TECHNICAL REPORT

卓時檢測 TIMEWAY TESTING LABORATORY

TESTING CNAS L2292

ISO/IEC17025Accredited Lab.

Report No: FCC 1104050
File reference No: 2011-04-09

Applicant: Shenzhen HAC Telecom Technology Co., Ltd.

Product: Zigbee module

Model No: HAC-UBee

Trademark: N/A

Test Standards: FCC Part 15 Subpart C, Paragraph 15.247

Test result: It is herewith confirmed and found to comply with the requirements set up by ANSI C63.4FCC Part 15 Subpart C, Paragraph 15.247 regulations for the evaluation of electromagnetic compatibility

Approved By

Jack Chung

Jack Chung
Manager

Dated: April 09, 2011

Results appearing herein relate only to the sample tested
The technical reports is issued errors and omissions exempt and is subject to withdrawal at

SHENZHEN TIMEWAY TECHNOLOGY CONSULTING CO LTD

5/F,Block 4, Anhua Industrial Zone.,No.8 TaiRan Rd.CheGongMiao,FuTian District, Shenzhen,CHINA.

Tel (755) 83448688 Fax (755) 83442996

Special Statement:

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meet with ISO/IEC-17025 requirements, which is approved by CNAL. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAL-LAB Code: L2292

The EMC Laboratory has been assessed and in compliance with CNAL/AC01:2002 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:1999 General Requirements) for the Competence of testing Laboratories.

FCC-Registration No.: 899988

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 899988.

IC- Registration No.: IC5205A-01

The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration IC No.: 5205A-01.

TEST REPORT

Test Report Conclusion

Content

TEST REPORT

1.0 **General Details**

1.1 Test Lab Details

Name : SHENZHEN TIMEWAY TECHNOLOGY CONSULTING CO LTD

Address: 5/F,Block 4, Anhua Industrial Zone.,No.8 TaiRan Rd.CheGongMiao,FuTian District, Shenzhen,CHINA.

Telephone: (755) 83448688

Fax: (755) 83442996

Site on File with the Federal Communications Commission – United Sates

Registration Number: 899988

For 3m & 10 m OATS

Site Listed with Industry Canada of Ottawa, Canada

Registration Number: IC: 5205A-01

For 3m & 10 m OATS

1.2 Applicant Details

Applicant: Shenzhen HAC Telecom Technology Co., Ltd.

Address: 1903, Tower A of Haisong Bldg, 9th Tairan Road, Chegongmiao, Futian, Shenzhen, China.

Telephone: 86-755-23981078

Fax: 86-755-23981070

1.3 Description of EUT

Product:	Zigbee module
Manufacturer:	Shenzhen HAC Telecom Technology Co., Ltd.
Model Number:	HAC-UBee
Type of Modulation	QPSK
Frequency range	2405-2480MHz
Channel Spacing	5MHz
Frequency Selection	By software
Channel Number	16 Channels

1.4 Submitted Sample: 1 Sample

1.5 Test Duration:

2011-04-02 to 2011-04-09

1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB

Radiated Emissions Uncertainty =4.7dB

1.7 Test Engineer

The sample tested by Terry Tang

Print Name: Terry Tang

2.0	Test Equipments				
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	ROHDE&SCHWARZ	ESPI 3	100379	2011-12-03	2012-12-02
TWO Line-V-NETW	ROHDE&SCHWARZ	EZH3-Z5	100294	2011-12-03	2012-12-02
TWO Line-V-NETW	ROHDE&SCHWARZ	EZH3-Z5	100253	2011-12-03	2012-12-02
Ultra Broadband ANT	ROHDE&SCHWARZ	HL562	100157	2011-12-03	2012-12-02
ESDV Test Receiver	ROHDE&SCHWARZ	ESDV	100008	2011-03-03	2012-03-03
Impuls-Begrenzer	ROHDE&SCHWARZ	ESH3-Z2	100281	2011-03-03	2012-03-03
System Controller	CT	SC100	-	2011-03-03	2012-03-03
Power Supply	LW	APS1502	-	-	-
Bilog Antenna	Chase	CBL6111C	2576	2011-03-03	2012-03-03
Loop Antenna	EMCO	6502	00042960	2011-03-03	2012-03-03
ESPI Test Receiver	ROHDE&SCHWARZ	ESI26	838786/013	2011-03-03	2012-03-03
3m OATS	--	--	N/A	2011-03-03	2012-03-03
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170265	2010-08-13	2011-08-12
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-631	2010-07-03	2011-07-02
Power meter	Anritsu	ML2487A	6K00003613	2011-03-03	2012-03-03
Power sensor	Anritsu	MA2491A	32263	2011-03-03	2012-03-03
Bilog Antenna	Schwarebeck	VULB9163	9163/340	2010-05-14	2011-05-13
LISN	AFJ	LS16C	10010947251	2010-04-26	2011-04-25
LISN (Three Phase)	Schwarebeck	NSLK 8126	8126453	2010-04-26	2011-04-25
9*6*6 Anechoic	--	--	N/A	2010-04-26	2011-04-25
EMI Test Receiver	RS	ESCS30	100139	2010-04-26	2011-04-25
LISN	AFJ	LS16C	10010947251	2010-04-26	2011-04-25
LISN (Three Phase)	Schwarebeck	NSLK 8126	8126453	2010-04-26	2011-04-25

3. DESCRIPTION OF TEST MODES

IEEE 802.15.4

The EUT had been tested under operating condition. There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2405
Middle	2445
High	2480

3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications:

Standard	Test Type	Result	Notes
FCC Part 15, Paragraph 15.107 & 15.207	Conducted Emission Test	PASS	Complies
FCC Part 15 Subpart C Paragraph 15.247(a)(2) Limit	Spectrum bandwidth of a Orthogonal Frequency Division Multiplex System Limit: 6dB bandwidth>500kHz	PASS	Complies
FCC Part 15, Paragraph 15.247(b)	Maximum peak output power Limit: max. 30dBm	PASS	Complies
FCC Part 15, Paragraph 15.109,15.205 & 15.209	Transmitter Radiated Emission Limit: Table 15.209	PASS	Complies
FCC Part 15, Paragraph 15.247(d)	Power Spectral Density Limit: max. 8dBm	PASS	Complies
FCC Part 15, Paragraph 15.247(c)	Out of Band Emission and Restricted Band Radiation Limit: 20dB less than peak value of fundamental frequency Restricted band limit: Table 15.209	PASS	Complies

3.2 Test Standards

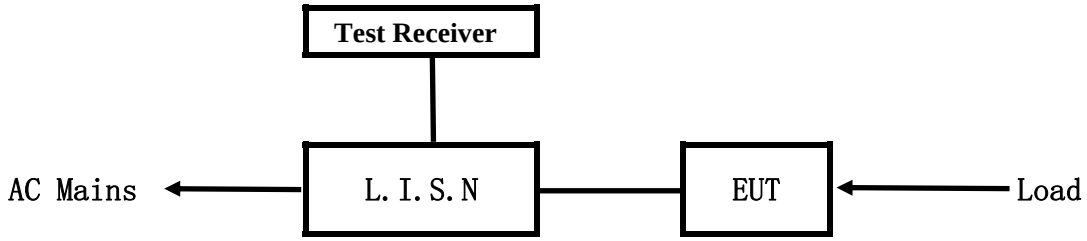
FCC Part 15 Subpart & Subpart C, Paragraph 15.247

4.0 EUT Modification

No modification by Shenzhen Timeway Technology Consulting Co.,Ltd

5. Power Line Conducted Emission Test

5.1 Schematics of the test

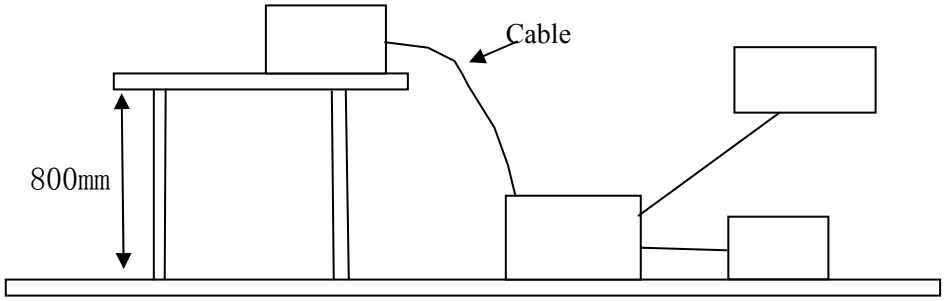


EUT: Equipment Under Test

5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.4-2009.The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.4 –2003.

Block diagram of Test setup



5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.4-2009. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

A. EUT

Device	Manufacturer	Model	FCC ID
Zigbee module	Shenzhen HAC Telecom Technology Co., Ltd.	HAC-UBee	WMUHAC-UBEEV3X

B. Internal Device

Device	Manufacturer	Model	FCC ID/DOC
N/A			

C. Peripherals

Device	Manufacturer	Model	FCC ID/DOC	Cable
Power Supply	MoSo	AB41-060A-100T	-	1m of length DC output cable without shielding

5.4 EUT Operating Condition

Operating condition is according to ANSI C63.4 -2003.

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.207 and 15.107

Frequency (MHz)	Class A Limits (dB μ V)		Class B Limits (dB μ V)	
	Quasi-peak Level	Average Level	Quasi-peak Level	Average Level
0.15 ～ 0.50	79.0	66.0	66.0～56.0*	56.0～46.0*
0.50 ～ 5.00	73.0	60.0	56.0	46.0
5.00 ～ 30.00	73.0	60.0	60.0	50.0

Notes: 1. *Decreasing linearly with logarithm of frequency.

2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

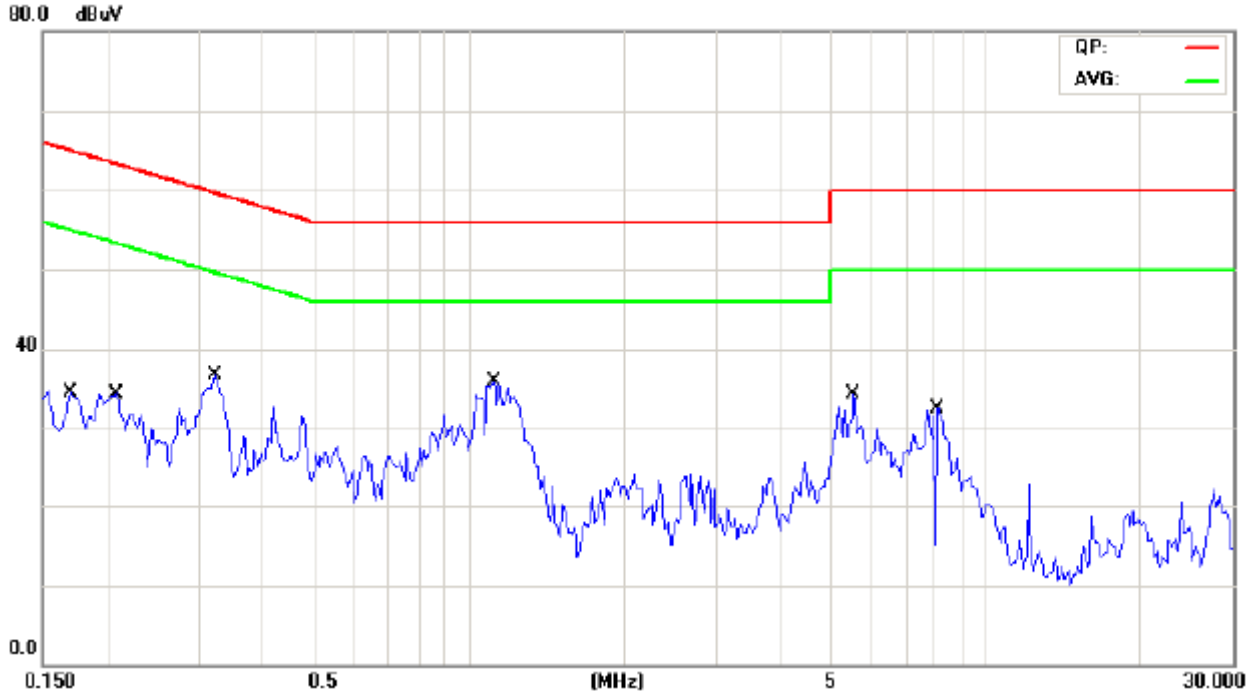
Note: the worse cases was selected to conducted the test

A Conducted Emission on Line Terminal of the power line (150kHz to 30MHz)

EUT set Condition: Keep Transmitting

Results: **Pass**

Please refer to following diagram for individual



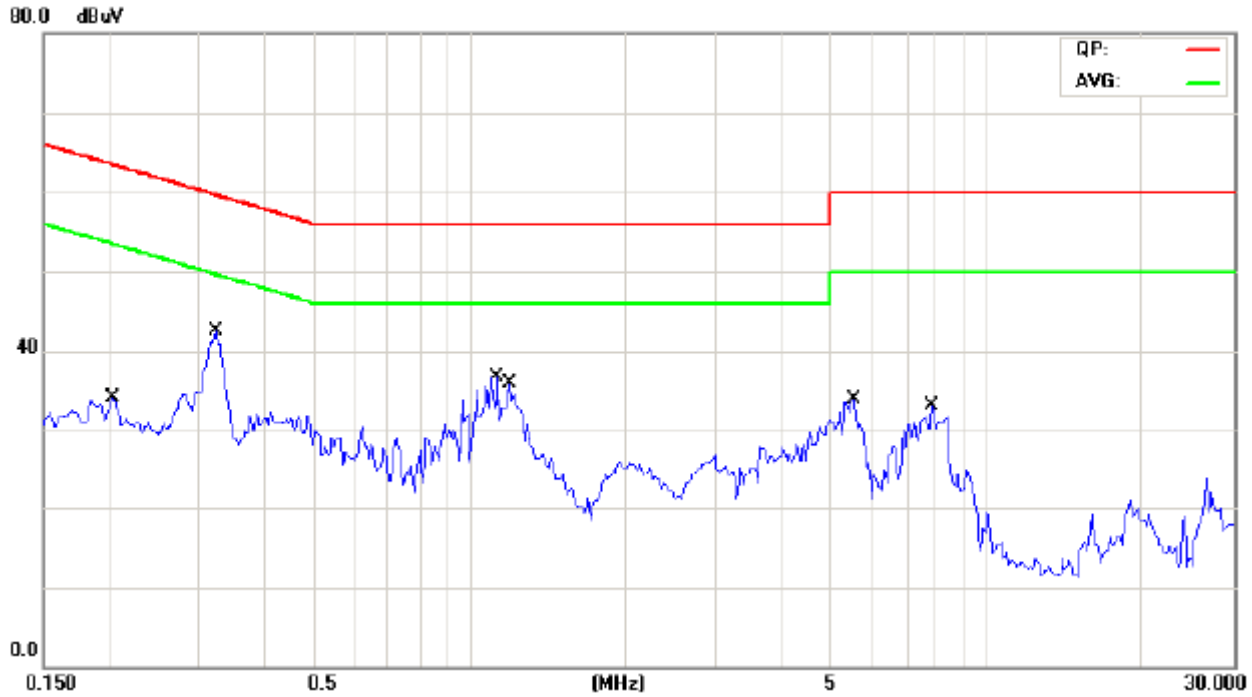
Frequency (MHz)	Reading(dB μ V)				Limit (dB μ V)	
	Line		Neutral			
	Quasi-peak	Average	Quasi-peak	Average	Quasi-peak	Average
0.3219	32.07	16.79	--	--	59.66	49.66
0.2047	29.14	25.81	--	--	63.41	53.41
1.1187	27.29	7.20	--	--	56.00	46.00
5.5586	25.11	9.56	--	--	60.00	50.00
8.0586	23.22	4.45	--	--	60.00	50.00
0.1695	27.08	19.38	--	--	64.98	54.98

A Conducted Emission on Neutral Terminal of the power line (150kHz to 30MHz)

EUT set Condition: Keep Transmitting

Results: **Pass**

Please refer to following diagram for individual



Frequency (MHz)	Reading(dB μ V)				Limit (dB μ V)	
	Line		Neutral			
	Quasi-peak	Average	Quasi-peak	Average	Quasi-peak	Average
0.3219			37.64	23.71	59.66	59.66
1.1305			27.80	10.79	56.00	56.00
5.5078			28.31	10.92	60.00	60.00
7.8398			25.38	7.20	60.00	60.00
0.2047			30.75	26.04	63.41	63.41
1.1968			30.89	14.65	56.00	56.00

6 Radiated Emission Test

6.1 Test Method and test Procedure:

(1) The EUT was tested according to ANSI C63.4 –2009. The radiated test was performed at Timeway Laboratory. This site is on file with the FCC laboratory division, Registration No.899988

(2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.4-2009.

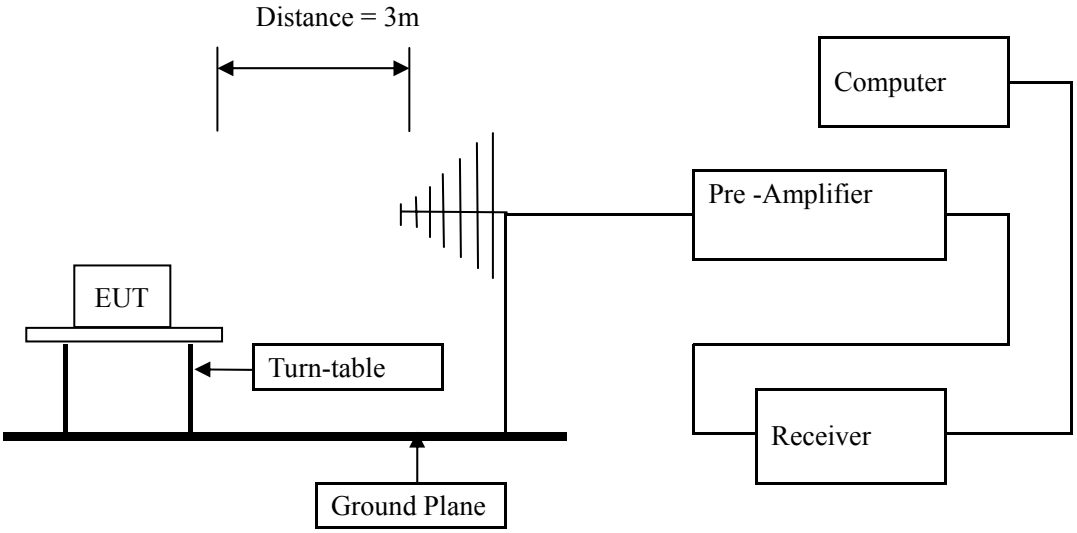
(3) The frequency spectrum from 30 MHz to 25 GHz was investigated. All readings from 30 MHz to 1 GHz are Quasi-peak values with a resolution bandwidth of 120 kHz. For measurement above 1GHz, peak values with RBW=VBW=1MHz and PK detector. AV value with RBW=1MHz, VBW=10Hz and PK detector. Measurements were made at 3 meters.

(4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.

(5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "**QP**" in the data table.

(6) The antenna polarization : Vertical polarization and Horizontal polarization.

Block diagram of Test setup



6.2 Configuration of The EUT

Same as section 5.3 of this report

6.3 EUT Operating Condition

Same as section 5.4 of this report.

