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Emissions
Test Report

EUT Name: Wireless Access Point

Model No.: APIN0324 and APIN0325

CFR 47 Part 15.247 2014 and RSS- 247: 2015

Prepared for:

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Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	06/06/2015	Original Document	N/A
1	07/14/2015	Added additional spurious emissions data in section 4.5.2 and additional graphs for PSD section 4.4.	SK

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:	Aruba Networks 1344 Crossman Ave. Sunnyvale CA 94089 (408) 990-2557
Requester / Applicant:	Rob Hastings
Name of Equipment:	Wireless Access Point
Model No.	APIN0324 and APIN0325
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.247 2014 and RSS- 247: 2015
Test Dates:	28 Feb 2015 to 3 May 2015

Guidance Documents:

Emissions: ANSI C63.10-2009; KDB 558074 D01 DTS Measurement Guidance v03r03

Test Methods:

Emissions: ANSI C63.10-2009; KDB 558074 D01 DTS Measurement Guidance v03r03

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.

Test Engineer	Date June 6, 2015	Lab Manager	Date

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

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.247 2014 and RSS- 247: 2015 based on the results of testing performed on 28 Feb 2015 to 3 May 2015 on the Wireless Access Point Model APIN0324 and APIN0325 manufactured by Aruba Networks 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 2400MHz to 2483.5MHz frequency band was covered this document.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.4	Test Parameters (from Standard)	Result
Spurious Emission in Transmitted Mode	CFR47 15.209, RSS-GEN Sect.8.9	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 15.247 (a2), RSS -GEN Sect.6.6 and RSS-247 Sect. 5.2 (1)	≥ 500 kHz	**Complied**
Maximum Transmitted Power	CFR47 15.247 (b3), RSS 247 Sect. 5.4 (4)	30 dBm	**Complied**
Peak Power Spectral Density	CFR47 15.247 (e), RSS 247 Sect. 5.2 (2)	8 dBm/ 3 kHz.	**Complied**
Bandedge Measurement	CFR47 15.247 (d), RSS 247 Sect. 5.5	20 dBr	**Complied**
RF Exposure	CFR47 15.247 (i), 2.1091 RSS-102	General Population	**Complied**

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 C63.4-2009, 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 C63.4-2009, 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 Aruba AP-320 Series wireless access points support IEEE 802.11ac standard for high-performance WLAN, and is equipped with two dual-band radios, which can provide access and monitor the network simultaneously. Multi-user Multiple-in, Multiple-output (MU-MIMO) technology allows this access point to deliver high-performance 802.11n 2.4 GHz and 802.11ac 5 GHz functionality, while also supporting 802.11a/b/g/n/ac wireless services.

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 Wireless Access Point Model APIN0325 has 4 internal fixed antennas. Model: APIN0324 has four ports with reverse polarity SMA connector. List of antenna is Section 6.3.

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.247: 2014 and RSS 247 Sect. 5.4 (4) & (6). 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.

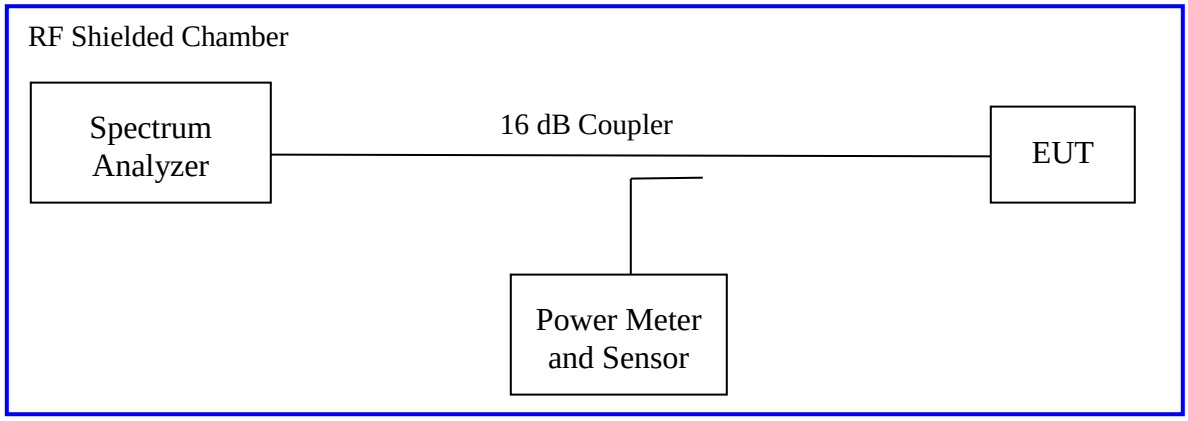
The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b3):2014 and RSS 247 Sect. 5.4 (4) & (6)

The maximum transmitted power is +30 dBm or 1Watt.

4.1.1 Test Method

The ANSI C63.10-2009 Section 6.10.3.1 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 mode on the sample, S/N 510, per CFR47 Part 15.247 (b3):2014 and RSS 247 Sect. 5.4 (4) & (6); 2400 MHz to 2483.5MHz. The worst mode results indicated below.

Test Setup:



Method AVGSA-1 of "Guidelines for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under CFR47 Part 15.247"applies since the EUT continuously transmit; where duty cycle is greater than 98%. Sample detector was used.

Each chain was measured individually and applied the measure-and-sum approach per KDB66291.

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: Interanal and External				**Power Setting:** See test plan			
Max. Directional Gain: + 11.5dBi				**Signal State:** Modulated at 100%.			
Ambient Temp.: 23 °C				**Relative Humidity:**33%			
802.11 b Mode, 4x4							
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412	27.5	18.21	17.97	17.66	17.84	23.94	-3.56
2437	27.5	18.12	18.09	17.74	17.56	23.91	-3.59
2462	27.5	18.17	17.99	17.48	18.04	23.95	-3.55
Note: 1.The highest output power was observed at 802.11b mode 1Mbps, 4 Data Streams. 2. RF output powers were summed per KDB 662911. 3. Power settings for each frequency of b mode are given in section 6.4 4. No Beamforming is considered for this mode. Highest Antenna gain is 8.5dBi, see section 6.3							
802.11 g Mode, 4x4							
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412	27.5	19.88	18.40	18.11	16.19	24.36	-3.14
2417	27.5	19.55	18.52	17.76	15.19	24.05	-3.45
2437	27.5	18.19	17.88	18.04	17.59	23.95	-3.55
2457	27.5	20.32	16.19	15.24	16.63	23.59	-3.91
2462	27.5	19.53	16.62	15.59	18.81	23.94	-3.56
Note: 1.The highest output power was observed at 802.11 g mode 6Mbps, 4 Data Streams. 2. All chains will be on at all the time RF output powers were summed per KDB 662911. 3. Power settings for each frequency of g mode are given in section 6.4 4. No Beamforming is considered for this mode. Highest Antenna gain is 8.5dBi, see section 6.3							

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

Test Conditions: Conducted Measurement, Normal Temperature								
Antenna Type: Integrated				**Power Setting:** See test plan				
Max. Directional Gain: int 8.6dBi Ext: 11.5dBi				**Signal State:** Modulated at 100%.				
Ambient Temp.: 23 °C				**Relative Humidity:**33%				
802.11n (HT20) Mode, 4x4								
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**CF dB**	**Total Power [dBm]**	**Margin [dB]**
2412	24.50	19.02	17.85	17.80	15.51	0.34	24.08	-0.42
2417	24.50	19.54	18.52	17.76	15.18	0.34	24.38	-0.12
2422	24.50	19.19	16.18	19.14	16.80	0.34	24.39	-0.11
2437	24.50	18.12	18.23	17.89	16.24	0.34	24.05	-0.45
2462	24.50	19.52	16.61	15.58	18.81	0.34	24.28	-0.22

Note: 1. The highest output power was observed at 802.11 HT20 6.5 Mbps, 4 Data Streams.

2. All chains will be on at all time and beam performing. RF output powers were summed per KDB 662911.

3. The total directional gain with internal antennas would be 8.6dBi; The limit is reduced for every dBi gain exceeding 6dBi. The limit would be 28.4dBm.

4. The total directional gain with External antennas would be 11.5dBi; 8.5dBi + 3dBi (Beam forming gain) asper CFR47 Part 15.247 (b) (4), the limit is reduced for every dBi gain exceeding 6dBi. The limit would be 24.50dBm. Worst case Limit is used here.

802.11n (HT40) Mode, 4x4								
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**CF [dB]**	**Total Power [dBm]**	**Margin [dB]**
2422	24.50	12.78	12.40	12.01	12.01	0.46	18.79	-5.71
2427	24.50	15.67	15.49	15.09	15.28	0.46	21.87	-2.63
2437	24.50	16.55	16.34	16.27	16.16	0.46	22.81	-1.69
2447	24.50	16.10	15.64	15.36	15.99	0.46	22.26	-2.24
2452	24.50	15.11	14.69	14.48	15.08	0.46	21.33	-3.17

Note: 1.The highest output power was observed at 802.11 HT40 mode, 4 Data Streams.
2. All chains will be on at all time and beam performing. RF output powers were summed per KDB 662911.
3. The total directional gain with internal antennas would be 8.6dBi; The limit is reduced for every dBi gain exceeding 6dBi. The limit would be 28.4dBm.
4. The total directional gain with Internal antennas would be 11.5dBi; 6dBi +3dBi (Beam forming gain) asper CFR47 Part 15.247 (b) (4), the limit is reduced for every dBi gain exceeding 6dBi. The limit would be 24.50dBm.

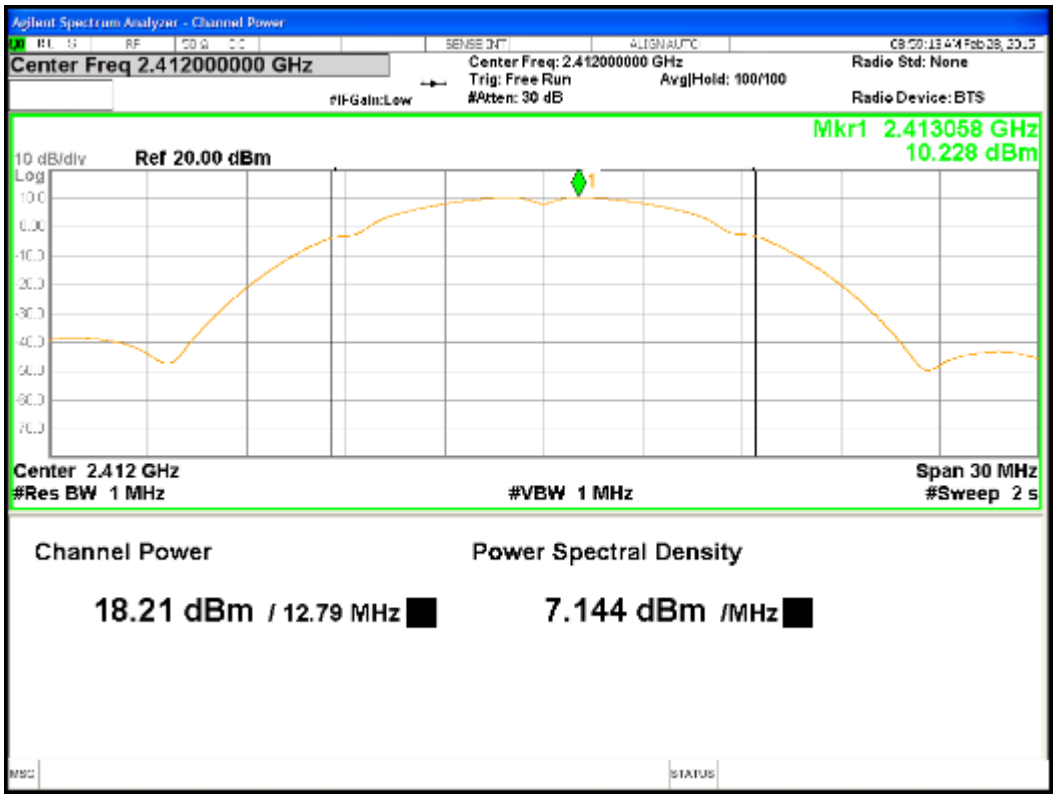


Figure 1: Maximum Transmitted Power, 2412MHz b mode at 1Mbps, Chain 0

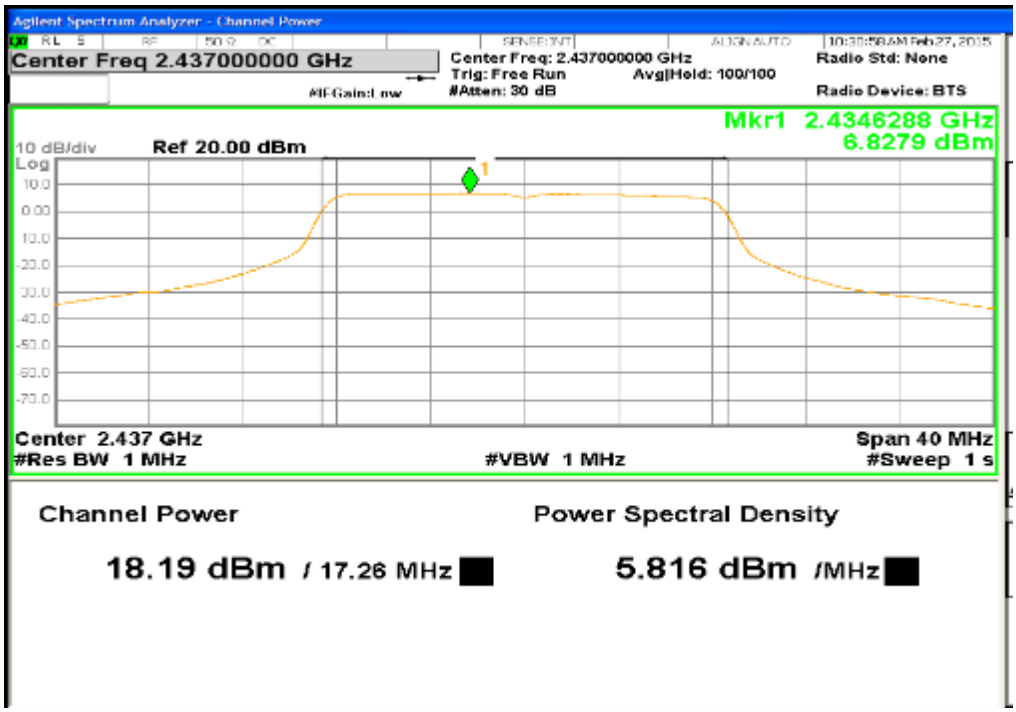


Figure 2: Maximum Transmitted Power, 2437MHz g mode at 6Mbps, Chain 0

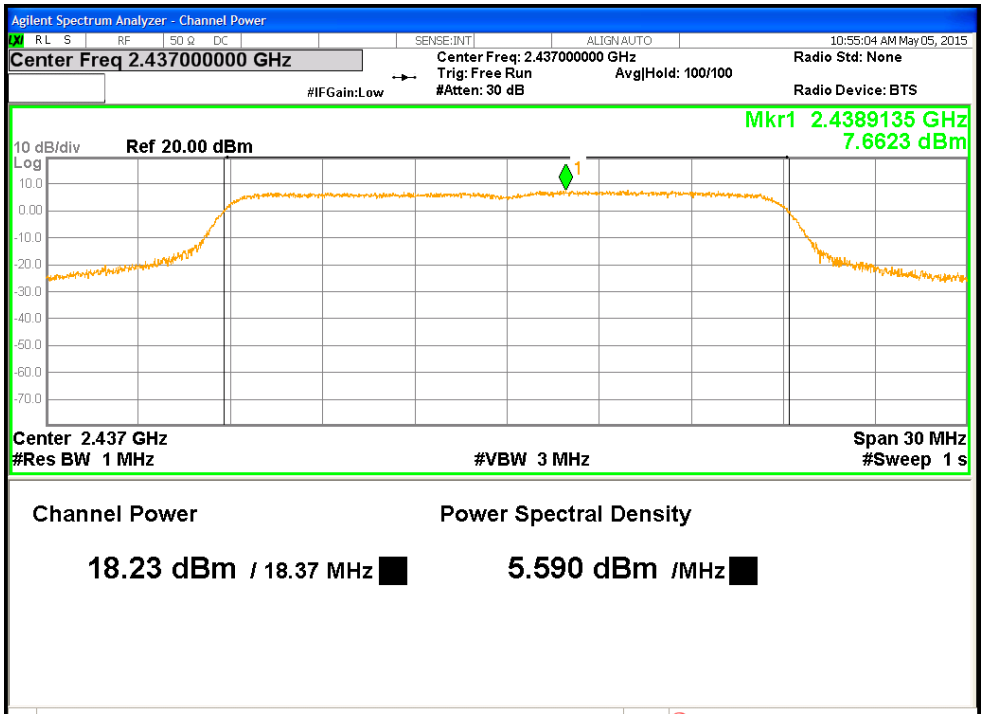


Figure 3: Maximum Transmitted Power, 2437MHz HT20 mode at 6.5Mbps , Chain 1

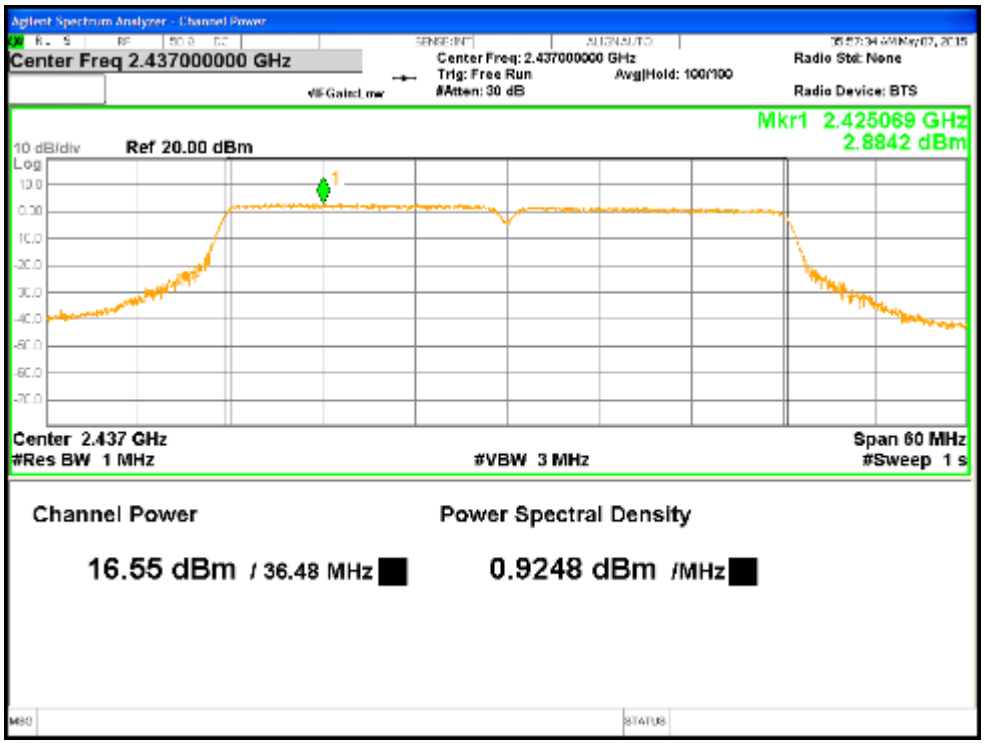


Figure 4: Maximum Transmitted Power, 2437MHz HT40 mode at 13Mbps , Chain 0

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.

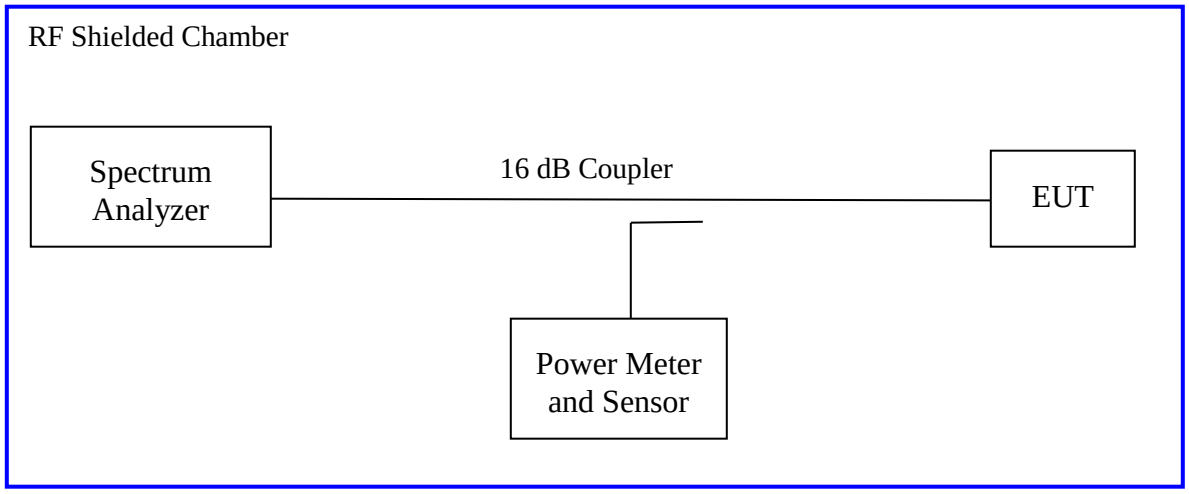
The DTS bandwidth is defined the bandwidth of 6 dBr from highest transmitted level of the fundamental frequency.

The bandwidth shall be at least 500 kHz per Section CFR47 15.247(a2) 2012 and RSS Gen Sect. 4.4.1: 2010.

4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth. The measurement was performed with modulation per CFR47 15.247(a2) 2014 and RSS Gen Sect. 8.8:2014. The preliminary investigation was performed to find the narrowest 6 dB bandwidth for each operational mode at different data rates. This worst finding was performed on 3 channels in each operating frequency range; 2400 MHz to 2483.5MHz on the sample, S/N 510. The results indicated below.

Test Setup:



4.2.2 Results

These occupied bandwidth measurements were taken for references only.

Table 4: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only						
Antenna Type: Integrated & External				**Power Setting:** See test plan		
Max. Directional Gain: + 11.5 dBi				**Signal State:** Modulated at 100%.		
Ambient Temp.: 22 °C				**Relative Humidity:**30%		
Bandwidth (MHz) for 802.11 b mode						
Freq. (MHz)	**Limit (kHz)**	**DTS Bandwidth (MHz)**				
		Ch0	**Ch1**	**Ch2**	**Ch3**	**Results**
2412	500	8.29	8.26	8.20	8.36	Pass
2437	500	8.21	8.16	8.30	8.32	Pass
2462	500	8.21	8.18	8.45	8.40	Pass
Freq. (MHz)	**Limit (kHz)**	**99% Bandwidth (MHz)**				
		Ch0	**Ch1**	**Ch2**	**Ch3**	**Results**
2412		12.70	12.77	12.68	12.70	
2437		12.73	12.57	12.70	12.80	
2462		12.71	12.75	12.69	12.78	
Note: The narrowest bandwidth was observed at 802.11b, mode 1.0Mbps						

Bandwidth (MHz) for 802.11g mode						
Freq. (MHz)	Limit (kHz)	DTS Bandwidth (MHz)				
		Ch0	Ch1	Ch2	Ch3	Results
2412	500	16.60	16.57	16.54	16.57	Pass
2437	500	16.53	16.52	16.54	16.50	Pass
2462	500	16.53	16.54	16.50	16.54	Pass
Freq. (MHz)	Limit (kHz)	99% Bandwidth (MHz)				
		Ch0	Ch1	Ch2	Ch3	Results
2412		16.54	16.61	16.60	16.63	
2437		16.67	16.67	16.69	16.65	
2462		16.68	16.70	16.65	16.68	
Note: The bandwidth was observed at 802.11g mode 6Mbps. Highlighted plots are available in the report						

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only						
Antenna Type: Integrated & External				**Power Setting:** See test plan		
Max. Directional Gain: + 11.5 dBi				**Signal State:** Modulated at 100%.		
Ambient Temp.: 22 °C				**Relative Humidity:**30%		
Bandwidth (MHz) for 802.11n HT20						
Freq. (MHz)	**Limit (kHz)**	**DTS Bandwidth (MHz)**				
		Ch0	**Ch1**	**Ch2**	**Ch3**	**Results**
2412	500	17.84	17.92	17.71	17.71	Pass
2437	500	17.85	17.85	17.83	17.83	Pass
2462	500	17.99	17.94	17.56	15.68	Pass
Freq. (MHz)	**Limit (kHz)**	**99% Bandwidth (MHz)**				
		Ch0	**Ch1**	**Ch2**	**Ch3**	**Results**
2412		17.77	17.88	17.71	17.78	
2437		17.89	17.84	17.90	17.84	
2462		18.02	17.96	17.67	17.81	
Note: The narrowest bandwidth was observed at 802.11n HT20, 6.5 Mbps						

802.11 HT40 Mode

Bandwidth (MHz) for 802.11n HT40						
Freq. (MHz)	**Limit (kHz)**	**DTS Bandwidth (MHz)**				
		Ch0	**Ch1**	**Ch2**	**Ch3**	**Results**
2422	500	35.93	36.55	30.30	35.62	Pass
2437	500	27.80	36.38	36.41	36.44	Pass
2452	500	37.78	36.66	36.57	36.14	Pass
Freq. (MHz)	**Limit (kHz)**	**99% Bandwidth (MHz)**				
		Ch0	**Ch1**	**Ch2**	**Ch3**	**Results**
2422		36.32	36.35	36.21	36.19	
2437		36.03	36.23	36.33	36.29	
2452		36.43	36.44	36.41	36.42	
Note: The bandwidth was observed at 802.11n HT40, 13.5 Mbps.						

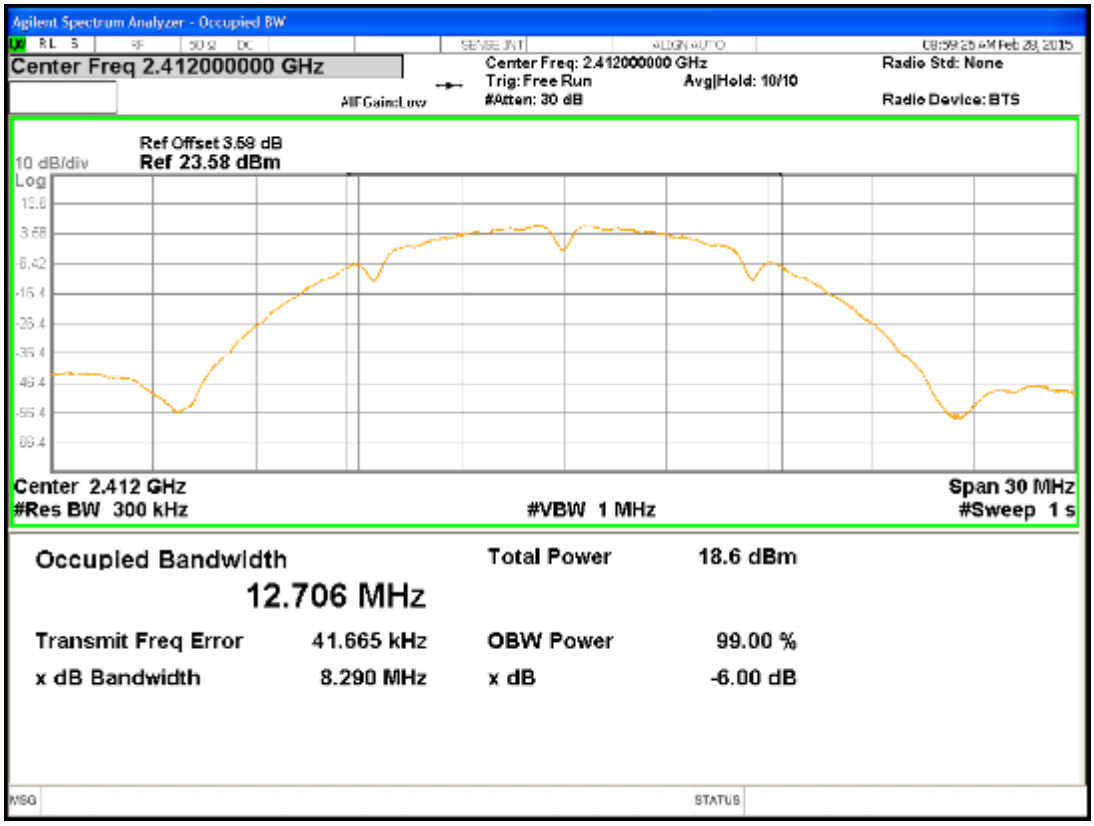


Figure 5: DTS Bandwidth, 2412MHz bmode1Mbps, Chain 0

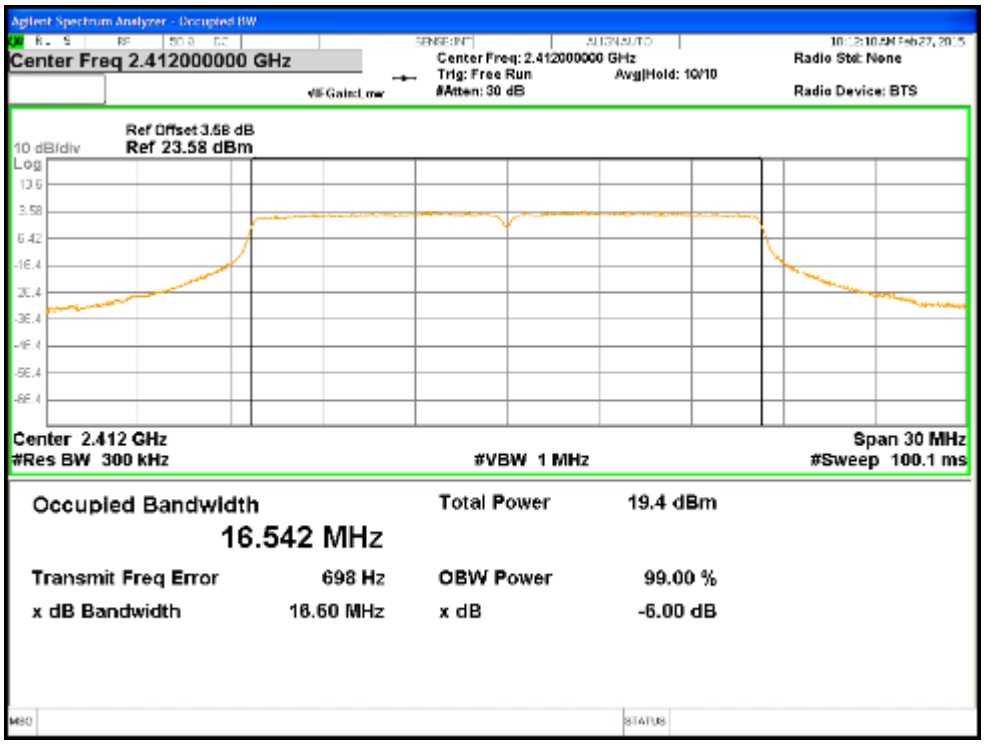


Figure 6: DTS Bandwidth, 2412MHz gmode6Mbps, Chain 0

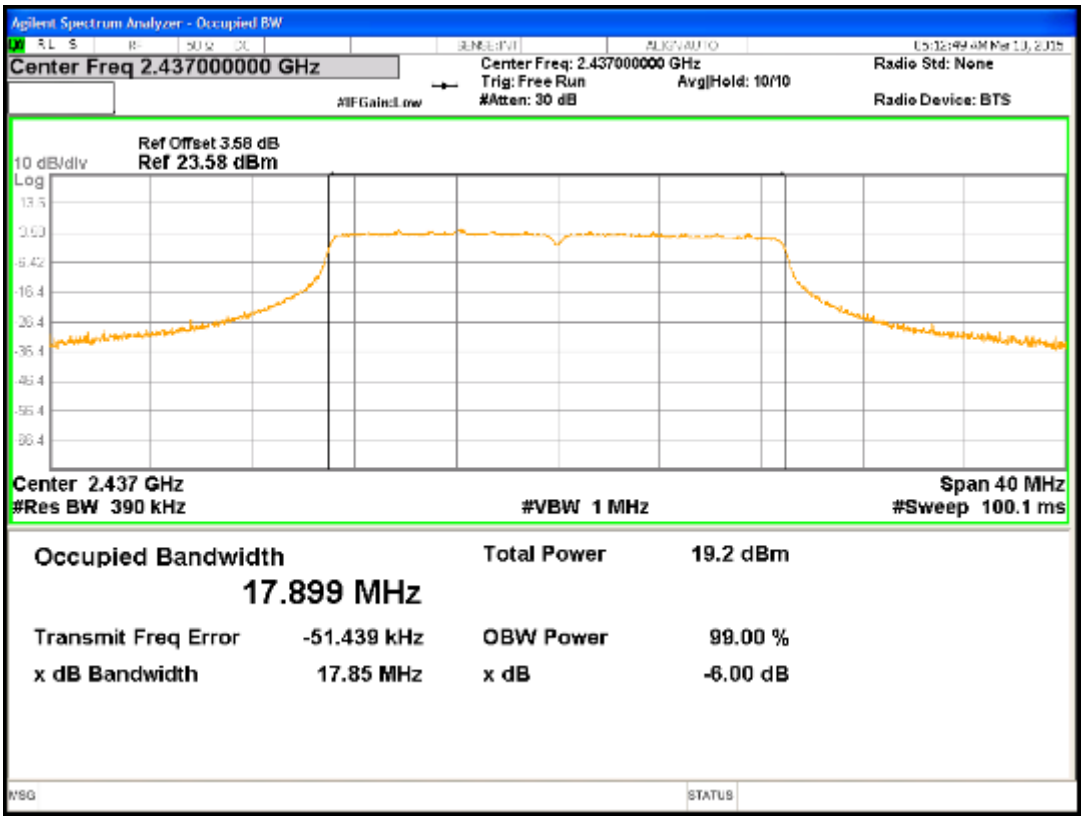


Figure 7: DTS Bandwidth at 2437 MHz, HT20 Chain 0

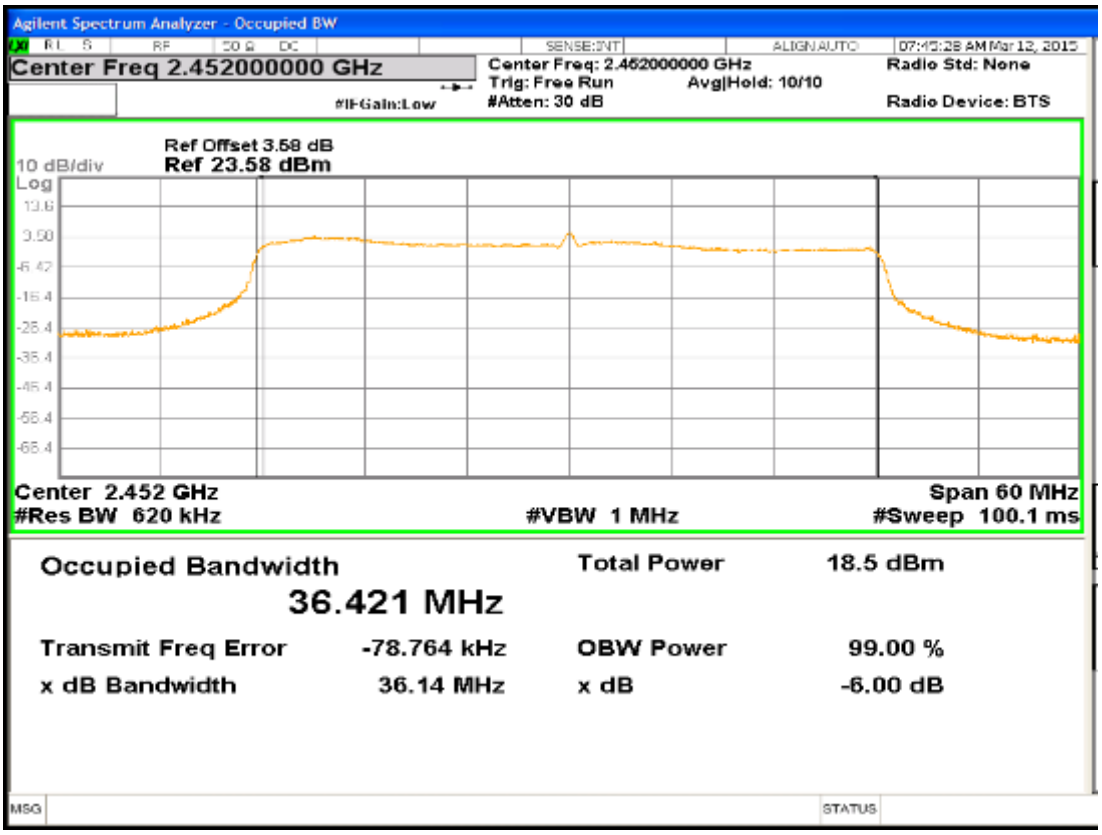


Figure 8: 99% Bandwidth at 2452MHz, HT 40 Chain 3

4.3 Unwanted Emissions into Non-Restricted Frequency Bands

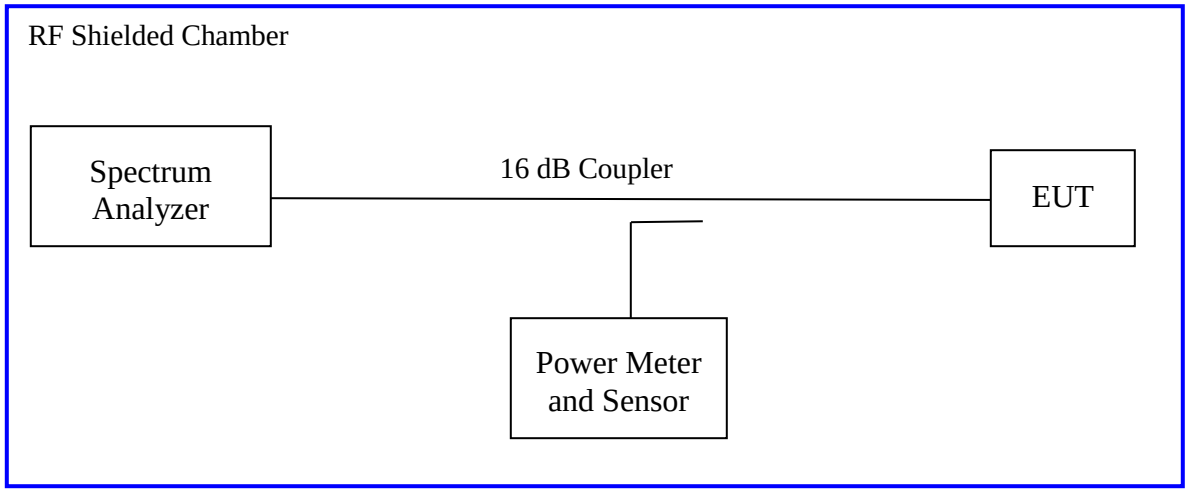
The setup was identical to RF output power measurement. Intentional radiators operating under the alternative provisions to the general emission limits, must be designed to ensure that the 20 dB or 30 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If the frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Since the transmitter complies with the conducted power limits base on the use of RMS averaging per CFR47 Part 15.247(b)(3), any frequency outside the band of 2400MHz to 2483.5MHz, the power output level must be below 30dB from the in-band transmitting signal; CFR 47 Part 15.215, 15.247(d), RSS GEN Section 8.9 and RSS 247 Section 5.5

4.3.1 Test Method

The conducted method was used to measure the out-of-band emission requirement. The measurement was performed with modulation per CFR47 15.247(4) (d) 2014 and *RSS GEN Section 8.9.* This test was conducted on 3 channels of Sample in each mode on Sample, S/N: 510. The worst sample result indicated below.

Test Setup:



Measurement Procedure AVG2 of KDB 558074

4.3.2 Results

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

Table 5: Emissions at the Band-Edge – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only					
Antenna Type: Integrated and External			**Power Setting:** See test plan		
Max. Directional Gain: +11.5 dBi			**Signal State:** Modulated at 100%.		
Ambient Temp.: 23 °C			**Relative Humidity:**30%		
Non-Restricted Frequency Band Emission					
Freq. (MHz)	**Mode**	**Chain**	**Ref. Level (dBm)**	**Plots**	**Results**
2412	1Mbps	0	-26.0	9, 10	Pass
2412	1Mbps	1	-26.6	11, 12	Pass
2412	1Mbps	2	-20.9	13, 14	Pass
2412	1Mbps	3	-20.6	15, 16	Pass
2437	1Mbps	0	-26.8	17, 18	Pass
2437	1Mbps	1	-26.5	19, 20	Pass
2437	1Mbps	2	-20.0	21, 22	Pass
2437	1Mbps	3	-20.2	23, 24	Pass
2462	1Mbps	0	-26.4	25, 26	Pass
2462	1Mbps	1	-26.6	27, 28	Pass
2462	1Mbps	2	-20.5	29, 30	Pass
2462	1Mbps	3	-19.7	31, 32	Pass
2412	6.0 Mbps	0	-30.9	33, 34	Pass
2412	6.0 Mbps	1	-31.0	35, 36	Pass
2412	6.0 Mbps	2	-30.8	37, 38	Pass
2412	6.0 Mbps	3	-31.0	49, 40	Pass
2437	6.0 Mbps	0	-31.0	41, 42	Pass

2437	6.0 Mbps	1	-30.3	43, 44	Pass
2437	6.0 Mbps	2	-30.9	45, 46	Pass
2437	6.0 Mbps	3	-31.0	47, 48	Pass
2462	6.0 Mbps	0	-30.9	49, 50	Pass
2462	6.0 Mbps	1	-30.9	51, 52	Pass
2462	6.0 Mbps	2	-31.2	53, 54	Pass
2462	6.0 Mbps	3	-30.9	55, 56	Pass

Note: All out of band emissions are lower than the 30dBr level.

The maximum out of band emission on each individual output put is at least 30 dB below the maximum in-band PSD on that output per KDB 662911.

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only					
Antenna Type: Integrated & External			**Power Setting:** See test plan		
Max. Directional Gain: +11.5 dBi			**Signal State:** Modulated at 100%.		
Ambient Temp.: 23 °C			**Relative Humidity:**30%		
Non-Restricted Frequency Band Emission					
Freq. (MHz)	**Mode**	**Chain**	**Ref. Level (dBm)**	**Plots**	**Results**
2412	6.5Mbps	0	-23.5	57, 58	Pass
2412	6.5Mbps	1	-31.3	59, 60	Pass
2412	6.5Mbps	2	-30.5	61, 62	Pass
2412	6.5Mbps	3	-26.4	63, 64	Pass
2437	6.5Mbps	0	-31.0	65, 66	Pass
2437	6.5Mbps	1	-30.5	67, 68	Pass
2437	6.5Mbps	2	-30.9	69, 70	Pass
2437	6.5Mbps	3	-31.0	71, 72	Pass
2462	6.5Mbps	0	-31.5	73, 74	Pass
2462	6.5Mbps	1	-31.3	75, 76	Pass
2462	6.5Mbps	2	-30.4	77, 78	Pass
2462	6.5Mbps	3	-26.1	79, 80	Pass
2422	13.5 Mbps	0	-44.6	81, 82	Pass
2422	13.5 Mbps	1	-34.0	83, 84	Pass
2422	13.5 Mbps	2	-32.6	85, 86	Pass
2422	13.5 Mbps	3	-32.1	87, 88	Pass

2452	13.5 Mbps	0	-33.7	88, 90	Pass
2452	13.5 Mbps	1	-34.4	91, 92	Pass
2452	13.5 Mbps	2	-33.6	93, 94	Pass
2452	13.5 Mbps	3	-28.9	95, 96	Pass
Note: All out of band emissions are lower than the 30dBr level. The maximum out of band emission on each individual output put is at least 30 dB below the maximum in-band PSD on that output per KDB 662911.					

