ENGINEERING TEST REPORT

Rugged Mobile Collaboration Device
Model No.: MCD2500n

FCC ID: T78-MCD2500

Applicant:

Librestream Technologies, Inc.
Suite 110, 895 Waverley Street
Winnipeg, MB R3T 5P4
Canada

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247 and Subpart E - U-NII

UltraTech's File No.: LIBT-049F15CE

This Test report is Issued under the Authority of
Tri M. Luu
Vice President of Engineering
UltraTech Group of Labs

Date: November 24, 2011

Report Prepared by: Dan Huynh	Tested by: Mr. Hung Trinh
Issued Date: November 24, 2011	Test Dates: October 11 ~ November 7, 2011

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com, Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com

FCC	VCCI	Industry Canada / Industrie Canada Approved Test Facility	NVLAP	BSMI	Korea KCC-RRL
91038	1309	46390-2049	NvLap Lab Code 200093-0	SL2-IN-E-1119R	CA2049

TABLE OF CONTENTS

EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247 and Subpart E –U-NII
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
Purpose of Test:	Application for equipment certification of Part 15 Spread Spectrum Transmitter, Digital Transmission System and Unlicensed National Information Infrastructure TX
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	[x] Commercial, industrial or business environment [ ] Residential environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2010	Code of Federal Regulations (CFR), Title 47 – Telecommunication
ANSI C63.4	2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Librestream Technologies, Inc.
Address:	Suite 110, 895 Waverley Street Winnipeg, MB R3T 5P4 Canada
Contact Person:	Mr. Gilles Aminot Phone #: 204-487-0612 ext 218 Fax #: 204-487-0914 Email Address: gilles.aminot@librestream.com

MANUFACTURER	
Name:	Librestream Technologies, Inc.
Address:	Suite 110, 895 Waverley Street Winnipeg, MB R3T 5P4 Canada
Contact Person:	Mr. Gilles Aminot Phone #: 204-487-0612 ext 218 Fax #: 204-487-0914 Email Address: gilles.aminot@librestream.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Librestream Onsight 2500R or Onsight 2500Ex
Product Name:	Rugged Mobile Collaboration Device
Model Name or Number:	MCD2500n
Serial Number:	Test Sample
Type of Equipment:	Digital Modulation Transmitter Part 15 Spread Spectrum Transmitter Unlicensed National Information Infrastructure TX
Input Power Supply Type:	External Power Supply, AC/DC adapter or Battery
Primary User Functions of EUT:	Wireless Video Streaming and Collaboration.

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER			
Equipment Type:	Portable		
Intended Operating Environment:	Commercial, industrial or business		
Power Supply Requirement:	**External Supply:** Min: ~10VDC Max 12VDC @ 1.5A External Power Supply Adapter: 120/230Vac 50/60Hz (AC/DC Adaptor) CUI Inc: Model EMSA120150-P5P-SZ **Battery Operation:** Min: ~6.1VDC Max: 8.4VDC		
RF Output Power Rating:	**802.11 a/b/g/n Radio:**	2412 - 2472 MHz:	802.11b: 15.15dBm 802.11g: 14.58dBm 802.11n: 14.87dBm
		5745 - 5825 MHz:	802.11a: 7.44dBm 802.11n: 8.00dBm
		5180 - 5240 MHz: 5260 - 5320 MHz: 5500 - 5700 MHz:	802.11a: 12.55dBm, 802.11n: 13.37dBm 802.11a: 13.49dBm, 802.11n: 13.67dBm 802.11a: 12.65dBm, 802.11n: 13.24dBm
	Bluetooth Radio:	2402 - 2480 MHz:	14.60dBm
Operating Frequency Range:	**802.11 a/b/g/n Radio:** 2412 - 2472 MHz, 5745 - 5825 MHz 5180 - 5240 MHz, 5260 - 5320 MHz 5500 - 5700 MHz **Bluetooth Radio:** 2402 - 2480 MHz		
RF Output Impedance:	50 Ohm		
Channel Spacing:	5 MHz and 20MHz (802.11a/b/g/n) 1 MHz (Bluetooth)		
Duty Cycle:	100 %		
Modulation Type:	**Redpine 802.11 Radio (FCC ID: XF6-RS9110N1103):** OFDM with BPSK, QPSK, 16-QAM, and 64-QAM 802.11b with CCK and DSSS **KwikBlue4 Bluetooth Radio (FCC ID: LUBBTM-4)** : Std data rate: • GFSK BbT = 0.5 EDR data rate • π/4 DQPSK (2Mbps) • 8DPSK (3Mbps)		

TRANSMITTER	
Oscillator Frequencies:	**Main PBCA:** 25.000 MHz, 32.758 kHz,19.2MHz, 27 MHz, 48.000 MHz, 8.000 MHz, 14.31818 MHz, 32.768KHz, 12.288 Mhz Main CPU (Internal Freq) 500MHz; SDRAM 250MHz **Redpine Radio Module**: 19.2 MHz, 20 MHz, 26 MHz, 38.4 MHz, 40 MHz, 52 MHz
Antenna Connector Type:	• Integral • Unique connector (U.FL)

2.4. ASSOCIATED ANTENNA DESCRIPTION

Antenna 1	
Manufacturer:	Centurion
Type:	Two - Internal Embedded (Integral)
Model:	Nano Blade Mini, Part #: MAF94264-B1
Frequency Range:	2.4 – 2.5 GHz 4.9 – 6.0 GHz
Gain (dBi):	2.0 – 2.5 dBi (2.4 – 2.5 GHz) 2.5 – 4.8 dBi (4.9 – 5.875 GHz)

Antenna 2	
Manufacturer:	Tyco
Type:	One - Integral
Model:	1513504-1
Frequency Range:	2400MHz – 2500MHz
Gain (dBi):	< 4 dBi

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Audio Line-in	1	2.5mm Jack	Shielded
2	Power	1	2.1mm x 5.5mm barrel	Non-shielded
3	S-Video	1	S-Video	Shielded
4	Ethernet	1	UTP, RJ45	Non-shielded
5	USB	1	USB-A	Shielded
6	Line/Mic In Audio	1	2.5mm Jack	Shielded

2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	AC/DC Adapter
Brand name:	V-Infinity
Model Name or Number:	EMSA120150
Serial Number:	N/A
Connected to EUT's Port:	Power

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	120 VAC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements.
Special Test Software:	Special software and hardware by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing.
Special Hardware Used:	None.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral / non-integral antenna equipment as described with the test results.

Transmitter Test Signals	**WLAN Module**	**Bluetooth Module**
Frequency Band(s):	2412 - 2462 MHz; 5745 - 5825 MHz; 5180 - 5240 MHz; 5260 - 5320 MHz; 5500 - 5700 MHz	2402 - 2480 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	2412 MHz, 2437 MHz and 2462 MHz 5745 MHz, 5785 MHz and 5825 MHz 5180 MHz, 5200 MHz and 5240 MHz 5260 MHz, 5300 MHz and 5320 MHz 5500 MHz, 5600 MHz and 5700 MHz	2402 MHz, 2441 MHz and 2480 MHz
RF Power Output: (measured maximum output power at antenna terminals)	802.11b: 15.29 dBm (2412 – 2462 MHz) 802.11g: 14.60 dBm (2412 – 2462 MHz) 802.11n: 14.88 dBm (2412 – 2462 MHz) 802.11a: 7.83 dBm (5745 – 5825 MHz) 802.11n: 7.97dBm (5745 – 5825 MHz) 802.11a: 13.69 dBm (5180 – 5240 MHz) 802.11n: 13.45 dBm (5180 – 5240 MHz) 802.11a: 13.78 dBm (5260 – 5320 MHz) 802.11n: 13.76 dBm (5260 – 5320 MHz) 802.11a: 13.31 dBm (5500 - 5700 MHz) 802.11n: 13.24 dBm (5500 - 5700 MHz)	14.47 dBm (2402 – 2480 MHz)
Normal Test Modulation:	802.11 a/b/g/n	GFSK, π/4 DQPSK, 8DPSK
Modulating Signal Source:	Internal	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

4.2.1. WLAN Module

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	See Note 1
15.207(a)	AC Power Line Conducted Emissions	Yes
15.247(a)(2)	6 dB Bandwidth	See Note 2
15.247(b)(3)	Peak Conducted Output Power - DTS	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(e)	Power Spectral Density	See Note 2
15.407 (a)	99% And 26 dB Occupied Bandwidth	See Note 2
15.407 (a)	Maximum Conducted Output Power	Yes
15.407 (a)	Power Spectral Density	See Note 2
15.407 (a)	Peak Excursion	See Note 2
15.407 (b)	Unwanted emission	Yes
15.247(i), 15.407(f), 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure	See SAR Test Report
15.407(f)	Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS).	Yes

Note 1: The EUT complies with the requirement, it employs an integrated antenna or unique (non-standard) antenna connector.
Note 2: Refer to original module test report.

4.2.2. Bluetooth Module

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	See Note 1
15.207(a)	AC Power Line Conducted Emissions	Yes
15.247(a)(1)	Provisions for Frequency Hopping Systems	See Note 2
15.247(b)	Peak Conducted Output Power	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	See Note 2
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(i) 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure	Yes

Note 1: The EUT complies with the requirement, it employs an integrated antenna or unique (non-standard) antenna connector.
Note 2: Refer to original module test report.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

The following was made for compliance:

The RF absorber shall be installed on top of RF board section.

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.10.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.
Refer to Exhibit 7 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER

Wireless video streaming and collaboration.

5.5. PEAK CONDUCTED OUTPUT POWER [§§ 15.247(b)(1) & (3), 15.407(a)(1), (2) & (3)]

5.5.1. Limit(s)

§ 15.247(b)(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.

§ 15.247(b)(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 one Watt limit can be based on a measurement of the maximum conducted output power. Maximum 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.

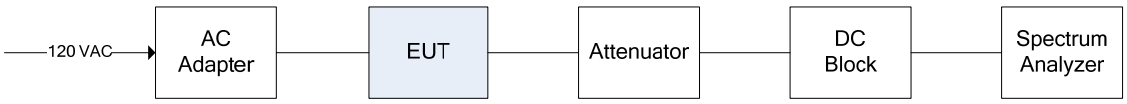
§15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output 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.

See §15.407(a)(1), (2) & (3)

5.5.2. Method of Measurements & Test Arrangement

ANSI C63.10, Section 6.10.2.

5.5.2.1. Test Arrangement



5.5.3. Test Data

5.5.3.1. FCC Part 15, Subpart C – 15.247 DTS

Test Method: Channel Power Output (Option 2 Method # 1)

802.11b mode (2412 – 2462 MHz band), rating: 0.0327 W, 15.15 dBm				
Data Rate 11 (CCK)	TX gain value setting	Power Conducted (dBm)		
		2412 MHz (CH1)	2437 MHz (CH6)	2462 MHz (CH11)
ANT # 1 (J4)	55	15.26	15.29	14.13
ANT # 2 (J3)	54	15.21	14.78	13.51

802.11g mode (2412 – 2462 MHz band), rating: 0.0287 W, 14.58 dBm				
Data Rate 54 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		2412 MHz (CH1)	2437 MHz (CH6)	2462 MHz (CH11)
ANT # 1 (J4)	60	14.54	14.60	13.30
ANT # 2 (J3)	59	14.49	14.08	12.83

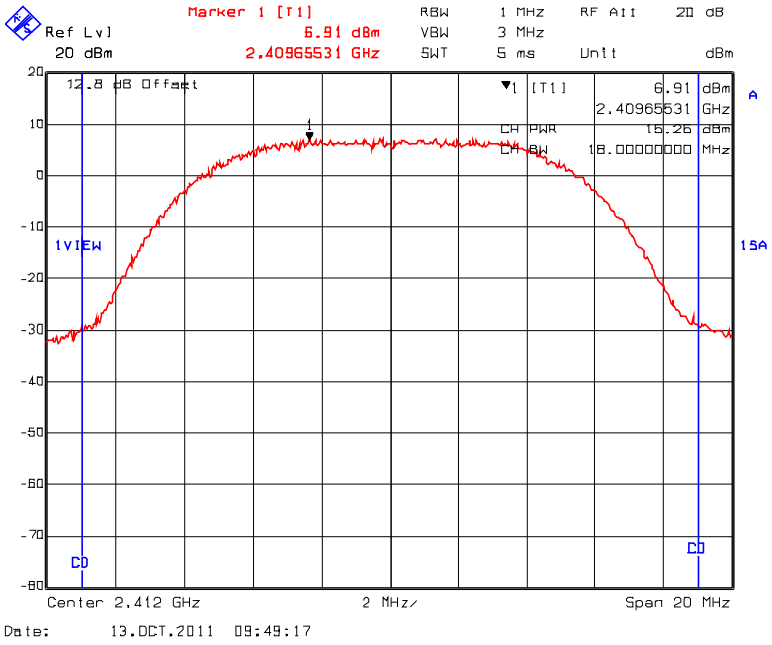
802.11n mode (2412 – 2462 MHz band), rating: 0.0287 W, 14.87dBm				
Data Rate MCS7 65 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		2412 MHz (CH1)	2437 MHz (CH6)	2462 MHz (CH11)
ANT # 1 (J4)	61	14.85	14.88	13.75
ANT # 2 (J3)	60	14.74	14.27	12.94

802.11a mode (5745 – 5825 MHz band), rating: 0.0063 W, 7.99 dBm				
Data Rate 54 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		5745 MHz (CH149)	5785 MHz (CH157)	5825 MHz (CH165)
ANT # 1 (J4)	54	7.83	7.12	6.34
ANT # 2 (J3)	57	7.71	6.49	5.17

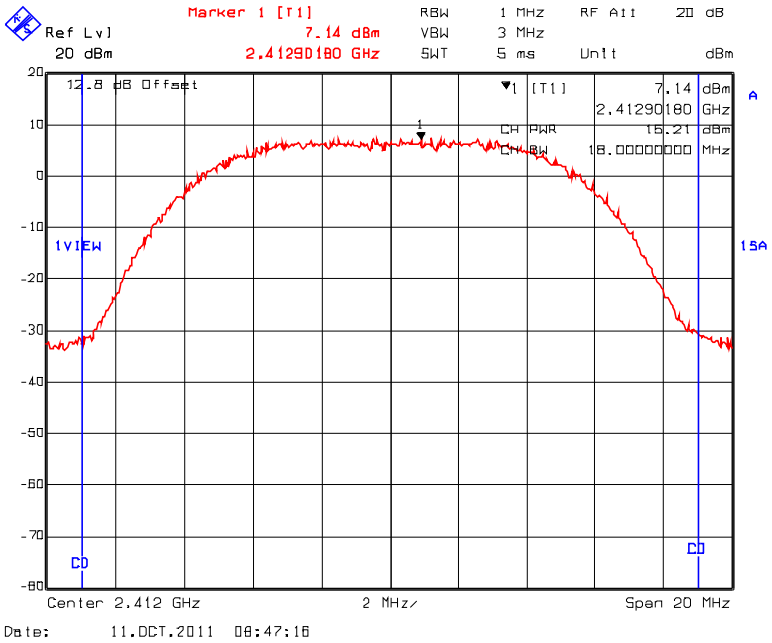
802.11n mode (5745 – 5825 MHz band), rating: 0.0063 W, 7.99 dBm				
Data Rate MCS7 65 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		5745 MHz (CH149)	5785 MHz (CH157)	5825 MHz (CH165)
ANT # 1 (J4)	53	7.71	7.04	6.42
ANT # 2 (J3)	57	7.97	6.61	5.37

See the following for test data plots:

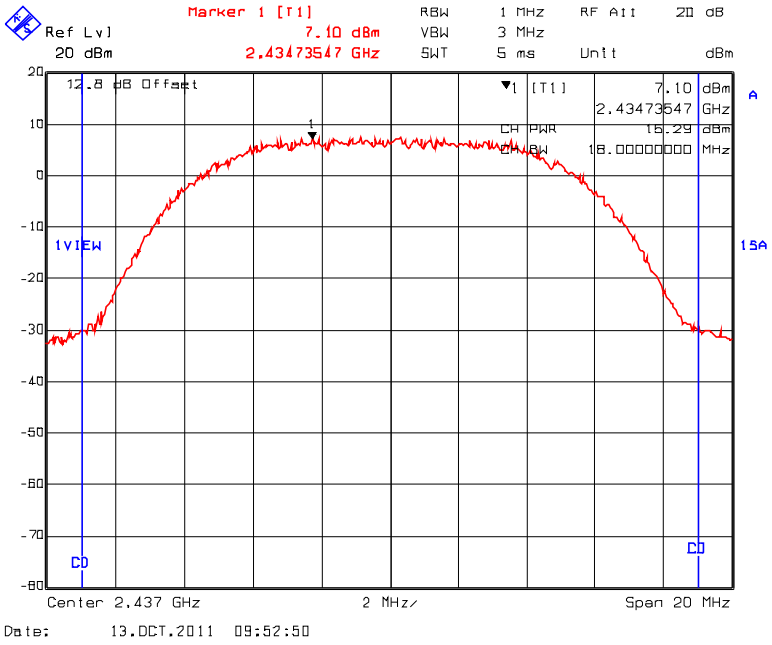
Plot 5.5.3.1.1. Peak Conducted Output Power, 802.11b Mode, CCK 11 Mbps, Antenna 1 (J4), Setting 55, 15.26dBm
Test Frequency: 2412 MHz



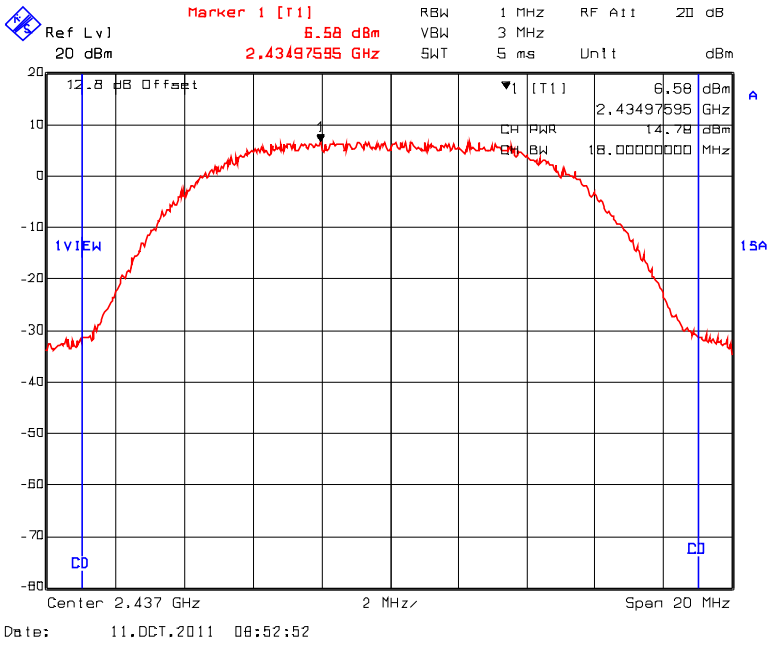
Plot 5.5.3.1.2. Peak Conducted Output Power, 802.11b Mode, CCK 11 Mbps, Antenna 2 (J3), Setting 54, 15.21dBm
Test Frequency: 2412 MHz



