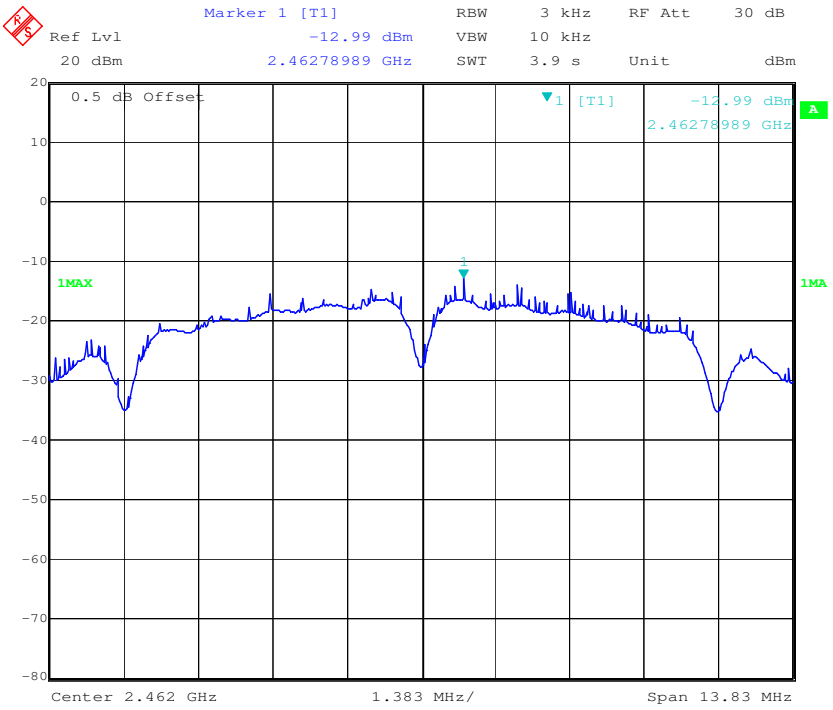
Power Spectral Density, 802.11b High Channel



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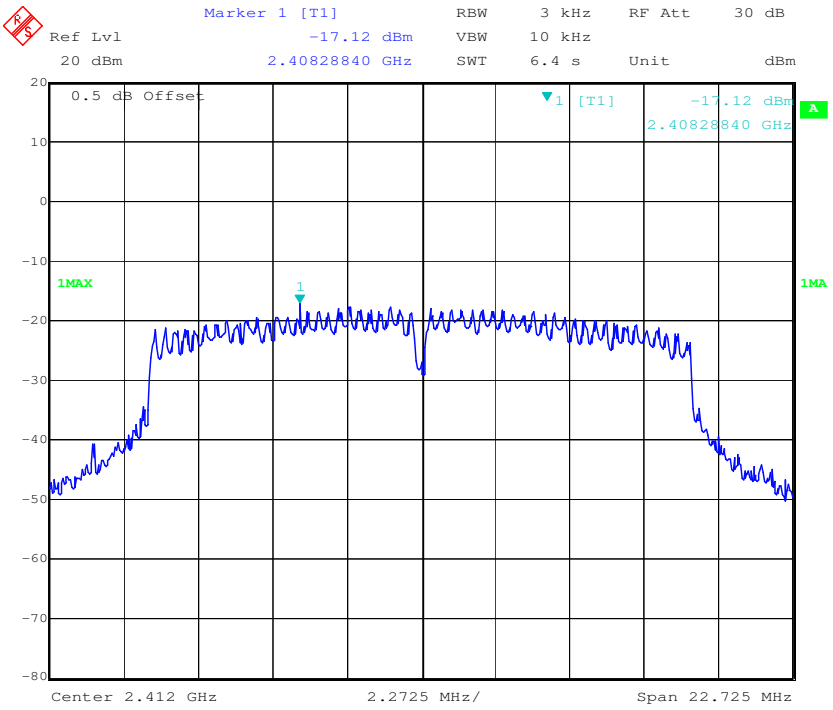
Power Spectral Density, 802.11g Low Channel