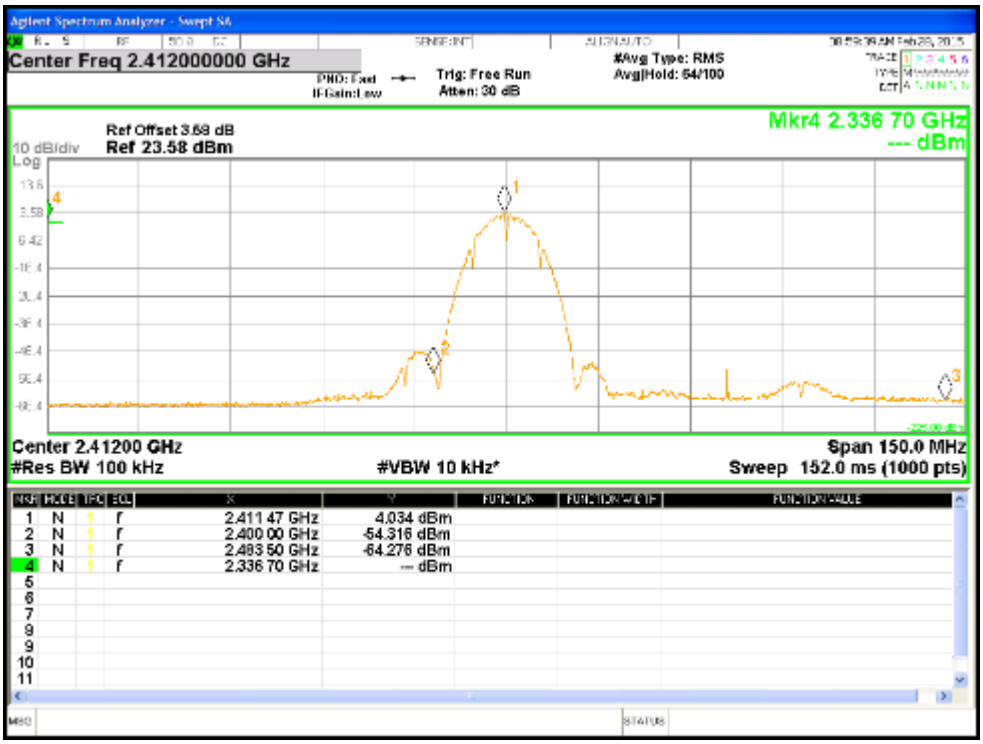


Figure 9: Reference Level for b mode at 2412 MHz, Chain 0

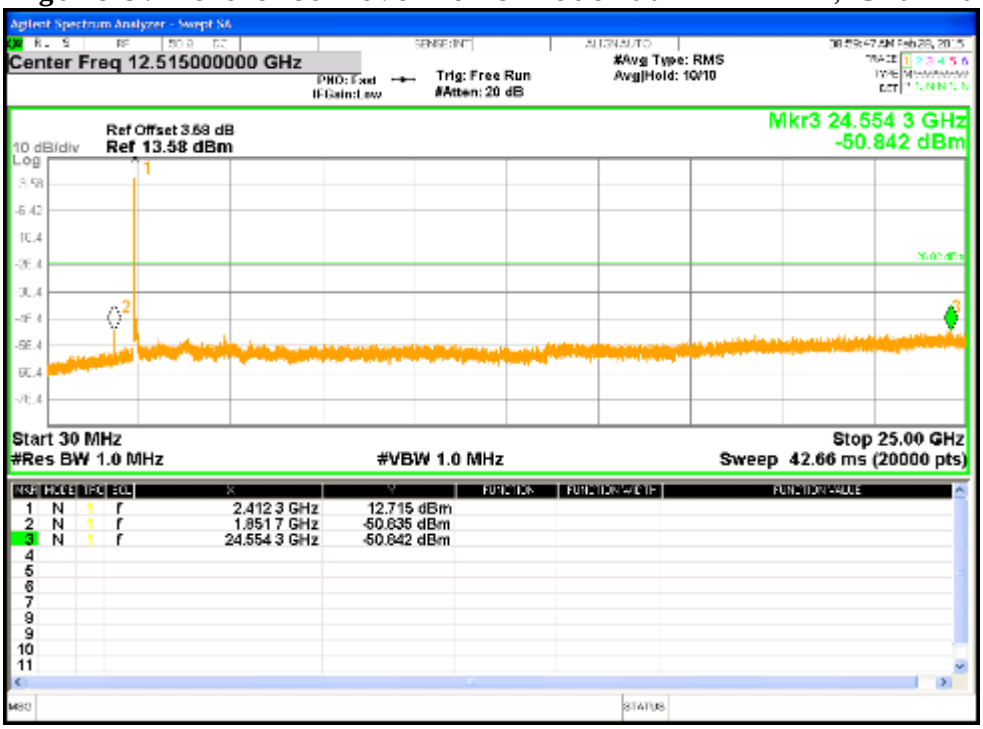


Figure 10: Out of Band Emission for B mode at 2412 MHz, Chain 0

Figure 11: Reference Level for b mode at 2412 MHz, Chain 1

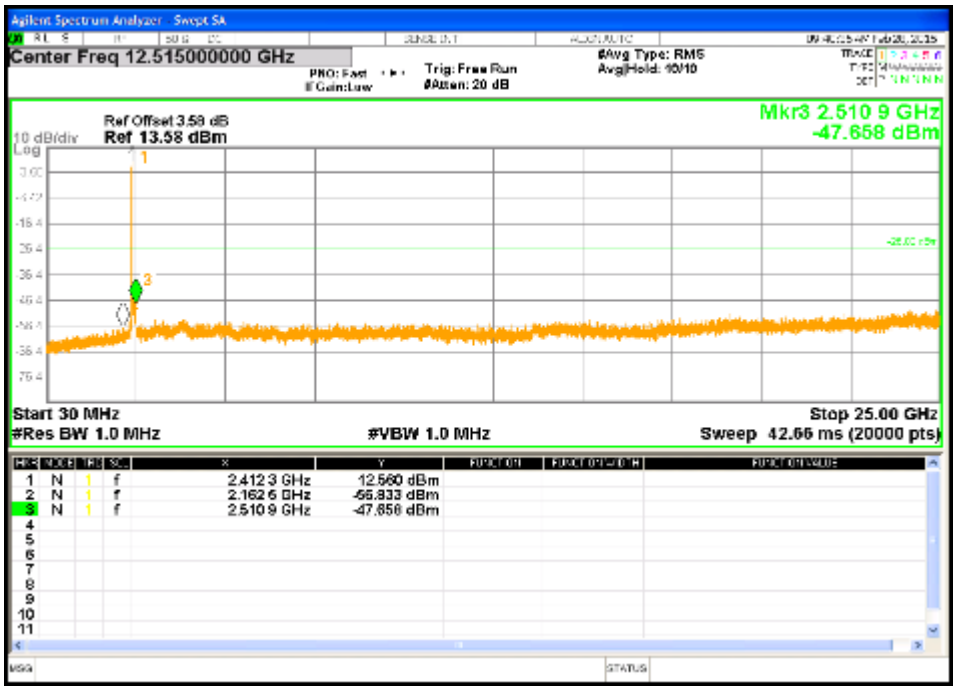


Figure 12: Out of Band emissions b mode 2412MHz, Chain 1

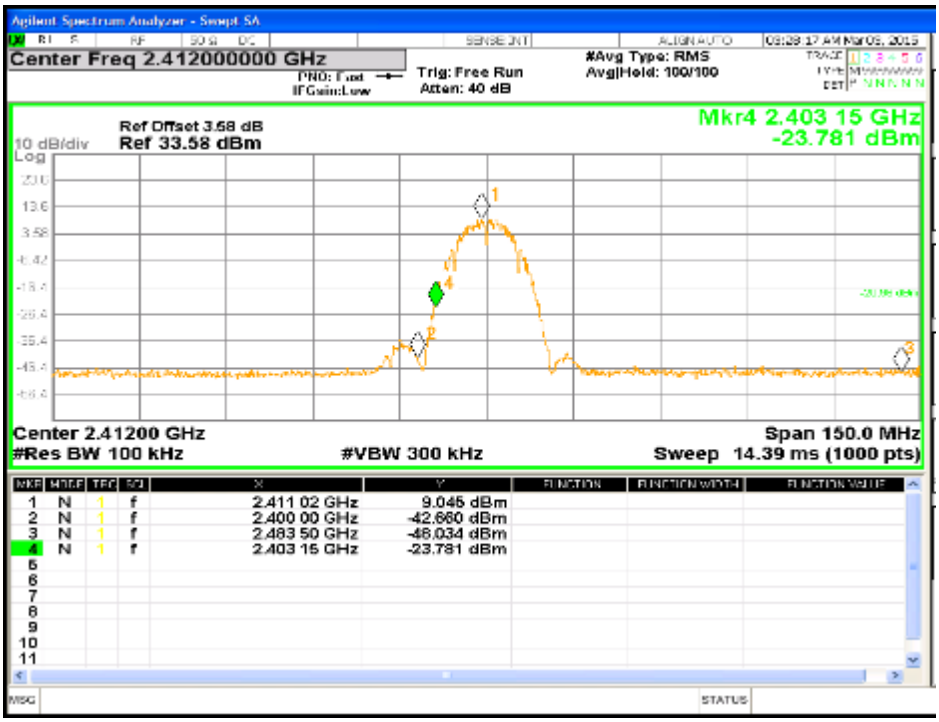


Figure 13: Reference Level for b mode at 2412 MHz, Chain 2

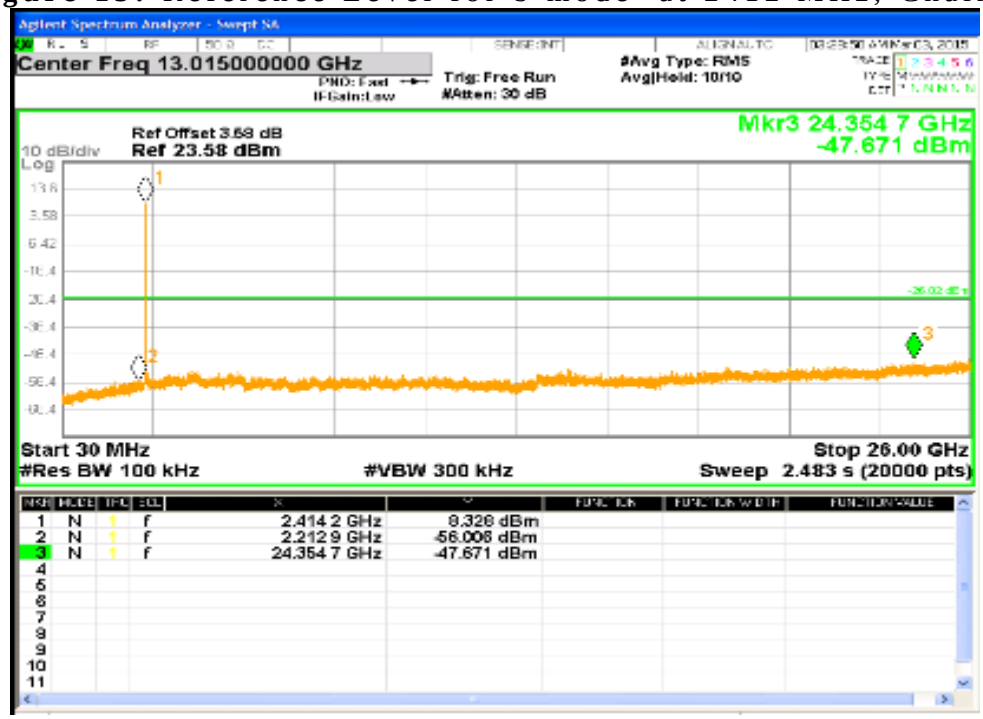


Figure 14: Out of Band Emission for B mode at 2412MHz, Chain2

Figure 15: Reference Level for B mode at 2412MHz, Chain3

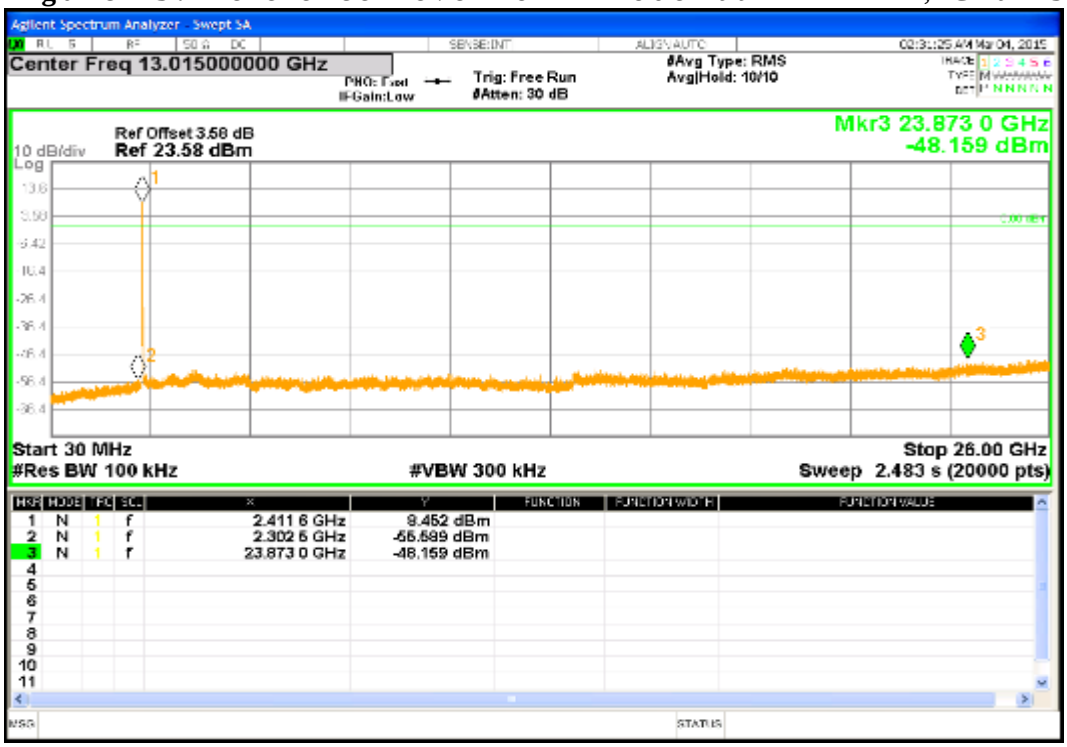


Figure 16: Out of Band Emission for B mode at 2412MHz, Chain3

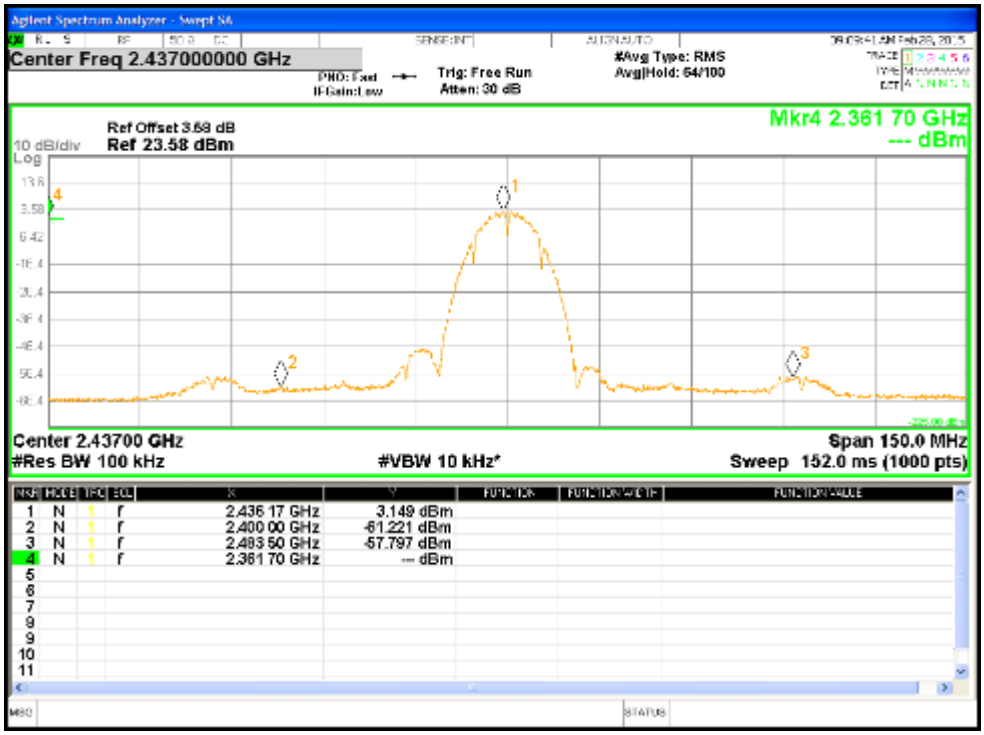


Figure 17: Reference Level for B mode at 2437MHz, Chain0

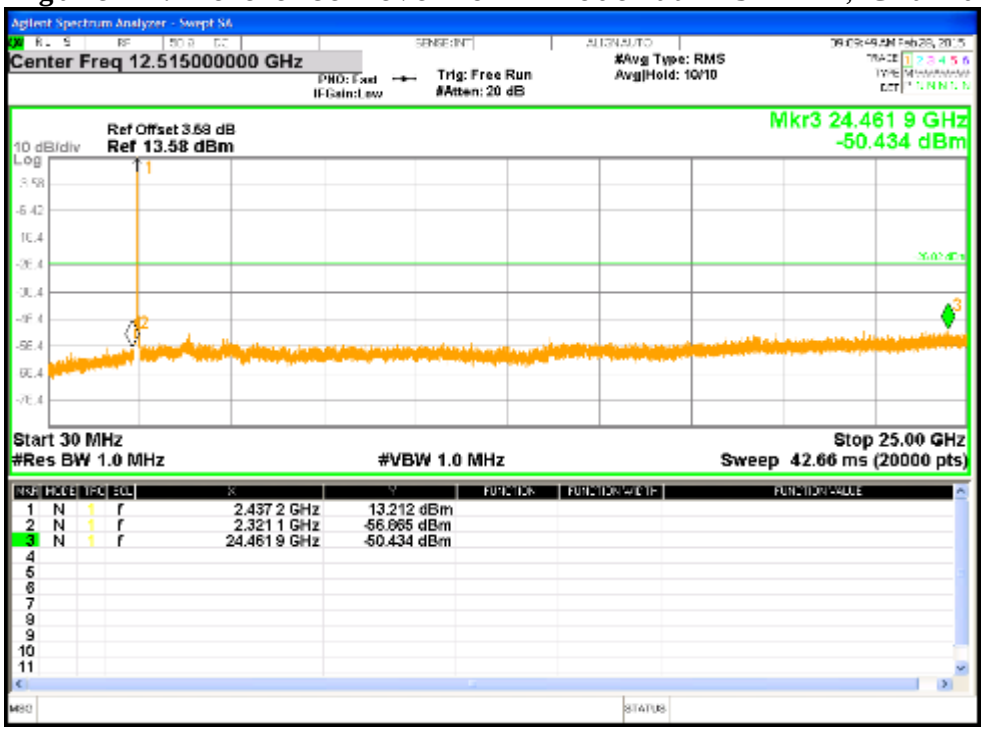


Figure 18: Out of Band Emission for B mode at 2437MHz, Chain0

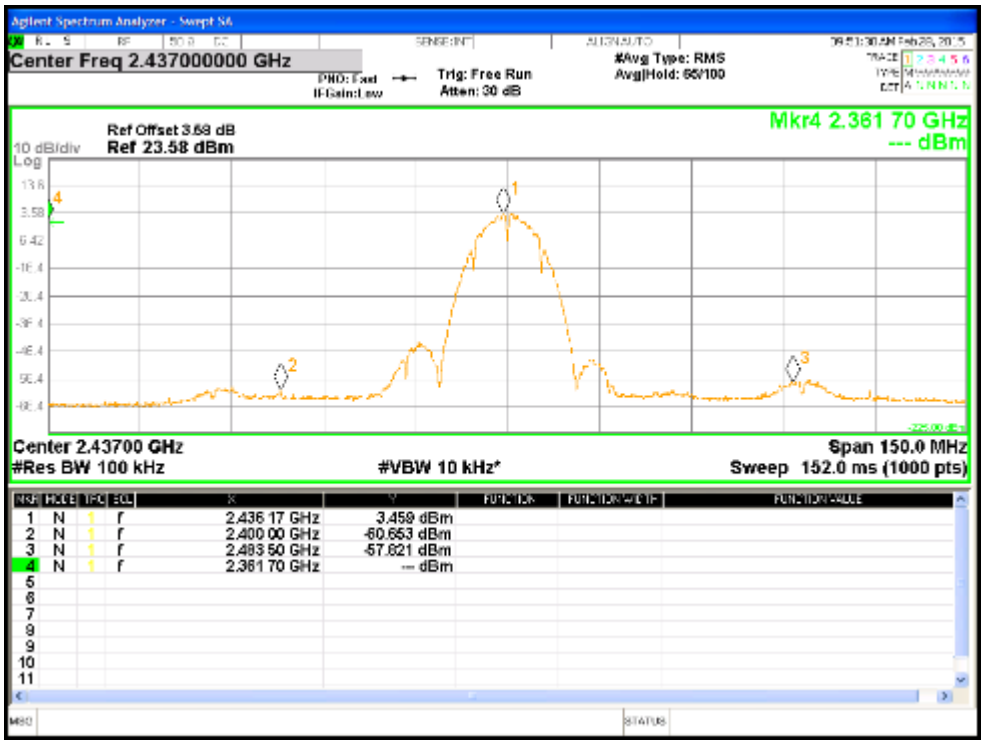


Figure 19: Reference Level for B mode at 2437MHz, Chain1

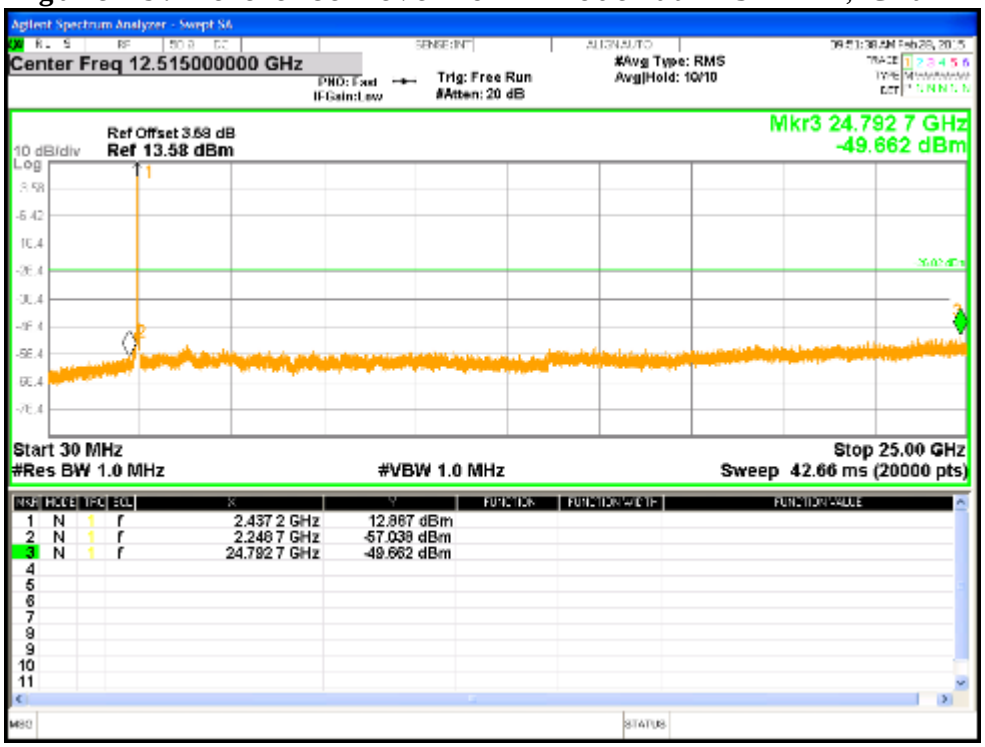


Figure 20: Out of Band Emission for B mode at 2437MHz, Chain1

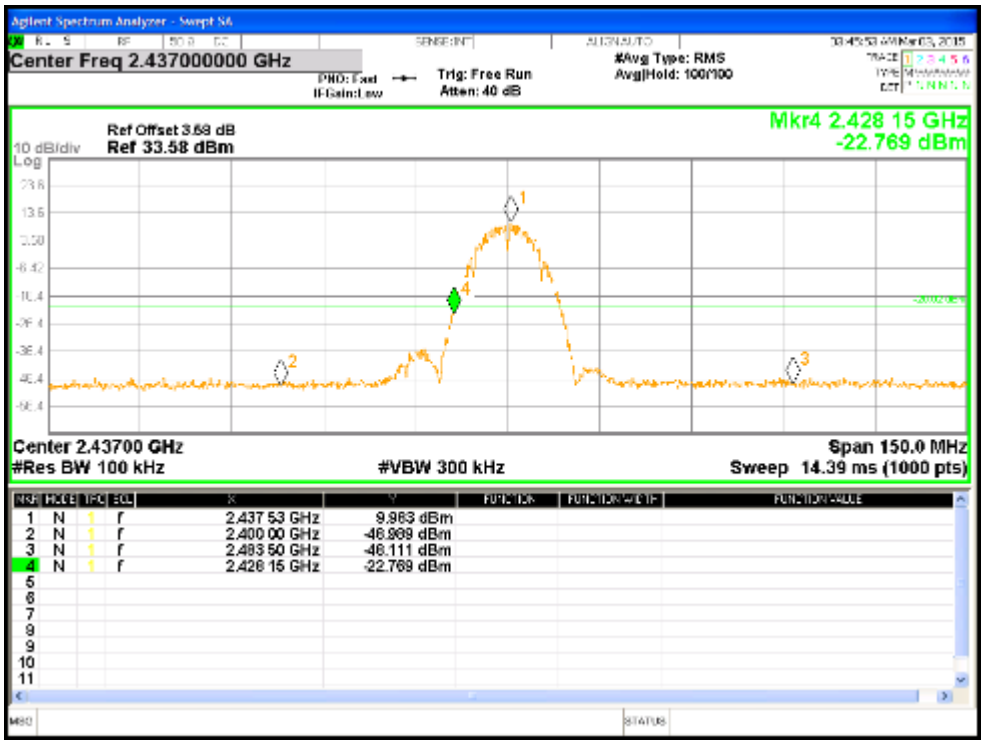


Figure 21: Reference Level for B mode at 2437MHz, Chain2

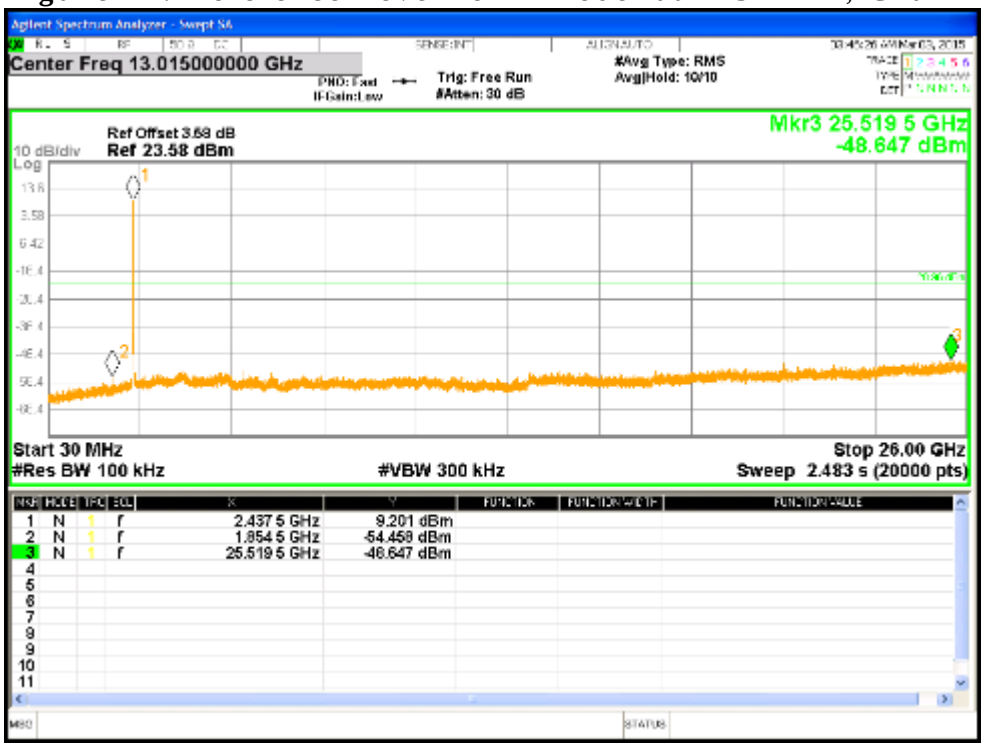


Figure 22: Out of Band Emission for B mode at 2437MHz, Chain2

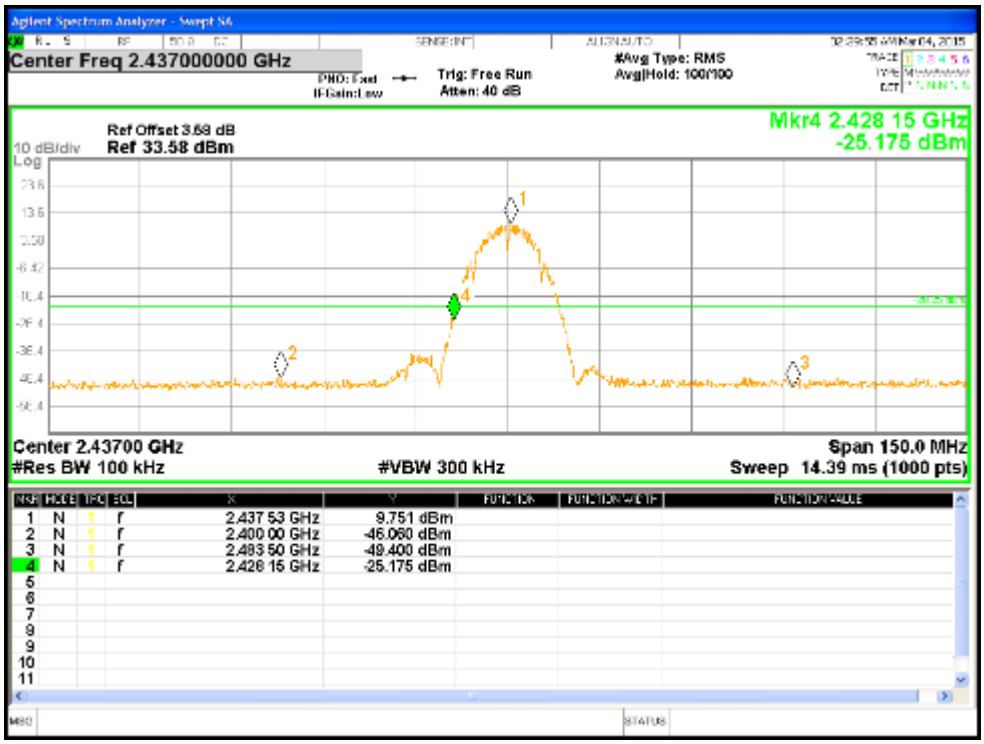


Figure 23: Reference Level for B mode at 2437MHz, Chain3

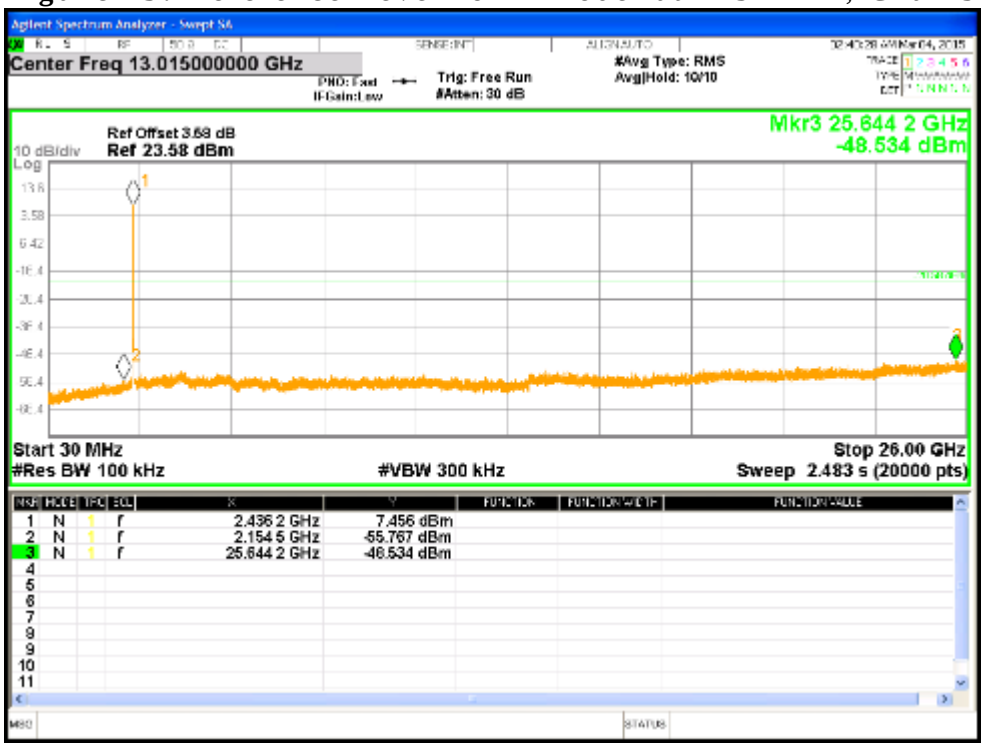
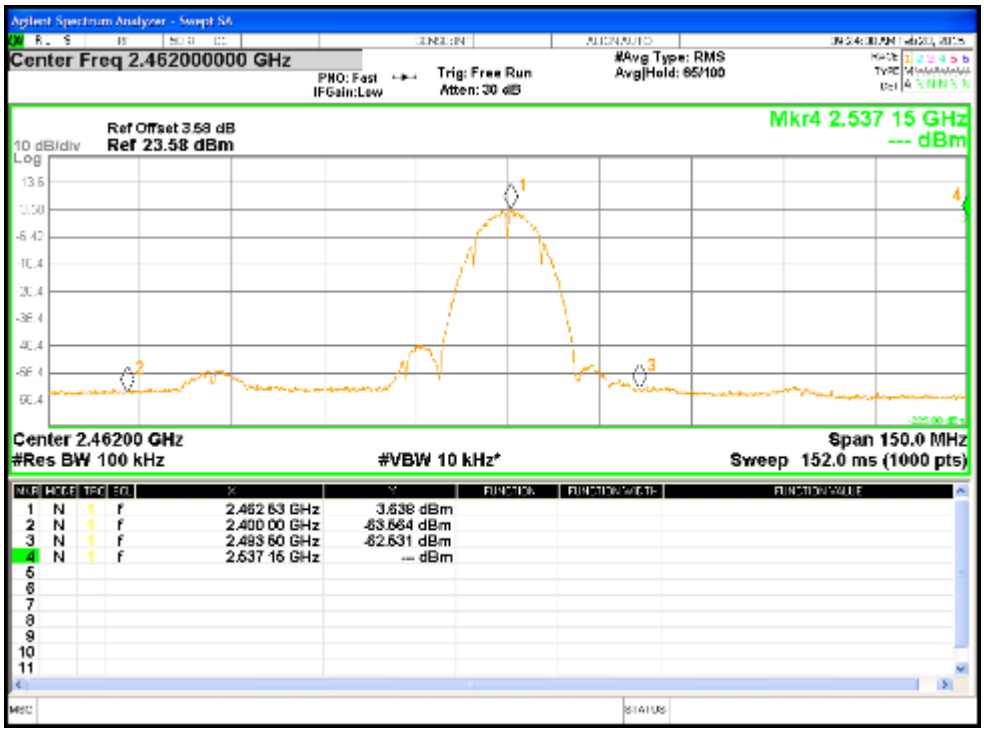


Figure 24: Out of Band Emission for B mode at 2437MHz, Chain3


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 95/100
Ref Offset 3.58 dB
10 dB/div
Ref 23.58 dBm
Log
Mkr4 2.537 15 GHz
--- dBm
Center 2.46200 GHz
#Res BW 100 kHz
#VBW 10 kHz*
Span 150.0 MHz
Sweep 152.0 ms (1000 pts)
1 N 1 f 2.462 63 GHz 3.638 dBm
2 N 1 f 2.400 00 GHz -63.664 dBm
3 N 1 f 2.483 50 GHz -62.631 dBm
4 N 1 f 2.537 15 GHz --- dBm

