

EMC Test Report

Project Number: 3677397

Report Number: 3677397EMC01

Revision Level: 0

Client: Persistent Systems, LLC

Equipment Under Test: 2.4GHz Wireless Module

Model: XR2

Applicable Standards: FCC Part 15 Subpart C, § 15.247


Class II Permissive Change

ANSI C63.10: 2009

Report issued on: 05 March 2015


Test Result: Compliant

Tested by:



Jeremy O. Pickens, Senior EMC Engineer

Reviewed by:



David Schramm, EMC Manager

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or Testing done by SGS International Electrical Approvals in connection with distribution or use of the product described in this report must be approved by SGS international Electrical Approvals in writing.

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Spectral Density	15.247(e)	RSS-210 A8.2(b)	Compliant
Peak Power Output	15.247(b) (3)	RSS-210 A8.4(4)	Compliant
Radiated Spurious Emissions / Restricted Bands	15.247(d), 15.35(b),15.209	RSS-210 A8.5	Compliant

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Persistent Systems, LLC
 Address: 303 Fifth Avenue
 Suite 306
 City, State, Zip, Country: New York, NY 10016

2.1 Test Laboratory

Name: SGS North America, Inc.
 Address: 620 Old Peachtree Road NW, Suite 100
 City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
 Type of lab: Testing Laboratory
 Certificate Number: 3212.01

2.2 General Information of EUT

Type of Product: 2.4GHz Wireless Module
 Model: XR2
 Serial Number: 00156D6C4F55
 FCC ID: SWX-XR2
 Frequency Range: 2417 to 2457 MHz
 Data Modes: 802.11bg
 Antenna: 7.4dBi Omni-directional, Model: WR-ANT-015

Rated Voltage: 48Vdc (PoE) to interface board

Sample Received Date: 02 February 2015
 Dates of testing: 09 - 13 February 2015

Operating Modes and Conditions

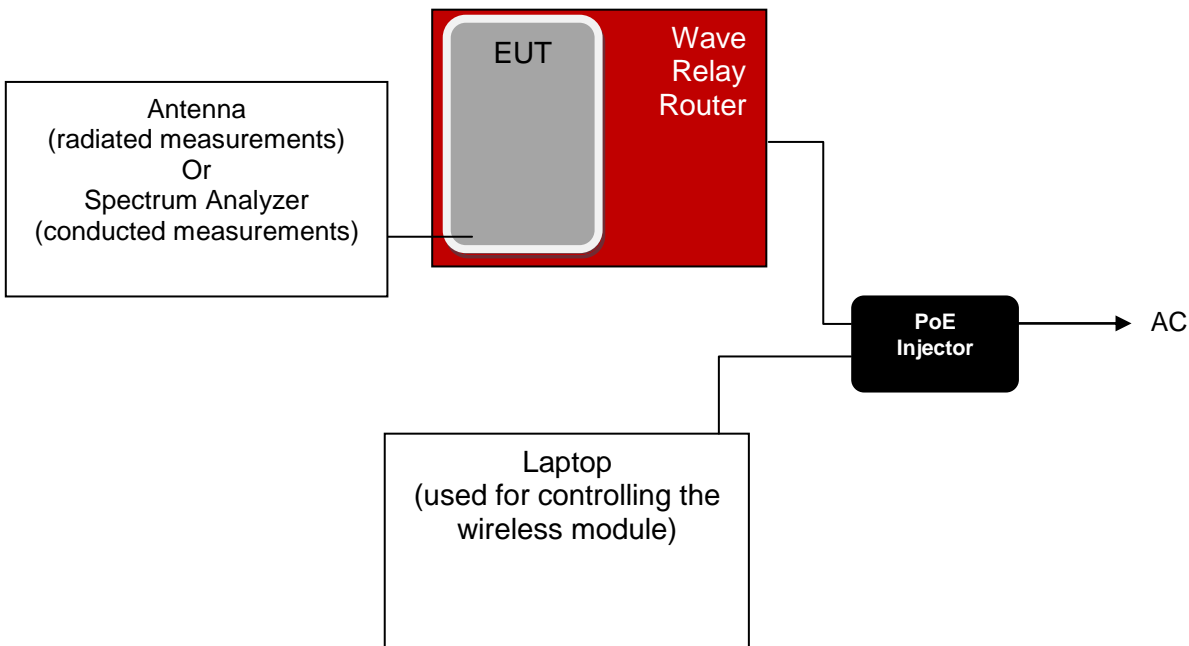
For fundamental and spurious measurements, the EUT was configured to operate continuously with Wi-Fi modulation enabled.

As specified in Section 5.10.5 of ANSI C63.10:2009:

- The software allowed configuration and operation on all available unlicensed wireless device channels.
- The software allowed configuration and operation using all available modulations and data rates
- The software allowed configuration and operation on all available power out levels

For 802.11b, measurements were recorded at 1 and 11Mbps. For 802.11g, measurements were recorded at 6 and 24Mbps. At data rates over 24Mbps, the output power was lower.

2.3 EUT Connection Block Diagram



2.4 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Ubiquiti Networks	EUT	XR2	00156D6C4F55
B	Persistent Systems, LLC	Wave Relay Router	MANET	294488
C	Persistent Systems, LLC	PoE Injector	WR-PWR-48V-60W	000027

3 Peak Output Power

3.1 Test Result

Test Description	Test Specification	Test Result
Peak Output Power	15.247(a) (1)	Compliant

3.2 Test Method

The power measurements were recorded using the integrated band power method. Data was recorded using the channel power measurement function of the spectrum analyzer. Measurements were recorded at the end of the shortest cable supplied by the manufacturer for use between the wireless module and an antenna.

Limit

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt (30dBm).

Because the antenna gain (7.4dBi) was greater than 6dBi, the limit was reduced by 1.4dBm to 28.6dBm.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.8 °C

Relative Humidity: 40.1 %

3.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	28-Aug-2015

Note: The calibration period equipment is 2 years.

3.5 Test Data

Protocol	Channel	Data Rate	Channel Power (dBm)
802.11b	2	1	22.4
802.11b	2	11	23.3
802.11b	6	1	24.7
802.11b	6	11	25.6
802.11b	10	1	22.2
802.11b	10	11	22.8
802.11g	2	6	20.3
802.11g	2	24	20.0
802.11g	6	6	22.9
802.11g	6	24	22.6
802.11g	10	6	20.3
802.11g	10	24	20.0

4 Power Spectral Density

4.1 Test Result

Test Description	Test Specification	Test Result
Power Spectral Density	15.247(e)	Compliant

4.2 Test Method

- RMS detector, trace averaging over 100 sweeps
- Resolution bandwidth of 3 kHz < RBW < 100 kHz
- Video bandwidth at 3xRBW

The limit is 8 dBm.

