FCC RF Test Report

APPLICANT	**:**	**Tobii Technology AB**
EQUIPMENT	**:**	**DMS-SE07**
BRAND NAME	**:**	**Tobii**
MODEL NAME	**:**	**Glasses2 RU**
FCC ID	**:**	**W5M-DMSSE07**
STANDARD	**:**	**FCC Part 15 Subpart C §15.247**
CLASSIFICATION	**:**	**(DTS) Digital Transmission System**

The product was received on Oct. 24, 2014 and testing was completed on Nov. 27, 2014. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

Testing Laboratory 1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR4O2406A	Rev. 01	Initial issue of report	Feb. 17, 2015
FR4O2406A	Rev. 02	Adding loop antenna in section 4.	Feb. 24, 2015

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	RSS-210 A8.2(a)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	RSS-Gen 4.6.1	99% Bandwidth	-	Pass	-
3.2	15.247(b)	RSS-210 A8.4	Power Output Measurement	≤ 30dBm	Pass	-
3.3	15.247(e)	RSS-210 A8.2(b)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	RSS-210 A8.5	Conducted Band Edges	≤ 20dBc	Pass	-
			Conducted Spurious Emission		Pass	-
3.5	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 0.61 dB at 2390.000 MHz
3.6	15.207	RSS-Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 3.90 dB at 16.230 MHz
3.7	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Tobii Technology AB
Karlsrov. 2D, 182 53 Danderyd, Sweden

1.2 Manufacturer

Advantech Co. Ltd
No.1, Alley 20, Lane 26, Rueiguang Rd., Neihu District,Taipei City, Taiwan, R.O.C.

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	DMS-SE07
Brand Name	Tobii
Model Name	Glasses2 RU
FCC ID	W5M-DMSSE07
EUT supports Radios application	WLAN 11a/b/g/n (HT20)

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification subjective to this standard

Product Specification subjective to this standard	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum (Peak) Output Power to Antenna	802.11b : 19.70 dBm (0.0933 W) 802.11g : 23.05 dBm (0.2018 W) 802.11n HT20 : 22.99 dBm (0.1991 W)
99% Occupied Bandwidth	802.11b : 14.15MHz 802.11g : 18.00MHz 802.11n HT20 : 18.90MHz
Antenna Type	802.11b/g/n : PIFA Antenna type with gain 2.10 dBi 802.11a/n : PIFA Antenna type with gain 3.63 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978		
Test Site No.	**Sporton Site No.**		
	TH02-HY	CO05-HY	03CH05-HY

Note: The test site complies with ANSI C63.4 2009 requirement.

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
- ANSI C63.10-2009

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conducted emission (150 kHz to 30 MHz) and radiated emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.

The final configuration from all the combinations and the worst-case data rates were investigated by measuring the maximum power across all the data rates and modulation modes under section 2.2.

Based on the worst configuration found above, the RF power setting is set individually to meet FCC compliance limit for the final conducted and radiated tests shown in section 2.3.

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437	-	-

2.2 Pre-Scanned RF Power

Preliminary tests were performed in different data rate and data rate associated with the highest power were chosen for full test shown in the following tables.

2.4GHz 802.11b mode				
Data Rate (MHz)	1M bps	2M bps	5.5M bps	11M bps
Peak Power (dBm)	19.70	19.66	19.53	19.43

2.4GHz 802.11g mode								
Data Rate (MHz)	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
Peak Power (dBm)	23.05	23.03	23.01	23.00	23.00	23.03	23.01	22.93

2.4GHz 802.11n HT20 mode								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	22.99	22.81	22.89	22.87	22.91	22.93	22.84	22.73

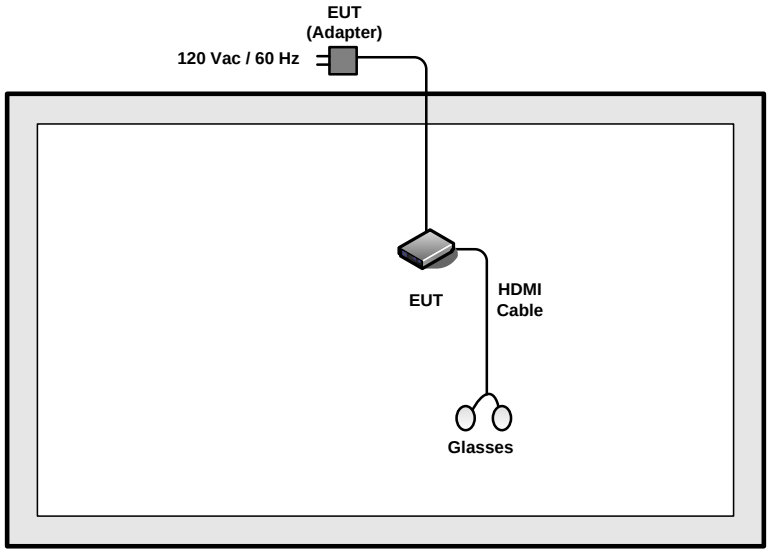
2.3 Test Mode

Final results of test modes, data rates and test channels are shown as following table.

Test Cases				
	Test Items	**Mode**	**Data Rate**	**Test Channel**
Conducted TCs	**6dB and 99% BW Power Spectral Density**	**802.11b**	**1 Mbps**	**1/6/11**
		802.11g	**6 Mbps**	**1/6/11**
		802.11n HT20	**MCS0**	**1/6/11**
	Output Power	**802.11b**	**1 Mbps**	**1/6/11**
		802.11g	**6 Mbps**	**1/6/11**
		802.11n HT20	**MCS0**	**1/6/11**
	Conducted Band Edge	**802.11b**	**1 Mbps**	**1/11**
		802.11g	**6 Mbps**	**1/11**
		802.11n HT20	**MCS0**	**1/11**
	Conducted Spurious Emission	**802.11b**	**1 Mbps**	**1/6/11**
		802.11g	**6 Mbps**	**1/6/11**
		802.11n HT20	**MCS0**	**1/6/11**
Radiated TCs	**Radiated Band Edge**	**802.11b**	**1 Mbps**	**1/11**
		802.11g	**6 Mbps**	**1/11**
		802.11n HT20	**MCS0**	**1/11**
	Radiated Spurious Emission	**802.11b**	**1 Mbps**	**1/6/11**
		802.11g	**6 Mbps**	**1/6/11**
		802.11n HT20	**MCS0**	**1/6/11**
AC Conducted Emission	Mode 1 : WLAN (2.4GHz) Link + TC			
Remark:	TC stands for Test Configuration, and consists of HDMI Cable, Adapter, and RJ-45.			

2.4 Connection Diagram of Test System

<WLAN Tx Mode>



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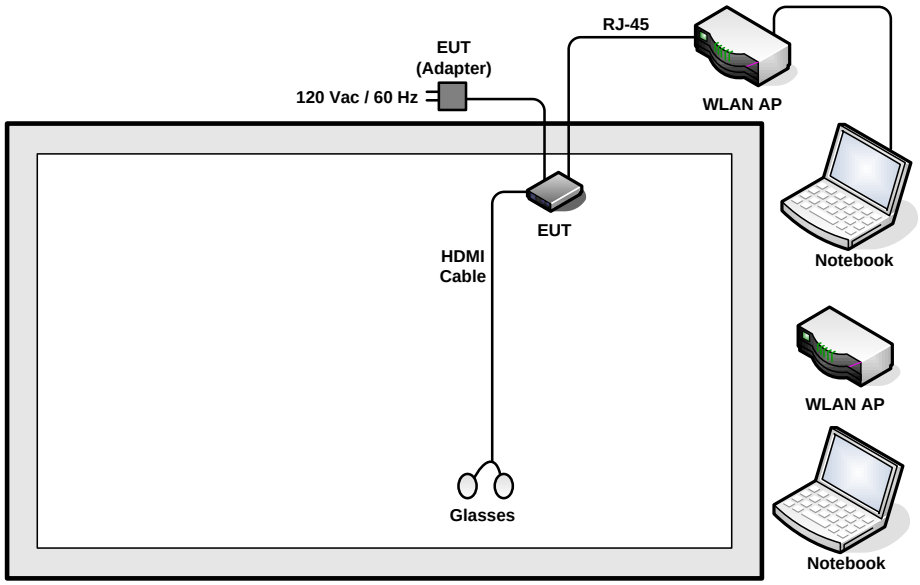


2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-Link	DIR-865L	KA2IR865LA1	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
3.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.6 EUT Operation Test Setup

For WLAN function, the calibrator command line tool installed in the notebook makes the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

2.7 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

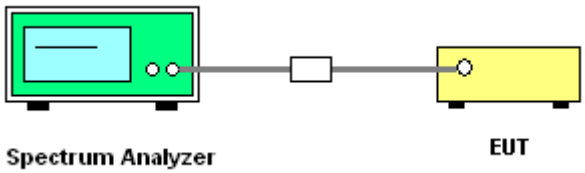
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v03r02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1MHz and set the Video bandwidth (VBW) = 3MHz.
6. Measure and record the results in the test report.

