



FCC PART 15.247

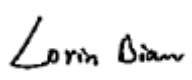

TEST REPORT

For

FORMIKE ELECTRONIC CO.,LTD.

Flats 401-403, 4/F, iPARK Building, 26 DengLiang Rd.,
NanShan District, Shenzhen, China

FCC ID: 2AK44-KWH-88W8-80XX

Report Type: Original Report	Product Name: WiFi Module
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Report Number: <u>RDG161219801</u>	
Report Date: <u>2017-03-06</u>	
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TABLE OF CONTENTS

GENERAL INFORMATION	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S)	4
TEST METHODOLOGY	4
TEST FACILITY	5
SYSTEM TEST CONFIGURATION	6
DESCRIPTION OF TEST CONFIGURATION	6
EQUIPMENT MODIFICATIONS	6
EUT EXERCISE SOFTWARE	6
LOCAL SUPPORT EQUIPMENT LIST AND DETAILS	8
SUPPORT CABLE LIST AND DETAILS	8
BLOCK DIAGRAM OF TEST SETUP	9
SUMMARY OF TEST RESULTS	10
FCC §15.247 (i) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)	11
APPLICABLE STANDARD	11
FCC §15.203 - ANTENNA REQUIREMENT	12
APPLICABLE STANDARD	12
ANTENNA CONNECTOR CONSTRUCTION	12
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	13
APPLICABLE STANDARD	13
MEASUREMENT UNCERTAINTY	13
EUT SETUP	13
EMI TEST RECEIVER SETUP	14
TEST PROCEDURE	14
CORRECTED AMPLITUDE & MARGIN CALCULATION	14
TEST EQUIPMENT LIST AND DETAILS	15
TEST DATA	15
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS	18
APPLICABLE STANDARD	18
MEASUREMENT UNCERTAINTY	18
EUT SETUP	19
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	20
TEST PROCEDURE	20
CORRECTED AMPLITUDE & MARGIN CALCULATION	20
TEST EQUIPMENT LIST AND DETAILS	21
TEST DATA	21
FCC §15.247(d) - SPURIOUS EMISSIONS AT ANTENNA PORT	25
APPLICABLE STANDARD	25
TEST PROCEDURE	25
TEST EQUIPMENT LIST AND DETAILS	25
TEST DATA	25
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH	31
APPLICABLE STANDARD	31
TEST PROCEDURE	31

TEST EQUIPMENT LIST AND DETAILS	31
TEST DATA	31
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER	37
APPLICABLE STANDARD	37
TEST PROCEDURE	37
TEST EQUIPMENT LIST AND DETAILS	37
TEST DATA	38
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE	39
APPLICABLE STANDARD	39
TEST PROCEDURE	39
TEST EQUIPMENT LIST AND DETAILS	39
TEST DATA	40
CC §15.247(e) - POWER SPECTRAL DENSITY	44
APPLICABLE STANDARD	44
TEST PROCEDURE	44
TEST EQUIPMENT LIST AND DETAILS	44
TEST DATA	44

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **FORMIKE ELECTRONIC CO.,LTD.**'s product, model number: **KWH-88W8-802 (FCC ID: 2AK44-KWH-88W8-80XX)** (the "EUT") in this report was a **WiFi Module**, which was measured approximately: 1.32 cm (L) x 1.35 cm (W) x 0.15 cm (H), rated input voltage: DC3.3V.

Note: The series product, model KWH-88W8-802, KWH-88W8-803, KWH-88W8-801 are electrically identical, the difference between them is the different model names, we selected KWH-88W8-802 for fully testing, the details was explained in the declaration letter.

**All measurement and test data in this report was gathered from final production sample, serial number: 161219801 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2016-12-21, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of **FORMIKE ELECTRONIC CO.,LTD.** in accordance with Part 2, Subpart J, Part 15, Subparts A, B 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)

N/A.

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.

The uncertainty of any RF tests which use conducted method measurement is ± 3.17 dB, the uncertainty of any radiation on emissions measurement is:

30M~200MHz: ± 4.7 dB;
200M~1GHz: ± 6.0 dB;
1G~6GHz: ± 5.13 dB;
6G~25GHz: ± 5.47 dB;

And the uncertainty will not be taken into consideration for all test data recorded in the report.

Test Facility

The test site used by BACL to collect test data is located in the 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, 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:

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.

Equipment Modifications

No modification was made to the EUT tested.

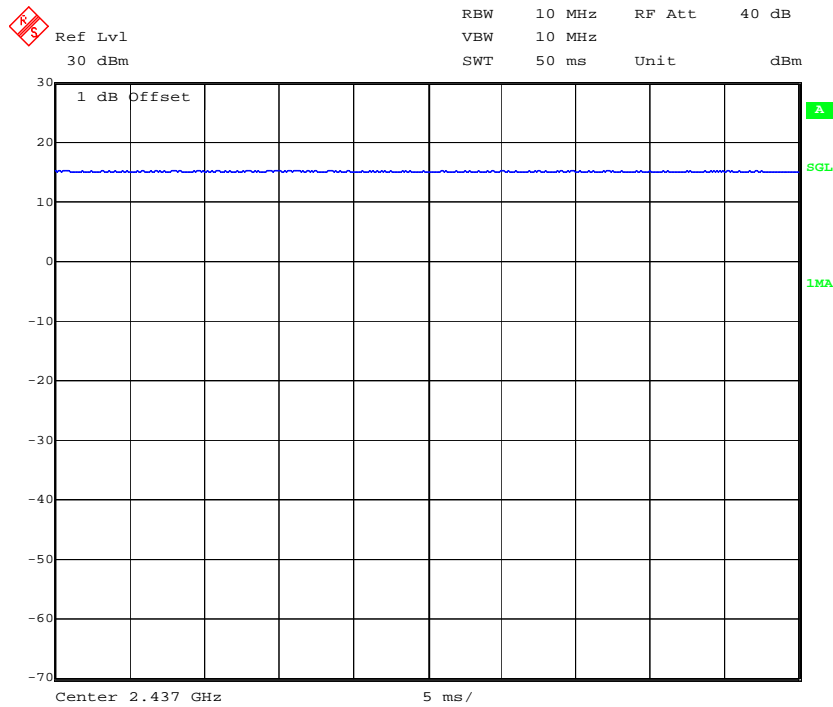
EUT Exercise Software

The software "Dos Command" was used for testing, which was provided by manufacturer, and configured maximum power and duty cycle in default mode.

The duty cycle as below:

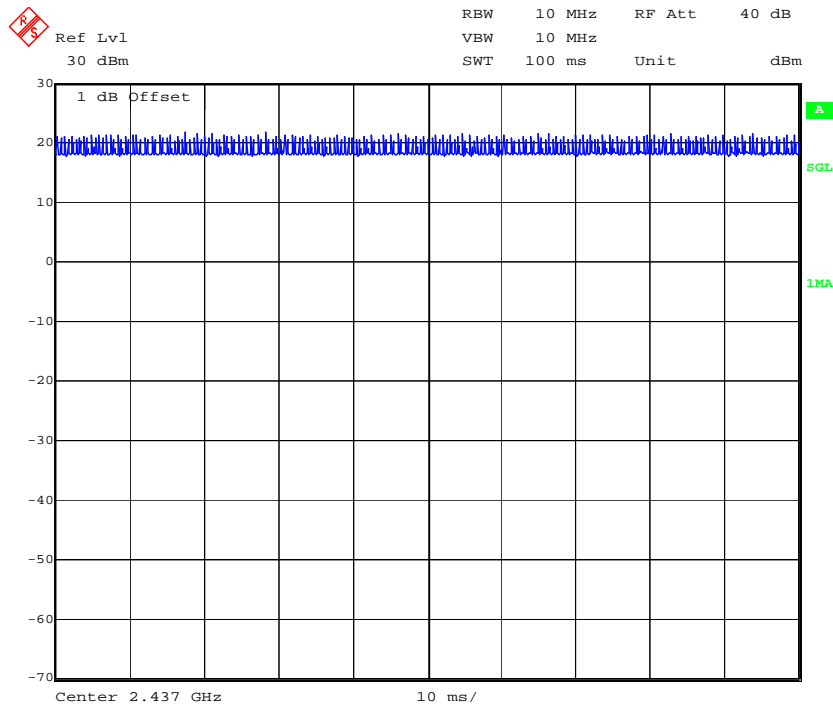
Test Mode	T _{on} (ms)	T _{on+off} (ms)	Duty Cycle (%)
802.11b	50	50	100%
802.11g	100	100	100%
802.11n ht20	100	100	100%

802.11b



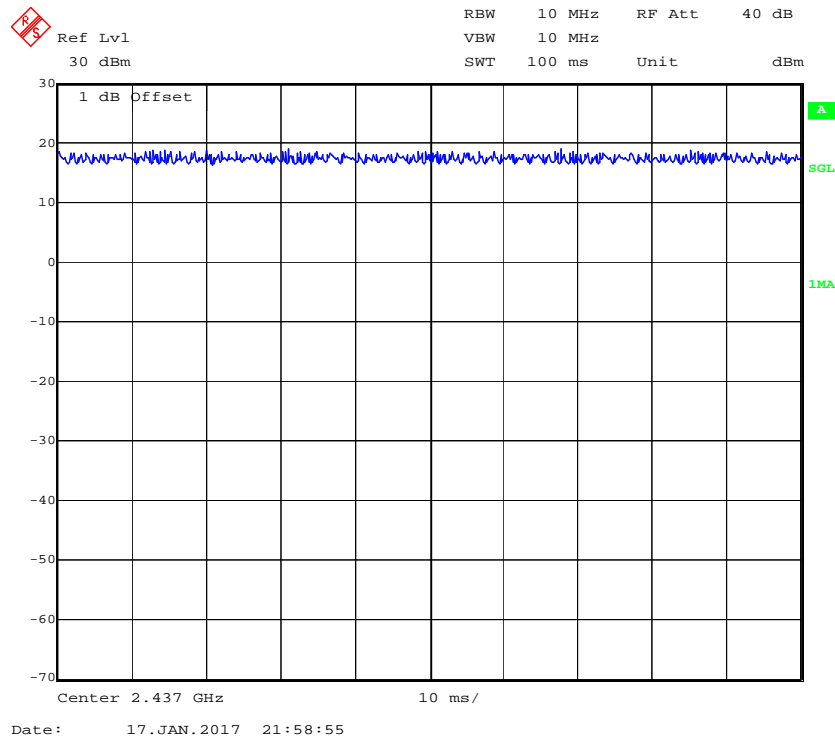
Date: 17.JAN.2017 22:01:04

802.11g



Date: 17.JAN.2017 21:57:18

802.11n ht20



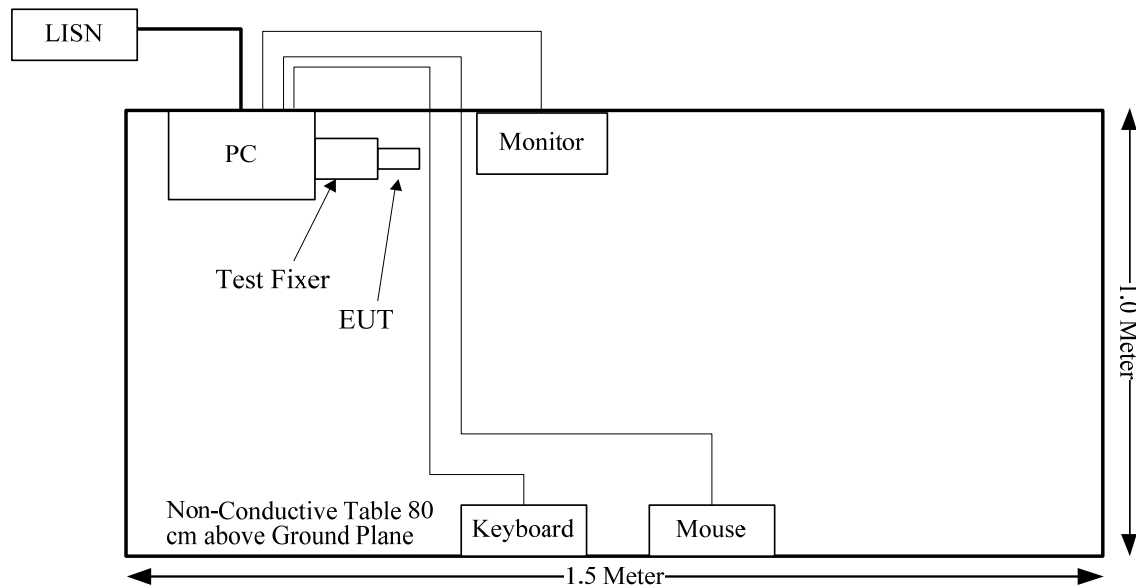
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
IBM	PC	8176	99Y7315
DELL	Display	E157FPC	060229-11
Lenovo	Keyboard	KB-US19EB	IMHYX011071016460
Lenovo	Mouse	MO-5013U	IMJS011041409259

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Mouse Cable	yes	No	1.4	Parallel Port of PC	Mouse
Keyboard Cable	yes	No	1.3	USB Port of PC	Keyboard
VGA Cable	yes	yes	1.2	VGA port of PC	Display

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247(d)	Spurious Emissions at antenna port	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

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/f ²)	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/cm²);

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:

Frequency (MHz)	Antenna Gain		Tune-up Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
2412-2462	5	3.16	20	100.00	20.00	0.0629	1.0

Note: The maximum tune-up power including tolerance is 20dBm, that declared by manufacturer.

