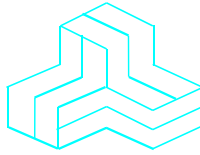


ENGINEERING TEST REPORT



Pico 2.4GHz High Speed 1W Module

Model: pX2

FCC ID: NS915PX2

Applicant:

Microhard Systems Inc.
150 Country Hills Landing NW
Calgary, Alberta
Canada T3K 5P3

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247
Digital Modulation Systems (DTS) Operating in 2400 – 2483.5 MHz Band

UltraTech's File No.: 15MCRS083_FCC15C247DTS

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

Date: June 16, 2015

Report Prepared by: Dan Huynh

Tested by: Hung Trinh

Issued Date: June 16, 2015

Test Dates: April 25 – June 12, 2015

- 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

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91038



1309



46390-2049



NVLAP LAB
CODE 200093-0



SL2-IN-E-
1119R



CA2049



TL363_B



TPTDP
DA1300

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 – Radio Frequency Devices
Purpose of Test:	Equipment Certification for Digital Modulation Systems (DTS) Transmitter Operating in the Frequency Band 2400-2483.5 MHz.
Test Procedures:	- ANSI C63.4 - ANSI C63.10 - FCC KDB Publication No. 558074 D01 DTS Meas Guidance v03r02
Environmental Classification:	☒ 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	2015	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
FCC, KDB Publication No. 558074 D01 DTS Meas Guidance v03r02	2014	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Microhard Systems Inc.
Address:	150 Country Hills Landing NW Calgary, Alberta Canada T3K 5P3
Contact Person:	Mr. Hany Shenouda Phone #: 403 248-0028 Fax #: 403 248 2762 Email Address: shenouda@microhardcorp.com

MANUFACTURER	
Name:	Microhard Systems Inc.
Address:	150 Country Hills Landing NW Calgary, Alberta Canada T3K 5P3
Contact Person:	Mr. Hany Shenouda Phone #: 403 248-0028 Fax #: 403 248-2762 Email Address: shenouda@microhardcorp.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:	Microhard Systems Inc.
Product Name:	Pico 2.4GHz High Speed 1W Module
Model Name or Number:	pX2
Serial Number:	Test Sample
Type of Equipment:	Digital Transmission System (DTS)
Input Power Supply Type:	External DC Power Supply
Primary User Functions of EUT:	802.11bgn module

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	• Mobile • Base Station (fixed use)
Intended Operating Environment:	▪ Commercial, industrial or business environment ▪ Residential environment
Power Supply Requirement:	3.3 VDC
RF Output Power Rating:	0.1 - 1 W typical
*Tx Gain Setting:	0-70
Operating Frequency Range:	2412 - 2462 MHz (for 802.11bg and 802.11n HT20) 2422 - 2452 MHz (for 802.11n HT40)
RF Output Impedance:	50 Ω
Duty Cycle:	Continuous
Modulation Type:	802.11bgn
Antenna Connector Types:	U.FL

*TX gain setting is a factory tune-up parameter, not available to end users.

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Antenna Type	Maximum Gain (dBi)
Rubber Ducky	2
Patch Antenna	14
Yagi Antenna	14.5
Omni Directional Antenna	15

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	RF port	1	U.FL	Shielded cable
2	DC supply and I/O port	1	Pin header	Direct connection (no cable)

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File #: 15MCRS083_FCC15C247DTS

June 16, 2015

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

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:	Test Jig
Brand name:	Microhard Systems Inc.
Model Name or Number:	N/A
Connected to EUT's Port:	I/O Port

Ancillary Equipment # 2	
Description:	AC/DC Adapter
Brand name:	BI Switching Power Supply
Model Name or Number:	BI30-120200-AdU
Connected to EUT's Port:	Test Jig of the EUT

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 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power Input Source:	3.3 VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	Special software provided by the Applicant to operate the EUT at each channel frequency continuously and in the range of typical modes of operation.
Special Hardware Used:	Test Jig
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	2412 - 2462 MHz 2422 - 2452 MHz
Frequency(ies) Tested:	2412 MHz, 2437 MHz, 2462 MHz 2422 MHz and 2452 MHz
RF Power Output: (measured maximum output power at antenna terminals)	29.88 dBm (973 mW) Peak
Normal Test Modulation:	802.11 bgn
Modulating Signal Source:	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: 2017-04-02.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes*
15.207(a)	AC Power Line Conducted Emissions	Yes
15.247(a)(2)	6 dB Bandwidth	Yes
15.247(b)(3)	Peak Conducted Output Power - DTS	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(e)	Power Spectral Density	Yes
15.247(i), 1.1307, 1.1310, 2.1091	RF Exposure	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

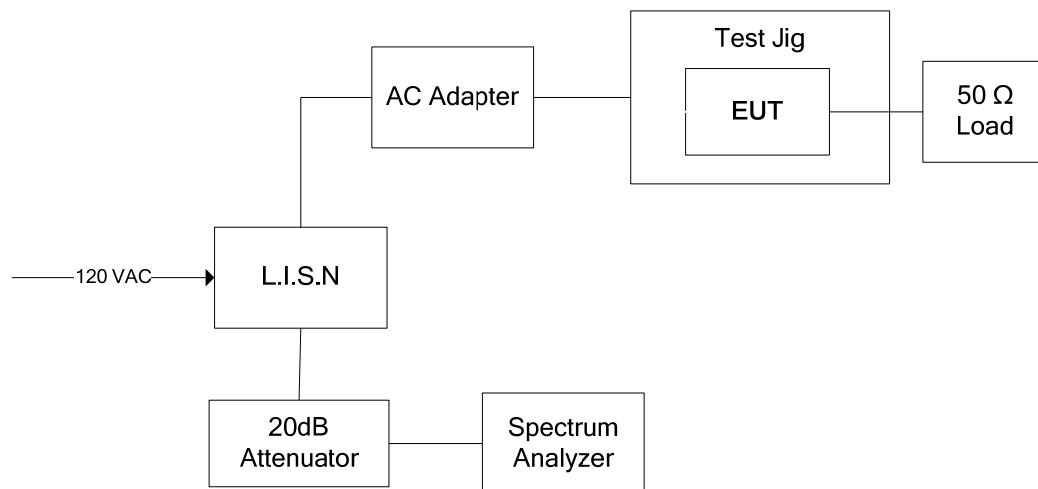
Frequency of emission (MHz)	Conducted Limits (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases linearly with the logarithm of the frequency

5.1.2. Method of Measurements

ANSI C63.4-2009

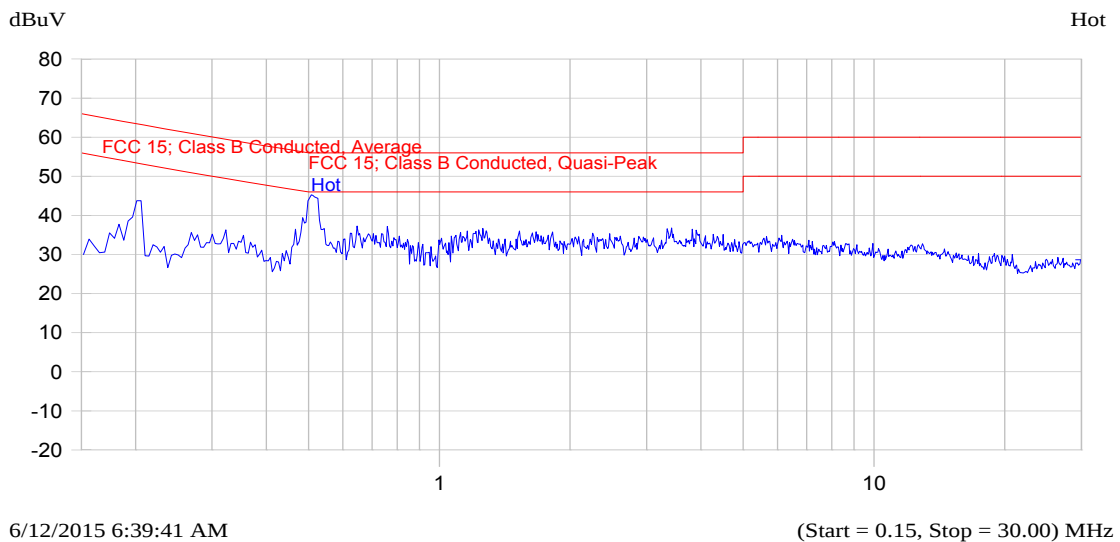
5.1.3. Test Arrangement



5.1.4. Test Data

Plot 5.1.4.1. Power Line Conducted Emissions; Line Voltage: 120 VAC; Line Tested: Hot

Current Graph

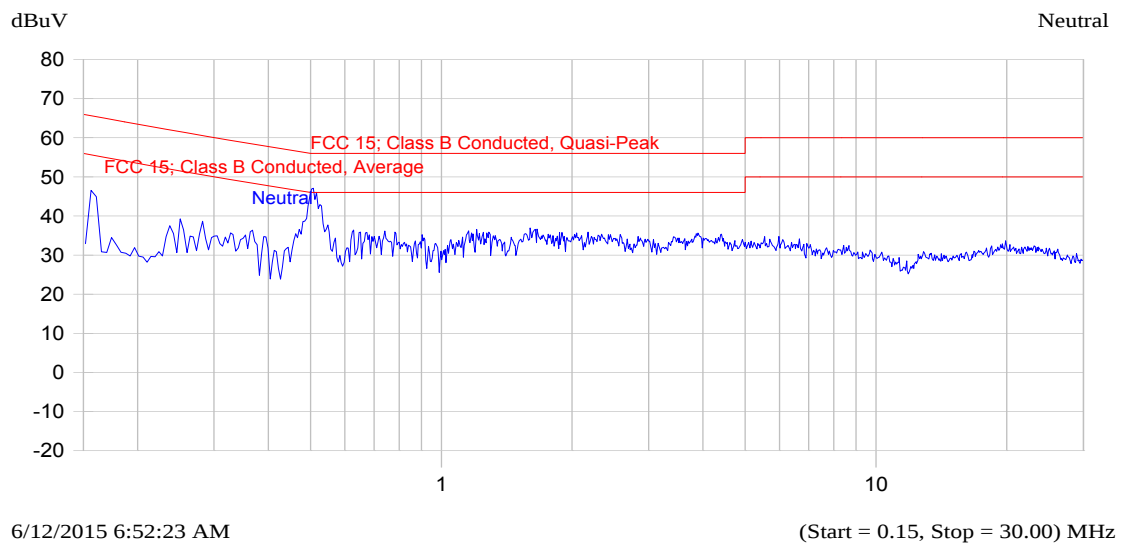


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.191	46.2	36.7	-27.3	29.6	-24.3	Hot
0.502	47.1	43.6	-12.4	38.0	-8.0	Hot

Plot 5.1.4.2. Power Line Conducted Emissions; Line Voltage 120 VAC; Line Tested: Neutral

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta dB	QP-QP Limit dB	Avg dBuV	Delta dB	Avg-Avg Limit dB	Trace Name
0.159	49.2	42.3	-23.2		30.7	-24.8		Neutral
0.507	47.8	44.9	-11.1		39.7	-6.3		Neutral

5.2. OCCUPIED BANDWIDTH [§ 15.247(a)(2)]

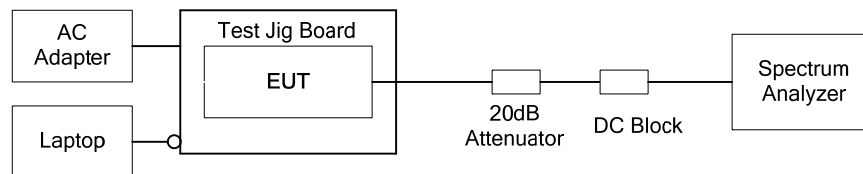
5.2.1. Limit(s)

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

5.2.2. Method of Measurements

KDB Publication No. 558074 D01 DTS Meas Guidance V03r02, Section 8.1 Option 1

5.2.3. Test Arrangement



5.2.4. Test Data

802.11b					
Modulation	Data Rate (Mbps)	Channel Number	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
DBPSK	1	1	2412	7.12	500
		6	2437	8.03	500
		11	2462	7.61	500
DQPSK	2	1	2412	7.67	500
		6	2437	6.13	500
		11	2462	7.36	500
CCK	11	1	2412	7.30	500
		6	2437	7.70	500
		11	2462	7.42	500

802.11g					
Modulation	Data Rate (Mbps)	Channel Number	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
BPSK	9	1	2412	16.62	500
		6	2437	16.62	500
		11	2462	16.55	500
QPSK	18	1	2412	16.62	500
		6	2437	16.62	500
		11	2462	16.62	500
16-QAM	36	1	2412	16.62	500
		6	2437	16.62	500
		11	2462	16.55	500
64-QAM	54	1	2412	16.62	500
		6	2437	16.62	500
		11	2462	16.62	500

802.11n HT20						
MCS Index	Modulation	Data Rate (Mbps)	Channel Number	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
0	BPSK 1/2	6.5	1	2412	17.82	500
			6	2437	17.89	500
			11	2462	17.82	500
2	QPSK 3/4	19.5	1	2412	17.75	500
			6	2437	17.82	500
			11	2462	17.82	500
4	16-QAM 3/4	39	1	2412	17.89	500
			6	2437	17.89	500
			11	2462	17.89	500
7	64-QAM 5/6	65	1	2412	17.89	500
			6	2437	17.89	500
			11	2462	17.82	500

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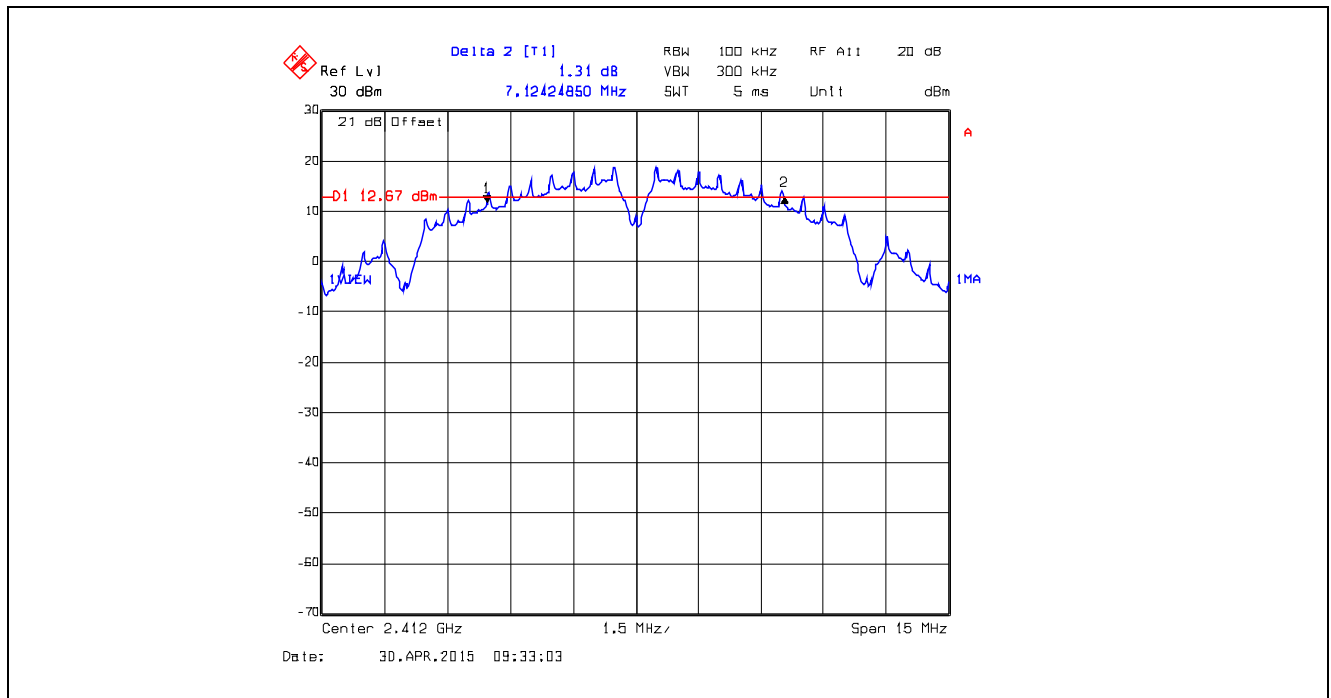
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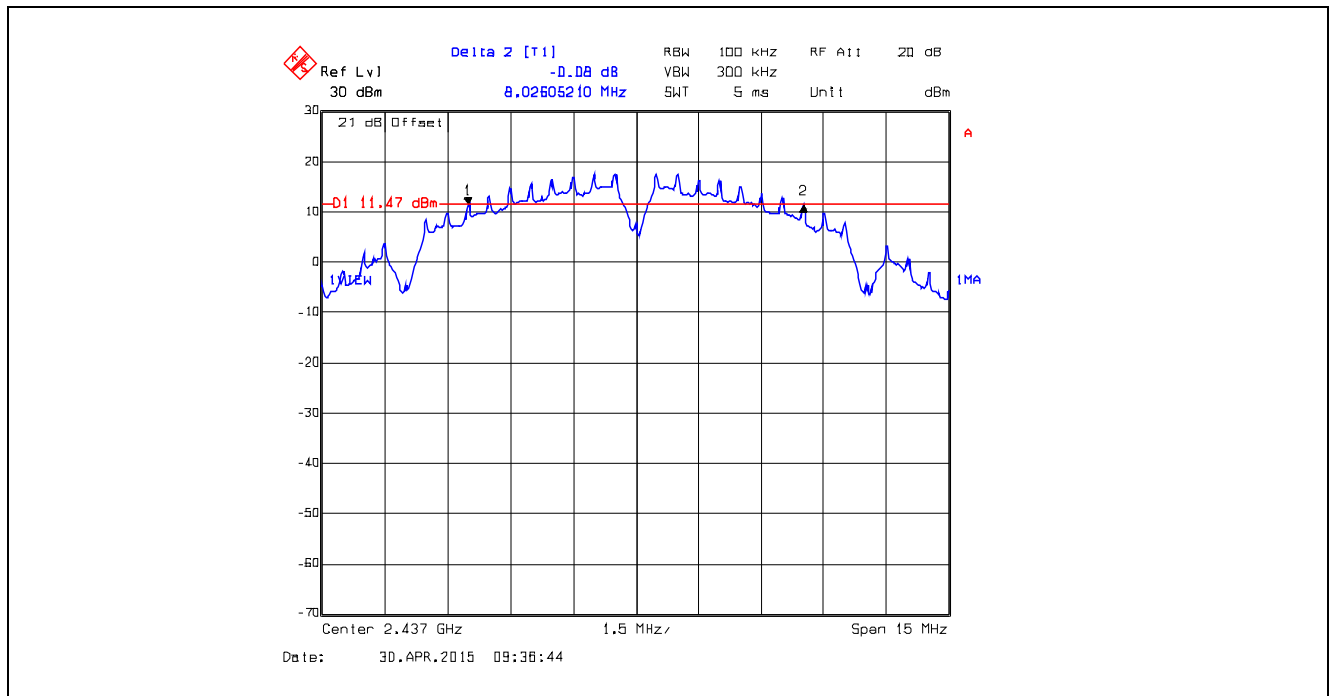
802.11n HT40						
MCS Index	Modulation	Data Rate (Mbps)	Channel Number	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
0	BPSK 1/2	13.5	3	2422	36.71	500
			6	2437	36.71	500
			9	2452	36.71	500
2	QPSK 3/4	40.5	3	2422	36.71	500
			6	2437	36.71	500
			9	2452	36.71	500
4	16-QAM 3/4	81	3	2422	36.71	500
			6	2437	36.71	500
			9	2452	36.71	500
7	64-QAM 5/6	135	3	2422	36.71	500
			6	2437	36.71	500
			9	2452	36.71	500

See the following plots for detailed measurements.

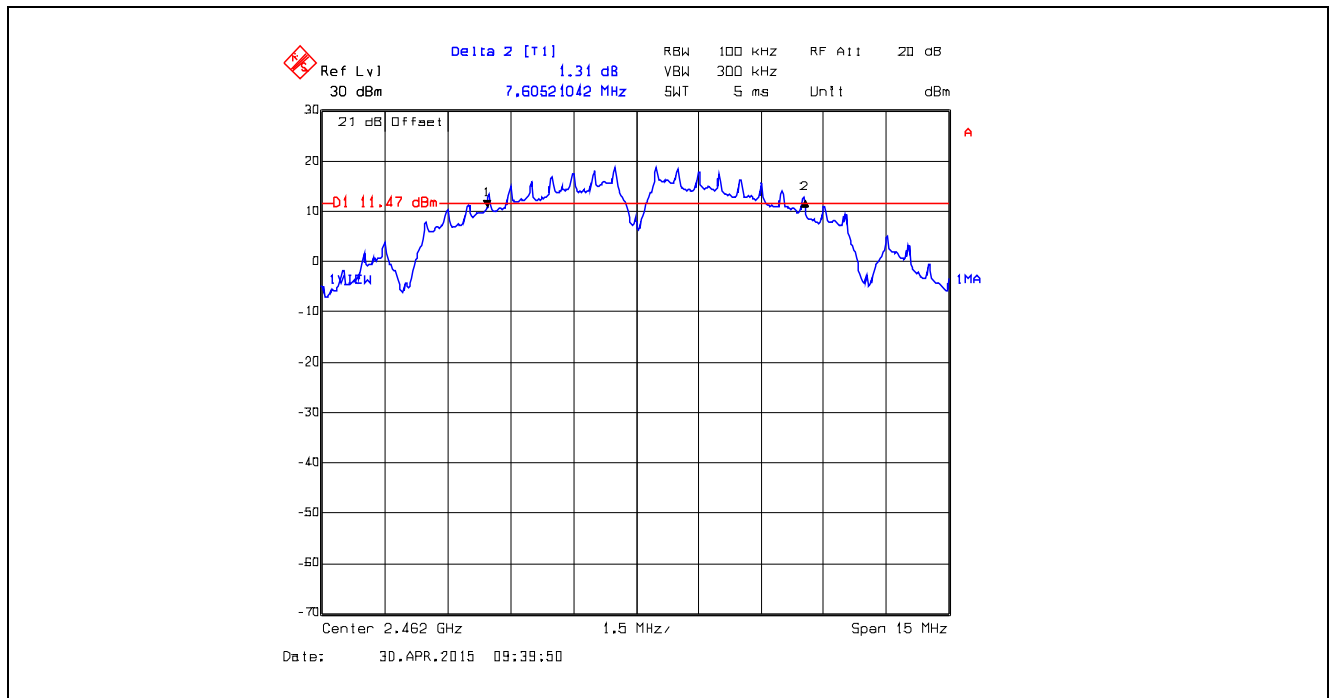
Plot 5.2.4.1. 6 dB Bandwidth, 802.11b, Ch 1, 2412 MHz, DBPSK 1 Mbps, TX Gain Setting 53



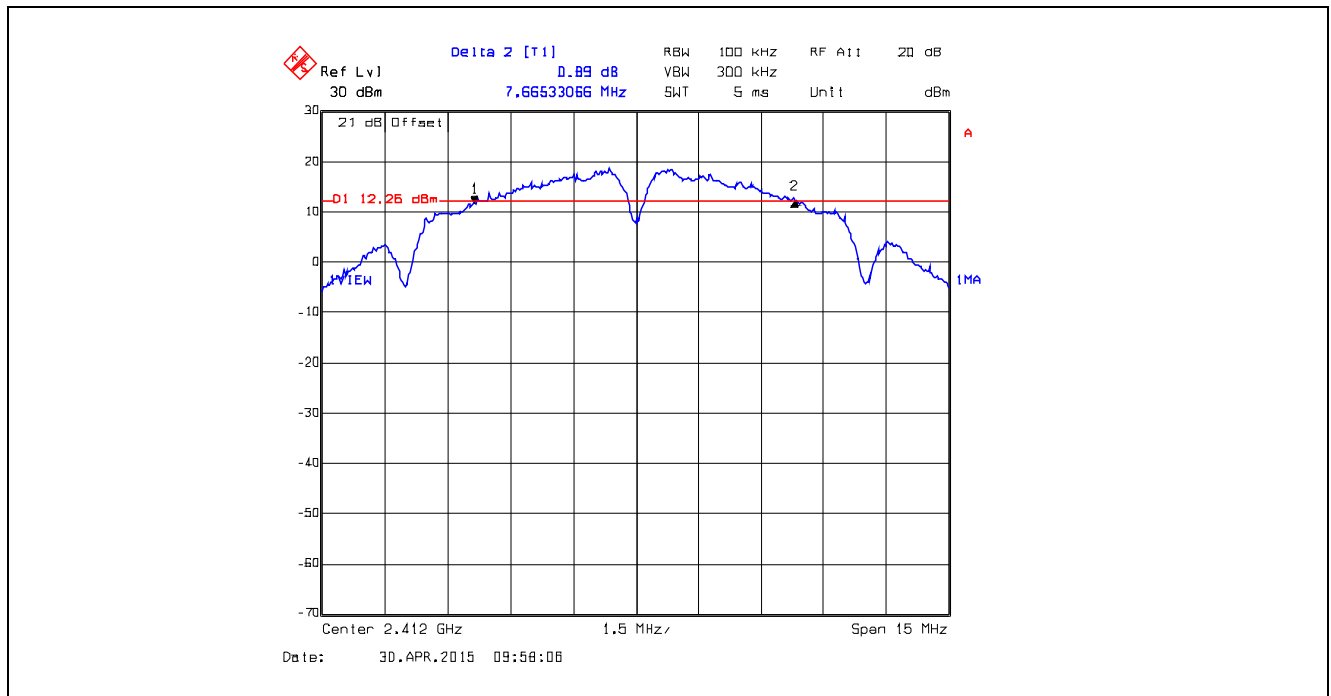
Plot 5.2.4.2. 6 dB Bandwidth, 802.11b, Ch 6, 2437 MHz, DBPSK 1 Mbps, TX Gain Setting 53



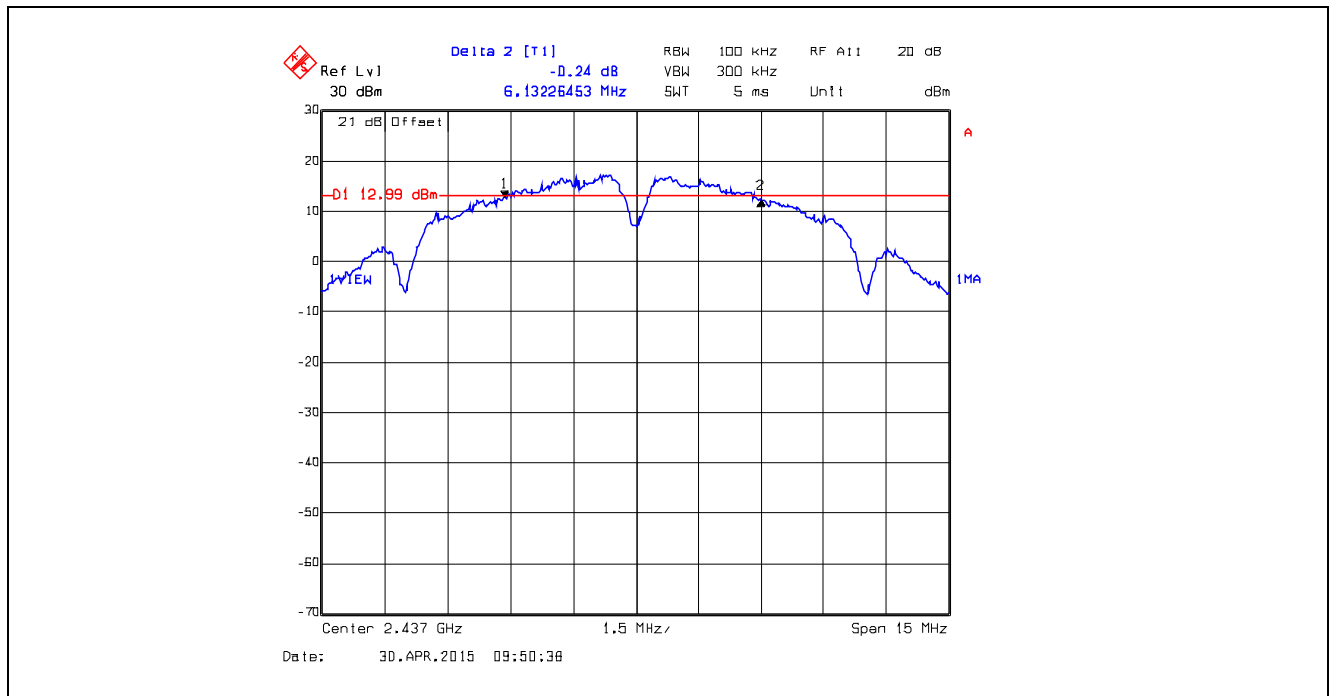
Plot 5.2.4.3. 6 dB Bandwidth, 802.11b, Ch 11, 2462 MHz, DBPSK 1 Mbps, TX Gain Setting 53



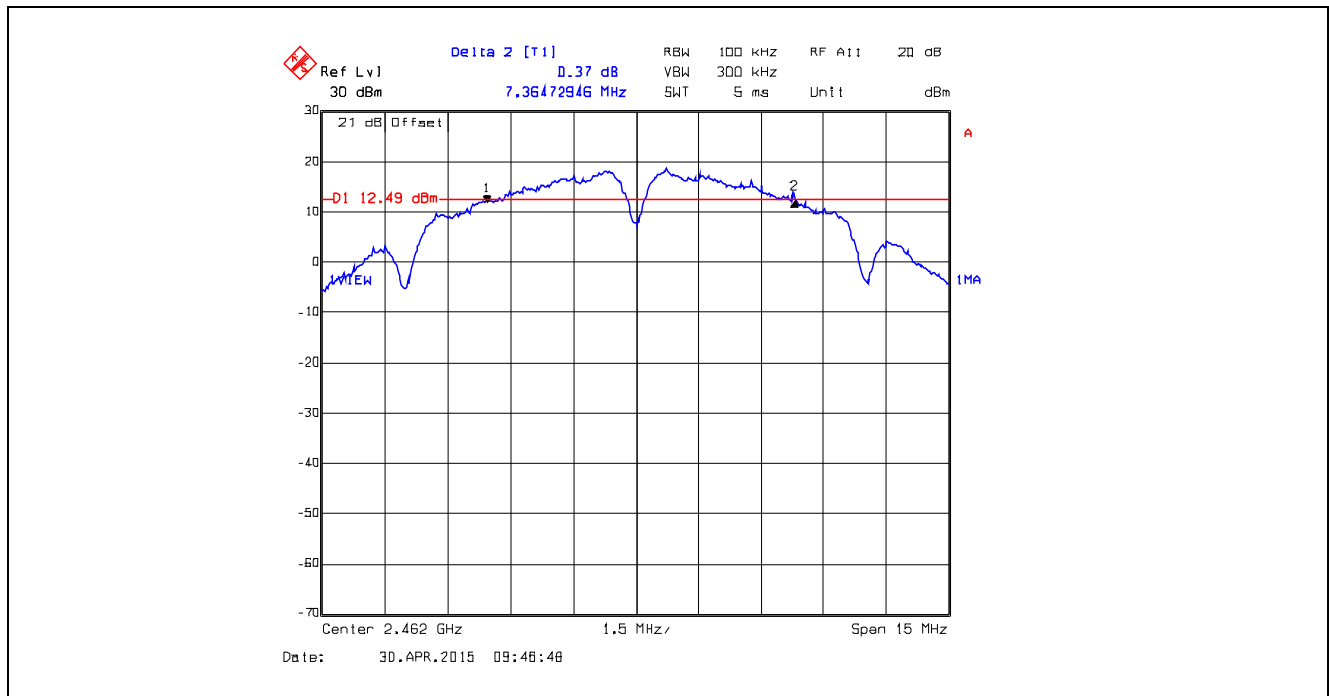
Plot 5.2.4.4. 6 dB Bandwidth, 802.11b, Ch 1, 2412 MHz, DQPSK 2 Mbps, TX Gain Setting 53



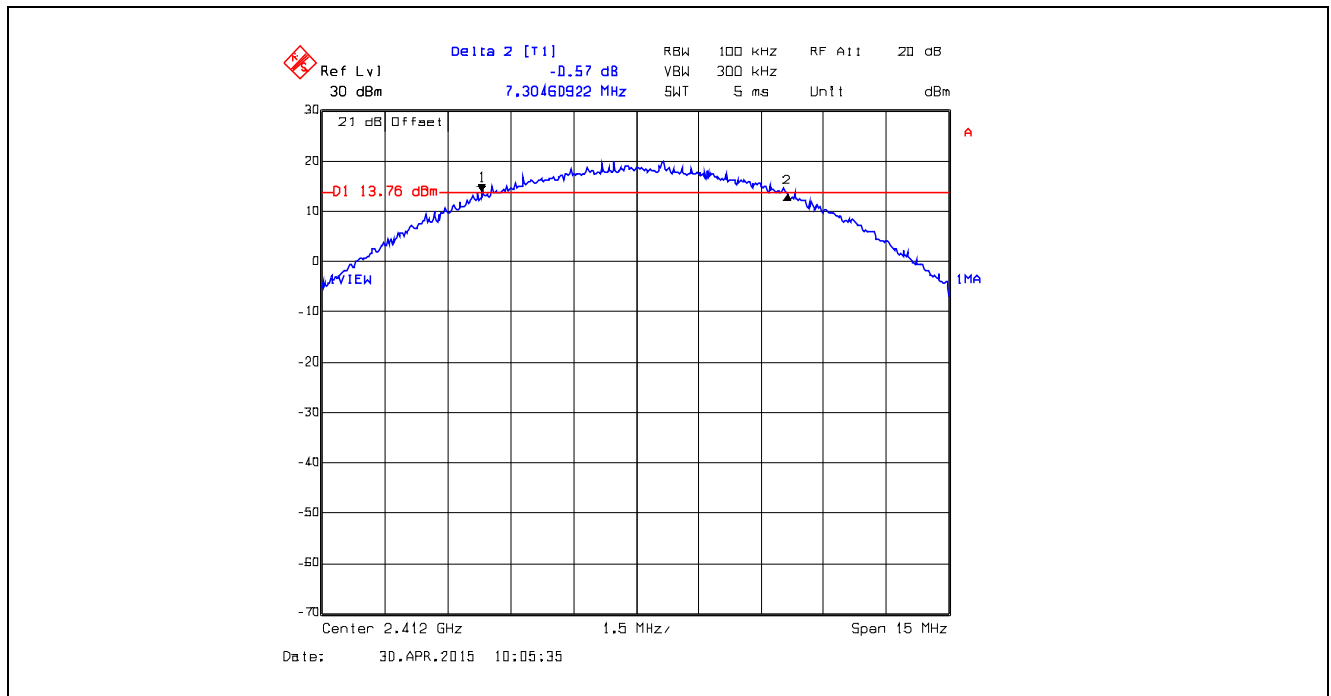
Plot 5.2.4.5. 6 dB Bandwidth, 802.11b, Ch 6, 2437 MHz, DQPSK 2 Mbps, TX Gain Setting 53



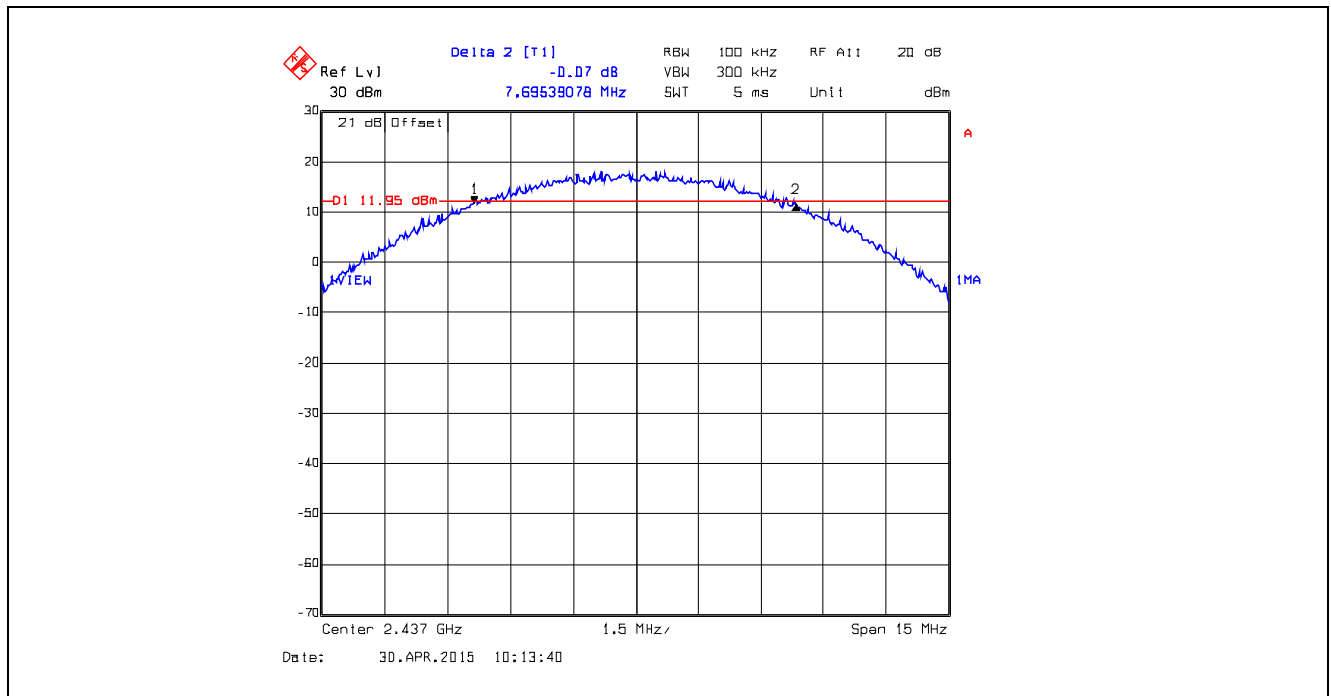
Plot 5.2.4.6. 6 dB Bandwidth, 802.11b, Ch 11, 2462 MHz, DQPSK 2 Mbps, TX Gain Setting 53



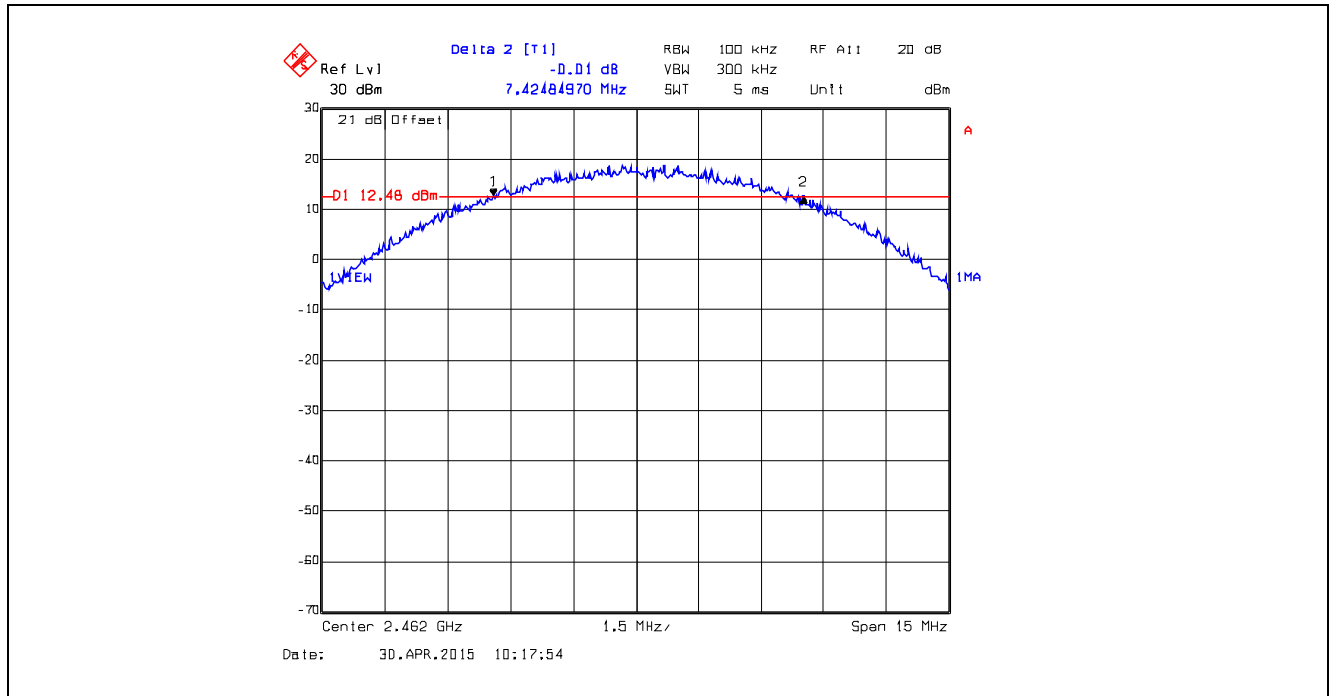
Plot 5.2.4.7. 6 dB Bandwidth, 802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53



Plot 5.2.4.8. 6 dB Bandwidth, 802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53



Plot 5.2.4.9. 6 dB Bandwidth, 802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53



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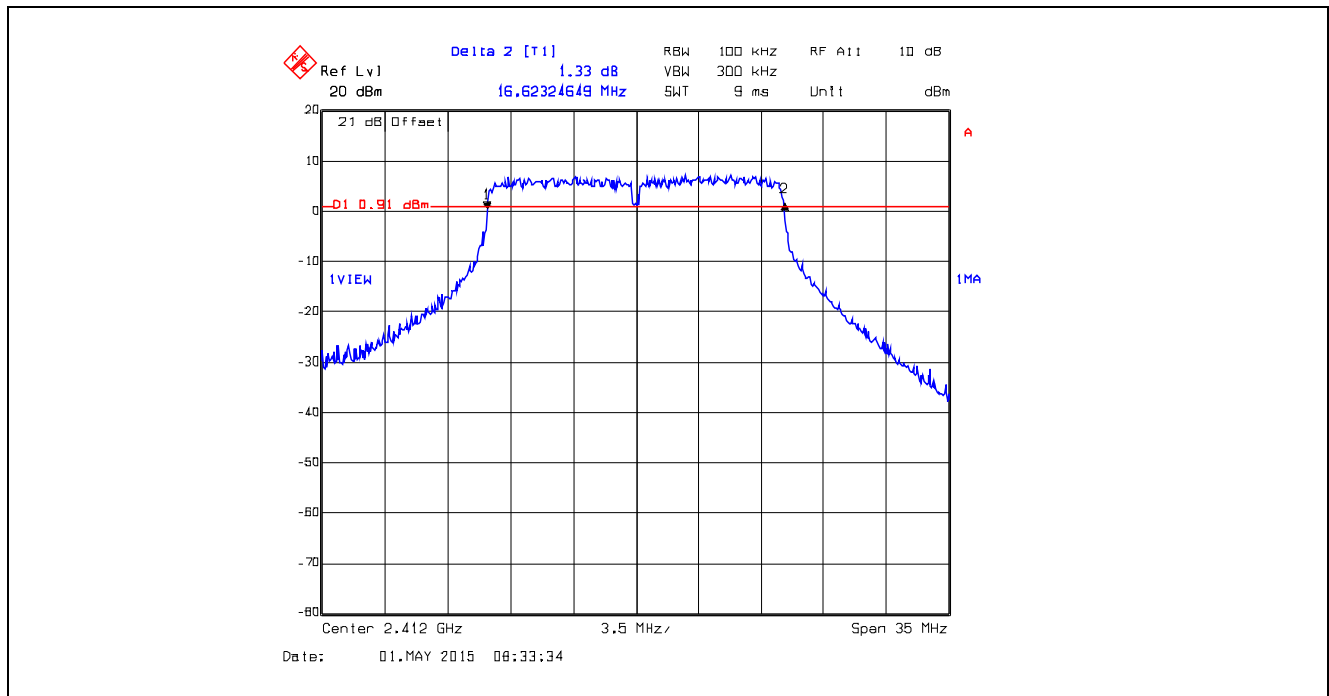
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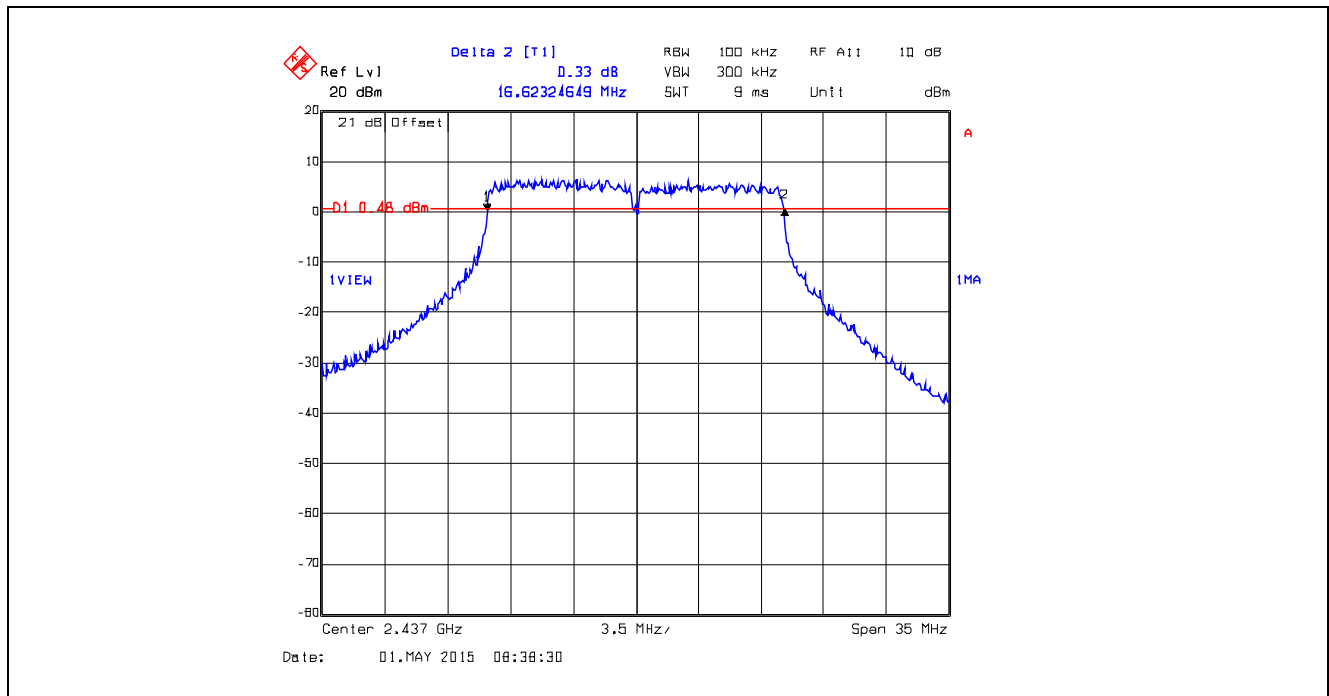
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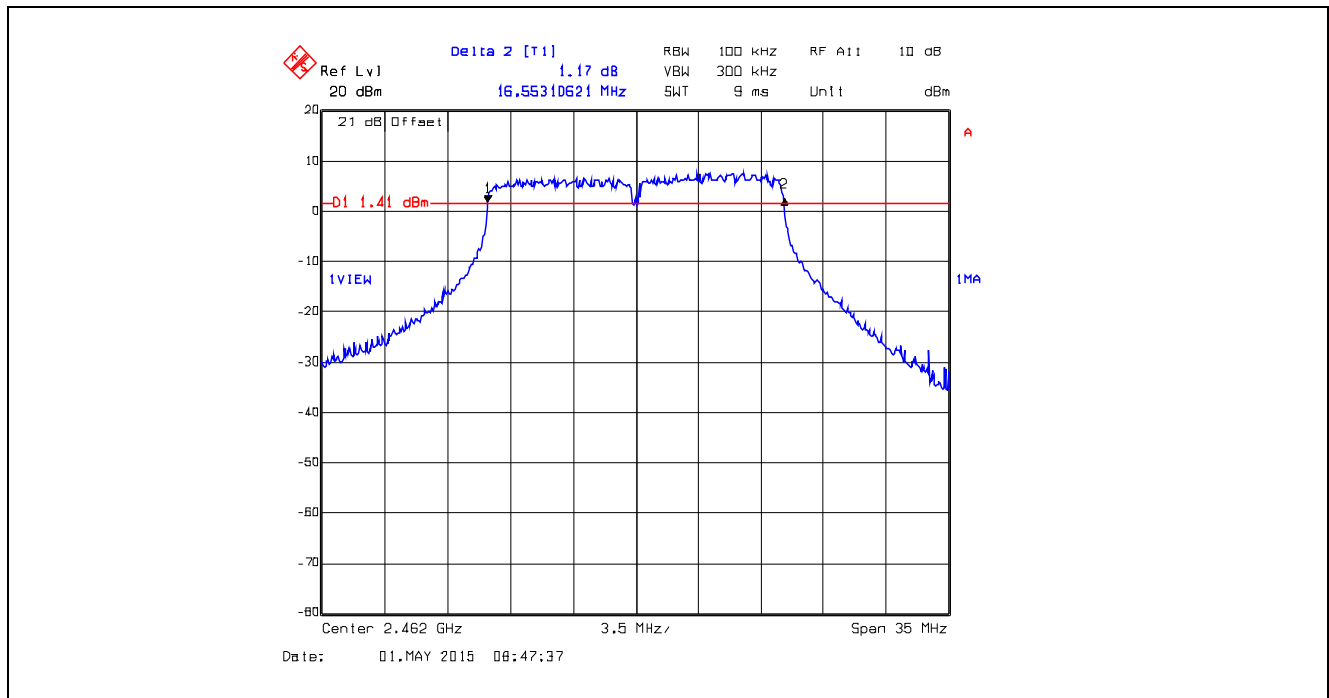
Plot 5.2.4.10. 6 dB Bandwidth, 802.11g, Ch 1, 2412 MHz, BPSK 9 Mbps, TX Gain Setting 47



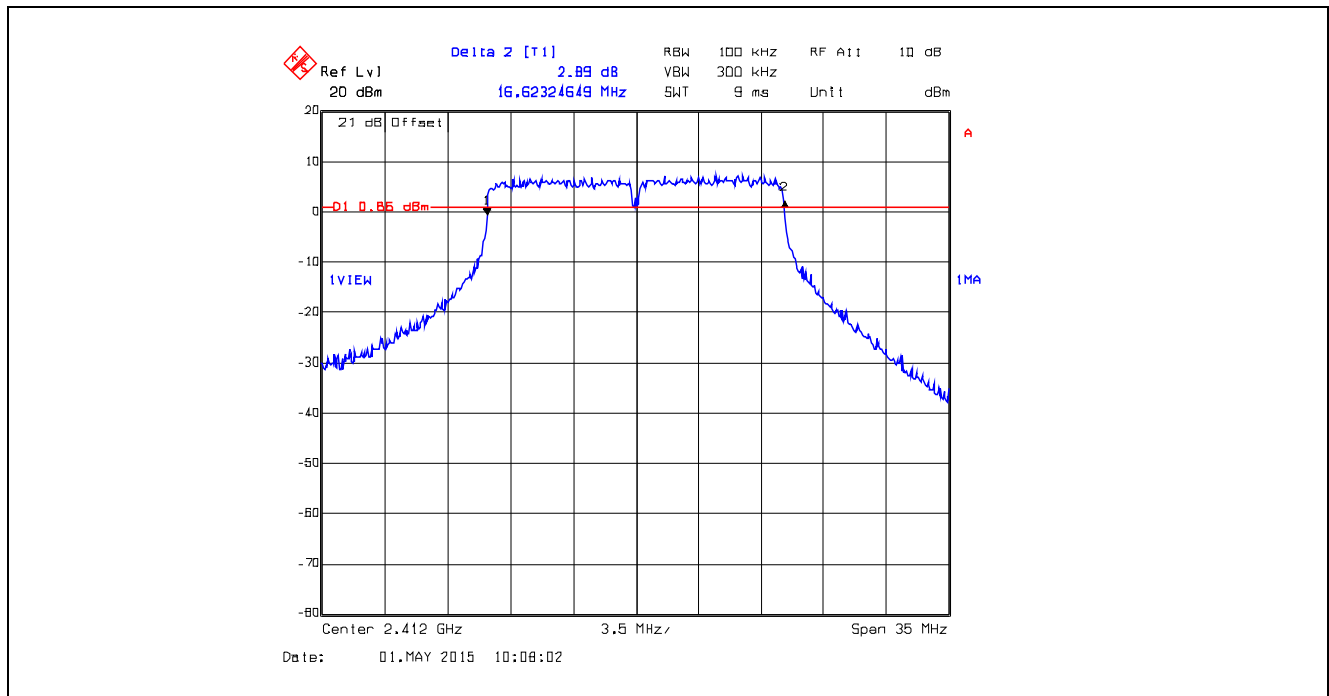
Plot 5.2.4.11. 6 dB Bandwidth, 802.11g, Ch 6, 2437 MHz, BPSK 9 Mbps, TX Gain Setting 47



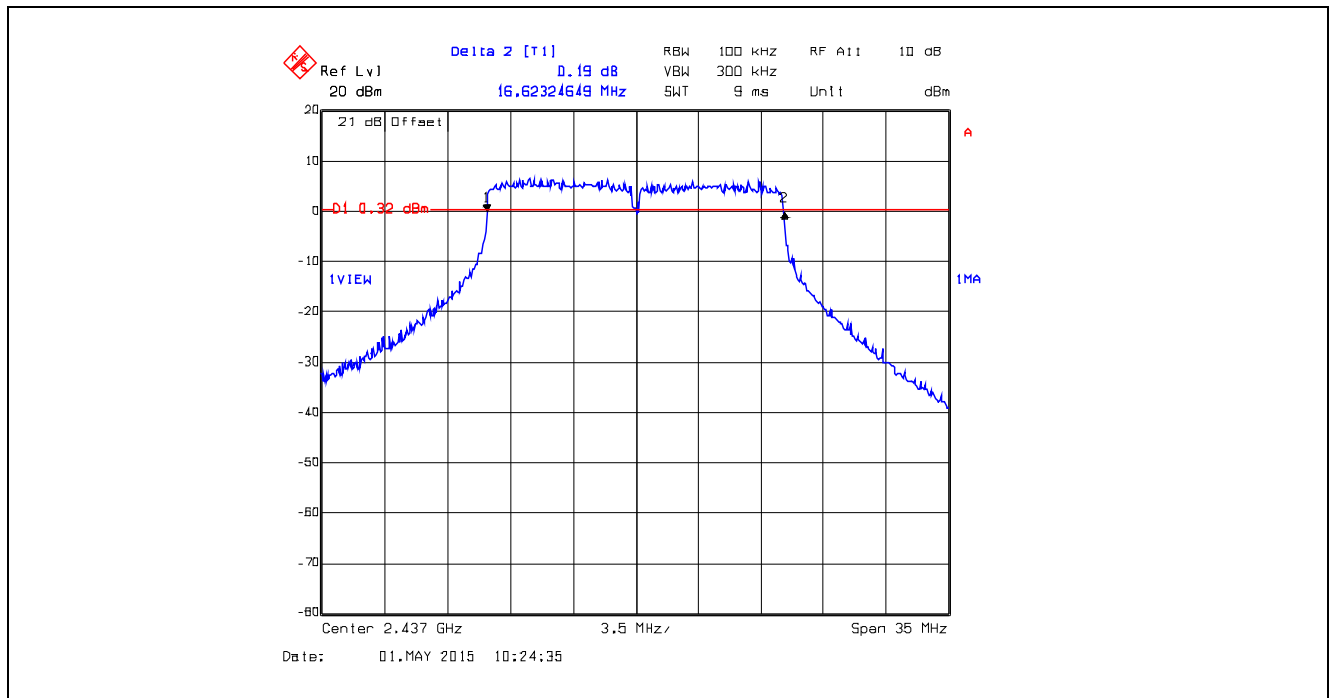
Plot 5.2.4.12. 6 dB Bandwidth, 802.11g, Ch 11, 2462 MHz, BPSK 9 Mbps, TX Gain Setting 47



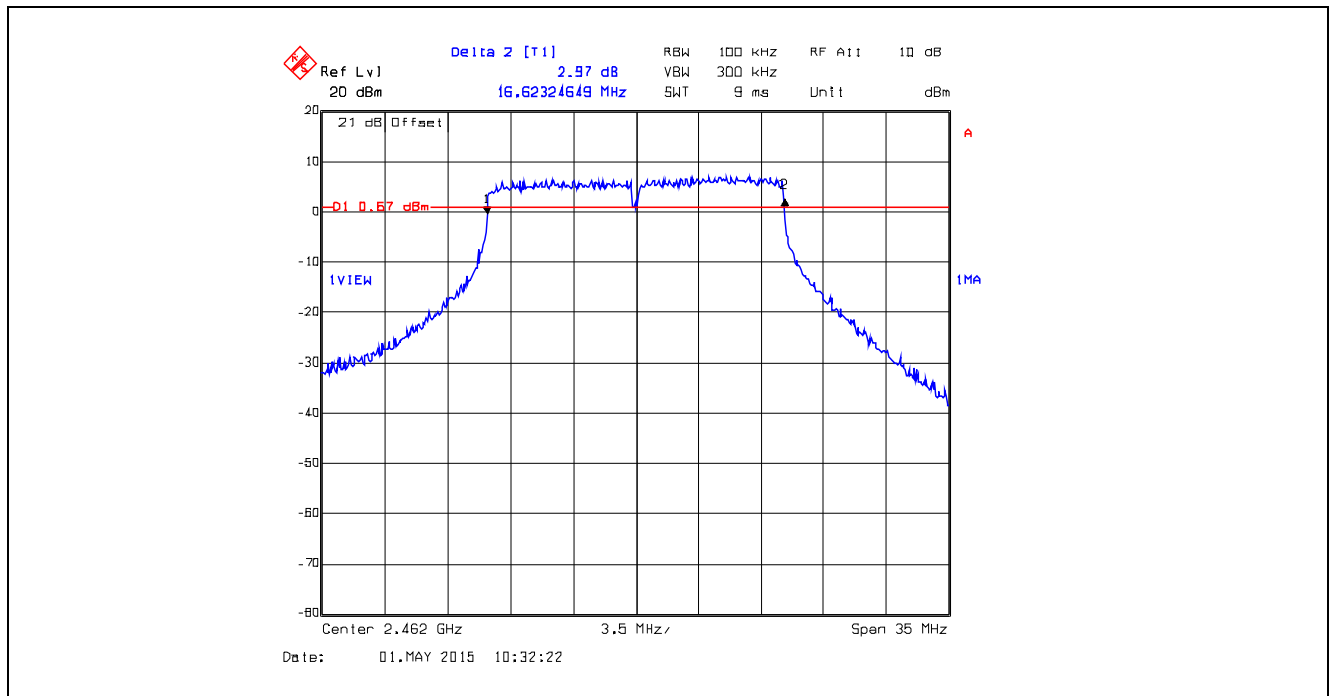
Plot 5.2.4.13. 6 dB Bandwidth, 802.11g, Ch 1, 2412 MHz, QPSK 18 Mbps, TX Gain Setting 47



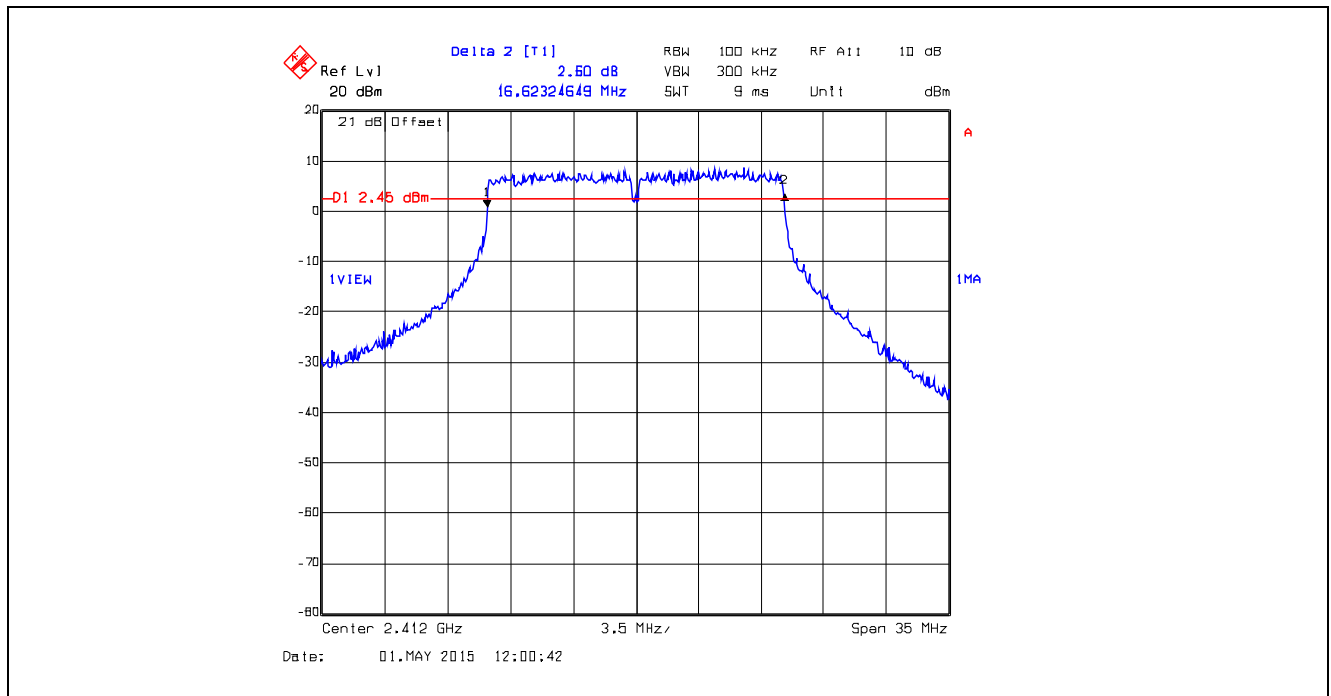
Plot 5.2.4.14. 6 dB Bandwidth, 802.11g, Ch 6, 2437 MHz, QPSK 18 Mbps, TX Gain Setting 47



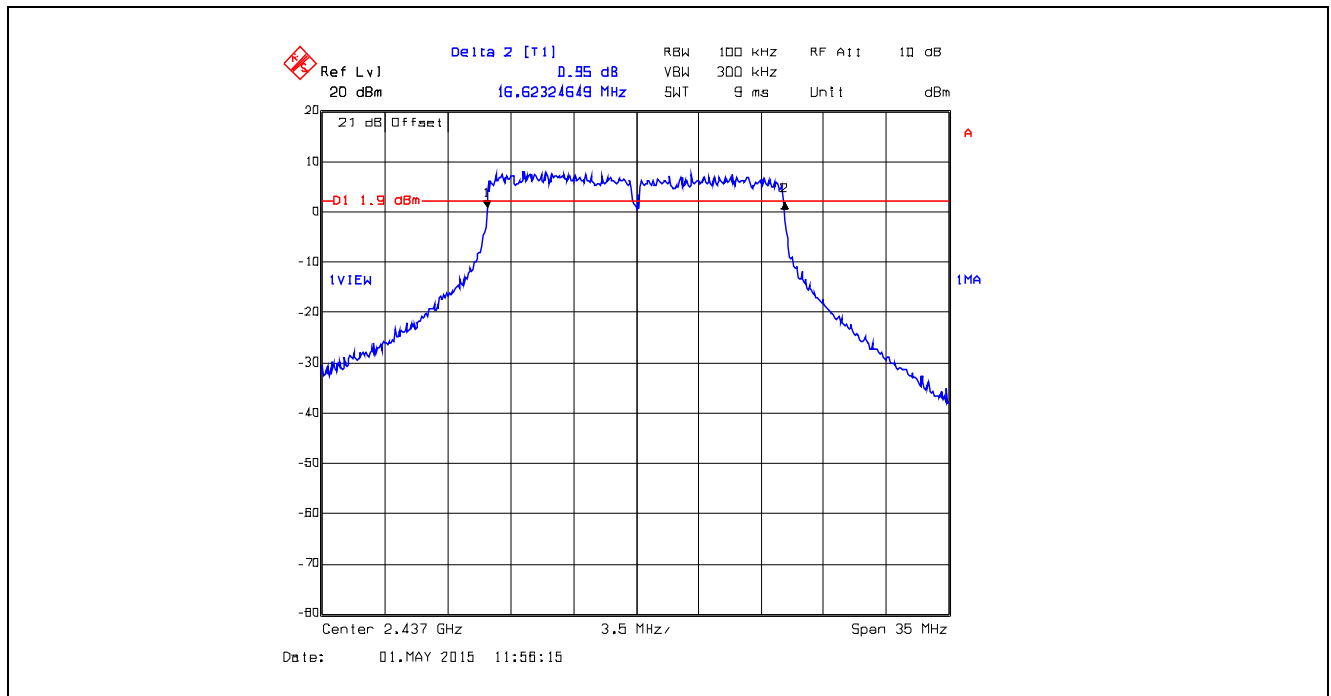
Plot 5.2.4.15. 6 dB Bandwidth, 802.11g, Ch 11, 2462 MHz, QPSK 18 Mbps, TX Gain Setting 47



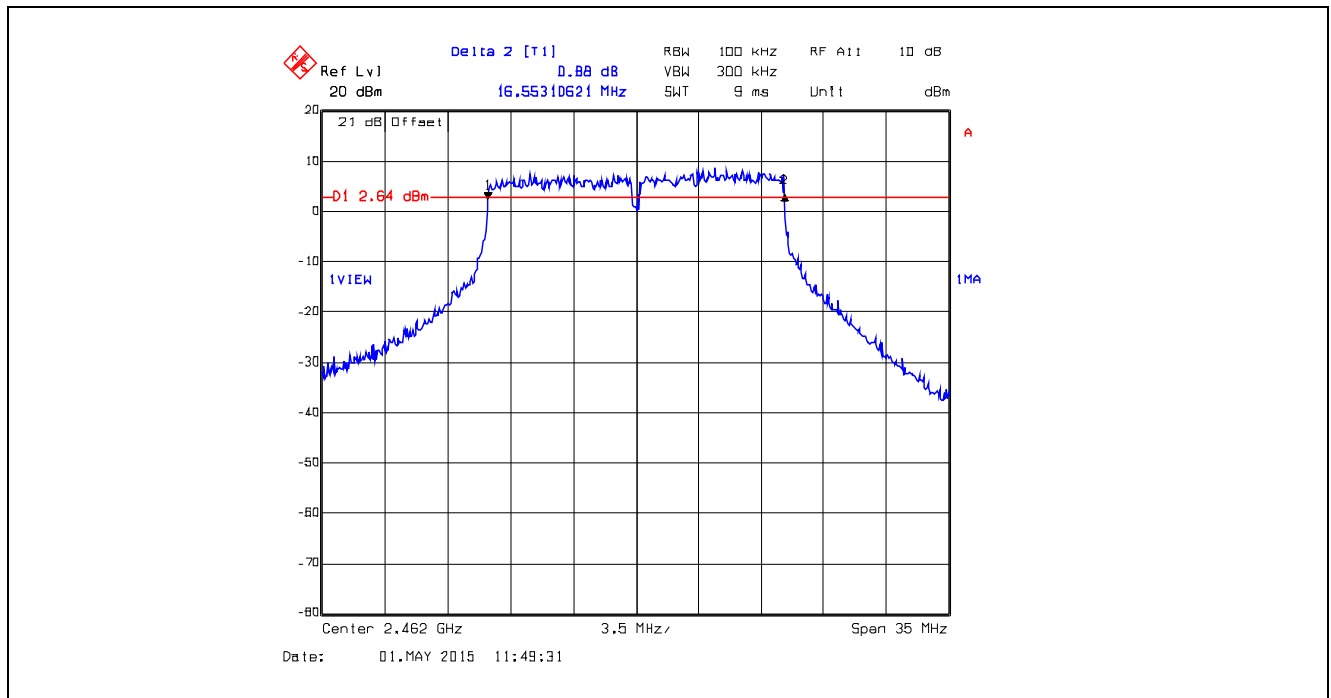
Plot 5.2.4.16. 6 dB Bandwidth, 802.11g, Ch 1, 2412 MHz, 16-QAM 36 Mbps, TX Gain Setting 47



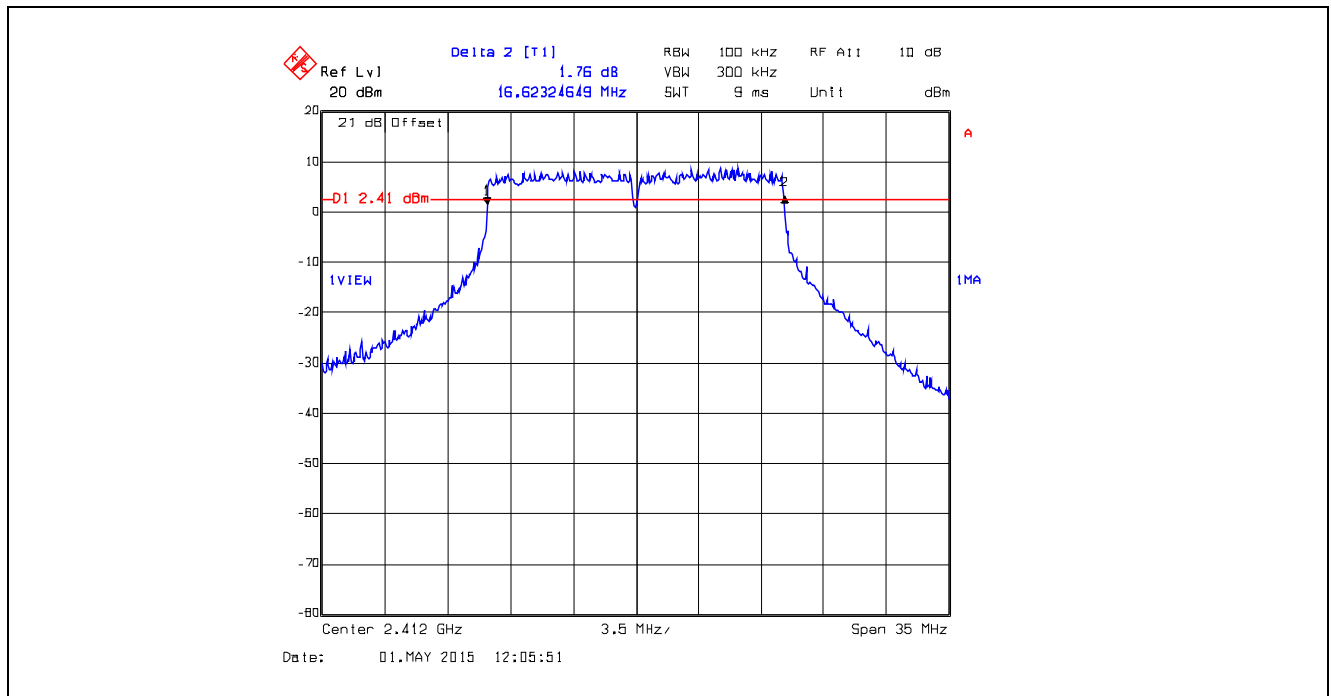
Plot 5.2.4.17. 6 dB Bandwidth, 802.11g, Ch 6, 2437 MHz, 16-QAM 36 Mbps, TX Gain Setting 47



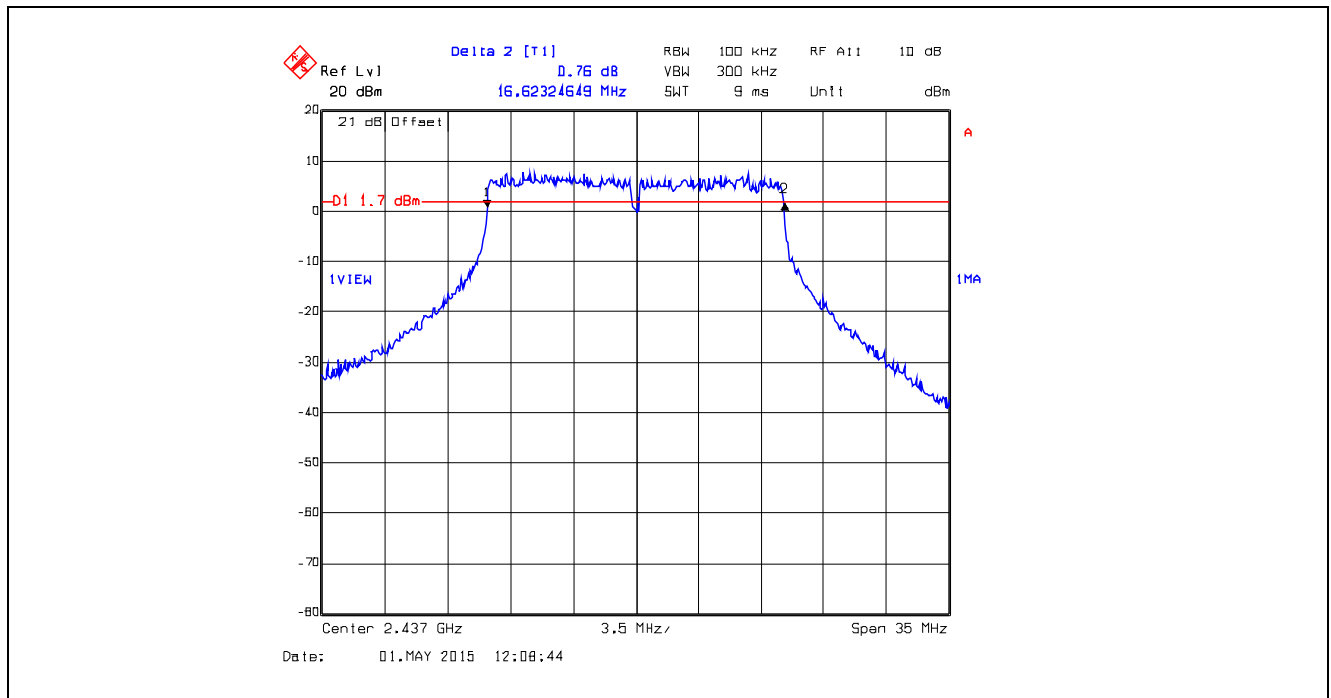
Plot 5.2.4.18. 6 dB Bandwidth, 802.11g, Ch 11, 2462 MHz, 16-QAM 36 Mbps, TX Gain Setting 47



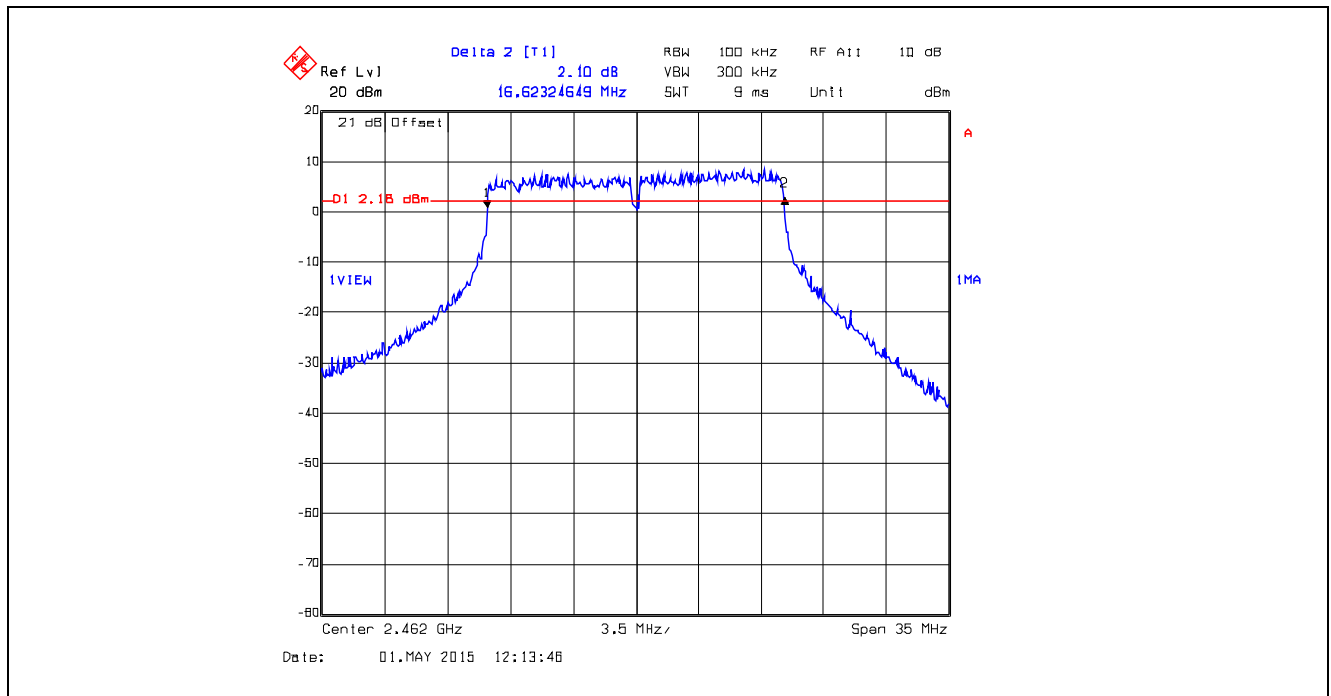
Plot 5.2.4.19. 6 dB Bandwidth, 802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47



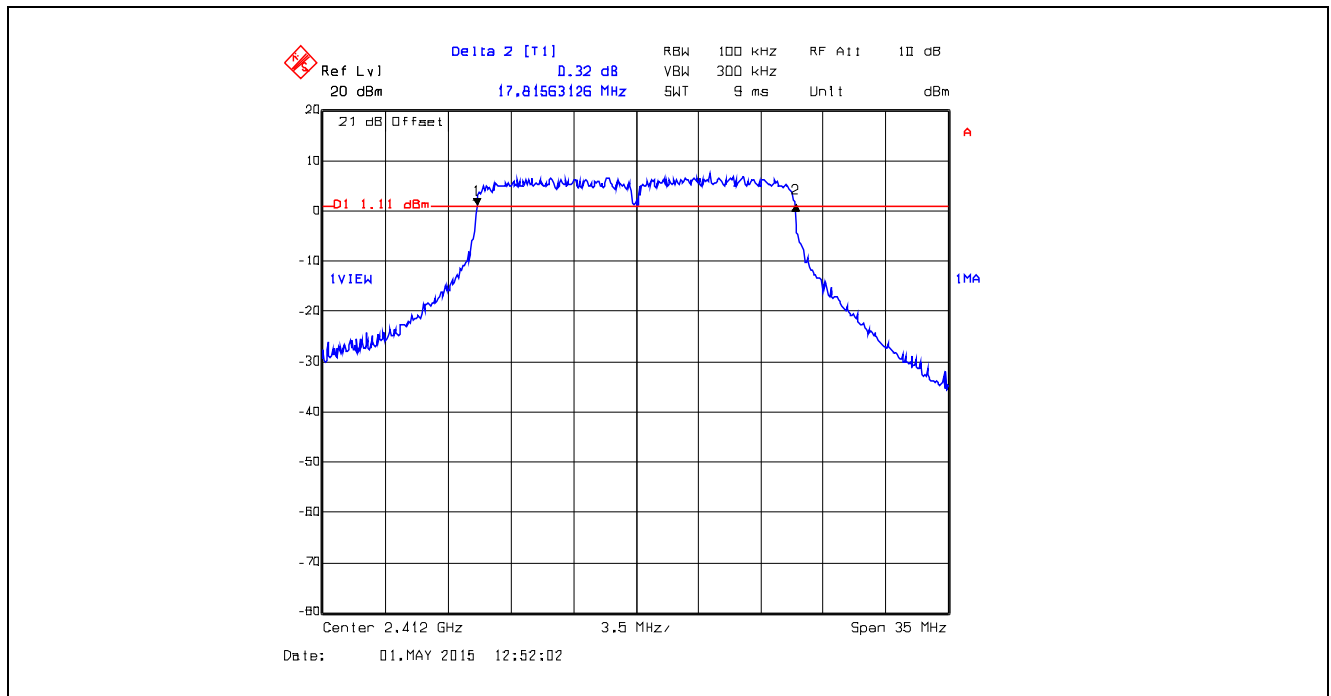
Plot 5.2.4.20. 6 dB Bandwidth, 802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47



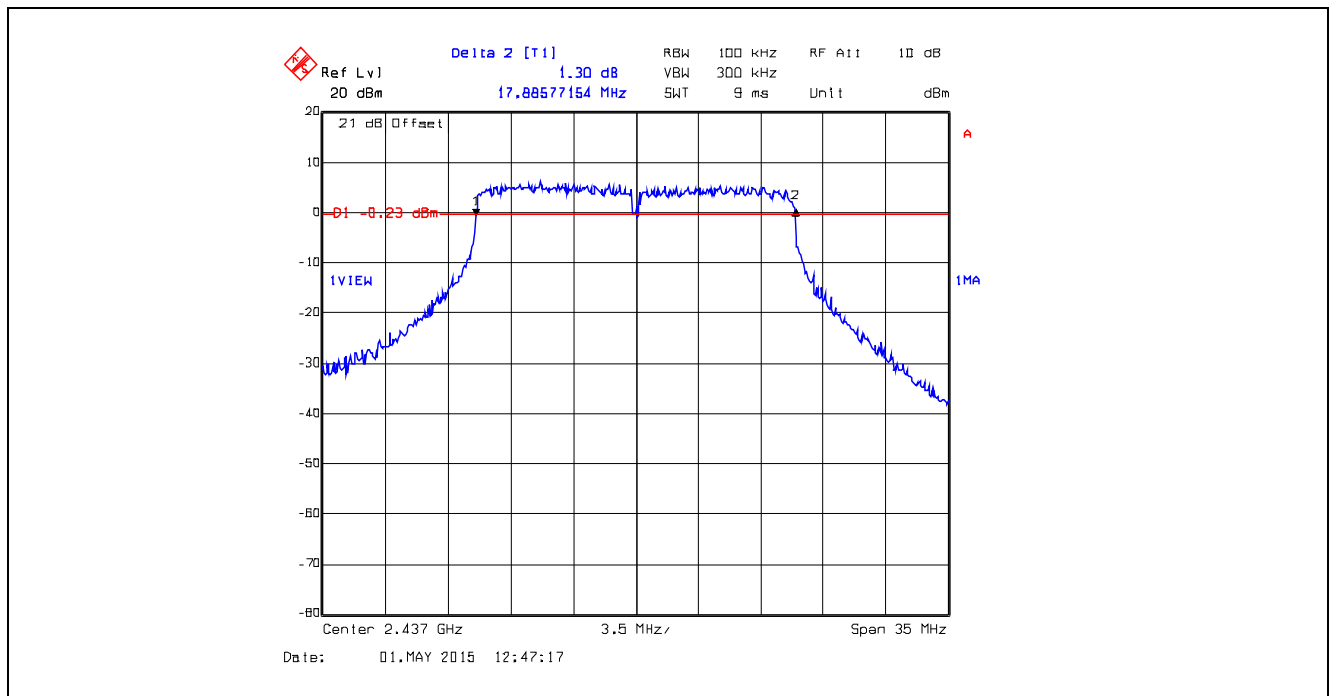
Plot 5.2.4.21. 6 dB Bandwidth, 802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47



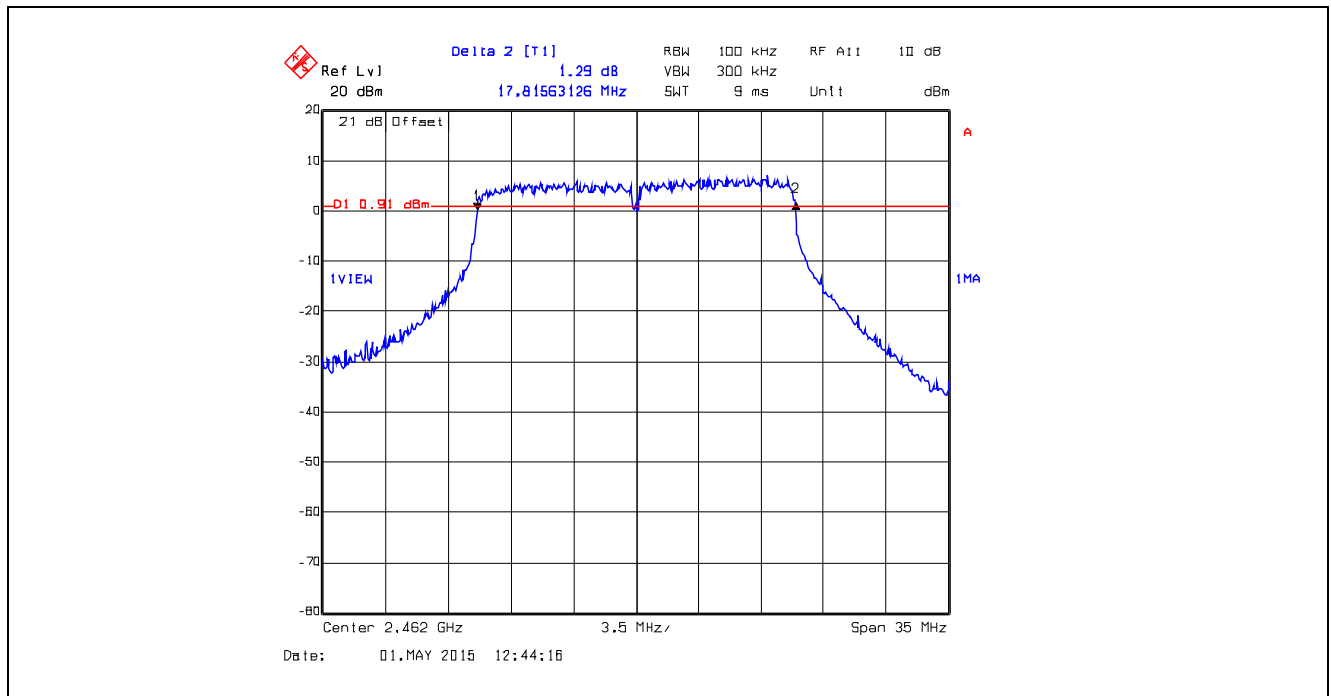
Plot 5.2.4.22. 6 dB Bandwidth, 802.11n HT20, Ch 1, 2412 MHz, MCS 0, BPSK 1/2 6.5 Mbps, TX Gain Setting 48



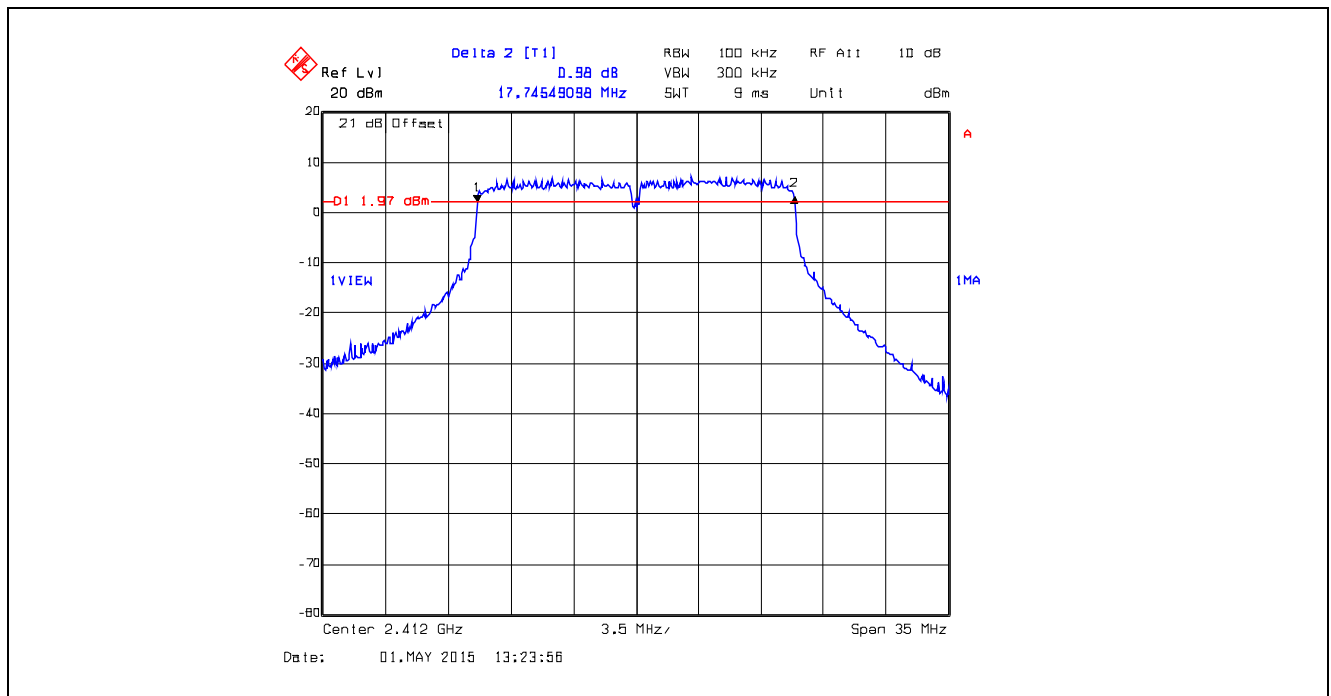
Plot 5.2.4.23. 6 dB Bandwidth, 802.11n HT20, Ch 6, 2437 MHz, MCS 0, BPSK 1/2 6.5 Mbps, TX Gain Setting 48



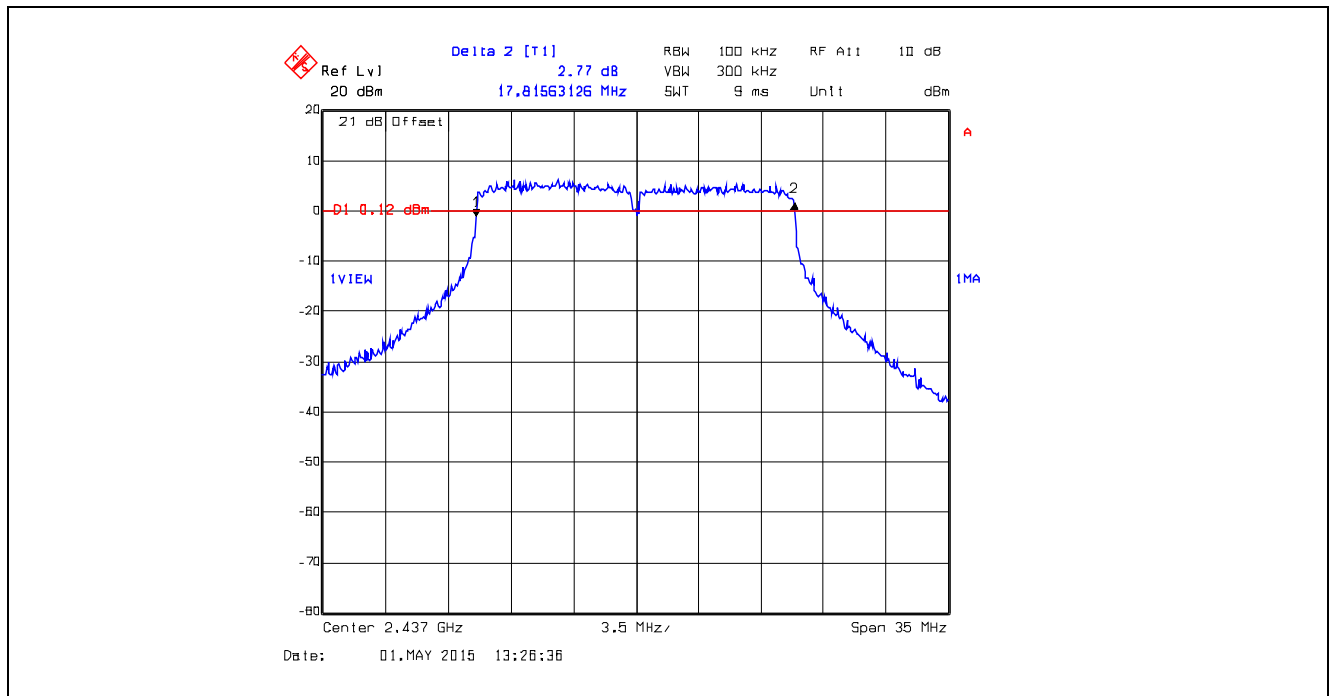
Plot 5.2.4.24. 6 dB Bandwidth, 802.11n HT20, Ch 11, 2462 MHz, MCS 0, BPSK 1/2 6.5 Mbps, TX Gain Setting 48



