Nemko-CCL, Inc.

1940 West Alexander Street
Salt Lake City, UT 84119
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Test Report

Certification

Test Of: C4-DSC-EN and SCH-VDS-E

FCC ID: R33C4DSC

Test Specifications:
FCC PART 15, Subpart C

Test Report Serial No: 205425-3.1

Applicant:
Control4
11734 S. Election Road, Suite 200
Draper, UT 84020

Dates of Test: April 23, 24 & 26, 2012
June 6, 7 & 11, 2012

Report Issue Date: July 18, 2012

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Nemko-CCL, Inc. to document compliance of the device described below with the requirements of Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full, partial reproduction may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: Control4
- Manufacturer: Control4
- Brand Name: Control4
- Model Number: C4-DSC-EN
- Brand Name: CISCO
- Model Number: SCH-VDS-E
- FCC ID Number: R33C4DSC

On this 12th day of July 2012, I, individually and for Nemko-CCL, Inc., certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has recognized that the Nemko-CCL, Inc. EMC testing facilities are in good standing, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Nemko-CCL, Inc.

Tested by: Norman P. Hansen
EMC Technician

Reviewed by: Thomas C. Jackson
General Manager

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name:	Control4 11734 S. Election Road, Suite 200 Draper, UT 84020
Contact Name:	Roger Midgley
Title:	Sr. Regulatory Compliance Engineer

1.2 Manufacturer:

Company Name:	Control4 11734 S. Election Road, Suite 200 Draper, UT 84020
Contact Name:	Roger Midgley
Title:	Sr. Regulatory Compliance Engineer

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	Control4
Model Number:	C4-DSC-EN
Serial Number:	Engineering Unit
Brand Name:	Cisco
Model Number:	SCH-VDS-E
Dimensions:	18.2 cm x 13.0 cm x 5.8 cm

2.2 Description of EUT:

The C4-DSC-EN is an exterior door station that provides video and audio to home control system devices. The C4-DSC-EN has an 802.11bgn transceiver and an Ethernet port for interfacing the home control system. The C4-DSC-EN may be powered by AC, POE, or a DC source. For testing using POE, an Ault PW130 POE injector was used to power the EUT. For testing using a DC source, a Delta Electronics 0950-4466 power supply was used. A contact/relay port is provided to interface sensors or contacts of devices such as gates, doors, or doorbells. The C4-DSC-EN has a metal back box that is placed in a wall and a metal front faceplate. The faceplate color is designated by 2 letters after the model number. Available color options are: BL for satin black, OB for oil rubbed bronze, VB for Venetian bronze, or SN for satin nickel.

The Cisco SCH-VDS-E is identical to the C4-DSC-EN except in branding and labeling.

This report covers the circuitry of the devices subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Subpart B was found to be compliant and is covered in Nemko-CCL, Inc. report #205425-2.1.

The C4-DSC-EN 802.11b/g/n transceiver uses 11 channels in the 2400 to 2483.5 MHz frequency range. Testing was performed at the upper, middle, and lower channels using 802.11b, 802.11g, and 802.11n. The C4-DSC-EN transceiver uses either an Aristotle Enterprises RFA-02-D3-16W-200, 1.41 dBi sleeve antenna or a Cirocomm Technology 03A153040379240, -5.0 dBi patch antenna. The channels and the maximum transmitter power settings to be incorporated in production software are shown below.

Channel	Frequency (MHz)	Power Setting		
		802.11b	802.11g	802.11n
1	2412	+12	+15	+14
2	2417	+12	+17	+16
3	2422	+12	+17	+16
4	2427	+12	+17	+16
5	2432	+12	+17	+16
6	2437	+12	+17	+16
7	2442	+12	+17	+16
8	2447	+12	+17	+16
9	2452	+12	+17	+16
10	2457	+12	+17	+16
11	2462	+12	+13	+12

2.3 EUT and Support Equipment:

The FCC ID numbers for all the EUT and support equipment used during the test are listed below:

Brand Name Model Number Serial Number	FCC ID Number or Compliance	Description	Name of Interface Ports / Interface Cables
BN: Control4 MN: C4-DSC-EN (Note 1) SN:	R33C4DSC	Door Station	See Section 2.4
BN: Control4 MN: C4-HC250B-BL SN: Engineering Unit	R33C4HC250	Controller	Ethernet with power/Cat5e cable with RJ-45 connectors
BN: Control4 MN: C4-TW7C0-BL SN:	R33C4TW7C0	In-wall touchscreen display	Ethernet with power/Cat5e cable with RJ-45 connectors

Brand Name Model Number Serial Number	FCC ID Number or Compliance	Description	Name of Interface Ports / Interface Cables
BN: Cisco MN: SD208P SN: DNI154410QG	DoC	POE Switch	Ethernet/Cat 5e cable (Note 2) Ethernet w/power/Cat5e cables
BN: Dell MN: Latitude SN: None	DoC	Computer	Ethernet/Cat 5e cable

Note: (1) EUT
(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.4 Interface Ports on EUT:

Name of Ports	No. of Ports Fitted to EUT	Cable Descriptions/Length
AC In	1 (when powered by AC)	3 conductor NEMA power cord/1.3 meters
DC In	1 (when powered by DC)	2 conductors from DC supply/1.2 meters
Ethernet	1	Cat 5e cable with RJ-45 connectors/1 meter or 7 meters
Contact/Relay	1	9 unshielded conductors with contact and relays terminated in 1kΩ/1.0 meter

2.5 Modification Incorporated/Special Accessories on EUT:

The following modifications were made to the EUT by the Client during testing to comply with the specification. This report is not complete without an accompanying signed attestation, that the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market.

1. A 0.1 uF capacitor was placed on pads to connect digital and i ground together.
2. The maximum transmit power settings to be incorporated in production software were set to the values shown in the table of section 2.2 of this report.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title:	FCC PART 15, Subpart C (47 CFR 15) 15.203, 15.207, and 15.247 Limits and methods of measurement of radio interference characteristics of radio frequency devices.
Purpose of Test:	The tests were performed to demonstrate initial compliance.

3.2 Methods & Procedures:

3.2.1 §15.203 Antenna Requirement

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 use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

3.2.2 §15.207 Conducted Limits

(a) Except for Class A digital devices, 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, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

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.

3.2.3 §15.247 Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400 – 2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels are used.

(2) Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

(b) The maximum peak output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725 – 5850 MHz bands: 1 watt. As an alternative to a peak power measurement, compliance with the Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (b)(4)(i) and (b)(4)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna /antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.

(d) 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time
interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The digital modulation operation of the hybrid
system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Note: Spread spectrum systems are sharing these bands on a noninterference basis with systems supporting critical Government requirements that have been allocated the usage of these bands, secondary only to ISM equipment operated under the provisions of Part 18 of this Chapter. Many of these Government systems are airborne radiolocation systems that emit a high EIRP which can cause interference to other users. Also, investigations of the effect of spread spectrum interference to U. S. Government operations in the 902-928 MHz band may require a future decrease in the power limits allowed for spread spectrum operation.

3.2.3 Test Procedure

The conducted disturbance at mains ports and radiated disturbance testing was performed according to the procedures in ANSI C63.4: 2003 and KDB 558074 D01 DTS Measurement Guidance v01. Testing was performed at Nemko-CCL, Inc.'s Wanship open area test site #2, located at 29145 Old Lincoln Highway, Wanship, UT. This site has been fully described in a report submitted to the FCC, and was accepted in a letter dated February 15, 2012 (90504).

Nemko-CCL, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2012.

For radiated emissions testing at 30 MHz or above, that is performed at distances closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply: 120 VAC/ 60 Hz when powered by the AC mains, or 12 – 24 VDC when DC powered, or 48 VDC when POE powered

4.2 Operating Modes:

The 802.11b/g/n transmitter was tested while in a constant transmit mode at the upper, middle, and lower channels. 802.11b, 802.11g, and 802.11n modes were tested. Data rates were at 1 mbps for testing in 802.11b mode. The data rate was at 6 mbps for 802.11g testing. The data rate was at 6.5 mbps for 802.11n testing. The AC and DC power was varied in accordance with FCC §15.31(e). No change was seen in transmitter characteristics. The transmitter was tested while powered by the AC mains, powered by an external DC source, and when powered by POE. No change in transmitter characteristics was seen with the different power sources.

The radiated band edge plots and data are from testing at the power levels shown in the table of Section 2.2 of this report. All other testing was performed at the maximum power level shown for each mode in the table of Section 2.2 (802.11b at +12, 802.11g at +17, and 802.11n at +16).

4.3 EUT Exercise Software:

Control4 software was used to exercise the transmitters.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC Part 15, Subpart C

The C4-DSC-EN 802.11b/g/n transceiver was subjected to each of the tests shown in the summary table below.

5.1.1 Summary of Tests:

Section	Environmental Phenomena	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.247(a)	Bandwidth Requirement	2400 – 2483.5	Complied
15.247(b)	Peak Output Power	2400 – 2483.5	Complied
15.247(c)	Antenna Conducted Spurious Emissions	4 – 25000	Complied
15.247(c)	Radiated Spurious Emissions	4 – 25000	Complied
15.247(d)	Peak Power Spectral Density	2400 – 2483.5	Complied
15.247(e)	Reserved Paragraph	N/A	Not Applicable
15.247(f)	Hybrid System Requirements	2400 – 2483.5	Not Applicable
15.247(g)	Frequency Hopping Channel Usage	2400 – 2438.5	Not Applicable
15.247(h)	Frequency Hopping Intelligence	2400 – 2483.5	Not Applicable

5.2 Result

In the configuration tested, the 802.11b/g/n transceiver complied with the requirements of the specification.

SECTION 6.0 802.11b/g/n TRANSCEIVER – MEASUREMENTS AND RESULTS

6.1 General Comments:

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Appendix 1 of this report.

6.2 Test Results:

6.2.1 §15.203 Antenna Requirements

The EUT is professionally installed and uses either an Aristotle Enterprises Model RFA-02-D3-16W-200, 1.41 dBi sleeve antenna or a Cirocomm Technology Model 03A153040379240, -5.0 dBi patch antenna. Both antennas use a RPSMA connector to connect to the EUT.

RESULT

The EUT complied with the specification.

6.2.2 §15.207 Conducted Disturbance at the AC Mains Ports

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.17	Hot Lead	Peak (Note 1)	49.5	55.0	-5.5
19.80	Hot Lead	Peak (Note 1)	45.0	50.0	-5.0
20.35	Hot Lead	Peak (Note 1)	44.9	50.0	-5.1
25.05	Hot Lead	Peak (Note 1)	45.7	50.0	-4.3
25.85	Hot Lead	Peak (Note 1)	45.5	50.0	-4.5
26.65	Hot Lead	Quasi-Peak (Note 2)	48.9	60.0	-11.1
26.65	Hot Lead	Average (Note 2)	47.3	50.0	-2.7
27.30	Hot Lead	Quasi-Peak (Note 2)	47.1	60.0	-12.9
27.30	Hot Lead	Average (Note 2)	45.3	50.0	-4.7
2.17	Neutral Lead	Peak (Note 1)	39.1	46.0	-6.9
23.25	Neutral Lead	Peak (Note 1)	46.0	50.0	-4.0

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBµV)	Limit (dBµV)	Margin (dB)
24.48	Neutral Lead	Peak (Note 1)	43.9	50.0	-6.1
25.05	Neutral Lead	Peak (Note 1)	45.3	50.0	-4.7
25.85	Neutral Lead	Peak (Note 1)	44.8	50.0	-5.2
26.75	Neutral Lead	Quasi-Peak (Note 2)	47.8	60.0	-12.2
26.75	Neutral Lead	Average (Note 2)	46.3	50.0	-3.7
27.30	Neutral Lead	Peak (Note 1)	46.0	60.0	-14.0
Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits. Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.					

RESULT

In the configuration tested, the EUT complied with the specification by 2.7 dB.

<u>6.2.3 §15.247(a)(2) Emission Bandwidth</u>

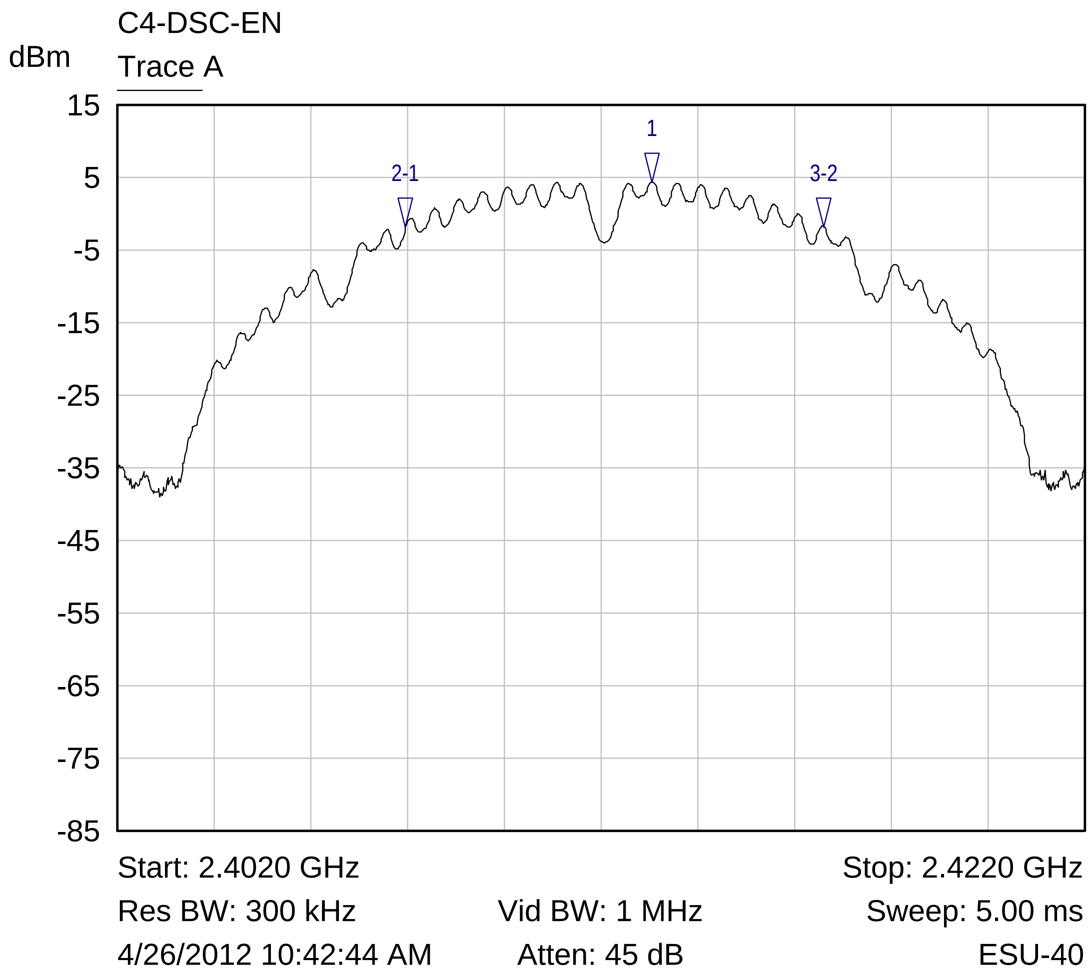
The 6 dB emission bandwidth must be greater than 500 kHz. The table and plots below show the 6 dB emission bandwidth.

Frequency (MHz)	802.11b Emission 6 dB bandwidth (MHz)	802.11g Emission 6 dB bandwidth (MHz)	802.11n Emission 6 dB bandwidth (MHz)
2412	8.64	16.24	17.42
2437	8.58	16.14	17.26
2462	8.60	16.08	17.46

RESULT

In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).

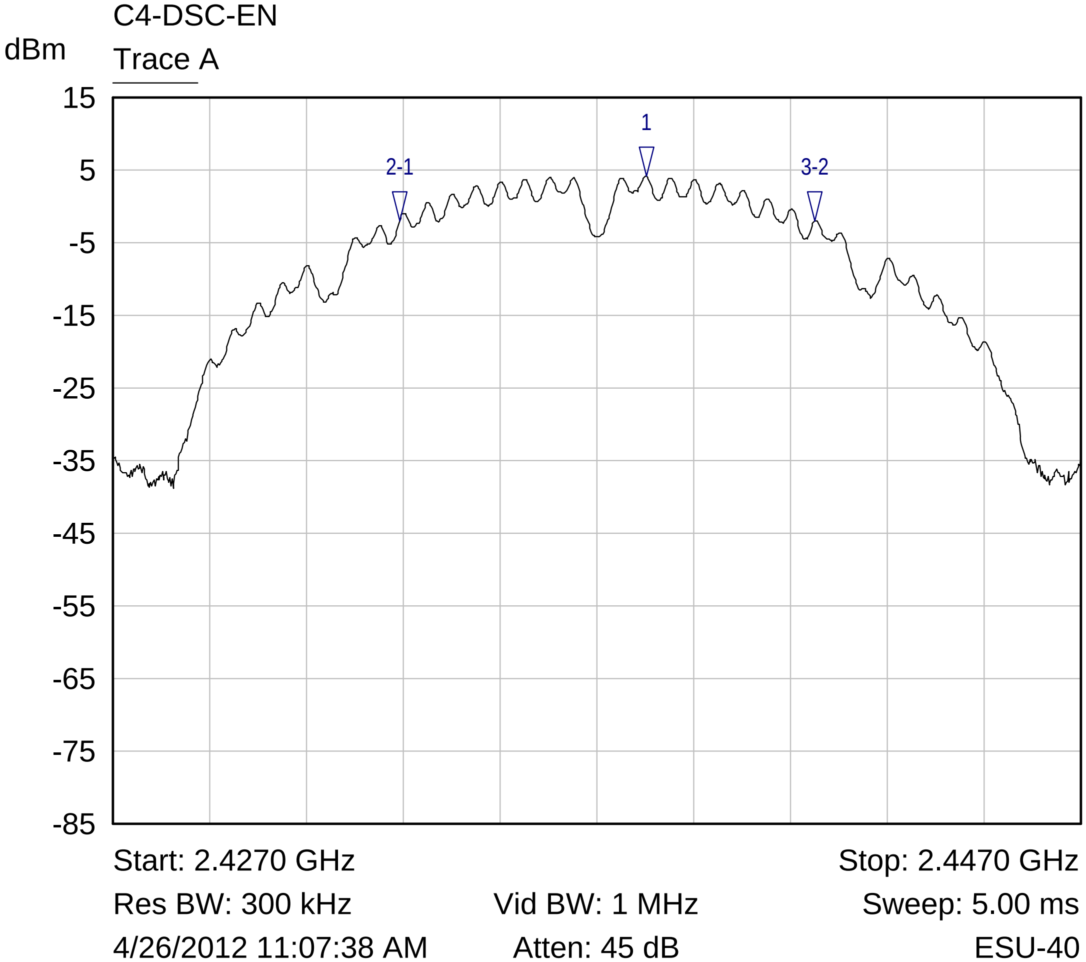
Lowest Channel 802.11b Emission 6 dB Bandwidth



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4130 GHz	4.42 dBm	
2-1 ▽	Trace A	-5.1000 MHz	-6.19 dB	
3-2 ▽	Trace A	8.6400 MHz	-0.06 dB	

Trace A 6 dB Bandwidth plot

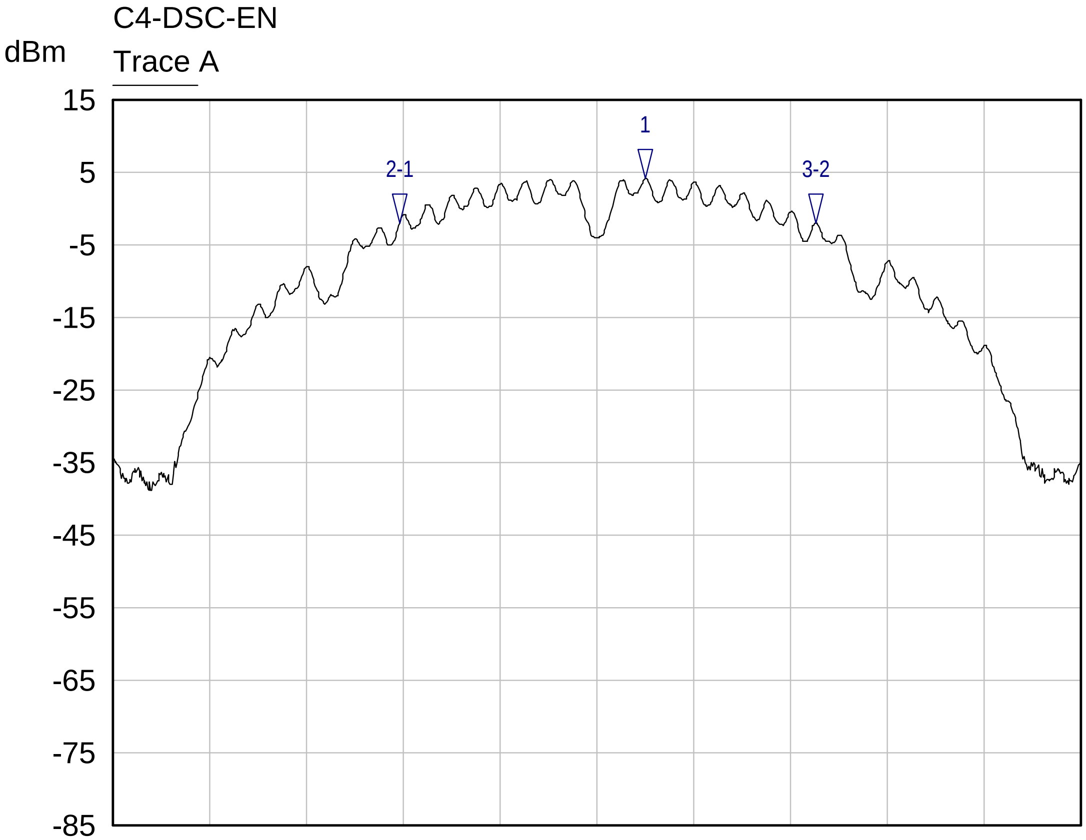
Middle Channel 802.11b Emission 6 dB Bandwidth



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4380 GHz	4.10 dBm	
2-1 ▽	Trace A	-5.1000 MHz	-6.06 dB	
3-2 ▽	Trace A	8.5800 MHz	-0.02 dB	

Trace A 6 dB Bandwidth plot

Highest Channel 802.11b Emission 6 dB Bandwidth

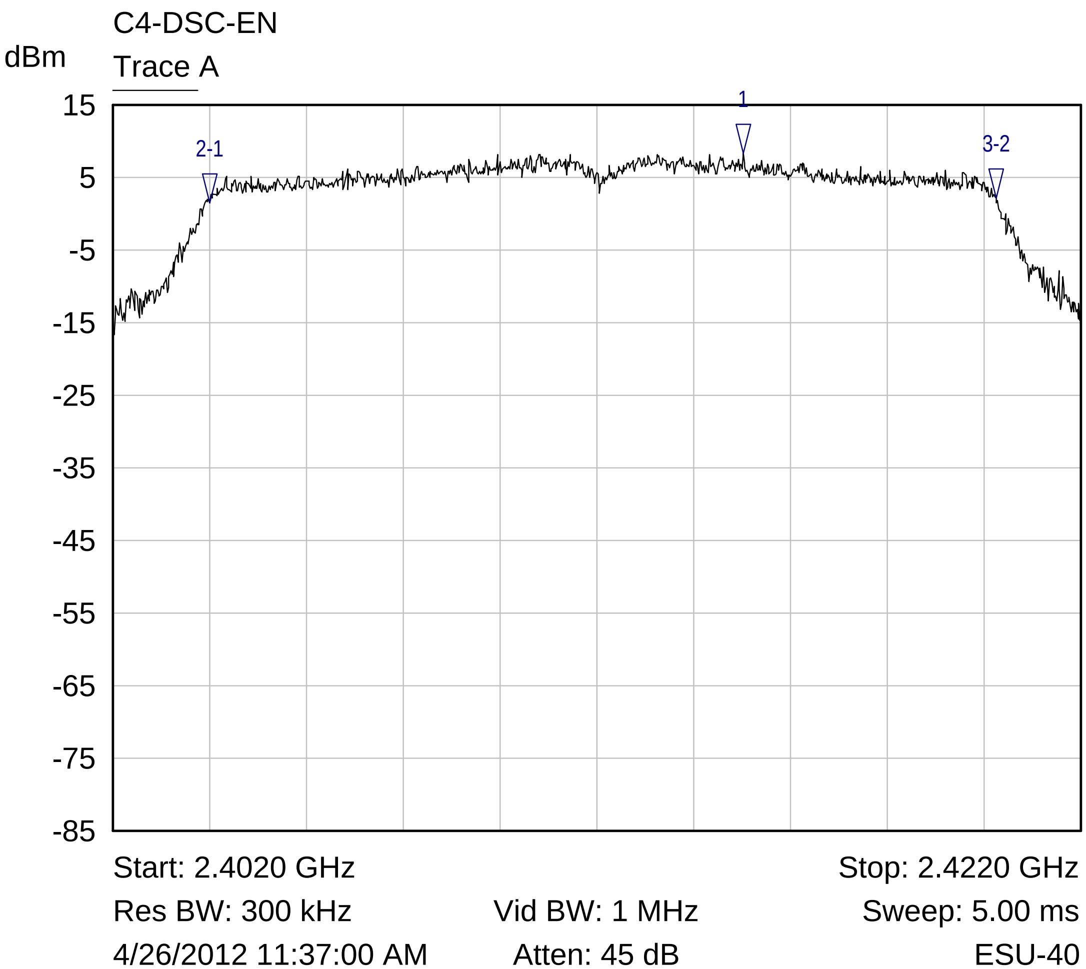


Start: 2.4520 GHz | Stop: 2.4720 GHz
Res BW: 300 kHz | Vid BW: 1 MHz | Sweep: 5.00 ms
4/26/2012 11:22:09 AM | Atten: 45 dB | ESU-40

Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4630 GHz	4.14 dBm	
2-1 ▽	Trace A	-5.0800 MHz	-6.07 dB	
3-2 ▽	Trace A	8.6000 MHz	-0.09 dB	

Trace A 6 dB Bandwidth plot

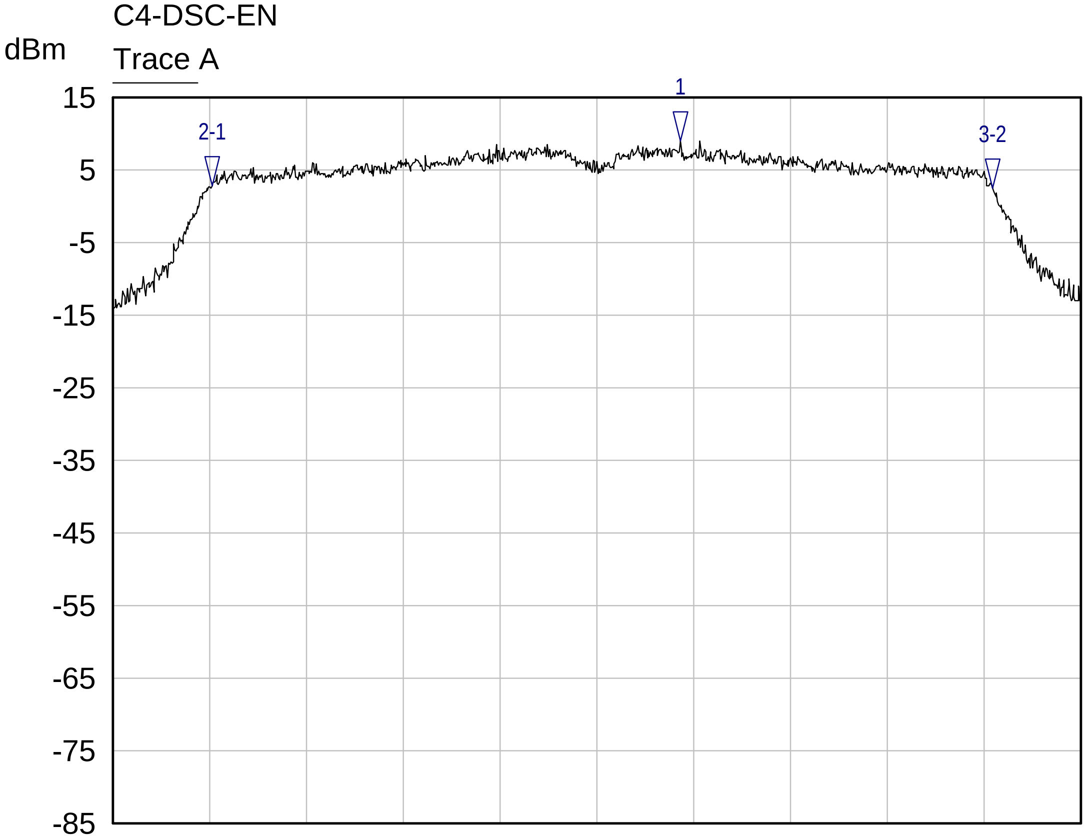
Lowest Channel 802.11g Emission 6 dB Bandwidth



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4150 GHz	8.34 dBm	
2-1 ▽	Trace A	-11.0200 MHz	-6.77 dB	
3-2 ▽	Trace A	16.2400 MHz	0.59 dB	

Trace A 6 dB Bandwidth plot

Middle Channel 802.11g Emission 6 dB Bandwidth

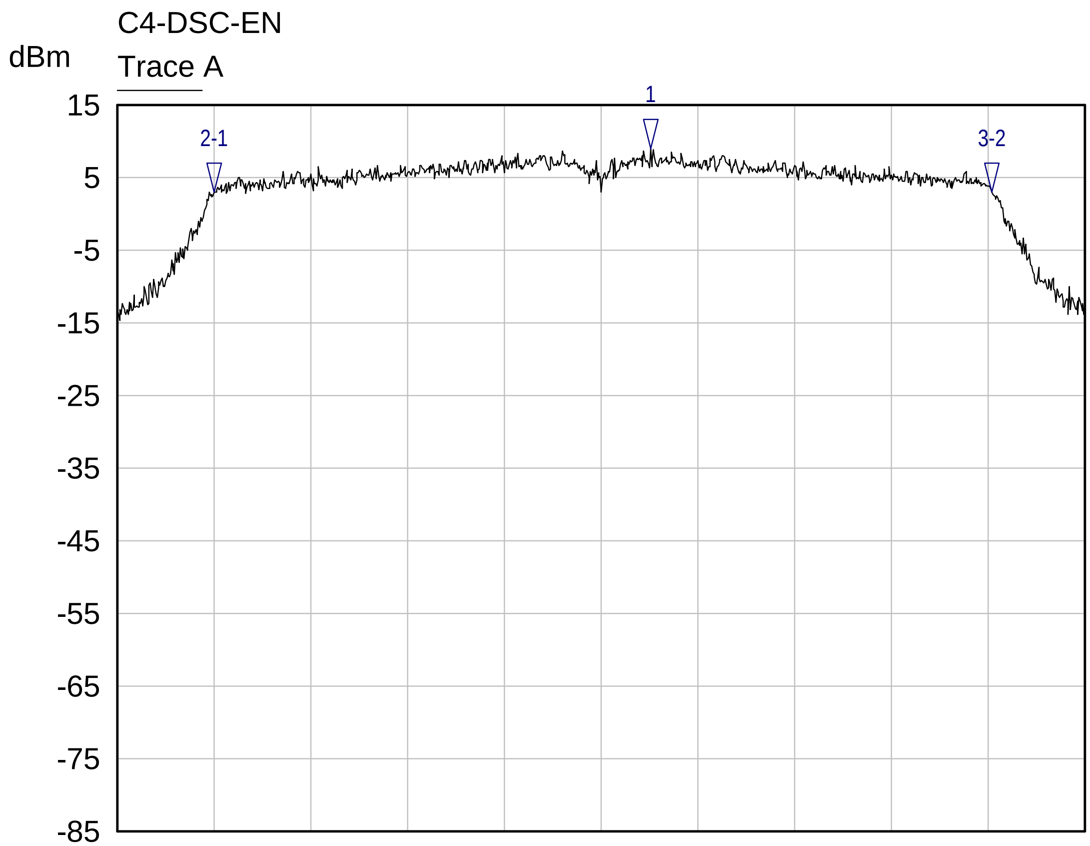


Start: 2.4270 GHz   Stop: 2.4470 GHz
Res BW: 300 kHz   Vid BW: 1 MHz   Sweep: 5.00 ms
4/26/2012 11:55:21 AM   Atten: 45 dB   ESU-40

Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4387 GHz	8.97 dBm	
2-1 ▽	Trace A	-9.6800 MHz	-6.18 dB	
3-2 ▽	Trace A	16.1400 MHz	-0.25 dB	

Trace A   6 dB Bandwidth plot

Highest Channel 802.11g Emission 6 dB Bandwidth

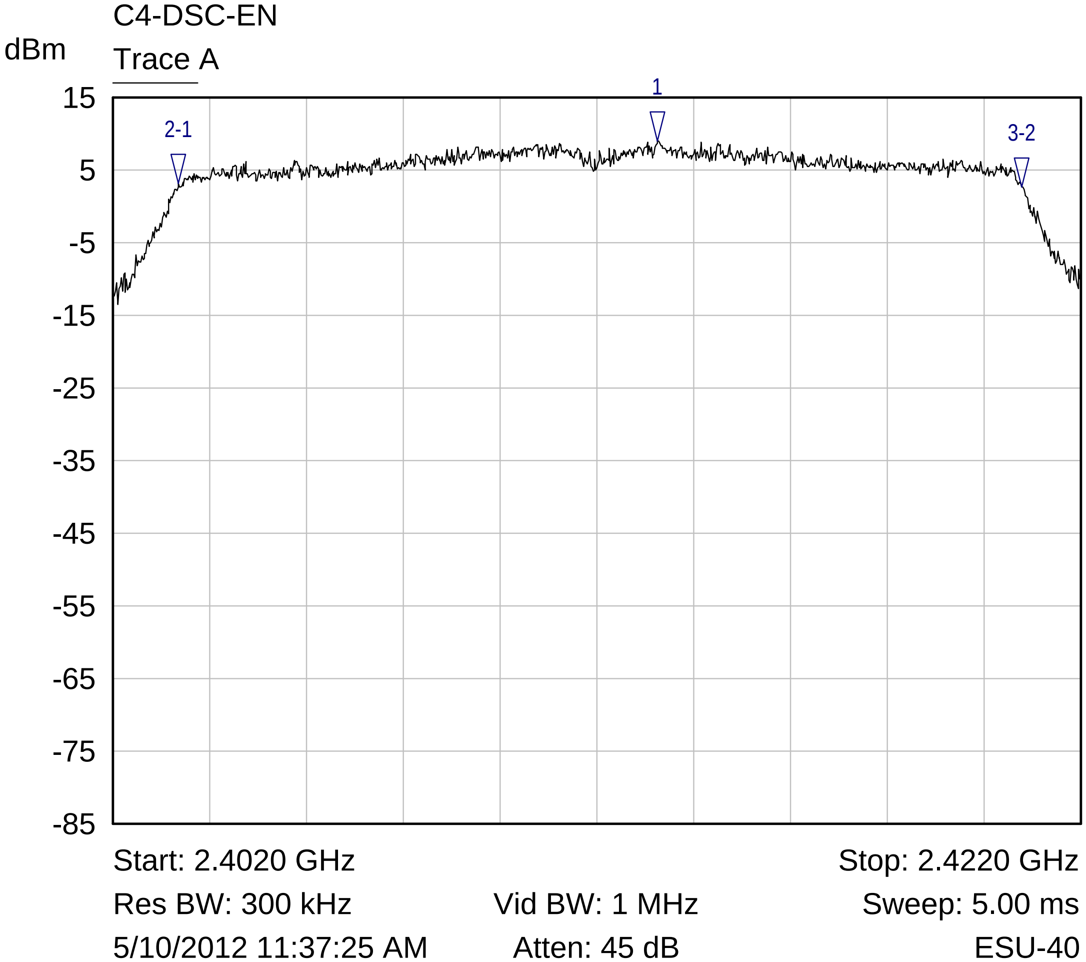


Start: 2.4520 GHz Stop: 2.4720 GHz
Res BW: 300 kHz Vid BW: 1 MHz Sweep: 5.00 ms
4/26/2012 12:15:09 PM Atten: 45 dB ESU-40

