

Company: Actiontec Electronics Inc

Test of: WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407

Report No.: ATEC11-8b Radiated Rev B

RADIATED TEST REPORT



RADIATED TEST REPORT

FROM



Test of: Actiontec Electronics Inc WEB5500
to

To: FCC CFR 47 Part 15 Subpart E 15.407

Test Report Serial No.: ATEC11-U8b Radiated Rev B

This report supersedes: ATEC11-U8b 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.
575 Boulder Court
Pleasanton California 94566
USA
Phone: +1 (925) 462-0304
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www.micomlabs.com



MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

Table of Contents

| | |
|---|-----------|
| 1. ACCREDITATION, LISTINGS & RECOGNITION | 4 |
| 1.1. Test Accreditation | 4 |
| 1.2. Recognition..... | 5 |
| 1.3. Product Certification | 6 |
| 2. DOCUMENT HISTORY | 7 |
| 3. TEST RESULT CERTIFICATE | 8 |
| 4. REFERENCES AND MEASUREMENT UNCERTAINTY | 9 |
| 4.1. Normative References | 9 |
| 4.2. Test and Uncertainty Procedure | 10 |
| 5. PRODUCT DETAILS AND TEST CONFIGURATIONS | 11 |
| 5.1. Technical Details | 11 |
| 5.2. Scope Of Test Program..... | 12 |
| 5.3. Equipment Model(s) and Serial Number(s)..... | 13 |
| 5.4. Antenna Details | 13 |
| 5.5. Cabling and I/O Ports | 13 |
| 5.6. Test Configurations..... | 14 |
| 5.7. Equipment Modifications | 14 |
| 5.8. Deviations from the Test Standard | 14 |
| 6. TEST SUMMARY | 15 |
| 7. TEST EQUIPMENT CONFIGURATION(S) | 16 |
| 8. MEASUREMENT AND PRESENTATION OF TEST DATA | 18 |
| 9. TEST RESULTS | 19 |
| 9.1. Radiated | 19 |
| 9.1.1. <i>Restricted Band Emissions</i> | 22 |
| 9.1.1.1. 5150-5250 MHz | 22 |
| 9.1.1.2. 5725-5850 MHz | 25 |
| 9.1.2. <i>Restricted Band-Edge Emissions</i> | 28 |
| 9.1.2.1. 5150-5250 MHz | 28 |
| 9.1.2.2. 5725-5850 MHz | 33 |
| 9.1.3. <i>Digital Emissions</i> | 42 |
| A. APPENDIX - GRAPHICAL IMAGES | 45 |
| A.1. Radiated | 46 |
| A.1.1. <i>Restricted Band Emissions</i> | 46 |
| A.1.1.1. Galtronics Custom PCB | 46 |
| A.1.2. <i>Digital Emissions</i> | 52 |

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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. Test 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>



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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) VCCI | CAB | APEC MRA 2 | RCB 210 |
| 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>



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

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2. DOCUMENT HISTORY

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

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

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 8 of 53

3. TEST RESULT CERTIFICATE

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

Model: WEB5500

Type Of Equipment: 802.11ac Wireless Network Extender

S/N's: F18

Test Date(s): 3rd – 17th November 2015

Tested By: MiCOM Labs, Inc.
575 Boulder Court
Pleasanton California 94566
USA

Telephone: +1 925 462 0304

Fax: +1 925 462 0306

Website: www.micomlabs.com

STANDARD(S)

FCC CFR 47 Part 15 Subpart E 15.407

TEST RESULTS

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:

Graeme Grieve
Quality Manager MiCOM Labs, Inc.



TESTING CERT #2381.01

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 | FCC 47 CFR Part 15.407 | 2014 | Radio Frequency Devices; Subpart E –Unlicensed National Information Infrastructure Devices |
| II | 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 |
| III | KDB 905462 D07 v01 | 10th June 2015 | Test guidance to demonstrate compliance for U-NII devices subject to DFS requirements. |
| IV | KDB 926956 D01 v01r02 | 17th October 2014 | U-NII Device Transition Plan |
| V | KDB 789033 D02 v01 | 6th June 2014 | General UNII Test Procedures New Rules V01 |
| VI | A2LA | June 2015 | R105 - Requirement's When Making Reference to A2LA Accreditation Status |
| VII | ANSI C63.10 | 2013 | American National Standard for Testing Unlicensed Wireless Devices |
| VIII | 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 |
| IX | CISPR 22 | 2008 | Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement |
| X | 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 |
| XI | FCC 06-96 | Jun 3 2006 | Memorandum Opinion and Order |
| XII | KDB 644545 D03 v01 | August 14th 2014 | Guidance for IEEE 802.11ac New Rules |
| XIII | FCC 47 CFR Part 2.1033 | 2014 | FCC requirements and rules regarding photographs and test setup diagrams. |
| XIV | 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.

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 E 15.407. Radio Frequency Devices; Subpart E – Unlicensed National Information Infrastructure Devices |
| 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-U8b |
| Date EUT received: | 3 rd November 2015 |
| Standard(s) applied: | FCC CFR 47 Part 15 Subpart E 15.407 |
| Dates of test (from - to): | 3 rd – 17 th 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): | 5150 - 5250 MHz; 5725 - 5850 MHz; |
| Primary function of equipment: | 802.11ac Wireless Network Extender |
| Secondary function of equipment: | None Provided |
| Type of Modulation: | OFDM |
| EUT Modes of Operation: | 802.11a; 802.11ac-80; 802.11n HT-20; 802.11n HT-40 |
| Declared Nominal Output Power (Ave): | 5150-5250 MHz: +28 dBm 5725-5850 MHz: +28 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: | 802.11a: 16M9D1D 802.11ac-80: 76M2D1D 802.11n HT-20: 18M2D1D 802.11n HT-40: 36M7D1D |
| 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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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 12 of 53

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 5150 - 5250 MHz; 5725 - 5850 MHz; for compliance against the following specification for non-DFS bands:

FCC CFR 47 Part 15 Subpart E 15.407

Radio Frequency Devices; Subpart E – Unlicensed National Information Infrastructure Devices

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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 | 3.5 | 2.3 | -- | V-Pol | 5150 - 5250 |
| integral | Galtronics | Custom PCB | Dipole | 3.5 | 0.9 | -- | H-Pol | 5150 - 5250 |
| integral | Galtronics | Custom PCB | Dipole | 4.3 | 2.4 | -- | V-Pol | 5725 - 5850 |
| integral | Galtronics | Custom PCB | Dipole | 3.9 | 0.2 | -- | H-Pol | 5725 - 5850 |

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 |
| 5150 - 5250 MHz | | | | |
| 802.11a | 6 | 5,180.00 | 5,200.00 | 5,240.00 |
| 802.11ac-80 | 29.3 | 5,210.00 | -- | -- |
| 802.11n HT-20 | 6.5 | 5,180.00 | -- | -- |
| 802.11n HT-40 | 13.5 | 5,190.00 | -- | -- |
| 5725 - 5850 MHz | | | | |
| 802.11a | 6 | 5,745.00 | 5,785.00 | -- |
| 802.11ac-80 | 29.3 | 5,775.00 | -- | -- |
| 802.11n HT-20 | 6.5 | -- | -- | 5,825.00 |
| 802.11n HT-40 | 13.5 | 5,755.00 | -- | 5,795.00 |

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

6. TEST SUMMARY

List of Measurements

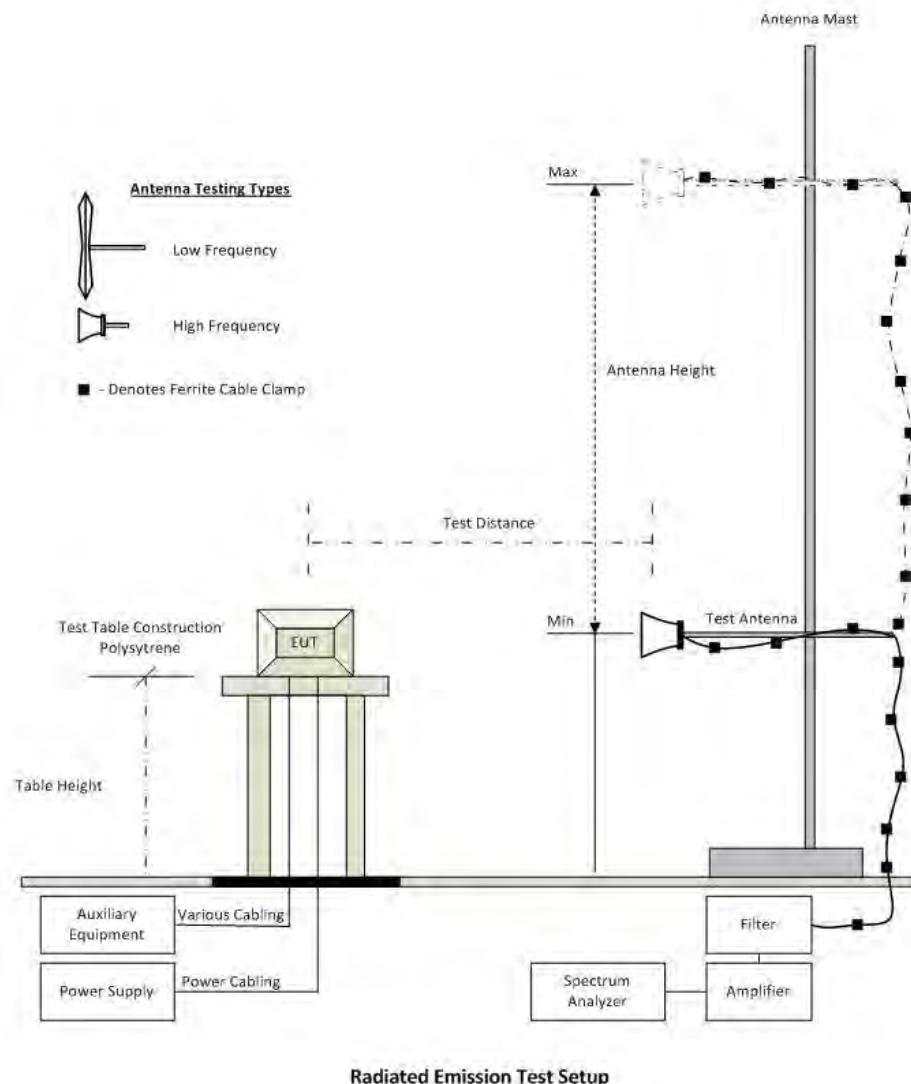
| Test Header | Result | Data Link |
|--------------------------------------|----------|---------------------------|
| (b)(2) Radiated | Complies | - |
| i).. Restricted Band Emissions | Complies | View Data |
| ii).. Restricted Band-Edge Emissions | Complies | View Data |
| iv).. Digital Emissions | Complies | View Data |

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7. TEST EQUIPMENT CONFIGURATION(S)

The following tests were performed using the radiated test set-up shown in the diagram. Radiated emissions below 1GHz.Radiated Emissions above 1GHz.

- 1).. Restricted Band Emissions
- 2).. Restricted Band-Edge Emissions
- 3).. Digital Emissions



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.

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| 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 |
| 310 | SMA Cable | Micro-Coax | UFA210A-0-0787-3G03G0 | 209089-001 | 30 Oct 2015 |
| 338 | Sunol 30 to 3000 MHz Antenna | Sunol | JB3 | A052907 | 15 Aug 2016 |
| 377 | Band Rejection Filter 5150 to 5880MHz | Microtronics | BRM50716 | 034 | 18 Aug 2016 |
| 393 | DC - 1050 MHz Low Pass Filter | Microcircuits | VLFX-1050 | N/A | 08 Oct 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 Nov 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 |
| 412 | USB to GPIB Interface | National Instruments | GPIB-USB HS | 11B8DC2 | Not Required |
| 413 | Mast Controller | Sunol Science | TWR95-4 | 030801-3 | Not Required |
| 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 |
| 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. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

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9. TEST RESULTS

9.1. Radiated

| Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions | | | |
|--|---|----------------------------|-------------|
| Standard: | FCC CFR 47:15.407 | Ambient Temp. (°C): | 20.0 - 24.5 |
| Test Heading: | Radiated Spurious and Band-Edge Emissions | Rel. Humidity (%): | 32 - 45 |
| Standard Section(s): | 15.407 (b), 15.205, 15.209 | Pressure (mBars): | 999 - 1001 |
| Reference Document(s): | See Normative References | | |

Test Procedure for Radiated Spurious and Band-Edge Emissions

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 Undesirable Measurement were per the Radiated Test Set-up specified in this document.

15.407 (b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

Limits for Restricted Bands (15.205, 15.209)

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.

$$FS = R + AF + CORR - FO$$

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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:

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength (dB μ V/m);

$$E = \frac{1000000 \times \sqrt{30P}}{3} \mu\text{V/m}$$

where P is the EIRP in Watts

Therefore: -27 dBm/MHz equates to 68.23 dB μ V/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 |

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 21 of 53

| | | | |
|-------------------|-----------|-----------|------------|
| 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).