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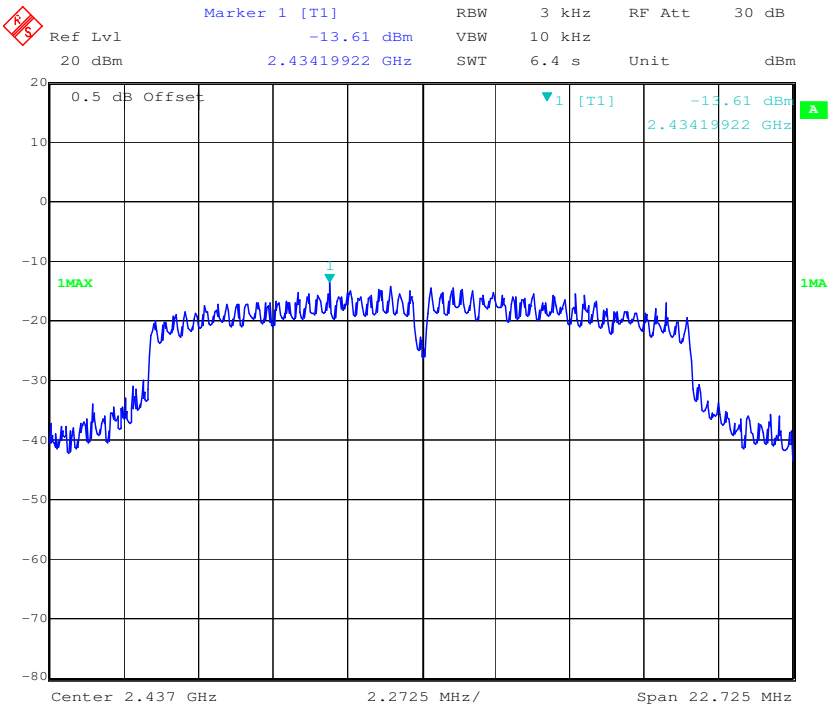
Power Spectral Density, 802.11g Middle Channel



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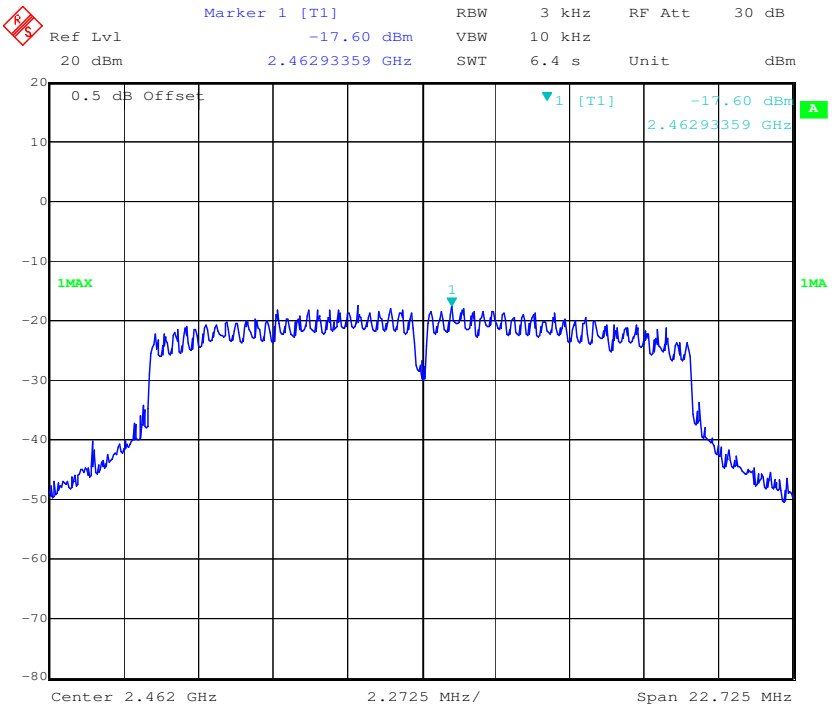
Power Spectral Density, 802.11g High Channel



