

TEST REPORT

FCC ID : YY9-HE405407
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Manufacturer : BCD China Electronics Manufacturing (Shenzhen) Ltd.
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Equipment Under Test (EUT) :

Product Name : PowerSync Cart 20 or 40 for iPad and iPad mini
Model No. : HE405LL/A, HE407LL/A

Standards : FCC CFR47 Part 15 C Section 15.247:2010

Date of Test : Aug. 28~30, 2013

Date of Issue : Nov. 12, 2013

Test Result : **PASS***

Remark:

* The sample detailed above has been tested to the requirements of FCC rules mentioned above.

The test results have been reviewed against the directives above and found to meet their essential requirements.

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.

The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

PERPARED BY:

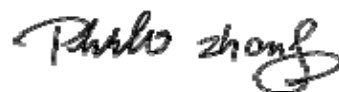
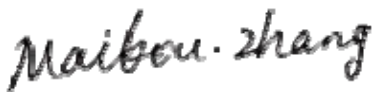
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Compiled by:

Approved by:



Maikou Zhang / Project Engineer

Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Radiated Emissions	15.205(a) 15.209(a)	PASS
Conducted Emissions	15.207(a)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3),(4)	PASS
Power Spectral Density	15.247(e)	PASS
Band Edge	15.247(d)	PASS
Emissions from out of band	15.247(d)	PASS
Emissions from the restricted bands	15.247(d)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

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4 General Information

4.1 General Description of E.U.T.

Product Name	: PowerSync Cart 20 or 40 for iPad and iPad mini
Model No.	: HE405LL/A, HE407LL/A
Model Difference	: HE405LL/A with two modules, two modules are exactly the same(Including circuit schematics, PCB and appearance), the HE407LL/A with a module. Model HE405LL/A internal module and HE407LL/A internal module exactly the same. The model HE405LL/A is testing sample.
Operation Frequency	: 2412MHz ~ 2462MHz
Antenna Gain	: 5dBi
Type of modulation	: IEEE 802.11b (CCK/QPSK/BPSK. IEEE 802.11g (BPSK/QPSK/16QAM/64QAM) IEEE 802.11n (BPSK/QPSK/16QAM/64QAM)
Note	: All the modulation modes were tested, all the test data deeply conform to the rules and the data of the worst mode are recorded in the following pages.

4.2 Details of E.U.T.

Technical Data	: Input:125 VAC, 8A (Max), 60Hz for HE405LL/A Input:125 VAC, 5A (Max), 60Hz for HE407LL/A Output: 5V,2.4A for each devices(HE405LL/A and HE407LL/A)
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4.3 Test Mode

Table 1 Tests Carried Out Under FCC part 15.247

Test Items	Test Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	72 Mbps	1/6/11	TX
Power Spectral Density	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	72 Mbps	1/6/11	TX
6 dB Bandwidth	802.11b	11 Mbps	1/11	TX
	802.11g	54 Mbps	1/11	TX
	802.11n HT20	72 Mbps	1/11	TX
Band Emissions	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	72 Mbps	1/6/11	TX
Transmitter Spurious Emissions	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	72 Mbps	1/6/11	TX

Note :Parameters set by test software during channel & power tests,the software provided by the customer was used to set the operating channels as well as the output power level. The RF output power set is the power expected by the manufacturer and is going to be fixed on the firmware of the final product .

Table 2 Tests Carried Out Under FCC part 15.207 & FCC part 15.209

Test Item	Test Mode
Radiation Emission, 30MHz ~ 1GHz	Wifi transmitting
Conduction Emission, 0.15MHz to 30MHz	Wifi linking

4.4 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A**

Waltek Services(Shenzhen) Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration number 7760A, July 12, 2012.

- **FCC – Registration No.: 880581**

Waltek Services(Shenzhen) Co., Ltd. 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 880581, May 26, 2011.

4.5 Test Location

Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd.,Songgang Street, Baoan District, Shenzhen, China

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	Sep.21,2012	Sep.20,2013
2.	LISN	R&S	ENV216	101215	Sep.21,2012	Sep.20,2013
3.	Cable	Top	TYPE16(3.5M)	-	Sep.21,2012	Sep.20,2013
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.21,2012	Sep.20,2013
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.21,2012	Sep.20,2013
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Sep.21,2012	Sep.20,2013
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Sep.21,2012	Sep.20,2013
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Sep.21,2012	Sep.20,2013
6.	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Sep.21,2012	Sep.20,2013
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Sep.21,2012	Sep.20,2013
8.	Cable	Top	EWO2014-7	-	Sep.21,2012	Sep.20,2013
9.	Cable	Top	TYPE16(13M)	-	Sep.21,2012	Sep.20,2013
10.	DC POWER SUPPLY	LWDQGS	PS-303D		Sep.21,2012	Sep.20,2013
11.	Humidity Chamber	GTH-225-40-1P	IAA061213		Sep.21,2012	Sep.20,2013
12.	Spectrum Analyzer	ROHDE & SCHWARZ	FSL6		Sep.21,2012	Sep.20,2013

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 4.74 dB (1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 E.U.T. Operation

Operating Environment:

Temperature:	25.5 °C
Humidity:	50 % RH
Atmospheric Pressure:	1011 mbar

EUT Operation:

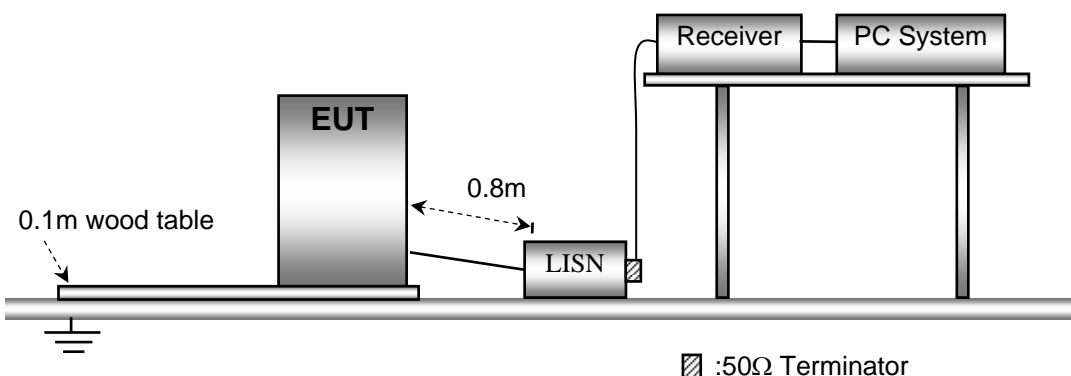
The pre-test was performed in wifi transmission mode, and the test data were shown as follow.

The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.2 EUT Setup

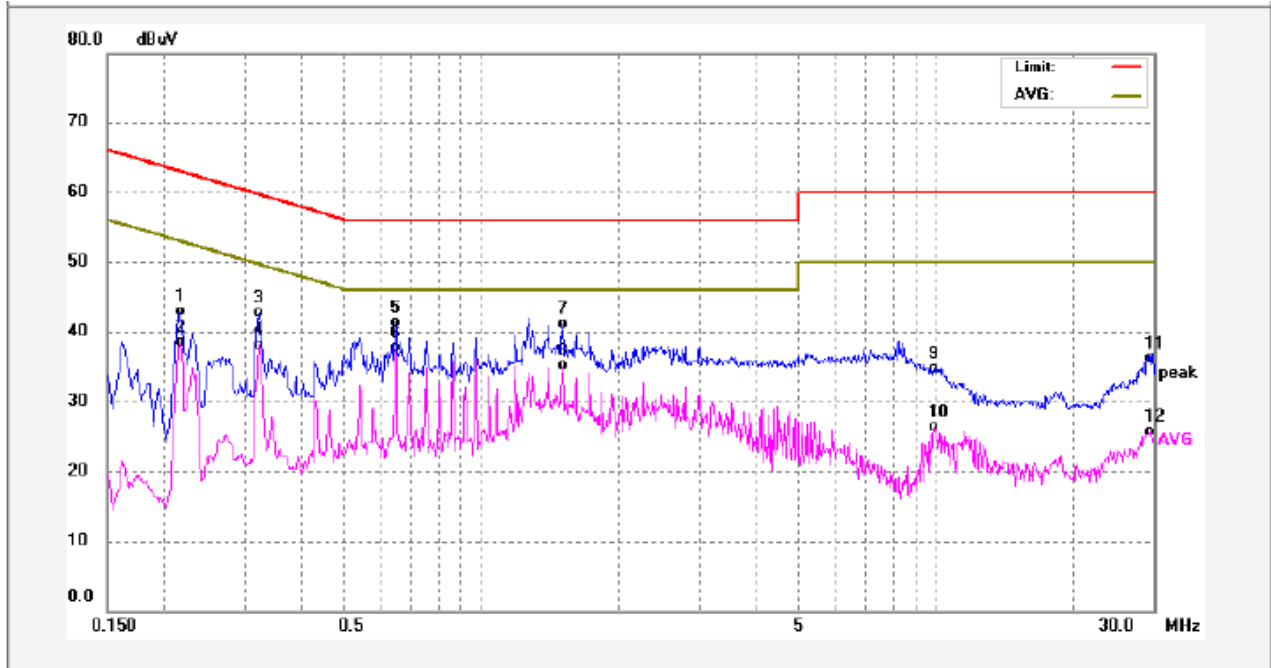
The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003.



6.3 Conducted Emission Test Result

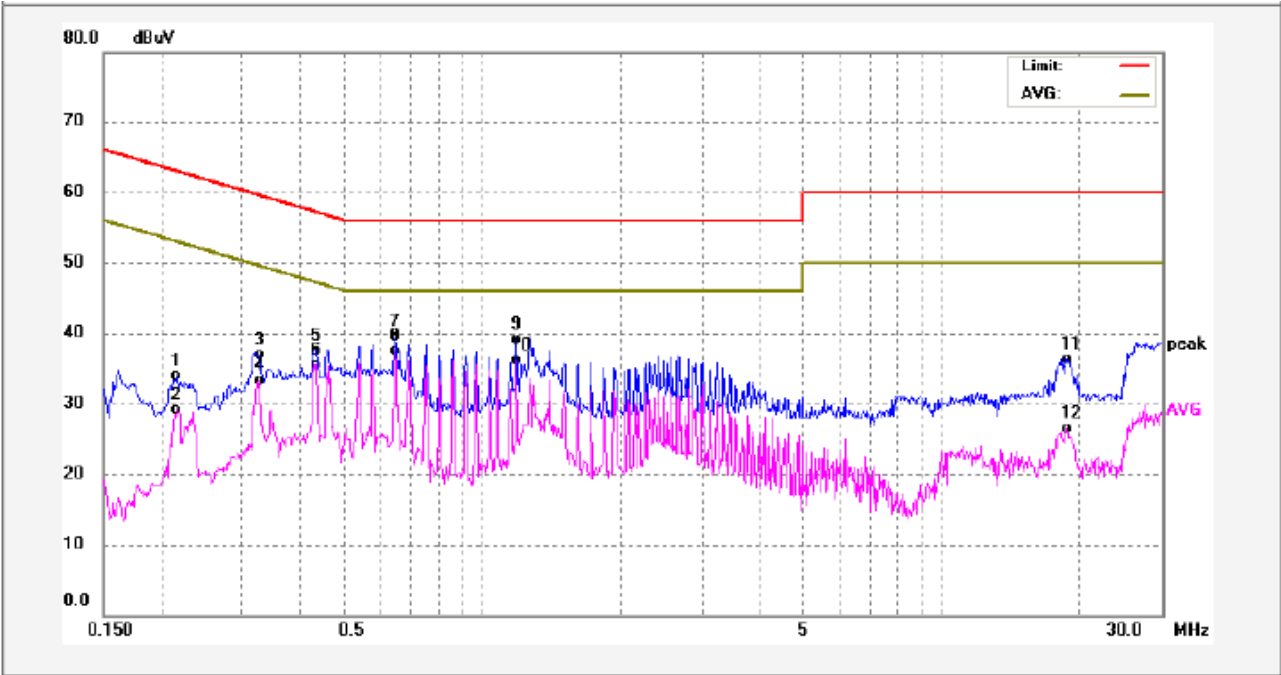
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2179	33.10	9.85	42.95	62.89	-19.94	QP	
2	0.2179	28.67	9.85	38.52	52.89	-14.37	AVG	
3	0.3220	32.78	9.88	42.66	59.65	-16.99	QP	
4	0.3220	28.15	9.88	38.03	49.65	-11.62	AVG	
5	0.6460	31.42	9.94	41.36	56.00	-14.64	QP	
6	0.6460	27.71	9.94	37.65	46.00	-8.35	AVG	
7	1.5100	31.10	10.00	41.10	56.00	-14.90	QP	
8	1.5100	25.11	10.00	35.11	46.00	-10.89	AVG	
9	9.9016	24.19	10.49	34.68	60.00	-25.32	QP	
10	9.9016	15.83	10.49	26.32	50.00	-23.68	AVG	
11	29.7455	23.92	12.27	36.19	60.00	-23.81	QP	
12	29.7455	13.44	12.27	25.71	50.00	-24.29	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2162	24.03	9.84	33.87	62.96	-29.09	QP	
2	0.2162	19.34	9.84	29.18	52.96	-23.78	AVG	
3	0.3266	27.00	9.88	36.88	59.54	-22.66	QP	
4	0.3266	23.44	9.88	33.32	49.54	-16.22	AVG	
5	0.4304	27.59	9.91	37.50	57.24	-19.74	QP	
6	0.4304	25.62	9.91	35.53	47.24	-11.71	AVG	
7	0.6460	29.52	9.94	39.46	56.00	-16.54	QP	
8	0.6460	27.60	9.94	37.54	46.00	-8.46	AVG	
9	1.1855	29.17	10.00	39.17	56.00	-16.83	QP	
10	1.1855	26.18	10.00	36.18	46.00	-9.82	AVG	
11	18.6459	25.21	11.12	36.33	60.00	-23.67	QP	
12	18.6459	15.35	11.12	26.47	50.00	-23.53	AVG	

7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209
& 15.247

Test Method: ANSI C63.4:2003

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Test mode: see section 4.4

7.1 EUT Operation :

Operating Environment:

Temperature: 25.5 °C

Humidity: 51 % RH

Atmospheric Pressure: 1009 mbar

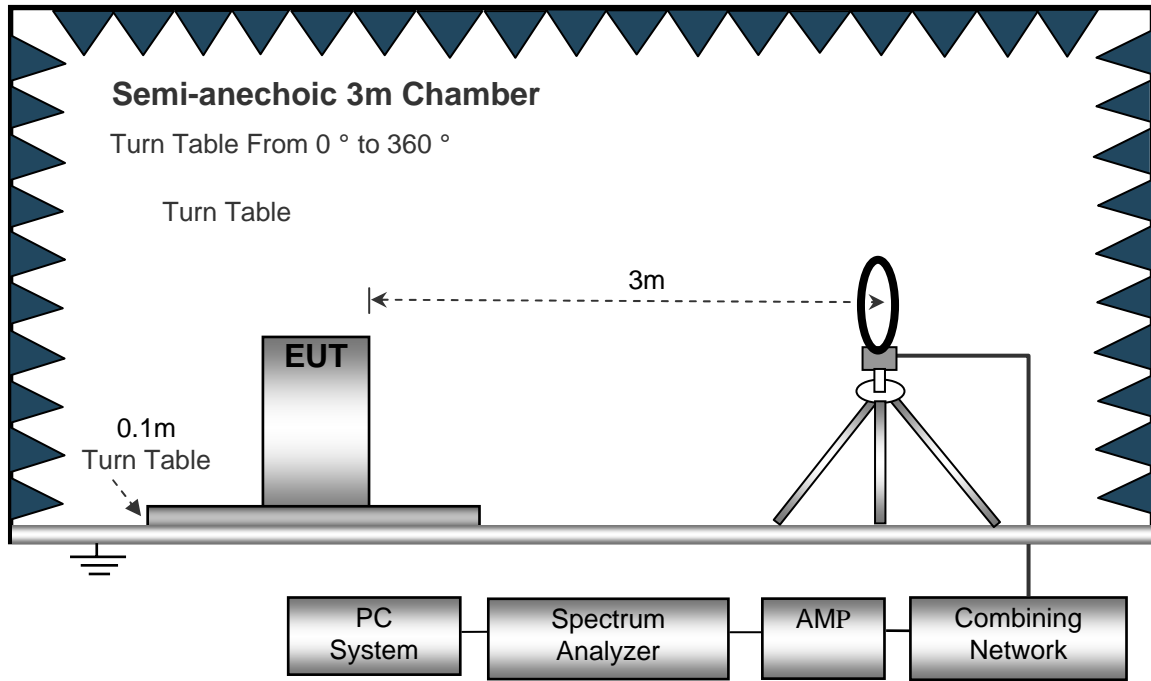
EUT Operation:

The test was performed in Wifi transmission mode, and the data is show in the report.

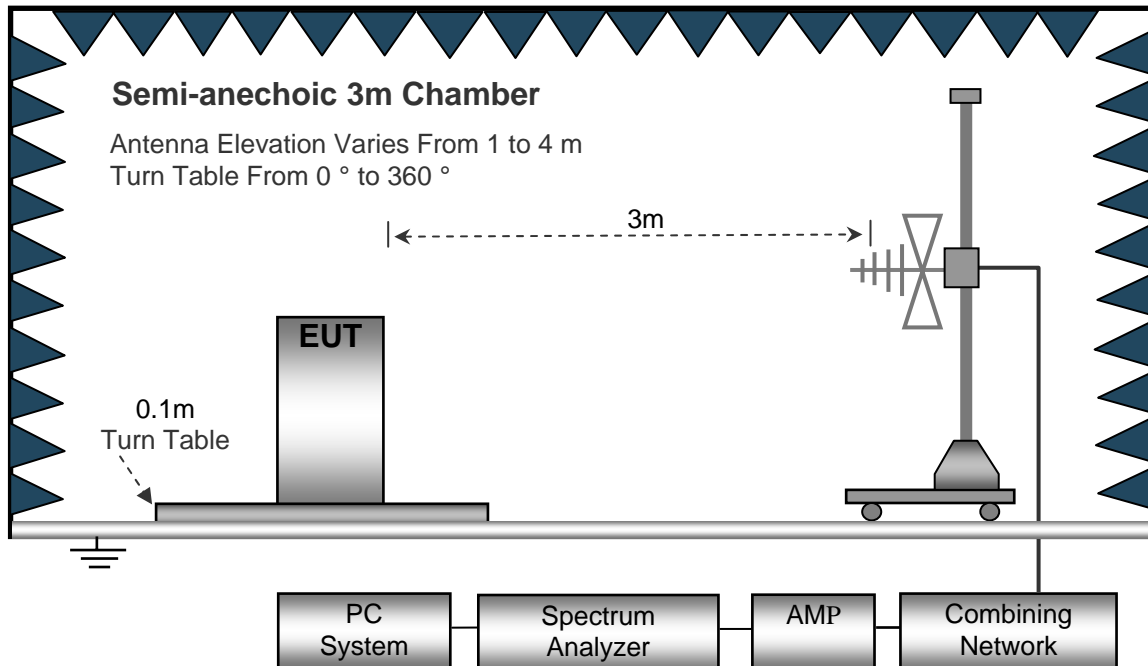
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

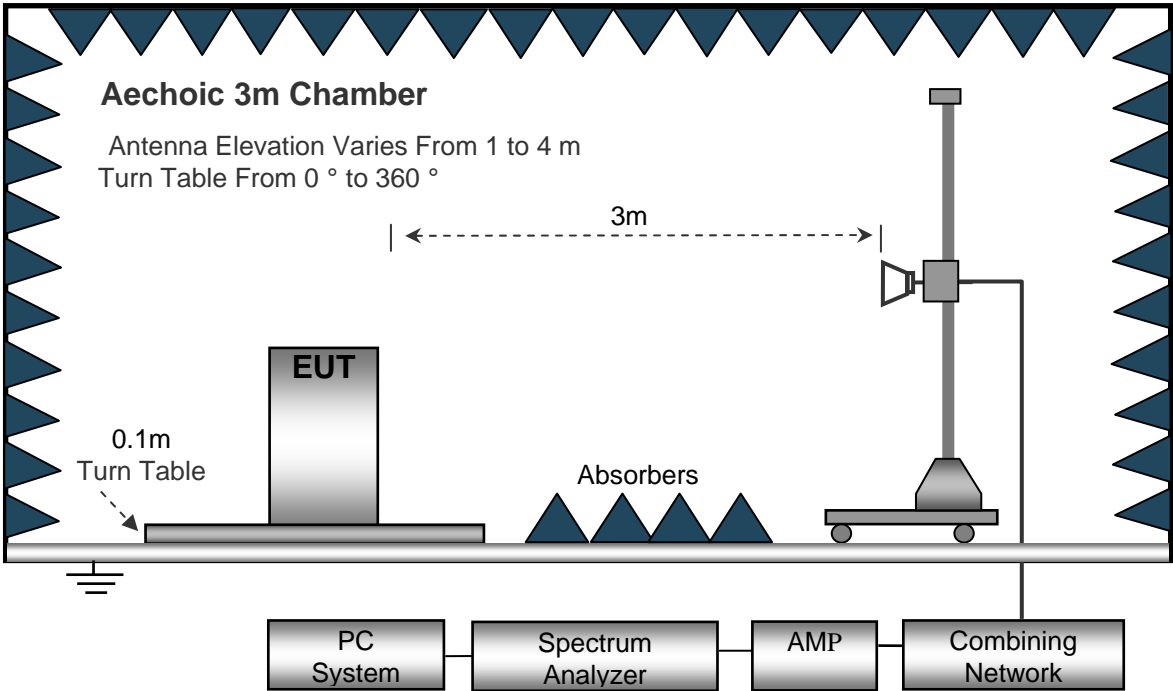
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested from 9kHz to 25000MHz.

Below 30MHz

Sweep SpeedAuto
IF Bandwidth10KHz
Video Bandwidth10KHz
Resolution Bandwidth10KHz

30MHz ~ 1GHz

Sweep SpeedAuto
IF Bandwidth120 KHz
Video Bandwidth100KHz
Quasi-Peak Adapter Bandwidth120 KHz
Quasi-Peak Adapter ModeNormal
Resolution Bandwidth100KHz

Above 1GHz

Sweep SpeedAuto
IF Bandwidth120 KHz
Video Bandwidth3MHz
Quasi-Peak Adapter Bandwidth120 KHz
Quasi-Peak Adapter ModeNormal
Resolution Bandwidth1MHz

7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in X axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used during radiated emissions above 1GHz measurement.

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

7.6 Summary of Test Results

Test Frequency : Below 30MHz

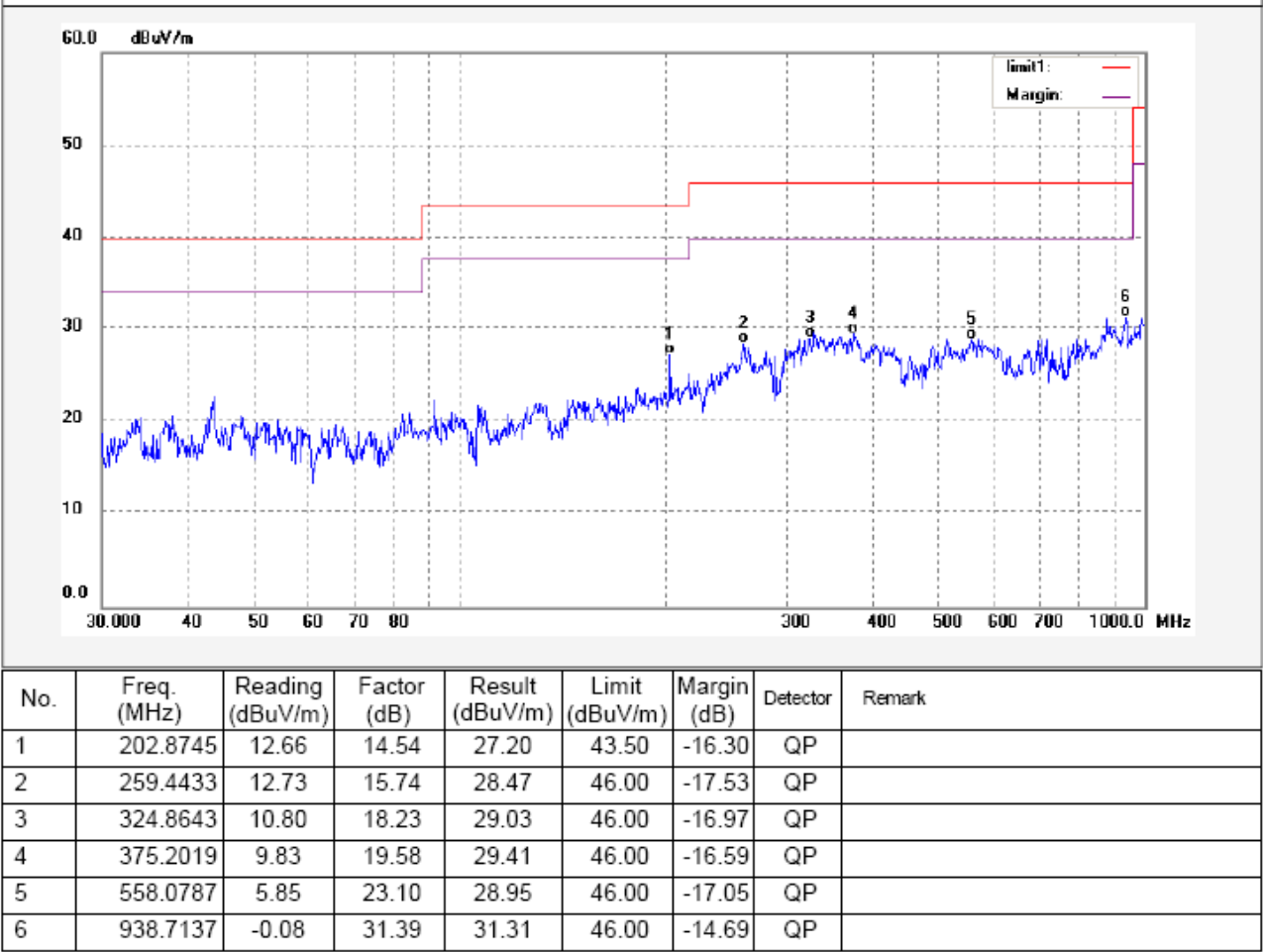
The measurements were more than 20 dB below the limit and not reported.

Test Frequency : 30MHz ~ 1000MHz

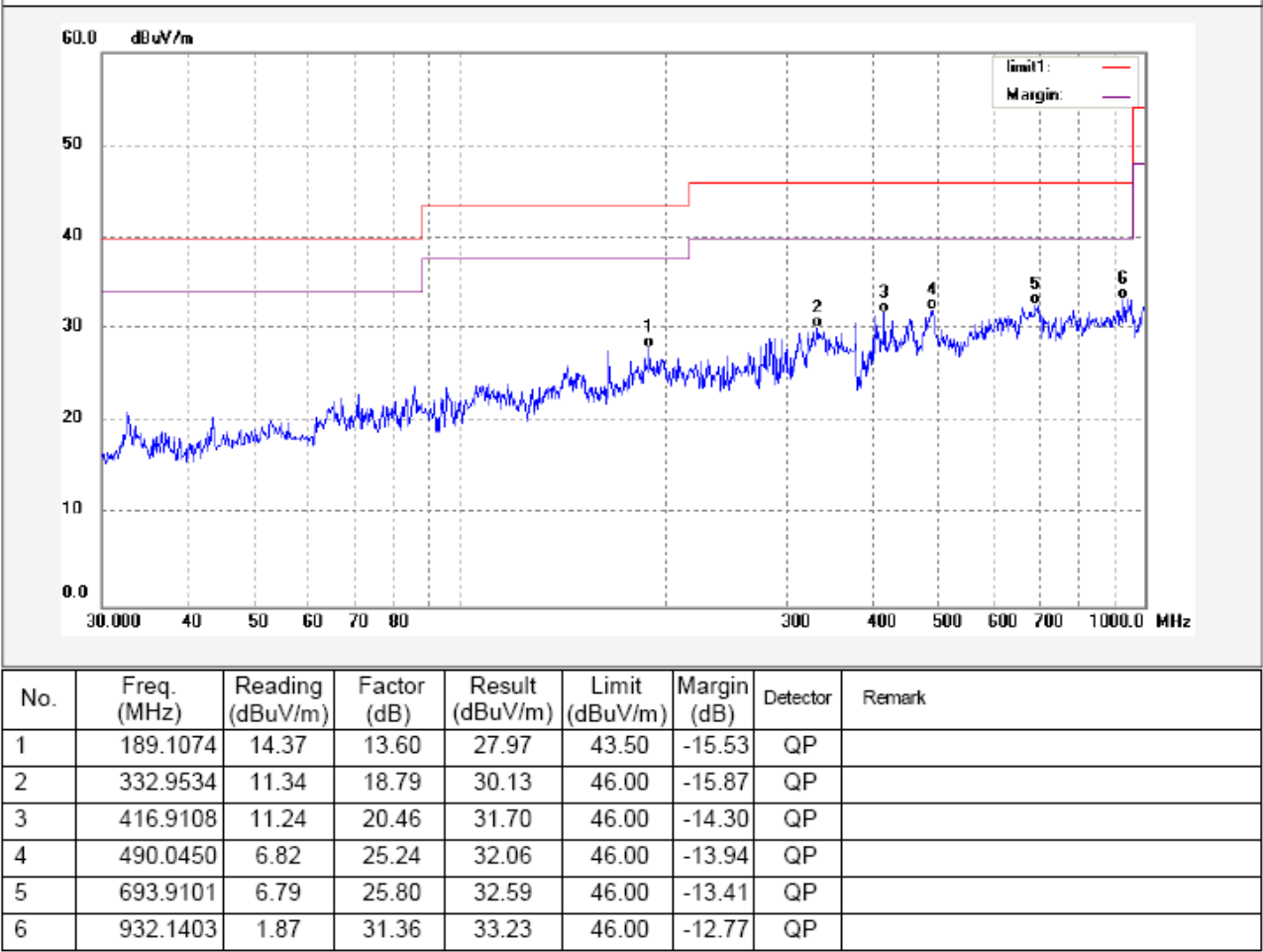
Remark: The pre-test was performed at TX 11b, TX 11g and TX 11n HT20 mode, and the worst is TX 11b mode, so the data shown is that mode's only.