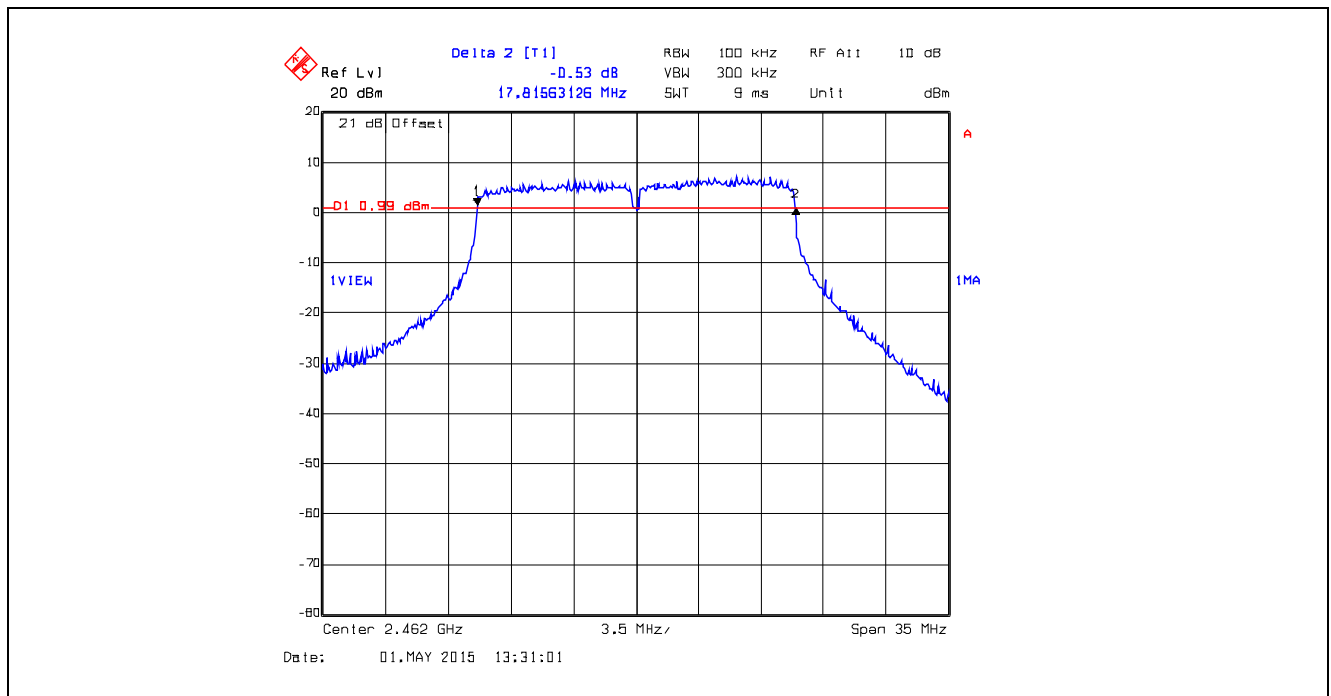
Plot 5.2.4.25. 6 dB Bandwidth, 802.11n HT20, Ch 1, 2412 MHz, MCS 2, QPSK 3/4 19.5 Mbps, TX Gain Setting 48



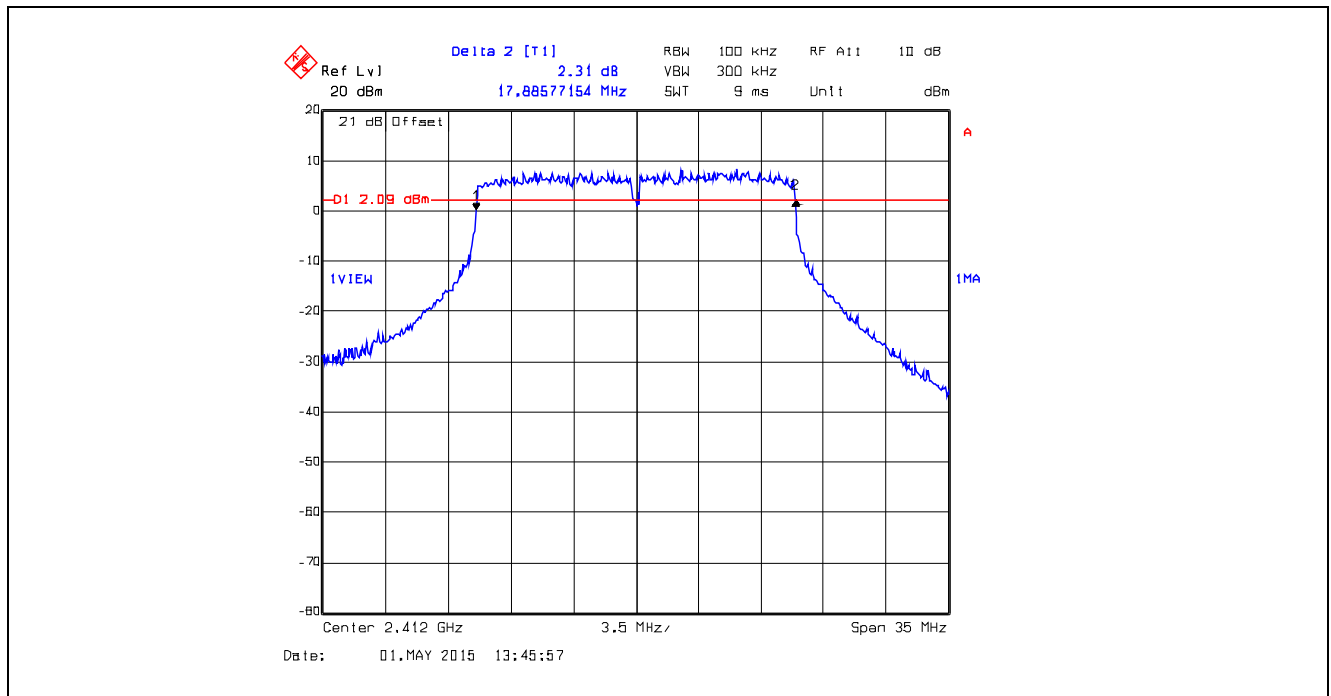
Plot 5.2.4.26. 6 dB Bandwidth, 802.11n HT20, Ch 6, 2437 MHz, MCS 2, QPSK 3/4 19.5 Mbps, TX Gain Setting 48



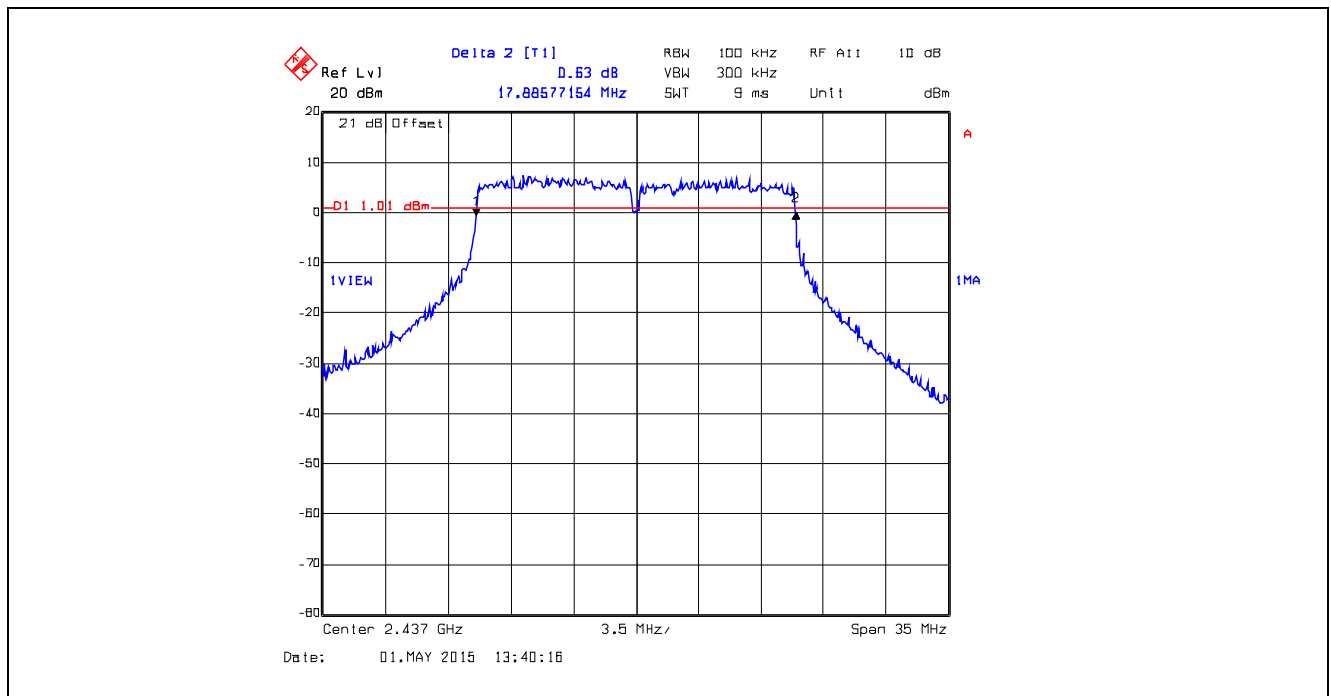
Plot 5.2.4.27. 6 dB Bandwidth, 802.11n HT20, Ch 11, 2462 MHz, MCS 2, QPSK 3/4 19.5 Mbps, TX Gain Setting 48



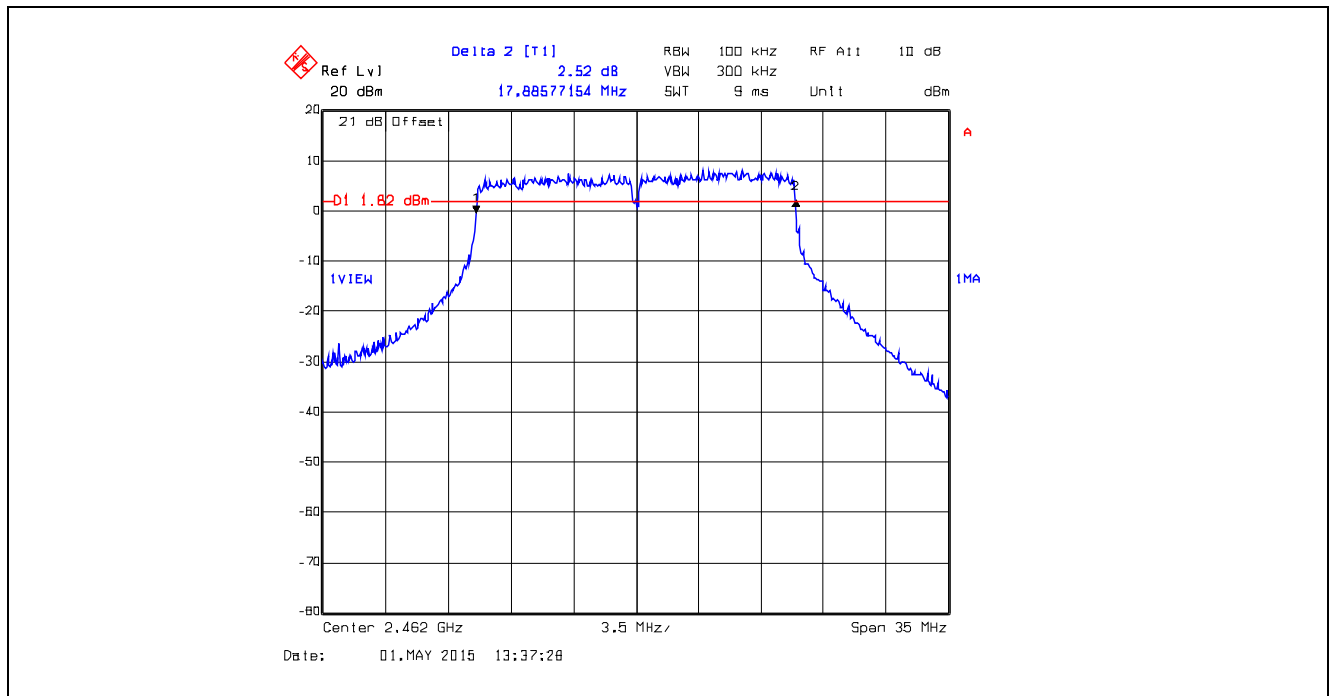
Plot 5.2.4.28. 6 dB Bandwidth, 802.11n HT20, Ch 1, 2412 MHz, MCS 4, 16-QAM 3/4 39 Mbps, TX Gain Setting 48



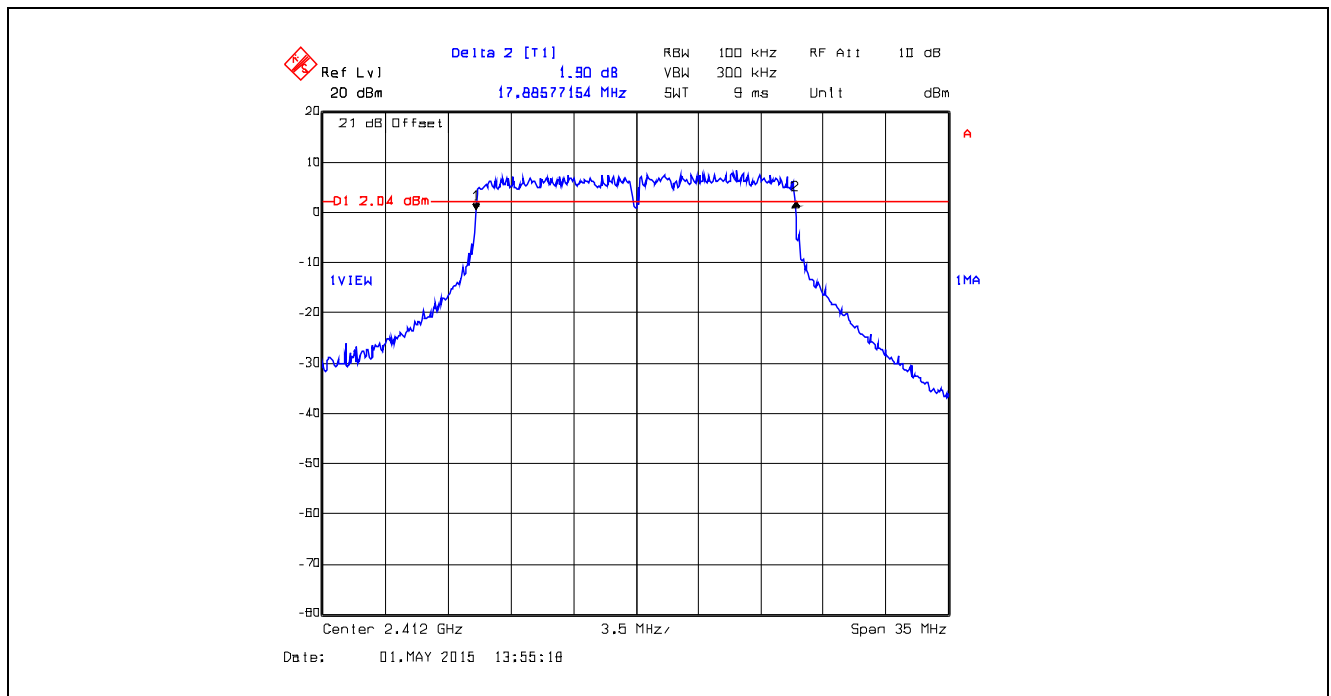
Plot 5.2.4.29. 6 dB Bandwidth, 802.11n HT20, Ch 6, 2437 MHz, MCS 4, 16-QAM 3/4 39 Mbps, TX Gain Setting 48



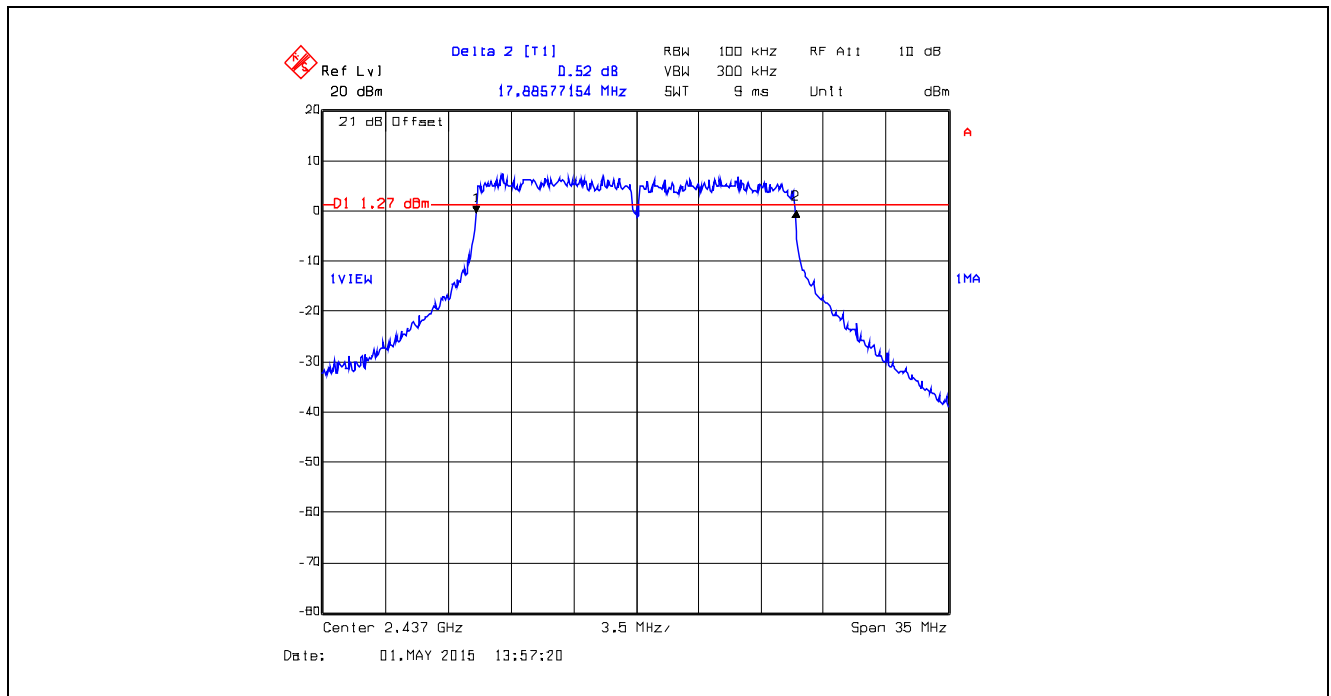
Plot 5.2.4.30. 6 dB Bandwidth, 802.11n HT20, Ch 11, 2462 MHz, MCS 4, 16-QAM 3/4 39 Mbps, TX Gain Setting 48



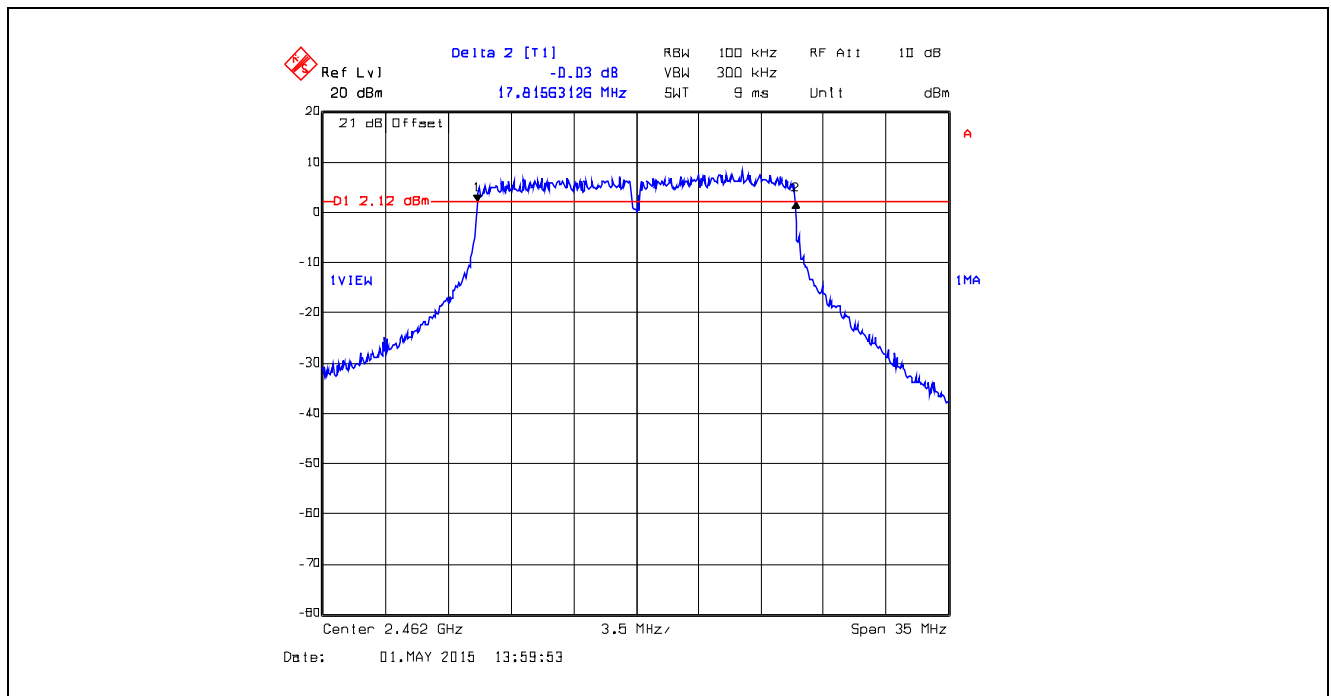
Plot 5.2.4.31. 6 dB Bandwidth, 802.11n HT20, Ch 1, 2412 MHz, MCS 7, 64-QAM 5/6 65 Mbps, TX Gain Setting 48



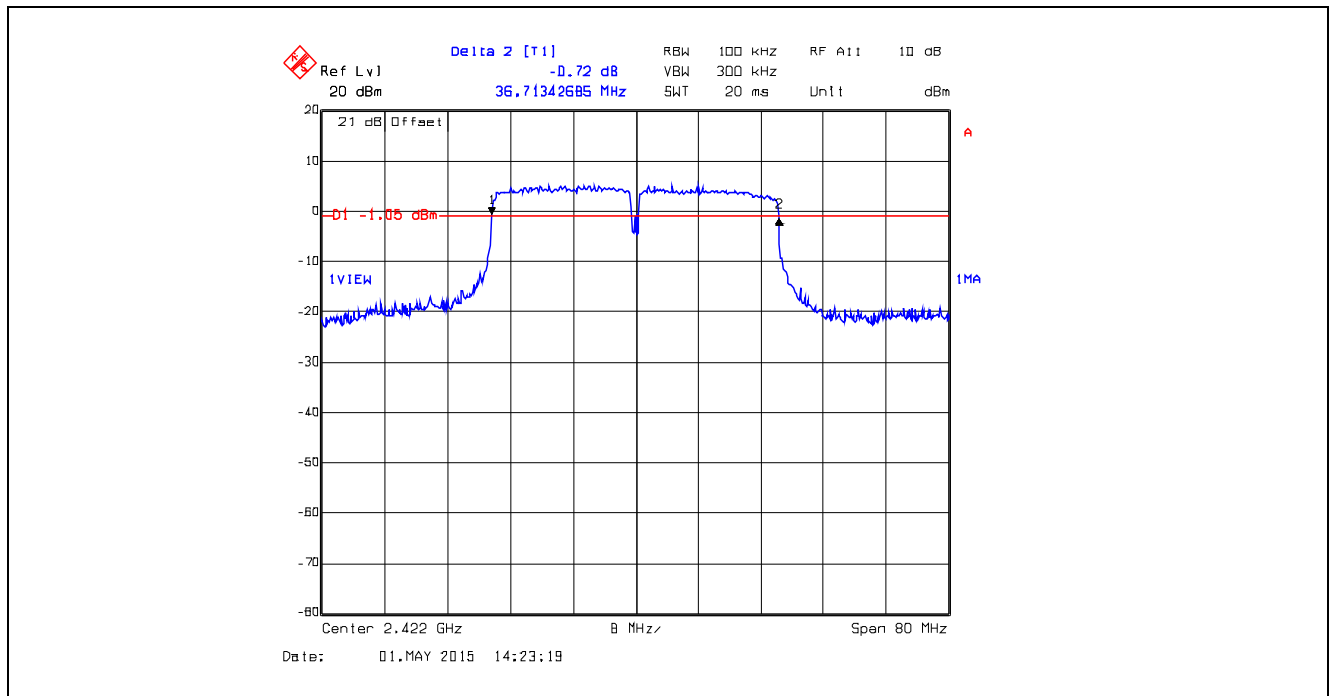
Plot 5.2.4.32. 6 dB Bandwidth, 802.11n HT20, Ch 6, 2437 MHz, MCS 7, 64-QAM 5/6 65 Mbps, TX Gain Setting 48



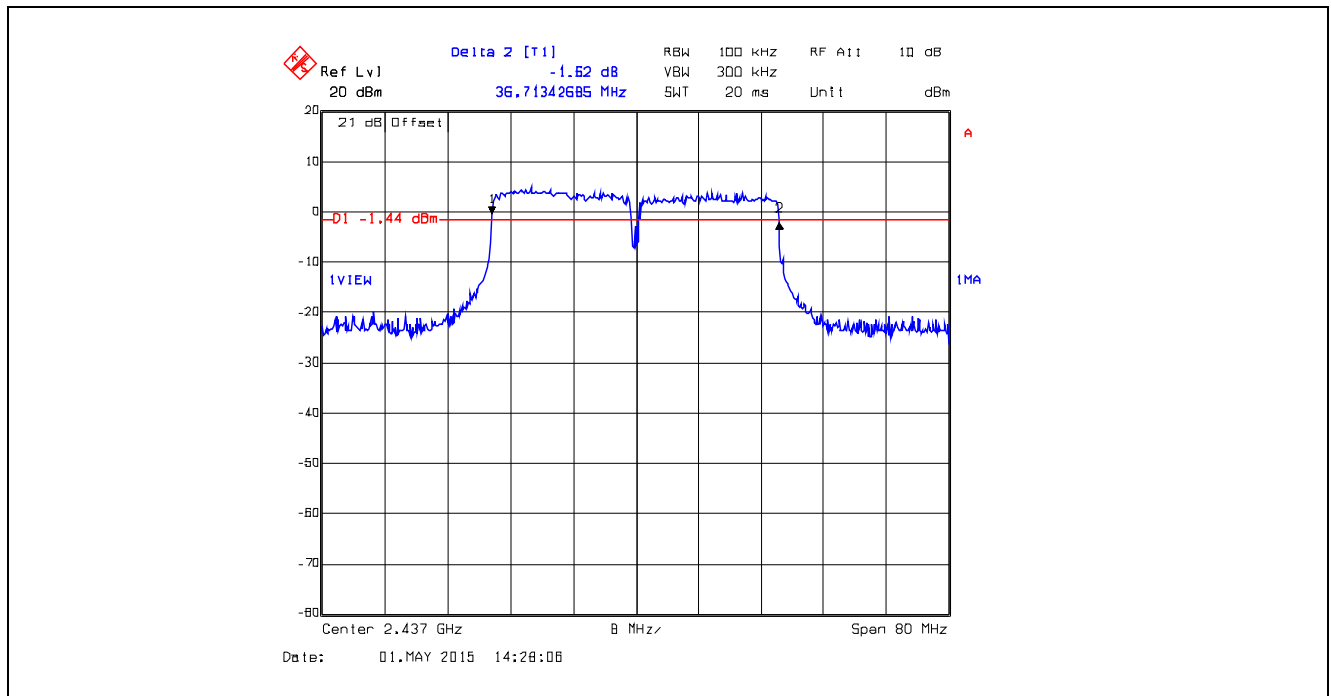
Plot 5.2.4.33. 6 dB Bandwidth, 802.11n HT20, Ch 11, 2462 MHz, MCS 7, 64-QAM 5/6 65 Mbps, TX Gain Setting 48



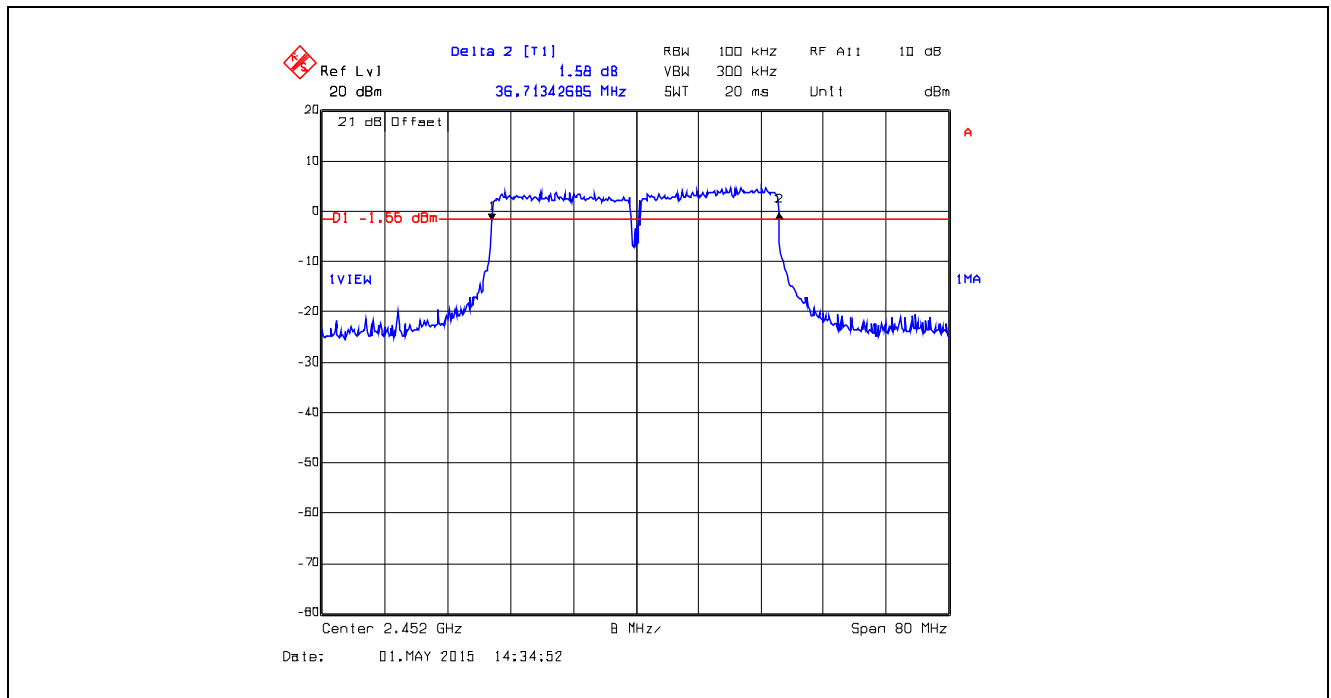
Plot 5.2.4.34. 6 dB Bandwidth, 802.11n HT40, Ch 3, 2422 MHz, MCS 0, BPSK 1/2 13.5 Mbps, TX Gain Setting 50



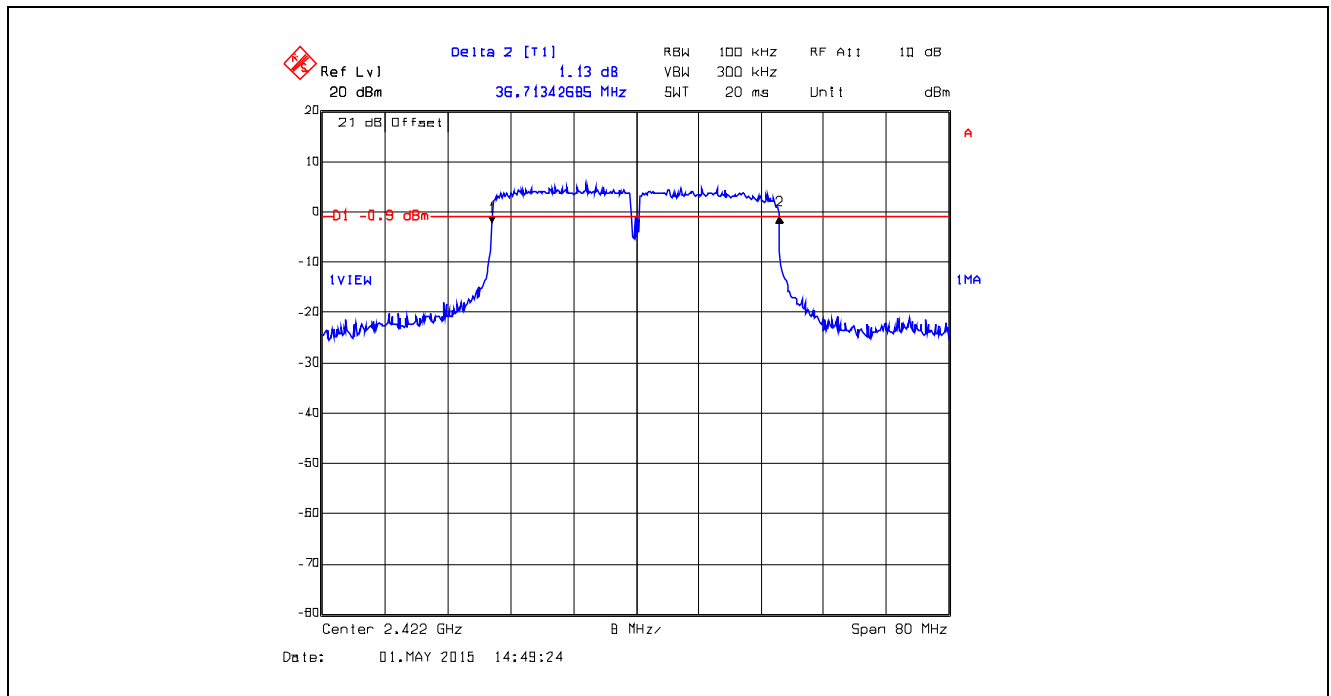
Plot 5.2.4.35. 6 dB Bandwidth, 802.11n HT40, Ch 6, 2437 MHz, MCS 0, BPSK 1/2 13.5 Mbps, TX Gain Setting 50



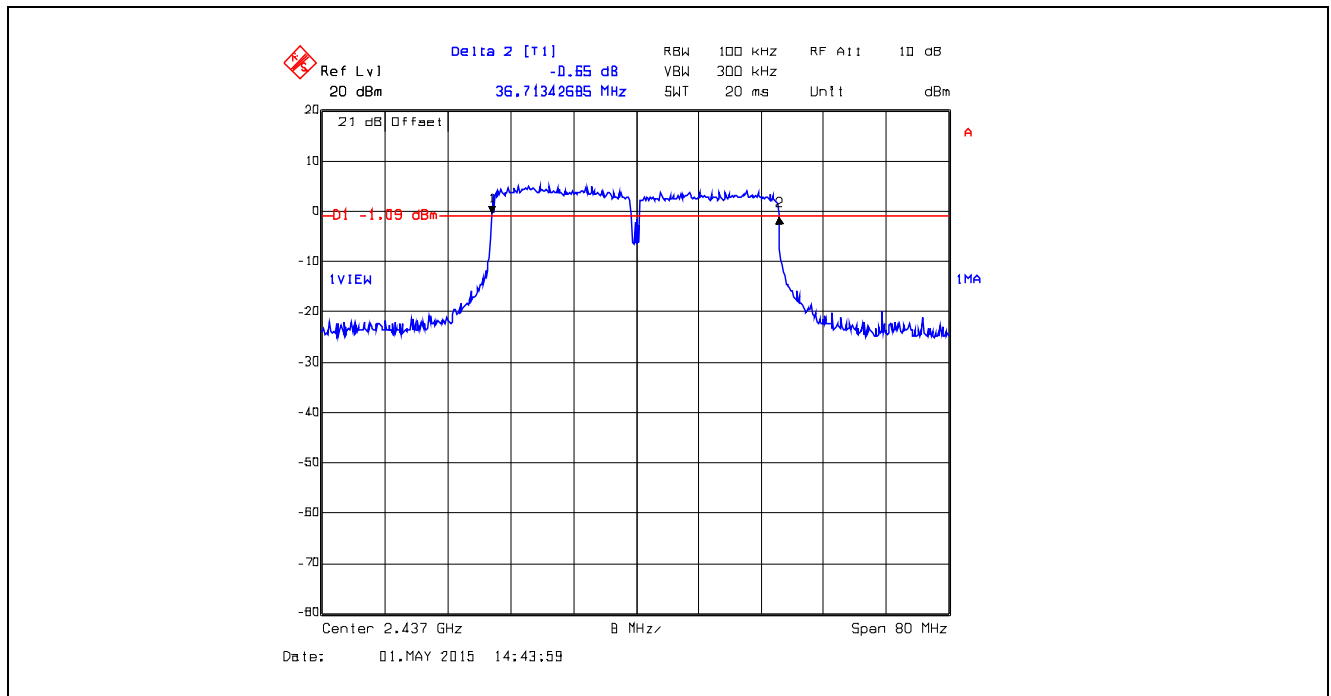
Plot 5.2.4.36. 6 dB Bandwidth, 802.11n HT40, Ch 9, 2452 MHz, MCS 0, BPSK 1/2 13.5 Mbps, TX Gain Setting 50



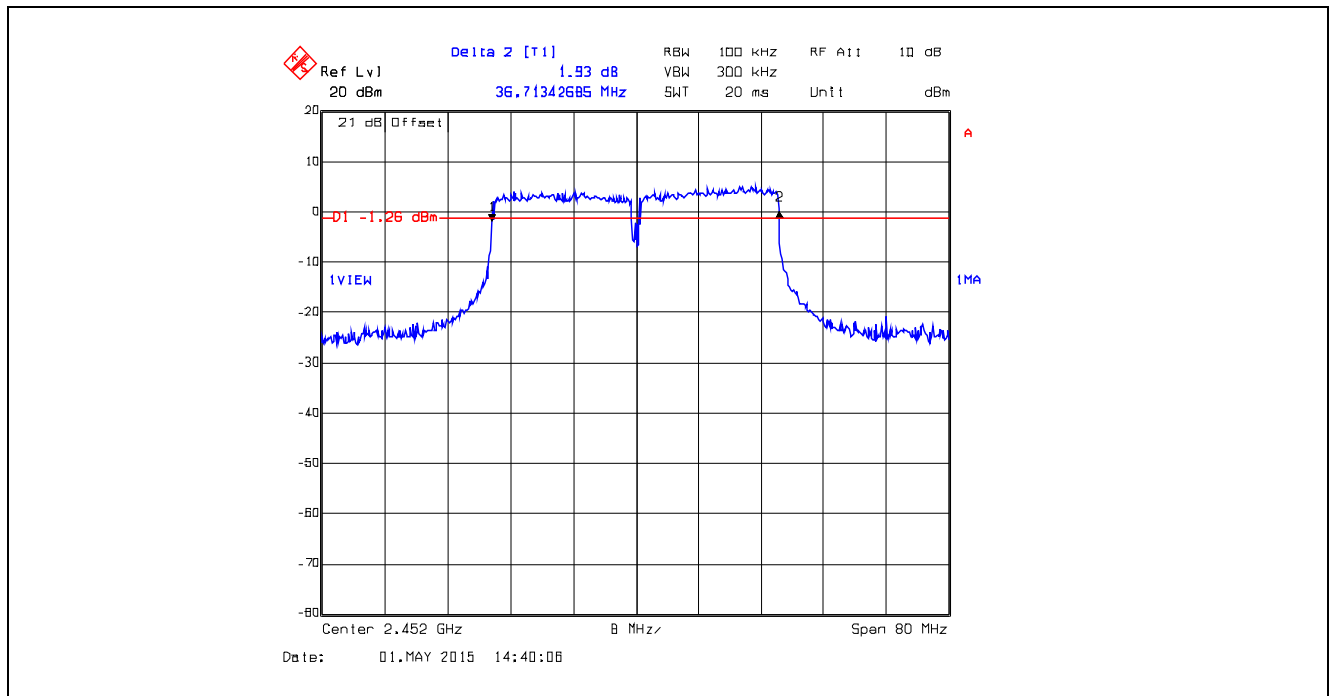
Plot 5.2.4.37. 6 dB Bandwidth, 802.11n HT40, Ch 3, 2422 MHz, MCS 2, QPSK 3/4 40.5 Mbps, TX Gain Setting 50



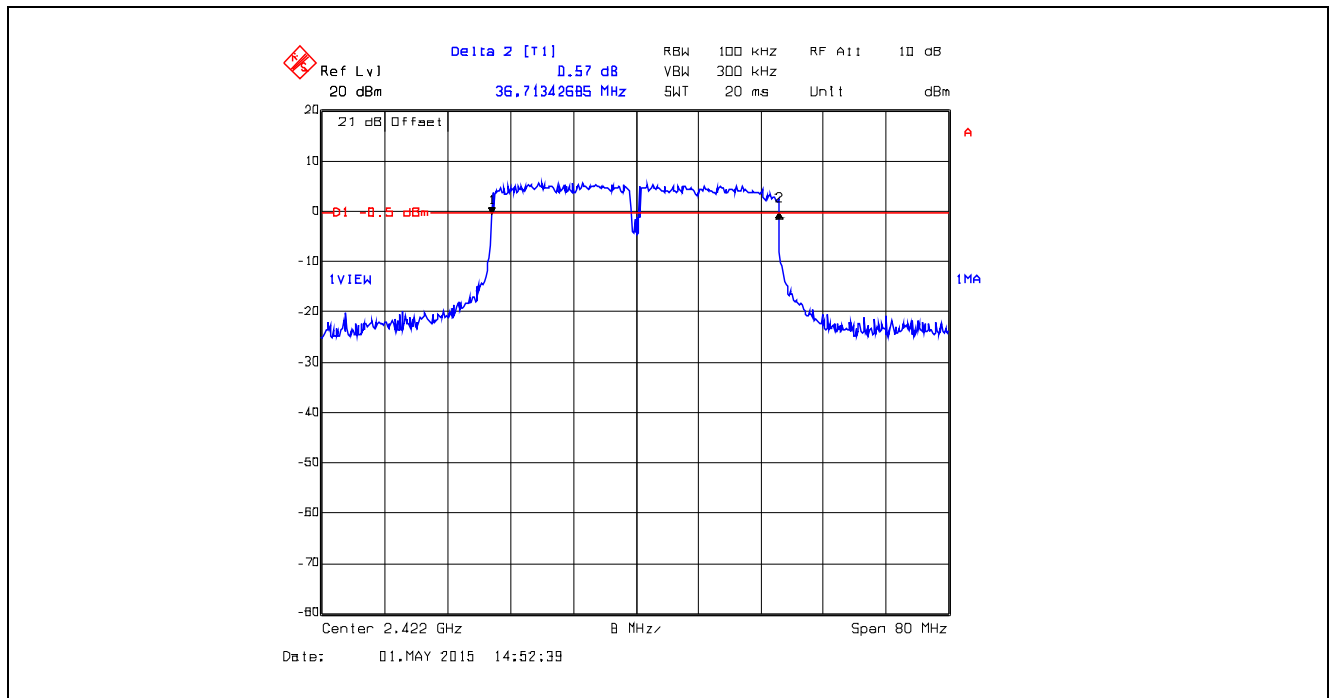
Plot 5.2.4.38. 6 dB Bandwidth, 802.11n HT40, Ch 6, 2437 MHz, MCS 2, QPSK 3/4 40.5 Mbps, TX Gain Setting 50



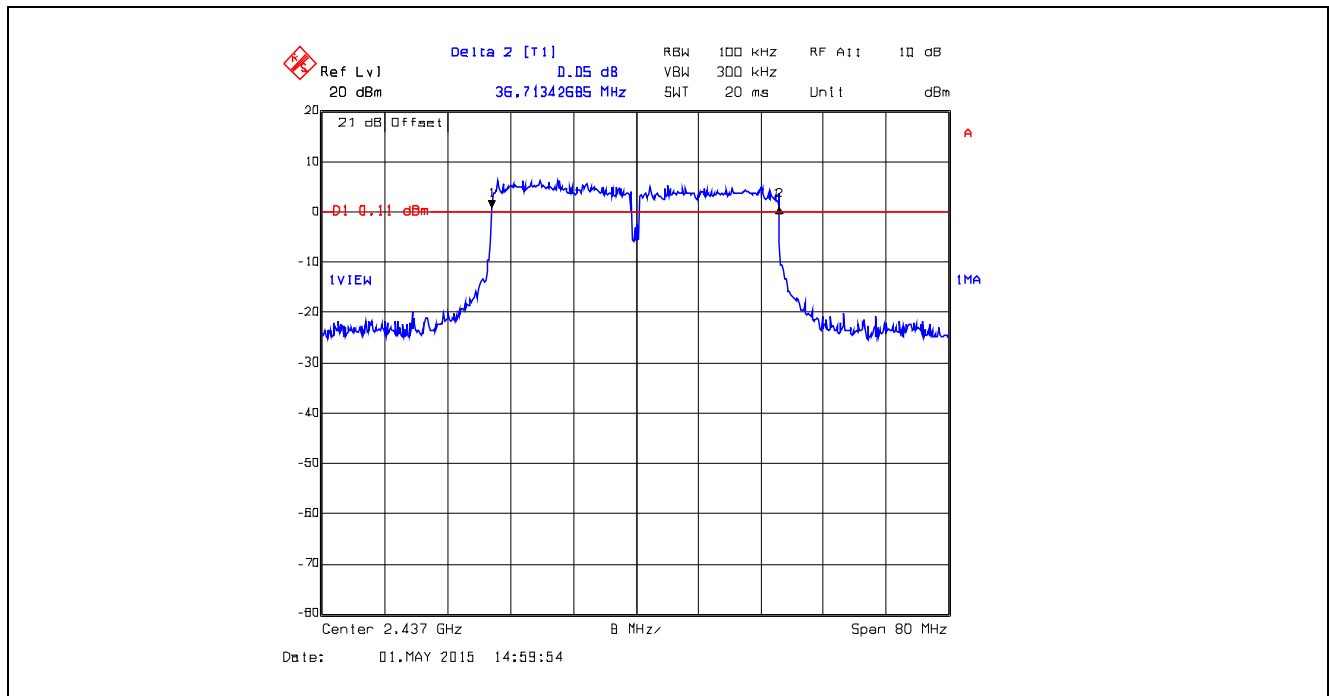
Plot 5.2.4.39. 6 dB Bandwidth, 802.11n HT40, Ch 9, 2452 MHz, MCS 2, QPSK 3/4 40.5 Mbps, TX Gain Setting 50



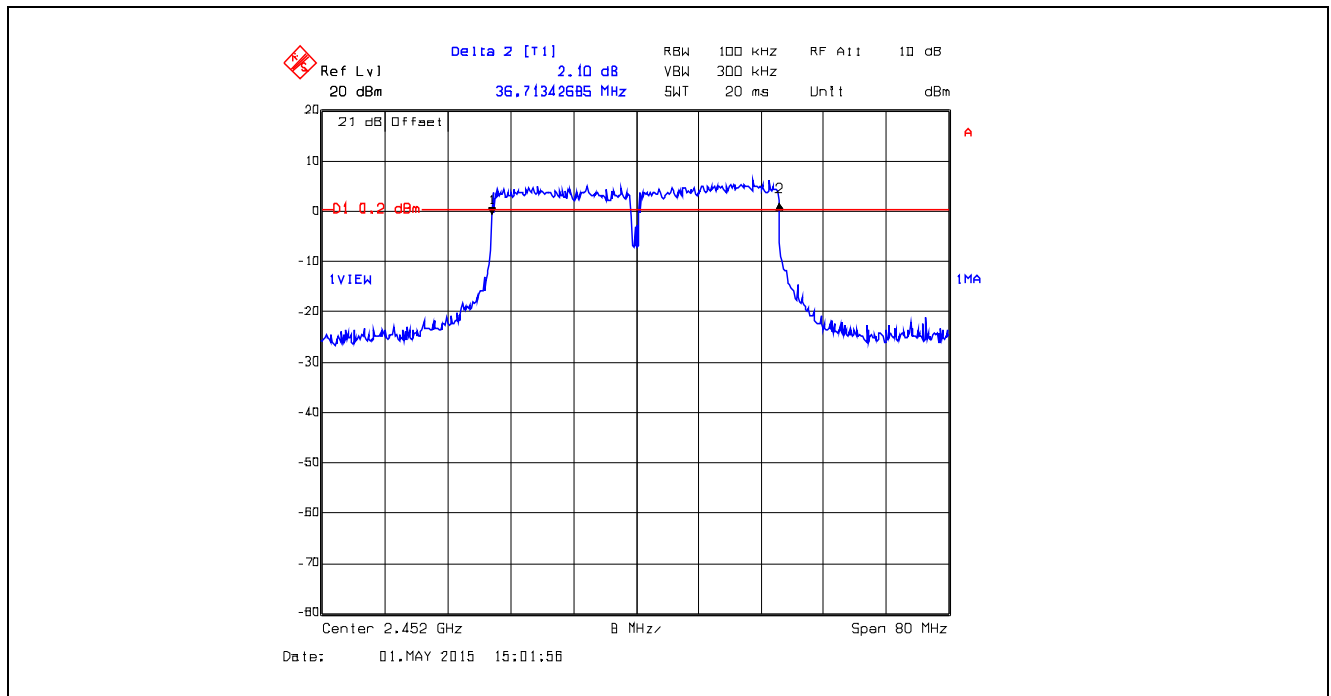
Plot 5.2.4.40. 6 dB Bandwidth, 802.11n HT40, Ch 3, 2422 MHz, MCS 4, 16-QAM 3/4 81 Mbps, TX Gain Setting 50



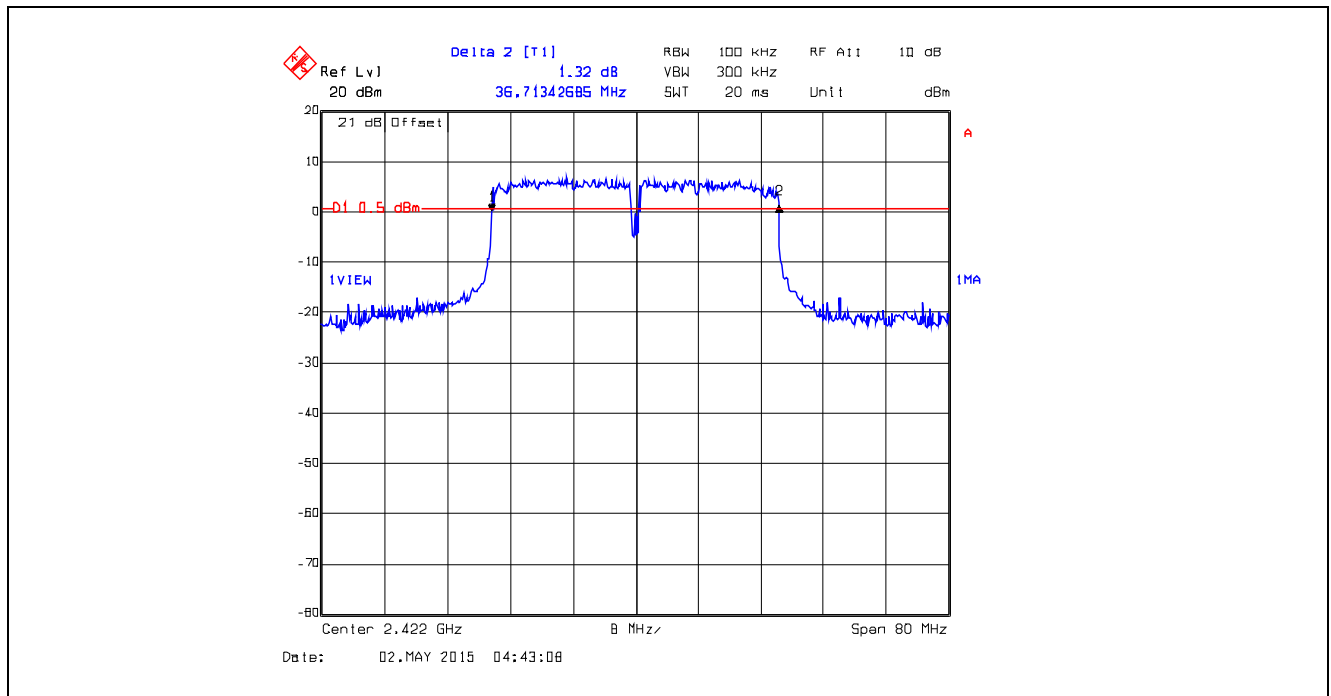
Plot 5.2.4.41. 6 dB Bandwidth, 802.11n HT40, Ch 6, 2437 MHz, MCS 4, 16-QAM 3/4 81 Mbps, TX Gain Setting 50



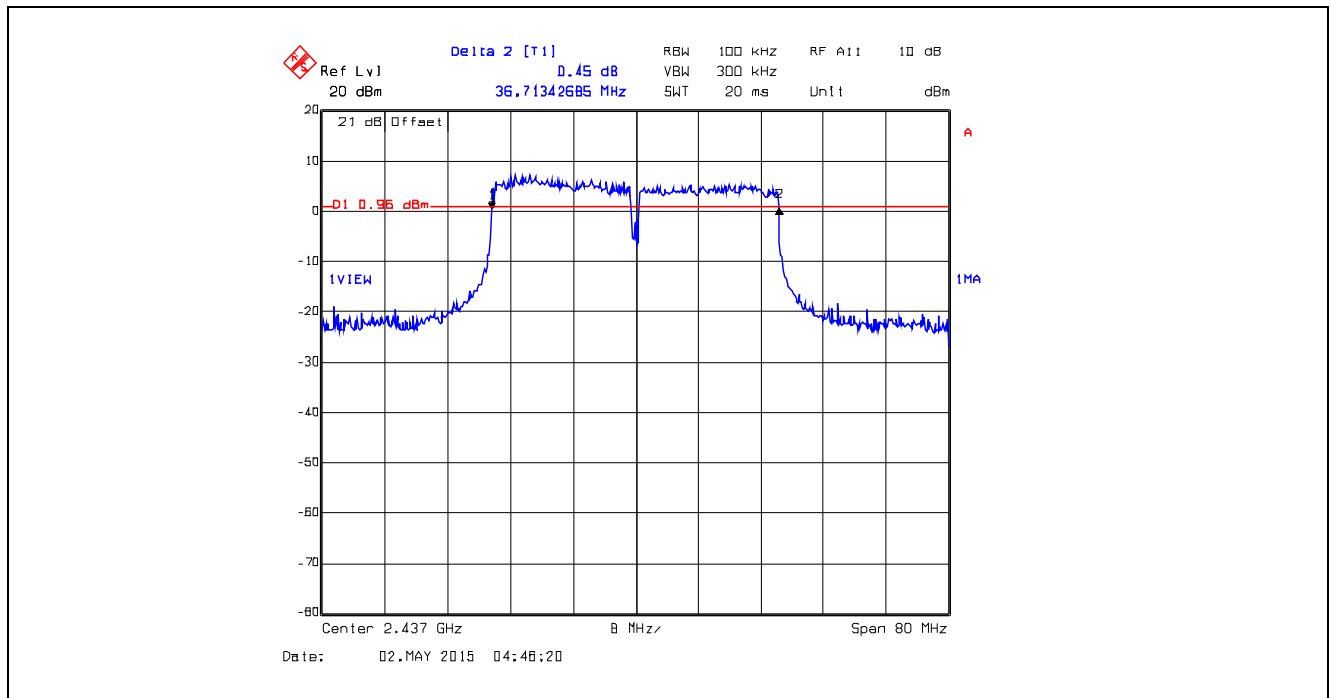
Plot 5.2.4.42. 6 dB Bandwidth, 802.11n HT40, Ch 9, 2452 MHz, MCS 4, 16-QAM 3/4 81 Mbps, TX Gain Setting 50



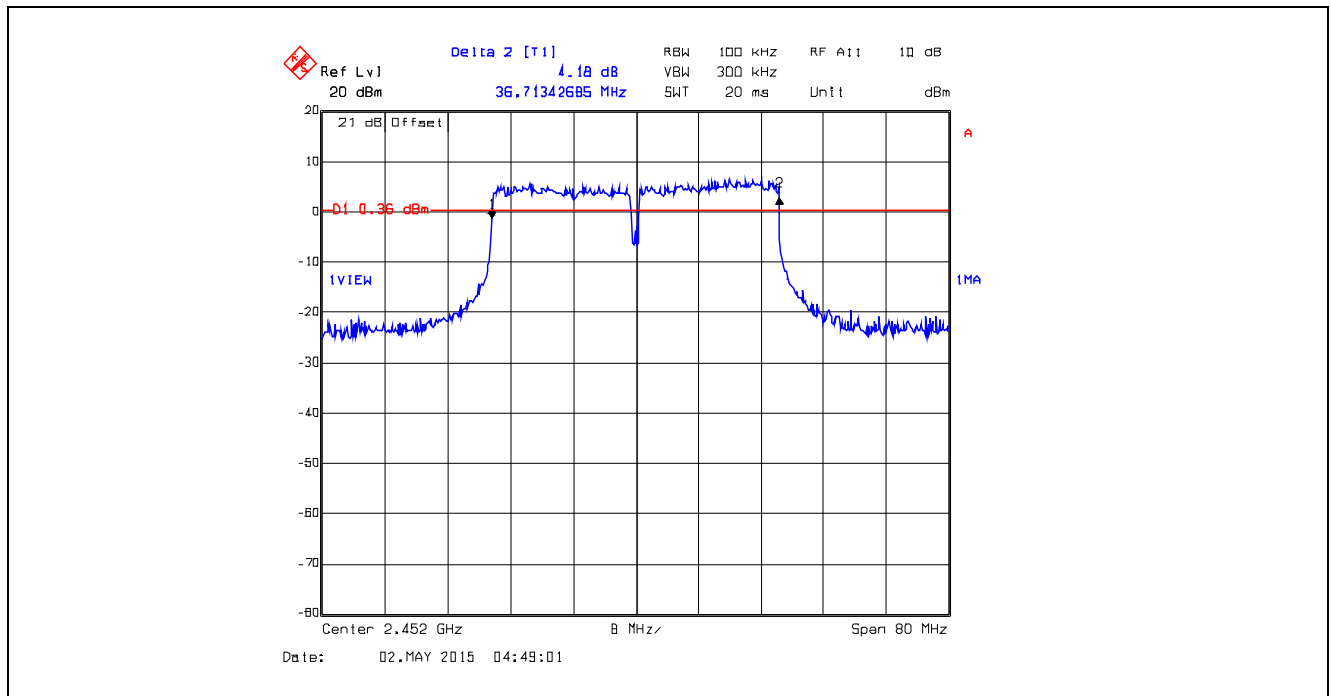
Plot 5.2.4.43. 6 dB Bandwidth, 802.11n HT40, Ch 3, 2422 MHz, MCS 7, 64-QAM 5/6 135 Mbps, TX Gain Setting 50



Plot 5.2.4.44. 6 dB Bandwidth, 802.11n HT40, Ch 6, 2437 MHz, MCS 7, 64-QAM 5/6 135 Mbps, TX Gain Setting 50



Plot 5.2.4.45. 6 dB Bandwidth, 802.11n HT40, Ch 9, 2452 MHz, MCS 7, 64-QAM 5/6 135 Mbps, TX Gain Setting 50



5.3. PEAK CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)(3)]

5.3.1. Limit(s)

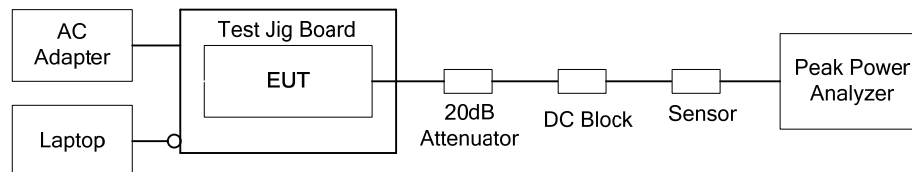
§ 15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power 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.

5.3.2. Method of Measurements & Test Arrangement

KDB Publication No. 558074 D01 DTS Meas Guidance V03r02, Section 9.1.2 PKPM1 Peak power meter method.

5.3.3. Test Arrangement



5.3.4. Test Data

Operating Mode	Modulation	Data Rate (Mbps)	Channel	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Margin (dBm)
802.11b High Power (TX Gain Setting 53)	DBPSK	1	1	2412	29.70	30	-0.30
			6	2437	28.91	30	-1.09
			11	2462	29.50	30	-0.50
	DQPSK	2	1	2412	29.70	30	-0.30
			6	2437	28.91	30	-1.09
			11	2462	29.50	30	-0.50
	CCK	11	1	2412	29.70	30	-0.30
			6	2437	28.91	30	-1.09
			11	2462	29.70	30	-0.30
802.11b Low Power (TX Gain Setting 35)	DBPSK	1	1	2412	21.45	30	-8.55
			6	2437	20.55	30	-9.45
			11	2462	21.10	30	-8.90
	DQPSK	2	1	2412	21.27	30	-8.73
			6	2437	20.19	30	-9.81
			11	2462	21.10	30	-8.90
	CCK	11	1	2412	21.45	30	-8.55
			6	2437	20.55	30	-9.45
			11	2462	21.10	30	-8.90

Operating Mode	Modulation	Data Rate (Mbps)	Channel	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Margin (dBm)
802.11g High Power (TX Gain Setting 47)	BPSK	9	1	2412	29.70	30	-0.30
			6	2437	29.31	30	-0.69
			11	2462	29.50	30	-0.50
	QPSK	18	1	2412	29.88	30	-0.12
			6	2437	29.31	30	-0.69
			11	2462	29.70	30	-0.30
	16-QAM	36	1	2412	29.70	30	-0.30
			6	2437	29.50	30	-0.50
			11	2462	29.70	30	-0.30
	64-QAM	54	1	2412	29.88	30	-0.12
			6	2437	29.50	30	-0.50
			11	2462	29.88	30	-0.12
802.11g Low Power (TX Gain Setting 26)	BPSK	9	1	2412	21.10	30	-8.90
			6	2437	20.55	30	-9.45
			11	2462	20.74	30	-9.26
	QPSK	18	1	2412	21.27	30	-8.73
			6	2437	20.55	30	-9.45
			11	2462	20.74	30	-9.26
	16-QAM	36	1	2412	21.27	30	-8.73
			6	2437	20.74	30	-9.26
			11	2462	21.37	30	-8.63
	64-QAM	54	1	2412	21.10	30	-8.90
			6	2437	20.87	30	-9.13
			11	2462	21.27	30	-8.73

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File #: 15MCRS083_FCC15C247DTS

June 16, 2015

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

Operating Mode	MCS Index	Modulation	Data Rate (Mbps)	Channel	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Margin (dBm)
802.11n, HT20 High Power (TX Gain Setting 48)	MCS0	BPSK 1/2	6.5	1	2412	29.70	30	-0.30
				6	2437	29.88	30	-0.12
				11	2462	29.70	30	-0.30
	MCS2	QPSK 3/4	19.5	1	2412	29.70	30	-0.30
				6	2437	29.88	30	-0.12
				11	2462	29.88	30	-0.12
	MCS4	16-QAM 3/4	39	1	2412	29.70	30	-0.30
				6	2437	29.50	30	-0.50
				11	2462	29.70	30	-0.30
	MCS7	64-QAM 5/6	65	1	2412	29.88	30	-0.12
				6	2437	29.88	30	-0.12
				11	2462	29.50	30	-0.50
802.11n, HT20 Low Power (TX Gain Setting 26)	MCS0	BPSK 1/2	6.5	1	2412	21.45	30	-8.55
				6	2437	20.92	30	-9.08
				11	2462	20.57	30	-9.43
	MCS2	QPSK 3/4	19.5	1	2412	21.10	30	-8.90
				6	2437	21.10	30	-8.90
				11	2462	20.74	30	-9.26
	MCS4	16-QAM 3/4	39	1	2412	21.45	30	-8.55
				6	2437	21.45	30	-8.55
				11	2462	21.10	30	-8.90
	MCS7	64-QAM 5/6	65	1	2412	20.92	30	-9.08
				6	2437	20.92	30	-9.08
				11	2462	21.35	30	-8.65

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Operating Mode	MCS Index	Modulation	Data Rate (Mbps)	Channel	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Margin (dBm)
802.11n, HT40 High Power (TX Gain Setting 50)	MCS0	BPSK 1/2	13.5	3	2422	29.88	30	-0.12
				6	2437	29.70	30	-0.30
				9	2452	29.88	30	-0.12
	MCS2	QPSK 3/4	40.5	3	2422	29.70	30	-0.30
				6	2437	29.88	30	-0.12
				9	2452	29.88	30	-0.12
	MCS4	16-QAM 3/4	81	3	2422	29.88	30	-0.12
				6	2437	29.50	30	-0.50
				9	2452	29.88	30	-0.12
	MCS7	64-QAM 5/6	135	3	2422	29.50	30	-0.50
				6	2437	29.88	30	-0.12
				9	2452	29.88	30	-0.12
802.11n, HT40 High Power (TX Gain Setting 27)	MCS0	BPSK 1/2	13.5	3	2422	20.92	30	-9.08
				6	2437	21.10	30	-8.90
				9	2452	20.92	30	-9.08
	MCS2	QPSK 3/4	40.5	3	2422	21.05	30	-8.95
				6	2437	20.77	30	-9.23
				9	2452	20.92	30	-9.08
	MCS4	16-QAM 3/4	81	3	2422	21.27	30	-8.73
				6	2437	20.92	30	-9.08
				9	2452	20.92	30	-9.08
	MCS7	64-QAM 5/6	135	3	2422	21.50	30	-8.50
				6	2437	20.92	30	-9.08
				9	2452	20.92	30	-9.08

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File #: 15MCRS083_FCC15C247DTS

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

5.4. TRANSMITTER BAND-EDGE & SPURIOUS CONDUCTED EMISSIONS [§ 15.247(d)]

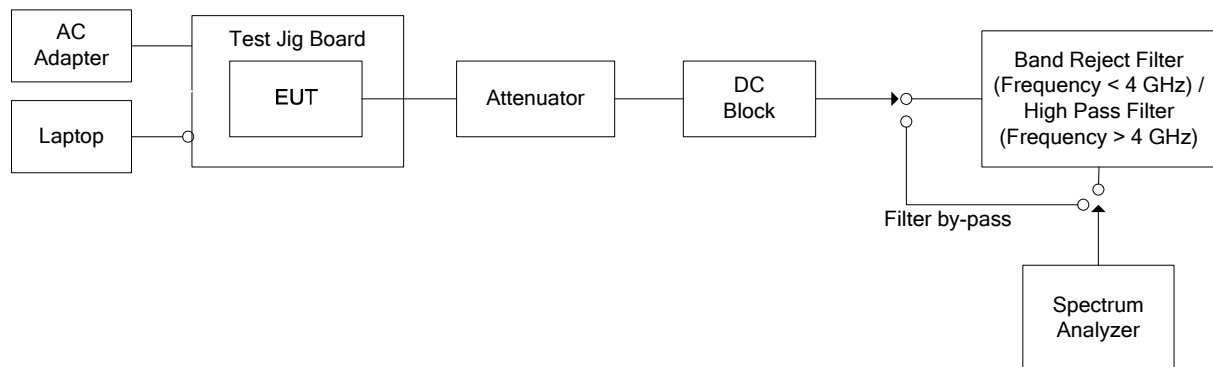
5.4.1. Limit(s)

§ 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)).

5.4.2. Method of Measurements

KDB Publication No. 558074 D01 DTS Meas Guidance V03r02, Sections 11, 12 and 13.

5.4.3. Test Arrangement

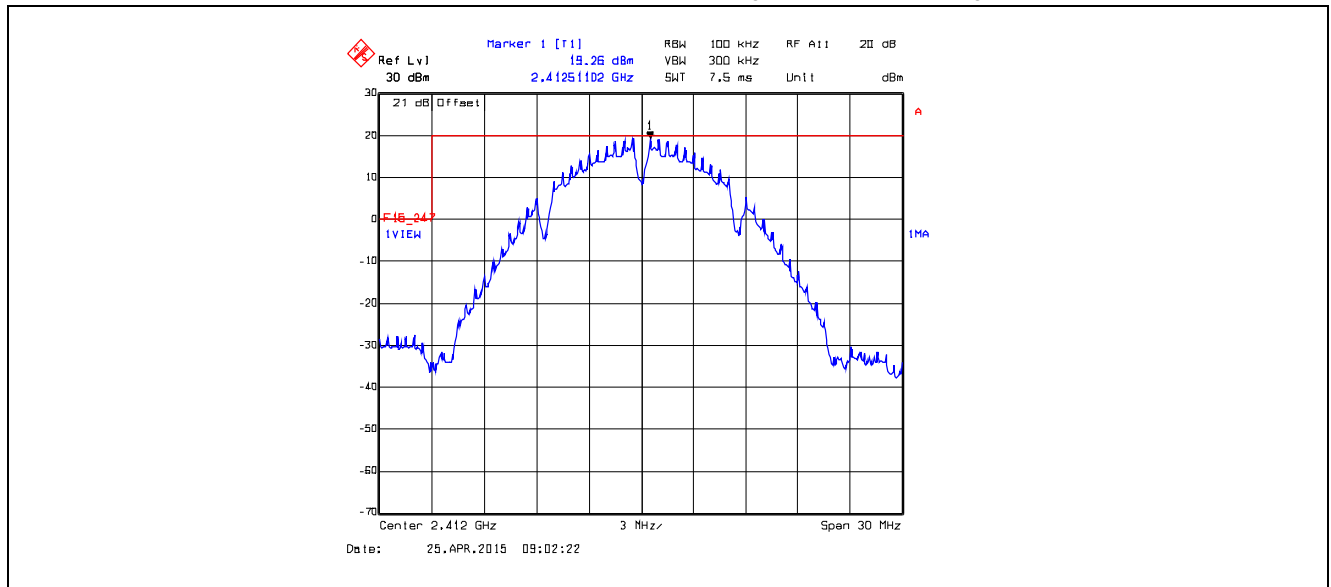


5.4.4. Test Data

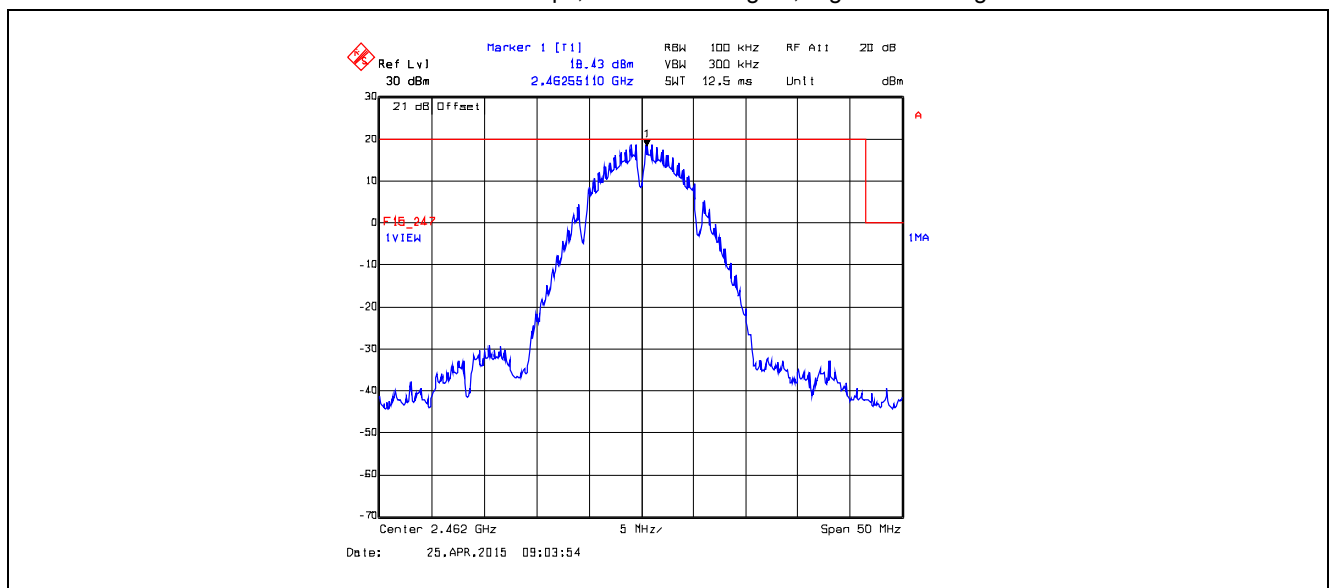
Remark(s): Exploratory tests performed to determined worst-case test configurations, the following test results represent the worst-case.

5.4.4.1. Band-Edge RF Conducted Emissions

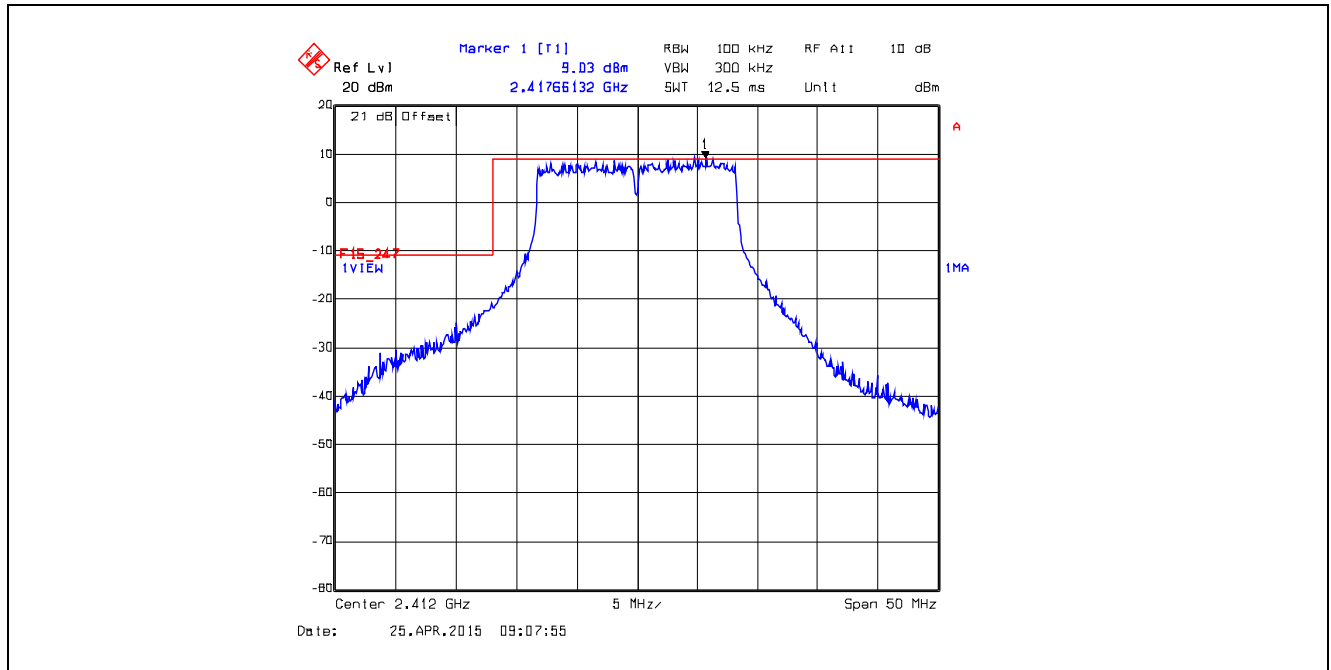
Plot 5.4.4.1.1. Band-Edge RF Conducted Emissions
802.11b CCK 11 Mbps, TX Gain Setting 53, Lower Band-edge



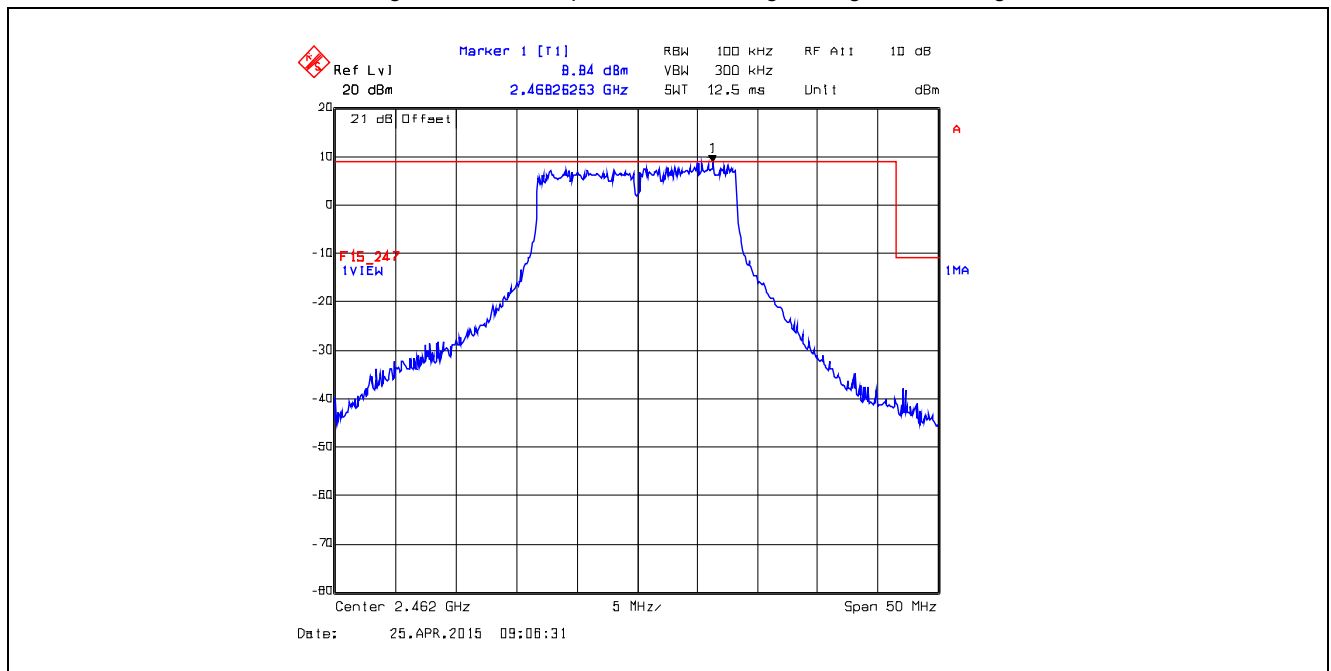
Plot 5.4.4.1.2. Band-Edge RF Conducted Emissions
802.11b CCK 11 Mbps, TX Gain Setting 53, Higher Band-edge



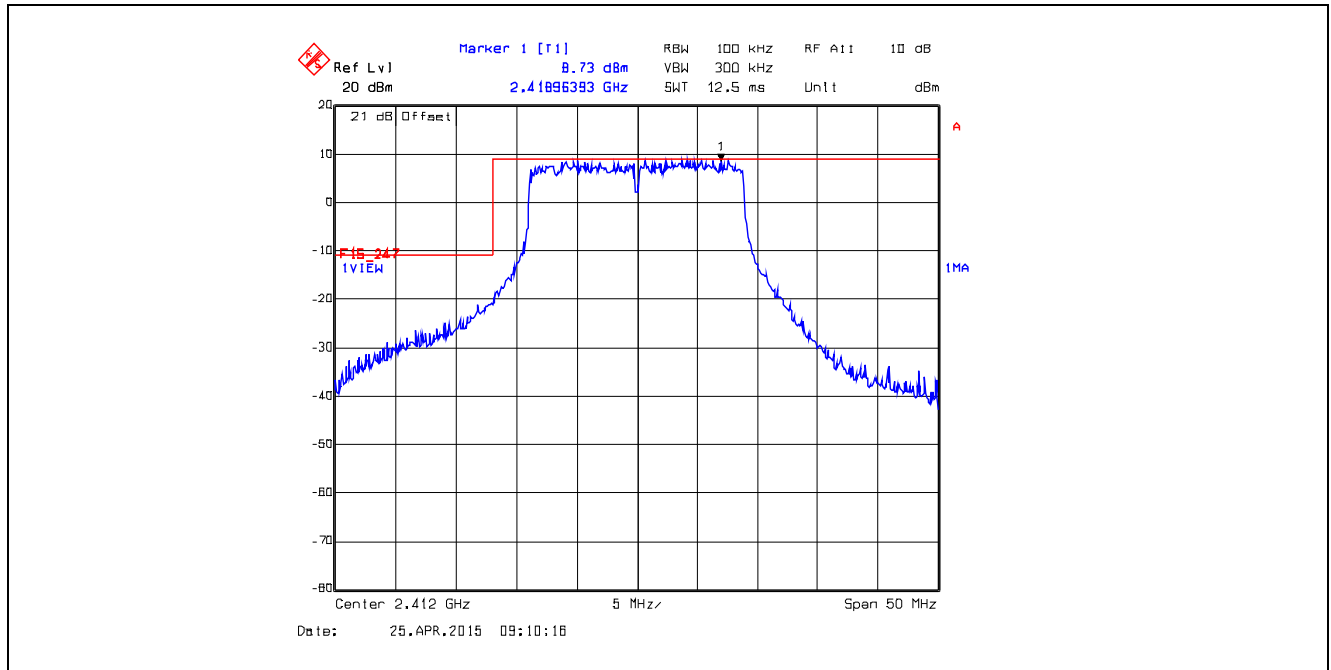
Plot 5.4.4.1.3. Band-Edge RF Conducted Emissions
802.11g 64-QAM 54 Mbps, TX Gain Setting 47, Lower Band-edge



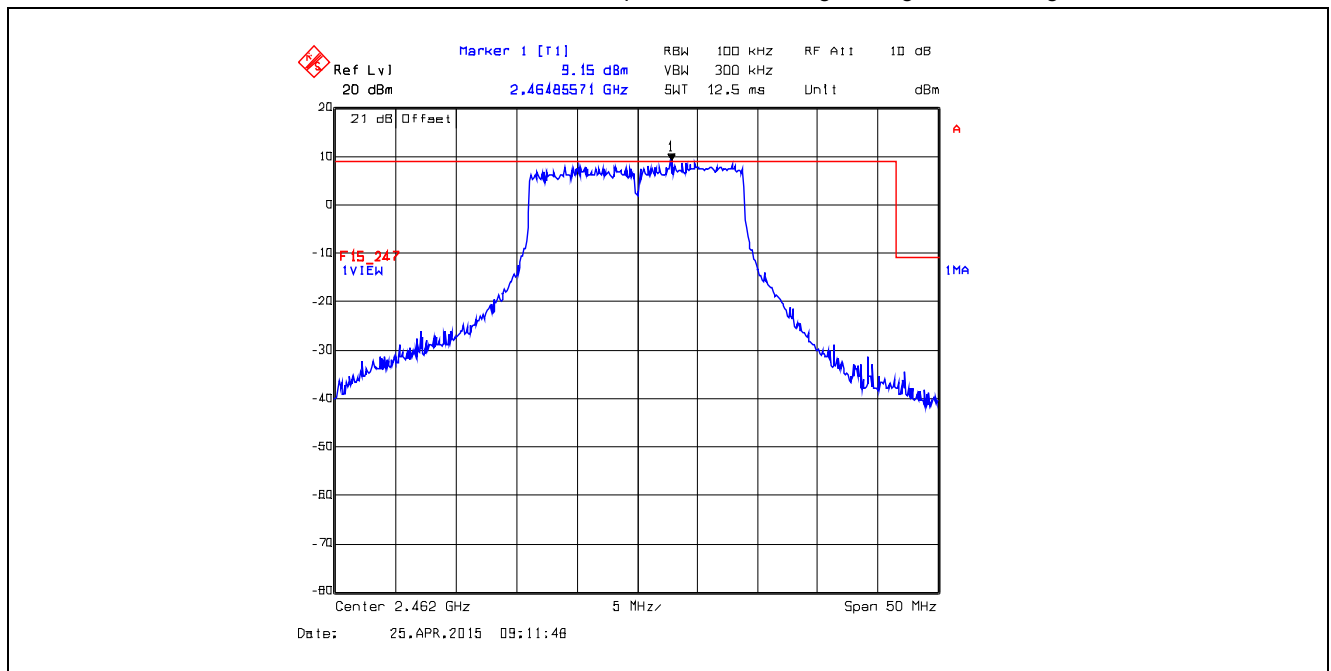
Plot 5.4.4.1.4. Band-Edge RF Conducted Emissions
802.11g 64-QAM 54 Mbps, TX Gain Setting 47, Higher Band-edge



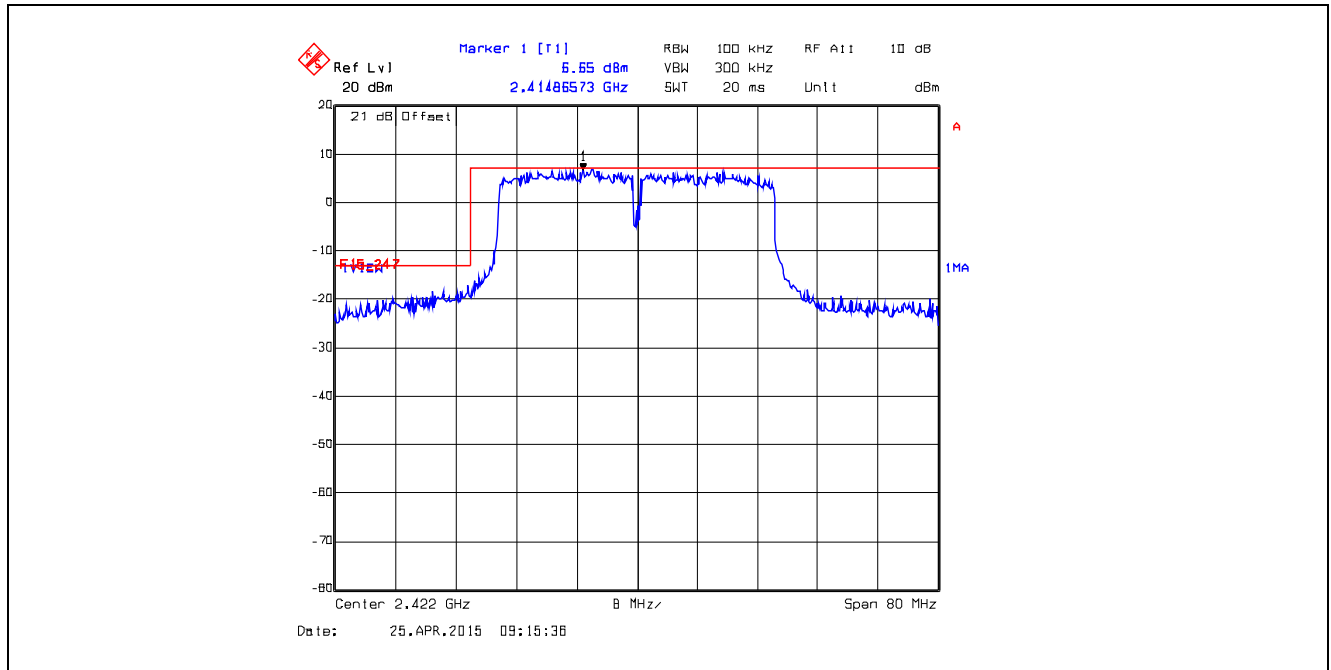
Plot 5.4.4.1.5. Band-Edge RF Conducted Emissions
802.11n HT20 64-QAM 5/6 65 Mbps, TX Gain Setting 48, Lower Band-edge



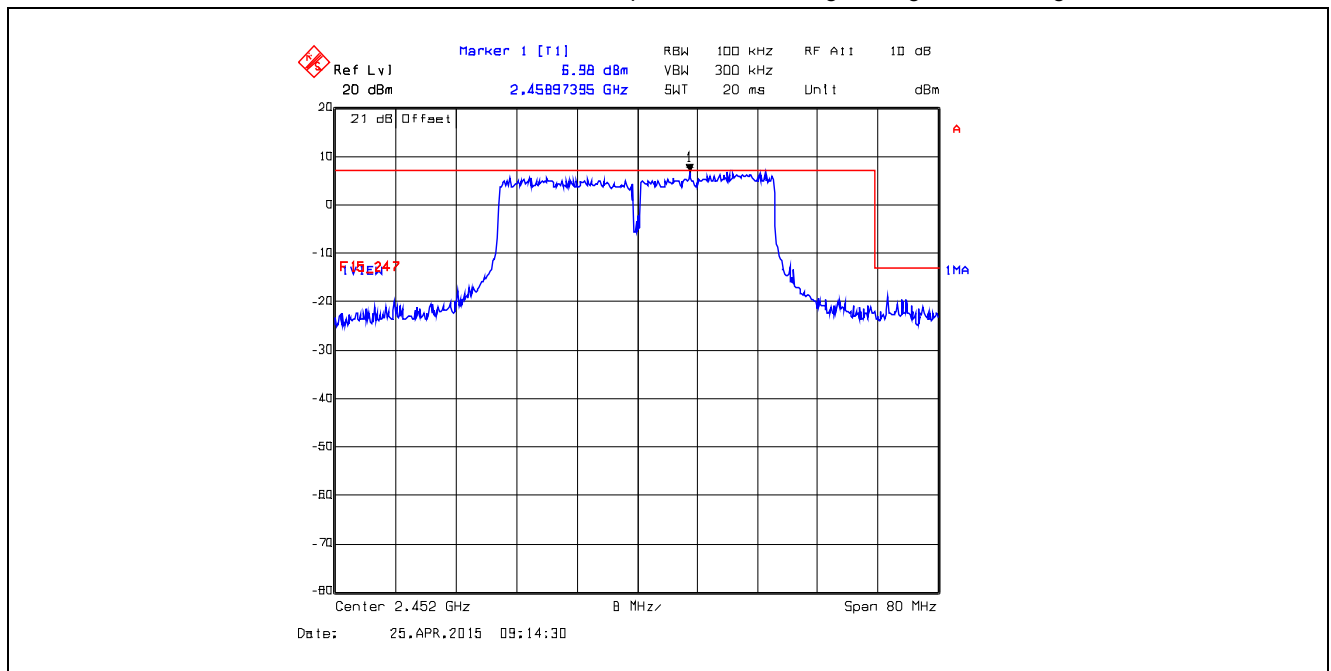
Plot 5.4.4.1.6. Band-Edge RF Conducted Emissions
802.11n HT20 64-QAM 5/6 65 Mbps, TX Gain Setting 48, Higher Band-edge



Plot 5.4.4.1.7. Band-Edge RF Conducted Emissions
802.11n HT40 64-QAM 5/6 135 Mbps, TX Gain Setting 50, Lower Band-edge

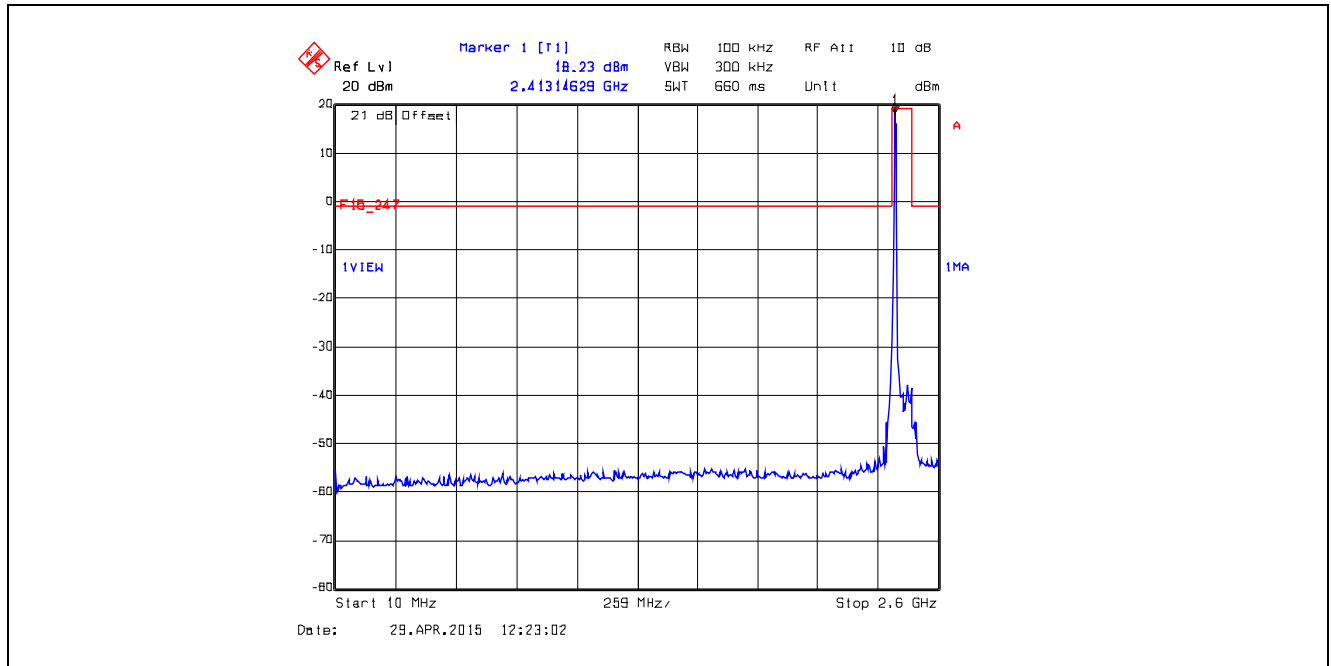


Plot 5.4.4.1.8. Band-Edge RF Conducted Emissions
802.11n HT40 64-QAM 5/6 135 Mbps, TX Gain Setting 50, Higher Band-edge

