

Report on the Radio Testing
For
Pace plc
on
DOCSIS 3 HYBRID GATEWAY STB
Report no. TRA-029714-47-00A
4th May 2016

Report Number: TRA-029714-47-00A
Issue: A

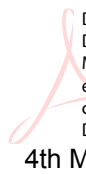
REPORT ON THE RADIO TESTING OF A
Pace plc
DOCSIS 3 HYBRID GATEWAY STB
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.407

TEST DATE: 30th August 2015 - 31st March 2016

Written by: D Winstanley

D Winstanley
Radio Test Engineers

Approved by: **John Charters**
Date:

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Materials Technology, ou,
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c=GB
Date: 2016.05.18 21:12:36 +01'00'
4th May 2016

J Charters
Department Manager - Radio

Disclaimers:

- [1] THIS DOCUMENT MAY BE REPRODUCED ONLY IN ITS ENTIRETY AND WITHOUT CHANGE
[2] THE RESULTS CONTAINED IN THIS DOCUMENT RELATE ONLY TO THE ITEM(S) TESTED

RF915 2.0

1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	4th May 2016	Original

2 Summary

TEST REPORT NUMBER:	TRA-029714-47-00A
WORKS ORDER NUMBER	TRA-028175-00
PURPOSE OF TEST:	USA: Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J.
TEST SPECIFICATION(S):	47CFR15.407
EQUIPMENT UNDER TEST (EUT):	DOCSIS 3 HYBRID GATEWAY STB
FCC IDENTIFIER:	NQ8ND7507
EUT SERIAL NUMBER:	FN34A152840077 & PAN900002321
MANUFACTURER/AGENT:	Pace plc
ADDRESS:	Victoria Road Saltaire Shipley West Yorkshire BD18 3LF United Kingdom
CLIENT CONTACT:	Robert Turner ☎ 01274 537080 ✉ robert.turner@pace.com
ORDER NUMBER:	Not Applicable
TEST DATE:	30th August 2015 - 31st March 2016
TESTED BY:	D Winstanley Element

2.1 Test Summary

<i>Test Method and Description</i>	<i>Requirement Clause 47CFR15</i>	<i>Applicable to this equipment</i>	<i>Result / Note</i>
Radiated spurious emissions Bandedge Emissions	15.407(b)(1/4/6)	☒	Pass
AC power line conducted emissions	15.407 (b)(6)	☐	Note 1
Emission / Occupied bandwidth	15.407(e)	☒	Pass
Transmit carrier power	15.407(a)(1/3)	☒	Pass
Power spectral density, conducted	15.407(a)(1/3)	☒	Pass
Frequency Stability	15.407(g)	☒	N/A

Notes:

1. See Test report TRA-028175-47-06A. AC Power line Conducted emissions were recorded with all radio devices active simultaneously

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

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4 Introduction

This report TRA-029714-47-00A presents the measurement results of the 5 GHz WiFi Radio testing on a Pace plc, DOCSIS 3 HYBRID GATEWAY STB to specification 47CFR15 Radio Frequency Devices

The testing was carried out for Pace plc by Element, at the address(es) detailed below.

☐	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	☒	Element Skelmersdale Unit 1 Pendle Place Skelmersdale West Lancashire WN8 9PN UK
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This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

All test and measurement equipment under the control of the laboratory and requiring calibration is subject to an established programme and procedures to control and maintain measurement standards. The quality management system meets the principles of ISO 9001, and has quality control procedures for monitoring the validity of tests undertaken. Records and sufficient detail are retained to establish an audit trail of calibration records relating to its test results for a defined period. Under control of the established calibration programme, key quantities or values of the test & measurement instrumentation are within specification and comply with the relevant traceable internationally recognised and appropriate standard specifications, which are UKAS calibrated as such where these properties have a significant effect on results. Participation in inter-laboratory comparisons and proficiency testing ensures satisfactory correlation of results conform to Elements own procedures, as well as statistical techniques for analysis of test data providing the appropriate confidence in measurements.

Throughout this report EUT denotes equipment under test.

FCC Site Listing:

Element is accredited for the above sites under the US-EU MRA, Designation number UK0009.

The test site requirements of ANSI C63.4-2014 are met up to 1GHz.

The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ANSI C63.4-2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- Industry Canada RSS-210, Issue 8, December 2010 – Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
- Industry Canada RSS-Gen, Issue 4, November 2014 – General Requirements for Compliance of Radio Apparatus

5.2 Deviations from Test Standards

There were no deviations from the test standard.

6 Glossary of Terms

§	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
C	Celsius
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DSSS	Direct Sequence Spread Spectrum
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	hertz
IC	Industry Canada
ITU	International Telecommunication Union
LBT	Listen Before Talk
m	metre
max	maximum
MIMO	Multiple Input and Multiple Output
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
Pt-mpt	Point-to-multipoint
Pt-pt	Point-to-point
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
Tx	transmitter
UKAS	United Kingdom Accreditation Service
V	volt
W	watt
Ω	ohm

7 Equipment Under Test

7.1 EUT Identification

- Name: DOCSIS 3 HYBRID GATEWAY STB
- Serial Number: FN34A152840077 & PAN900002321
- Model Number: ND7506
- Software Revision: Not Applicable
- Build Level / Revision Number: Not Applicable

7.2 System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

- Name: HDMI HDCP Ready Unit
- Sample Number: S03
- Serial Number: DP2012110417
- Model Number: None
- Name: Arris Cadant C3 CMTS
- Sample Number: S04
- Serial Number: 65000181-002109
- Model Number: None
- Name: PX031ECB Box
- Sample Number: S05
- Serial Number: PADA00015189
- Model Number: None
- Name: Dell Latitude Laptop
- Sample Number: S06
- Serial Number: SAL-17646
- Model Number: D430
- Name: Dell Latitude Laptop
- Sample Number: S07
- Serial Number: PACE0000019241
- Model Number: E6400
- Name: AOC 4K Television
- Sample Number: TRA-024769S07
- Serial Number: HCXE8JA002064
- Model Number: None

7.3 EUT Mode of Operation

7.3.1 Transmission

The EUT was under the control of test software named 'digidebug' which when run exercised the EUT in its worst case configuration. While the test was running the EUT was decoding AV (audio visual) data from a MOCA (Multimedia over Coax Alliance) stream and then displaying it via HDMI at 2160p resolution. The EUT was connected to a DOCSIS head end. The HDD of the EUT was also active, with data being written to it and then read back. An internal SD card was inserted in order that the SD card TX and RX clock lines (50MHz) were active. A source playing HD AV was connected to the HDMI input of the EUT. Both USB ports were connected to USB 3.0 memory sticks. All other ports were terminated appropriately.

Wifi transmitter control was via commands sent through a terminal program (Tera Term in this case). The commands provided by the manufacturer setup the device into a permanent transmit mode. The commands allowed adjustment of the following parameters of significant interest.

Modulation Scheme	Channel	Power setting	Data Rate	Radiated Transmit Chain Setting	Conducted Transmit Chain Setting
802.11a	36	74	54	txchain 7	txchain 1,2 or 3
	40	76	54	txchain 7	txchain 1,2 or 3
	48	73	54	txchain 7	txchain 1,2 or 3
	149	70	54	txchain 7	txchain 1,2 or 3
	157	69	54	txchain 7	txchain 1,2 or 3
	165	71	54	txchain 7	txchain 1,2 or 3
802.11n VHT20	36	81	MCS9	txchain 7	txchain 1,2 or 3
	40	84	MCS9	txchain 7	txchain 1,2 or 3
	48	84	MCS9	txchain 7	txchain 1,2 or 3
	149	70	MCS9	txchain 7	txchain 1,2 or 3
	157	70	MCS9	txchain 7	txchain 1,2 or 3
	165	74	MCS9	txchain 7	txchain 1,2 or 3
802.11n VHT40	38	60	MCS9	txchain 7	txchain 1,2 or 3
	46	88	MCS9	txchain 7	txchain 1,2 or 3
	151	67	MCS9	txchain 7	txchain 1,2 or 3
	159	82	MCS9	txchain 7	txchain 1,2 or 3
802.11n VHT80	42	58	MCS9	txchain 7	txchain 1,2 or 3
	155	66	MCS9	txchain 7	txchain 1,2 or 3

txchain 1 : Chain 0 only

txchain 2 : Chain 1 only

txchain 4 : Chain 2 only

txchain 7 : Chains 0, 1 and 2 simultaneously

7.3.2 Reception

This report covers transmitter operation only, results for unintentional emissions can be found in test report TRA-028175-44-00A

7.4 EUT Radio Parameters

7.4.1 General

Frequency of operation:	5.15 GHz – 5.25 GHz : 5.725GHz – 5.85 GHz
Modulation type(s):	OFDM
Occupied channel bandwidth(s):	20 MHz – 80 MHz
Channel spacing:	5 MHz
Declared output power(s):	Up to 1 Watt (conducted)
Warning against use of alternative antennas in user manual (yes/no):	Not Applicable
Nominal Supply Voltage:	110 Vac
Location of notice for license exempt use:	Label / user manual / both.
Duty cycle:	Upto 100 %

7.4.2 Product specific declarations

Multiple antenna configuration(s), e.g. MIMO:	MIMO
Fixed pt-pt operations (yes/no):	No
Installation manual advice on pt-pt operational restrictions (yes/no):	Not Applicable
Fixed pt-mpt operations (yes/no):	Not Applicable
Simultaneous tx (yes/no):	Yes

7.4.3 Antennas

Type:	Omni directional/polarity Antennas, except the Bluetooth and Front Low band - PCB style
Frequency range:	5.15 GHz – 5.25 GHz : 5.725GHz – 5.85 GHz
Impedance:	50 Ohms
Gain:	See chart
Polarisation:	Omni
Beam width:	Not Applicable
Connector type:	U-FL
Mounting:	Case Mounted

7.5 EUT Description

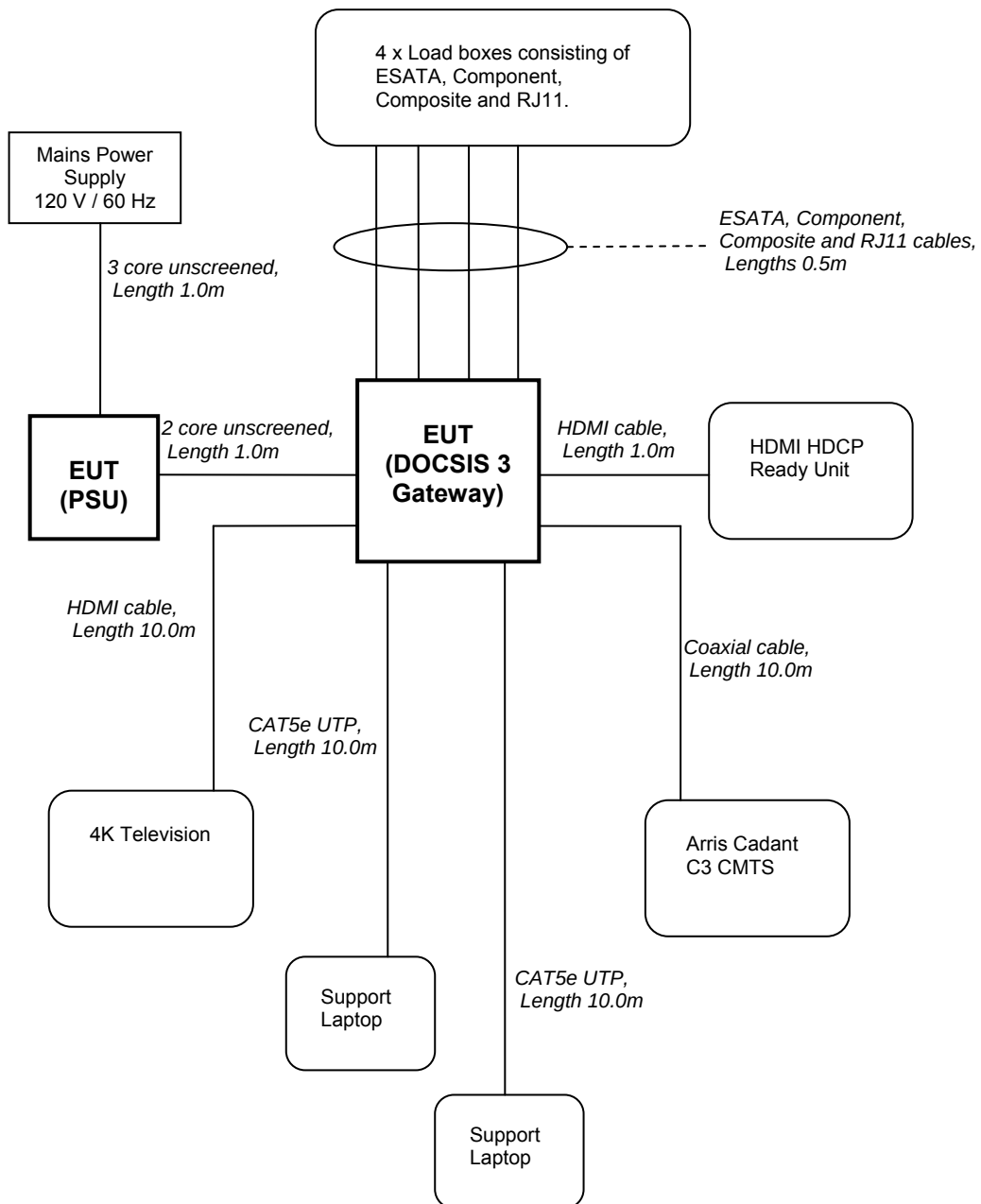
The EUT is a DOCSIS 3 Gateway, delivering broadband to the home via Ethernet or 5GHz Wi-Fi. The Gateway is capable of taking IP sourced video streams and displaying them on a TV via HDMI 2, Component and CVBS. It can connect to client boxes, routing video to up to three additional rooms within the home. Primary connection to the clients is via 5GHz Wi-Fi (802.11ac) but the client can also be connected via MOCA or Ethernet. Bluetooth is implemented on the Gateway to provide the option to connect to a smart remote control.

8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup - Block Diagram

The following diagram shows basic EUT interconnections with cable type and cable lengths identified:



10 General Technical Parameters

10.1 Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was approx. 5 V dc from the adaptor / 110 V ac, 60 Hz, from the mains.

10.2 Varying Test Conditions

There are no specific frequency stability requirements for the type of device. The results contained in this report demonstrate that the occupied bandwidth is contained within the authorised band and the manufacturer has declared sufficient frequency stability (refer to section 7.4).

Variation of supply voltage is required to ensure stability of the declared output power. During carrier power testing the following variations were made:

	Category	Nominal	Variation
☒	Mains	110 V ac +/-2 %	85 % and 115 %
☐	Battery	New battery	N/A

11 Radiated emissions

11.1 Definitions

Spurious emissions

Emissions on a frequency or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Restricted bands

A frequency band in which intentional radiators are permitted to radiate only spurious emissions but not fundamental signals.

11.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber (REF940)
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Channels	36, 40, 48, 38, 46, 42, 149, 457, 165, 151, 159, 155
EUT Channel Bandwidths:	20 MHz / 40 MHz / 80 MHz
Deviations From Standard:	None
Measurement BW:	30 MHz to 1 GHz: 120 kHz Above 1 GHz: 1 MHz
Measurement Detector:	Up to 1 GHz: quasi-peak Above 1 GHz: RMS average and Peak

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 °C to +35 °C (as declared)
Humidity: 32 % RH	20 % RH to 75 % RH (as declared)
Supply: 110V ac	110 V ac $\pm$ 10 % (as declared)

11.3 Test Limit

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.

Except as shown above, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

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 EIRP of –27 dBm/MHz.

For transmitters operating in the 5.725–5.825 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 EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

The provisions of 15.205 apply to intentional radiators operating under this section.

Where regulatory limits are defined as EIRP in dBm/MHz limits are converted to field strength values as per ANSI C63.10

Operating Band (GHz)	EIRP Limit (dBm / MHz)	Field Strength Limit (dBμv/m@ 3m)
5.15–5.25 GHz	–27 dBm/MHz	68.2 dBμv/m@ 3m
5.725–5.825 GHz	–17 dBm/MHz	78.2 dBμv/m@ 3m
	–27 dBm/MHz	68.2 dBμv/m@ 3m

Unwanted emissions that fall within the restricted frequency bands of 15.205 shall comply with the limits specified below:

General Field Strength Limits of 15.209 for License-Exempt Transmitters at Frequencies above 30 MHz

Frequency (MHz)	Field Strength (μV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

11.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, the emissions from the EUT were measured on a spectrum analyzer / EMI receiver.

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst-case determined for function, operation, orientation, etc. for both vertical and horizontal polarisations. Pre-scan plots are shown with a peak detector and 100 kHz RBW.

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360 degrees in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in dBμV/m at the regulatory distance, using:

$$FS = PR + CL + AF - PA + DC - CF$$

Where,

PR is the power recorded on the receiver / spectrum analyzer in dBμV;

CL is the cable loss in dB;

AF is the test antenna factor in dB/m;

PA is the pre-amplifier gain in dB (where used);

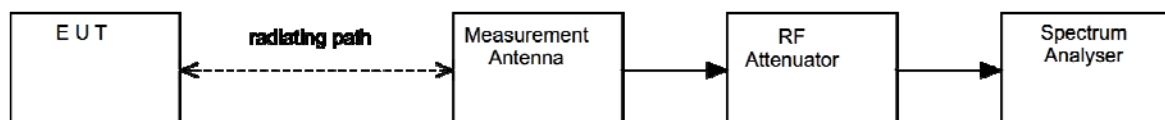
DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);

CF is the distance factor in dB (where measurement distance different to limit distance);

This field strength value is then compared with the regulatory limit.

Where regulatory limits are defined in EIRP in dBm/MHz these limits are converted to field strength values as per ANSI C63.10

Figure i Test Setup



11.5 Test Equipment

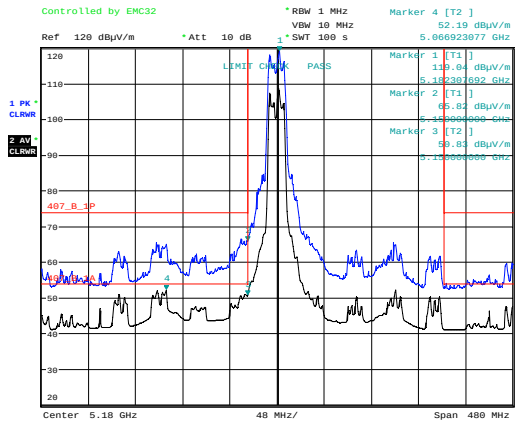
Type of Equipment	Maker/Supplier	Model Number	Element Number	Calibration Due Date
Bilog	Chase	CBL611/A	UH191	26/02/2017
ESVS10	R&S	ESVS10	L352	07/08/2016
Spectrum Analyser	R&S	FSU26	REF909	13/02/2016
Horn Antenna	EMCO	3115	L139	20/09/2015
Pre-Amplifier	Agilent	8449B	L572	10/02/2016
Horn Antenna	Flann	20240-20	L300	10/02/2016
Horn Antenna	Flann	22240-20	L301	Note 1
Filter	BSC	SN 4478	U543	23/08/2017
BandStop Filter 5.15 - 5.35 GHz)	BSC	SN4832	REF841	In Use
BandStop Filter (5.725 - 5.875 GHz)	BSC	SN 4834	REF843	In Use

ANSI C63.10 - 4.4.3 a) Antenna calibration

Standard gain horns need not be periodically recalibrated, unless damage or deterioration is suspected or known to have occurred. If a standard gain horn is not periodically recalibrated, then its critical dimensions (see IEEE Std 1309-2005) shall be verified and documented on an annual basis

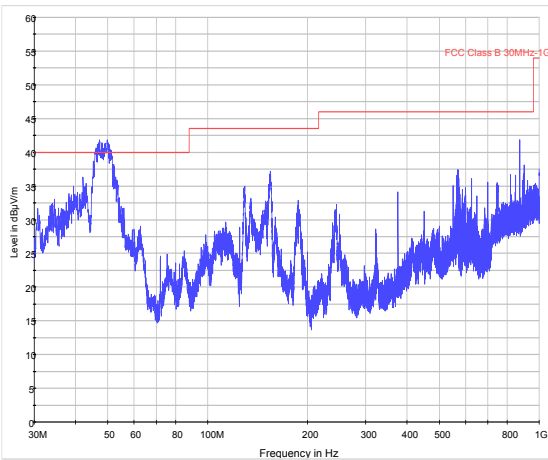
11.6 Test Results

Modulation: 802.11a – 5180 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5427.42	56.07	11.70	33.90	36.01	0.00	0.00	65.66	1918.67	5012
Av	5427.42	44.35	11.70	33.90	36.01	0.00	0.00	53.94	497.74	500
Pk	5611.63	59.61	6.40	33.90	36.08	0.00	0.00	63.83	1554.18	2570
Pk	5827.44	50.94	6.80	34.00	36.19	0.00	0.00	55.55	599.10	2570
Pk	6043.27	51.11	6.50	34.40	36.28	0.00	0.00	55.73	611.65	2570
Pk	6906.60	52.03	6.60	35.50	36.50	0.00	0.00	57.63	761.20	2570

