Test of Aruba Networks, WAP3212

To: FCC 47 CFR Part 15.247 & IC RSS-210

Test Report Serial No.: ARUB189-U2 Rev A

TEST REPORT

FROM

Test of Aruba Networks, WAP3212

to

To FCC 47 CFR Part 15.247 & IC RSS-210

Test Report Serial No.: ARUB189-U2 Rev A

Note: this report contains data with regard to the 2400-2483.5 MHz and 5725-5850 MHz operational modes of the Aruba Networks WAP3212 Wireless Access Point. Test data for the 5,150 - 5,350 and 5,470–5,725 MHz is reported in MiCOM Labs test report ARUB189-U4

This report supersedes: NONE

Applicant: Aruba Networks
1344 Crossman Avenue
Sunnyvale
California 94089, USA

Product Function: Wireless Access Point for use in aircraft

Copy No: pdf Issue Date: 3rd February 2015

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
575 Boulder Court
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

ACCREDITED
TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

This page has been left intentionally blank

TABLE OF CONTENTS

ACCREDITATION, LISTINGS & RECOGNITION 5
TESTING ACCREDITATION 5
RECOGNITION 6
PRODUCT CERTIFICATION 7
TEST RESULT CERTIFICATE 9
1. REFERENCES AND MEASUREMENT UNCERTAINTY 10
1.1. Normative References 10
1.2. Test and Uncertainty Procedures 11
2. PRODUCT DETAILS AND TEST CONFIGURATIONS 12
2.1. Technical Details 12
2.2. Scope of Test Program 13
2.3. Equipment Model(s) and Serial Number(s) 14
2.4. Antenna Details 14
2.5. Cabling and I/O Ports 14
2.6. Test Configurations 15
2.7. Equipment Modifications 15
2.8. Deviations from the Test Standard 15
3. TEST EQUIPMENT CONFIGURATION(S) 16
3.1. Radiated Spurious Emission Test Set-up > 1 GHz 16
3.2. Digital Emissions Test Set-up (0.03 – 1 GHz) 17
4. TEST SUMMARY 19
5. TEST RESULTS 21
5.1. Device Characteristics 21
5.1.1. Radiated Emission Testing 21

ACCREDITATION, LISTINGS & RECOGNITION

TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 28th day of February 2014.

President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2015

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

RECOGNITION

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

**NB – Notified Body

PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC 17065. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf

United States of America – Telecommunication Certification Body (TCB)
TCB Identifier – US0159

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

Japan – Recognized Certification Body (RCB)
RCB Identifier - 210

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	3rd February 2015	Initial release.

TEST RESULT CERTIFICATE

Manufacturer:	Aruba Networks 1344 Crossman Avenue Sunnyvale California 94089, USA	Tested By:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California, 94566, USA
EUT:	802.11a/b/g/n/ac Wireless LAN Access Point	Telephone:	+1 925 462 0304
Model:	WAP3212-001001 / RD-FA2066-01	Fax:	+1 925 462 0306
S/N's:	P000013		
Test Date(s):	15th - 24th December 2014	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 15.247 & IC RSS-210	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:

A2LA ACCREDITED
TESTING CERT #2381.01

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

1. REFERENCES AND MEASUREMENT UNCERTAINTY

1.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
i.	FCC 47 CFR Part 15, Subpart C	2012	Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES Subpart C—Intentional Radiators
ii.	RSS-210 Annex 8	2010	Radio Standards Specification 210, Issue 8, Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
iii.	FCC OET KDB 662911	31st October 2013	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
iv.	RSS-GEN	2010	Radio Standards Specification-Gen, Issue 3, General Requirements and Information for the Certification of Radiocommunication Equipment
v.	FCC 47 CFR Part 15, Subpart B	2012	47 CFR Part 15, SubPart B; Unintentional Radiators
vi.	ICES-003	31st August 2013	Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard Digital Apparatus; Issue 5
vii.	ANSI C63.4	2009	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
viii.	CISPR 22/ EN 55022	2010	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
ix.	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
x.	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
xi.	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
xii.	A2LA	July 2014	Reference to A2LA Accreditation Status – A2LA Advertising Policy

1.2. Test and Uncertainty Procedures

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

2. PRODUCT DETAILS AND TEST CONFIGURATIONS

2.1. Technical Details

Details	Description
Purpose:	Test of the Aruba Networks, WAP3212 to FCC Part 15.247 and Industry Canada RSS-210 regulations.
Applicant:	Aruba Networks 1344 Crossman Avenue Sunnyvale, California 94089, USA
Manufacturer:	As applicant.
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton, California 94566 USA
Test report reference number:	ARUB189-U2 Rev A
Date EUT received:	15th December 2014
Standard(s) applied:	FCC 47 CFR Part 15.247 & IC RSS-210
Dates of test (from - to):	15th - 24th December 2014
No of Units Tested:	One
Type of Equipment:	802.11a/b/g/n/ac Wireless Access Point 3x3 Spatial Multiplexing MIMO configuration
Manufacturers Trade Name:	Cabin Wireless Access Point (CWAP)
Model(s):	WAP3212-001001 / RD-FA2066-01
Location for use:	Indoor only
Declared Frequency Range(s):	2400 - 2483.5 MHz; 5725 - 5850 MHz
Hardware Rev:	Mod 0
Firmware Rev:	e500rd_ap225.ari (radio-board)
Software Rev:	SWWAP-002-001
Type of Modulation:	Per 802.11 –CCK, BPSK, QPSK, DSSS, OFDM
Declared Nominal Average Output Power:	802.11b: +18 dBm 802.11g:Leg. +18dBm,HT-20 +18 dBm,HT-40 +14 dBm 802.11a:Leg. +18dBm,HT-20 +18 dBm,HT-40 +14 dBm 802.11ac-40 +14dBm, 802.11ac-80 +12dBm
EUT Modes of Operation:	802.11a/b/g, 802.11n HT-20, HT-40, ac-40, ac-80
Transmit/Receive Operation:	Time Division Duplex
Input Voltage and Current:	115 Vac (360-800 Hz)
Operating Temperature Range:	Declared range 0º to +40ºC
ITU Emission Designator:	2400 – 2483.5 MHz 802.11b 13M9G1D 2400 – 2483.5 MHz 802.11g 16M6D1D 2400 – 2483.5 MHz 802.11n – HT-20 17M8D1D 2400 – 2483.5 MHz 802.11n – HT-40 36M6D1D 5725 – 5850 MHz 802.11a 17M7D1D 5725 – 5850 MHz 802.11n – HT-20 17M7D1D 5725 – 5850 MHz 802.11n – HT-40 36M4D1D 5725 – 5850 MHz 802.11VHT-40 36M4D1D 5725 – 5850 MHz 802.11VHT-80 75M9D1D
Equipment Dimensions:	L 279,4mm x W 230,0mm x H 59,5mm
Weight:	2.0 kg
Primary function of equipment:	Wireless Access Point for transmitting data and voice within aircraft

2.2. Scope of Test Program

Aruba Networks WAP3212 Wireless Access Point

The scope of the test program was to test the Aruba Networks, WAP3212, 3x3 Spatial Multiplexing MIMO configurations in the frequency ranges 2400 - 2483.5 MHz and 5725 – 5850 MHz for compliance against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications.

FCC Correspondence – Tracking Number 906981

Aruba Networks sent an official inquiry (Tracking Number 906981) dated 21st October 2014 to the FCC requesting clarification on the reuse of test data. Received the following response from the FCC;

FCC response 12/04/2014:

You may reuse the conducted data but must do new radiated measurements. If the new application is under a different applicant's name, the applicant will need permission to reuse the data. This letter must be uploaded to the new application.

Conducted test data can be found in MiCOM Labs test report number:
ARUB145-U1 Aruba Networks APIN0224, APIN0225 FCC Pt 15.247 & IC RSS 210

FCC OET KDB Implementation

This test program implements the following FCC KDB – 662911 4/4/2011;
Emissions Testing of Transmitters with Multiple Outputs in the Same Band

The KDB document provides guidance for measurements of conducted output emissions of devices that employ a single transmitter with multiple outputs in the same band, with the outputs occupying the same or overlapping frequency ranges. It applies to EMC compliance measurements on devices that transmit on multiple antennas simultaneously in the same or overlapping frequency ranges through a coordinated process. Examples include, but are not limited to, devices employing beam forming or multiple-input and multiple-output (MIMO.) This guidance applies to both licensed and unlicensed devices wherever the FCC rules call for conducted output measurements. Guidance is provided for in-band, out-of-band and spurious emission measurements.

This guidance does not apply to the multiple transmitters included in a composite device, such as a device that combines an 802.11 modem with a cell phone in one enclosure with each driving its own antenna.

2.3. Equipment Model(s) and Serial Number(s)

Equipment Type	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	802.11a/b/g/n/ac WLAN	Aruba Networks	WAP3212-001001 / RD-FA2066-01	P000013
Support	Laptop PC	IBM	Thinkpad	None

2.4. Antenna Details

Model	Type	Gain	Freq. Band	Note
		dBi	MHz	
metal sheet	Omni	4.0	2400 - 2500	(3x per band, per unit)
metal sheet	Omni	4.5	5150 - 5875	(3x per band, per unit)

2.5. Cabling and I/O Ports

Number and type of I/O ports

1. 2 x 10/100/1000 Ethernet (Daisy-Chainable)
2. 115 Vac (360-800 Hz), supply connector
3. 4 x Strapping pins for discrete input/outputs

2.6. Test Configurations

Antenna Test Configurations for Radiated Emissions

Results for the following configurations are provided in this report.
Radiated emissions testing was performed for three different antennas that represent the highest gain for each antenna type intended for use with the EUT;- Integral antenna (As used in APINR109) ; ANT-18 60 degree sector antenna; ANT-19 monopole antenna.

