Emissions
Test Report

EUT Name: Audio Player

Model No.: No519

CFR 47 Part 15.407 2015 and RSS 247: 2015

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0	06/06/2016	Original Document	N/A
1	07/21/2016	Corrected minor error to test report.	Kerwinn Corpuz
2	10/07/2016	Replaced model from No.519 to No519	Kerwinn Corpuz

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:	Harman International Industries, Inc 50 Waterview Drive, Suite 240 Shelton, CT 06484 (203) 924-5349
Requester / Applicant:	John Garay
Name of Equipment:	Audio Player
Model No.	No519
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.407 2015 and RSS 247: 2015
Test Dates:	09 Feb 2016 to 05 Apr 2016

Guidance Documents:

Emissions: ANSI C63.10-2013, KDB 789033 D02 General UNII Test Procedures New Rules v01r02

Test Methods:

Emissions: ANSI C63.10-2013, KDB 789033 D02 General UNII Test Procedures New Rules v01r02

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by A2LA or any agency of the U.S. Government. This report contains data that are not covered by A2LA accreditation. This report shall not be reproduced except in full, without the written authorization of TUV Rheinland of North America.

Kerwinn Corpuz		David Spencer	
Test Engineer	Date July 21, 2016	A2LA Signatory	Date July 21, 2016

Testing Cert #3331.02 **US5254** **2932M-1**

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1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.407 2015 and RSS 247: 2015 based on the results of testing performed on 09 Feb 2016 to 05 Apr 2016 on the Audio Player Model No519 manufactured by Harman International Industries, Inc This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report. The 5500 MHz to 5700 MHz frequency band is covered in this document.

Operation between 5600MHz and 5650MHz (Channels 120, 124 and 128) is blocked by permanent configuration settings.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.10: 2013	Test Parameters (Measured)	Result
Spurious Emission in Transmitted Mode	CFR47 15.209, CFR47 15.407 (b) RSS-GEN Sect.7.2.3, RSS 247 Sect. 6.2.3.2	Class B	**Complied**
Restricted Bands of Operation	CFR47 15.205, RSS GEN Sect.8.10	Class B	**Complied**
AC Power Conducted Emission	CFR47 15.207, RSS-GEN Sect.8.8	Class B	**Complied**
Occupied Bandwidth	CFR47 15.407 (a), RSS GEN Sect.6.6	See plots	**Complied**
Maximum Output Power	CFR47 15.407 (a) [see note 2]	14.35 dBm (11a mode) 13.83 dBm (HT 20) 12.88 dBm (HT 40)	**Complied**
Maximum Output Power	RSS 247 Sect.6.2.3.1 [see note 3]	86.10 mW (11a mode) 78.38 mW (HT 20) 61.38 mW (HT 40)	**Complied**
Peak Power Spectral Density	CFR47 15.407 (a), RSS 247 Sect.6.2.3.1	< 11 dBm/MHz	**Complied**
Conducted Emission – Antenna Port	CFR47 15.407 (b), RSS 247 Sect.6.2.3.2	30 MHz - 40 GHz < -27 dBm/MHz	**Complied**
Frequency Stability	CFR47 15.407 (g), RSS GEN Sect. 6.11	±20 ppm	**Complied**
RF Exposure	CFR47 15.247 (f), 2.1091 RSS-102 Issue 5	General Population	**Complied**

Note: 1. This test report covers 5470 MHz to 5725MHz band.
2. Measurement are conducted.
3. Max power, 1 Spatial Stream, are in E.I.R.P.

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

None

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 is recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (US5254). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / A2LA

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:1999 and ISO 9002 (Lab Code Testing Cert #3331.02). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932M). This reference number is the indication to the Industry Canada Certification Officers that the site meets the requirements of RSS 212, Issue 1 (Provisional). The accreditation is updated every 3 years.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0031

VCCI Registration No. for Santa Clara: A-0032

2.1.5 Acceptance by Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / A2LA accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, Pleasanton, California 94566, USA. The 2305 Mission College, Santa Clara, 95054, USA location is considered a Pleasanton annex.

2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 and 5 meters. The site is listed with the FCC and accredited by A2LA (Lab Code Testing Cert #3331.02). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meter and 5 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 4.8 m x 3.175 mm thick aluminum floor connected to PE ground.

For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors.

For EFT, Surge, PQF, the HCP and VCP are removed.

RF Field Immunity testing is performed in a 7.3m x 4.3m x 4.1m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.8m x 3.7m x 3.175mm thick aluminum ground plane.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.3.2 Measurement Uncertainty

Per CISPR 16-4-2	**U_{lab}**	**U_{cispr}**
Radiated Disturbance @ 10 meters		
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
1 – 6 GHz	2.12 dB	4.25 dB
6 – 18 GHz	2.47 dB	4.93 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.3 dB

Voltech PM6000A

The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 5.0%.	Per CISPR 16-4-2 Methods

2.3.3 Measurement Uncertainty Immunity

The estimated combined standard uncertainty for ESD immunity measurements is ± 8.2%.	Per IEC 61000-4-2
The estimated combined standard uncertainty for radiated immunity measurements is ± 4.10 dB.	Per IEC 61000-4-3
The estimated combined standard uncertainty for conducted immunity measurements with CDN is ± 3.66 dB	Per IEC 61000-4-6
The estimated combined standard uncertainty for power frequency magnetic field immunity is ± 2.9%.	Per IEC 61000-4-8

Thermo KeyTek EMC Pro

The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 2.6%.
The estimated combined standard uncertainty for surge immunity measurements is ± 2.6%.
The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 1.74%.

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

3 Product Information

3.1 Product Description

The Model No519, Mark Levinson Audio Player, a modern music player. It combines wireless and wired music streaming with a traditional CD player, plus connections for USB drives, additional digital sources, and Bluetooth audio and HARMAN Clari-Fi® technology for home capable of operating in the 2.4 GHz and 5 GHz frequency bands over 20 MHz and 40 MHz channels.

3.2 Equipment Configuration

A description of the equipment configuration is given in the Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.3 Operating Mode

A description of the operation mode is given in the Test Plan Section. In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.4 Unique Antenna Connector

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of CFR47 Parts 15.211, 15.213, 15.217, 15.219, or 15.221.

3.4.1 Results

The Audio Player has an external Omnidirectional antenna and has maximum gain + 5.0 dBi. There are no beam forming and no additional antenna available.

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.407: 2015 and RSS 247: 2015. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Procedures described in section 8 of the standard were used.

4.1 Output Power Requirements

The maximum output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

The maximum output power and harmonics shall not exceed CFR47 Part 15.407 (a):2015 and RSS 247 Sect. 6.2.3.1: 2015

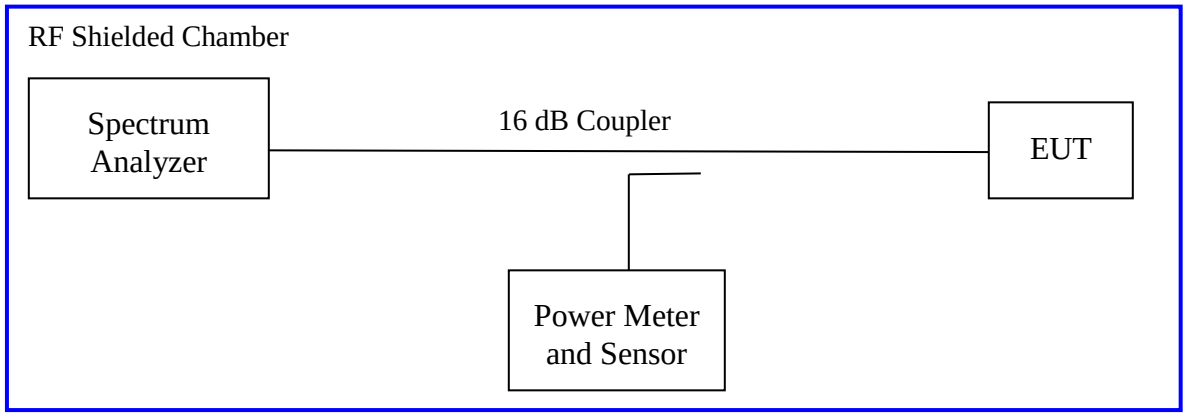
The maximum transmitted powers are (worse case)

Band 5470-5725 MHz: 250 mW or 11 + 10Log(B) where B is the 99% emission bandwidth.

4.1.1 Test Method

The ANSI C63.10-2013 Section 12.3.2.2 conducted method was used to measure the channel power output. The preliminary investigation was performed at different data rate/ chain to determine the highest power output for each mode. The worst findings were conducted on 3 channels in each operating range per CFR47 Part 15.407(a): 2015 and RSS 247 Sect. 6.2.3.1; 5470 MHz to 5600 MHz and 5650 MHz to 5725 MHz. The worst mode results indicated below.

Test Setup:



Method SA-1 of "Guidelines for Complance Testing of Unlicensed National Information Infrastructure (U-NII) Devices"applies since the EUT continuously transmit; where duty cycle is greater than 98%. Sample detector was used.

4.1.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 2: RF Output Power at the Antenna Port – Test Results

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		**Power Setting:** See test plan	
Max. Directional Gain: + 5.0 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 21° C		**Relative Humidity:**34%	
802.11a (FCC Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5500.00	24.00	13.29	-10.71
5580.00	24.00	13.98	-10.02
5700.00	24.00	14.35	-9.65
802.11a (RSS Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5500.00	24.00	13.29	-10.71
5580.00	24.00	13.98	-10.02
5700.00	24.00	14.35	-9.65
Note: 1.The highest output power was observed at 6Mbps, 1 Data Stream. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			

Table 3: RF Output Power at the Antenna Port – Test Results Continues

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		**Power Setting:** See test plan	
Max. Directional Gain: + 5 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 21° C		**Relative Humidity:**34%	
802.11n (FCC Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5500.00	24.00	12.43	-11.57
5580.00	24.00	13.19	-10.81
5700.00	24.00	13.83	-10.17
802.11n (RSS Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5500.00	24.00	12.43	-11.57
5580.00	24.00	13.19	-10.81
5700.00	24.00	13.83	-10.17

Note: 1.The highest output power was observed at HT20 MCS0, 1 Data Stream.
2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.

Table 4: RF Output Power at the Antenna Port – Test Results Continues

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		**Power Setting:** See test plan	
Max. Directional Gain: + 5 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 21° C		**Relative Humidity:**34%	
802.11n (FCC Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5510.00	24.00	12.10	-11.90
5550.00	24.00	12.24	-11.76
5670.00	24.00	12.88	-11.12
802.11n (RSS Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5510.00	24.00	12.10	-11.90
5550.00	24.00	12.24	-11.76
5670.00	24.00	12.88	-11.12

Note: 1.The highest output power was observed at HT40 MCS0, 1 Data Stream.
2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.

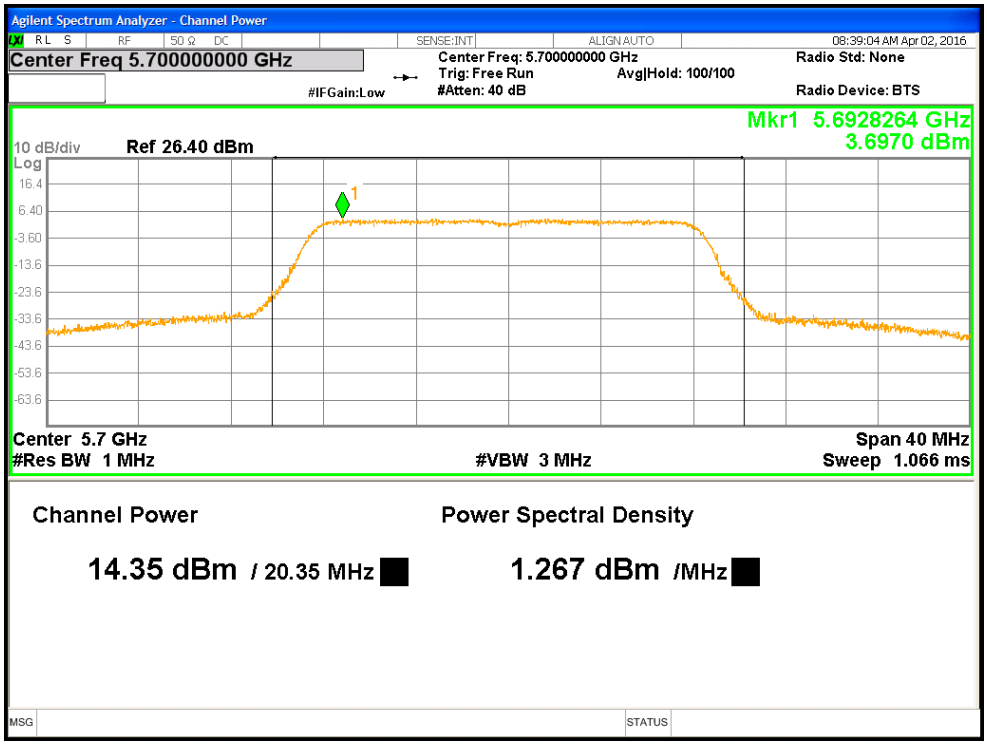


Figure 1: Maximum Transmitted Power, 5700 MHz at 802.11a 6Mbps

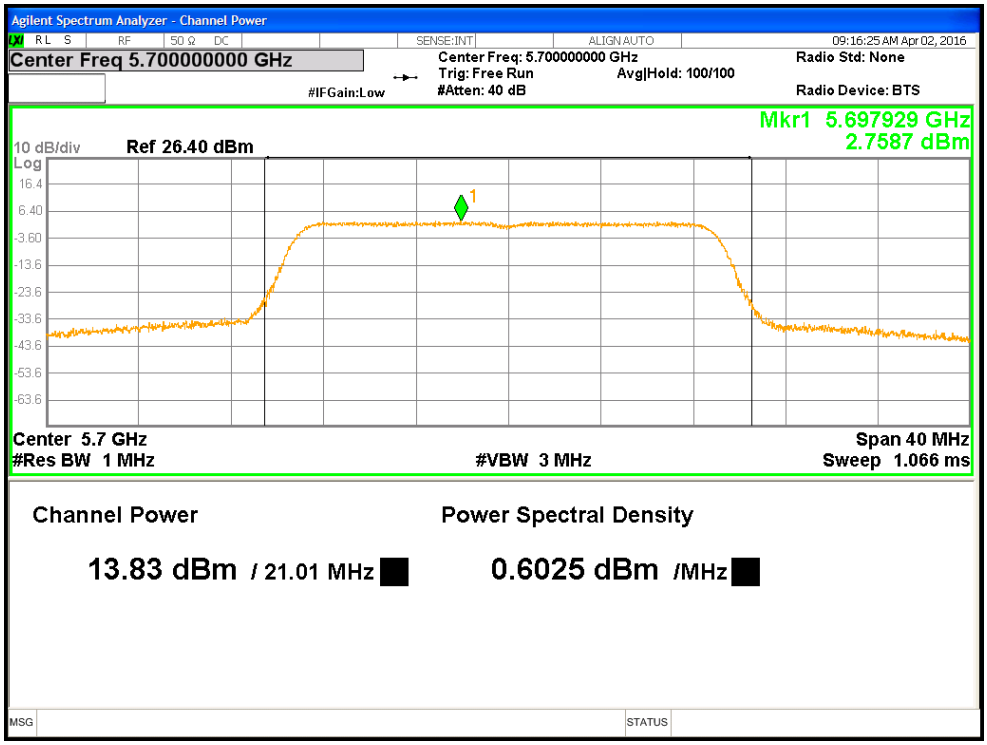


Figure 2: Maximum Transmitted Power, 5700 MHz at HT20 MCS0

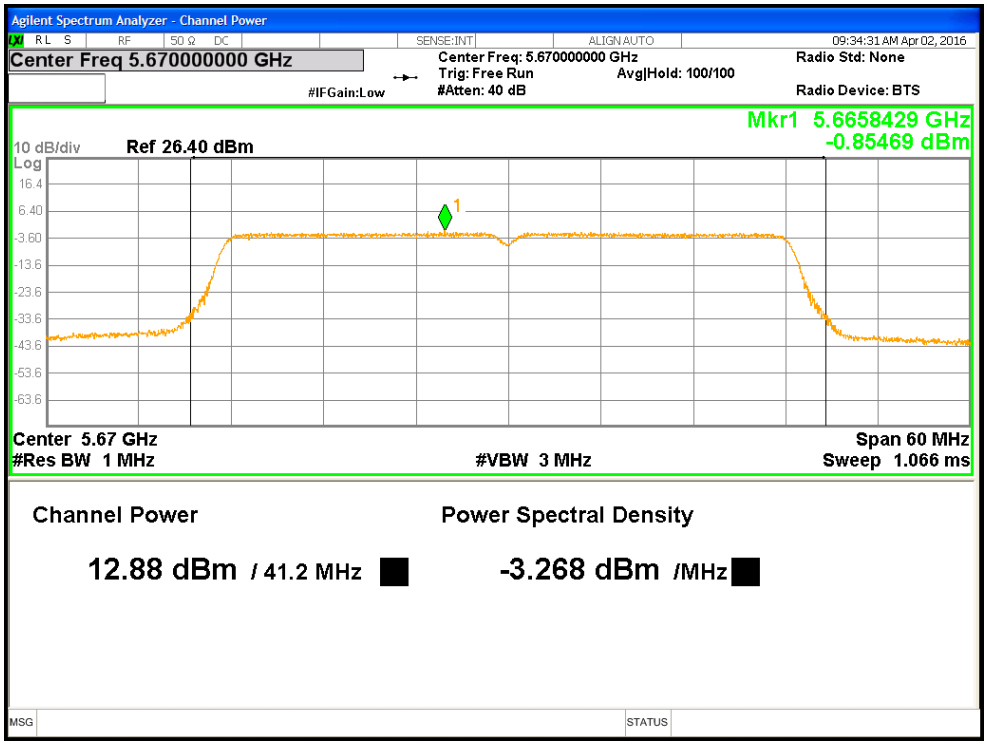


Figure 3: Maximum Transmitted Power, 5670 MHz at HT40 MCS0

4.2 Occupied Bandwidth

The occupied bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.

The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

The 26 dB bandwidth is defined the bandwidth of 26 dBr from highest transmitted level of the fundamental frequency.

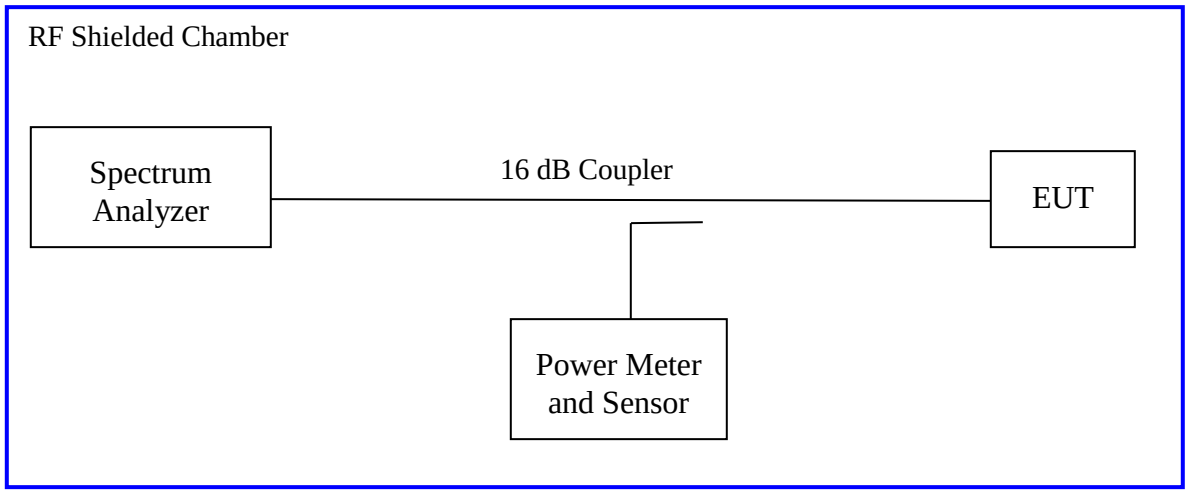
There is no restriction limits for the bandwidth. The 26 dB bandwidth was used to determine the limit for maximum conducted output power per CFR47 Part 15.407(a).

4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth. The measurement was performed with modulation per CFR47 15.407(a) 2015 and RSS Gen Sect.6.6:2014. The preliminary investigation was performed to find the narrowest 26 dB bandwidth for each operational mode at different data rates. This worst finding was performed on 3 channels in each operating frequency range; 5470 MHz to 5600 MHz and 5650 MHz to 5725 MHz.

The worst results indicated below.

Test Setup:



4.2.2 Results

These occupied bandwidth measurements were taken for references only.

Table 5: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature		
Antenna Type: Omnidirectional		**Power Setting:** See test plan
Max. Directional Gain: + 5.0 dBi		
Signal State: Modulated at 100%.		
Ambient Temp.: 22° C		**Relative Humidity:**35%
802.11a		
Frequency (MHz)	**26dB Bandwidth (MHz)**	**99% Bandwidth (MHz)**
5500	19.82	16.587
5580	19.91	16.552
5700	19.77	16.550
Note: 1. The bandwidth was measured at **6.0 Mbps**. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.		
802.11n		
Frequency (MHz)	**26dB Bandwidth (MHz)**	**99% Bandwidth (MHz)**
5500	20.14	17.710
5580	20.33	17.747
5700	20.26	17.755
Note: 1. The bandwidth was measured at **HT20 MCS0**. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.		

Table 6: Occupied Bandwidth – Test Results Continues

Test Conditions: Conducted Measurement, Normal Temperature		
Antenna Type: Omnidirectional		**Power Setting:** See test plan
Max. Directional Gain: + 5.0 dBi		
Signal State: Modulated at 100%.		
Ambient Temp.: 22° C		**Relative Humidity:**35%
802.11n		
Frequency (MHz)	**26dB Bandwidth (MHz)**	**99% Bandwidth (MHz)**
5510	40.22	36.280
5550	40.31	36.309
5670	40.23	36.239
Note: 1. The bandwidth was measured at **HT40 MCS0**. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.		