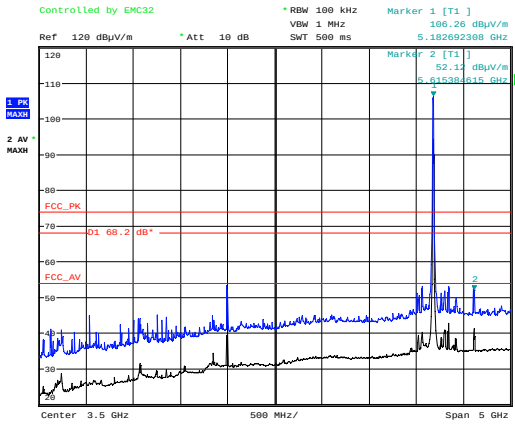


Date: 7.SEP.2015 16:08:48

Bandedge

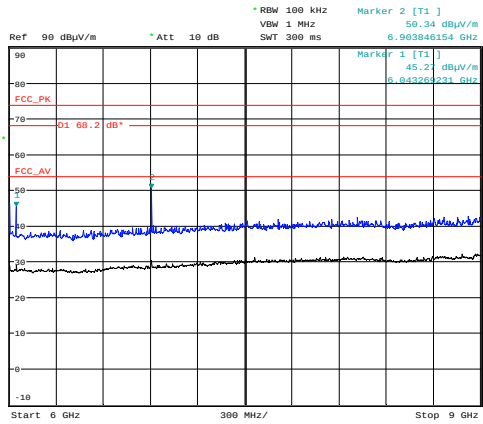


30 MHz – 1 GHz



Date: 8.SEP.2015 09:34:34

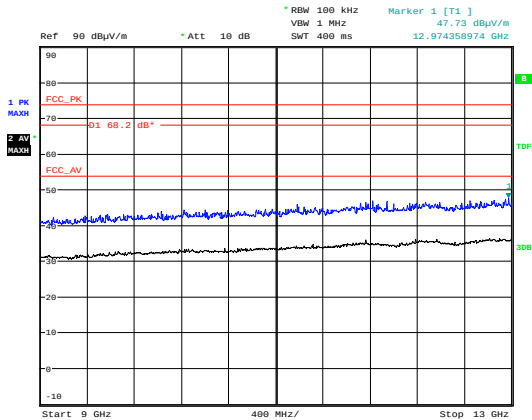
1 GHz – 6 GHz



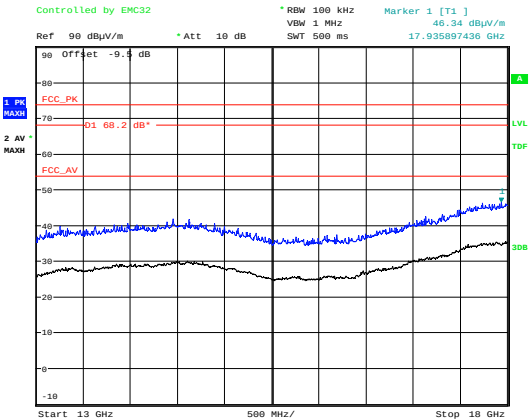
Date: 9.SEP.2015 11:56:11

6 GHz – 9 GHz

Modulation: 802.11a – 5180 MHz



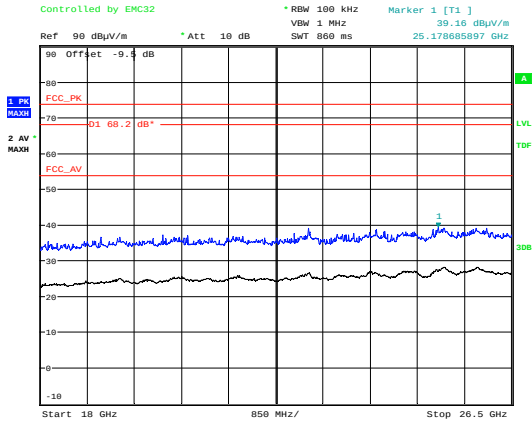
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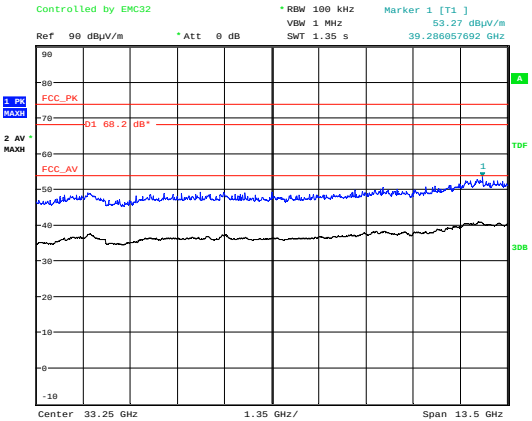
Date: 9.SEP.2015 13:57:27

9 GHz – 13 GHz

13 GHz – 18 GHz



Date: 9.SEP.2015 16:10:01

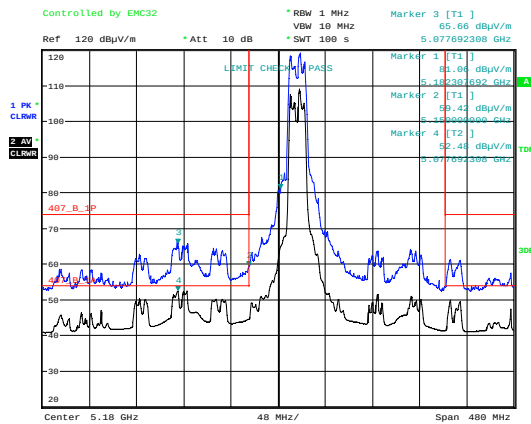


Date: 10.SEP.2015 08:53:04

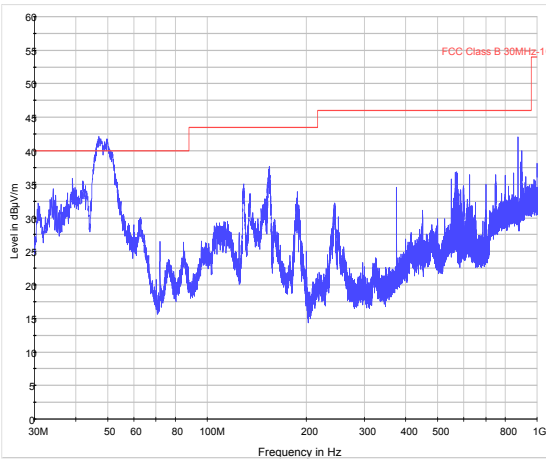
18 GHz – 26.5 GHz

26.5 GHz – 40 GHz

Modulation: 802.11a – 5200 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
Pk	5442.89	57.79	10.50	33.90	36.01	0.00	0.00	66.18	2037.04	5012
Av	5442.89	45.30	10.50	33.90	36.01	0.00	0.00	53.69	483.62	500
Pk	5633.26	60.73	6.50	34.00	36.09	0.00	0.00	65.14	1807.17	2570
Pk	5849.94	50.94	6.50	34.00	36.20	0.00	0.00	55.24	578.10	2570
Pk	6066.60	50.64	6.50	34.50	36.29	0.00	0.00	55.35	585.46	2570
Pk	6933.27	52.53	6.60	35.50	36.50	0.00	0.00	58.13	806.31	2570

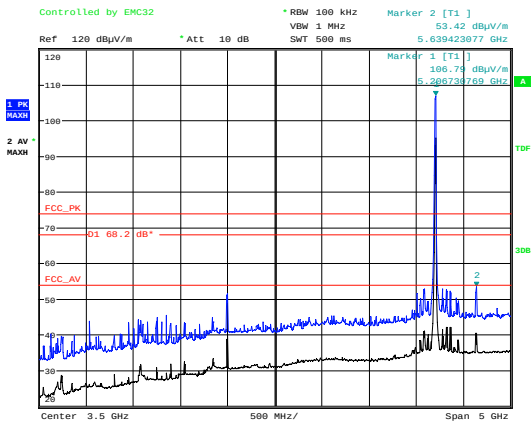


Date: 7.SEP.2015 16:12:32

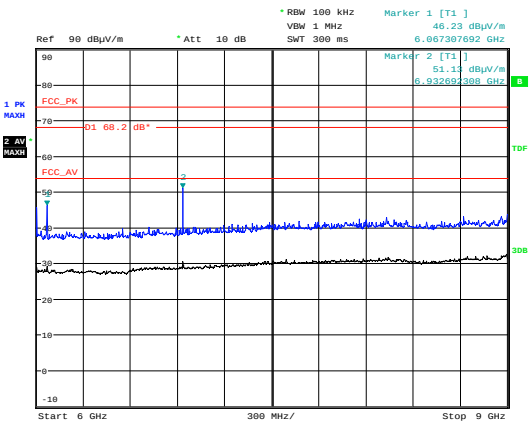


Bandedge

30 MHz – 1 GHz



Date: 8.SEP.2015 09:35:51

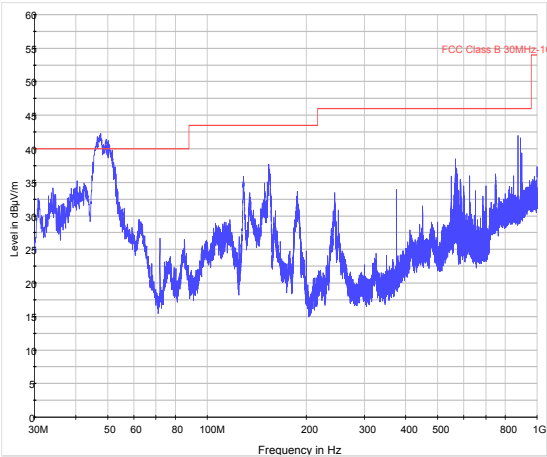
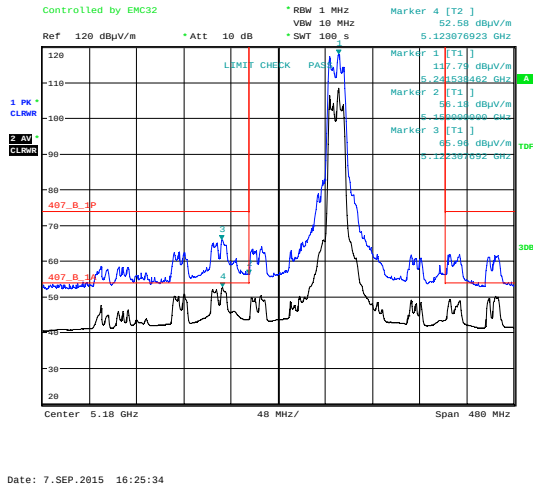


Date: 9.SEP.2015 11:55:01

1 GHz – 6 GHz

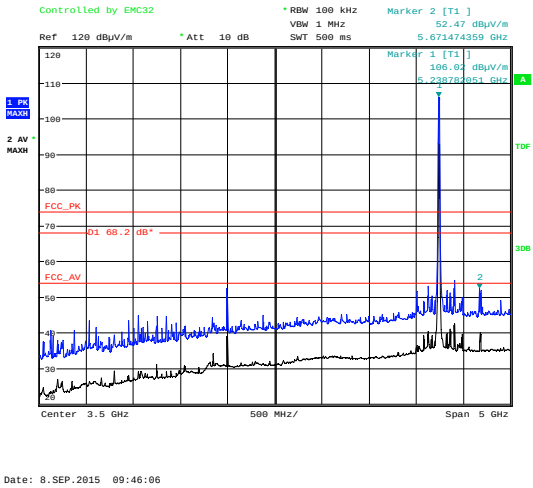
6 GHz – 9 GHz

Modulation: 802.11a – 5240 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5481.34	59.33	8.00	33.90	36.02	0.00	0.00	65.21	1821.80	2570
Pk	5676.75	61.33	6.50	34.00	36.11	0.00	0.00	65.72	1931.97	2570
Pk	5894.95	50.15	6.60	34.10	36.22	0.00	0.00	54.63	538.89	2570
Pk	6113.27	50.32	6.40	34.50	36.31	0.00	0.00	54.91	556.54	2570
Pk	6986.60	51.23	6.60	35.60	36.51	0.00	0.00	56.92	701.46	2570

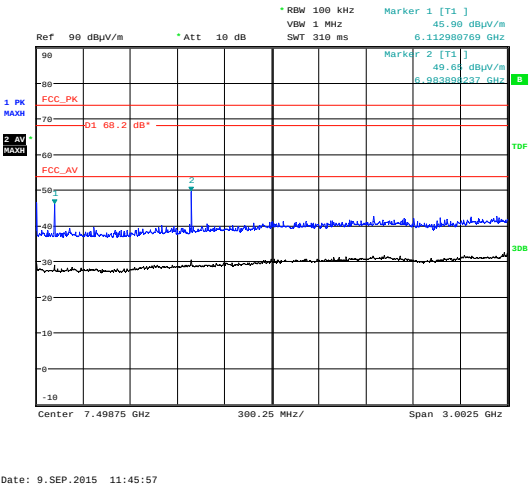


Bandedge

30 MHz – 1 GHz

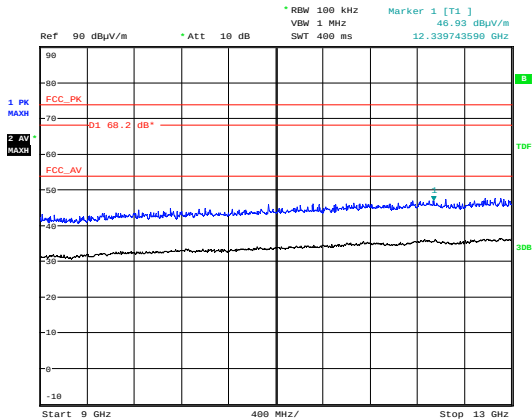


1 GHz – 6 GHz

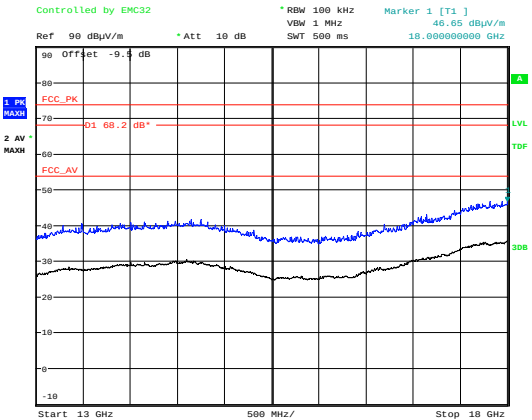


6 GHz – 9 GHz

Modulation: 802.11a – 5240 MHz

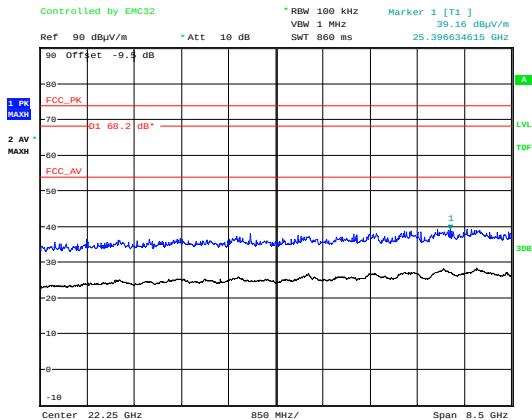


Date: 9.SEP.2015 11:47:39



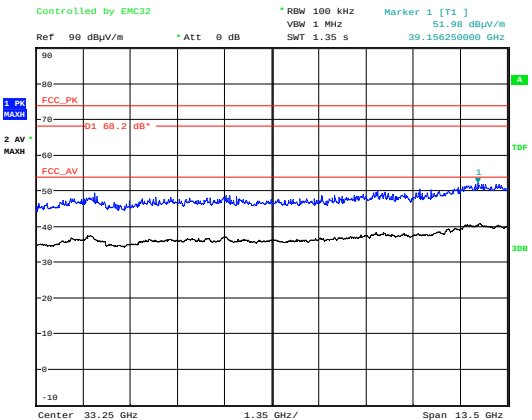
Date: 9.SEP.2015 14:03:10

9 GHz – 13 GHz



Date: 9.SEP.2015 16:16:34

13 GHz – 18 GHz

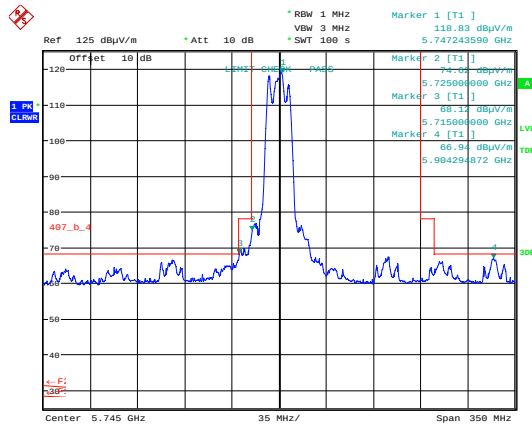


Date: 10.SEP.2015 08:55:11

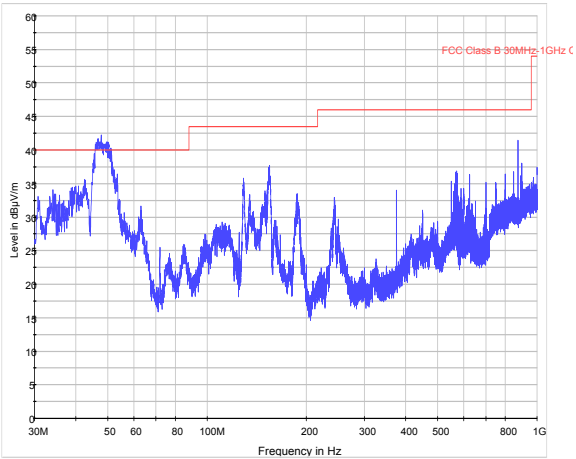
18 GHz – 26.5 GHz

26.5 GHz – 40 GHz

Modulation: 802.11a – 5745 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5271.28	55.79	5.40	33.80	35.96	0.00	0.00	59.03	894.33	2570
Pk	5507.72	54.94	5.50	33.90	36.03	0.00	0.00	58.31	823.19	2570
Pk	5983.94	58.45	5.70	34.30	36.26	0.00	0.00	62.19	1286.77	2570
Pk	6223.70	50.05	5.60	34.60	36.35	0.00	0.00	53.90	495.45	2570

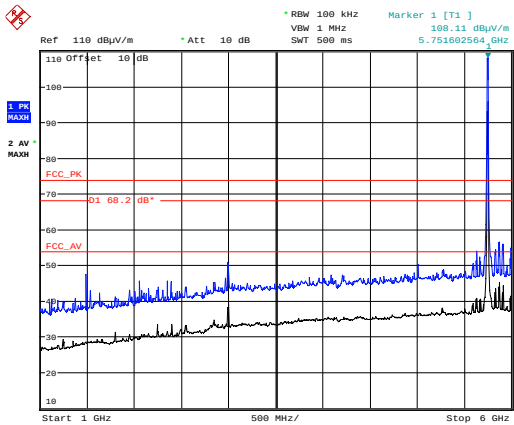


Date: 28.AUG.2015 14:15:50

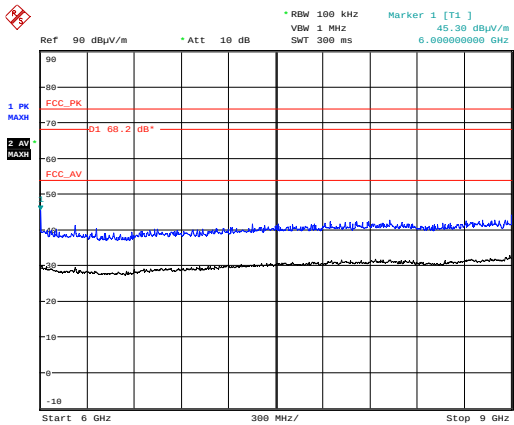


Bandedge

30 MHz – 1 GHz



Date: 31.AUG.2015 13:25:47

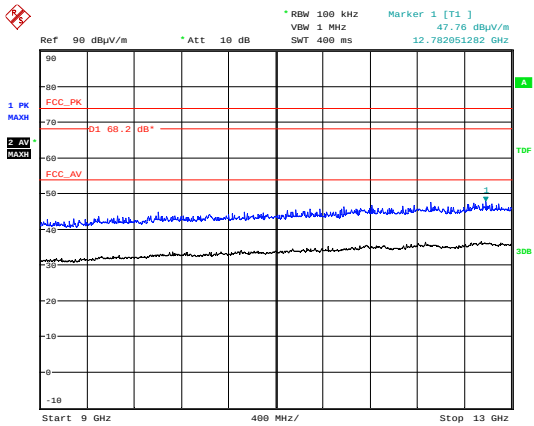


Date: 31.AUG.2015 11:45:35

1 GHz – 6 GHz

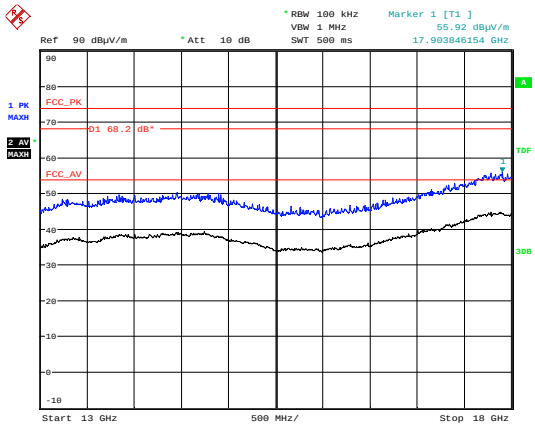
6 GHz – 9 GHz

Modulation: 802.11a – 5745 MHz



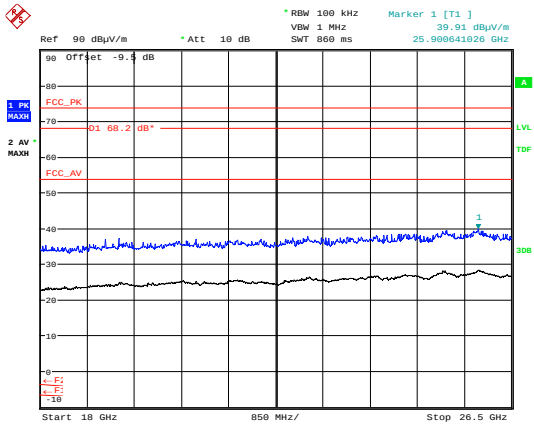
Date: 31.AUG.2015 11:46:27

9 GHz – 13 GHz



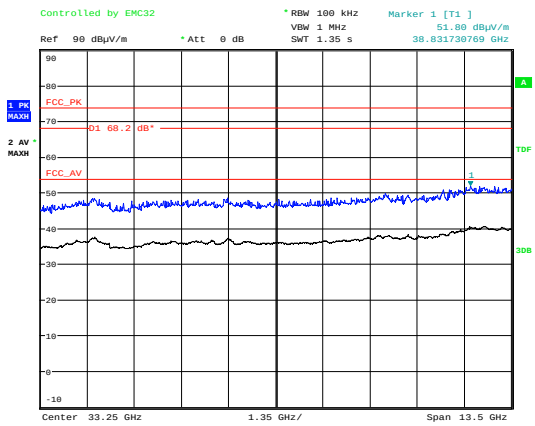
Date: 31.AUG.2015 11:47:37

13 GHz – 18 GHz



Date: 31.AUG.2015 17:37:53

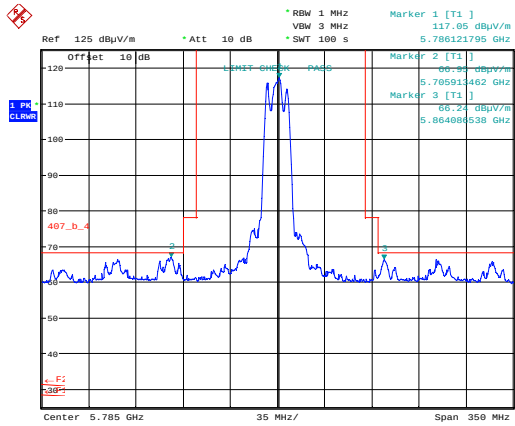
18 GHz – 26.5 GHz



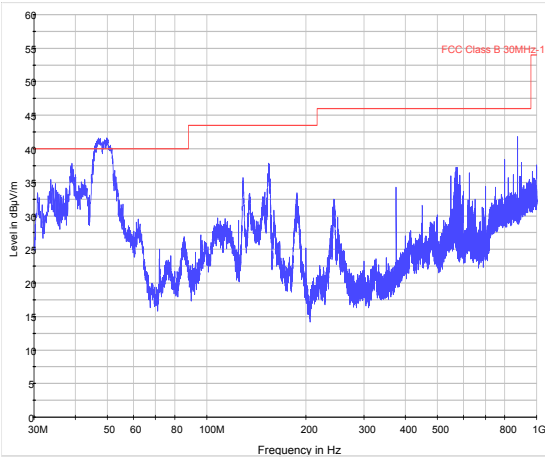
Date: 10.SEP.2015 08:56:29

26.5 GHz – 40 GHz

Modulation: 802.11a – 5785 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
Pk	5306.01	60.13	4.70	36.40	35.91	0.00	0.00	65.32	1845.02	2570
Pk	5543.92	57.59	4.70	36.80	35.90	0.00	0.00	63.19	1443.78	2570
Pk	6020.07	57.91	4.90	37.50	35.88	0.00	0.00	64.43	1665.33	2570
Pk	6267.00	51.40	5.10	38.00	35.90	0.00	0.00	58.60	851.14	2570