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 22 of 53

9.1.1. Restricted Band Emissions

9.1.1.1. 5150-5250 MHz

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

| | | | |
|---------------------------------|-----------------------|------------------------|-------------|
| Antenna: | Galtronics Custom PCB | Variant: | 802.11a |
| Antenna Gain (dBi): | 6.00 | Modulation: | OFDM |
| Beam Forming Gain (Y): | Not Applicable | Duty Cycle (%): | 100 |
| Channel Frequency (MHz): | 5180.00 | Data Rate: | 6.00 MBit/s |
| Power Setting: | 23 | Tested By: | JMH |

Test Measurement Results

| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| #1 | 2257.91 | 37.10 | 2.63 | -12.11 | 27.62 | Max Avg | Vertical | 156 | 193 | 54.0 | -26.4 | Pass |
| #2 | 2257.91 | 63.33 | 2.63 | -12.11 | 53.85 | Max Peak | Vertical | 156 | 193 | 74.0 | -20.2 | Pass |
| #3 | 5178.00 | 74.43 | 3.69 | -11.51 | 66.61 | Fundamental | Vertical | 151 | 1 | -- | -- | |
| #4 | 6906.66 | 56.33 | 4.11 | -7.54 | 52.90 | Peak (NRB) | Horizontal | 151 | 197 | -- | -- | Pass |
| #5 | 9667.95 | 53.98 | 5.27 | -6.13 | 53.12 | Peak (NRB) | Horizontal | 151 | 318 | -- | -- | Pass |
| #6 | 10357.64 | 59.53 | 5.55 | -5.28 | 59.80 | Peak (NRB) | Vertical | 151 | 0 | -- | -- | Pass |

Test Notes: EUT at 150cm powered by ACTIONTEC PS NB524j120150VU

NRB – Non-Restricted Band

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 23 of 53

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

| | | | |
|---------------------------------|-----------------------|------------------------|-------------|
| Antenna: | Galtronics Custom PCB | Variant: | 802.11a |
| Antenna Gain (dBi): | 6.00 | Modulation: | OFDM |
| Beam Forming Gain (Y): | Not Applicable | Duty Cycle (%): | 100 |
| Channel Frequency (MHz): | 5200.00 | Data Rate: | 6.00 MBit/s |
| Power Setting: | 23 | Tested By: | JMH |

Test Measurement Results

| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| #1 | 2260.73 | 37.07 | 2.63 | -12.12 | 27.58 | Max Avg | Vertical | 124 | 200 | 54.0 | -26.4 | Pass |
| #2 | 2260.73 | 64.01 | 2.63 | -12.12 | 54.52 | Max Peak | Vertical | 124 | 200 | 74.0 | -19.5 | Pass |
| #3 | 5201.72 | 79.73 | 3.66 | -11.46 | 71.93 | Fundamental | Horizontal | 151 | 1 | -- | -- | |
| #4 | 6933.20 | 57.30 | 4.11 | -7.49 | 53.92 | Peak (NRB) | Horizontal | 151 | 232 | -- | -- | Pass |
| #5 | 9667.94 | 53.06 | 5.27 | -6.13 | 52.20 | Peak (NRB) | Horizontal | 151 | 358 | -- | -- | Pass |
| #6 | 10410.14 | 59.49 | 5.49 | -4.96 | 60.02 | Peak (NRB) | Vertical | 151 | 0 | -- | -- | Pass |

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

NRB – Non-Restricted Band

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 24 of 53

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

| | | | |
|---------------------------------|-----------------------|------------------------|-------------|
| Antenna: | Galtronics Custom PCB | Variant: | 802.11a |
| Antenna Gain (dBi): | 6.00 | Modulation: | OFDM |
| Beam Forming Gain (Y): | Not Applicable | Duty Cycle (%): | 100 |
| Channel Frequency (MHz): | 5240.00 | Data Rate: | 6.00 MBit/s |
| Power Setting: | 23 | Tested By: | JMH |

Test Measurement Results

| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| #1 | 2257.83 | 37.07 | 2.63 | -12.11 | 27.59 | Max Avg | Vertical | 117 | 179 | 54.0 | -26.4 | Pass |
| #2 | 2257.83 | 64.39 | 2.63 | -12.11 | 54.91 | Max Peak | Vertical | 117 | 179 | 74.0 | -19.1 | Pass |
| #3 | 5241.72 | 79.17 | 3.63 | -11.36 | 71.44 | Fundamental | Horizontal | 151 | 0 | -- | -- | |
| #4 | 6986.58 | 55.95 | 4.13 | -7.45 | 52.63 | Peak (NRB) | Horizontal | 151 | 214 | -- | -- | Pass |
| #5 | 9667.83 | 53.53 | 5.27 | -6.13 | 52.67 | Peak (NRB) | Horizontal | 151 | 360 | -- | -- | Pass |
| #6 | 10490.06 | 62.75 | 5.45 | -4.39 | 63.81 | Peak (NRB) | Vertical | 151 | 0 | -- | -- | Pass |

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

NRB – Non-Restricted Band

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 25 of 53

9.1.1.2. 5725-5850 MHz

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

| | | | |
|---------------------------------|-----------------------|------------------------|-------------|
| Antenna: | Galtronics Custom PCB | Variant: | 802.11a |
| Antenna Gain (dBi): | 6.70 | Modulation: | OFDM |
| Beam Forming Gain (Y): | Not Applicable | Duty Cycle (%): | 100 |
| Channel Frequency (MHz): | 5745.00 | Data Rate: | 6.00 MBit/s |
| Power Setting: | 23 | Tested By: | JMH |

Test Measurement Results

| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| #1 | 3829.99 | 54.92 | 3.21 | -10.83 | 47.30 | Max Avg | Vertical | 197 | 307 | 54.0 | -6.7 | Pass |
| #2 | 3829.99 | 61.70 | 3.21 | -10.83 | 54.08 | Max Peak | Vertical | 197 | 307 | 74.0 | -20.0 | Pass |
| #3 | 5737.43 | 63.70 | 3.82 | -10.67 | 56.85 | Fundamental | Horizontal | 151 | 1 | -- | -- | |
| #4 | 7659.93 | 49.64 | 4.37 | -6.95 | 47.06 | Max Avg | Vertical | 127 | 281 | 54.0 | -6.9 | Pass |
| #5 | 7659.93 | 57.38 | 4.37 | -6.95 | 54.80 | Max Peak | Vertical | 127 | 281 | 74.0 | -19.2 | Pass |
| #6 | 9667.89 | 53.73 | 5.27 | -6.13 | 52.87 | Peak (NRB) | Horizontal | 151 | 314 | -- | -- | Pass |
| #7 | 11491.43 | 49.85 | 5.45 | -4.84 | 50.46 | Max Avg | Horizontal | 140 | 25 | 54.0 | -3.5 | Pass |
| #8 | 11491.43 | 63.10 | 5.45 | -4.84 | 63.71 | Max Peak | Horizontal | 140 | 25 | 74.0 | -10.3 | Pass |

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

NRB – Non-Restricted Band

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 26 of 53

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

| | | | |
|---------------------------------|-----------------------|------------------------|-------------|
| Antenna: | Galtronics Custom PCB | Variant: | 802.11a |
| Antenna Gain (dBi): | 6.70 | Modulation: | OFDM |
| Beam Forming Gain (Y): | Not Applicable | Duty Cycle (%): | 100 |
| Channel Frequency (MHz): | 5785.00 | Data Rate: | 6.00 MBit/s |
| Power Setting: | 23 | Tested By: | JMH |

Test Measurement Results

| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| #1 | 2259.17 | 36.87 | 2.63 | -12.11 | 27.39 | Max Avg | Vertical | 156 | 124 | 54.0 | -26.6 | Pass |
| #2 | 2259.17 | 61.83 | 2.63 | -12.11 | 52.35 | Max Peak | Vertical | 156 | 124 | 74.0 | -21.7 | Pass |
| #3 | 3856.66 | 52.14 | 3.23 | -10.81 | 44.56 | Max Avg | Vertical | 155 | 271 | 54.0 | -9.4 | Pass |
| #4 | 3856.66 | 59.36 | 3.23 | -10.81 | 51.78 | Max Peak | Vertical | 155 | 271 | 74.0 | -22.3 | Pass |
| #5 | 5777.92 | 67.81 | 3.80 | -10.48 | 61.13 | Fundamental | Vertical | 151 | 0 | -- | -- | |
| #6 | 9667.95 | 54.18 | 5.27 | -6.13 | 53.32 | Peak (NRB) | Horizontal | 151 | 277 | -- | -- | Pass |
| #7 | 11571.78 | 48.51 | 5.42 | -4.63 | 49.30 | Max Avg | Vertical | 170 | 313 | 54.0 | -4.7 | Pass |
| #8 | 11571.78 | 61.64 | 5.42 | -4.63 | 62.43 | Max Peak | Vertical | 170 | 313 | 74.0 | -11.6 | Pass |

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

NRB – Non-Restricted Band

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 27 of 53

Equipment Configuration for Radiated Spurious - Restricted Band Emissions

| | | | |
|---------------------------------|-----------------------|------------------------|-------------|
| Antenna: | Galtronics Custom PCB | Variant: | 802.11a |
| Antenna Gain (dBi): | 6.70 | Modulation: | OFDM |
| Beam Forming Gain (Y): | Not Applicable | Duty Cycle (%): | 100 |
| Channel Frequency (MHz): | 5825.00 | Data Rate: | 6.00 MBit/s |
| Power Setting: | 23 | Tested By: | JMH |

Test Measurement Results

| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| #1 | 2250.86 | 36.81 | 2.63 | -12.10 | 27.34 | Max Avg | Vertical | 100 | 186 | 54.0 | -26.7 | Pass |
| #2 | 2250.86 | 63.18 | 2.63 | -12.10 | 53.71 | Max Peak | Vertical | 100 | 186 | 74.0 | -20.3 | Pass |
| #3 | 3883.33 | 56.22 | 3.25 | -10.76 | 48.71 | Max Avg | Vertical | 189 | 307 | 54.0 | -5.3 | Pass |
| #4 | 3883.33 | 62.66 | 3.25 | -10.76 | 55.15 | Max Peak | Vertical | 189 | 307 | 74.0 | -18.9 | Pass |
| #5 | 5819.88 | 67.75 | 3.83 | -10.26 | 61.32 | Fundamental | Horizontal | 151 | 243 | -- | -- | |
| #6 | 7766.56 | 53.41 | 4.43 | -6.71 | 51.13 | Peak (NRB) | Vertical | 151 | 243 | -- | -- | Pass |
| #7 | 9667.86 | 52.28 | 5.27 | -6.13 | 51.42 | Peak (NRB) | Horizontal | 151 | 243 | -- | -- | Pass |
| #8 | 11651.67 | 49.16 | 5.48 | -4.46 | 50.18 | Max Avg | Vertical | 185 | 313 | 54.0 | -3.8 | Pass |
| #9 | 11651.67 | 62.48 | 5.48 | -4.46 | 63.50 | Max Peak | Vertical | 185 | 313 | 74.0 | -10.5 | Pass |

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

NRB – Non-Restricted Band

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9.1.2. Restricted Band-Edge Emissions

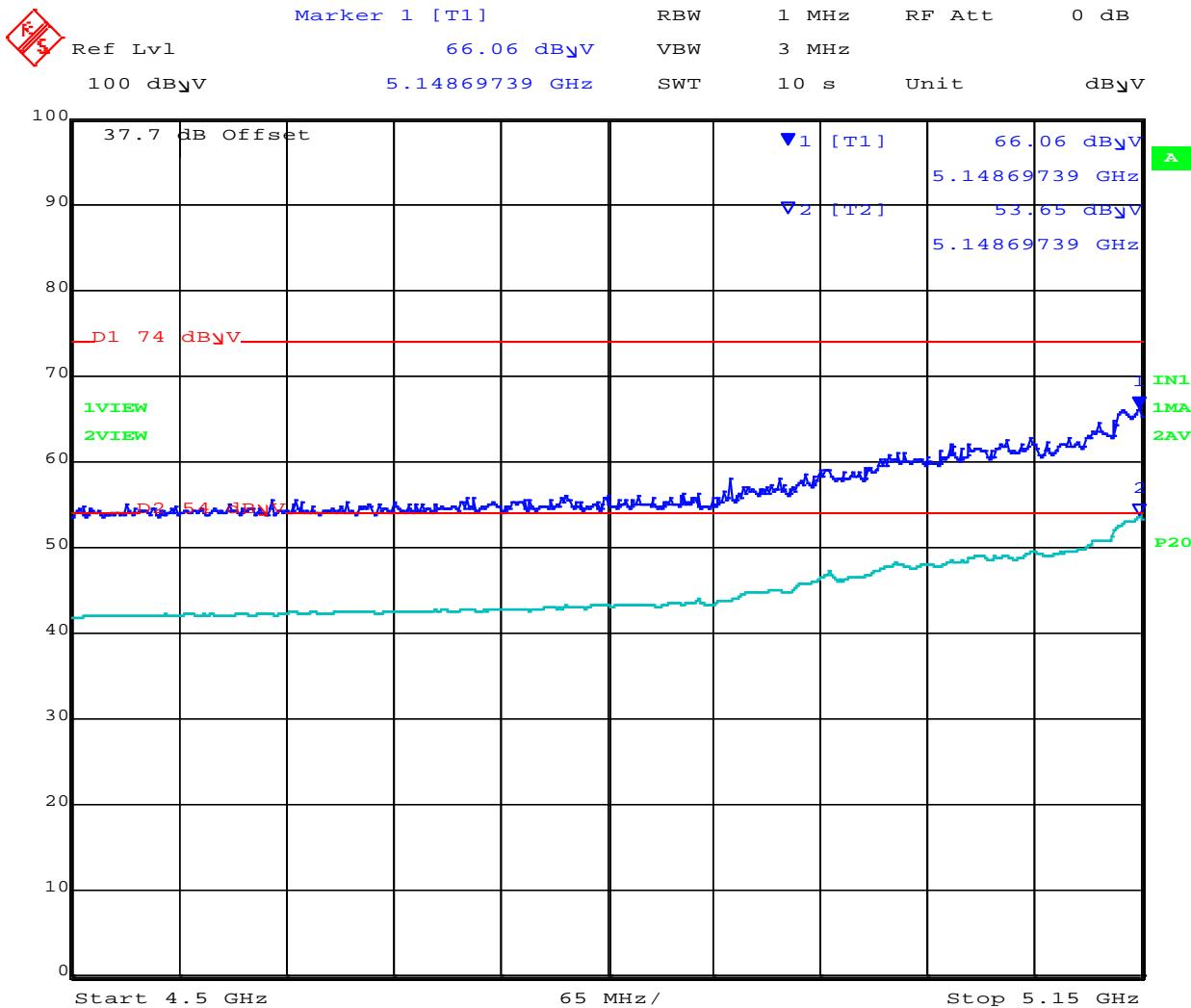
9.1.2.1. 5150-5250 MHz

RESULTS SUMMARY FOR RADIATED BAND-EDGE EMISSIONS

| Galtronics Custom PCB SMT | | Band-Edge Freq | Peak (Limit 74.0dB μ V/m) | Average (Limit 54.0dB μ V/m) | Power Setting |
|---------------------------|---------------------------|----------------|----------------------------------|-------------------------------------|---------------|
| Operational Mode | Operating Frequency (MHz) | MHz | dB μ V/m | dB μ V/m | |
| 802.11a | 5180.00 | 5150.00 | 66.06 | 53.65 | 20.00 |
| | | | | | |
| 802.11ac-80 | 5210.00 | 5150.00 | 66.30 | 53.44 | 19.00 |
| | | | | | |
| 802.11n HT-20 | 5180.00 | 5150.00 | 65.24 | 52.83 | 16.00 |
| | | | | | |
| 802.11n HT-40 | 5190.00 | 5150.00 | 70.70 | 53.86 | 16.00 |

Click on the links to view the data.

