



# FCC PART 15.247

## TEST REPORT

For

### Hobbico Inc

2904 Research Road , Champaign, Illinois, United States

**FCC ID: IYFW2**

<b>Report Type:</b> Original Report	<b>Product Name:</b> WiFi Camera Kodo FPV
<b>Test Engineer:</b> <i>Kevin Hu</i>	<i>Kevin hu</i>
<b>Report Number:</b> RDG170503003A	
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<b>Reviewed By:</b> Henry Ding EMC Leader	<i>Henry Ding</i>
<b>Test Laboratory:</b>	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: 028-65525123, Fax: 028-65525125 www.baclcorp.com

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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The **Hobbico Inc**'s product, model number: **DIDE0016 (FCC ID: IYFW2, IC: 11104A-W2)** (the "EUT") in this report was a **WiFi Camera Kodo FPV**, which was measured approximately: 16.9 cm (L) x 16.9 cm (W) x 4.5 cm (H), rated input voltage: DC3.7V from battery and the battery can be removed and charged by using USB charger cable.

*\*All measurement and test data in this report was gathered from final production sample, serial number: 170503003 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-05-04, and EUT conformed to test requirement.*

### Objective

This report is prepared on behalf of **Hobbico Inc** 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 Rules Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209, 15.247 rules

### Related Submittal(s)/Grant(s)

Submitted with the part of a system with FCC ID: IYFD2

### Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"

All of the measurements detailed in this Test Report were performed by Bay Area Compliance Laboratories Corp. (Chengdu).

The Bay Area Compliance Laboratories Corp. Chengdu's measurement Uncertainties (calculated for a k=2 Coverage Factor corresponding to approximately 95% Coverage) were as follows:

-For all of the AC Line Conducted Emissions Tests reported herein:  $\pm 3.17$  dB.  
-For of all of the Direct Antenna Conducted Emissions Tests reported herein:  $\pm 0.56$  dB.

-For of all of the direct Radiated Emissions Tests reported herein are:  
30 MHz to 200 MHz:  $\pm 4.7$  dB;  
200 MHz to 1 GHz:  $\pm 6.0$  dB;  
1 GHz to 6 GHz:  $\pm 5.13$ dB; and,  
6 GHz to 40 GHz:  $\pm 5.47$ 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 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.

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## 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, the device employed 802.11b/g/n20 modes and 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 802.11n20 modes were tested with Channel 1, 6 and 11.

### EUT Exercise Software

The software "DutApiWiFi8801BrdigeUart.exe" was used for testing, which was provided by manufacturer. 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. The maximum power was configured as below table, that provided by the manufacturer:

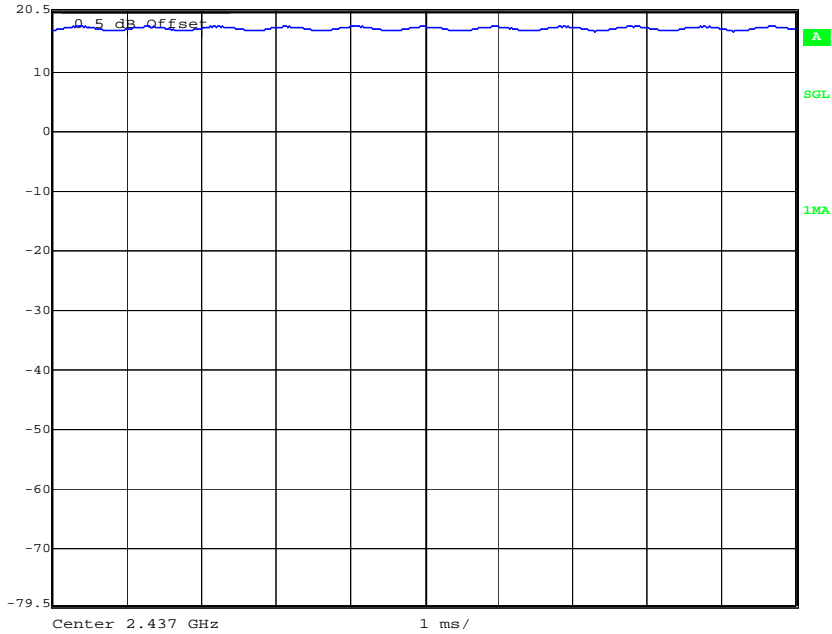
Test Mode	Test Software Version	DutApiWiFi8801BrdigeUart.exe		
		Test Frequency	Data Rate	Power Level Setting
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting	26	26	26
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level Setting	28	28	28
802.11n20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting	28	28	28

The duty cycle as below:

Mode	T <sub>on</sub> (ms)	T <sub>on+off</sub> (ms)	Duty Cycle (%)
802.11 b	10	10	100%
802.11 g	10	10	100%
802.11n ht20	10	10	100%

### 802.11b

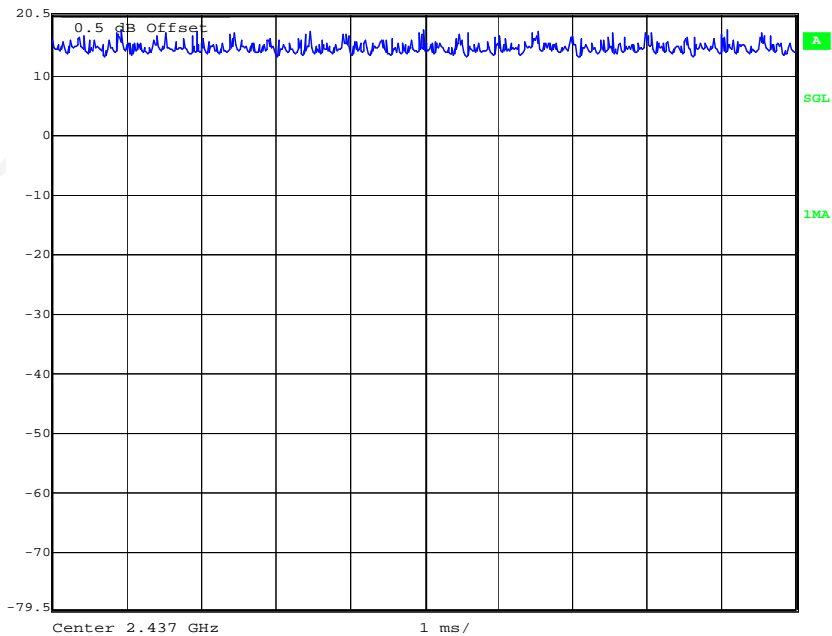
 Ref Lvl 20.5 dBm RBW 10 MHz RF Att 30 dB  
VBW 10 MHz  
SWT 10 ms Unit dBm



