



# RADIO TESTREPORT

Report No.: STS1808216W01

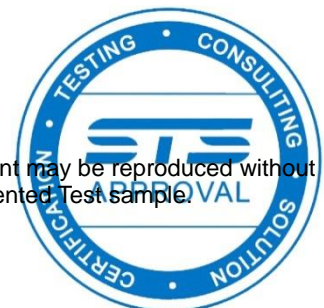
Issued for

SIDAS SAS

18, rue Léon Béridot- BP 353, 38509 Voiron, France

<b>Product Name:</b>	U-Pack BLE Therm-ic
<b>Brand Name:</b>	SIDAS, THERM-IC
<b>Model Name:</b>	U-Pack B
<b>Series Model:</b>	N/A
<b>FCC ID:</b>	2ANSXUPACK
<b>Test Standard:</b>	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart C Section 15.209 CFR47 FCC Part 15: Subpart B Section 15.107 CFR47 FCC Part 15: Subpart B Section 15.109

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### TEST RESULT CERTIFICATION

**Applicant's name** .....: SIDAS SAS  
 Address .....: 18, rue Léon Béridot- BP 353, 38509 Voiron, France  
**Manufacture's Name** .....: Shenzhen Komkia Technologies Co., Ltd.  
 Address .....: Building D,OA-04, Fenghuang 3rd Industrial Zone, Fuyong Town,  
 BaoAn District, Shenzhen City. Guangdong, 518103 China

#### Product description

Product Name.....: U-Pack BLE Therm-ic  
 Brand Name.....: SIDAS, THERM-IC  
 Model Name .....: U-Pack B  
 SeriesModel.....: N/A  
**Test Standards** .....: CFR47 FCC Part 15: Subpart C Section 15.247  
 CFR47 FCC Part 15: Subpart C Section 15.207  
 CFR47 FCC Part 15: Subpart C Section 15.209  
 CFR47 FCC Part 15: Subpart B Section 15.107  
 CFR47 FCC Part 15: Subpart B Section 15.109

Test procedure .....: ANSI C63.10: 2013, ANSI C63.4: 2014

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 .....: 24 Aug. 2018 -31 Aug. 2018  
 Date of Issue .....: 05 Sep. 2018  
 Test Result.....: **Pass**

Testing Engineer : Chris Chen  
 ( Chris Chen )

Technical Manager : Sean She  
 ( Sean She )

Authorized Signatory : Vita Li  
 ( Vita Li )





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**Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	05 Sept. 2018	STS1808216W01	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,Subpart C			
StandardSection	Test Item	Judgment	Remark
FCC Part 15.207(a)	Conducted Emission	N/A	
FCC Part 15.247(a)(2)	6dB Bandwidth	PASS	
FCC Part 15.247(b)(3)	Output Power	PASS	
FCC Part 15.247(d)	Radiated Spurious Emission	PASS	
FCC Part 15.247(d)	Conducted Spurious & Band EdgeEmission	PASS	
FCC Part 15.247(e)	Power Spectral Density	PASS	
FCC Part 15.205	Restricted Band Edge Emission	PASS	
FCC Part 15.247(d)&15.209(a)	Band Edge Emission	PASS	
FCC Part 15.247(b)(4) &15.203	Antenna Requirement	PASS	

FCC Part 15,Subpart B			
StandardSection	Test Item	Judgment	Remark
FCC Part 15.107(a)	Conducted Emission	N/A	Class B limit
FCC Part 15.109(a)	Radiated Emission	PASS	Class B limit

NOTE:

- 1) 'N/A' denotes test is not applicable in this test report
- 2) All tests were performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014.



## 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  
A2LA Certificate No.: 4338.01

## 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 (9KHz-150KHz)	$\pm 2.88\text{dB}$
2	Conducted Emission (150KHz-30MHz)	$\pm 2.67\text{dB}$
3	RF power,conducted	$\pm 0.71\text{dB}$
4	Spurious emissions,conducted	$\pm 0.63\text{dB}$
5	All emissions,radiated (9KHz-30MHz)	$\pm 3.02\text{dB}$
6	All emissions,radiated(30MHz-200MHz)	$\pm 3.80\text{dB}$
7	All emissions,radiated(200MHz-1000MHz)	$\pm 3.97\text{dB}$
8	All emissions,radiated(>1G)	$\pm 3.03\text{dB}$



## 2 GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

Product Name	U-Pack BLE Therm-ic	
Trade Name	SIDAS, THERM-IC	
Model Name	U-Pack B	
Series Model	N/A	
Model Difference	N/A	
Product Description	The U-Pack BLE Therm-ic is a device used to control the temperature of a 7.5ohm heating element, controlled through the connection to a phone using the Bluetooth standard 2.4GHz frequency. It is powered by the 5V output of a standard power bank.	
	Operation Frequency:	2402 - 2480 MHz
	Modulation Type:	GFSK
	Bit Rate of Transmitter:	1 M/bps
	Number Of Channel:	40 channels
	Antenna Designation:	Please see Note 4
	Antenna Gain(dBi):	-0.5dBi
	Duty Cycle:	>98%
Channel List	Please refer to the Note 2.	
Power Rating	Input: DC 5.0V via USB port	
Hardware version	N/A	
Software version	N/A	
Radio Hardware version	N/A	
Radio Software version	N/A	
Test Software	N/A	
RF Power Setting TEST Software (power class)	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

RF Channel and Frequency of BLE			
RF Channel	Freq.(MHz)	RF Channel	Freq.(MHz)
<b>37</b>	<b>2402</b>	18	2442
00	2404	19	2444
01	2406	20	2446
02	2408	21	2448
03	2410	22	2450
04	2402	23	2452
05	2414	24	2454
06	2416	25	2456
07	2418	26	2458
08	2420	27	2460
09	2422	28	2480
10	2424	29	2464
38	2426	30	2466
11	2428	31	2468
12	2430	32	2470
13	2432	33	2472
14	2434	34	2474
15	2436	35	2476
16	2438	36	2478
<b>17</b>	<b>2440</b>	<b>39</b>	<b>2480</b>

3 Note:

- 1) 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;
- 2) Test frequencies are lowest channel: 2402 MHz, middle channel: 2440 MHz and highest channel: 2480MHz.

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Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	U-pack	Integral Antenna	N/A	-0.5	BLE 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 BLE CH37	1 Mbps
Mode 2	TX BLE CH17	1 Mbps
Mode 3	TX BLE CH39	1 Mbps
Mode4	Normal operating mode	/

Note:

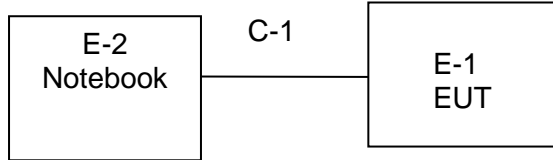
- 1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported
- 2) Controlled using a bespoke application on the laptop PC supplied by the customer. The application was used to enable a continuous transmission mode and to select the test channels, data rates and modulation schemes as required.





## 2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiation 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-2	Notebook	DELL	VOSTRO.3800	N/A	N/A

Item	Shielded Type	Ferrite Core	Length	Note
C-1	USB Cable	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 『Length』 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

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
EMI Test Receiver	R&S	ESCI	102086	2017.10.15	2018.10.14
Spectrum Analyzer	Agilent	E4407B	MY50140340	2018.03.08	2019.03.07
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2018.11.01
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-1343	2017.10.27	2018.10.26
SHF-EHF Horn Antenna(18G-40GHz)	A-INFO	LB-180400-KF	N/A	2018.03.11	2019.03.10
Temperature & Humidity	HH660	Mieo	N/A	2017.10.15	2018.10.14
Temperature & Humidity	HH660	Mieo	N/A	2017.10.15	2018.10.14
Pre-mpifier (0.1M-3GHz)	EM	EM330	60538	2018.03.11	2019.03.10
PreAmplifier (1G-26.5GHz)	Agilent	8449B	60538	2017.10.15	2018.10.14
Passive Loop(9K--30MHz)	ZHNAN	ZN3090C	16035	2018.03.11	2019.03.10
Low frequency cable	EM	R01	N/A	2018.03.11	2019.03.10
Low frequency cable	EM	R06	N/A	2018.03.11	2019.03.10
High frequency cable	SCHWARZBECK	R04	N/A	2018.03.11	2019.03.10
High frequency cable	SCHWARZBECK	R02	N/A	2018.03.11	2019.03.10
Semi-anechoic chamber	Changling	966	N/A	2017.10.15	2018.10.14
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

### RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2017.10.15	2018.10.14
Power Meter	R&S	NRP	100510	2017.10.15	2018.10.14
Spectrum Analyzer	Agilent	N9020A	MY51110105	2017.10.15	2018.10.14
Signal Analyzer	Agilent	N9020A	MY49100060	2018.03.09	2019.03.10

#### Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.



### 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), 107(a) limit in the table below has to be followed.

This item was performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	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.

