Company: Actiontec Electronics Inc

Test of: WEB5500
To: FCC CFR 47 Part 15 Subpart C 15.247 (DTS)

Report No.: ATEC11-5b Radiated Rev B

RADIATED TEST REPORT

MiCOM Labs
opening wireless markets

RADIATED TEST REPORT

FROM

MiCOM Labs
opening wireless markets

Test of: Actiontec Electronics Inc WEB5500
to

To: FCC CFR 47 Part 15 Subpart C 15.247 (DTS)

Test Report Serial No.: ATEC11-U5b Radiated Rev B

This report supersedes: ATEC11-U5b Radiated Rev A

Note: this report is one of a set of four reports that together address the requirements for certification purposes

Report Number	Test Report Type
ATEC11-U2	FCC Part 15B Test Report
ATEC11-U5a, b	2.4 GHz Conducted & Radiated Test Reports
ATEC11-U8 a, b,	5 GHz (non-DFS) Conducted, Radiated Test Reports
ATEC11-U11 a, b, c	5 GHz (DFS) Conducted, Radiated, DFS Test Reports

Applicant: Actiontec Electronics Inc
760 N Mary Avenue
Sunnyvale, California 94085
USA

Product Function: 802.11ac Wireless Network Extender

Issue Date: 27th April 2017

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
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Pleasanton California 94566
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ACCREDITED
TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. Testing Accreditation

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2005. 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

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 4th day of February 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2017

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

1.2. Recognition

MiCOM Labs, Inc has widely recognized wireless testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA countries. MiCOM Labs test reports are accepted globally.

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 4143A-3
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	

EU MRA – European Union Mutual Recognition Agreement.
NB – Notified Body
APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. 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

1.3. Product Certification

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. 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

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 4th day of February 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2017

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

United States of America – Telecommunication Certification Body (TCB)
Industry Canada – Certification Body, CAB Identifier – US0159
Europe – Notified Body (NB), NB Identifier - 2280
Japan – Recognized Certification Body (RCB), RCB Identifier - 210

2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	22nd November 2015	
Rev A	10th January 2016	Initial Release
Rev B	27th April 2017	Remove Photographs

In the above table the latest report revision will replace all earlier versions.

3. TEST RESULT CERTIFICATE

Manufacturer:	Actiontec Electronics Inc 760 N Mary Avenue Sunnyvale California 94085 USA	**Tested By:**	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Model:	WEB5500	**Telephone:**	+1 925 462 0304
Type Of Equipment:	802.11ac Wireless Network Extender	**Fax:**	+1 925 462 0306
S/N's:	F18		
Test Date(s):	3rd – 17th November 2015	**Website:**	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC CFR 47 Part 15 Subpart C 15.247 (DTS)	**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.

ACCREDITED
TESTING CERT #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

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4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	KDB 662911	Oct 31 2013	Guidance for measurement of output emission of devices that employ single transmitter with multiple outputs or systems with multiple transmitters operating simultaneously in the same frequency band
II	KDB 558074 D01 v03r03	9th June 2015	Guidance for performing compliance measurements on Digital Transmission Systems (DTS) operating under section 15.247.
III	A2LA	June 2015	R105 - Requirement's When Making Reference to A2LA Accreditation Status
IV	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
V	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
VI	CISPR 22	2008	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
VII	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
VIII	FCC 47 CFR Part 15.247	2014	Radio Frequency Devices; Subpart C – Intentional Radiators
IX	KDB 644545 D03 v01	August 14th 2014	Guidance for IEEE 802.11ac New Rules
X	FCC 47 CFR Part 2.1033	2014	FCC requirements and rules regarding photographs and test setup diagrams.
XI	M 3003	Edition 3 Nov. 2012	Expression of Uncertainty and Confidence in Measurements

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4.2. Test and Uncertainty Procedure

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.

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5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the Actiontec Electronics Inc WEB5500 to FCC CFR 47 Part 15 Subpart C 15.247 (DTS). Radio Frequency Devices; Subpart C – Intentional Radiators
Applicant:	Actiontec Electronics Inc 760 N Mary Avenue Sunnyvale California 94085 USA
Manufacturer:	As Applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	ATEC11 - WEB5500 FCC
Date EUT received:	3rd November 2015
Standard(s) applied:	FCC CFR 47 Part 15 Subpart C 15.247 (DTS)
Dates of test (from - to):	3rd – 17th November 2015
No of Units Tested:	1
Type of Equipment:	802.11a/b/g/n/ac
Model(s):	WEB5500
Location for use:	Indoor
Declared Frequency Range(s):	2400 - 2483.5 MHz;
Primary function of equipment:	802.11ac Wireless Network Extender
Secondary function of equipment:	None Provided
Type of Modulation:	Per 802.11 –CCK, BPSK, QPSK, DSSS, OFDM
EUT Modes of Operation:	2400 - 2483.5 MHz: 802.11b; 802.11g; 802.11n HT-20; 802.11n HT-40;
Declared Nominal Output Power (Ave):	2400 - 2483.5 MHz: 802.11b: +25 dBm; 802.11g: +22 dBm; 802.11n HT-20: +22 dBm; 802.11n HT-40:+22 dBm
Transmit/Receive Operation:	Transceiver - Half Duplex
Rated Input Voltage and Current:	AC/ DC adaptor (adaptor sold with unit) Input: 115 Vac 0.6A Output: 12Vdc, 1.5 A
Operating Temperature Range:	Declared Range 0°C to 45°C
ITU Emission Designator:	2400 – 2483.5 MHz 802.11b 15M9G1D 2400 – 2483.5 MHz 802.11g 16M8D1D 2400 – 2483.5 MHz 802.11n – HT-20 18M0D1D 2400 – 2483.5 MHz 802.11n – HT-40 36M4D1D
Equipment Dimensions:	4.75” (W) x 7.00” (H) x 2.25” (D)
Weight:	0.75 lb
Hardware Rev:	AM2
Software Rev:	V.3.1.9.3c

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5.2. Scope Of Test Program

Actiontec Electronics Inc WEB5500

The scope of the test program was to test the Actiontec Electronics Inc WEB5500, 802.11a/b/g/n/ac configurations in the frequency ranges 2400 - 2483.5 MHz; for compliance against the following specification:

FCC CFR 47 Part 15 Subpart C 15.247 (DTS)
Radio Frequency Devices; Subpart C – Intentional Radiators

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	802.111ac Wireless Network Extender	Actiontec	WEB5500	F18
EUT	Power Adapter 100 - 240Vac 50/60Hz 0.6A 12 Vdc 1.5 A	Actiontec	NBS24J120150VU	Unknown
Support	Laptop PC	IBM	Thinkpad	None

5.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
integral	Galtronics	Custom PCB	Dipole	5.5	-	360	-	2400 - 2483.5
integral	Galtronics	Custom PCB	Dipole	3.0	-	360	-	2400 - 2483.5

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

5.5. Cabling and I/O Ports

Port Type	Max Cable Length	# Of Ports	Screened	Conn Type	Data Type
Ethernet	100m	2	N	RJ-45	Packet Data

5.6. Test Configurations

Results for the following configurations are provided in this report:

Operational Mode(s) (802.11a/b/g/n/ac)	Data Rate with Highest Power MBit/s	Channel Frequency (MHz)		
		Low	Mid	High
2400 - 2483.5 MHz				
802.11b	1.00	2412.00	2437.00	2462.00
802.11g	6.00	2412.00	2437.00	2462.00
802.11n HT-20	6.50	2412.00	2437.00	2462.00
802.11n HT-40	13.50	2422.00	2437.00	2452.00

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5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:
1. NONE

5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:
1. NONE

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6. TEST SUMMARY

List of Measurements

Test Header	Result	Data Link
15.247(d) Emissions	Complies	-
Radiated Emissions	Complies	-
(i) 15.205 Restricted Band Emissions	Complies	View Data
(ii) 15.205 Restricted Band-Edge Emissions	Complies	View Data
(iii) 15.209 Digital Emissions (0.03 - 1 GHz)	Complies*	-
ac Wireline Emissions		
(i) 15.207 AC Wireline Conducted Limits	Complies*	-

