Shanghai Feixun Communication Co., Ltd.

Wireless router

Main Model: FIR151B
Serial Model: N/A

June 16, 2014

Report No.: 14050023-FCC-R1
(This report supersedes none)

Modifications made to the product : None

This Test Report is Issued Under the Authority of:

William Long	Alex Liu	
William Long **Compliance Engineer**	**Alex Liu** **Technical Manager**	

RF Test Report

To: FCC Part 15.247: 2013, ANSI C63.4: 2009

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Laboratory Introduction

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Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC , RF/Wireless , Telecom
Canada	EMC, RF/Wireless , Telecom
Taiwan	EMC, RF, Telecom , Safety
Hong Kong	RF/Wireless ,Telecom
Australia	EMC, RF, Telecom , Safety
Korea	EMI, EMS, RF , Telecom, Safety
Japan	EMI, RF/Wireless, Telecom
Singapore	EMC , RF , Telecom
Europe	EMC, RF, Telecom , Safety

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1 EXECUTIVE SUMMARY & EUT INFORMATION

The purpose of this test programme was to demonstrate compliance of the Shanghai Feixun Communication Co., Ltd., Wireless router and model: FIR151B against the current Stipulated Standards. The Wireless router has demonstrated compliance with the FCC Part 15.247: 2013, ANSI C63.4: 2009.

EUT Information

EUT Description	Wireless router
Main Model	FIR151B
Serial Model	N/A
Antenna Gain	WIFI: 5 dBi
Input Power	Adapter 1: Model: PSAA06X-120 (X=A, C, E, K, S) Input: AC 100-240V 200mA Output: DC 12V 500mA Adapter 2: Model: RD1200500-C55-8MG Input: AC 100-240V 250mA Output: DC 12V 500mA
Classification Per Stipulated Test Standard	FCC Part 15.247: 2013, ANSI C63.4: 2009

2 TECHNICAL DETAILS

Purpose	**Compliance testing of Wireless router with stipulated standard**
Applicant / Client	**Shanghai Feixun Communication Co., Ltd. No.3666,Sixian Rd.,Songjiang District,Shanghai,P.R.China**
Manufacturer	**Shanghai Feixun Communication Co., Ltd. No.3666,Sixian Rd.,Songjiang District,Shanghai,P.R.China**
Laboratory performing the tests	**SIEMIC (Nanjing-China) Laboratories NO.2-1,Longcang Dadao, Yuhua Economic Development Zone, Nanjing, China Tel: +86(25)86730128/86730129 Fax: +86(25)86730127 Email: China@siemic.com.cn**
Test report reference number	**14050023-FCC-R1**
Date EUT received	**May 16, 2014**
Standard applied	**FCC Part 15.247: 2013, ANSI C63.4: 2009**
Dates of test (from – to)	**May 20 to June 15, 2014**
No of Units :	**#1**
Equipment Category :	**Spread Spectrum System/Device**
Trade Name :	**PHICOMM**
RF Operating Frequency (ies)	**WIFI: 802.11b/g/n(20M): 2412-2462 MHz 802.11n(40M): 2422-2452 MHz**
Number of Channels	**802.11b/g/n(20M): 11CH 802.11n(40M): 7CH**
Modulation	**802.11b/g/n: CCK/OFDM**
Port	**Power Port, LAN*4 Port, WAN Port**
FCC ID :	**YJYFIR151B**

3 MODIFICATION

N/A

4 TEST SUMMARY

The product was tested in accordance with the following specifications.
All testing has been performed according to below product classification:

Test Results Summary

FCC Rules	Description of Test	Result
§15.247 (i), §2.1091	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.247 (a)(2)	DTS (6 dB&20 dB) CHANNEL BANDWIDTH	Compliance
§15.247(b)(3)	Conducted Maximum Output Power	Compliance
§15.247(e)	Power Spectral Density	Compliance
§15.247(d)	Band-Edge & Unwanted Emissions into Non-Restricted Frequency Bands	Compliance
§15.207 (a),	AC Power Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands	Compliance

5 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

5.1 §15.247 (i) and §2.1091 – RF Exposure

The EUT is a Mobile device, thus requires RF exposure evaluation;
please refer to SIEMIC RF Exposure Report: 14050023-FCC-H1.

5.2 §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The antenna is up to ANTENNA REQUIREMENT.

Result: Compliance.

5.3 §15.247(a) (2) –DTS (6 dB&20 dB) CHANNEL BANDWIDTH

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions

Temperature	20°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
4. Test date : May 28 to June 05, 2014
   Tested By : William Long

Requirement(s): The minimum 6 dB bandwidth of a DTS transmission shall be at least 500 kHz. Within this document, this bandwidth is referred to as the DTS bandwidth. The procedures provided herein for measuring the maximum peak conducted output power assume the use of the DTS bandwidth.

Procedures:

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

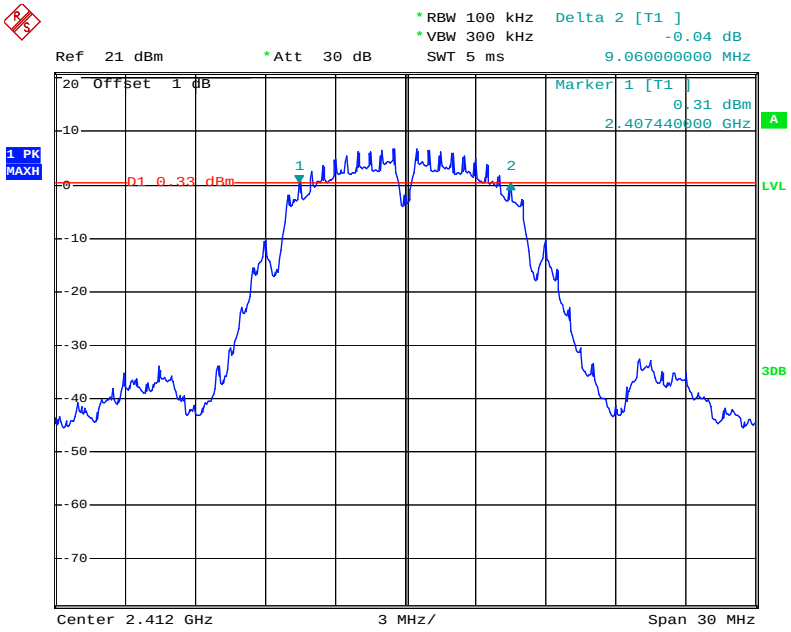
Test Result: Pass.

Please refer to the following tables and plots.

6dB bandwidth:

Channel	Channel Frequency (MHz)	Data Rate (Mbps)	Measured 6dB Bandwidth (MHz)	FCC Part 15.247 Limit (kHz)
802.11b mode				
Low	2412	1	9.06	＞500
Middle	2437	1	9.12	＞500
High	2462	1	9.06	＞500
802.11g mode				
Low	2412	6	15.12	＞500
Middle	2437	6	15.12	＞500
High	2462	6	15.12	＞500
802.11n(20M) mode				
Low	2412	MCS0	15.12	＞500
Middle	2437	MCS0	15.12	＞500
High	2462	MCS0	15.12	＞500
802.11n(40M) mode				
Low	2422	MCS0	36.50	＞500
Middle	2437	MCS0	36.40	＞500
High	2452	MCS0	36.50	＞500

802.11b Low Channel



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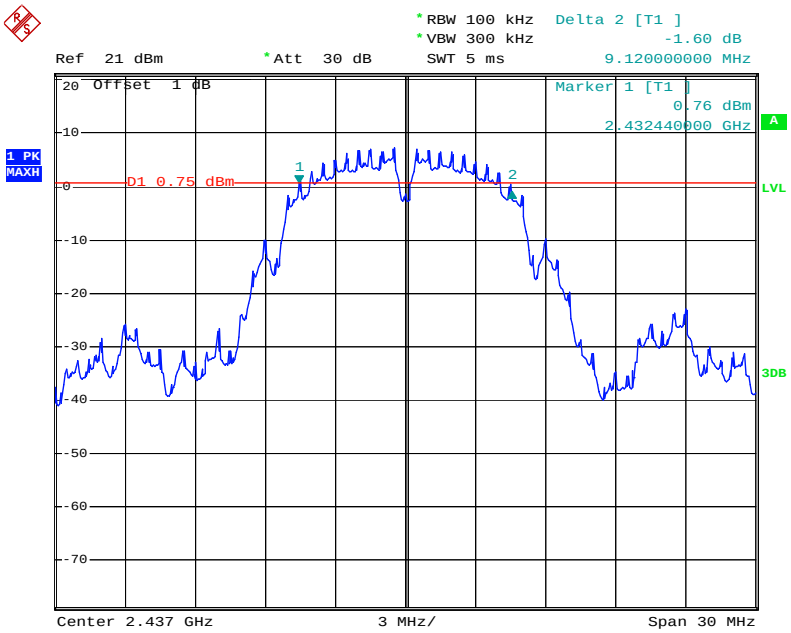
802.11b Middle Channel



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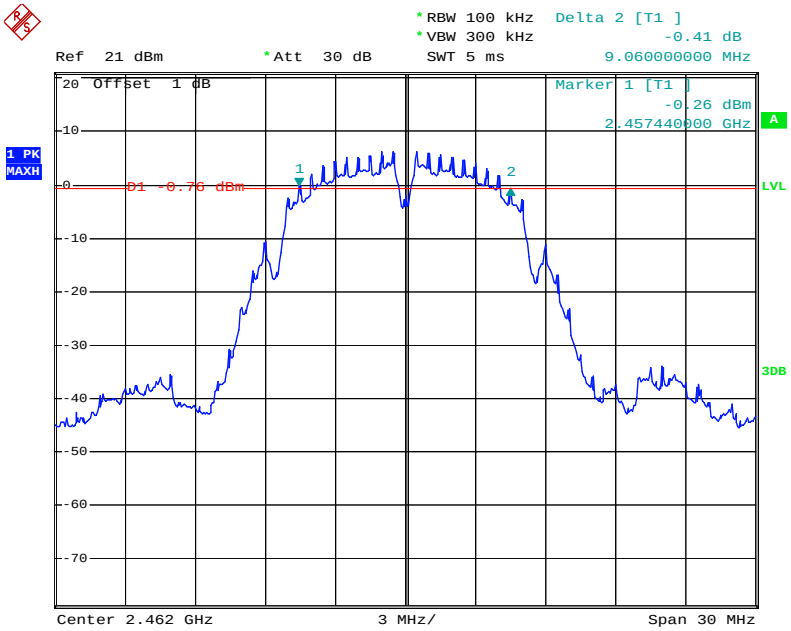
802.11b High Channel



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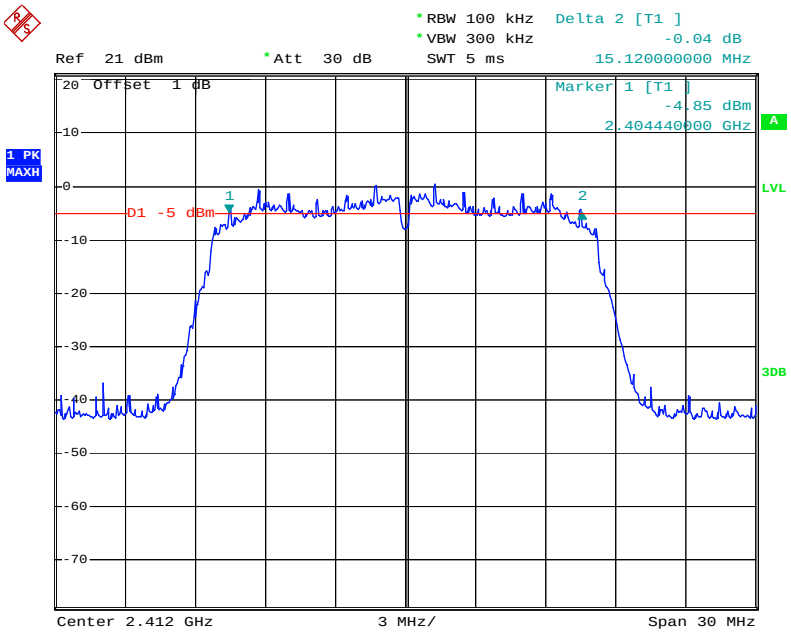
802.11g Low Channel



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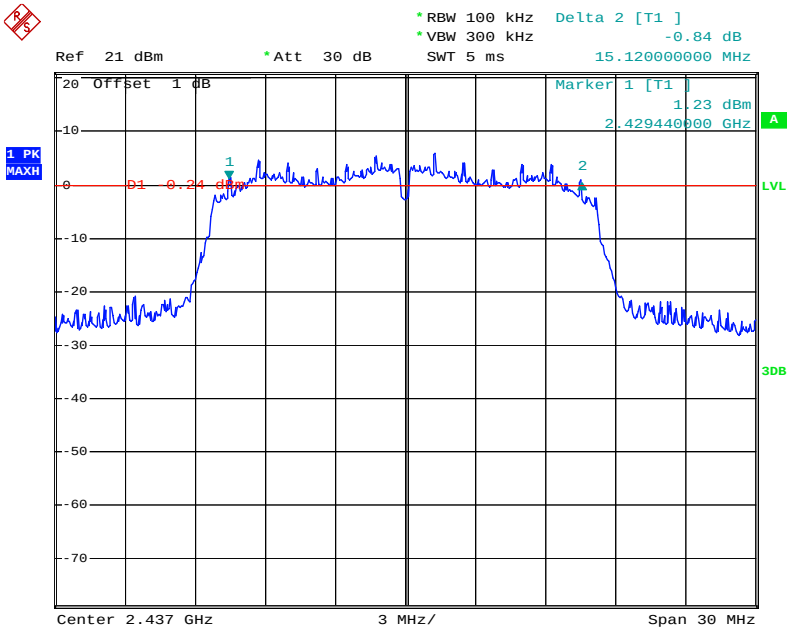
802.11g Middle Channel



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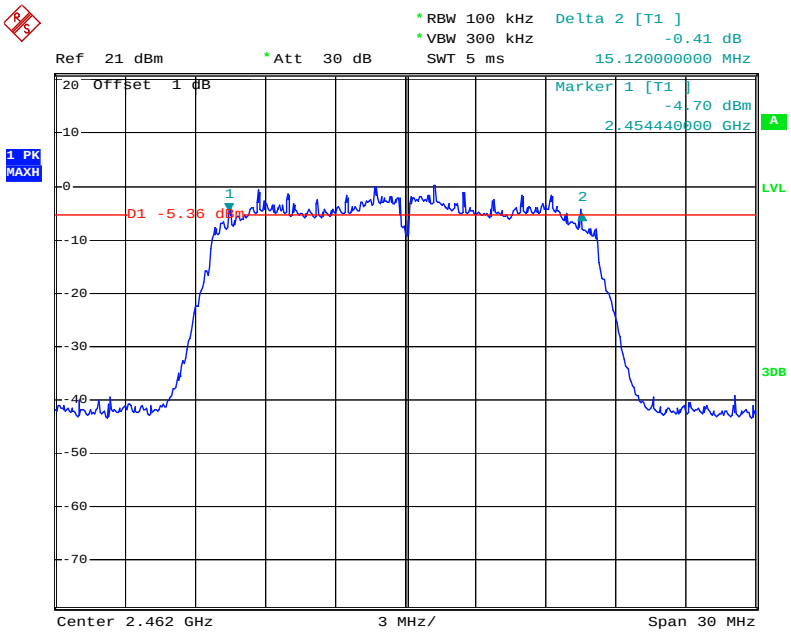

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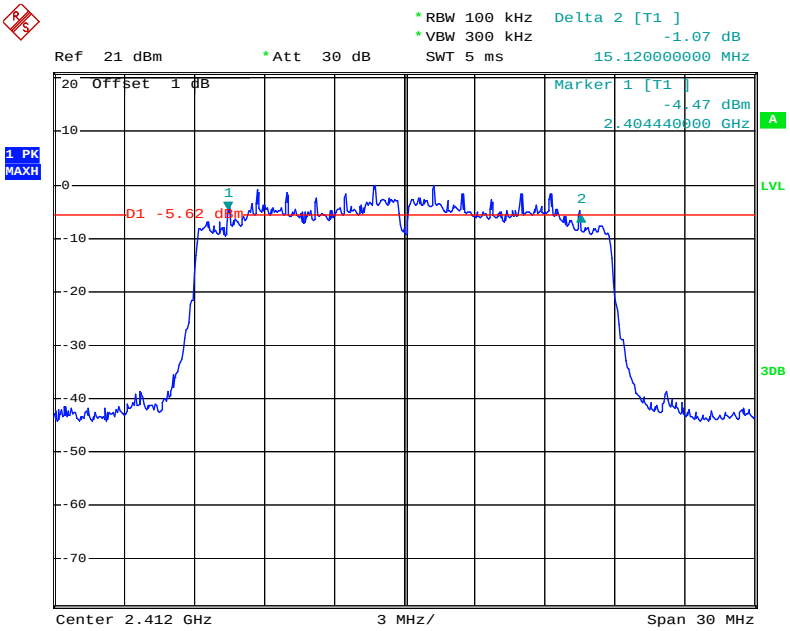
802.11n(20M) Low Channel



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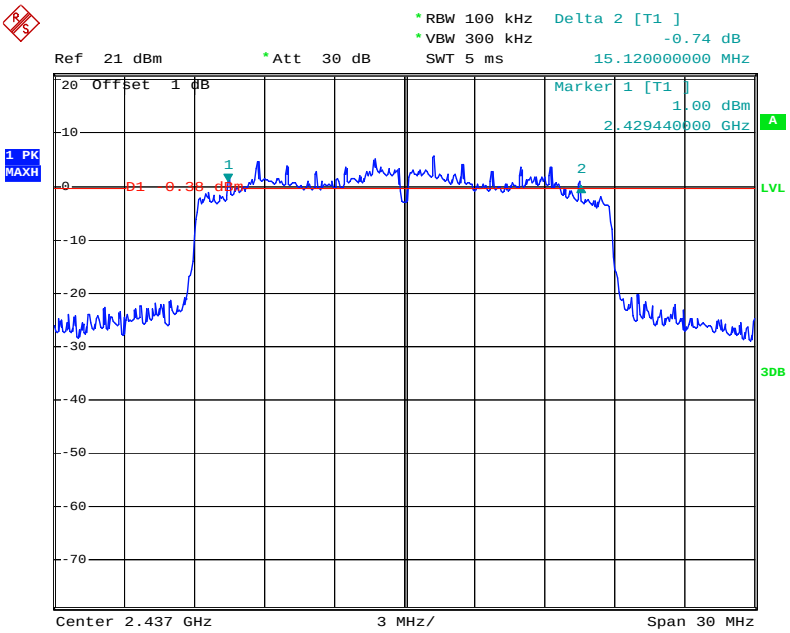

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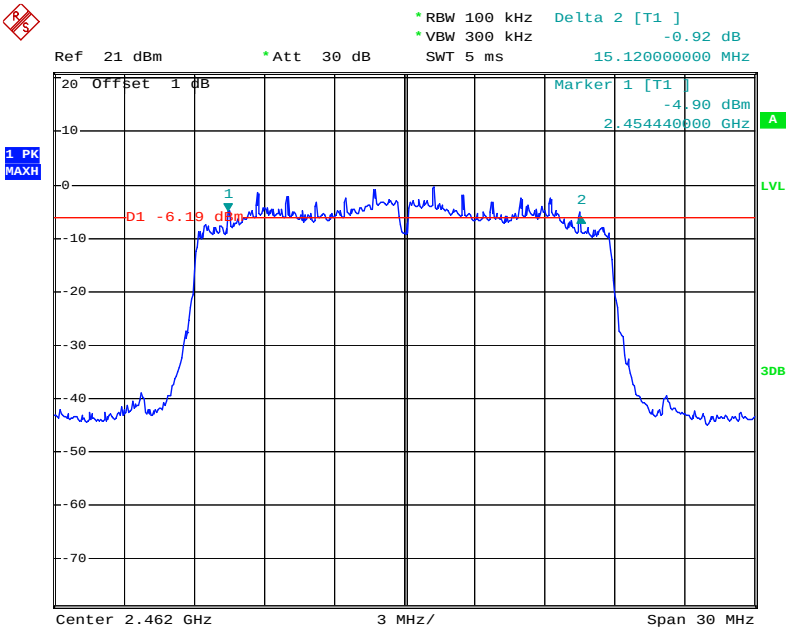

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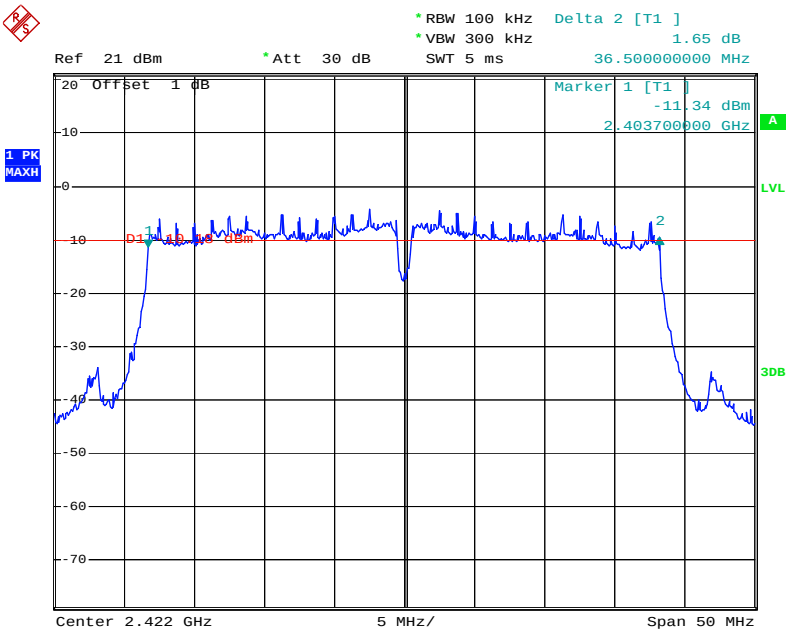