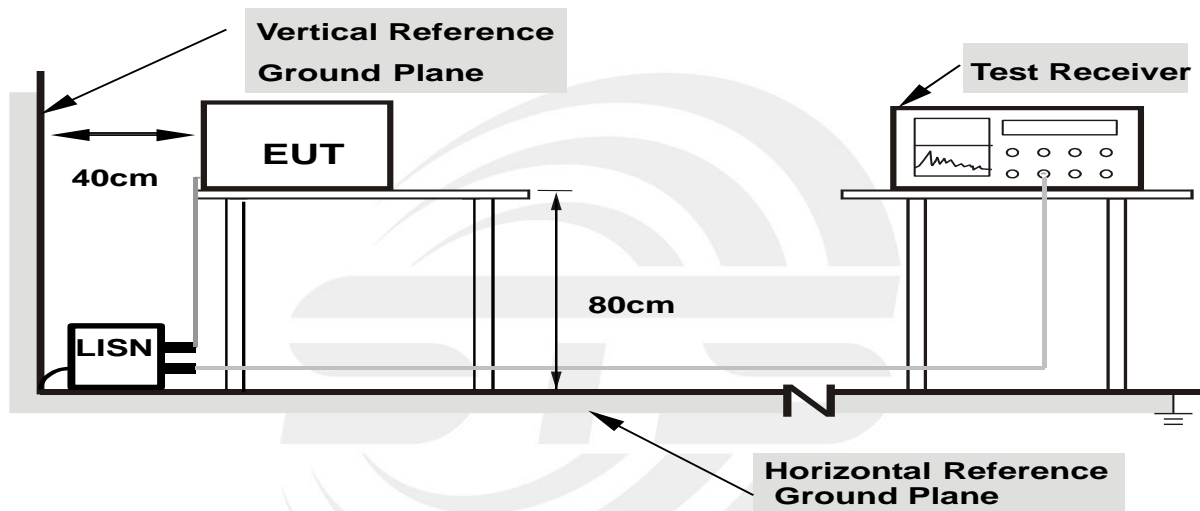
The following table is the setting of the receiver

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°C	Relative Humidity:	61%
Test Voltage:	N/A	Phase:	L/N
Test Mode:	N/A		

Note: The EUT is power by DC, this test item is not applicable.





### 3.2 RADIATED EMISSION MEASUREMENT

#### 3.2.1 RADIATED EMISSION LIMITS

Frequencies (MHz)	Class A (at 10m) dBuV/m	Class B (at 3m) dBuV/m
30~88	39.0	40.0
88~216	43.5	43.5
216~960	46.5	46.0
Above 960	49.5	54.0

#### LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class A (dBuV/m) (at 3M)		Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE	PEAK	AVERAGE
Above 1000	80	60	74	54

Note:

- 1) The tighter limit applies at the band edges.
- 2) Emission level (dBuV/m)=20log Emission level (uV/m).

#### 3.2.2 TEST PROCEDURE

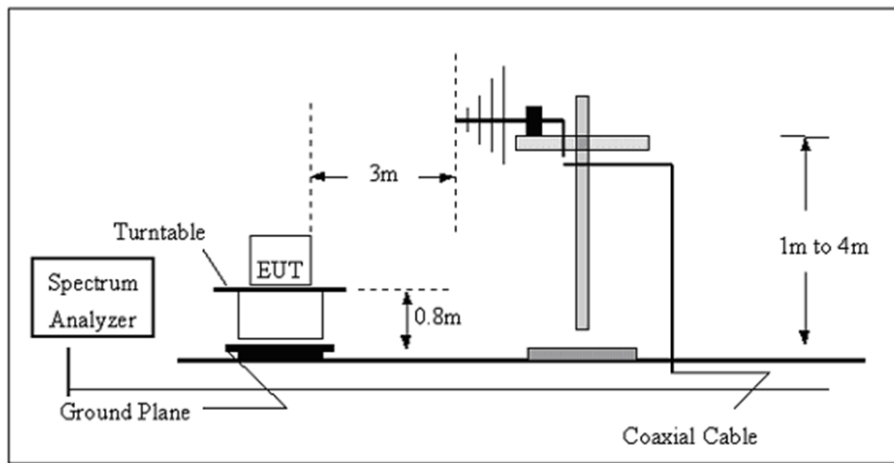
- a) The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 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 0.8 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*

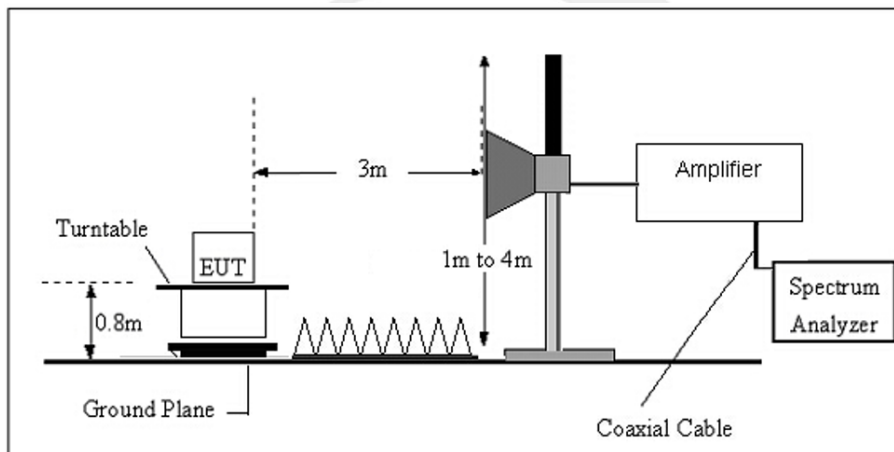


### 3.2.3 TEST SETUP

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



#### b) Radiated Emission Test-Up Frequency Above 1GHz



### 3.2.4 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.



### 3.2.5 TEST RESULTS

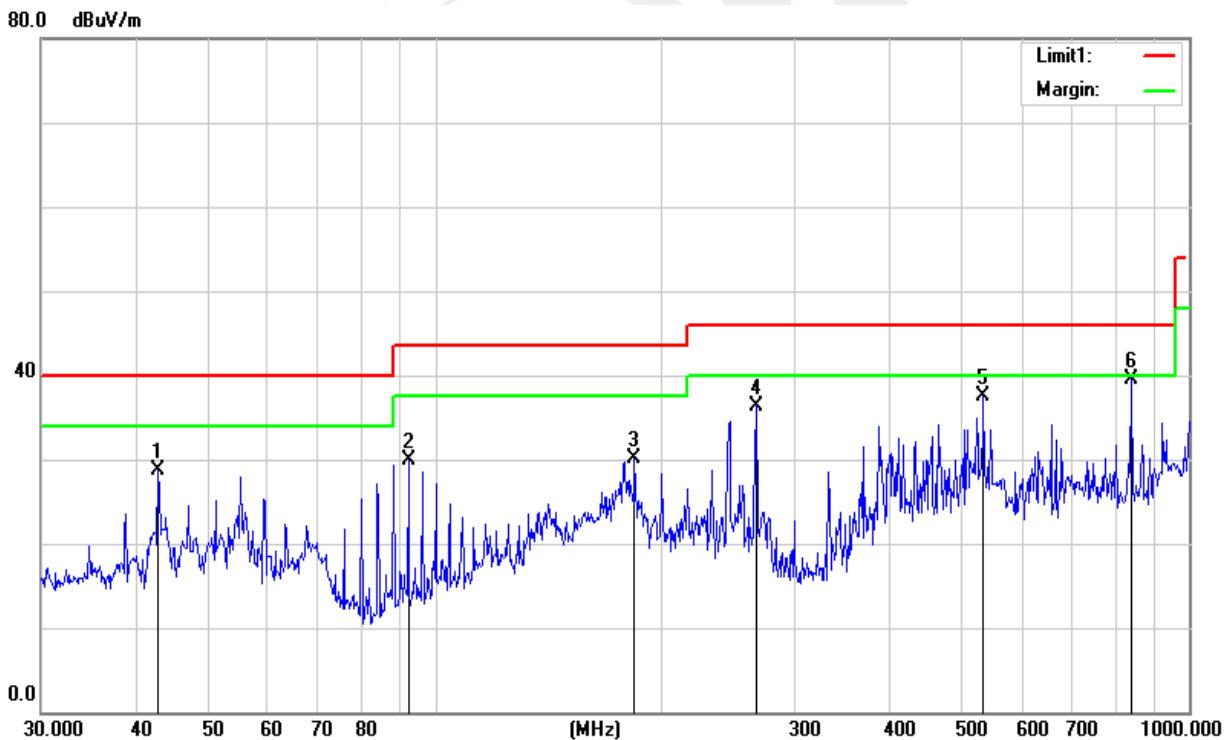
Between 30-1000MHz:

Temperature:	26.9 °C	Relative Humidity:	62%
Pressure:	1010hPa	Phase:	Horizontal
Test Voltage:	DC 5V	Test Mode:	Mode 4 (Part 15B)

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	42.8997	46.54	-17.83	28.71	40.00	-11.29	QP
2	92.1388	49.93	-19.98	29.95	43.50	-13.55	QP
3	183.8440	49.90	-19.76	30.14	43.50	-13.36	QP
4	266.6090	51.73	-15.33	36.40	46.00	-9.60	QP
5	533.8320	45.00	-7.58	37.42	46.00	-8.58	QP
6	839.1816	42.37	-2.78	39.59	46.00	-6.41	QP