*Results included in the ATEC11-U2 Part 15B Unintentional Radiators

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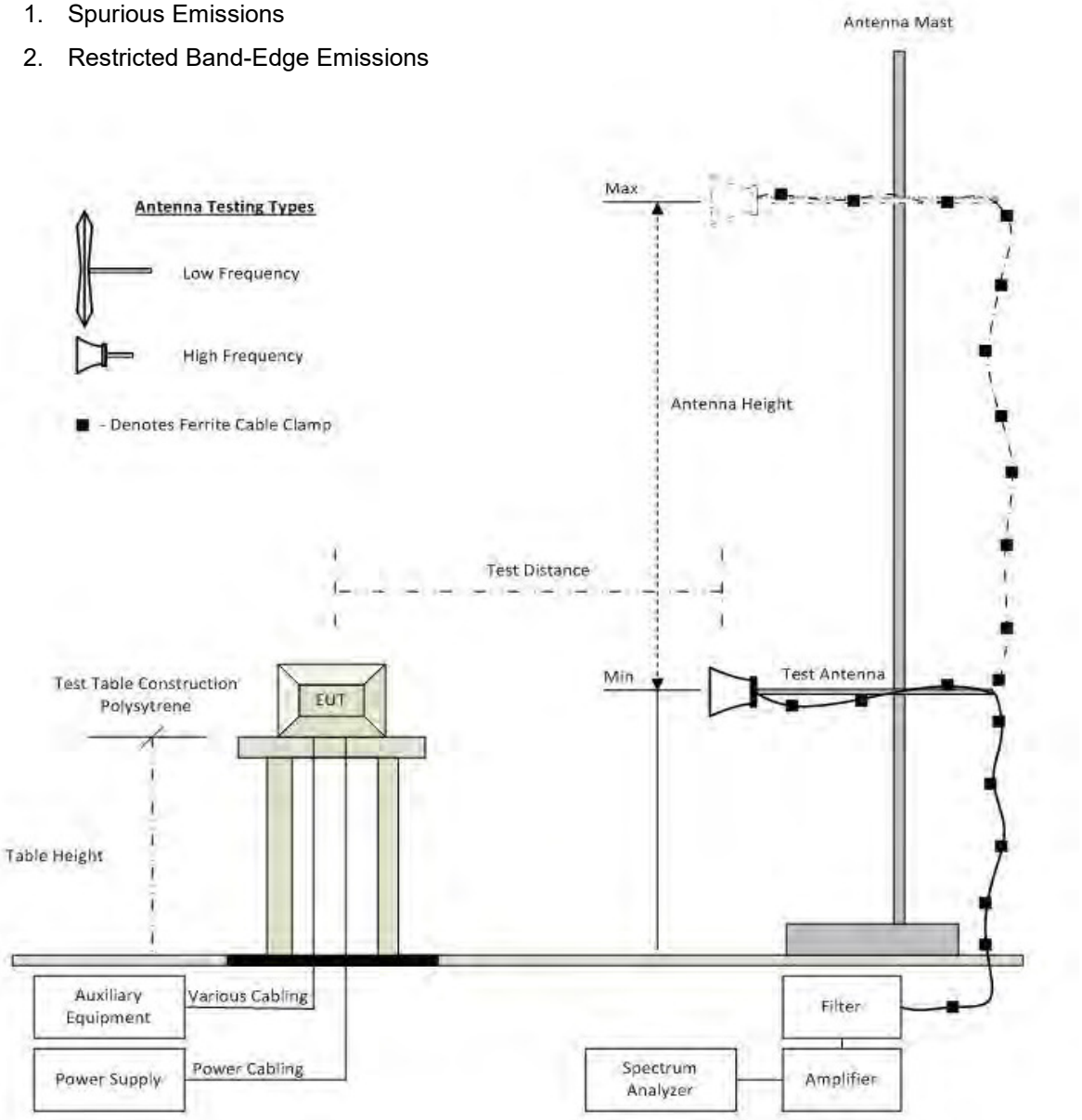
7. TEST EQUIPMENT CONFIGURATION(S)

7.1. Radiated Emissions - 3m Chamber

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

1. Spurious Emissions
2. Restricted Band-Edge Emissions

.



Radiated Emission Test Setup

A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

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	27 Aug 2016
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	15 Aug 2016
342	2.4 GHz Notch Filter	EWT	EWT-14-0203	H1	18 Aug 2016
396	2.4 GHz Notch Filter	Microtronics	BRM50701	001	18 Aug 2016
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	24 Feb 2016
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	10 Dec 2015
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	28 May 2016
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
447	Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0.73	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	25 Feb 2016
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	25 Feb 2016
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	25 Feb 2016
465	Low Pass Filter DC-1000 MHz	Mini-Circuits	NLP-1200+	VUU01901402	18 Aug 2016
480	Cable - Bulkhead to Amp	SRC Haverhill	157-157-3050360	480	11 Aug 2016
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-151-3050787	481	11 Aug 2016
482	Cable - Amp to Antenna	SRC Haverhill	157-157-3051574	482	11 Aug 2016

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8. TEST RESULTS

8.1. Emissions

8.1.1. Radiated Emissions

8.1.1.1. Restricted Band Emissions

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions (Restricted Bands)			
Standard:	FCC CFR 47 Part 15 Subpart C 15.247 (DTS)	**Ambient Temp. (ºC):**	20.0 - 24.5
Test Heading:	Radiated Spurious and Band-Edge Emissions	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.205, 15.209	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Radiated Spurious and Band-Edge Emissions (Restricted Bands)
Radiated emissions for restricted bands 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. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

Test configuration and setup for Radiated Spurious and Band-Edge Measurement were per the Radiated Test Set-up specified in this document.

Limits for Restricted Bands
Peak emission: 74 dBuV/m
Average emission: 54 dBuV/m

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

Example:
Given receiver input reading of 51.5 dBmV; 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 (FS) of the measured emission is:

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

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are as follows:
Level (dBmV/m) = 20 * Log (level (mV/m))

40 dBmV/m = 100 mV/m
48 dBmV/m = 250 mV/m

Restricted Bands of Operation (15.205)
(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below

Frequency Band			
MHz	**MHz**	**MHz**	**GHz**
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
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	2690-2900	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	Above 38.6
13.36-13.41			

(b) Except as provided 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 §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to §15.213.

(4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of subparts D or F of this part.

(7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

Antenna:	Galtronics Custom PCB	**Variant:**	802.11b
Antenna Gain (dBi):	5.5	**Modulation:**	CCK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	2412.00	**Data Rate:**	1.00 MBit/s
Power Setting:	58	**Tested By:**	JMH

Test Measurement Results

Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2219.79	42.78	2.62	-12.39	33.01	Max Avg	Vertical	103	60	54.0	-21.0	Pass
#2	2219.79	70.30	2.62	-12.39	60.53	Max Peak	Vertical	103	60	74.0	-13.5	Pass
#3	2239.47	43.22	2.65	-12.20	33.67	Max Avg	Vertical	117	318	54.0	-20.3	Pass
#4	2239.47	71.26	2.65	-12.20	61.71	Max Peak	Vertical	117	318	74.0	-12.3	Pass
#5	2263.96	43.57	2.64	-12.12	34.09	Max Avg	Vertical	105	322	54.0	-19.9	Pass
#6	2263.96	72.99	2.64	-12.12	63.51	Max Peak	Vertical	105	322	74.0	-10.5	Pass
#7	2289.82	45.00	2.67	-12.17	35.50	Max Avg	Vertical	100	319	54.0	-18.5	Pass
#8	2289.82	73.39	2.67	-12.17	63.89	Max Peak	Vertical	100	319	74.0	-10.1	Pass
#9	2410.60	52.62	2.69	-11.80	43.51	Fundamental	Horizontal	100	124	--	--	
#10	2410.60	36.40	2.69	-11.80	27.29	Max Avg	Horizontal	135	330	54.0	-34.0	Pass
#11	2410.60	49.13	2.69	-11.80	40.02	Max Peak	Horizontal	135	330	74.0	-28.2	Pass
#12	4823.91	56.64	3.54	-11.15	49.03	Max Avg	Vertical	151	87	54.0	-5.0	Pass
#13	4823.91	60.45	3.54	-11.15	52.84	Max Peak	Vertical	151	87	74.0	-21.2	Pass
#14	6431.94	52.76	3.99	-7.99	48.76	Peak (NRB)	Horizontal	151	282	--	--	Pass
#15	7237.08	54.25	4.25	-7.34	51.16	Peak (NRB)	Horizontal	151	282	--	--	Pass
#16	9647.82	53.47	5.29	-6.08	52.68	Peak (NRB)	Horizontal	148	89	--	--	Pass