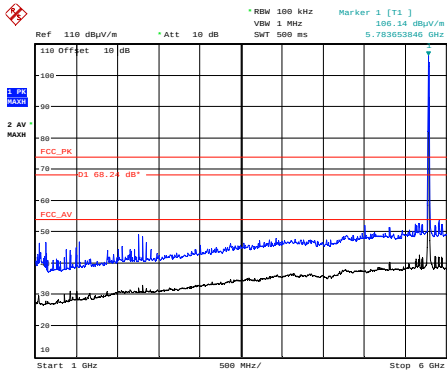


Date: 28.AUG.2015 14:11:34



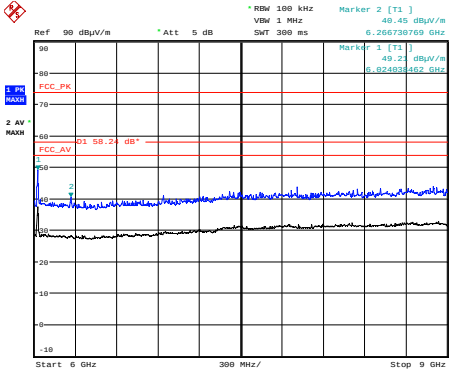
Bandedge

30 MHz – 1 GHz



Date: 29.MAR.2016 13:09:41

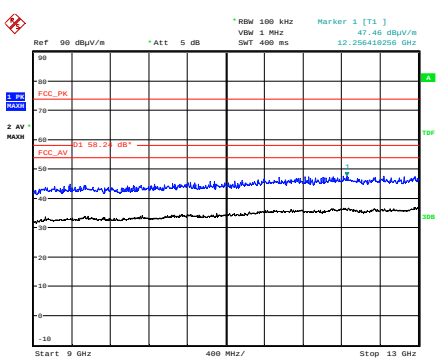
1 GHz – 6 GHz



Date: 30.MAR.2016 16:18:59

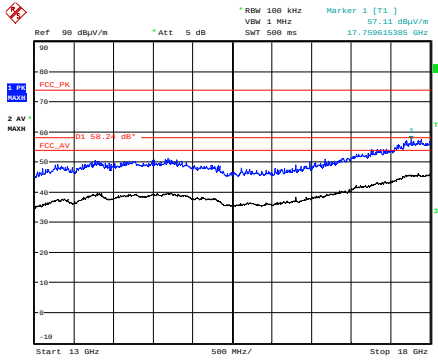
6 GHz – 9 GHz

Modulation: 802.11a – 5785 MHz



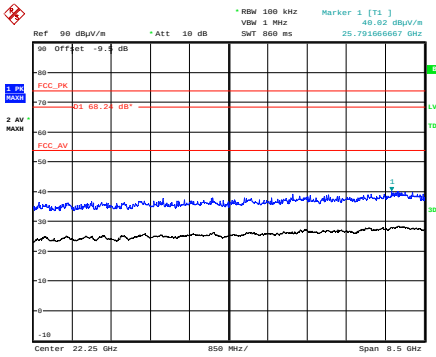
Date: 30.MAR.2016 16:19:48

9 GHz – 13 GHz



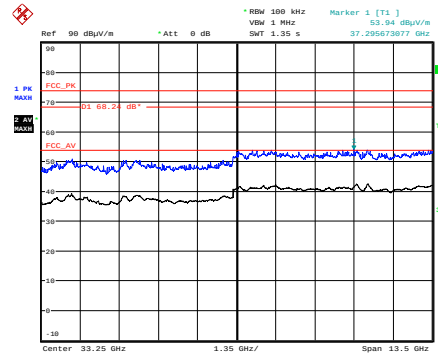
Date: 30.MAR.2016 16:21:03

13 GHz – 18 GHz



Date: 29.MAR.2016 15:31:04

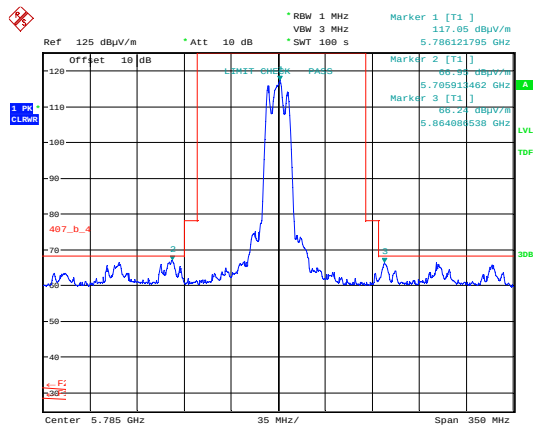
18 GHz – 26.5 GHz



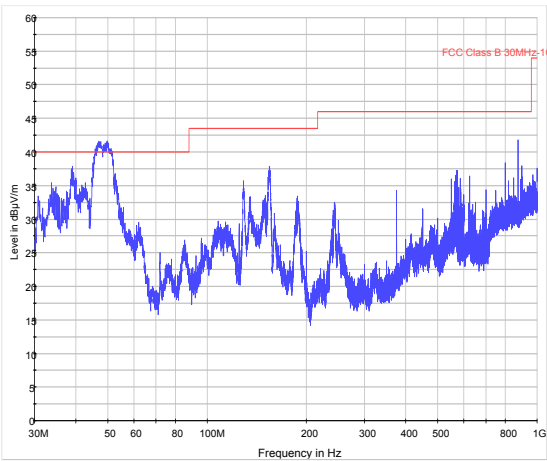
Date: 29.MAR.2016 16:02:45

26.5 GHz – 40 GHz

Modulation: 802.11a – 5285 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5343.14	59.09	4.70	36.50	35.91	0.00	0.00	64.38	1655.77	2570
Pk	5586.96	61.25	4.70	36.80	35.90	0.00	0.00	66.85	2200.39	2570
Pk	6067.76	57.81	4.90	37.60	35.89	0.00	0.00	64.42	1663.41	2570
Pk	6310.40	53.06	5.10	38.10	35.91	0.00	0.00	60.35	1041.12	2570

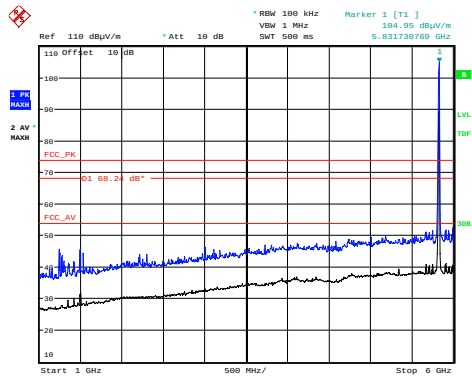


Date: 28.AUG.2015 14:11:34

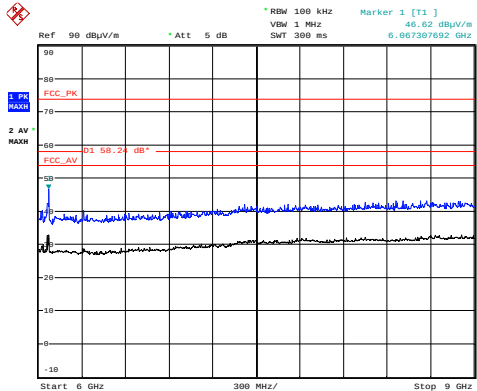


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30 MHz – 1 GHz



Date: 29.MAR.2016 13:05:42

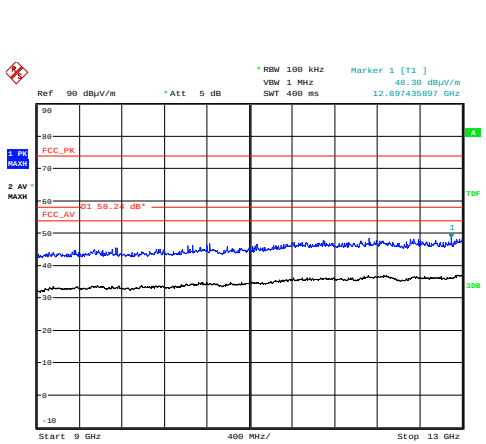


Date: 30.MAR.2016 16:25:03

1 GHz – 6 GHz

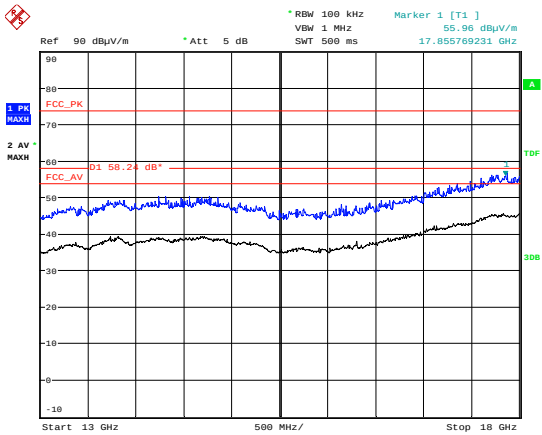
6 GHz – 9 GHz

Modulation: 802.11a – 5785 MHz



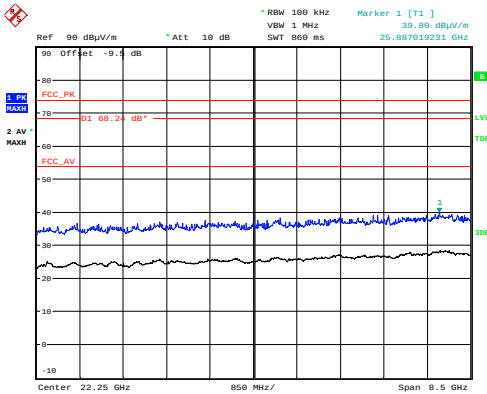
Date: 30.MAR.2016 16:28:20

9 GHz – 13 GHz



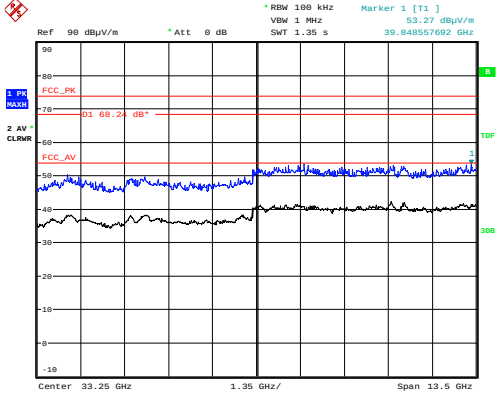
Date: 30.MAR.2016 16:29:30

13 GHz – 18 GHz



Date: 29.MAR.2016 15:34:39

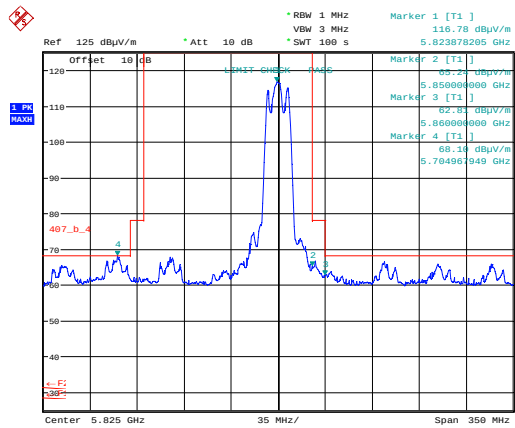
18 GHz – 26.5 GHz



Date: 29.MAR.2016 15:55:41

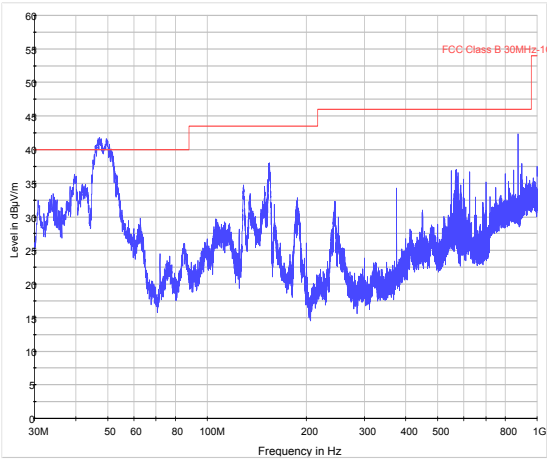
26.5 GHz – 40 GHz

Modulation: 802.11a – 5825 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5343.14	59.09	4.70	36.50	35.91	0.00	0.00	64.38	1655.77	2570
Pk	5586.96	61.25	4.70	36.80	35.90	0.00	0.00	66.85	2200.39	2570
Pk	6067.76	57.81	4.90	37.60	35.89	0.00	0.00	64.42	1663.41	2570
Pk	6310.40	53.06	5.10	38.10	35.91	0.00	0.00	60.35	1041.12	2570

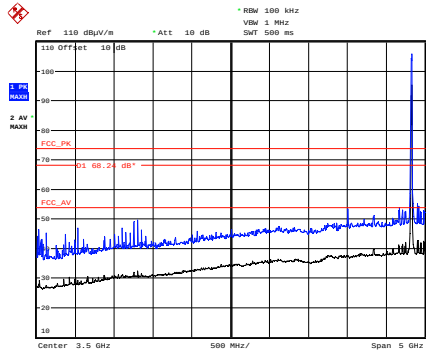


Date: 28.AUG.2015 13:54:56

Bandedge

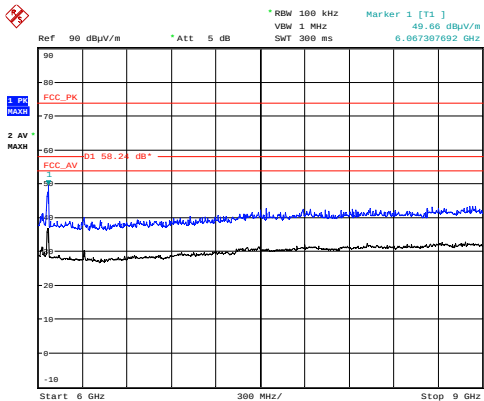


30 MHz – 1 GHz



Date: 29.MAR.2016 13:04:05

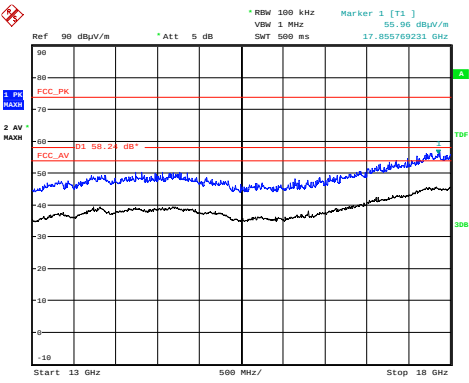
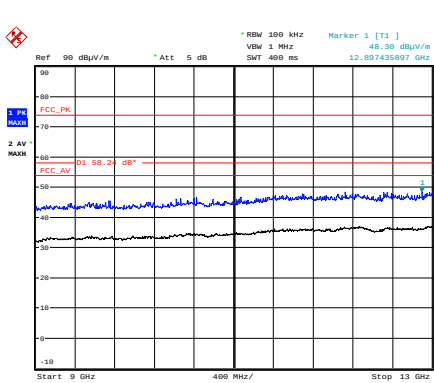
1 GHz – 6 GHz



Date: 30.MAR.2016 16:29:14

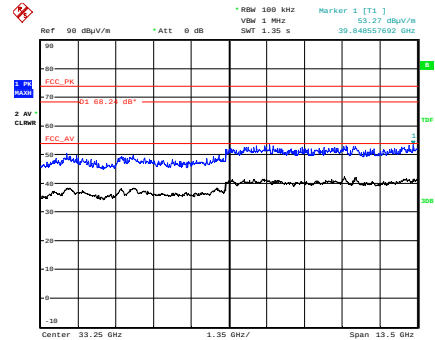
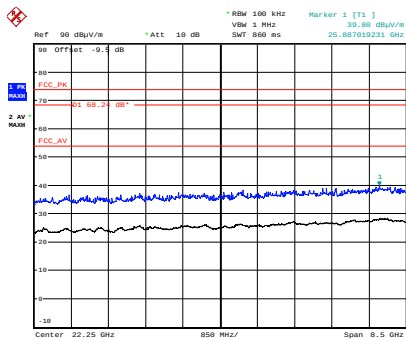
6 GHz – 9 GHz

Modulation: 802.11a – 5825 MHz



9 GHz – 13 GHz

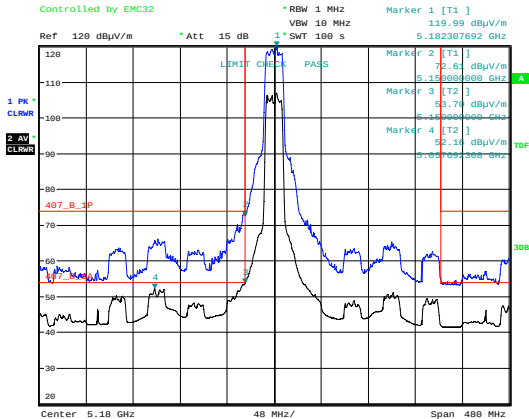
13 GHz – 18 GHz



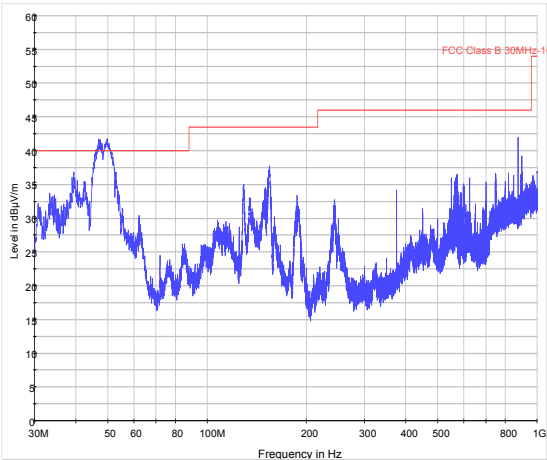
18 GHz – 26.5 GHz

26.5 GHz – 40 GHz

Modulation: 802.11ac VHT20 – 5180 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
Pk	5422.61	57.90	12.10	34.00	36.01	0.00	0.00	67.99	2509.00	5012
Av	5422.61	43.84	12.10	34.00	36.01	0.00	0.00	53.93	497.16	500
Pk	5611.54	61.64	6.40	33.90	36.08	0.00	0.00	65.86	1963.36	2570
Pk	5827.44	50.88	6.80	34.00	36.19	0.00	0.00	55.49	594.98	2570
Pk	6043.28	50.73	6.50	34.40	36.28	0.00	0.00	55.35	585.46	2570
Pk	6906.60	52.52	6.60	35.50	36.50	0.00	0.00	58.12	805.38	2570