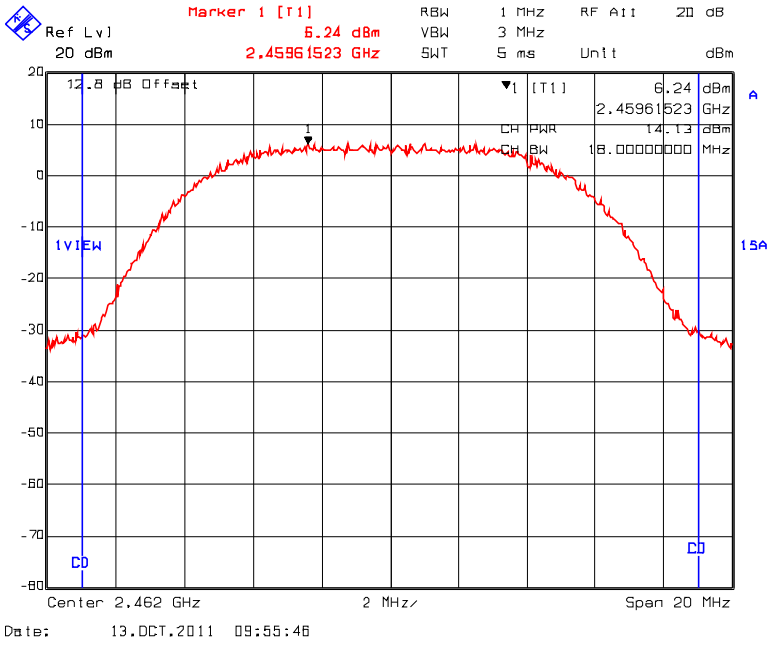
Plot 5.5.3.1.3. Peak Conducted Output Power, 802.11b Mode, CCK 11 Mbps, Antenna 1 (J4), Setting 55, 15.29dBm
Test Frequency: 2437 MHz



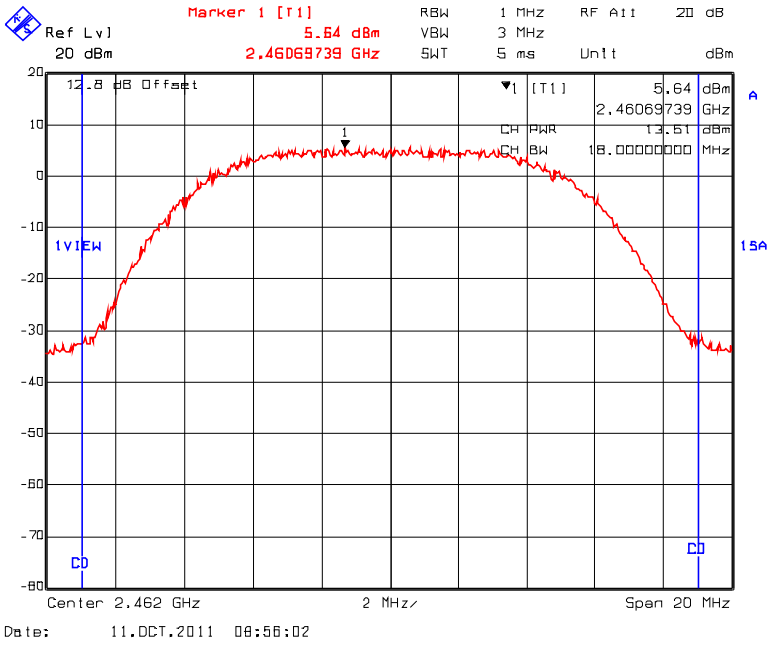
Plot 5.5.3.1.4. Peak Conducted Output Power, 802.11b Mode, CCK 11 Mbps, Antenna 2 (J3), Setting 54, 14.78dBm
Test Frequency: 2437 MHz



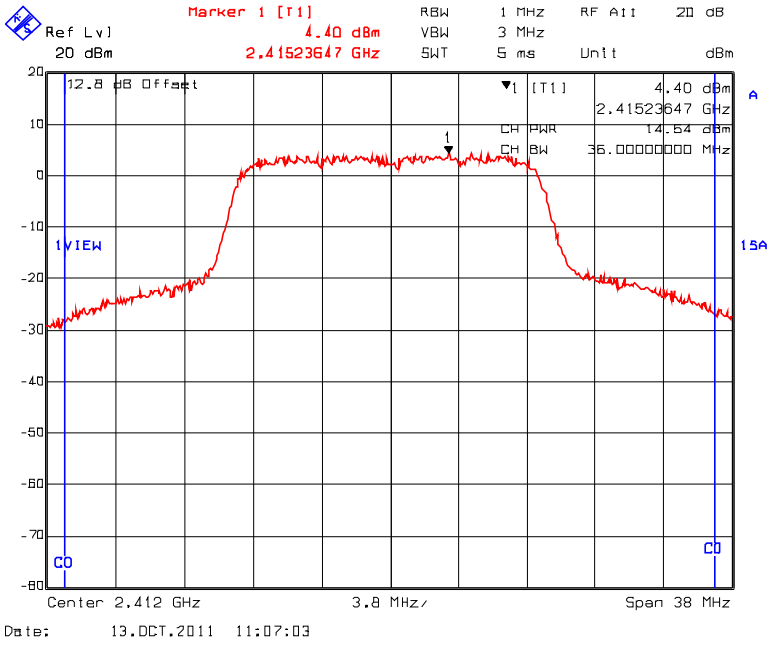
Plot 5.5.3.1.5. Peak Conducted Output Power, 802.11b Mode, CCK 11 Mbps, Antenna 1 (J4), Setting 55, 14.13 dBm
Test Frequency: 2462 MHz



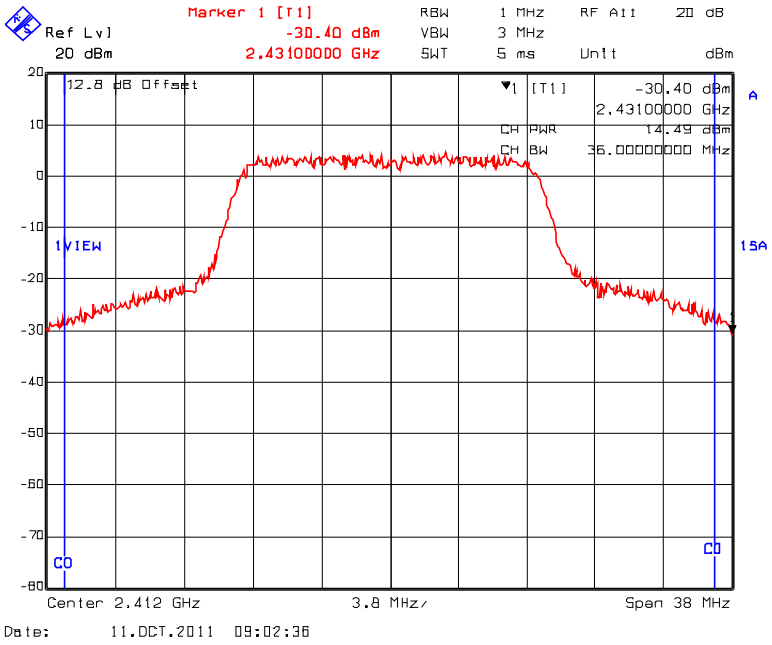
Plot 5.5.3.1.6. Peak Conducted Output Power, 802.11b Mode, CCK 11 Mbps, Antenna 2 (J3), Setting 54, 13.51 dBm
Test Frequency: 2462 MHz



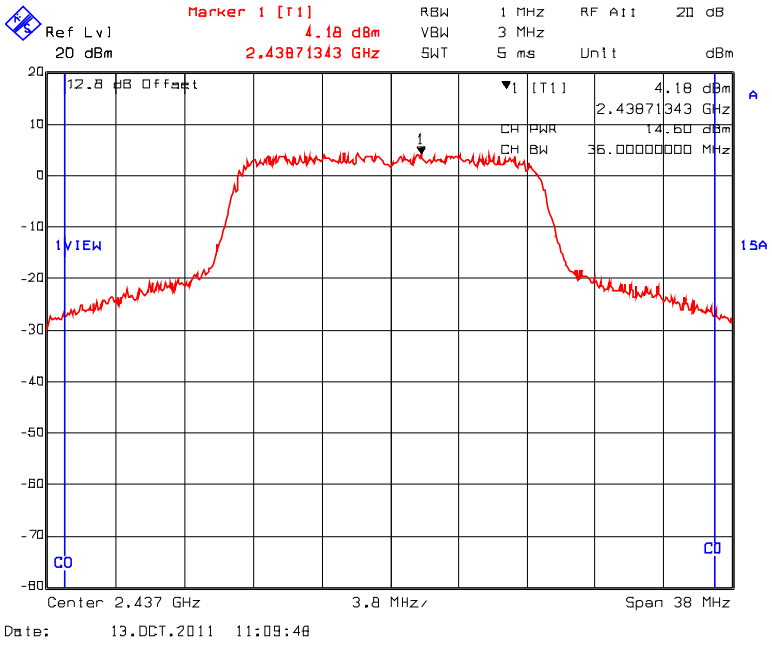
Plot 5.5.3.1.7. Peak Conducted Output Power, 802.11g Mode, 64QAM 54 Mbps, Antenna 1 (J4), Setting 60, 14.54 dBm
Test Frequency: 2412 MHz



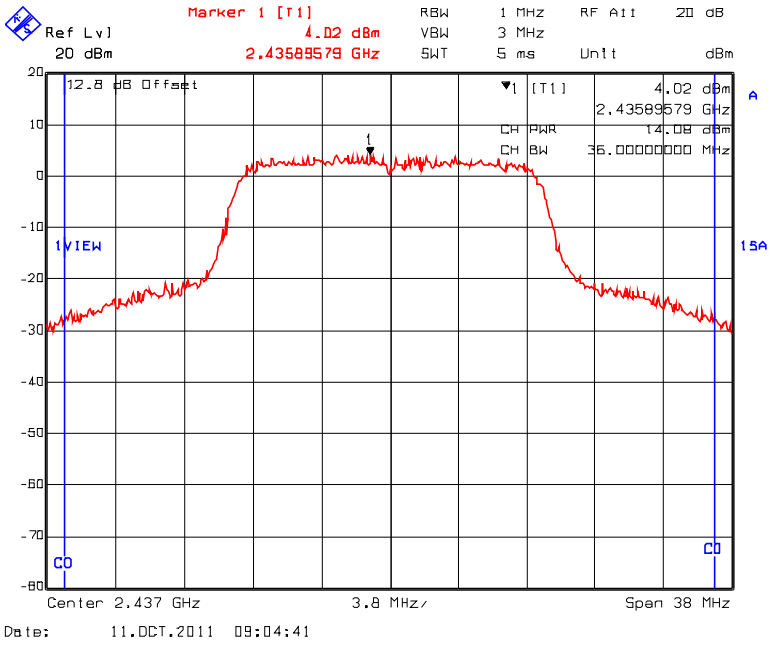
Plot 5.5.3.1.8. Peak Conducted Output Power, 802.11g Mode, 64QAM 54 Mbps, Antenna 2 (J3), Setting 59, 14.49 dBm
Test Frequency: 2412 MHz



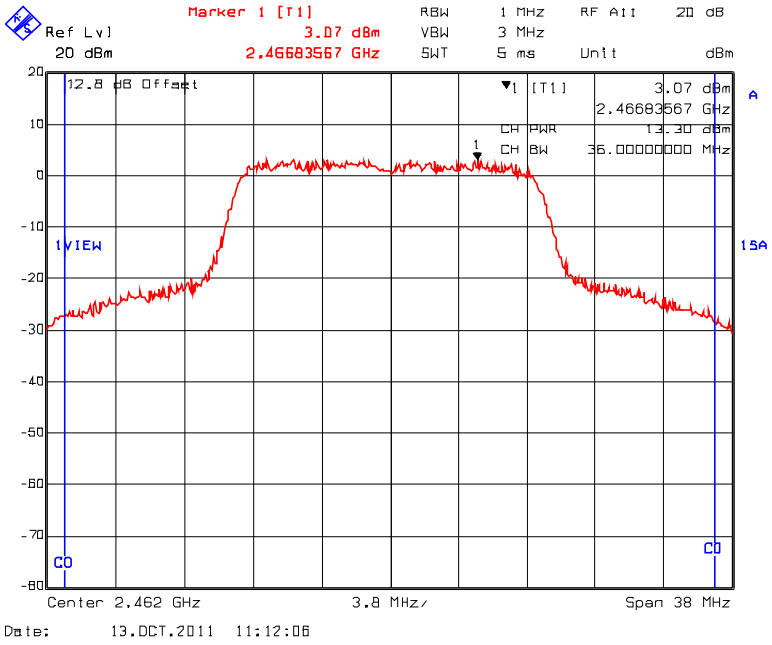
Plot 5.5.3.1.9. Peak Conducted Output Power, 802.11g Mode, 64QAM 54 Mbps, Antenna 1 (J4), Setting 60, 14.60 dBm
Test Frequency: 2437 MHz



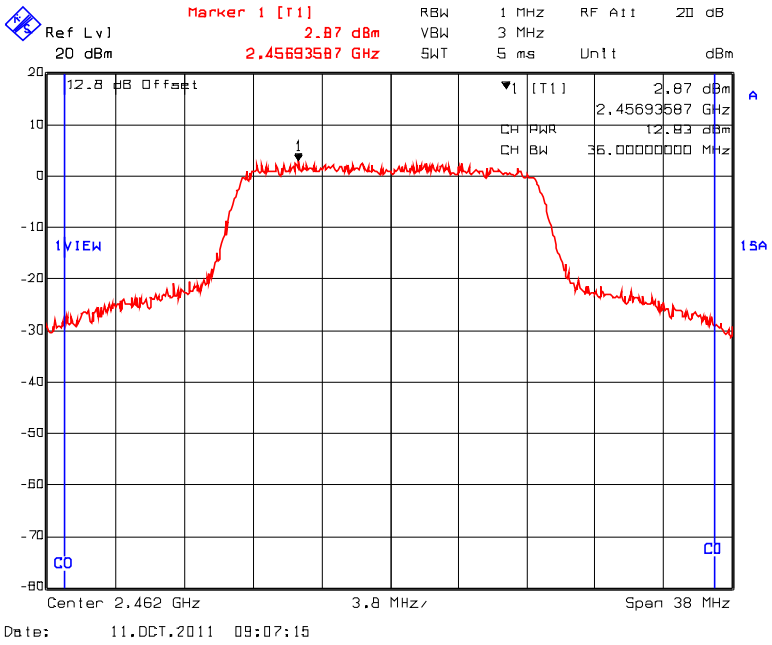
Plot 5.5.3.1.10. Peak Conducted Output Power, 802.11g Mode, 64QAM 54 Mbps, Antenna 2 (J3), Setting 59, 14.08 dBm
Test Frequency: 2437 MHz



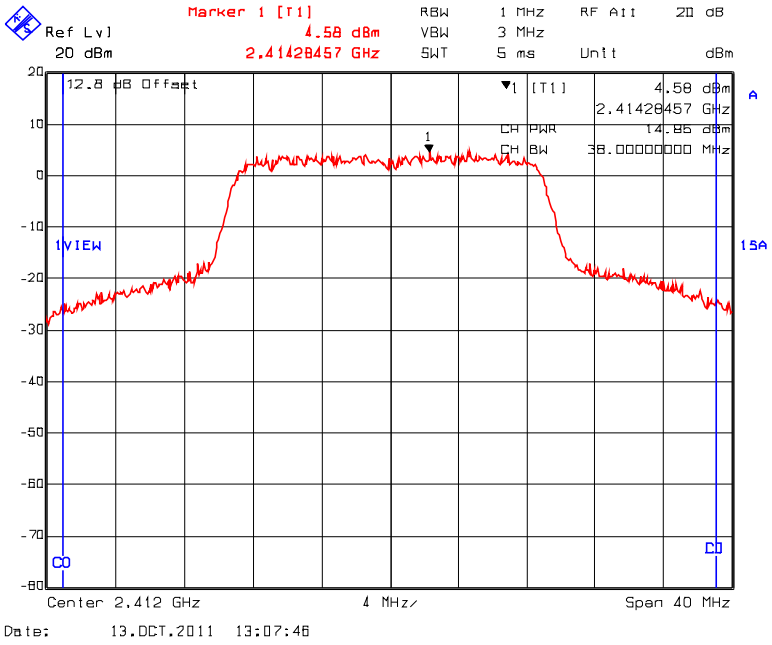
Plot 5.5.3.1.11. Peak Conducted Output Power, 802.11g Mode, 64QAM 54 Mbps, Antenna 1 (J4), Setting 60, 13.30 dBm
Test Frequency: 2462 MHz



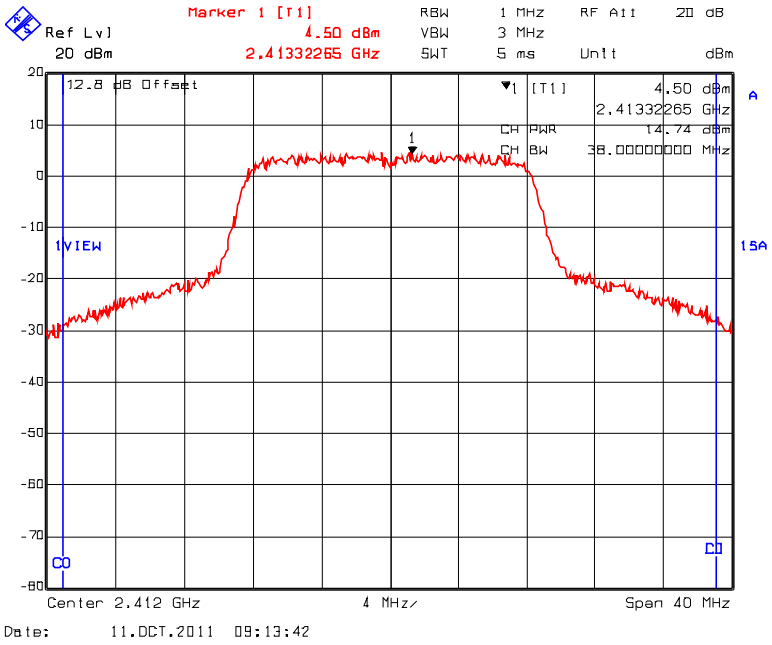
Plot 5.5.3.1.12. Peak Conducted Output Power, 802.11g Mode, 64QAM 54 Mbps, Antenna 2 (J3), Setting 59, 12.83 dBm
Test Frequency: 2462 MHz