Test Notes: EUT at 150cm powered by Actiontec PS NB524J120150VU

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Equipment Configuration for Radiated Spurious - Restricted Band Emissions

Antenna:	Galtronics Custom PCB	**Variant:**	802.11b
Antenna Gain (dBi):	5.5	**Modulation:**	CCK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	2437.00	**Data Rate:**	1.00 MBit/s
Power Setting:	58	**Tested By:**	JMH

Test Measurement Results

Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2244.85	42.15	2.64	-12.14	32.65	Max Avg	Vertical	154	59	54.0	-21.4	Pass
#2	2244.85	68.72	2.64	-12.14	59.22	Max Peak	Vertical	154	59	74.0	-14.8	Pass
#3	2276.19	43.70	2.66	-12.15	34.21	Max Avg	Vertical	157	50	54.0	-19.8	Pass
#4	2276.19	70.33	2.66	-12.15	60.84	Max Peak	Vertical	157	50	74.0	-13.2	Pass
#5	2437.91	56.83	2.72	-11.73	47.82	Fundamental	Vertical	151	330	--	--	
#6	6431.86	53.72	3.99	-7.99	49.72	Peak (NRB)	Horizontal	151	158	--	--	Pass
#7	7310.19	55.31	4.23	-7.29	52.25	Max Avg	Horizontal	182	51	54.0	-1.8	Pass
#8	7310.19	63.26	4.23	-7.29	60.20	Max Peak	Horizontal	182	51	74.8	-13.8	Pass
#9	9648.06	54.14	5.29	-6.08	53.35	Peak (NRB)	Vertical	151	284	--	--	Pass
#10	9747.77	57.68	5.29	-6.23	56.74	Peak (NRB)	Horizontal	151	284	--	--	Pass
Test Notes: EUT at 150cm powered by Actiontec PS NB524J120150VU												

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Equipment Configuration for Radiated Spurious - Restricted Band Emissions

Antenna:	Galtronics Custom PCB	**Variant:**	802.11b
Antenna Gain (dBi):	5.5	**Modulation:**	CCK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	2462.00	**Data Rate:**	1.00 MBit/s
Power Setting:	58	**Tested By:**	JMH

Test Measurement Results

Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
#1	2217.19	41.64	2.62	-12.42	31.84	Max Avg	Vertical	100	321	54.0	-22.2	Pass
#2	2217.19	67.94	2.62	-12.42	58.14	Max Peak	Vertical	100	321	74.0	-15.9	Pass
#3	2285.65	43.05	2.67	-12.17	33.55	Max Avg	Vertical	100	328	54.0	-20.5	Pass
#4	2285.65	68.60	2.67	-12.17	59.10	Max Peak	Vertical	100	328	74.0	-14.9	Pass
#5	2462.89	57.02	2.74	-11.67	48.09	Fundamental	Horizontal	101	1	--	--	
#6	6432.02	55.79	3.99	-7.99	51.79	Peak (NRB)	Horizontal	151	1	--	--	Pass
#7	7387.01	56.16	4.29	-7.17	53.28	Max Avg	Horizontal	149	47	54.0	-0.7	Pass
#8	7387.01	64.29	4.29	-7.17	61.41	Max Peak	Horizontal	149	47	74.0	-12.6	Pass
#9	9647.90	54.31	5.29	-6.08	53.52	Peak (NRB)	Vertical	151	281	--	--	Pass
#10	9847.82	53.66	5.39	-5.94	53.11	Peak (NRB)	Horizontal	151	281	--	--	Pass

Test Notes: EUT at 150cm powered by Actiontec PS NB524J120150VU

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8.1.1.2. Restricted Band-Edge Emissions

Complied Summary of Radiated Band-Edge Results

Galtronics Custom PCB SMT		Band-Edge Freq	Peak (Limit 74.0dBµV/m)	Average (Limit 54.0dBµV/m)	Power Setting
Operational Mode	Operating Frequency (MHz)	MHz	dBµV/m	dBµV/m	
802.11b	2412.00	2390.00	72.63	47.42	58.00
802.11g	2412.00	2390.00	72.89	51.86	58.00
802.11n HT-20	2412.00	2390.00	73.32	51.48	57.00*
802.11n HT-40	2422.00	2390.00	71.16	52.80	57.00*
802.11b	2462.00	2483.50	71.10	48.62	58.00
802.11g	2462.00	2483.50	71.58	52.39	58.00
802.11n HT-20	2462.00	2483.50	73.40	51.16	56.00*
802.11n HT-40	2452.00	2483.50	71.94	52.18	57.00*

*Power reduction was required

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A. APPENDIX - GRAPHICAL IMAGES

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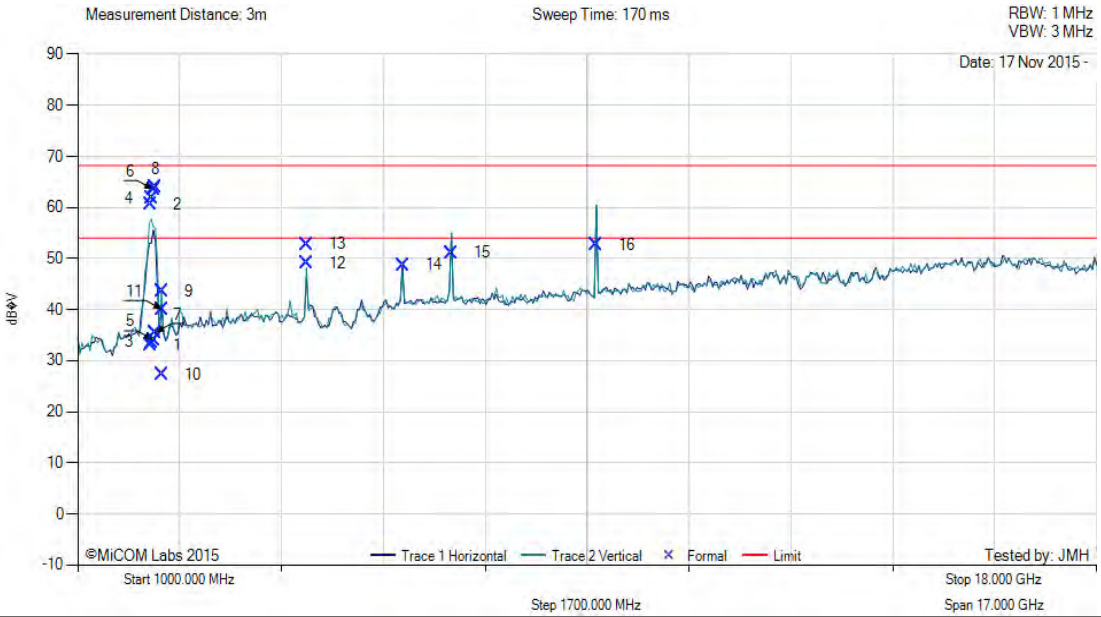
A.1. Emissions

A.1.1. Radiated Emissions

A.1.1.1. Restricted Band Emissions

RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS

Variant: 802.11b, Test Freq: 2412.00 MHz, Antenna: Galtronics Custom PCB, Power Setting: 58, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2219.79	42.78	2.62	-12.39	33.01	Max Avg	Vertical	103	60	54.0	-21.0	Pass
2	2219.79	70.30	2.62	-12.39	60.53	Max Peak	Vertical	103	60	74.0	-13.5	Pass
3	2239.47	43.22	2.65	-12.20	33.67	Max Avg	Vertical	117	318	54.0	-20.3	Pass
4	2239.47	71.26	2.65	-12.20	61.71	Max Peak	Vertical	117	318	74.0	-12.3	Pass
5	2263.96	43.57	2.64	-12.12	34.09	Max Avg	Vertical	105	322	54.0	-19.9	Pass
6	2263.96	72.99	2.64	-12.12	63.51	Max Peak	Vertical	105	322	74.0	-10.5	Pass
7	2289.82	45.00	2.67	-12.17	35.50	Max Avg	Vertical	100	319	54.0	-18.5	Pass
8	2289.82	73.39	2.67	-12.17	63.89	Max Peak	Vertical	100	319	74.0	-10.1	Pass
9	2410.60	52.62	2.69	-11.80	43.51	Fundamental	Horizontal	100	124	--	--	
10	2410.60	36.40	2.69	-11.80	27.29	Max Avg	Horizontal	135	330	54.0	-34.0	Pass
11	2410.60	49.13	2.69	-11.80	40.02	Max Peak	Horizontal	135	330	74.0	-28.2	Pass
12	4823.91	56.64	3.54	-11.15	49.03	Max Avg	Vertical	151	87	54.0	-5.0	Pass
13	4823.91	60.45	3.54	-11.15	52.84	Max Peak	Vertical	151	87	74.0	-21.2	Pass
14	6431.94	52.76	3.99	-7.99	48.76	Peak (NRB)	Horizontal	151	282	--	--	Pass
15	7237.08	54.25	4.25	-7.34	51.16	Peak (NRB)	Horizontal	151	282	--	--	Pass
16	9647.82	53.47	5.29	-6.08	52.68	Peak (NRB)	Horizontal	148	89	--	--	Pass