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.8 °C

Relative Humidity: 40.1 %

4.4 Test Equipment

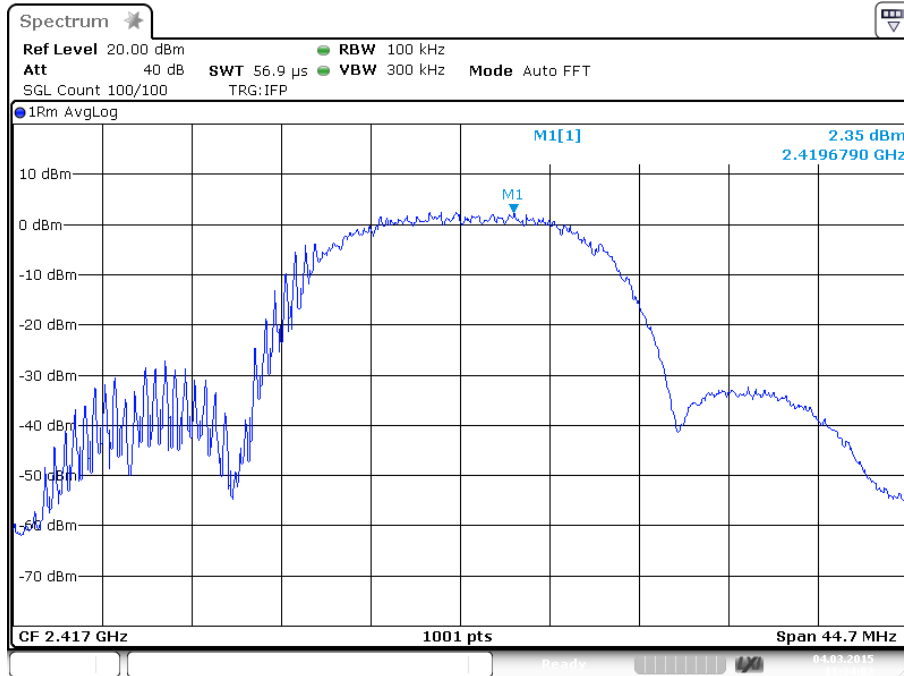
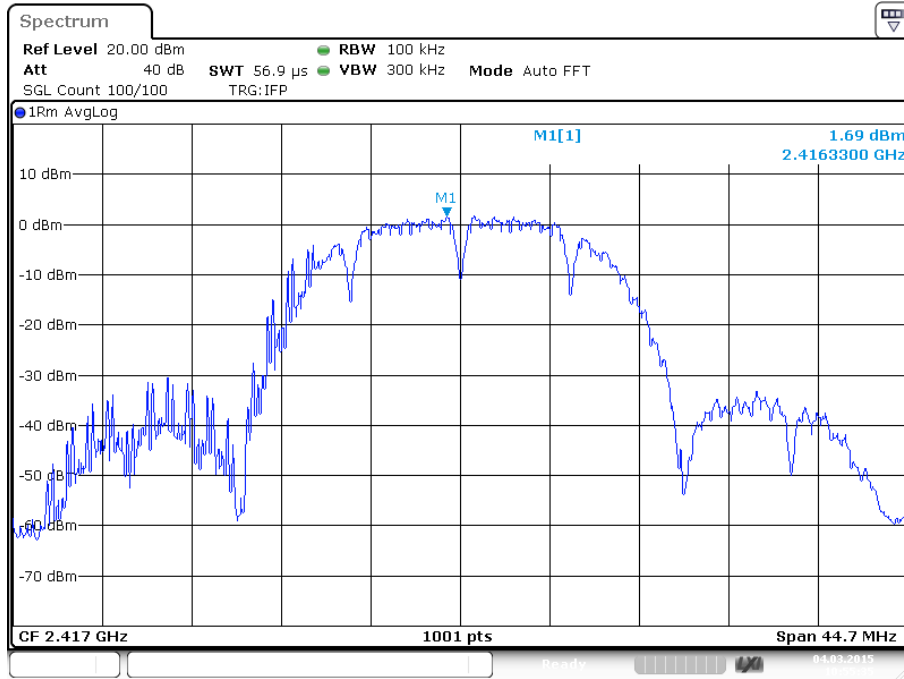
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
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Note: The calibration period equipment is 2 years.

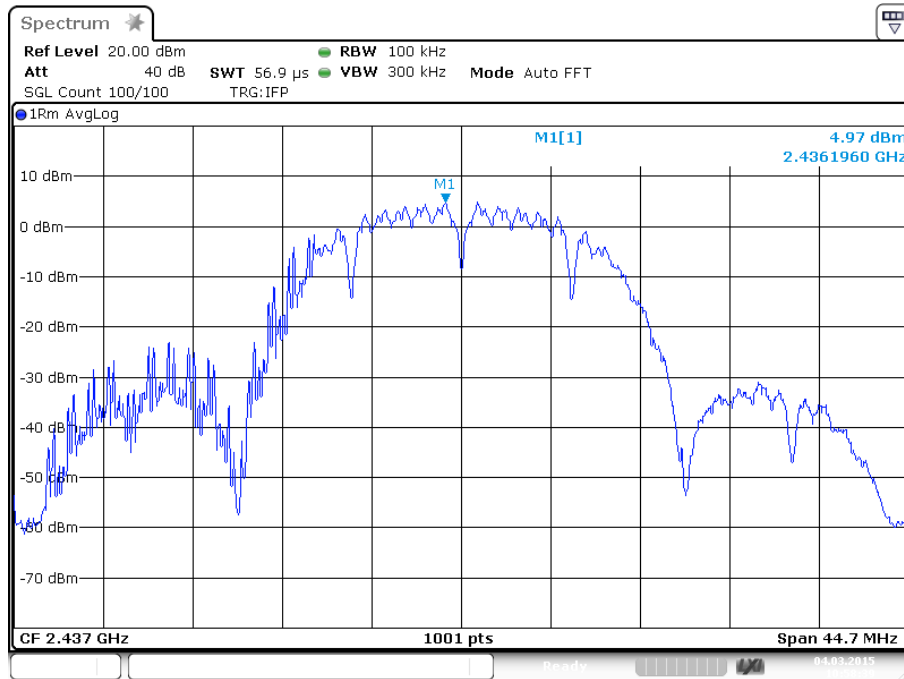
4.5 Test Data

Protocol	Channel	Data Rate	PSD (dBm)
802.11b	2	1	1.69
802.11b	2	11	2.37
802.11b	6	1	4.97
802.11b	6	11	5.21
802.11b	10	1	1.17
802.11b	10	11	1.98
802.11g	2	6	0.05
802.11g	2	24	0.81
802.11g	6	6	3.87
802.11g	6	24	3.61
802.11g	10	6	0.79
802.11g	10	24	-0.84

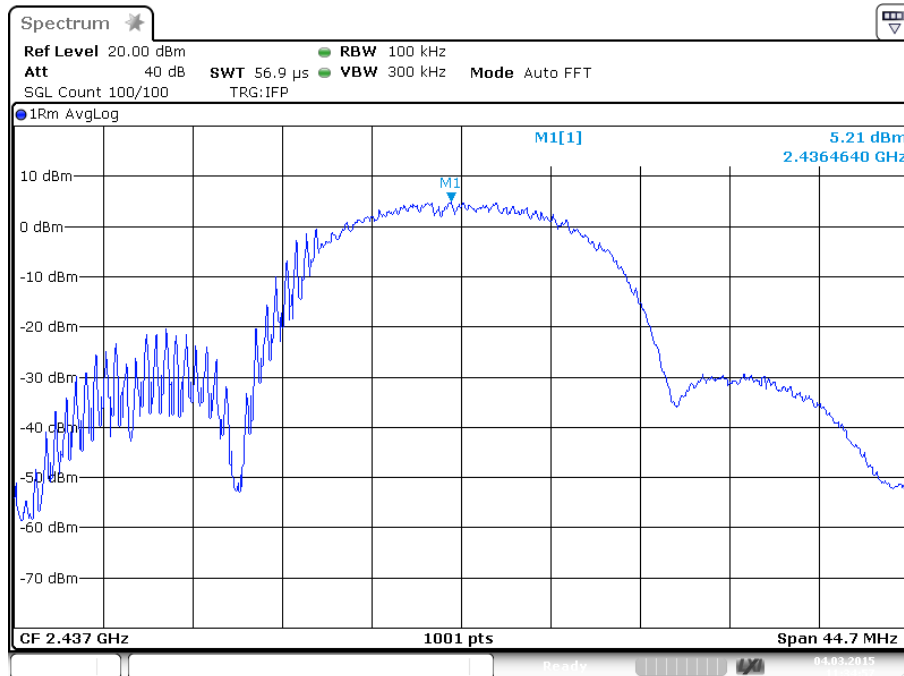
802.11b
Channel 2
Data Rates: 1 and 11 MB