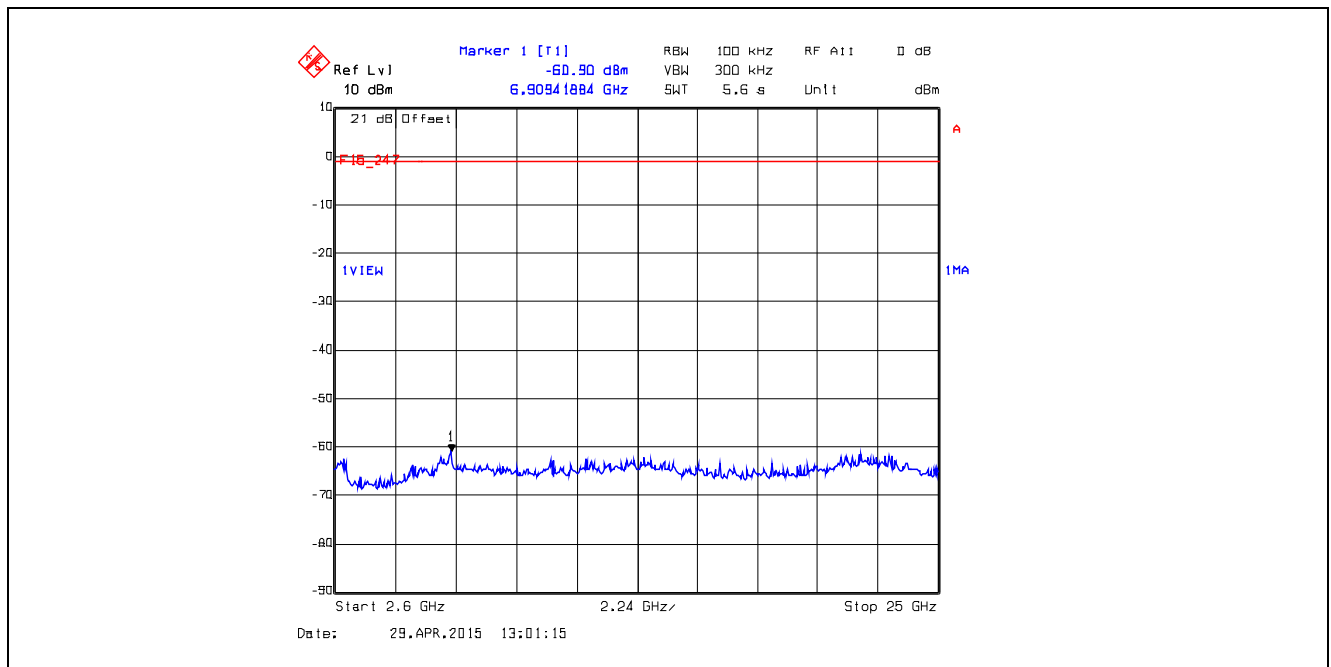


5.4.4.2. Spurious RF Conducted Emissions in Non-restricted Frequency Bands

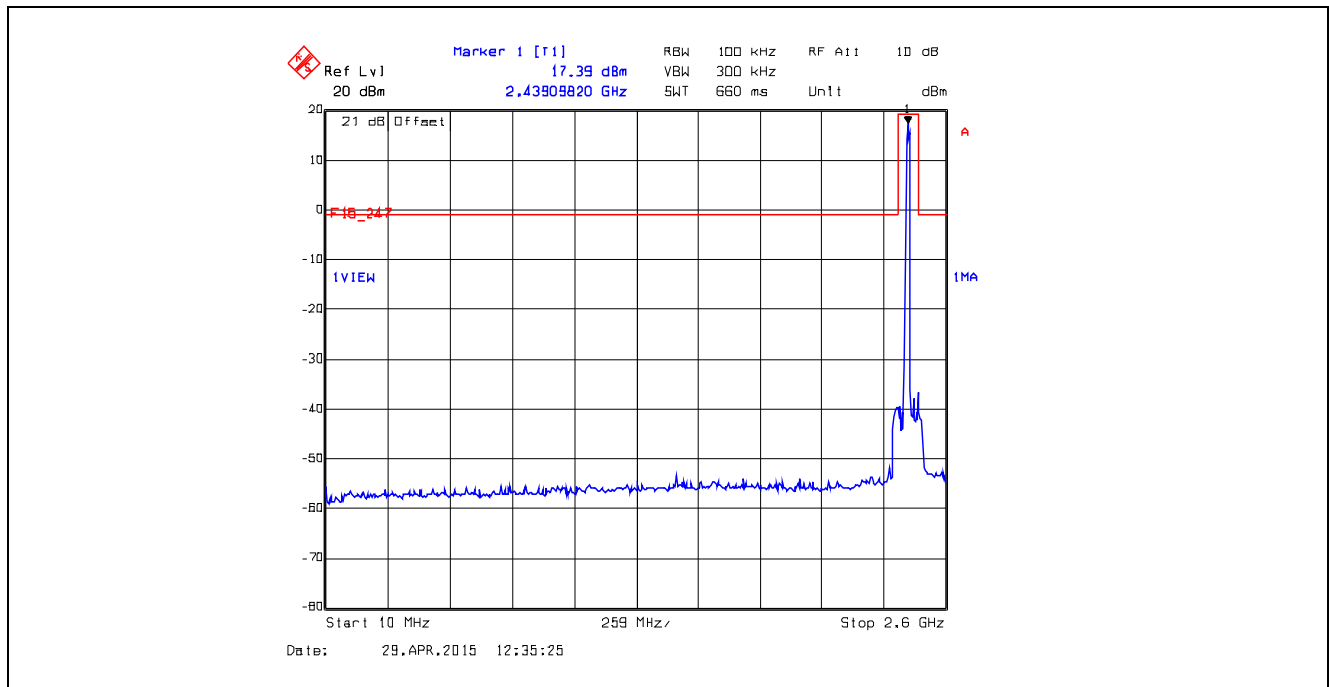
Plot 5.4.4.2.1. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11b, Channel 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53, 10 MHz – 2.6 GHz



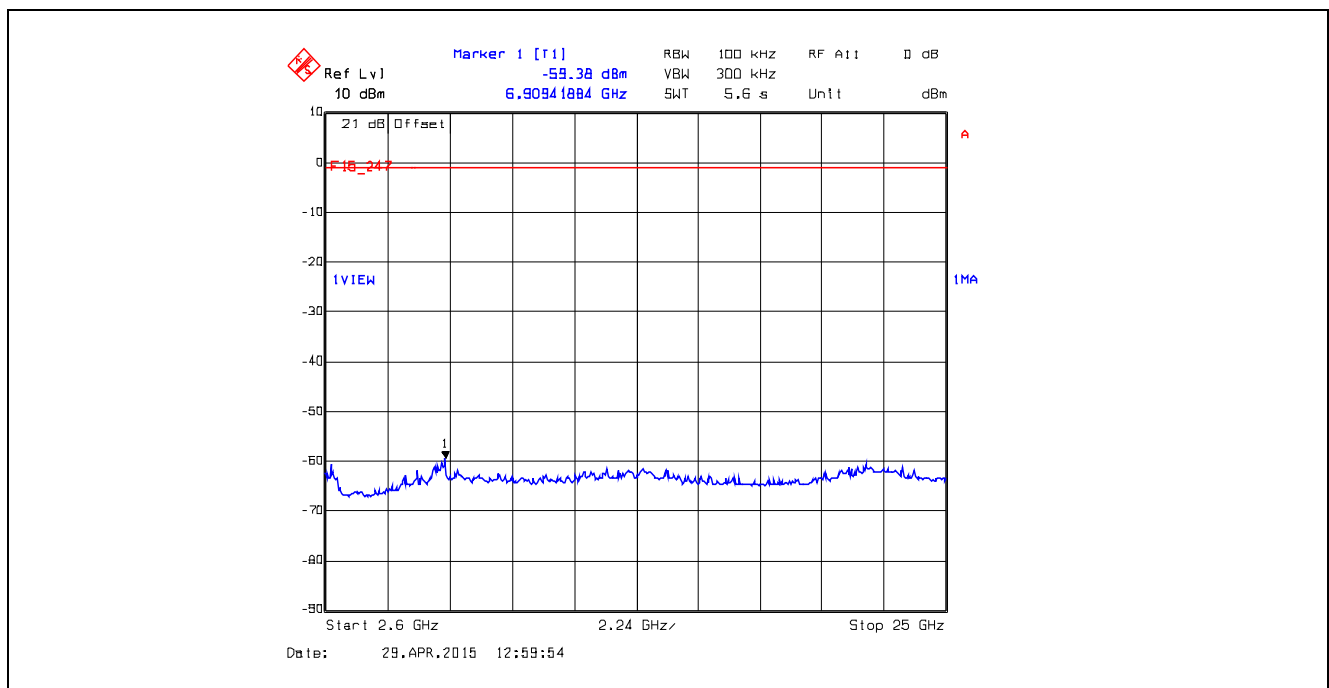
Plot 5.4.4.2.2. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11b, Channel 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53, 2.6 GHz – 25 GHz



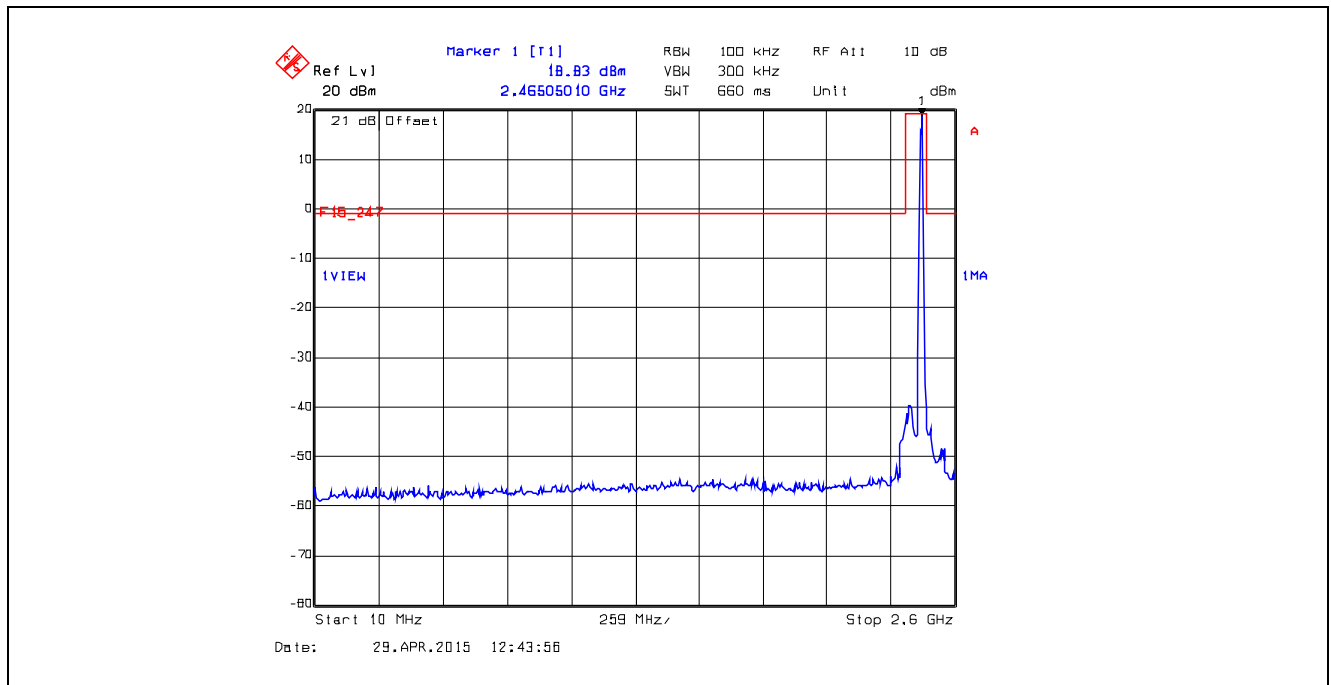
Plot 5.4.4.2.3. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11b, Channel 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53, 10 MHz – 2.6 GHz



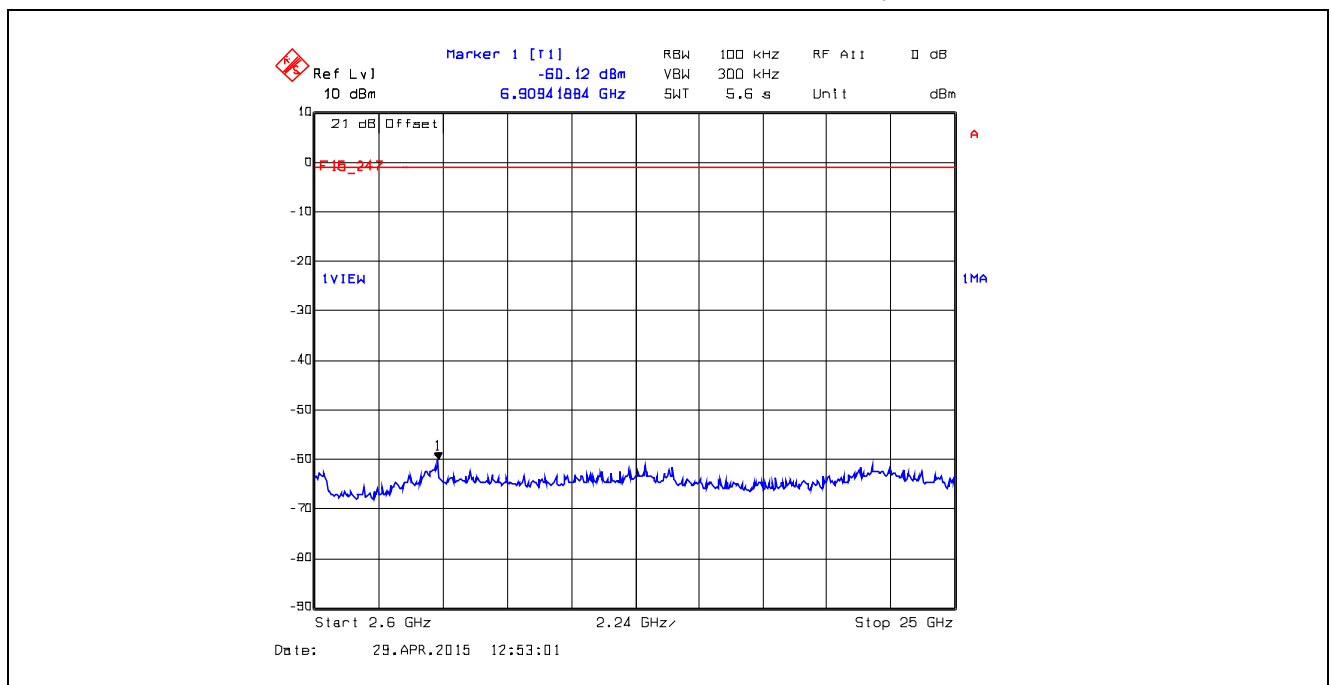
Plot 5.4.4.2.4. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11b, Channel 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53, 2.6 GHz – 25 GHz



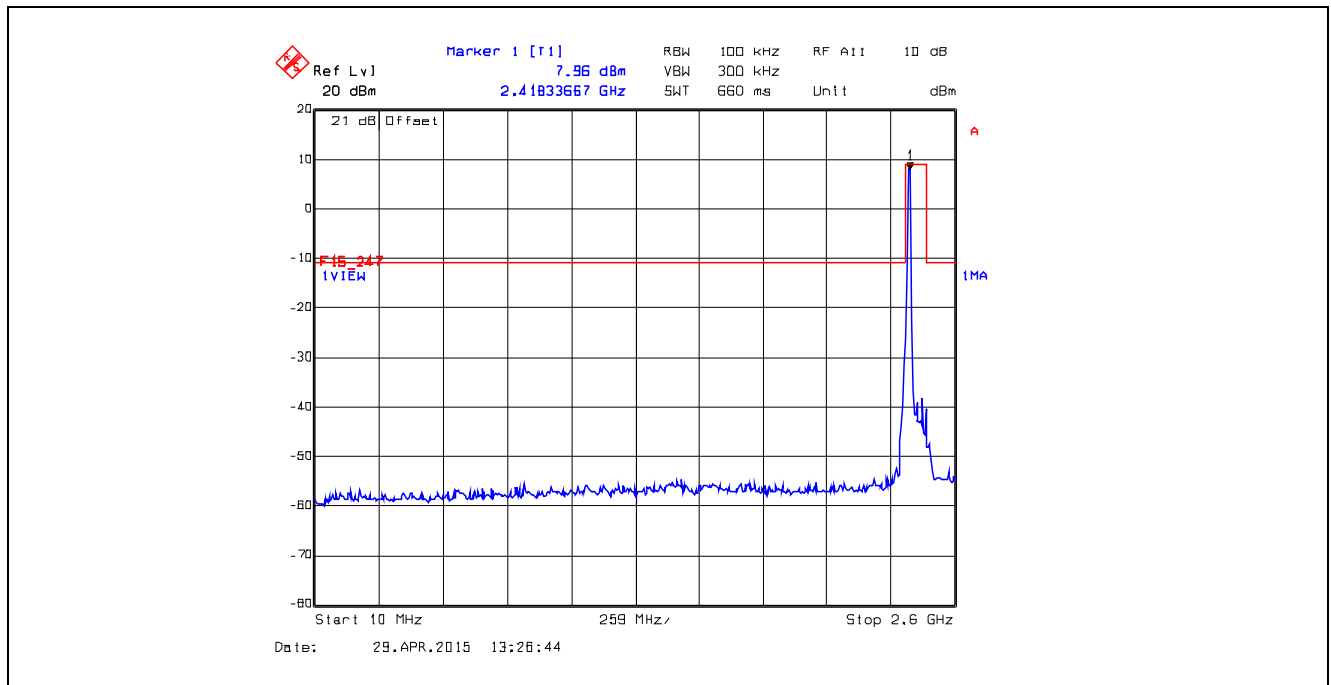
Plot 5.4.4.2.5. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11b, Channel 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53, 10 MHz – 2.6 GHz



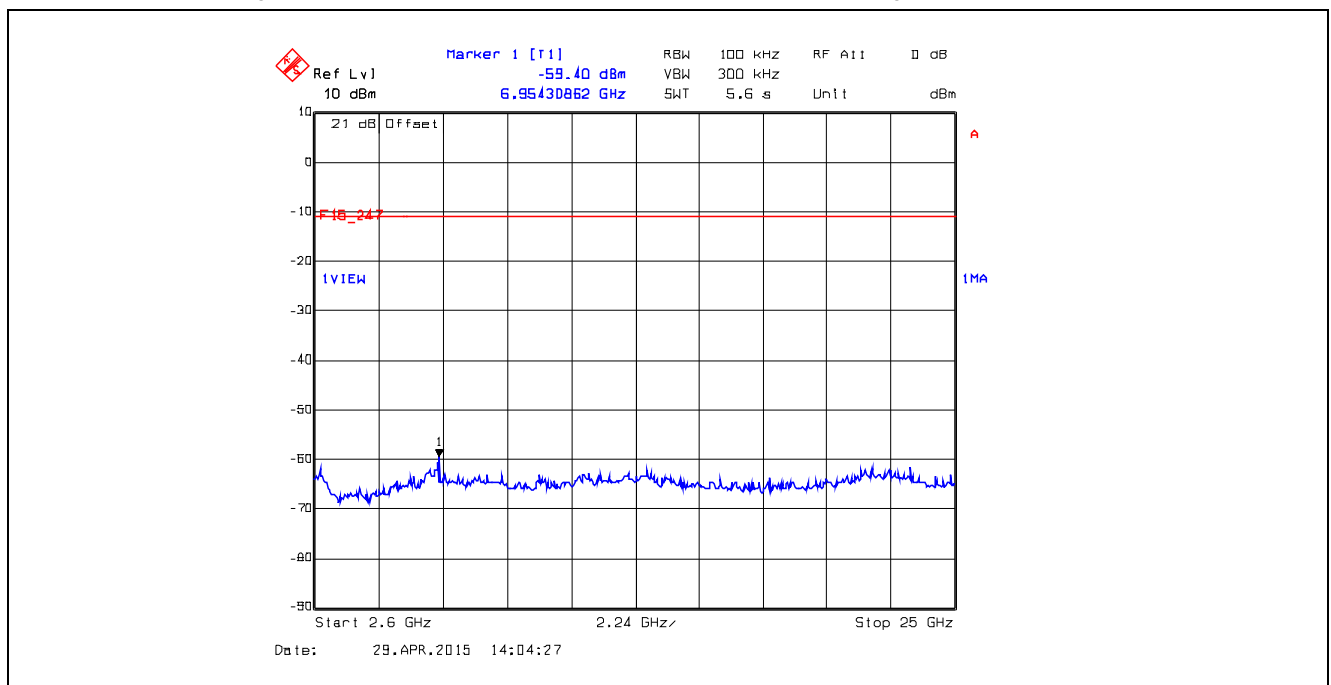
Plot 5.4.4.2.6. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11b, Channel 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53, 2.6 GHz – 25 GHz



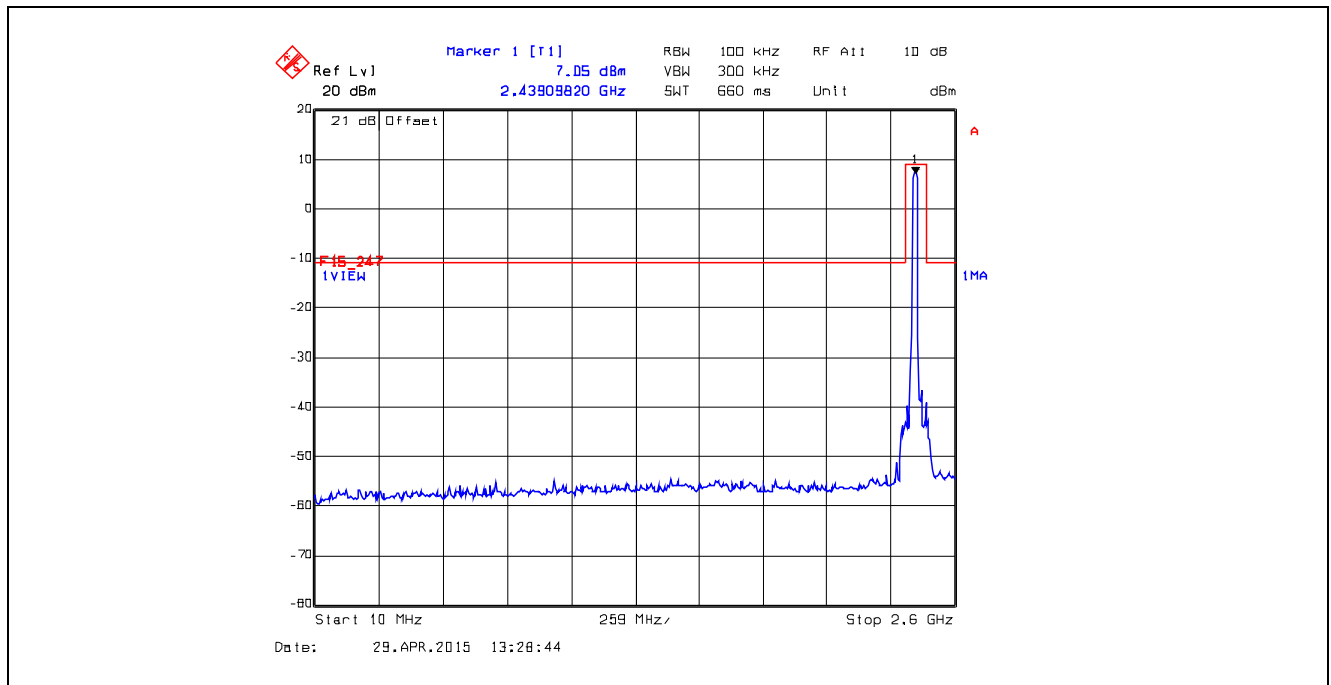
Plot 5.4.4.2.7. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11g, Channel 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 10 MHz – 2.6 GHz



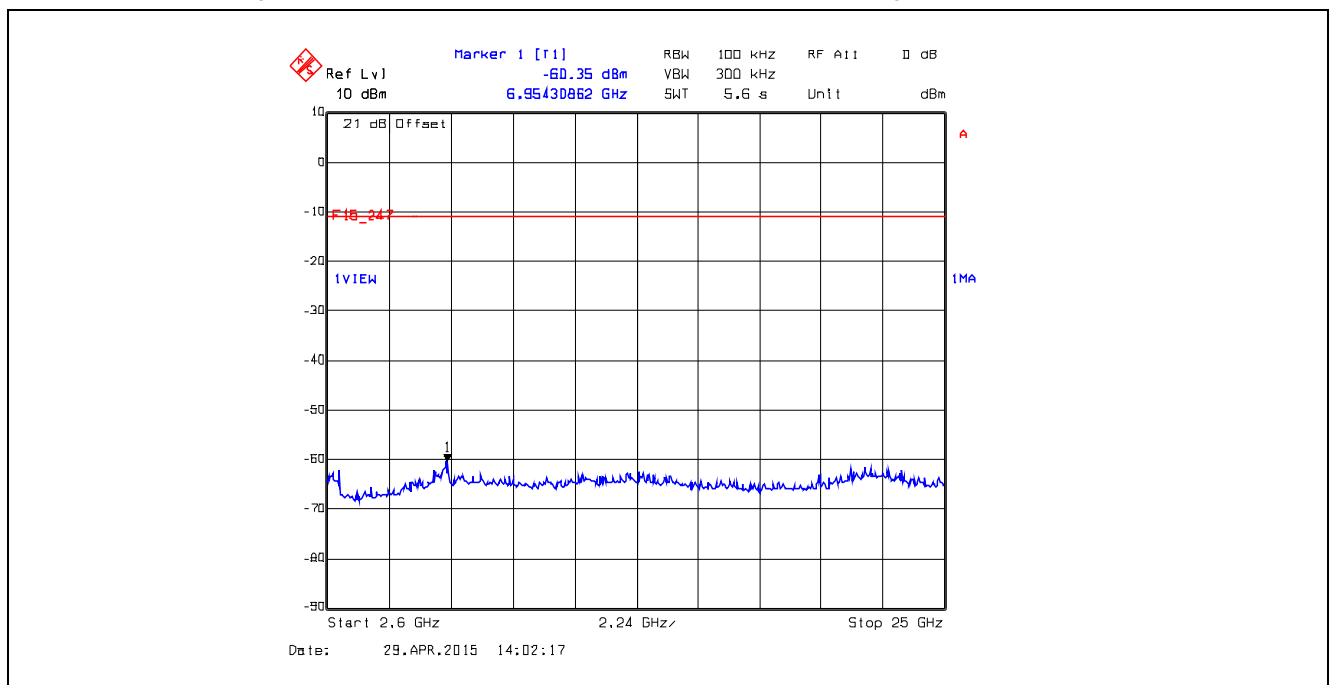
Plot 5.4.4.2.8. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11g, Channel 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 2.6 GHz – 25 GHz



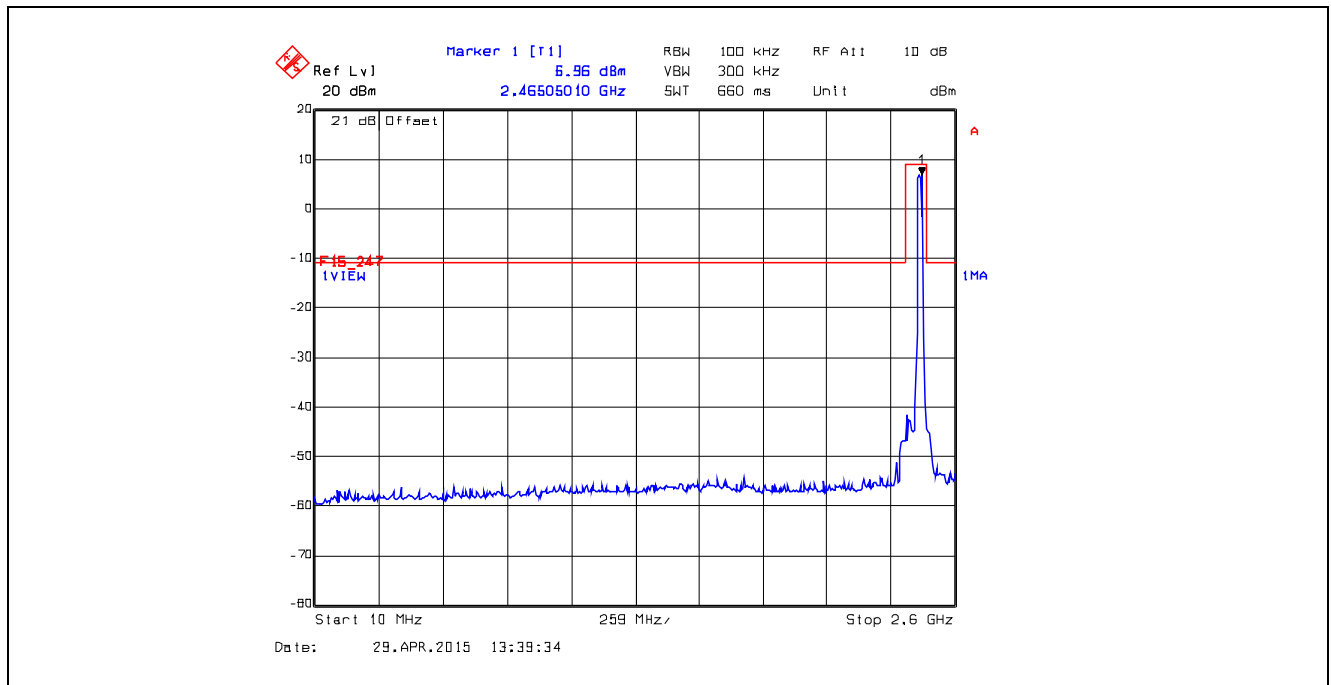
Plot 5.4.4.2.9. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11g, Channel 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 10 MHz – 2.6 GHz



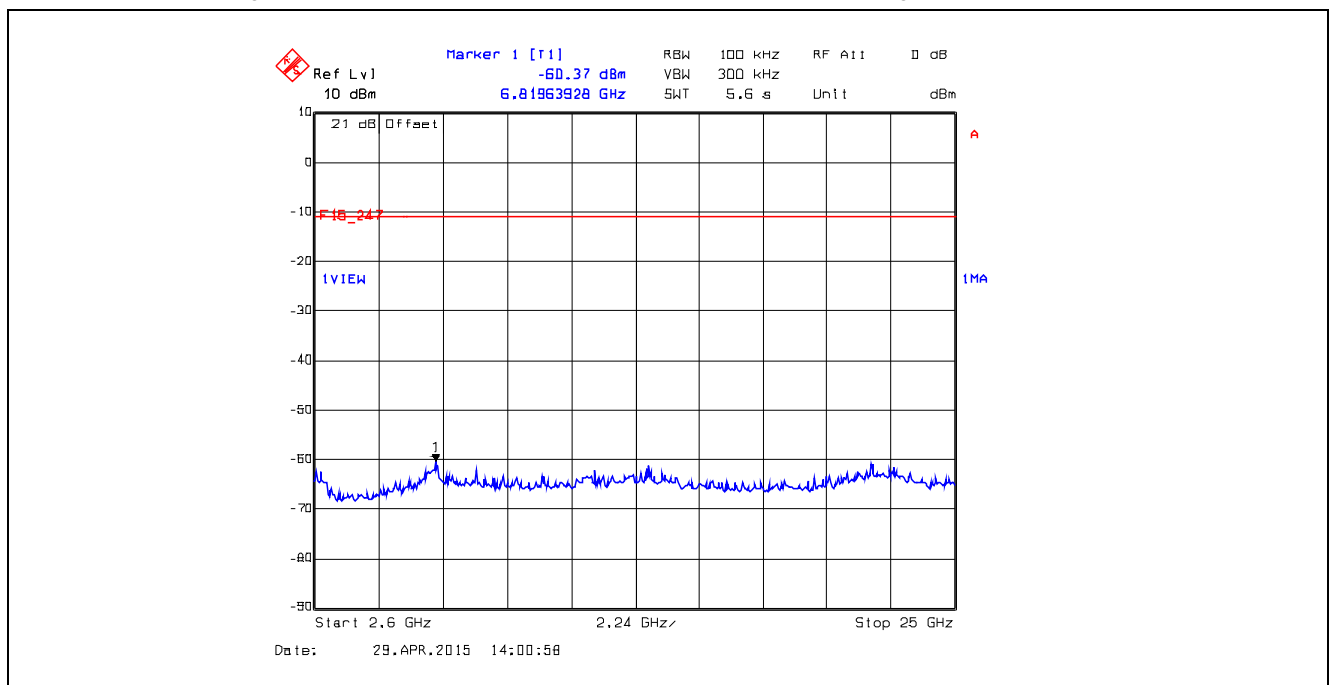
Plot 5.4.4.2.10. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11g, Channel 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 2.6 GHz – 25 GHz



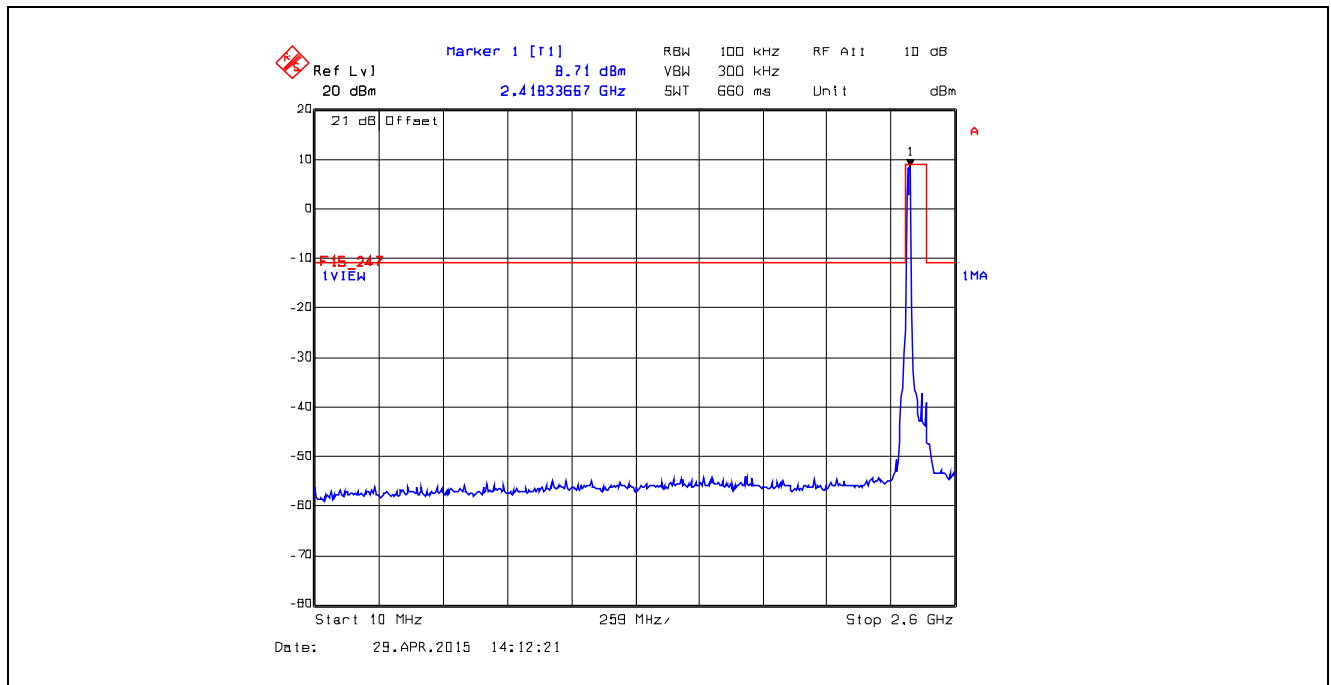
Plot 5.4.4.2.11. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11g, Channel 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 10 MHz – 2.6 GHz



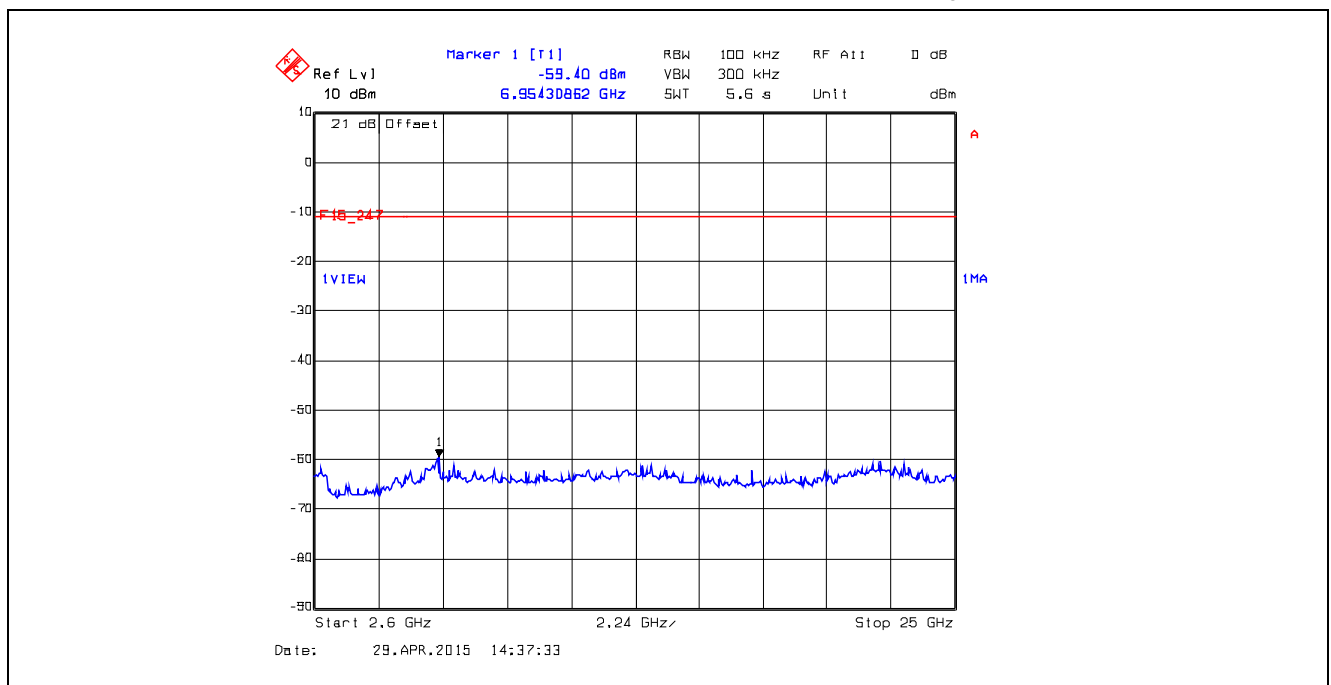
Plot 5.4.4.2.12. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11g, Channel 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 2.6 GHz – 25 GHz



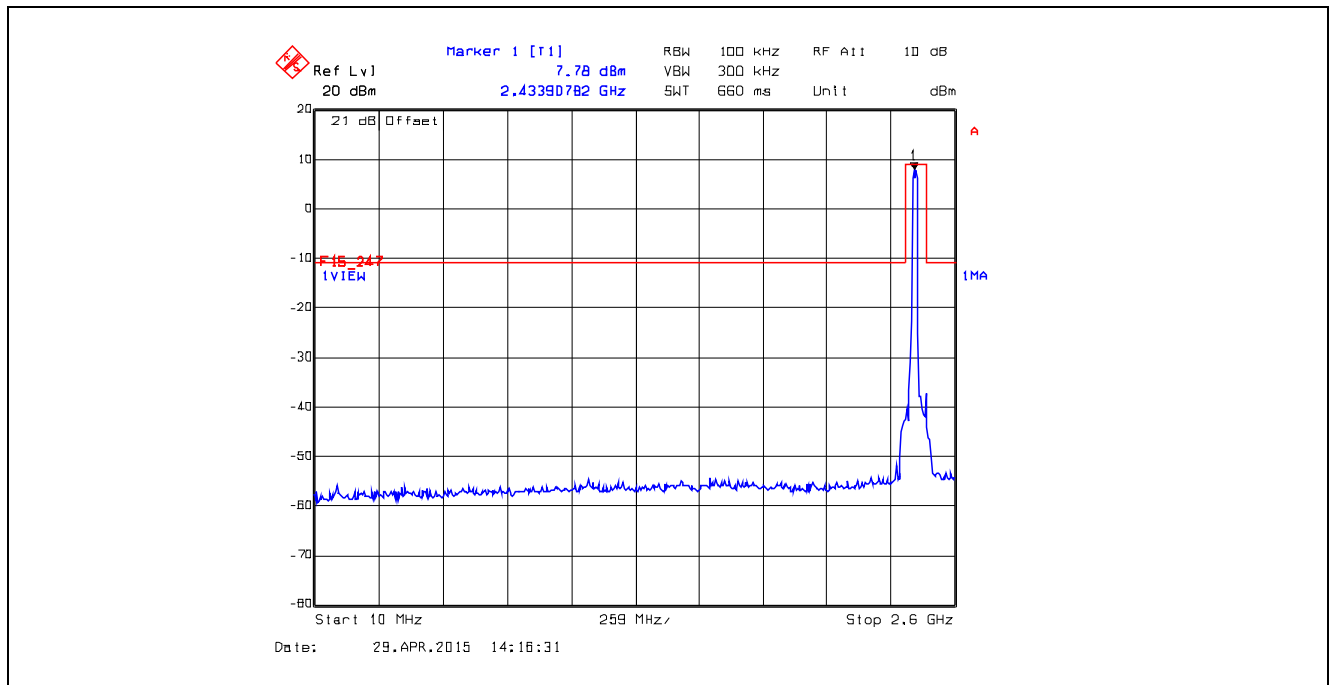
Plot 5.4.4.2.13. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT20, Channel 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 10 MHz – 2.6 GHz



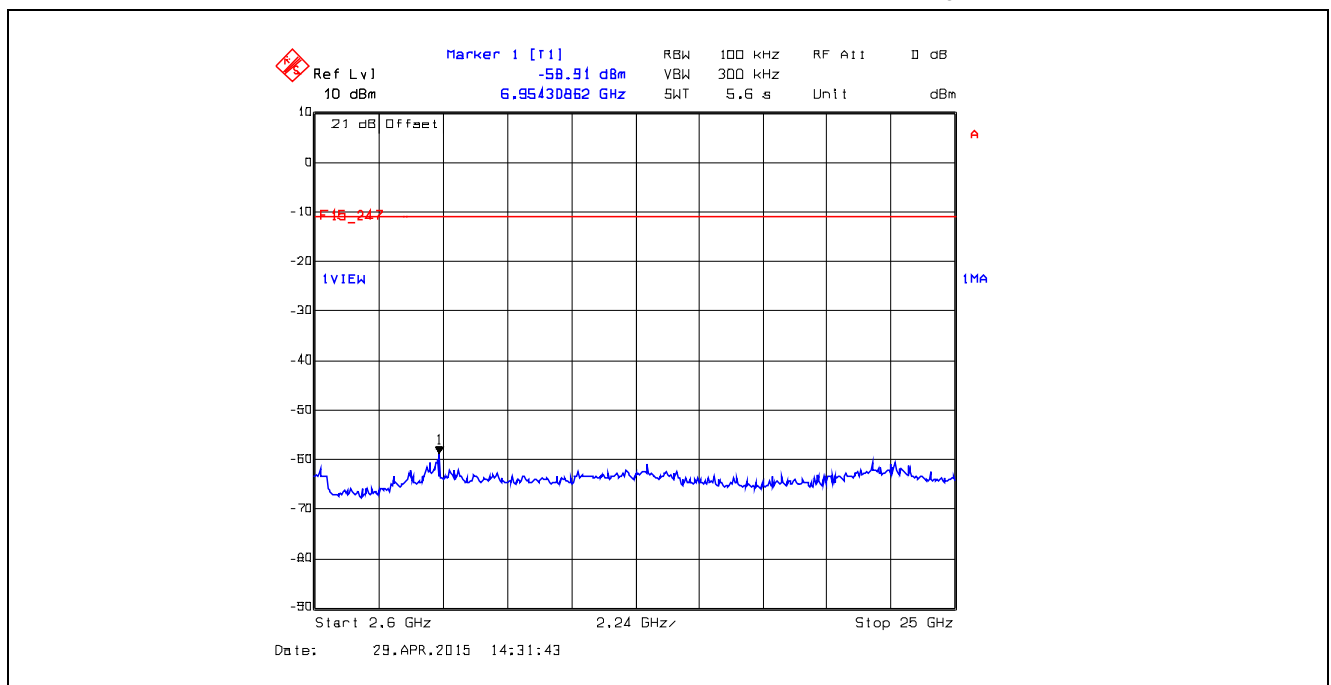
Plot 5.4.4.2.14. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT20, Channel 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 2.6 GHz – 25 GHz



Plot 5.4.4.2.15. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT20, Channel 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 10 MHz – 2.6 GHz



Plot 5.4.4.2.16. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT20, Channel 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 2.6 GHz – 25 GHz



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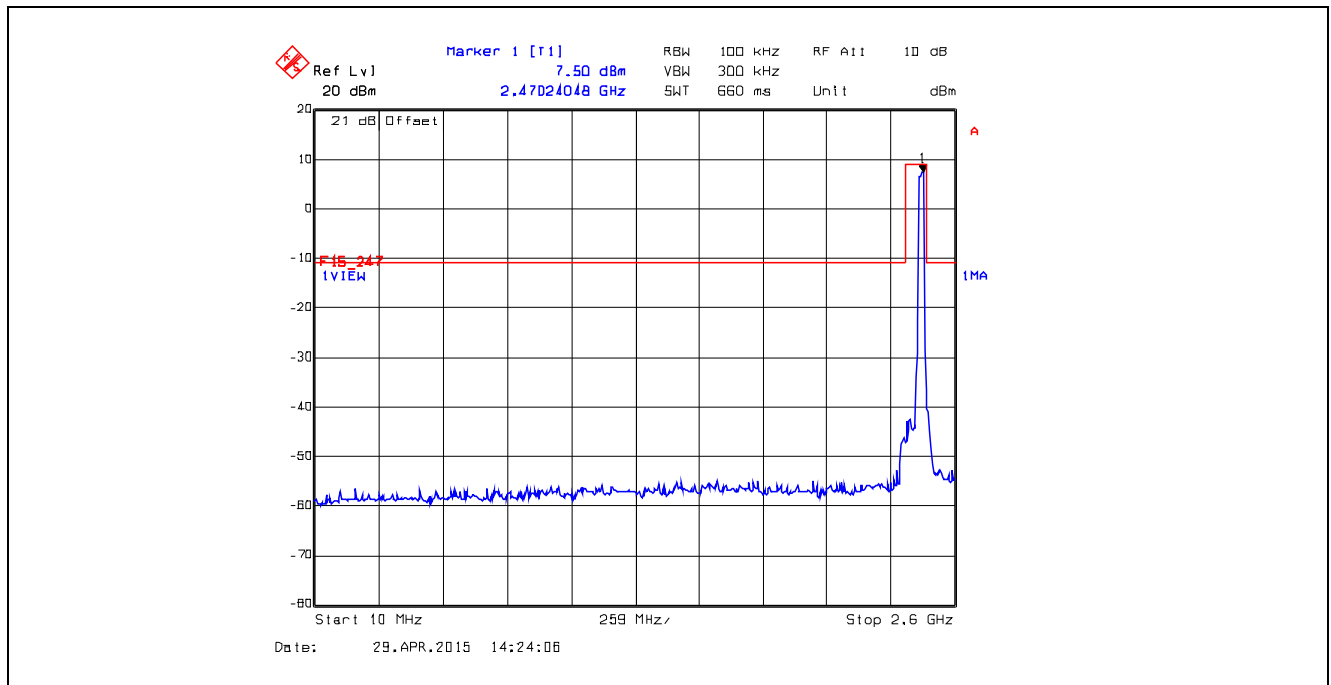
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 15MCRS083_FCC15C247DTS

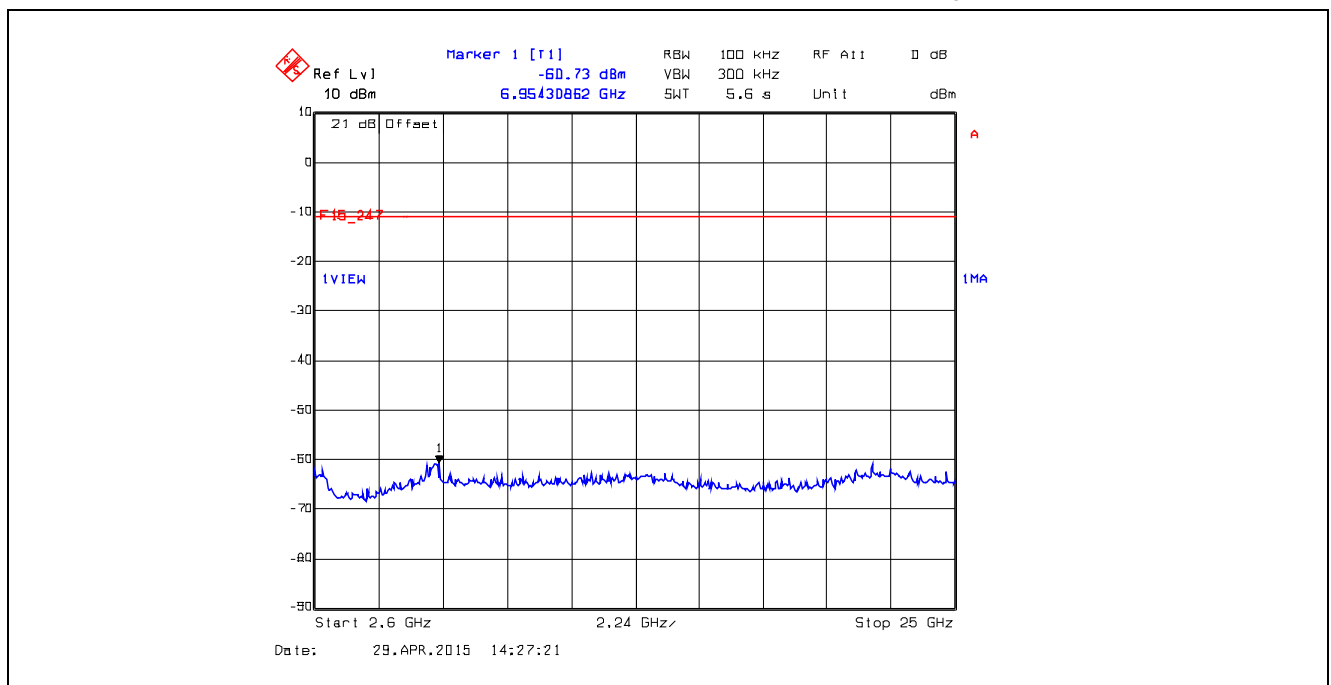
June 16, 2015

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

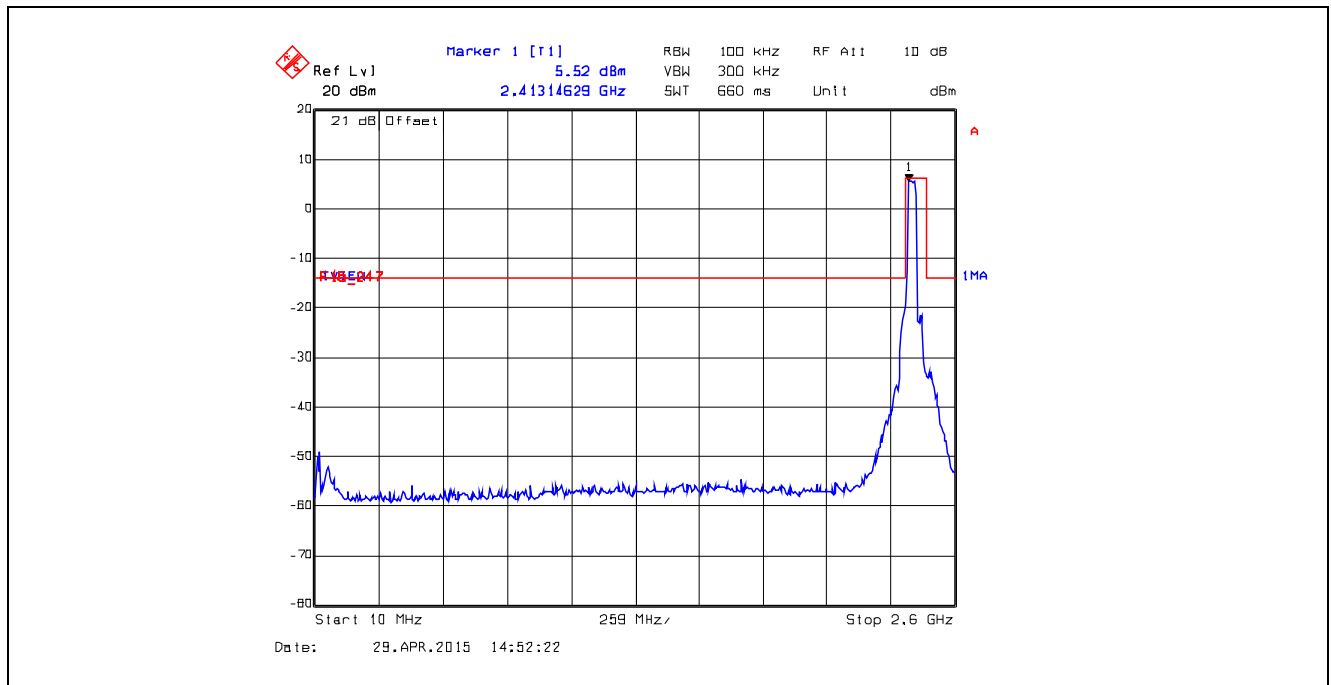
Plot 5.4.4.2.17. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT20, Channel 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 10 MHz – 2.6 GHz



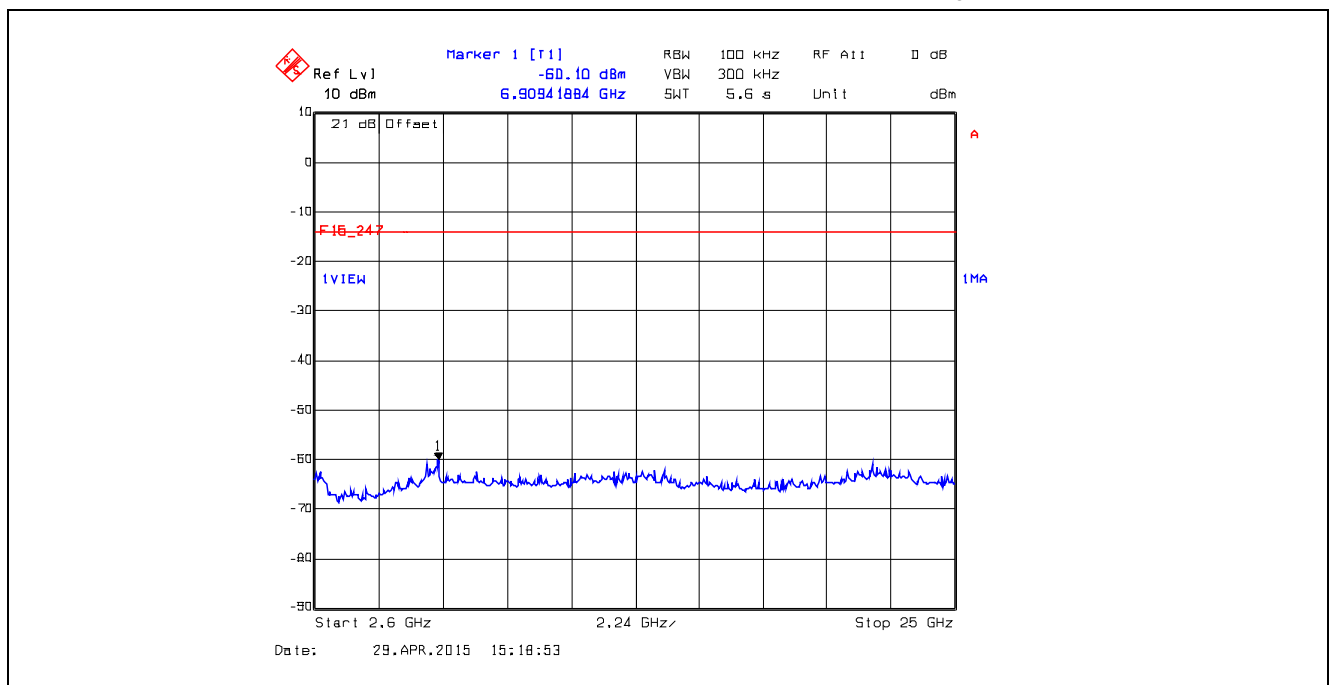
Plot 5.4.4.2.18. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT20, Channel 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 2.6 GHz – 25 GHz



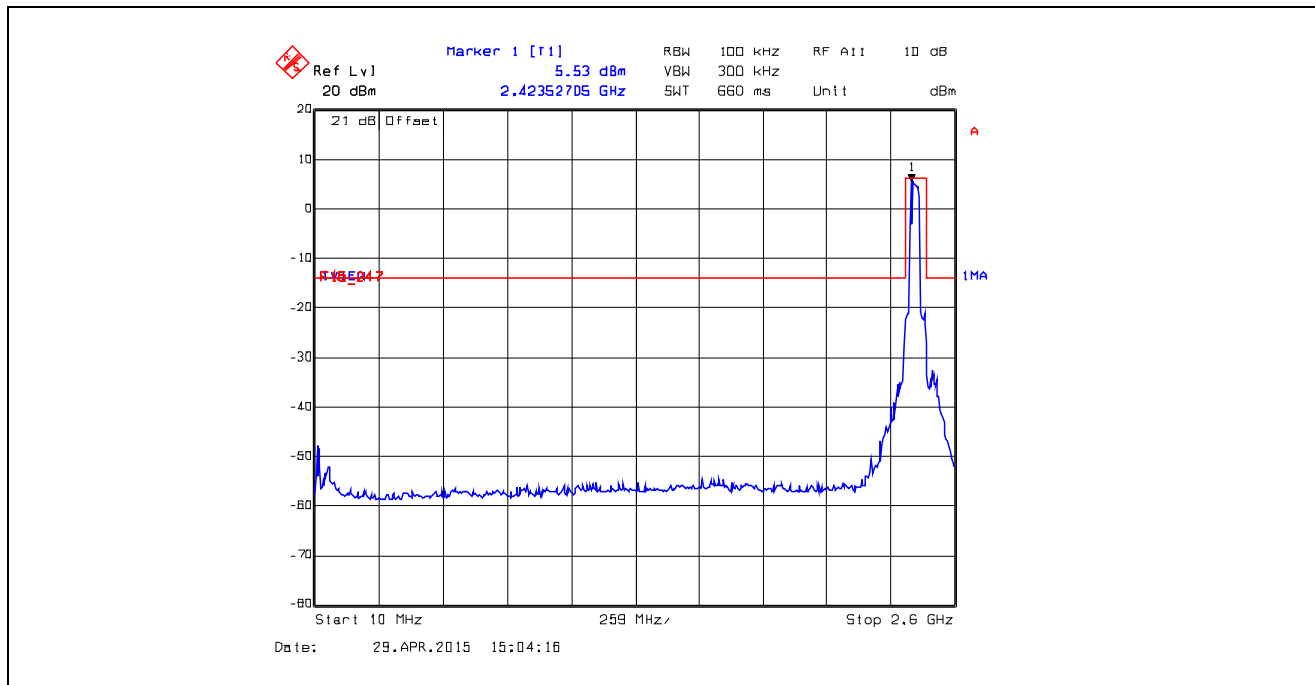
Plot 5.4.4.2.19. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT40, Channel 3, 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 10 MHz – 2.6 GHz



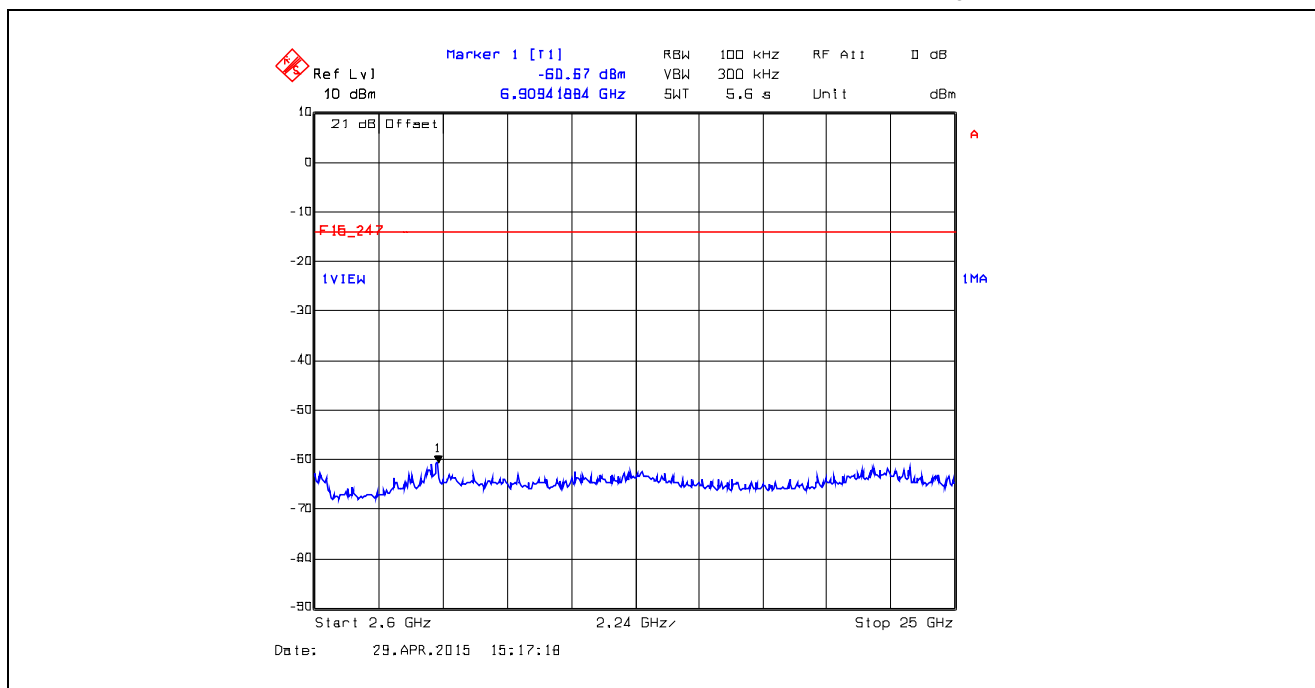
Plot 5.4.4.2.20. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT40, Channel 3, 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 2.6 GHz – 25 GHz



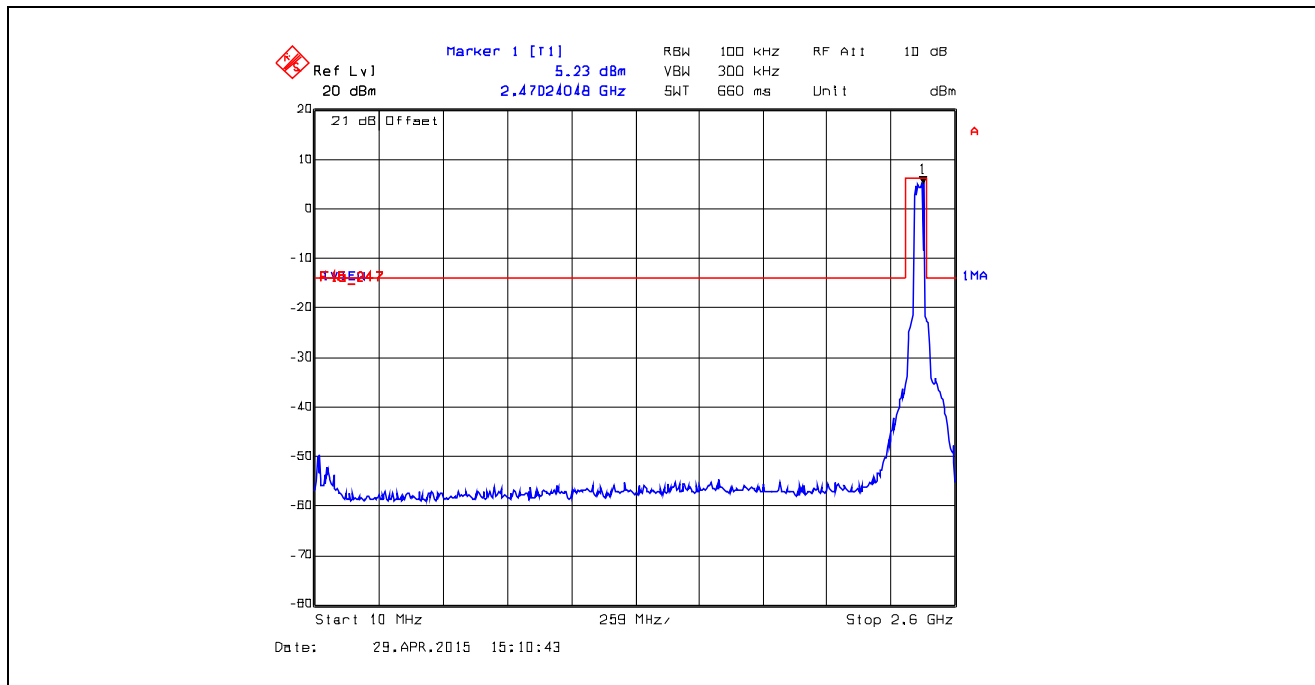
Plot 5.4.4.2.21. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT40, Channel 6, 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 10 MHz – 2.6 GHz



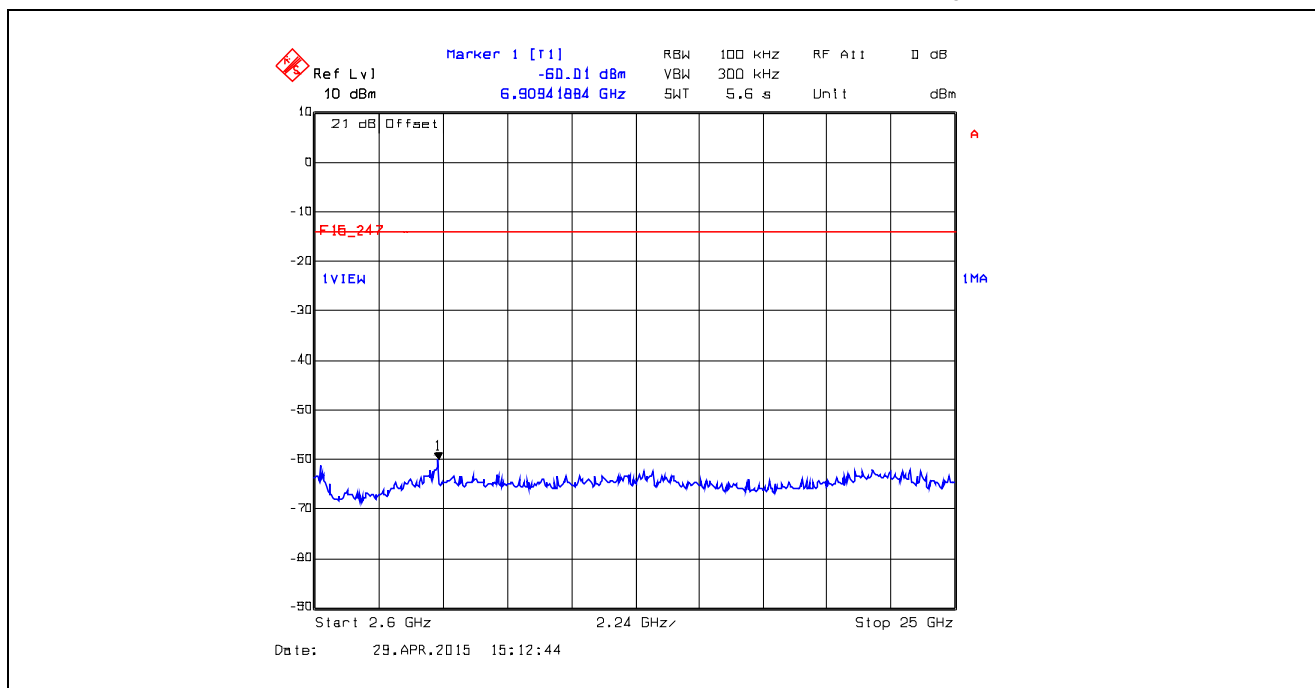
Plot 5.4.4.2.22. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT40, Channel 6, 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 2.6 GHz – 25 GHz



Plot 5.4.4.2.23. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT40, Channel 9, 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 10 MHz – 2.6 GHz



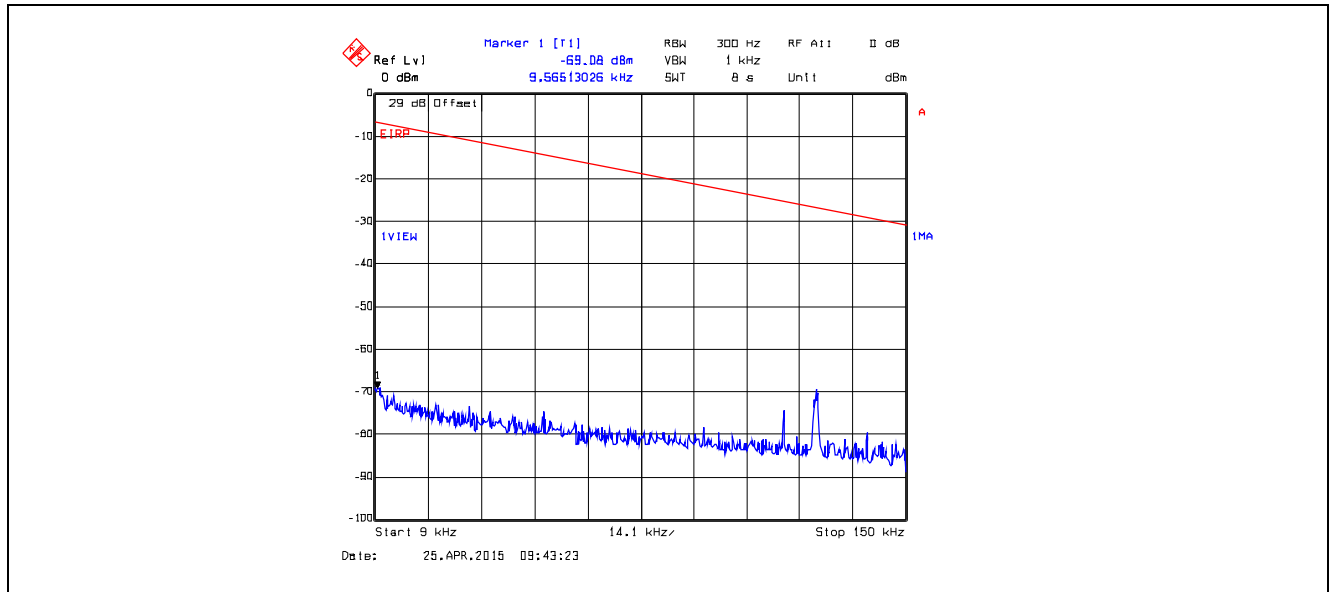
Plot 5.4.4.2.24. Conducted Spurious Emissions in Non-restricted Frequency Bands
802.11n HT40, Channel 9, 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 2.6 GHz – 25 GHz



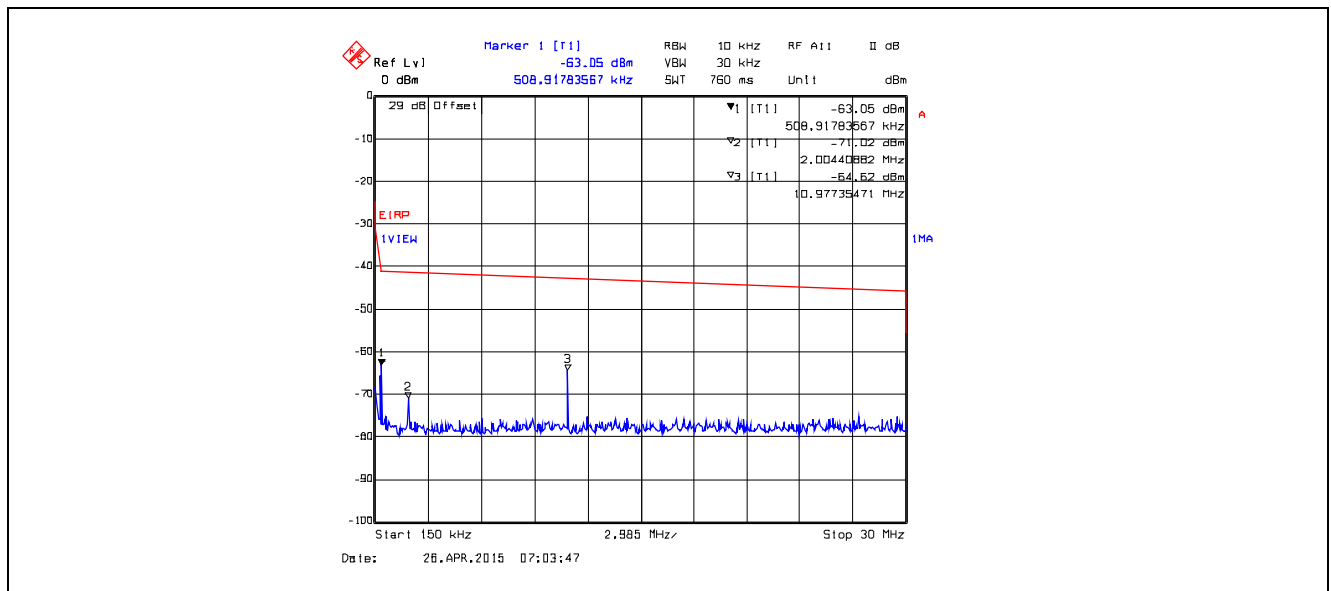
5.4.4.3. Conducted Spurious Emissions in Restricted Frequency Bands, Highest Power Setting for Lowest Antenna Gain (2 dBi)

Remark: Offset = [Insertion Loss] + [Transmit Antenna Gain (in dBi)] + [Maximum Ground Reflection Factor]

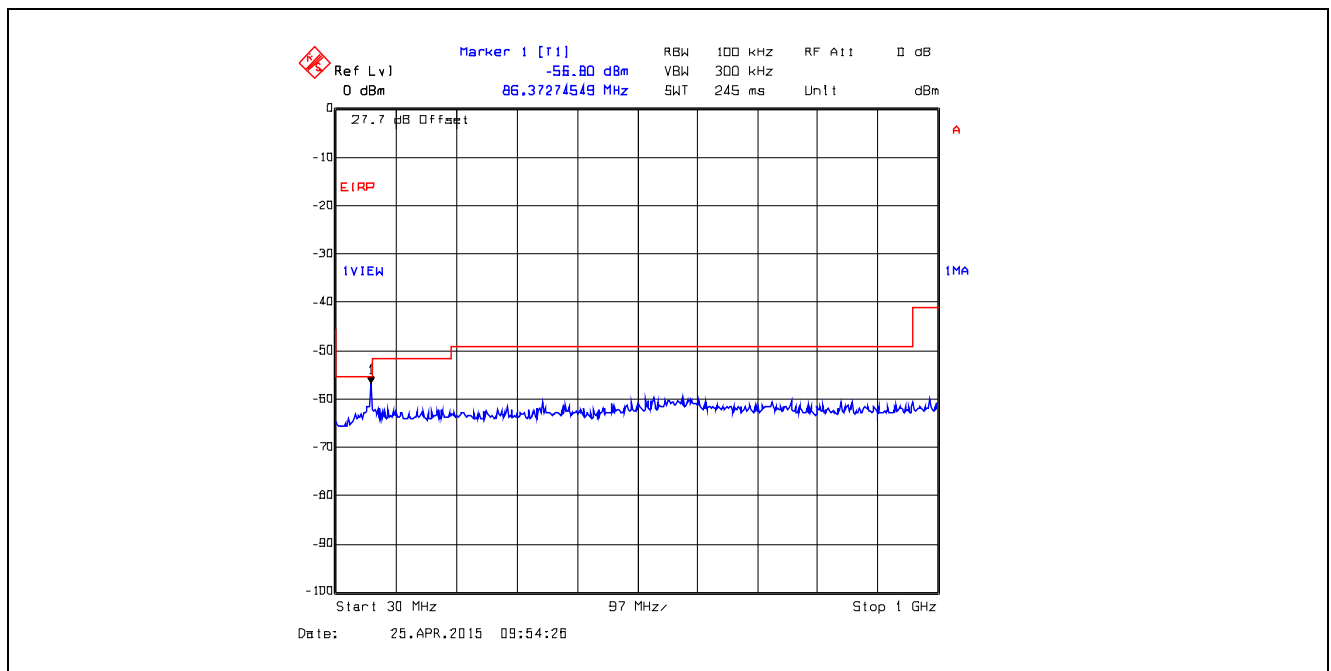
Plot 5.4.4.3.1. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53, 9 kHz - 150 kHz, Peak Detector



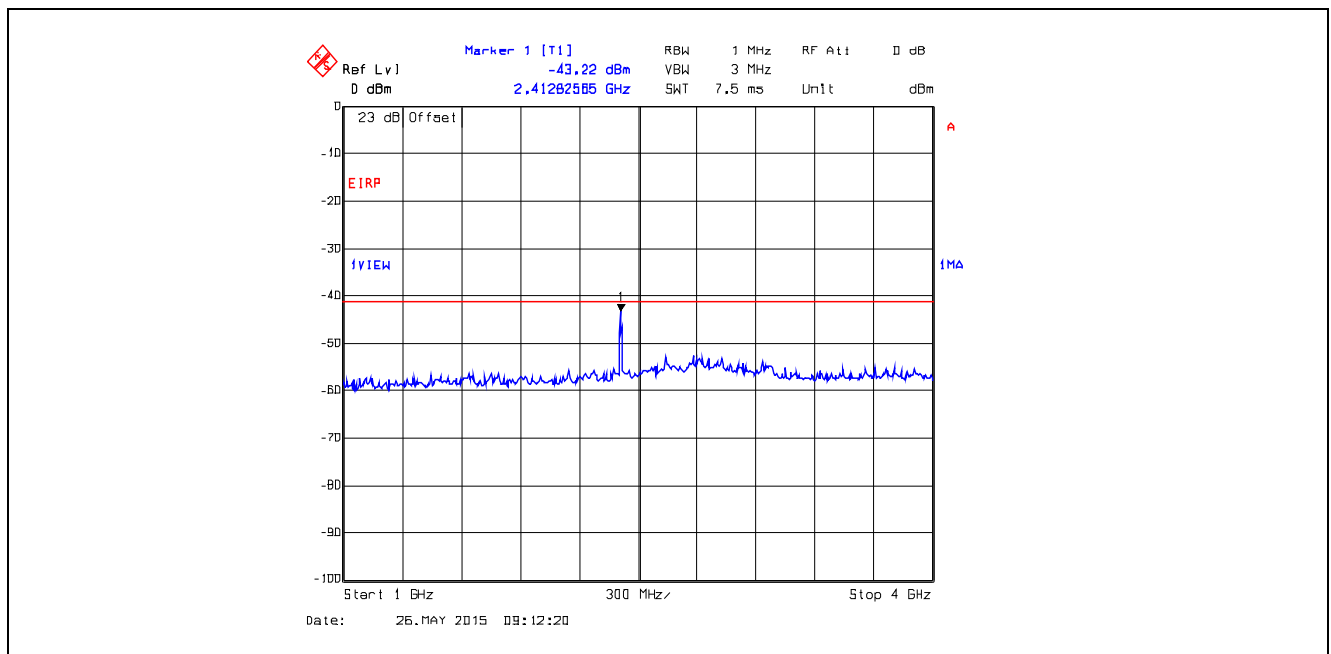
Plot 5.4.4.3.2. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53, 150 kHz - 30 MHz, Peak Detector



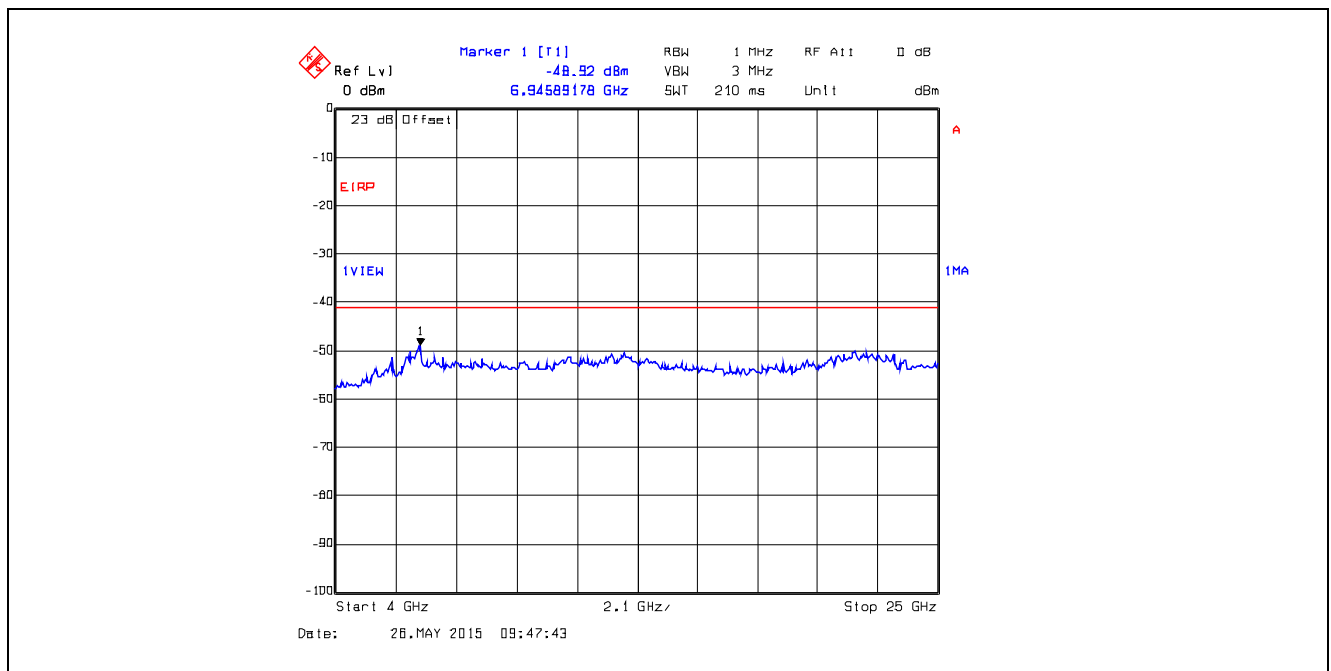
Plot 5.4.4.3.3. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53, 30 MHz - 1 GHz, Peak Detector



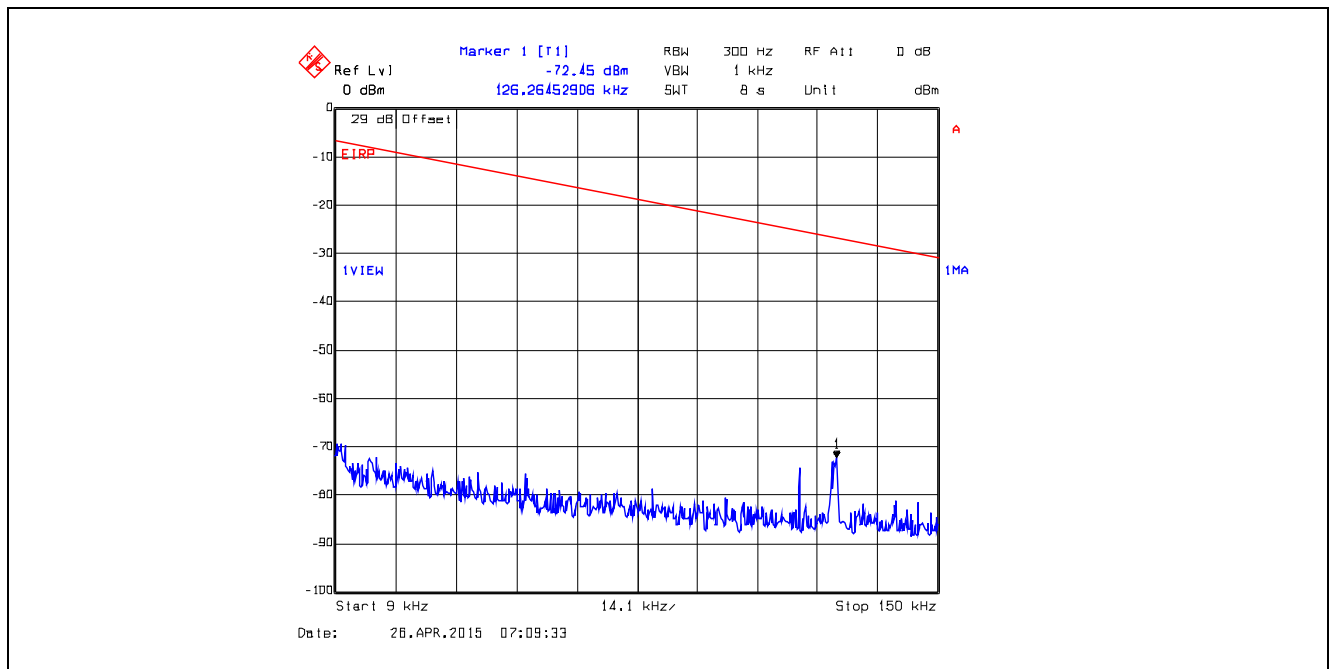
Plot 5.4.4.3.4. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53, 1 GHz - 4 GHz, Peak Detector



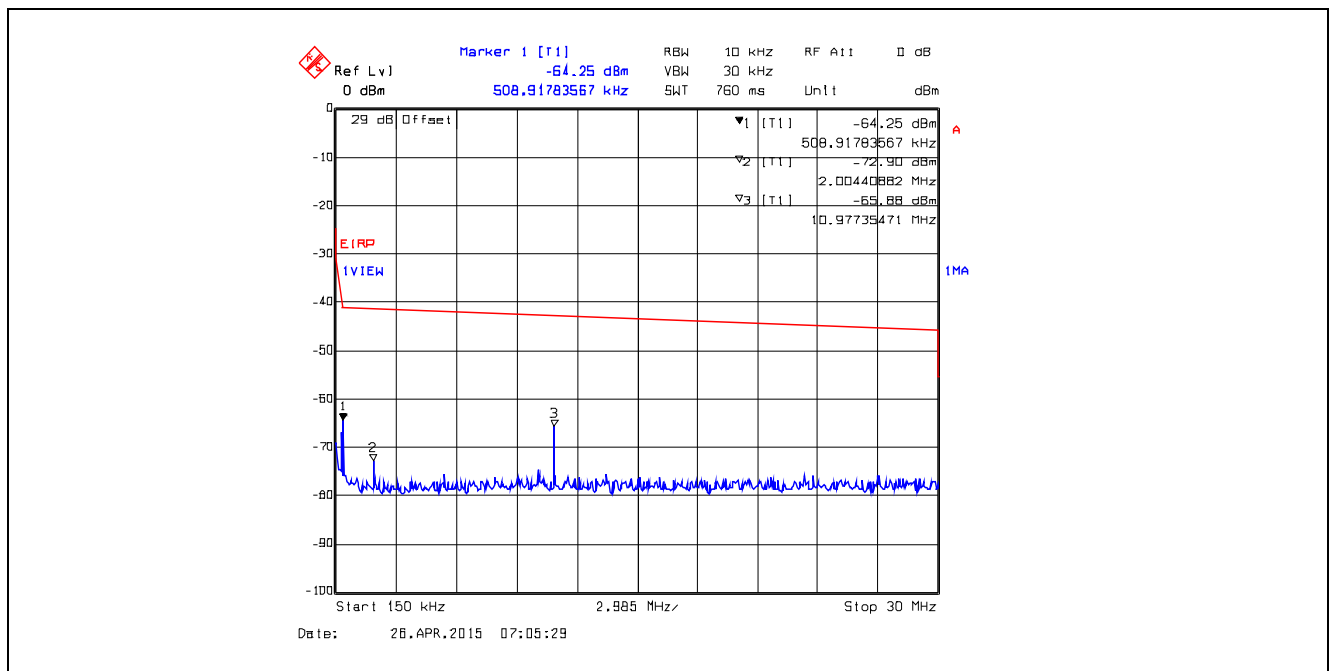
Plot 5.4.4.3.5. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53, 4 GHz - 25 GHz, Peak Detector



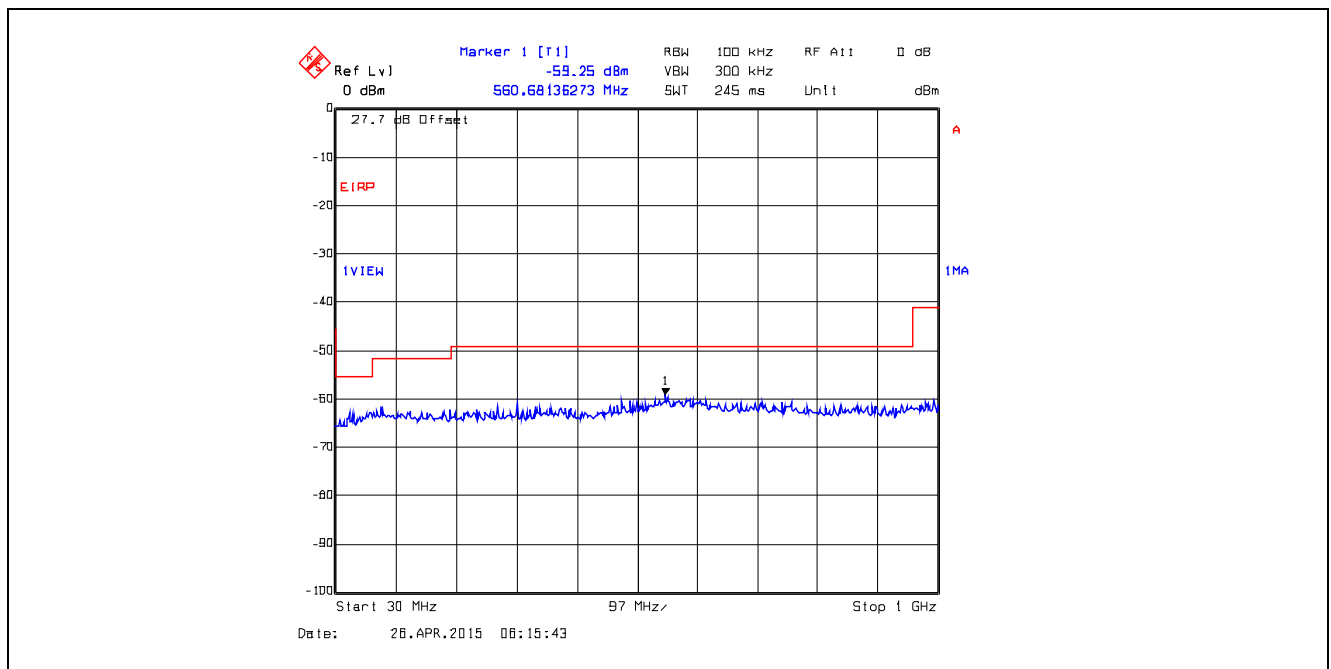
Plot 5.4.4.3.6. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53, 9 kHz - 150 kHz, Peak Detector