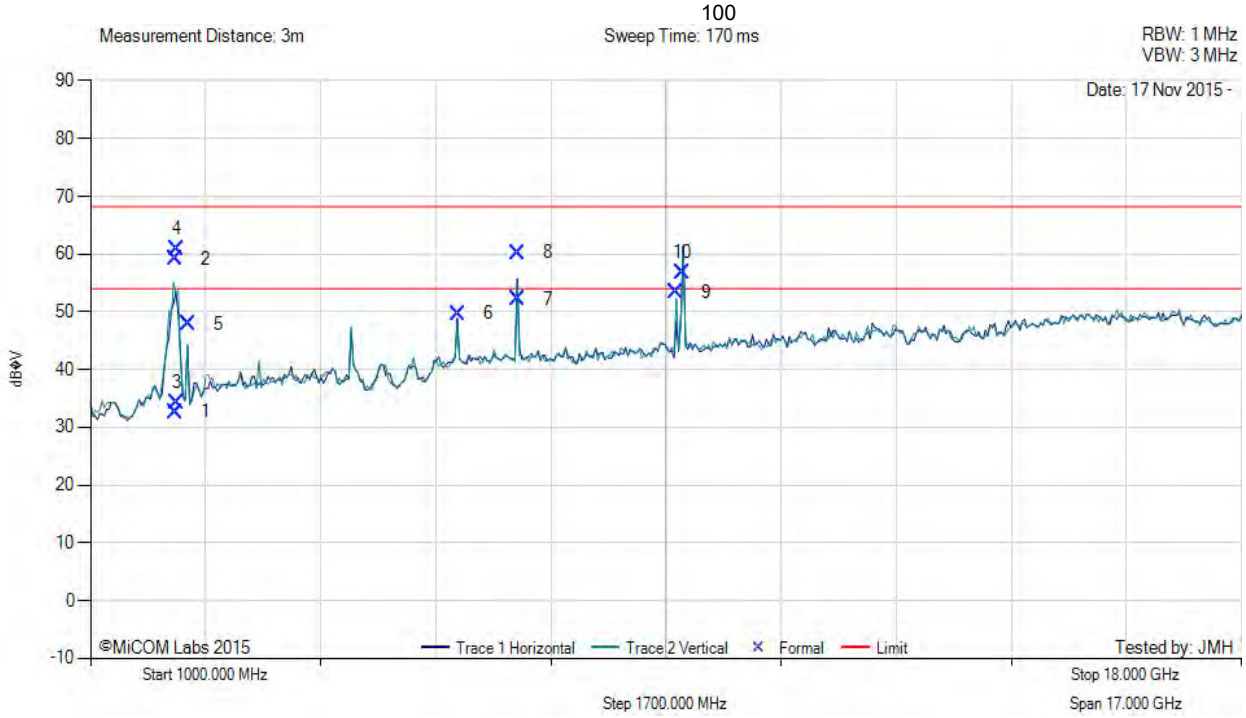
Test Notes: EUT at 150cm powered by Actiontec PS NB524J120150VU

NRB – Non-Restricted Band

back to matrix

RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS

Variant: 802.11b, Test Freq: 2437.00 MHz, Antenna: Galtronics Custom PCB, Power Setting: 58, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2244.85	42.15	2.64	-12.14	32.65	Max Avg	Vertical	154	59	54.0	-21.4	Pass
2	2244.85	68.72	2.64	-12.14	59.22	Max Peak	Vertical	154	59	74.0	-14.8	Pass
3	2276.19	43.70	2.66	-12.15	34.21	Max Avg	Vertical	157	50	54.0	-19.8	Pass
4	2276.19	70.33	2.66	-12.15	60.84	Max Peak	Vertical	157	50	74.0	-13.2	Pass
5	2437.91	56.83	2.72	-11.73	47.82	Fundamental	Vertical	151	330	--	--	
6	6431.86	53.72	3.99	-7.99	49.72	Peak (NRB)	Horizontal	151	158	--	--	Pass
7	7310.19	55.31	4.23	-7.29	52.25	Max Avg	Horizontal	182	51	54.0	-1.8	Pass
8	7310.19	63.26	4.23	-7.29	60.20	Max Peak	Horizontal	182	51	74.8	-13.8	Pass
9	9648.06	54.14	5.29	-6.08	53.35	Peak (NRB)	Vertical	151	284	--	--	Pass
10	9747.77	57.68	5.29	-6.23	56.74	Peak (NRB)	Horizontal	151	284	--	--	Pass

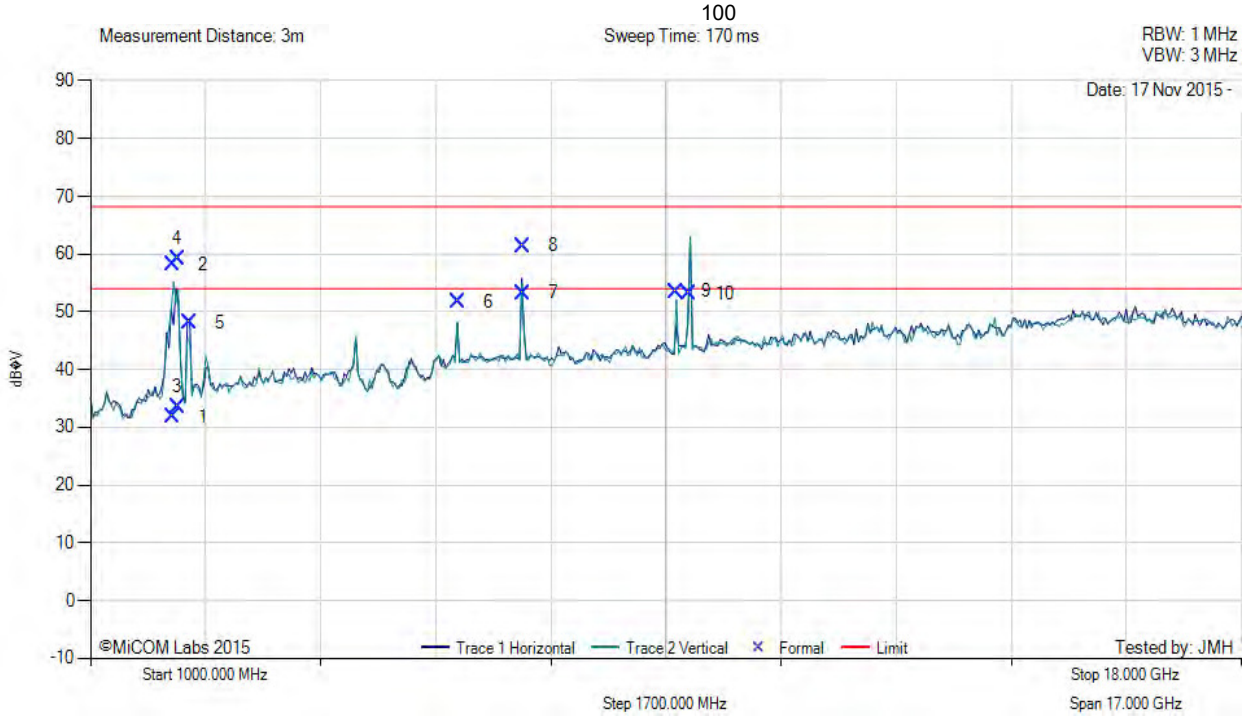
Test Notes: EUT at 150cm powered by Actiontec PS NB524J120150VU

