



# RADIO TEST REPORT

Report No: STS1709141W01

Issued for

Shenzhen Hysiry Technology Co., Ltd.

Room 406, Fourth floor, Buliding 1, Area D Huameiju Decoration Materials City, Xinhu Road, Xin'an street, Bao'an District, Shenzhen China.

Product Name:	ESP8266-12H
Brand Name:	N/A
Test Model Name:	ESP8266-12H
Series Model:	IESP8266-01H,ESP8266-12L
FCC ID:	2AKBPESP826612H
Test Standard:	FCC Part 15.247

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### **TEST RESULT CERTIFICATION**

Applicant's name ...... Shenzhen Hysiry Technology Co., Ltd.

Materials City, Xinhu Road, Xin'an street, Bao'an District, Shenzhen

China.

Manufacture's Name ...... Shenzhen Hysiry Technology Co., Ltd.

Materials City, Xinhu Road, Xin'an street, Bao'an District, Shenzhen

China.

**Product description** 

Product name ...... ESP8266-12H

Trade mark .....: N/A

Test model name..... ESP8266-12H

Series model...... IESP8266-01H,ESP8266-12L

Standards ..... FCC Part15.247

Test procedure ...... ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test .....

Date (s) of performance of tests ...... 14 Sep. 2017 ~19 Sep. 2017

Test Result...... Pass

Testing Engineer : Sean She

(Sean she)

Technical Manager :

(Hakim.hou)

Authorized Signatory:

(Vita Li)



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# **Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	20 Sep. 2017	STS1709141W01	ALL	Initial Issue





# 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards: KDB 558074 D01 DTS Meas Guidance v04

FCC Part 15.247,Subpart C				
Standard Section	Test Item	Judgment	Remark	
15.207	Conducted Emission	PASS		
15.247 (a)(2)	6dB Bandwidth	PASS		
15.247 (b)(3)	Output Power	PASS		
15.247 (c)	Radiated Spurious Emission	PASS		
15.247 (d)	Conducted Spurious & Band Edge Emission	PASS		
15.247 (e)	Power Spectral Density	PASS		
15.205	Restricted Band Edge Emission	PASS		
Part 15.247(d)/part 15.209(a)	Band Edge Emission	PASS		
15.203	Antenna Requirement	PASS		

# NOTE:

- (1)" N/A" denotes test is not applicable in this Test Report
- (2) all tests are according to ANSI C63.10-2013.





#### 1.1 TEST FACTORY

Shenzhen STS Test Services Co., Ltd.

Add.: 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road,

Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

CNAS Registration No.: L7649;

FCC Registration No.: 625569; IC Registration No.: 12108A

#### 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y  $\pm$  U  $^{,}$  where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2  $^{,}$  providing a level of confidence of approximately 95 %  $^{,}$ 

No.	Item	Uncertainty
1	Conducted Emission (9KHz-150KHz)	±2.88dB
2	Conducted Emission (150KHz-30MHz)	±2.67dB
3	RF power,conducted	±0.71dB
4	Spurious emissions,conducted	±0.63dB
5	All emissions,radiated (9KHz-30MHz)	±3.02dB
6	All emissions,radiated (30MHz-200MHz)	±3.80dB
7	All emissions,radiated (200MHz-1000MHz)	±3.97dB
8	All emissions,radiated(>1G)	±3.03dB



# 2. GENERAL INFORMATION

# 2.1 GENERAL DESCRIPTION OF EUT

Equipment	ESP8266-12H		
Trade Name	N/A		
Model Name	ESP8266-12H		
Series Model	IESP8266-01H,ESI	P8266-12L	
Model Difference	Only different in mo	odel name	
	The EUT is a ESP8	3266-12H	
	Operation Frequency:	802.11b/g/n 20: 2412~2462 MHz	
	Modulation Type:	CCK/BPSK/QPSK/16QAM	
Product Description	Bit Rate of Transmitter:	802.11b:11/5.5/2/1 Mbps 802.11g:54/48/36/24/18/12/9/6 Mbps 802.11n(20MHz): 65/58.5/52/39/26/19.5/13/6.5 Mbps	
	Number Of Channel:	802.11b/g/n20: 11CH	
	Antenna Designation:	Please see Note 3.	
	Antenna Gain (dBi):	1 dbi	
	Duty Cycle:	>98%	
Channel List	Please refer to the	Note 2.	
Power rating	DC 3.3V		
Hardware version number	v1.0		
Software version number	v1.0		
Connecting I/O Port(s)	Please refer to the User's Manual		

#### Note:

1 For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



2

	Operation Frequency of channel
	802.11b/g/n(20MHz)
Channel	Frequency
01	2412
02	2417
03	2422
04	2427
05	2432
06	2437
07	2442
08	2447
09	2452
10	2457
11	2462

#### 3 Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Carrier Frequency Channel

2.4GHz Test Frequency:

For 802.11b/g/n (HT20)		
Channel	Freq.(MHz)	
01	2412	
06	2437	
11	2462	

3

Ant	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	EP-DB1607	PCB Antenna	N/A	1	WLAN Antenna



#### 2.2 DESCRIPTION OF TEST MODES

Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Data Rate
Mode 1	TX IEEE 802.11b CH1	1 Mbps
Mode 2	TX IEEE 802.11b CH6	1 Mbps
Mode 3	TX IEEE 802.11 b CH11	1 Mbps
Mode 4	TX IEEE 802.11g CH1	6 Mbps
Mode 5	TX IEEE 802.11g CH6	6 Mbps
Mode 6	TX IEEE 802.11g CH11	6 Mbps
Mode 7	TX IEEE 802.11n HT20 CH1	MCS 0
Mode 8	TX IEEE 802.11n HT20 CH6	MCS 0
Mode 9	TX IEEE 802.11n HT20 CH11	MCS 0

#### Note:

- (1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported
- (2) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V,50/60Hz is shown in the report
- (3) The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

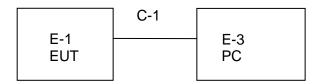
# AC Conducted Emission

	Test Case
AC Conducted Emission	Mode10: Keeping WIFI TX

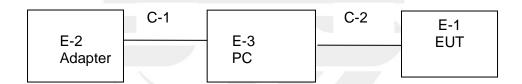


# 2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

# **Radiation Test Set**



# conduction Test Set





#### 2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-1	ESP8266-12H	N/A	ESP8266-12H	N/A	EUT
E-2	Adapter	N/A	PA-1650-86	N/A	N/A
E-3	PC	HP	500-320cx	N/A	N/A

Item	Shielded Type	Ferrite Core	Length	Note
C-1	Cable shielded line (Charging)	NO	110cm	N/A
C-2	USB connecting line	NO	100cm	N/A

#### Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in <code>"Length\_"</code> column.
- (3) "YES" is means "shielded" "with core"; "NO" is means "unshielded" "without core".