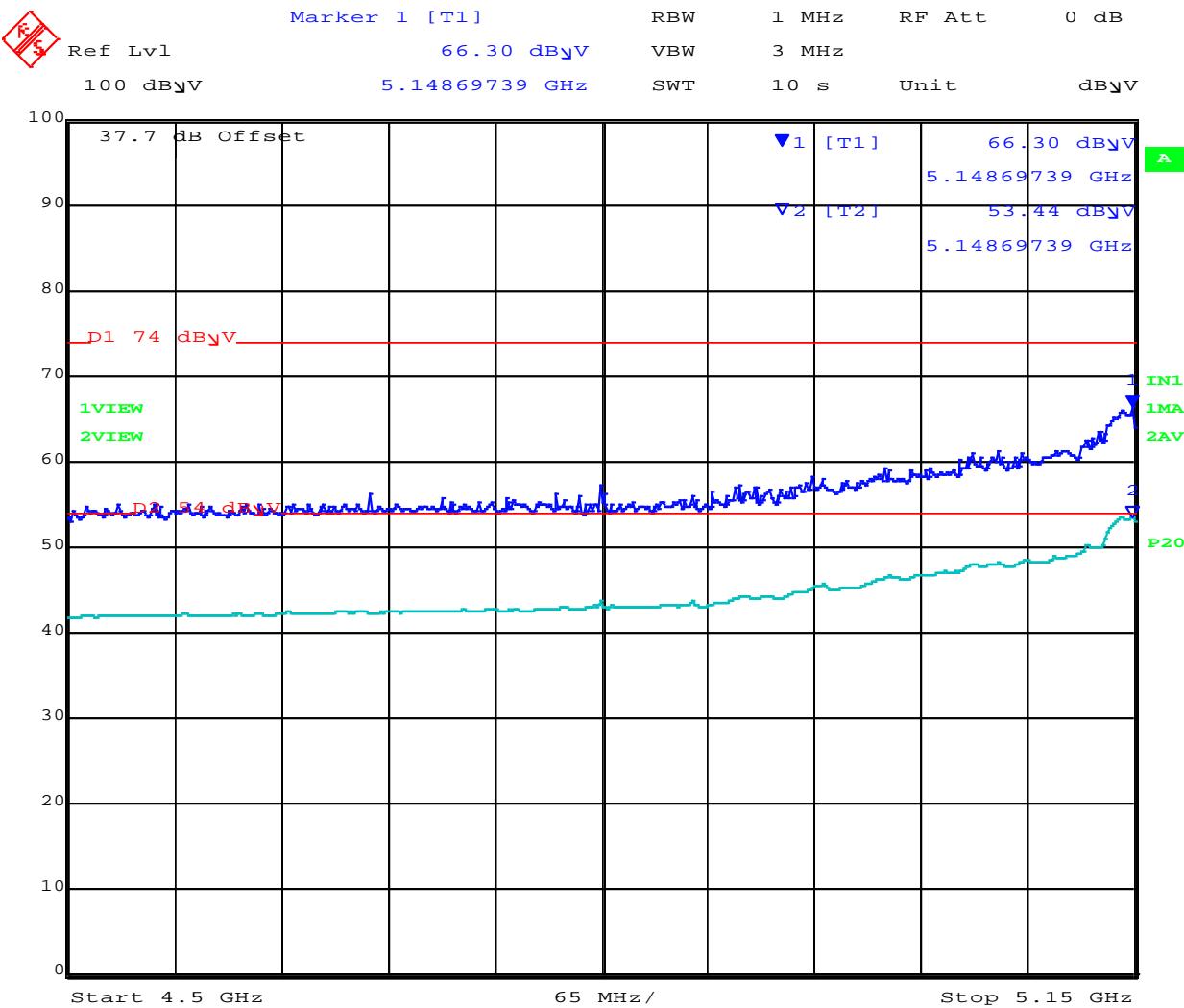
802.11a Radiated Band-Edge 5150 MHz, Channel Frequency 5180 MHz



[Back to Matrix](#)

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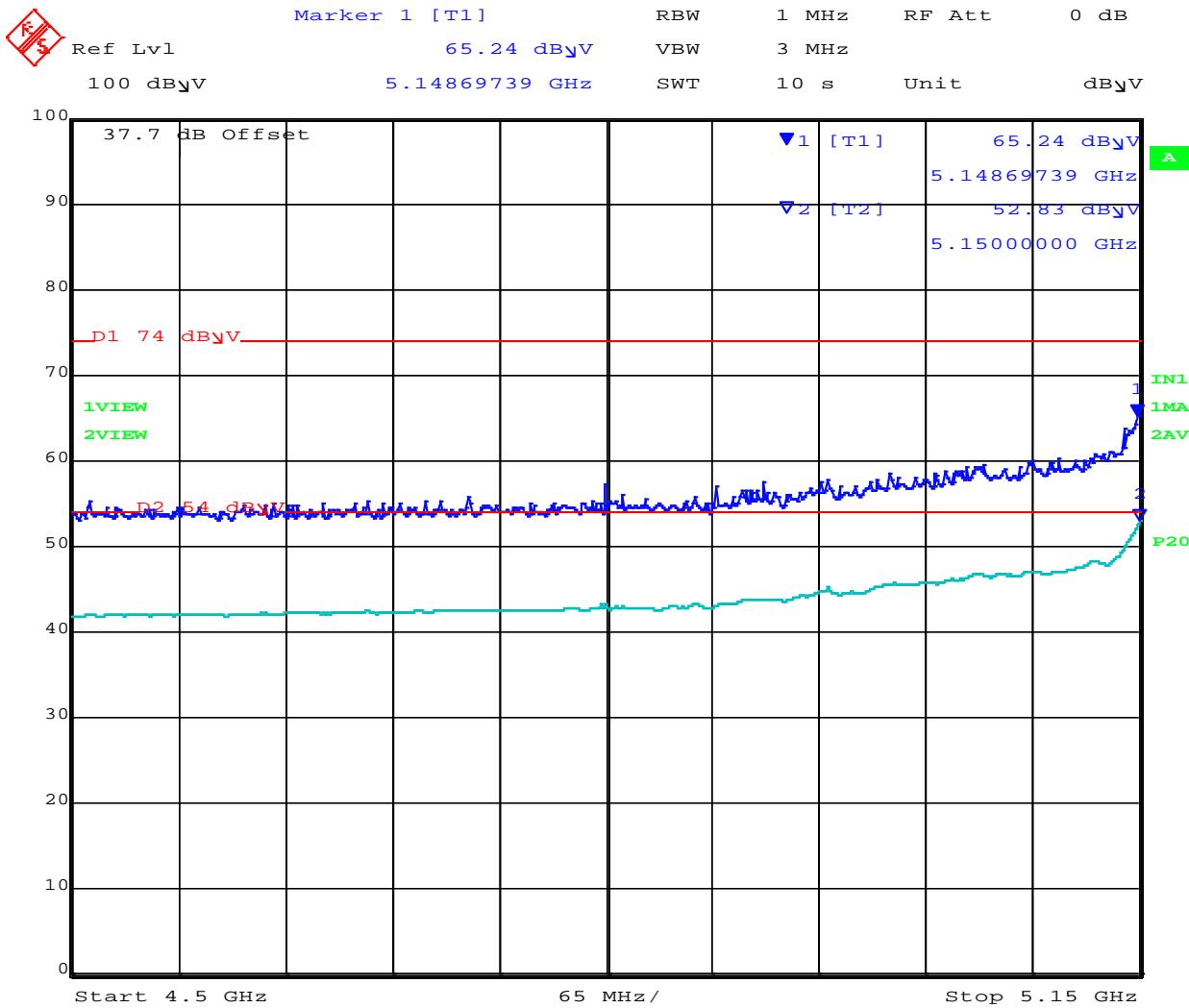
802.11n HT-20 Radiated Band-Edge 5150 MHz, Channel Frequency 5180 MHz



D

[Back to Matrix](#)

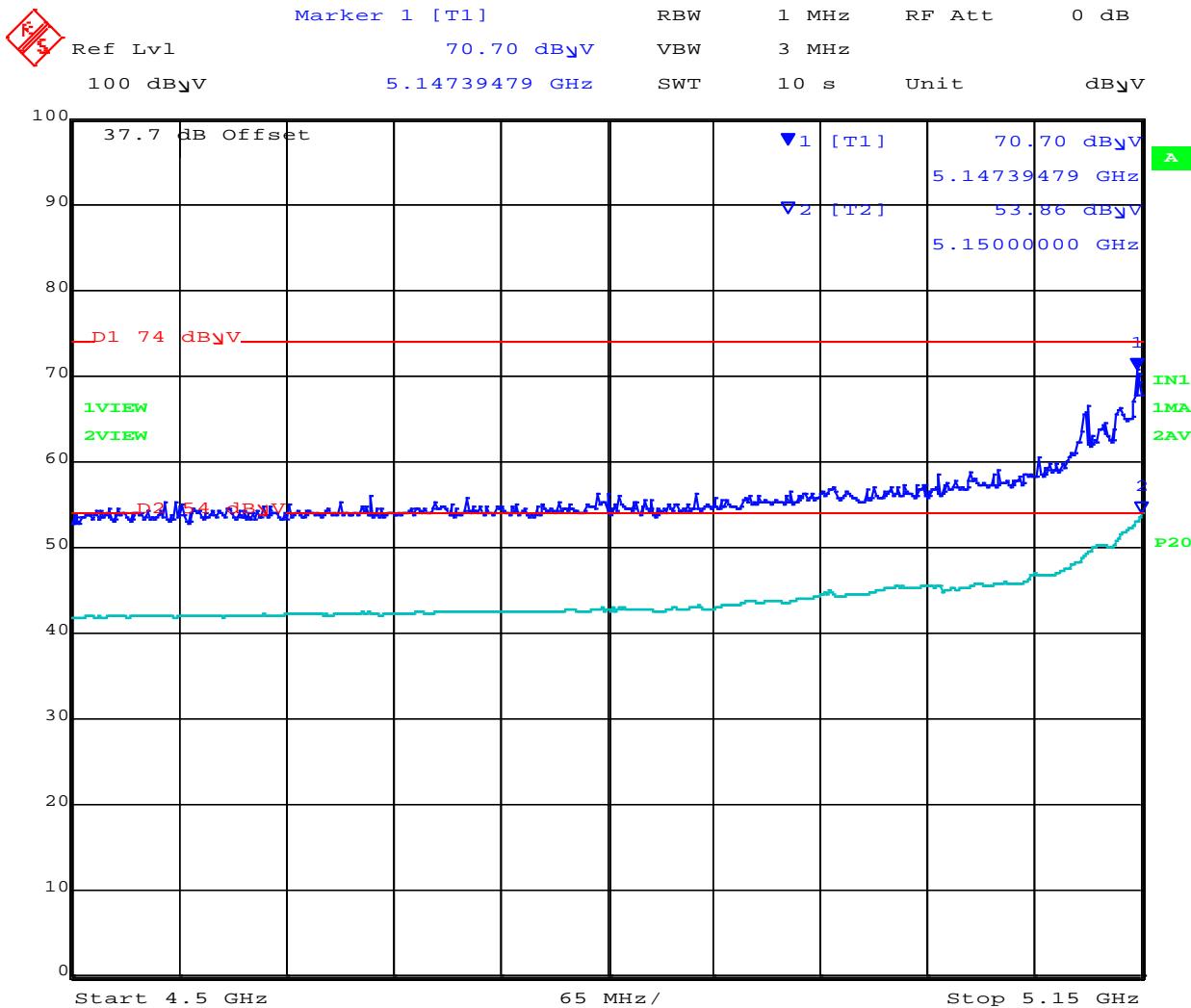
802.11n HT-40 Radiated Band-Edge 5150 MHz, Channel Frequency 5190 MHz



[Back to Matrix](#)

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802.11ac-80 Radiated Band-Edge 5150 MHz, Channel Frequency 5210 MHz



[Back to Matrix](#)