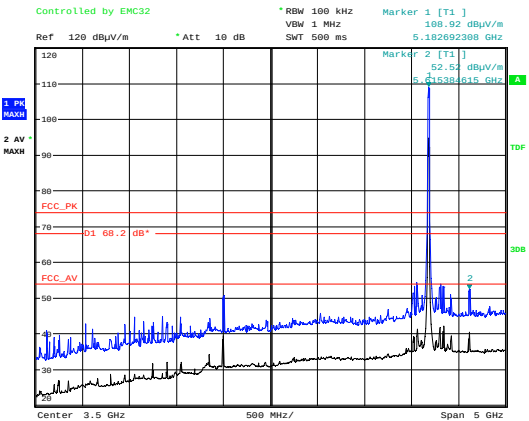


Date: 7.SEP.2015 16:31:53



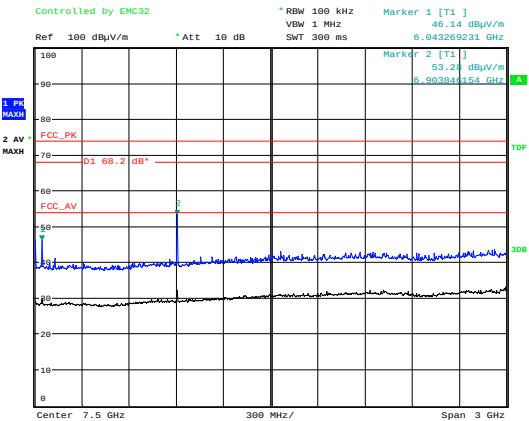
Bandedge

30 MHz – 1 GHz



Date: 7.SEP.2015 16:51:18

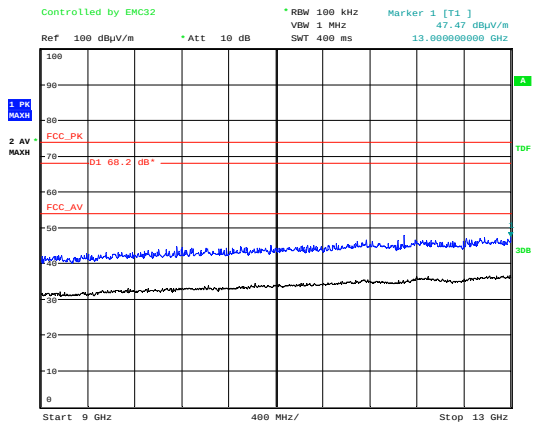
1 GHz – 6 GHz



Date: 8.SEP.2015 14:38:03

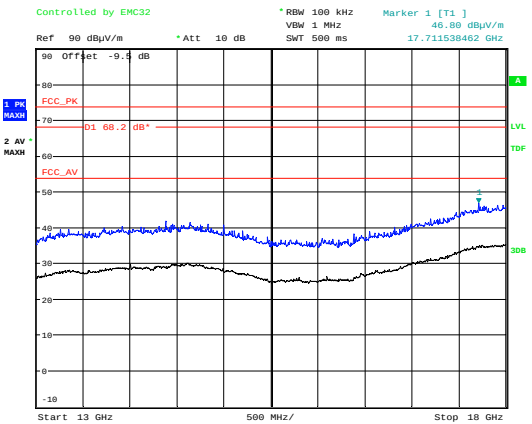
6 GHz – 9 GHz

Modulation: 802.11ac VHT20 – 5180 MHz



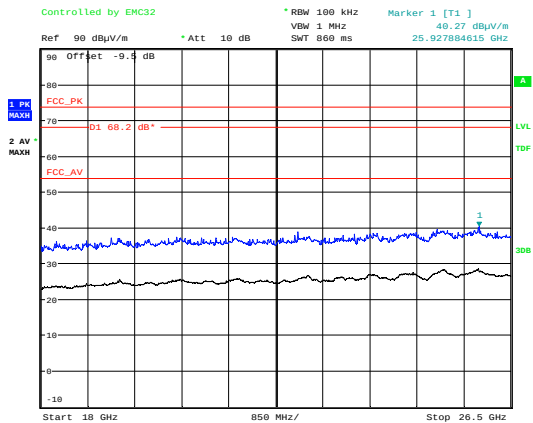
Date: 8.SEP.2015 14:30:44

9 GHz – 13 GHz



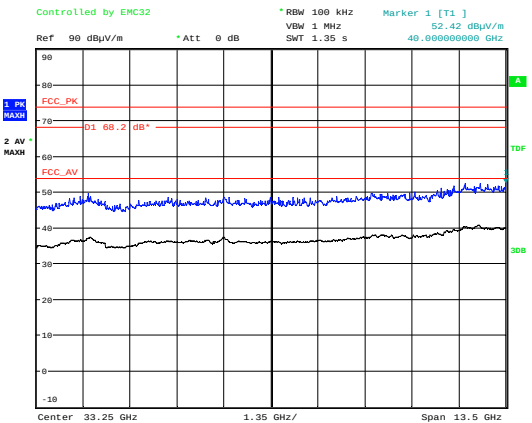
Date: 9.SEP.2015 14:05:13

13 GHz – 18 GHz



Date: 9.SEP.2015 16:01:30

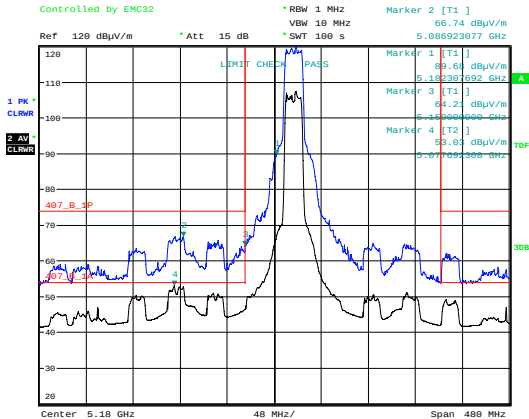
18 GHz – 26.5 GHz



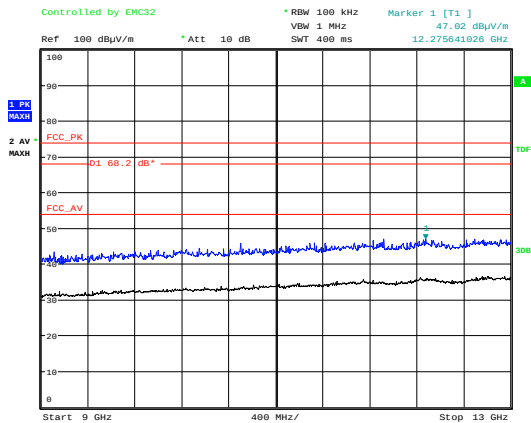
Date: 10.SEP.2015 09:28:09

26.5 GHz – 40 GHz

Modulation: 802.11ac VHT20 – 5200 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
Pk	5447.44	59.94	10.10	33.90	36.01	0.00	0.00	67.93	2491.72	5012
Av	5447.44	45.83	10.10	33.90	36.01	0.00	0.00	53.82	490.91	500
Pk	5633.28	61.65	6.50	34.00	36.09	0.00	0.00	66.06	2009.09	2570
Pk	5849.94	51.01	6.50	34.00	36.20	0.00	0.00	55.31	582.77	2570
Pk	6066.61	49.60	6.50	34.50	36.29	0.00	0.00	54.31	519.40	2570
Pk	6933.27	53.26	6.60	35.50	36.50	0.00	0.00	58.86	877.00	2570

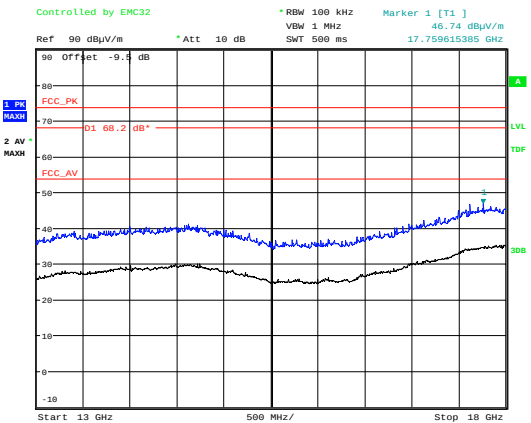


Modulation: 802.11ac VHT20 – 5200 MHz



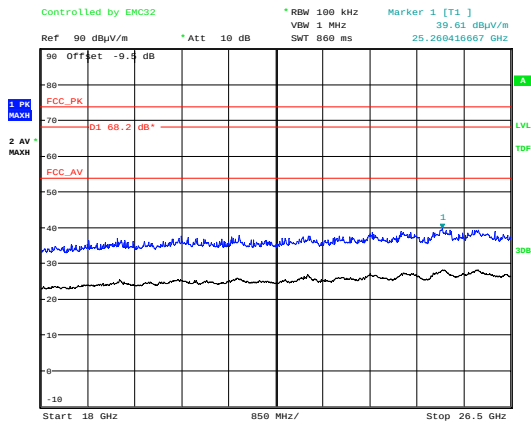
Date: 8.SEP.2015 14:41:20

9 GHz – 13 GHz



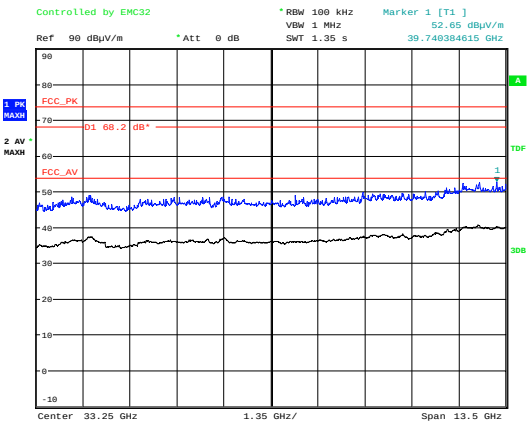
Date: 9.SEP.2015 14:09:45

13 GHz – 18 GHz



Date: 9.SEP.2015 16:03:07

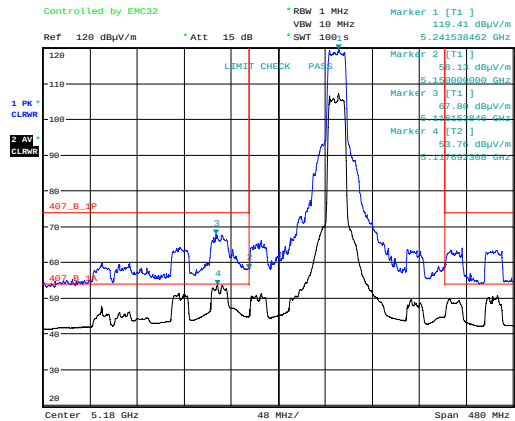
18 GHz – 26.5 GHz



Date: 10.SEP.2015 09:26:54

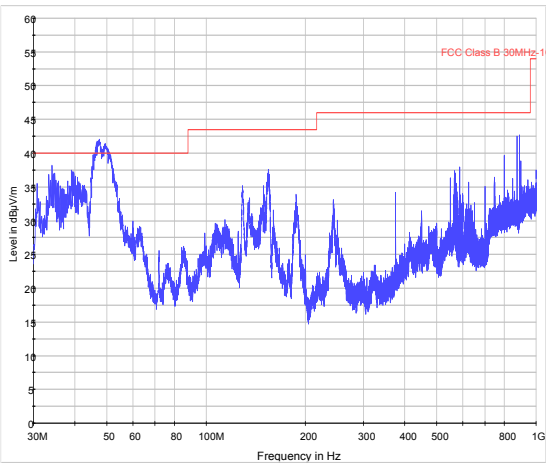
26.5 GHz – 40 GHz

Modulation: 802.11ac VHT20 – 5240 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5481.34	61.65	8.00	33.90	36.02	0.00	0.00	67.53	2379.58	2570
Pk	5676.75	61.56	6.50	34.00	36.11	0.00	0.00	65.95	1983.81	2570
Pk	5894.95	51.55	6.60	34.10	36.22	0.00	0.00	56.03	633.14	2570
Pk	6113.27	50.27	6.40	34.50	36.31	0.00	0.00	54.86	553.35	2570
Pk	6986.60	51.81	6.60	35.60	36.51	0.00	0.00	57.50	749.89	2570

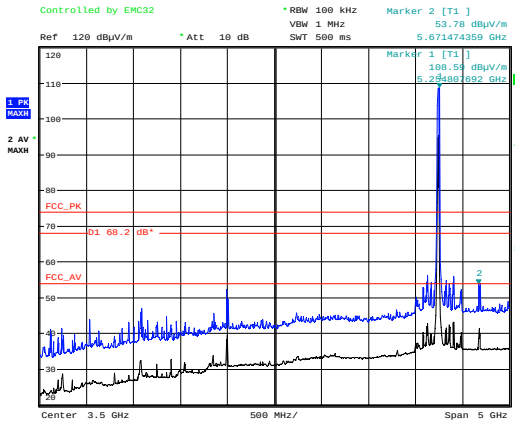


Date: 7.SEP.2015 16:37:04

Bandedge

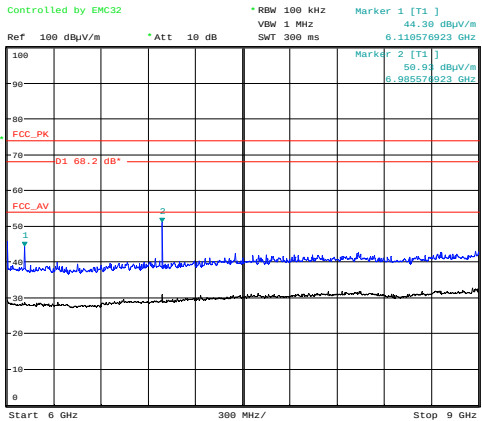


30 MHz – 1 GHz



Date: 7.SEP.2015 16:46:12

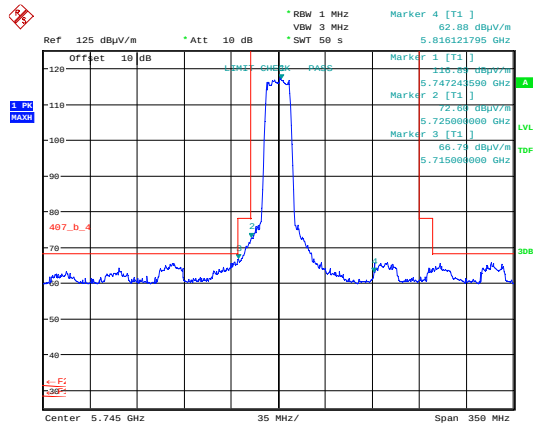
1 GHz – 6 GHz



Date: 8.SEP.2015 14:47:55

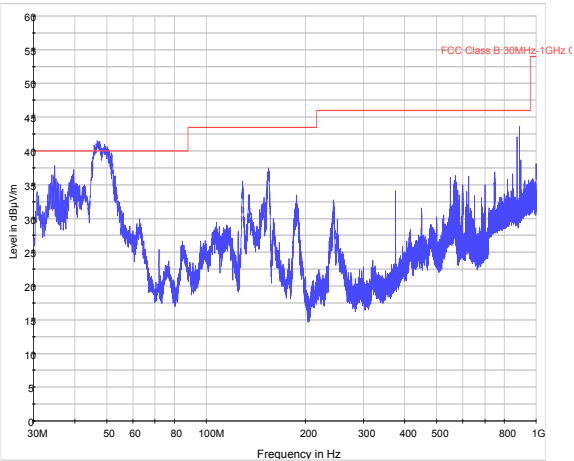
6 GHz – 9 GHz

Modulation: 802.11ac VHT20 – 5745 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
Pk	5266.18	60.45	4.70	36.40	35.91	0.00	0.00	65.64	1914.26	5012
Av	5266.18	47.78	4.70	36.40	35.91	0.00	0.00	52.97	445.14	500
Pk	5505.64	58.64	4.70	36.70	35.90	0.00	0.00	64.14	1610.65	5012
Av	5505.64	44.55	4.70	36.70	35.90	0.00	0.00	50.05	318.05	500
Pk	5984.31	56.32	4.90	37.50	35.88	0.00	0.00	62.84	1386.76	5012
Av	5984.31	42.13	4.90	37.50	35.88	0.00	0.00	48.65	270.71	500
Pk	6223.71	51.26	4.80	38.00	35.90	0.00	0.00	58.16	809.10	5012
Av	6223.71	39.99	4.80	38.00	35.90	0.00	0.00	46.89	221.05	500

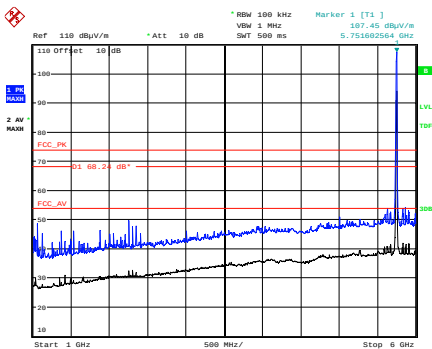


Date: 28.AUG.2015 13:28:47

Bandedge

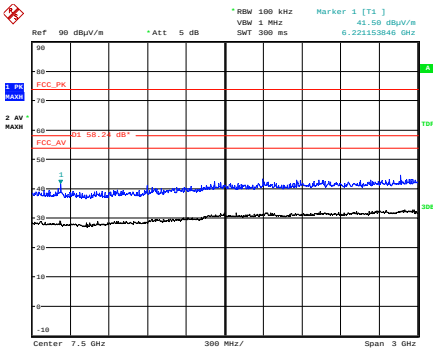


30 MHz – 1 GHz



Date: 29.MAR.2016 13:11:37

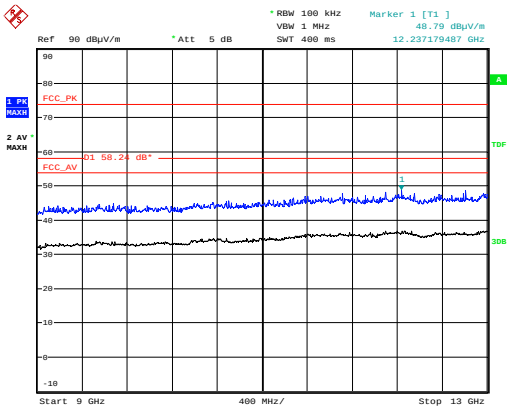
1 GHz – 6 GHz



Date: 30.MAR.2016 16:03:32

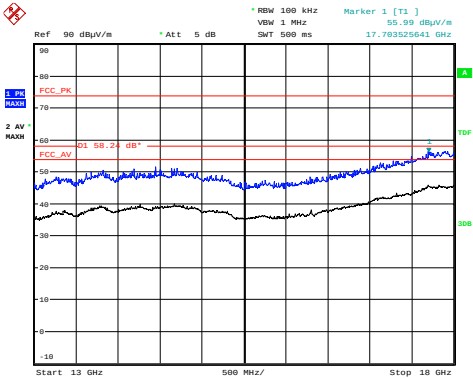
6 GHz – 9 GHz

Modulation: 802.11a c VHT20– 5745 MHz



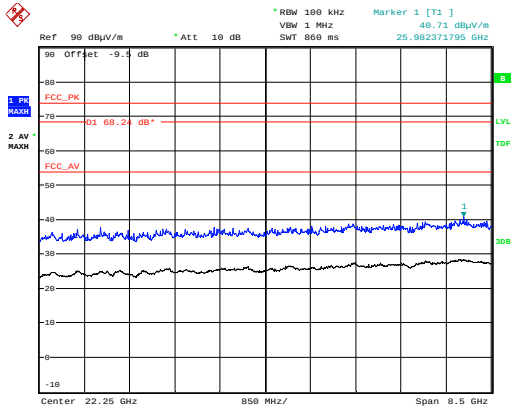
Date: 30.MAR.2016 16:04:36

9 GHz – 13 GHz



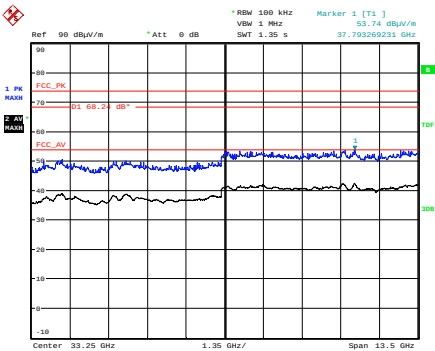
Date: 30.MAR.2016 16:05:14

13 GHz – 18 GHz



Date: 29.MAR.2016 15:25:35

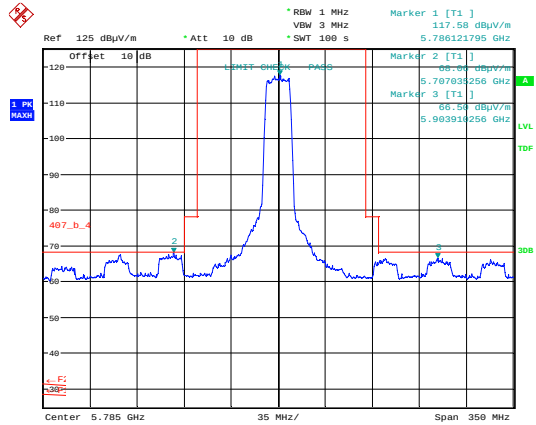
18 GHz – 26.5 GHz



Date: 29.MAR.2016 16:08:19

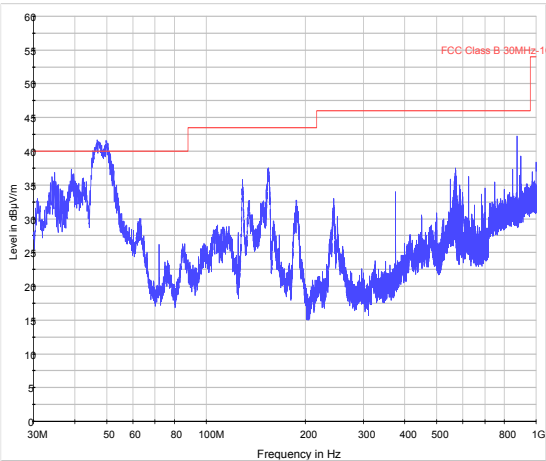
26.5 GHz – 40 GHz

Modulation: 802.11ac VHT20 – 5785 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5301.63	54.25	5.40	33.80	35.97	0.00	0.00	57.48	748.17	2570
Pk	5543.91	57.18	5.50	33.90	36.05	0.00	0.00	60.53	1062.92	2570
Pk	6026.00	58.39	5.70	34.40	36.28	0.00	0.00	62.21	1289.73	2570
Pk	6267.00	50.29	5.90	34.50	36.36	0.00	0.00	54.33	520.60	2570