# 2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

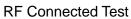
Radiation Test equipment

Radiation Test equipment					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESW	101535	2017.06.01	2018.05.31
Bilog Antenna	TESEQ	CBL6111D	34678	2017.03.24	2018.03.23
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-1343	2017.03.06	2018.03.05
SHF-EHF Horn Antenna (15G-40GHz)	BBHA 9170	SCHWARZBECK	BBHA9170367	2017.05.02	2018.05.01
Temperature & Humitidy	HH660	Mieo	N/A	2016.10.25	2017.10.24
Temperature & Humitidy	HH660	Mieo	N/A	2016.10.25	2017.10.24
Pre-mplifier (0.1M-3GHz)	EM	EM330	60538	2017.03.12	2018.03.11
PreAmplifier (1G-26.5GHz)	Agilent	8449B	60538	2016.10.23	2017.10.22
Pre-mplifier (18G-40G)	MINI-CIRCUITS	AP-040G	1382501	2017.05.15	2018.05.14
Operational Manual Passive Loop (9K30MHz)	ETS	6512	00165355	2017.03.06	2018.03.05
Low frequency cable	EM	R01	N/A	2017.03.12	2018.03.11
Low frequency cable	EM	R06	N/A	2017.03.12	2018.03.11
High frequency cable	SCHWARZBECK	R04	N/A	2017.03.12	2018.03.11
High frequency cable	SCHWARZBECK	R02	N/A	2017.03/12	2018.03.11
Semi-anechoic chamber	Changling	966	N/A	2016.10.23	2017.10.22
trun table	EM	SC100_1	60531	N/A	N/A
Antnna mast EM		SC100	N/A	N/A	N/A
Max-full Antenna Corp	MF	MFA-440H	N/A	N/A	N/A

# Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2016.10.23	2017.10.22
LISN	R&S	ENV216	101242	2016.10.26	2017.10.25
conduction Cable	EM	C01	N/A	2017.03.12	2018.03.11
Temperature & Humitidy	Mieo	HH660	N/A	2016.10.23	2017.10.22





Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2016.10.23	2017.10.22
Power Meter	R&S	NRP	100510	2016.10.23	2017.10.22
Spectrum Analyzer	Agilent	E4407B	MY50140340	2017.03.11	2018.03.10
Signal Analyzer	Agilent	N9020A	MY49100060	2017.03.11	2018.03.10





#### 3. EMC EMISSION TEST

#### 3.1 CONDUCTED EMISSION MEASUREMENT

#### 3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

operating frequency band. In case the emission fall within the restricted band specified on Part 15. 207(a) limit in the table below has to be followed.

EDECLIENCY (MU-)	Conducted Emission limit (dBuV)		
FREQUENCY (MHz)	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	
0.50 -5.0	56.00	46.00	
5.0 -30.0	60.00	50.00	

#### Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

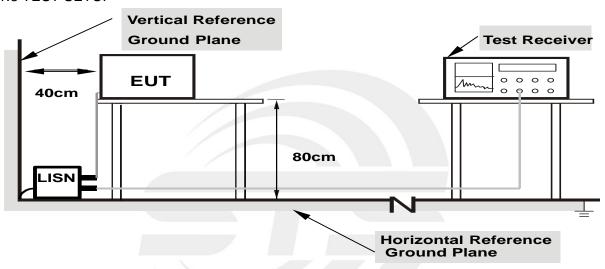
Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz



#### 3.1.2 TEST PROCEDURE

- a. The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item -EUT Test Photos.

#### 3.1.3 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

# 3.1.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



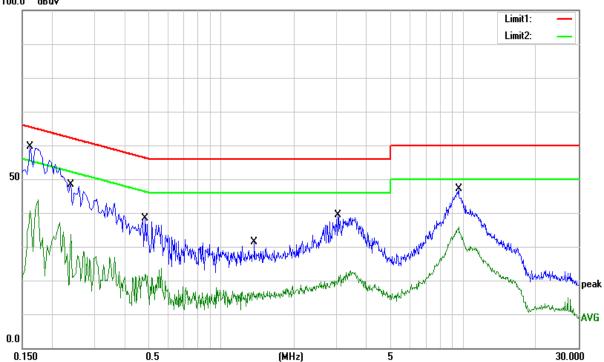
#### 3.1.5 TEST RESULT

Temperature:	25.4 ℃	Relative Humidity:	60%
Pressure:	1010hPa	Phase:	L
Test Voltage:	AC 120V/60Hz	Test Mode:	Mode 10

Frequency	Reading	Correct	Result	Limit	Margin	Remark
(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	Remark
0.1620	49.75	9.79	59.54	65.36	-5.82	QP
0.1620	18.83	9.79	28.62	55.36	-26.74	AVG
0.2380	38.49	9.95	48.44	62.17	-13.73	QP
0.2380	11.85	9.95	21.80	52.17	-30.37	AVG
0.4860	28.44	10.03	38.47	56.24	-17.77	QP
0.4860	11.31	10.03	21.34	46.24	-24.90	AVG
1.3700	21.67	9.79	31.46	56.00	-24.54	QP
1.3700	6.12	9.79	15.91	46.00	-30.09	AVG
3.0300	29.47	9.81	39.28	56.00	-16.72	QP
3.0300	10.54	9.81	20.35	46.00	-25.65	AVG
9.5580	36.86	10.16	47.02	60.00	-12.98	QP
9.5580	23.08	10.16	33.24	50.00	-16.76	AVG

# Remark:

- 1. All readings are Quasi-Peak and Average values.
- 2. Margin = Result (Result = Reading + Factor )—Limit



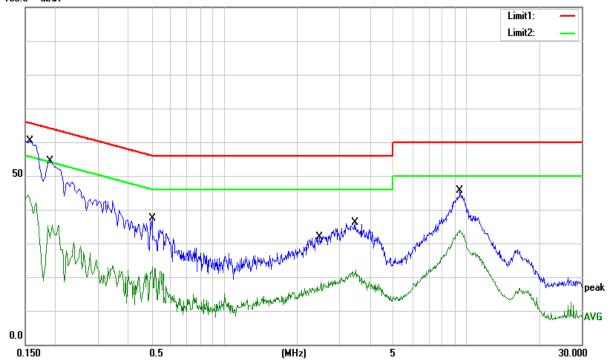
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Temperature:	25.4 ℃	Relative Humidity:	60%
Pressure:	1010hPa	Phase:	N
Test Voltage:	AC 120V/60Hz	Test Mode:	Mode 10

Frequency	Reading	Correct	Result	Limit	Margin	Remark
(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	Remark
0.1580	50.54	9.77	60.31	65.57	-5.26	QP
0.1580	31.69	9.77	41.46	55.57	-14.11	AVG
0.1900	44.45	9.85	54.30	64.04	-9.74	QP
0.1900	25.08	9.85	34.93	54.04	-19.11	AVG
0.5020	27.32	9.98	37.30	56.00	-18.70	QP
0.5020	6.85	9.98	16.83	46.00	-29.17	AVG
2.4780	21.93	9.89	31.82	56.00	-24.18	QP
2.4780	8.42	9.89	18.31	46.00	-27.69	AVG
3.4540	26.09	9.92	36.01	56.00	-19.99	QP
3.4540	10.41	9.92	20.33	46.00	-25.67	AVG
9.4300	35.62	9.92	45.54	60.00	-14.46	QP
9.4300	21.97	9.92	31.89	50.00	-18.11	AVG