Radiated emissions testing was performed for all possible configurations for antenna ANT-18 which is the highest gain antenna used with the equipment. Radiated emissions testing was performed for the other two antennas in worst case mode (mode with the highest spectral density)

2,400 – 2483.5 MHz

15.247	
802.11b,g, 802.11n HT-20	SE 2412
	SE 2437
	SE 2462
	BE 2390
	BE 2483.5
802.11n HT-40	SE 2412
	SE 2437
	SE 2462
	BE 2390
	BE 2483.5

5,725 – 5850 MHz

15.247	
802.11a 802.11n HT-20	a SE 5745
	a SE 5785
	a SE 5825
802.11n HT-40	SE 5755
	SE 5795
	BE 5460
802.11ac-80	SE 5775
	BE 5460

KEY;-

SE – Spurious Emission
BE – Band-Edge

2.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

2.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

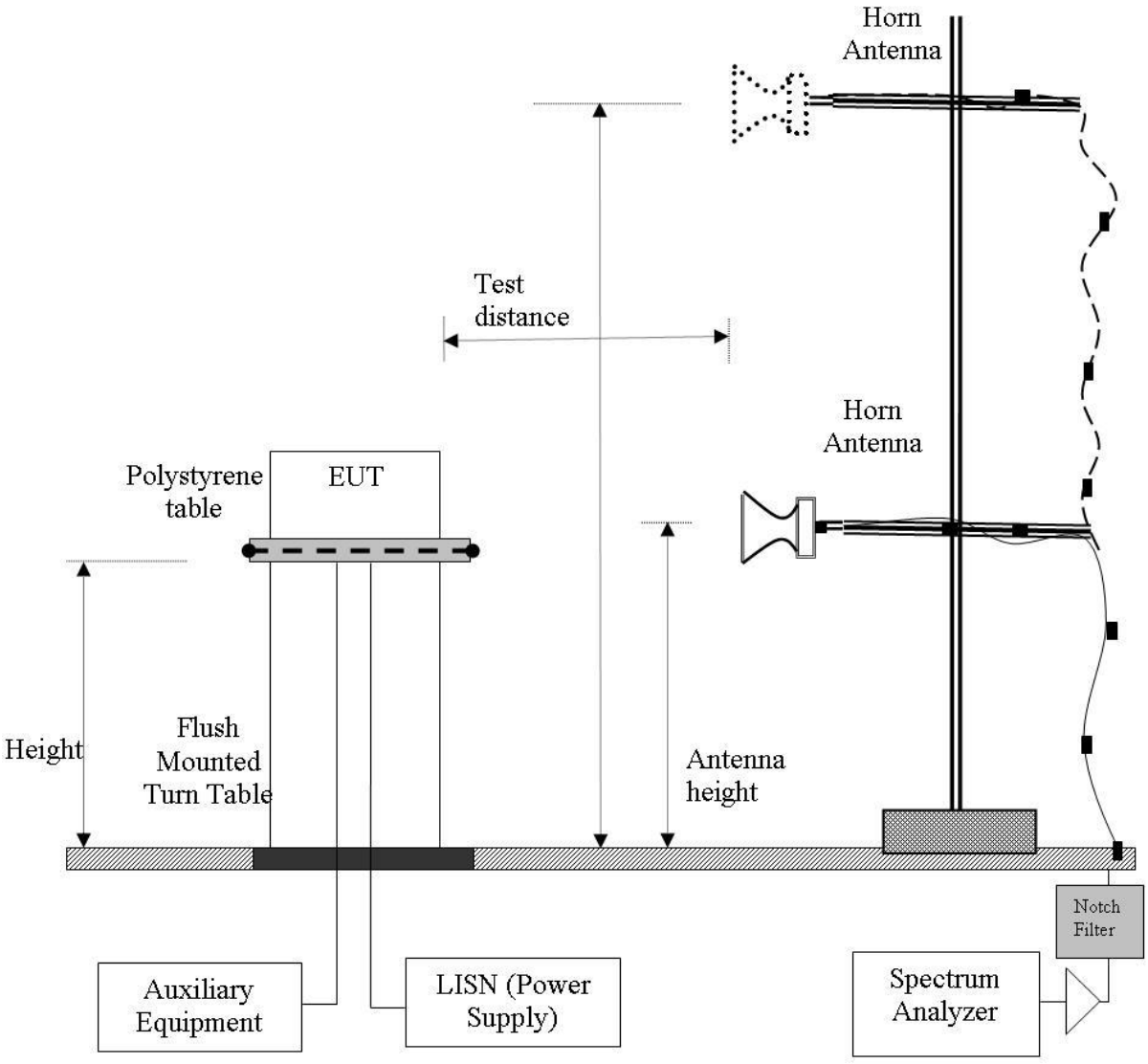
1. NONE

3. TEST EQUIPMENT CONFIGURATION(S)

3.1. Radiated Spurious Emission Test Set-up > 1 GHz

The following tests were performed using the conducted test set-up shown in the diagram below.

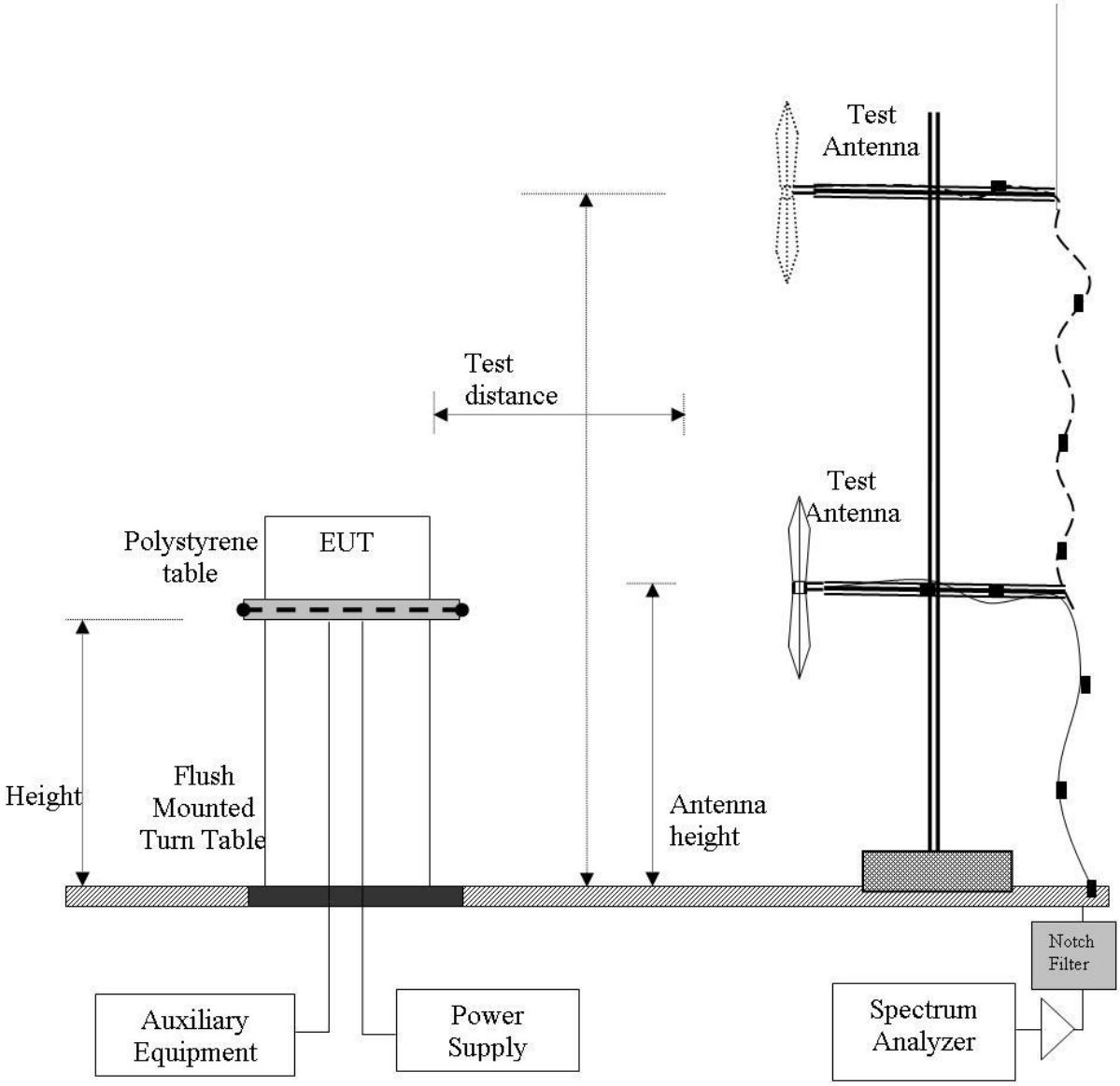
Radiated Emission Measurement Setup – Above 1 GHz



3.2. Digital Emissions Test Set-up (0.03 – 1 GHz)

The following tests were performed using the conducted test set-up shown in the diagram below.

Digital Emission Measurement Setup – Below 1 GHz



Traceability of Test Equipment Utilized for Radiated Emission Testing

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	04 Dec 2015
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CY101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	31 Jul 2015
301	5470 to 5725 MHz Notch Filter	Microtronics	RBC50704	001	08 Oct 2015
302	5150 to 5350 MHz Notch Filter	Microtronics	BRC50703	002	08 Oct 2015
303	5725 to 5875 MHz Notch filter	Microtronics	BRC50705	003	08 Oct 2015
310	SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001	30 Oct 2015
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	14 Aug 2015
342	2.4 GHz Notch Filter	EWT	EWT-14-0203	H1	08 Oct 2015
343	5.15 GHz Notch Filter	EWT	EWT-14-0200	H1	08 Oct 2015
344	5.35 GHz Notch Filter	EWT	EWT-14-0201	H1	08 Oct 2015
345	5.46 GHz Notch Filter	EWT	EWT-14-0202	H1	08 Oct 2015
377	Band Rejection Filter 5150 to 5880MHz	Microtronics	BRM50716	034	08 Oct 2015
396	2.4 GHz Notch Filter	Microtronics	BRM50701	001	07 Oct 2015
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	23 Oct 2015
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	10 Oct 2015
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	30 May 2015
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
502	Test Software for Radiated Emissions	EMISoft	Vasona	Version 5 Build 59	Not Required
87	Uninterruptible Power Supply	Falcon Electric	ED2000-1/2LC	F3471 02/01	Cal when used

4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247** and **Industry Canada RSS-210** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a)(2) **A8.2(1)** **4.4**	6 dB and 99 % Bandwidths	≥500 kHz	Conducted	Complies*	NT
15.247(b)(3) **15.31(e)** **A8.4(4)**	Peak Output Power Voltage Variation	Shall not exceed 1W Variation of supply voltage 85 % -115 %	Conducted	Complies*	NT
15.247(e) **A8.2**	Peak Power Spectral Density	Shall not be greater than +8 dBm in any 3 kHz band	Conducted	Complies*	NT
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **4.7**	Spurious Emissions (30MHz - 26 GHz b/g and 30 MHz – 40 GHz a)	The radiated emission in any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density	Conducted	Complies*	NT

NT – Not tested

* Not tested as part of this program, see Section 2.2 ‘Scope of Test Program’

List of Measurements (continued)