Test Channel: 2412MHz

Antenna polarization: Vertical

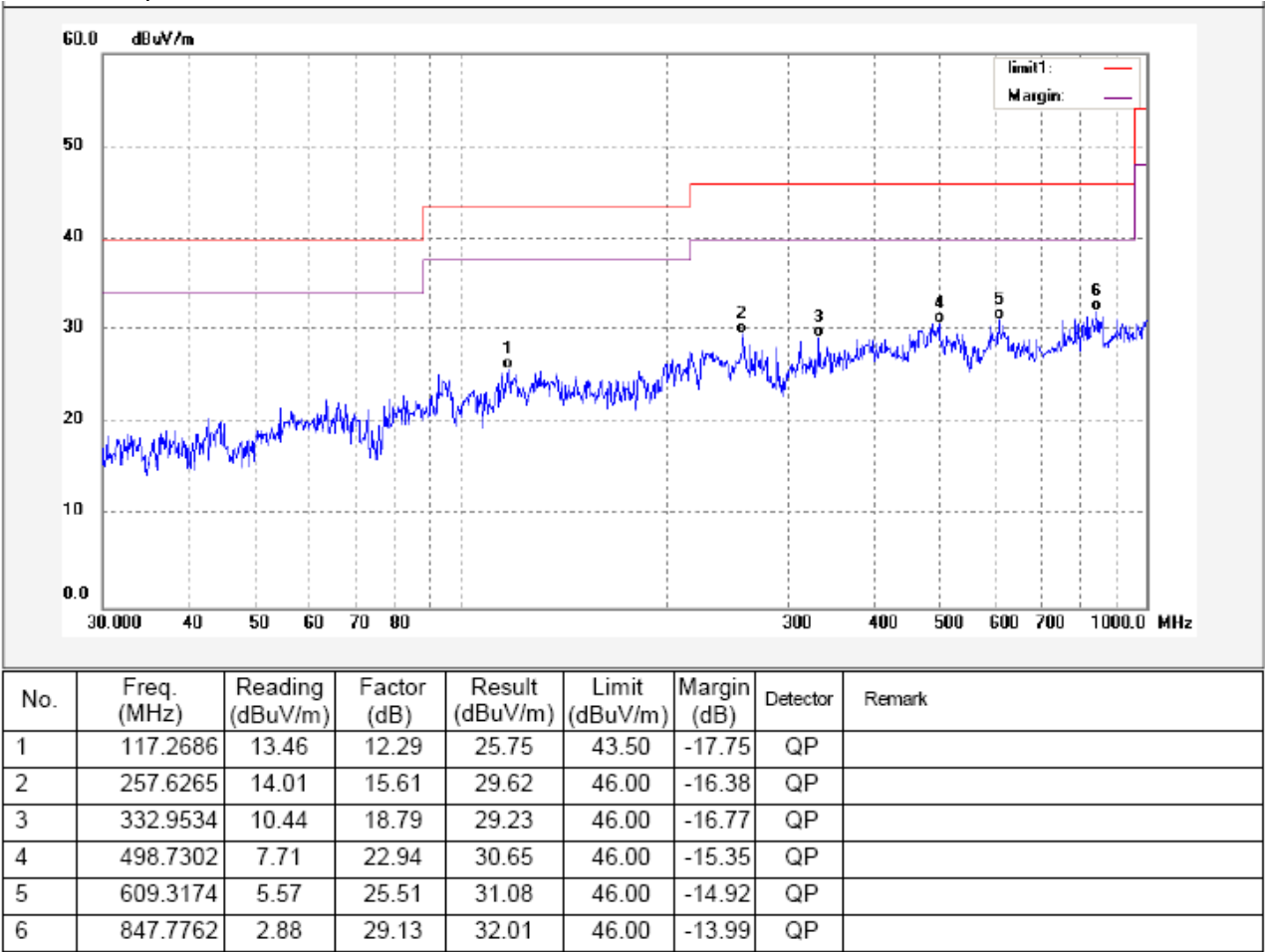


Antenna polarization: Horizontal

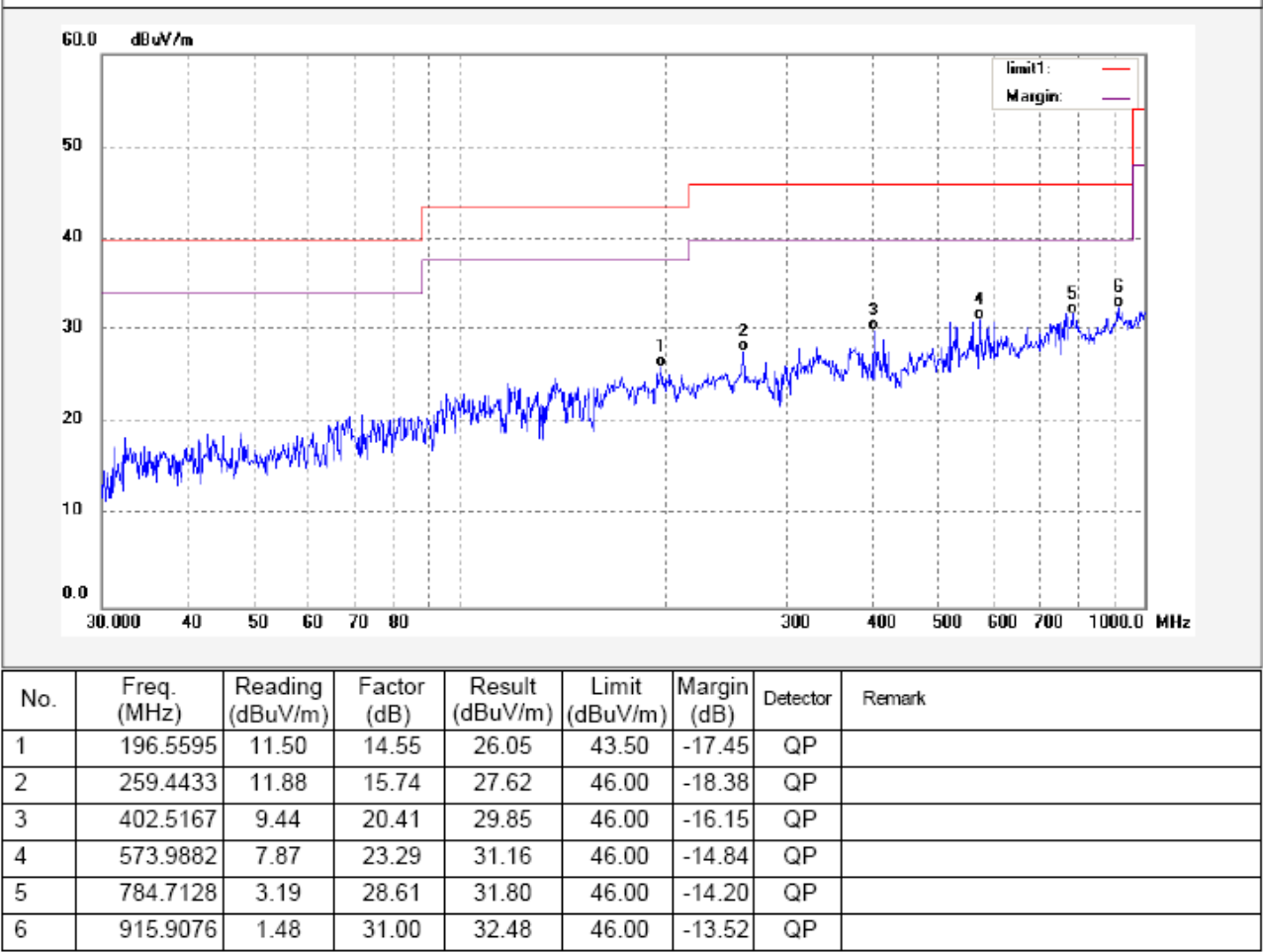


Test Channel: 2437MHz

Antenna polarization: Vertical

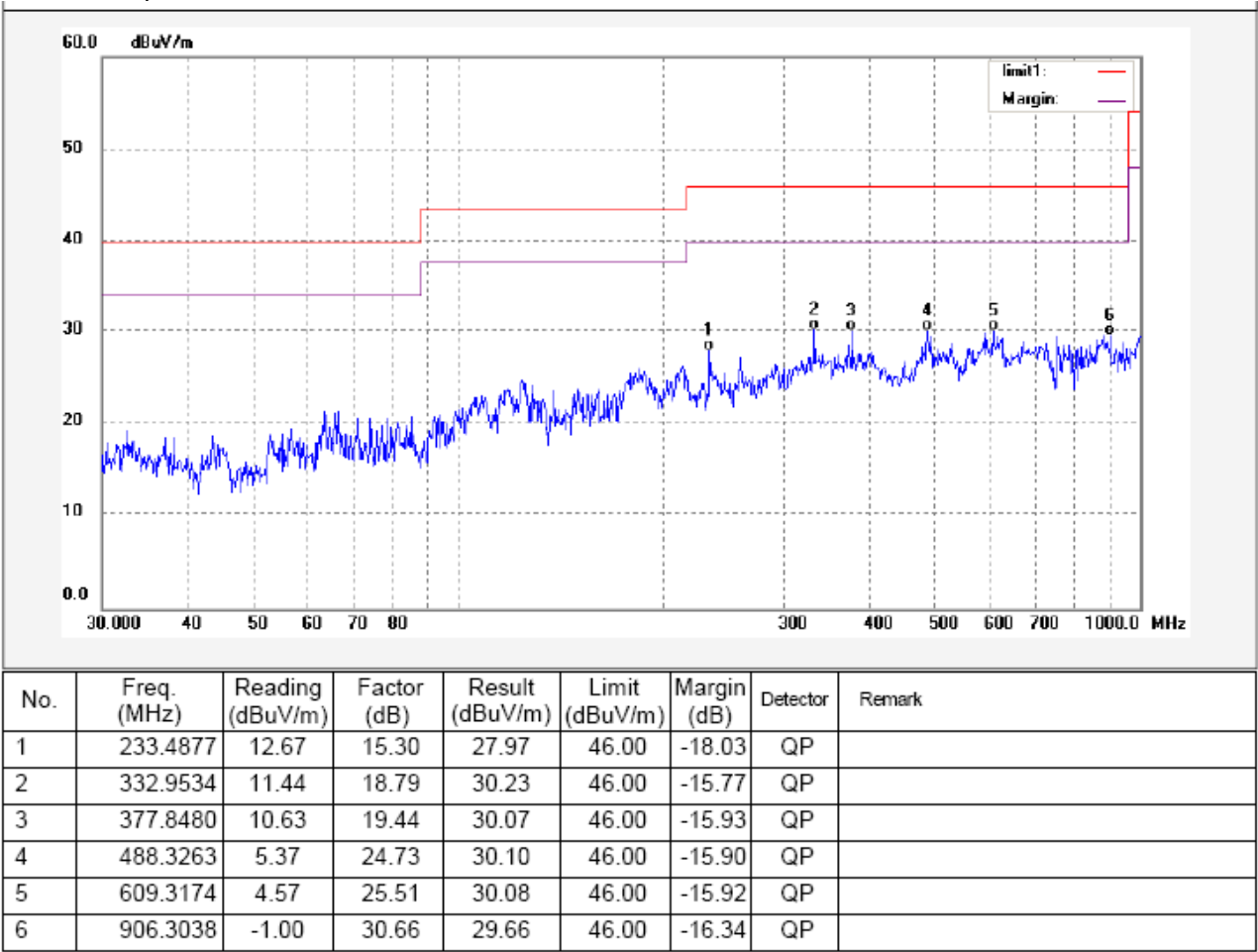


Antenna polarization: Horizontal

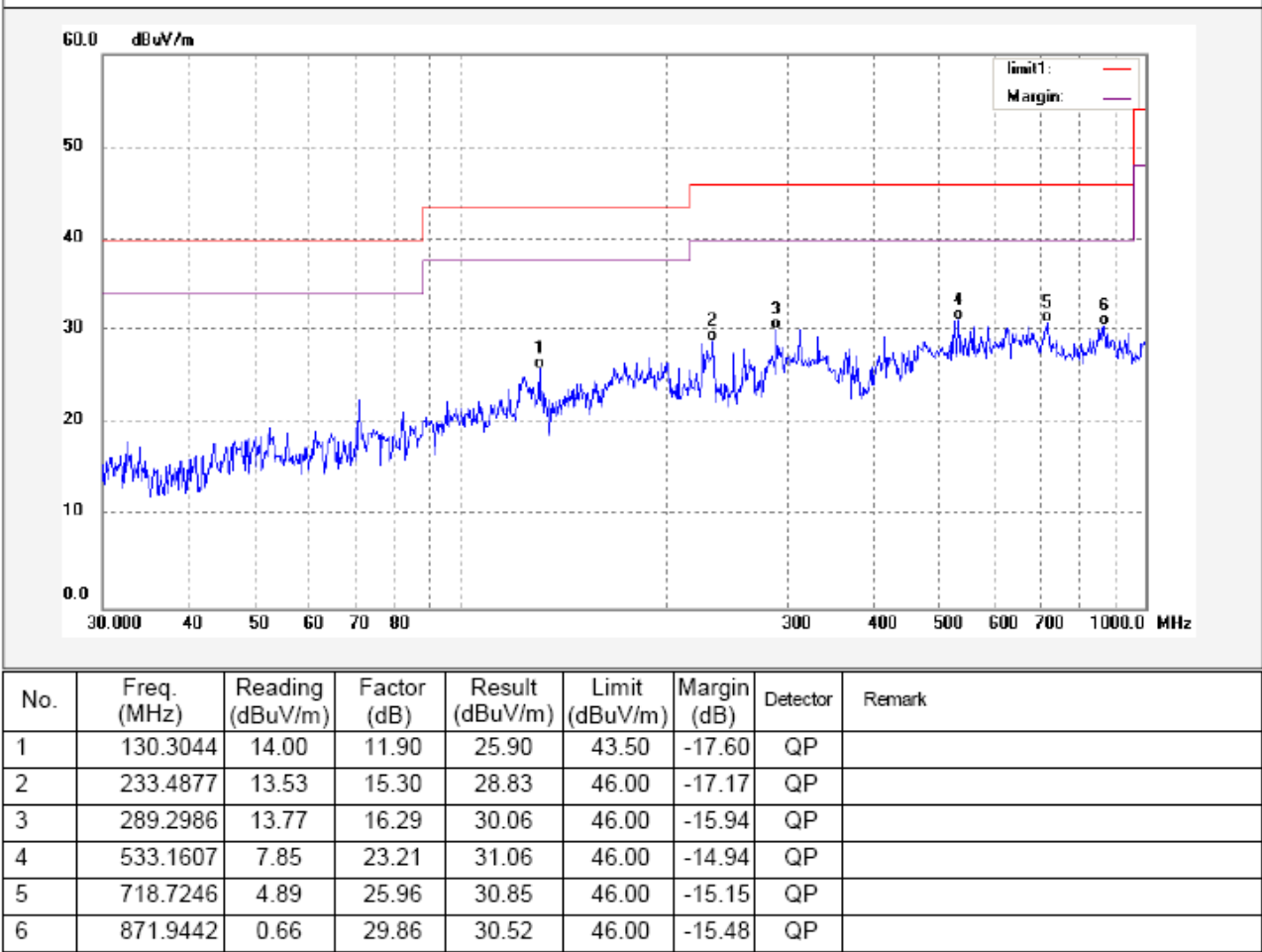


Test Channel: 2462MHz

Antenna polarization: Vertical



Antenna polarization: Horizontal



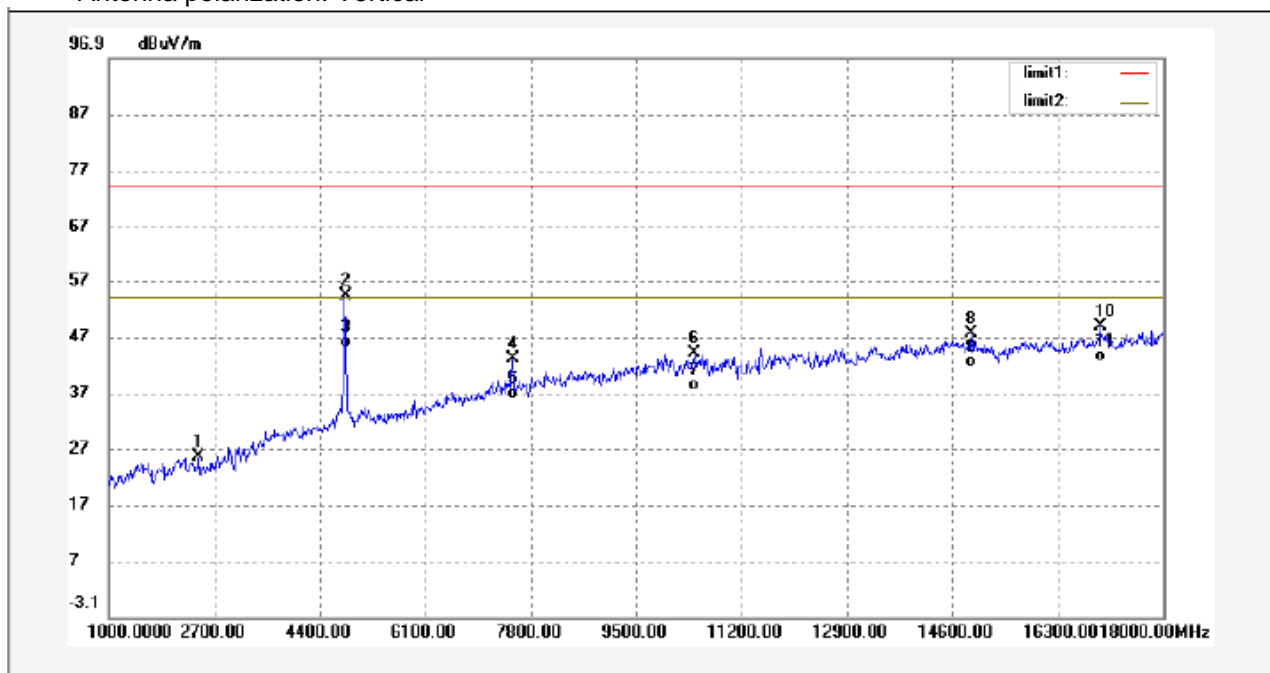
Test Frequency: From 1GHz -18GHz

Remark: The pre-test was performed at TX 11b, TX 11g and TX 11n HT20 mode, and the worst is TX 11b mode, so the data shown is that mode's only.

Test mode: Continuously Transmit

Modulation:TX 11b, Test Channel: 2412MHz

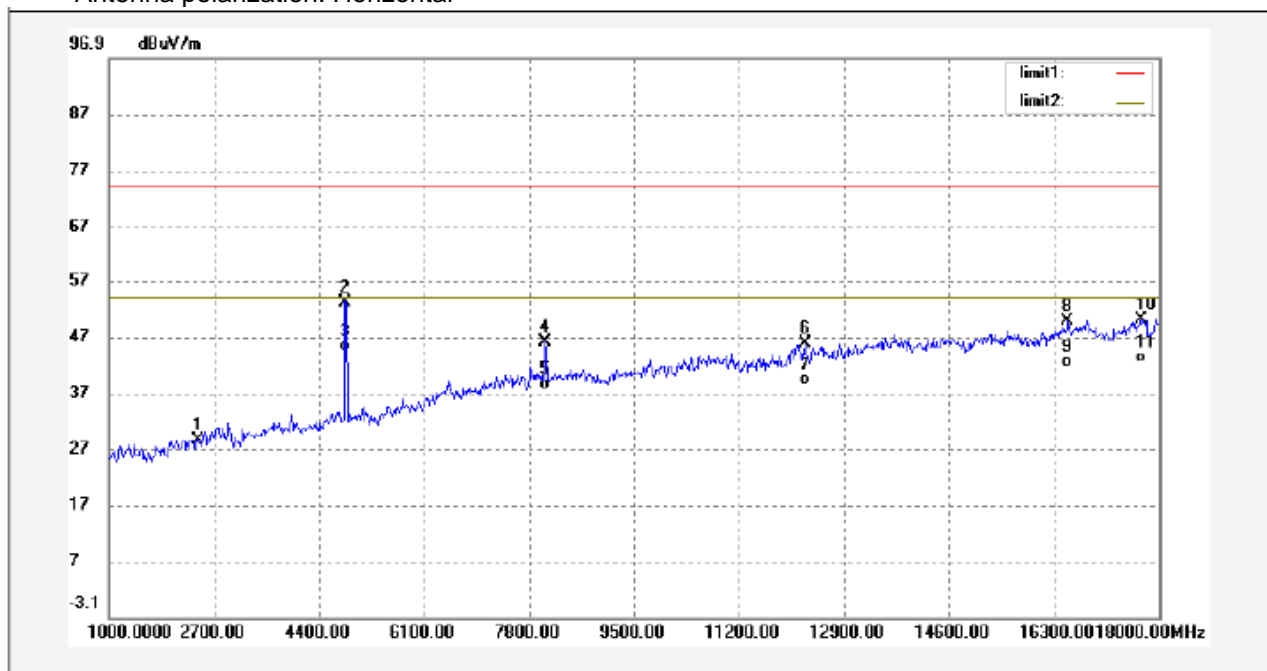
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2412.000	41.20	-15.61	25.59	74.00	-48.41	peak	
2	4824.000	66.33	-11.96	54.37	74.00	-19.63	peak	
3	4824.000	57.04	-11.96	45.08	54.00	-8.92	AVG	
4	7511.000	49.80	-6.83	42.97	74.00	-31.03	peak	
5	7511.000	42.57	-6.83	35.74	54.00	-18.26	AVG	
6	10435.000	48.45	-4.34	44.11	74.00	-29.89	peak	
7	10435.000	41.65	-4.34	37.31	54.00	-16.69	AVG	
8	14906.000	48.02	-0.58	47.44	74.00	-26.56	peak	
9	14906.000	42.17	-0.58	41.59	54.00	-12.41	AVG	
10	16980.000	48.35	0.39	48.74	74.00	-25.26	peak	
11	16980.000	42.10	0.39	42.49	54.00	-11.51	AVG	

Remark: 2.4GHz high-pass filter is used during radiated emissions above 1GHz measurement.

Antenna polarization: Horizontal

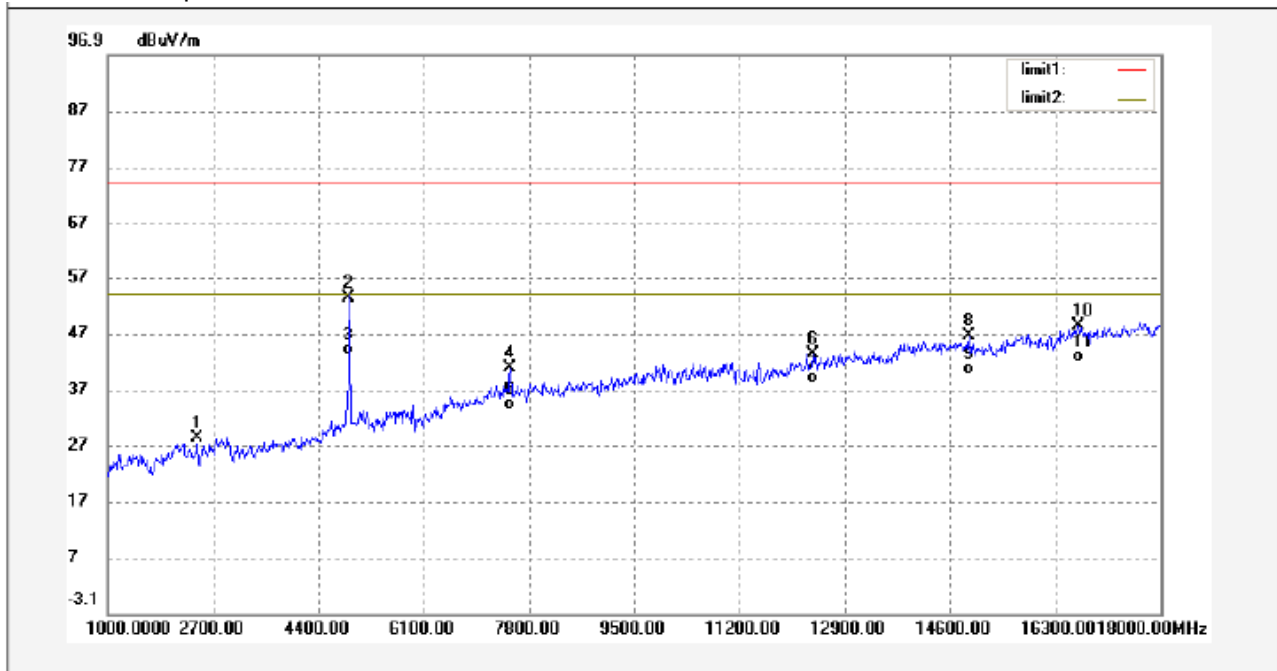


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2412.000	44.21	-15.61	28.60	74.00	-45.40	peak	
2	4824.000	65.01	-11.96	53.05	74.00	-20.95	peak	
3	4824.000	56.23	-11.96	44.27	54.00	-9.73	AVG	
4	8055.000	52.05	-6.05	46.00	74.00	-28.00	peak	
5	8055.000	43.47	-6.05	37.42	54.00	-16.58	AVG	
6	12271.000	50.43	-4.55	45.88	74.00	-28.12	peak	
7	12271.000	42.87	-4.55	38.32	54.00	-15.68	AVG	
8	16521.000	51.68	-1.85	49.83	74.00	-24.17	peak	
9	16521.000	43.27	-1.85	41.42	54.00	-12.58	AVG	
10	17711.000	46.38	3.71	50.09	74.00	-23.91	peak	
11	17711.000	38.54	3.71	42.25	54.00	-11.75	AVG	

Remark: 2.4GHz high-pass filter is used during radiated emissions above 1GHz measurement.