Date: 26.MAY.2017 06:26:35

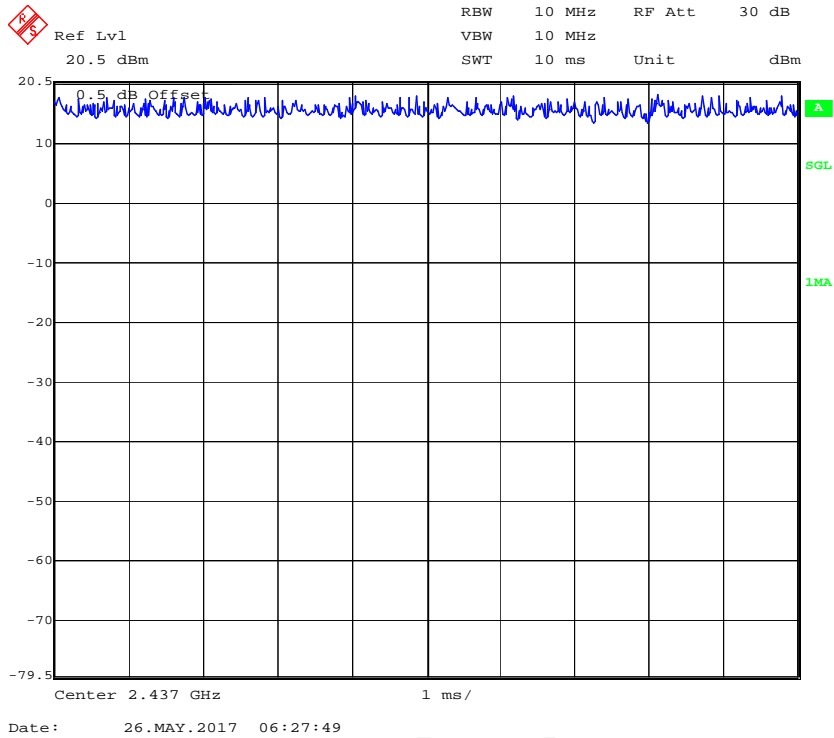
### 802.11g

 Ref Lvl 20.5 dBm RBW 10 MHz RF Att 30 dB  
VBW 10 MHz  
SWT 10 ms Unit dBm



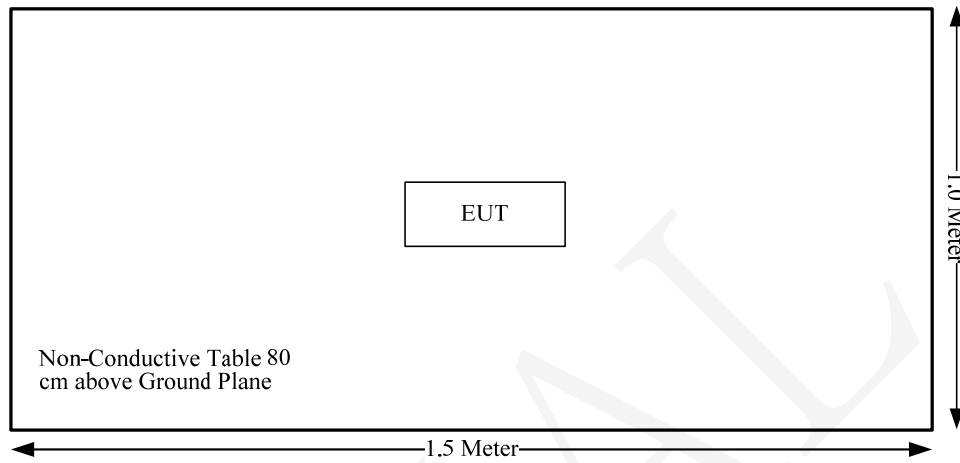
Date: 26.MAY.2017 06:27:12

802.11n ht20

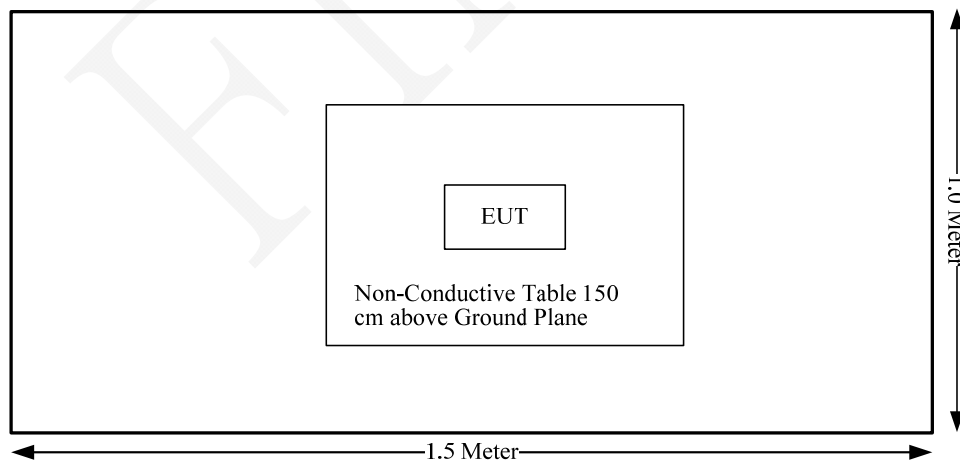


## Block Diagram of Test Setup

30MHz-1GHz:



1GHz-25GHz:





## SUMMARY OF TEST RESULTS

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FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Not Applicable
§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

Note: Not Applicable: the EUT was powered by battery.

## 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 <sup>2</sup> )	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	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.

### Calculation formula:

Prediction of power density at the distance of the applicable MPE limit

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

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		Conducted average output power including Tune-up Tolerance		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
	(dBi)	(numeric)	(dBm)	(mW)			
2412-2462	2	1.58	18	63.10	20.00	0.0199	1.0

**Result:** The device meet FCC MPE at 20 cm distance

## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **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 an IPEX port connect to the internal FPC antenna. The Maximum gain is 2.0 dBi, compliance the requirements, Please refer to the EUT photos.

**Result:** Compliance.

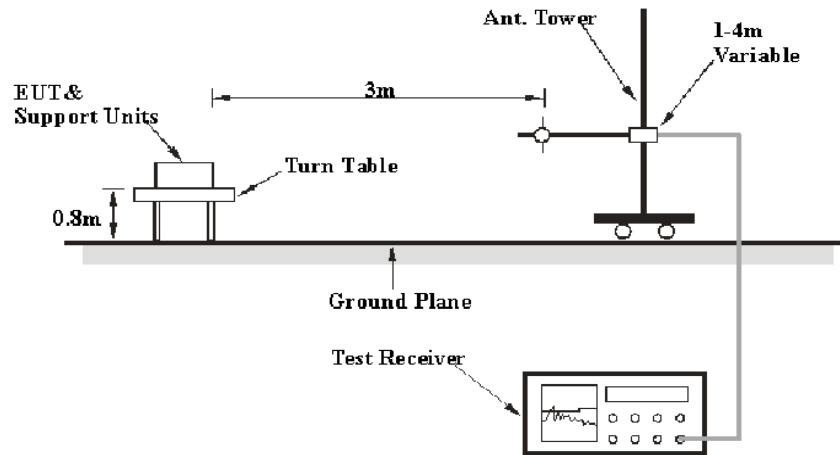
## FCC §15.209, §15.205 , §15.247(d) - SPURIOUS EMISSIONS

### Applicable Standard

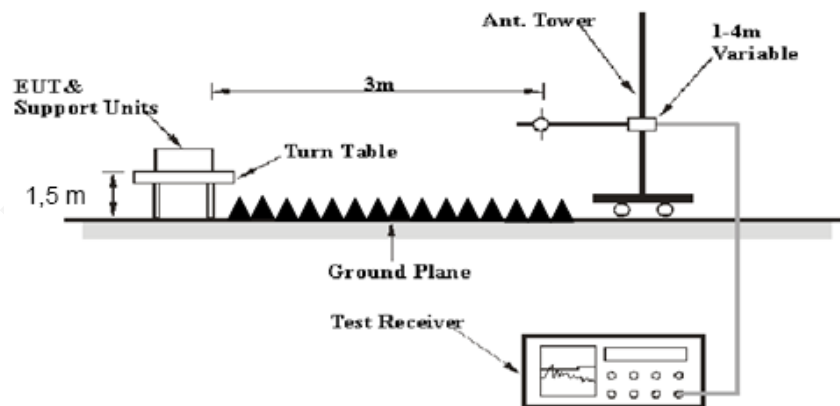
FCC §15.247 (d); §15.209; §15.205;

### EUT Setup

#### Below 1GHz:



#### Above 1GHz:



The radiated emission tests were performed in the 3 meters 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:

30-1000MHz:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

1GHz- 25GHz:

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

## 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	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 Technologies	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) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B "Implementation of traceability policy in accredited laboratories".

### Test Results Summary

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

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	28.6°C
<b>Relative Humidity:</b>	43 %
<b>ATM Pressure:</b>	100.1 kPa

\* The testing was performed by Kevin Hu on 2017-05-26.

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	70.90	PK	H	23.50	3.00	0.00	97.4	N/A	N/A
2412	66.64	AV	H	23.50	3.00	0.00	93.14	N/A	N/A
2412	62.37	PK	V	23.50	3.00	0.00	88.87	N/A	N/A
2412	58.12	AV	V	23.50	3.00	0.00	84.62	N/A	N/A
2390	27.88	PK	H	23.57	3.00	0.00	54.45	74	19.55
2390	15.79	AV	H	23.57	3.00	0.00	42.36	54	11.64
4824	47.77	PK	H	30.84	5.11	26.87	56.85	74	17.15
4824	41.55	AV	H	30.84	5.11	26.87	50.63	54	3.37
7236	43.60	PK	H	34.77	6.18	26.36	58.19	74	15.81
7236	36.72	AV	H	34.77	6.18	26.36	51.31	54	2.69
1352	31.00	PK	H	23.72	2.47	26.47	30.72	74	43.28
1352	19.51	AV	H	23.72	2.47	26.47	19.23	54	34.77
45.76	43.6	QP	H	10.97	0.36	28.51	26.42	40.00	13.58
Middle Channel: 2437 MHz									
2437	71.62	PK	H	23.41	3.00	0.00	98.03	N/A	N/A
2437	66.96	AV	H	23.41	3.00	0.00	93.37	N/A	N/A
2437	62.21	PK	V	23.41	3.00	0.00	88.62	N/A	N/A
2437	58.78	AV	V	23.41	3.00	0.00	85.19	N/A	N/A
4874	48.74	PK	H	31.00	5.09	26.87	57.96	74	16.04
4874	42.59	AV	H	31.00	5.09	26.87	51.81	54	2.19
7311	43.54	PK	H	34.92	6.21	26.40	58.27	74	15.73
7311	37.79	AV	H	34.92	6.21	26.40	52.52	54	1.48
1389	31.97	PK	H	23.81	2.52	26.44	31.86	74	42.14
1389	21.70	AV	H	23.81	2.52	26.44	21.59	54	32.41
3120	38.92	PK	H	24.87	3.61	26.45	40.95	74	33.05
3120	28.66	AV	H	24.87	3.61	26.45	30.69	54	23.31
45.76	43.74	QP	H	10.97	0.36	28.51	26.56	40.00	13.44
High Channel: 2462 MHz									
2462	71.22	PK	H	23.33	2.99	0.00	97.54	N/A	N/A
2462	67.17	AV	H	23.33	2.99	0.00	93.49	N/A	N/A
2462	62.44	PK	V	23.33	2.99	0.00	88.76	N/A	N/A
2462	58.95	AV	V	23.33	2.99	0.00	85.27	N/A	N/A
2483.5	32.34	PK	H	23.26	2.99	0.00	58.59	74	15.41
2483.5	16.56	AV	H	23.26	2.99	0.00	42.81	54	11.19
4924	48.06	PK	H	31.16	5.07	26.88	57.41	74	16.59
4924	41.87	AV	H	31.16	5.07	26.88	51.22	54	2.78
7386	44.18	PK	H	35.07	6.25	26.43	59.07	74	14.93
7386	36.75	AV	H	35.07	6.25	26.43	51.64	54	2.36
1421	32.30	PK	H	23.89	2.56	26.41	32.34	74	41.66
1421	20.34	AV	H	23.89	2.56	26.41	20.38	54	33.62
45.76	44.16	QP	H	10.97	0.36	28.51	26.98	40.00	13.02