6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

Frequencies in restricted band are complied to limit on Paragraph 15.209 and 15.109

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note: 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

2. In the Above Table, the higher limit applies at the band edges.

3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT

Test result

General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: **Keep Transmitting (Low channel)**

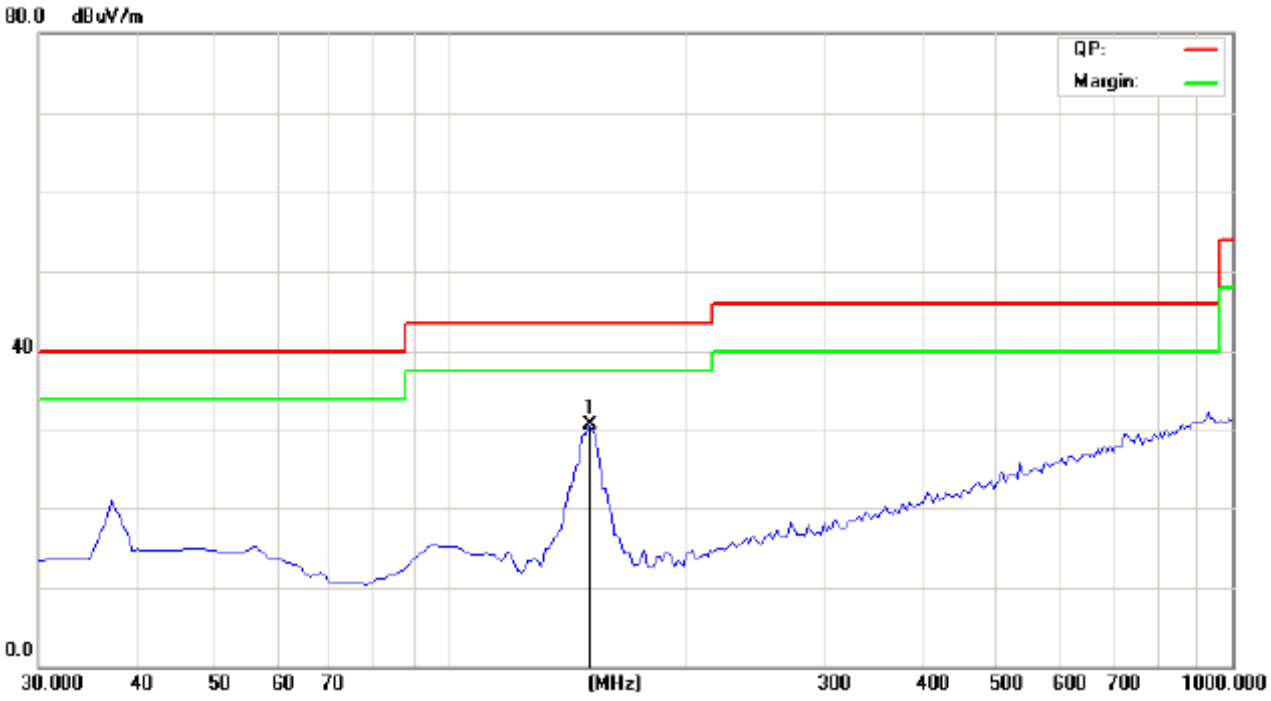
Results: **Pass**

Antenna: **Inverted F PCB Antenna**

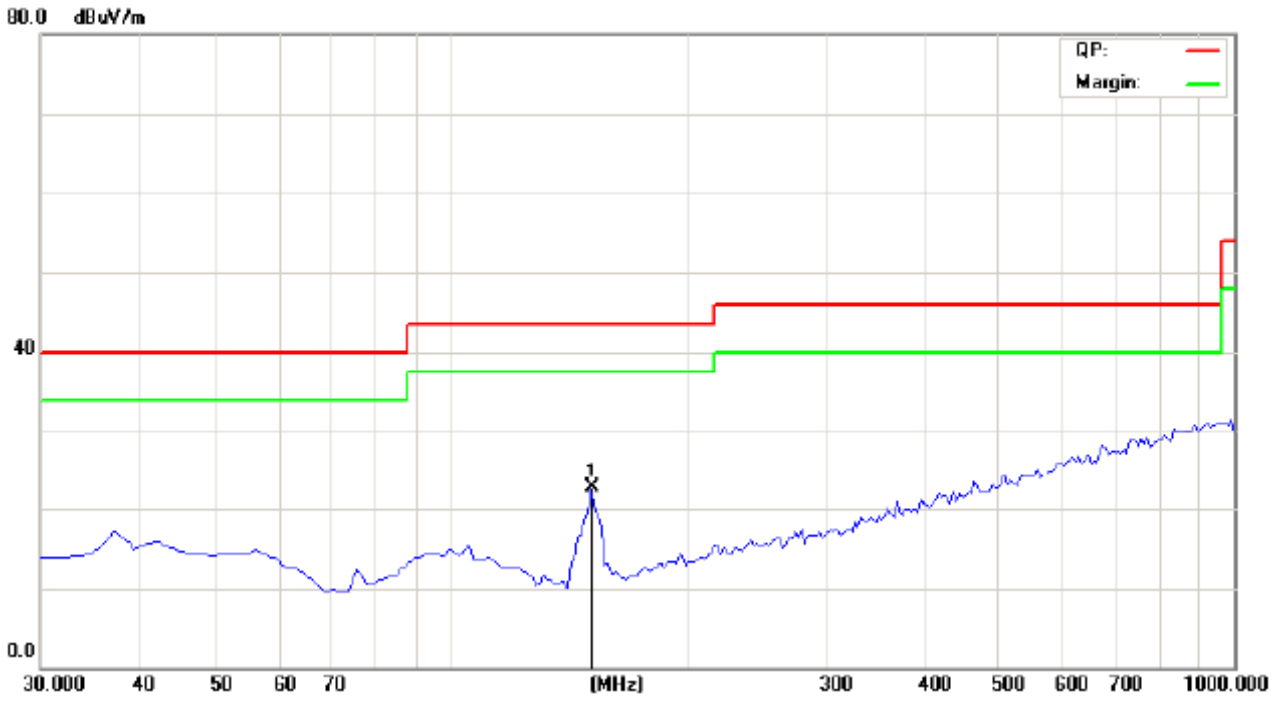
Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
151.250	30.61	H	43.50
151.250	22.66	V	43.50

Test Figure:

H



V



Test result

General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: **Keep Transmitting (Low channel)**

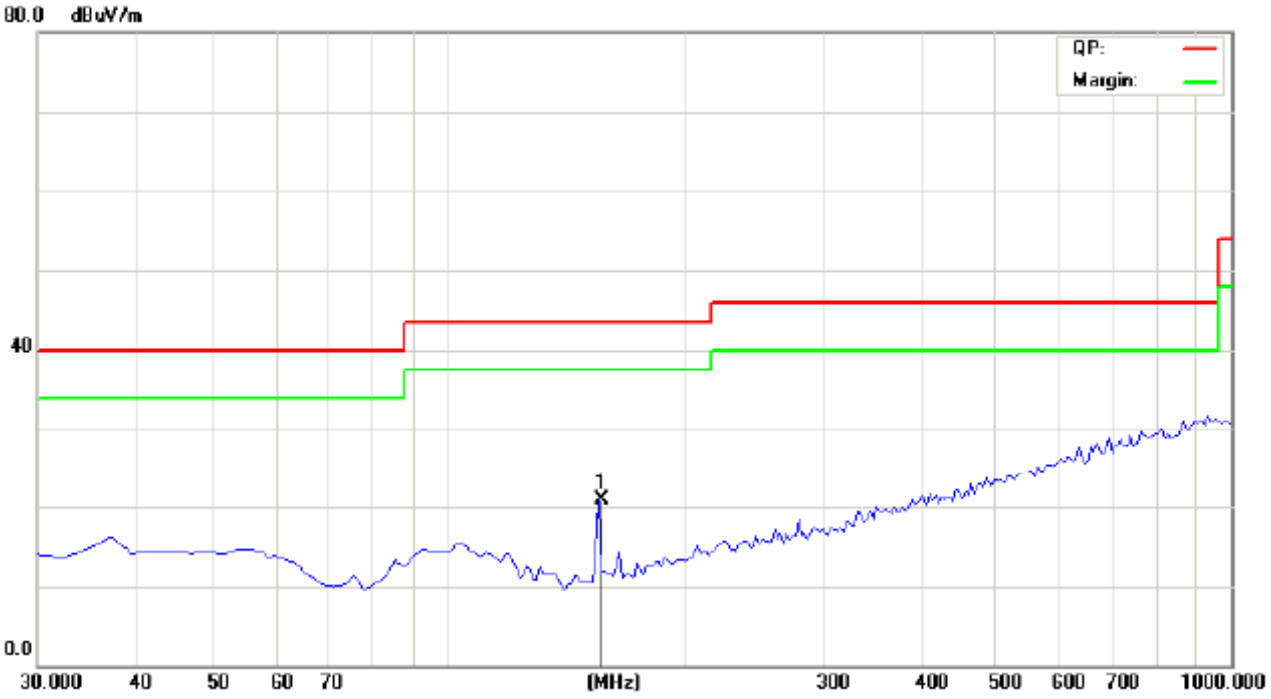
Results: **Pass**

Antenna: **Dipole Antenna**

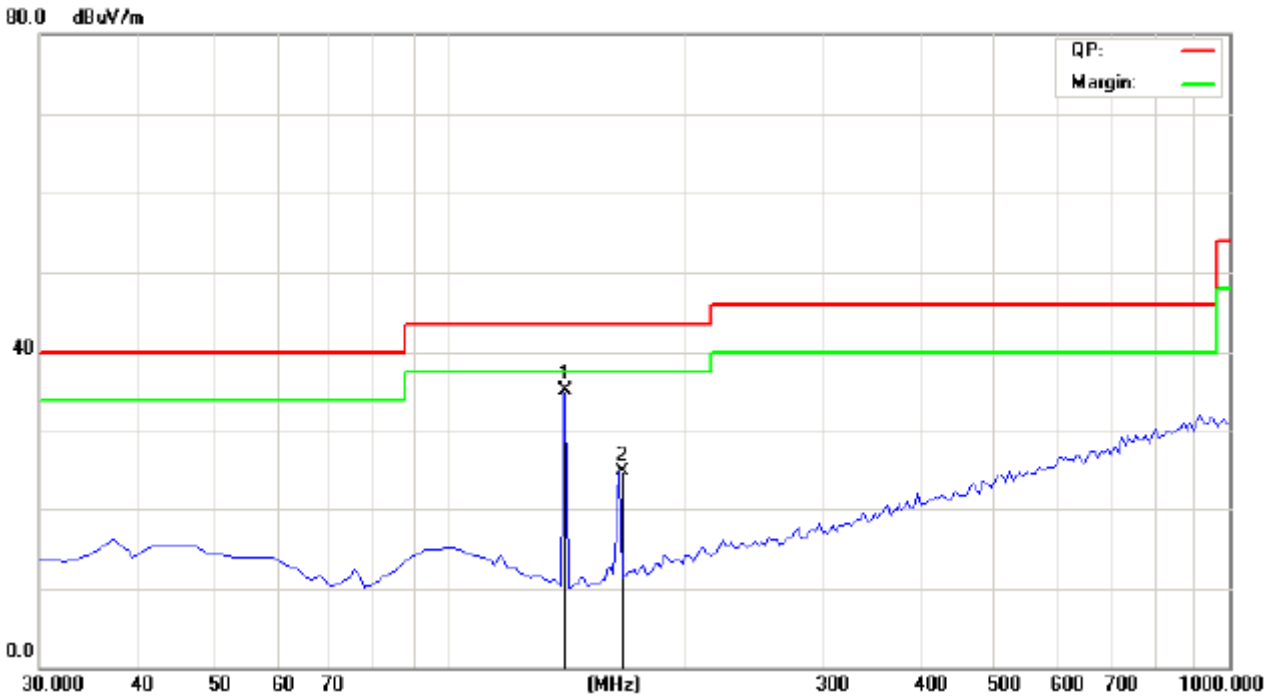
Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
141.550	35.04	V	43.50
165.800	24.96	V	43.50
156.100	20.92	H	43.50

Test Figure:

H



V



Operation Mode: Keep Transmitting (EUT with Inverted F PCB Antenna)

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
2405	79.25（PK）	H	Fundamental Frequency
2405	80.15（PK）	V	
4810	--	H	74(Peak)/ 54(AV)
7215	--	H	74(Peak)/ 54(AV)
9620	--	H/V	74(Peak)/ 54(AV)
12025	--	H/V	74(Peak)/ 54(AV)
14430	--	H/V	74(Peak)/ 54(AV)
16835	--	H/V	74(Peak)/ 54(AV)
19240	--	H/V	74(Peak)/ 54(AV)
21645	--	H/V	74(Peak)/ 54(AV)
24050	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit

2. Remark “---” means that the emissions level is too low to be measured

Operation Mode: Keep Transmitting (EUT with Inverted F PCB Antenna)

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
2445	78.15（PK）	H	Fundamental Frequency
2445	80.41（PK）	V	
4890	--	H	74(Peak)/ 54(AV)
7335	--	V	74(Peak)/ 54(AV)
9780	--	H/V	74(Peak)/ 54(AV)
12225	--	H/V	74(Peak)/ 54(AV)
14670	--	H/V	74(Peak)/ 54(AV)
17115	--	H/V	74(Peak)/ 54(AV)
19560	--	H/V	74(Peak)/ 54(AV)
22005	--	H/V	74(Peak)/ 54(AV)
24450	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit
2. Remark "---" means that the emissions level is too low to be measured

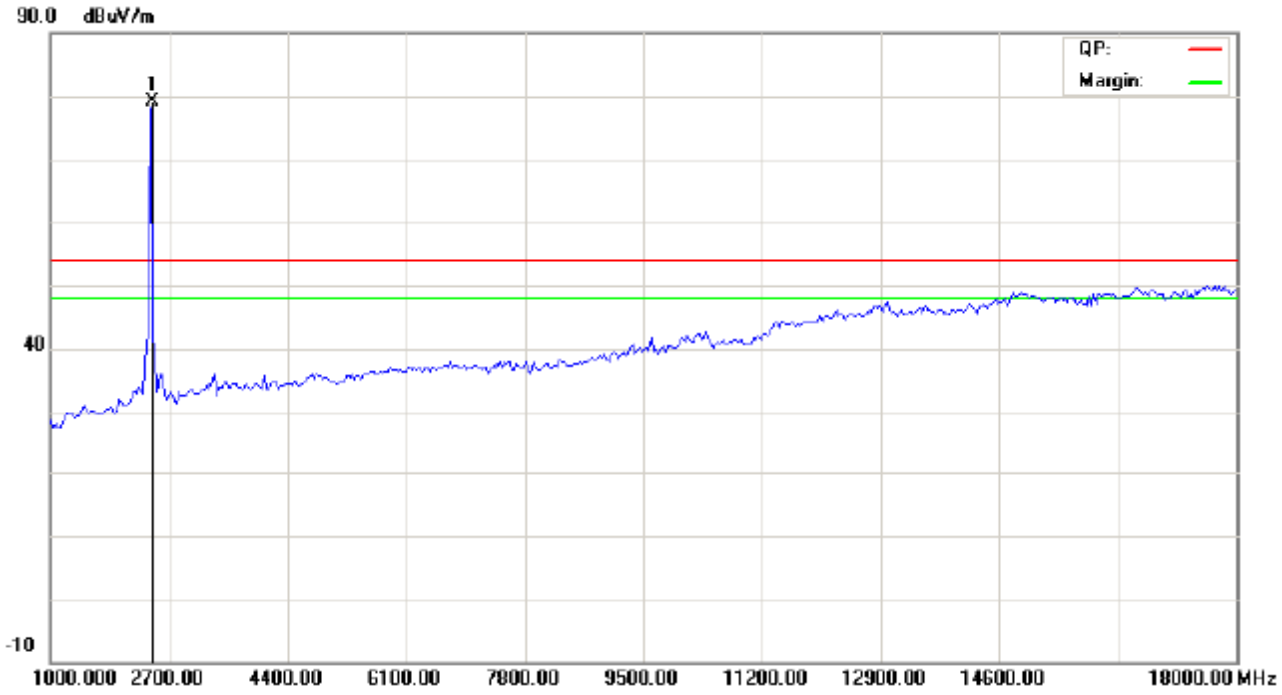
Operation Mode: Keep Transmitting (EUT with Inverted F PCB Antenna)

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
2480	78.69（PK）	H	Fundamental Frequency
2480	82.39（PK）	V	
4960	--	H	74(Peak)/ 54(AV)
7440	--	V	74(Peak)/ 54(AV)
9920	--	H/V	74(Peak)/ 54(AV)
12400	--	H/V	74(Peak)/ 54(AV)
14880	--	H/V	74(Peak)/ 54(AV)
17360	--	H/V	74(Peak)/ 54(AV)
19840	--	H/V	74(Peak)/ 54(AV)
22320	--	H/V	74(Peak)/ 54(AV)
24800	--	H/V	74(Peak)/ 54(AV)

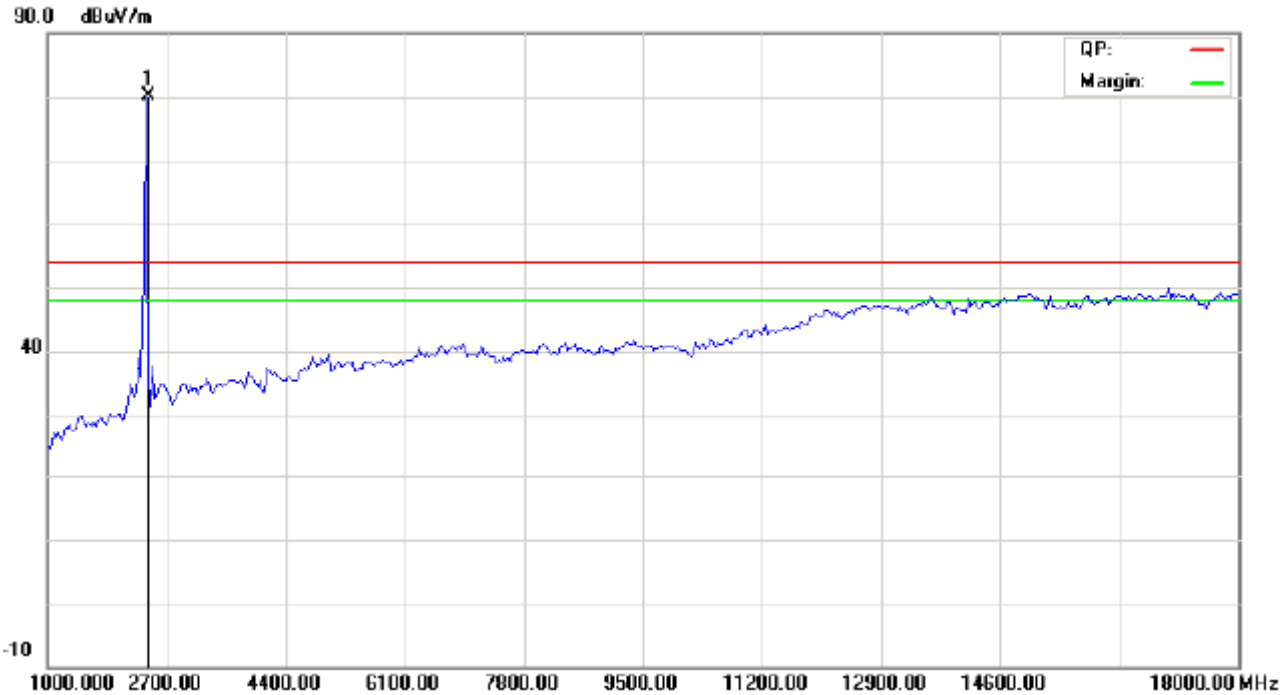
Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit
2. Remark "---" means that the emissions level is too low to be measured

Please refer to the following test plots for details:

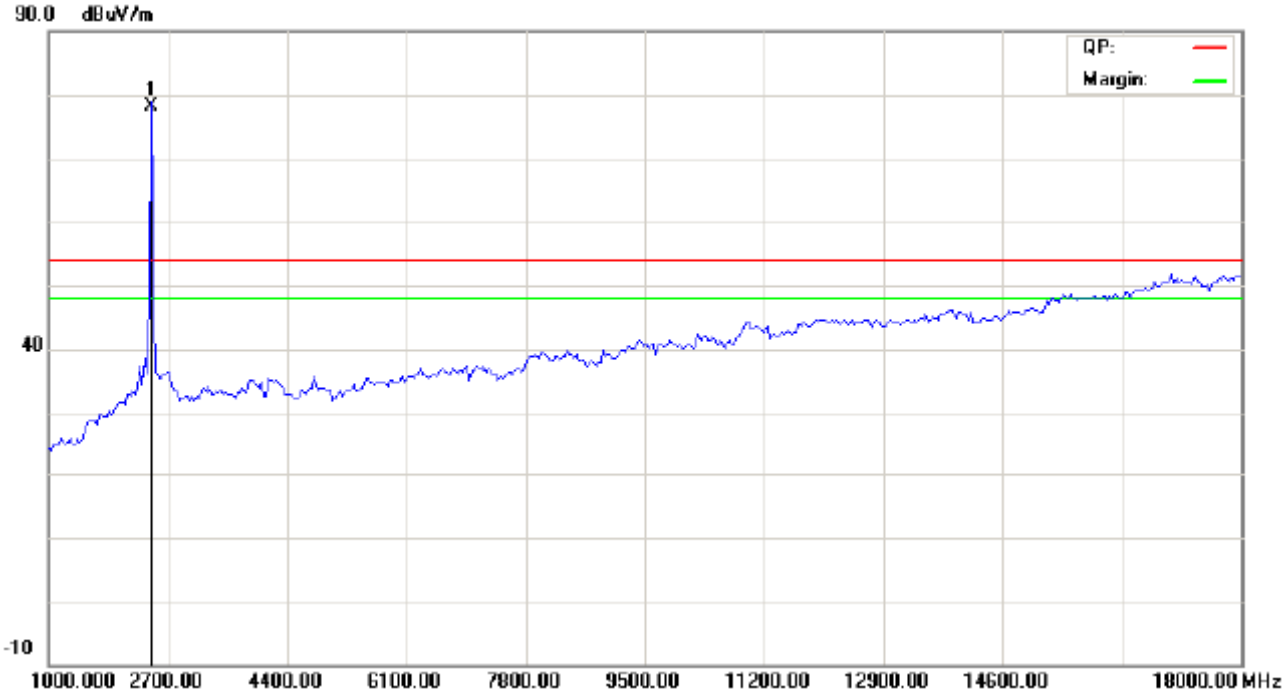
Low CH: Horizontal



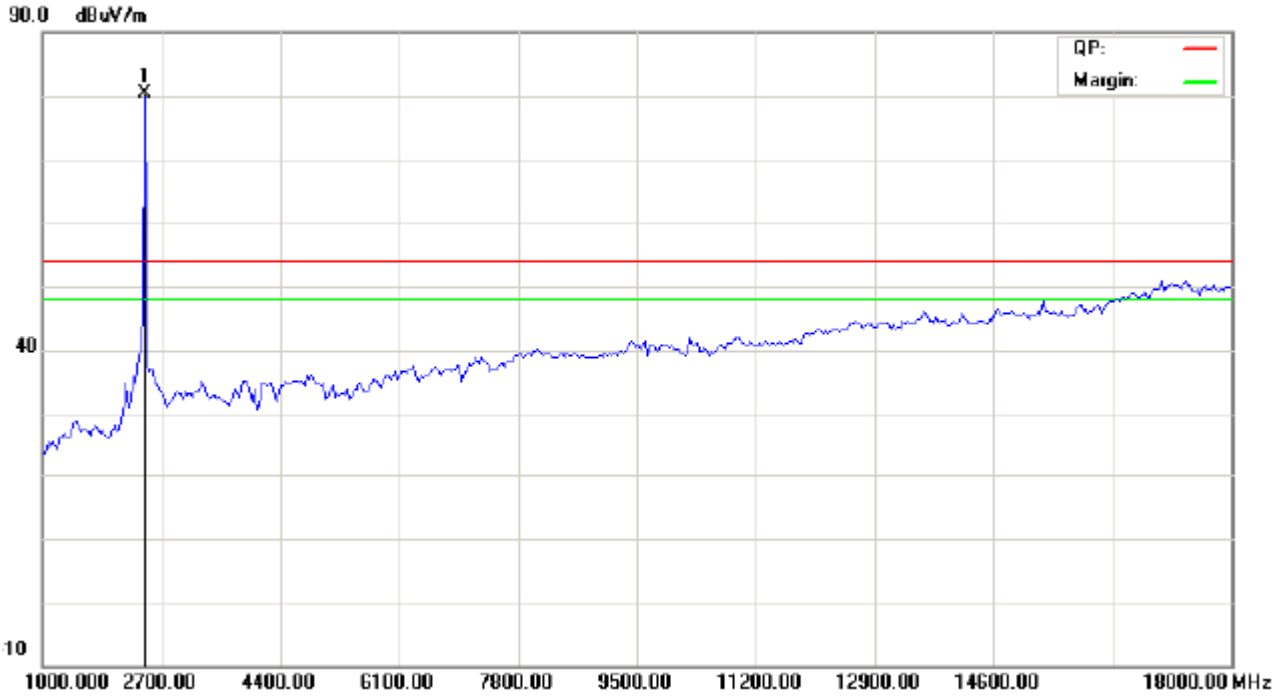
Low CH: Vertical



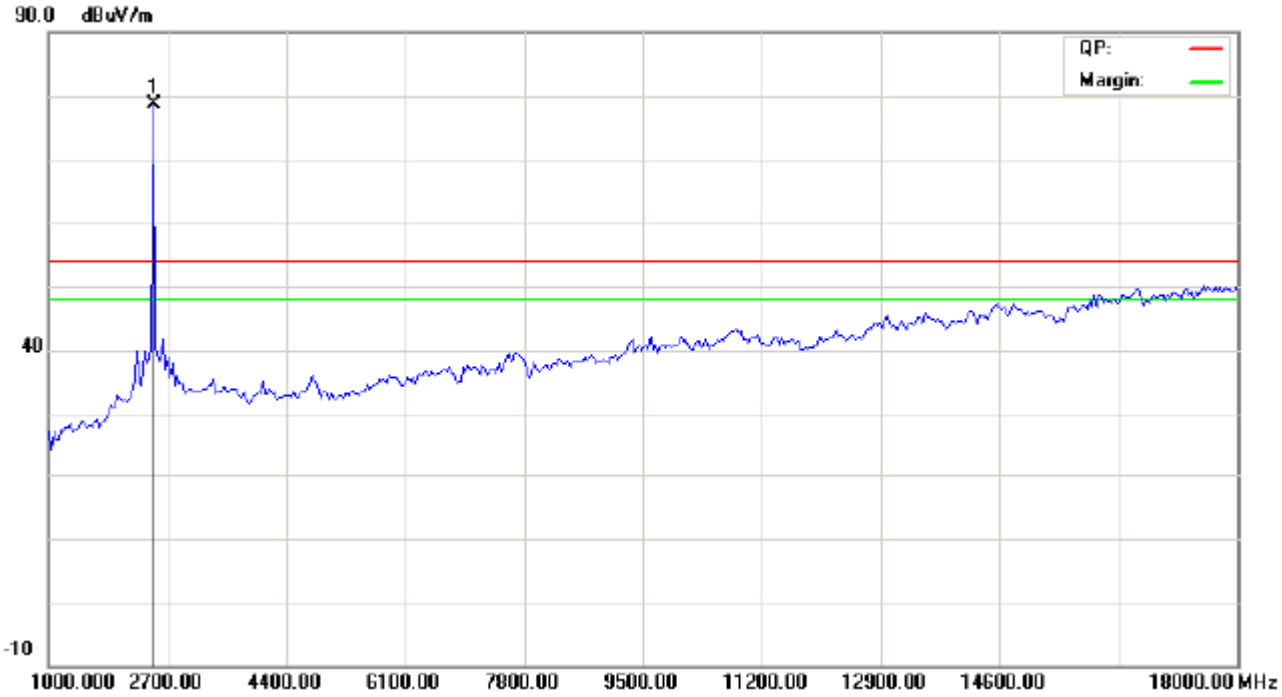
Middle CH: Horizontal



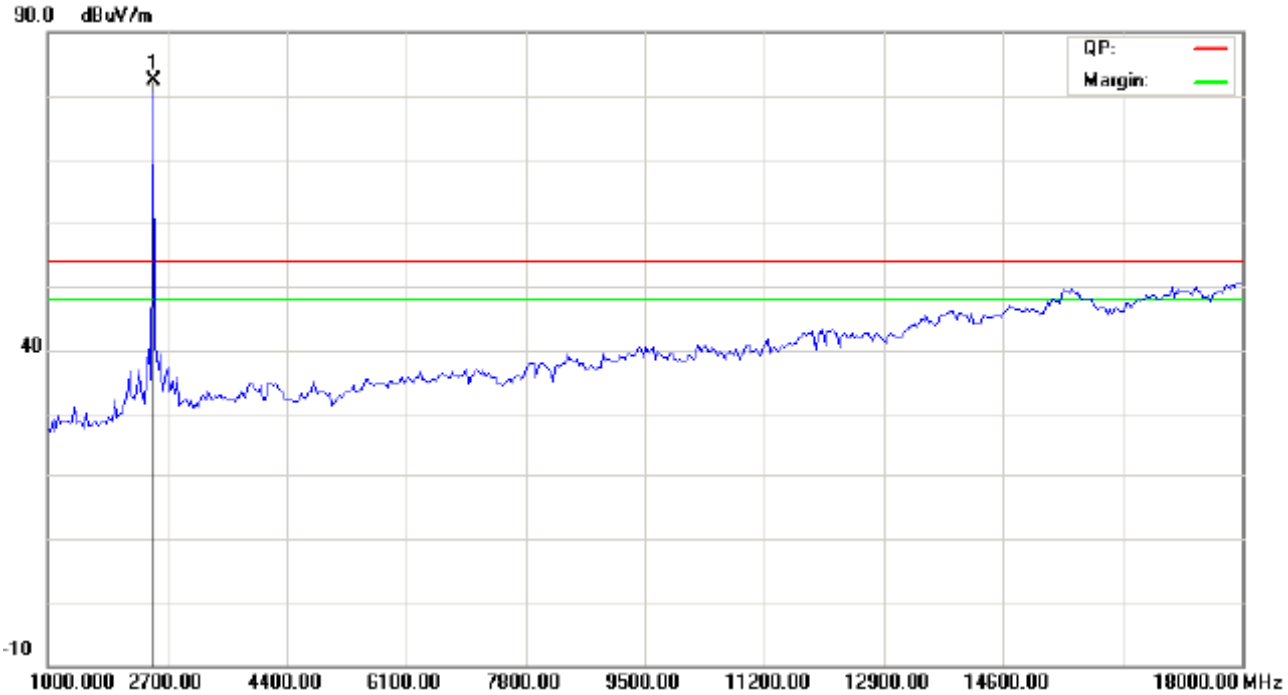
Middle CH: Vertical



High CH: Horizontal



High CH: Vertical



Note: For the radiated emissions from 18GHz-25GHz, it is the floor noise that meets the requirement of FCC rule.

Operation Mode: Keep Transmitting (EUT with Dipole antenna)

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
2405	79.64 (PK)	H	Fundamental Frequency
2405	80.78 (PK)	V	
4810	--	H	74(Peak)/ 54(AV)
7215	--	V	74(Peak)/ 54(AV)
9620	--	H/V	74(Peak)/ 54(AV)
12025	--	H/V	74(Peak)/ 54(AV)
14430	--	H/V	74(Peak)/ 54(AV)
16835	--	H/V	74(Peak)/ 54(AV)
19240	--	H/V	74(Peak)/ 54(AV)
21645	--	H/V	74(Peak)/ 54(AV)
24050	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit

2. Remark "---" means that the emissions level is too low to be measured

Operation Mode: Keep Transmitting (EUT with Dipole antenna)

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
2445	79.69 (PK)	H	Fundamental Frequency
2445	80.15(PK)	V	
4890	--	H	74(Peak)/ 54(AV)
7335	--	V	74(Peak)/ 54(AV)
9780	--	H/V	74(Peak)/ 54(AV)
12225	--	H/V	74(Peak)/ 54(AV)
14670	--	H/V	74(Peak)/ 54(AV)
17115	--	H/V	74(Peak)/ 54(AV)
19560	--	H/V	74(Peak)/ 54(AV)
22005	--	H/V	74(Peak)/ 54(AV)
24450	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit

2. Remark "---" means that the emissions level is too low to be measured

Operation Mode: Keep Transmitting (EUT with Dipole antenna)

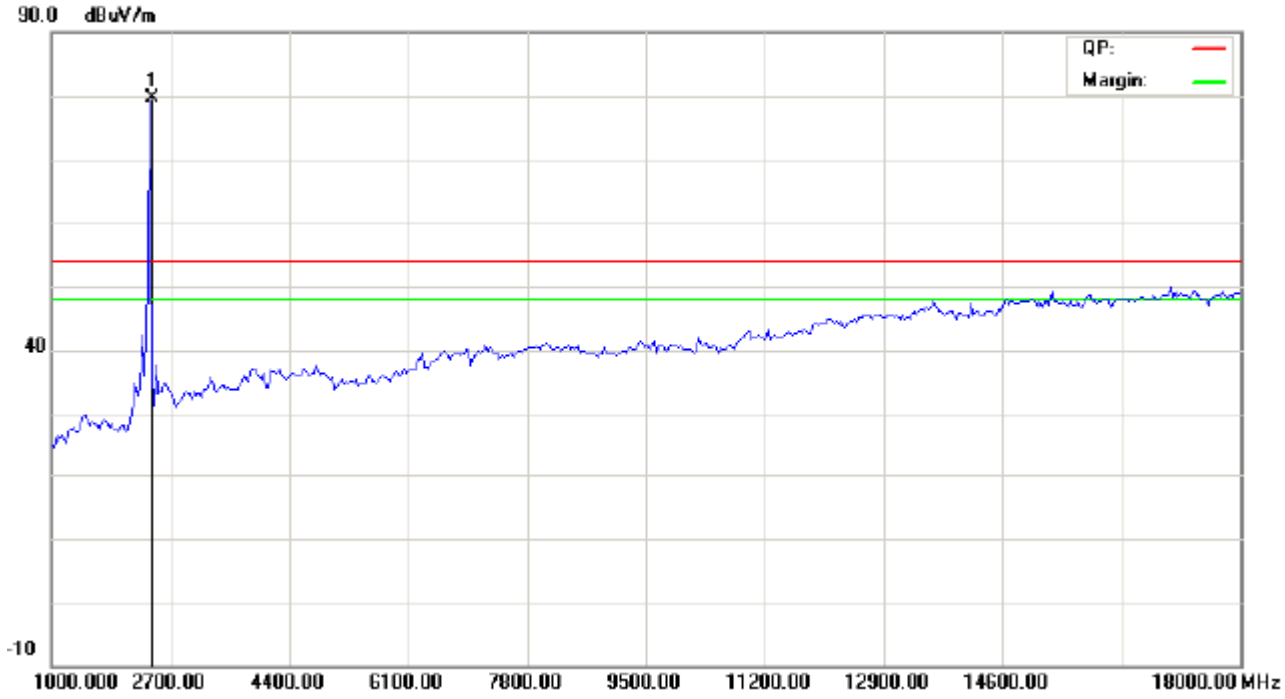
Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
2480	79.23(PK)	H	Fundamental Frequency
2480	82.36(PK)	V	
4960	--	H	74(Peak)/ 54(AV)
7440	--	V	74(Peak)/ 54(AV)
9920	--	H/V	74(Peak)/ 54(AV)
12400	--	H/V	74(Peak)/ 54(AV)
14880	--	H/V	74(Peak)/ 54(AV)
17360	--	H/V	74(Peak)/ 54(AV)
19840	--	H/V	74(Peak)/ 54(AV)
22320	--	H/V	74(Peak)/ 54(AV)
24800	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit

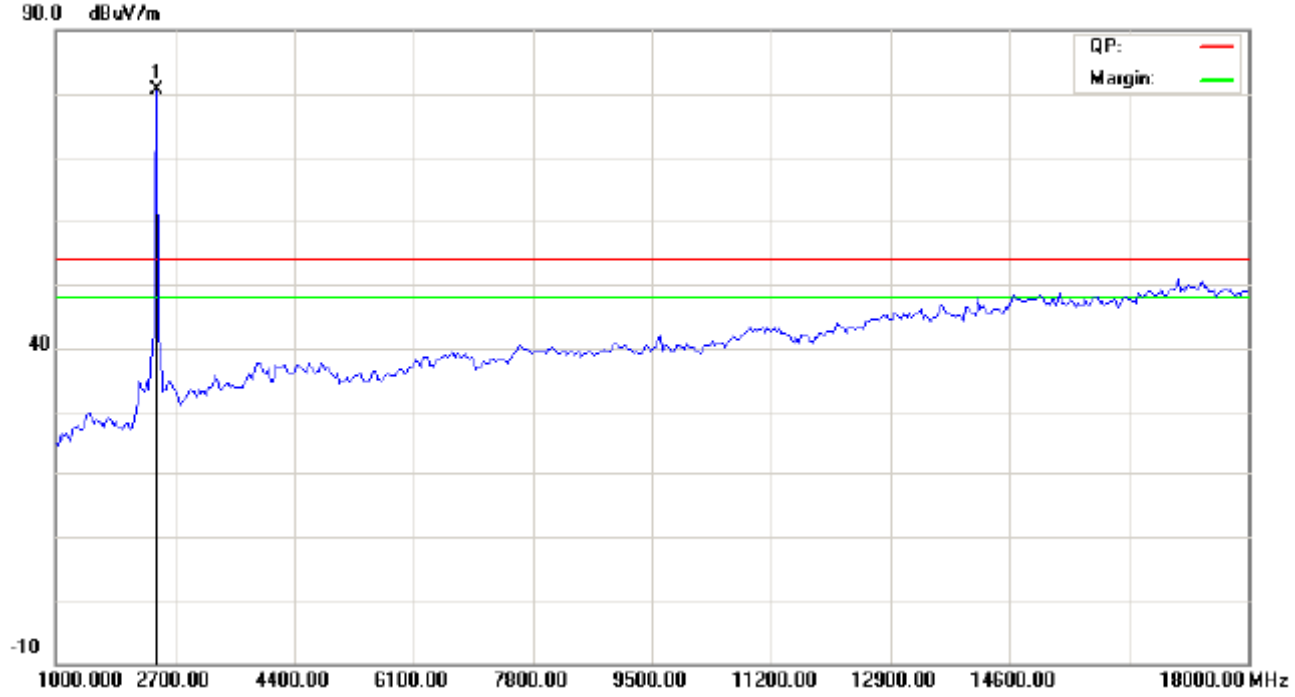
2. Remark "---" means that the emissions level is too low to be measured

Please refer to the following test plots for details:

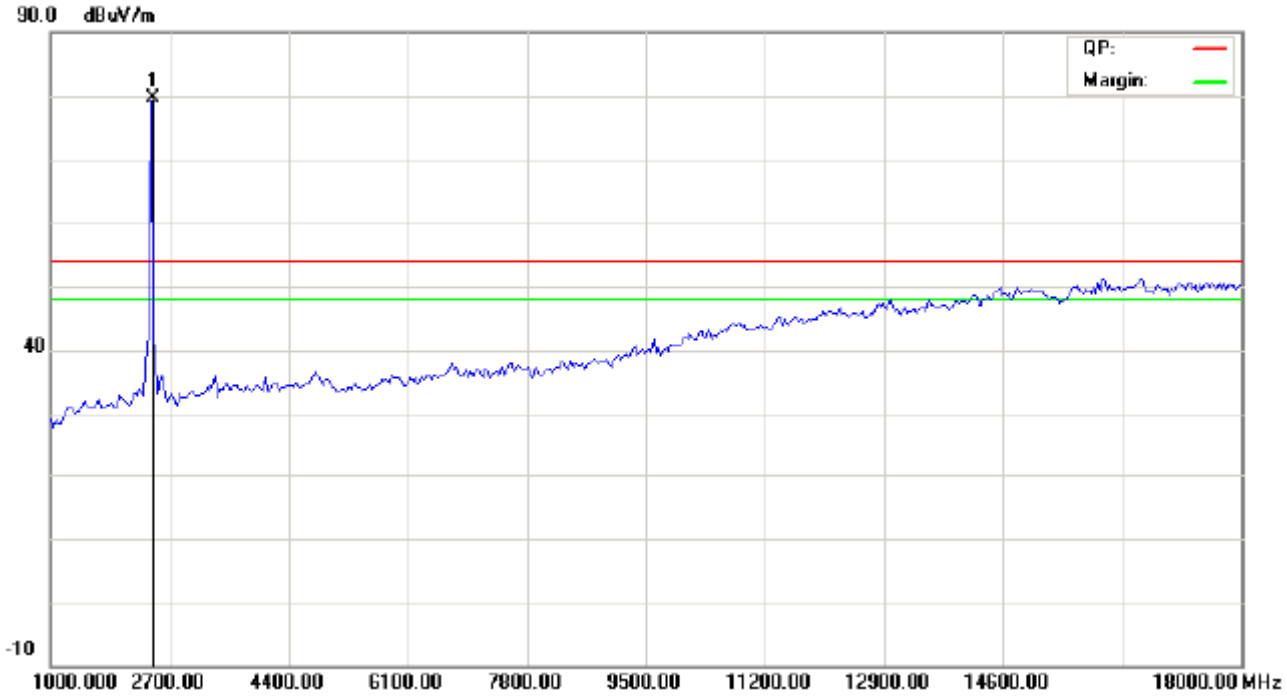
Low CH: Horizontal



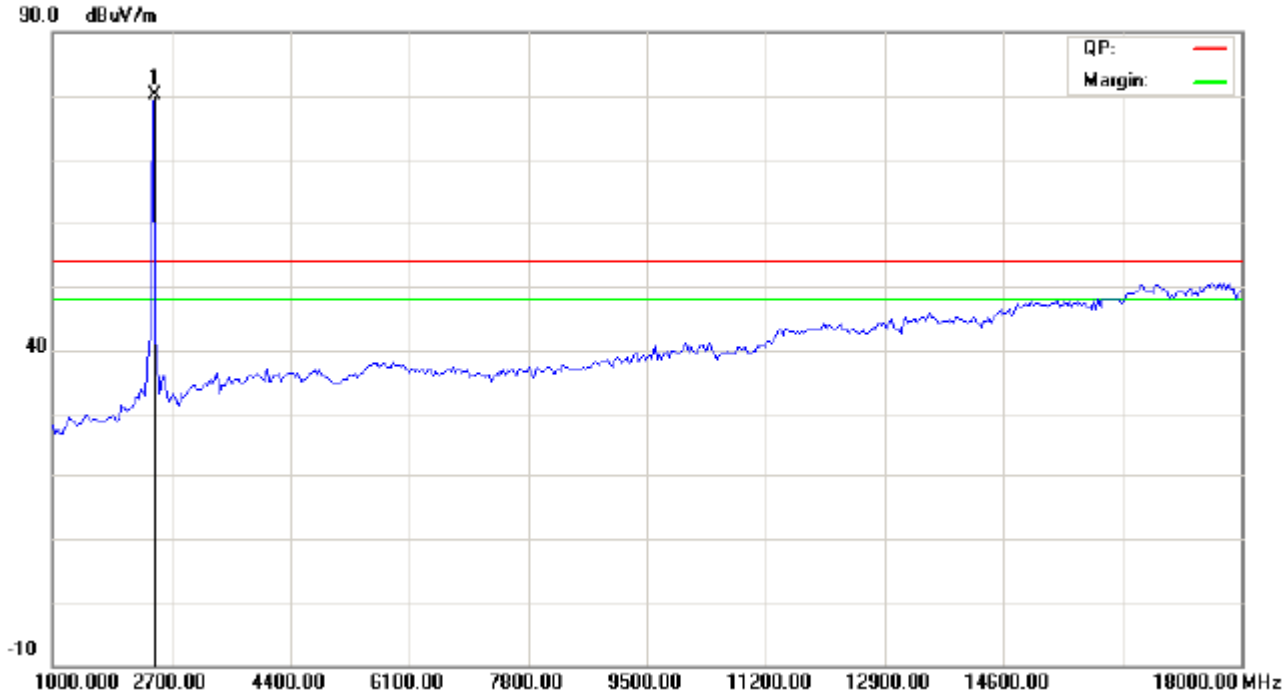
Low CH: Vertical



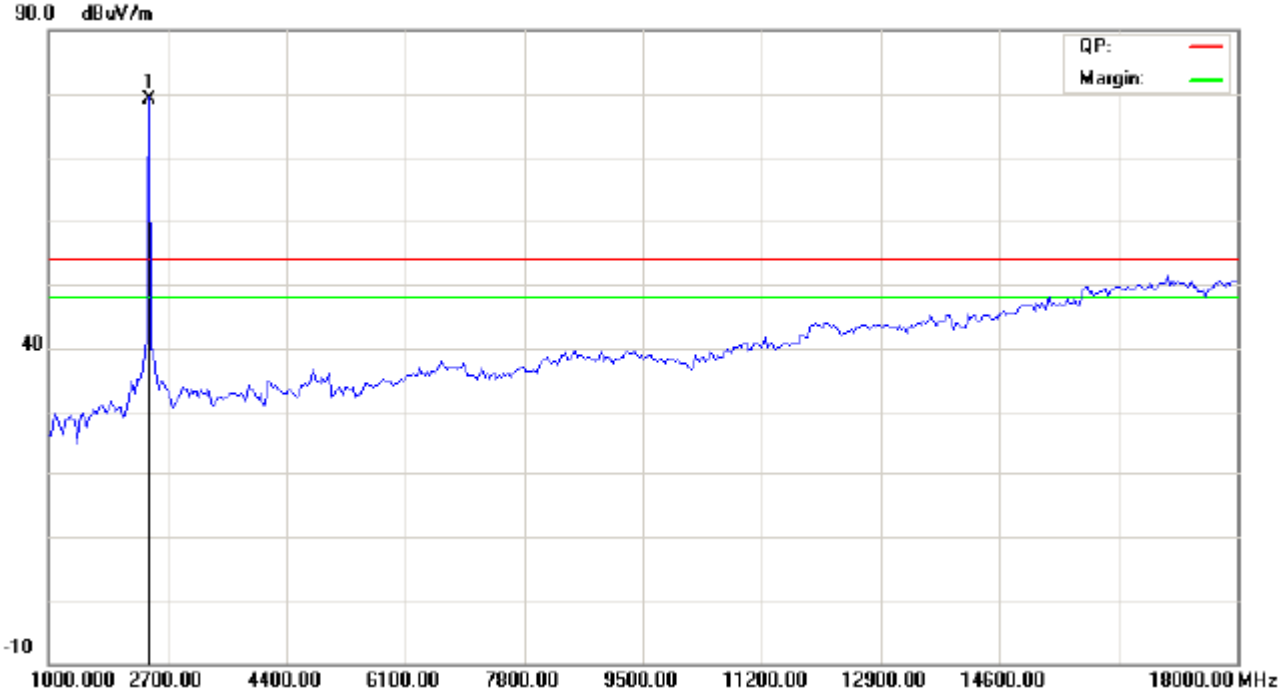
Middle CH: Horizontal



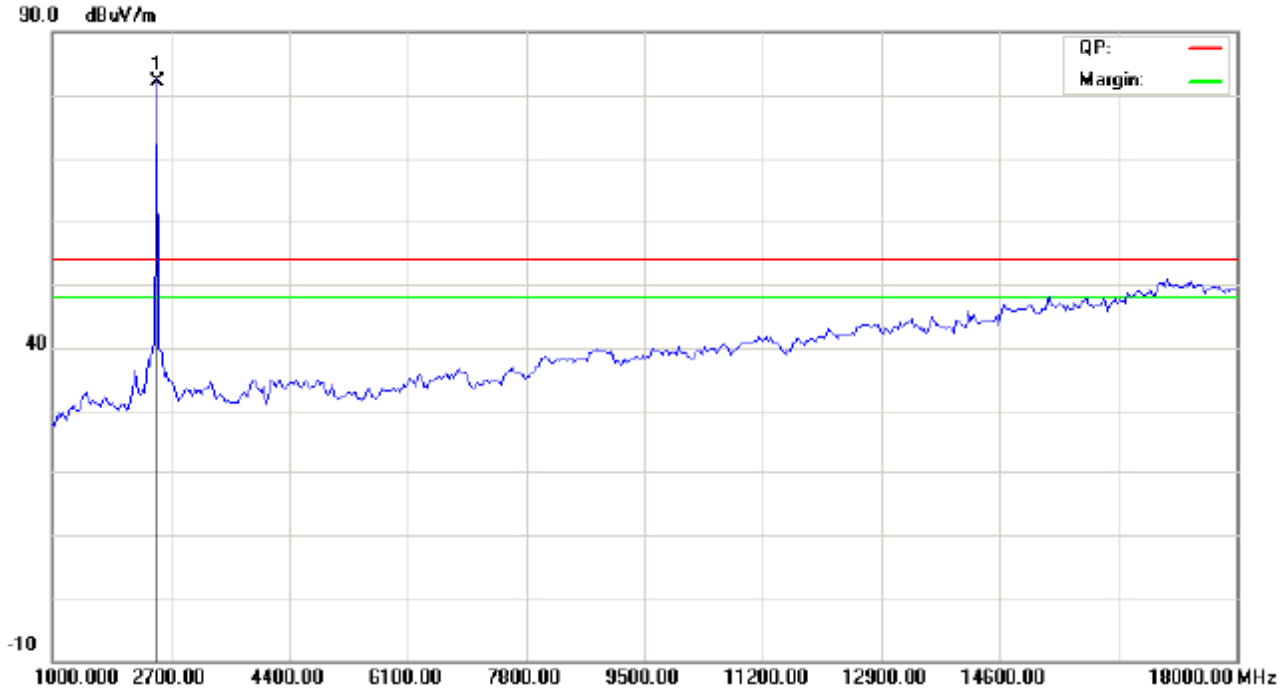
Middle CH: Vertical



High CH: Horizontal



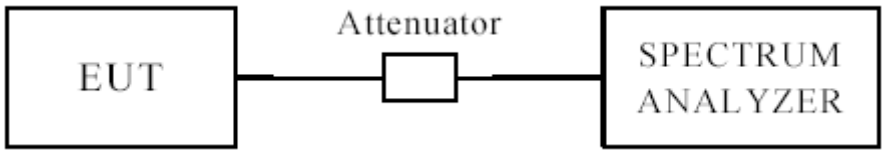
High CH: Vertical



Note: For the radiated emissions from 18GHz-25GHz, it is the floor noise that meet the requirement of FCC rule.

7.0 6dB Bandwidth Measurement

7.1 Test Setup



7.2 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is >500kHz

7.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator.

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 kHz RBW and 100 kHz VBW; The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

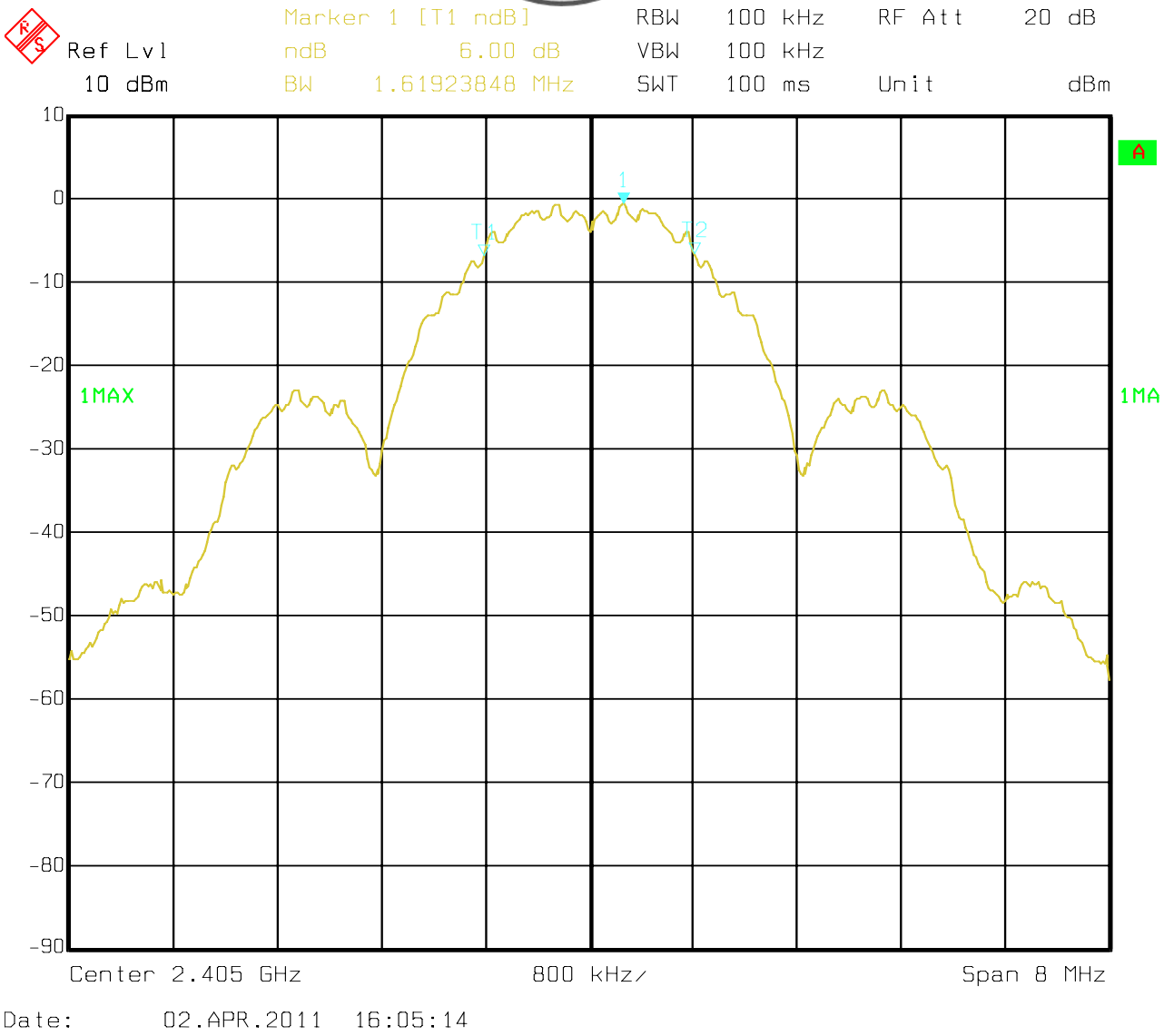
7.4 Test Result

TEST REPORT

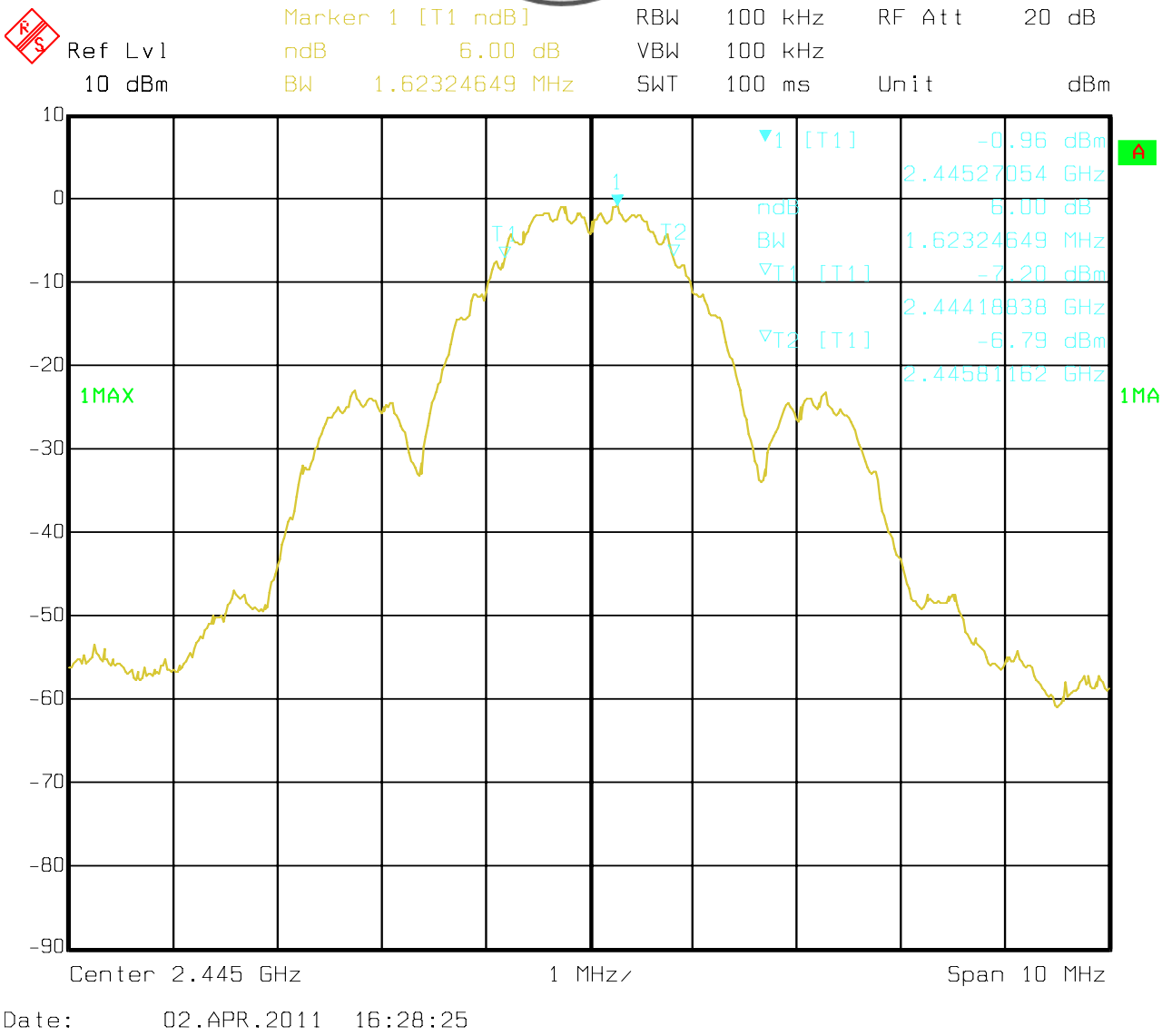
EUT	Zigbee module	Model	HAC-UBee
Mode	Keep Transmitting	Input Voltage	DC4.8V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Channel Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/ Fail
Low	2405	1.619	0.5	Pass
Middle	2445	1.623	0.5	Pass
High	2480	1.623	0.5	Pass

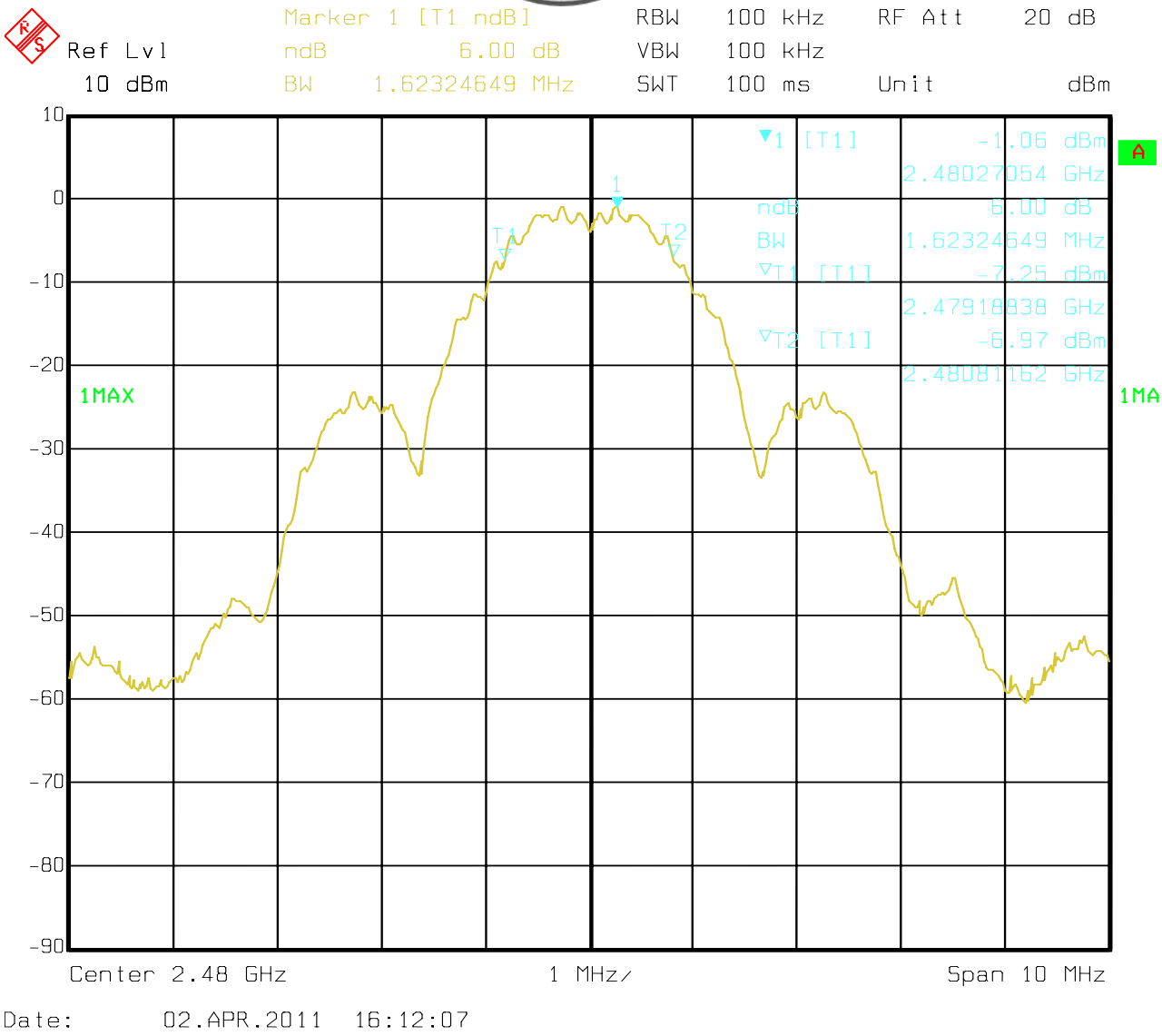
1. Low Channel



2. Middle Channel

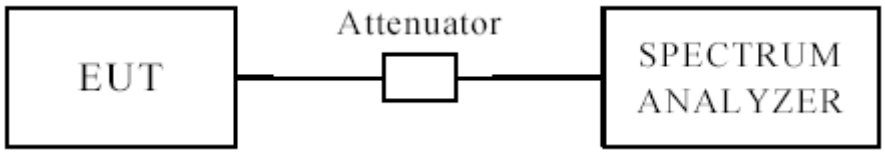


3. High Channel



8. Maximum Peak Output Power

8.1 Test Setup



8.2 Limits of Maximum Peak Output Power

The Maximum Peak Output Power Measurement is 30dBm.

8.3 Test Procedure

The RF power output was measured with a spectrum connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate centre frequency.