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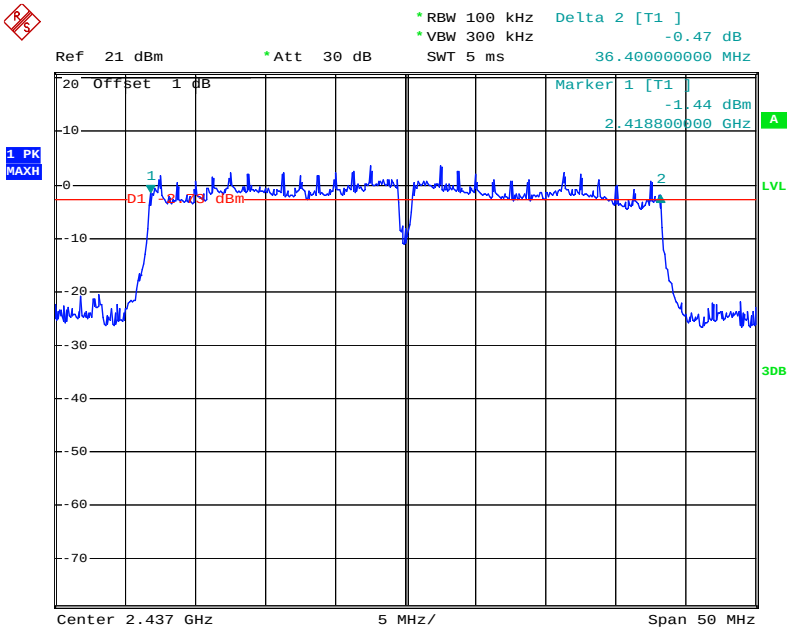
802.11n(40M) Middle Channel



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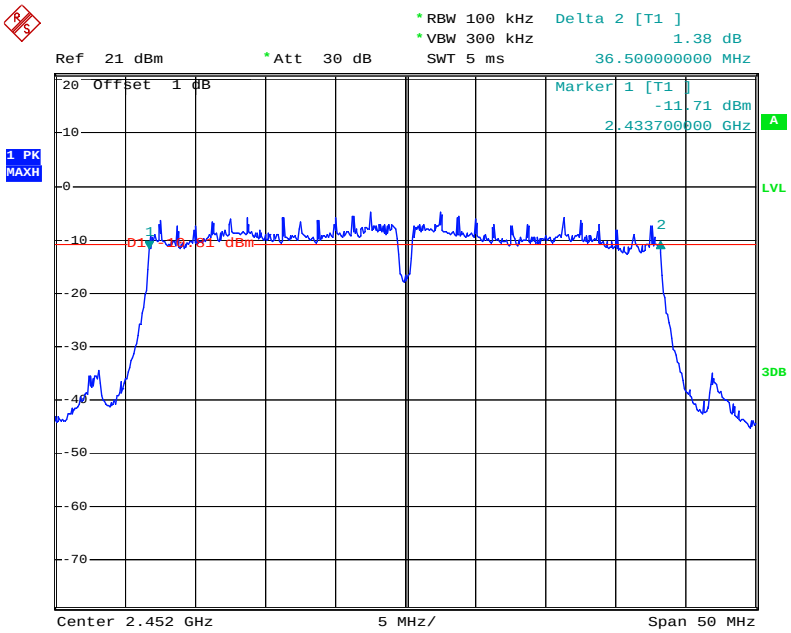

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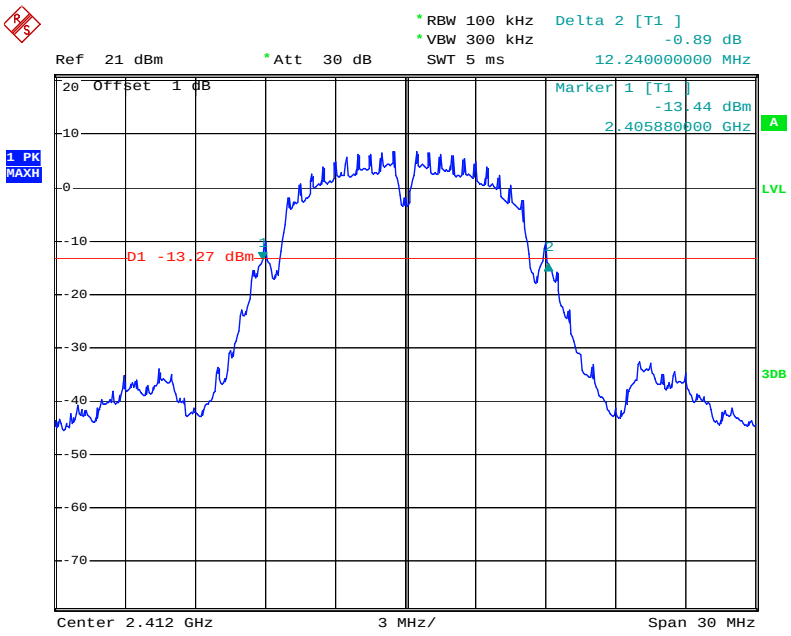
20dB bandwidth:

Channel	Channel Frequency (MHz)	Data Rate (Mbps)	Measured 20dB Bandwidth (MHz)	FCC Part 15.247 Limit (kHz)
802.11b mode				
Low	2412	1	12.24	>500
Middle	2437	1	12.24	>500
High	2462	1	12.24	>500
802.11g mode				
Low	2412	6	17.58	>500
Middle	2437	6	17.58	>500
High	2462	6	17.58	>500
802.11n(20M) mode				
Low	2412	MCS0	18.12	>500
Middle	2437	MCS0	18.06	>500
High	2462	MCS0	18.12	>500
802.11n(40M) mode				
Low	2422	MCS0	37.60	>500
Middle	2437	MCS0	37.60	>500
High	2452	MCS0	37.60	>500

802.11b Low Channel



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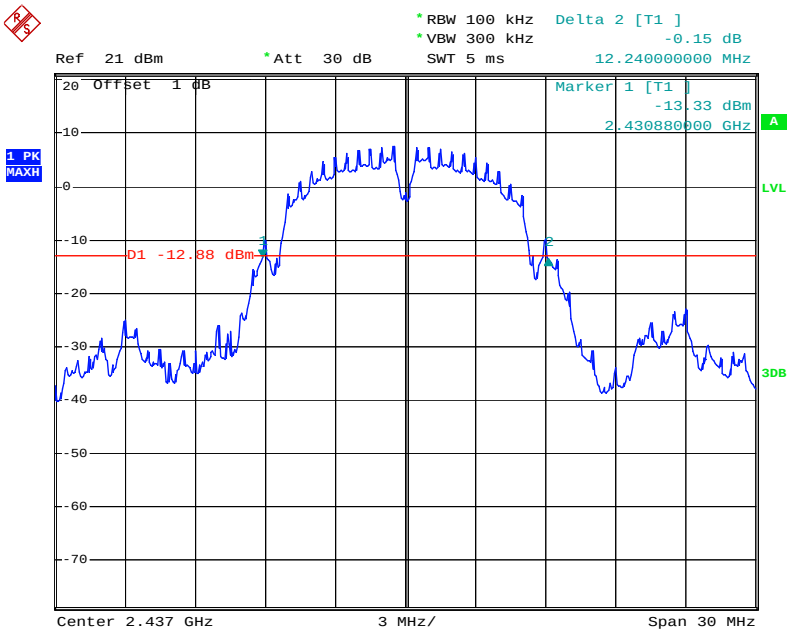
802.11b Middle Channel



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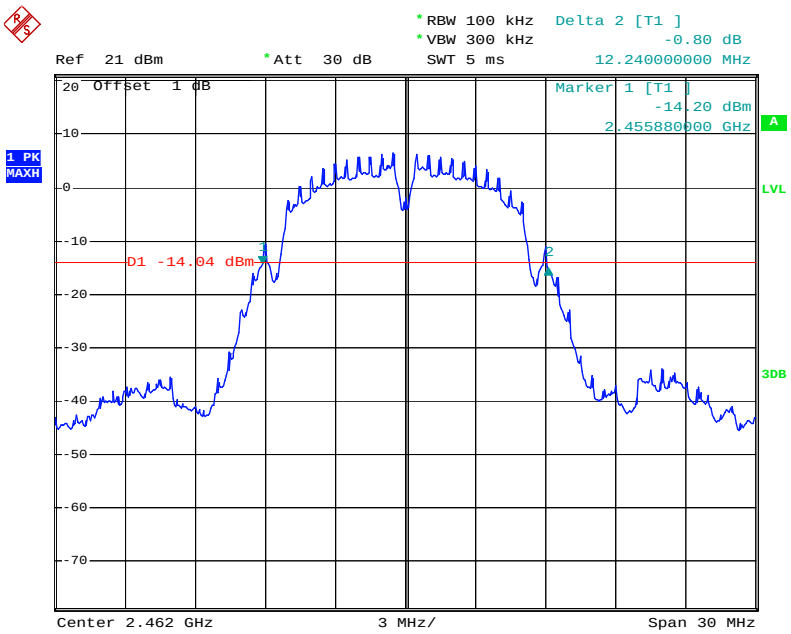
802.11b High Channel



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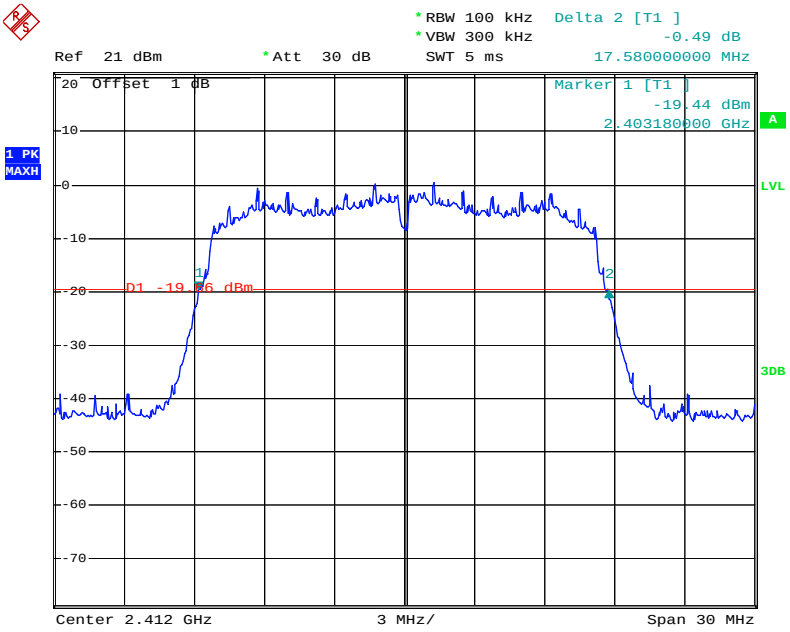

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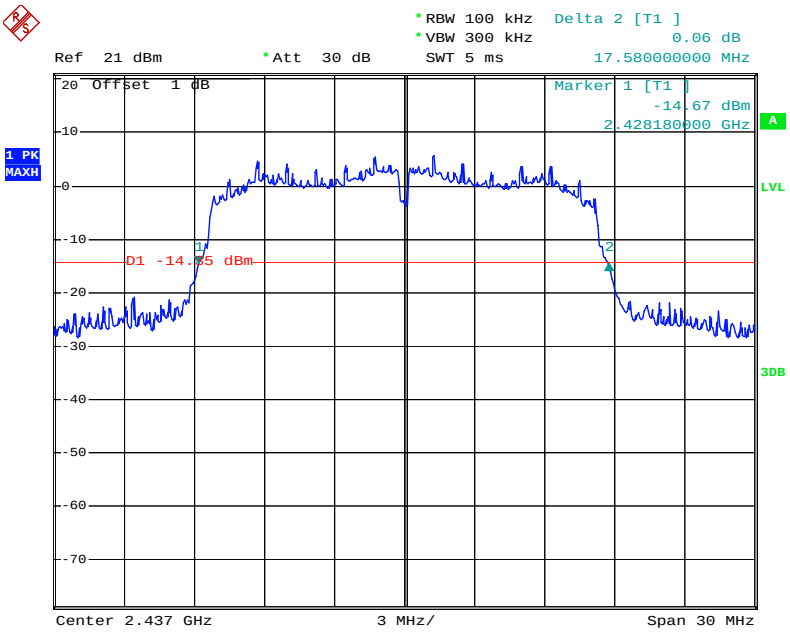
802.11g Middle Channel



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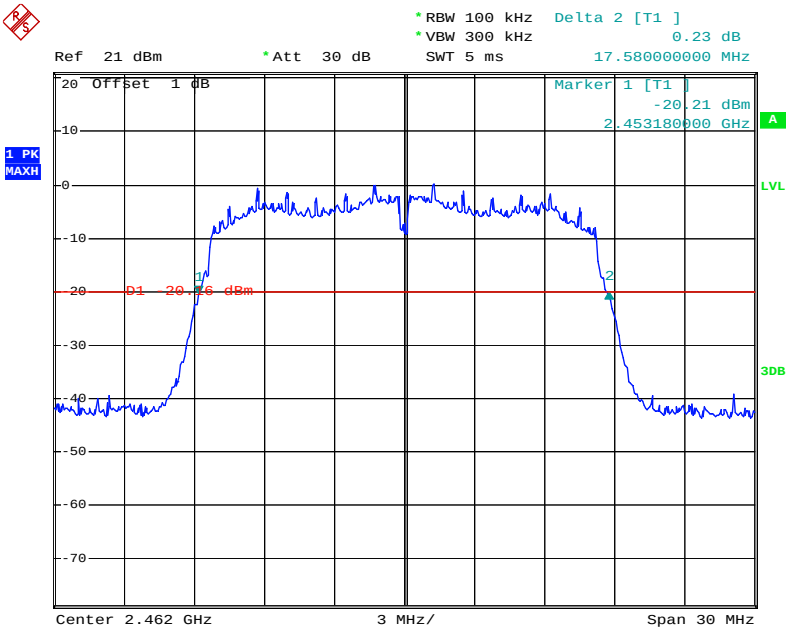
802.11g High Channel



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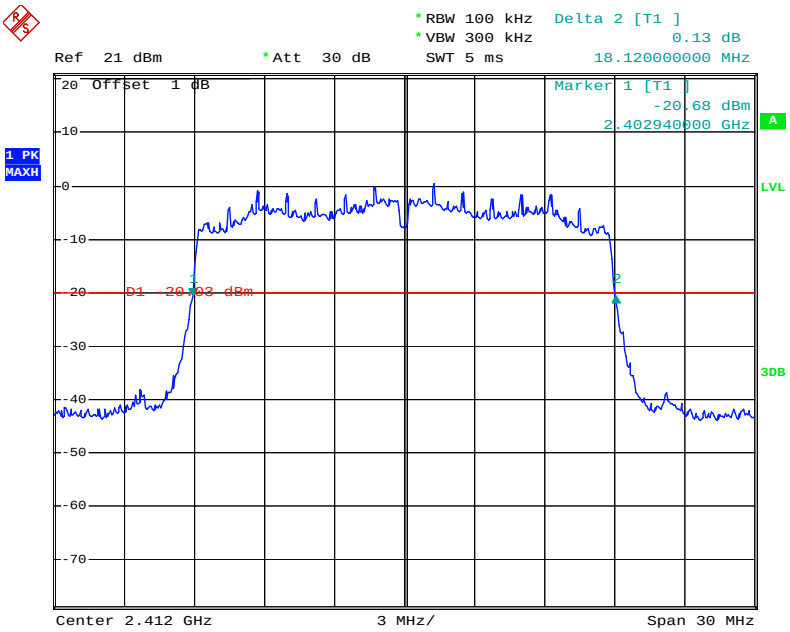
802.11n (20M) Low Channel



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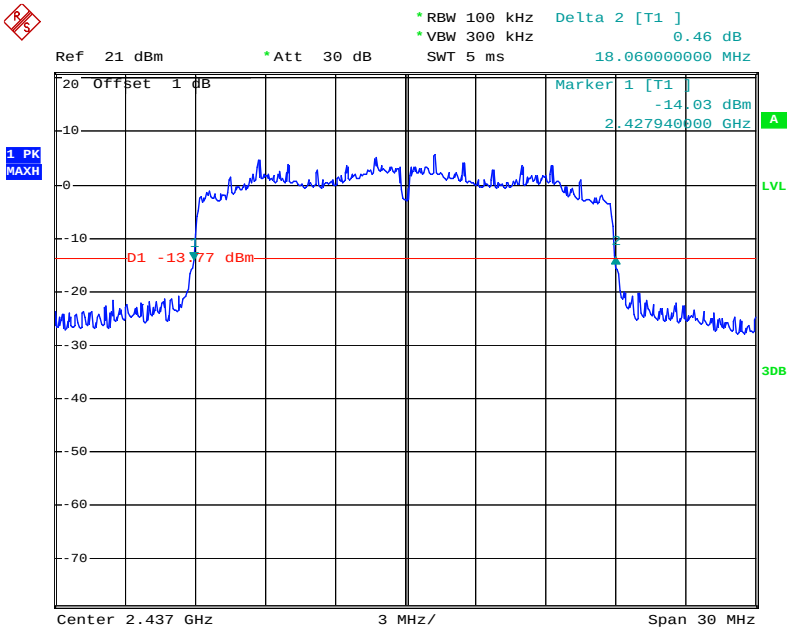
802.11n(20M) Middle Channel



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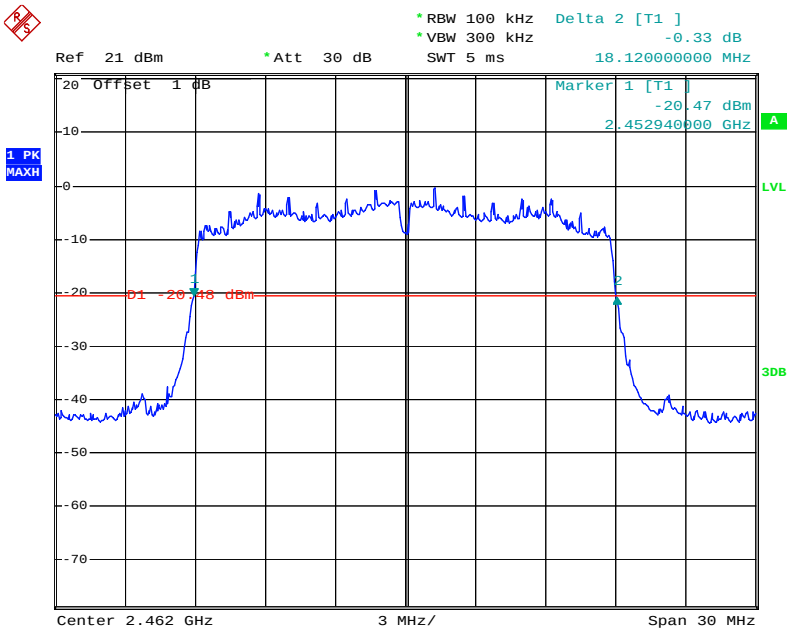
802.11n(20M) High Channel



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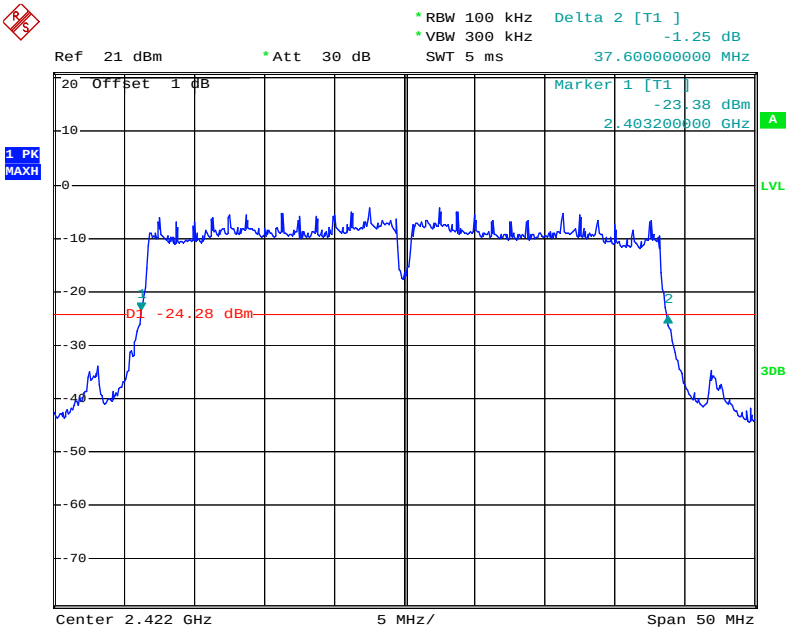
802.11n (40M) Low Channel



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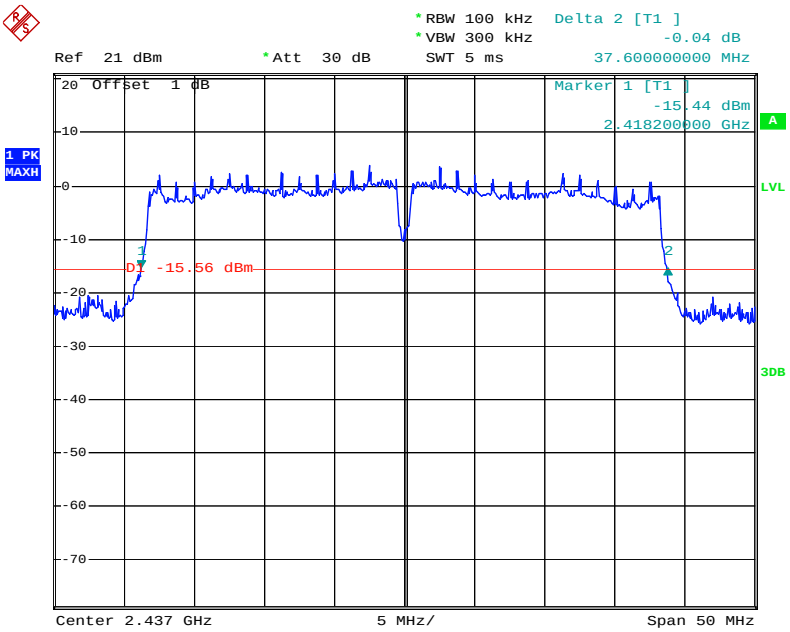
802.11n(40M) Middle Channel



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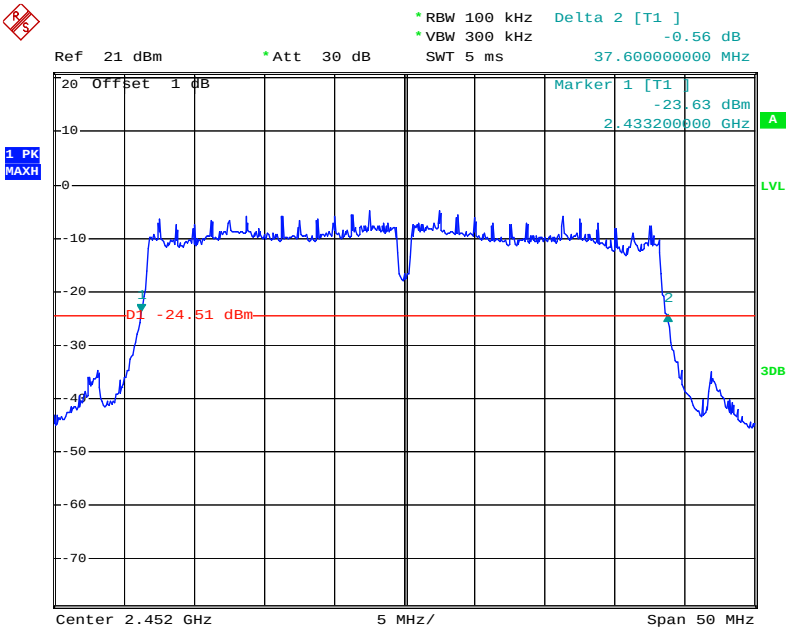
802.11n(40M) High Channel



Date: 5.JUN.2014 12:41:47

5.4 §15.247(b) (3) - Conducted Maximum Output Power

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Temperature	20°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

4. Test date : May 28 to June 15, 2014
   Tested By : William Long

Standard Requirement:

Maximum Peak Conducted Output Power

The following procedures can be used to determine the maximum peak conducted output power of a DTS EUT.