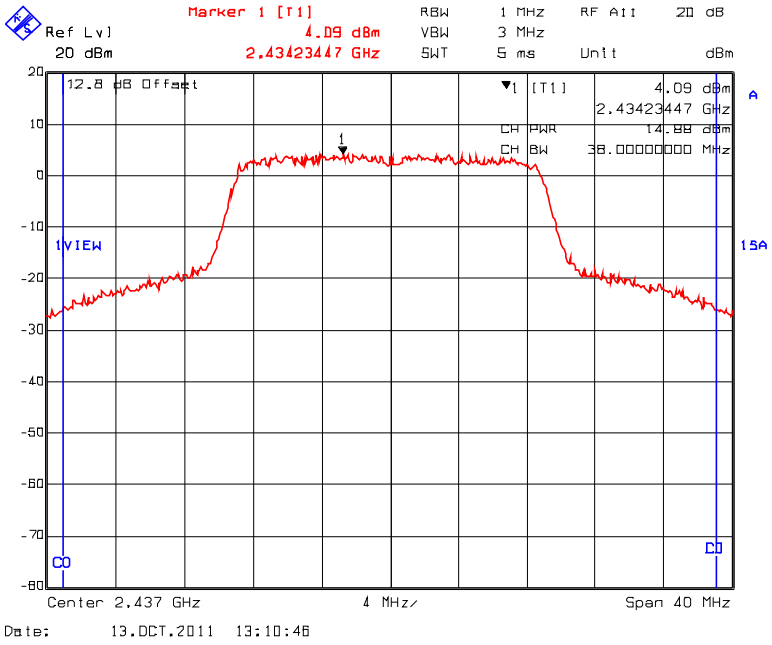
Plot 5.5.3.1.13. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 1 (J4), Setting 61, 14.85 dBm
Test Frequency: 2412 MHz



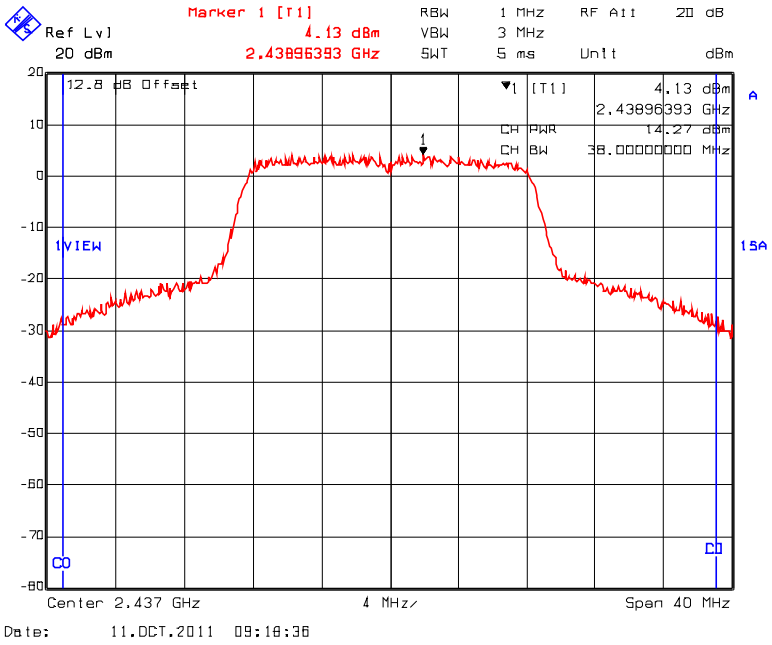
Plot 5.5.3.1.14. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 2 (J3), Setting 60, 14.74 dBm
Test Frequency: 2412 MHz



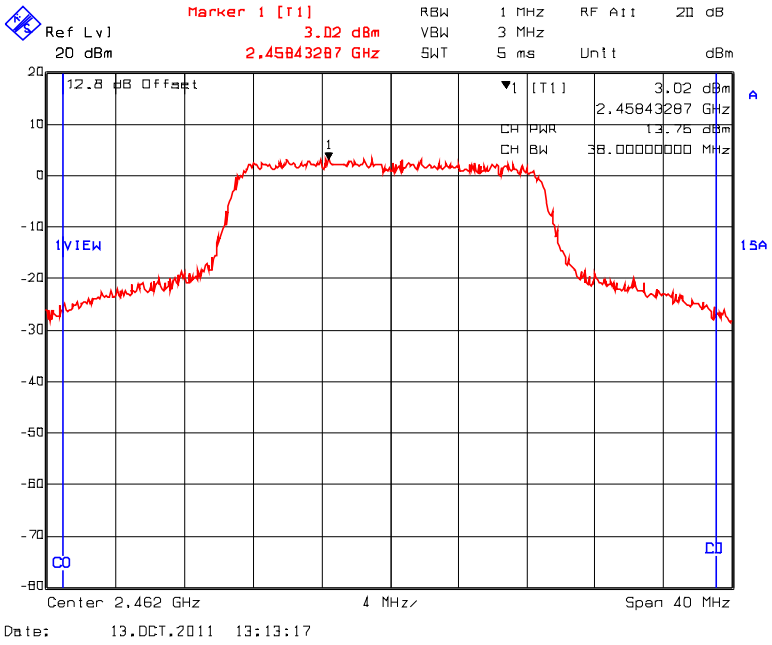
Plot 5.5.3.1.15. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 1 (J4), Setting 61, 14.88 dBm
Test Frequency: 2437 MHz



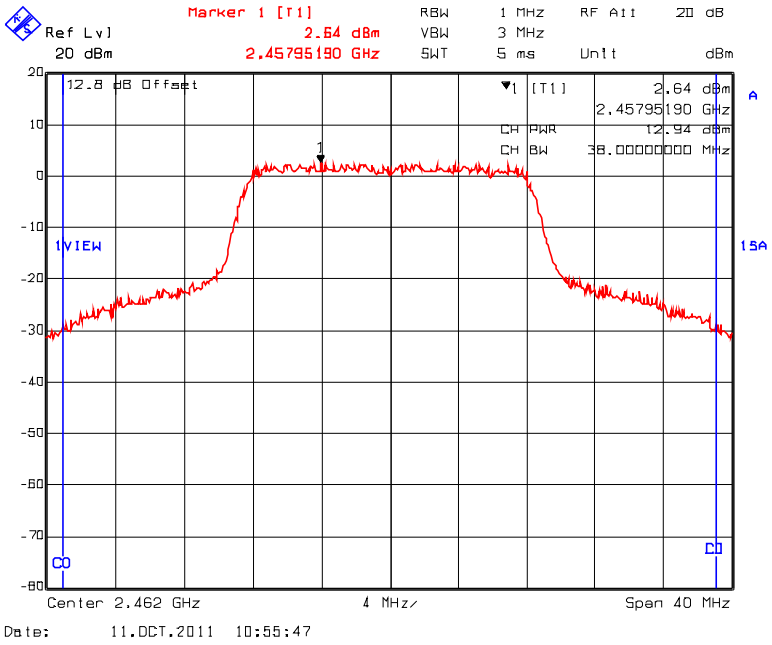
Plot 5.5.3.1.16. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 2 (J3), Setting 60, 14.27 dBm
Test Frequency: 2437 MHz



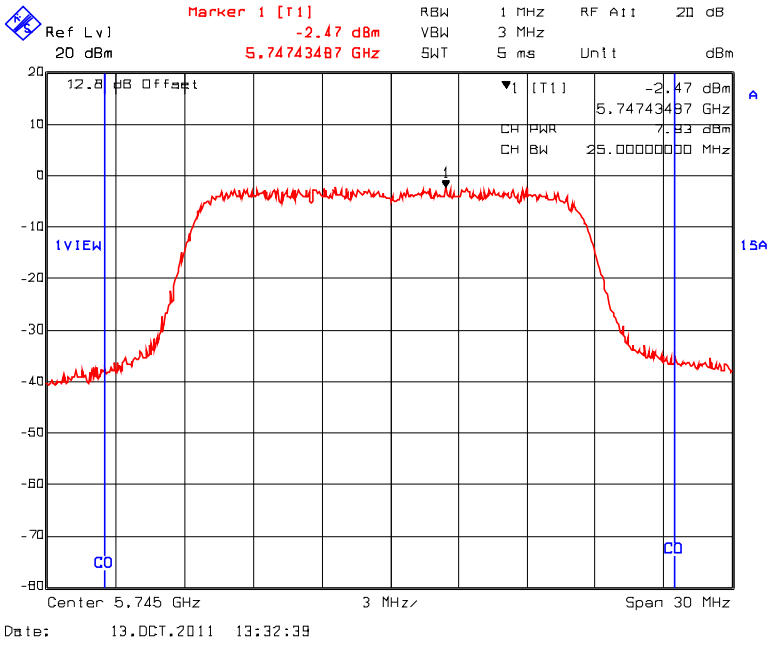
Plot 5.5.3.1.17. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 1 (J4), Setting 61, 13.75 dBm
Test Frequency: 2462 MHz



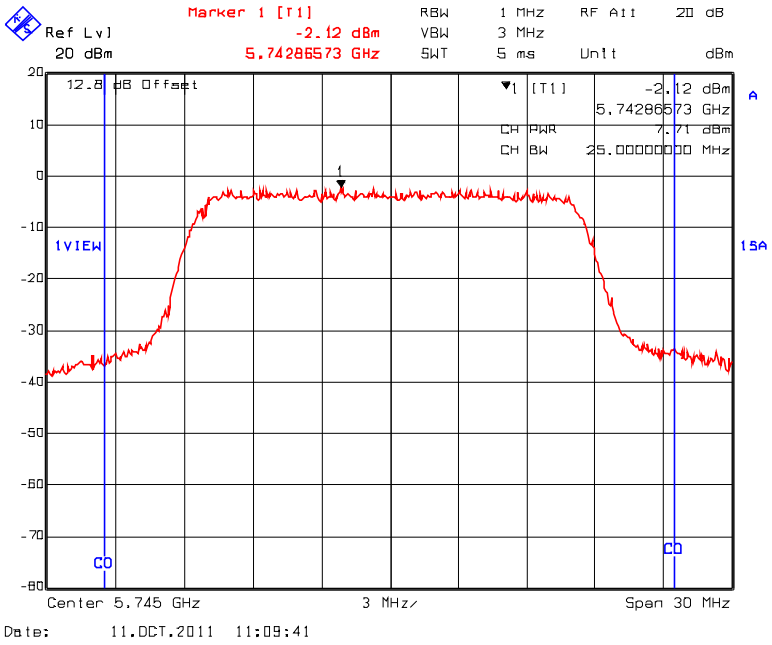
Plot 5.5.3.1.18. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 2 (J3), Setting 60, 12.94 dBm
Test Frequency: 2462 MHz



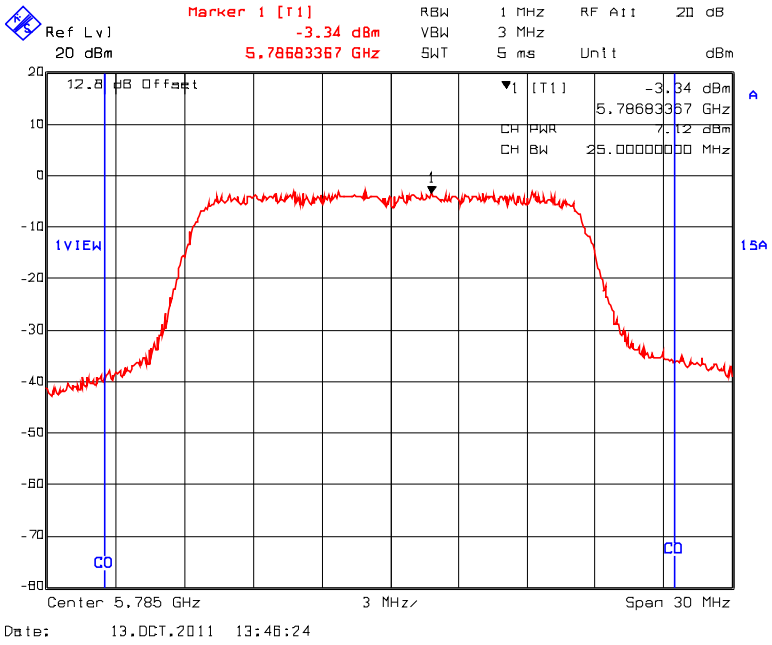
Plot 5.5.3.1.19. Peak Conducted Output Power, 802.11a Mode, 64QAM 54 Mbps, Antenna 1 (J4), Setting 54, 7.83 dBm
Test Frequency: 5745 MHz



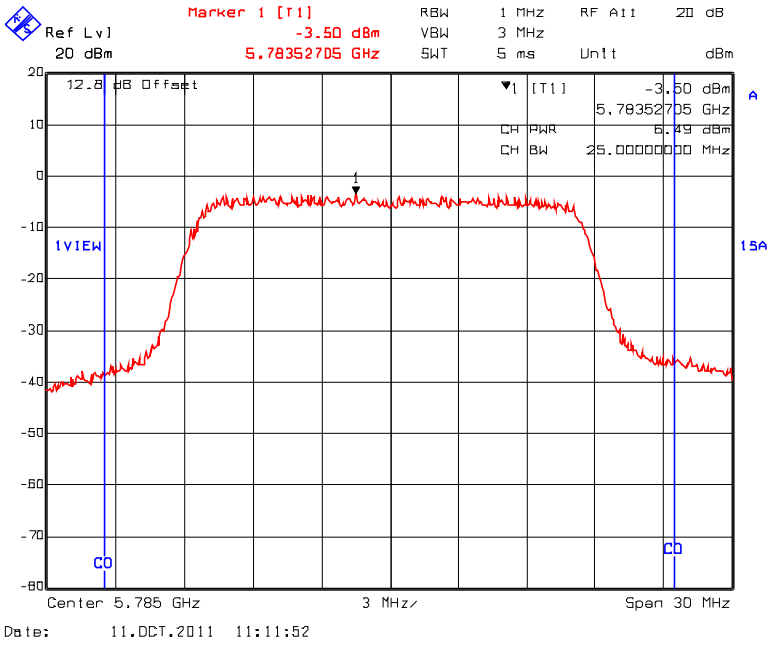
Plot 5.5.3.1.20. Peak Conducted Output Power, 802.11a Mode, 64QAM 54 Mbps, Antenna 2 (J3), Setting 57, 7.71 dBm
Test Frequency: 5745 MHz



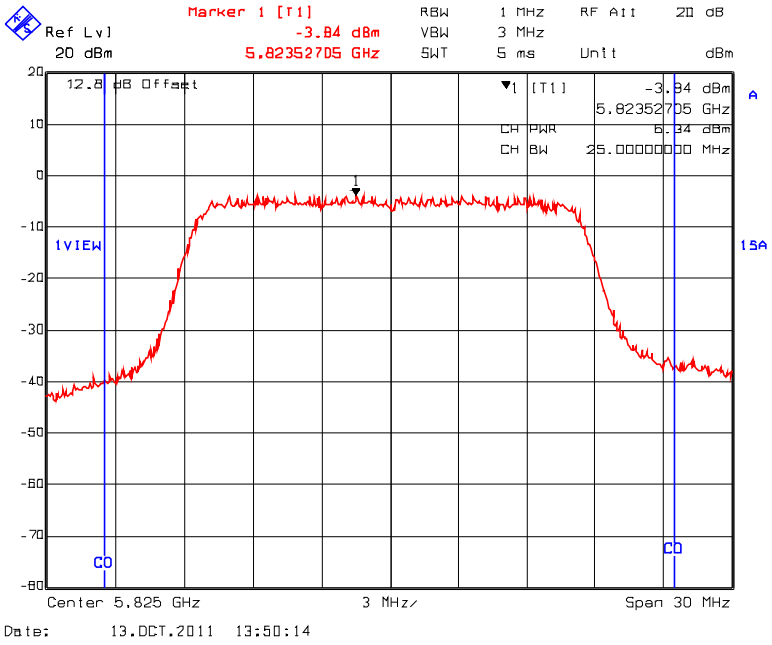
Plot 5.5.3.1.21. Peak Conducted Output Power, 802.11a Mode, 64QAM 54 Mbps, Antenna 1 (J4), Setting 54, 7.12 dBm
Test Frequency: 5785 MHz



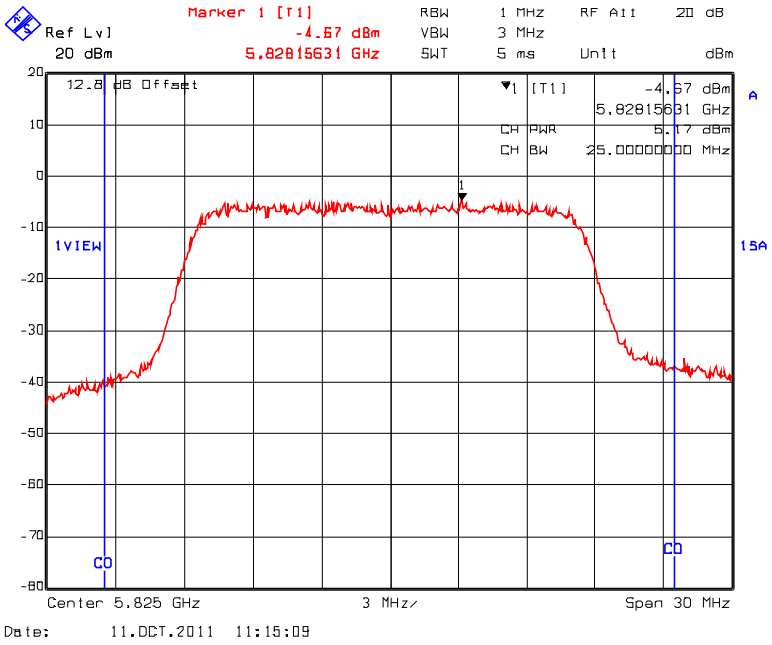
Plot 5.5.3.1.22. Peak Conducted Output Power, 802.11a Mode, 64QAM 54 Mbps, Antenna 2 (J3), Setting 57, 6.49 dBm
Test Frequency: 5785 MHz



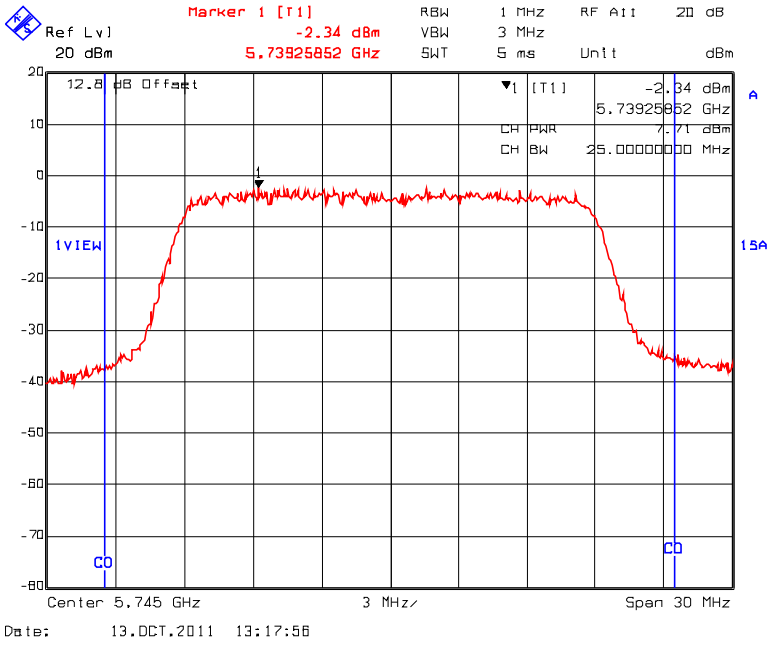
Plot 5.5.3.1.23. Peak Conducted Output Power, 802.11a Mode, 64QAM 54 Mbps, Antenna 1 (J4), Setting 54, 6.34 dBm
Test Frequency: 5825 MHz