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247, Industry Canada RSS-210,** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **2.6** **4.7**	Radiated Emissions	Restricted Bands	Radiated	Complies	5.1.1
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	
	Radiated Band Edge	Band-edge results Peak Emissions		Complies	
15.205 / **15.209** **2.2**	Digital Emissions	Emissions <1 GHz (30M-1 GHz)	Radiated	Complies	*5.1.2*
15.207 **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	N/A EUT is for use in aircraft	*NT*

NT – Not tested

Note 1: *Test results reported in this document relate only to the items tested*
Note 2: *The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria*
Note 3: *Section 3.7 Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix*

5. TEST RESULTS

5.1. Device Characteristics

5.1.1. Radiated Emission Testing

Transmitter Radiated Spurious Emissions (above 1 GHz); Peak Field Strength Measurements; and Radiated Band Edge Measurements – Restricted Bands

FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2, §2.6
Industry Canada RSS-Gen §4.7

Test Procedure
Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Operational Modes

Operational mode(s) tested for spurious emissions were the modes which delivered maximum spectral density 802.11b and 802.11a.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

FS = R + AF + CORR - FO

where: FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

For example:
Given receiver input reading of 51.5 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

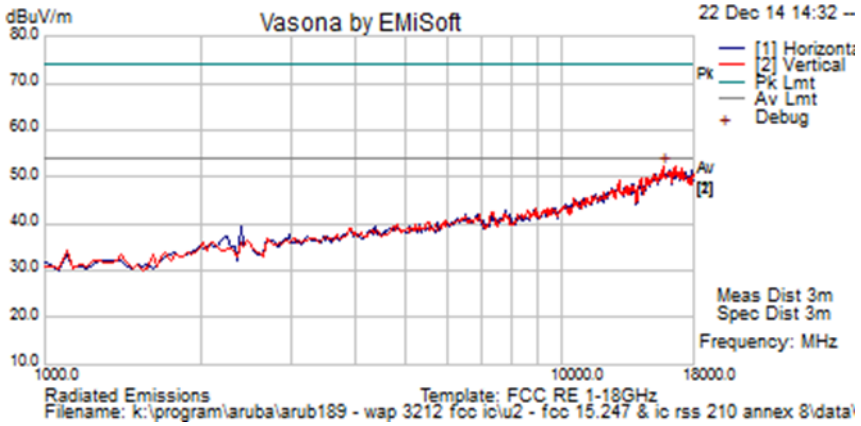
Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

NOTE: KDB 662911 was implemented for Out-of-Band measurements. Where necessary Option (2) Measure and add 10 log (N) dB was implemented

5.1.1.1. Spurious Emissions

Test Freq.	2412 MHz CH 1	**Engineer**	JMH
Variant	802.11b; 1 Mbit/s	**Temp (ºC)**	20.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	60
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 72/4=18 dBm		

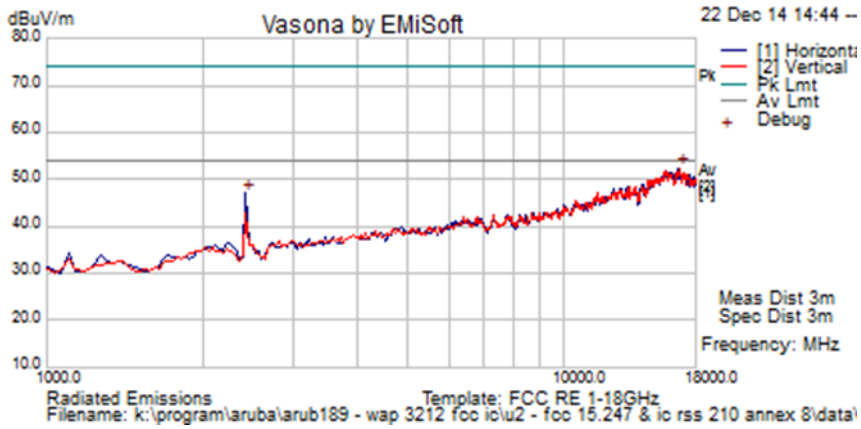


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
15717.435	40.5	11.6	0.2	52.3	Peak [Scan]	H	150	0	54	-1.73	Pass	Noise

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

Test Freq.	2437 MHz CH 6	**Engineer**	JMH
Variant	802.11b; 1 Mbit/s	**Temp (ºC)**	20.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	60
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 72/4=18 dBm		

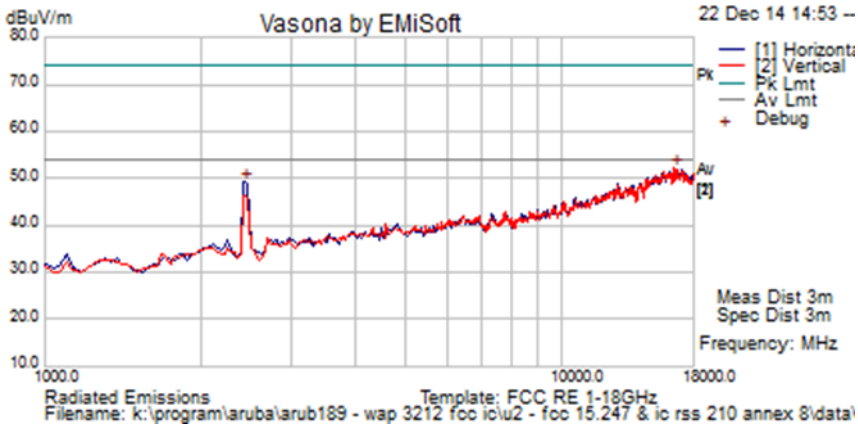


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
16807.615	39.1	12.2	1.1	52.4	Peak [Scan]	V	200	0	54	-1.58	Pass	Noise
2431.999	54.7	3.9	-11.7	46.9	Peak [Scan]							FUND

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

Test Freq.	2462 MHz CH 11	**Engineer**	JMH
Variant	802.11b; 1 Mbit/s	**Temp (ºC)**	20.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	60
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 72/4=18 dBm		

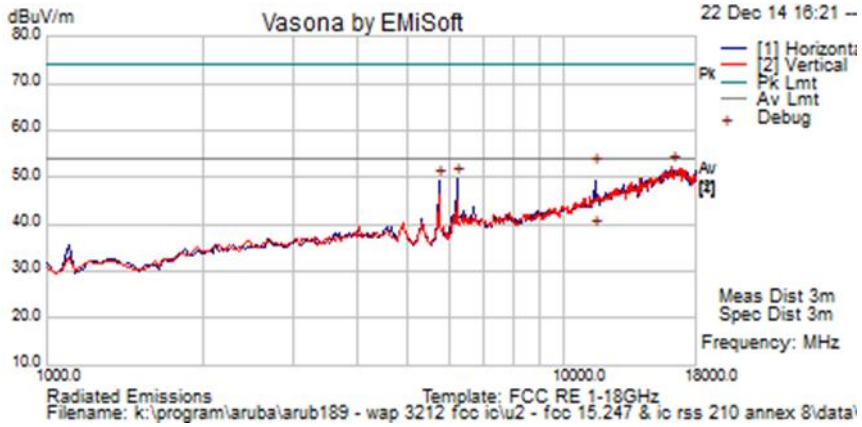


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
16501.002	38.5	12.0	1.7	52.2	Peak [Scan]	V	200	0	54	-1.85	Pass	Noise
2430.86172	57.0	3.9	-11.8	49.2	Peak [Scan]							FUND

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

Test Freq.	5745 MHz ch 149	**Engineer**	JMH
Variant	802.11a; 6 Mbit/s	**Temp (ºC)**	20.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	60
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 72/4=18 dBm		

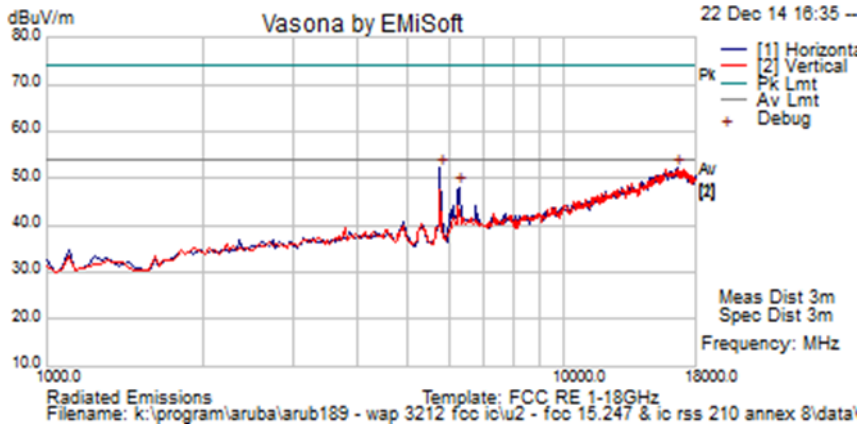


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
16194.389	39.4	12.0	1.1	52.5	Peak [Scan]	V	100	0	54	-1.51	Pass	Noise
6212.42485	52.1	6.6	-8.8	49.8	Peak [Scan]	H						NRB
5735.471	53.8	6.2	-10.7	49.4	Peak [Scan]							FUND
11490.362	47.4	9.4	-4.8	51.9	Peak Max	V	173	263	74	-22.1	Pass	RB
11490.362	34.4	9.4	-4.8	39.0	Average Max	V	173	263	54	-15.0	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

Test Freq.	5785 MHz ch 157	**Engineer**	JMH
Variant	802.11a; 6 Mbit/s	**Temp (ºC)**	20.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	60
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 72/4=18 dBm		

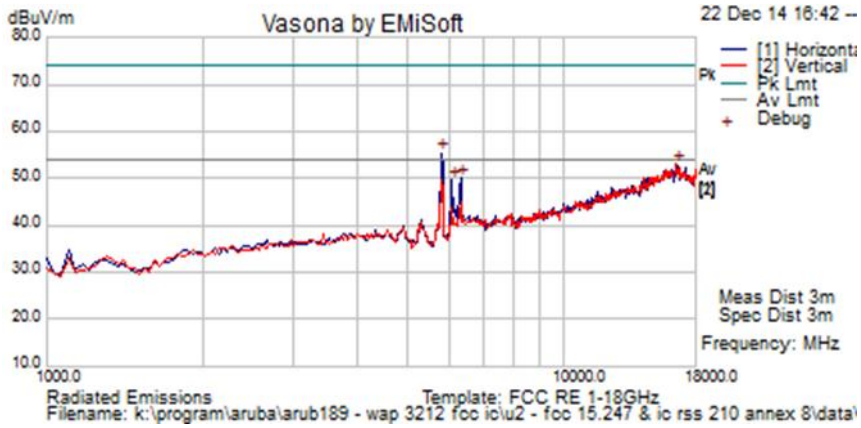


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
16569.138	38.8	11.9	1.6	52.3	Peak [Scan]	H	150	0	54	-1.7	Pass	Noise
5769.53908	56.4	6.3	-10.5	52.1	Peak [Scan]							FUND
6280.561	50.1	6.6	-8.5	48.2	Peak [Scan]	H						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