**Remark:**

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



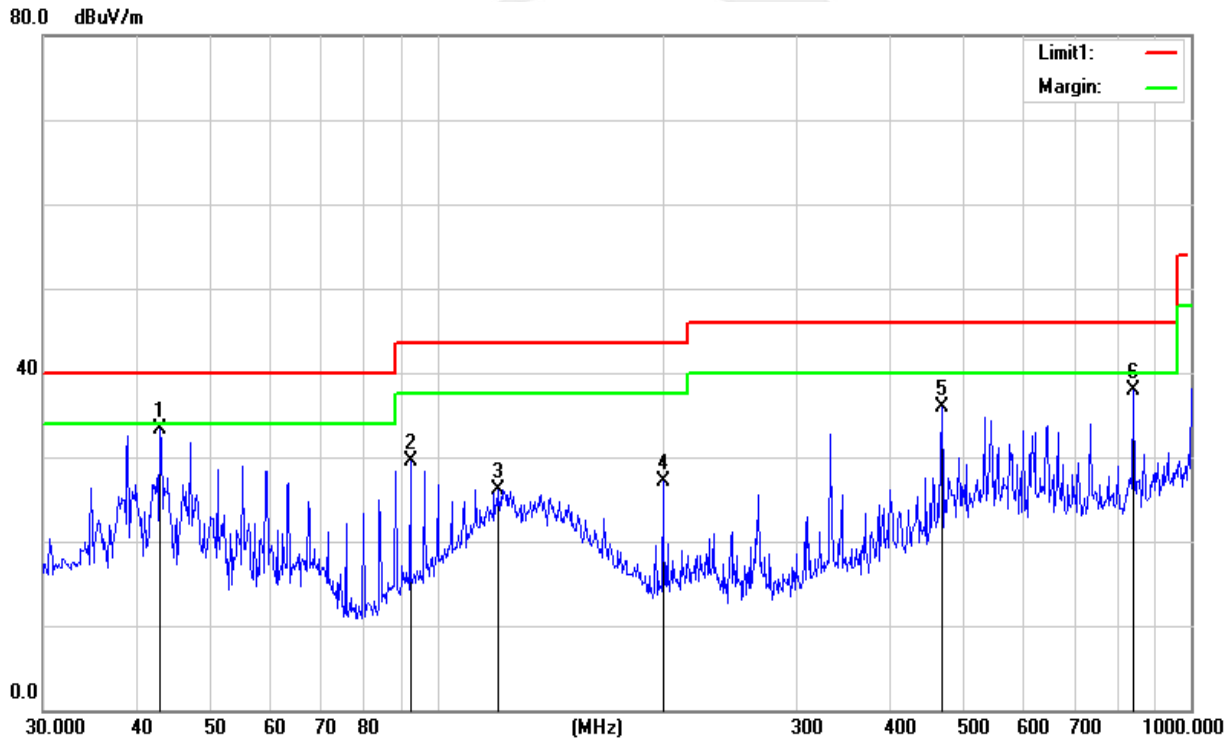


Temperature:	26.9 °C	Relative Humidity:	62%
Pressure:	1010hPa	Phase:	Vertical
Test Voltage:	DC 5V	Test Mode:	Mode 4 (Part 15B)

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	42.8997	51.20	-17.83	33.37	40.00	-6.63	QP
2	92.1388	49.47	-19.98	29.49	43.50	-14.01	QP
3	120.6991	43.74	-17.68	26.06	43.50	-17.44	QP
4	199.2855	47.28	-20.17	27.11	43.50	-16.39	QP
5	467.2348	45.85	-9.87	35.98	46.00	-10.02	QP
6	839.1816	40.62	-2.78	37.84	46.00	-8.16	QP

**Remark:**

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

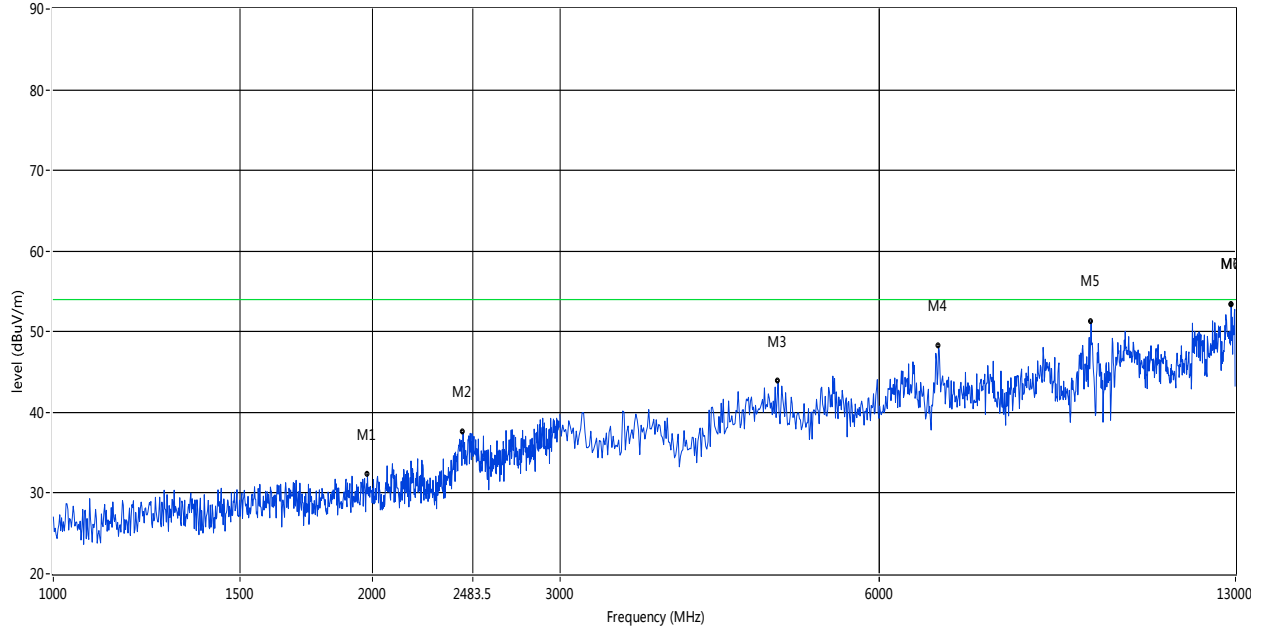




Between 1GHz – 13GHz:

Temperature:	24 °C	Relative Humidity:	61%
Test Voltage:	DC 5V	Phase:	Horizontal

RE\_FCC Test Case\_FCC 15B 1GHz-13GHz

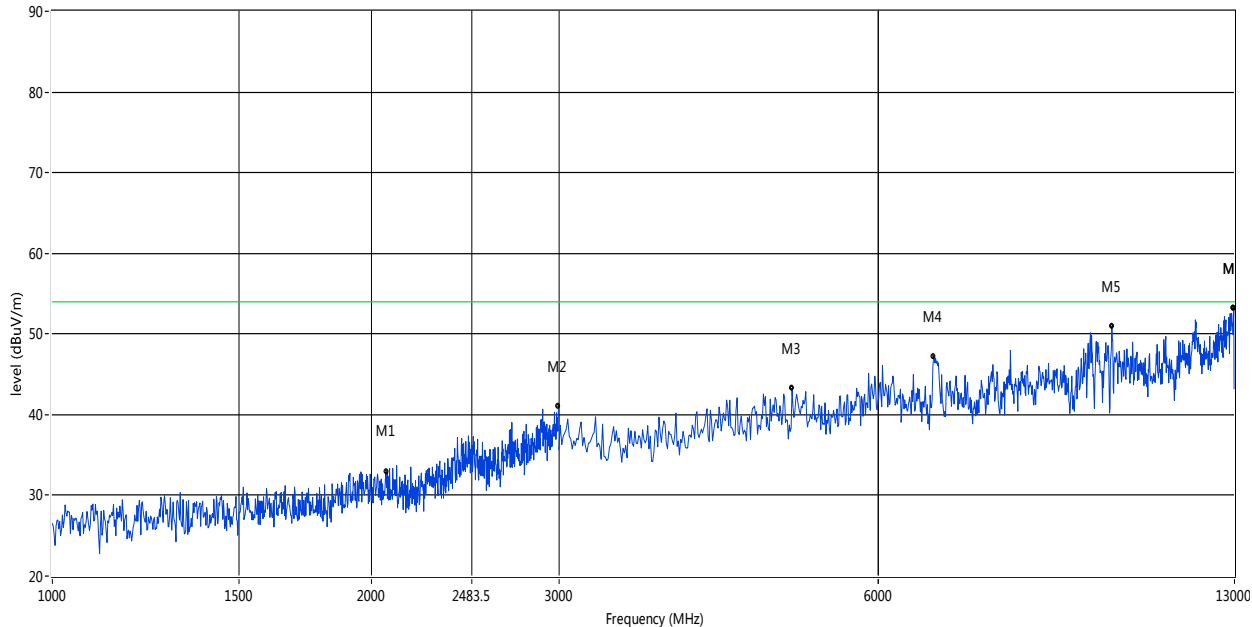


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	ANT	Verdict
1	1977.023	32.30	-17.43	74.0	-41.70	Peak	H	Pass
2	2432.567	37.54	-13.97	74.0	-36.46	Peak	H	Pass
3	4818.182	43.81	-7.90	74.0	-30.19	Peak	H	Pass
4	6826.174	48.19	-3.95	74.0	-25.81	Peak	H	Pass
5	9503.497	51.29	2.61	74.0	-22.71	Peak	H	Pass
6**	12880.120	41.68	1.05	54.0	-12.32	Av	H	Pass
6	12880.120	53.39	1.05	74.0	-20.61	Peak	H	Pass



Temperature:	24 °C	Relative Humidity:	61%
Test Voltage:	DC 5V	Phase:	Vertical

RE\_FCC Test Case\_FCC 15B 1GHz-13GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	ANT	Verdict
1	2066.933	32.96	-17.13	74.0	-41.04	Peak	V	Pass
2	2998.002	40.96	-11.24	74.0	-33.04	Peak	V	Pass
3	4978.022	43.27	-7.86	74.0	-30.73	Peak	V	Pass
4	6766.234	47.21	-4.22	74.0	-26.79	Peak	V	Pass
5	9963.037	50.91	0.59	74.0	-23.09	Peak	V	Pass
6**	12980.020	42.38	2.57	54.0	-11.62	Av	V	Pass
6	12980.020	53.13	2.57	74.0	-20.87	Peak	V	Pass