Modulation:TX 11b, Test Channel: 2437MHz

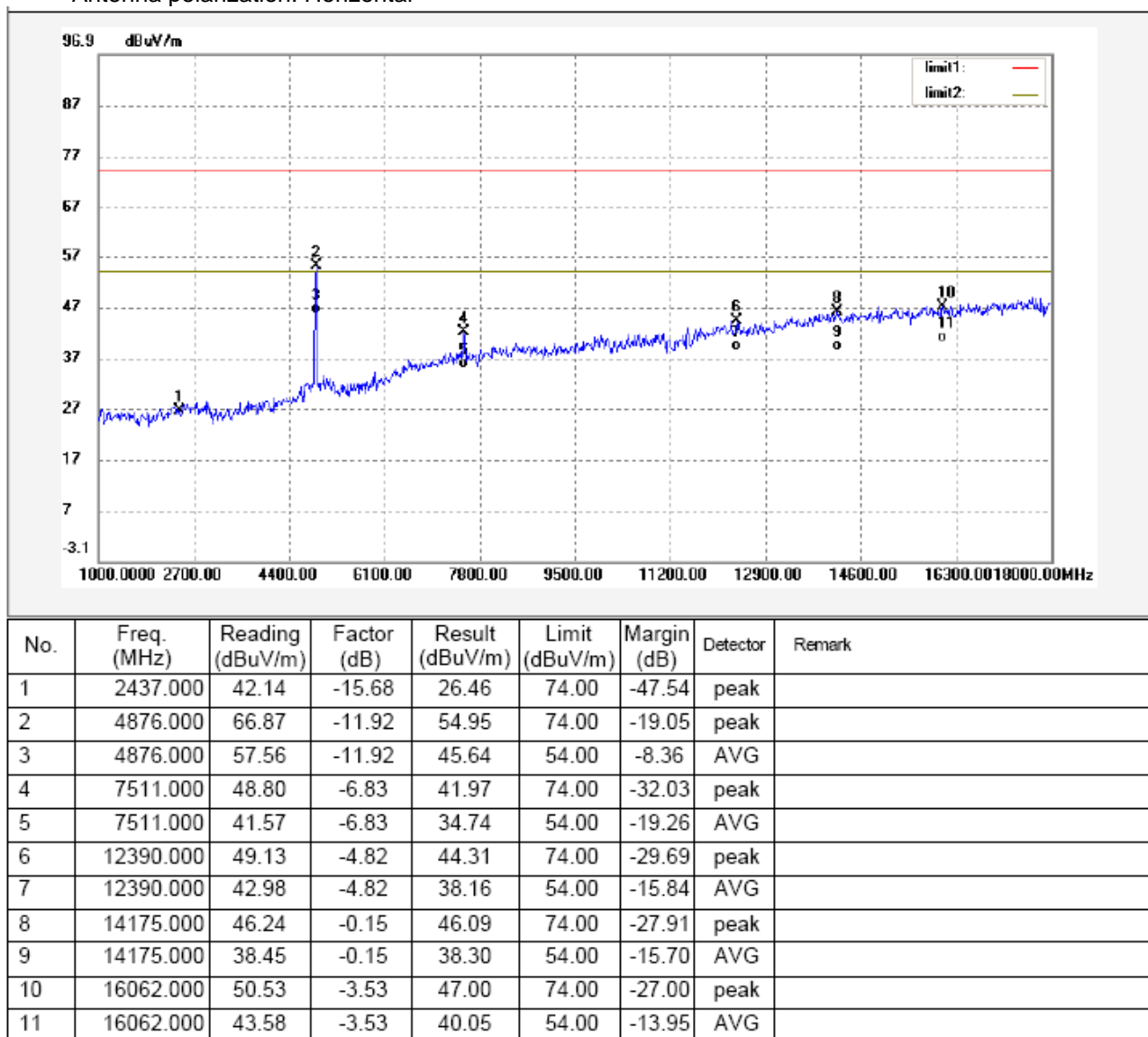
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2437.000	43.98	-15.68	28.30	74.00	-45.70	peak	
2	4876.000	65.22	-11.92	53.30	74.00	-20.70	peak	
3	4876.000	55.00	-11.92	43.08	54.00	-10.92	AVG	
4	7494.000	47.58	-6.83	40.75	74.00	-33.25	peak	
5	7494.000	40.12	-6.83	33.29	54.00	-20.71	AVG	
6	12390.000	48.13	-4.82	43.31	74.00	-30.69	peak	
7	12390.000	42.87	-4.82	38.05	54.00	-15.95	AVG	
8	14906.000	47.02	-0.58	46.44	74.00	-27.56	peak	
9	14906.000	40.02	-0.58	39.44	54.00	-14.56	AVG	
10	16674.000	49.27	-0.98	48.29	74.00	-25.71	peak	
11	16674.000	42.65	-0.98	41.67	54.00	-12.33	AVG	

Remark: 2.4GHz high-pass filter is used during radiated emissions above 1GHz measurement.

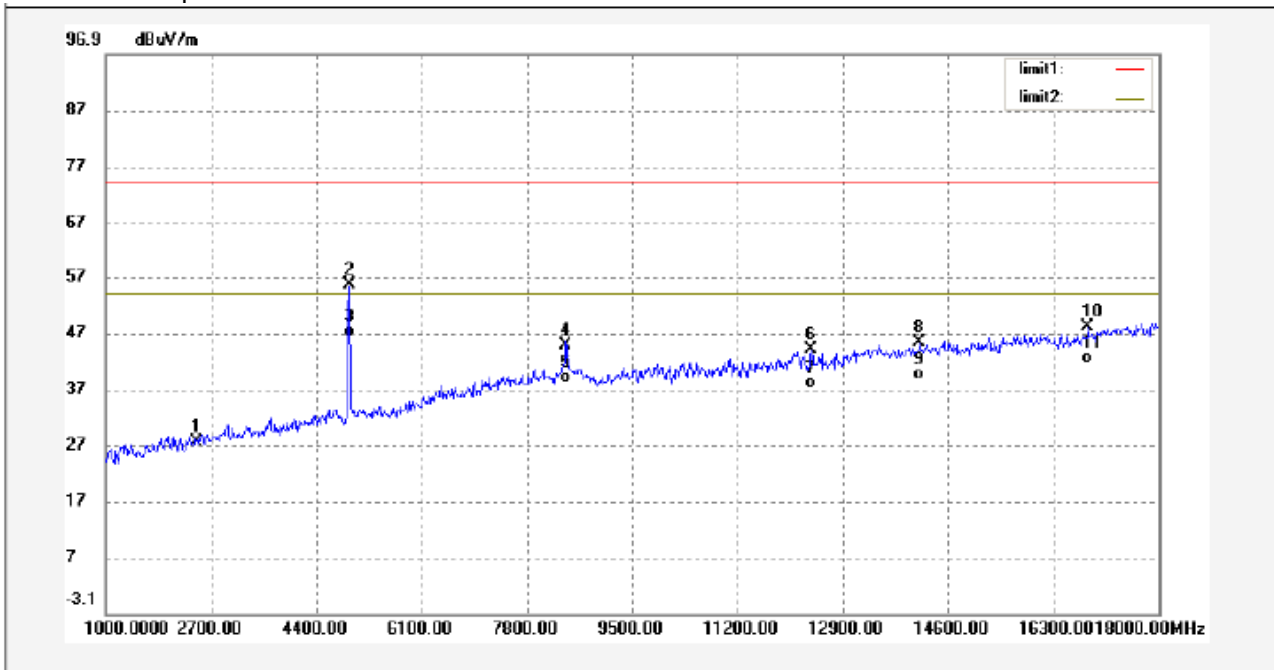
Antenna polarization: Horizontal



Remark: 2.4GHz high-pass filter is used during radiated emissions above 1GHz measurement.

Modulation:TX 11b, Test Channel: 2462MHz

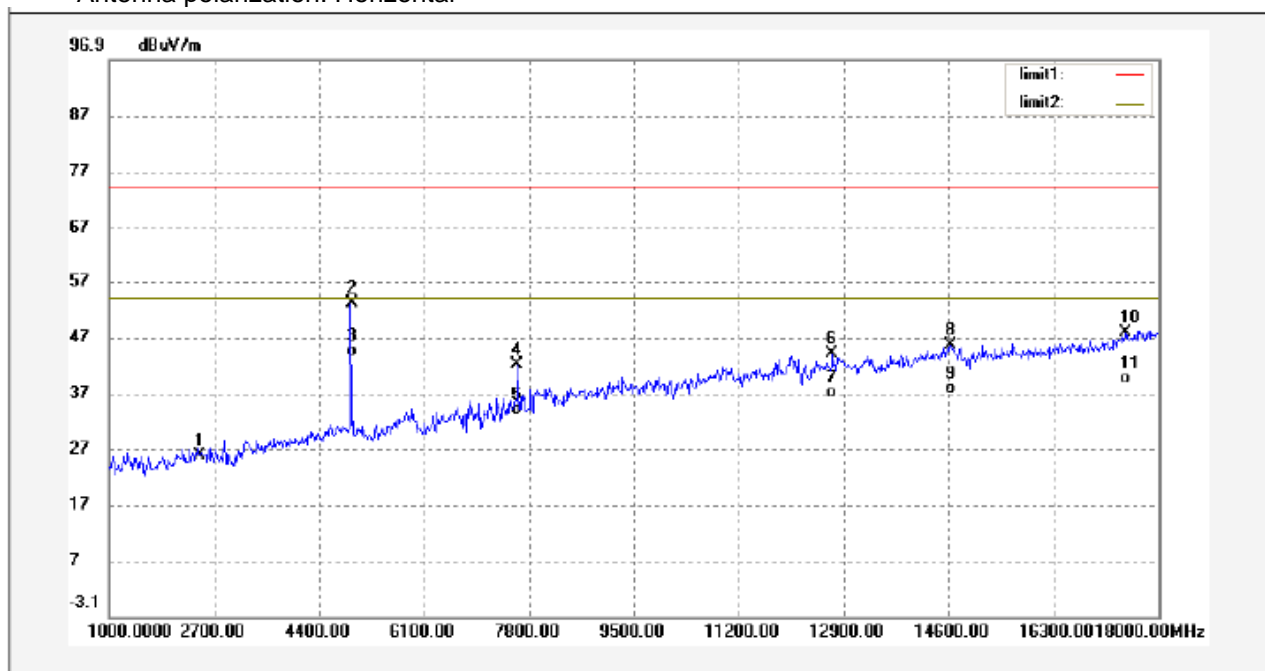
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2462.000	43.22	-15.70	27.52	74.00	-46.48	peak	
2	4924.000	67.44	-11.83	55.61	74.00	-18.39	peak	
3	4924.000	58.01	-11.83	46.18	54.00	-7.82	AVG	
4	8429.000	51.74	-7.02	44.72	74.00	-29.28	peak	
5	8429.000	45.02	-7.02	38.00	54.00	-16.00	AVG	
6	12390.000	48.84	-4.82	44.02	74.00	-29.98	peak	
7	12390.000	41.87	-4.82	37.05	54.00	-16.95	AVG	
8	14141.000	45.60	-0.23	45.37	74.00	-28.63	peak	
9	14141.000	38.67	-0.23	38.44	54.00	-15.56	AVG	
10	16861.000	48.18	-0.03	48.15	74.00	-25.85	peak	
11	16861.000	41.56	-0.03	41.53	54.00	-12.47	AVG	

Remark: 2.4GHz high-pass filter is used during radiated emissions above 1GHz measurement.

Antenna polarization: Horizontal



Remark: 2.4GHz high-pass filter is used during radiated emissions above 1GHz measurement.

Test Frequency: Above 18GHz

The measurements were more than 20 dB below the limit and not reported.

8 Band Edge Measurement

Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) and 15.205(c).
Test Method:	KDB558074 D01 V02 10/04/2012
Measurement Distance:	3m
Detector:	For Peak value: RBW = 1MHz VBW = 3MHz; Sweep = auto Detector function = peak Trace = max hold For Average value: RBW = 1MHz VBW=10Hz; Sweep = auto Detector function = Average Trace = max hold

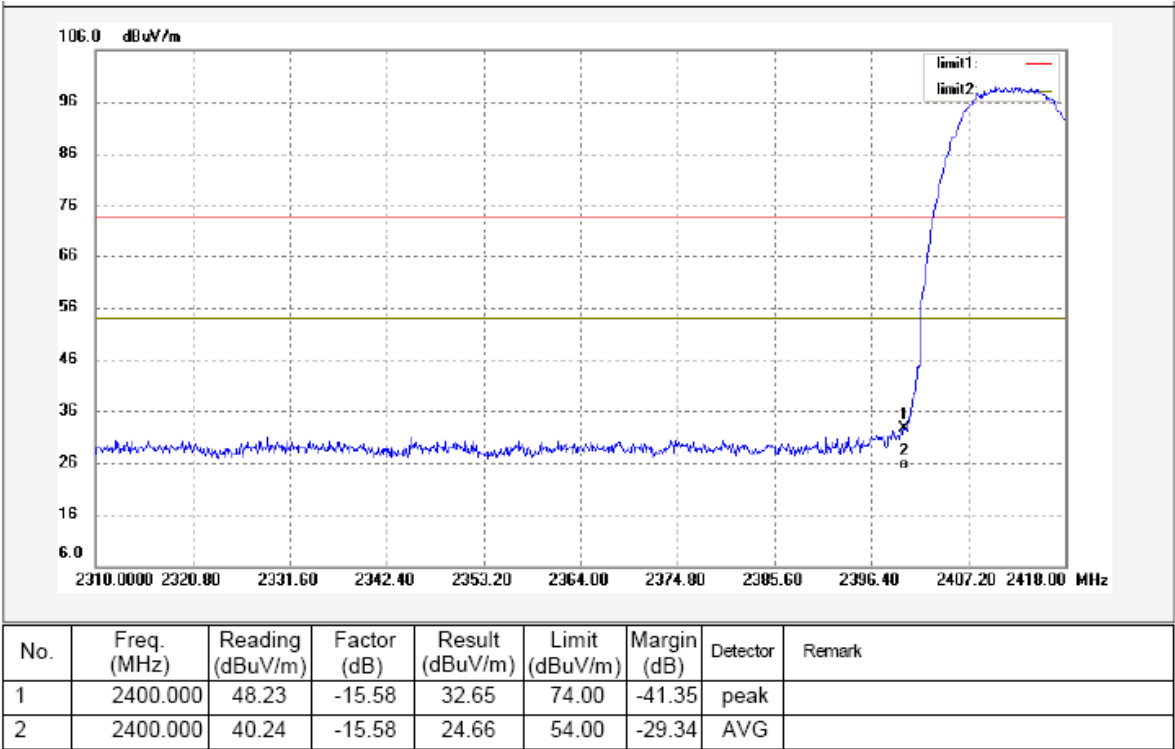
8.1 Test Produce

1. The EUT is placed on a turntable, which is 0.8m above the ground plane and worked at highest radiated power.
2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. continuous transmitting