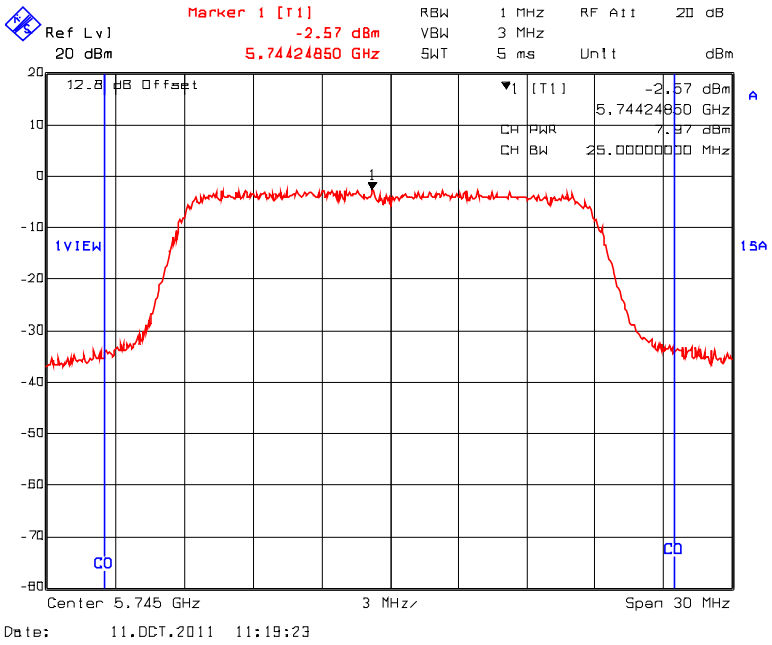
Plot 5.5.3.1.24. Peak Conducted Output Power, 802.11a Mode, 64QAM 54 Mbps, Antenna 2 (J3), Setting 57, 5.17 dBm
Test Frequency: 5825 MHz



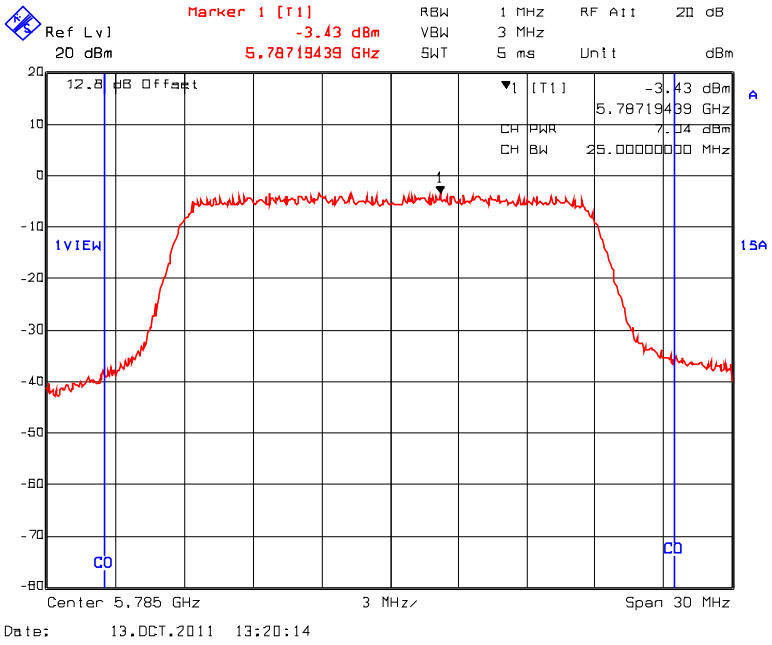
Plot 5.5.3.1.25. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 1 (J4), Setting 53, 7.71 dBm
Test Frequency: 5745 MHz



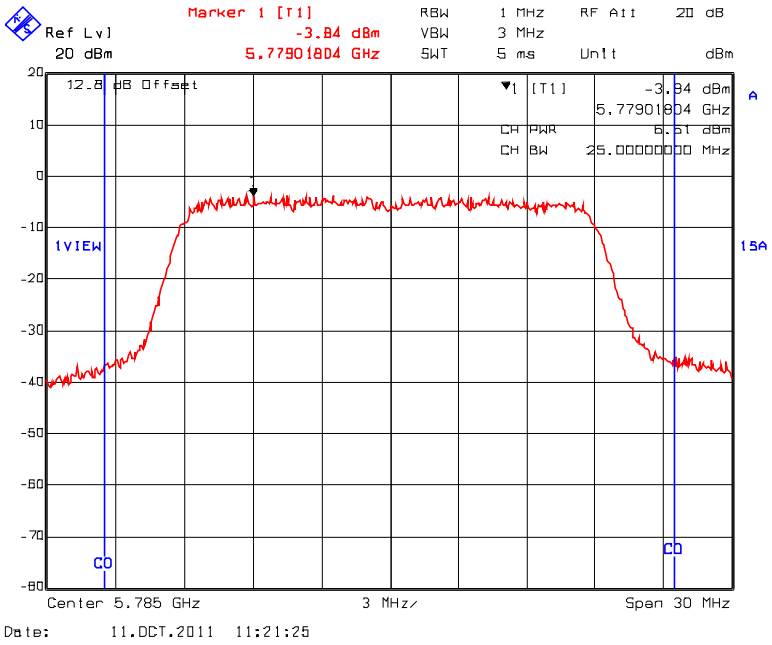
Plot 5.5.3.1.26. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 2 (J3), Setting 57, 7.97 dBm
Test Frequency: 5745 MHz



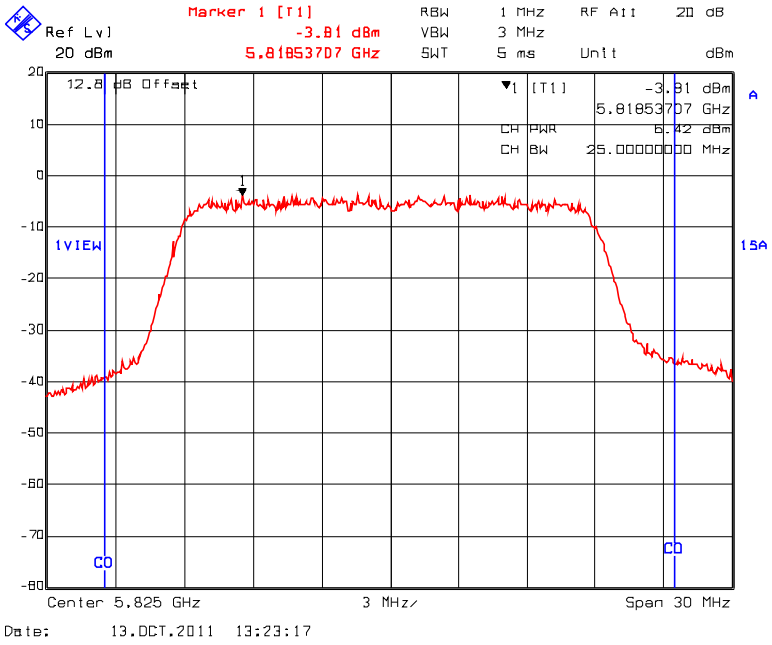
Plot 5.5.3.1.27. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 1 (J4), Setting 53, 7.04 dBm
Test Frequency: 5785 MHz



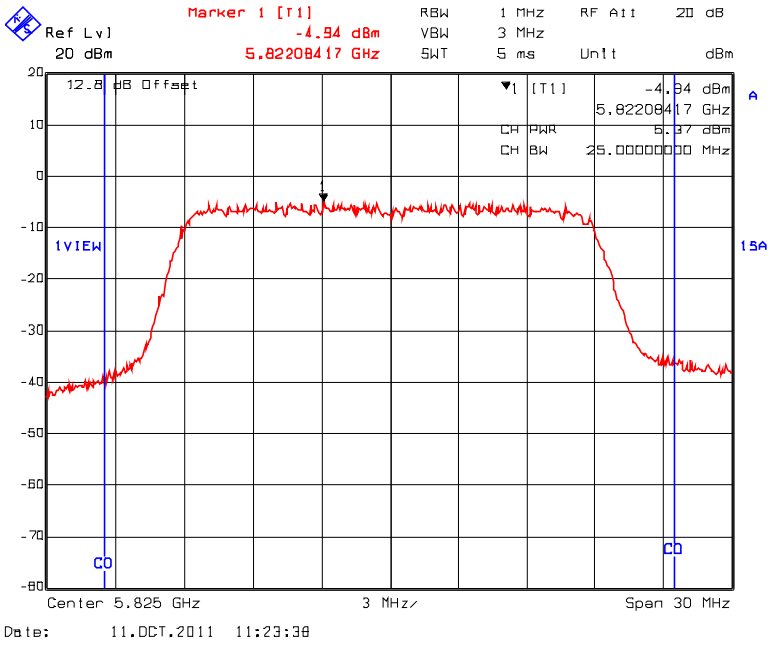
Plot 5.5.3.1.28. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 2 (J3), Setting 57, 6.61 dBm
Test Frequency: 5785 MHz



Plot 5.5.3.1.29. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 1 (J4), Setting 53, 6.42 dBm
Test Frequency: 5825 MHz



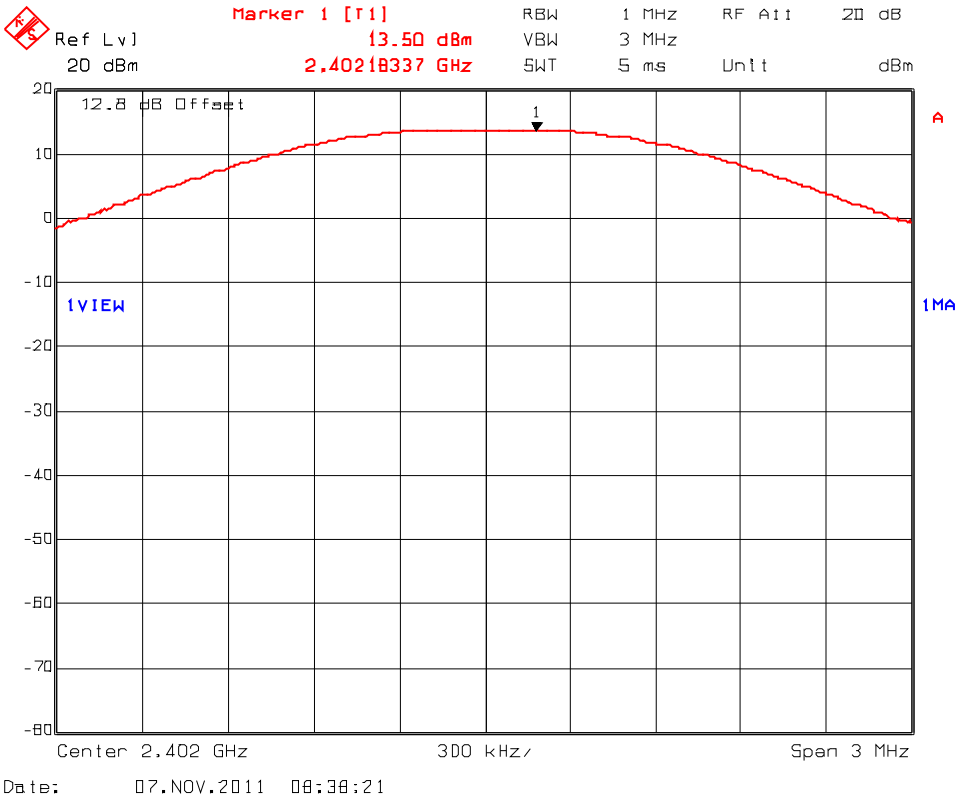
Plot 5.5.3.1.30. Peak Conducted Output Power, 802.11n Mode, 64QAM 65 Mbps, Antenna 2 (J3), Setting 57, 5.37 dBm
Test Frequency: 5825 MHz



5.5.3.2. FCC Part 15, Subpart C – 15.247 Bluetooth (2402 – 2480 MHz)

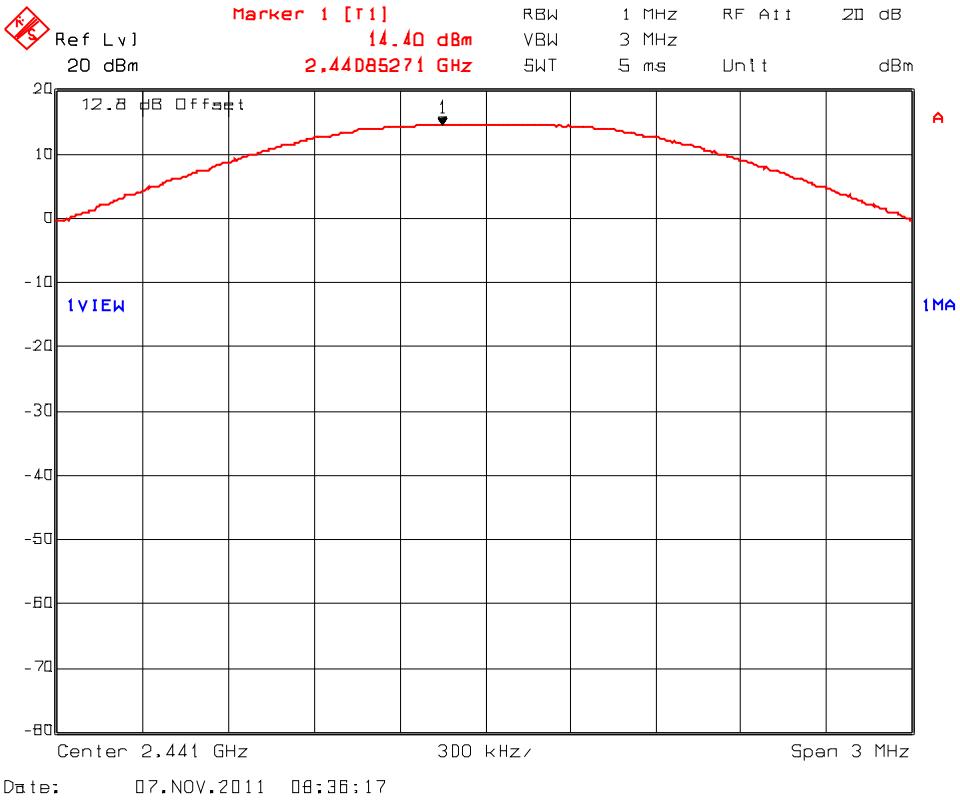
Frequency (MHz)	Peak Conducted Power dBm)	Peak Conducted Power Limit (dBm)
2402	13.50	30
2441	14.40	30
2480	14.47	30

Plot 5.5.3.2.1. Peak Conducted Output Power, Parameter 2 setting 64046, Modulation: TXData1
Test Frequency: 2402 MHz

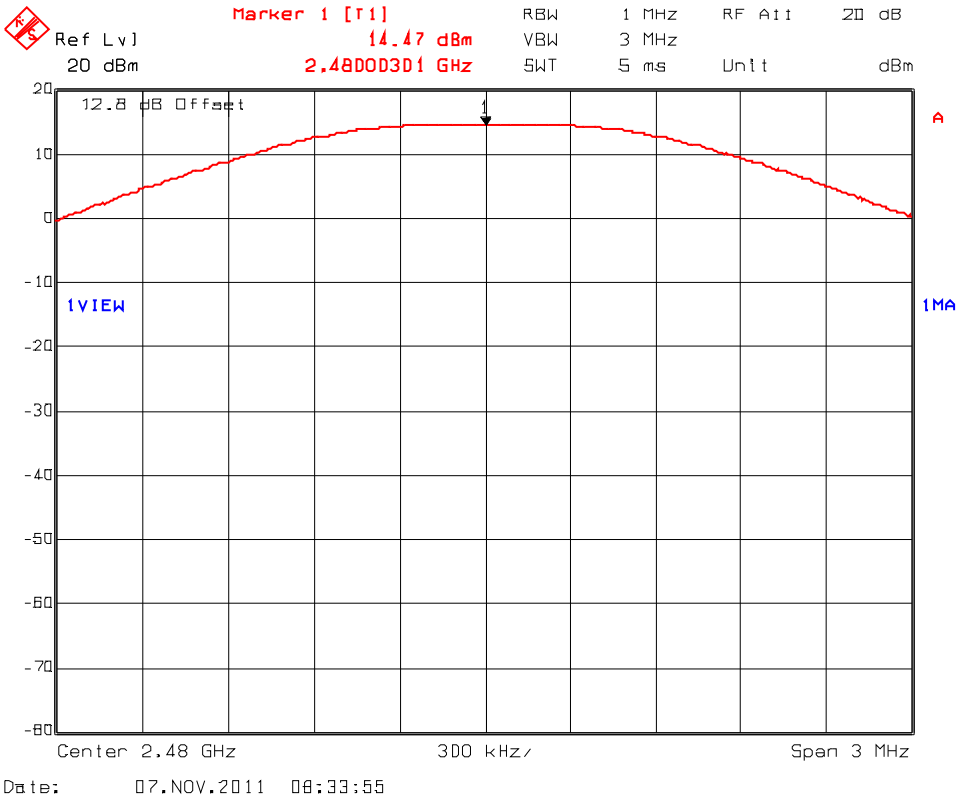


All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 5.5.3.2.2. Peak Conducted Output Power, Parameter 2 setting 64046, Modulation: TXData1
Test Frequency: 2441 MHz



Plot 5.5.3.2.3. Peak Conducted Output Power, Parameter 2 setting 64046, Modulation: TXData1
Test Frequency: 2480 MHz



5.5.3.3. FCC Part 15, Subpart E – 15.401

Test Method: Channel Power Output (Method # 1)

802.11a mode (5150 – 5250 MHz band), rating 0.0217 W, 13.36 dBm				
Data Rate 54 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		5180 MHz (CH36)	5200 MHz (CH40)	5240 MHz (CH48)
ANT # 1 (J4)	54	13.31	13.46	13.19
ANT # 2 (J3)	57	13.32	13.69	13.58

802.11n mode (5150 – 5250 MHz band) , rating 0.0217W, 13.36dBm				
Data Rate MCS7 65 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		5180 MHz (CH36)	5200 MHz (CH40)	5240 MHz (CH48)
ANT # 1 (J4)	53	13.37	13.45	13.21
ANT # 2 (J3)	55	13.01	13.22	13.32