Mkr	Trace	X-Axis	Value	Notes
1 ∇	Trace A	2.4630 GHz	9.08 dBm	
2-1 ∇	Trace A	-9.0200 MHz	-6.02 dB	
3-2 ∇	Trace A	16.0800 MHz	-0.09 dB	

Trace A 6 dB Bandwidth plot

Lowest Channel 802.11n Emission 6 dB Bandwidth

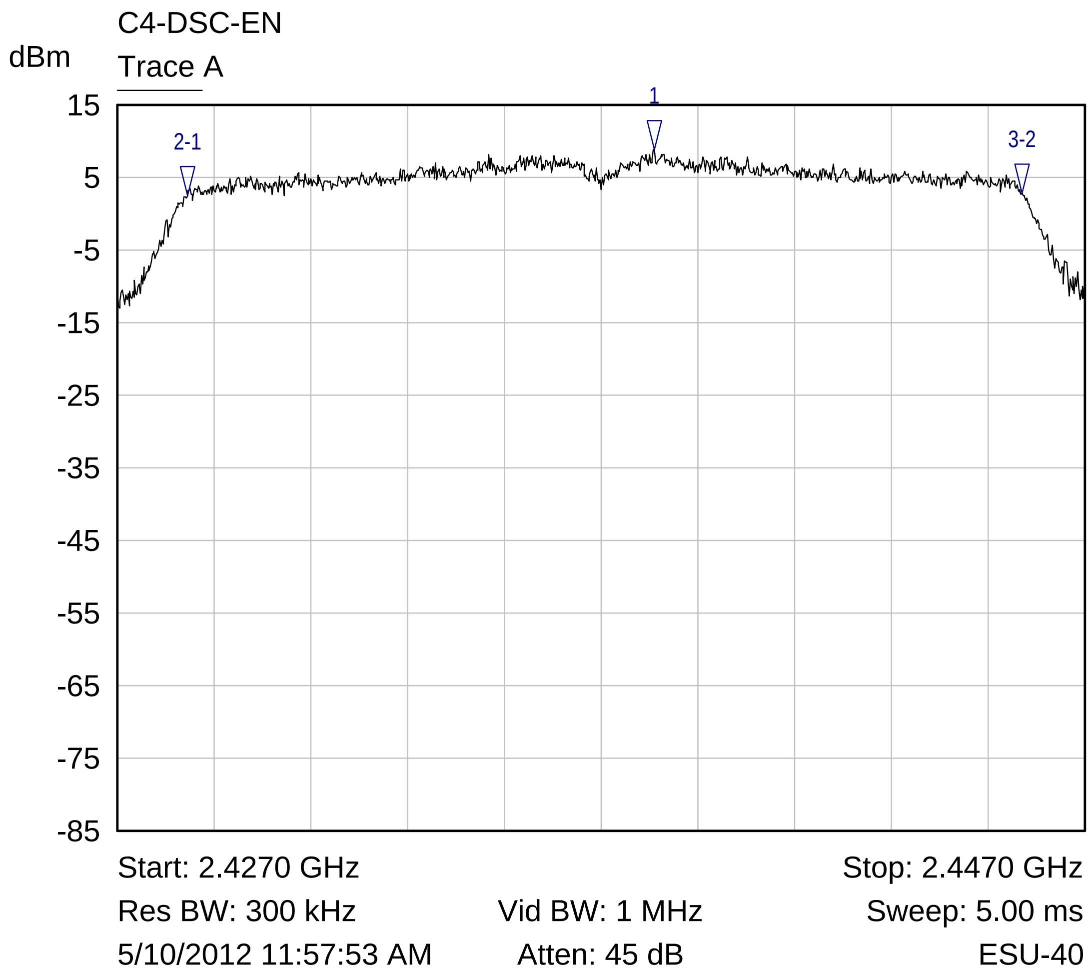


Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4133 GHz	8.95 dBm	
2-1 ▽	Trace A	-9.9000 MHz	-5.84 dB	
3-2 ▽	Trace A	17.4200 MHz	-0.52 dB	

802.11n +17

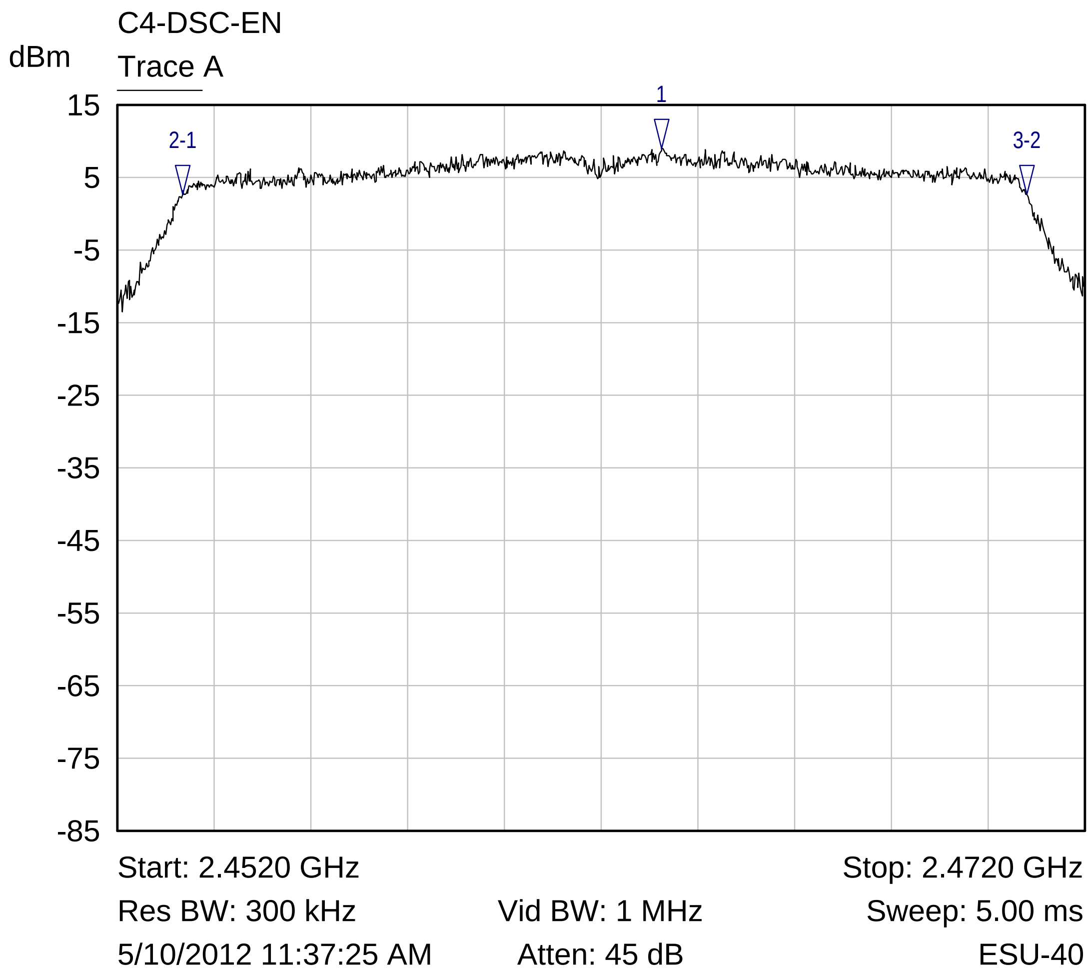
Trace A Band width

Middle Channel 802.11n Emission 6 dB Bandwidth



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4381 GHz	8.85 dBm	
2-1 ▽	Trace A	-9.6600 MHz	-6.32 dB	
3-2 ▽	Trace A	17.2600 MHz	0.23 dB	

Highest Channel 802.11n Emission 6 dB Bandwidth



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4633 GHz	8.95 dBm	
2-1 ▽	Trace A	-9.9200 MHz	-6.36 dB	
3-2 ▽	Trace A	17.4600 MHz	0.14 dB	

6.2.4 §15.247(b)(3) Peak Output Power

The maximum peak RF Conducted output power measured for this device was 24.52 dBm or 283.14 mW. The limit is 30 dBm or 1 Watt when using antennas with 6 dBi or less gain. The antennas specified for use with this device have a maximum gain less than 6 dBi. The measurements were made using the highest power for any channel for each transmit mode.

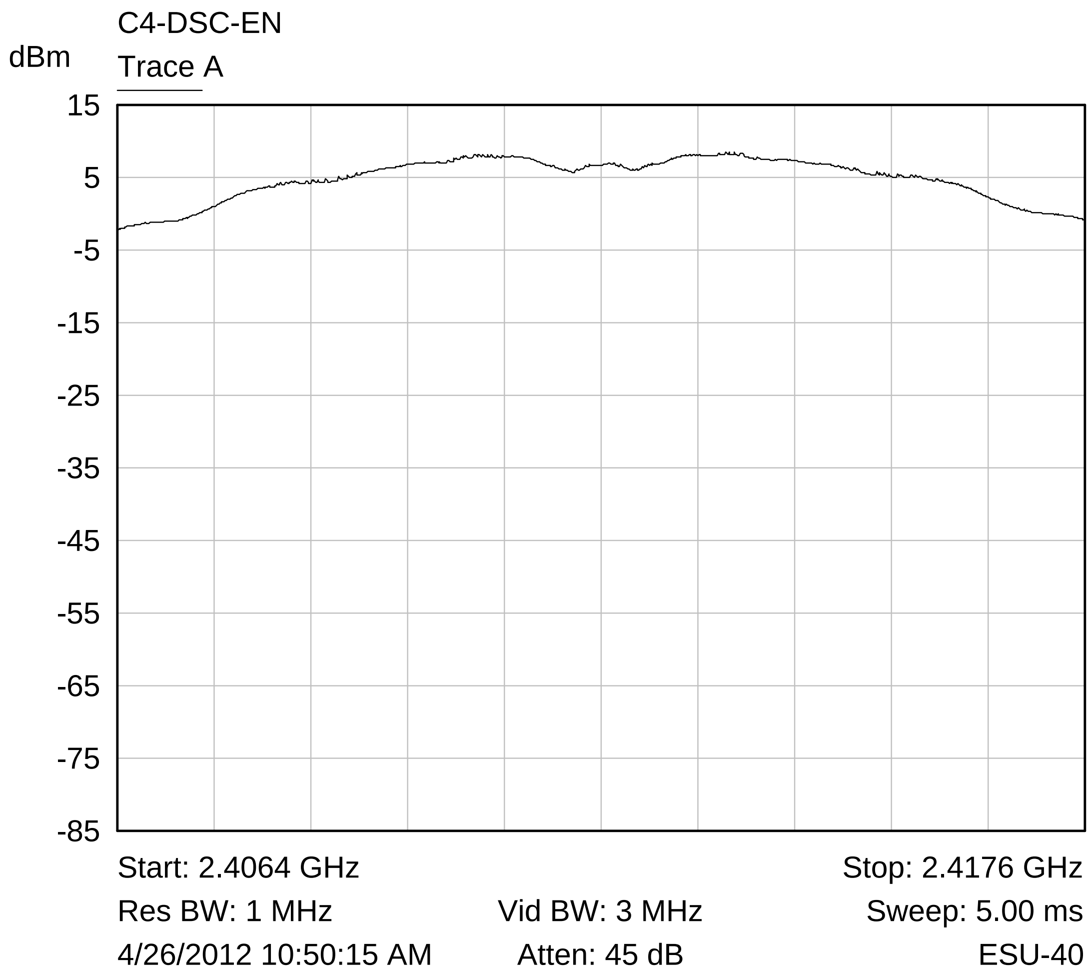
The method described in KDB 558074 D01 DTS Measurement Guidance v01 5.2.1.2 was used to measure the peak power.

Frequency (MHz)	802.11b Measured Output Power (dBm)	802.11b Measured Output Power (mW)	802.11g Measured Output Power (dBm)	802.11g Measured Output Power (mW)	802.11n Measured Output Power (dBm)	802.11n Measured Output Power (mW)
2412	15.21	33.19	23.54	225.94	24.52	283.14
2437	14.59	28.77	23.94	247.74	23.77	238.23
2462	14.58	28.70	23.88	244.34	23.71	234.96

RESULT

In the configuration tested, the RF peak output power was less than 1 Watt; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).

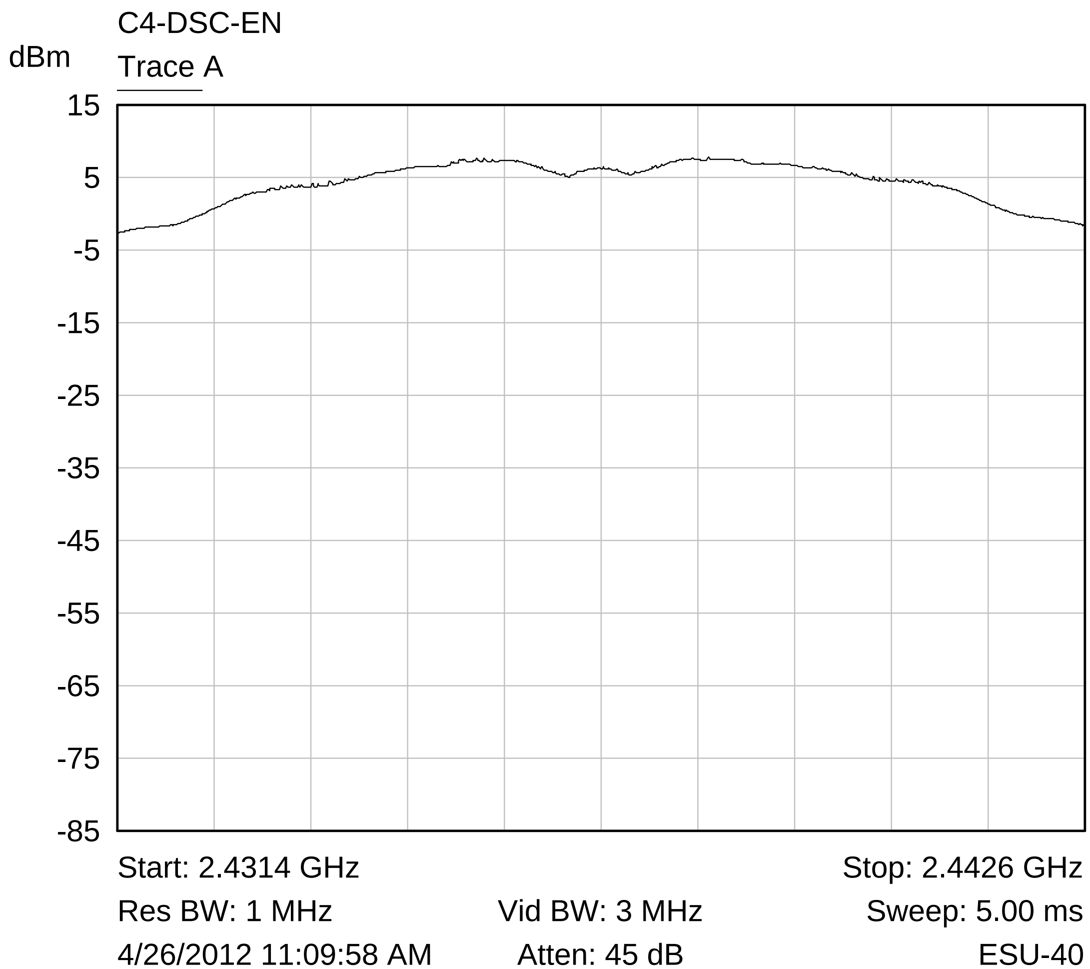
Lowest Channel 802.11b Output Power Plot



Trace A Output power

Measurement Parameter	Value
Channel power	15.21 dBm

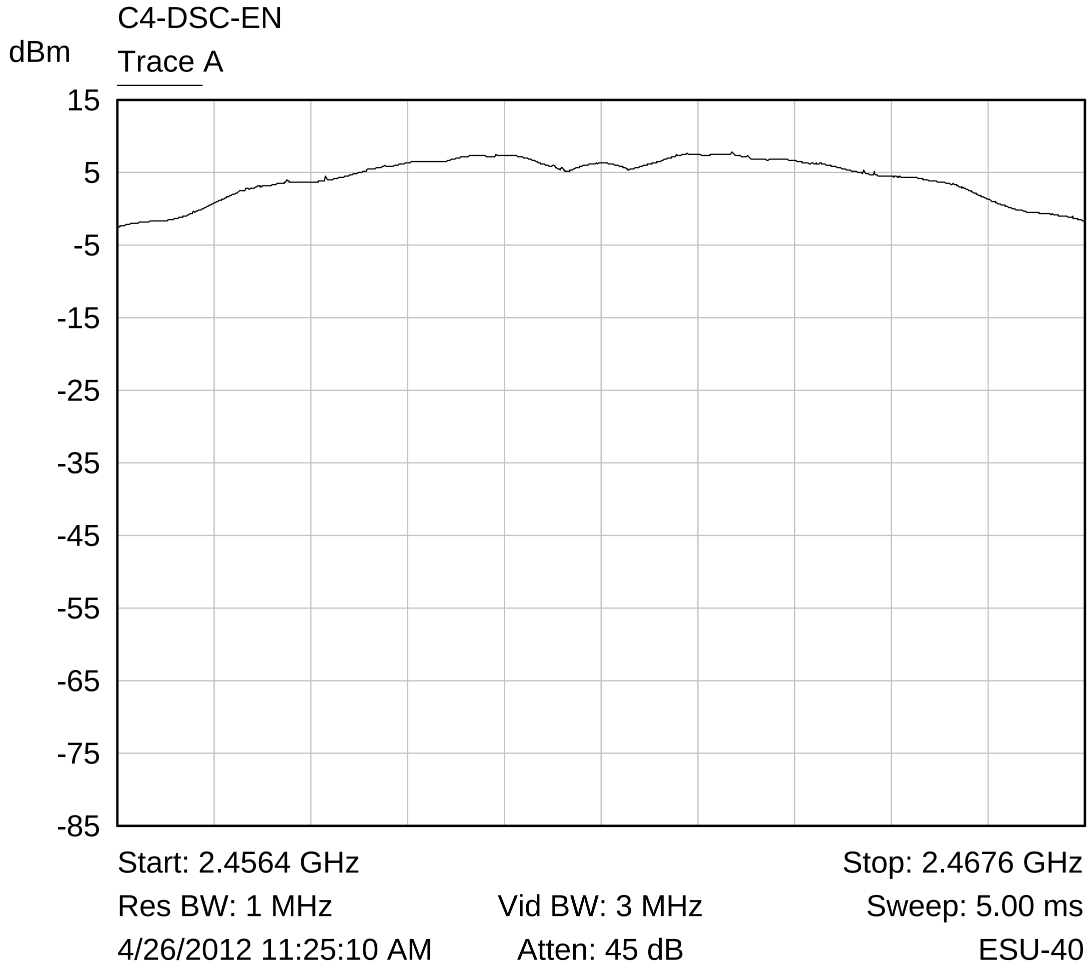
Middle Channel 802.11b Output Power Plot



Trace A Output power

Measurement Parameter	Value
Channel power	14.59 dBm

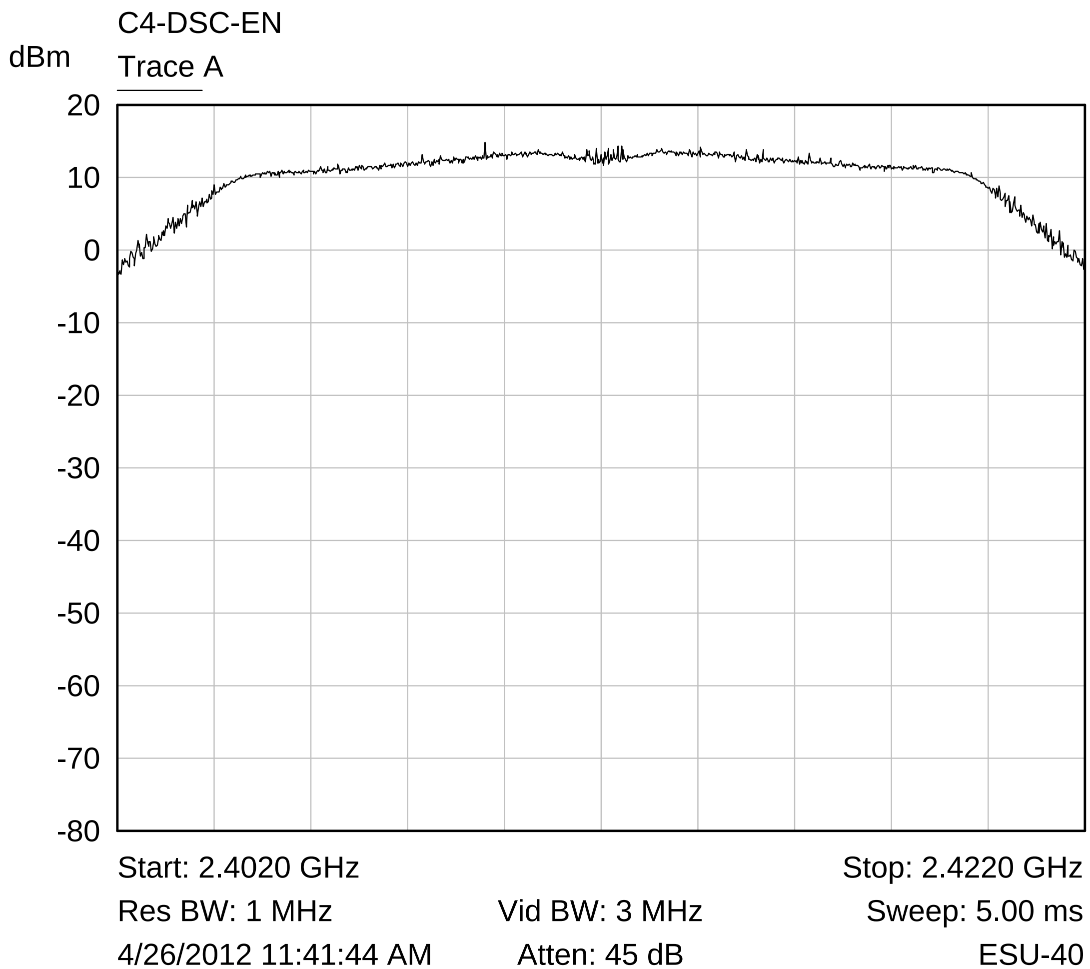
Highest Channel 802.11b Output Power Plot



Trace A Output power

Measurement Parameter	Value
Channel power	14.58 dBm

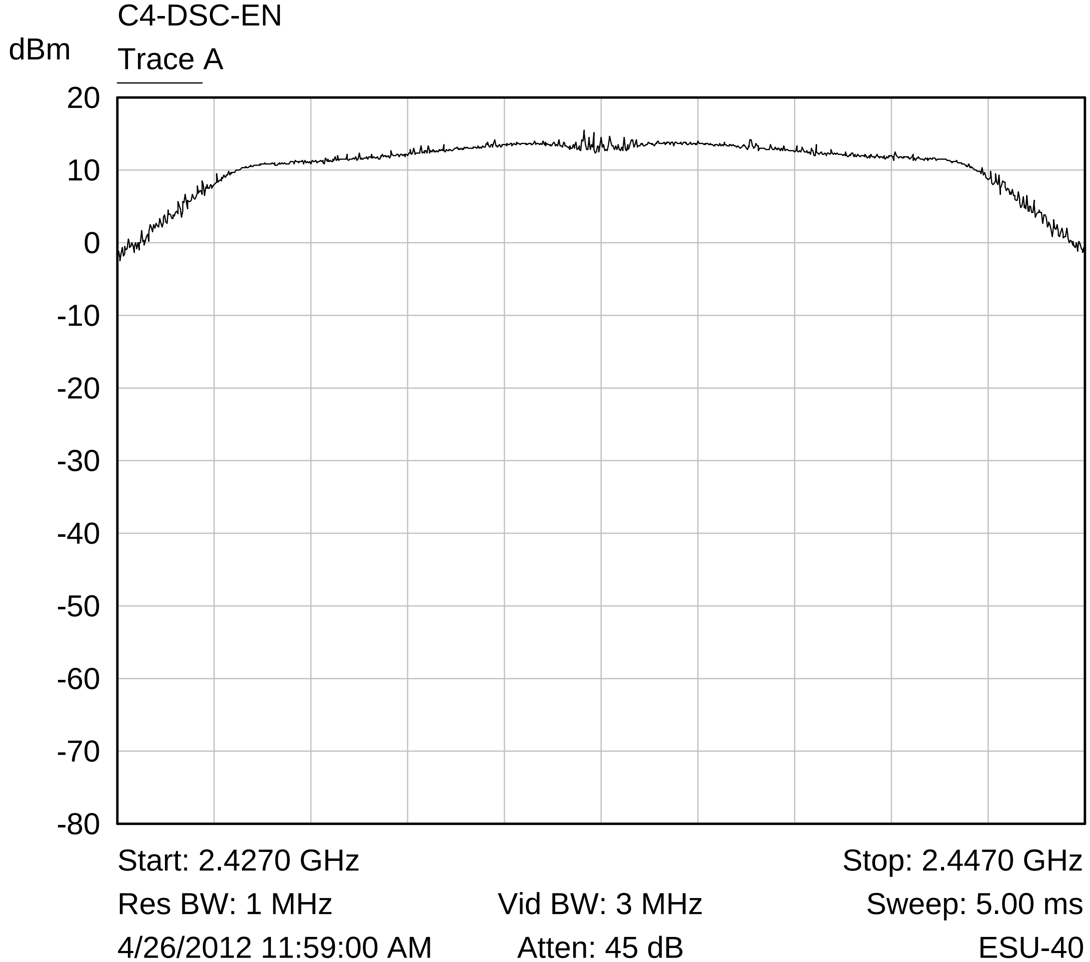
Lowest Channel 802.11g Output Power Plot



Trace A Output power

Measurement Parameter	Value
Channel power	23.54 dBm

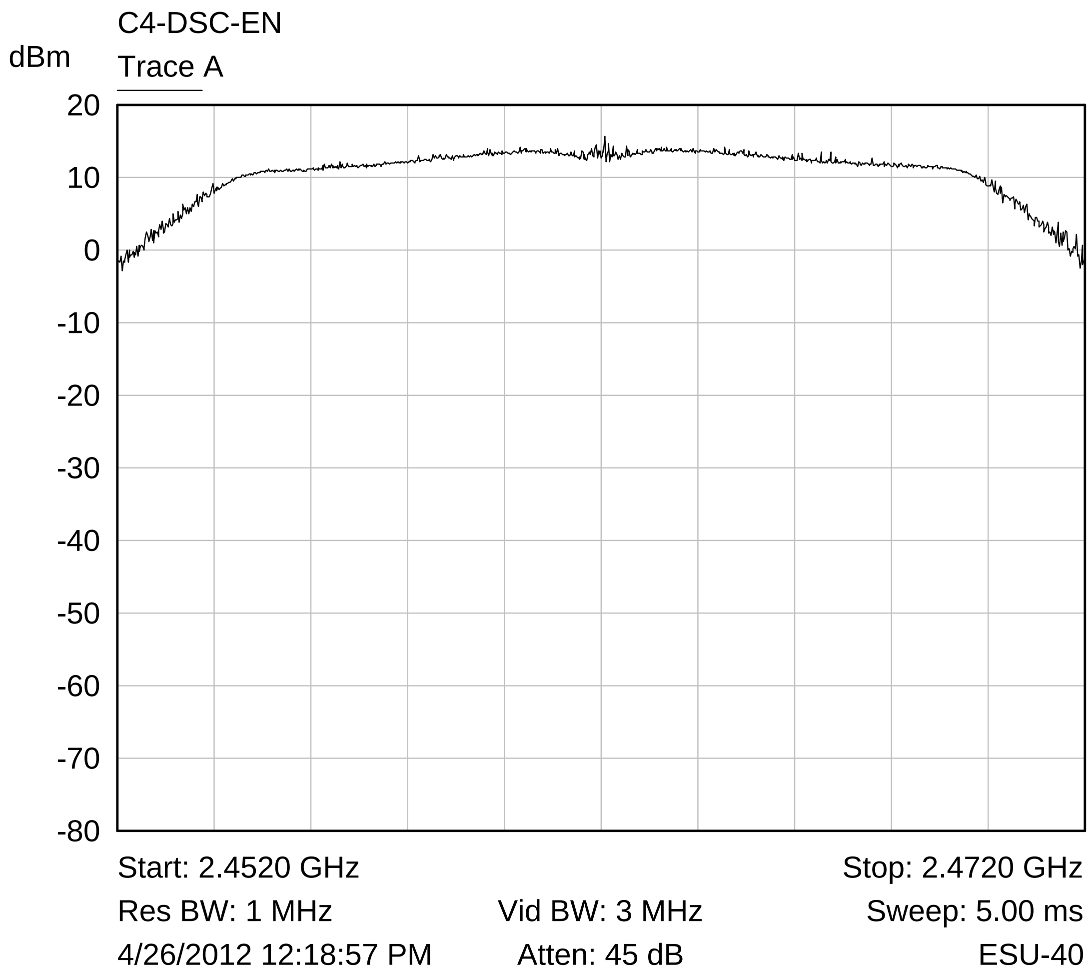
Middle Channel 802.11g Output Power Plot



Trace A Output power

Measurement Parameter	Value
Channel power	23.94 dBm

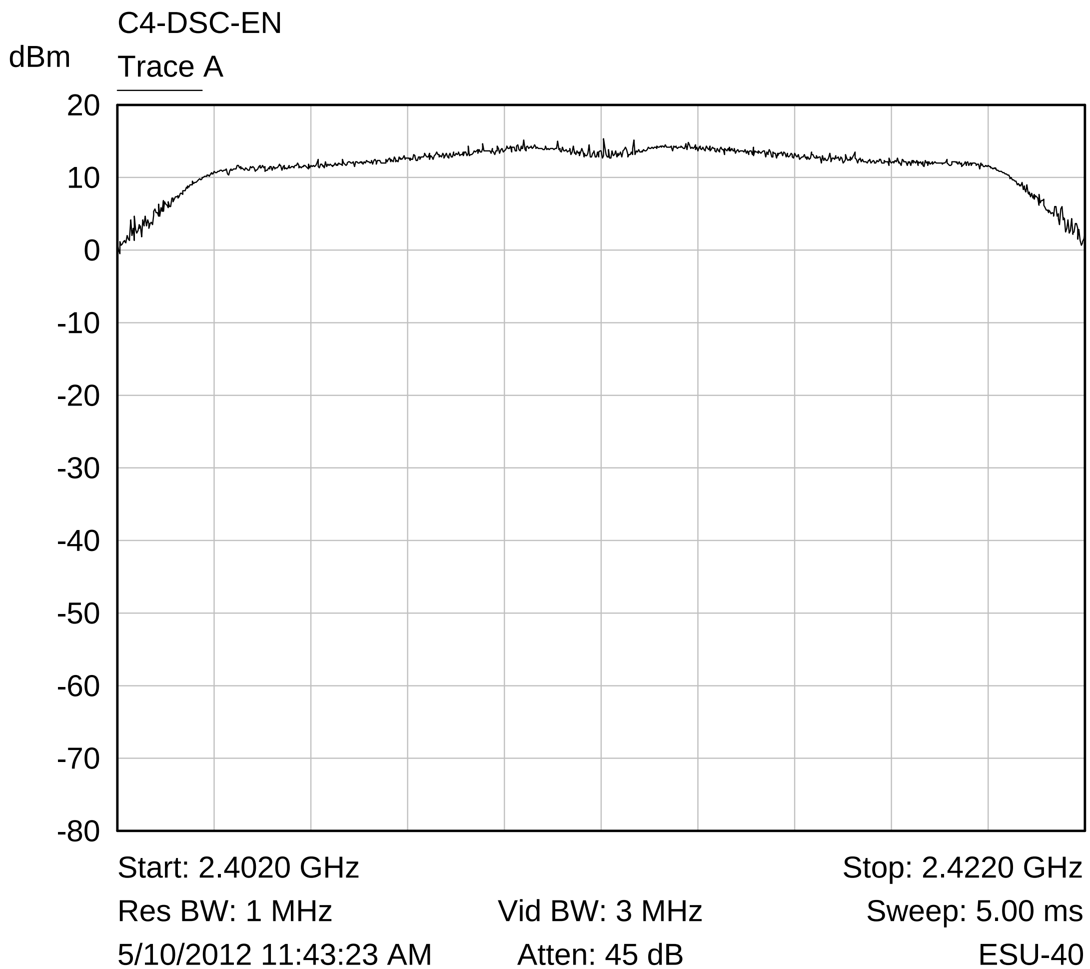
Highest Channel 802.11g Output Power Plot



Trace A Output power

Measurement Parameter	Value
Channel power	23.88 dBm

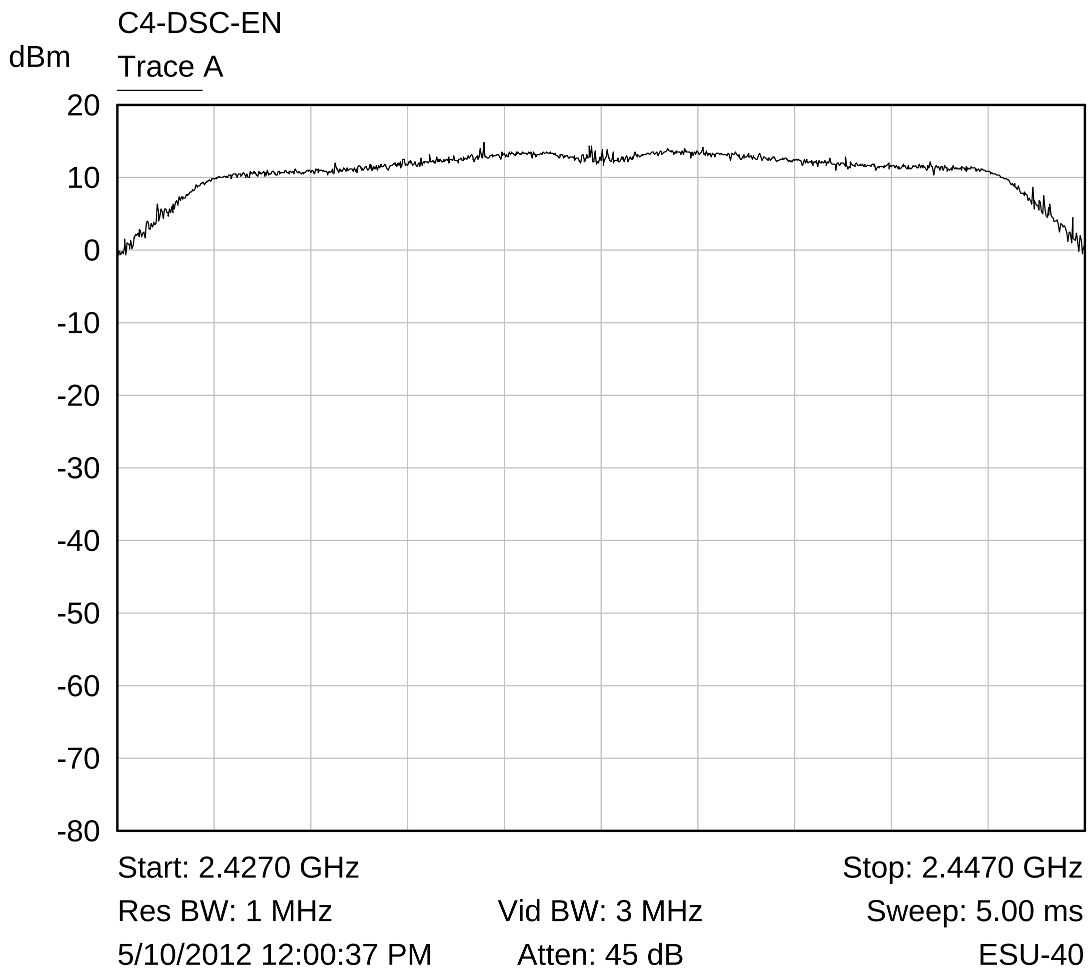
Lowest Channel 802.11n Output Power Plot



Trace A

Measurement Parameter	Value
Channel power	24.52 dBm

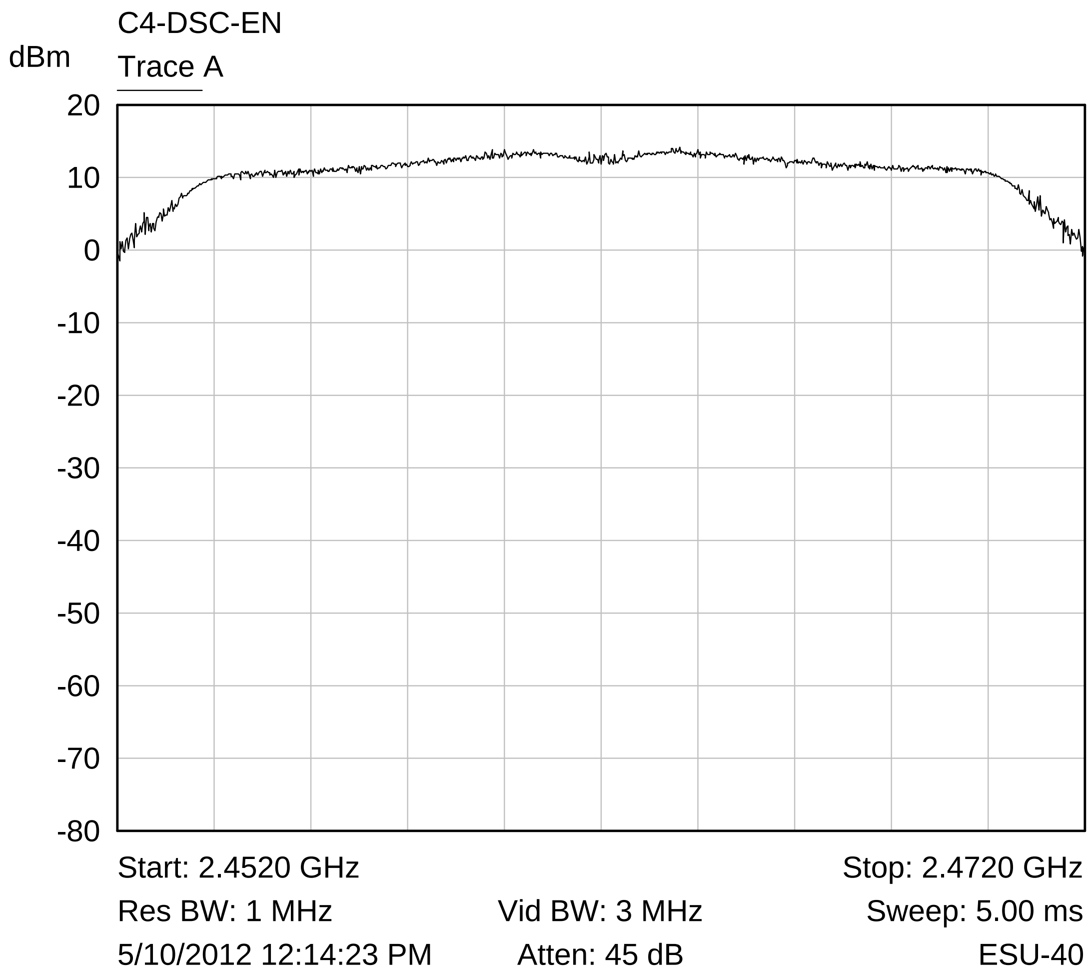
Middle Channel 802.11n Output Power Plot



Trace A

Measurement Parameter	Value
Channel power	23.77 dBm

Highest Channel 802.11n Output Power Plot



Trace A

Measurement Parameter	Value
Channel power	23.71 dBm

6.2.5 §15.247(c) Spurious Emissions

6.2.5.1 Conducted Spurious Emissions

The frequency range from 4 MHz to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The tables show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency, and upper frequency. The measurements were made using the highest power for any channel for each transmit mode. Shown below are plots with the EUT tuned to the upper and lower channels. These demonstrate compliance with the provisions of this section at the band edges.