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	70.52	PK	H	23.50	3.00	0.00	97.02	N/A	N/A
2412	61.86	AV	H	23.50	3.00	0.00	88.36	N/A	N/A
2412	60.29	PK	V	23.50	3.00	0.00	86.79	N/A	N/A
2412	51.63	AV	V	23.50	3.00	0.00	78.13	N/A	N/A
2390	35.35	PK	H	23.57	3.00	0.00	61.92	74	12.08
2390	24.22	AV	H	23.57	3.00	0.00	50.79	54	3.21
4824	47.77	PK	H	30.84	5.11	26.87	56.85	74	17.15
4824	36.15	AV	H	30.84	5.11	26.87	45.23	54	8.77
7236	43.60	PK	H	34.77	6.18	26.36	58.19	74	15.81
7236	32.07	AV	H	34.77	6.18	26.36	46.66	54	7.34
1352	31.00	PK	H	23.72	2.47	26.47	30.72	74	43.28
1352	19.51	AV	H	23.72	2.47	26.47	19.23	54	34.77
45.76	44.6	QP	H	10.97	0.36	28.51	27.42	40.00	12.58
Middle Channel: 2437 MHz									
2437	71.82	PK	H	23.41	3.00	0.00	98.23	N/A	N/A
2437	62.06	AV	H	23.41	3.00	0.00	88.47	N/A	N/A
2437	64.38	PK	V	23.41	3.00	0.00	90.79	N/A	N/A
2437	53.01	AV	V	23.41	3.00	0.00	79.42	N/A	N/A
4874	26.08	PK	H	31.00	5.09	26.87	35.3	74	38.7
4874	15.04	AV	H	31.00	5.09	26.87	24.26	54	29.74
7311	46.97	PK	H	34.92	6.21	26.40	61.7	74	12.3
7311	35.62	AV	H	34.92	6.21	26.40	50.35	54	3.65
1389	40.34	PK	H	23.81	2.52	26.44	40.23	74	33.77
1389	29.08	AV	H	23.81	2.52	26.44	28.97	54	25.03
3120	40.38	PK	H	24.87	3.61	26.45	42.41	74	31.59
3120	29.04	AV	H	24.87	3.61	26.45	31.07	54	22.93
45.76	45.04	QP	H	10.97	0.36	28.51	27.86	40.00	12.14
High Channel: 2462 MHz									
2462	71.16	PK	H	23.33	2.99	0.00	97.48	N/A	N/A
2462	59.09	AV	H	23.33	2.99	0.00	85.41	N/A	N/A
2462	61.09	PK	V	23.33	2.99	0.00	87.41	N/A	N/A
2462	51.70	AV	V	23.33	2.99	0.00	78.02	N/A	N/A
2483.5	36.17	PK	H	23.26	2.99	0.00	62.42	74	11.58
2483.5	24.89	AV	H	23.26	2.99	0.00	51.14	54	2.86
4924	48.29	PK	H	31.16	5.07	26.88	57.64	74	16.36
4924	36.46	AV	H	31.16	5.07	26.88	45.81	54	8.19
7386	44.47	PK	H	35.07	6.25	26.43	59.36	74	14.64
7386	32.32	AV	H	35.07	6.25	26.43	47.21	54	6.79
1421	31.08	PK	H	23.89	2.56	26.41	31.12	74	42.88
1421	19.64	AV	H	23.89	2.56	26.41	19.68	54	34.32
45.76	44.39	QP	H	10.97	0.36	28.51	27.21	40.00	12.79



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	70.66	PK	H	23.50	3.00	0.00	97.16	N/A	N/A
2412	60.09	AV	H	23.50	3.00	0.00	86.59	N/A	N/A
2412	63.29	PK	V	23.50	3.00	0.00	89.79	N/A	N/A
2412	51.97	AV	V	23.50	3.00	0.00	78.47	N/A	N/A
2390	35.89	PK	H	23.57	3.00	0.00	62.46	74	11.54
2390	24.62	AV	H	23.57	3.00	0.00	51.19	54	2.81
4824	47.96	PK	H	30.84	5.11	26.87	57.04	74	16.96
4824	36.84	AV	H	30.84	5.11	26.87	45.92	54	8.08
7236	43.80	PK	H	34.77	6.18	26.36	58.39	74	15.61
7236	31.93	AV	H	34.77	6.18	26.36	46.52	54	7.48
1352	30.65	PK	H	23.72	2.47	26.47	30.37	74	43.63
1352	19.11	AV	H	23.72	2.47	26.47	18.83	54	35.17
45.76	44.53	QP	H	10.97	0.36	28.51	27.35	40.00	12.65
Middle Channel: 2437 MHz									
2437	70.79	PK	H	23.41	3.00	0.00	97.2	N/A	N/A
2437	59.56	AV	H	23.41	3.00	0.00	85.97	N/A	N/A
2437	62.95	PK	V	23.41	3.00	0.00	89.36	N/A	N/A
2437	51.72	AV	V	23.41	3.00	0.00	78.13	N/A	N/A
4874	47.32	PK	H	31.00	5.09	26.87	56.54	74	17.46
4874	35.65	AV	H	31.00	5.09	26.87	44.87	54	9.13
7311	47.69	PK	H	34.92	6.21	26.40	62.42	74	11.58
7311	36.30	AV	H	34.92	6.21	26.40	51.03	54	2.97
1389	40.62	PK	H	23.81	2.52	26.44	40.51	74	33.49
1389	27.85	AV	H	23.81	2.52	26.44	27.74	54	26.26
3120	39.27	PK	H	24.87	3.61	26.45	41.3	74	32.7
3120	28.58	AV	H	24.87	3.61	26.45	30.61	54	23.39
45.76	44.95	QP	H	10.97	0.36	28.51	27.77	40.00	12.23
High Channel: 2462 MHz									
2462	71.54	PK	H	23.33	2.99	0.00	97.86	N/A	N/A
2462	59.96	AV	H	23.33	2.99	0.00	86.28	N/A	N/A
2462	63.25	PK	V	23.33	2.99	0.00	89.57	N/A	N/A
2462	52.10	AV	V	23.33	2.99	0.00	78.42	N/A	N/A
2483.5	36.40	PK	H	23.26	2.99	0.00	62.65	74	11.35
2483.5	24.98	AV	H	23.26	2.99	0.00	51.23	54	2.77
4924	47.54	PK	H	31.16	5.07	26.88	56.89	74	17.11
4924	36.08	AV	H	31.16	5.07	26.88	45.43	54	8.57
7386	44.48	PK	H	35.07	6.25	26.43	59.37	74	14.63
7386	32.55	AV	H	35.07	6.25	26.43	47.44	54	6.56
1421	30.91	PK	H	23.89	2.56	26.41	30.95	74	43.05
1421	19.25	AV	H	23.89	2.56	26.41	19.29	54	34.71
45.76	45.39	QP	H	10.97	0.36	28.51	28.21	40.00	11.79

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

### Applicable Standard

According to FCC §15.247(a) (2)

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.
- h) Measure the 99% bandwidth use OBW test function.



### 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
Unknown	RF Cable	Unknown	C-5	Each Time	/

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

### Test Data

#### Environmental Conditions

Temperature:	28.6 °C
Relative Humidity:	43 %
ATM Pressure:	100.1 kPa

\* The testing was performed by Kevin Hu on 2017-05-26.