### 3.3 RADIATED SPURIOUS EMISSION MEASUREMENT

#### 3.3.1 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)

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

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

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	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/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted	1 MHz /3MHz

For Band edge

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 2300 to 2422 MHz Upper Band Edge: 2452to 2500 MHz
RB / VB (emission in restricted band)	1 MHz /3MHz



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

### 3.3.2 TEST PROCEDURE

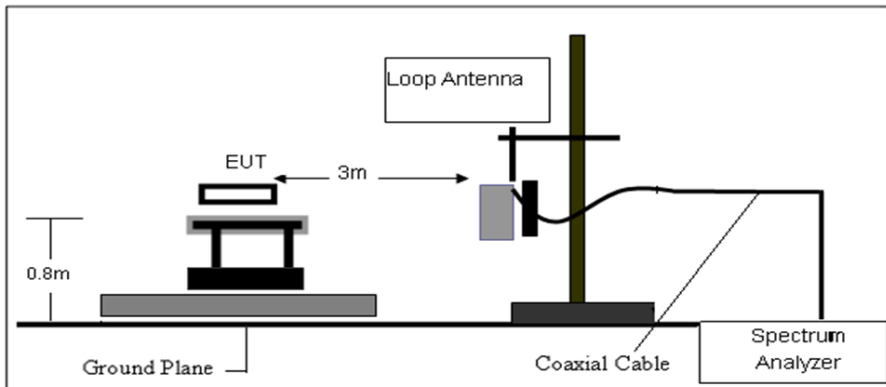
- The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters(above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 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
- 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.
- 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.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

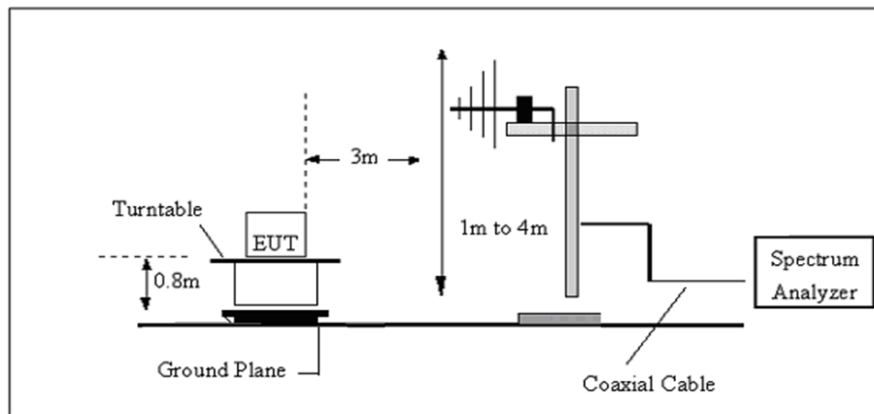
*Both horizontal and vertical antenna polarities were tested and performed test to three orthogonal axis. The worst case emissions were reported*

### 3.3.3 TEST SETUP

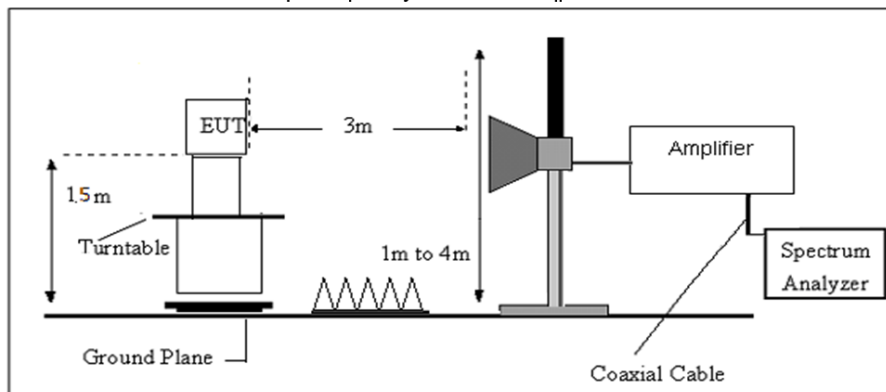
#### a) Radiated Emission Test-Up Frequency Below 30MHz



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



#### c) Radiated Emission Test-Up Frequency Above 1GHz



### 3.3.4 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.





### 3.3.5 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

$$\text{Factor} = \text{AF} + \text{CL} - \text{AG}$$

### 3.3.6 TEST RESULT

9KHz-30MHz

Temperature:	26.9°C	Relative Humidity:	62%
Test Voltage:	DC 5V	Polarization :	--
Test Mode :	--		

Freq.	Reading	Limit	Margin	State	Test Result
(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 (specific distance/test distance)(dB);

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



(30MHz - 1000MHz)

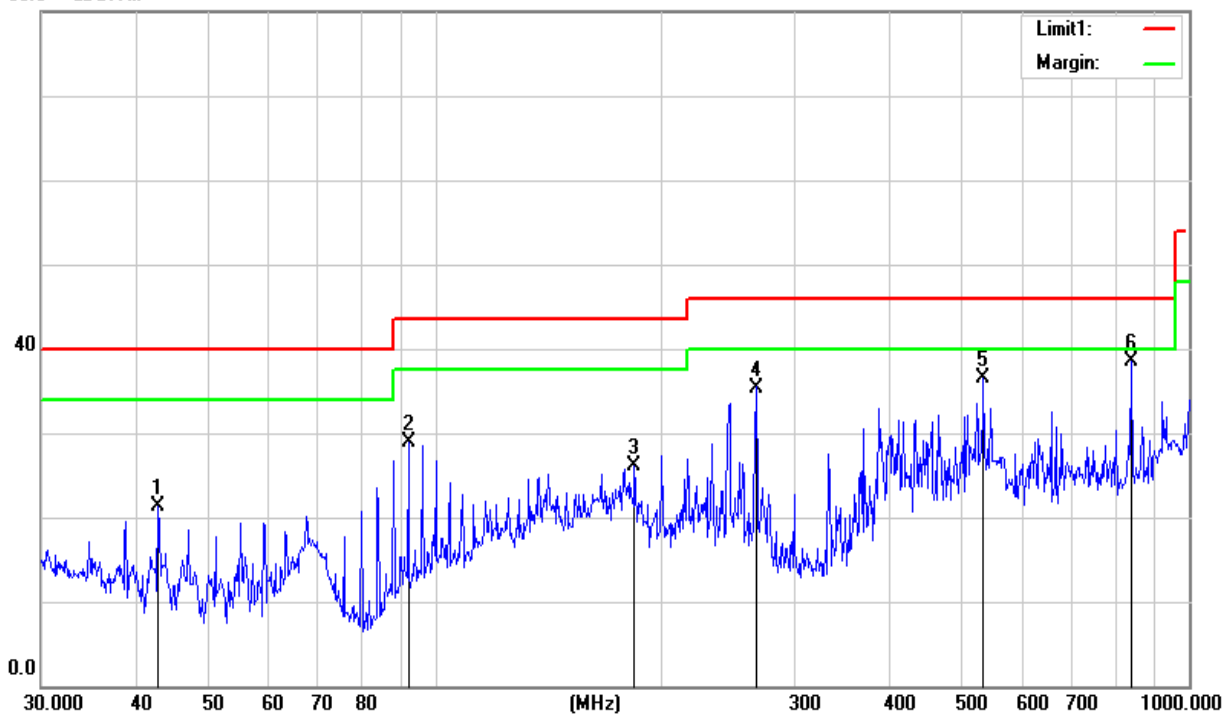
Temperature:	26.9°C	Relative Humidity:	62%
Test Voltage:	DC 5V	Polarization :	Horizontal
Test Mode:	Mode 1/2/3 (Mode 2 worst case)		

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
42.8998	39.04	-17.83	21.21	40.00	-18.79	QP
92.1388	48.93	-19.98	28.95	43.50	-14.55	QP
183.8440	45.90	-19.76	26.14	43.50	-17.36	QP
266.6090	50.73	-15.33	35.40	46.00	-10.60	QP
533.8321	44.00	-7.58	36.42	46.00	-9.58	QP
839.1818	41.37	-2.78	38.59	46.00	-7.41	QP

Remark:

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

80.0 dBuV/m





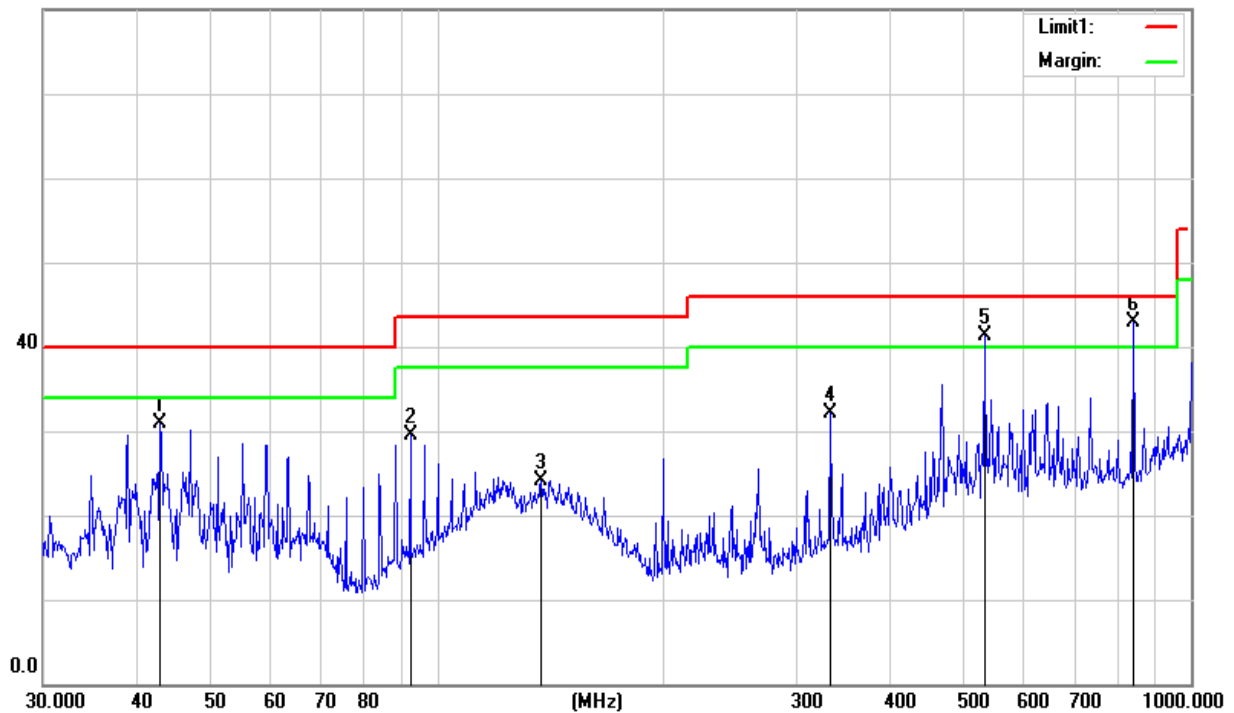
Temperature:	26.9°C	Relative Humidity:	62%
Test Voltage:	DC 5V	Polarization :	Vertical
Test Mode:	Mode 1/2/3 (Mode 2 worst case)		

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
42.8998	48.70	-17.83	30.87	40.00	-9.13	QP
92.1388	49.47	-19.98	29.49	43.50	-14.01	QP
137.4202	41.61	-17.52	24.09	43.50	-19.41	QP
332.5187	46.26	-14.07	32.19	46.00	-13.81	QP
531.9635	49.05	-7.75	41.30	46.00	-4.70	QP
839.1818	45.62	-2.78	42.84	46.00	-3.16	QP

Remark:.

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

80.0 dBuV/m





(1GHz – 18GHz) Restricted band and Spurious emission Requirements

**Low Channel**

Frequency (MHz)	Reading (dBμV)	Amplifier (dB)	Loss (dB)	Antenna Factor (dB/m)	Corrected Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
Low Channel (2402 MHz)										
3264.76	48.56	44.70	6.70	28.20	-9.80	38.76	74.00	-35.24	PK	Vertical
3264.76	38.16	44.70	6.70	28.20	-9.80	28.36	54.00	-25.64	AV	Vertical
3264.81	48.47	44.70	6.70	28.20	-9.80	38.67	74.00	-35.33	PK	Horizontal
3264.81	38.76	44.70	6.70	28.20	-9.80	28.96	54.00	-25.04	AV	Horizontal
4804.45	58.77	44.20	9.04	31.60	-3.56	55.21	74.00	-18.79	PK	Vertical
4804.45	49.37	44.20	9.04	31.60	-3.56	45.81	54.00	-8.19	AV	Vertical
4804.56	59.30	44.20	9.04	31.60	-3.56	55.74	74.00	-18.26	PK	Horizontal
4804.56	50.60	44.20	9.04	31.60	-3.56	47.04	54.00	-6.96	AV	Horizontal
5359.73	45.51	44.20	9.86	32.00	-2.34	43.17	74.00	-30.83	PK	Vertical
5359.73	37.28	44.20	9.86	32.00	-2.34	34.94	54.00	-19.06	AV	Vertical
5359.83	45.87	44.20	9.86	32.00	-2.34	43.53	74.00	-30.47	PK	Horizontal
5359.83	37.41	44.20	9.86	32.00	-2.34	35.07	54.00	-18.93	AV	Horizontal
7205.94	51.87	43.50	11.40	35.50	3.40	55.27	74.00	-18.73	PK	Vertical
7205.94	41.96	43.50	11.40	35.50	3.40	45.36	54.00	-8.64	AV	Vertical
7205.92	50.55	43.50	11.40	35.50	3.40	53.95	74.00	-20.05	PK	Horizontal
7205.92	40.72	43.50	11.40	35.50	3.40	44.12	54.00	-9.88	AV	Horizontal



**Mid Channel**

Frequency (MHz)	Reading (dBμV)	Amplifier (dB)	Loss (dB)	Antenna	Corrected	Emission		Margin (dB)	Detector Type	Comment
				Factor (dB/m)	Factor (dB)	Level (dBμV/m)	Limits (dBμV/m)			
Mid Channel (2440 MHz)										
3264.85	48.84	44.70	6.70	28.20	-9.80	39.04	74.00	-34.96	PK	Vertical
3264.85	37.86	44.70	6.70	28.20	-9.80	28.06	54.00	-25.94	AV	Vertical
3264.56	48.27	44.70	6.70	28.20	-9.80	38.47	74.00	-35.53	PK	Horizontal
3264.56	38.77	44.70	6.70	28.20	-9.80	28.97	54.00	-25.03	AV	Horizontal
4880.48	59.37	44.20	9.04	31.60	-3.56	55.81	74.00	-18.19	PK	Vertical
4880.48	49.18	44.20	9.04	31.60	-3.56	45.62	54.00	-8.38	AV	Vertical
4880.46	58.41	44.20	9.04	31.60	-3.56	54.85	74.00	-19.15	PK	Horizontal
4880.46	49.44	44.20	9.04	31.60	-3.56	45.88	54.00	-8.12	AV	Horizontal
5359.70	45.30	44.20	9.86	32.00	-2.34	42.96	74.00	-31.04	PK	Vertical
5359.70	37.39	44.20	9.86	32.00	-2.34	35.05	54.00	-18.95	AV	Vertical
5359.81	45.27	44.20	9.86	32.00	-2.34	42.93	74.00	-31.07	PK	Horizontal
5359.81	37.40	44.20	9.86	32.00	-2.34	35.06	54.00	-18.94	AV	Horizontal
7310.90	50.62	43.50	11.40	35.50	3.40	54.02	74.00	-19.98	PK	Vertical
7310.90	41.56	43.50	11.40	35.50	3.40	44.96	54.00	-9.04	AV	Vertical
7310.78	51.96	43.50	11.40	35.50	3.40	55.36	74.00	-18.64	PK	Horizontal
7310.78	41.20	43.50	11.40	35.50	3.40	44.60	54.00	-9.40	AV	Horizontal



**High Channel**

Frequency (MHz)	Reading (dBμV)	Amplifier (dB)	Loss (dB)	Antenna Factor (dB/m)	Corrected Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
High Channel (2480 MHz)										
3264.77	48.87	44.70	6.70	28.20	-9.80	39.07	74.00	-34.93	PK	Vertical
3264.77	39.60	44.70	6.70	28.20	-9.80	29.80	54.00	-24.20	AV	Vertical
3264.80	48.20	44.70	6.70	28.20	-9.80	38.40	74.00	-35.60	PK	Horizontal
3264.80	38.62	44.70	6.70	28.20	-9.80	28.82	54.00	-25.18	AV	Horizontal
4960.30	58.82	44.20	9.04	31.60	-3.56	55.26	74.00	-18.74	PK	Vertical
4960.30	50.48	44.20	9.04	31.60	-3.56	46.92	54.00	-7.08	AV	Vertical
4960.36	58.24	44.20	9.04	31.60	-3.56	54.68	74.00	-19.32	PK	Horizontal
4960.36	49.48	44.20	9.04	31.60	-3.56	45.92	54.00	-8.08	AV	Horizontal
5359.70	45.04	44.20	9.86	32.00	-2.34	42.70	74.00	-31.30	PK	Vertical
5359.70	37.56	44.20	9.86	32.00	-2.34	35.22	54.00	-18.78	AV	Vertical
5359.66	45.75	44.20	9.86	32.00	-2.34	43.41	74.00	-30.59	PK	Horizontal
5359.66	37.75	44.20	9.86	32.00	-2.34	35.41	54.00	-18.59	AV	Horizontal
7439.96	50.52	43.50	11.40	35.50	3.40	53.92	74.00	-20.08	PK	Vertical
7439.96	42.19	43.50	11.40	35.50	3.40	45.59	54.00	-8.41	AV	Vertical
7439.86	51.80	43.50	11.40	35.50	3.40	55.20	74.00	-18.80	PK	Horizontal
7439.86	40.77	43.50	11.40	35.50	3.40	44.17	54.00	-9.83	AV	Horizontal

Remark:

- Factor = Antenna Factor + Cable Loss – Pre-amplifier.
- Emission Level = Reading + Factor  
Margin = Limit - Emission Level
- 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.