NRB – Non-Restricted Band

back to matrix

RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS

Variant: 802.11b, Test Freq: 2462.00 MHz, Antenna: Galtronics Custom PCB, Power Setting: 58, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2217.19	41.64	2.62	-12.42	31.84	Max Avg	Vertical	100	321	54.0	-22.2	Pass
2	2217.19	67.94	2.62	-12.42	58.14	Max Peak	Vertical	100	321	74.0	-15.9	Pass
3	2285.65	43.05	2.67	-12.17	33.55	Max Avg	Vertical	100	328	54.0	-20.5	Pass
4	2285.65	68.60	2.67	-12.17	59.10	Max Peak	Vertical	100	328	74.0	-14.9	Pass
5	2462.89	57.02	2.74	-11.67	48.09	Fundamental	Horizontal	101	1	--	--	
6	6432.02	55.79	3.99	-7.99	51.79	Peak (NRB)	Horizontal	151	1	--	--	Pass
7	7387.01	56.16	4.29	-7.17	53.28	Max Avg	Horizontal	149	47	54.0	-0.7	Pass
8	7387.01	64.29	4.29	-7.17	61.41	Max Peak	Horizontal	149	47	74.0	-12.6	Pass
9	9647.90	54.31	5.29	-6.08	53.52	Peak (NRB)	Vertical	151	281	--	--	Pass
10	9847.82	53.66	5.39	-5.94	53.11	Peak (NRB)	Horizontal	151	281	--	--	Pass

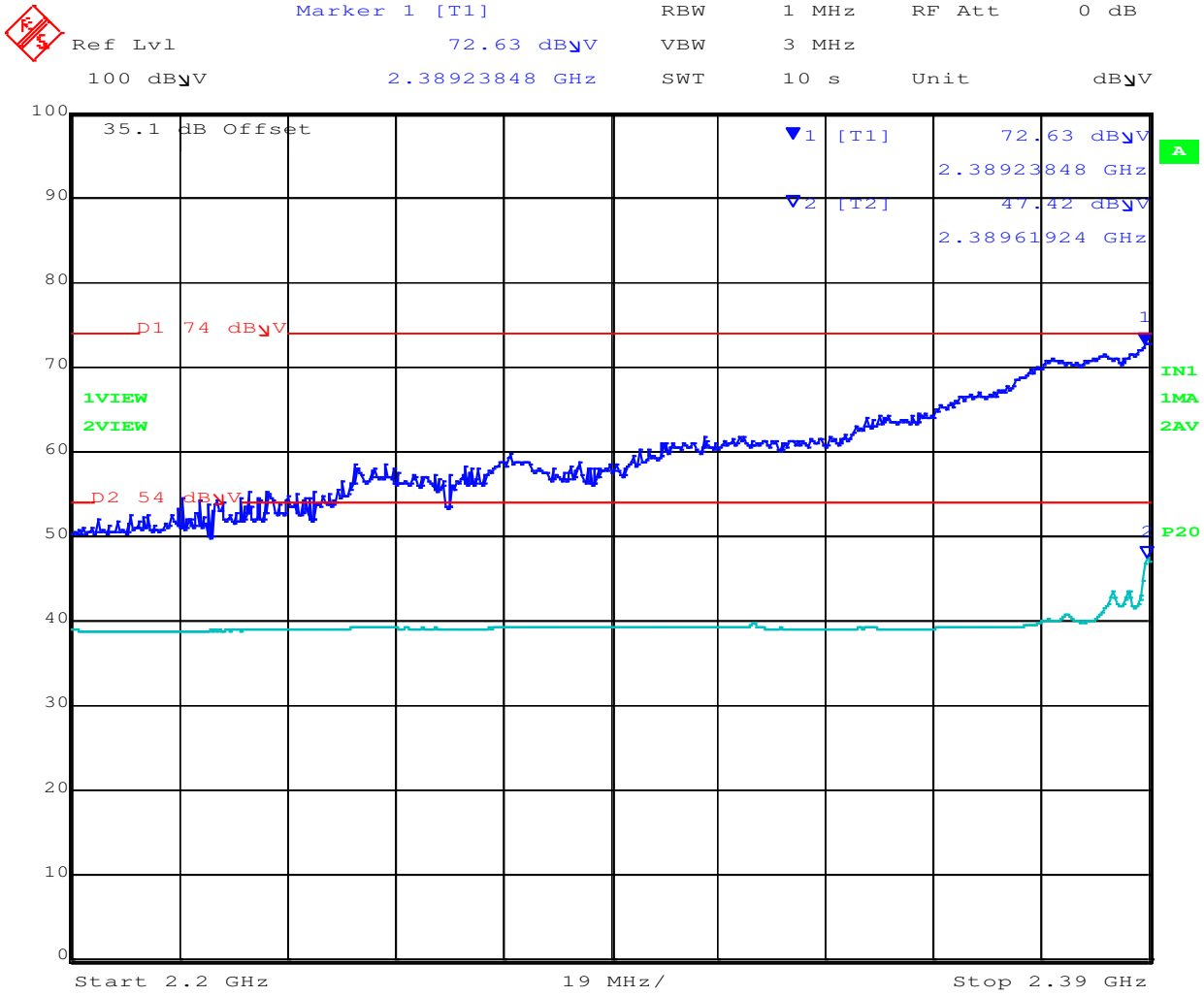
Test Notes: EUT at 150cm powered by Actiontec PS NB524J120150VU

NRB – Non-Restricted Band

back to matrix

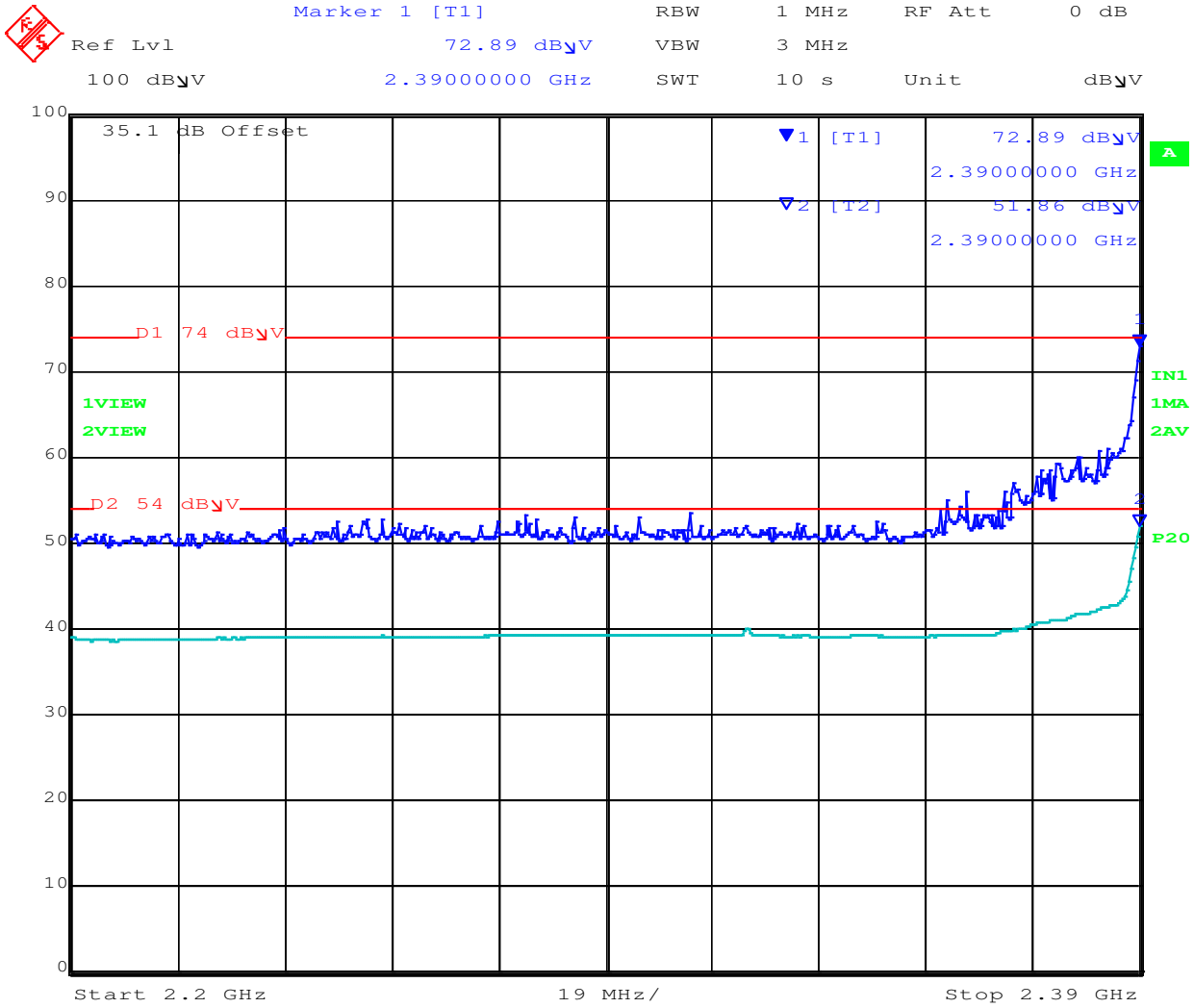
A.1.1.2. Restricted Band-Edge Emissions

RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS - Variant: 802.11b 2412 MHz