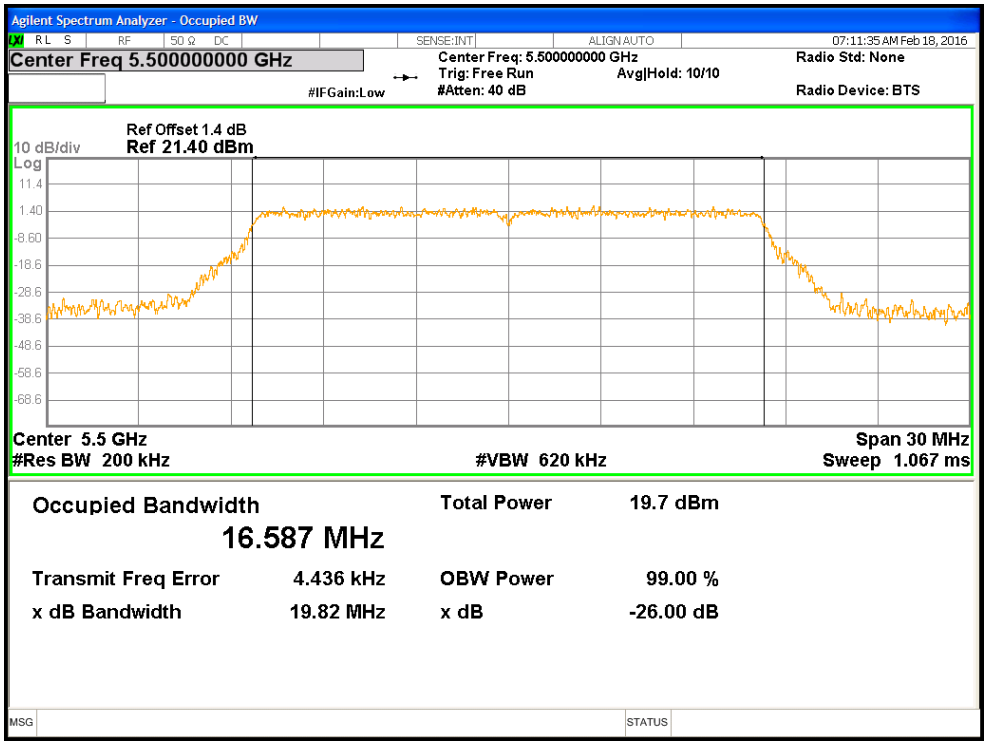


Figure 4: 26dB & 99% Occupied Bandwidth, 5500 MHz at 802.11a 6Mbps

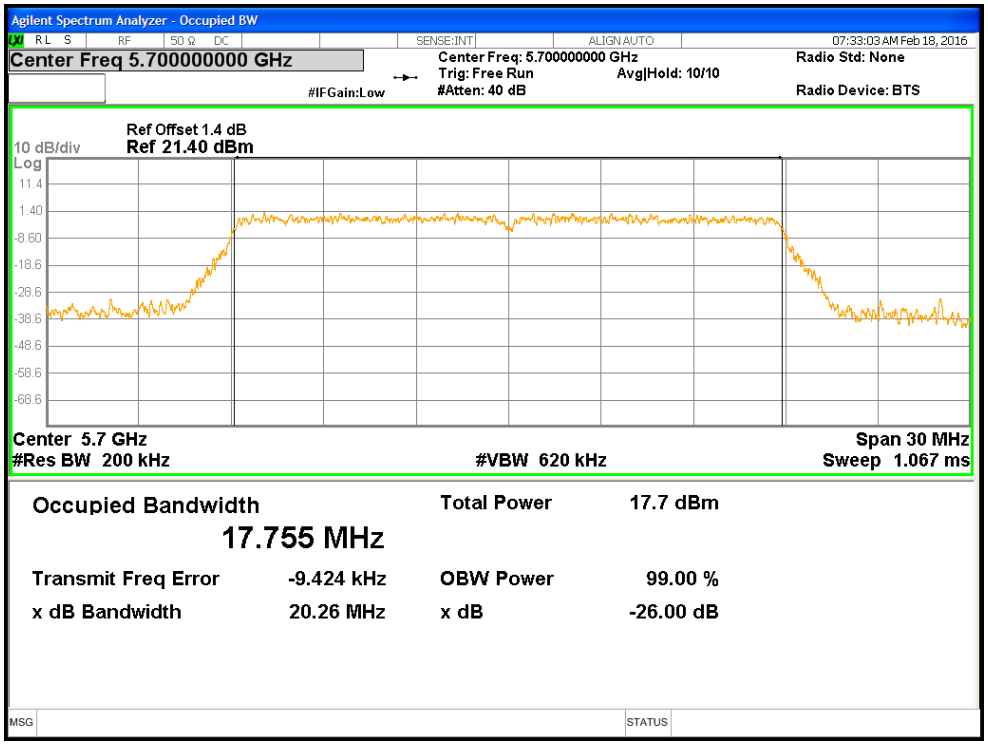


Figure 5: 26dB & 99% Occupied Bandwidth, 5700 MHz at HT20 MCS0

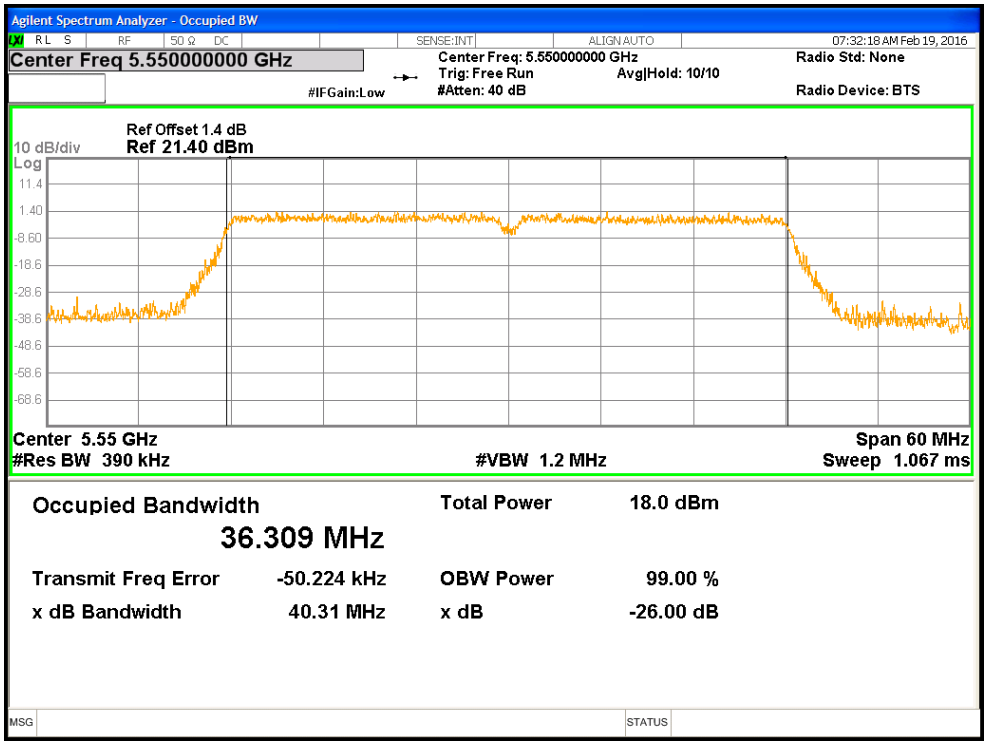


Figure 6: 26dB & 99% Occupied Bandwidth, 5550 MHz at HT40 MCS0

4.3 Peak Power Spectral Density

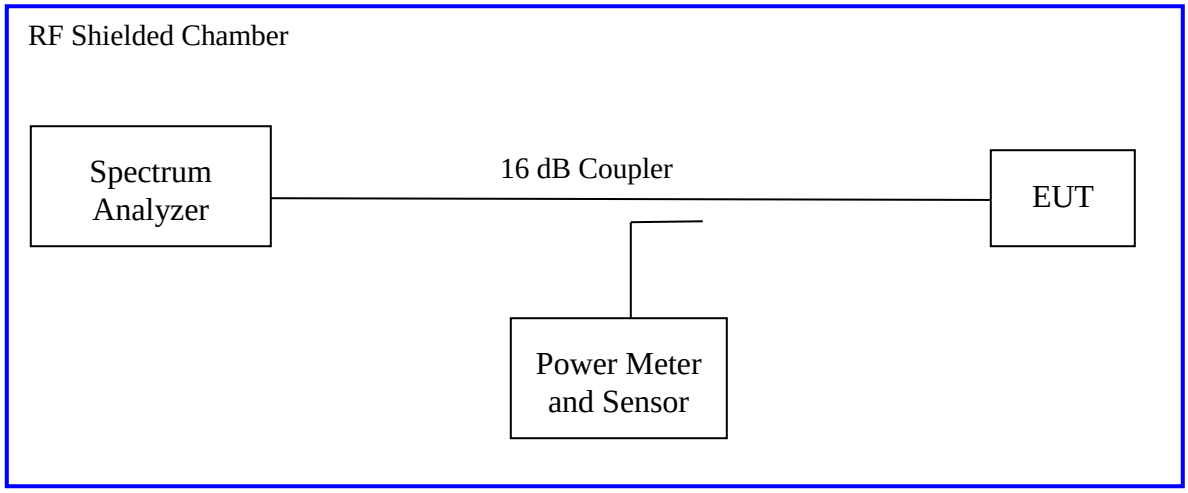
According to the CFR47 Part 15.407 (a)(2) in the 5.47 – 5.725 GHz and RSS 247 Sect. 6.2.3.1 in the 5.47 – 5.60 GHz and 5.65 – 5.725 GHz band, the spectral power density output of the antenna port shall be less than 11 dBm in any 1 MHz band during any time interval of continuous transmission.

4.3.1 Test Method

The conducted method was used to measure the channel power output per ANSI C63.10-2013 Section 12.3.2.2. The measurement was performed with modulation per CFR47 Part 15.407 (a) and RSS 247 Sect. 6.2.3.1. The pre-evaluation was performed to find the worst modes. The worst findings were conducted on 3 channels in each operating frequency range of 5470 MHz to 5600 MHz and 5650 MHz to 5725 MHz.

The worst sample result indicated below.

Test Setup:



4.3.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 7: Peak Power Spectral Density – Test Results

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		**Power Setting:** See test plan	
Max. Directional Gain: + 5.0 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 21° C		**Relative Humidity:**34%	
802.11a (FCC & RSS Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5500.00	11.00	2.317	-8.68
5580.00	11.00	3.568	-7.43
5700.00	11.00	3.192	-7.81
Note: 1.The highest output power was observed at 6Mbps, 1 Data Stream. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			
802.11n (FCC & RSS Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5500.00	11.00	1.202	-9.80
5580.00	11.00	2.056	-8.94
5700.00	11.00	2.209	-8.79
Note: 1.The highest output power was observed at HT20 MCS0, 1 Data Stream. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			

Table 8: Peak Power Spectral Density – Test Results Continues

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		**Power Setting:** See test plan	
Max. Directional Gain: + 5.0 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 21° C		**Relative Humidity:**34%	
802.11n (FCC & RSS Limit)			
Operating Channel (MHz)	**Limit [dBm]**	**Max Power [dBm]**	**Margin [dB]**
5510.00	11.00	-2.335	-13.34
5550.00	11.00	-2.189	-13.19
5670.00	11.00	-1.625	-12.63

Note: 1.The highest output power was observed at HT40 MCS0, 1 Data Stream.
2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.

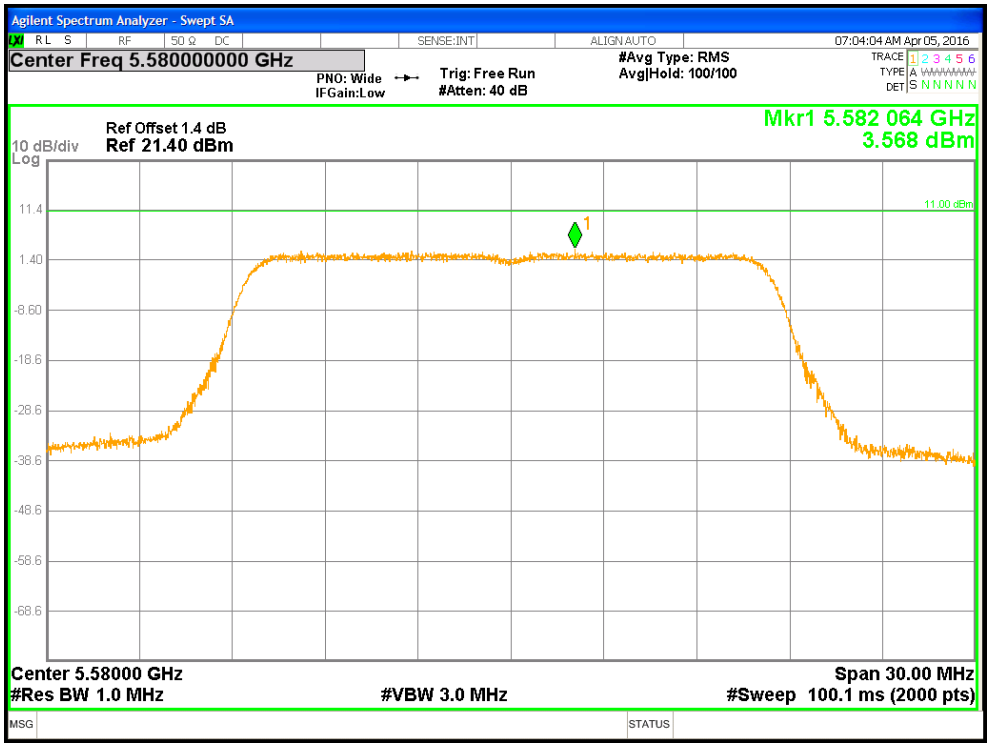


Figure 7: Power Spectral Density (FCC & RSS), 5580 MHz at 802.11a 6Mbps

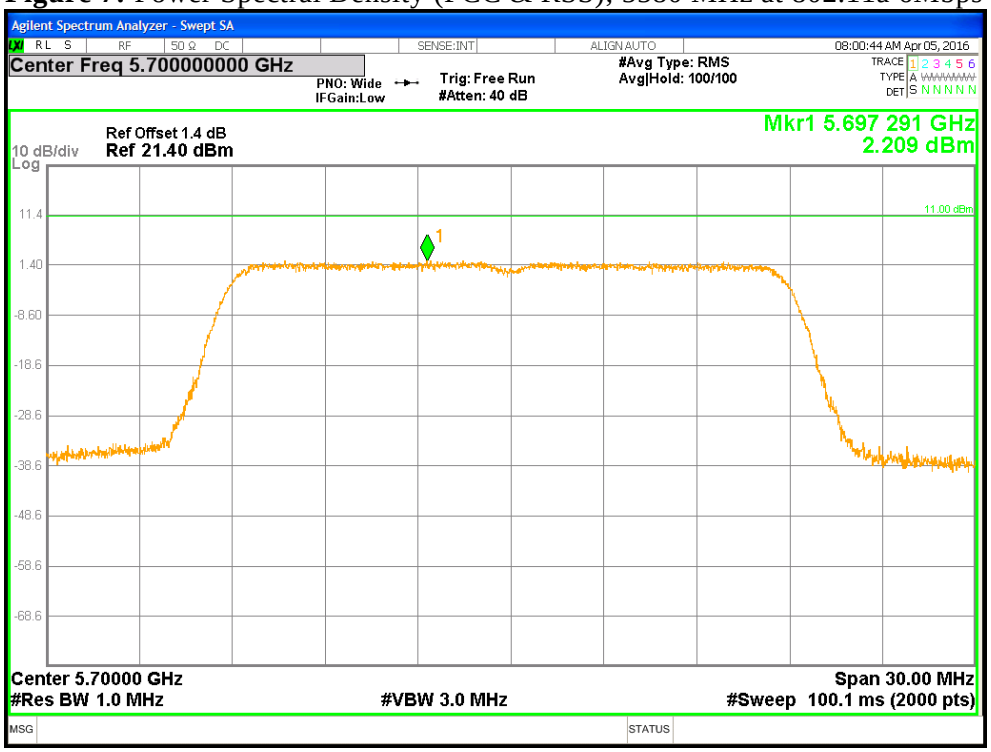


Figure 8: Power Spectral Density (FCC & RSS), 5700 MHz at HT20 MCS0

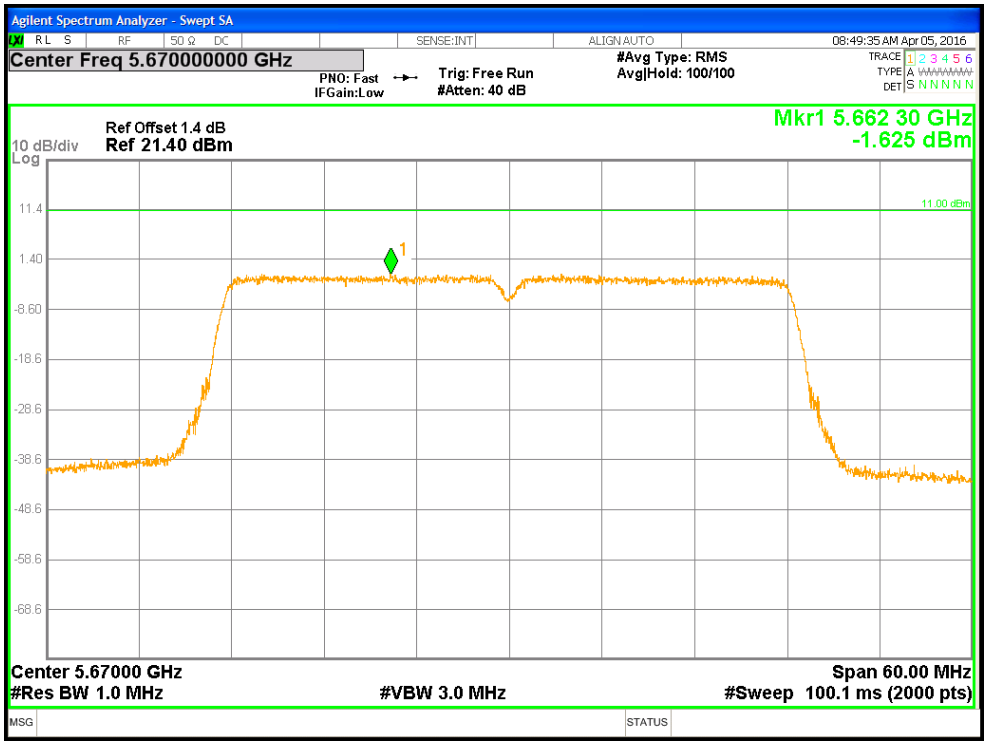


Figure 9: Power Spectral Density (FCC & RSS), 5670 MHz at HT40 MCS0

4.4 Undesirable Emission Limits

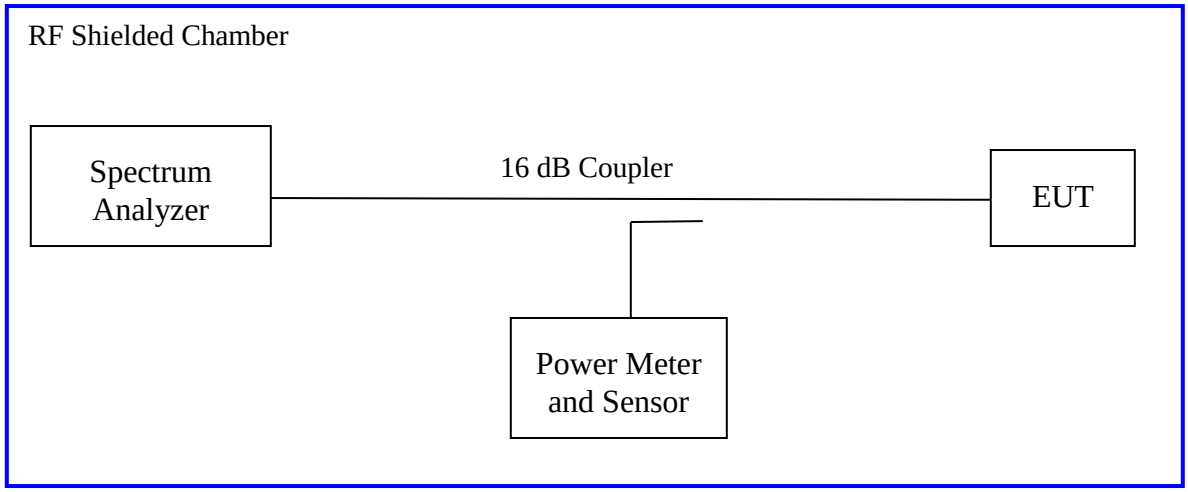
CFR47 15.407 (b) and RSS 247 Sect.6.2.3.2: The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

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.

4.4.1 Test Method

The conducted method was used to measure the undesirable emission requirement. The measurement was performed with modulation. This test was conducted on 3 channels of Sample in each mode on Sample. The worst sample result indicated below.

Test Setup:



Measurement Procedure AVG2 of KDB 662911

4.4.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 9: Emissions at the Band-Edge – Test Results

Test Conditions: Conducted Measurement, Normal Temperature					
Antenna Type: Omnidirectional			**Power Setting:** See test plan		
Max. Directional Gain: + 5.0 dBi					
Signal State: Modulated at 100%.					
Ambient Temp.: 21° C			**Relative Humidity:**34%		
Non-Restricted Frequency Band Emission					
Freq. (MHz)	**Mode**	**Measured (dBm)**	**Limit (dBm)**	**Plots**	**Comments**
5470.00	11a-6Mbps	-40.13	-27.00	Fig. 10	Pass: low channel bandedge
38844.8	11a-6Mbps	-31.96	-27.00	Fig. 11	Pass: low channel undesirable
39035.4	11a-6Mbps	-31.65	-27.00	Fig. 12	Pass: mid channel undesirable
5725.18	11a-6Mbps	-35.45	-27.00	Fig. 13	Pass: high channel bandedge
38365.2	11a-6Mbps	-32.39	-27.00	Fig. 14	Pass: high channel undesirable
5470.00	HT20-MCS0	-41.06	-27.00	Fig. 15	Pass: low channel bandedge
39070.0	HT20-MCS0	-32.09	-27.00	Fig. 16	Pass: low channel undesirable
39965.4	HT20-MCS0	-31.64	-27.00	Fig. 17	Pass: mid channel undesirable
5725.18	HT20-MCS0	-34.18	-27.00	Fig. 18	Pass: high channel bandedge
38558.4	HT20-MCS0	-32.08	-27.00	Fig. 19	Pass: high channel undesirable
5470.00	HT40 MCS0	-37.62	-27.00	Fig. 20	Pass: low channel bandedge
38782.2	HT40 MCS0	-32.46	-27.00	Fig. 21	Pass: low channel undesirable
36574.5	HT40 MCS0	-32.72	-27.00	Fig. 22	Pass: mid channel undesirable
5725.00	HT40 MCS0	-46.92	-27.00	Fig. 23	Pass: high channel bandedge
39954.7	HT40 MCS0	-32.71	-27.00	Fig. 24	Pass: high channel undesirable
Note: 1. All out of band emissions are lower than the -27dBm level. 2. The maximum out of band emission on each individual output is at least 27 dB below the maximum in-band PSD on that output per KDB 662911.					

