

# FCC Part 15C

## Measurement And Test Report For

### **Xiamen Tongren IOT Technology Co.,Ltd.**

4F-A, Block A, Huaxun Buliding, Software Park, Torch Hi-tech Zone,  
Xiamen, China.

**FCC ID: 2AD3CUS-G101**

**Jan. 17, 2015**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> Smart Gateway
<b>Report Number:</b>	MTI141204001RF-1
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<b>Reviewed By:</b>	Jason Zheng <i>Jason Zheng</i>
<b>Approved &amp; Authorized By:</b>	Hebe Lee <i>Hebe Lee</i>
<b>Test Date:</b>	Jan. 05 - Jan. 17, 2015
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**Note:** This test report is limited to the above client company and the product model only. It may not be duplicated without prior written consent of Shenzhen Microtest Technology Co.,Ltd.

TEST RESULT CERTIFICATION	
<b>Applicant's name</b> .....	<b>Xiamen Tongren IOT Technology Co.,Ltd.</b>
Address .....	4F-A, Block A, Huaxun Buliding, Software Park, Torch Hi-tech Zone, Xiamen, China.
<b>Manufacture's Name</b> .....	<b>Xiamen Tongren IOT Technology Co.,Ltd.</b>
Address .....	4F-A, Block A, Huaxun Buliding, Software Park, Torch Hi-tech Zone, Xiamen, China.
<b>Product description</b>	
Product name .....	Smart Gateway
Model and/or type reference :	US-G101
Serial Model .....	N/A
<b>Standards</b> .....	FCC Part15.247
Test procedure .....	ANSI C63.4-2003

## Table of Contents

	Page
<b>1 . SUMMARY OF TEST RESULTS</b>	<b>5</b>
1.1 TEST FACILITY	6
1.2 MEASUREMENT UNCERTAINTY	6
<b>2 . GENERAL INFORMATION</b>	<b>7</b>
2.1 GENERAL DESCRIPTION OF EUT	7
2.2 DESCRIPTION OF TEST MODES	9
2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	10
2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)	11
2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS	12
<b>3 . EMC EMISSION TEST</b>	<b>13</b>
3.1 CONDUCTED EMISSION MEASUREMENT	13
3.1.1 POWER LINE CONDUCTED EMISSION LIMITS	13
3.1.2 TEST PROCEDURE	14
3.1.3 DEVIATION FROM TEST STANDARD	14
3.1.4 TEST SETUP	14
3.1.5 EUT OPERATING CONDITIONS	14
3.1.6 TEST RESULTS	15
3.2 RADIATED EMISSION MEASUREMENT	17
3.2.1 RADIATED EMISSION LIMITS	17
3.2.2 TEST PROCEDURE	18
3.2.3 DEVIATION FROM TEST STANDARD	18
3.2.4 TEST SETUP	19
3.2.5 EUT OPERATING CONDITIONS	20
3.2.6 TEST RESULTS (BETWEEN 9KHZ - 30 MHZ)	21
3.2.7 TEST RESULTS (BETWEEN 30MHZ - 1GHZ)	22
3.2.8 TEST RESULTS (ABOVE 1000 MHZ)	23
<b>4 . POWER SPECTRAL DENSITY TEST</b>	<b>28</b>
4.1 APPLIED PROCEDURES / LIMIT	28
4.1.1 TEST PROCEDURE	28
4.1.2 DEVIATION FROM STANDARD	28
4.1.3 TEST SETUP	28
4.1.4 EUT OPERATION CONDITIONS	28
4.1.5 TEST RESULTS	29
<b>5 . BANDWIDTH TEST</b>	<b>31</b>
5.1 APPLIED PROCEDURES / LIMIT	31
5.1.1 TEST PROCEDURE	31
5.1.2 DEVIATION FROM STANDARD	31

## Table of Contents

	Page
5.1.3 TEST SETUP	31
5.1.4 EUT OPERATION CONDITIONS	31
5.1.5 TEST RESULTS	32
6 . PEAK OUTPUT POWER TEST	34
6.1 APPLIED PROCEDURES / LIMIT	34
6.1.1 TEST PROCEDURE	34
6.1.2 DEVIATION FROM STANDARD	34
6.1.3 TEST SETUP	34
6.1.4 EUT OPERATION CONDITIONS	34
6.1.5 TEST RESULTS	35
7 . 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE	36
7.1 DEVIATION FROM STANDARD	36
7.2 TEST SETUP	36
7.3 EUT OPERATION CONDITIONS	36
7.4 TEST RESULTS	37
8 . ANTENNA REQUIREMENT	39
8.1 STANDARD REQUIREMENT	39
8.2 EUT ANTENNA	39

## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (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)	Peak Output Power	PASS	
15.247 (c)	Radiated Spurious Emission	PASS	
15.247 (d)	Power Spectral Density	PASS	
15.205	Band Edge Emission	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

## 1.1 TEST FACILITY

Shenzhen Toby Technology Co., Ltd.

Add.: 10/F.,A Block, Jiada R&D Bldg., No.5 Songpingshan, Road, Science&Technology Park,  
Shenzhen, 518057

FCC Registration No.:811562

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded 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 Test	$\pm 1.38\text{dB}$
2	RF power, conducted	$\pm 0.16\text{dB}$
3	Spurious emissions, conducted	$\pm 0.21\text{dB}$
4	All emissions, radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

Equipment	Smart Gateway	
Trade Name	USUNG	
Model Name	US-G101	
Serial Model	N/A	
Model Difference	N/A	
Product Description	The EUT is a Smart Gateway	
	Operation Frequency:	2405~2480 MHz,(Channel Number:16, Channel Frequency=2405+5(K-1), K=1,2,3...16)
	Modulation Type:	O-QPSK
	Number Of Channel	16CH
	Antenna Designation:	Please see Note 3.
	Output Power(Conducted):	9.52dBm (Max.)
	Antenna Gain (dBi)	2.0dbi
	Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.	
Channel List	Please refer to the Note 2.	
Adapter	Model:SMP012C050200 AC Power Input: 100-240V~, 50/60Hz, 0.4A Output: 5.0V ---2.0A	
Battery	N/A	
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.

Channel List for 802.15.4							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2405	05	2425	09	2445	13	2465
02	2410	06	2430	10	2450	14	2470
03	2415	07	2435	11	2455	15	2475
04	2420	08	2440	12	2460	16	2480

3.

Table for Filed Antenna

Ant .	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
A	N/A	N/A	PCB antenna	Reverse SMA-type	2.0	Zigbee Antenna



## 2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	CH1TX
Mode 2	CH8TX
Mode 3	CH16TX
Mode 4	Zigbee Link Mode

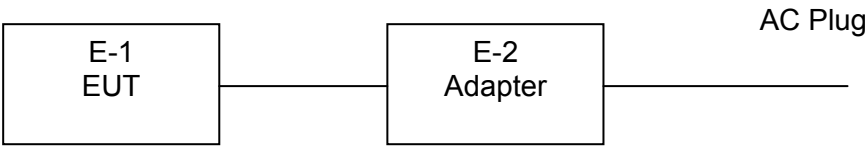
For Conducted Emission	
Final Test Mode	Description
Mode 4	Zigbee Link Mode

For Radiated Emission	
Final Test Mode	Description
Mode 1	CH1TX
Mode 2	CH8TX
Mode 3	CH16TX
Mode 4	Zigbee Link Mode

Note:

- (1) The measurements are performed at the highest, middle, lowest available channels.
- (2) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



## 2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

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	Brand	Model/Type No.	Series No.	Note
E-1	Smart Gateway	USUNG	US-G101	N/A	EUT
E-2	Adapter	N/A	SMP012C050200	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	0.5m	

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 『Length』 column.

## 2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

### Radiation Test equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date
Spectrum Analyzer	Agilent	E4407B	MY45106456	Mar. 20, 2014	Mar. 19, 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	DE25181	Mar. 07, 2014	Mar.06, 2015
EMI Test Receiver	Rohde & Schwarz	ESCI	101165	Mar. 07, 2014	Mar.06, 2015
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar. 07, 2014	Mar.06, 2015
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar. 07, 2014	Mar.06, 2015
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar. 07, 2014	Mar.06, 2015
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar. 07, 2014	Mar.06, 2015
Pre-amplifier	HP	11909A	185903	Mar. 07, 2014	Mar.06, 2015
Pre-amplifier	HP	8447B	3008A00849	Mar. 07, 2014	Mar.06, 2015
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar. 07, 2014	Mar.06, 2015
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Feb. 11, 2014	Feb.10, 2015
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A

### Conduction Test equipment

Description	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	100321	2014-08-10	2015-08-09
50ΩCoaxial Switch	Anritsu	MP59B	X10321	2014-08-10	2015-08-09
L.I.S.N	Rohde & Schwarz	ENV216	101131	2014-08-10	2015-08-09
L.I.S.N	SCHWARZBECK	NNBL 8226-2	8226-2/164	2014-08-10	2015-08-09