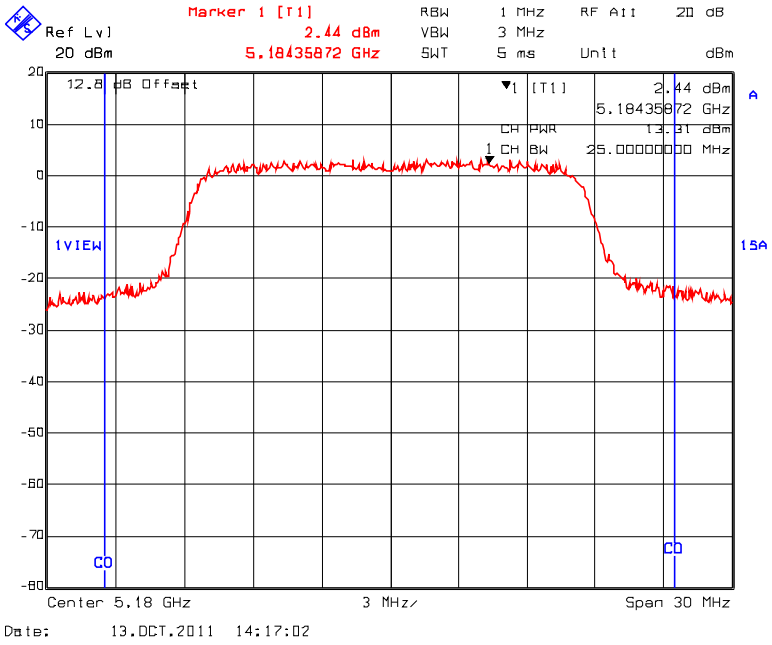
802.11a mode (5250 – 5350 MHz band) , rating 0.0233W, 13.67dBm				
Data Rate 54 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		5260 MHz (CH52)	5300 MHz (CH60)	5320 MHz (CH64)
ANT # 1 (J4)	55	13.21	13.54	13.78
ANT # 2 (J3)	56	13.60	13.51	13.51

802.11n mode (5250 – 5350 MHz band) , rating 0.0233W, 13.67dBm				
Data Rate MCS7 65 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		5260 MHz (CH52)	5300 MHz (CH60)	5320 MHz (CH64)
ANT # 1 (J4)	54	13.15	13.61	13.76
ANT # 2 (J3)	56	13.70	13.66	13.55

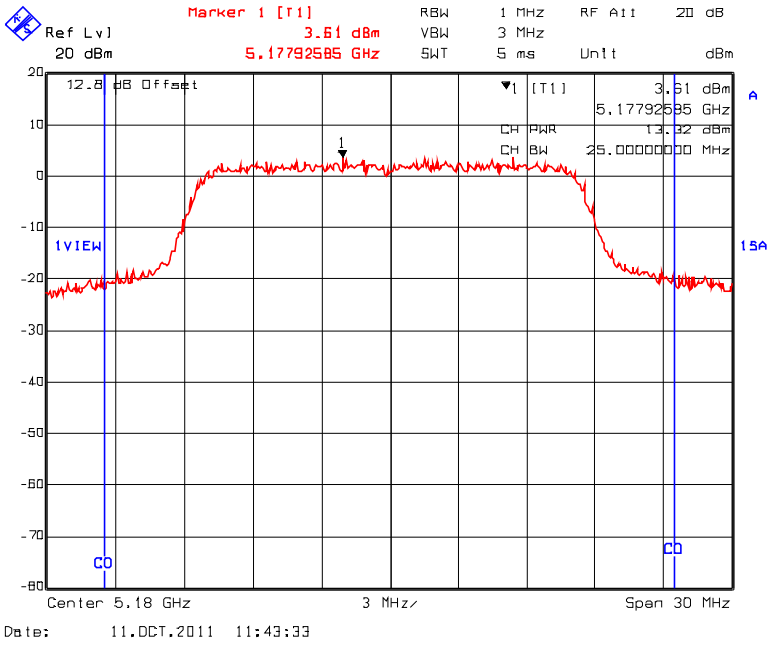
802.11a mode (5470 – 5725 MHz band) , rating 0.021 W, 13.24 dBm				
Data Rate 54 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		5500 MHz (CH100)	5600 MHz (CH120)	5700 MHz (CH140)
ANT # 1 (J4)	50	13.31	12.29	9.07
ANT # 2 (J3)	59	13.24	11.33	9.68

802.11n mode (5470 – 5725 MHz band) , rating 0.0211W, 13.24dBm				
Data Rate MCS7 65 (64QAM)	TX gain value setting	Power Conducted (dBm)		
		5500 MHz (CH100)	5600 MHz (CH120)	5700 MHz (CH140)
ANT # 1 (J4)	52	13.15	12.18	9.03
ANT # 2 (J3)	58	13.24	11.66	9.43

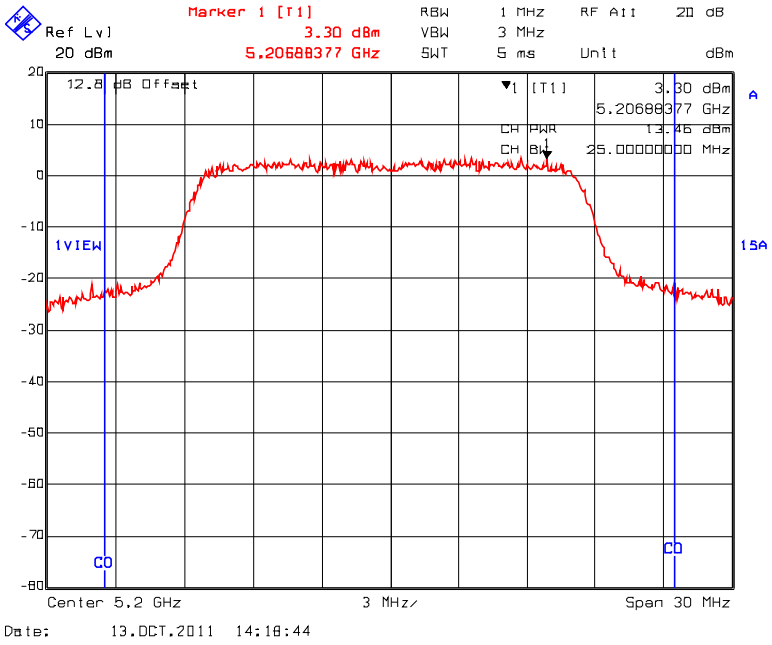
Plot 5.5.3.3.1. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 54, 13.31 dBm
Test Frequency: 5180 MHz



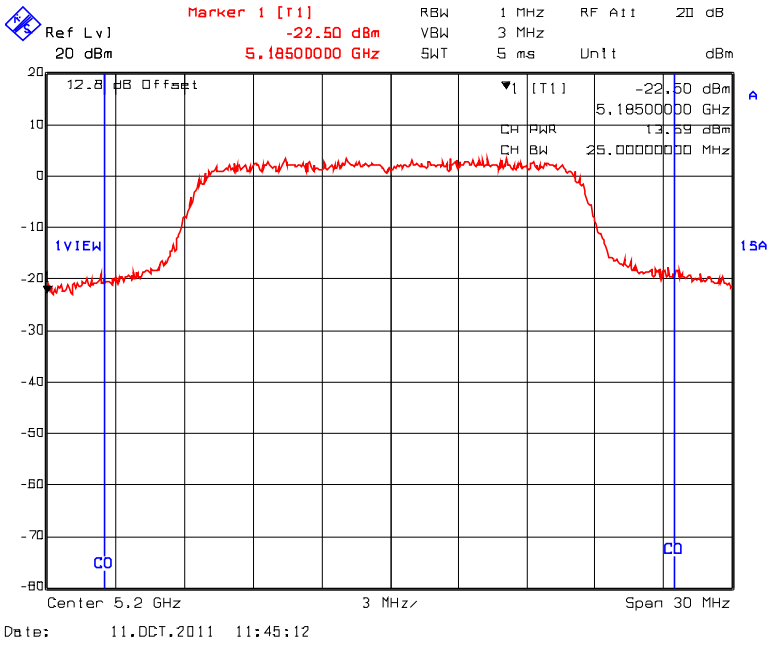
Plot 5.5.3.3.2. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 57, 13.32 dBm
Test Frequency: 5180 MHz



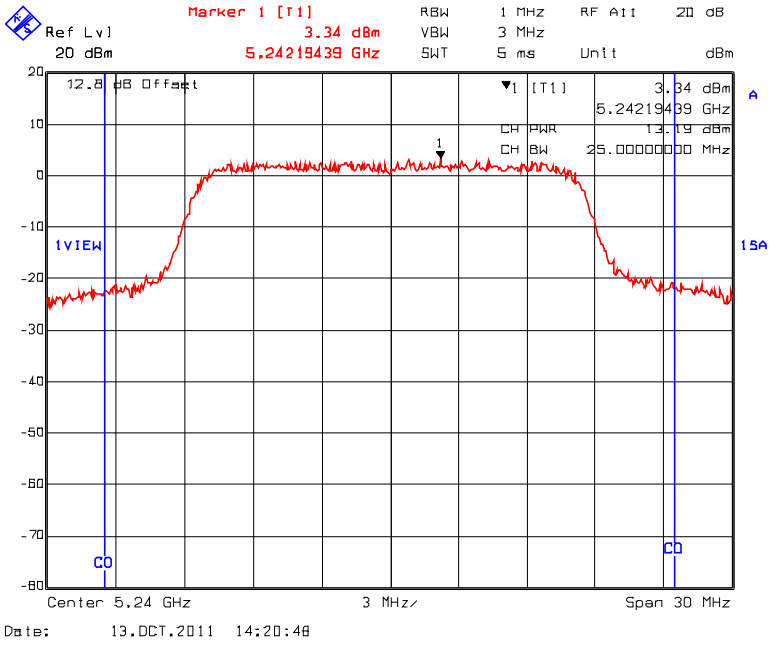
Plot 5.5.3.3.3. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 54, 13.46 dBm
Test Frequency: 5200 MHz



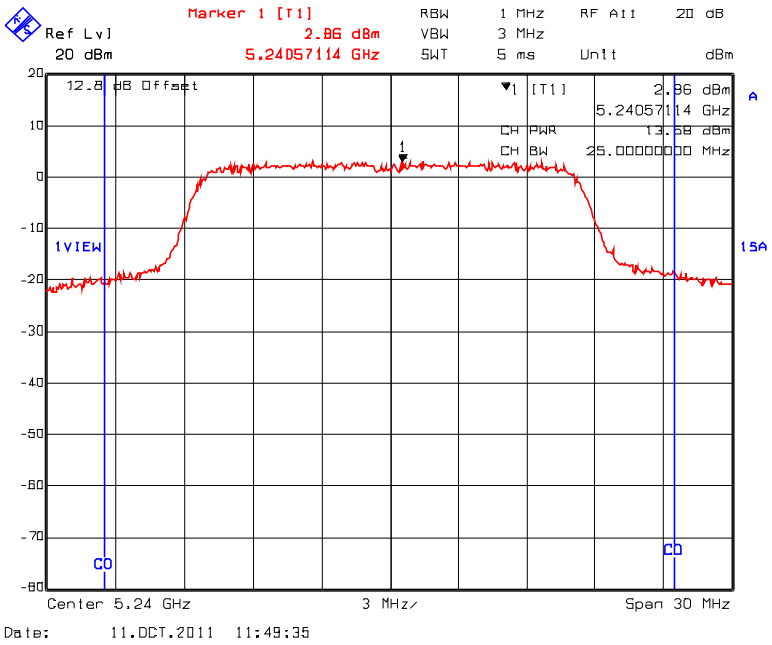
Plot 5.5.3.3.4. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 57, 13.69 dBm
Test Frequency: 5200 MHz



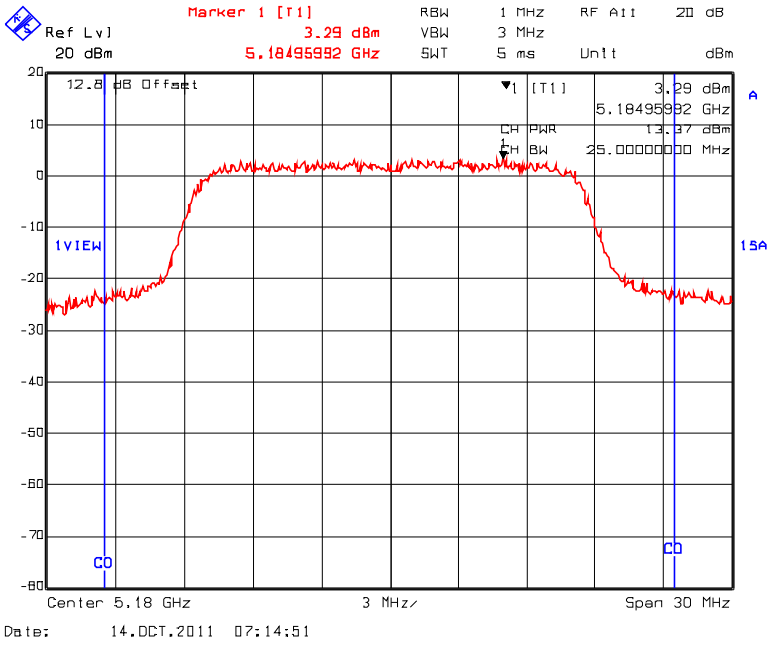
Plot 5.5.3.3.5. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 54, 13.19 dBm Test Frequency: 5240 MHz



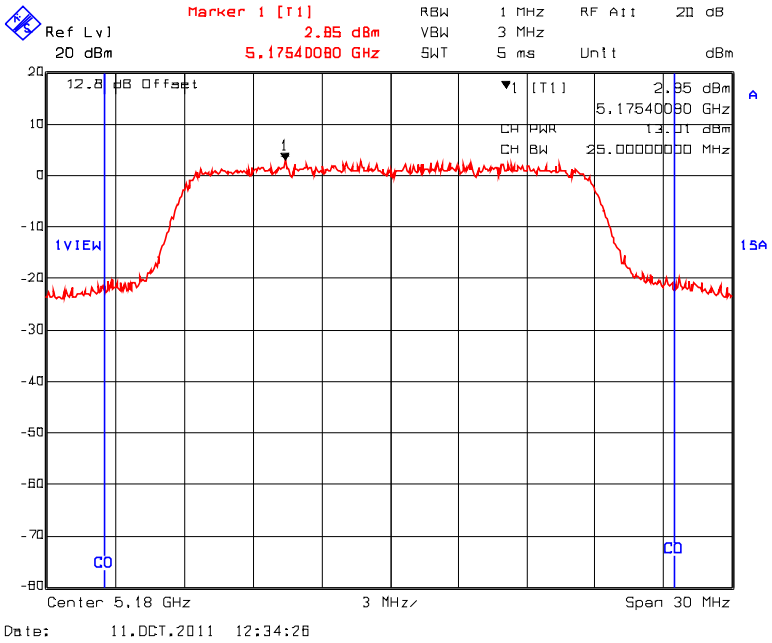
Plot 5.5.3.3.6. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 57, 13.58 dBm Test Frequency: 5240 MHz



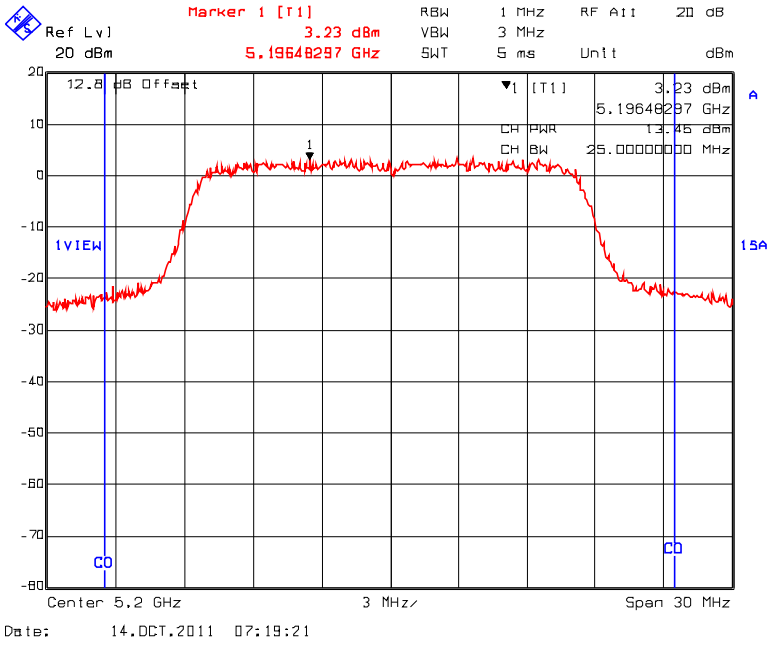
Plot 5.5.3.3.7. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 53, 13.37 dBm
Test Frequency: 5180 MHz



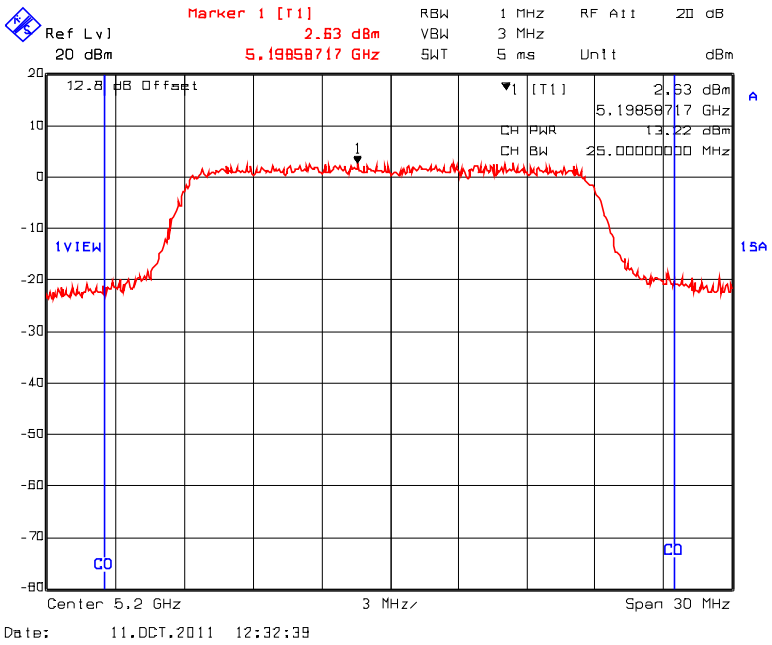
Plot 5.5.3.3.8. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 55, 13.01 dBm
Test Frequency: 5180 MHz



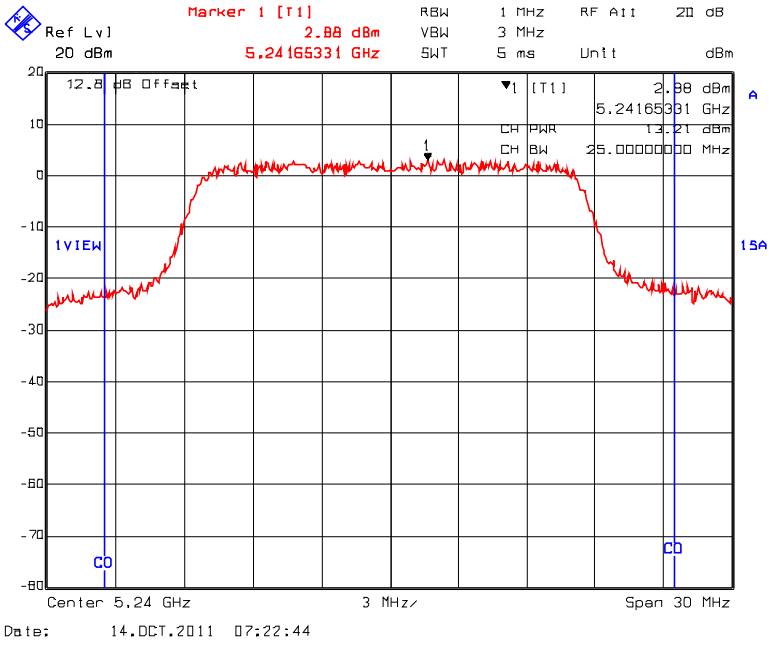
Plot 5.5.3.3.9. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 53, 13.45 dBm
Test Frequency: 5200 MHz