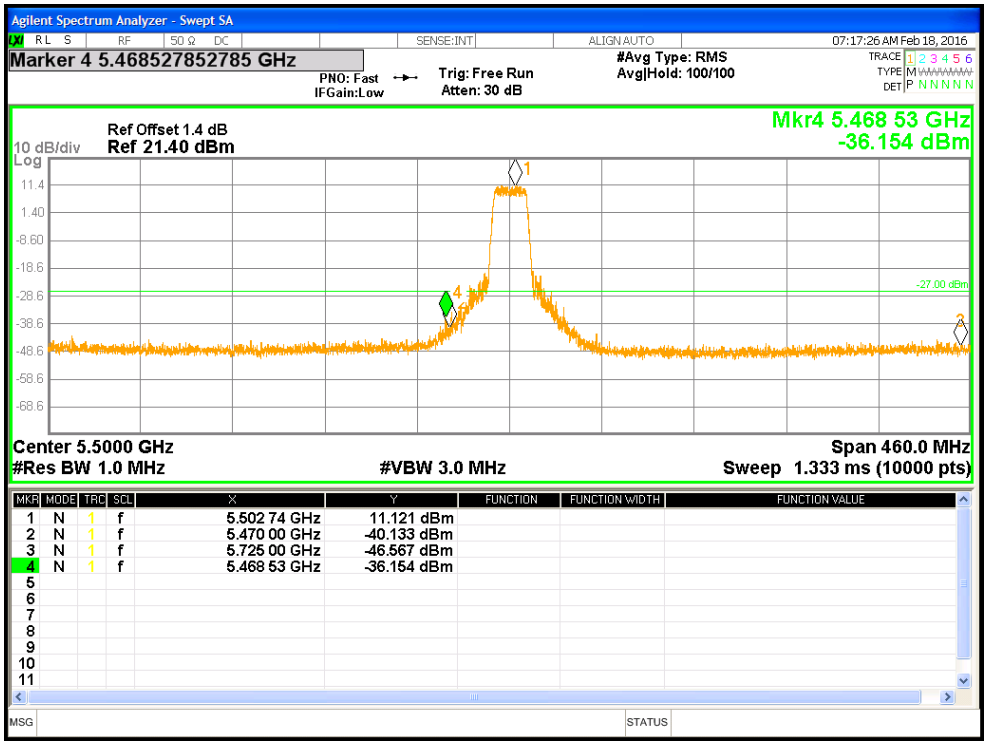


Figure 10: Measured Bandedge for 802.11a-6Mbps at 5500 MHz

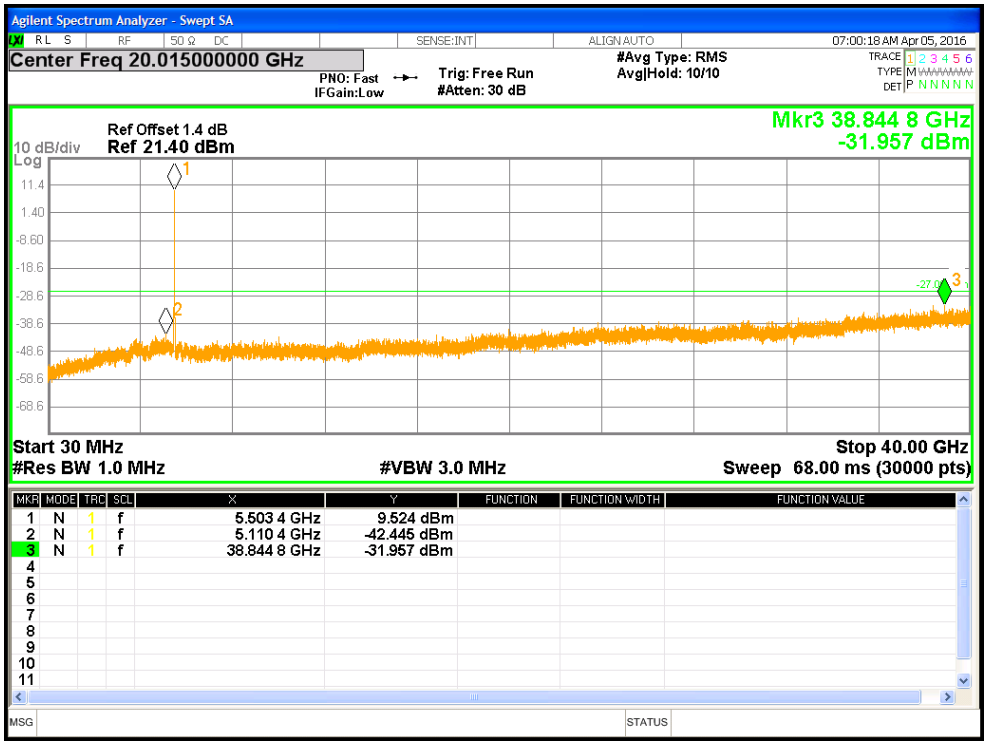


Figure 11: Undesirable Emission for 802.11a-6Mbps at 5500 MHz

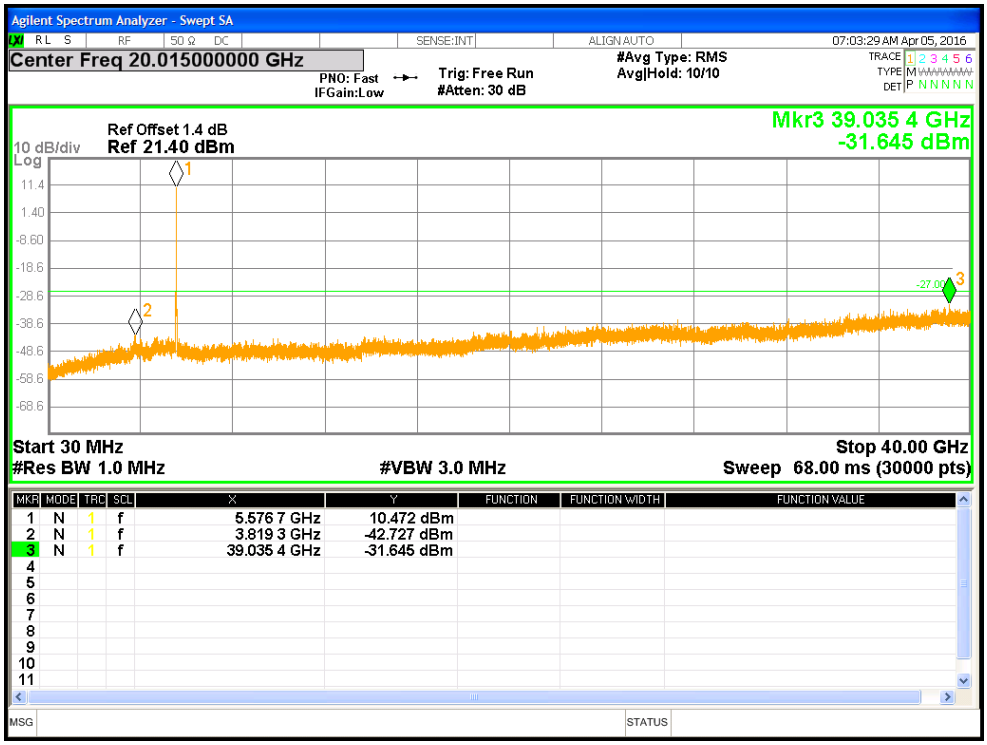


Figure 12: Undesirable Emission for 802.11a-6Mbps at 5580 MHz

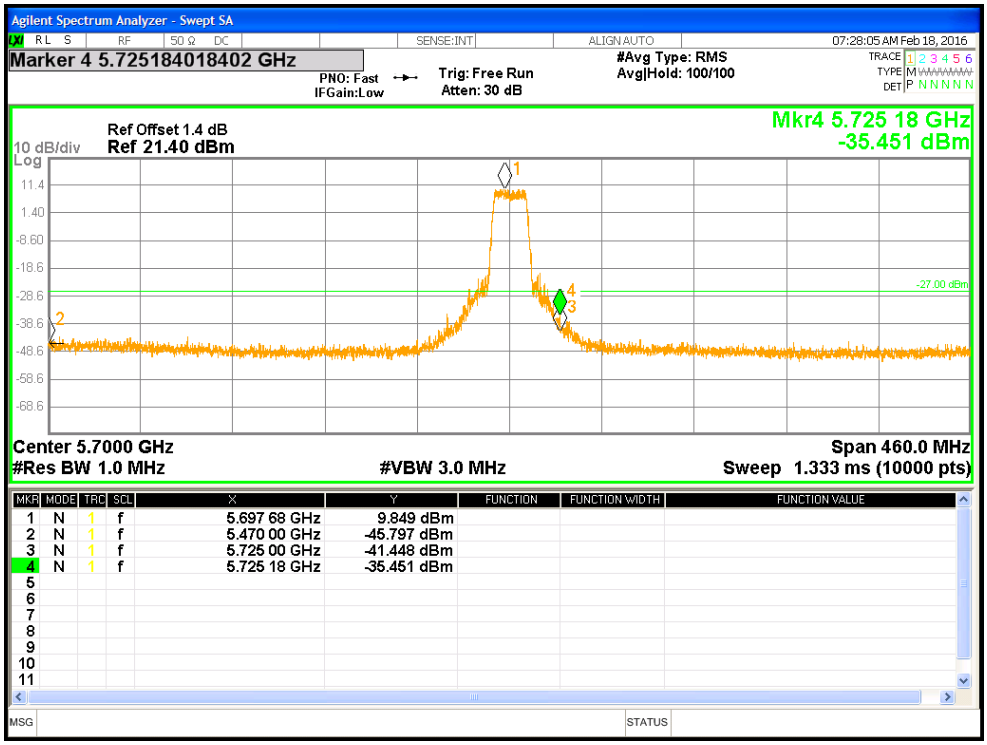


Figure 13: Measured Bandedge for 802.11a-6Mbps at 5700 MHz

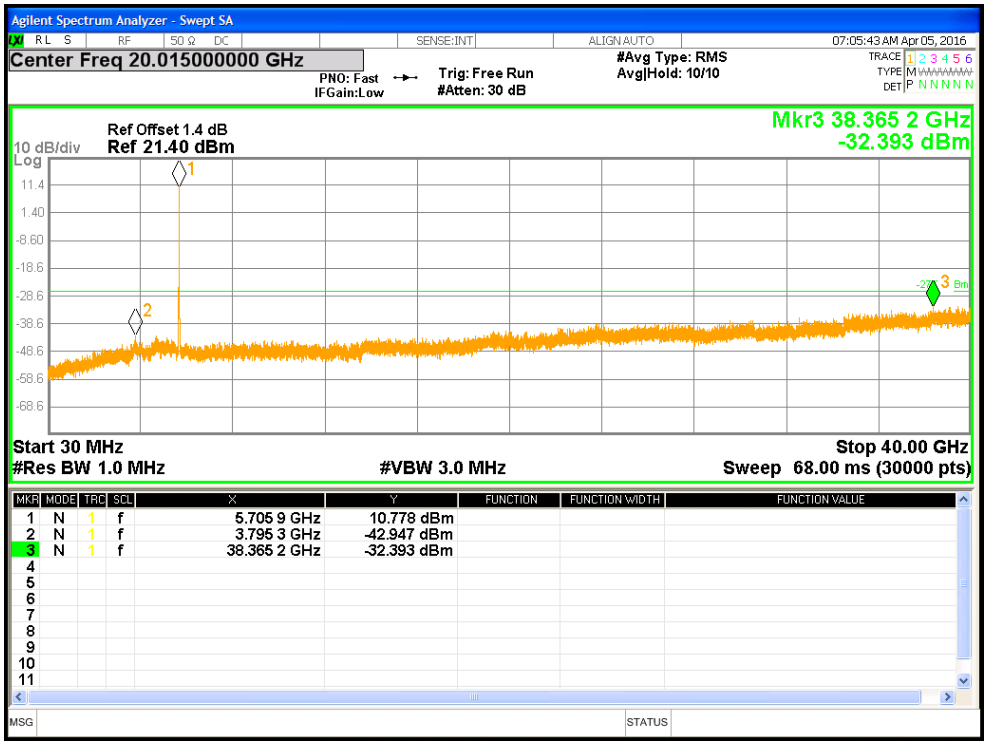


Figure 14: Undesirable Emission for 802.11a-6Mbps at 5700 MHz

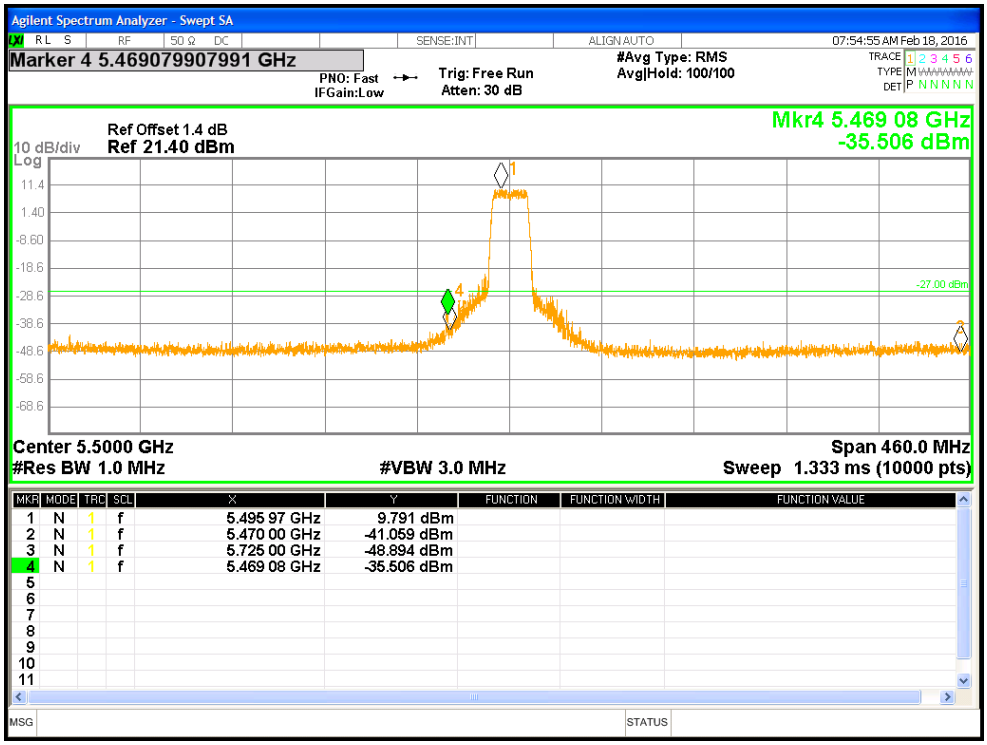


Figure 15: Measured Bandedge for HT20-MCS0 at 5500 MHz

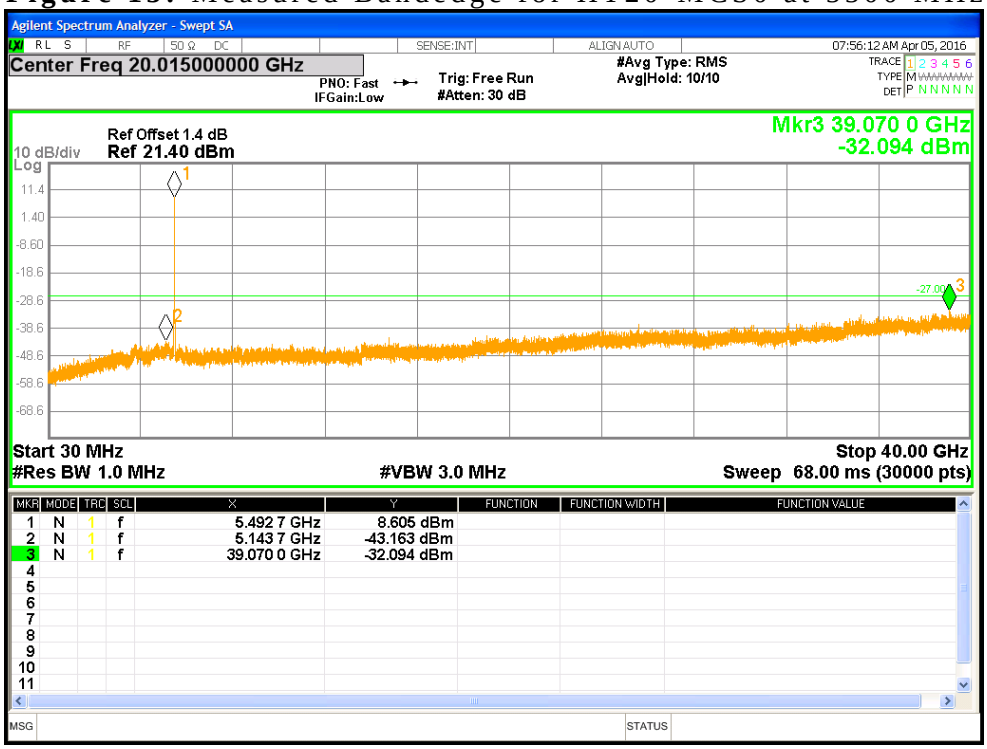


Figure 16: Undesirable Emission for HT20-MCS0 at 5500 MHz

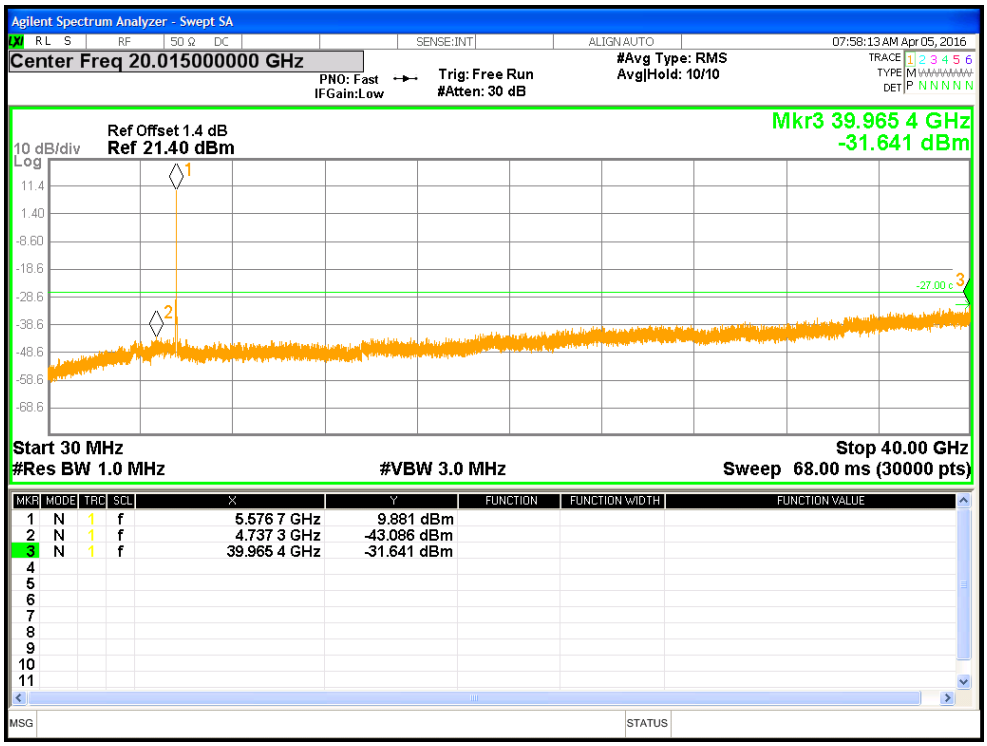


Figure 17: Undesirable Emission for HT20-MCS0 at 5580 MHz

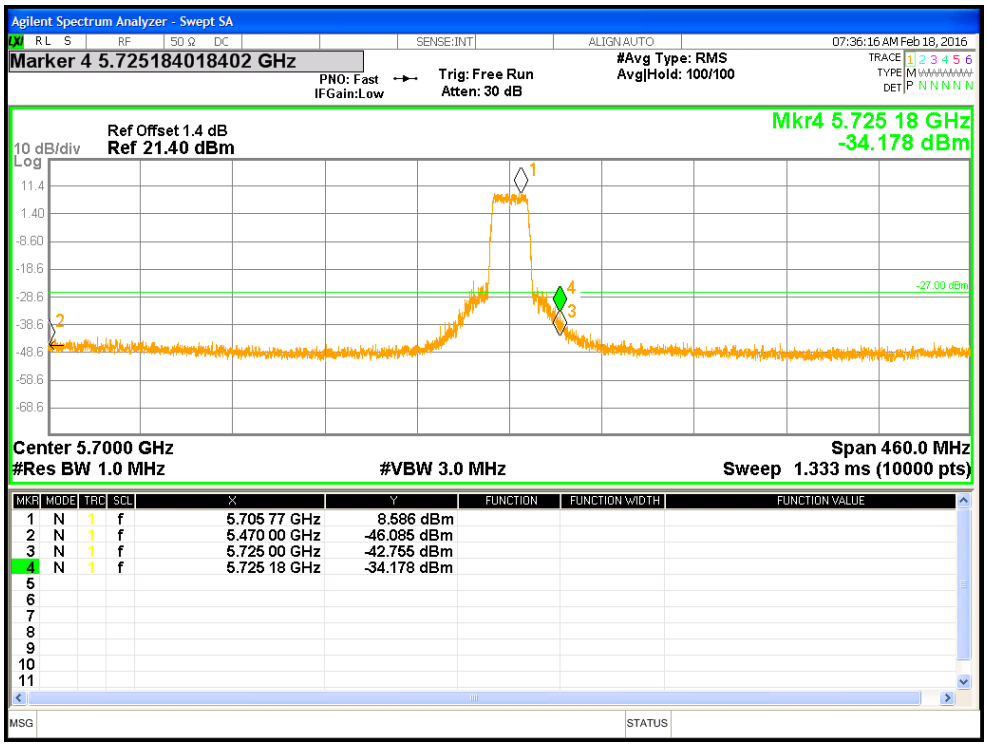


Figure 18: Measured Bandedge for HT20-MCS0 at 5700 MHz

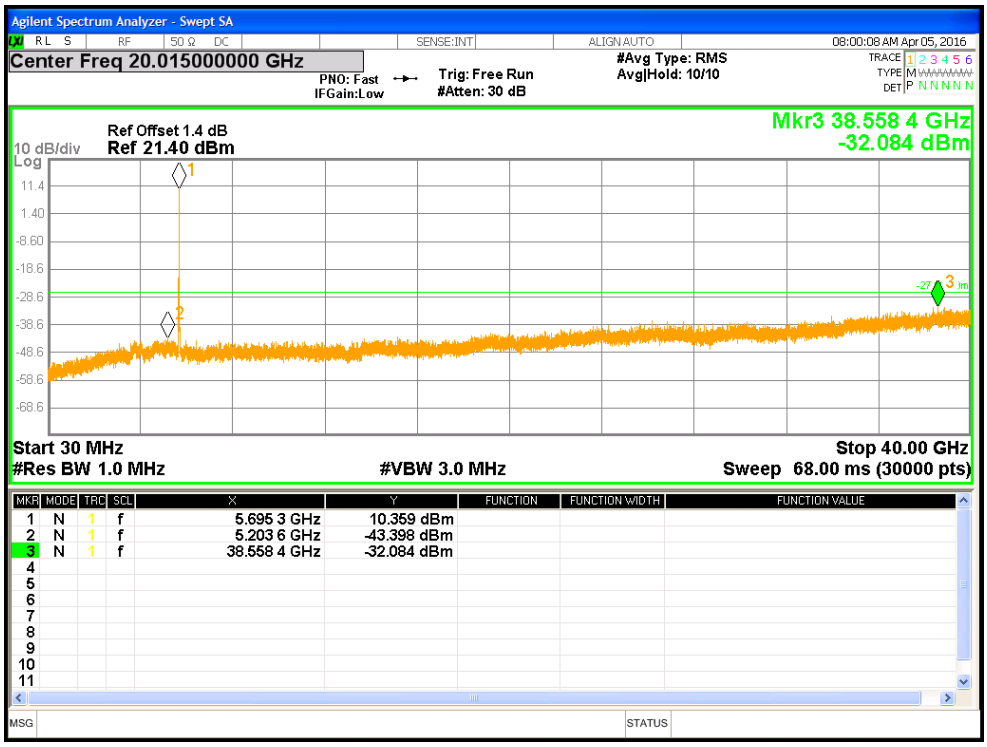


Figure 19: Undesirable Emission for HT20-MCS0 at 5700 MHz

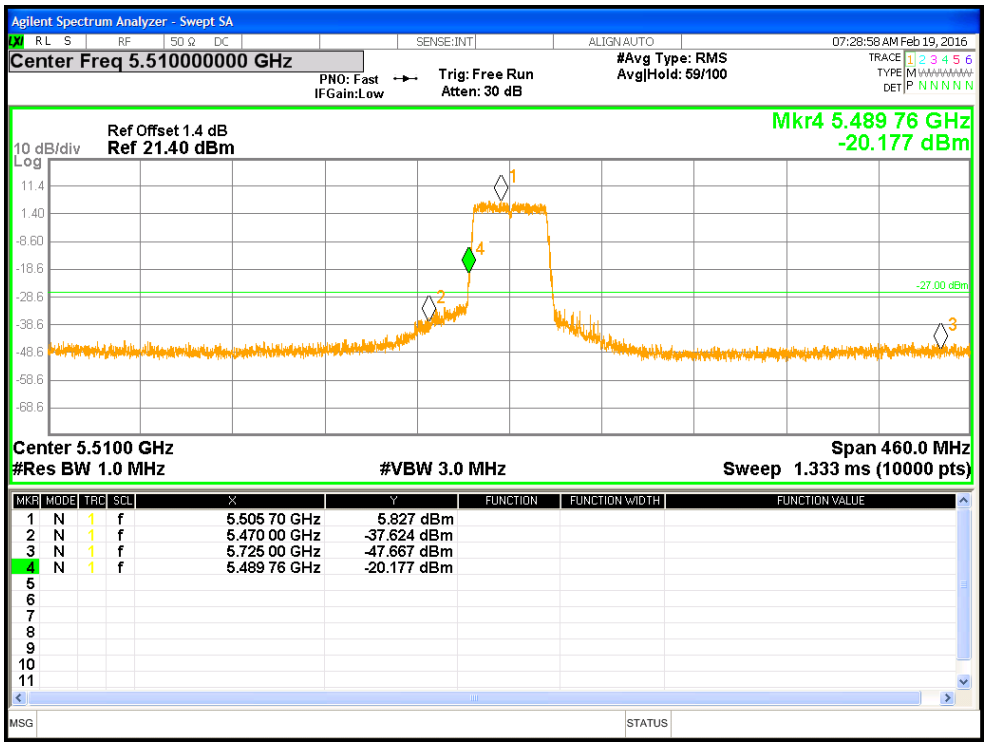


Figure 20: Measured Bandedge for HT40-MCS0 at 5510 MHz

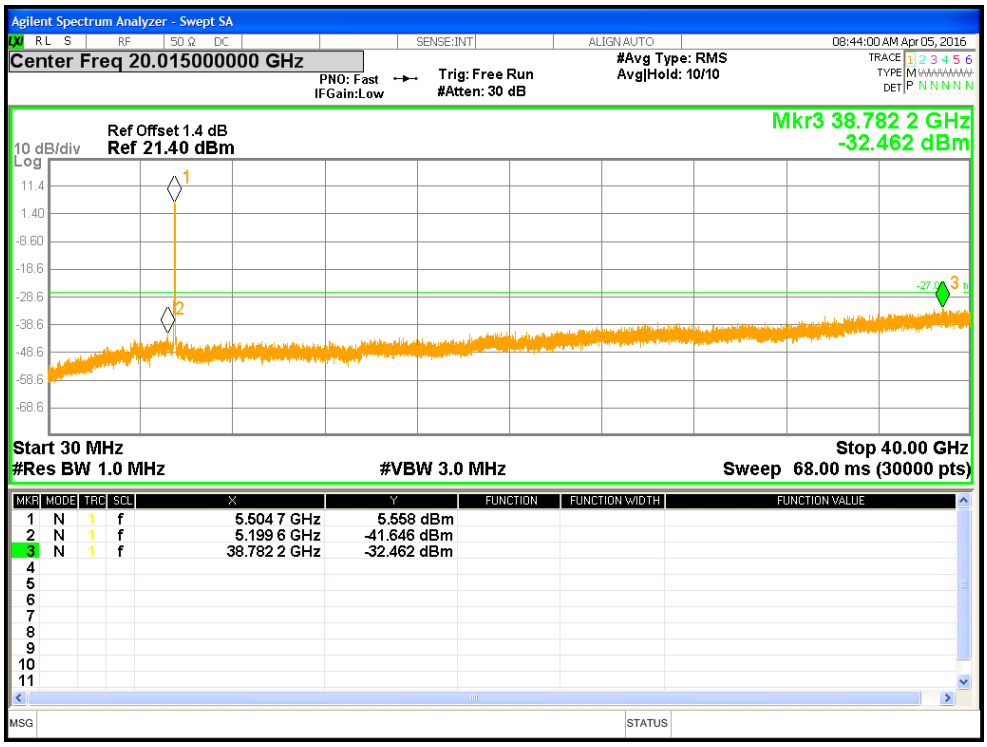


Figure 21: Undesirable Emission for HT40-MCS0 at 5510 MHz

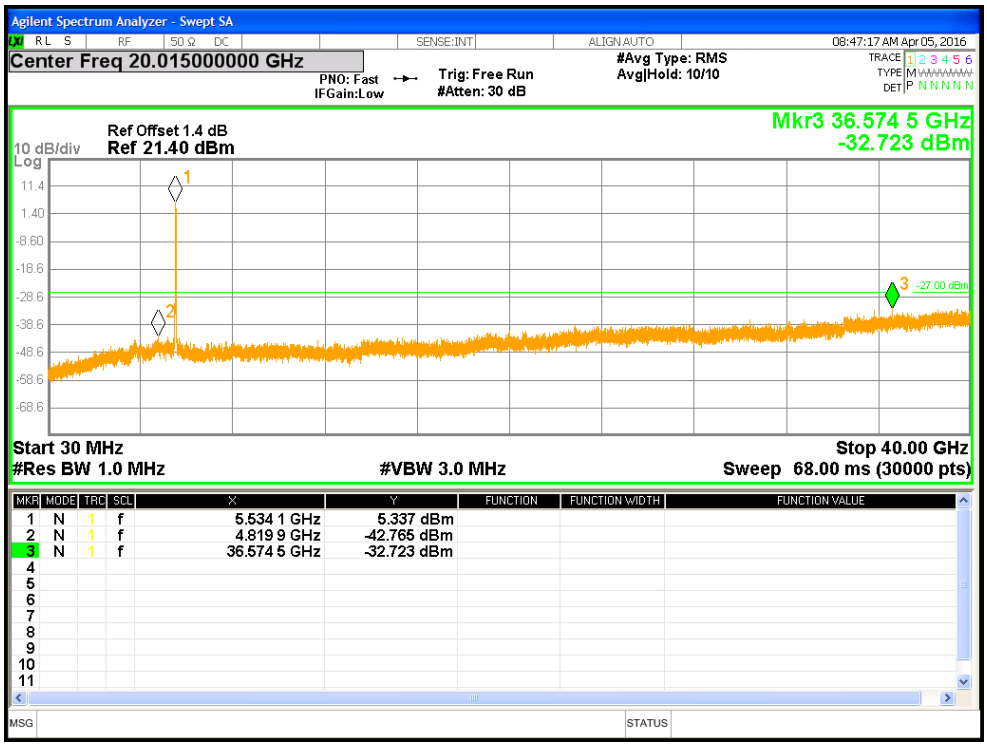


Figure 22: Undesirable Emission for HT40-MCS0 at 5550 MHz

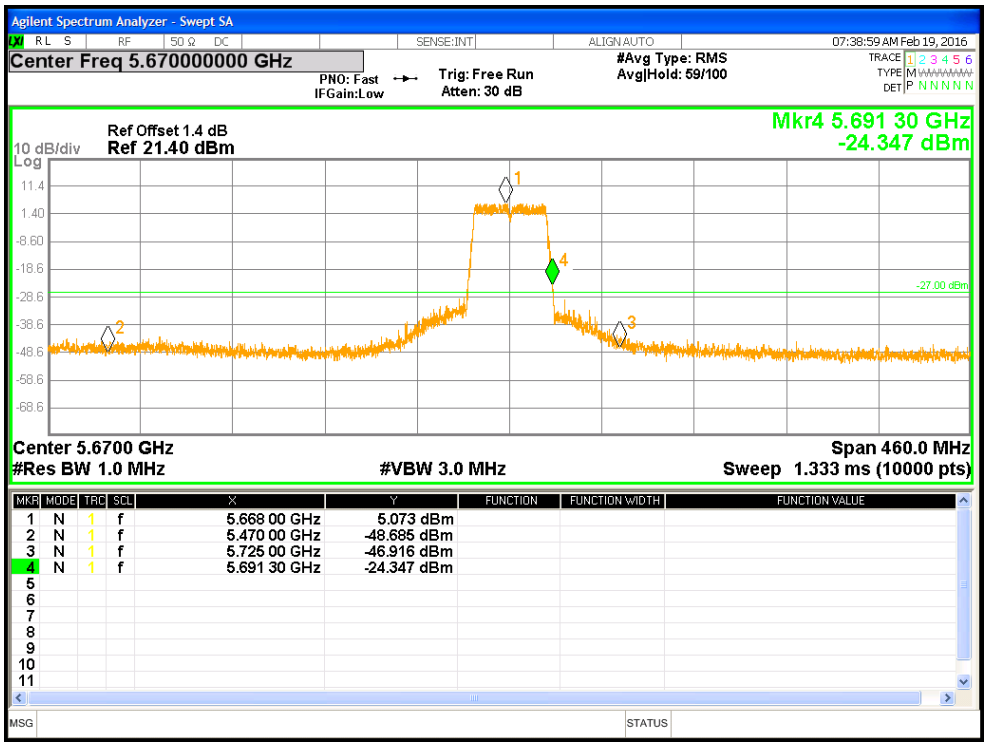


Figure 23: Measured Bandedge for HT40-MCS0 at 5670 MHz

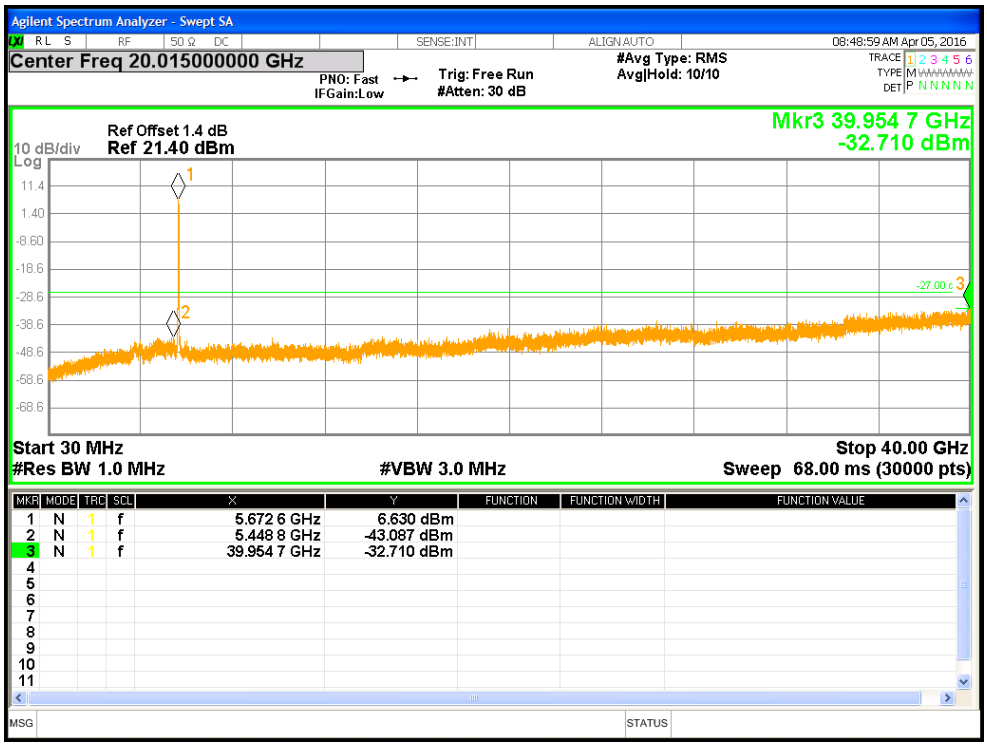


Figure 24: Undesirable Emission for HT40-MCS0 at 5670 MHz

4.5 Transmitter Spurious Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205, 15.209, 15.407(b), RSS 247 Sect. 6., RSS GEN Sect.8.9, 8.10

4.5.1 Test Methodology

4.5.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Pres-scans were performed to determine the worst, data rate/ chains for 802.11a, 802.11n (HT20 and HT40).

4.5.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

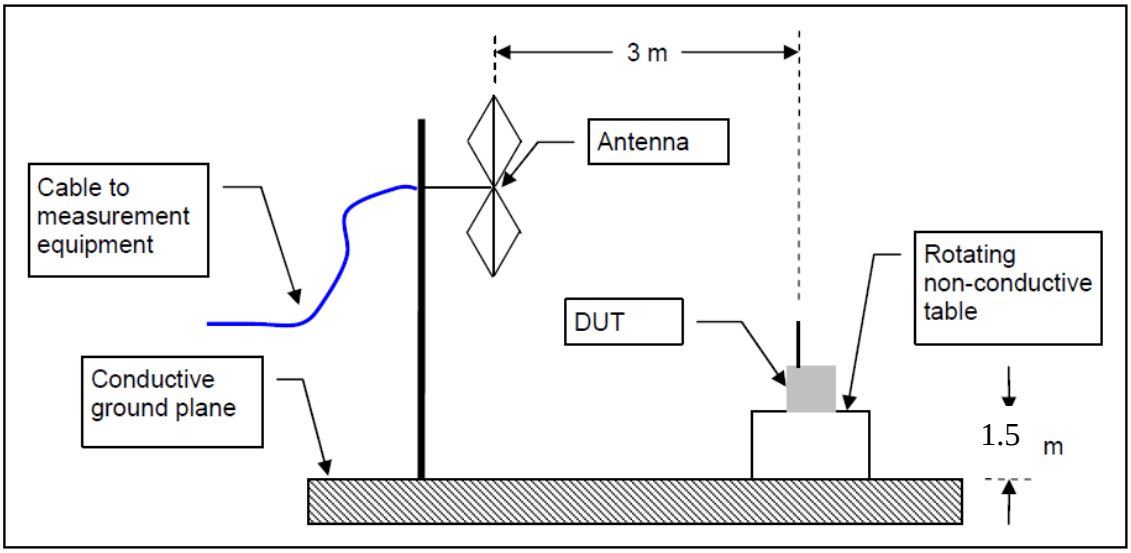
Final results are:

1. 802.11a at 6Mbps (covering HT20)
2. 802.11n: HT40 at MCS0

4.5.1.3 Deviations

None.

Test Setup:



4.5.2 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2015, RSS 247 Sect. 6: 2015, RSS GEN Sect. 8.10: 2014

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490.....	2400/F(kHz)	300
0.490-1.705.....	24000/F(kHz)	30
1.705-30.0.....	30	30
30-88.....	100 **	3
88-216.....	150 **	3
216-960.....	200 **	3
Above 960.....	500	3

According to CFR47 15.407 (b) and RSS 247 Sect. 6.2.3.2, all harmonics and spurious emissions which are outside the 5150 MHz - 5250 MHz, 5250 MHz – 5350 MHz, or 5470 MHz – 5725 MHz shall not exceed -27 dBm/MHz. This is equivalent to 68.2 dBuV/m at 3 meter distance.