### 3. EMC EMISSION TEST

#### 3.1 CONDUCTED EMISSION MEASUREMENT

##### 3.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	Quasi-peak	Average	
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	73.00	60.00	56.00	46.00	CISPR
5.0 -30.0	73.00	60.00	60.00	50.00	CISPR

0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	73.00	60.00	56.00	46.00	FCC
5.0 -30.0	73.00	60.00	60.00	50.00	FCC

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

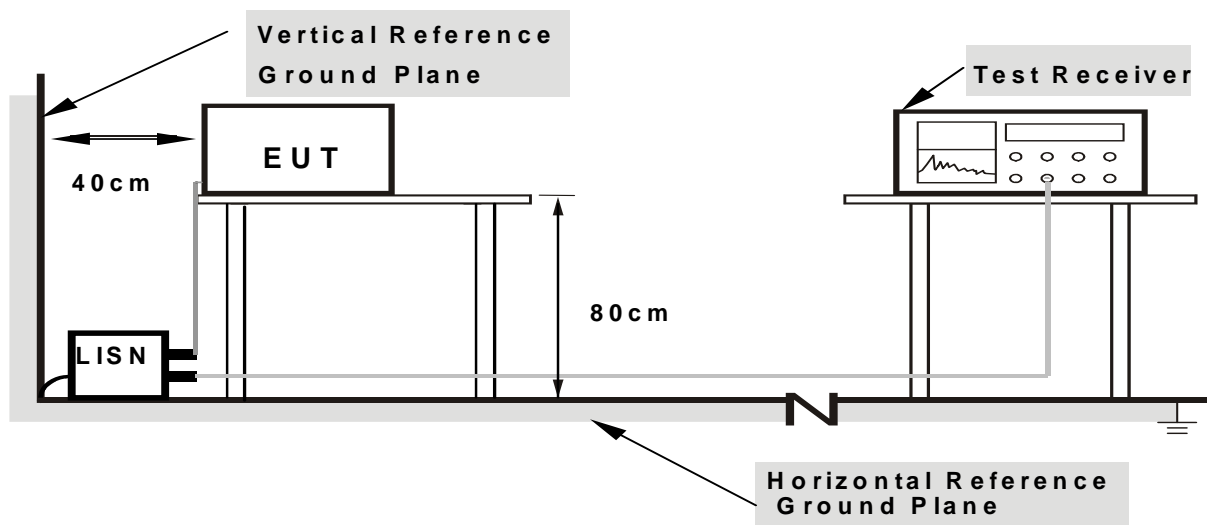
### 3.1.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal 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 DEVIATION FROM TEST STANDARD

No deviation

### 3.1.4 TEST SETUP



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

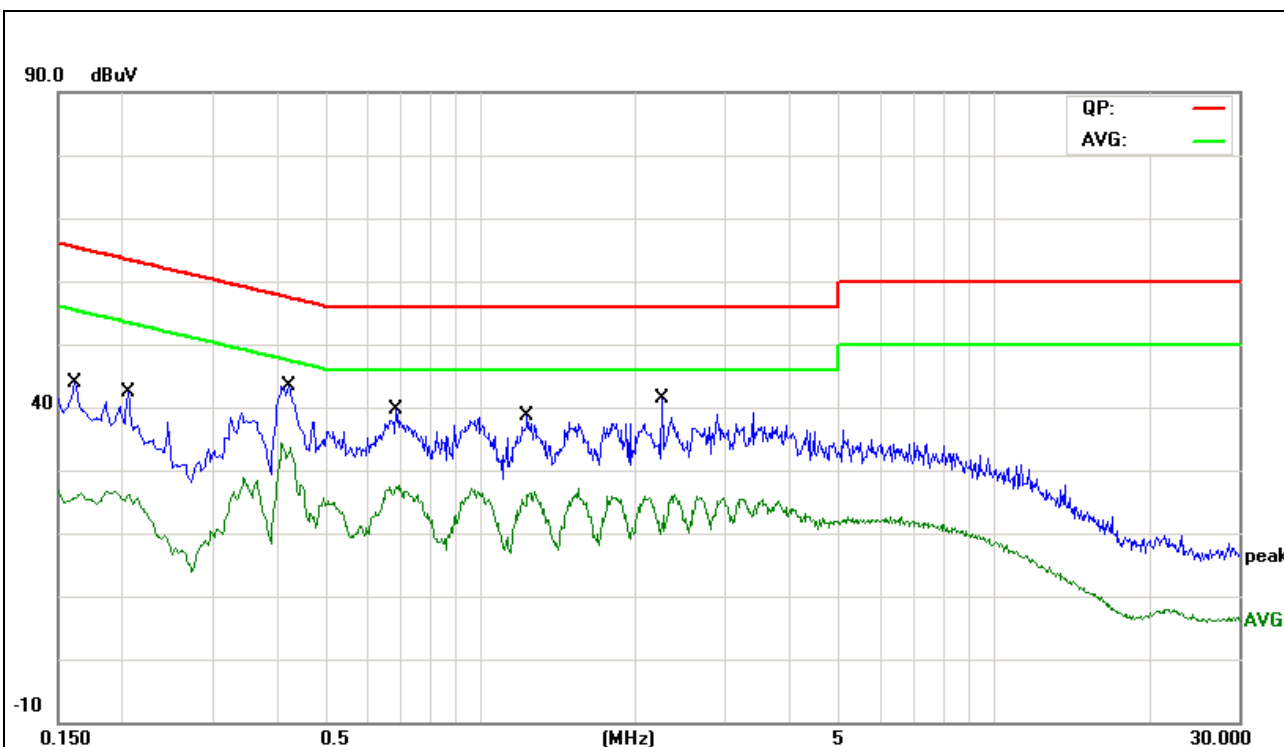
**2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes**

### 3.1.5 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.

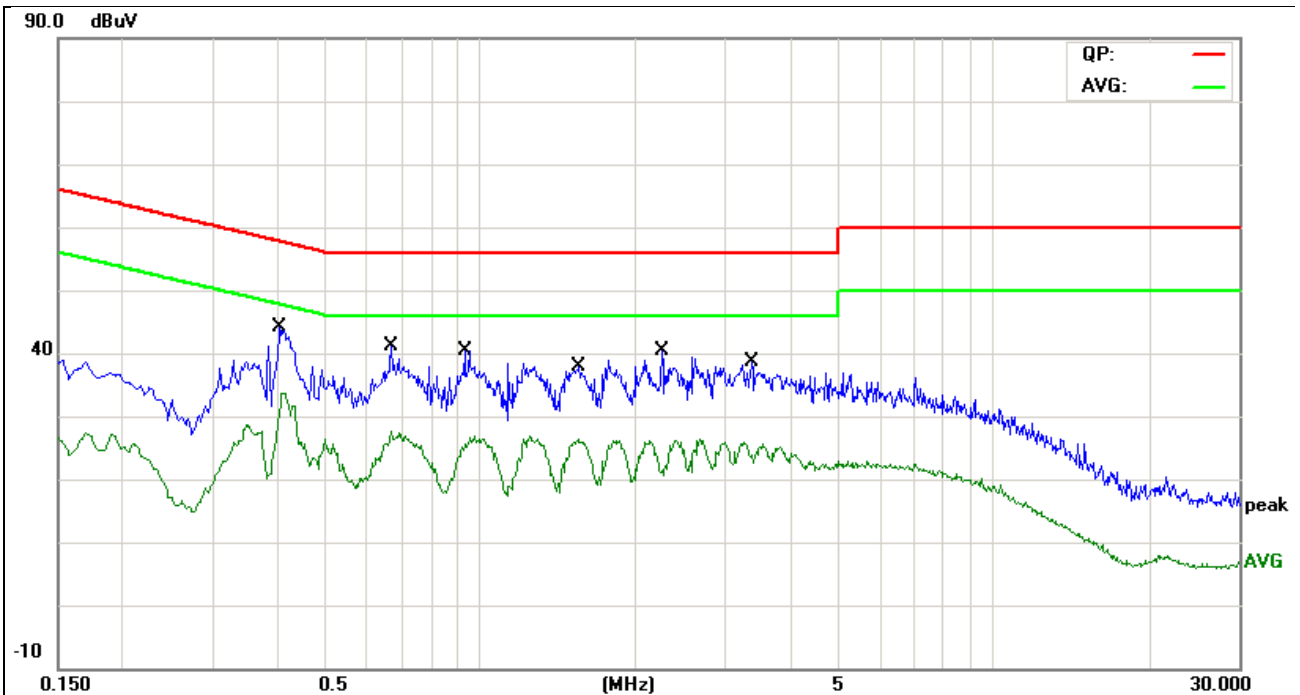
### 3.1.6 TEST RESULTS

EUT :	Smart Gateway	Model Name. :	US-G101
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC 120V	Test Mode :	Mode 4