# Remark:

- 1. All readings are Quasi-Peak and Average values.
- 2. Margin = Result (Result = Reading + Factor )—Limit 100.0 dBuV





# 3.2 RADIATED EMISSION MEASUREMENT

#### 3.2.1 RADIATED EMISSION LIMITS

in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

EINITE OF TOTAL PROPERTY (0.000MILE TOUGHTIE)						
Frequencies	Field Strength	Measurement Distance				
(MHz)	(micorvolts/meter)	(meters)				
0.009~0.490	2400/F(KHz)	300				
0.490~1.705	24000/F(KHz)	30				
1.705~30.0	30	30				
30~88	100	3				
88~216	150	3				
216~960	200	3				
Above 960	500	3				

# LIMITS OF RADIATED EMISSION MEASUREMENT (1000MHz-25GHz)

EDECLIENCY (MH-)	(dBuV/m) (at 3M)			
FREQUENCY (MHz)	PEAK	AVERAGE		
Above 1000	74	54		

#### Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

#### For Radiated Emission

Spectrum Parameter	Setting		
Attenuation	Auto		
Detector	Peak		
Start Frequency	1000 MHz(Peak/AV)		
Stop Frequency	10th carrier hamonic(Peak/AV)		
RB / VB (emission in restricted	4 MILI- /2MILI-		
band)	1 MHz /3MHz		

# For Band edge

Spectrum Parameter	Setting		
Detector	Peak		
Start/Stop Frequency	Lower Band Edge: 2300 to 2412 MHz		
Start/Stop Frequency	Upper Band Edge: 2462 to 2500 MHz		
RB / VB (emission in restricted band)	1 MHz /3MHz		



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Receiver Parameter	Setting
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

#### 3.2.2 TEST PROCEDURE

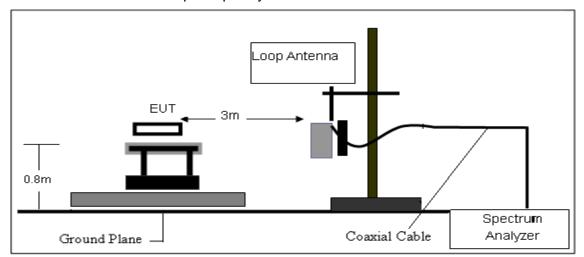
- a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz
- b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarizations of the antenna are set to make the measurement
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos. Note:

Both horizontal and vertical antenna polarities were tested and performed test to three orthogonal axis. The worst case emissions were reported

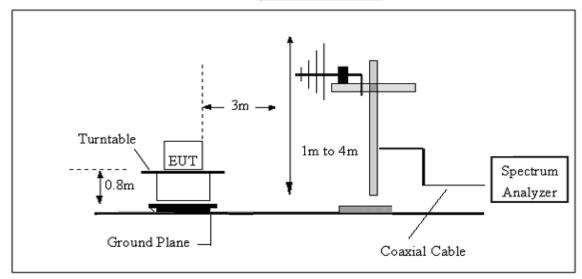


#### 3.2.3 TEST SETUP

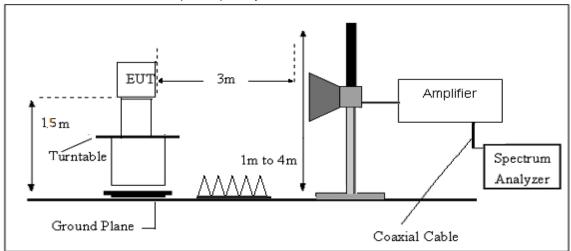
# (A) Radiated Emission Test-Up Frequency Below 30MHz



# (B) Radiated Emission Test-Up Frequency 30MHz~1GHz



# (C) Radiated Emission Test-Up Frequency Above 1GHz



#### 3.2.4 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



### 3.2.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG





#### 3.2.6 TEST RESULT

#### 9KHz-30MHz

Temperature:	26 ℃	Relative Humidtity:	60%
Pressure:	1010 hPa	Test Voltage:	DC 3.3V From Adapter
Test Mode:	TX Mode	Polarization:	

Freq.	Reading	Limit	Margin	State	Test
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	Result
					PASS
					PASS

#### Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.



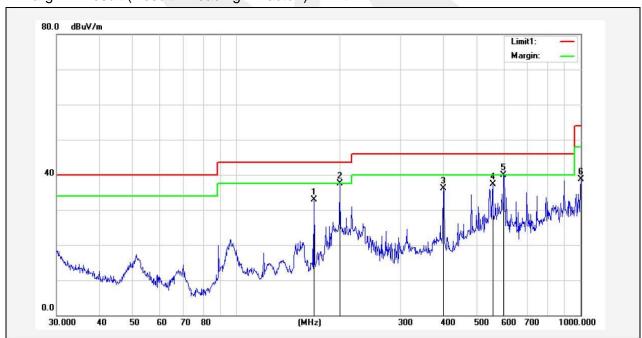
# (30MHz - 1000MHz)

Temperature:	26 ℃	Relative Humidtity:	60%
Pressure:	1010 hPa	Test Voltage:	DC 3.3V From Adapter
LIAST IVIONA.	Mode 1/2/3/4/5/6/7/8/9 (Mode 3-1M worst mode)	Polarization:	Horizontal

Frequency	Reading	Correct	Result	Limit	Margin	Remark
(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
167.8242	52.09	-19.15	32.94	43.50	-10.56	QP
199.2855	57.58	-20.17	37.41	43.50	-6.09	QP
399.0300	47.47	-11.28	36.19	46.00	-9.81	QP
554.8253	44.00	-6.67	37.33	46.00	-8.67	QP
597.2234	47.04	-7.10	39.94	46.00	-6.06	QP
1000.0000	38.86	-0.07	38.79	54.00	-15.21	QP

# Remark:

# 1. Margin = Result (Result = Reading + Factor )—Limit





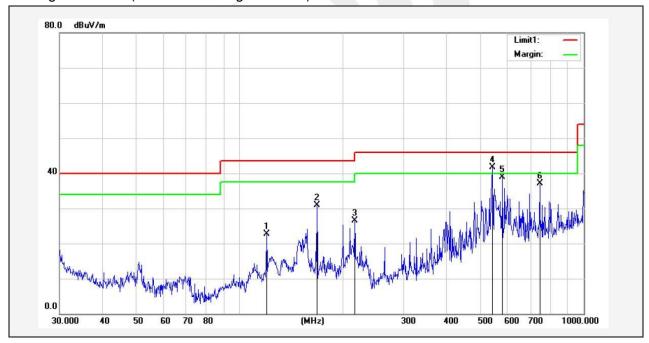
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Temperature:	<b>26</b> ℃	Relative Humidtity:	60%
Pressure:	1010 hPa	LIEST MOLTAGE.	DC 3.3V From Adapter
LIDGE IVIDAD.	Mode 1/2/3/4/5/6/7/8/9 (Mode 3-1M worst mode)	Polarization:	Vertical