The emissions must be attenuated 20 dB below the highest power level measured within the authorized band as measured with a 100 kHz RBW. The highest level measured in 802.11b mode was 4.1 dBm; therefore, the criteria is 4.1 – 20.0 = -15.9 dBm. For 802.11g mode, the maximum level was 6.8 dBm; therefore, the criteria is 6.8 – 20 = -13.2 dBm. For 802.11n mode, the maximum level was 7.5 dBm; therefore, the criteria is 7.5 – 20 = -12.5 dBm.

RESULT

Conducted spurious emissions were attenuated 20 dB or more from the fundamental; therefore, the EUT complies with the specification.

6.2.5.1.1 802.11b Mode

Transmitting on the Lowest Channel – 802.11b

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4824	-44.8	-15.9	-28.9
7236	-67.8	-15.9	-51.9
9648	-69.2	-15.9	-53.3
12060	-68.9	-15.9	-53.0
14472	-67.1	-15.9	-51.2
16884	-67.6	-15.9	-51.7
19296	-67.4	-15.9	-51.5
21708	-67.3	-15.9	-51.4
24120	-65.8	-15.9	-49.9

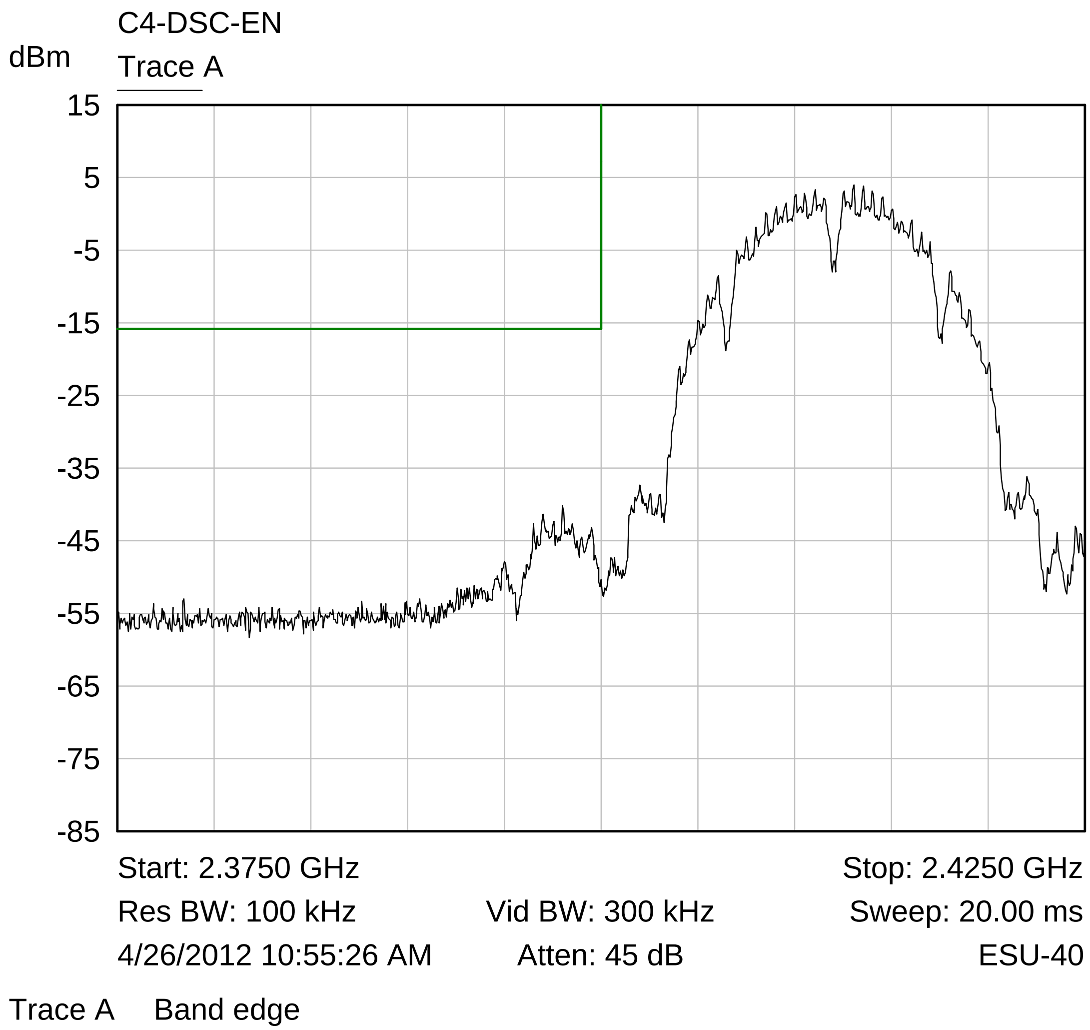
Transmitting on the Middle Channel – 802.11b

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4874	-48.4	-15.9	-32.5
7311	-66.7	-15.9	-50.8
9748	-68.8	-15.9	-52.9
12185	-68.5	-15.9	-52.6
14662	-67.0	-15.9	-51.1
17059	-67.7	-15.9	-51.8
19496	-67.5	-15.9	-51.6
21993	-66.6	-15.9	-50.7
24370	-65.9	-15.9	-50.0

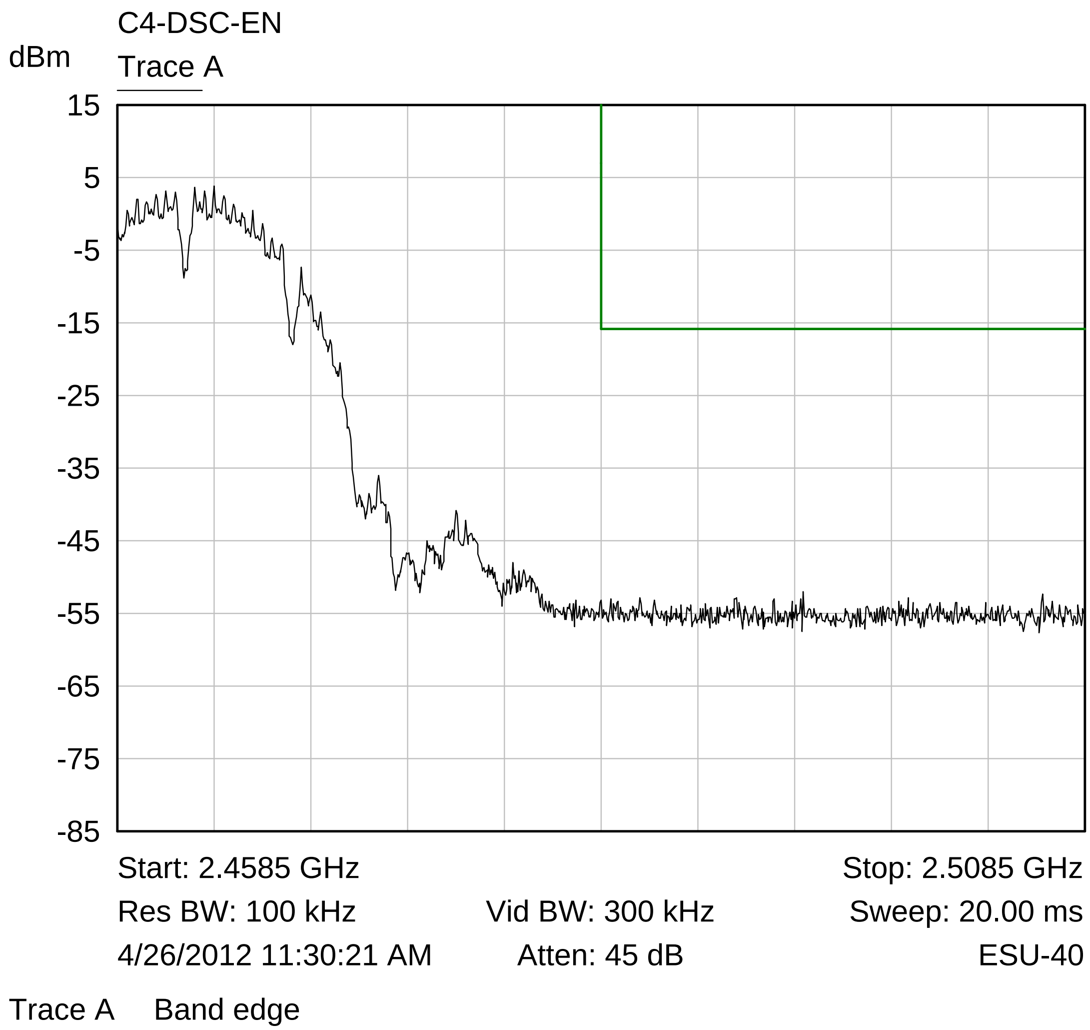
Transmitting on the Highest Channel – 802.11b

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4924	-54.7	-15.9	-38.8
7386	-66.4	-15.9	-50.5
9848	-66.2	-15.9	-50.3
12310	-66.4	-15.9	-50.5
14772	-66.8	-15.9	-50.9
17234	-66.5	-15.9	-50.6
19696	-65.5	-15.9	-49.6
22158	-65.9	-15.9	-50.0
24620	-64.9	-15.9	-49.0

Lower Band Edge Plot – 802.11b



Upper Band Edge Plot – 802.11b



6.2.5.1.2 802.11g Mode

Transmitting on the Lowest Channel – 802.11g

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4824	-48.1	-13.2	-34.9
7236	-57.3	-13.2	-44.1
9648	-66.1	-13.2	-52.9
12060	-66.9	-13.2	-53.7
14472	-66.5	-13.2	-53.3
16884	-66.2	-13.2	-53.0
19296	-67.1	-13.2	-53.9
21708	-66.4	-13.2	-53.2
24120	-65.0	-13.2	-51.8

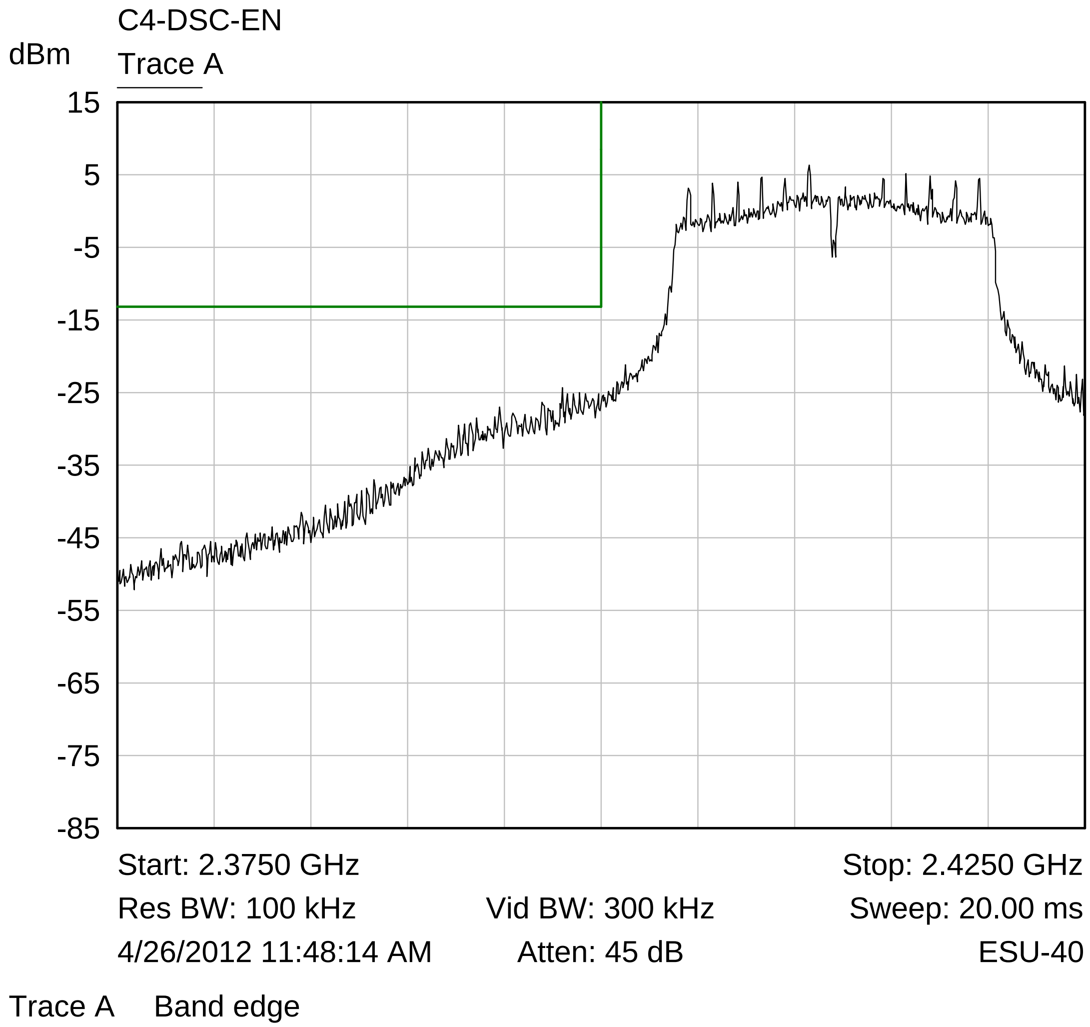
Transmitting on the Middle Channel – 802.11g

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4874	-47.6	-13.2	-34.4
7311	-58.4	-13.2	-45.2
9748	-62.4	-13.2	-49.2
12185	-66.1	-13.2	-52.9
14662	-67.0	-13.2	-53.8
17059	-66.0	-13.2	-52.8
19496	-65.7	-13.2	-52.5
21993	-66.2	-13.2	-53.0
24370	-64.4	-13.2	-51.2

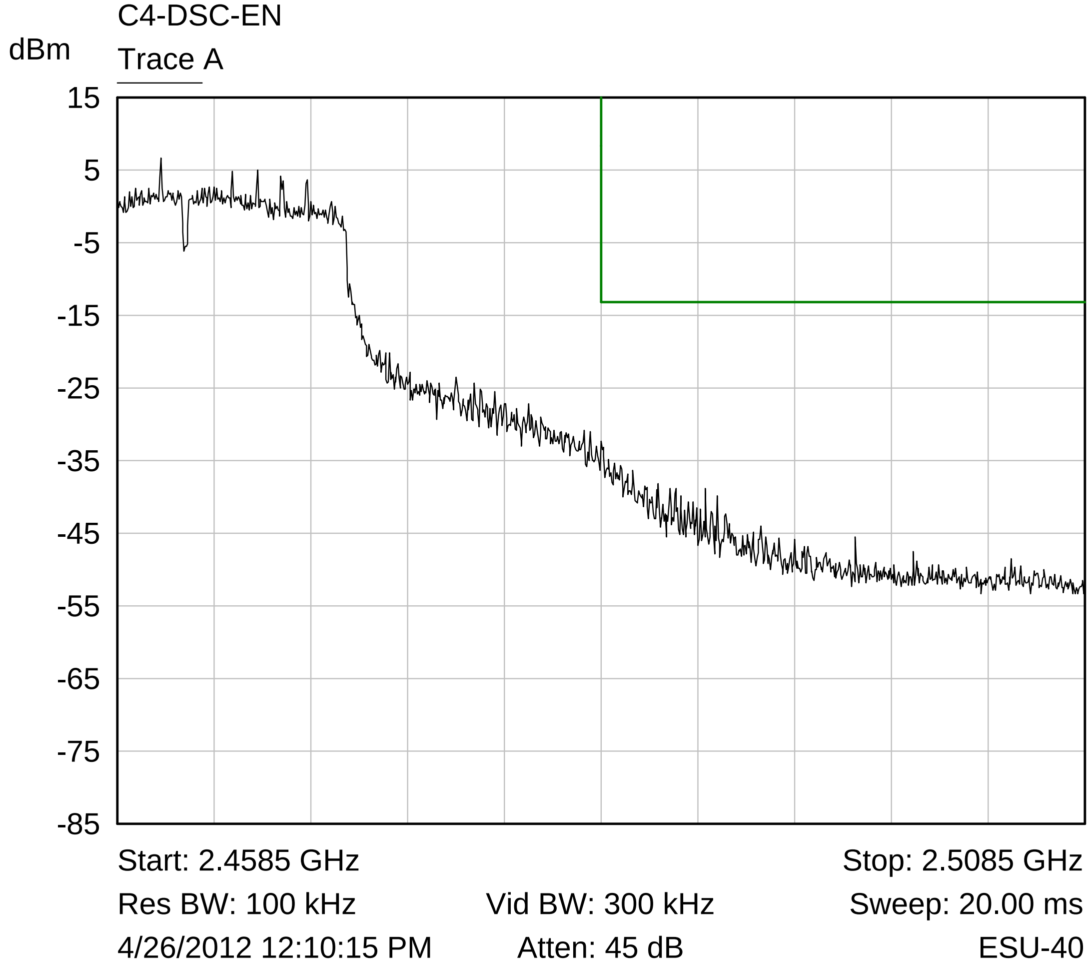
Transmitting on the Highest Channel – 802.11g

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4924	-46.4	-13.2	-33.2
7386	-49.5	-13.2	-36.3
9848	-56.7	-13.2	-43.5
12310	-63.0	-13.2	-49.8
14772	-65.9	-13.2	-52.7
17234	-66.2	-13.2	-53.0
19696	-66.5	-13.2	-53.3
22158	-65.5	-13.2	-52.3
24620	-64.1	-13.2	-50.9

Lower Band Edge Plot – 802.11g



Upper Band Edge Plot – 802.11g



Trace A Band edge

6.2.5.1.3 802.11n Mode

Transmitting on the Lowest Channel – 802.11n

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4824	-56.4	-12.5	-43.9
7236	-63.2	-12.5	-50.7
9648	-64.8	-12.5	-52.3
12060	-63.9	-12.5	-51.4
14472	-64.5	-12.5	-52.0
16884	-63.6	-12.5	-51.1
19296	-62.5	-12.5	-50.0
21708	-62.8	-12.5	-50.3
24120	-61.0	-12.5	-48.5

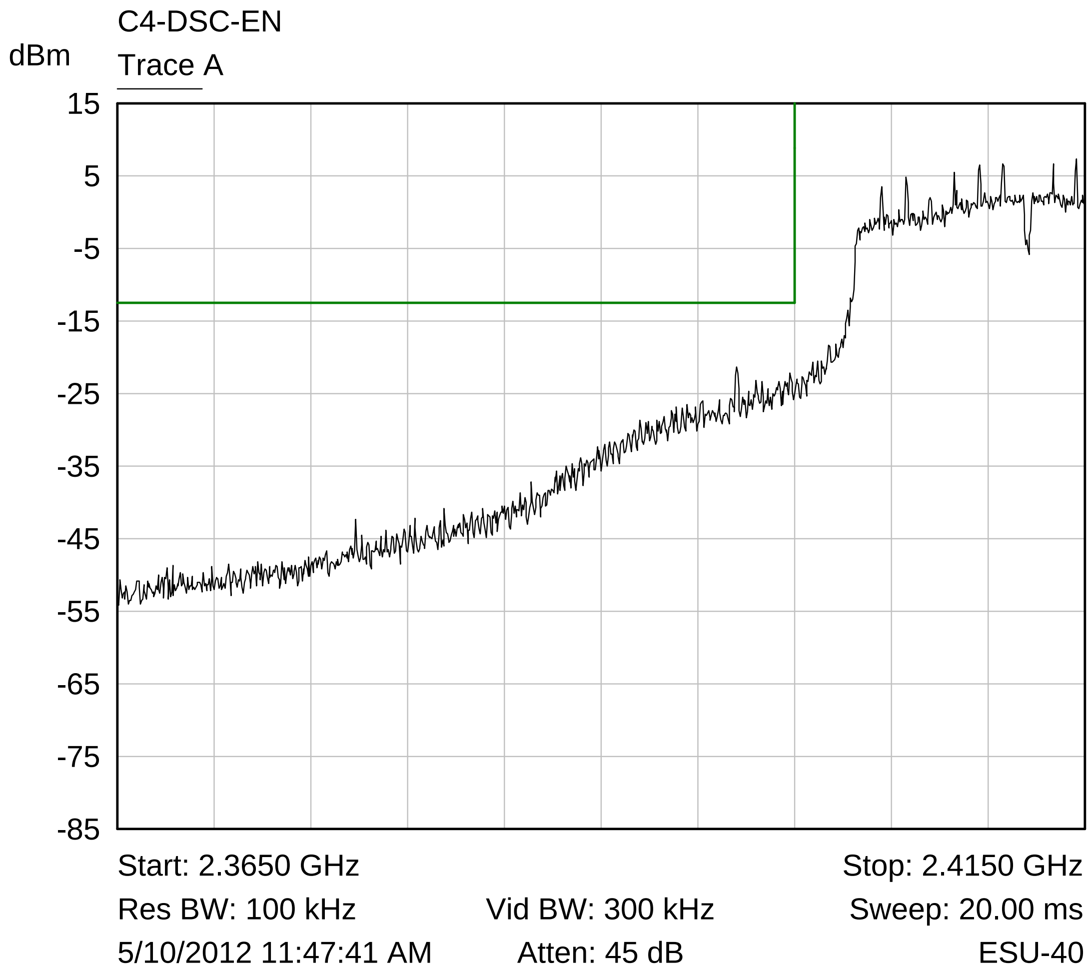
Transmitting on the Middle Channel – 802.11n

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4874	-57.1	-12.5	-44.6
7311	-63.0	-12.5	-50.5
9748	-64.9	-12.5	-52.4
12185	-64.4	-12.5	-51.9
14662	-63.1	-12.5	-50.6
17059	-63.3	-12.5	-50.8
19496	-64.0	-12.5	-51.5
21993	-62.4	-12.5	-49.9
24370	-62.2	-12.5	-49.7

Transmitting on the Highest Channel – 802.11n

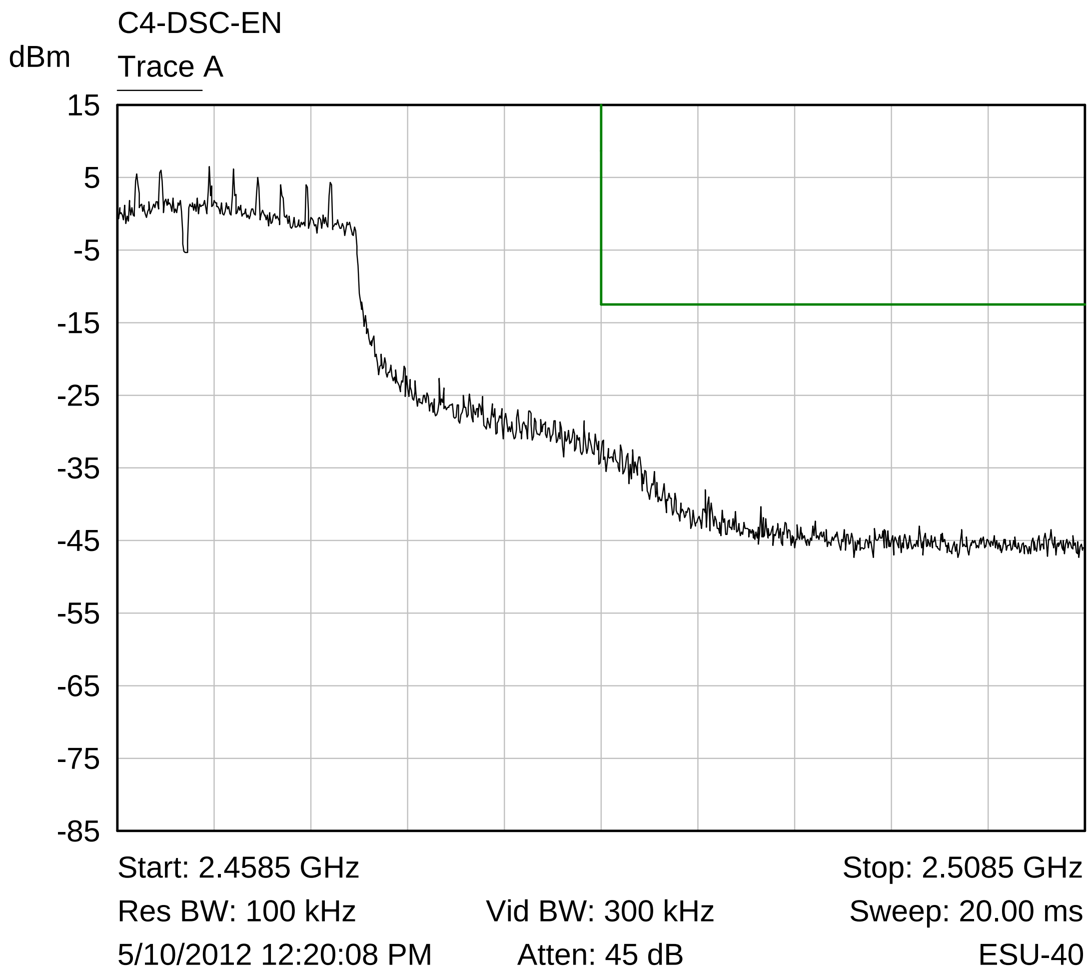
Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)	Margin (dB)
4924	-59.8	-12.5	-47.3
7386	-66.3	-12.5	-53.8
9848	-63.2	-12.5	-50.7
12310	-65.3	-12.5	-52.8
14772	-65.4	-12.5	-52.9
17234	-64.5	-12.5	-52.0
19696	-64.6	-12.5	-52.1
22158	-64.7	-12.5	-52.2
24620	-62.1	-12.5	-49.6

Lower Band Edge Plot – 802.11n



Trace A band edge

Upper Band Edge Plot – 802.11n



Trace A band edge

6.2.5.2 Radiated Emissions in the Restricted Bands of §15.205

The frequency range from 4 MHz to 25 GHz was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any emission that fell into the restricted bands of §15.205. The tables show the worst-case emission measured from the C4-DSC-EN. For frequencies above 12.5 GHz, a measurement distance of 1 meter was used. The noise floor was a minimum of 6 dB below the limit. The emissions in the restricted bands must meet the limits specified in §15.209. Tabular data for each of the spurious emissions when transmitting at the maximum power setting for any channel for each mode is shown below. Plots of the band edges are also shown. Since the upper and lower channels using 802.11g and 802.11n operate at a lower power level than the other channels, band edge plots are also shown for channels 2 and 10 at the higher power setting.

AVERAGE FACTOR

There was no average factor applied.

RESULT

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

6.2.5.2.1 Sleeve Antenna
6.2.5.2.1.1 802.11b

Transmitting at the Lowest Frequency – 802.11b

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	15.4	37.8	53.2	74.0	-20.8
4824.0	Average	Vertical	12.7	37.8	50.5	54.0	-3.5
4824.0	Peak	Horizontal	17.8	37.8	55.6	74.0	-18.4
4824.0	Average	Horizontal	15.4	37.8	53.2	54.0	-0.8
7236.0	Peak	Vertical	2.8	42.1	44.9	74.0	-29.1
7236.0	Average	Vertical	-9.1	42.1	33.0	54.0	-21.0
7236.0	Peak	Horizontal	3.1	42.1	45.2	74.0	-28.8
7236.0	Average	Horizontal	-9.1	42.1	33.0	54.0	-21.0

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
12060.0	Peak	Vertical	-0.2	47.1	46.9	74.0	-27.1
12060.0	Average	Vertical	-12.4	47.1	34.7	54.0	-19.3
12060.0	Peak	Horizontal	-0.8	47.1	46.3	74.0	-27.7
12060.0	Average	Horizontal	-12.4	47.1	34.7	54.0	-19.3

Transmitting at the Middle Frequency – 802.11b

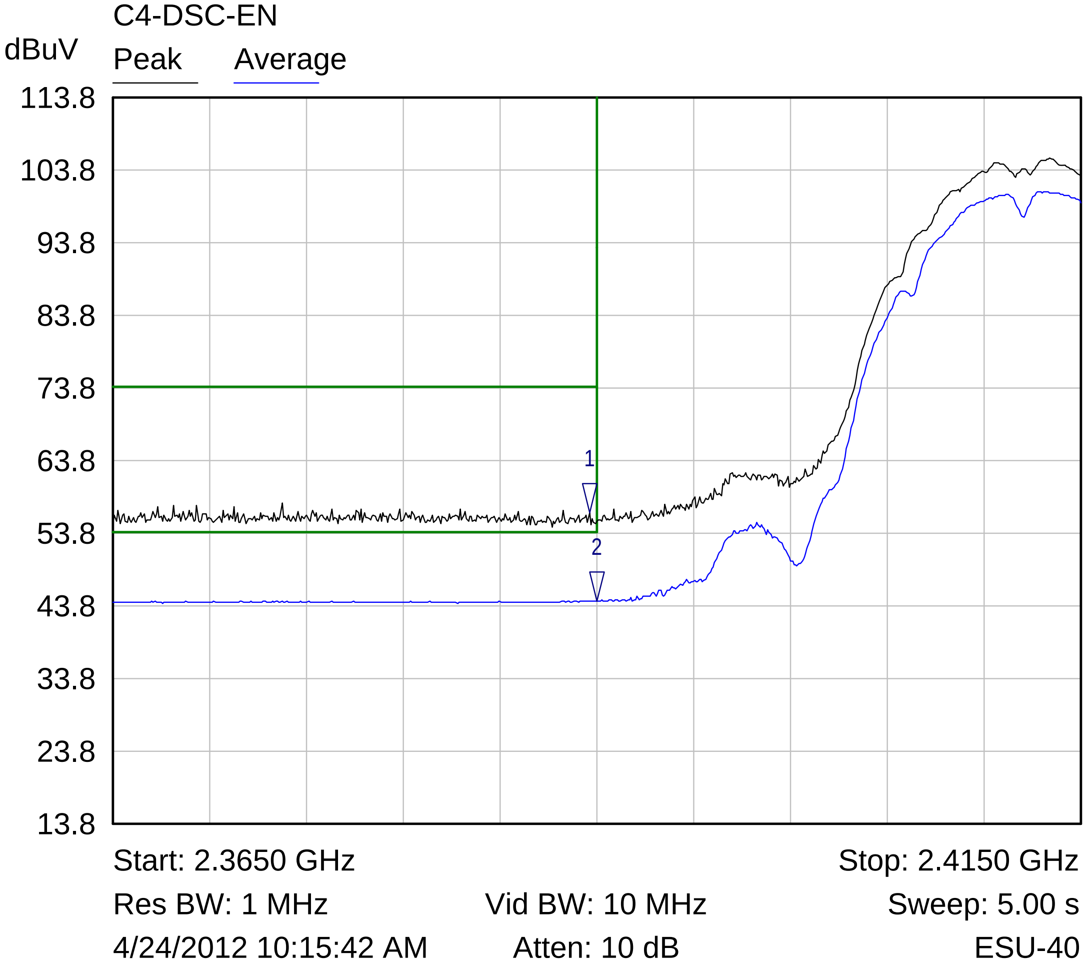
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874.0	Peak	Vertical	15.5	37.9	54.5	74.0	-19.5
4874.0	Average	Vertical	12.8	37.9	51.8	54.0	-2.2
4874.0	Peak	Horizontal	16.7	37.9	53.3	74.0	-20.7
4874.0	Average	Horizontal	14.2	37.9	50.6	54.0	-3.4
7311.0	Peak	Vertical	3.0	42.3	44.3	74.0	-29.7
7311.0	Average	Vertical	9.0	42.3	34.3	54.0	-19.7
7311.0	Peak	Horizontal	3.6	42.3	45.4	74.0	-28.6
7311.0	Average	Horizontal	-8.9	42.3	34.5	54.0	-19.5
12185.0	Peak	Vertical	0.9	47.0	46.8	74.0	-27.2
12185.0	Average	Vertical	-11.4	47.0	35.6	54.0	-18.4
12185.0	Peak	Horizontal	1.2	47.0	46.8	74.0	-27.2
12185.0	Average	Horizontal	-11.2	47.0	35.2	54.0	-18.8

Transmitting at the Highest Frequency – 802.11b

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924.0	Peak	Vertical	12.6	38.0	51.9	74.0	-22.1
4924.0	Average	Vertical	9.7	38.0	49.0	54.0	-5.0
4924.0	Peak	Horizontal	13.2	38.0	50.1	74.0	-23.9
4924.0	Average	Horizontal	10.3	38.0	46.3	54.0	-7.7
7386.0	Peak	Vertical	2.6	42.5	44.9	74.0	-29.1
7386.0	Average	Vertical	-9.7	42.5	33.4	54.0	-20.6
7386.0	Peak	Horizontal	2.6	42.5	45.4	74.0	-28.6
7386.0	Average	Horizontal	-9.4	42.5	33.5	54.0	-20.5
12310.0	Peak	Vertical	1.3	47.0	46.6	74.0	-27.4
12310.0	Average	Vertical	-11.2	47.0	35.6	54.0	-18.4
12310.0	Peak	Horizontal	0.7	47.0	47.7	74.0	-26.3
12310.0	Average	Horizontal	-11.2	47.0	35.4	54.0	-18.6

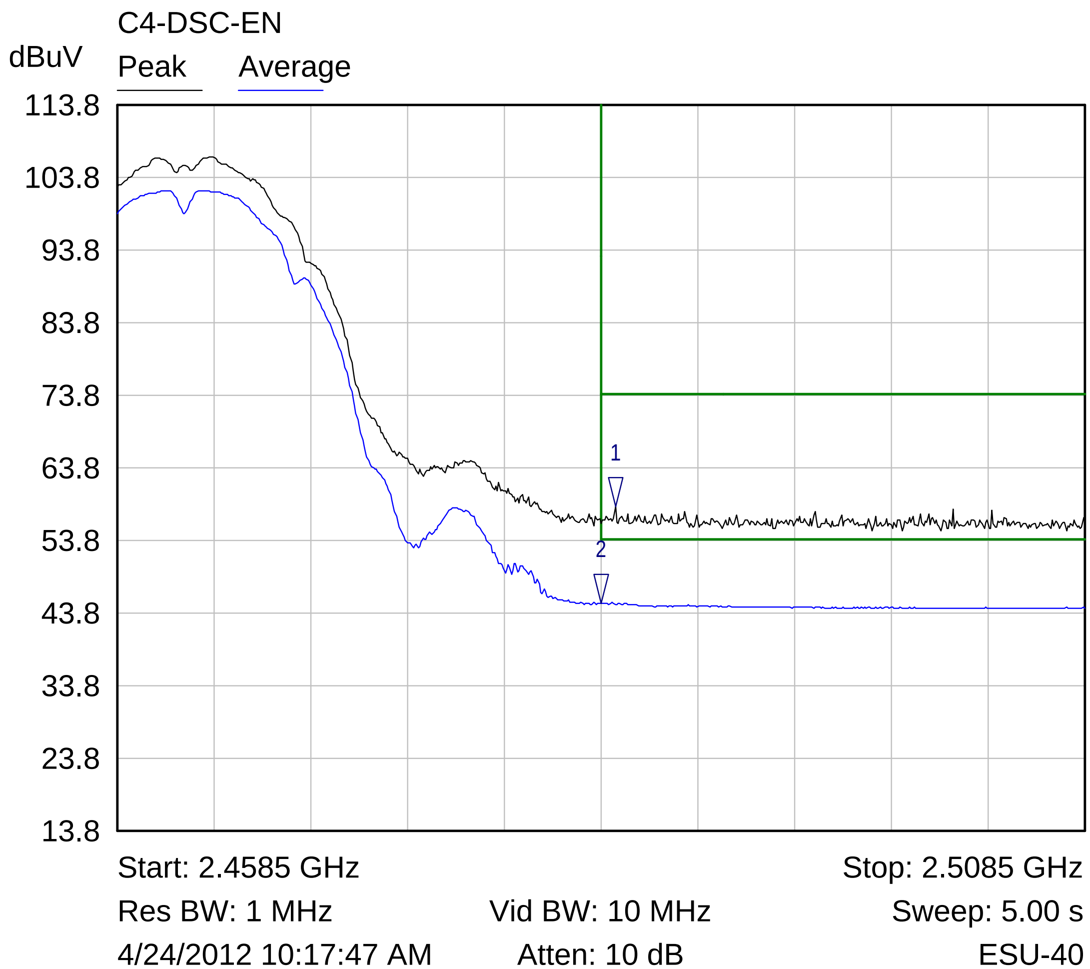
No other emissions were seen in the restricted bands. Noise floor was greater than 6 dB below the limit. At frequencies above 12.5 GHz, a 1 meter measurement distance was used.