4.5.3 Test Results

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and test plan.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 10: Transmit Spurious Emission at Band-Edge Requirements

Test Conditions: Radiated Measurement, Normal Temperature

Antenna Type: Omnidirectional **Power Setting:** See test plan

Max. Directional Gain: + 5.0 dBi

Signal State: Modulated at 100%.

Ambient Temp.: 18° C **Relative Humidity:**29%

Band-Edge Results

Freq. (MHz)	Level (dBuV/m)	Pol. (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
5469.2	66.87	V	74.00	-7.13	Pk	133	132	PLOT 25: 11a-6Mbps-5500MHz-TP16
5470.0	50.82	V	54.00	-3.18	Ave	133	132	PLOT 26: 11a-6Mbps-5500MHz-TP16
5466.9	63.89	H	74.00	-10.11	Pk	126	121	PLOT 27: 11a-6Mbps-5500MHz-TP16
5470.0	48.90	H	54.00	-5.10	Ave	126	121	PLOT 28: 11a-6Mbps-5500MHz-TP16
5726.0	67.52	V	68.20	-0.68	Pk	133	113	PLOT 29: 11a-6Mbps-5700MHz-TP16
5726.0	63.09	H	68.20	-5.11	Pk	128	100	PLOT 30: 11a-6Mbps-5700MHz-TP16
5469.6	66.75	V	74.00	-7.25	Pk	134	126	PLOT 31: HT20-MCS0-5500MHz-TP15
5470.0	50.35	V	54.00	-3.65	Ave	134	126	PLOT 32: HT20-MCS0-5500MHz-TP15
5469.6	63.02	H	74.00	-10.98	Pk	127	122	PLOT 33: HT20-MCS0-5500MHz-TP15
5470.0	48.90	H	54.00	-5.10	Ave	127	122	PLOT 34: HT20-MCS0-5500MHz-TP15
5725.0	67.82	V	68.20	-0.38	Pk	133	142	PLOT 35: HT20-MCS0-5700MHz-TP15
5727.4	63.68	H	68.20	-4.52	Pk	145	156	PLOT 36: HT20-MCS0-5700MHz-TP15
5468.8	73.07	V	74.00	-0.93	Pk	136	134	PLOT 37: HT40-MCS0-5510MHz-TP15
5468.8	52.84	V	54.00	-1.16	Ave	136	134	PLOT 38: HT40-MCS0-5510MHz-TP15
5468.8	62.09	H	74.00	-11.91	Pk	125	118	PLOT 39: HT40-MCS0-5510MHz-TP15
5470.0	49.09	H	54.00	-4.91	Ave	125	118	PLOT 40: HT40-MCS0-5510MHz-TP15
5726.0	64.14	V	68.20	-4.06	Pk	134	130	PLOT 41: HT40-MCS0-5670MHz-TP15
5725.7	62.66	H	68.20	-5.54	Pk	144	164	PLOT 42: HT40-MCS0-5670MHz-TP15

Note: 1. All the band-edge measurements met the restricted band requirements of CFR47 15.205.
2. For non-restricted band-edge, limit applied is 68.2 dBuV/m.

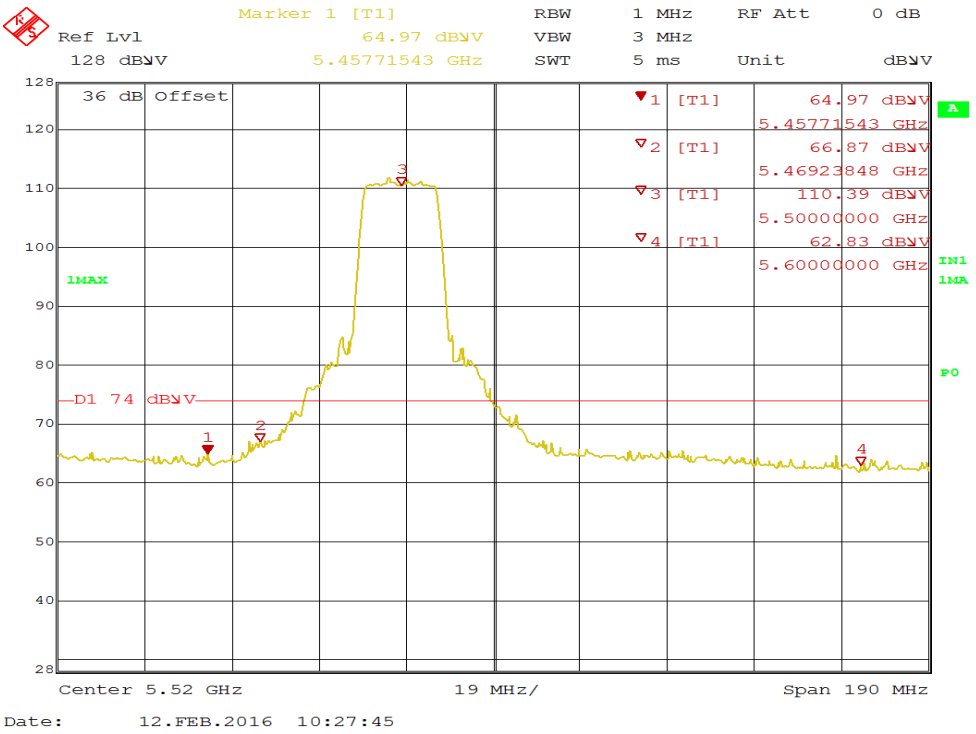


Figure 25: Radiated Emission 5470 MHz Edge for 11a 5500 MHz – Vert. (Pk)

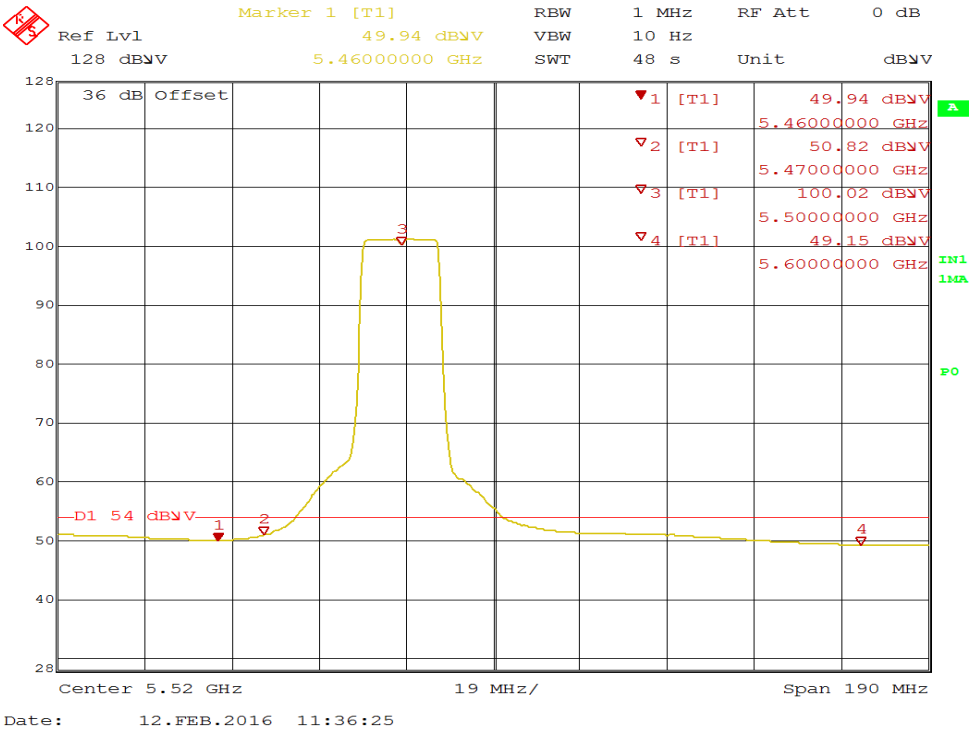


Figure 26: Radiated Emission 5470 MHz Edge for 11a 5500 MHz – Vert. (Ave)

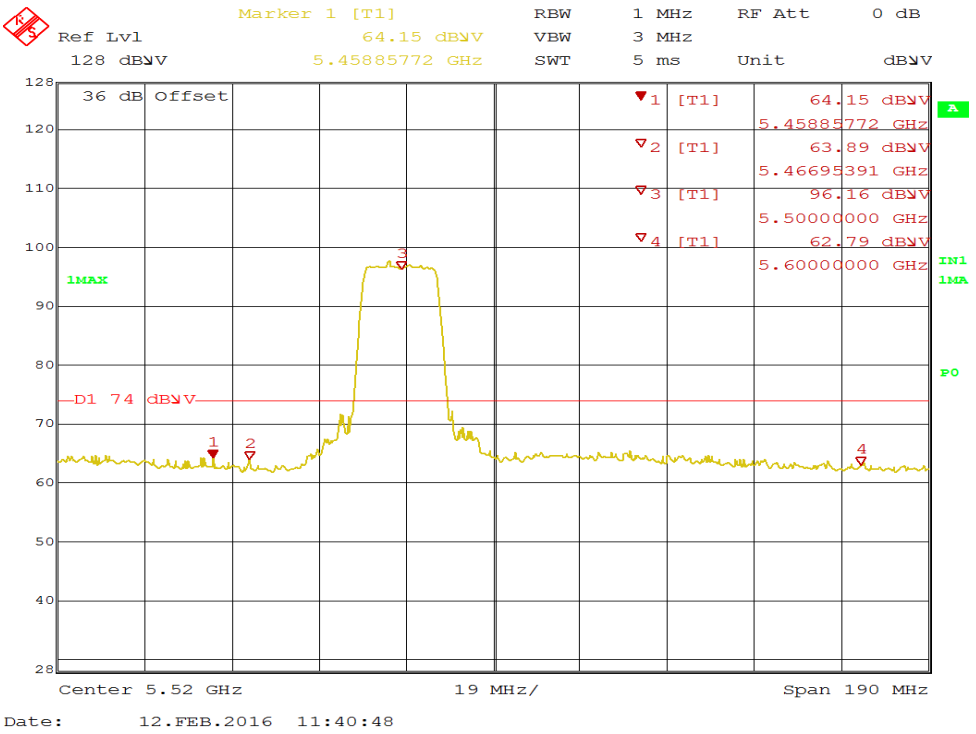


Figure 27: Radiated Emission 5470 MHz Edge for 11a 5500 MHz – Horz. (Pk)

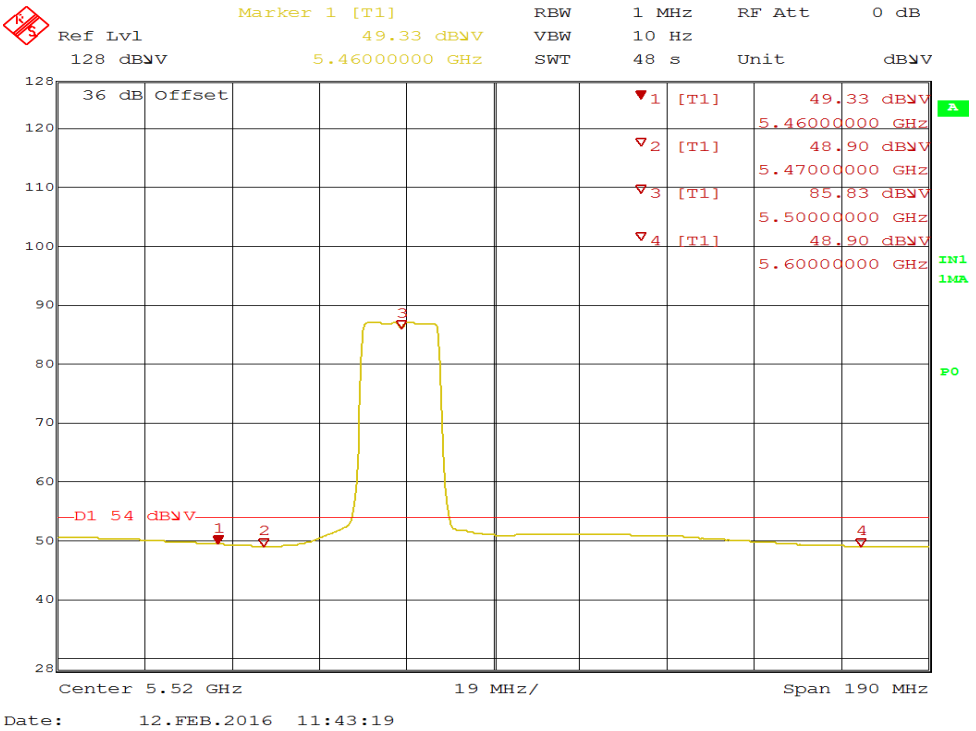


Figure 28: Radiated Emission 5470 MHz Edge for 11a 5500 MHz – Horz. (Ave)

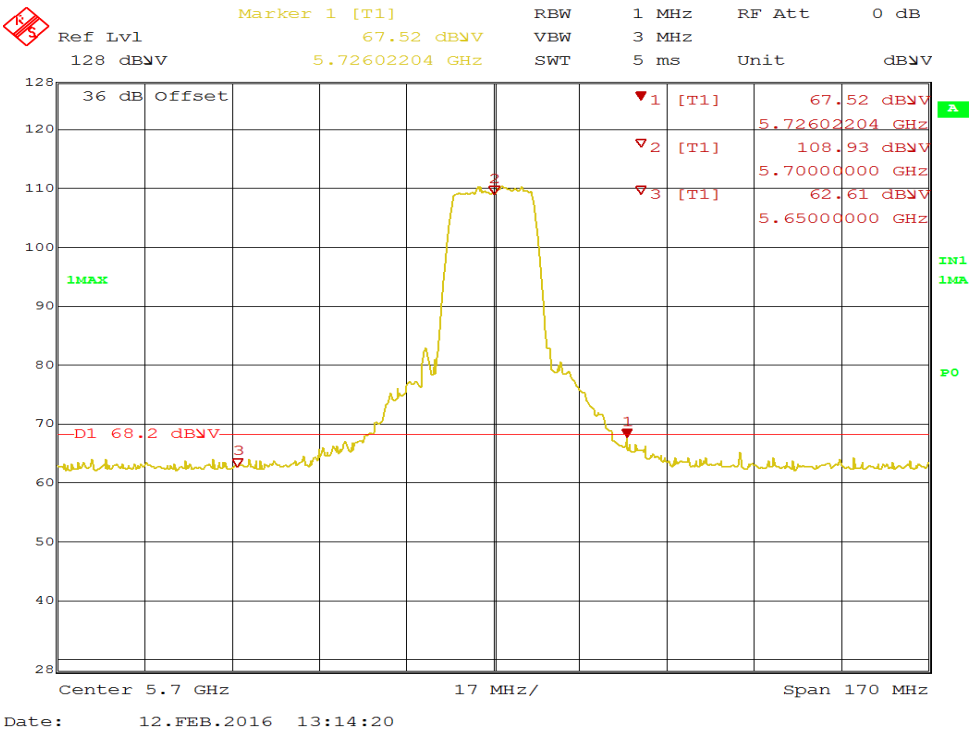


Figure 29: Radiated Emission 5725 MHz Edge for 11a 5700 MHz – Vert. (Pk)

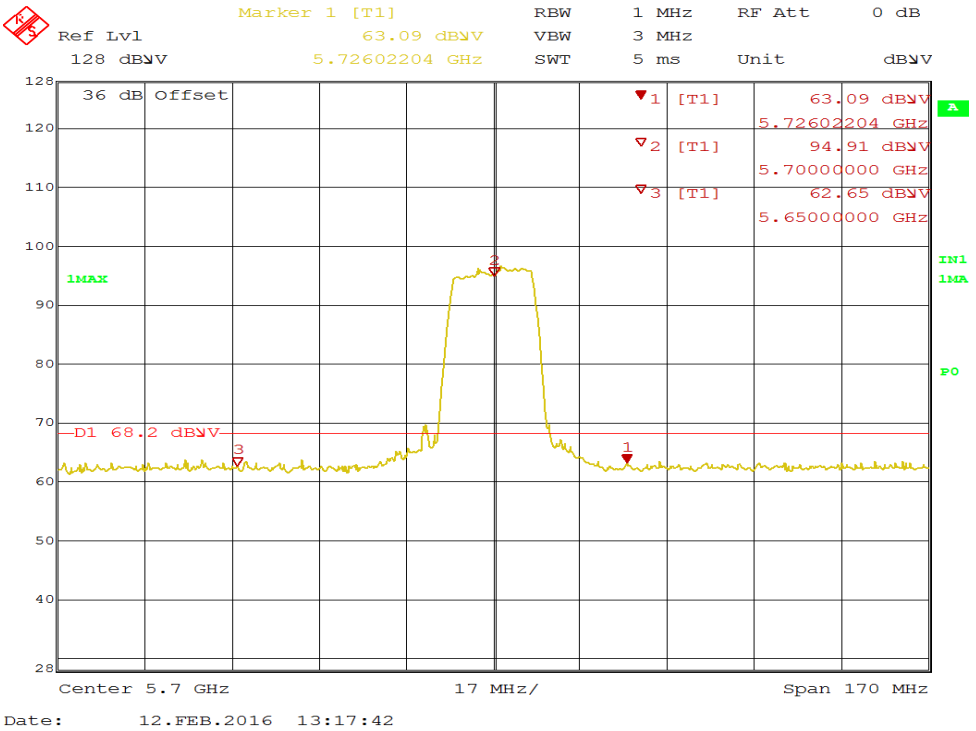


Figure 30: Radiated Emission 5725 MHz Edge for 11a 5700 MHz – Horz. (Pk)