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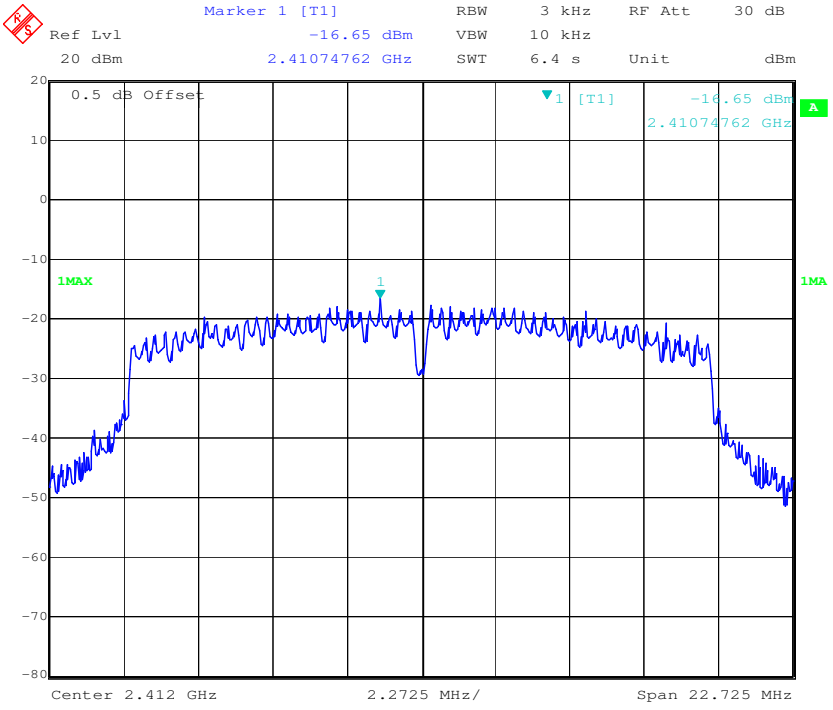
Power Spectral Density, 802.11n ht20 Low Channel



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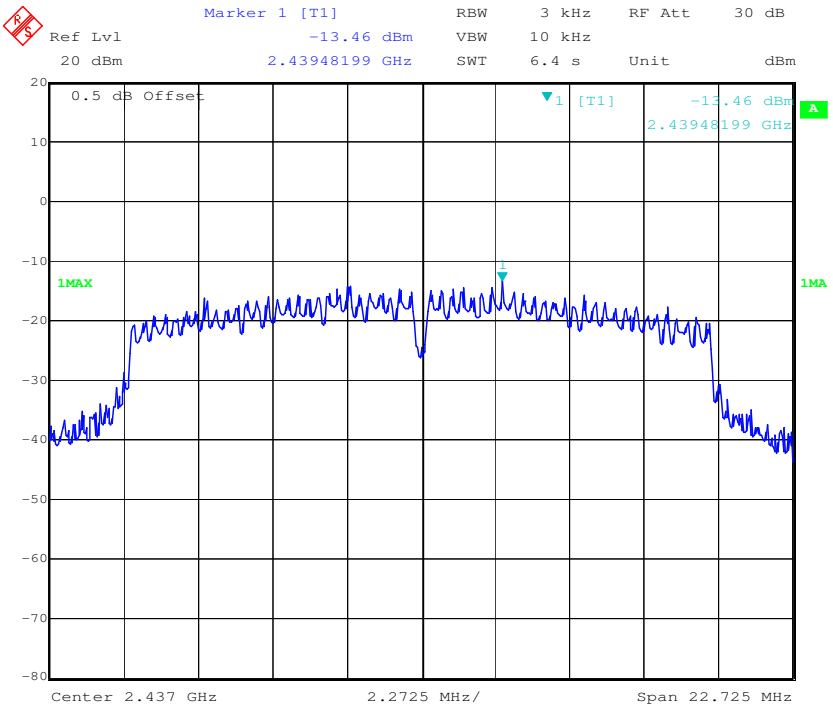
Power Spectral Density, 802.11n ht20 Middle Channel