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1620	24.82	9.94	34.76	65.36	-30.60	QP	
2		0.1620	14.54	9.94	24.48	55.36	-30.88	AVG	
3		0.2060	22.33	10.02	32.35	63.36	-31.01	QP	
4		0.2060	14.28	10.02	24.30	53.36	-29.06	AVG	
5		0.4220	28.64	10.02	38.66	57.41	-18.75	QP	
6	*	0.4220	20.57	10.02	30.59	47.41	-16.82	AVG	
7		0.6860	24.15	10.11	34.26	56.00	-21.74	QP	
8		0.6860	16.89	10.11	27.00	46.00	-19.00	AVG	
9		1.2300	23.55	10.06	33.61	56.00	-22.39	QP	
10		1.2300	15.20	10.06	25.26	46.00	-20.74	AVG	
11		2.2540	18.54	10.05	28.59	56.00	-27.41	QP	
12		2.2540	9.77	10.05	19.82	46.00	-26.18	AVG	

EUT :	Smart Gateway	Model Name. :	US-G101
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	AC 120V	Test Mode :	Mode 4



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.4060	30.07	10.05	40.12	57.73	-17.61	QP	
2	*	0.4060	22.04	10.05	32.09	47.73	-15.64	AVG	
3		0.6700	25.82	10.02	35.84	56.00	-20.16	QP	
4		0.6700	18.24	10.02	28.26	46.00	-17.74	AVG	
5		0.9300	24.34	10.13	34.47	56.00	-21.53	QP	
6		0.9300	16.03	10.13	26.16	46.00	-19.84	AVG	
7		1.5540	24.12	10.10	34.22	56.00	-21.78	QP	
8		1.5540	16.59	10.10	26.69	46.00	-19.31	AVG	
9		2.2580	21.14	10.06	31.20	56.00	-24.80	QP	
10		2.2580	11.10	10.06	21.16	46.00	-24.84	AVG	
11		3.3780	21.84	10.06	31.90	56.00	-24.10	QP	
12		3.3780	13.47	10.06	23.53	46.00	-22.47	AVG	



### 3.2 RADIATED EMISSION MEASUREMENT

#### 3.2.1 RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (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

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~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 up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both 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:

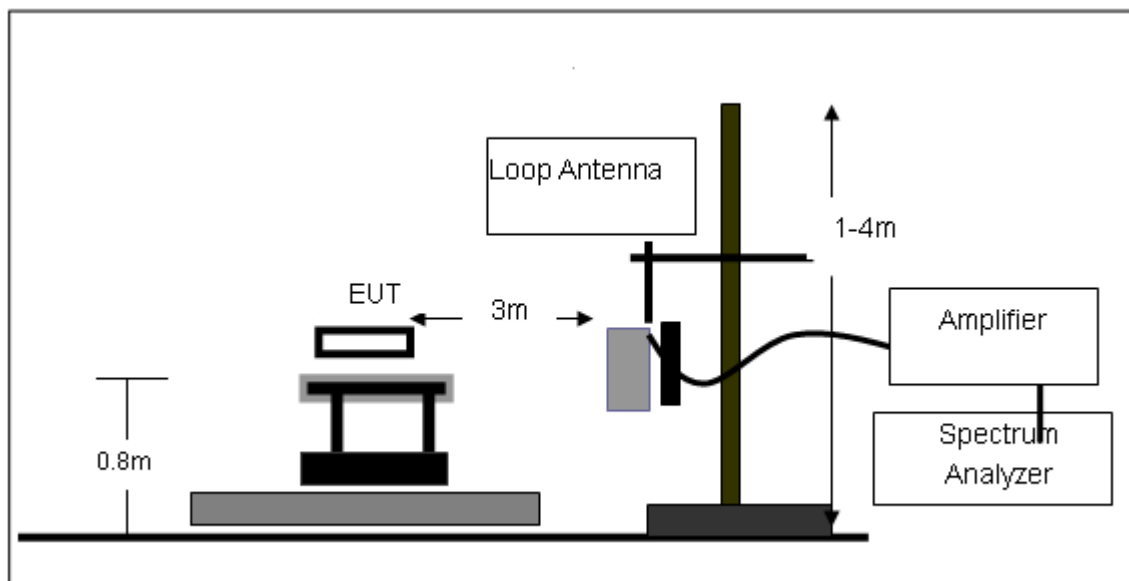
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

### **3.2.3 DEVIATION FROM TEST STANDARD**

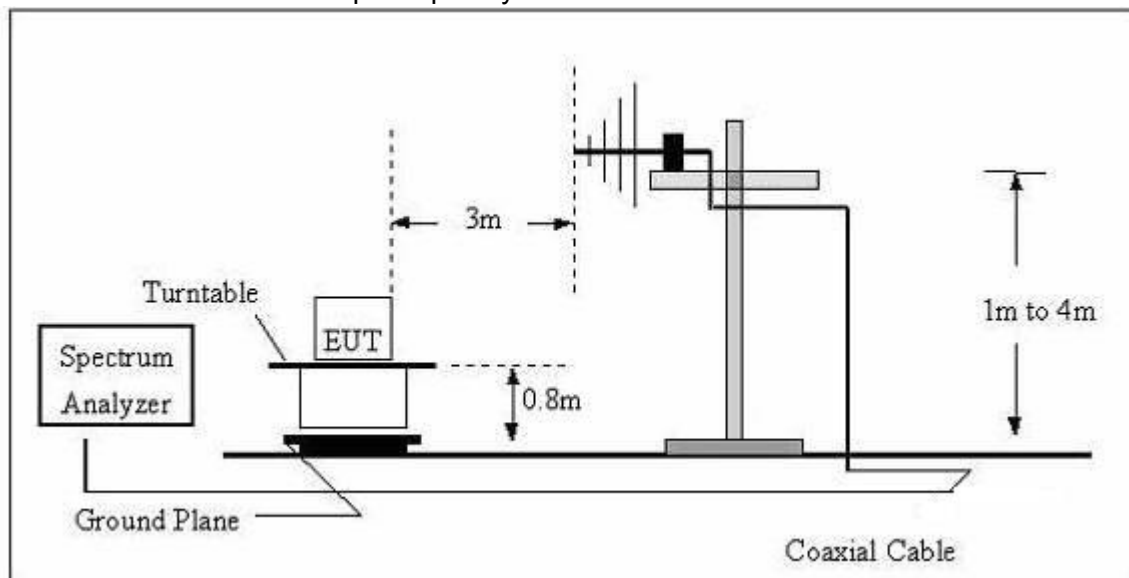
No deviation

### 3.2.4 TEST SETUP

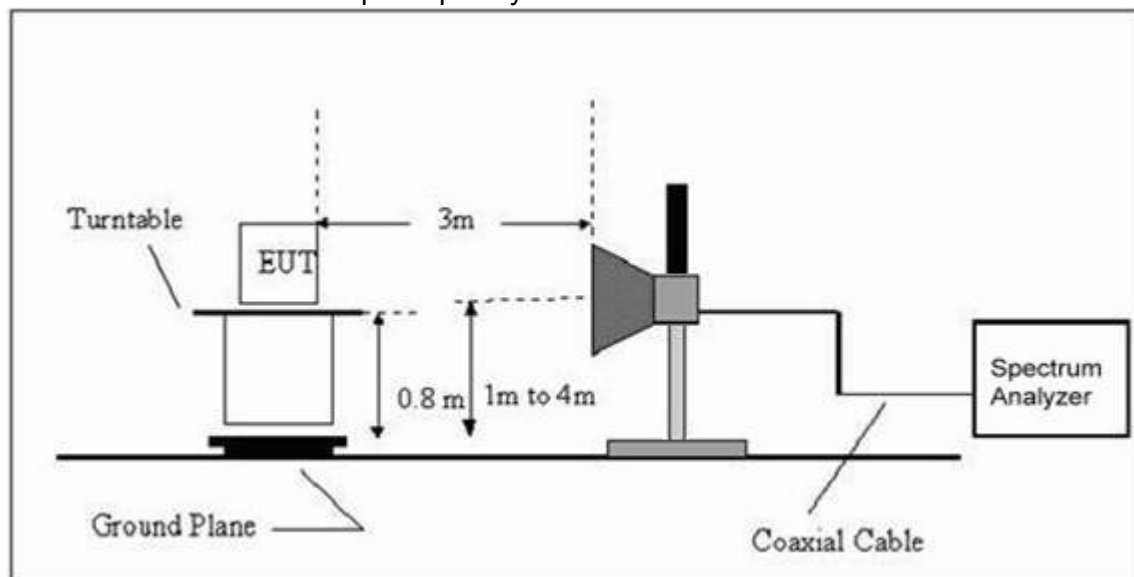
#### (A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



### 3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

### 3.2.6 TEST RESULTS (BETWEEN 9KHZ – 30 MHZ)

EUT:	Smart Gateway	Model Name. :	US-G101
Temperature:	20 °C	Relative Humidity:	48%
Pressure:	1010 hPa	Test Voltage :	AC 120V
Test Mode :	TX	Polarization :	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	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 =  $40 \log (\text{specific distance}/\text{test distance})$ (dB);

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

### 3.2.7 TEST RESULTS (BETWEEN 30MHZ – 1GHZ)

EUT :	Smart Gateway	Model Name :	US-G101
Temperature :	20 °C	Relative Humidity :	48%
Pressure:	1010 hPa	Test Voltage :	AC 120V
Test Mode :	TX		

Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
H	56.7252	33.26	-14.45	18.81	40	-21.19	QP
H	88.7255	32.47	-13.72	18.75	40	-21.25	QP
H	127.4347	32.36	-14.58	17.78	43.5	-25.72	QP
H	165.2738	33.83	-12.51	21.32	43.5	-22.18	QP
H	565.8453	36.52	-13.84	22.68	46	-23.32	QP
H	847.1679	35.63	-11.92	23.71	46	-22.29	QP
V	41.2693	36.47	-13.66	22.81	40	-17.19	QP
V	55.1976	41.39	-14.82	26.57	40	-13.43	QP
V	66.3682	41.61	-14.65	26.96	40	-13.04	QP
V	79.1793	41.38	-14.74	26.64	40	-13.36	QP
V	154.9474	42.97	-13.92	29.05	43.5	-14.45	QP
V	782.2366	36.67	-12.38	24.29	46	-21.71	QP
<b>Remark:</b> Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level- Limit Factor = Antenna Factor + Cable Loss – Pre-amplifier. Factor added by measurement software automatically							

### 3.2.8 TEST RESULTS (1G-25GHZ)

#### 802.15.4

Normal Voltage

Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
Low Channel (2405MHz)							
Vertical	2458.072	62.73	-13.14	49.59	74	-24.41	Pk
Horizontal	2457.893	63.35	-14.53	48.82	74	-25.18	Pk
Vertical	4810.359	61.83	-11.66	50.17	74	-23.83	Pk
Horizontal	4810.414	61.37	-11.49	49.88	74	-24.12	Pk
Vertical	1683.652	62.57	-13.62	48.95	74	-25.05	Pk
Vertical	1725.413	63.26	-14.53	48.73	74	-25.27	Pk
Vertical	2131.724	62.29	-13.52	48.77	74	-25.23	Pk
Horizontal	1376.743	61.17	-13.72	47.45	74	-26.55	Pk
Horizontal	1631.853	62.61	-15.57	47.04	74	-26.96	Pk
Horizontal	1878.267	60.39	-14.66	45.73	74	-28.27	Pk
Mid Channel (2440 MHz)							
Vertical	2494.373	63.36	-12.61	50.75	74	-23.25	Pk
Horizontal	2495.944	62.72	-11.89	50.83	74	-23.17	Pk
Vertical	4880.833	63.61	-11.46	52.15	74	-21.85	Pk
Horizontal	4880.946	62.84	-11.51	51.33	74	-22.67	Pk
Vertical	1189.036	64.26	-11.73	52.53	74	-21.47	Pk
Vertical	1677.468	61.74	-14.27	47.47	74	-26.53	Pk
Vertical	2097.853	60.61	-11.27	49.34	74	-24.66	Pk
Horizontal	1438.384	63.36	-14.72	48.64	74	-25.36	Pk
Horizontal	1686.857	64.93	-15.65	49.28	74	-24.72	Pk
Horizontal	1948.258	65.11	-15.16	49.95	74	-24.05	Pk
High Channel (2480 MHz)							
Vertical	2474.227	62.88	-11.73	51.15	74	-22.85	Pk
Horizontal	2474.699	61.73	-11.56	50.17	74	-23.83	Pk
Vertical	4960.754	61.16	-11.52	49.64	74	-24.36	Pk
Horizontal	4960.257	61.55	-11.62	49.93	74	-24.07	Pk
Vertical	1467.754	62.27	-12.26	50.01	74	-23.99	Pk
Vertical	1688.753	63.74	-13.53	50.21	74	-23.79	Pk
Vertical	2114.853	59.23	-12.26	46.97	74	-27.03	Pk
Horizontal	1272.257	60.68	-14.47	46.21	74	-27.79	Pk
Horizontal	1534.268	59.62	-15.38	44.24	74	-29.76	Pk
Horizontal	1865.743	60.88	-15.82	45.06	74	-28.94	Pk

Note: The PK value is less than the AV value, AV value is not required  
Factor added by measurement software automatically.

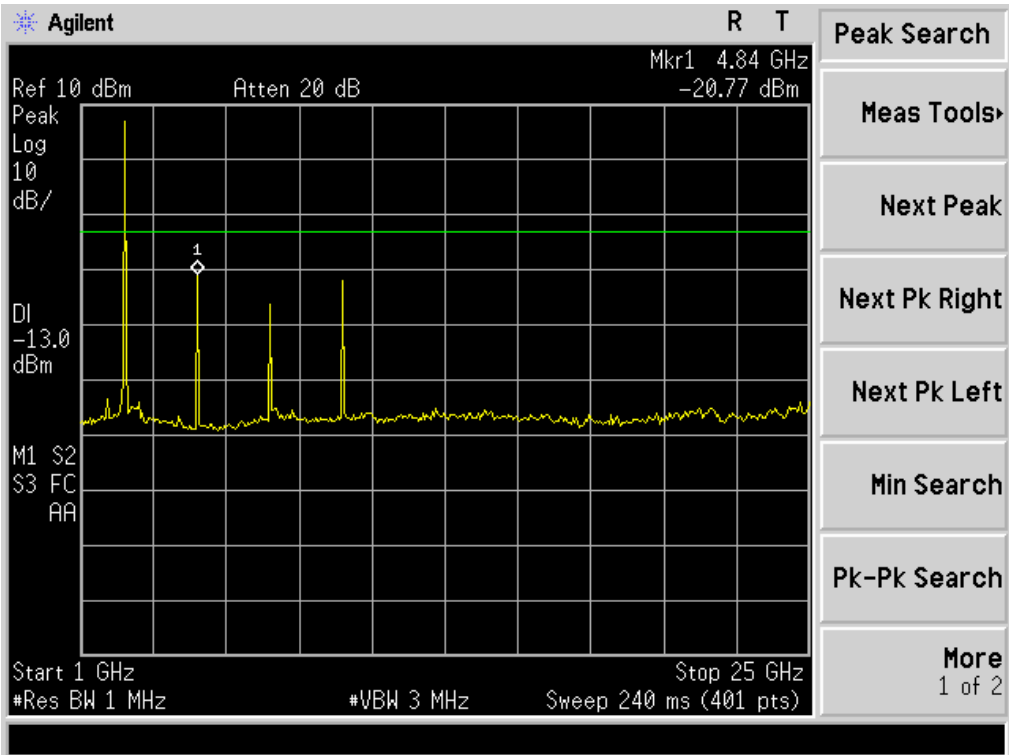
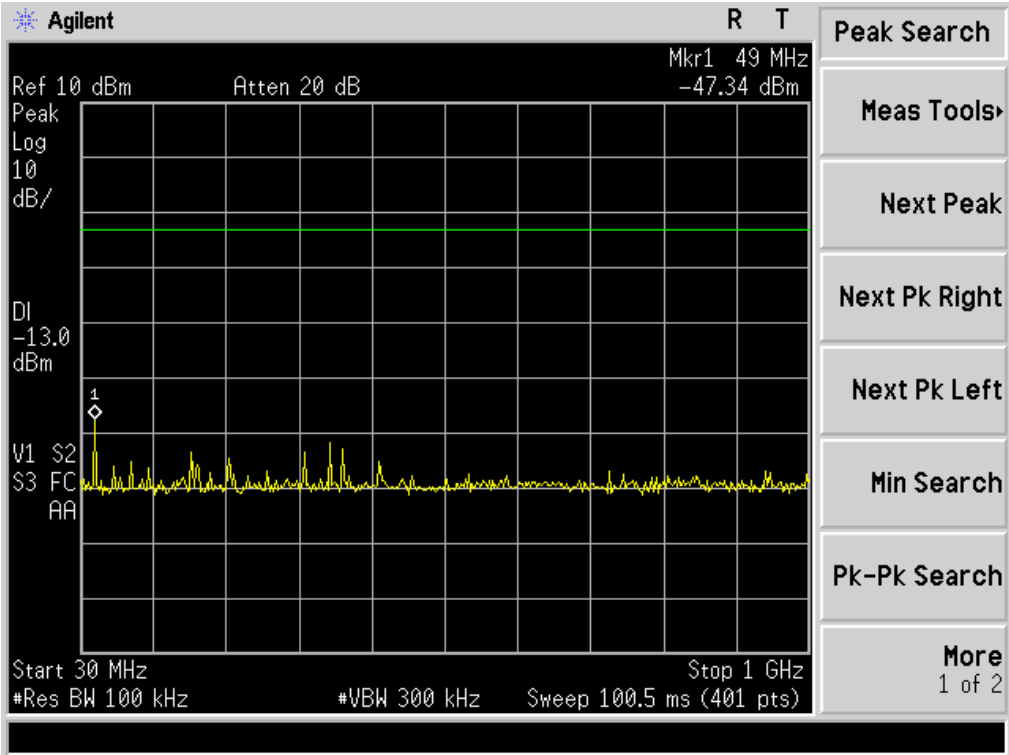
**BAND EDGE(Radiated)**

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	Type	
802.15.4							
2390	58.57	-13.43	45.14	74	-28.86	peak	Vertical
2390	58.86	-13.43	45.43	74	-28.57	peak	Horizontal
2483.5	59.63	-12.89	46.74	74	-27.26	peak	Vertical
2483.5	59.78	-12.89	46.89	74	-27.11	peak	Horizontal