*Test Mode: Transmitting*

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

<b>Test mode</b>	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>6 dB Emission Bandwidth (MHz)</b>	<b>Limit (MHz)</b>
802.11b	Low	2412	10.18	≥0.5
	Middle	2437	10.10	≥0.5
	High	2462	10.18	≥0.5
802.11g	Low	2412	16.59	≥0.5
	Middle	2437	16.59	≥0.5
	High	2462	16.59	≥0.5
802.11n ht20	Low	2412	17.72	≥0.5
	Middle	2437	17.88	≥0.5
	High	2462	17.88	≥0.5

6dB Emission Bandwidth:

802.11b Low Channel



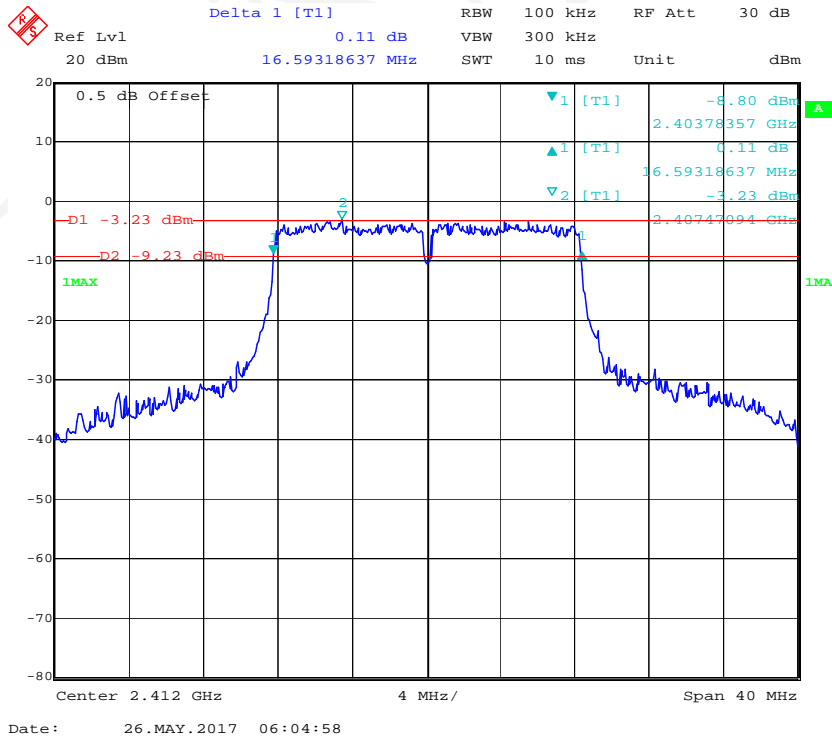
802.11b Middle Channel



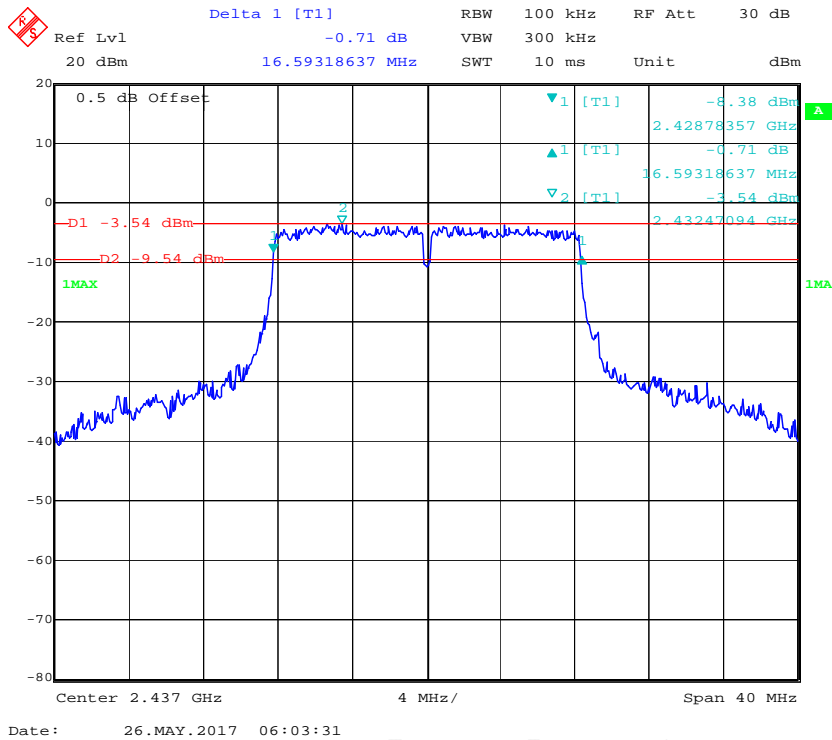
### 802.11b High Channel



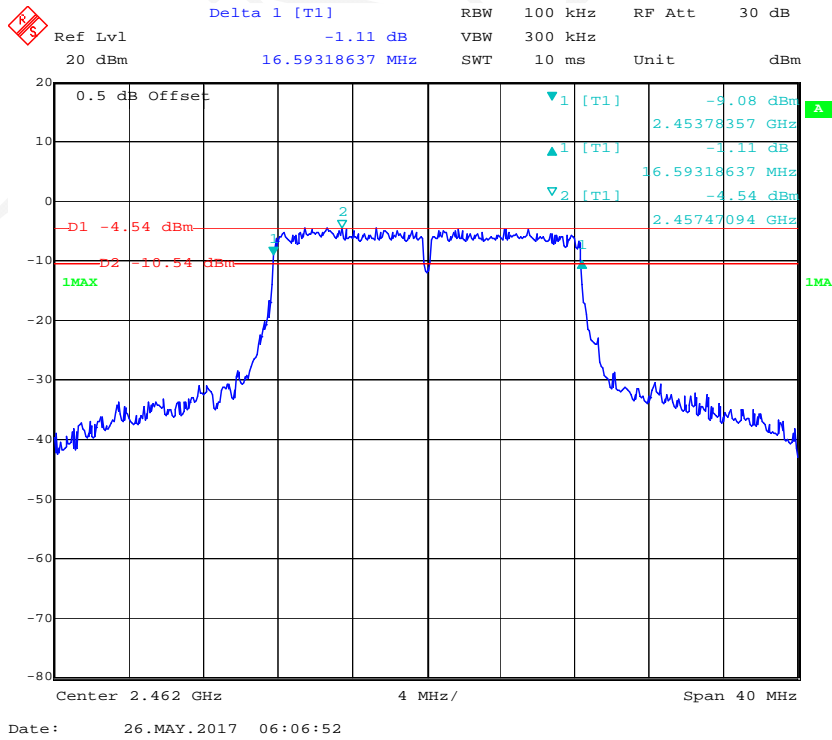
### 802.11g Low Channel



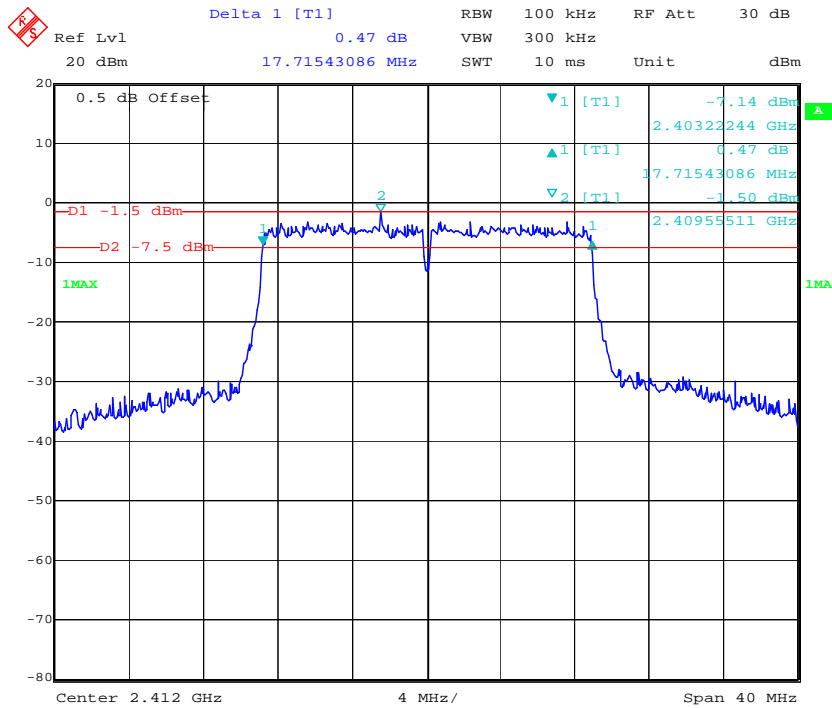
### 802.11g Middle Channel



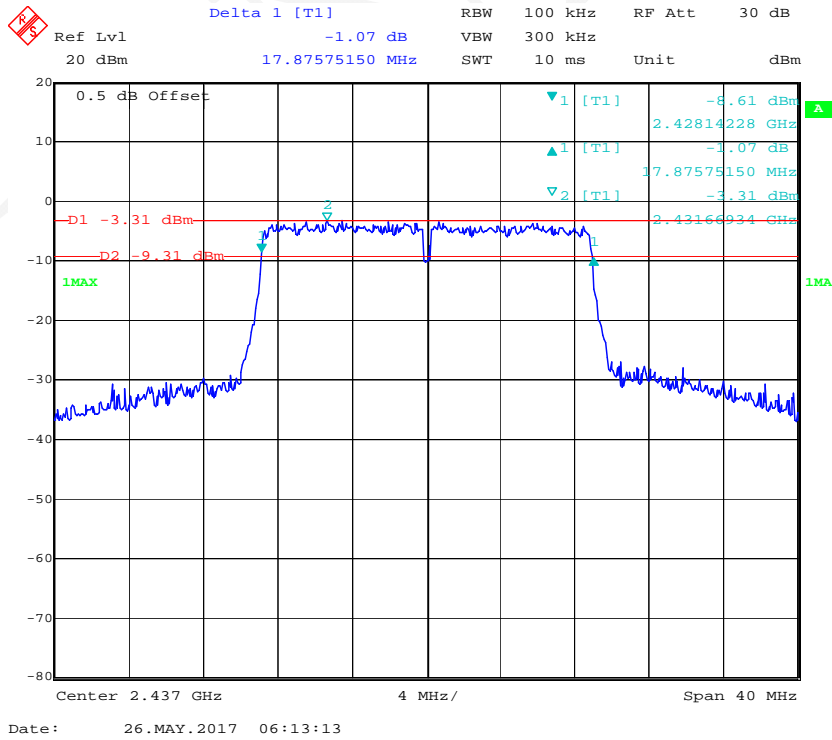
### 802.11g High Channel



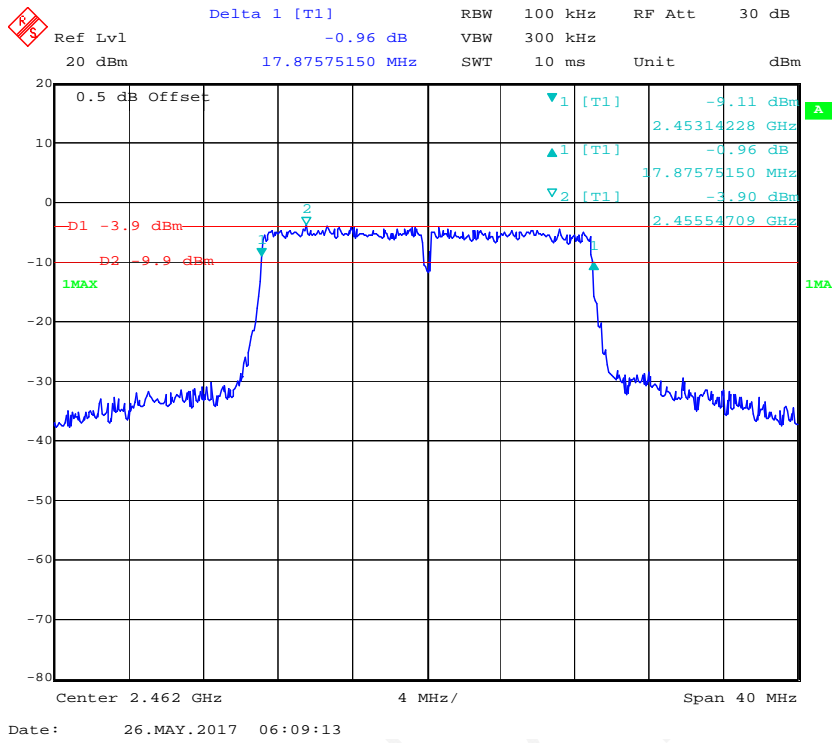
### 802.11n ht20 Low Channel



### 802.11n ht20 Middle Channel



### 802.11n ht20 High Channel





## FCC §15.247(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.
4. Set the power Meter to test Peak output power, record the result as peak power.



### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54170074	2017-01-03	2018-01-03
Agilent	P-Series Power Meter	N1912A	MY5000798	2017-01-03	2018-01-03
Unknown	RF Cable	Unknown	C-5	Each Time	/