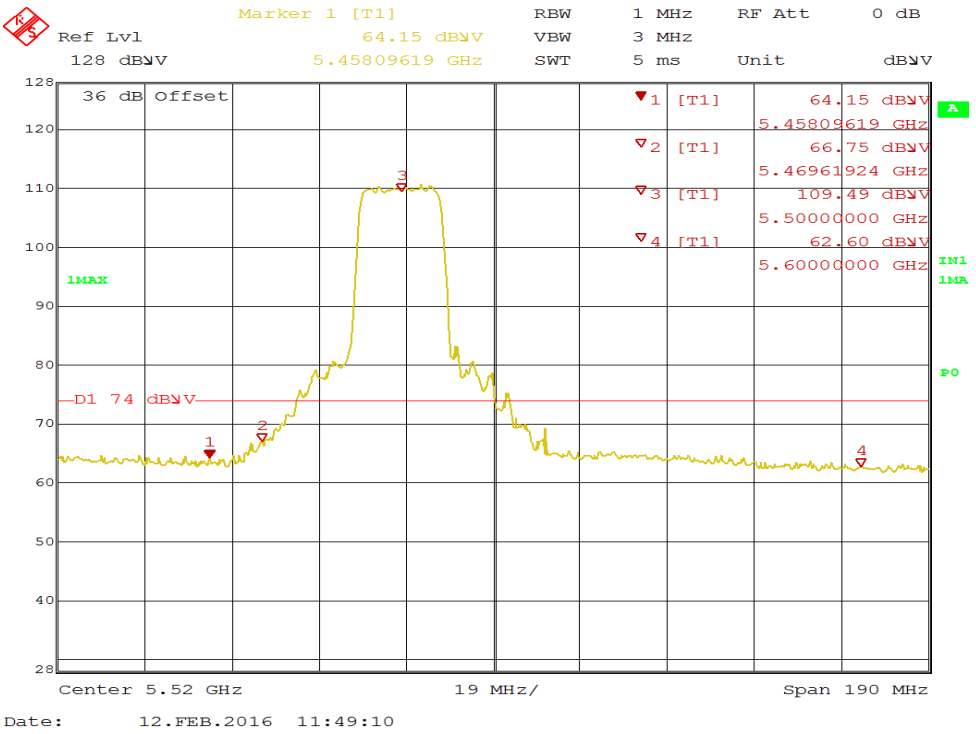


Figure 31: Radiated Emission 5470 MHz Edge for HT20 5500 MHz – Vert. (Pk)

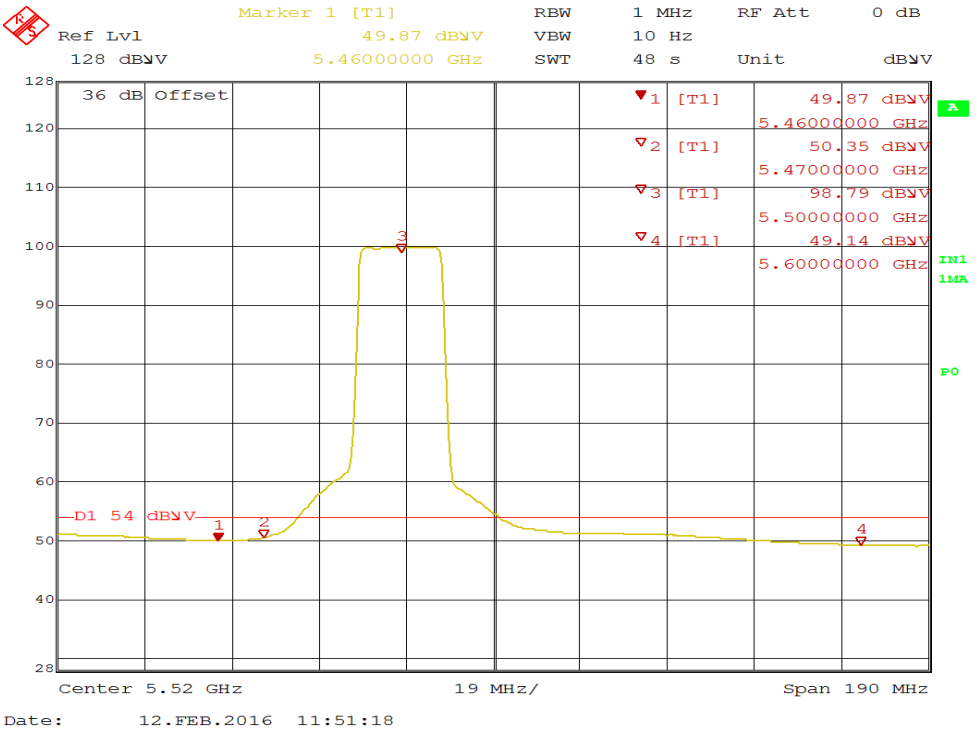


Figure 32: Radiated Emission 5470 MHz Edge for HT20 5500 MHz – Vert. (Ave)

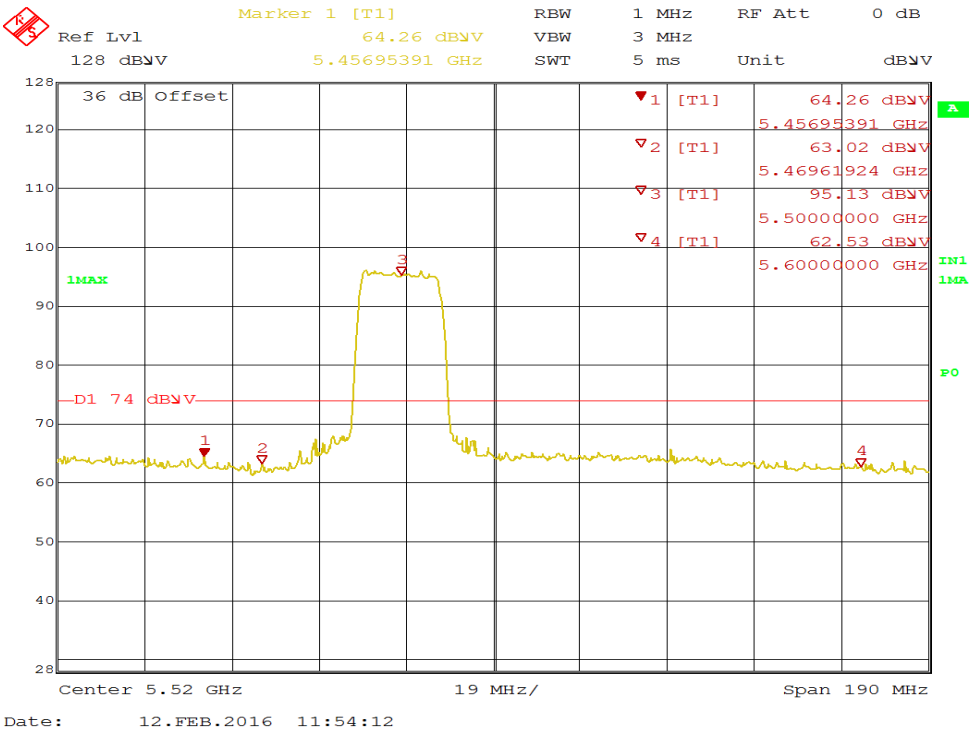


Figure 33: Radiated Emission 5470 MHz Edge for HT20 5500 MHz – Horz. (Pk)

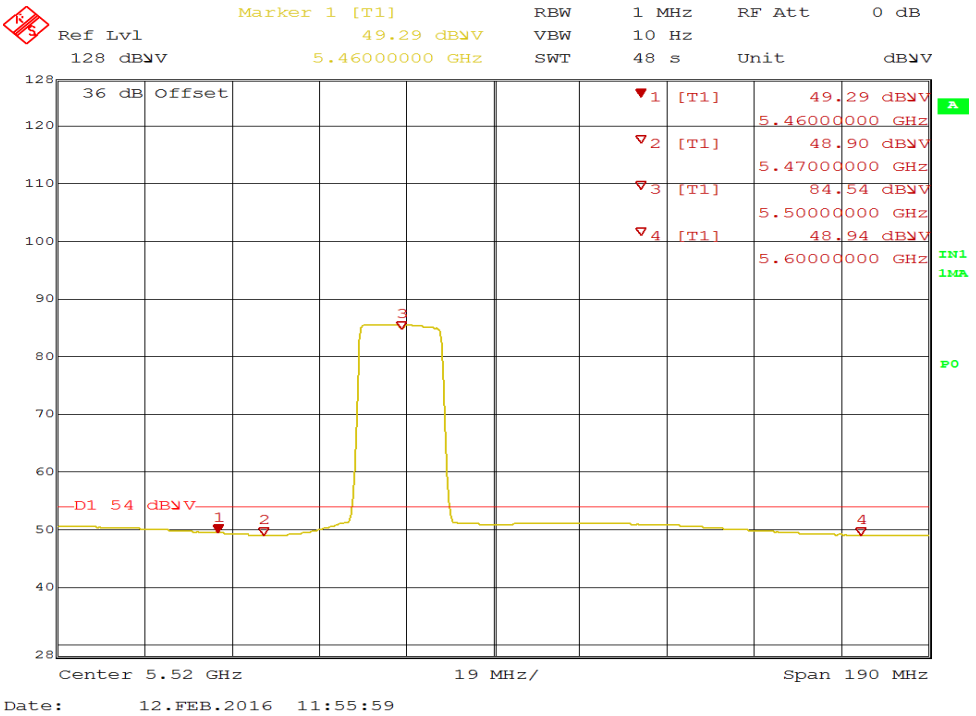


Figure 34: Radiated Emission 5470 MHz Edge for HT20 5500 MHz – Horz. (Ave)

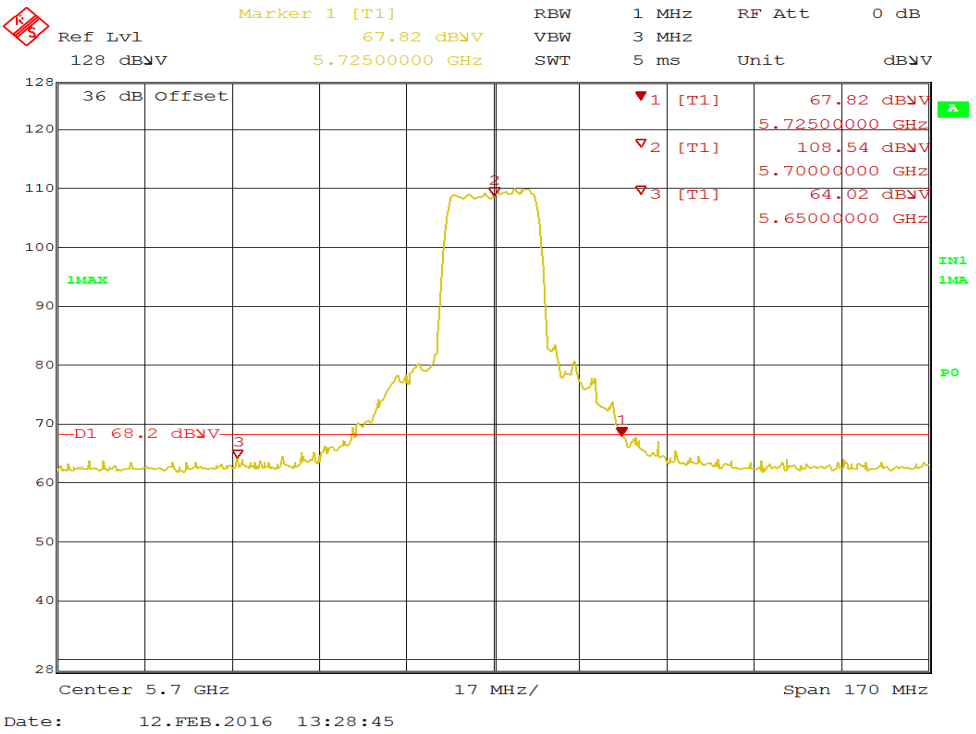


Figure 35: Radiated Emission 5725 MHz Edge for HT20 5700 MHz – Vert. (Pk)

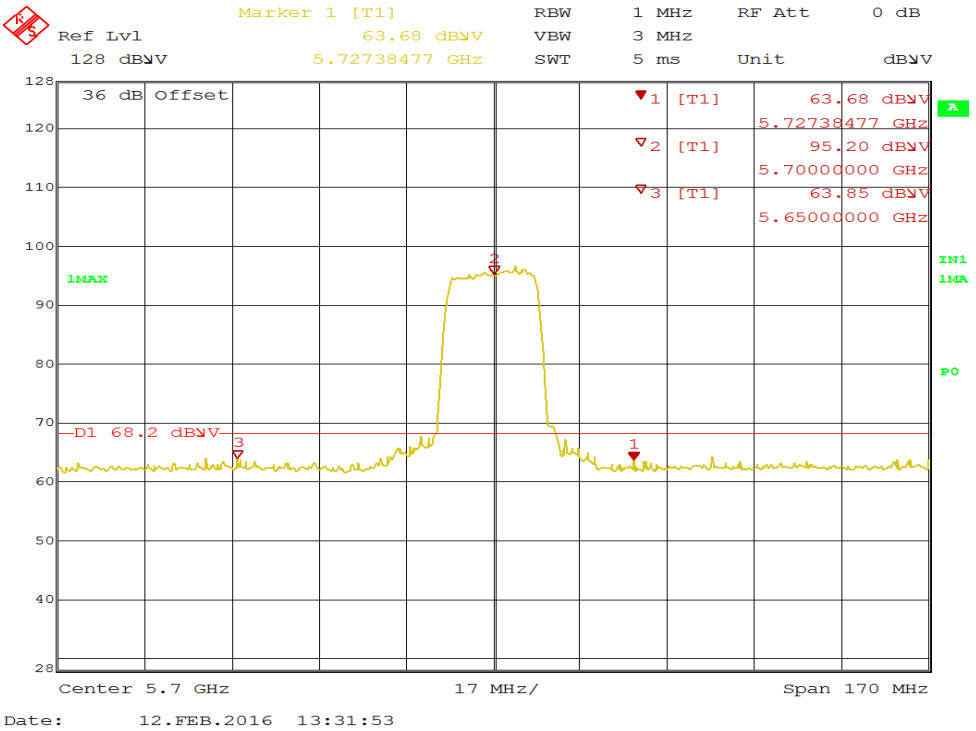


Figure 36: Radiated Emission 5725 MHz Edge for HT20 5700 MHz – Horz. (Pk)

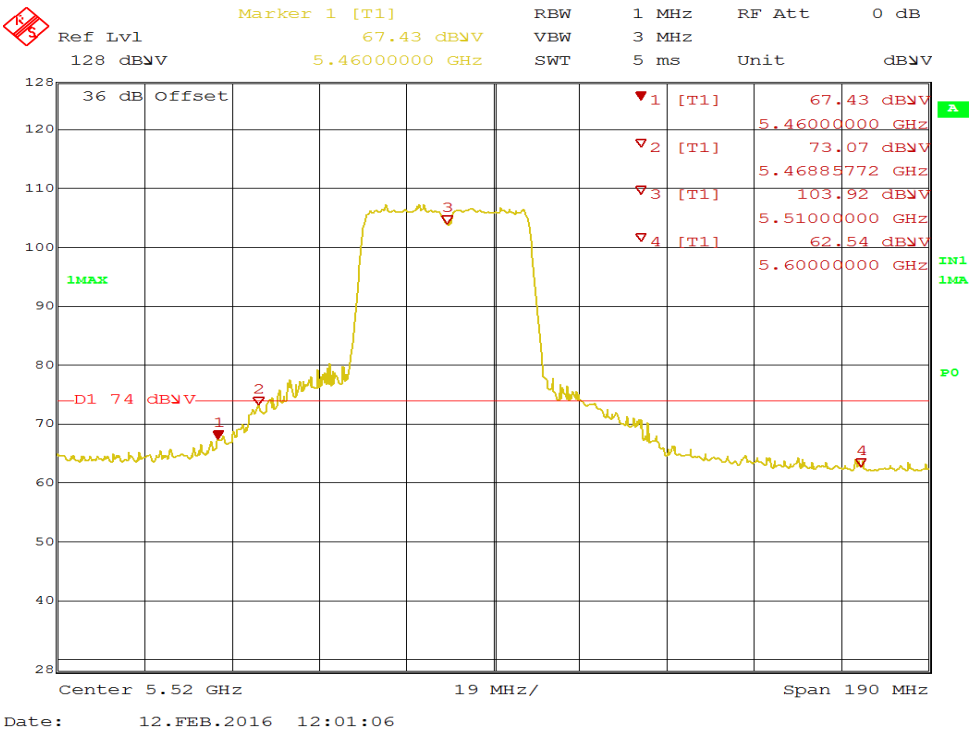


Figure 37: Radiated Emission 5470 MHz Edge for HT40 5510 MHz – Vert. (Pk)

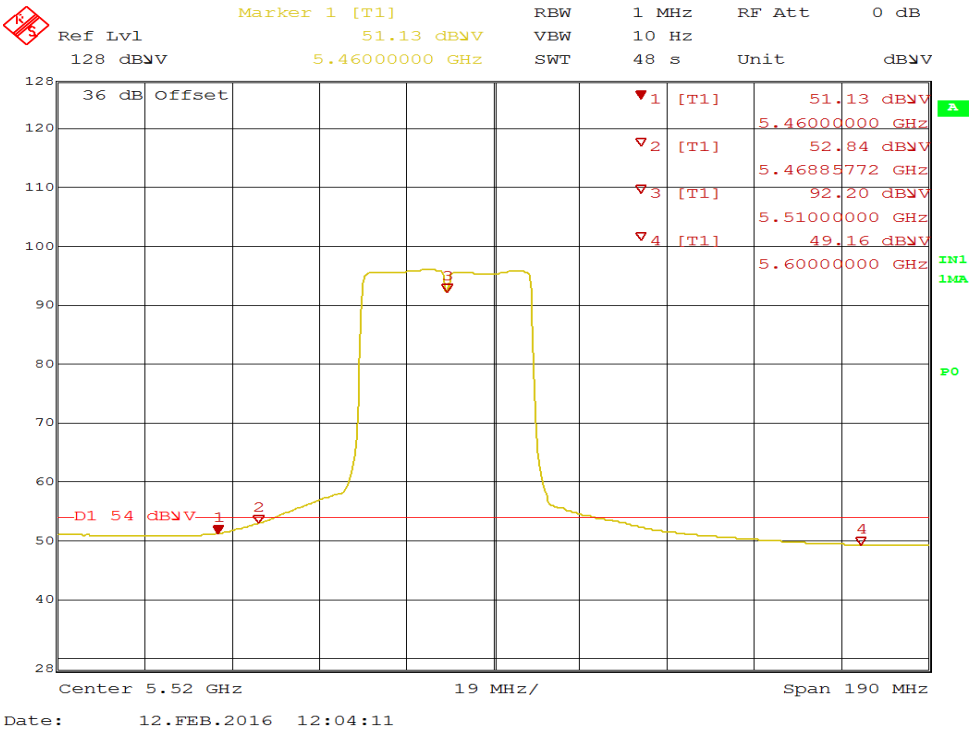


Figure 38: Radiated Emission 5470 MHz Edge for HT40 5510 MHz – Vert. (Ave)

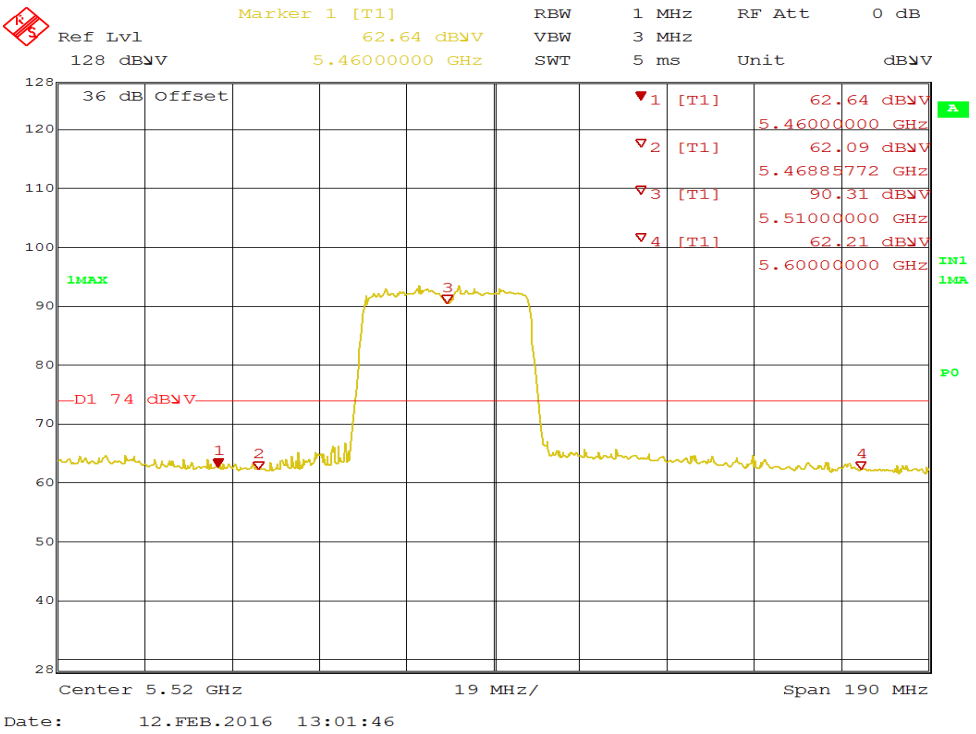


Figure 39: Radiated Emission 5470 MHz Edge for HT40 5510 MHz – Horz. (Pk)

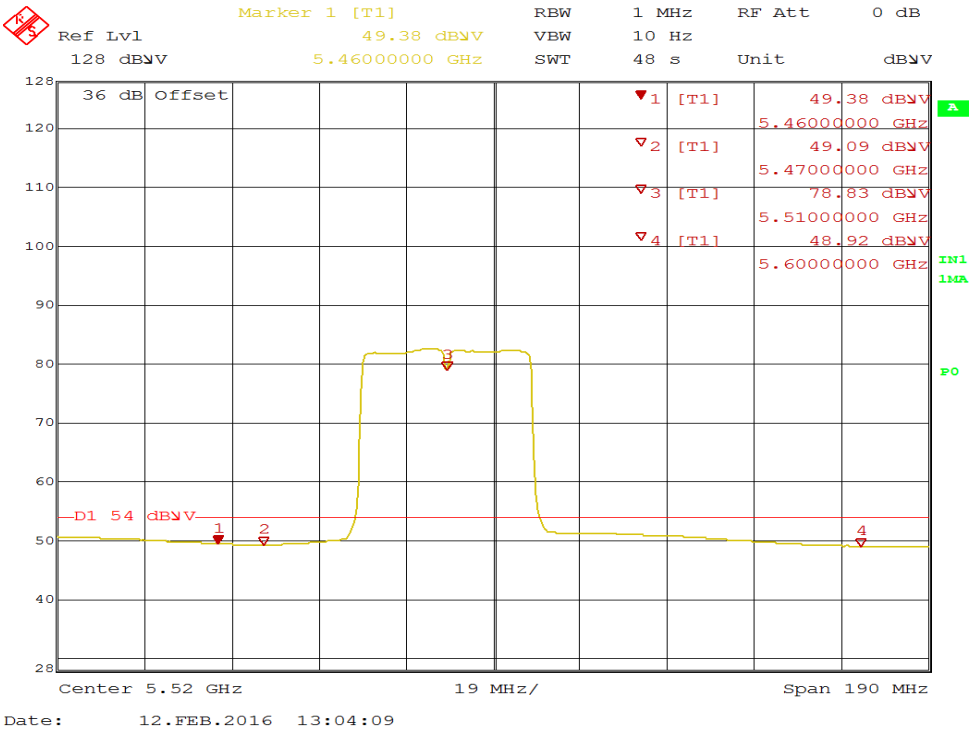


Figure 40: Radiated Emission 5470 MHz Edge for HT40 5510 MHz – Horz. (Ave)

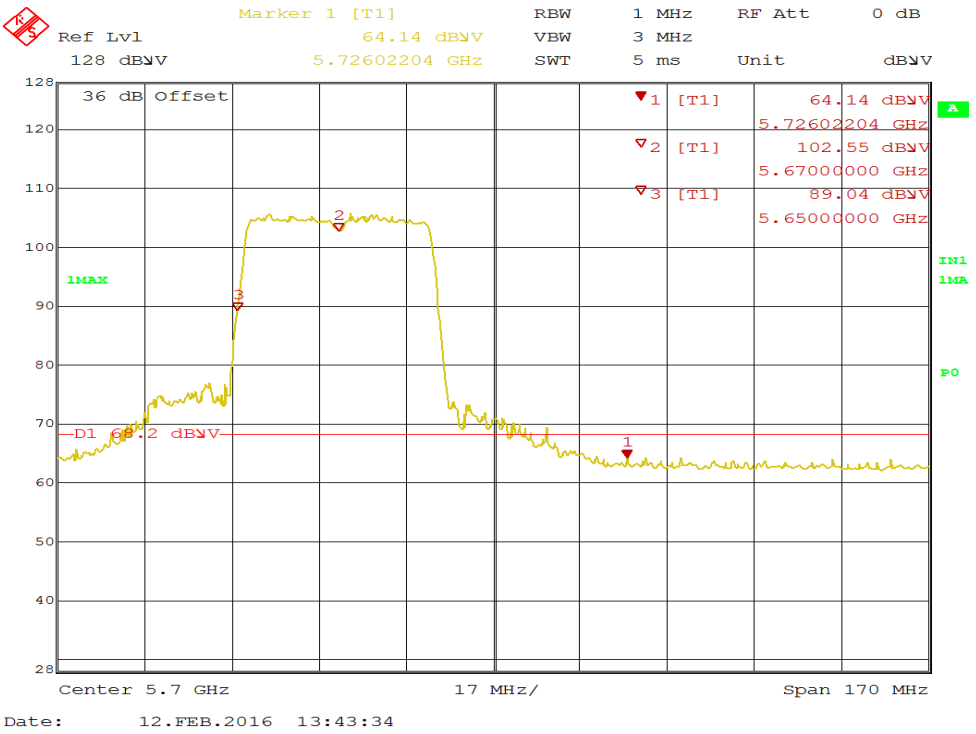


Figure 41: Radiated Emission 5725 MHz Edge for HT40 5670 MHz – Vert. (Pk)