Radiated Lower Band Edge Plot – 802.11b



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.3896 GHz	56.58 dBuV	
2 ▽	Average	2.3900 GHz	44.53 dBuV	

Radiated Upper Band Edge Plot – 802.11b



Mkr	Trace	X-Axis	Value	Notes
1 ∇	Peak	2.4842 GHz	58.50 dBuV	
2 ∇	Average	2.4835 GHz	45.08 dBuV	

6.2.5.2.1.2 802.11g

Transmitting at the Lowest Frequency – 802.11g

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4824.0	Peak	Vertical	17.3	37.8	55.1	74.0	-18.9
4824.0	Average	Vertical	4.9	37.8	42.7	54.0	-11.3
4824.0	Peak	Horizontal	20.7	37.8	58.5	74.0	-15.5
4824.0	Average	Horizontal	8.0	37.8	45.8	54.0	-8.2
7236.0	Peak	Vertical	3.1	42.1	45.2	74.0	-28.8
7236.0	Average	Vertical	-8.7	42.1	33.4	54.0	-20.6
7236.0	Peak	Horizontal	3.2	42.1	45.3	74.0	-28.7
7236.0	Average	Horizontal	-8.7	42.1	33.4	54.0	-20.6
12060.0	Peak	Vertical	0.8	47.1	47.9	74.0	-26.1
12060.0	Average	Vertical	-11.2	47.1	35.9	54.0	-18.1
12060.0	Peak	Horizontal	0.9	47.1	48.0	74.0	-26.0
12060.0	Average	Horizontal	-11.2	47.1	35.9	54.0	-18.1

Transmitting at the Middle Frequency – 802.11g

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874.0	Peak	Vertical	16.9	37.9	54.8	74.0	-19.2
4874.0	Average	Vertical	4.7	37.9	42.6	54.0	-11.4
4874.0	Peak	Horizontal	18.7	37.9	56.6	74.0	-17.4
4874.0	Average	Horizontal	6.2	37.9	44.1	54.0	-9.9
7311.0	Peak	Vertical	3.5	42.3	45.8	74.0	-28.2
7311.0	Average	Vertical	-9.0	42.3	33.3	54.0	-20.7

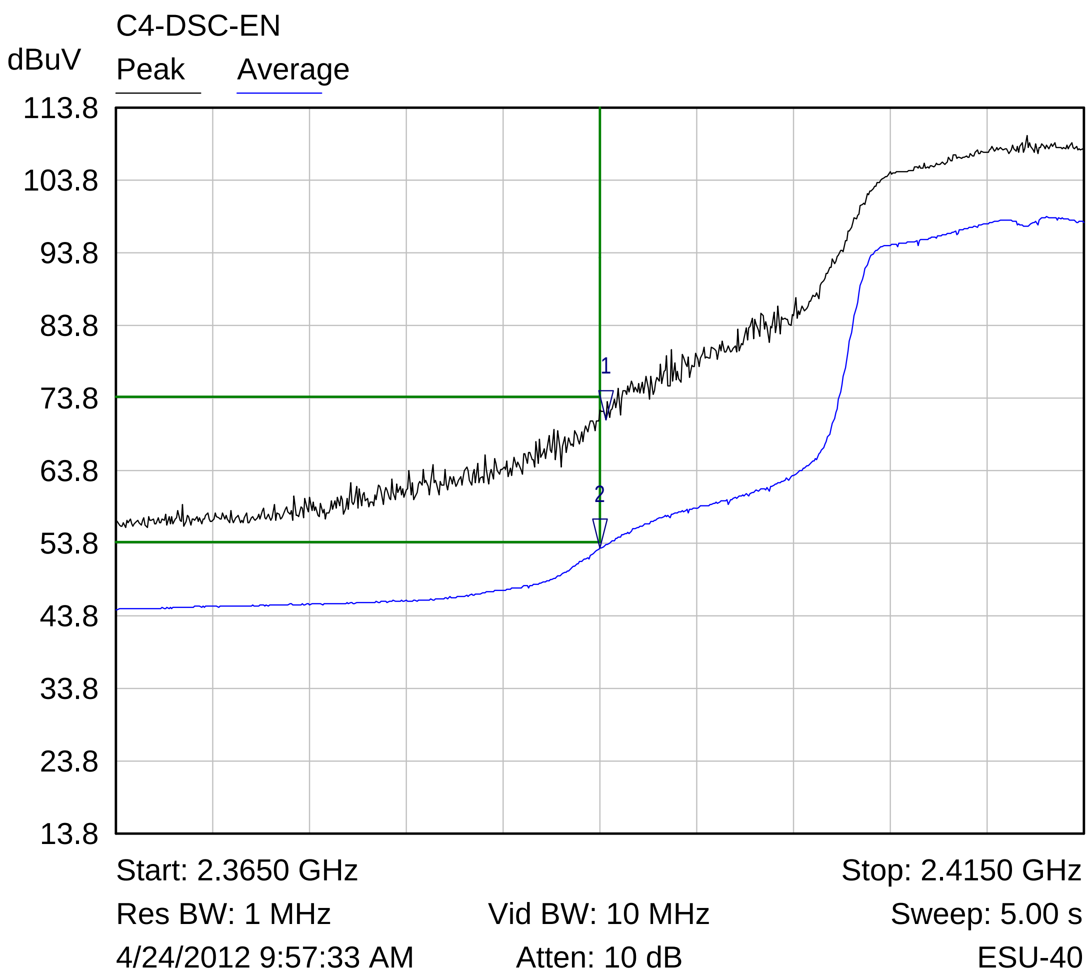
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
7311.0	Peak	Horizontal	3.4	42.3	45.7	74.0	-28.3
7311.0	Average	Horizontal	-8.8	42.3	33.5	54.0	-20.5
12185.0	Peak	Vertical	0.4	47.0	47.4	74.0	-26.6
12185.0	Average	Vertical	-11.5	47.0	35.5	54.0	-18.5
12185.0	Peak	Horizontal	0.6	47.0	47.6	74.0	-26.4
12185.0	Average	Horizontal	-11.5	47.0	35.5	54.0	-18.5

Transmitting at the Highest Frequency – 802.11g

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4924.0	Peak	Vertical	12.6	38.0	50.6	74.0	-23.4
4924.0	Average	Vertical	1.2	38.0	39.2	54.0	-14.8
4924.0	Peak	Horizontal	18.3	38.0	56.3	74.0	-17.7
4924.0	Average	Horizontal	5.2	38.0	43.2	54.0	-10.8
7386.0	Peak	Vertical	2.5	42.5	45.0	74.0	-29.0
7386.0	Average	Vertical	-9.2	42.5	33.3	54.0	-20.7
7386.0	Peak	Horizontal	2.9	42.5	45.4	74.0	-28.6
7386.0	Average	Horizontal	-9.0	42.5	33.5	54.0	-20.5
12310.0	Peak	Vertical	0.7	47.0	47.7	74.0	-26.3
12310.0	Average	Vertical	-11.5	47.0	35.5	54.0	-18.5
12310.0	Peak	Horizontal	0.9	47.0	47.9	74.0	-26.1
12310.0	Average	Horizontal	-11.4	47.0	35.6	54.0	-18.4

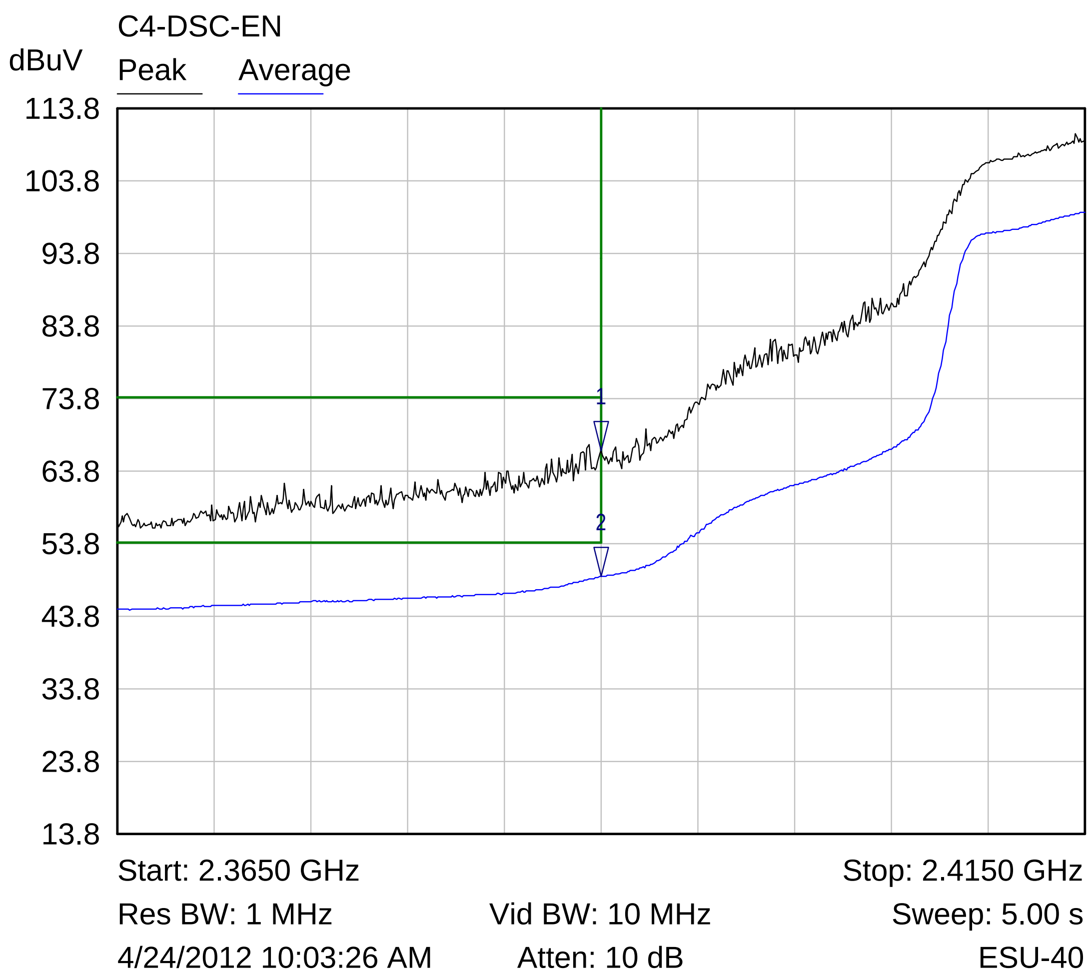
No other emissions were seen in the restricted bands. Noise floor was greater than 6 dB below the limit. At frequencies above 12.5 GHz, a 1 meter measurement distance was used.

Radiated Lower Band Edge Plot Channel 1 – 802.11g – Power level at +15



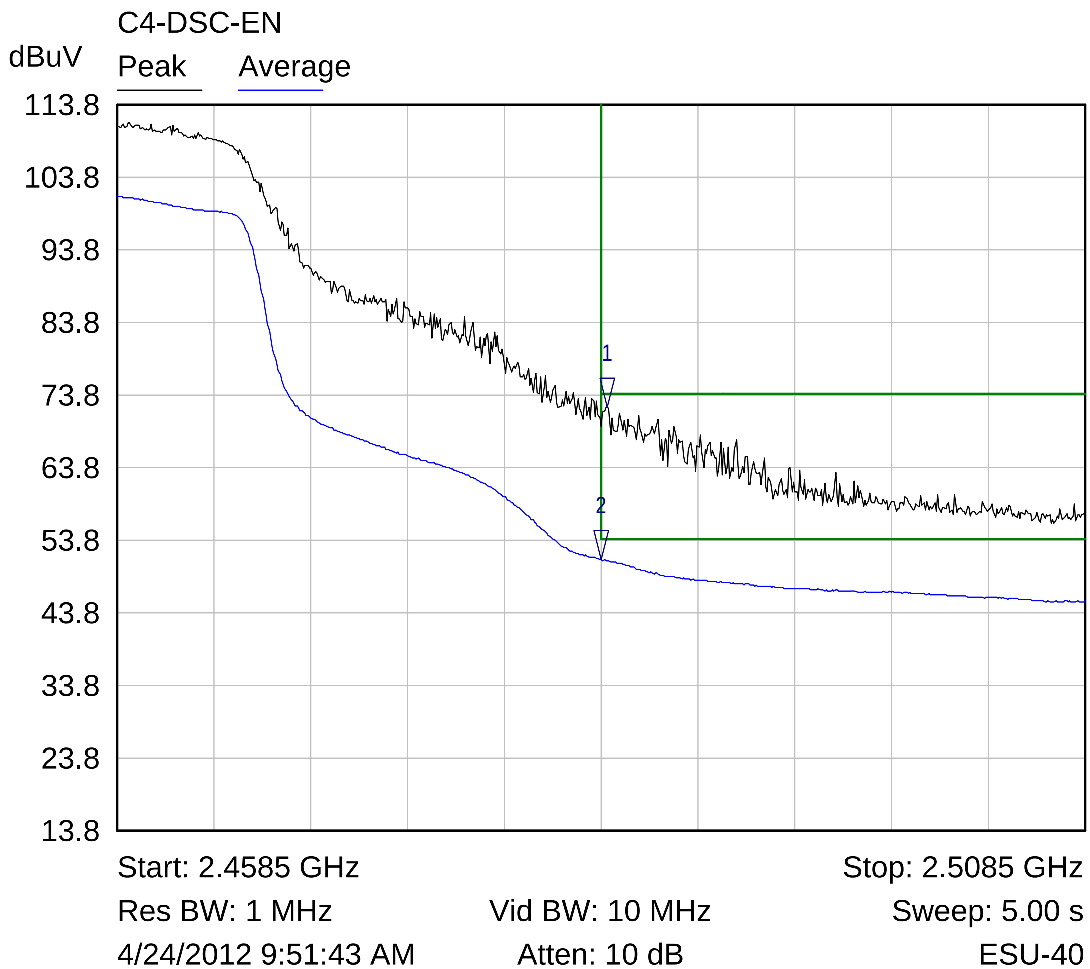
Mkr	Trace	X-Axis	Value	Notes
1 ∇	Peak	2.3903 GHz	70.74 dBuV	
2 ∇	Average	2.3900 GHz	53.06 dBuV	

Radiated Lower Band Edge Plot Channel 2 – 802.11g – Power level at +17



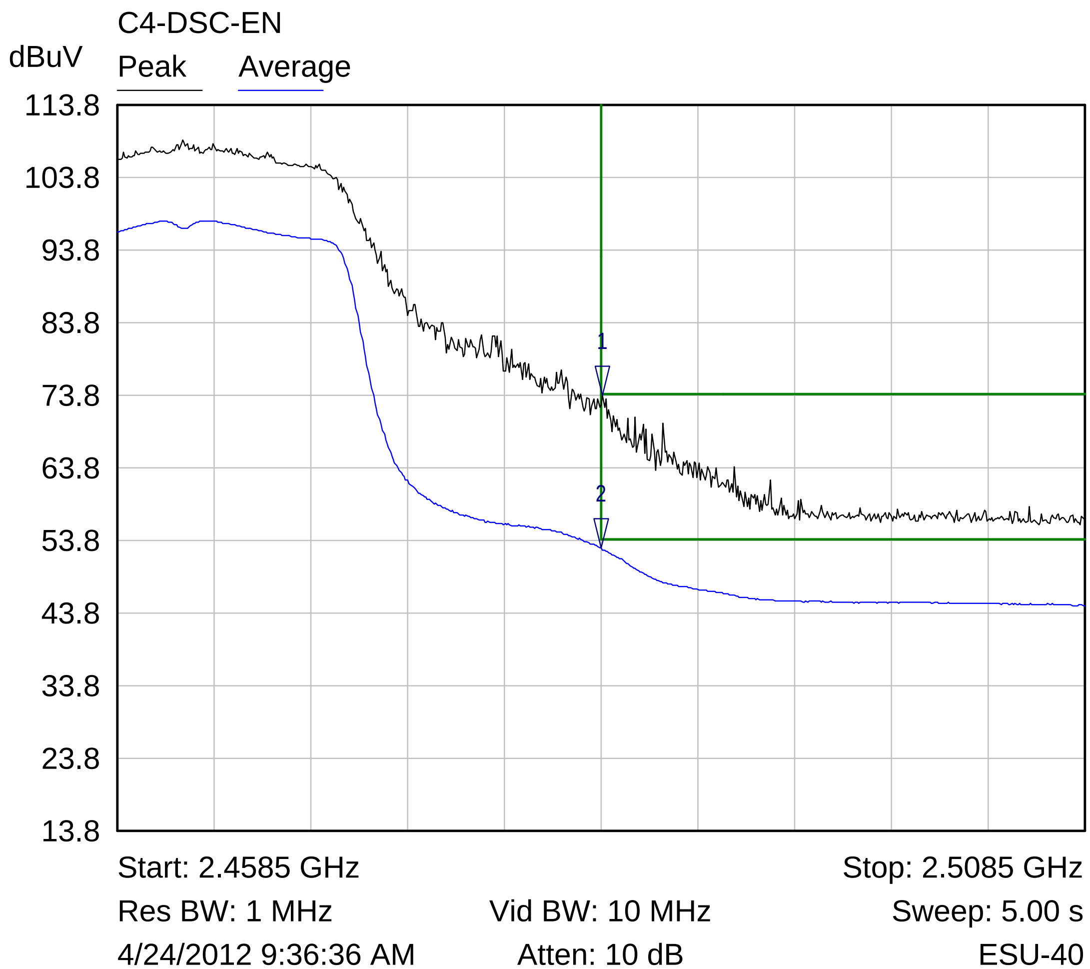
Mkr	Trace	X-Axis	Value	Notes
1 ∇	Peak	2.3900 GHz	66.71 dBuV	
2 ∇	Average	2.3900 GHz	49.27 dBuV	

Radiated Upper Band Edge Plot Channel 10 – 802.11g – Power level at +17



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.4838 GHz	72.08 dBuV	
2 ▽	Average	2.4835 GHz	51.15 dBuV	

Radiated Upper Band Edge Plot Channel 11 – 802.11g – Power level at +13



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.4836 GHz	73.79 dBuV	
2 ▽	Average	2.4835 GHz	52.77 dBuV	

6.2.5.2.1.3 802.11n

Transmitting at the Lowest Frequency (2412 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	14.5	37.8	52.3	74.0	-21.7
4824.0	Average	Vertical	3.1	37.8	40.9	54.0	-13.1
4824.0	Peak	Horizontal	17.0	37.8	54.8	74.0	-19.2
4824.0	Average	Horizontal	5.7	37.8	43.5	54.0	-10.5
7236.0	Peak	Vertical	3.8	42.1	45.9	74.0	-28.1
7236.0	Average	Vertical	-8.7	42.1	33.4	54.0	-20.6
7236.0	Peak	Horizontal	3.1	42.1	45.2	74.0	-28.8
7236.0	Average	Horizontal	-8.9	42.1	33.2	54.0	-20.8
12060.0	Peak	Vertical	0.6	47.1	47.7	74.0	-26.3
12060.0	Average	Vertical	-11.5	47.1	35.6	54.0	-18.4
12060.0	Peak	Horizontal	0.1	47.1	47.2	74.0	-26.8
12060.0	Average	Horizontal	-11.6	47.1	35.5	54.0	-18.5

Transmitting at the Middle Frequency (2437 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	14.7	37.9	52.6	74.0	-21.4
4874.0	Average	Vertical	3.0	37.9	40.9	54.0	-13.1
4874.0	Peak	Horizontal	17.6	37.9	55.5	74.0	-18.5
4874.0	Average	Horizontal	5.8	37.9	43.7	54.0	-10.3
7311.0	Peak	Vertical	3.0	42.3	45.3	74.0	-28.7
7311.0	Average	Vertical	-9.1	42.3	33.2	54.0	-20.8

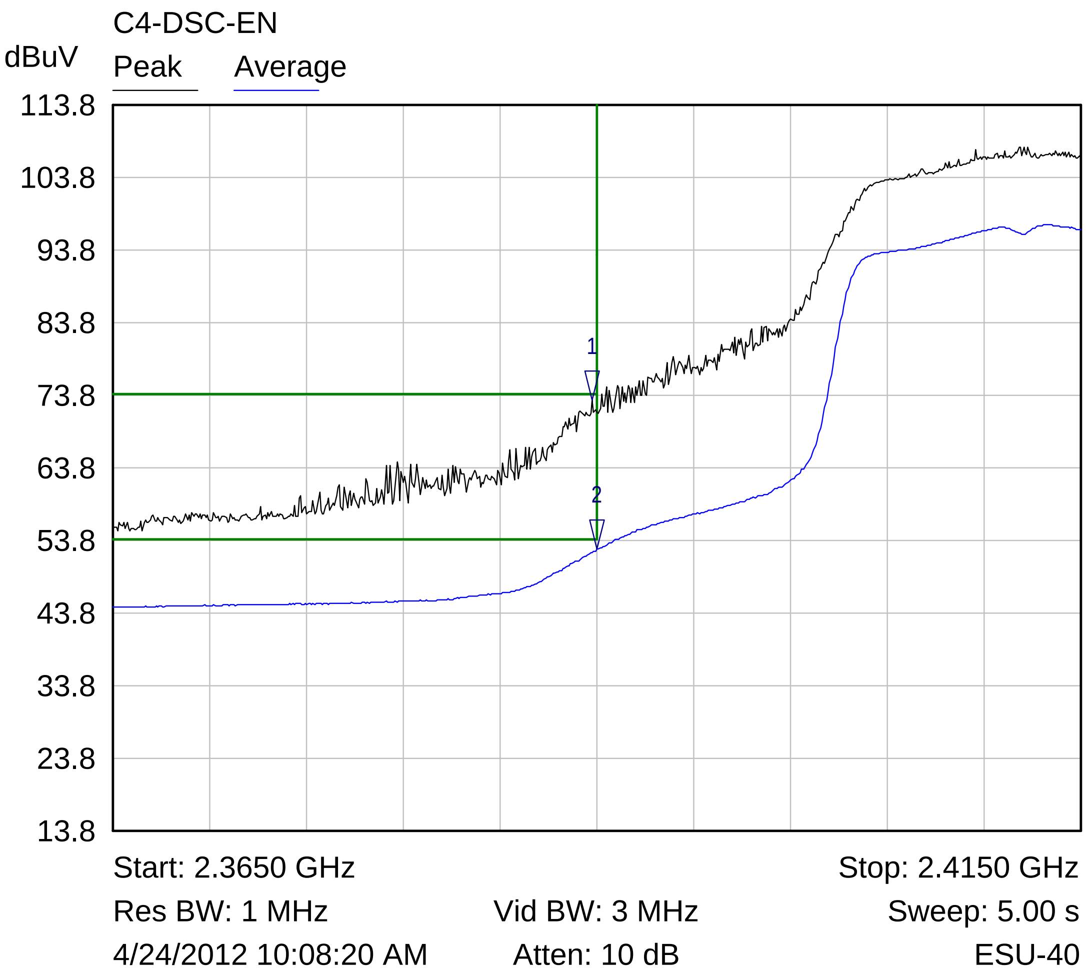
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
7311.0	Peak	Horizontal	4.7	42.3	47.0	74.0	-27.0
7311.0	Average	Horizontal	-9.0	42.3	33.3	54.0	-20.7
12185.0	Peak	Vertical	0.4	47.0	47.4	74.0	-26.6
12185.0	Average	Vertical	-11.7	47.0	35.3	54.0	-18.7
12185.0	Peak	Horizontal	0.3	47.0	47.3	74.0	-26.7
12185.0	Average	Horizontal	-12.0	47.0	35.0	54.0	-19.0

Transmitting at the Highest Frequency (2462 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4924.0	Peak	Vertical	12.3	38.0	50.3	74.0	-23.7
4924.0	Average	Vertical	0.2	38.0	38.2	54.0	-15.8
4924.0	Peak	Horizontal	15.5	38.0	53.5	74.0	-20.5
4924.0	Average	Horizontal	3.8	38.0	41.8	54.0	-12.2
7386.0	Peak	Vertical	3.1	42.5	45.6	74.0	-28.4
7386.0	Average	Vertical	-9.2	42.5	33.3	54.0	-20.7
7386.0	Peak	Horizontal	3.2	42.5	45.7	74.0	-28.3
7386.0	Average	Horizontal	-9.1	42.5	33.4	54.0	-20.6
12310.0	Peak	Vertical	0.5	47.0	47.5	74.0	-26.5
12310.0	Average	Vertical	-11.6	47.0	35.4	54.0	-18.6
12310.0	Peak	Horizontal	0.7	47.0	47.7	74.0	-26.3
12310.0	Average	Horizontal	-11.7	47.0	35.3	54.0	-18.7

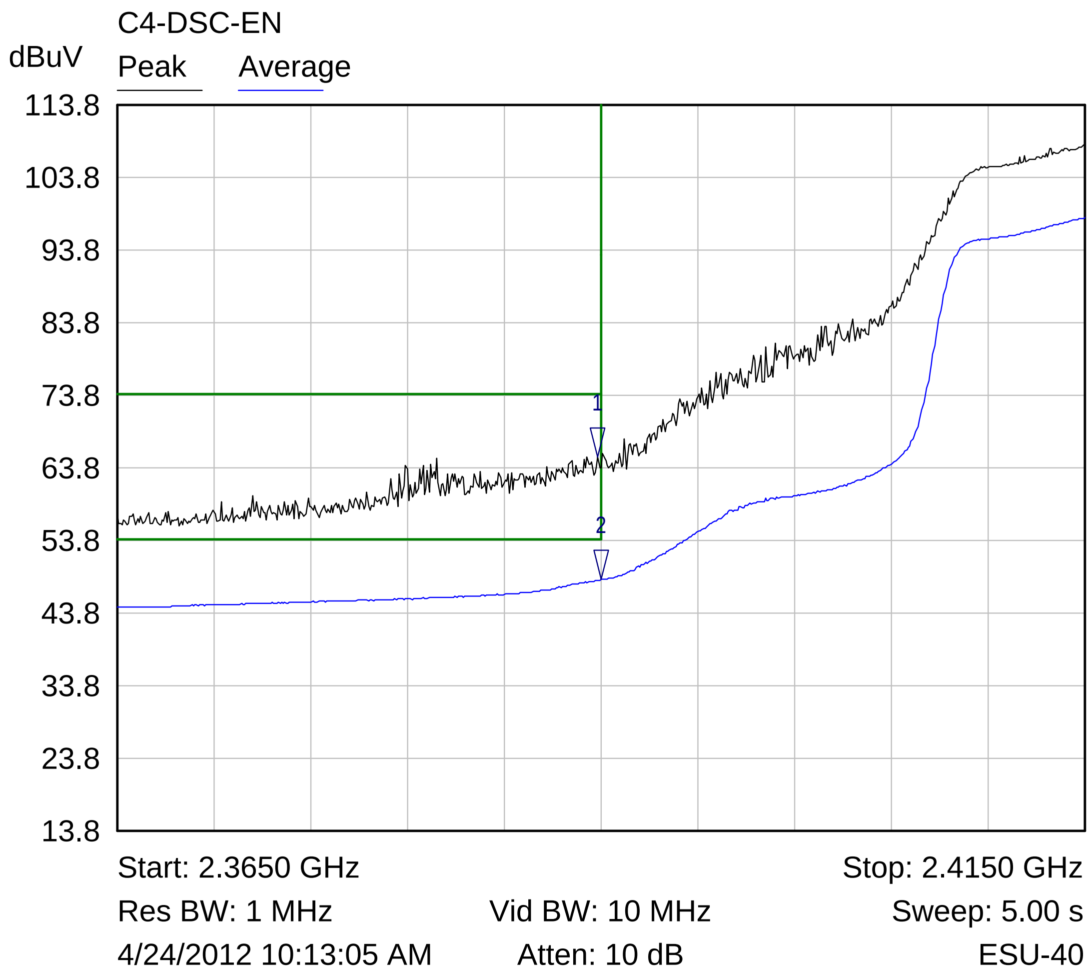
No other emissions were seen in the restricted bands. Noise floor was greater than 6 dB below the limit. At frequencies above 12.5 GHz, a 1 meter measurement distance was used.