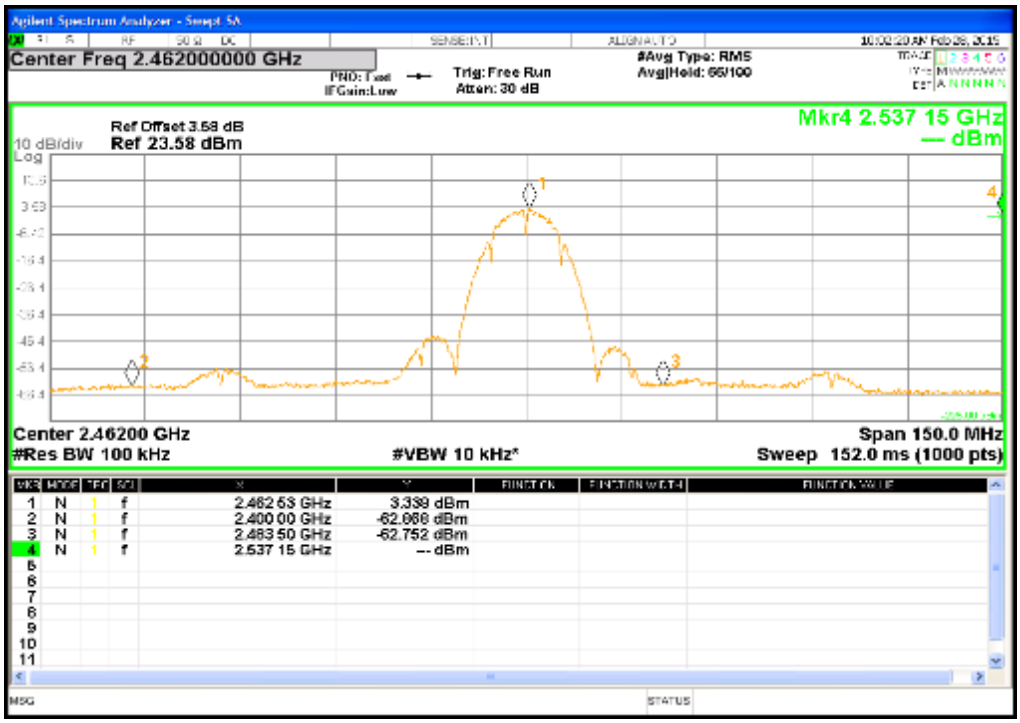


Figure 25: Reference Level for B mode at 2462MHz, Chain1

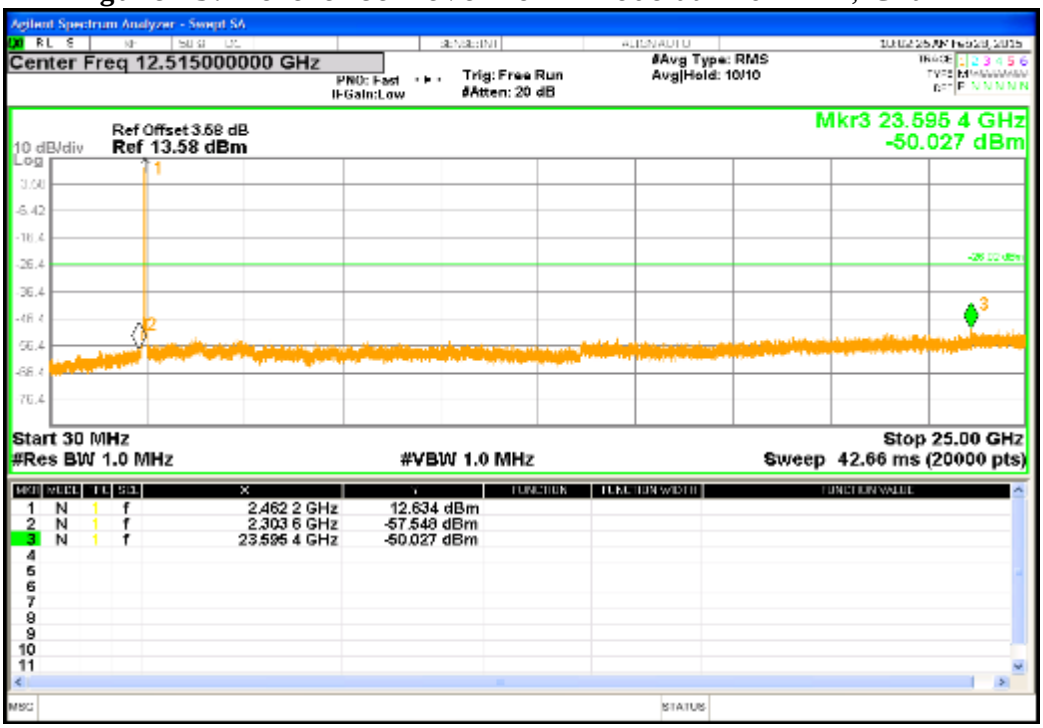


Figure 26: Out of Band Emission for B mode at 2462MHz, Chain1

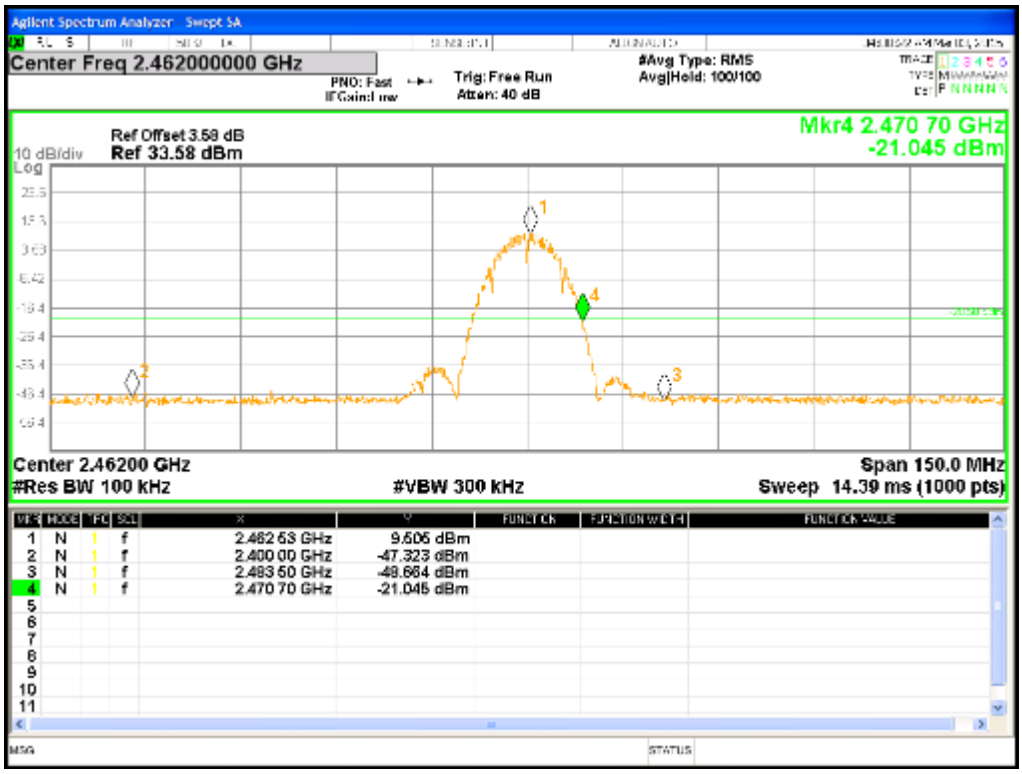


Figure 27: Reference Level for B mode at 2462MHz, Chain2

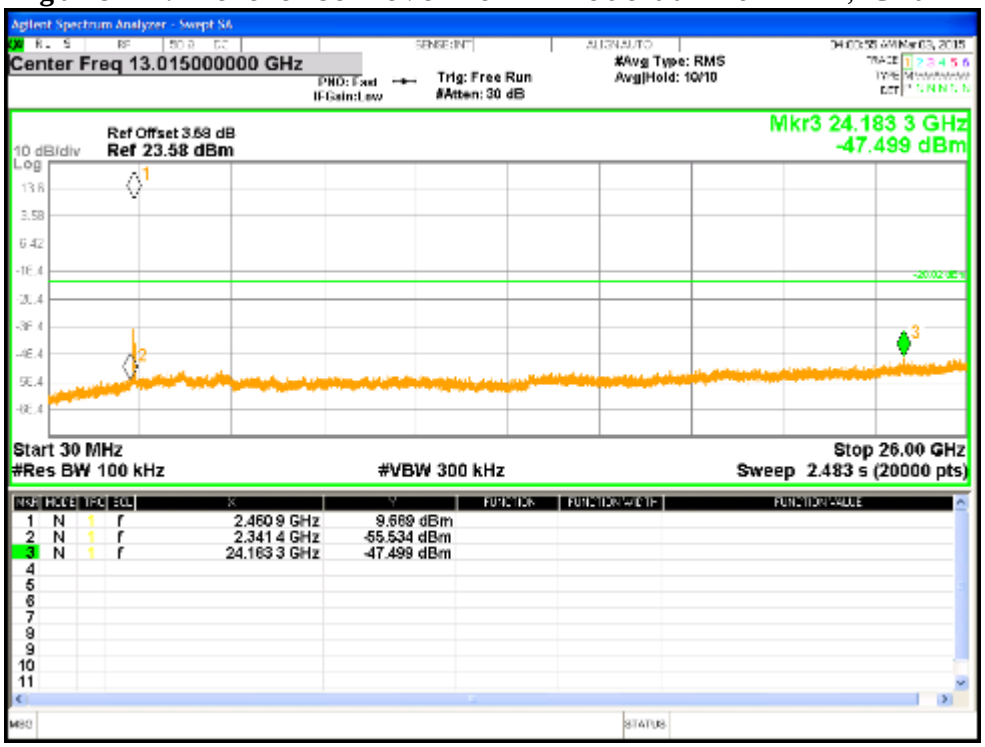


Figure 28: Out of Band Emission for B mode at 2462MHz, Chain2

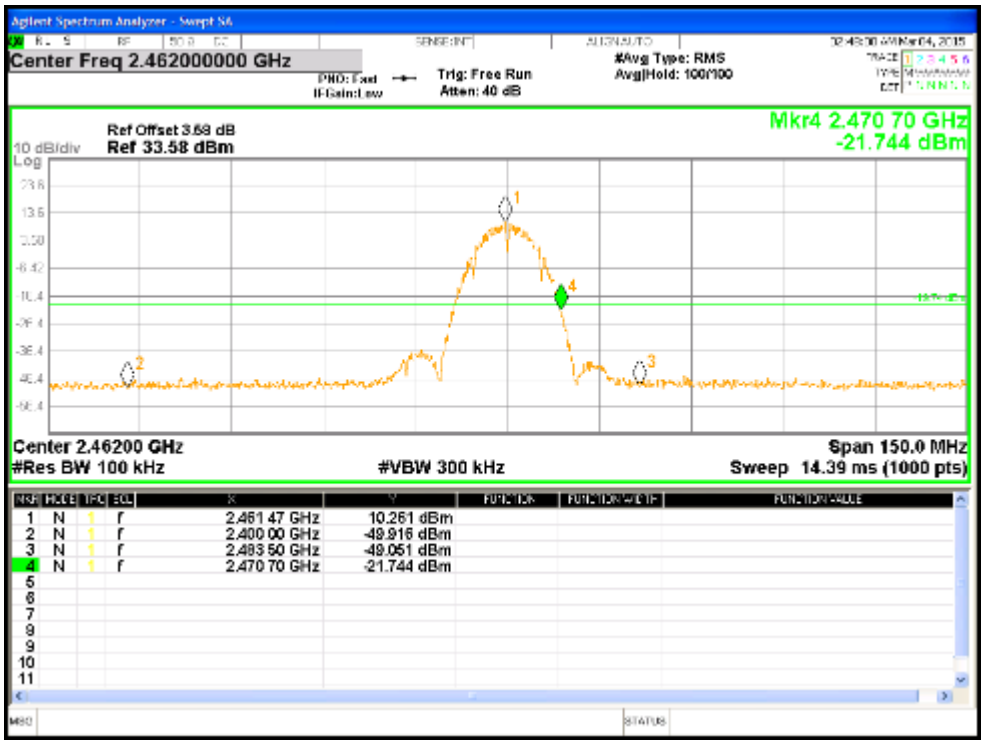


Figure 29: Reference Level for B mode at 2462MHz, Chain3

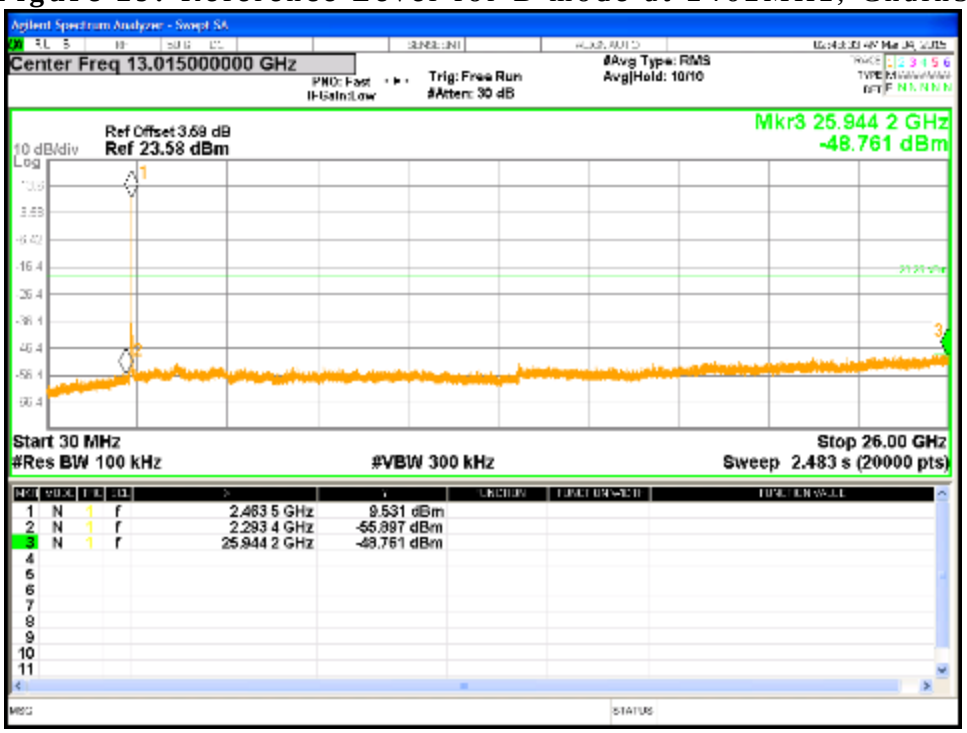


Figure 30: Out of Band Emission for B mode at 2462MHz, Chain3

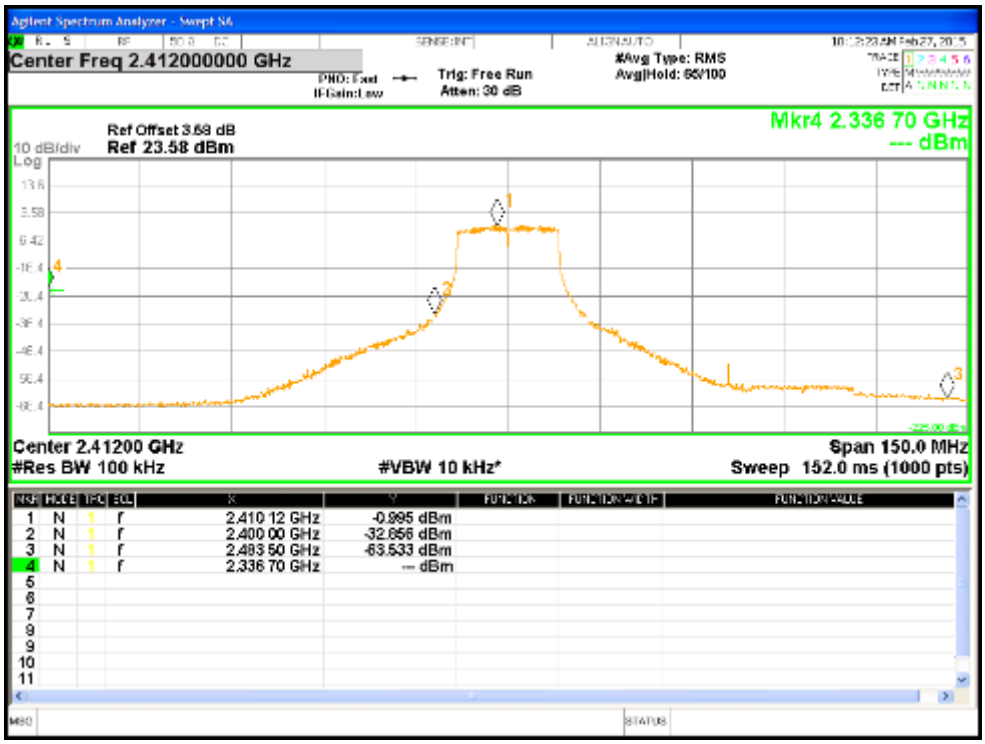


Figure 31: Reference Level for g mode at 2412MHz, Chain0

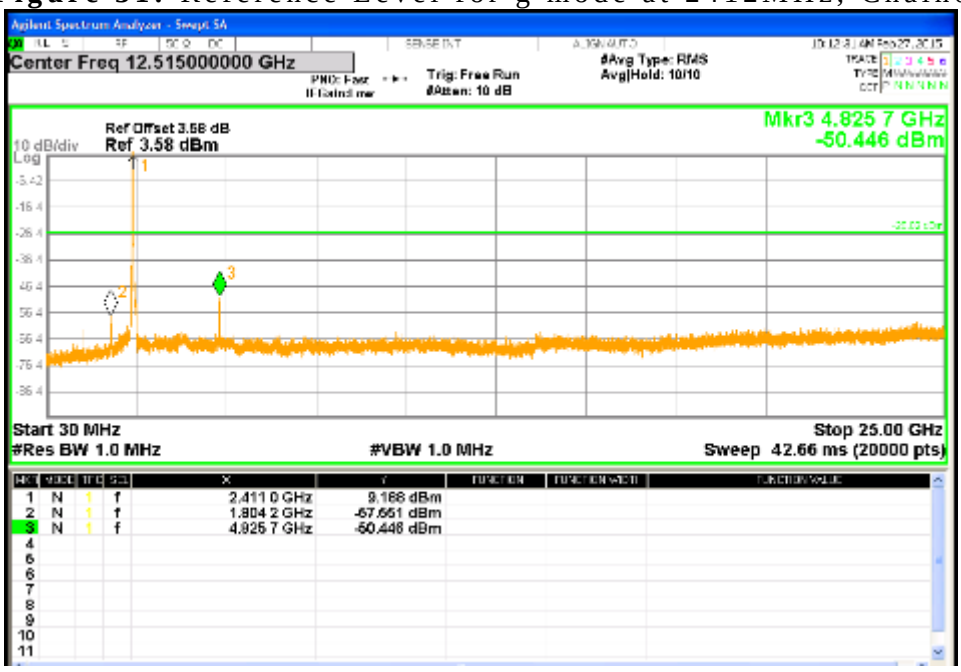


Figure 32: Out of Band Emission for g mode at 2412MHz, Chain0

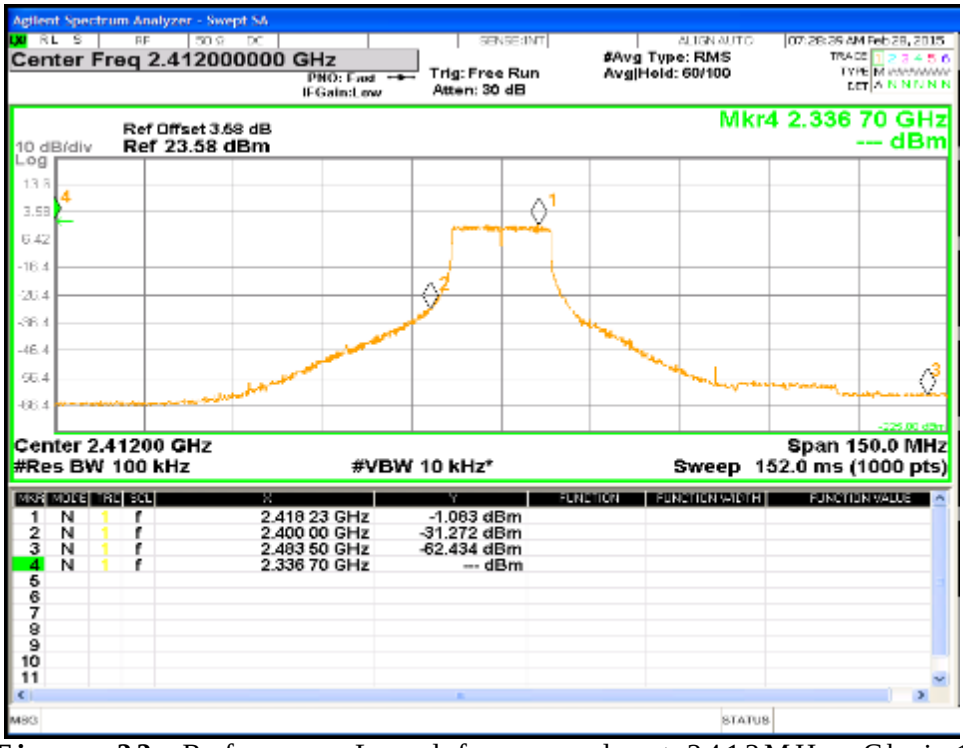


Figure 33: Reference Level for g mode at 2412MHz, Chain1

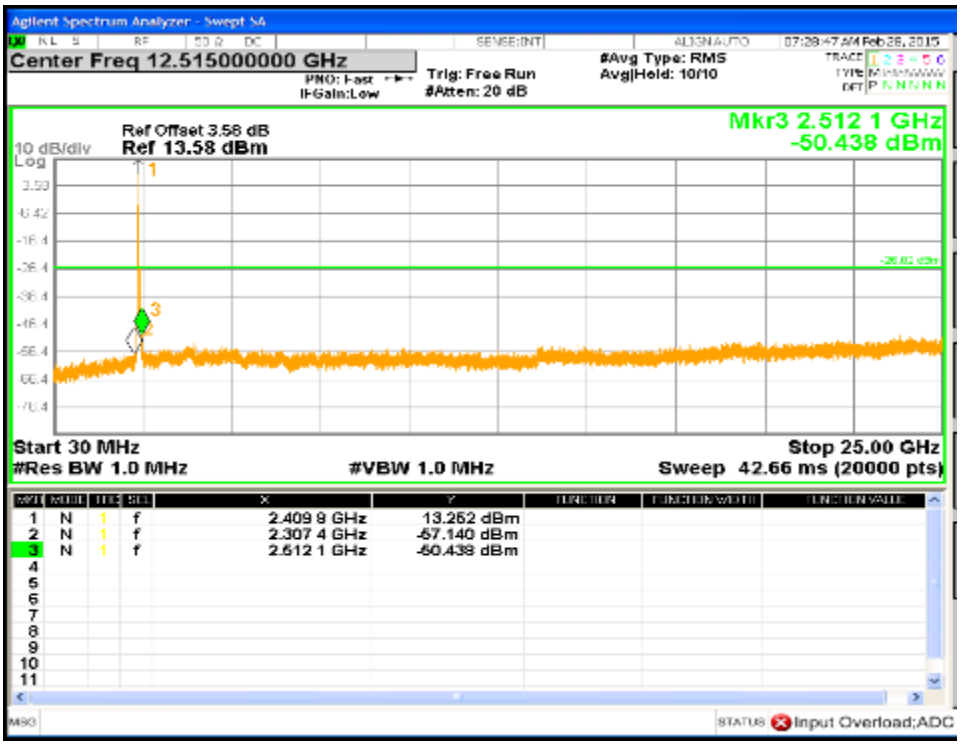


Figure 34: Out of Band Emission for g mode at 2412MHz, Chain1

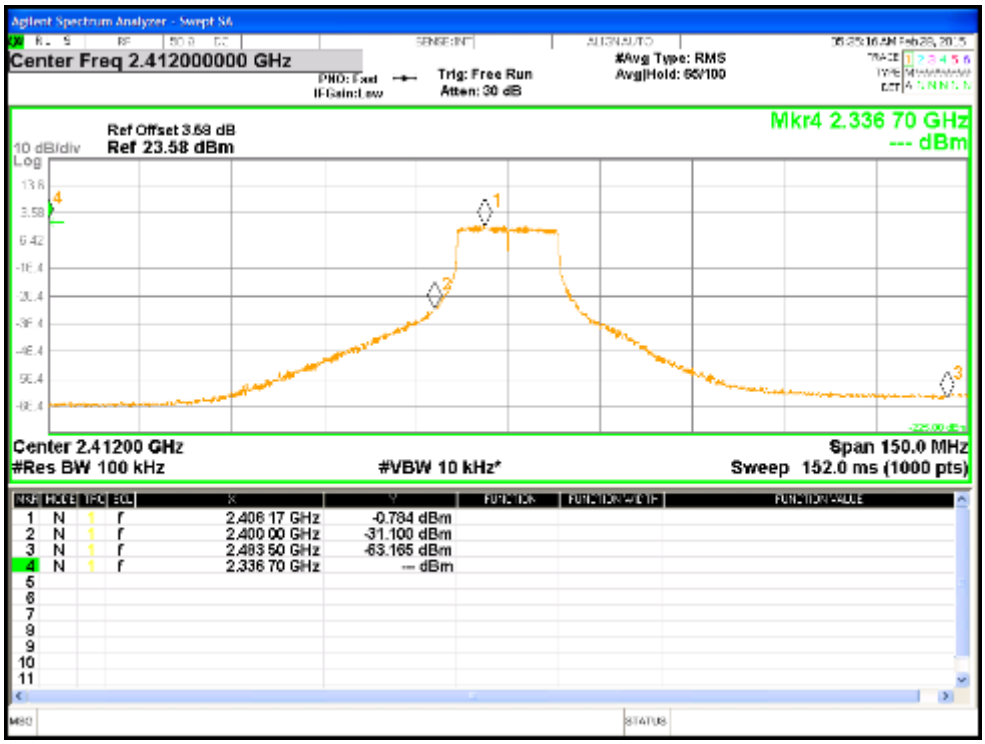


Figure 35: Reference Level for 802.11g mode 2412MHz, Chain 2

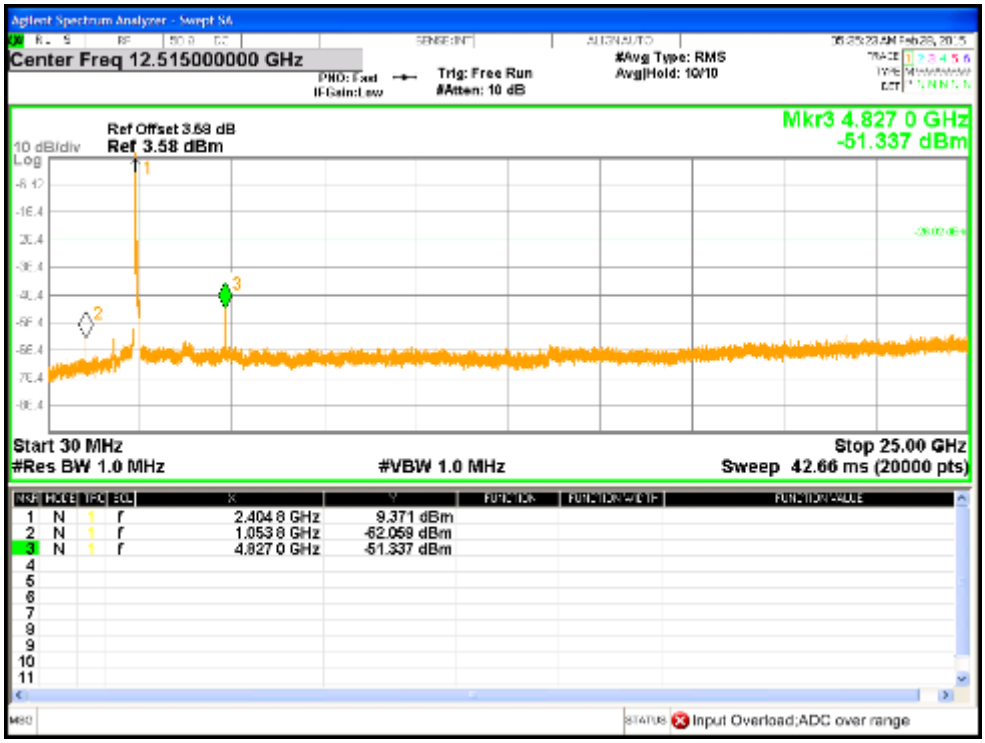


Figure 36: Out of Band Emission for 802.11g mode 2412MHz, Chain 2

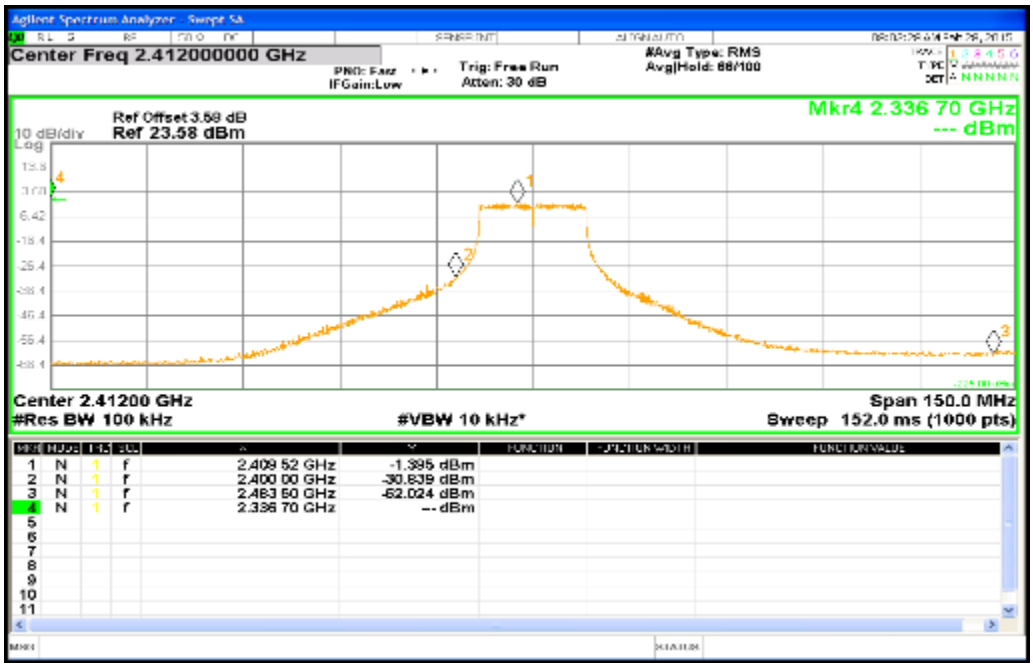


Figure 37: Reference Level for 802.11g mode 2412MHz, Chain 3

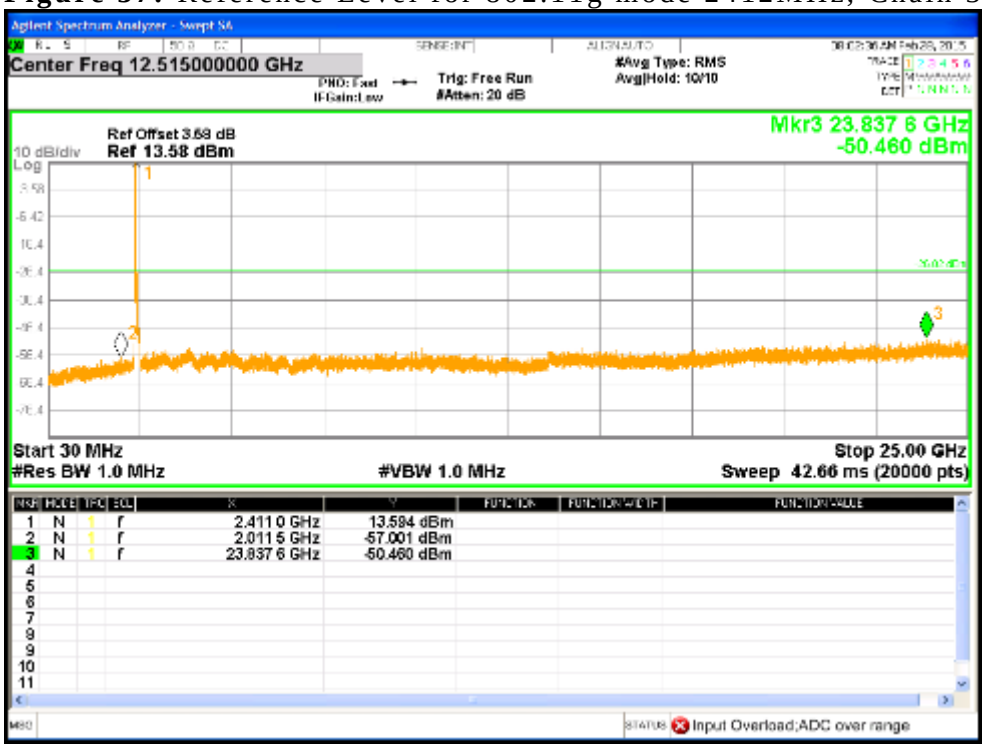


Figure 38: Out of Band Emission for 802.11g mode 2412MHz, Chain3

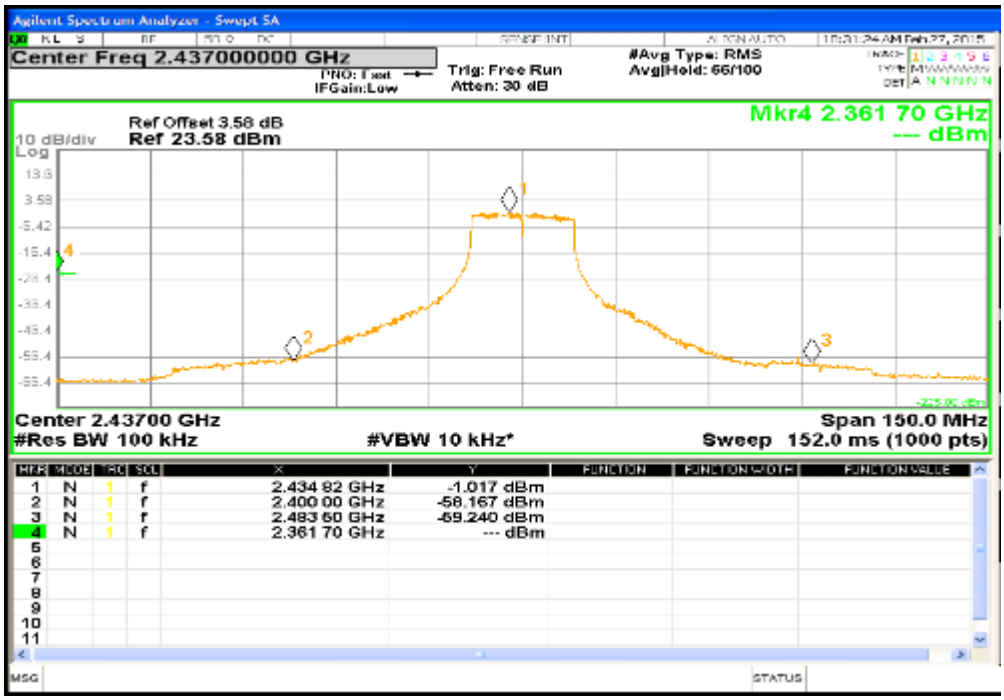


Figure 39: Reference Level for 802.11g mode 2437MHz, Chain0

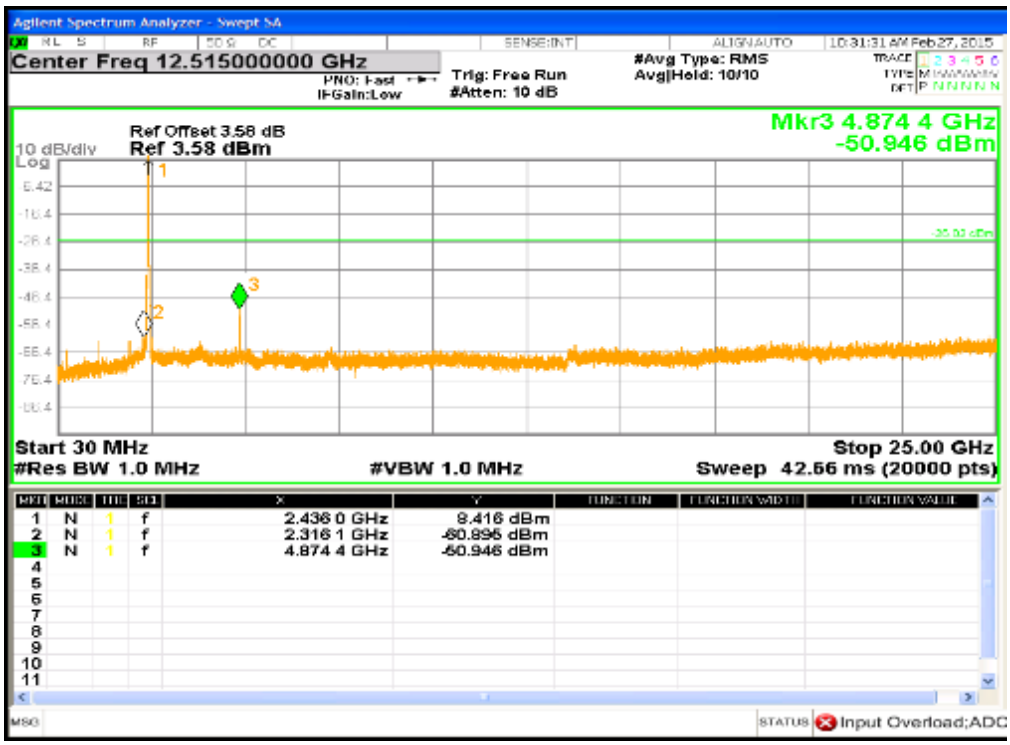


Figure 40: Out of Band Emission for 802.11g mode 2437MHz, Chain0

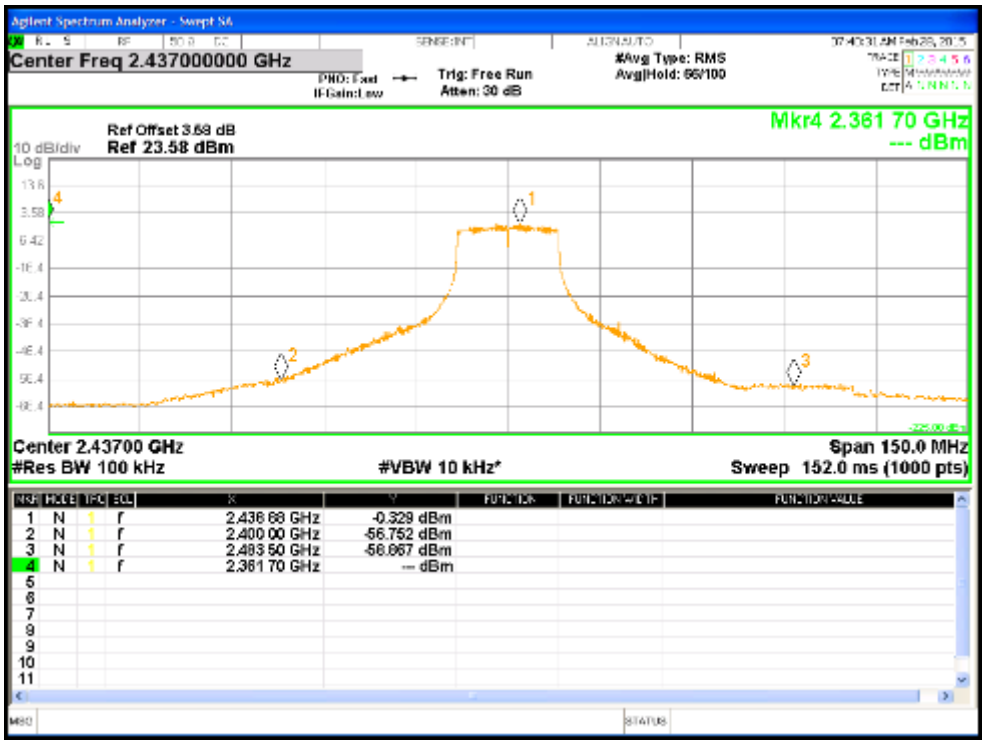


Figure 41: Reference Level for 802.11g mode 2437MHz, Chain1

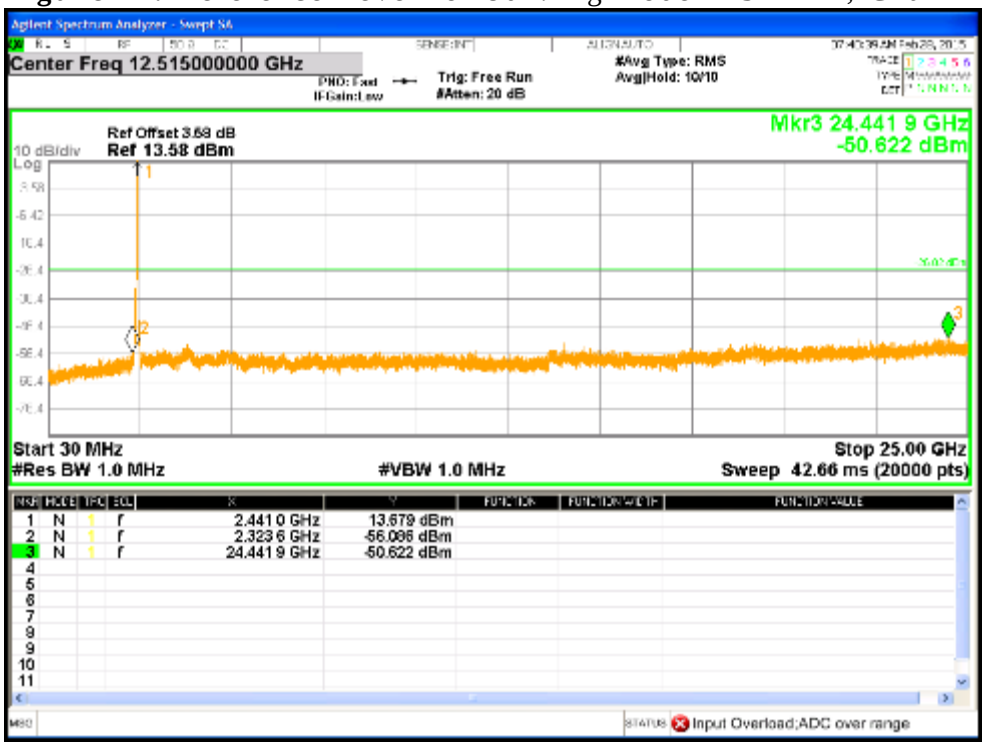


Figure 42: Out of Band Emission for 802.11g mode 2437MHz, Chain1

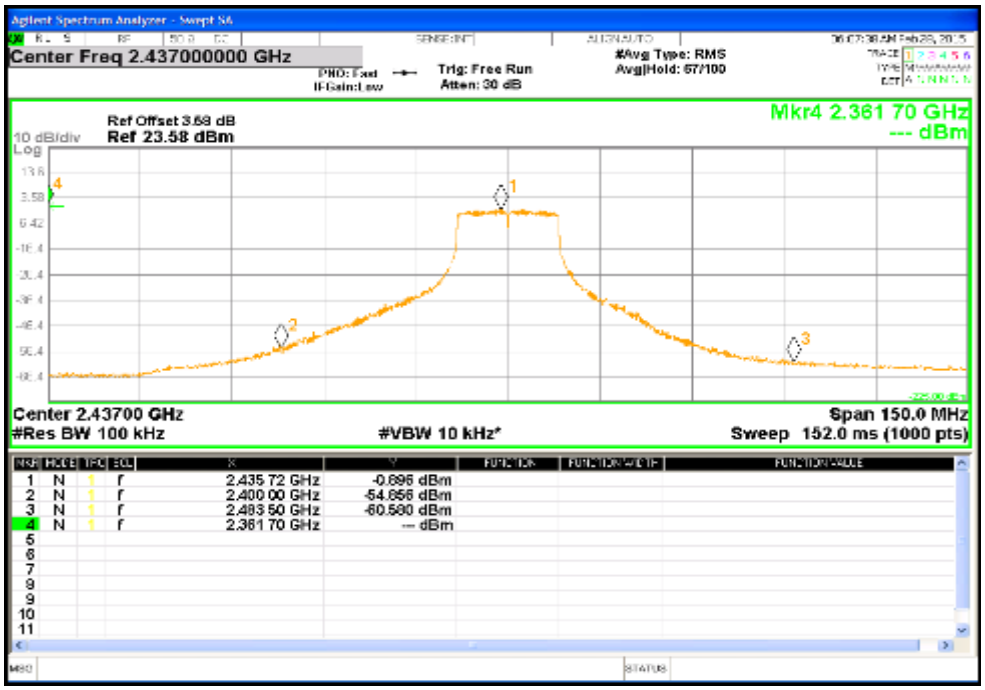


Figure 43: Reference Level for 802.11g mode 2437MHz, Chain2

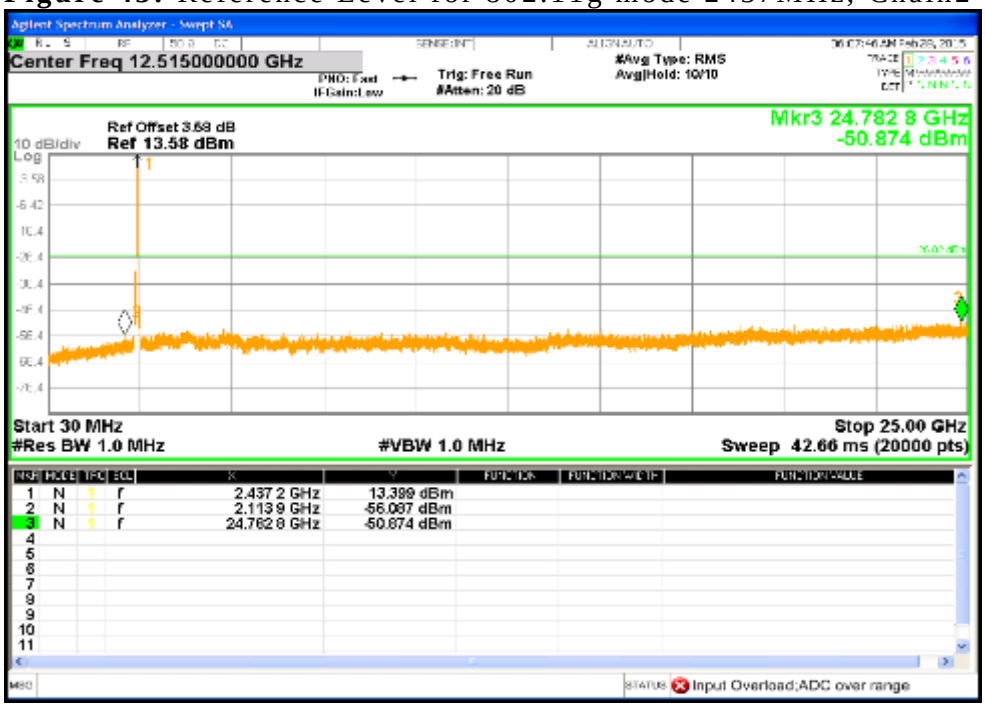


Figure 44: Out of Band Emission for 802.11g mode 2437MHz, Chain2

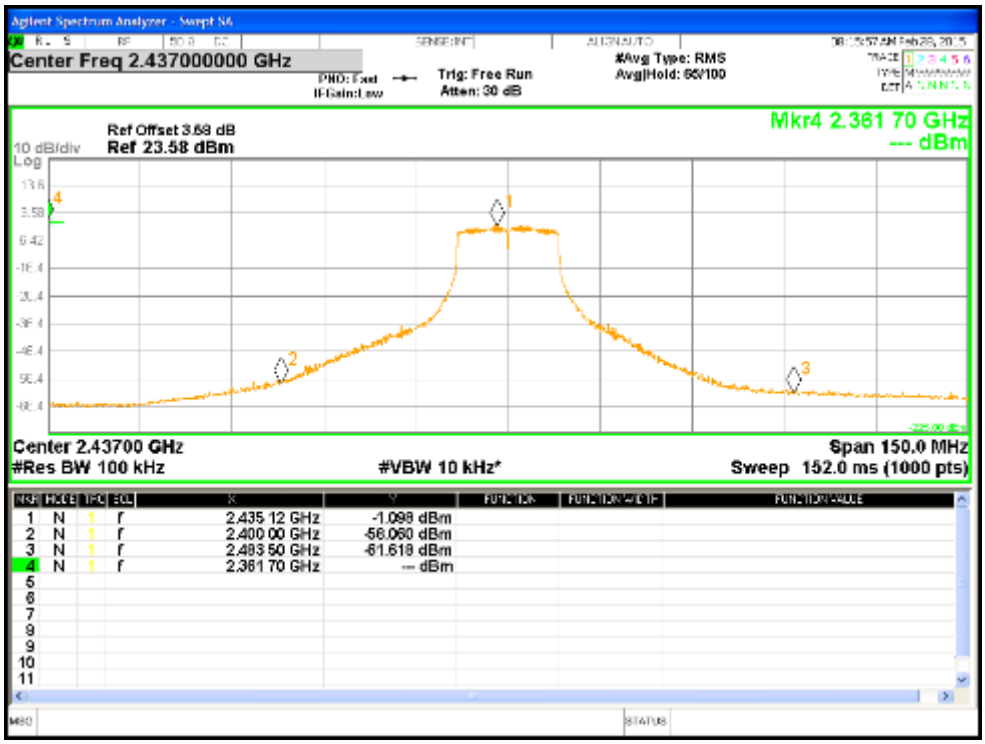


Figure 45: Reference Level for 802.11g mode 2437MHz, Chain3

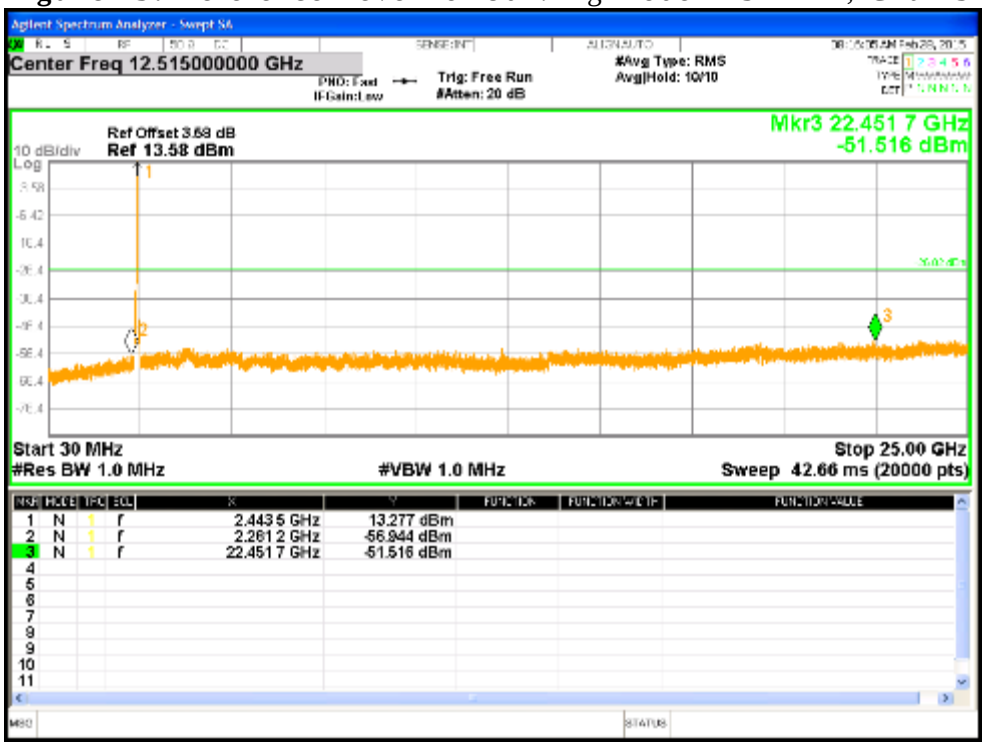


Figure 46: Out of Band Emission for 802.11g mode 2437MHz, Chain3

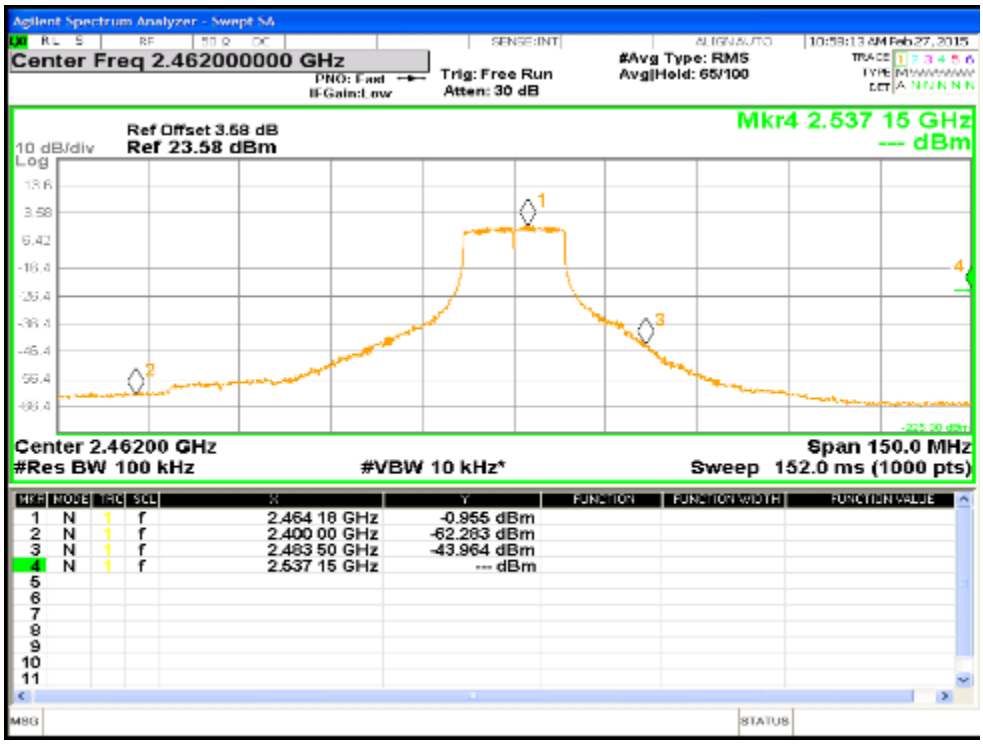


Figure 47: Reference Level for 802.11g mode 2462MHz, Chain0

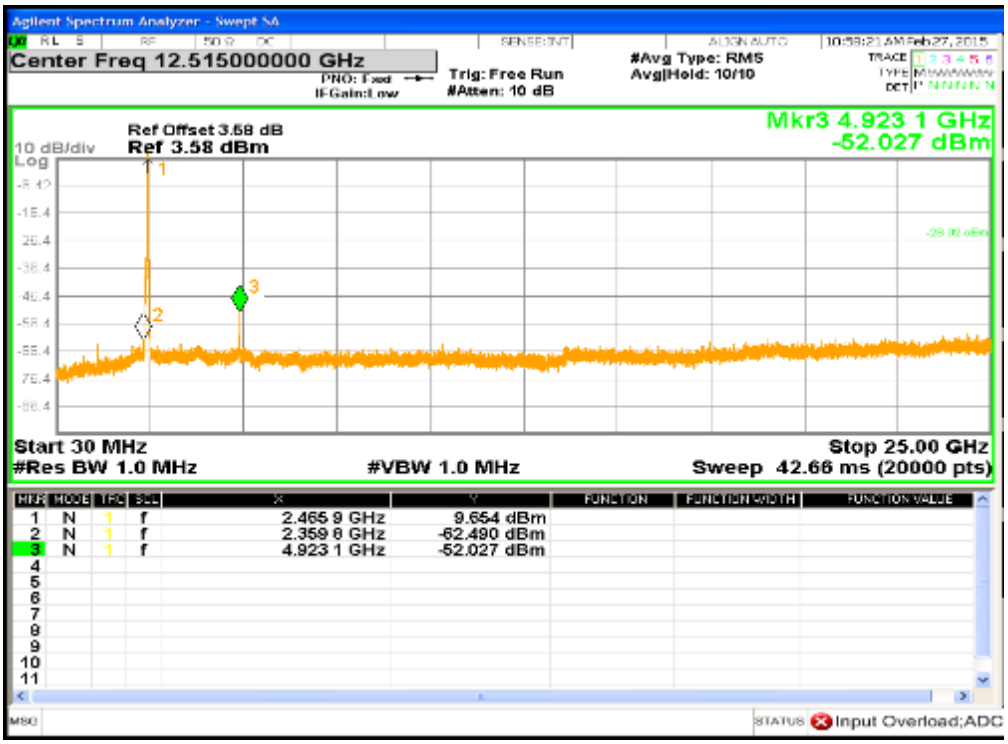


Figure 48: Out of Band Emission for 802.11g mode 2462MHz, Chain0

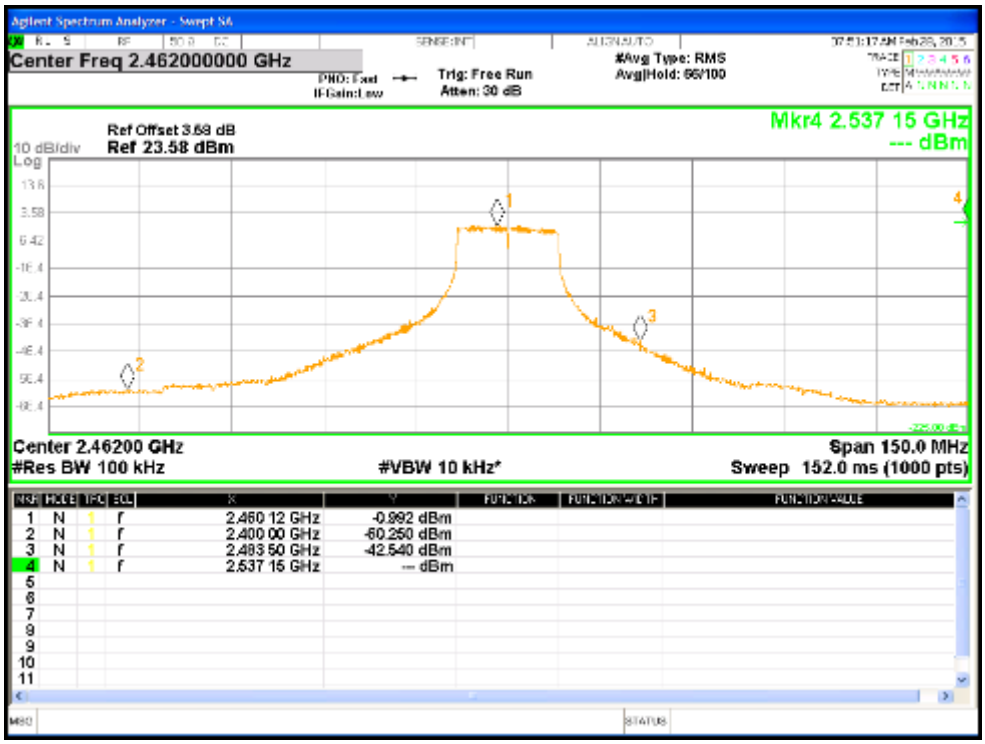


Figure 49: Reference Level for 802.11g mode 2462MHz, Chain1

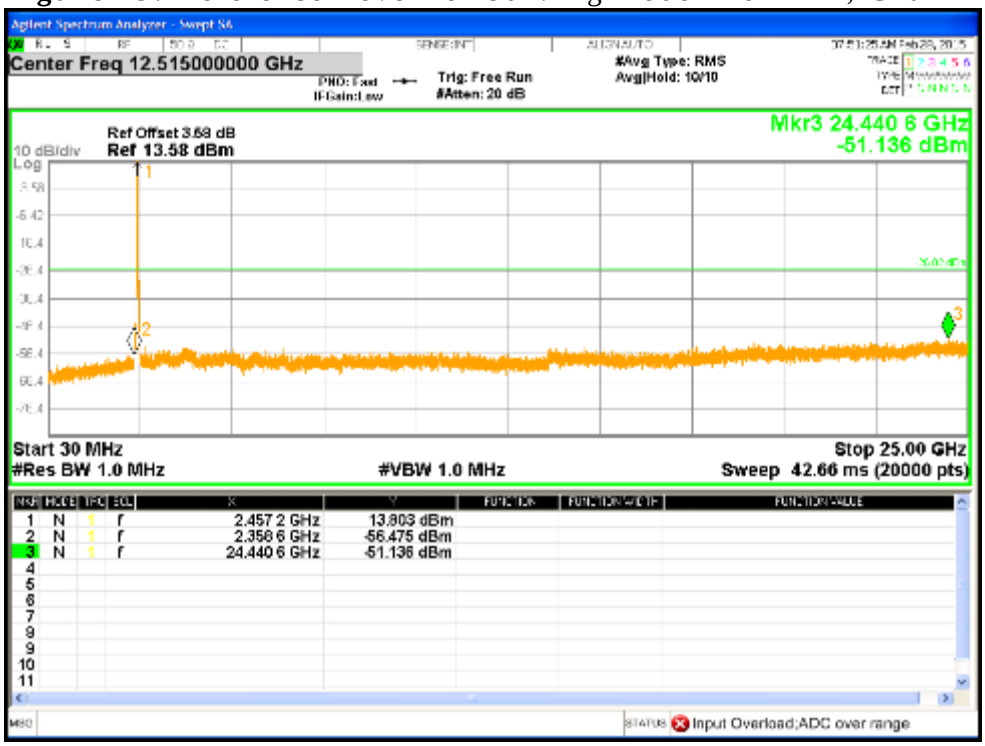


Figure 50: Out of Band Emission for 802.11g mode 2462MHz, Chain1

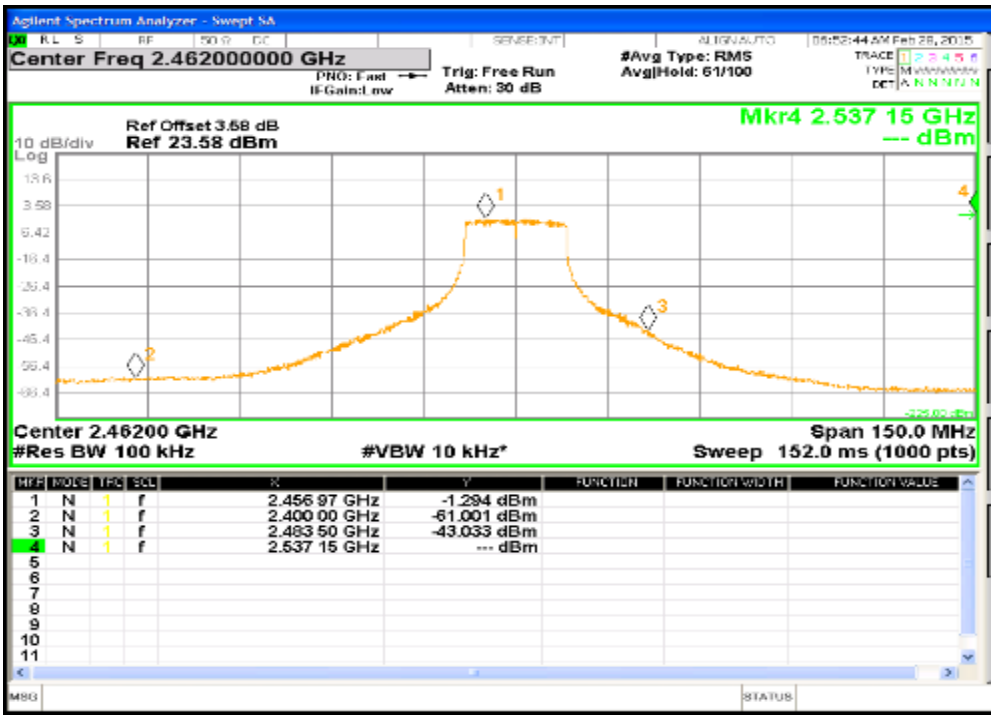


Figure 51: Reference Level for 802.11g mode 2462MHz, Chain2

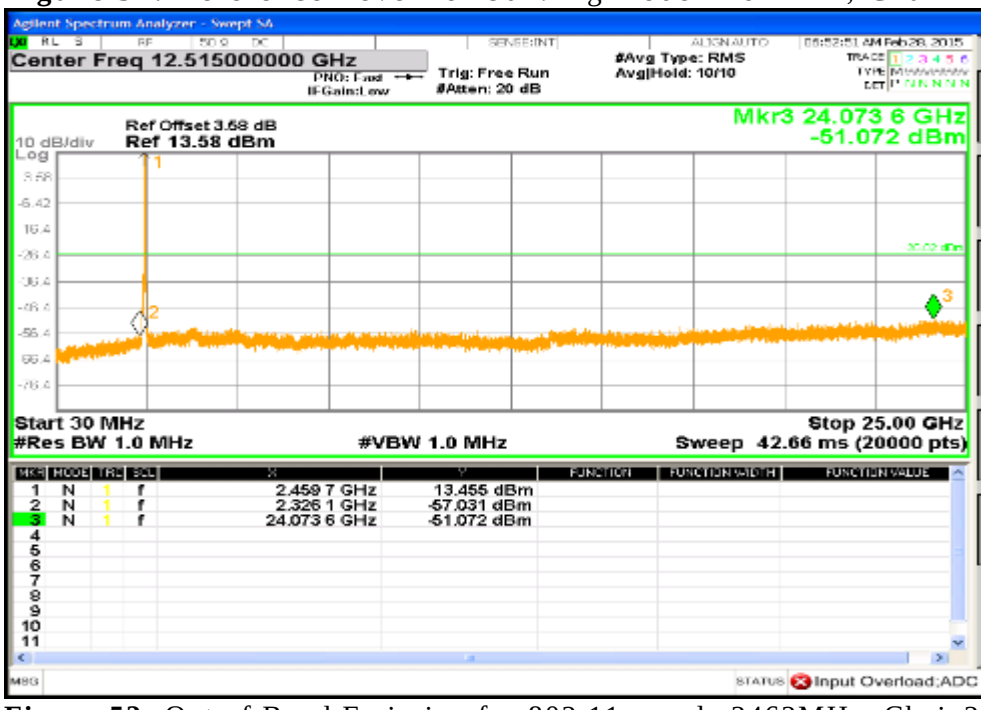


Figure 52: Out of Band Emission for 802.11g mode 2462MHz, Chain2

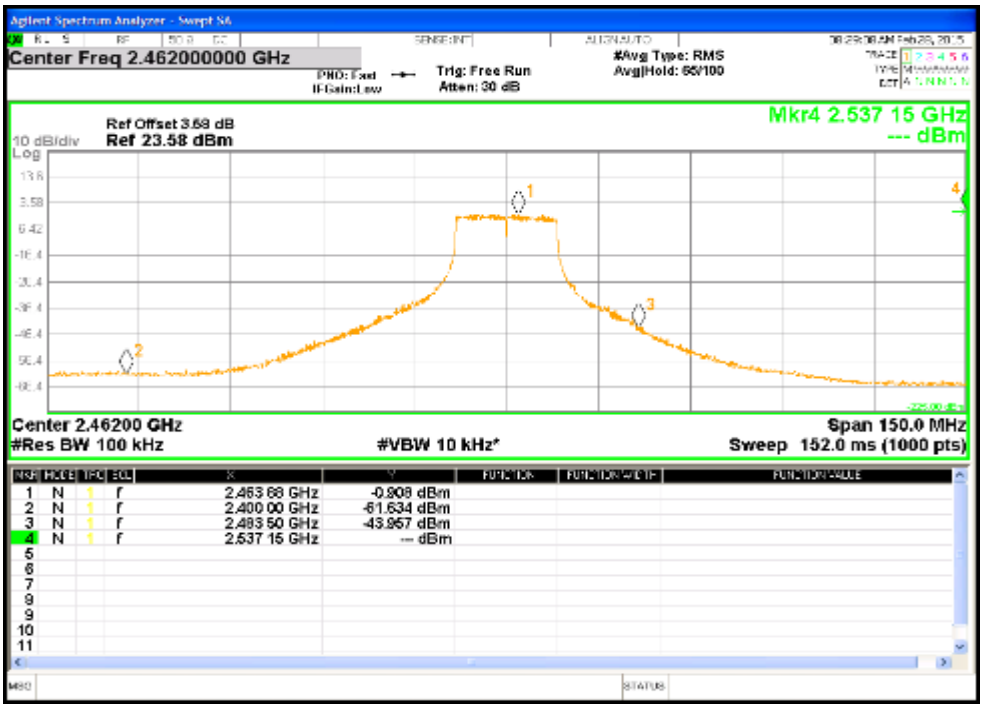


Figure 53: Reference Level for 802.11g mode 2462MHz, Chain3

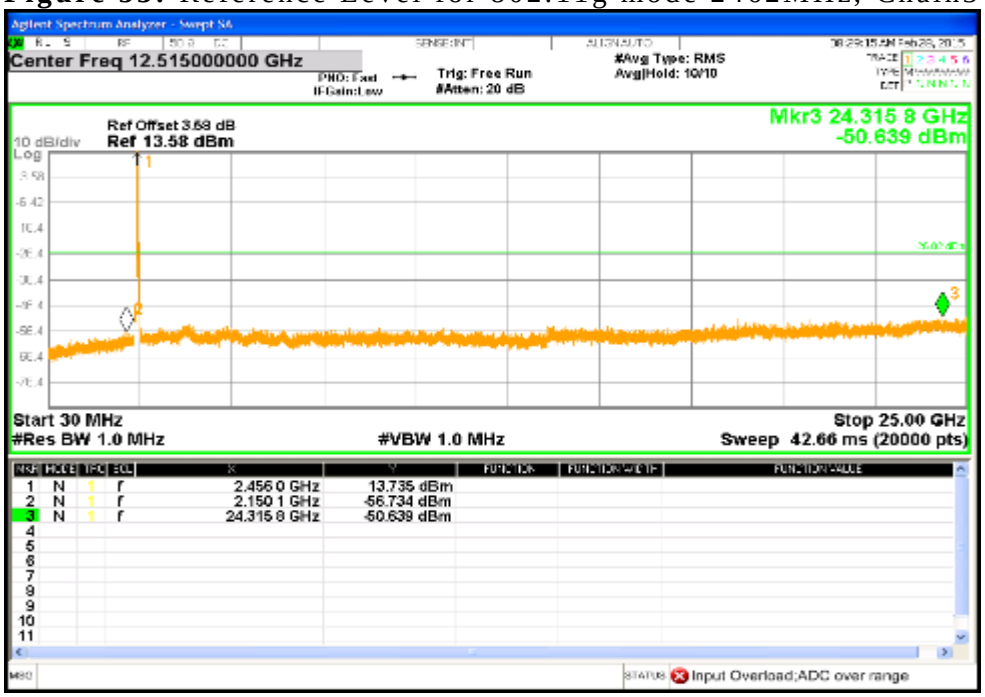


Figure 54: Out of Band Emission for 802.11g mode 2462MHz, Chain3

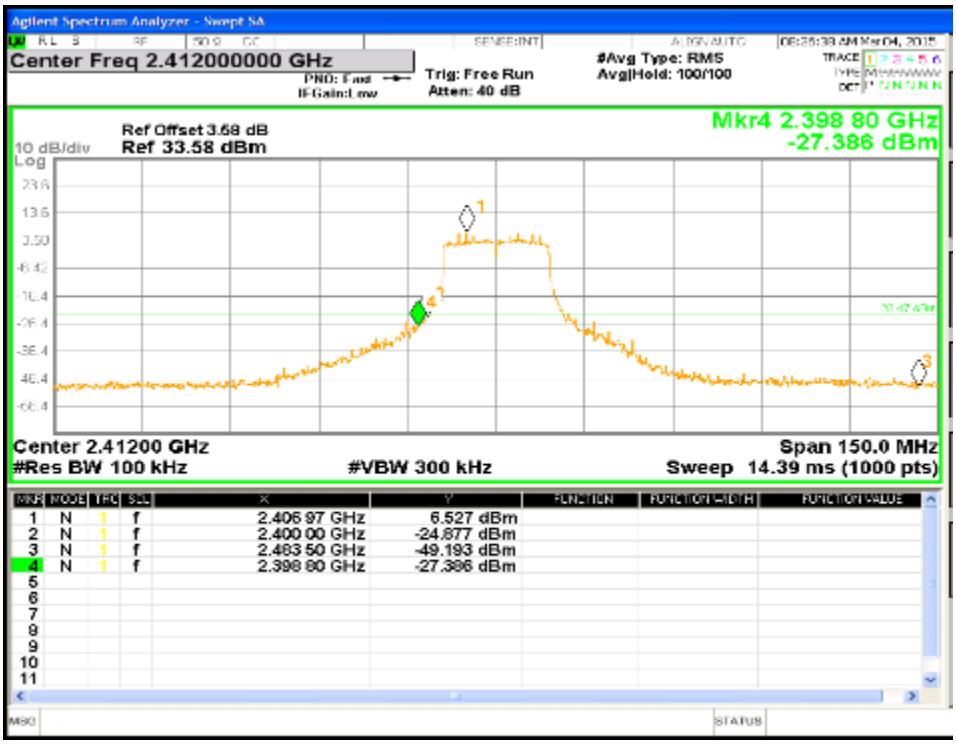


Figure 55: Reference Level for HT20 at2412 MHz, Chain 0

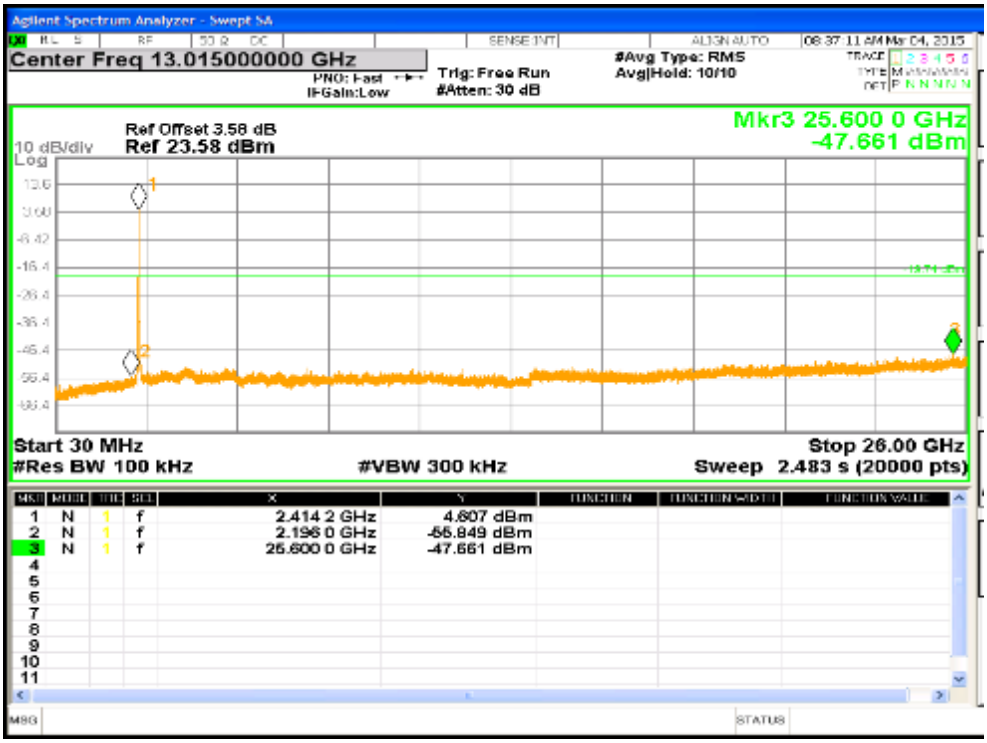


Figure 56: Out of Band Emission for HT20 at2412MHz, Chain 0

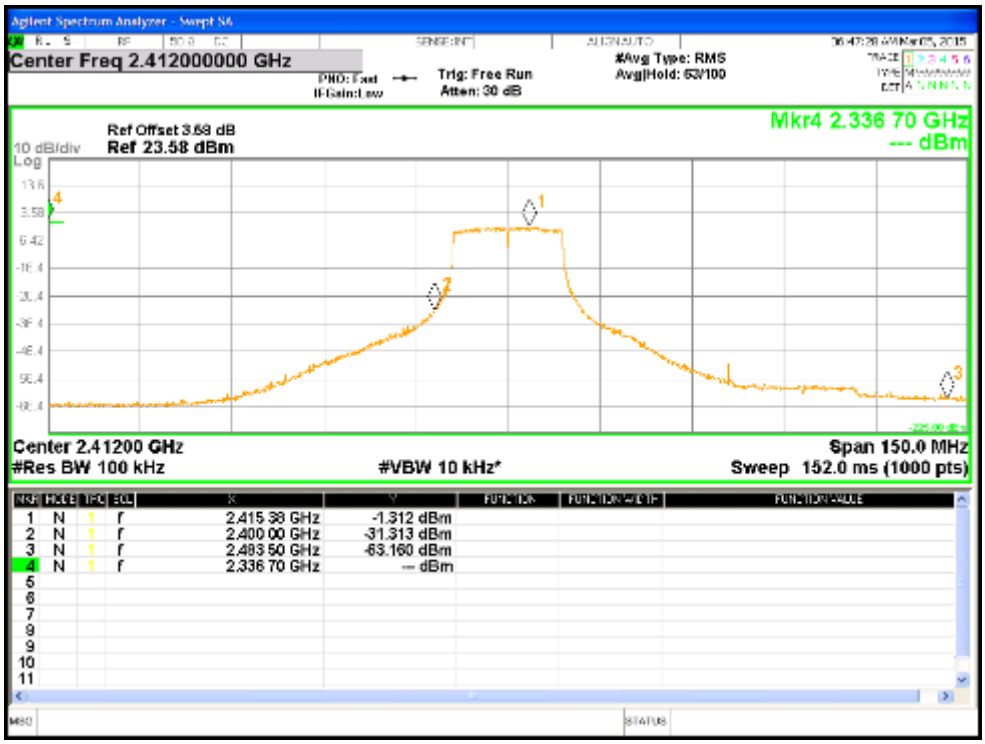


Figure 57: Reference Level for HT20 at 2412MHz, Chain 1

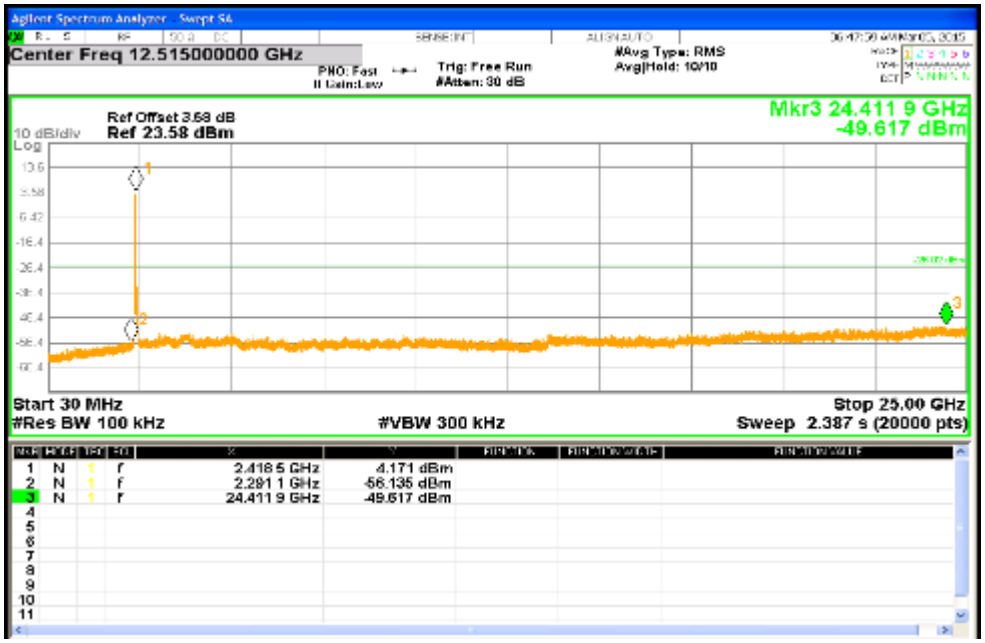


Figure 58: Out of Band Emission for HT20 at 2412MHz, Chain 1

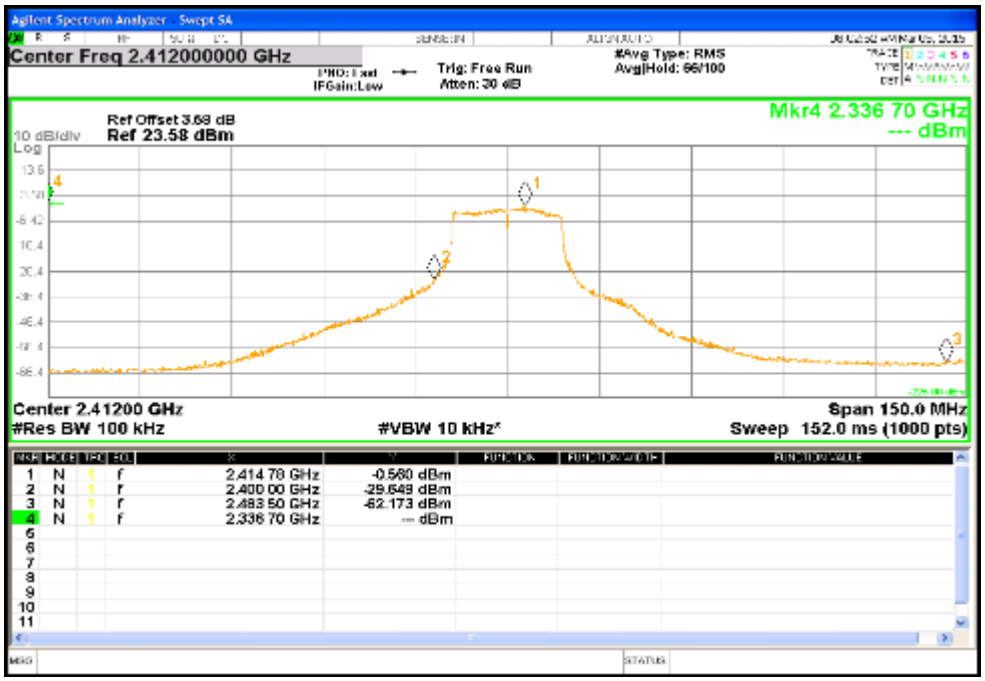


Figure 59: Reference Level for HT20 at2412 MHz, Chain 2

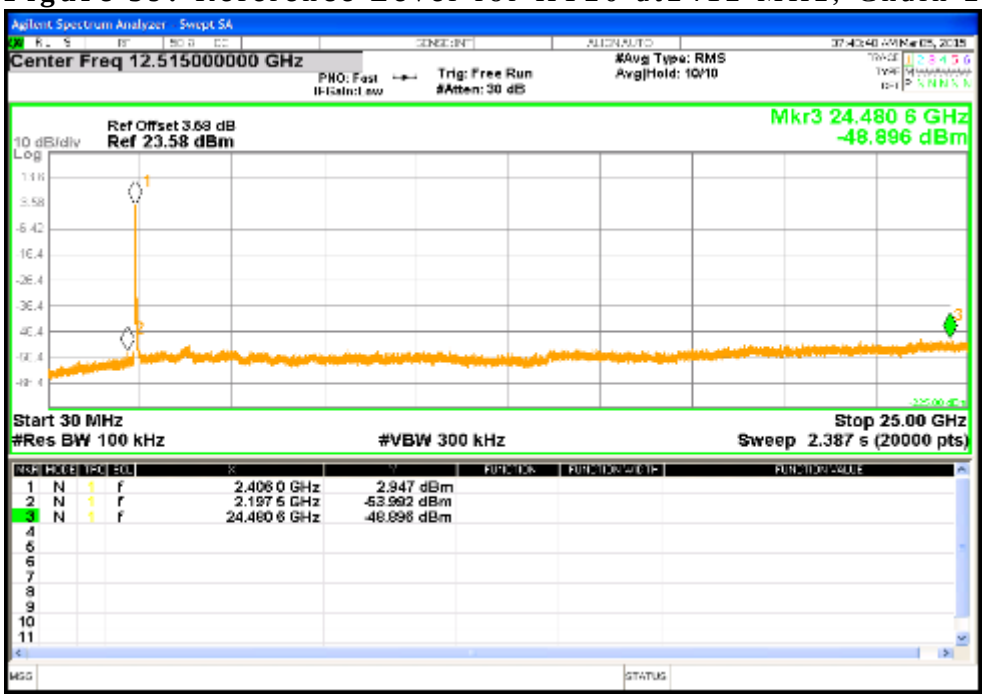


Figure 60: Out of band Emissions for HT20 at2412 MHz, Chain 2