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B "Implementation of traceability policy in accredited laboratories".

### Test Data

#### Environmental Conditions

Temperature:	28.6 °C
Relative Humidity:	43 %
ATM Pressure:	100.1 kPa

\* The testing was performed by Kevin Hu on 2017-05-26.

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	17.74	30
	Middle	2437	16.56	30
	High	2462	16.22	30
802.11g	Low	2412	17.58	30
	Middle	2437	17.16	30
	High	2462	16.23	30
802.11n ht20	Low	2412	17.85	30
	Middle	2437	17.45	30
	High	2462	16.97	30

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

### **Applicable Standard**

According to FCC§15.247(d):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 to 300 kHz of spectrum analyzer 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**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
Unknown	RF Cable	Unknown	C-5	Each Time	/

\* **Statement of Traceability:** BAACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

## Test Data

### Environmental Conditions

<b>Temperature:</b>	28.6 °C
<b>Relative Humidity:</b>	43 %
<b>ATM Pressure:</b>	100.1 kPa

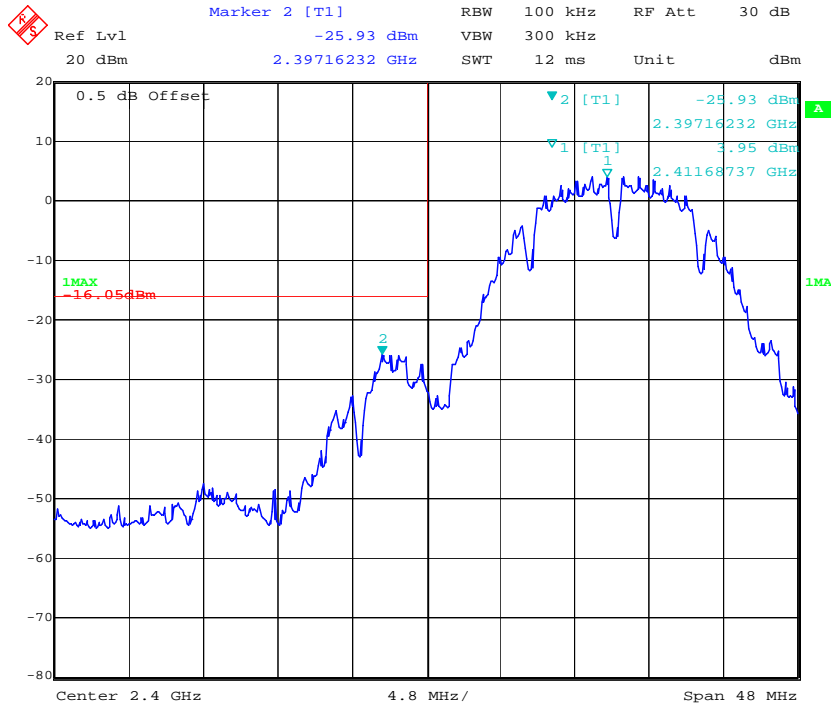
*\* The testing was performed by Kevin Hu on 2017-05-26.*

*Test mode: Transmitting*

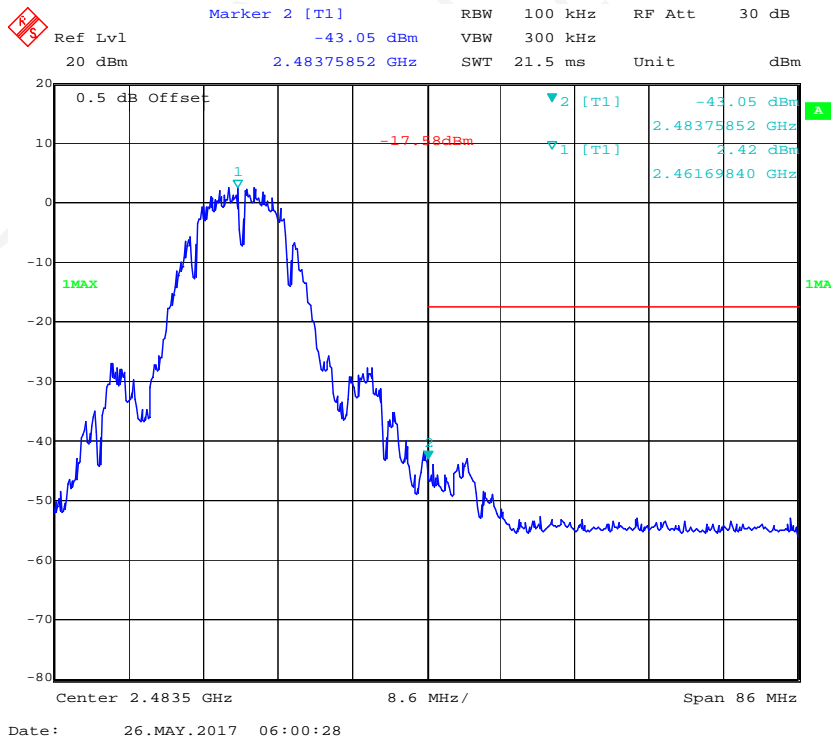
*Test Result: Compliant. Please refer to following plots.*