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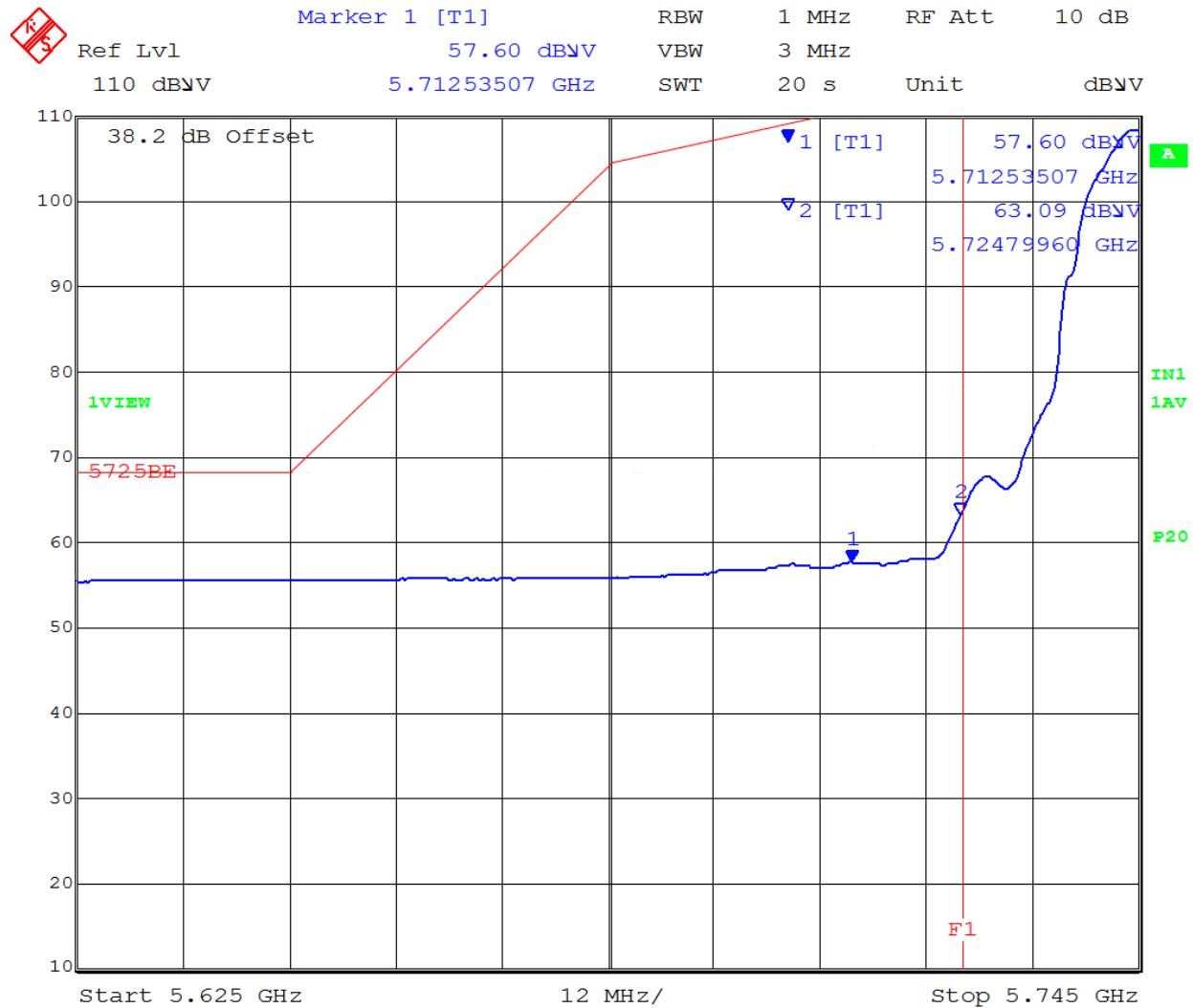
9.1.2.2. 5725-5850 MHz

Restricted Band Edge Emissions

| | 5725 MHz Restricted Band-Edge | | 5850 MHz Restricted Band-Edge | |
|------------------|-------------------------------|---------------|-------------------------------|---------------|
| Operational Mode | Limit 122.2 dBuV/m | Power Setting | Limit 122.2 dBuV/m | Power Setting |
| 802.11a | 63.09 | 23 | 56.85 | 23 |
| 802.11n HT-20 | 66.96 | 23 | 57.60 | 23 |
| 802.11n HT-40 | 67.12 | 23 | 55.34 | 23 |
| 802.11ac-80 | 64.37 | 23 | 59.39 | 23 |

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802.11a Radiated Band-Edge 5725 MHz, Channel Frequency 5745 MHz

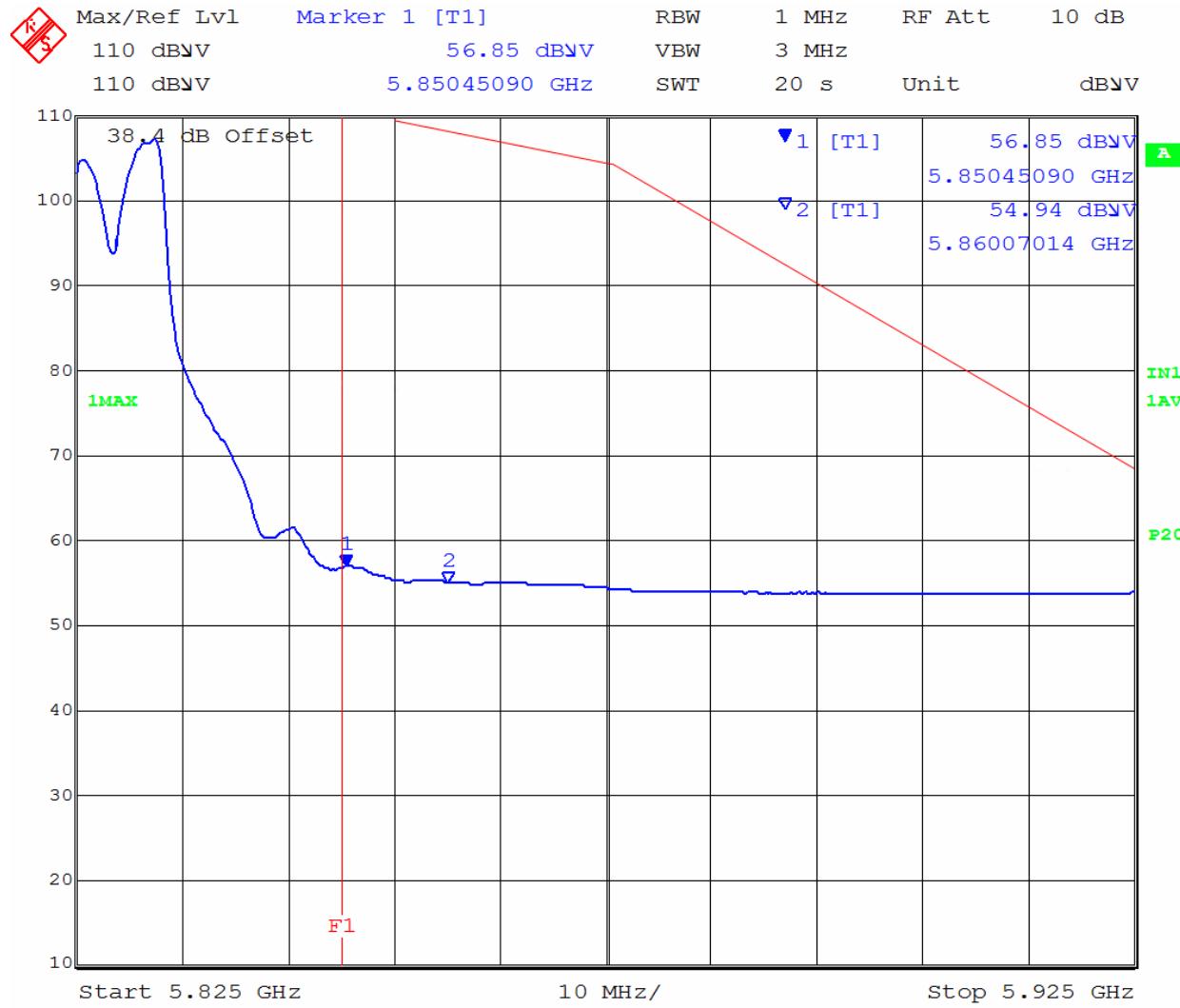


Date: 16.NOV.2015 19:35:08

[Back to Matrix](#)

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802.11a Radiated Band-Edge 5850 MHz, Channel Frequency 5825 MHz

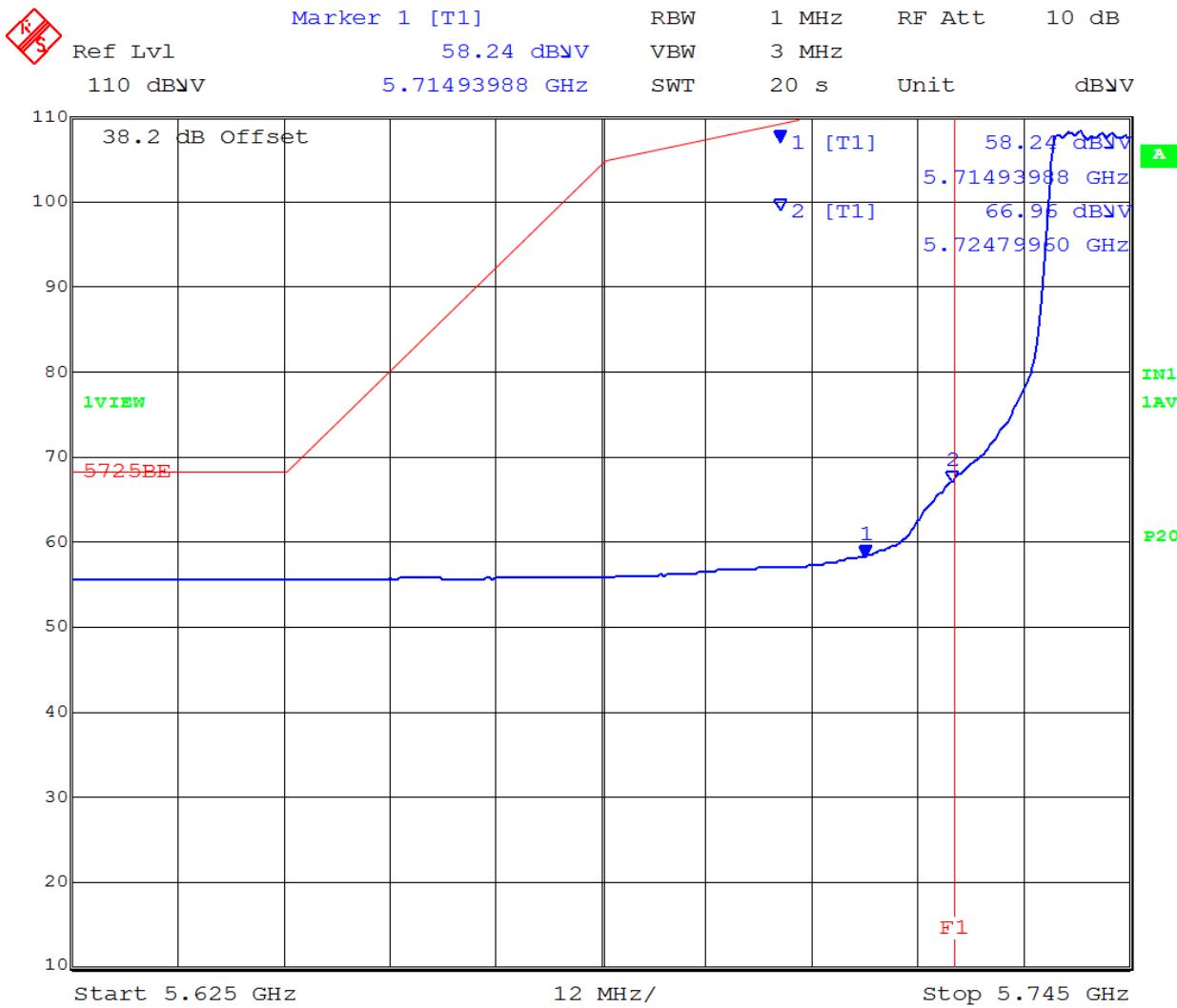


Date: 16.NOV.2015 18:02:54

[Back to Matrix](#)

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802.11n HT-20 Radiated Band-Edge 5725 MHz, Channel Frequency 5745 MHz