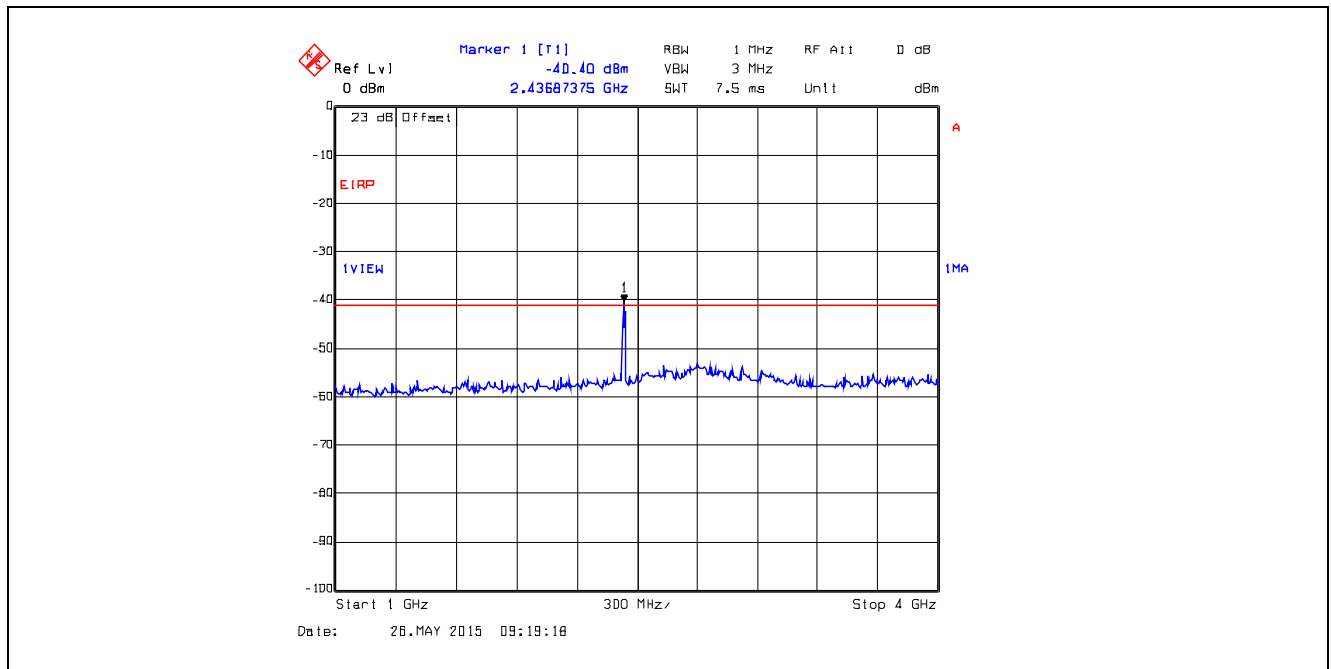
Plot 5.4.4.3.7. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53, 150 kHz - 30 MHz, Peak Detector



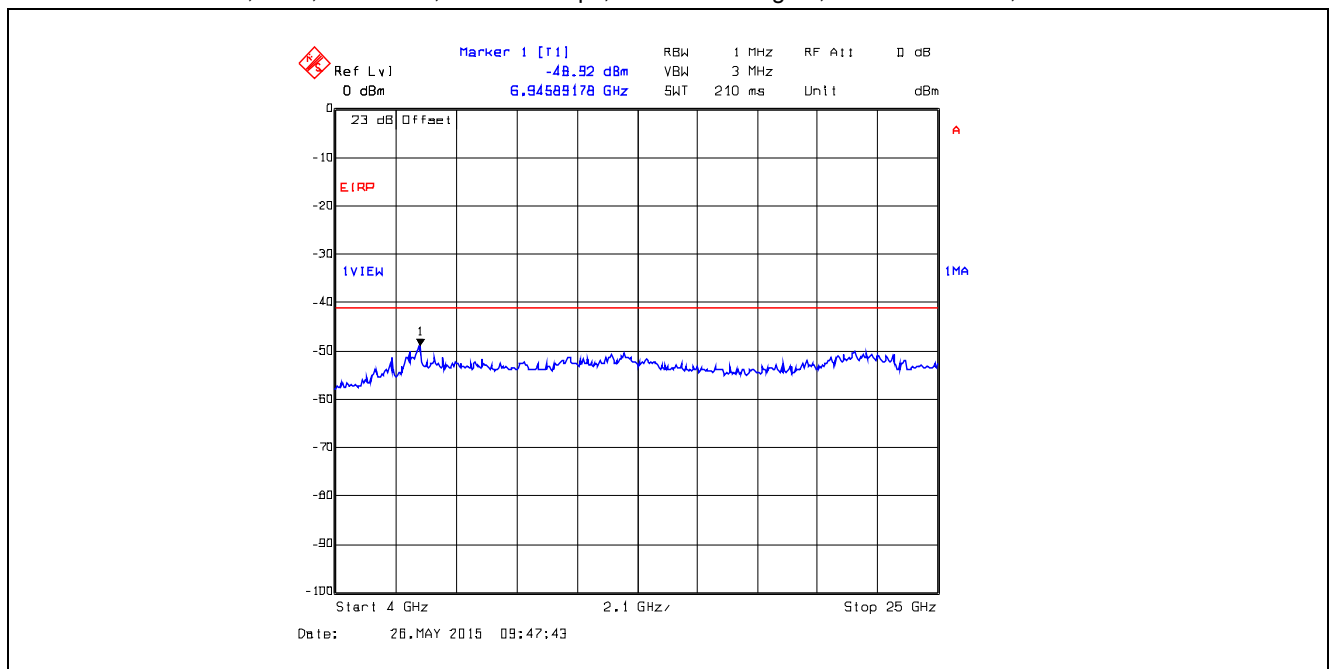
Plot 5.4.4.3.8. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53, 30 MHz - 1 GHz, Peak Detector



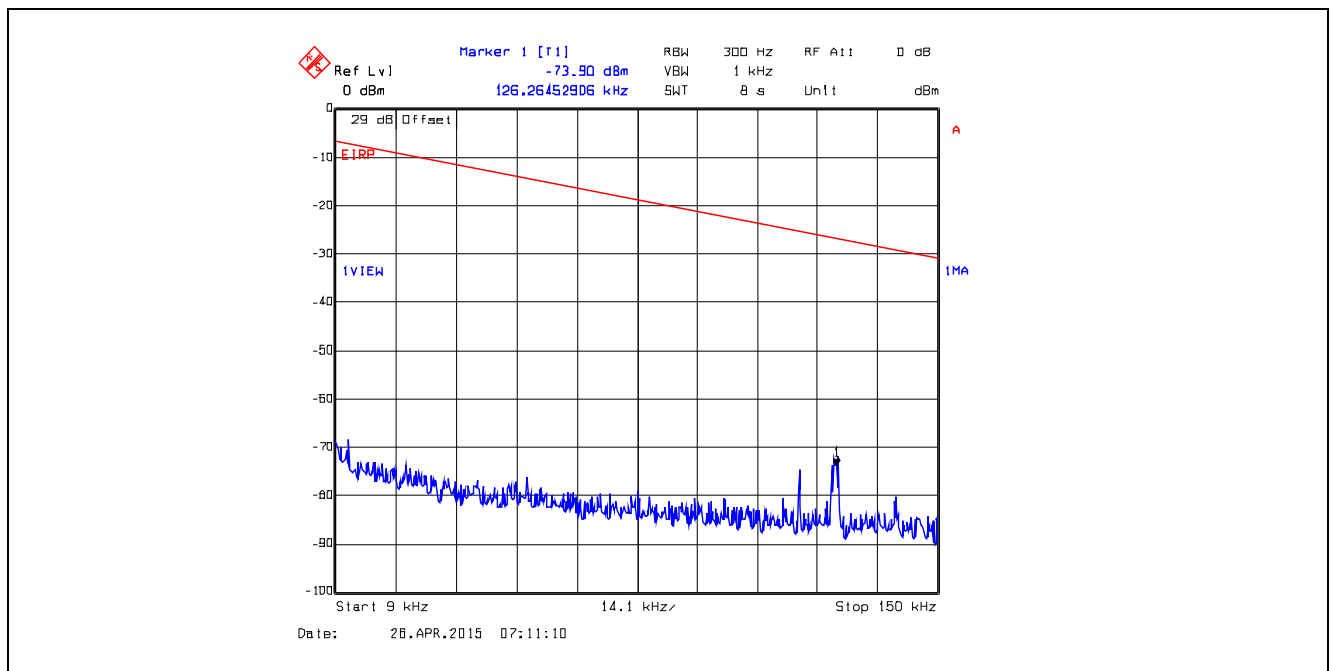
Plot 5.4.4.3.9. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53, 1 GHz - 4 GHz, Peak Detector
Marker 1 is outside of RB



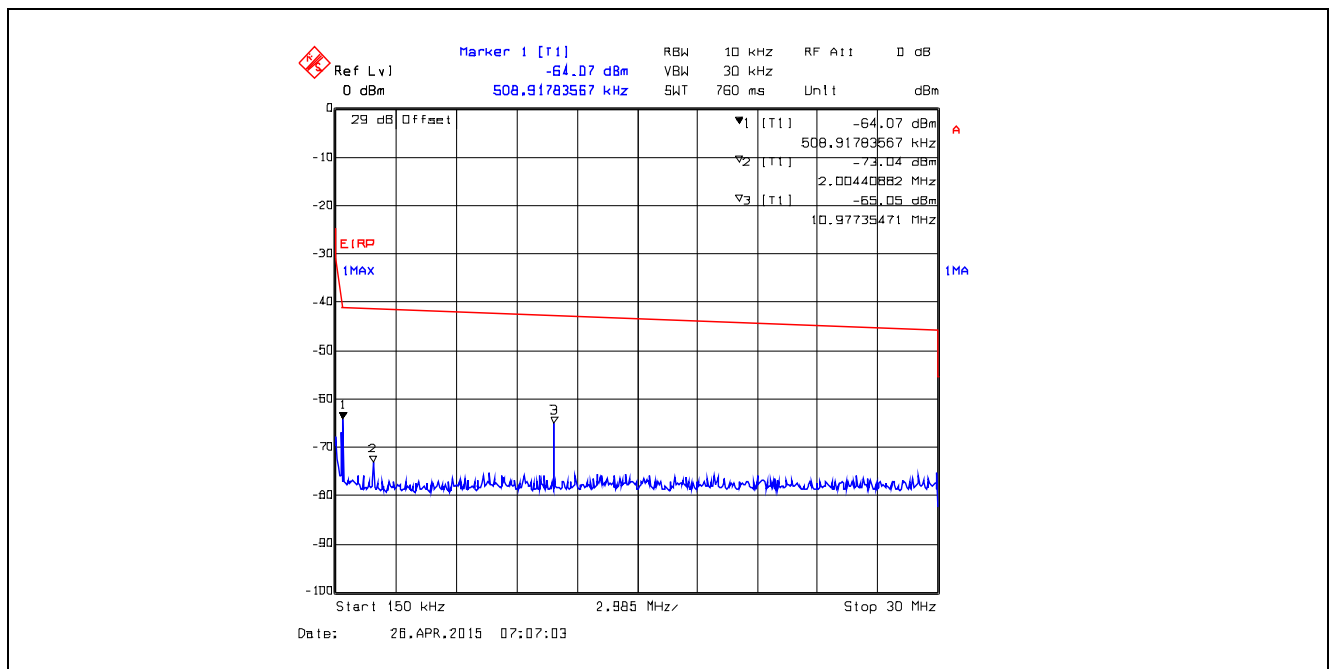
Plot 5.4.4.3.10. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53, 4 GHz - 25 GHz, Peak Detector



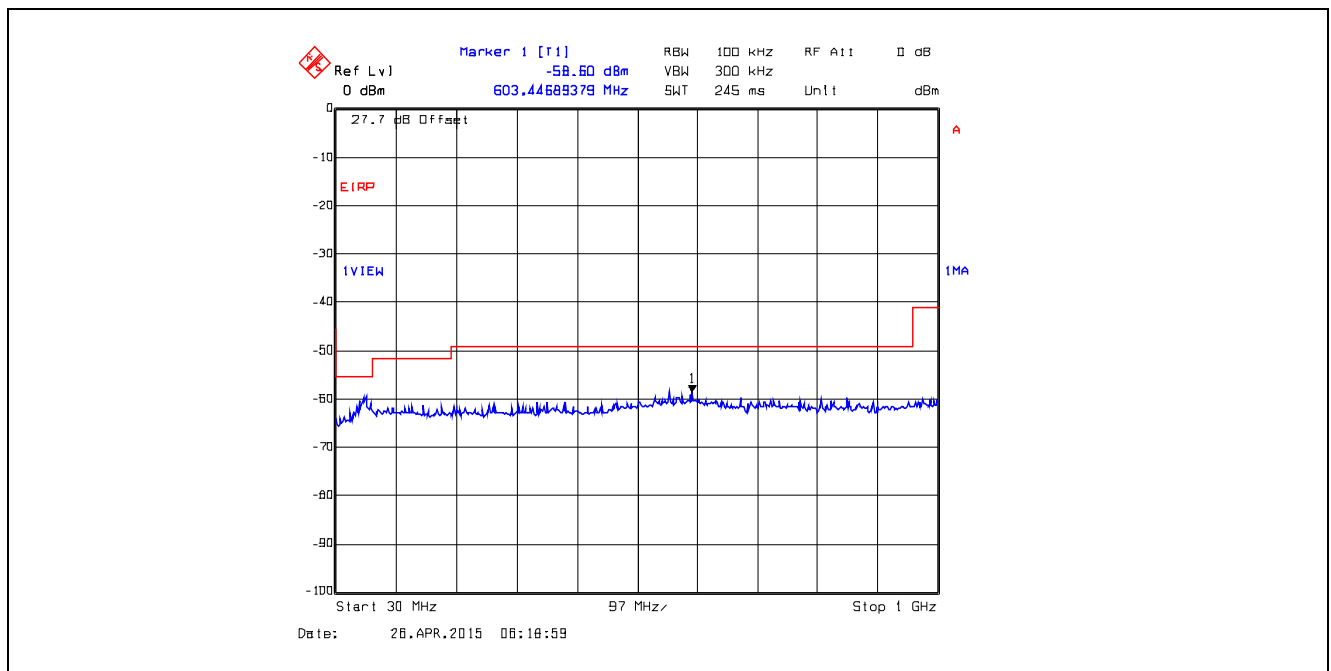
Plot 5.4.4.3.11. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53, 9 kHz - 150 kHz, Peak Detector



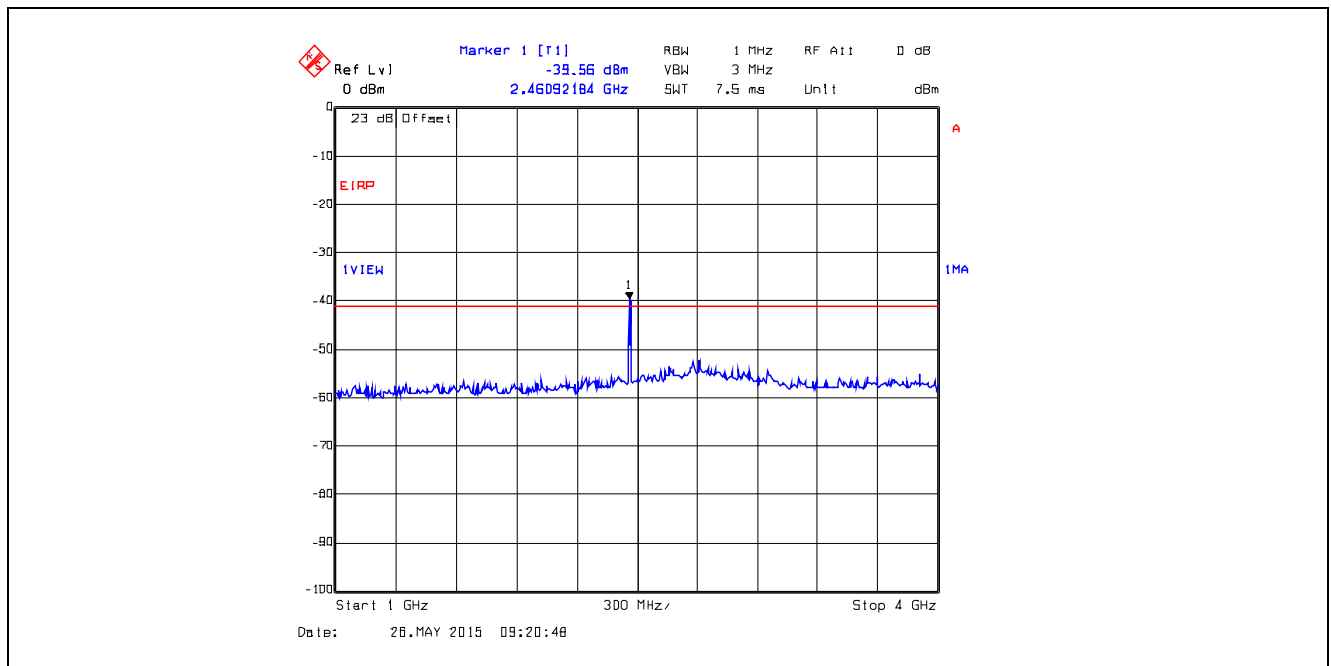
Plot 5.4.4.3.12. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53, 150 kHz - 30 MHz, Peak Detector



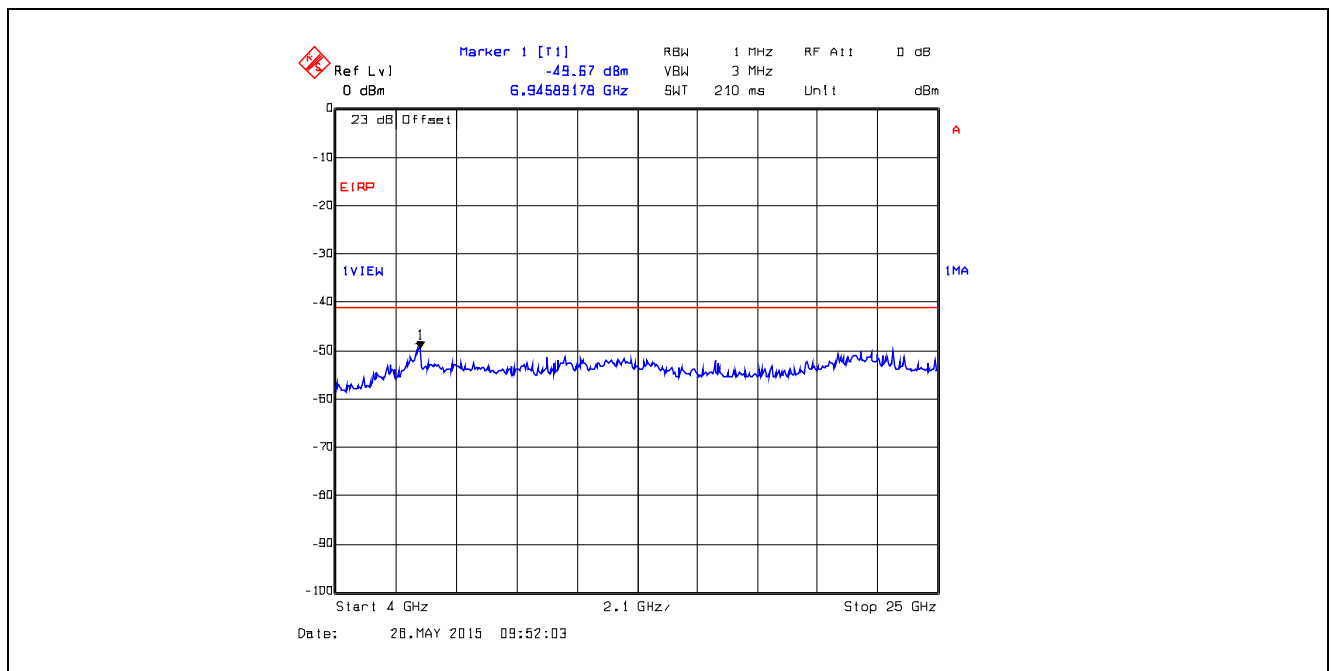
Plot 5.4.4.3.13. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53, 30 MHz - 1 GHz, Peak Detector



Plot 5.4.4.3.14. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53, 1 GHz - 4 GHz, Peak Detector
Marker 1 is outside of RB



Plot 5.4.4.3.15. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53, 4 GHz - 25 GHz, Peak Detector



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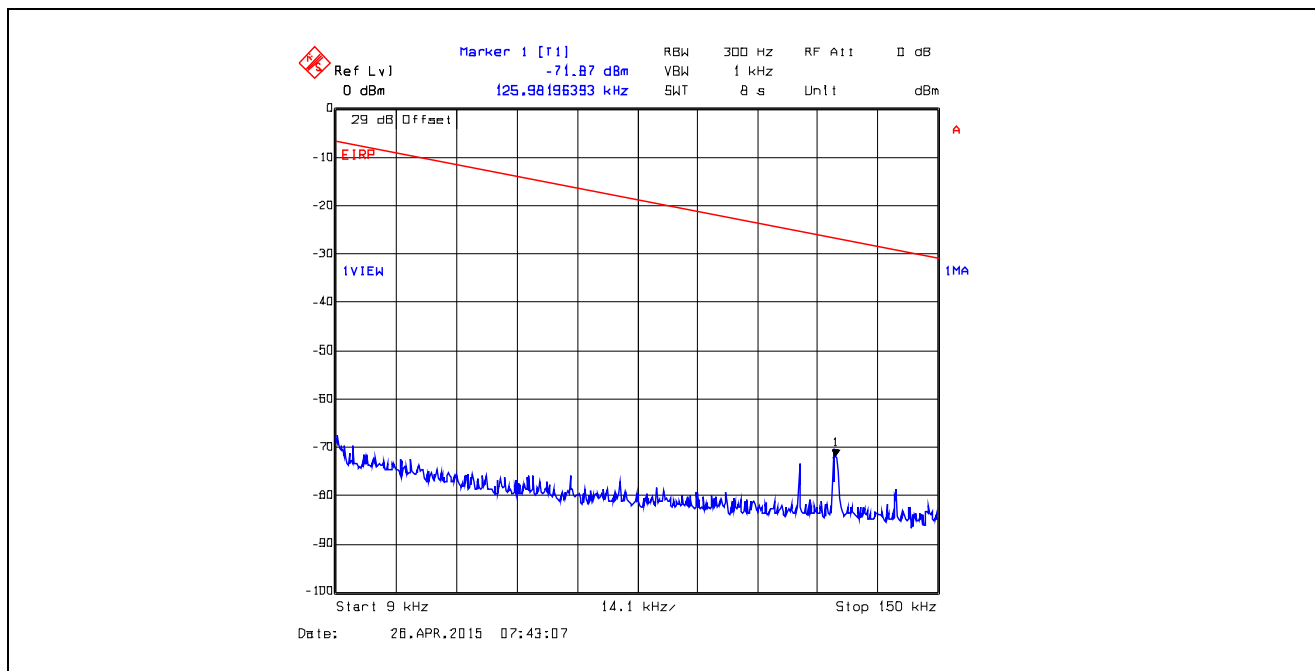
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 15MCRS083_FCC15C247DTS

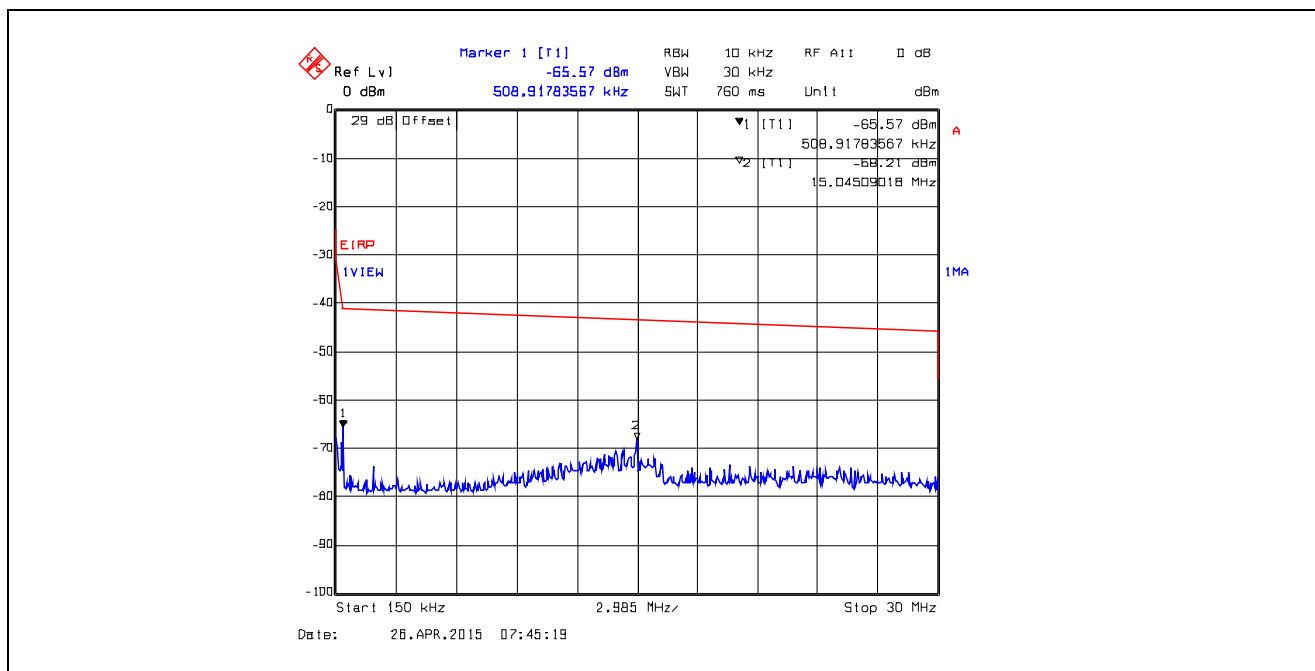
June 16, 2015

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

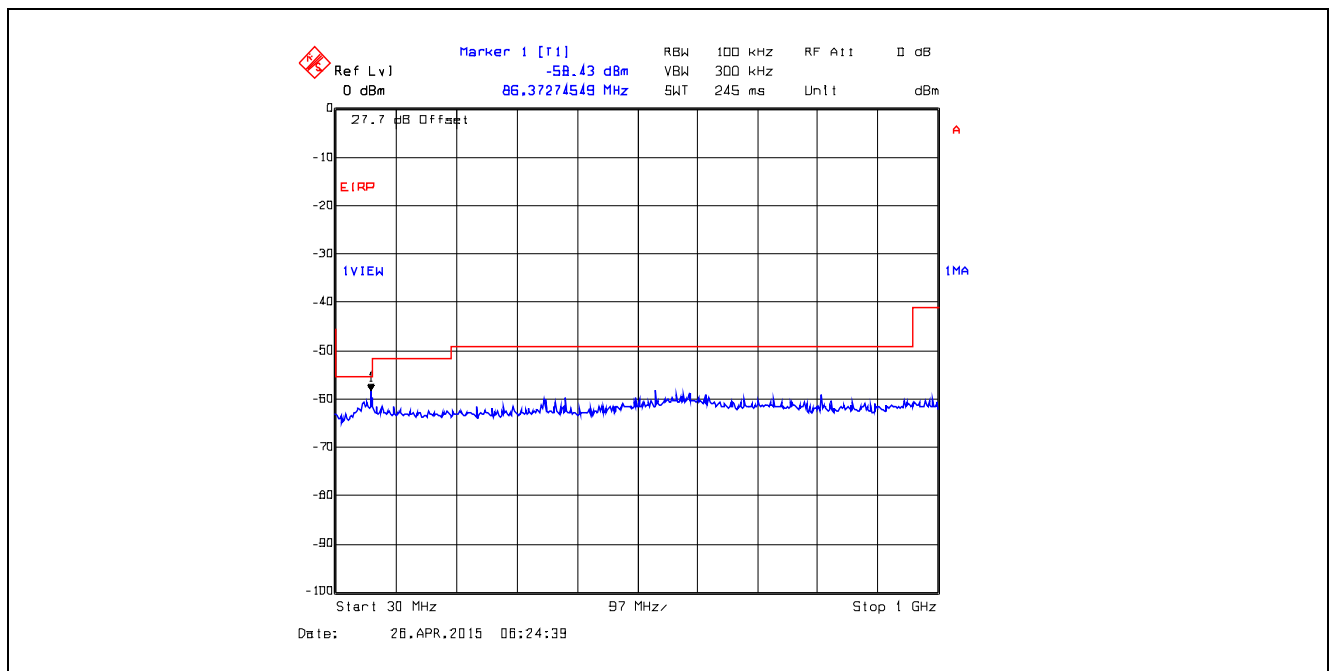
Plot 5.4.4.3.16. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 9 kHz - 150 kHz, Peak Detector



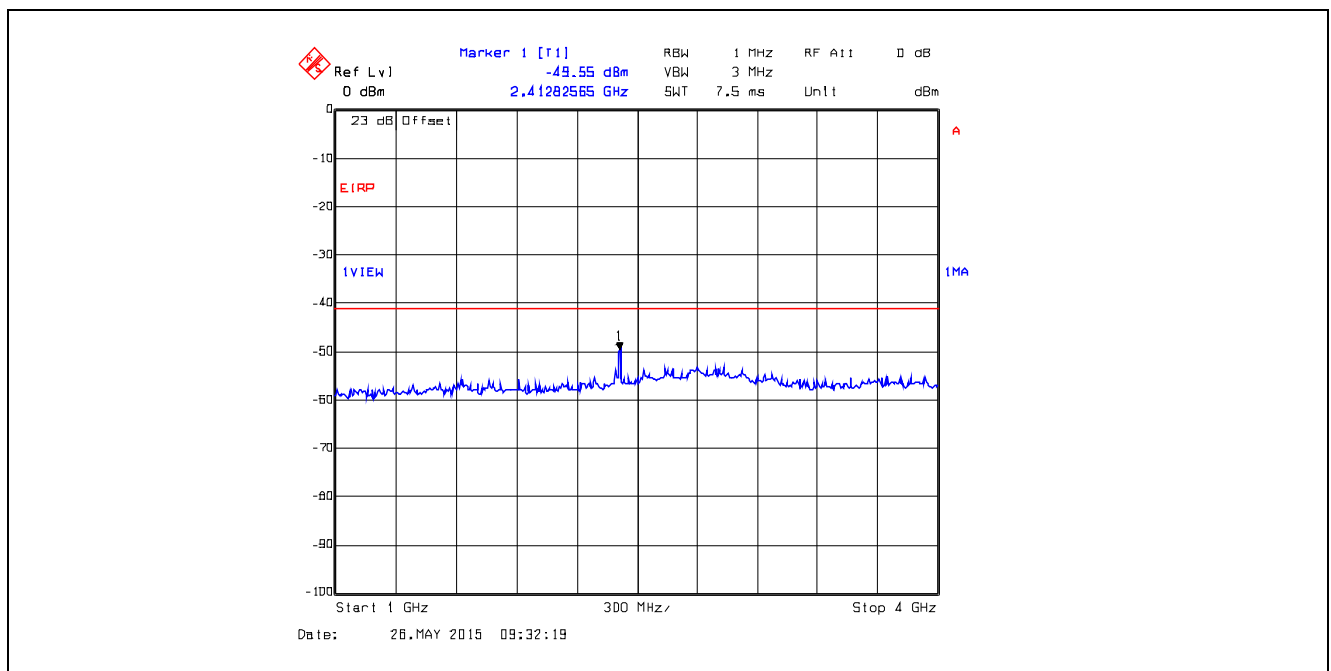
Plot 5.4.4.3.17. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 150 kHz - 30 MHz, Peak Detector



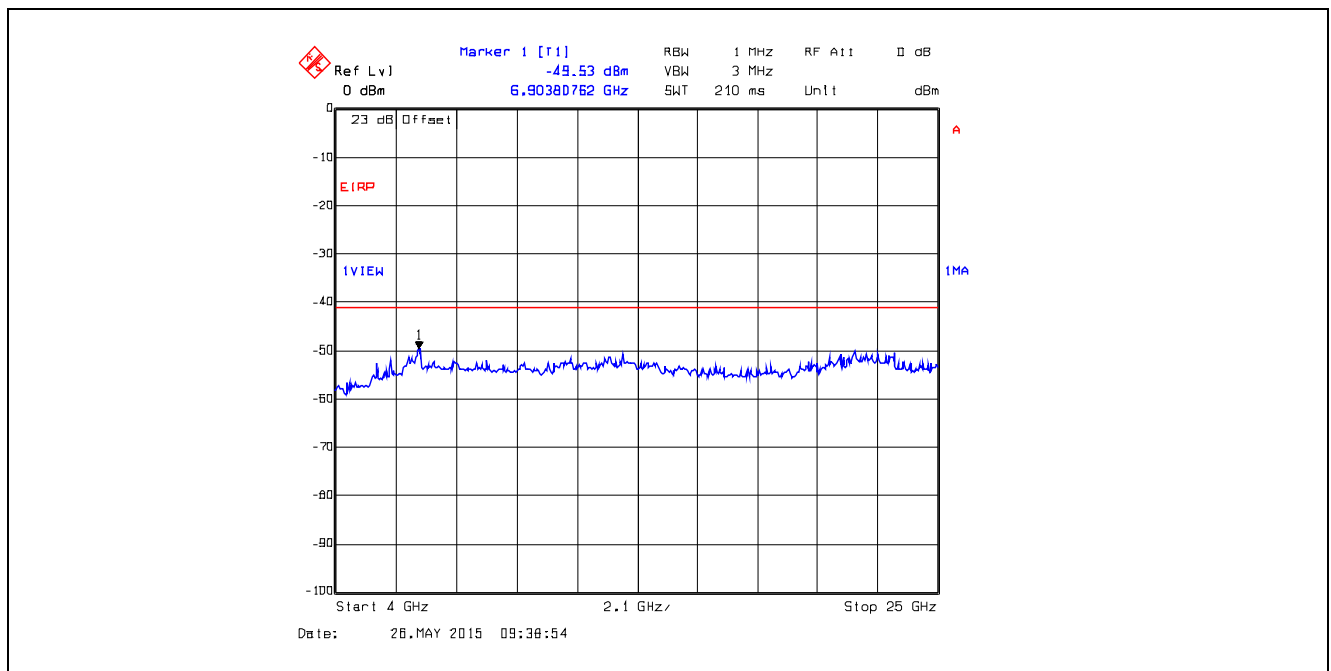
Plot 5.4.4.3.18. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 30 MHz - 1 GHz, Peak Detector



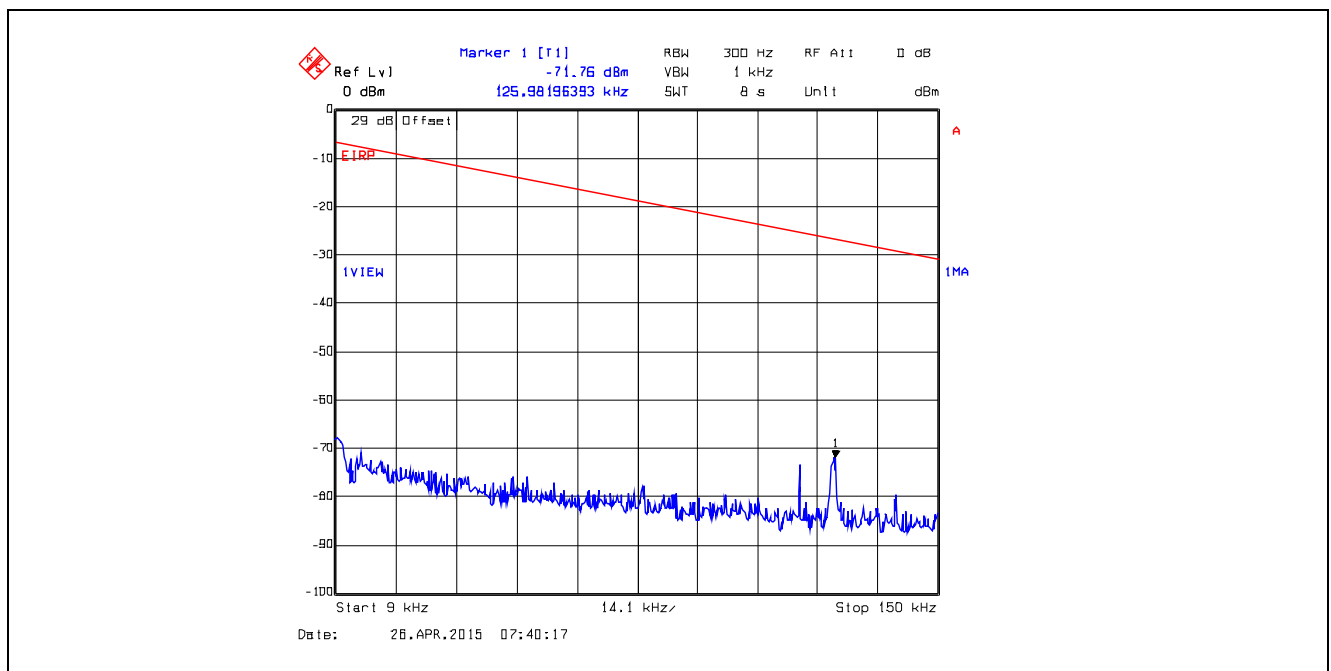
Plot 5.4.4.3.19. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 1 GHz - 4 GHz, Peak Detector



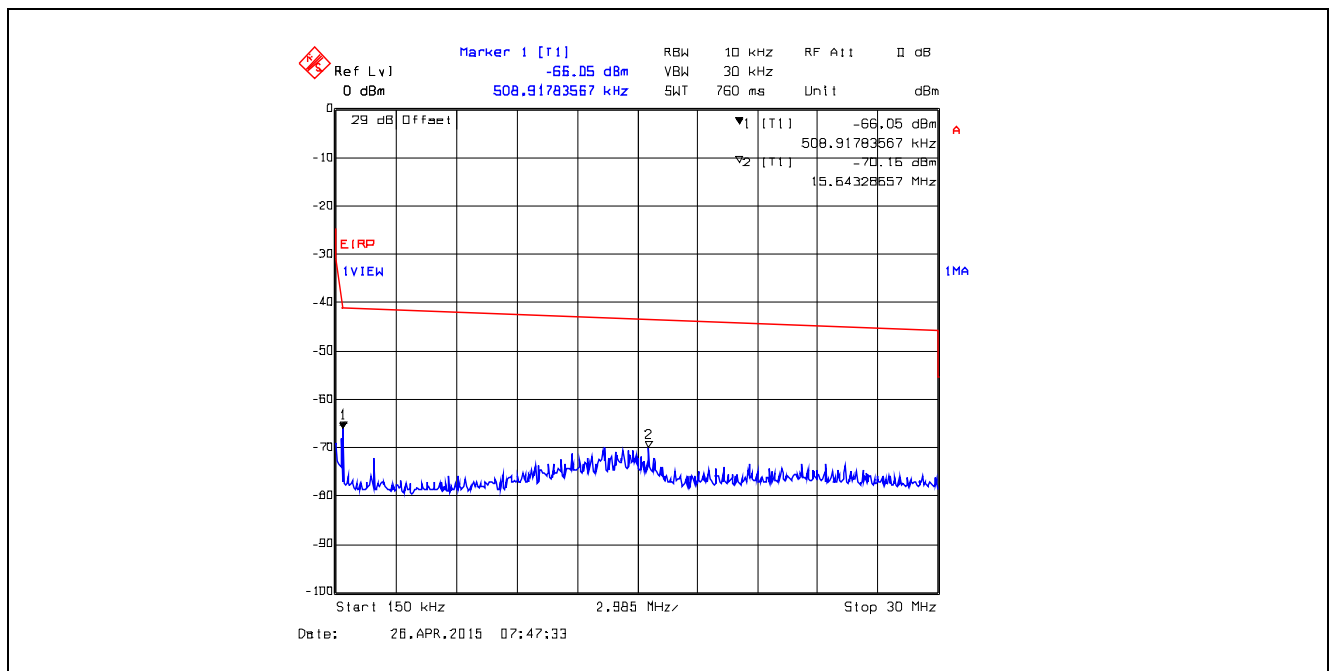
Plot 5.4.4.3.20. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 4 GHz - 25 GHz, Peak Detector



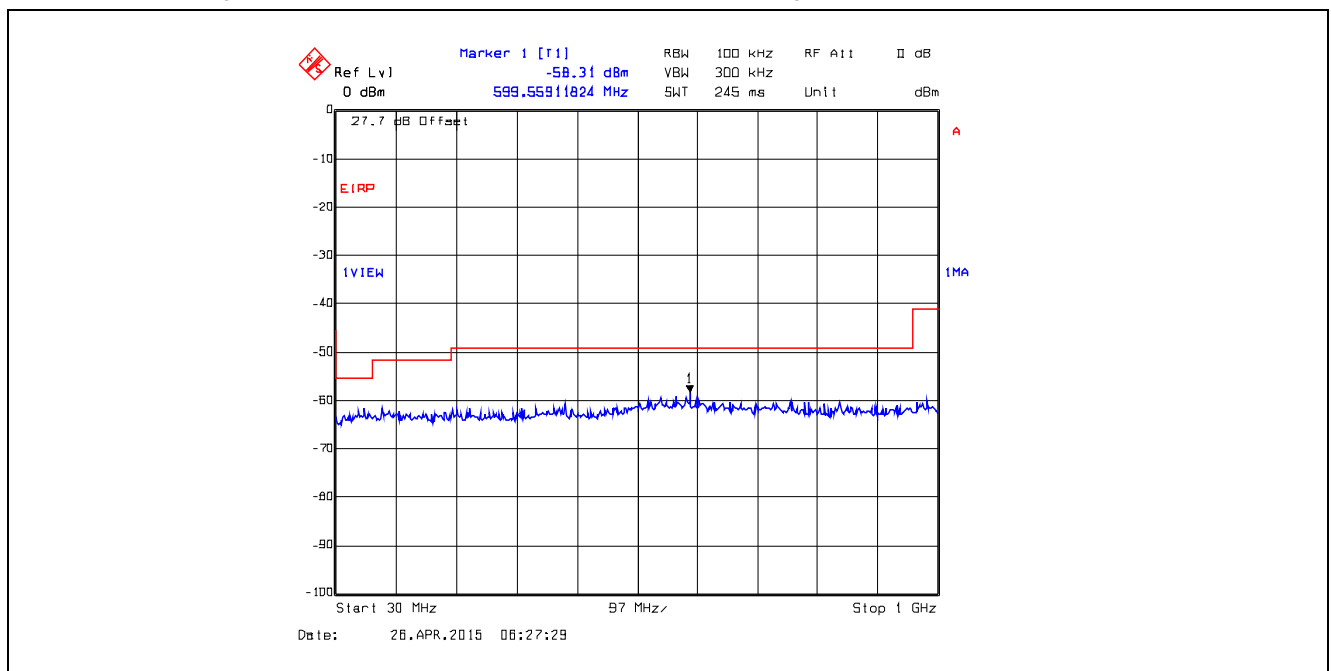
Plot 5.4.4.3.21. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 9 kHz - 150 kHz, Peak Detector



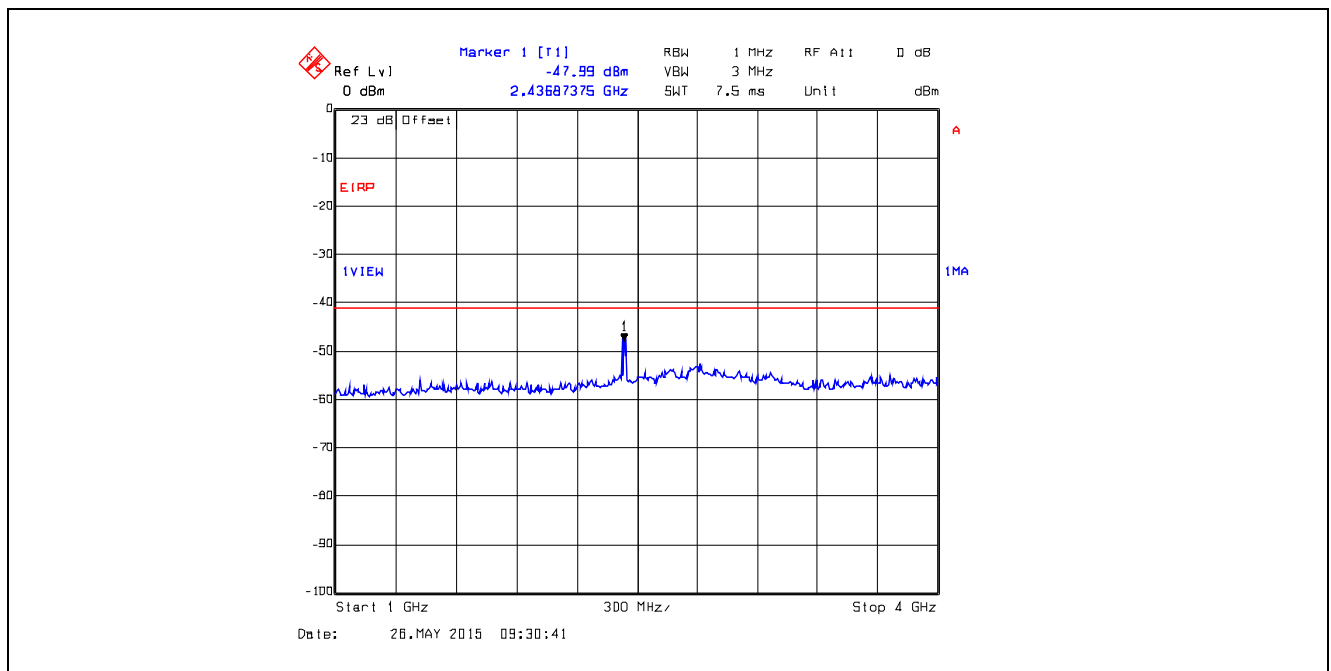
Plot 5.4.4.3.22. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 150 kHz - 30 MHz, Peak Detector



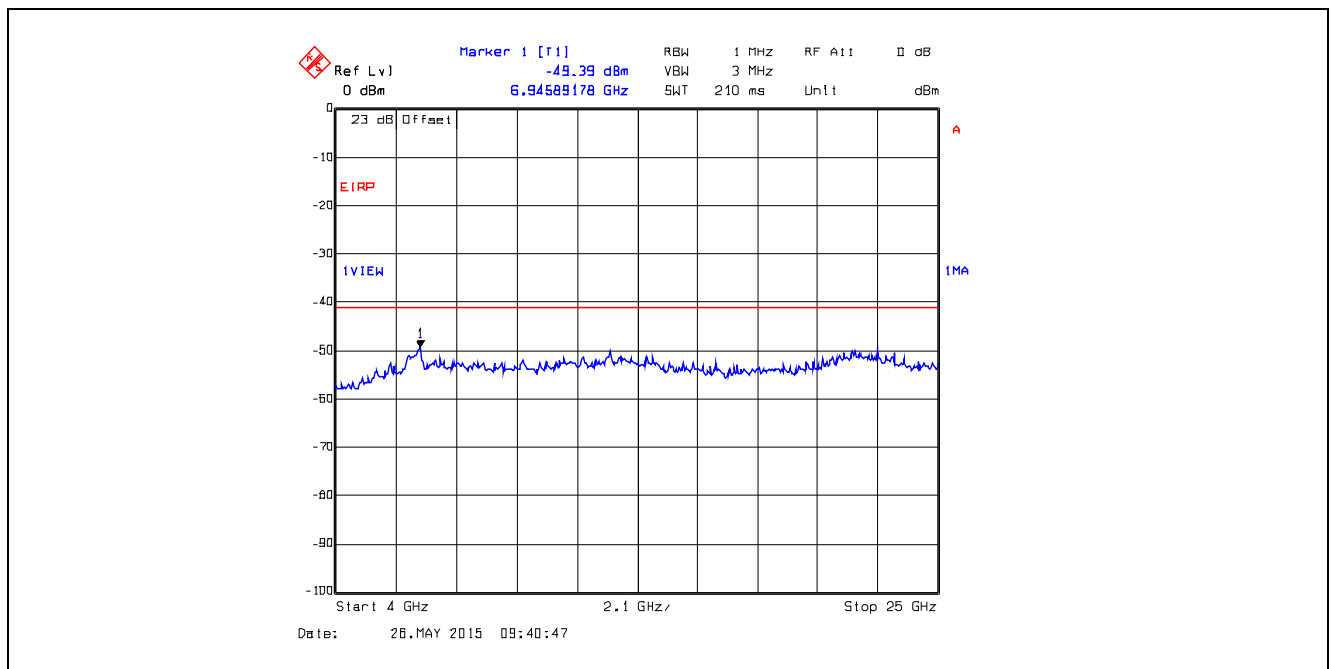
Plot 5.4.4.3.23. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 30 MHz - 1 GHz, Peak Detector



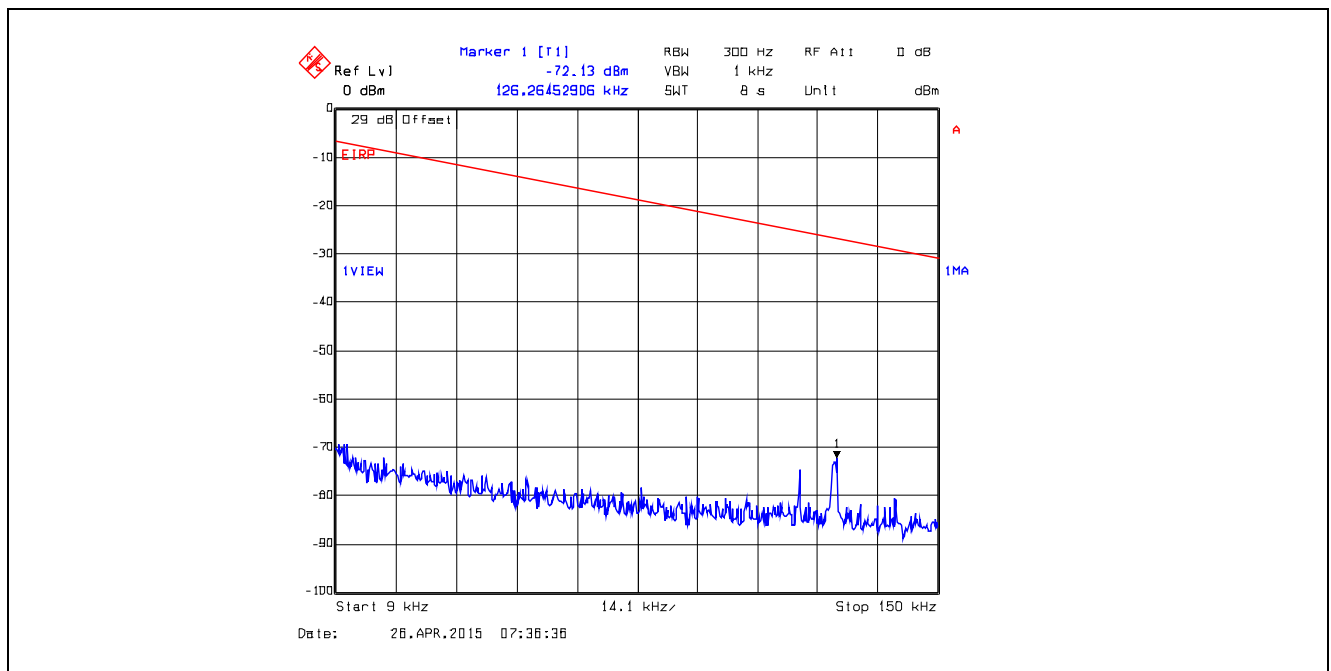
Plot 5.4.4.3.24. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 1 GHz - 4 GHz, Peak Detector



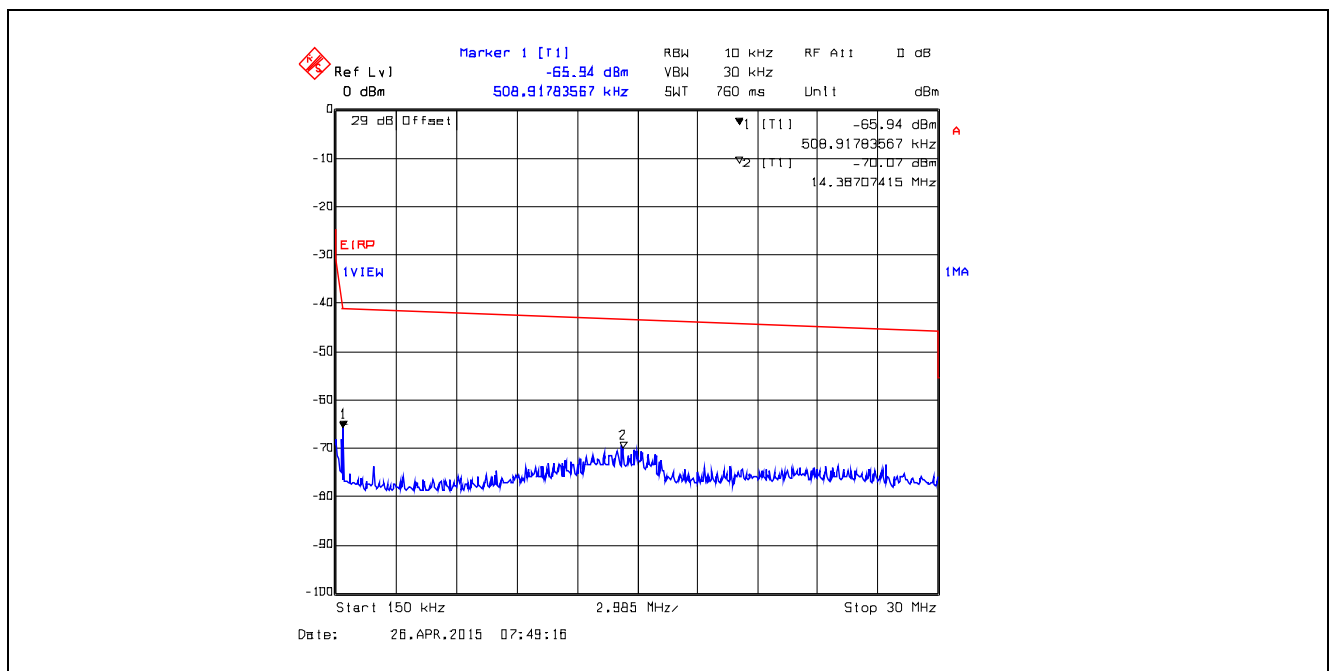
Plot 5.4.4.3.25. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 4 GHz - 25 GHz, Peak Detector



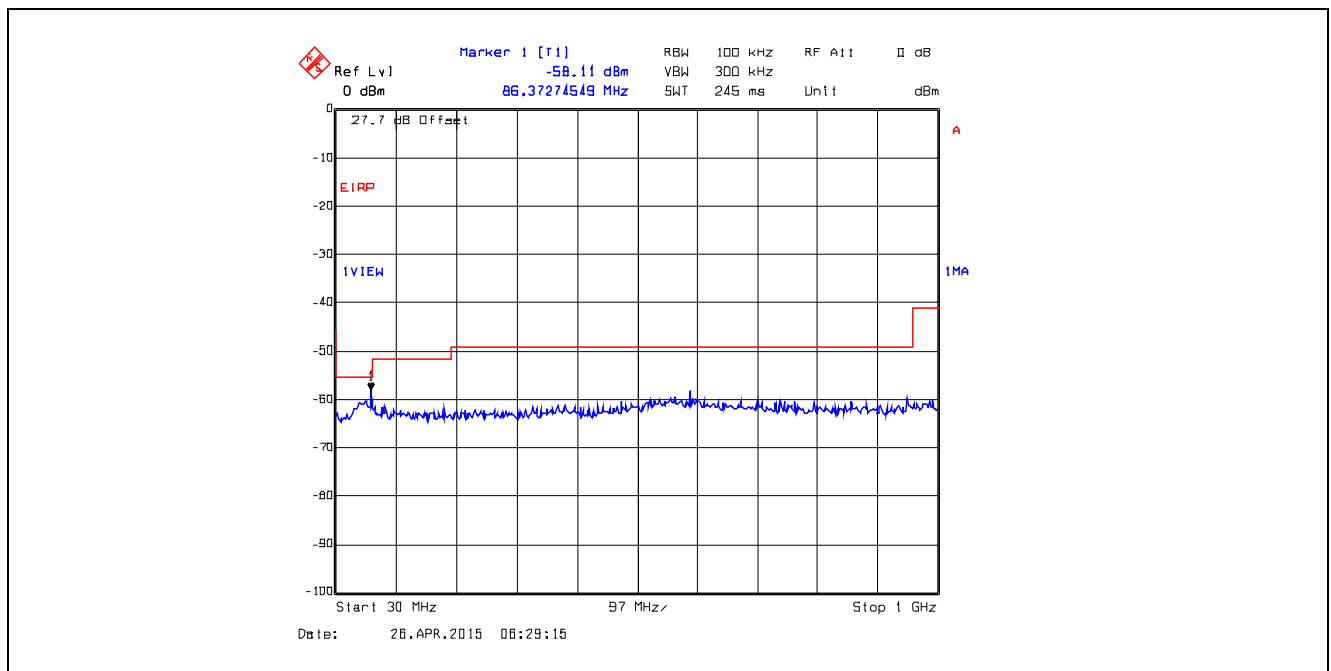
Plot 5.4.4.3.26. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 9 kHz - 150 kHz, Peak Detector



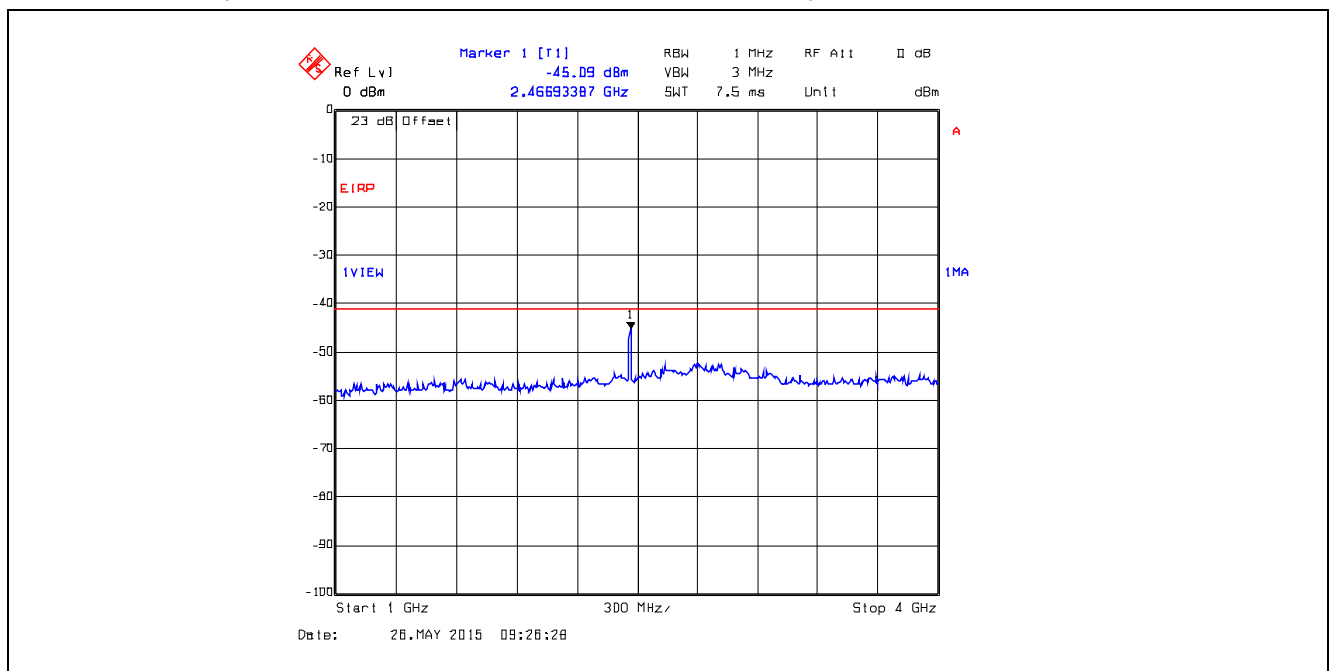
Plot 5.4.4.3.27. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 150 kHz - 30 MHz, Peak Detector



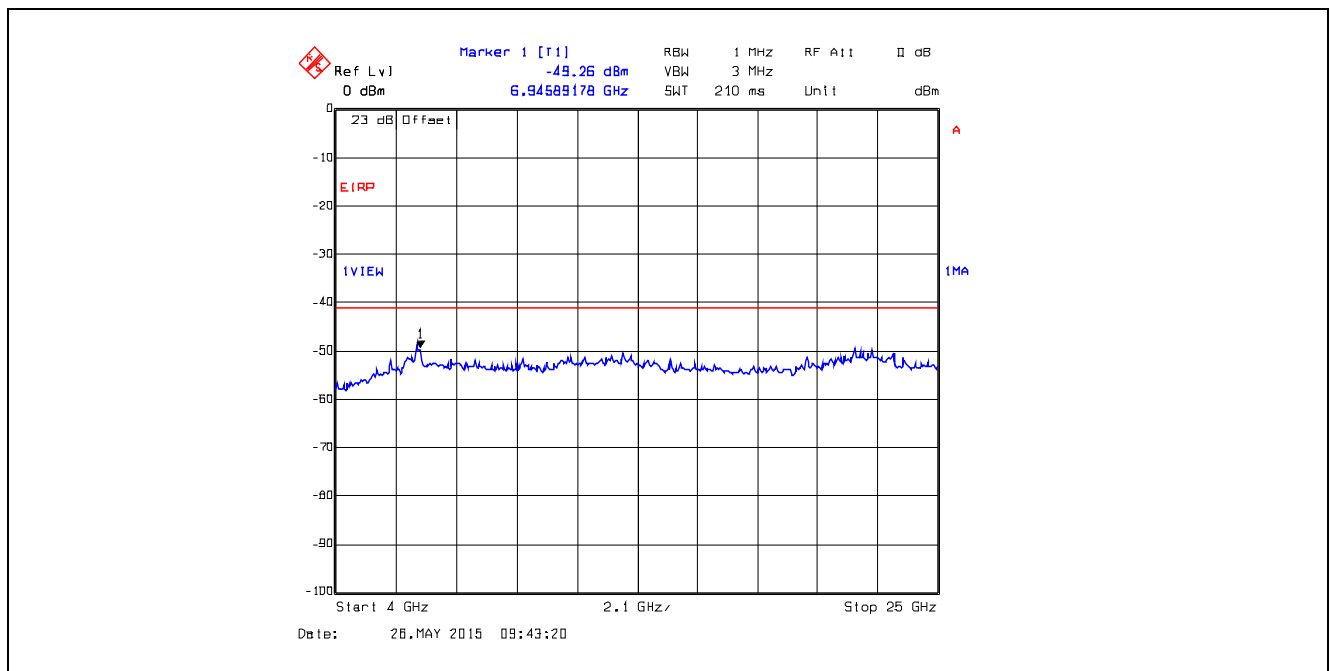
Plot 5.4.4.3.28. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 30 MHz - 1 GHz, Peak Detector



Plot 5.4.4.3.29. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 1 GHz - 4 GHz, Peak Detector



Plot 5.4.4.3.30. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47, 4 GHz - 25 GHz, Peak Detector



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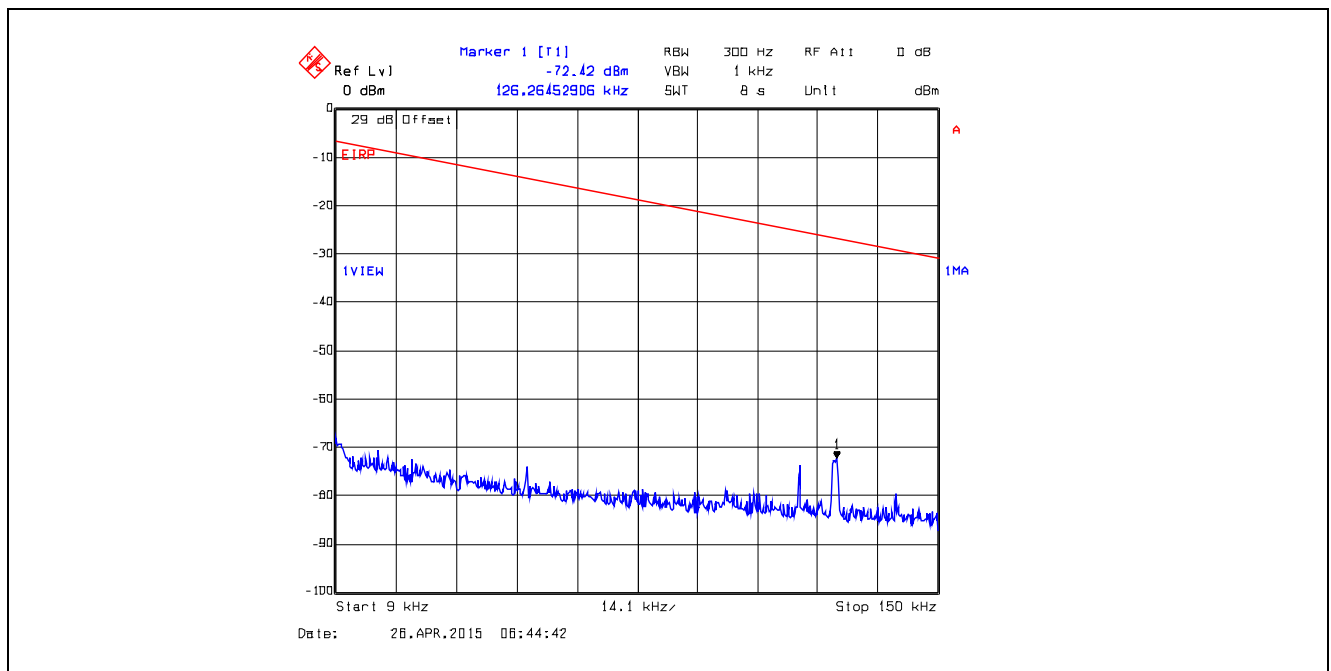
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 15MCRS083_FCC15C247DTS

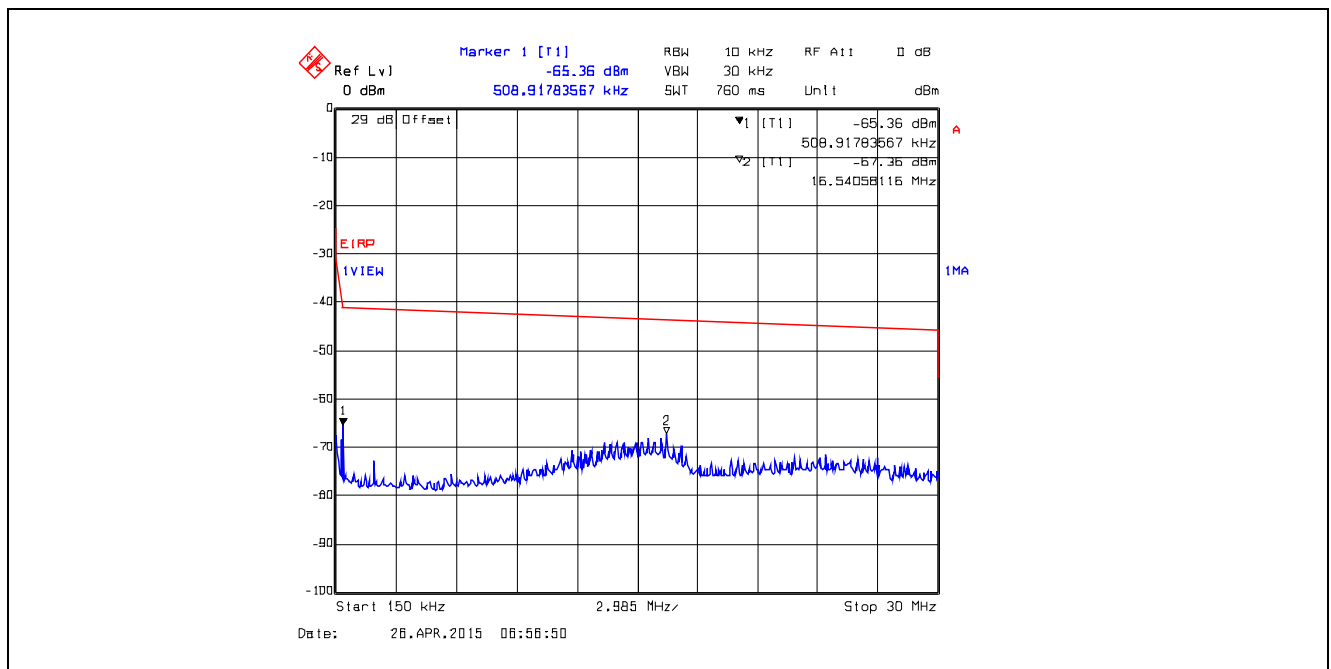
June 16, 2015

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

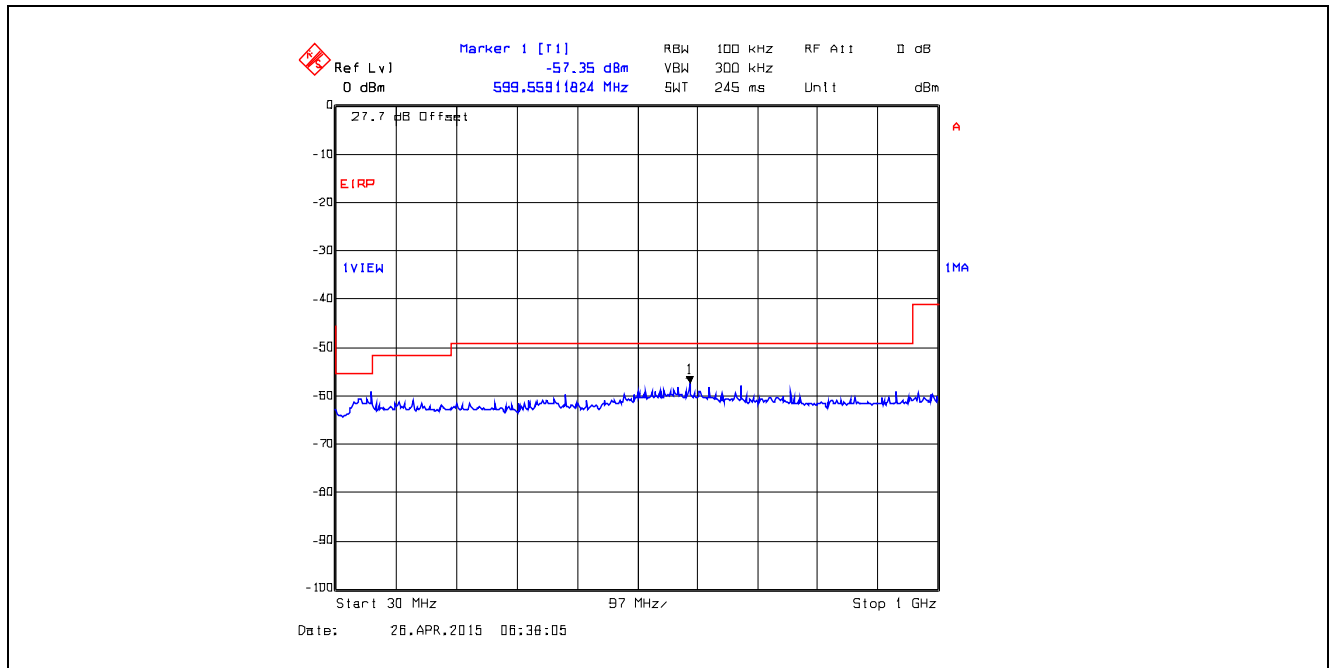
Plot 5.4.4.3.31. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 9 kHz - 150 kHz, Peak Detector



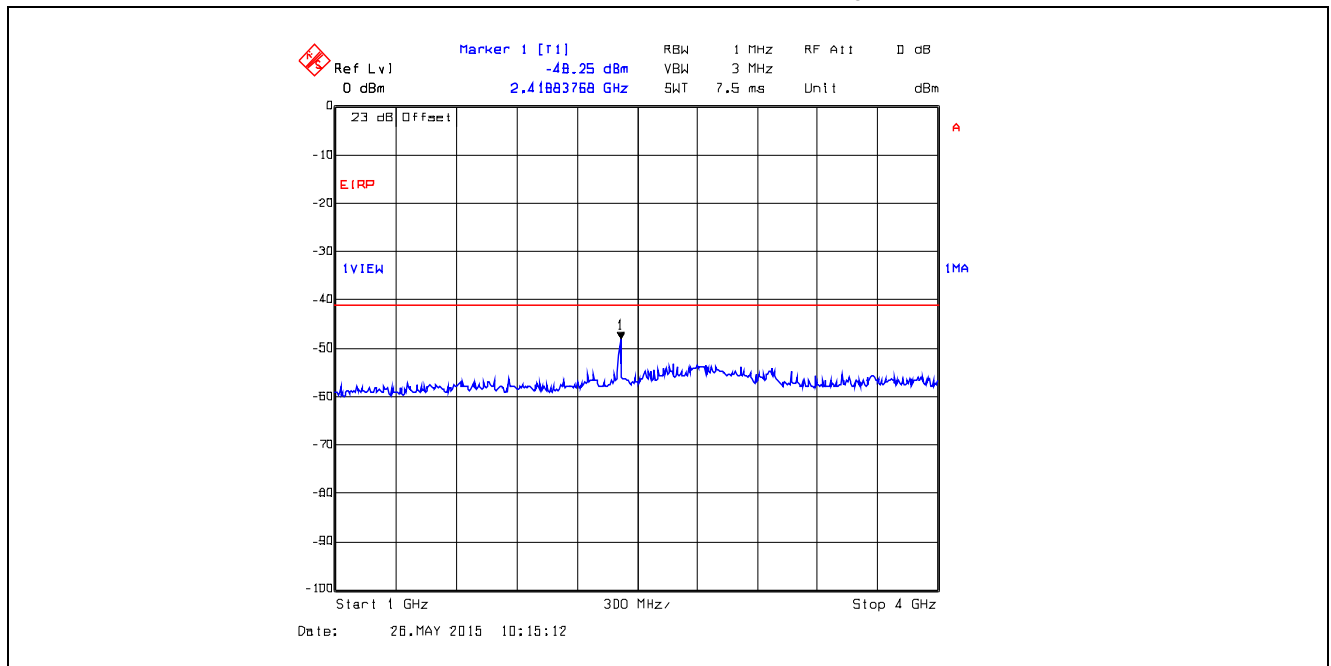
Plot 5.4.4.3.32. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 150 kHz - 30 MHz, Peak Detector



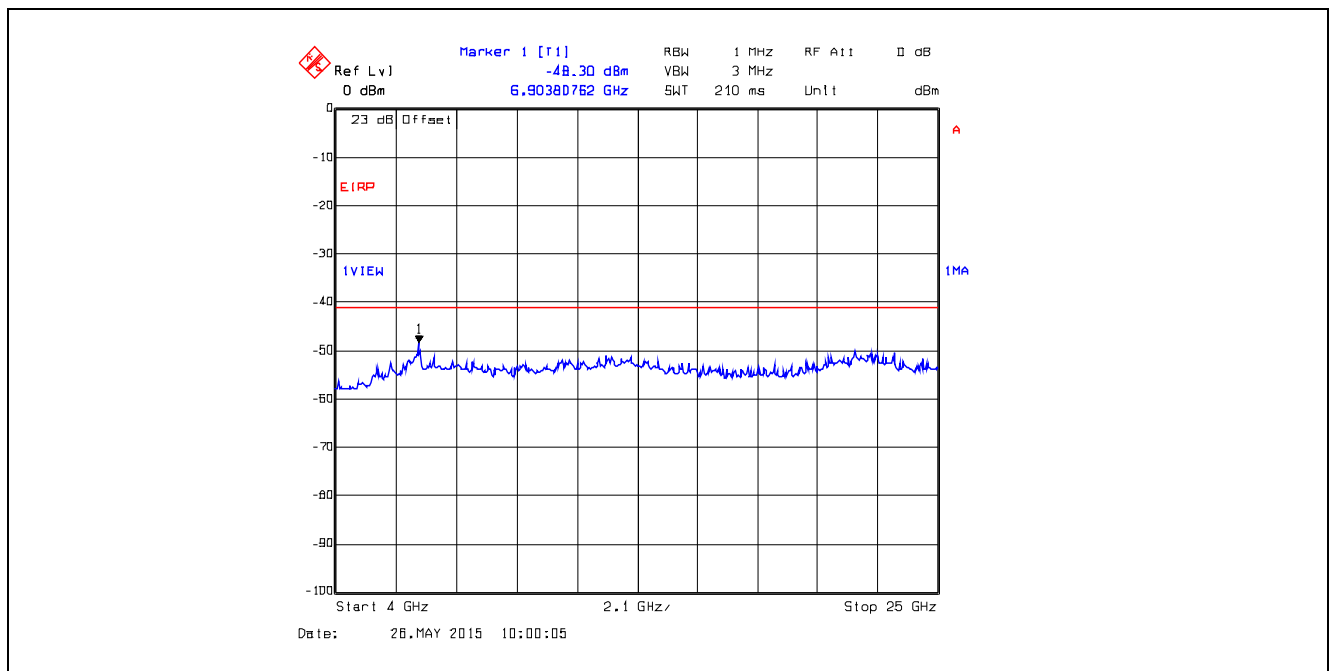
Plot 5.4.4.3.33. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 30 MHz - 1 GHz, Peak Detector



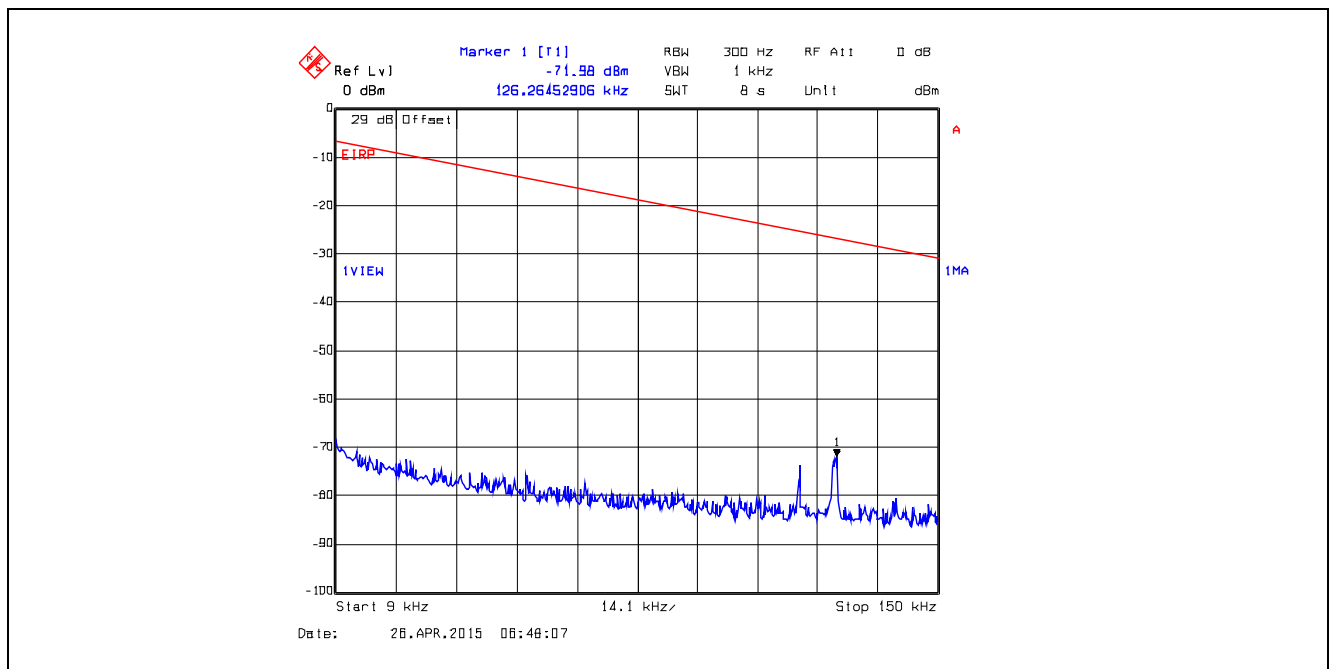
Plot 5.4.4.3.34. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 1 GHz – 4 GHz, Peak Detector



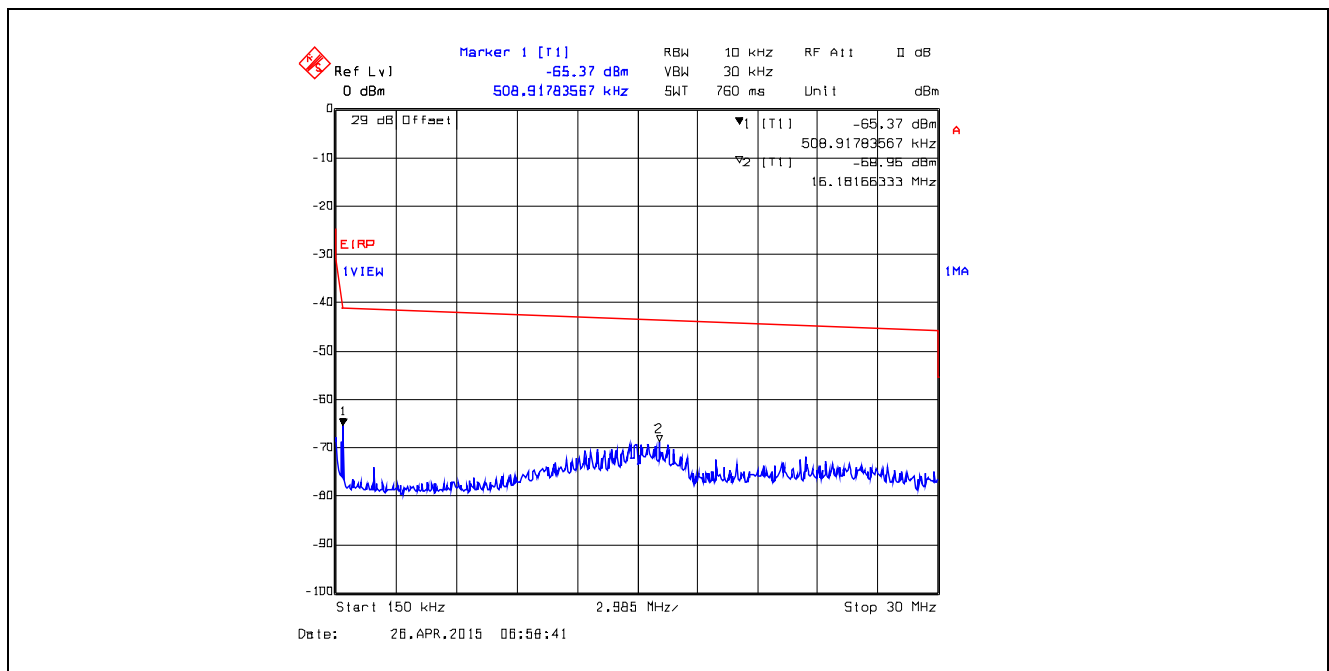
Plot 5.4.4.3.35. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 4 GHz - 25GHz, Peak Detector



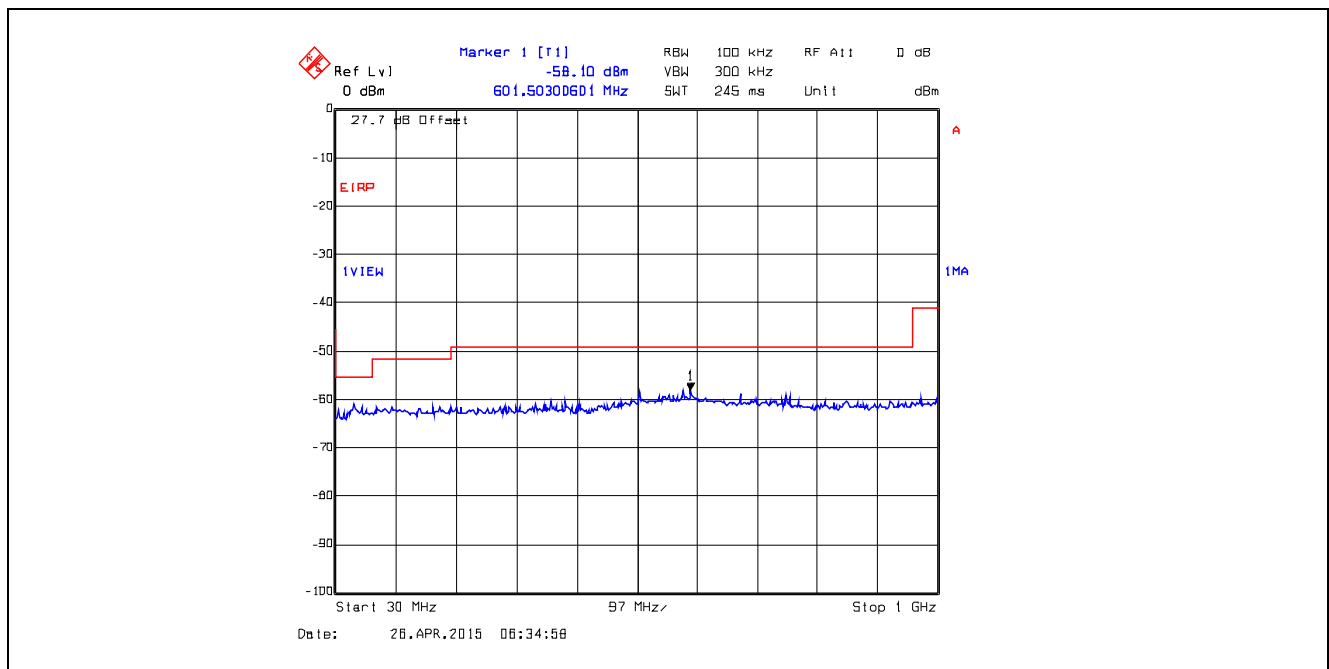
Plot 5.4.4.3.36. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 9 kHz - 150 kHz, Peak Detector



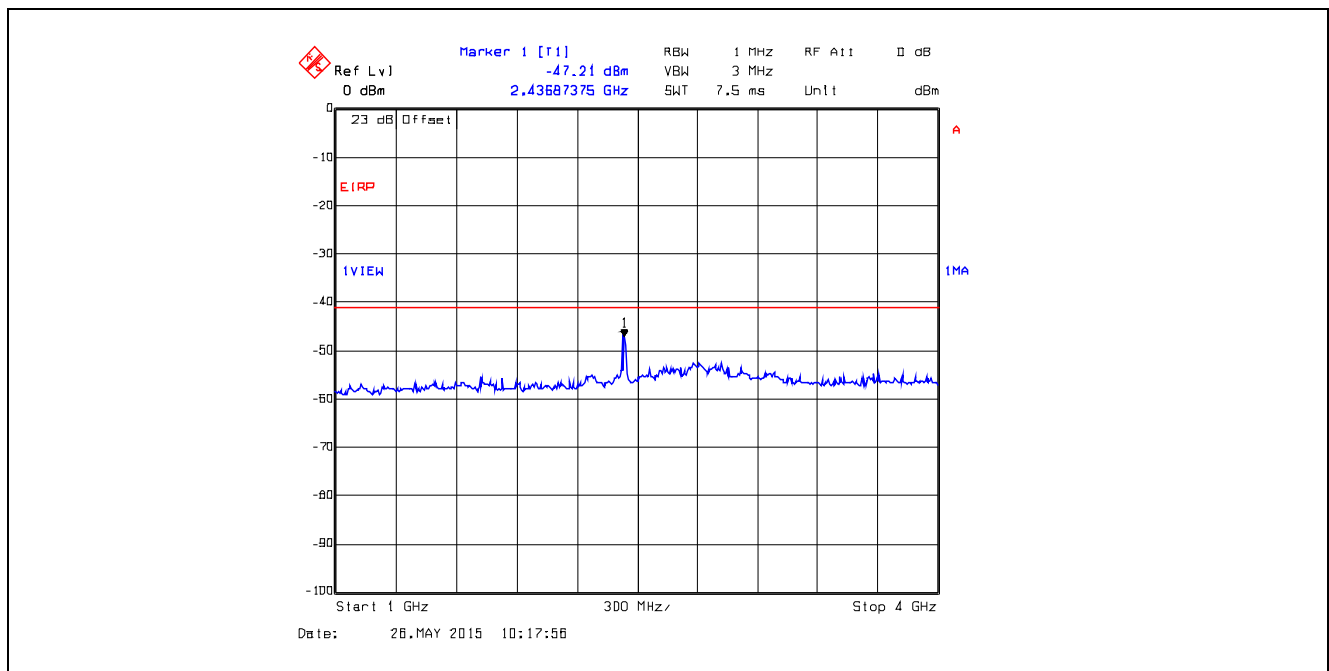
Plot 5.4.4.3.37. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 150 kHz - 30 MHz, Peak Detector



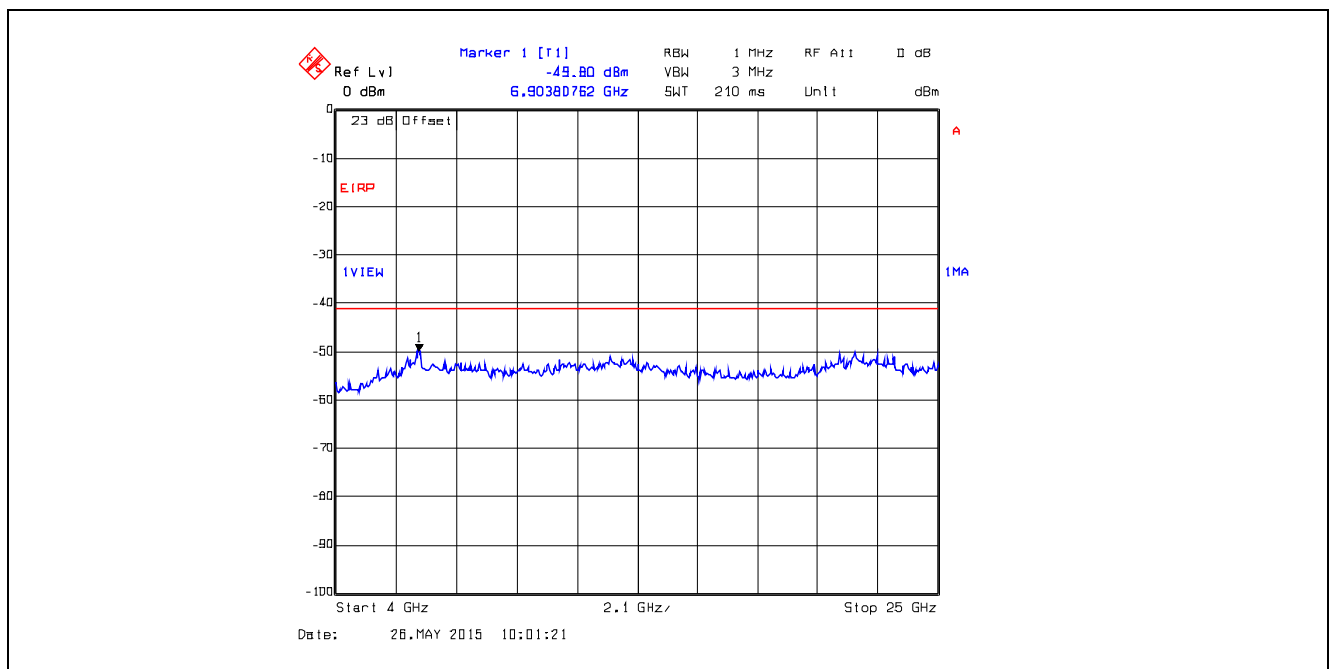
Plot 5.4.4.3.38. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 30 MHz - 1 GHz, Peak Detector