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 have a PIFA antenna. The antenna permanently attached to the module. Maximum antenna gain is 5dBi. 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_{cisp} 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_{cisp} of Table 1, then:

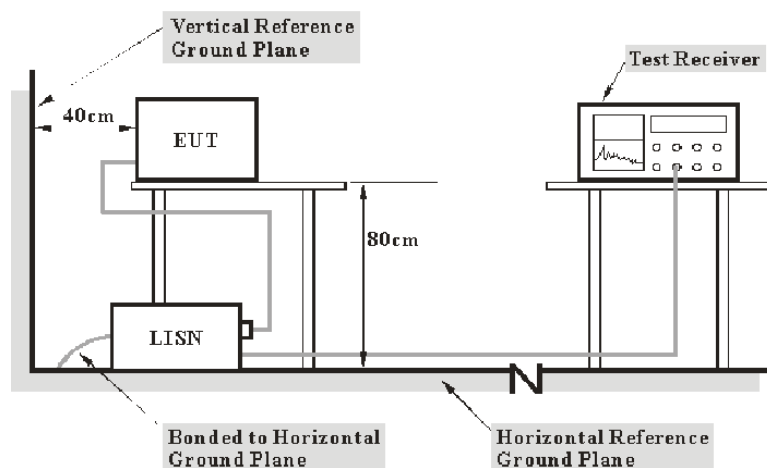
–compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit;
 –non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit.

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_{cisp}

Measurement	U_{cisp}
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 PC was connected to an AC 120 V/60 Hz 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 PC 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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

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	3560.6550.06	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	357.8810.52	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

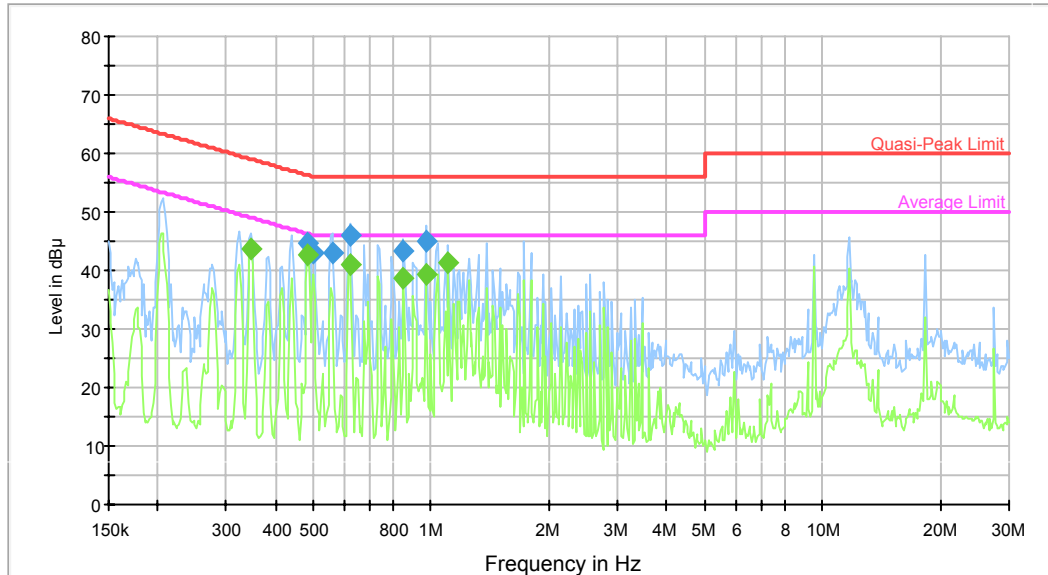
Environmental Conditions

Temperature:	25.6 °C
Relative Humidity:	48 %
ATM Pressure:	101.1 kPa

The testing was performed by Lorin Bian on 2017-01-05.

Test Mode: Transmitting

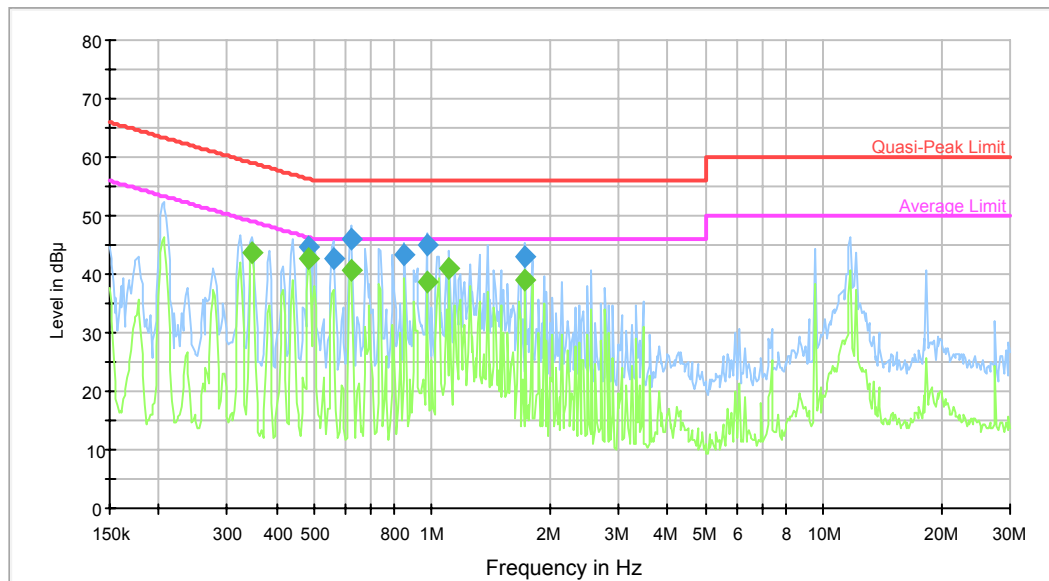
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.483938	44.6	9.000	L1	19.7	11.7	56.3	Compliance
0.499611	43.0	9.000	L1	19.7	13.0	56.0	Compliance
0.558572	43.0	9.000	L1	19.7	13.0	56.0	Compliance
0.619536	46.1	9.000	L1	19.7	9.9	56.0	Compliance
0.852094	43.5	9.000	L1	19.7	12.5	56.0	Compliance
0.967957	45.1	9.000	L1	19.7	10.9	56.0	Compliance

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.346296	43.7	9.000	L1	19.7	5.4	49.1	Compliance
0.483938	42.5	9.000	L1	19.7	3.8	46.3	Compliance
0.619536	41.0	9.000	L1	19.7	5.0	46.0	Compliance
0.852094	38.7	9.000	L1	19.7	7.3	46.0	Compliance
0.967957	39.2	9.000	L1	19.7	6.8	46.0	Compliance
1.108371	41.3	9.000	L1	19.7	4.7	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.483938	44.6	9.000	N	19.6	11.7	56.3	Compliance
0.558572	42.7	9.000	N	19.6	13.3	56.0	Compliance
0.619536	46.0	9.000	N	19.6	10.0	56.0	Compliance
0.852094	43.4	9.000	N	19.6	12.6	56.0	Compliance
0.967957	45.1	9.000	N	19.7	10.9	56.0	Compliance
1.731709	42.9	9.000	N	19.7	13.1	56.0	Compliance

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.346296	43.7	9.000	N	19.6	5.4	49.1	Compliance
0.483938	42.7	9.000	N	19.6	3.6	46.3	Compliance
0.619536	40.8	9.000	N	19.6	5.2	46.0	Compliance
0.967957	38.8	9.000	N	19.7	7.2	46.0	Compliance
1.108371	40.9	9.000	N	19.7	5.1	46.0	Compliance
1.731709	38.9	9.000	N	19.7	7.1	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;

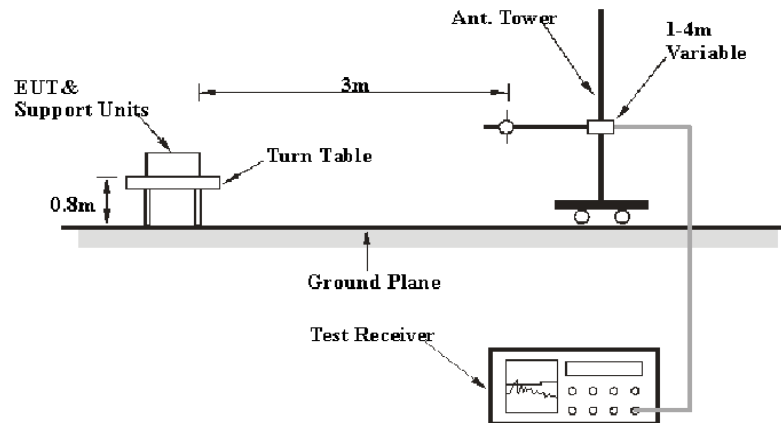
6G~25GHz: ±5.47 dB;

Table 2 – Values of U_{cispr}

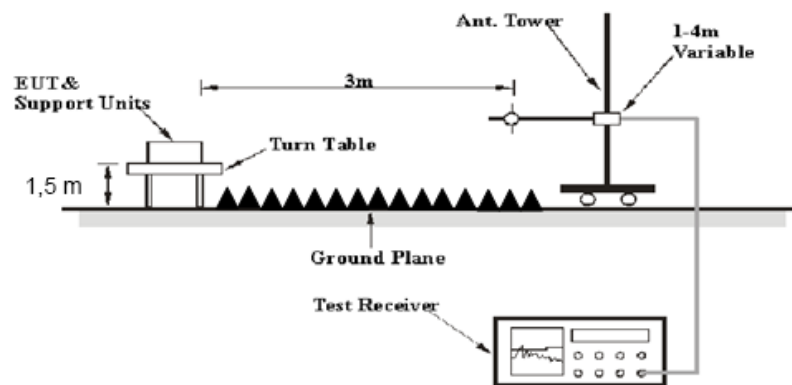
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

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	A101808	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
HP	Amplifier	8449B	3008A00277	2016-12-02	2017-12-01
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2016-11-10	2017-11-09

* **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:	24.2 °C
Relative Humidity:	49 %
ATM Pressure:	101.8 kPa

* The testing was performed by Lorin Bian from 2017-03-04.