Frequency	Reading	Correct	Result	Limit	Margin	Remark
(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
119.8556	40.42	-17.70	22.72	43.50	-20.78	QP
167.8243	49.98	-19.15	30.83	43.50	-12.67	QP
216.0240	45.81	-19.37	26.44	46.00	-19.56	QP
543.2742	48.54	-6.92	41.62	46.00	-4.38	QP
580.7026	45.68	-6.73	38.95	46.00	-7.05	QP
744.8661	40.57	-3.54	37.03	46.00	-8.97	QP

# Remark:.

1. Margin = Result (Result = Reading + Factor )—Limit







# (1000MHz-25GHz) Restricted band and Spurious emission Requirements

# 802.11b Low Channel

				Antenna	Corrected	Emission				
Frequency	Reading	Amplifier	Loss	Factor	Factor	Level	Limits	Margin	Detector	
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	Comment
				Low	Channel (2412 N	ИНz)				
3264.66	48.58	44.70	6.70	28.20	-9.80	38.78	74.00	-35.22	PK	Vertical
3264.66	39.22	44.70	6.70	28.20	-9.80	29.42	54.00	-24.58	AV	Vertical
3264.73	48.23	44.70	6.70	28.20	-9.80	38.43	74.00	-35.57	PK	Horizontal
3264.73	38.33	44.70	6.70	28.20	-9.80	28.53	54.00	-25.47	AV	Horizontal
4824.52	58.53	44.20	9.04	31.60	-3.56	54.97	74.00	-19.03	PK	Vertical
4824.52	39.08	44.20	9.04	31.60	-3.56	35.52	54.00	-18.48	AV	Vertical
4824.54	58.55	44.20	9.04	31.60	-3.56	54.99	74.00	-19.01	PK	Horizontal
4824.54	39.20	44.20	9.04	31.60	-3.56	35.64	54.00	-18.36	AV	Horizontal
5359.84	45.12	44.20	9.86	32.00	-2.34	42.78	74.00	-31.22	PK	Vertical
5359.84	37.60	44.20	9.86	32.00	-2.34	35.26	54.00	-18.74	AV	Vertical
5359.65	46.34	44.20	9.86	32.00	-2.34	44.00	74.00	-30.00	PK	Horizontal
5359.65	37.37	44.20	9.86	32.00	-2.34	35.03	54.00	-18.97	AV	Horizontal
7235.89	50.76	43.50	11.40	35.50	3.40	54.16	74.00	-19.84	PK	Vertical
7235.89	33.61	43.50	11.40	35.50	3.40	37.01	54.00	-16.99	AV	Vertical
7235.79	50.75	43.50	11.40	35.50	3.40	54.15	74.00	-19.85	PK	Horizontal
7235.79	32.55	43.50	11.40	35.50	3.40	35.95	54.00	-18.05	AV	Horizontal
11035.85	41.21	43.60	14.30	39.50	10.20	51.41	74.00	-22.59	PK	Vertical
11035.85	29.74	43.60	14.30	39.50	10.20	39.94	54.00	-14.06	AV	Vertical
11036.00	40.57	43.60	14.30	39.50	10.20	50.77	74.00	-23.23	PK	Horizontal
11036.00	30.30	43.60	14.30	39.50	10.20	40.50	54.00	-13.50	AV	Horizontal
13299.42	40.25	42.60	15.90	38.90	12.20	52.45	74.00	-21.55	PK	Vertical
13299.42	28.54	42.60	15.90	38.90	12.20	40.74	54.00	-13.26	AV	Vertical
13299.32	40.33	42.60	15.90	38.90	12.20	52.53	74.00	-21.47	PK	Horizontal
13299.32	29.39	42.60	15.90	38.90	12.20	41.59	54.00	-12.41	AV	Horizontal





# 802.11b Mid Channel

				Antenna	Corrected	Emission				
Frequency	Reading	Amplifier	Loss	Factor	Factor	Level	Limits	Margin	Detector	
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	Comment
				Mid	Channel (2437 N	ИHz)				
3264.87	48.96	44.70	6.70	28.20	-9.80	39.16	74.00	-34.84	PK	Vertical
3264.87	38.91	44.70	6.70	28.20	-9.80	29.11	54.00	-24.89	AV	Vertical
3264.77	49.24	44.70	6.70	28.20	-9.80	39.44	74.00	-34.56	PK	Horizontal
3264.77	37.90	44.70	6.70	28.20	-9.80	28.10	54.00	-25.90	AV	Horizontal
4874.56	59.43	44.20	9.04	31.60	-3.56	55.87	74.00	-18.13	PK	Vertical
4874.56	39.22	44.20	9.04	31.60	-3.56	35.66	54.00	-18.34	AV	Vertical
4874.52	59.35	44.20	9.04	31.60	-3.56	55.79	74.00	-18.21	PK	Horizontal
4874.52	38.58	44.20	9.04	31.60	-3.56	35.02	54.00	-18.98	AV	Horizontal
5359.65	45.10	44.20	9.86	32.00	-2.34	42.76	74.00	-31.24	PK	Vertical
5359.65	37.78	44.20	9.86	32.00	-2.34	35.44	54.00	-18.56	AV	Vertical
5359.70	45.76	44.20	9.86	32.00	-2.34	43.42	74.00	-30.58	PK	Horizontal
5359.70	37.52	44.20	9.86	32.00	-2.34	35.18	54.00	-18.82	AV	Horizontal
7310.90	51.49	43.50	11.40	35.50	3.40	54.89	74.00	-19.11	PK	Vertical
7310.90	33.38	43.50	11.40	35.50	3.40	36.78	54.00	-17.22	AV	Vertical
7310.84	50.85	43.50	11.40	35.50	3.40	54.25	74.00	-19.75	PK	Horizontal
7310.84	33.19	43.50	11.40	35.50	3.40	36.59	54.00	-17.41	AV	Horizontal
9747.76	41.05	43.60	14.30	39.50	10.20	51.25	74.00	-22.75	PK	Vertical
9747.76	30.11	43.60	14.30	39.50	10.20	40.31	54.00	-13.69	AV	Vertical
9748.19	40.86	43.60	14.30	39.50	10.20	51.06	74.00	-22.94	PK	Horizontal
9748.19	30.60	43.60	14.30	39.50	10.20	40.80	54.00	-13.20	AV	Horizontal
13299.21	40.03	42.60	15.90	38.90	12.20	52.23	74.00	-21.77	PK	Vertical
13299.21	28.54	42.60	15.90	38.90	12.20	40.74	54.00	-13.26	AV	Vertical
13299.32	40.21	42.60	15.90	38.90	12.20	52.41	74.00	-21.59	PK	Horizontal
13299.32	29.83	42.60	15.90	38.90	12.20	42.03	54.00	-11.97	AV	Horizontal