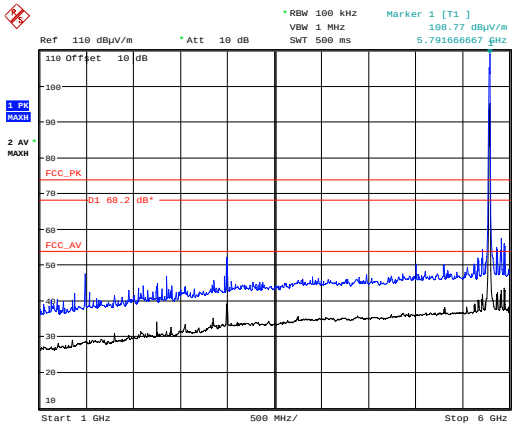


Date: 28.AUG.2015 13:46:52

Bandedge

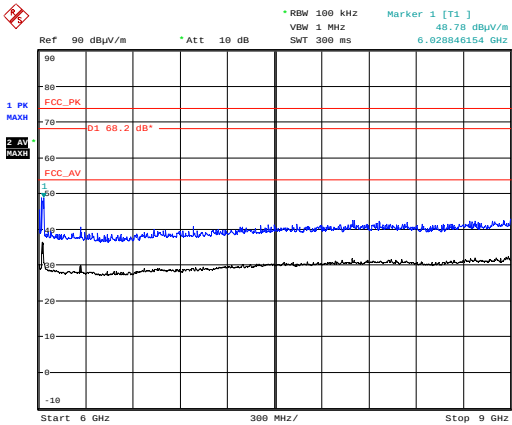


30 MHz – 1 GHz



Date: 31.AUG.2015 14:12:07

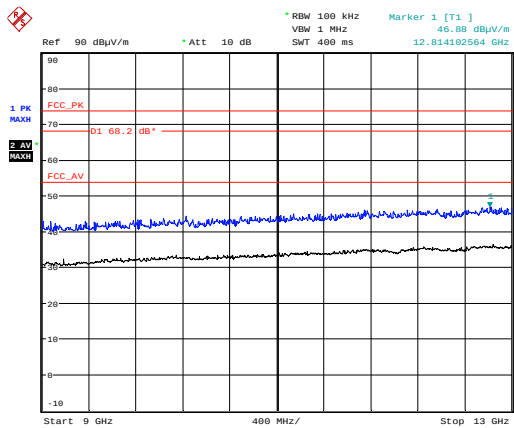
1 GHz – 6 GHz



Date: 31.AUG.2015 12:19:16

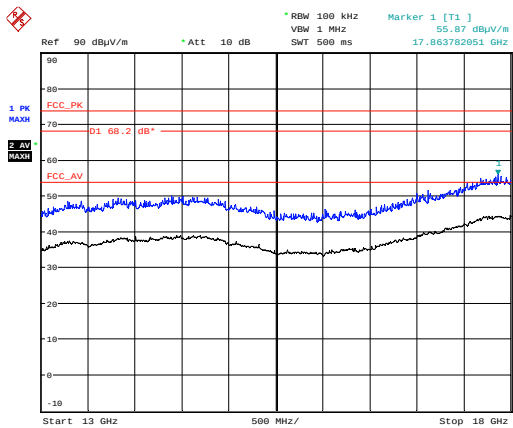
6 GHz – 9 GHz

Modulation: 802.11ac VHT20 – 5785 MHz



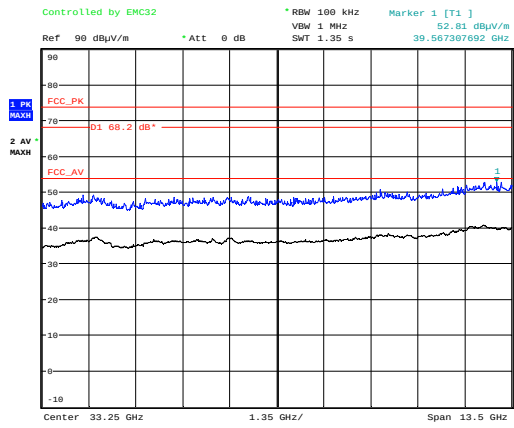
Date: 31.AUG.2015 12:19:50

9 GHz – 13 GHz



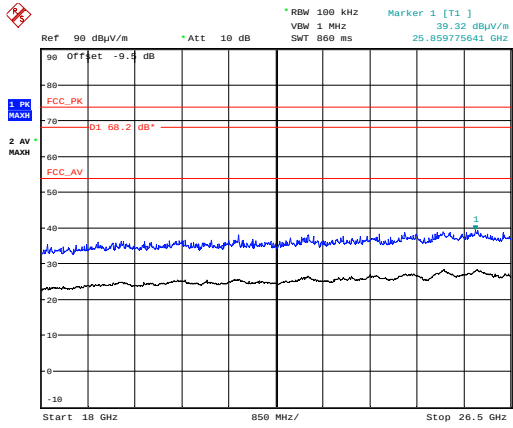
Date: 31.AUG.2015 12:20:25

13 GHz – 18 GHz



Date: 10.SEP.2015 09:22:22

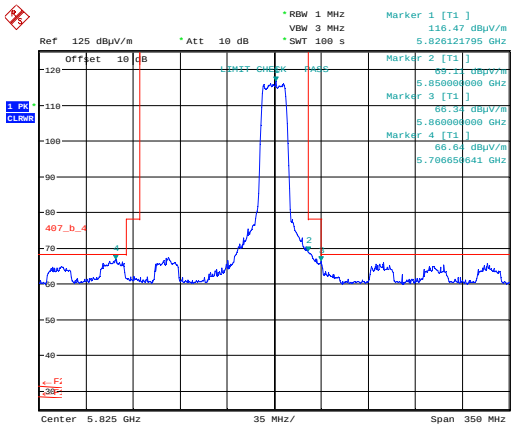
18 GHz – 26.5 GHz



Date: 31.AUG.2015 17:46:44

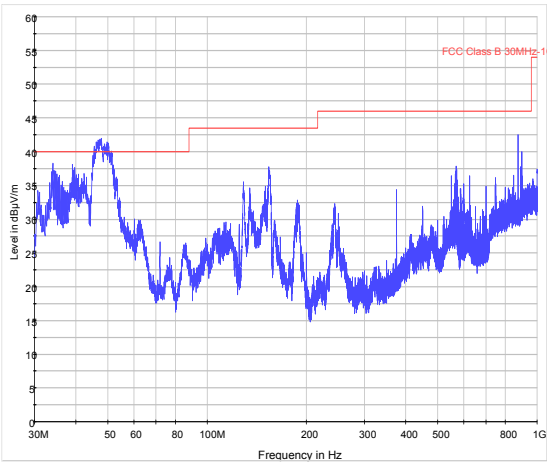
26.5 GHz – 40 GHz

Modulation: 802.11ac VHT20 – 5825 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5338.28	60.10	4.70	36.50	35.91	0.00	0.00	65.39	1859.94	5012
Av	5338.28	47.26	4.70	36.50	35.91	0.00	0.00	52.55	424.13	500
Pk	5582.27	57.35	4.70	36.80	35.90	0.00	0.00	62.95	1404.43	5012
Av	5582.27	45.23	4.70	36.80	35.90	0.00	0.00	50.83	347.94	500
Pk	6065.93	59.98	4.90	37.60	35.89	0.00	0.00	66.59	2135.50	5012
Av	6065.93	48.72	4.90	37.60	35.89	0.00	0.00	55.33	584.12	500
Pk	6310.37	51.33	5.10	38.10	35.91	0.00	0.00	58.62	853.10	5012
Av	6310.37	38.59	5.10	38.10	35.91	0.00	0.00	45.88	196.79	500

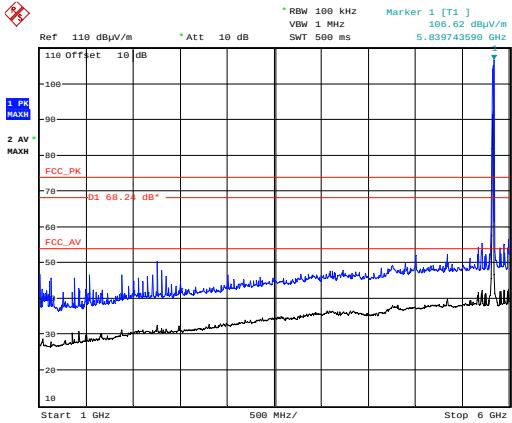


Date: 28.AUG.2015 13:51:06

Bandedge

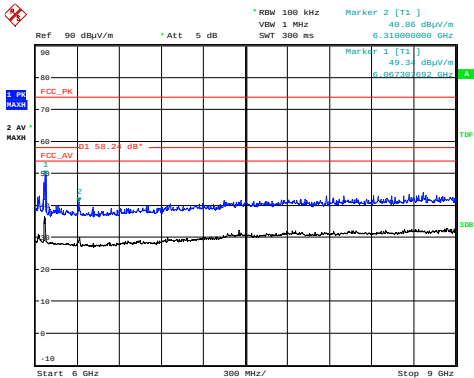


30 MHz – 1 GHz



Date: 29.MAR.2016 14:22:15

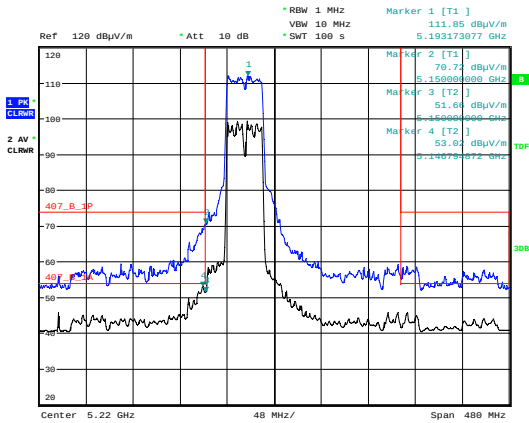
1 GHz – 6 GHz



Date: 30.MAR.2016 16:16:27

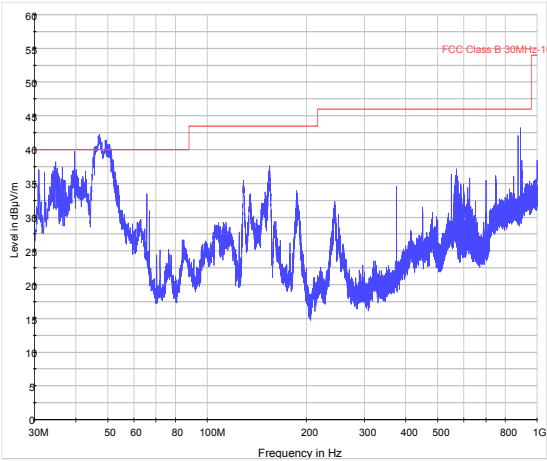
6 GHz – 9 GHz

Modulation: 802.11ac VHT40 – 5190 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
Pk	5622.46	53.07	6.50	34.00	36.09	0.00	0.00	57.48	748.17	2570
Pk	6054.94	53.55	6.40	34.40	36.29	0.00	0.00	58.06	799.83	2570
Pk	6919.91	53.27	6.50	35.50	36.50	0.00	0.00	58.77	867.96	2570

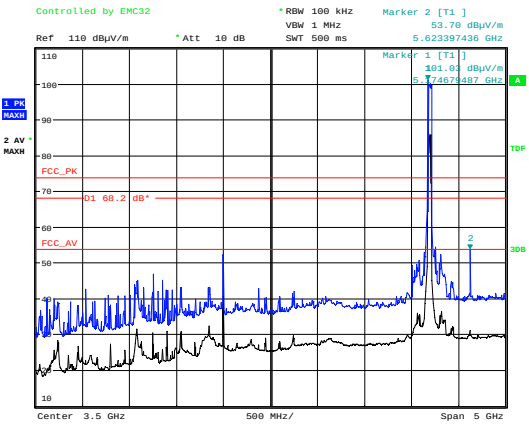


Date: 4.SEP.2015 12:04:05

Bandedge

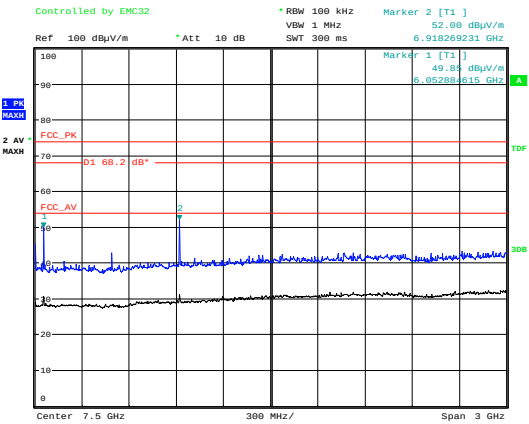


30 MHz – 1 GHz



Date: 8.SEP.2015 09:53:49

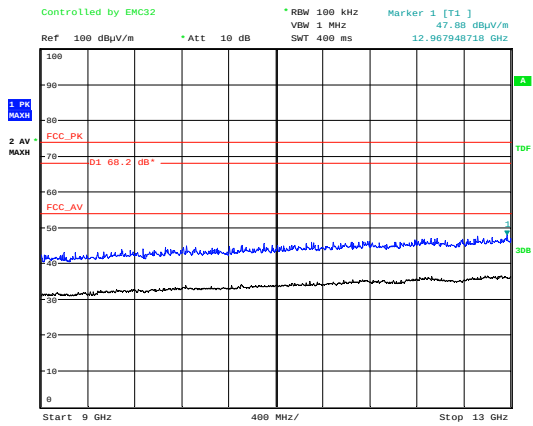
1 GHz – 6 GHz



Date: 8.SEP.2015 13:03:35

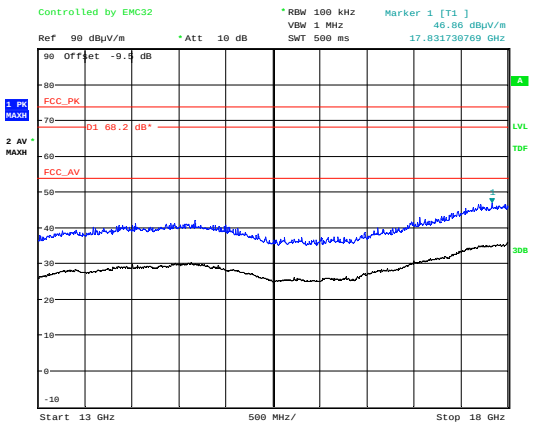
6 GHz – 9 GHz

Modulation: 802.11ac VHT40 – 5190 MHz



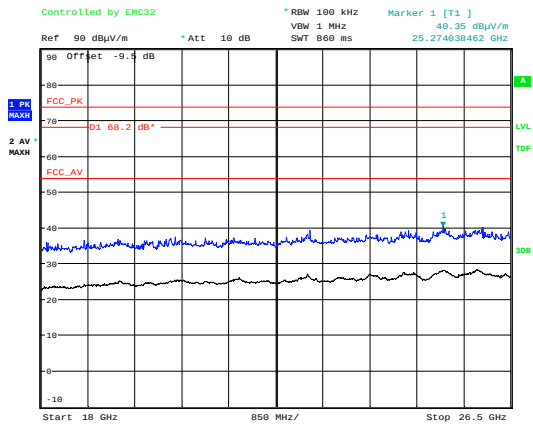
Date: 8.SEP.2015 13:09:14

9 GHz – 13 GHz



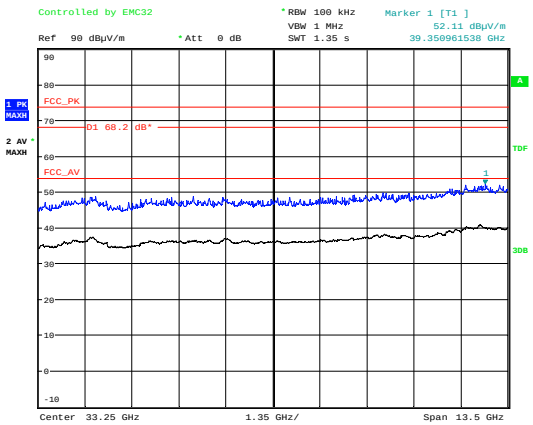
Date: 9.SEP.2015 14:17:54

13 GHz – 18 GHz



Date: 9.SEP.2015 15:45:16

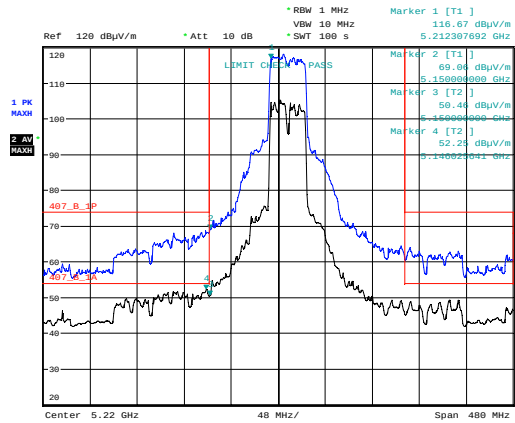
18 GHz – 26.5 GHz



Date: 10.SEP.2015 09:30:12

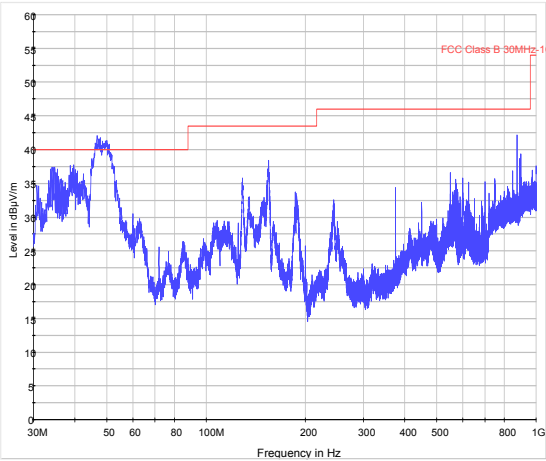
26.5 GHz – 40 GHz

Modulation: 802.11ac VHT40 – 5230 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5665.78	56.90	6.60	34.00	36.11	0.00	0.00	61.39	1173.55	2570
Pk	6101.61	52.71	6.20	34.50	36.30	0.00	0.00	57.11	716.97	2570
Pk	6973.25	52.71	6.60	35.50	36.51	0.00	0.00	58.30	822.24	2570

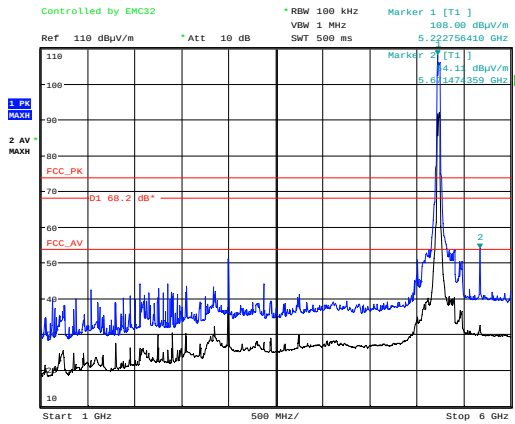


Date: 4.SEP.2015 13:47:42

Bandedge

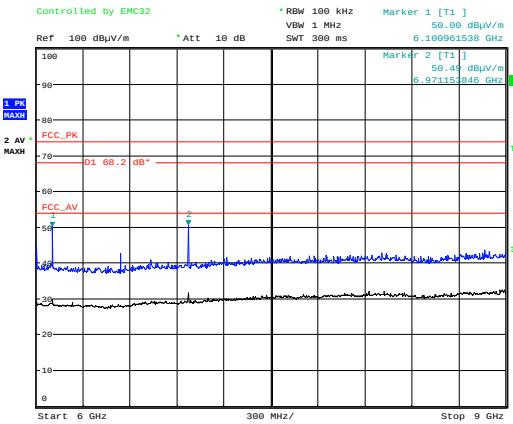


30 MHz – 1 GHz



Date: 8.SEP.2015 10:11:23

1 GHz – 6 GHz

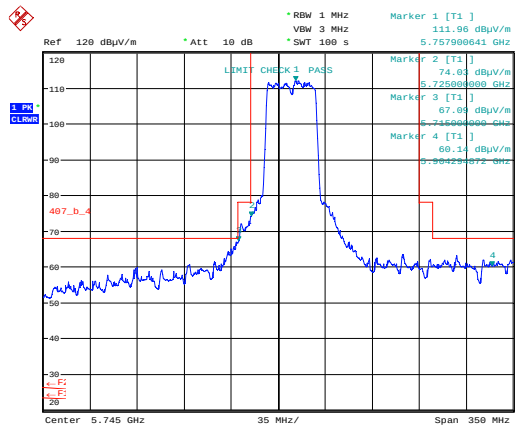


Date: 8.SEP.2015 13:15:46

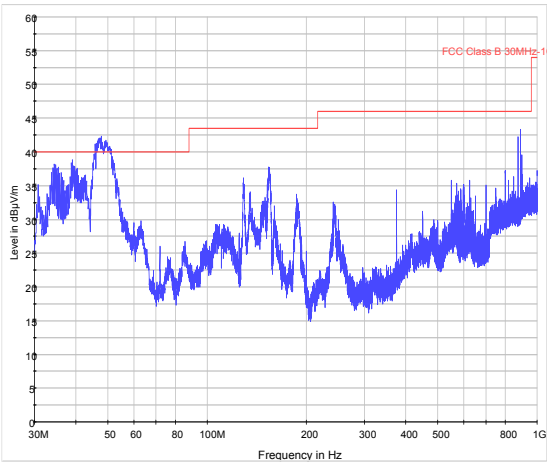
6 GHz – 9 GHz

Modulation: 802.11ac VHT40 – 5755 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5275.38	56.51	4.70	36.40	35.91	0.00	0.00	61.70	1216.19	5012
Av	5275.38	46.63	4.70	36.40	35.91	0.00	0.00	51.82	389.94	500
Pk	6000.00	55.64	4.90	37.50	35.88	0.00	0.00	62.16	1282.33	5012
Av	6000.00	41.82	4.90	37.50	35.88	0.00	0.00	48.34	261.22	500
Pk	6234.53	50.15	4.80	38.00	35.90	0.00	0.00	57.05	712.03	5012
Av	6234.53	39.34	4.80	38.00	35.90	0.00	0.00	46.24	205.12	500