Note: the peak power was measured

8.4Test Results

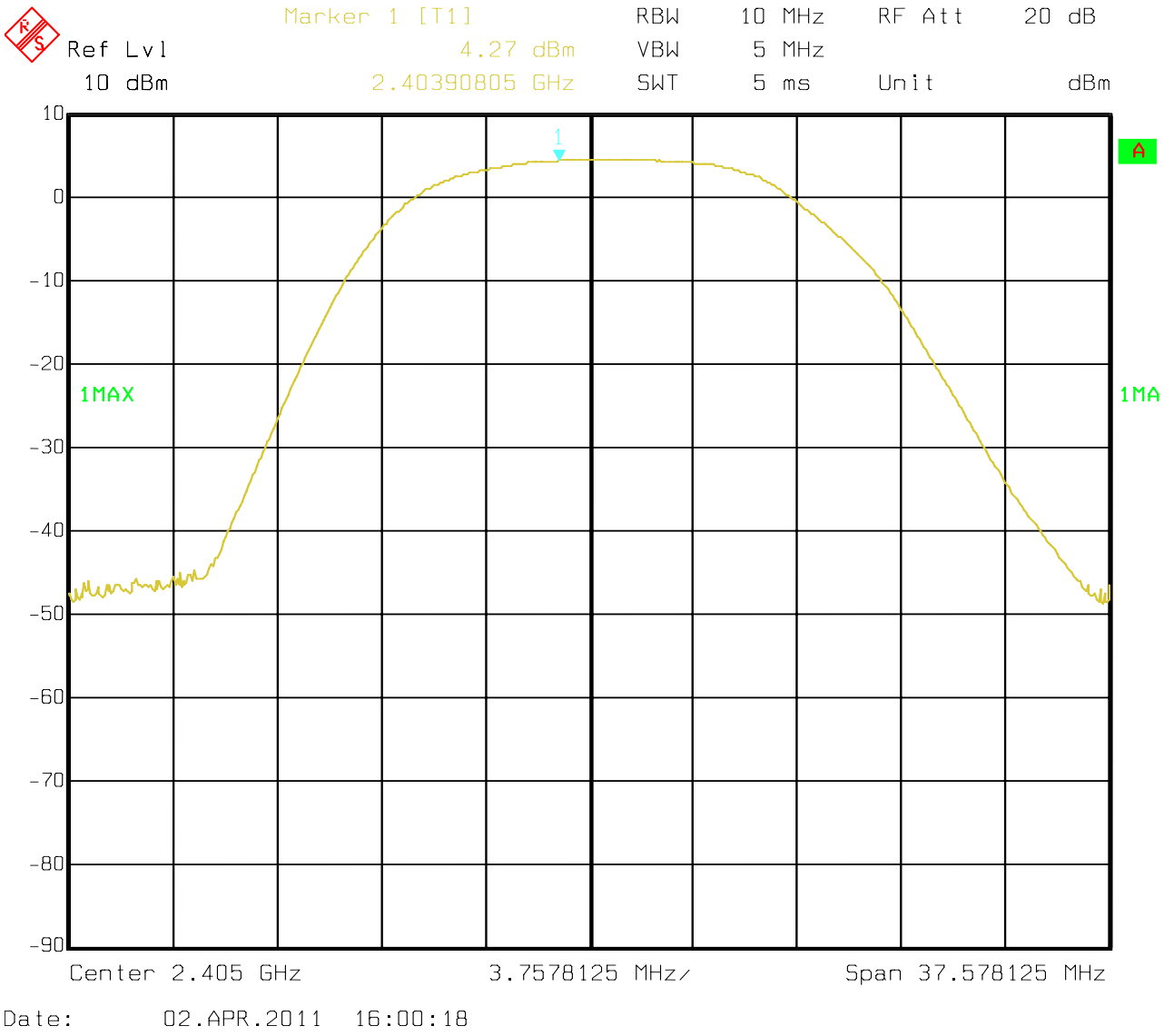
EUT	Zigbee module	Model	HAC-UBee
Mode	Keep Transmitting	Input Voltage	DC4.8V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Pass/ Fail
Low	2405	4.27	30	Pass
Middle	2445	4.08	30	Pass
High	2480	4.01	30	Pass

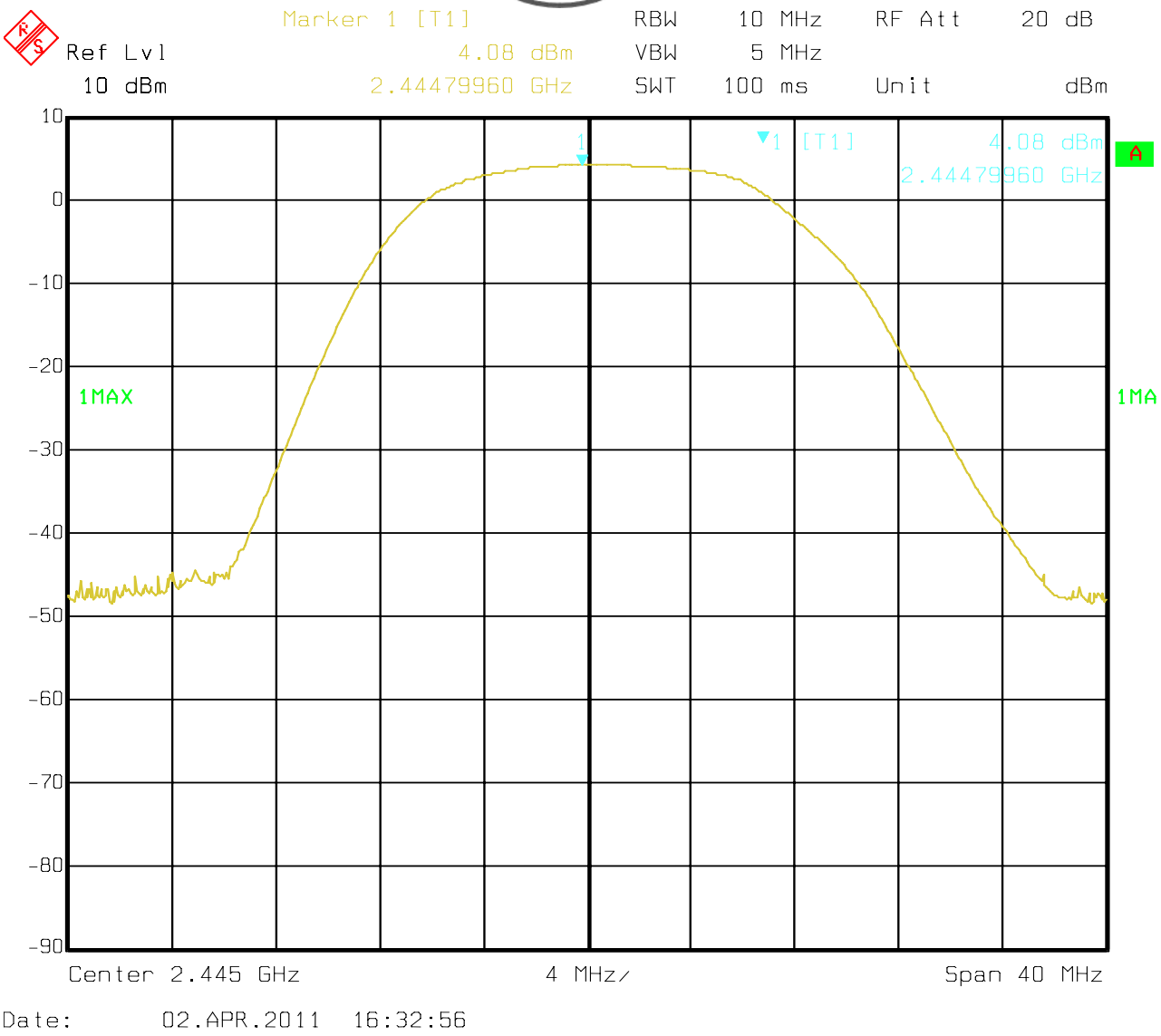
Note: The result basic equation calculation as follow:

Peak Power Output = Peak Power Reading + Cable loss + Attenuator

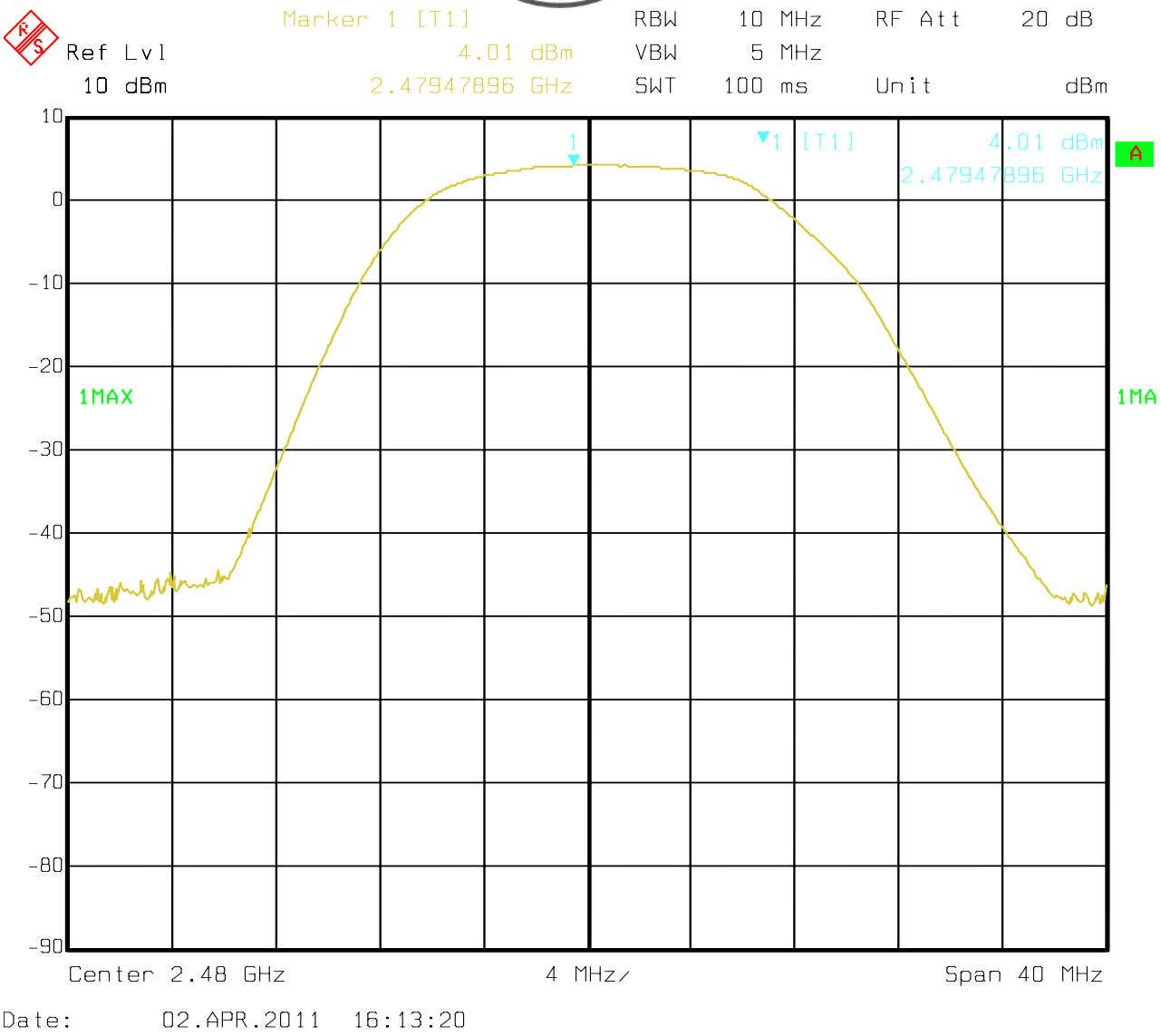
Test Figure:
Low Channel:



Middle Channel:

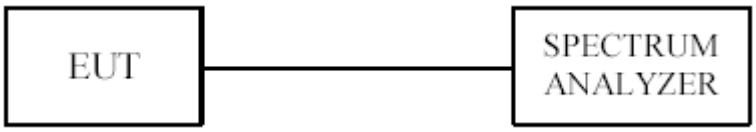


High Channel:



9. Power Spectral Density Measurement

9.1 Test Setup



9.2 Limits of Power Spectral Density Measurement

The Maximum Power Spectral Density Measurement is 8dBm.

9.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator, the bandwidth of the fundamental frequency was measured with the spectrum analyzer using 3KHz RBW and 10kHz VBW, set sweep time=100s, **PK detector.**

The power spectral density was measured and recorded.

The sweep time is allowed to be longer than span / 3KHz for a full response of the mixer in the spectrum analyzer.

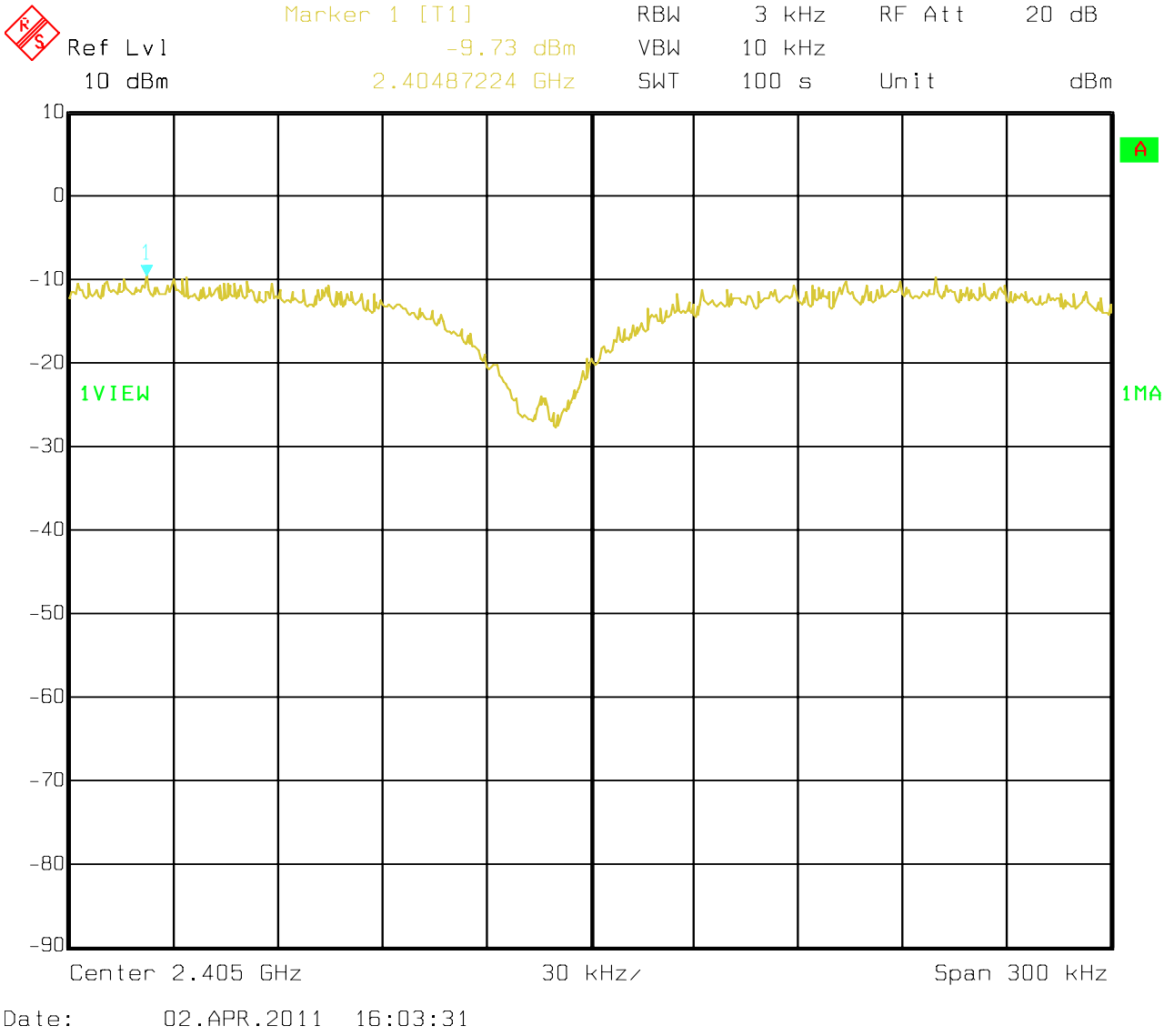
9.4Test Result

EUT	Zigbee module	Model	HAC-UBee
Mode	Keep Transmitting	Input Voltage	DC4.8V
Temperature	24 deg. C,	Humidity	56% RH

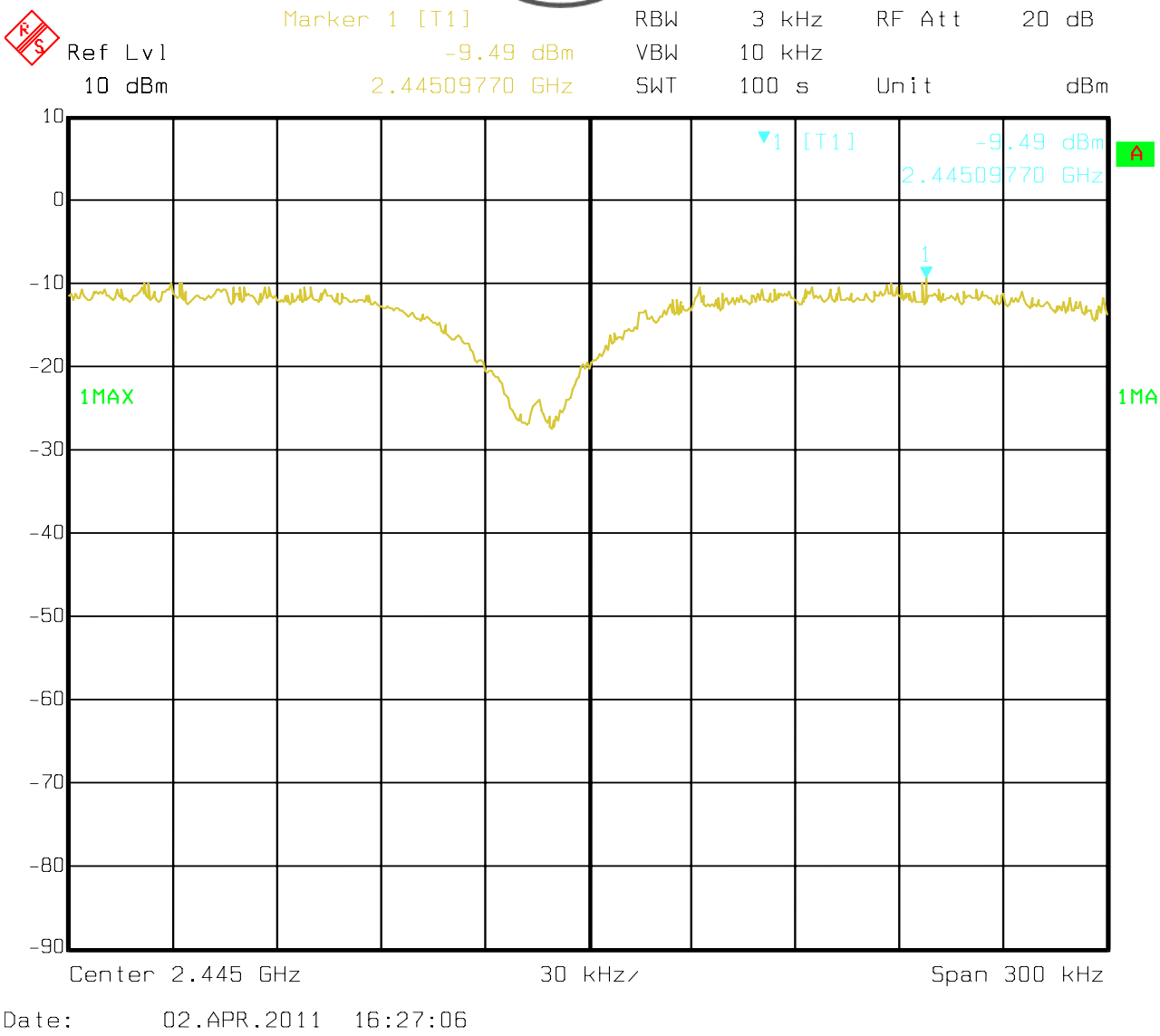
Channel	Channel Frequency (MHz)	Final RF Power Level in 3kHz BW (dBm)	Maximum Limit (dBm)	Pass/ Fail
Low	2405	-9.73	8	Pass
Middle	2445	-9.49	8	Pass
High	2480	-10.20	8	Pass

9.5 Photo of Power Spectral Density Measurement

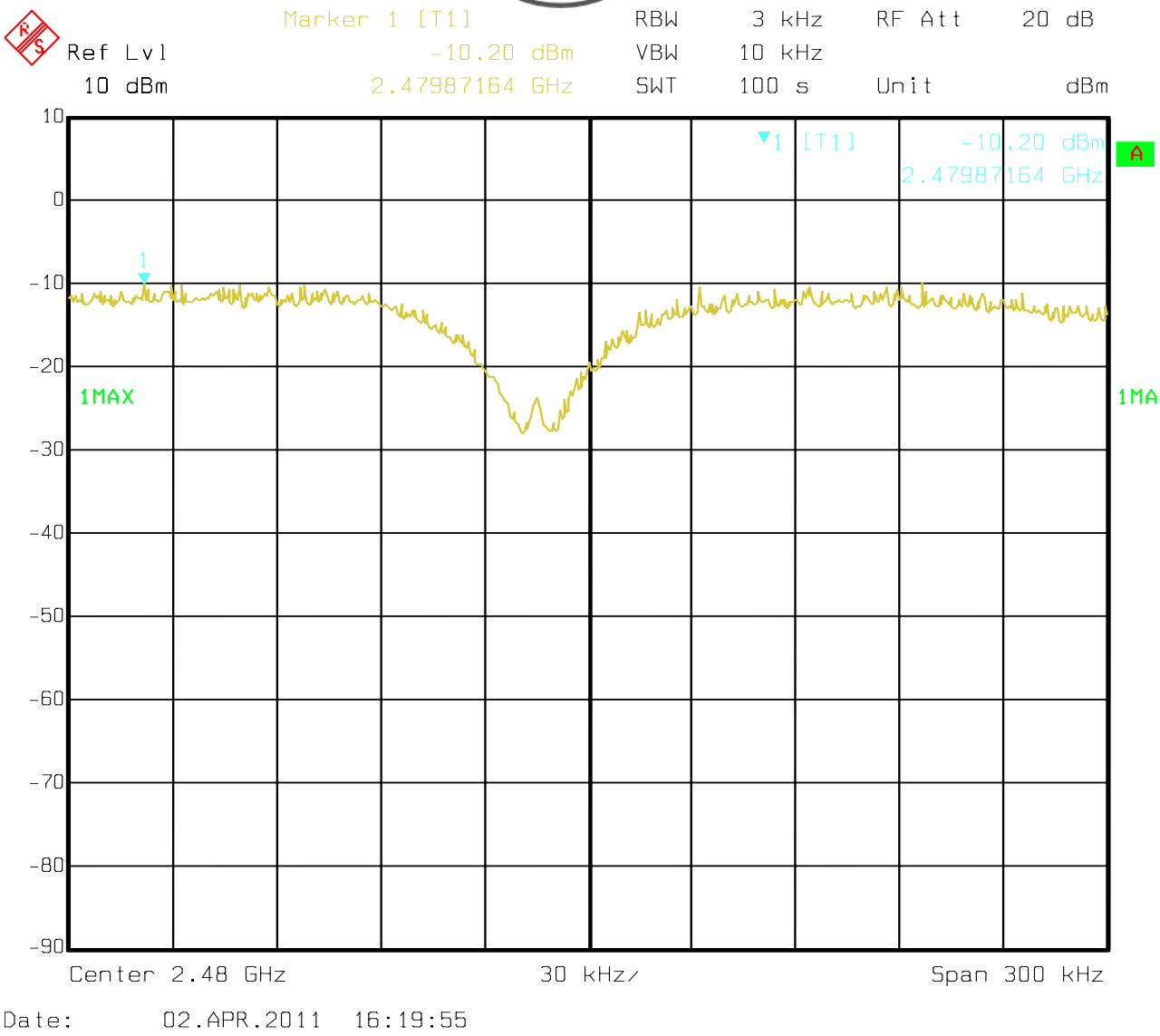
1. Low Channel



2. Middle Channel

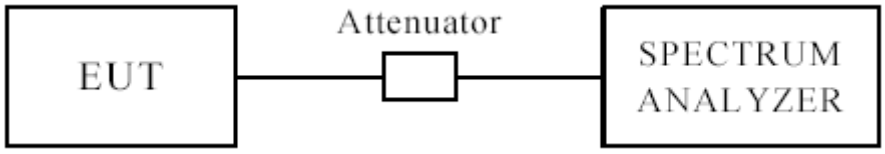


3. High Channel



10 Out of Band Measurement

10.1 Test Setup for band edge



The restricted band requirement based on radiated emission test; please see the clause 6 for the test setup