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# 802.11b High Channel

Antenna Corrected Emission										
Frequency	Reading	Amplifier	Loss	Factor	Factor	Level	Limits	Margin	Detector	
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	Comment
	High Channel (2462 MHz)									
3264.89	47.98	44.70	6.70	28.20	-9.80	38.18	74.00	-35.82	PK	Vertical
3264.89	39.82	44.70	6.70	28.20	-9.80	30.02	54.00	-23.98	AV	Vertical
3264.62	48.62	44.70	6.70	28.20	-9.80	38.82	74.00	-35.18	PK	Horizontal
3264.62	37.93	44.70	6.70	28.20	-9.80	28.13	54.00	-25.87	AV	Horizontal
4924.44	59.51	44.20	9.04	31.60	-3.56	55.95	74.00	-18.05	PK	Vertical
4924.44	39.07	44.20	9.04	31.60	-3.56	35.51	54.00	-18.49	AV	Vertical
4924.53	59.54	44.20	9.04	31.60	-3.56	55.98	74.00	-18.02	PK	Horizontal
4924.53	38.30	44.20	9.04	31.60	-3.56	34.74	54.00	-19.26	AV	Horizontal
5359.60	45.38	44.20	9.86	32.00	-2.34	43.04	74.00	-30.96	PK	Vertical
5359.60	37.11	44.20	9.86	32.00	-2.34	34.77	54.00	-19.23	AV	Vertical
5359.77	45.84	44.20	9.86	32.00	-2.34	43.50	74.00	-30.50	PK	Horizontal
5359.77	37.68	44.20	9.86	32.00	-2.34	35.34	54.00	-18.66	AV	Horizontal
7385.90	50.80	43.50	11.40	35.50	3.40	54.20	74.00	-19.80	PK	Vertical
7385.90	33.12	43.50	11.40	35.50	3.40	36.52	54.00	-17.48	AV	Vertical
7385.87	51.17	43.50	11.40	35.50	3.40	54.57	74.00	-19.43	PK	Horizontal
7385.87	33.14	43.50	11.40	35.50	3.40	36.54	54.00	-17.46	AV	Horizontal
9847.85	41.19	43.60	14.30	39.50	10.20	51.39	74.00	-22.61	PK	Vertical
9847.85	30.93	43.60	14.30	39.50	10.20	41.13	54.00	-12.87	AV	Vertical
9848.25	40.43	43.60	14.30	39.50	10.20	50.63	74.00	-23.37	PK	Horizontal
9848.25	30.95	43.60	14.30	39.50	10.20	41.15	54.00	-12.85	AV	Horizontal

#### Remark:

- 1. Factor = Antenna Factor + Cable Loss Pre-amplifier.
- 2. Scan with 802.11b, 802.11g, 802.11n (HT-20) the worst case is 802.11b. Emission Level = Reading + Factor Margin = Limit Emission Leve
- 3. The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.





# 3.2.6 TEST RESULTS (Band edge Requirements)

				Antenna	Corrected	Emission				
Frequency	Reading	Amplifier	Loss	Factor	Factor	Level	Limits	Margin	Detector	
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	Comment
					802.11b					
2390.00	67.44	43.80	4.91	25.90	-12.99	54.45	74.00	-19.55	PK	Vertical
2390.00	53.08	43.80	4.91	25.90	-12.99	40.09	54.00	-13.91	AV	Vertical
2390.00	69.05	43.80	4.91	25.90	-12.99	56.06	74.00	-17.94	PK	Horizontal
2390.00	52.24	43.80	4.91	25.90	-12.99	39.25	54.00	-14.75	AV	Horizontal
2483.50	69.27	43.80	5.12	25.90	-12.78	56.49	74.00	-17.51	PK	Vertical
2483.50	53.07	43.80	5.12	25.90	-12.78	40.29	54.00	-13.71	AV	Vertical
2483.50	70.52	43.80	5.12	25.90	-12.78	57.74	74.00	-16.26	PK	Horizontal
2483.50	53.24	43.80	5.12	25.90	-12.78	40.46	54.00	-13.54	AV	Horizontal
	802.11g									
2390.00	67.40	43.80	4.91	25.90	-12.99	54.41	74.00	-19.59	PK	Vertical
2390.00	53.52	43.80	4.91	25.90	-12.99	40.53	54.00	-13.47	AV	Vertical
2390.00	66.53	43.80	4.91	25.90	-12.99	53.54	74.00	-20.46	PK	Horizontal
2390.00	53.86	43.80	4.91	25.90	-12.99	40.87	54.00	-13.13	AV	Horizontal
2483.50	66.43	43.80	5.12	25.90	-12.78	53.65	74.00	-20.35	PK	Vertical
2483.50	52.65	43.80	5.12	25.90	-12.78	39.87	54.00	-14.13	AV	Vertical
2483.50	65.21	43.80	5.12	25.90	-12.78	52.43	74.00	-21.57	PK	Horizontal
2483.50	52.44	43.80	5.12	25.90	-12.78	39.66	54.00	-14.34	AV	Horizontal
					802.11n20					
2390.00	66.91	43.80	4.91	25.90	-12.99	53.92	74.00	-20.08	PK	Vertical
2390.00	52.55	43.80	4.91	25.90	-12.99	39.56	54.00	-14.44	AV	Vertical
2390.00	65.50	43.80	4.91	25.90	-12.99	52.51	74.00	-21.49	PK	Horizontal
2390.00	54.27	43.80	4.91	25.90	-12.99	41.28	54.00	-12.72	AV	Horizontal
2483.50	65.41	43.80	5.12	25.90	-12.78	52.63	74.00	-21.37	PK	Vertical
2483.50	53.08	43.80	5.12	25.90	-12.78	40.30	54.00	-13.70	AV	Vertical
2483.50	66.54	43.80	5.12	25.90	-12.78	53.76	74.00	-20.24	PK	Horizontal
2483.50	52.91	43.80	5.12	25.90	-12.78	40.13	54.00	-13.87	AV	Horizontal

Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier.

Low measurement frequencies is range from 2300 to 2412 MHz, high measurement frequencies is range from 2462 to 2500 MHz.

Only show the worst point data of the emissions in the frequency 2300-2412 MHz and 2462-2500 MHz.