Test Freq.	5825 MHz ch 165	**Engineer**	JMH
Variant	802.11a; 6 Mbit/s	**Temp (ºC)**	20.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	60
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 72/4=18 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5803.607	59.5	6.3	-10.4	55.4	Peak [Scan]							FUND
16535.07	39.4	11.9	1.6	52.9	Peak [Scan]	V	150	0	54	-1.06	Pass	Noise
6314.629	51.9	6.6	-8.4	50.1	Peak [Scan]	H						NRB
6076.15231	52.8	6.5	-9.6	49.7	Peak [Scan]	H						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

5.1.1.2. Band-Edge - Spurious Emissions

Peak Limit 74.0 dBµV, Peak Limit 54.0 dBµV

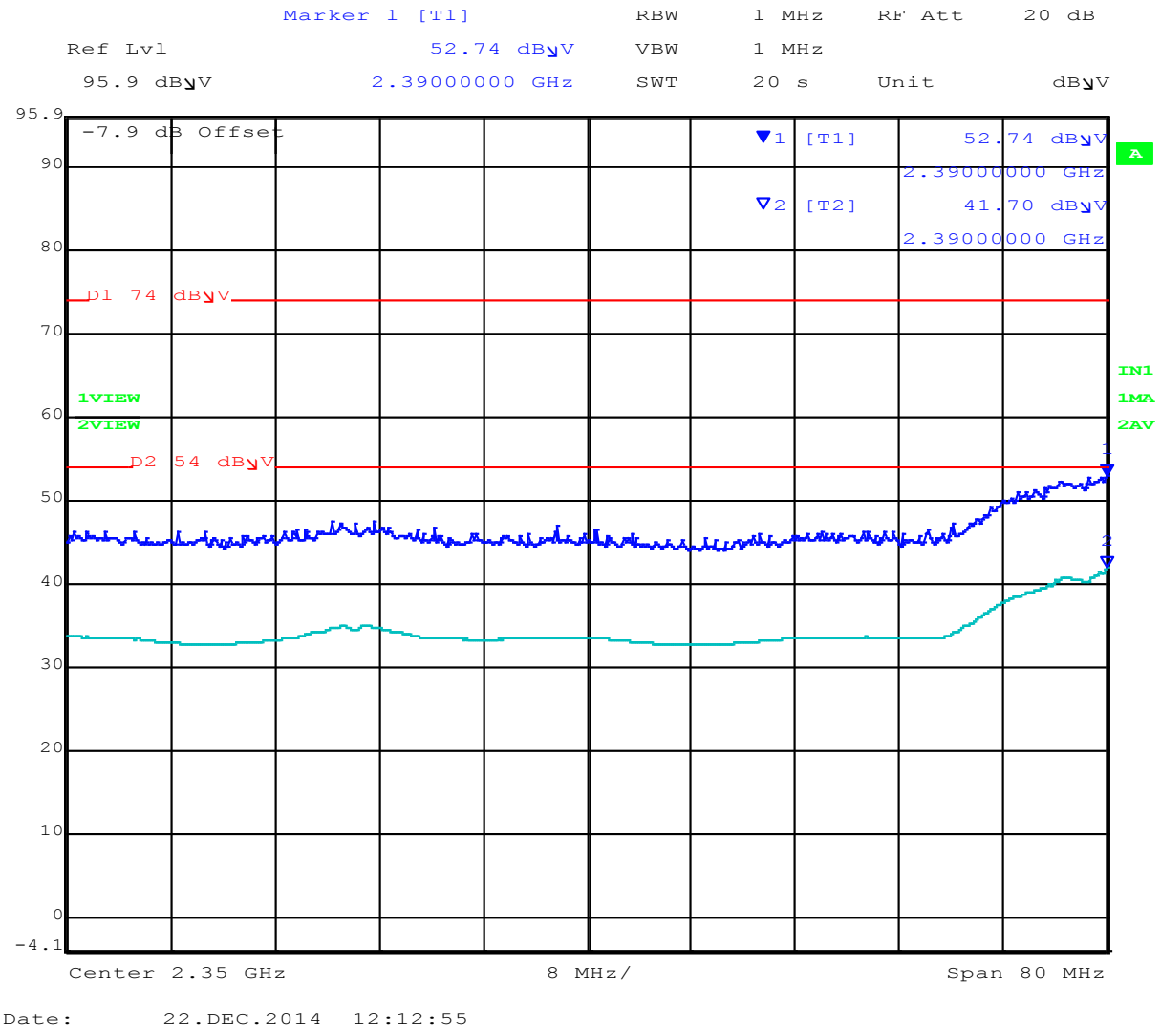
2.4 GHz Frequency Band

	2390 MHz			2483.5 MHz		
	dBµV		Power Setting	dBµV		Power Setting
Operational Mode	Peak	Average		Peak	Average	
b	52.74	41.70	76.0	57.45	46.47	76.0
g	73.56	53.26	75.0	73.79	52.68	75.0
n HT-20	71.72	52.92	74.0	72.18	51.49	71.0
n HT-40	67.17	53.51	65.0	70.62	53.60	64.0

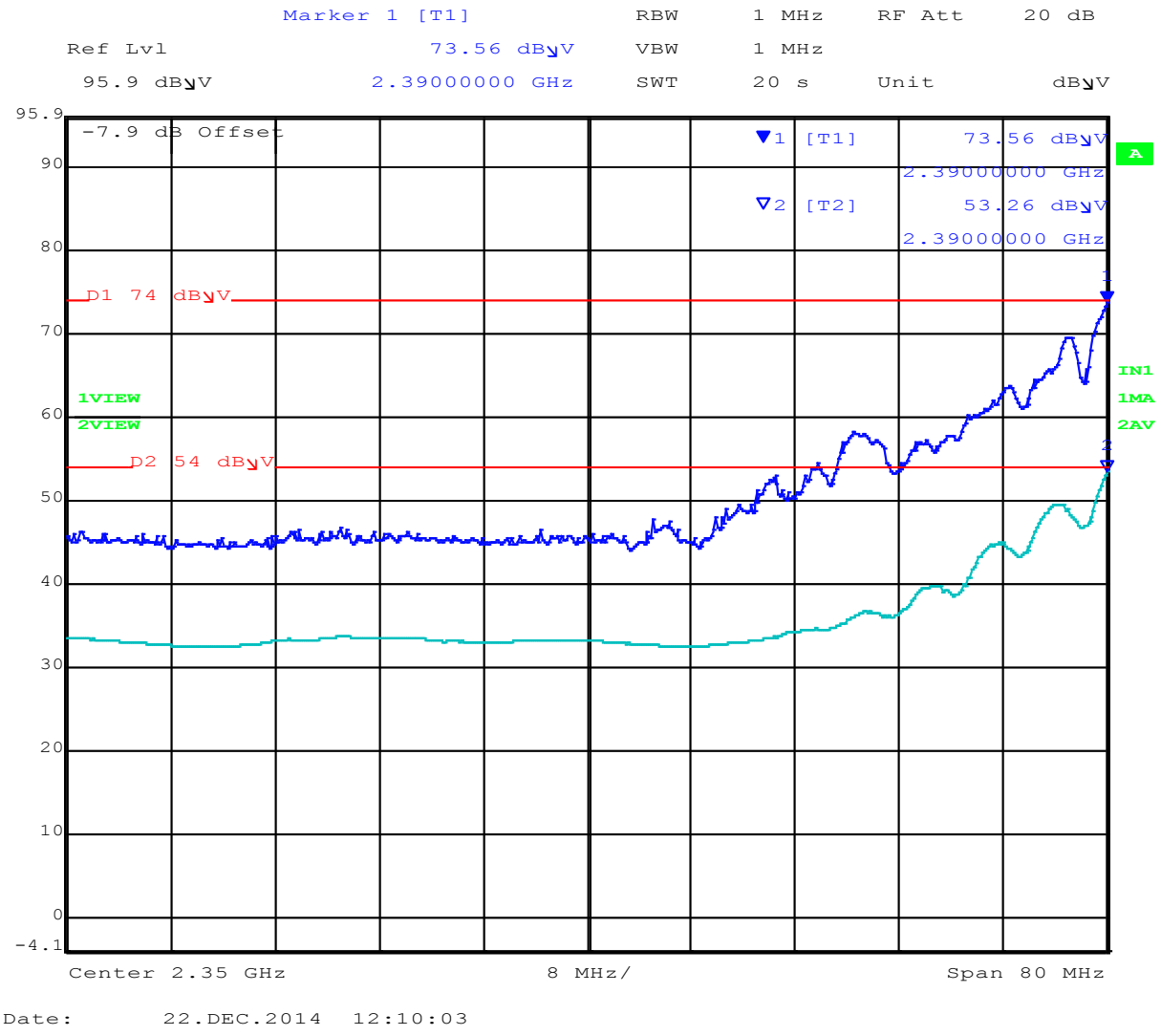
5.8 GHz Frequency Band

	5460 MHz		
	dBµV		Power Setting
Operational Mode	Peak	Average	
a	51.70	39.23	76.0
n HT-20	50.95	38.92	76.0
n HT-40	50.63	38.54	76.0
ac-80	50.56	28.46	66.0