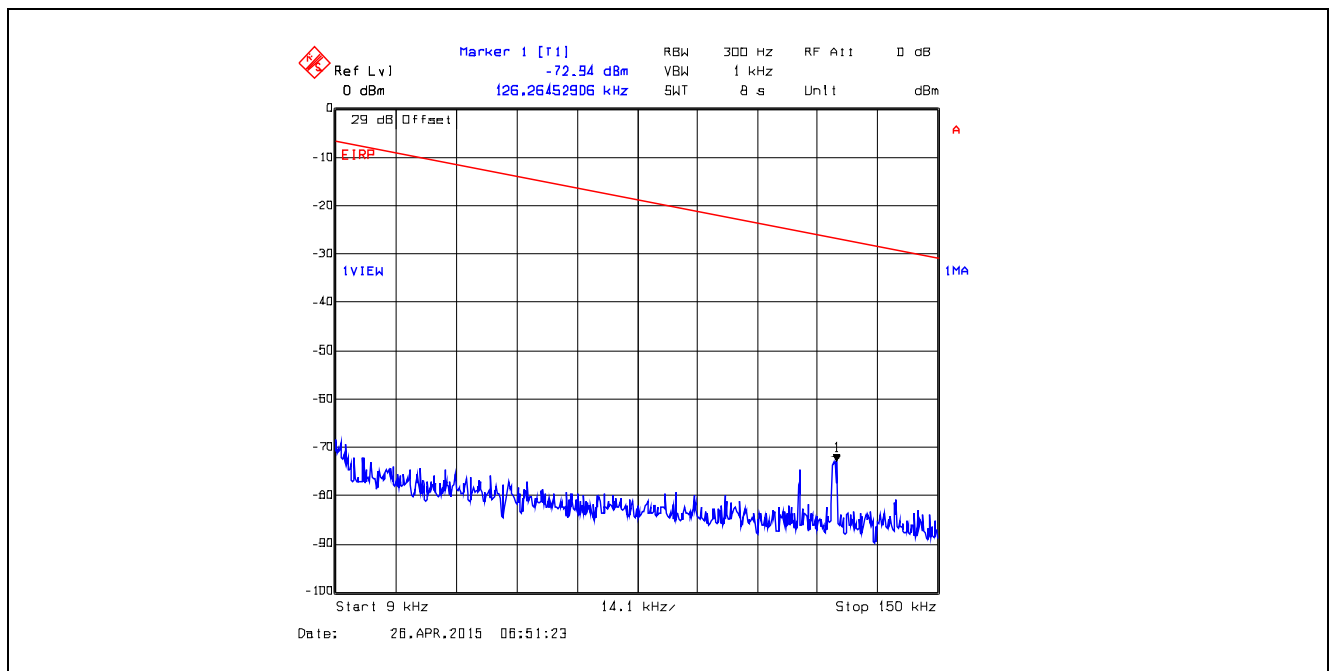
Plot 5.4.4.3.39. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 1 GHz - 4 GHz, Peak Detector



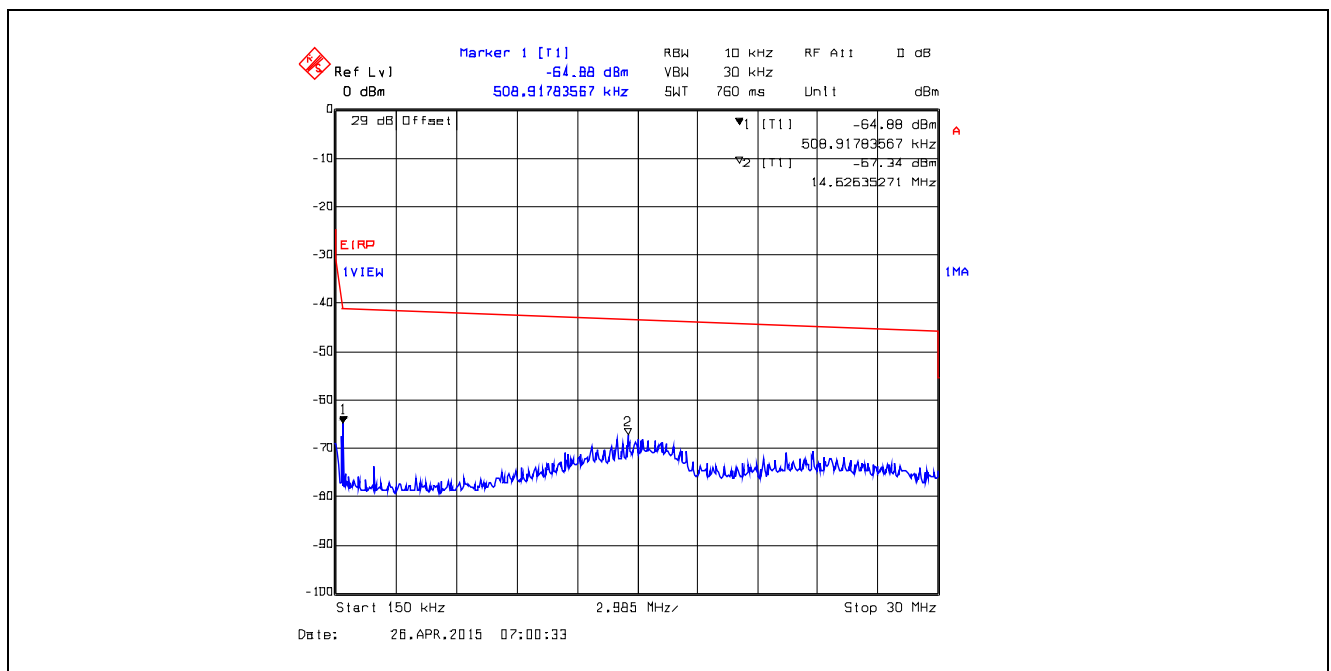
Plot 5.4.4.3.40. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 4 GHz - 25 GHz, Peak Detector



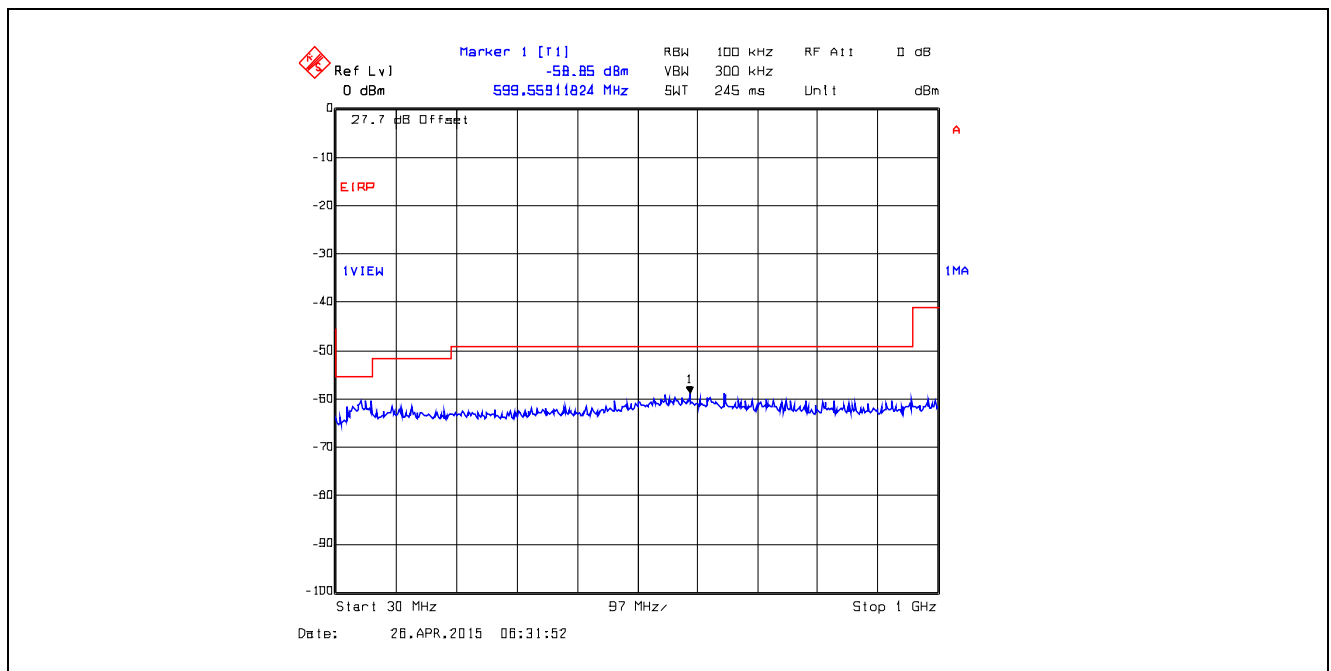
Plot 5.4.4.3.41. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 9 kHz - 150 kHz, Peak Detector



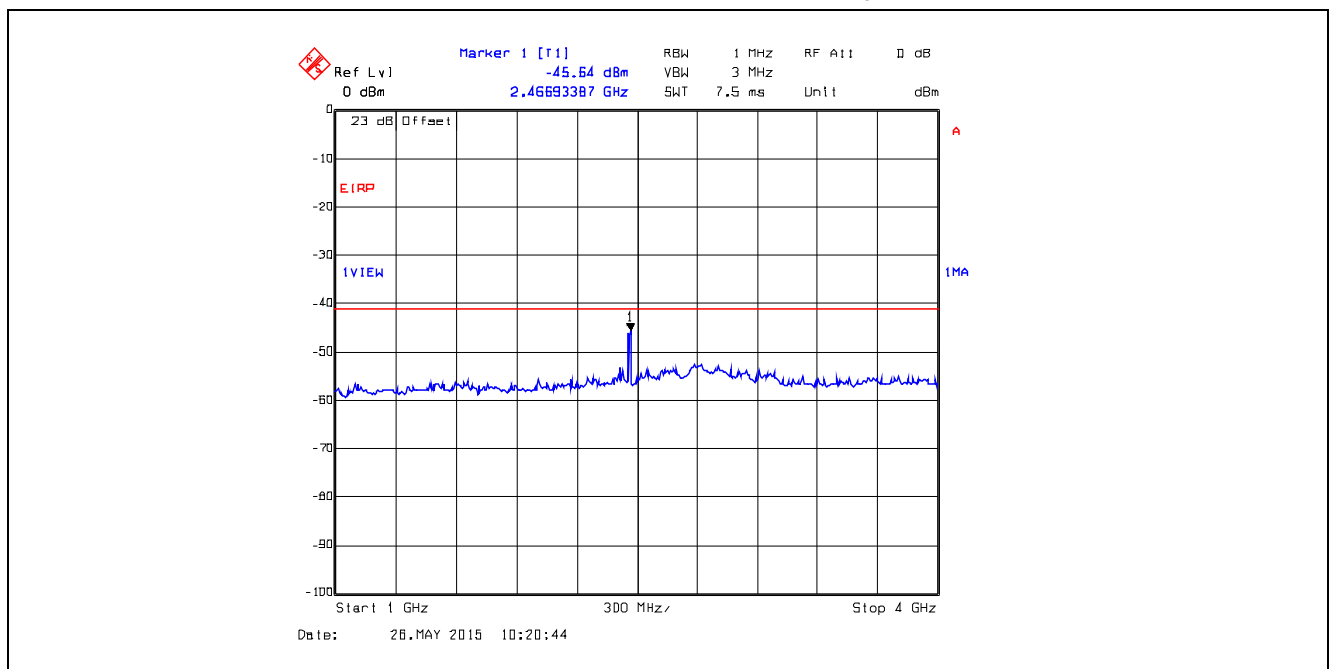
Plot 5.4.4.3.42. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 150 kHz - 30 MHz, Peak Detector



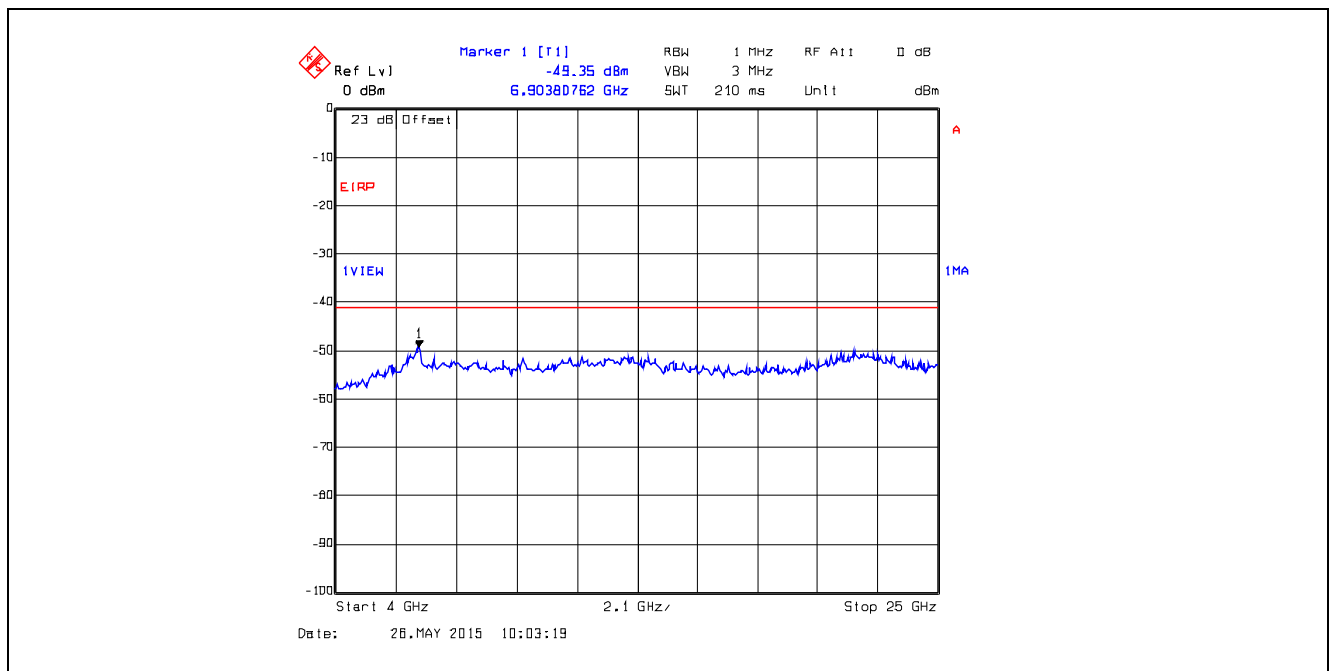
Plot 5.4.4.3.43. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 30 MHz - 1 GHz, Peak Detector



Plot 5.4.4.3.44. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 1 GHz - 4 GHz, Peak Detector



Plot 5.4.4.3.45. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 48, 4 GHz - 25 GHz, Peak Detector



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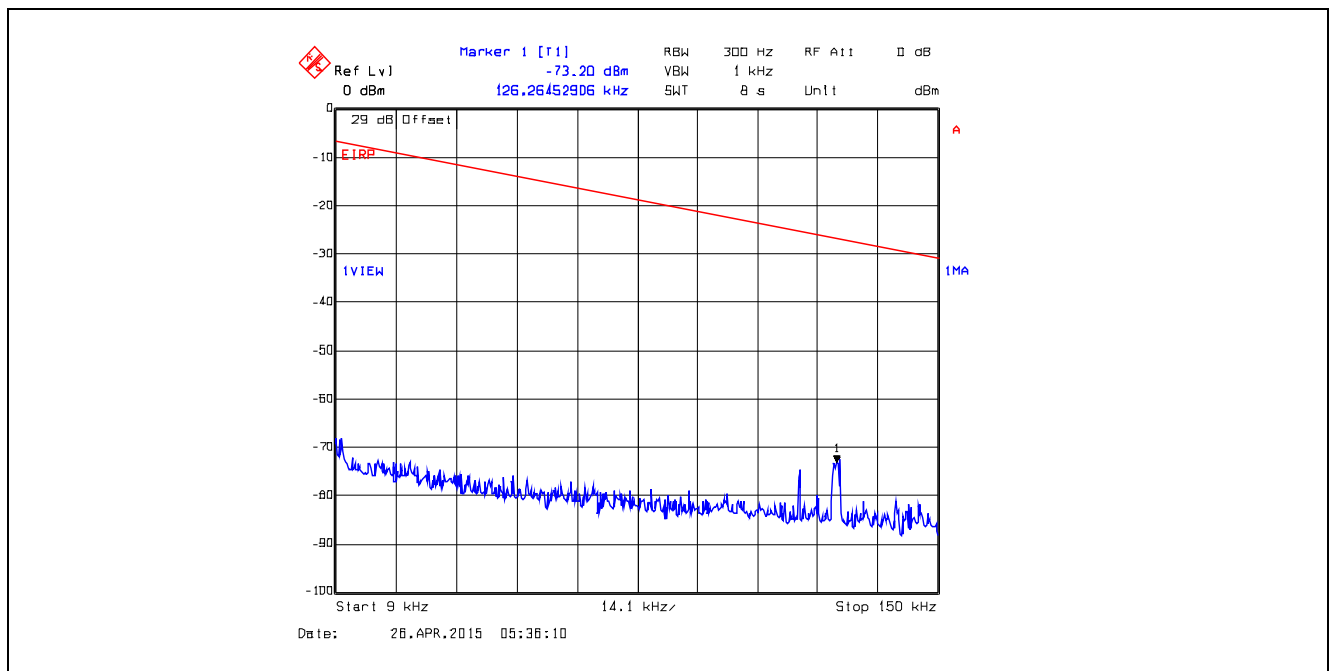
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 15MCRS083_FCC15C247DTS

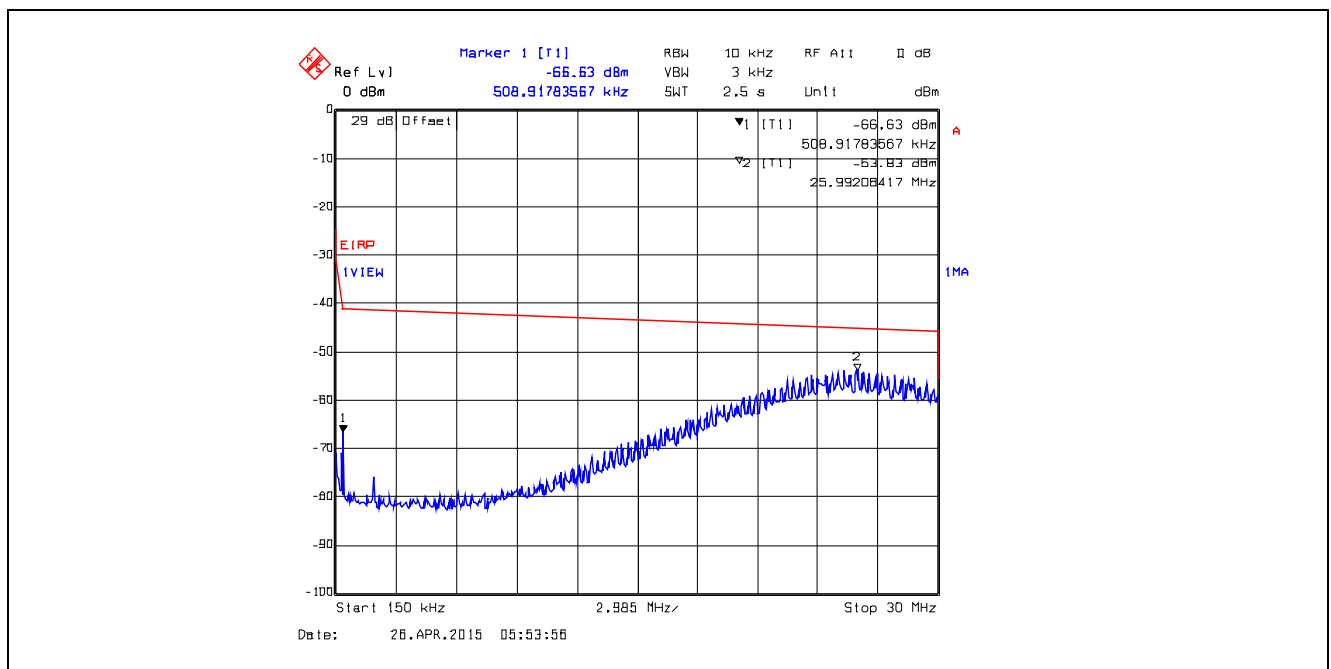
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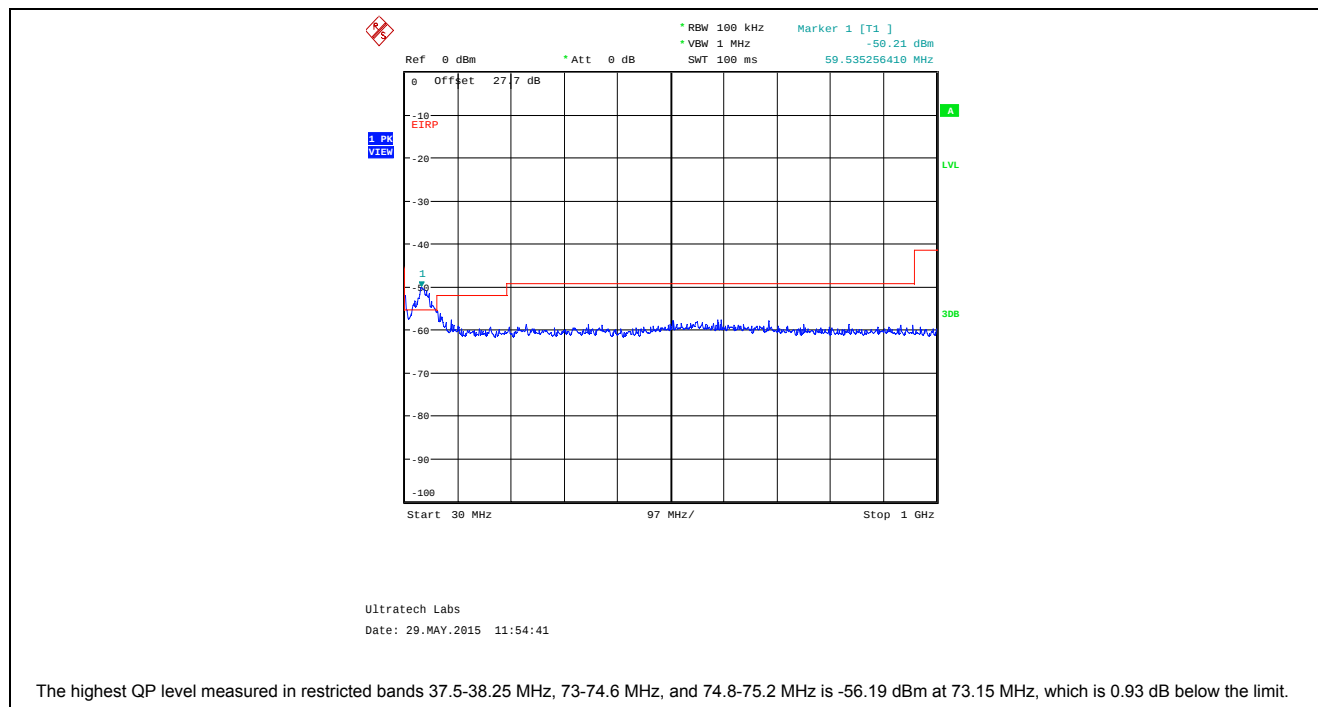
Plot 5.4.4.3.46. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3, 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 9 kHz - 150 kHz, Peak Detector



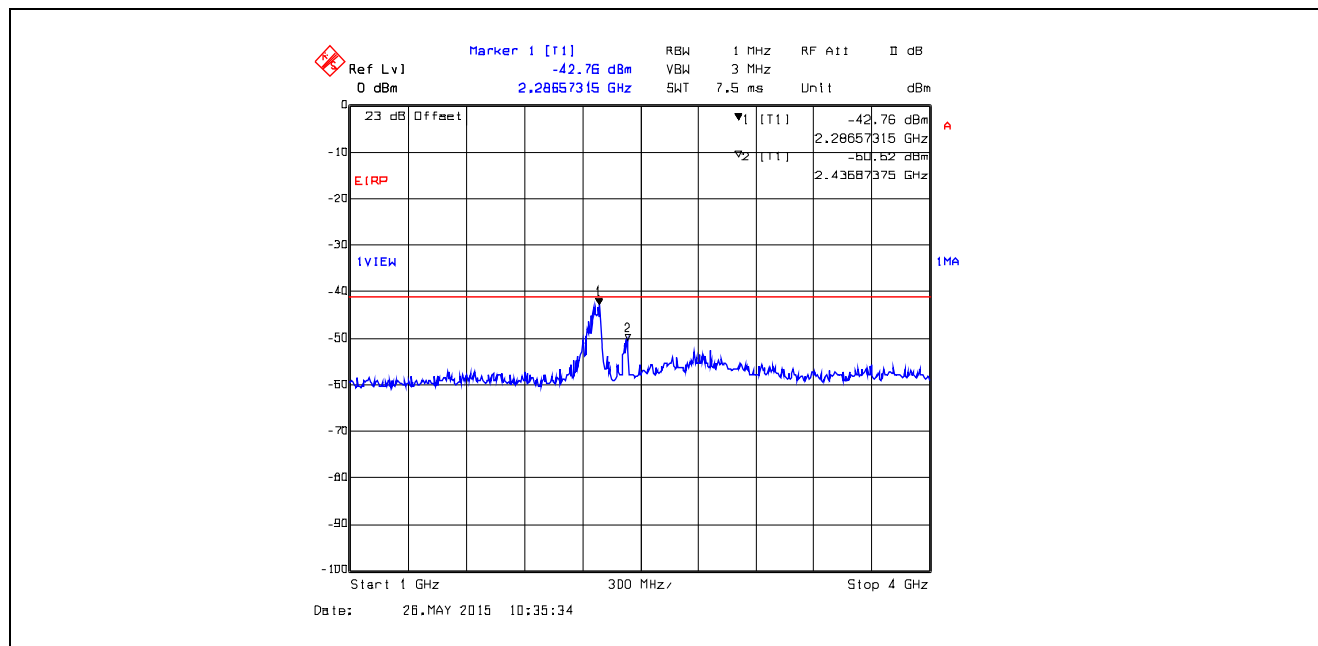
Plot 5.4.4.3.47. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3, 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 150 kHz - 30 MHz, Peak Detector



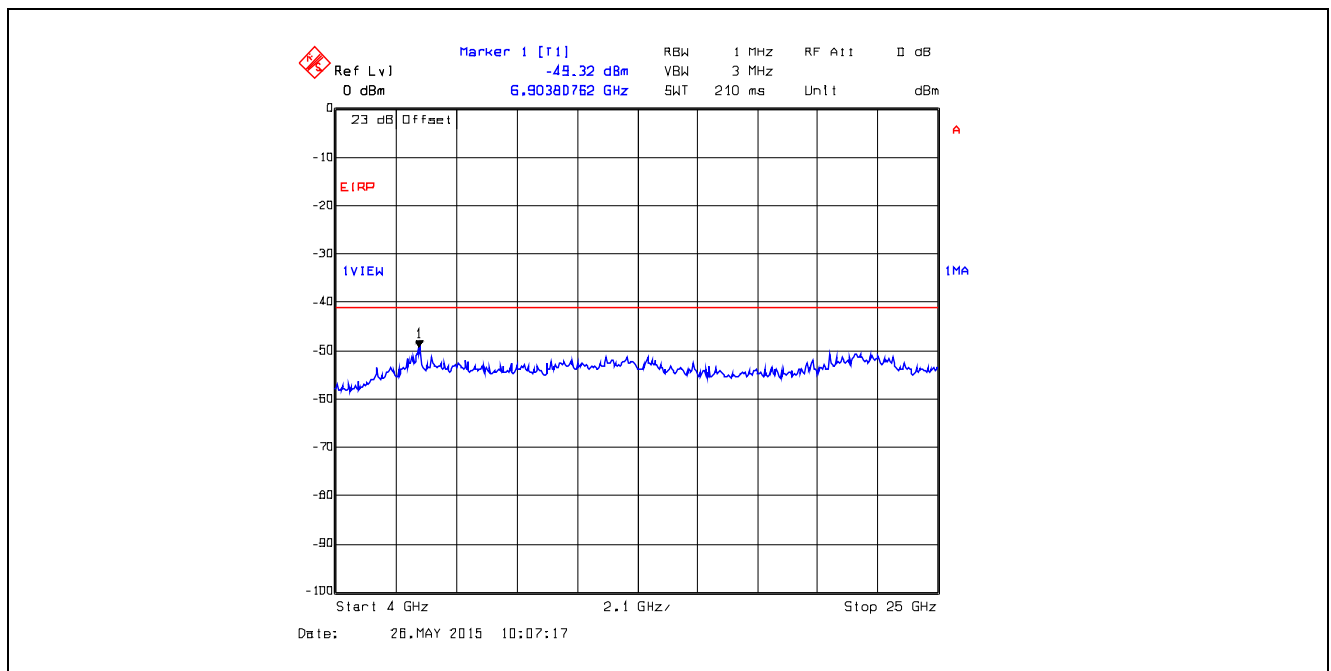
Plot 5.4.4.3.48. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3, 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 30 MHz - 1 GHz, Peak Detector



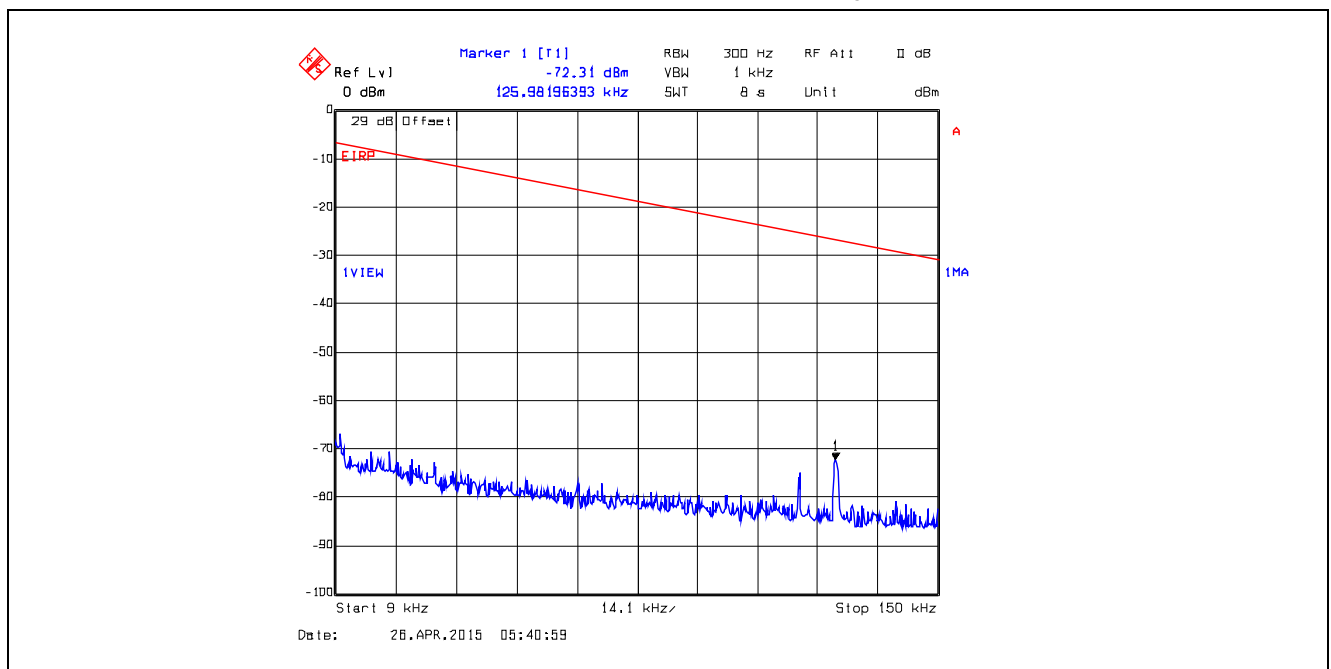
Plot 5.4.4.3.49. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3, 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 1 GHz – 4 GHz, Peak Detector



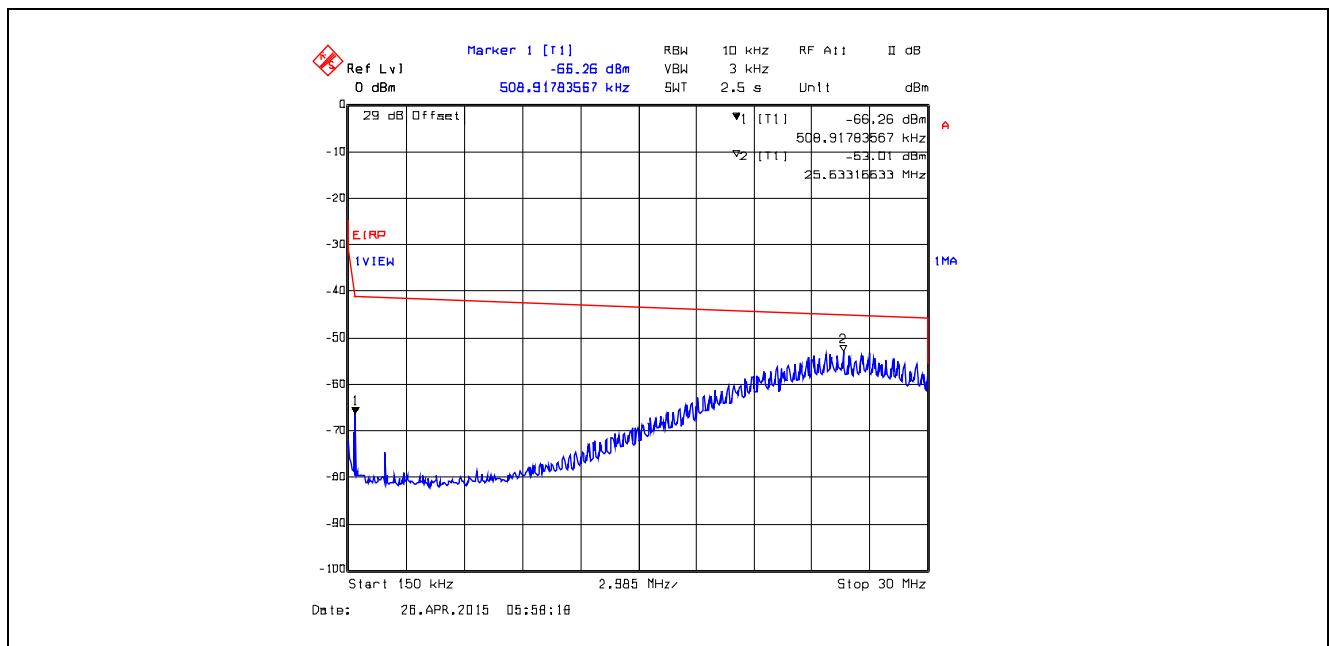
Plot 5.4.4.3.50. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3, 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 4 GHz – 25 GHz, Peak Detector



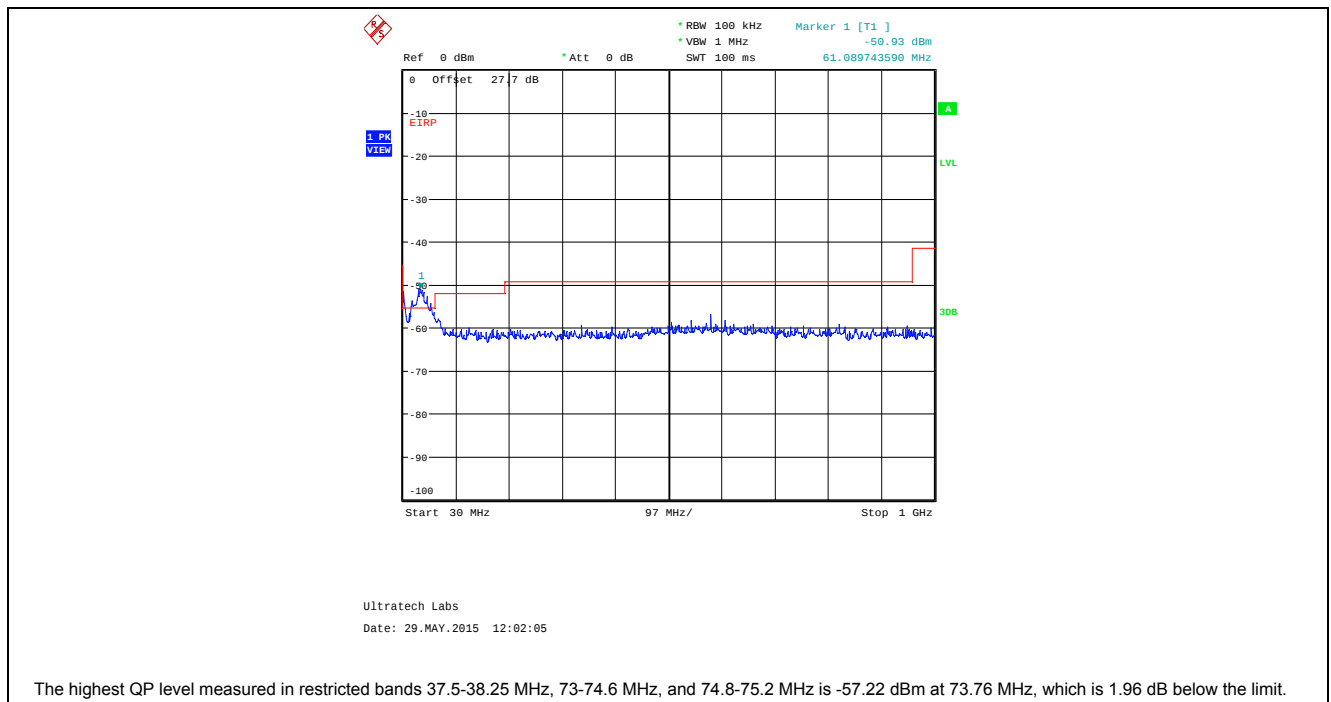
Plot 5.4.4.3.51. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6, 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 9 kHz - 150 kHz, Peak Detector



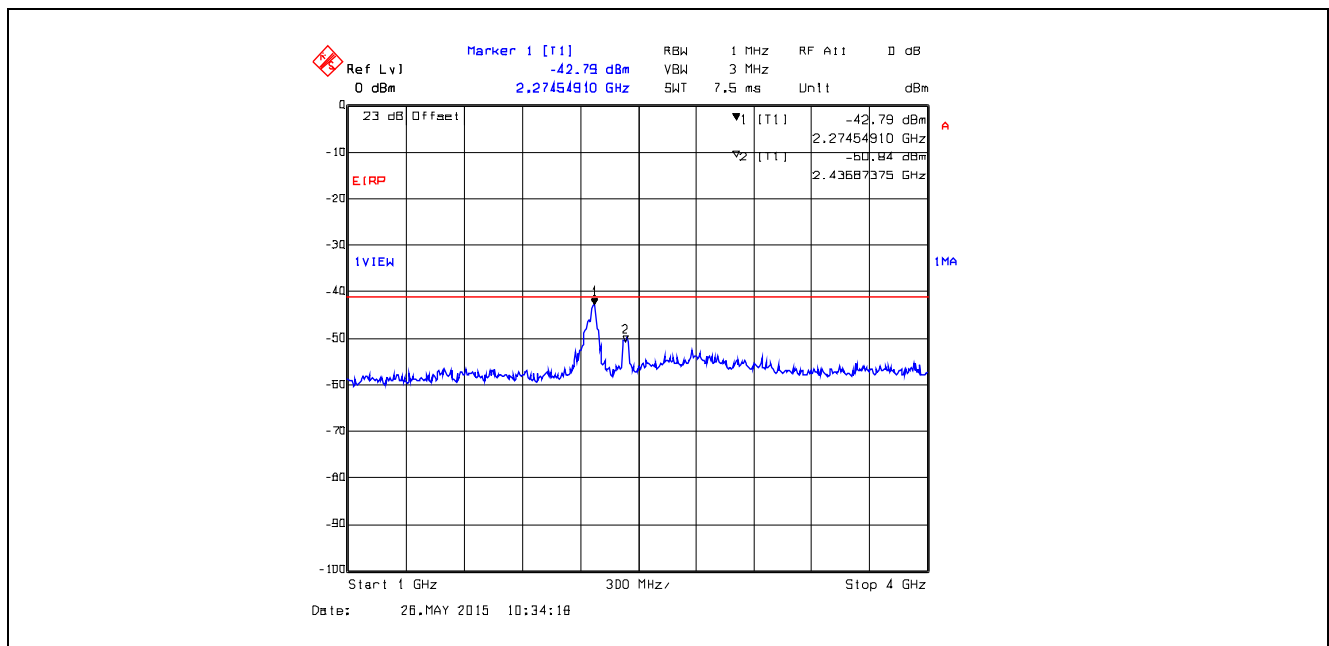
Plot 5.4.4.3.52. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6, 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 150 kHz - 30 MHz, Peak Detector



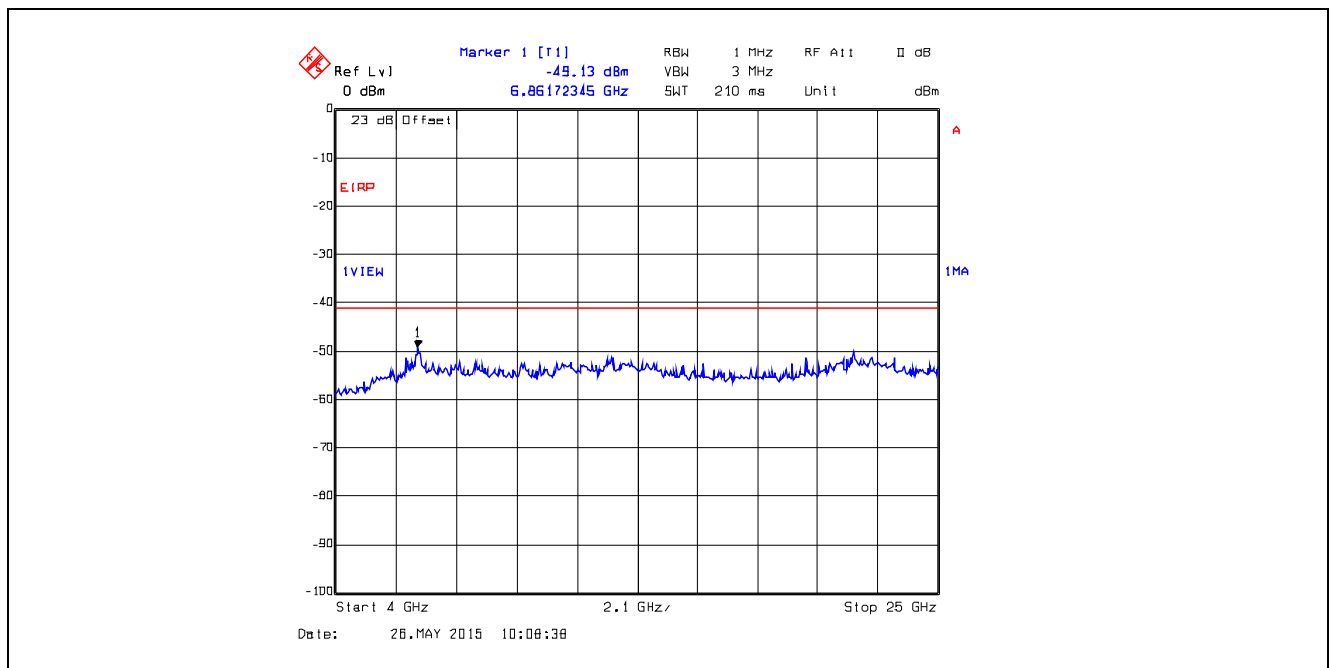
Plot 5.4.4.3.53. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6, 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 30 MHz - 1 GHz, Peak Detector



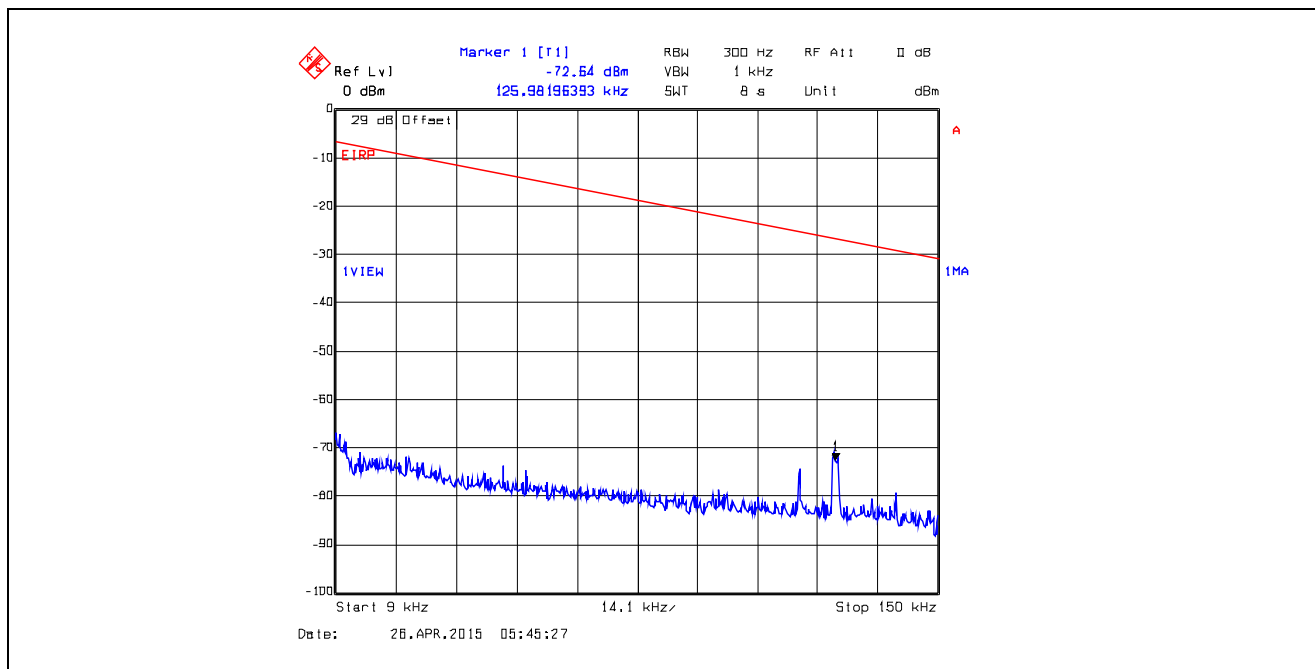
Plot 5.4.4.3.54. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6, 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 1 GHz – 4 GHz, Peak Detector



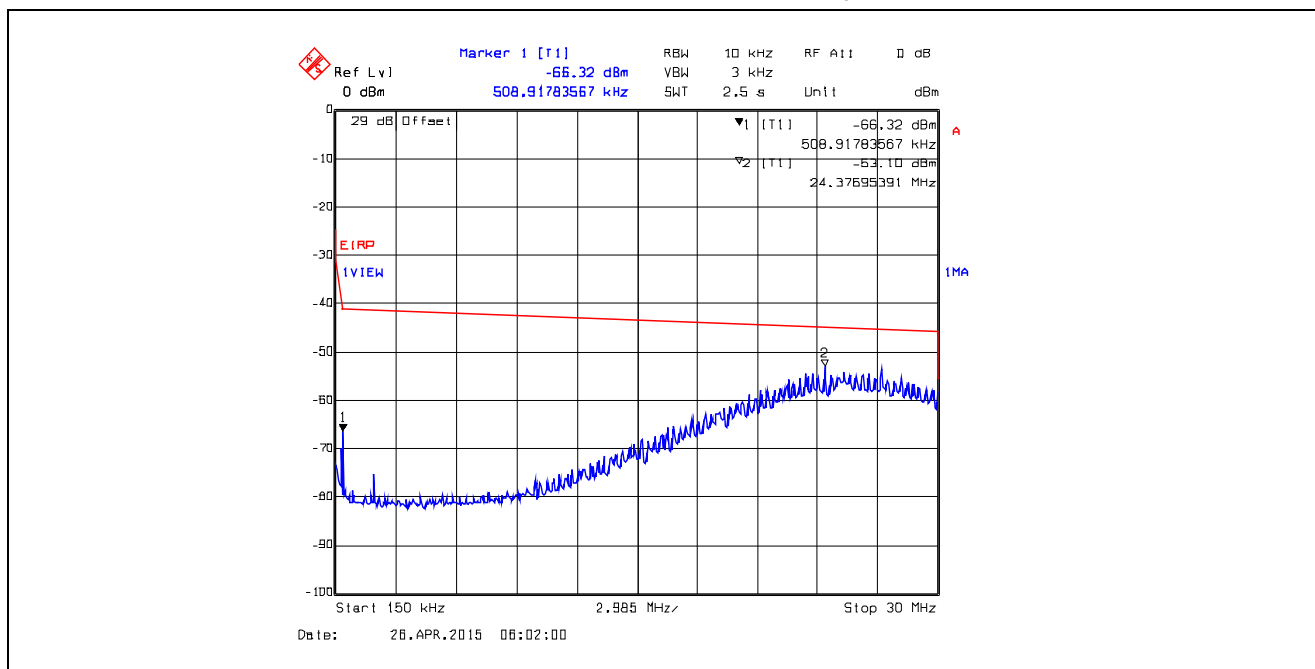
Plot 5.4.4.3.55. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6, 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 4 GHz – 25 GHz, Peak Detector



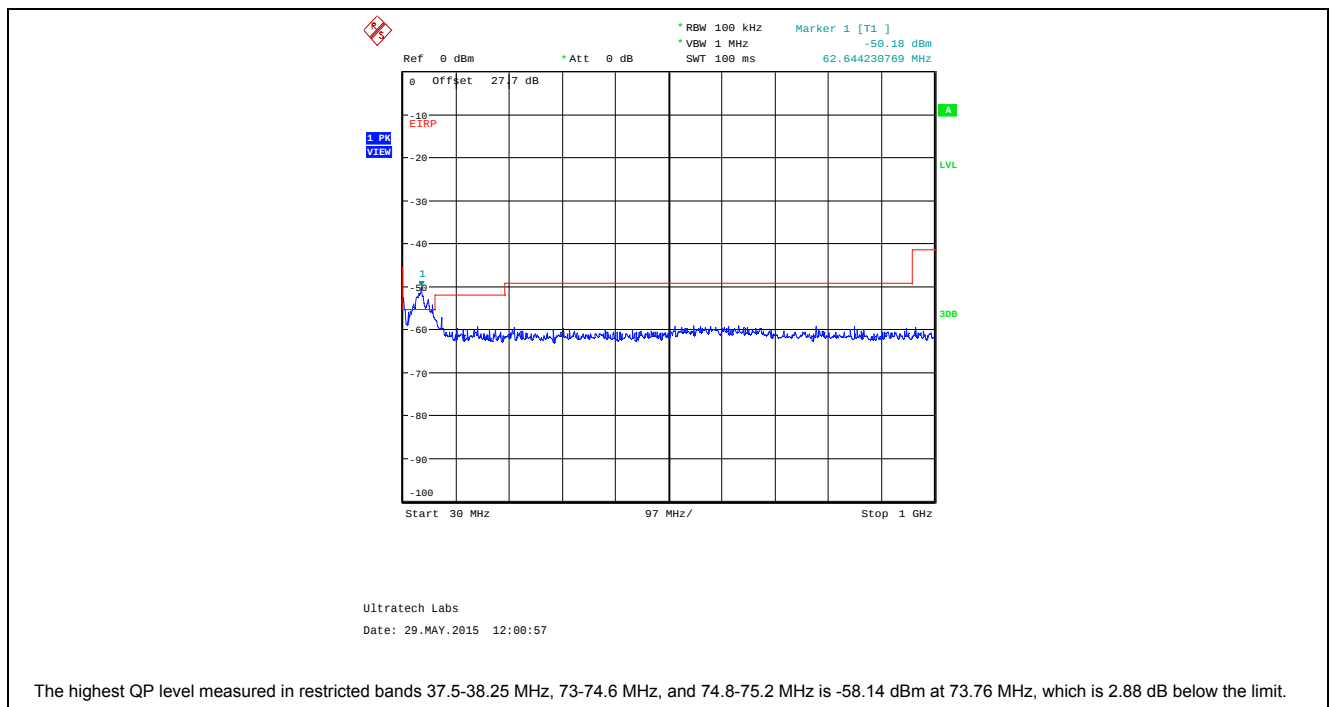
Plot 5.4.4.3.56. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9, 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 9 kHz - 150 kHz, Peak Detector



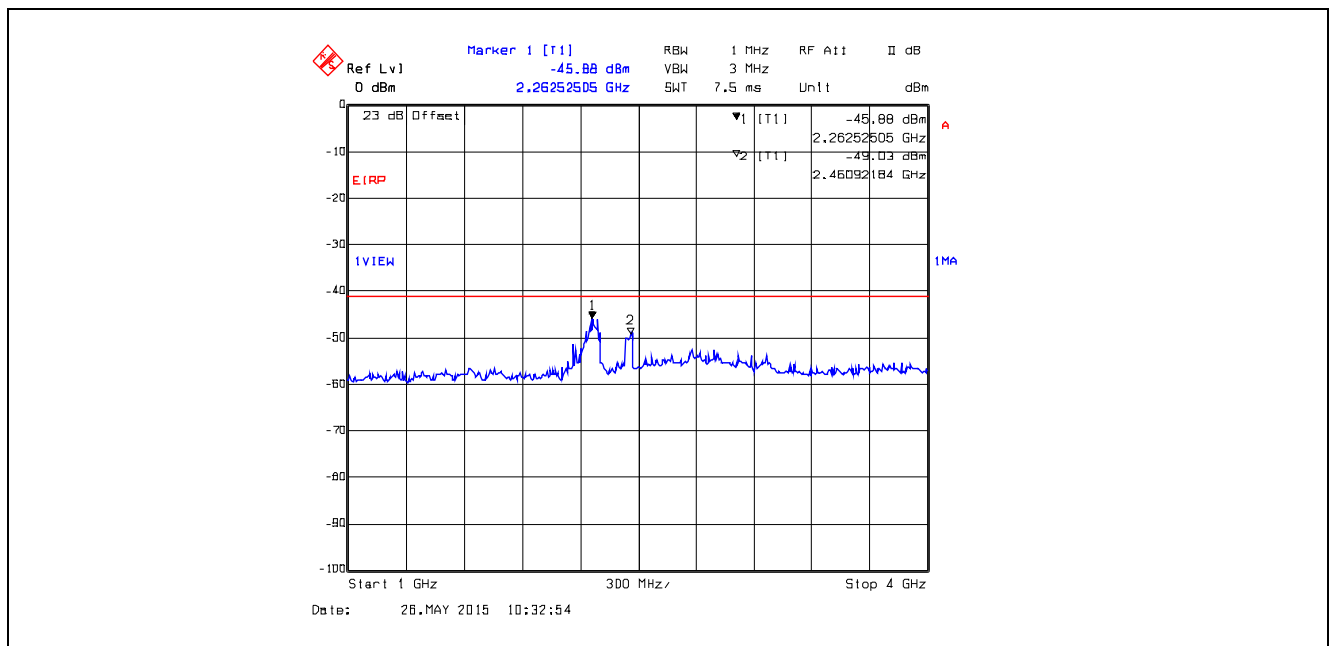
Plot 5.4.4.3.57. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9, 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 150 kHz - 30 MHz, Peak Detector



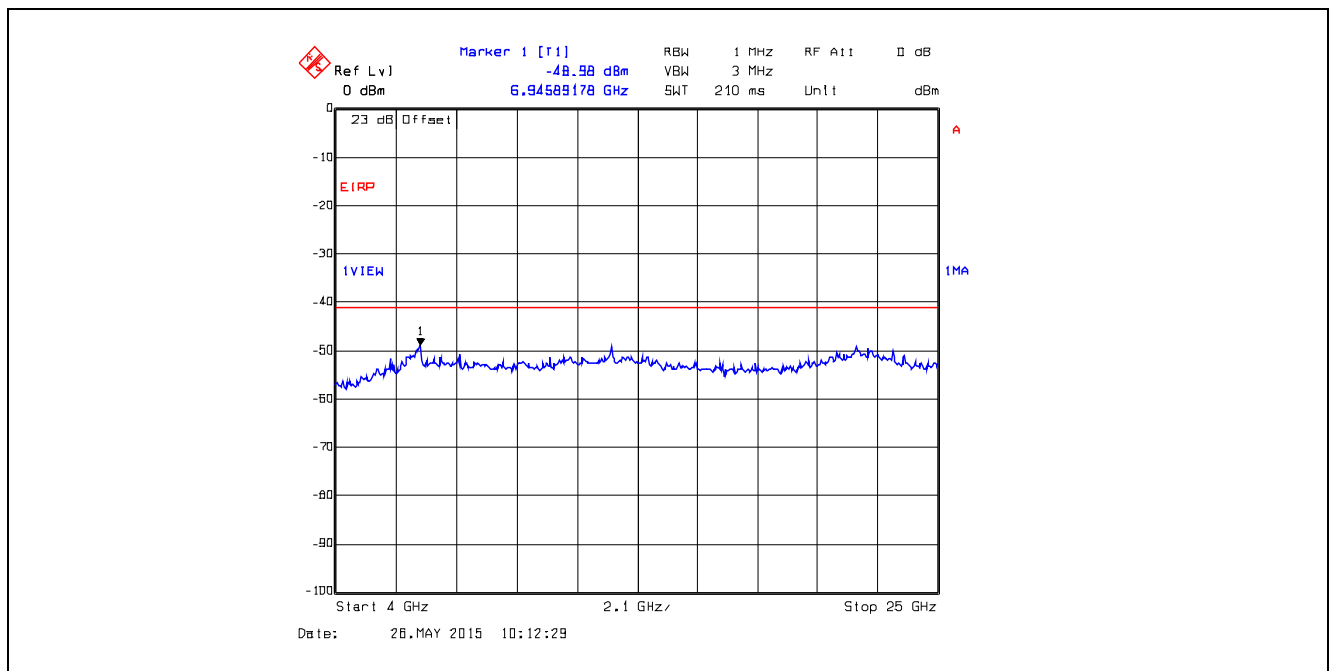
Plot 5.4.4.3.58. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9, 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 30 MHz - 1 GHz, Peak Detector



Plot 5.4.4.3.59. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9, 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 1 GHz – 4 GHz, Peak Detector



Plot 5.4.4.3.60. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9, 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 50, 4 GHz – 25 GHz, Peak Detector



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File #: 15MCRS083_FCC15C247DTS

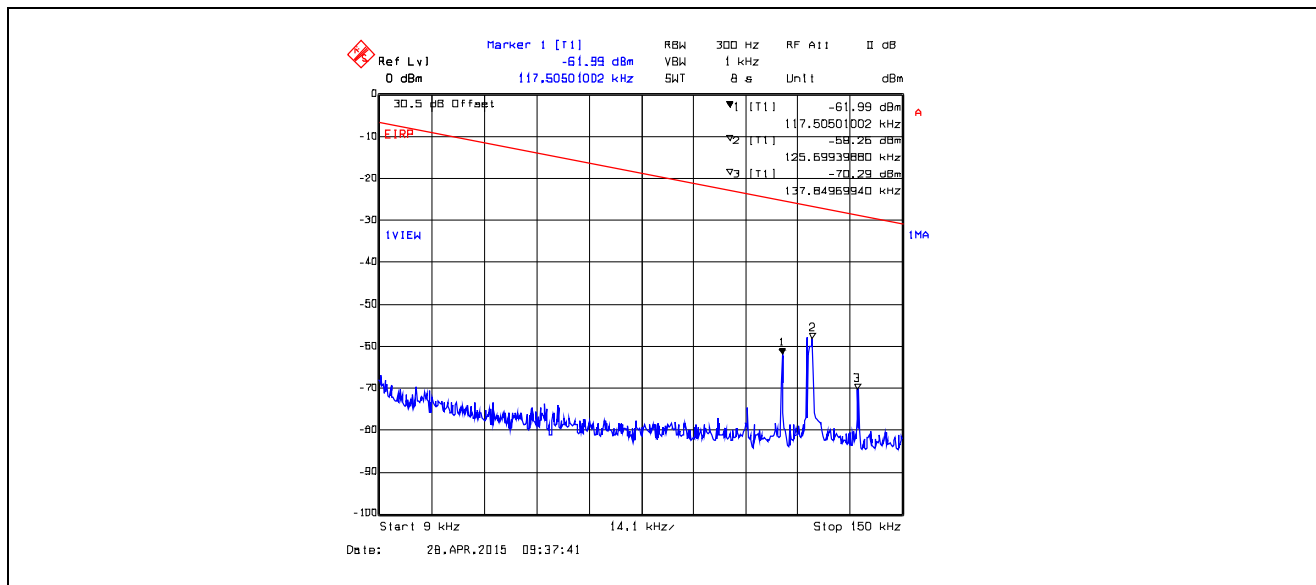
June 16, 2015

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

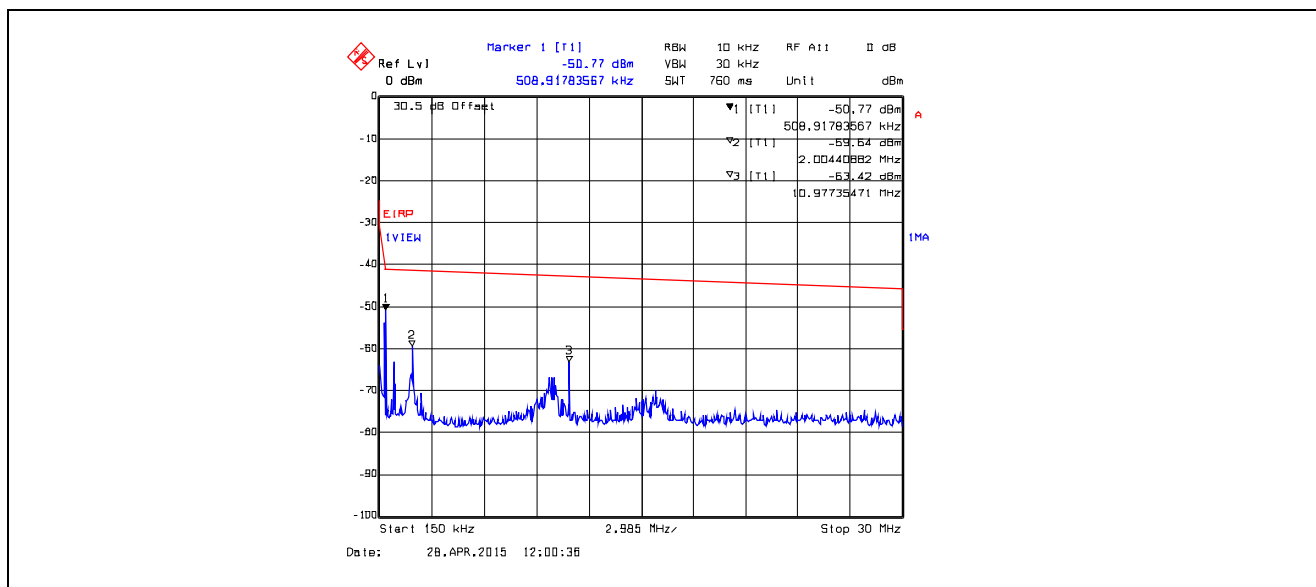
5.4.4.4. Conducted Spurious Emissions in Restricted Frequency Bands, Lowest Power Setting for Highest Gain Antenna (15 dBi)

Remark: Offset = [Insertion Loss] + [Maximum Transmit Antenna Gain (in dBi)] + [Maximum Ground Reflection Factor]

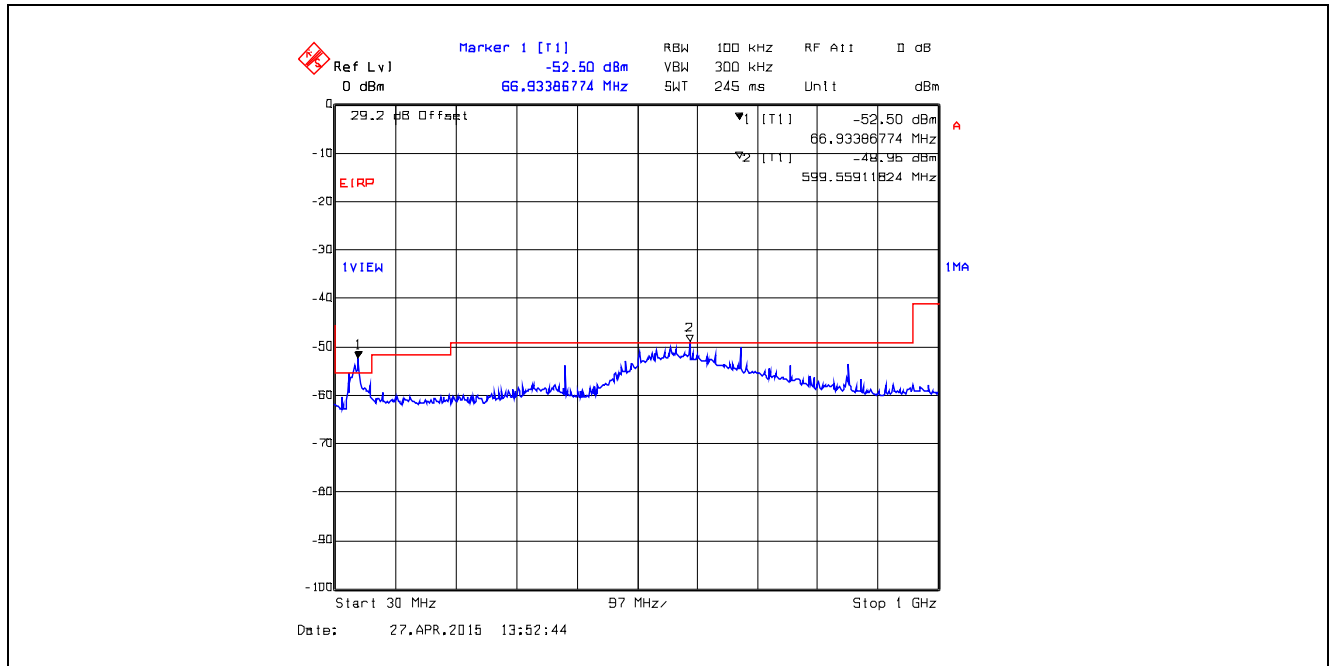
Plot 5.4.4.4.1. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 35, 9 kHz - 150 kHz, Peak Detector



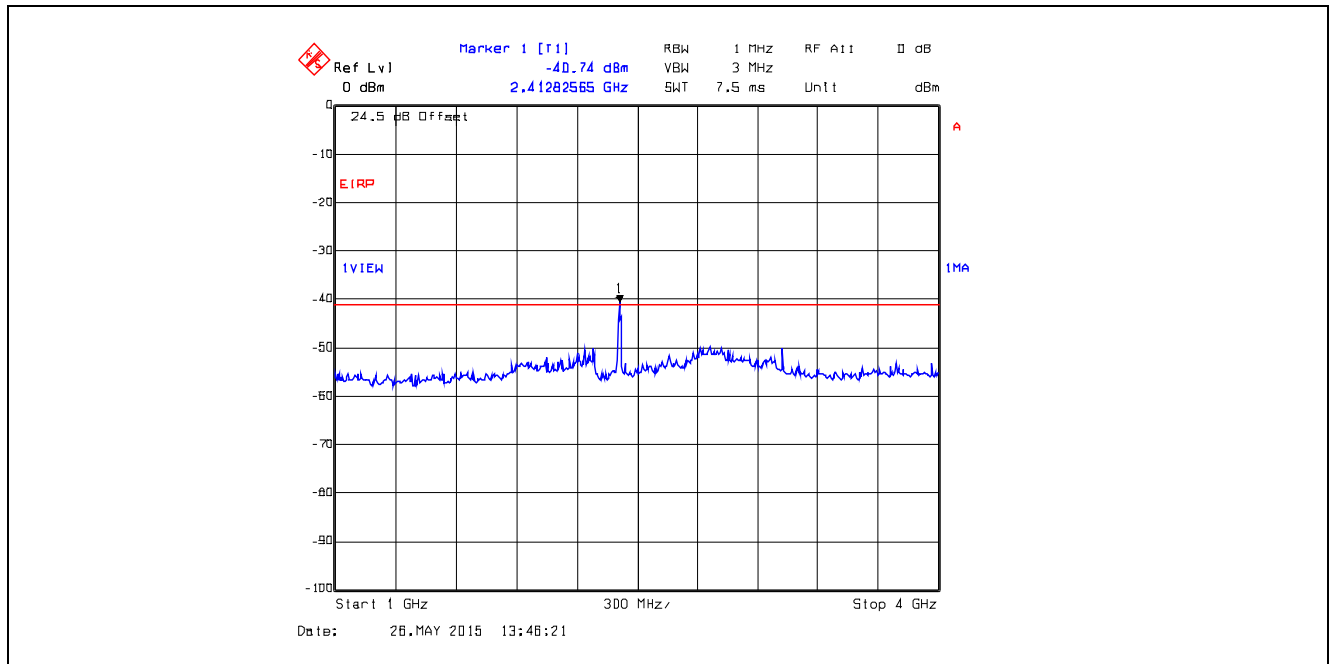
Plot 5.4.4.4.2. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 35, 150 kHz - 30 MHz, Peak Detector



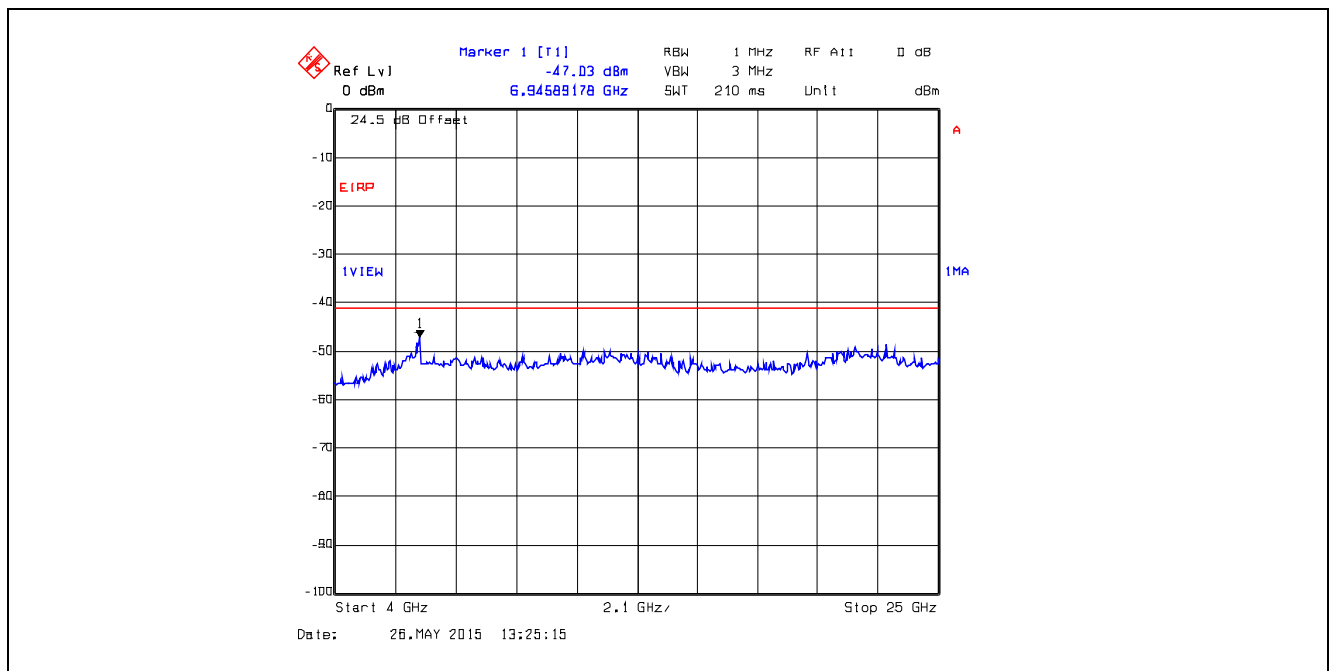
Plot 5.4.4.4.3. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 35, 30 MHz - 1 GHz, Peak Detector
Markers 1 & 2 are outside of RB



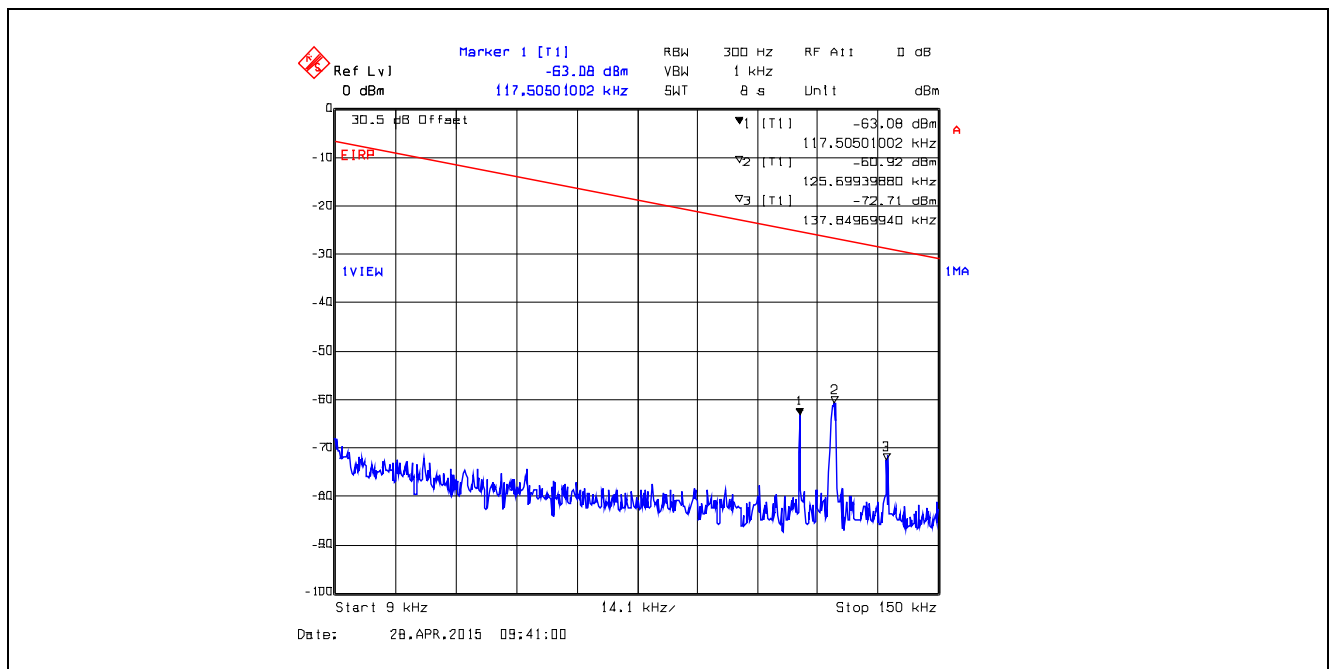
Plot 5.4.4.4.4. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 35, 1 GHz - 4 GHz, Peak Detector



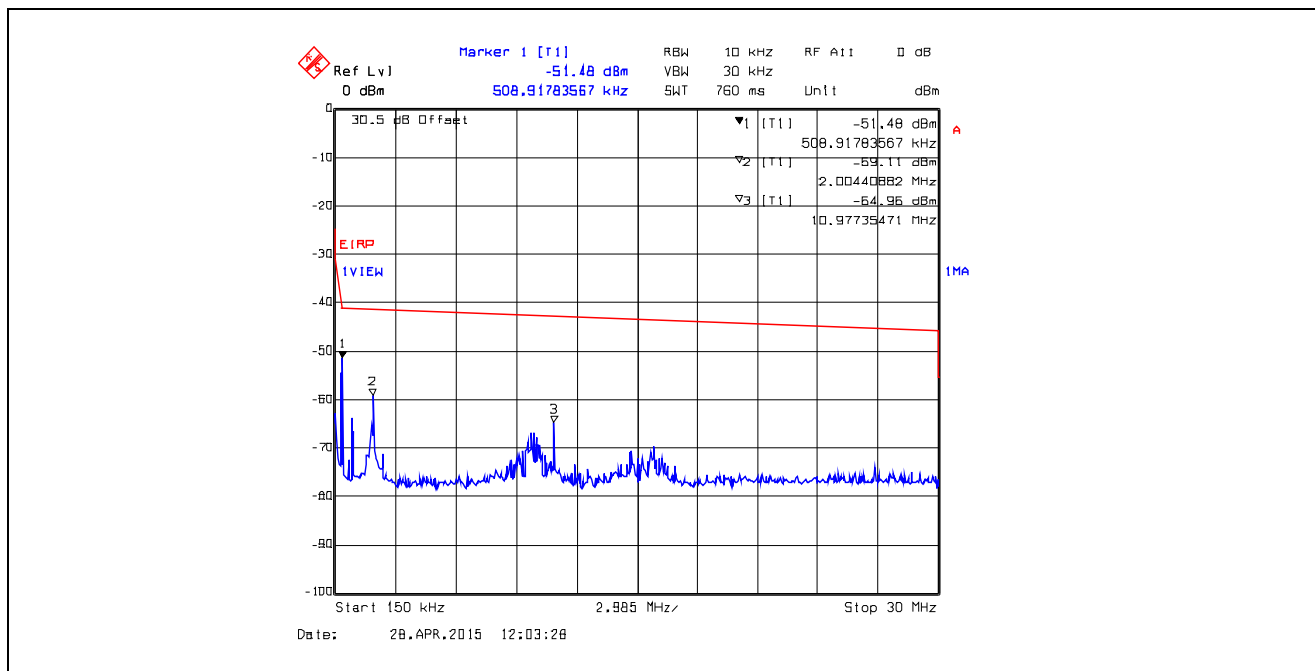
Plot 5.4.4.4.5. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 35, 4 GHz - 25 GHz, Peak Detector



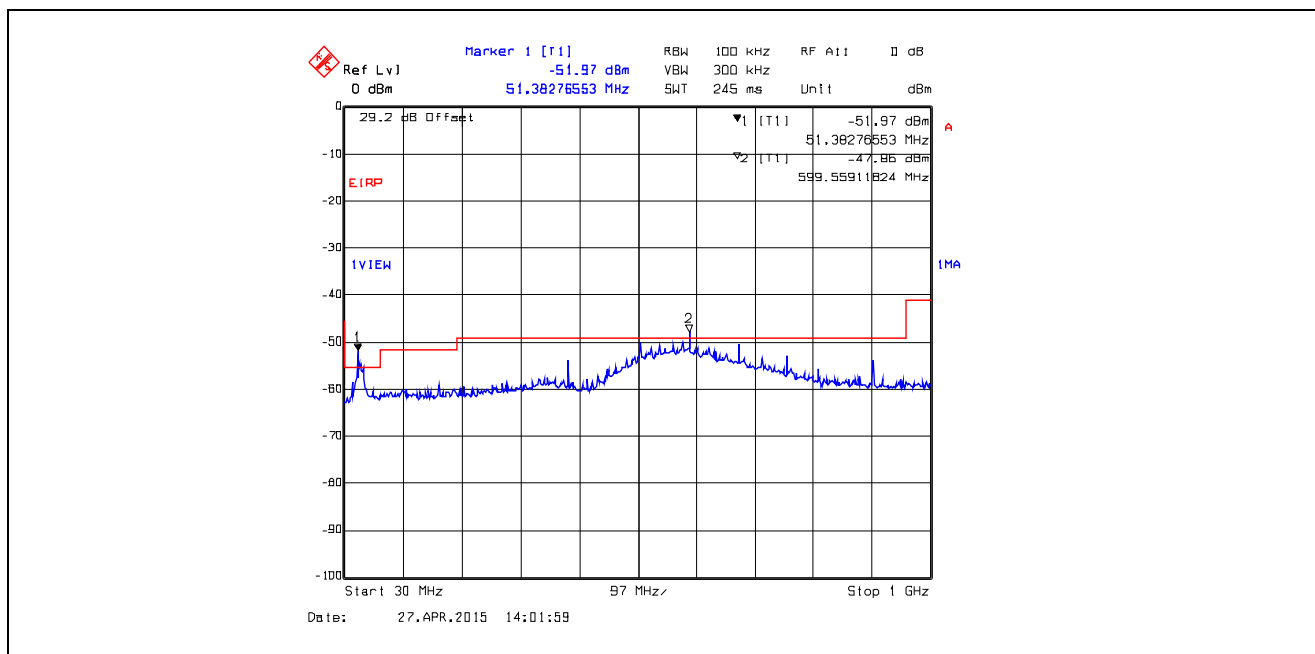
Plot 5.4.4.4.6. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 35, 9 kHz - 150 kHz, Peak Detector



Plot 5.4.4.4.7. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 35, 150 kHz - 30 MHz, Peak Detector



Plot 5.4.4.4.8. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 35, 30 MHz – 1 GHz, Peak Detector
Markers 1 & 2 are outside of RB



Marker 1 [1]
 -37.76 dBm
 2.43687375 GHz

RBW 1 MHz
 VBW 3 MHz
 SWT 7.5 ms

RF Att 1
 Unit dBm

Ref Lvl 0 dBm

24.5 dB Offset

EIRP

VIEW

IMA

A

Start 1 GHz 300 MHz Stop 4 GHz

Date: 26.MAY 2015 13:22:21

Marker 1 [r1]
 Ref Lvl -48.13 dBm
 0 dBm 6.94589178 GHz
 RBW 1 MHz RF All $\square$ dB
 VBW 3 MHz
 SWT 210 ms Unit dBm

24.5 dB Offset

EIRP

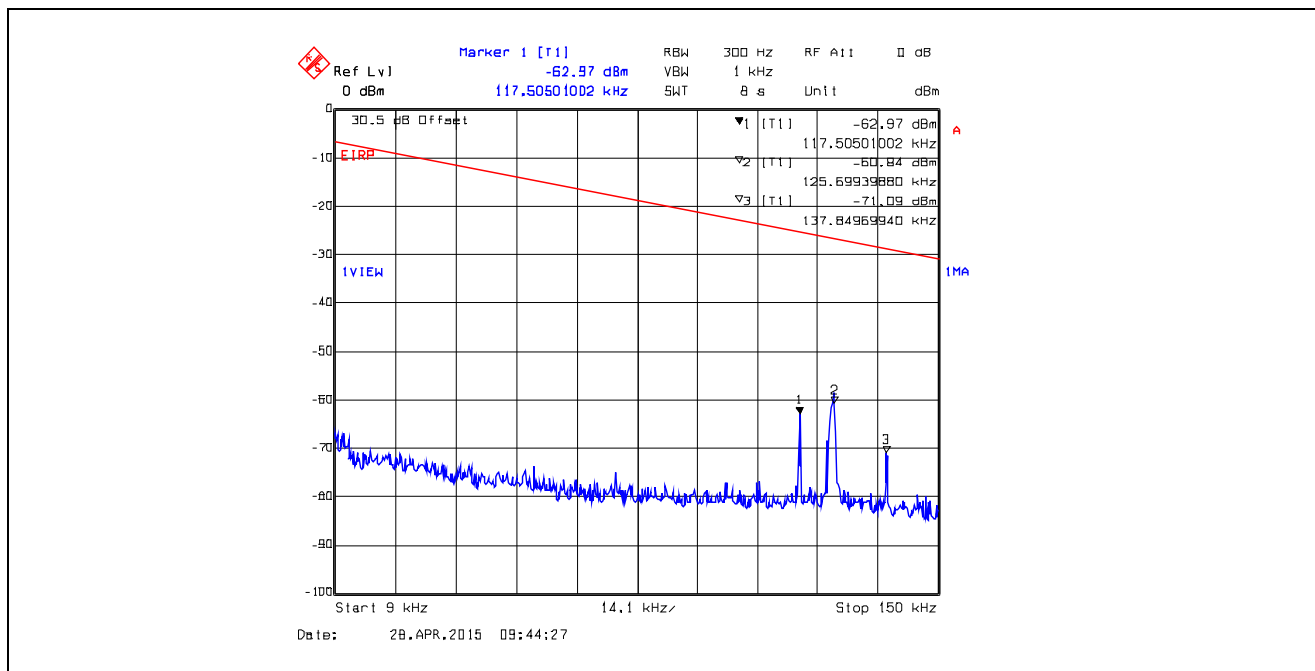
1VIEW

IMA

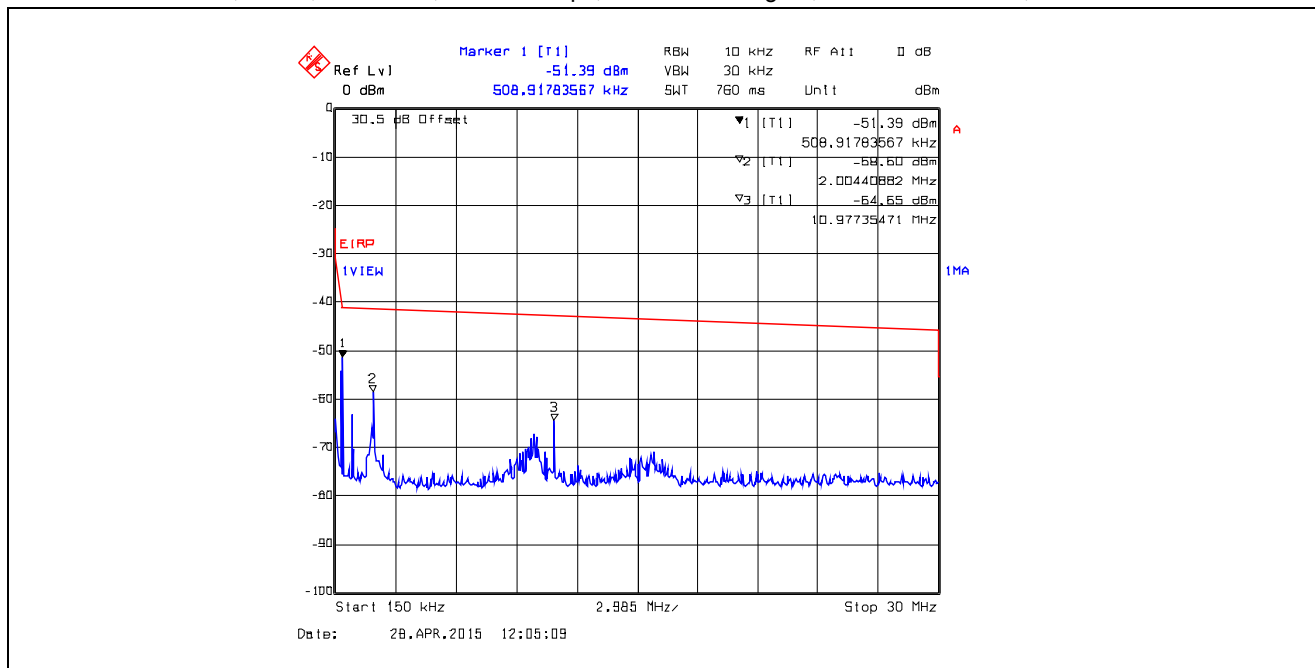
Start 4 GHz 2.1 GHz/ Stop 25 GHz

Date: 26.MAY 2015 13:23:29

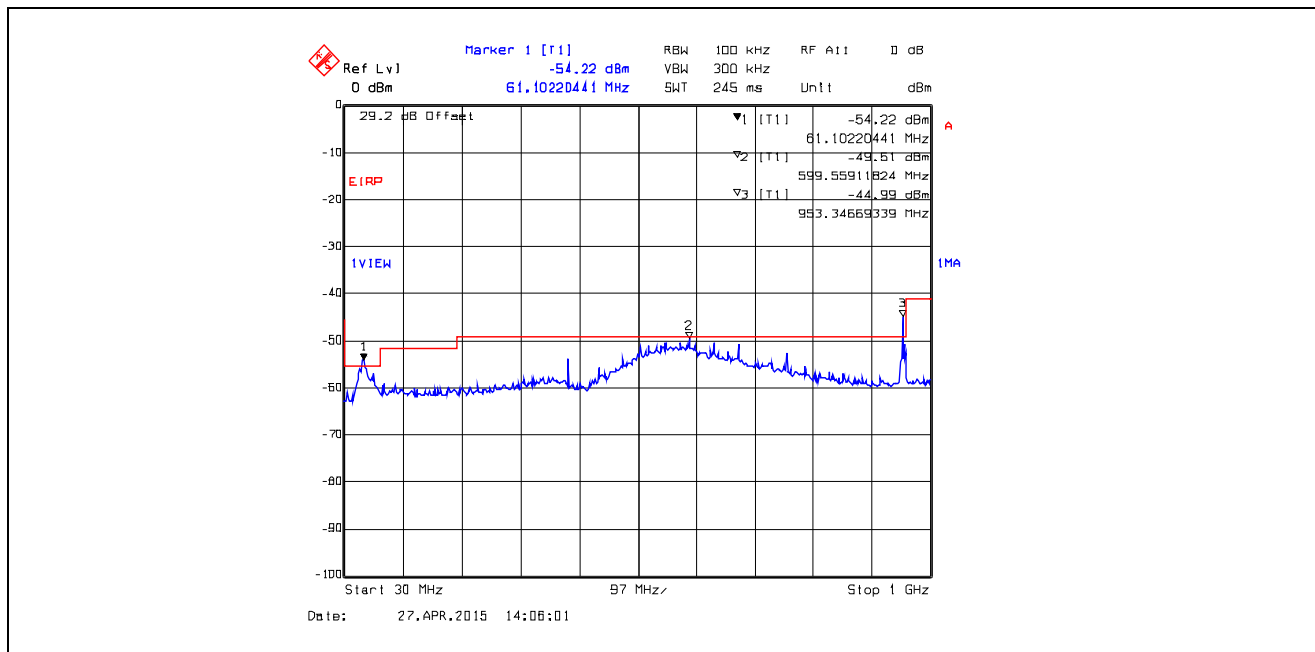
Plot 5.4.4.4.11. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 35, 9 kHz - 150 kHz, Peak Detector



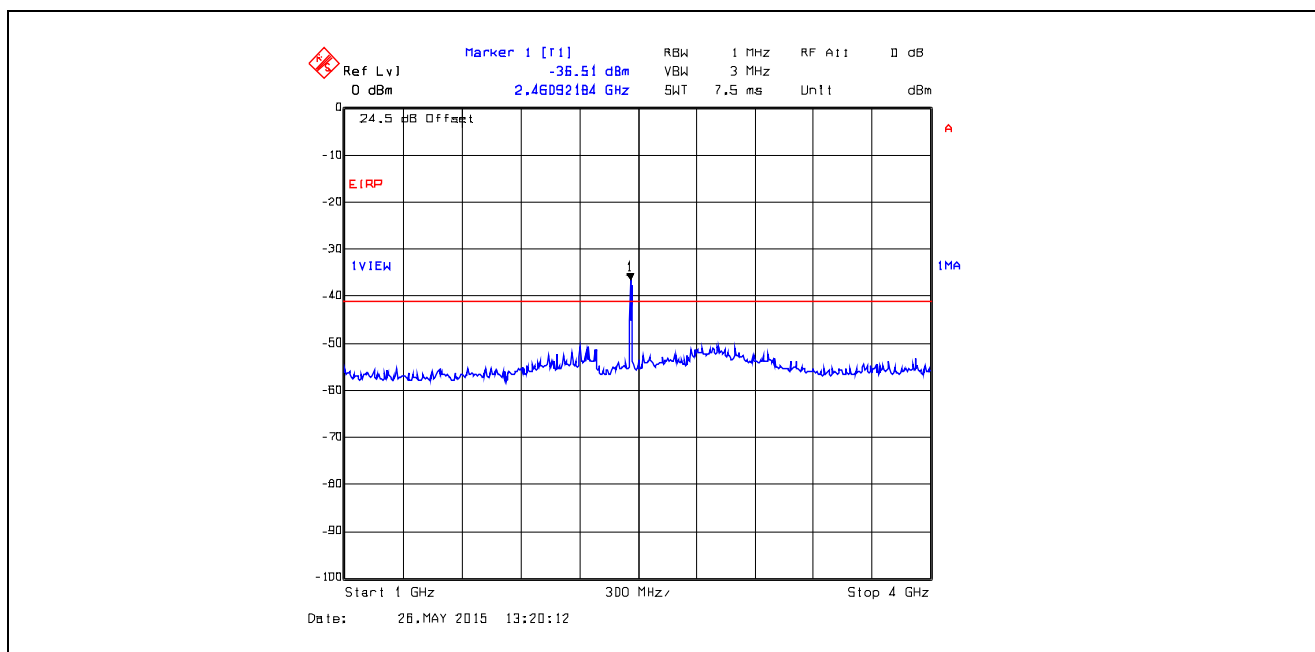
Plot 5.4.4.4.12. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 35, 150 kHz - 30 MHz, Peak Detector