Maximum Conducted Output Power

§15.247(b)(3) permits the maximum (average) conducted output power to be measured as an alternative to the maximum peak conducted output power for demonstrating compliance to the limit. When these procedures are utilized, the power is referenced to the emission bandwidth (EBW) rather than the DTS bandwidth (see Section 2.0 for definitions).

When using a spectrum/signal analyzer to perform these measurements, it must be capable of utilizing a number of measurement points in each sweep that is greater than or equal to twice the span/RBW in order to ensure bin-to-bin spacing of ≤ RBW/2 so that narrowband signals are not lost between frequency bins.

The ideal method for measuring the maximum (average) conducted output power is with the EUT is configured to transmit continuously (duty cycle ≥ 98%) at its maximum power control level. However, when this condition cannot be realized, video triggering or signal gating can be used to ensure that the measurements are performed only during periods when the EUT is transmitting at its maximum power control level. An option is also provided that can be used when none of the above requirements can be met with the available measurement instrumentation.

Procedures:

Maximum peak conducted output power:

Integrated band power method

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

1. Set the RBW = 1 MHz.
2. Set the VBW ≥ 3 x RBW
3. Set the span ≥ 1.5 x DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function. sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

Maximum conducted (average) output power:

Method AVGSA-1 (trace averaging with the EUT transmitting at full power throughout each sweep)

This procedure should be used with an RMS power averaging detector; however, a sample detector can be used when an RMS detector is not available. This is the baseline method for measuring the maximum (average) conducted output power.

1. Set span to at least 1.5 times the OBW.
2. Set RBW = 1-5% of the OBW, not to exceed 1 MHz.

3. Set VBW ≥ 3 x RBW.
4. Number of points in sweep ≥ 2 x span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto.
6. Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
7. If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".
8. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
9. Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Test Result: Pass.

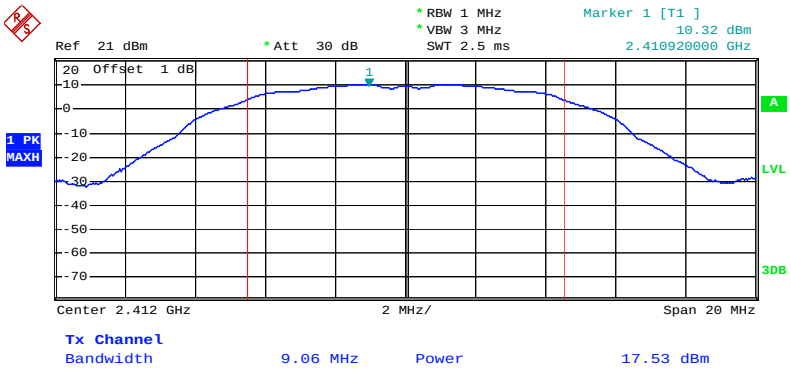
Please refer to the following tables and plots.

The Power

Channel	Channel Frequency (MHz)	Data Rate (Mbps)	PK Output Power (dBm)	AV Output Power (dBm)	Limit (dBm)
802.11b mode					
Low	2412	1	17.53	14.73	30
Middle	2437	1	18.12	15.73	30
High	2462	1	16.96	14.37	30
802.11g mode					
Low	2412	6	18.29	12.14	30
Middle	2437	6	23.54	17.15	30
High	2462	6	18.14	11.99	30
802.11n(20M) mode					
Low	2412	MCS0	17.74	11.59	30
Middle	2437	MCS0	23.35	17.12	30
High	2462	MCS0	17.38	11.35	30
802.11n(40M) mode					
Low	2422	MCS0	15.64	10.14	30
Middle	2437	MCS0	24.06	17.09	30
High	2452	MCS0	15.43	10.04	30