18GHz – 25GHz										
Frequency (MHz)	Meter		Loss (dB)	Antenna	Orrected	Emission		Margin (dB)	Detector	
	Reading (dBμV)	Amplifier (dB)		Factor (dB/m)	Factor (dB)	Level (dBμV/m)	Limits (dBμV/m)		Type	Comment
Low Channel (2402 MHz)										
19523.71	38.63	32.16	12.57	43.60	24.01	62.64	74.00	-11.36	PK	Vertical
19523.71	26.05	32.16	12.57	43.60	24.01	50.06	54.00	-3.94	AV	Vertical
19523.65	38.96	32.16	12.57	43.60	24.01	62.97	74.00	-11.03	PK	Horizontal
19523.65	26.96	32.16	12.57	43.60	24.01	50.97	54.00	-3.03	AV	Horizontal
23890.67	38.18	30.57	13.92	43.20	26.55	64.73	74.00	-9.27	PK	Vertical
23890.67	26.23	30.57	13.92	43.20	26.55	52.78	54.00	-1.22	AV	Vertical
Middle Channel (2440 MHz)										
19523.79	38.61	32.16	12.57	43.60	24.01	62.62	74.00	-11.38	PK	Vertical
19523.79	27.76	32.16	12.57	43.60	24.01	51.77	54.00	-2.23	AV	Vertical
19523.61	38.91	32.16	12.57	43.60	24.01	62.92	74.00	-11.08	PK	Horizontal
19523.61	27.35	32.16	12.57	43.60	24.01	51.36	54.00	-2.64	AV	Horizontal
High Channel (2480 MHz)										
19523.70	39.25	32.16	12.57	43.60	24.01	63.26	74.00	-10.74	PK	Vertical
19523.70	26.54	32.16	12.57	43.60	24.01	50.55	54.00	-3.45	AV	Vertical
19523.55	38.81	32.16	12.57	43.60	24.01	62.82	74.00	-11.18	PK	Horizontal
19523.55	26.00	32.16	12.57	43.60	24.01	50.01	54.00	-3.99	AV	Horizontal

Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Emission Level = Reading + Factor  
Margin = Limit - Emission Level
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.



## 3.3.7 TEST RESULTS (BAND EDGE REQUIREMENTS)

Frequency (MHz)	Reading (dB $\mu$ V)	Amplifier (dB)	Loss (dB)	Antenna Factor (dB/m)	Corrected Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type	Comment
2390.00	68.40	43.80	4.91	25.90	-12.99	55.41	74.00	-18.59	PK	Vertical
2390.00	54.45	43.80	4.91	25.90	-12.99	41.46	54.00	-12.54	AV	Vertical
2390.00	68.36	43.80	4.91	25.90	-12.99	55.37	74.00	-18.63	PK	Horizontal
2390.00	53.59	43.80	4.91	25.90	-12.99	40.60	54.00	-13.40	AV	Horizontal
2483.50	70.22	43.80	5.12	25.90	-12.78	57.44	74.00	-16.56	PK	Vertical
2483.50	52.54	43.80	5.12	25.90	-12.78	39.76	54.00	-14.24	AV	Vertical
2483.50	69.85	43.80	5.12	25.90	-12.78	57.07	74.00	-16.93	PK	Horizontal
2483.50	53.35	43.80	5.12	25.90	-12.78	40.57	54.00	-13.43	AV	Horizontal

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.  
Low measurement frequencies is range from 2300 to 2422 MHz, high measurement frequencies is range from 2452 to 2500 MHz.  
Only show the worst point data of the emissions in the frequency 2300-2422 MHz and 2452-2500 MHz.



## 4 CONDUCTED SPURIOUS & BAND EDGE EMISSION

### 4.1 APPLIED PROCEDURES / LIMIT

According to FCC Part 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

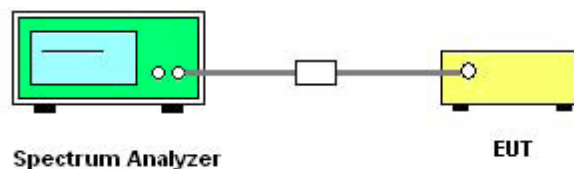
For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 to 2422 MHz Upper Band Edge: 2452to 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 50Ohm; 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

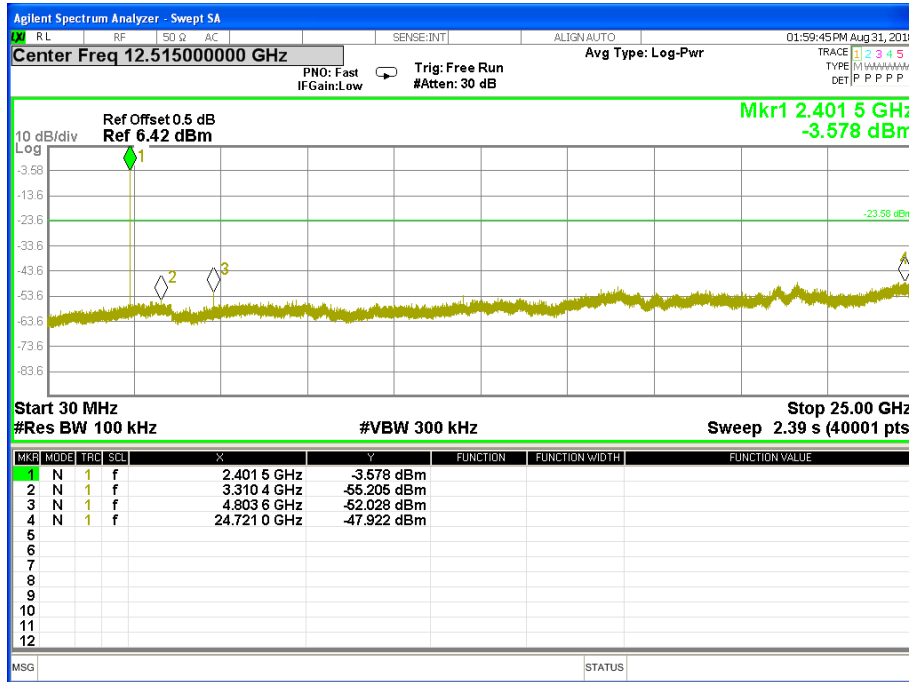
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



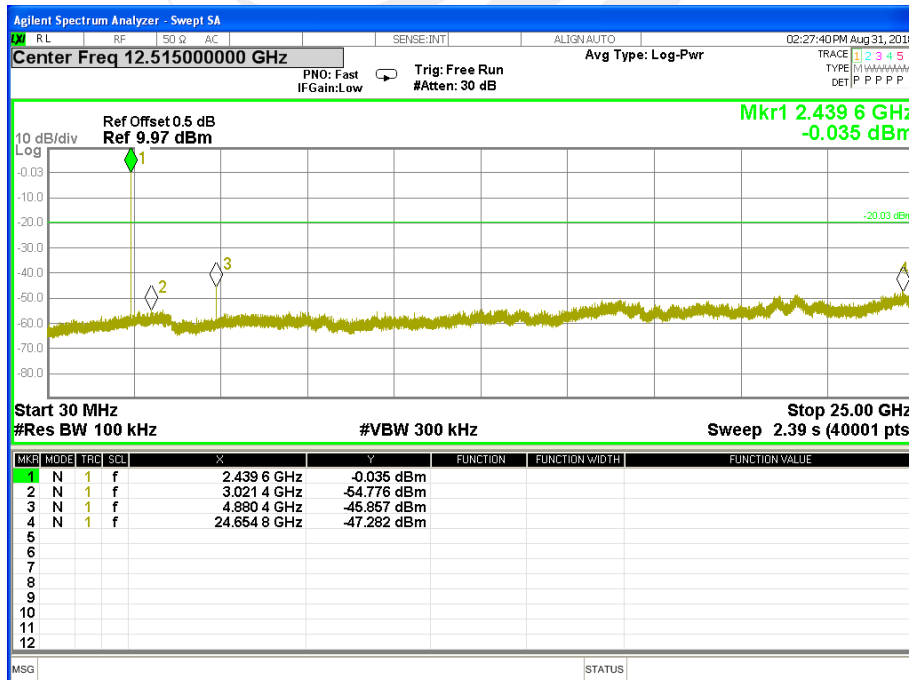
4.6 TEST RESULTS

Temperature :	25°C	Relative Humidity :	60%
Test Voltage :	DC 5V	Test Mode :	TX Mode /CH37, CH17, CH39