Test Mode: Transmitting

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 (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	75.29	PK	H	23.50	3.00	0.00	101.79	N/A	N/A
2412	72.1	AV	H	23.50	3.00	0.00	98.60	N/A	N/A
2412	72.65	PK	V	23.50	3.00	0.00	99.15	N/A	N/A
2412	68.74	AV	V	23.50	3.00	0.00	95.24	N/A	N/A
2390	28.75	PK	H	23.57	3.00	0.00	55.32	74.00	18.68
2390	17.48	AV	H	23.57	3.00	0.00	44.05	54.00	9.95
4824	46.47	PK	H	30.84	5.11	26.87	55.55	74.00	18.45
4824	40.28	AV	H	30.84	5.11	26.87	49.36	54.00	4.64
7236	43.65	PK	H	34.77	6.18	26.36	58.24	74.00	15.76
7236	30.18	AV	H	34.77	6.18	26.36	44.77	54.00	9.23
1732	36.25	PK	H	24.47	2.85	26.56	37.01	74.00	36.99
1732	20.18	AV	H	24.47	2.85	26.56	20.94	54.00	33.06
646.92	38.09	QP	V	20.25	1.93	28.85	31.42	46.00	14.58
700.27	36.8	QP	V	20.80	1.93	28.72	30.81	46.00	15.19
Middle Channel: 2437 MHz									
2437	74.26	PK	H	23.41	3.00	0.00	100.67	N/A	N/A
2437	70.04	AV	H	23.41	3.00	0.00	96.45	N/A	N/A
2437	71.22	PK	V	23.41	3.00	0.00	97.63	N/A	N/A
2437	67.49	AV	V	23.41	3.00	0.00	93.90	N/A	N/A
4874	46.85	PK	H	31.00	5.09	26.87	56.07	74.00	17.93
4874	40.52	AV	H	31.00	5.09	26.87	49.74	54.00	4.26
7311	42.14	PK	H	34.92	6.21	26.40	56.87	74.00	17.13
7311	30.68	AV	H	34.92	6.21	26.40	45.41	54.00	8.59
1539	35.27	PK	H	24.16	2.70	26.37	35.76	74.00	38.24
1539	22.56	AV	H	24.16	2.70	26.37	23.05	54.00	30.95
2264	33.24	PK	H	24.00	3.02	26.86	33.40	74.00	40.60
2264	21.06	AV	H	24.00	3.02	26.86	21.22	54.00	32.78
646.92	38.63	QP	V	20.25	1.93	28.85	31.96	46.00	14.04
700.27	37.19	QP	V	20.80	1.93	28.72	31.20	46.00	14.80
High Channel: 2462 MHz									
2462	74.25	PK	H	23.33	2.99	0.00	100.57	N/A	N/A
2462	71.02	AV	H	23.33	2.99	0.00	97.34	N/A	N/A
2462	71.26	PK	V	23.33	2.99	0.00	97.58	N/A	N/A
2462	68.24	AV	V	23.33	2.99	0.00	94.56	N/A	N/A
2483.5	28.22	PK	H	23.26	2.99	0.00	54.47	74.00	19.53
2483.5	17.48	AV	H	23.26	2.99	0.00	43.73	54.00	10.27
4924	48.74	PK	H	31.16	5.07	26.88	58.09	74.00	15.91
4924	31.06	AV	H	31.16	5.07	26.88	40.41	54.00	13.59
7386	43.22	PK	H	35.07	6.25	26.43	58.11	74.00	15.89
7386	28.74	AV	H	35.07	6.25	26.43	43.63	54.00	10.37
2044	33.19	PK	H	24.75	3.04	26.83	34.15	74.00	39.85
2044	22.64	AV	H	24.75	3.04	26.83	23.60	54.00	30.40
646.92	38.92	QP	V	20.25	1.93	28.85	32.25	46.00	13.75
700.27	37.63	QP	V	20.80	1.93	28.72	31.64	46.00	14.36

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 (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	72.14	PK	H	23.50	3.00	0.00	98.64	N/A	N/A
2412	63.47	AV	H	23.50	3.00	0.00	89.97	N/A	N/A
2412	70.25	PK	V	23.50	3.00	0.00	96.75	N/A	N/A
2412	60.43	AV	V	23.50	3.00	0.00	86.93	N/A	N/A
2390	25.36	PK	H	23.57	3.00	0.00	51.93	74.00	22.07
2390	17.84	AV	H	23.57	3.00	0.00	44.41	54.00	9.59
4824	45.95	PK	H	30.84	5.11	26.87	55.03	74.00	18.97
4824	30.28	AV	H	30.84	5.11	26.87	39.36	54.00	14.64
7236	42.66	PK	H	34.77	6.18	26.36	57.25	74.00	16.75
7236	30.17	AV	H	34.77	6.18	26.36	44.76	54.00	9.24
1586	35.44	PK	H	24.24	2.74	26.41	36.01	74.00	37.99
1586	23.47	AV	H	24.24	2.74	26.41	24.04	54.00	29.96
646.92	39.19	QP	V	20.25	1.93	28.85	32.52	46.00	13.48
700.27	38.07	QP	V	20.80	1.93	28.72	32.08	46.00	13.92
Middle Channel: 2437 MHz									
2437	72.54	PK	H	23.41	3.00	0.00	98.95	N/A	N/A
2437	63.85	AV	H	23.41	3.00	0.00	90.26	N/A	N/A
2437	70.74	PK	V	23.41	3.00	0.00	97.15	N/A	N/A
2437	60.29	AV	V	23.41	3.00	0.00	86.70	N/A	N/A
4874	45.28	PK	H	31.00	5.09	26.87	54.50	74.00	19.50
4874	32.09	AV	H	31.00	5.09	26.87	41.31	54.00	12.69
7311	42.58	PK	H	34.92	6.21	26.40	57.31	74.00	16.69
7311	30.11	AV	H	34.92	6.21	26.40	44.84	54.00	9.16
1663	35.47	PK	H	24.36	2.79	26.49	36.13	74.00	37.87
1663	23.19	AV	H	24.36	2.79	26.49	23.85	54.00	30.15
646.92	38.41	QP	V	20.25	1.93	28.85	31.74	46.00	14.26
700.27	35.74	QP	V	20.80	1.93	28.72	29.75	46.00	16.25
High Channel: 2462 MHz									
2462	72.15	PK	H	23.33	2.99	0.00	98.47	N/A	N/A
2462	63.22	AV	H	23.33	2.99	0.00	89.54	N/A	N/A
2462	70.14	PK	V	23.33	2.99	0.00	96.46	N/A	N/A
2462	60.38	AV	V	23.33	2.99	0.00	86.70	N/A	N/A
2483.5	28.56	PK	H	23.26	2.99	0.00	54.81	74.00	19.19
2483.5	17.49	AV	H	23.26	2.99	0.00	43.74	54.00	10.26
4924	47.26	PK	H	31.16	5.07	26.88	56.61	74.00	17.39
4924	33.61	AV	H	31.16	5.07	26.88	42.96	54.00	11.04
7386	42.62	PK	H	35.07	6.25	26.43	57.51	74.00	16.49
7386	30.67	AV	H	35.07	6.25	26.43	45.56	54.00	8.44
1576	36.09	PK	H	24.22	2.73	26.40	36.64	74.00	37.36
1576	24.64	AV	H	24.22	2.73	26.40	25.19	54.00	28.81
646.92	38.95	QP	V	20.25	1.93	28.85	32.28	46.00	13.72
700.27	36.13	QP	V	20.80	1.93	28.72	30.14	46.00	15.86

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 (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	72.15	PK	H	23.50	3.00	0.00	98.65	N/A	N/A
2412	62.31	AV	H	23.50	3.00	0.00	88.81	N/A	N/A
2412	70.18	PK	V	23.50	3.00	0.00	96.68	N/A	N/A
2412	59.88	AV	V	23.50	3.00	0.00	86.38	N/A	N/A
2390	28.74	PK	H	23.57	3.00	0.00	55.31	74.00	18.69
2390	18.06	AV	H	23.57	3.00	0.00	44.63	54.00	9.37
4824	47.84	PK	H	30.84	5.11	26.87	56.92	74.00	17.08
4824	33.69	AV	H	30.84	5.11	26.87	42.77	54.00	11.23
7236	44.65	PK	H	34.77	6.18	26.36	59.24	74.00	14.76
7236	30.25	AV	H	34.77	6.18	26.36	44.84	54.00	9.16
2950	36.21	PK	H	24.10	3.39	26.46	37.24	74.00	36.76
2950	24.57	AV	H	24.10	3.39	26.46	25.60	54.00	28.40
646.92	39.24	QP	V	20.25	1.93	28.85	32.57	46.00	13.43
700.27	36.57	QP	V	20.80	1.93	28.72	30.58	46.00	15.42
Middle Channel: 2437 MHz									
2437	72.19	PK	H	23.41	3.00	0.00	98.60	N/A	N/A
2437	62.66	AV	H	23.41	3.00	0.00	89.07	N/A	N/A
2437	70.18	PK	V	23.41	3.00	0.00	96.59	N/A	N/A
2437	58.94	AV	V	23.41	3.00	0.00	85.35	N/A	N/A
4874	48.79	PK	H	31.00	5.09	26.87	58.01	74.00	15.99
4874	34.06	AV	H	31.00	5.09	26.87	43.28	54.00	10.72
7311	44.66	PK	H	34.92	6.21	26.40	59.39	74.00	14.61
7311	31.64	AV	H	34.92	6.21	26.40	46.37	54.00	7.63
1588	35.84	PK	H	24.24	2.74	26.42	36.40	74.00	37.60
1588	22.47	AV	H	24.24	2.74	26.42	23.03	54.00	30.97
646.92	39.51	QP	V	20.25	1.93	28.85	32.84	46.00	13.16
700.27	37.01	QP	V	20.80	1.93	28.72	31.02	46.00	14.98
High Channel: 2462 MHz									
2462	72.25	PK	H	23.33	2.99	0.00	98.57	N/A	N/A
2462	62.67	AV	H	23.33	2.99	0.00	88.99	N/A	N/A
2462	70.14	PK	V	23.33	2.99	0.00	96.46	N/A	N/A
2462	69.28	AV	V	23.33	2.99	0.00	95.60	N/A	N/A
2483.5	27.68	PK	H	23.26	2.99	0.00	53.93	74.00	20.07
2483.5	18.96	AV	H	23.26	2.99	0.00	45.21	54.00	8.79
4924	48.55	PK	H	31.16	5.07	26.88	57.90	74.00	16.10
4924	33.59	AV	H	31.16	5.07	26.88	42.94	54.00	11.06
7386	42.84	PK	H	35.07	6.25	26.43	57.73	74.00	16.27
7386	29.98	AV	H	35.07	6.25	26.43	44.87	54.00	9.13
2950	35.44	PK	H	24.10	3.39	26.46	36.47	74.00	37.53
2950	21.69	AV	H	24.10	3.39	26.46	22.72	54.00	31.28
646.92	37.84	QP	V	20.25	1.93	28.85	31.17	46.00	14.83
700.27	35.69	QP	V	20.80	1.93	28.72	29.70	46.00	16.30

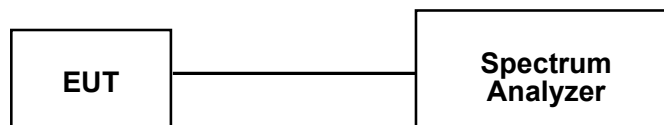
FCC §15.247(d) - SPURIOUS EMISSIONS AT ANTENNA PORT

Applicable Standard

FCC §15.247 (d)

Test Procedure

- a) Set RBW = 1 MHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the emission from 30MHz to 25GHz.