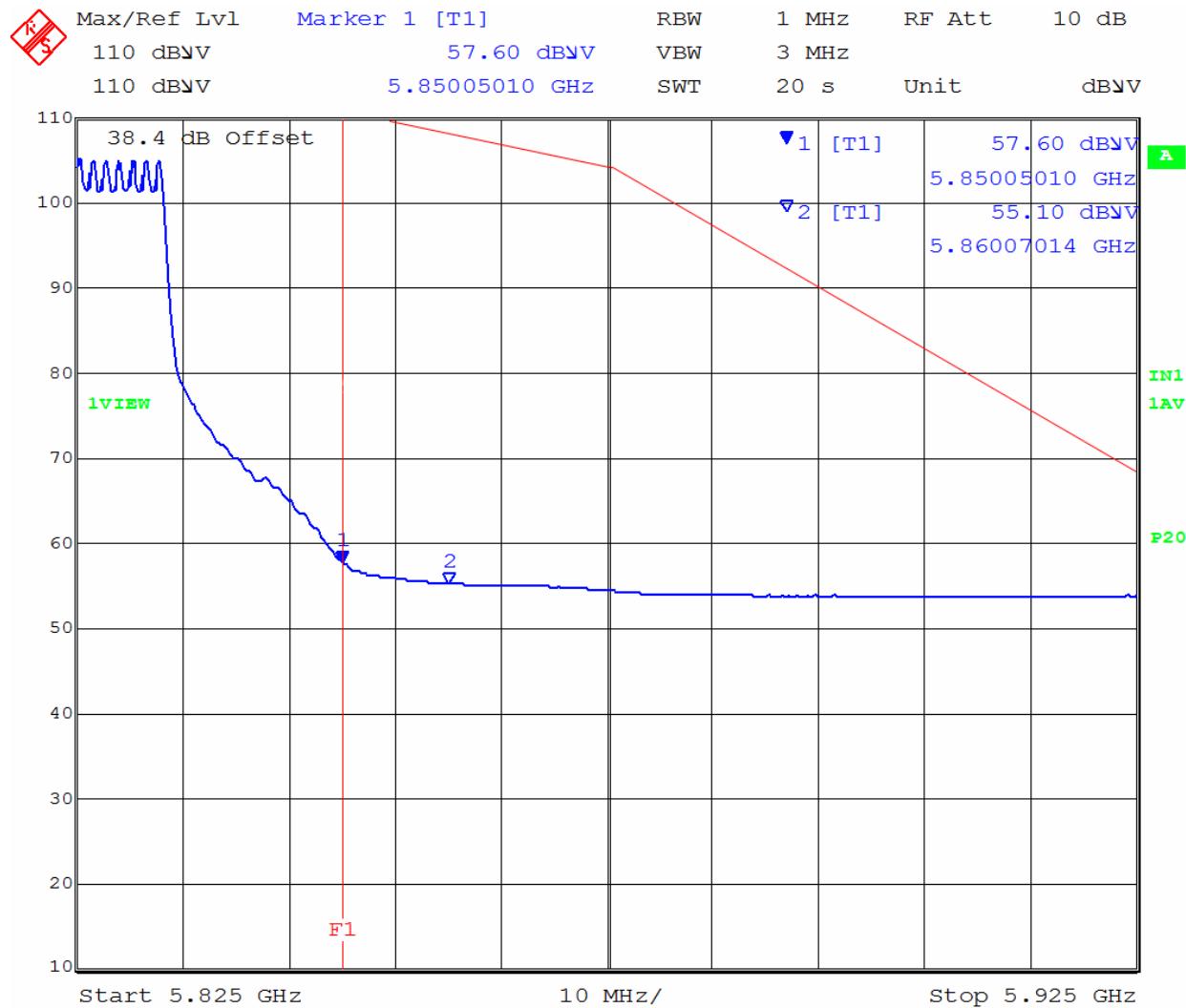


Date: 16.NOV.2015 19:20:59

[Back to Matrix](#)

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802.11n HT-20 Radiated Band-Edge 5850 MHz, Channel Frequency 5825 MHz

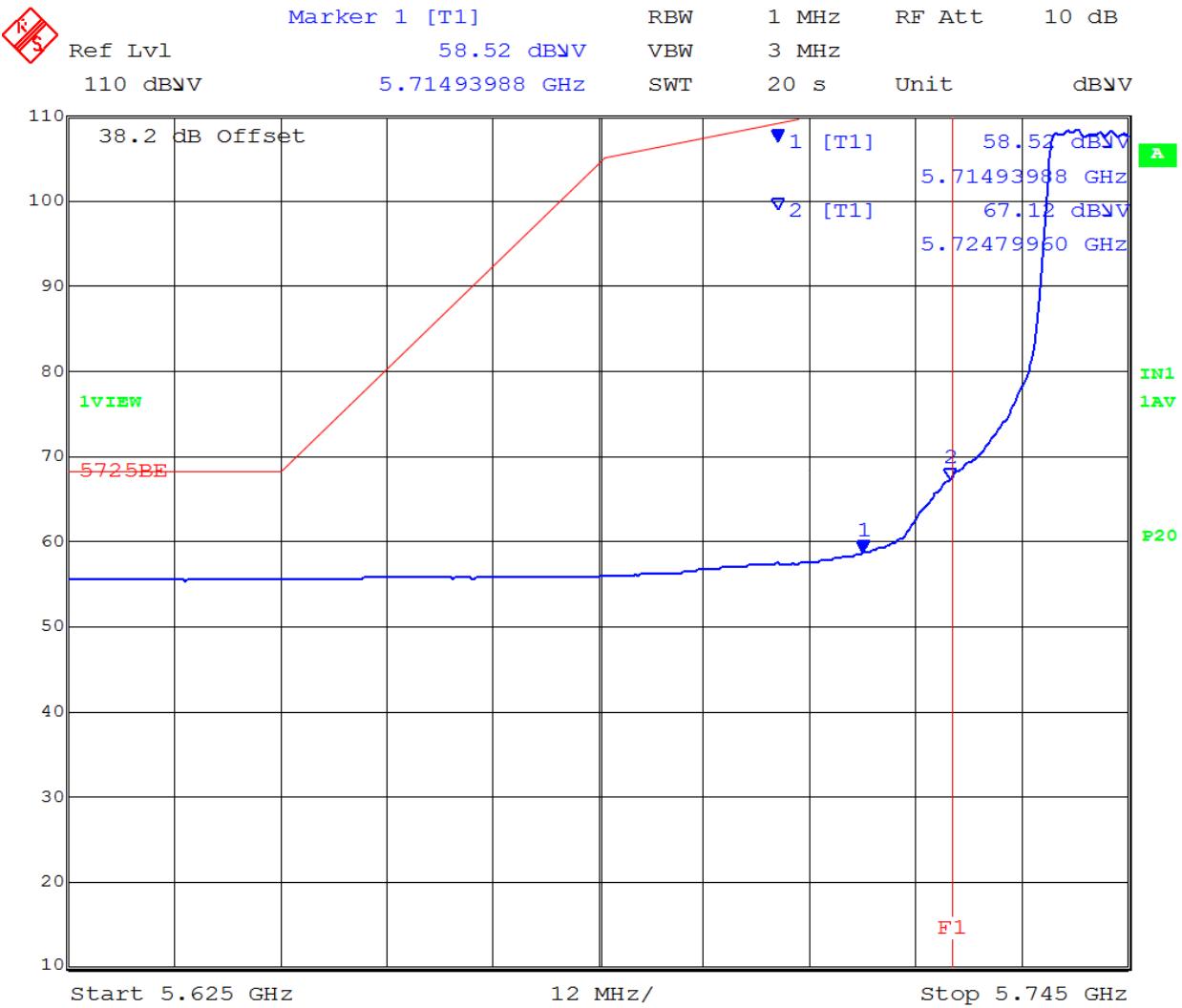


Date: 16.NOV.2015 18:07:44

[Back to Matrix](#)

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802.11n HT-40 Radiated Band-Edge 5725 MHz, Channel Frequency 5755 MHz

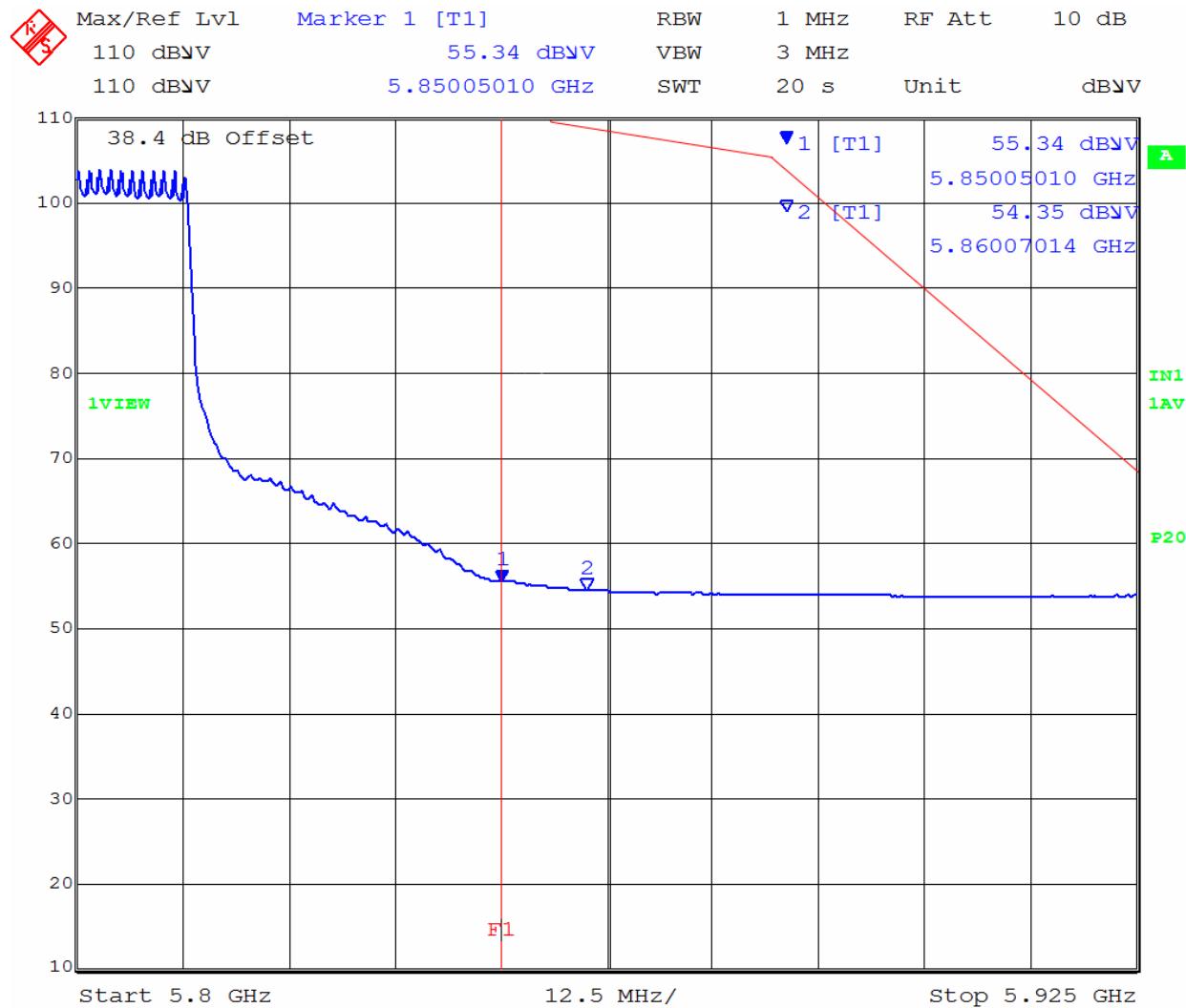


Date: 16.NOV.2015 19:32:35

[Back to Matrix](#)

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802.11n HT-40 Radiated Band-Edge 5850 MHz, Channel Frequency 5795 MHz

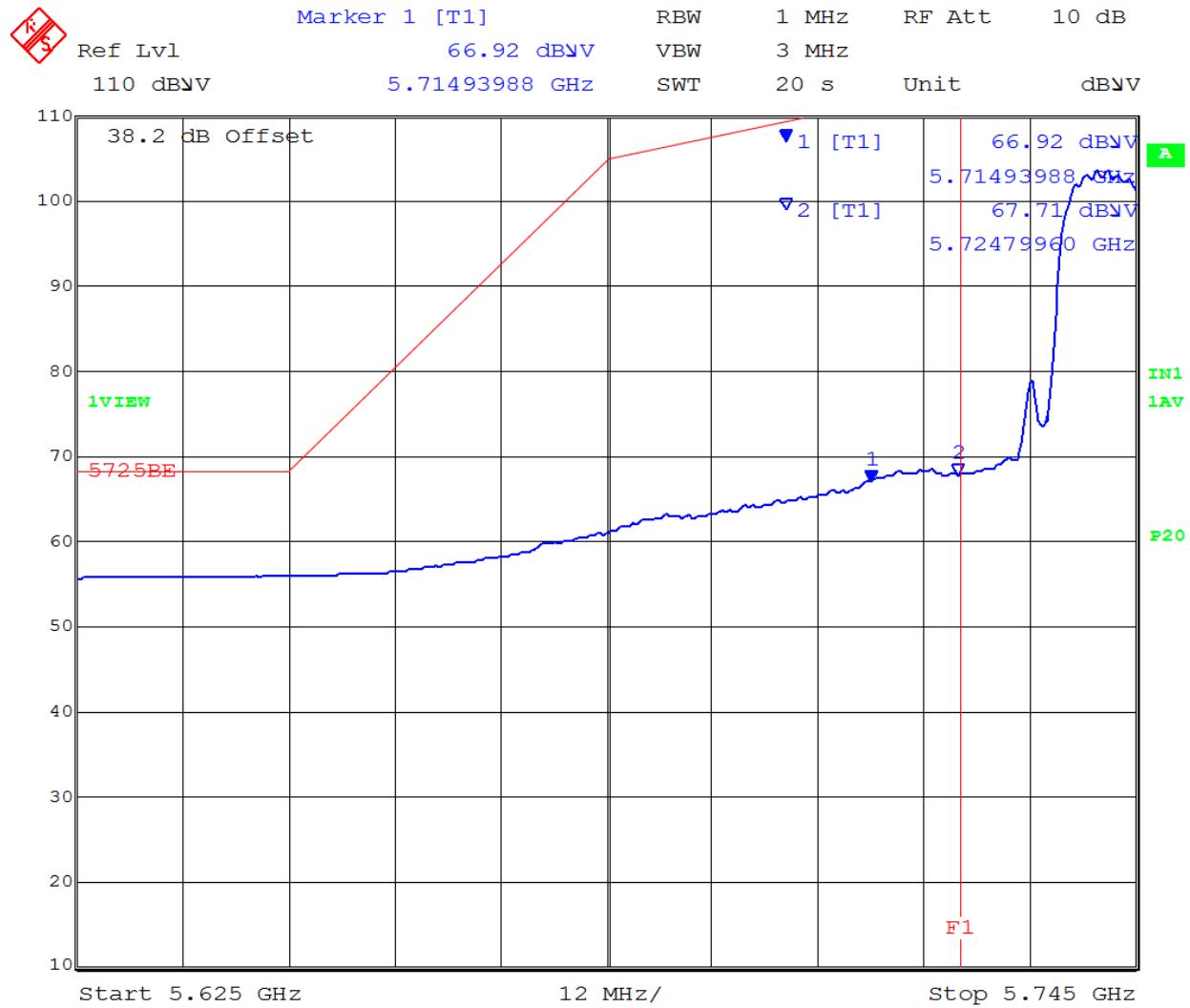


Date: 16.NOV.2015 18:10:05

[Back to Matrix](#)