CH37

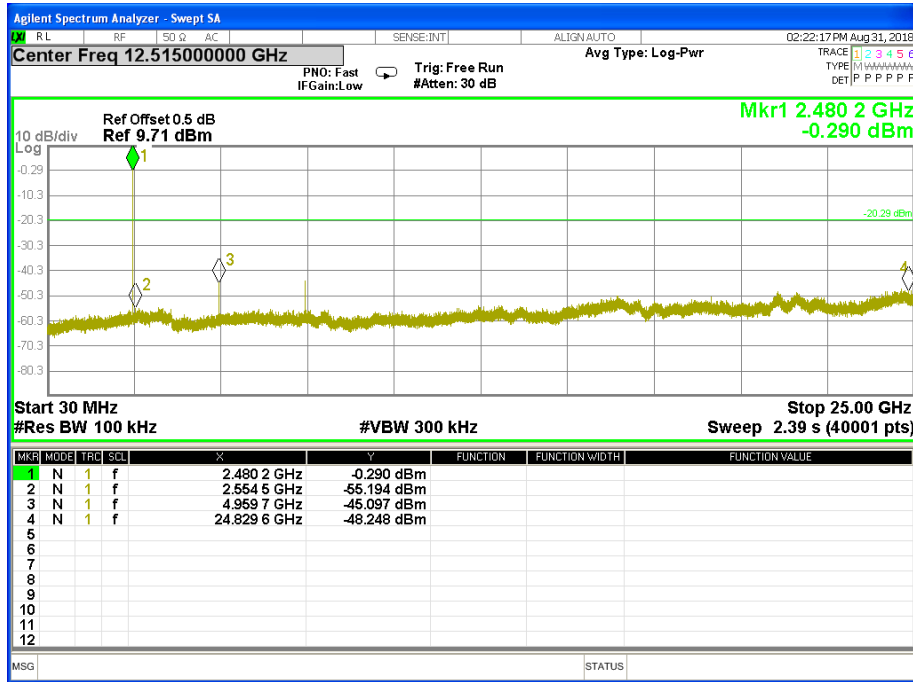


CH17





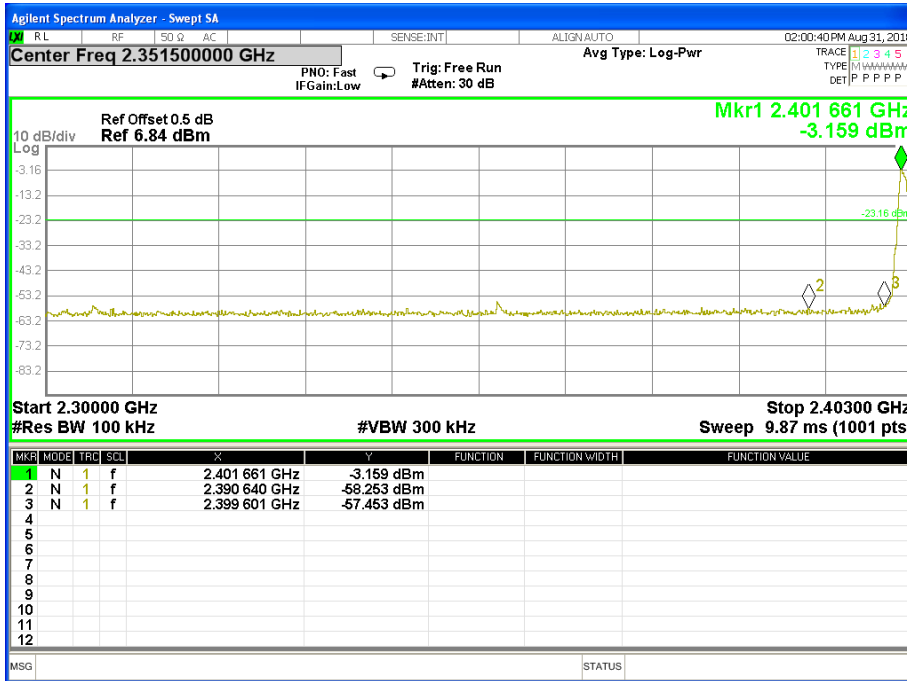
CH39



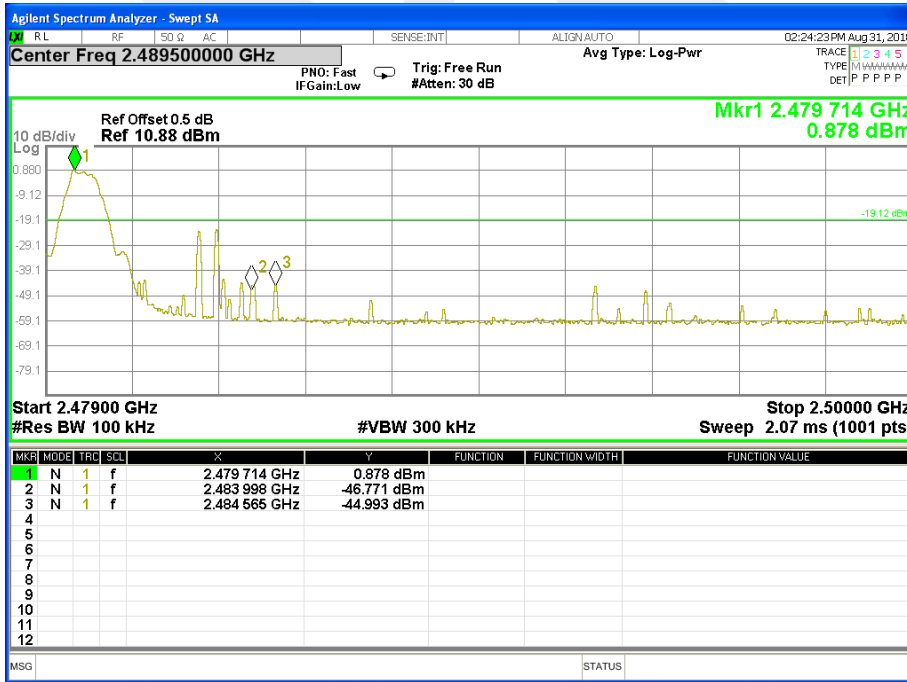


Band edge

CH37



CH39





## 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	$\leq 8$ dBm (RBW $\geq 3$ KHz)	2400-2483.5	PASS

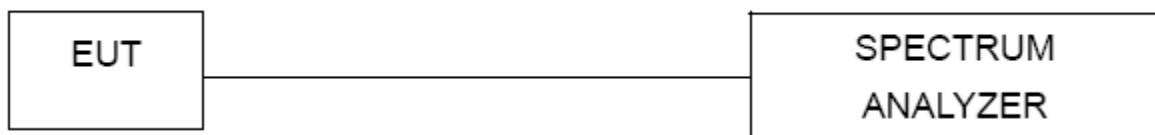
### 5.2 TEST PROCEDURE

- 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  $100\text{ kHz} \geq \text{RBW} \geq 3\text{ kHz}$ .
- 4) Set the  $\text{VBW} \geq 3 \times \text{RBW}$ .
- 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



### 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.

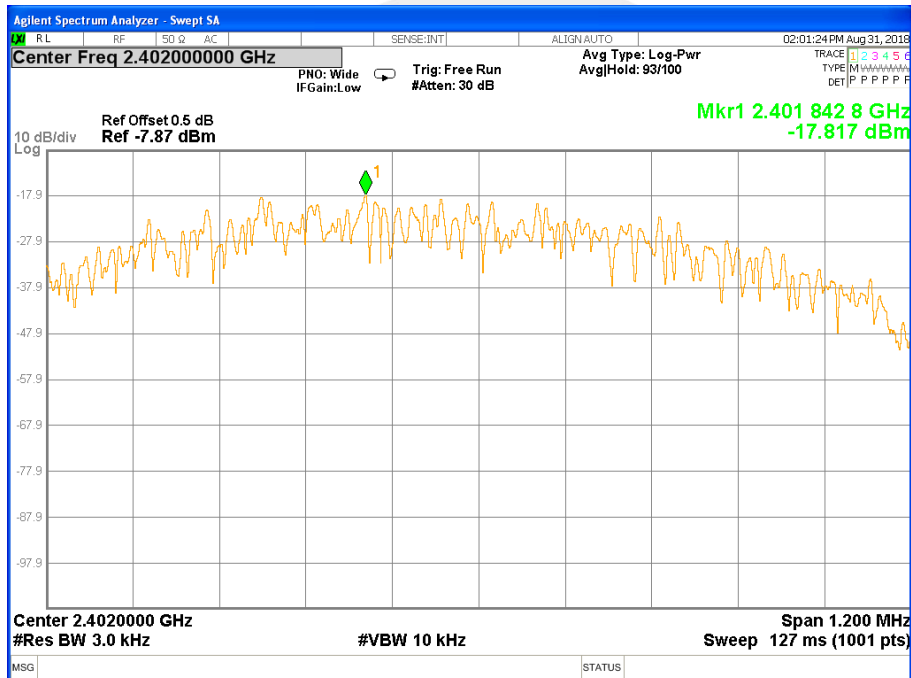


5.6 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	DC 5V	Test Mode:	TX Mode /CH37, CH17, CH39

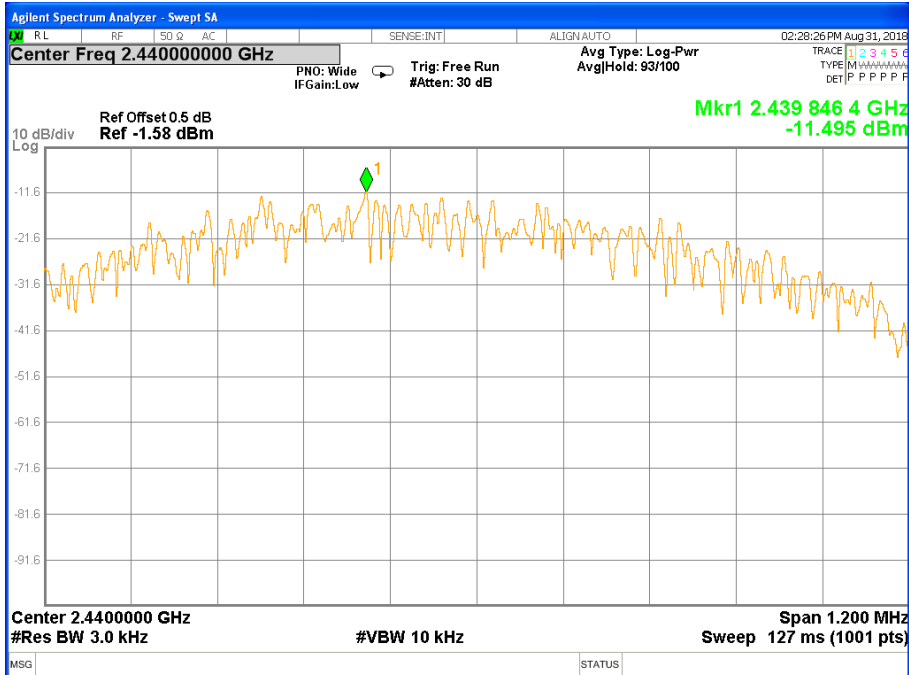
Test Mode	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3KHz)	Result
BLE mode (1 Mbps)	2402.00	-17.817	≤ 8.00	PASS
	2440.00	-11.495	≤ 8.00	PASS
	2480.00	-13.255	≤ 8.00	PASS