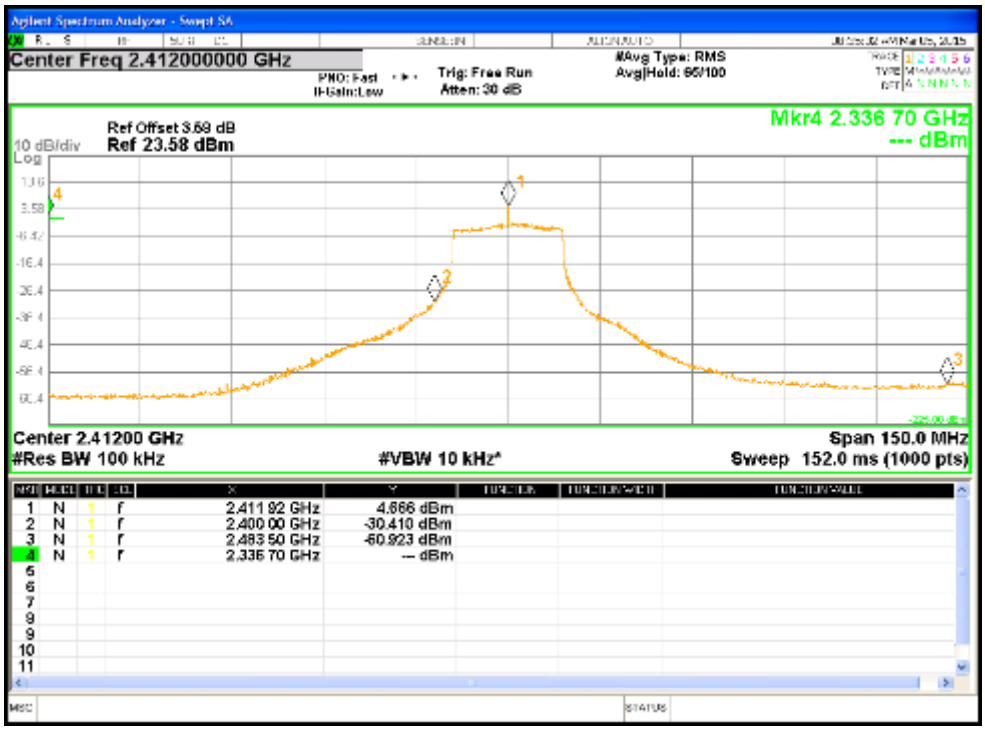


Figure 61: Reference Level for HT20 at 2412MHz, Chain 3

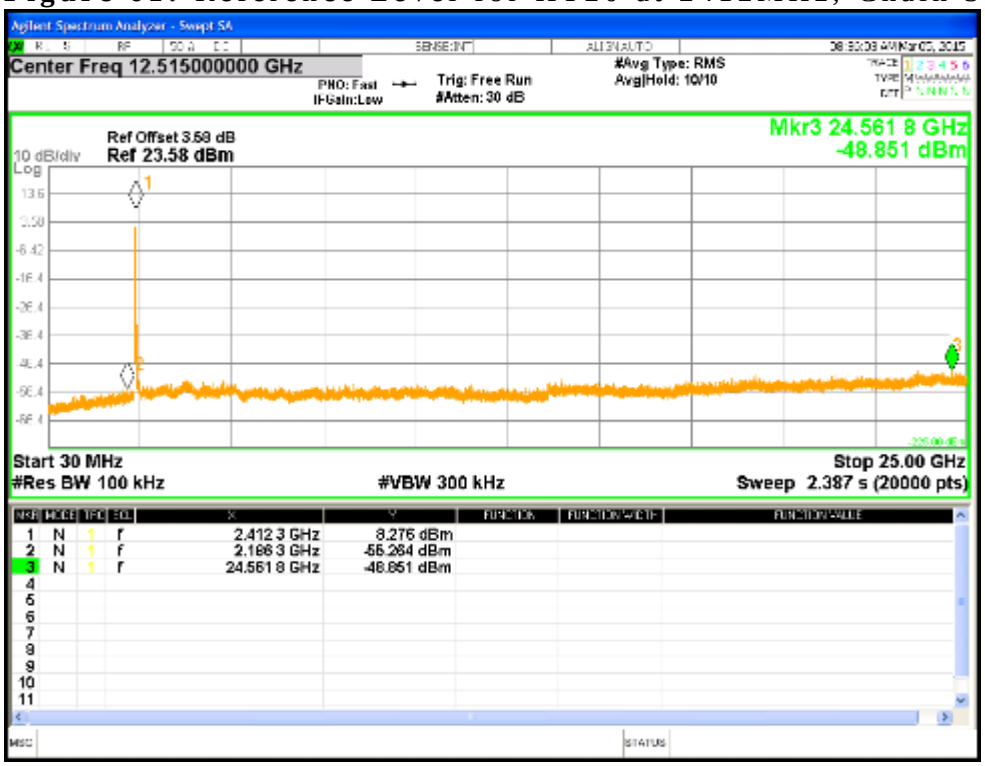


Figure 62: Out of Band Emission for HT20 at 2412MHz, Chain 3

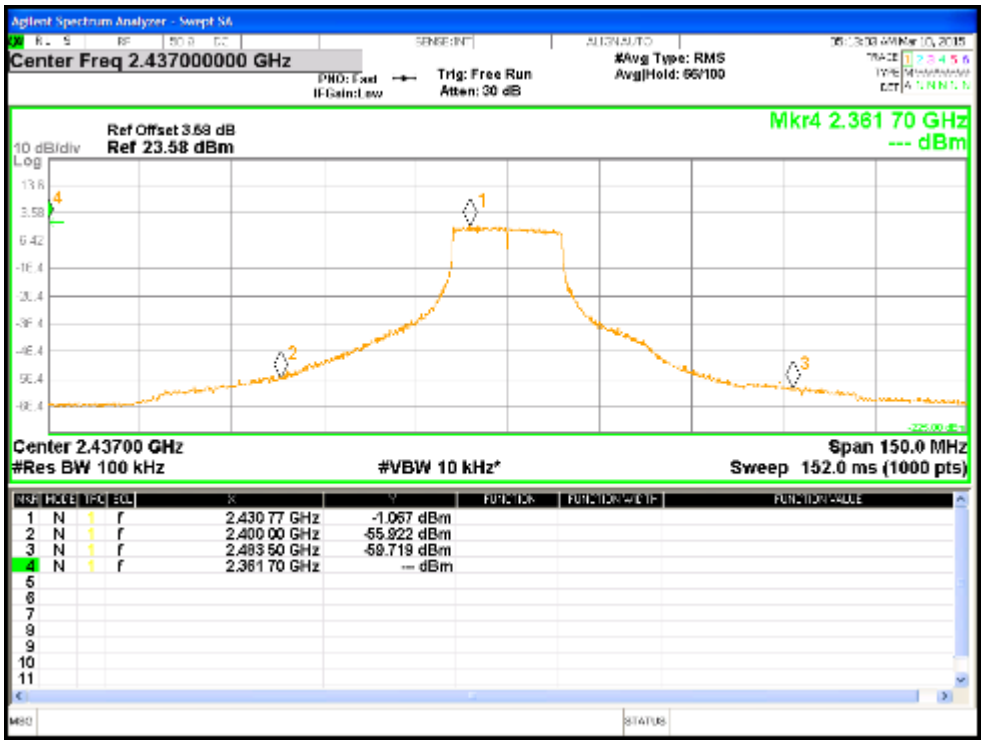


Figure 63: Reference Level for HT20 at 2437MHz, Chain 0

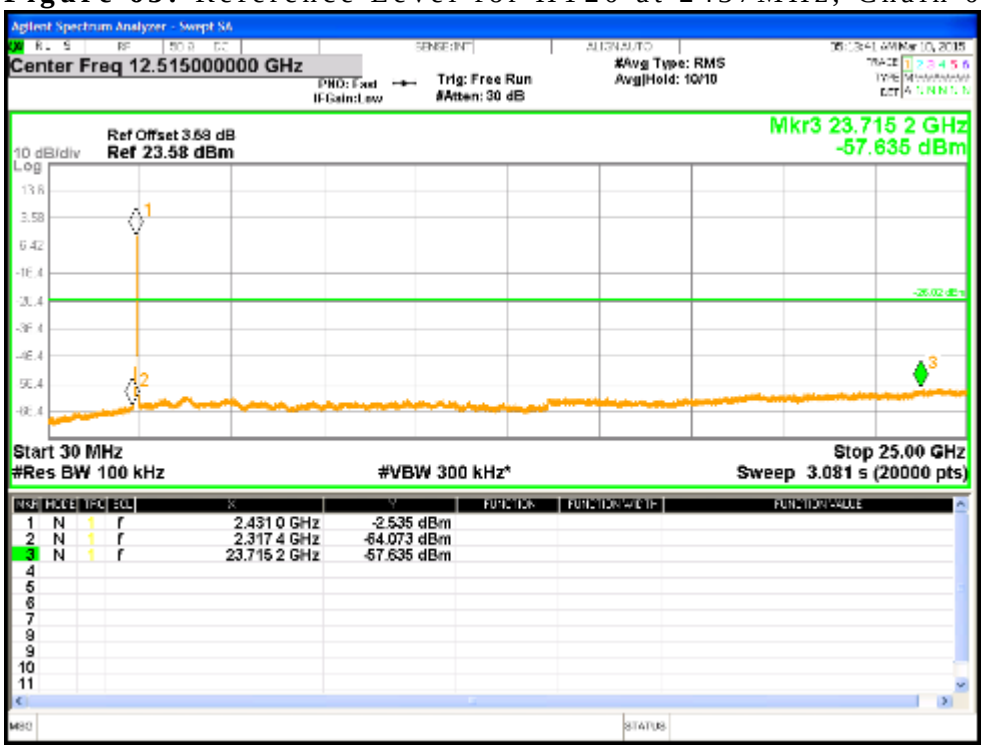


Figure 64: Out of Band Emission for HT20 at 2437MHz, Chain 0

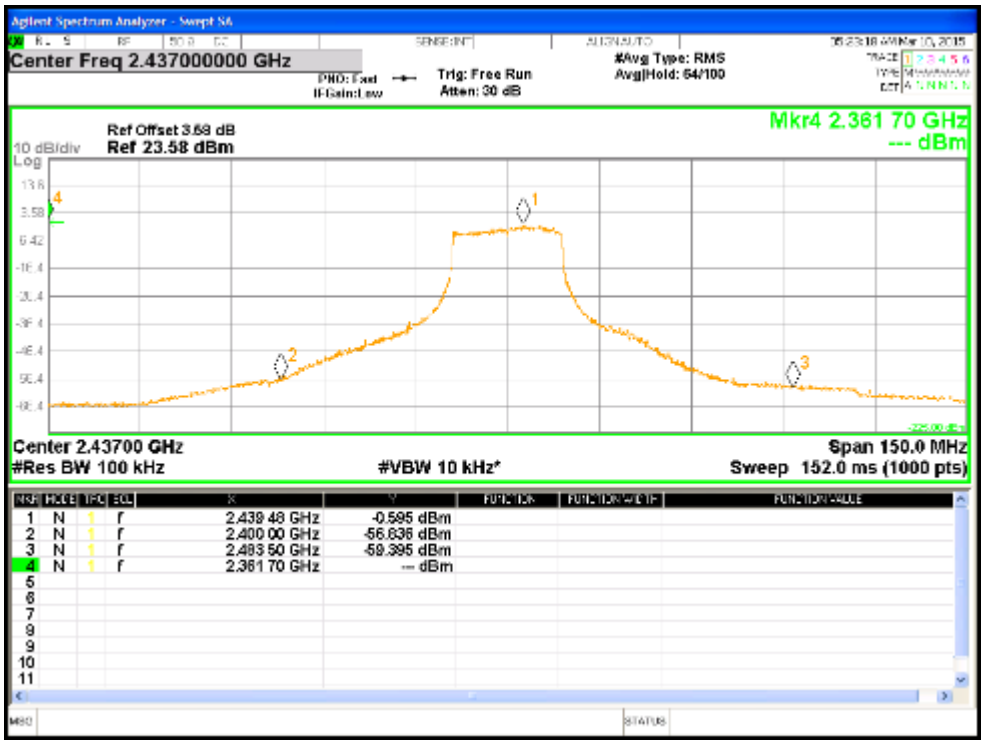


Figure 65: Reference Level for HT20 at 2437MHz, Chain 1

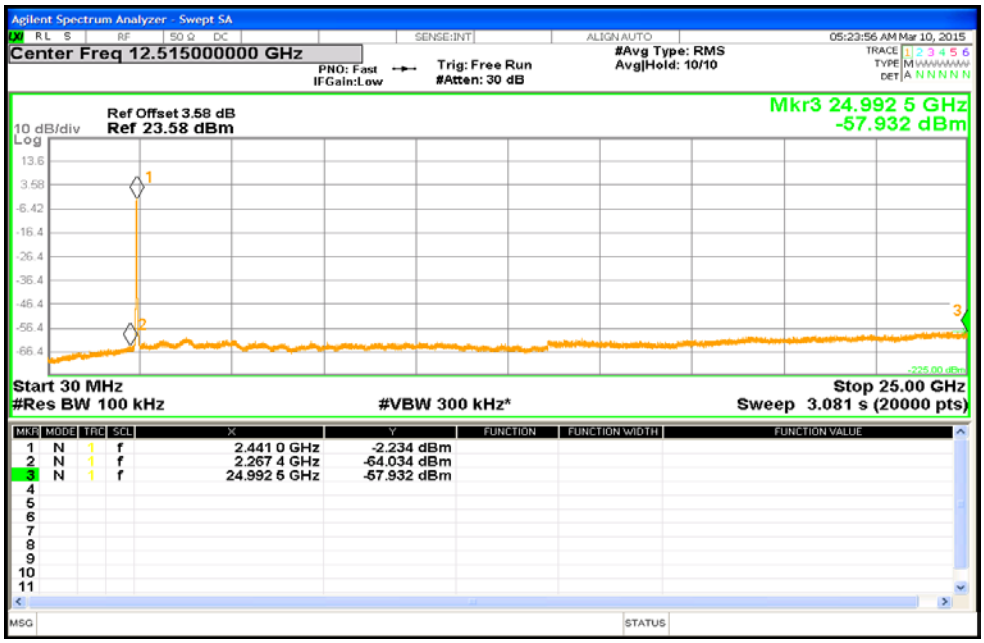


Figure 66: Out of Band Emission for HT20 at 2437MHz, Chain 1

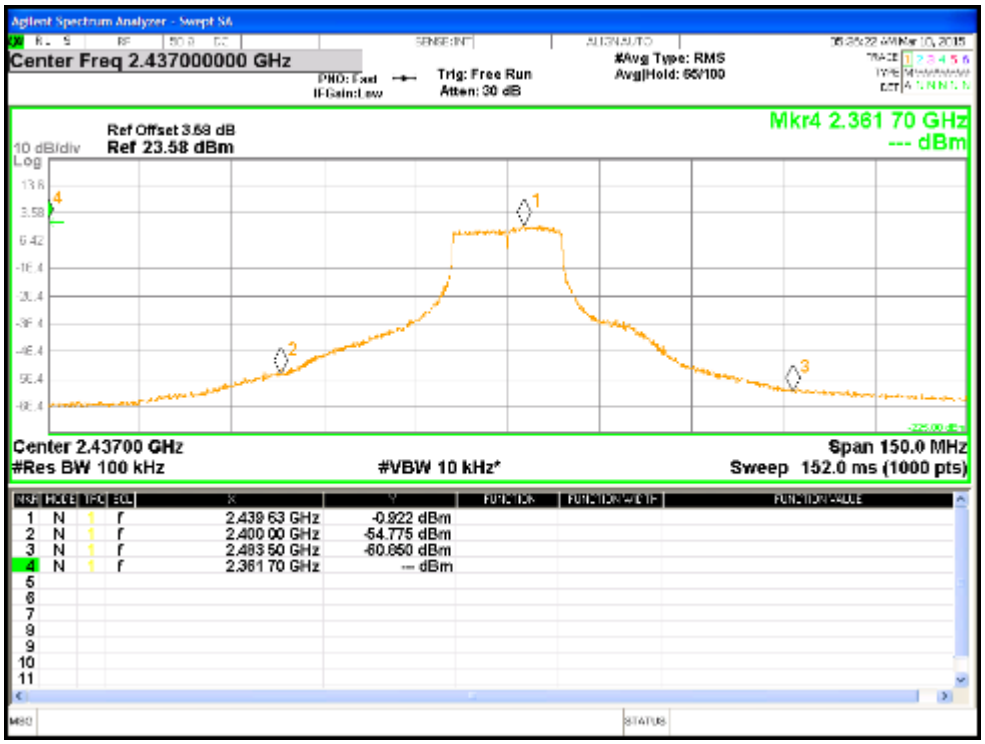


Figure 67: Reference Level for HT20 at 2437MHz, Chain 2

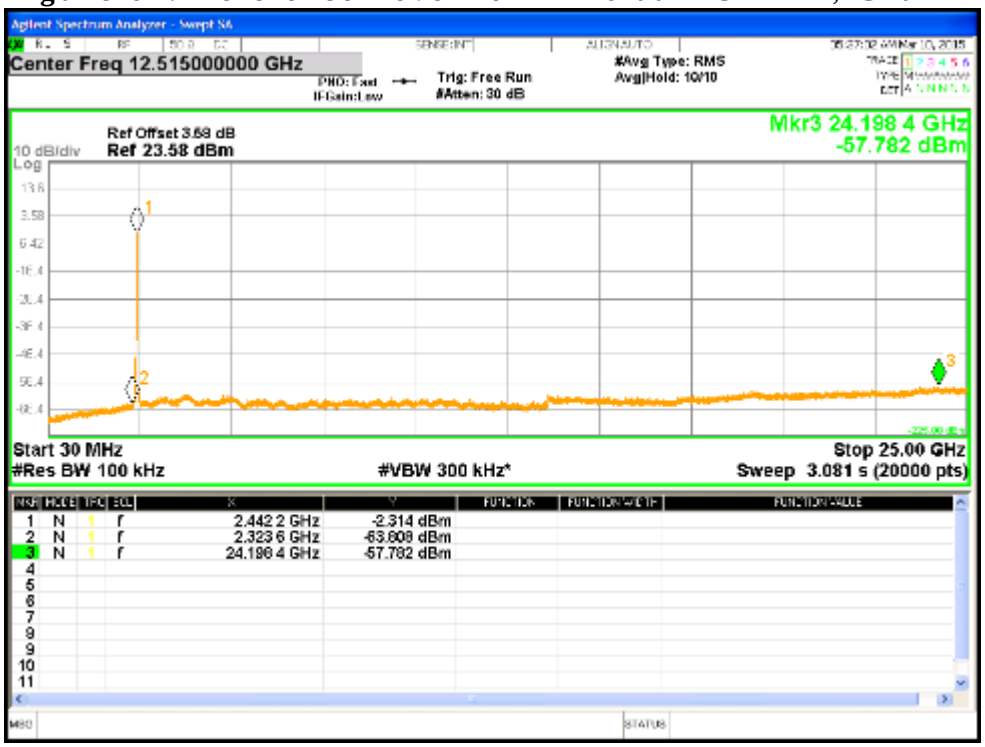


Figure 68: Out of Band Emission for HT20 at 2437MHz, Chain 2

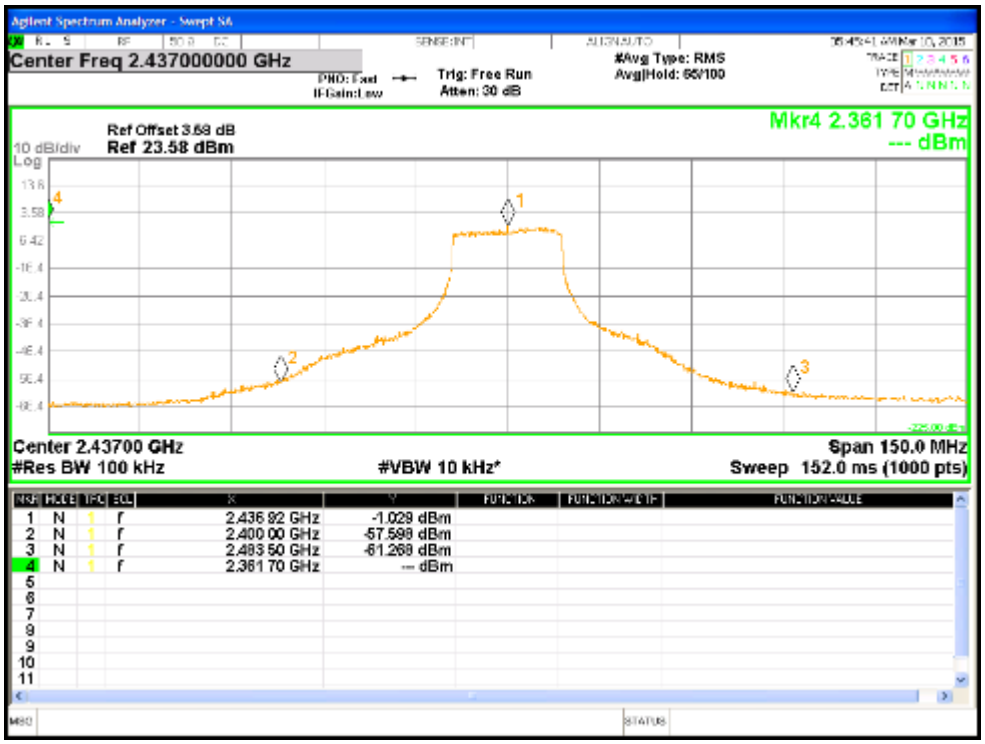


Figure 69: Reference Level for HT20 at 2437MHz, Chain 3

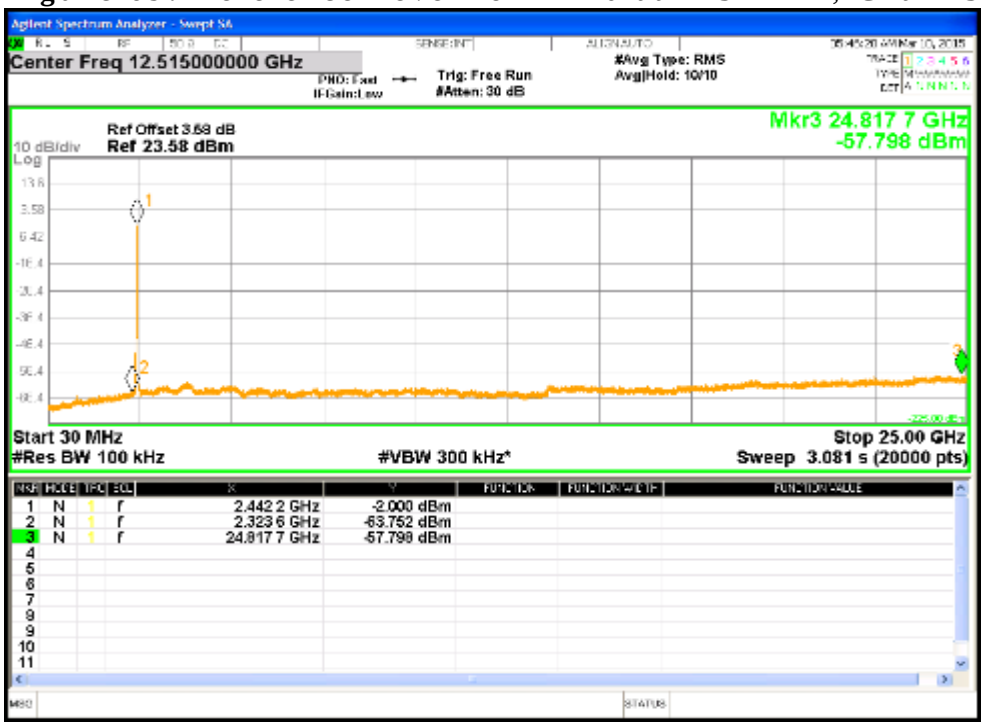


Figure 70: Out of Band Emission for HT20 at 2437MHz, Chain 3

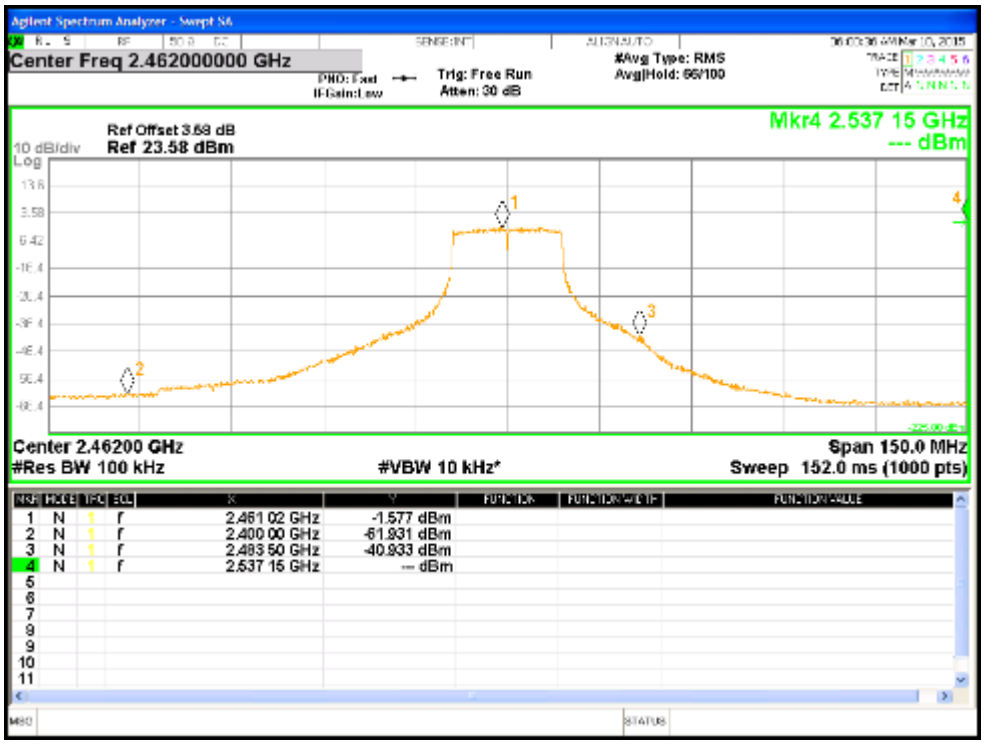


Figure 71: Reference Level for HT20 at 2462MHz, Chain 0

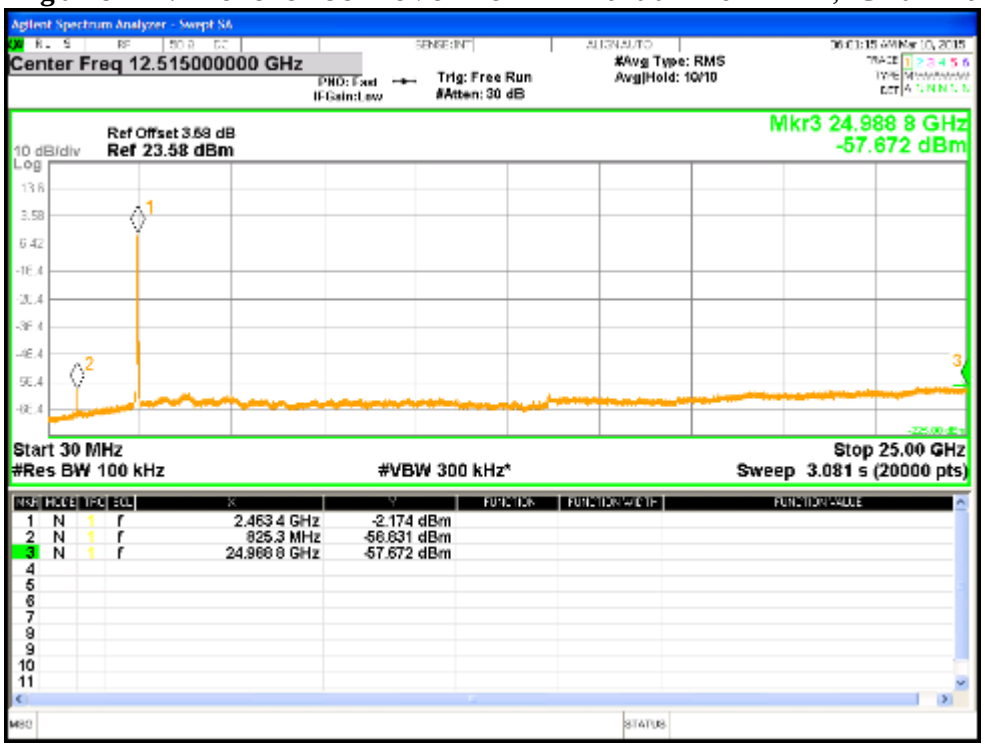


Figure 72: Out of Band Emission for HT20 at 2462MHz, Chain 0

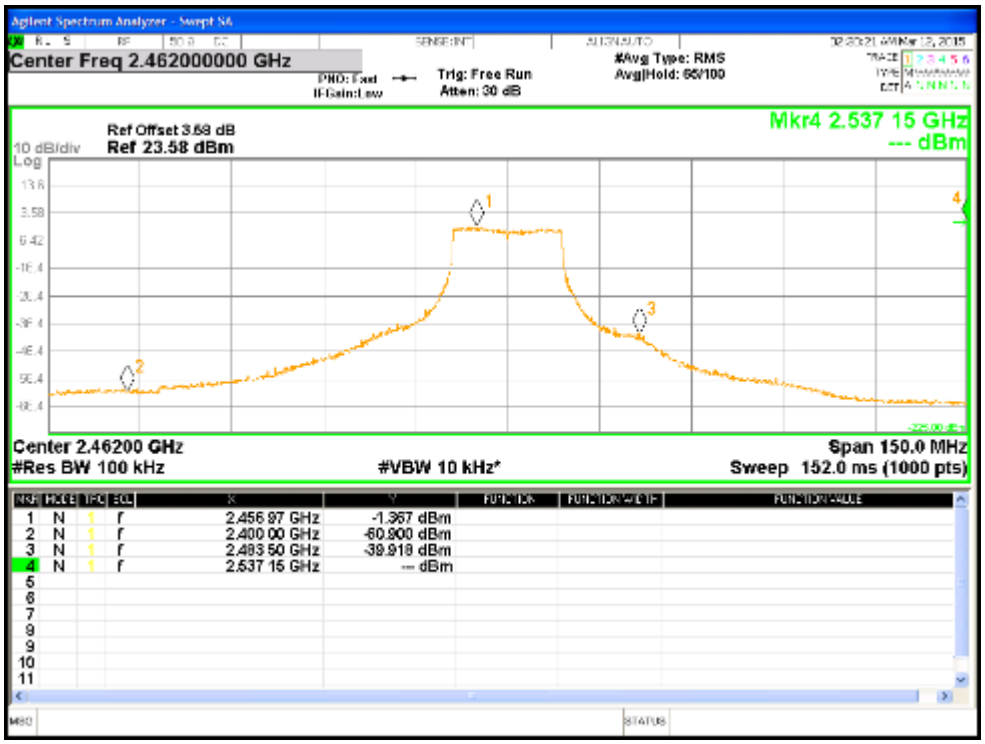


Figure 73: Reference Level for HT20 at 2462MHz, Chain 1

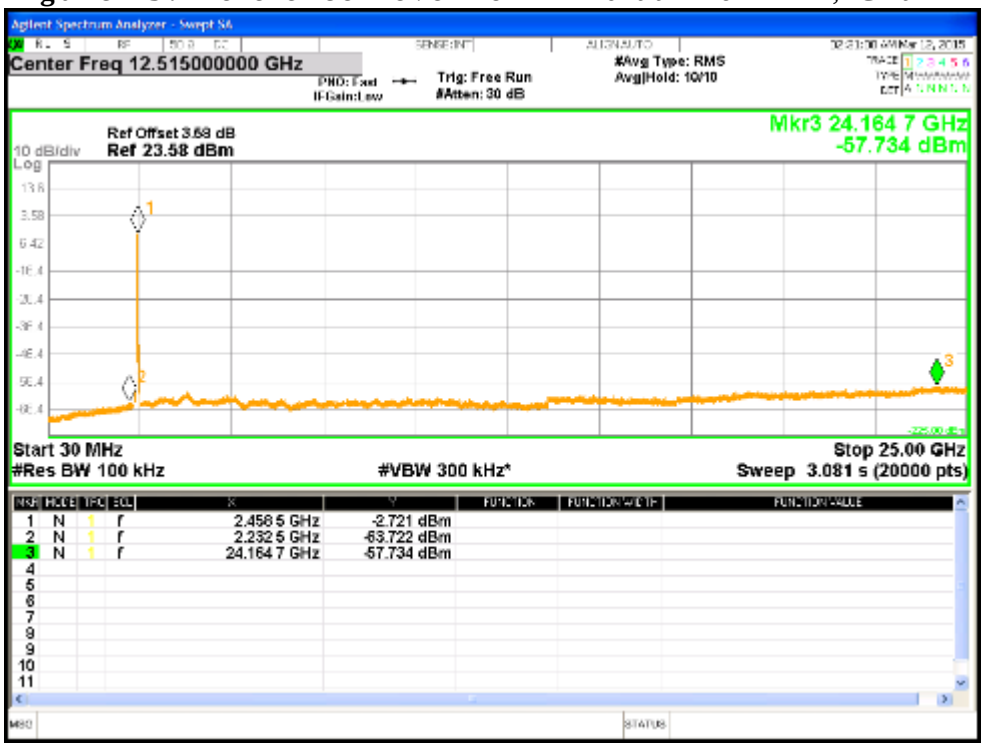


Figure 74: Out of Band Emission for HT20 at 2462MHz, Chain 1

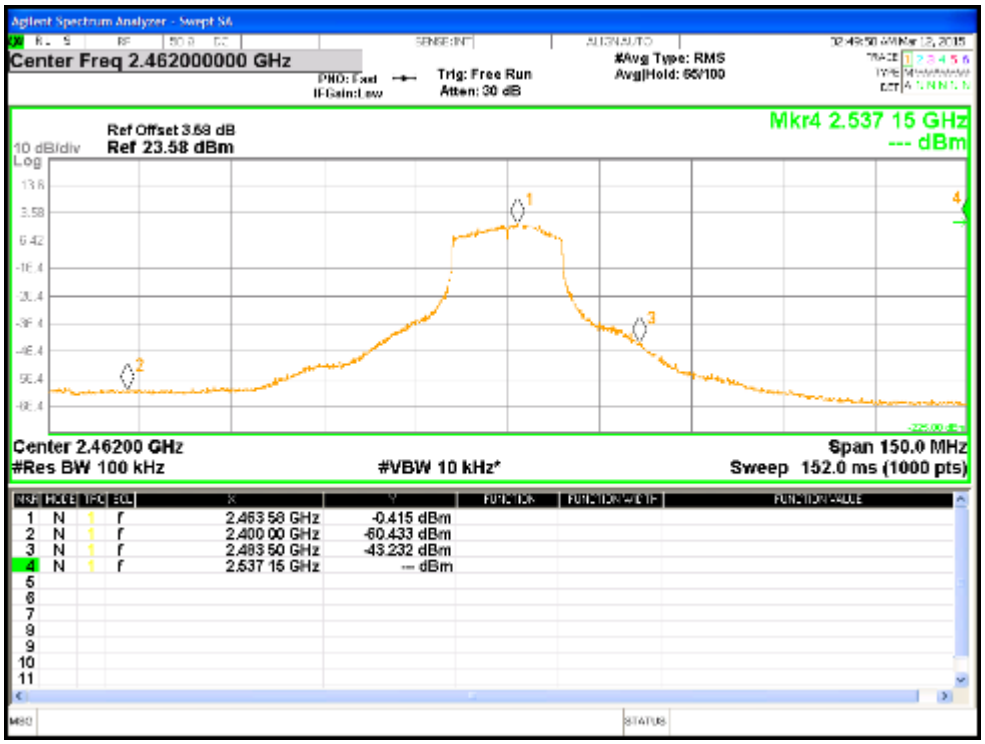


Figure 75: Reference Level for HT20 at 2462MHz, Chain 2

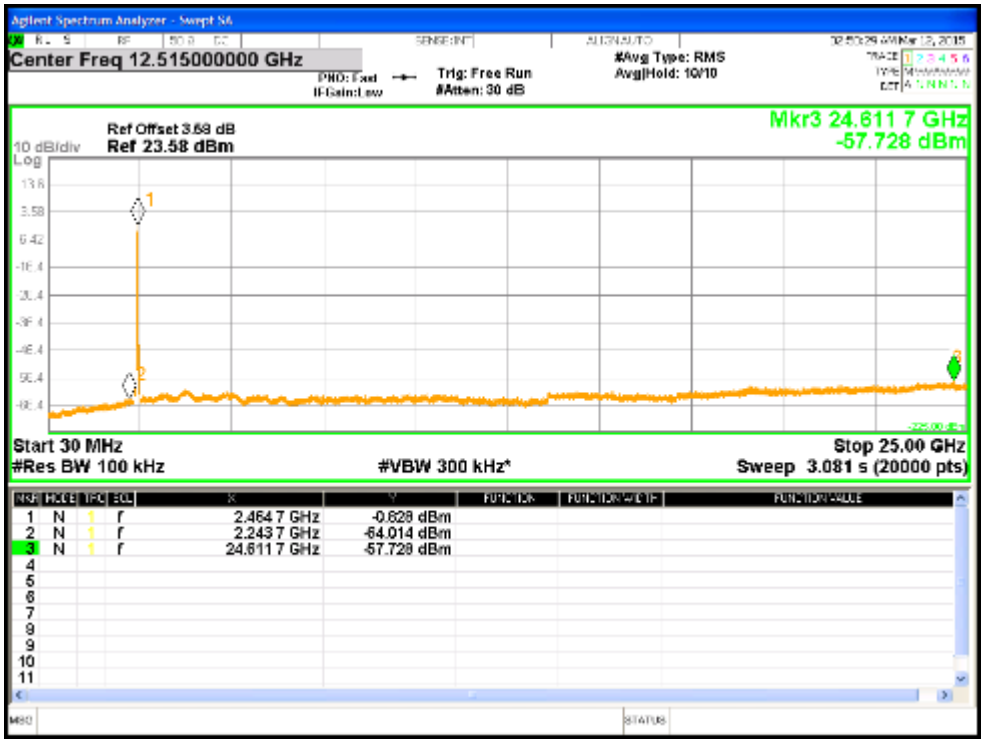


Figure 76: Out of Band Emission for HT20 at 2462MHz, Chain 2

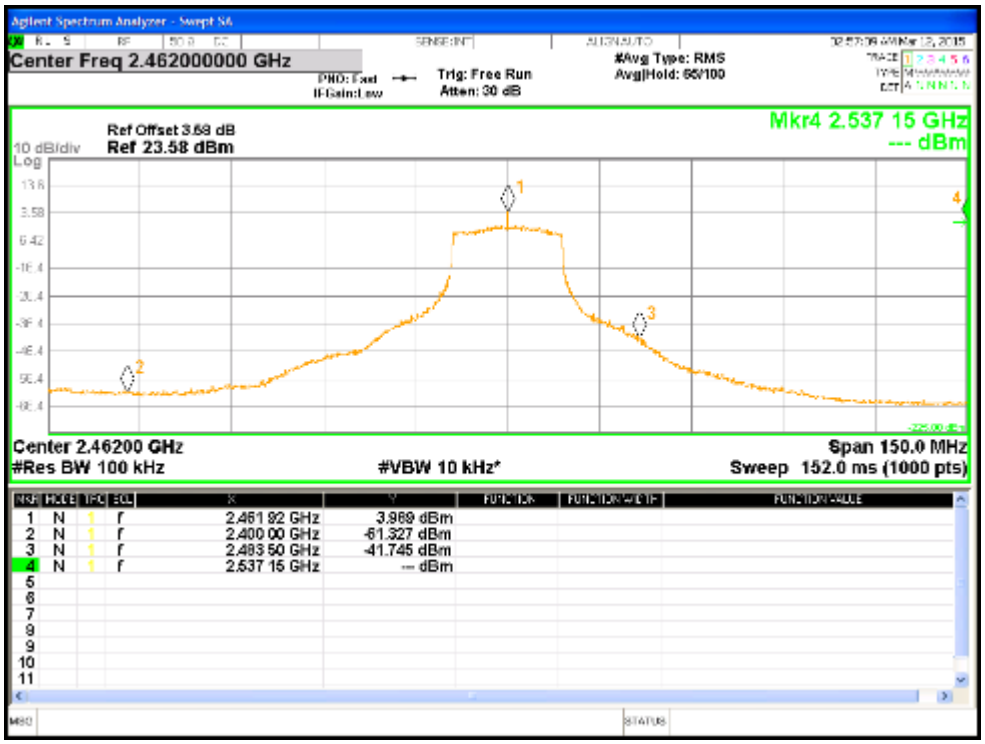


Figure 77: Reference Level for HT20 at 2462MHz, Chain 3

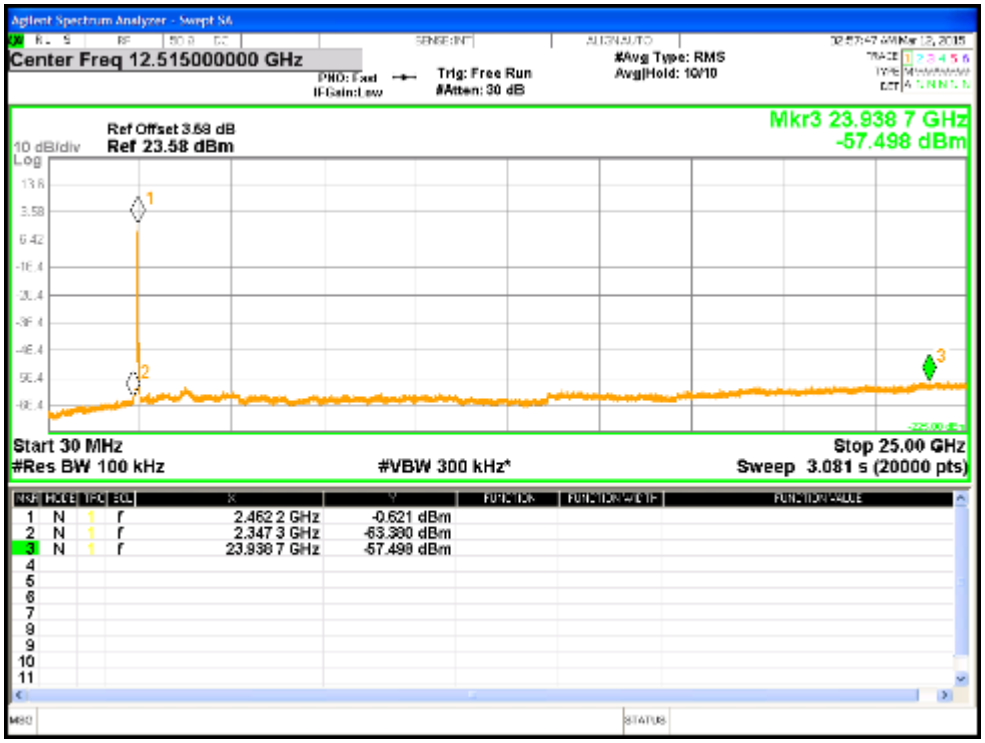


Figure 78: Out of Band Emission for HT20 at 2462MHz, Chain 3

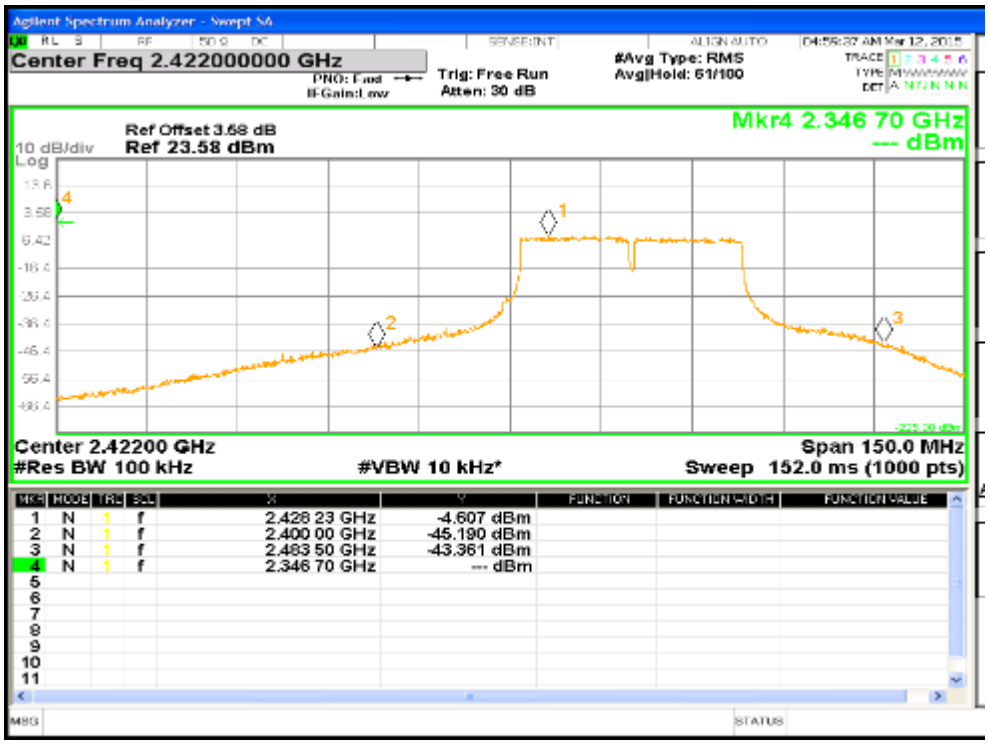


Figure 79: Reference Level for HT40 at2422 MHz, Chain 0

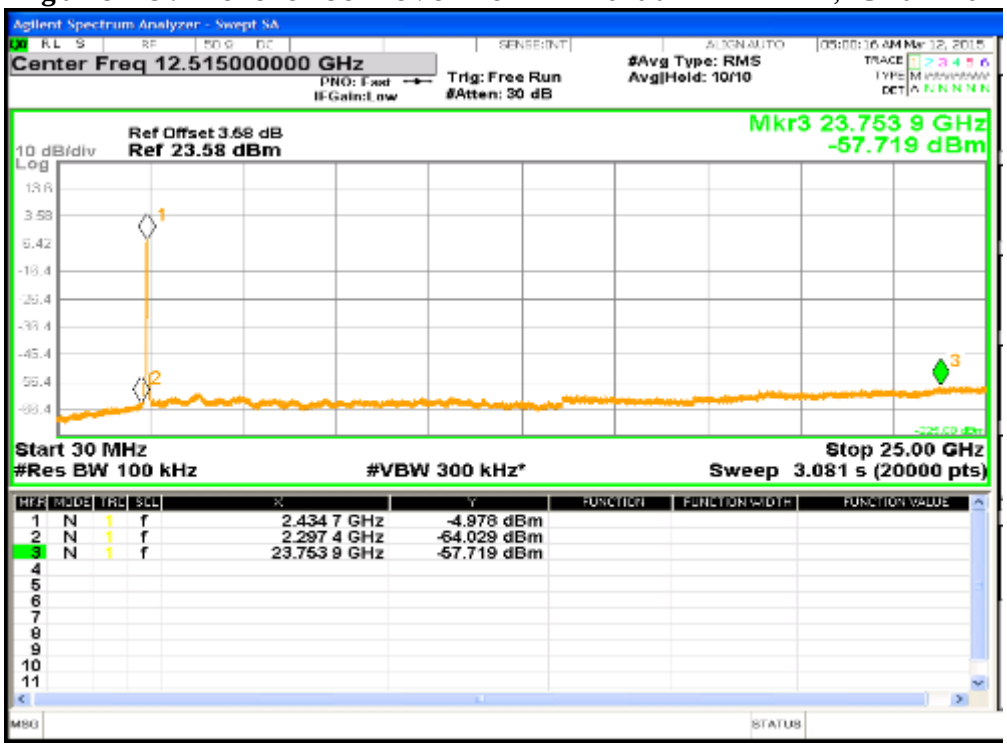


Figure 80: Out of Band Emission for HT40 at 2422MHz, Chain 0

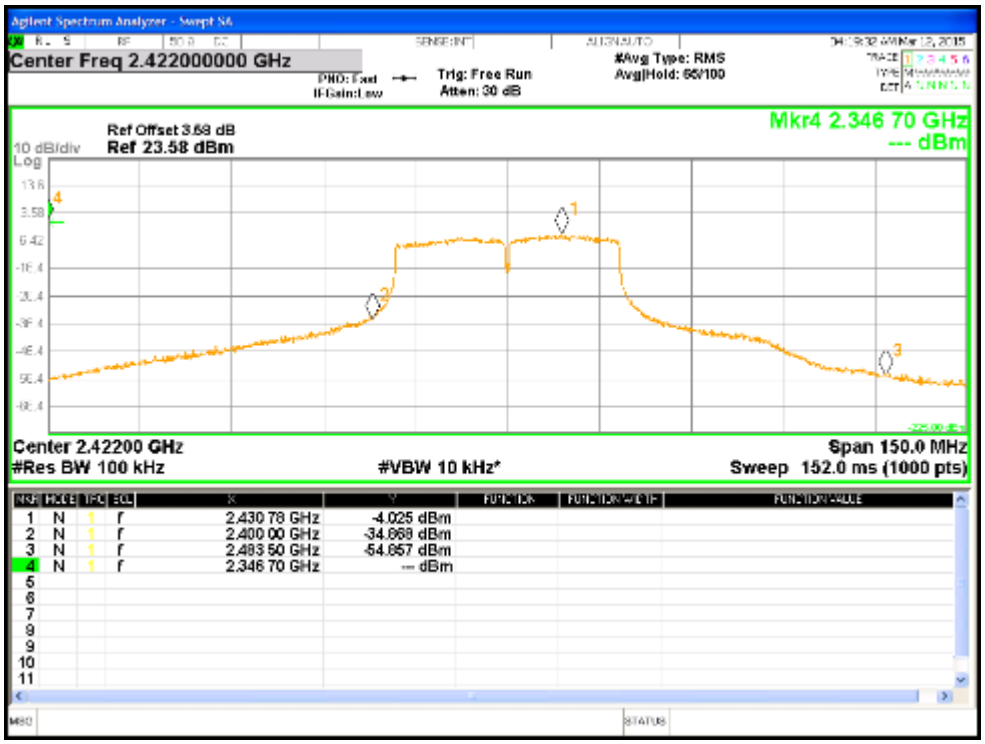


Figure 81: Reference Level for HT40 at2422 MHz, Chain 1

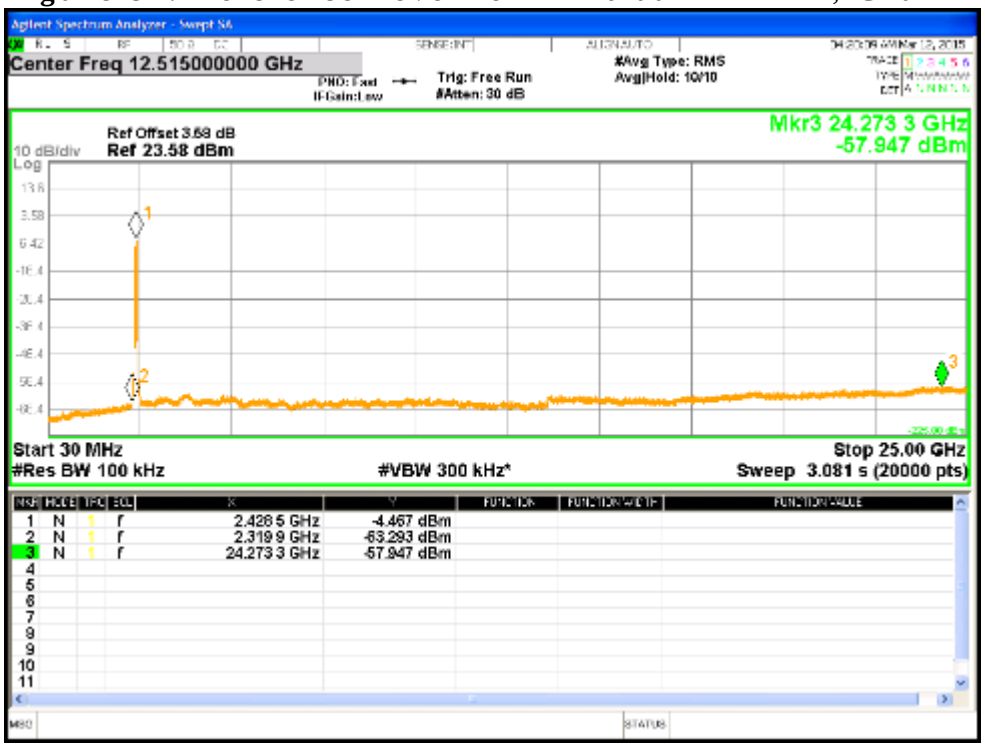


Figure 82: Out of Band Emission for HT40 at 2422MHz, Chain 1

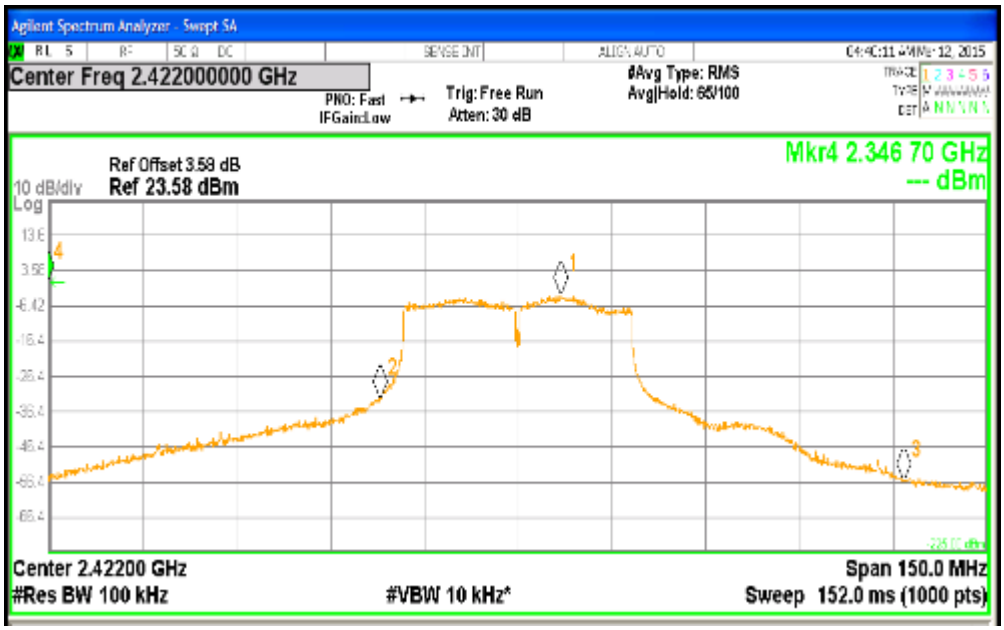


Figure 83: Reference Level for HT40 at2422 MHz, Chain 2

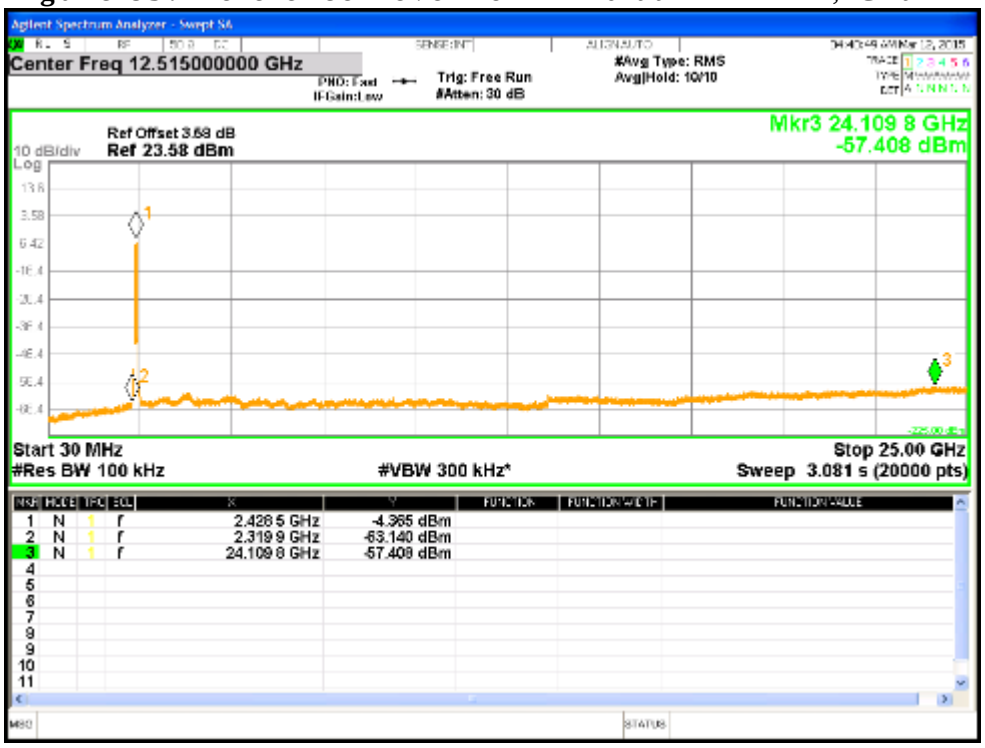


Figure 84: Out of Band Emission for HT40 at 2422MHz, Chain 2

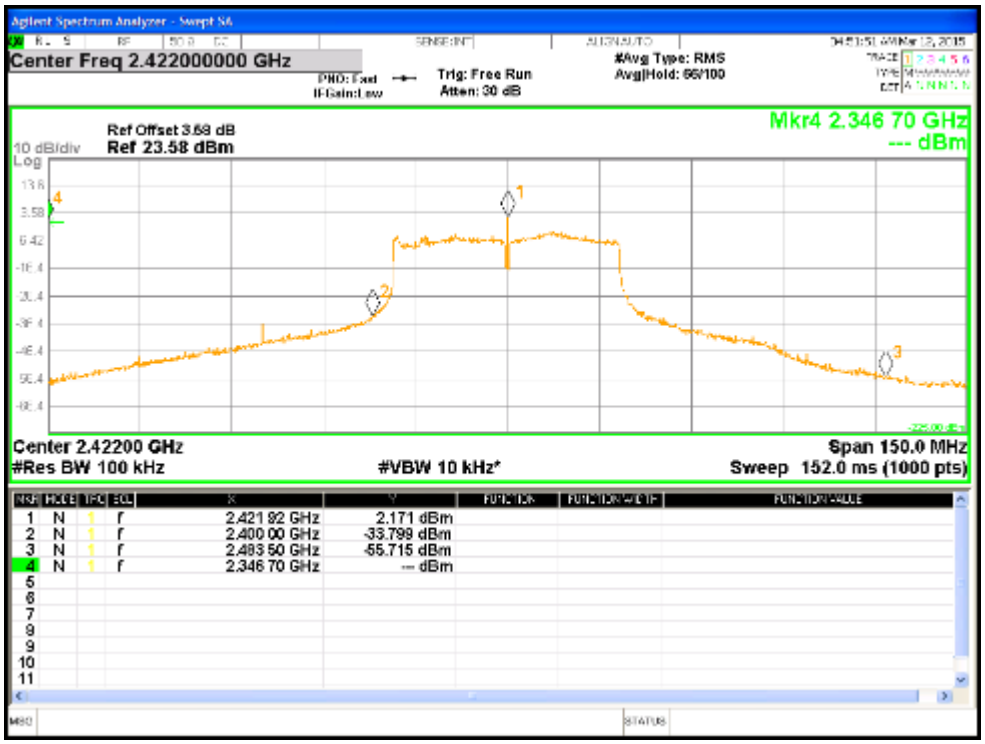


Figure 85: Reference Level for HT40 at2422 MHz, Chain 3

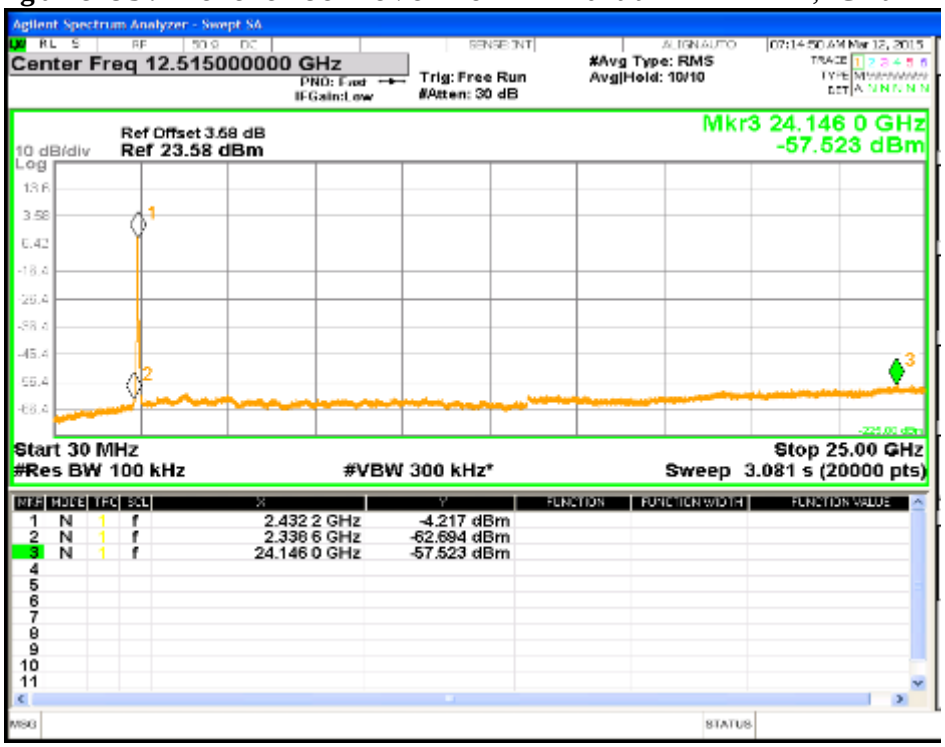


Figure 86: Out of Band Emission for HT40 at 2422MHz, Chain 3

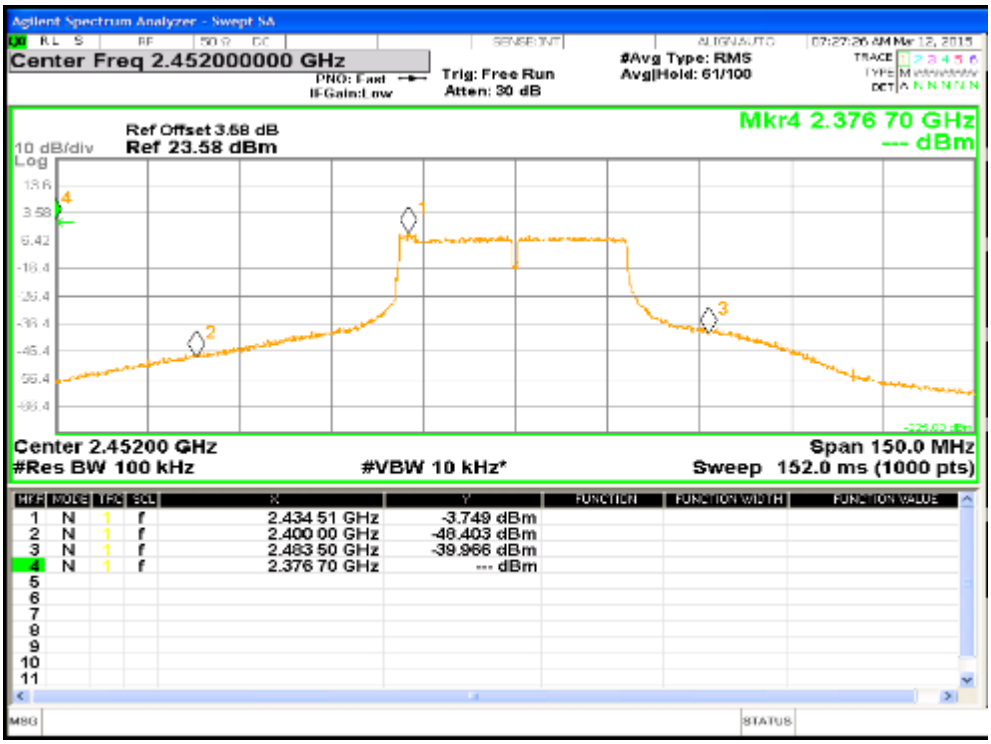


Figure 87: Reference Level for HT40 at2452 MHz, Chain 0

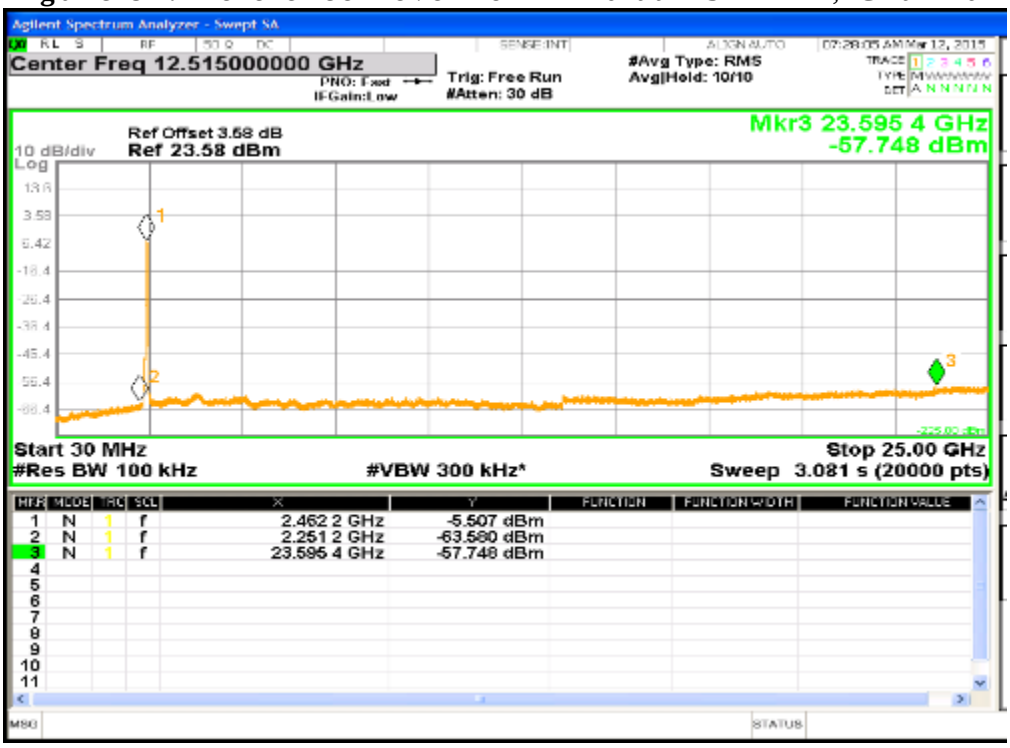


Figure 88: Out of Band Emission for HT40 at 2452MHz, Chain 0

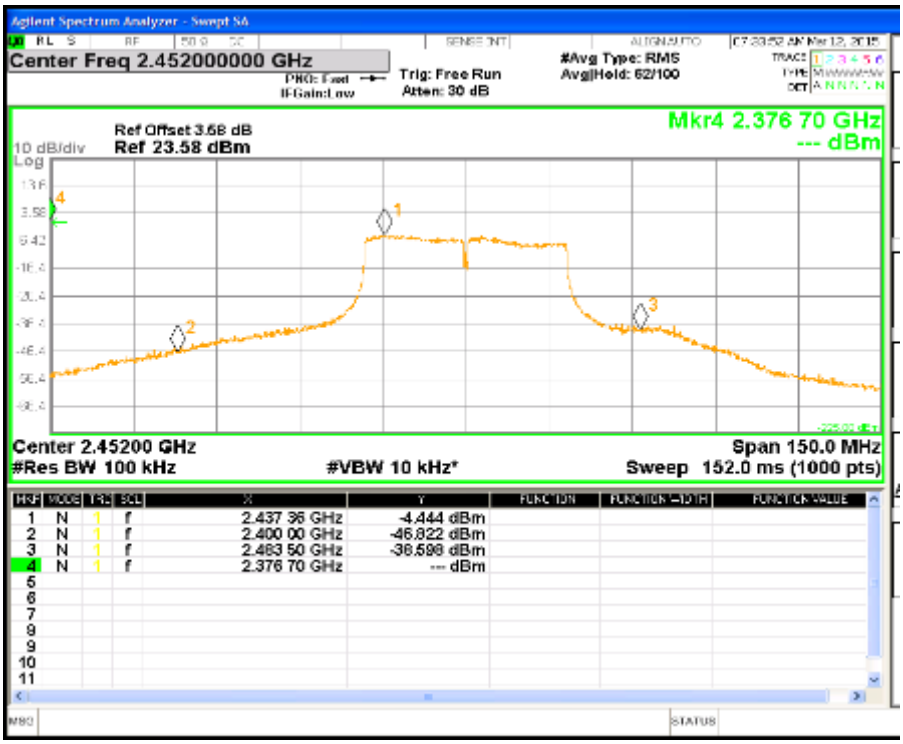


Figure 89: Reference Level for HT40 at2452 MHz, Chain 1

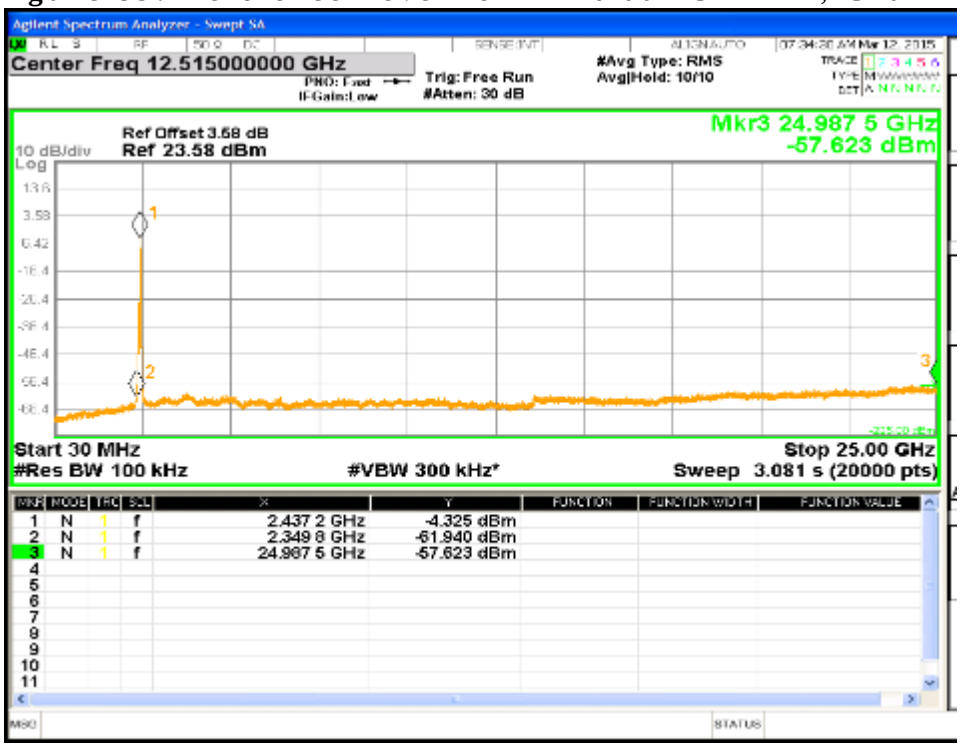


Figure 90: Out of Band Emission for HT40 at 2452MHz, Chain 1

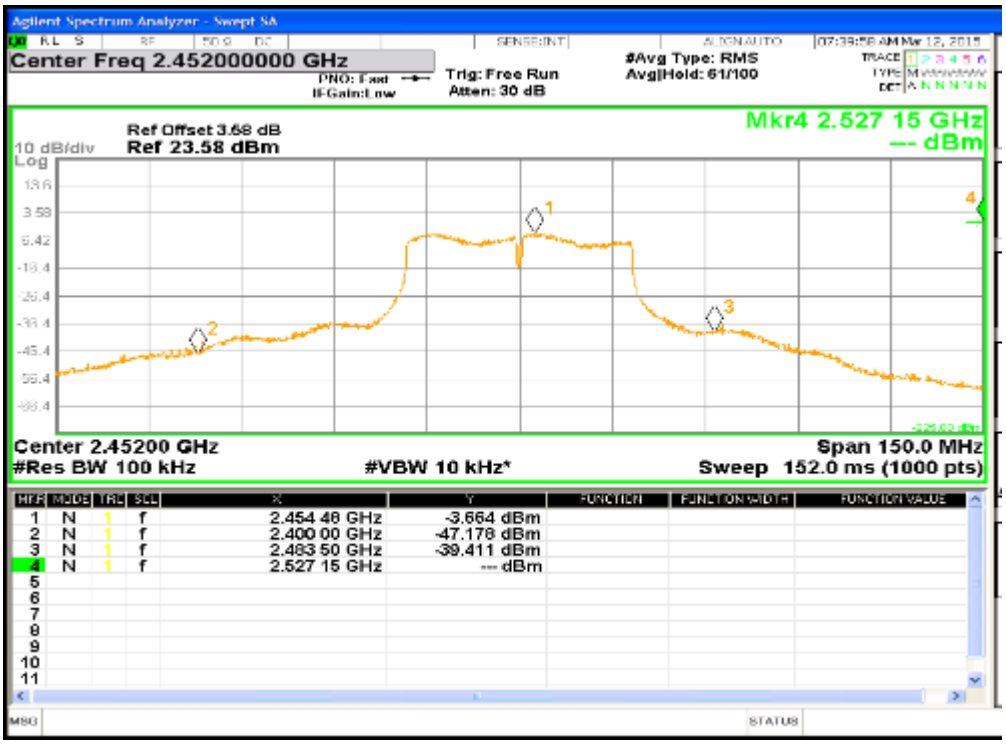


Figure 91: Reference Level for HT40 at2452 MHz, Chain 2

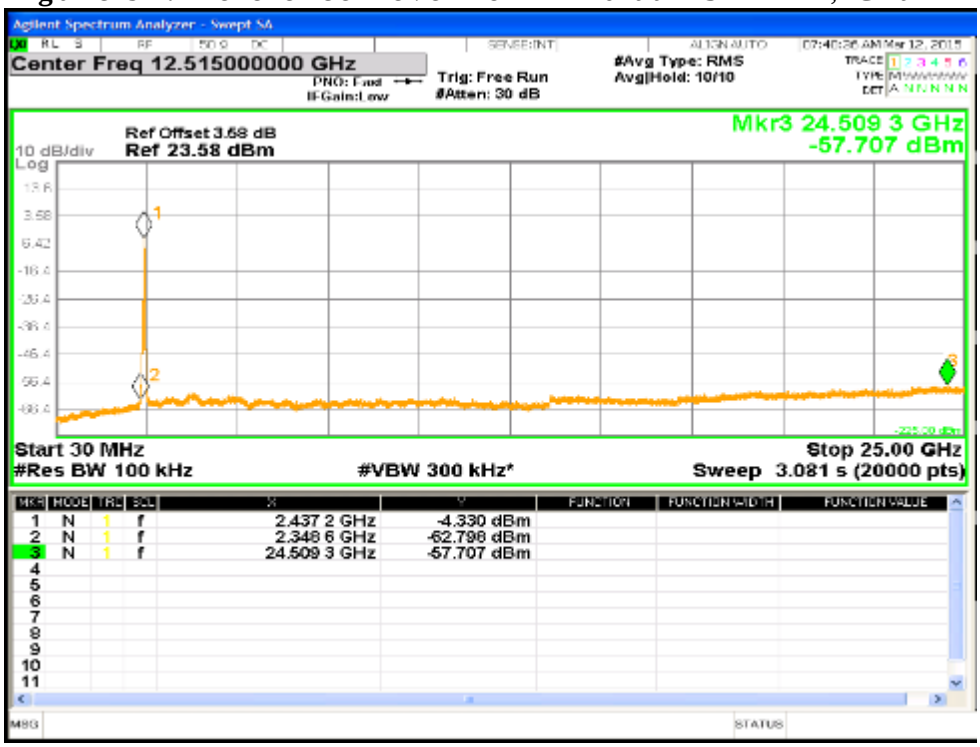


Figure 92: Out of Band Emission for HT40 at 2452MHz, Chain 2

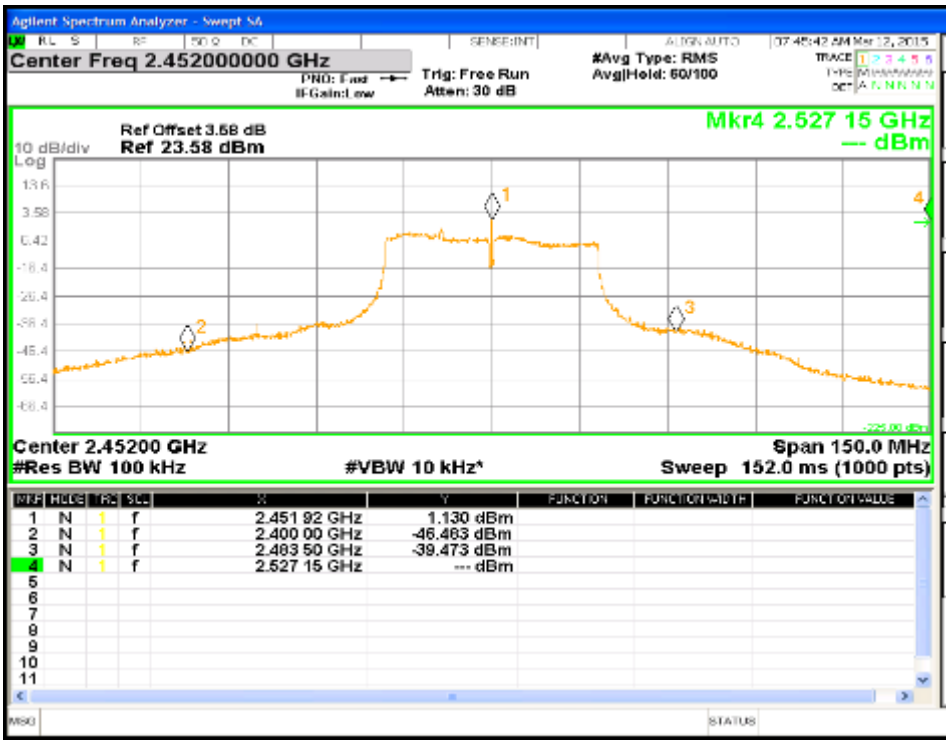


Figure 93: Reference Level for HT40 at2452 MHz, Chain 3

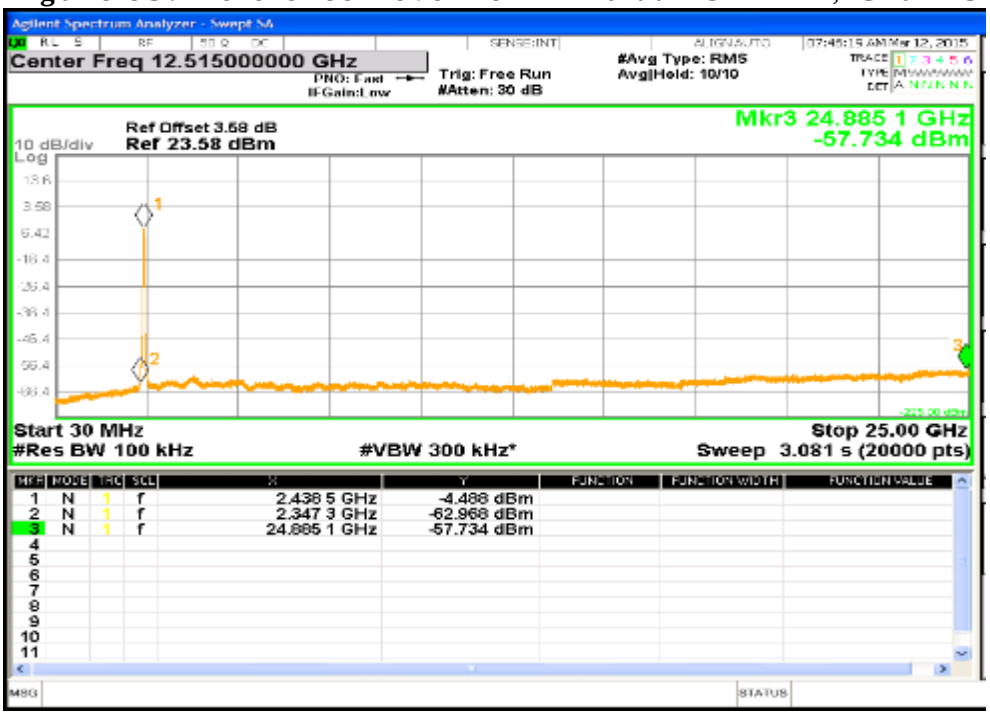


Figure 94: Out of Band Emission for HT40 at 2452MHz, Chain 3

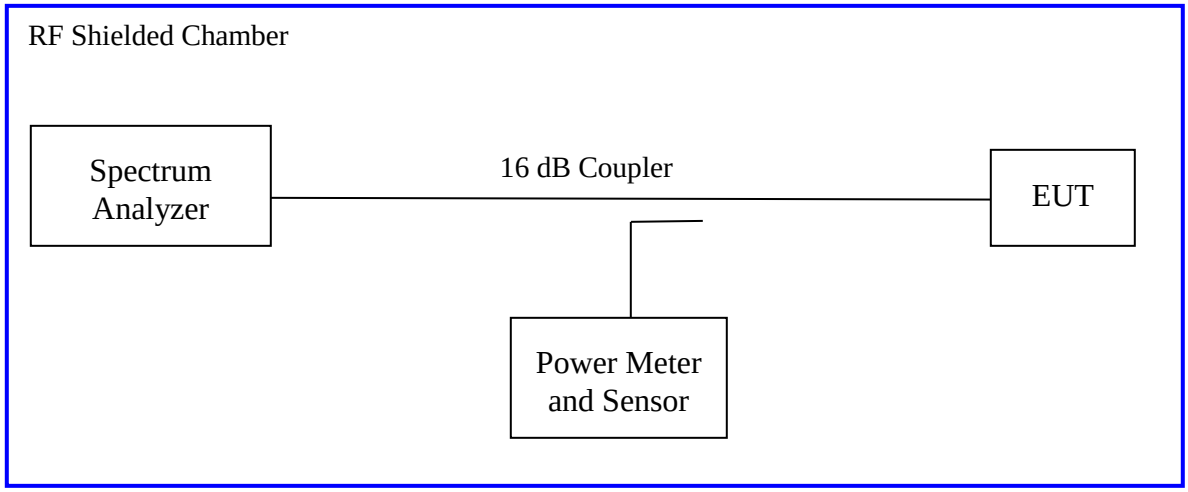
4.4 Peak Power Spectral Density

According to the CFR47 Part 15.247 (e) and RSS 247 Section 5.2 (2), the spectral power density output of the antenna port shall be less than 8dBm in any 3kHz band during any time interval of continuous transmission.