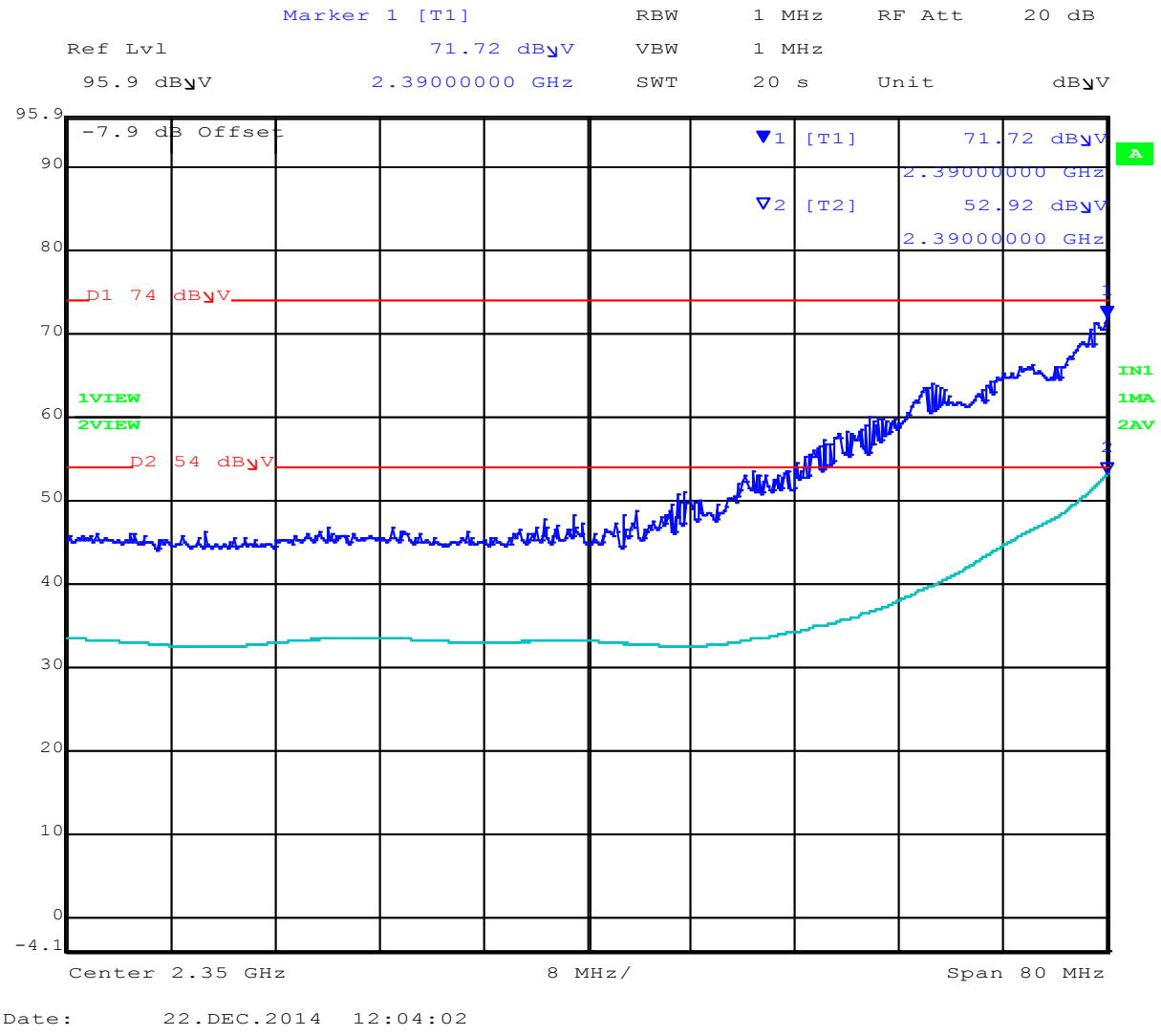
802.11b Radiated Band-Edge @ 2390 MHz



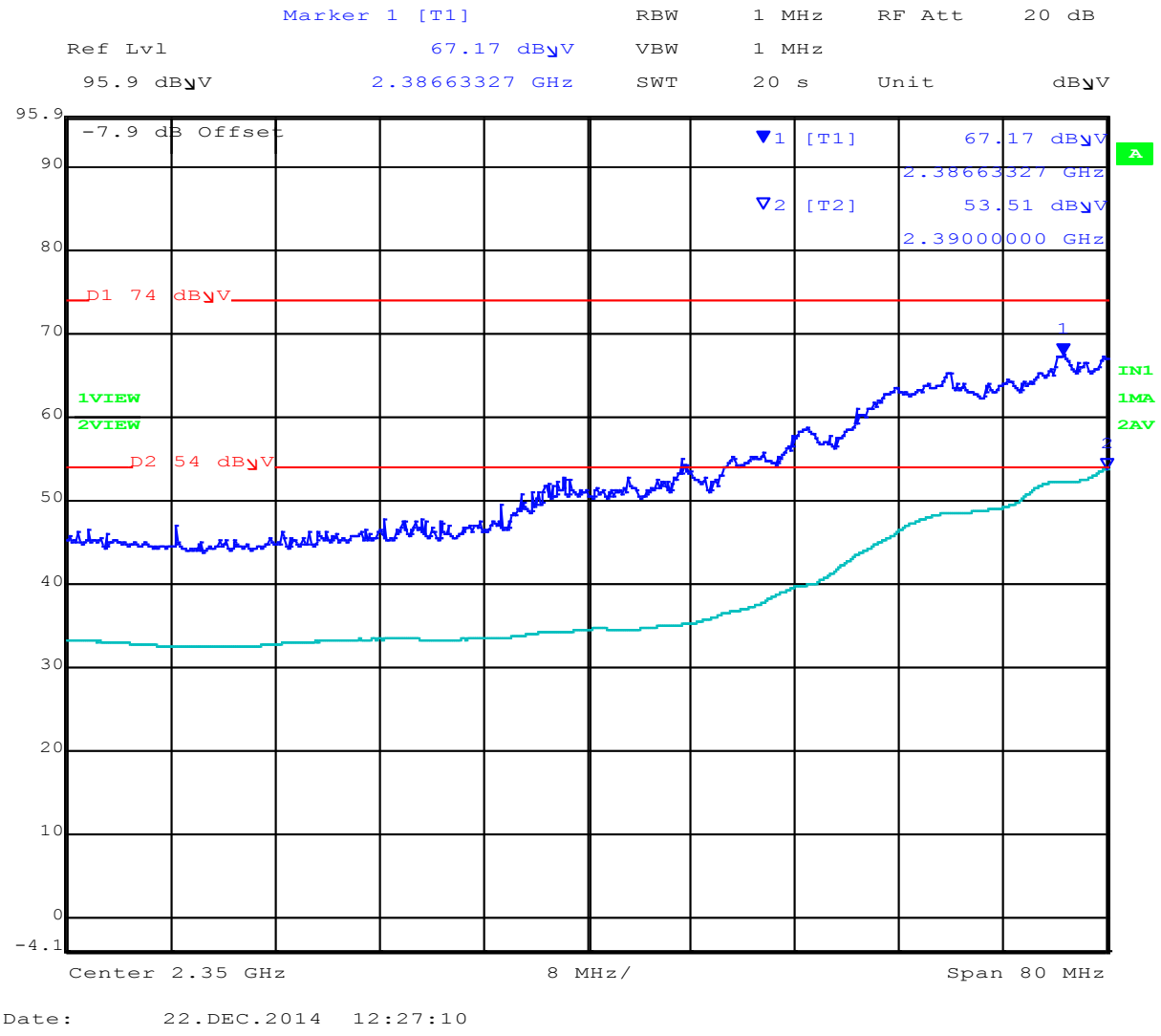
802.11g Radiated Band-Edge @ 2390 MHz



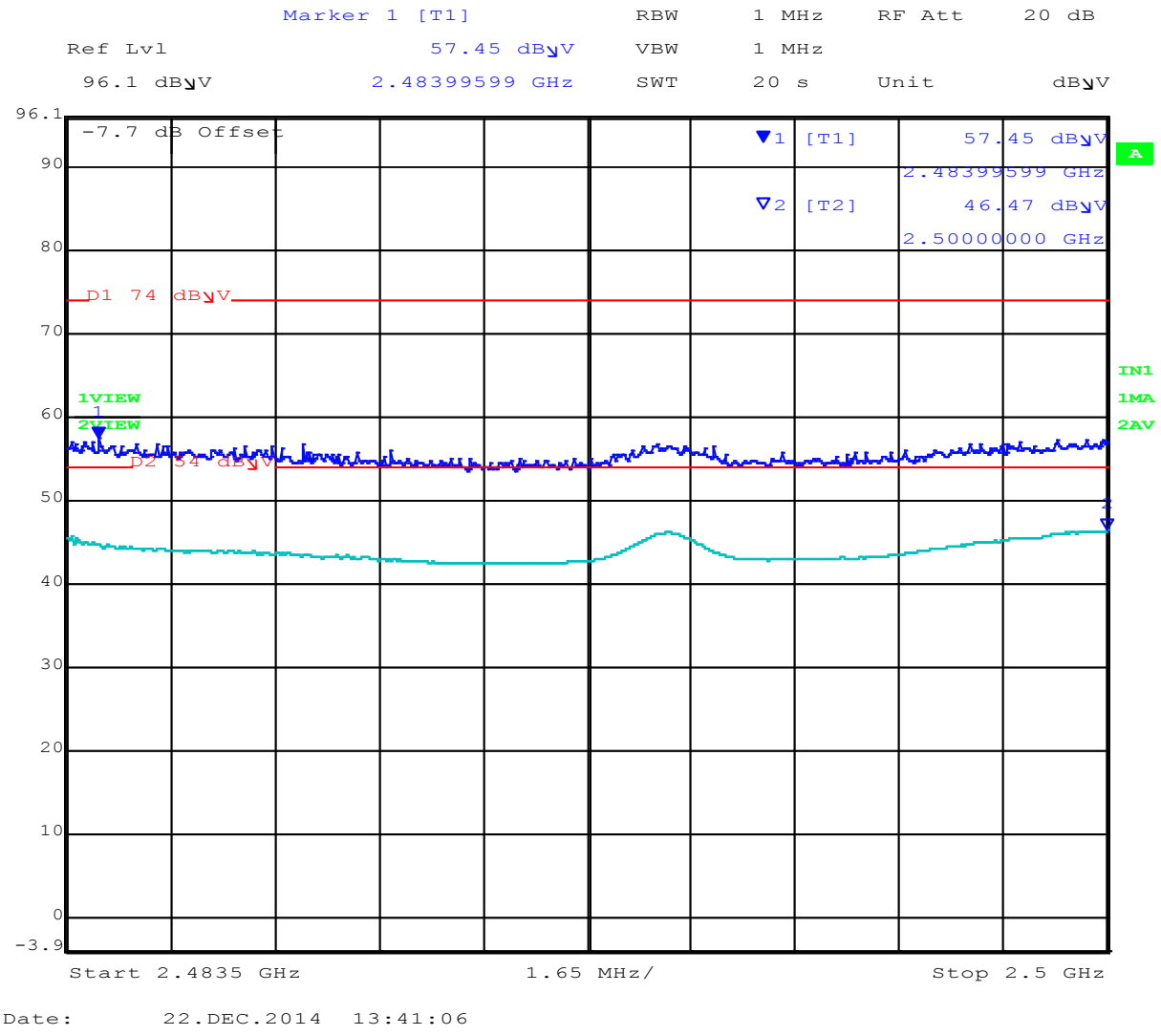
802.11n HT-20 Radiated Band-Edge @ 2390 MHz