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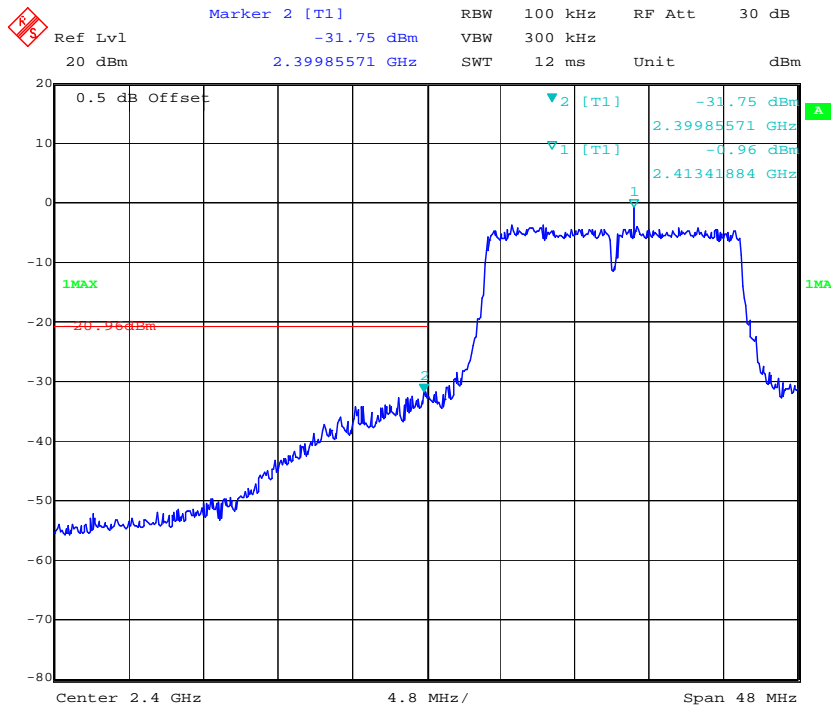
### 802.11b: Band Edge, Left Side



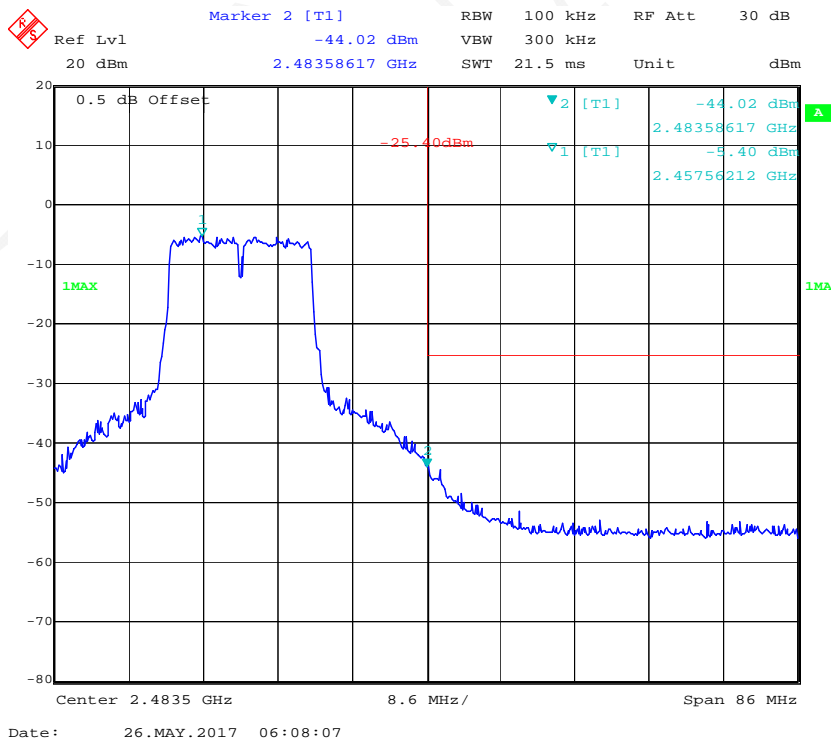
### 802.11b: Band Edge, Right Side



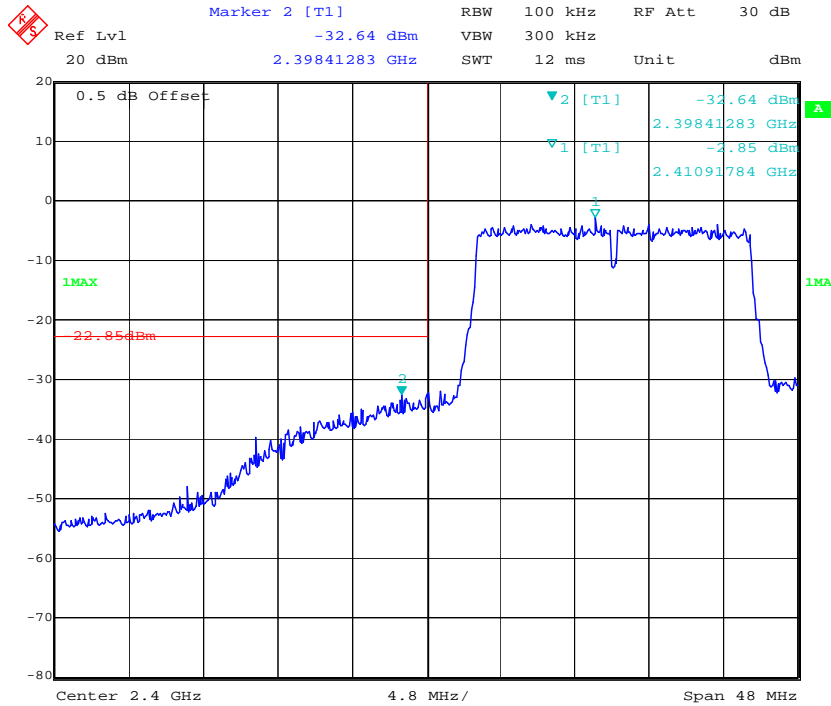
### 802.11g: Band Edge, Left Side



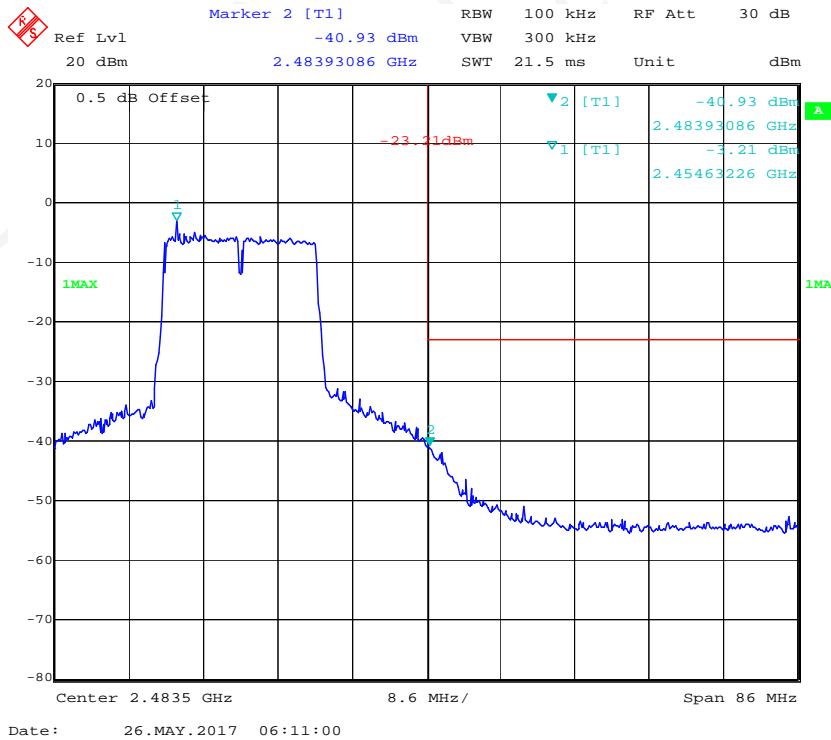
### 802.11g: Band Edge, Right Side



### 802.11n ht20 Band Edge, Left Side



### 802.11n ht20 Band Edge, Right Side



## FCC §15.247(e) - POWER SPECTRAL DENSITY

### Applicable Standard

According to FCC§15.247(e):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
Unknown	RF Cable	Unknown	C-5	Each Time	/

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B "Implementation of traceability policy in accredited laboratories".



## Test Data

### Environmental Conditions

Temperature:	28.6 °C
Relative Humidity:	43 %
ATM Pressure:	100.1 kPa

\* The testing was performed by Kevin Hu on 2017-05-26.