802.11b
Channel 6
Data Rates: 1 and 11 MB

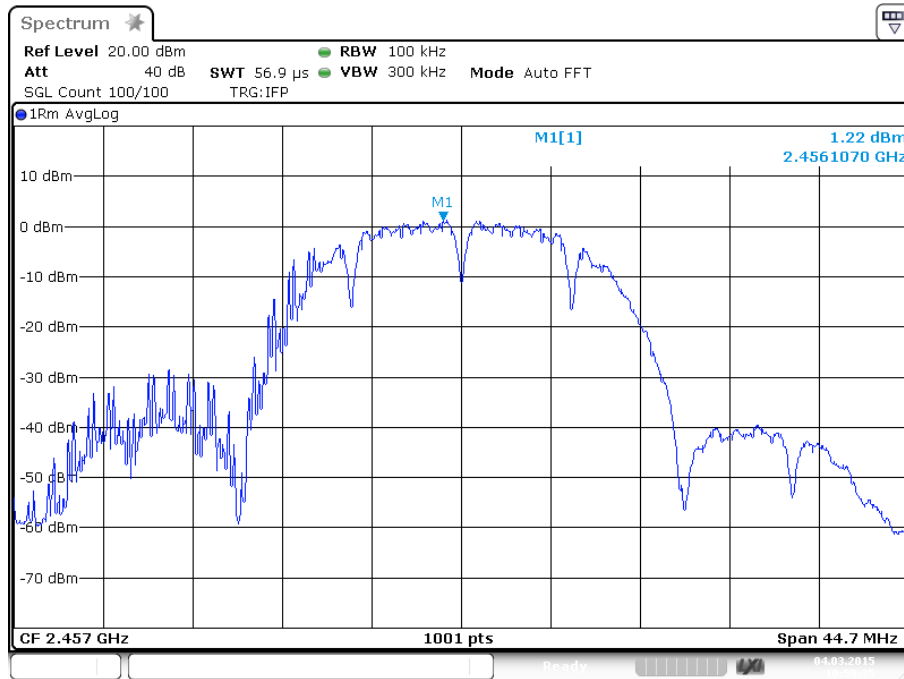


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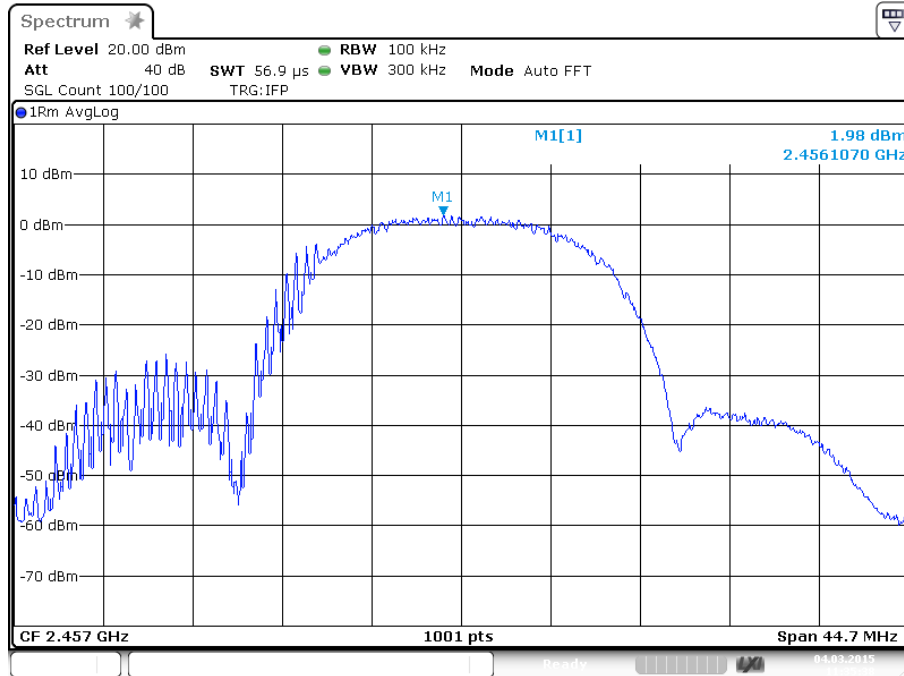


Date: 4.MAR.2015 11:34:58

802.11b
Channel 10
Data Rates: 1 and 11 MB

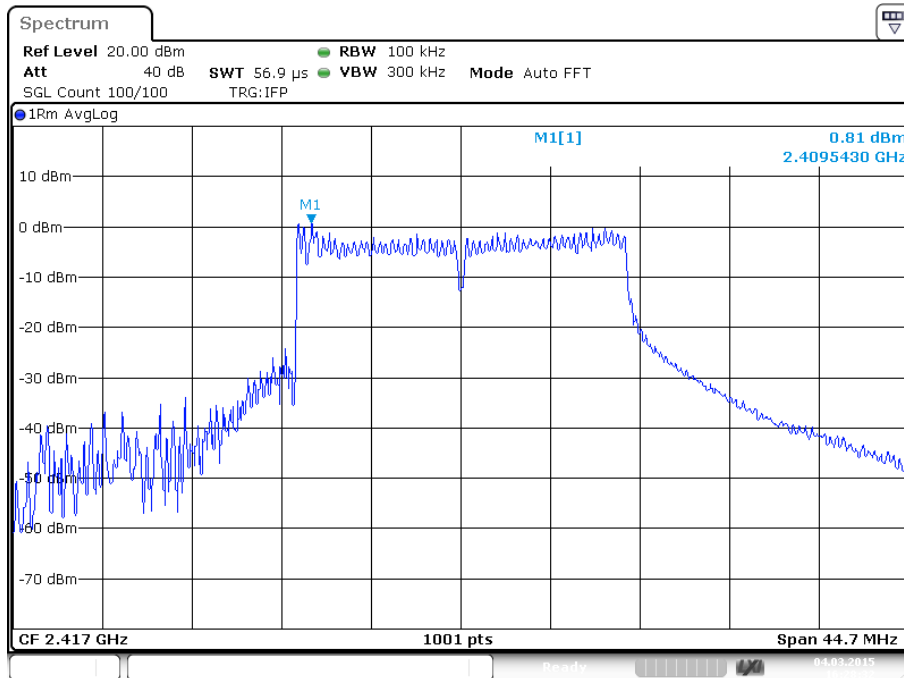
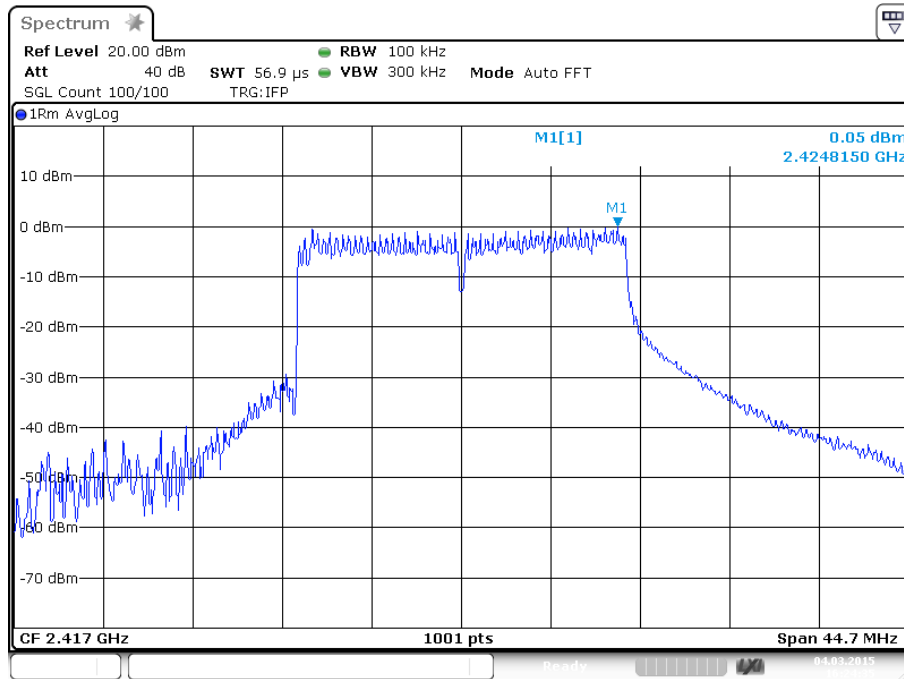


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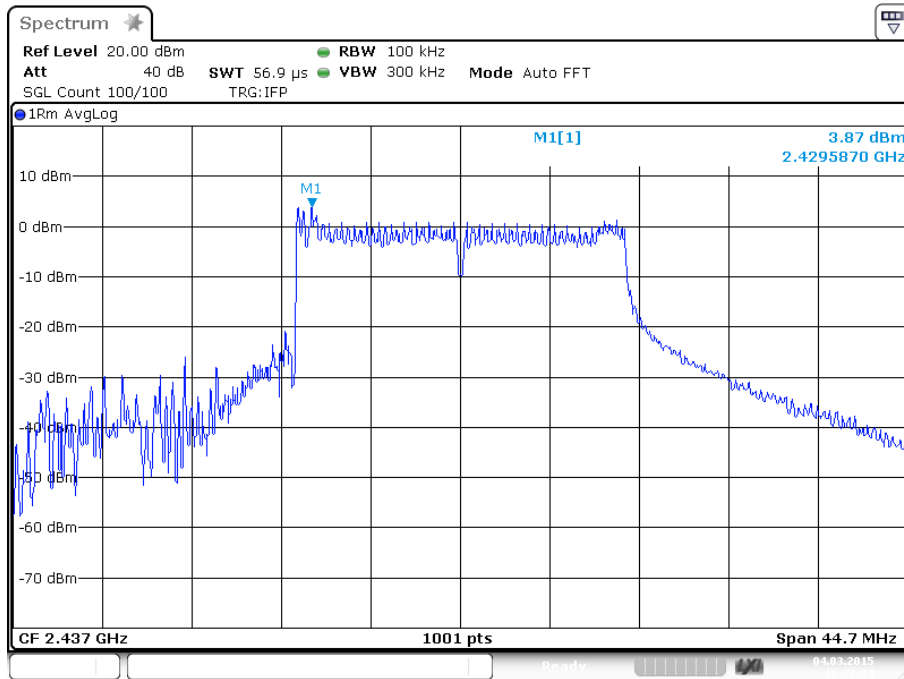