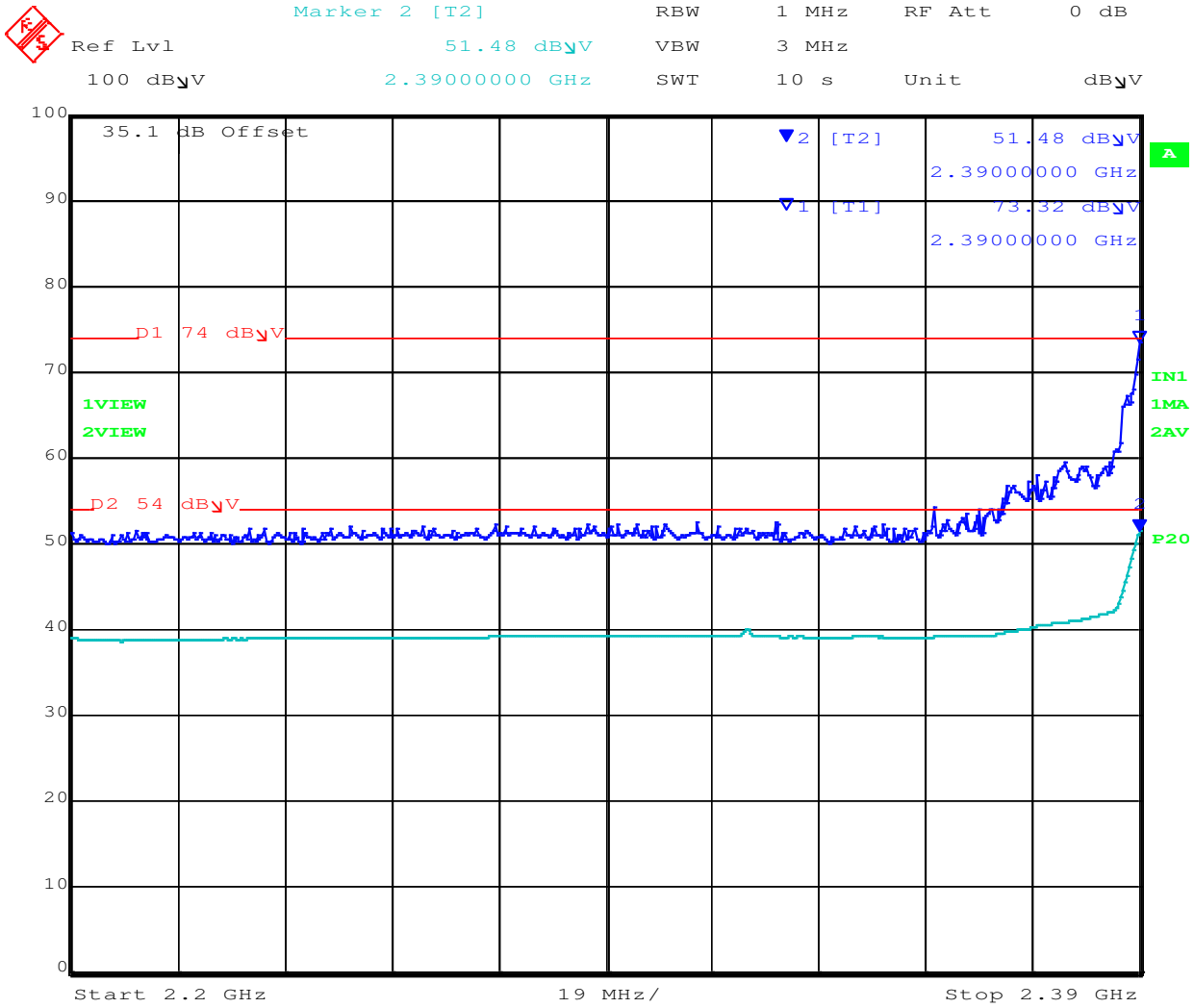
back to matrix

RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS - 802.11g 2412 MHz



back to matrix

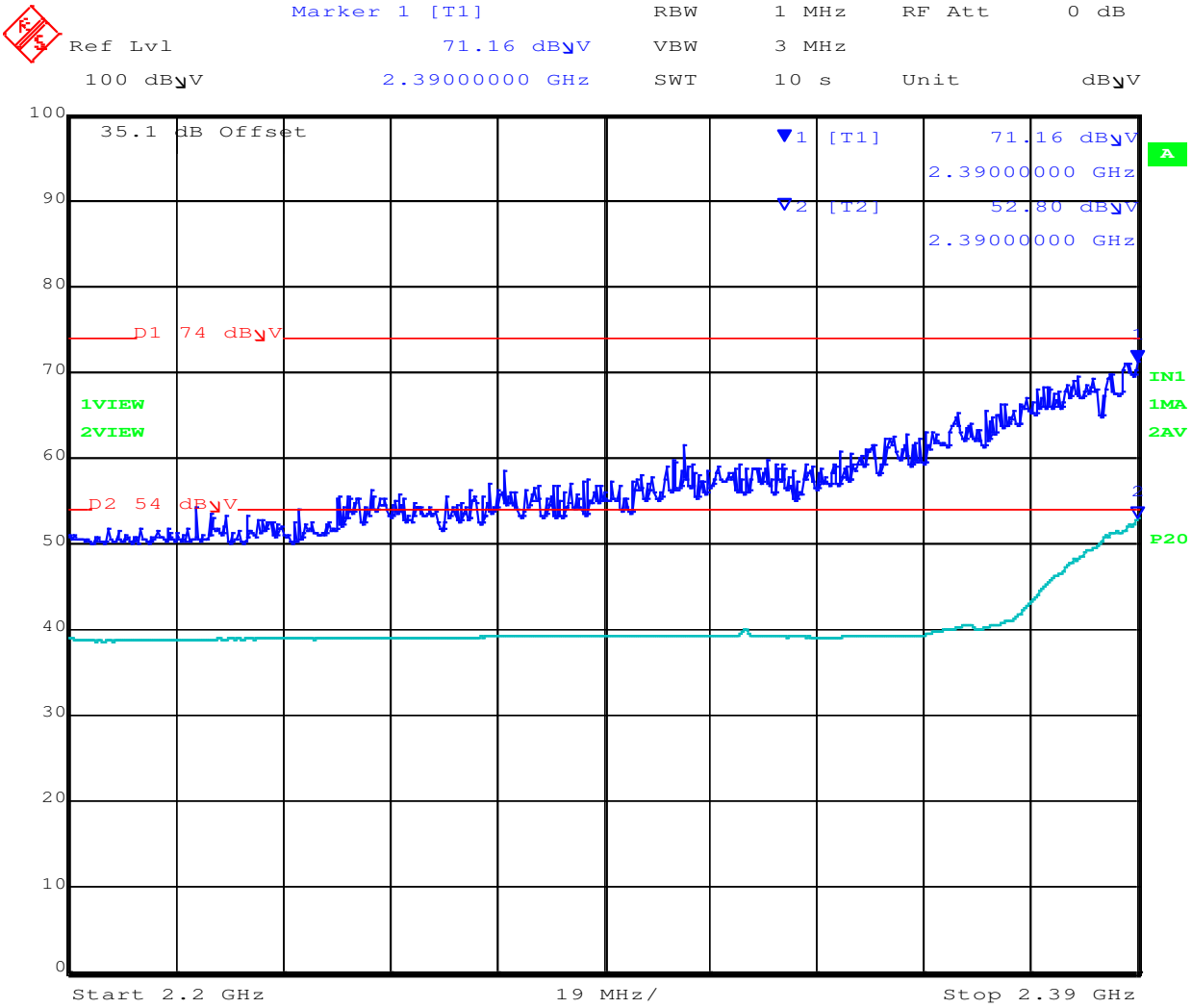
RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS - 802.11n HT20 2412 MHz – Power Reduction Required*