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

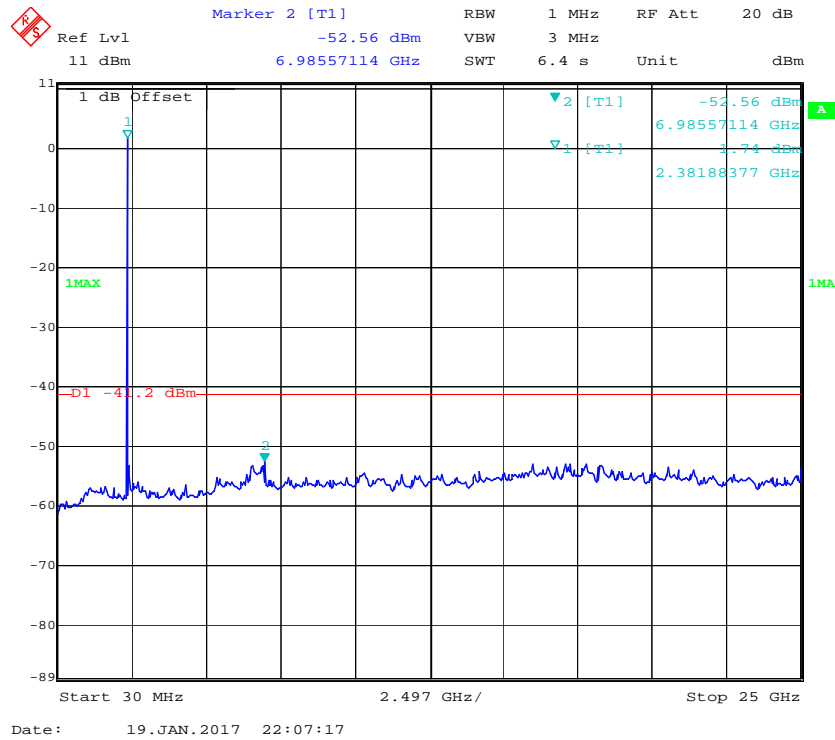
Environmental Conditions

Temperature:	26.8 °C
Relative Humidity:	41 %
ATM Pressure:	99.3 kPa

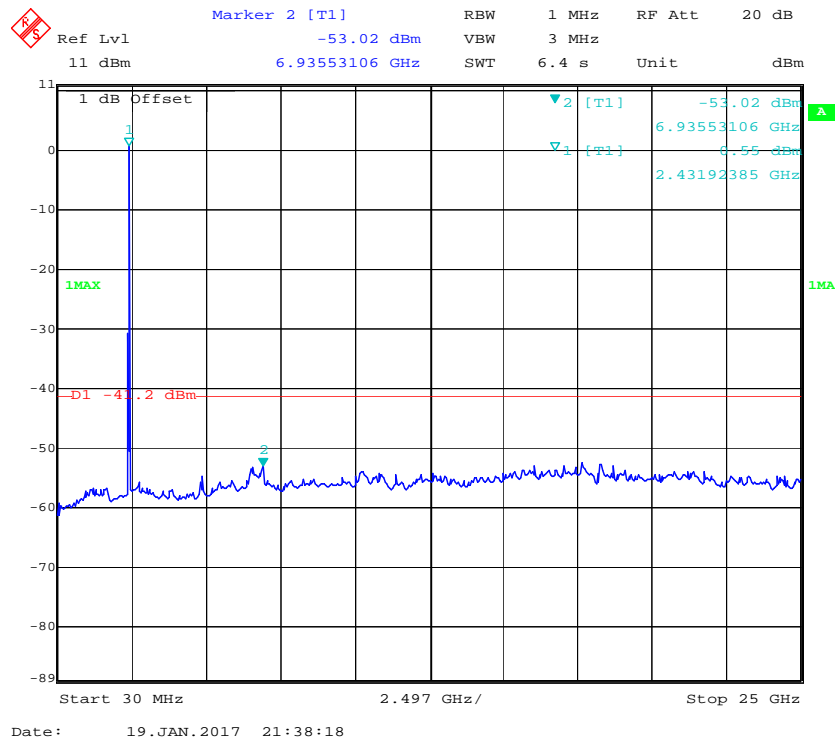
* The testing was performed by Lorin Bian on 2017-01-19.

Test Results: Compliant, (All emission under the Average limit 54dBuV/m(EIRP -41.2dBm)) more than 5dB.