Radiated Lower Band Edge Plot Channel 1 – 802.11n – Power level at +14



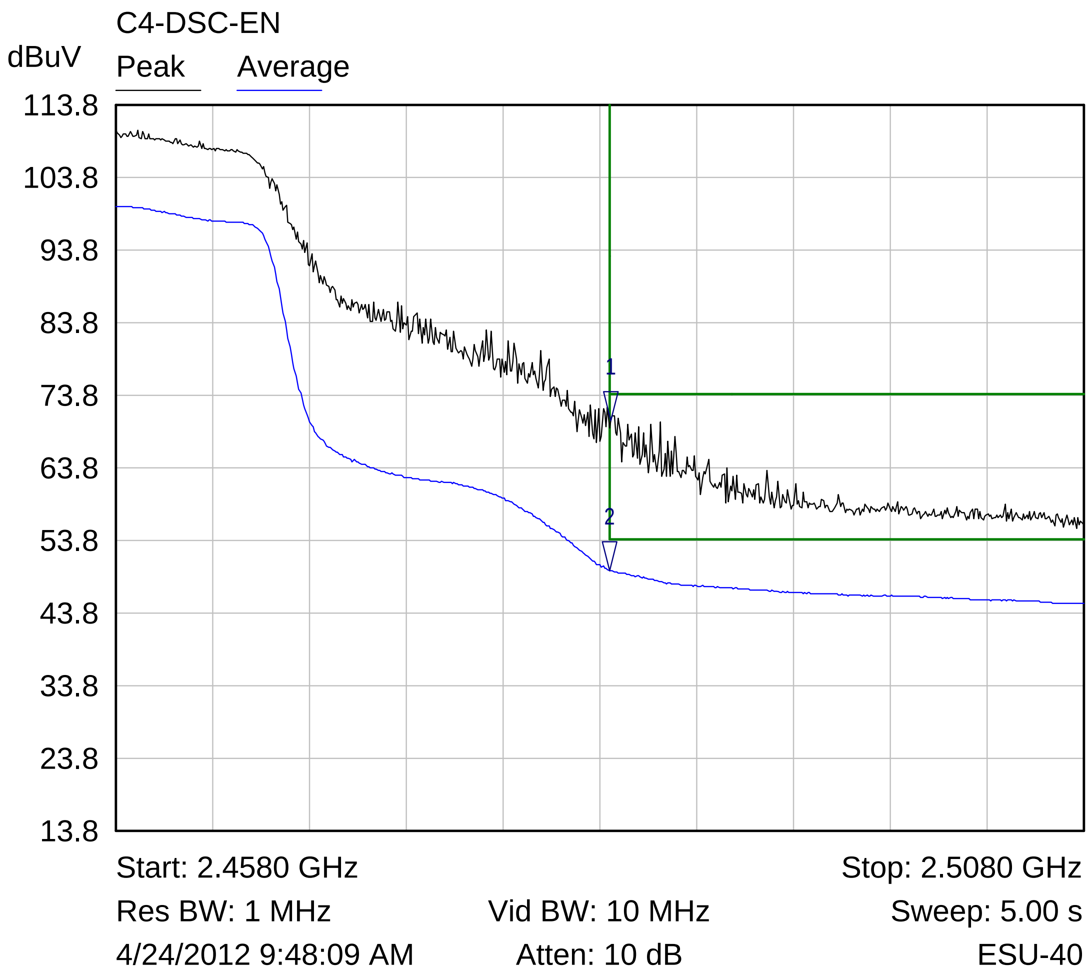
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.3898 GHz	73.06 dBuV	
2 ▽	Average	2.3900 GHz	52.55 dBuV	

Radiated Lower Band Edge Plot Channel 2 – 802.11n – Power level at +16



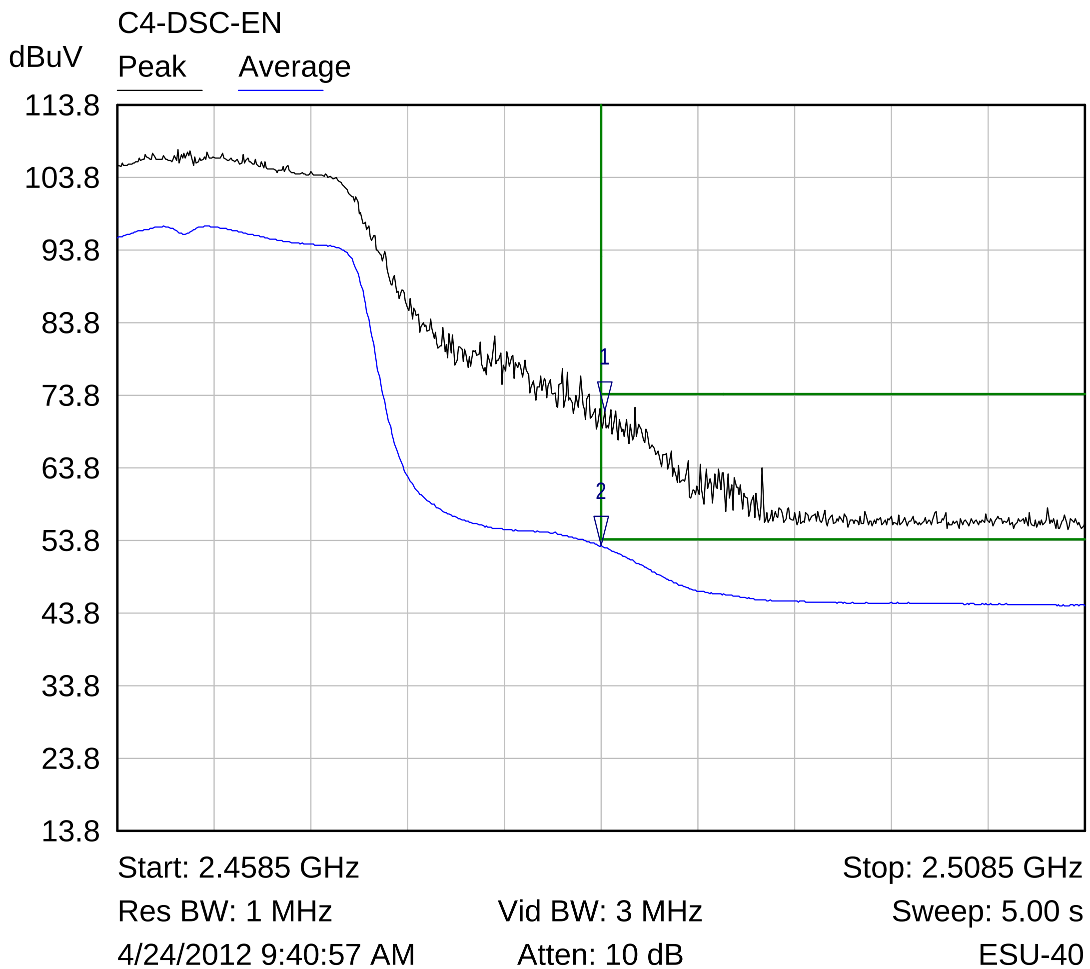
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.3898 GHz	65.26 dBuV	
2 ▽	Average	2.3900 GHz	48.42 dBuV	

Radiated Upper Band Edge Plot Channel 10 – 802.11n – Power level at +16



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.4836 GHz	70.36 dBuV	
2 ▽	Average	2.4835 GHz	49.71 dBuV	

Radiated Upper Band Edge Plot Channel 11 – 802.11n – Power level at +12



Mkr	Trace	X-Axis	Value	Notes
1 ∇	Peak	2.4837 GHz	71.71 dBuV	
2 ∇	Average	2.4835 GHz	53.06 dBuV	

6.2.5.2.2 Patch Antenna
6.2.5.2.2.1 802.11b

Transmitting at the Lowest Frequency – 802.11b

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	18.4	37.8	56.2	74.0	-17.8
4824.0	Average	Vertical	16.0	37.8	53.8	54.0	-0.2
4824.0	Peak	Horizontal	14.6	37.8	52.4	74.0	-21.6
4824.0	Average	Horizontal	11.7	37.8	49.5	54.0	-4.5
7236.0	Peak	Vertical	4.3	42.1	46.4	74.0	-27.6
7236.0	Average	Vertical	-9.5	42.1	32.6	54.0	-21.4
7236.0	Peak	Horizontal	4.4	42.1	46.5	74.0	-27.5
7236.0	Average	Horizontal	-9.5	42.1	32.6	54.0	-21.4
12060.0	Peak	Vertical	1.3	47.1	48.4	74.0	-25.6
12060.0	Average	Vertical	-11.8	47.1	35.3	54.0	-18.7
12060.0	Peak	Horizontal	1.7	47.1	48.8	74.0	-25.2
12060.0	Average	Horizontal	-11.7	47.1	35.4	54.0	-18.6

Transmitting at the Middle Frequency – 802.11b

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	14.2	37.9	52.1	74.0	-21.9
4874.0	Average	Vertical	11.1	37.9	49.0	54.0	-5.0
4874.0	Peak	Horizontal	9.8	37.9	47.7	74.0	-26.3
4874.0	Average	Horizontal	5.5	37.9	43.4	54.0	-10.6
7311.0	Peak	Vertical	3.6	42.3	45.9	74.0	-28.1

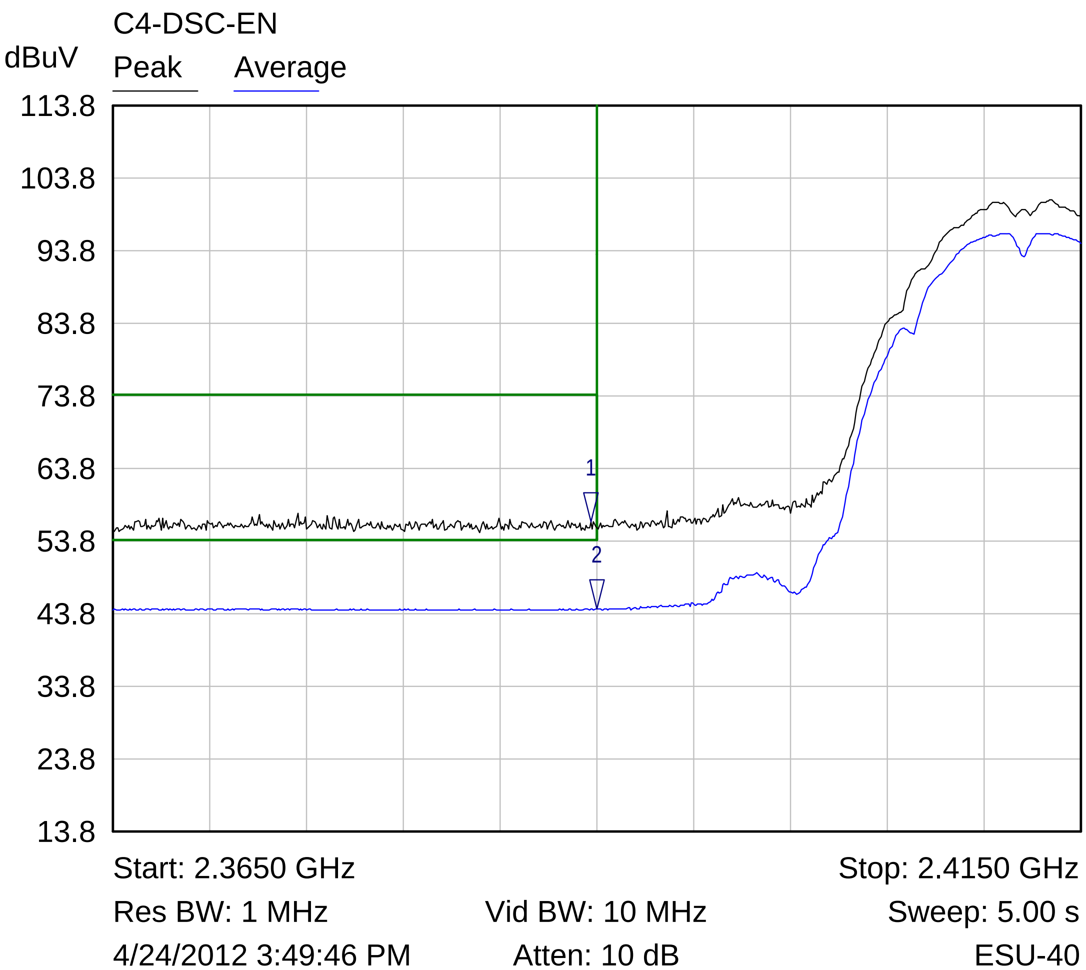
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
7311.0	Average	Vertical	-9.3	42.3	33.0	54.0	-21.0
7311.0	Peak	Horizontal	3.2	42.3	45.5	74.0	-28.5
7311.0	Average	Horizontal	-8.9	42.3	33.4	54.0	-20.6
12185.0	Peak	Vertical	0.8	47.0	47.8	74.0	-26.2
12185.0	Average	Vertical	-11.2	47.0	35.8	54.0	-18.2
12185.0	Peak	Horizontal	1.5	47.0	48.5	74.0	-25.5
12185.0	Average	Horizontal	-11.2	47.0	35.8	54.0	-18.2

Transmitting at the Highest Frequency – 802.11b

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4924.0	Peak	Vertical	11.7	38.0	49.7	74.0	-24.3
4924.0	Average	Vertical	8.3	38.0	46.3	54.0	-7.7
4924.0	Peak	Horizontal	8.2	38.0	46.2	74.0	-27.8
4924.0	Average	Horizontal	3.5	38.0	41.5	54.0	-12.5
7386.0	Peak	Vertical	2.7	42.5	45.2	74.0	-28.8
7386.0	Average	Vertical	-9.4	42.5	33.1	54.0	-20.9
7386.0	Peak	Horizontal	2.5	42.5	45.0	74.0	-29.0
7386.0	Average	Horizontal	-9.4	42.5	33.1	54.0	-20.9
12310.0	Peak	Vertical	0.7	47.0	47.7	74.0	-26.3
12310.0	Average	Vertical	-11.1	47.0	35.9	54.0	-18.1
12310.0	Peak	Horizontal	0.9	47.0	47.9	74.0	-26.1
12310.0	Average	Horizontal	-11.2	47.0	35.8	54.0	-18.2

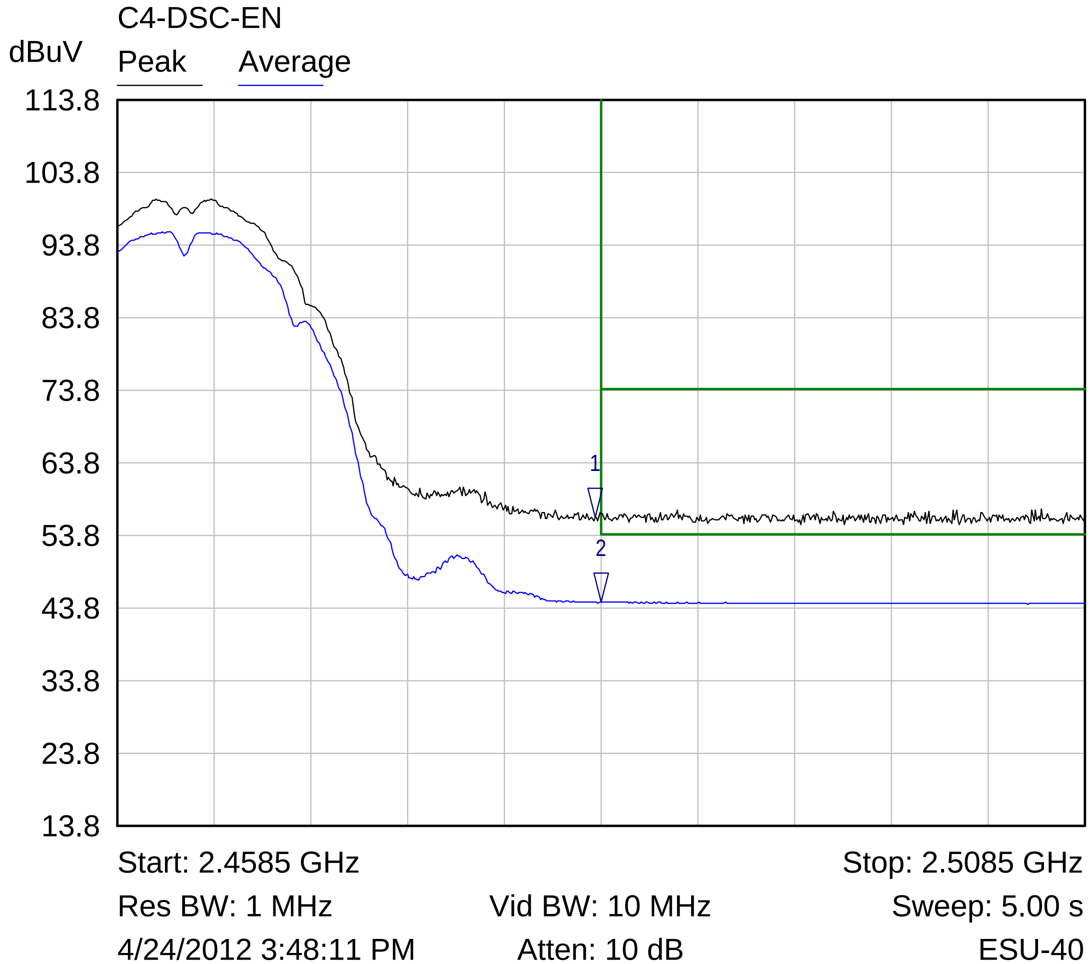
No other emissions were seen in the restricted bands. Noise floor was greater than 6 dB below the limit. At frequencies above 12.5 GHz, a 1 meter measurement distance was used.

Radiated Lower Band Edge Plot – 802.11b



Mkr	Trace	X-Axis	Value	Notes
1 ∇	Peak	2.3897 GHz	56.43 dBuV	
2 ∇	Average	2.3900 GHz	44.42 dBuV	

Radiated Upper Band Edge Plot – 802.11b



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.4832 GHz	56.23 dBuV	
2 ▽	Average	2.4835 GHz	44.58 dBuV	

6.2.5.2.2.2 802.11g

Transmitting at the Lowest Frequency – 802.11g

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	21.0	37.8	58.8	74.0	-15.2
4824.0	Average	Vertical	7.7	37.8	45.5	54.0	-8.5
4824.0	Peak	Horizontal	18.9	37.8	56.7	74.0	-17.3
4824.0	Average	Horizontal	5.0	37.8	42.8	54.0	-11.2
7236.0	Peak	Vertical	3.6	42.1	45.7	74.0	-28.3
7236.0	Average	Vertical	-9.1	42.1	33.0	54.0	-21.0
7236.0	Peak	Horizontal	3.1	42.1	45.2	74.0	-28.8
7236.0	Average	Horizontal	-9.0	42.1	33.1	54.0	-20.9
12060.0	Peak	Vertical	1.7	47.1	48.8	74.0	-25.2
12060.0	Average	Vertical	-10.8	47.1	36.3	54.0	-17.7
12060.0	Peak	Horizontal	1.2	47.1	48.3	74.0	-25.7
12060.0	Average	Horizontal	-11.0	47.1	36.1	54.0	-17.9

Transmitting at the Middle Frequency – 802.11g

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	20.6	37.9	58.5	74.0	-15.5
4874.0	Average	Vertical	7.5	37.9	45.4	54.0	-8.6
4874.0	Peak	Horizontal	17.1	37.9	55.0	74.0	-19.0
4874.0	Average	Horizontal	4.2	37.9	42.1	54.0	-11.9
7311.0	Peak	Vertical	3.4	42.3	45.7	74.0	-28.3
7311.0	Average	Vertical	-9.9	42.3	32.4	54.0	-21.6

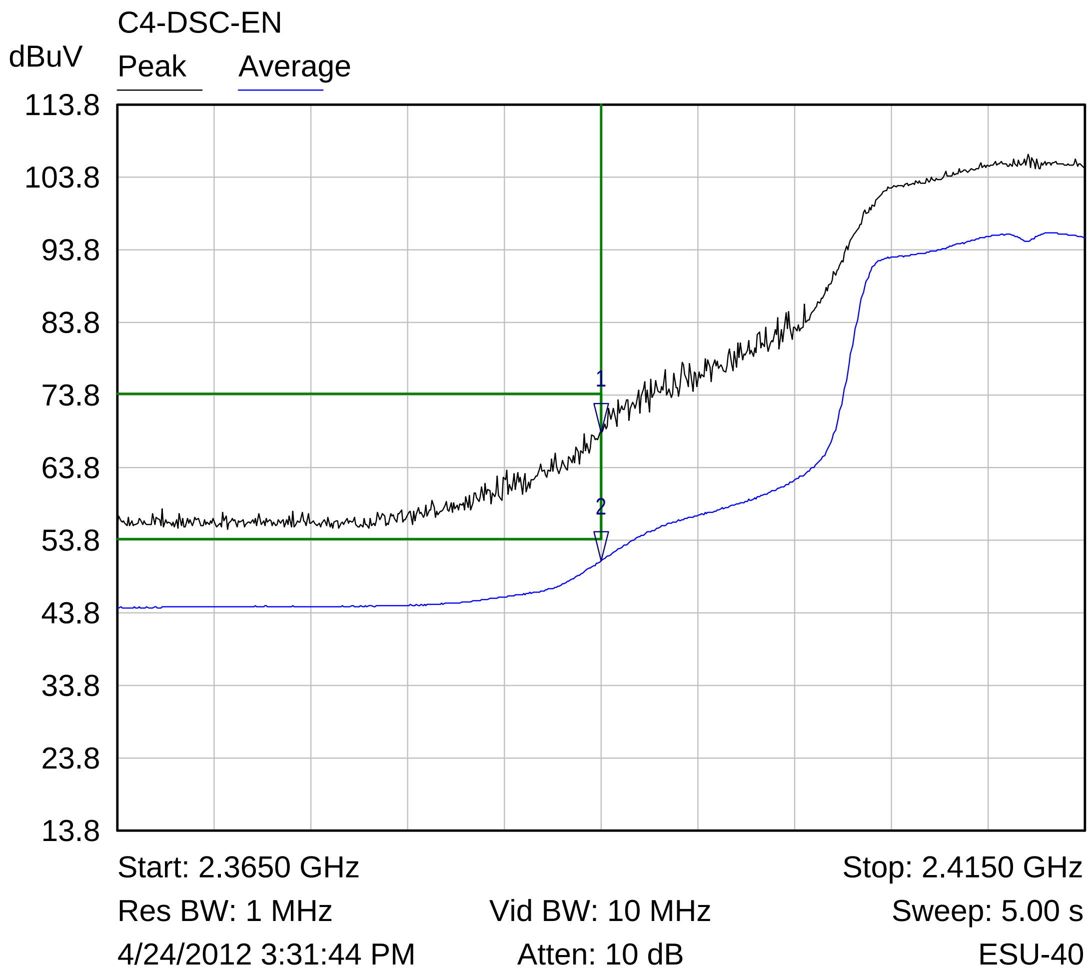
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
7311.0	Peak	Horizontal	3.5	42.3	45.8	74.0	-28.2
7311.0	Average	Horizontal	-9.7	42.3	32.6	54.0	-21.4
12185.0	Peak	Vertical	0.9	47.0	47.9	74.0	-26.1
12185.0	Average	Vertical	-12.2	47.0	34.8	54.0	-19.2
12185.0	Peak	Horizontal	0.7	47.0	47.7	74.0	-26.3
12185.0	Average	Horizontal	-12.2	47.0	34.8	54.0	-19.2

Transmitting at the Highest Frequency – 802.11g

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924.0	Peak	Vertical	19.1	38.0	57.1	74.0	-16.9
4924.0	Average	Vertical	5.1	38.0	43.1	54.0	-10.9
4924.0	Peak	Horizontal	15.1	38.0	53.1	74.0	-20.9
4924.0	Average	Horizontal	1.4	38.0	39.4	54.0	-14.6
7386.0	Peak	Vertical	3.9	42.5	46.4	74.0	-27.6
7386.0	Average	Vertical	-8.6	42.5	33.9	54.0	-20.1
7386.0	Peak	Horizontal	3.0	42.5	45.5	74.0	-28.5
7386.0	Average	Horizontal	-8.7	42.5	33.8	54.0	-20.2
12310.0	Peak	Vertical	1.2	47.0	48.2	74.0	-25.8
12310.0	Average	Vertical	-11.0	47.0	36.0	54.0	-18.0
12310.0	Peak	Horizontal	1.5	47.0	48.5	74.0	-25.5
12310.0	Average	Horizontal	-11.1	47.0	35.9	54.0	-18.1

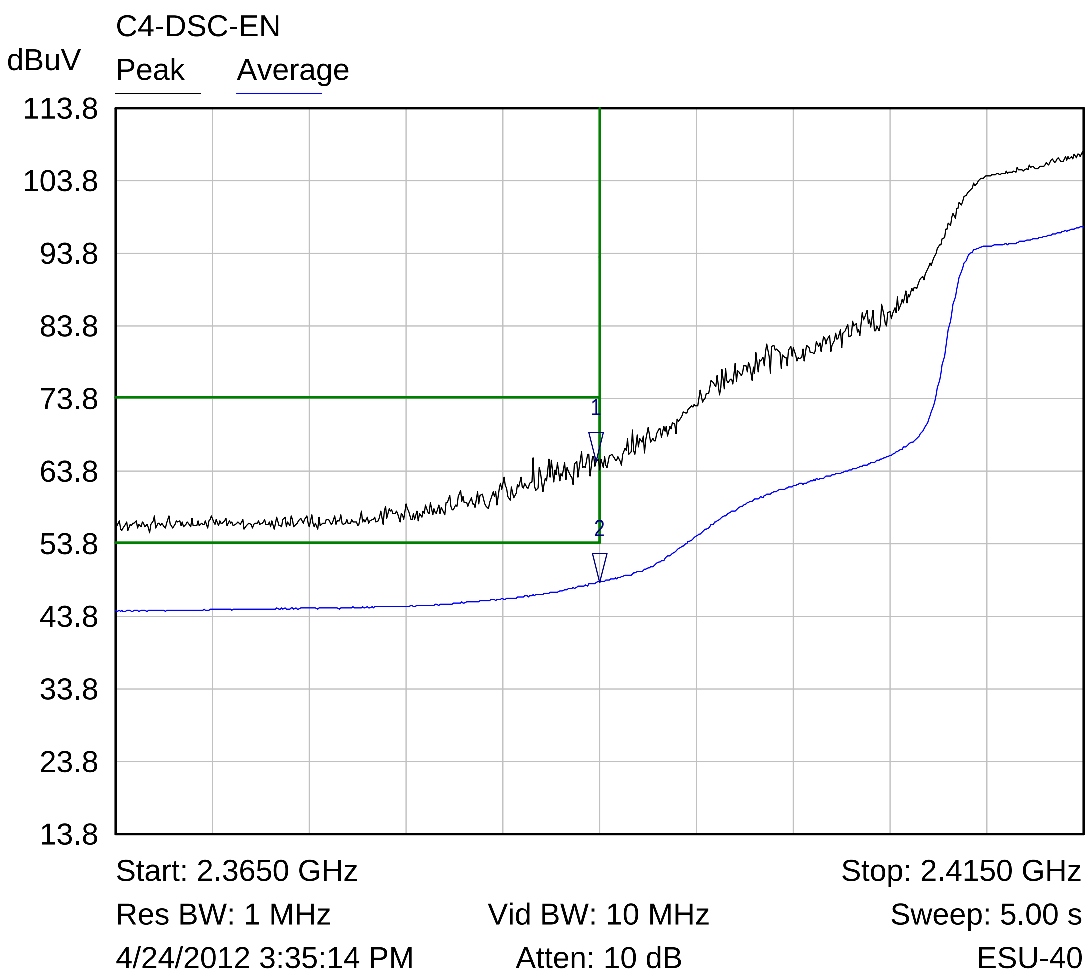
No other emissions were seen in the restricted bands. Noise floor was greater than 6 dB below the limit. At frequencies above 12.5 GHz, a 1 meter measurement distance was used.

Radiated Lower Band Edge Plot Channel 1 – 802.11g – Power level at +15



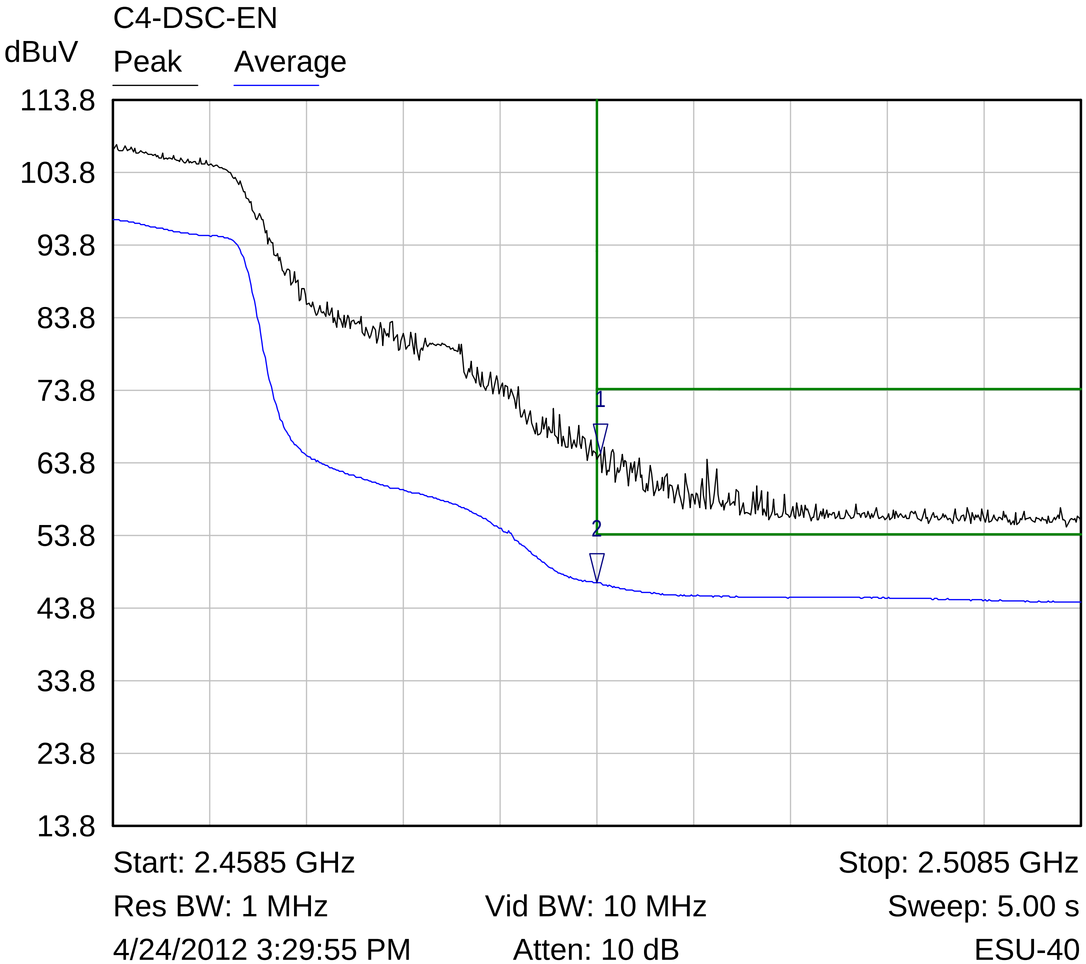
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.3900 GHz	68.62 dBuV	
2 ▽	Average	2.3900 GHz	50.98 dBuV	

Radiated Lower Band Edge Plot Channel 2 – 802.11g – Power level at +17



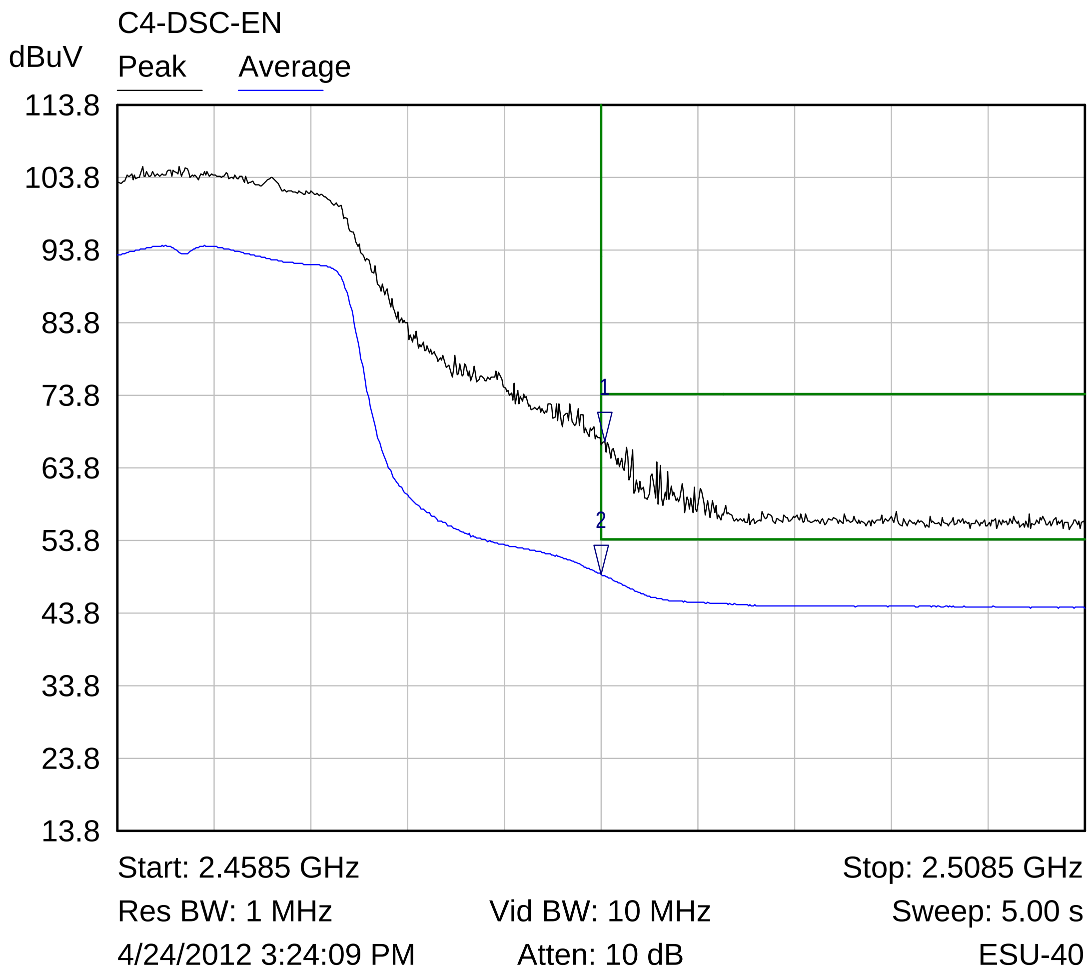
Mkr	Trace	X-Axis	Value	Notes
1 ∇	Peak	2.3898 GHz	65.07 dBuV	
2 ∇	Average	2.3900 GHz	48.45 dBuV	

Radiated Upper Band Edge Plot Channel 10 – 802.11g – Power level at +17



Mkr	Trace	X-Axis	Value	Notes
1 ∇	Peak	2.4837 GHz	65.17 dBuV	
2 ∇	Average	2.4835 GHz	47.23 dBuV	

Radiated Upper Band Edge Plot Channel 11 – 802.11g – Power level at +13



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.4837 GHz	67.38 dBuV	
2 ▽	Average	2.4835 GHz	49.17 dBuV	

6.2.5.2.2.3 802.11n

Transmitting at the Lowest Frequency (2412 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4824.0	Peak	Vertical	19.5	37.8	57.3	74.0	-16.7
4824.0	Average	Vertical	6.3	37.8	44.1	54.0	-9.9
4824.0	Peak	Horizontal	15.3	37.8	53.1	74.0	-20.9
4824.0	Average	Horizontal	2.2	37.8	40.0	54.0	-14.0
7236.0	Peak	Vertical	3.6	42.1	45.7	74.0	-28.3
7236.0	Average	Vertical	-8.8	42.1	33.3	54.0	-20.7
7236.0	Peak	Horizontal	3.4	42.1	45.5	74.0	-28.5
7236.0	Average	Horizontal	-8.9	42.1	33.2	54.0	-20.8
12060.0	Peak	Vertical	1.1	47.1	48.2	74.0	-25.8
12060.0	Average	Vertical	-10.8	47.1	36.3	54.0	-17.7
12060.0	Peak	Horizontal	1.2	47.1	48.3	74.0	-25.7
12060.0	Average	Horizontal	-10.9	47.1	36.2	54.0	-17.8

Transmitting at the Middle Frequency (2437 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874.0	Peak	Vertical	18.7	37.9	56.6	74.0	-17.4
4874.0	Average	Vertical	5.6	37.9	43.5	54.0	-10.5
4874.0	Peak	Horizontal	14.6	37.9	52.5	74.0	-21.5
4874.0	Average	Horizontal	1.3	37.9	39.2	54.0	-14.8
7311.0	Peak	Vertical	3.0	42.3	45.3	74.0	-28.7
7311.0	Average	Vertical	-8.6	42.3	33.7	54.0	-20.3