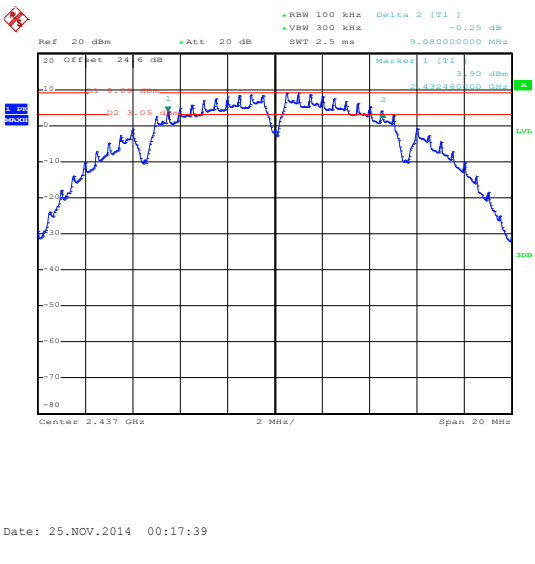
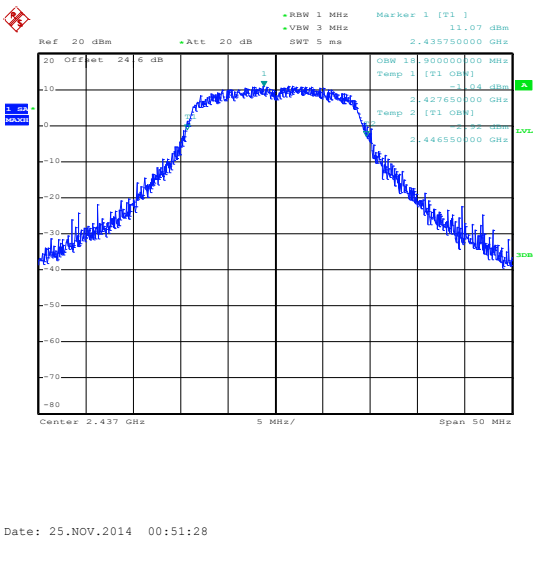
3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Test Band :	2.4GHz	Temperature :	24~26℃
Test Engineer :	Bill Kuo	Relative Humidity :	45~49%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	99% Bandwidth (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
11b	1Mbps	1	1	2412	14.15	9.52	0.5	Pass
11b	1Mbps	1	6	2437	14.15	9.08	0.5	Pass
11b	1Mbps	1	11	2462	14.15	9.08	0.5	Pass
11g	6Mbps	1	1	2412	17.90	15.60	0.5	Pass
11g	6Mbps	1	6	2437	18.00	15.36	0.5	Pass
11g	6Mbps	1	11	2462	18.00	15.36	0.5	Pass
HT20	MCS0	1	1	2412	18.80	15.72	0.5	Pass
HT20	MCS0	1	6	2437	18.90	15.16	0.5	Pass
HT20	MCS0	1	11	2462	18.90	15.40	0.5	Pass

Minimum 6dB Bandwidth	Maximum 99% Occupied Bandwidth
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting Antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the Antenna exceeds 6dBi.

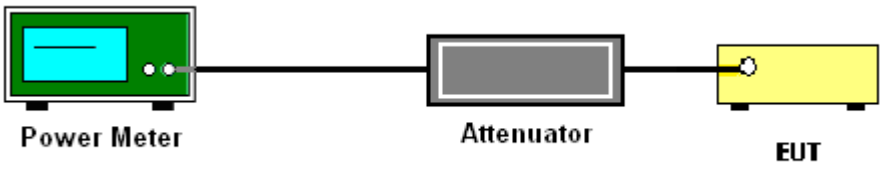
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r02.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Test Mode :	2.4GHz	Temperature :	24~26℃
Test Engineer :	Bill Kuo	Relative Humidity :	45~49%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	RF Output Power (dBm)	Power Limit (dBm)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	19.44	30	2.10	Pass
11b	1Mbps	1	6	2437	19.70	30	2.10	Pass
11b	1Mbps	1	11	2462	19.64	30	2.10	Pass
11g	6Mbps	1	1	2412	22.70	30	2.10	Pass
11g	6Mbps	1	6	2437	23.05	30	2.10	Pass
11g	6Mbps	1	11	2462	22.89	30	2.10	Pass
HT20	MCS0	1	1	2412	22.99	30	2.10	Pass
HT20	MCS0	1	6	2437	22.85	30	2.10	Pass
HT20	MCS0	1	11	2462	22.73	30	2.10	Pass

Note: Measured power (dBm) has offset with cable loss.

3.2.6 Test Result of Average output Power (Reporting Only)

Test Mode :	2.4GHz	Temperature :	24~26℃
Test Engineer :	Bill Kuo	Relative Humidity :	45~49%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	Duty Factor (dB)	Average Output Power (dBm)	Power Limit (dBm)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	0.00	17.32	30	2.10	Pass
11b	1Mbps	1	6	2437	0.00	17.48	30	2.10	Pass
11b	1Mbps	1	11	2462	0.00	17.46	30	2.10	Pass
11g	6Mbps	1	1	2412	0.10	13.96	30	2.10	Pass
11g	6Mbps	1	6	2437	0.10	14.86	30	2.10	Pass
11g	6Mbps	1	11	2462	0.10	14.68	30	2.10	Pass
HT20	MCS0	1	1	2412	0.10	13.83	30	2.10	Pass
HT20	MCS0	1	6	2437	0.10	13.80	30	2.10	Pass
HT20	MCS0	1	11	2462	0.10	13.65	30	2.10	Pass

Note: Measured power (dBm) has offset with cable loss and duty factor.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

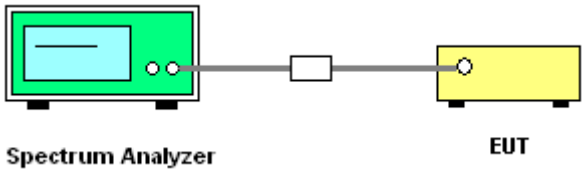
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

3.3.4 Test Setup



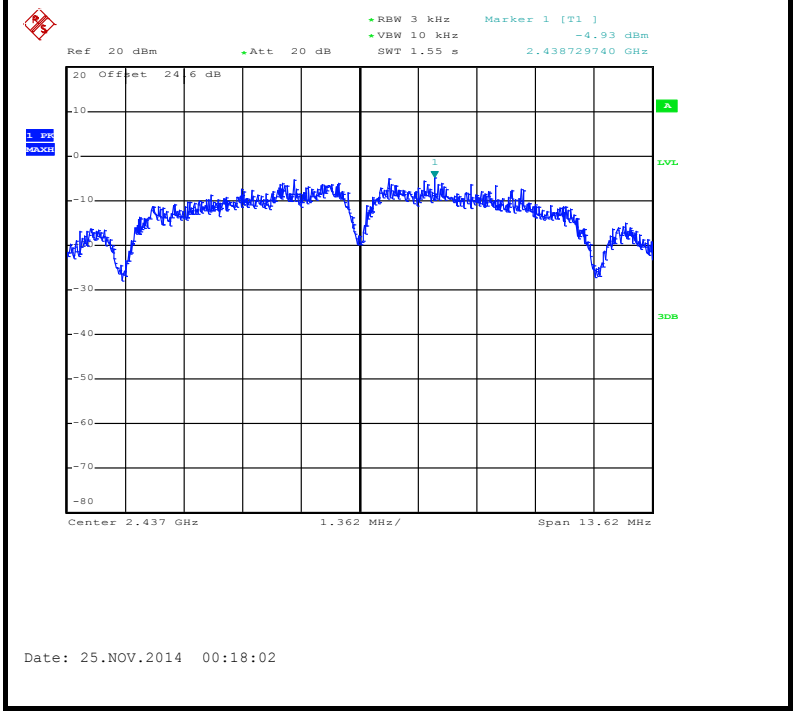
3.3.5 Test Result of Power Spectral Density

Test Mode :	2.4GHz	Temperature :	24~26℃
Test Engineer :	Bill Kuo	Relative Humidity :	45~49%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	Peak Power Density (dBm/3kHz)	Max. Limits (dBm/3kHz)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	-5.68	8	2.10	Pass
11b	1Mbps	1	6	2437	-4.93	8	2.10	Pass
11b	1Mbps	1	11	2462	-5.29	8	2.10	Pass
11g	6Mbps	1	1	2412	-11.94	8	2.10	Pass
11g	6Mbps	1	6	2437	-9.84	8	2.10	Pass
11g	6Mbps	1	11	2462	-10.09	8	2.10	Pass
HT20	MCS0	1	1	2412	-9.96	8	2.10	Pass
HT20	MCS0	1	6	2437	-9.98	8	2.10	Pass
HT20	MCS0	1	11	2462	-11.91	8	2.10	Pass

Note: Measured power density (dBm) has offset with cable loss.

Worst Case Power Density (dBm/3kHz)



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and 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).