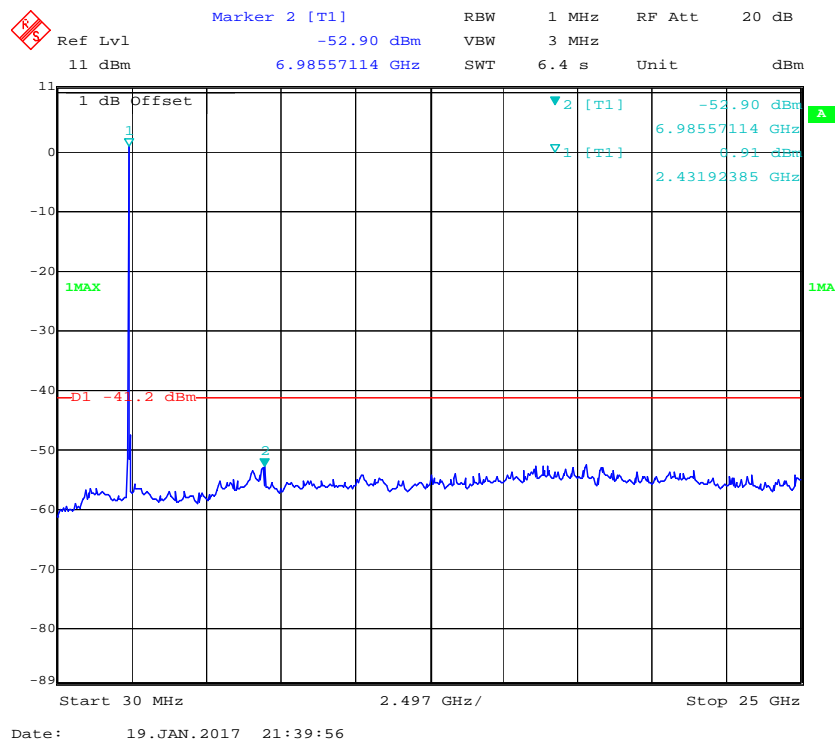
802.11b Low Channel



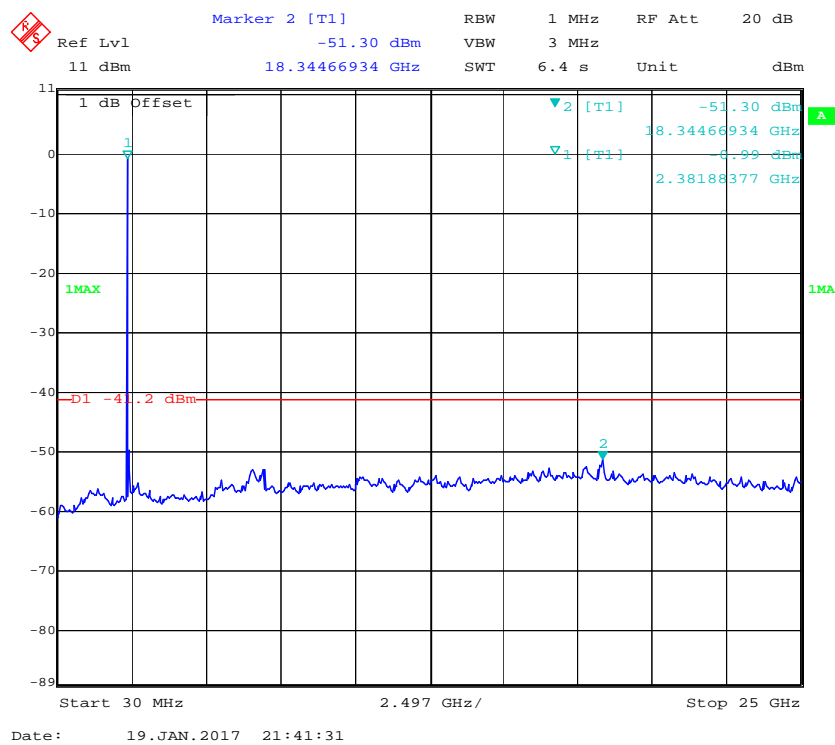
802.11b Middle Channel



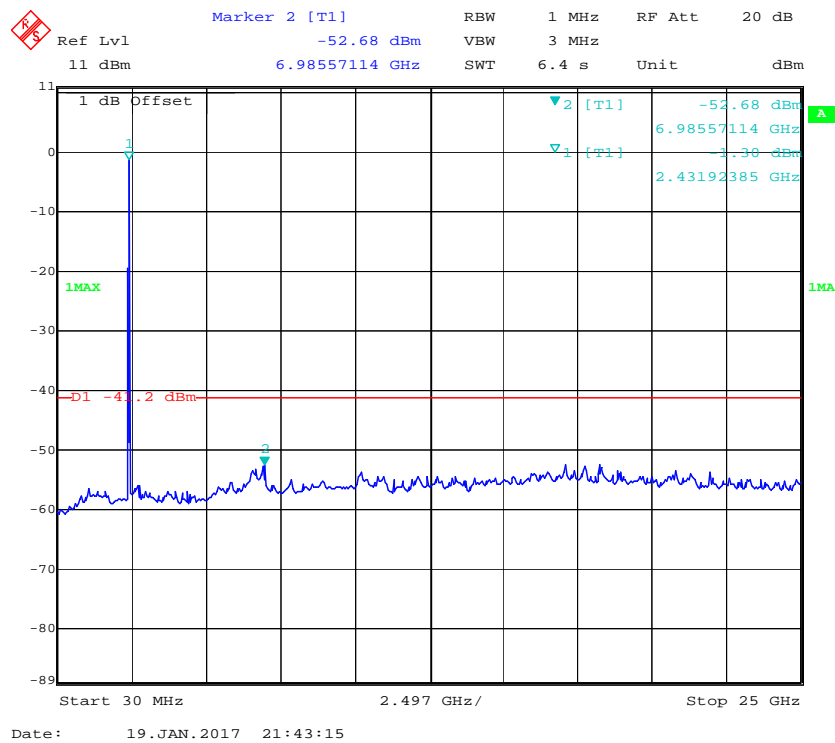
802.11b High Channel



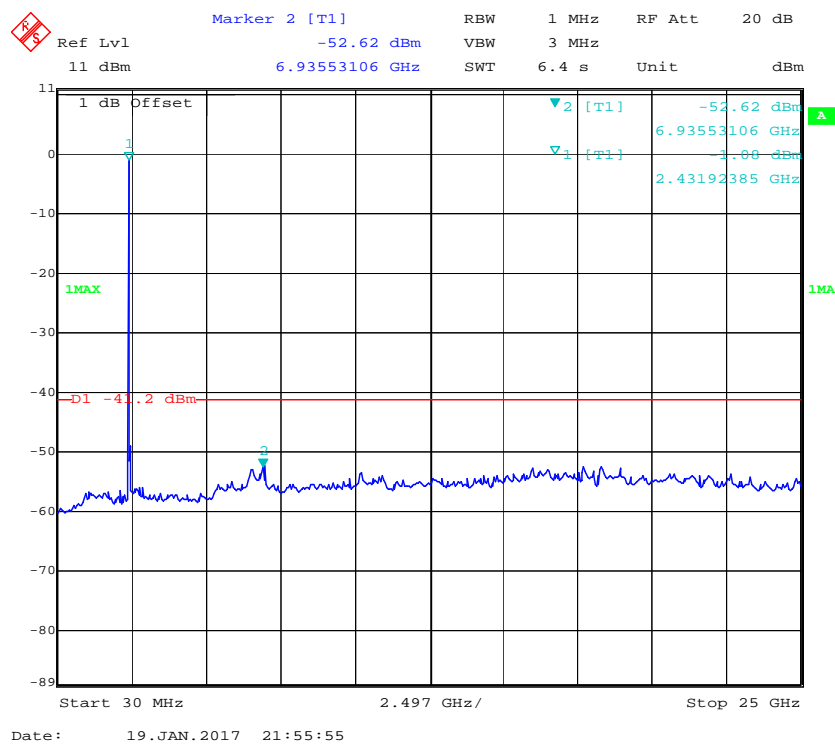
802.11g Low Channel



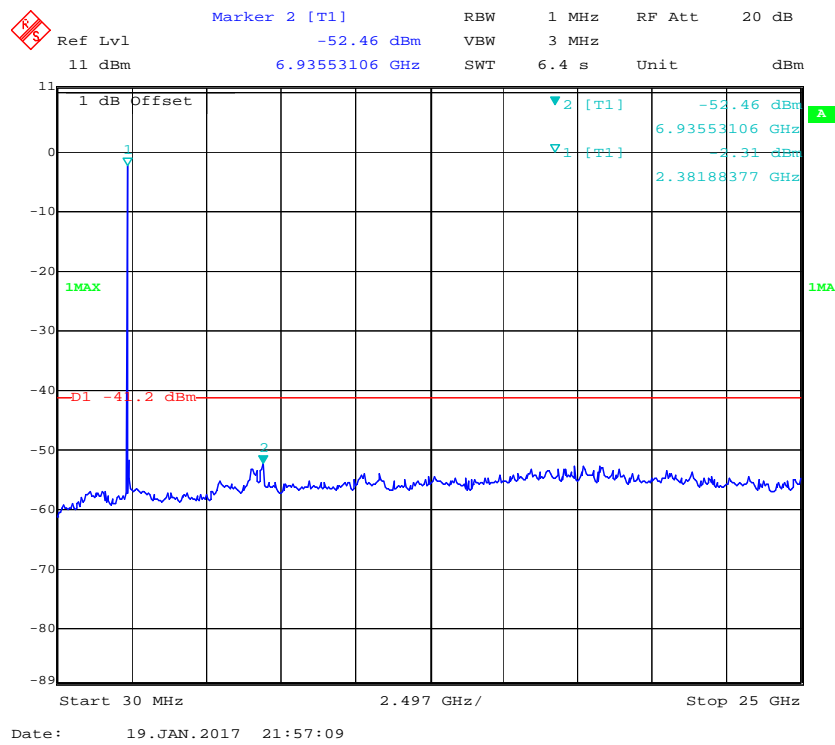
802.11g Middle Channel



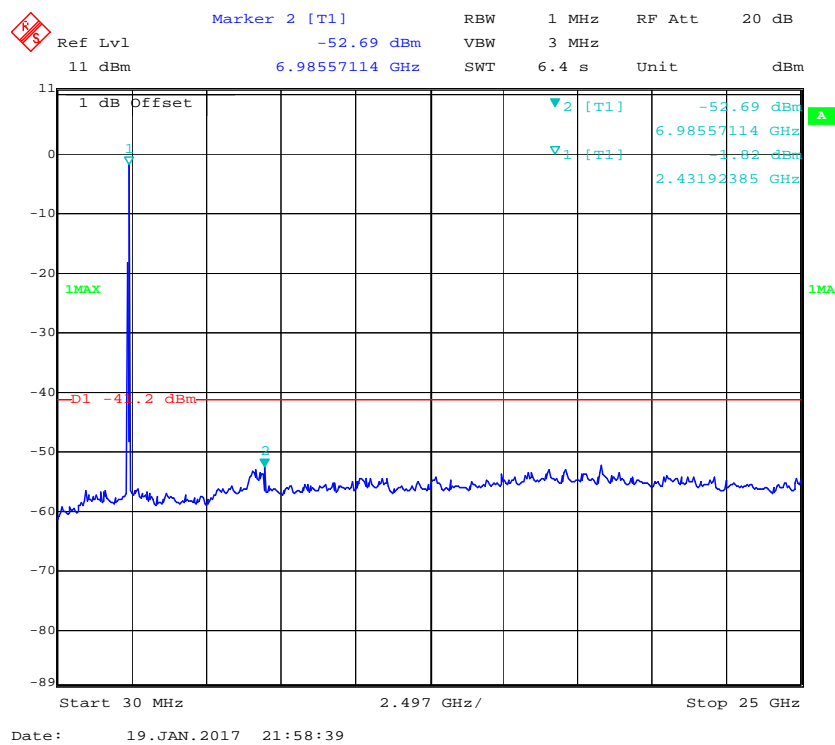
802.11g High Channel



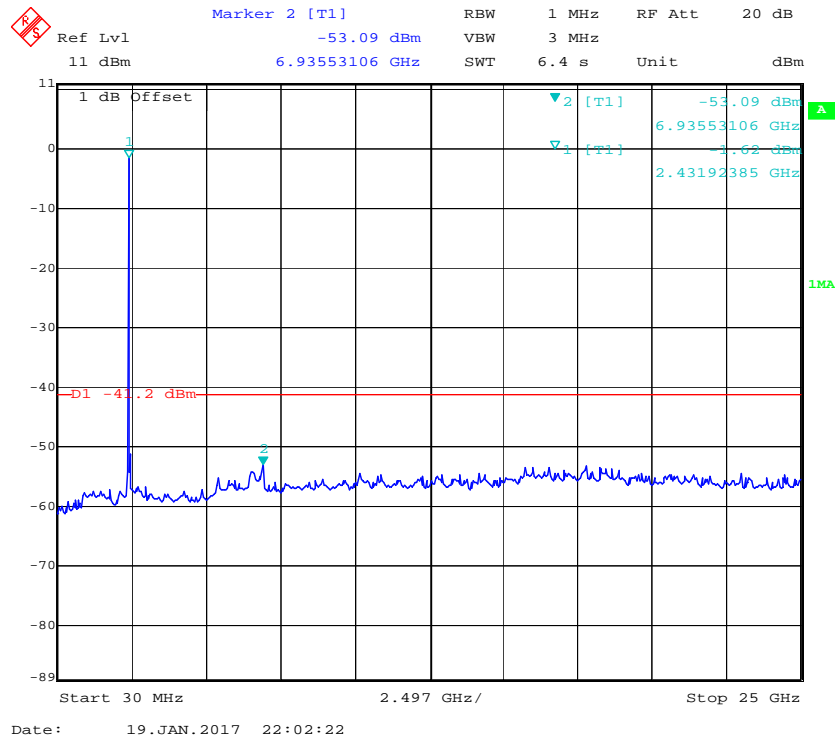
802.11n ht20 Low Channel



802.11n ht20 Middle Channel



802.11n ht20 High Channel



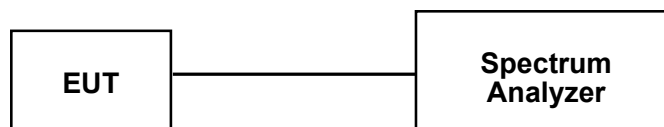
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ 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

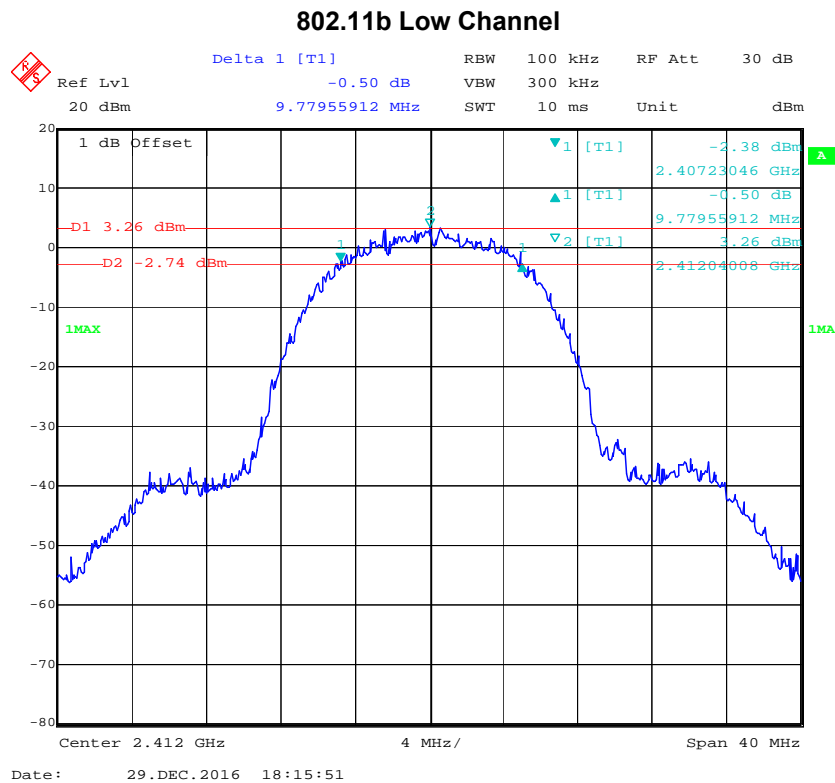
Temperature:	22.8~25.7 °C
Relative Humidity:	32~39 %
ATM Pressure:	101.6~101.8 kPa

* The testing was performed by Lorin Bian from 2016-12-29 to 2017-01-17.

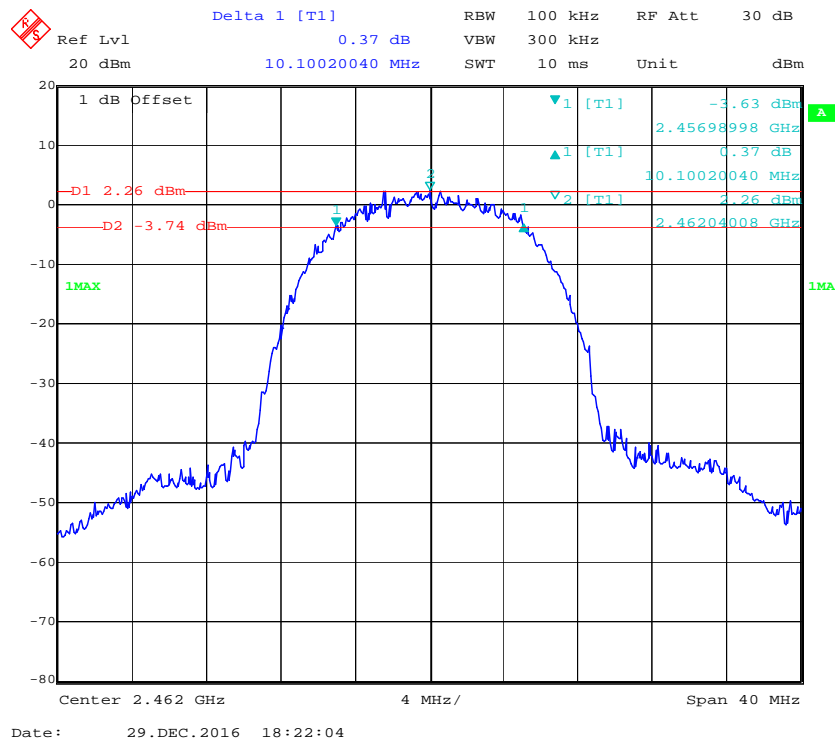
Test Mode: Transmitting

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

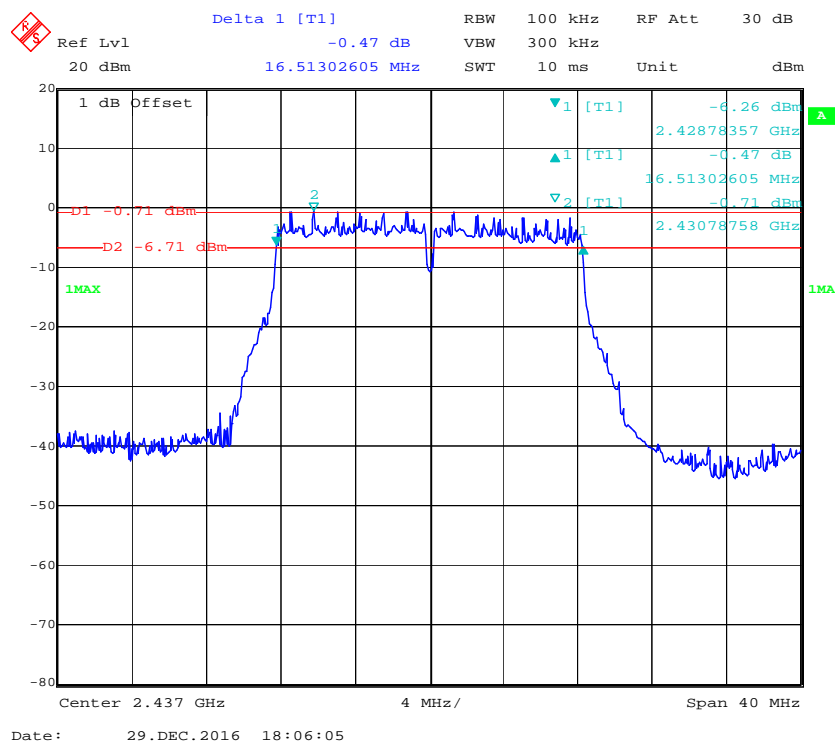
Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	9.78	≥ 0.5
	Middle	2437	10.50	≥ 0.5
	High	2462	10.1	≥ 0.5
802.11g	Low	2412	16.51	≥ 0.5
	Middle	2437	16.51	≥ 0.5
	High	2462	16.59	≥ 0.5
802.11n20	Low	2412	17.64	≥ 0.5
	Middle	2437	17.8	≥ 0.5
	High	2462	17.72	≥ 0.5