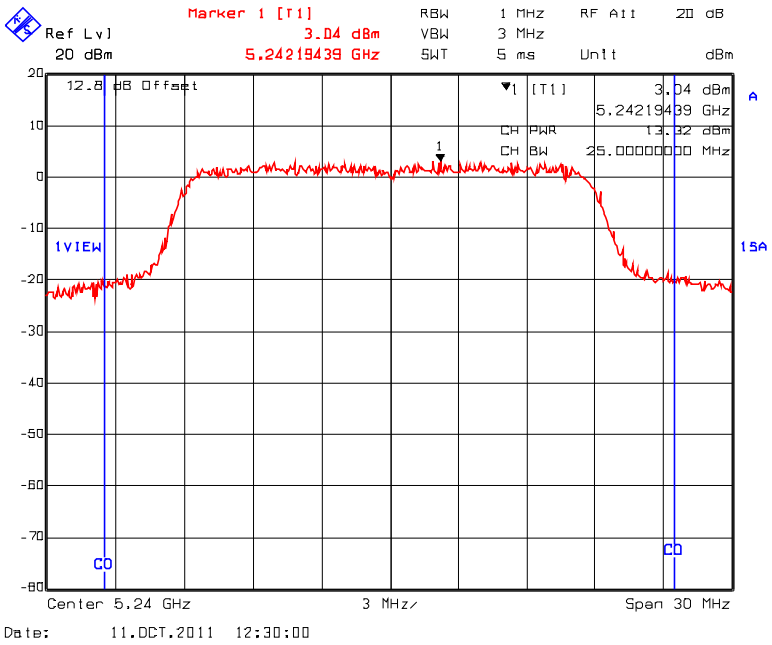
Plot 5.5.3.3.10. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 55, 13.22 dBm
Test Frequency: 5200 MHz



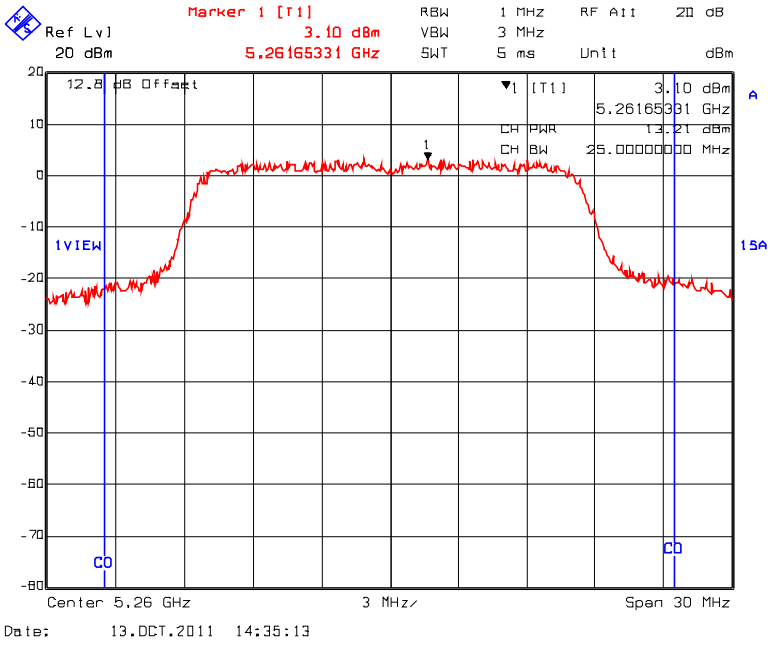
Plot 5.5.3.3.11. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 53, 13.21 dBm
Test Frequency: 5240 MHz



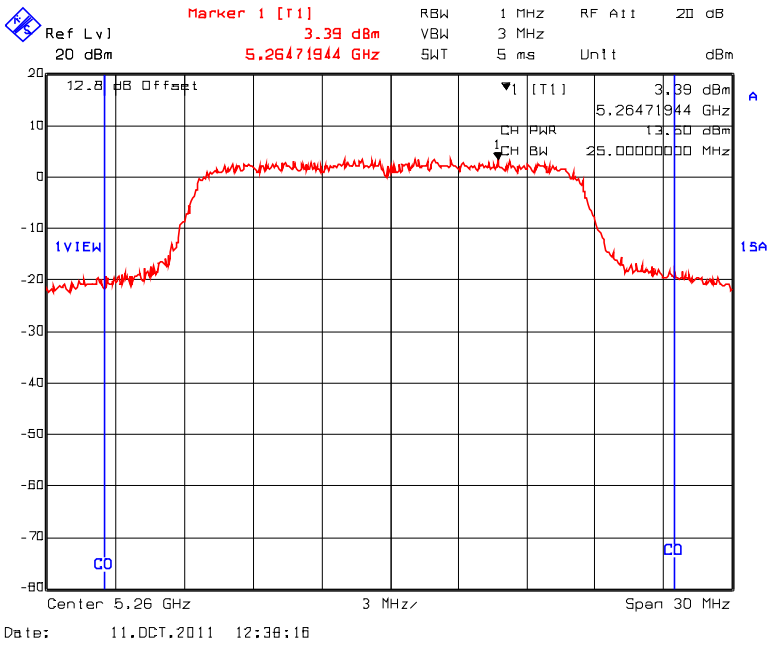
Plot 5.5.3.3.12. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 55, 13.32 dBm
Test Frequency: 5240 MHz



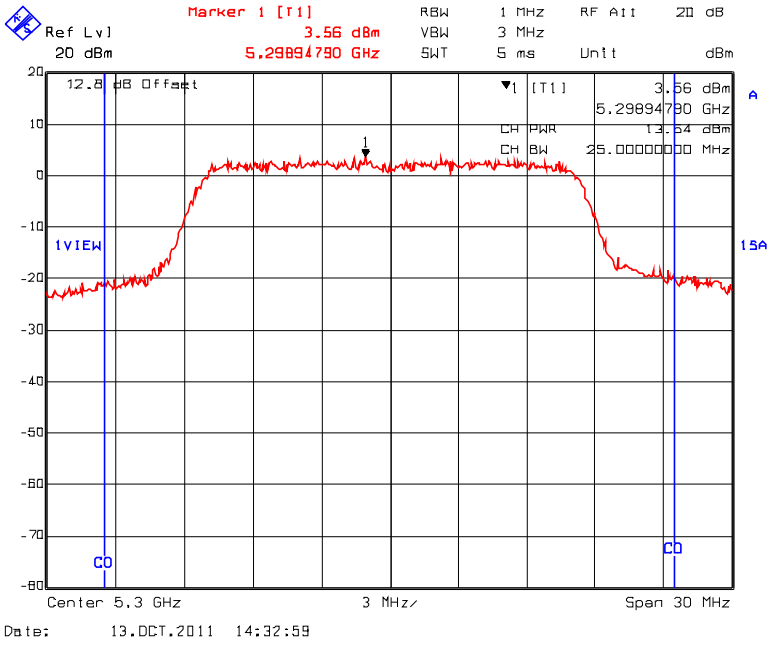
Plot 5.5.3.3.13. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 55, 13.21 dBm
Test Frequency: 5260 MHz



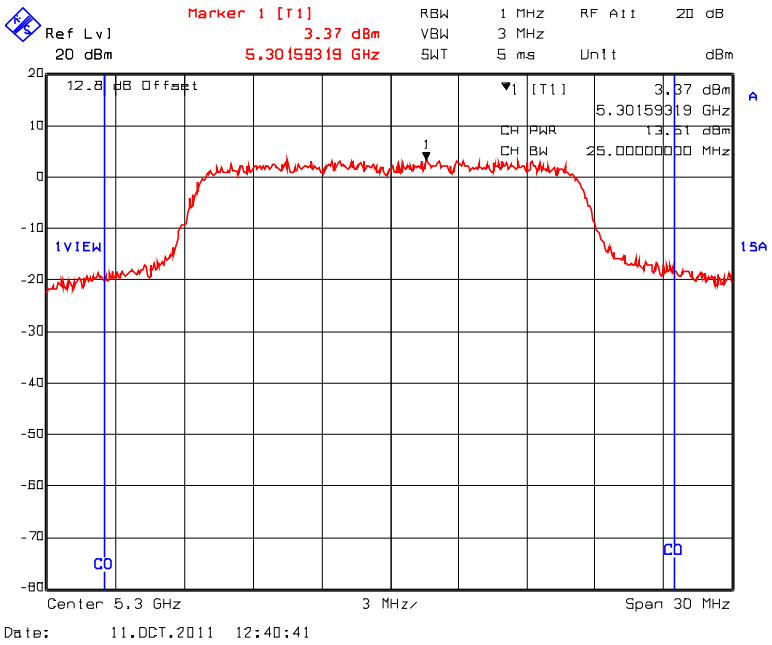
Plot 5.5.3.3.14. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 56, 13.60 dBm
Test Frequency: 5260 MHz



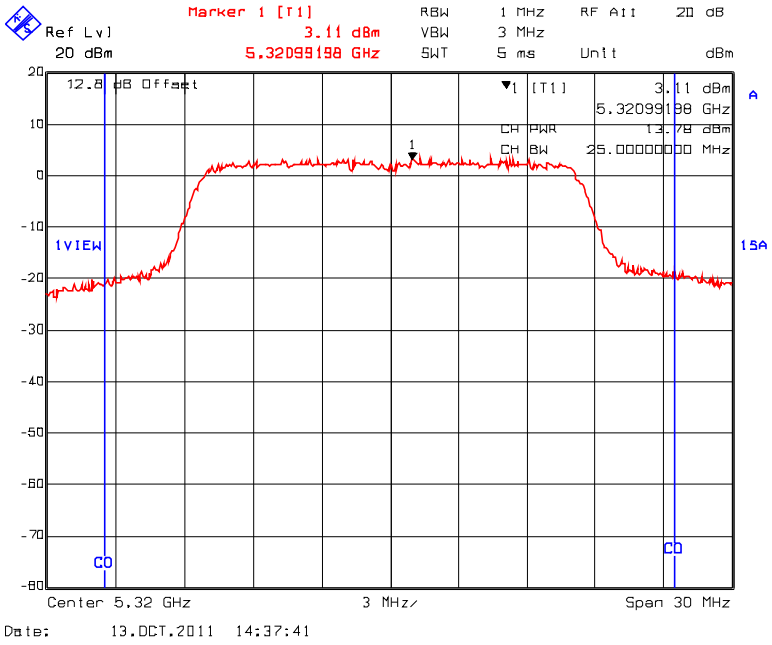
Plot 5.5.3.3.15. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 55, 13.54 dBm
Test Frequency: 5300 MHz



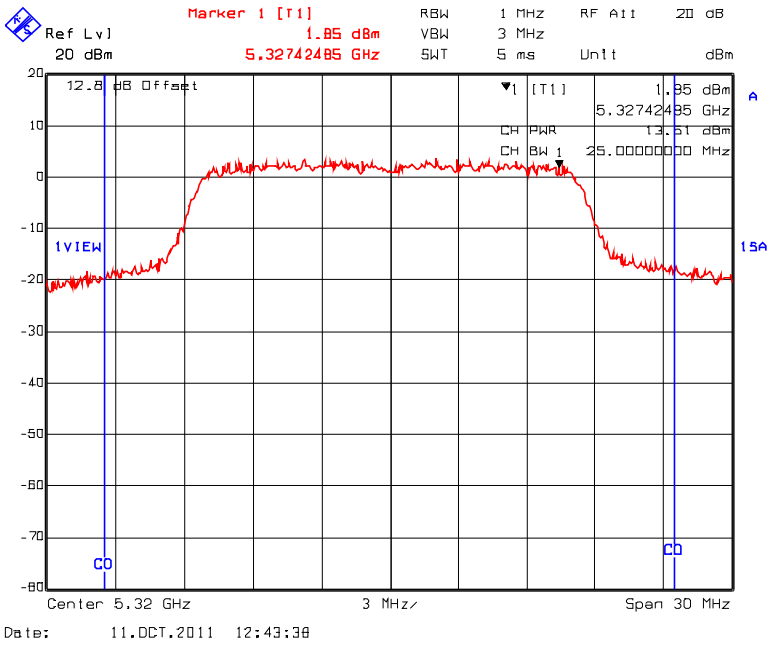
Plot 5.5.3.3.16. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 56, 13.51 dBm
Test Frequency: 5300 MHz



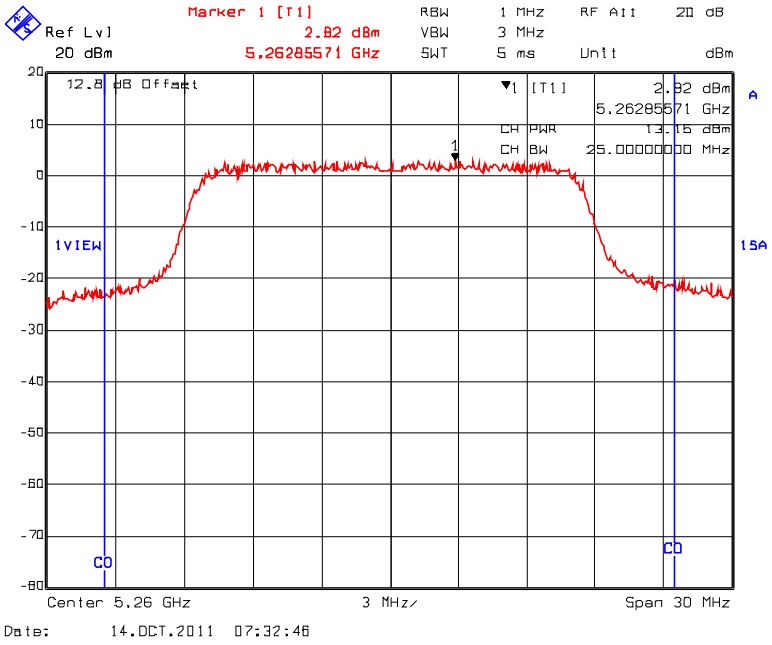
Plot 5.5.3.3.17. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 55, 13.78 dBm Test Frequency: 5320 MHz



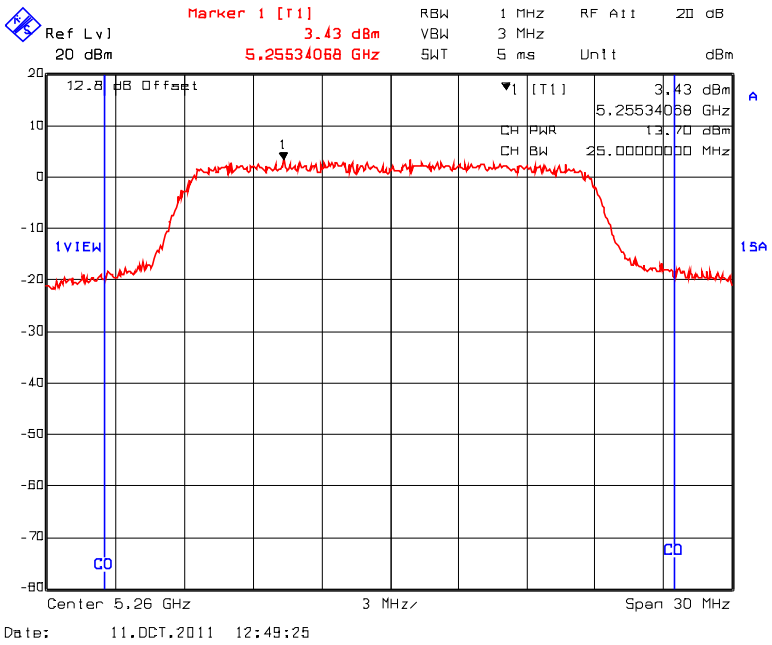
Plot 5.5.3.3.18. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 56, 13.51 dBm Test Frequency: 5320 MHz



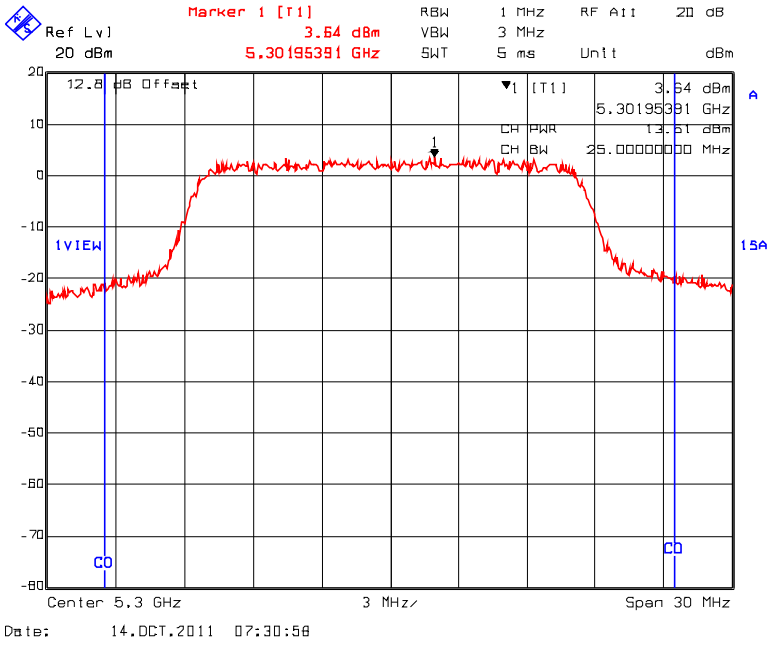
Plot 5.5.3.3.19. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 54, 13.15 dBm
Test Frequency: 5260 MHz



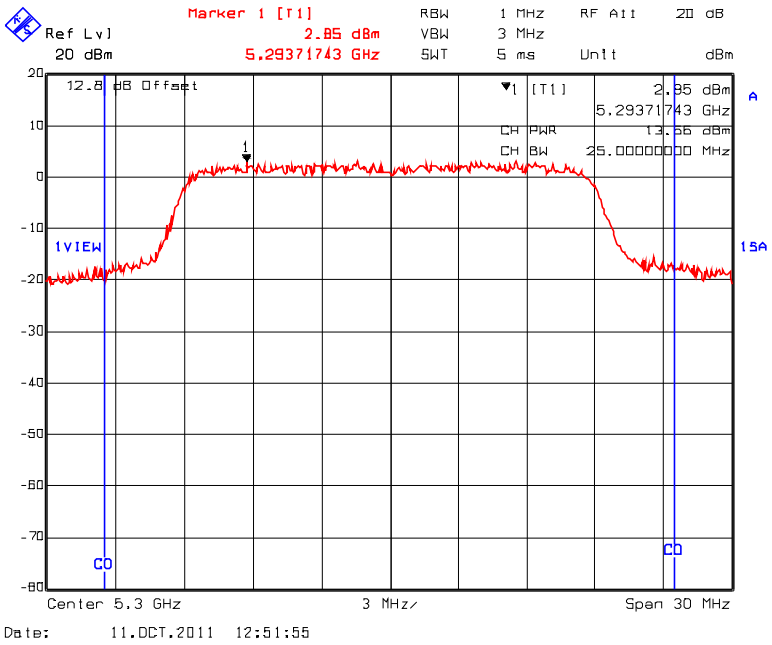
Plot 5.5.3.3.20. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 56, 13.70 dBm
Test Frequency: 5260 MHz