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802.11ac-80 Radiated Band-Edge 5725 MHz, Channel Frequency 5775 MHz

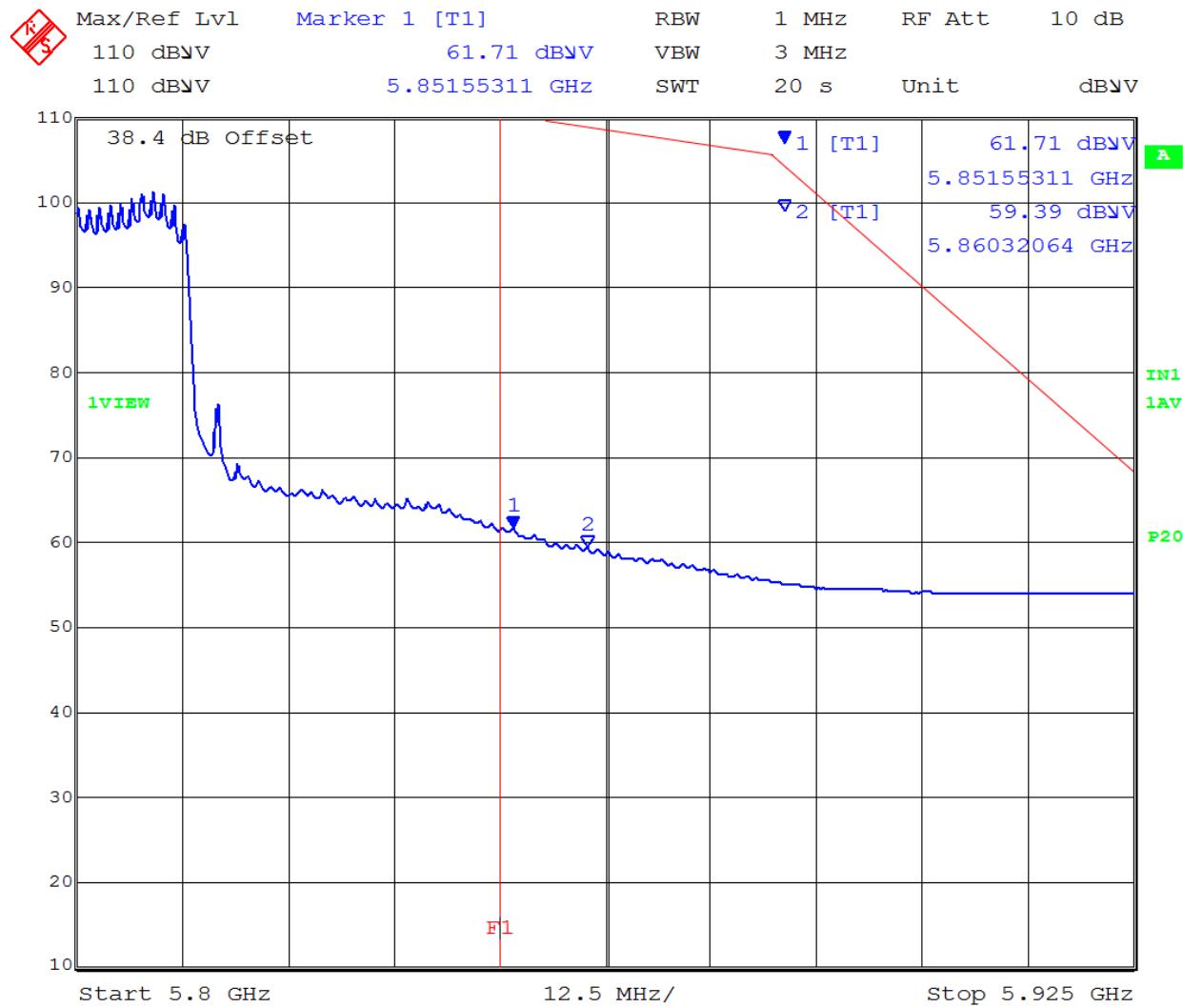


Date: 16.NOV.2015 19:26:51

[Back to Matrix](#)

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802.11ac-80 Radiated Band-Edge 5850 MHz, Channel Frequency 5775 MHz



Date: 16.NOV.2015 18:25:00

[Back to Matrix](#)

9.1.3. Digital Emissions

| Radiated Test Conditions for Radiated Digital Emissions (0.03 – 1 GHz) | | | |
|--|--------------------------|----------------------------|-------------|
| Standard: | FCC CFR 47:15.247 | Ambient Temp. (°C): | 20.0 - 24.5 |
| Test Heading: | Digital Emissions | Rel. Humidity (%): | 32 - 45 |
| Standard Section(s): | 15.209 | Pressure (mBars): | 999 - 1001 |
| Reference Document(s): | See Normative References | | |

Test Procedure for Radiated Digital Emissions (0.03 – 1 GHz)

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.

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

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 51.5dBmV; 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:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3\text{dBmV/m}$$

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are done as:

$$\text{Level (dBmV/m)} = 20 * \text{Log}(\text{level (mV/m)})$$

$$40 \text{ dBmV/m} = 100\text{mV/m}$$

$$48 \text{ dBmV/m} = 250\text{mV/m}$$

Limits for Radiated Digital Emissions (0.03 – 1 GHz) (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:

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| Frequency (MHz) | Field Strength | | Measurement Distance (m) |
|-----------------|-------------------------|------------------------------|--------------------------|
| | µV/m (microvolts/meter) | dBµV/m (dB microvolts/meter) | |
| 0.009-0.490 | 2400/F(kHz) | -- | 300 |
| 0.490-1.705 | 24000/F(kHz) | -- | 30 |
| 1.705-30.0 | 30 | 29.5 | 30 |
| 30-88 | 100** | 40 | 3 |
| 88-216 | 150** | 43.5 | 3 |
| 216-960 | 200** | 46.0 | 3 |
| Above 960 | 500 | 54.0 | 3 |

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges. (c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. (d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. (e) The provisions in §§15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part. (f) In accordance with §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in §15.109 that are applicable to the incorporated digital device. (g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.



Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 44 of 53

Equipment Configuration for Digital Emissions

| | | | |
|---------------------------------|-----------------------|------------------------|-------------|
| Antenna: | Galtronics Custom PCB | Variant: | 802.11a |
| Antenna Gain (dBi): | 6.00 | Modulation: | OFDM |
| Beam Forming Gain (Y): | Not Applicable | Duty Cycle (%): | NA |
| Channel Frequency (MHz): | 5180.00 | Data Rate: | 6.00 MBit/s |
| Power Setting: | NA | Tested By: | JMH |

Test Measurement Results

| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|----------|--------|---------|--------------------|-----------|------------|
| #1 | 30.58 | 38.57 | 3.43 | -10.61 | 31.39 | MaxQP | Vertical | 101 | 7 | 40.0 | -8.6 | Pass |
| #2 | 31.42 | 38.00 | 3.43 | -10.61 | 30.82 | MaxQP | Vertical | 111 | 50 | 40.0 | -9.2 | Pass |
| #3 | 32.75 | 37.20 | 3.44 | -12.09 | 28.55 | MaxQP | Vertical | 100 | 106 | 40.0 | -11.5 | Pass |
| #4 | 32.75 | 36.93 | 3.44 | -12.09 | 28.28 | MaxQP | Vertical | 100 | 97 | 40.0 | -11.7 | Pass |
| #5 | 56.20 | 53.35 | 3.61 | -24.13 | 32.83 | MaxQP | Vertical | 100 | 5 | 40.0 | -7.2 | Pass |
| #6 | 60.83 | 53.48 | 3.65 | -23.92 | 33.21 | MaxQP | Vertical | 118 | 54 | 40.0 | -6.8 | Pass |
| #7 | 79.29 | 55.54 | 3.77 | -23.47 | 35.84 | MaxQP | Vertical | 100 | 6 | 40.0 | -4.2 | Pass |
| #8 | 98.47 | 58.79 | 3.87 | -21.84 | 40.82 | MaxQP | Vertical | 100 | 360 | 43.0 | -2.2 | Pass |
| #9 | 101.89 | 58.51 | 3.89 | -20.63 | 41.77 | MaxQP | Vertical | 100 | 94 | 43.0 | -1.2 | Pass |

Test Notes: EUT on table connected to laptop and hub outside chamber. Laptop pinging EUT and data file transfer. Actiontec PS NB524J120150VU

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Title: Actiontec Electronics Inc WEB5500
To: FCC CFR 47 Part 15 Subpart E 15.407
Serial #: ATEC11-U8b Radiated Rev B
Issue Date: 27th April 2017
Page: 45 of 53

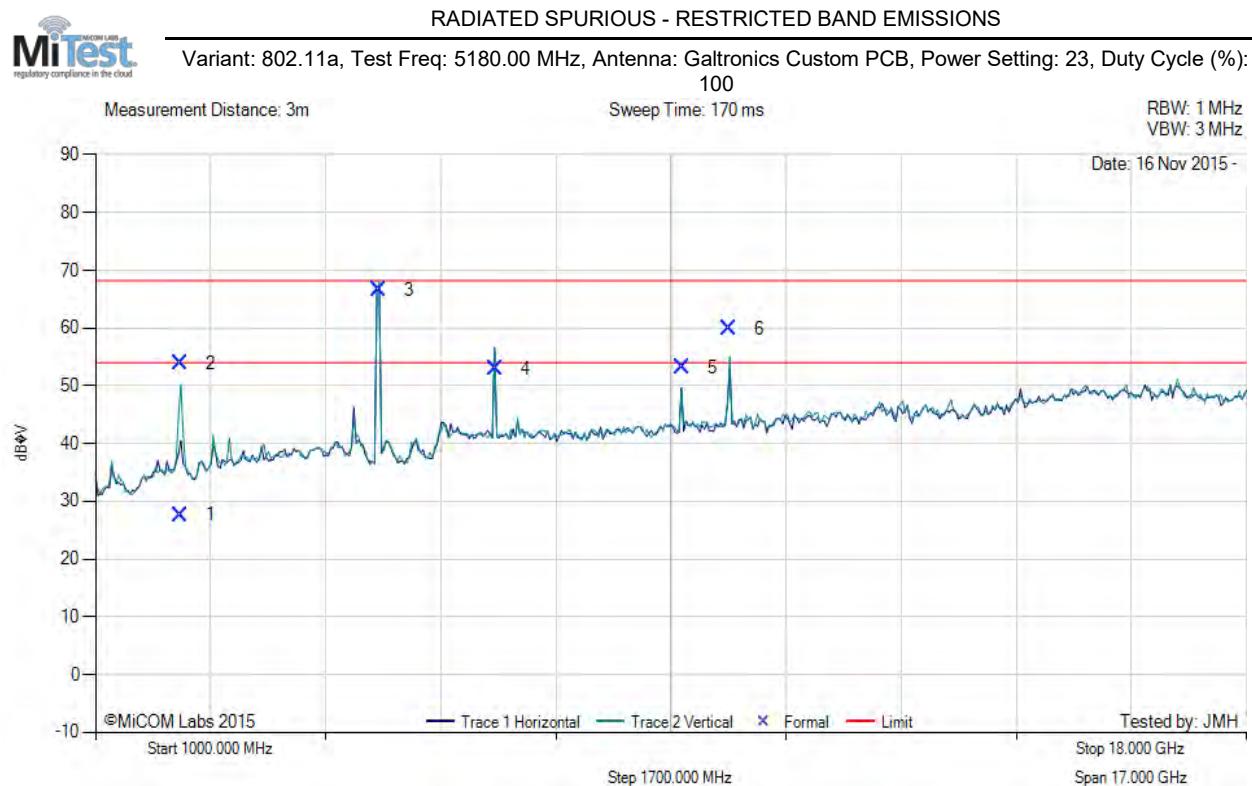
A. APPENDIX - GRAPHICAL IMAGES

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A.1. Radiated

A.1.1. Restricted Band Emissions

A.1.1.1. Galtronics Custom PCB



| 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 | 2257.91 | 37.10 | 2.63 | -12.11 | 27.62 | Max Avg | Vertical | 156 | 193 | 54.0 | -26.4 | Pass |
| 2 | 2257.91 | 63.33 | 2.63 | -12.11 | 53.85 | Max Peak | Vertical | 156 | 193 | 74.0 | -20.2 | Pass |
| 3 | 5178.00 | 74.43 | 3.69 | -11.51 | 66.61 | Fundamental | Vertical | 151 | 1 | -- | -- | |
| 4 | 6906.66 | 56.33 | 4.11 | -7.54 | 52.90 | Peak (NRB) | Horizontal | 151 | 197 | -- | -- | Pass |
| 5 | 9667.95 | 53.98 | 5.27 | -6.13 | 53.12 | Peak (NRB) | Horizontal | 151 | 318 | -- | -- | Pass |
| 6 | 10357.64 | 59.53 | 5.55 | -5.28 | 59.80 | Peak (NRB) | Vertical | 151 | 0 | -- | -- | Pass |