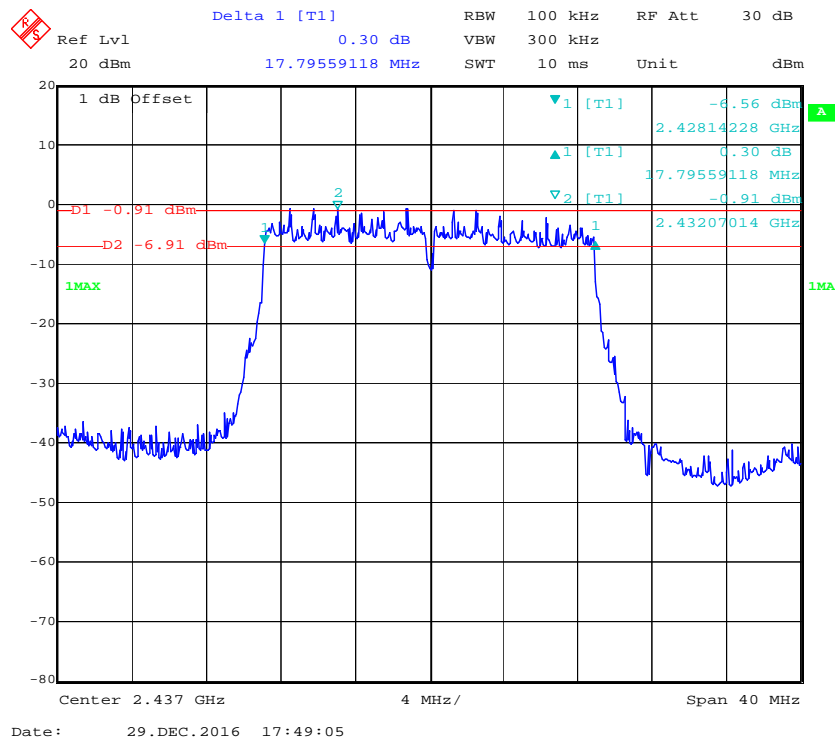
Page 33 of 49



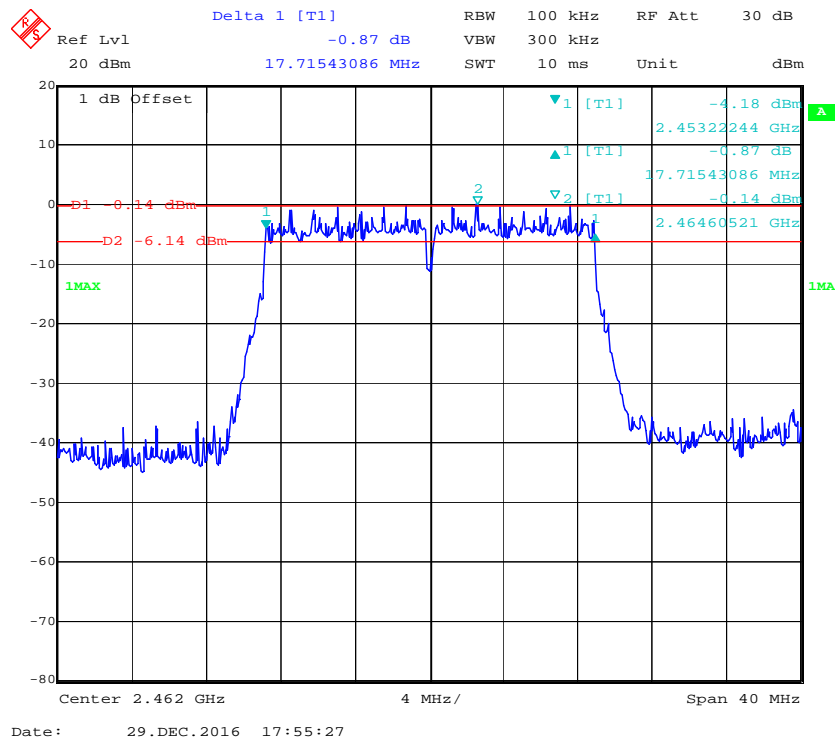
Page 34 of 49



802.11n ht20 Middle Channel



802.11n ht20 High Channel



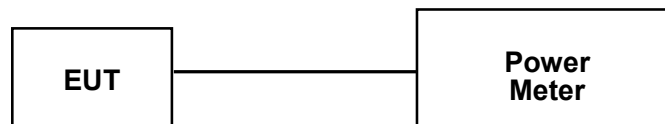
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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	2016-01-03	2017-01-03
Agilent	P-Series Power Meter	N1912A	MY5000798	2016-01-03	2017-01-03
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:	25.7 °C
Relative Humidity:	32 %
ATM Pressure:	101.8 kPa

** The testing was performed by Lorin Bian on 2016-12-29.*

Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
802.11b	Low	2412	19.21	30
	Middle	2437	17.64	30
	High	2462	18.21	30
802.11g	Low	2412	18.61	30
	Middle	2437	17.04	30
	High	2462	17.36	30
802.11n20	Low	2412	17.11	30
	Middle	2437	15.74	30
	High	2462	16.06	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

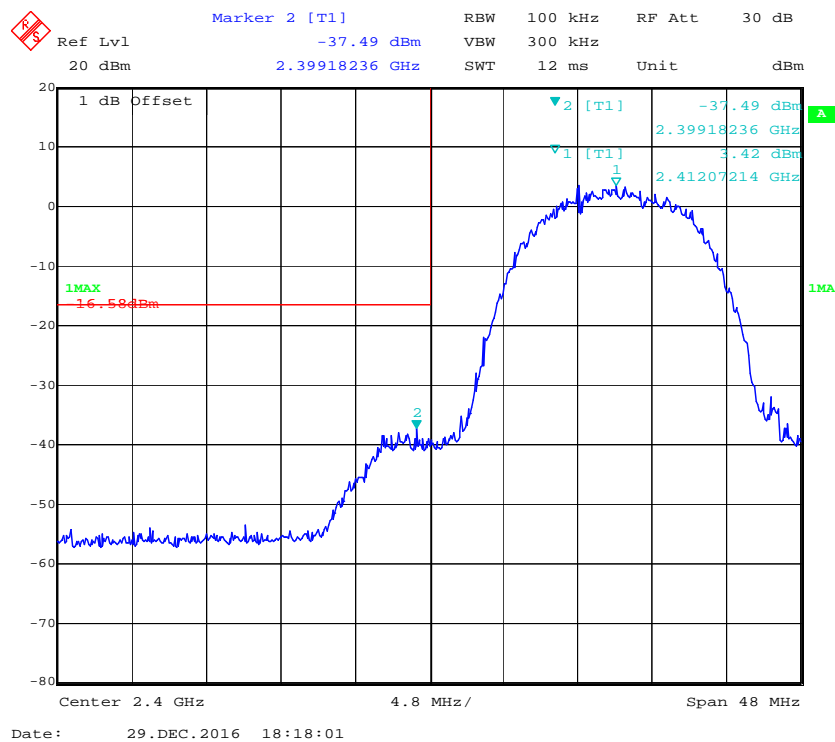
Temperature:	25.7 °C
Relative Humidity:	32 %
ATM Pressure:	101.8 kPa

* The testing was performed by Lorin Bian on 2016-12-29.

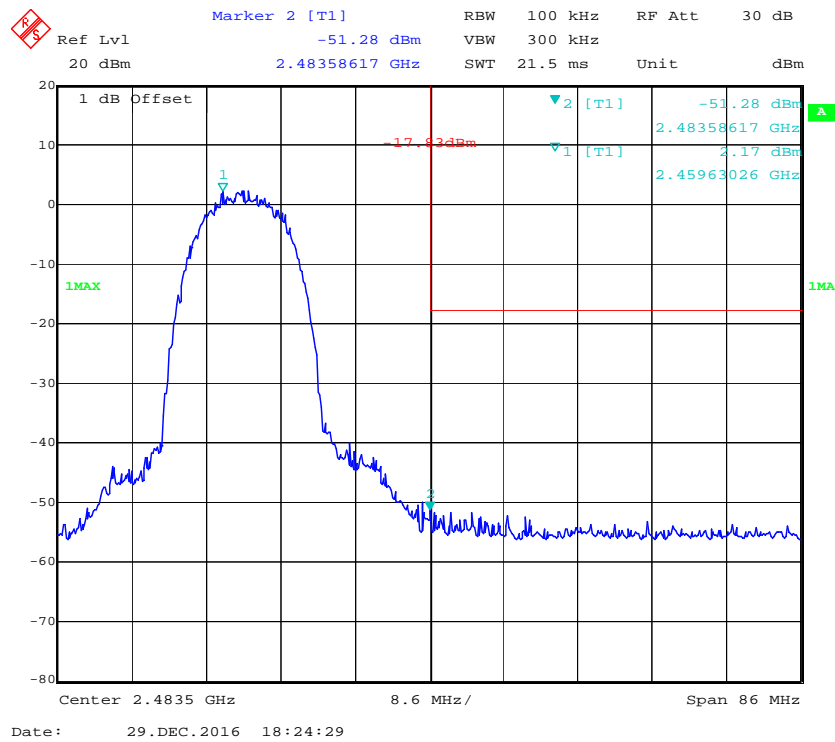
Test mode: Transmitting

Test Result: Compliant. Please refer to following plots.