10.2 Limits of Out of Band Emissions Measurement

1. Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

10.3 Test Procedure

For signals in the restricted bands above and below the 2.4-2.483GHz allocated band a measurement was made of radiated emission test.(Peak values with RBW=VBW=1MHz and PK detector. AV value with RBW=1MHz, VBW=10Hz and PK detector)

For bandage test, the spectrum set as follows: RBW=VBW=100 kHz. A conducted measurement used

10.4 Test Result

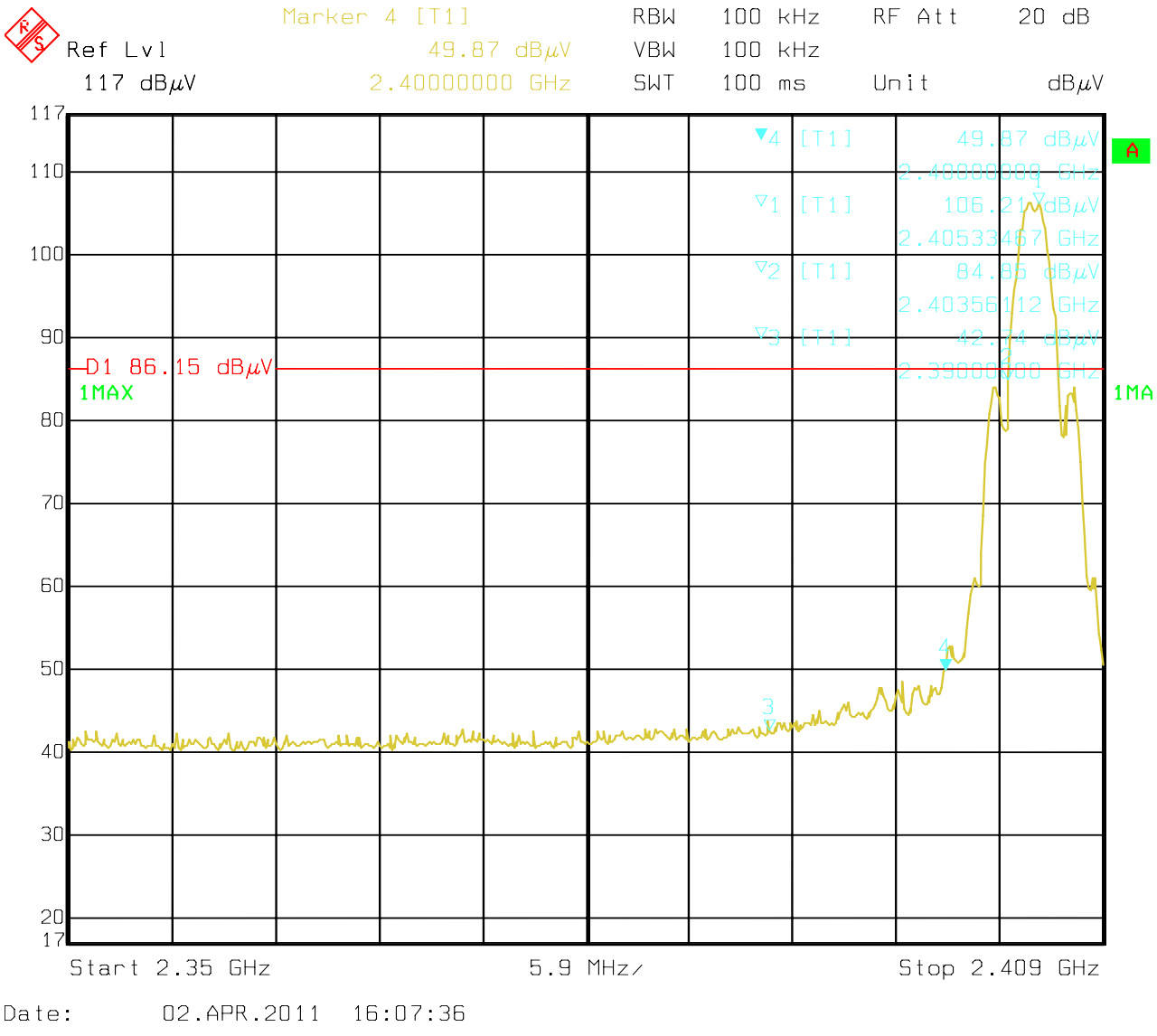
Please see next pages

Low Channel

10.4 Band edge Measurement

EUT	Zigbee module	Model	HAC-UBee
Mode	Keep Transmitting	Input Voltage	DC4.8V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:

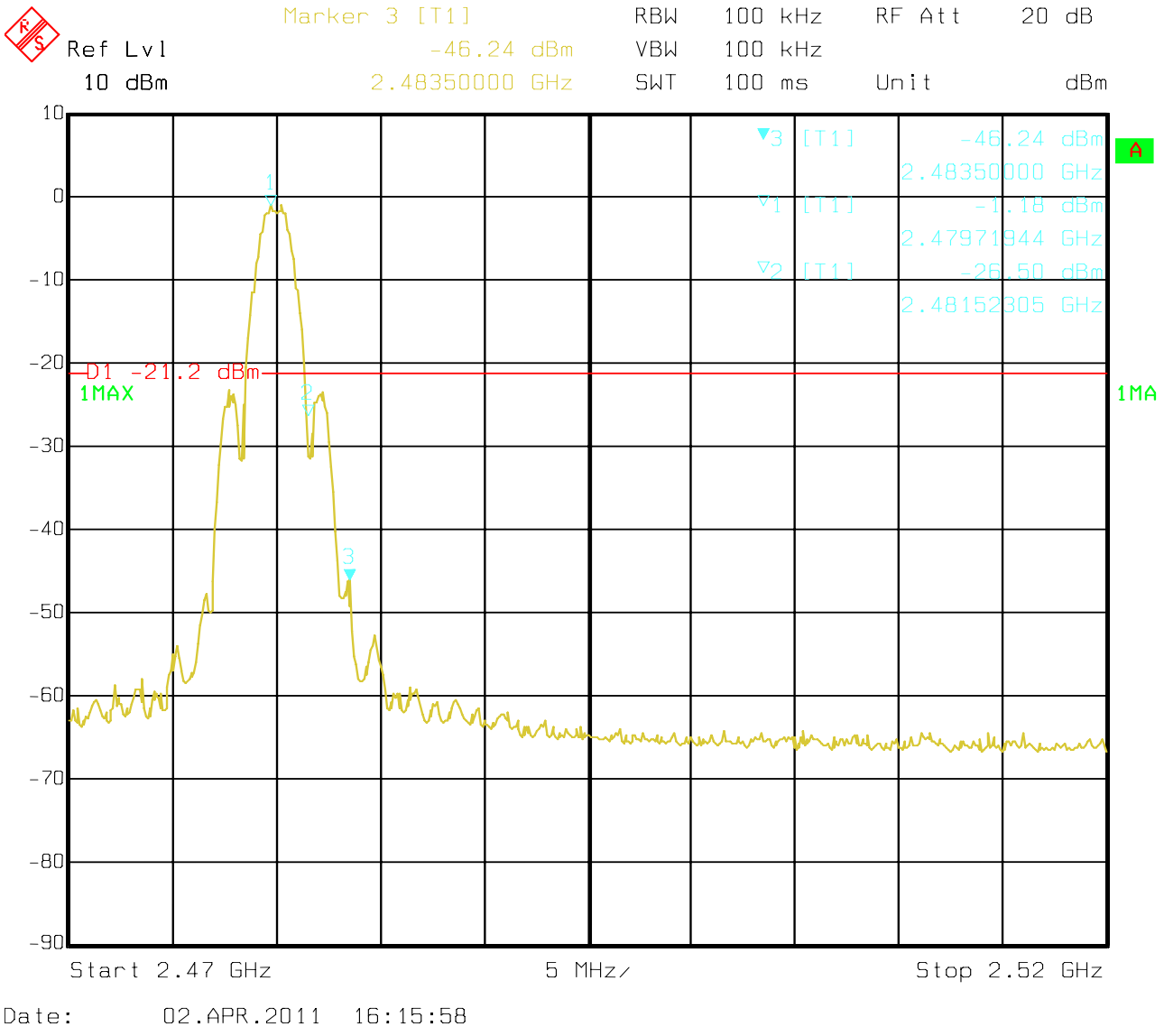


High Channel

10.4 Band edge Measurement

EUT	Zigbee module	Model	HAC-UBee
Mode	Keep Transmitting	Input Voltage	DC4.8V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



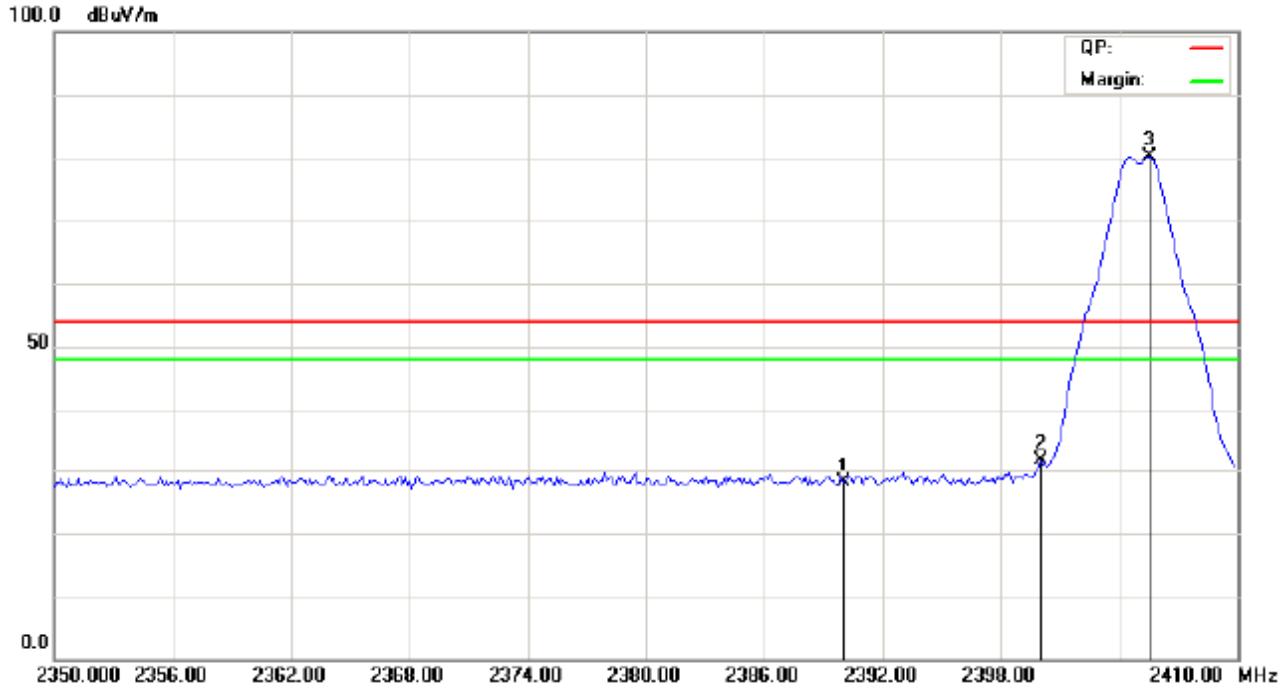
Low Channel: (For Dipole Antenna)

10.4 Restricted band Measurement

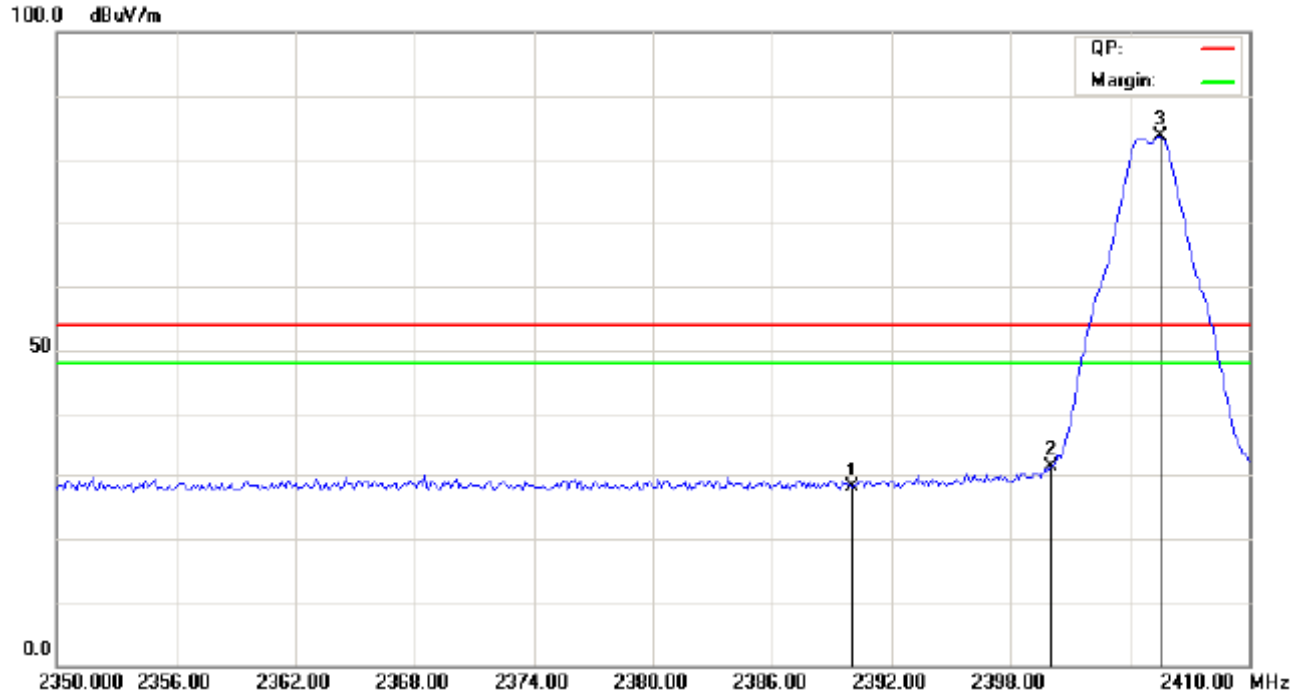
EUT	Zigbee module		Model	HAC-UBee
Mode	Keep Transmitting		Input Voltage	DC4.8V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2390MHz	PK (dBμV/m)	28.05(V) /28.07(H)	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

Test Figure:

Horizontal



Vertical



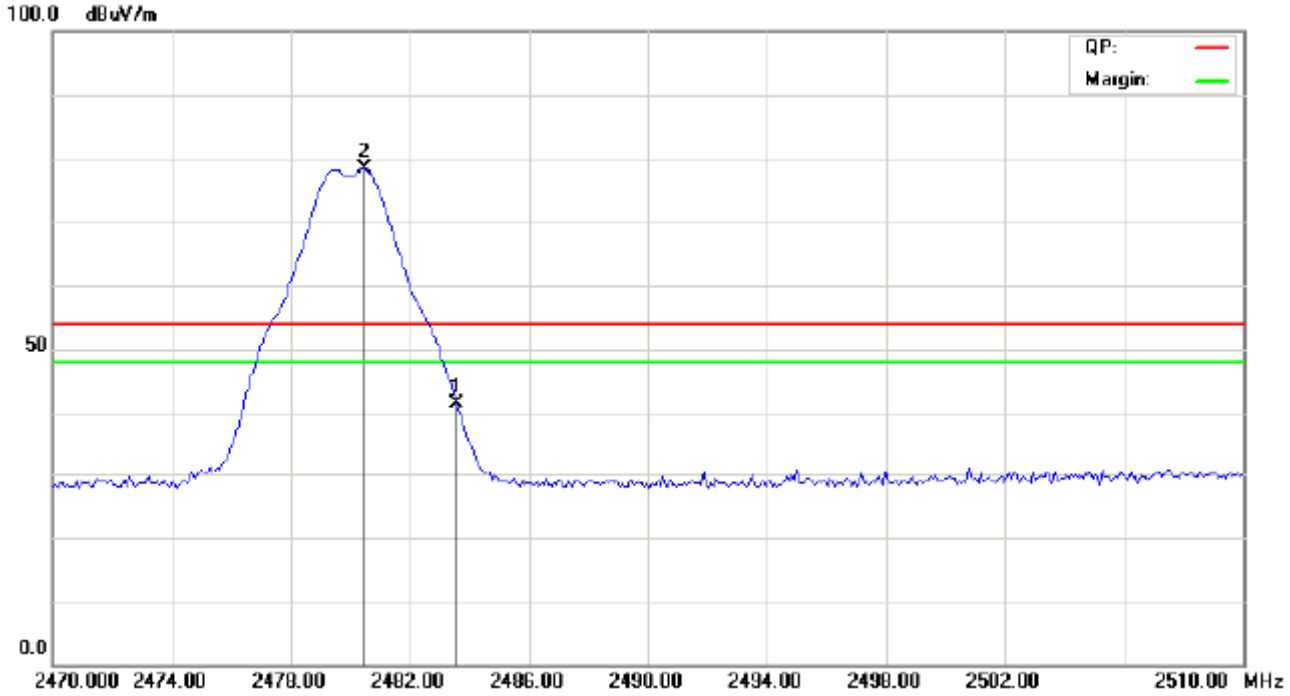
High Channel: (For Dipole Antenna)

10.4 Restricted band Measurement

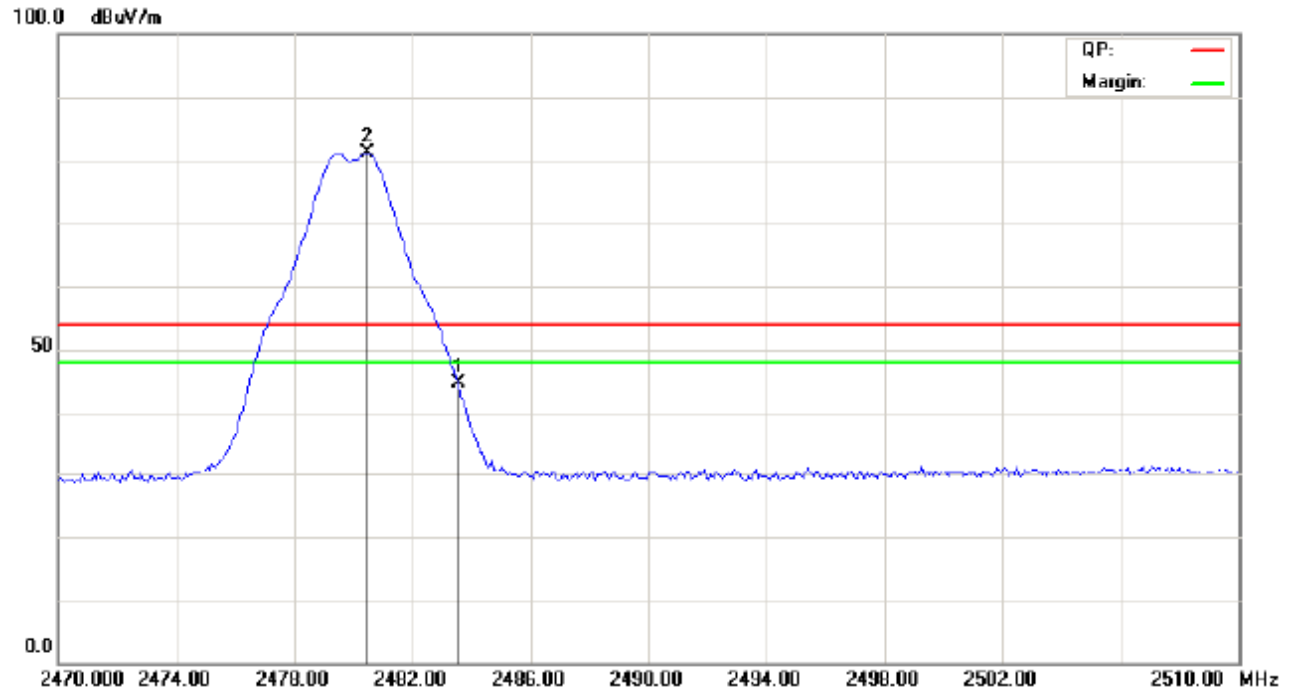
EUT	Zigbee module		Model	HAC-UBee
Mode	Keep Transmitting		Input Voltage	DC4.8V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:		Pass	Detector	PK
The Max. FS in Restrict Band 2483.5MHz	PK (dBμV/m)	44.55(V)/41.45(H)	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