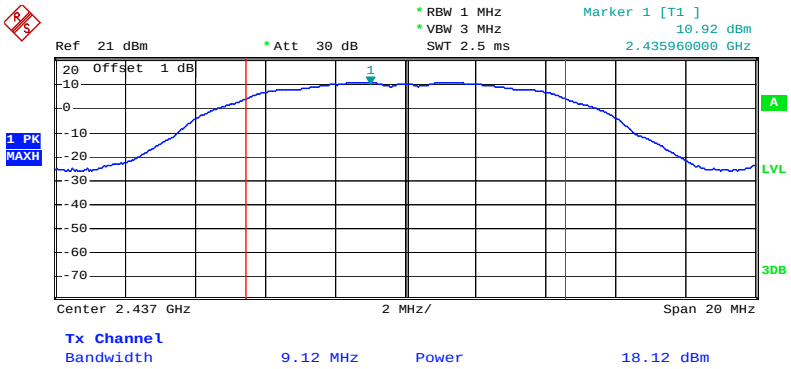
The Peak Power

802.11b Low Channel



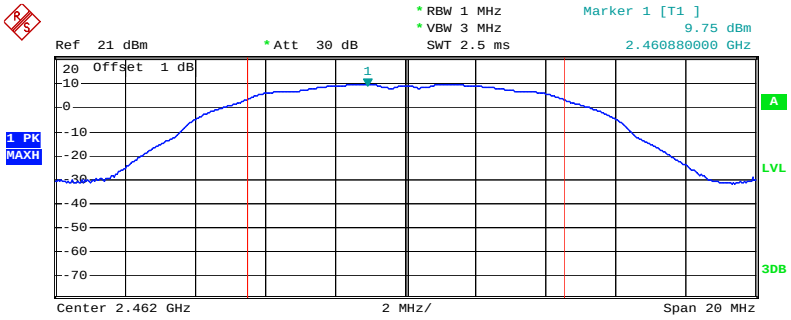
Date: 28.MAY.2014 16:24:58

802.11b Middle Channel



Date: 5.JUN.2014 18:55:09

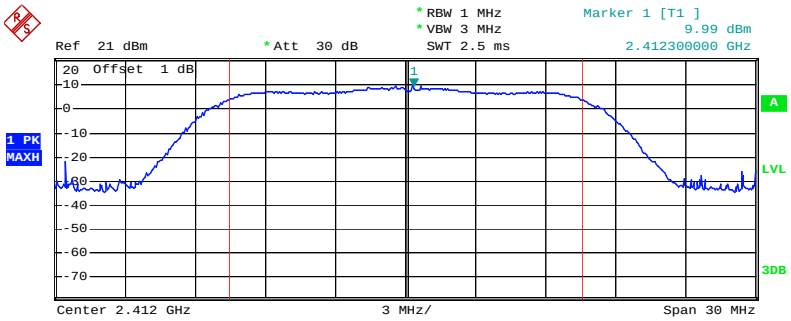
802.11b High Channel



Tx Channel
Bandwidth 9.06 MHz Power 16.96 dBm

Date: 28.MAY.2014 16:26:44

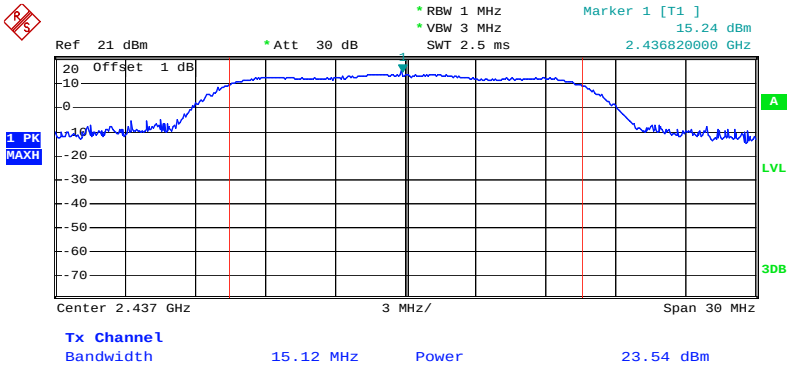
802.11g Low Channel



Tx Channel
Bandwidth 15.12 MHz Power 18.29 dBm

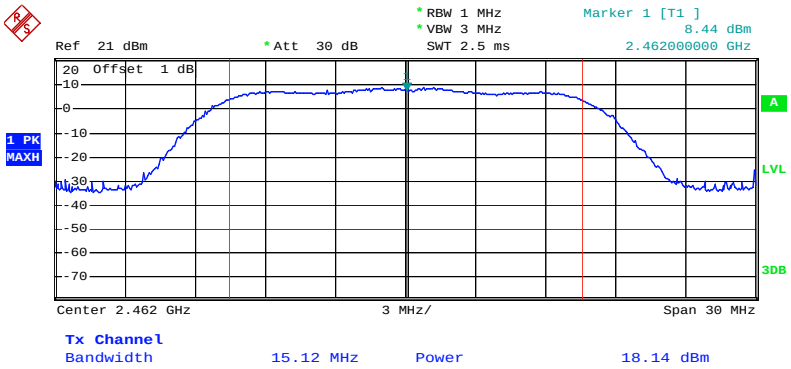
Date: 28.MAY.2014 16:30:21

802.11g Middle Channel



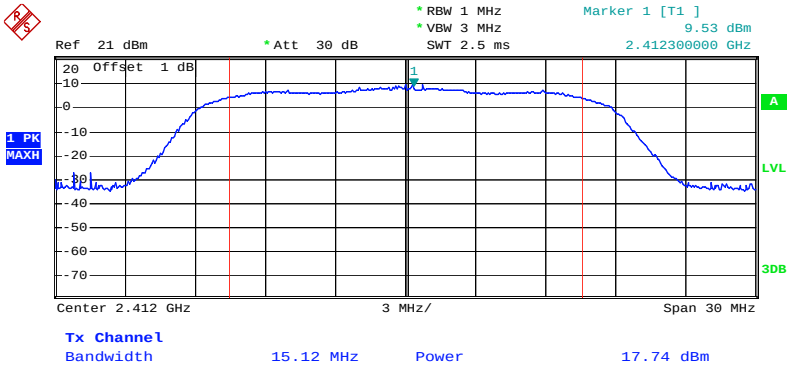
Date: 5.JUN.2014 12:58:42

802.11g High Channel



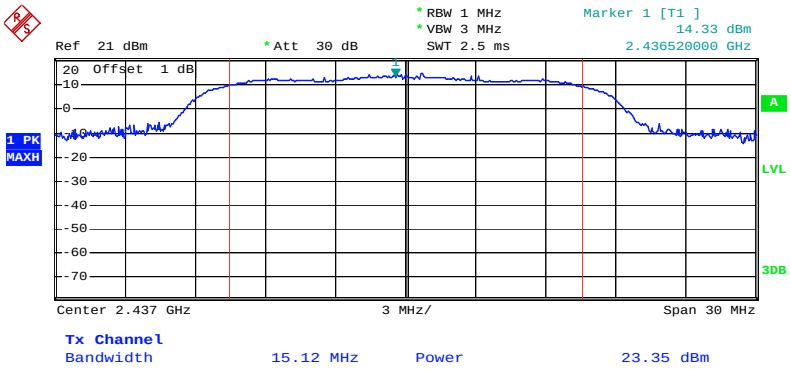
Date: 28.MAY.2014 16:28:18

802.11n(20M) Low Channel



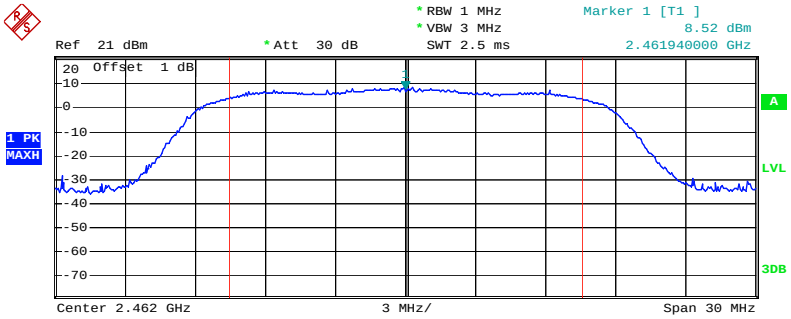
Date: 28.MAY.2014 16:32:15

802.11n(20M) Middle Channel



Date: 5.JUN.2014 12:59:30

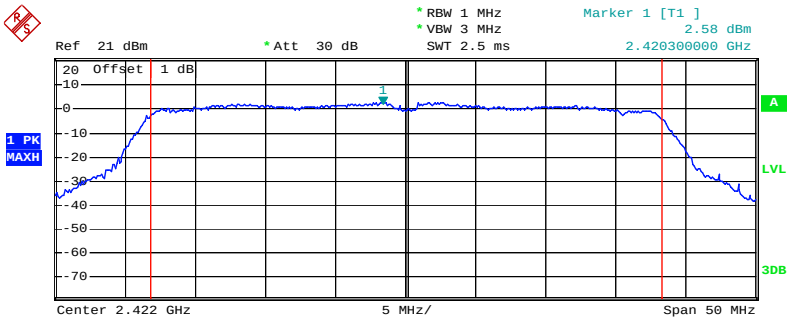
802.11n(20M) High Channel



Tx Channel
Bandwidth 15.12 MHz Power 17.38 dBm

Date: 28.MAY.2014 16:34:11

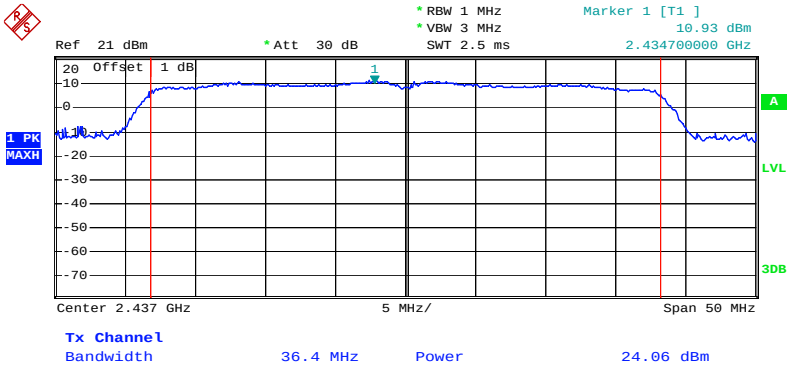
802.11n(40M) Low Channel



Tx Channel
Bandwidth 36.5 MHz Power 15.64 dBm

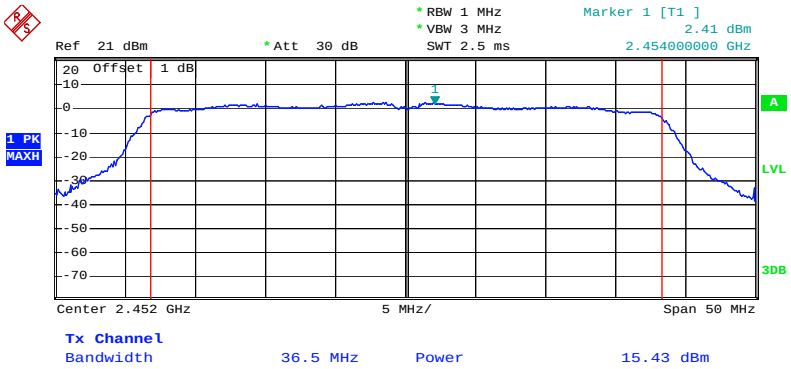
Date: 5.JUN.2014 12:49:40

802.11n(40M) Middle Channel



Date: 5.JUN.2014 12:29:25

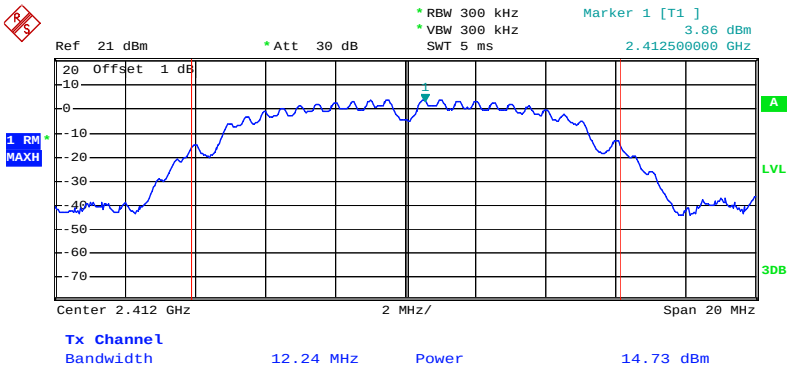
802.11n(40M) High Channel



Date: 5.JUN.2014 12:50:38

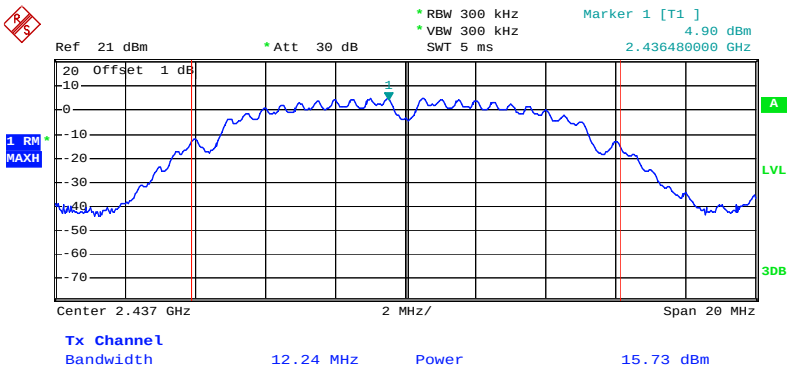
The Average Power

802.11b Low Channel



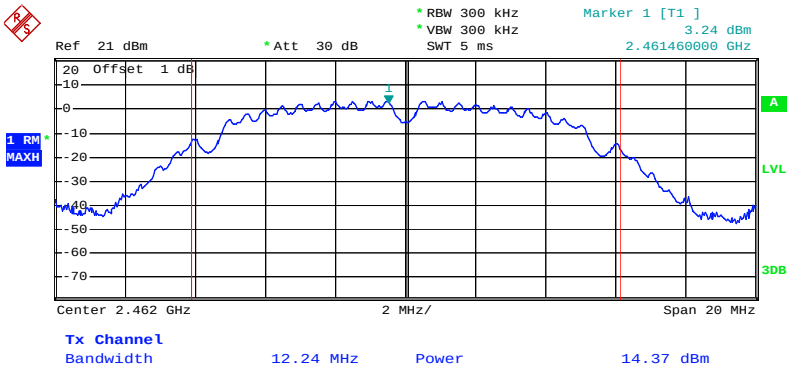
Date: 15.JUN.2014 16:51:34

802.11b Middle Channel



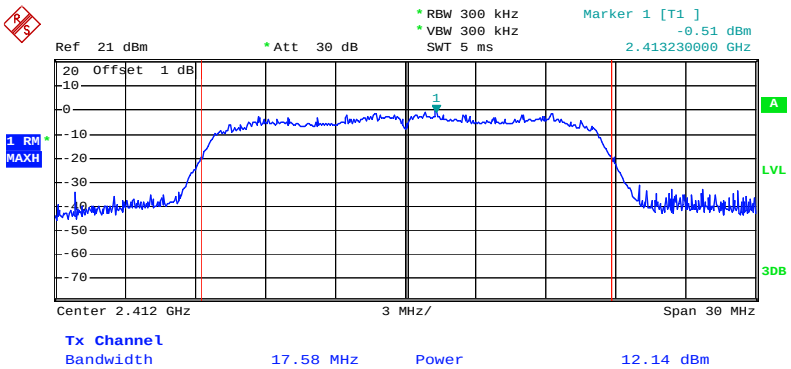
Date: 15.JUN.2014 16:54:02

802.11b High Channel



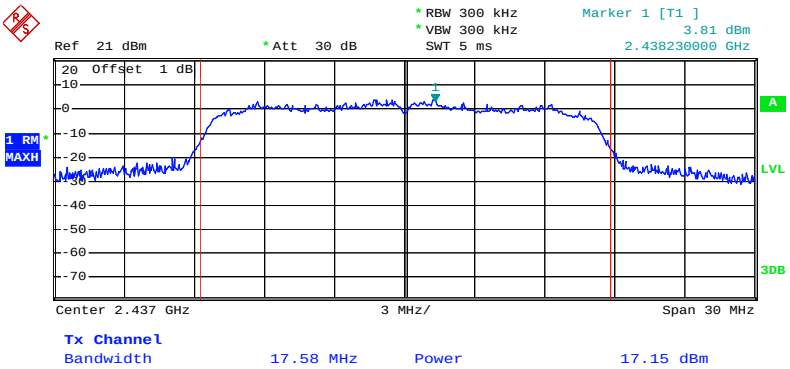
Date: 15.JUN.2014 16:54:59

802.11g Low Channel



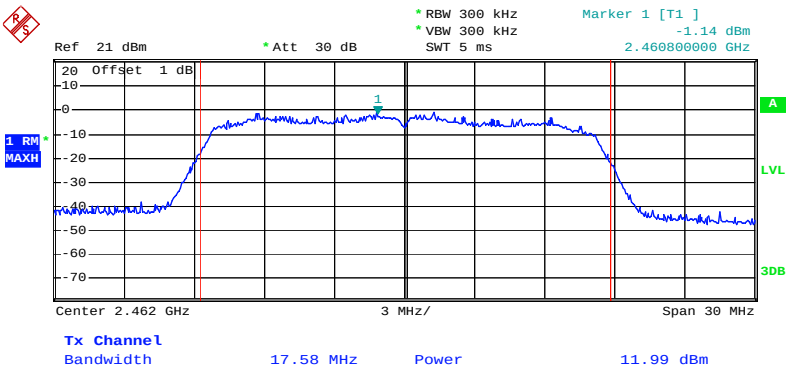
Date: 15.JUN.2014 16:56:13

802.11g Middle Channel



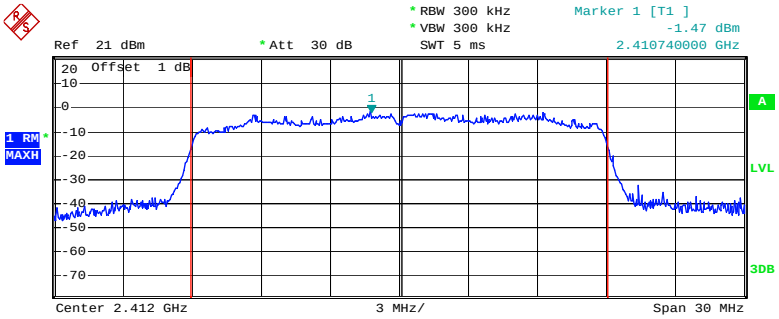
Date: 15.JUN.2014 16:57:10

802.11g High Channel



Date: 15.JUN.2014 16:58:04

802.11n(20M) Low Channel

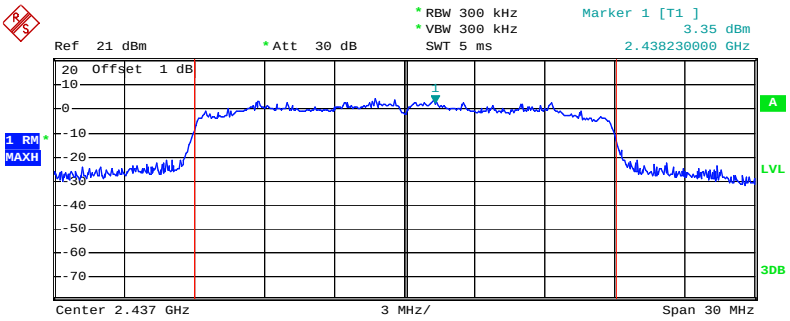


Tx Channel

Bandwidth	18.12 MHz	Power	11.59 dBm

Date: 15.JUN.2014 16:59:36

802.11n(20M) Middle Channel

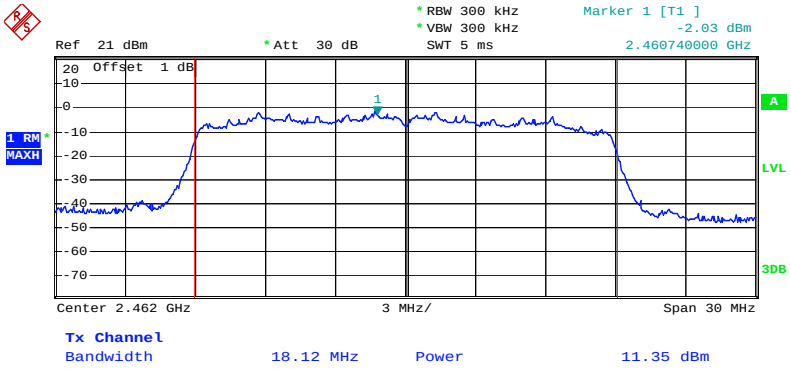


Tx Channel

Bandwidth	18.06 MHz	Power	17.12 dBm

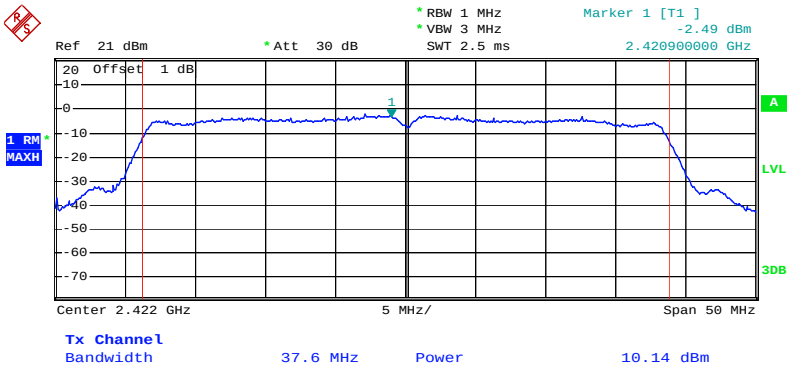
Date: 15.JUN.2014 17:01:07

802.11n(20M) High Channel



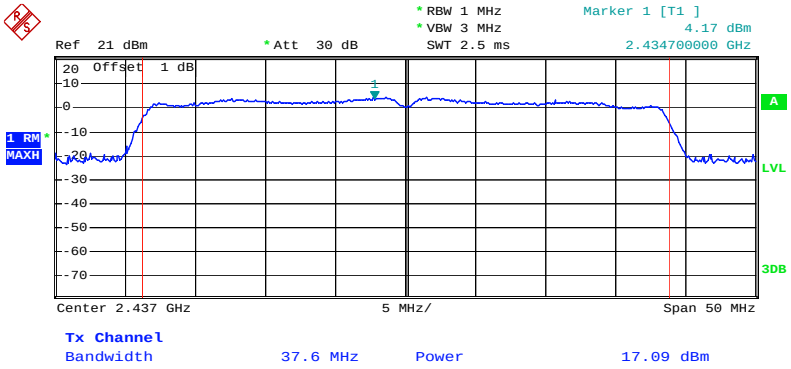
Date: 15.JUN.2014 17:12:37

802.11n(40M) Low Channel



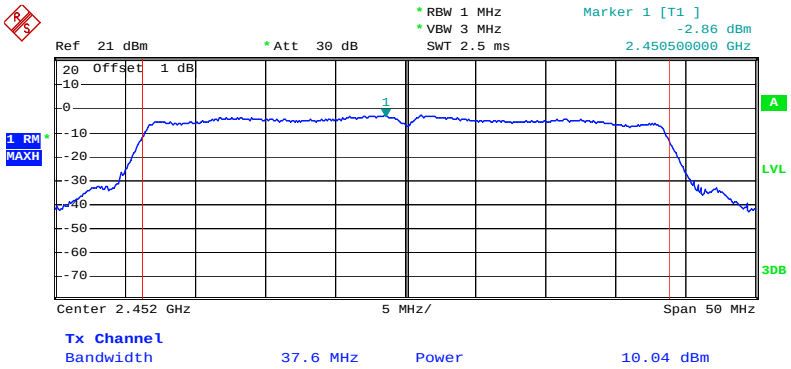
Date: 5.JUN.2014 12:48:44

802.11n(40M) Middle Channel



Date: 5.JUN.2014 12:28:02

802.11n(40M) High Channel



Date: 5.JUN.2014 12:48:22

5.5 §15.247(e) - Power Spectral Density

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions

Temperature	20°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
4. Test date : May 28 to June 05, 2014
   Tested By : William Long

Requirement(s):
A conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz band segment within the DTS bandwidth is specified during any time interval of continuous transmission.4 By rule, the same method as used to determine the conducted output power shall be used to determine the power spectral density (i.e., if maximum peak conducted output power was measured then the peak PSD procedure shall be used and if maximum conducted output power was measured then the average PSD procedure shall be used).
If the average PSD is measured with a power averaging (RMS) detector or a sample detector, then the spectrum analyzer must be capable of utilizing a number of measurement points in each sweep that is greater than or equal to twice the span/RBW in order to ensure bin-to-bin spacing of ≤ RBW/2 so that narrowband signals are not lost between frequency bins.

Procedures:
This procedure must be used if maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit, and is optional if the maximum (average) conducted output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW ≥ 3 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

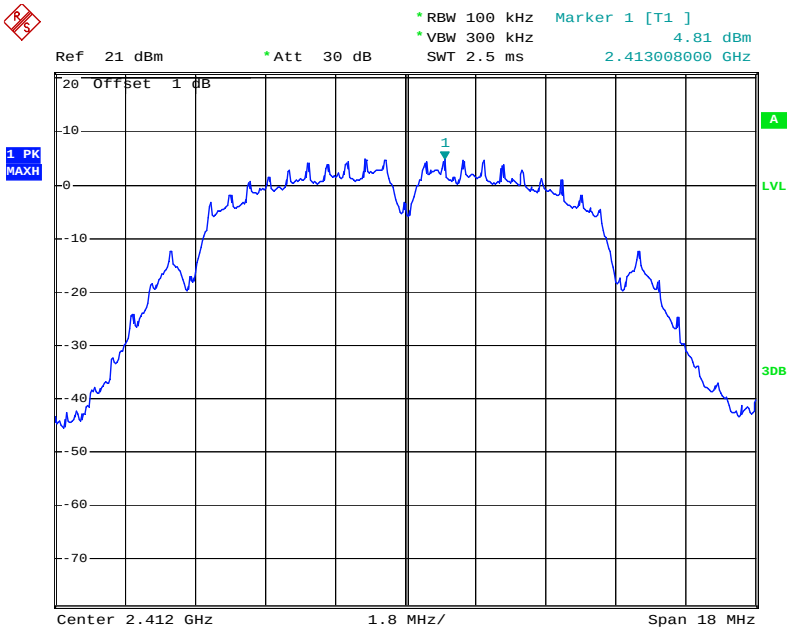
Test Result: Pass.

Please refer to the following tables and plots.

PSD:

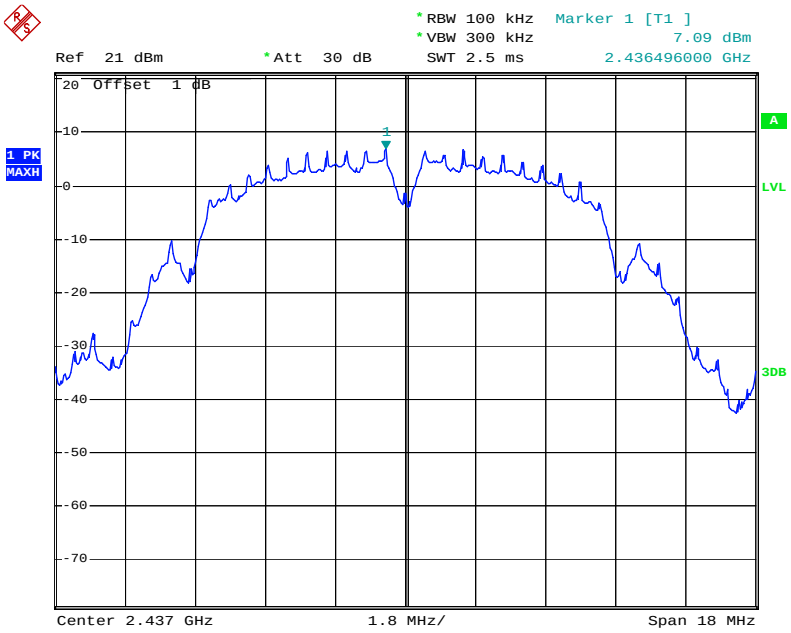
Channel	Frequency (MHz)	Data Rate	PSD (dBm)	Limit (dBm)
802.11b mode				
Low	2412	1	4.81	8
Middle	2437	1	7.09	8
High	2462	1	4.10	8
802.11g mode				
Low	2412	6	0.36	8
Middle	2437	6	5.24	8
High	2462	6	0.07	8
802.11n(20M) mode				
Low	2412	MCS0	-0.32	8
Middle	2437	MCS0	4.74	8
High	2462	MCS0	-0.50	8
802.11n(40M) mode				
Low	2422	MCS0	-4.26	8
Middle	2437	MCS0	1.64	8
High	2452	MCS0	-4.63	8