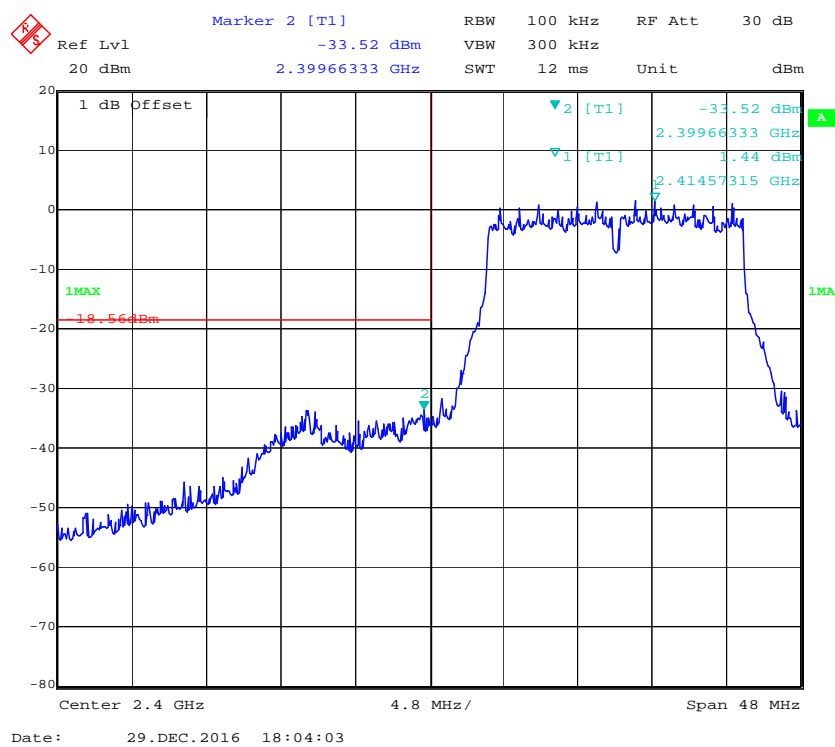
802.11b: Band Edge, Left Side



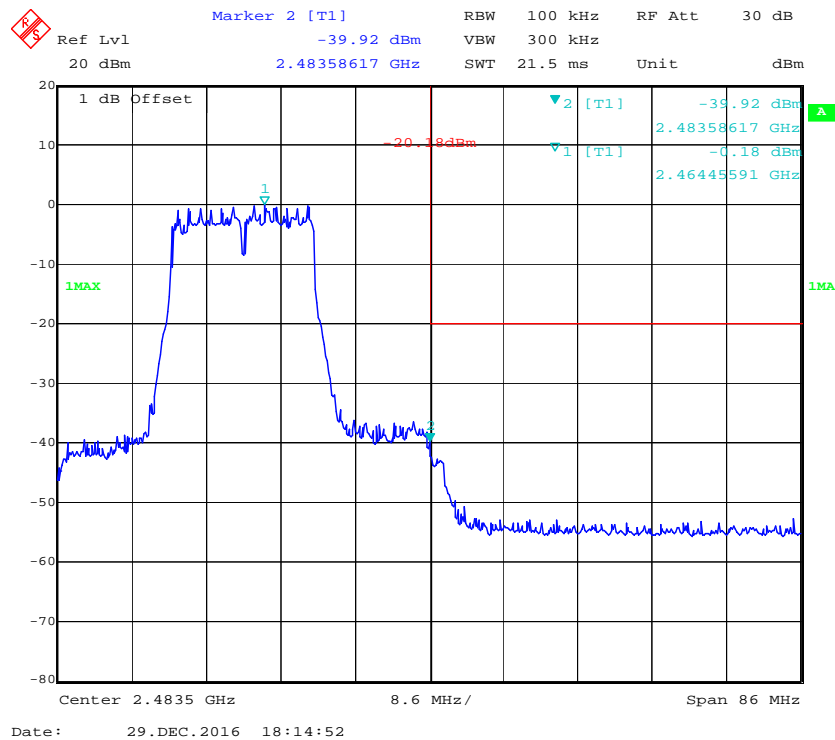
802.11b: Band Edge, Right Side



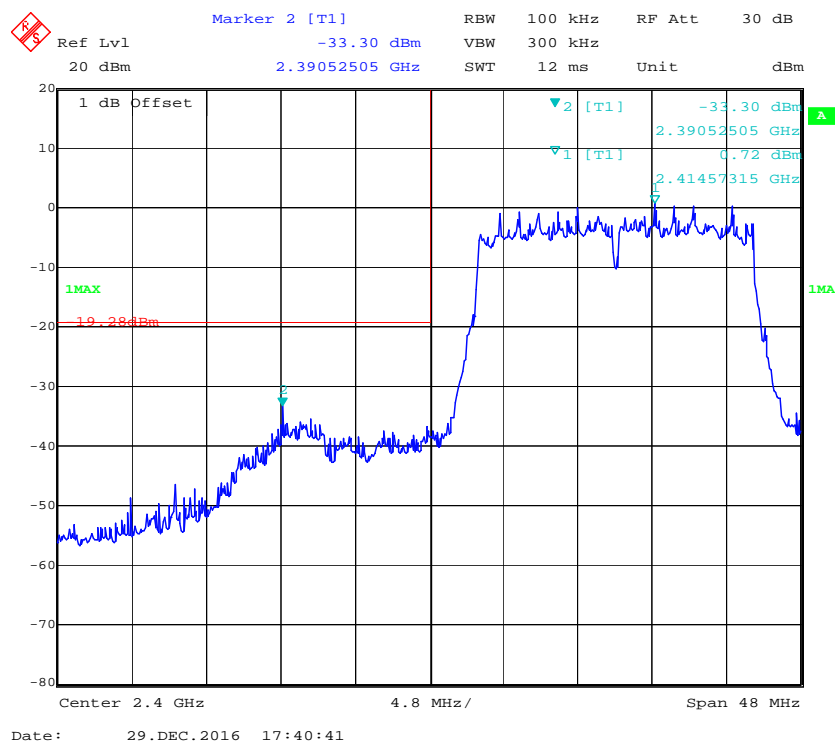
802.11g: Band Edge, Left Side



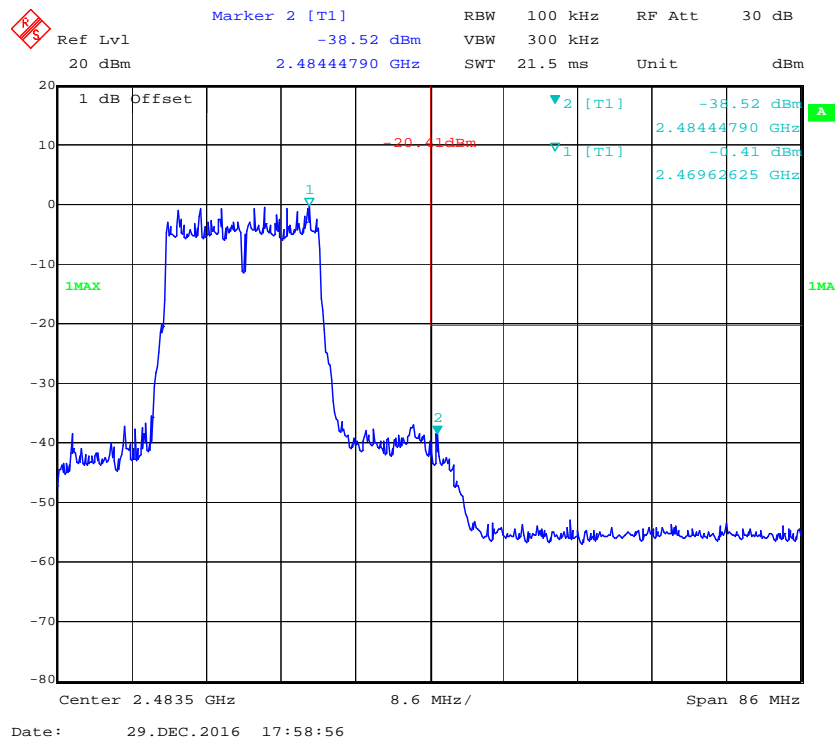
802.11g: Band Edge, Right Side



802.11n ht20 Band Edge, Left Side



802.11n ht20 Band Edge, Right Side



CC §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: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq 3 \times \text{RBW}$.
- 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:	22.8~25.7 °C
Relative Humidity:	32~39 %
ATM Pressure:	101.6~101.8 kPa

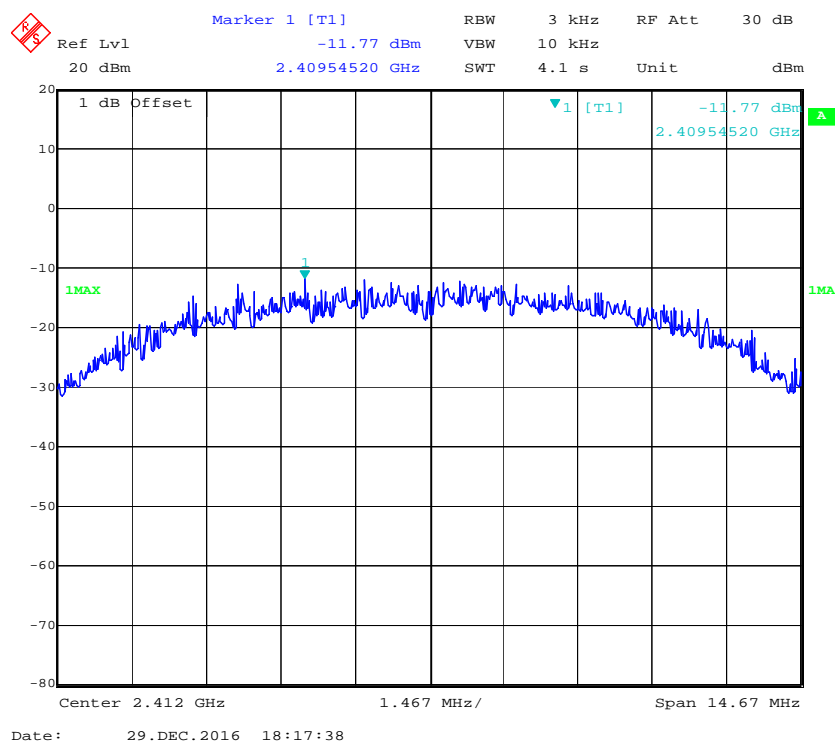
* The testing was performed by Lorin Bian from 2016-12-29 to 2017-01-17.

Test Mode: Transmitting

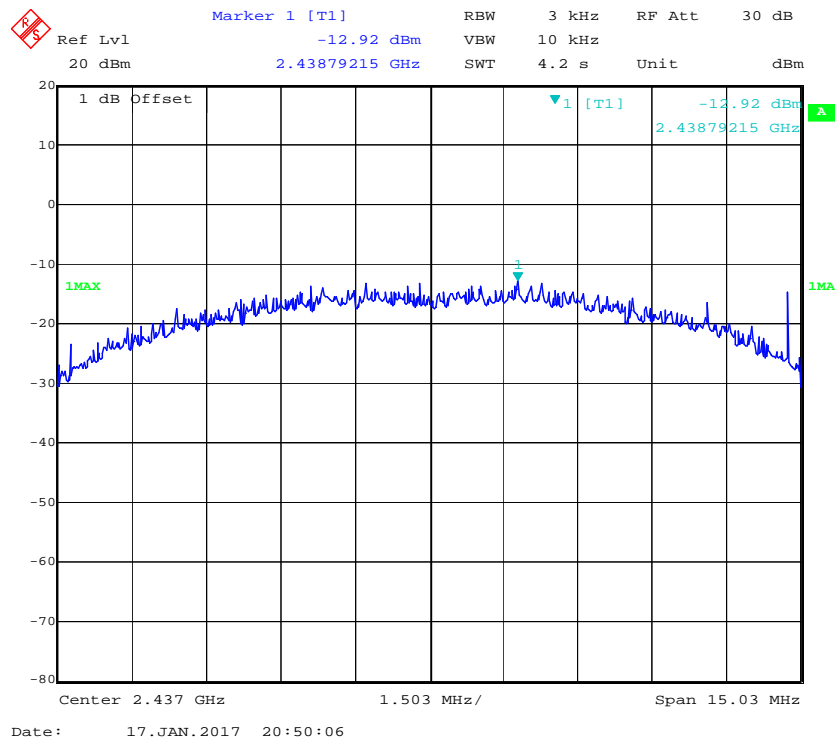
Test Result: Compliant. Please refer to the following table and plots

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-11.77	≤8
	Middle	2437	-12.92	≤8
	High	2462	-12.72	≤8
802.11g	Low	2412	-13.72	≤8
	Middle	2437	-15.47	≤8
	High	2462	-15.34	≤8
802.11n20	Low	2412	-14.54	≤8
	Middle	2437	-16.06	≤8
	High	2462	-15.84	≤8

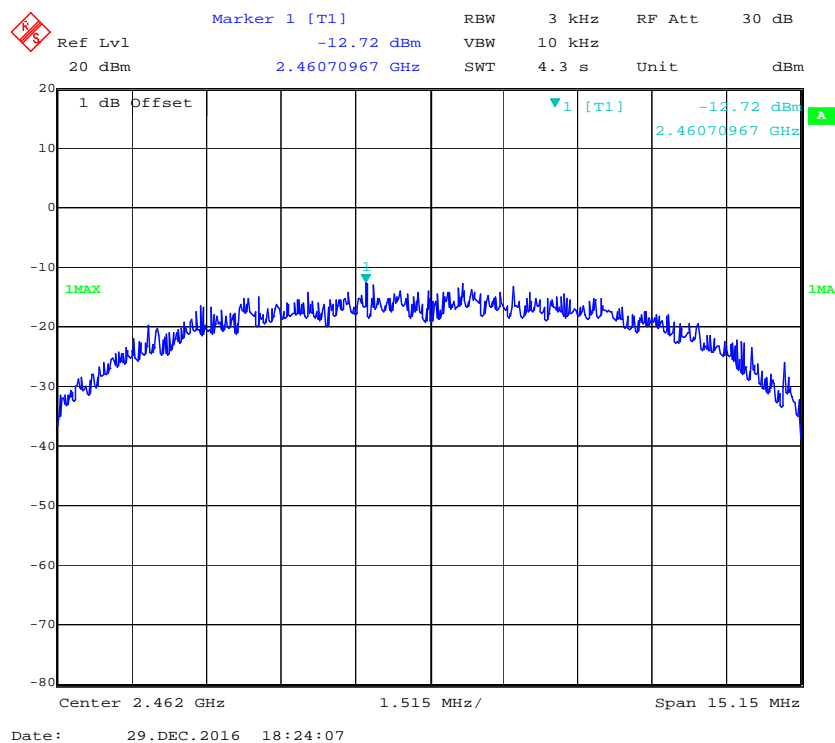
Power Spectral Density, 802.11b Low Channel