Test Notes: EUT at 150cm powered by ACTIONTEC PS NB524j120150VU

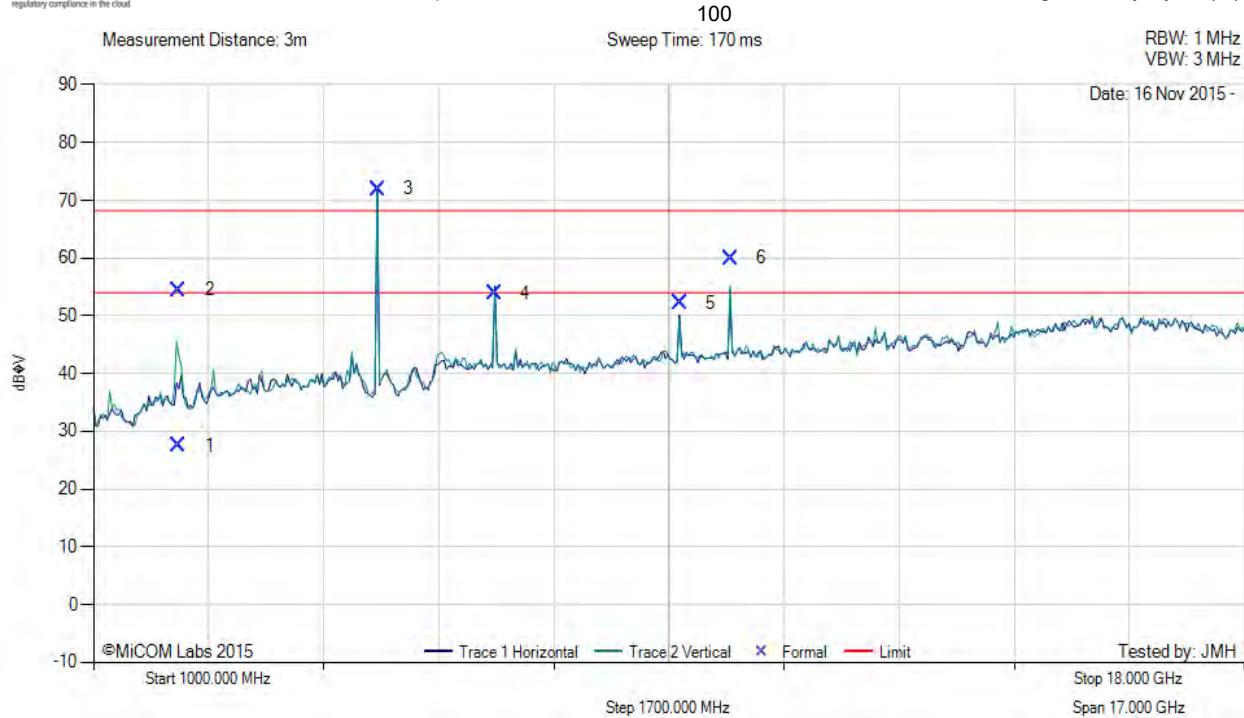
NRB – Non-Restricted Band

[back to matrix](#)



RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS

Variant: 802.11a, Test Freq: 5200.00 MHz, Antenna: Galtronics Custom PCB, Power Setting: 23, Duty Cycle (%):



| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| 1 | 2260.73 | 37.07 | 2.63 | -12.12 | 27.58 | Max Avg | Vertical | 124 | 200 | 54.0 | -26.4 | Pass |
| 2 | 2260.73 | 64.01 | 2.63 | -12.12 | 54.52 | Max Peak | Vertical | 124 | 200 | 74.0 | -19.5 | Pass |
| 3 | 5201.72 | 79.73 | 3.66 | -11.46 | 71.93 | Fundamental | Horizontal | 151 | 1 | -- | -- | |
| 4 | 6933.20 | 57.30 | 4.11 | -7.49 | 53.92 | Peak (NRB) | Horizontal | 151 | 232 | -- | -- | Pass |
| 5 | 9667.94 | 53.06 | 5.27 | -6.13 | 52.20 | Peak (NRB) | Horizontal | 151 | 358 | -- | -- | Pass |
| 6 | 10410.14 | 59.49 | 5.49 | -4.96 | 60.02 | Peak (NRB) | Vertical | 151 | 0 | -- | -- | Pass |

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

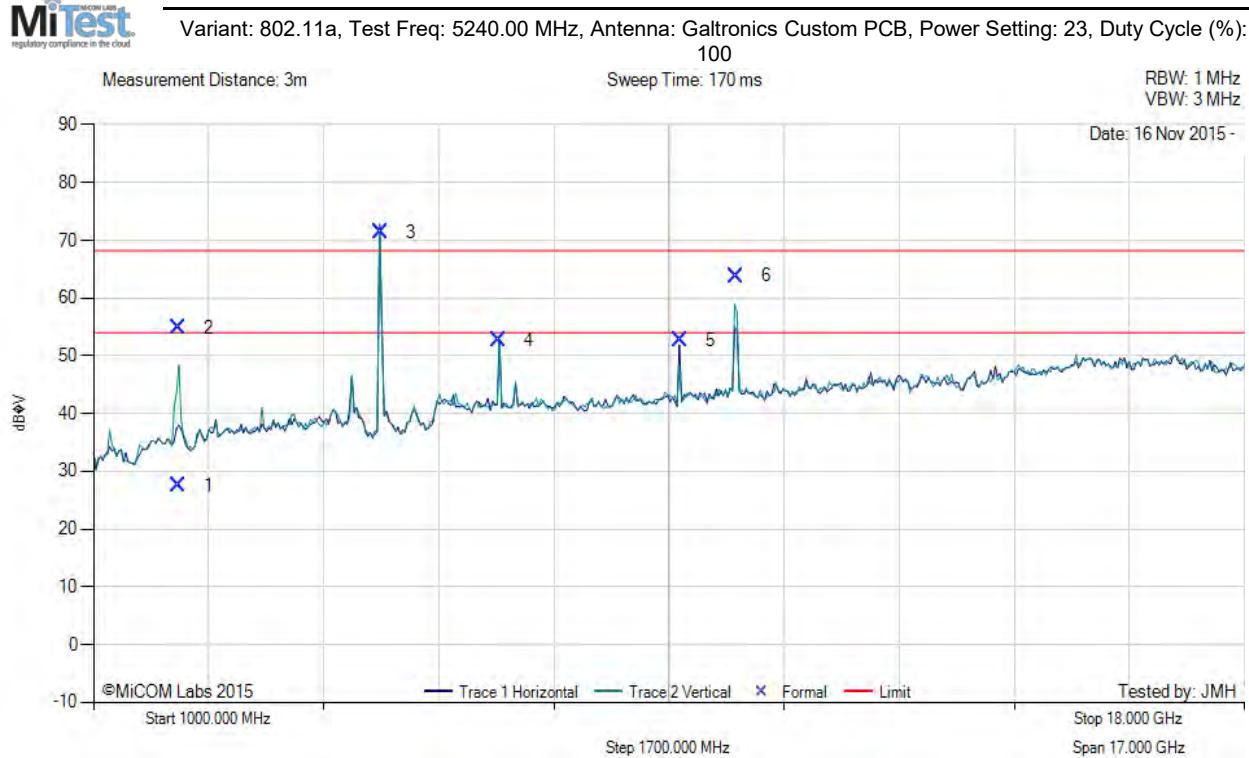
NRB – Non-Restricted Band

[back to matrix](#)

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RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS



| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| 1 | 2257.83 | 37.07 | 2.63 | -12.11 | 27.59 | Max Avg | Vertical | 117 | 179 | 54.0 | -26.4 | Pass |
| 2 | 2257.83 | 64.39 | 2.63 | -12.11 | 54.91 | Max Peak | Vertical | 117 | 179 | 74.0 | -19.1 | Pass |
| 3 | 5241.72 | 79.17 | 3.63 | -11.36 | 71.44 | Fundamental | Horizontal | 151 | 0 | -- | -- | |
| 4 | 6986.58 | 55.95 | 4.13 | -7.45 | 52.63 | Peak (NRB) | Horizontal | 151 | 214 | -- | -- | Pass |
| 5 | 9667.83 | 53.53 | 5.27 | -6.13 | 52.67 | Peak (NRB) | Horizontal | 151 | 360 | -- | -- | Pass |
| 6 | 10490.06 | 62.75 | 5.45 | -4.39 | 63.81 | Peak (NRB) | Vertical | 151 | 0 | -- | -- | Pass |

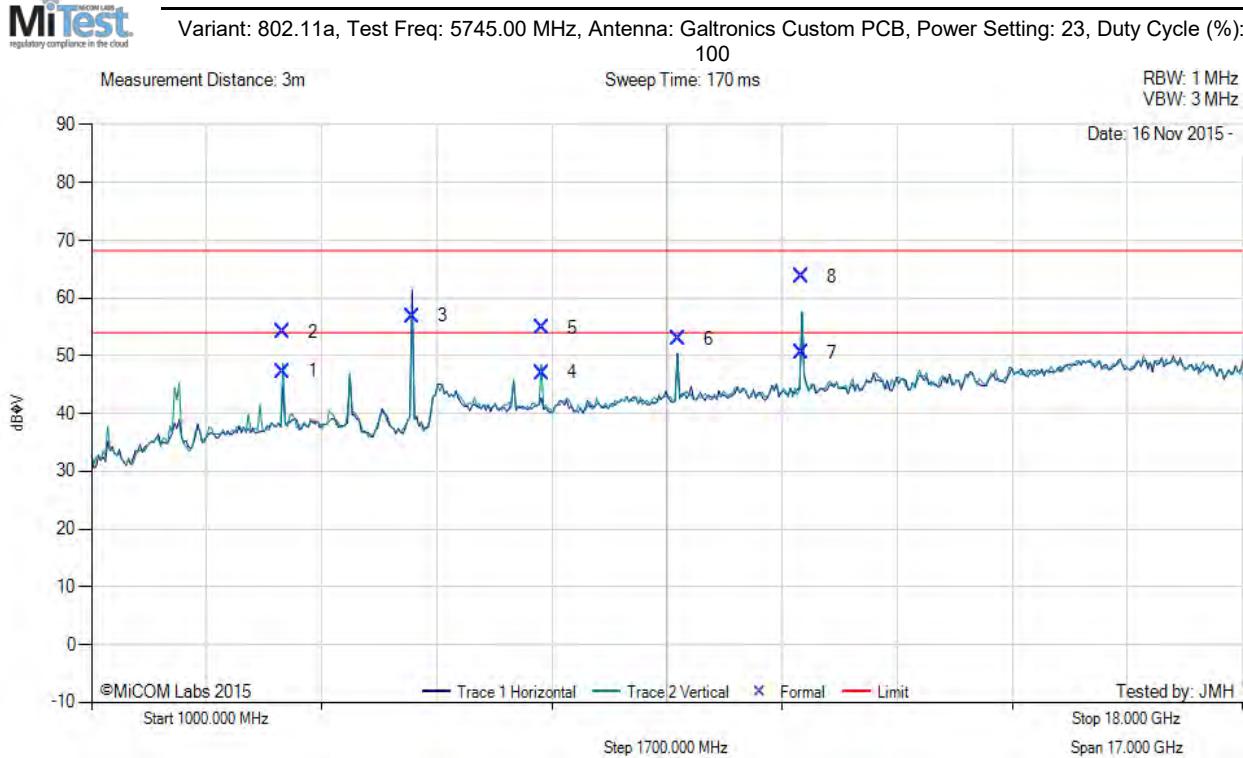
Test Notes: EUT at 150cm powered by Actiontec PS NB524J120150VU

NRB – Non-Restricted Band

[back to matrix](#)



RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS



| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| 1 | 3829.99 | 54.92 | 3.21 | -10.83 | 47.30 | Max Avg | Vertical | 197 | 307 | 54.0 | -6.7 | Pass |
| 2 | 3829.99 | 61.70 | 3.21 | -10.83 | 54.08 | Max Peak | Vertical | 197 | 307 | 74.0 | -20.0 | Pass |
| 3 | 5737.43 | 63.70 | 3.82 | -10.67 | 56.85 | Fundamental | Horizontal | 151 | 1 | -- | -- | |
| 4 | 7659.93 | 49.64 | 4.37 | -6.95 | 47.06 | Max Avg | Vertical | 127 | 281 | 54.0 | -6.9 | Pass |
| 5 | 7659.93 | 57.38 | 4.37 | -6.95 | 54.80 | Max Peak | Vertical | 127 | 281 | 74.0 | -19.2 | Pass |
| 6 | 9667.89 | 53.73 | 5.27 | -6.13 | 52.87 | Peak (NRB) | Horizontal | 151 | 314 | -- | -- | Pass |
| 7 | 11491.43 | 49.85 | 5.45 | -4.84 | 50.46 | Max Avg | Horizontal | 140 | 25 | 54.0 | -3.5 | Pass |
| 8 | 11491.43 | 63.10 | 5.45 | -4.84 | 63.71 | Max Peak | Horizontal | 140 | 25 | 74.0 | -10.3 | Pass |