8.2 Test Result

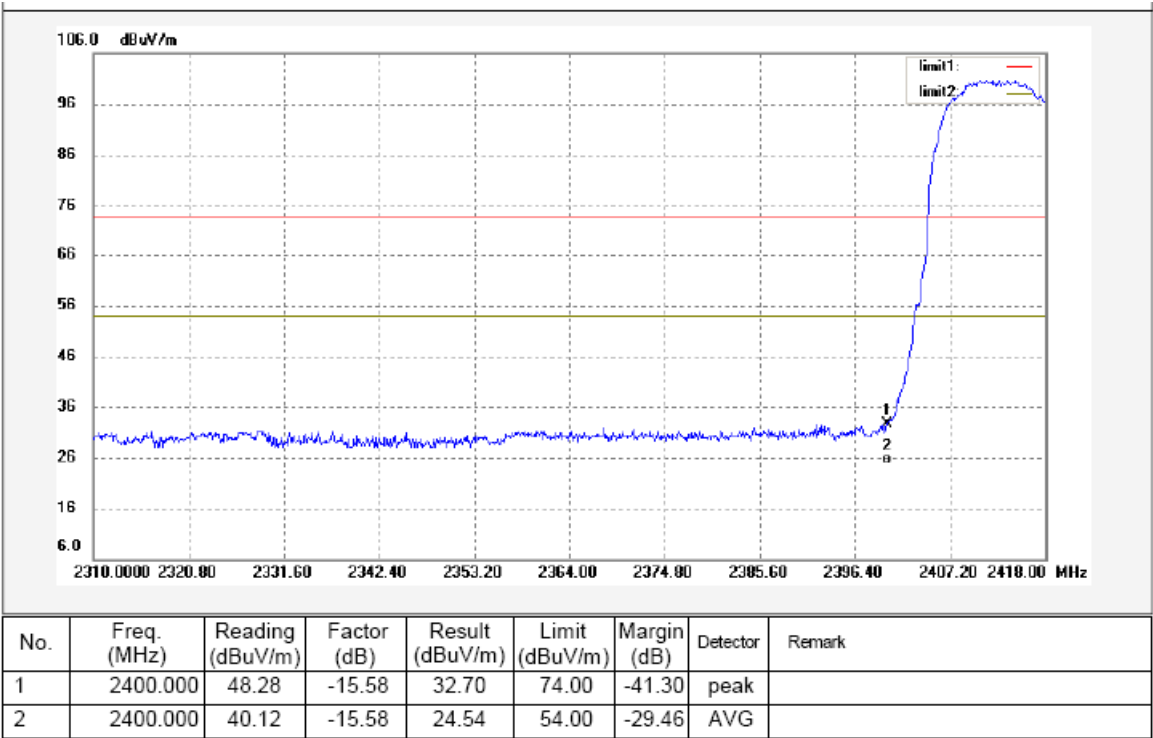
Mode: TX 11b channel 1

Antenna Polarization:Horizontal



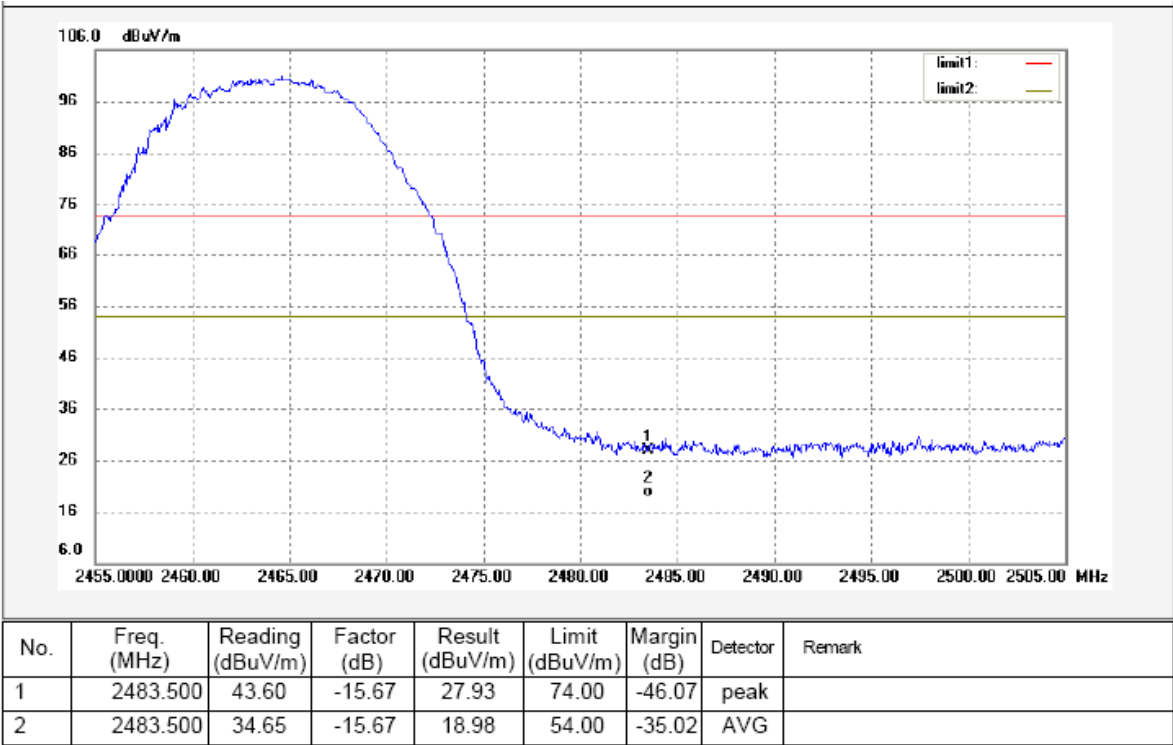
Mode: TX 11b channel 1

Antenna Polarization:Vertical



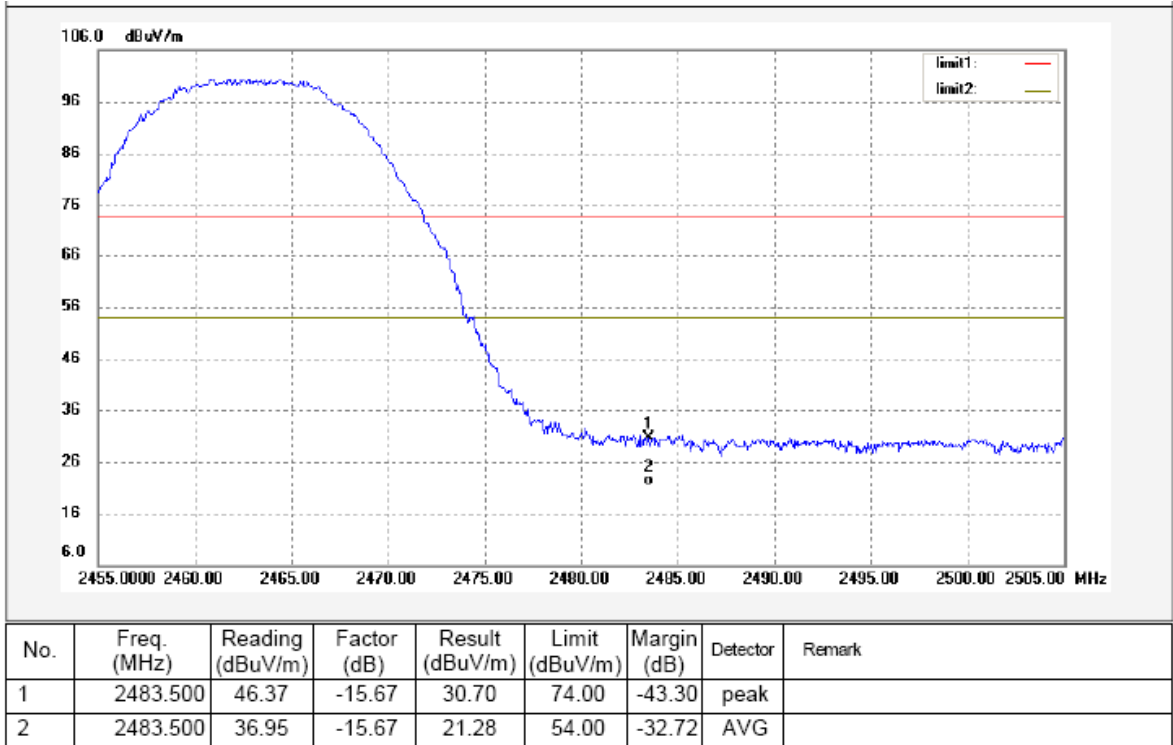
Mode: TX 11b channel 11

Antenna Polarization:Horizontal



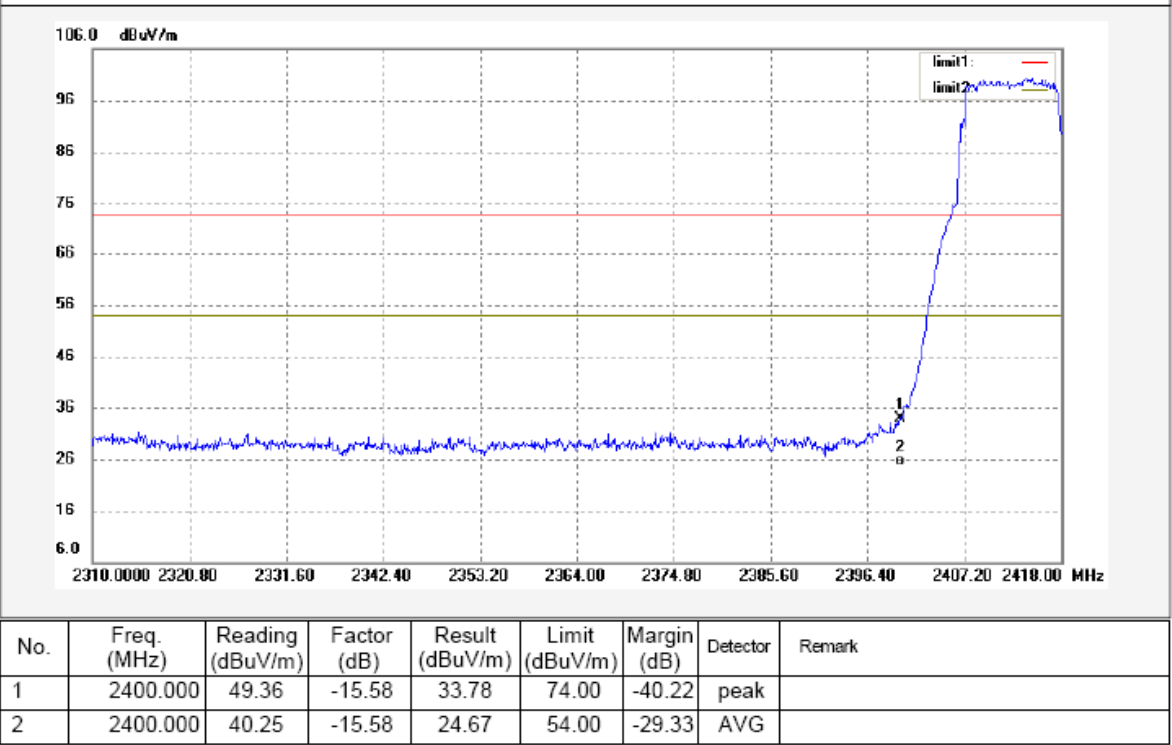
Mode: TX 11b channel 11

Antenna Polarization:Vertical



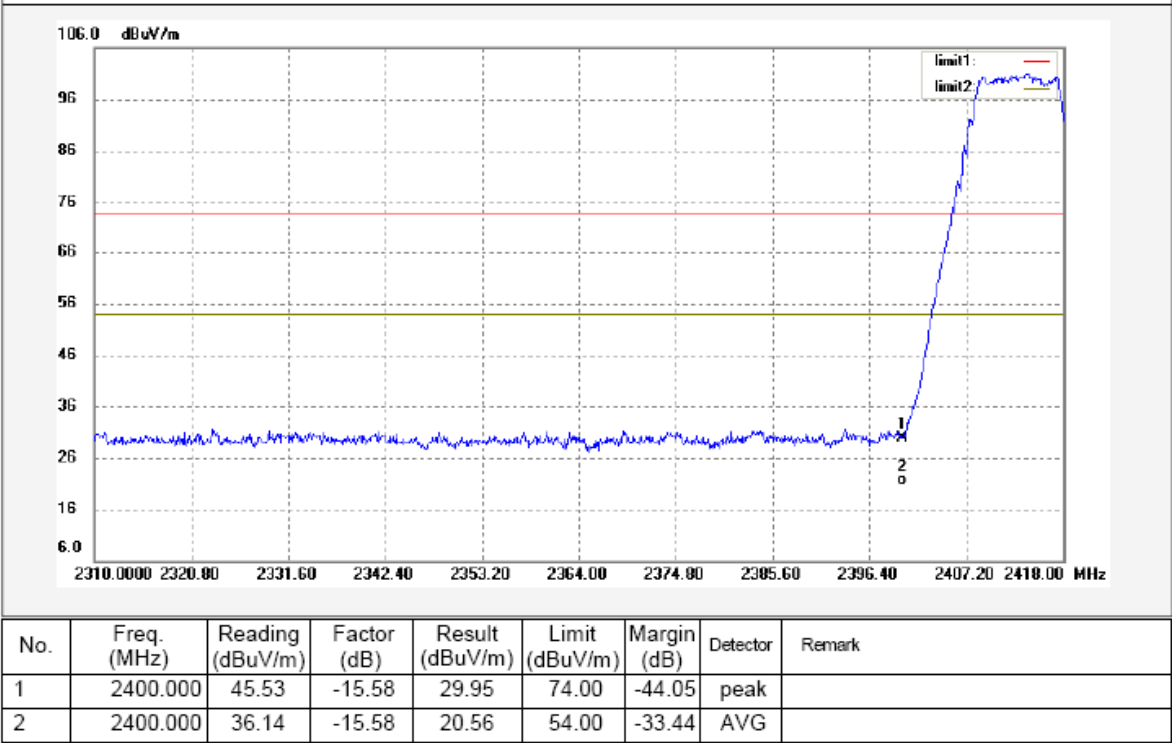
Mode: TX 11g channel 1

Antenna Polarization:Horizontal



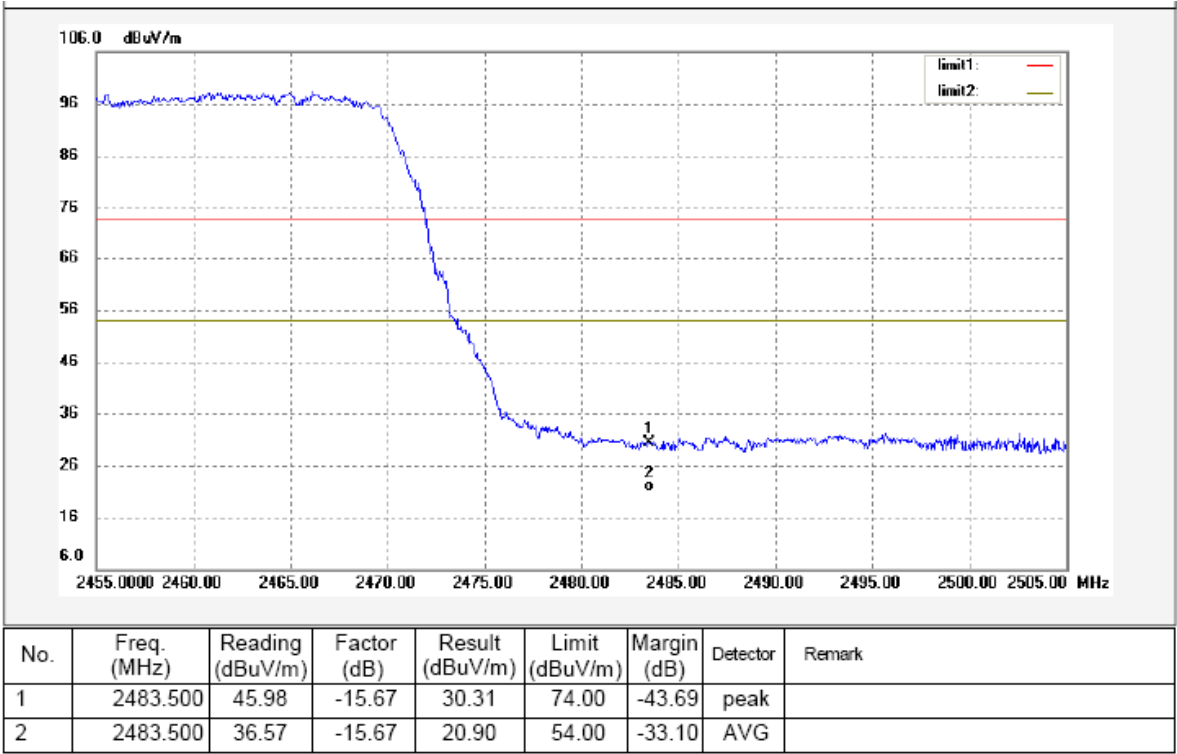
Mode: TX 11g channel 1

Antenna Polarization:Vertical



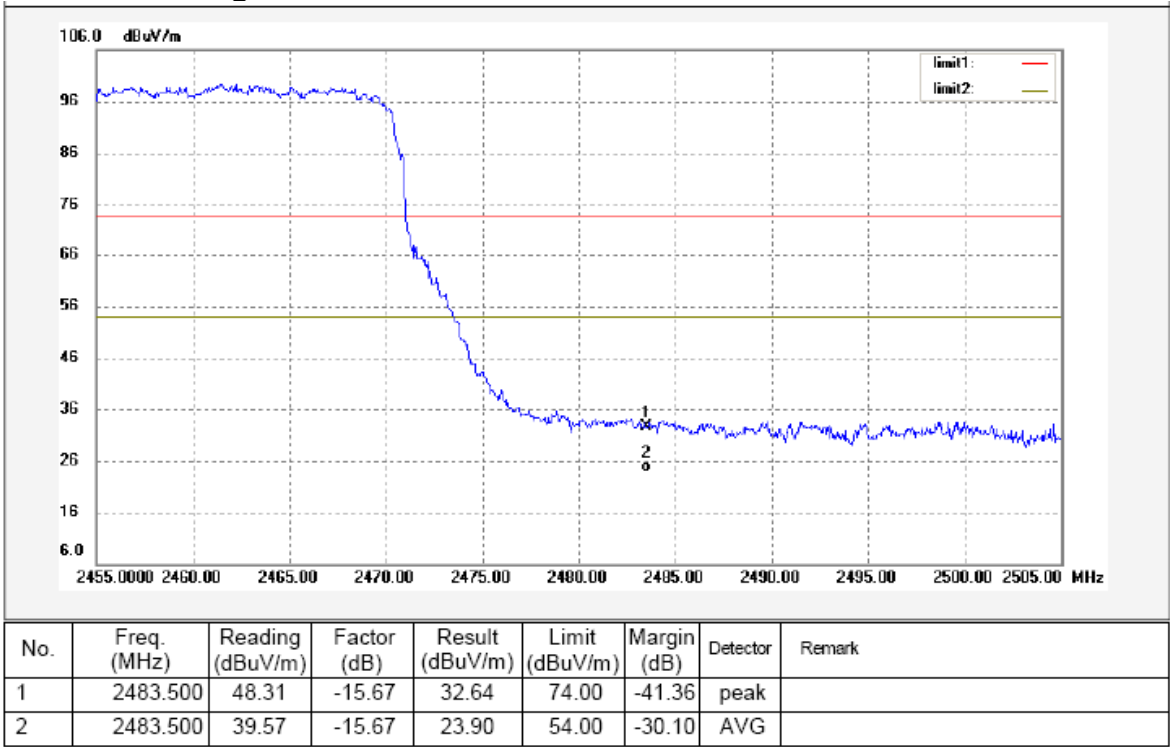
Mode: TX 11g channel 11

Antenna Polarization:Horizontal



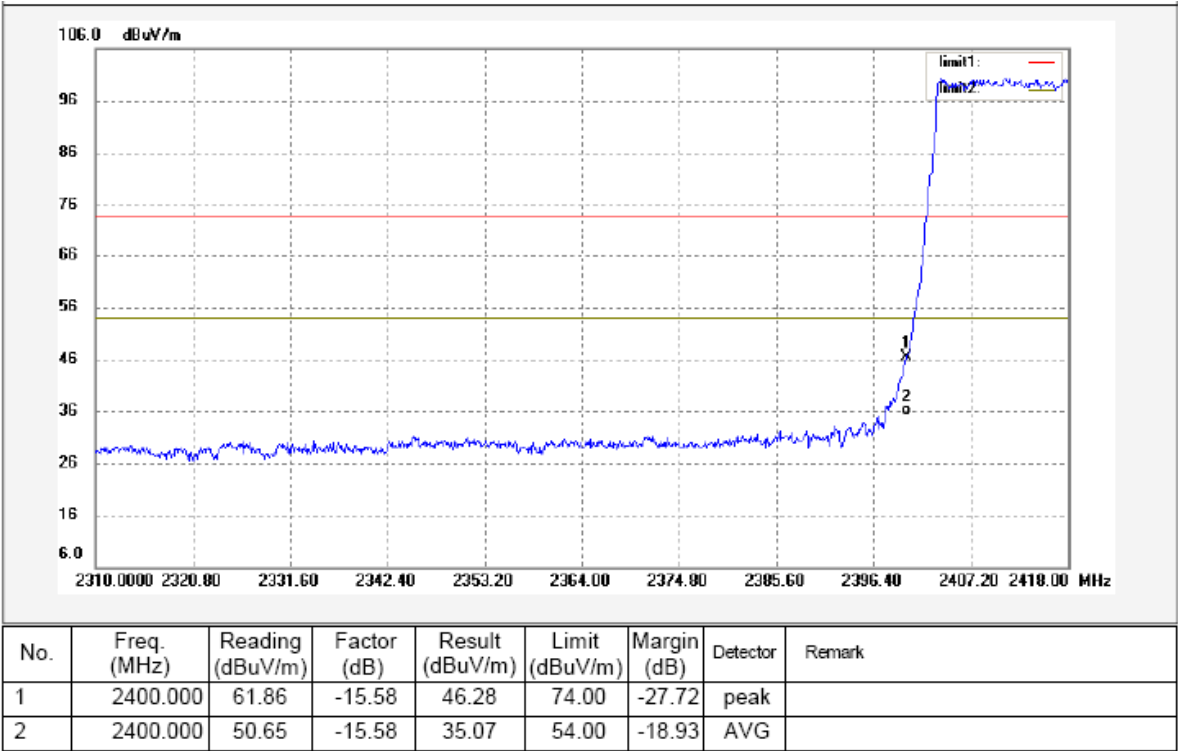
Mode: TX 11g channel 11

Antenna Polarization:Vertical



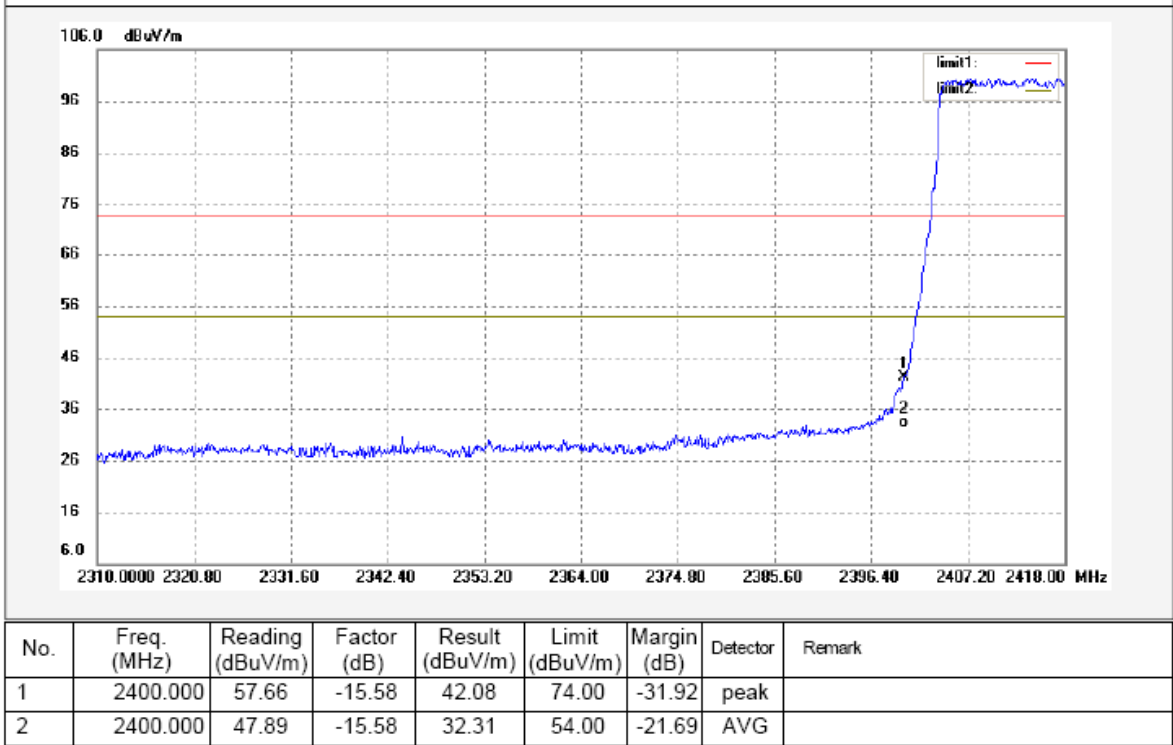
Mode: TX 11n HT 20 channel 1

Antenna Polarization:Horizontal



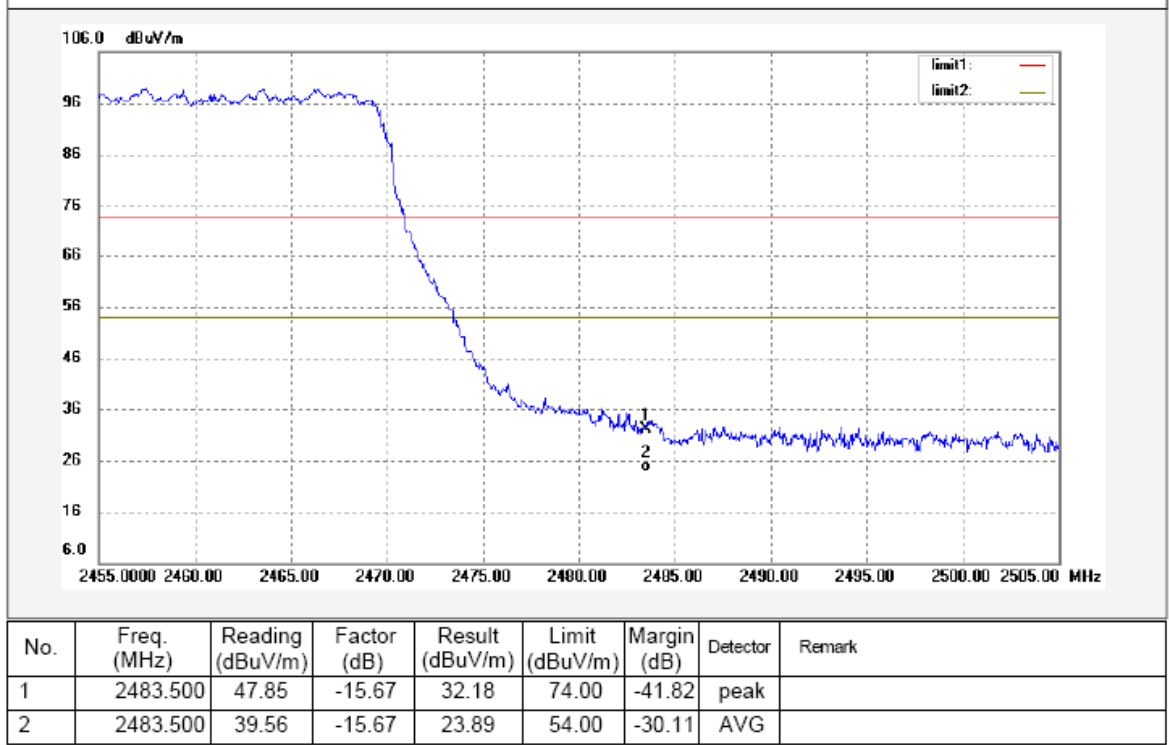
Mode: TX 11n HT 20 channel 1

Antenna Polarization:Vertical



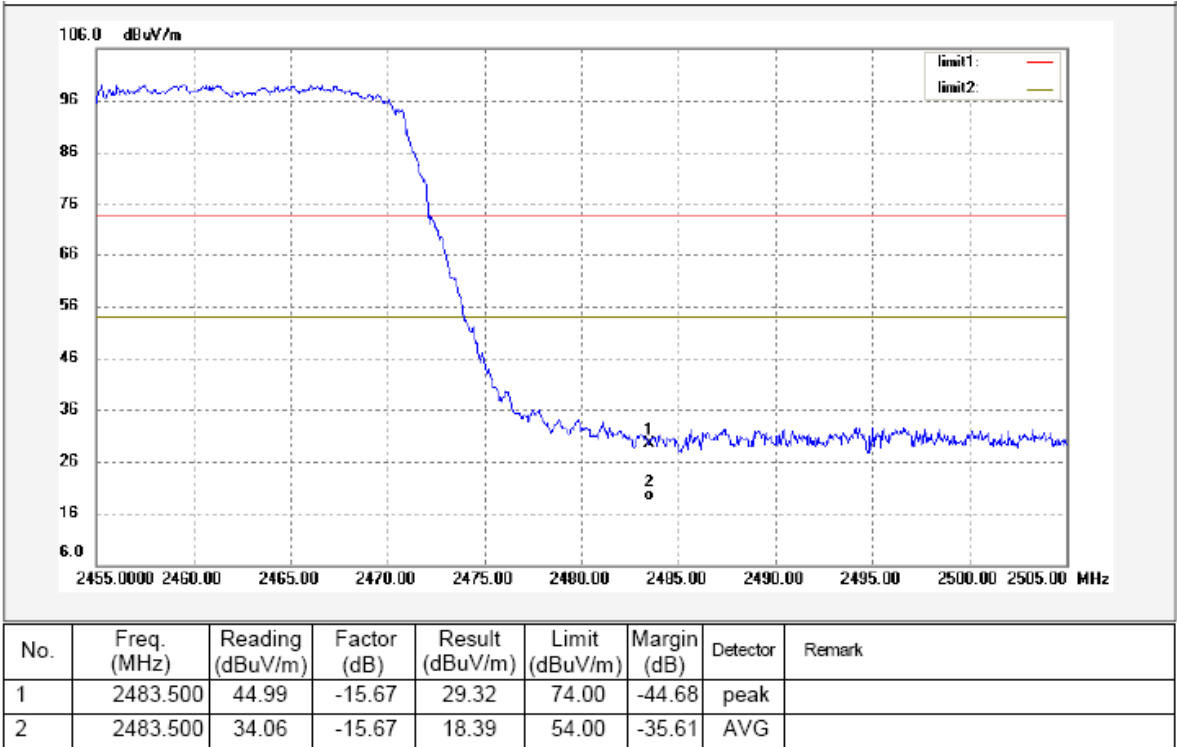
Mode: TX 11n HT 20 channel 11

Antenna Polarization:Horizontal



Mode: TX 11n HT 20 channel 11

Antenna Polarization:Vertical



9 6 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB558074 D01 V02 10/04/2012

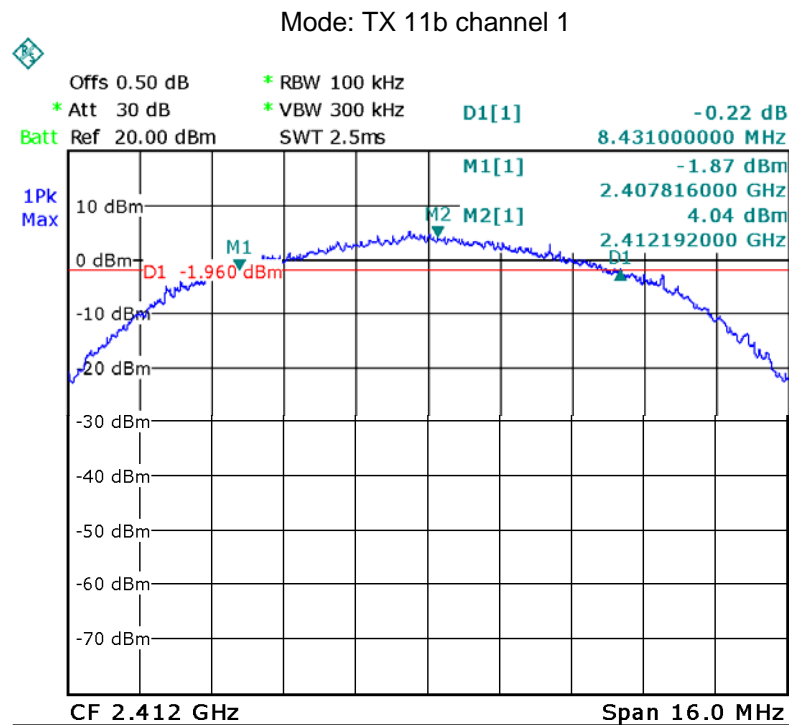
9.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 100kHz

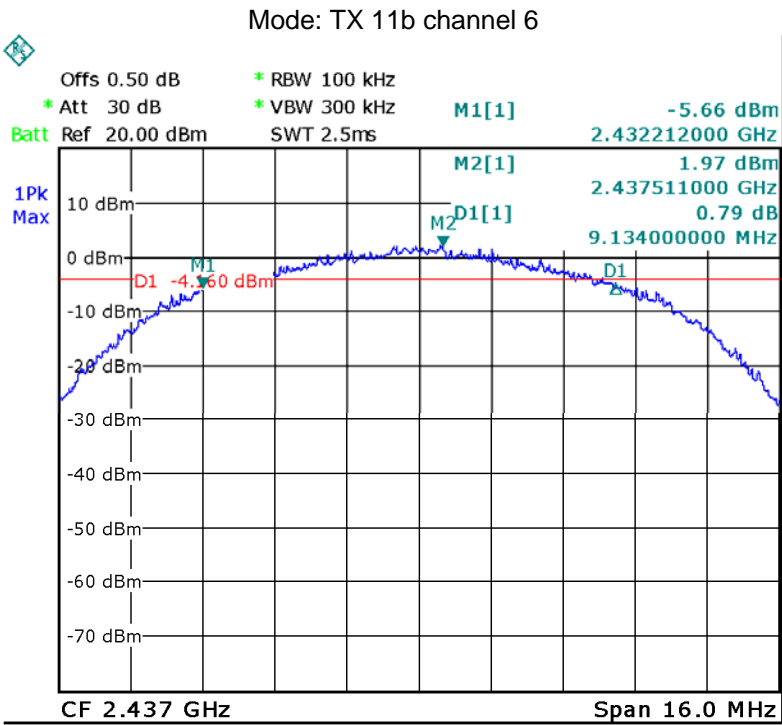
9.2 Test Result:

Operation mode	Bandwidth (MHz)		
TX 11b	Channel 1	Channel 6	Channel 11
	8.431	9.134	9.293
TX 11g	Channel 1	Channel 6	Channel 11
	16.391	16.383	16.383
TX 11n HT 20	Channel 1	Channel 6	Channel 11
	17.269	17.645	17.484

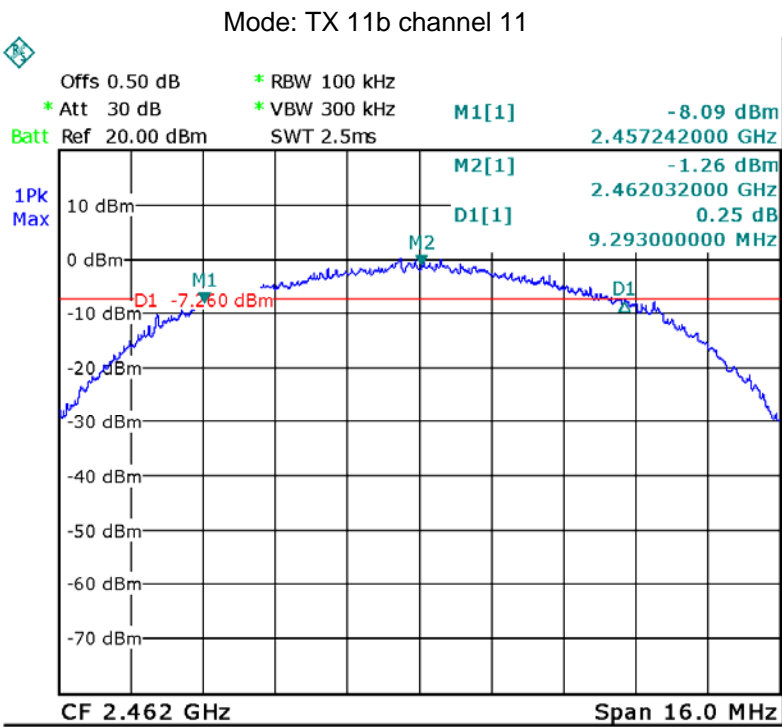
Test result plot as follows:



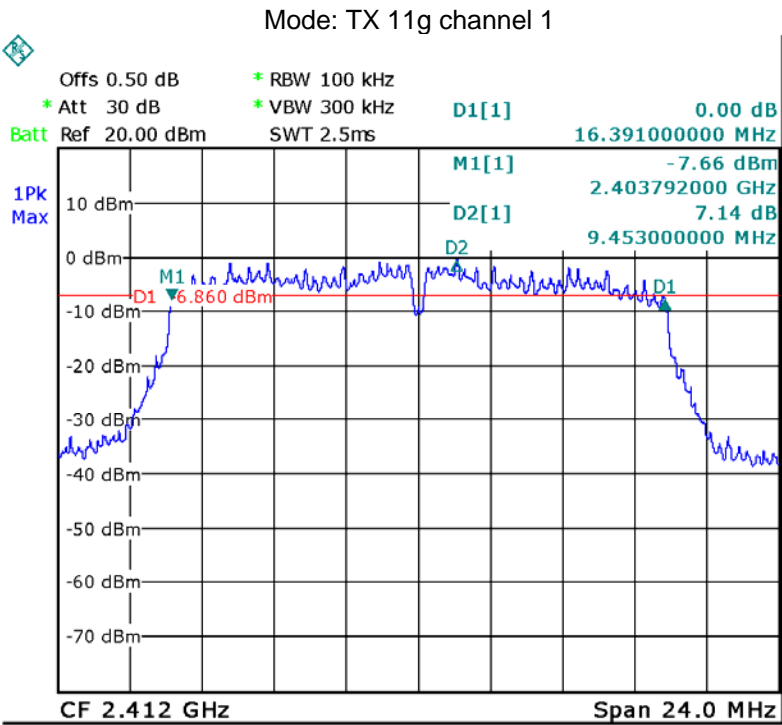
Date: 29.AUG.2013 17:00:03



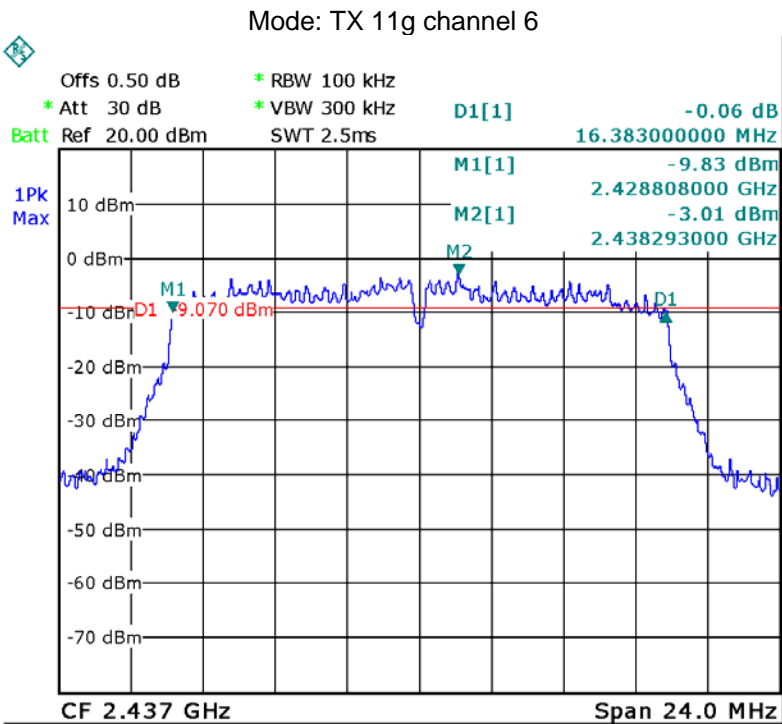
Date: 29.AUG.2013 17:01:46



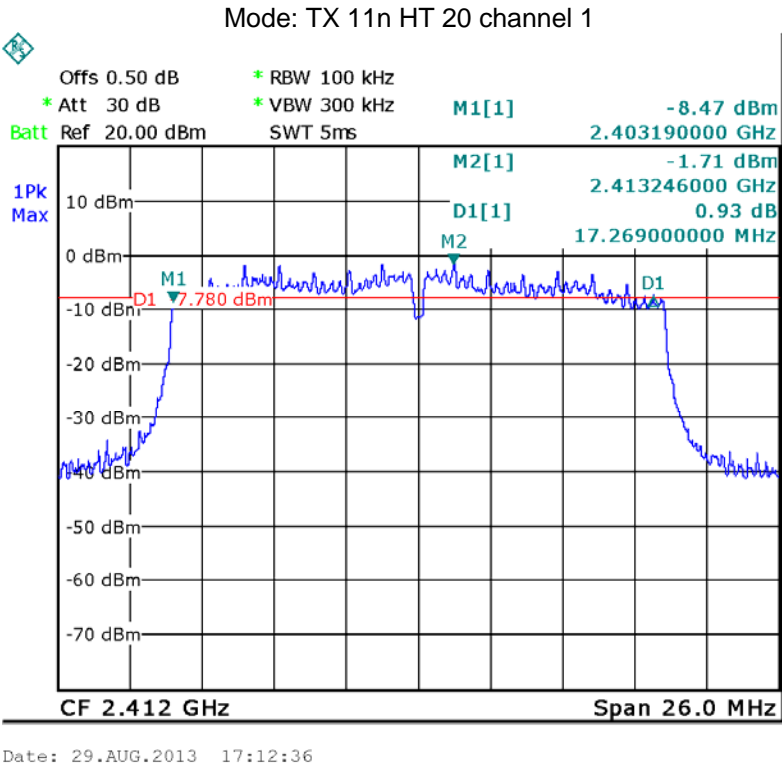
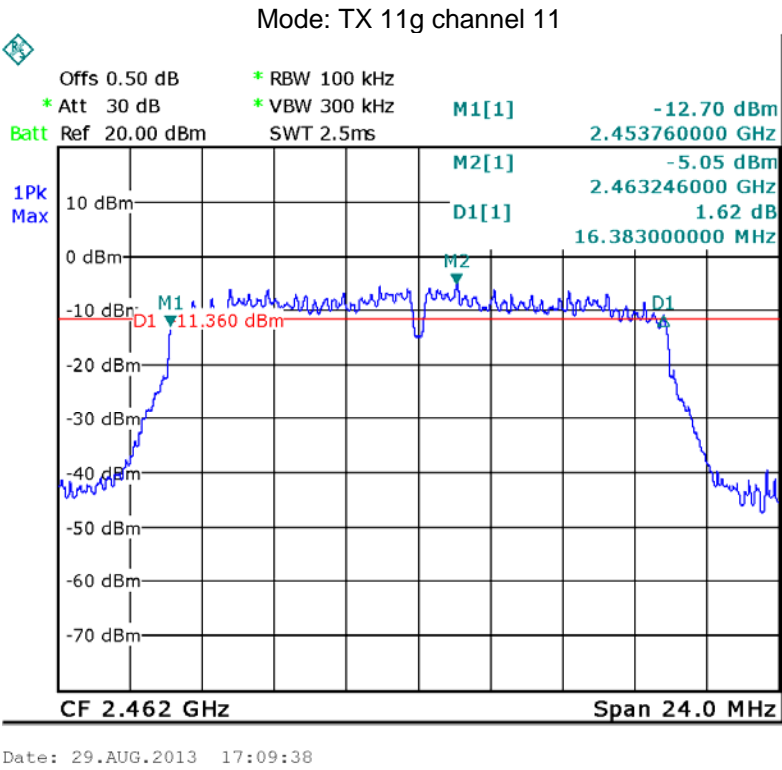
Date: 29.AUG.2013 17:04:28