*Power Reduction to PS 57 required

back to matrix

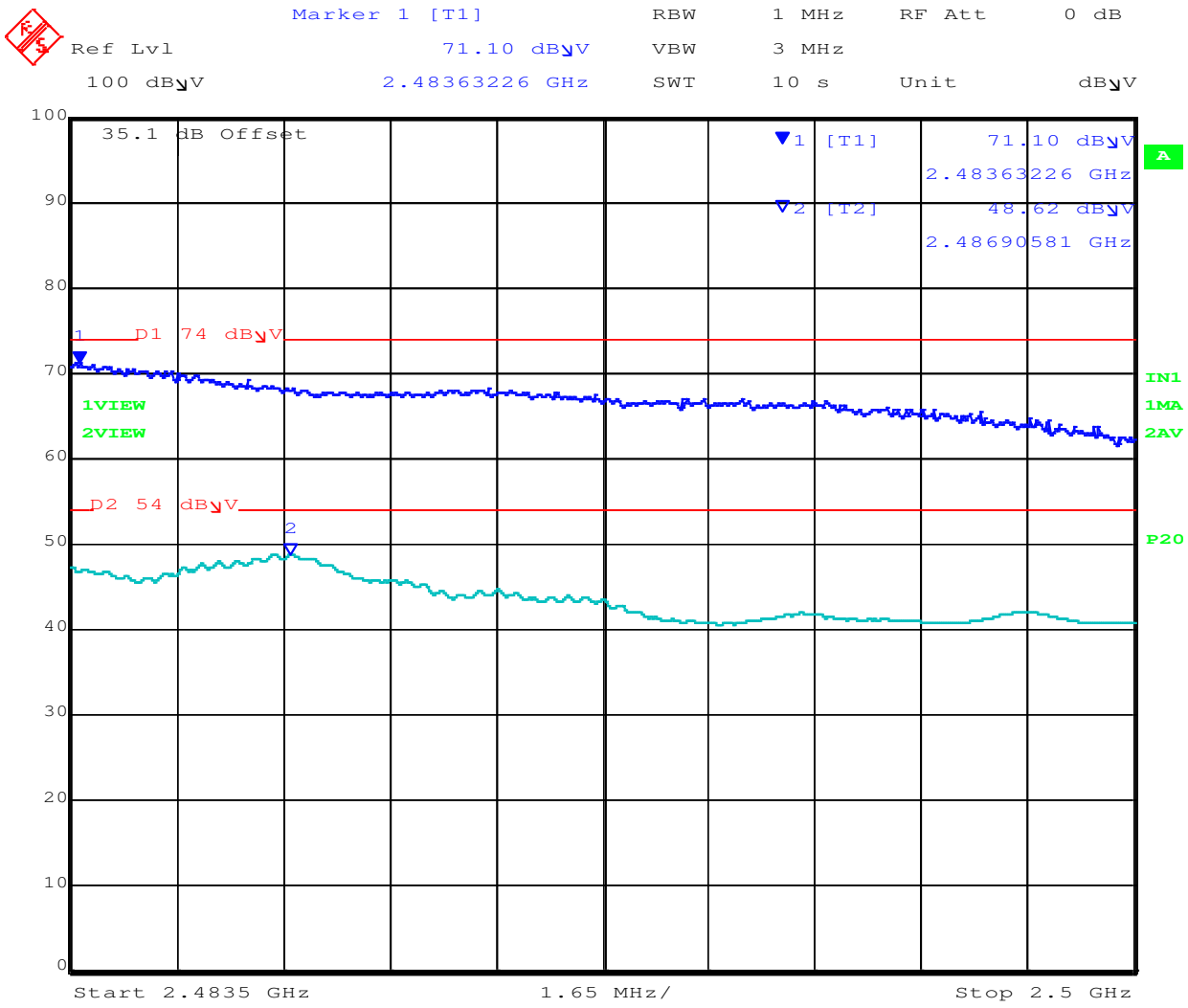
RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS - 802.11n HT40 2422 MHz – Power Reduction Required*