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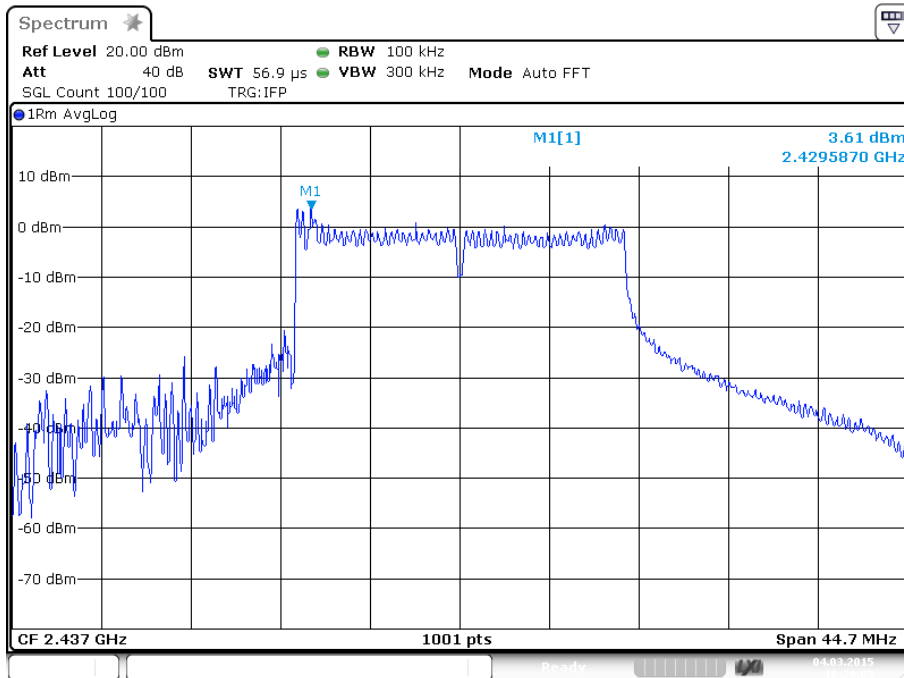
802.11g
Channel 2
Data Rates: 6 and 24 MB



802.11g
Channel 6
 Data Rates: 6 and 24 MB

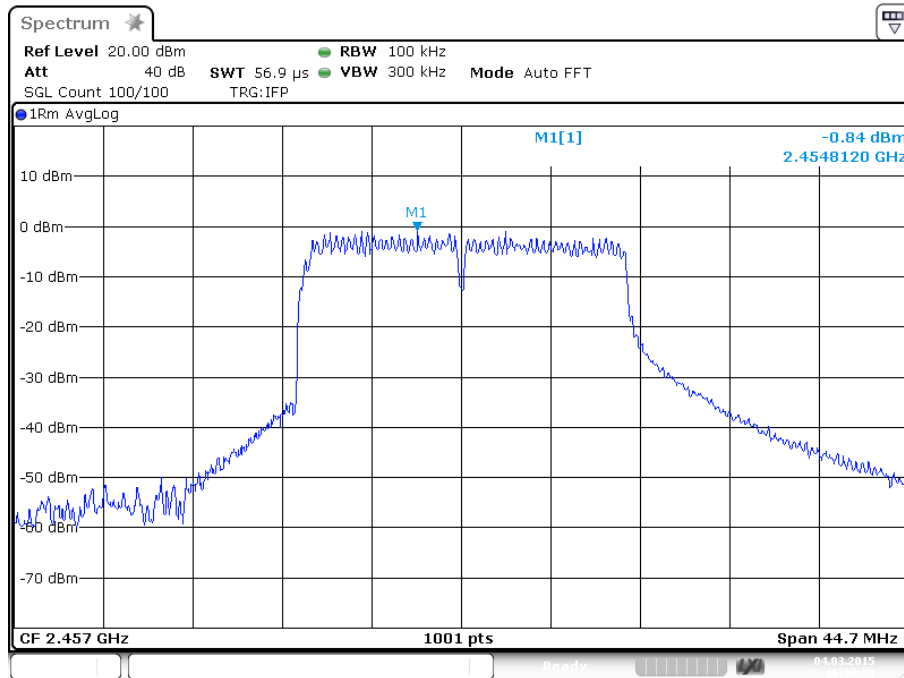
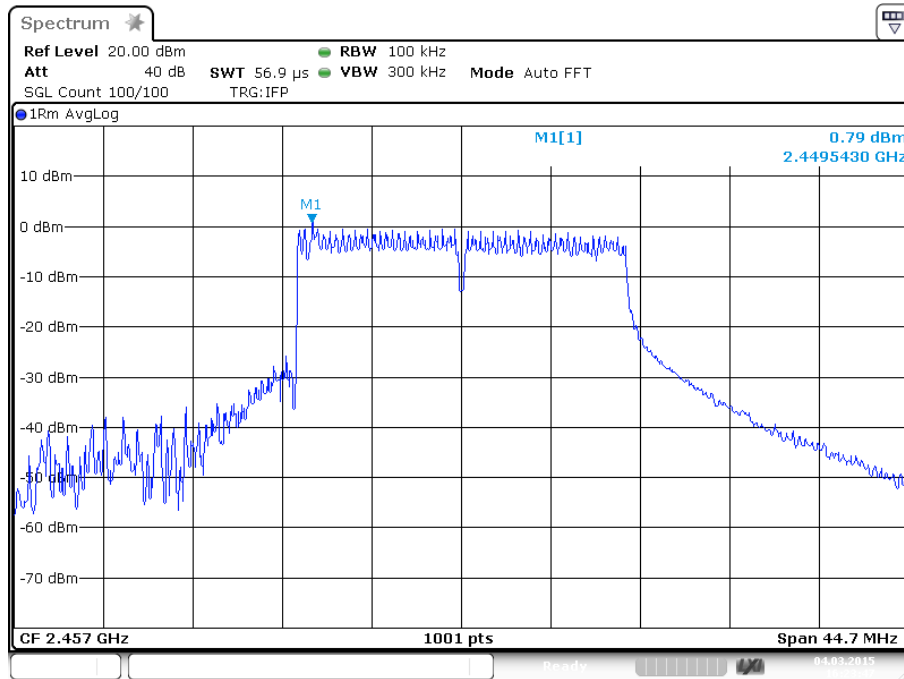


Date: 4.MAR.2015 16:22:34



Date: 4.MAR.2015 16:29:06

802.11g
Channel 10
Data Rates: 6 and 24 MB



5 Radiated Emissions at Band Edge / Restricted Band

5.1 Test Result

Test Description	Test Specification	Test Result
Field strength of spurious radiation	15.247 (d) and 15.209	Compliant

5.2 Test Method

Peak and average field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz. Measurements were made using the conducted methods defined in Section 12 of FCC publication D01 DTS Meas Guidance v03r02. The measurements were recorded and using the equation $E = EIRP - 20\log D + 104.8$, the readings were converted to a radiated field strength equivalent. The resultant data were compared to the average limit of 54 dB μ V/m and peak limit of 74 dB μ V/m.

Measurements taken at harmonics of the fundamental transmit frequency were recorded using radiated methods at a distance of 3 meters.

5.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 20.8 °C
Relative Humidity: 29.7 %

5.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	7-Oct-2015
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	10-Apr-2015
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079712	4-Aug-2015
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079711	4-Aug-2015
RF CABLE	SF106	HUBER&SUHNER	B085888	5-Aug-2015
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	4-Aug-2015
COAXIAL CABLE	1134	GORE	B094785	5-Aug-2015
RF CABLE	SF106	HUBER&SUHNER	B085892	5-Aug-2015
DESKTOP AMPLIFIER 30M-18GHZ	NSP1800-25-HG	MITEQ	B085930	12-Mar-2015
FIXED GAIN AMPLIFIER	NSP1840-HG	MITEQ	B087572	14-Oct-2015
BAND REJECT FILTER	BRM50702	MICRO-TRONICS	NA	105

Note: The calibration period equipment is 1 year.