Power Spectral Density, 802.11b Low Channel



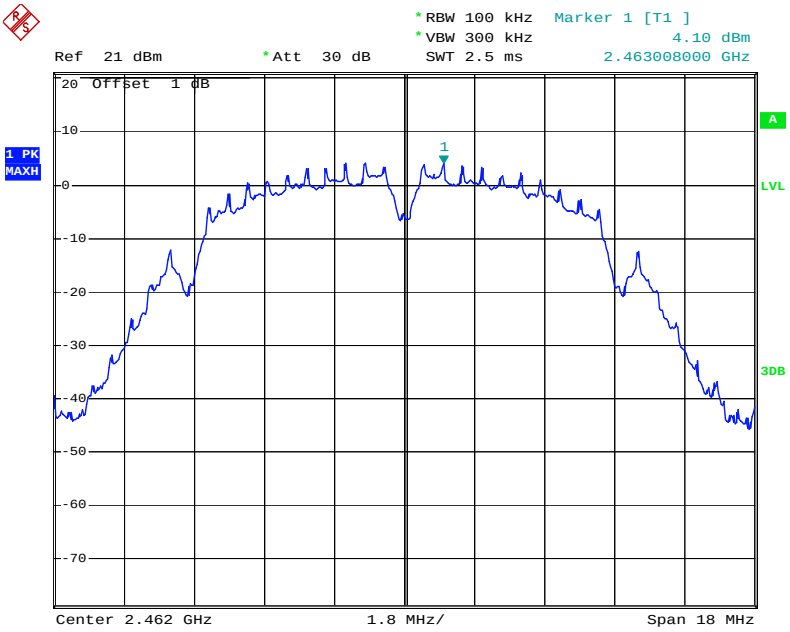
Date: 28.MAY.2014 15:33:45

Power Spectral Density, 802.11b Middle Channel



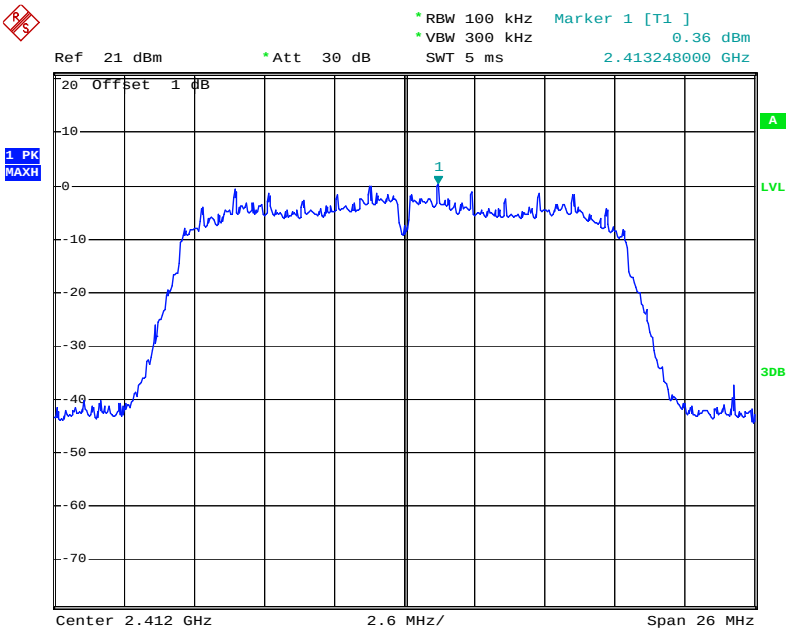
Date: 5.JUN.2014 19:04:59

Power Spectral Density, 802.11b High Channel



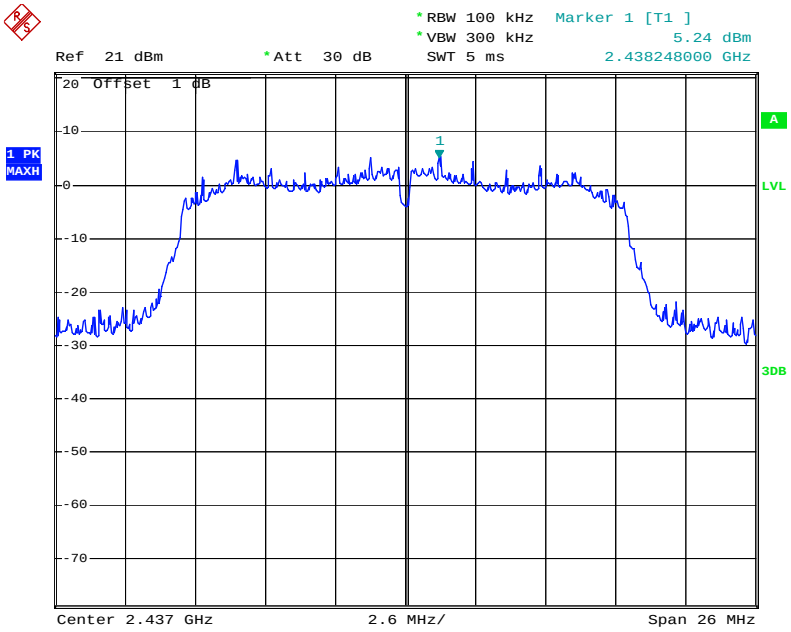
Date: 28.MAY.2014 15:36:01

Power Spectral Density, 802.11g Low Channel



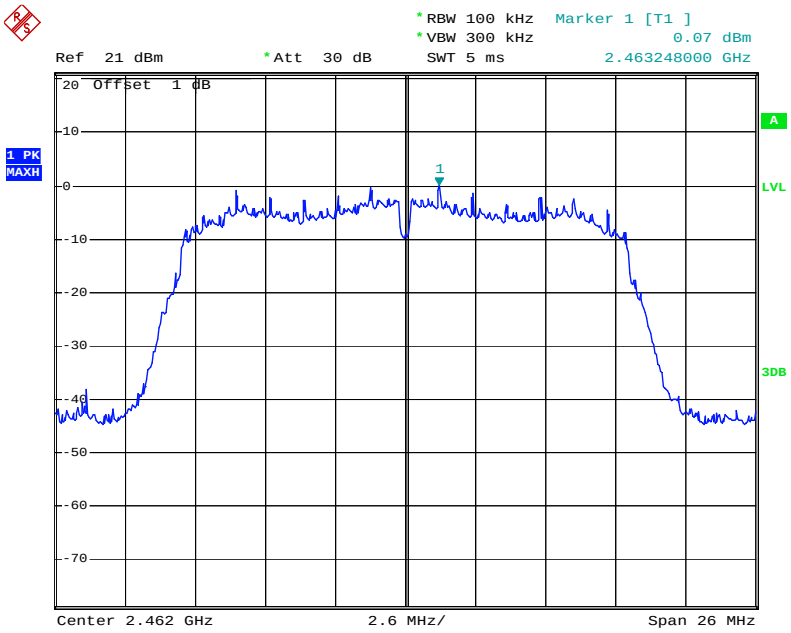
Date: 28.MAY.2014 15:39:32

Power Spectral Density, 802.11g Middle Channel



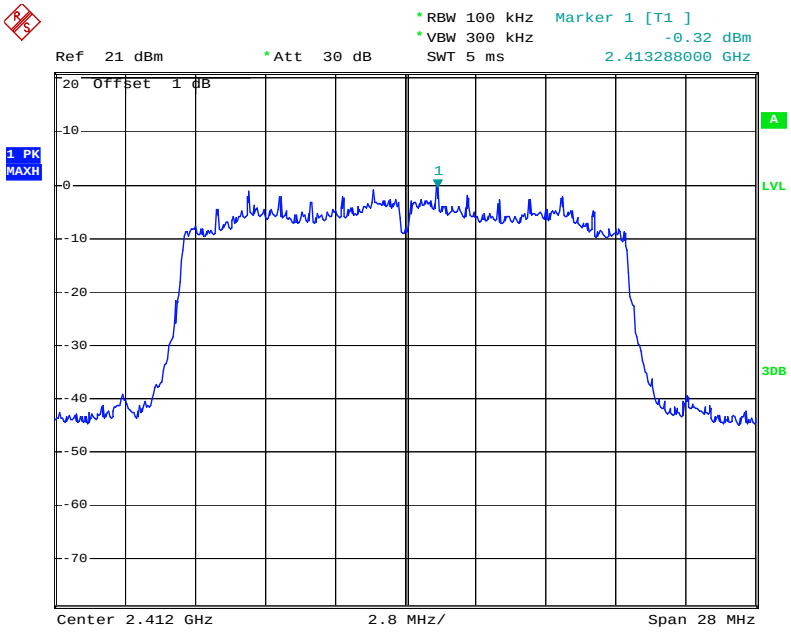
Date: 5.JUN.2014 13:02:26

Power Spectral Density, 802.11g High Channel



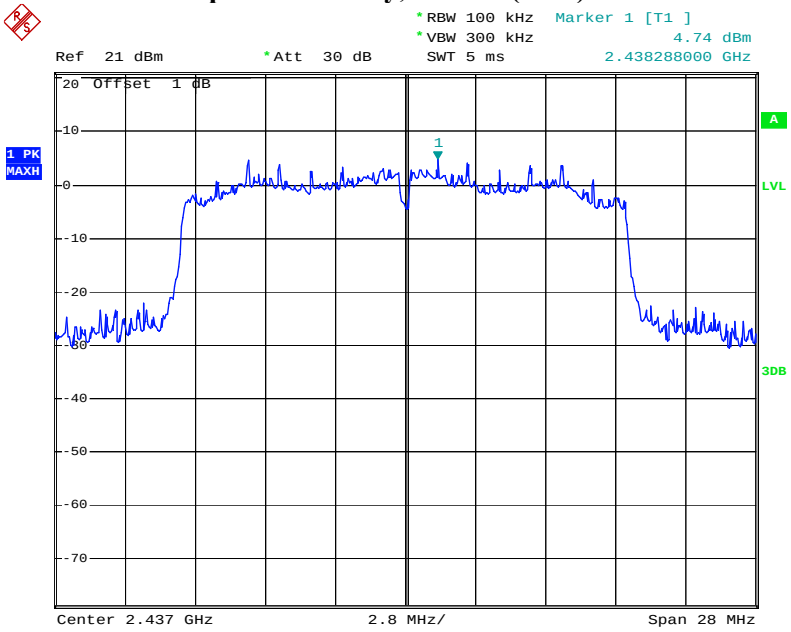
Date: 28.MAY.2014 15:37:36

Power Spectral Density, 802.11n(20M) Low Channel



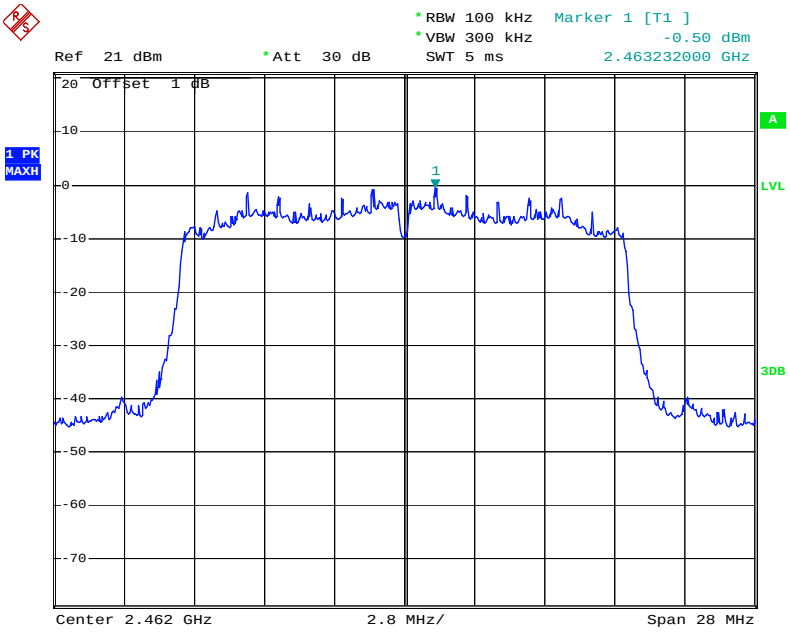
Date: 28.MAY.2014 15:40:43

Power Spectral Density, 802.11n(20M) Middle Channel



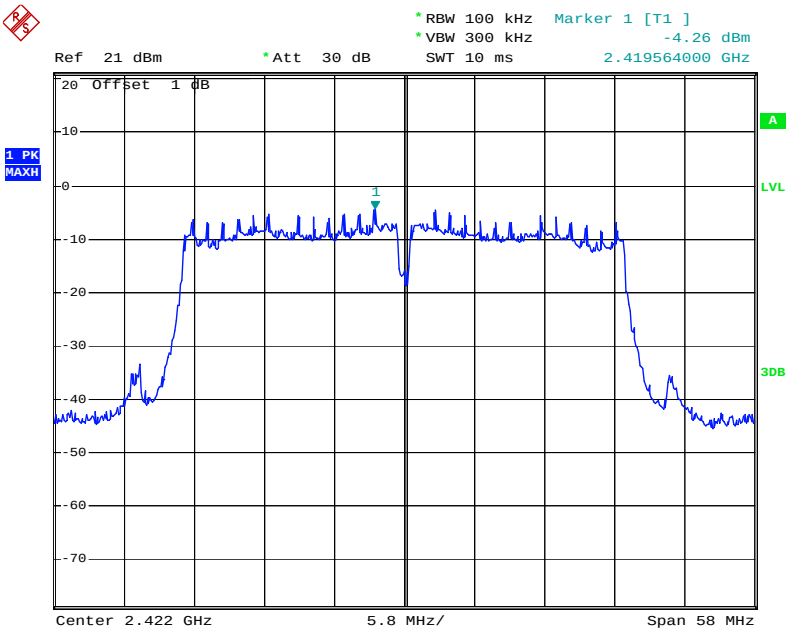
Date: 5.JUN.2014 13:03:08

Power Spectral Density, 802.11n(20M) High Channel



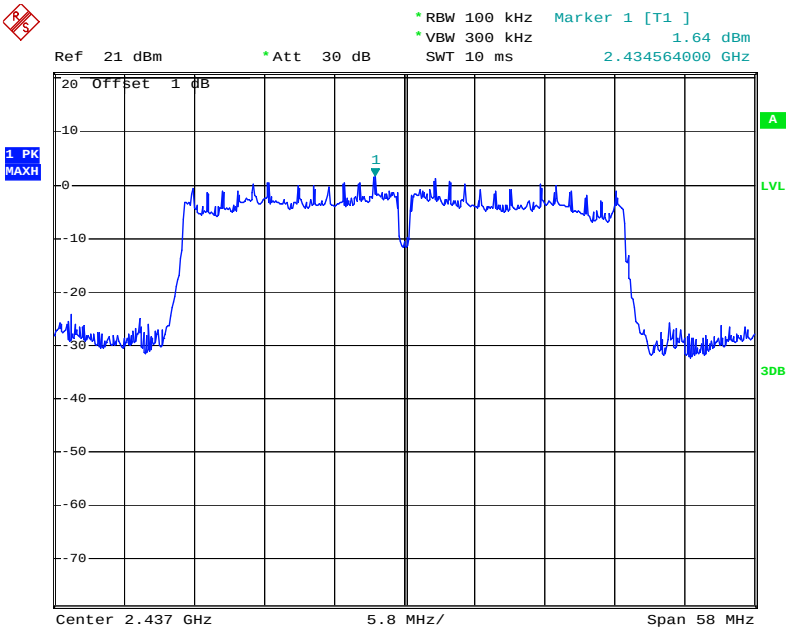
Date: 28.MAY.2014 15:42:47

Power Spectral Density, 802.11n(40M) Low Channel



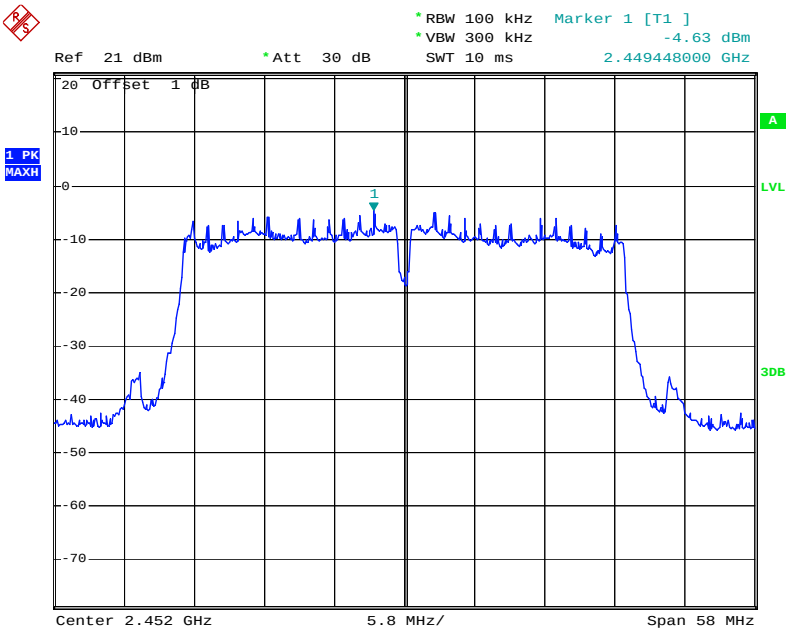
Date: 5.JUN.2014 13:04:46

Power Spectral Density, 802.11n(40M) Middle Channel



Date: 5.JUN.2014 13:06:39

Power Spectral Density, 802.11n(40M) High Channel



Date: 5.JUN.2014 13:05:34

5.6 §15.247(d) –Band-Edge & Unwanted Emissions into Non-Restricted Frequency Bands

1. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

2. Environmental Conditions

Temperature	20 °C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

3. Test date : May 26 to June 05, 2014
   Tested By : William Long

Standard Requirement:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Procedures: (Radiated Method Only)

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum Analyzer as below:

   a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.

   b. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.

   c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth for Average detection (AV) as below at frequency above 1GHz.

   ■ 1 kHz (Duty cycle < 98%) ☐ 10 Hz (Duty cycle > 98%)
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

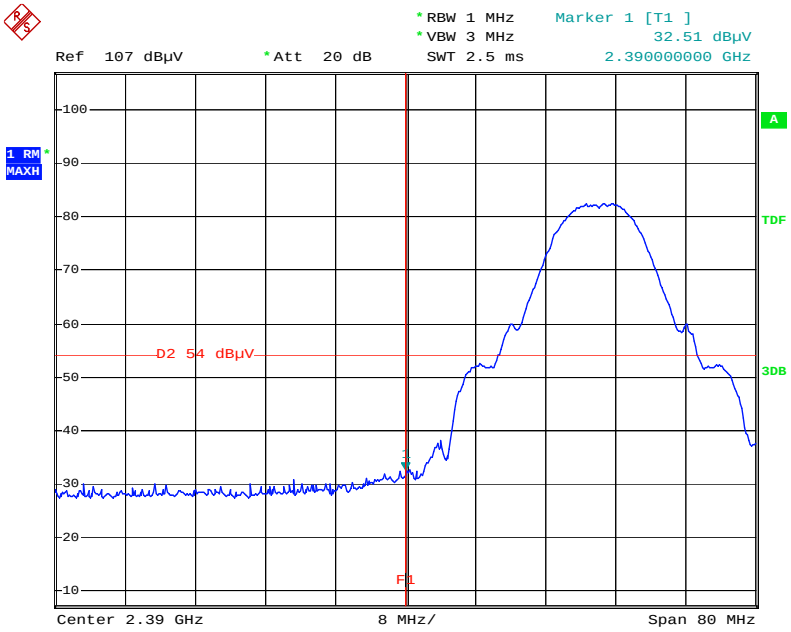
Note:

For Hopping device, should test hopping mode and CW Tx mode separately. For hopping mode, find out the worst points outside the frequency band firstly, then set the worst points as the center frequency, use above average 3 (c) spectrum analyzer set, find out the final worst average value separately.

Test Result: Pass.

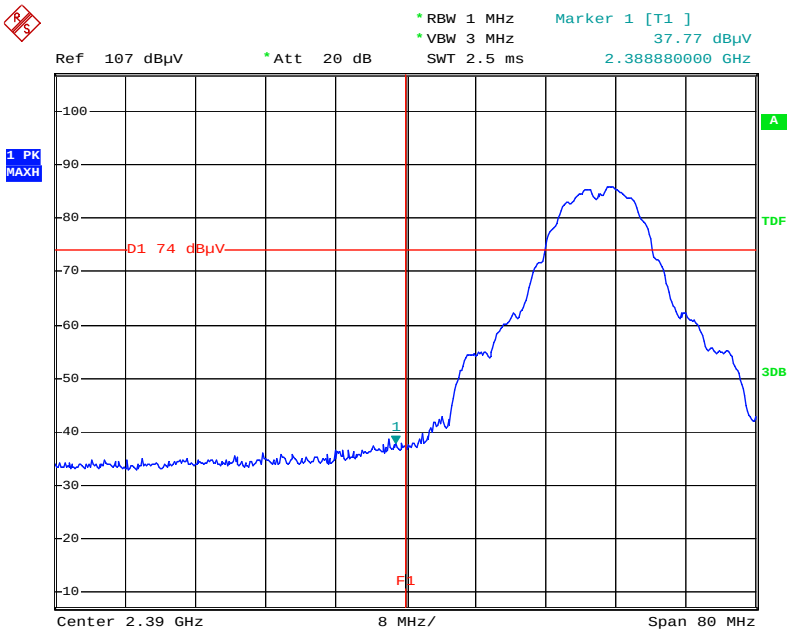
Please refer to the following tables and plots.

802.11b: Band Edge, Left Side (Average)



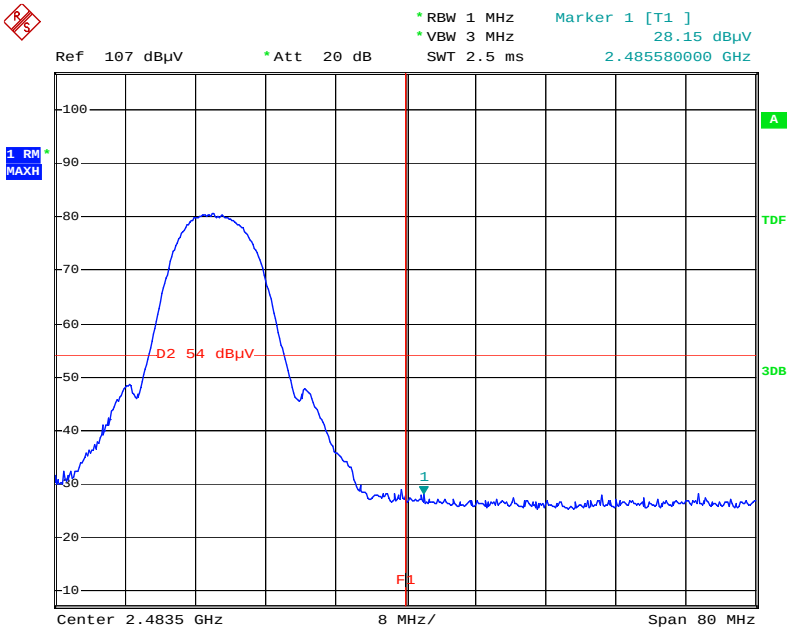
Date: 26.MAY.2014 18:50:21

802.11b: Band Edge, Left Side (Peak)



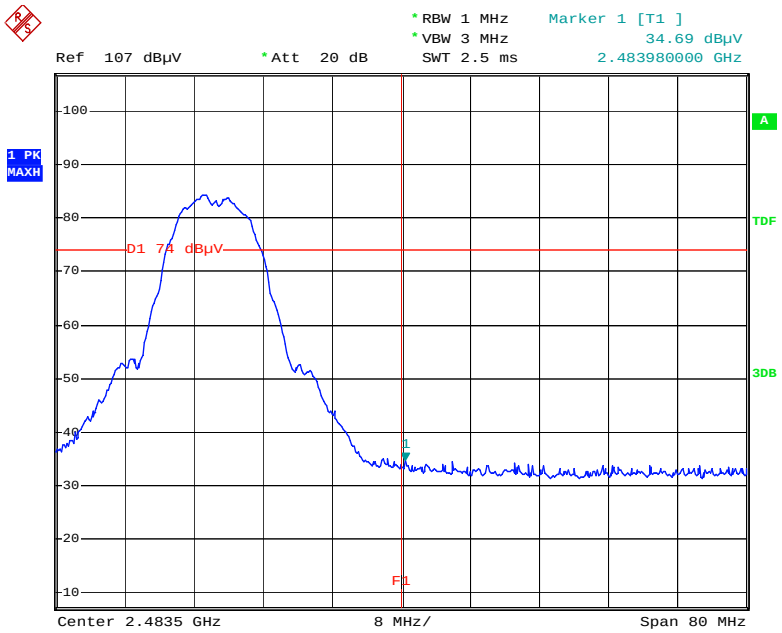
Date: 26.MAY.2014 18:28:09

802.11b: Band Edge, Right Side (Average)



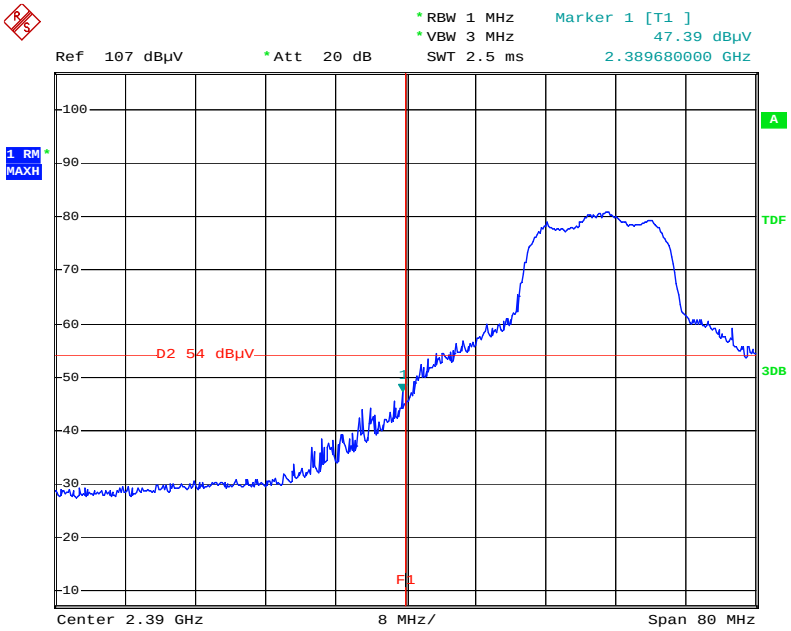
Date: 26.MAY.2014 18:51:01

802.11b: Band Edge, Right Side (Peak)



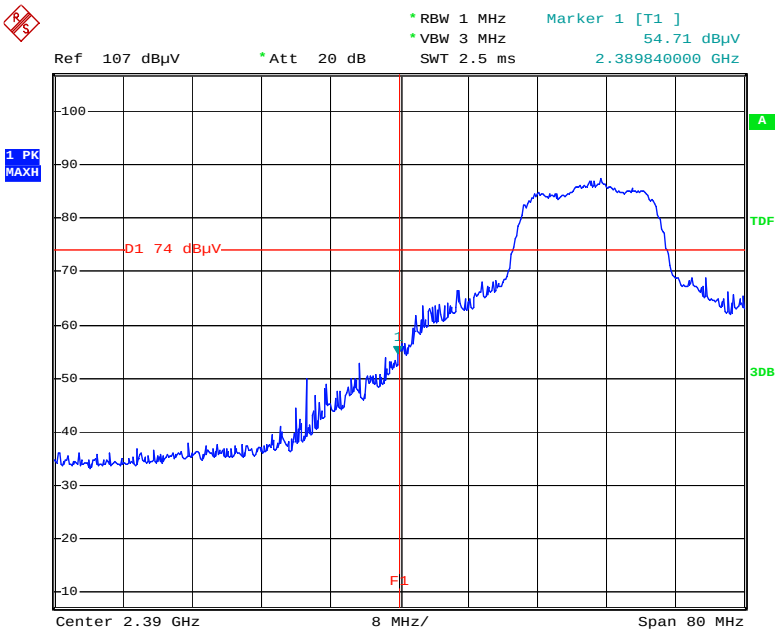
Date: 26.MAY.2014 18:54:12

802.11g: Band Edge, Left Side (Average)



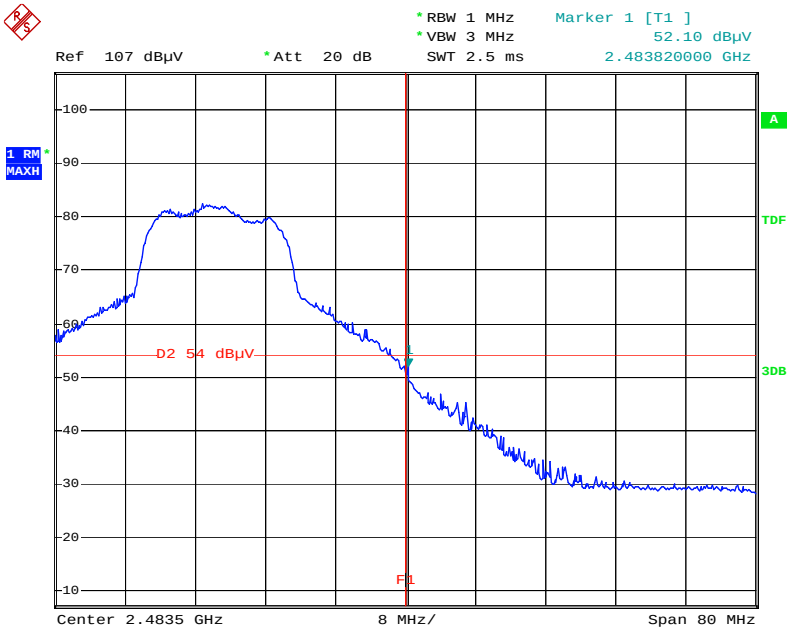
Date: 26.MAY.2014 18:44:50

802.11g: Band Edge, Left Side (Peak)



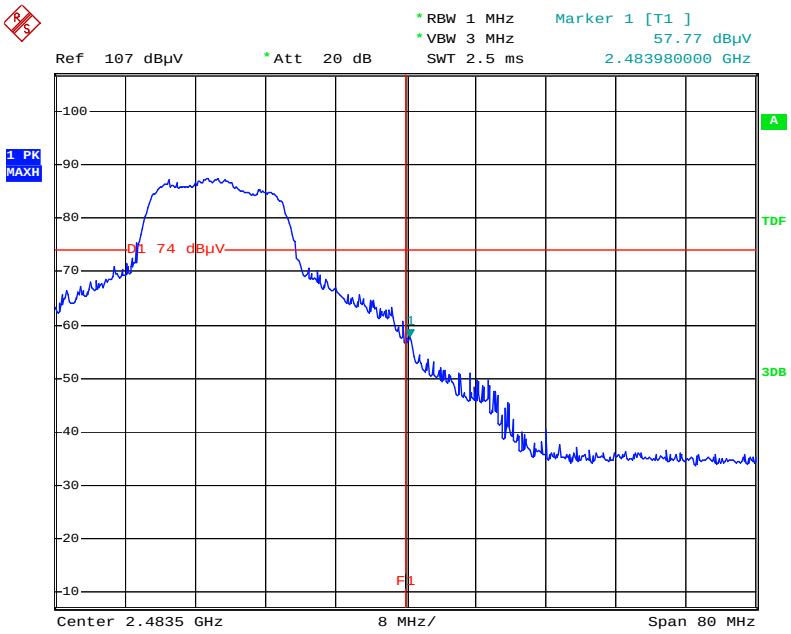
Date: 26.MAY.2014 18:40:10

802.11g: Band Edge, Right Side (Average)



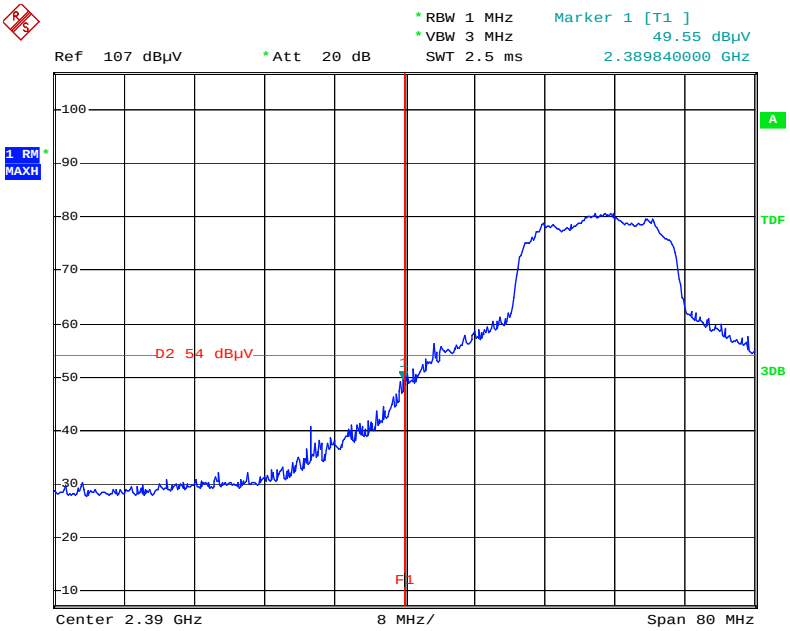
Date: 26.MAY.2014 19:00:41

802.11g: Band Edge, Right Side (Peak)