*Power Reduction to PS 57 required

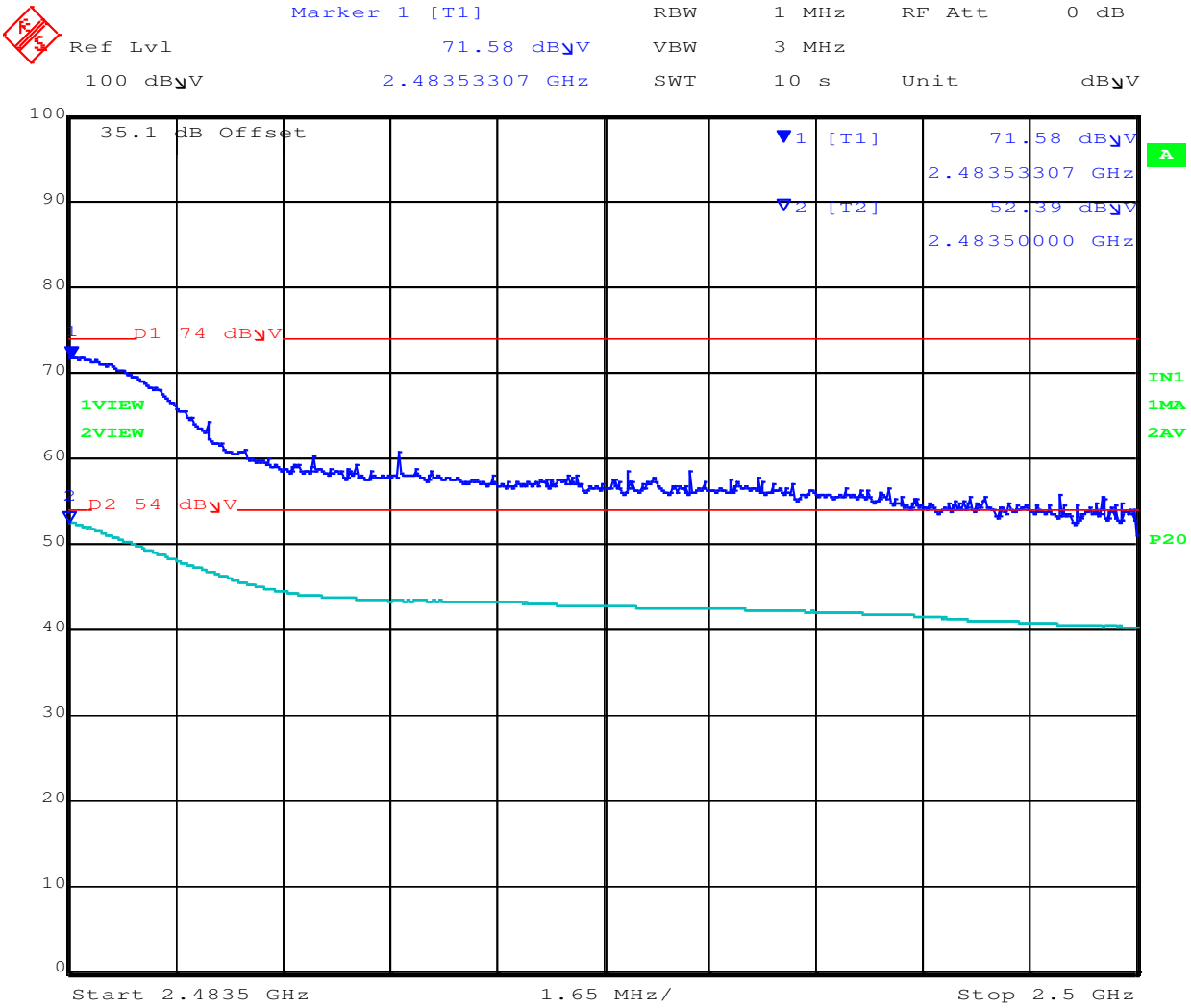
back to matrix

RADIATED – UPPER RESTRICTED BAND-EDGE EMISSIONS -802.11b 2462 MHz



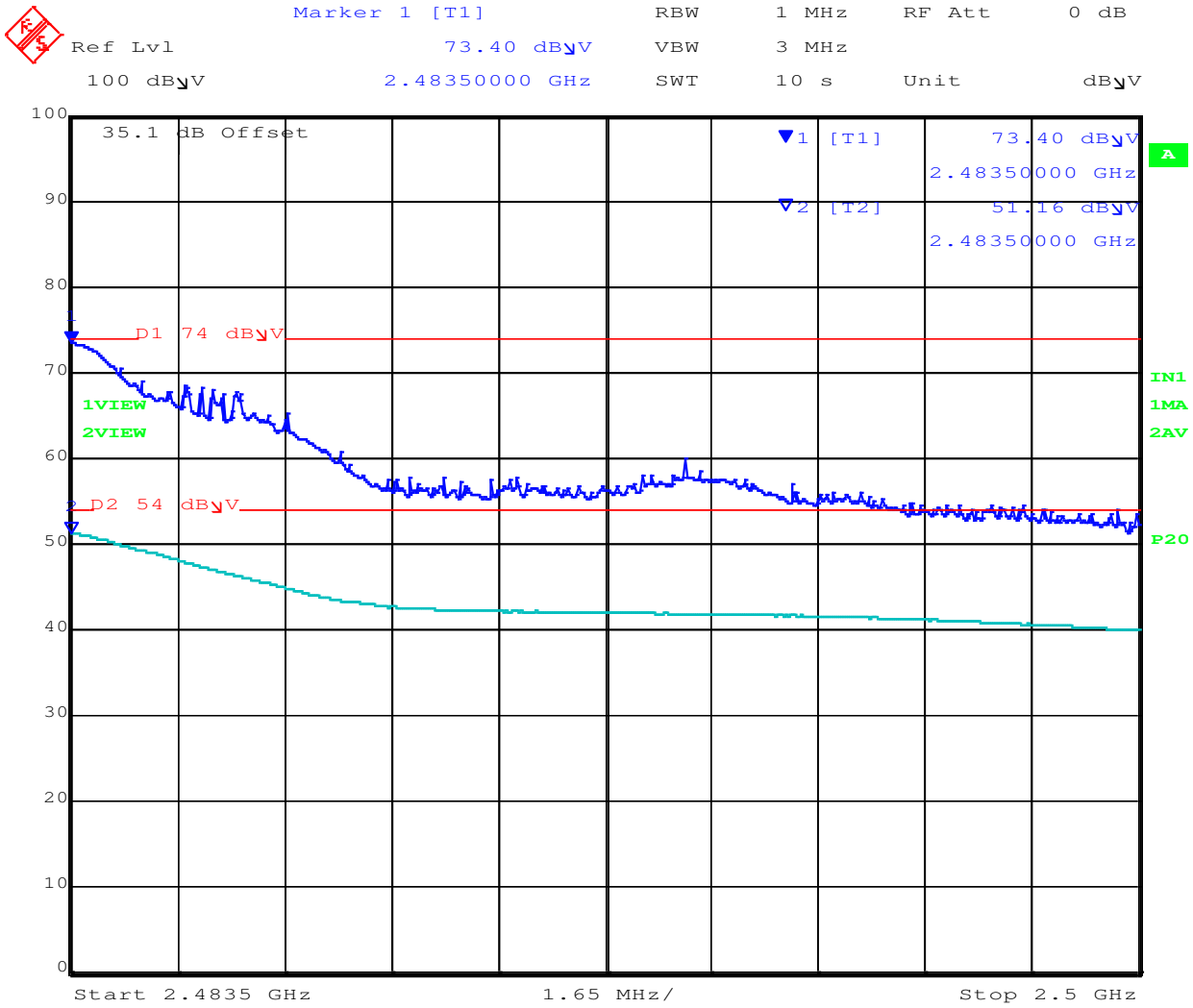
back to matrix

RADIATED – UPPER RESTRICTED BAND-EDGE EMISSIONS - 802.11g 2462 MHz



back to matrix

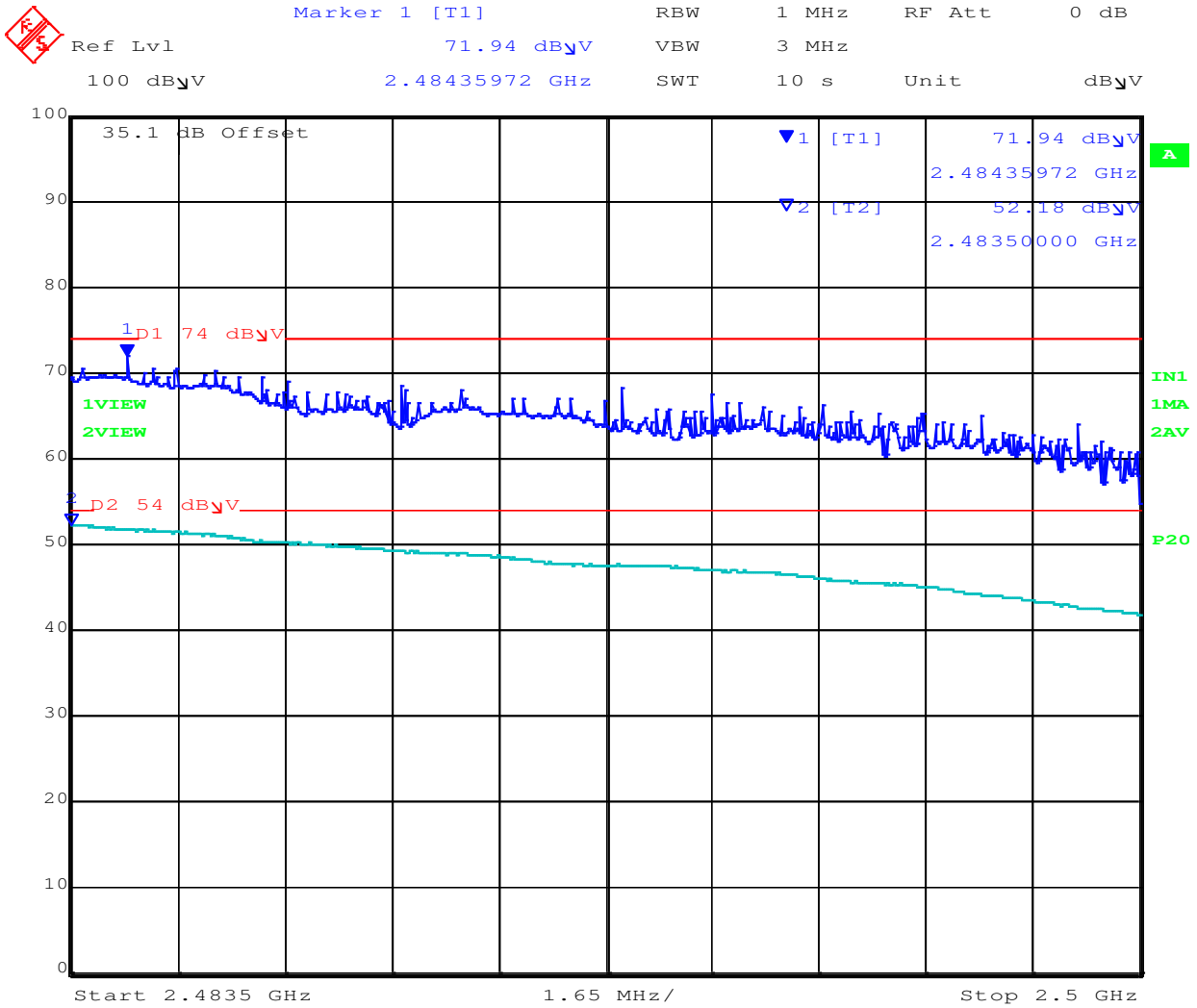
RADIATED – UPPER RESTRICTED BAND-EDGE EMISSIONS - 802.11n HT20 2462 MHz – Power Reduction Required*



*Power Reduction to PS 56 required

back to matrix

RADIATED – UPPER RESTRICTED BAND-EDGE EMISSIONS - 802.11n HT40 2452 MHz – Power Reduction Required*



*Power Reduction to PS 57 required

back to matrix

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