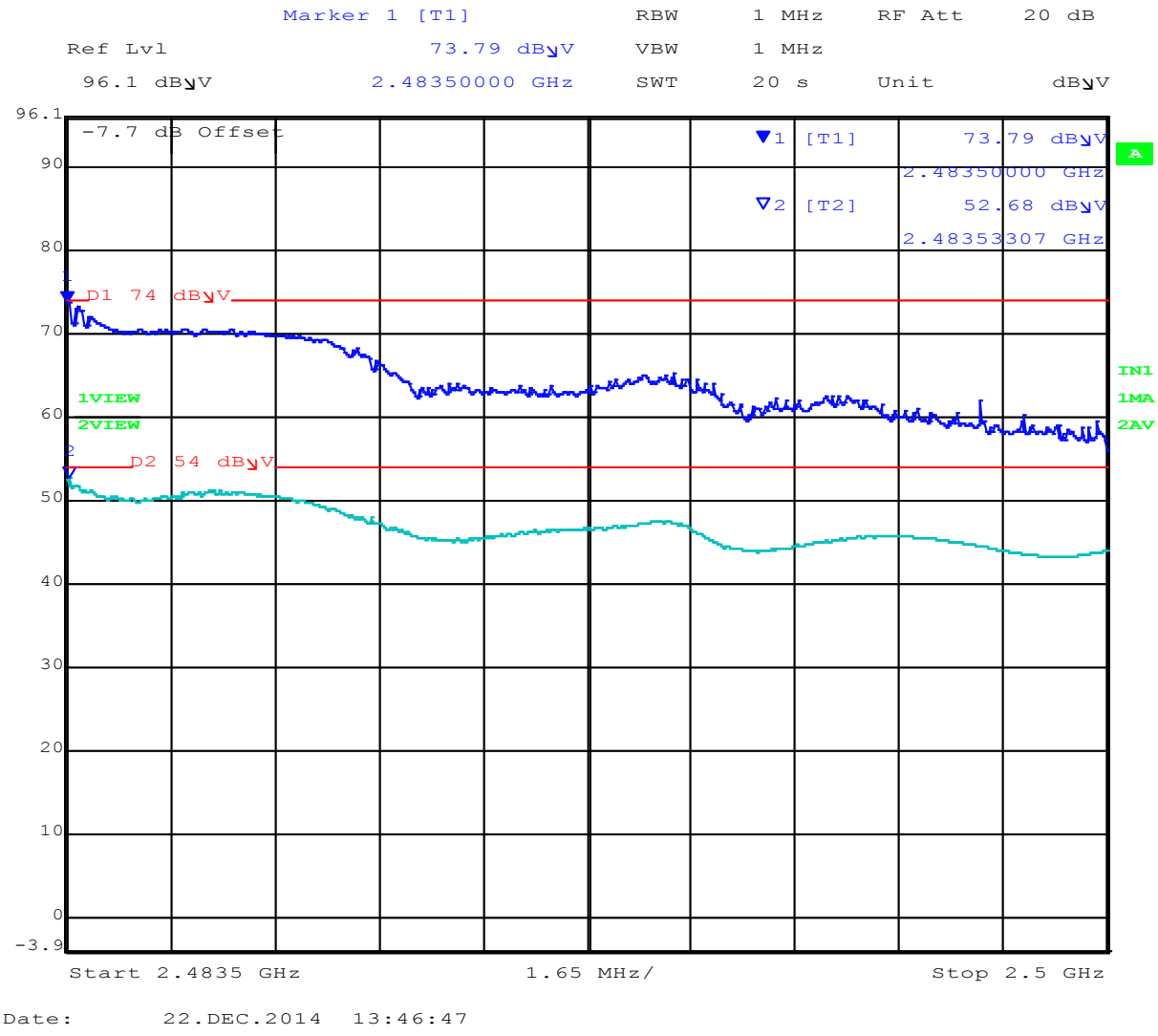
802.11n HT-40 Radiated Band-Edge @ 2390 MHz