Change plots

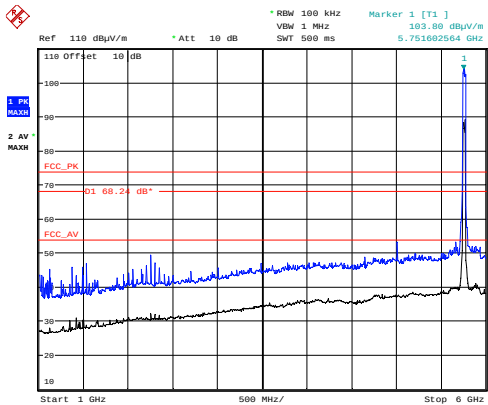


Date: 28.AUG.2015 14:27:29

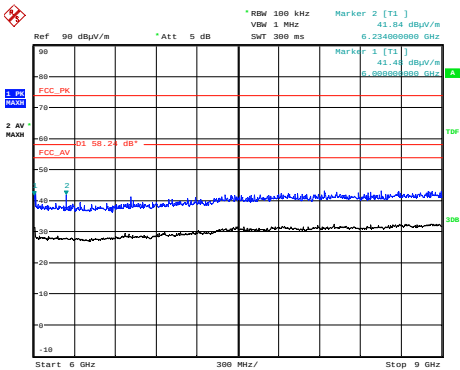


Bandedge

30 MHz – 1 GHz



Date: 29.MAR.2016 14:30:19

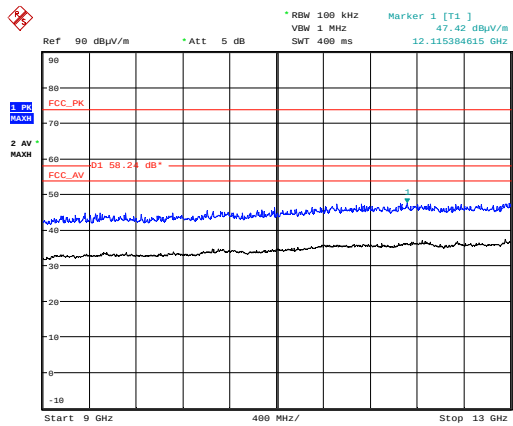


Date: 30.MAR.2016 15:39:46

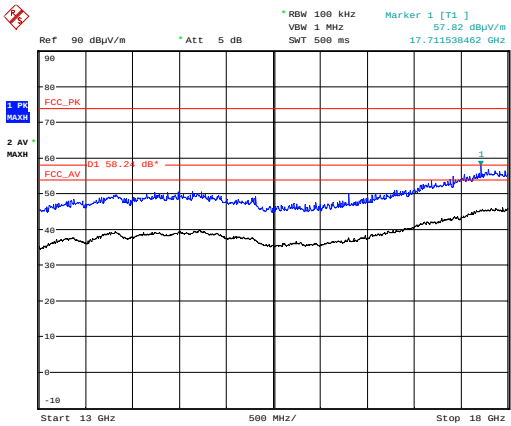
1 GHz – 6 GHz

6 GHz – 9 GHz

Modulation: 802.11ac VHT40 – 5755 MHz



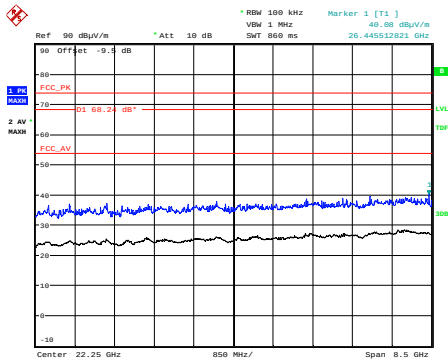
Date: 30.MAR.2016 15:38:56



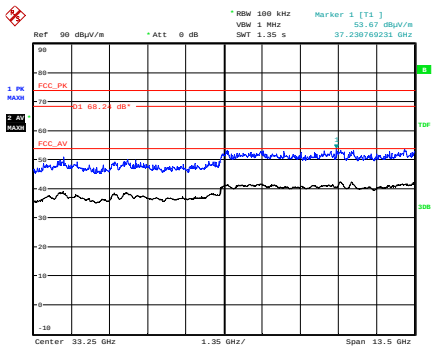
Date: 30.MAR.2016 15:37:57

9 GHz – 13 GHz

13 GHz – 18 GHz



Date: 29.MAR.2016 15:23:48

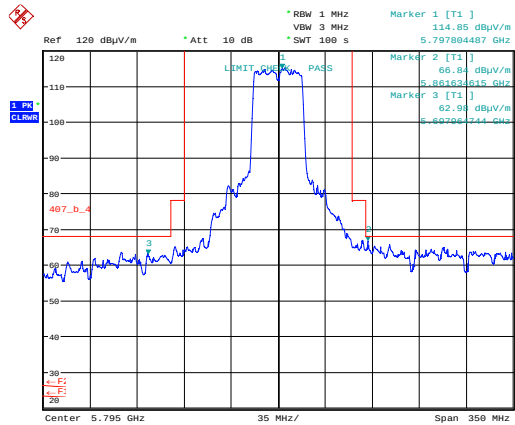


Date: 29.MAR.2016 16:12:05

18 GHz – 26.5 GHz

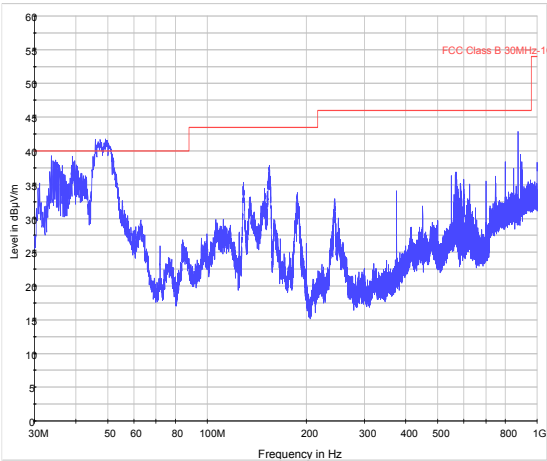
26.5 GHz – 40 GHz

Modulation: 802.11ac VHT40 – 5795 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5312.04	55.27	4.70	36.40	35.91	0.00	0.00	60.46	1054.39	5012
Av	5312.04	44.50	4.70	36.40	35.91	0.00	0.00	49.69	305.14	500
Pk	6031.25	57.29	4.90	37.60	35.88	0.00	0.00	63.91	1568.56	5012
Av	6031.25	43.37	4.90	37.60	35.88	0.00	0.00	49.99	315.86	500
Pk	6277.86	48.45	5.10	38.10	35.91	0.00	0.00	55.74	612.35	5012
Av	6277.86	36.80	5.10	38.10	35.91	0.00	0.00	44.09	160.14	500
Pk	6760.93	49.70	5.30	38.60	35.95	0.00	0.00	57.65	762.96	5012
Av	6760.93	40.33	5.30	38.60	35.95	0.00	0.00	48.28	259.42	500

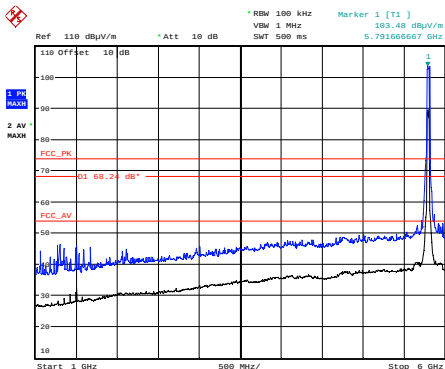


Date: 28.AUG.2015 14:35:31

Bandedge

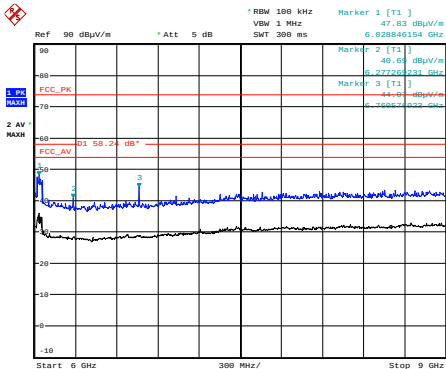


30 MHz – 1 GHz



Date: 29.MAR.2016 14:33:59

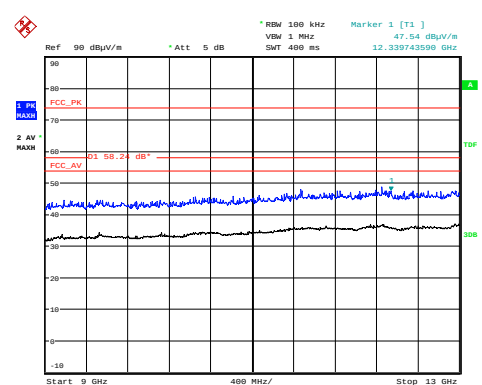
1 GHz – 6 GHz



Date: 30.MAR.2016 15:42:08

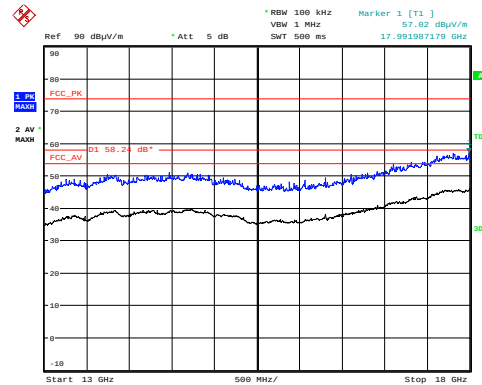
6 GHz – 9 GHz

Modulation: 802.11ac VHT40 – 5795 MHz



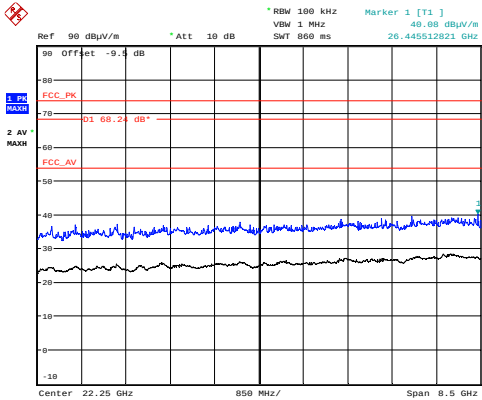
Date: 30.MAR.2016 15:43:06

9 GHz – 13 GHz



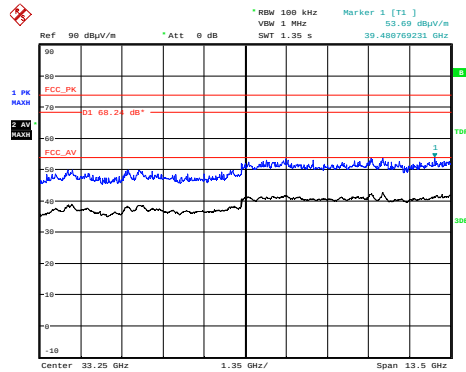
Date: 30.MAR.2016 15:44:08

13 GHz – 18 GHz



Date: 29.MAR.2016 15:23:40

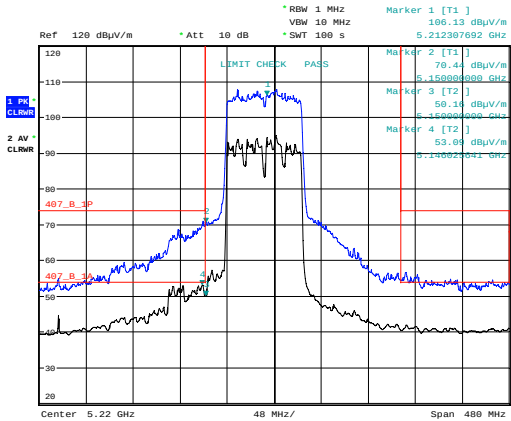
18 GHz – 26.5 GHz



Date: 29.MAR.2016 16:13:09

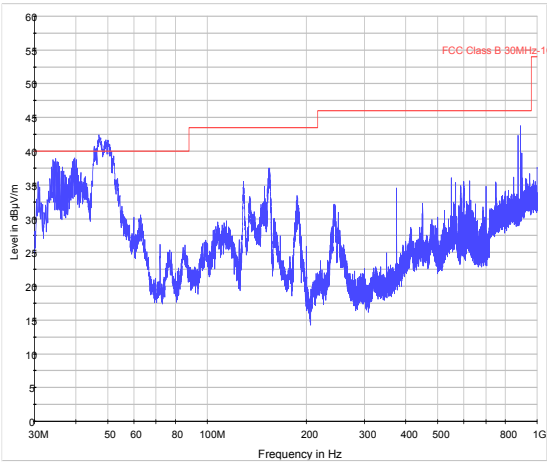
26.5 GHz – 40 GHz

Modulation: 802.11ac VHT80 – 5210 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBµV/m)	Field Strength (µV/m)	Limit (µV/m)
Pk	5788.84	58.01	6.40	33.90	36.17	0.00	0.00	62.14	1279.38	2570
Pk	6946.61	51.89	6.60	35.50	36.50	0.00	0.00	57.49	749.03	2570

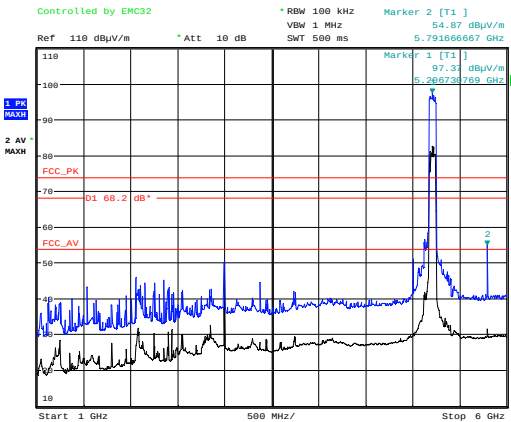


Date: 4.SEP.2015 14:11:19

Bandedge

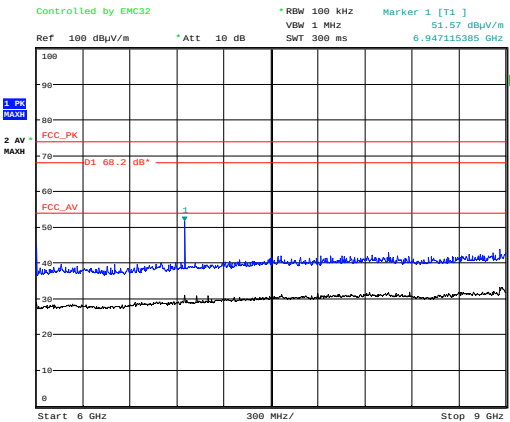


30 MHz – 1 GHz



Date: 8.SEP.2015 10:30:41

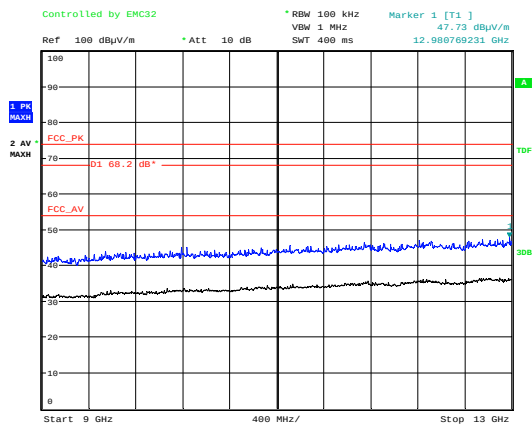
1 GHz – 6 GHz



Date: 8.SEP.2015 10:57:17

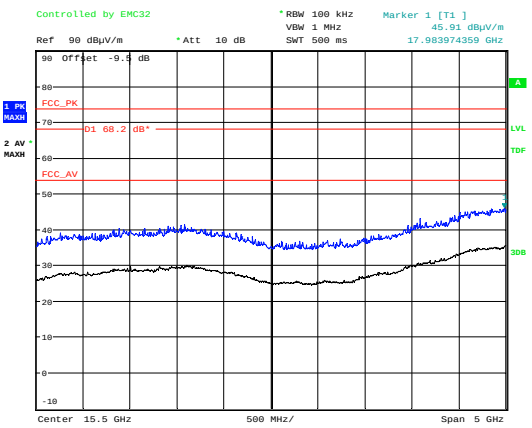
6 GHz – 9 GHz

Modulation: 802.11ac VHT80 – 5210 MHz



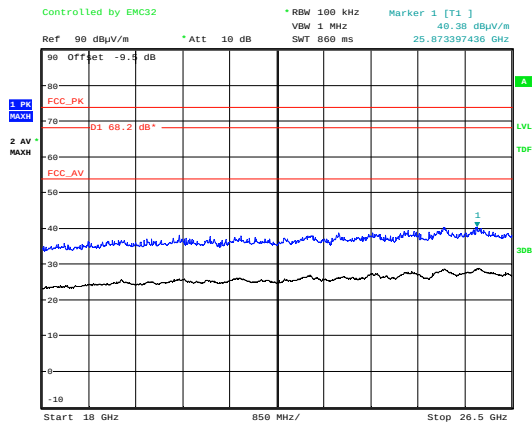
Date: 8.SEP.2015 11:12:46

9 GHz – 13 GHz



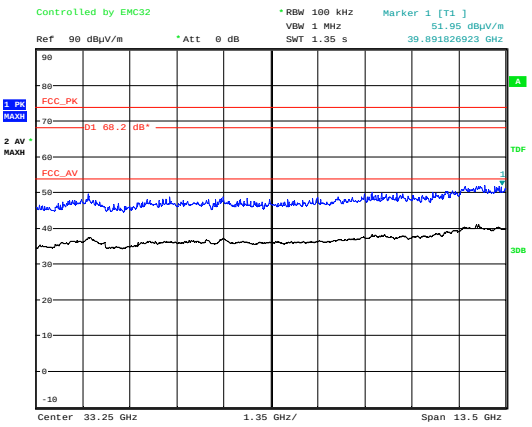
Date: 9.SEP.2015 15:05:23

13 GHz – 18 GHz



Date: 9.SEP.2015 15:29:38

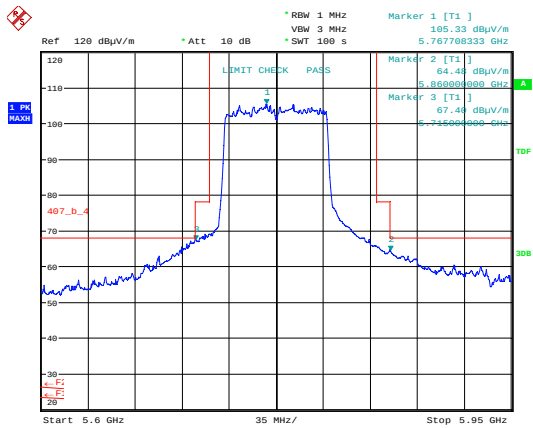
18 GHz – 26.5 GHz



Date: 10.SEP.2015 09:50:40

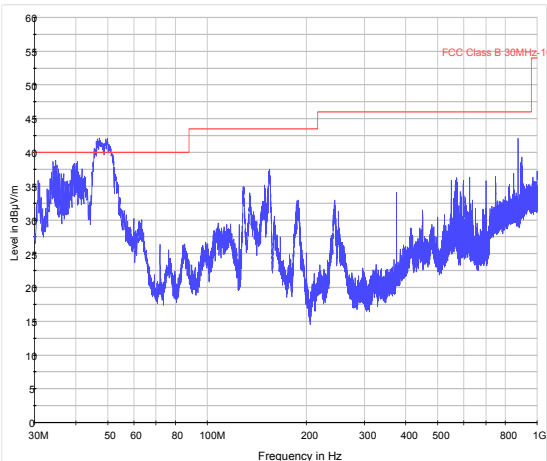
26.5 GHz – 40 GHz

Modulation: 802.11ac VHT80 – 5775 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
Pk	5133.27	51.93	4.50	36.20	35.91	0.00	0.00	56.72	685.49	5012
Pk	6416.54	53.43	5.00	38.30	35.92	0.00	0.00	60.81	1097.74	5012

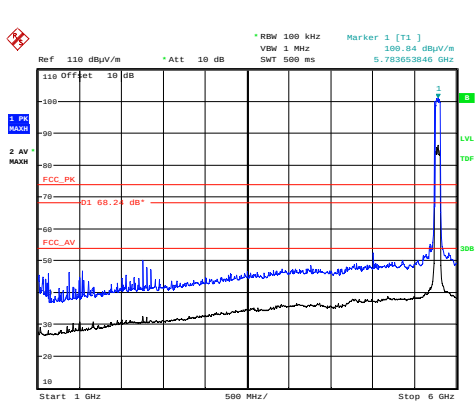


Date: 28.AUG.2015 14:49:25

Bandedge

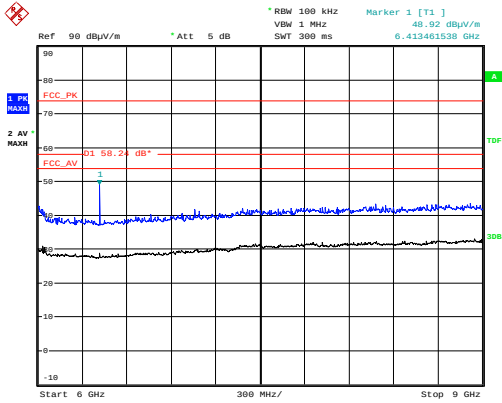


30 MHz – 1 GHz



Date: 29.MAR.2016 14:39:00

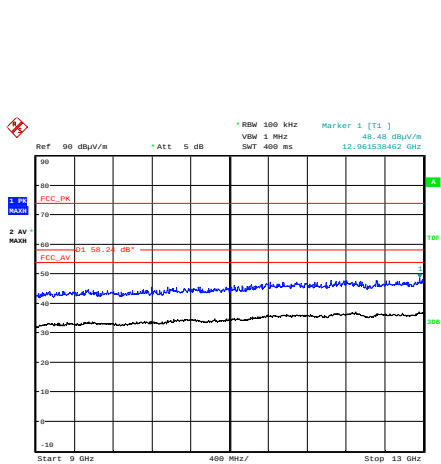
1 GHz – 6 GHz



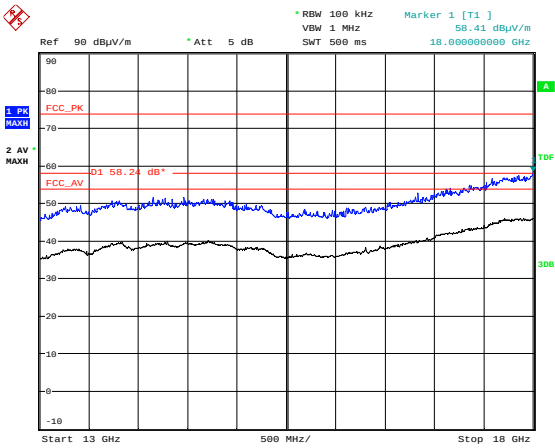
Date: 30.MAR.2016 15:19:11

6 GHz – 9 GHz

Modulation: 802.11ac VHT80 – 5775 MHz



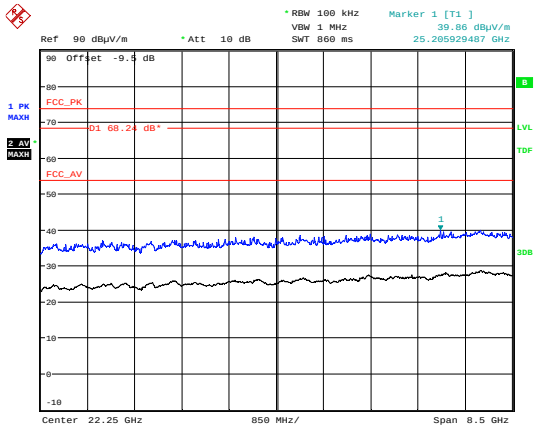
Date: 30.MAR.2016 15:28:59



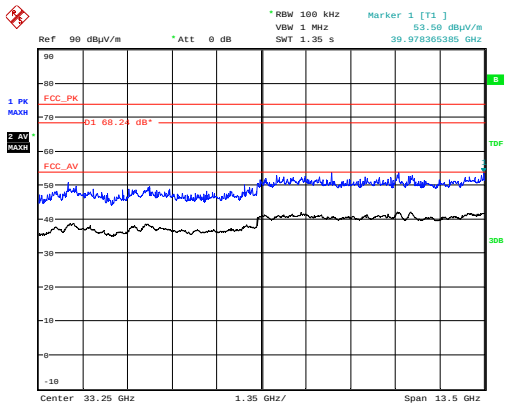
Date: 30.MAR.2016 15:26:23

9 GHz – 13 GHz

13 GHz – 18 GHz



Date: 29.MAR.2016 15:17:13



Date: 29.MAR.2016 16:14:58

18 GHz – 26.5 GHz

26.5 GHz – 40 GHz

12 Occupied Bandwidth

12.1 Definition

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Lab
Test Standard and Clause:	FCC: ANSI C63.10-2013, Clause 11.8, KDB 558074
EUT Channels	36, 40, 48, 38, 46, 42, 149, 457, 165, 151, 159, 155
EUT Channel Bandwidths:	20 MHz / 40 MHz / 80 MHz
EUT Test Modulations:	802.11a , 80211ac VHT20, VHT40, VHT80
Deviations From Standard:	None
Measurement BW:	100 kHz
(FCC requirement: 100 kHz)	
Spectrum Analyzer Video BW:	300 kHz
(requirement at least 3x RBW)	
Measurement Span:	20 MHz
(requirement 2 to 5 times OBW)	25 MHz
	50 MHz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 °C to +35 °C (as declared)
Humidity: 32 % RH	20 % RH to 75 % RH (as declared)
Supply: 110V ac	110 V ac ±10 % (as declared)

12.3 Test Limit

Within the 5.725GHz – 5.825 GHz band the minimum -6 dB bandwidth shall be at least 500 kHz.