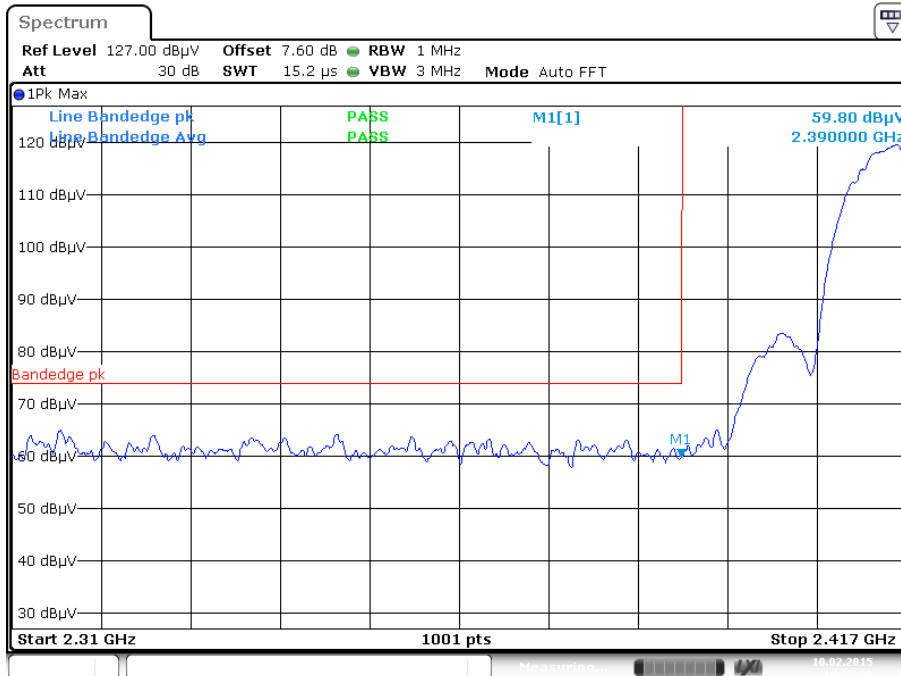
5.5 Test Setup Photographs

Test setup photographs are located in a separate exhibit.

5.6 Test Data

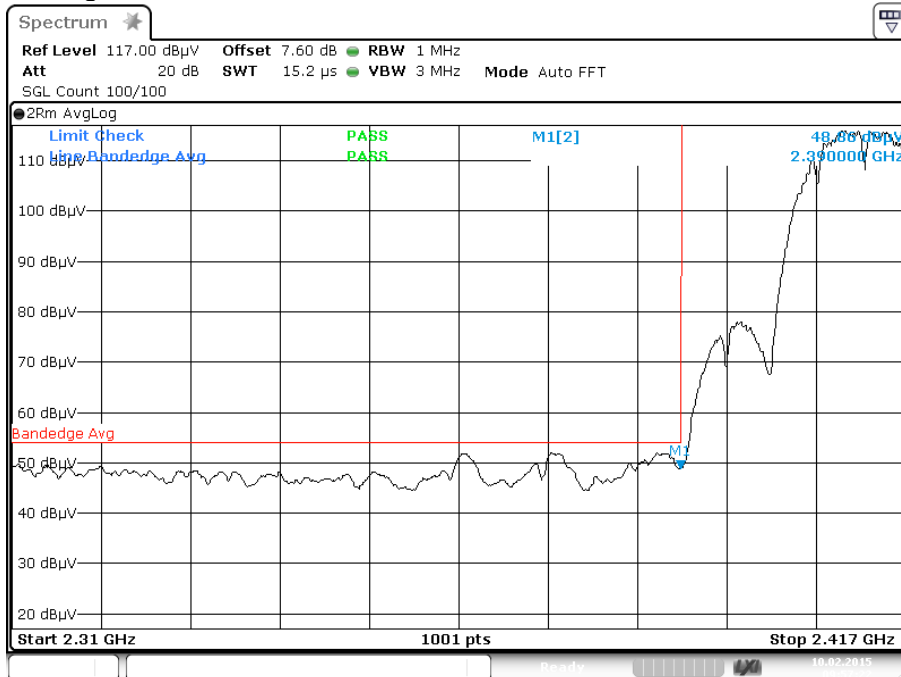
802.11b, 1Mbit/s, Ch2

Peak



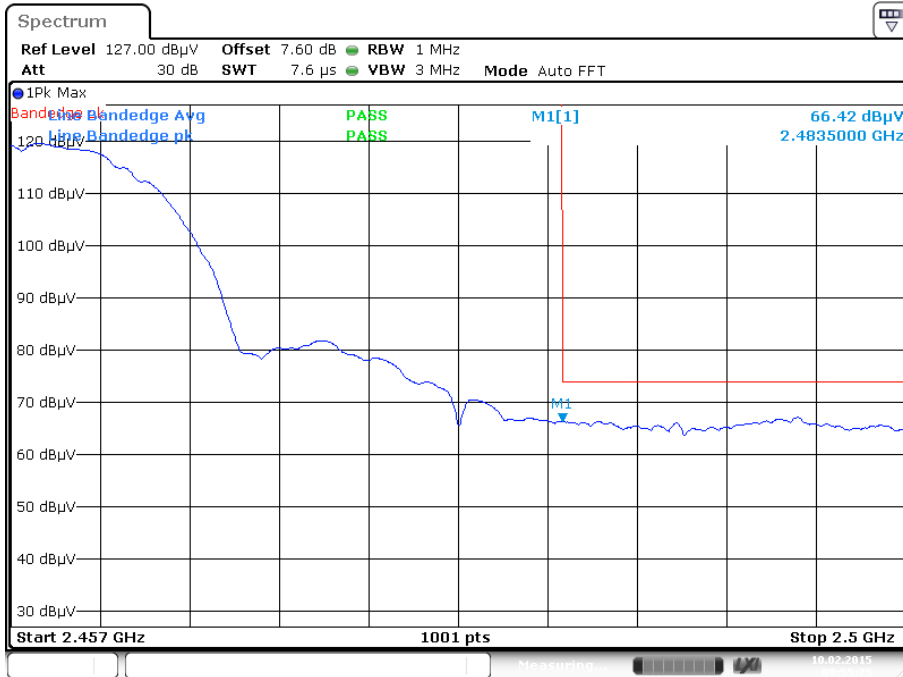
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Average

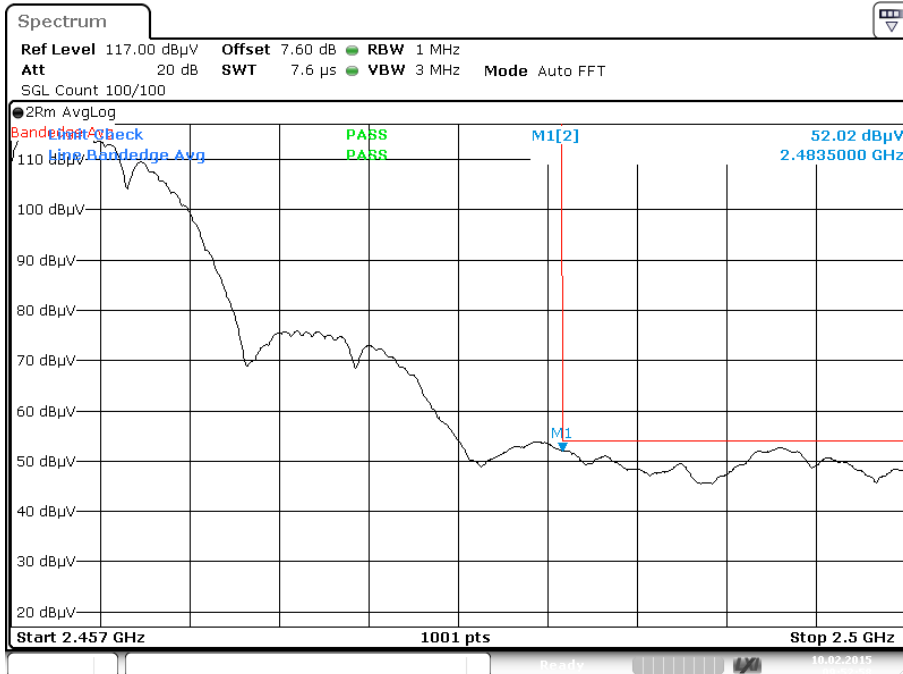


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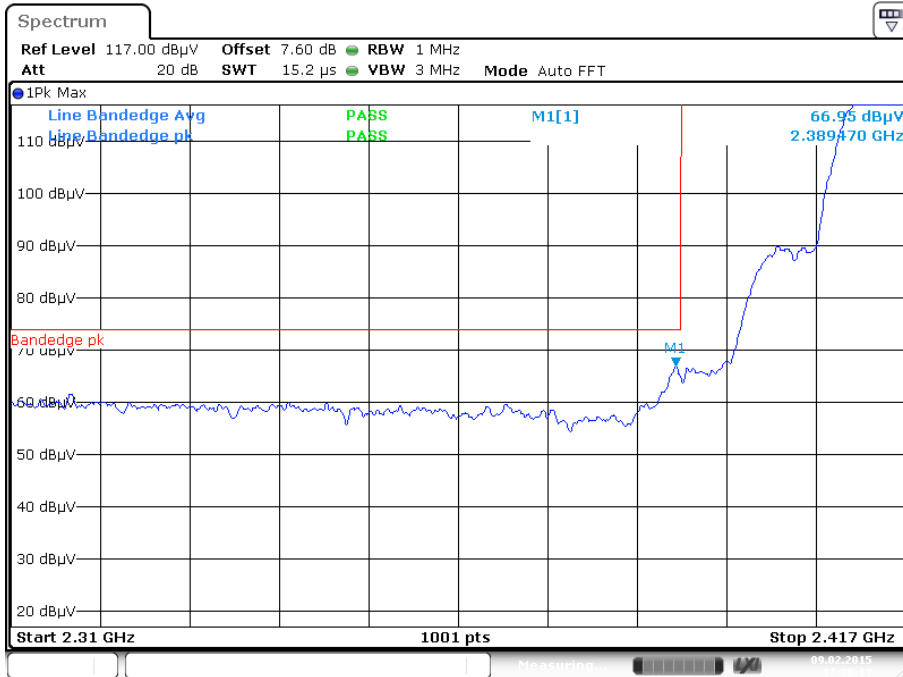
802.11b, 1Mbit/s, Ch10 Peak