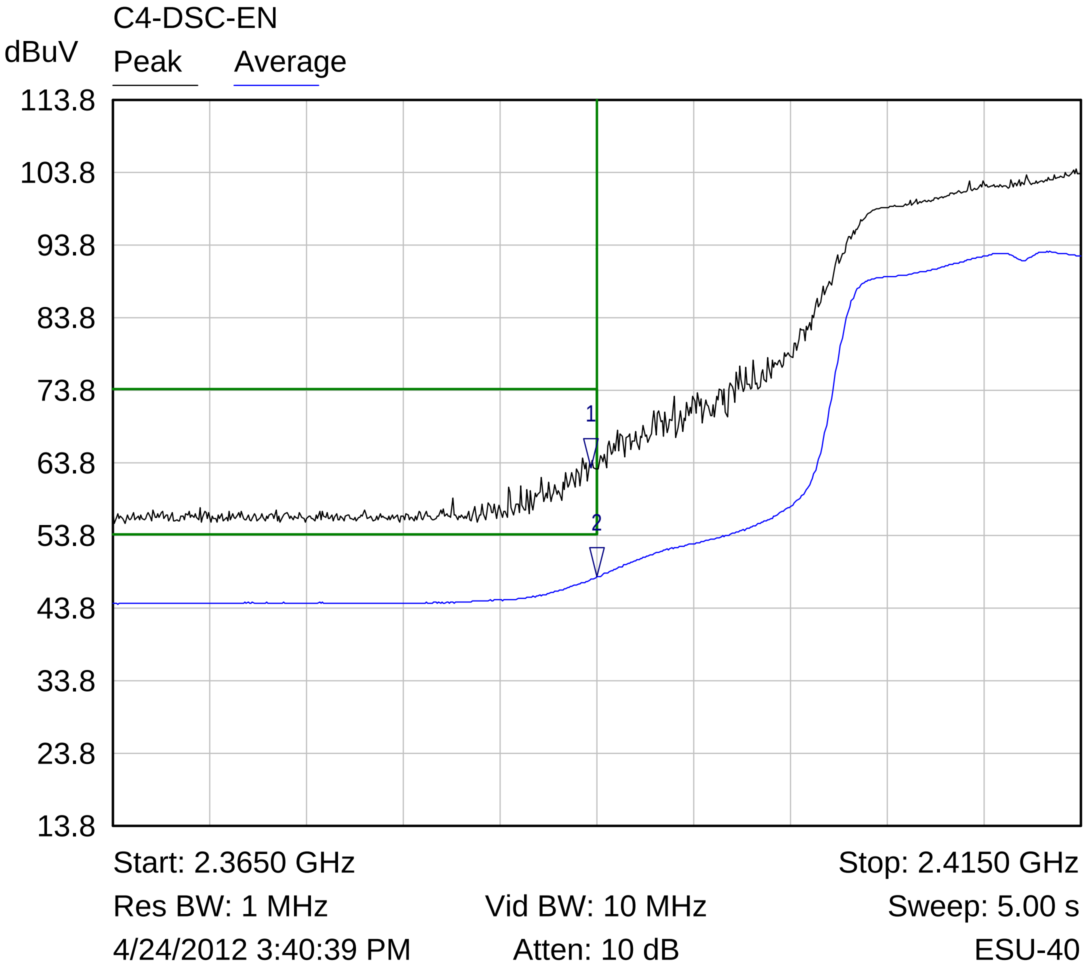
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
7311.0	Peak	Horizontal	3.2	42.3	45.5	74.0	-28.5
7311.0	Average	Horizontal	-8.8	42.3	33.5	54.0	-20.5
12185.0	Peak	Vertical	0.7	47.0	47.7	74.0	-26.3
12185.0	Average	Vertical	-11.5	47.0	35.5	54.0	-18.5
12185.0	Peak	Horizontal	1.1	47.0	48.1	74.0	-25.9
12185.0	Average	Horizontal	-11.3	47.0	35.7	54.0	-18.3

Transmitting at the Highest Frequency (2462 MHz)

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4924.0	Peak	Vertical	17.5	38.0	55.5	74.0	-18.5
4924.0	Average	Vertical	4.1	38.0	42.1	54.0	-11.9
4924.0	Peak	Horizontal	13.3	38.0	51.3	74.0	-22.7
4924.0	Average	Horizontal	-0.1	38.0	37.9	54.0	-16.1
7386.0	Peak	Vertical	3.3	42.5	45.8	74.0	-28.2
7386.0	Average	Vertical	-9.0	42.5	33.5	54.0	-20.5
7386.0	Peak	Horizontal	3.0	42.5	45.5	74.0	-28.5
7386.0	Average	Horizontal	-8.6	42.5	33.9	54.0	-20.1
12310.0	Peak	Vertical	1.5	47.0	48.5	74.0	-25.5
12310.0	Average	Vertical	-11.2	47.0	35.8	54.0	-18.2
12310.0	Peak	Horizontal	0.9	47.0	47.9	74.0	-26.1
12310.0	Average	Horizontal	-11.2	47.0	35.8	54.0	-18.2

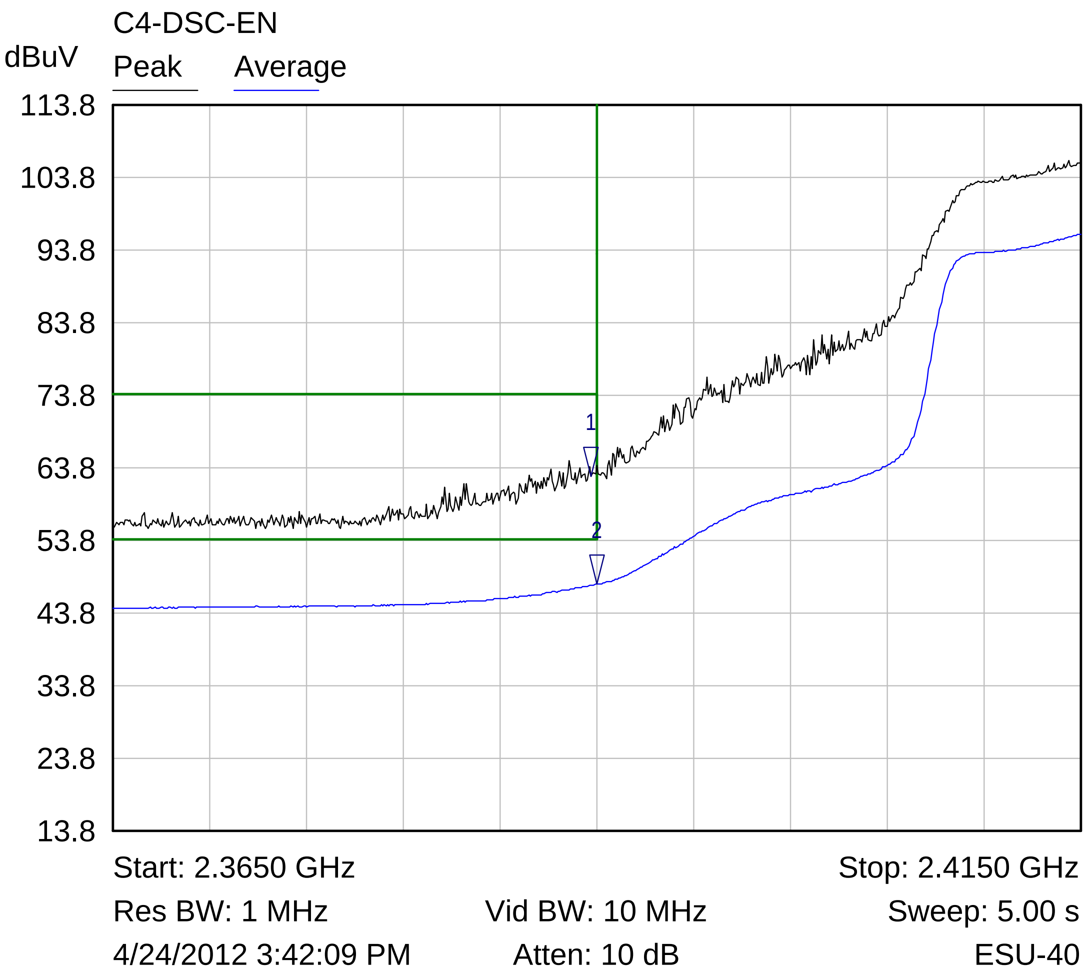
No other emissions were seen in the restricted bands. Noise floor was greater than 6 dB below the limit. At frequencies above 12.5 GHz, a 1 meter measurement distance was used.

Radiated Lower Band Edge Plot Channel 1 – 802.11n – Power level at +12



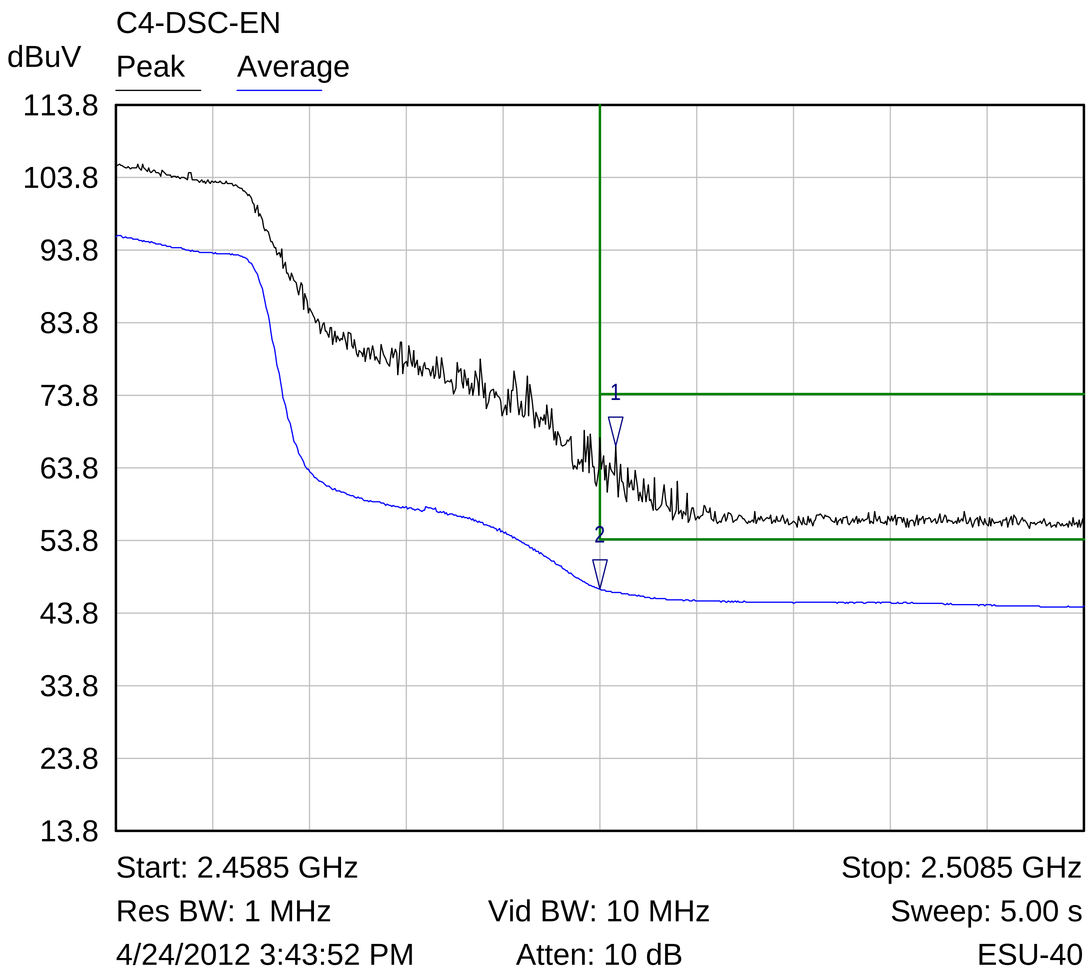
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.3897 GHz	63.15 dBuV	
2 ▽	Average	2.3900 GHz	48.08 dBuV	

Radiated Lower Band Edge Plot Channel 2 – 802.11n – Power level at +16



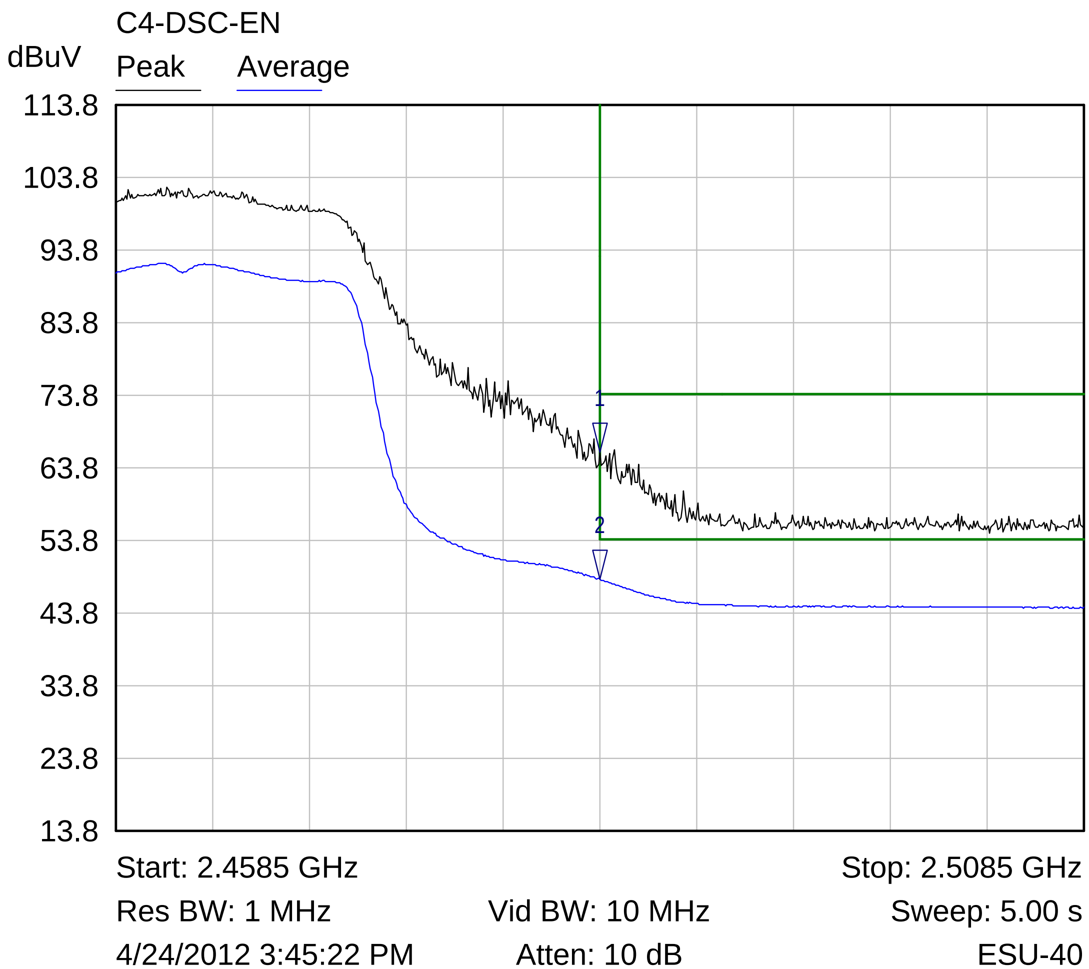
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.3897 GHz	62.58 dBuV	
2 ▽	Average	2.3900 GHz	47.77 dBuV	

Radiated Upper Band Edge Plot Channel 10 – 802.11n – Power level at +16



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak	2.4843 GHz	66.84 dBuV	
2 ▽	Average	2.4835 GHz	47.11 dBuV	

Radiated Upper Band Edge Plot Channel 11 – 802.11n – Power level at +12



Mkr	Trace	X-Axis	Value	Notes
1 ∇	Peak	2.4835 GHz	65.89 dBuV	
2 ∇	Average	2.4835 GHz	48.49 dBuV	

6.2.6 §15.247(d) Peak Power Spectral Density

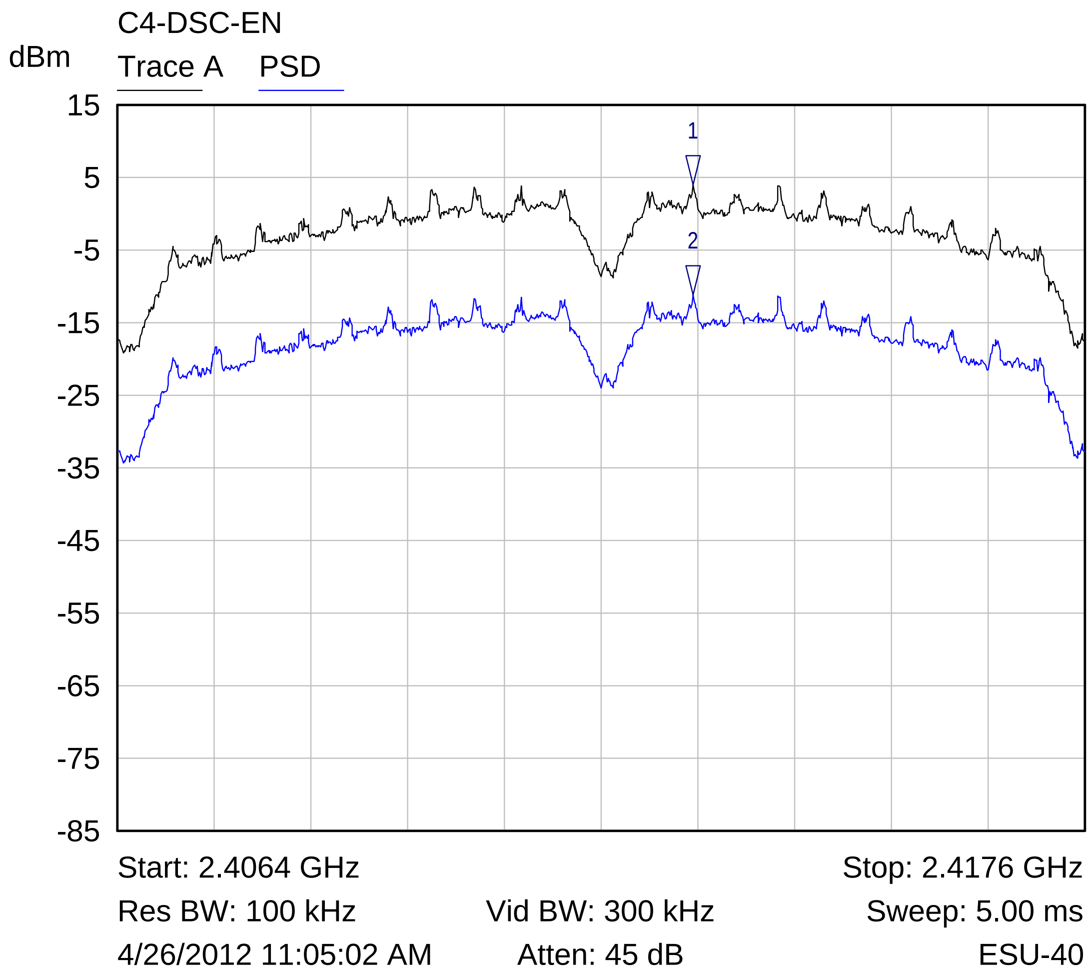
The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. KDB 558074 DTS D01 Measurement Guidance v01 5.3.1was used to measure the 3 kHz power spectral density of the emission. The measurements were made using the highest power for any channel for each transmit mode. The result of this testing is summarized in the table below.

Frequency (MHz)	802.11b Measurement (dBm)	802.11g Measurement (dBm)	802.11n Measurement (dBm)
2412	-11.13	-8.93	-7.66
2437	-11.90	-8.51	-8.40
2462	-12.05	-8.41	-8.68

RESULT

The maximum peak power spectral density was -7.66 dBm. The EUT complies with the specification by 15.66 dB.

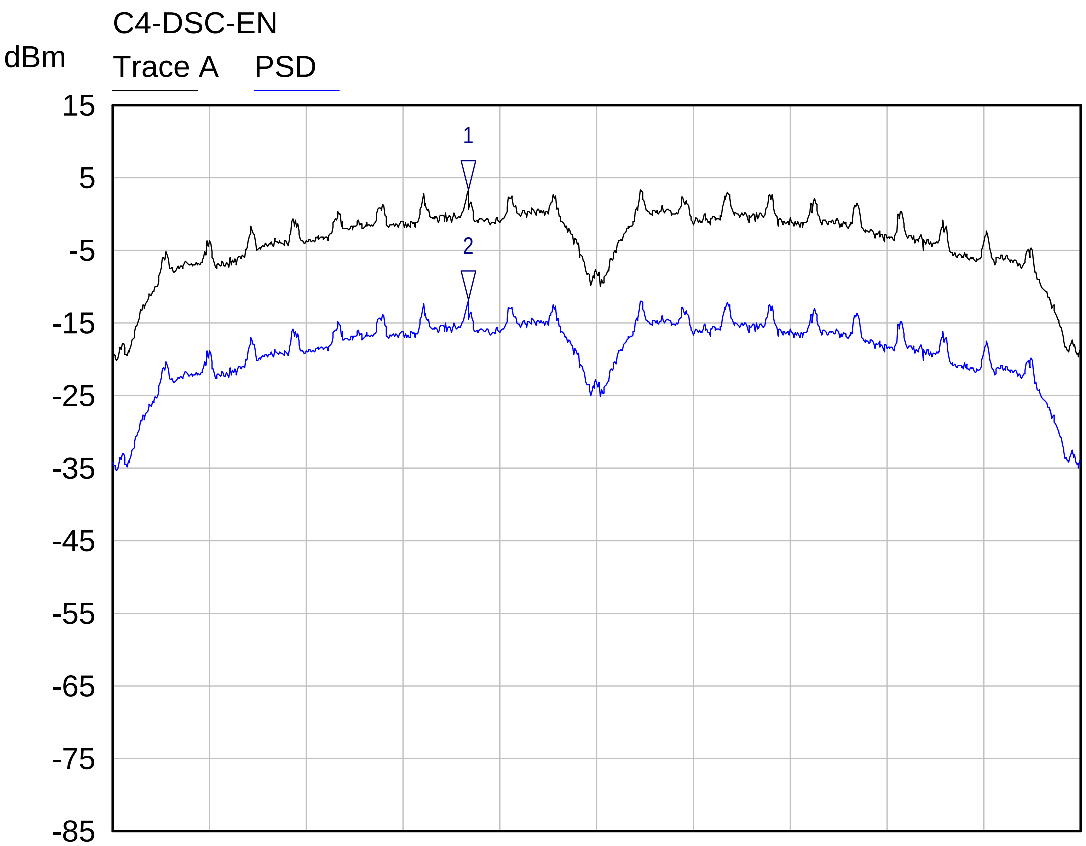
Lowest channel – 802.11b



Mkr	Trace	X-Axis	Value	Notes
1 ∇	Trace A	2.4130 GHz	4.07 dBm	
2 ∇	PSD	2.4130 GHz	-11.13 dBm	

Trace A 3 kHz power spectral density - No BWCF applied

Middle channel – 802.11b



Start: 2.4314 GHz | Stop: 2.4426 GHz

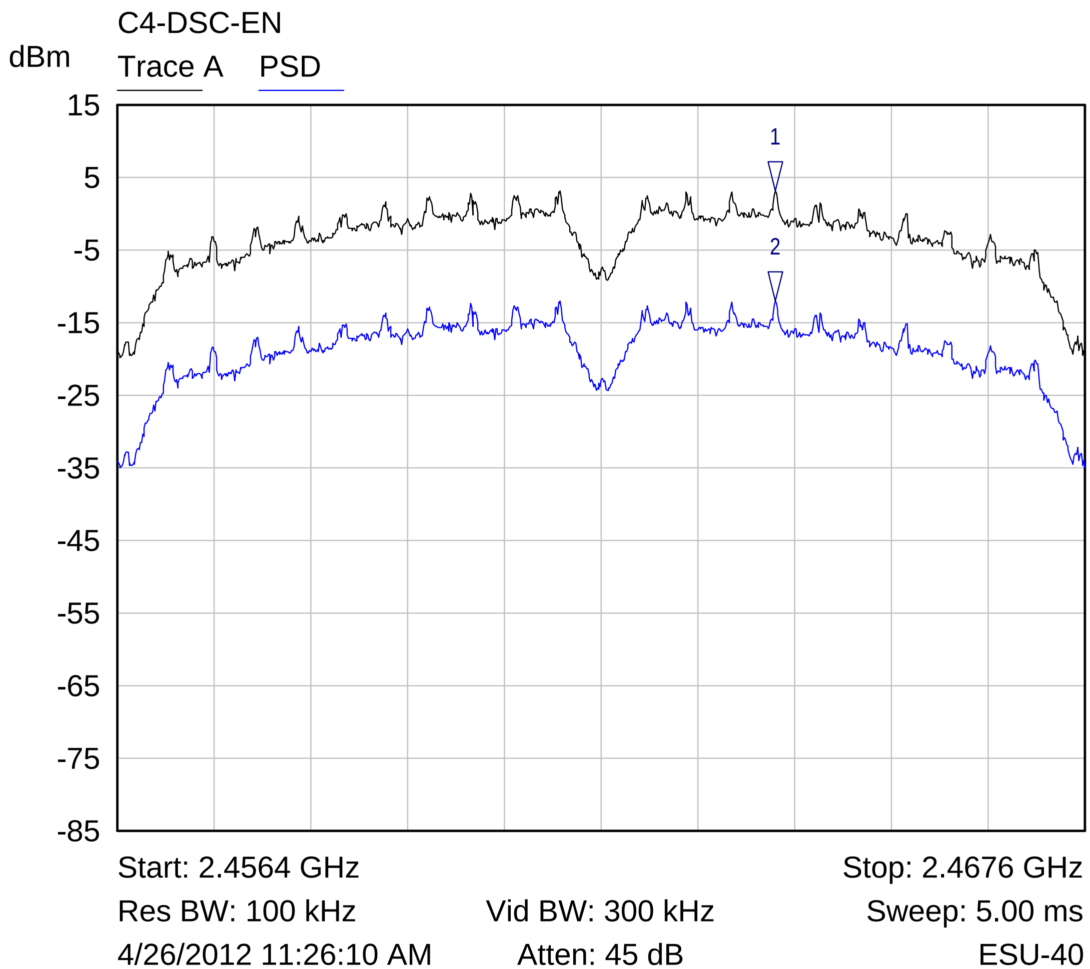
Res BW: 100 kHz | Vid BW: 300 kHz | Sweep: 5.00 ms

4/26/2012 11:11:49 AM | Atten: 45 dB | ESU-40

Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4355 GHz	3.30 dBm	
2 ▽	PSD	2.4355 GHz	-11.90 dBm	

Trace A 3 kHz power spectral density - No BWCF applied

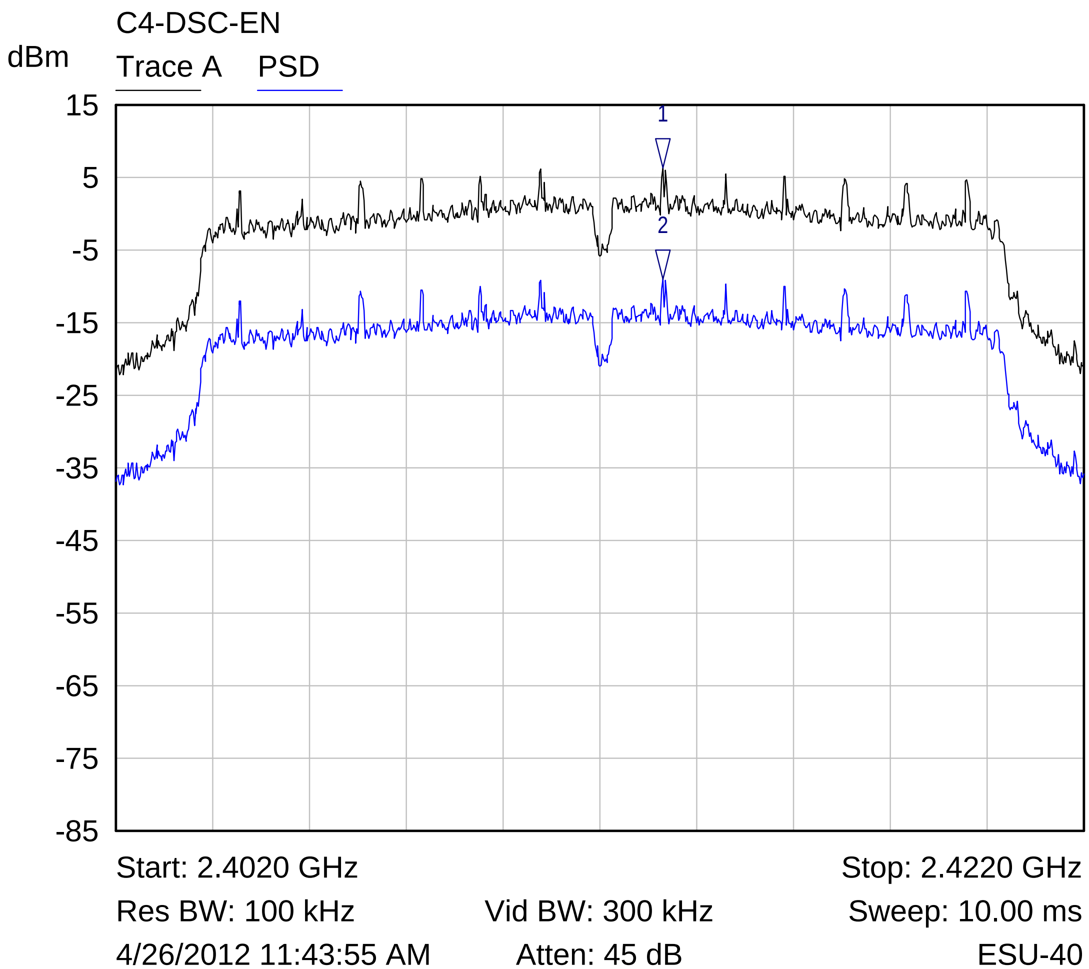
Upper channel – 802.11b



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4640 GHz	3.15 dBm	
2 ▽	PSD	2.4640 GHz	-12.05 dBm	

Trace A 3 kHz power spectral density - No BWCF applied

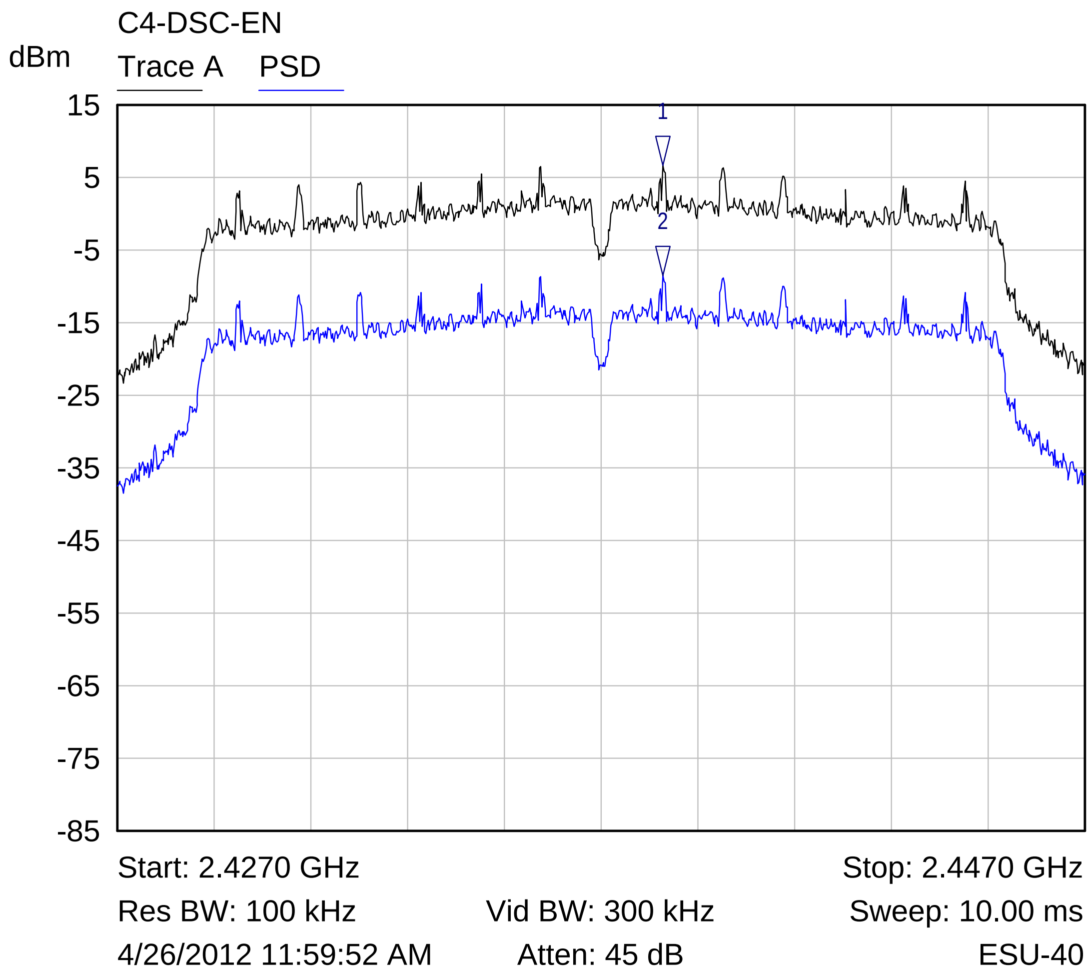
Lower channel – 802.11g



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4133 GHz	6.27 dBm	
2 ▽	PSD	2.4133 GHz	-8.93 dBm	

Trace A   3 kHz power spectral density - No BWCF applied

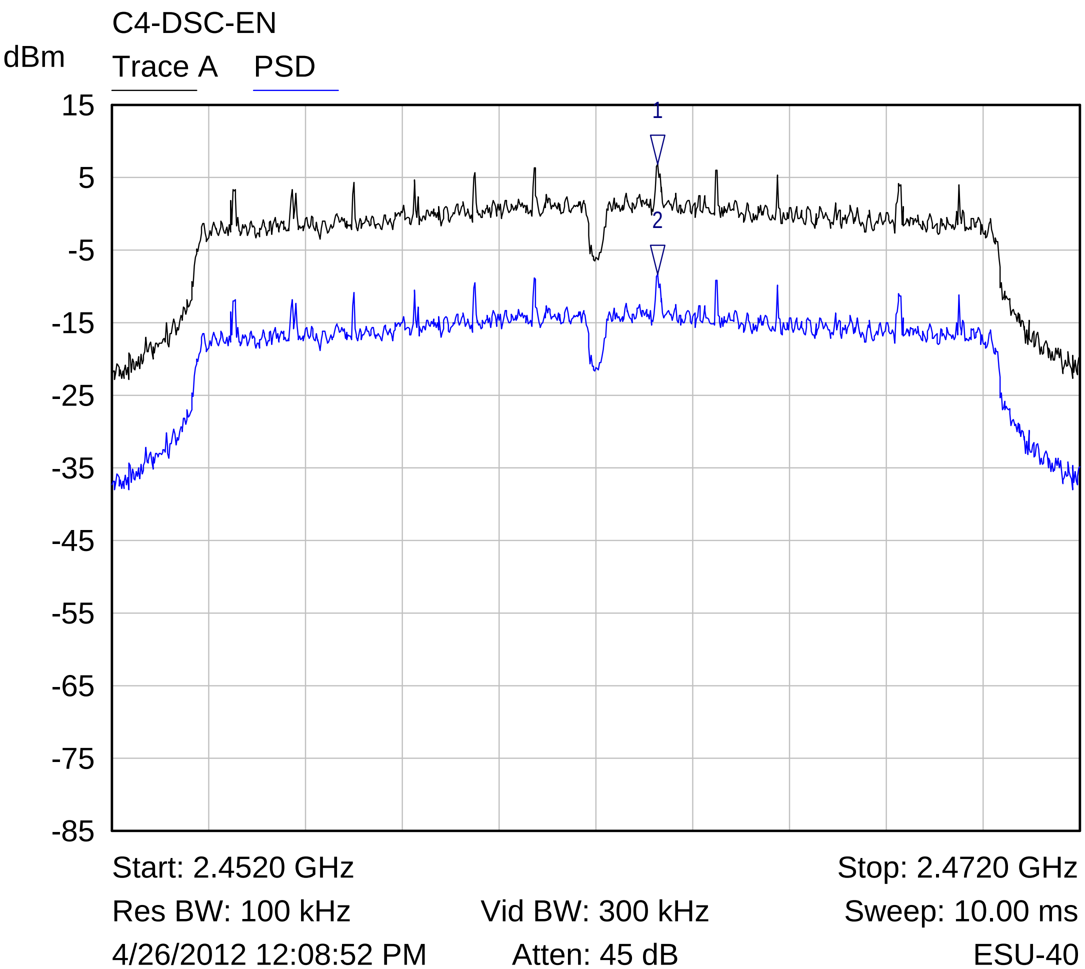
Middle channel – 802.11g



Mkr	Trace	X-Axis	Value	Notes
1 ∇	Trace A	2.4383 GHz	6.69 dBm	
2 ∇	PSD	2.4383 GHz	-8.51 dBm	