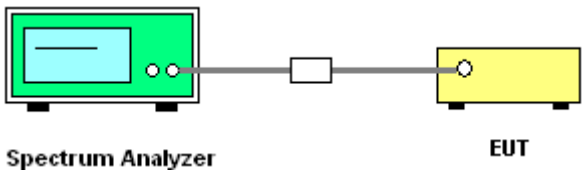
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions 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 when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup

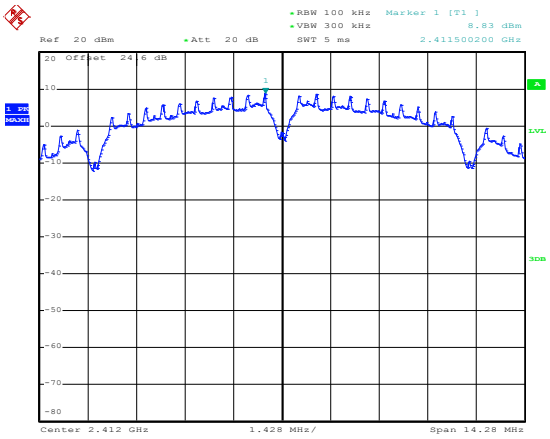


3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Mode :	802.11b	**Temperature :**	24~26℃
Test Band :	2.4GHz Low	**Relative Humidity :**	45~49%
Test Channel :	01	**Test Engineer :**	Bill Kuo

WLAN 802.11b Channel 01

100kHz PSD reference Level



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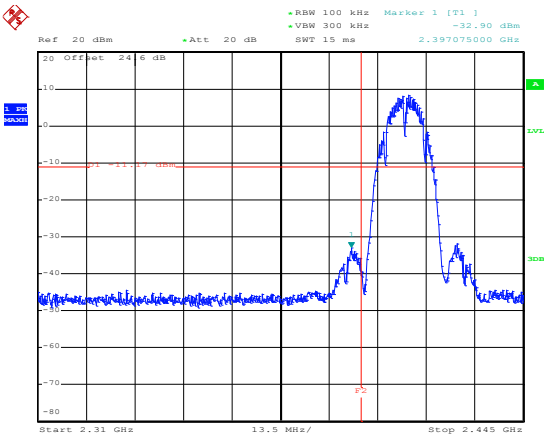
Low Channel Plot



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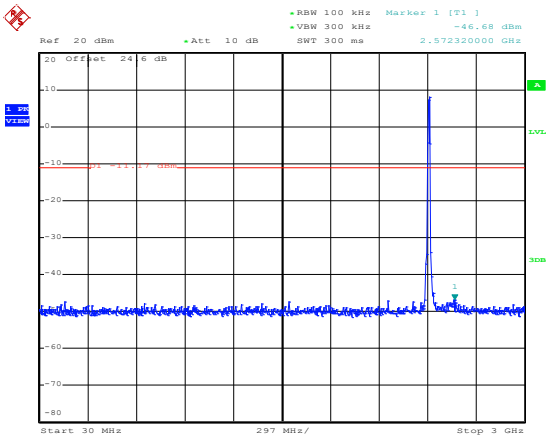
Spurious Emission 30MHz~3GHz



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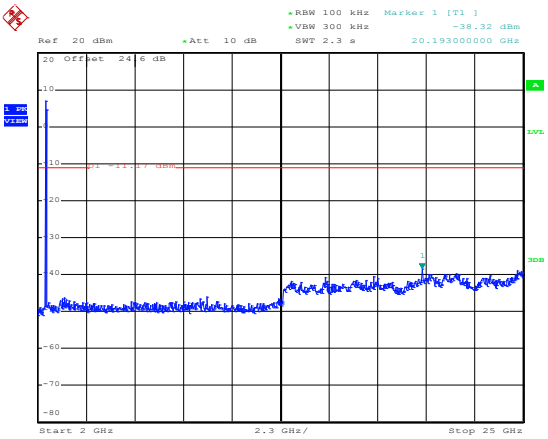
Spurious Emission 2GHz~25GHz



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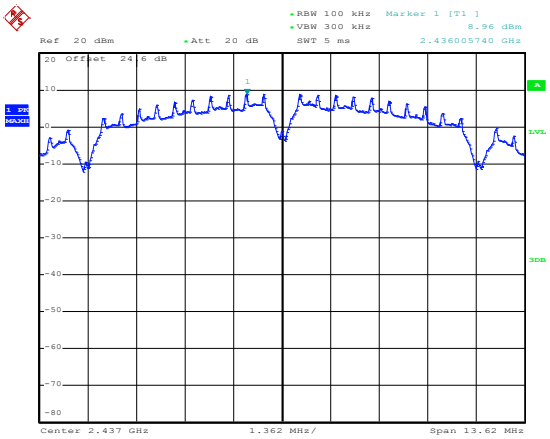
Test Mode :	802.11b	**Temperature :**	24~26℃
Test Band :	2.4GHz Mid.	**Relative Humidity :**	45~49%
Test Channel :	06	**Test Engineer :**	Bill Kuo

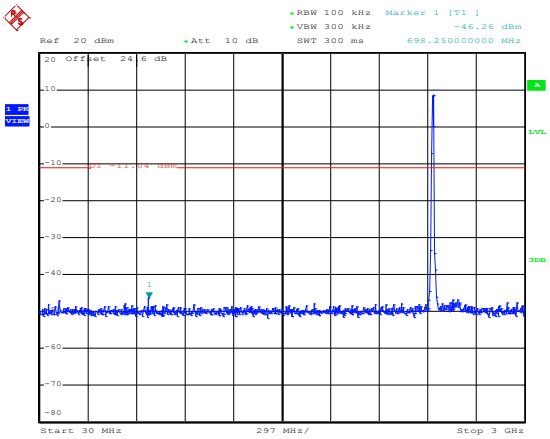
WLAN 802.11b Channel 06

100kHz PSD reference Level



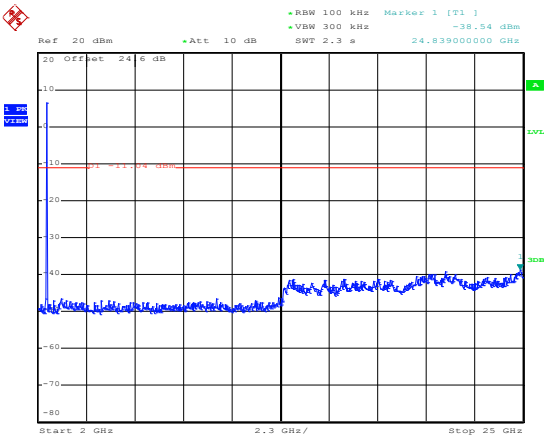
Date: 25.NOV.2014 00:18:23

Spurious Emission 30MHz~3GHz



Date: 25.NOV.2014 00:19:01

Spurious Emission 2GHz~25GHz

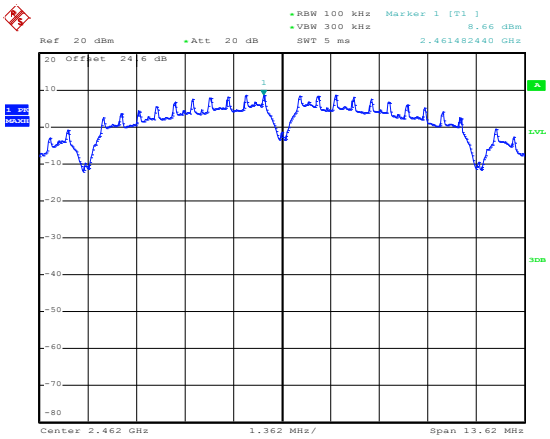


Date: 25.NOV.2014 00:19:19

Test Mode :	802.11b	Temperature :	24~26℃
Test Band :	2.4GHz High	Relative Humidity :	45~49%
Test Channel :	11	Test Engineer :	Bill Kuo