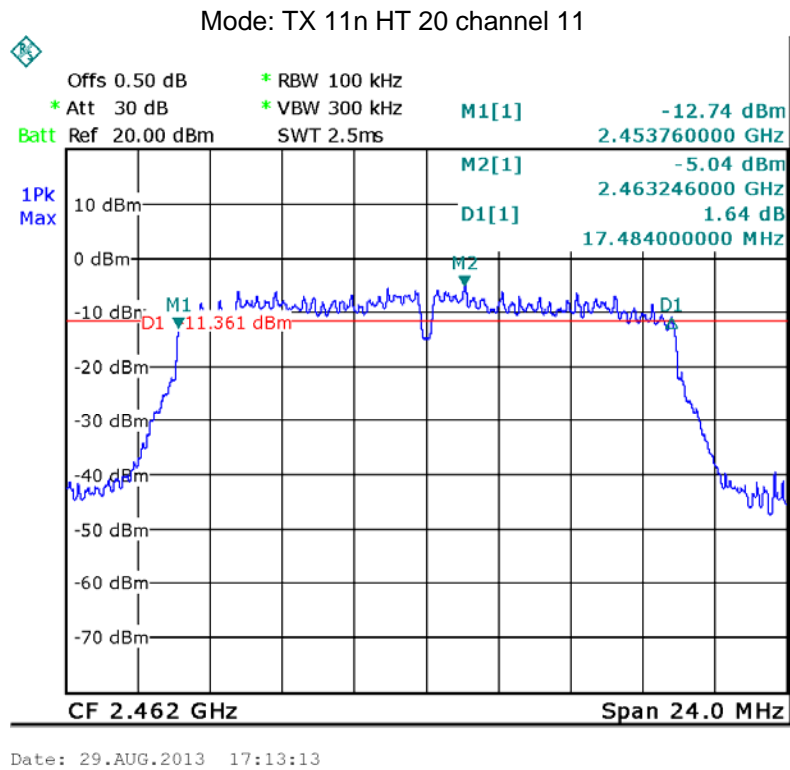
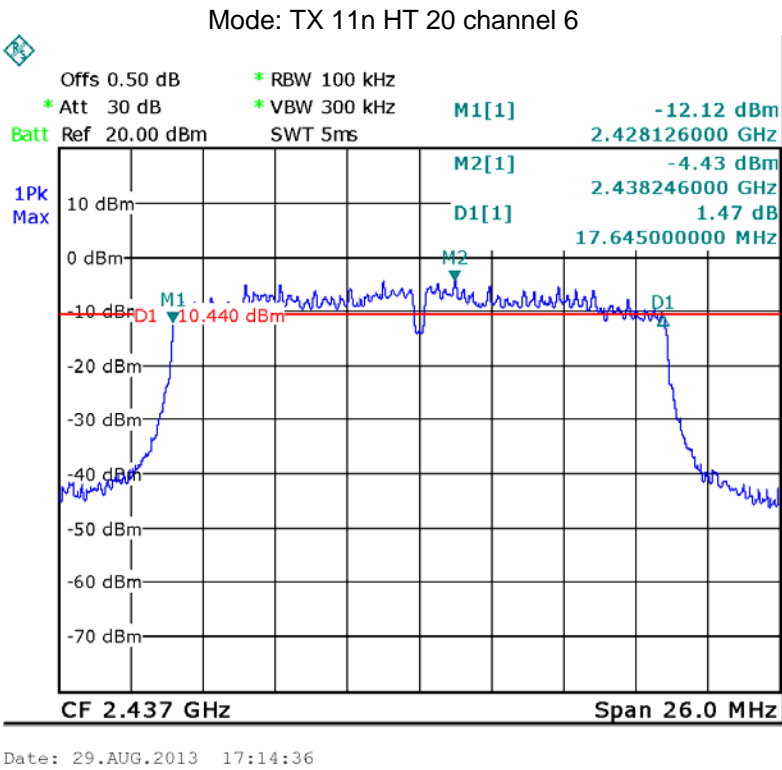


Date: 29.AUG.2013 17:07:10



Date: 29.AUG.2013 17:08:32





10 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB558074 D01 V02 10/04/2012

10.1 Test Procedure:

KDB558074 D01 V02 10/04/2012 section 8.1.2 Option 2

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak, Set the span to fully encompass the DTS bandwidth.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

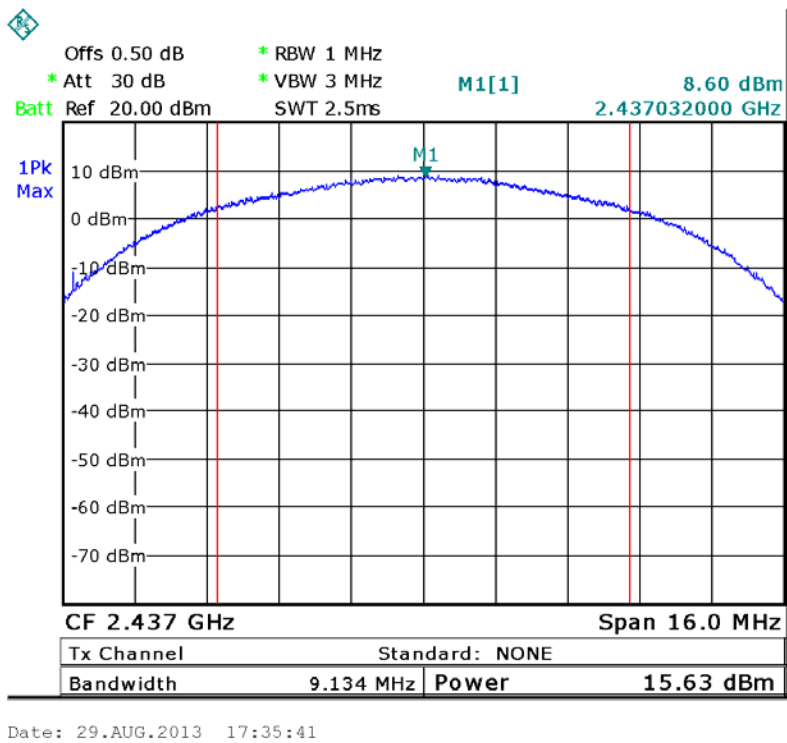
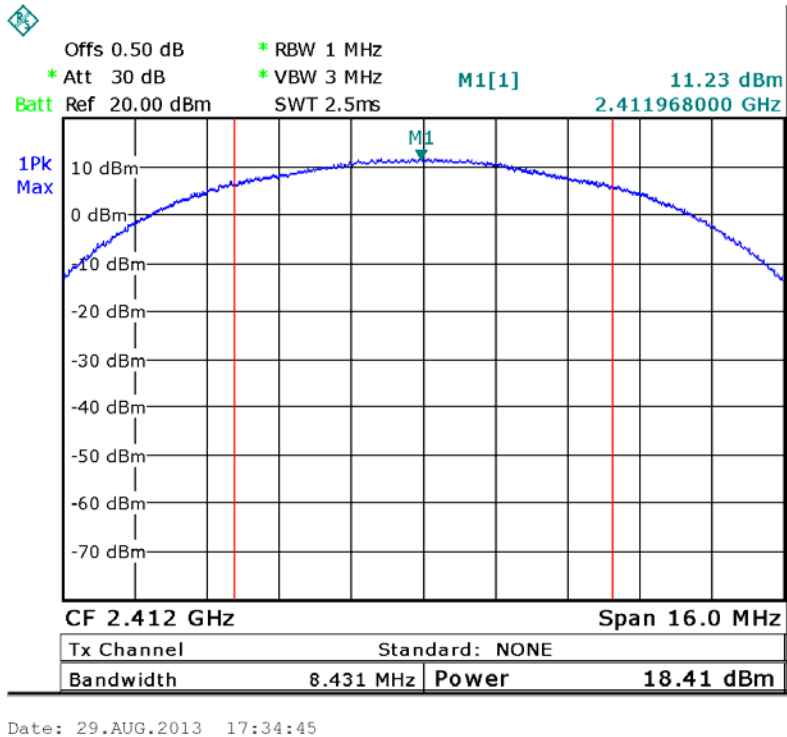
10.2 Test Result:

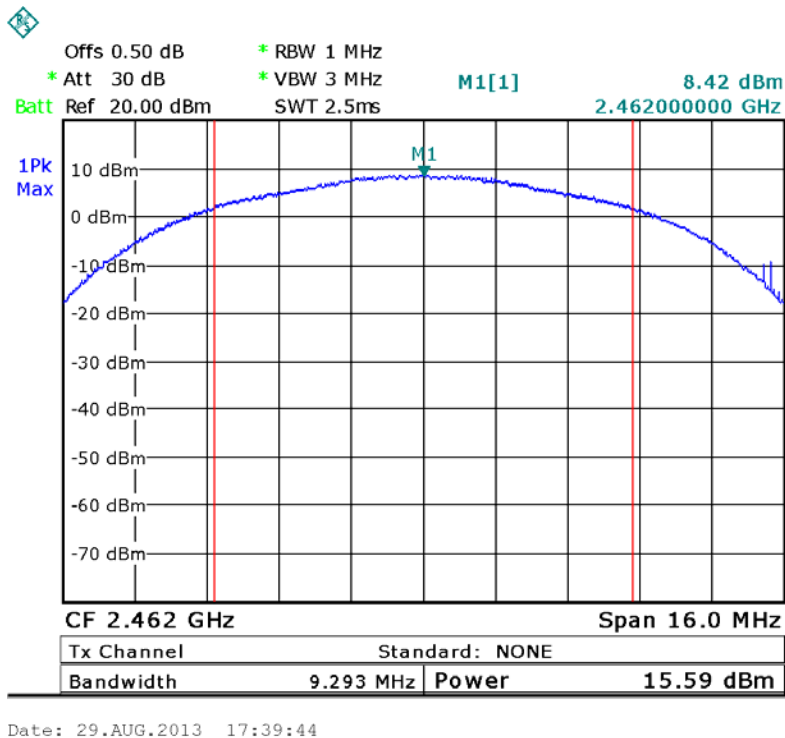
Test mode :TX 11b		
10 Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
18.41	15.63	15.59
Limit		
1W/30dBm		

Test mode :TX 11g		
10 Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
18.17	18.23	16.24
Limit		
1W/30dBm		

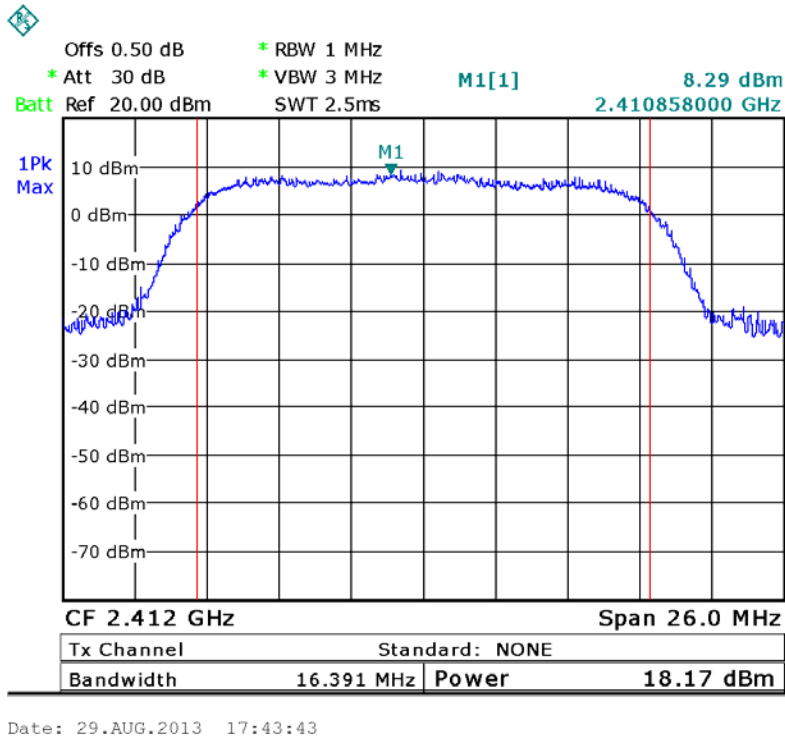
Test mode :TX 11n HT 20		
10 Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
17.13	15.60	14.91
Limit		
1W/30dBm		

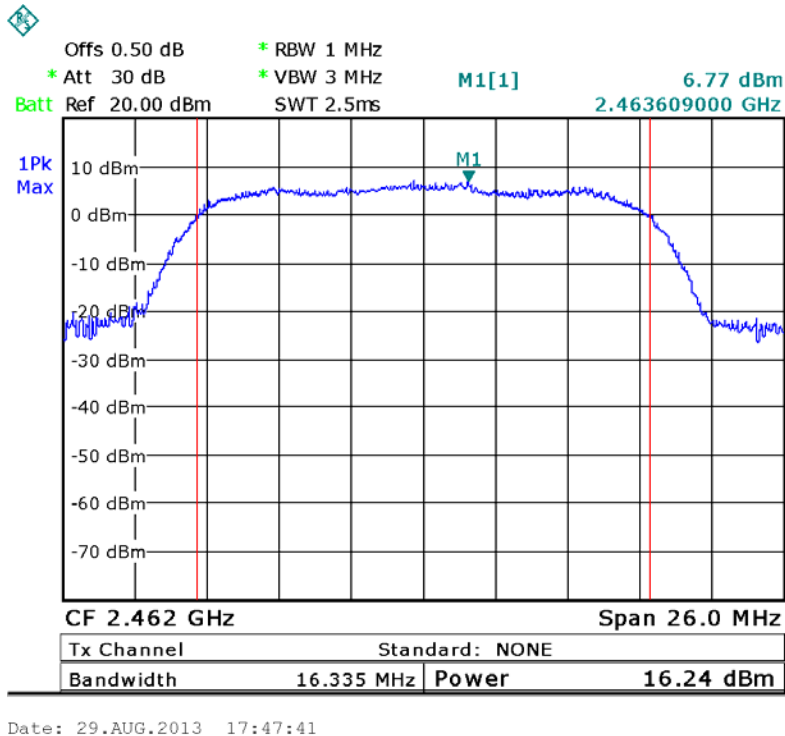
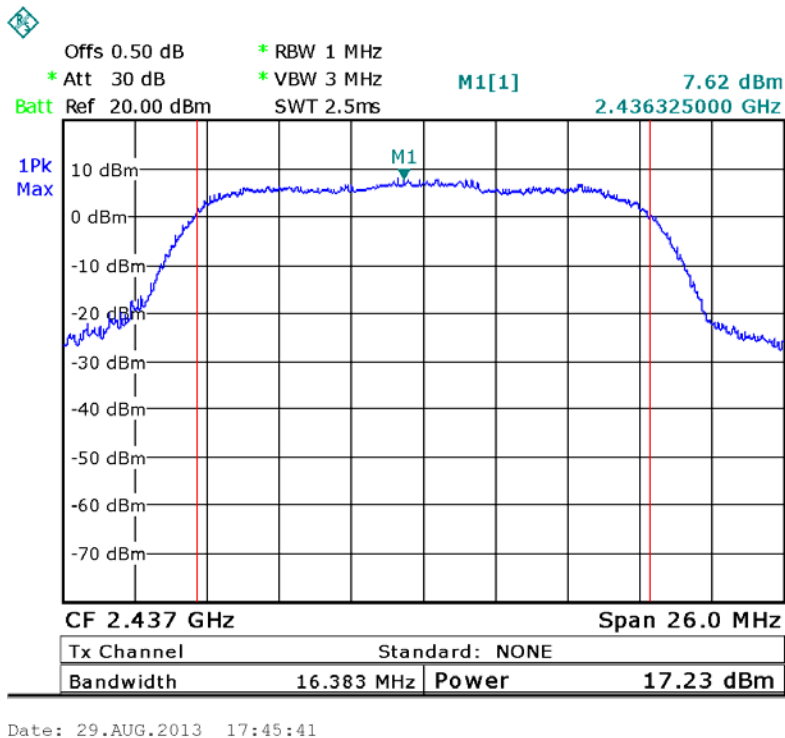
Test mode :TX 11b



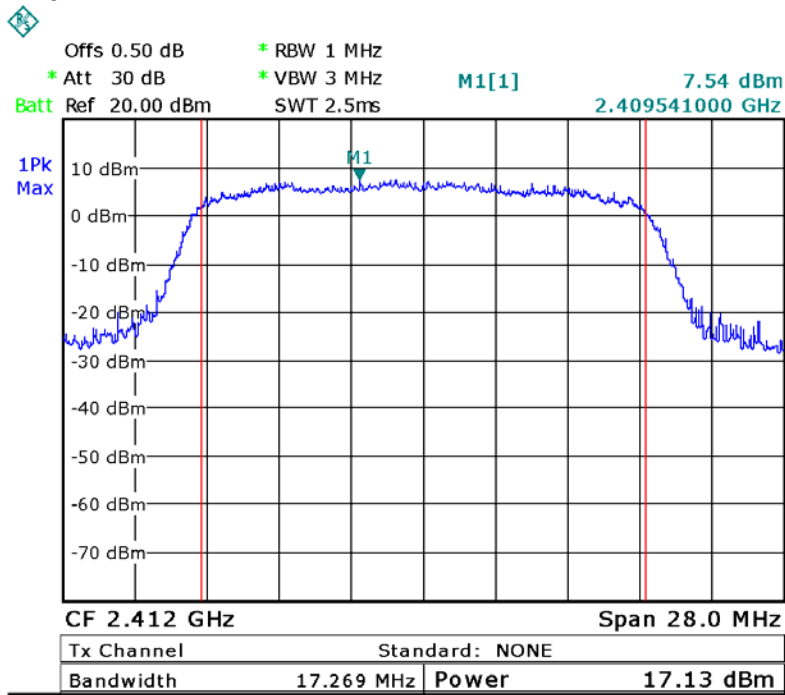


Test mode :TX 11g

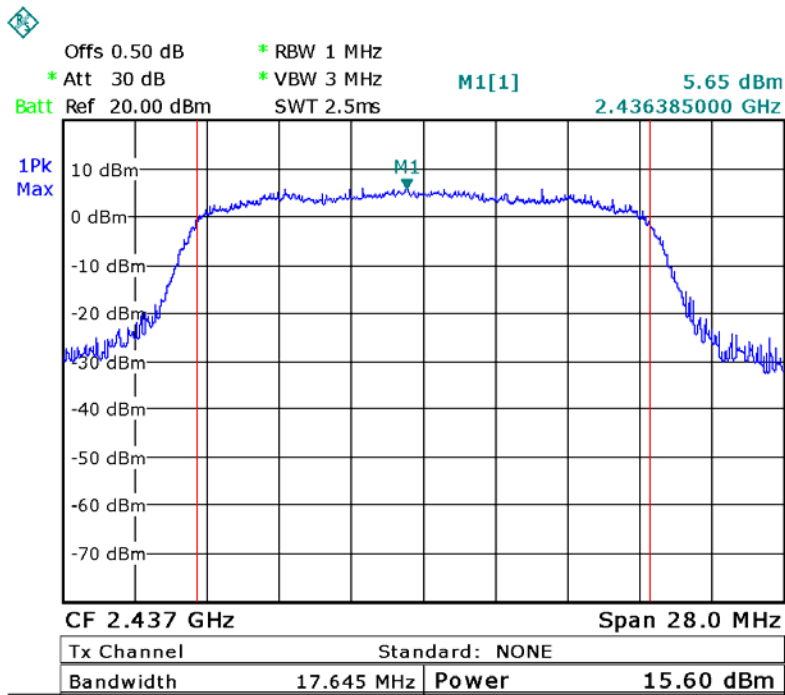




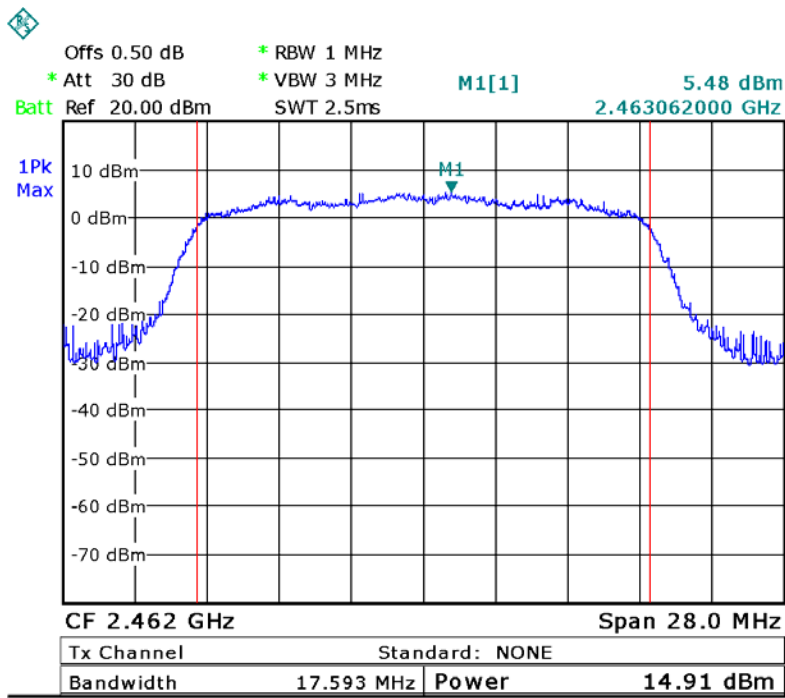
Test mode :TX 11n HT 20



Date: 29.AUG.2013 17:50:14



Date: 29.AUG.2013 17:51:34



Date: 29.AUG.2013 17:53:42

11 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB558074 D01 V02 10/04/2012

11.1 Test Procedure:

KDB558074 D01 V02 10/04/2012 section 9.1 Option 1

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section
Submit this plot.

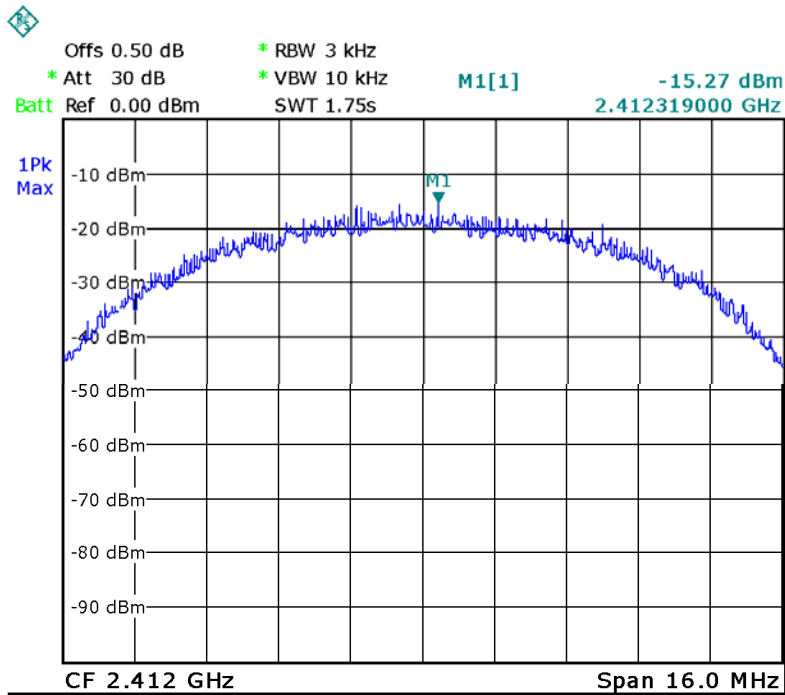
11.2 Test Result:

Test mode :TX 11b		
10 Maximum Peak Output Power (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-15.27	-18.89	-19.78
8dBm per 3kHz		

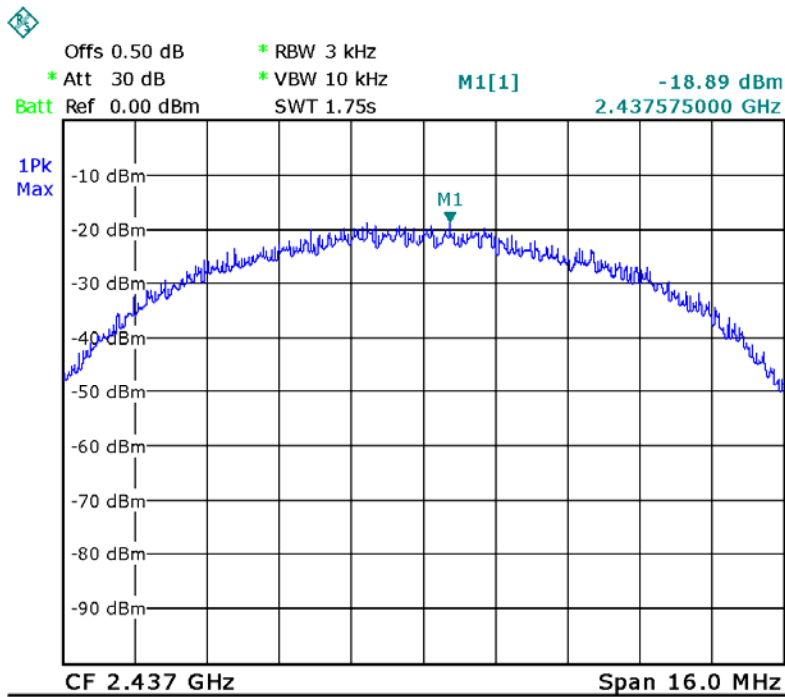
Test mode :TX 11g		
10 Maximum Peak Output Power (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-19.11	-22.68	-24.56
Limit		
8dBm per 3kHz		

Test mode :TX 11n HT 20		
10 Maximum Peak Output Power (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-18.97	-21.49	-25.17
Limit		
8dBm per 3kHz		