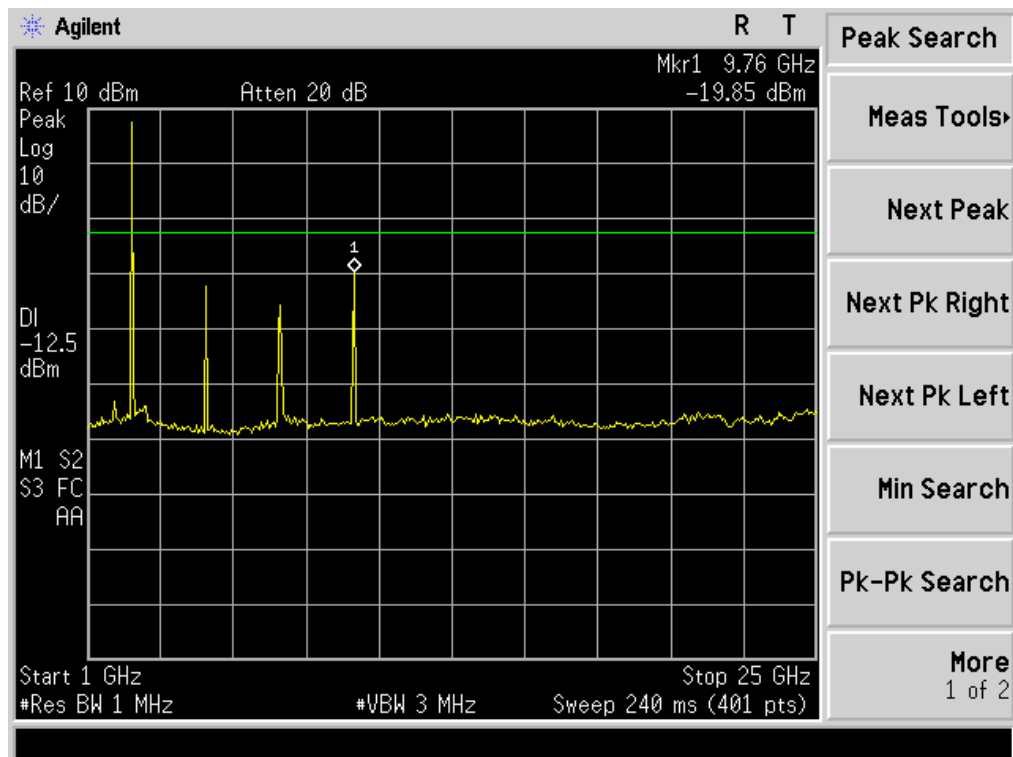
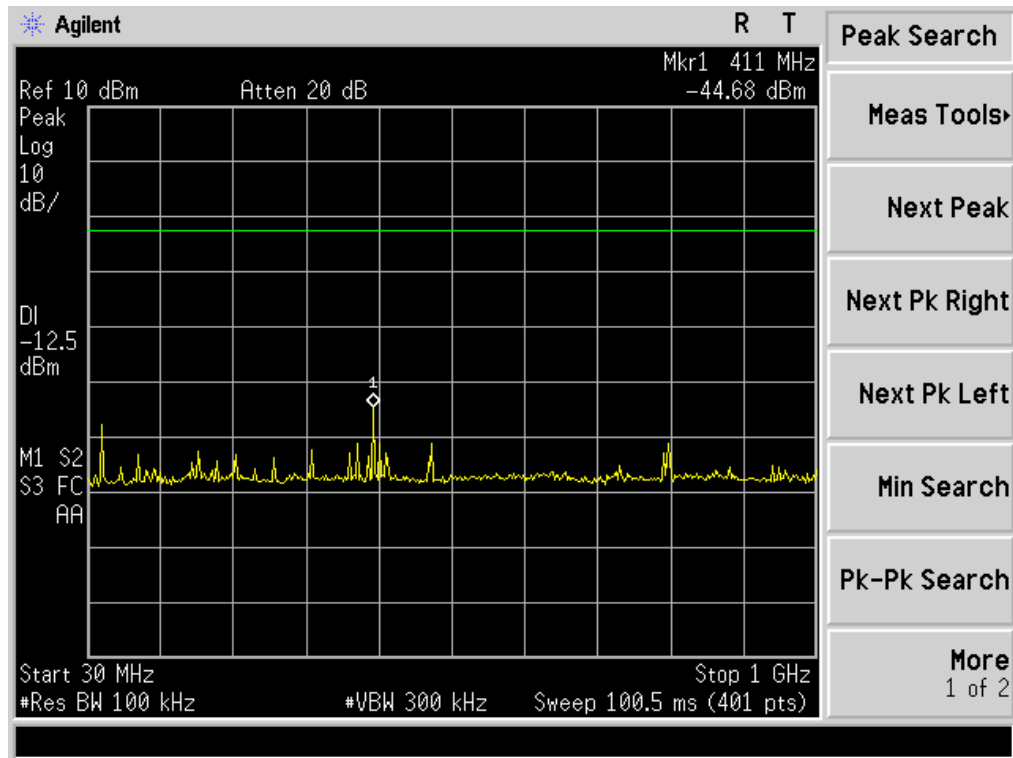
NOTE: The PK value is less than the AV value, AV value is not required.



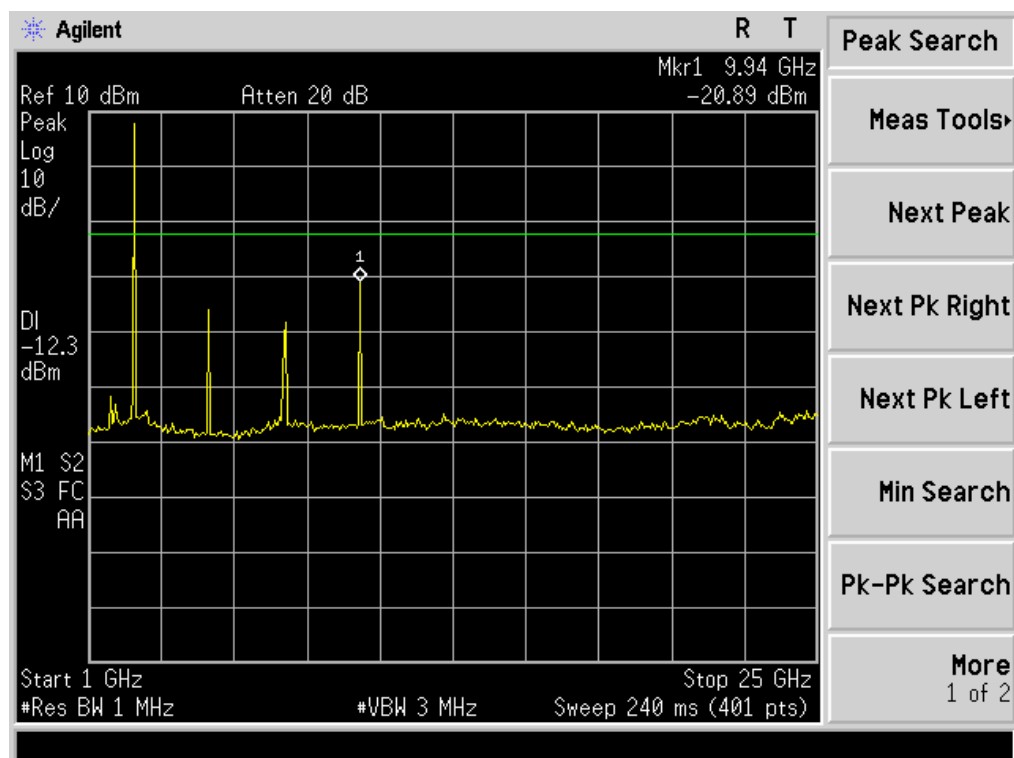
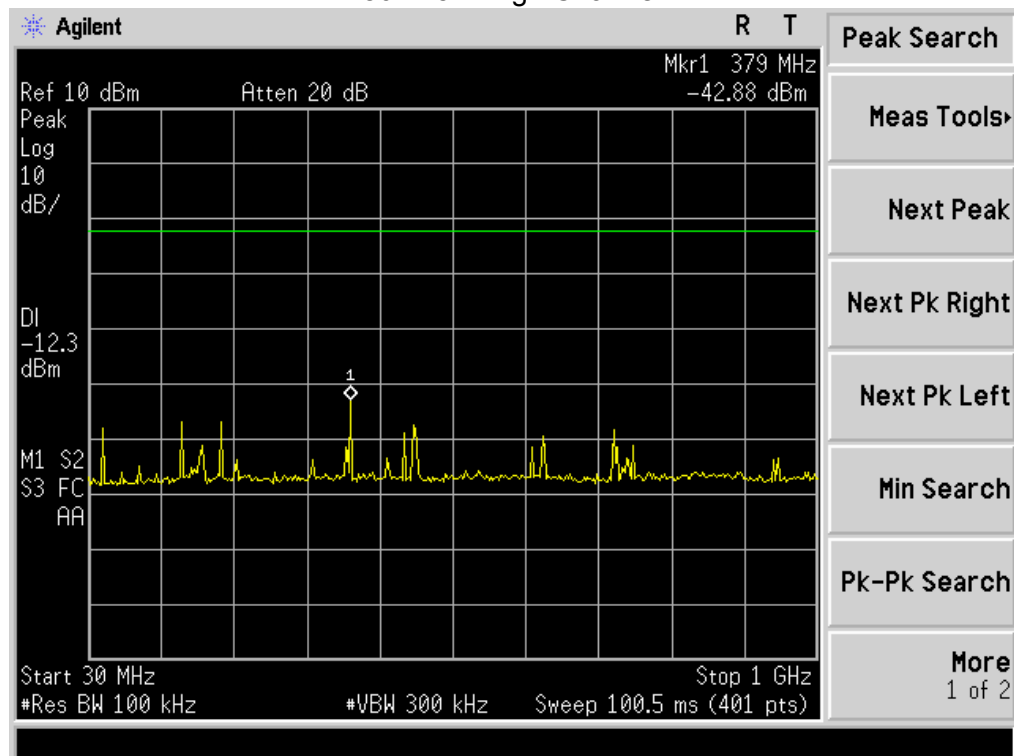
Conducted Spurious Emissions at Antenna Port:  
802.15.4 Low Channel