TX CH37

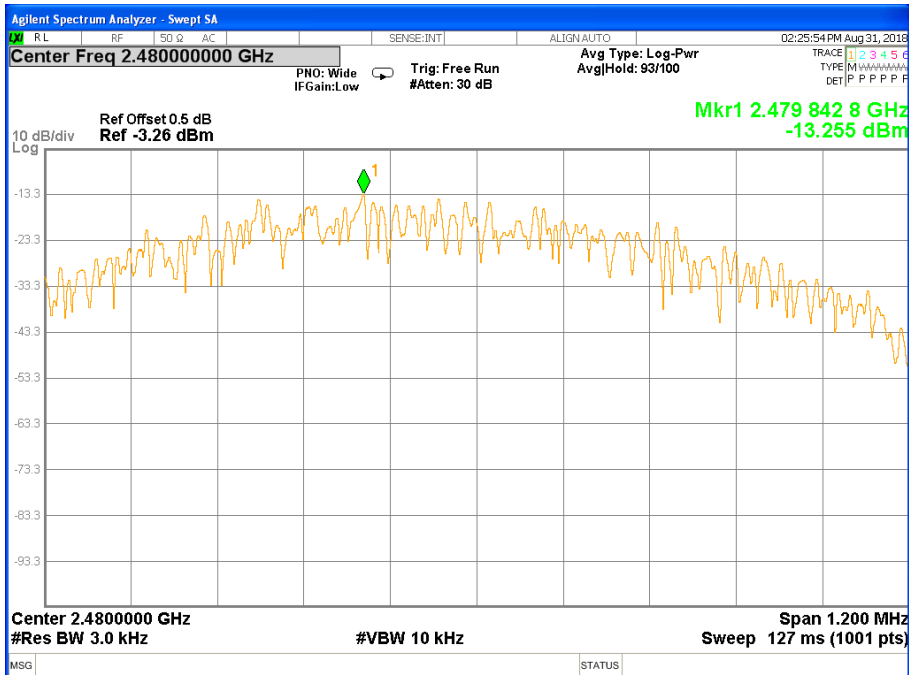




### TX CH17



### TX CH39





## 6 BANDWIDTH TEST

### 6.1 APPLIED PROCEDURES / LIMIT

FCC Part15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	6dB Bandwidth	$\geq 500\text{KHz}$	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 $\geq$ 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 $\geq$ 6 dB.

### 6.3 DEVIATION FROM STANDARD

No deviation.

### 6.4 TEST SETUP



### 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.





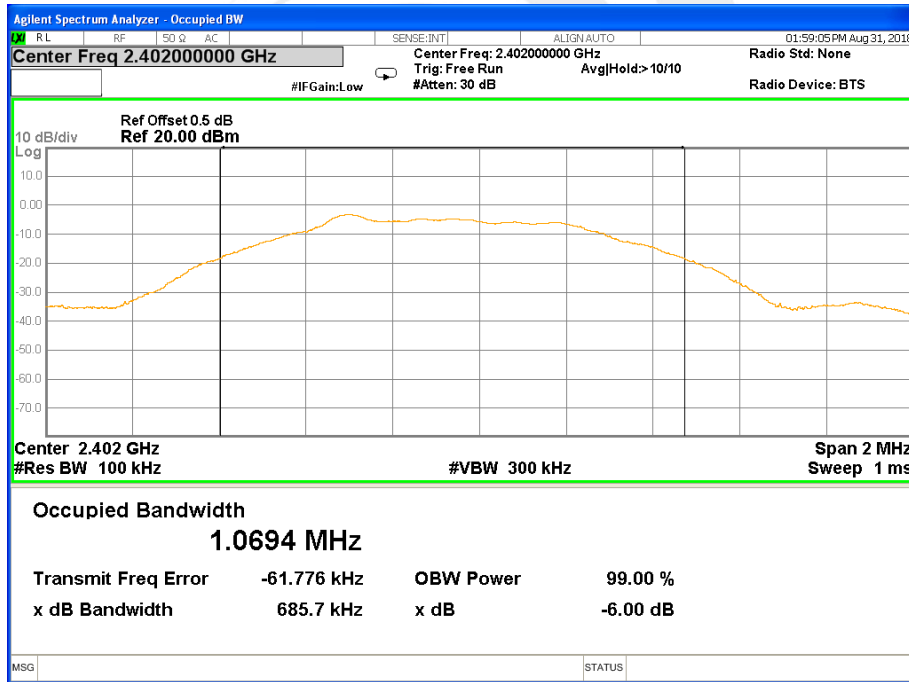
6.6 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	DC 5V	Test Mode:	TX Mode /CH37, CH17, CH39

Remark: PEAK DETECTOR IS USED

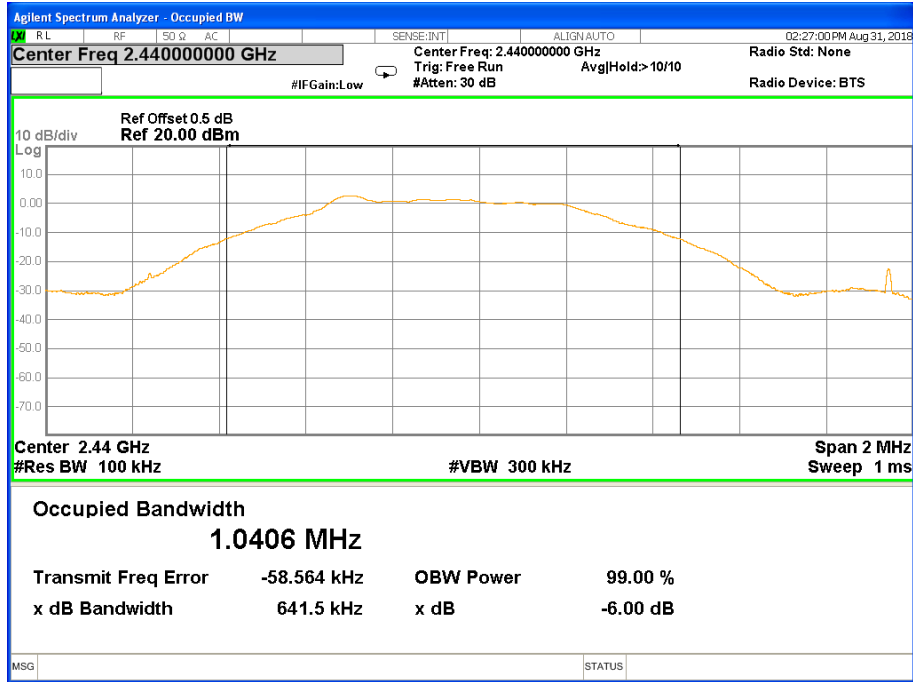
Test Mode	Frequency (MHz)	6dB Bandwidth (MHz)	Limit of 6dB Bandwidth (MHz)	Result
BLE mode (1 Mbps)	2402.00	0.686	≥ 0.50	PASS
	2440.00	0.642	≥ 0.50	PASS
	2480.00	0.635	≥ 0.50	PASS

6dB Bandwidth  
TX CH37

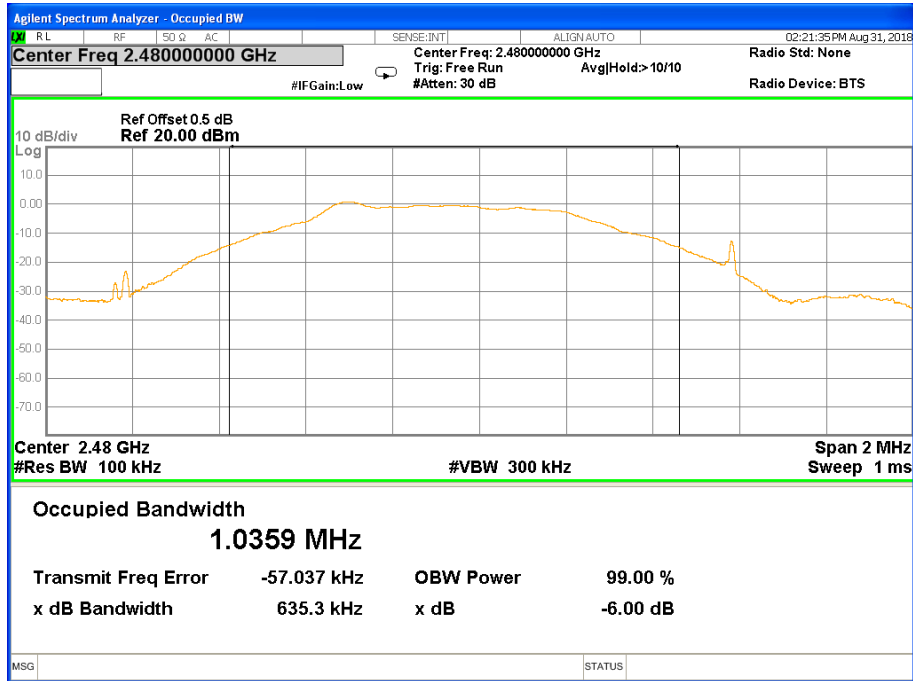




### TX CH17



### TX CH39





## 7 PEAK OUTPUT POWER TEST

### 7.1 APPLIED PROCEDURES / LIMIT

FCC Part15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
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



### 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.



## 7.6 TEST RESULTS

Temperature :	25°C	Relative Humidity :	60%
Test Voltage :	DC 5V		

Test Channel	Frequency (MHz)	Conducted Output Power		Limit (dBm)
		Peak(dBm)	AVG(dBm)	
CH37	2402.00	-2.10	-3.70	30.00
CH17	2440.00	3.90	2.30	30.00
CH39	2480.00	1.90	0.30	30.00

Note:

- 1) The cable loss and antenna gain are taken into account in results.
- 2) Antenna gain(G): -0.5 dBi





## 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 Integral Antenna. It comply with the standard requirement.