Test Figure:

Horizontal:



Vertical:



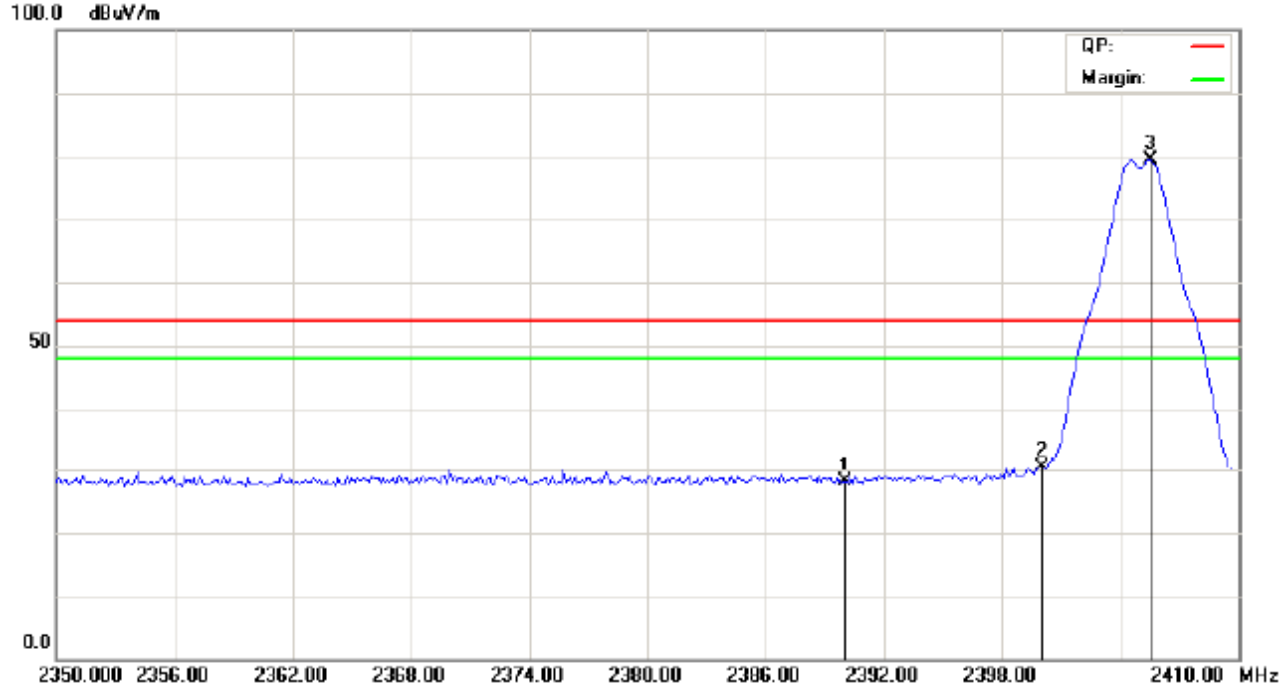
Low Channel: (For Inverted F PCB Antenna)

10.4 Restricted band Measurement

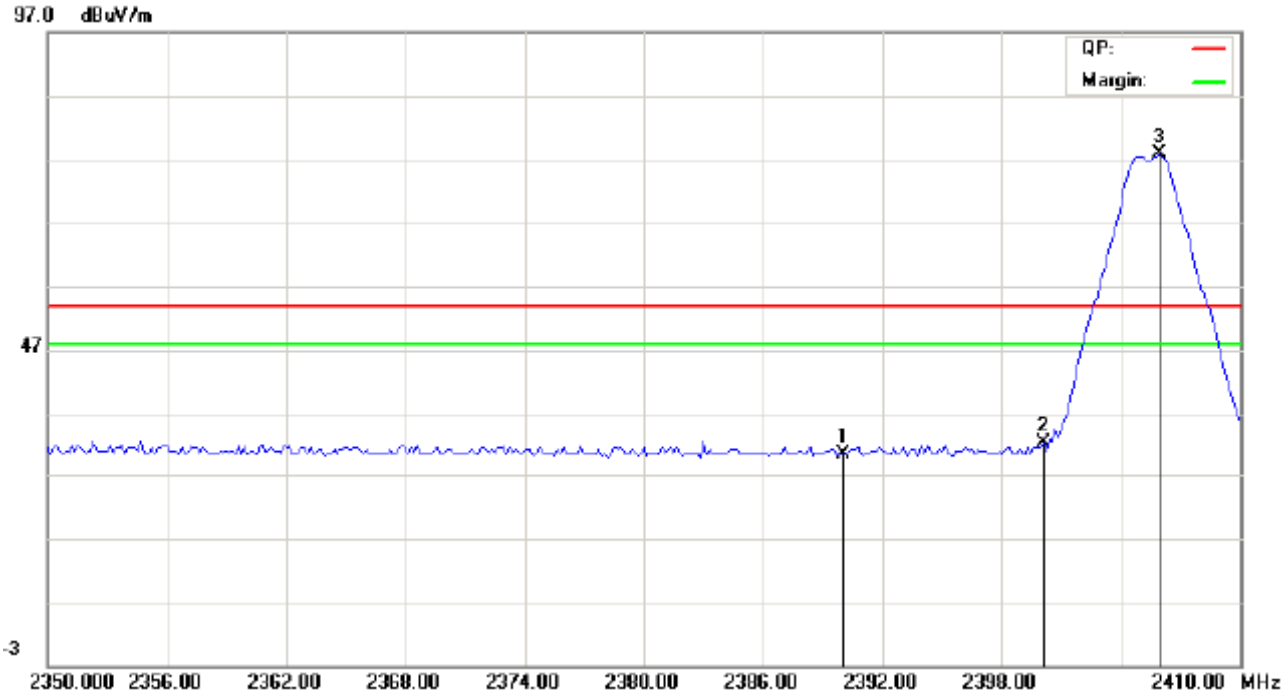
EUT	Zigbee module		Model	HAC-UBee
Mode	Keep Transmitting		Input Voltage	DC4.8V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:		Pass	Detector	PK
The Max. FS in Restrict Band 2483.5MHz	PK (dBμV/m)	28.05(H)/30.70(V)	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

Test Figure:

Horizontal:



Vertical:



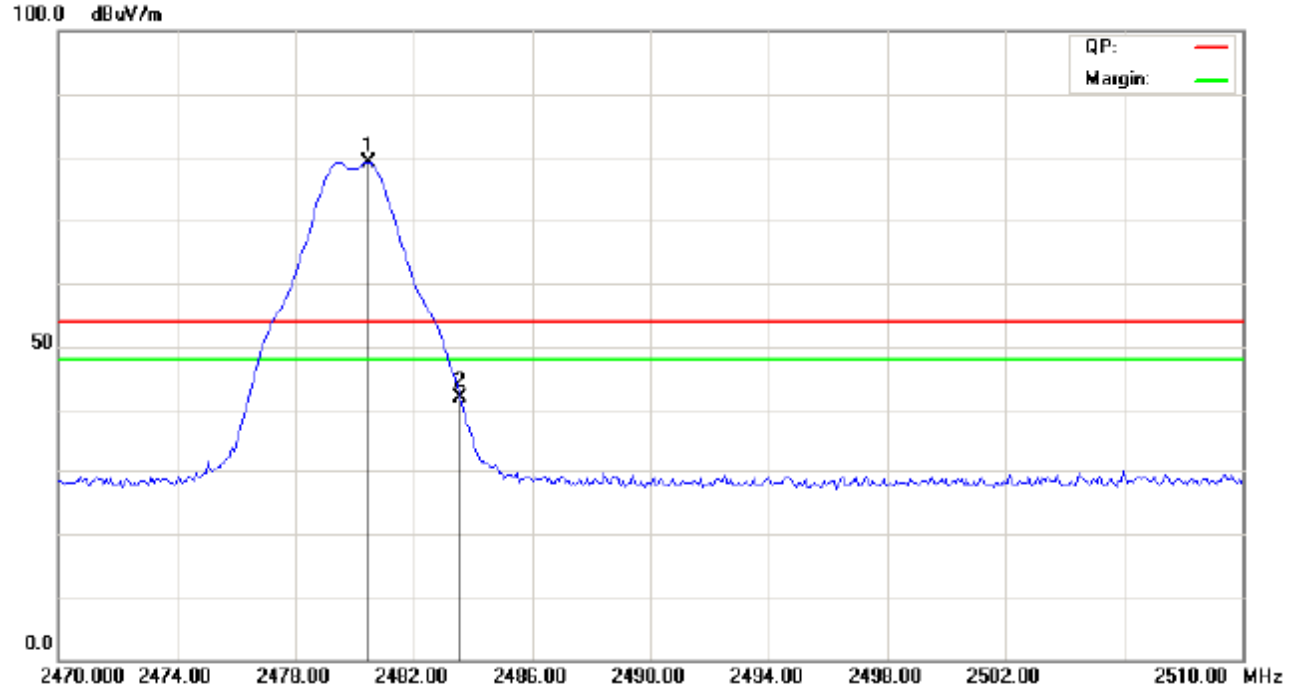
High Channel: (For Inverted F PCB Antenna)

10.4 Restricted band Measurement

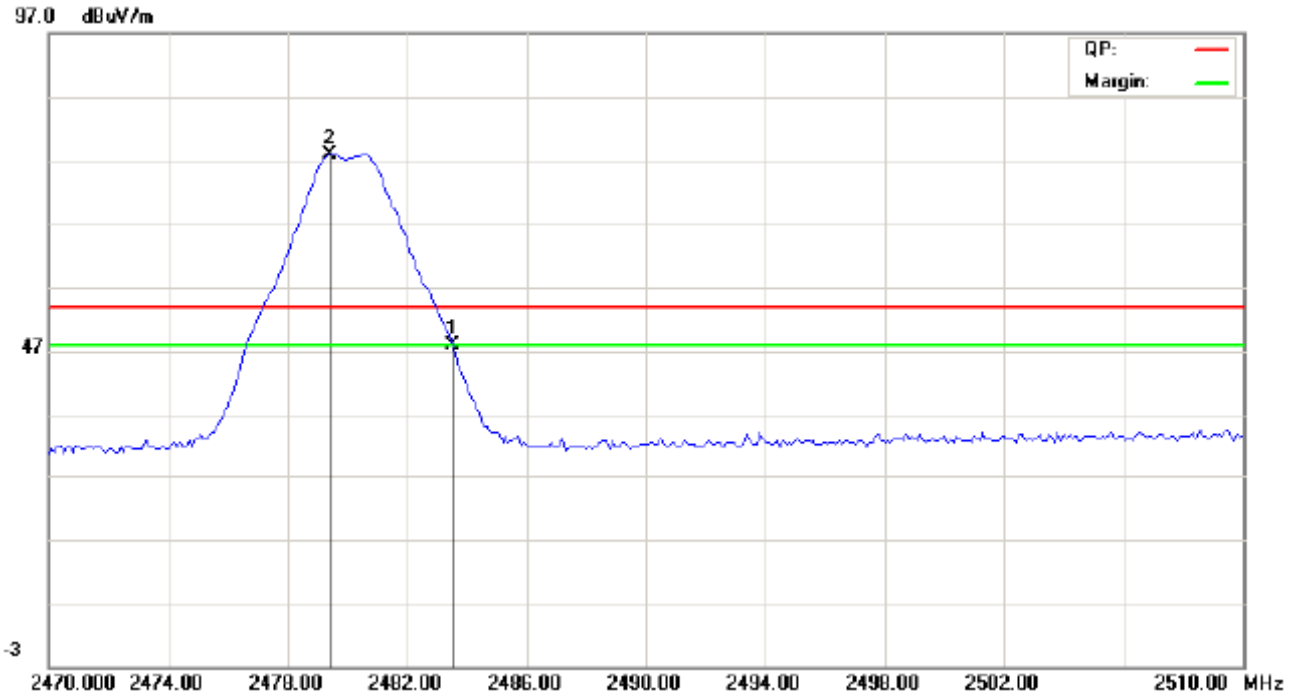
EUT	Zigbee module		Model	HAC-UBee
Mode	Keep Transmitting		Input Voltage	DC4.8V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:		Pass	Detector	PK
The Max. FS in Restrict Band 2483.5MHz	PK (dBμV/m)	47.91(V)/41.99(H)	Limit	74(dBμV/m)
	AV (dBμV/m)	--		54(dBμV/m)

Test Figure:

Horizontal:



Vertical:



11.0 Antenna Requirement

11.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitter antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the mount in dB that the directional gain of the antenna exceeds 6 dBi.

11.2 Antenna Connected construction

The EUT can employ two types of antenna.

The gain of Inverted F PCB antenna is 1.1dBi

The gain of Dipole antenna is 2.15dBi

If using E1 PCB antenna, the E2 External dipole antenna is unconnected;

If using E2 External antenna, the capacitor C38 should be removed. And the capacitor C38 must be soldered.

Please see photos and schematics for details.

12.0 RF Exposure

Applicable Standard

According to §1.1307(b)(5), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline. This modular can be used in a Portable device. **KDB616217 was used as the guidance.**
According to §1.1310 and §2.1093 RF exposure is calculated.

Measurement Result

This is a Zigbee Module and the conducted output power is 4.27dBm (2.673mW).

For EUT with Inverted F PCB Antenna:
so the EIRP is 2.673*1.288=3.443mW which is lower than low threshold 60/fGHz mW (60/2.480GHz= 24.19mW), and the antenna is 1.1dBi which is less than 6dBi.

For EUT with Dipole Antenna:
so the EIRP is 2.673*1.641=4.386mW which is lower than low threshold 60/fGHz mW (60/2.480GHz= 24.19mW), and the antenna is 2.15dBi which is less than 6dBi.

The SAR measurement is not necessary.

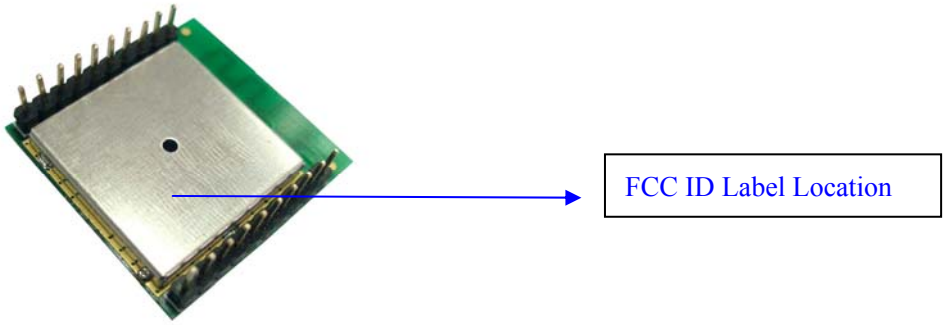
13.0 FCC ID Label

FCC ID: WMUHAC-UBEEV3X

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Mark Location:

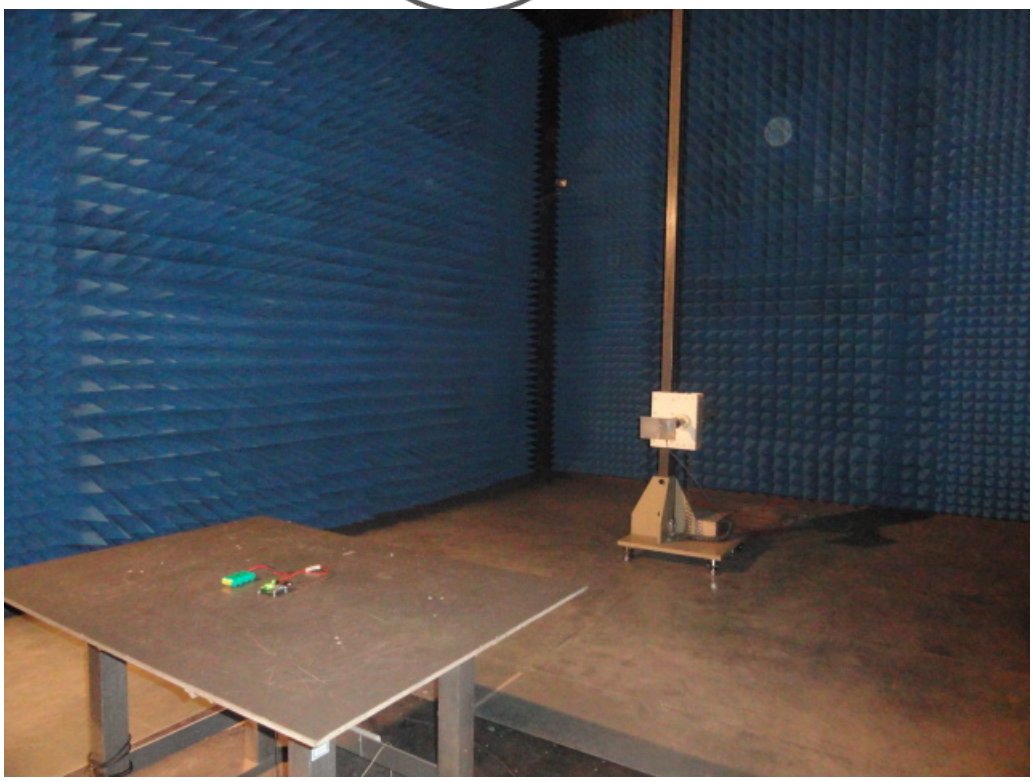


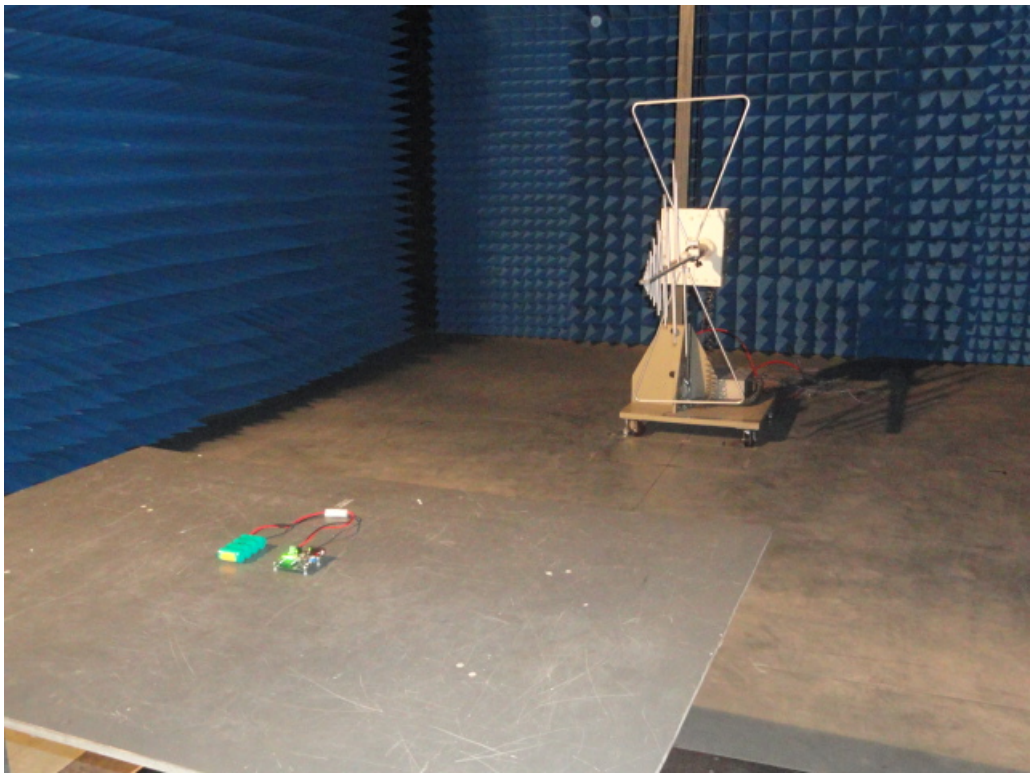
14.0 Photo of testing

Conducted Emissions

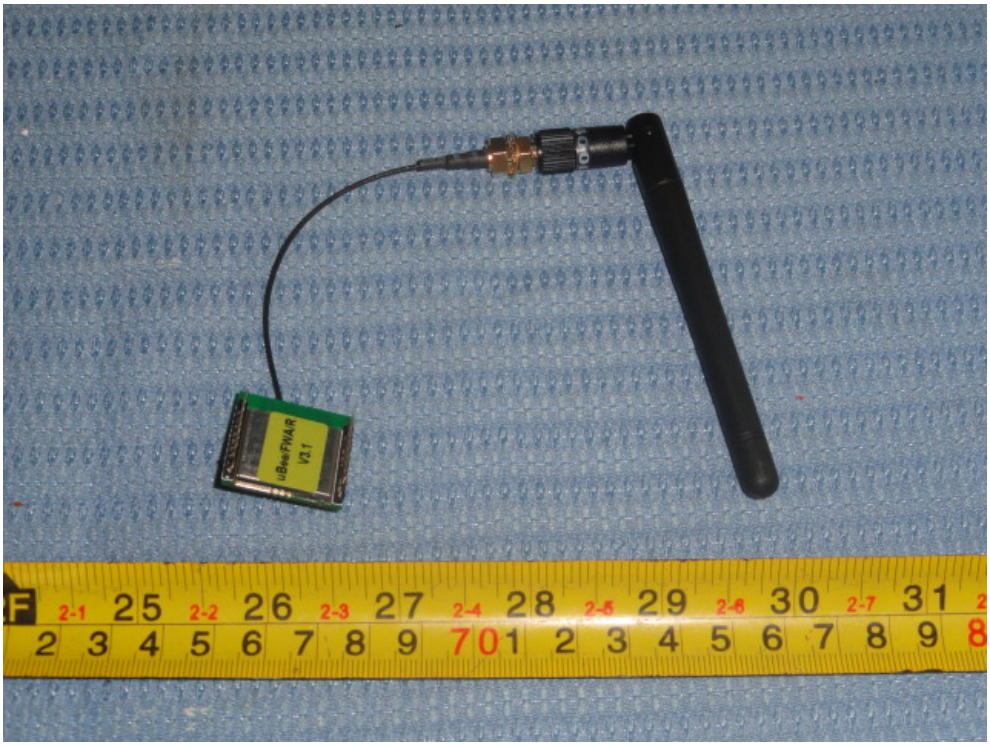
TEST REPORT

Radiated Emissions

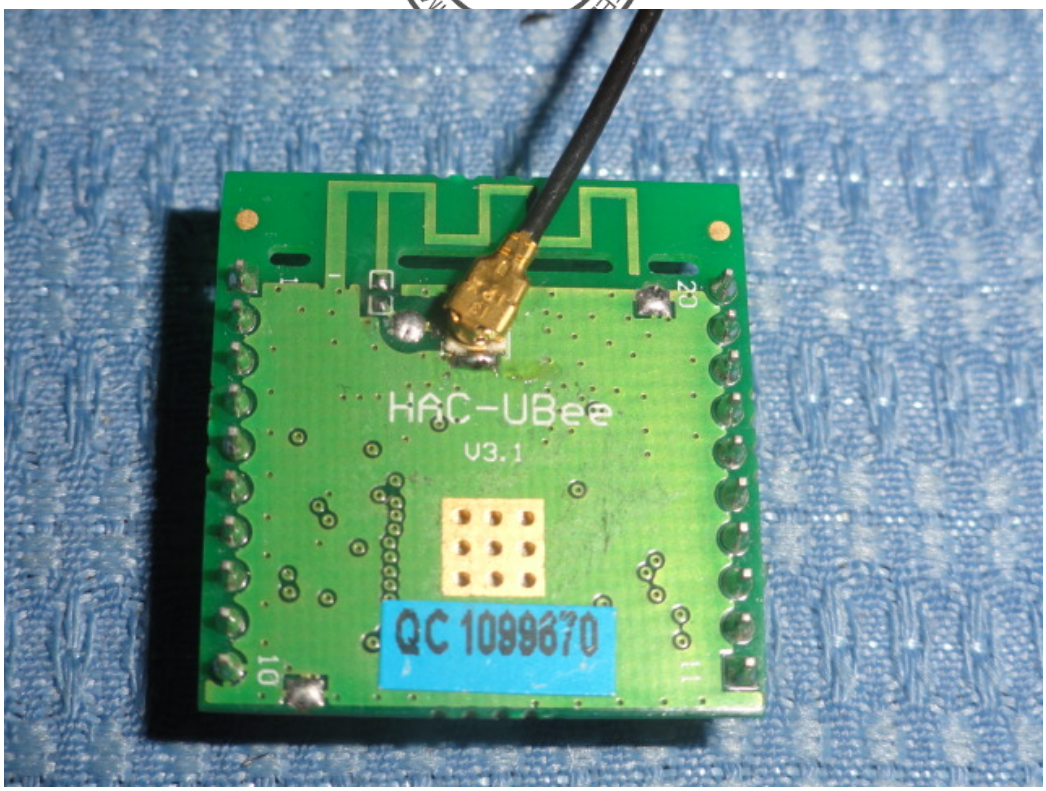


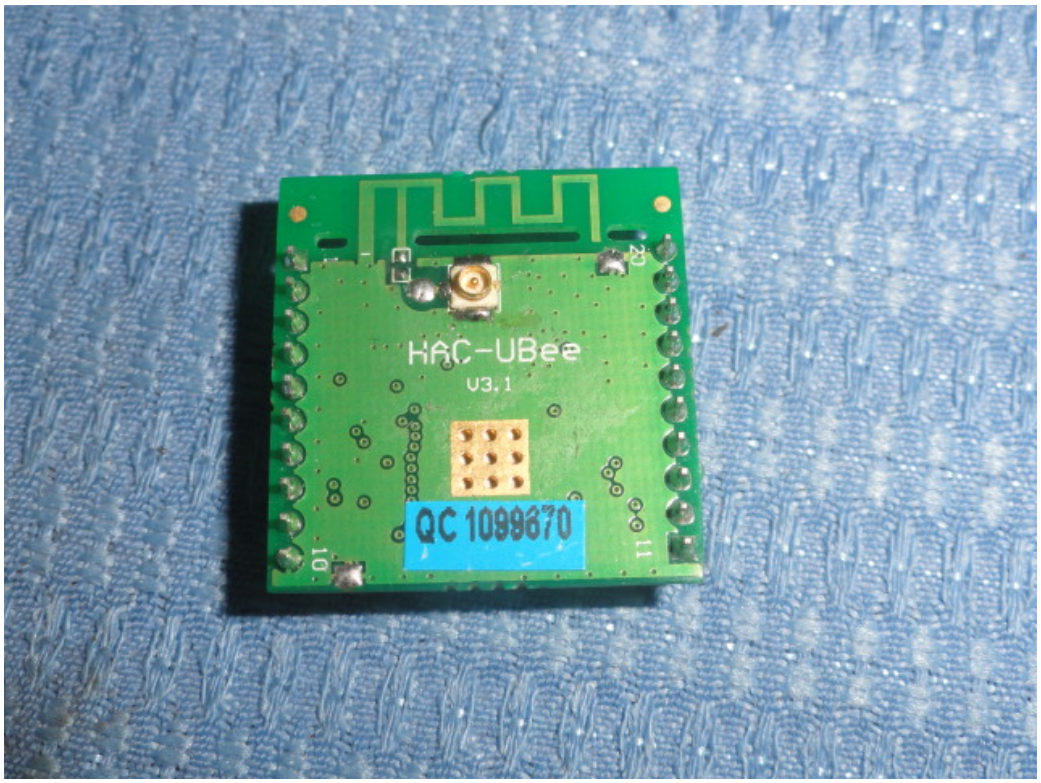


14.3 Photo for the EUT

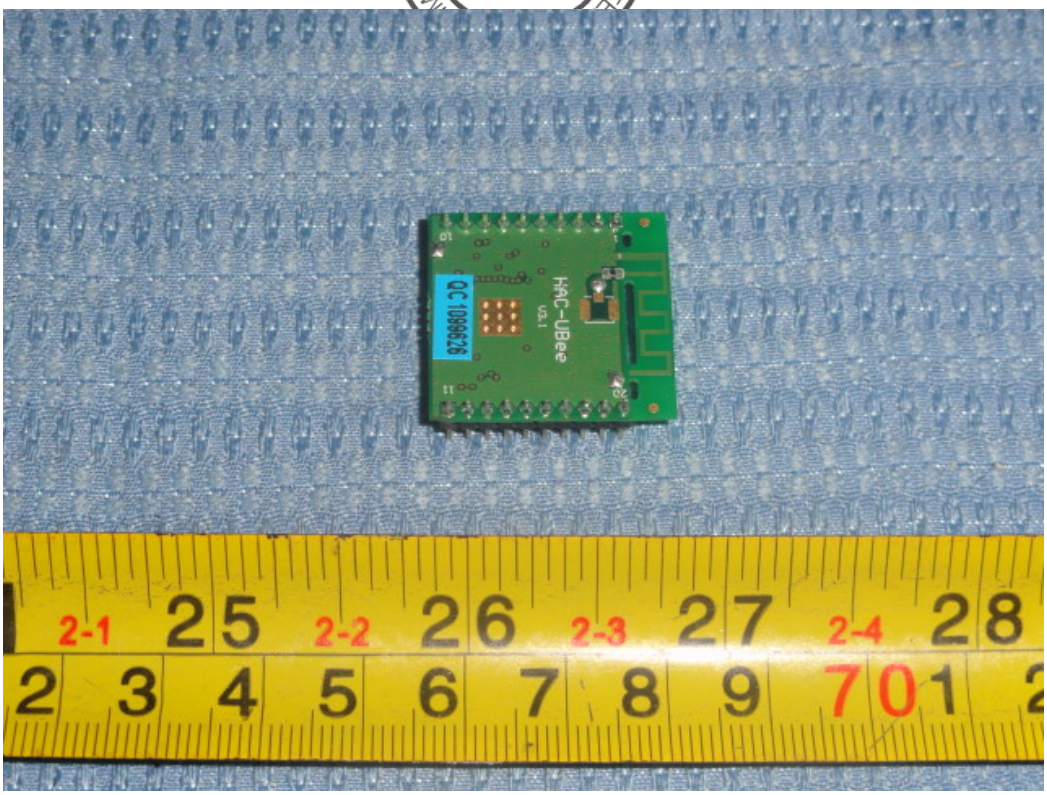


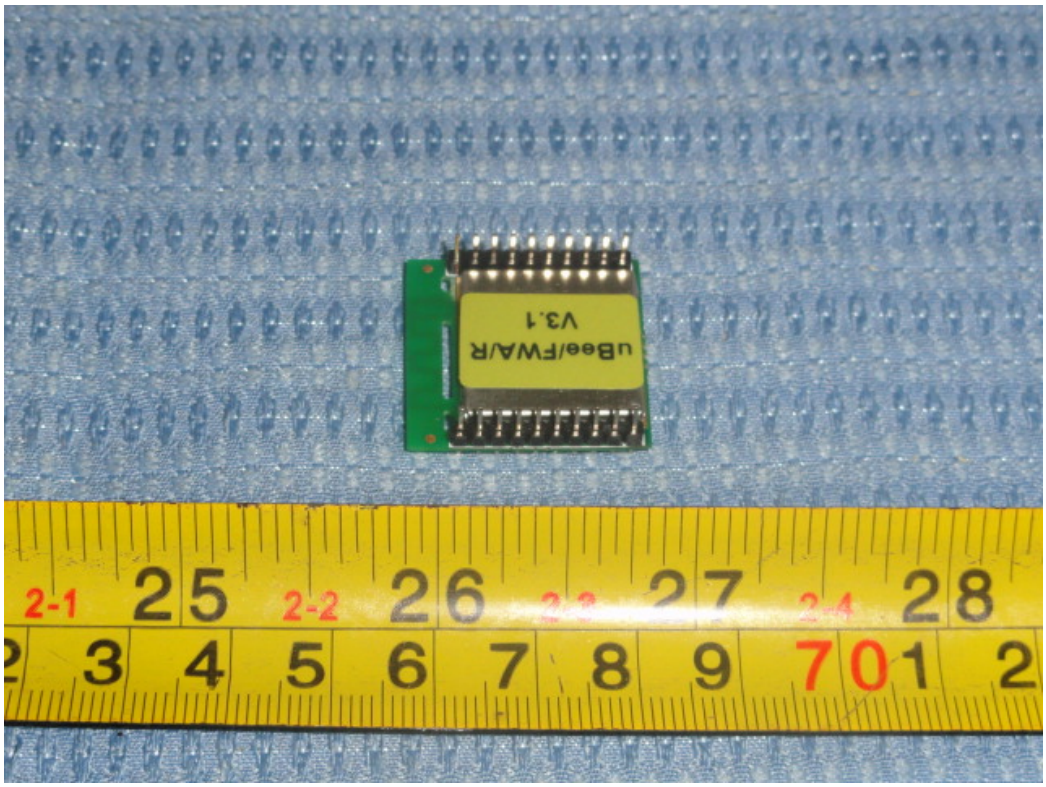
EUT With Dipole Antenna



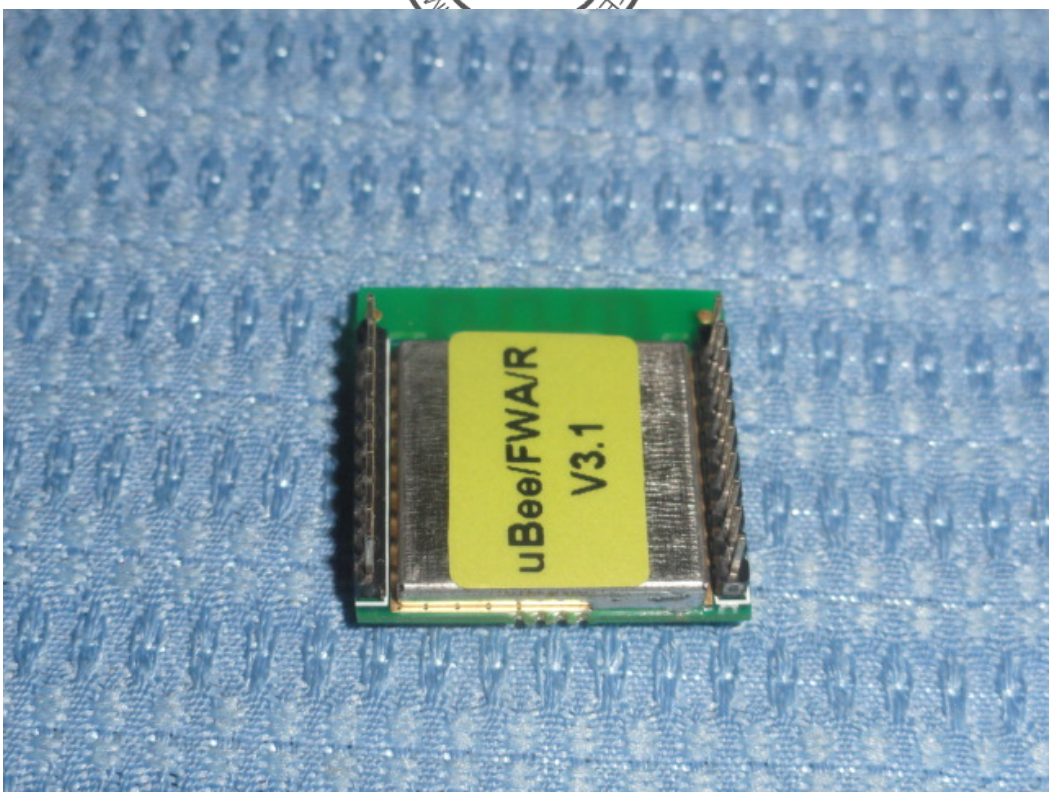


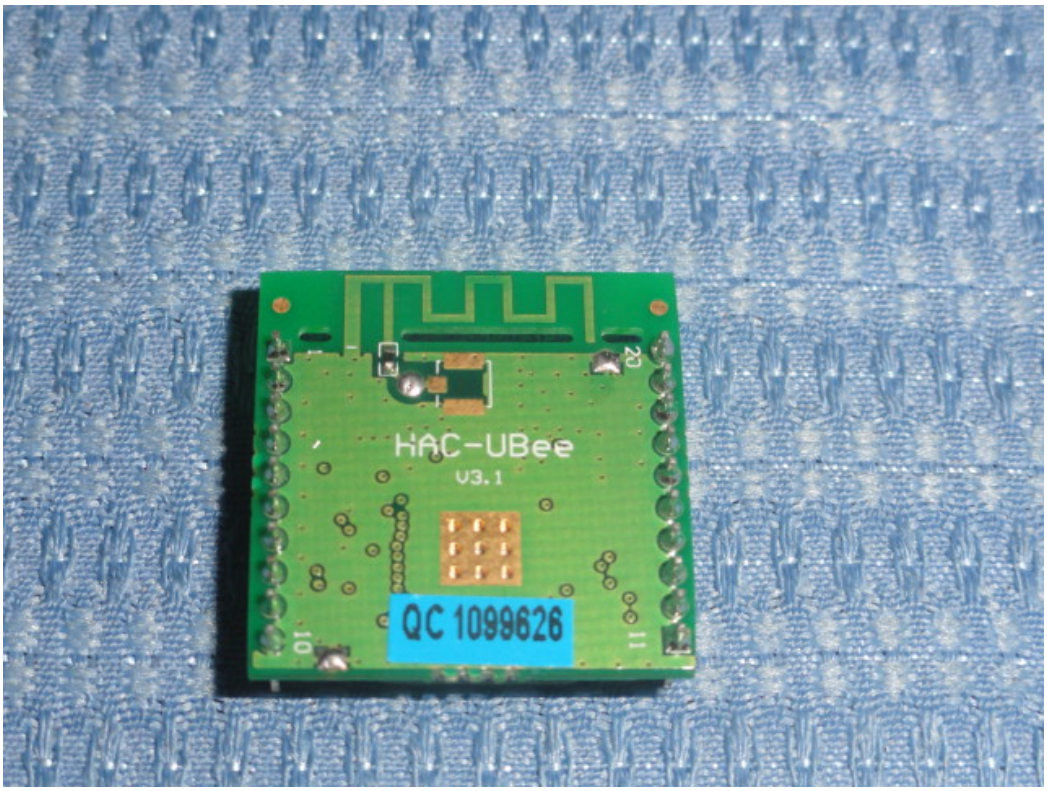
EUT With Dipole Antenna



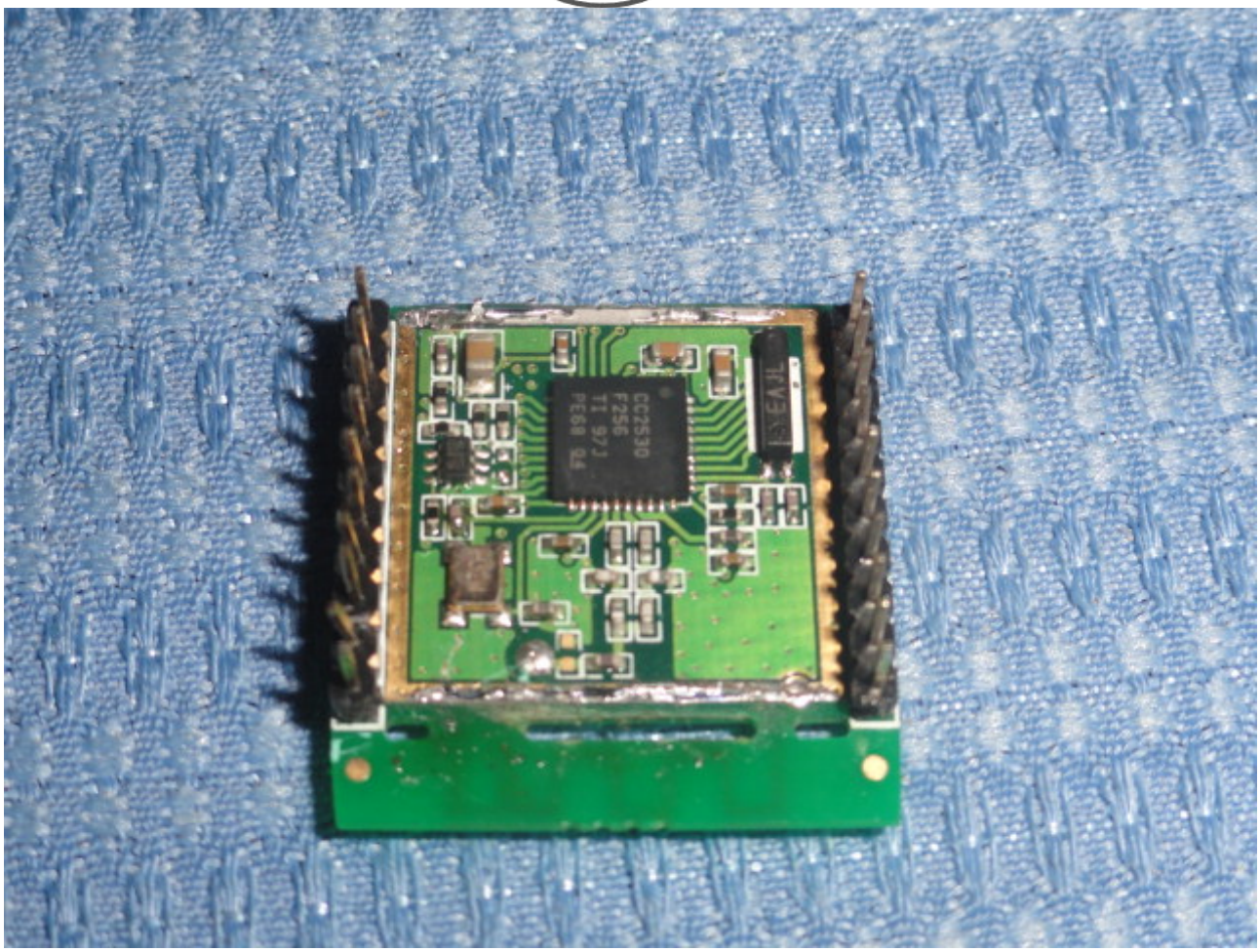


EUT With Inverted F PCB Antenna





EUT With Inverted F PCB Antenna



End of the report