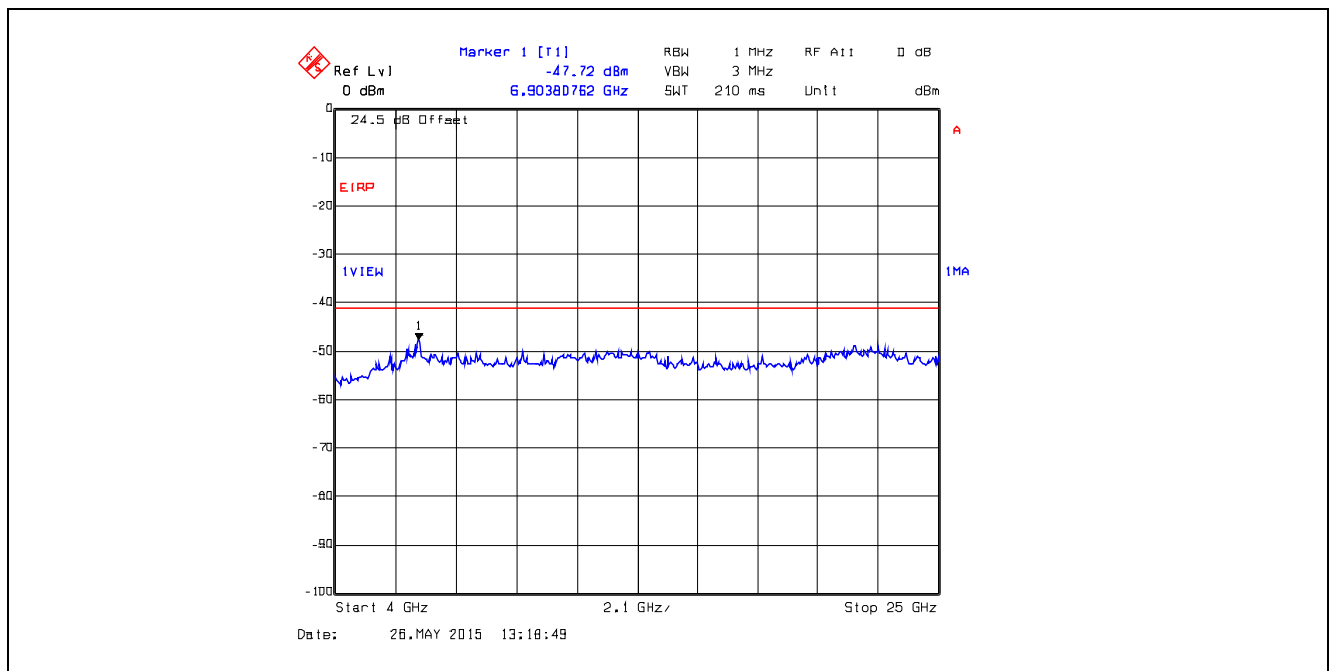
Plot 5.4.4.4.13. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 35, Peak Detector
Markers 1, 2 & 3 are outside of RB



Plot 5.4.4.4.14. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 35, 1 GHz - 4 GHz, Peak Detector
Marker 1 is outside of RB



Plot 5.4.4.15. Conducted Spurious Emissions in Restricted Frequency Bands
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 35, 4 GHz - 25 GHz, Peak Detector



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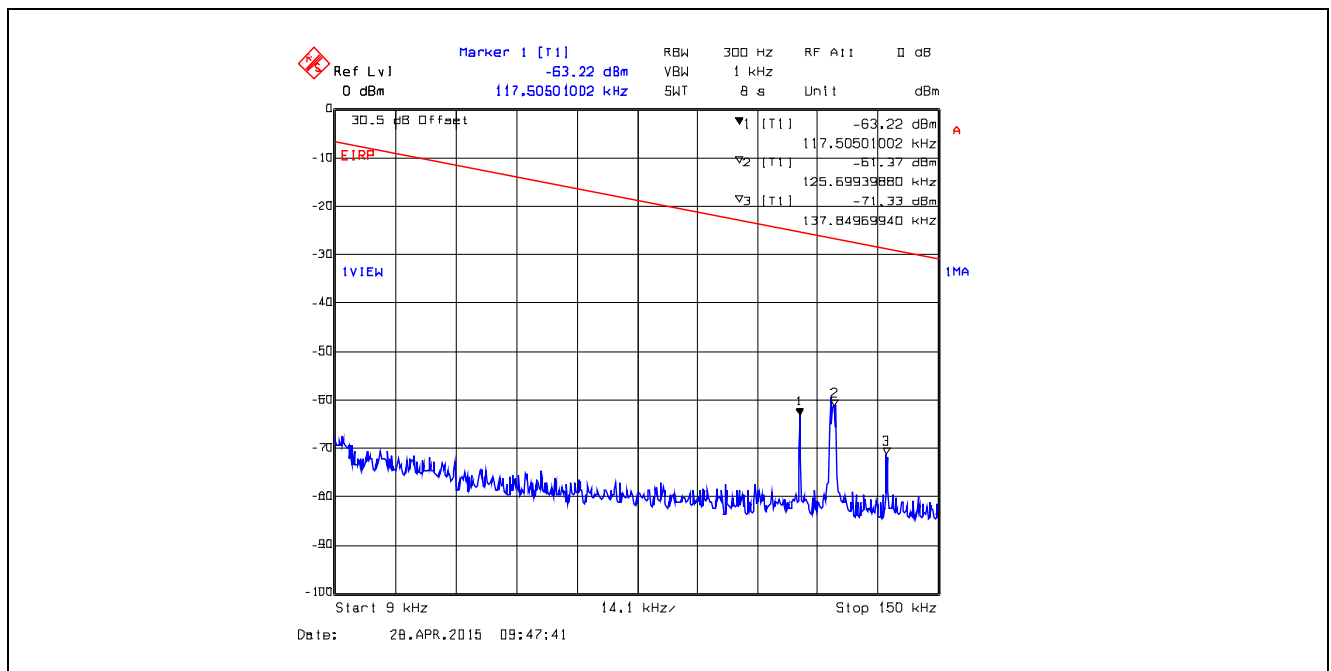
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 15MCRS083_FCC15C247DTS

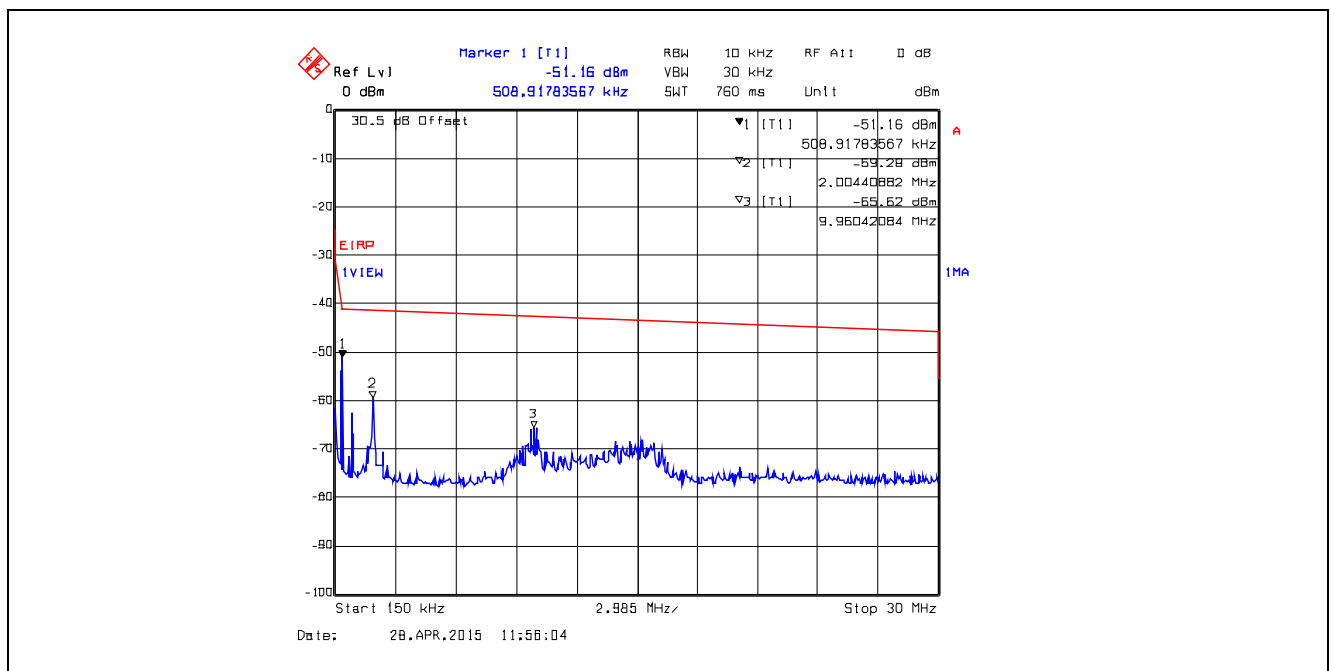
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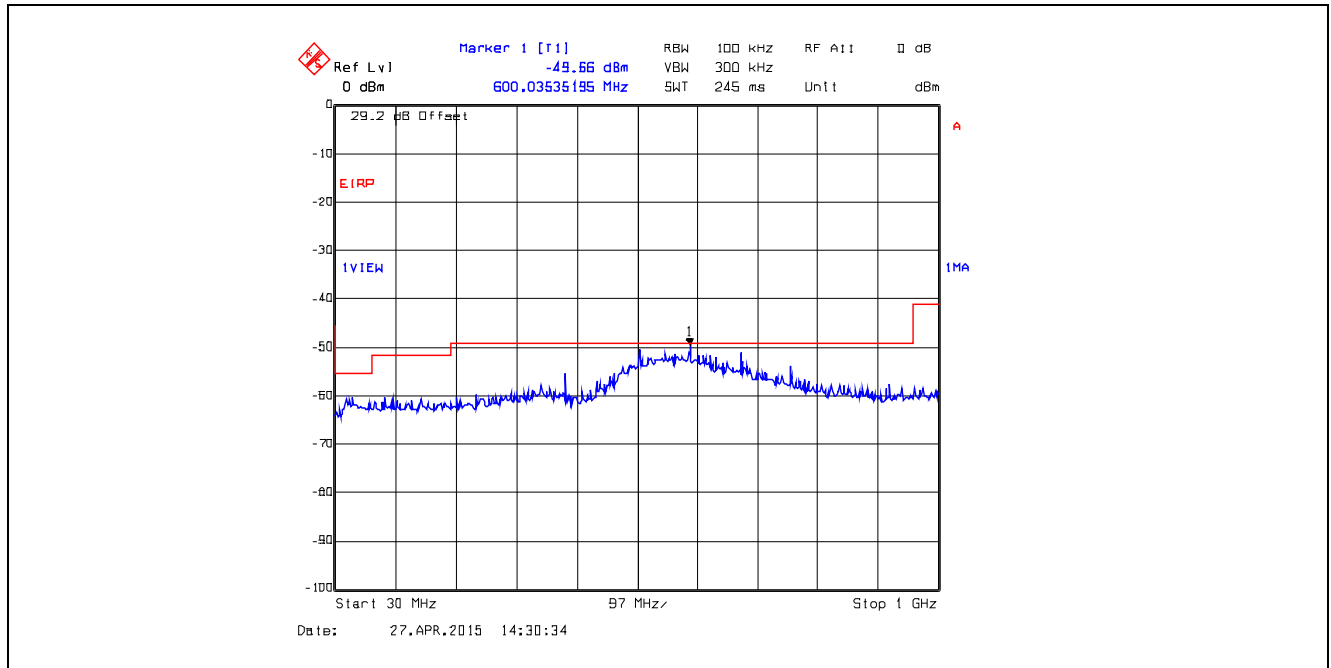
Plot 5.4.4.16. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 9 kHz - 150 kHz, Peak Detector



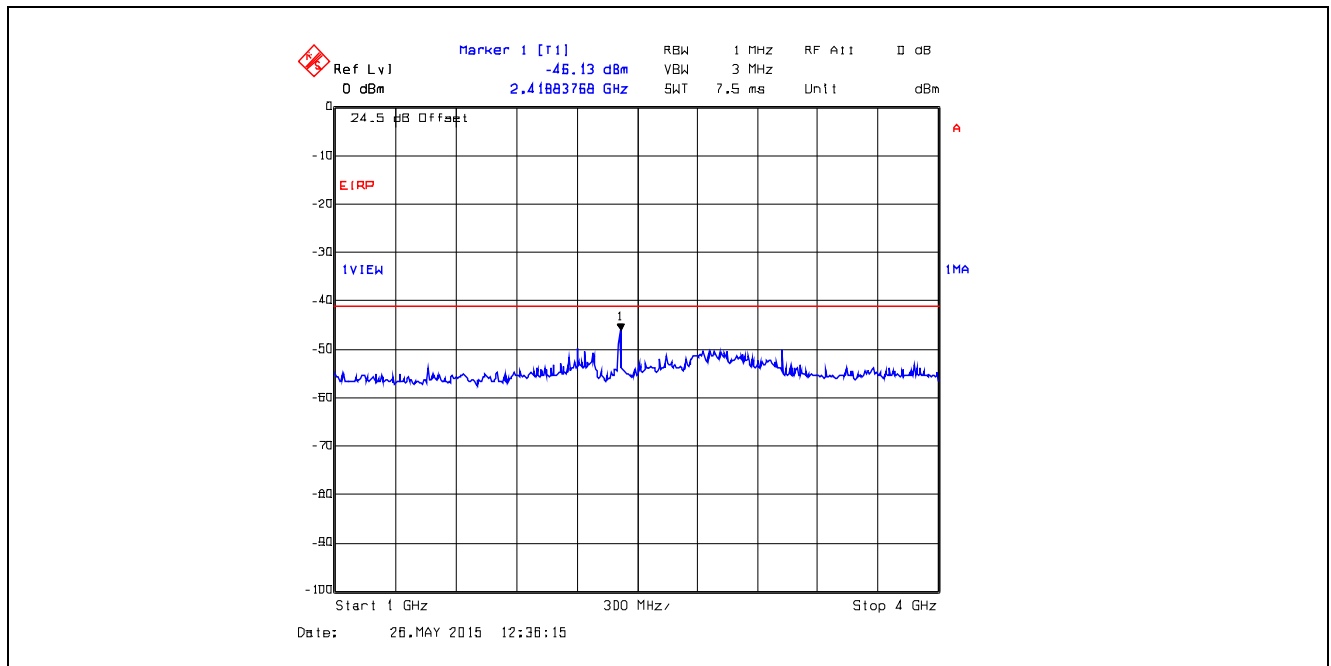
Plot 5.4.4.17. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 150 kHz - 30 MHz, Peak Detector



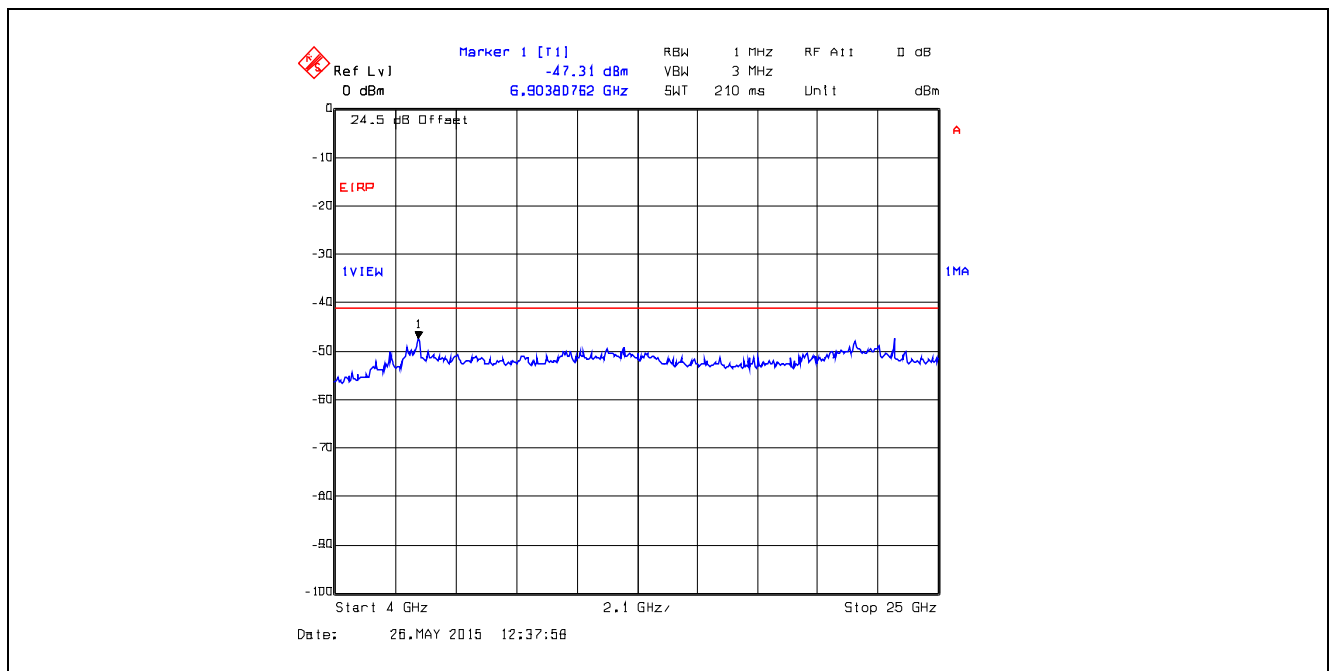
Plot 5.4.4.18. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 30 MHz - 1 GHz, Peak Detector
Marker 1 is outside of RB



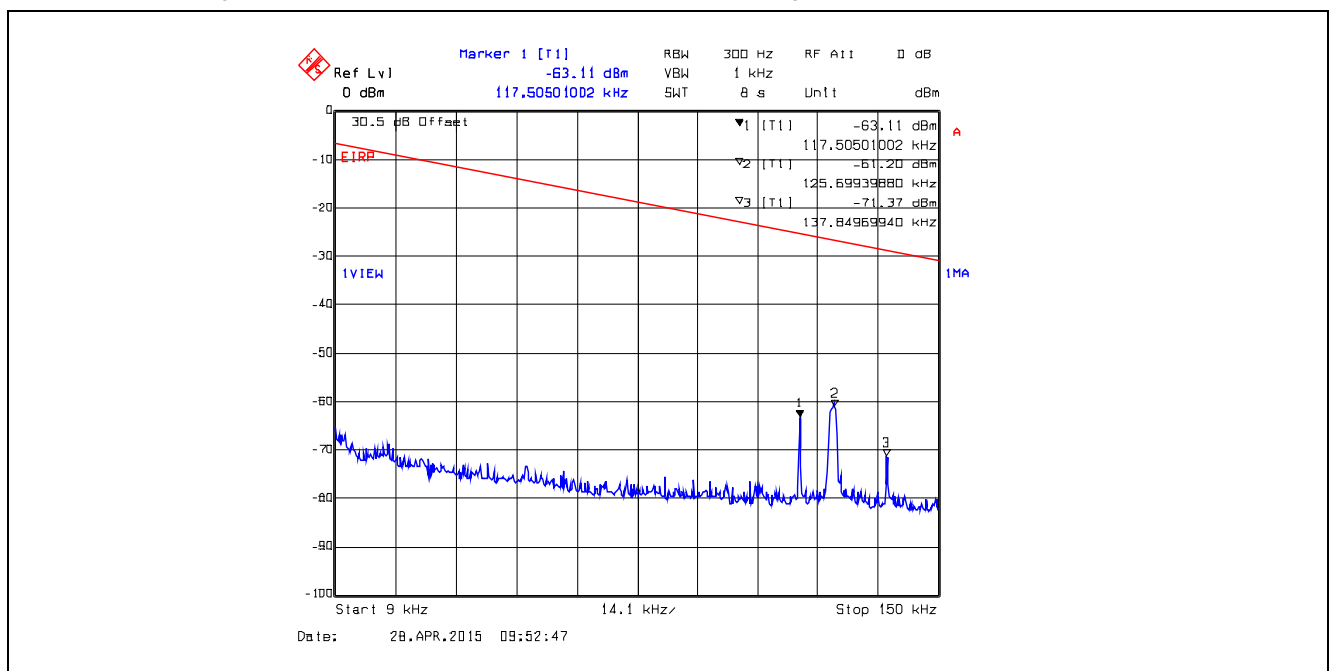
Plot 5.4.4.19. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 1 GHz - 4 GHz, Peak Detector



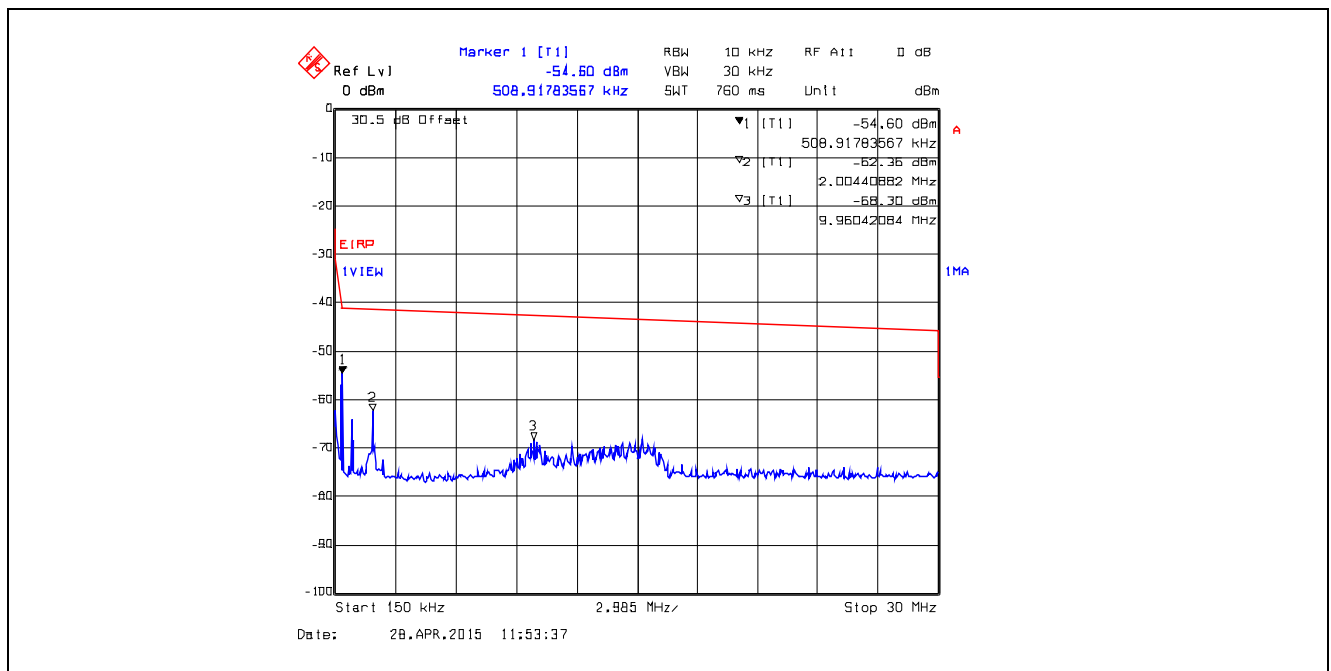
Plot 5.4.4.4.20. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 4 GHz - 25 GHz, Peak Detector



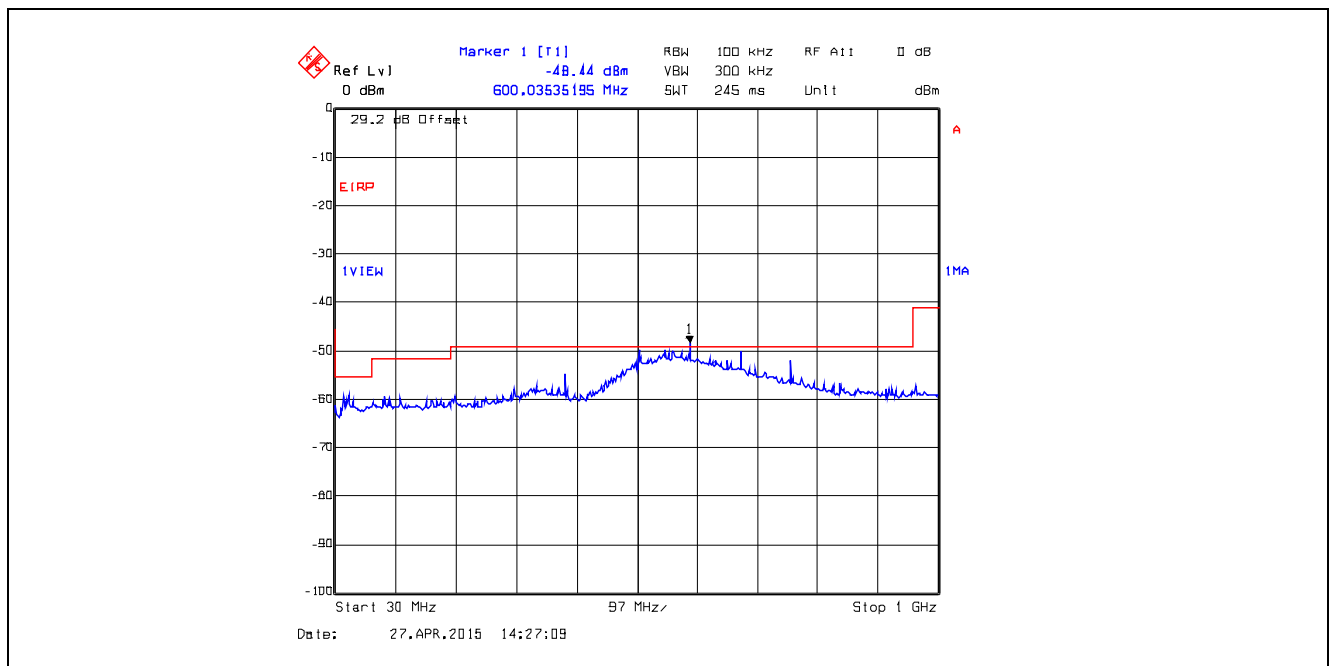
Plot 5.4.4.4.21. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 9 kHz – 150 kHz, Peak Detector



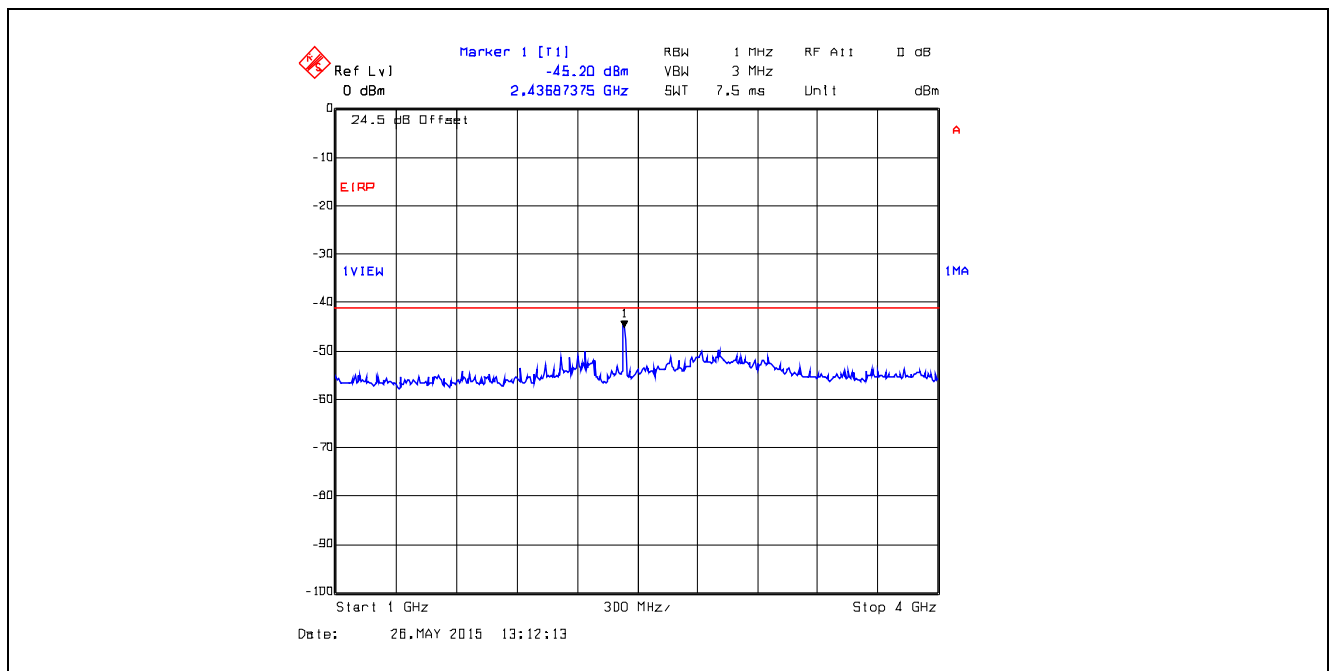
Plot 5.4.4.22. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 150 kHz – 30 MHz, Peak Detector



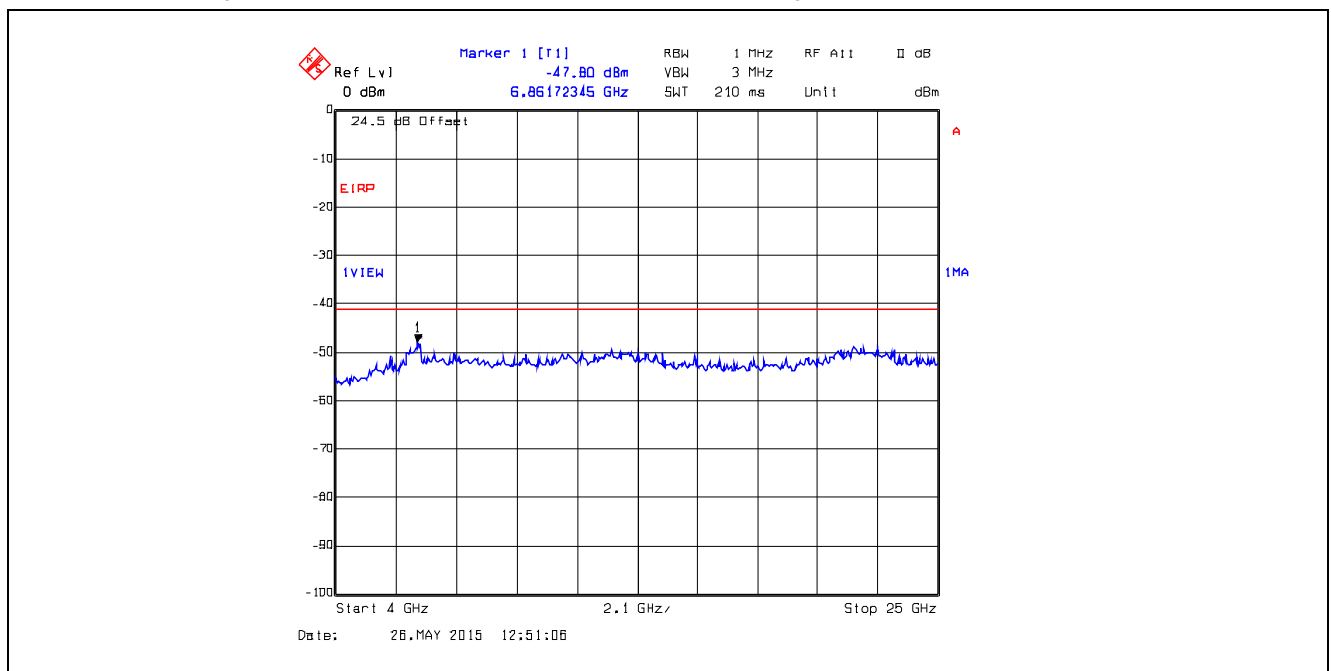
Plot 5.4.4.23. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 30 MHz – 1 GHz, Peak Detector
Marker 1 is outside of RB



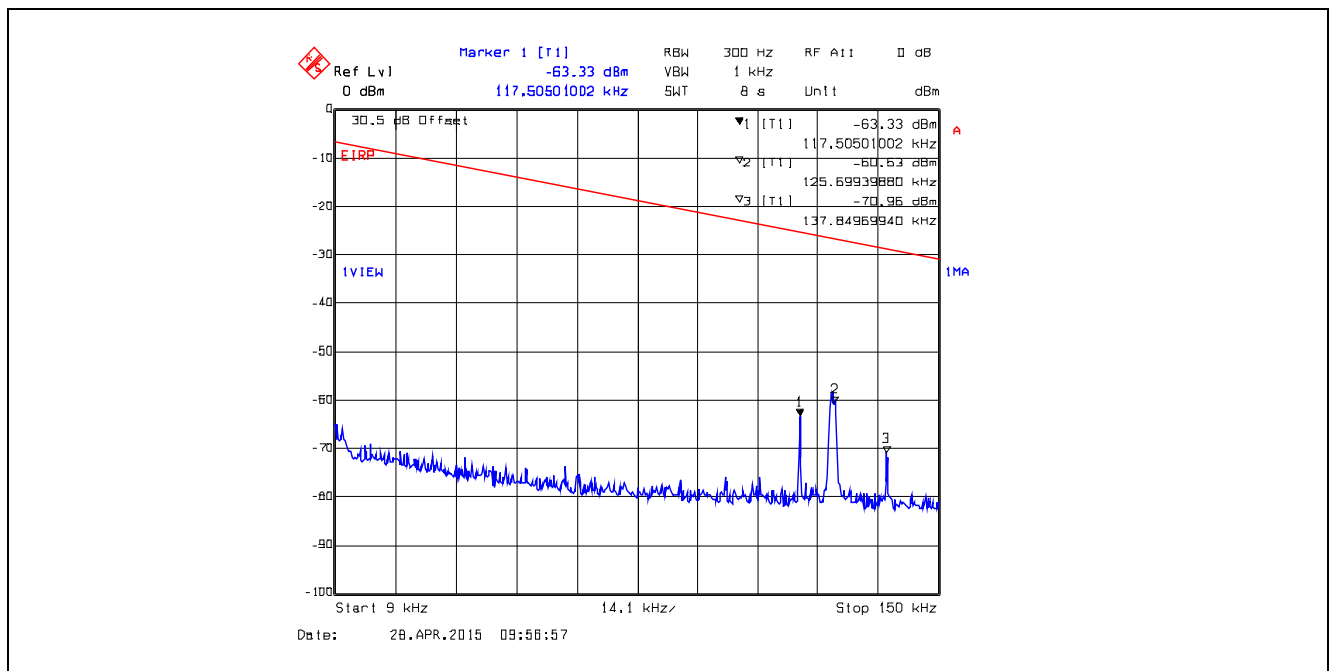
Plot 5.4.4.24. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 1 GHz - 4 GHz, Peak Detector



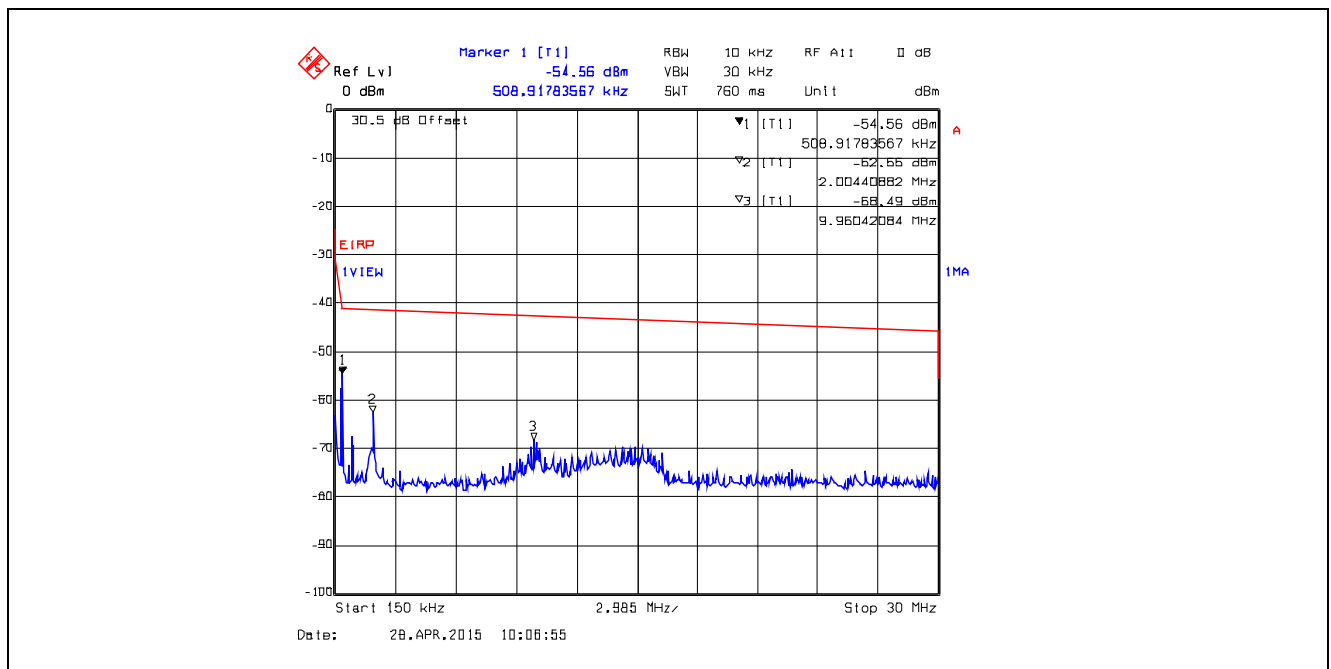
Plot 5.4.4.25. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 4 GHz - 25 GHz, Peak Detector



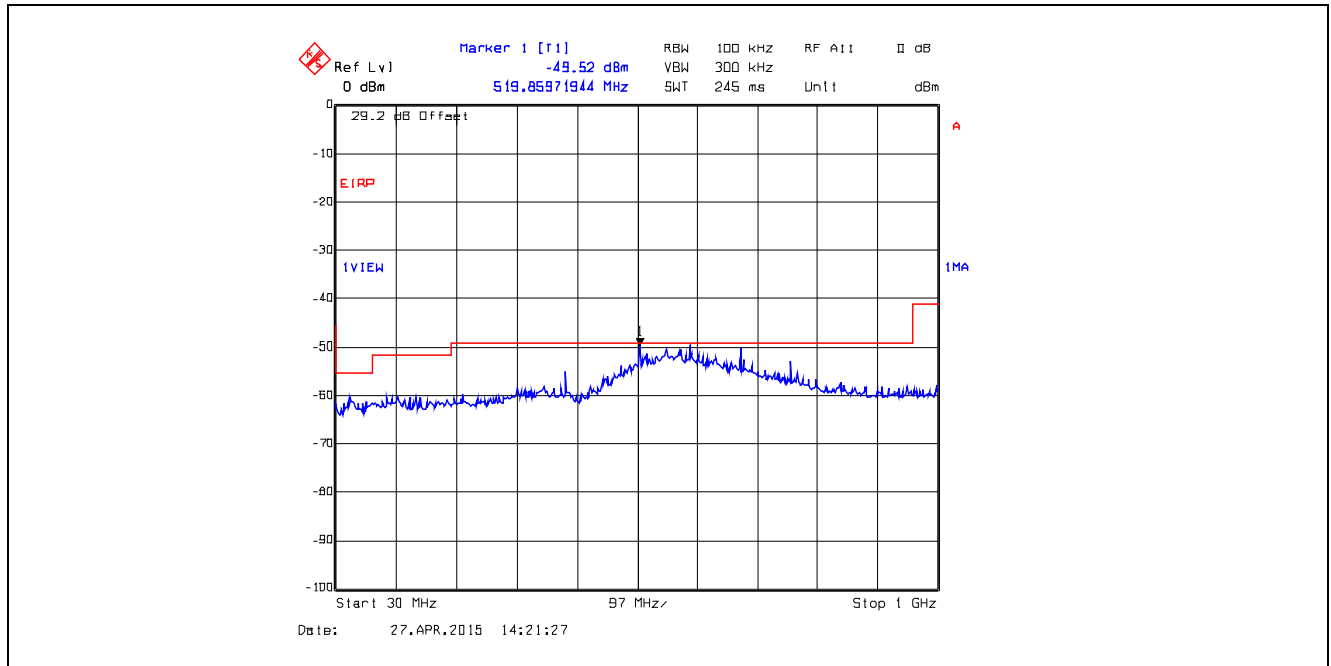
Plot 5.4.4.26. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 9 kHz – 150 kHz, Peak Detector



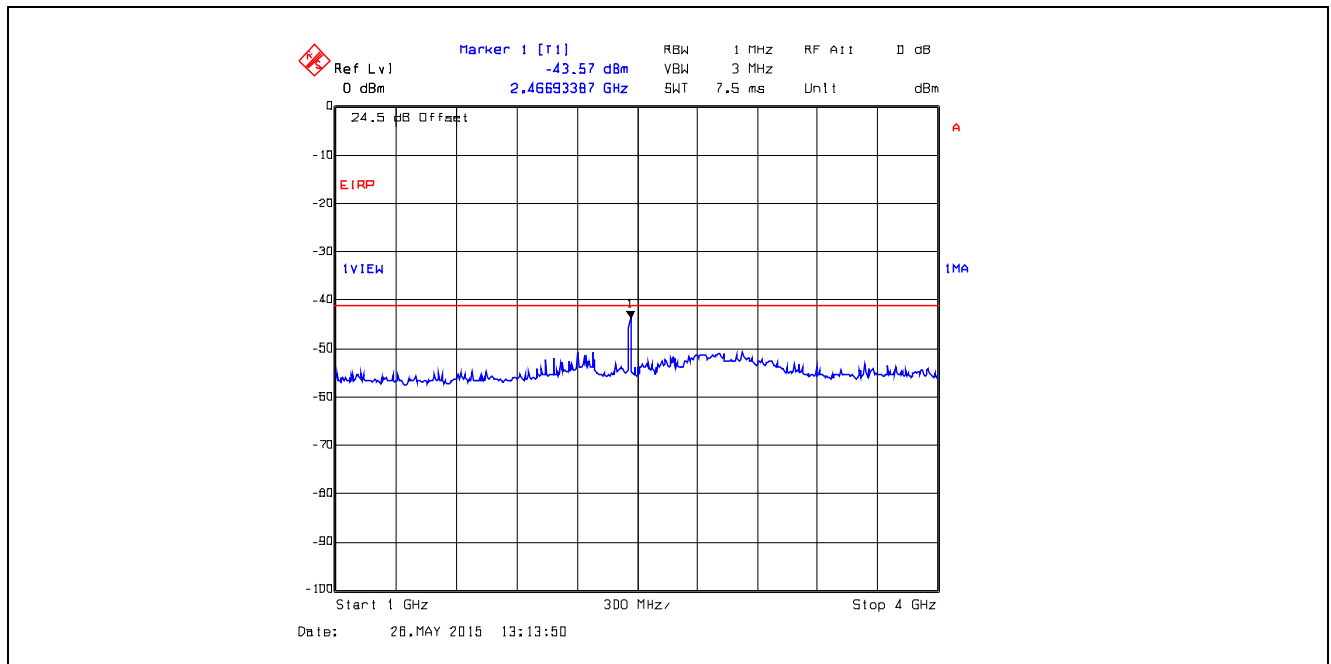
Plot 5.4.4.27. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 150 kHz – 30 MHz, Peak Detector



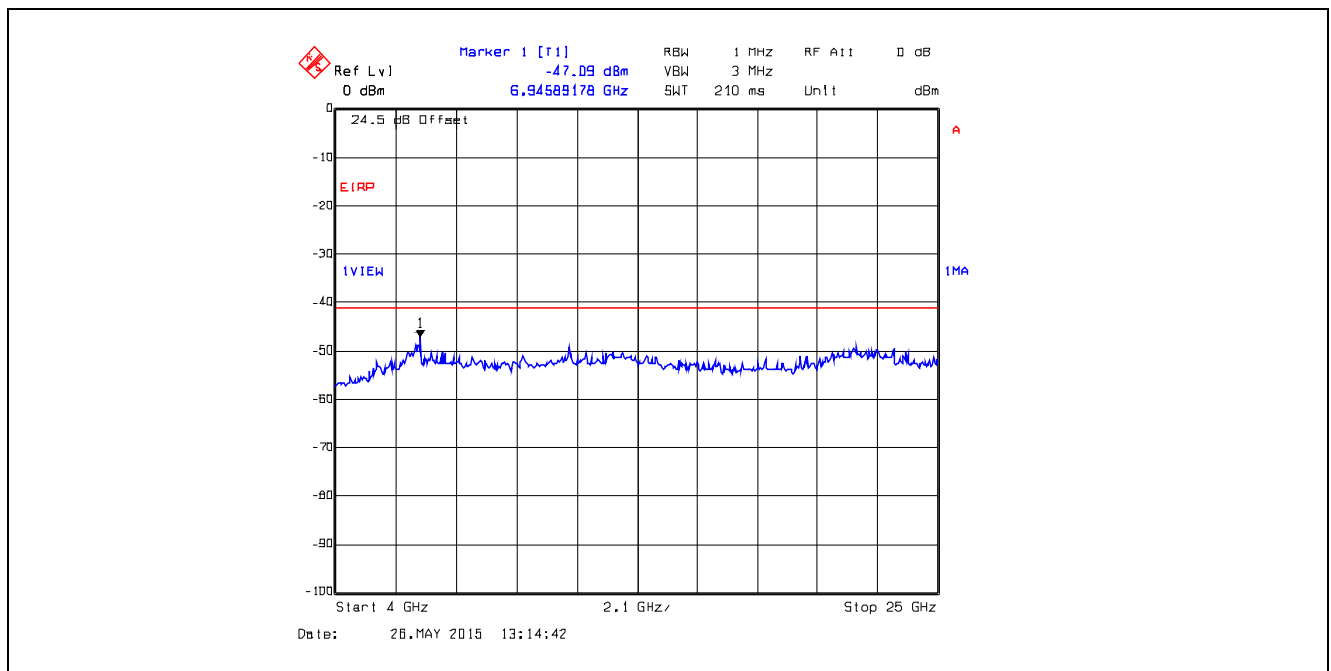
Plot 5.4.4.28. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 30 MHz – 1 GHz, Peak Detector
Marker 1 is outside of RB



Plot 5.4.4.29. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 1 GHz – 4 GHz, Peak Detector



Plot 5.4.4.4.30. Conducted Spurious Emissions in Restricted Frequency Bands
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 26, 4 GHz – 25 GHz, Peak Detector



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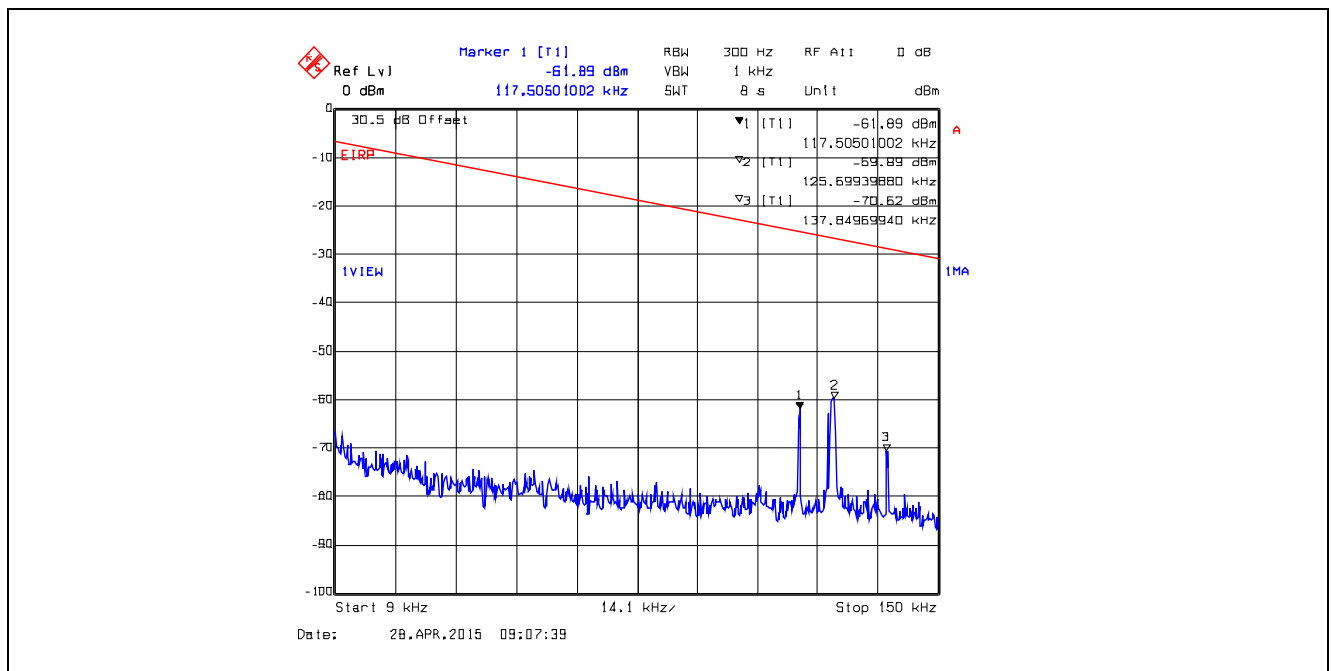
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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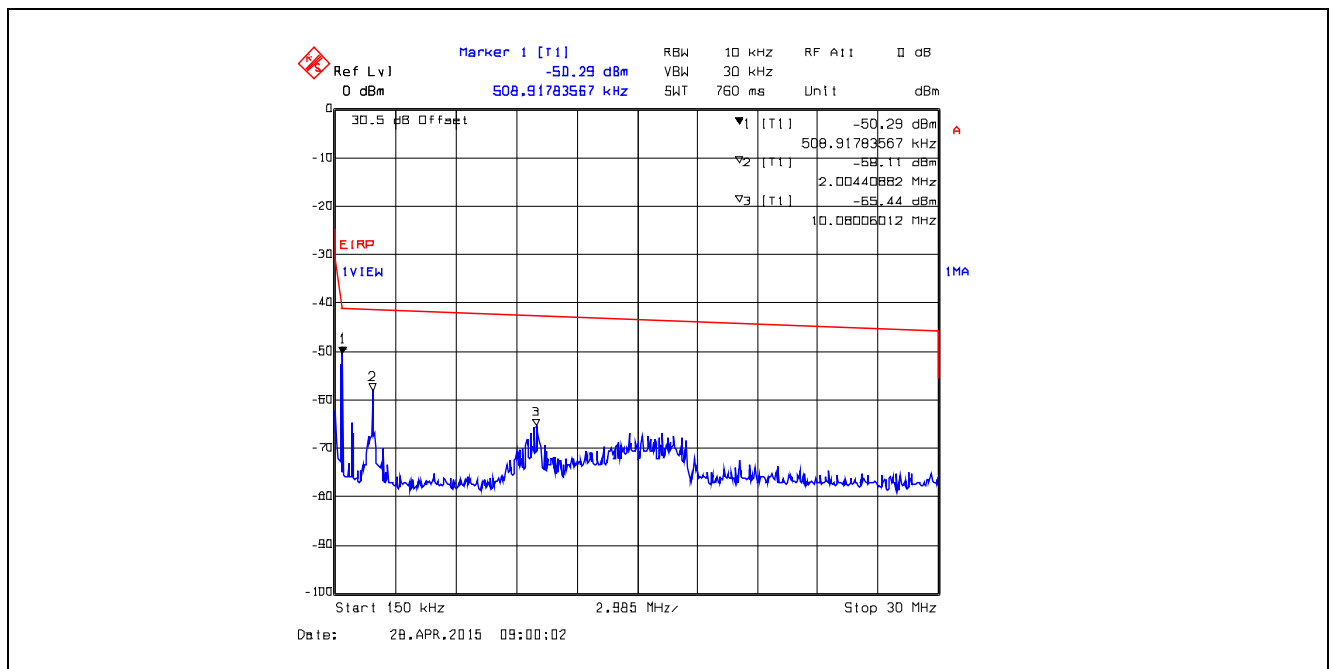
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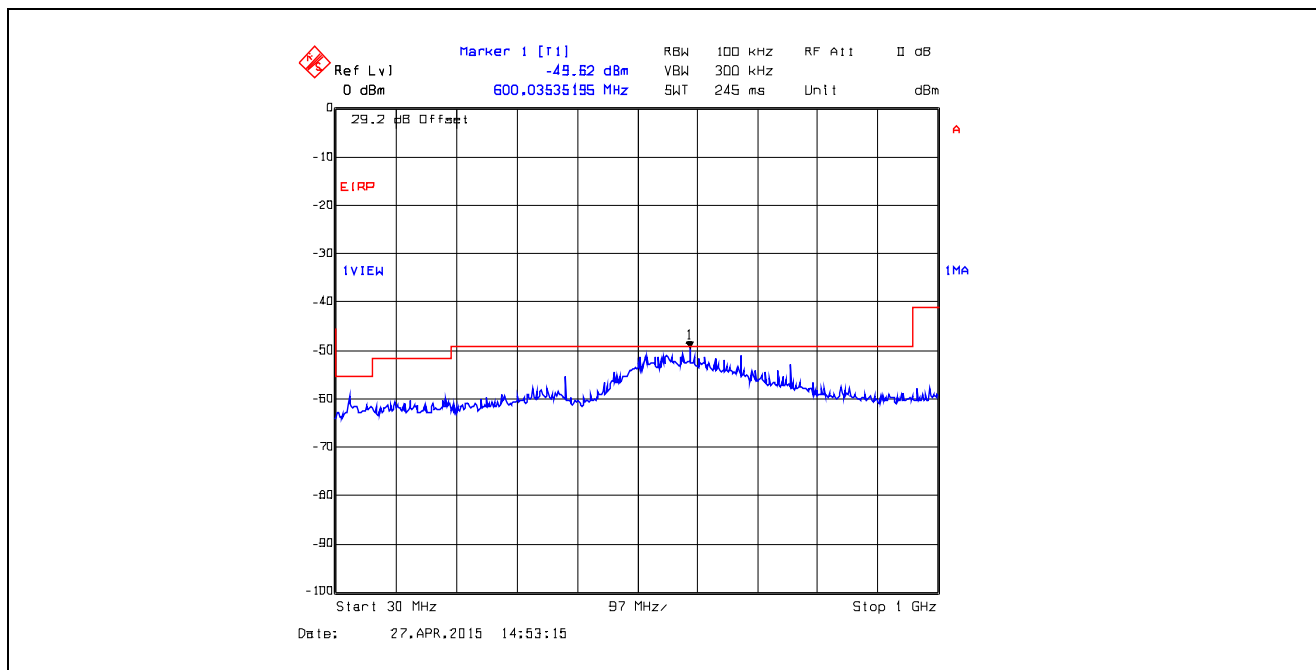
Plot 5.4.4.4.31. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 9 kHz – 150 kHz, Peak Detector



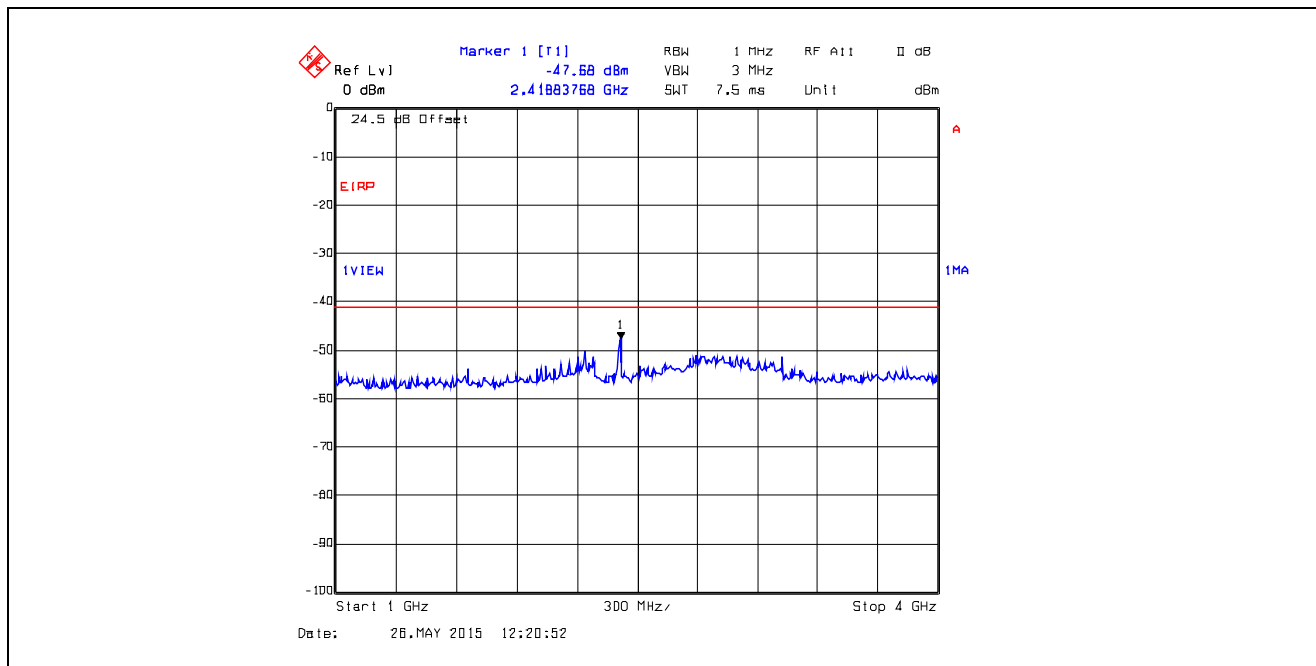
Plot 5.4.4.4.32. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 150 kHz – 30 MHz, Peak Detector



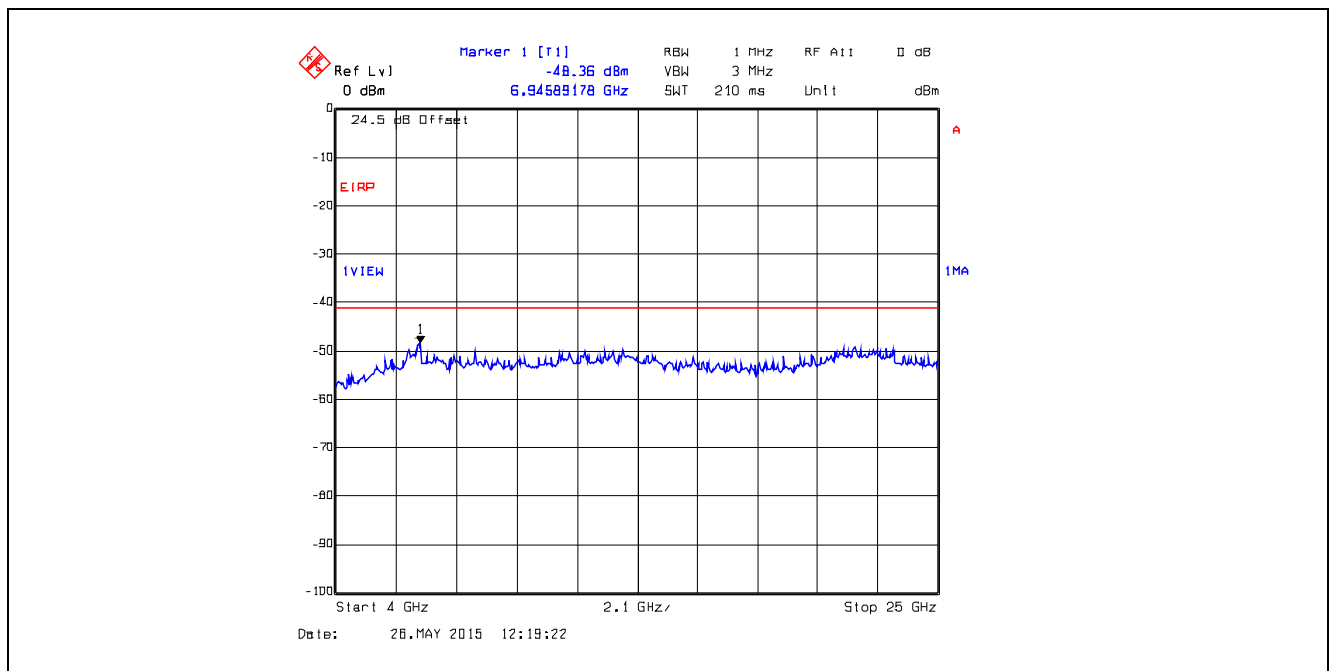
Plot 5.4.4.4.33. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 30 MHz – 1 GHz, Peak Detector
Marker 1 is outside of RB



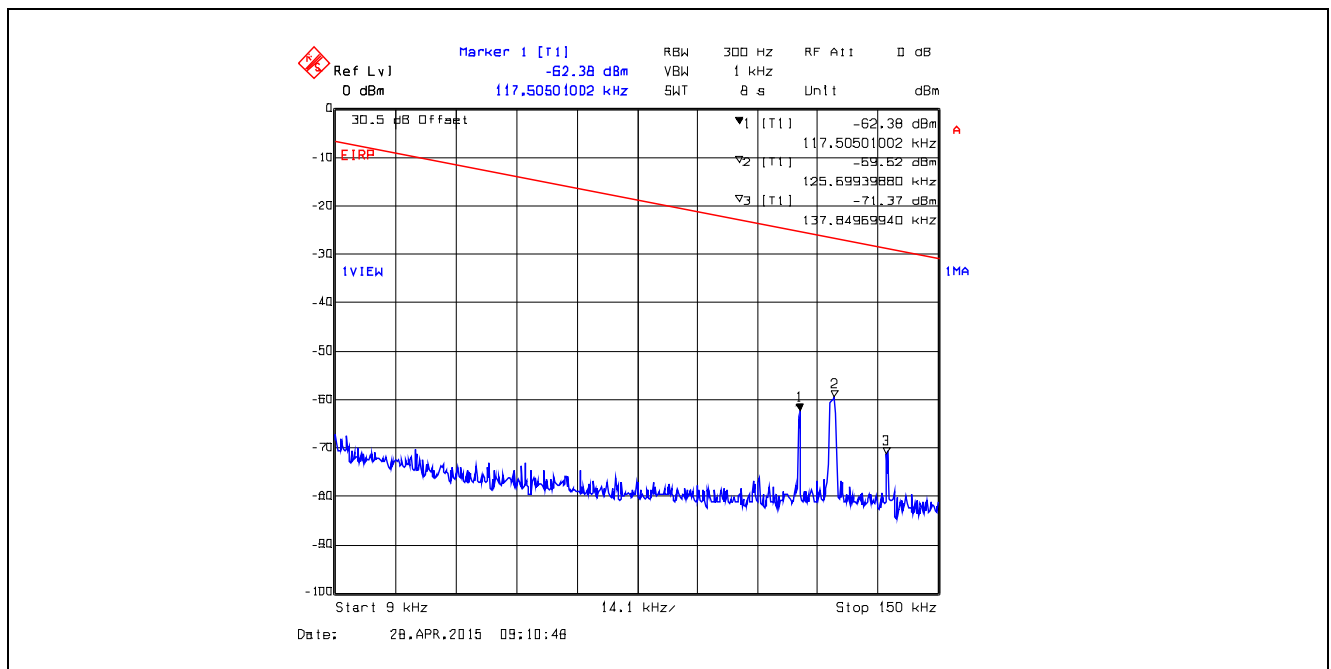
Plot 5.4.4.4.34. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 1 GHz – 4 GHz, Peak Detector



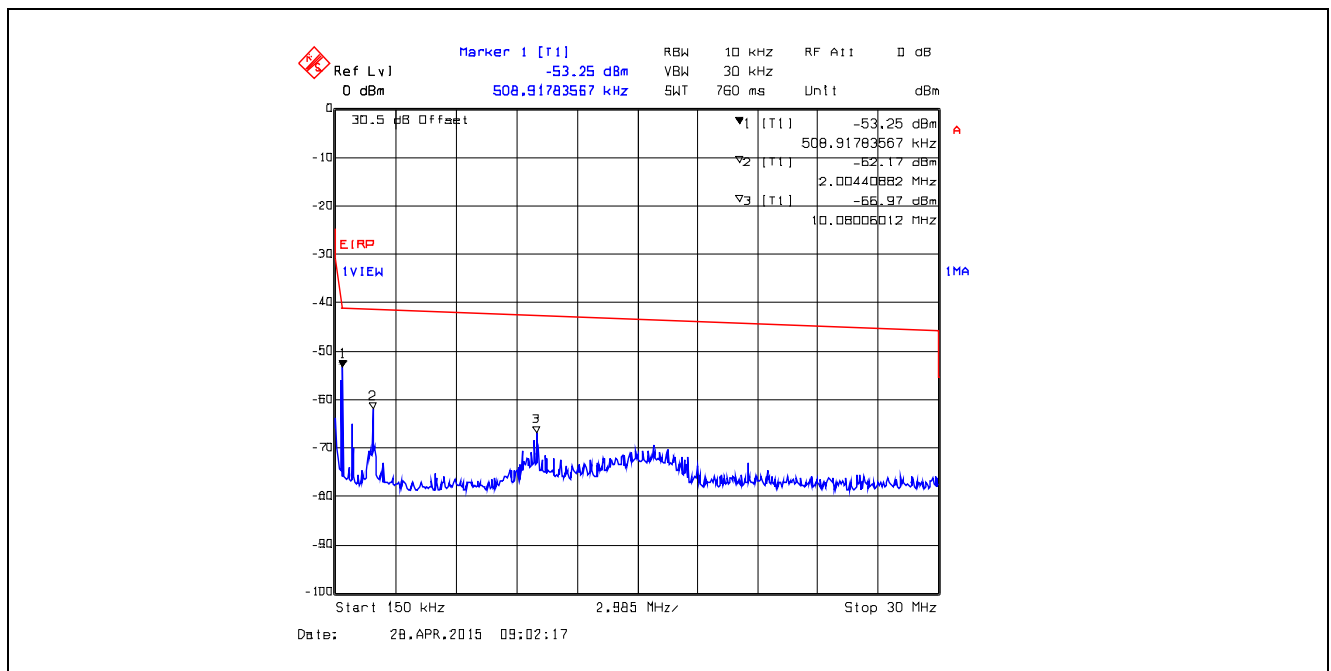
Plot 5.4.4.4.35. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 1, 2412 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 4 GHz - 25 GHz, Peak Detector



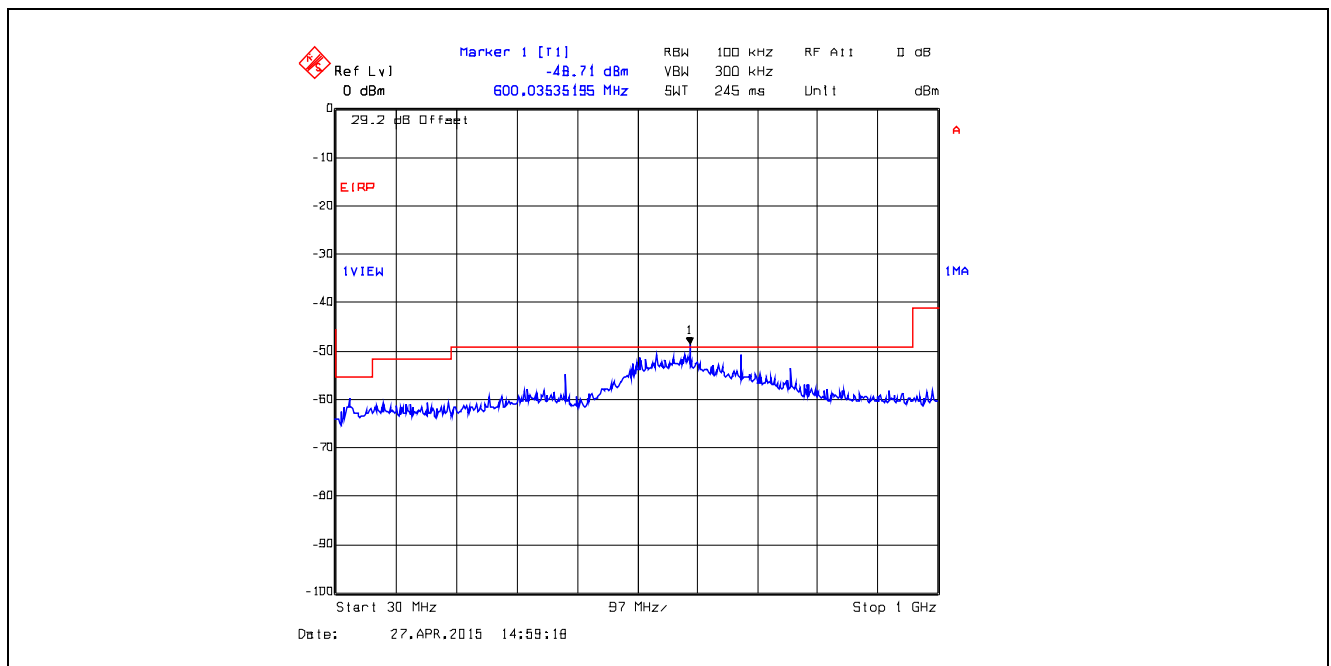
Plot 5.4.4.4.36. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 9 kHz – 150 kHz, Peak Detector



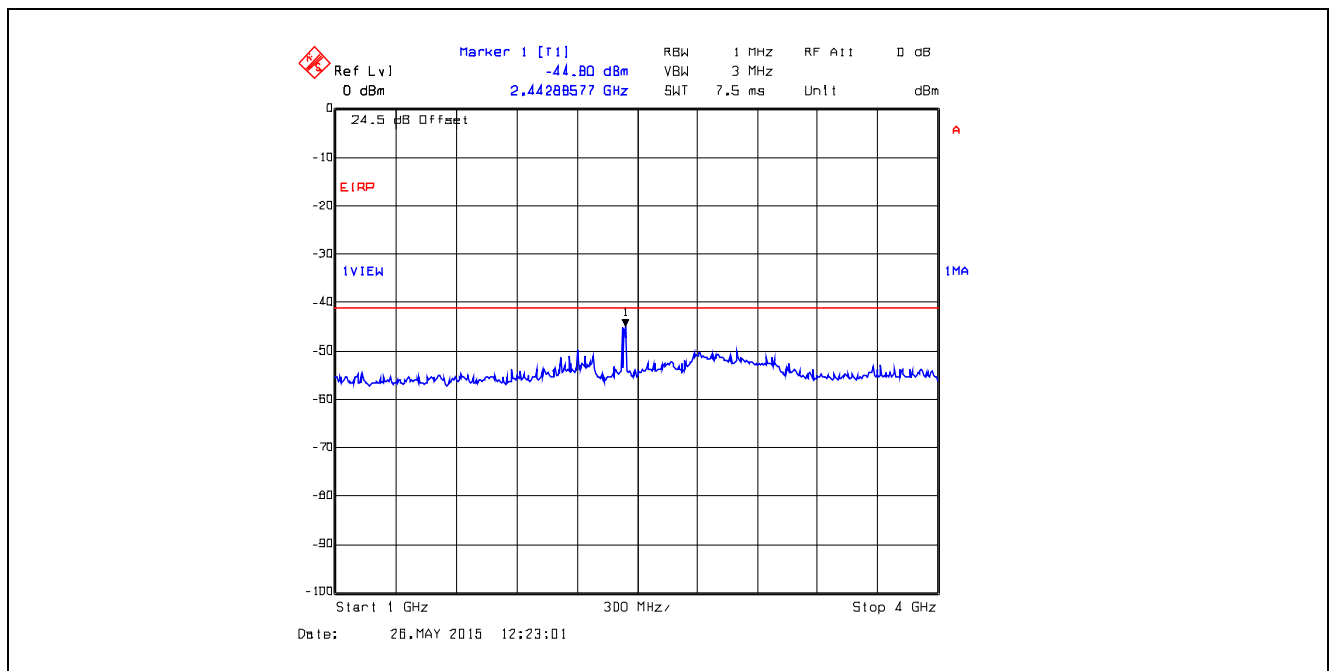
Plot 5.4.4.4.37. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 150 kHz – 30 MHz, Peak Detector



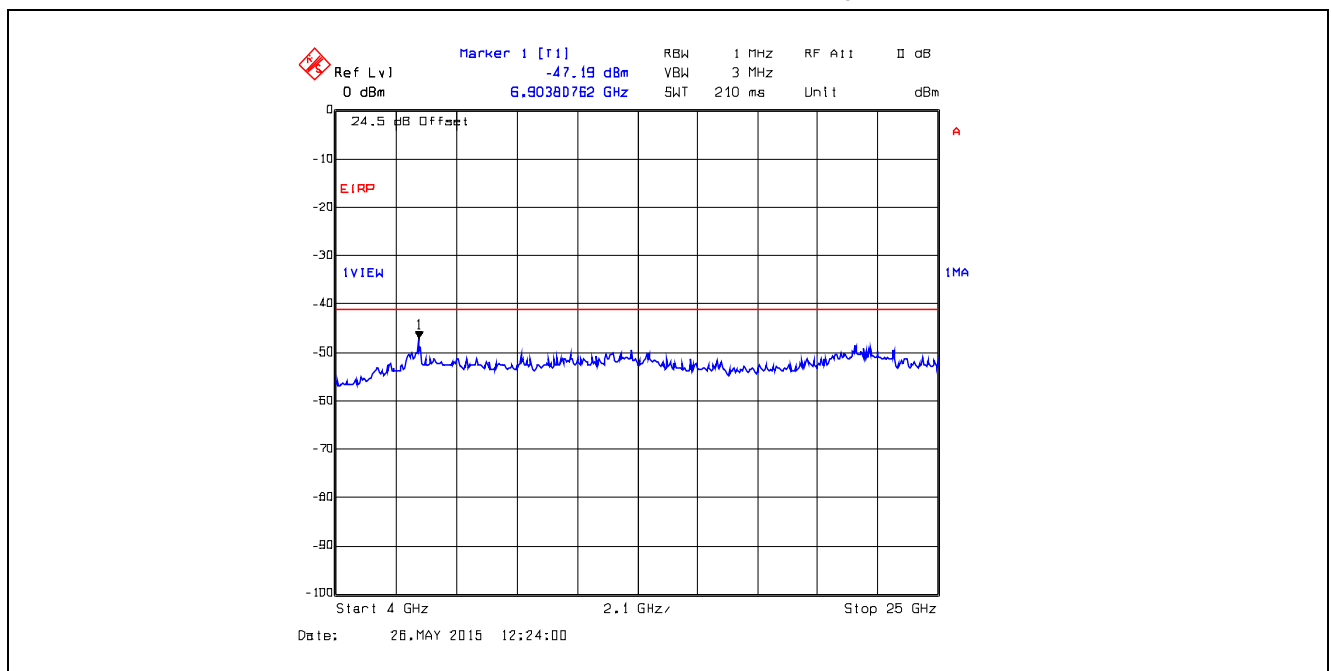
Plot 5.4.4.4.38. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 30 MHz – 1 GHz, Peak Detector
Marker 1 is outside of RB



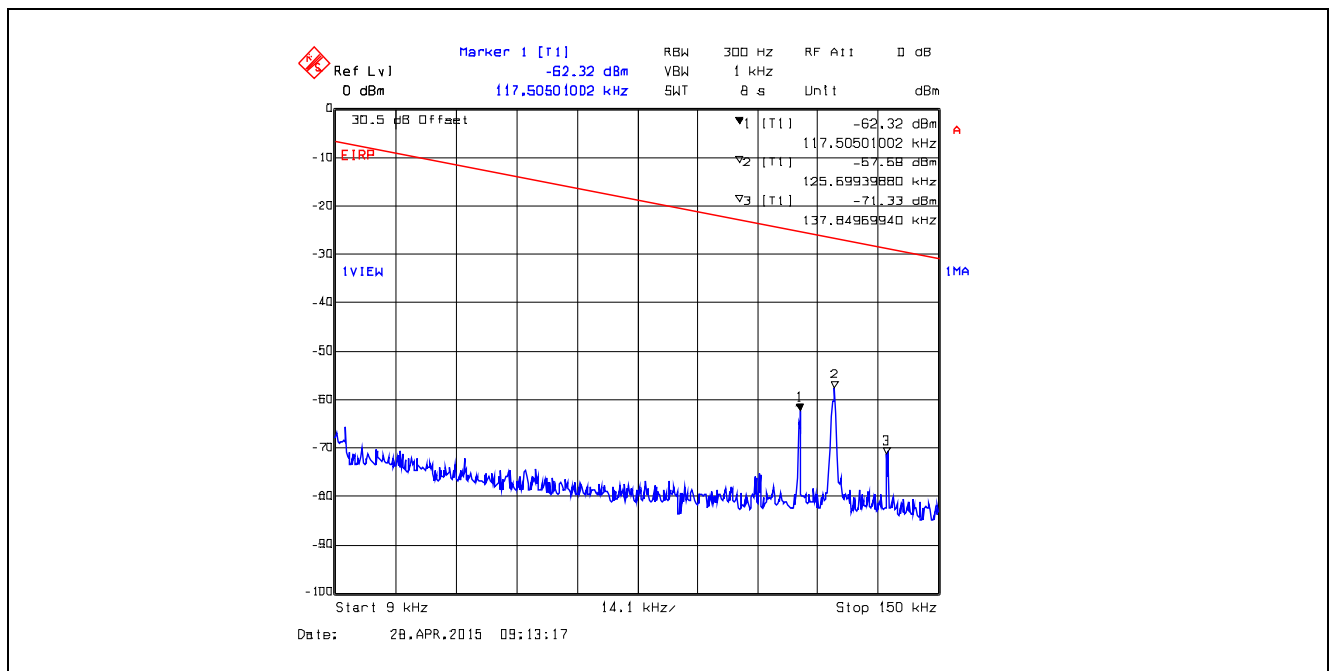
Plot 5.4.4.4.39. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 1 GHz – 4 GHz, Peak Detector



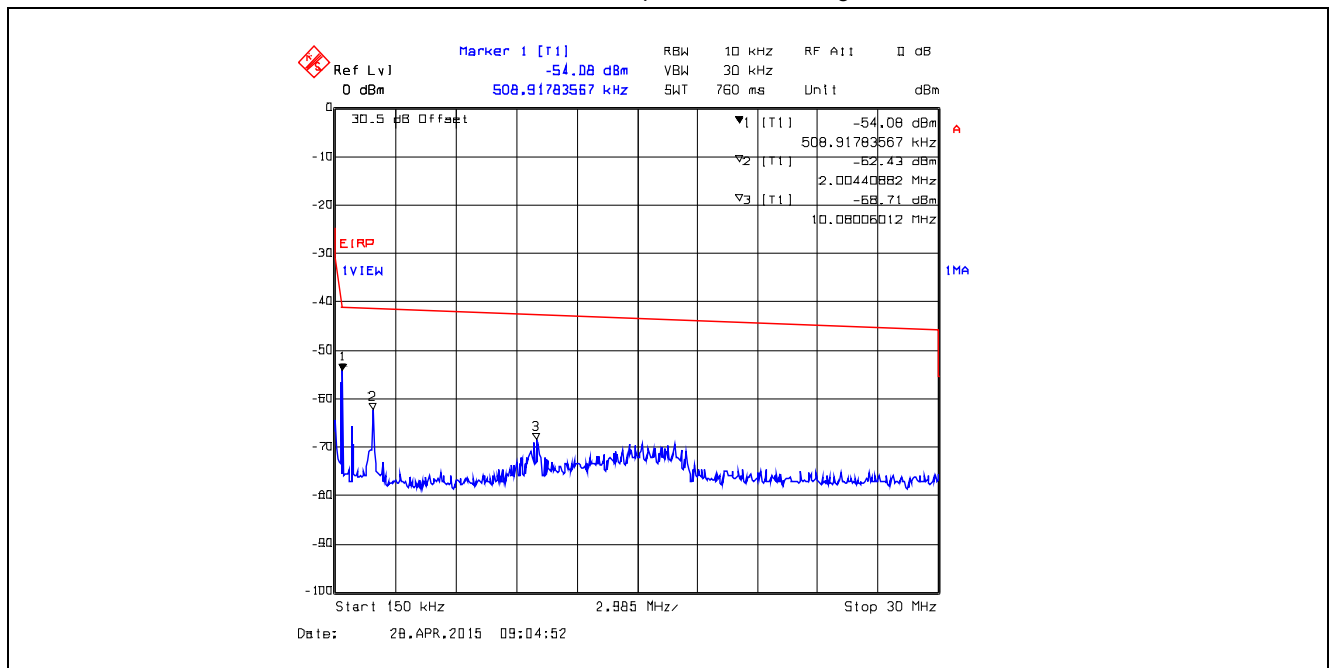
Plot 5.4.4.4.40. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 6, 2437 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 4 GHz – 25 GHz, Peak Detector



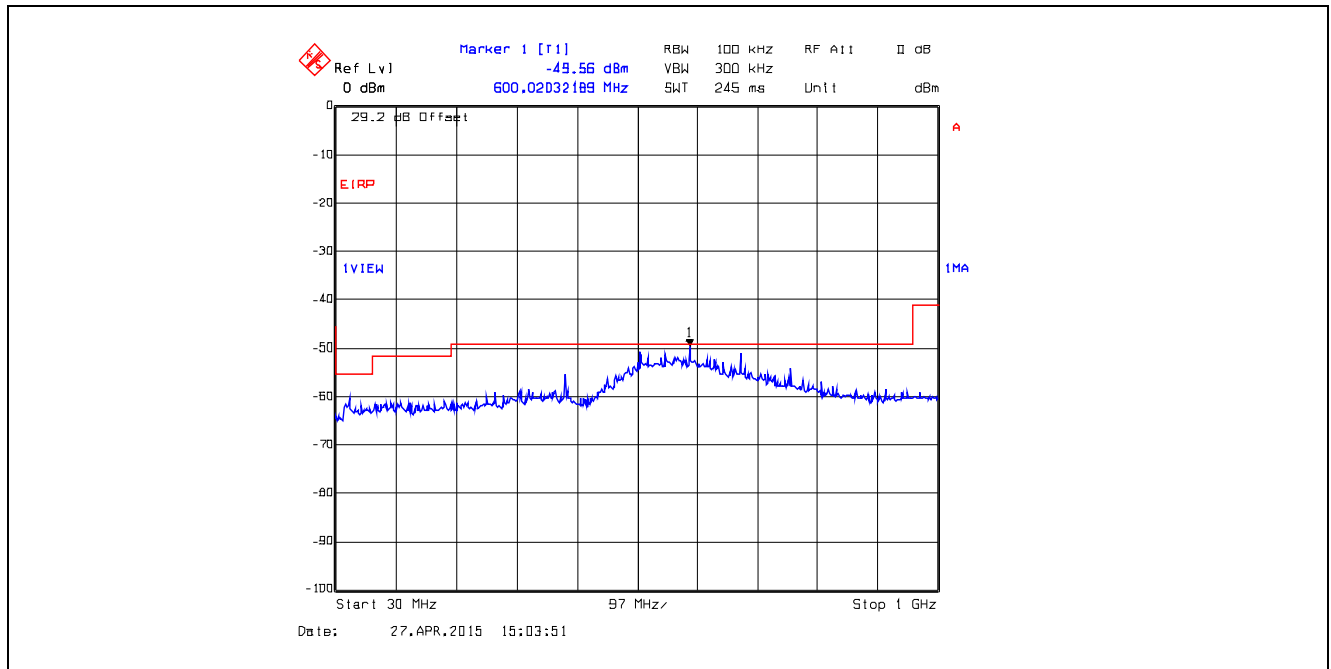
Plot 5.4.4.41. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 9 kHz – 150 kHz, Peak Detector



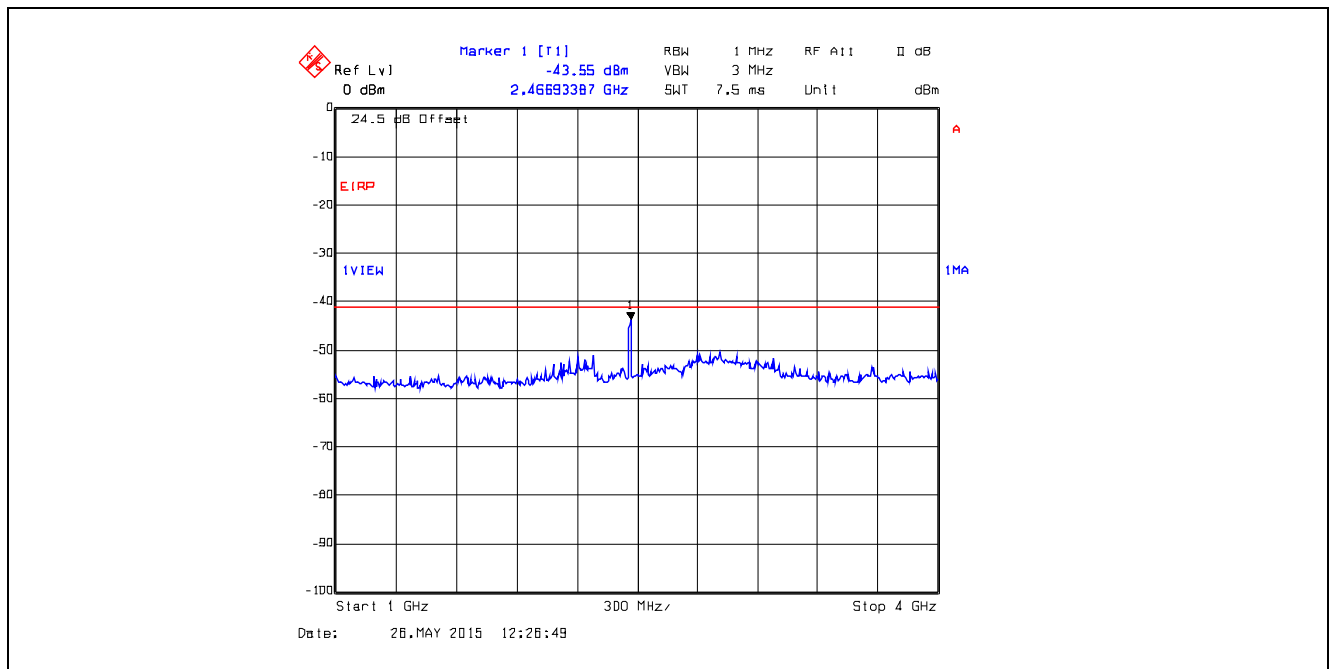
Plot 5.4.4.42. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 150 kHz - 30 MHz, Peak Detector



Plot 5.4.4.43. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 30 MHz – 1 GHz, Peak Detector
Marker 1 is outside of RB



Plot 5.4.4.44. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 1 GHz - 4 GHz, Peak Detector



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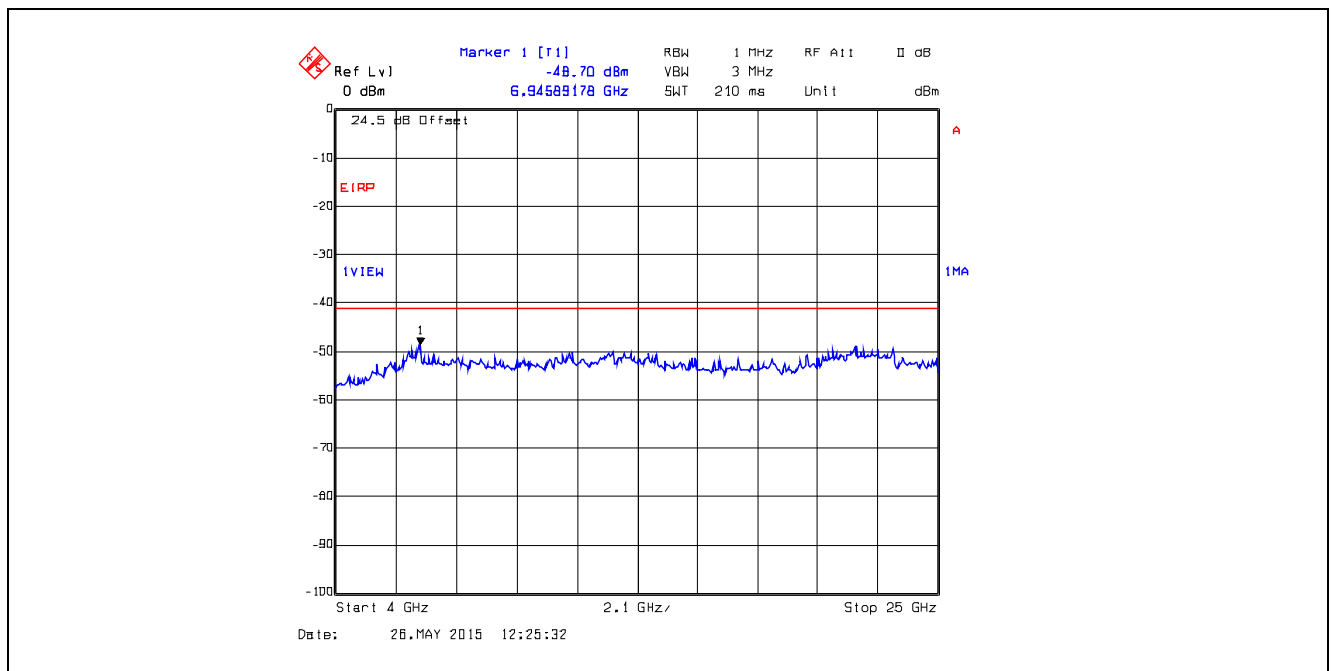
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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Plot 5.4.4.45. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT20, Ch 11, 2462 MHz, 64-QAM 5/6 65 Mbps, TX Gain Setting 26, 4 GHz - 25 GHz, Peak Detector



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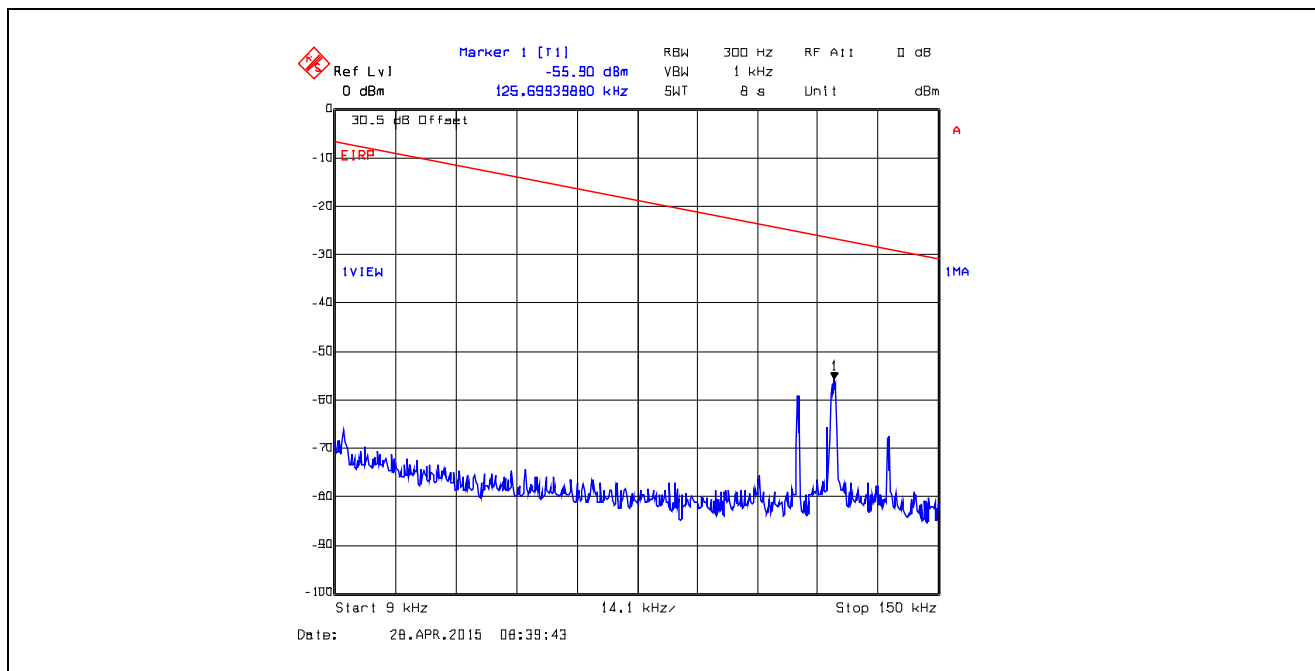
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 15MCRS083_FCC15C247DTS