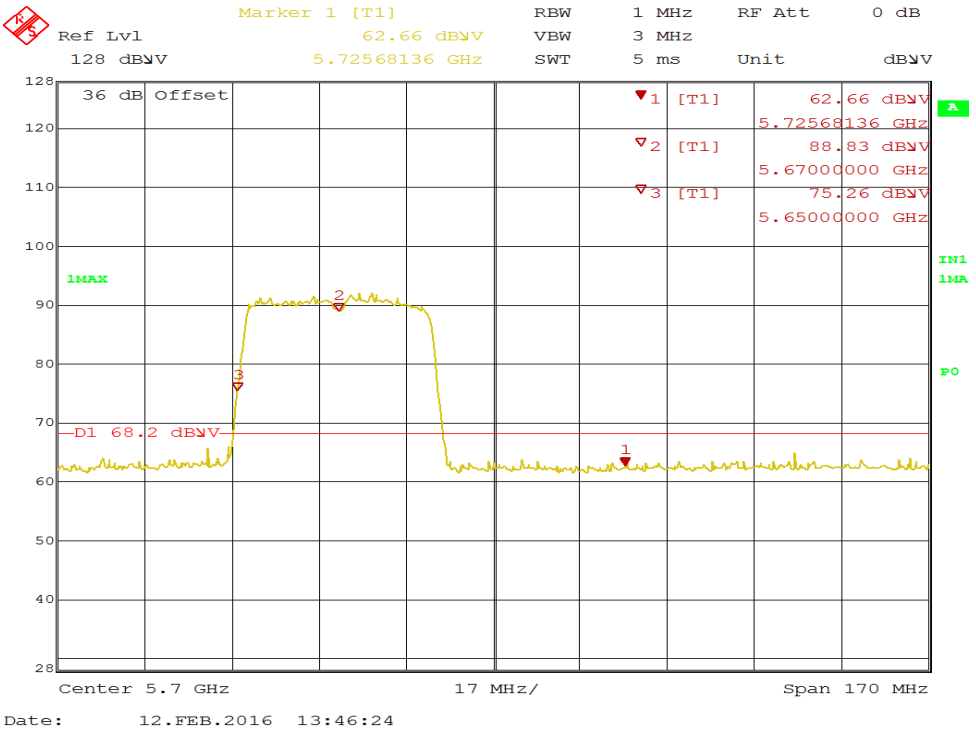
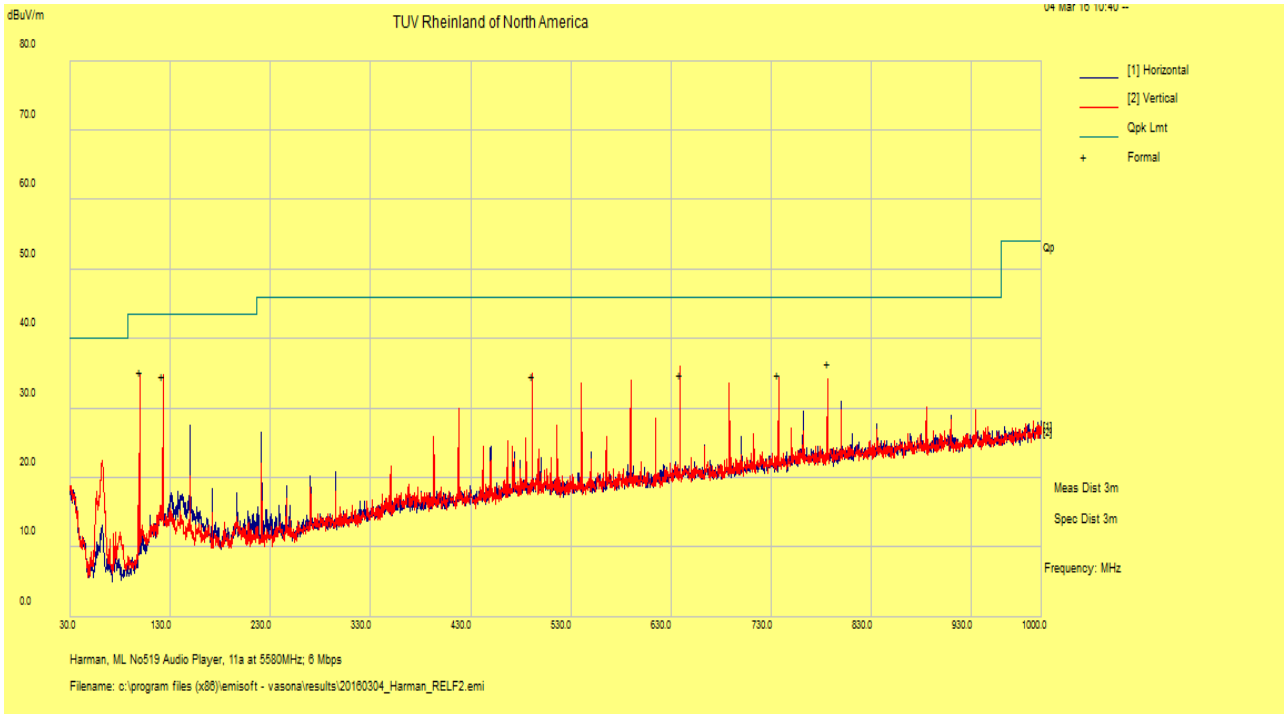


Figure 42: Radiated Emission 5725 MHz Edge for HT40 5670 MHz – Horz. (Pk)

SOP 1 Radiated Emissions		Tracking # 31661072.001 Page 1 of 13	
EUT Name	Audio Player	**Date**	March 4, 2016
EUT Model	No519	**Temp / Hum in**	21° C / 35%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11a at 6 Mbps	**Line AC / Freq**	110 Vac/60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Kerwinn Corpuz

30 MHz – 1 GHz Transmit at 5580 MHz

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
100.01	53.87	3.12	-21.77	35.22	QP	V	100	-2	43.50	-8.28
122.88	49.24	3.26	-17.86	34.63	QP	V	102	136	43.50	-8.87
491.49	43.93	4.66	-13.95	34.64	QP	V	103	34	46.00	-11.37
638.97	41.47	5.08	-11.71	34.84	QP	V	100	196	46.00	-11.17
737.26	40.34	5.35	-10.80	34.89	QP	V	134	-2	46.00	-11.11
786.42	41.10	5.48	-10.11	36.48	QP	V	120	361	46.00	-9.52



Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. Worst case was observed on Mid channel of 802.11a 6 Mbps mode.
2. Mode tested are 802.11n HT20, HT40 (low, mid & high channel).
3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

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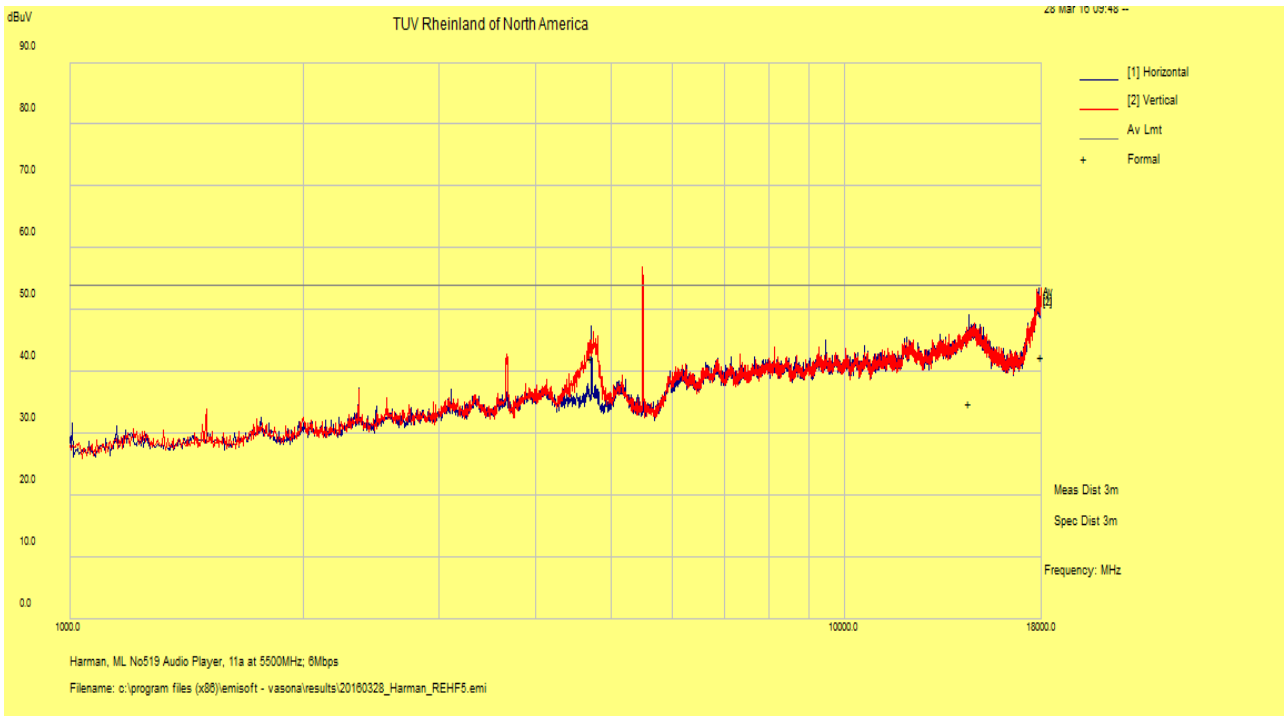
EUT Name	Audio Player	**Date**	March 28, 2016
EUT Model	No519	**Temp / Hum in**	19° C / 30%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11a at 6Mbps	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 GHz Transmit at 5500 MHz (Low Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
4718.52	57.37	1.83	-16.96	42.24	Average	H	116	184	54.00	-11.76
14499.38	38.86	3.38	-7.46	34.77	Average	H	101	184	54.00	-19.23
17997.36	35.93	4.05	2.41	42.39	Average	H	229	276	54.00	-11.61



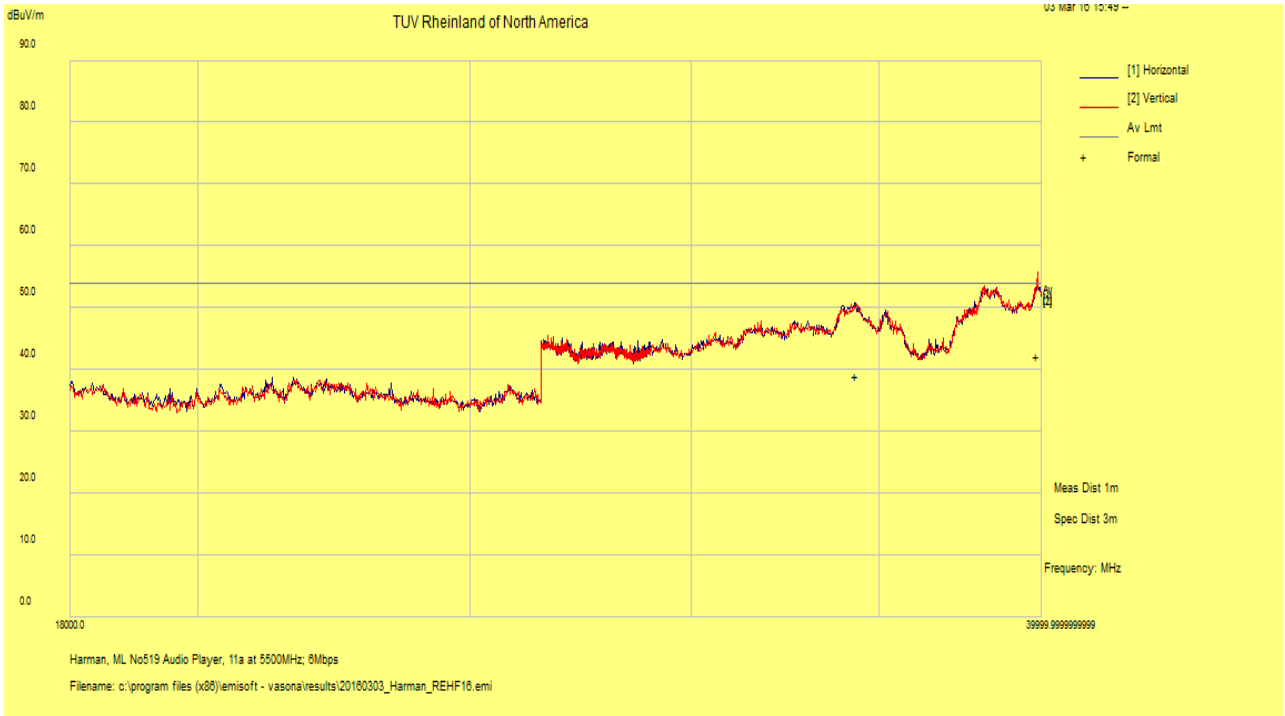
Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. Worst case was observed on 802.11a 6Mbps mode.
2. Mode covered is HT20.
3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
4. Emission above the Spurious Limit is the Fundamental.

SOP 1 Radiated Emissions		Tracking # 31661072.001 Page 3 of 13	
EUT Name	Audio Player	**Date**	March 3, 2016
EUT Model	No519	**Temp / Hum in**	21° C / 37%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11a at 6Mbps	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

18 – 40 GHz Transmit at 5500 MHz (Low Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
34335.18	44.36	7.00	-12.44	38.93	Average	H	159	248	54.00	-15.07
39866.01	48.05	7.64	-13.53	42.16	Average	V	149	48	54.00	-11.84



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. Worst case was observed on 802.11a 6Mbps mode.
2. Mode covered is HT20.
3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
4. Observed no significant emissions, spectrum noise floor.

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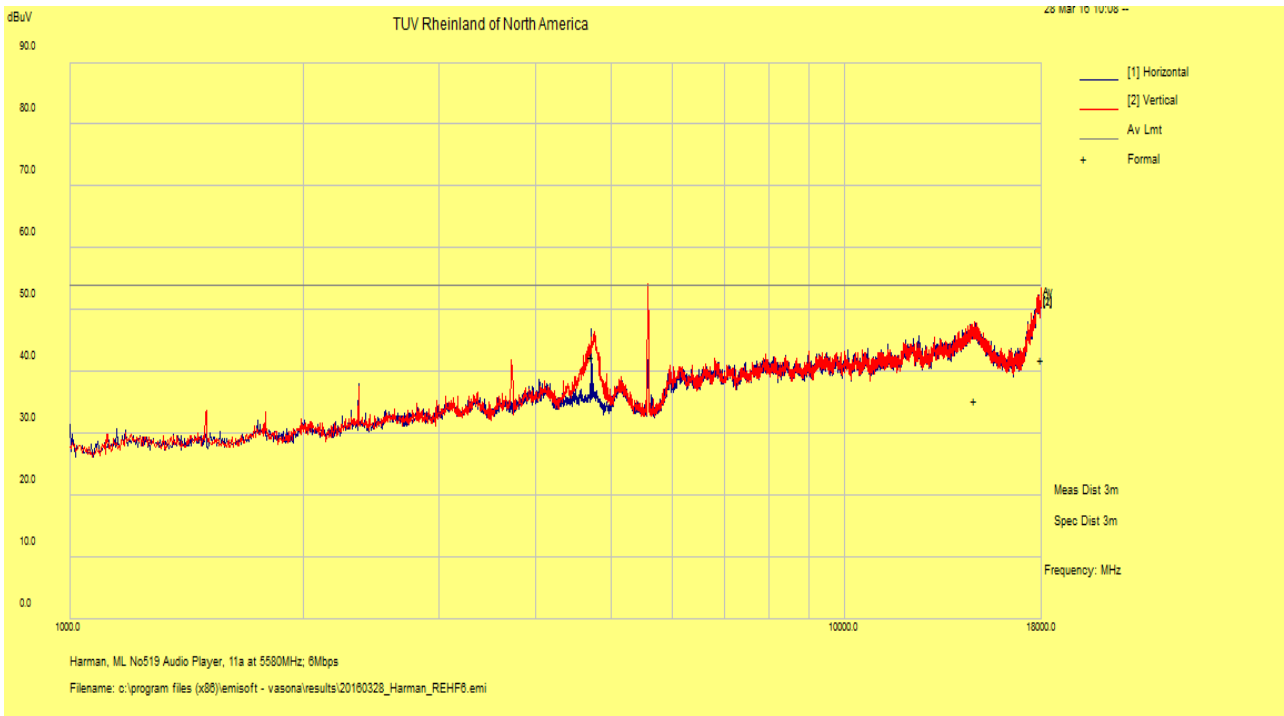
EUT Name	Audio Player	**Date**	March 28, 2016
EUT Model	No519	**Temp / Hum in**	19° C / 30%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11a at 6Mbps	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 GHz Transmit at 5580 MHz (Mid Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
4718.59	57.58	1.83	-16.96	42.45	Average	H	104	156	54.00	-11.55
14753.04	38.21	3.39	-6.36	35.24	Average	V	226	153	54.00	-18.76
17992.96	35.58	4.04	2.31	41.93	Average	V	172	141	54.00	-12.07



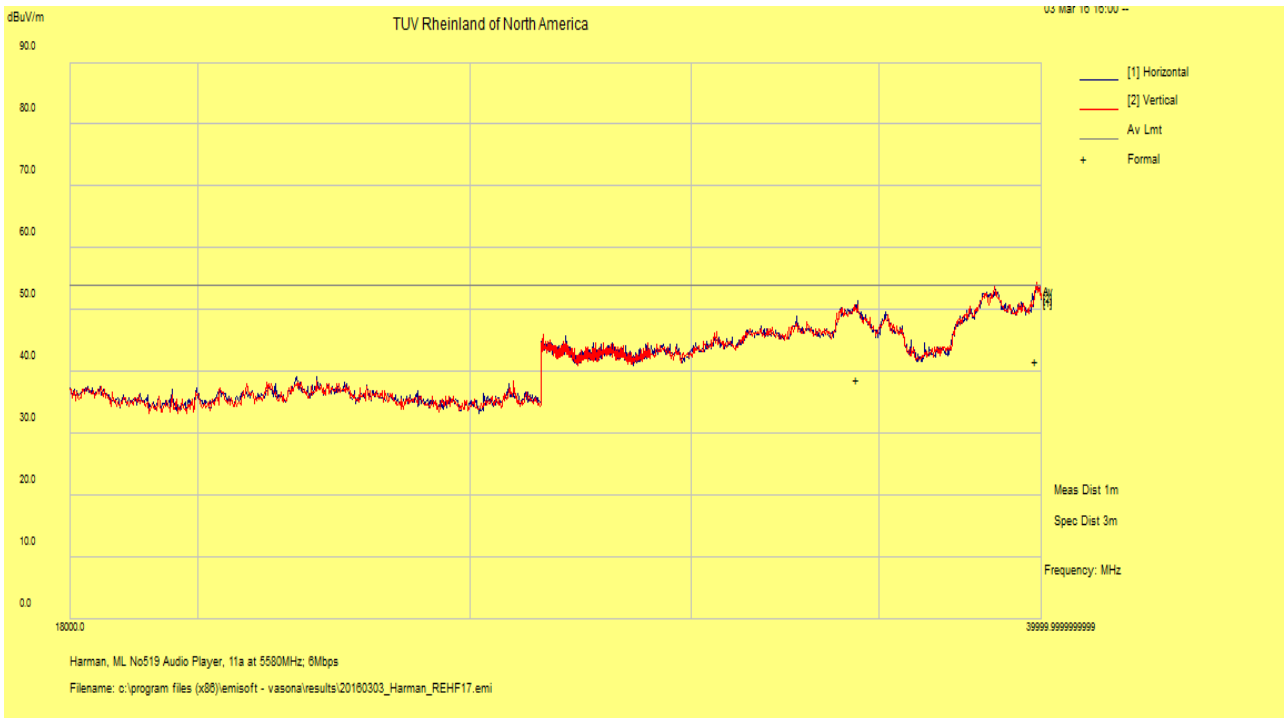
Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. Worst case was observed on 802.11a 6Mbps mode.
2. Mode covered is HT20.
3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
4. Emission above the Spurious Limit is the Fundamental.

SOP 1 Radiated Emissions		Tracking # 31661072.001 Page 5 of 13	
EUT Name	Audio Player	**Date**	March 3, 2016
EUT Model	No519	**Temp / Hum in**	20° C / 37%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11a at 6Mbps	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

18 – 40 GHz Transmit at 5580 MHz (Mid Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
34377.66	44.17	7.01	-12.44	38.74	Average	H	171	298	54.00	-15.26
39822.01	47.61	7.65	-13.54	41.73	Average	V	142	20	54.00	-12.27



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

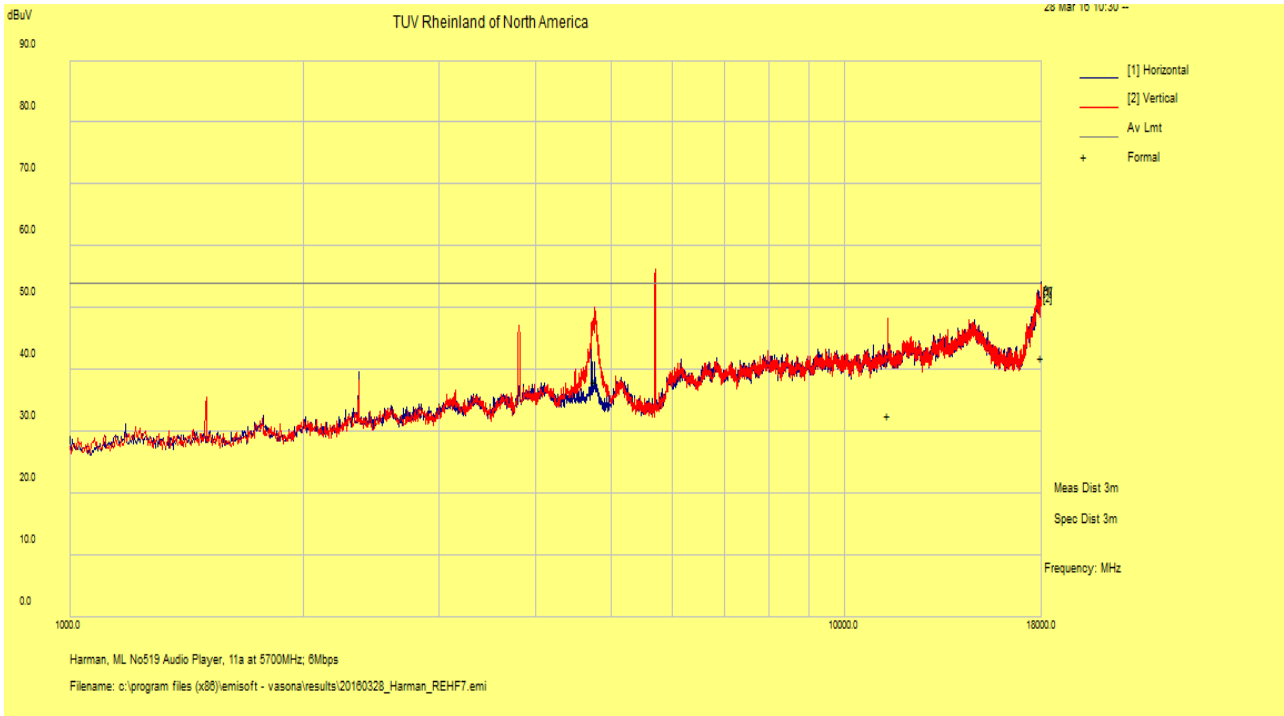
Note: 1. Worst case was observed on 802.11a 6Mbps mode.
2. Mode covered is HT20.
3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
4. Observed no significant emissions, spectrum noise floor.