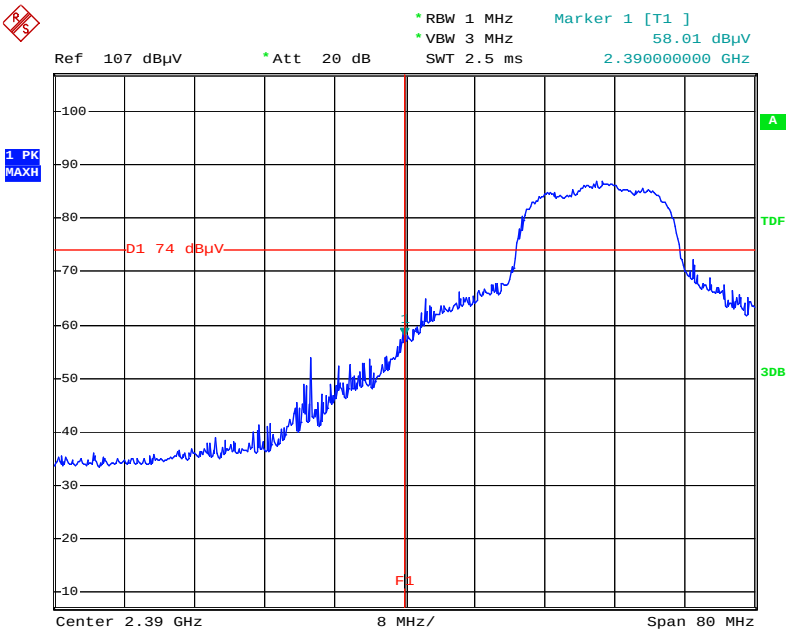
Date: 26.MAY.2014 19:07:08

802.11n(20M): Band Edge, Left Side (Average)



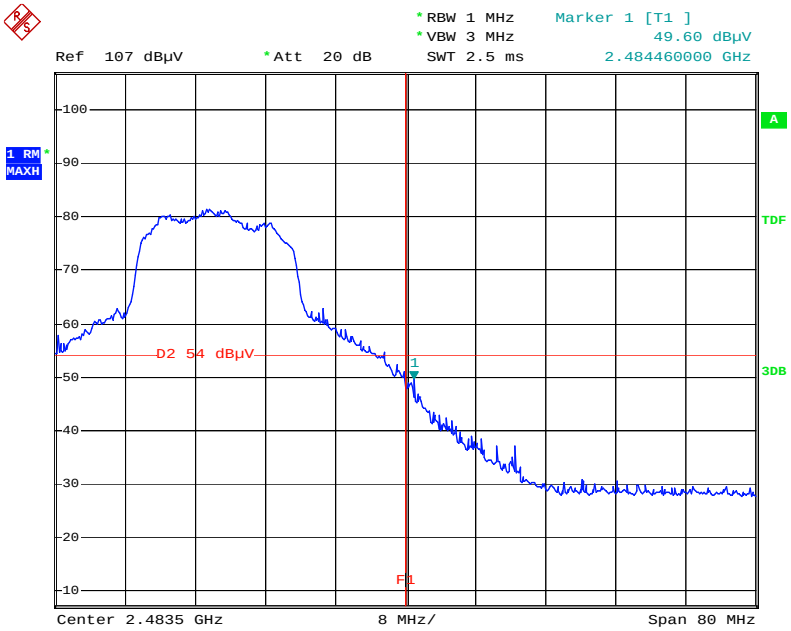
Date: 26.MAY.2014 18:44:15

802.11n(20M): Band Edge, Left Side (Peak)



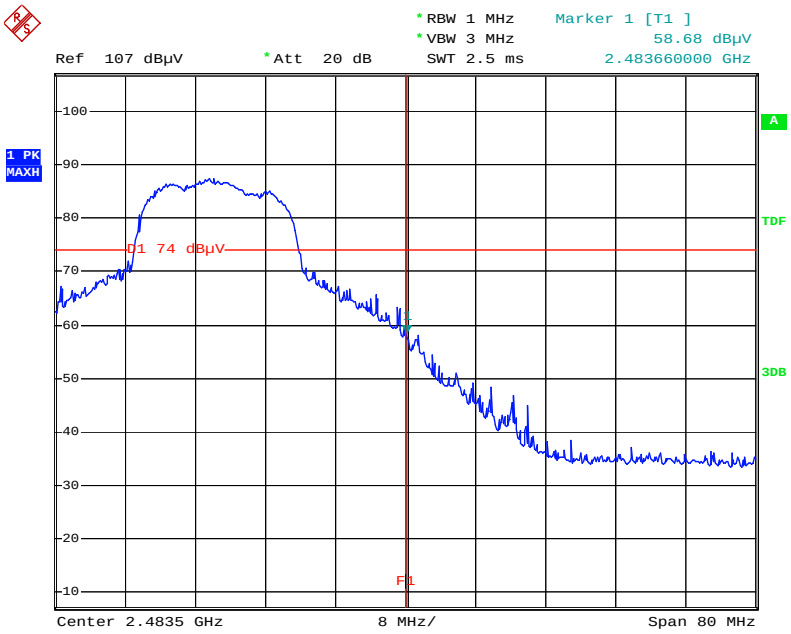
Date: 26.MAY.2014 18:40:39

802.11n(20M): Band Edge, Right Side (Average)



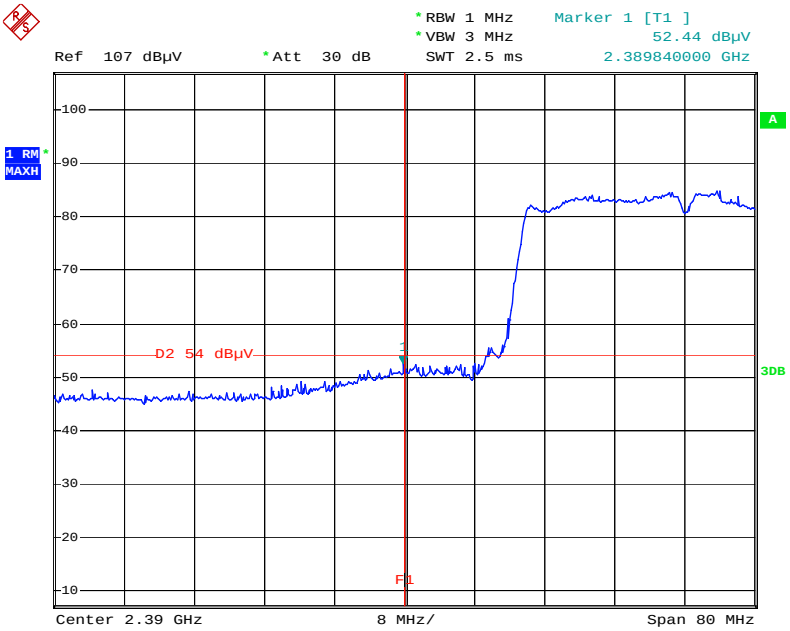
Date: 26.MAY.2014 19:02:20

802.11n(20M): Band Edge, Right Side (Peak)



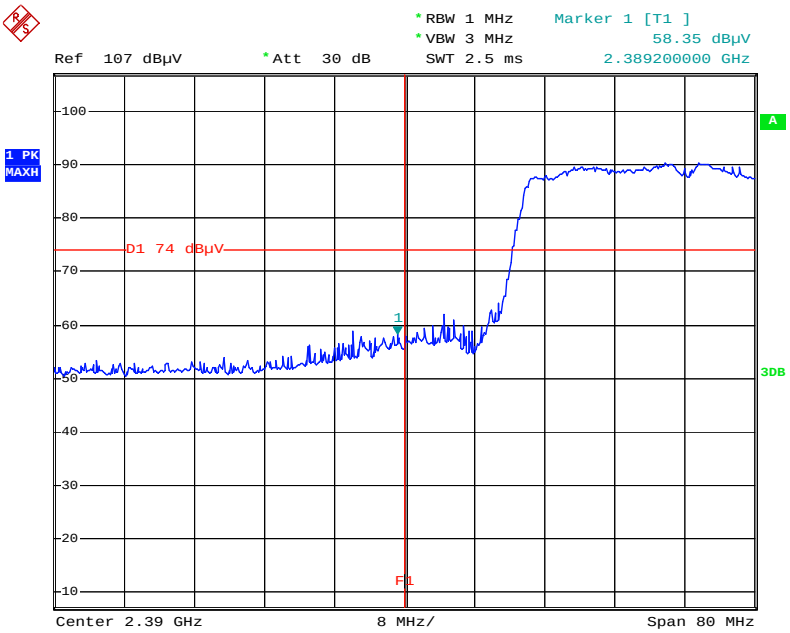
Date: 26.MAY.2014 19:05:33

802.11n(40M): Band Edge, Left Side (Average)



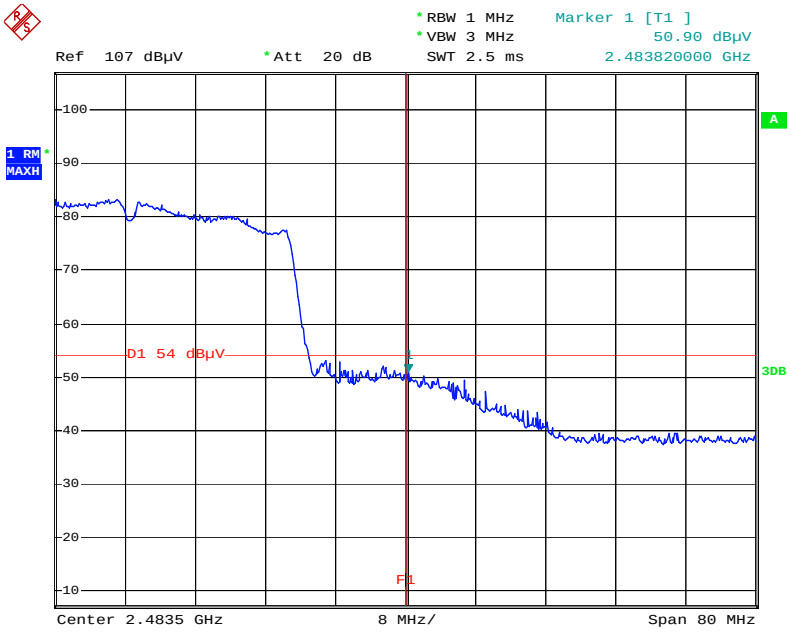
Date: 5.JUN.2014 17:56:32

802.11n(40M): Band Edge, Left Side (Peak)



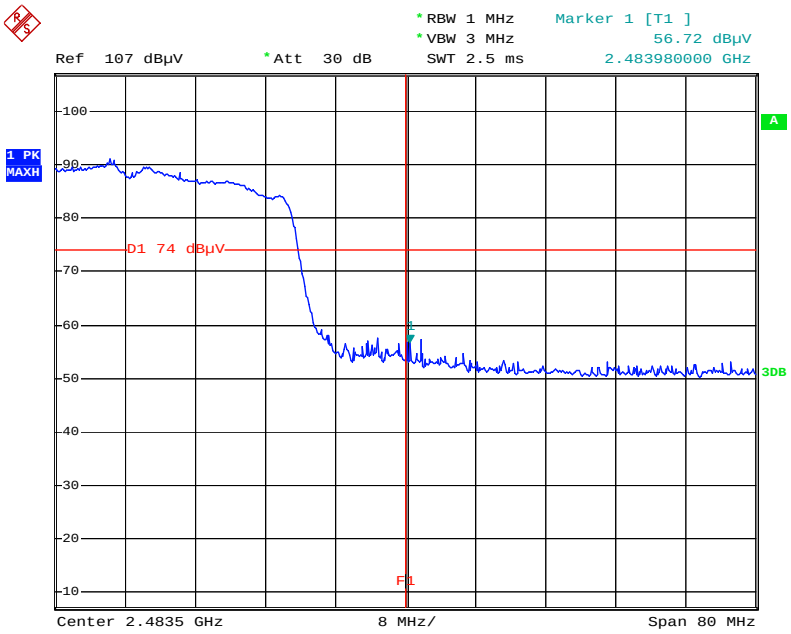
Date: 5.JUN.2014 17:57:32

802.11n(40M): Band Edge, Right Side (Average)



Date: 5.JUN.2014 19:19:28

802.11n(40M): Band Edge, Right Side (Peak)



Date: 5.JUN.2014 17:59:20

5.7 §15.207 (a) - AC Power Line Conducted Emissions

Requirement:

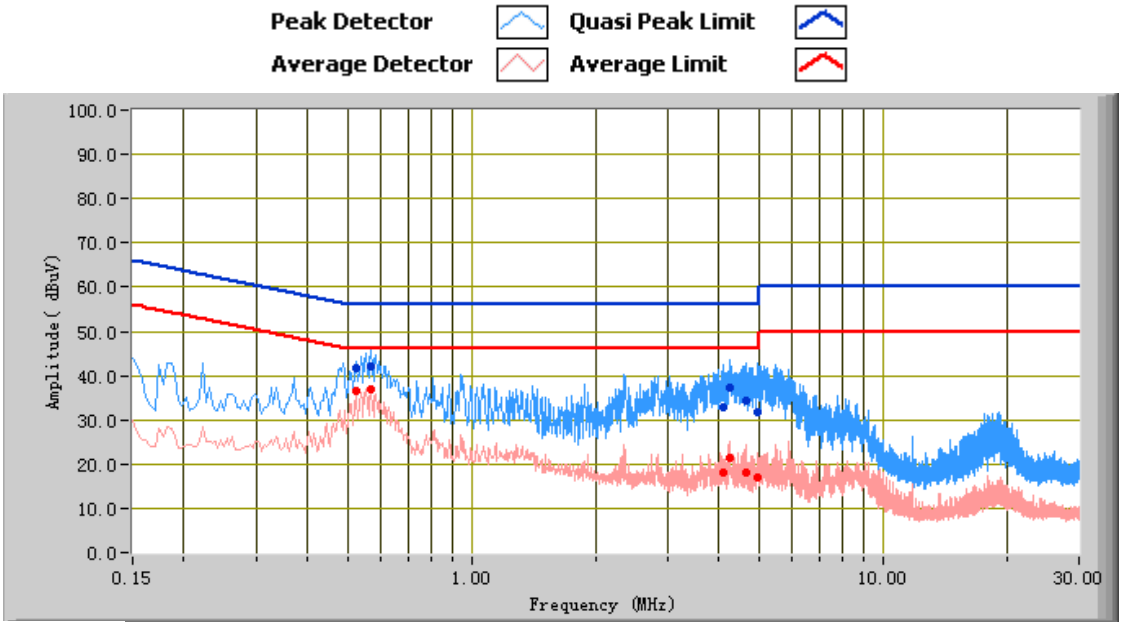
Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

Procedures:

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.
4. Environmental Conditions
   Temperature 20°C
   Relative Humidity 50%
   Atmospheric Pressure 1019mbar
5. Test date: May 20, 2014
   Tested By : William Long

Test Mode:	Transmitting Mode(Adapter: PSAA06A-120)

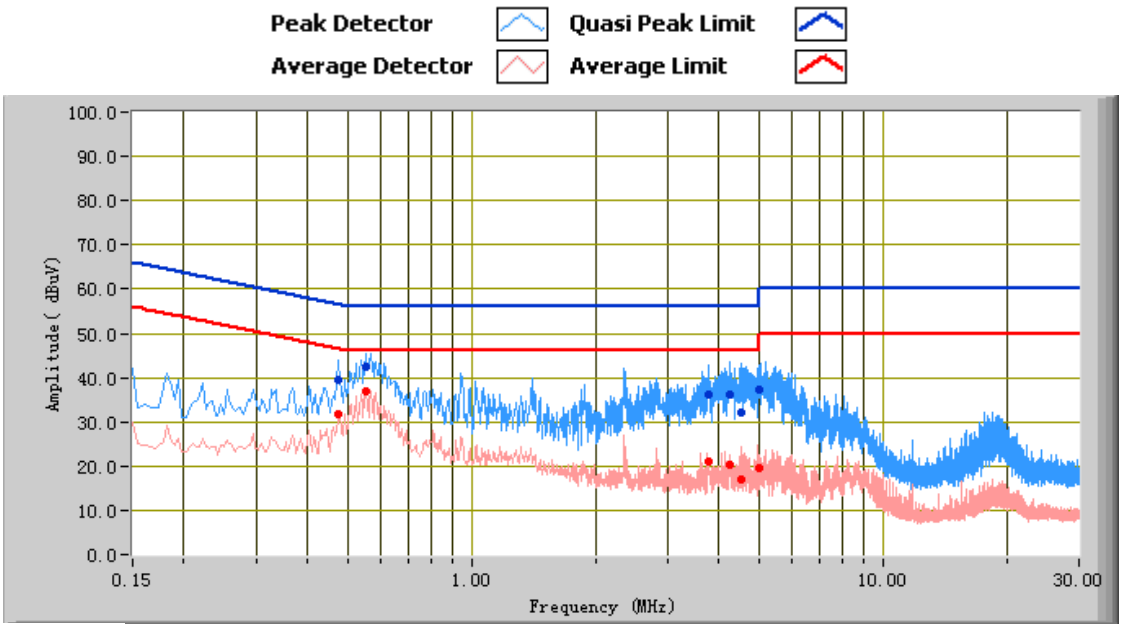


Test Data

Phase Line Plot at 120Vac, 60Hz

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Factors (dB)
0.57	42.22	56.00	-13.78	36.80	46.00	-9.20	11.03
4.25	37.19	56.00	-18.81	21.55	46.00	-24.45	10.89
0.52	41.55	56.00	-14.45	36.46	46.00	-9.54	11.07
4.98	31.76	56.00	-24.24	16.99	46.00	-29.01	10.89
4.65	34.49	56.00	-21.51	18.02	46.00	-27.98	10.89
4.10	32.94	56.00	-23.06	17.93	46.00	-28.07	10.89

Test Mode:	Transmitting Mode(Adapter: PSAA06A-120)

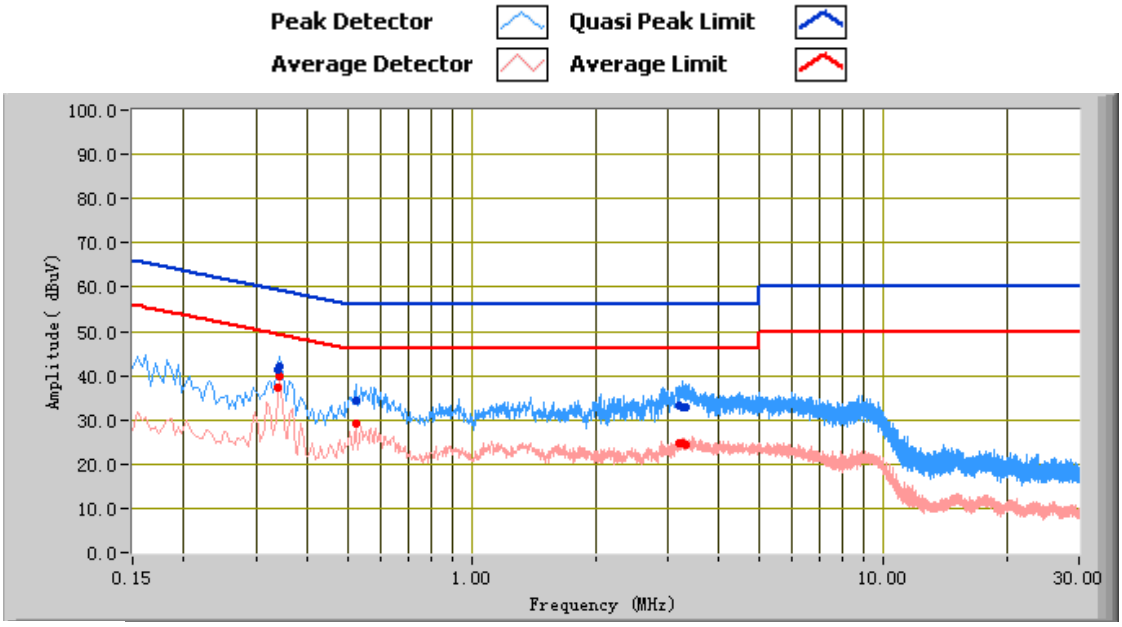


Test Data

Phase Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Factors (dB)
0.55	42.59	56.00	-13.41	36.99	46.00	-9.01	11.02
0.47	39.63	56.44	-16.82	31.86	46.44	-14.58	11.10
4.26	36.06	56.00	-19.94	20.29	46.00	-25.71	10.94
4.52	32.08	56.00	-23.92	17.11	46.00	-28.89	10.95
3.77	36.34	56.00	-19.66	21.16	46.00	-24.84	10.94
4.99	37.45	56.00	-18.55	19.47	46.00	-26.53	10.95

Test Mode:	Transmitting Mode(Adapter: RD1200500-C55-8MG)

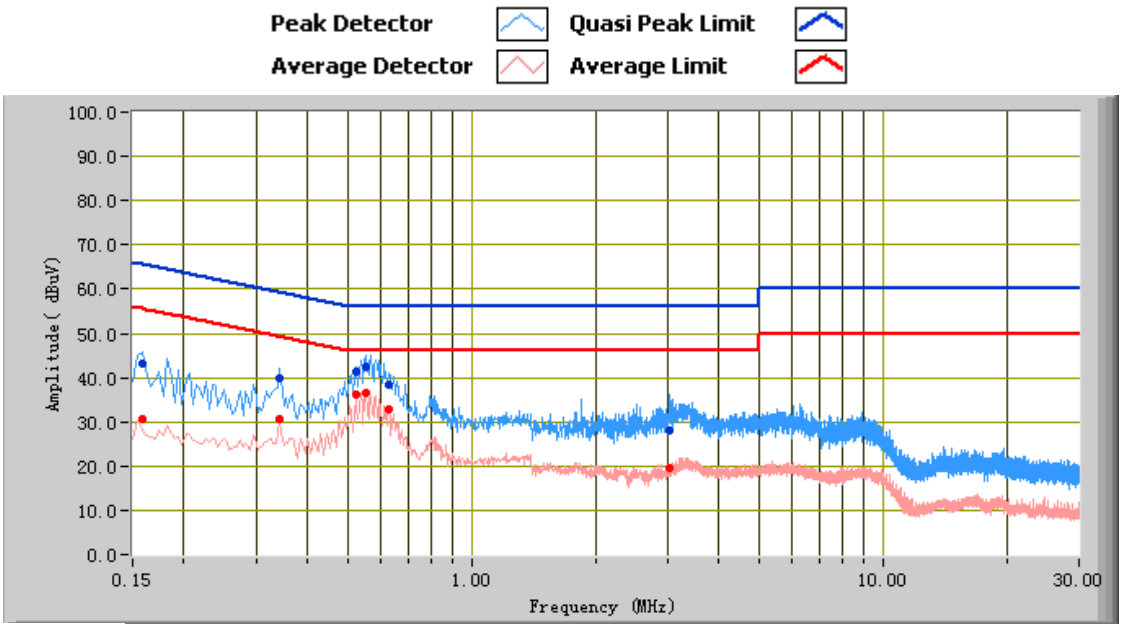


Test Data

Phase Line Plot at 120Vac, 60Hz

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Factors (dB)
0.34	42.11	59.16	-17.05	39.84	49.16	-9.31	11.32
0.34	41.24	59.25	-18.01	37.37	49.25	-11.88	11.32
3.27	32.83	56.00	-23.17	24.55	46.00	-21.45	10.88
3.33	32.68	56.00	-23.32	24.53	46.00	-21.47	10.88
0.52	34.38	56.00	-21.62	29.02	46.00	-16.98	11.07
3.21	33.29	56.00	-22.71	24.72	46.00	-21.28	10.88

Test Mode:	Transmitting Mode(Adapter: RD1200500-C55-8MG)



Test Data

Phase Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Factors (dB)
0.55	42.61	56.00	-13.39	36.65	46.00	-9.35	11.04
0.52	41.34	56.00	-14.66	36.18	46.00	-9.82	11.07
0.63	38.37	56.00	-17.63	32.92	46.00	-13.08	10.98
0.34	39.78	59.16	-19.37	30.47	49.16	-18.69	11.32
3.03	27.90	56.00	-28.10	19.58	46.00	-26.42	10.88
0.16	43.01	65.57	-22.56	30.58	55.57	-24.99	12.11

5.8 §15.209, §15.205 & §15.247(d) - Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz & 1GHz above (3m & 10m) is +/-6dB.
4. Environmental Conditions

Temperature	20°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

5. Test date : May 20, 2014
   Tested By : William Long

Requirement:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Procedures:

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:

   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.

   b. The EUT was then rotated to the direction that gave the maximum emission.