4.4.1 Test Method

The conducted method was used to measure the channel peak power spectral density per ANSI C63.10-2009 Section 6.11.2. The measurement was performed with modulation per CFR47 Part 15.247 (e) and RSS 247 Section 5.2 (2). This test was conducted on 3 channels of Sample, S/N 510. The worst findings were conducted on 3 channels in each operating mode of 2400MHz to 2483.5MHz indicated below.

Test Setup:



Measurement procedure AVGPSD-1 of KDB 558074 D01 DTS Meas. Guidance v03r03 was applied.

4.4.2 Results

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

Table 6: Peak Power Spectral Density – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only							
Antenna Type: Integrated & External				**Power Setting:** See Test plan			
Max. Directional Gain: +11.5 dBi				**Signal State:** Modulated at 100%.			
Ambient Temp.: 23 °C				**Relative Humidity:**32%			
Peak Power Spectral Density							
802.11b Mode							
Freq. (MHz)	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Max. PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
2412	-12.979	-13.053	-13.664	-14.637	-12.979	8.00	-20.979
2437	-13.071	-13.477	-13.109	-13.793	-13.071	8.00	-21.071
2462	-12.969	-13.315	-13.312	-12.963	-12.963	8.00	-20.963
Note: 1. The highest peak output power was observed at 1Mbps per data stream. Highlighted Plots are placed in the report							
802.11g Mode							
Freq. (MHz)	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Max. PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
2412	-3.178	-4.932	-2.858	-7.04	-2.858	8.00	-10.85
2417	-3.797	-6.681	-5.992	-7.993	-3.797	8.00	-11.79
2437	-4.929	-5.532	-4.423	-4.002	-4.002	8.00	-12.00
2457	-3.498	-6.156	-8.685	-6.269	-3.398	8.00	-11.39
2462	-5.525	-6.377	-8.169	-5.176	-5.176	8.00	-13.1
Note: 1. The highest peak output power was observed at 6Mbps per data stream. Highlighted Plots are placed in the report							

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only								
Antenna Type: Integrated & External					**Power Setting:** See Test plan			
Max. Directional Gain: +10.5 dBi					**Signal State:** Modulated at 100%.			
Ambient Temp.: 23 °C					**Relative Humidity:**32%			
Peak Power Spectral Density								
802.11n (HT20) Mode								
Freq. (MHz)	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**CF [dB]**	**Max. PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
2412	-11.63	-12.24	-12.96	-14.54	0.34	-6.35	2.50	-8.35
2437	-11.71	-13.60	-12.94	-14.72	0.34	-6.74	2.50	-9.24
2462	-11.83	-13.12	-13.83	-12.97	0.34	-5.81	2.50	-8.31
Note: 1. The highest peak output power was observed at HT20 6.5 Mbps per data stream. 2. CF = (10*Log(3kHz/100kHz)) + (10*Log(N)) where N is accounted for the number of data streams being used per KDB 662911. 3. The total directional gain would be 11.5dBi; 8.5dBi + 3 dBi (directional gain). Per CFR47 Part 15.247, the limit is reduced for every dBi gain exceeding 6dBi. The limit would be 2.50 dBm. 4. This result is the combined PSD of all channels. Combined plot of measured PSD values is displayed in the following pages								
802.11n (HT40) Mode								
Freq. (MHz)	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**CF [dB]**	**Max. PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
2422	-17.35	-17.77	-18.58	-17.56	0.45	-11.31	2.50	-13.31
2452	-19.84	-19.75	-19.59	-18.75	0.45	-12.98	2.50	-13.48
Note: 1. The highest peak output power was observed at HT40 13.5 Mbps per data stream. 2. CF = (10*Log(3kHz/100kHz)) + (10*Log(N)) where N is accounted for the number of data streams being used per KDB 662911. 3. The total directional gain would be 11.5dBi; 6dBi +10*Log(2). Per CFR47 Part 15.247, the limit is reduced for every dBi gain exceeding 6dBi. The limit would be 2.50dBm.								