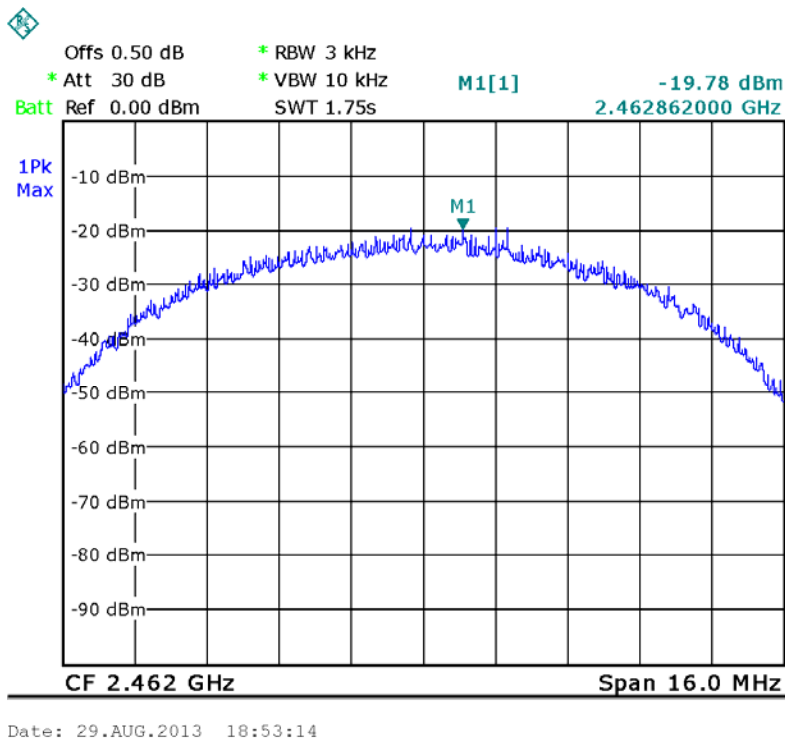
Test mode :TX 11b



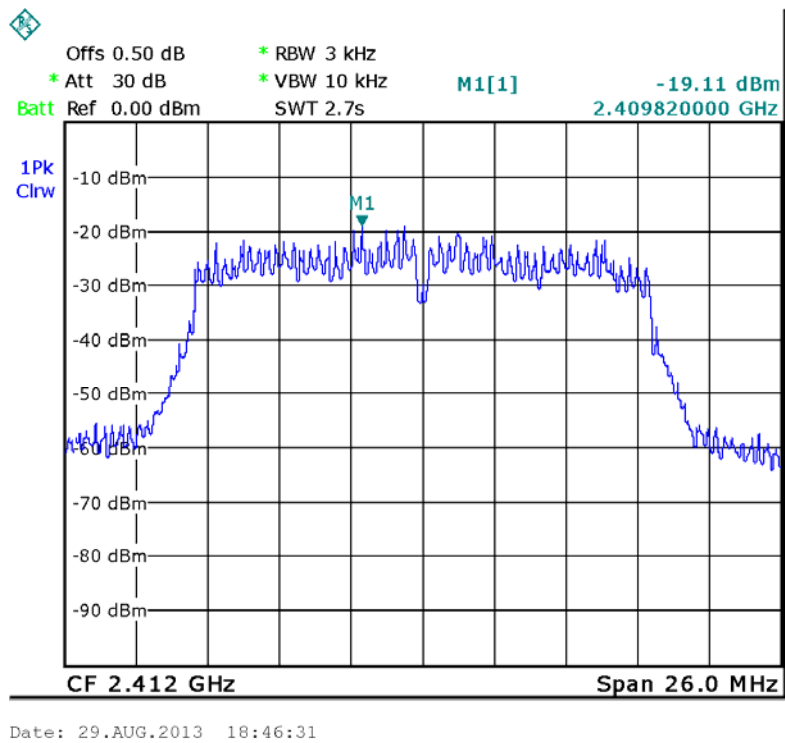
Date: 29.AUG.2013 18:52:01

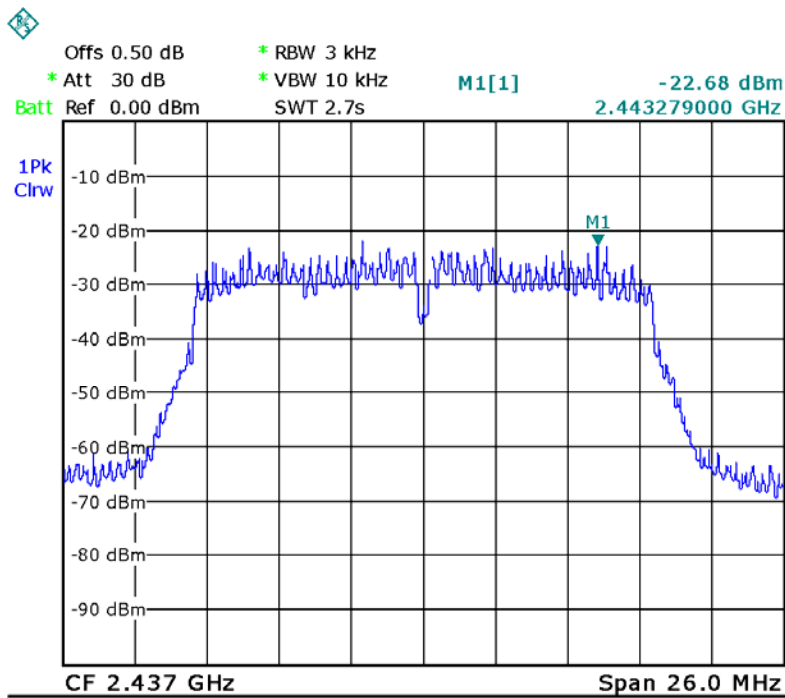


Date: 29.AUG.2013 18:51:04

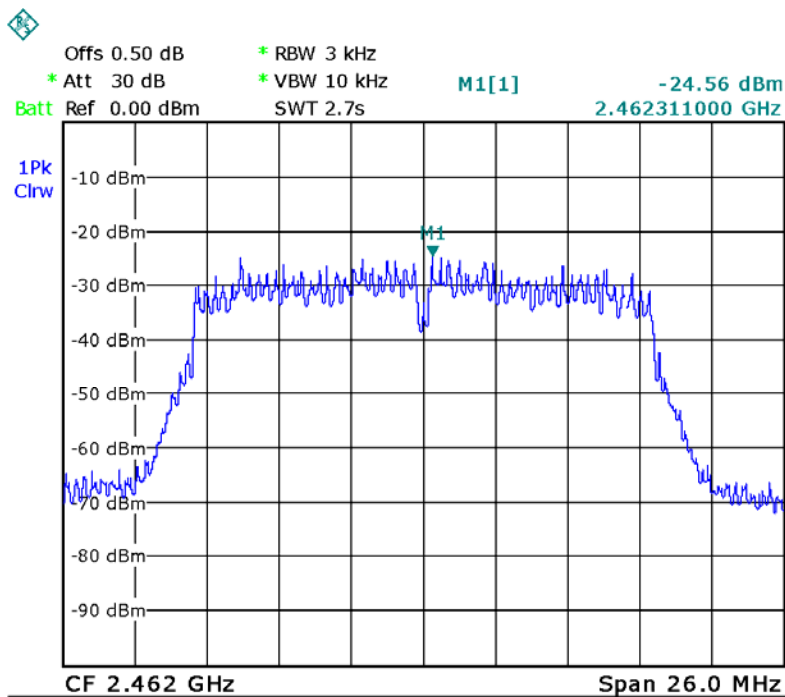


Test mode :TX 11g



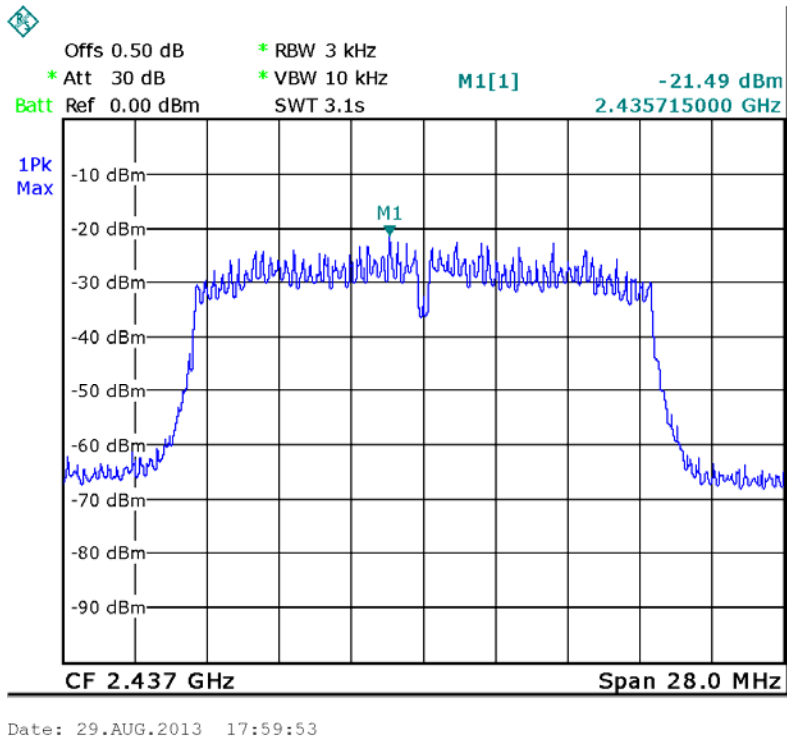
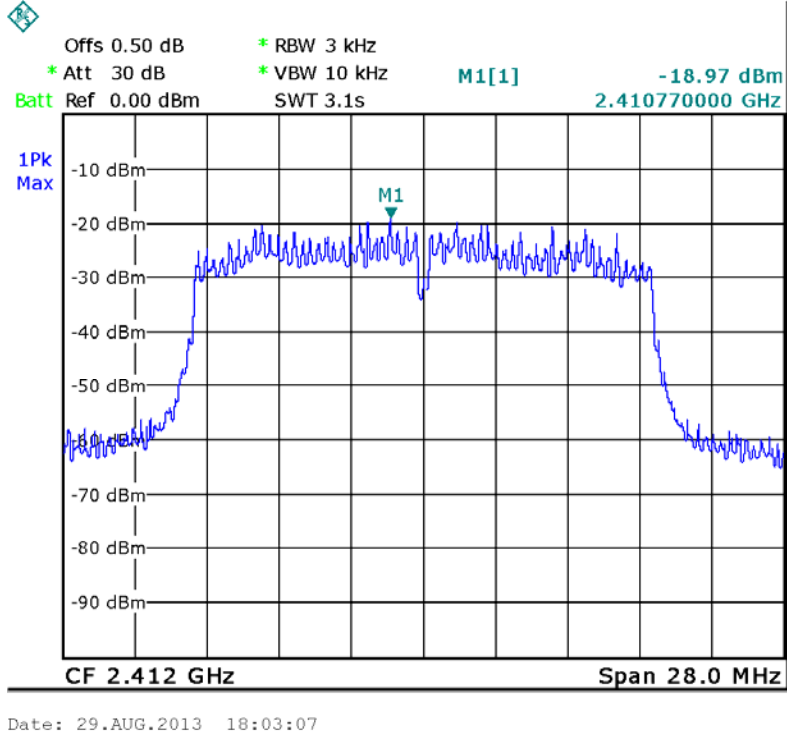


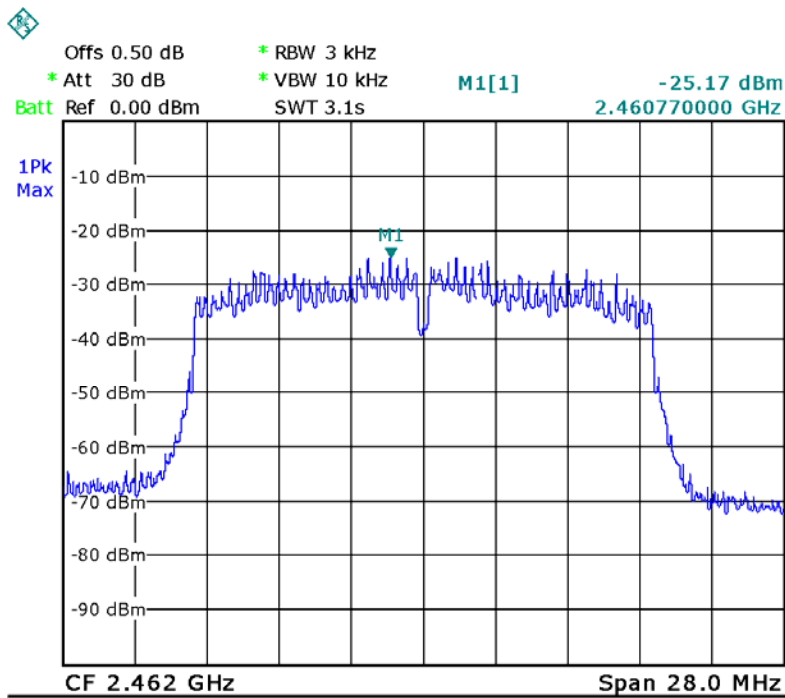
Date: 29.AUG.2013 18:47:42



Date: 29.AUG.2013 18:49:01

Test mode :TX 11n HT 20





Date: 29.AUG.2013 17:55:29

12 Emissions from out of band

Test Requirement:	FCC CFR47 Part 15 Section 15.247(d)
Test Method:	KDB558074 D01 V02 10/04/2012
Test Limit:	Emissions produced by the device outside the authorized frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the fundamental.
Test Mode:	Test in fixing operating frequency at lower, middle, upper channel.

12.1 Test Procedure:

KDB558074 D01 V02 10/04/2012 section 10.1 clause1

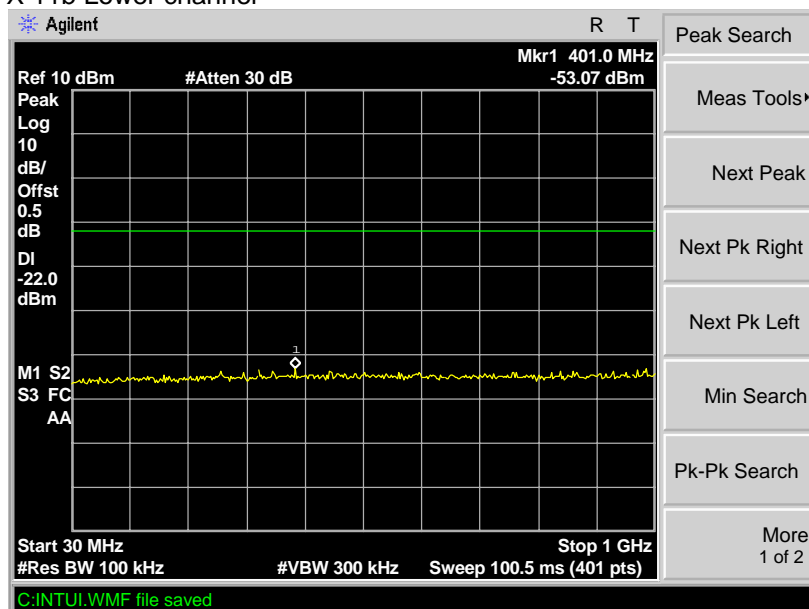
The maximum peak conducted output power procedure was used to demonstrate compliance to 15.247(b)(3) requirements, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz. This measurement was performed over a frequency range that spans from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency.

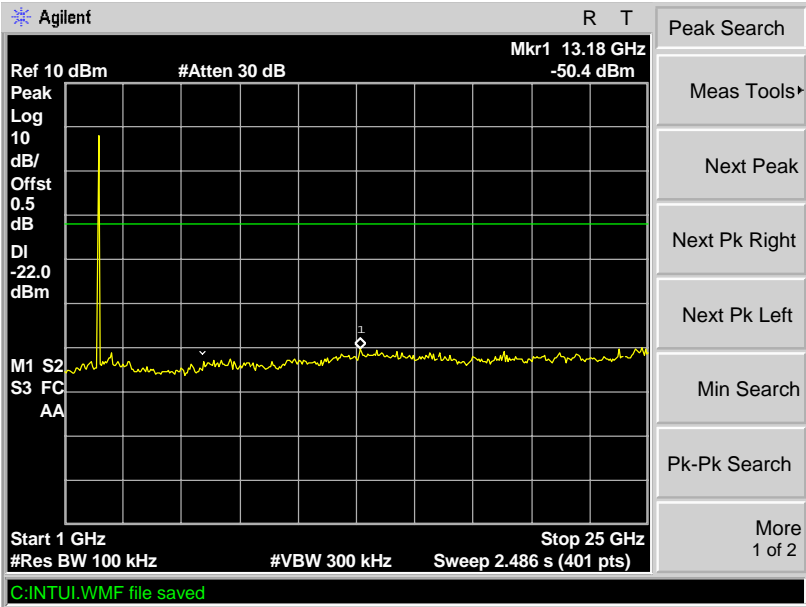
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency
3. For below 1GHz, Set RBW = 100kHz and VBW = 100kHz. Sweep = auto. For above 1GHz, Set RBW = 100kHz and VBW = 100kHz. Sweep = auto.
4. mark the worst point and record.

12.2 Test Result:

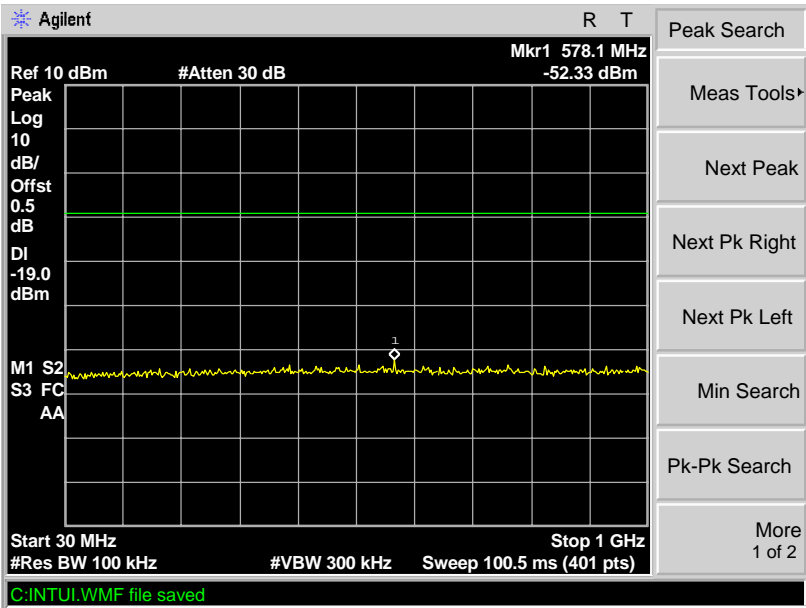
Remark: For emissions below 30MHz, no emission higher than background level, so the data does not show in the report.