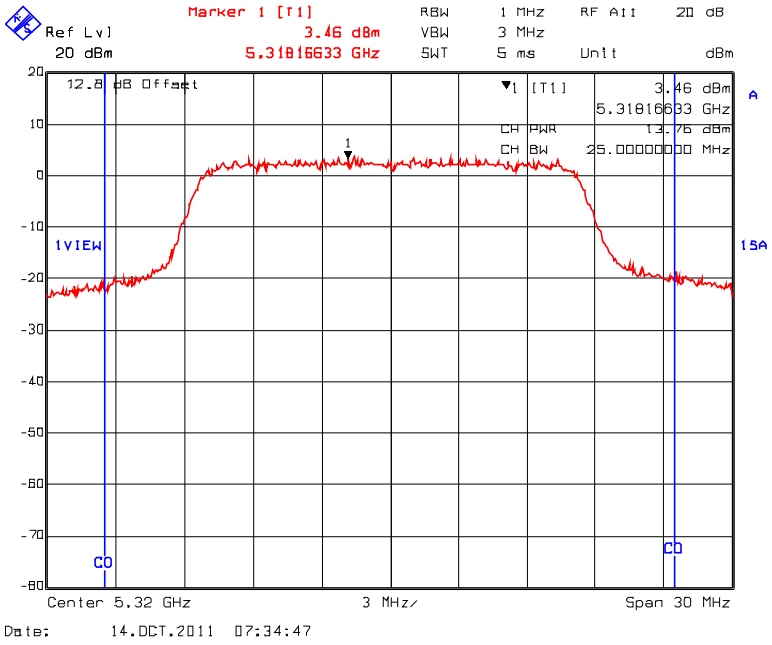
Plot 5.5.3.3.21. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 54, 13.61 dBm
Test Frequency: 5300 MHz



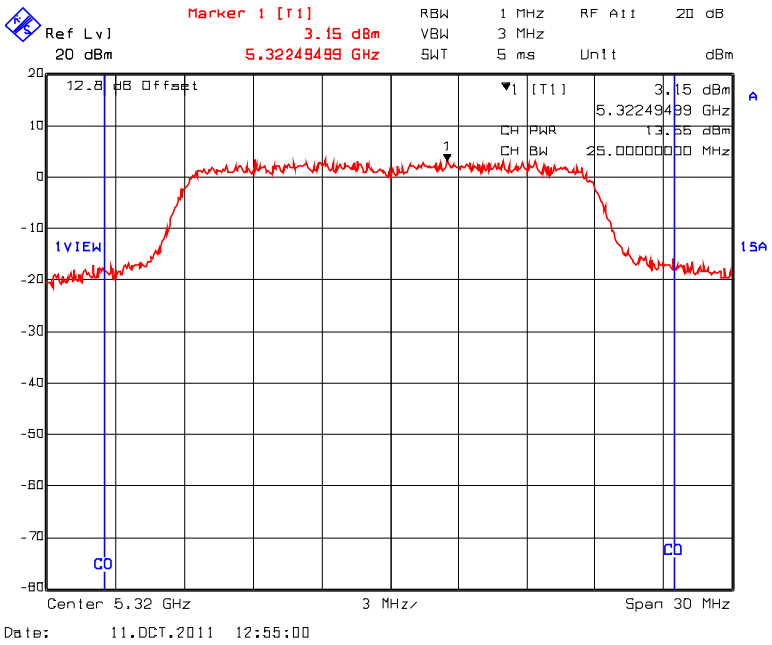
Plot 5.5.3.3.22. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 56, 13.56 dBm
Test Frequency: 5300 MHz



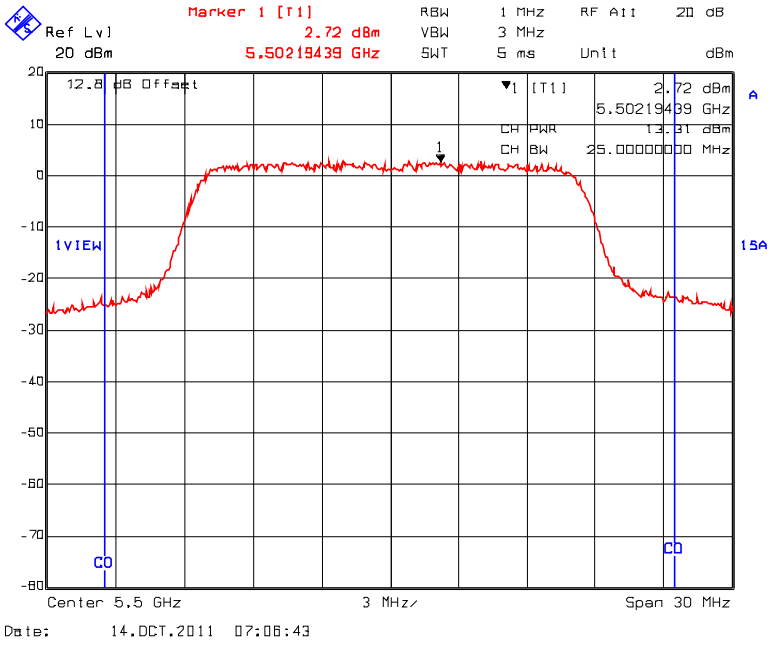
Plot 5.5.3.3.23. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 54, 13.76 dBm
Test Frequency: 5320 MHz



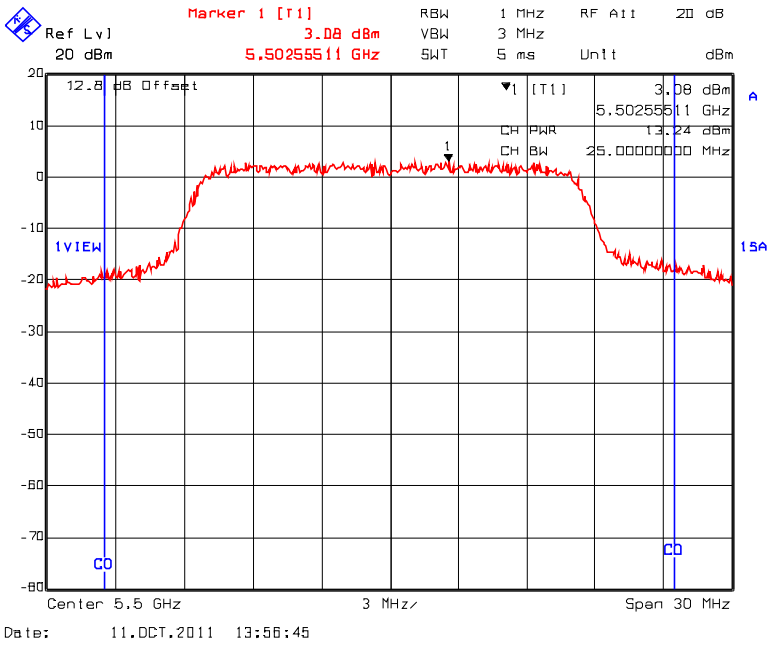
Plot 5.5.3.3.24. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 56, 13.55 dBm
Test Frequency: 5320 MHz



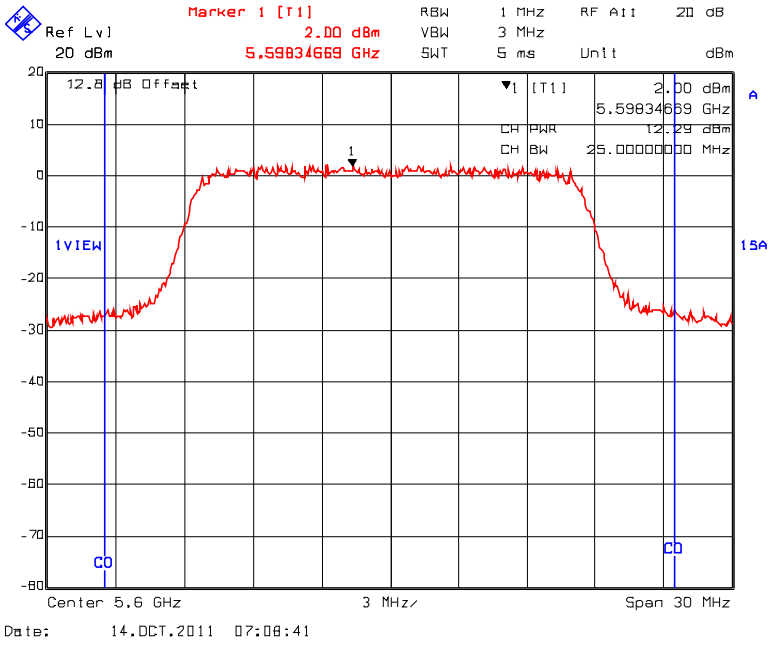
Plot 5.5.3.3.25. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 50, 13.31 dBm
Test Frequency: 5500 MHz



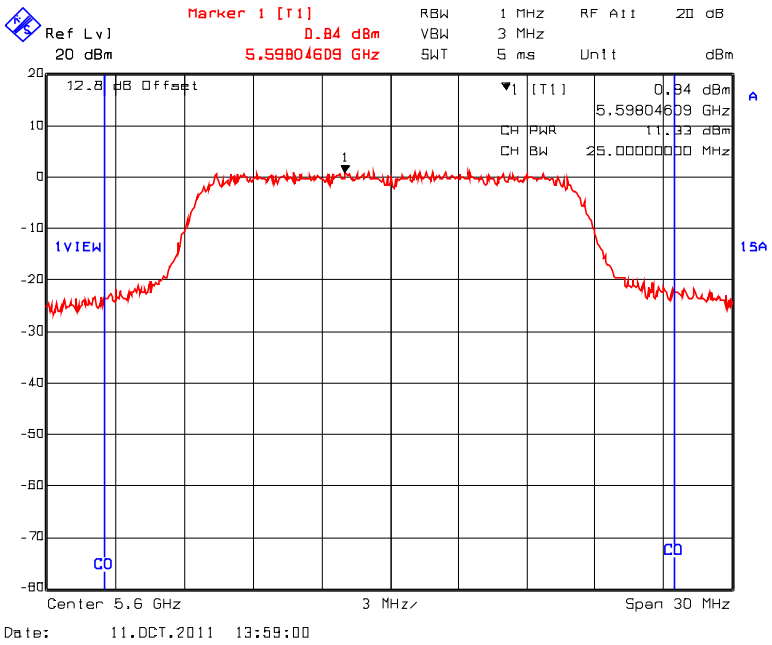
Plot 5.5.3.3.26. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 59, 13.24 dBm
Test Frequency: 5500 MHz



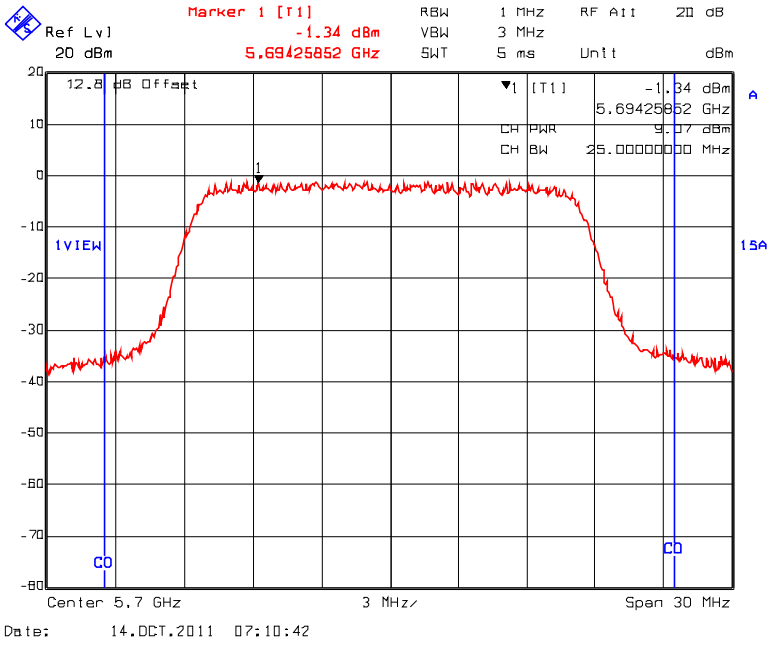
Plot 5.5.3.3.27. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 50, 12.29 dBm
Test Frequency: 5600 MHz



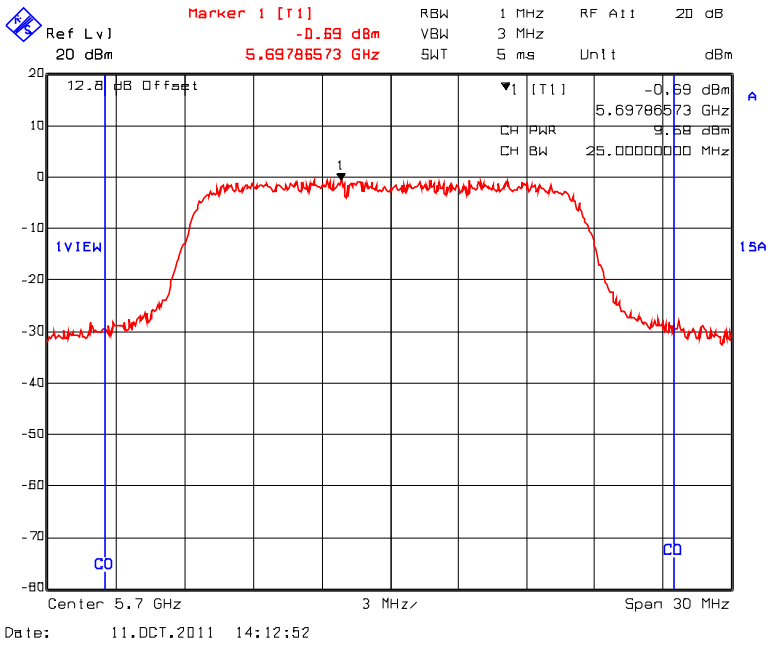
Plot 5.5.3.3.28. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 59, 11.33 dBm
Test Frequency: 5600 MHz



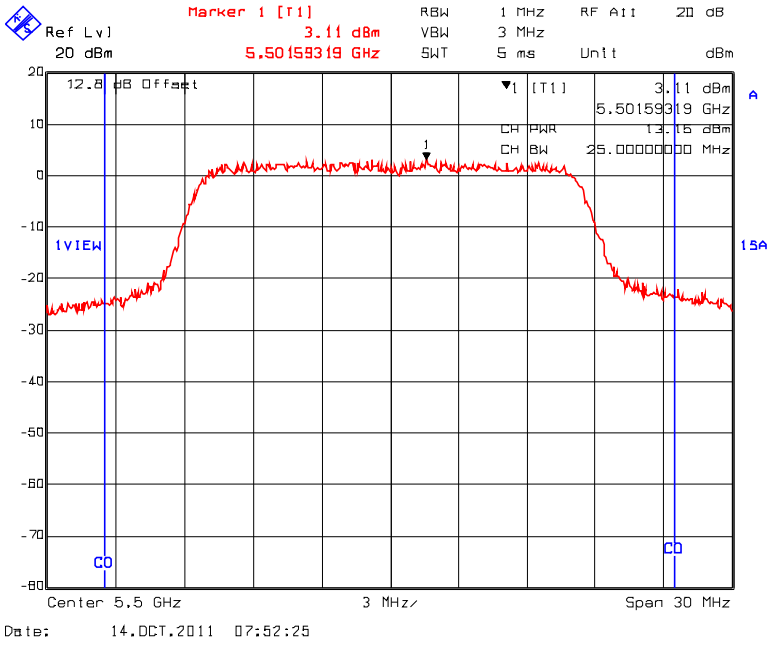
Plot 5.5.3.3.29. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 1 (J4), Setting 50, 9.07 dBm Test Frequency: 5700 MHz



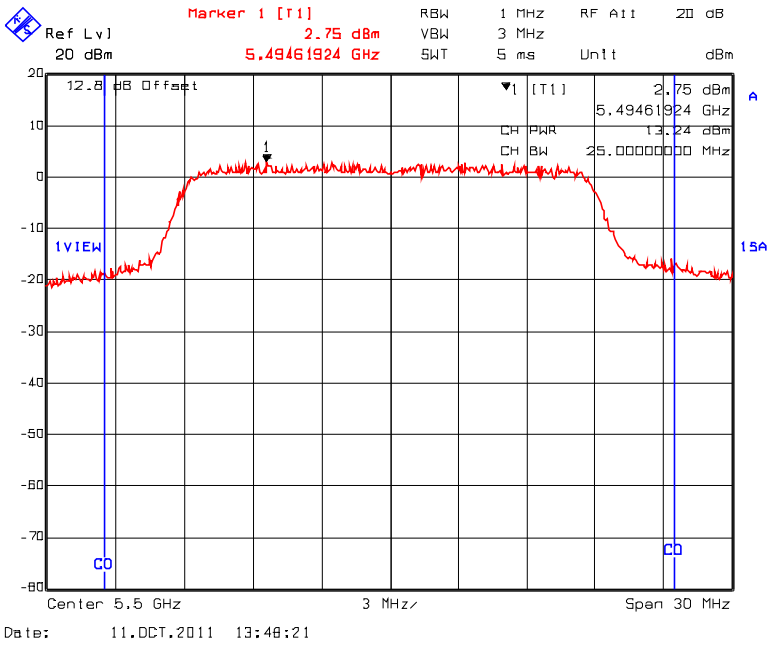
Plot 5.5.3.3.30. Peak Conducted Output Power, 802.11a, 64QAM 54 Mbps, Antenna 2 (J3), Setting 59, 9.58 dBm Test Frequency: 5700 MHz



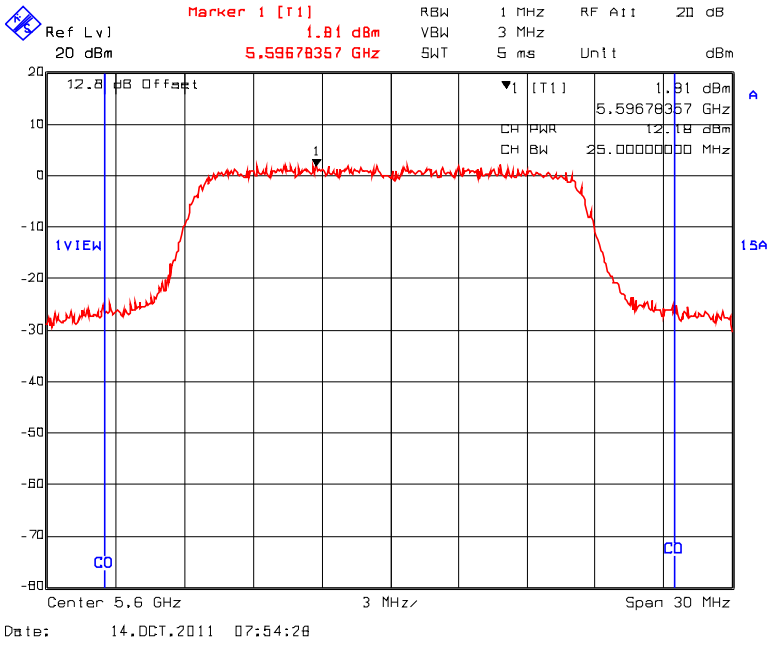
Plot 5.5.3.3.31. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 52, 13.15 dBm
Test Frequency: 5500 MHz