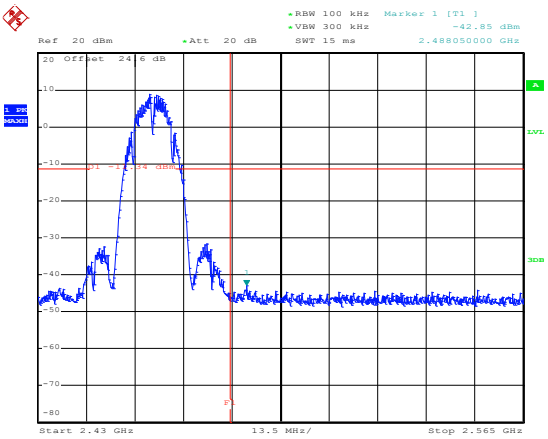
WLAN 802.11b Channel 11

100kHz PSD reference Level



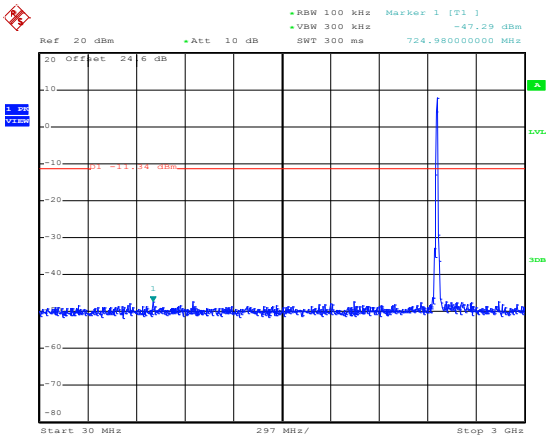
Date: 25.NOV.2014 00:25:54

High Channel Plot



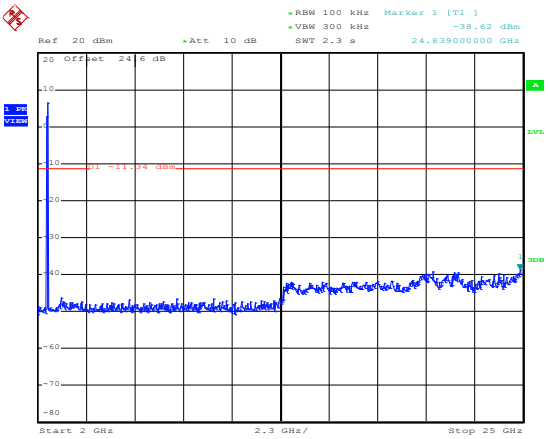
Date: 25.NOV.2014 00:26:10

Spurious Emission 30MHz~3GHz



Date: 25.NOV.2014 00:27:55

Spurious Emission 2GHz~25GHz

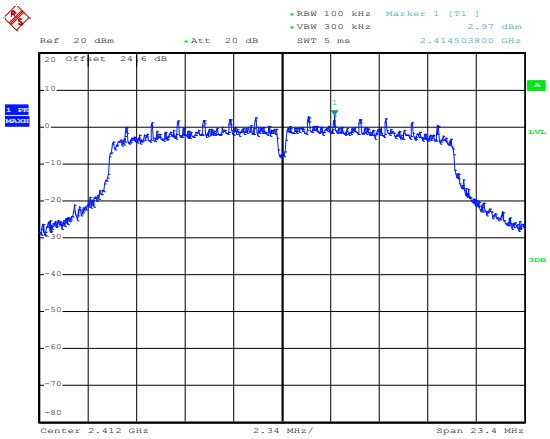


Date: 25.NOV.2014 00:28:13

Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz Low	**Relative Humidity :**	45~49%
Test Channel :	01	**Test Engineer :**	Bill Kuo

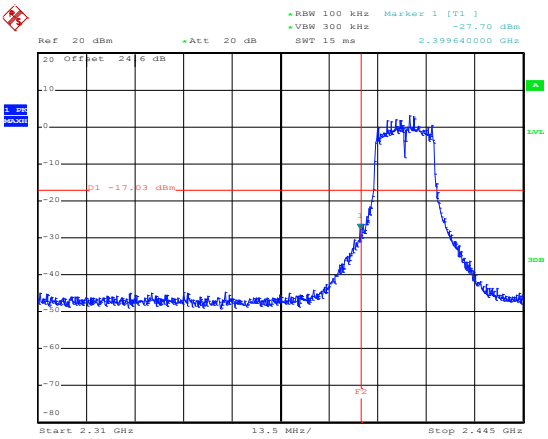
WLAN 802.11g Channel 01

100kHz PSD reference Level



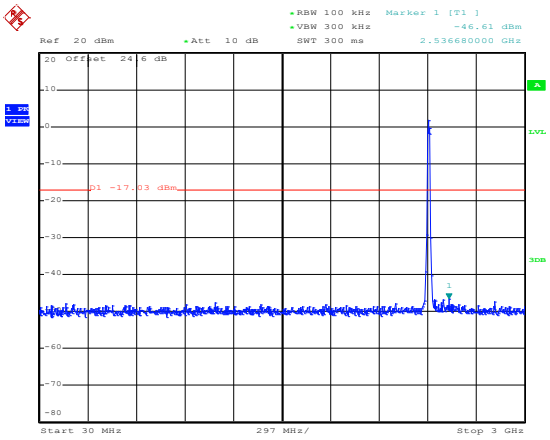
Date: 25.NOV.2014 00:58:32

Low Channel Plot



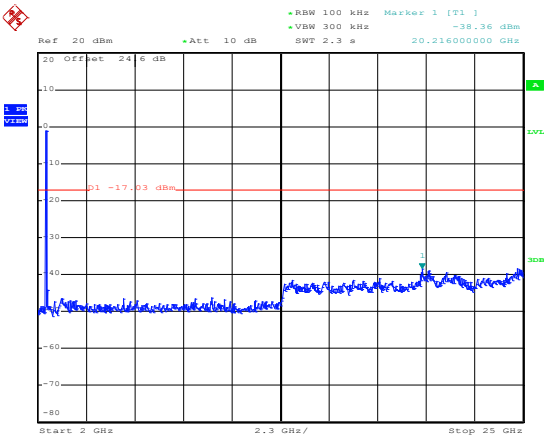
Date: 25.NOV.2014 00:58:49

Spurious Emission 30MHz~3GHz



Date: 25.NOV.2014 00:59:11

Spurious Emission 2GHz~25GHz

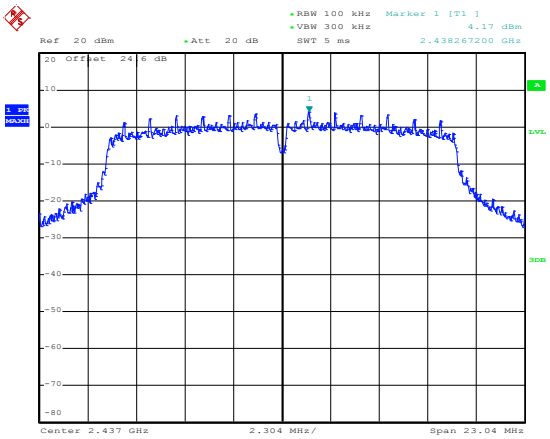


Date: 25.NOV.2014 00:59:29

Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz Mid.	**Relative Humidity :**	45~49%
Test Channel :	06	**Test Engineer :**	Bill Kuo

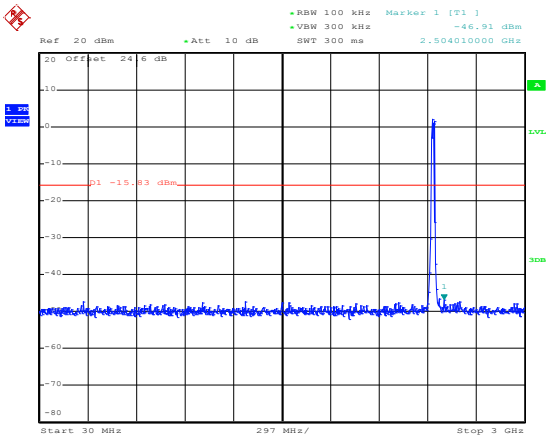
WLAN 802.11g Channel 06

100kHz PSD reference Level



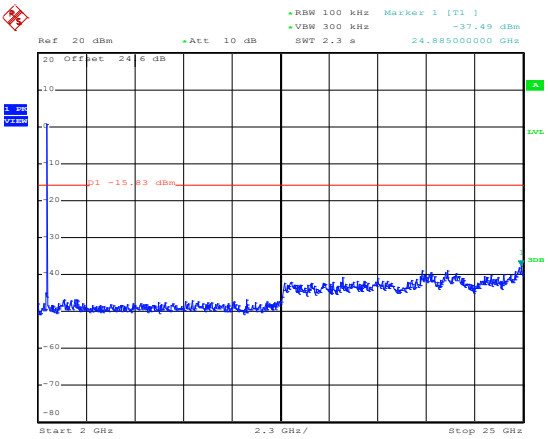
Date: 25.NOV.2014 00:35:52

Spurious Emission 30MHz~3GHz



Date: 25.NOV.2014 00:36:52

Spurious Emission 2GHz~25GHz

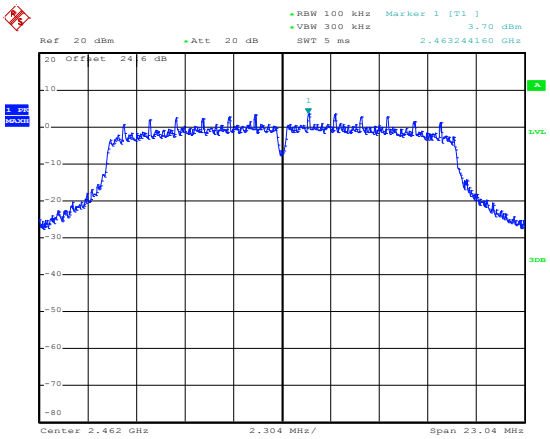


Date: 25.NOV.2014 00:37:10

Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	45~49%
Test Channel :	11	**Test Engineer :**	Bill Kuo