   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.

3. A Quasi-peak measurement was then made for that frequency point for below 1GHz test, PK and AV for above 1GHz emission test.

   a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.

   b. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.

   c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth for Average detection (AV) as below at frequency above 1GHz.

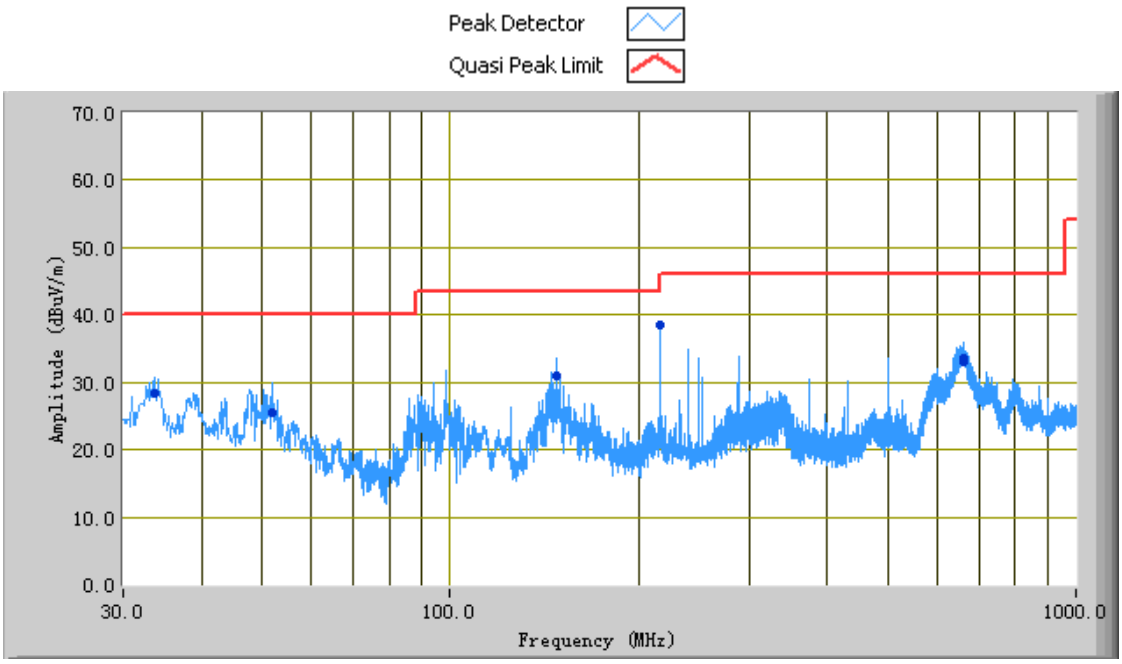
   ☐ 1 kHz (Duty cycle < 98%) ■ 10 Hz (Duty cycle > 98%)

4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

Test Result: Pass

Test Mode:	**Transmitting Mode(Adapter: PSAA06A-120)**

(Below 1GHz)



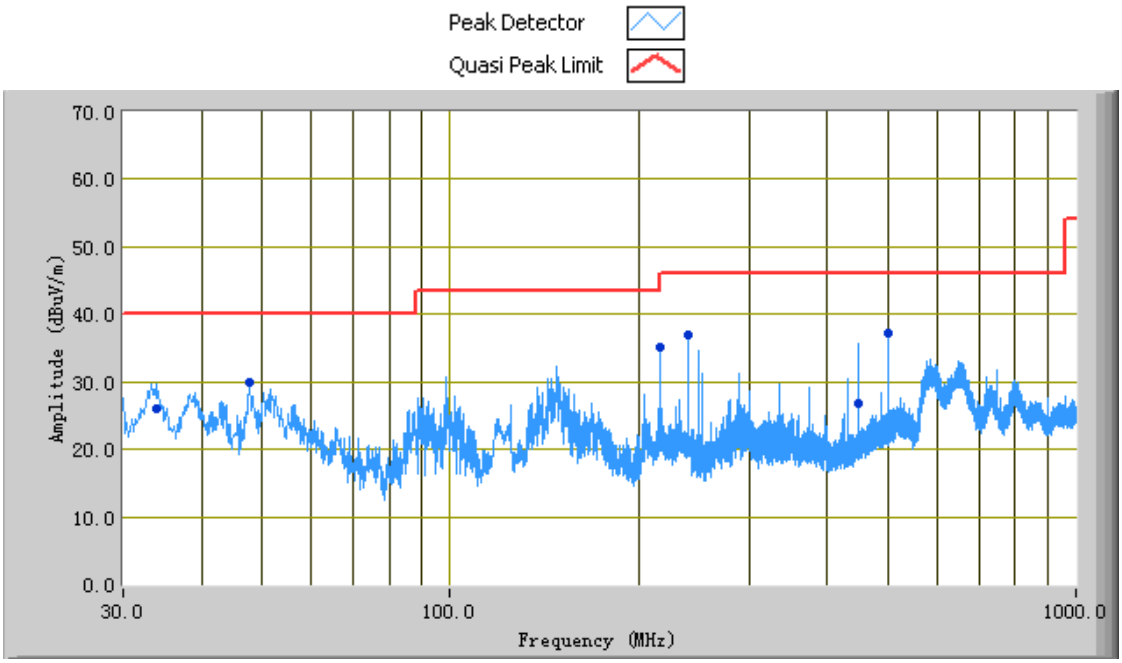
Test Data

Vertical & Horizontal Polarity Plot @3m

Frequency (MHz)	Quasi Peak (dBµV/m)	Azimuth	Polarity (H/V)	Height (cm)	Factors (dB)	Limit (dBµV/m)	Margin (dB)
216.41	38.53	115.00	H	148.00	-33.89	46.00	-7.47
33.67	28.43	221.00	V	108.00	-25.54	40.00	-11.57
148.11	30.90	155.00	H	168.00	-33.40	43.50	-12.60
51.85	25.42	138.00	V	109.00	-35.52	40.00	-14.58
660.25	33.46	340.00	V	114.00	-22.64	46.00	-12.54
662.27	33.15	352.00	V	112.00	-22.61	46.00	-12.85

Test Mode:	Transmitting Mode (Adapter: RD1200500-C55-8MG)

(Below 1GHz)



Test Data

Vertical & Horizontal Polarity Plot @3m

Frequency (MHz)	Quasi Peak (dBµV/m)	Azimuth	Polarity (H/V)	Height (cm)	Factors (dB)	Limit (dBµV/m)	Margin (dB)
500.01	37.13	294.00	V	119.00	-29.70	46.00	-8.87
240.00	36.94	327.00	H	130.00	-33.10	46.00	-9.06
47.80	29.89	178.00	V	102.00	-33.26	40.00	-10.11
33.86	25.99	240.00	V	103.00	-25.67	40.00	-14.01
450.01	26.83	216.00	V	115.00	-30.25	46.00	-19.17
216.42	35.09	4.00	V	134.00	-33.89	46.00	-10.91

Above 1 GHz (Adapter: PSAA06A-120):

Test Mode: Transmitting

Note: Other modes were verified, only the result of worst case basic rate mode was presented.

Mode: 802.11b

Low Channel (2412 MHz)

Frequency (MHz)	Substituted level (dBμV/m)	Detector (PK/AV)	Direction (degree)	Height (cm)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.02	65.89	AV	205	152	V	32.5	2.83	55	46.22	54	-7.78
4824.02	66.02	AV	15	152	H	32.3	2.83	55	46.15	54	-7.85
4824.02	78.02	PK	26	125	V	32.5	2.83	55	58.35	74	-15.65
4824.02	79.3	PK	33	136	H	32.3	2.83	55	59.43	74	-14.57
1510.26	55.23	AV	168	125	V	25	1.84	55	27.07	54	-26.93
1510.26	50.89	AV	25	165	H	25.2	1.84	55	22.93	54	-31.07
1510.26	60.22	PK	256	202	V	25	1.84	55	32.06	74	-41.94
1510.26	59.59	PK	189	166	H	25.2	1.84	55	31.63	74	-42.37

Middle Channel (2437 MHz)

Frequency (MHz)	Substituted level (dBμV/m)	Detector (PK/AV)	Direction (degree)	Height (cm)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.11	69.15	AV	15	205	V	32.5	2.83	55	49.48	54	-4.52
4874.11	68.22	AV	262	151	H	32.3	2.83	55	48.35	54	-5.65
4874.11	85.22	PK	30	332	V	32.5	2.83	55	65.55	74	-8.45
4874.11	84.19	PK	266	254	H	32.3	2.83	55	64.32	74	-9.68
2014.88	53.33	AV	189	166	V	26.9	2.34	55	27.57	54	-26.43
2014.88	51.17	AV	56	251	H	26.6	2.34	55	25.11	54	-28.89
2014.88	66.48	PK	224	188	V	26.9	2.34	55	40.72	74	-33.28
2014.88	62.89	PK	89	205	H	26.6	2.34	55	36.83	74	-37.17

High Channel (2462 MHz)

Frequency (MHz)	Substituted level (dBμV/m)	Detector (PK/AV)	Direction (degree)	Height (cm)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4923.89	63.78	AV	154	203	V	32.5	2.83	55	44.11	54	-9.89
4923.89	65.18	AV	26	262	H	32.3	2.83	55	45.31	54	-8.69
4923.89	76.88	PK	8	151	V	32.5	2.83	55	57.21	74	-16.79
4923.89	77.02	PK	226	223	H	32.3	2.83	55	57.15	74	-16.85
3051.55	50.33	AV	265	165	V	28.8	2.66	55	26.79	54	-27.21
3051.55	51.02	AV	21	154	H	29	2.66	55	27.68	54	-26.32
3051.55	63.59	PK	154	202	V	28.8	2.66	55	40.05	74	-33.95
3051.55	64.08	PK	288	165	H	29	2.66	55	40.74	74	-33.26

Above 1 GHz (Adapter: RD1200500-C55-8MG):

Test Mode: Transmitting

Note: Other modes were verified, only the result of worst case basic rate mode was presented.

Mode: 802.11b

Low Channel (2412 MHz)

Frequency (MHz)	Substituted level (dBµV/m)	Detector (PK/AV)	Direction (degree)	Height (cm)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4824.12	66.18	AV	205	202	V	32.5	2.83	55	46.51	54	-7.49
4824.12	66.23	AV	16	113	H	32.3	2.83	55	46.36	54	-7.64
4824.12	78.56	PK	252	262	V	32.5	2.83	55	58.89	74	-15.11
4824.12	79.49	PK	201	255	H	32.3	2.83	55	59.62	74	-14.38
2610.11	50.16	AV	151	166	V	27.8	2.5	55	25.46	54	-28.54
2610.11	52.06	AV	198	302	H	28.1	2.5	55	27.66	54	-26.34
2610.11	61.02	PK	25	152	V	27.8	2.5	55	36.32	74	-37.68
2610.11	60.89	PK	188	206	H	28.1	2.5	55	36.49	74	-37.51

Middle Channel (2437 MHz)

Frequency (MHz)	Substituted level (dBµV/m)	Detector (PK/AV)	Direction (degree)	Height (cm)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874.16	70.26	AV	31	201	V	32.5	2.83	55	50.59	54	-3.41
4874.16	69.88	AV	151	115	H	32.3	2.83	55	50.01	54	-3.99
4874.16	87.06	PK	15	221	V	32.5	2.83	55	67.39	74	-6.61
4874.16	85.99	PK	211	221	H	32.3	2.83	55	66.12	74	-7.88
3315.05	49.5	AV	223	115	V	28.8	2.66	55	25.96	54	-28.04
3315.05	55.23	AV	26	203	H	29	2.66	55	31.89	54	-22.11
3315.05	68	PK	2	151	V	28.8	2.66	55	44.46	74	-29.54
3315.05	69.89	PK	165	236	H	29	2.66	55	46.55	74	-27.45

High Channel (2462 MHz)

Frequency (MHz)	Substituted level (dBµV/m)	Detector (PK/AV)	Direction (degree)	Height (cm)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4923.95	64.52	AV	202	154	V	32.5	2.83	55	44.85	54	-9.15
4923.95	66.22	AV	165	252	H	32.3	2.83	55	46.35	54	-7.65
4923.95	77.26	PK	298	289	V	32.5	2.83	55	57.59	74	-16.41
4923.95	78.33	PK	56	223	H	32.3	2.83	55	58.46	74	-15.54
2551.56	43.56	AV	9	202	V	27.8	2.5	55	18.86	54	-35.14
2551.56	52.89	AV	154	156	H	28.1	2.5	55	28.49	54	-25.51
2551.56	55.89	PK	265	215	V	27.8	2.5	55	31.19	74	-42.81
2551.56	60.44	PK	89	263	H	28.1	2.5	55	36.04	74	-37.96

Annex A. TEST INSTRUMENT

Annex A.i. TEST INSTRUMENTATION

Instrument	Model	Serial #	Calibration Date	Calibration Due Date
AC Line Conducted Emissions				
R&S EMI Test Receiver	ESPI3	101216	09/27/2013	09/26/2014
V-LISN	ESH3-Z5	838979/005	09/27/2013	09/26/2014
Com-Power Transient Limiter	LIT-153	531021	09/27/2013	09/26/2014
A- INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	10/09/2013	10/08/2014
SIEMIC Labview Conducted Emissions software	V1.0	N/A	N/A	N/A
RF conducted test				
R&S EMI Receiver	ESPI3	101216	09/27/2013	09/26/2014
Power Splitter	1#	1#	02/02/2014	02/01/2015
Hp Spectrum Analyzer	8563E	3821A09023	09/27/2013	09/26/2014
Temperature/Humidity Chamber	1007H	N/A	01/07/2014	01/06/2015
Radiated Emissions				
Hp Spectrum Analyzer	8563E	3821A09023	09/27/2013	09/26/2014
R&S EMI Receiver	ESPI3	101216	09/27/2013	09/26/2014
Antenna (30MHz~6GHz)	JB6	A121411	04/15/2014	04/14/2015
EMCO Horn Antenna (1 ~18GHz)	3115	N/A	10/09/2013	10/08/2014
A- INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	10/09/2013	10/08/2014
Horn Antenna (18~40GHz)	AH-840	101013	04/22/2014	04/22/2015
Microwave Pre-Amp (18~40GHz)	PA-840	181250	05/29/2014	05/28/2015
Hp Agilent Pre-Amplifier	8447F	1937A01160	10/27/2013	10/26/2014
MITEQ Pre-Amplifier (0.1 ~ 18GHz)	AMF-7D-00101800-30-10P	1451709	10/27/2013	10/26/2014