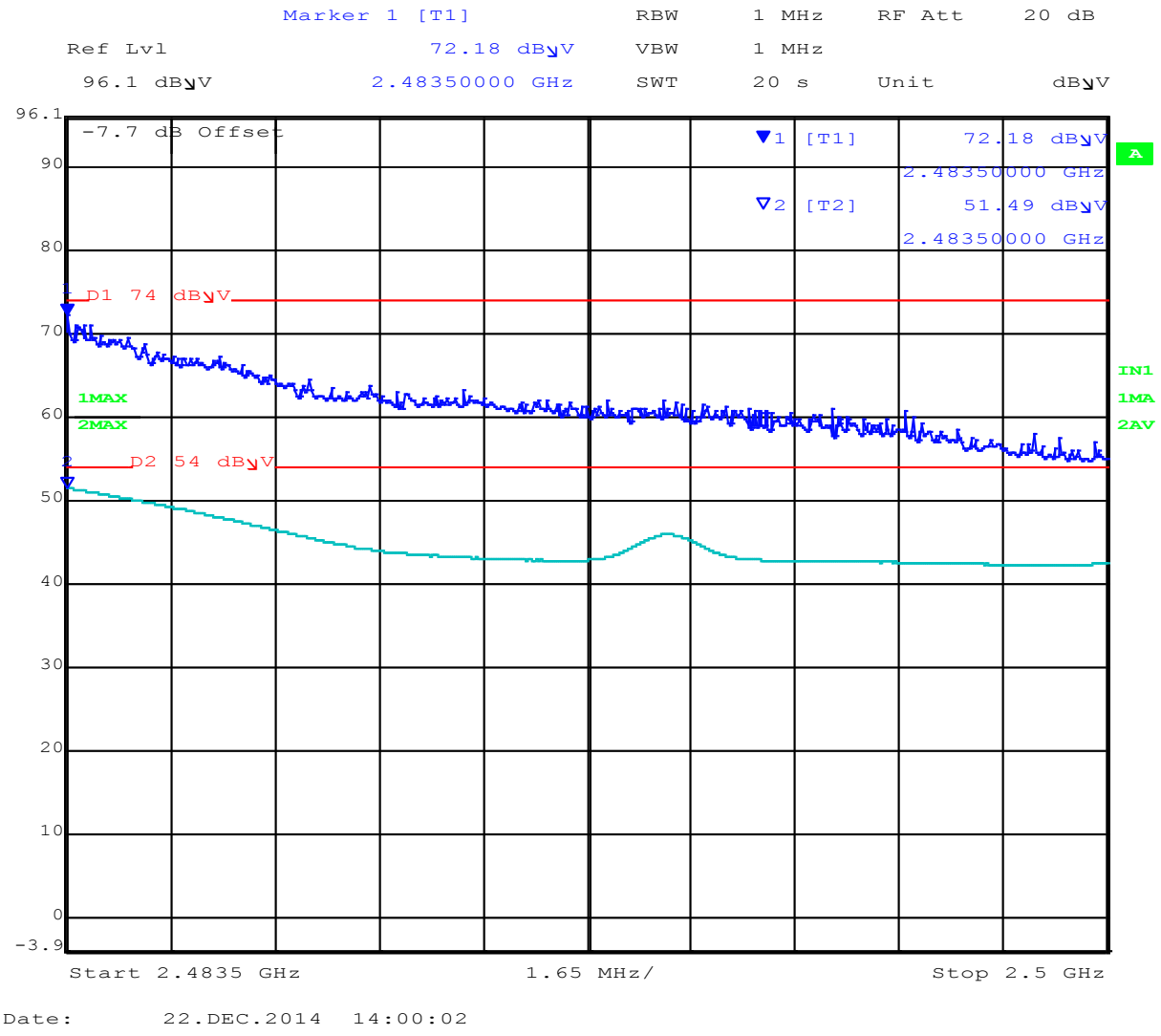
802.11b Radiated Band-Edge @ 2483.5 MHz



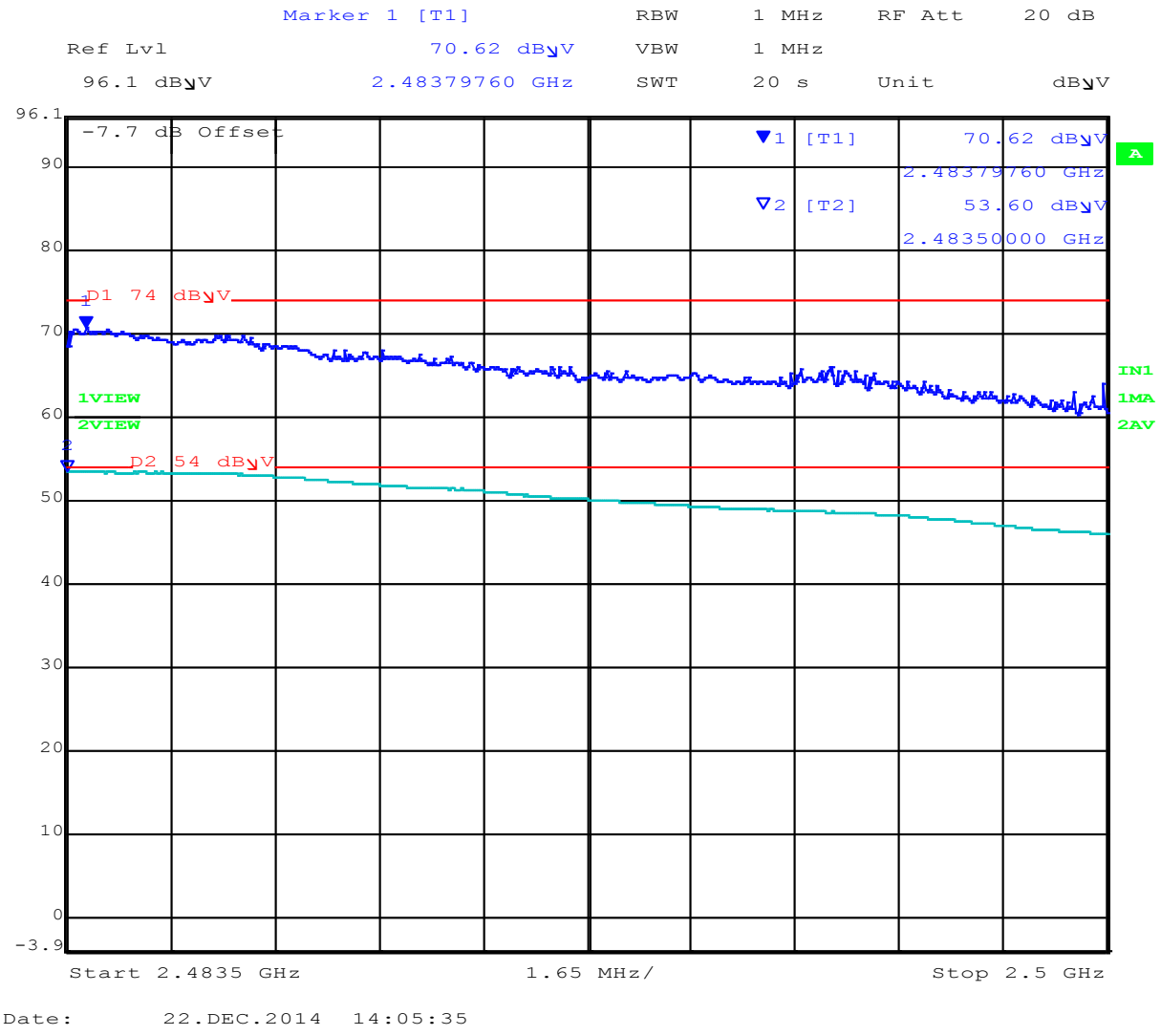
802.11g Radiated Band-Edge @ 2483.5 MHz



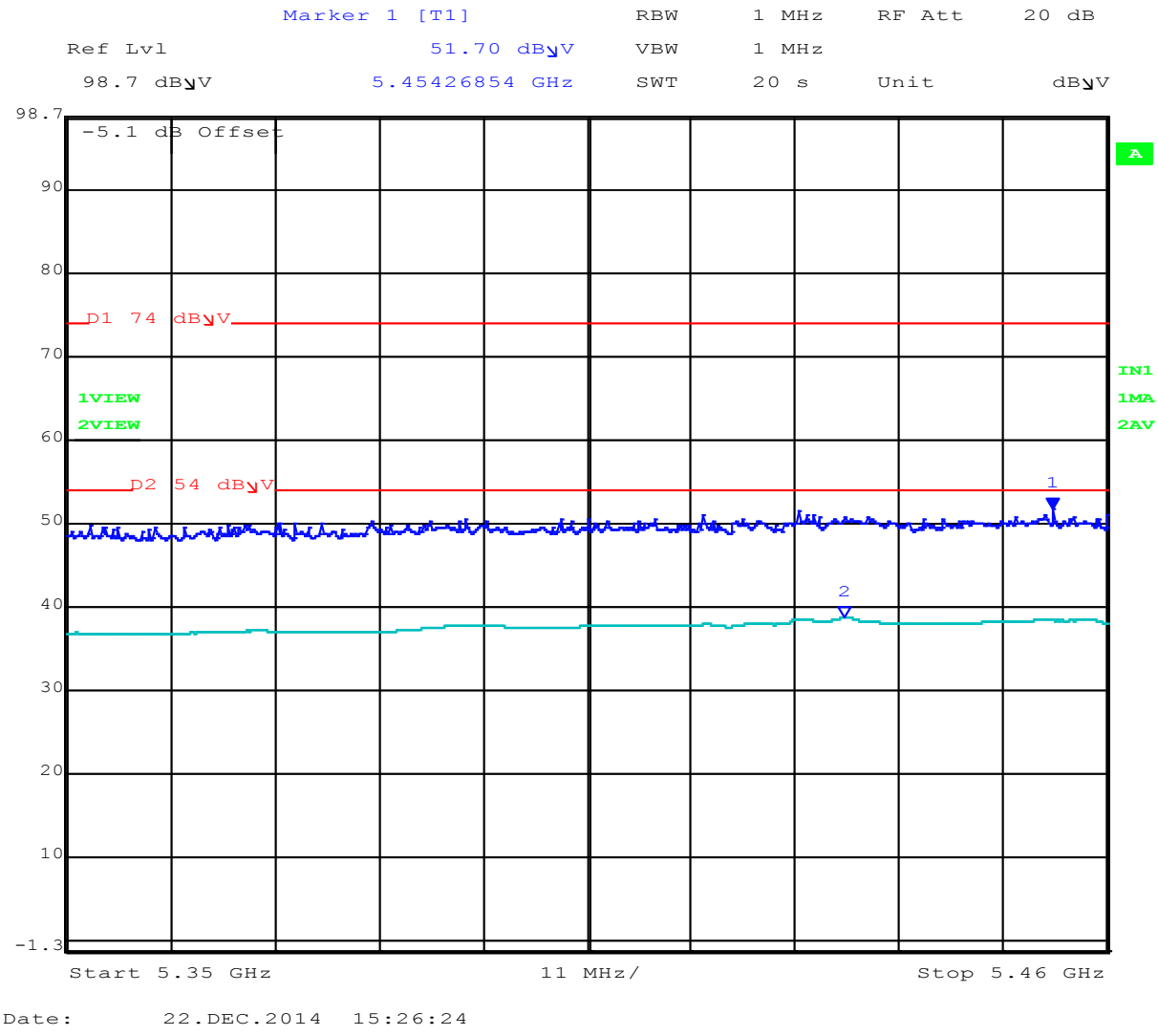
802.11n HT-20 Radiated Band-Edge @ 2483.5 MHz



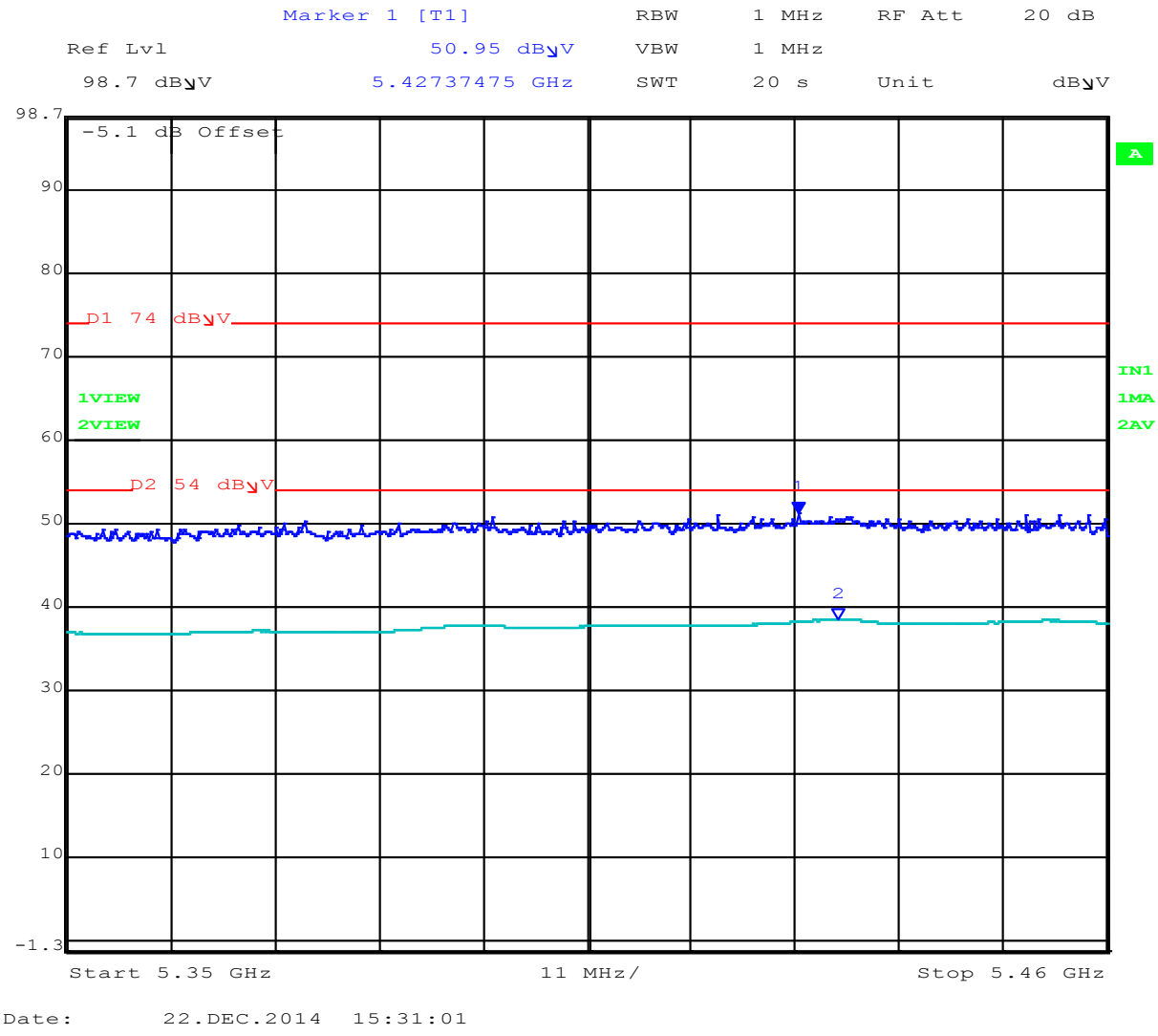
802.11n HT-40 Radiated Band-Edge @ 2483.5 MHz