# 802.15.4 Middle Channel



# 802.15.4 High Channel



## 4. POWER SPECTRAL DENSITY TEST

### 4.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

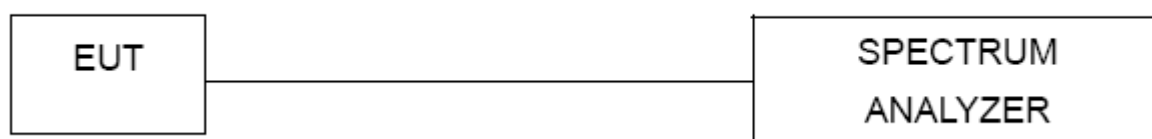
#### 4.1.1 TEST PROCEDURE

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 RBW  $\geq 3$  kHz.
4. Set the VBW  $\geq 3 \times$  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.

#### 4.1.2 DEVIATION FROM STANDARD

No deviation.

#### 4.1.3 TEST SETUP



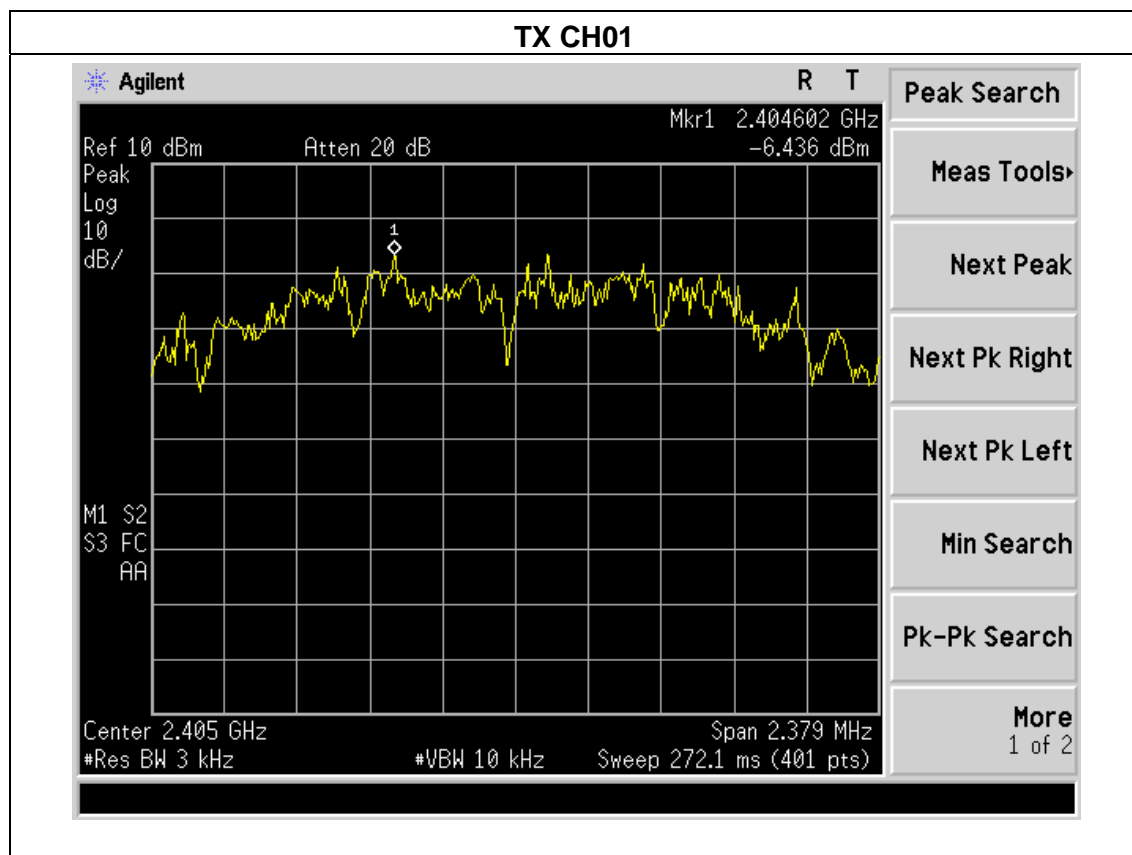
#### 4.1.4 EUT OPERATION CONDITIONS

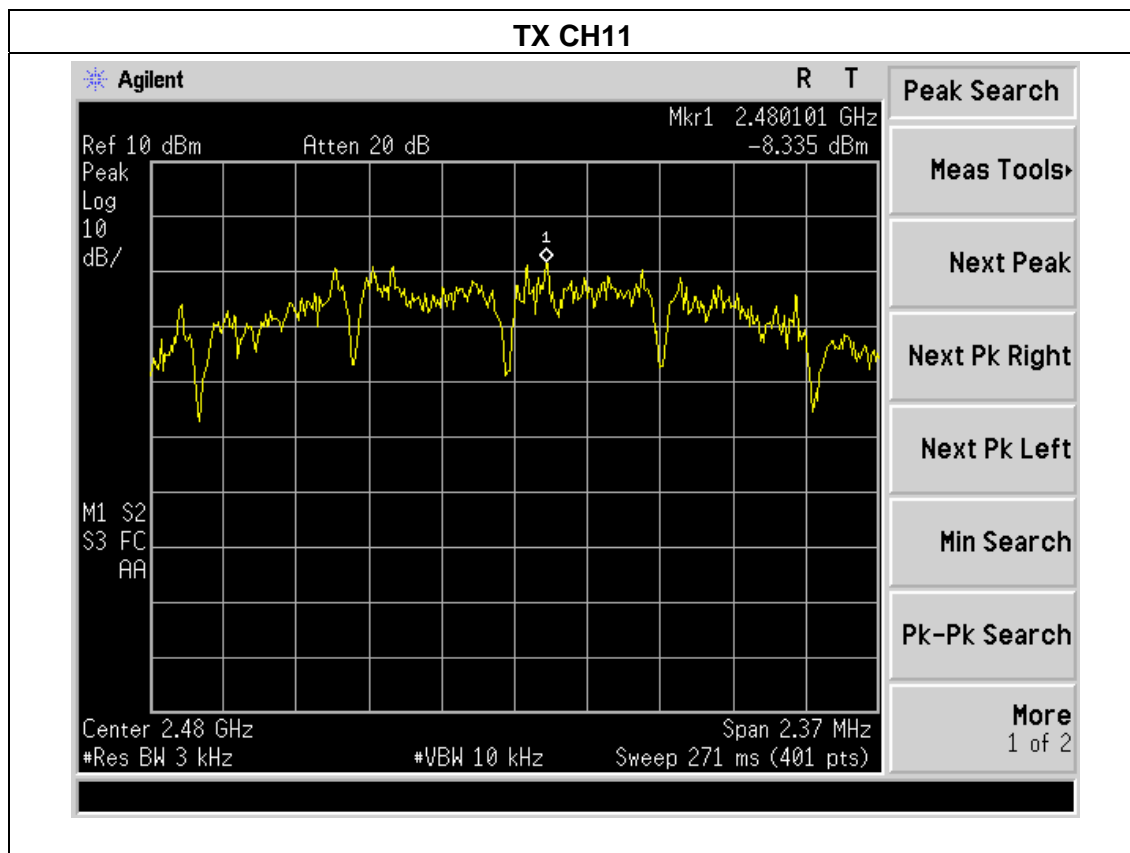
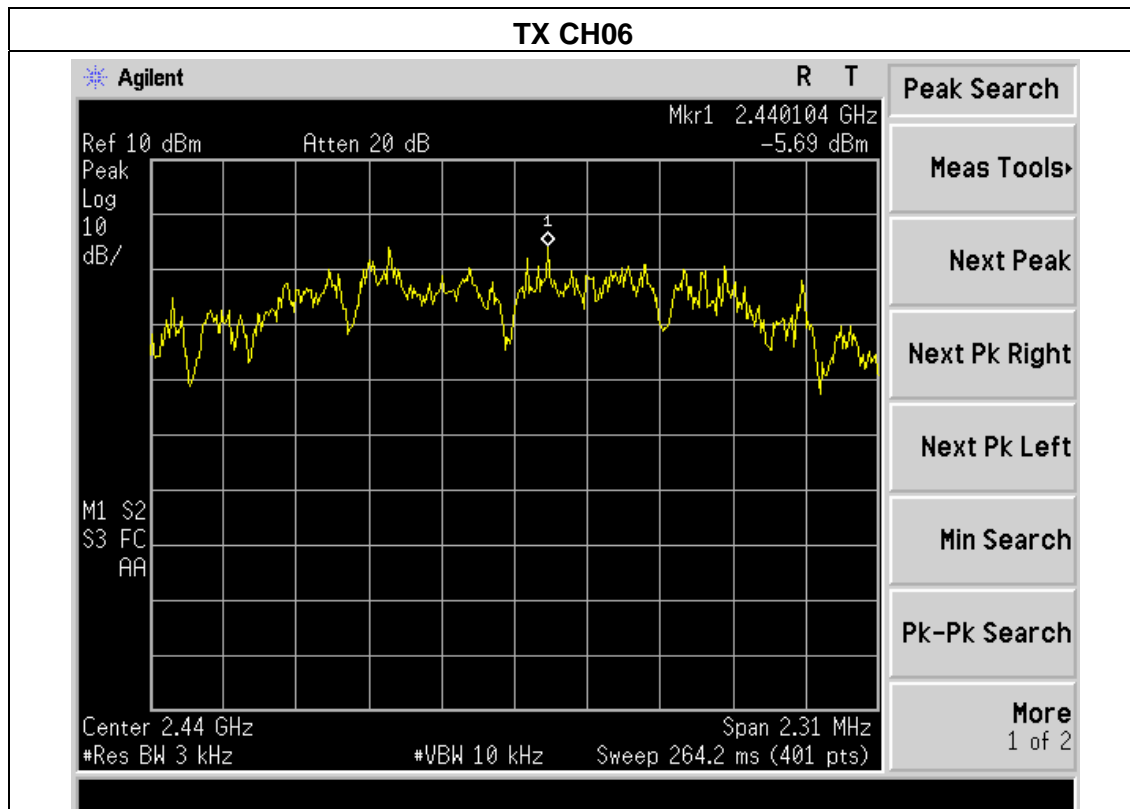
The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.