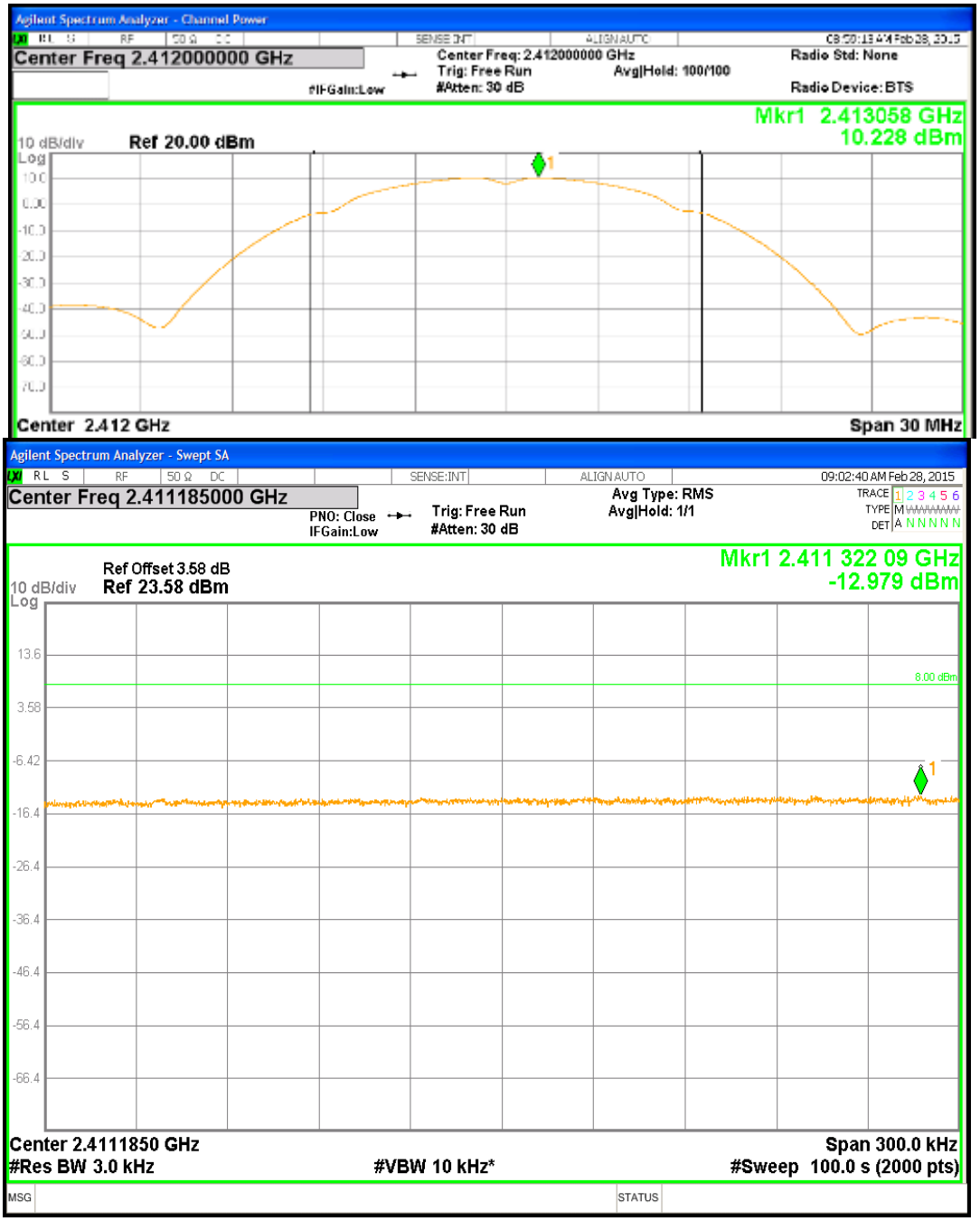


Figure 95: PPSD, 2412MHz at 802.11b, Chain 0 – 1Mbps

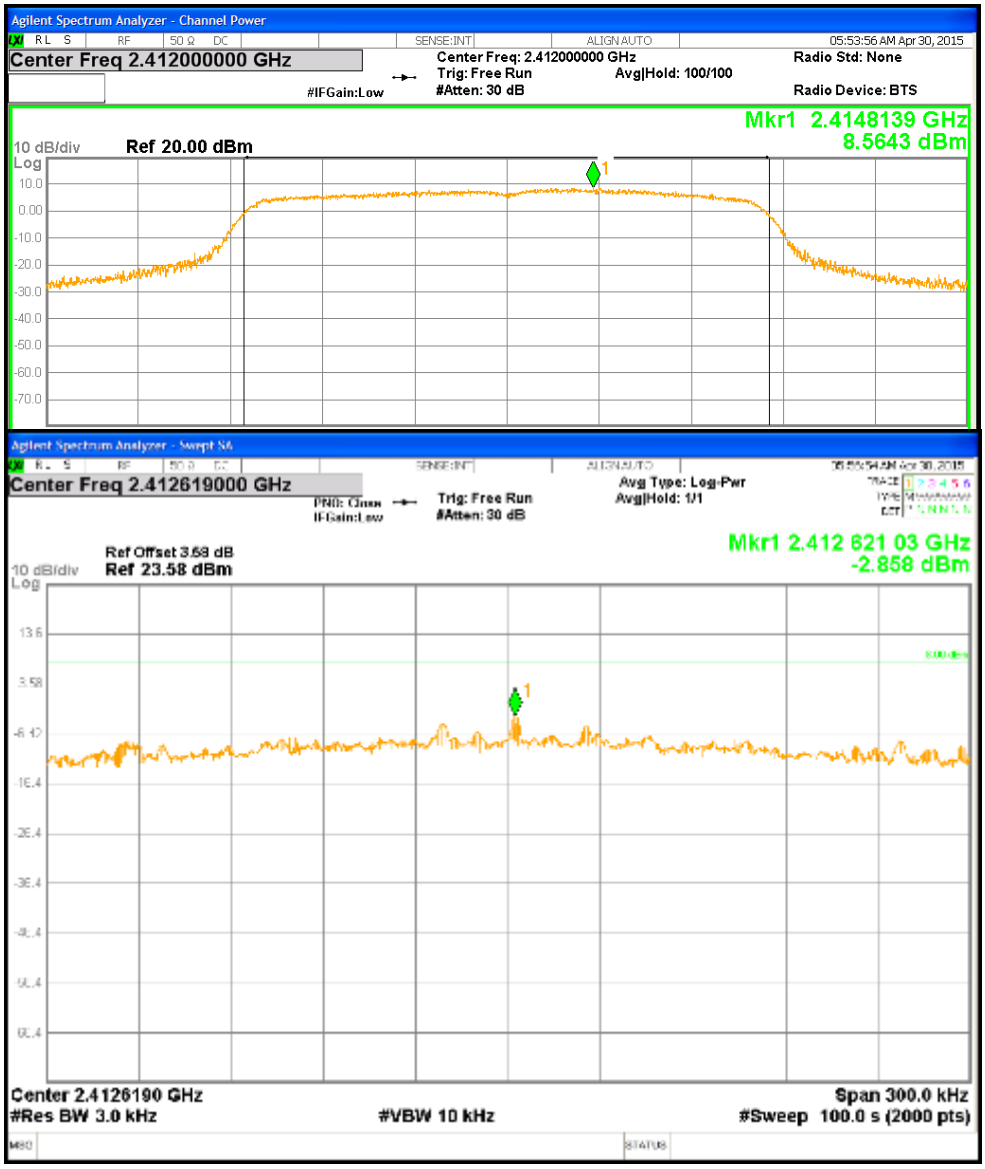


Figure 96: PPSD, MHz at 802.11g,2412 Chain 2 – 6.0 Mbps

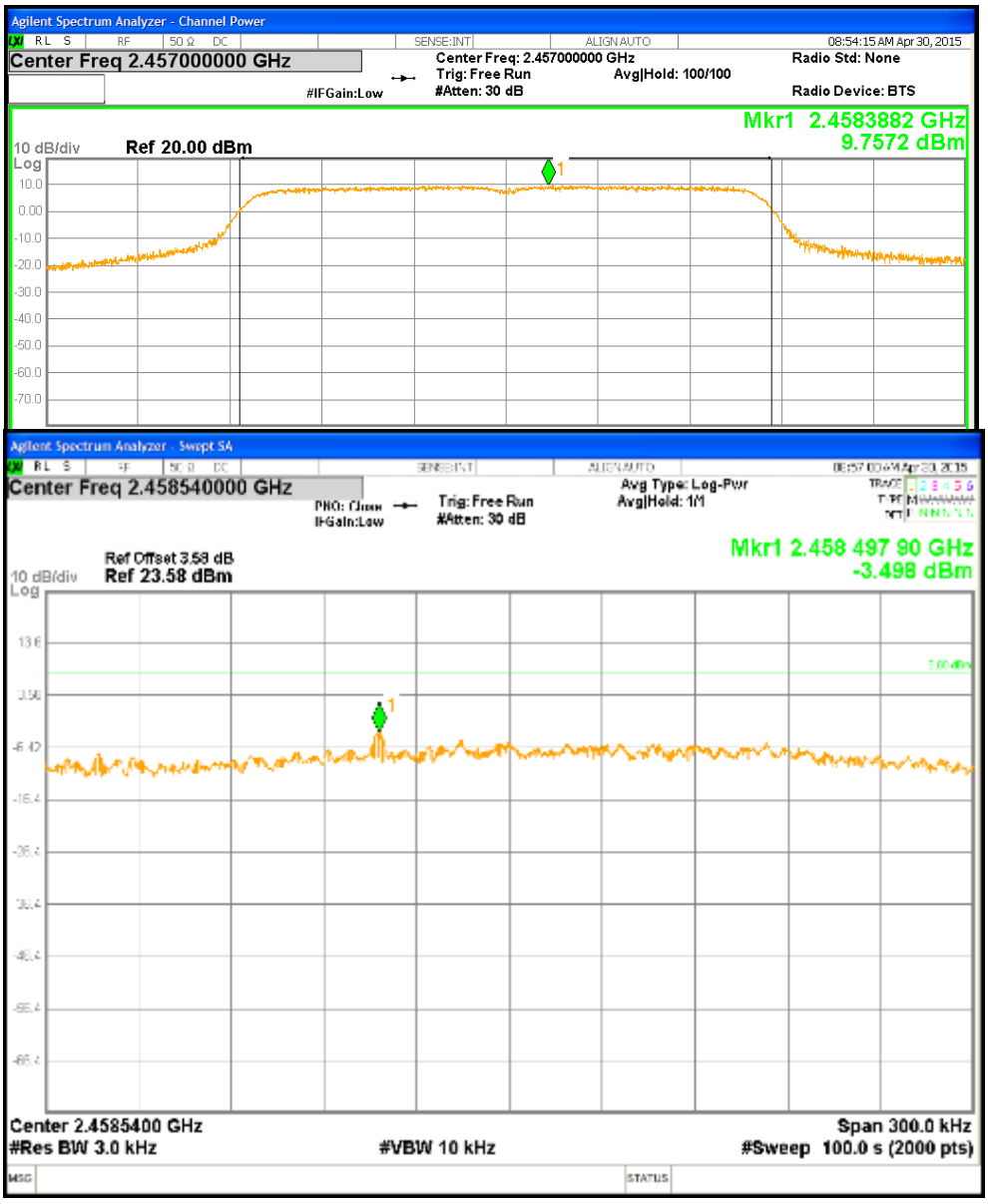


Figure 97: PPSD, 2457MHz at 802.11g mode , Chain 0 – 6 Mbps

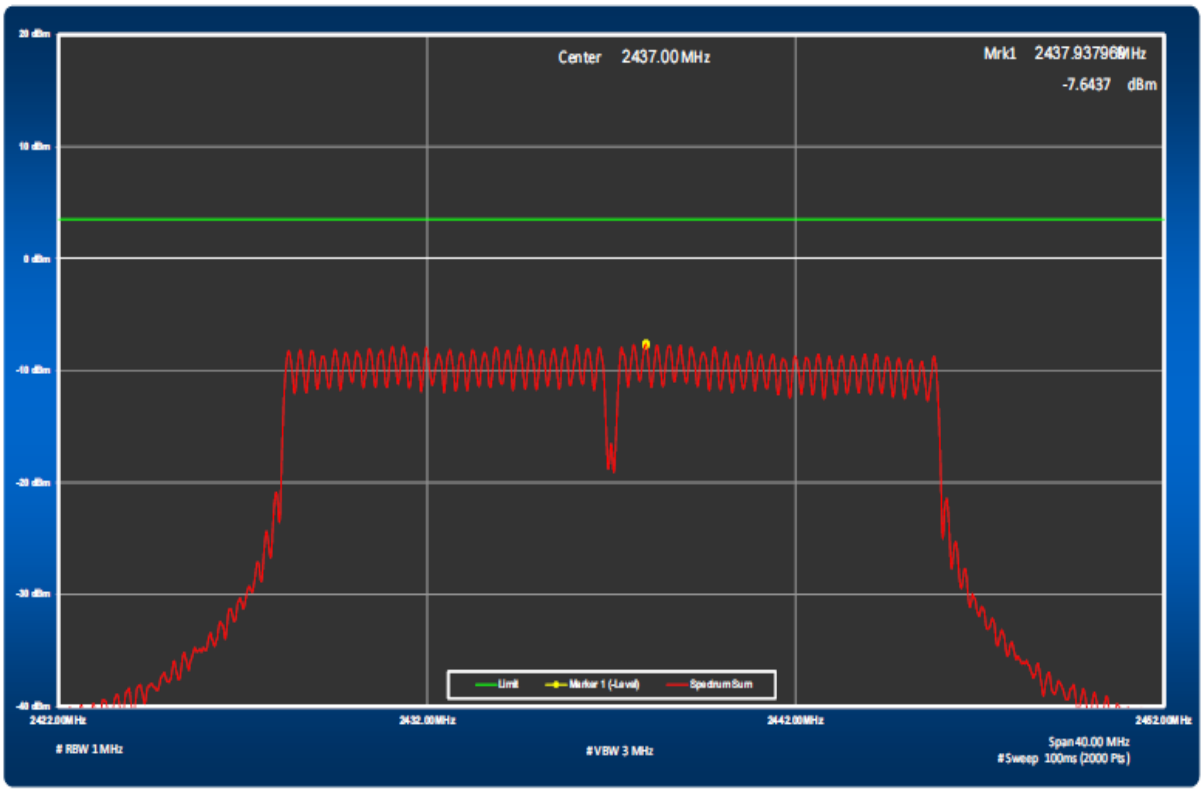


Figure 98: PPSD, 2437MHz at 802.11n HT20, All channels combined – 6.5 Mbps

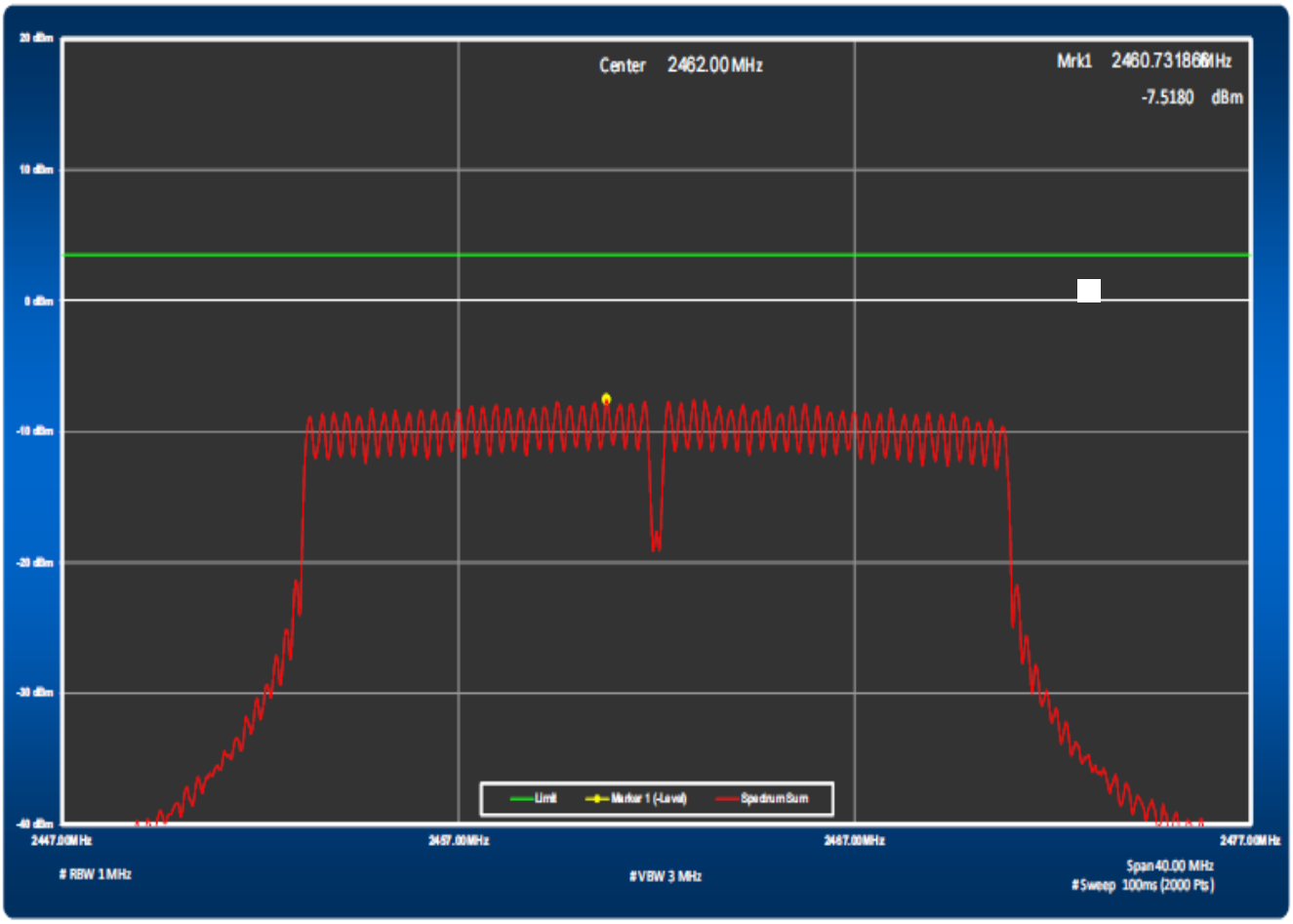


Figure 99: PPSD, 2462MHz at 802.11n HT20, All channels combined – 6.5 Mbps

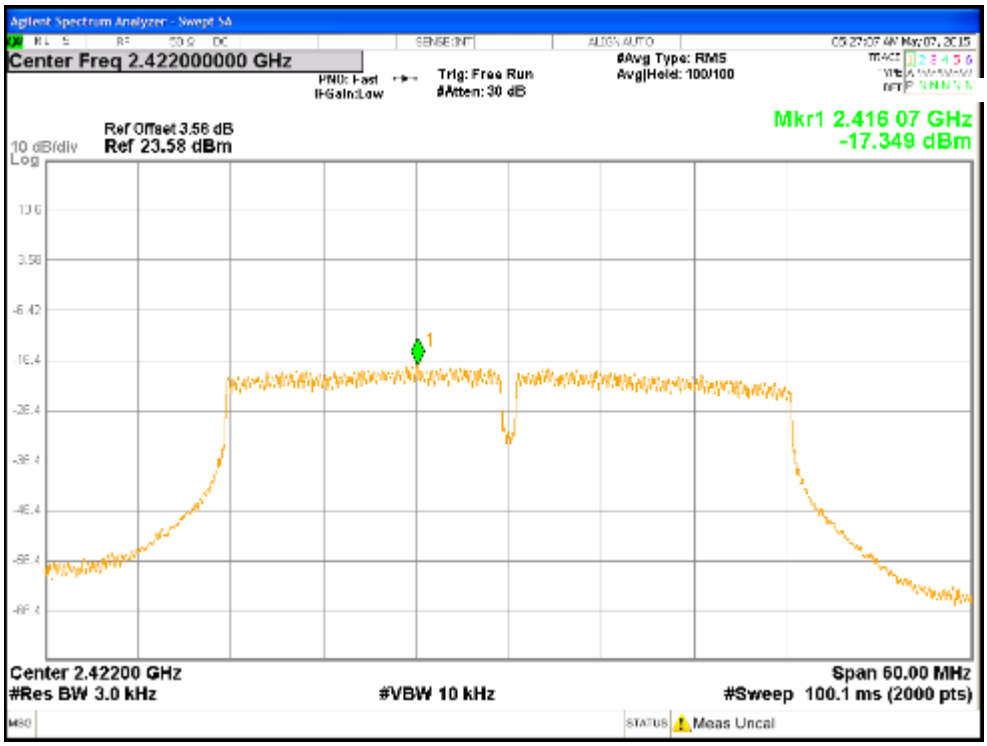


Figure 100: PPSD, 2422MHz at 802.11n HT40, Chain 0 – 13.5 Mbps

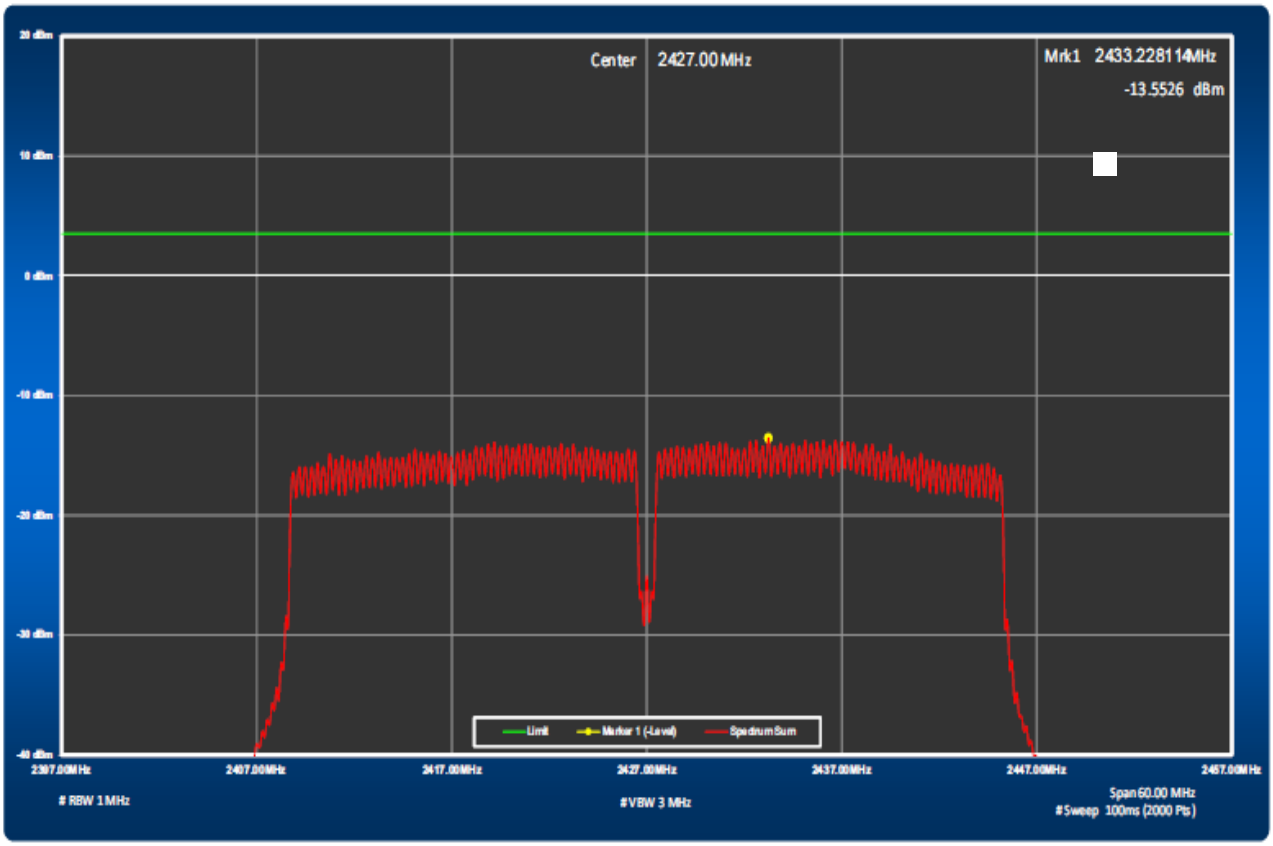


Figure 101: PPSD, 2422MHz at 802.11n HT40, All channels combined – 13.5 Mbps

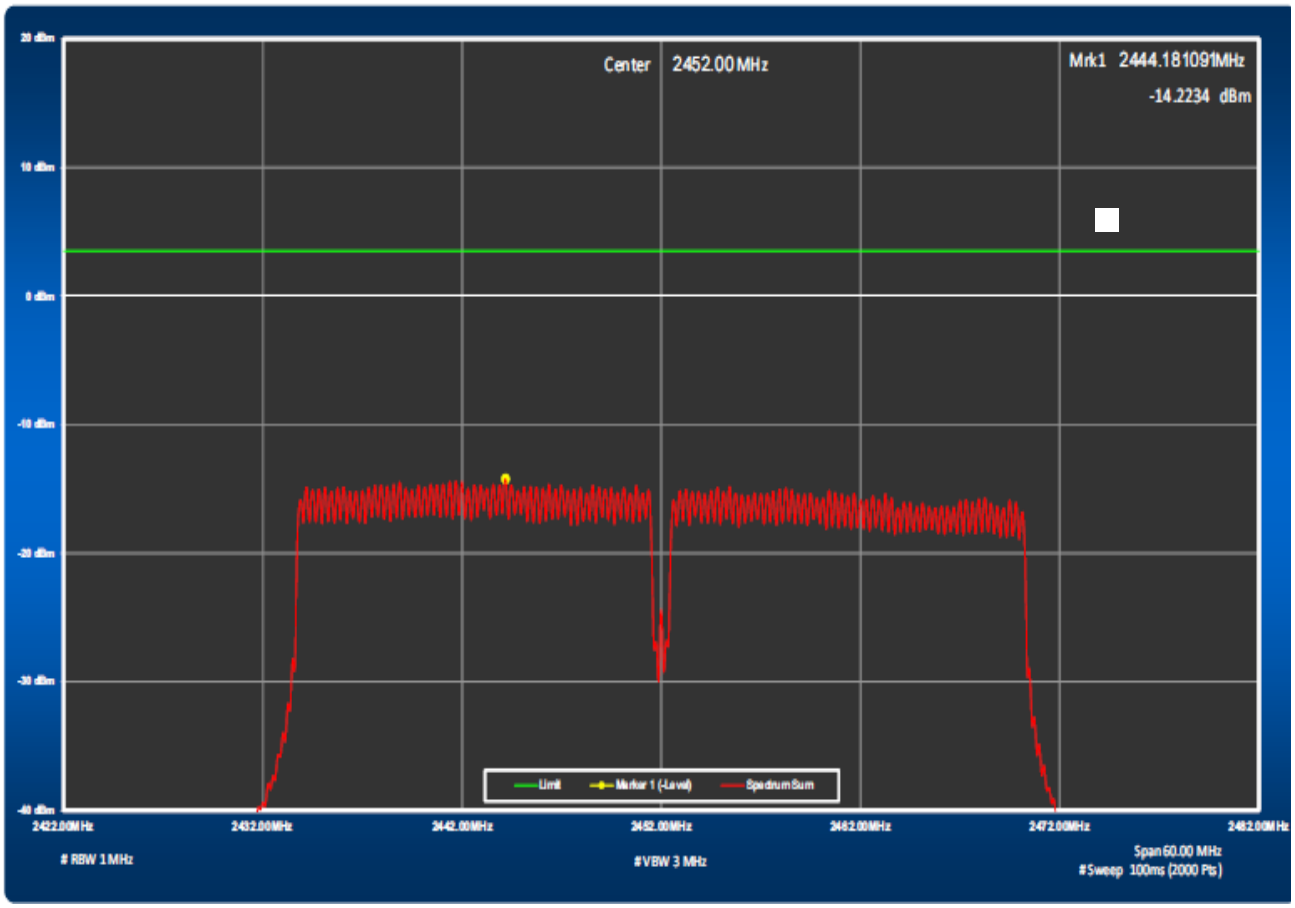


Figure 102: PPSD, 2452MHz at 802.11n HT40, All channels combined – 13.5 Mbps

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 GEN Sect. 8.9

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 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 axis, data rate/ chains.

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 above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

The final scans performed on the worst axis, X-Axis, for three operating channels;

1 Mbit/s for 802.11 b Mode: 2412 MHz, 2437 MHz, 2462 MHz

6.0 Mbit/s for 802.11n g Mode: 2412 MHz, 2437 MHz, 2462 MHz

6.5 Mbit/s for 802.11n HT20 Mode: 2412 MHz, 2437 MHz, 2462 MHz

13.5 Mbit/s for 802.11n HT40 Mode: 2422 MHz, 2437 MHz, 2452MHz

4.5.1.3 Deviations

None.

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: 2009.

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

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 7: Transmit Spurious Emission at Band-Edge Requirements

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only								
Antenna Type: Internal Antennas					**Power Setting:** See test plan			
Max. Directional Gain: + 8.6dBi					**Signal State:** Modulated at 100%.			
Ambient Temp.: 23 °C					**Relative Humidity:**33%			
Band-Edge Results								
Freq. (MHz)	Level (dBuV/m)	Polarity (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2389.89	60.5	V	74	-13.50	Pk	236	94	B mode 1Mbps
2389.89	43.66	V	54	-10.34	Avg	236	94	B mode 1Mbps
2389.69	56.92	H	74	-17.08	Pk	75	227	B mode 1Mbps
2389.69	43.10	H	54	-10.90	Avg	75	227	B mode 1Mbps
2485.00	64.46	V	74	-9.54	Pk	235	205	B mode 1Mbps
2485.00	45.77	V	54	-8.23	Avg	235	205	B mode 1Mbps
2485.00	55.75	H	74	-18.25	Pk	266	218	B mode 1Mbps
2485.00	42.92	H	54	-11.08	Avg	266	218	B mode 1Mbps
2390. 00	68.64	V	74	-5.36	Pk	62	239	PS15.5 g mode TX 2412
2390. 00	51.04	V	54	-2.96	Avg	62	239	PS15.5 g mode TX 2412
2390. 00	61.18	H	74	-12.82	Pk	231	223	PS15.5 g mode TX 2412
2390. 00	43.41	H	54	-10.59	Avg	231	223	PS15.5 g mode TX 2412
2390.00	53.47	V	54	-0.53	Avg	146	189	PS17.5 g mode TX 2417
2389.90	71.15	V	74	-2.85	Pk	146	189	PS17.5 g mode TX 2417
2390.00	69.93	V	74	-4.07	Pk	146	189	PS18 g mode TX 2422
2390.00	50.36	V	54	-3.64	Avg	146	189	PS 18 g mode TX 2422
2483.80	73.49	V	74	-0.51	Pk	238	218	PS15.5 g mode TX 2462
2483.80	53.70	V	54	-0.30	Avg	238	216	PS15.5 g mode TX 2462
2483.60	47.19	V	54	-6.81	Avg	241	241	PS 17.5 g mode TX 2457
2485.40	68.35	V	74	-5.65	Pk	241	241	PS 17.5 g mode TX 2457
2483.60	47.62	V	54	-6.38	Avg	55	213	PS 18 g mode TX 2552
2483.801	65.08	V	74	-8.92	Pk	55	213	PS 18 g mode TX 2552
Note: 1. Band-edge frequencies were taken at 2390 MHz and 2483.5MHz both are restricted band edges. For g mode 6Mbps was used 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205 and 15.209 Antenna Vertical was worst case								

Band-Edge Results								
Freq. (MHz)	Level (dBuV/m)	Polarity (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2389.29	71.11	V	74	-2.88	Pk	269	245	PS 15.5 HT20 TX 2412
2389.09	51.91	V	54	-2.08	Avg	269	245	PS 15.5 HT20 TX 2412
2485.2	72.85	V	74	-1.15	Pk	325	244	PS 15.5 HT20 TX 2462
2485.2	49.18	V	54	-4.82	Avg	325	244	PS 15.5 HT20 TX 2462
2484.00	70.17	H	74	-3.8	Pk	60	232	PS 18 HT20 TX on 2462
2484.00	48.92	H	54	-5.01	Avg	60	232	PS 18 HT20 TX on 2462
2386.693	73.75	V	74	-0.25	Pk	240	235	PS 17.0 HT 20 TX 2417
2387.695	53.64	V	54	-0.36	Avg	240	235	PS 17.0 HT 20 TX 2417
2390.00	69.36	V	74	-4.64	Pk	228	159	PS 18.0 HT20 TX 2422
2390.00	48.62	V	54	-5.38	Avg	228	159	PS 18.0 HT20 TX 2422
2483.801	68.74	V	74	-5.26	PK	238	207	PS 18 HT20 TX 2452
2483.801	50.25	V	54	-3.75	Avg	238	207	PS 18 HT20 TX 2452

Note: 1. Band-edge frequencies were taken at 2390 MHz and 2483.5MHz both are restricted band edges.

2. All the band-edge measurements met the restricted band requirements of CFR47 15.205 and 15.209. Antenna Vertical was worst case

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only								
Antenna Type: Internal Antennas					**Power Setting:** See test plan			
Max. Directional Gain: + 8.6dBi					**Signal State:** Modulated at 100%.			
Ambient Temp.: 23 °C					**Relative Humidity:**33%			
Band-Edge Results								
Freq. (MHz)	Level (dBuV/m)	Polarity (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2390.00	69.98	V	74	-4.02	Pk	236	227	HT40 PS12 TX on 2422
2390.00	53.69	V	54	-0.31	Avg	236	227	HT40 PS12 TX on 2422
2489.36	72.15	V	74	-1.85	Pk	251	246	HT 40PS14.5 TX on2452
2484.25	47.84	V	54	-6.16	Avg	251	246	HT 40PS14.5 TX on 2452
2384.29	68.82	V	74	-5.18	Pk	46	201	HT40 PS15.0 TX 2427
2383.69	52.40	V	54	-1.60	Avg	46	201	HT40 PS15.0 TX 2427
2382.48	66.98	V	74	-7.02	Pk	236	211	HT40 PS15.0 TX 2432
2382.48	49.69	V	54	-4.31	Avg	236	211	HT40 PS15.0 TX 2432

Note: 1. Band-edge frequencies were taken at 2390 MHz and 2483.5MHz both are restricted band edges.
2. All the band-edge measurements met the restricted band requirements of CFR47 15.205 and 15.209.
3. HT40 band edge measurements were made at 13.5Mbps Antenna Vertical was worst case

Band Edge measurements with External Antennas

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only								
Antenna Type: External Antennas					**Power Setting:** See test plan			
Max. Directional Gain: + 11.5dBi					**Signal State:** Modulated at 100%.			
Ambient Temp.: 23 °C					**Relative Humidity:**33%			
Band-Edge Results								
Freq. (MHz)	Level (dBuV/m)	Polarity (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2389.30	61.22	V	74	-12.78	Pk	343	103	B mode 1Mbps
2390.10	48.42	V	54	-5.58	Avg	343	103	B mode 1Mbps
2390.10	57.48	H	74	-16.52	Pk	54	126	B mode 1Mbps
2390.10	45.24	H	54	-8.76	Avg	54	126	B mode 1Mbps
2484.00	58.83	H	74	-15.17	Pk	293	179	B mode 1Mbps
2484.00	45.20	H	54	-8.80	Avg	293	179	B mode 1Mbps
2486.81	66.17	V	74	-7.83	Pk	85	132	B mode 1Mbps
2486.81	46.69	V	54	-7.31	Avg	85	132	B mode 1Mbps
2390.00	71.04	V	74	-2.96	Pk	-22	193	PS13.5 g mode TX 2412
2390.00	51.40	V	54	-2.60	Avg	-22	193	PS13.5 g mode TX 2412
2484.20	68.60	V	74	-5.40	Pk	224	133	PS14 g mode TX 2462
2484.20	48.11	V	54	-5.89	Avg	224	133	PS14 g mode TX 2462
2389.50	73.59	V	74	-0.41	Pk	215	166	PS17 g mode TX 2417
2389.50	52.13	V	54	-1.87	Avg	215	166	PS17 g mode TX 2417
2388.90	73.54	V	74	-0.46	Pk	194	224	PS18 g mode TX 2422
2389.50	52.94	V	54	-1.06	Avg	194	224	PS 18 g mode TX 2422
2485.40	72.57	V	74	-1.43	PK	181	142	PS 17 g mode TX 2457
2483.80	52.64	V	54	-1.36	Avg	181	142	PS 17 g mode TX 2457
2485.00	72.93	V	74	-1.07	Pk	178	120	PS 18 g mode TX 2552
2484.00	49.84	V	54	-4.19	Avg	178	120	PS 18 g mode TX 2552
Note: 1. Band-edge frequencies were taken at 2390 MHz and 2483.5MHz both are restricted band edges. For g mode 6Mbps was used 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205 and 15.209 3. Vertical polarization of receiving antenna was the worst case.								

Band-Edge Results								
Freq. (MHz)	Level (dBuV/m)	Polarity (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2389.75	72.21	V	74	-1.79	Pk	196	161	PS 15.5 HT20 TX 2412
2390.00	53.89	V	54	-0.11	Avg	196	161	PS 15.5 HT20 TX 2412
2483.65	72.90	V	74	-1.10	Pk	196	165	PS 16 HT20 TX 2462
2483.65	53.92	V	54	-0.08	Avg	196	165	PS 16 HT20 TX 2462
2388.25	72.98	V	74	-1.02	Pk	200	101	PS 16.5 HT20 TX on 2417
2388.25	50.28	V	54	-3.72	Avg	200	101	PS 16.5 HT20 TX on 2417
2387.44	73.01	V	74	-0.99	Pk	190	100	PS 18.0 HT 20 TX 2422
2389.85	53.46	V	54	-0.54	Avg	190	100	PS 18.0 HT 20 TX 2422
2483.65	67.98	V	74	-6.02	PK	208	115	PS 17.5 HT20 TX 2457
2483.65	51.36	V	54	-2.64	Avg	208	115	PS 17.5 HT20 TX 2457
2483.65	70.70	V	74	-3.30	Pk	184	122	PS 18 HT20 TX 2452
2483.65	51.59	V	54	-2.41	Avg	184	122	PS 18 HT20 TX 2452

Note: 1. Band-edge frequencies were taken at 2390 MHz and 2483.5MHz both are restricted band edges.

2. All the band-edge measurements met the restricted band requirements of CFR47 15.205 and 15.209 Antenna Vertical was worst case.

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only								
Antenna Type: External				**Power Setting:** See test plan				
Max. Directional Gain: + 11.5dBi				**Signal State:** Modulated at 100%.				
Ambient Temp.: 23 °C				**Relative Humidity:**33%				
Band-Edge Results								
Freq. (MHz)	Level (dBuV/m)	Polarity (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2389.85	70.97	V	74	-3.03	Pk	212	215	HT40 PS11.5 TX on 2422
2384.99	53.35	V	54	-0.65	Avg	212	215	HT40 PS11.5 TX on 2422
2487.26	73.13	V	74	-0.87	Pk	178	166	HT 40PS14.5 TX on2452
2487.26	50.86	V	54	-3.14	Avg	178	166	HT 40PS14.5 TX on 2452
2484.25	70.74	V	74	-3.26	Pk	188	184	HT40 PS15.0 TX 2427
2483.95	50.57	V	54	-3.43	Avg	188	184	HT40 PS15.0 TX 2427
2380.43	69.66	V	74	-4.34	Pk	196	161	HT40 PS16.0 TX 2437
2380.43	53.72	V	54	-0.28	Avg	196	161	HT40 PS16.0 TX 2437
Note: 1. Band-edge frequencies were taken at 2390 MHz and 2483.5MHz both are restricted band edges. 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205 and 15.209. 3. HT40 band edge measurements were made at 13.5Mbps Antenna Vertical was worst case								

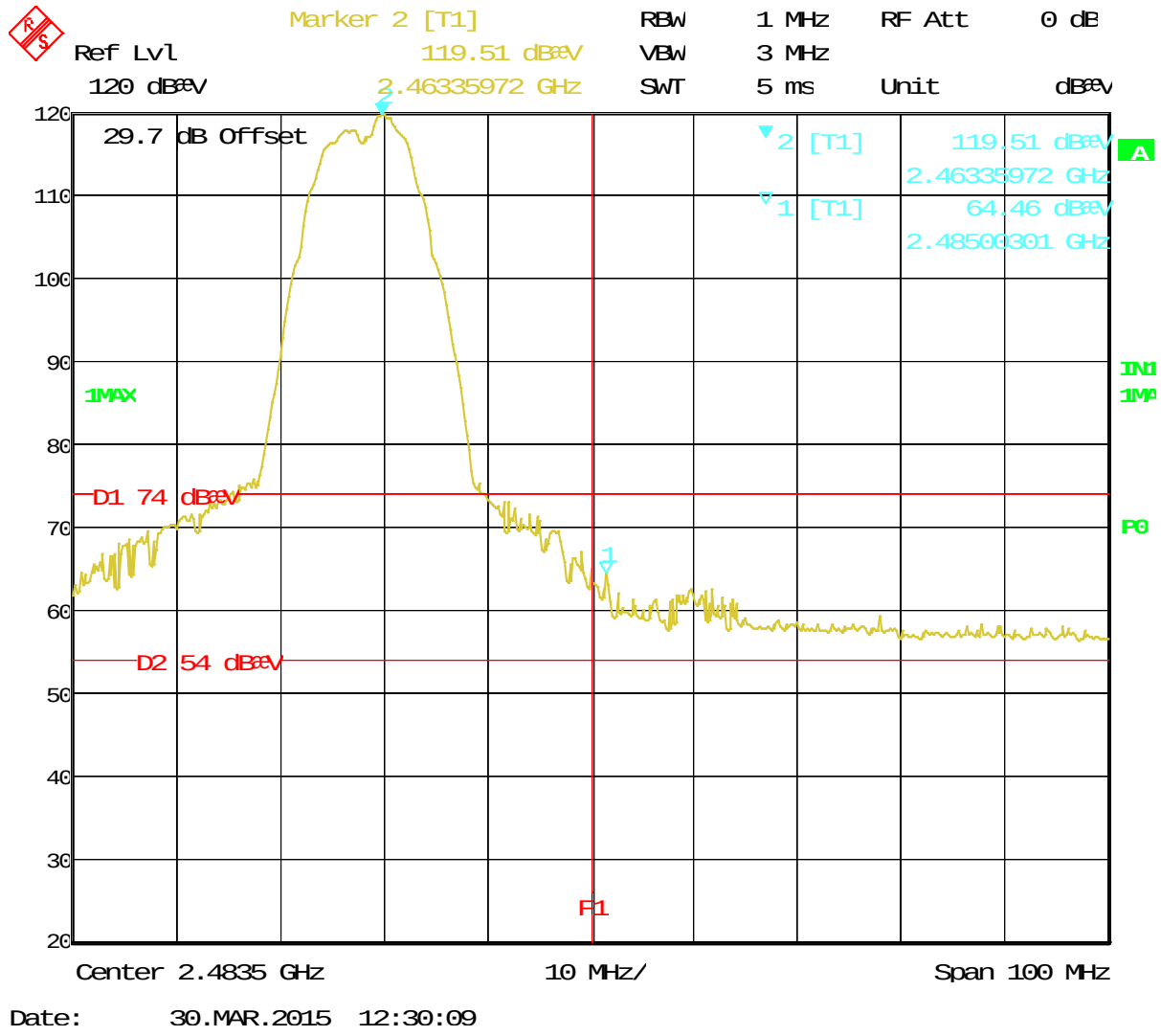


Figure 103: Radiated Emission at the Edge for 2412MHz b mode – Vert. (PK)

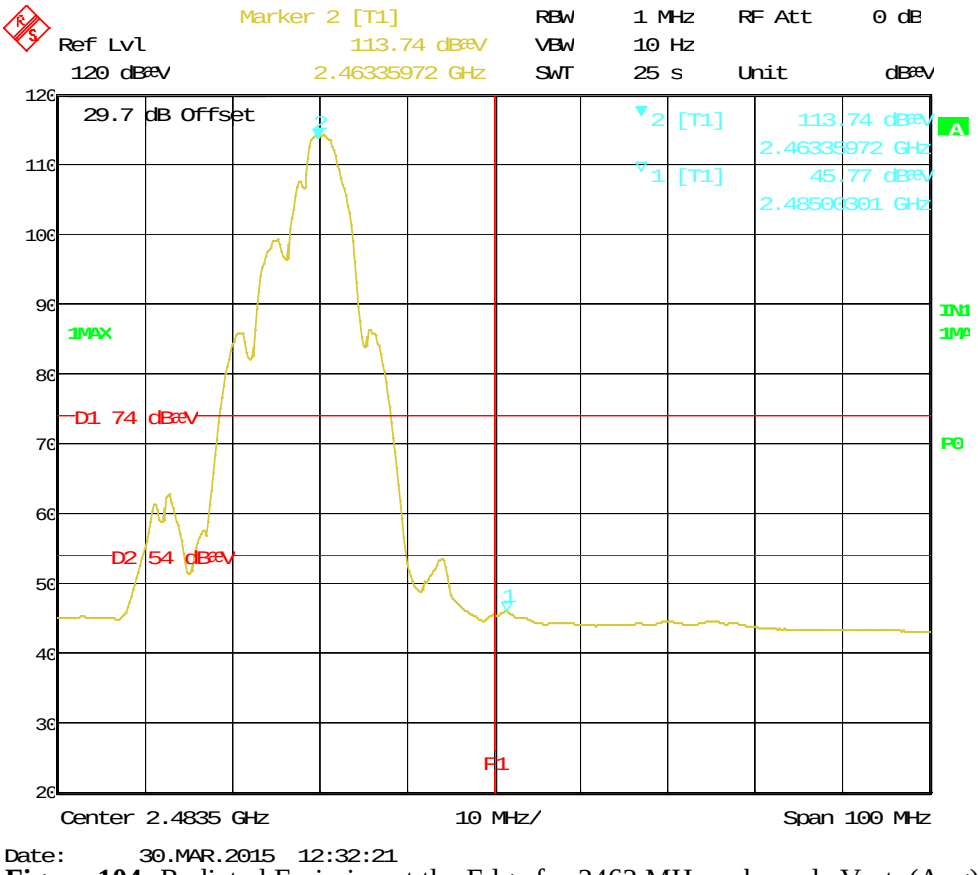


Figure 104: Radiated Emission at the Edge for 2462 MHz – b mode Vert. (Avg)

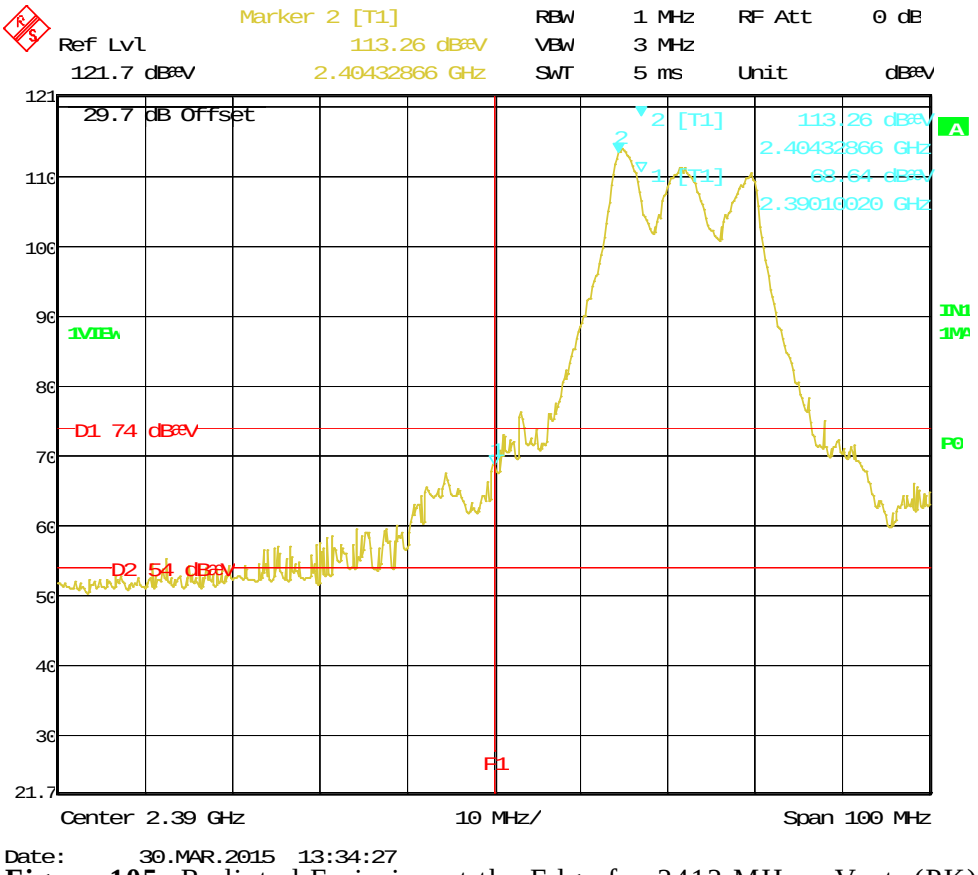


Figure 105: Radiated Emission at the Edge for 2412 MHz – Vert. (PK)

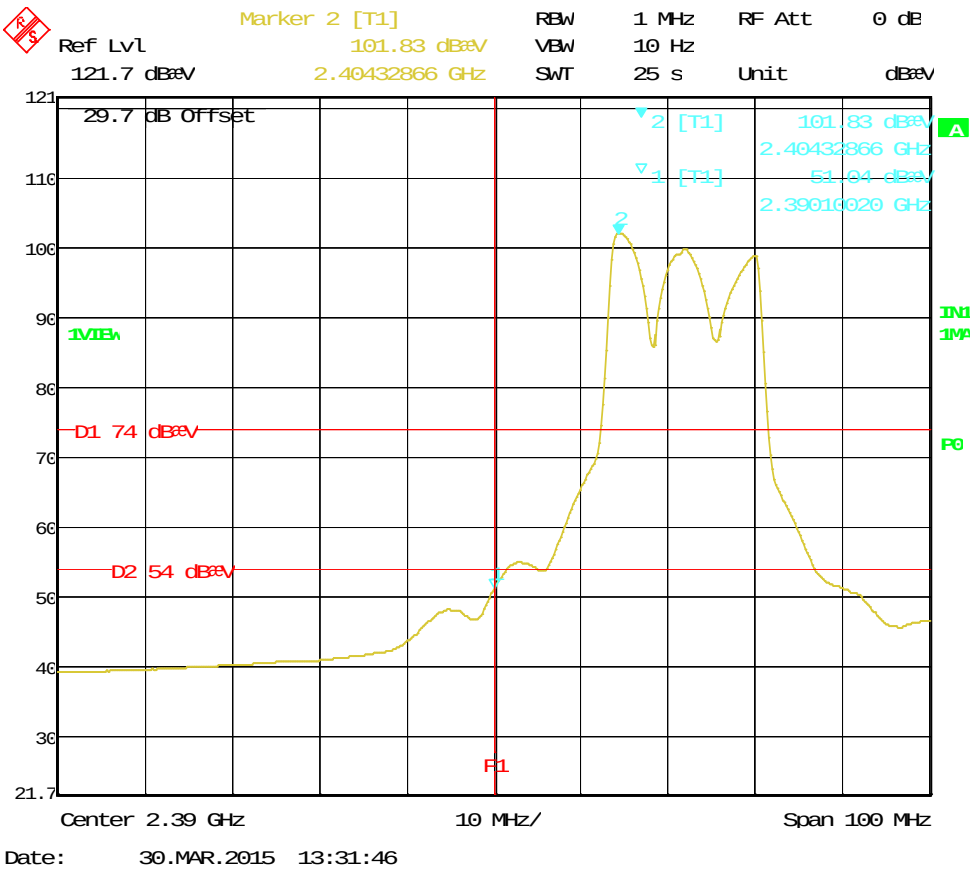


Figure 106: Radiated Emission at the Edge for 2412 MHz – Vert. (Avg)

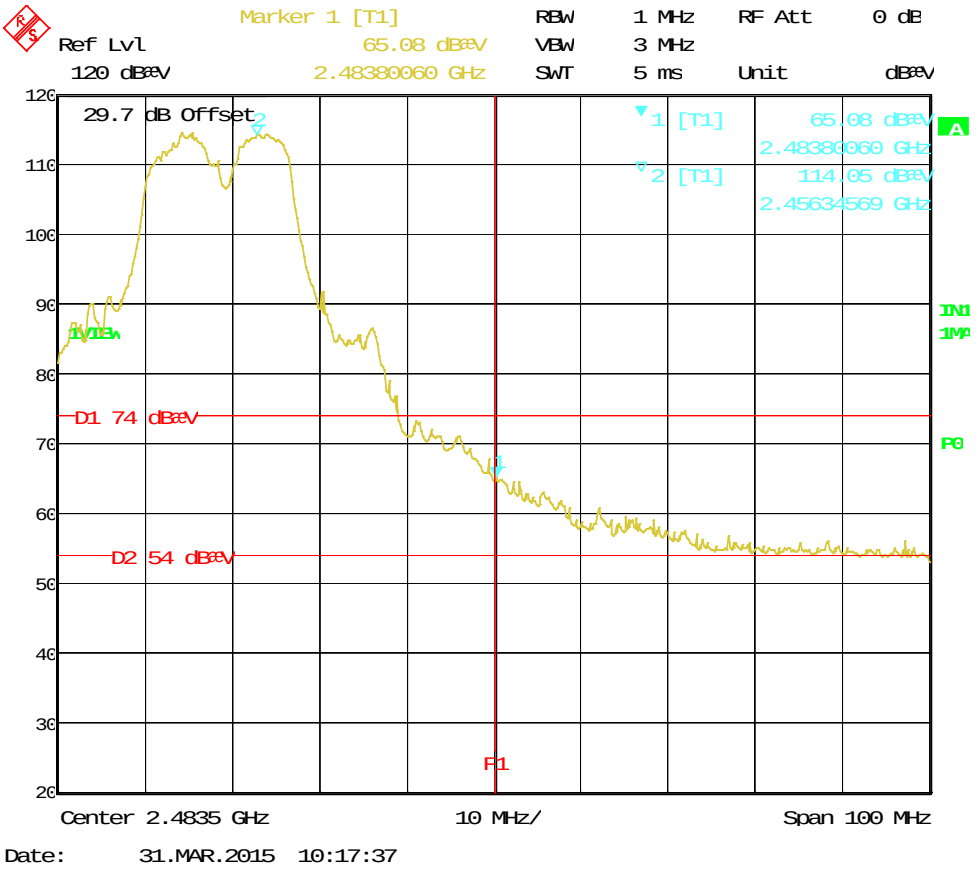


Figure 107: Radiated Emission at the Edge for 2452 MHz g mode Vert. (PK)

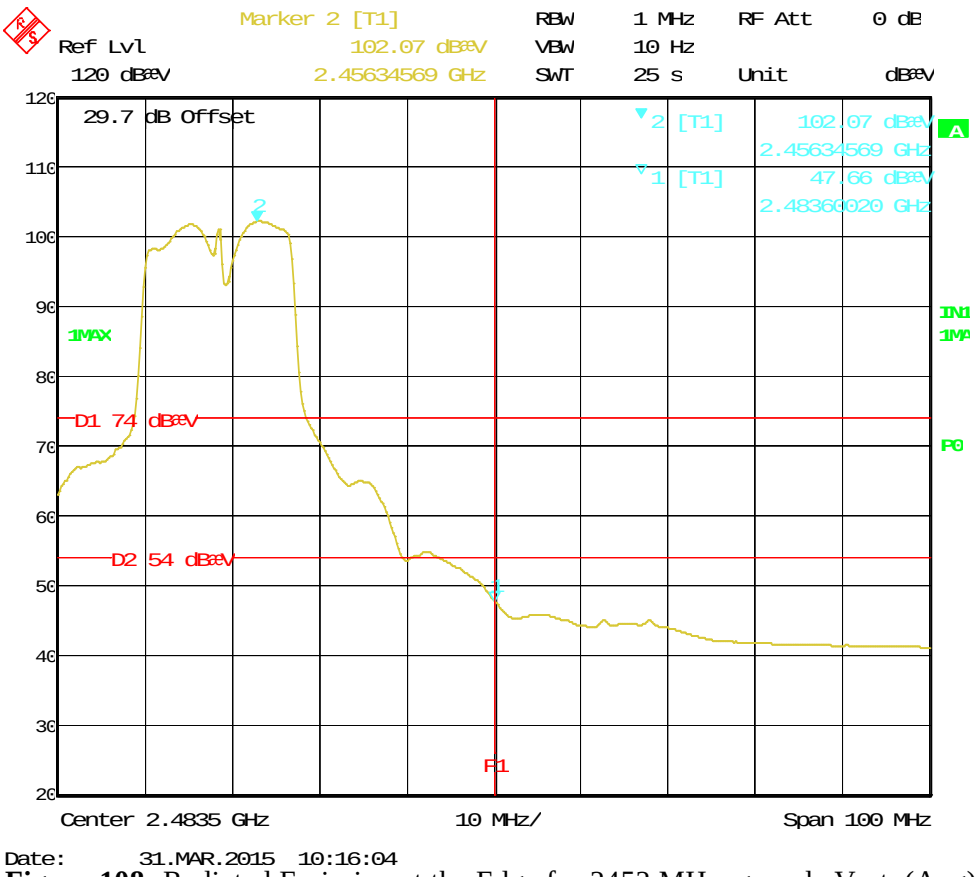


Figure 108: Radiated Emission at the Edge for 2452 MHz g mode Vert. (Avg)

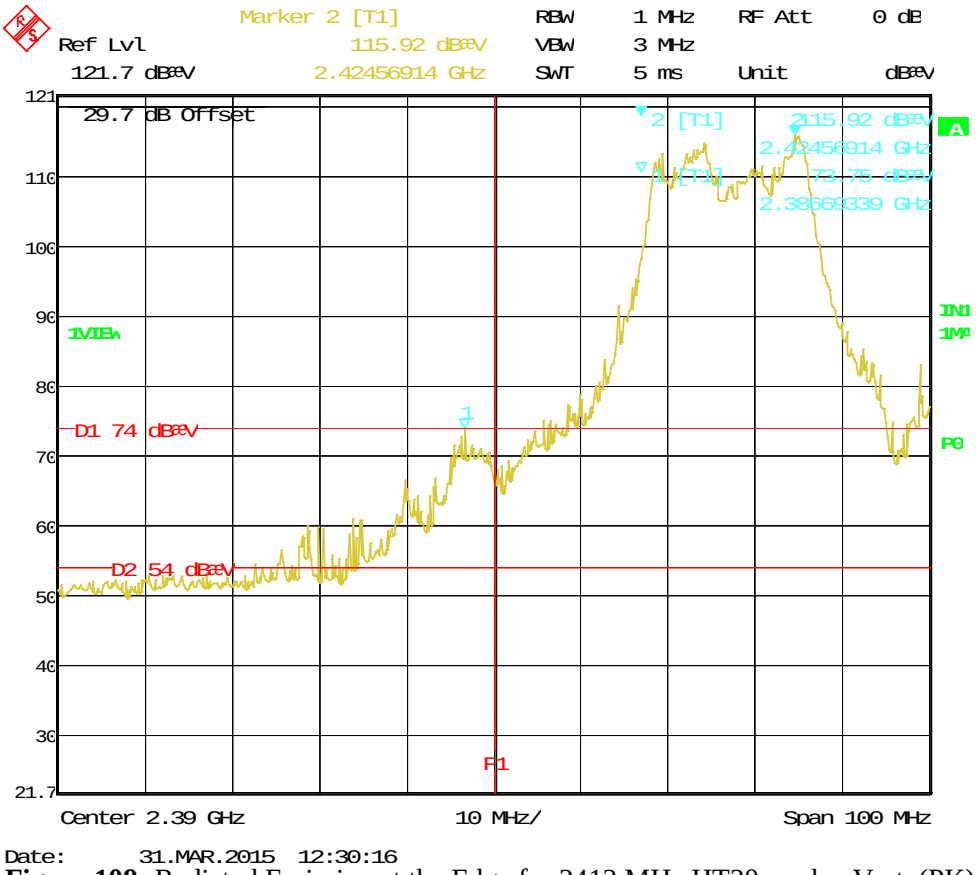


Figure 109: Radiated Emission at the Edge for 2412 MHz HT20 mode– Vert. (PK)

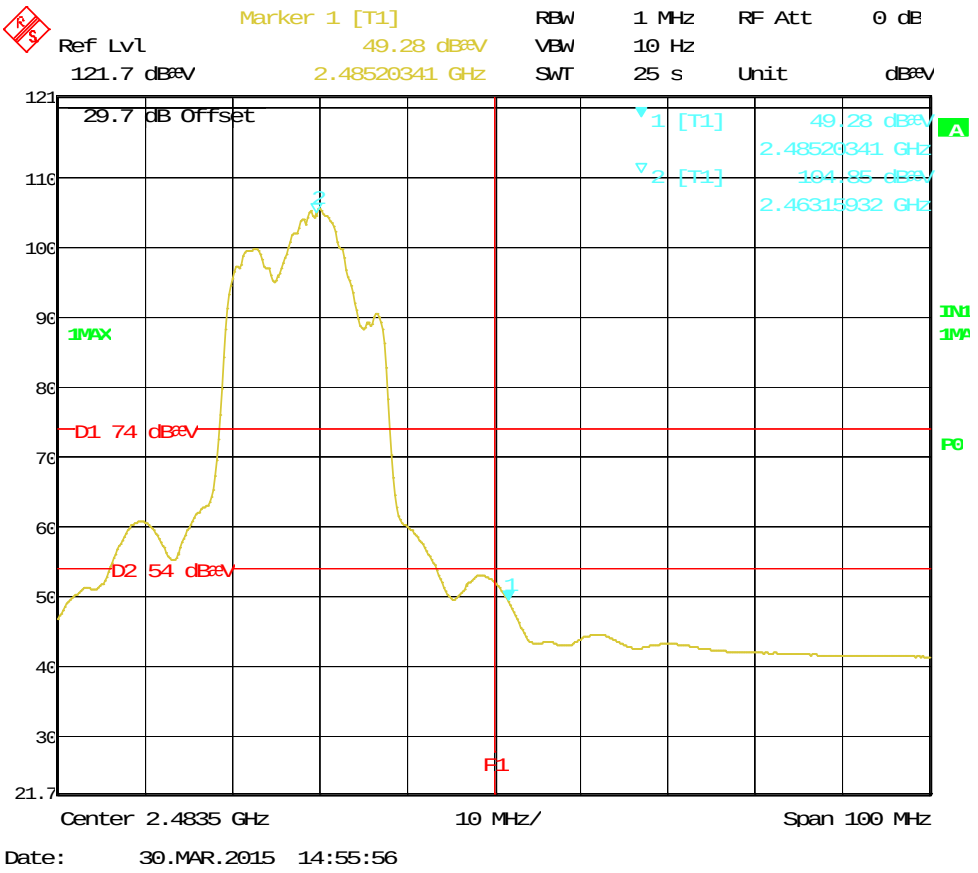


Figure 110: Radiated Emission at the Edge for 2462 MHz HT20 mode – Vert. (Avg)

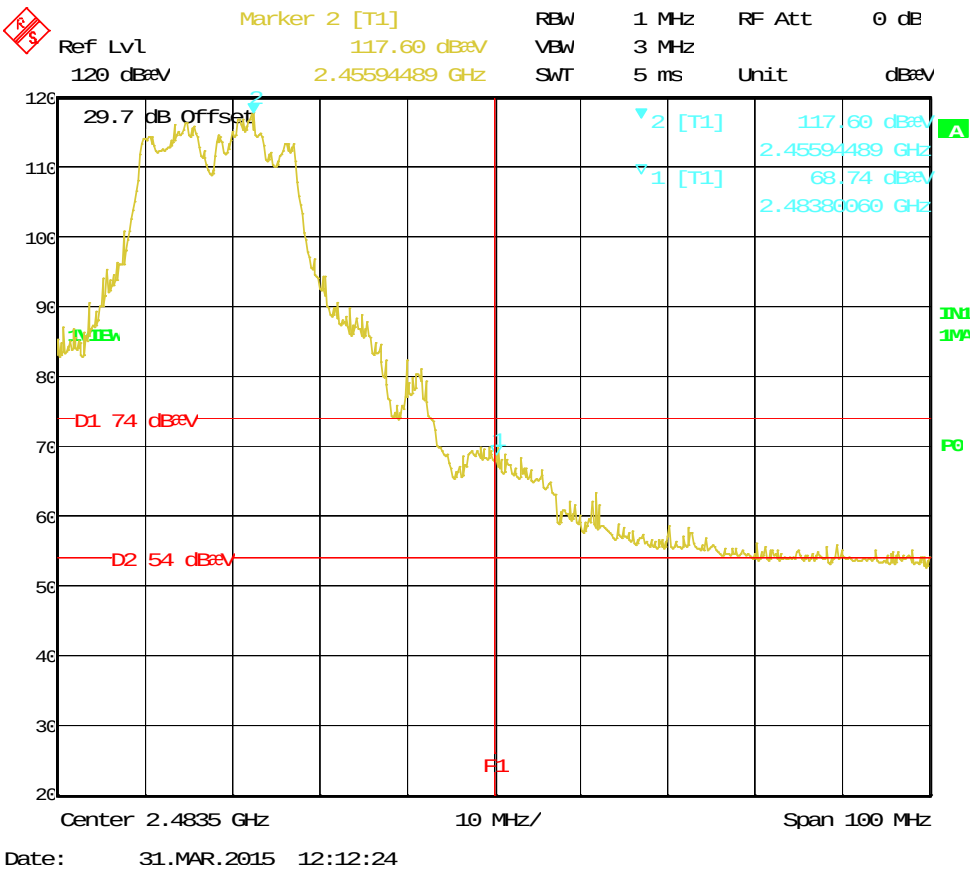


Figure 111: Radiated Emission at the Edge for 2452 MHz –HT20 Vert. (PK)

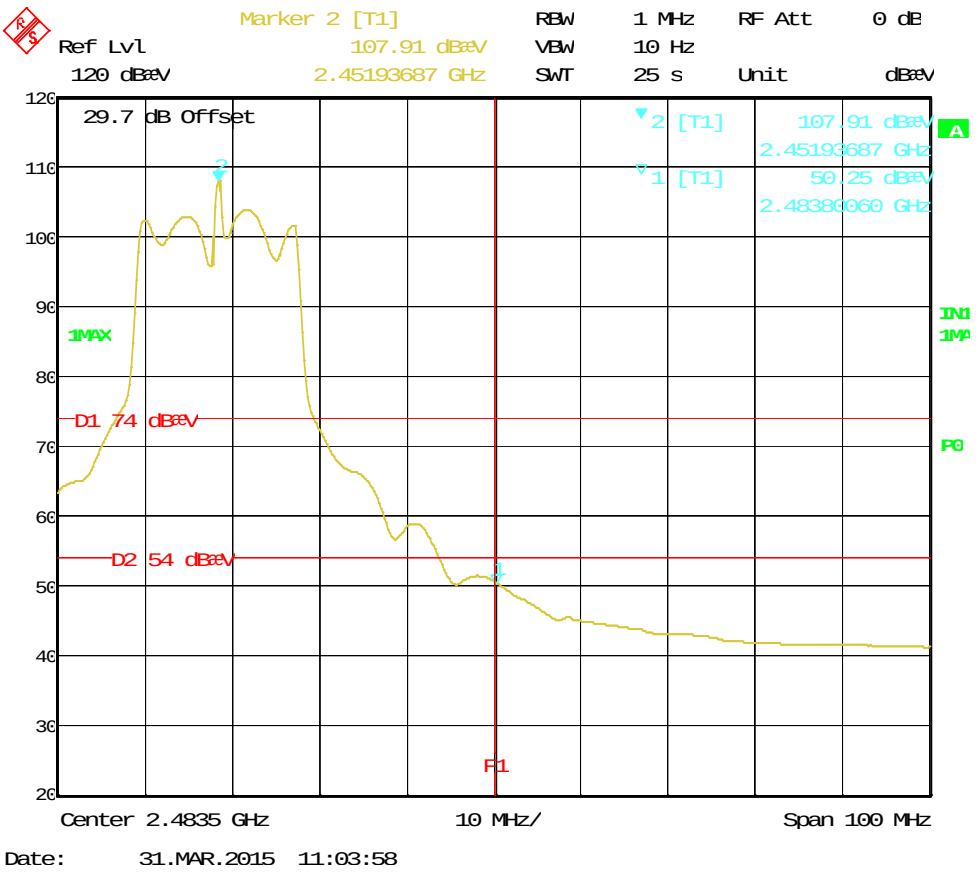


Figure 112: Radiated Emission at the Edge for 2452MHz HT20 – Vert (Avg)

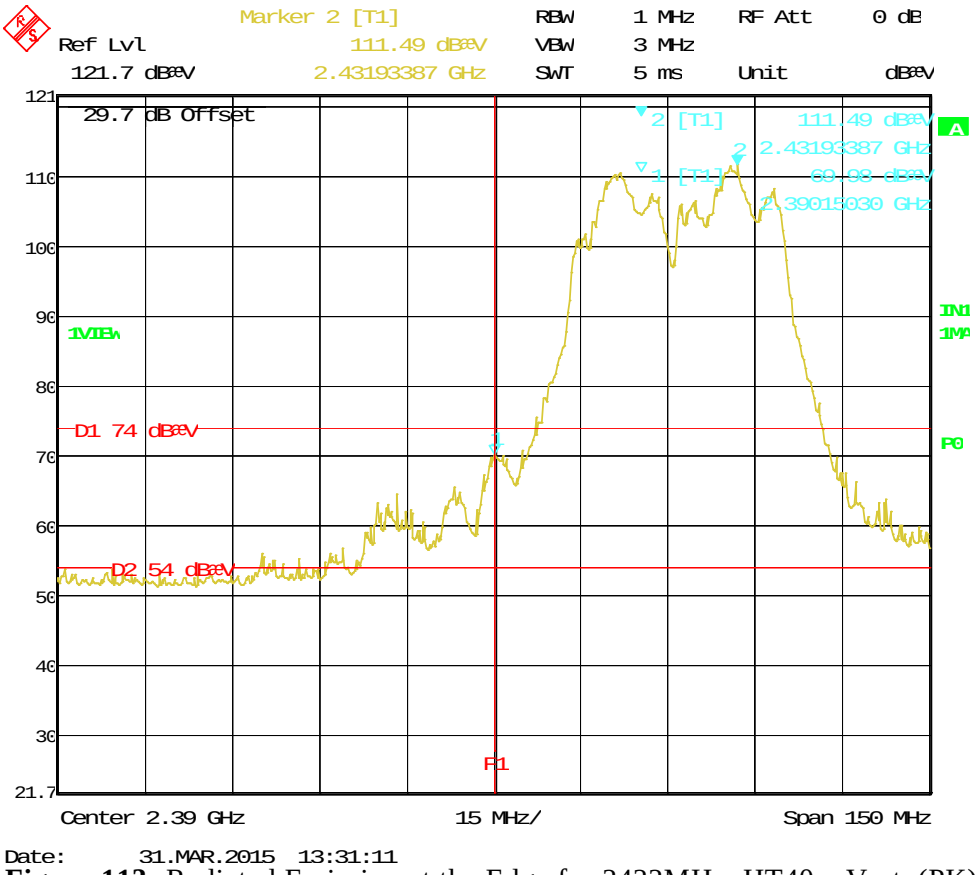


Figure 113: Radiated Emission at the Edge for 2422MHz HT40 – Vert. (PK)

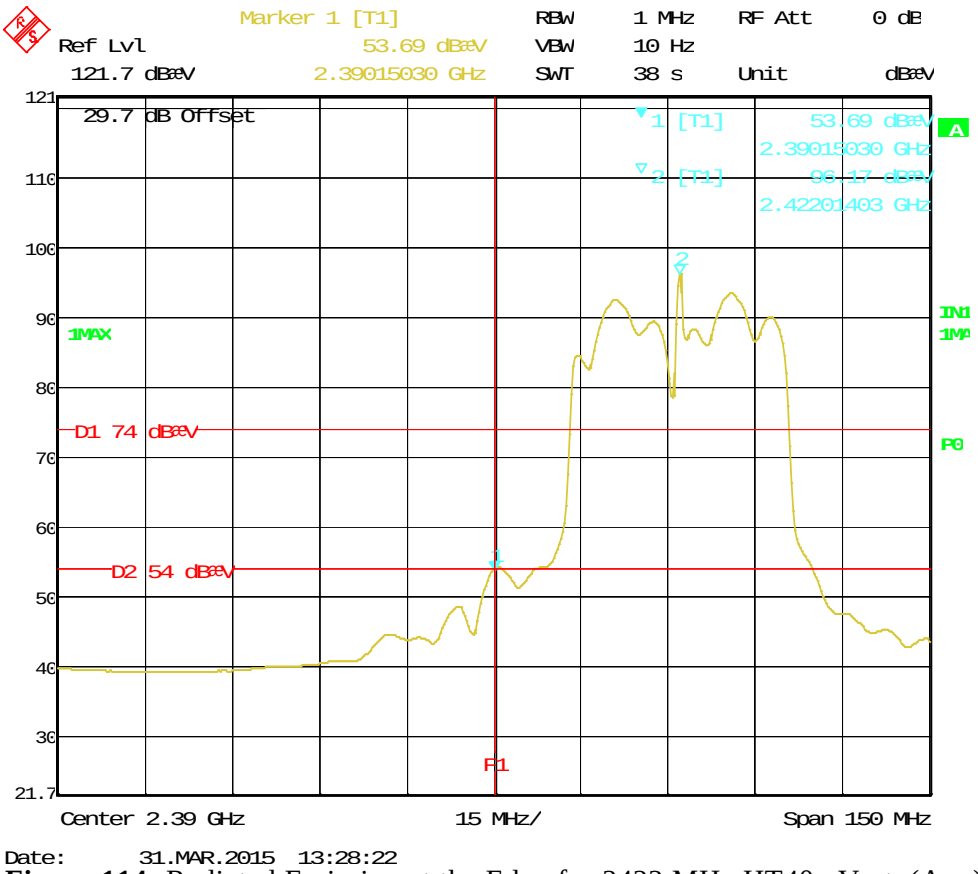


Figure 114: Radiated Emission at the Edge for 2422 MHz HT40– Vert. (Avg)