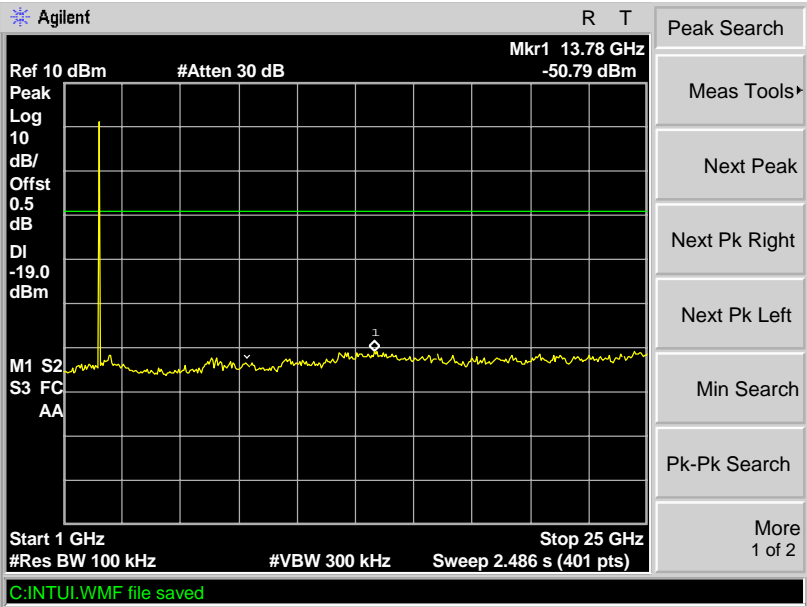
Test mode :TX 11b Lower channel



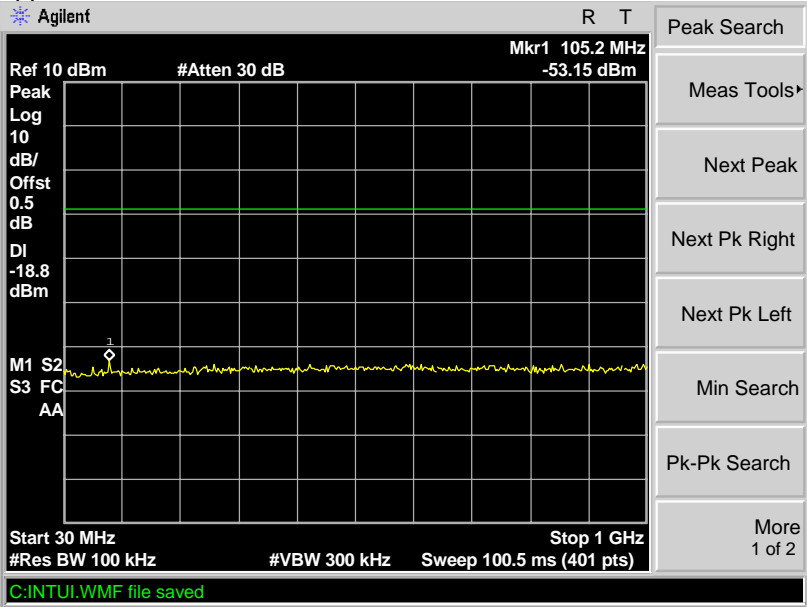


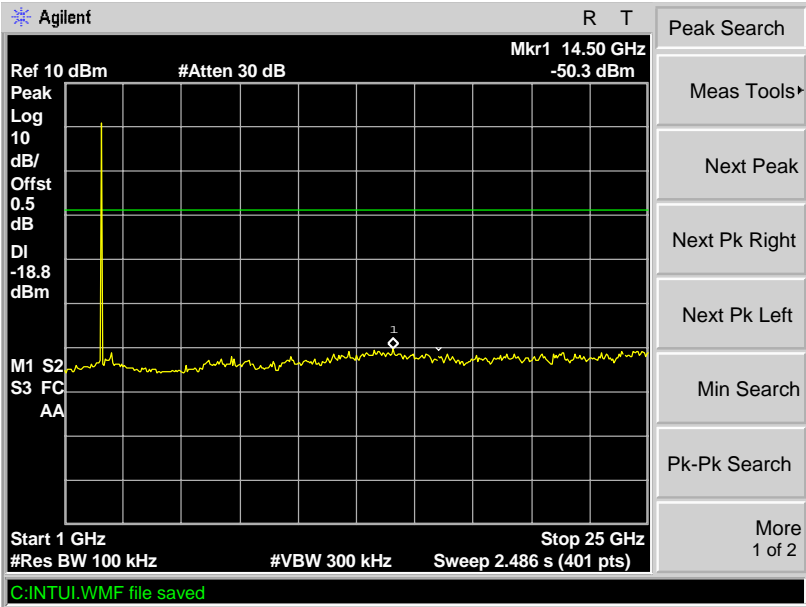
Test mode :TX 11b Middle channel



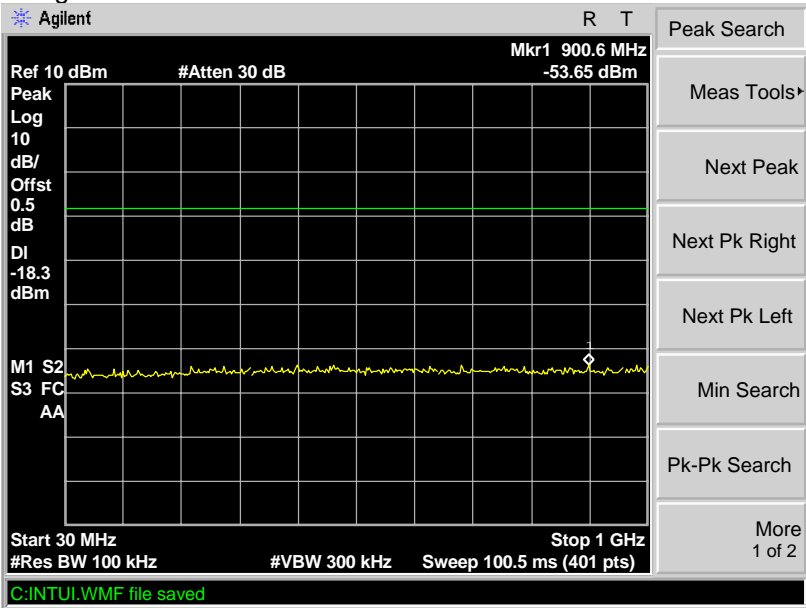


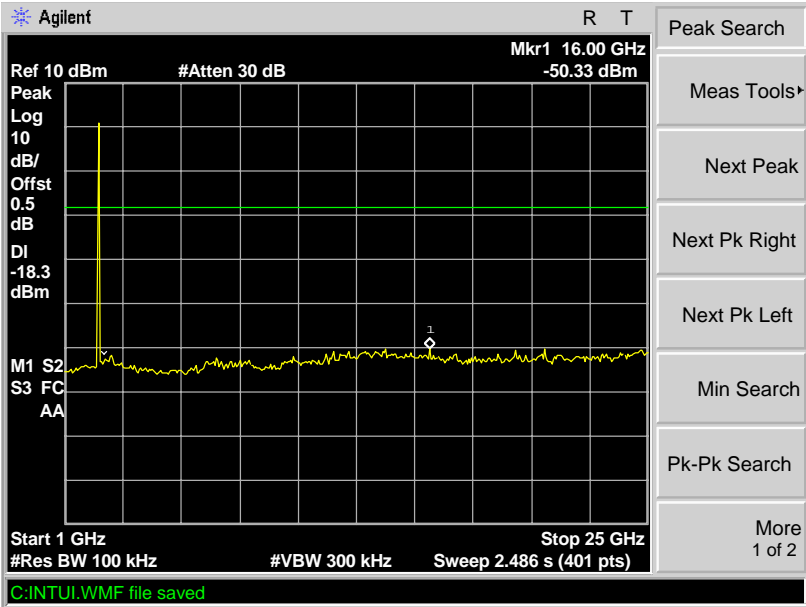
Test mode :TX 11b Upper channel



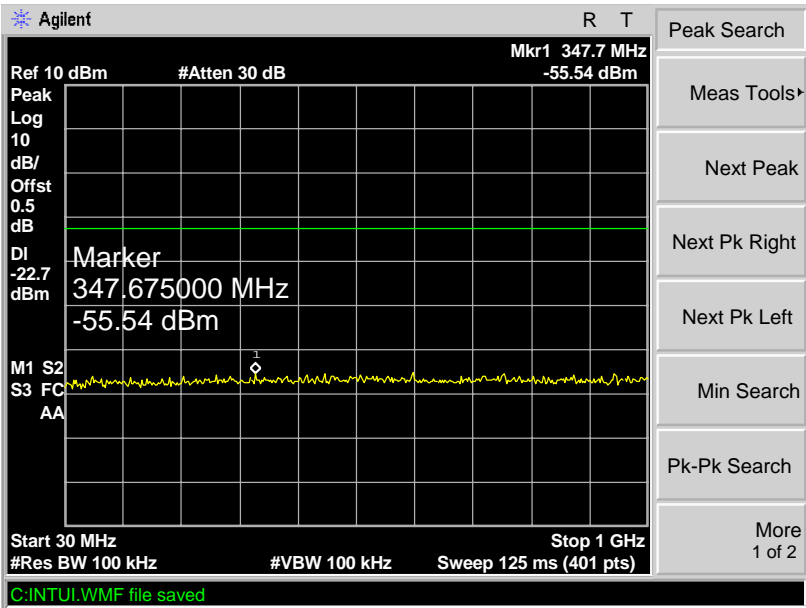


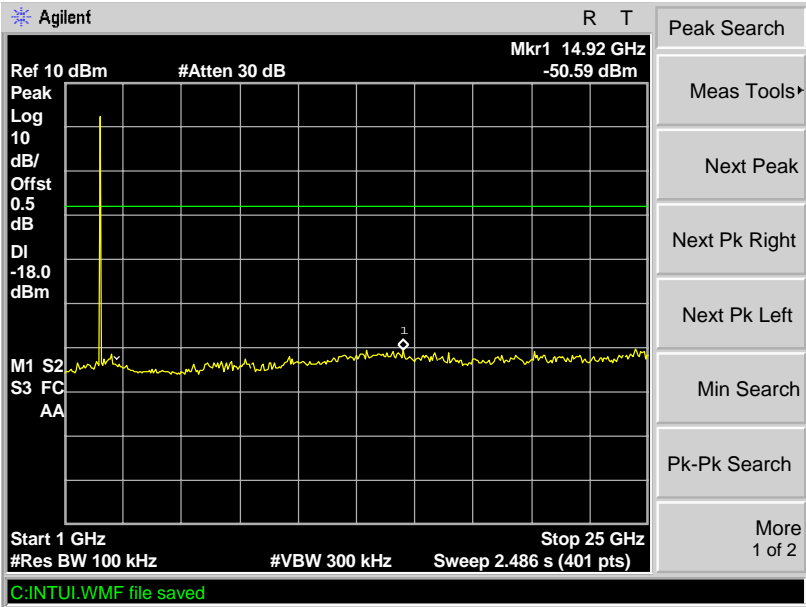
Test mode :TX 11g Lower channel



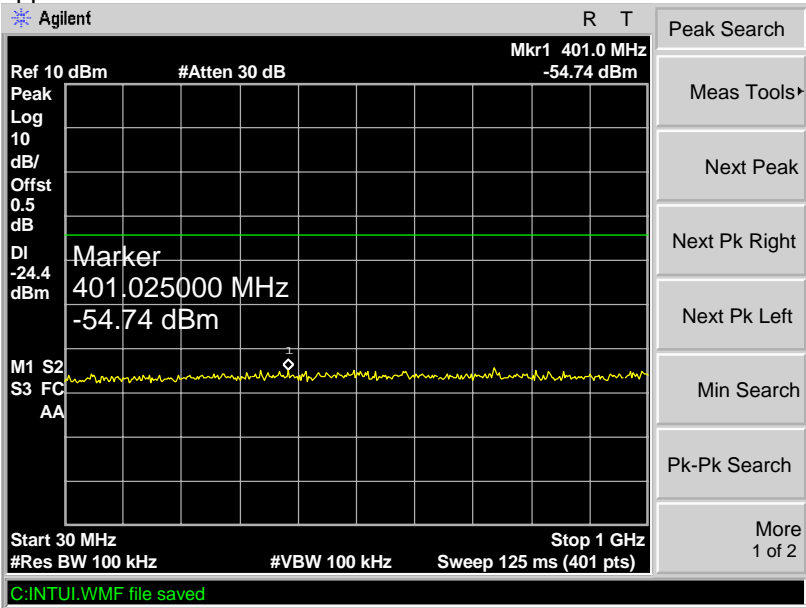


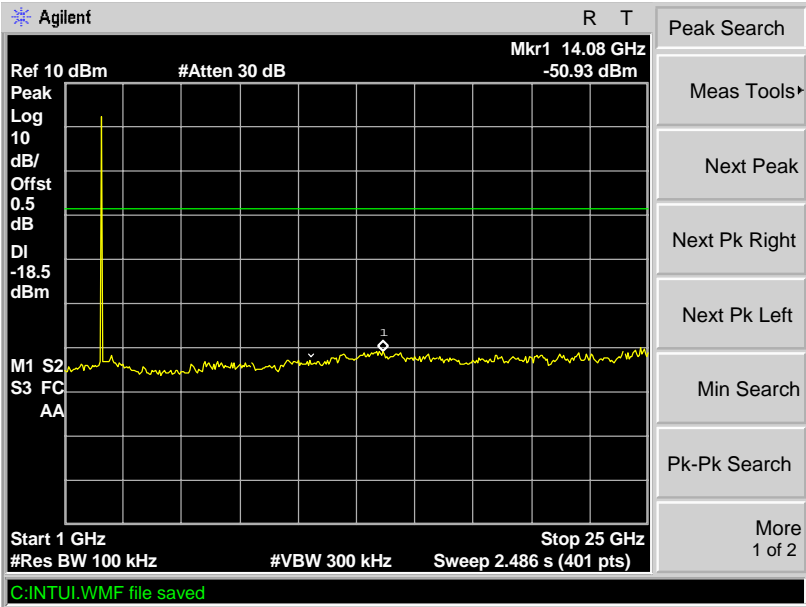
Test mode :TX 11g Middle channel



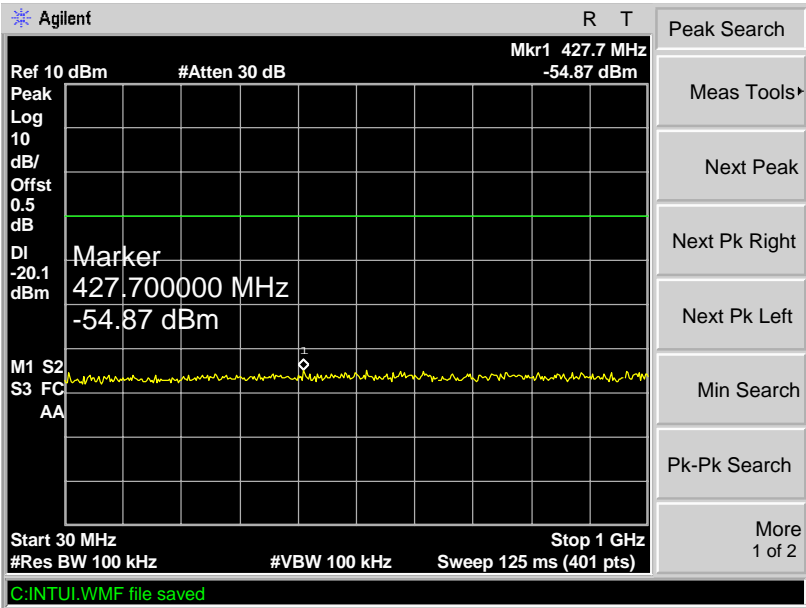


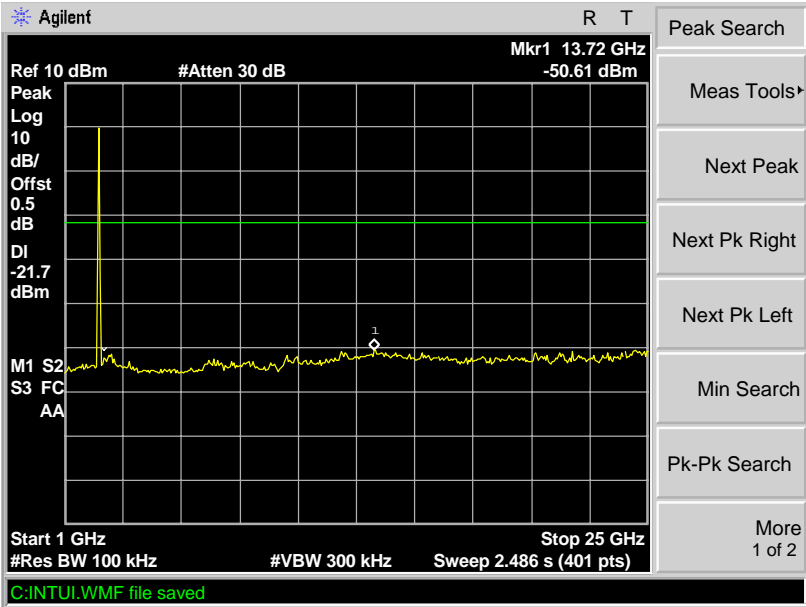
Test mode :TX 11g Upper channel



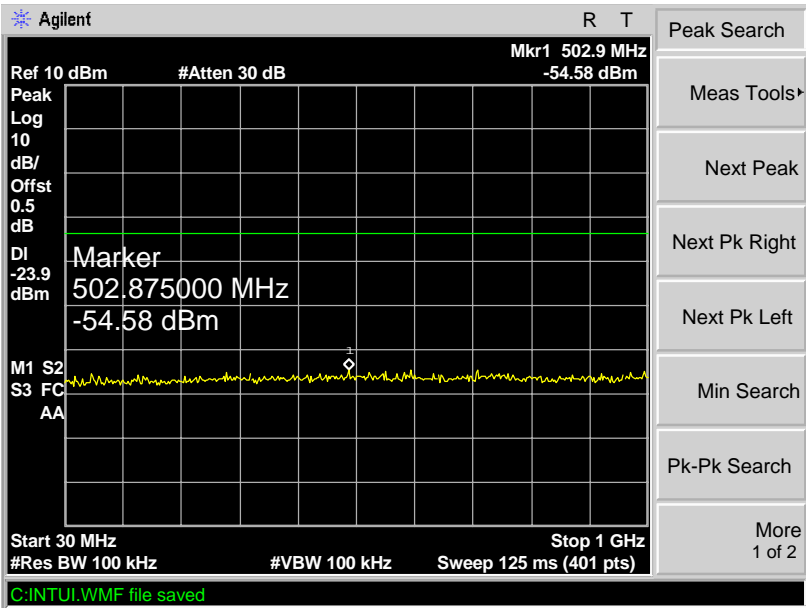


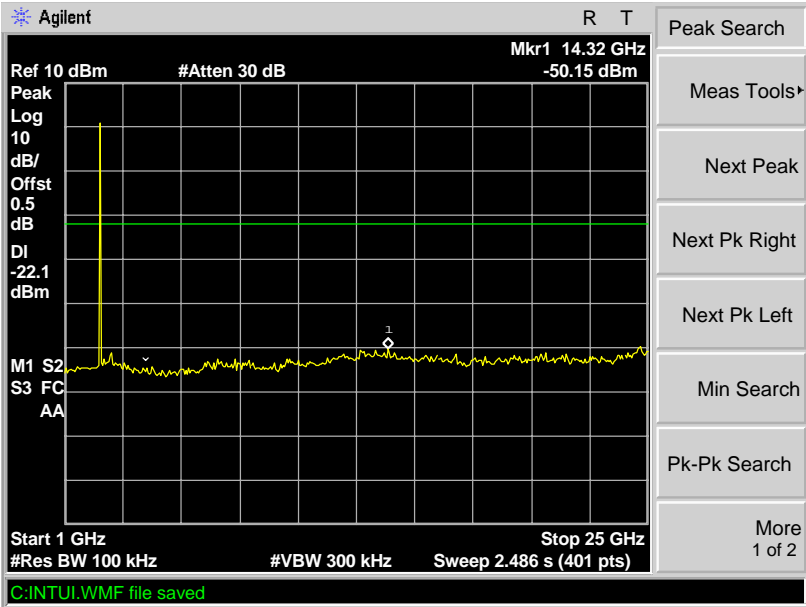
Test mode :TX 11n HT20 Lower channel



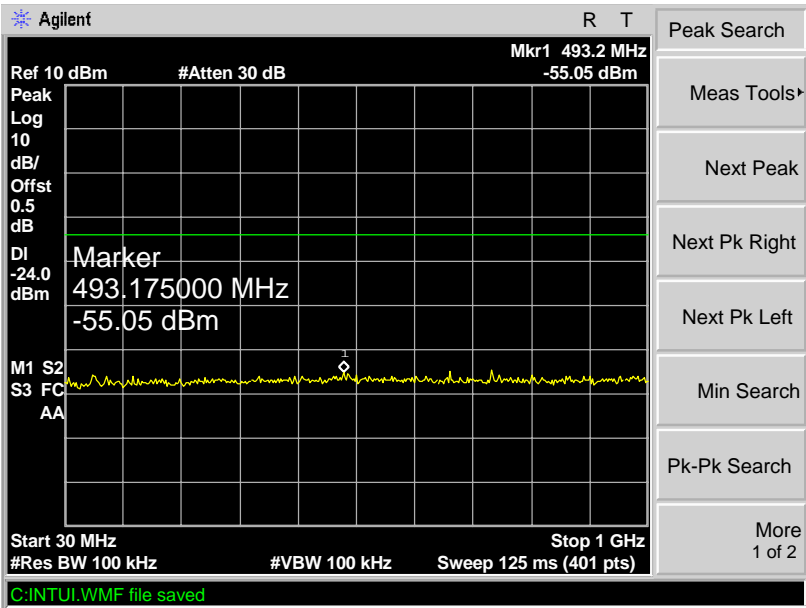


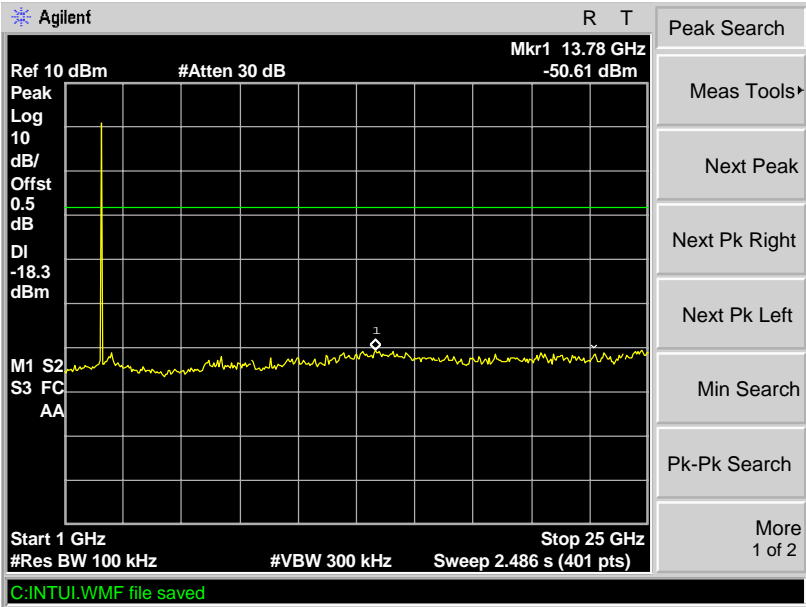
Test mode :TX 11n HT20 Middle channel





Test mode :TX 11n HT20 Upper channel





13 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a Airgain single band embedded antenna, fulfill the requirement of this section.

14 RF Exposure

Test Requirement: FCC Part 1.1307

Test Mode: The EUT work in test mode(Tx).

14.1 Requirements:

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

14.2 The procedures / limit

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

14.3 MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

Operation Mode	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
802.11b	3.16	18.41	69.34	0.044	1
802.11g	3.16	18.17	65.61	0.041	1
802.11n HT 20	3.16	17.13	51.64	0.032	1

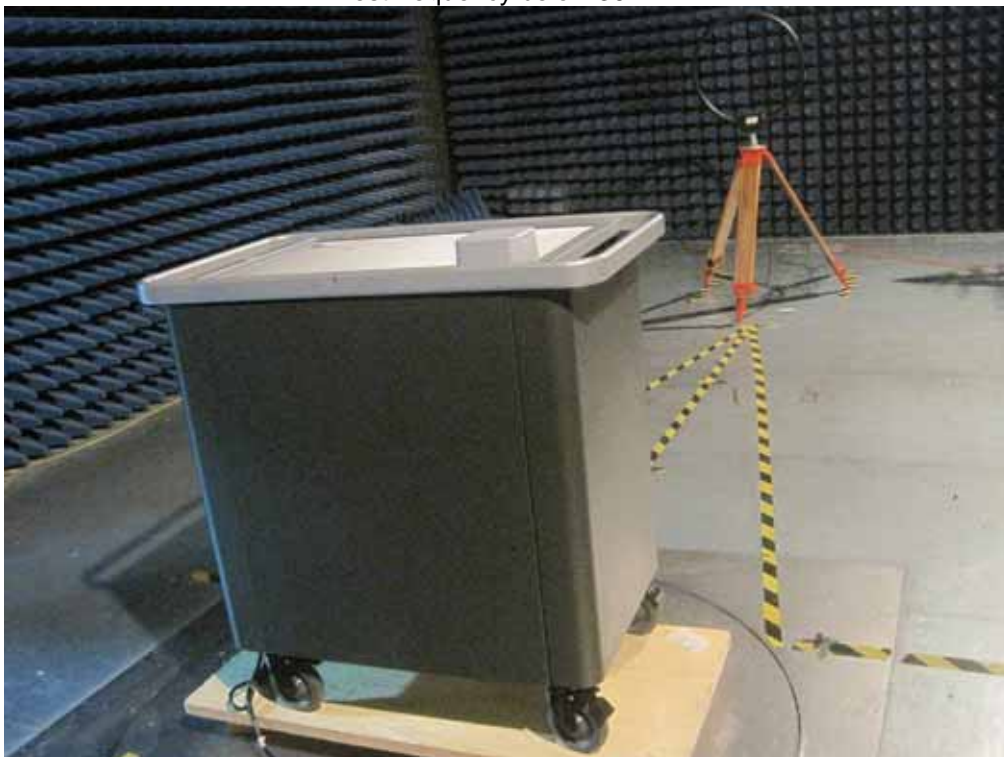
15 Photographs – Test Setup

15.1 Conducted Emission



15.2 Radiated Emission

Test frequency below 30MHz



Test frequency from 30MHz to 1GHz



Test frequency above 1GHz



16 Photographs - Constructional Details

16.1 EUT – External View for HE405LL/A







16.2 EUT – External View for HE407LL/A

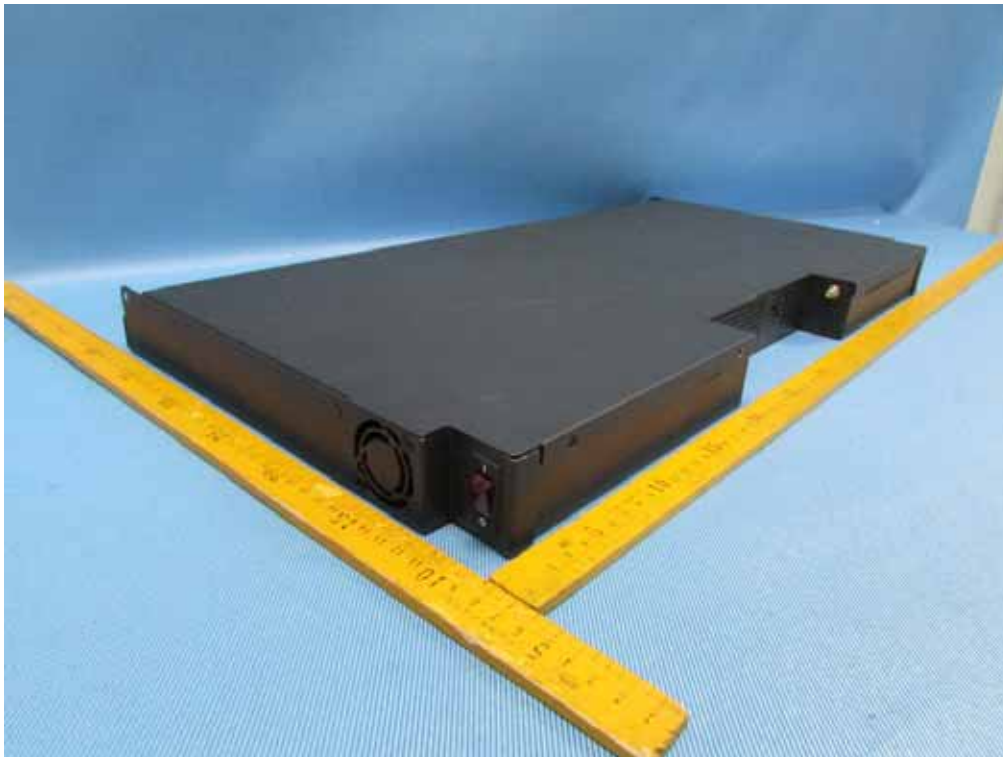




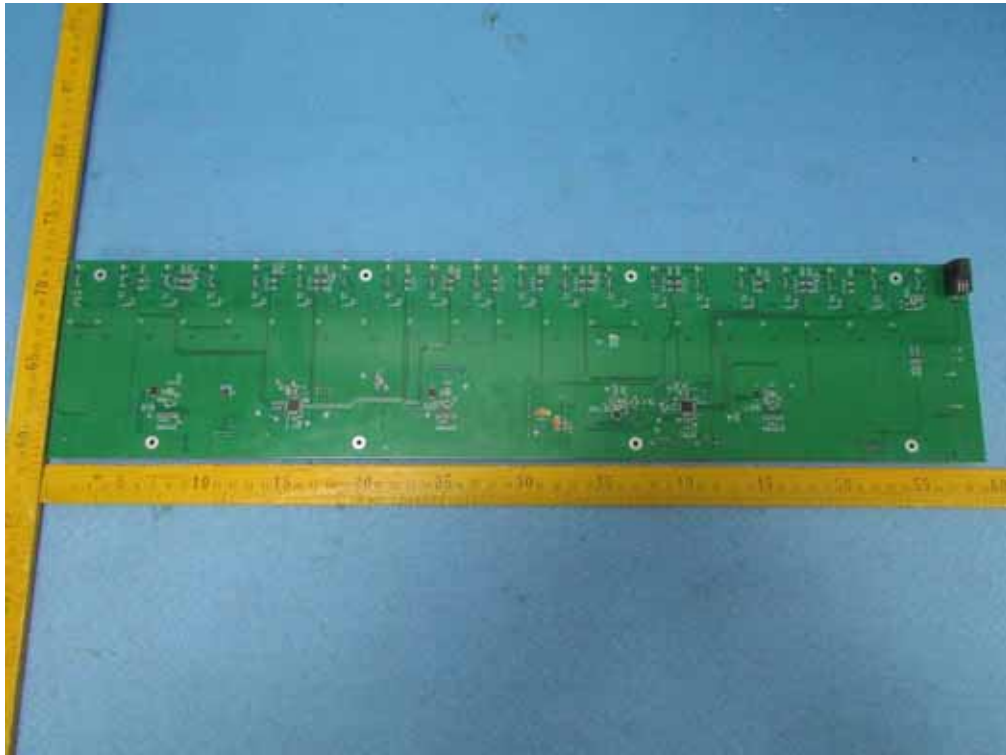
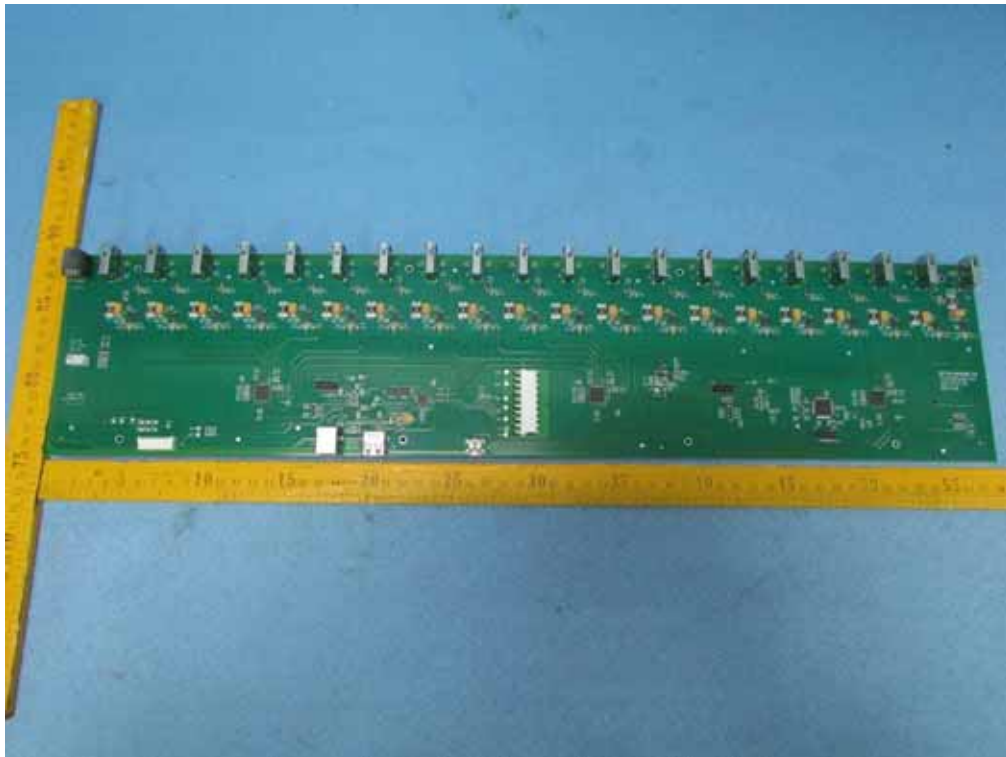


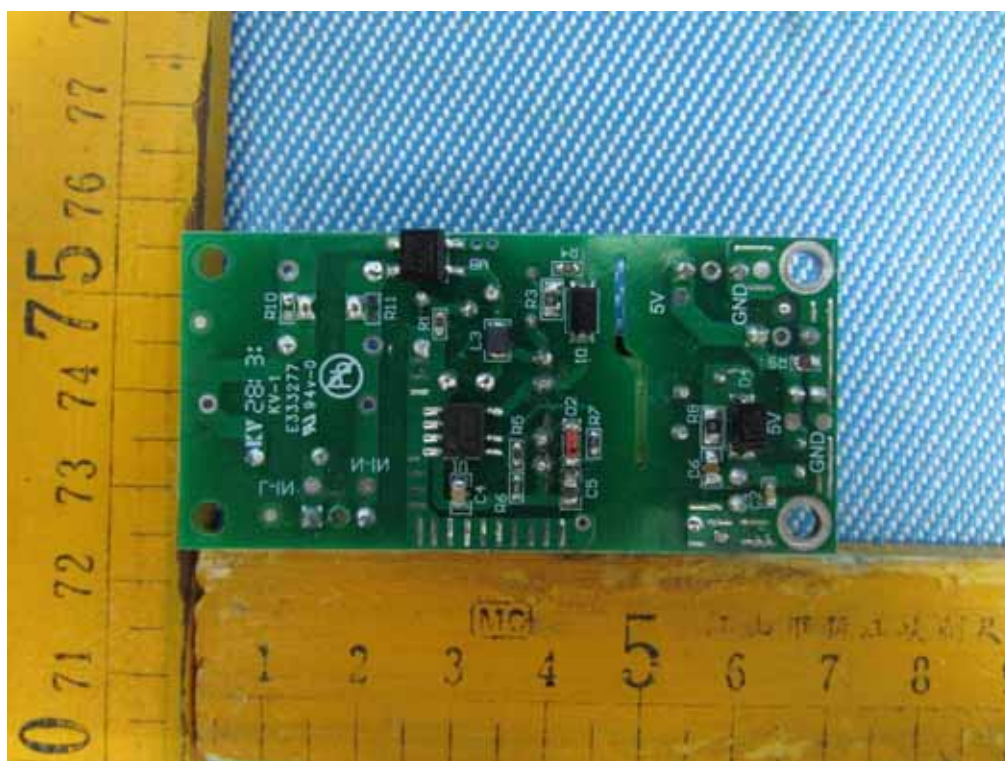
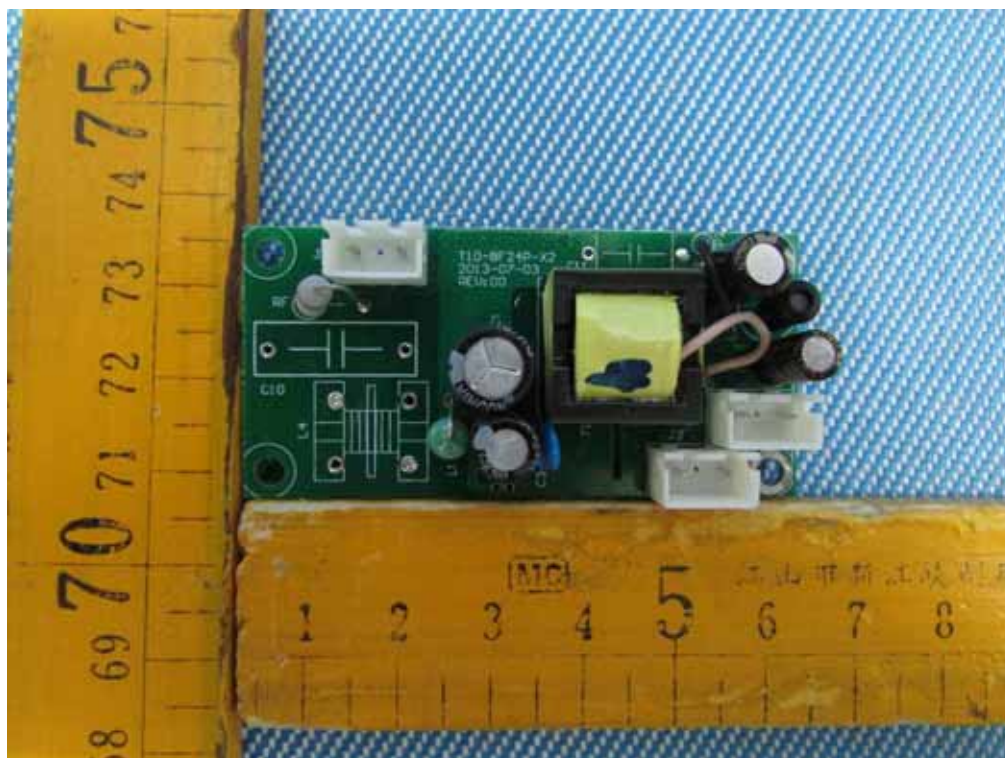
16.3 EUT- Internal View

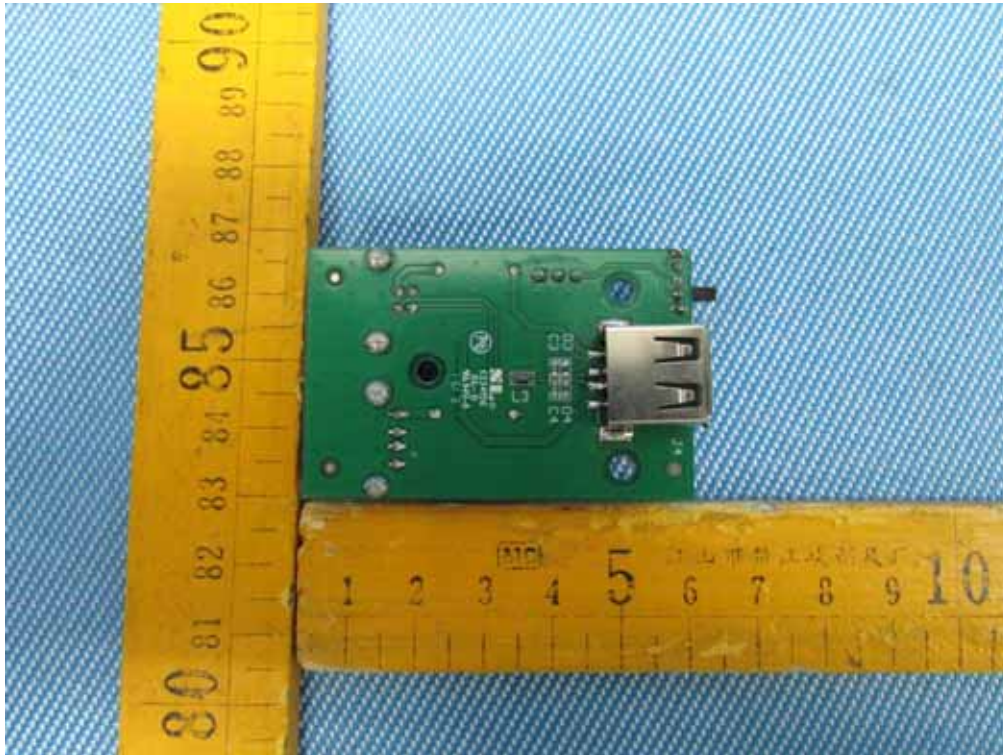
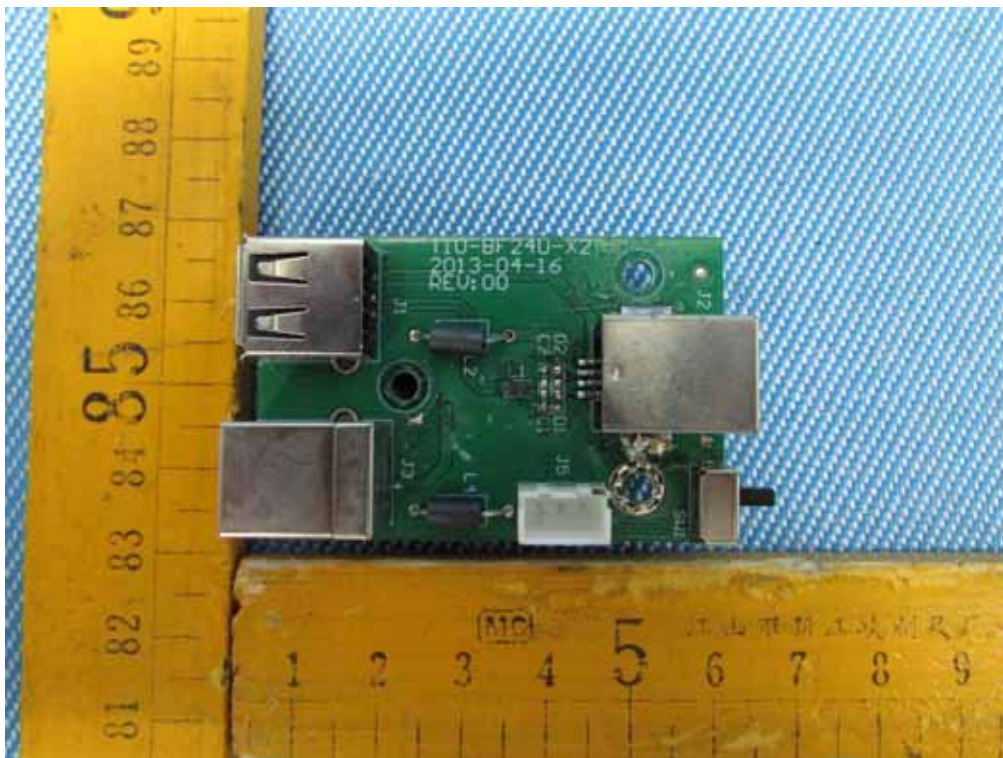