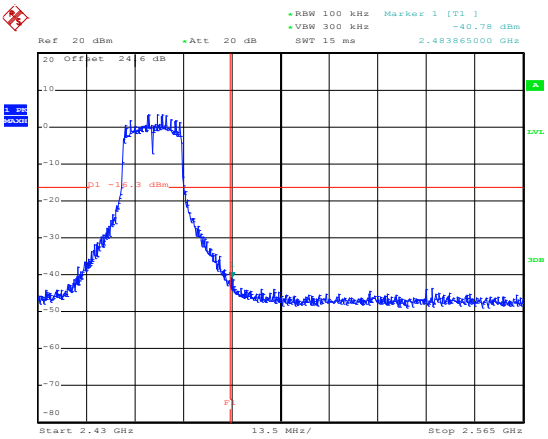
WLAN 802.11g Channel 11

100kHz PSD reference Level



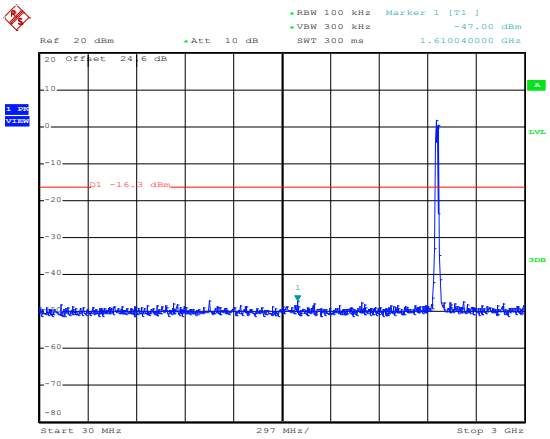
Date: 25.NOV.2014 00:32:04

High Channel Plot



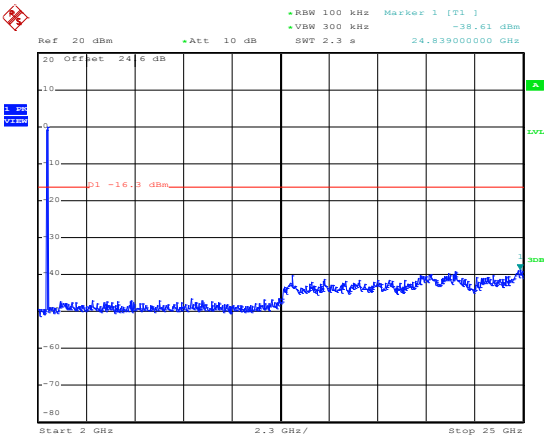
Date: 25.NOV.2014 00:32:21

Spurious Emission 30MHz~3GHz



Date: 25.NOV.2014 00:32:49

Spurious Emission 2GHz~25GHz

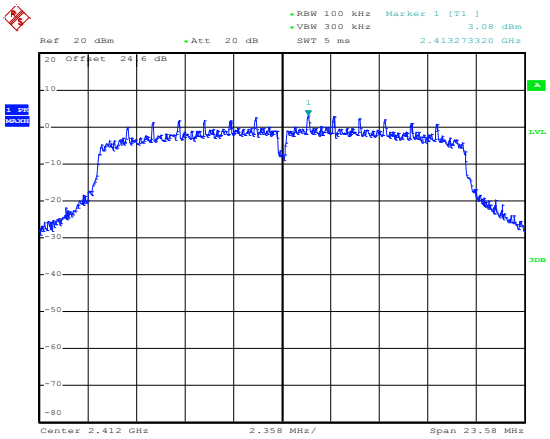


Date: 25.NOV.2014 00:33:08

Test Mode :	802.11n HT20	Temperature :	24~26℃
Test Band :	2.4GHz Low	Relative Humidity :	45~49%
Test Channel :	01	Test Engineer :	Bill Kuo

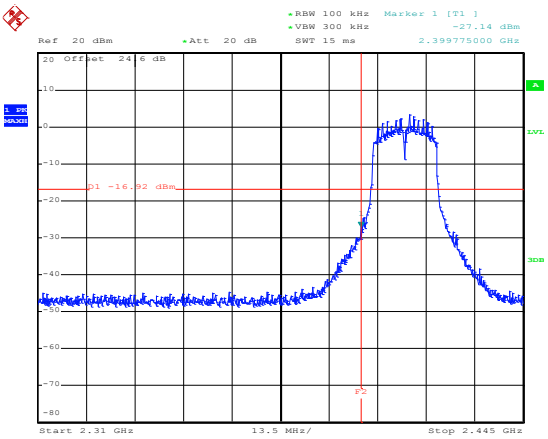
WLAN 802.11n HT20 Channel 01

100kHz PSD reference Level



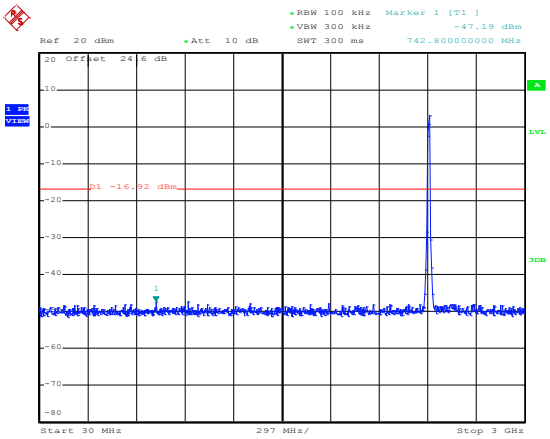
Date: 25.NOV.2014 00:45:59

Low Channel Plot



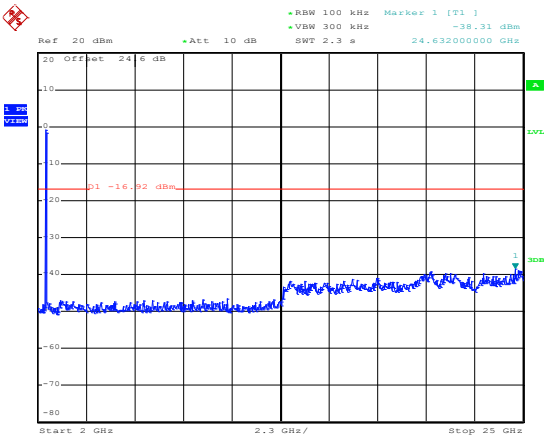
Date: 25.NOV.2014 00:46:15

Spurious Emission 30MHz~3GHz



Date: 25.NOV.2014 00:46:55

Spurious Emission 2GHz~25GHz

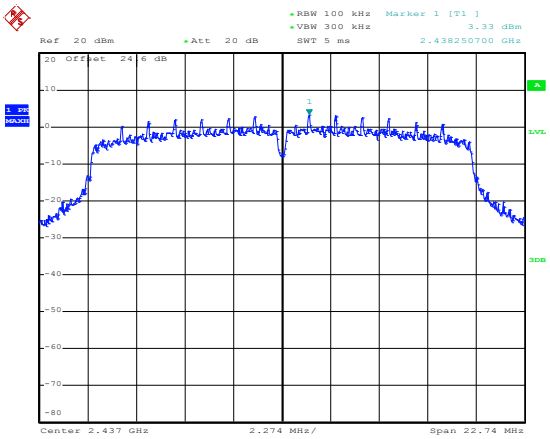


Date: 25.NOV.2014 00:47:13

Test Mode :	802.11n HT20	Temperature :	24~26℃
Test Band :	2.4GHz Mid.	Relative Humidity :	45~49%
Test Channel :	06	Test Engineer :	Bill Kuo