#### 4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

#### 4.1 APPLIED PROCEDURES / LIMIT

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

#### 4.2 TEST PROCEDURE

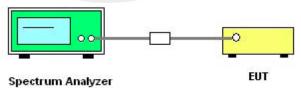
Spectrum Parameter	Setting		
Detector	Peak		
Start/Stop Frequency	30 MHz to 10th carrier harmonic		
RB / VB (emission in restricted band)	100 KHz/300 KHz		
Trace-Mode:	Max hold		

# For Band edge

Spectrum Parameter	Setting		
Detector	Peak		
Stort/Ston Fraguency	Lower Band Edge: 2300 to 2412 MHz		
Start/Stop Frequency	Upper Band Edge: 2462 to 2500 MHz		
RB / VB (emission in restricted band)	100 KHz/300 KHz		
Trace-Mode:	Max hold		

### 4.3 DEVIATION FROM STANDARD No deviation.

#### 4.4 TEST SETUP



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 500hm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

#### 4.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

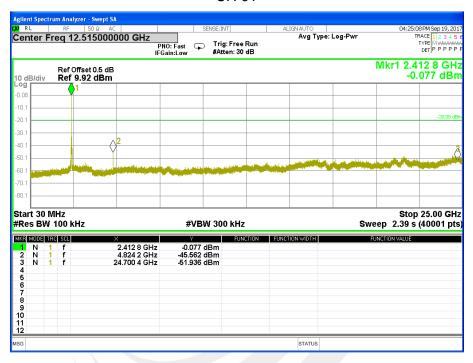


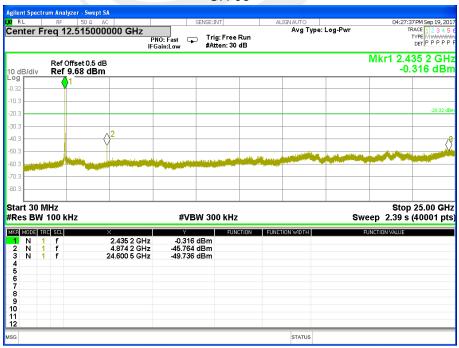


#### 4.6 TEST RESULTS

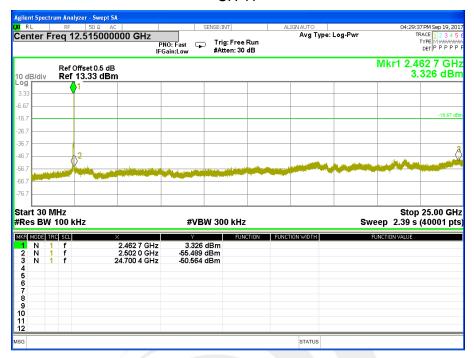
Temperature:	25 ℃	Relative Humidity:	60%
Pressure:	1015 hPa	Test Voltage:	DC 3.3V
Test Mode:	TX b Mode /CH01, CH06, CH1	1	

# CH 01





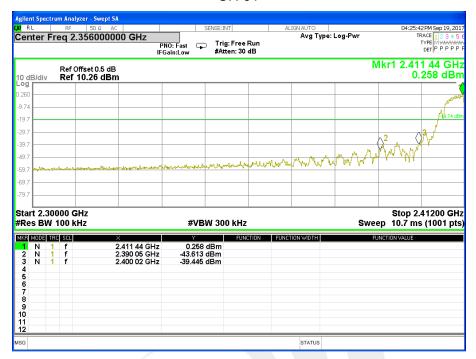






#### Band edge

#### CH 01



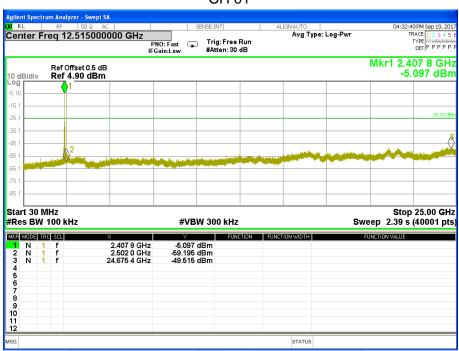


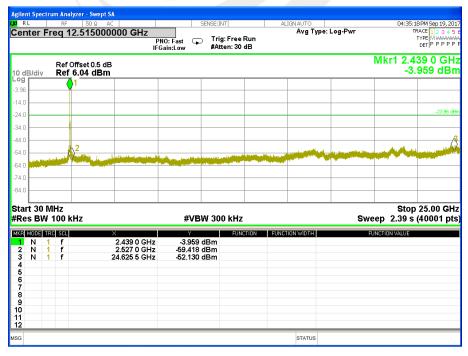


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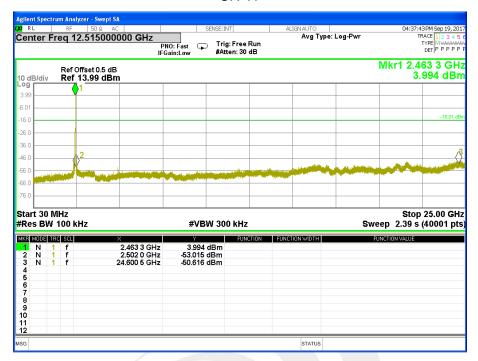
Temperature:	25 ℃	Relative Humidity:	60%
Pressure:	1015 hPa	Test Voltage:	DC 3.3V
Test Mode: TX g Mode /CH01, CH06, CH11		1	

#### CH 01











#### Band edge

#### CH 01



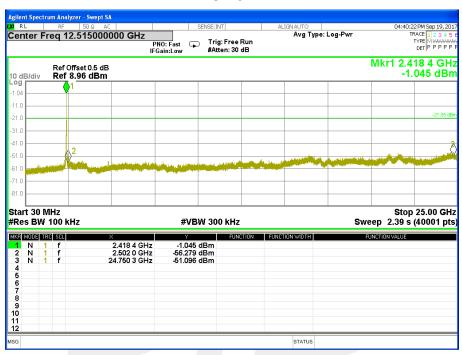




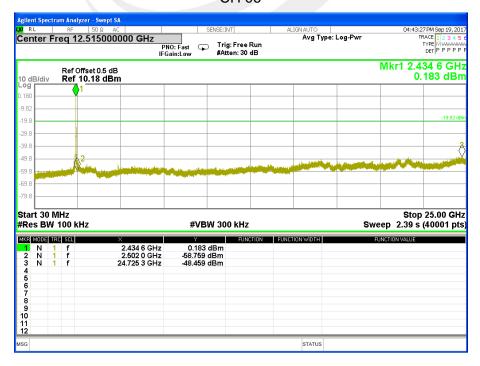
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Temperature:	25 ℃	Relative Humidity:	60%
Pressure:	1015 hPa	Test Voltage:	DC 3.3V
Test Mode:	TX n Mode(20M) /CH01, CH06, CH11		

#### CH 01

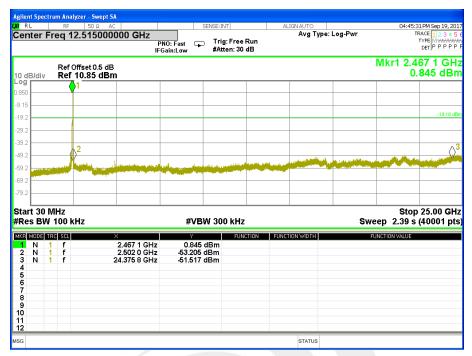


## CH 06





## CH 11





## Band edge

## CH 01



## CH 11





#### 5. POWER SPECTRAL DENSITY TEST

#### 5.1 APPLIED PROCEDURES / LIMIT

FCC Part15.247 , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e)	Power Spectral Density	≤8 dBm (RBW ≥ 3KHz)	2400-2483.5	PASS