Average

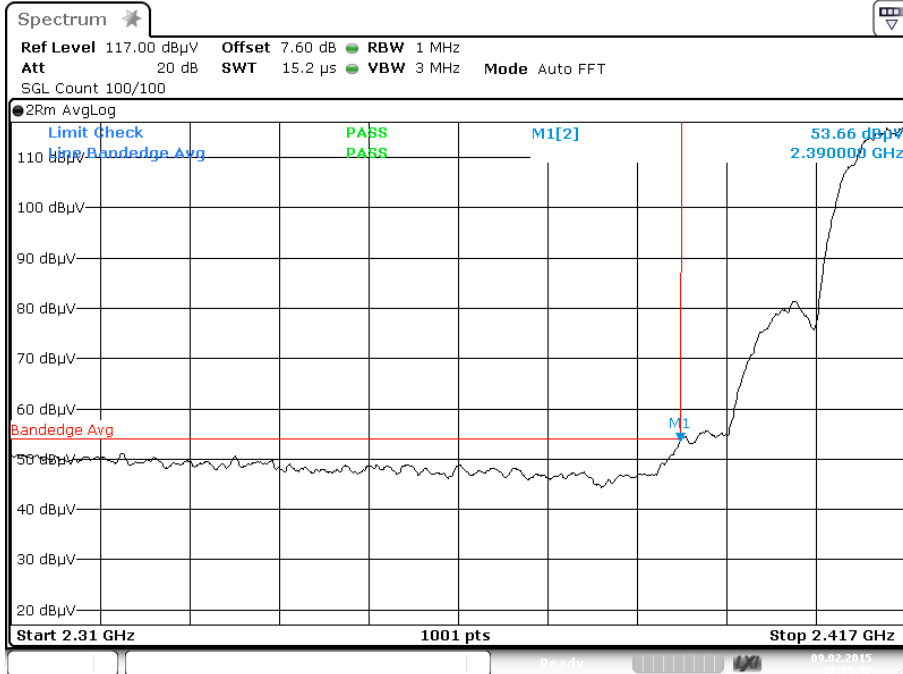


802.11b, 11Mbit/s, Ch2 Peak



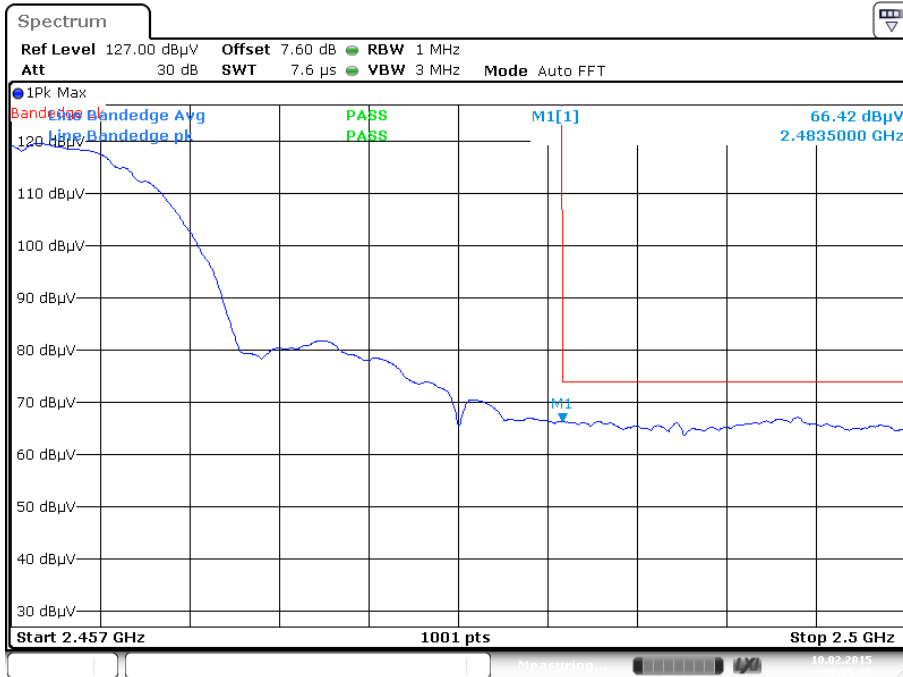
Date: 9.FEB.2015 17:20:13

Average

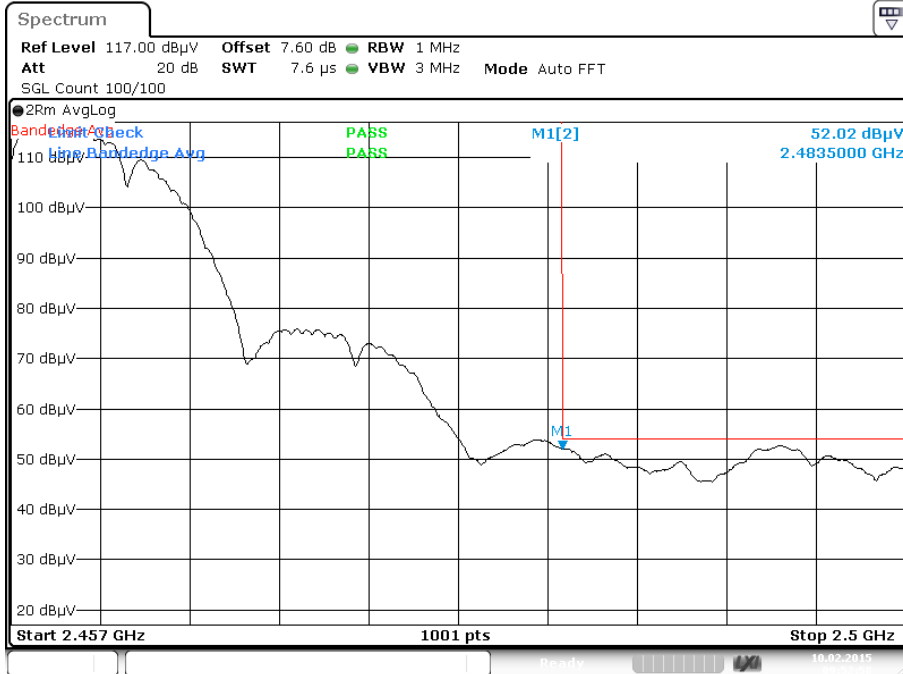


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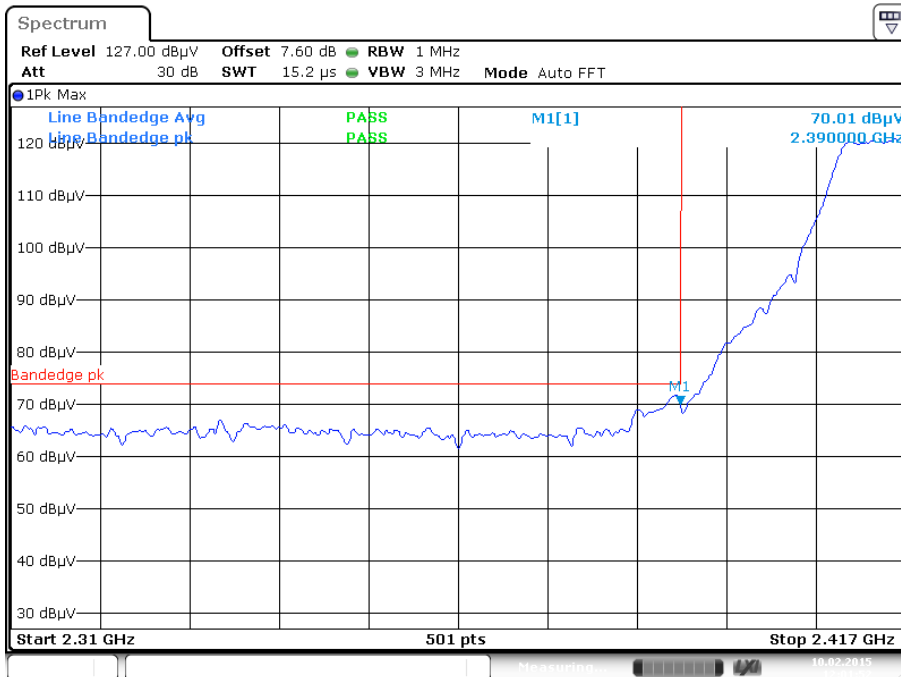
802.11b, 11Mbit/s, Ch10 Peak