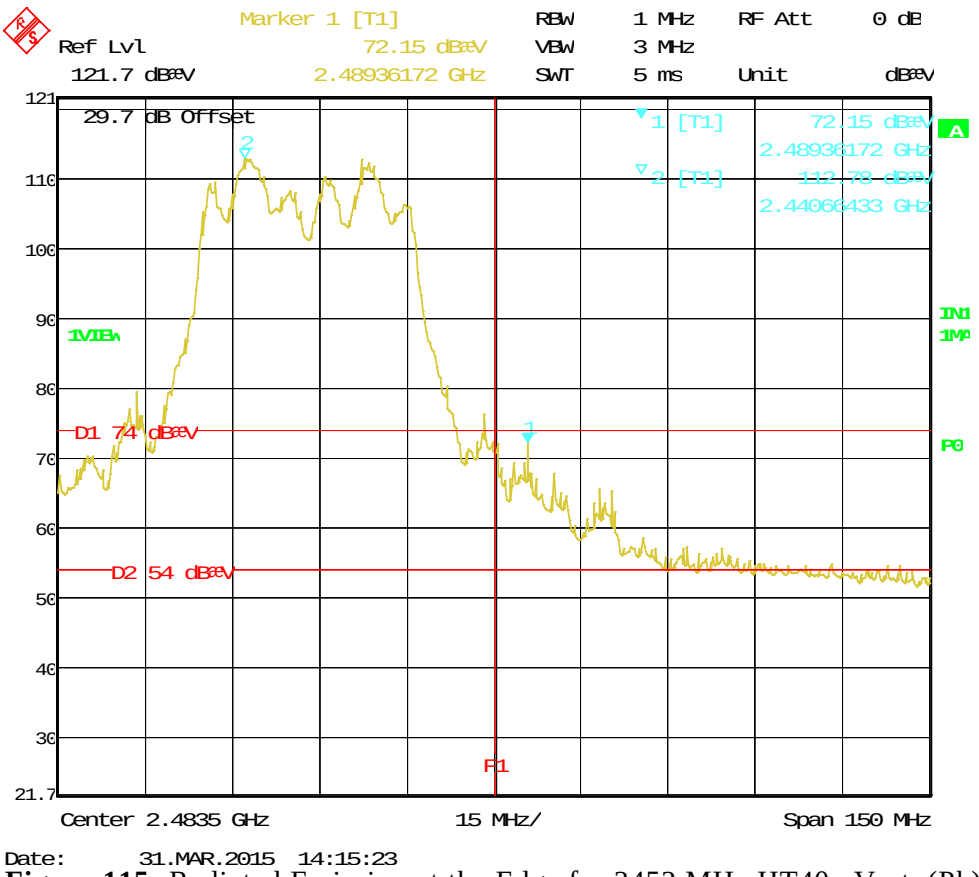


Figure 115: Radiated Emission at the Edge for 2452 MHz HT40– Vert. (Pk)

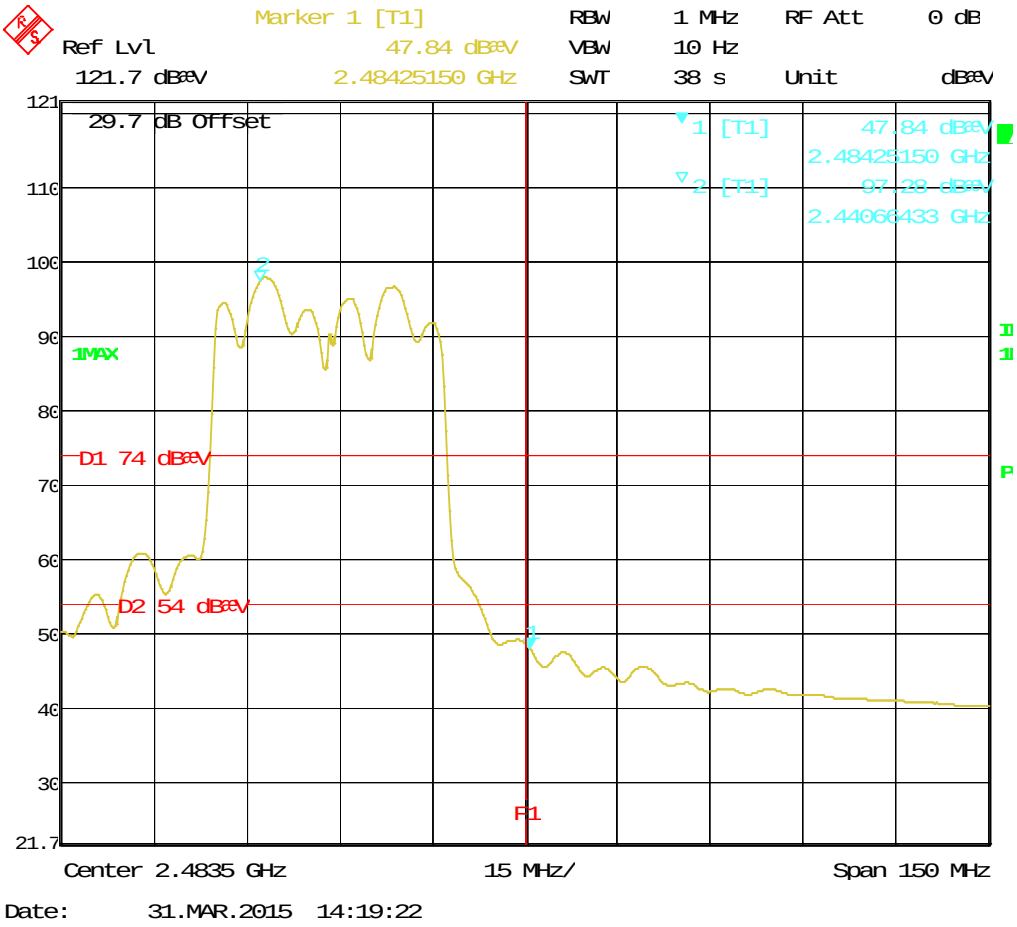


Figure 116: Radiated Emission at the Edge for 2452 MHz HT40– Vert. (Avg)

Band Edge compliance of AP-0324 with External Antennas

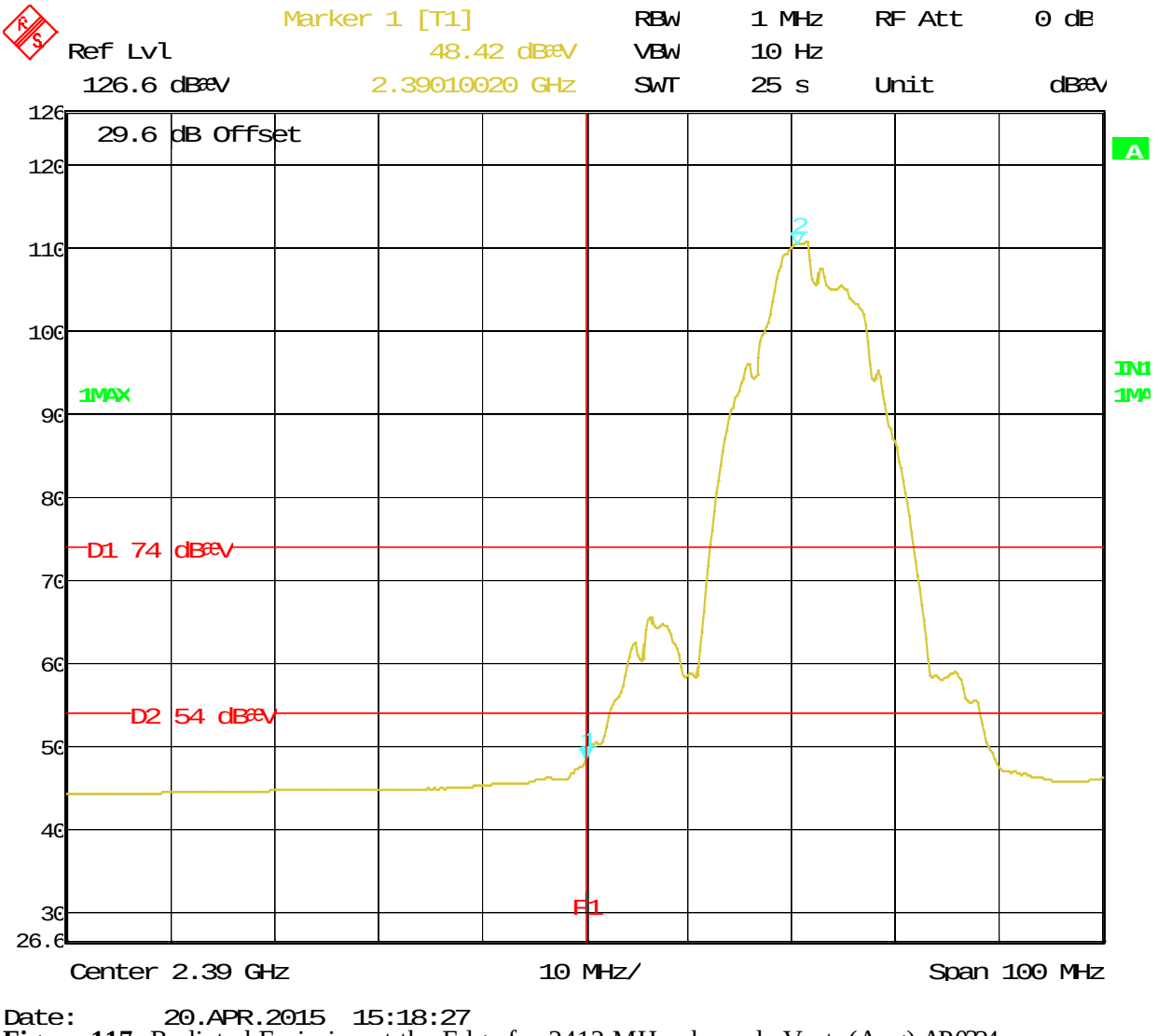


Figure 117: Radiated Emission at the Edge for 2412 MHz –b mode Vert. (Avg) AP-0324

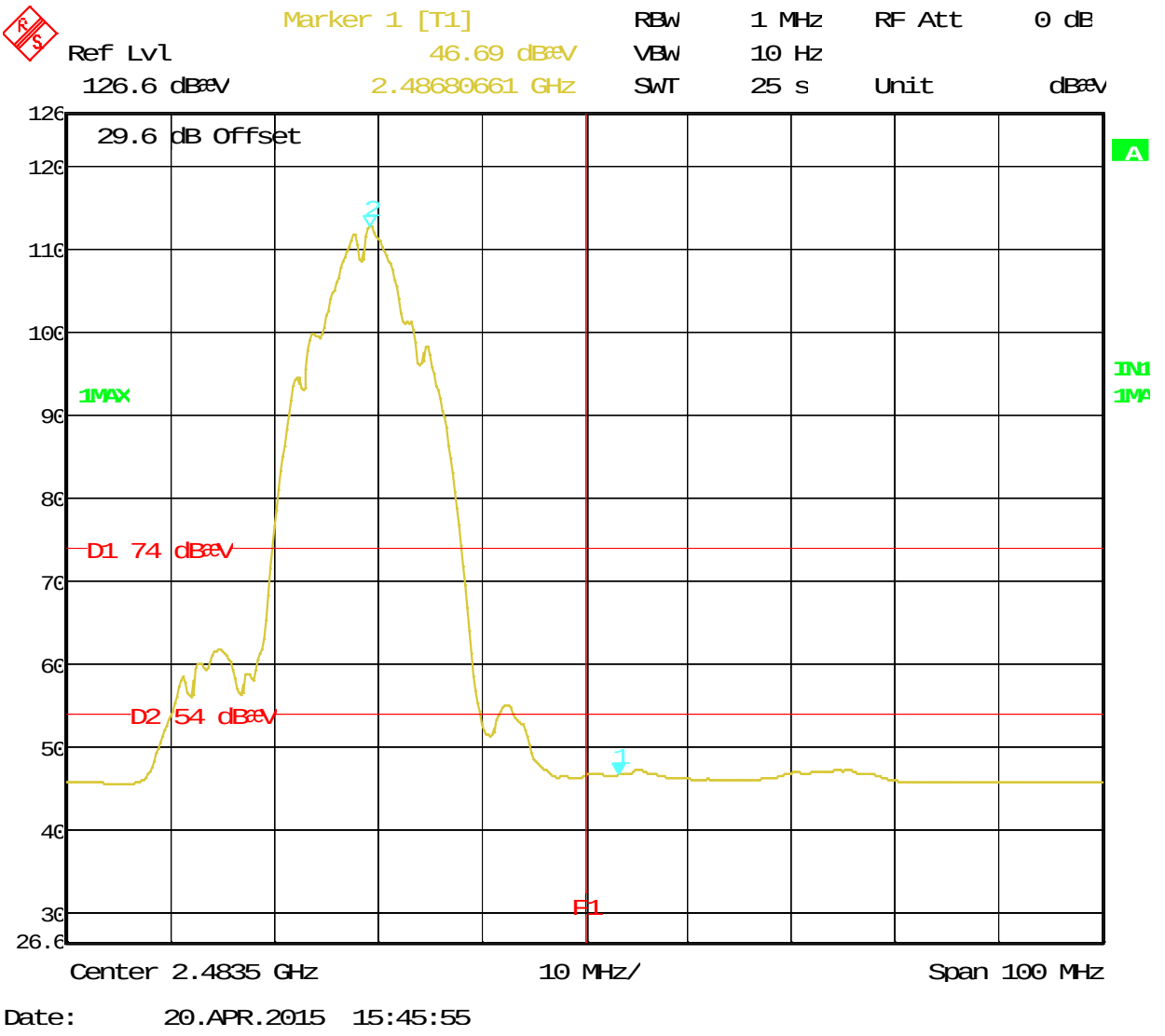


Figure 118: Radiated Emission at the Edge for 2462 MHz – b mode Vert. (Avg)

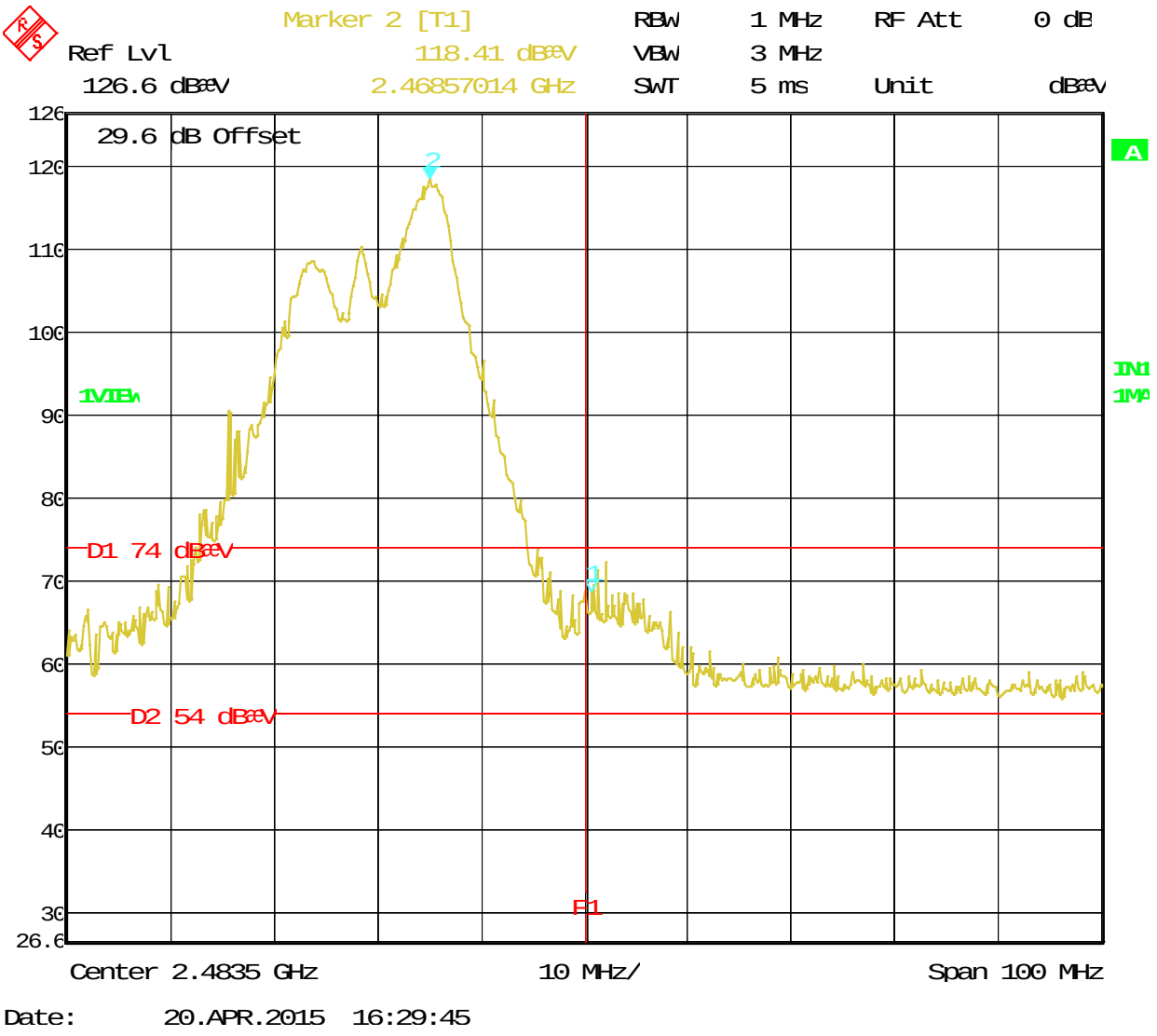


Figure 119: Radiated Emission at the Edge for 2462 MHz – g mode Vert. (PK) AP0324

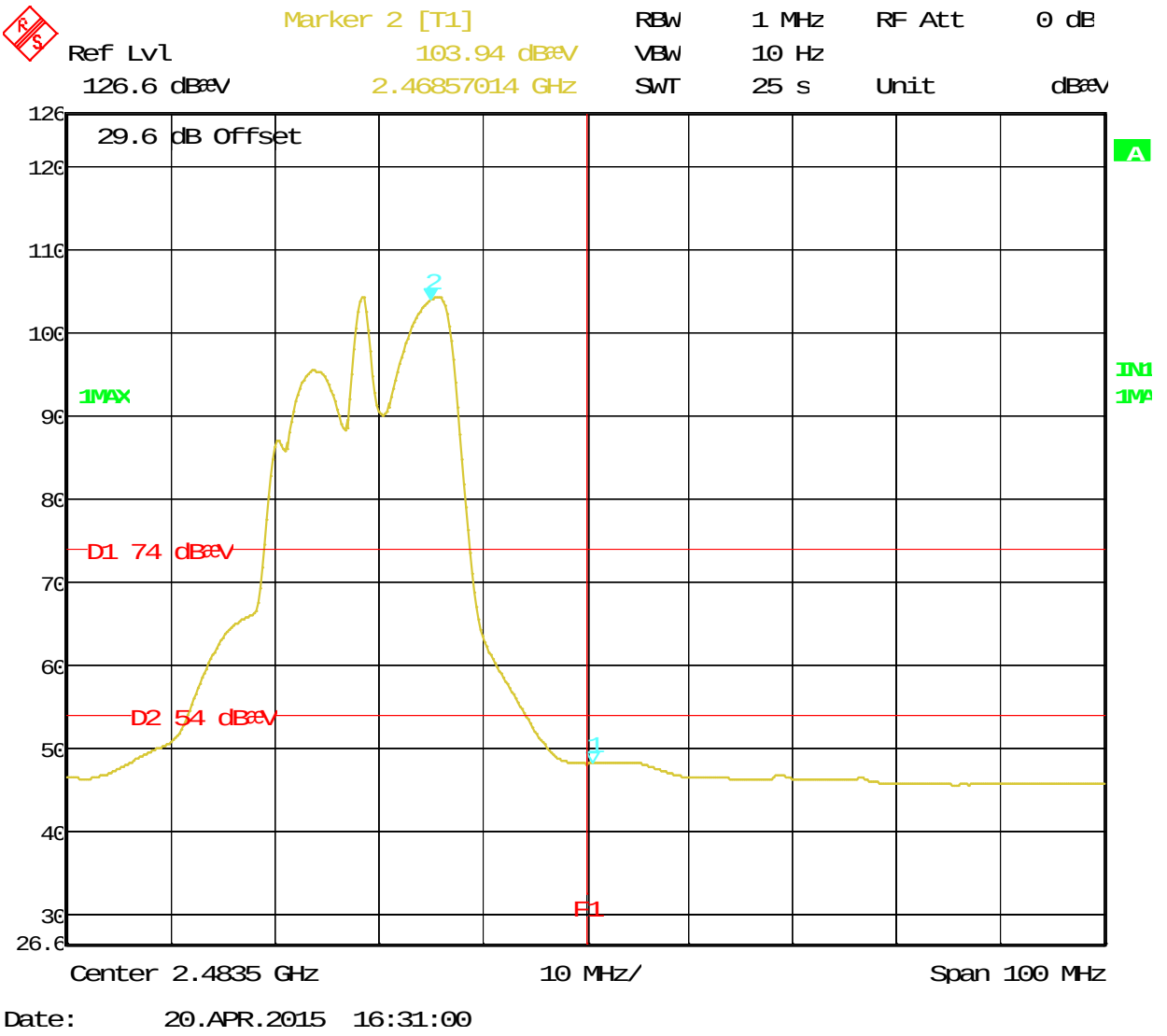


Figure 120: Radiated Emission at the Edge for 2462 MHz – g mode Vert. (Avg) AP0324

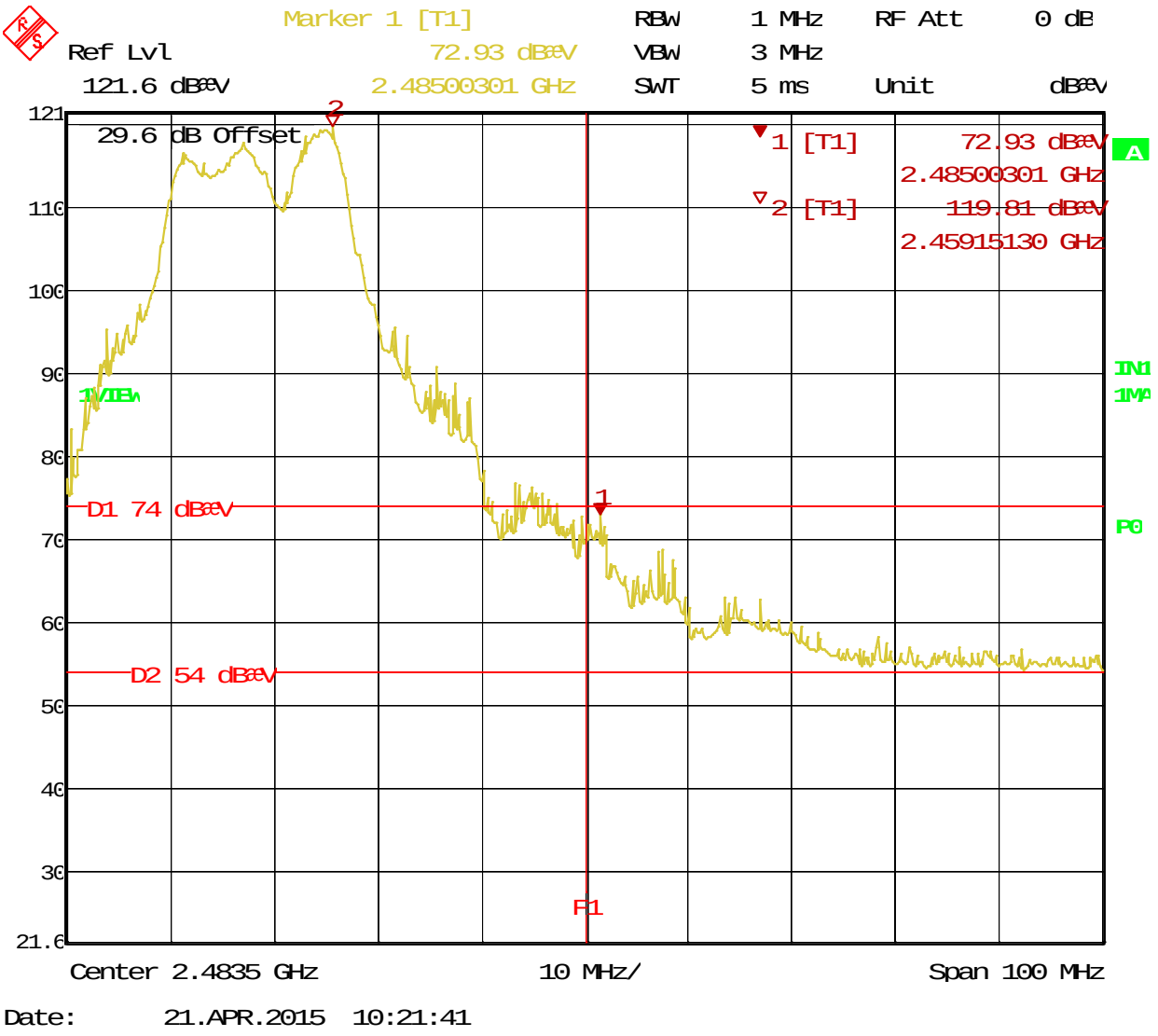


Figure 121: Radiated Emission at the Edge for 2452 MHz – g mode Vert. (PK) AP0324

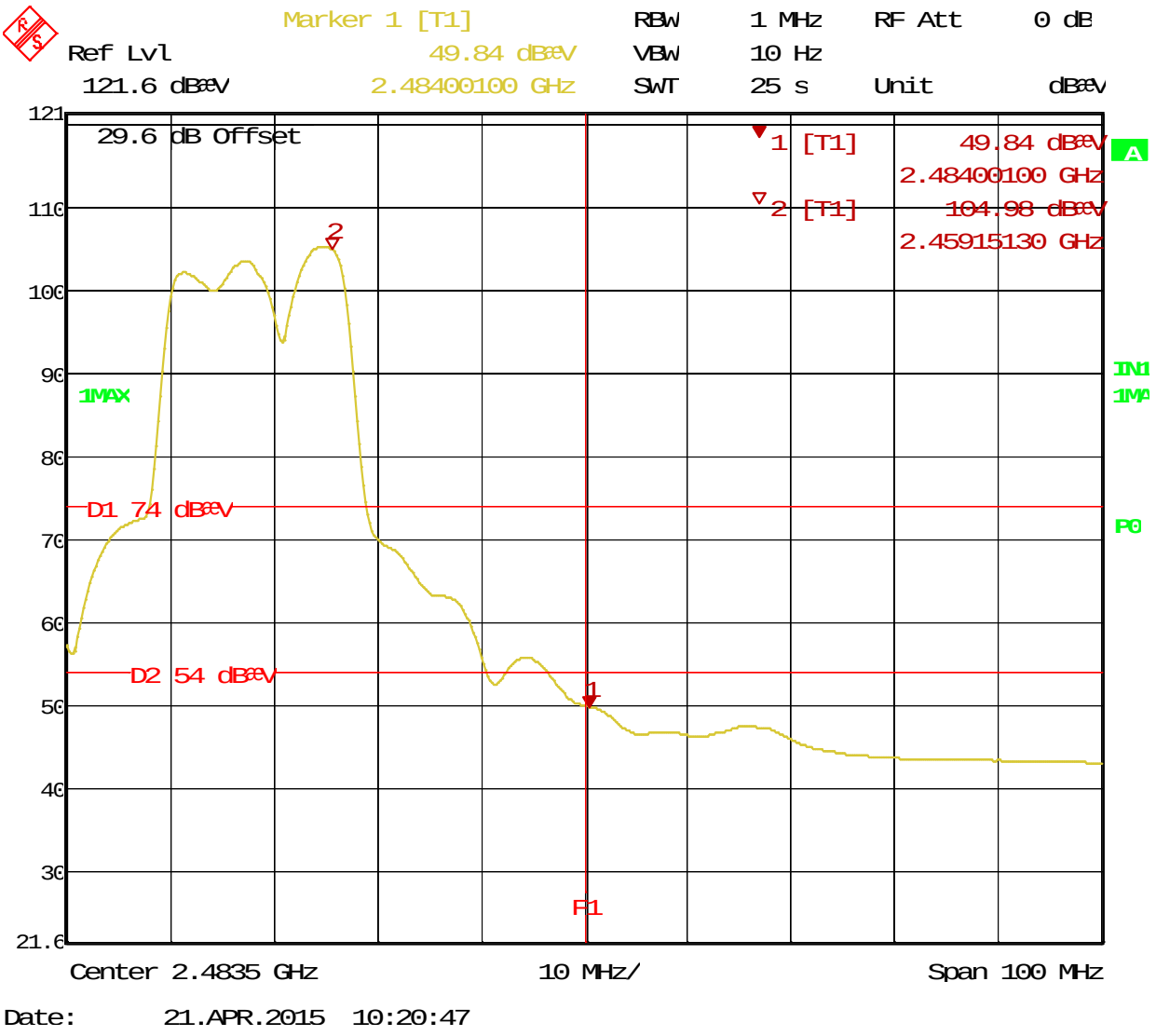


Figure 122: Radiated Emission at the Edge for 2452 MHz – g mode Vert. (Avg) AP0324

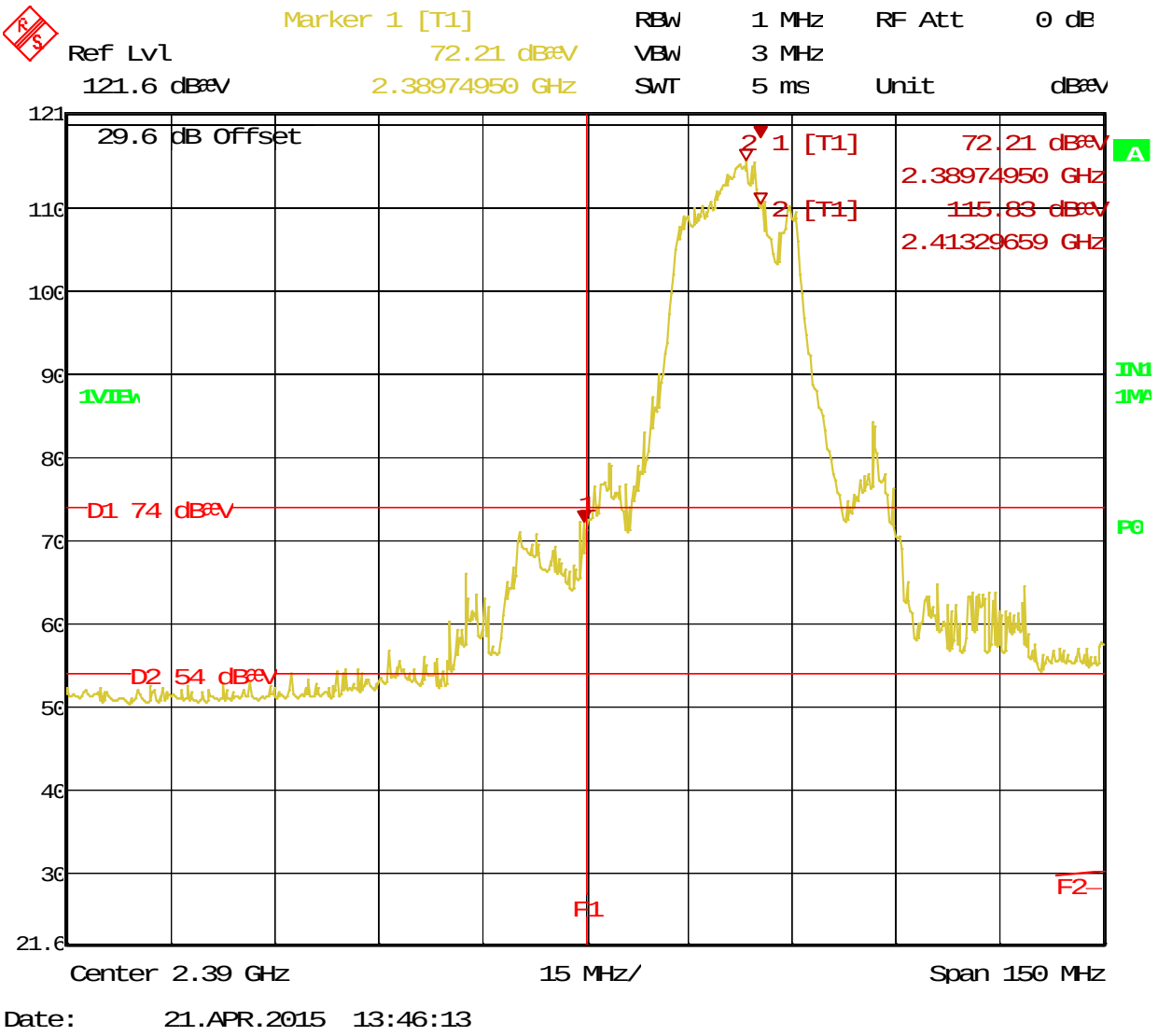


Figure 123: Radiated Emission at the Edge for 2412 MHz – HT20 mode Vert. (PK) AP0324

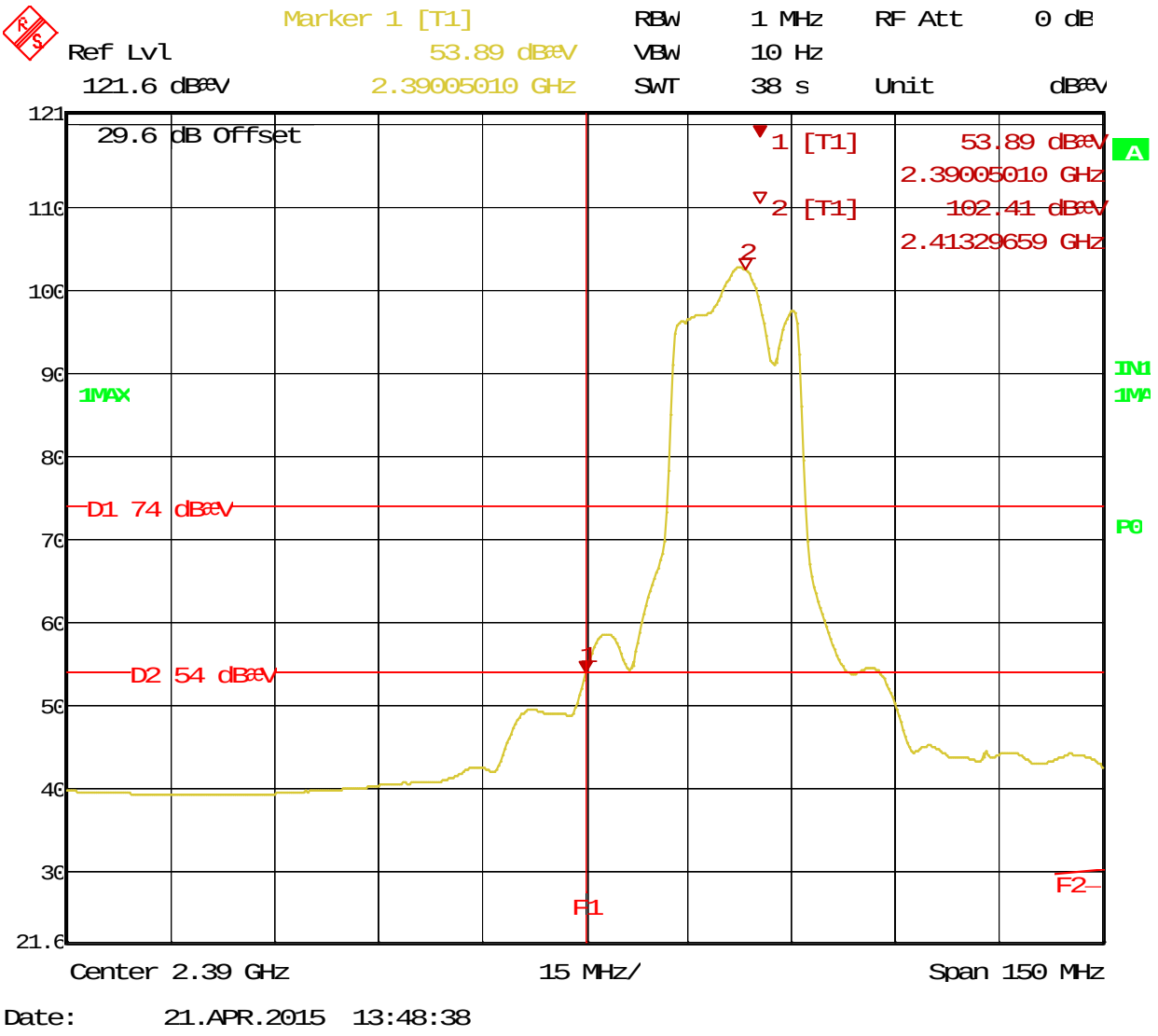


Figure 124: Radiated Emission at the Edge for 2412 MHz – g mode Vert. (Avg) AP0324

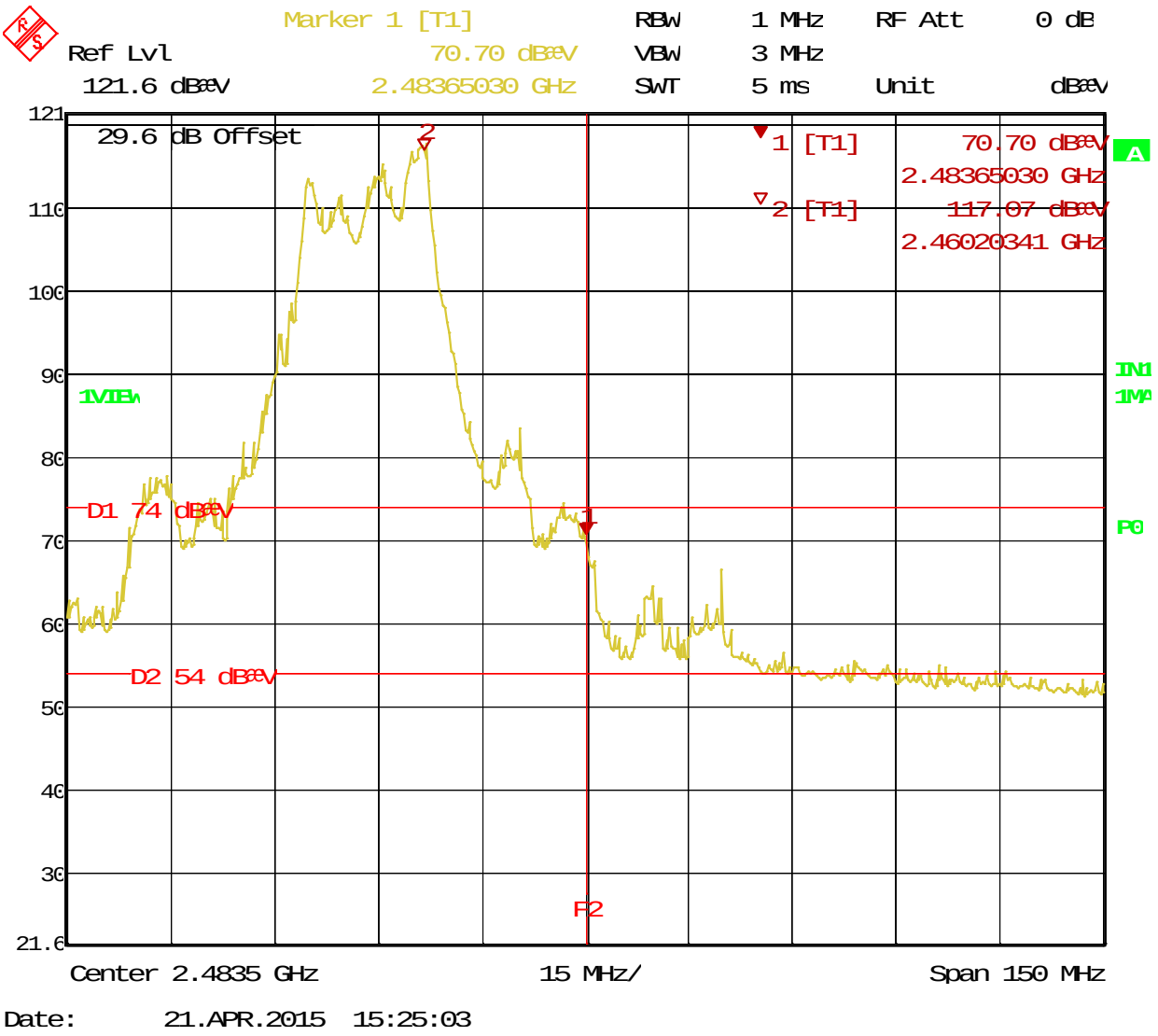


Figure 125: Radiated Emission at the Edge for 2452 MHz – HT20 mode Vert. (PK) AP0324

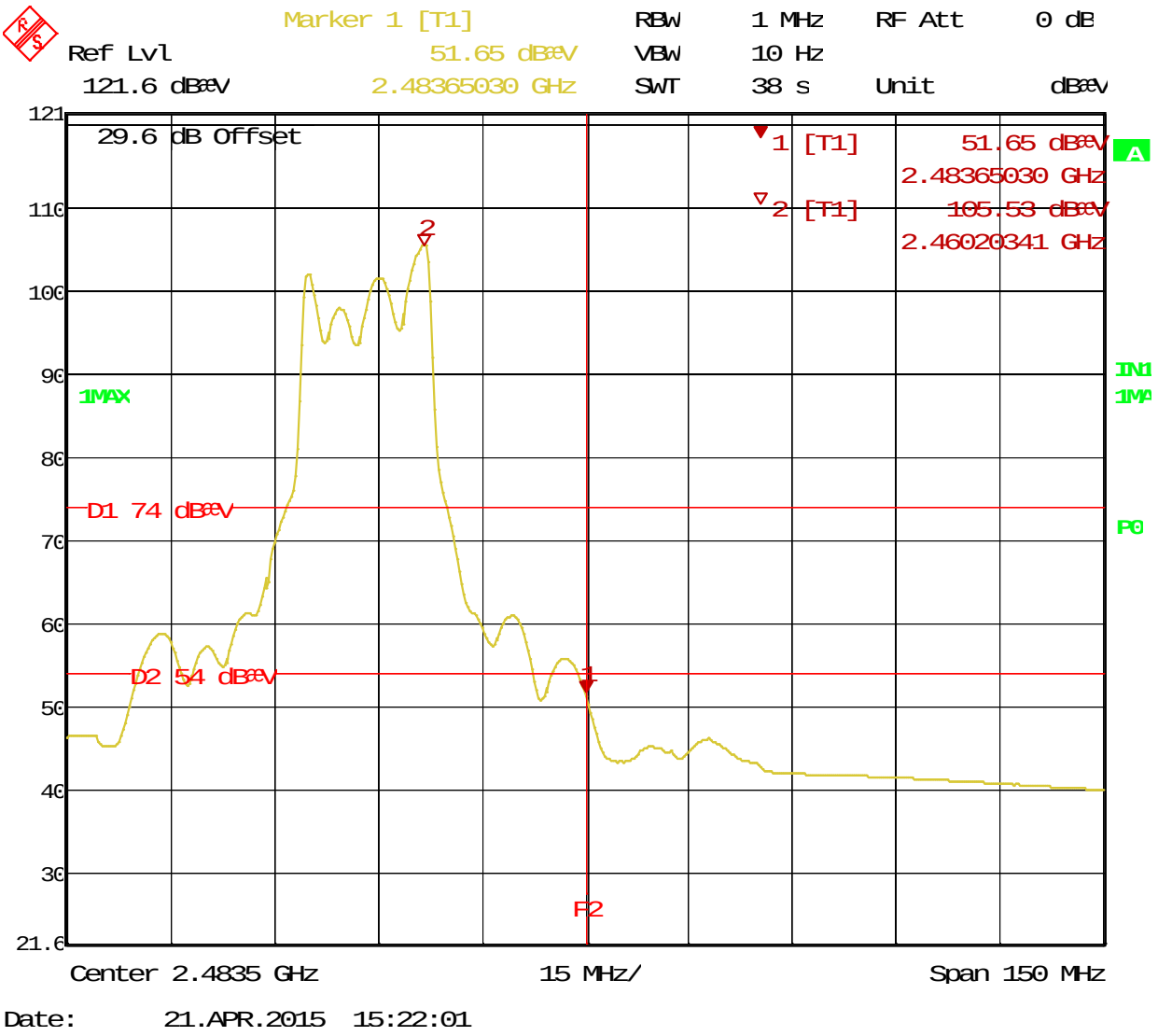


Figure 126: Radiated Emission at the Edge for 2452 MHz – HT20 mode Vert. (Avg) AP0324

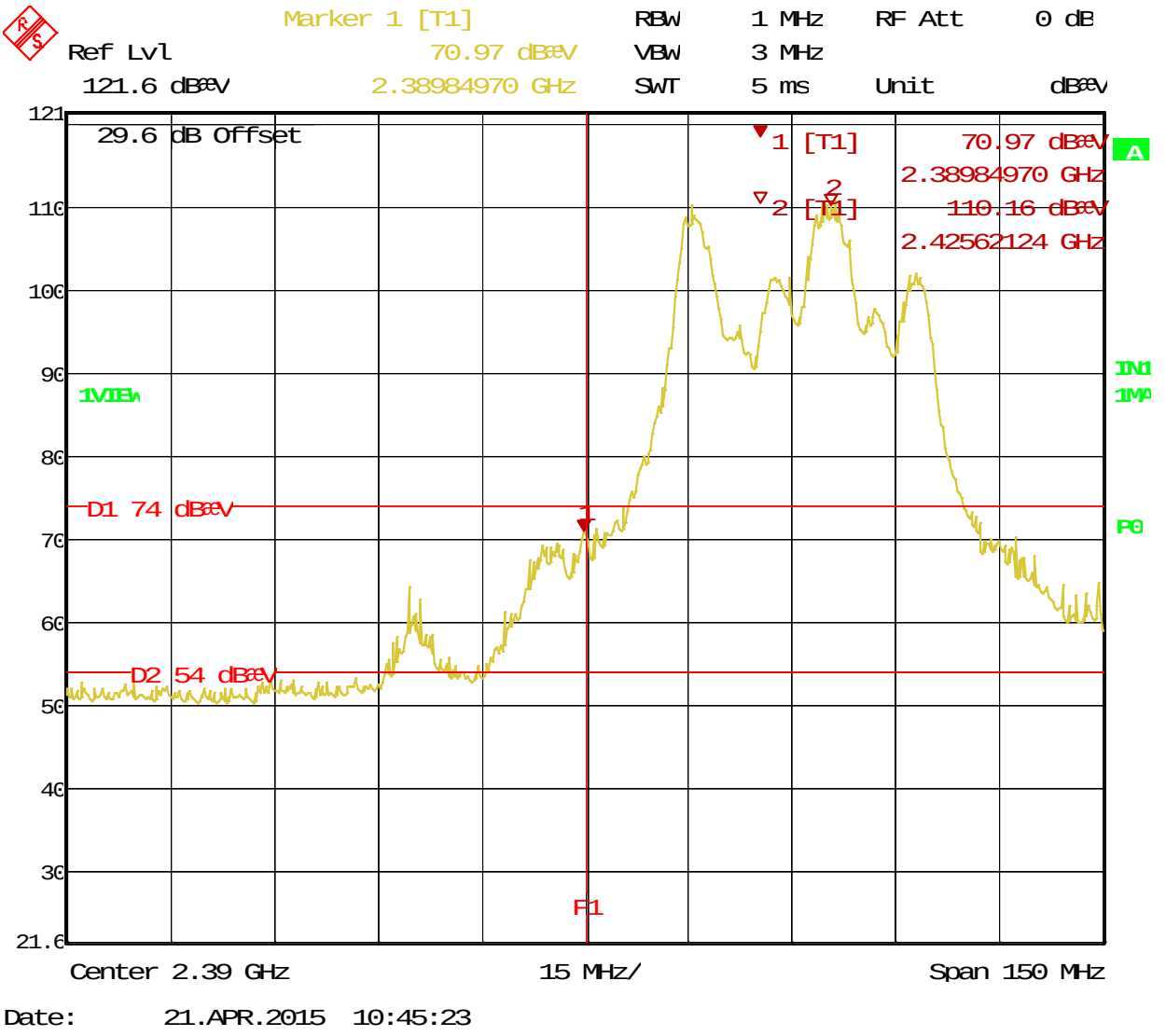
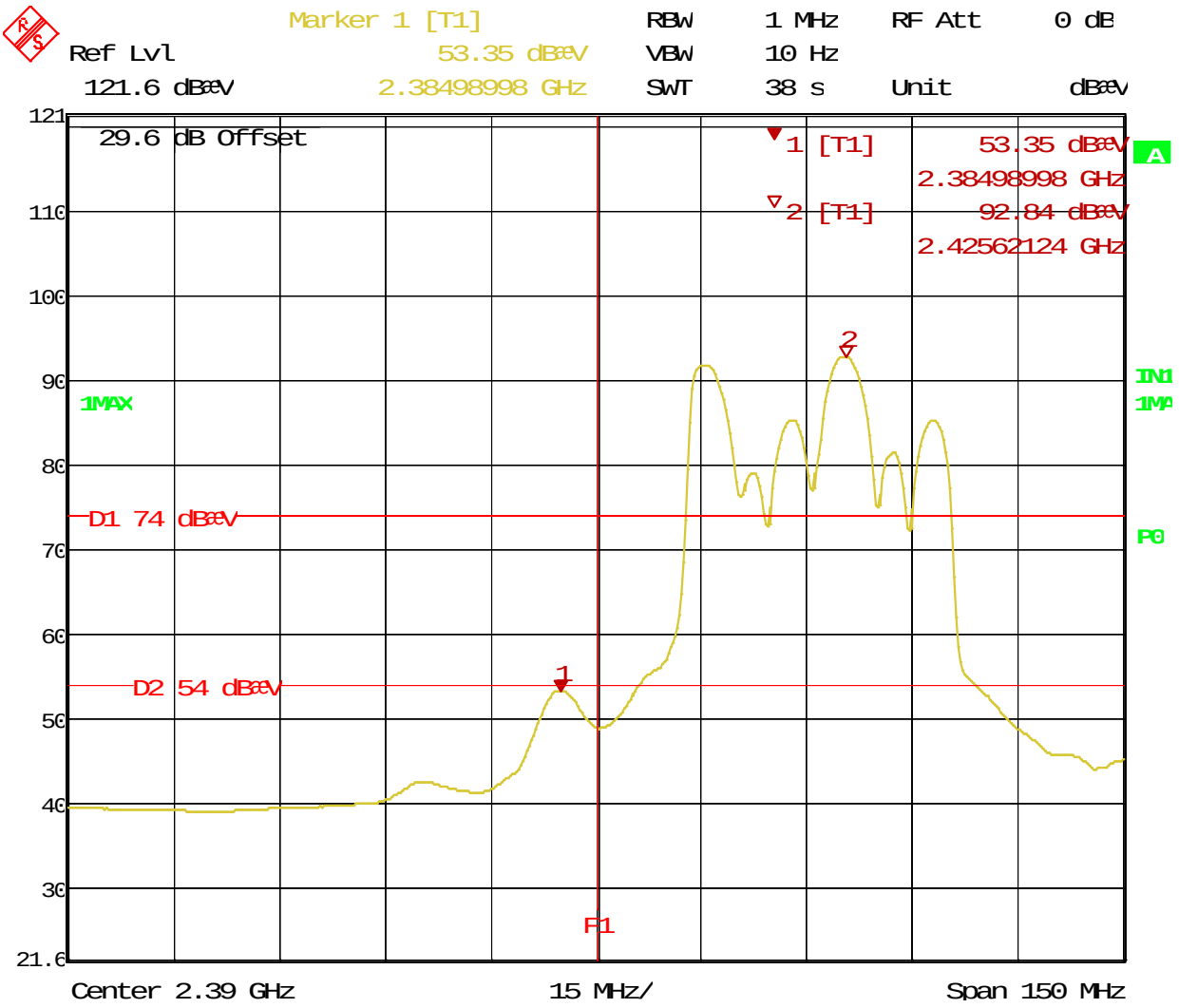


Figure 127: Radiated Emission at the Edge for 2422 MHz – HT40 mode Vert. (PK) AP0324



Date: 21.APR.2015 10:43:09

Figure 128: Radiated Emission at the Edge for 2422 MHz – HT40 mode Vert. (Avg) AP0324