#### **5.2 TEST PROCEDURE**

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. Set the span to 1.5 times the DTS channel bandwidth.
- 3. Set the 100 kHz  $\geq$  RBW  $\geq$  3 kHz.
- 4. Set the VBW  $\geq$  3 x RBW.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level.
- 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

# 5.3 DEVIATION FROM STANDARD No deviation.

#### 5.4 TEST SETUP

EUT	SPECTRUM
	ANALYZER

#### 5.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



## 5.6 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	60%
Pressure:	1015 hPa	Test Voltage:	DC 3.3V
Test Mode:	TX b Mode /CH01, CH06, CH11		

Frequency	Power Density (dBm/3kHz)	Limit (dBm)	Result
2412 MHz	-14.262	≤8	PASS
2437 MHz	-13.671	≤8	PASS
2462 MHz	-10.822	≤8	PASS







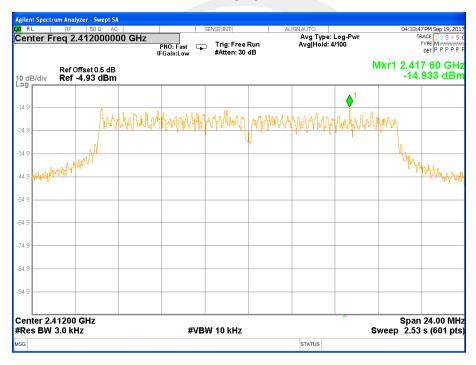




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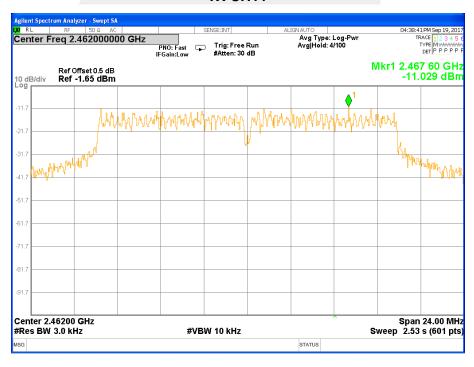
Temperature:	25 ℃	Relative Humidity:	60%
Pressure:	1015 hPa	Test Voltage:	DC 3.3V
Test Mode:	TX g Mode /CH01, CH06, CH11		

Frequency	Power Density (dBm/3kHz)	Limit (dBm)	Result
2412 MHz	-14.933	≤8	PASS
2437 MHz	-12.994	≤8	PASS
2462 MHz	-11.029	≤8	PASS







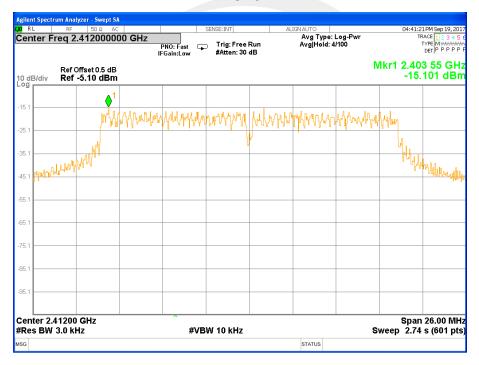




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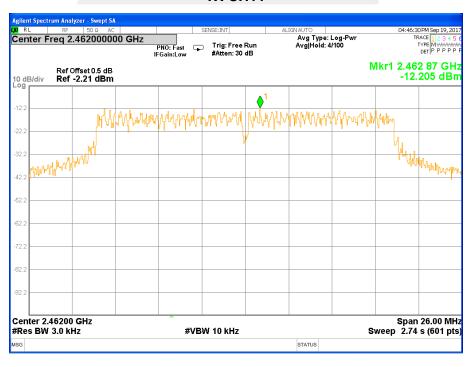
Temperature:	25 ℃	Relative Humidity:	60%
Pressure:	1015 hPa	Test Voltage:	DC 3.3V
Test Mode:	TX n Mode(20M) /CH01, CH06, CH11		

Frequency	Power Density (dBm/3kHz)	Limit (dBm)	Result
2412 MHz	-15.101	≤8	PASS
2437 MHz	-14.886	≤8	PASS
2462 MHz	-12.205	≤8	PASS









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#### 6. BANDWIDTH TEST

#### 6.1 APPLIED PROCEDURES / LIMIT

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	≥500KHz (6dB bandwidth)	2400-2483.5	PASS

### **6.2 TEST PROCEDURE**

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW≥3RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be≥6 dB.

## 6.3 DEVIATION FROM STANDARD No deviation.

#### 6.4 TEST SETUP

EUT	SPECTRUM
	ANALYZER

## **6.5 EUT OPERATION CONDITIONS**

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



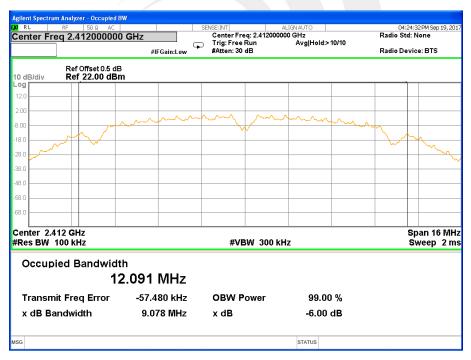


## 6.6 TEST RESULTS

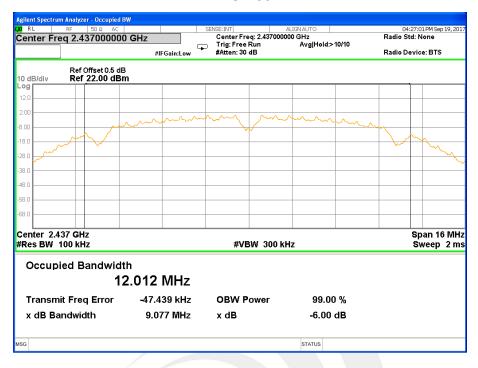
Temperature:	25 ℃	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage:	DC 3.3V
Test Mode:	TX b Mode /CH01, CH06, CH11		

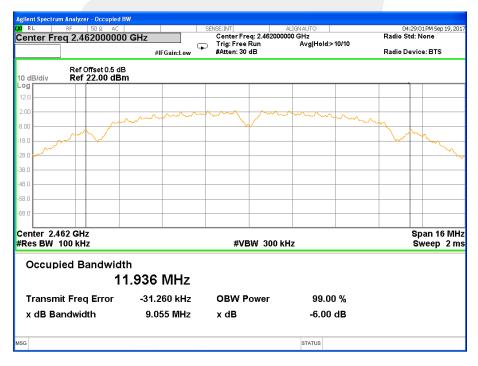
Remark: PEAK DETECTOR IS USED

Frequency	6dB Bandwidth (MHz)	Channel Separation (KHz)	Result
2412 MHz	9.08	≥500KHz	PASS
2437 MHz	9.08	≥500KHz	PASS
2462 MHz	9.06	≥500KHz	PASS