Trace A 3 kHz power spectral density - No BWCF applied

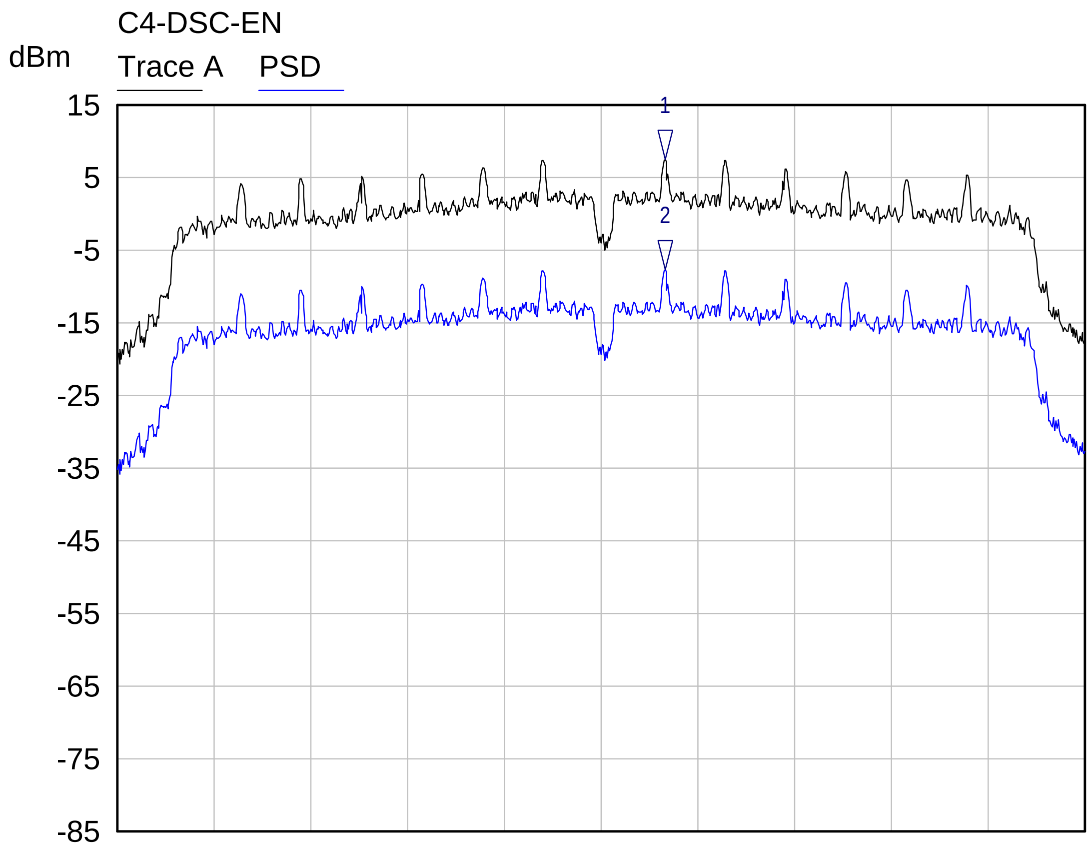
Upper channel – 802.11g



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4633 GHz	6.79 dBm	
2 ▽	PSD	2.4633 GHz	-8.41 dBm	

Trace A 3 kHz power spectral density - No BWCF applied

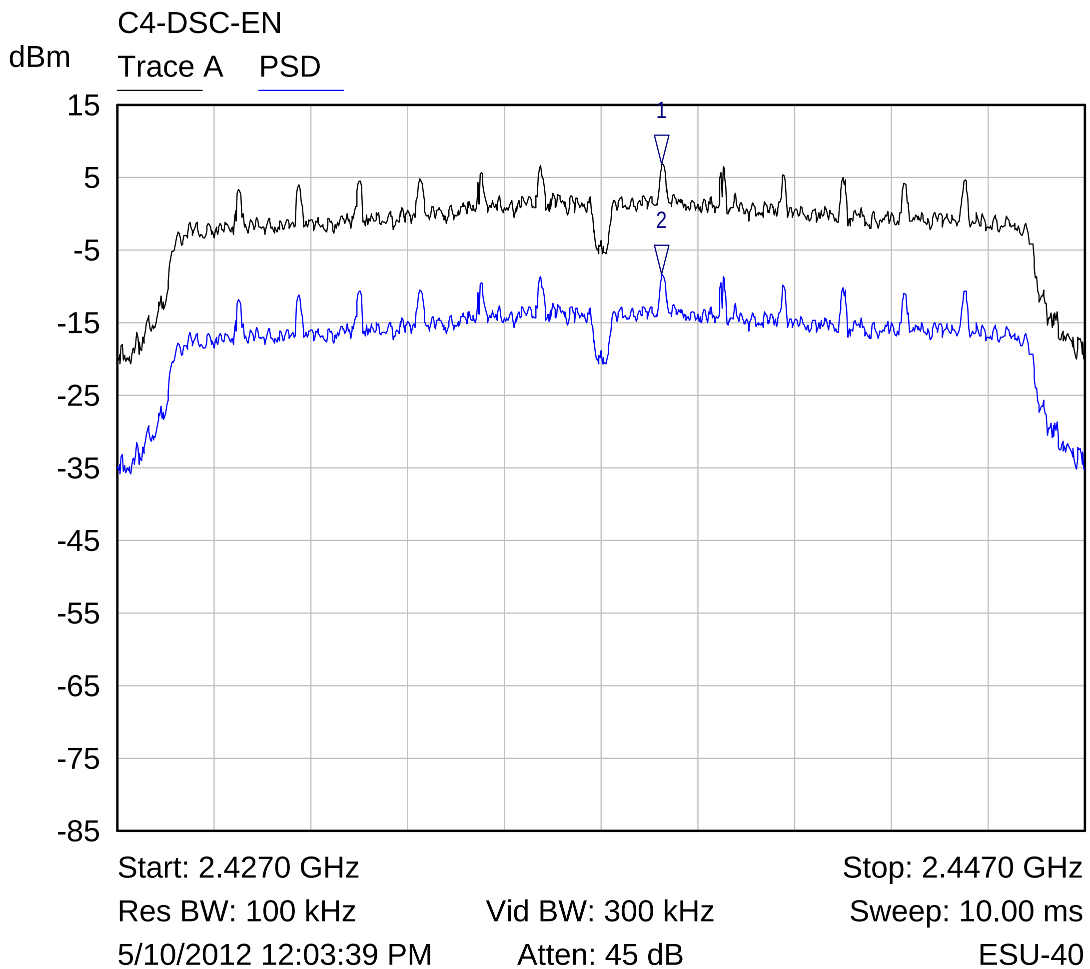
Lower channel – 802.11n



Start: 2.4020 GHz Stop: 2.4220 GHz
Res BW: 100 kHz Vid BW: 300 kHz Sweep: 10.00 ms
5/10/2012 11:45:04 AM Atten: 45 dB ESU-40

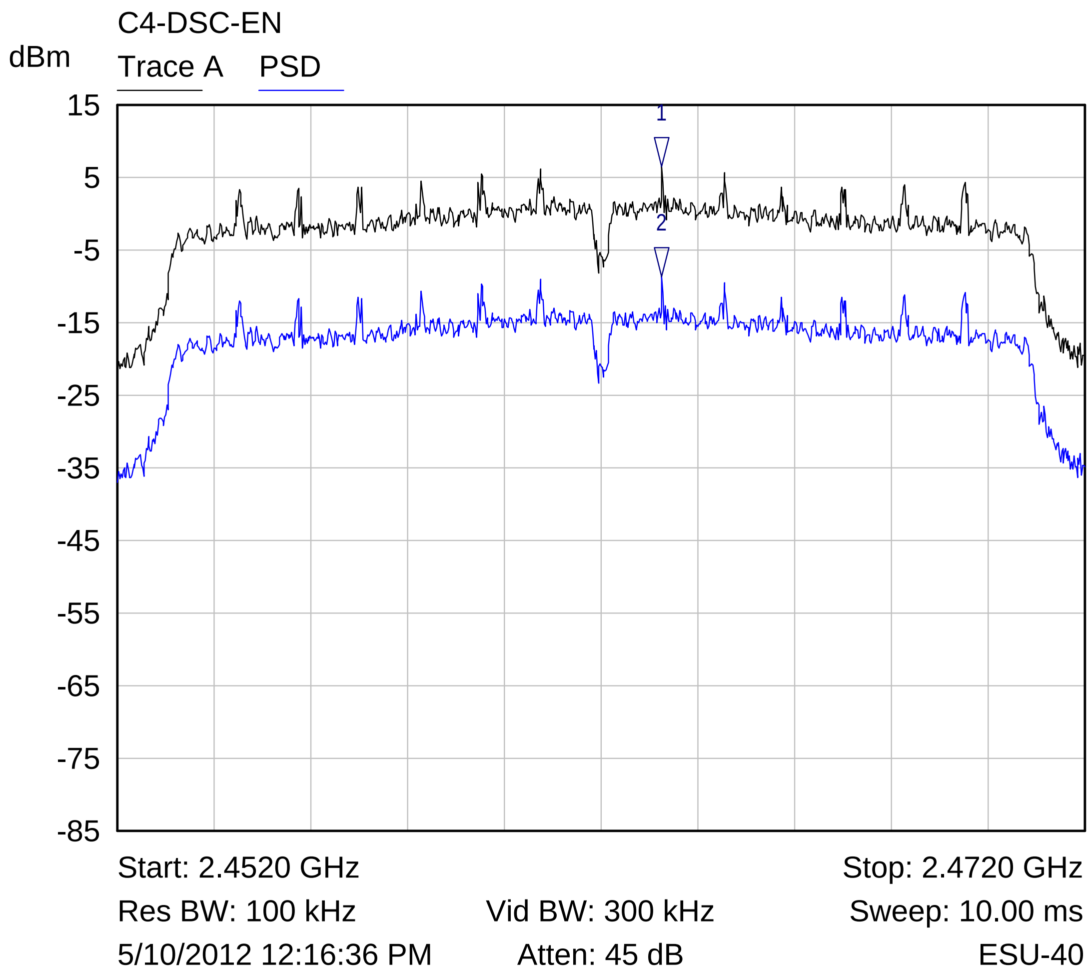
Mkr	Trace	X-Axis	Value	Notes
1 ∇	Trace A	2.4133 GHz	7.54 dBm	
2 ∇	PSD	2.4133 GHz	-7.66 dBm	

Middle channel – 802.11n



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4383 GHz	6.80 dBm	
2 ▽	PSD	2.4383 GHz	-8.40 dBm	

Upper channel – 802.11n



Mkr	Trace	X-Axis	Value	Notes
1 ∇	Trace A	2.4633 GHz	6.52 dBm	
2 ∇	PSD	2.4633 GHz	-8.68 dBm	

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 §15.207 Conducted Disturbance at the AC Mains

The conducted disturbance at mains ports from the EUT was measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted disturbance at mains ports measurements are performed in a screen room using a (50 Ω/50 μH) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of equipment with each device having its own power cord, the point of connection for the LISN is determined from the following rules:

a) Each power cord, which is terminated in a mains supply plug, shall be tested separately.
b) Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
c) Power cords which are specified by the manufacturer to be connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.
d) Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.
e) When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

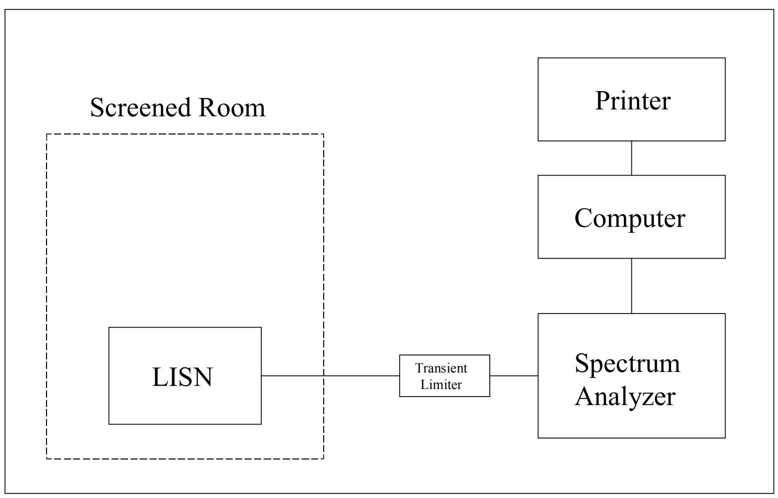
For AC mains port testing the desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor. The equipment is placed a minimum of 40 cm from all walls. Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	11/16/2011
Test Software	Nemko-CCL, Inc.	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	01/17/2012
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	01/18/2012

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
LISN	EMCO	3825/2	9305-2099	03/12/2012
Conductance Cable Wanship Site #2	Nemko-CCL, Inc.	Cable J	N/A	12/14/2011
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/14/2011

An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

Conducted Emissions Test Setup

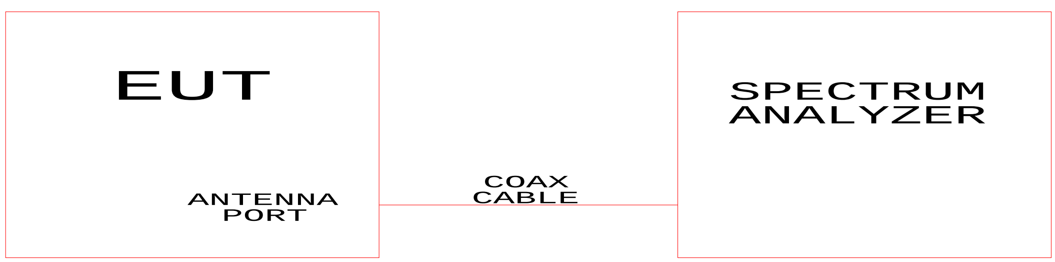


A1.2 Direct Connection at the Antenna Port Tests

Type of Equipment	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137
Spectrum Analyzer/Receiver	Rohde & Schwarz	1302.6005.40	100064
Low Loss Cable (1 dB)	N/A	N/A	N/A

An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

Test Configuration Block Diagram



A1.5 §15.247(c) Radiated Spurious Emissions in the Restricted Bands

The radiated emissions from the intentional radiator were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings.

A loop antenna was used to measure emissions below 30 MHz. Emission readings more than 20 dB below the limit at any frequency may not be listed in the reported data. For frequencies between 9 kHz and 30 MHz, or the lowest frequency generated or used in the device greater than 9 kHz, and less than 30 MHz, the spectrum analyzer resolution bandwidth was set to 9 kHz and the video bandwidth was set to 30 kHz. For average measurements, the spectrum analyzer average detector was used.

For frequencies above 30 MHz, an amplifier and preamplifier were used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges. For peak emissions above 1000 MHz the spectrum analyzer’s resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz. For average measurements above 1000 MHz the spectrum analyzer’s resolution bandwidth was set to 1 MHz and the average detector of the analyzer was used.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz and a Double Ridge Guide Horn antenna was used to measure the frequency range of 1 GHz to 18 GHz, and a Pyramidal Horn antenna was used to measure the frequency range of 18 GHz to 25 GHz, at a distance of 3 meters and 1 meter from the EUT. The readings obtained by the antenna are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors.

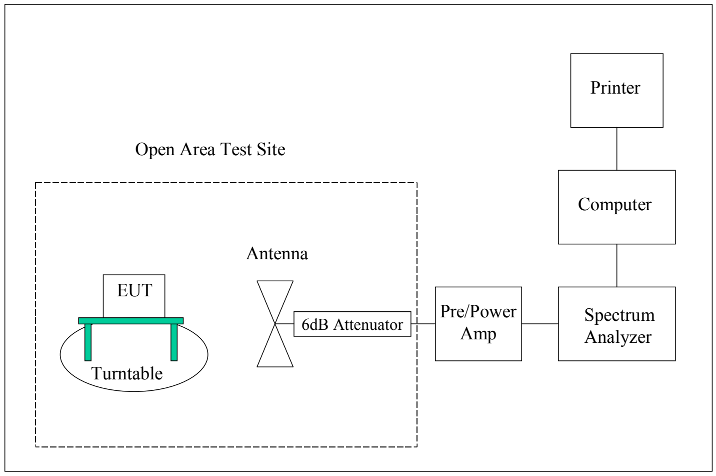
The configuration of the intentional radiator was varied to find the maximum radiated emission. The intentional radiator was connected to the peripherals listed in Section 2.4 via the interconnecting cables listed in Section 2.5. These interconnecting cables were manipulated manually by a technician to obtain worst case radiated emissions. The intentional radiator was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there are multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

Desktop intentional radiators are measured on a non-conducting table 80 centimeters above the ground plane. The table is placed on a turntable which is level with the ground plane. The turntable has slip rings, which supply AC power to the intentional radiator. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	11/16/2011
Test Software	Nemko-CCL, Inc.	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer/Receiver	Rohde & Schwarz	1302.6005.40	100064	07/28/2011
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	01/17/2012
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	01/18/2012
Loop Antenna	EMCO	6502	2011	03/11/2011
Biconilog Antenna	EMCO	3142	9601-1009	04/21/2011
Double Ridged Guide Antenna	EMCO	3115	9604-4779	03/10/2011
Pyramidal Standard Gain Horn	EMC Test System	3160-09	0003-1197	04/04/09
Pyramidal Standard Gain Horn	EMC Test System	3160-10	0001-1116	11/09/2010
2.4 GHz Filter	Microtronics	HPM50111-03	001	06/26/2012
High Frequency Amplifier	Miteq	AFS4-01001800-43-10P-4	1096455	06/26/2012
6’ High Frequency Cable	Microcoax	UFB197C-0-0720-000000	1296	05/14/2012
20’ High Frequency Cable	Microcoax	UFB197C-1-3120-000000	1297	05/14/2012
3 Meter Radiated Emissions Cable Wanship Site #2	Microcoax	UFB205A-0-4700-000000	1295	05/10/2011
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/25/2011
6 dB Attenuator	Hewlett Packard	8491A	32835	12/14/2011

An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

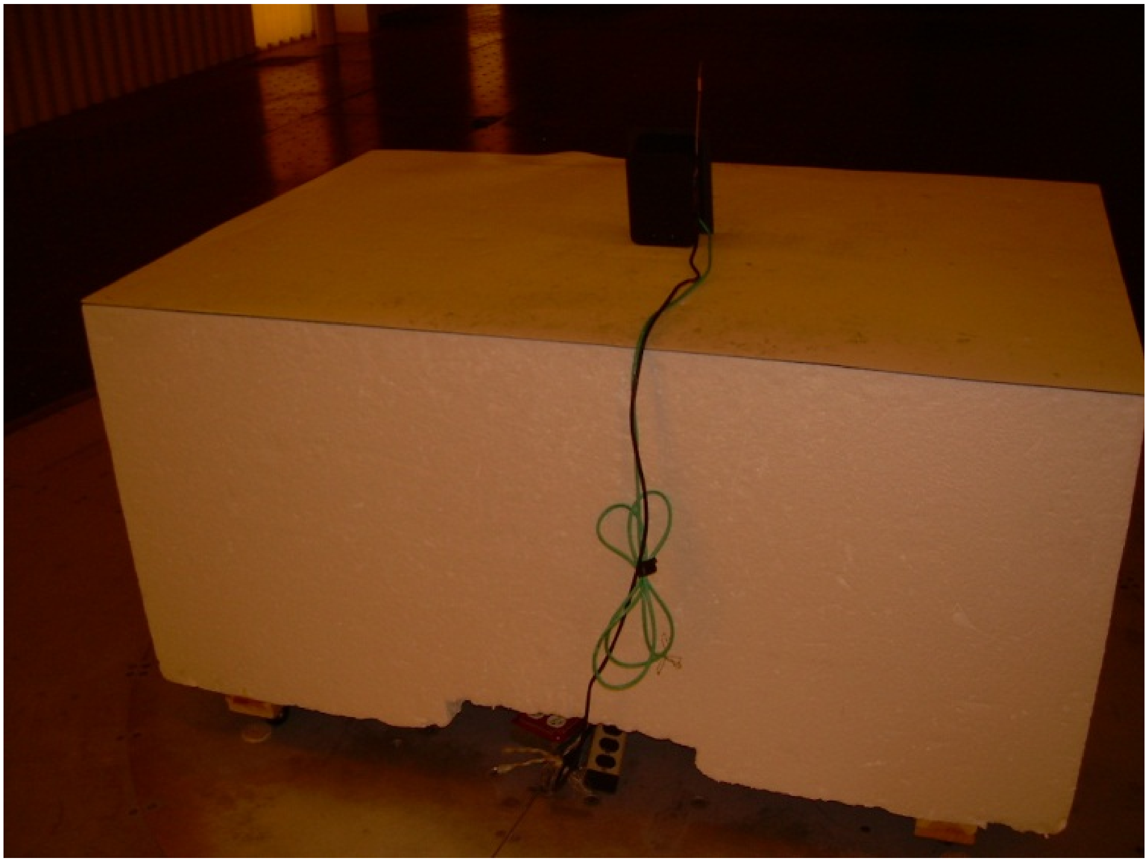
Radiated Emissions Test Setup



APPENDIX 2 PHOTOGRAPHS

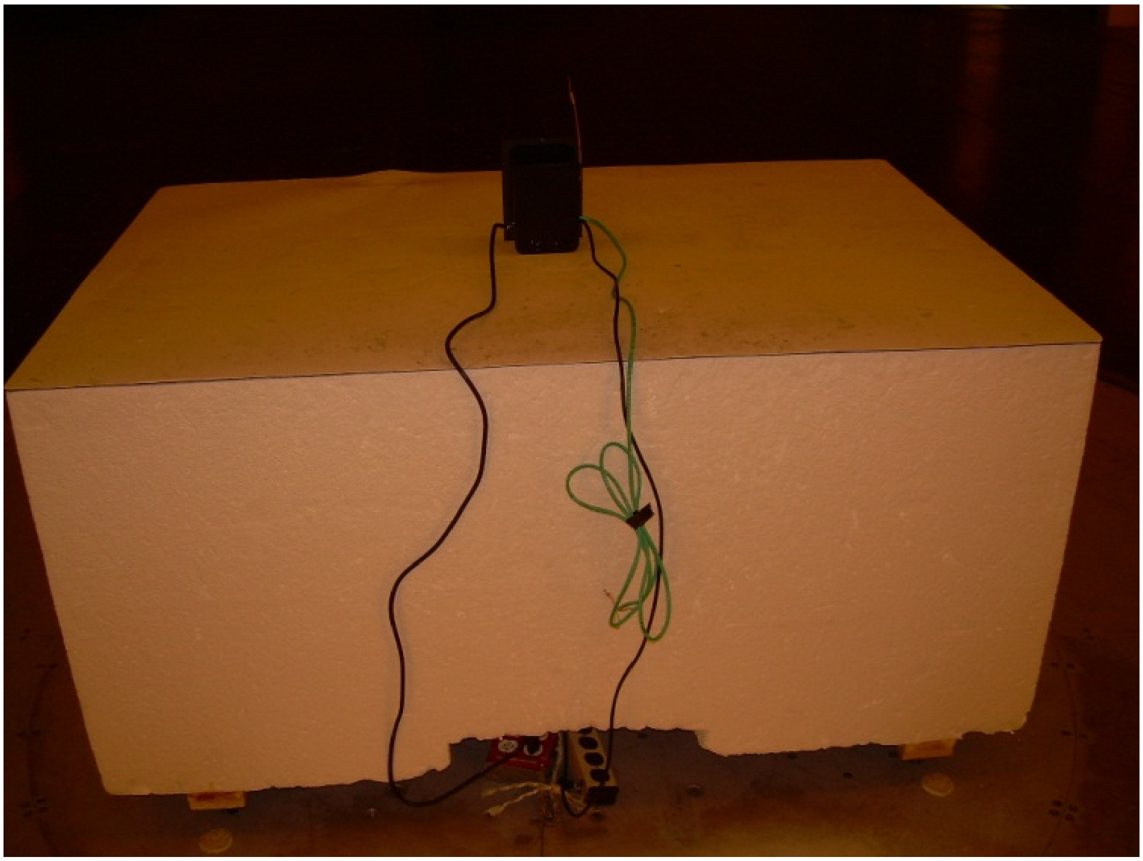
Photograph 1 – Front View Radiated Disturbance Worst Case Configuration – POE Power

Photograph 2 – Back View Radiated Disturbance Worst Case Configuration – POE Power



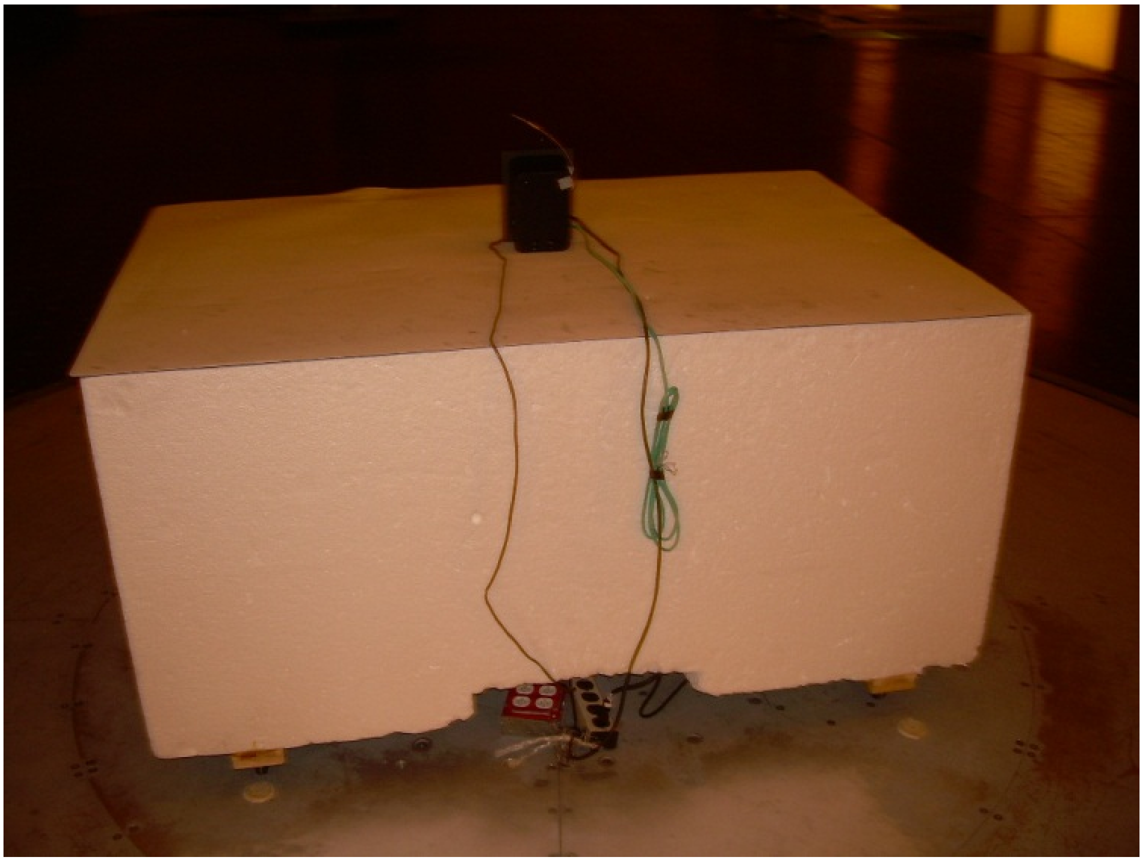
Photograph 3 – Front View Radiated Disturbance – AC Power

Photograph 4 – Back View Radiated Disturbance – AC Power

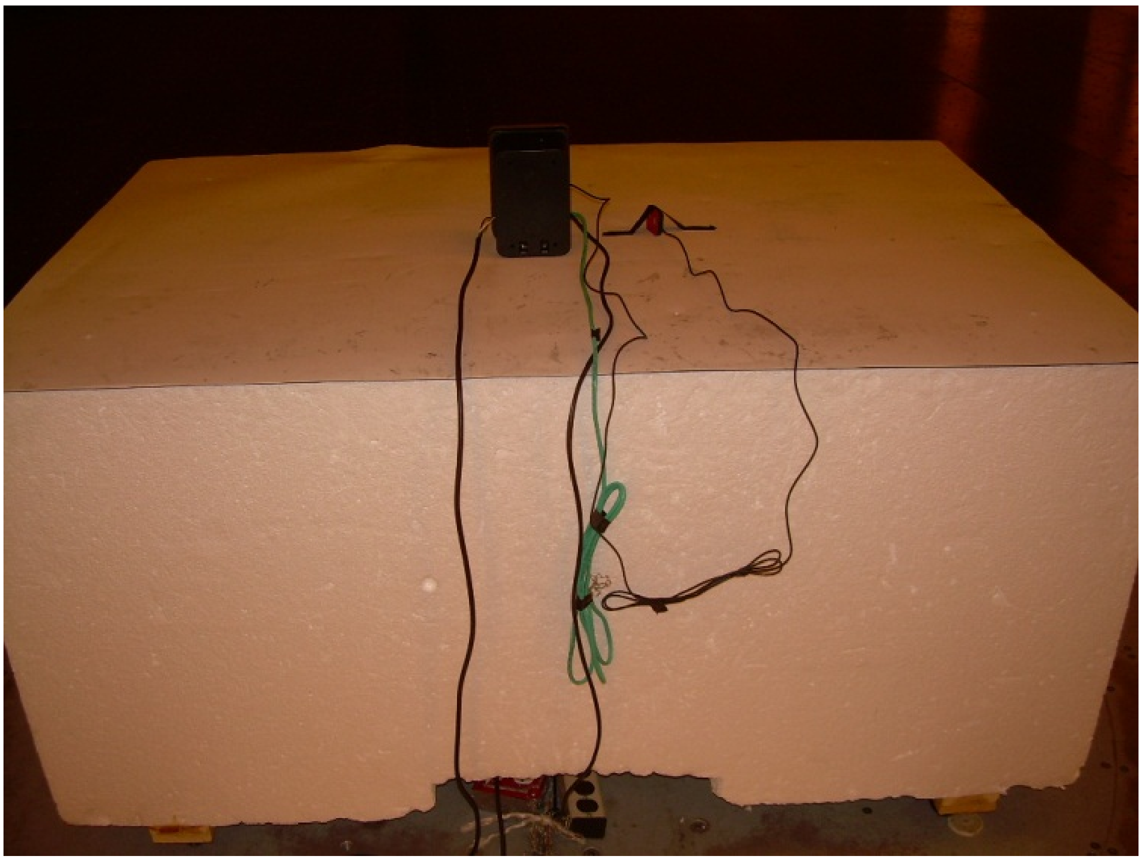


Photograph 5 – Front View Radiated Disturbance – DC Power

Photograph 6 – Back View Radiated Disturbance – DC Power

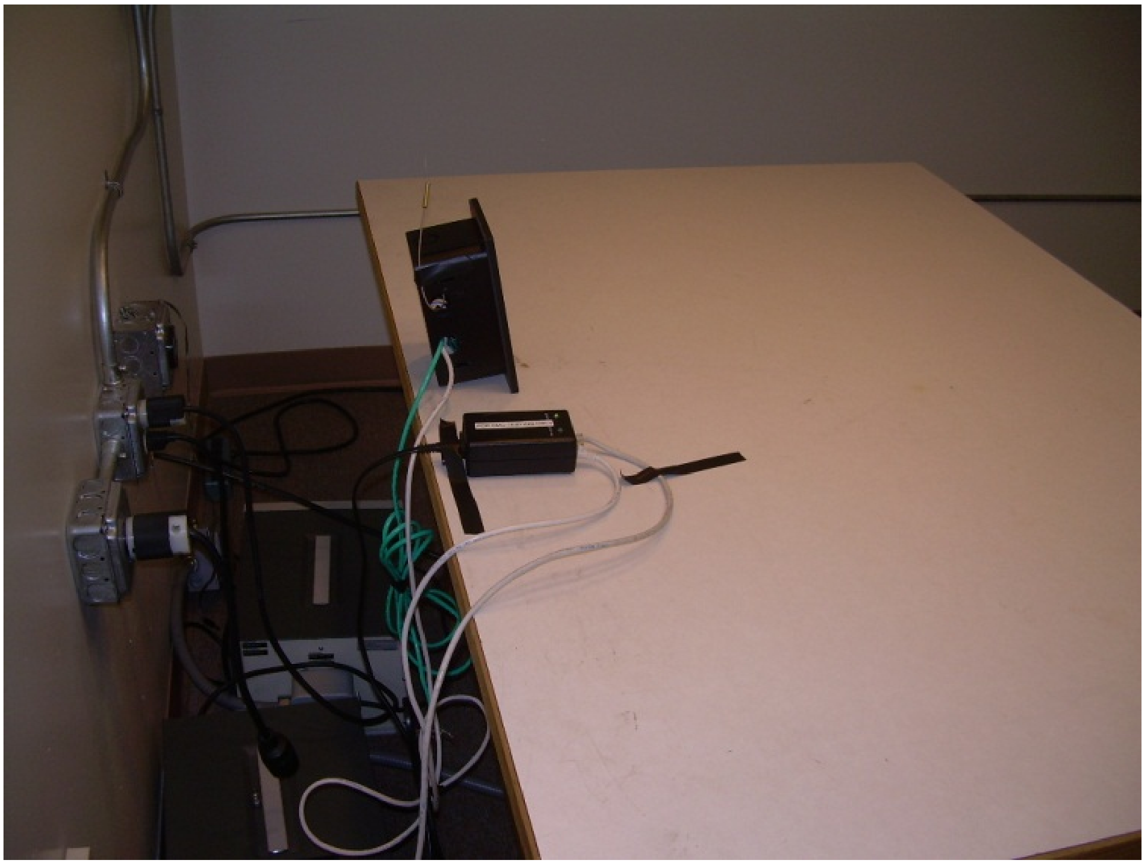


Photograph 7 – View Showing Worst-Case Patch Antenna Placement

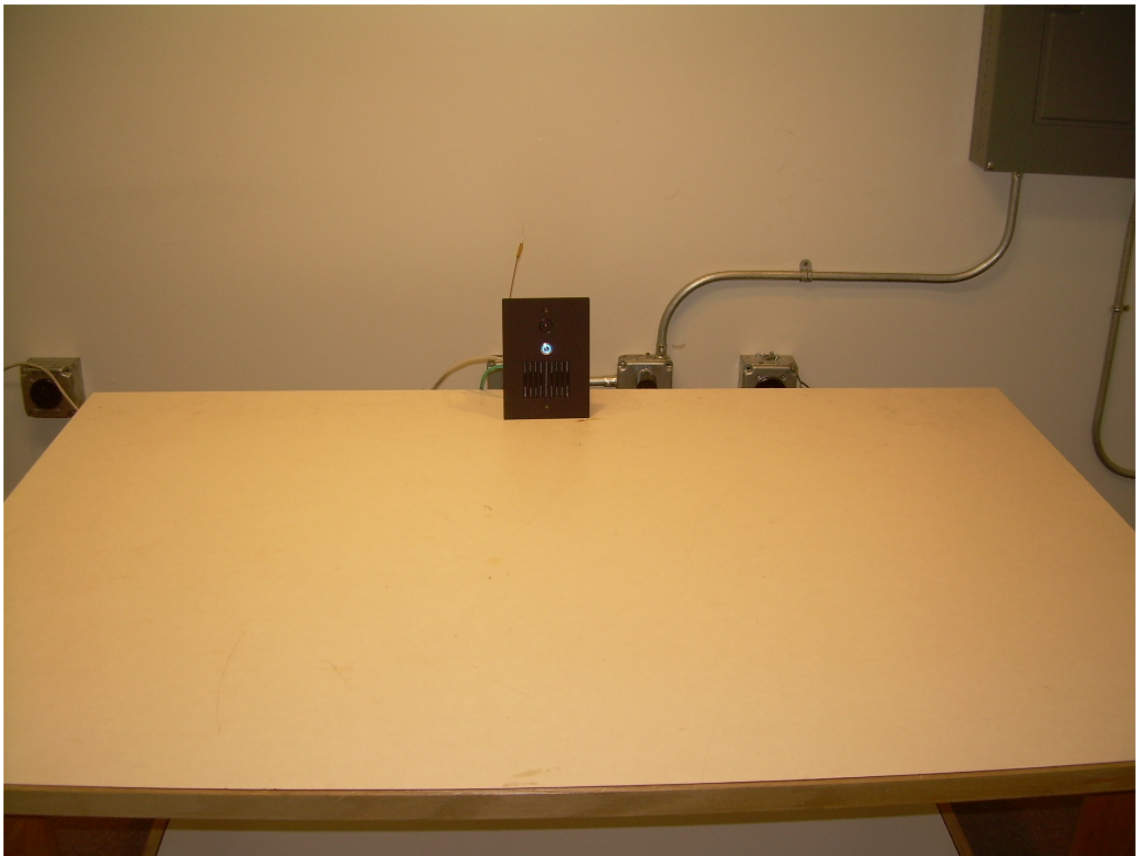


Photograph 8 – Front View Conducted Disturbance Worst Case Configuration – POE Power