Average

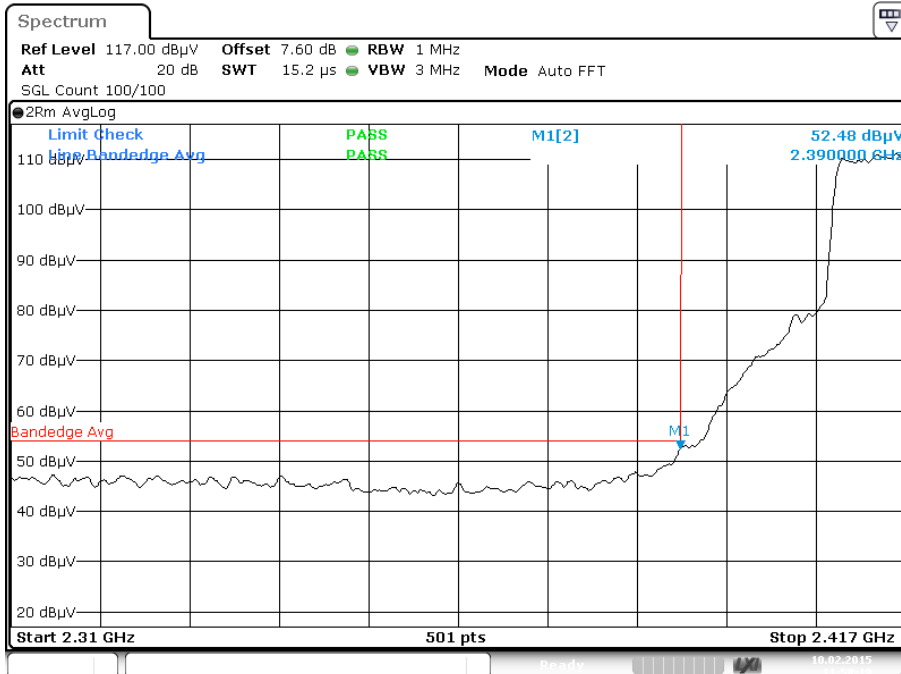


802.11g, 6Mbit/s, Ch2 Peak



Date: 10.FEB.2015 12:01:52

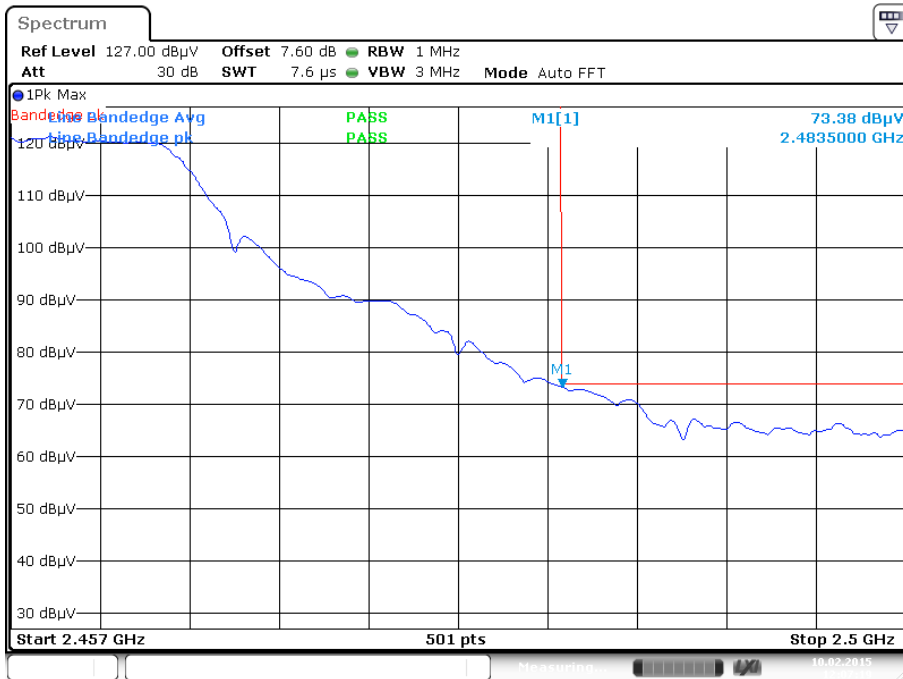
Average



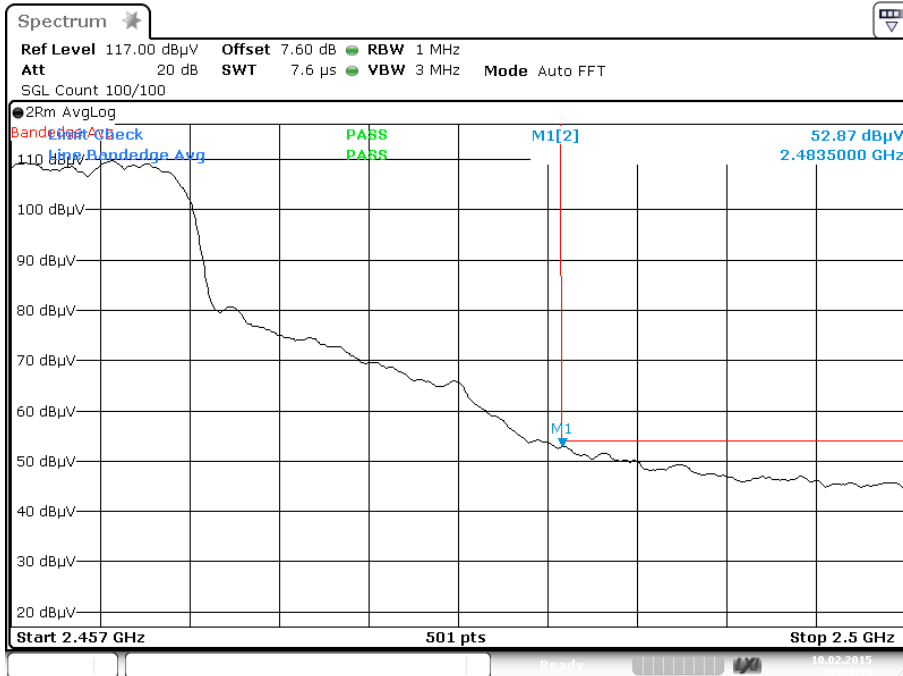
Date: 10.FEB.2015 11:58:19

802.11g, 6Mbit/s, Ch10

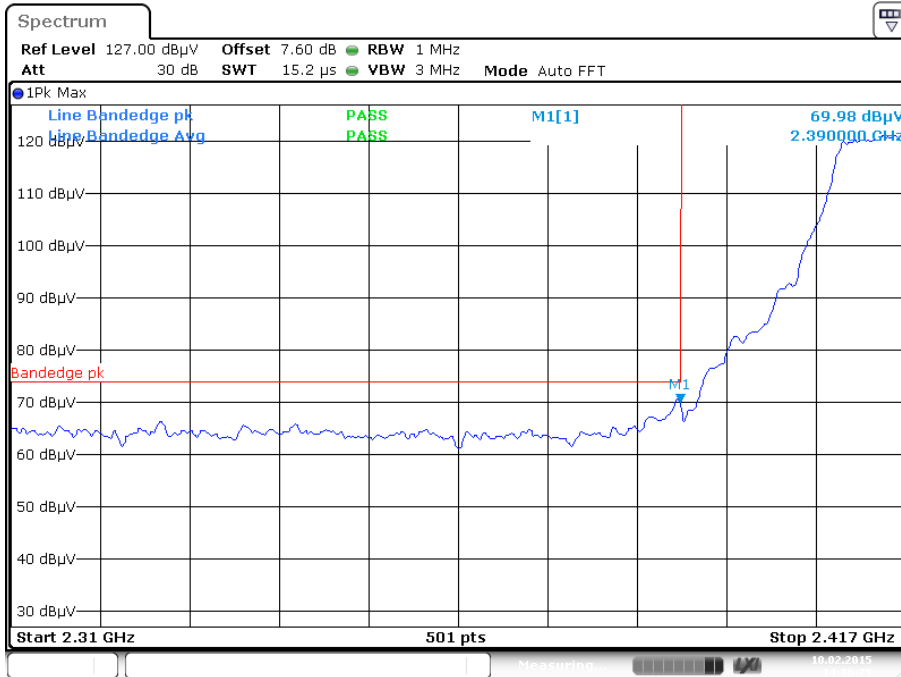
Peak



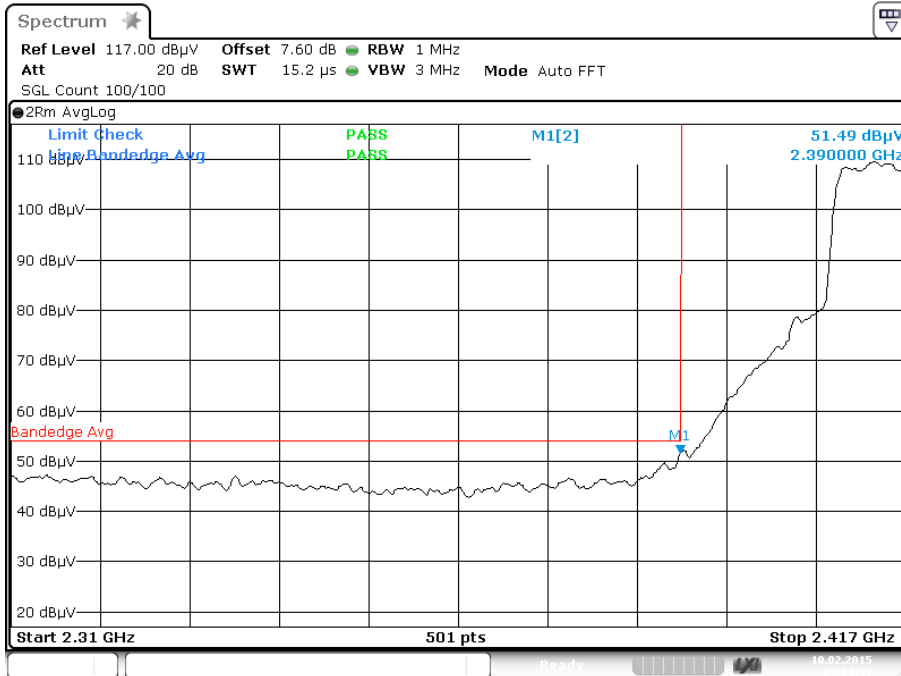
Average



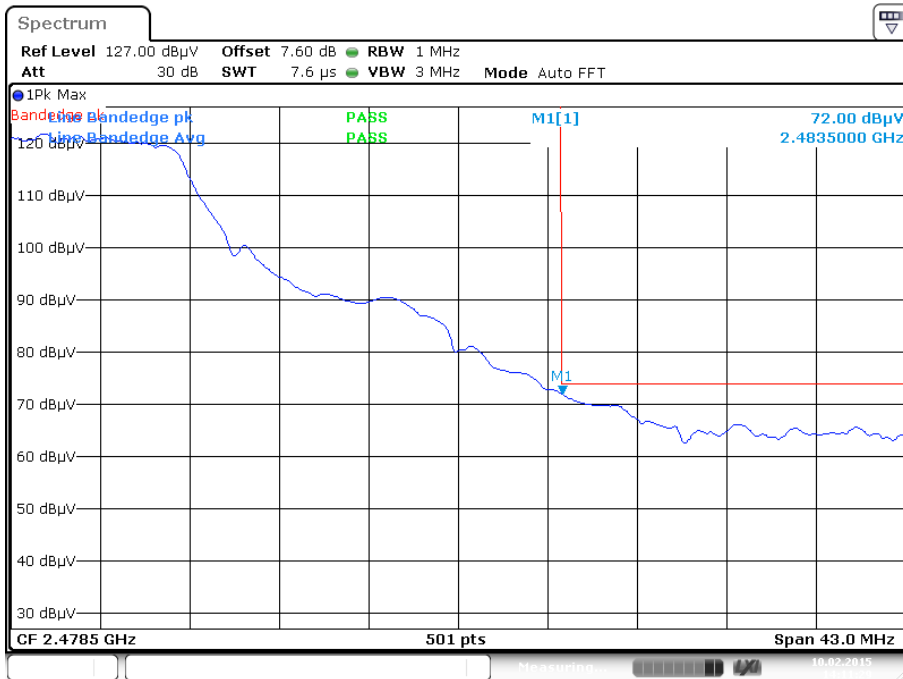
802.11g, 24Mbit/s, Ch2 Peak



Average

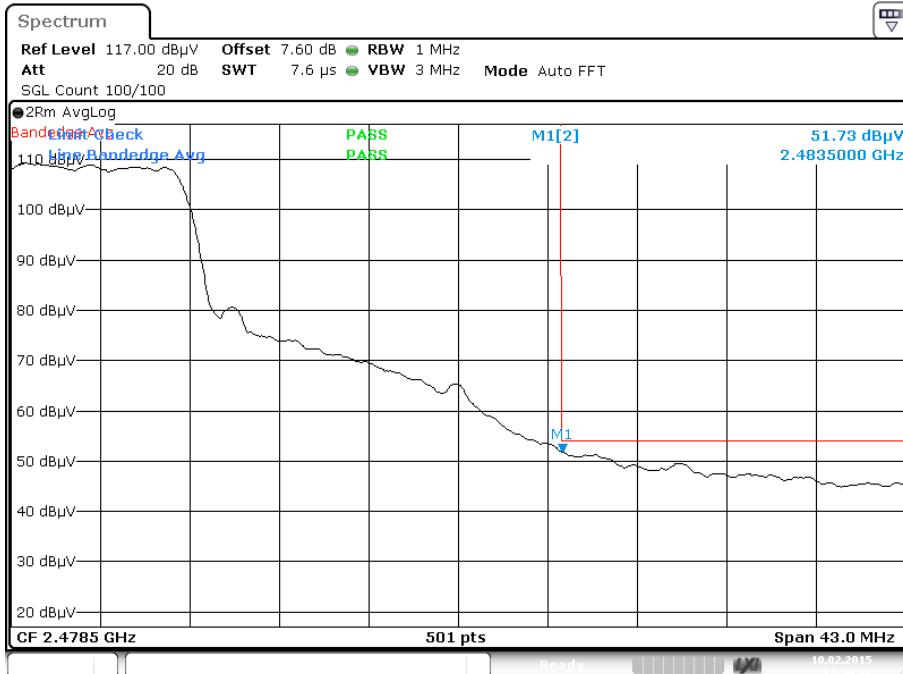


802.11g, 24Mbit/s, Ch10 (worst case) Peak



Date: 10.FEB.2015 14:11:30

Average



Date: 10.FEB.2015 13:34:12

802.11B - 1Mbps (7.4dBi Antenna)

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Avg Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Channel 2										
4834.00	54.0	V	187.9	135.3	34.6	6.4	43.9	51.1	54.0	-2.9
7251.00	41.2	V	171.1	300.2	35.9	8.1	41.6	43.6	54.0	-10.4
Channel 6										
4874.00	55.9	V	148.0	288.6	34.6	6.4	44.0	52.9	54.0	-1.1
7311.00	46.2	V	178.9	281.7	35.8	8.2	41.6	48.6	54.0	-5.4