SOP 1 Radiated Emissions — Tracking # 31661072.001 Page 6 of 13

EUT Name	Audio Player	**Date**	March 28, 2016
EUT Model	No519	**Temp / Hum in**	19° C / 30%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11a at 6Mbps	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 GHz Transmit at 5700 MHz (High Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
17974.21	36.05	4.02	1.84	41.91	Average	H	215	282	54.00	-12.09
4762.72	53.24	1.87	-17.06	38.06	Average	V	248	234	54.00	-15.95
11399.10	40.89	2.83	-11.23	32.49	Average	V	231	145	54.00	-21.51



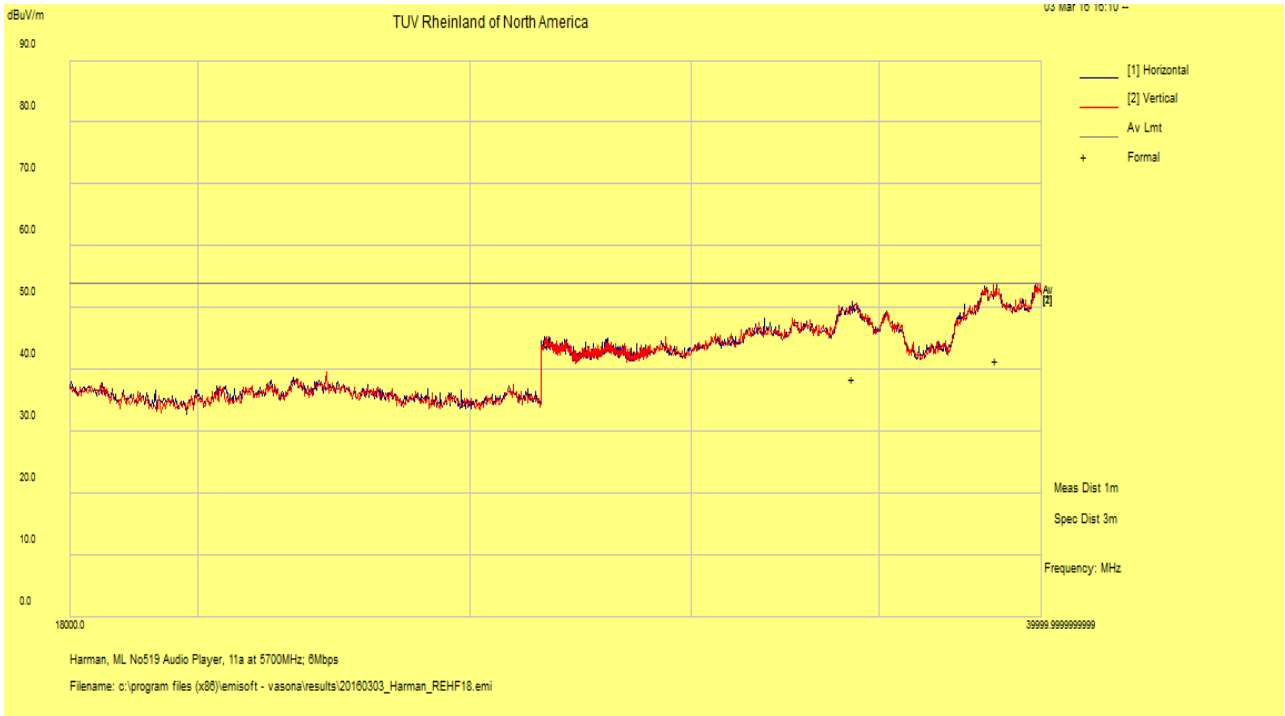
Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. Worst case was observed on 802.11a 6Mbps mode.
2. Mode covered is HT20.
3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
4. Emission above the Spurious Limit is the Fundamental.

SOP 1 Radiated Emissions		Tracking # 31661072.001 Page 7 of 13	
EUT Name	Audio Player	**Date**	March 3, 2016
EUT Model	No519	**Temp / Hum in**	19° C / 30%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11a at 6Mbps	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

18 – 40 GHz Transmit at 5700 MHz (High Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
34247.60	44.03	6.99	-12.43	38.58	Average	H	141	348	54.00	-15.42
38546.42	45.91	7.56	-11.96	41.50	Average	H	167	158	54.00	-12.50



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. Worst case was observed on 802.11a 6Mbps mode.
2. Mode covered is HT20.
3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
4. Observed no significant emissions, spectrum noise floor.

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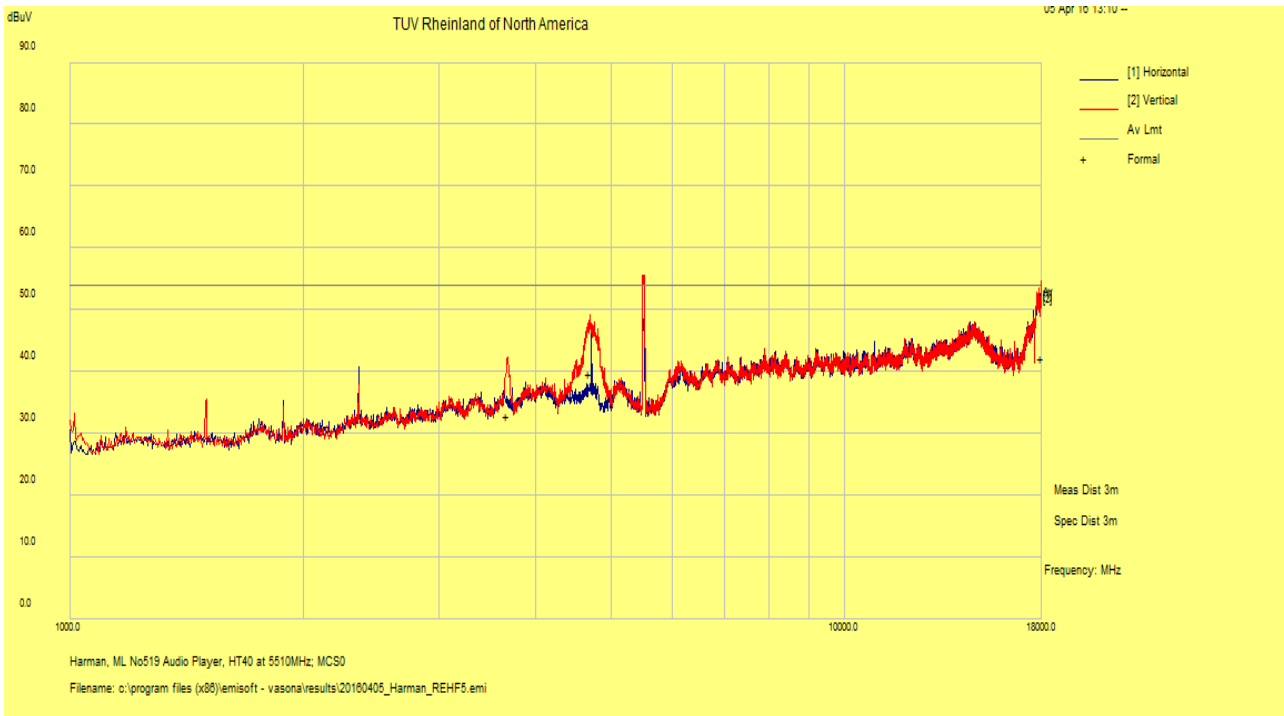
EUT Name	Audio Player	**Date**	April 5, 2016
EUT Model	No519	**Temp / Hum in**	20° C / 34%rh
EUT Serial	919	**Temp / Hum out**	N/A
EUT Config.	802.11n at HT40 MCS0	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 GHz Transmit at 5510 MHz (Low Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
3676.34	49.42	1.57	-18.18	32.81	Average	V	166	138	54.00	-21.19
4692.38	54.77	1.83	-17.05	39.55	Average	V	130	132	54.00	-14.45
17980.04	36.11	4.03	1.99	42.12	Average	V	100	28	54.00	-11.88



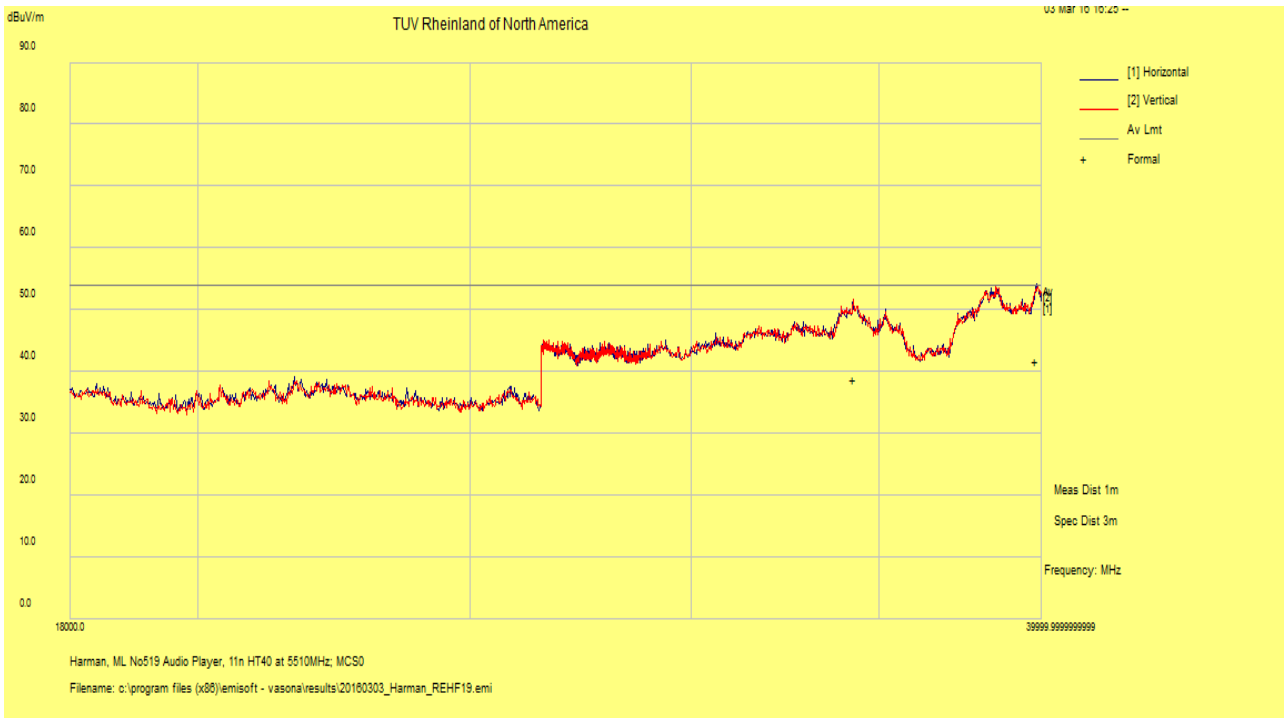
Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
2. Emission above the Spurious Limit is the Fundamental.

SOP 1 Radiated Emissions		Tracking # 31661072.001 Page 9 of 13	
EUT Name	Audio Player	**Date**	March 3, 2015
EUT Model	No519	**Temp / Hum in**	21° C / 37%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11n at HT40 MCS0	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

18 – 40 GHz Transmit at 5510 MHz (Low Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
39822.56	47.62	7.65	-13.54	41.73	Average	H	138	190	54.00	-12.27
34269.05	44.20	6.99	-12.43	38.76	Average	V	154	220	54.00	-15.24



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
2. Observed no significant emissions, spectrum noise floor.

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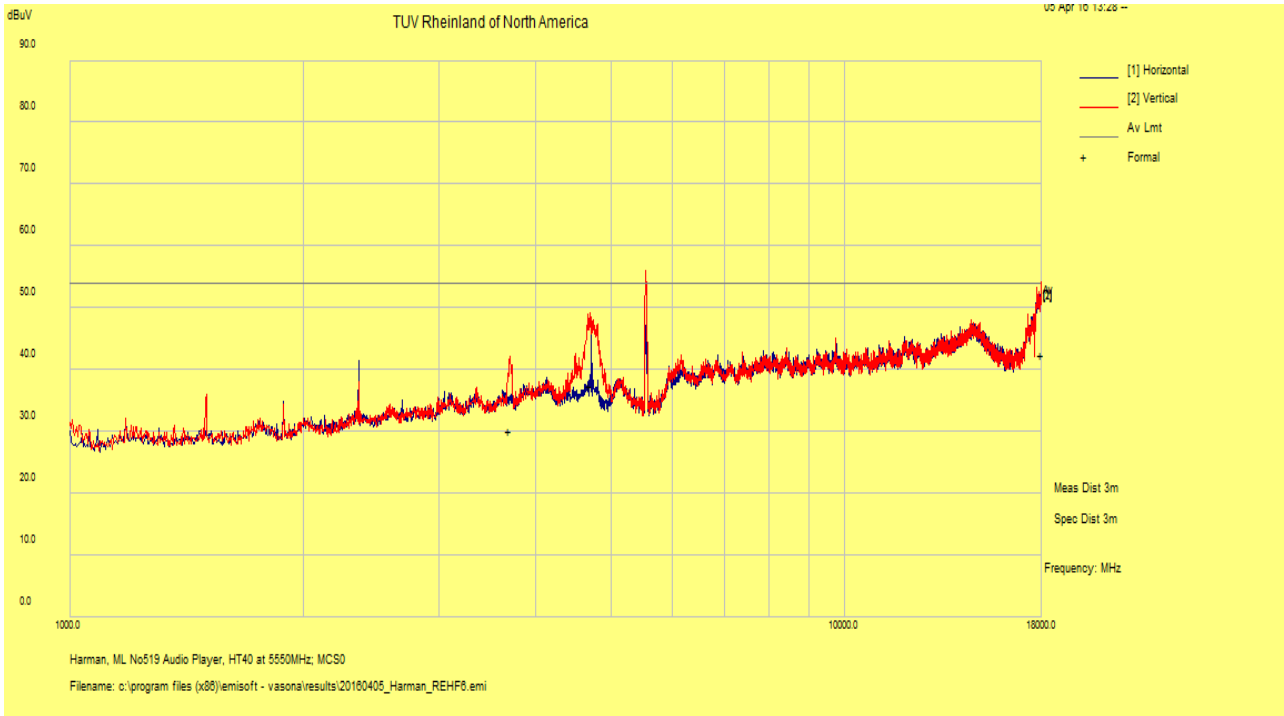
EUT Name	Audio Player	**Date**	April 5, 2016
EUT Model	No519	**Temp / Hum in**	20° C / 34%rh
EUT Serial	919	**Temp / Hum out**	N/A
EUT Config.	802.11n at HT40 MCS0	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 GHz Transmit at 5550 MHz (Mid Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
3699.54	46.73	1.58	-18.15	30.16	Average	V	122	170	54.00	-23.84
4703.71	52.66	1.83	-17.01	37.48	Average	V	238	124	54.00	-16.52
17984.15	36.37	4.03	2.09	42.49	Average	V	239	-2	54.00	-11.51



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
2. Emission above the Spurious Limit is the Fundamental.

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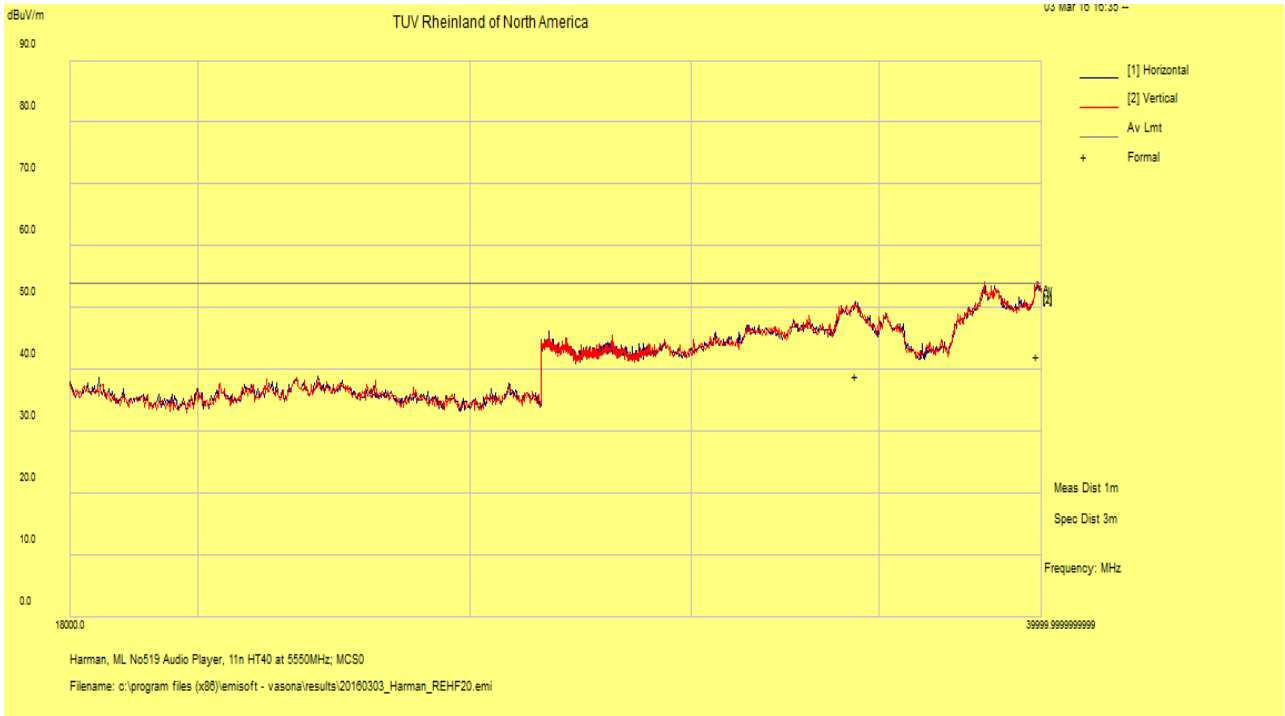
EUT Name	Audio Player	**Date**	March 3, 2015
EUT Model	No519	**Temp / Hum in**	21° C / 37%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11n at HT40 MCS0	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

18 – 40 GHz Transmit at 5550 MHz (Mid Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
34335.74	44.36	7.00	-12.44	38.93	Average	H	147	128	54.00	-15.07
39868.89	48.06	7.64	-13.53	42.16	Average	H	163	260	54.00	-11.84



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
2. Observed no significant emissions, spectrum noise floor.

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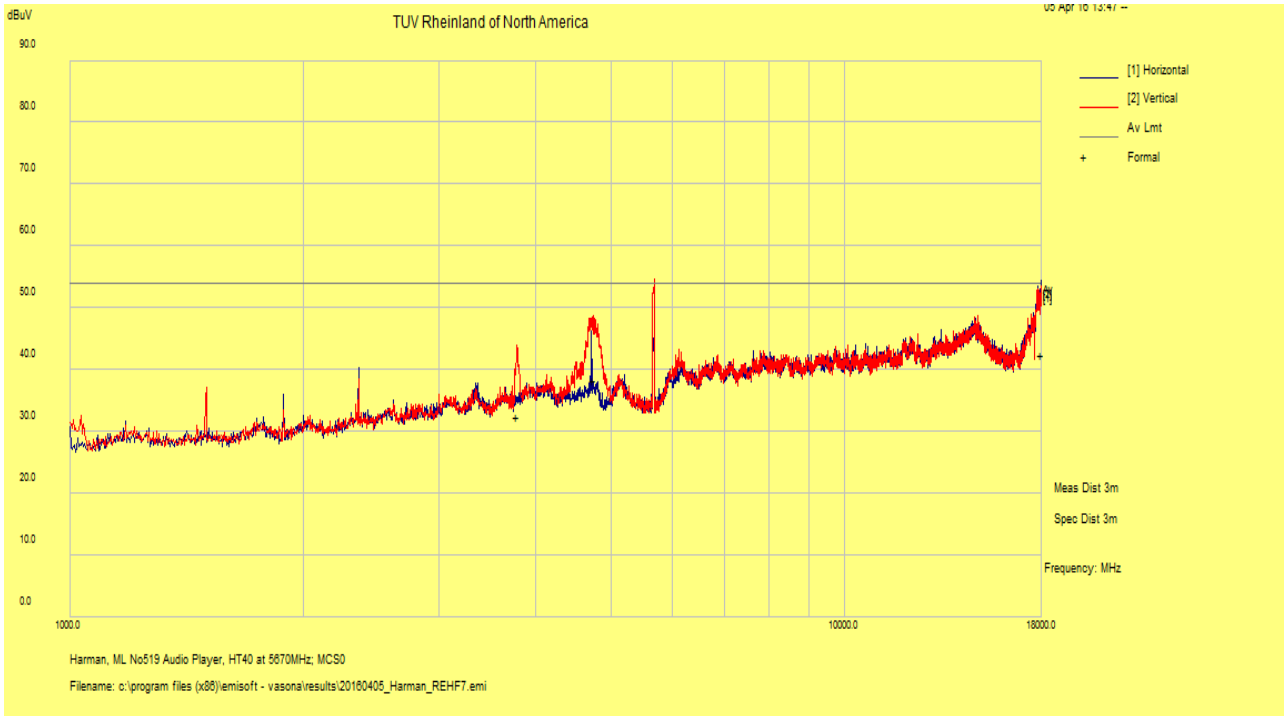
EUT Name	Audio Player	**Date**	April 5, 2016
EUT Model	No519	**Temp / Hum in**	20° C / 34%rh
EUT Serial	919	**Temp / Hum out**	N/A
EUT Config.	802.11n at HT40 MCS0	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 GHz Transmit at 5670 MHz (High Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
17989.76	36.02	4.04	2.23	42.29	Average	H	196	298	54.00	-11.71
3778.60	48.19	1.59	-17.32	32.45	Average	V	207	264	54.00	-21.55
4749.95	53.33	1.87	-17.03	38.18	Average	V	165	126	54.00	-15.83



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

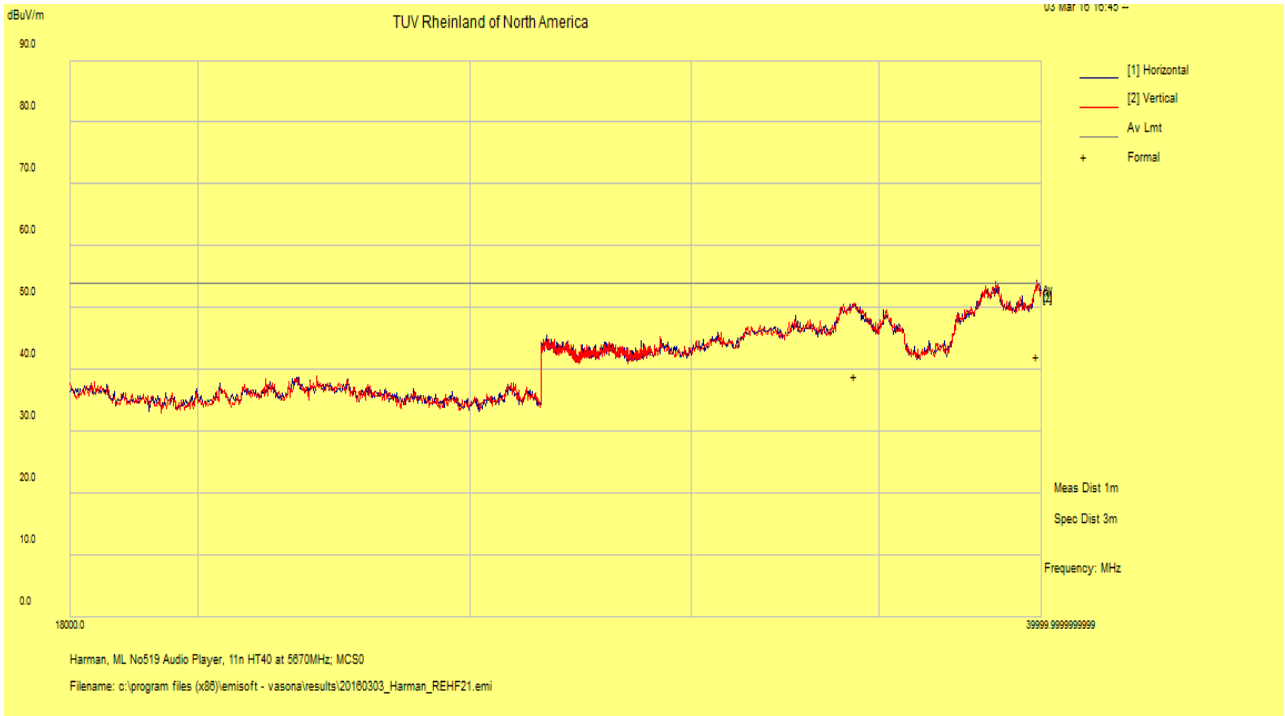
Note: 1. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
2. Emission above the Spurious Limit is the Fundamental.

SOP 1 Radiated Emissions — Tracking # 31661072.001 Page 13 of 13

EUT Name	Audio Player	**Date**	March 3, 2015
EUT Model	No519	**Temp / Hum in**	21° C / 37%rh
EUT Serial	916	**Temp / Hum out**	N/A
EUT Config.	802.11n at HT40 MCS0	**Line AC / Freq**	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m – AHA-840	**Performed by**	Kerwinn Corpuz

18 – 40 GHz Transmit at 5670 MHz (High Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
39846.68	48.01	7.65	-13.54	42.12	Average	H	162	246	54.00	-11.88
34311.72	44.34	7.00	-12.44	38.90	Average	V	117	196	54.00	-15.10



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
2. Observed no significant emissions, spectrum noise floor.

4.6 AC Conducted Emissions

Testing was performed in accordance with ANSI C63.4: 2014. These test methods are listed under the laboratory's A2LA Scope of Accreditation.

This test measures the levels emanating from the EUT's AC input port, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

The AC conducted emissions of equipment under test shall not exceed the values in CFR47 Part 15.207: 2015 and RSS GEN: 2014.

4.6.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50μH / 50Ω LISNs.

Testing is performed in Lab 5. The setup photographs clearly identify which site was used. The vertical ground plane used in the semi-anechoic chamber is a 2m x 2m solid aluminum frame and panel, and it is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN.

4.6.1.1 Deviations

There were no deviations from this test methodology.

4.6.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Test result was extracted from Report No. 31660721.001. Measurement was performed using center transmit channel in the UNII Band 1.