#### 4.1.5 TEST RESULTS

EUT :	Smart Gateway	Model Name :	US-G101
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1015 hPa	Test Voltage :	AC 120V
Test Mode :	TX Mode /CH01, CH08, CH16		

Frequency	Power Density (dBm)	Limit (dBm)	Result
2405 MHz	-6.436	8	PASS
2440 MHz	-5.690	8	PASS
2480 MHz	-8.335	8	PASS





## 5. BANDWIDTH TEST

### 5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

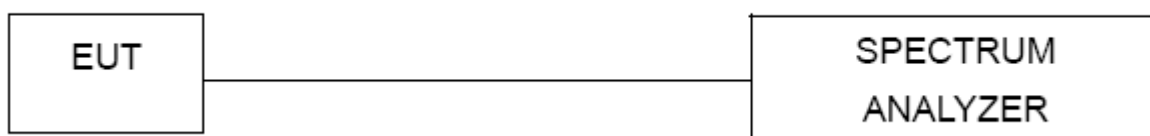
#### 5.1.1 TEST PROCEDURE

1. Set RBW= 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3 \times \text{RBW}$ .
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

#### 5.1.2 DEVIATION FROM STANDARD

No deviation.

#### 5.1.3 TEST SETUP



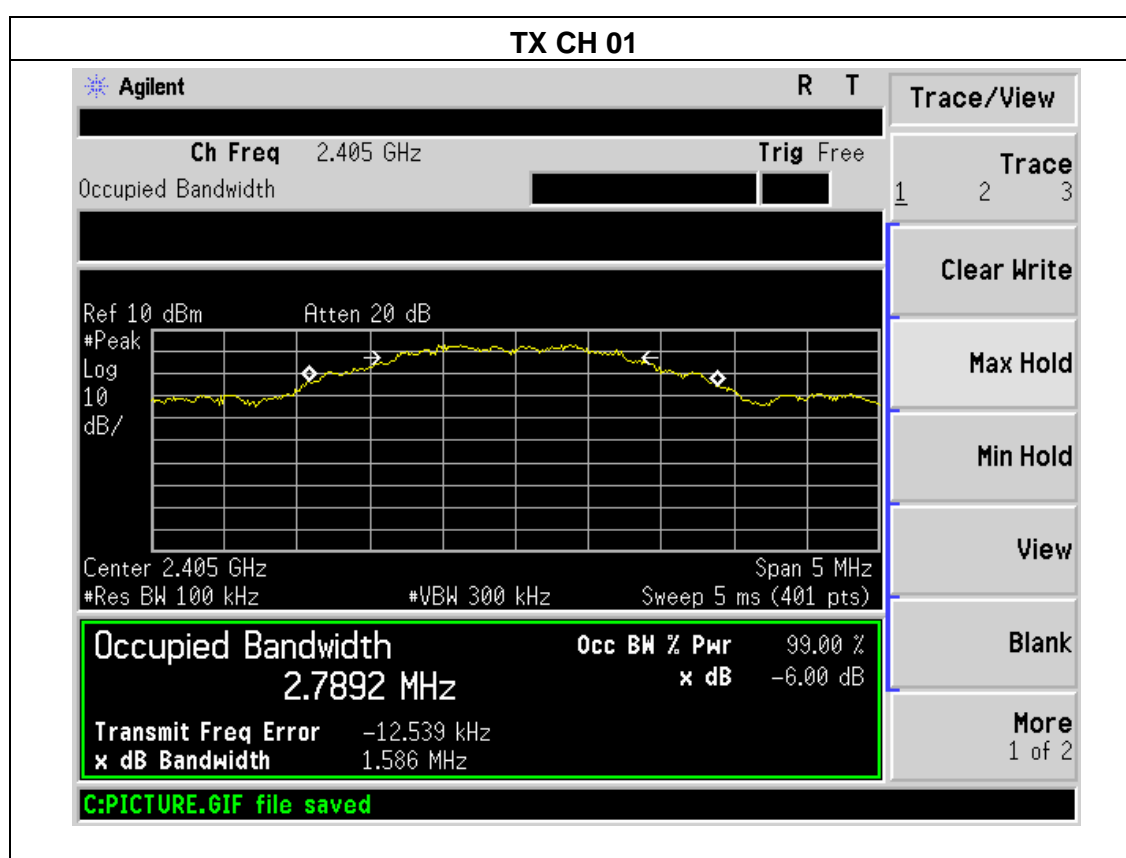
#### 5.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