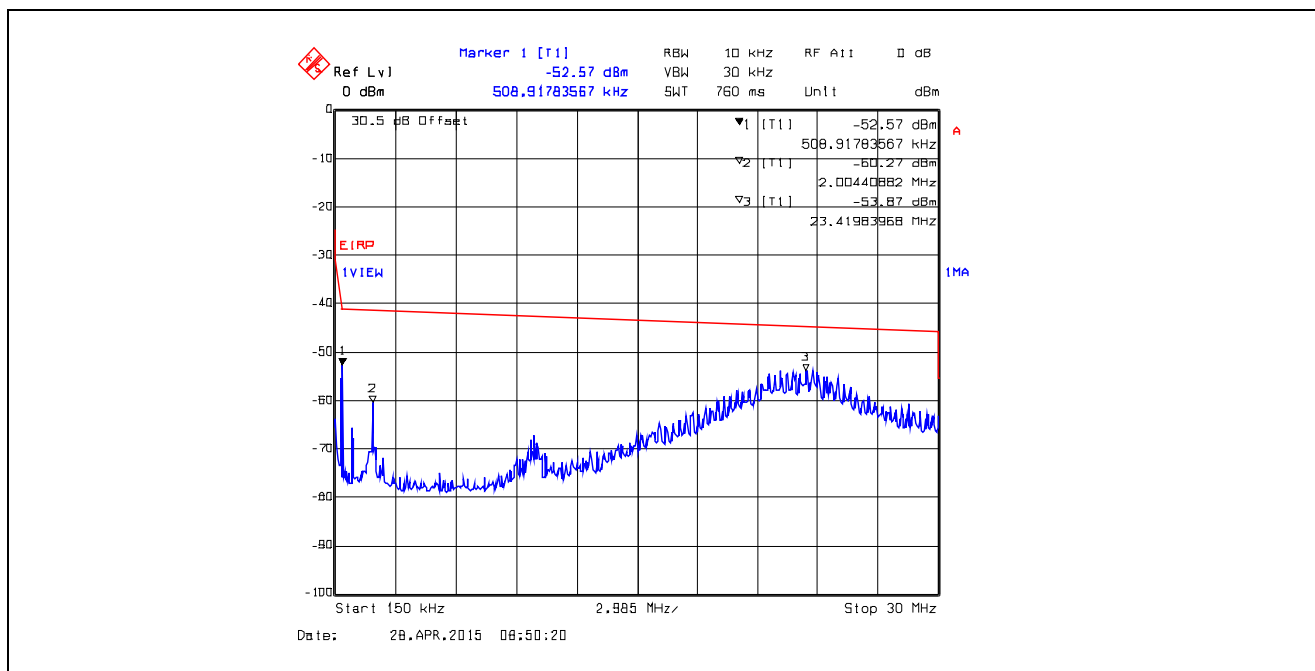
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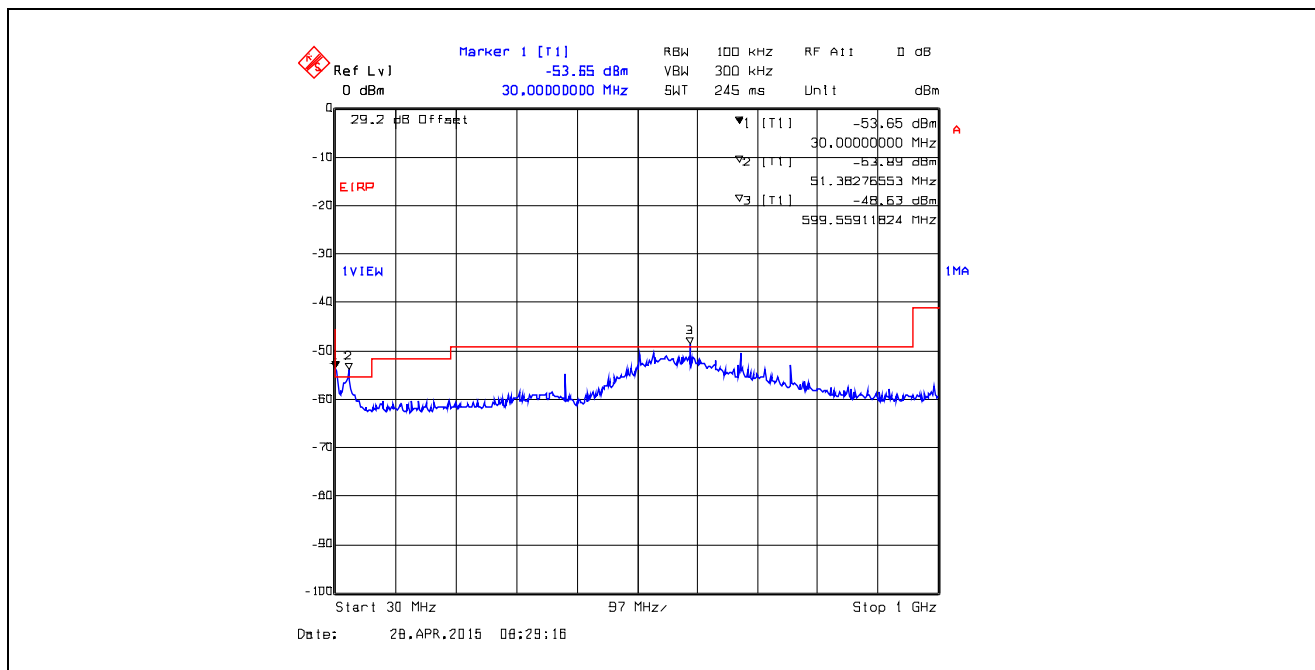
Plot 5.4.4.46. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 9 kHz - 150 kHz, Peak Detector



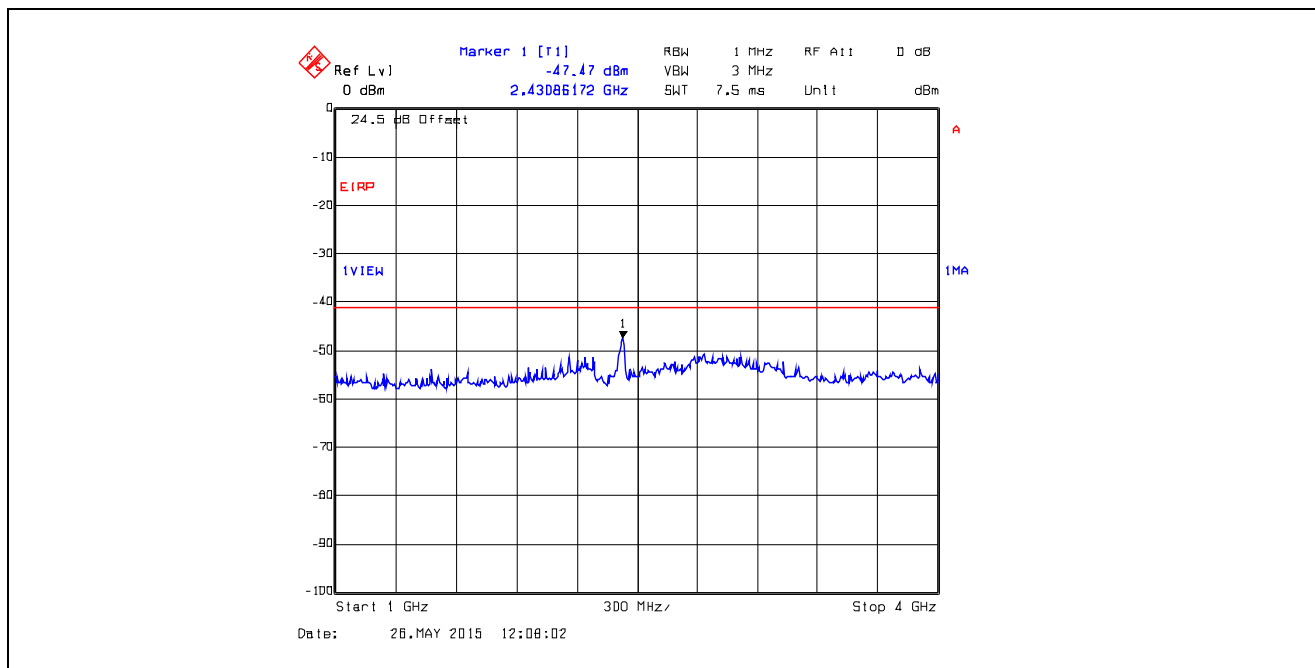
Plot 5.4.4.47. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 150 kHz - 30 MHz, Peak Detector



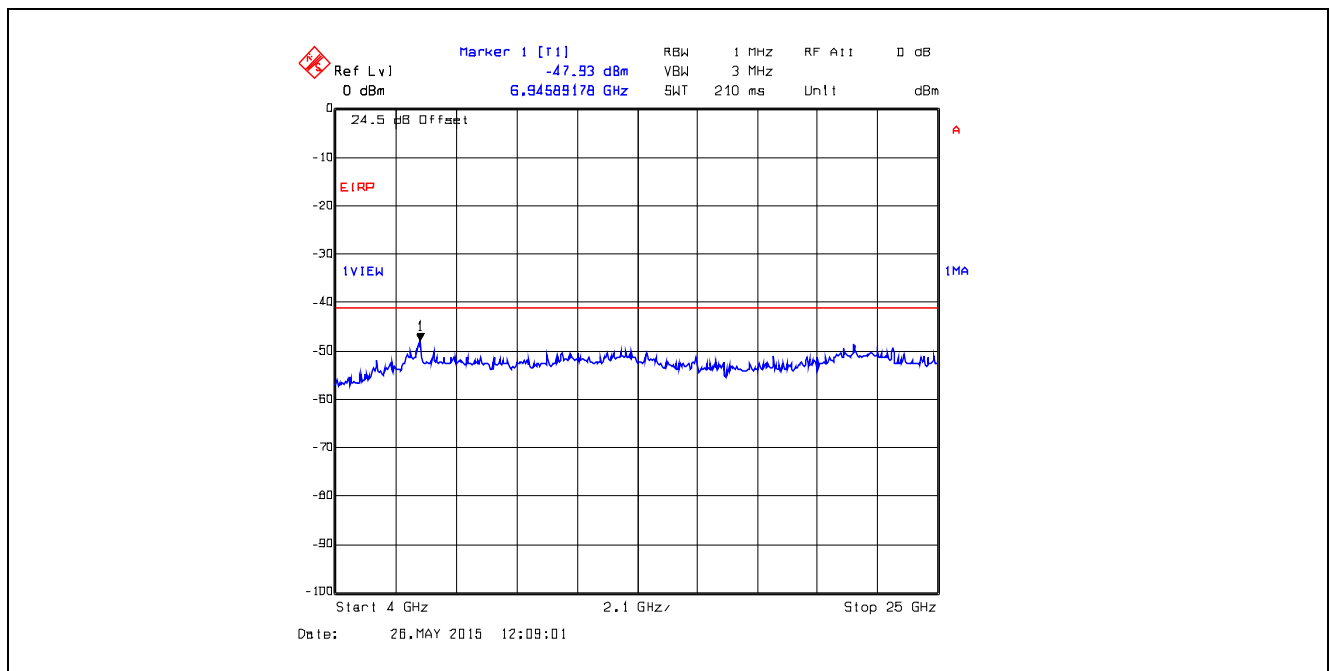
Plot 5.4.4.48. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 30 MHz - 1 GHz, Peak Detector
Marker 1, 2 & 3 are outside of RB



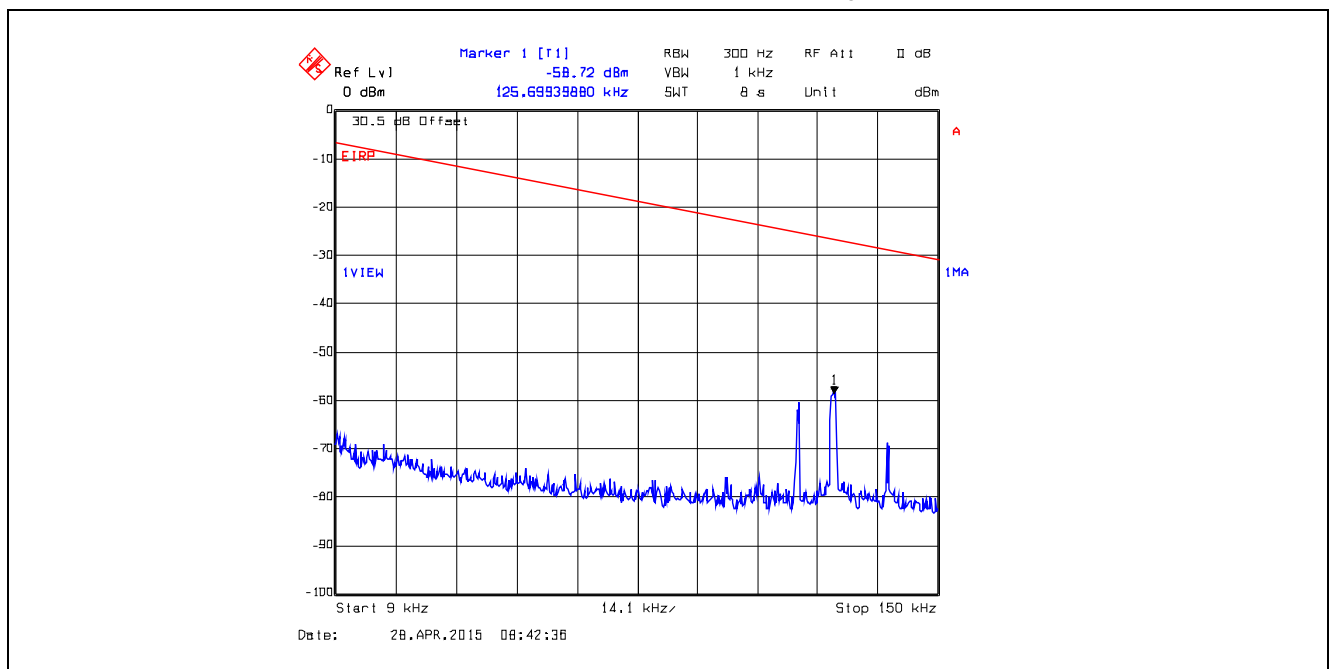
Plot 5.4.4.49. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 1 GHz - 4 GHz, Peak Detector



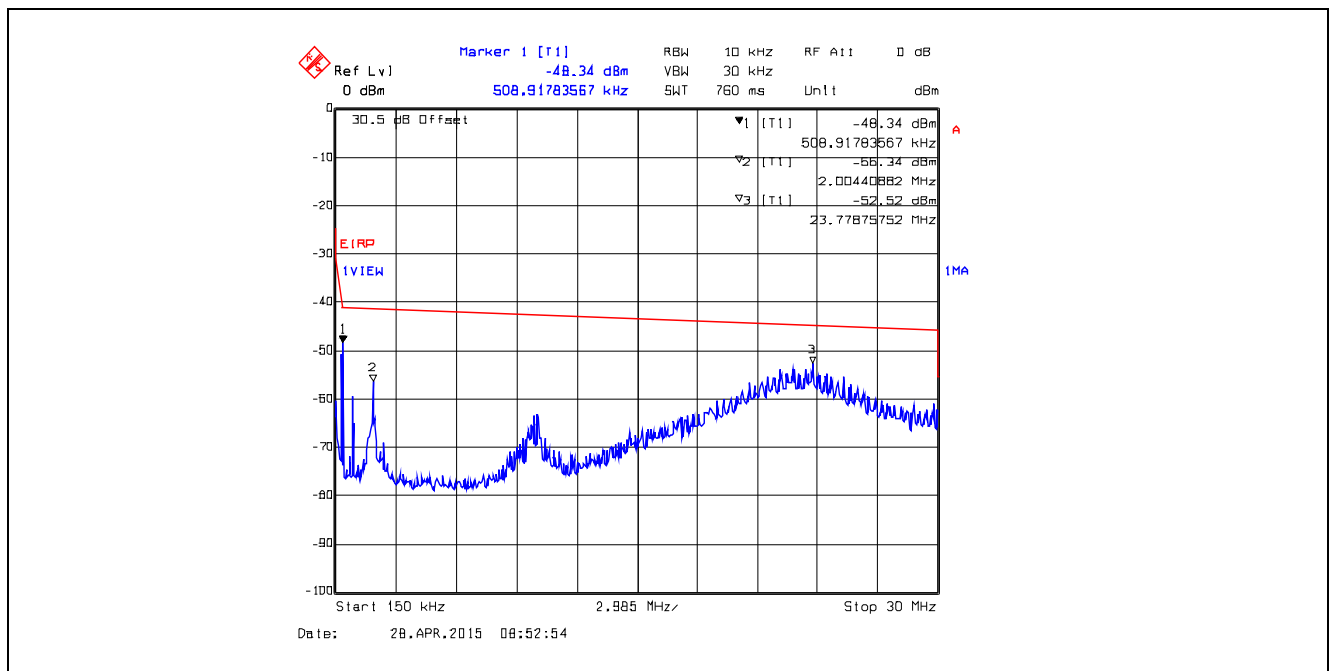
Plot 5.4.4.4.50. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 3 2422 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 4 GHz – 25 GHz, Peak Detector



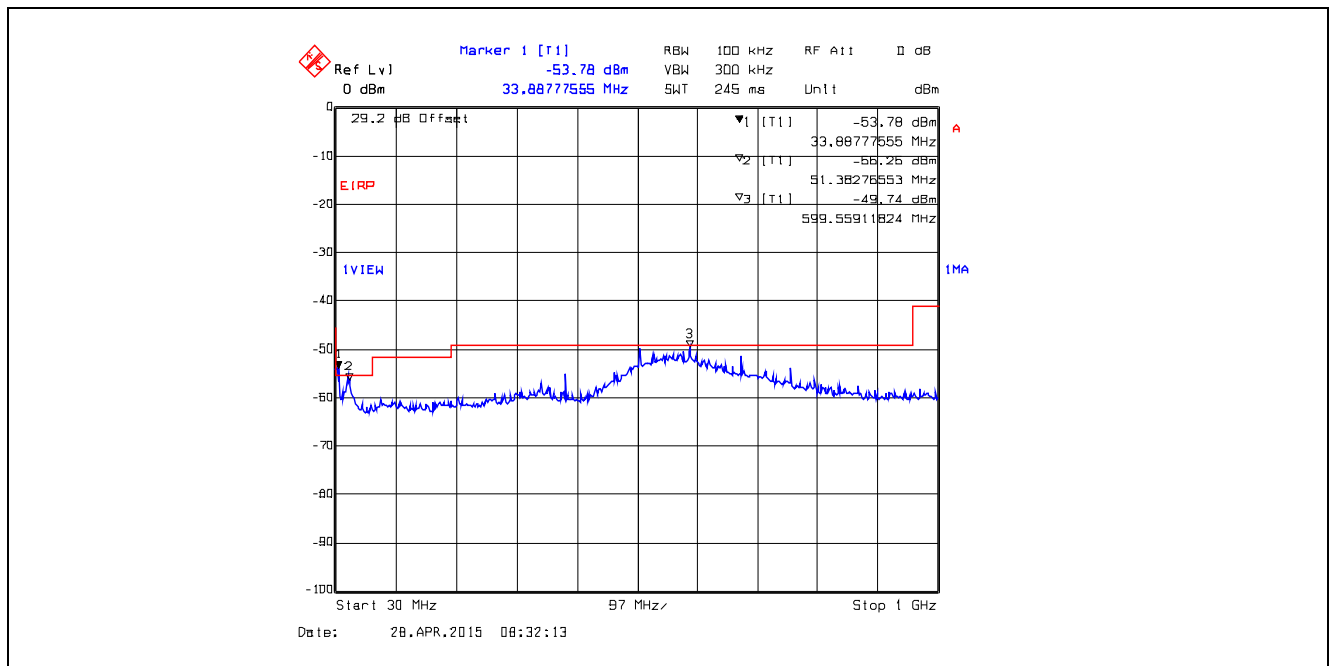
Plot 5.4.4.4.51. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 9 kHz – 150 kHz, Peak Detector



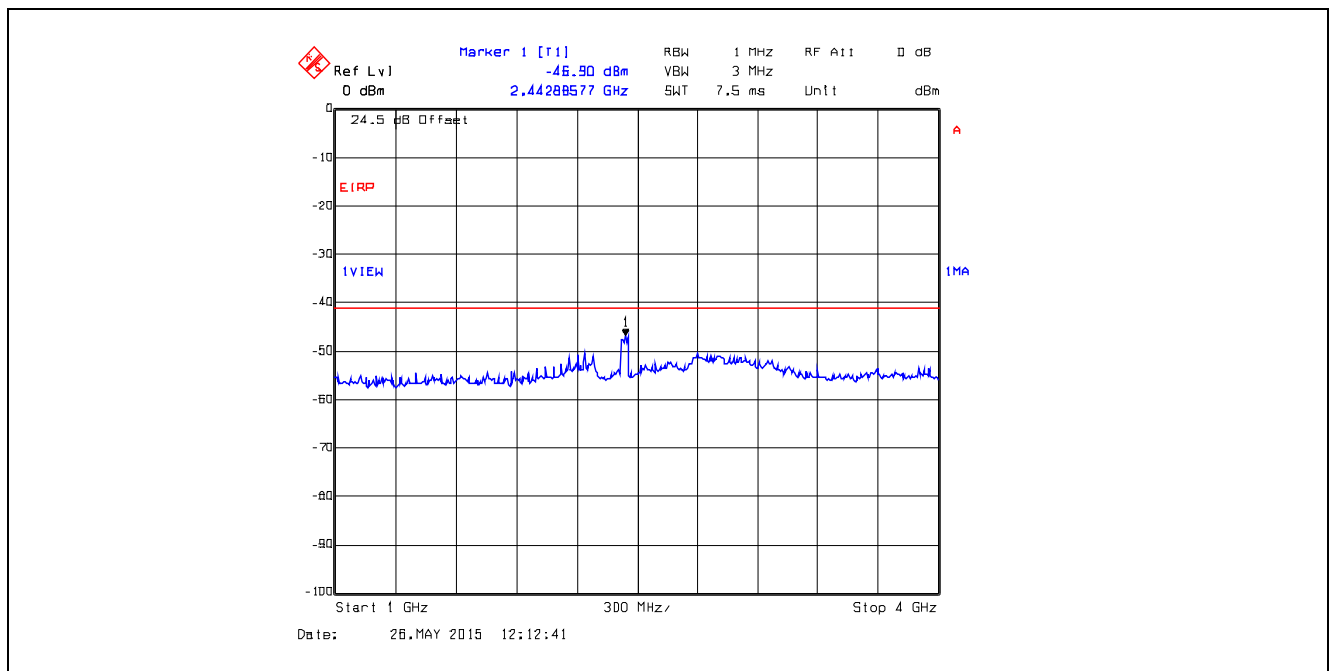
Plot 5.4.4.4.52. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 150 kHz – 30 MHz, Peak Detector



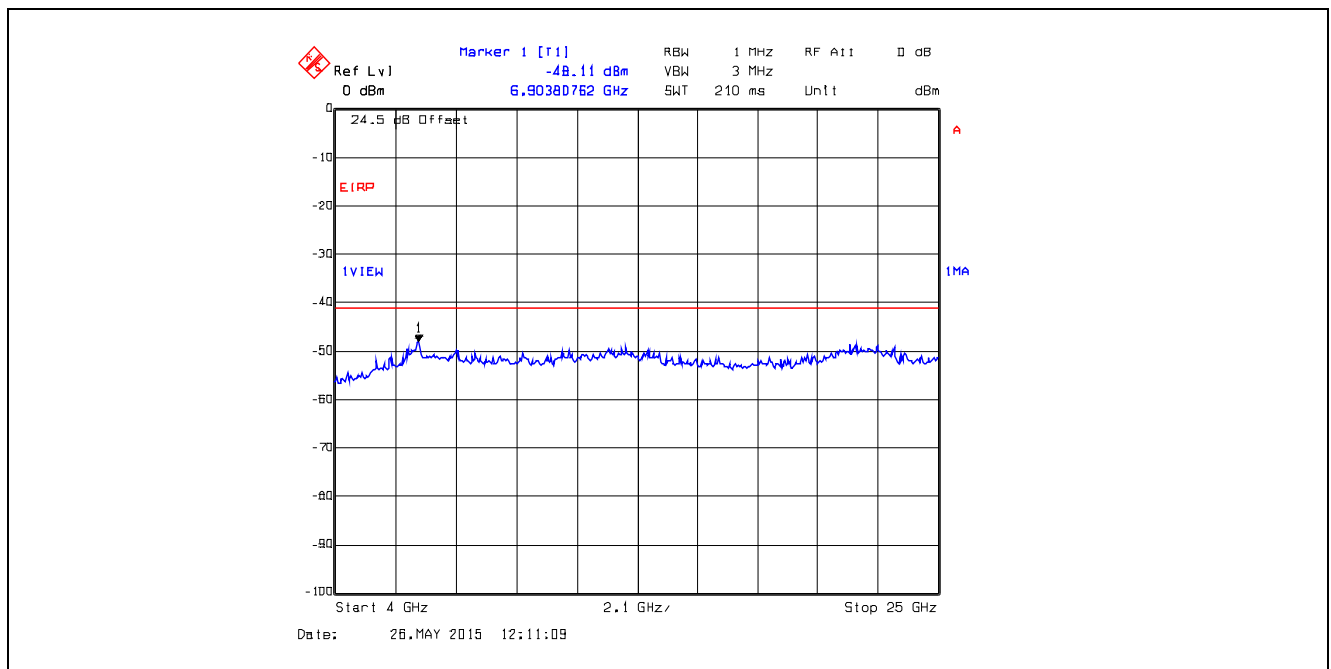
Plot 5.4.4.4.53. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 30 MHz – 1 GHz, Peak Detector
Marker 1, 2 & 3 are outside of RB



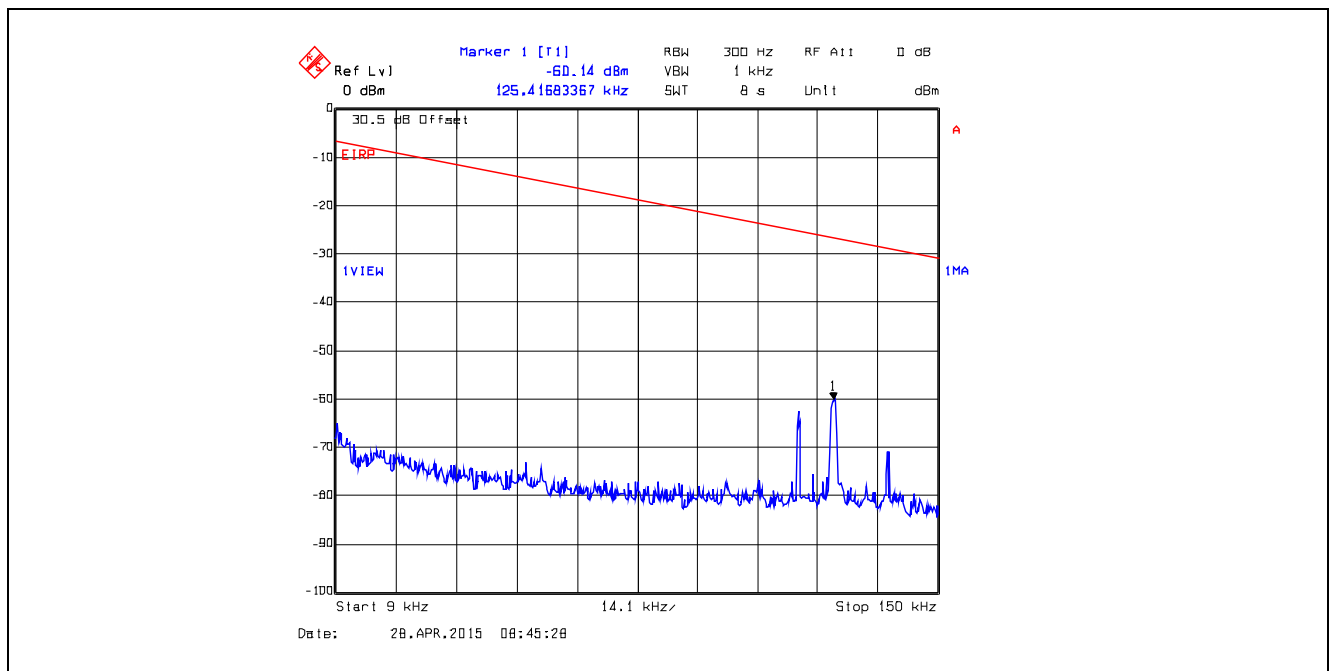
Plot 5.4.4.54. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 1 GHz - 4 GHz, Peak Detector



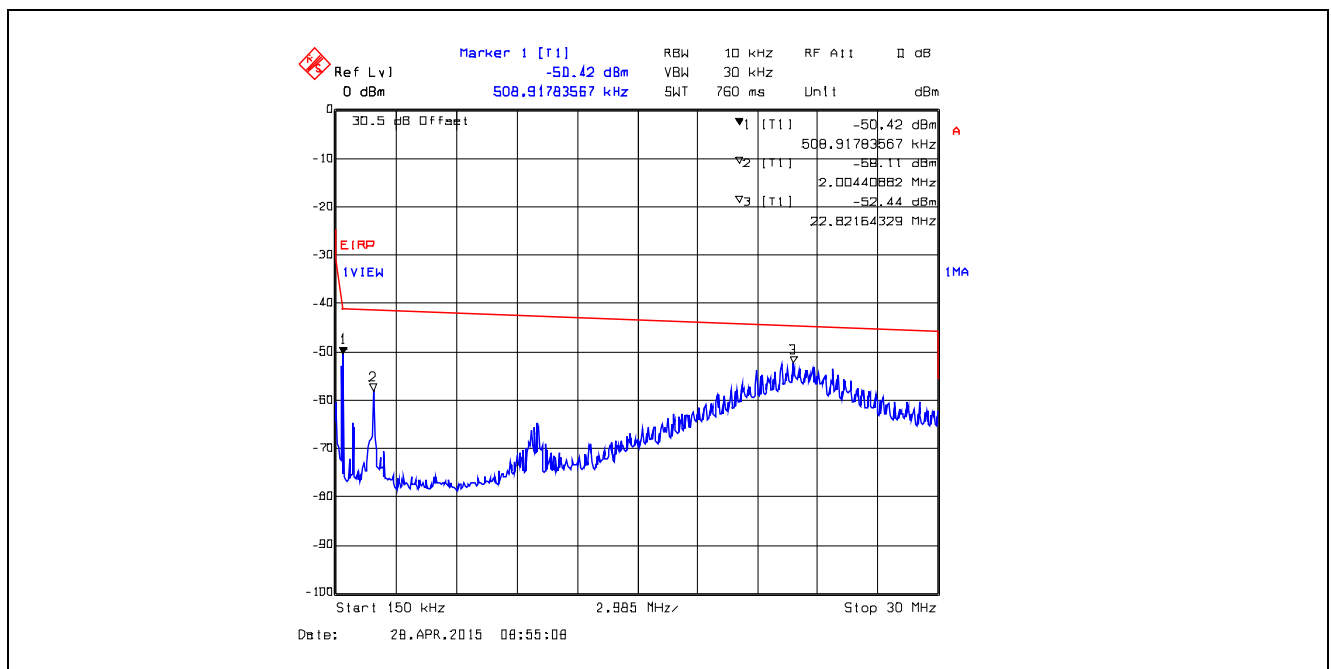
Plot 5.4.4.55. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 6 2437 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 4 GHz - 25 GHz, Peak Detector



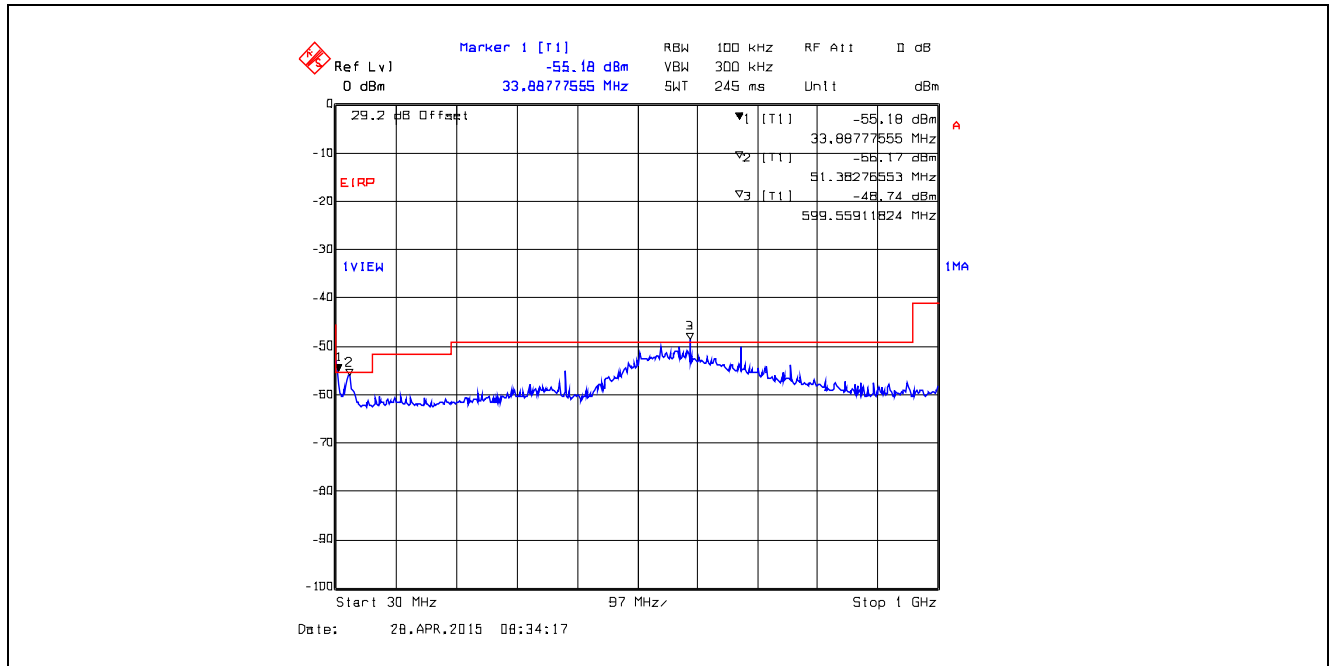
Plot 5.4.4.56. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 9 kHz – 150 kHz, Peak Detector



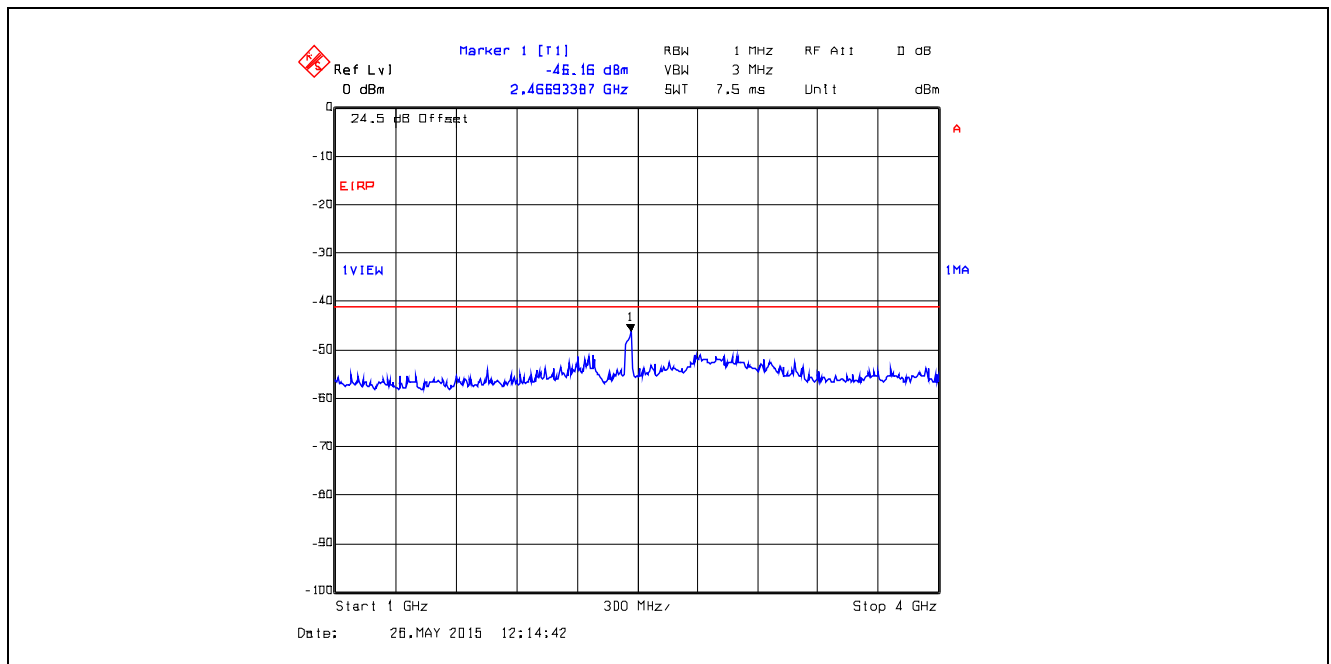
Plot 5.4.4.57. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 150 kHz – 30 MHz, Peak Detector



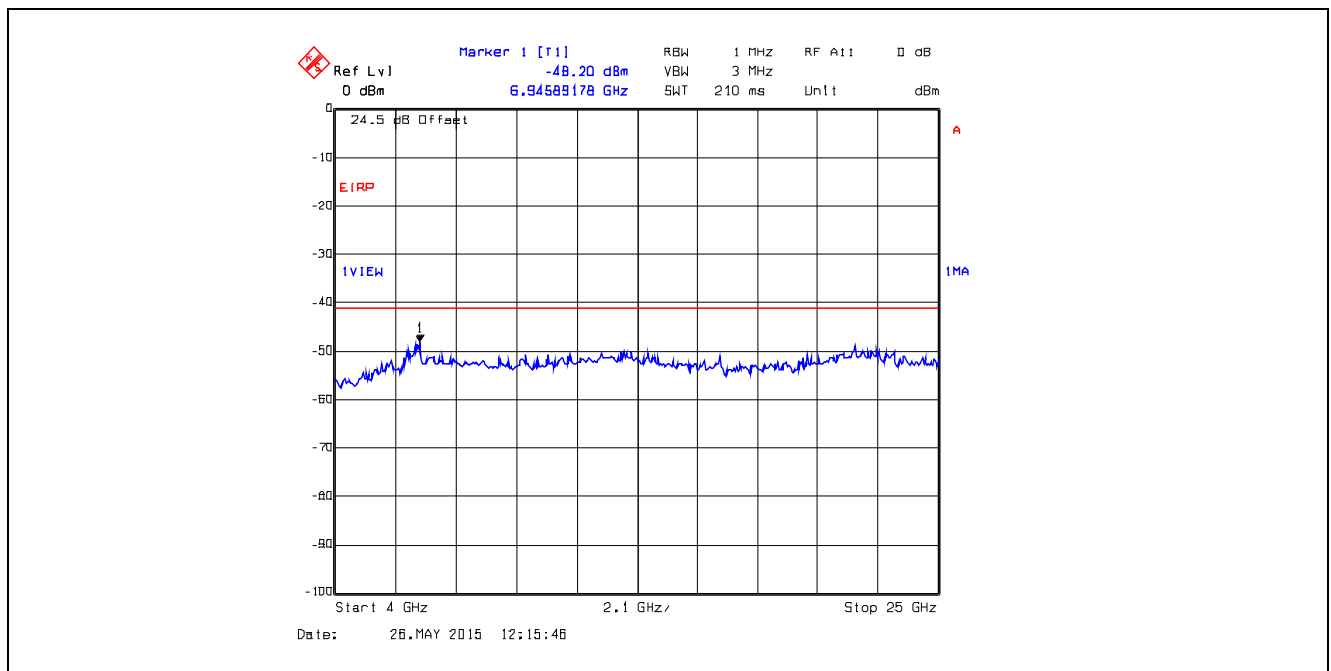
Plot 5.4.4.58. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 30 MHz – 1 GHz, Peak Detector
Markers 1, 2 & 3 are outside of RB



Plot 5.4.4.59. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 1 GHz – 4 GHz, Peak Detector



Plot 5.4.4.4.60. Conducted Spurious Emissions in Restricted Frequency Bands
802.11n HT40, Ch 9 2452 MHz, 64-QAM 5/6 135 Mbps, TX Gain Setting 27, 4 GHz – 25 GHz, Peak Detector



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

5.5.1. 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 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)).

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

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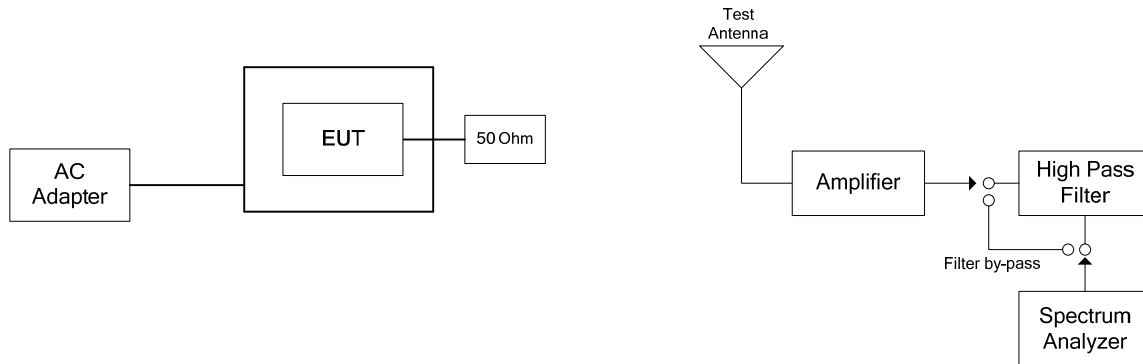
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5.5.2. Method of Measurements

KDB Publication No. 558074 D01 DTS Meas Guidance V03r02, Section 12.2.7 and ANSI C63.10.

5.5.3. Test Arrangement



5.5.4. Test Data

Remark(s):

- 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.
- § 15.247 (d) spurious emission limit:

$$E = (EIRP - 20\log(d) + 104.8) - 20 = (36 \text{ dBm} - 20\log(3) + 104.8) - 20 = 111.3 \text{ dB}\mu\text{V/m}$$
- Exploratory tests performed to determined worst-case test configurations, the following test results at high power setting represent the worst-case.

5.5.4.1. 802.11b, DBPSK 1 Mbps, High Power, TX Gain Setting 53

Fundamental Frequency:		2412 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dB μ V/m)	RF Avg Level (dB μ V/m)	Antenna Plane (H/V)	Limit 15.209 (dB μ V/m)	Limit 15.247 (dB μ V/m)	Margin (dB)	Pass/Fail
4824	50.71	37.31	V	54.0	111.3	-16.7	Pass*
4824	50.54	36.78	H	54.0	111.3	-17.2	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

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

Fundamental Frequency:		2437 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dB μ V/m)	RF Avg Level (dB μ V/m)	Antenna Plane (H/V)	Limit 15.209 (dB μ V/m)	Limit 15.247 (dB μ V/m)	Margin (dB)	Pass/Fail
4874	50.71	37.81	V	54.00	111.3	-16.19	Pass*
4874	51.24	37.58	H	54.00	111.3	-16.42	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

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

Fundamental Frequency:		2462 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dB μ V/m)	RF Avg Level (dB μ V/m)	Antenna Plane (H/V)	Limit 15.209 (dB μ V/m)	Limit 15.247 (dB μ V/m)	Margin (dB)	Pass/Fail
4924	50.06	36.78	V	54.0	111.3	-17.2	Pass*
4924	50.52	36.49	H	54.0	111.3	-17.5	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

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

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June 16, 2015

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5.5.4.2. 802.11g, 64-QAM 54 Mbps, High Power, TX Gain Setting 47

Fundamental Frequency:		2412 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:		2437 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:		2462 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

5.5.4.3. 802.11n HT20, 64-QAM 5/6 65 Mbps, High Power, TX Gain Setting 48

Fundamental Frequency:		2412 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:		2437 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:		2462 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

5.5.4.4. 802.11n HT40, 64-QAM 5/6 Mbps 135 Mbps, High Power, TX Gain Setting 50

Fundamental Frequency:		2422 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:		2437 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

Fundamental Frequency:		2452 MHz					
Frequency Test 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
30 - 25000	*	*	H/V	*	111.3	*	*
*All spurious emissions and harmonics are more than 20 dB below the applicable limit.							

5.6. POWER SPECTRAL DENSITY [§ 15.247(e)]

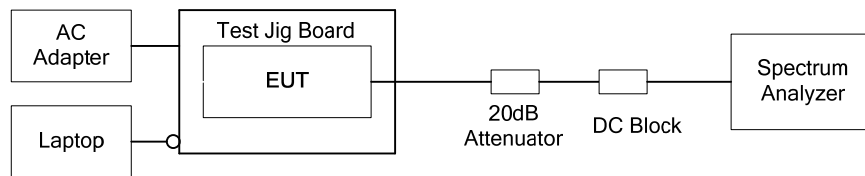
5.6.1. Limit(s)

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.

5.6.2. Method of Measurements

Publication No. KDB Publication No. 558074 D01 DTS Meas Guidance V03r02, Section 10.2 Method PKPSD

5.6.3. Test Arrangement



5.6.4. Test Data

802.11b					
Modulation	Data Rate (Mbps)	Channel Number	Frequency (MHz)	PSD (dBm)	Limit (dBm)
DBPSK	1	1	2412	5.04	8
		6	2437	4.52	8
		11	2462	5.36	8
DQPSK	2	1	2412	5.03	8
		6	2437	3.93	8
		11	2462	5.67	8
CCK	11	1	2412	0.10	8
		6	2437	-0.10	8
		11	2462	0.56	8

802.11g					
Modulation	Data Rate (Mbps)	Channel Number	Frequency (MHz)	PSD (dBm)	Limit (dBm)
BPSK	9	1	2412	-4.93	8
		6	2437	-5.26	8
		11	2462	-4.69	8
QPSK	18	1	2412	-4.58	8
		6	2437	-5.04	8
		11	2462	-5.01	8
16-QAM	36	1	2412	-5.32	8
		6	2437	-5.48	8
		11	2462	-4.87	8
64-QAM	54	1	2412	-3.85	8
		6	2437	-5.68	8
		11	2462	-3.61	8

802.11n HT20						
MCS Index	Modulation	Data Rate (Mbps)	Channel Number	Frequency (MHz)	PSD (dBm)	Limit (dBm)
0	BPSK 1/2	6.5	1	2412	-2.55	8
			6	2437	-5.68	8
			11	2462	-4.70	8
2	QPSK 3/4	19.5	1	2412	-5.00	8
			6	2437	-4.74	8
			11	2462	-3.65	8
4	16-QAM 3/4	39	1	2412	-3.43	8
			6	2437	-4.68	8
			11	2462	-4.86	8
7	64-QAM 5/6	65	1	2412	-4.15	8
			6	2437	-5.49	8
			11	2462	-4.09	8

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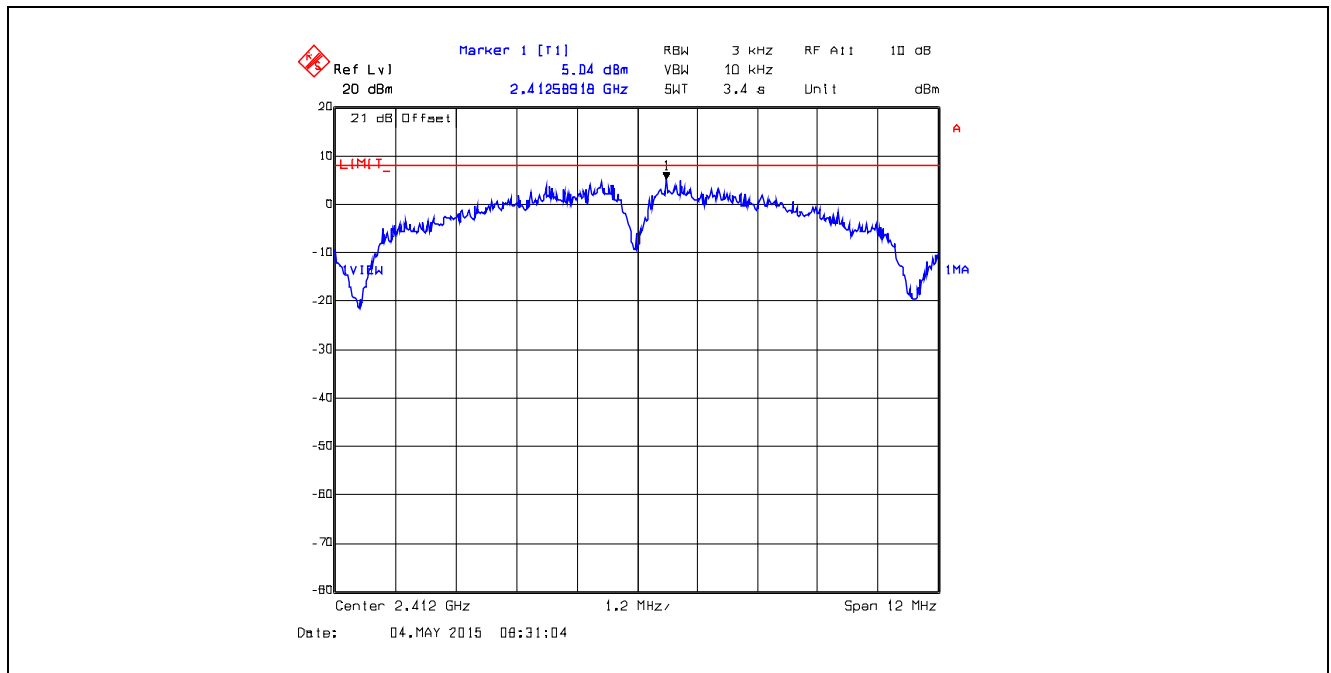
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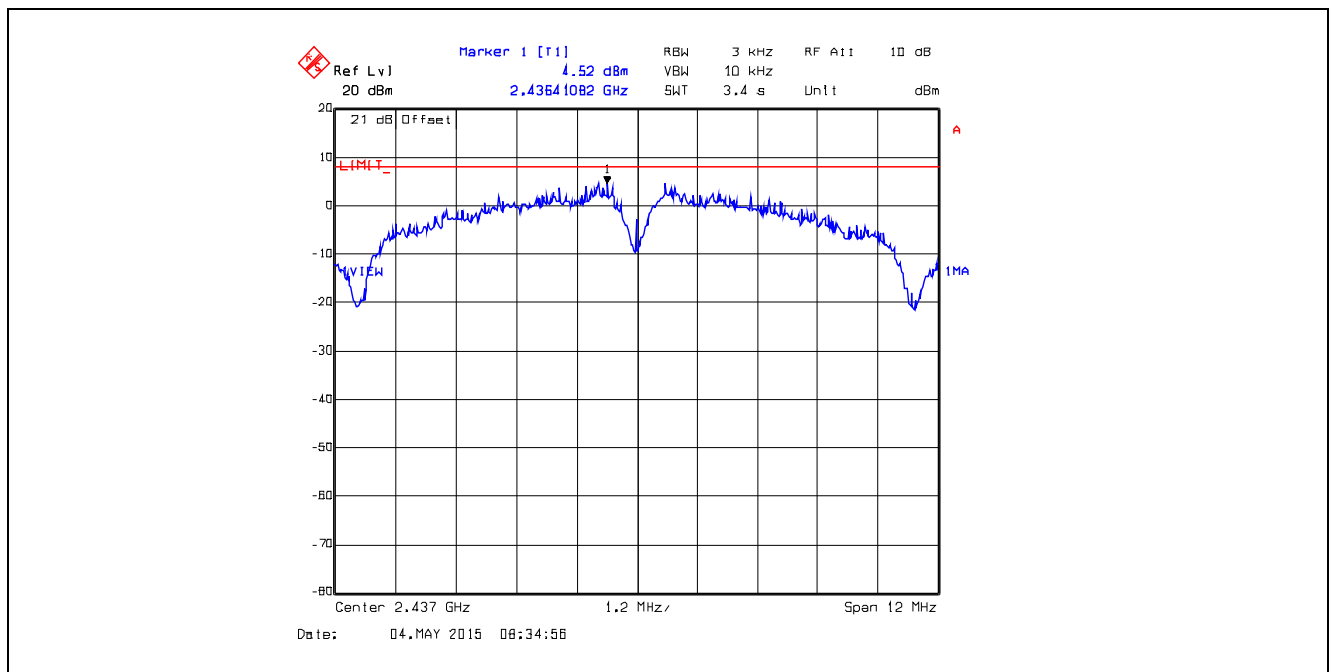
802.11n HT40						
MCS Index	Modulation	Data Rate (Mbps)	Channel Number	Frequency (MHz)	PSD (dBm)	Limit (dBm)
0	BPSK 1/2	13.5	3	2422	-5.59	8
			6	2437	-5.86	8
			9	2452	-7.29	8
2	QPSK 3/4	40.5	3	2422	-6.40	8
			6	2437	-7.44	8
			9	2452	-6.94	8
4	16-QAM 3/4	81	3	2422	-3.73	8
			6	2437	-5.85	8
			9	2452	-7.08	8
7	64-QAM 5/6	135	3	2422	-4.29	8
			6	2437	-5.68	8
			9	2452	-5.44	8

See the following plots for measurement details.

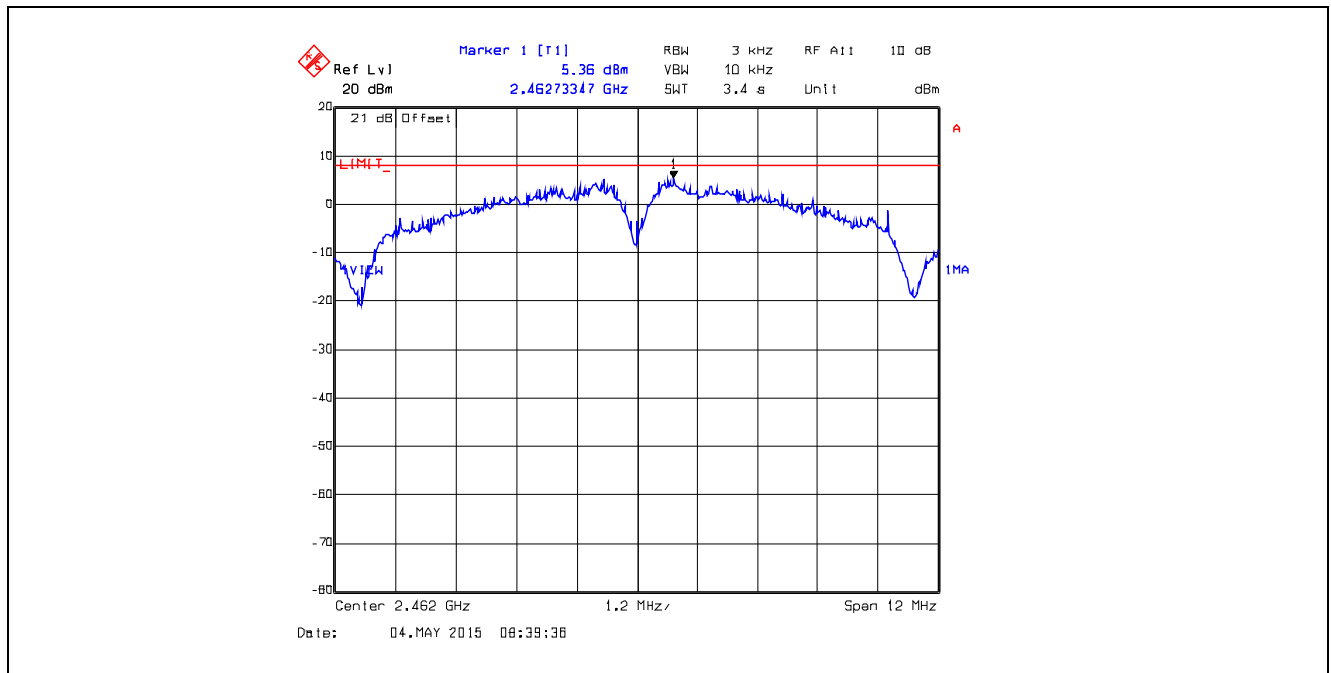
Plot 5.6.4.1. Power Spectral Density
802.11b, Ch 1, 2412 MHz, DBPSK 1 Mbps, TX Gain Setting 53



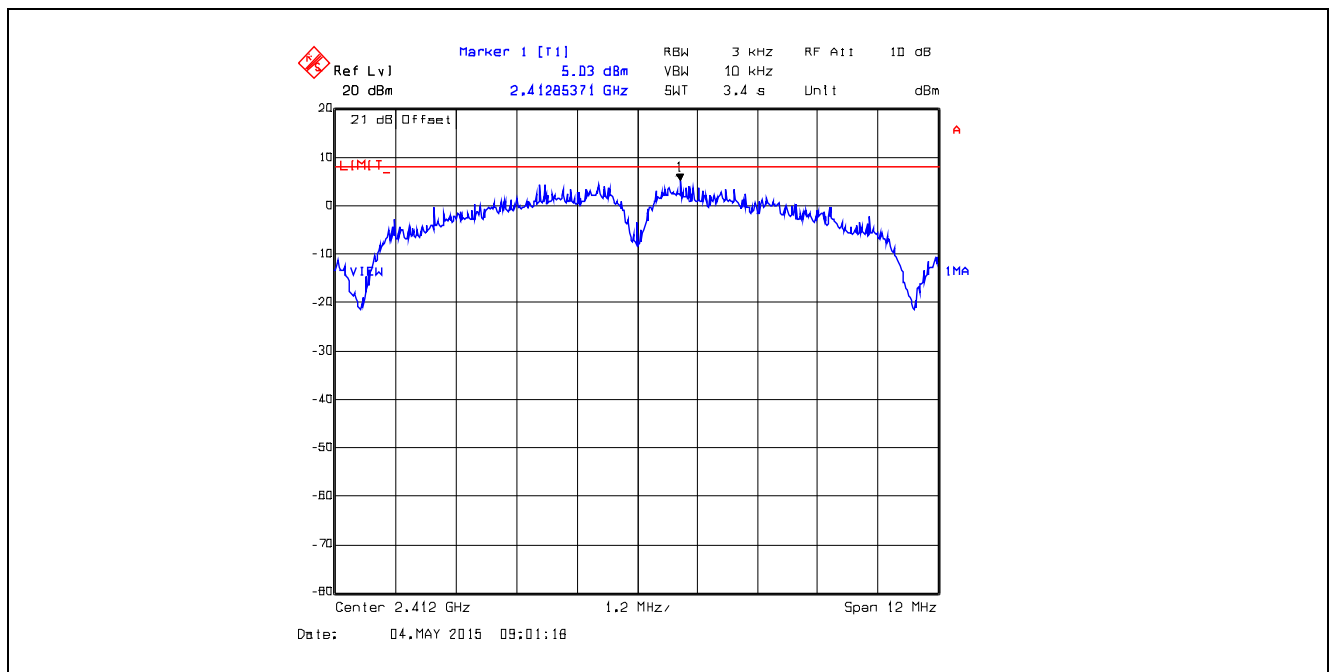
Plot 5.6.4.2. Power Spectral Density
802.11b, Ch 6, 2437 MHz, DBPSK 1 Mbps, TX Gain Setting 53



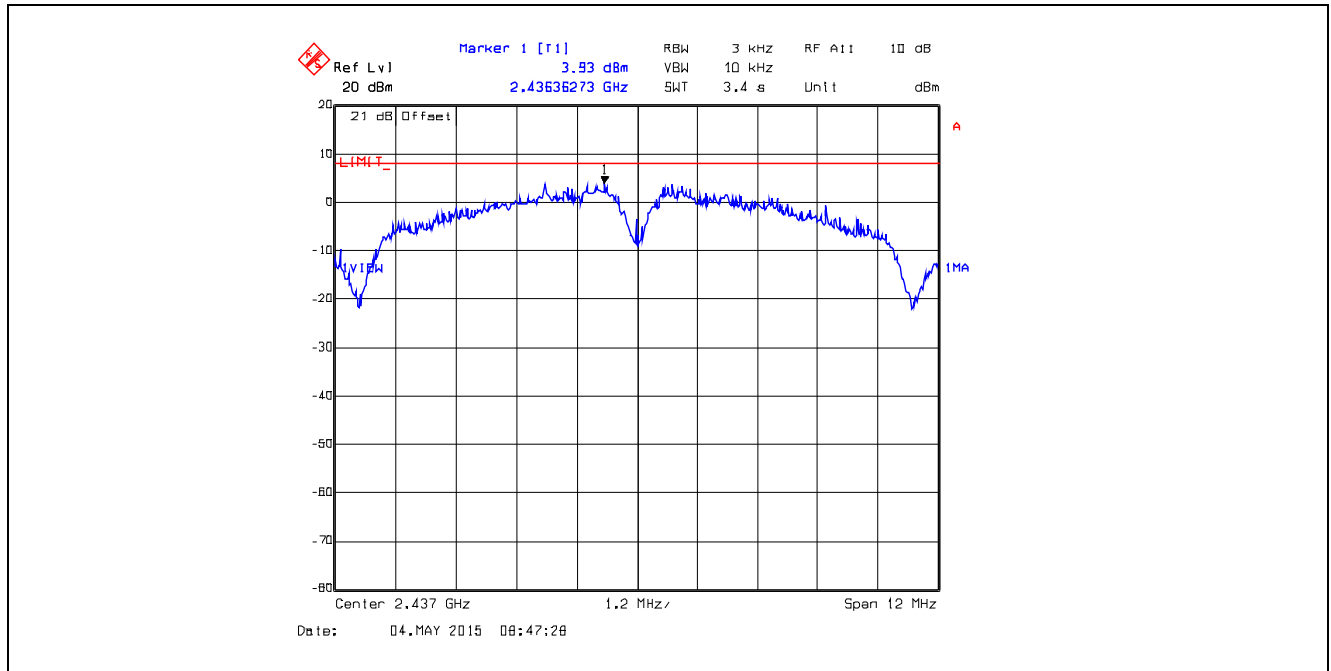
Plot 5.6.4.3. Power Spectral Density
802.11b, Ch 11, 2462 MHz, DBPSK 1 Mbps, TX Gain Setting 53



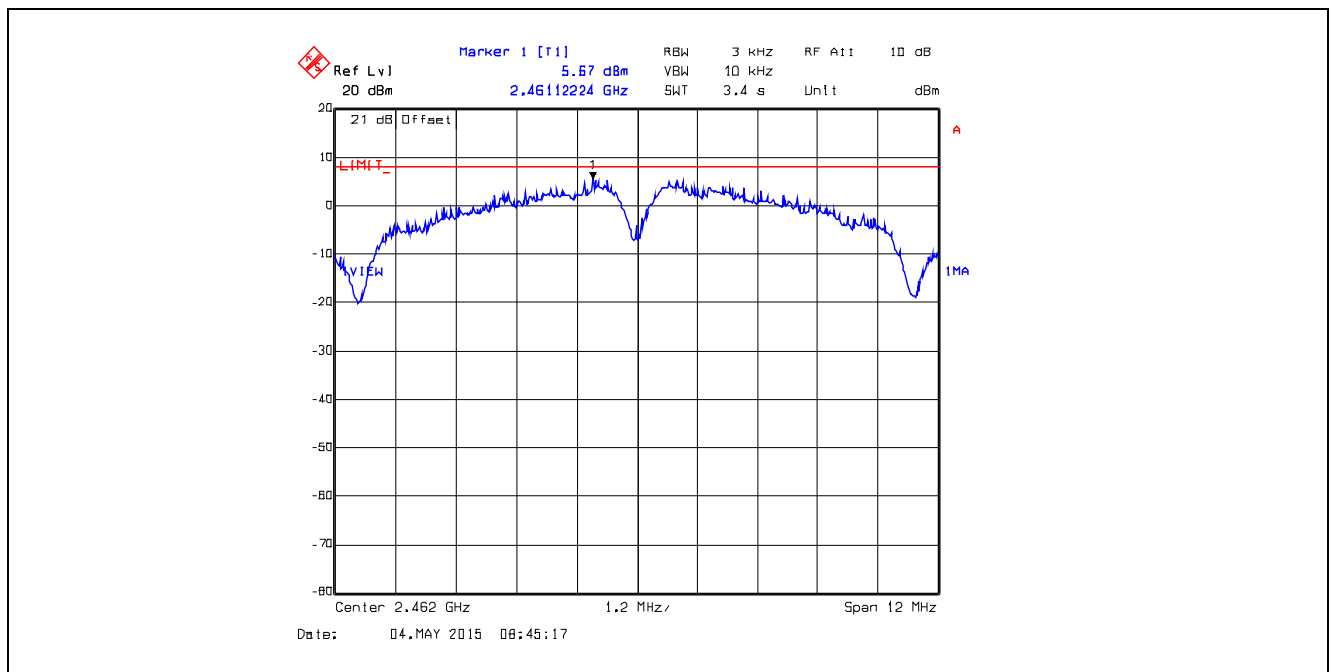
Plot 5.6.4.4. Power Spectral Density
802.11b, Ch 1, 2412 MHz, DQPSK 2 Mbps, TX Gain Setting 53



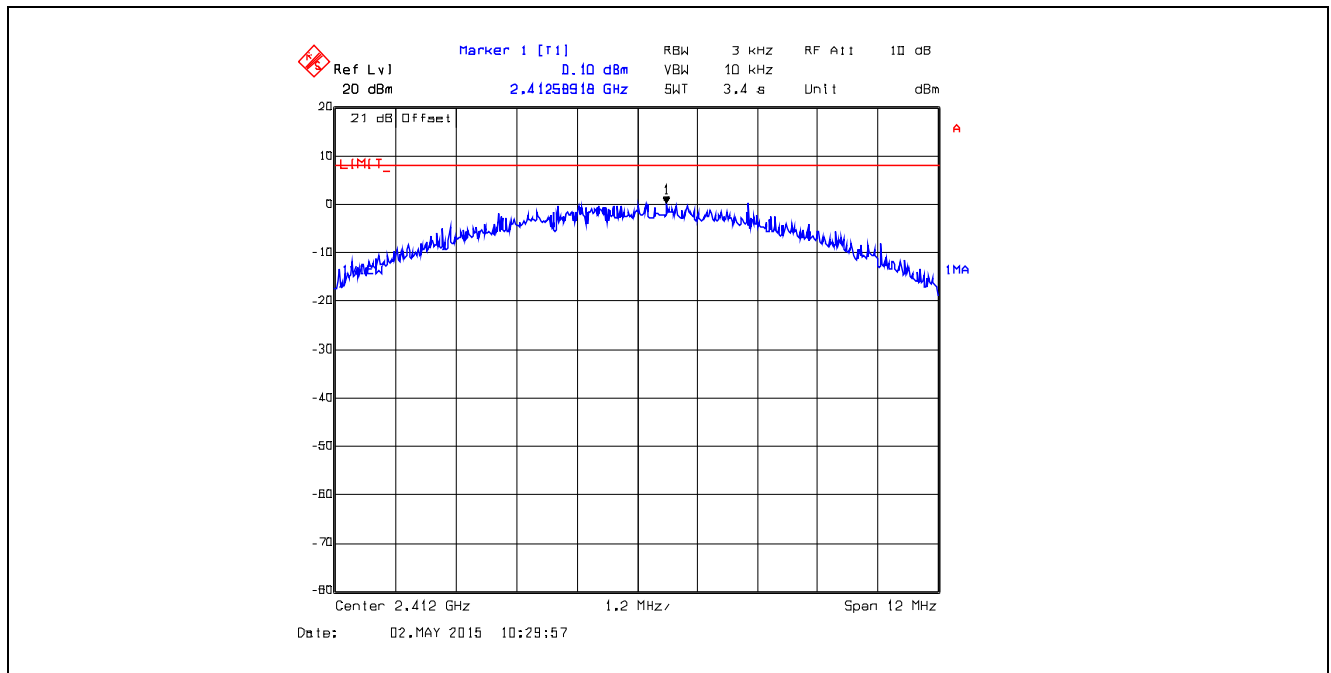
Plot 5.6.4.5. Power Spectral Density
802.11b, Ch 6, 2437 MHz, DQPSK 2 Mbps, TX Gain Setting 53



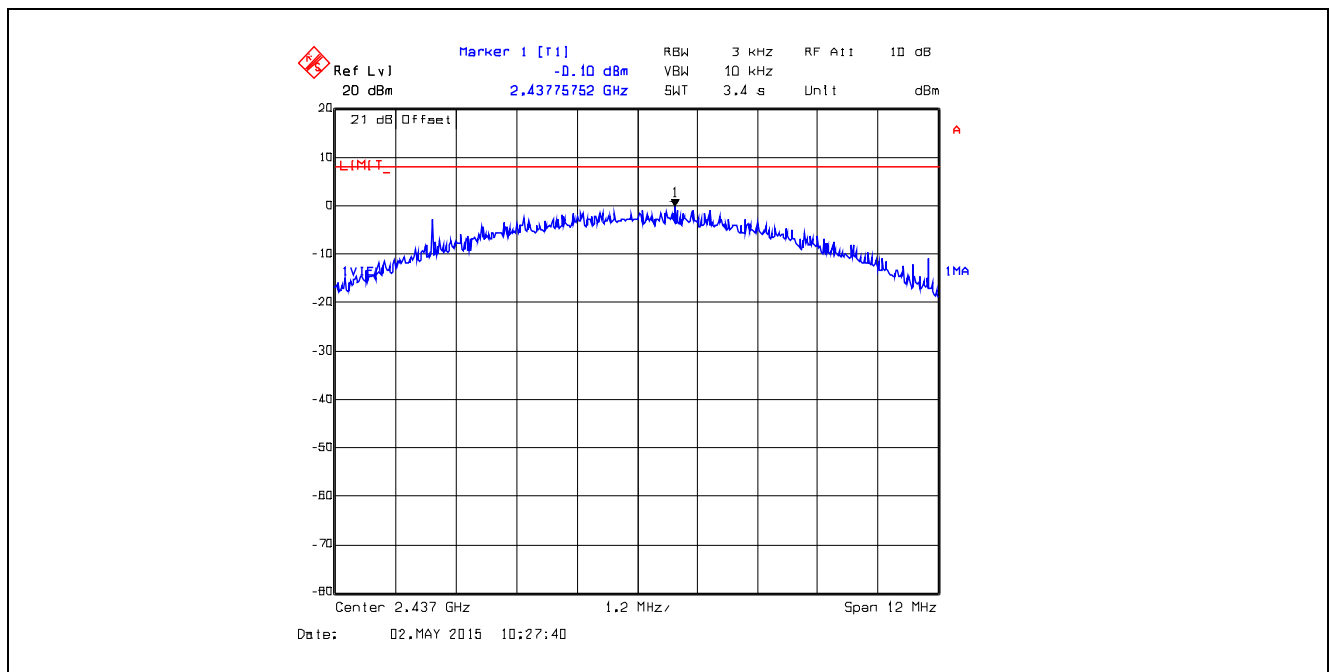
Plot 5.6.4.6. Power Spectral Density
802.11b, Ch 11, 2462 MHz, DQPSK 2 Mbps, TX Gain Setting 53



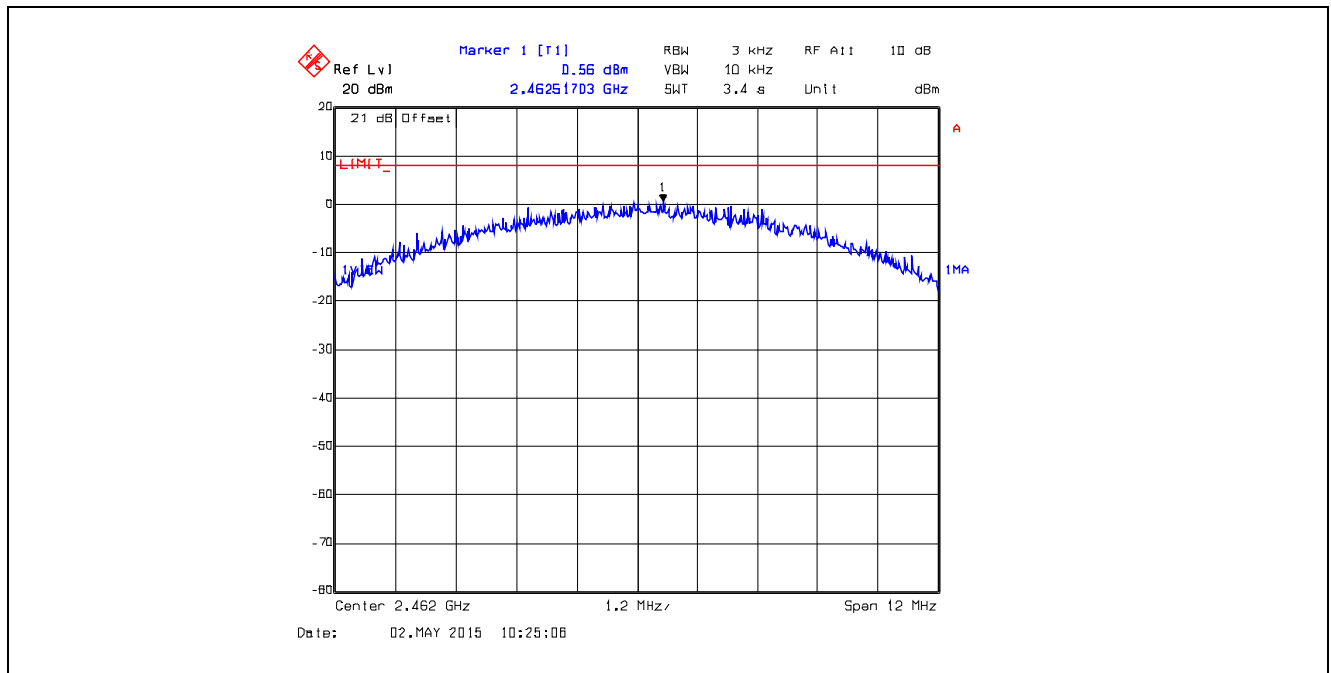
Plot 5.6.4.7. Power Spectral Density
802.11b, Ch 1, 2412 MHz, CCK 11 Mbps, TX Gain Setting 53



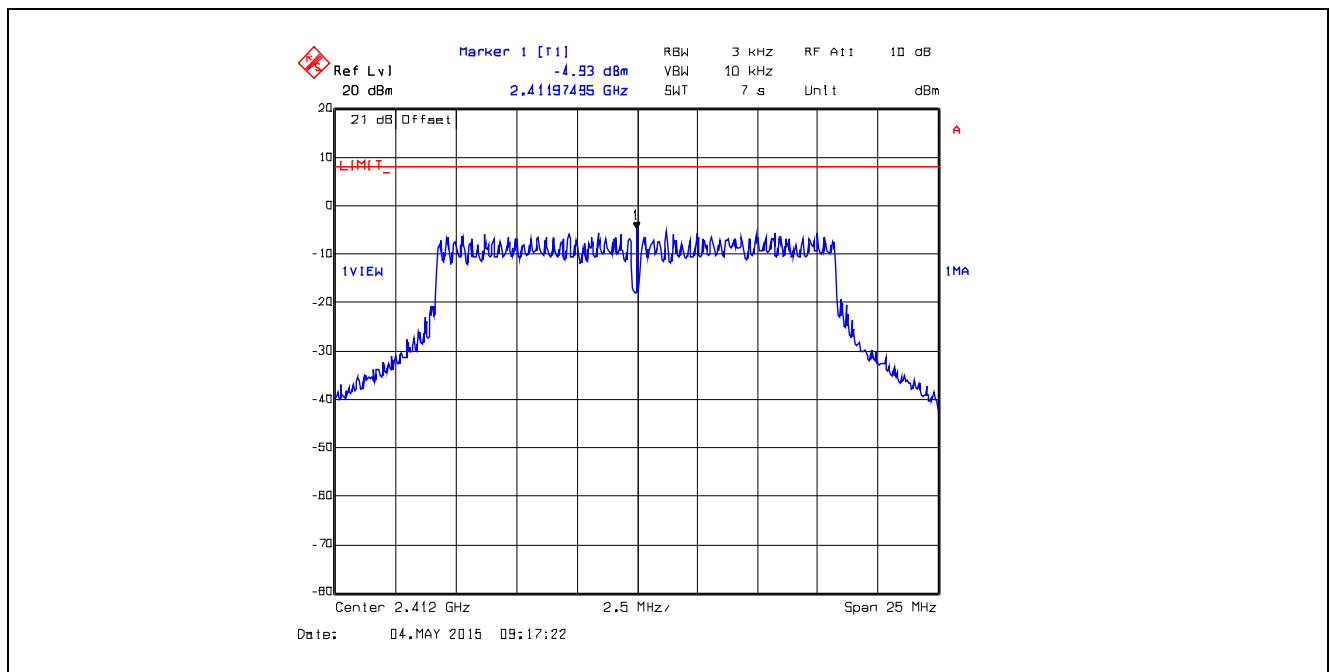
Plot 5.6.4.8. Power Spectral Density
802.11b, Ch 6, 2437 MHz, CCK 11 Mbps, TX Gain Setting 53



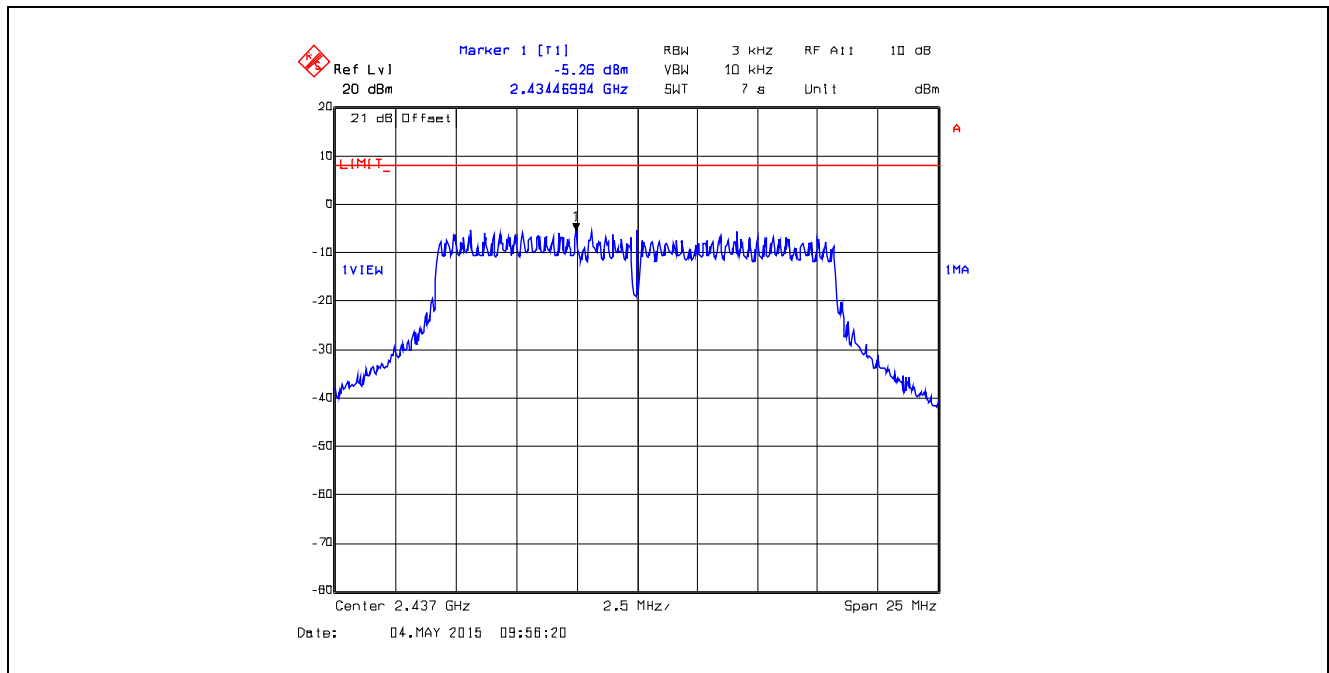
Plot 5.6.4.9. Power Spectral Density
802.11b, Ch 11, 2462 MHz, CCK 11 Mbps, TX Gain Setting 53



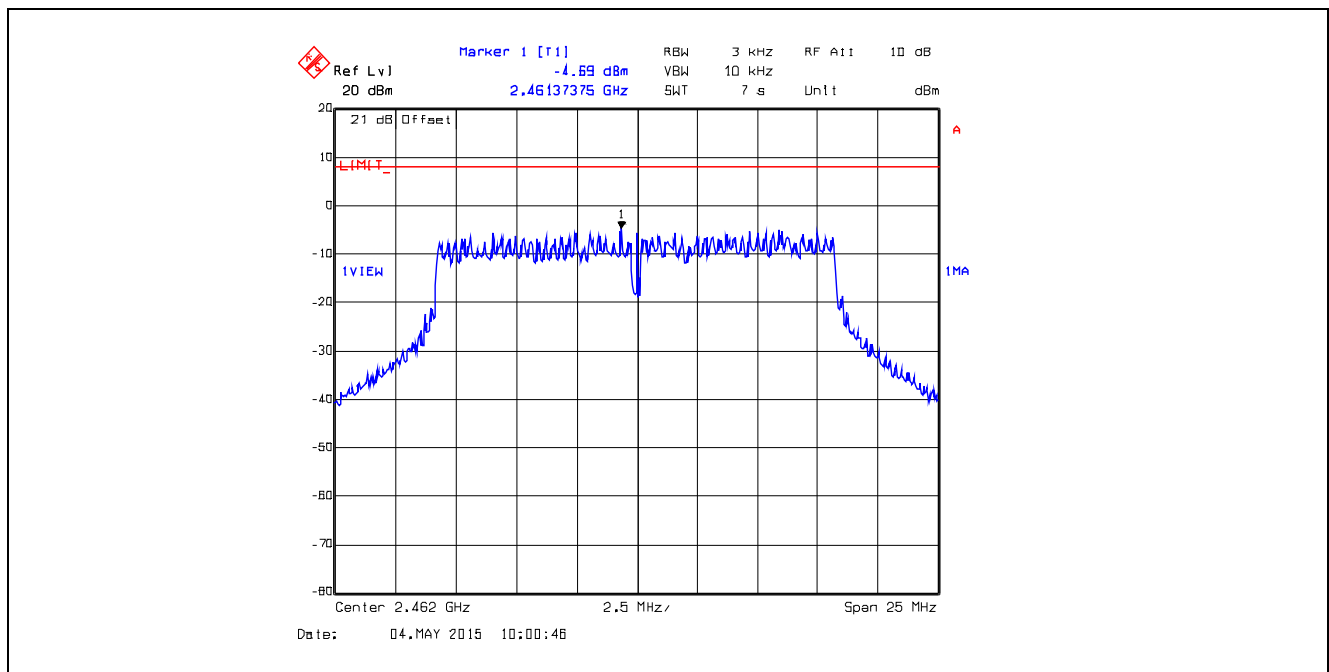
Plot 5.6.4.10. Power Spectral Density
802.11g, Ch 1, 2412 MHz, BPSK 9 Mbps, TX Gain Setting 47



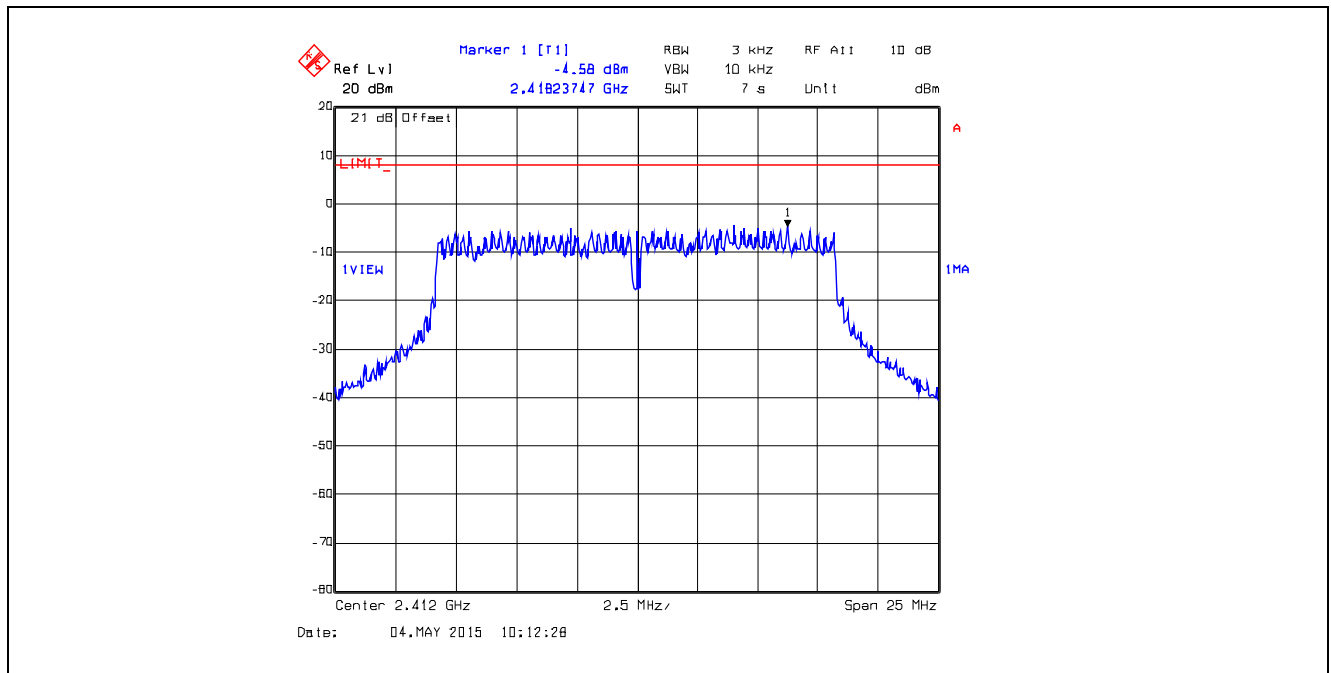
Plot 5.6.4.11. Power Spectral Density
802.11g, Ch 6, 2437 MHz, BPSK 9 Mbps, TX Gain Setting 47



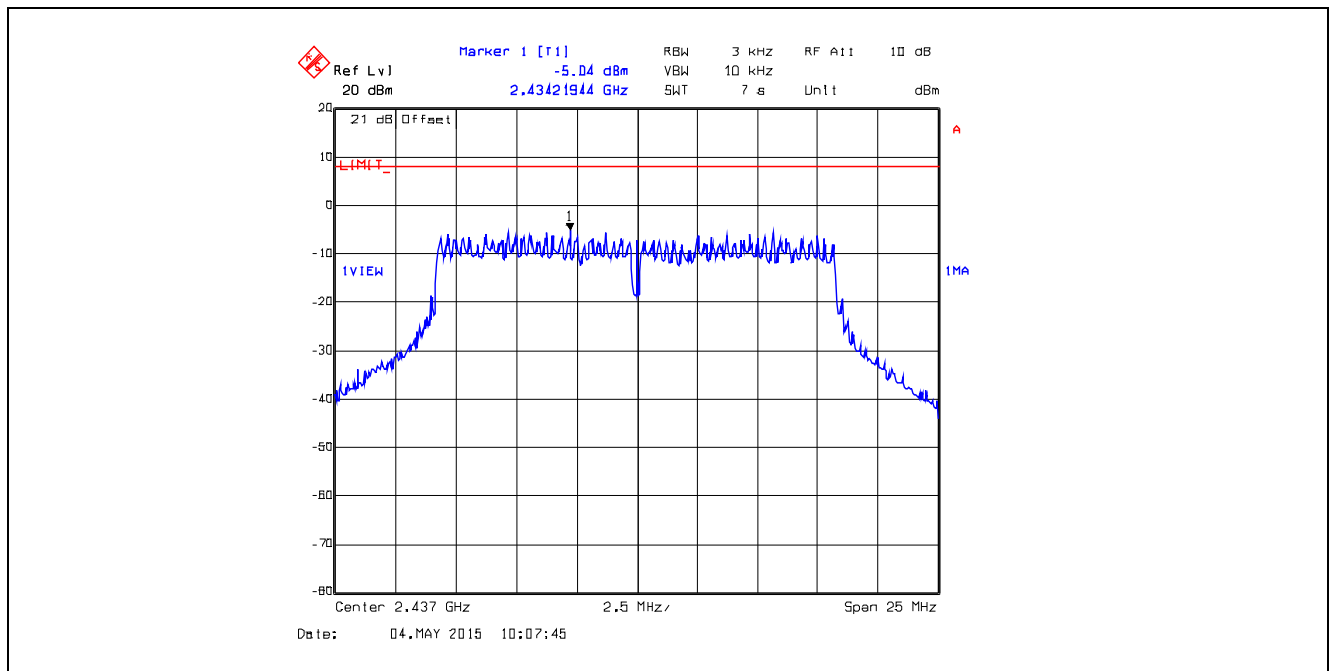
Plot 5.6.4.12. Power Spectral Density
802.11g, Ch 11, 2462 MHz, BPSK 9 Mbps, TX Gain Setting 47



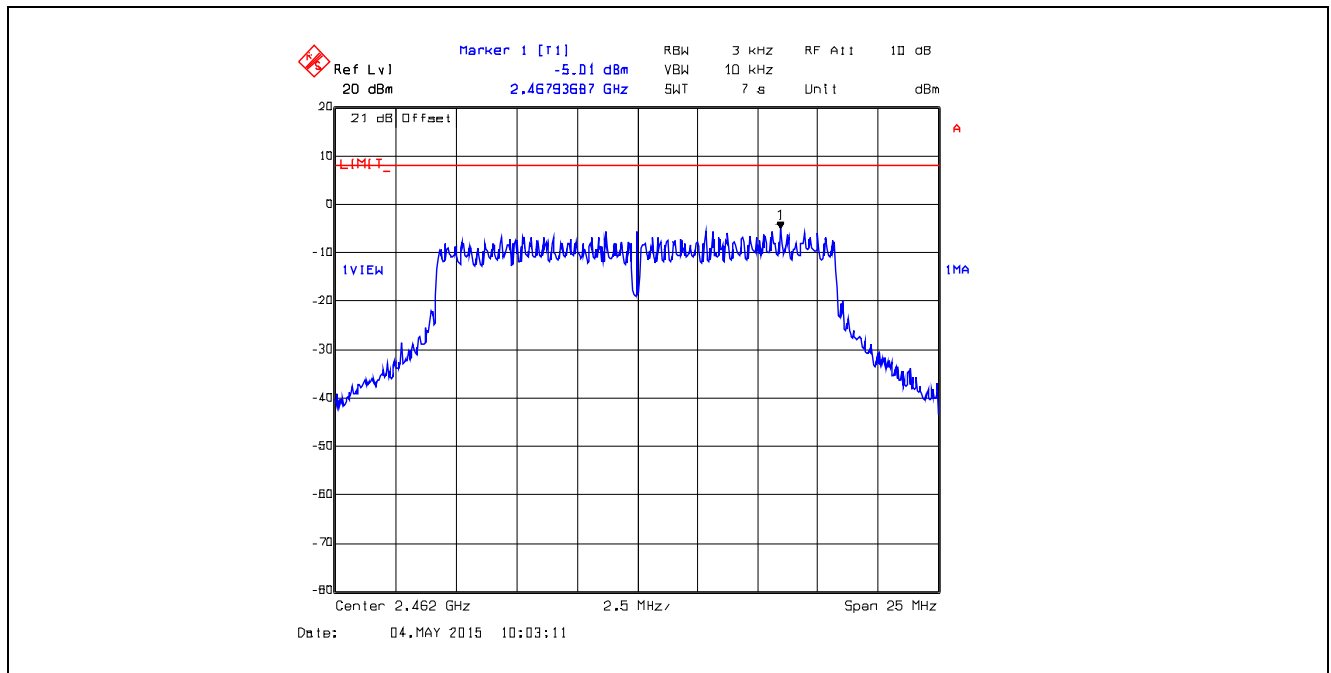
Plot 5.6.4.13. Power Spectral Density
802.11g, Ch 1, 2412 MHz, QPSK 18 Mbps, TX Gain Setting 47



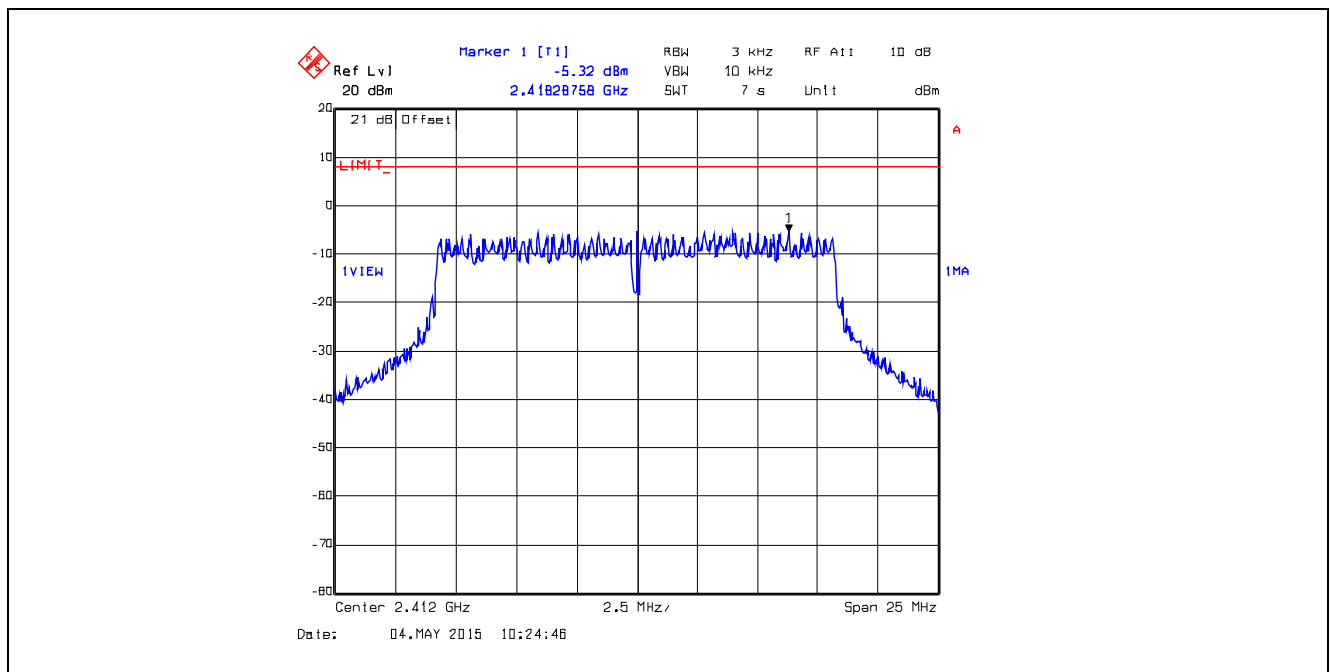
Plot 5.6.4.14. Power Spectral Density
802.11g, Ch 6, 2437 MHz, QPSK 18 Mbps, TX Gain Setting 47