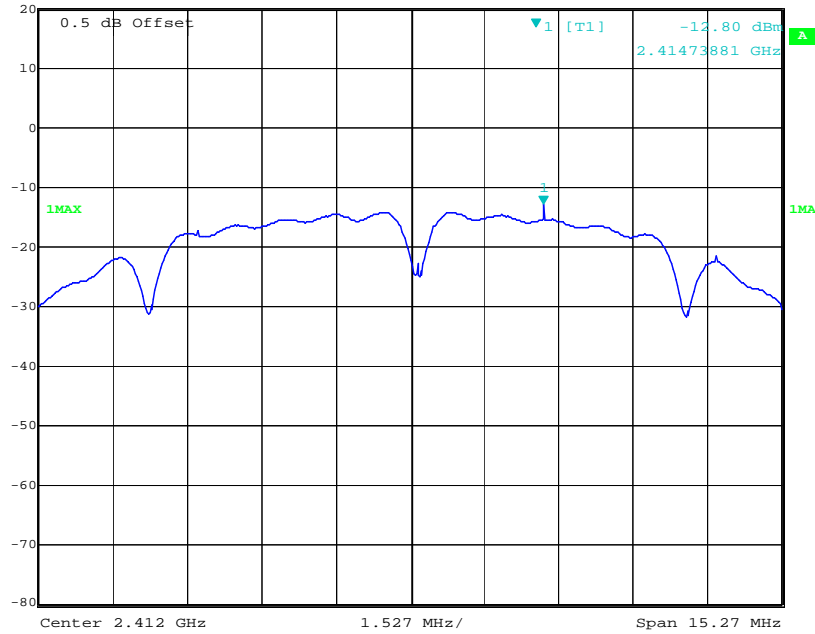
Test Mode: Transmitting

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	-12.8	≤8.0
	Middle	2437	-14.56	≤8.0
	High	2462	-14.45	≤8.0
802.11g	Low	2412	-18.36	≤8.0
	Middle	2437	-19.06	≤8.0
	High	2462	-20.09	≤8.0
802.11n ht20	Low	2412	-16.71	≤8.0
	Middle	2437	-16.86	≤8.0
	High	2462	-17.48	≤8.0

### Power Spectral Density, 802.11b Low Channel

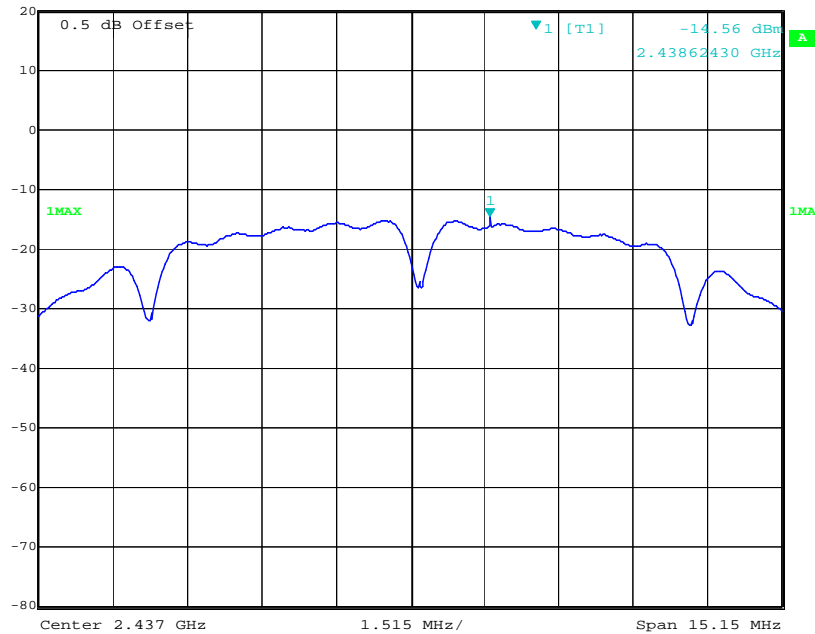
Marker 1 [T1] RBW 3 kHz RF Att 30 dB  
Ref Lvl -12.80 dBm VBW 10 kHz  
20 dBm 2.41473881 GHz SWT 4.3 s Unit dBm



Date: 26.MAY.2017 05:56:15


### Power Spectral Density, 802.11b Middle Channel

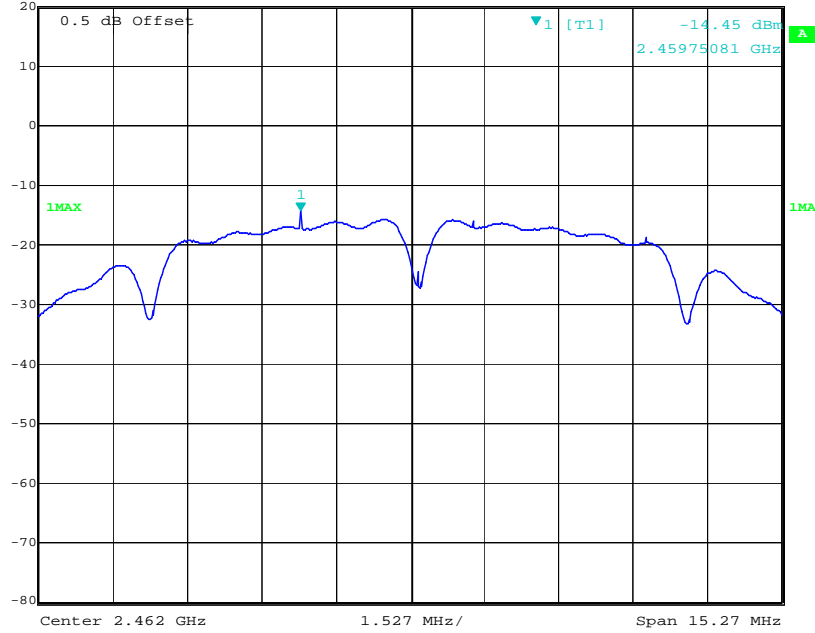
Marker 1 [T1] RBW 3 kHz RF Att 30 dB  
Ref Lvl -14.56 dBm VBW 10 kHz  
20 dBm 2.43862430 GHz SWT 4.3 s Unit dBm



Date: 26.MAY.2017 05:58:05


### Power Spectral Density, 802.11b High Channel

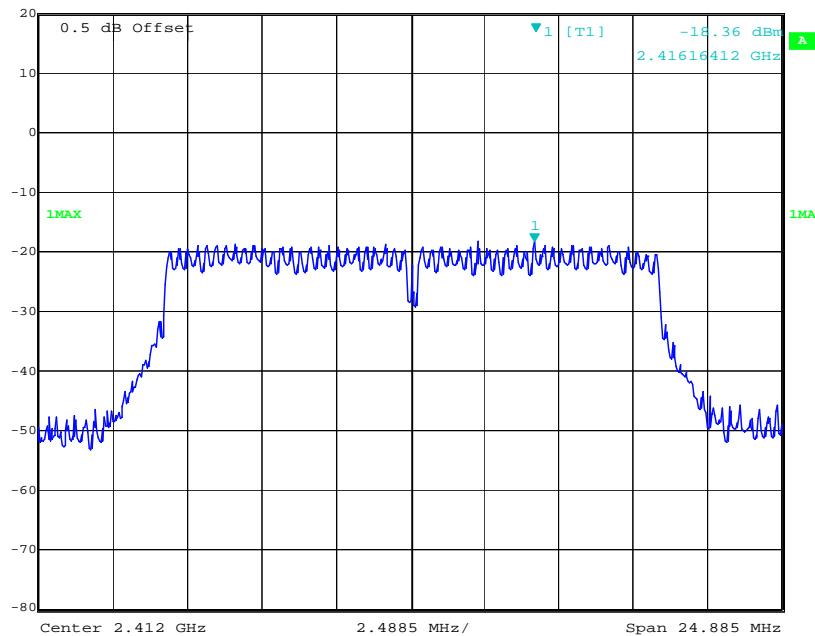
 Marker 1 [T1] RBW 3 kHz RF Att 30 dB  
Ref Lvl -14.45 dBm VBW 10 kHz  
20 dBm 2.45975081 GHz SWT 4.3 s Unit dBm



Date: 26.MAY.2017 05:59:54

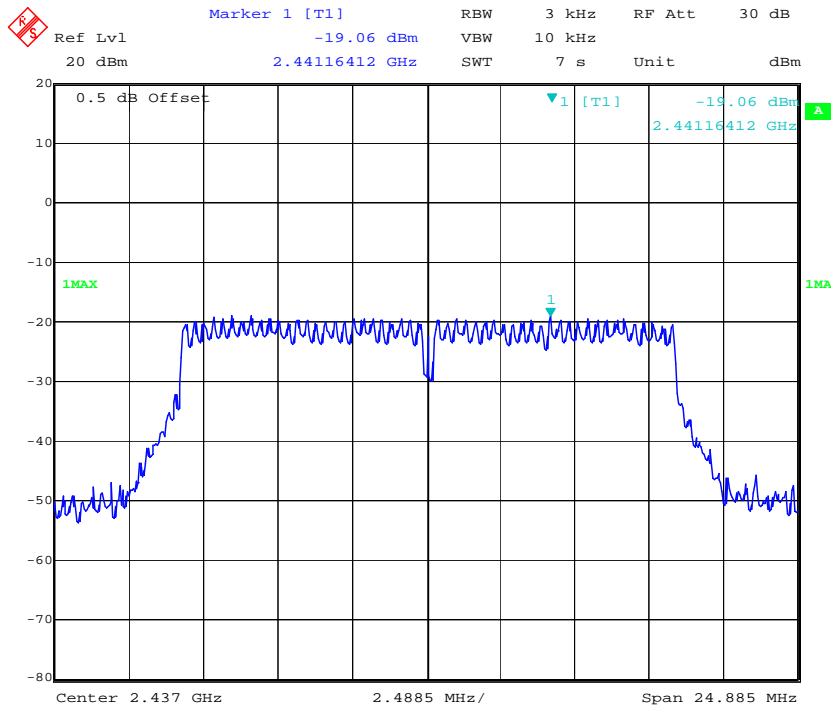
### Power Spectral Density, 802.11g Low Channel