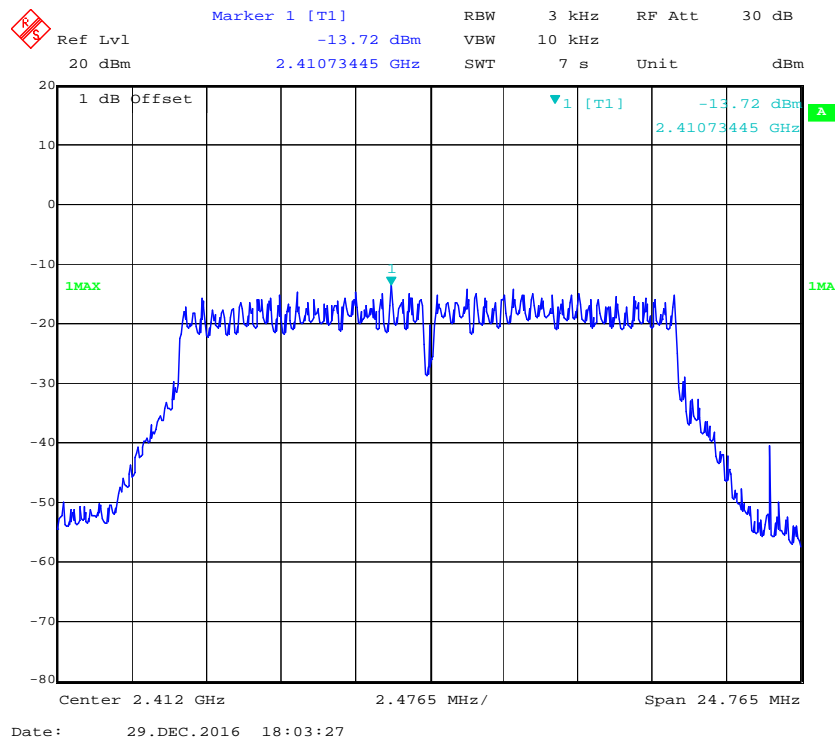
Power Spectral Density, 802.11b Middle Channel



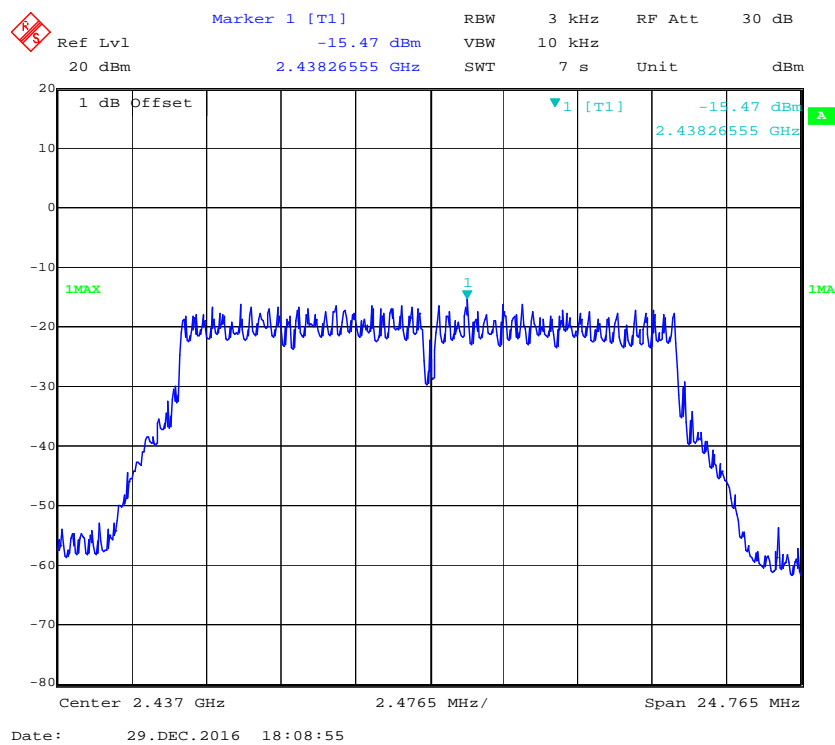
Power Spectral Density, 802.11b High Channel



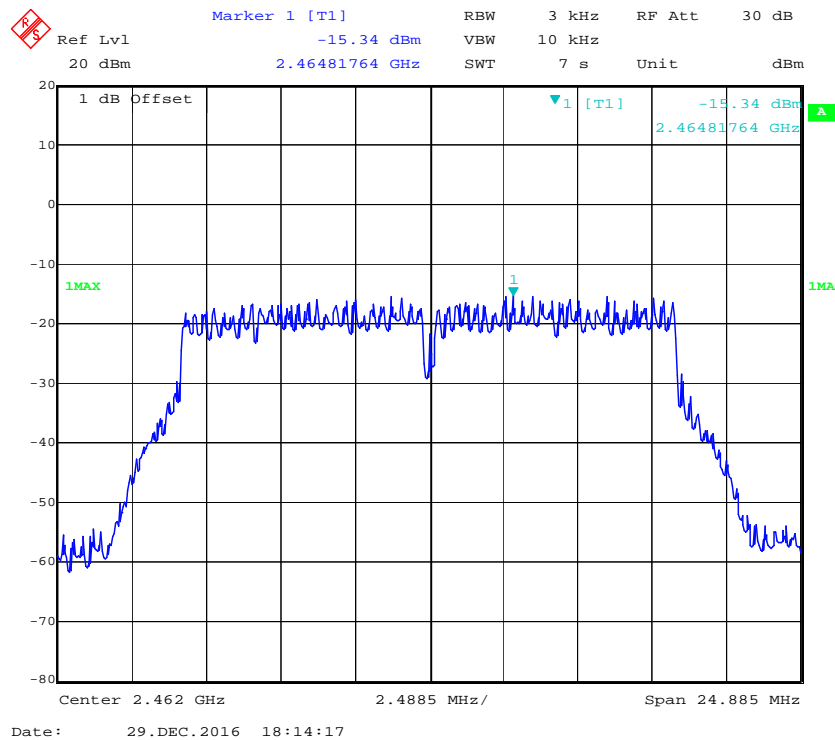
Power Spectral Density, 802.11g Low Channel



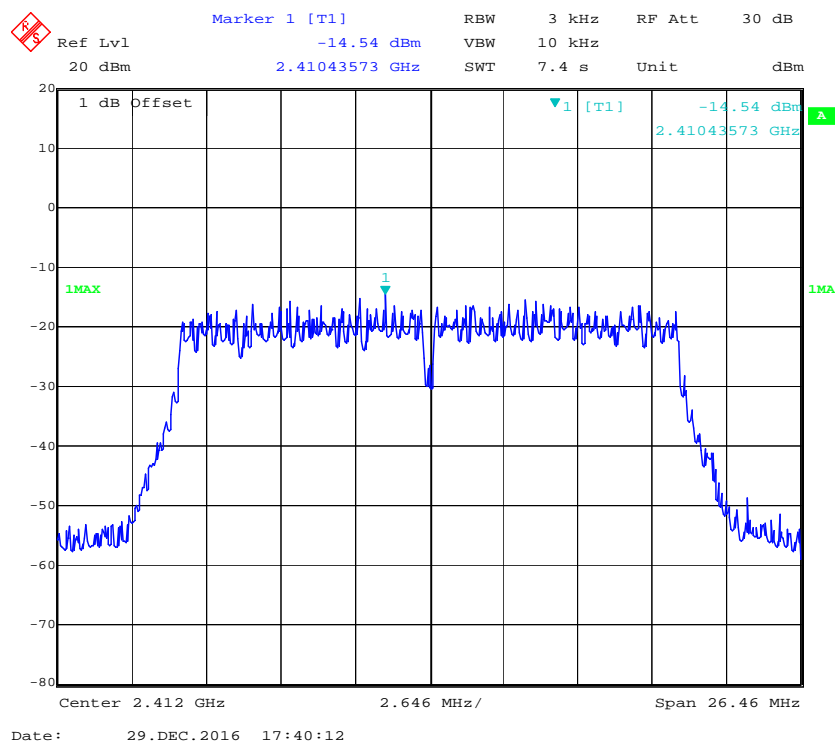
Power Spectral Density, 802.11g Middle Channel



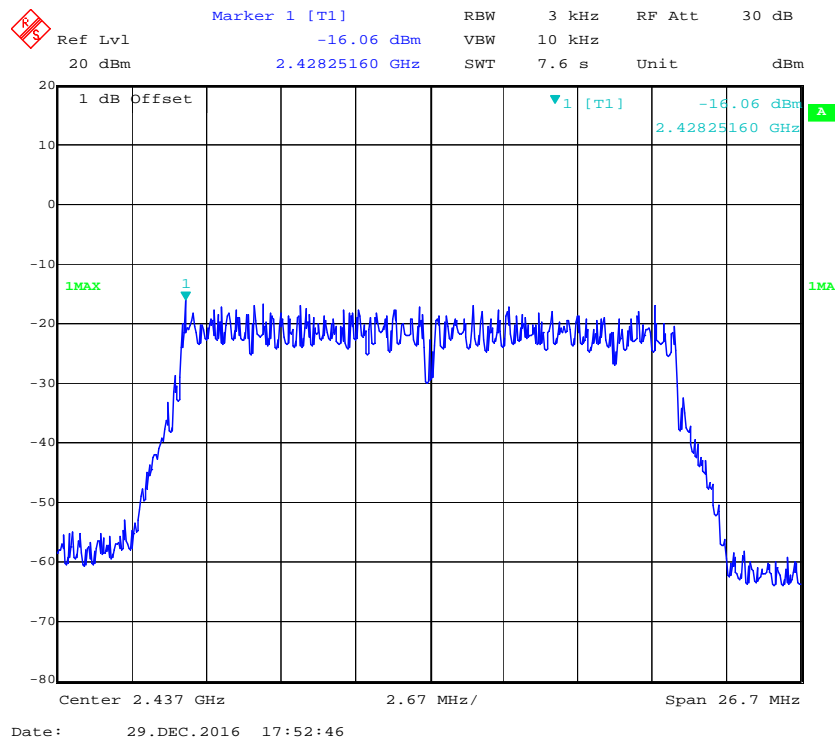
Power Spectral Density, 802.11g High Channel



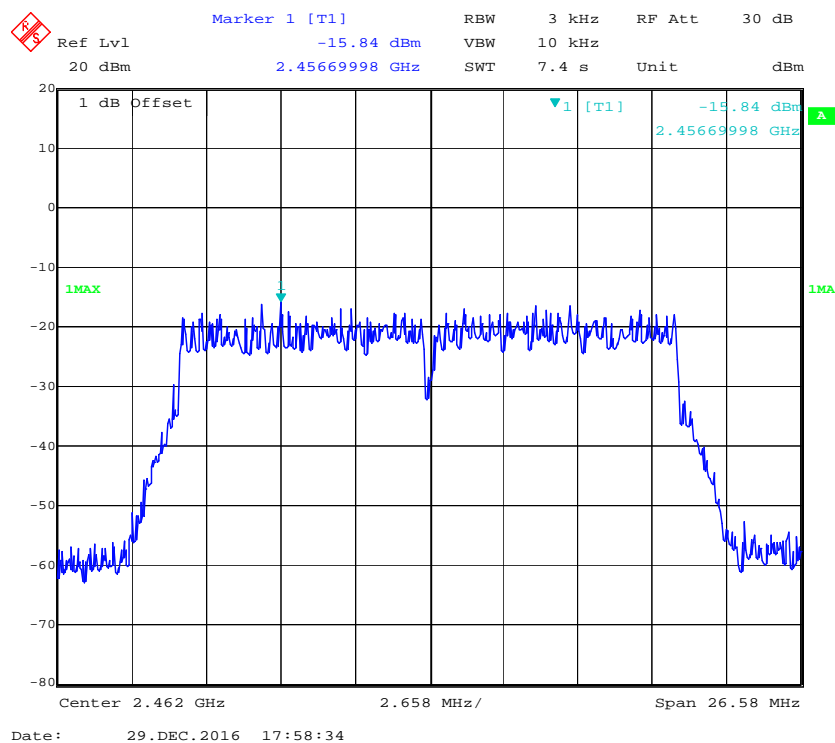
Power Spectral Density, 802.11n ht20 Low Channel



Power Spectral Density, 802.11n ht20 Middle Channel



Power Spectral Density, 802.11n ht20 High Channel



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