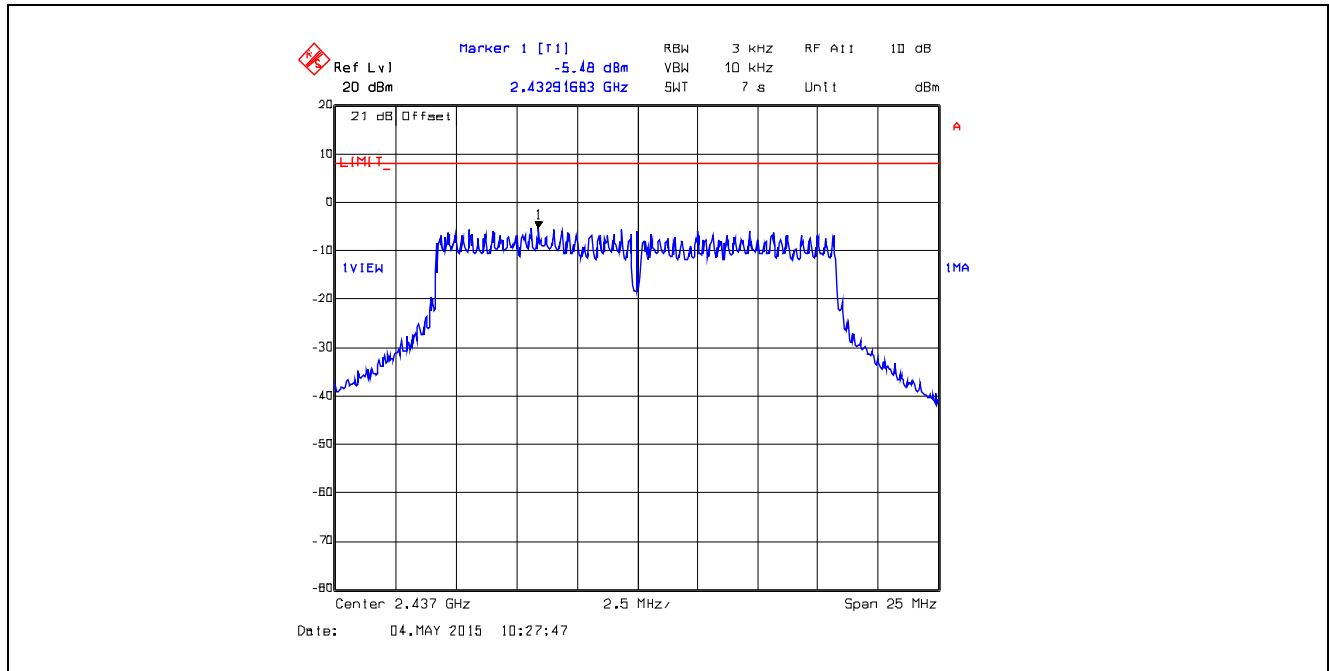
Plot 5.6.4.15. Power Spectral Density
802.11g, Ch 11, 2462 MHz, QPSK 18 Mbps, TX Gain Setting 47



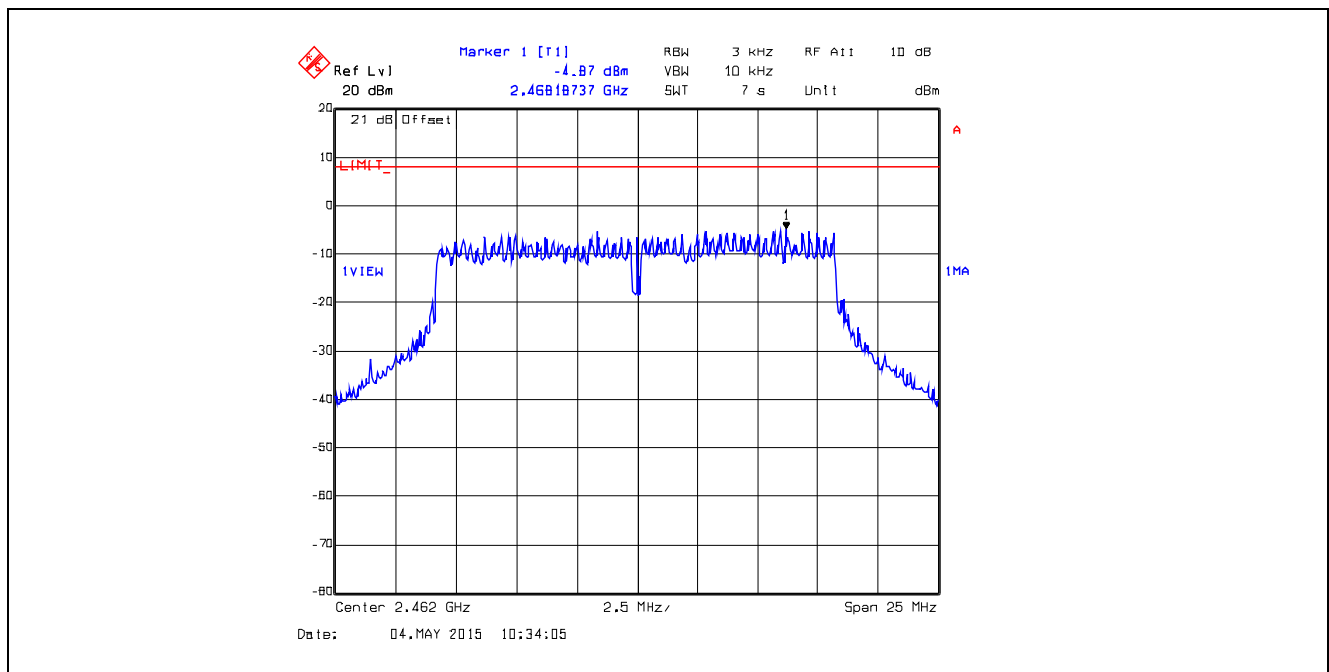
Plot 5.6.4.16. Power Spectral Density
802.11g, Ch 1, 2412 MHz, 16-QAM 36 Mbps, TX Gain Setting 47



Plot 5.6.4.17. Power Spectral Density
802.11g, Ch 6, 2437 MHz, 16-QAM 36 Mbps, TX Gain Setting 47



Plot 5.6.4.18. Power Spectral Density
802.11g, Ch 11, 2462 MHz, 16-QAM 36 Mbps, TX Gain Setting 47



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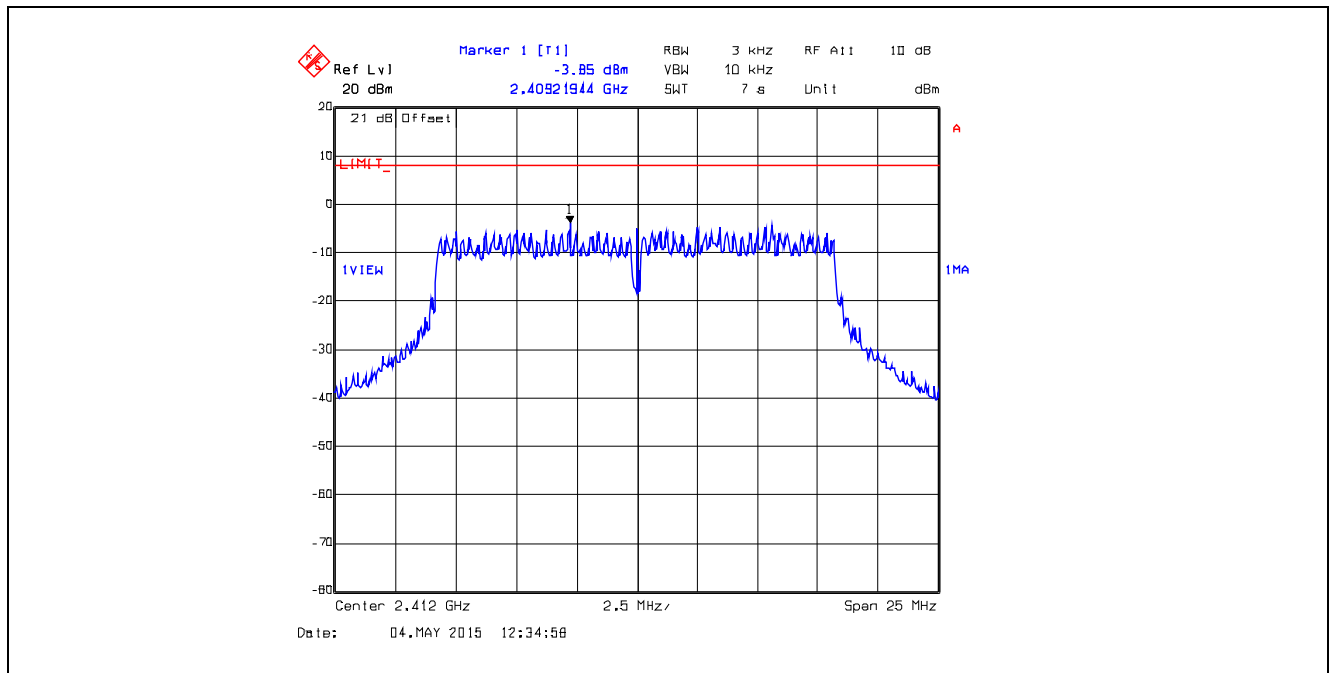
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File #: 15MCRS083_FCC15C247DTS

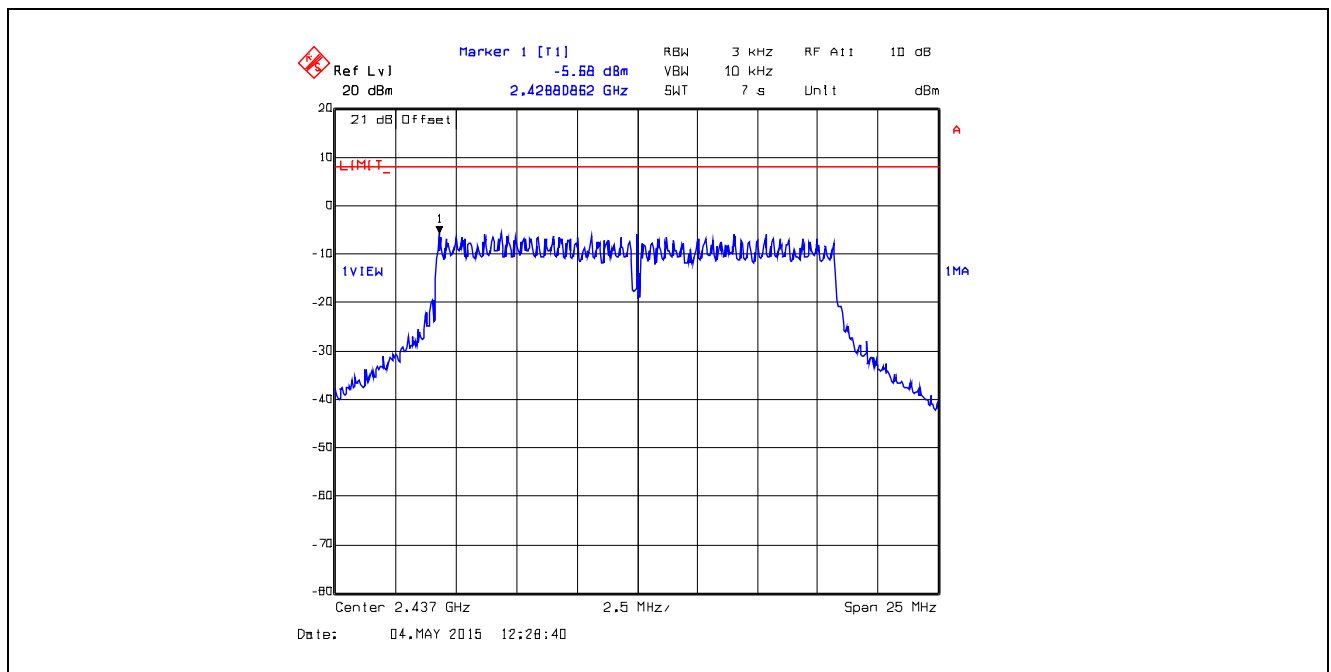
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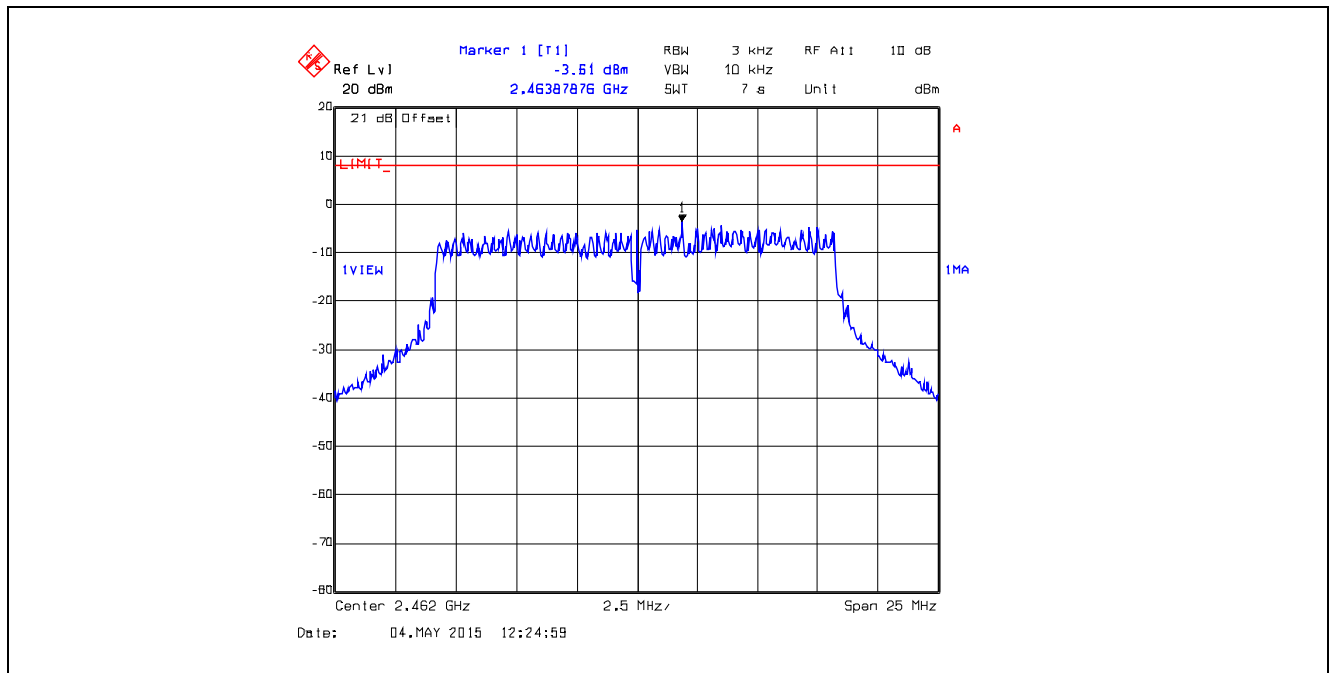
Plot 5.6.4.19. Power Spectral Density
802.11g, Ch 1, 2412 MHz, 64-QAM 54 Mbps, TX Gain Setting 47



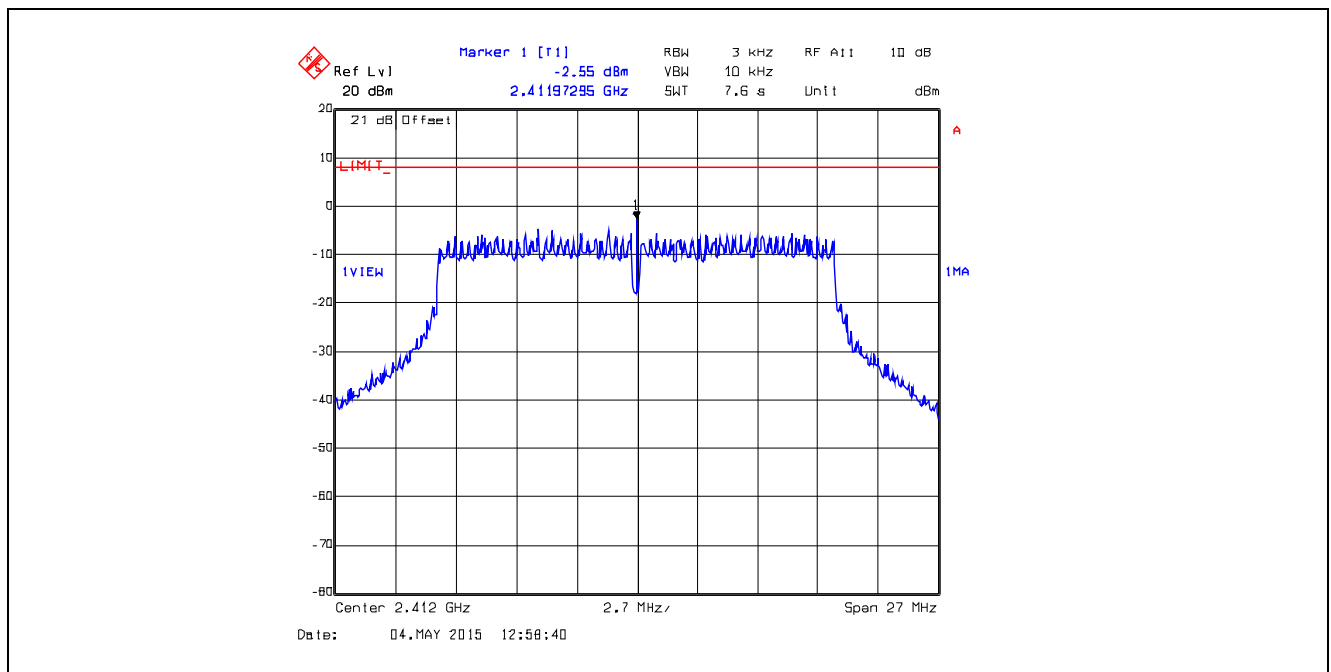
Plot 5.6.4.20. Power Spectral Density
802.11g, Ch 6, 2437 MHz, 64-QAM 54 Mbps, TX Gain Setting 47



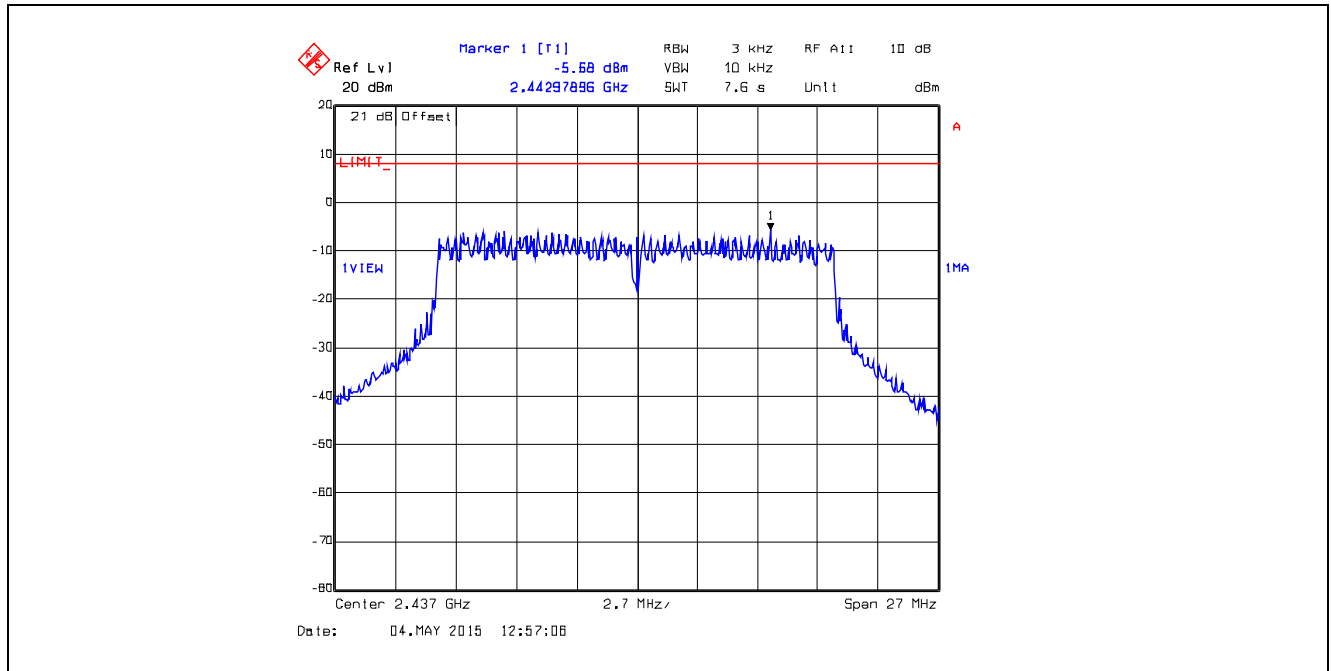
Plot 5.6.4.21. Power Spectral Density
802.11g, Ch 11, 2462 MHz, 64-QAM 54 Mbps, TX Gain Setting 47



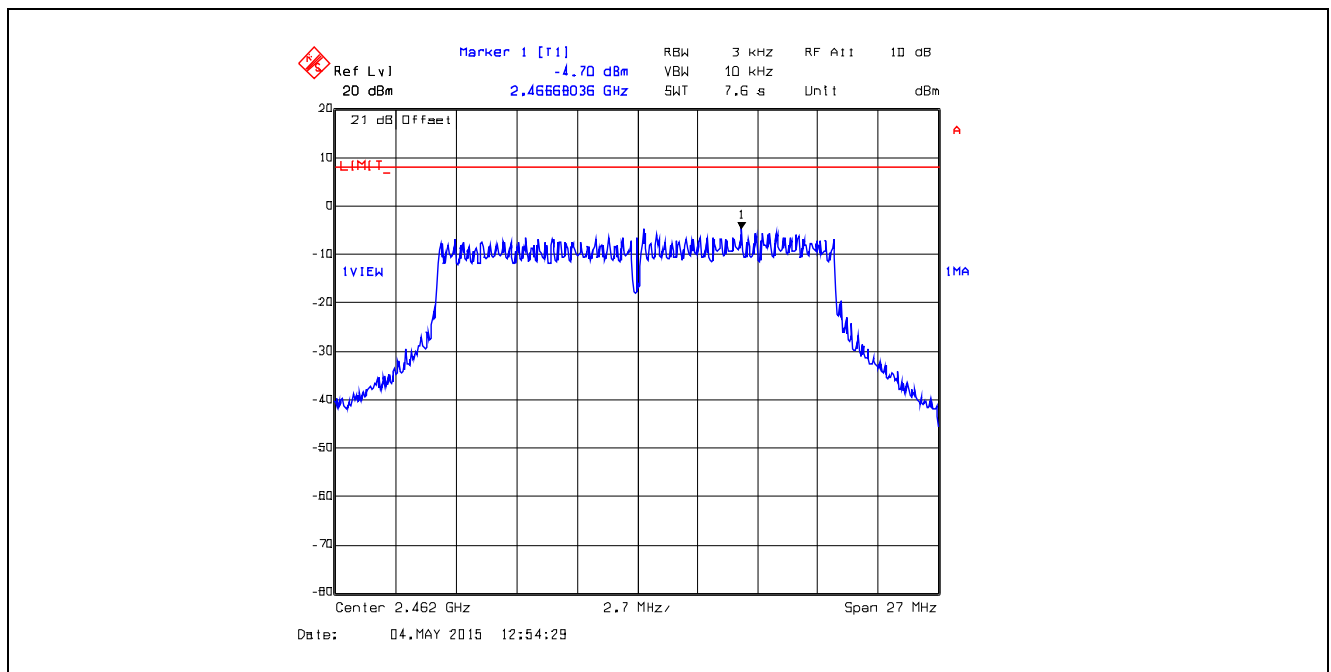
Plot 5.6.4.22. Power Spectral Density
802.11n HT20, Ch 1, 2412 MHz, MCS 0, BPSK 1/2 6.5 Mbps, TX Gain Setting 48



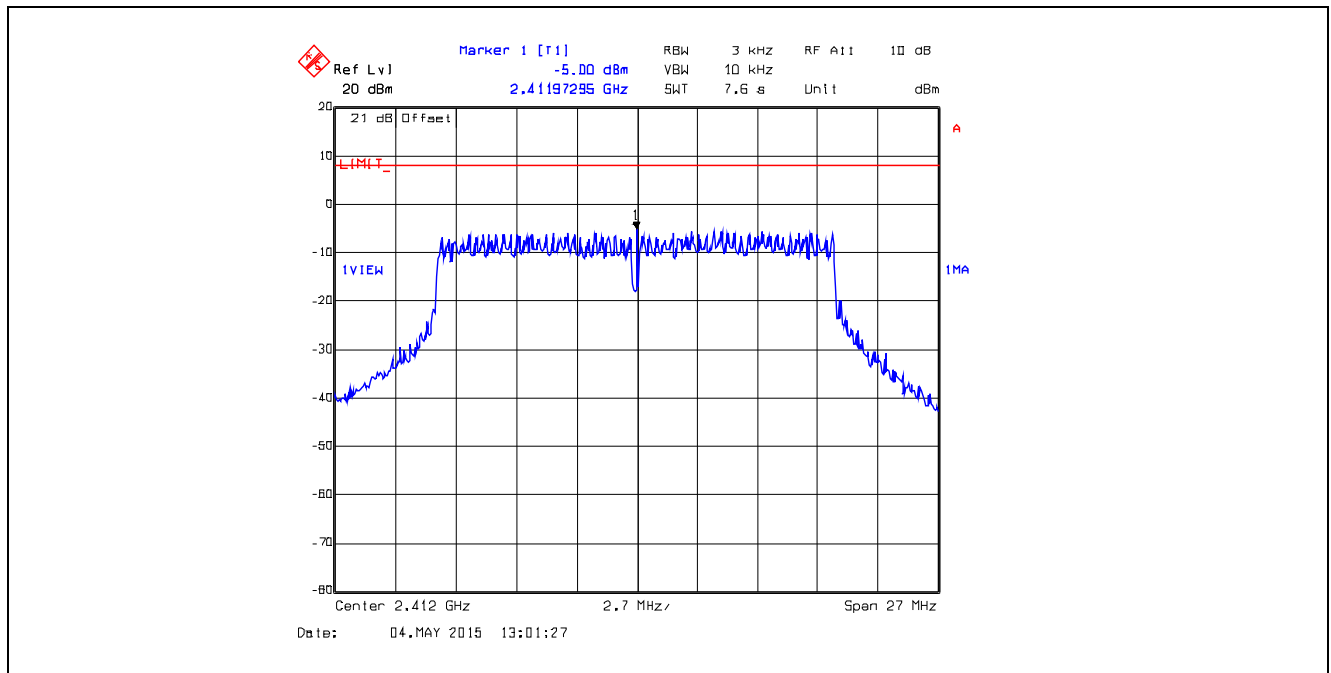
Plot 5.6.4.23. Power Spectral Density
802.11n HT20, Ch 6, 2437 MHz, MCS 0, BPSK 1/2 6.5 Mbps, TX Gain Setting 48



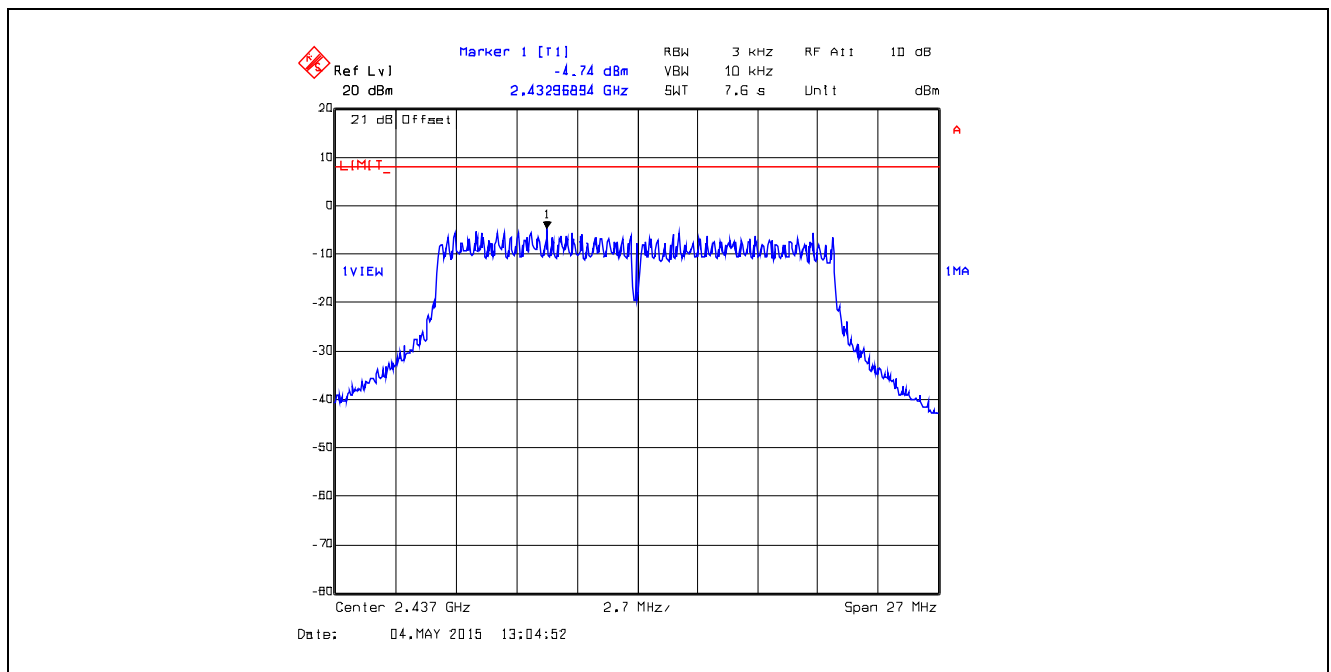
Plot 5.6.4.24. Power Spectral Density
802.11n HT20, Ch 11, 2462 MHz, MCS 0, BPSK 1/2 6.5 Mbps, TX Gain Setting 48



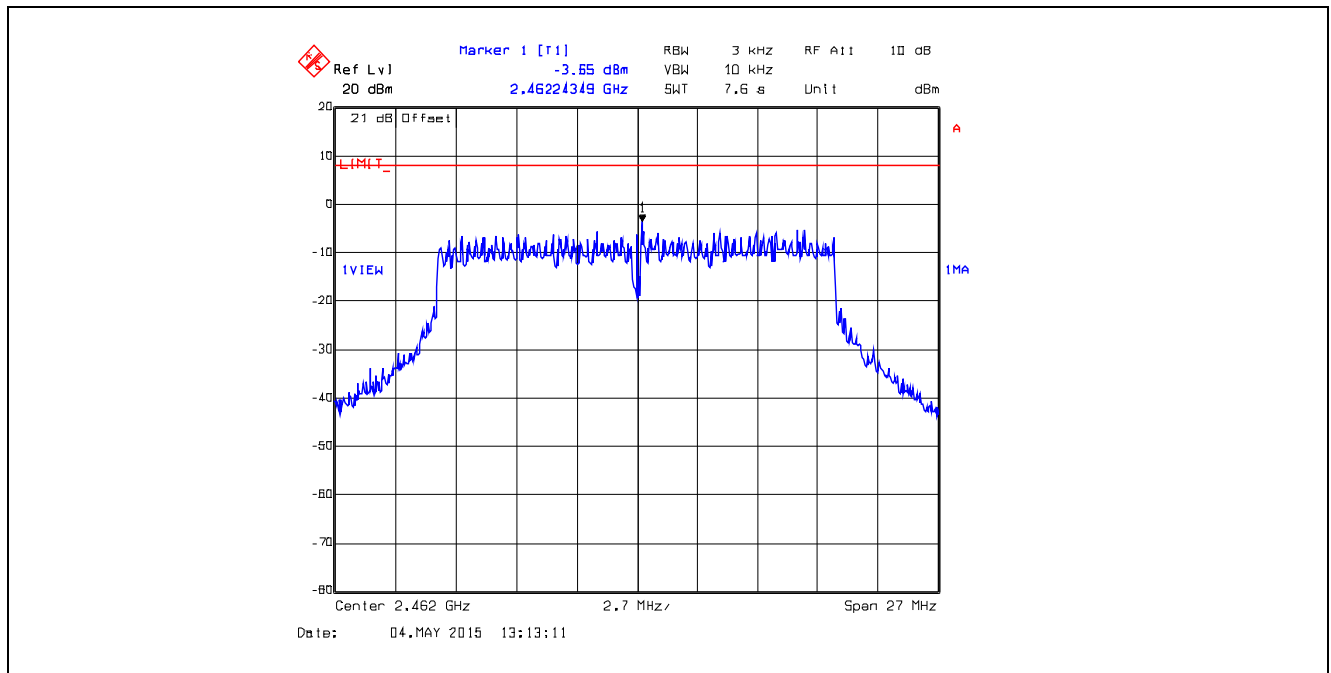
Plot 5.6.4.25. Power Spectral Density
802.11n HT20, Ch 1, 2412 MHz, MCS 2, QPSK 3/4 19.5 Mbps, TX Gain Setting 48



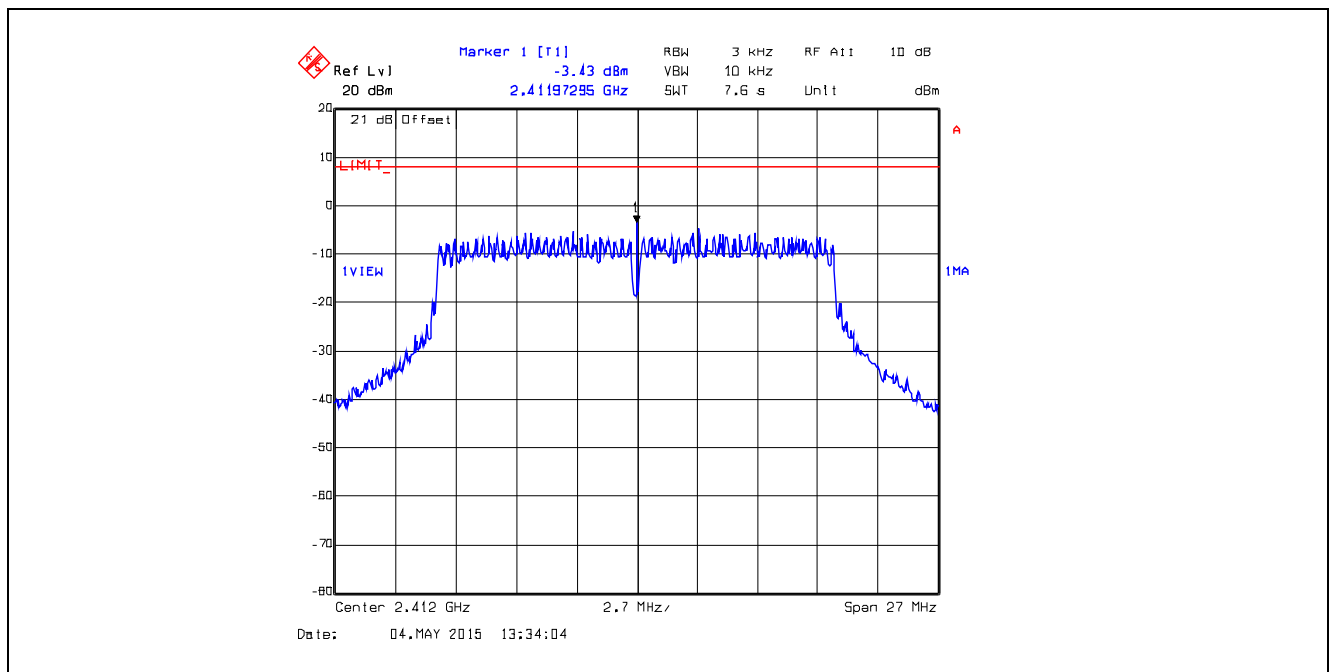
Plot 5.6.4.26. Power Spectral Density
802.11n HT20, Ch 6, 2437 MHz, MCS 2, QPSK 3/4 19.5 Mbps, TX Gain Setting 48



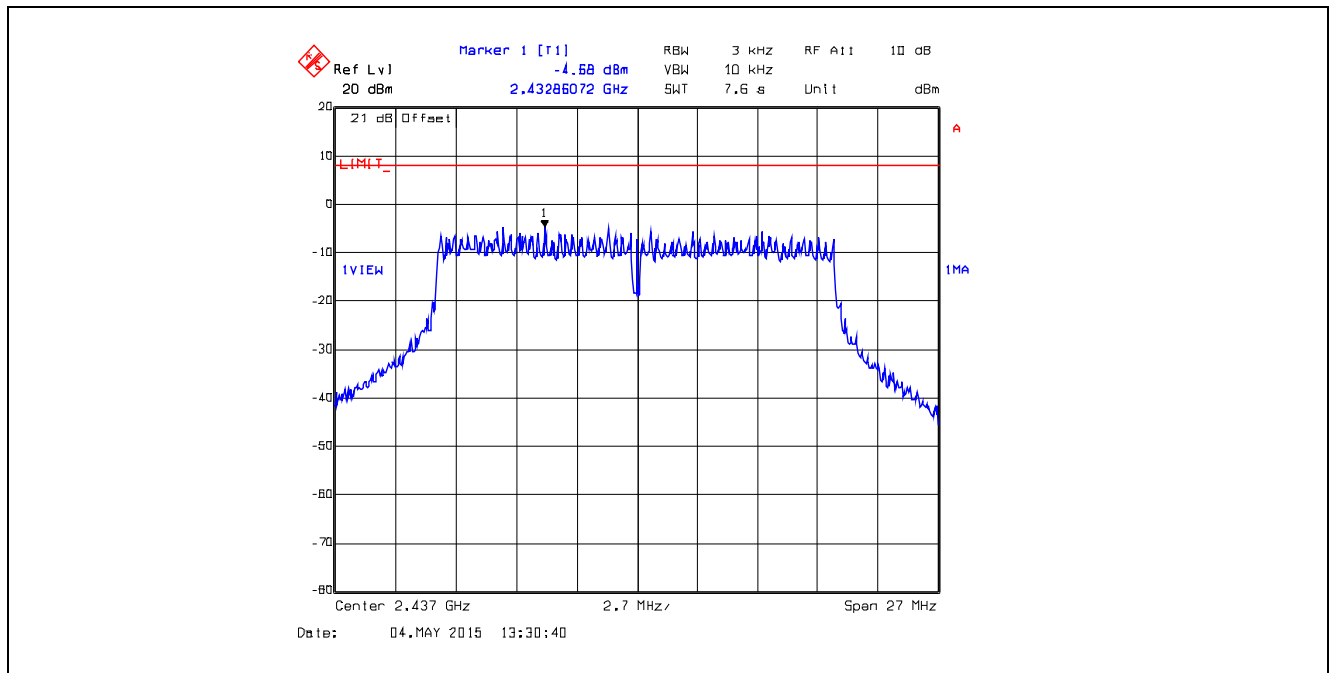
Plot 5.6.4.27. Power Spectral Density
802.11n HT20, Ch 11, 2462 MHz, MCS 2, QPSK 3/4 19.5 Mbps, TX Gain Setting 48



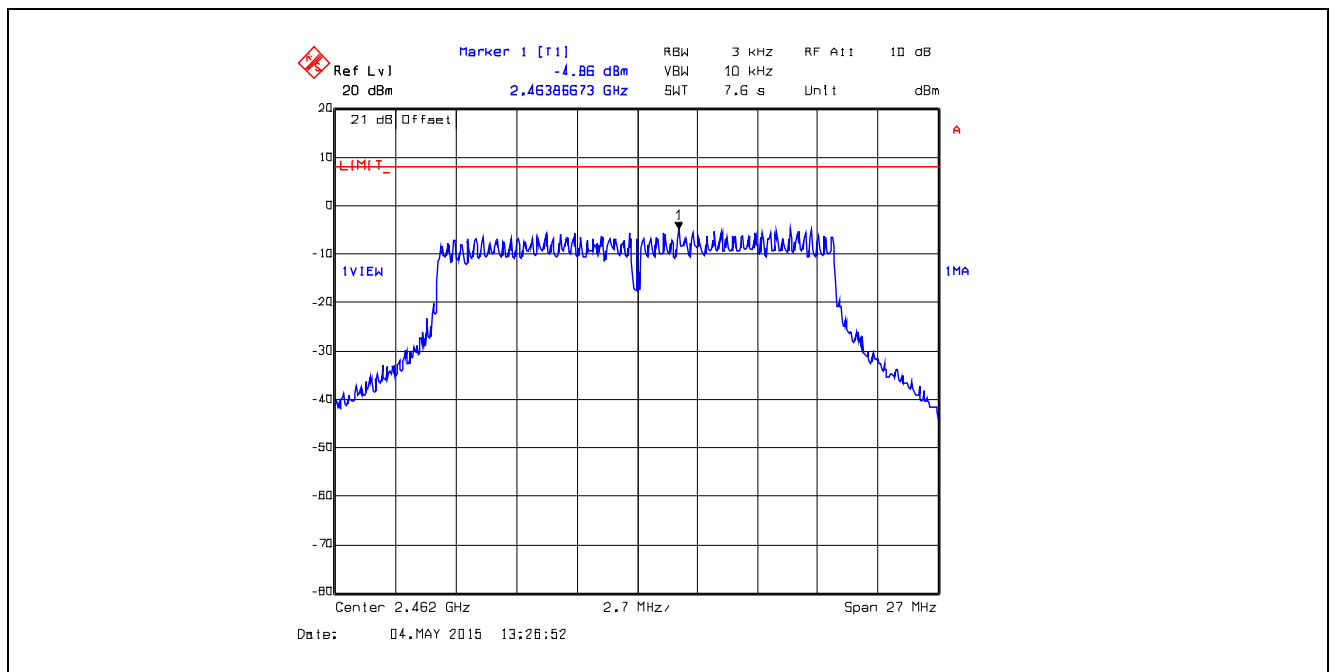
Plot 5.6.4.28. Power Spectral Density
802.11n HT20, Ch 1, 2412 MHz, MCS 4, 16-QAM 3/4 39 Mbps, TX Gain Setting 48



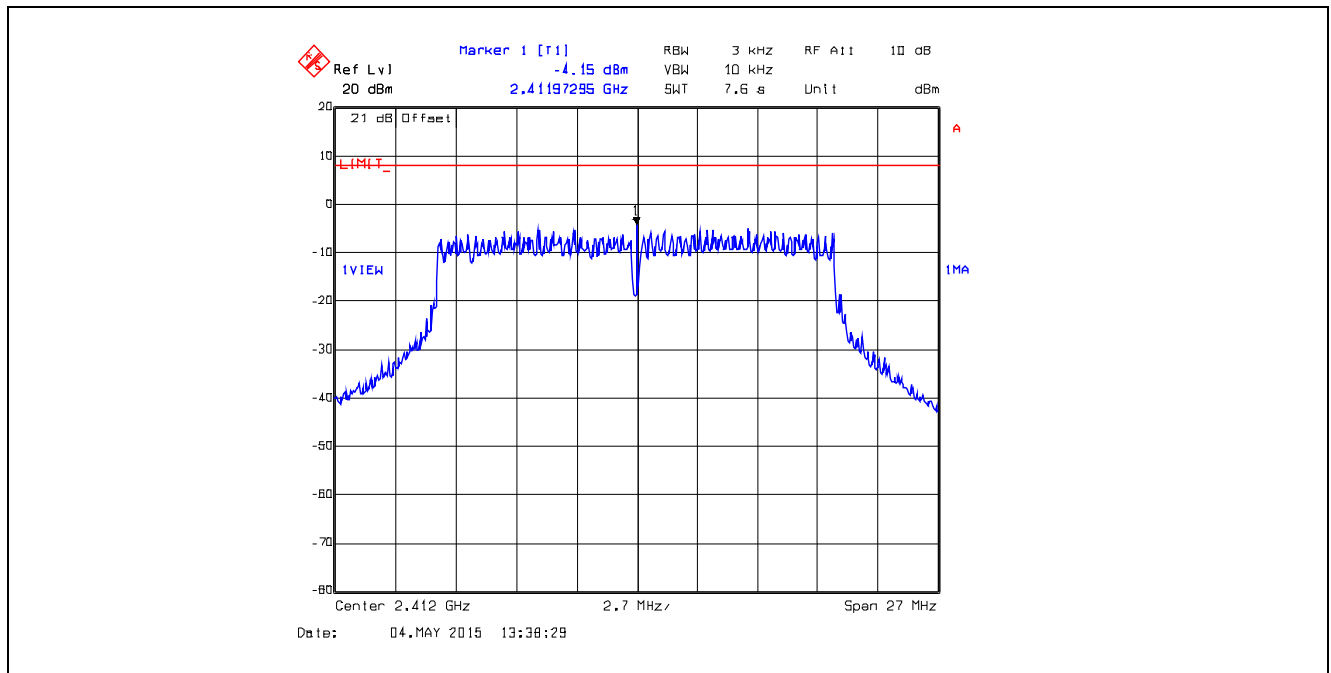
Plot 5.6.4.29. Power Spectral Density
802.11n HT20, Ch 6, 2437 MHz, MCS 4, 16-QAM 3/4 39 Mbps, TX Gain Setting 48



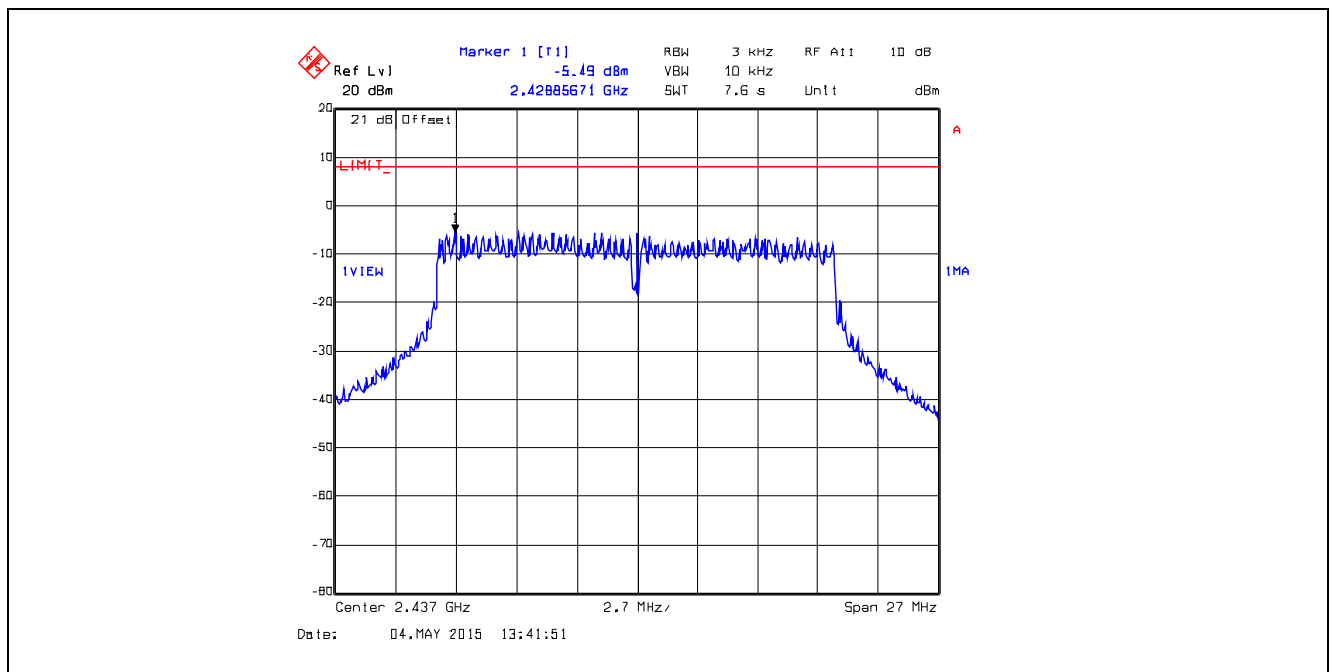
Plot 5.6.4.30. Power Spectral Density
802.11n HT20, Ch 11, 2462 MHz, MCS 4, 16-QAM 3/4 39 Mbps, TX Gain Setting 48



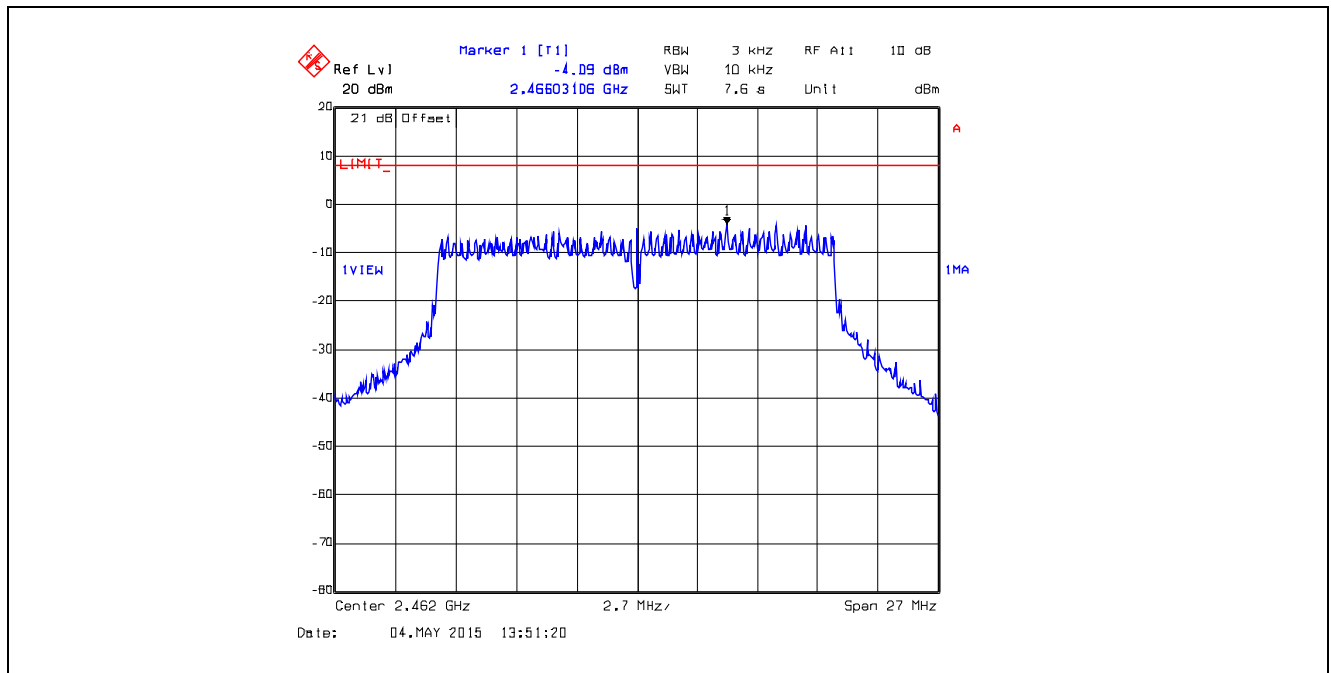
Plot 5.6.4.31. Power Spectral Density
802.11n HT20, Ch 1, 2412 MHz, MCS 7, 64-QAM 5/6 65 Mbps, TX Gain Setting 48



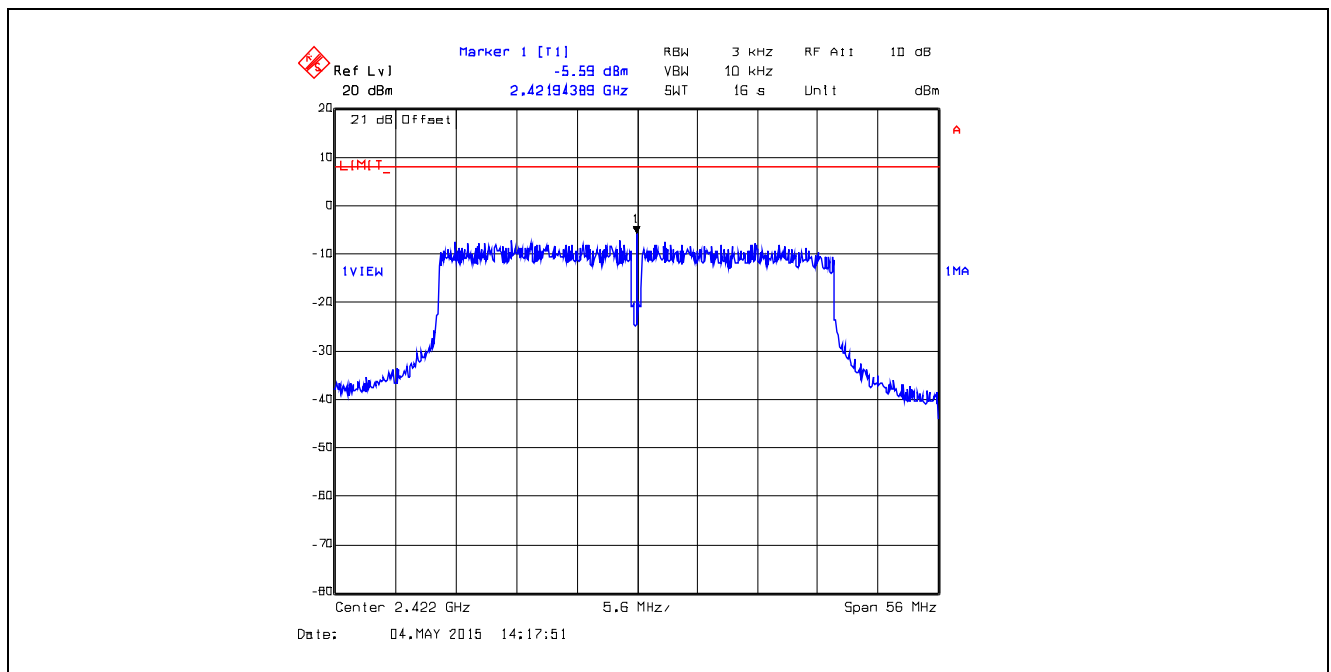
Plot 5.6.4.32. Power Spectral Density
802.11n HT20, Ch 6, 2437 MHz, MCS 7, 64-QAM 5/6 65 Mbps, TX Gain Setting 48



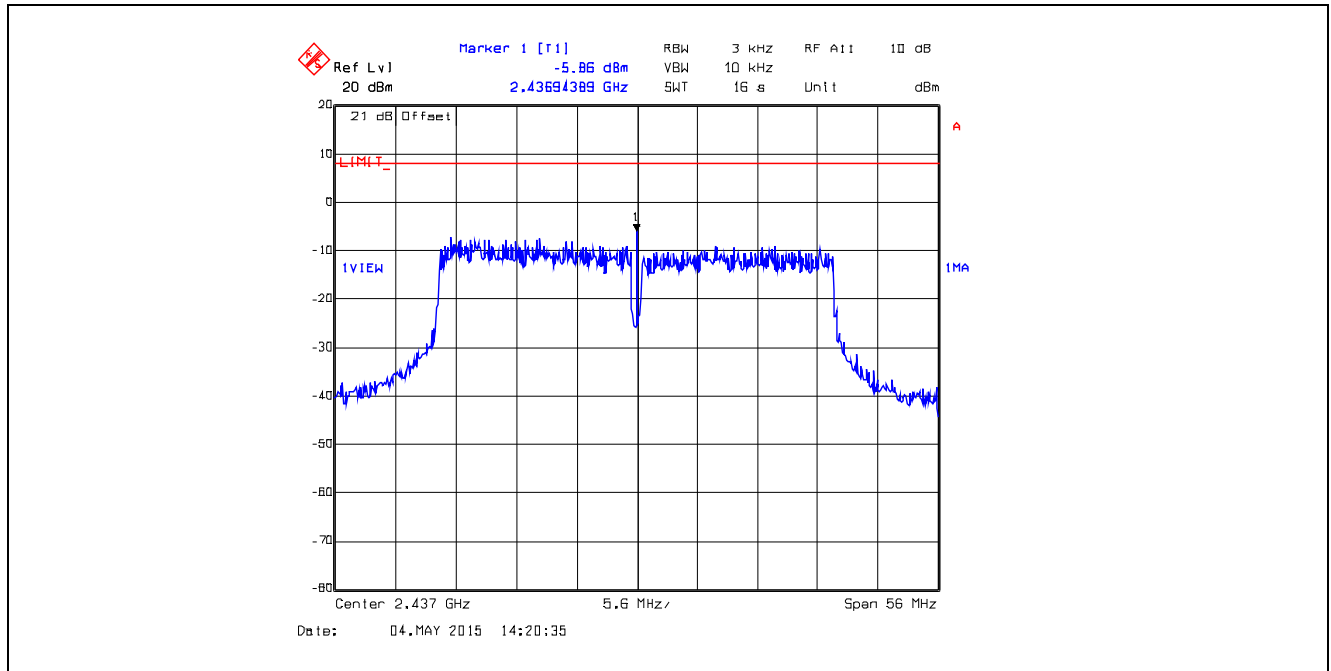
Plot 5.6.4.33. Power Spectral Density
802.11n HT20, Ch 11, 2462 MHz, MCS 7, 64-QAM 5/6 65 Mbps, TX Gain Setting 48



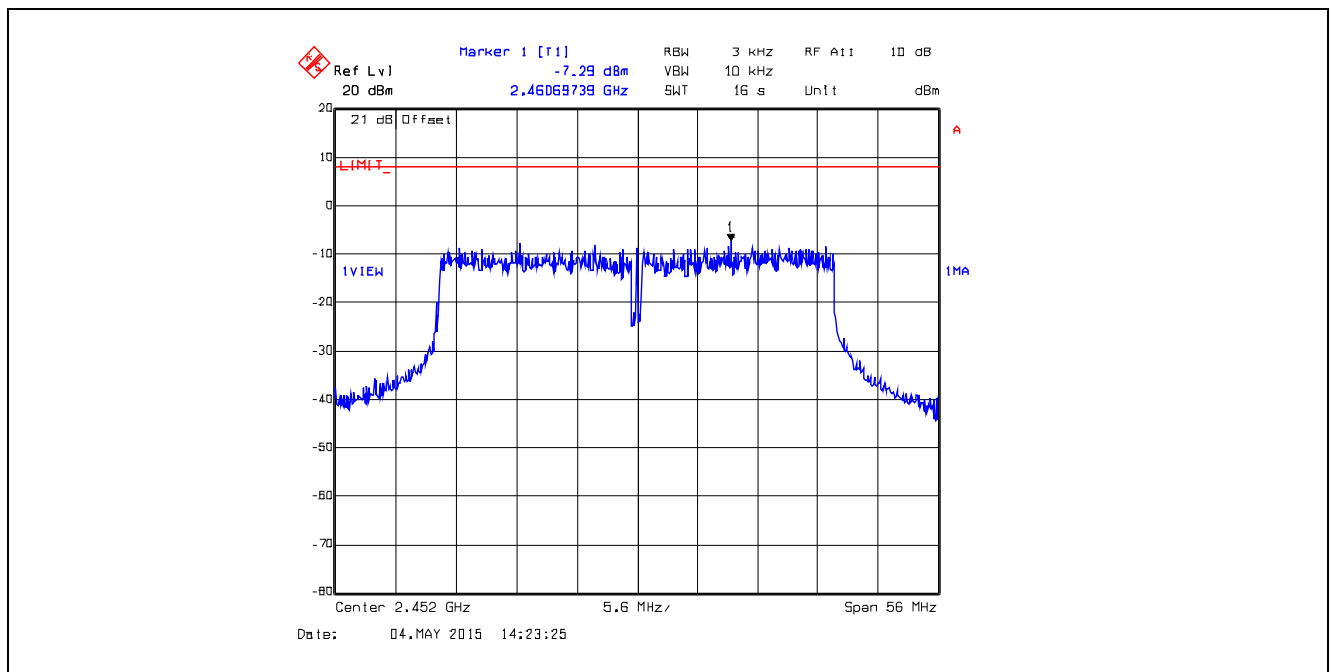
Plot 5.6.4.34. Power Spectral Density
802.11n HT40, Ch 3, 2422 MHz, MCS 0, BPSK 1/2 13.5 Mbps, TX Gain Setting 50



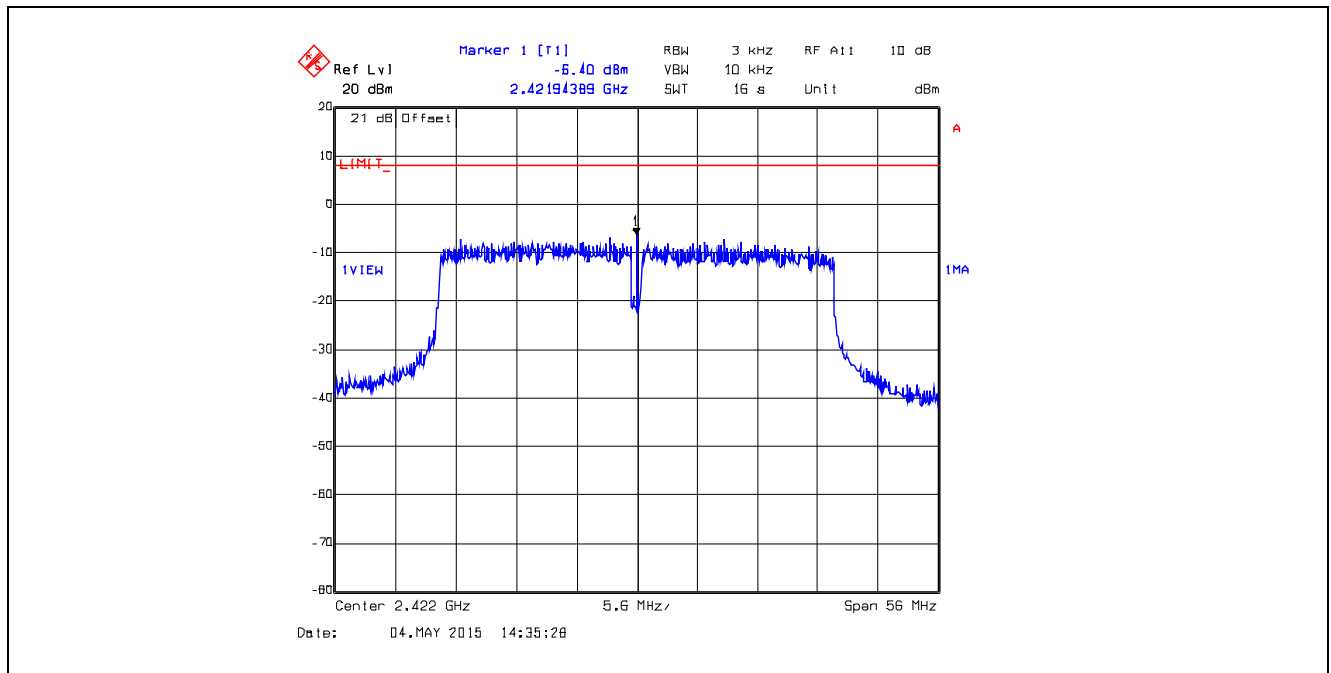
Plot 5.6.4.35. Power Spectral Density
802.11n HT40, Ch 6, 2437 MHz, MCS 0, BPSK 1/2 13.5 Mbps, TX Gain Setting 50



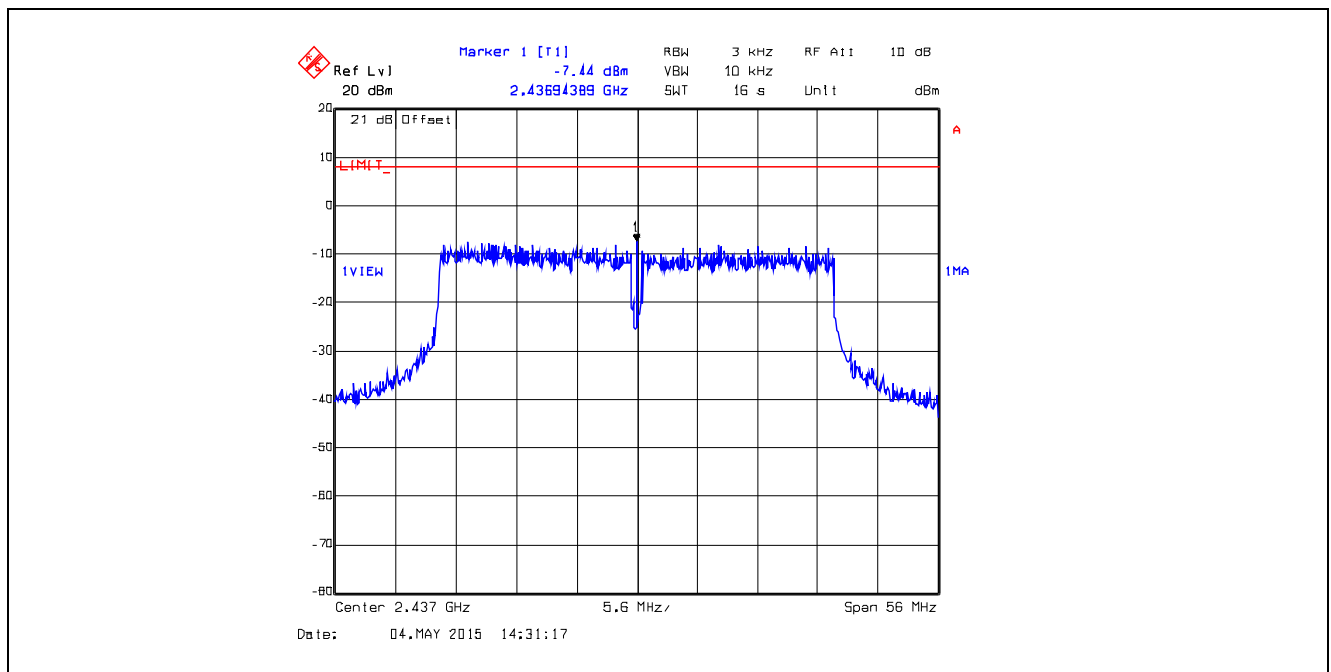
Plot 5.6.4.36. Power Spectral Density
802.11n HT40, Ch 9, 2452 MHz, MCS 0, BPSK 1/2 13.5 Mbps, TX Gain Setting 50



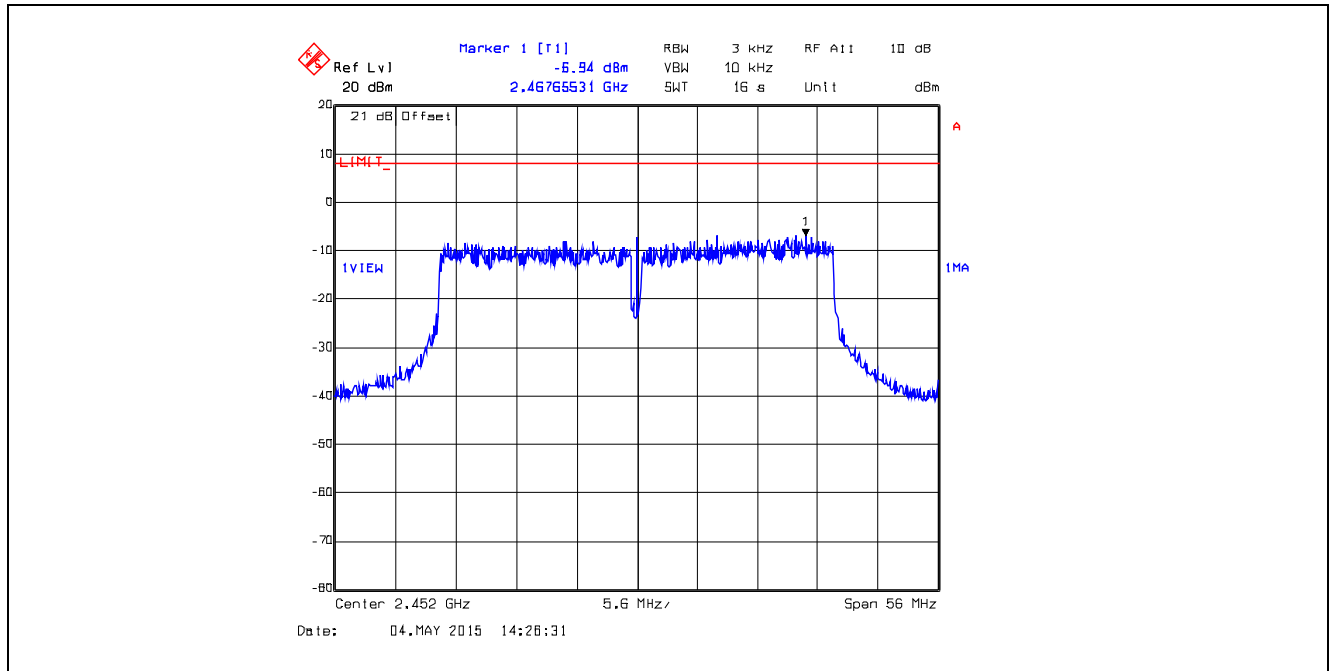
Plot 5.6.4.37. Power Spectral Density
802.11n HT40, Ch 3, 2422 MHz, MCS 2, QPSK 3/4 40.5 Mbps, TX Gain Setting 50



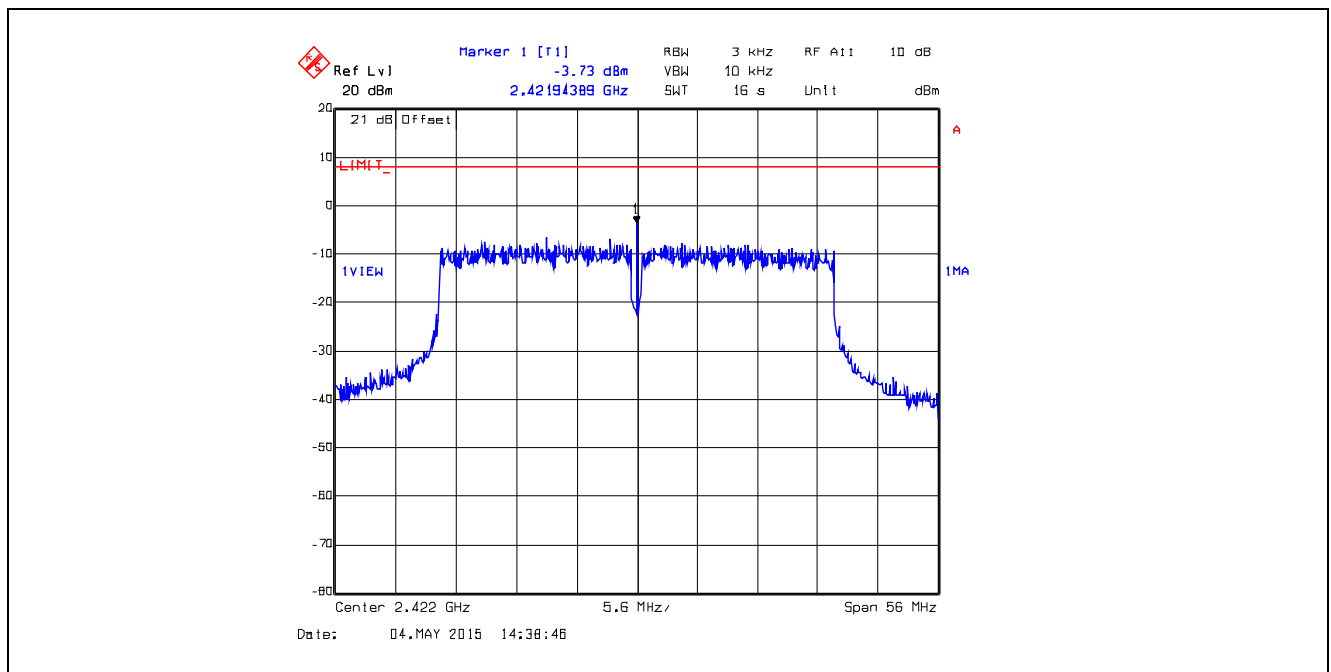
Plot 5.6.4.38. Power Spectral Density
802.11n HT40, Ch 6, 2437 MHz, MCS 2, QPSK 3/4 40.5 Mbps, TX Gain Setting 50



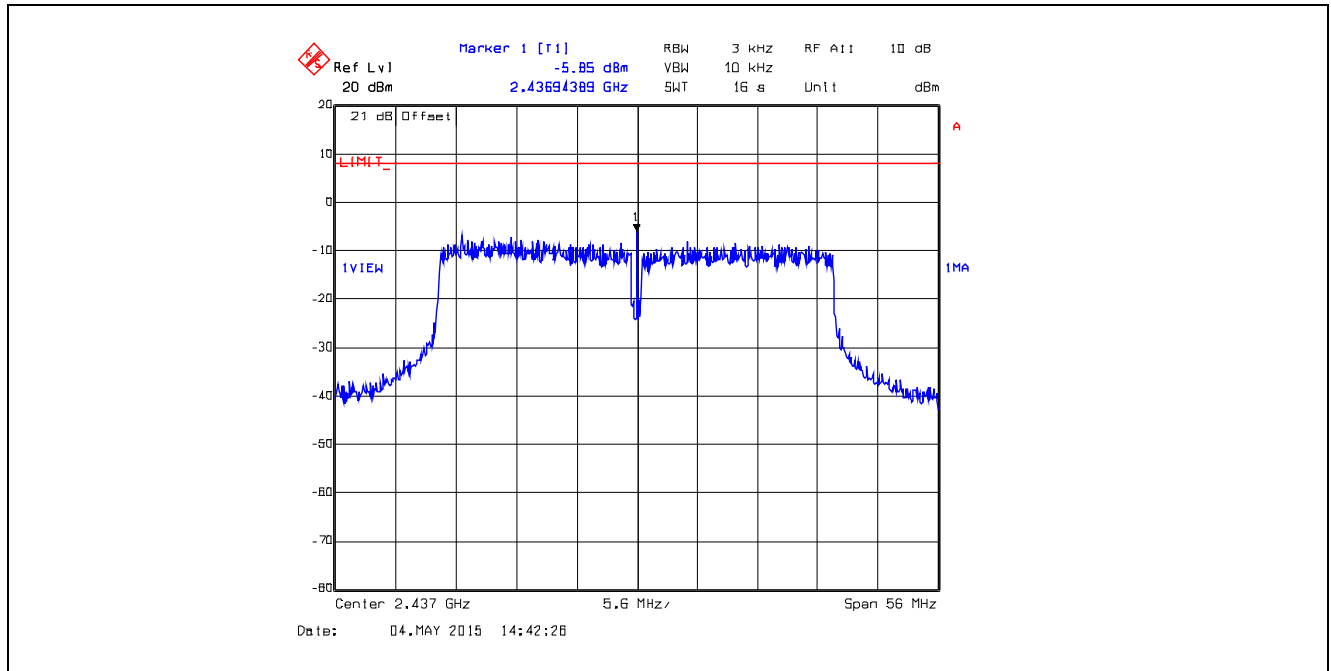
Plot 5.6.4.39. Power Spectral Density
802.11n HT40, Ch 9, 2452 MHz, MCS 2, QPSK 3/4 40.5 Mbps, TX Gain Setting 50



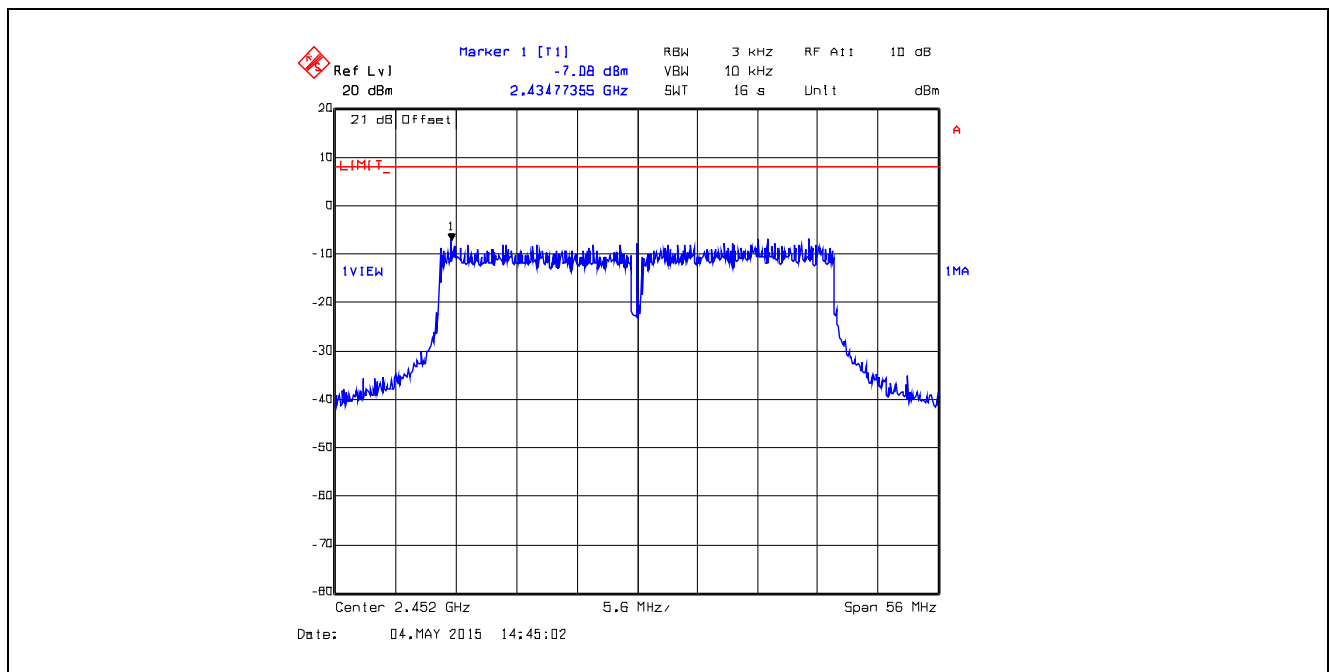
Plot 5.6.4.40. Power Spectral Density
802.11n HT40, Ch 3, 2422 MHz, MCS 4, 16-QAM 3/4 81 Mbps, TX Gain Setting 50



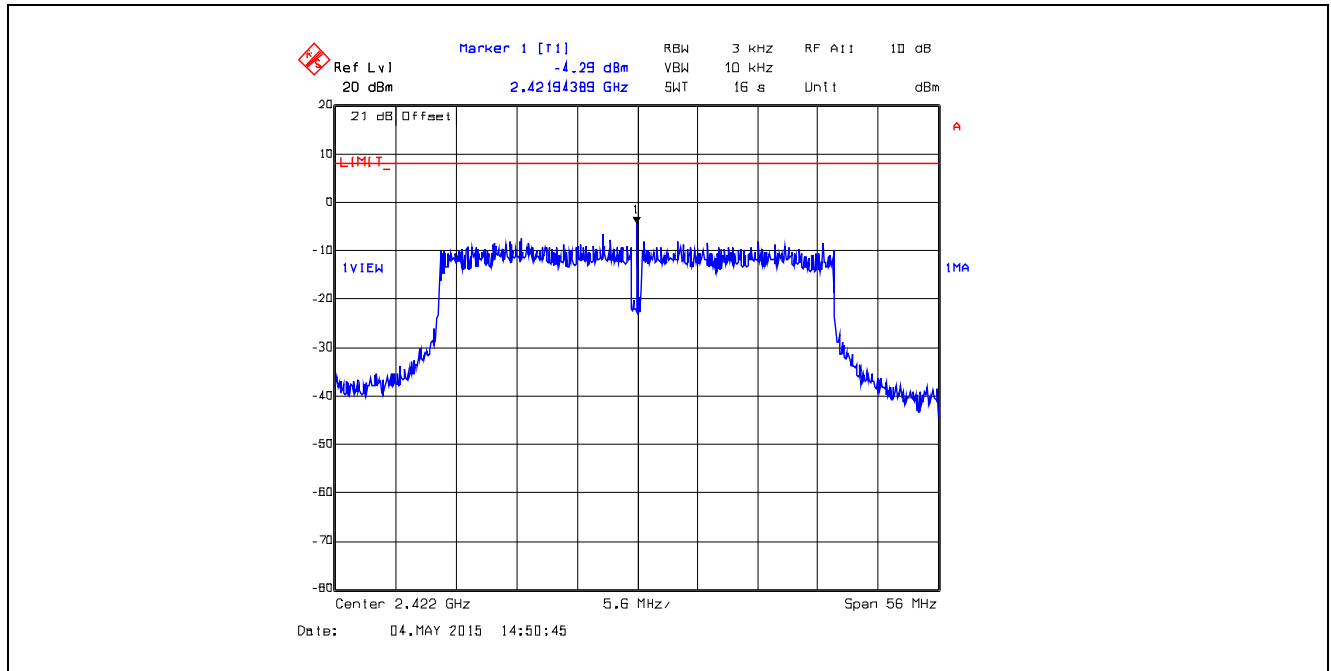
Plot 5.6.4.41. Power Spectral Density
802.11n HT40, Ch 6, 2437 MHz, MCS 4, 16-QAM 3/4 81 Mbps, TX Gain Setting 50



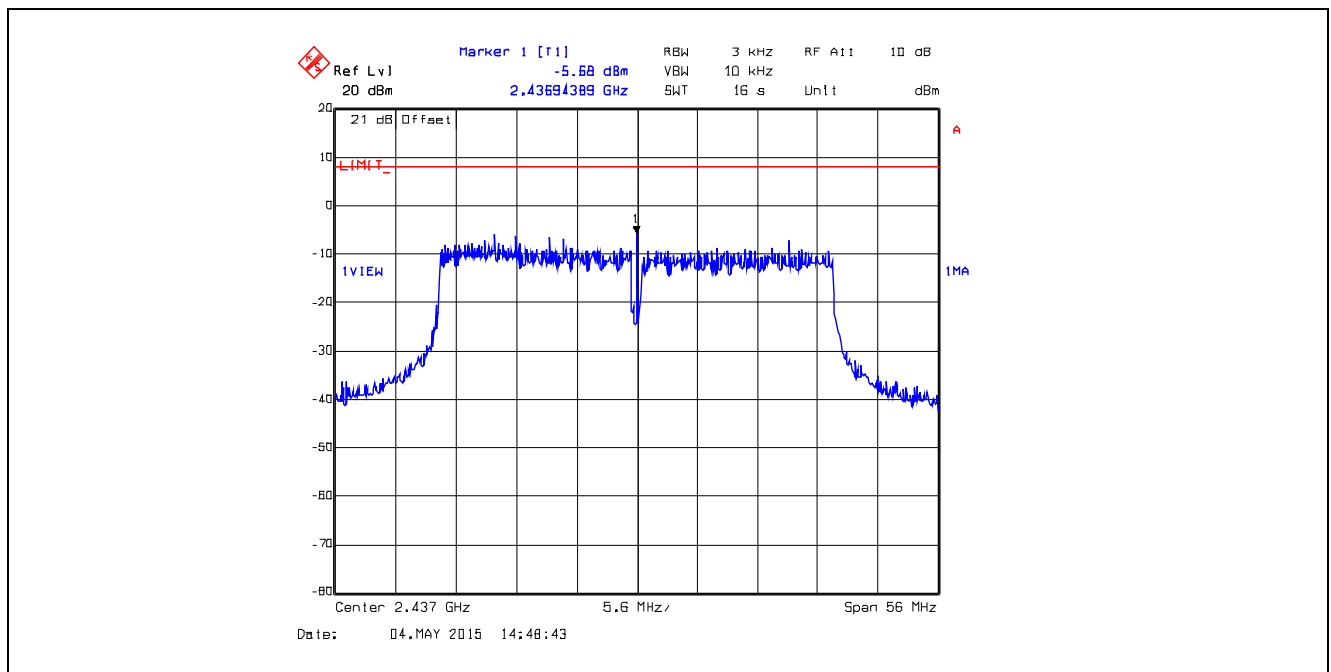
Plot 5.6.4.42. Power Spectral Density
802.11n HT40, Ch 9, 2452 MHz, MCS 4, 16-QAM 3/4 81 Mbps, TX Gain Setting 50



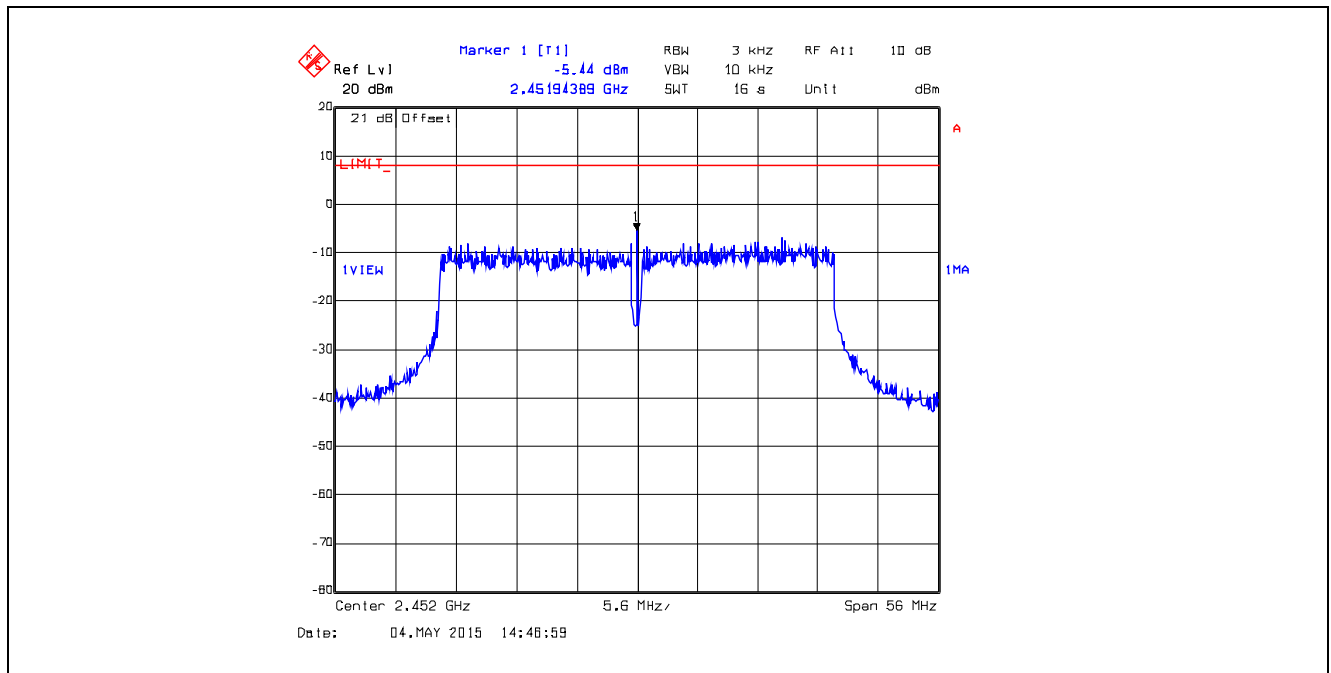
Plot 5.6.4.43. Power Spectral Density
802.11n HT40, Ch 3, 2422 MHz, MCS 7, 64-QAM 5/6 135 Mbps, TX Gain Setting 50



Plot 5.6.4.44. Power Spectral Density
802.11n HT40, Ch 6, 2437 MHz, MCS 7, 64-QAM 5/6 135 Mbps, TX Gain Setting 50



Plot 5.6.4.45. Power Spectral Density
802.11n HT40, Ch 9, 2452 MHz, MCS 7, 64-QAM 5/6 135 Mbps, TX Gain Setting 50



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June 16, 2015

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5.7. RF EXPOSURE REQUIREMENTS [§§ 15.247(i), 1.1310 & 2.1091]

5.7.1. Limits

§ 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Note 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.7.2. Method of Measurements

Calculation Method of Power Density/RF Safety Distance:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

Where,
P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm²
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

$$r = \sqrt{\frac{PG}{4\pi \cdot S}} = \sqrt{\frac{EIRP}{4\pi \cdot S}}$$

5.7.3. RF Evaluation

5.7.3.1. Standalone

Maximum EIRP, P_{EIRP}[dBm]:	36.00
MPE Limit for General Population/Uncontrolled Exposure, S_{uncontrolled}[mW/cm²]	1.0
Calculated RF Safety Distance for General Population/Uncontrolled Exposure, r_{safety uncontrolled}[cm]	17.8

5.7.3.2. Co-location

Pursuant to KDB 447498 D01 General RF Exposure Guidance v05r02, Section 7.2:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 .

Co-location will only applies to EUT with 2 dBi dipole antenna, worst case EIRP of 32 dBm will be used in co-location at the minimum 23 cm evaluation separation distance required by the operating configurations and exposure conditions of the host device.

The maximum calculated MPE ratio of the EUT with 2 dBi dipole antenna

Frequency (MHz)	EUT EIRP (dBm)	EUT EIRP (mW)	Evaluation Distance (cm)	Power Density (mW/cm ²)	FCC/IC MPE Limit (mW/cm ²)	MPE Ratio
2412	32	1584.893	23	0.238	1.0	0.238

The maximum calculated MPE ratio for the EUT with 2 dBi dipole antenna is 0.238, this configuration can be co-located with other antennas provided the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device is ≤ 1.0 - $0.238 \leq 0.762$. The following table addresses the co-location of the EUT with 2 dBi antenna with the specified radio modules.

EUT with 2 dBi dipole antenna co-location with radio module indentified in this table

*Radio Module	Frequency (MHz)	EIRP (mW)	Evaluation Distance (cm)	Power Density (mW/cm ²)	FCC/IC MPE Limit (mW/cm ²)	MPE Ratio	MPE Ratio of EUT with 2 dBi antenna	Sum of MPE Ratio	Verdict
Data Card Module (FCC ID: R17LN930, IC: 5131A-LN930)	824.2	2511.89	23	0.378	0.549	0.689	0.238	0.927	Compliant
LTE Data Transmitter Module (FCC ID: R5Q-TOBYL100, IC: 8595B-TOBYL100)	782	2564.484	23	0.386	0.521	0.741	0.238	0.979	Compliant
GSM/UMTS/LTE Data Module (FCC ID: XPYTOBYL200, IC: 8595A-TOBYL200)	1909.8	2944.219	23	0.443	1.0	0.443	0.238	0.681	Compliant

* The test data of the radio modules represented in this table is the worst-case configuration (maximum MPE ratio) derived from the original radio modules MPE reports. Refer to these reports for details.

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3412A00103	9 kHz–26.5 GHz	09 Apr 2017
Attenuator	Pasternack	PE7010-20	-	DC–2 GHz	02 Jan 2016
L.I.S.N	EMCO	3825/2	2209	0.10 -100 MHz	03 Sep 2015
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	21 Nov 2015
Attenuator	Pasternack	7024-20	6	DC–26.5 GHz	Cal on use
DC Block	Picosecond Pulse Labs	5501A	4678	0.7 kHz–26 GHz	Cal on use
Peak Power Analyzer	Hewlett Packard	8990A	3314A00602	0.5 - 40 GHz	11 Nov 2015
Peak Power Sensor	Hewlett Packard	84814A	3205A00175	0.5 - 40 GHz	13 Nov 2015
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Cal on use
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 2400 MHz	Cal on use
Attenuator	Pasternack	7024-10	4	DC–26.5 GHz	Cal on use
Band Reject Filter	Micro-Tronics	BRM50701	105	Cut off 2.4-2.483 GHz	Cal on use
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	04 Feb 2016
RF Amplifier	AH System	PAM-0118	225	0.02 – 18 GHz	07 Apr 2016
Biconilog	EMCO	3142C	26873	26-3000 MHz	14 Apr 2016
Horn Antenna	EMCO	3155	6570	1 – 18 GHz	11 Sep 2015
Horn Antenna	EMCO	3160-09	118385	18 – 26.5 GHz	04 Aug 2016

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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 (9 kHz – 30 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.44	± 1.8
U	Expanded uncertainty U: $U = 2u_c(y)$	± 2.89	± 3.6

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured (dB)	Limit (dB)
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: $U = 2u_c(y)$	± 4.79	± 5.2

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured (dB)	Limit (dB)
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 (dB)	Limit (dB)
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