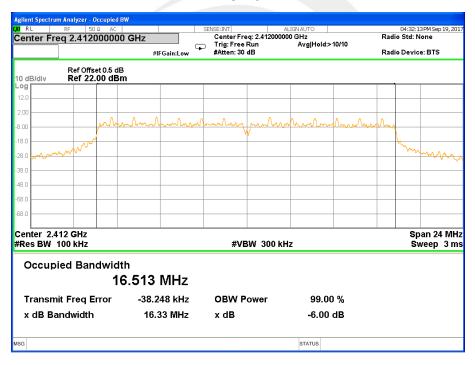




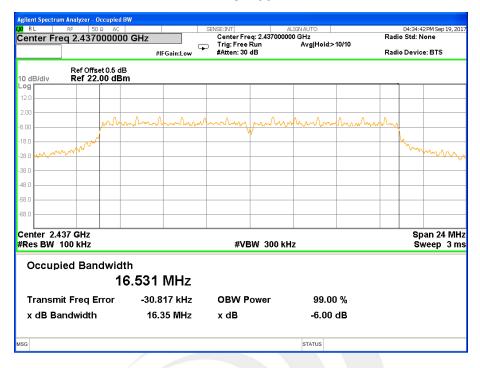
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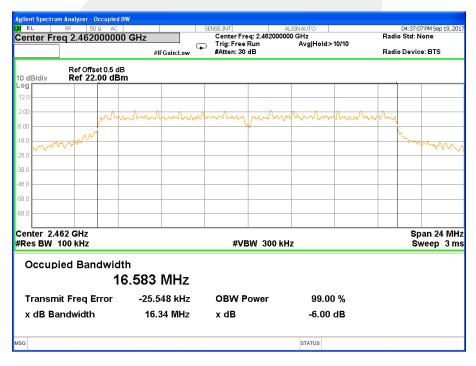
Temperature:	<b>25</b> ℃	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage:	DC 3.3V
Test Mode:	TX g Mode /CH01, CH06, CH11		

Frequency	6dB Bandwidth (MHz)	Channel Separation (KHz)	Result
2412 MHz	16.33	≥500KHz	PASS
2437 MHz	16.35	≥500KHz	PASS
2462 MHz	16.34	≥500KHz	PASS







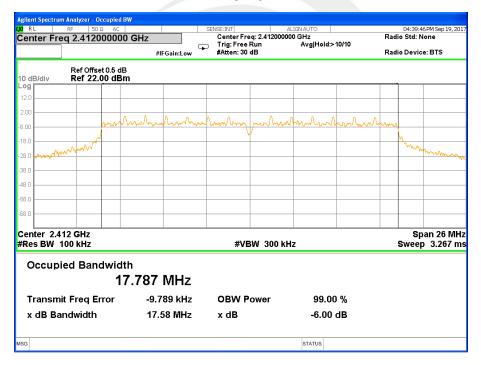




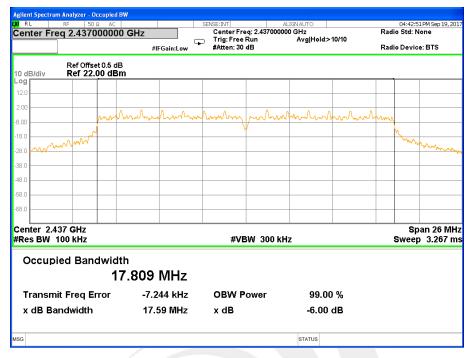
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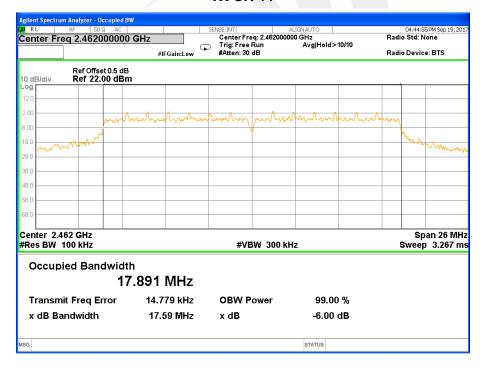
Temperature:	<b>25</b> ℃	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage:	DC 3.3V
Test Mode:	TX n Mode(20M) /CH01, CH06, CH11		

Frequency	6dB Bandwidth (MHz)	Channel Separation (KHz)	Result
2412 MHz	17.58	≥500KHz	PASS
2437 MHz	17.59	≥500KHz	PASS
2462 MHz	17.59	≥500KHz	PASS











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## 7. PEAK OUTPUT POWER TEST

## 7.1 APPLIED PROCEDURES / LIMIT

FCC Part 15.247,Subpart C					
Section Test Item Limit Frequency Range (MHz) Result					
15.247(b)(3)	15.247(b)(3) Output Power 1 watt or 30dBm 2400-2483.5 PASS				

## 7.2 TEST PROCEDURE

a. The EUT was directly connected to the Power Meter

# 7.3 DEVIATION FROM STANDARD No deviation.

## 7.4 TEST SETUP

EUT	Power meter

## 7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

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## 7.6 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage:	DC 3.3V

TX 802.11b Mode					
Test	Frequency	Conducted Output Power		LIMIT	
Channel	(MHz)	Peak(dBm)	AVG(dBm)	dBm	
CH01	2412	10.46	9.45	30	
CH06	2437	10.39	9.37	30	
CH11	2462	11.02	9.98	30	

	TX 802.11g Mode					
Test	Frequency	Conducted	Output Power	LIMIT		
Channel	hannel (MHz) Peak(dBm) AVG(dBm)		dBm			
CH01	2412	10.29	9.26	30		
CH06	2437	9.68	8.65	30		
CH11	2462	9.86	8.84	30		

TX 802.11n20 Mode					
Test	Frequency	Conducted	Output Power	LIMIT	
Channel	Channel (MHz) Peak(dBm) AVG(dBm)		dBm		
CH01	2412	10.06	8.02	30	
CH06	2437	9.51	7.49	30	
CH11	2462	9.73	7.71	30	



## 8. ANTENNA REQUIREMENT

## 8.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, 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.

## 8.2 EUT ANTENNA

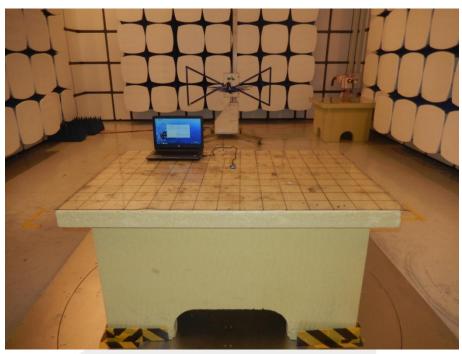
The EUT antenna is PCB Antenna. It comply with the standard requirement.





## APPENDIX - PHOTOS OF TEST SETUP









## **Conducted Measurement Photos**



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