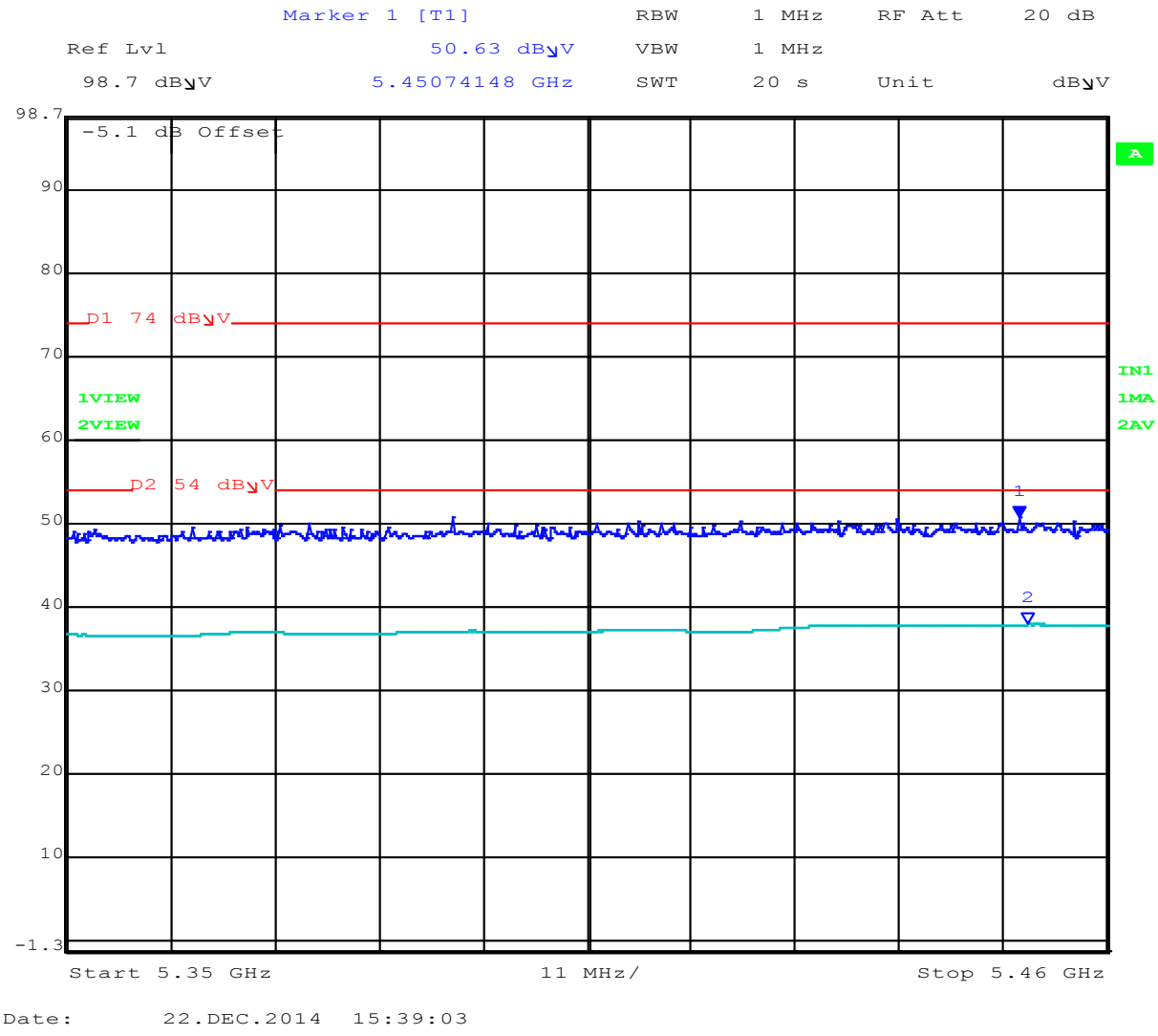
802.11a Radiated Band-Edge @ 5460 MHz



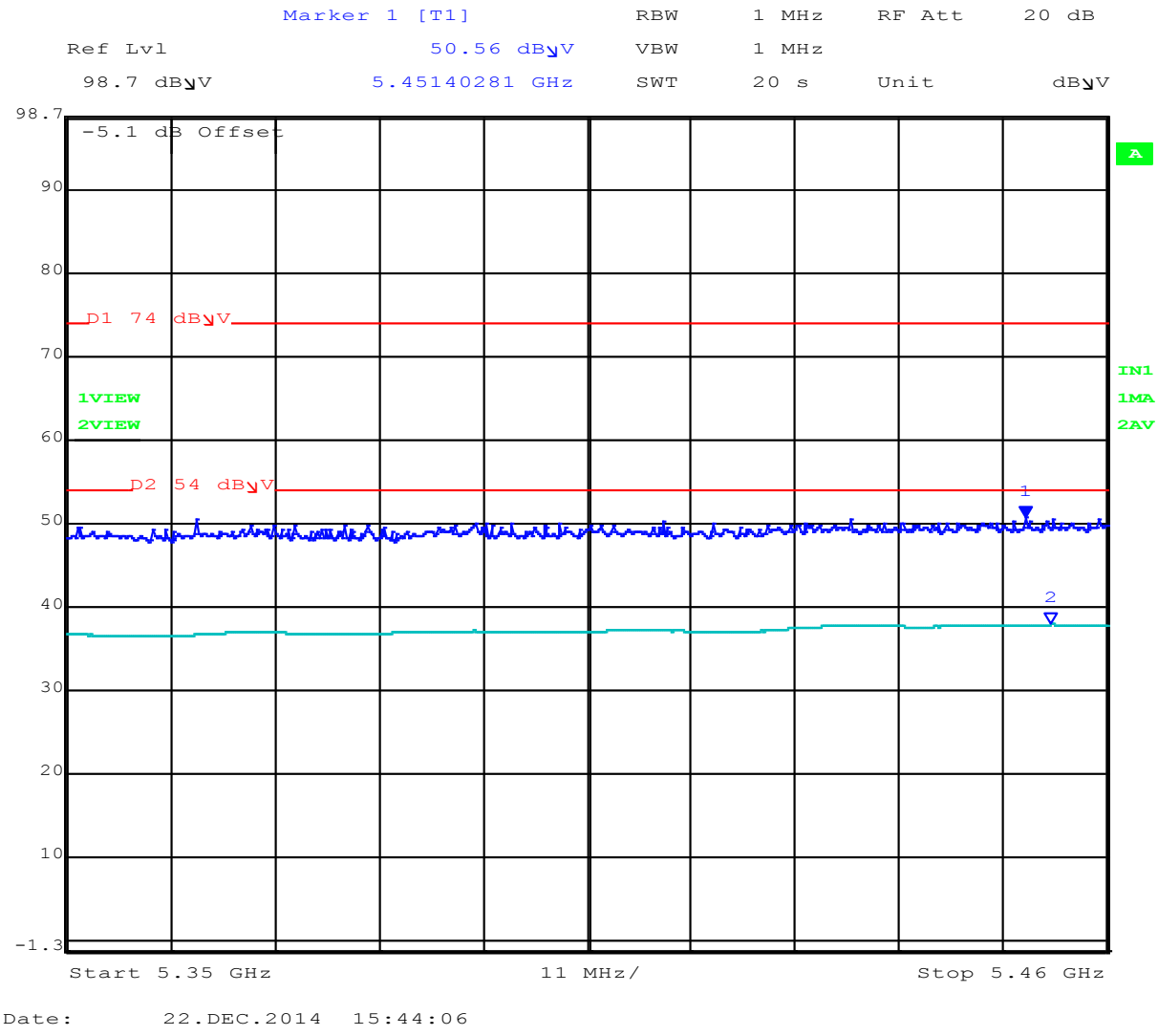
802.11n HT-20 Radiated Band-Edge @ 5460 MHz



802.11n HT-40 Radiated Band-Edge @ 5460 MHz



802.11ac-80 Radiated Band-Edge @ 5460 MHz



Specification Limits

FCC §15.247(d) and RSS-210 §A8.5 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 radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

FCC §15.247(d)
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 §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(a)).

IC RSS-210 §A8.5 If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

IC RSS-Gen §4.7
The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz , whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

FCC §15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

FCC §15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC §15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

§15.209 (a) Limit Matrix

Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

5.1.1.3. Digital Emissions (0.03-1 GHz)

FCC, Part 15 Subpart C §15.205/ §15.209
Industry Canada RSS-210 §2.2

Test Procedure

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

The EUT had two methods of powering on ac/dc converter and Power over Ethernet (POE). Both modes were tested for emissions below 1GHz.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain

For example:
Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

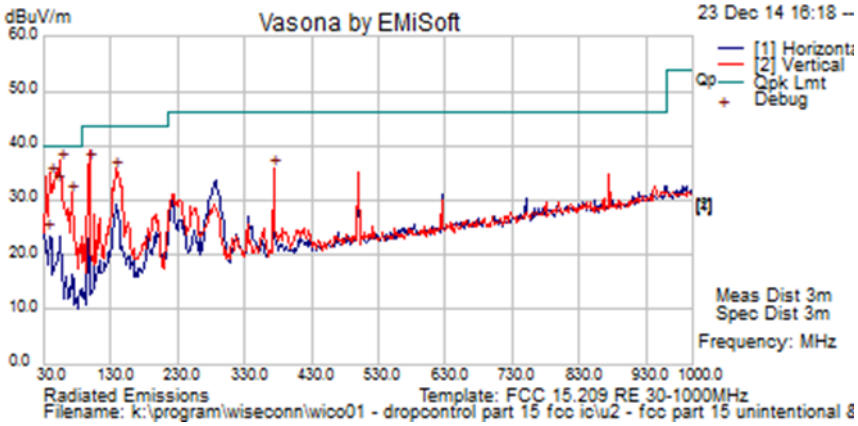
$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 dB\mu V/m$$

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

$$Level (dB\mu V/m) = 20 * Log (level (\mu V/m))$$

40 dBμV/m = 100μV/m
48 dBμV/m = 250μV/m

EUT	WAP3212	**Engineer**	JMH
Variant	Digital Emissions	**Temp (ºC)**	21.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	42
Standard Limit	FCC Class B	**Press. (mBars)**	1007
Support Equip	Laptop outside chamber		
Test Notes	SN# P000013		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
55.356	57.2	3.7	-24.1	36.8	Quasi Max	V	99	200	40	-3.2	Pass	
98.105	54.6	4.1	-21.8	36.930	Quasi Max	V	99	325	43.5	-6.6	Pass	
49.469	52.1	3.7	-23.0	32.9	Quasi Max	V	99	345	40.0	-7.2	Pass	
34.960	33.8	3.6	-13.6	23.8	Quasi Max	V	99	242	40.0	-16.2	Pass	
40.943	48.6	3.6	-18.1	34.1	Quasi Max	V	99	236	40	-5.9	Pass	
136.632	48.9	4.3	-17.9	35.3	Peak [Scan]	V	98	361	43.5	-8.2	Pass	
71.629	50.2	3.9	-23.1	31.0	Peak [Scan]	V	98	361	40	-9.0	Pass	
374.028	45.7	5.4	-15.3	35.7	Peak [Scan]	V	98	361	46	-10.3	Pass	

Legend:	DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency
	TRNS= Transient Emission, Brbnd= Broadband emission

Specification

Limits

§15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

§15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

§15.209 (a) and **RSS-Gen §2.2** Limit Matrix

Frequency(MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

575 Boulder Court
Pleasanton, California 94566, USA
Tel: 1.925.462.0304
Fax: 1.925.462.0306
www.micomlabs.com