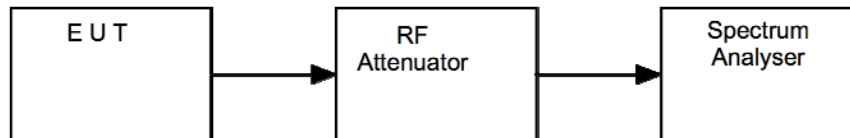
The emission bandwidth is -26 dB down on the maximum level of the modulated carrier.

12.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iii, the bandwidth of the EUT was measured on a spectrum analyser.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

Figure iii Test Setup



12.5 Test Equipment

<i>Type of Equipment</i>	<i>Maker/Supplier</i>	<i>Model Number</i>	<i>Element Number</i>	<i>Calibration Due Date</i>
Spectrum Analyser	R&S	FSU26	REF909	13/02/2016
Spectrum Analyser	R&S	FSU26	UH405	11/05/2016
10 dB Attenuator	Radiall	R411820121	N/A	In Use
20 dB Attenuator	Radiall	R411810121	N/A	In Use

12.6 Test Results

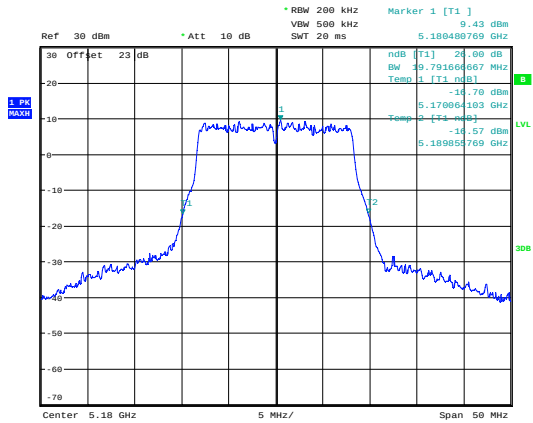
Modulation: 802.11a;					
Channel Frequency (MHz)	Power setting	F_L (MHz)	F_H (MHz)	26dB Bandwidth (kHz)	Result
5180	74	5170.064103	5189.855769	19791.666	PASS
5200	76	5189.983974	5209.855769	19871.795	PASS
5240	73	5230.064103	5249.855769	19791.666	PASS
5745	70	5735.144231	5754.855769	19711.538	PASS
5785	69	5775.144231	5794.855769	19711.538	PASS
5285	71	5815.144231	5834.935897	19791.666	PASS

Modulation: 802.11ac VHT20;					
Channel Frequency (MHz)	Power setting	F_L (MHz)	F_H (MHz)	26dB Bandwidth (kHz)	Result
5180	74	5169.823718	5189.935897	20112.179	PASS
5200	76	5189.903846	5209.935897	20032.051	PASS
5240	73	5229.903846	5249.935897	20032.051	PASS
5745	70	5734.743590	5755.176282	20432.692	PASS
5785	66	5774.823817	5795.016026	20192.209	PASS
5285	74	5814.663462	5835.256410	20592.948	PASS

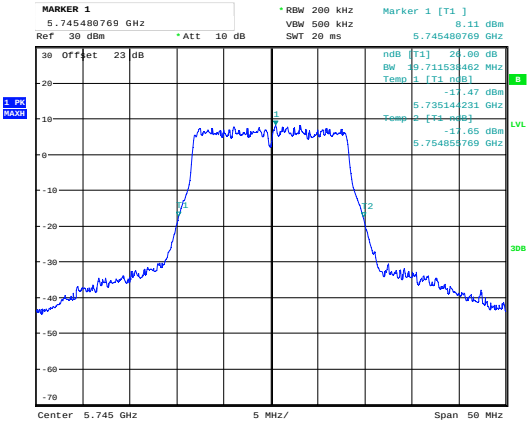
Modulation: 802.11ac VHT40;					
Channel Frequency (MHz)	Power setting	F_L (MHz)	F_H (MHz)	26dB Bandwidth (kHz)	Result
5190	38	5169.871795	5210.128205	40256.41	PASS
5230	46	5209.871795	5250.000000	40128.205	PASS
5755	67	5734.871795	5775.128205	40256.410	PASS
5795	82	5774.871795	5815.000000	40128.205	PASS

Modulation: 802.11ac VHT80;					
Channel Frequency (MHz)	Power setting	F_L (MHz)	F_H (MHz)	26dB Bandwidth (kHz)	Result
5210	58	5168.974359	5251.346154	82371.795	PASS
5775	66	5733.653846	5816.346154	82692.308	PASS

802.11a

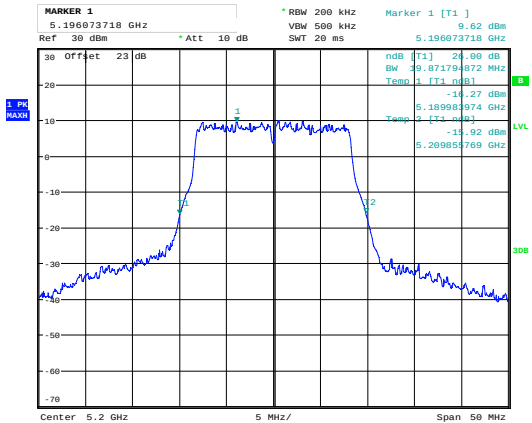


Date: 17.SEP.2015 11:31:43



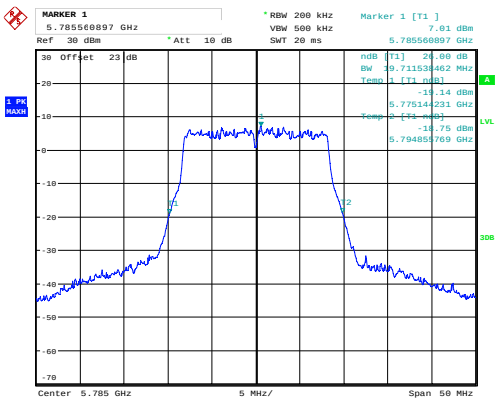
Date: 17.SEP.2015 11:45:06

5180 MHz



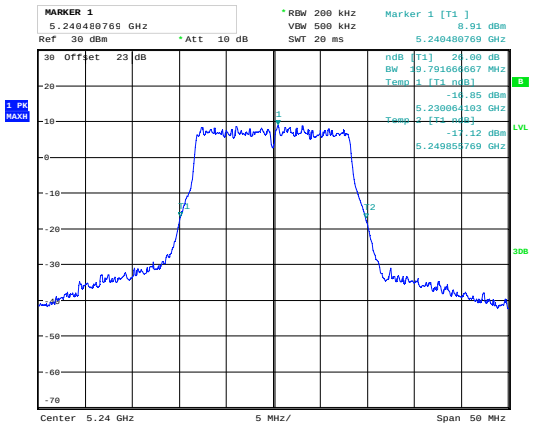
Date: 17.SEP.2015 11:36:44

5745 MHz



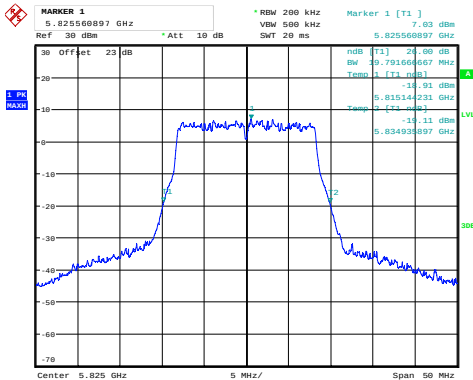
Date: 31.MAR.2016 11:25:14

5200 MHz



Date: 17.SEP.2015 11:40:50

5785 MHz

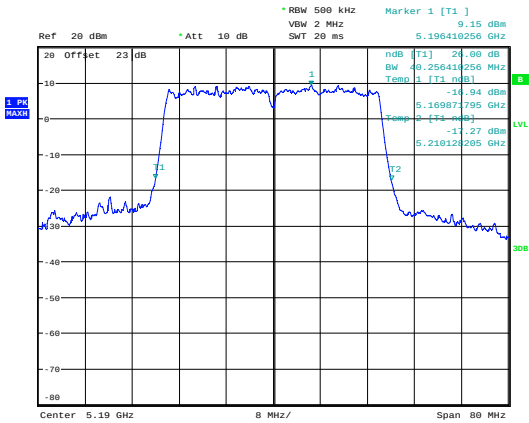


Date: 31.MAR.2016 11:29:27

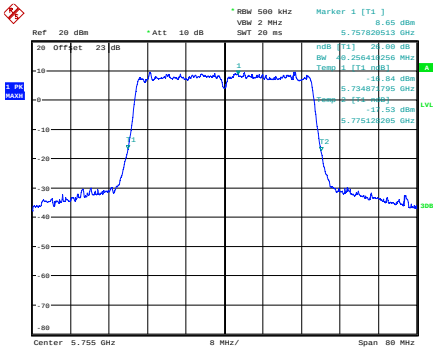
5240 MHz

5825 MHz

802.11ac VH40



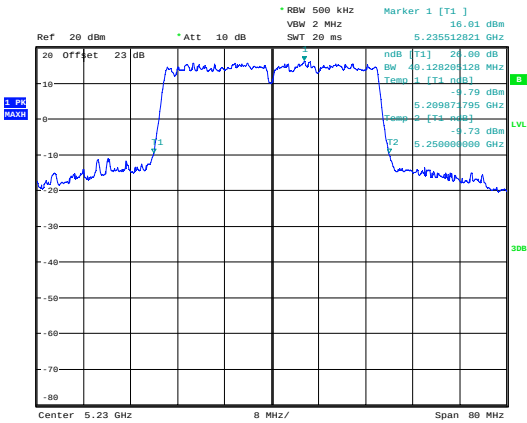
Date: 15.SEP.2015 15:20:00



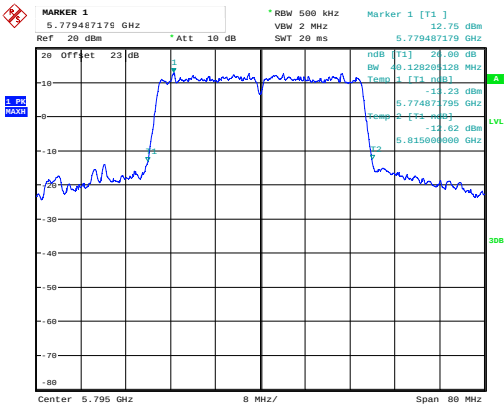
Date: 31.MAR.2016 13:07:05

5190 MHz

5755 MHz



Date: 15.SEP.2015 15:21:24

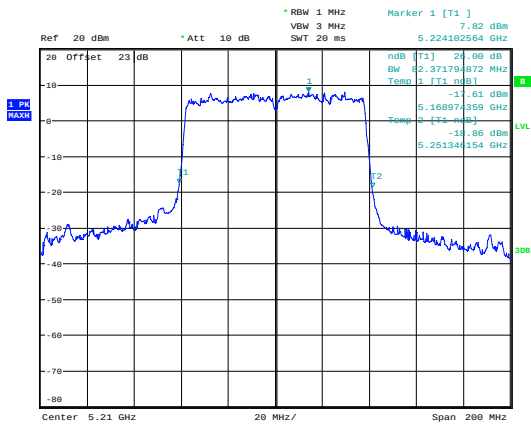


Date: 31.MAR.2016 13:15:21

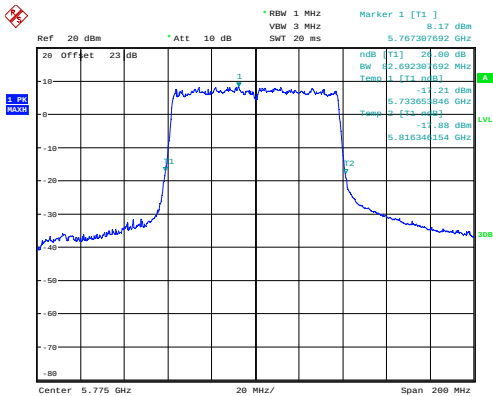
5230 MHz

5795 MHz

802.11ac VH80



Date: 15.SEP.2015 15:24:12



Date: 31.MAR.2016 13:18:58

5210 MHz

5775 MHz

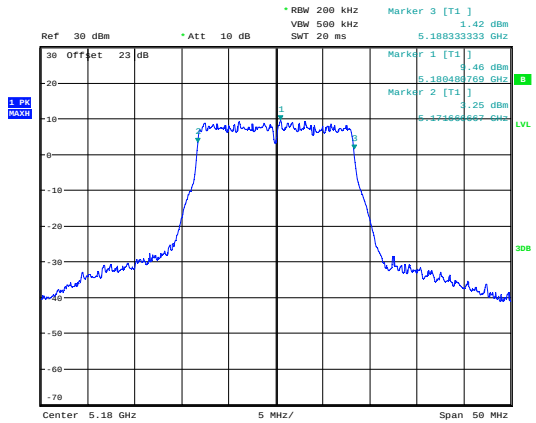
Modulation: 802.11a;					
Channel Frequency (MHz)	Power setting	F_L (MHz)	F_H (MHz)	6dB Bandwidth (kHz)	Result
5180	74	5171.666667	5188.333333	16666.666	PASS
5200	76	5191.666667	5208.249359	16582.692	PASS
5240	73	5231.666667	5248.333333	16666.666	PASS
5475	70	5736.666667	5753.333333	16666.666	PASS
5785	69	5776.666667	5793.317308	16650.641	PASS
5285	71	5816.682692	5833.365385	16682.693	PASS

Modulation: 802.11ac VHT20;					
Channel Frequency (MHz)	Power setting	F_L (MHz)	F_H (MHz)	6dB Bandwidth (kHz)	Result
5180	74	5171.025641	5188.910256	17884.615	PASS
5200	76	5191.025641	5208.910256	17884.615	PASS
5240	73	5231.041667	5249.00641	17964.743	PASS
5475	70	5736.025641	5753.974359	17948.718	PASS
5785	66	5775.945513	5793.939103	17993.590	PASS
5285	74	5816.025641	5833.974359	17948.718	PASS

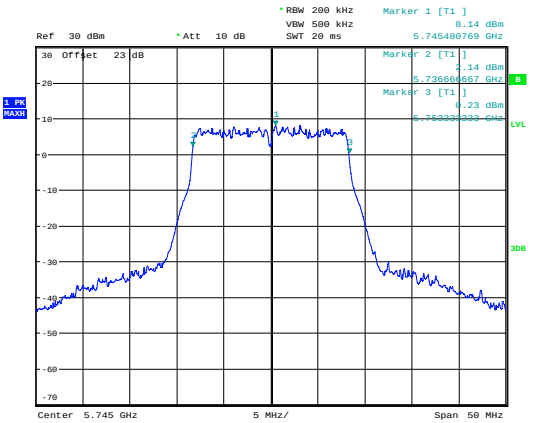
Modulation: 802.11ac VHT40;					
Channel Frequency (MHz)	Power setting	F_L (MHz)	F_H (MHz)	6dB Bandwidth (kHz)	Result
5190	38	5171.538462	5208.410256	36871.794	PASS
5230	46	5211.358974	5248.410256	37051.282	PASS
5755	67	5736.538462	5773.461538	36923.076	PASS
5795	82	5776.589744	5813.461538	36871.794	PASS

Modulation: 802.11ac VHT80;					
Channel Frequency (MHz)	Power setting	F_L (MHz)	F_H (MHz)	6dB Bandwidth (kHz)	Result
5210	58	5171.538462	5248.461538	76923.076	PASS
5775	66	5736.538462	5813.461538	76923.076	PASS

802.11a

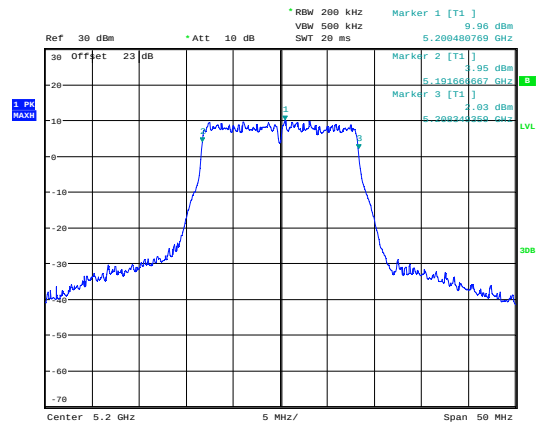


Date: 17.SEP.2015 11:33:11



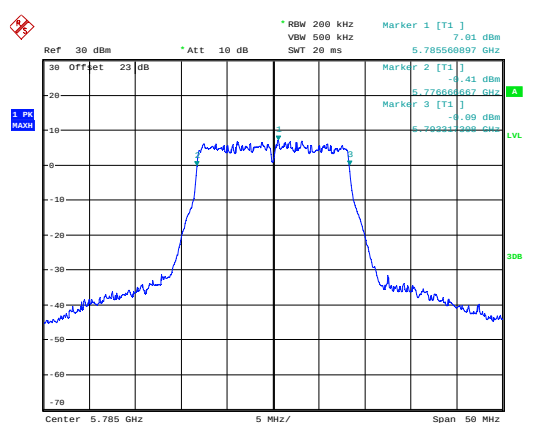
Date: 17.SEP.2015 11:45:56

5180 MHz



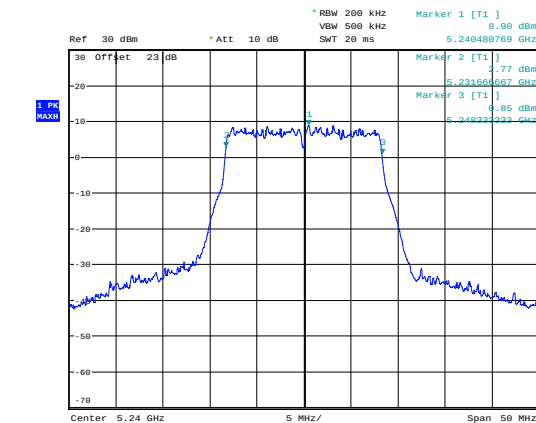
Date: 17.SEP.2015 11:38:11

5745 MHz



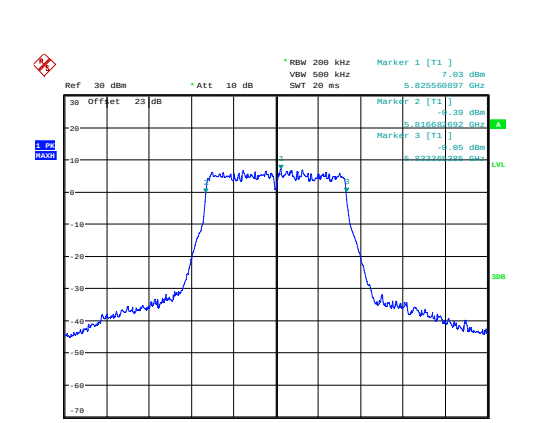
Date: 31.MAR.2016 11:24:24

5200 MHz



Date: 17.SEP.2015 11:39:44

5785 MHz

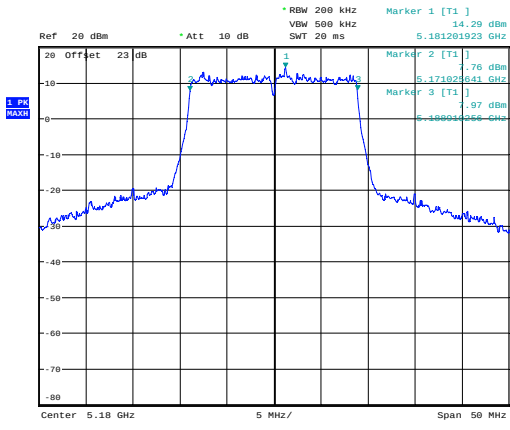


Date: 31.MAR.2016 11:29:54

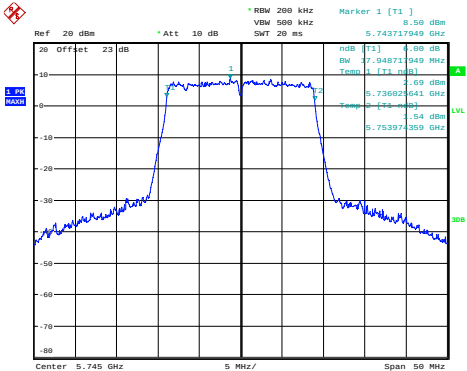
5240 MHz

5825 MHz

802.11ac VH20

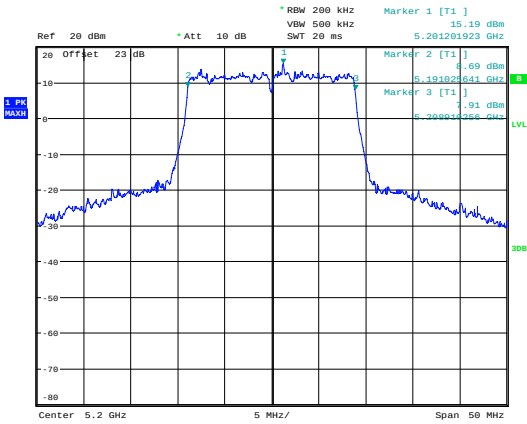


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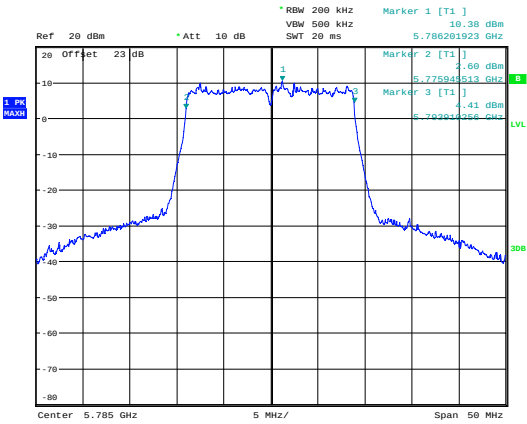
Date: 31.MAR.2016 12:57:27