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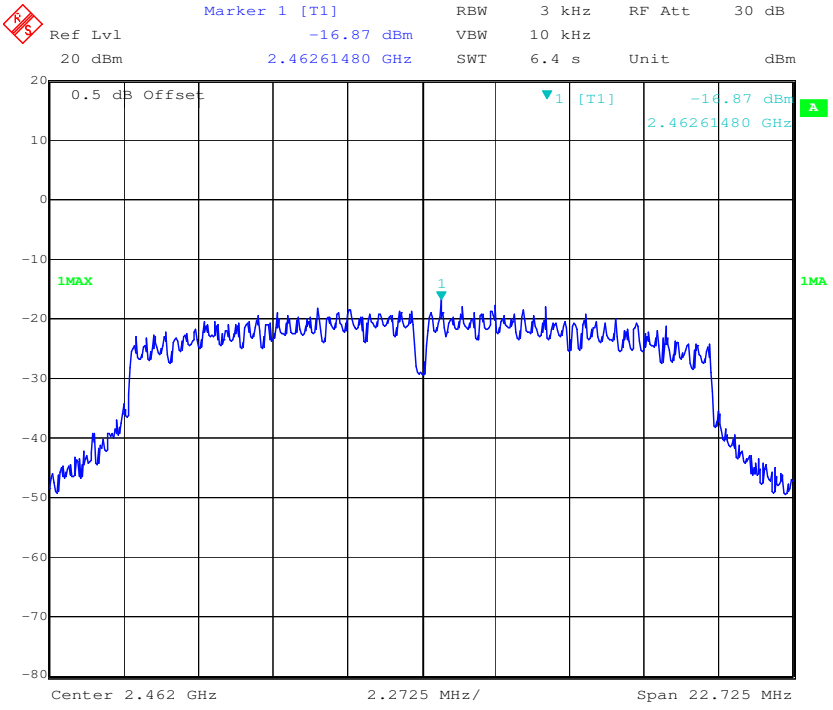
Power Spectral Density, 802.11n ht20 High Channel



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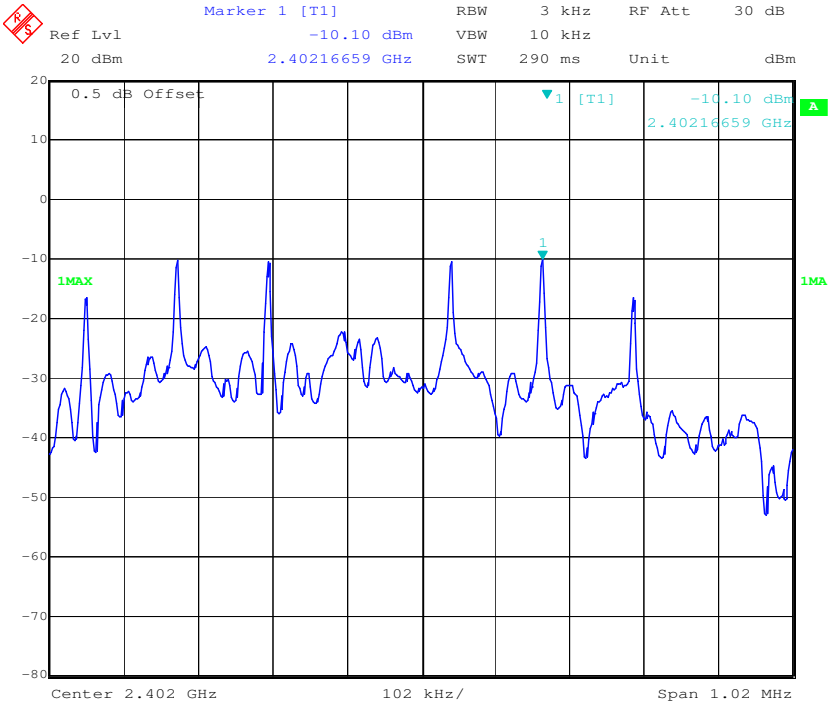
Power Spectral Density, BLE Low Channel