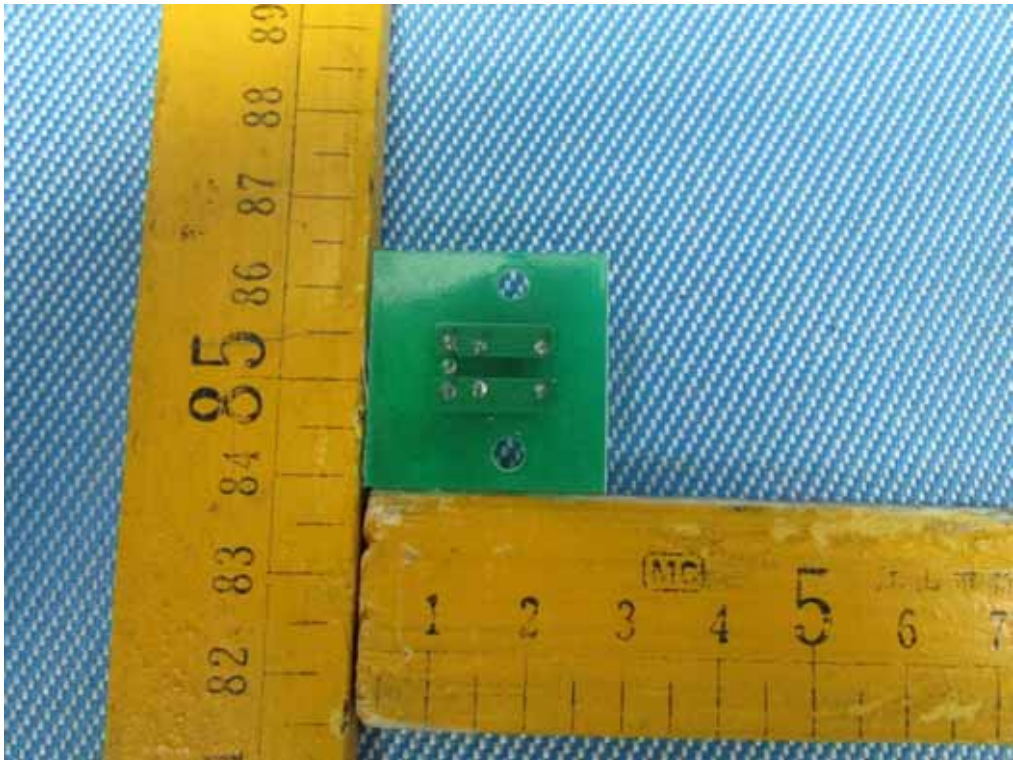
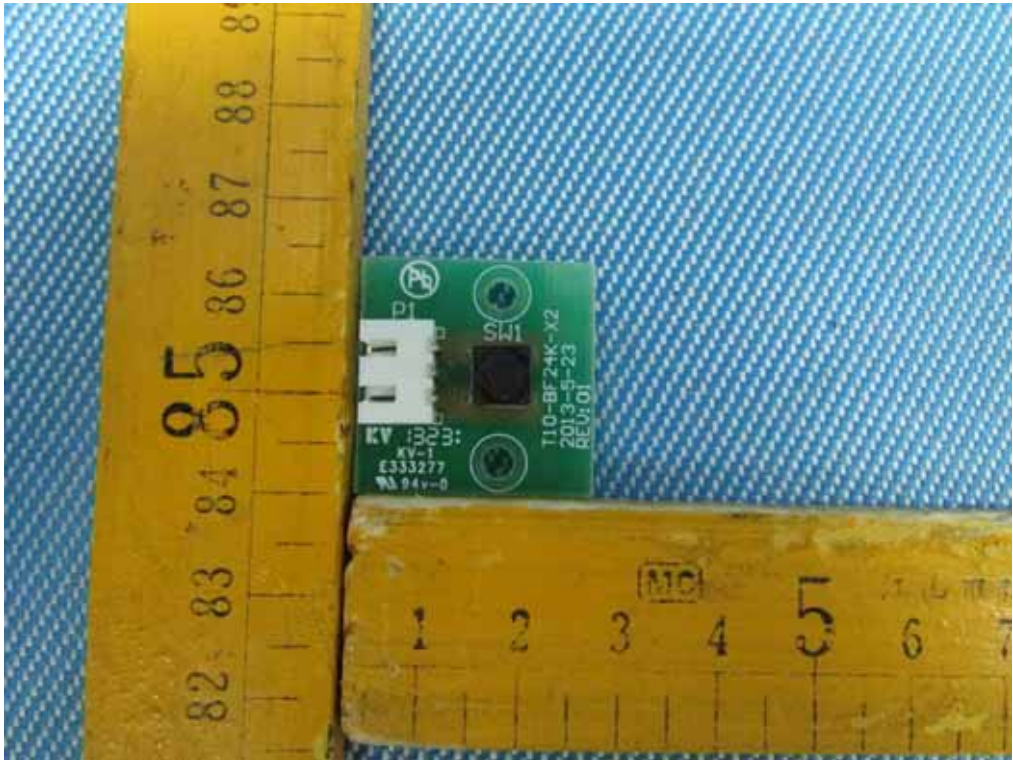


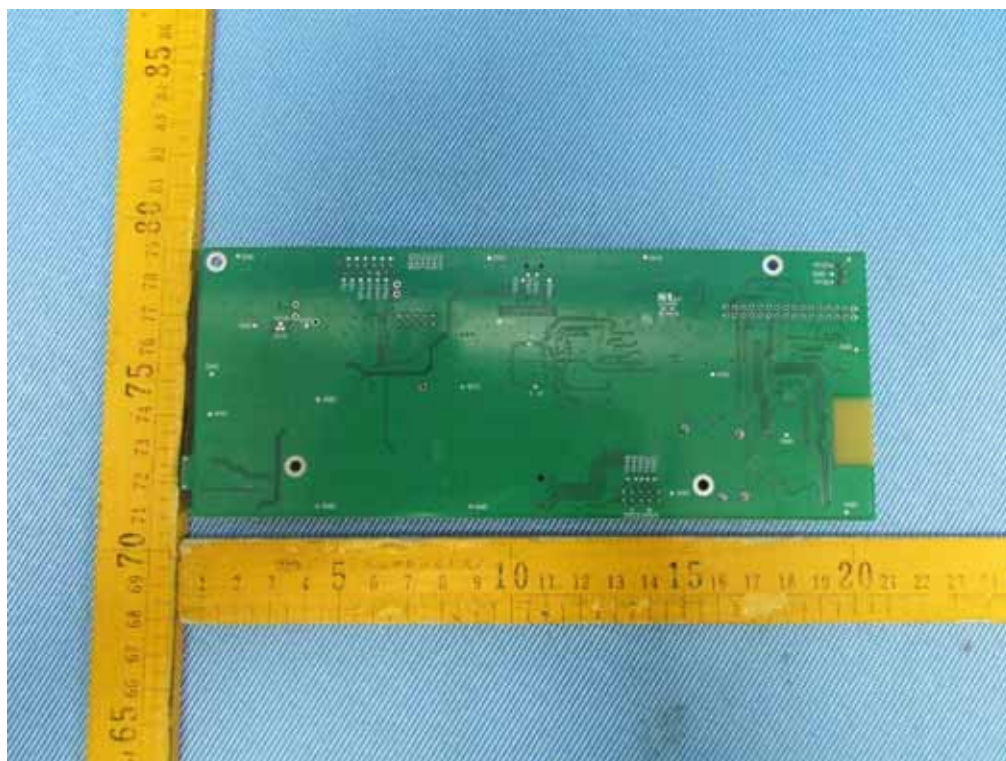
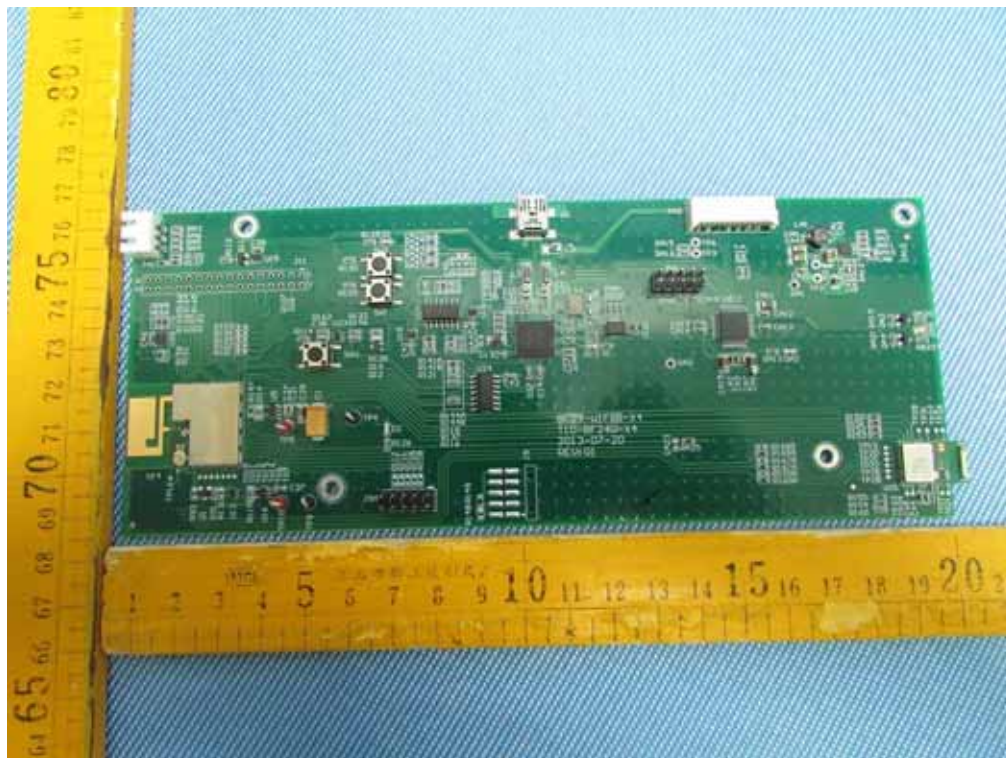






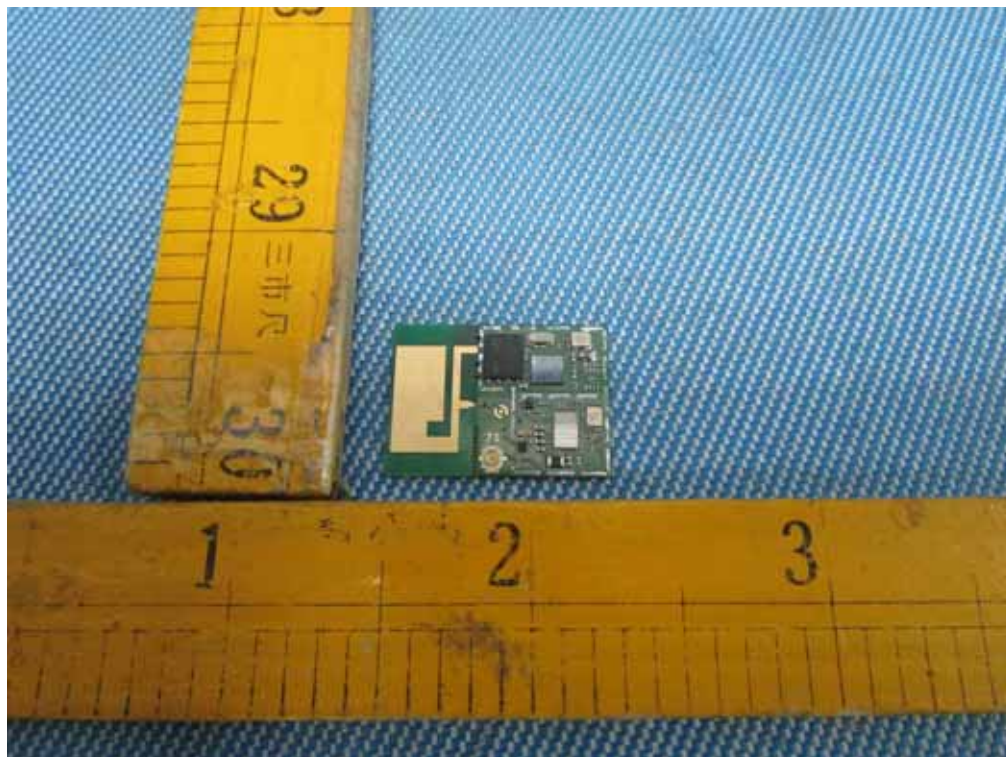
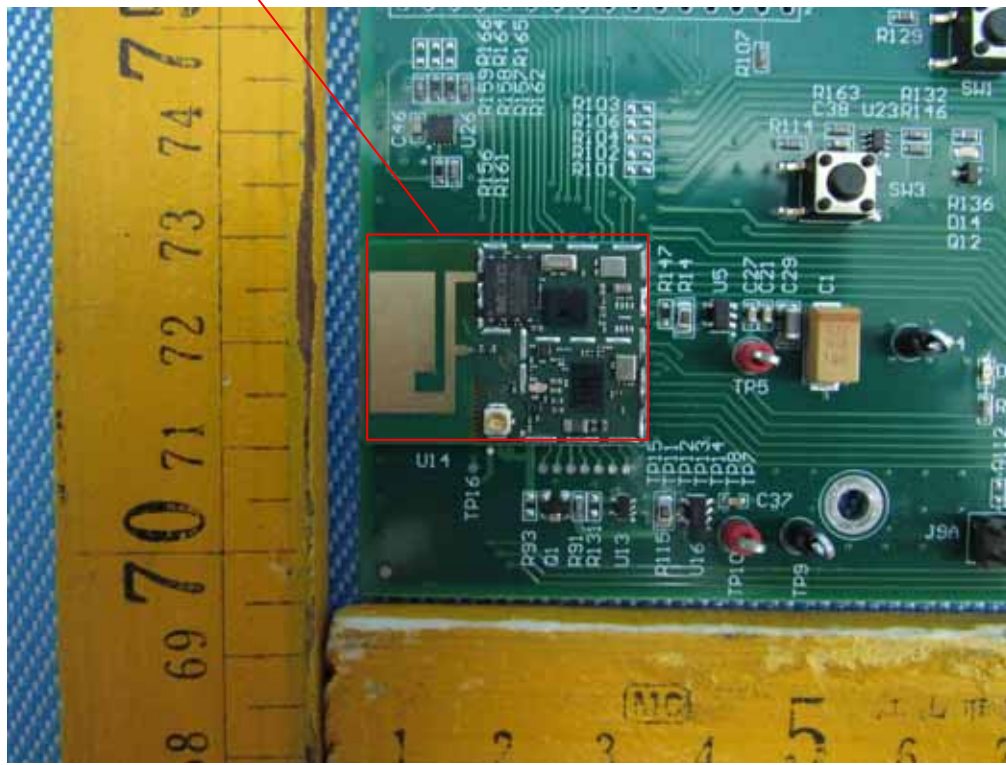


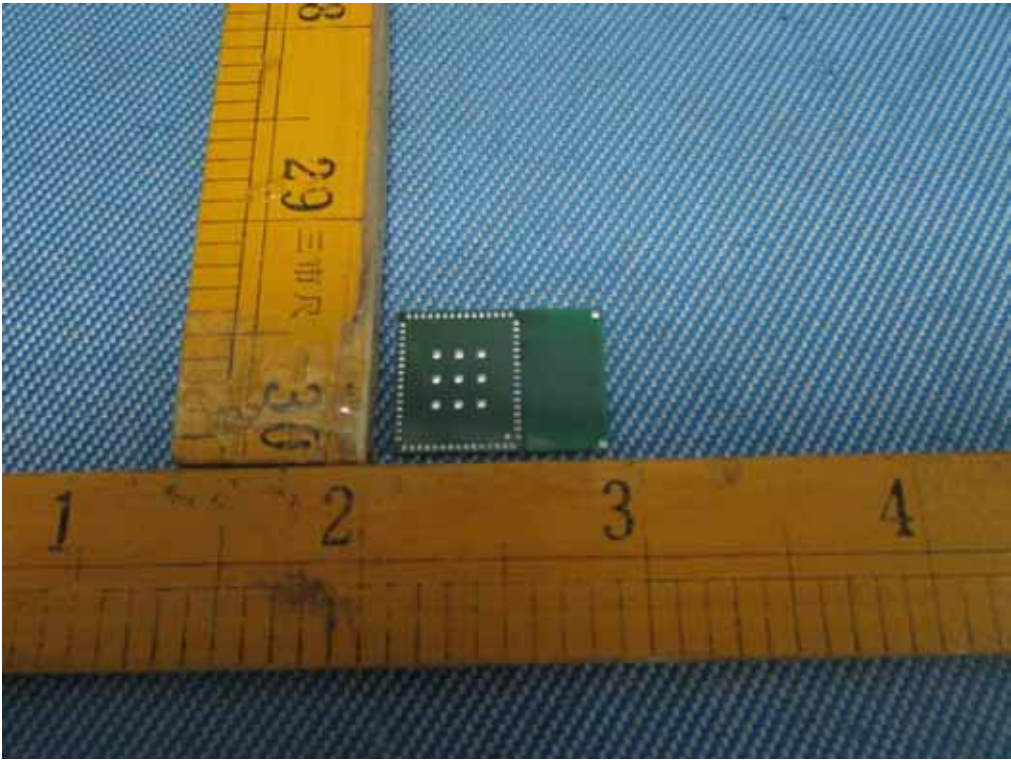




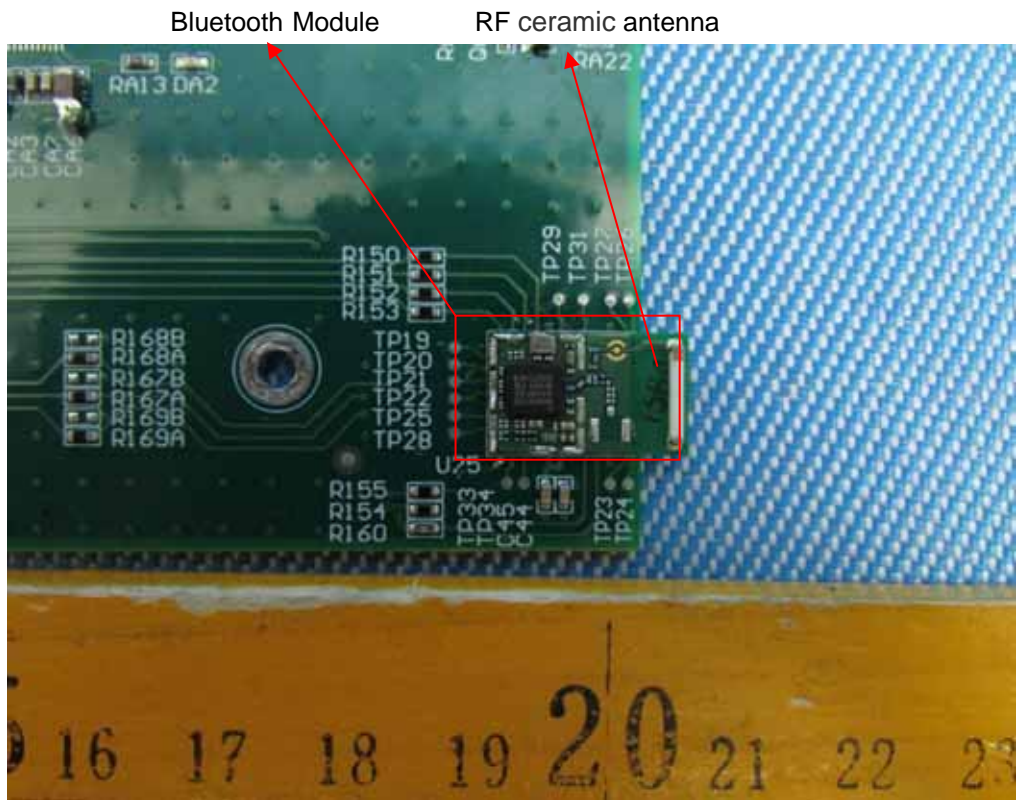
16.4 WIFI Module View

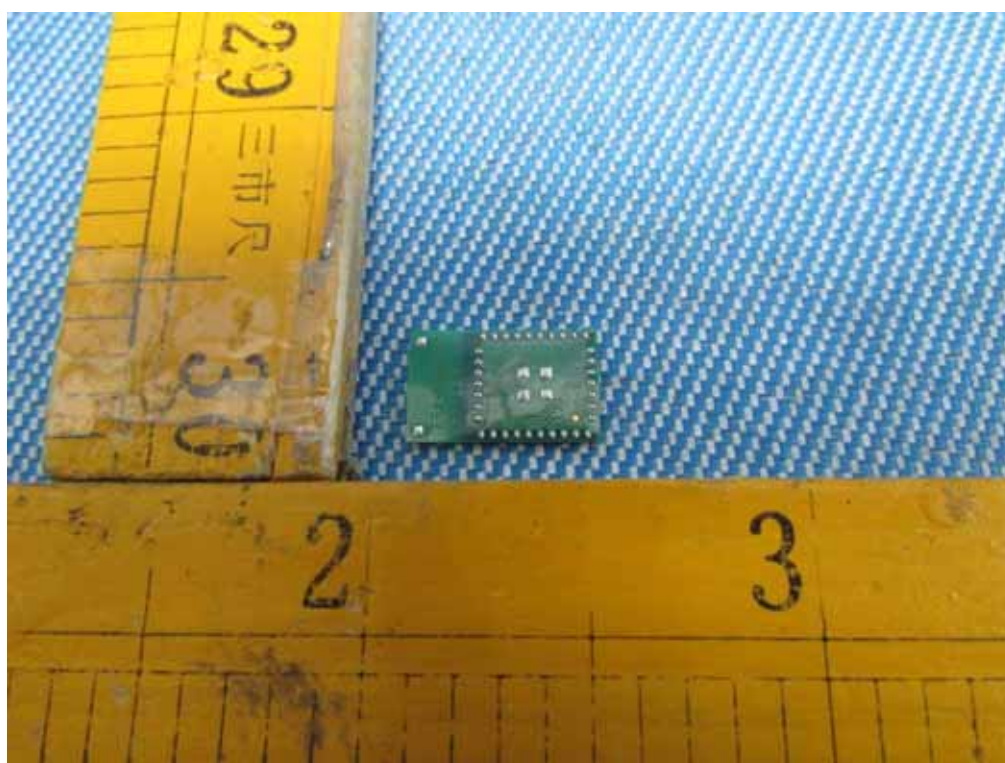
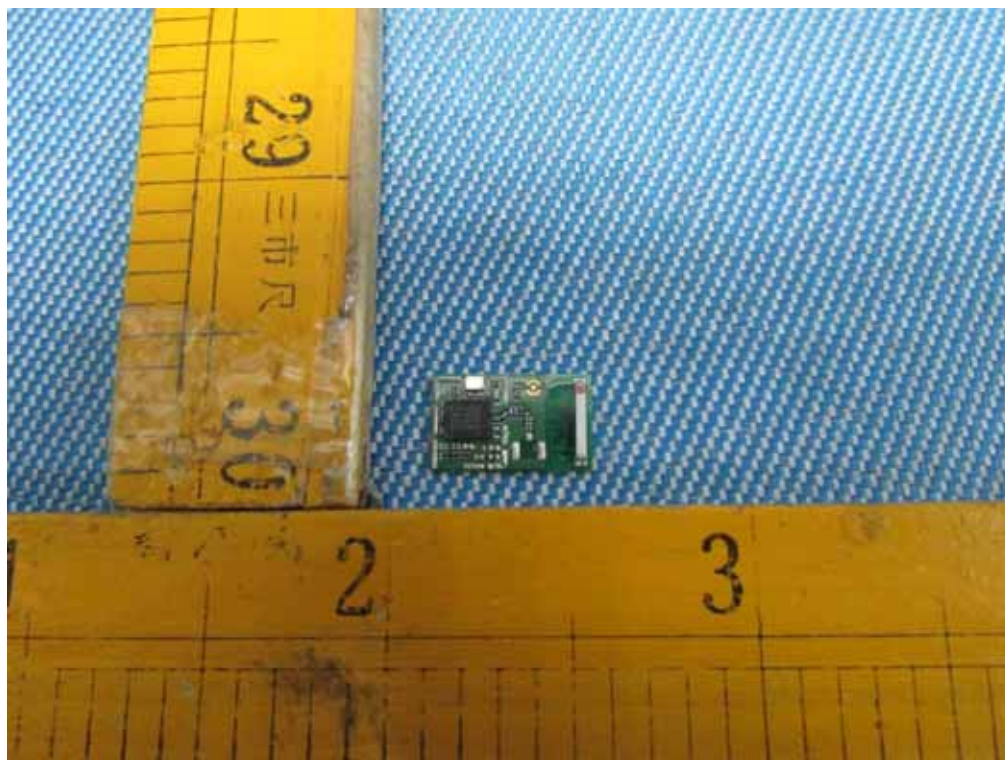
Wifi Module





16.5 BT Module View

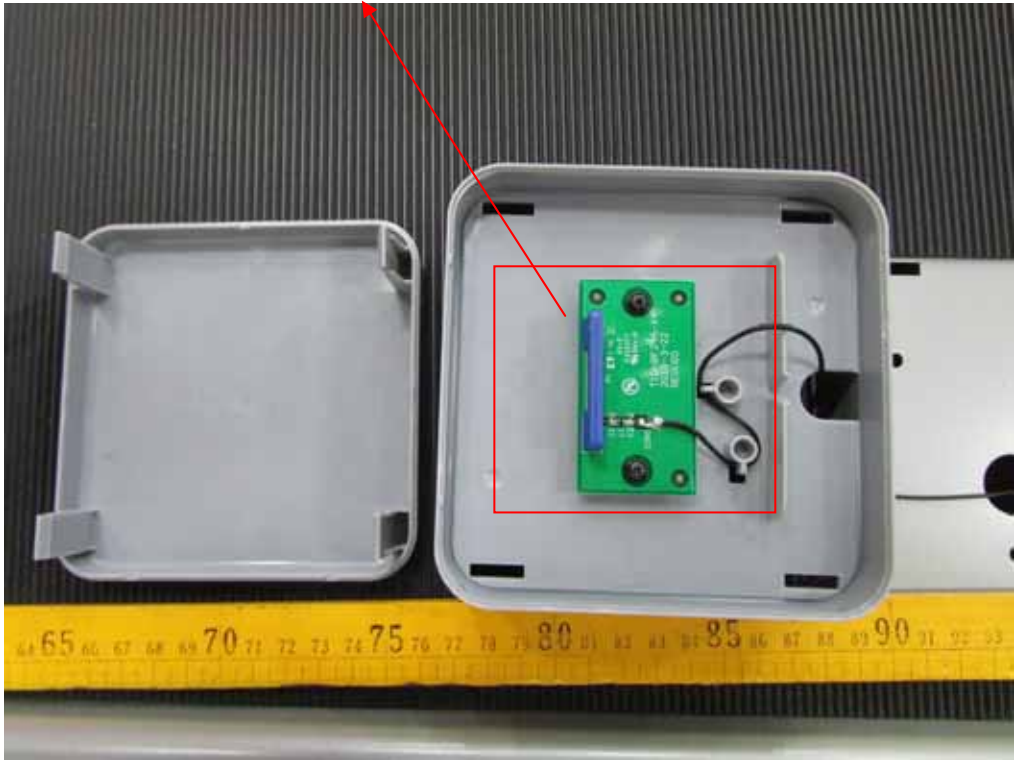




16.6 EUT- Pizza box View



Wifi antenna





==End of test report==