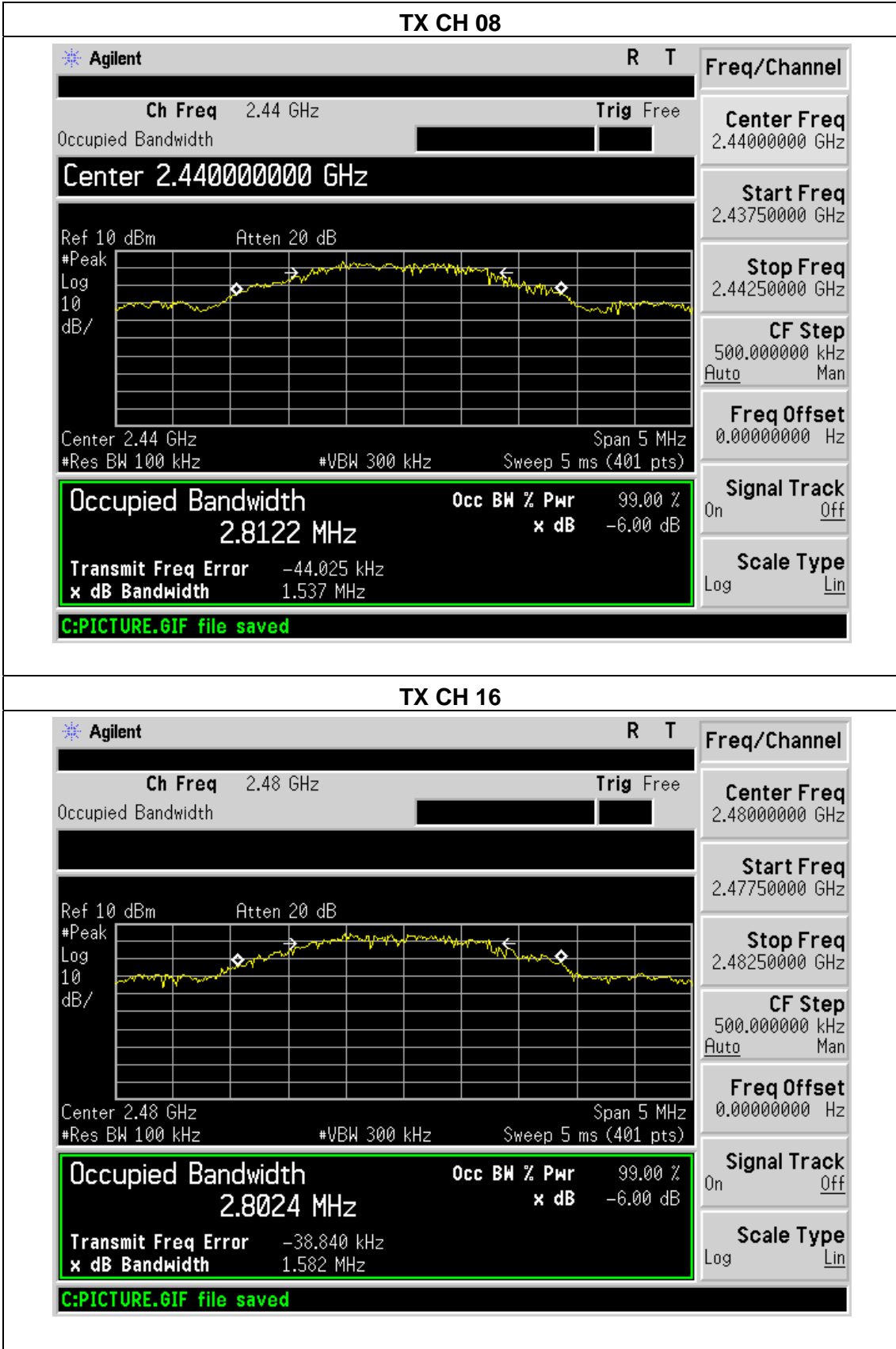
## 5.1.5 TEST RESULTS

EUT :	Smart Gateway	Model Name :	US-G101
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	AC 120V
Test Mode :	TX Mode /CH01, CH08, CH16		

Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
Low	2405	1.531	500	Pass
Middle	2440	1.580	500	Pass
High	2480	1.624	500	Pass







## 6. PEAK OUTPUT POWER TEST

### 6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

#### 6.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the Power meter

#### 6.1.2 DEVIATION FROM STANDARD

No deviation.

#### 6.1.3 TEST SETUP



#### 6.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

### 6.1.5 TEST RESULTS

EUT :	Smart Gateway	Model Name :	US-G101
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	AC 120V
Test Mode :	TX Mode /CH01, CH08, CH16		

TX 802.15.4 Mode			
Test Channe	Frequency	Maximum Conducted Output Power(PK)	LIMIT
	(MHz)	(dBm)	dBm
CH01	2405	9.52	30
CH08	2440	9.43	30
CH16	2480	9.45	30

## 7. 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)).

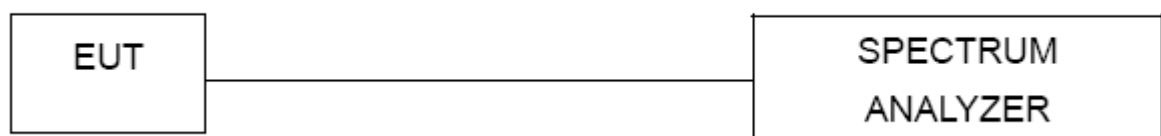
### TEST PROCEDURE

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) 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.
- c) 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.
- d) 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.
- e) Repeat above procedures until all measured frequencies were complete.

### 7.1 DEVIATION FROM STANDARD

No deviation.

### 7.2 TEST SETUP



### 7.3 EUT OPERATION CONDITIONS

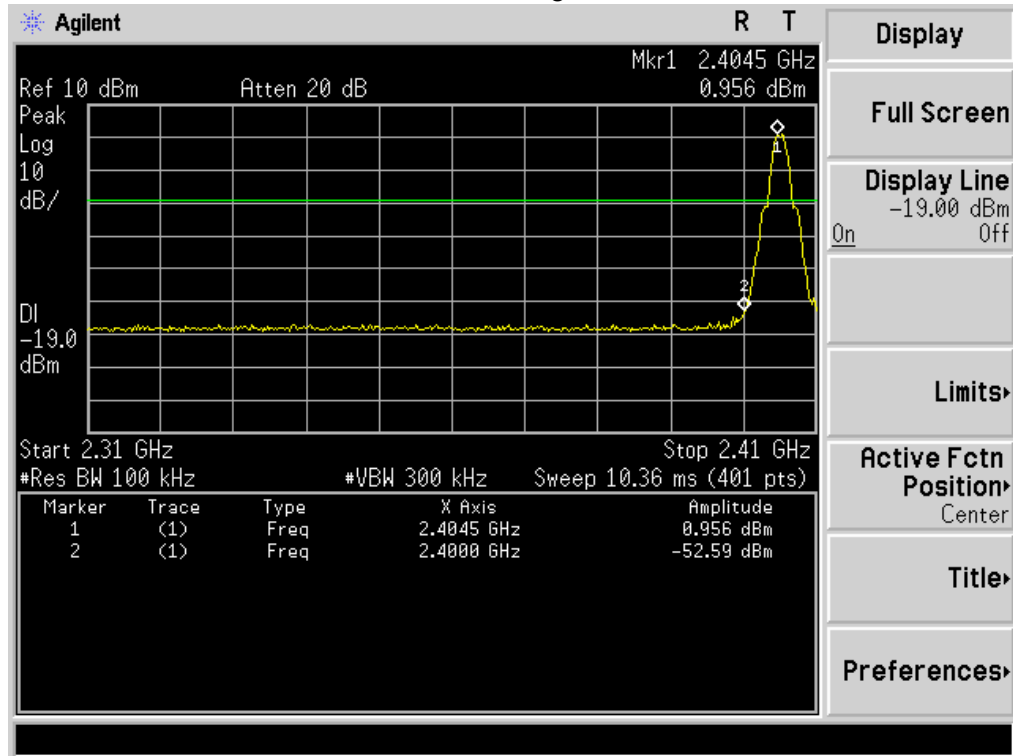
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

## 7.4 TEST RESULTS

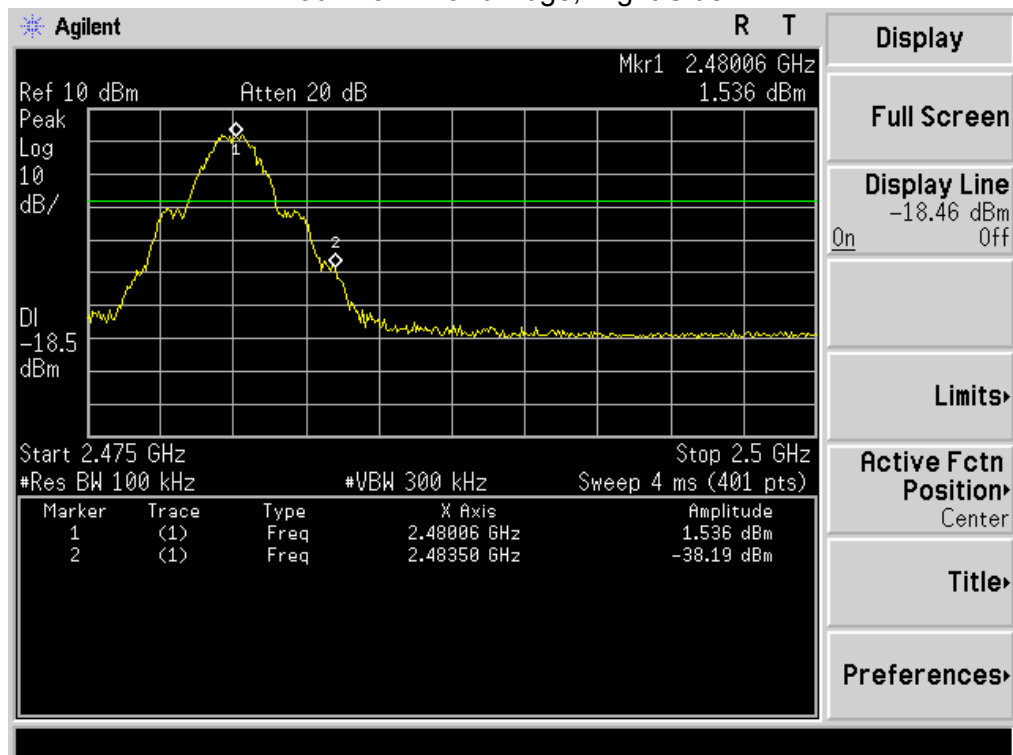
EUT :	Smart Gateway	Model Name :	US-G101
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	AC 120V

Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
802.15.4mode			
Left-band	56.165	20	Pass
Right-band	38.391	20	Pass

### 802.15.4: Band Edge, Left Side



### 802.15.4: Band Edge, Right Side



## **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 External antenna(Reverse SMA-type,3dbi). It comply with the standard requirement. In case of replacement of broken antenna the same antenna type must be used.

## 9. EUT TEST PHOTO

### Radiated Measurement Photos