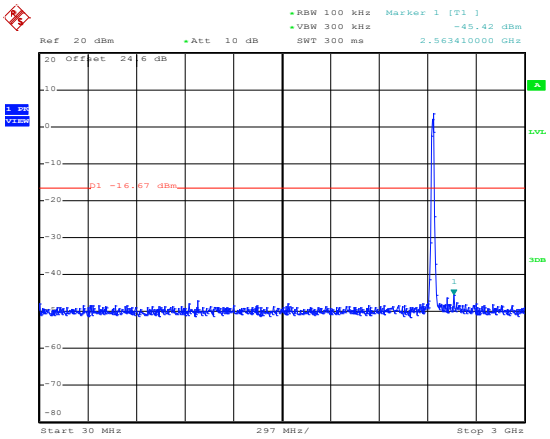
WLAN 802.11n HT20 Channel 06

100kHz PSD reference Level



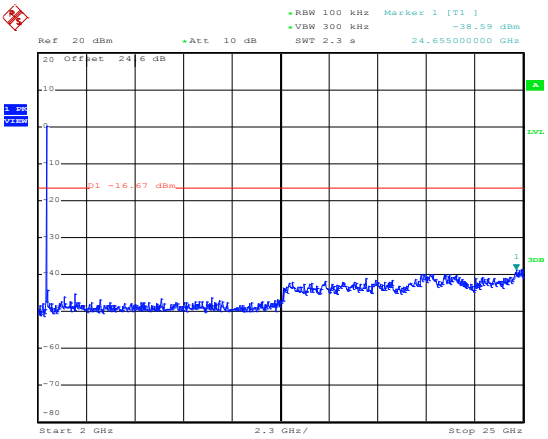
Date: 25.NOV.2014 00:50:34

Spurious Emission 30MHz~3GHz



Date: 25.NOV.2014 00:50:57

Spurious Emission 2GHz~25GHz

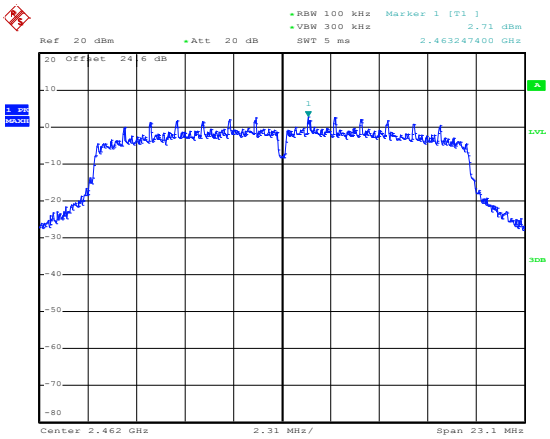


Date: 25.NOV.2014 00:51:15

Test Mode :	802.11n HT20	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	45~49%
Test Channel :	11	**Test Engineer :**	Bill Kuo

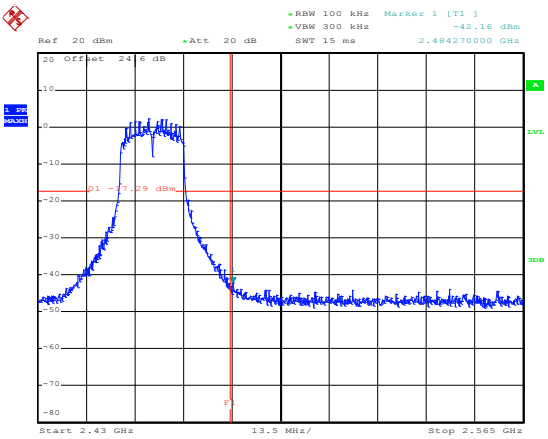
WLAN 802.11n HT20 Channel 11

100kHz PSD reference Level



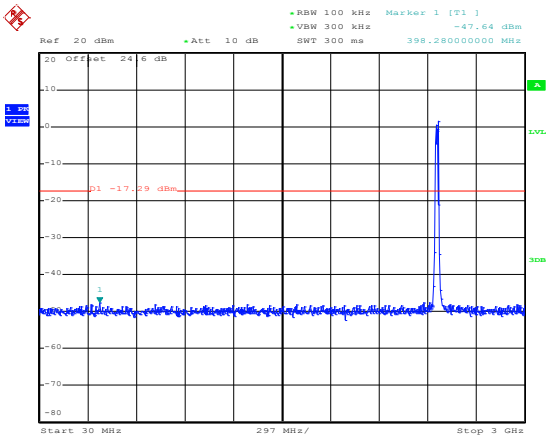
Date: 25.NOV.2014 00:53:47

High Channel Plot



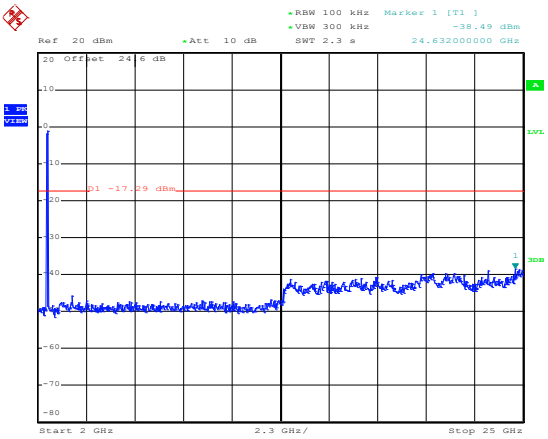
Date: 25.NOV.2014 00:54:05

Spurious Emission 30MHz~3GHz



Date: 25.NOV.2014 00:54:27

Spurious Emission 2GHz~25GHz



Date: 25.NOV.2014 00:54:45

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/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

3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

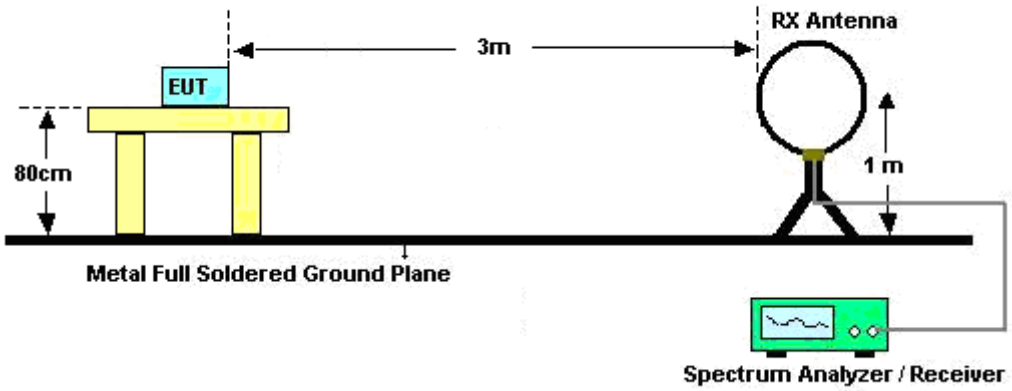
3.5.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

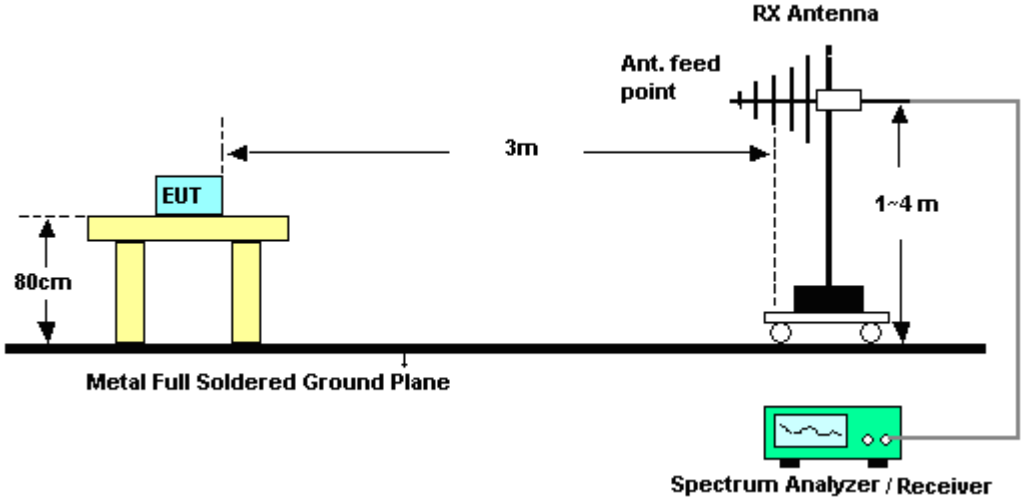
Band	Duty Cycle(%)	T(μs)	1/T(kHz)	VBW Setting
802.11b	100	-	-	10Hz
802.11g	97.77	1400	0.714285714	1kHz
2.4GHz 802.11n HT20	97.62	1312	0.762195122	1kHz

3.5.4 Test Setup

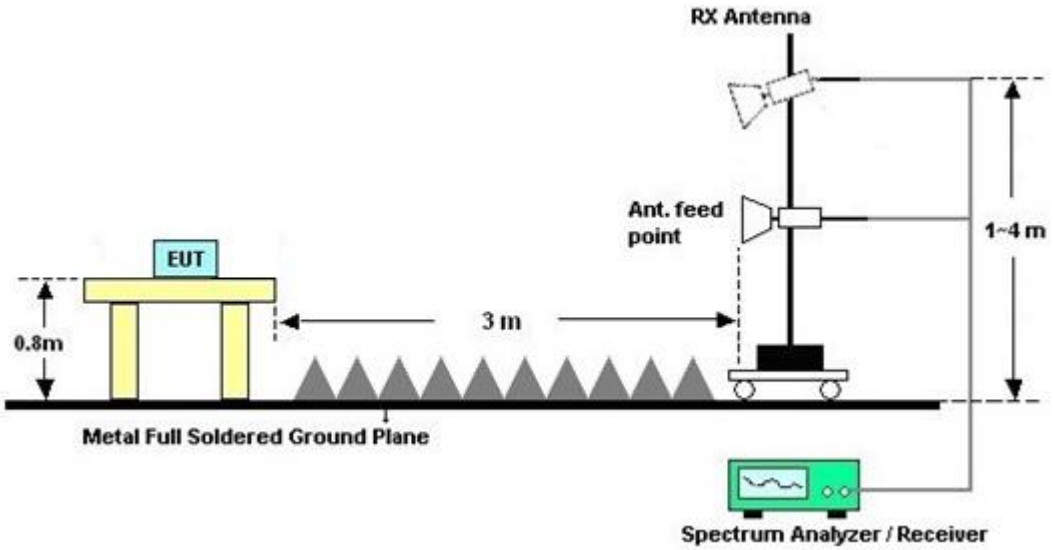
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.5.6 Test Result