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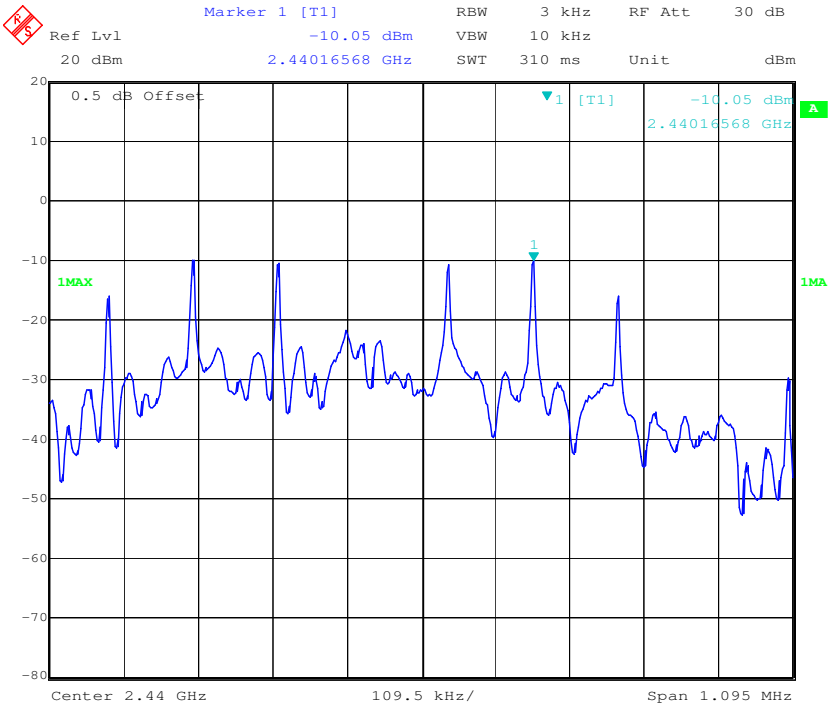
Power Spectral Density, BLE Middle Channel



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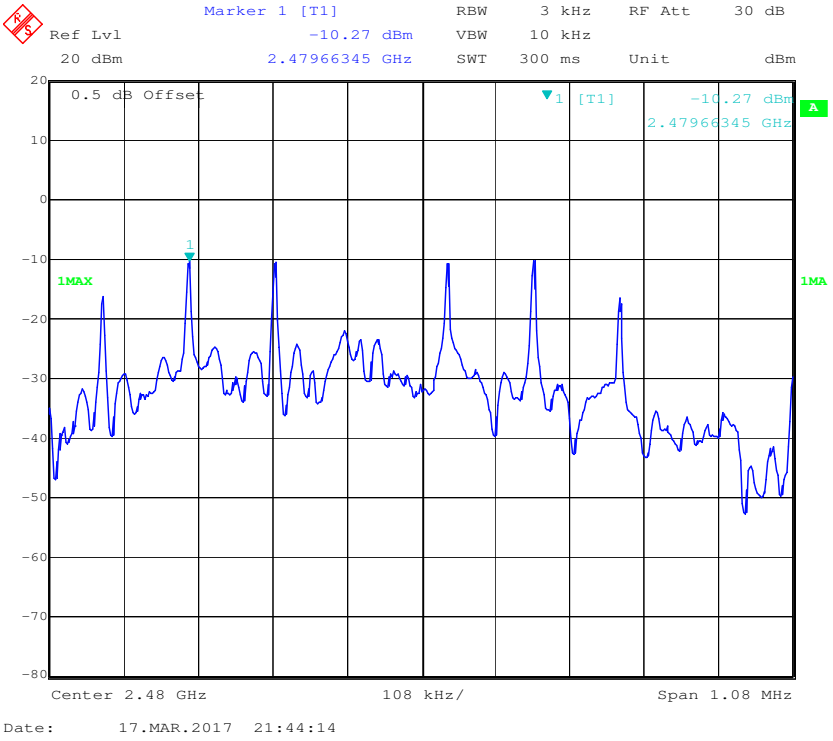
Power Spectral Density, BLE High Channel



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