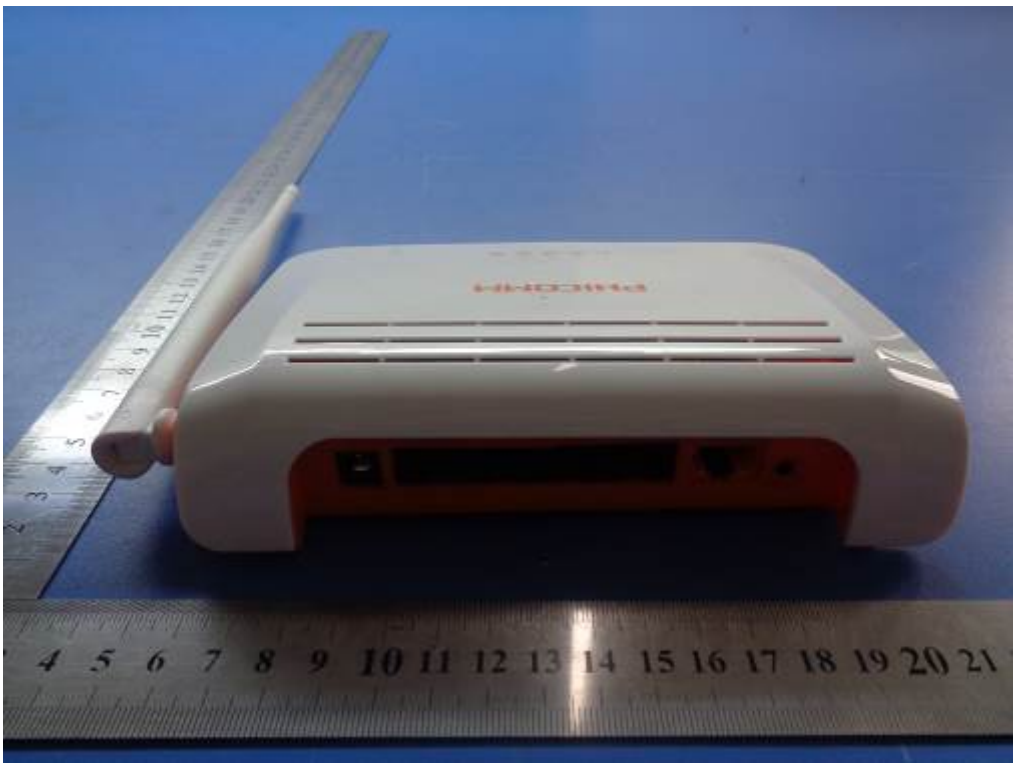
Annex B. EUT AND TEST SETUP PHOTOGRAPHS

Annex B.i. Photograph : EUT External Photo

All Packages – Front View

EUT - Front View

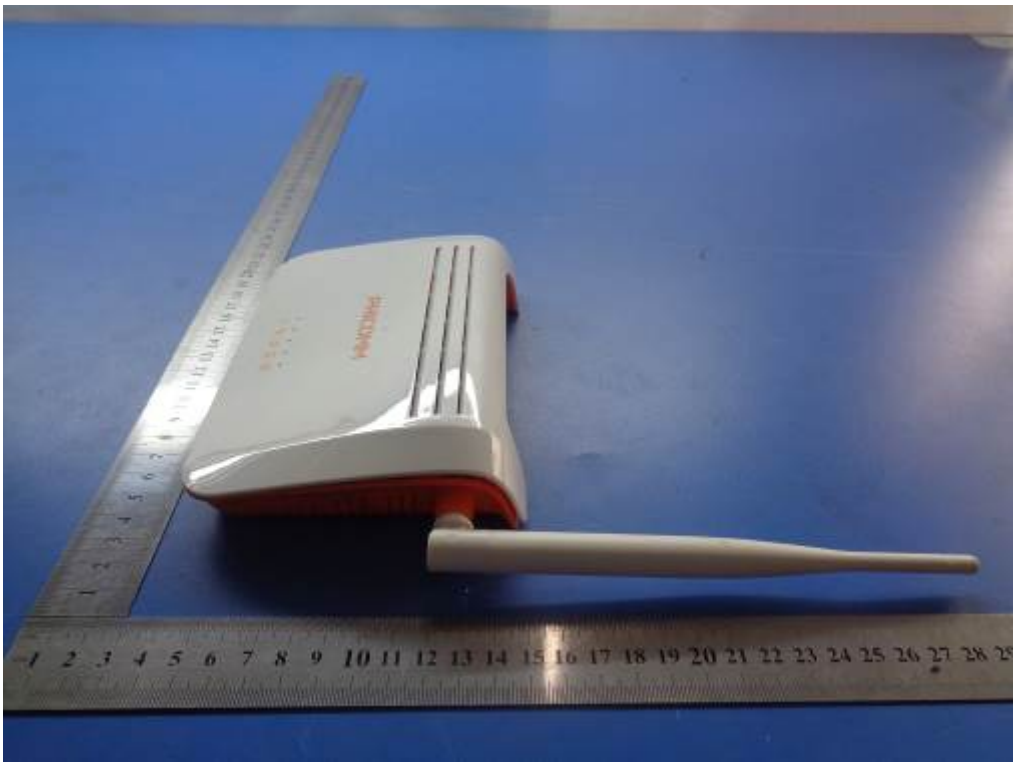
EUT - Rear View



EUT – Top View

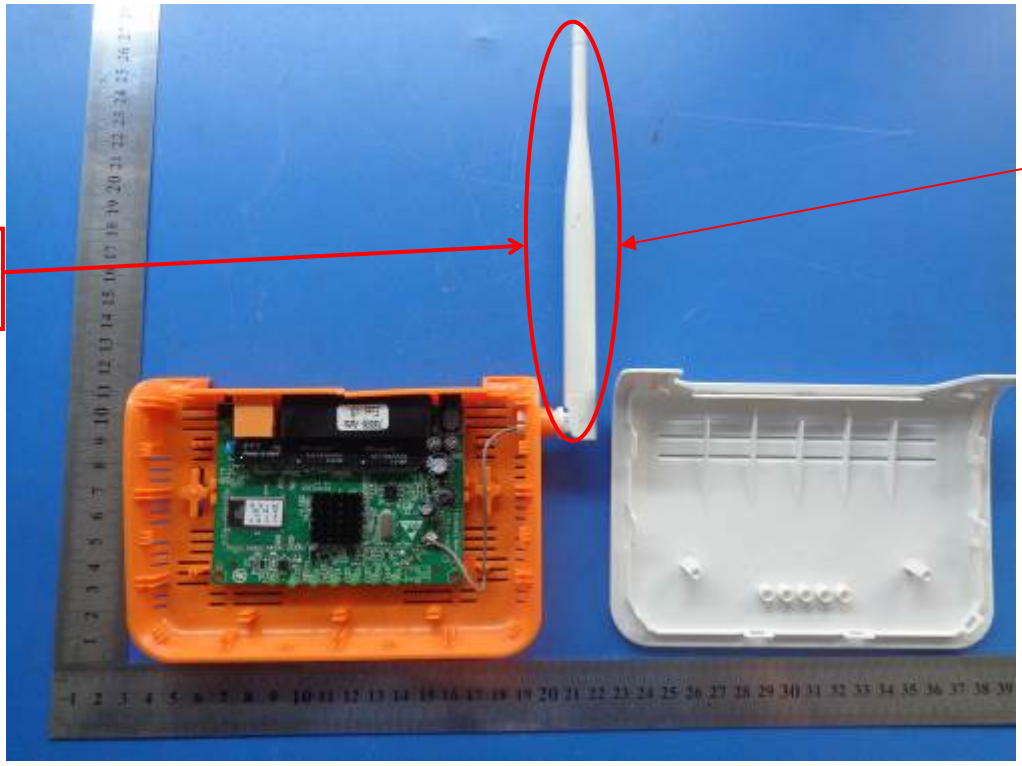
EUT – Bottom View

EUT – Left View

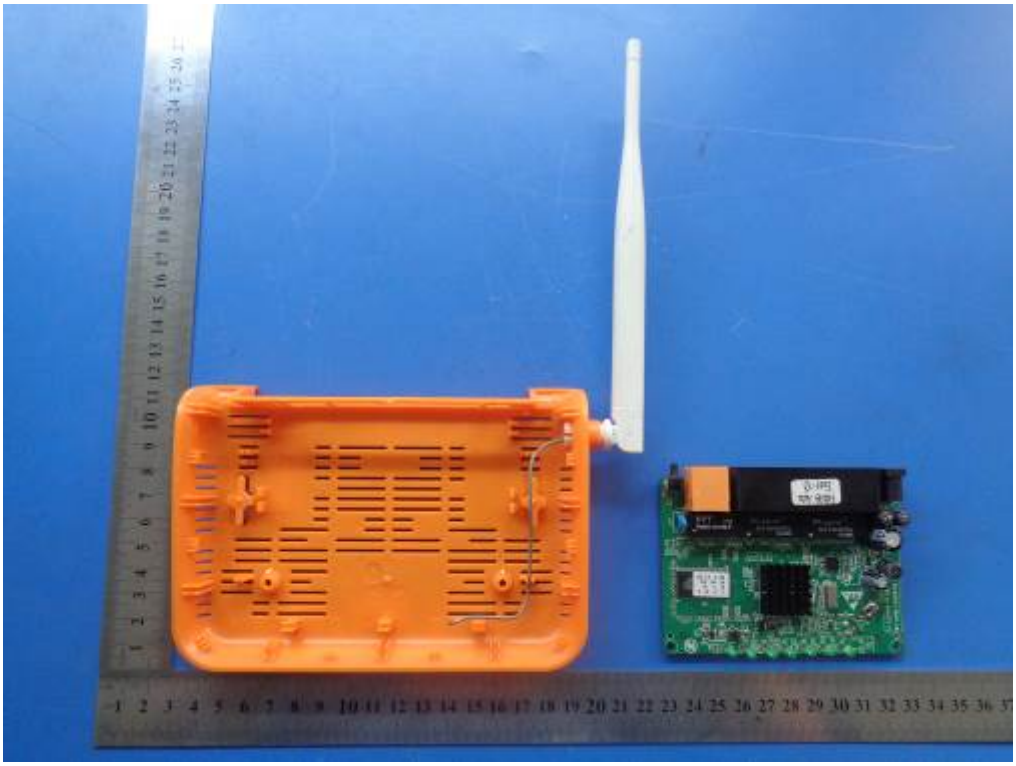


EUT – Right View

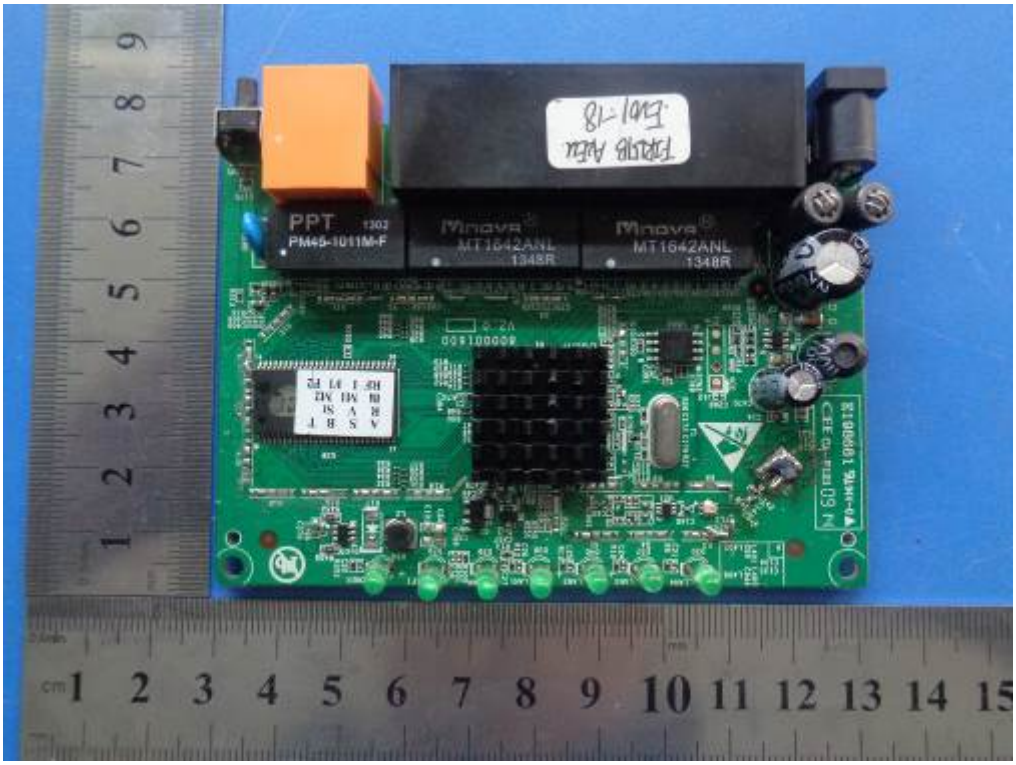
Annex B.ii. Photograph 2: EUT Internal Photo



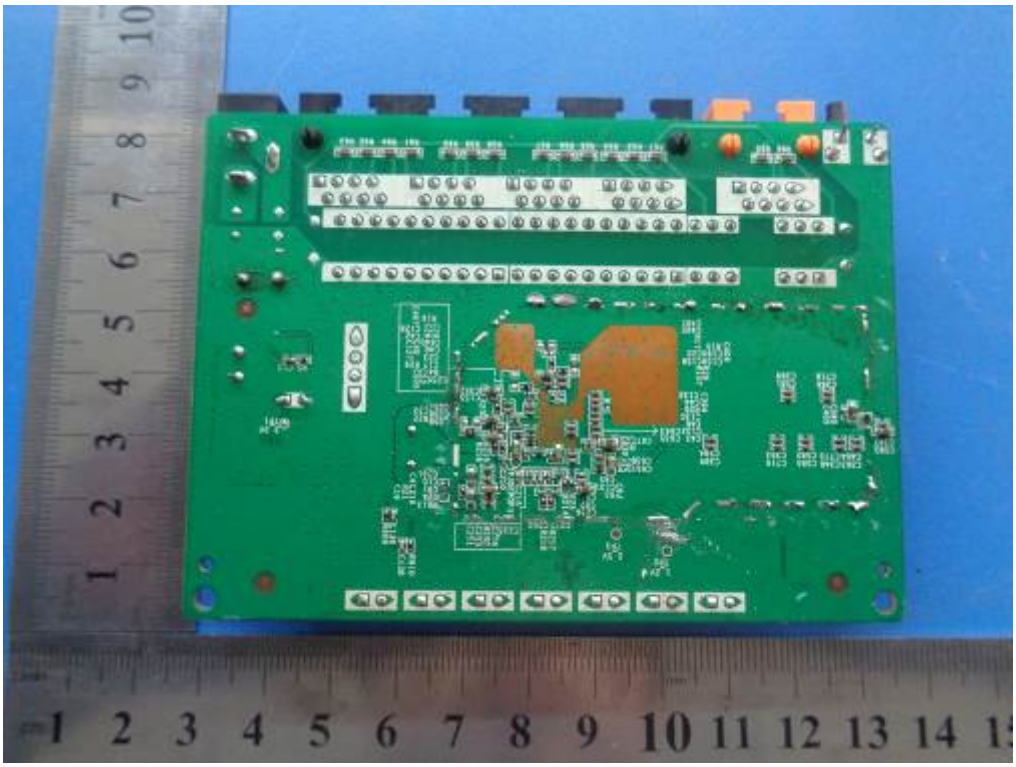
EUT – Uncover Front View 1



EUT – Uncover Front View 2



EUT – PCB Front View

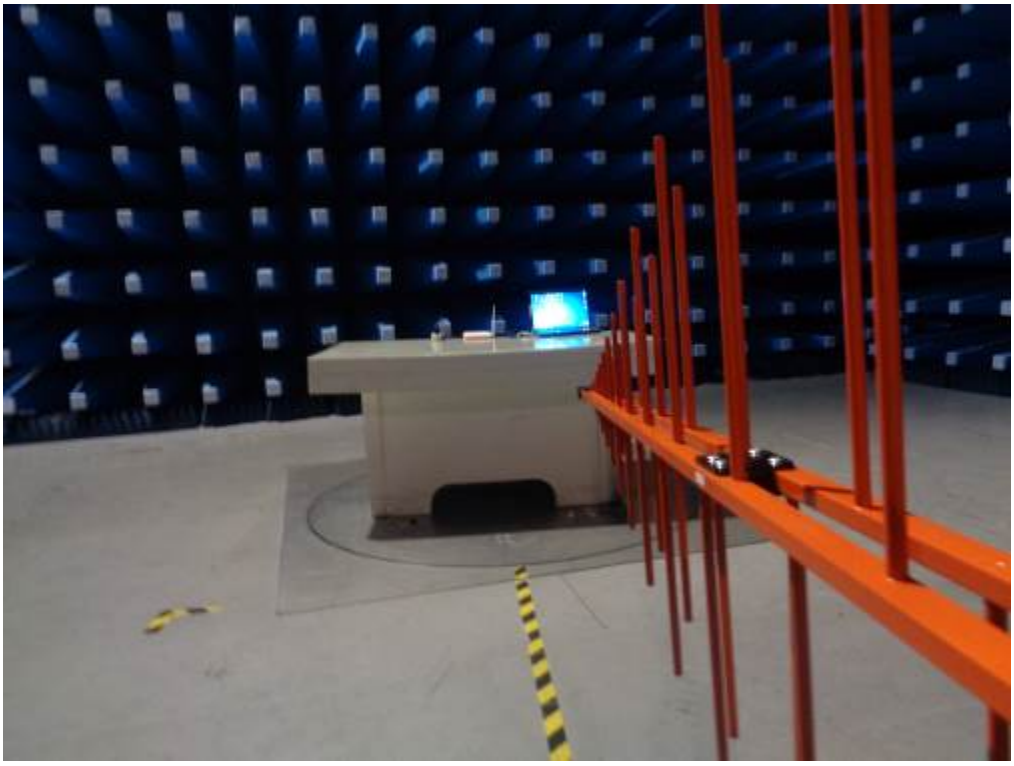


EUT – PCB Rear View

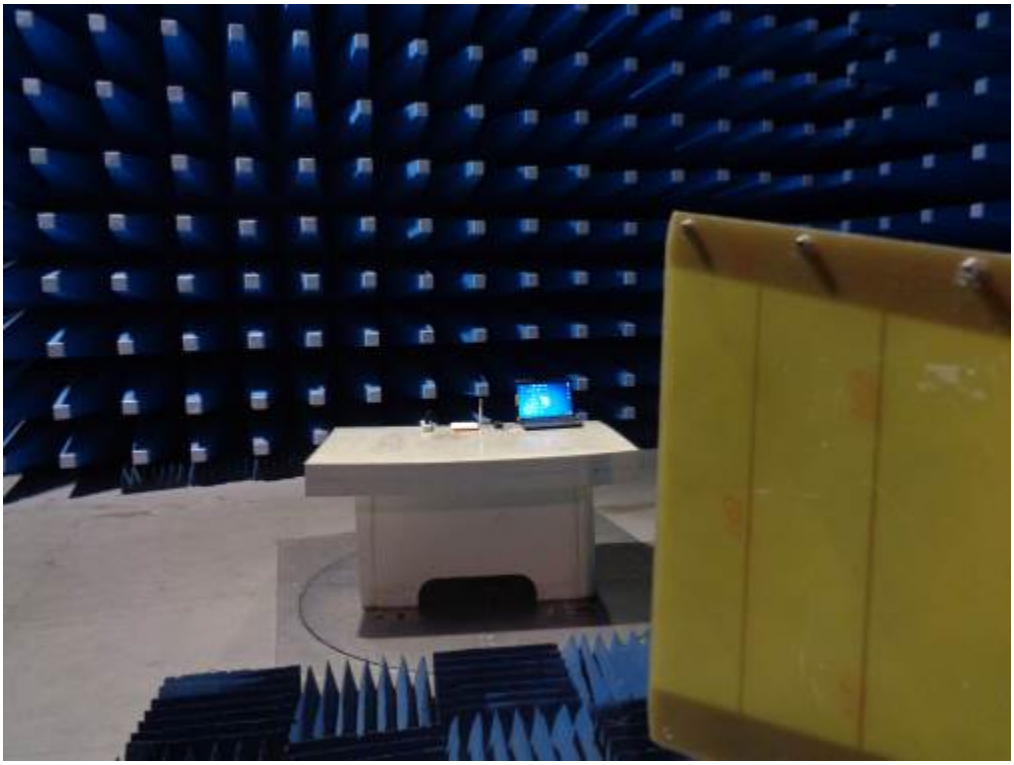
Annex B.iii. Photograph 3: Test Setup Photo

Conducted Emissions Test Setup – Front View

Conducted Emissions Test Setup – Side View



Radiated Spurious Emissions Test Setup Below 1GHz - Front View



Radiated Spurious Emissions Test Setup Above 1GHz –Front View

Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

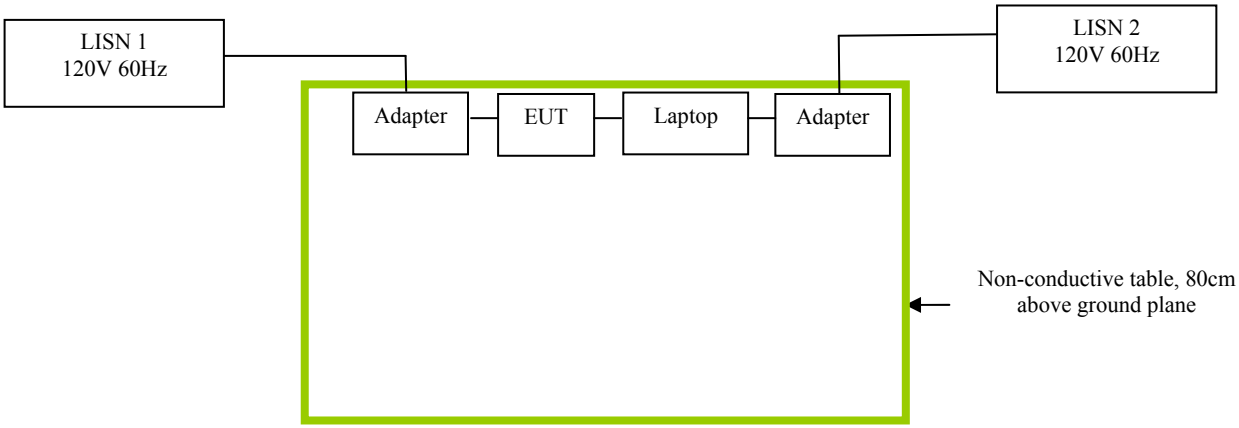
EUT TEST CONDITIONS

Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION

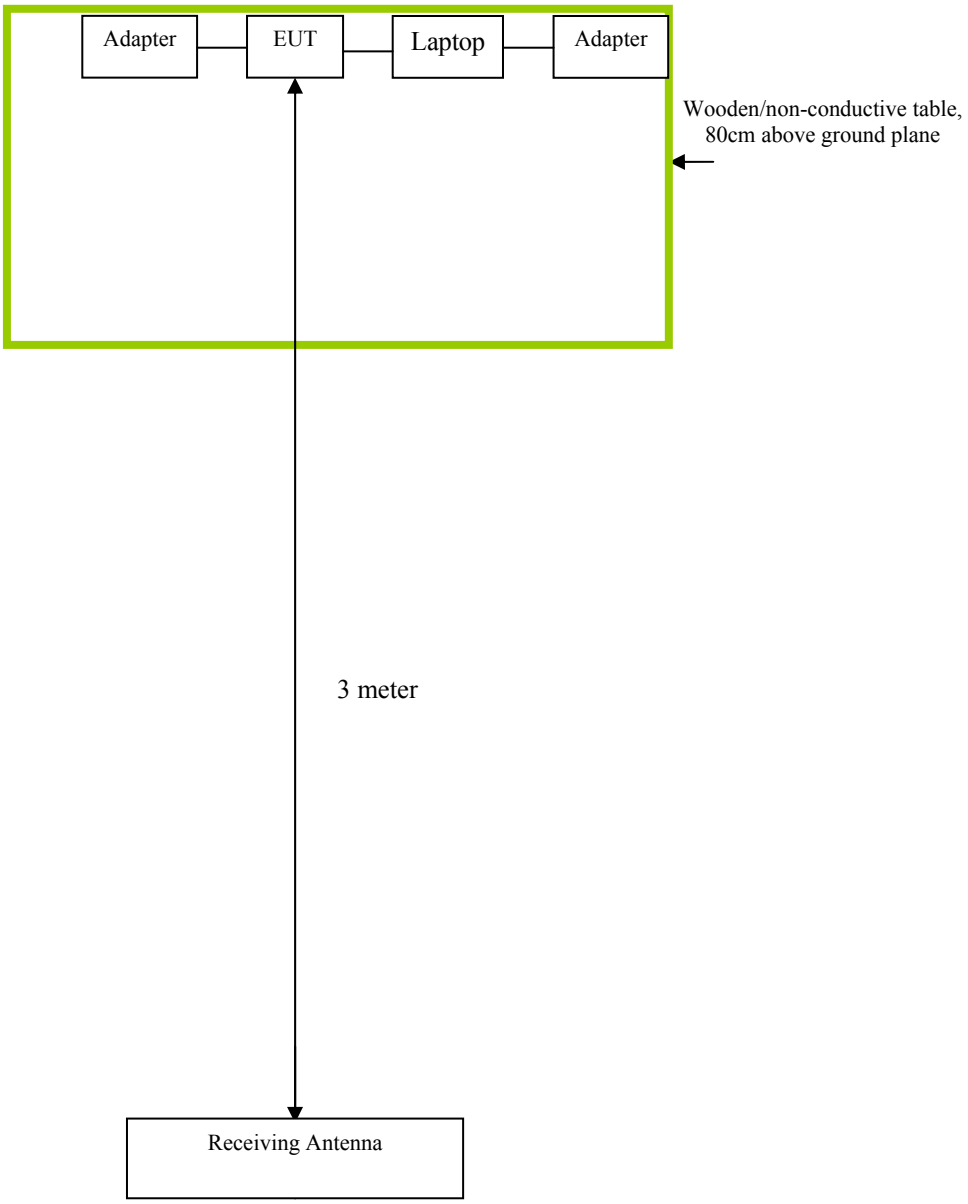
The following is a description of supporting equipment and details of cables used with the EUT.

Manufacturer	Equipment Description (Including Brand Name)	Model	Calibration Date	Calibration Due Date
Gateway	Laptop	MS2288 & LXWHF02013951C3CA 92200	N/A	N/A

Block Configuration Diagram for AC Line Conducted Emissions



Block Configuration Diagram for Radiated Emissions



Annex C.ii. EUT OPERATING CONDITIONS

The following is the description of how the EUT is exercised during testing.

Test	Description Of Operation
Emissions Testing	The EUT was continuously transmitting to stimulate the worst case.

Annex D. USER MANUAL / BLOCK DIAGRAM / SCHEMATICS / PART LIST

Please see attachment

Annex E. DECLARATION OF SIMILARITY

N/A