 Marker 1 [T1] RBW 3 kHz RF Att 30 dB  
Ref Lvl -18.36 dBm VBW 10 kHz  
20 dBm 2.41616412 GHz SWT 7 s Unit dBm

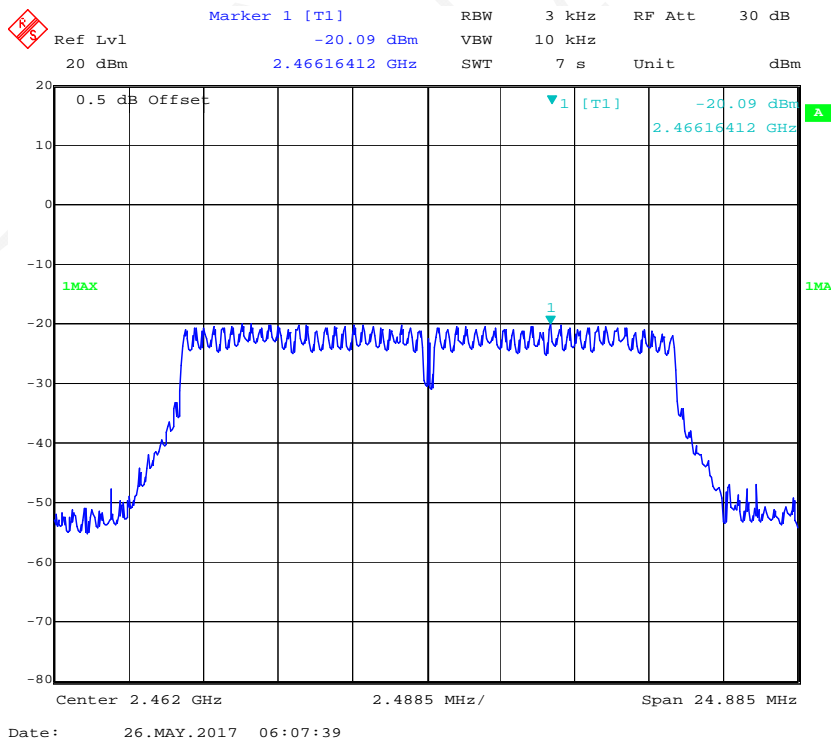


Date: 26.MAY.2017 06:05:45

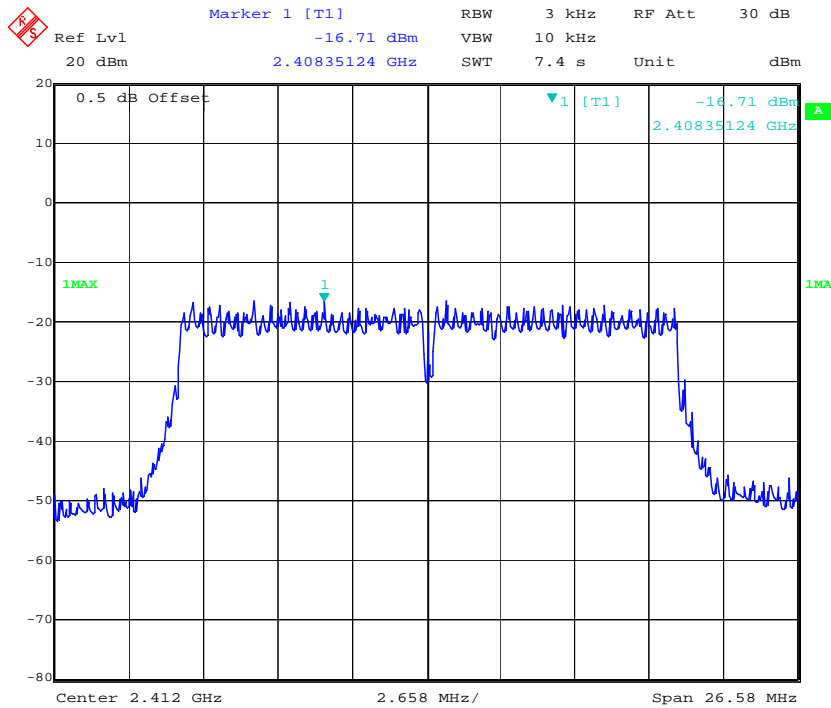
### Power Spectral Density, 802.11g Middle Channel



### Power Spectral Density, 802.11g High Channel

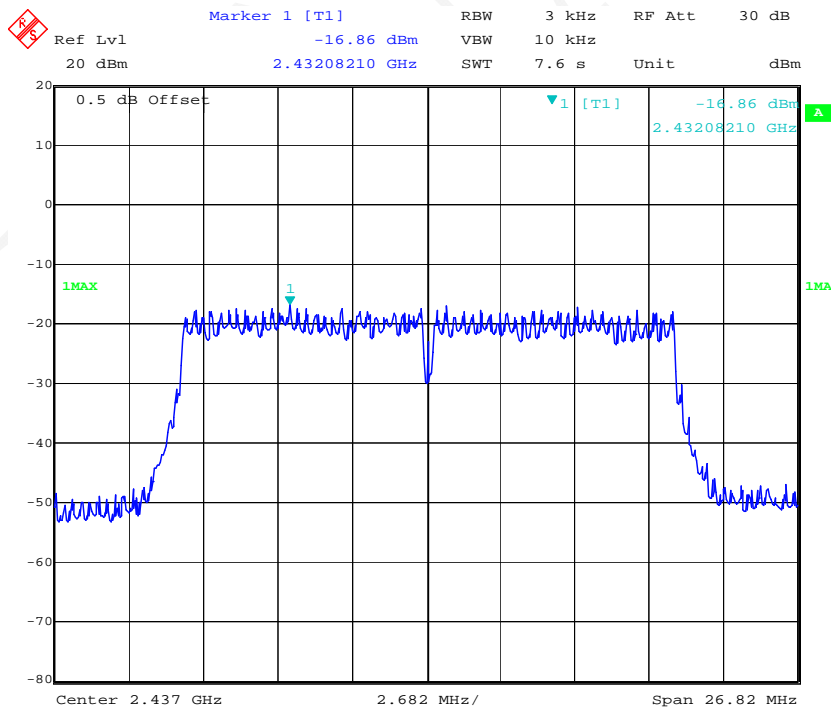


### Power Spectral Density, 802.11n ht20 Low Channel




Date: 26.MAY.2017 06:16:16

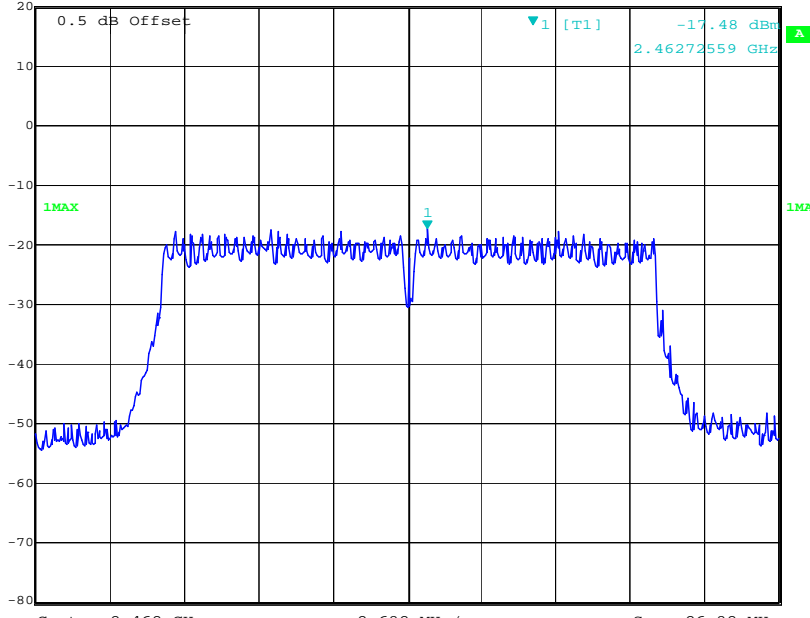
### Power Spectral Density, 802.11n ht20 Middle Channel



Date: 26.MAY.2017 06:14:27

### Power Spectral Density, 802.11n ht20 High Channel

 Marker 1 [T1] RBW 3 kHz RF Att 30 dB  
Ref Lvl -17.48 dBm VBW 10 kHz  
20 dBm 2.46272559 GHz SWT 7.6 s Unit dBm



Center 2.462 GHz 2.682 MHz/ Span 26.82 MHz  
Date: 26.MAY.2017 06:10:13

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