Channel 10										
4914.00	55.5	V	175.6	285.2	34.6	6.5	44.0	52.6	54.0	-1.4
7371.00	40.0	V	176.4	283.2	35.8	8.2	41.6	42.4	54.0	-11.6
Avg Value = Level + AF + CL - Amp										
Margin = Avg Value - Limit										

802.11G - 6Mbps (7.4dBi Antenna)

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Avg Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Channel 2										
4834.00	43.2	V	209.4	303.2	34.6	6.4	43.9	40.3	54.0	-13.7
7251.00	45.4	V	195.9	230.6	35.9	8.1	41.6	47.8	54.0	-6.2
Channel 6										
4874.00	52.3	V	166.3	315.4	34.6	6.4	44.0	49.3	54.0	-4.7
7311.00	51.3	V	212.2	313.1	35.8	8.2	41.6	53.7	54.0	-0.3
9748.00	37.6	V	163.3	313.1	36.9	9.2	39.3	44.4	54.0	-9.6
Channel 10										
4914.00	43.4	V	338.6	261.7	34.6	6.5	44.0	40.5	54.0	-13.5
7371.00	41.8	V	195.4	278.8	35.8	8.2	41.6	44.2	54.0	-9.8
Avg Value = Level + AF + CL - Amp										
Margin = Avg Value - Limit										

6 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	05 March 2015