5180 MHz



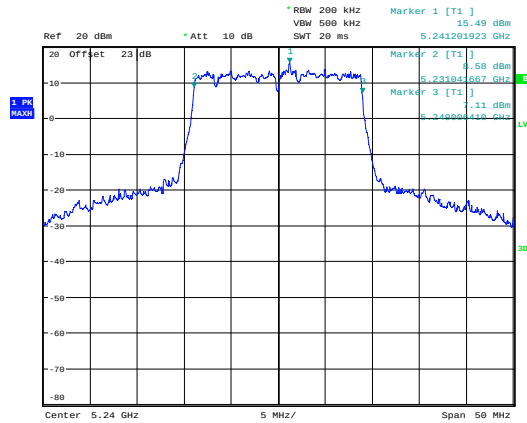
Date: 15.SEP.2015 15:58:59

5745 MHz



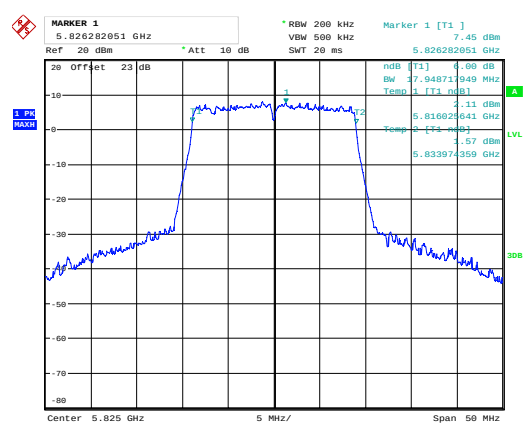
Date: 15.SEP.2015 16:07:39

5200 MHz



Date: 15.SEP.2015 16:01:09

5785 MHz

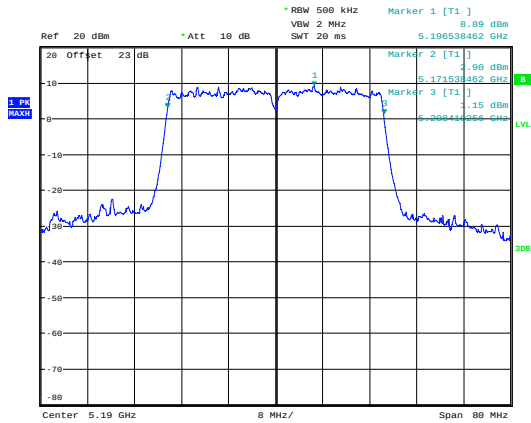


Date: 31.MAR.2016 13:03:02

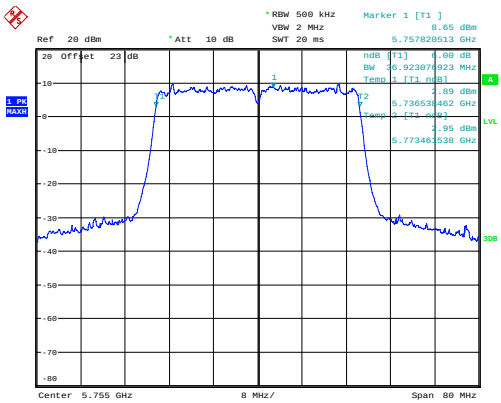
5240 MHz

5285 MHz

802.11ac VH40

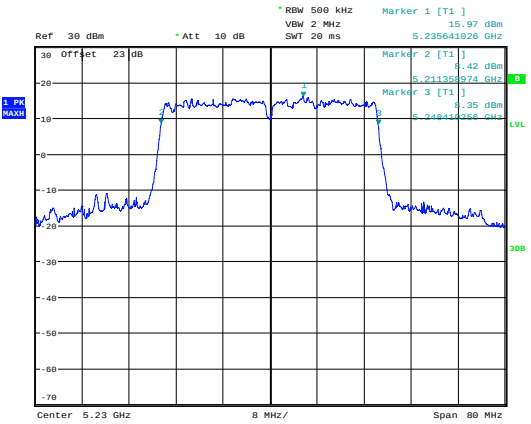


Date: 15.SEP.2015 15:48:00



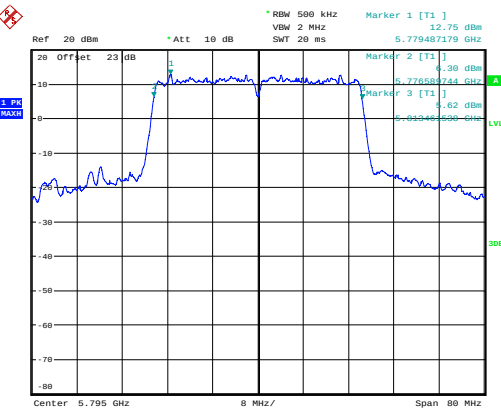
Date: 31.MAR.2016 13:09:36

5190 MHz



Date: 15.SEP.2015 15:49:28

5755 MHz

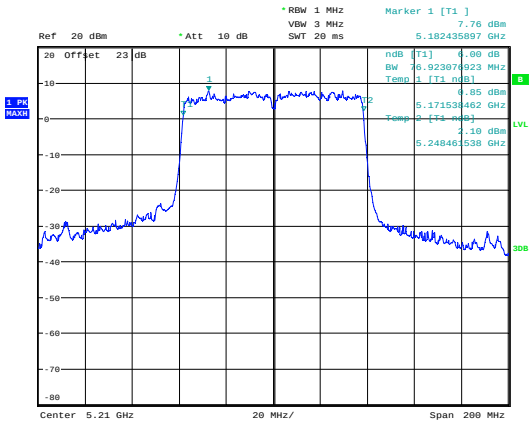


Date: 31.MAR.2016 13:16:09

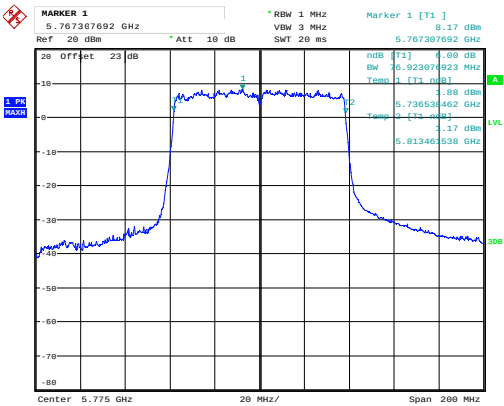
5230 MHz

5795 MHz

802.11ac VH80



Date: 15.SEP.2015 15:35:07



Date: 31.MAR.2016 13:18:20

5210 MHz

5775 MHz

13 Maximum conducted output power

13.1 Definition

The maximum peak conducted output power is defined as the maximum power level measured with a peak detector using a filter with width and shape of which is sufficient to accept the signal bandwidth.

The maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

13.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Lab
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.9.2, KDB 558074
EUT Channels	36, 40, 48, 38, 46, 42, 149, 457, 165, 151, 159, 155
EUT Occupied Bandwidths:	20 MHz / 40 MHz / 80 MHz
EUT Duty Cycle:	<98%
Deviations From Standard:	None
Measurement BW:	1 MHz 25 MHz
Measurement Span:	50 MHz 100MHz
Measurement Detector:	RMS
Voltage Extreme Environment Test Range:	Mains Power = 85 % and 115 % of Nominal (FCC only requirement); Battery Power = new battery.

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 °C to +35 °C (as declared)
Humidity: 37 % RH	20 % RH to 75 % RH (as declared)

13.3 Test Limit

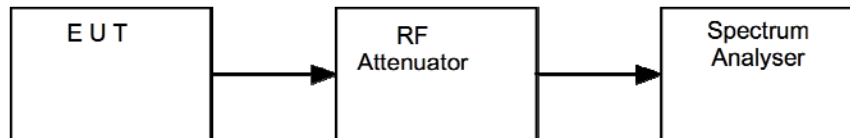
For indoor and outdoor access points operating in the bands 5.15 – 5.25 GHz and any device operating in the band 5725 to 5850 MHz, the maximum peak conducted output power shall not exceed 1 W.

13.4 Test Method

The EUT was setup as per section 9 of this report and, as per Figure iv, the analyser was used to measure each antenna output in turn, having taken account of all path losses. The resolution bandwidth of the spectrum analyser was set between 1 and 5 % of the EUT occupied bandwidth and the analyser band power function used to calculate the average power. The results were summed as in the tables below.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

Figure iv Test Set-up



13.5 Test Equipment

<i>Type of Equipment</i>	<i>Maker/Supplier</i>	<i>Model Number</i>	<i>Element Number</i>	<i>Calibration Due Date</i>
Spectrum Analyser	R&S	FSU26	REF909	13/02/2016
Spectrum Analyser	R&S	FSU26	UH405	11/05/2016
10 dB Attenuator	Radiall	R411820121	N/A	In Use
20 dB Attenuator	Radiall	R411810121	N/A	In Use

13.6 Test Results

Modulation: 802.11a; Data rate: 54Mbps					
Channel (MHz)	Power setting	Antenna Chain	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)
5180	74	0	-3.92	23	80.91
		1	-4.03	23	78.89
		2	-4.33	23	73.62
Total:					233.42
Result:					PASS
5200	76	0	-3.54	23	88.31
		1	-3.67	23	85.70
		2	-3.97	23	79.98
Total:					254.00
Result:					PASS
5240	73	0	-4.60	23	69.18
		1	-4.64	23	68.55
		2	-4.78	23	66.37
Total:					204.11
Result:					PASS
5745	70	0	-5.34	23	58.34
		1	-5.06	23	62.23
		2	-5.05	23	62.37
Total:					182.95
Result:					PASS
5785	69	0	-6.41	23	45.60
		1	-6.25	23	47.32
		2	-6.08	23	49.20
Total:					142.12
Result:					PASS
5825	74	0	-5.66	23	54.20
		1	-5.66	23	54.20
		2	-5.43	23	57.15
Total:					165.55
Result:					PASS

Modulation: 802.11ac VHT20; Data rate: MCS9					
Channel MHz	Power setting	Antenna Chain	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)
5180	81	0	-2.29	23	117.76
		1	-4.34	23	73.45
		2	-2.46	23	113.24
Total:					132.57
Result:					PASS
5200	84	0	-1.81	23	131.52
		1	-1.65	23	136.46
		2	-3.12	23	97.27
Total:					179.65
Result:					PASS
5240	84	0	-2.02	23	125.31
		1	-2.14	23	121.90
		2	-3.37	23	91.83
Total:					168.81
Result:					PASS
5745	70	0	-5.89	23	51.40
		1	-5.82	23	52.24
		2	-5.62	23	54.70
Total:					158.35
Result:					PASS
5785	70	0	-5.31	23	58.75
		1	-5.38	23	57.81
		2	-5.00	23	63.10
Total:					179.65
Result:					PASS
5825	74	0	-5.32	23	58.61
		1	-5.50	23	56.23
		2	-4.90	23	64.57
Total:					179.41
Result:					PASS

Modulation: 802.11ac VHT40; Data rate: MCS9					
Channel MHz	Power setting	Antenna Chain	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)
5190	60	0	-7.04	23	39.45
		1	-7.38	23	36.48
		2	-6.98	23	39.99
Total:					115.92
Result:					PASS
5230	88	0	-0.65	23	171.79
		1	-0.88	23	162.93
		2	0.17	23	207.49
Total:					542.21
Result:					PASS
5755	67	0	-6.01	23	50.00
		1	-5.93	23	50.93
		2	-5.48	23	56.49
Total:					157.43
Result:					PASS
5795	82	0	-2.78	23	105.20
		1	-2.68	23	107.65
		2	-2.20	23	120.23
Total:					333.07
Result:					PASS

Modulation: 802.11ac VHT80; Data rate: MCS9					
Channel MHz	Power setting	Antenna Chain	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)
5210	58	0	-8.22	23	30.06
		1	-8.26	23	29.79
		2	-8.62	23	27.42
Total:					87.26
Result:					PASS
5775	66	0	-6.99	23	39.90
		1	-6.77	23	41.98
		2	-6.46	23	45.08
Total:					126.96
Result:					PASS

14 Power spectral density

14.1 Definition

The power per unit bandwidth.

14.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Lab
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.10
EUT Channels / Frequencies Measured:	36, 40, 48, 38, 46, 42, 149, 457, 165, 151, 159, 155
EUT Channel Bandwidths:	20 MHz / 40 MHz / 80 MHz
Deviations From Standard:	None
Measurement BW:	1 MHz , 500 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	10 MHz, 5 MHz
Measurement Span: (requirement 1.5 times Channel BW)	50 MHz, 100 MHz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 °C to +35 °C (as declared)
Humidity: 32 % RH	20 % RH to 75 % RH (as declared)
Supply: 110V ac	110V ac ±10% (as declared)

14.3 Test Limit

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 17 dBm in any 1MHz bandwidth in the band 5.15 GHz – 5.25 GHz or 30 dBm in any 500 kHz bandwidth in the band 5.725 GHz – 5.825 GHz during any time interval of continuous transmission. If transmitting antennas of directional gain greater than 6dBi are used maximum power spectral density shall be reduced by the amount in dB that the directional gain exceeds 6 dBi

Frequency (MHz)	5180	5200	5240	5475	5875	5285
Direction Gain of Antenna*	8.73	8.22	8.42	8.20	8.34	8.49
Exceeds 6 dBi ?	Yes	Yes	Yes	Yes	Yes	Yes
Exceeds 6 dBi by	2.73	2.22	2.42	2.20	2.34	2.49
Spec limit (dBm/MHz)	17	17	17	30	30	30
Number Of Antennas	3	3	3	3	3	3
Correlated Signals	Yes	Yes	Yes	Yes	Yes	Yes
Limit (dBm)	14.27	14.78	14.58	27.80	27.66	27.51

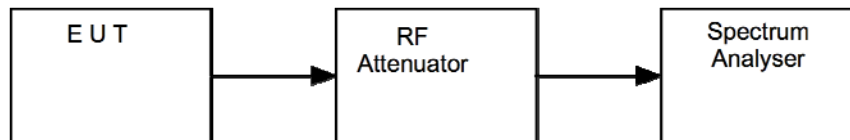
* Directional Gain of antenna Calculated as per KDB 662911 D01 Multiple Transmitter Output v02r01
 Directional gain = $10 \log[(10G1/20 + 10G2/20 + \dots + 10GN/20)^2 / NANT]$ dBi

14.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure vi, the peak emission of the EUT was measured on a spectrum analyser, with path losses taken into account.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

Figure vi Test Setup



14.5 Test Equipment

<i>Type of Equipment</i>	<i>Maker/Supplier</i>	<i>Model Number</i>	<i>Element Number</i>	<i>Calibration Due Date</i>
Spectrum Analyser	R&S	FSU26	REF909	13/02/2016
Spectrum Analyser	R&S	FSU26	UH405	11/05/2016
10 dB Attenuator	Radiall	R411820121	N/A	In Use
20 dB Attenuator	Radiall	R411810121	N/A	In Use

14.6 Test Results

Modulation: 802.11a; Data rate: 54Mbps					
Channel (MHz)	Power setting	Antenna Chain	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)
5180 [#]	74	0	-14.00	23.00	7.94
		1	-14.07	23.00	7.81
		2	-17.00	23.00	3.99
Total (dBm):					12.95
Result:					PASS
5200 [#]	76	0	-13.80	23.00	8.31
		1	-13.73	23.00	8.45
		2	-14.37	23.00	7.30
Total (dBm):					13.81
Result:					PASS
5240 [#]	73	0	-14.88	23.00	6.49
		1	-14.89	23.00	6.47
		2	-15.44	23.00	5.71
Total (dBm):					12.71
Result:					PASS
5745 ^{\$}	70	0	-18.39	23	2.89
		1	-18.27	23	2.97
		2	-18.57	23	2.77
Total (dBm):					9.36
Result:					PASS
5785 ^{\$}	69	0	-19.24	23	2.38
		1	-19.36	23	2.31
		2	-19.10	23	2.45
Total (dBm):					8.54
Result:					PASS
5825 ^{\$}	71	0	-18.61	23	2.75
		1	-18.54	23	2.79
		2	-18.34	23	2.92
Total (dBm):					9.28
Result:					PASS

Measurements As Per KDB KDB 662911 D01 Multiple Transmitter Output v02r012) In-Band Power Spectral Density (PSD) Measurements

a) Measure and sum the spectra across the outputs

\$ b) Measure and sum spectral maxima across the outputs

Modulation: 802.11ac VHT20; Data rate: MCS9					
Channel MHz	Power setting	Antenna Chain	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)
5180 [#]	81	0	-13.55	23.00	8.82
		1	-13.11	23.00	9.74
		2	-13.55	23.00	8.81
Total (dBm):					14.18
Result:					PASS
5200 [#]	84	0	-13.03	23.00	9.93
		1	-13.29	23.00	9.34
		2	-13.16	23.00	9.64
Total (dBm):					14.47
Result:					PASS
5240 [#]	84	0	-13.88	23.00	8.16
		1	-13.06	23.00	9.85
		2	-12.55	23.00	11.08
Total (dBm):					14.43
Result:					PASS
5745 ^{\$}	70	0	-19.88	23	2.05
		1	-19.04	23	2.49
		2	-19.40	23	2.29
Total (dBm):					8.34
Result:					PASS
5785 ^{\$}	70	0	-19.18	23	2.41
		1	-18.92	23	2.56
		2	-18.49	23	2.82
Total (dBm):					8.92
Result:					PASS
5825 ^{\$}	74	0	-18.92	23	2.56
		1	-18.61	23	2.75
		2	-18.92	23	2.56
Total (dBm):					8.80
Result:					PASS

Measurements As Per KDB KDB 662911 D01 Multiple Transmitter Output v02r012) In-Band Power Spectral Density (PSD) Measurements

a) Measure and sum the spectra across the outputs

\$ b) Measure and sum spectral maxima across the outputs

Modulation: 802.11ac VHT40; Data rate: MCS9					
Channel MHz	Power setting	Antenna Chain	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)
5190 ^{\$}	60	0	-20.99	23	1.59
		1	-20.68	23	1.71
		2	-20.75	23	1.68
Total (dBm):					6.97
Result:					PASS
5230 ^{\$}	88	0	-14.68	23	6.79
		1	-14.52	23	7.05
		2	-14.44	23	7.18
Total (dBm):					13.23
Result:					PASS
5755 ^{\$}	67	0	-23.54	23	0.88
		1	-22.63	23	1.09
		2	-22.23	23	1.19
Total (dBm):					5.01
Result:					PASS
5795 ^{\$}	82	0	-19.80	23	2.09
		1	-19.29	23	2.35
		2	-19.27	23	2.36
Total (dBm):					8.32
Result:					PASS

Measurements As Per KDB KDB 662911 D01 Multiple Transmitter Output v02r012) In-Band Power Spectral Density (PSD) Measurements

a) Measure and sum the spectra across the outputs

\$ b) Measure and sum spectral maxima across the outputs

Modulation: 802.11ac VHT80; Data rate: MCS9					
Channel MHz	Power setting	Antenna Chain	Analyzer Level (dBm)	Cable loss (dB)	Power (mW)
5210 ^{\$}	58	0	-25.43	23	0.57
		1	-24.73	23	0.67
		2	-25.15	23	0.61
Total (dBm):					2.68
Result:					PASS
5775 ^{\$}	66	0	-26.53	23	0.44
		1	-25.68	23	0.54
		2	-26.11	23	0.49
Total (dBm):					1.68
Result:					PASS

Measurements As Per KDB KDB 662911 D01 Multiple Transmitter Output v02r012) In-Band Power Spectral Density (PSD) Measurements

a) Measure and sum the spectra across the outputs

\$ b) Measure and sum spectral maxima across the outputs

15 Frequency Stability

15.1 Definition

The Frequency stability is the accuracy of the transmitted signal under extreme operating conditions.

15.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Lab
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.8
EUT Channels / Frequencies Measured:	5240 MHz
Deviations From Standard:	None
Temperature Extreme Environment Test Range:	N/A
Voltage Extreme Environment Test Range:	N/A

Environmental Conditions (Normal Environment)

Temperature: 20 °C	+15 °C to +35 °C (as declared)
Humidity: 43 % RH	20 % RH to 75 % RH (as declared)
Supply: 110 V ac	110 V ac ± 15 % (as declared)

15.3 Test Limit

Ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified.

15.4 Test Method

15.5 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

In the case the EUT is designed for operation from a lead-acid battery power source, the extreme test voltages are evaluated between 90% and 130% of the nominal battery voltage declared by the manufacturer.

For float charge applications using gel-cell type batteries, extreme test voltages are evaluated between 85% and 115% of the nominal battery voltage declared.

For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

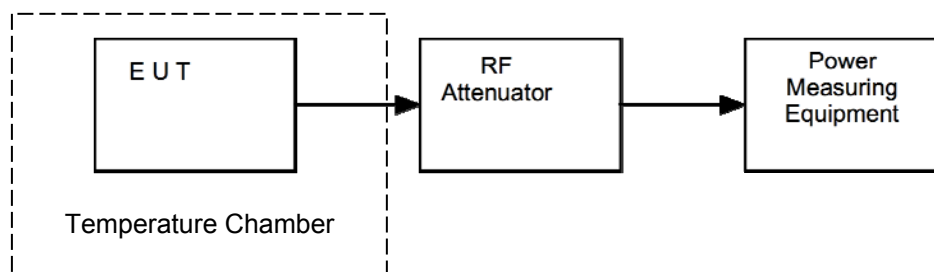
15.6 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

Tests are performed at the upper and lower extremes as required and typically at 10° steps between.

Before any temperature measurements are made, the equipment is allowed to reach a thermal balance in the test chamber.

Figure vii Test Setup



15.7 Test Equipment

Type of Equipment	Maker/Supplier	Model Number	Element Number	Calibration Due Date
Spectrum Analyser	R&S	FSU26	UH405	11/05/2016
Multimeter	Agilent	34405a	REF976	03/06/2016
Temperature indicator	Fluke	52 Series II	L426	30/05/2016
Temperature chamber	ETC		U522	Use L426
Variac	Farnell		U34	Use REF976

15.8 Test Results

Power Supply Variation

Frequency Stability Vs Voltage variation			
Operating Frequency - 5240 MHz			
Volts	Temp °C	Fc (MHz)	Drift (PPM)
100%	20	5239.945	-10.496
115%	20	5239.938	-11.928
85%	20	5239.747	-48.378

Thermal Variation

Frequency Stability Vs Temperature variation			
Operating Frequency - 5240 MHz			
Volts	Temp °C	Fc (MHz)	Drift (PPM)
100%	-30	5240.000	0.000
100%	-20	5240.040	7.646
100%	-10	5239.990	-1.908
100%	0	5239.958	-8.111
100%	10	5239.960	-7.646
100%	20	5239.945	-10.496
100%	30	5239.898	-19.561
100%	40	5239.898	-19.561
100%	50	5239.923	-14.790

16 Measurement Uncertainty

Calculated Measurement Uncertainties

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95 % confidence:

[1] Radiated spurious emissions

Uncertainty in test result (30 MHz to 1 GHz) = **4.6 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[2] AC power line conducted emissions

Uncertainty in test result = **3.4 dB**

[3] Occupied bandwidth

Uncertainty in test result = **15.5 %**

[4] Conducted carrier power

Uncertainty in test result (Power Meter) = **1.08 dB**

[5] Conducted / radiated RF power out-of-band

Uncertainty in test result – up to 8.1 GHz = **3.31 dB**

Uncertainty in test result – 8.1 GHz to 15.3 GHz = **4.43 dB**

Uncertainty in test result (30 MHz to 1 GHz) = **4.6 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[6] Power spectral density

Uncertainty in test result (Spectrum Analyser) = **2.48 dB**