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

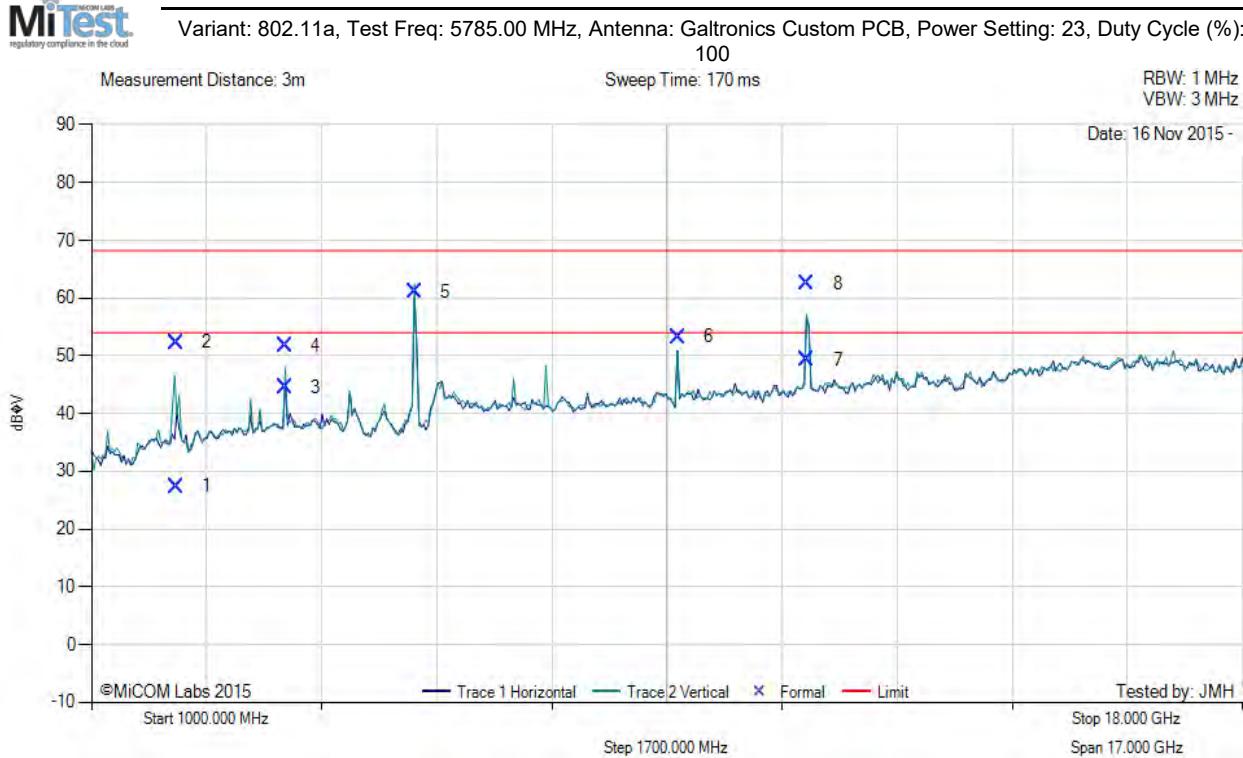
NRB – Non-Restricted Band

[back to matrix](#)

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RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS



| Num | Frequency MHz | Raw dB _{FS} | Cable Loss | AF dB | Level dB _{FS} /m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB _{FS} /m | Margin dB | Pass /Fail |
|-----|---------------|----------------------|------------|--------|---------------------------|------------------|------------|--------|---------|---------------------------|-----------|------------|
| 1 | 2259.17 | 36.87 | 2.63 | -12.11 | 27.39 | Max Avg | Vertical | 156 | 124 | 54.0 | -26.6 | Pass |
| 2 | 2259.17 | 61.83 | 2.63 | -12.11 | 52.35 | Max Peak | Vertical | 156 | 124 | 74.0 | -21.7 | Pass |
| 3 | 3856.66 | 52.14 | 3.23 | -10.81 | 44.56 | Max Avg | Vertical | 155 | 271 | 54.0 | -9.4 | Pass |
| 4 | 3856.66 | 59.36 | 3.23 | -10.81 | 51.78 | Max Peak | Vertical | 155 | 271 | 74.0 | -22.3 | Pass |
| 5 | 5777.92 | 67.81 | 3.80 | -10.48 | 61.13 | Fundamental | Vertical | 151 | 0 | -- | -- | |
| 6 | 9667.95 | 54.18 | 5.27 | -6.13 | 53.32 | Peak (NRB) | Horizontal | 151 | 277 | -- | -- | Pass |
| 7 | 11571.78 | 48.51 | 5.42 | -4.63 | 49.30 | Max Avg | Vertical | 170 | 313 | 54.0 | -4.7 | Pass |
| 8 | 11571.78 | 61.64 | 5.42 | -4.63 | 62.43 | Max Peak | Vertical | 170 | 313 | 74.0 | -11.6 | Pass |

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

NRB – Non-Restricted Band

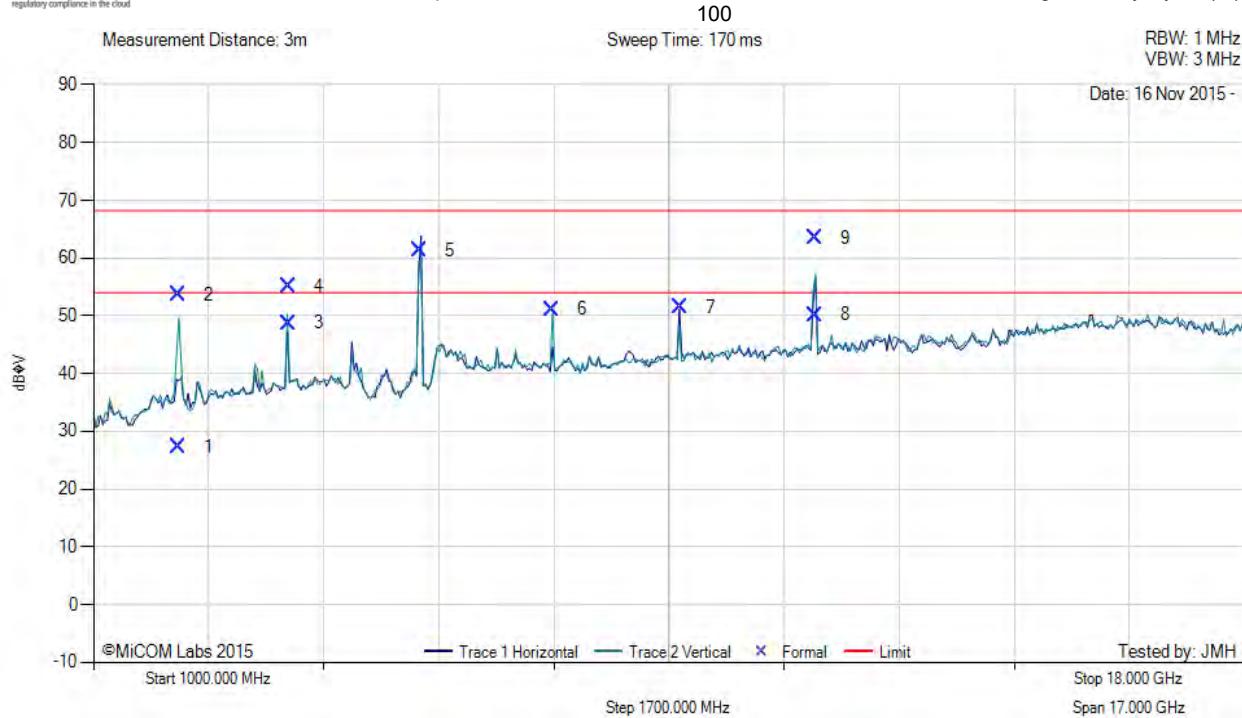
[back to matrix](#)

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RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS

Variant: 802.11a, Test Freq: 5825.00 MHz, Antenna: Galtronics Custom PCB, Power Setting: 23, Duty Cycle (%):



| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|------------|--------|---------|--------------------|-----------|------------|
| 1 | 2250.86 | 36.81 | 2.63 | -12.10 | 27.34 | Max Avg | Vertical | 100 | 186 | 54.0 | -26.7 | Pass |
| 2 | 2250.86 | 63.18 | 2.63 | -12.10 | 53.71 | Max Peak | Vertical | 100 | 186 | 74.0 | -20.3 | Pass |
| 3 | 3883.33 | 56.22 | 3.25 | -10.76 | 48.71 | Max Avg | Vertical | 189 | 307 | 54.0 | -5.3 | Pass |
| 4 | 3883.33 | 62.66 | 3.25 | -10.76 | 55.15 | Max Peak | Vertical | 189 | 307 | 74.0 | -18.9 | Pass |
| 5 | 5819.88 | 67.75 | 3.83 | -10.26 | 61.32 | Fundamental | Horizontal | 151 | 243 | -- | -- | |
| 6 | 7766.56 | 53.41 | 4.43 | -6.71 | 51.13 | Peak (NRB) | Vertical | 151 | 243 | -- | -- | Pass |
| 7 | 9667.86 | 52.28 | 5.27 | -6.13 | 51.42 | Peak (NRB) | Horizontal | 151 | 243 | -- | -- | Pass |
| 8 | 11651.67 | 49.16 | 5.48 | -4.46 | 50.18 | Max Avg | Vertical | 185 | 313 | 54.0 | -3.8 | Pass |
| 9 | 11651.67 | 62.48 | 5.48 | -4.46 | 63.50 | Max Peak | Vertical | 185 | 313 | 74.0 | -10.5 | Pass |

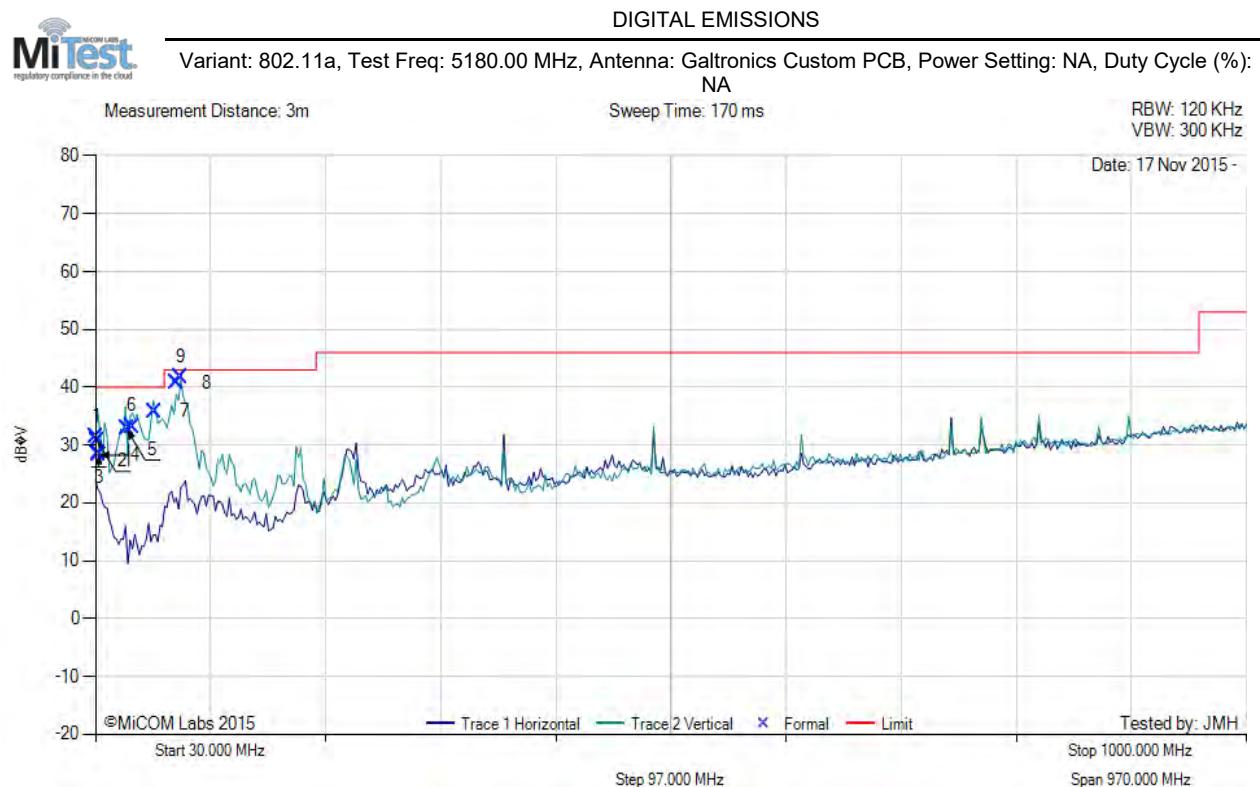
Test Notes: EUT at 150cm powered by Actiontec PS NB524J120150VU

NRB – Non-Restricted Band

[back to matrix](#)

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A.1.2. Digital Emissions



| Num | Frequency MHz | Raw dB μ V | Cable Loss | AF dB | Level dB μ V/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dB μ V/m | Margin dB | Pass /Fail |
|-----|---------------|----------------|------------|--------|--------------------|------------------|----------|--------|---------|--------------------|-----------|------------|
| 1 | 30.58 | 38.57 | 3.43 | -10.61 | 31.39 | MaxQP | Vertical | 101 | 7 | 40.0 | -8.6 | Pass |
| 2 | 31.42 | 38.00 | 3.43 | -10.61 | 30.82 | MaxQP | Vertical | 111 | 50 | 40.0 | -9.2 | Pass |
| 3 | 32.75 | 37.20 | 3.44 | -12.09 | 28.55 | MaxQP | Vertical | 100 | 106 | 40.0 | -11.5 | Pass |
| 4 | 32.75 | 36.93 | 3.44 | -12.09 | 28.28 | MaxQP | Vertical | 100 | 97 | 40.0 | -11.7 | Pass |
| 5 | 56.20 | 53.35 | 3.61 | -24.13 | 32.83 | MaxQP | Vertical | 100 | 5 | 40.0 | -7.2 | Pass |
| 6 | 60.83 | 53.48 | 3.65 | -23.92 | 33.21 | MaxQP | Vertical | 118 | 54 | 40.0 | -6.8 | Pass |
| 7 | 79.29 | 55.54 | 3.77 | -23.47 | 35.84 | MaxQP | Vertical | 100 | 6 | 40.0 | -4.2 | Pass |
| 8 | 98.47 | 58.79 | 3.87 | -21.84 | 40.82 | MaxQP | Vertical | 100 | 360 | 43.0 | -2.2 | Pass |
| 9 | 101.89 | 58.51 | 3.89 | -20.63 | 41.77 | MaxQP | Vertical | 100 | 94 | 43.0 | -1.2 | Pass |

Test Notes: EUT on table connected to laptop and hub outside chamber. Laptop pinging EUT and data file transfer. Actiontec PS NB524J120150VU

[back to matrix](#)

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