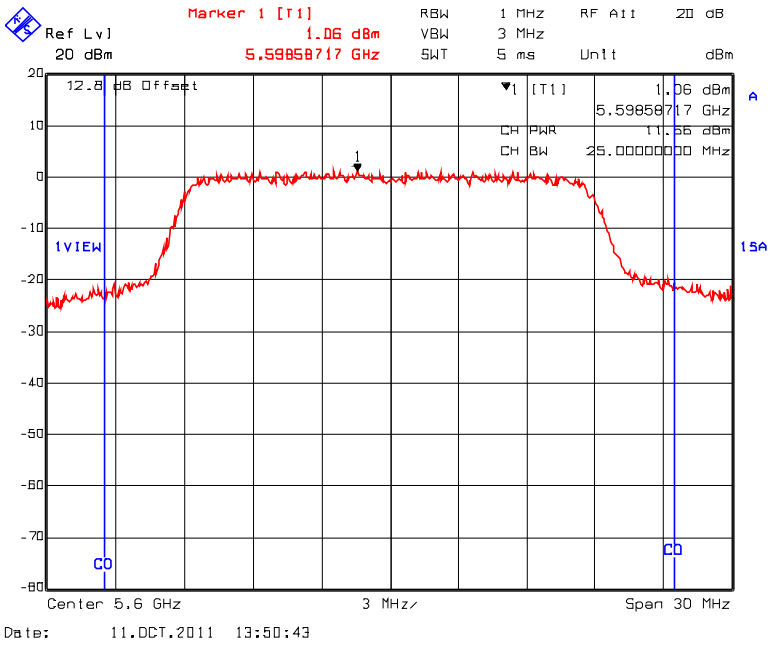
Plot 5.5.3.3.32. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 58, 13.24 dBm
Test Frequency: 5500 MHz



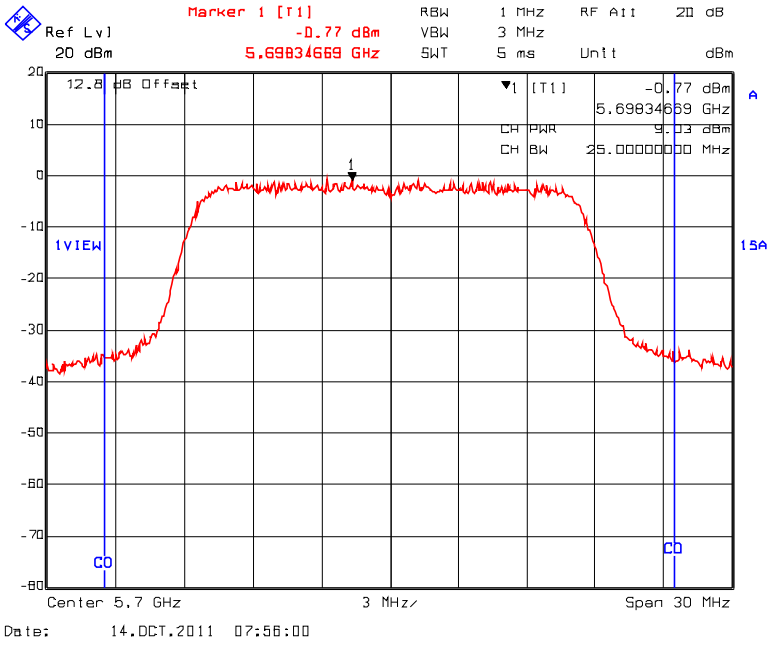
Plot 5.5.3.3.33. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 52, 12.18 dBm
Test Frequency: 5600 MHz



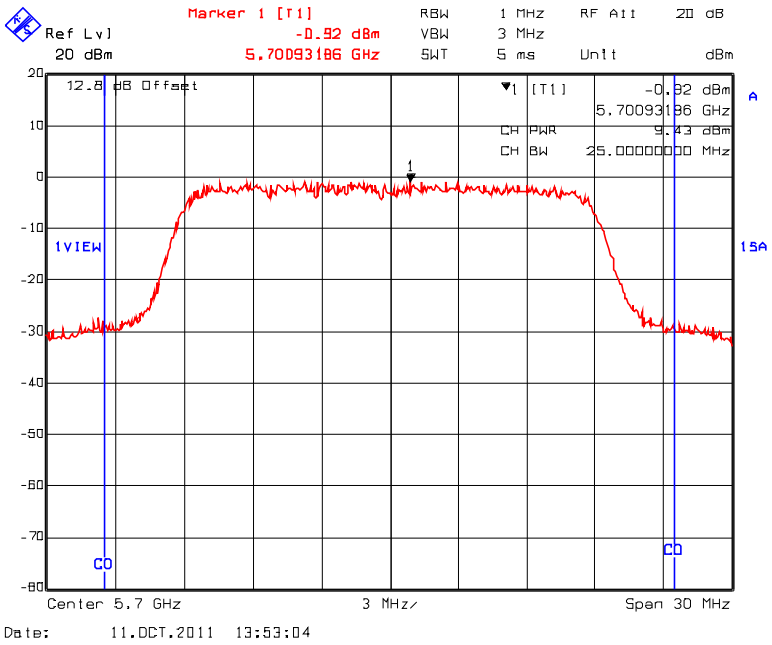
Plot 5.5.3.3.34. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 58, 11.56 dBm
Test Frequency: 5600 MHz



Plot 5.5.3.3.35. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 1 (J4), Setting 52, 9.03 dBm
Test Frequency: 5700 MHz



Plot 5.5.3.3.36. Peak Conducted Output Power, 802.11n, MCS7 64QAM 65 Mbps, Antenna 2 (J3), Setting 58, 9.43 dBm
Test Frequency: 5700 MHz



5.6. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

5.6.1. Limit(s)

§ 15.247 (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 § 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)).

§ 15.407 (b) (1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band.

(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(4) For transmitters operating in the 5.725–5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

Section 15.205(a) - Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41.			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

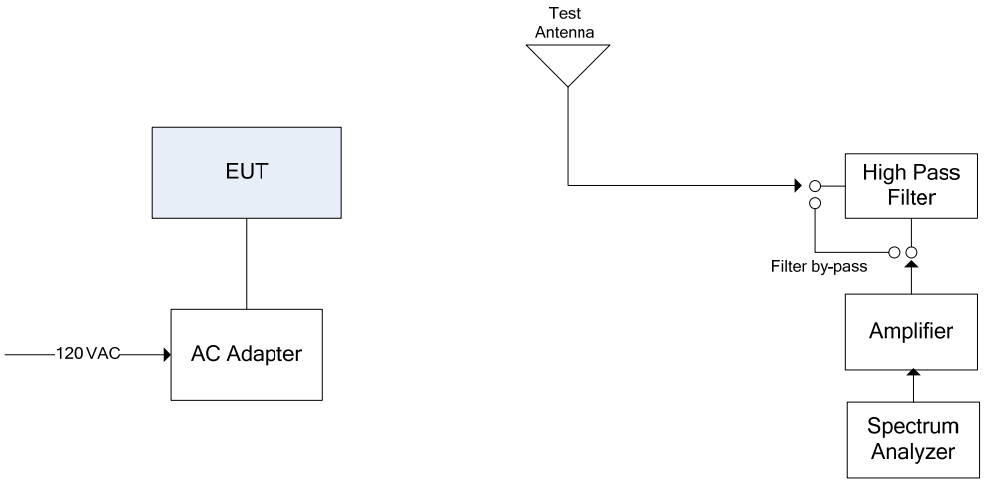
Section 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

5.6.2. Method of Measurements

ANSI C63.10.

5.6.3. Test Arrangement



5.6.4. Test Data

Remarks:

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- The following test results are the worst-case measurements.

5.6.4.1. Spurious Radiated Emissions from WLAN Module

5.6.4.1.1. 2412 – 2462 MHz Band, 802.11n, 65 Mbps, Setting 60, Antenna 2

Fundamental Frequency: 2412 MHz
Test Frequency Range: 30 MHz – 25 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
2412	101.22	--	V	--	--	--	--
2412	101.28	--	H	--	--	--	--
4824	61.06	46.12	V	54.0	81.3	-7.9	Pass*
4824	61.04	45.15	H	54.0	81.3	-8.9	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency: 2437 MHz
Test Frequency Range: 30 MHz – 25 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
2437	99.33	--	V	--	--	--	--
2437	100.32	--	H	--	--	--	--
4874	59.50	42.51	V	54.0	80.3	-11.5	Pass*
4874	60.46	43.49	H	54.0	80.3	-10.5	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency: 2462 MHz
Test Frequency Range: 30 MHz – 25 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
2462	97.85	--	V	--	--	--	--
2462	101.00	--	H	--	--	--	--
4924	57.99	41.92	V	54.0	81.0	-12.1	Pass*
4924	58.50	42.92	H	54.0	81.0	-11.1	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.6.4.1.2. 5745 – 5825 MHz Band, All Configurations

Fundamental Frequency:	5745 MHz						
Test Frequency Range:	30 MHz – 40 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
5745	104.85	--	V	--	--	--	--
5745	105.69	--	H	--	--	--	--
*	*	*	*	*	*	*	*

*No emissions found.

Fundamental Frequency:	5785 MHz						
Test Frequency Range:	30 MHz – 40 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
5785	103.97	--	V	--	--	--	--
5785	103.83	--	H	--	--	--	--
*	*	*	*	*	*	*	*

*No emissions found.

Fundamental Frequency:	5825 MHz						
Test Frequency Range:	30 MHz – 40 GHz						
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit 15.247 (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
5825	103.36	--	V	--	--	--	--
5825	104.37	--	H	--	--	--	--
*	*	*	*	*	*	*	*

*No emissions found.

5.6.4.1.3. 5150-5250 MHz Band, 802.11a, 64QAM, 54Mbps, Setting 57, Antenna 2

Fundamental Frequency: 5180 MHz
Test Frequency Range: 30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	EIRP (dBm)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit EIRP 15.407(b) (dBm/MHz)	Margin (dB)	Pass/ Fail
10360	62.24	--	-32.96	V	54.0	-27.0	-6.0	Pass
10360	65.86	--	-29.34	H	54.0	-27.0	-2.3	Pass
15540	64.97	50.39	--	V	54.0	-27.0	-3.6	Pass*
15540	67.24	52.26	--	H	54.0	-27.0	-1.7	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency: 5200 MHz
Test Frequency Range: 30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	EIRP (dBm)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit EIRP 15.407(b) (dBm/MHz)	Margin (dB)	Pass/ Fail
10400	61.78	--	-33.42	V	54.0	-27.0	-6.4	Pass
10400	64.62	--	-30.58	H	54.0	-27.0	-3.6	Pass
15600	64.69	49.65	--	V	54.0	-27.0	-4.4	Pass*
15600	66.60	50.87	--	H	54.0	-27.0	-3.1	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency: 5240 MHz
Test Frequency Range: 30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	EIRP (dBm)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit EIRP 15.407(b) (dBm/MHz)	Margin (dB)	Pass/ Fail
10480	63.74	--	-31.46	V	54.0	-27.0	-4.5	Pass
10480	64.70	--	-30.50	H	54.0	-27.0	-3.5	Pass
15720	64.11	49.11	--	V	54.0	-27.0	-4.9	Pass*
15720	63.70	49.70	--	H	54.0	-27.0	-4.3	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.6.4.1.4. 5250-5350 MHz Band, 802.11a, 64QAM, 54Mbps, Setting 56, Antenna 2

Fundamental Frequency:	5260 MHz
Test Frequency Range:	30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	EIRP (dBm)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit EIRP 15.407(b) (dBm/MHz)	Margin (dB)	Pass/ Fail
10520	61.12	--	-34.08	V	54.0	-27.0	-7.1	Pass
10520	63.03	--	-32.17	H	54.0	-27.0	-5.2	Pass
15780	62.15	46.43	--	V	54.0	-27.0	-7.6	Pass*
15780	62.95	47.48	--	H	54.0	-27.0	-6.5	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	5300 MHz
Test Frequency Range:	30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	EIRP (dBm)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit EIRP 15.407(b) (dBm/MHz))	Margin (dB)	Pass/ Fail
10600	58.48	45.67	--	V	54.0	-27.0	-8.3	Pass*
10600	61.19	48.26	--	H	54.0	-27.0	-5.7	Pass*
15900	61.02	46.24	--	V	54.0	-27.0	-7.8	Pass*
15900	61.88	47.14	--	H	54.0	-27.0	-6.9	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	5320 MHz
Test Frequency Range:	30 MHz – 40 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	EIRP (dBm)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit EIRP 15.407(b) (dBm/MHz)	Margin (dB)	Pass/ Fail
10640	59.99	45.51	--	V	54.0	-27.0	-8.5	Pass*
10640	59.85	47.64	--	H	54.0	-27.0	-6.4	Pass*
15960	59.86	47.32	--	V	54.0	-27.0	-6.7	Pass*
15960	61.77	47.28	--	H	54.0	-27.0	-6.7	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.6.4.1.5. 5470-5725 MHz Band, 802.11a, 64QAM, 54Mbps, Setting 59, Antenna 2

Fundamental Frequency:	5500 MHz							
Test Frequency Range:	30 MHz – 40 GHz							
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**EIRP (dBm)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit EIRP 15.407(b) (dBm/MHz)**	**Margin (dB)**	**Pass/ Fail**
11000	64.33	49.94	--	V	54.0	-27.0	-4.1	Pass*
11000	65.02	51.83	--	H	54.0	-27.0	-2.2	Pass*
16500	62.61	--	-32.59	V	54.0	-27.0	-5.6	Pass
16500	63.19	--	-32.01	H	54.0	-27.0	-5.0	Pass

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	5600 MHz							
Test Frequency Range:	30 MHz – 40 GHz							
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**EIRP (dBm)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit EIRP 15.407(b) (dBm/MHz))**	**Margin (dB)**	**Pass/ Fail**
11200	64.95	51.93	--	V	54.0	-27.0	-2.1	Pass*
11200	66.77	52.65	--	H	54.0	-27.0	-1.4	Pass*
16800	60.25	--	-34.95	V	54.0	-27.0	-8.0	Pass
16800	60.42	--	-34.78	H	54.0	-27.0	-7.8	Pass

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:	5700 MHz							
Test Frequency Range:	30 MHz – 40 GHz							
Frequency (MHz)	**RF Peak Level (dBµV/m)**	**RF Avg Level (dBµV/m)**	**EIRP (dBm)**	**Antenna Plane (H/V)**	**Limit 15.209 (dBµV/m)**	**Limit EIRP 15.407(b) (dBm/MHz)**	**Margin (dB)**	**Pass/ Fail**
11400	60.81	48.92	--	V	54.0	-27.0	-5.1	Pass*
11400	65.34	50.92	--	H	54.0	-27.0	-3.1	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.6.4.2. Spurious Radiated Emissions from Bluetooth Module, 2402 – 2480 MHz Band

Fundamental Frequency: 2402 MHz
Test Frequency Range: 30 MHz – 25 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
2402	109.38	--	V	--	--	--	--
2402	101.28	--	H	--	--	--	--
4804	65.01	33.70	V	54.0	89.4	-20.3	Pass*
4804	64.37	33.85	H	54.0	89.4	-20.2	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency: 2441 MHz
Test Frequency Range: 30 MHz – 25 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
2441	109.85	--	V	--	--	--	--
2441	110.76	--	H	--	--	--	--
4882	69.14	34.08	V	54.0	90.8	-19.9	Pass*
4882	69.40	34.34	H	54.0	90.8	-19.7	Pass*
7323	59.89	38.53	V	54.0	90.8	-15.5	Pass*
7323	61.67	39.01	H	54.0	90.8	-15.0	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency: 2480 MHz
Test Frequency Range: 30 MHz – 25 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
2480	110.14	--	V	--	--	--	--
2480	112.21	--	H	--	--	--	--
4960	69.06	34.08	V	54.0	92.2	-19.9	Pass*
4960	72.11	34.38	H	54.0	92.2	-19.6	Pass*
7440	54.90	38.14	V	54.0	92.2	-15.9	Pass*
7440	59.03	39.49	H	54.0	92.2	-14.5	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.6.4.3. Spurious Radiated Emissions from Co-location of Bluetooth Module and WLAN Module

The middle frequency of the Bluetooth module and WLAN module were set to transmit continuously, no new spurious radiated emissions were detected. Below is a table of test results summary.

Test Configuration			Observations
	Bluetooth Module	WLAN Module	
1	2441 MHz at max. data rate	2437 MHz, 802.11b mode	No new spurious emissions.
2	2441 MHz at max. data rate	2437 MHz, 802.11g mode	No new spurious emissions.
3	2441 MHz at max. data rate	2437 MHz, 802.11n mode	No new spurious emissions.
4	2441 MHz at max. data rate	5785 MHz, 802.11a mode	No new spurious emissions.
5	2441 MHz at max. data rate	5785 MHz, 802.11n mode	No new spurious emissions.
6	2441 MHz at max. data rate	5300 MHz, 802.11a mode	No new spurious emissions.
7	2441 MHz at max. data rate	5300 MHz, 802.11n mode	No new spurious emissions.

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	15 Mar 2012
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz	27 Sep 2012
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	17 Feb 2012
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	15 Mar 2012
RF Amplifier	Com-Power	PA-103A	161243	10 MHz – 1 GHz	23 Feb 2012
Horn Antenna	ETS-Lindgren	360-10	00102686	26.5 – 40 GHz	30 May 2012
Horn Antenna	ETS-Lindgren	360-09	00118385	18 – 26.5 GHz	30 May 2012
Horn Antenna	Emco	3115	6570	1 – 18 GHz	22 Feb 2012
Biconi-Log Antenna	Emco	3142C	00034792	26 – 3000 MHz	26 Apr 2012
Log Periodic	ETS-Lindgren	93148	1101	200 – 2000 MHz	04 Jan 2012
Attenuator	Narda	4768-10	-	DC – 40 GHz (2w)	Cal. on use
DC-Block	Hewlett Packard	11742A	12460	0.045-26.5 GHz	Cal. on use
High Pass Filter	K & L	11SH10-4000/1200	4	Cut off 2400 MHz	Cal. on use
High Pass Filter	K & L	11SH10-8000/T18000	3	Cut off 5000 MHz	Cal. on use
Power Meter	Hewlett Packard	8900D	2131A01044	100 kHz – 18 GHz	25 Aug 2012
Power Sensor	Hewlett Packard	84811A	2551A01484	100 kHz – 18 GHz	25 Aug 2012

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (150 kHz – 30 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.57**	**± 1.8**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.14**	**± 3.6**

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.15**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.30**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.87**	Under consideration
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	Under consideration