Please refer to appendix A as below.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

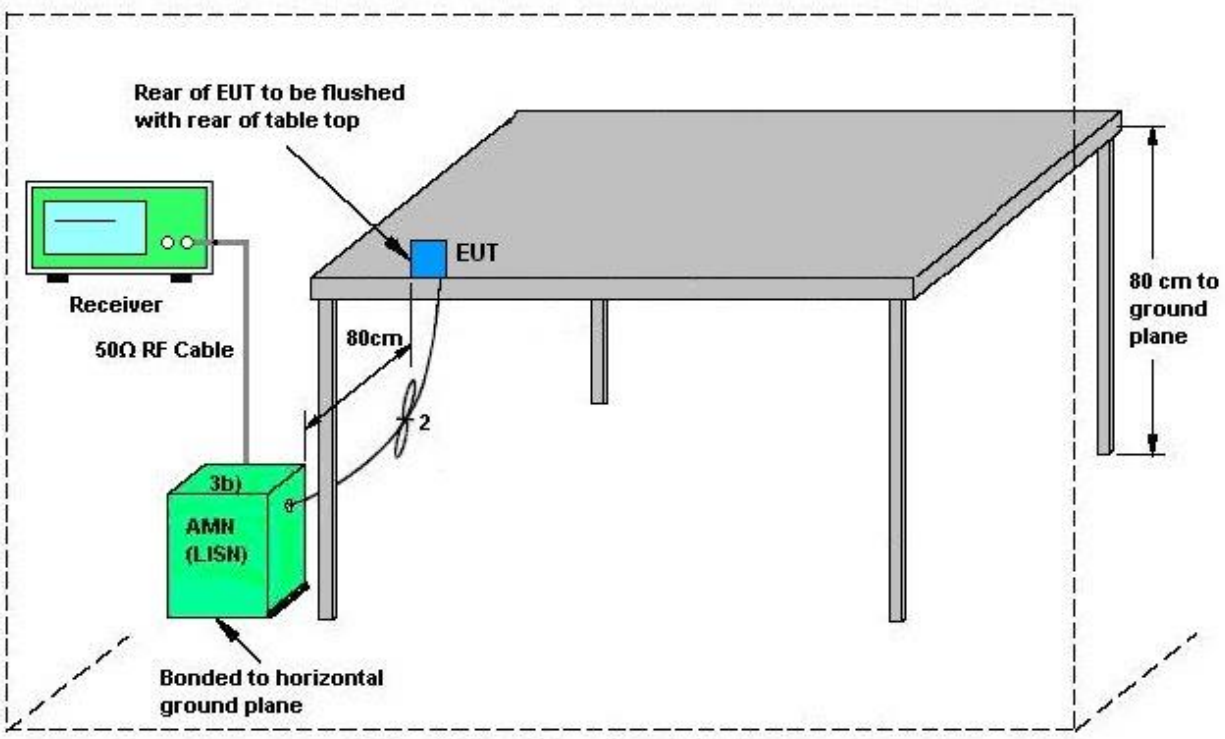
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

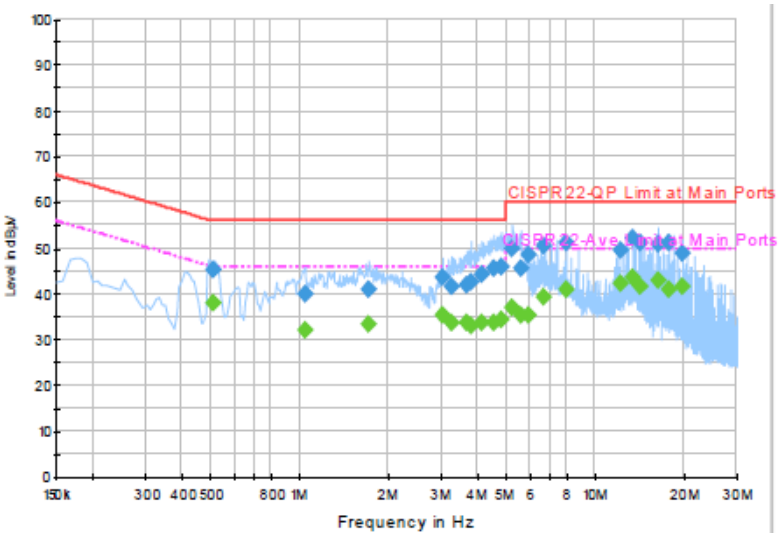
3.6.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

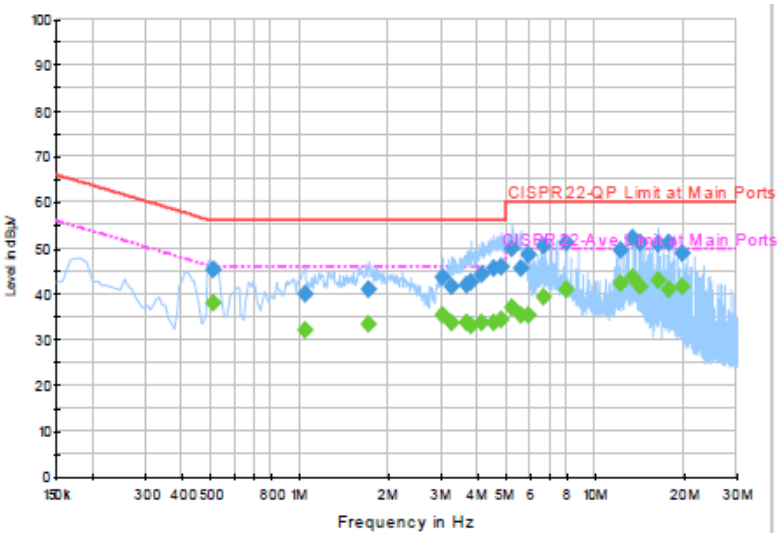
Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Eric Jeng	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	WLAN (2.4GHz) Link + TC		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.510000	45.3	Off	L1	19.5	10.7	56.0
1.038000	40.1	Off	L1	19.5	15.9	56.0
1.710000	40.9	Off	L1	19.5	15.1	56.0
3.038000	43.6	Off	L1	19.5	12.4	56.0
3.246000	41.5	Off	L1	19.5	14.5	56.0
3.662000	42.0	Off	L1	19.5	14.0	56.0
3.806000	42.6	Off	L1	19.5	13.4	56.0
4.134000	44.1	Off	L1	19.6	11.9	56.0
4.510000	45.7	Off	L1	19.6	10.3	56.0
4.814000	46.0	Off	L1	19.6	10.0	56.0
5.238000	49.9	Off	L1	19.6	10.1	60.0
5.606000	45.5	Off	L1	19.6	14.5	60.0
5.910000	48.4	Off	L1	19.6	11.6	60.0
6.702000	50.5	Off	L1	19.6	9.5	60.0
7.926000	51.0	Off	L1	19.6	9.0	60.0
12.198000	49.4	Off	L1	19.7	10.6	60.0
13.358000	52.1	Off	L1	19.7	7.9	60.0
14.214000	51.3	Off	L1	19.7	8.7	60.0
16.230000	50.7	Off	L1	19.7	9.3	60.0
17.694000	51.2	Off	L1	19.7	8.8	60.0
19.710000	49.0	Off	L1	19.7	11.0	60.0

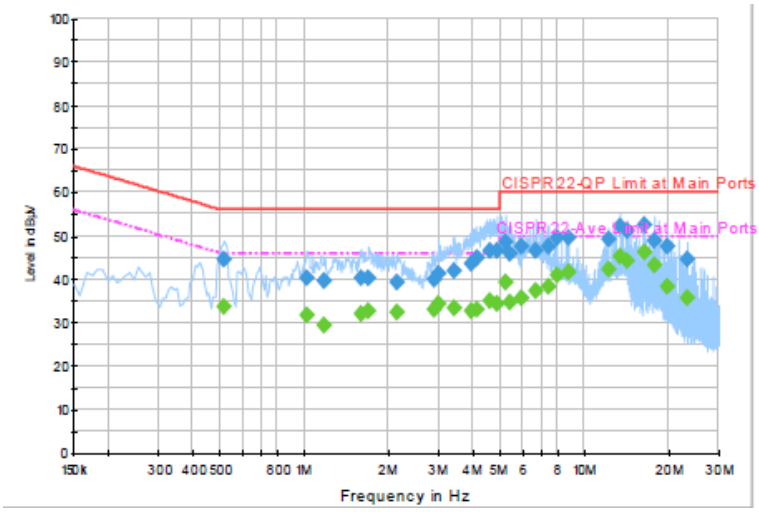
Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Eric Jeng	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	WLAN (2.4GHz) Link + TC		



Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.510000	37.8	Off	L1	19.5	8.2	46.0
1.038000	32.0	Off	L1	19.5	14.0	46.0
1.710000	33.2	Off	L1	19.5	12.8	46.0
3.038000	35.5	Off	L1	19.5	10.5	46.0
3.246000	33.5	Off	L1	19.5	12.5	46.0
3.662000	33.7	Off	L1	19.5	12.3	46.0
3.806000	32.9	Off	L1	19.5	13.1	46.0
4.134000	33.7	Off	L1	19.6	12.3	46.0
4.510000	33.7	Off	L1	19.6	12.3	46.0
4.814000	34.5	Off	L1	19.6	11.5	46.0
5.238000	37.0	Off	L1	19.6	13.0	50.0
5.606000	35.2	Off	L1	19.6	14.8	50.0
5.910000	35.2	Off	L1	19.6	14.8	50.0
6.702000	39.4	Off	L1	19.6	10.6	50.0
7.926000	41.1	Off	L1	19.6	8.9	50.0
12.198000	42.1	Off	L1	19.7	7.9	50.0
13.358000	43.6	Off	L1	19.7	6.4	50.0
14.214000	41.7	Off	L1	19.7	8.3	50.0
16.230000	43.0	Off	L1	19.7	7.0	50.0
17.694000	41.0	Off	L1	19.7	9.0	50.0
19.710000	41.4	Off	L1	19.7	8.6	50.0

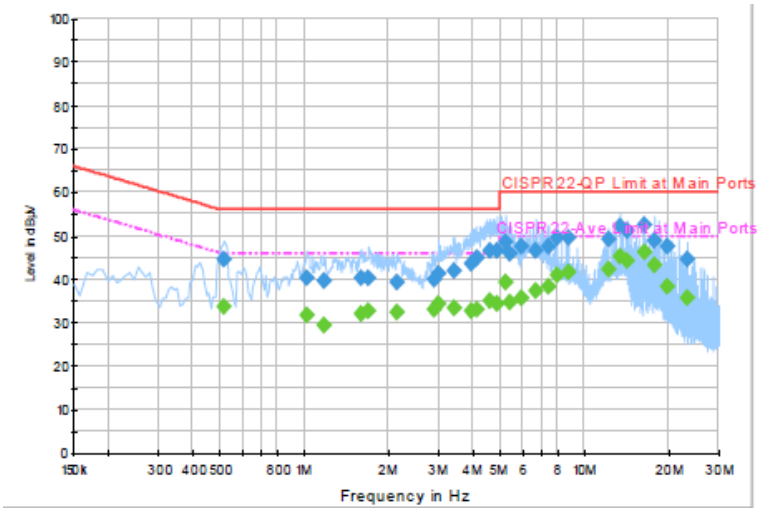
Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Eric Jeng	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN (2.4GHz) Link + TC		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.518000	44.6	Off	N	19.5	11.4	56.0
1.014000	40.4	Off	N	19.5	15.6	56.0
1.174000	39.5	Off	N	19.5	16.5	56.0
1.598000	40.3	Off	N	19.5	15.7	56.0
1.694000	40.3	Off	N	19.5	15.7	56.0
2.126000	39.2	Off	N	19.2	16.8	56.0
2.886000	39.8	Off	N	19.5	16.2	56.0
3.006000	41.1	Off	N	19.6	14.9	56.0
3.430000	41.9	Off	N	19.6	14.1	56.0
3.918000	43.4	Off	N	19.6	12.6	56.0
4.118000	44.9	Off	N	19.6	11.1	56.0
4.566000	46.6	Off	N	19.6	9.4	56.0
4.862000	46.4	Off	N	19.6	9.6	56.0
5.238000	48.4	Off	N	19.6	11.6	60.0
5.422000	45.8	Off	N	19.6	14.2	60.0
5.910000	47.6	Off	N	19.6	12.4	60.0
6.702000	46.4	Off	N	19.6	13.6	60.0
7.374000	47.6	Off	N	19.6	12.4	60.0
7.926000	49.7	Off	N	19.6	10.3	60.0
8.718000	49.6	Off	N	19.7	10.4	60.0
12.198000	49.3	Off	N	19.7	10.7	60.0
13.358000	52.1	Off	N	19.7	7.9	60.0
14.214000	51.1	Off	N	19.7	8.9	60.0
16.230000	52.5	Off	N	19.8	7.5	60.0
17.694000	48.7	Off	N	19.8	11.3	60.0
19.710000	47.4	Off	N	19.8	12.6	60.0
23.126000	44.5	Off	N	19.9	15.5	60.0

Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Eric Jeng	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN (2.4GHz) Link + TC		



Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.518000	33.6	Off	N	19.5	12.4	46.0
1.014000	31.7	Off	N	19.5	14.3	46.0
1.174000	29.5	Off	N	19.5	16.5	46.0
1.598000	32.1	Off	N	19.5	13.9	46.0
1.694000	32.7	Off	N	19.5	13.3	46.0
2.126000	32.5	Off	N	19.2	13.5	46.0
2.886000	33.2	Off	N	19.5	12.8	46.0
3.006000	34.4	Off	N	19.6	11.6	46.0
3.430000	33.2	Off	N	19.6	12.8	46.0
3.918000	32.6	Off	N	19.6	13.4	46.0
4.118000	33.2	Off	N	19.6	12.8	46.0
4.566000	34.9	Off	N	19.6	11.1	46.0
4.862000	34.4	Off	N	19.6	11.6	46.0
5.238000	39.1	Off	N	19.6	10.9	50.0
5.422000	34.7	Off	N	19.6	15.3	50.0
5.910000	35.7	Off	N	19.6	14.3	50.0
6.702000	37.3	Off	N	19.6	12.7	50.0
7.374000	38.1	Off	N	19.6	11.9	50.0
7.926000	40.9	Off	N	19.6	9.1	50.0
8.718000	41.5	Off	N	19.7	8.5	50.0
12.198000	42.1	Off	N	19.7	7.9	50.0
13.358000	45.2	Off	N	19.7	4.8	50.0
14.214000	44.1	Off	N	19.7	5.9	50.0
16.230000	46.1	Off	N	19.8	3.9	50.0
17.694000	43.3	Off	N	19.8	6.7	50.0
19.710000	38.4	Off	N	19.8	11.6	50.0
23.126000	35.5	Off	N	19.9	14.5	50.0

3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 09, 2014	Nov. 14, 2014~ Nov. 25, 2014	Jun. 08, 2015	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Aug. 09, 2014	Nov. 14, 2014~ Nov. 25, 2014	Aug. 08, 2015	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Aug. 09, 2014	Nov. 14, 2014~ Nov. 25, 2014	Aug. 08, 2015	Conducted (TH02-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 12, 2014	Nov. 27, 2014	Nov. 11, 2015	Conduction (CO05-HY)
LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2013	Nov. 27, 2014	Dec. 11, 2014	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 04, 2013	Nov. 27, 2014	Dec. 03, 2014	Conduction (CO05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Nov. 27, 2014	N/A	Conduction (CO05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 09, 2014	Nov. 19, 2014~ Nov. 20, 2014	Jun. 08, 2015	Radiation (03CH05-HY)
Bilog Antenna	Schaffner	CBL6111C	2725	30MHz~1GHz	Sep. 27, 2014	Nov. 19, 2014~ Nov. 20, 2014	Sep. 26, 2015	Radiation (03CH05-HY)
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz~18GHz	Apr. 16, 2014	Nov. 19, 2014~ Nov. 20, 2014	Apr. 15, 2015	Radiation (03CH05-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Oct. 02, 2014	Nov. 19, 2014~ Nov. 20, 2014	Oct. 01, 2015	Radiation (03CH05-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	100kHz~18GHz	Jul. 07, 2014	Nov. 19, 2014~ Nov. 20, 2014	Jul. 06, 2015	Radiation (03CH05-HY)
Preamplifier	EMCI	EMC011830	980148	DC~18GHz	Jun. 23, 2014	Nov. 19, 2014~ Nov. 20, 2014	Jun. 22, 2015	Radiation (03CH05-HY)
Preamplifier	COM-POWER	PA-103	161075	9kHz~30MHz	Apr. 15, 2014	Nov. 19, 2014~ Nov. 20, 2014	Apr. 14, 2015	Radiation (03CH05-HY)
Preamplifier	Miteq	TTA0204	1872107	18GHz~40GHz	May 23, 2014	Nov. 19, 2014~ Nov. 20, 2014	May 22, 2015	Radiation (03CH05-HY)
Turn Table	HD	HD100	420/611	0 - 360 degree	N/A	Nov. 19, 2014~ Nov. 20, 2014	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	HD100	240/666	1 m - 4 m	N/A	Nov. 19, 2014~ Nov. 20, 2014	N/A	Radiation (03CH05-HY)
Loop Antenna	R&S	HFH2-Z2	100315	9 kHz~30 MHz	Jul. 28, 2014	Nov. 19, 2014~ Nov. 20, 2014	Jul. 27, 2015	Radiation (03CH05-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.26**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.10**