Table 11: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at Normal Conditions only		
Antenna Type: Omnidirectional	**Power Level:** See Test Plan	
AC Power: 110 Vac/60 Hz	**Configuration:** Tabletop	
Ambient Temperature: 22° C	**Relative Humidity:** 35% RH	
Configuration	**Frequency Range**	**Test Result**
Line 1 (Hot)	0.15 to 30 MHz	Pass
Line 2 (Neutral)	0.15 to 30 MHz	Pass

SOP 2 Conducted Emissions

Tracking # 31661072.001 Page 1 of 4

EUT Name	Audio Player	**Date**	March 1, 2016
EUT Model	No519	**Temp / Hum in**	22° C / 34% rh
EUT Serial	919	**Temp / Hum out**	N/A
EUT Config.	TX mode	**Line AC / Freq**	110Vac/60Hz
Standard	CFR47 Part 15.207 and RSS Gen	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 1	**Performed by**	Kerwinn Corpuz

Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB	
0.272	27.10	9.96	0.13	37.18	QP	Live	61.04	-23.86	Pass
0.272	24.69	9.96	0.13	34.77	Ave	Live	51.04	-16.27	Pass
16.229	25.87	10.17	-0.02	36.02	QP	Live	60.00	-23.98	Pass
16.229	24.61	10.17	-0.02	34.76	Ave	Live	50.00	-15.24	Pass
17.694	26.39	10.19	-0.04	36.54	QP	Live	60.00	-23.46	Pass
17.694	24.11	10.19	-0.04	34.26	Ave	Live	50.00	-15.74	Pass
18.244	27.65	10.19	-0.04	37.79	QP	Live	60.00	-22.21	Pass
18.244	25.15	10.19	-0.04	35.29	Ave	Live	50.00	-14.71	Pass
21.664	25.49	10.22	-0.10	35.61	QP	Live	60.00	-24.39	Pass
21.664	25.10	10.22	-0.10	35.22	Ave	Live	50.00	-14.78	Pass
23.129	27.06	10.22	-0.12	37.16	QP	Live	60.00	-22.84	Pass
23.129	25.66	10.22	-0.12	35.76	Ave	Live	50.00	-14.24	Pass

Spec Margin = QP./Ave. - Limit, ± Uncertainty

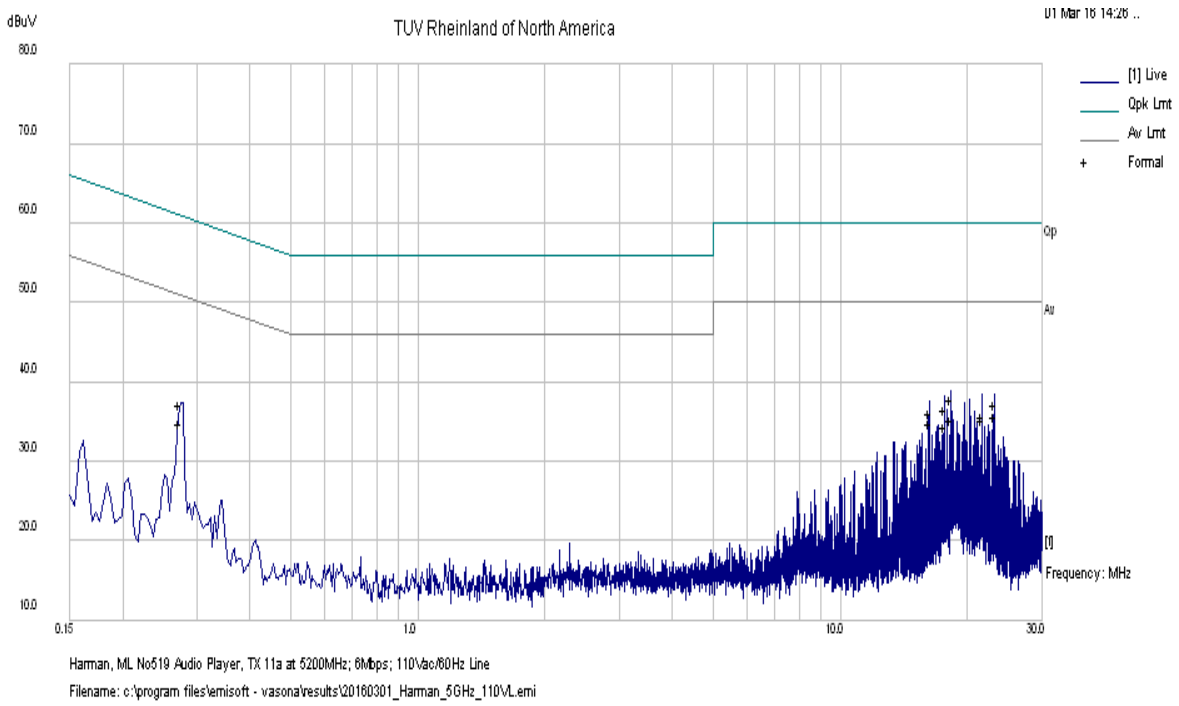
Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: EUT was setup as table top equipment and transmitted at 5200 MHz in 802.11a at 6Mbps

SOP 2 Conducted Emissions — Tracking # 31661072.001 Page 2 of 4

EUT Name	Audio Player	**Date**	March 1, 2016
EUT Model	No519	**Temp / Hum in**	22° C / 34% rh
EUT Serial	919	**Temp / Hum out**	N/A
EUT Config.	TX mode	**Line AC**	110Vac/60Hz
Standard	CFR47 Part 15.207 and RSS Gen	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 1	**Performed by**	Kerwinn Corpuz

150 kHz to 30 MHz Plot for Line 1 (Hot)



Note: Met FCC Class B limit.

SOP 2 Conducted Emissions

Tracking # 31661072.001 Page 3 of 4

EUT Name	Audio Player	**Date**	March 1, 2016
EUT Model	No519	**Temp / Hum in**	22° C / 34% rh
EUT Serial	919	**Temp / Hum out**	N/A
EUT Config.	TX mode	**Line AC / Freq**	110Vac/60Hz
Standard	CFR47 Part 15.207 and RSS Gen	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 2	**Performed by**	Kerwinn Corpuz

Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB	
0.273	26.98	9.96	0.13	37.06	QP	Neutral	61.03	-23.97	Pass
0.273	24.55	9.96	0.13	34.64	Ave	Neutral	51.03	-16.39	Pass
16.228	26.01	10.17	-0.02	36.16	QP	Neutral	60.00	-23.84	Pass
16.228	24.85	10.17	-0.02	35.00	Ave	Neutral	50.00	-15.00	Pass
18.244	27.08	10.19	-0.04	37.22	QP	Neutral	60.00	-22.78	Pass
18.244	25.40	10.19	-0.04	35.55	Ave	Neutral	50.00	-14.45	Pass
20.258	26.07	10.20	-0.08	36.20	QP	Neutral	60.00	-23.80	Pass
20.258	24.01	10.20	-0.08	34.13	Ave	Neutral	50.00	-15.87	Pass
21.664	26.61	10.22	-0.10	36.73	QP	Neutral	60.00	-23.27	Pass
21.664	25.02	10.22	-0.10	35.14	Ave	Neutral	50.00	-14.86	Pass
23.128	27.06	10.22	-0.12	37.16	QP	Neutral	60.00	-22.84	Pass
23.128	25.29	10.22	-0.12	35.39	Ave	Neutral	50.00	-14.61	Pass

Spec Margin = QP./Ave. - Limit, ± Uncertainty

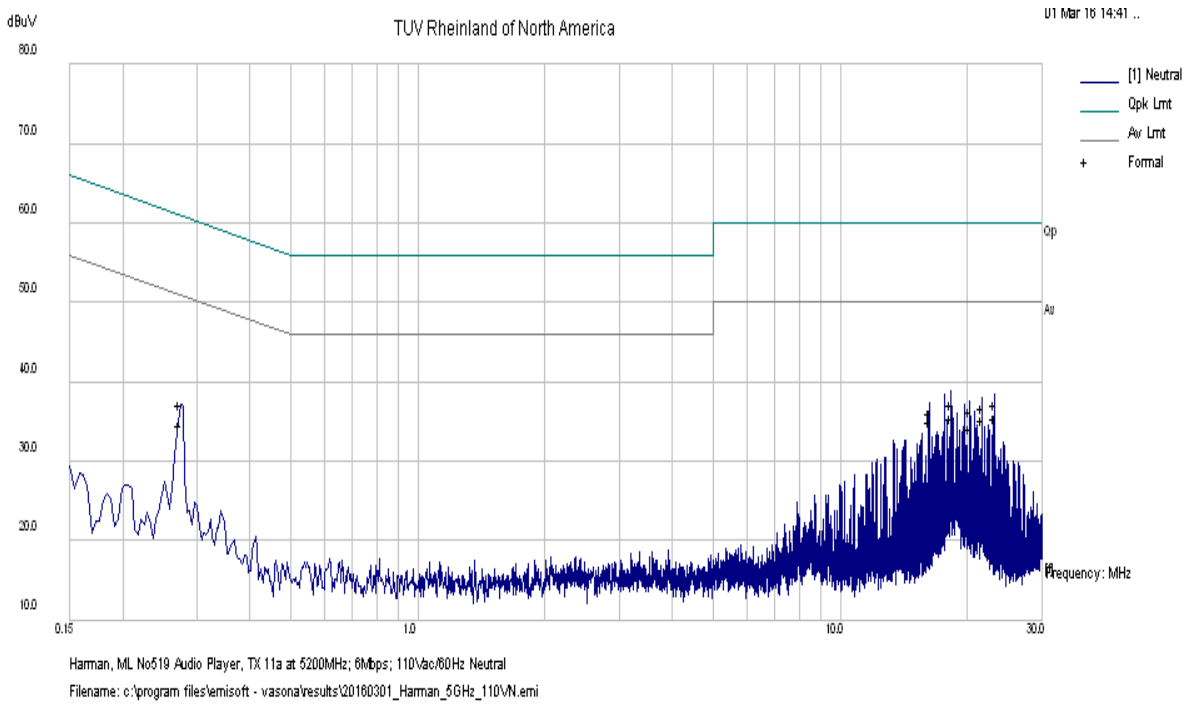
Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: EUT was setup as table top equipment and transmitted at 5200 MHz in 802.11a at 6Mbps

SOP 2 Conducted Emissions — Tracking # 31661072.001 Page 4 of 4

EUT Name	Audio Player	**Date**	March 1, 2016
EUT Model	No519	**Temp / Hum in**	22° C / 34% rh
EUT Serial	919	**Temp / Hum out**	N/A
EUT Config.	TX mode	**Line AC**	110Vac/60Hz
Standard	CFR47 Part 15.207 and RSS Gen	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 2	**Performed by**	Kerwinn Corpuz

150 kHz to 30 MHz Plot for Line 2 (Neutral)



Note: Met FCC Class B Limit.

4.7 Frequency Stability

In accordance with 47 CFR Part 15.407(g) and RSS GEN Sect. 6.11 the frequency stability of U-NII devices must be such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual. The Manufacturer calls out operating temperature ranges of +10º to +40º C

4.7.1 Test Methodology

The manufacturer of the equipment is responsible for ensuring that the frequency stability is such that emissions are always maintained within the band of operation under all conditions. This test performs according to ANSI C63.10-2013 Section 6.8

4.7.2 Manufacturer Declaration

The frequency stability of the reference oscillator sets the frequency stability of the RF transceiver signals. Therefore all of the RF signal should have ±20 ppm stability.

This stability accounts for room temp tolerance of the crystal oscillator circuit, frequency variation across temperature, and crystal ageing.

Worst case:
5.200 GHz - ±20 ppm/104 kHz

±20 ppm at 5.2 GHz translates to a maximum frequency shift of ±104 kHz. As the edge of the channels are at least one MHz from either of the band edges, ±103 kHz is more than sufficient to guarantee that the intentional emission will remain in the band over the entire operating range of the radio.

4.7.3 Limit

CFR47 Part 15.407(g) and RSS GEN Sect. 6.11 - Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

4.7.4 Test results:

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s) since the maximum frequency drift was 14.42 ppm.

Test result was extracted from Report No. 31660721.001. Measurement was performed using center transmit channel in the UNII Band 1.

Table 12: Frequency Stability – Test Results

Temperature	Time	PPM
10° C	Start	5.77
	2 Min.	7.21
	5 Min	1.44
	10 min	4.33
20° C	Start	14.42
	2 Min.	10.10
	5 Min	0.00
	10 min	5.77
30° C	Start	4.33
	2 Min.	1.44
	5 Min	2.88
	10 min	2.88
40° C	Start	7.21
	2 Min.	4.33
	5 Min	4.33
	10 min	5.77
Note: All frequency drifts were less than ±20 ppm. The worst frequency drift was 14.42 ppm		

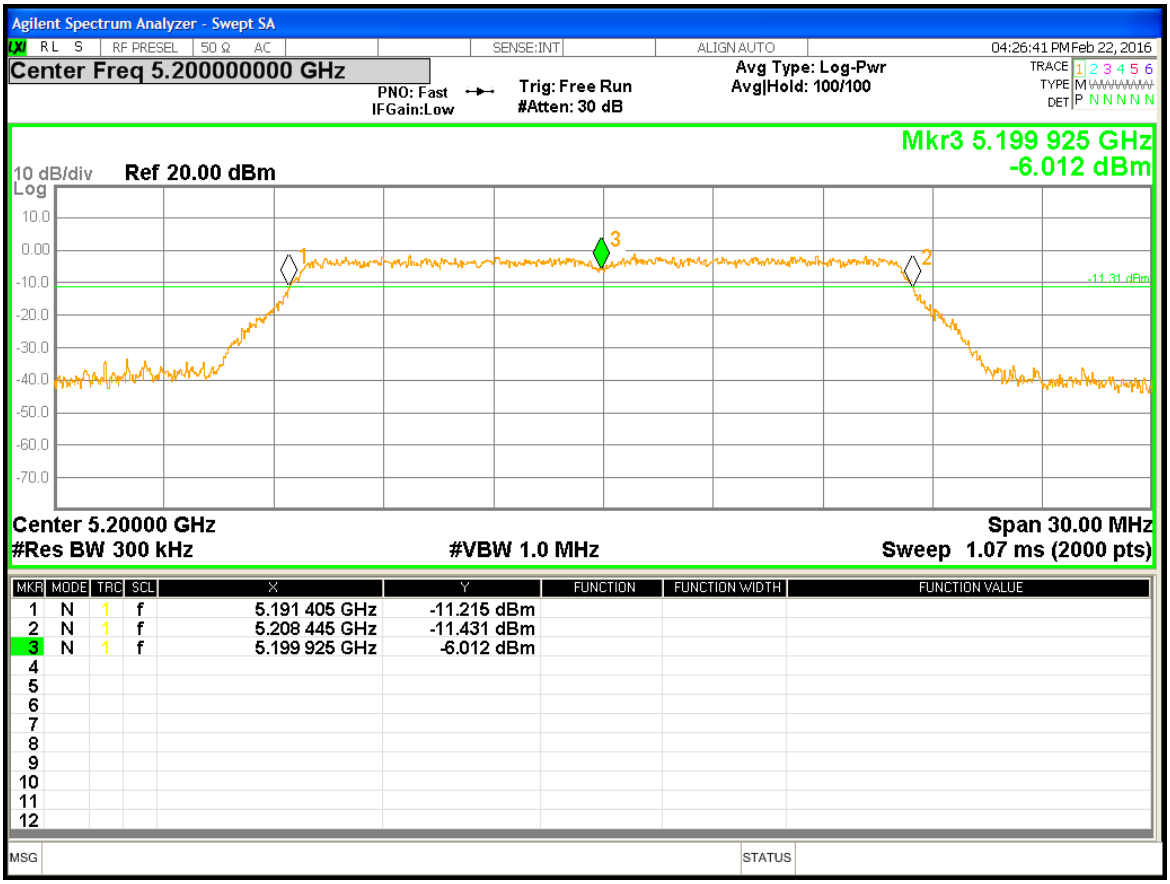


Figure 43: Frequency Stability – Worst Case

4.8 Voltage Variation

In accordance with 47 CFR Part 15.31 (e) intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.8.1 Test Methodology

The ac supply voltage was varied between 85% and 115% of the nominal rated supply voltage. The fundamental frequency was observed during the variation. The access point was powered 110 Vac / 60 Hz by programmable power supply. The voltage was varied from 93.5 Vac to 126.5 Vac mean while the fundamental frequencies were observed and record for the maximum drift in ppm; part per millions.

4.8.2 Test results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). The fundamental frequencies drifted less than ±20 ppm.

Test result was extracted from Report No. 31660721.001. Measurement was performed using center transmit channel in the UNII Band 1.

Table 13: Voltage Variation – Test Results

Frequency MHz	**Nominal (110Vac)** MHz	**Lo Voltage (93.5Vac)** MHz	**Hi Voltage (126.5Vac)** MHz	**Max Drift** ppm
5200	-2.788	0.096	-0.962	-2.788

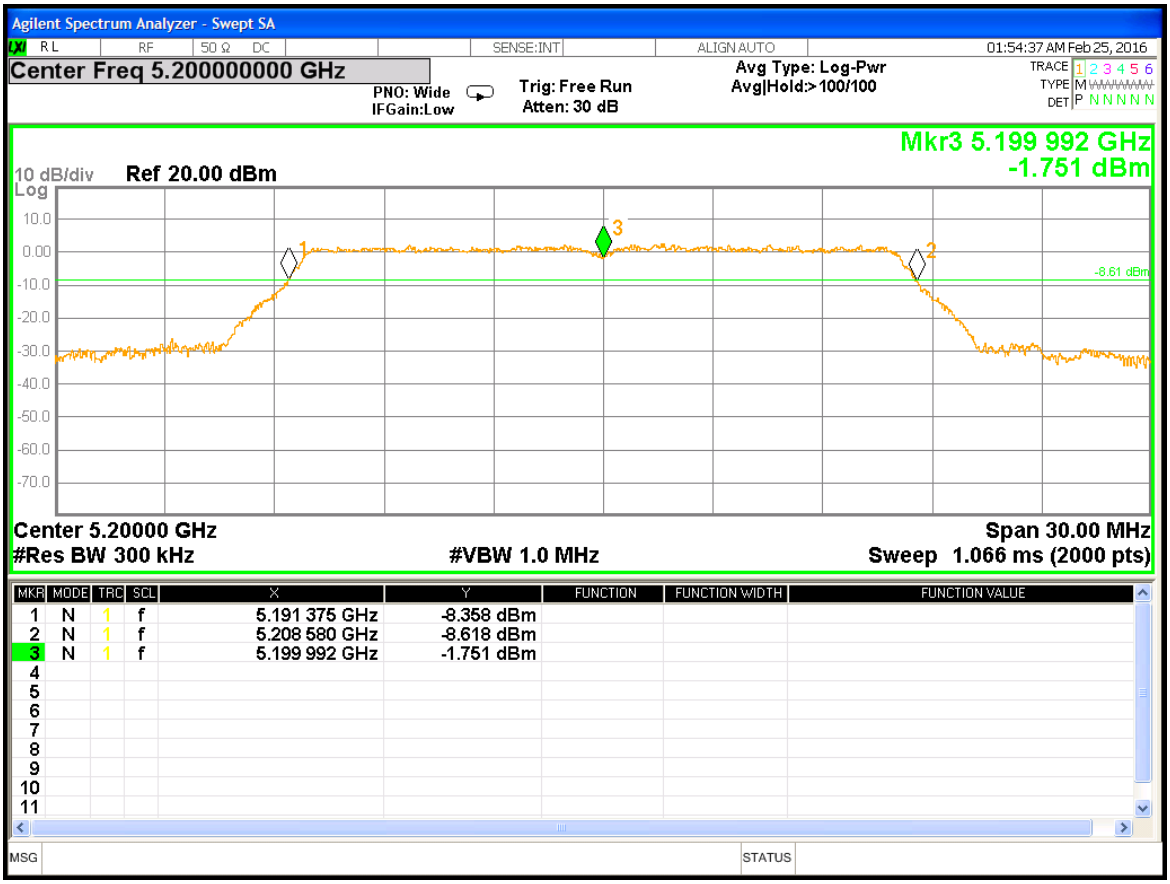


Figure 44: Voltage Variation – Worst Case

4.9 Maximum Permissible Exposure

4.9.1 Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this calculation is declared by the manufacturer, and the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

4.9.2 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm2)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	…	…	1.0	6
300 - 1500	…	…	f/300	6
1500 - 100,000	…	…	5	6
(B)Limits For General Population / Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/ f^2)	30
30–300	27.5	0.037	0.2	30
300 - 1500	…	…	f/1500	30
1500 - 100,000	…	…	1.0	30

F = Frequency in MHz
* = Plane-wave equivalent power density

4.9.3 EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

4.9.4 Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in user's manual. So, this device is classified as a **Mobile Device**.

See below calculation for 5.7 GHz, worse case, RF Exposure at a distance of 20cm.

4.9.5 Test Results

4.9.5.1 Antenna Gain

The 5.7 GHz transmitting antenna gain was +5.0 dBi or 3.16 (numeric).

4.9.5.2 Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement.

Limit for MPE (from FCC part 1.1310 table1) is 1.0 mW/cm^2

The highest measured power is +14.35 dBm or 27.227 mW

Using the Friss transmission formula, the EIRP is Pout*G, and R is 20cm.

Pd = (27.227*3.16) / (1600π) = 0.01713 mW/cm^2, which is 0.98287 mW/cm^2 below to the limit.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.9.6 Sample Calculation

The Friss transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;
Pd = power density in mW/cm2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
$\pi \approx 3.1416$
R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).

5 Test Equipment List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yyyy	Next Cal mm/dd/yyyy
Bilog Antenna	Sunol Sciences	JB3	A102606	07/08/2014	07/08/2016
Horn Antenna	Sunol Sciences	DRH-118	A040806	02/10/2015	02/10/2017
Antenna (18-40 GHz)	Com-Power	AHA-840	105005	07/08/2015	07/08/2016
Spectrum Analyzer	Rohde & Schwarz	FSL6	100169	01/20/2016	01/20/2017
Spectrum Analyzer	Agilent	N9038A	MY51210195	01/26/2016	01/26/2017
Spectrum Analyzer	Agilent	N9030A	MY52350885	03/02/2016	05/17/2017
Spectrum Analyzer	Rohde Schwarz	ESIB	832427/002	01/15/2016	01/15/2017
Spectrum Analyzer	Rohde Schwarz	FSV40	1321.3008K40	11/01/2015	11/01/2016
Amplifier	Sonoma Instruments	310	185516	01/18/2016	01/18/2017
Amplifier	Miteq	TTA1800-30-4G	1842452	01/20/2016	01/20/2017
Power Meter	Agilent	E4418B	MY45103902	01/20/2016	01/20/2017
Power Sensor	Hewlett Packard	8482A	1925A04647	01/20/2016	01/20/2017
Thermometer	Fluke	52II	96480032	07/15/2015	07/15/2016
Thermo Chamber	Espec	BTZ-133	0613436	03/16/2015	03/16/2016
Thermo Chamber	Tenney Engineering, Inc.	T30RS	E099	01/21/2016	01/21/2017
AC Power Source	California Instruments	1001P	L06329	NCR	NCR
Notch Filter (5GHz)	Micro-Tronics	BRM50702	037	01/21/2016	01/21/2017
Notch Filter (2.4GHz)	Micro-Tronics	BRM50716-02	003	01/21/2016	01/21/2017
Signal Generator	Anritsu	MG3694A	42803	01/19/2016	01/19/2017

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 EMC Test Plan

6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

6.2 Customer

Table 14: Customer Information

Company Name	Harman International Industries, Inc
Address	50 Waterview Drive, Suite 240
City, State, Zip	Shelton, CT 06484
Country	USA
Phone	(203) 924-5349
Fax	(203) 924-2382

Table 15: Technical Contact Information

Name	John Garay
E-mail	John.garay@harman.com
Phone	(203) 924-5349
Fax	(203) 924-2382

6.3 Equipment Under Test (EUT)

Table 16: EUT Specifications

EUT Specifications	
Dimensions	W: 17.25in (438.15mm) x D: 15.25-16in (387.35-406.4mm) x H: 6in (152.4mm)
AC Input	100-240V AC, 50 – 60 Hz
Environment	Indoor
Operating Temperature Range:	+10 to +40 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Hardware Version	Lab1 (L1)
Part Number	Stream820/4WE10-4-D3
RF Software Version	Marvell-sdio-fw_14.66.35-p25.bb
802.11-radio modules	
Operating Mode	802.11a, 802.11n (HT20, HT40)
Transmitter Frequency Band	5.47 GHz – 5.56 GHz and 5.65 GHz – 5.725 GHz, U-NII-2C band
Max. Rated Power Output	See Channel Planning Table.
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	Omnidirectional
Antenna Gain	+5.0 dBi
Modulation Type	☐ AM ☐ FM ☒ DSSS ☒ OFDM ☐ Other describe: 16QAM and 64 QAM
Data Rate	802.11a: 1 Spatial Streams: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n HT20: 1 Spatial Streams: 6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps 802.11n HT40: 1 Spatial Streams: 13.5, 27, 40.5, 54, 81, 108, 121.5, 135 Mbps
TX/RX Chain (s)	Single chain; no beam forming
Directional Gain Type	☒ Uncorrelated ☐ Beam-Forming ☐ Other describe:
Type of Equipment	☒ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☐ Other:
Note: None.	

Table 17: EUT Channel Power Specifications

Max Power for single Chain

TP Setting	No.	Frequency (MHz)	Target Power Value dBm		
			802.11a	802.11n (HT20)	802.11n (HT40)
16	100	5500	13.29		
16	116	5580	13.98		
16	140	5700	14.35		
15	100	5500		12.43	
15	116	5580		13.19	
15	140	5700		13.83	
15	102	5510			12.10
15	110	5550			12.24
15	134	5670			12.88
Note: The adjusted power target values are updated at the evaluated frequencies.					

Table 18: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
Ethernet	RJ45	☒ No	☒ Metric: 2 m	☐ N/A

Table 19: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Lenovo	T420	R8-G4YVG 11/06	Setup EUT operating channel
Note: None.				

Table 20: Description of Sample used for Testing

Device	Serial	RF Connection	CFR47 Part 15.247
Audio Player	919 & 916*	Omnidirectional Antenna	Radiated Emissions
	919	Omnidirectional Antenna	Radiated Bandedge Emissions, AC Conducted Emissions
	919	Direct Connection	Peak Transmit Power, Peak Power Spectral Density, Occupied Bandwidth, Band-Edge, Out-of-Band Emissions
Note: *Serial #919 had RF communication issue. Therefore, Serial #916 was used to investigate as secondary unit.			

Table 21: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
Audio Player	Omnidirectional	Transmit	EUT laid flat.	N/A	N/A
Note: None.					

6.4 Test Specifications

Testing requirements

Table 22: Test Specifications

Emissions and Immunity	
Standard	**Requirement**
CFR 47 Part 15.407: 2015	All
RSS 247 Issue 1, 2015	All

END OF REPORT