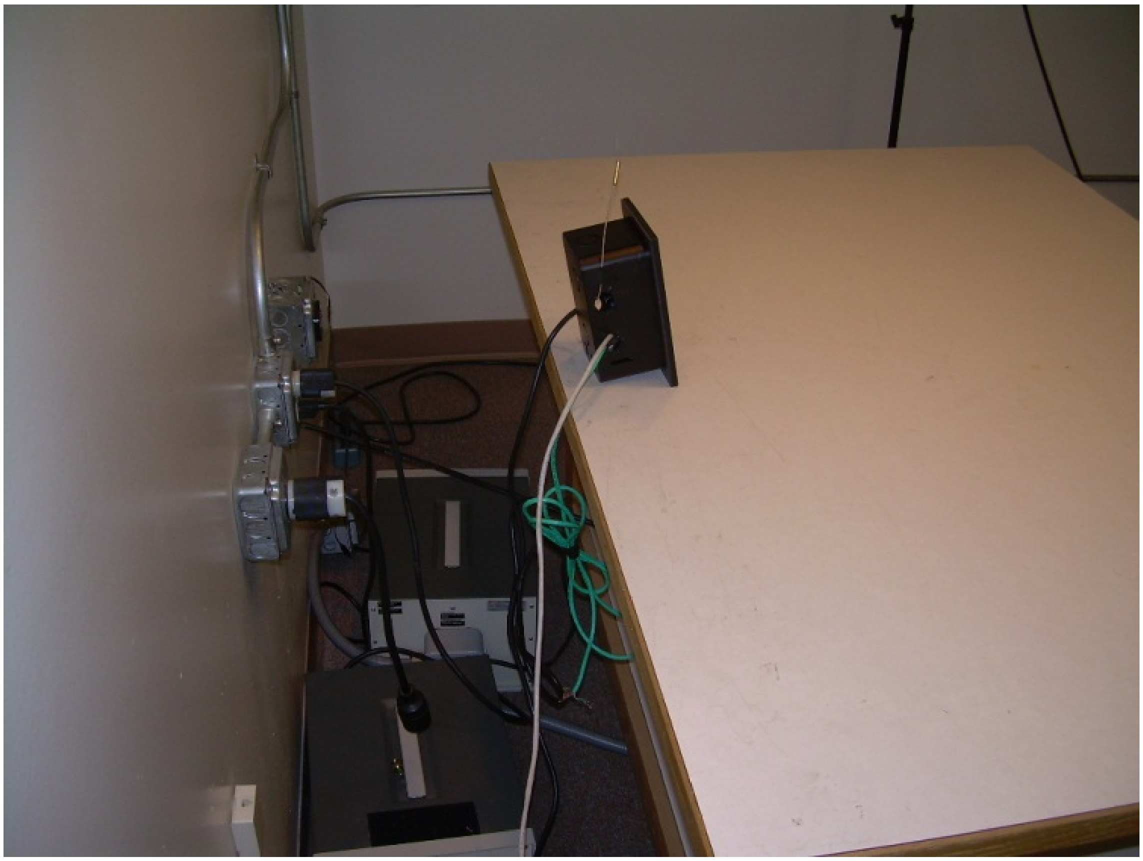
Photograph 9 – Back View Conducted Disturbance Worst Case Configuration – POE Power



Photograph 10 – Front View Conducted Disturbance – AC Power

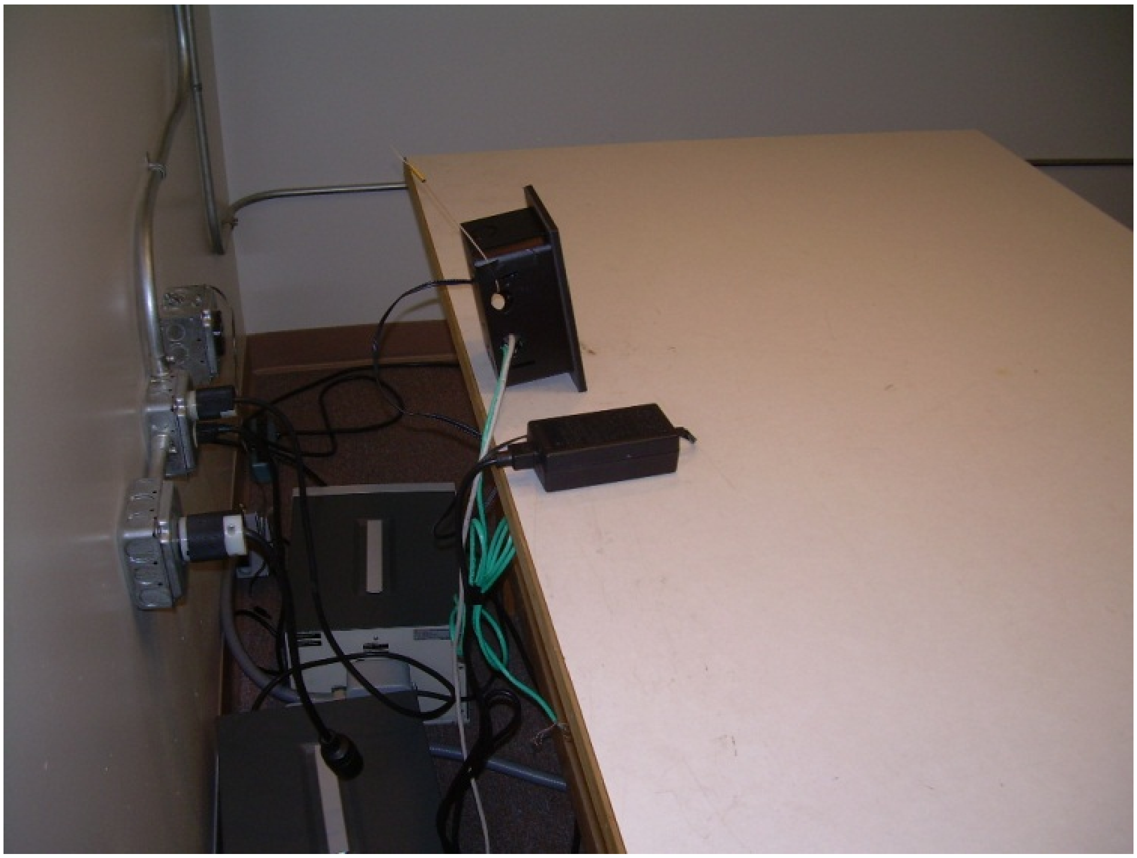


Photograph 11 – Back View Conducted Disturbance – AC Power



Photograph 12 – Front View Conducted Disturbance – DC Power

Photograph 13 – Back View Conducted Disturbance – DC Power



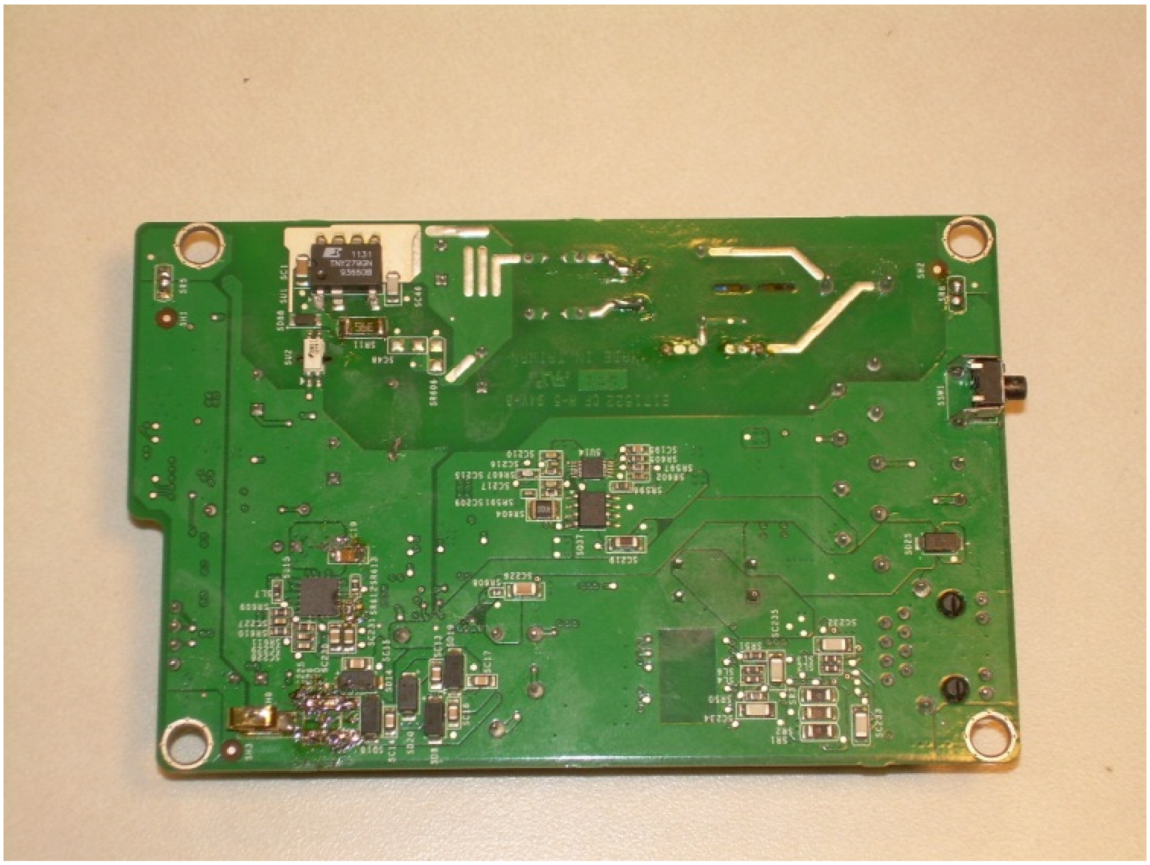
Photograph 14 – Front View of the EUT

Photograph 15 – Back View of the EUT Inside Back Box

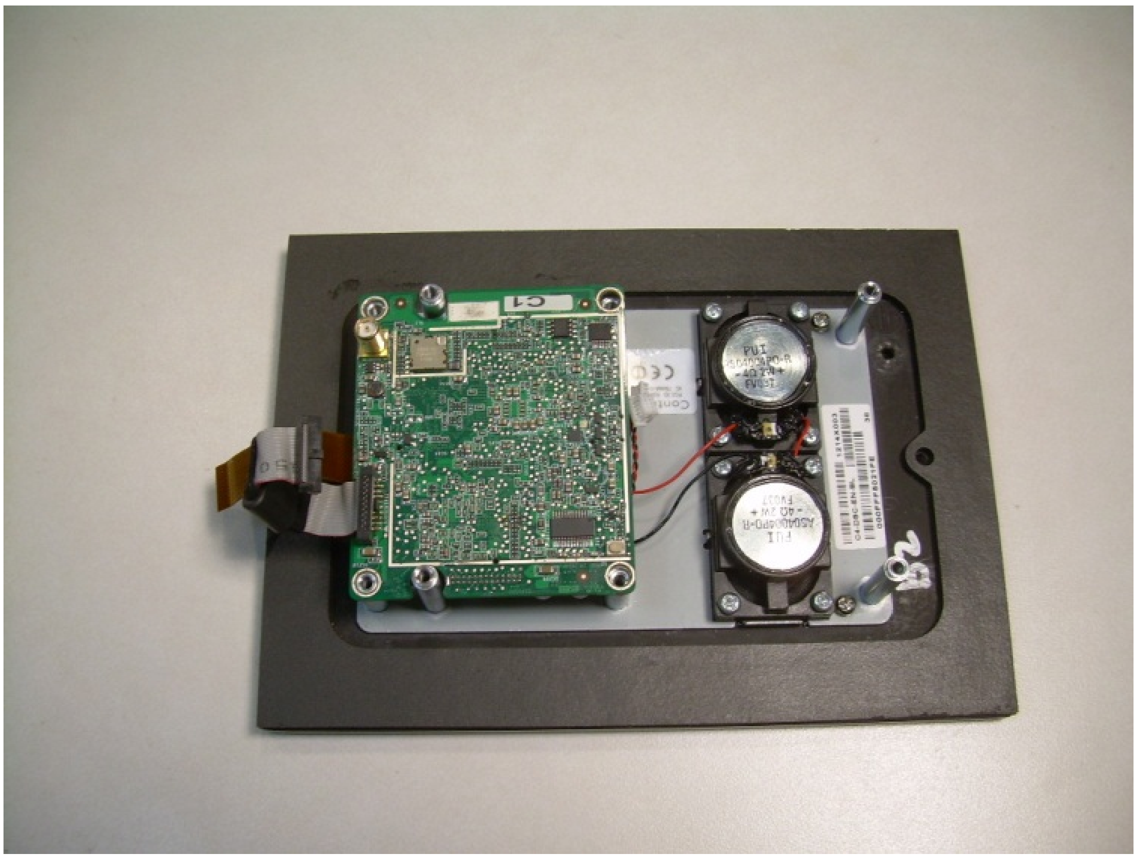
Photograph 16 – Back View of the EUT With Back Box Removed

Photograph 17 – View of the Component Side of the Power PCB

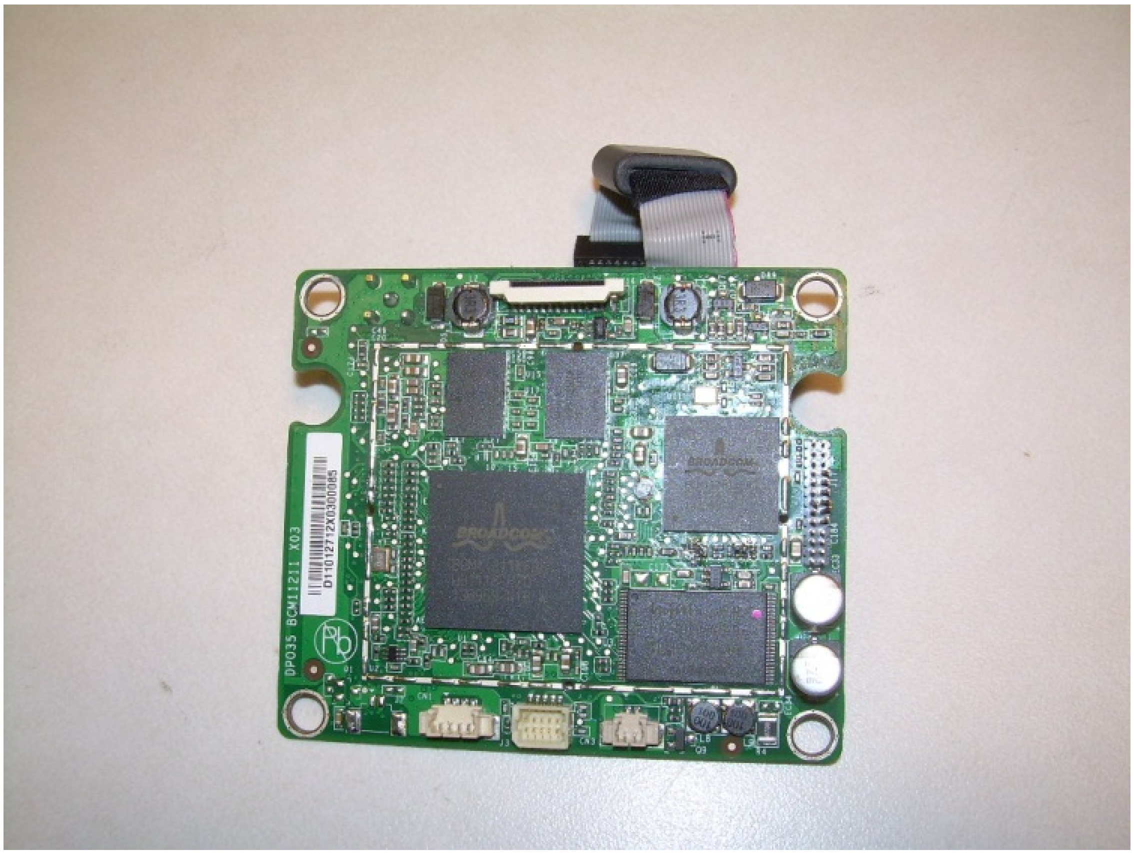
Photograph 18 – View of the Trace Side of the Power PCB



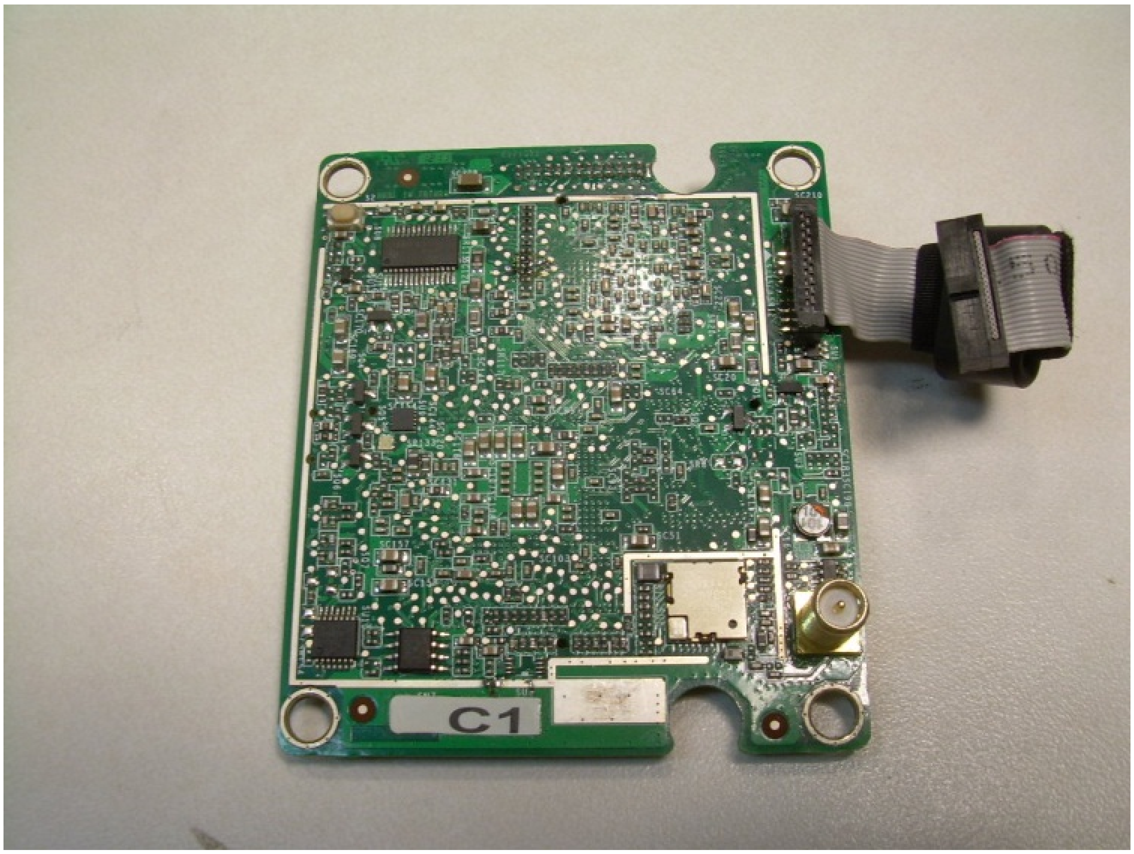
Photograph 19 – View of the EUT with Back Box and Power PCB Removed



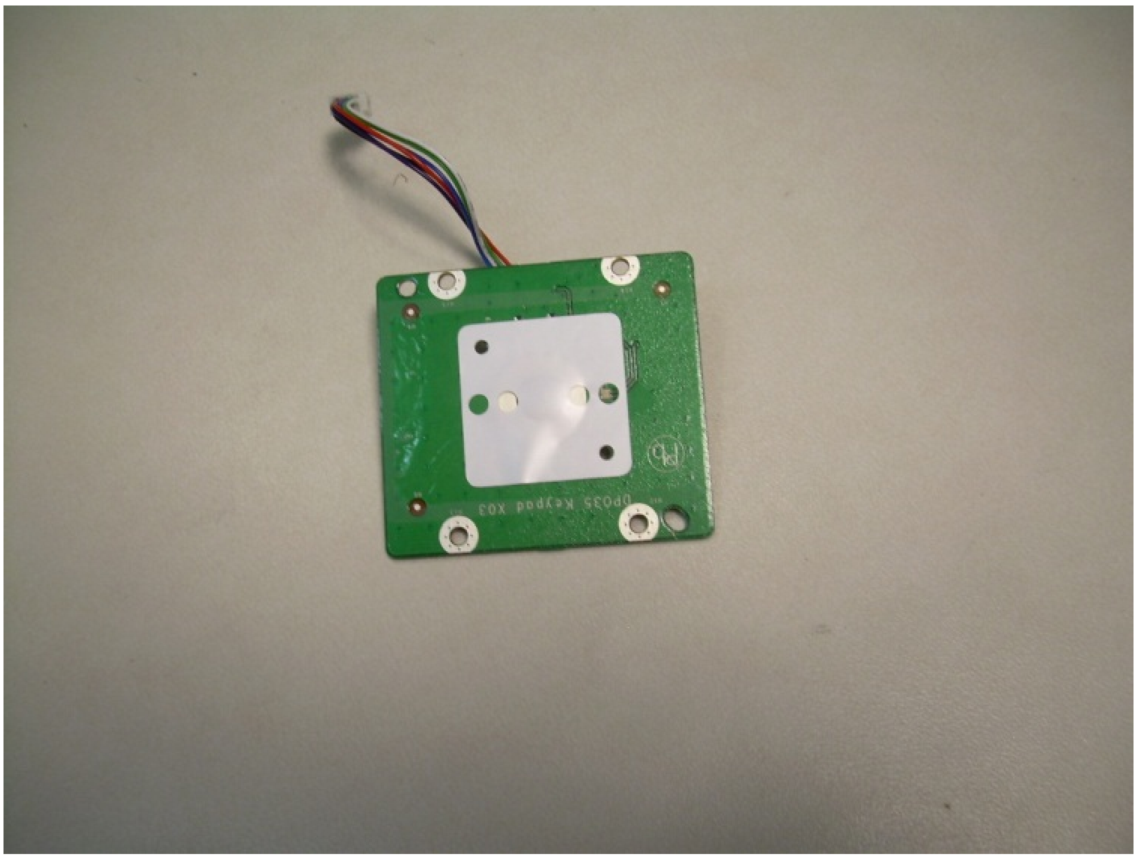
Photograph 20 – View of the Component Side of the Main/RF PCB



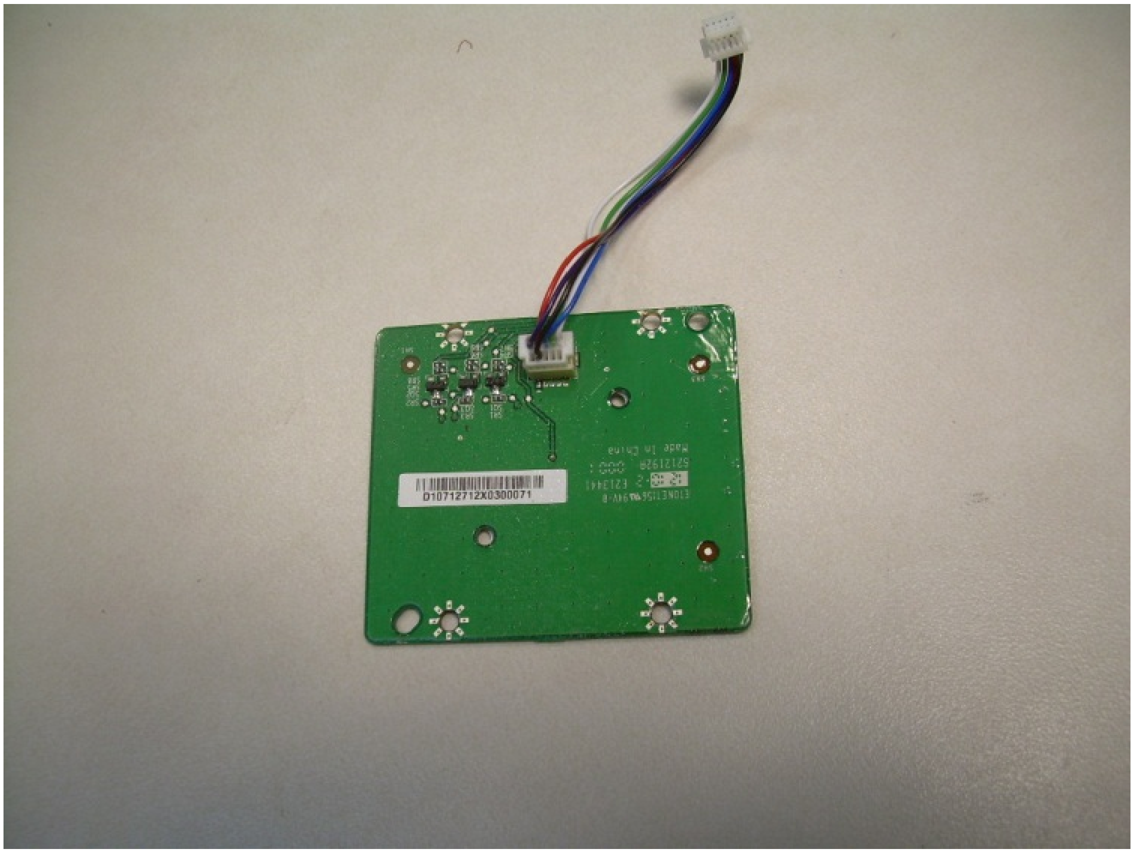
Photograph 21 – View of the Trace Side of the Main/RF PCB



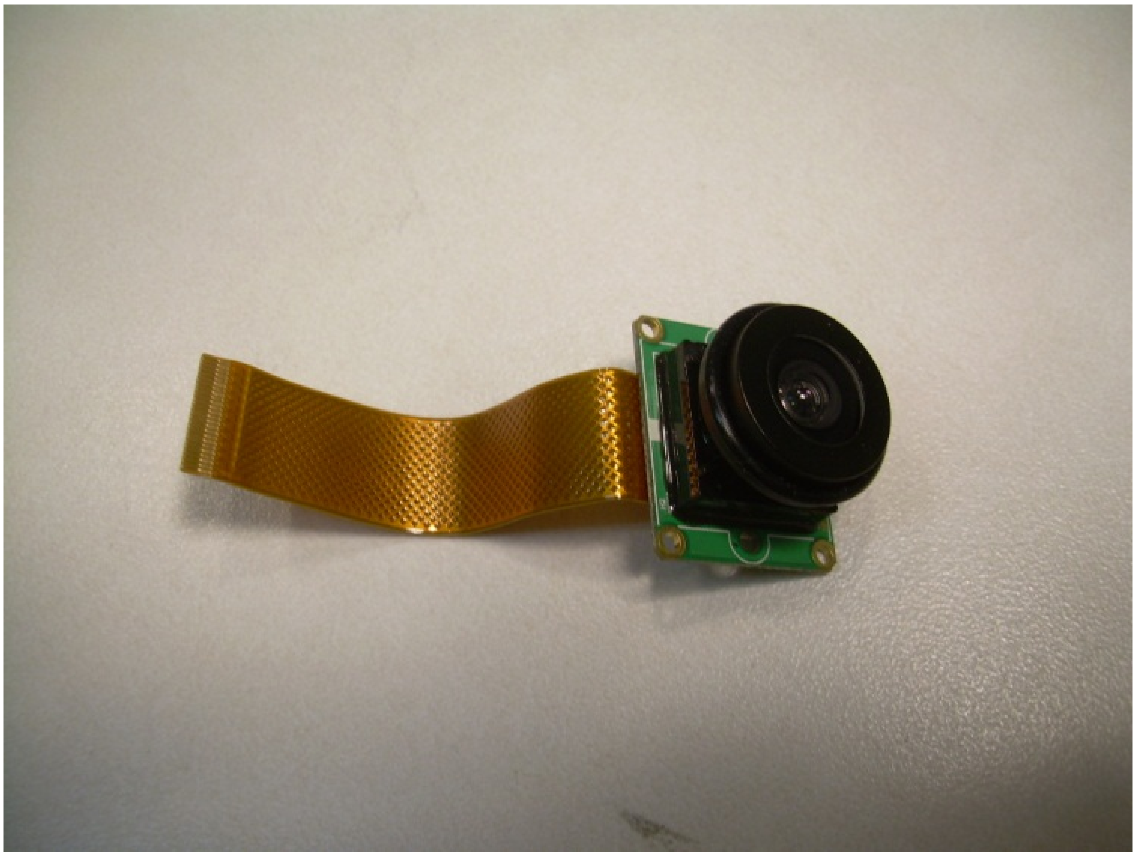
Photograph 22 – View of the Switch Side of the LED/Switch PCB



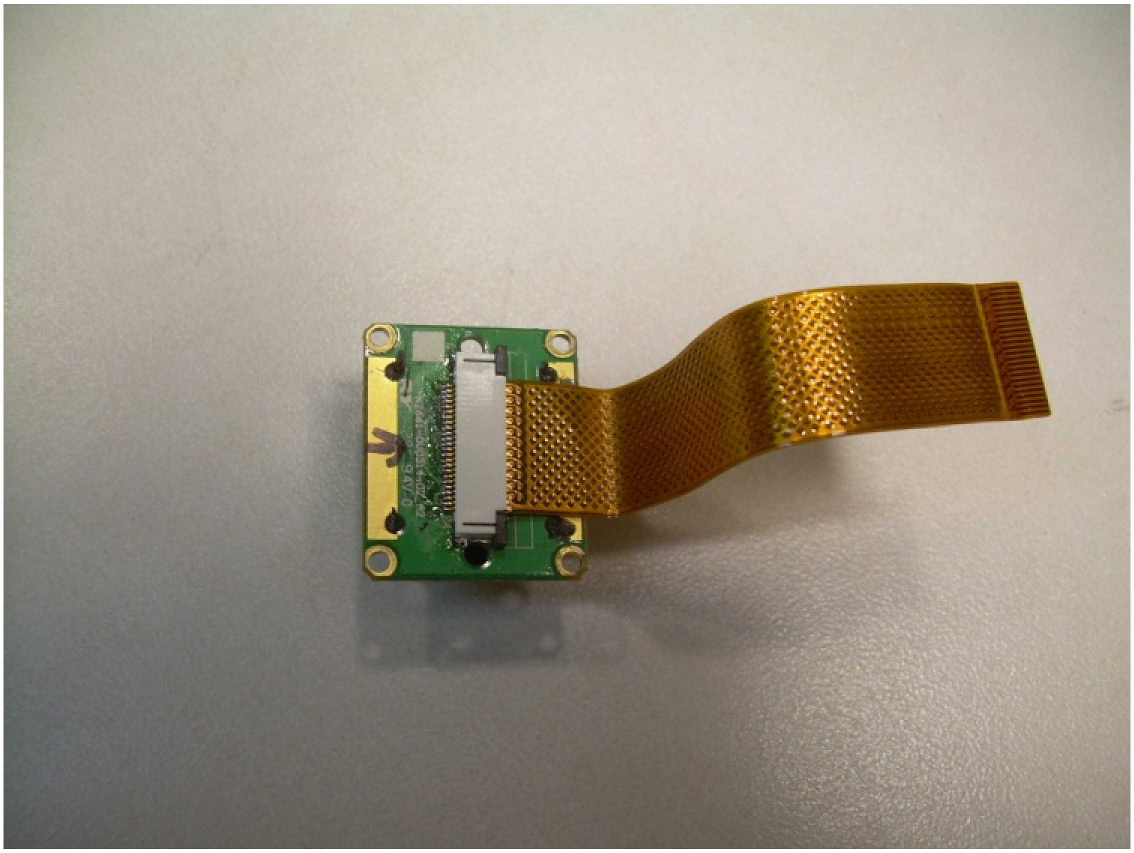
Photograph 23 – View of the Trace Side of the LED/Switch PCB



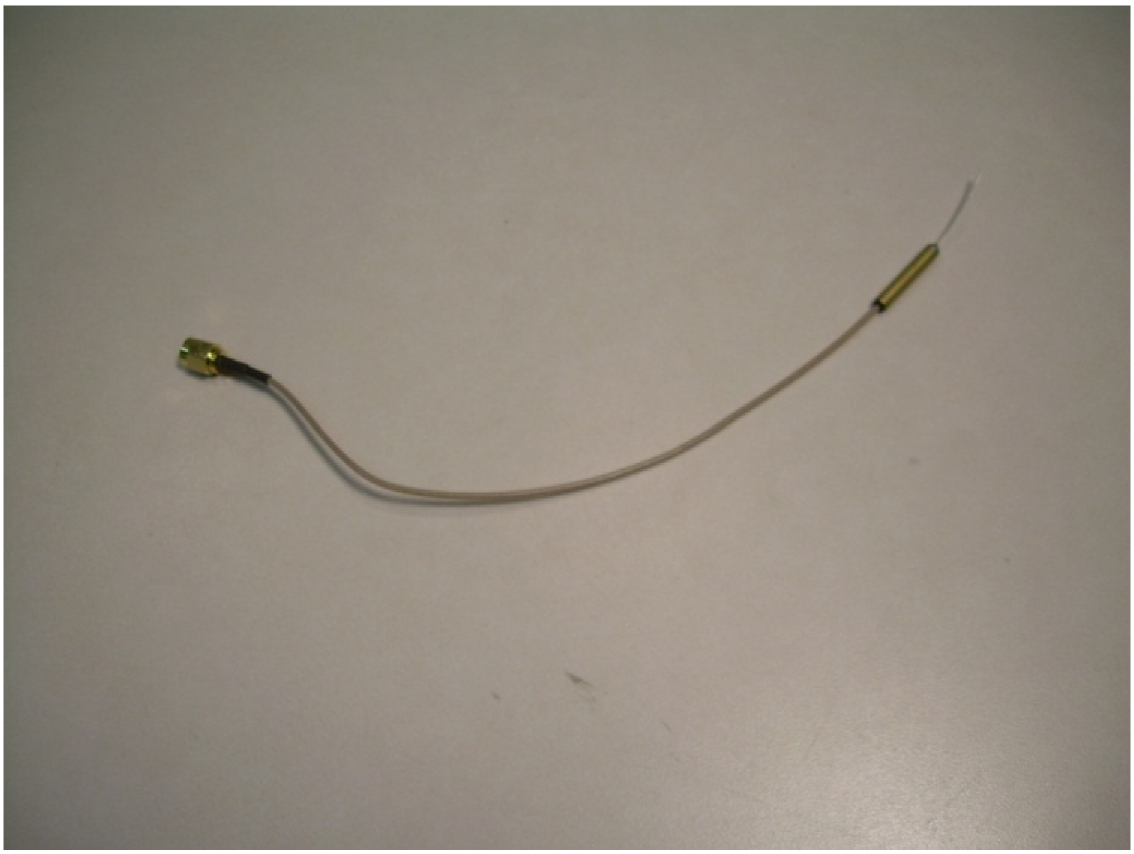
Photograph 24 – View of the Imager Side of the Camera PCB



Photograph 25 – View of the Trace Side of the Camera PCB



Photograph 26 – View of the Sleeve Antenna



Photograph 27 – View of the Patch Antenna