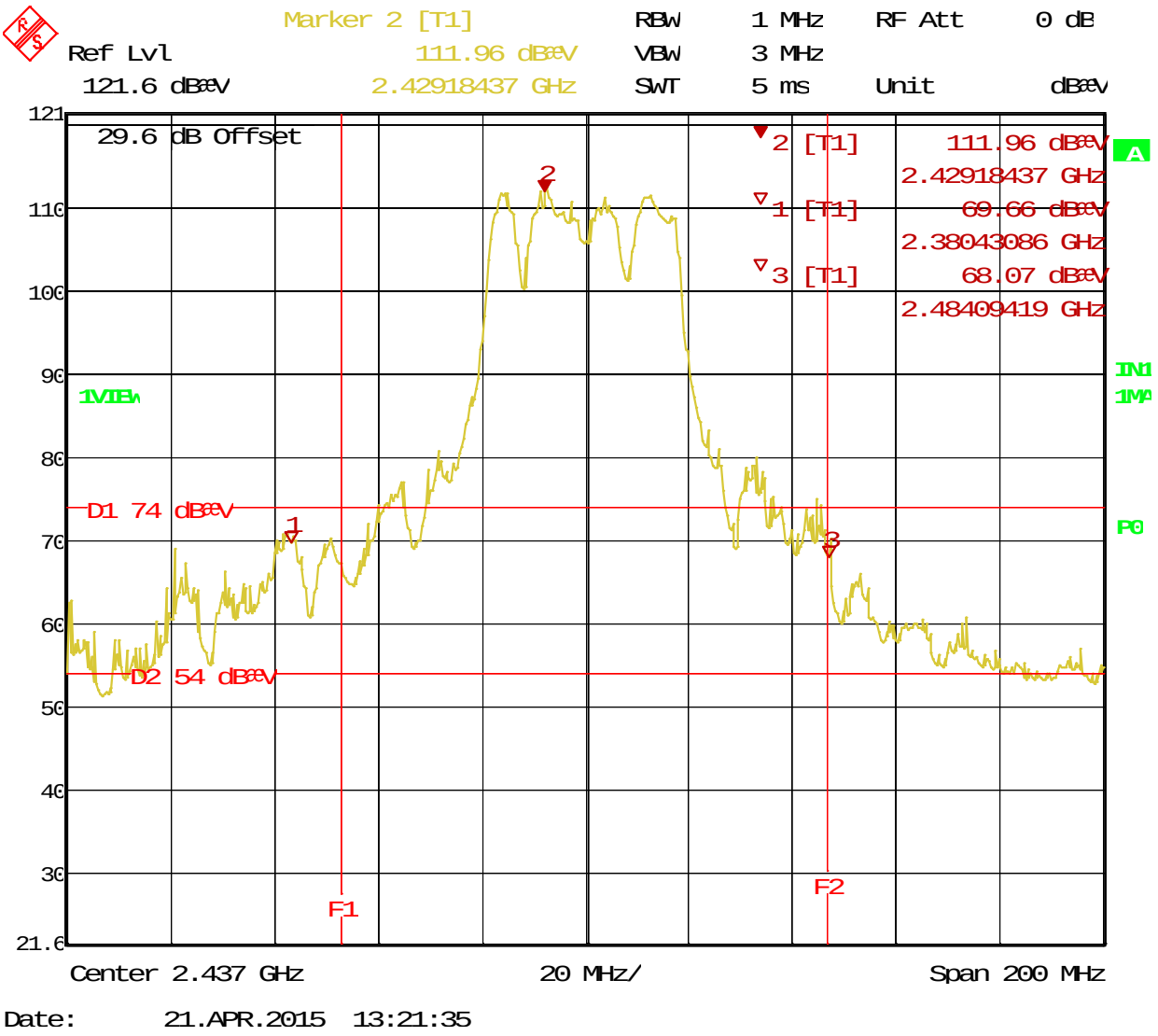


Figure 129: Radiated Emission at the Edge for 2437 MHz – HT40 mode Vert. (PK) AP0324

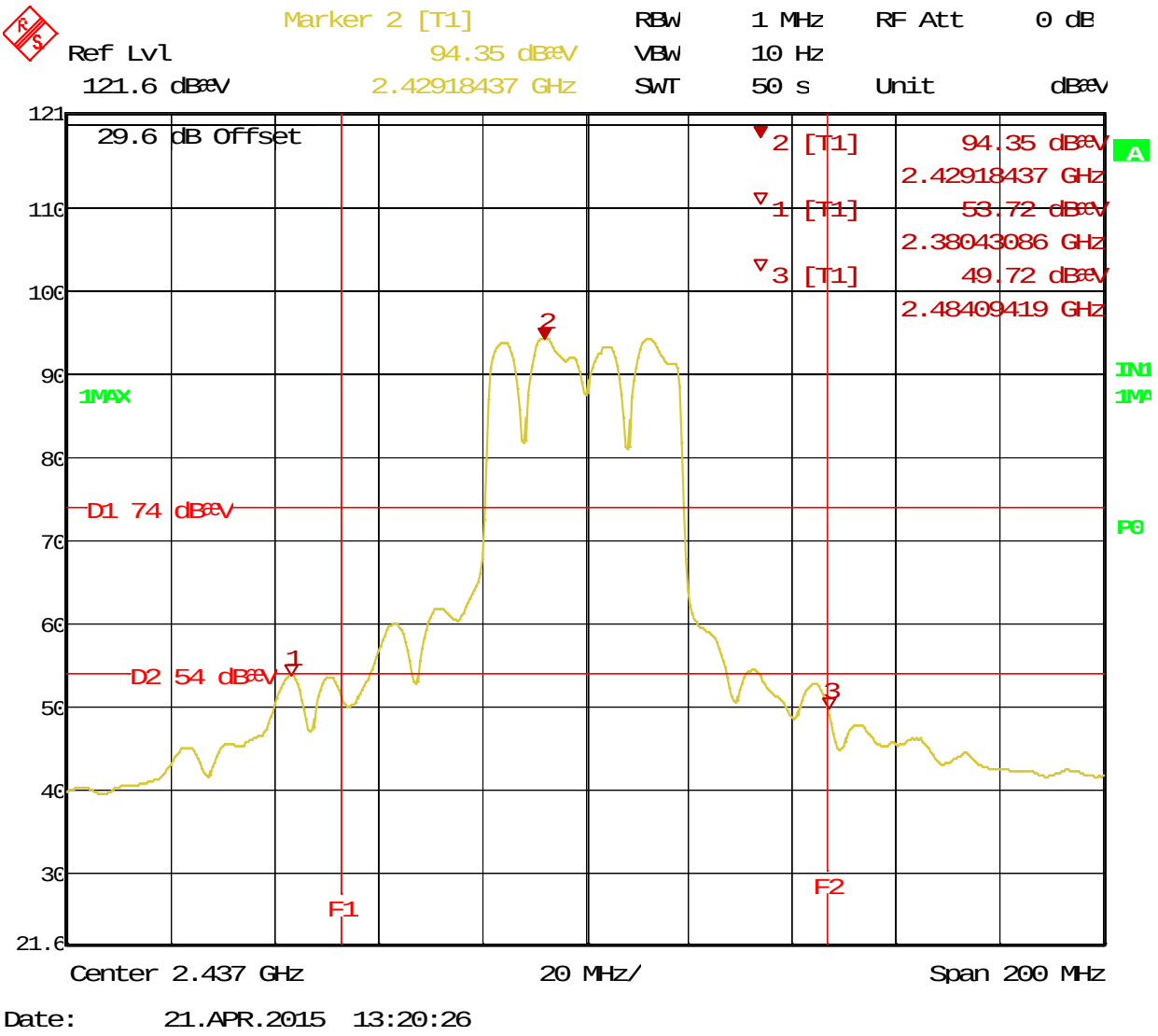


Figure 130: Radiated Emission at the Edge for 2437 MHz – HT40 mode Vert. (Avg) AP0324

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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000409, with Internal antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b mode at 1.0 Mbps/ chain	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

30 MHz 1 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2412-MHz, 2437 and 2462MHz

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	
36.09	46.04	2.66	-15.46	33.24	QP	V	134	6	40.00	-6.76	Pass
47.80	56.01	2.76	-23.12	35.65	QP	V	101	14	40.00	-4.35	Pass
50.43	54.61	2.78	-24.24	33.15	QP	V	117	356	40.00	-6.85	Pass
68.21	50.33	2.91	-24.55	28.70	QP	V	155	320	40.00	-11.30	Pass
240.02	38.18	3.81	-20.69	21.30	QP	V	157	-9	46.00	-24.70	Pass
281.33	34.33	3.97	-19.00	19.29	QP	V	121	61	46.00	-26.71	Pass
422.18	30.25	4.45	-16.12	18.59	QP	V	121	229	46.00	-27.41	Pass
30 MHz 1 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2437MHz											
36.01	47.40	2.66	-15.41	34.65	QP	V	101	231	40.00	-5.35	Pass
43.80	49.45	2.72	-20.97	31.20	QP	V	103	32	40.00	-8.80	Pass
60.22	57.98	2.85	-25.12	35.71	QP	V	101	208	40.00	-4.29	Pass
66.31	53.12	2.90	-24.68	31.33	QP	V	135	113	40.00	-8.67	Pass
101.89	54.11	3.14	-21.82	35.42	QP	V	121	273	43.50	-8.08	Pass
240.03	38.54	3.81	-20.69	21.66	QP	V	127	88	46.00	-24.34	Pass
30 MHz 1 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2462MHz											
43.79	54.04	2.72	-20.96	35.81	QP	V	102	96	40.00	-4.20	Pass
60.22	57.98	2.85	-25.12	35.71	QP	V	101	208	40.00	-4.29	Pass
238.77	41.27	3.80	-20.72	24.35	QP	V	120	273	46.00	-21.65	Pass
432.18	31.25	4.45	-16.12	19.59	QP	V	121	229	46.00	-26.41	Pass

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

SOP 1 Radiated Emissions

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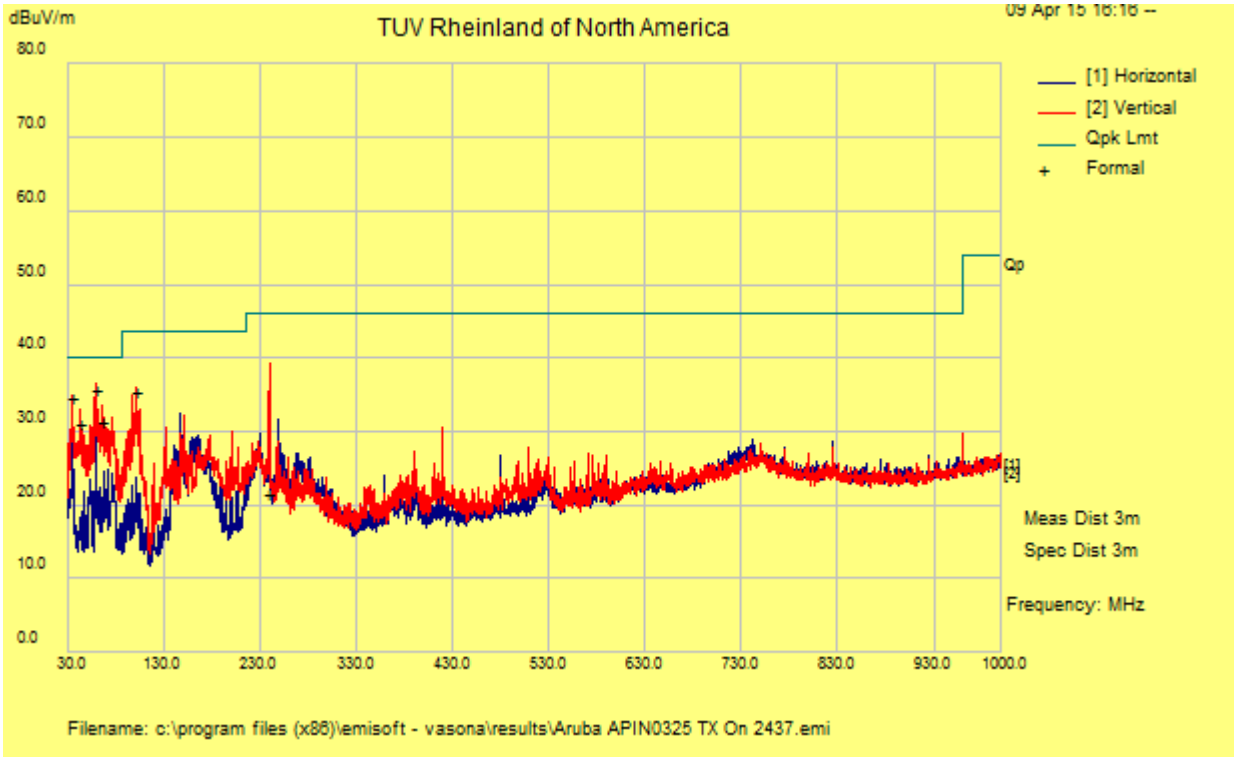
EUT Name	Wireless Access Point	**Date**	April 09, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 28%rh
EUT Serial	DD0000409, with Internal antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b at 1Mbps/ chain	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m – JB3	**Performed by**	Suresh

30MHz to 1 GHz Plot for Transmit b Mode at 2437 MHz



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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000409, with Internal antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b mode at 1.0 Mbps/ chain	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

1 to 18 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2412-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	
4825.14	54.93	1.89	-16.08	40.75	Pk	V	253	280	74.00	-33.26	Pass
4825.14	55.12	1.89	-16.08	40.94	Avg	V	253	280	54.00	-13.06	Pass
7235.25	52.60	2.28	-11.59	43.30	Pk	V	126	114	74.00	-30.70	Pass
7235.25	53.59	2.28	-11.59	44.28	Avg	V	126	114	54.00	-9.72	Pass
9647.56	50.42	2.68	-8.02	45.08	Pk	V	263	285	74.00	-28.92	Pass
9647.56	51.42	2.68	-8.02	46.08	Avg	V	263	285	54.00	-7.92	Pass
12061.20	54.00	2.94	-10.72	46.22	Pk	V	180	167	74.00	-27.78	Pass
12061.20	56.03	2.94	-10.72	48.25	Avg	V	180	167	54.00	-5.75	Pass
14471.43	53.11	3.39	-7.35	49.14	Pk	V	108	240	74.00	-24.86	Pass
14471.43	53.57	3.39	-7.35	49.60	Avg	V	108	240	54.00	-4.40	Pass
1 to 18 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2437MHz											
1126.53	55.47	0.82	-25.39	30.90	PK	V	133	193	74.00	-43.10	Pass
1126.53	56.63	0.82	-25.39	32.06	Avg	V	133	193	54.00	-21.94	Pass
4872.77	54.10	1.88	-15.88	40.10	PK	V	138	152	74.00	-33.90	Pass
4872.77	54.89	1.88	-15.88	40.90	Avg	V	138	152	54.00	-13.10	Pass
5128.73	54.37	1.88	-15.70	40.55	PK	V	108	355	74.00	-33.45	Pass
5128.73	55.33	1.88	-15.70	41.51	Avg	V	108	355	54.00	-12.49	Pass
7312.38	52.61	2.30	-11.37	43.53	PK	V	125	187	74.00	-30.47	Pass
7312.38	53.05	2.30	-11.37	43.97	Avg	V	125	187	54.00	-10.03	Pass
14558.91	53.26	3.42	-7.37	49.30	PK	V	155	143	74.00	-24.70	Pass
14558.91	54.49	3.42	-7.37	50.54	Avg	V	155	143	54.00	-3.47	Pass

1 to 18 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2462MHz											
4923.97	55.59	1.89	-15.63	41.85	Pk	V	119	306	74.00	-32.15	Pass
4923.97	56.54	1.89	-15.63	42.80	Avg	V	119	306	54.00	-11.20	Pass
7387.04	51.74	2.30	-11.16	42.88	Pk	V	250	284	74.00	-31.12	Pass
7387.04	52.86	2.30	-11.16	44.00	Avg	V	250	284	54.00	-10.00	Pass
9847.73	50.29	2.71	-7.95	45.04	Pk	V	157	198	74.00	-28.96	Pass
9847.73	51.65	2.71	-7.95	46.40	Avg	V	157	198	54.00	-7.60	Pass
12309.02	55.09	3.01	-10.92	47.18	Pk	V	107	202	74.00	-26.83	Pass
12309.02	56.47	3.01	-10.92	48.55	Avg	V	107	202	54.00	-5.45	Pass
14770.28	52.80	3.39	-7.64	48.55	Pk	V	221	16	74.00	-25.45	Pass
14770.28	54.60	3.39	-7.64	50.35	Avg	V	221	16	54.00	-3.65	Pass

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

SOP 1 Radiated Emissions

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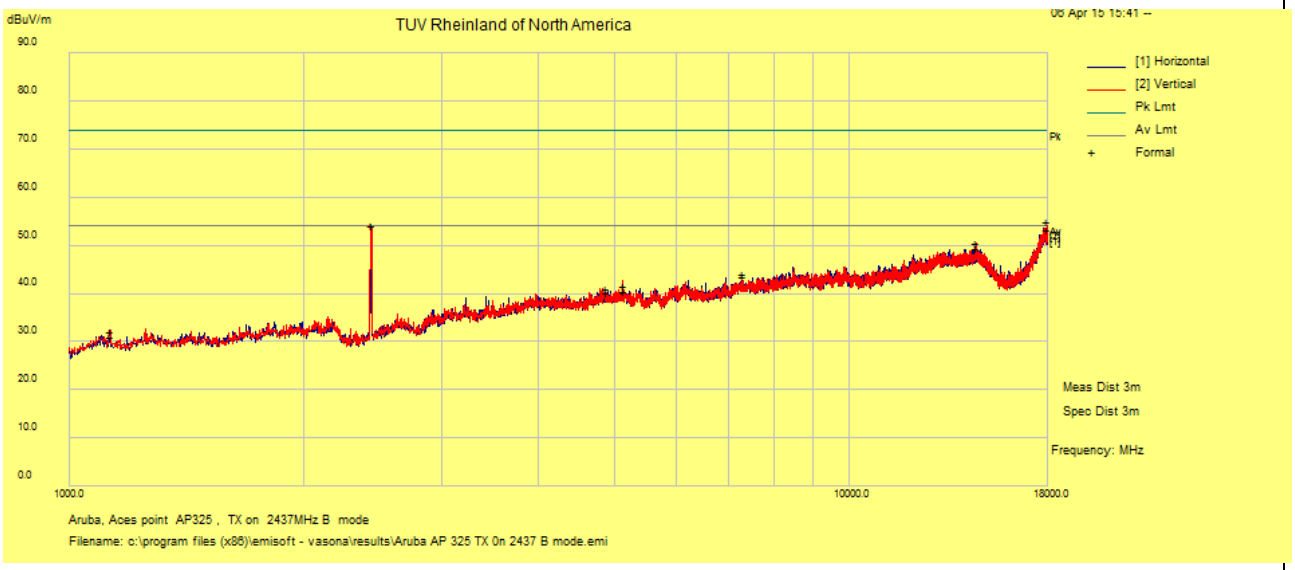
EUT Name	Wireless Access Point	**Date**	April 15, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 28%rh
EUT Serial	DD0000409, with Internal antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b at 1Mbps/ chain	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m – JB3	**Performed by**	Suresh

1 to 18 GHz Plots for Transmit b Mode at 2437 MHz



Notes: FCC Class B Limit. Add more plots

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EUT Name	Wireless Access Point	**Date**	April 15, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000409, with Internal antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 g at 6.0Mbps	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 to 18 GHz Transmitted at 802.11g mode 6Mbps/chain TX On 2412MHz

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	
3198.35	55.98	1.44	-19.27	38.15	Avg	H	126	106	54.00	-15.85	Pass
1500.53	56.92	0.95	-24.92	32.95	Avg	V	219	302	54.00	-21.05	Pass
1834.28	56.91	1.06	-23.49	34.49	Avg	V	200	197	54.00	-19.51	Pass
4871.32	54.31	1.88	-15.87	40.32	Avg	V	107	79	74.00	-33.68	Pass
13781.39	54.64	3.15	-8.82	48.97	Avg	V	225	355	54.00	-5.04	Pass
7310.15	51.54	2.30	-11.38	42.47	Avg	V	139	10	54.00	-2.46	Pass
1 to 18 GHz Transmitted at 802.11g mode 6Mbps/chain TX On 2437 MHz											
3198.48	41.57	1.44	-19.3	23.73	Avg	H	131	68	54	-30.27	Pass
13968.97	40.12	3.14	-8.56	34.7	Avg	H	101	44	54	-19.3	Pass
1593.012	42.36	0.98	-25.1	18.26	Avg	V	161	202	54	-35.74	Pass
4873.36	40.08	1.88	-15.9	26.09	Avg	V	122	128	54	-27.91	Pass
5989.612	41.4	2.07	-15.2	28.23	Avg	V	180	322	54	-25.77	Pass
7312.59	38.82	2.29	-11.4	29.74	Avg	V	169	154	54	-24.26	Pass
1 to 18 GHz Transmitted at 802.11g mode 6Mbps/chain TX On 2462 MHz											
2425.50	41.38	1.25	-21.83	20.81	Avg	H	174	222	65.20	-44.39	Pass
6906.77	47.80	2.16	-13.10	36.85	Avg	H	163	92	65.20	-28.35	Pass
2480.31	41.56	1.27	-21.86	20.97	Avg	V	150	320	65.20	-44.23	Pass
4924.68	41.95	1.24	-21.94	21.25	Avg	V	107	180	65.20	-43.95	Pass
7388.88	41.35	2.79	-8.71	35.43	Avg	V	139	50	65.20	-29.77	Pass

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

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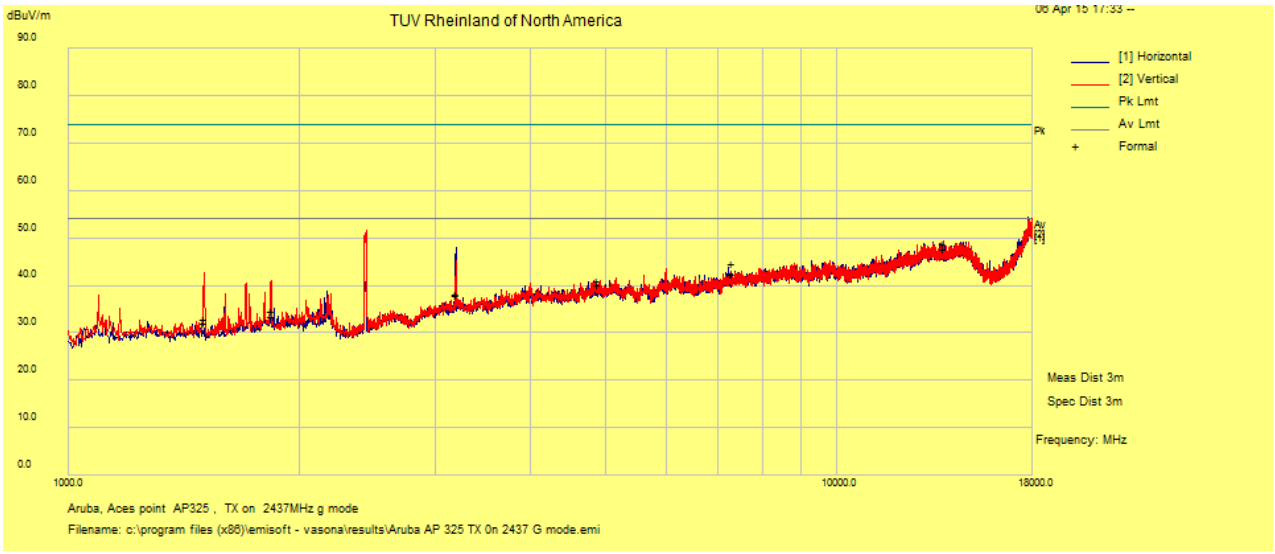
EUT Name	Wireless Access Point	**Date**	April 15, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000409, with Internal antennas	**Temp / Hum out**	N/A
EUT Config.	x-Axis, 802.11g at 6Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh

1 to 18 GHz Plots for Transmit Mode g at 2437MHz



Notes: Mid Channel plot is placed here. Mid channel was worst case Low, Mid and high channels were investigated.

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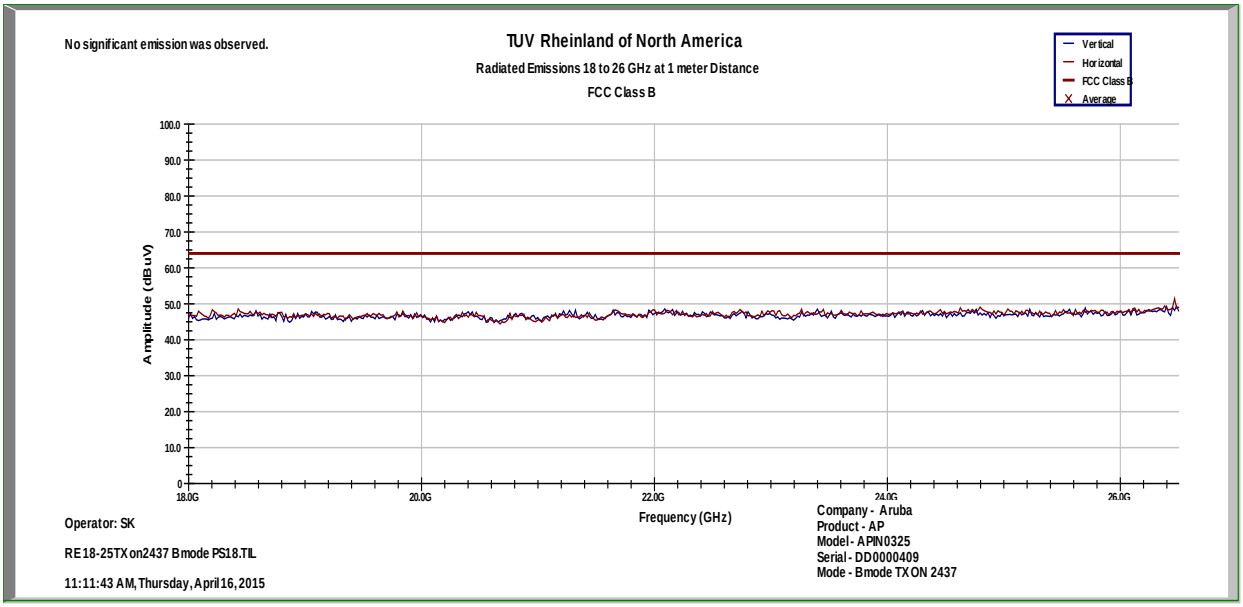
EUT Name	Wireless Access Point	**Date**	April 16, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000409, with Internal antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b mode	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	1m - RA42-K-F-4B-C	**Performed by**	Suresh

18 -26GHz Plots for Transmit b Mode at 2437 MHz



Notes: Limit was extrapolated to 1m distance for 18GHz – 26 GHz range. Mid channel was worst case Low, Mid and high channels were investigated.

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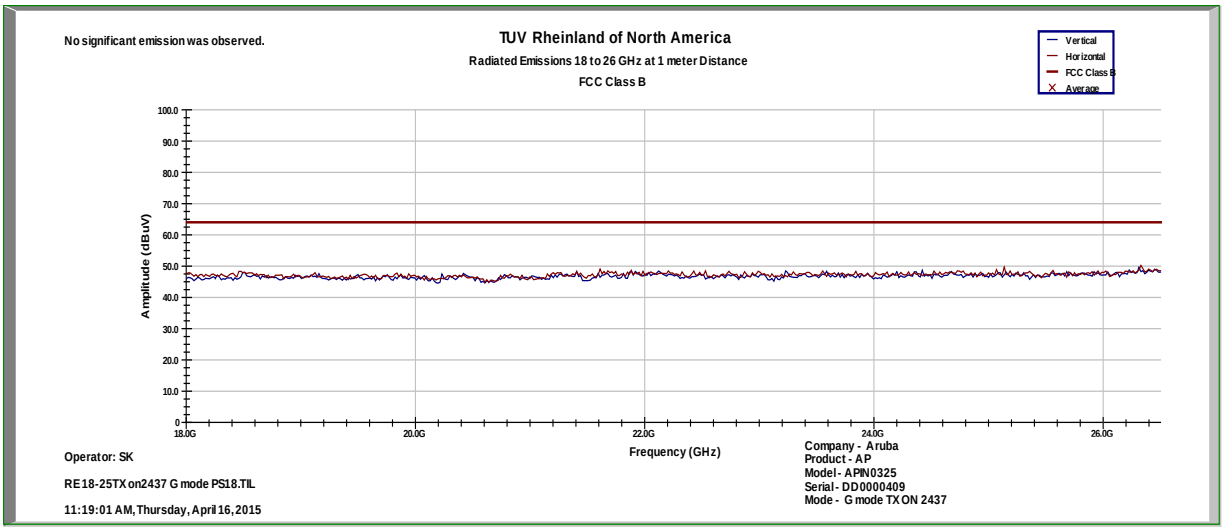
EUT Name	Wireless Access Point	**Date**	April 16, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000409, with Internal antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11g at 6 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

18-26GHz Plots for Transmit Mode g at 2437 MHz



Notes: Limit was extrapolated to 1m distance for 18GHz – 26 GHz range. Mid channel was worst case Low, Mid and high channels were investigated.

Note2: Preliminary investigation of spurious emissions in HT20 and HT40 modes were higher with higher gain external Antennas. Please note that only limited number of external antenna plots and results are paced in the report.

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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510, with External antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b mode at 1.0 Mbps/ chain	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

30 MHz 1 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On, 2437MHz

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	
141.19	54.49	3.35	-19.20	38.64	QP	H	252	304	43.50	-4.86	Pass
42.93	52.57	2.72	-20.18	35.11	QP	V	100	74	40.00	-4.89	Pass
77.20	56.70	2.98	-24.34	35.34	QP	V	121	86	40.00	-4.66	Pass
104.75	54.45	3.16	-20.84	36.77	QP	V	125	16	43.50	-6.74	Pass
231.83	57.96	3.77	-20.72	41.01	QP	V	172	8	46.00	-4.99	Pass
34.65	43.47	2.64	-13.9	32.19	QP	V	102	158	40	-7.81	Pass
30 MHz 1 GHz Transmitted at 802.11g MHz 6Mbps/chain TX On 2437MHz											
195.89	54.46	3.61	-19.62	38.45	QP	H	118	270	43.50	-5.05	Pass
248.11	52.60	3.83	-20.39	36.05	QP	H	100	100	46.00	-9.96	Pass
278.49	43.42	3.95	-18.86	28.52	QP	H	122	356	46.00	-17.48	Pass
33.12	37.42	2.62	-12.68	27.37	QP	V	112	12	40.00	-12.63	Pass
531.32	39.04	4.78	-14.19	29.63	QP	V	103	8	46.00	-16.37	Pass

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp
Mid channel was worst case Low, Mid and High channels were investigated.

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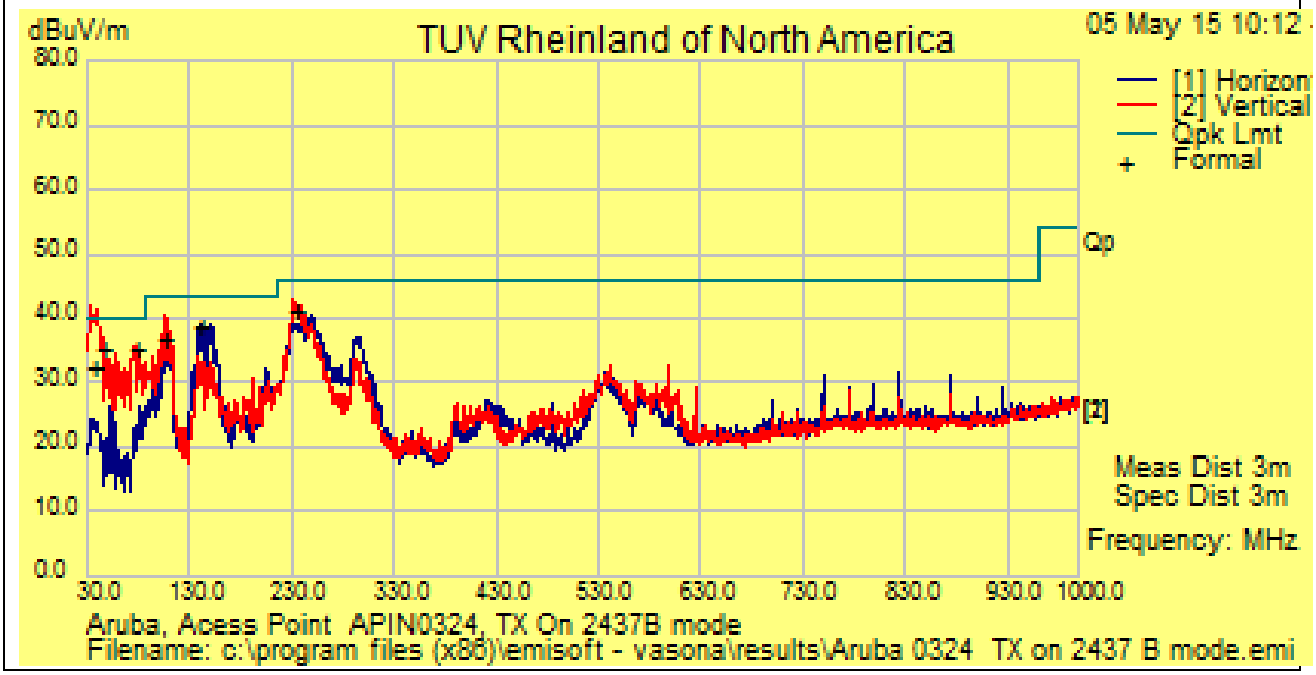
EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 28%rh
EUT Serial	DD0000510, with External Antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b at 1Mbps/ chain	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m – JB3	**Performed by**	Suresh

30MHz to 1 GHz Plot for Transmit b Mode at 2437 MHz



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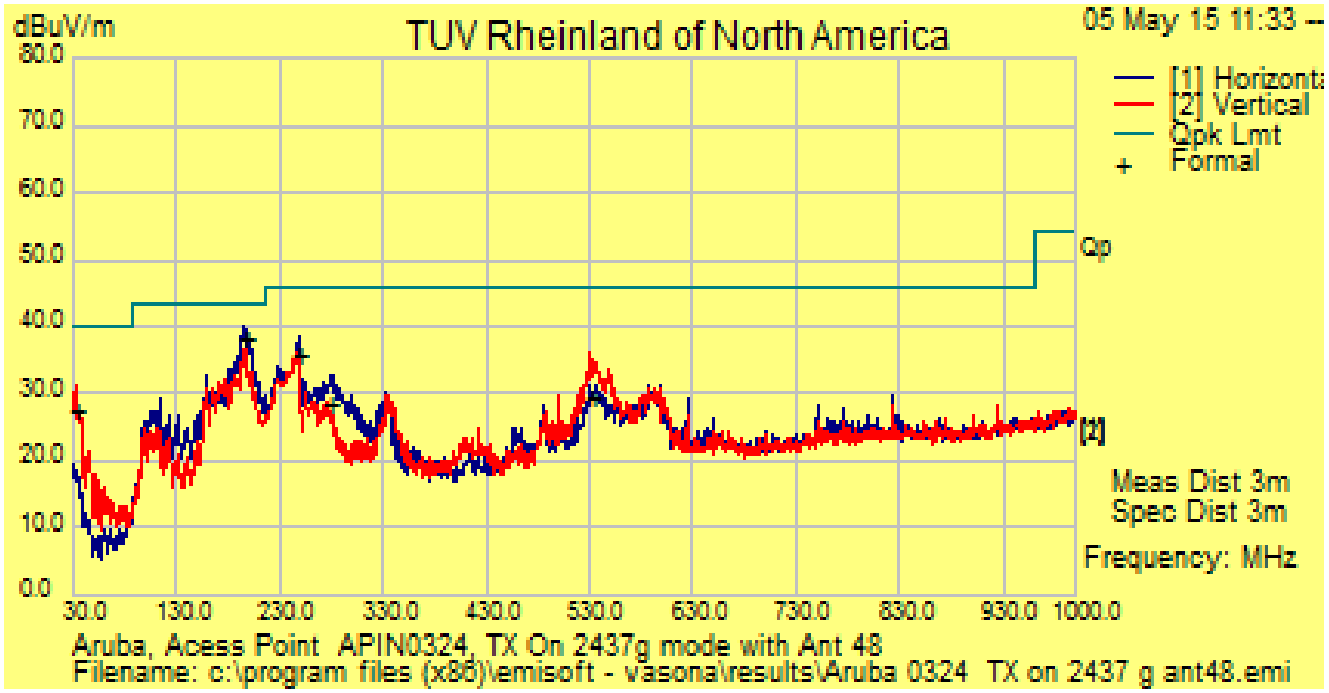
EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 28%rh
EUT Serial	DD0000510, with External antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11g at 1Mbps/ chain	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m – JB3	**Performed by**	Suresh

30MHz to 1 GHz Plot for Transmit g Mode at 2437 MHz



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EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510, with External antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b mode at 1.0 Mbps/ chain	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

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	
1 to 18 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2412-MHz											
3199.22	41.59	1.44	-19.27	23.76	Avg	H	116	288	54.00	-30.24	Pass
1599.66	48.03	0.98	-25.08	23.93	Avg	V	153	134	54.00	-30.07	Pass
1859.70	42.19	1.07	-23.39	19.88	Avg	V	145	186	54.00	-34.12	Pass
2152.90	43.13	1.16	-22.64	21.66	Avg	V	142	222	54.00	-32.34	Pass
3188.10	42.72	1.44	-19.29	24.87	Avg	V	164	172	54.00	-29.13	Pass
4823.83	46.19	1.89	-16.08	32.00	Avg	V	101	264	54.00	-22.00	Pass
7235.25	45.22	2.28	-11.59	35.91	Avg	V	169	124	54.00	-18.09	Pass
1 to 18 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2437MHz											
2051.69	44.97	1.13	-22.99	23.11	Avg	H	131	364	54.00	-30.89	Pass
4824.07	49.02	1.89	-16.08	34.83	Avg	H	201	339	54.00	-19.17	Pass
14609.79	38.53	3.44	-7.28	34.69	Avg	H	165	330	54.00	-19.31	Pass
1857.13	64.77	1.07	-23.41	42.43	Avg	V	112	80	54.00	-11.57	Pass
2051.69	44.97	1.13	-22.99	23.11	Avg	H	131	364	54.00	-30.89	Pass
1 to 18 GHz Transmitted at 802.11b MHz 1Mbps/chain TX On 2462MHz											
2198.69	43.81	1.17	-22.69	22.28	Avg	H	150	-8	54.00	-31.72	Pass
4873.51	40.03	1.88	-15.88	26.04	Avg	V	115	-8	54.00	-27.96	Pass
7386.75	39.12	2.30	-11.37	30.04	Avg	V	119	169	54.00	-23.96	Pass

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty

Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Tests were performed with Highest gain External antenna

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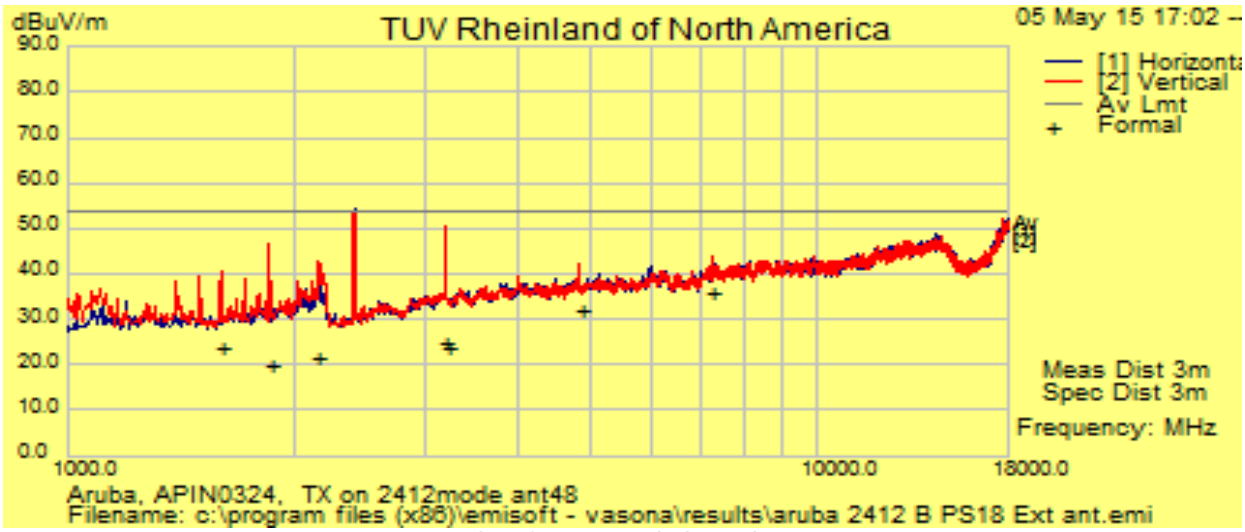
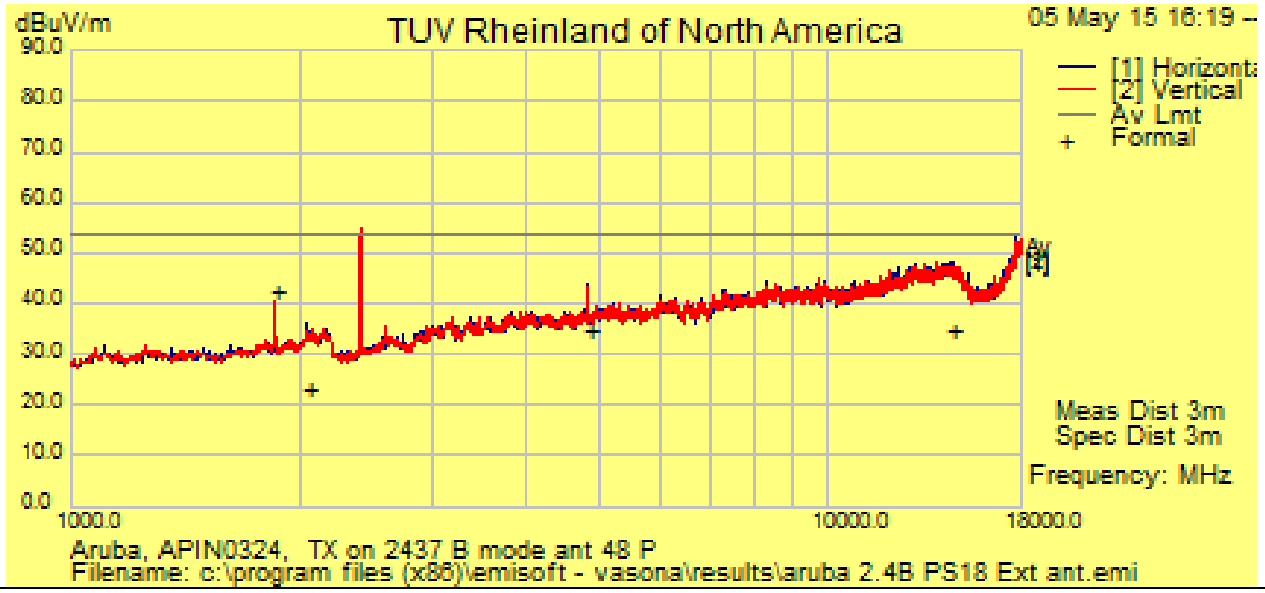
EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 28%rh
EUT Serial	DD0000510, with External antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b at 1Mbps/ chain	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m – JB3	**Performed by**	Suresh

1 to 18 GHz Plots for Transmit b Mode at 2412 MHz



1 to 18 GHz Plots for Transmit b Mode at 2437 MHz



Notes: FCC Class B Limit.

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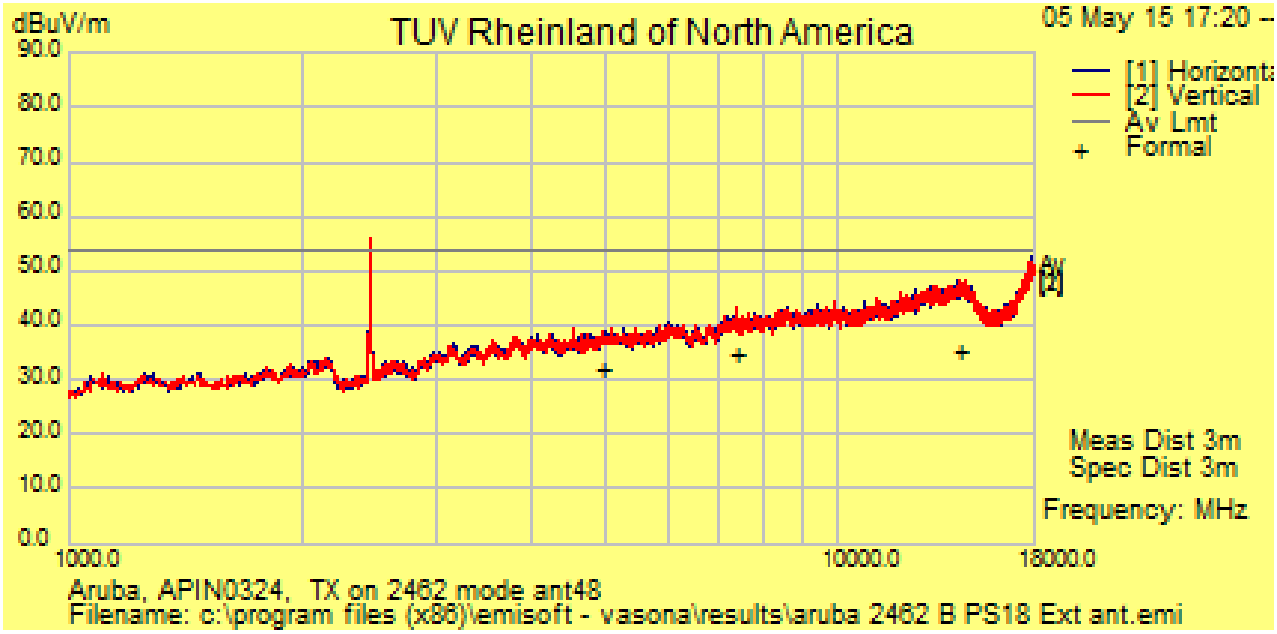
EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 28%rh
EUT Serial	DD0000510, with External antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11b at 1Mbps/ chain	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m – JB3	**Performed by**	Suresh

1 to 18 GHz Plots for Transmit b Mode at 2462 MHz



Notes: FCC Class B Limit.

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EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000510, with External antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 g at 6.0Mbps	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 to 18 GHz Transmitted at 802.11g mode 6Mbps/chain TX On 2437MHz

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	
3198.48	41.57	1.44	-19.3	23.73	Avg	H	131	68	54	-30.27	Pass
13968.97	40.12	3.14	-8.56	34.7	Avg	H	101	44	54	-19.30	Pass
1593.012	42.36	0.98	-25.1	18.26	Avg	V	161	202	54	-35.74	Pass
4873.36	40.08	1.88	-15.9	26.09	Avg	V	122	128	54	-27.91	Pass
5989.61	41.4	2.07	-15.2	28.23	Avg	V	180	322	54	-25.77	Pass
7312.59	38.82	2.29	-11.4	29.74	Avg	V	169	154	54	-24.26	Pass

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

Mid channel was worst case with max TX power. Low, mid and High channels were investigated

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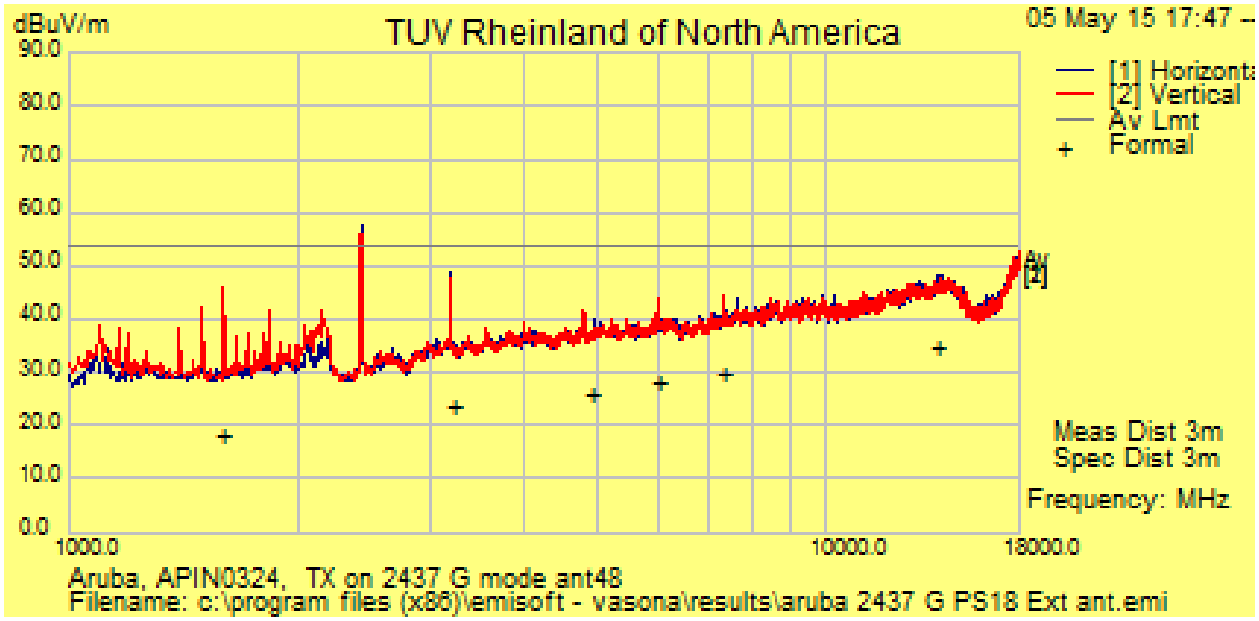
EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000510, with External antennas	**Temp / Hum out**	N/A
EUT Config.	x-Axis, 802.11g at 6Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh

1 to 18 GHz Plots for Transmit Mode g at 2437MHz



Notes: Mid channel was worst case with max TX power Low, Mid and High channel were investigated

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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510 with External antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802. HT20 mode	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

30 MHz 1 GHz Transmitted at 802.11 HT20 MHz 6.5Mbps/chain TX On 2437 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	
43.80	54.51	2.72	-20.97	36.27	QP	V	103	9	40.00	-3.74	Pass
47.80	54.66	2.76	-23.12	34.30	QP	V	107	-8	40.00	-5.70	Pass
60.03	53.15	2.85	-25.14	30.87	QP	V	100	317	40.00	-9.13	Pass
68.94	50.99	2.92	-24.49	29.41	QP	V	125	66	40.00	-10.59	Pass
240.02	45.67	3.81	-20.69	28.79	QP	V	252	158	46.00	-17.22	Pass
420.06	29.06	4.45	-16.20	17.32	QP	V	100	277	46.00	-28.68	Pass
Above 1 GHz Transmitted at 802.11 HT20 MHz 6.5Mbps/chain TX On 2437 MHz											
2198.69	43.81	1.17	-22.69	22.28	Avg	H	150	-8	54.00	-31.72	Pass
4873.51	40.03	1.88	-15.88	26.04	Avg	V	115	-8	54.00	-27.96	Pass
7310.75	39.12	2.30	-11.37	30.04	Avg	V	119	169	54.00	-23.96	Pass
4778.76	40.71	1.87	-16.00	26.58	Avg	H	101	23	54.00	-27.42	Pass
4872.22	40.50	1.88	-15.88	26.51	Avg	H	188	-8	54.00	-27.49	Pass
3188.05	41.98	1.44	-19.29	24.12	Avg	V	121	368	54.00	-29.88	Pass
7309.74	43.39	2.30	-11.38	34.31	Avg	V	141	123	54.00	-19.69	Pass

Note: Mid channel was worst case with max TX power Low, Mid and High channel were investigated

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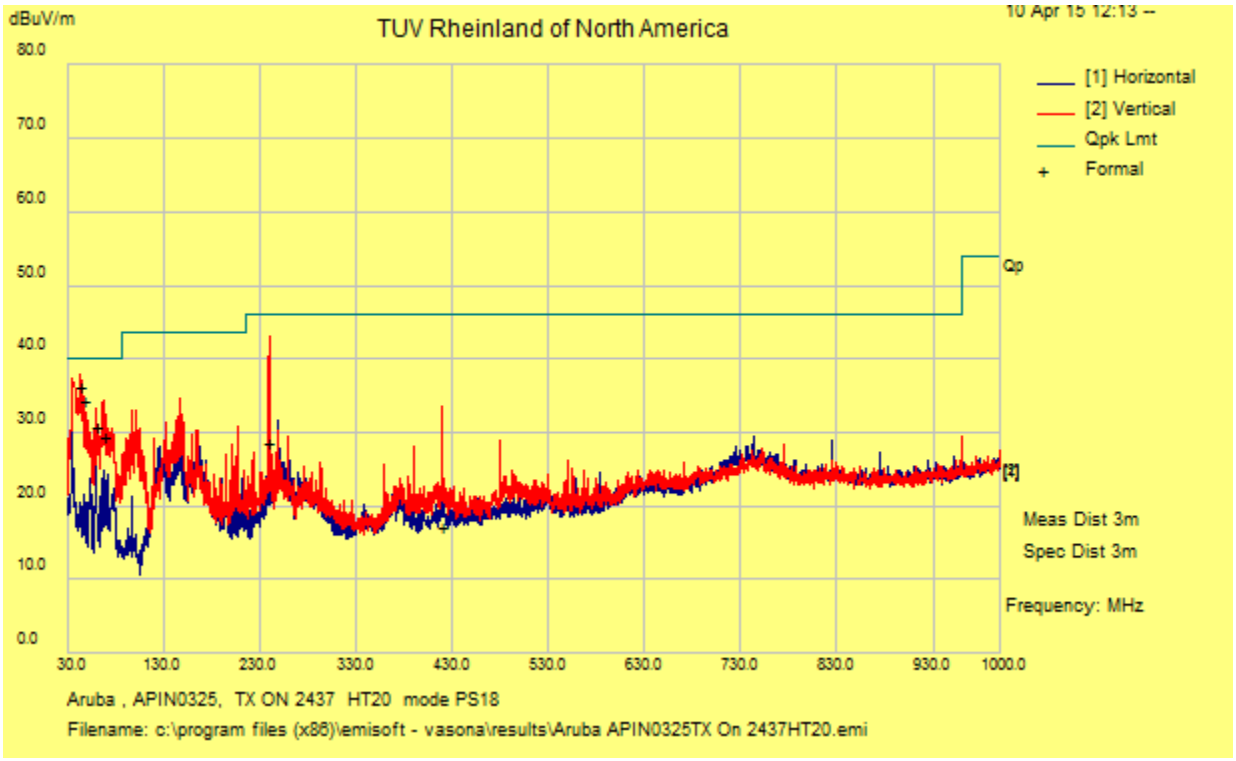
EUT Name	Wireless Access Point	**Date**	April 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000510 External antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n HT20 at 6.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	1m - RA42-K-F-4B-C	**Performed by**	Suresh K

30 MHz to 1GHz Plots for Transmit Mode HT 20 at 2437MHz



Notes: Mid channel was worst case with max TX power Low, Mid and High channel were investigated

SOP 1 Radiated Emissions

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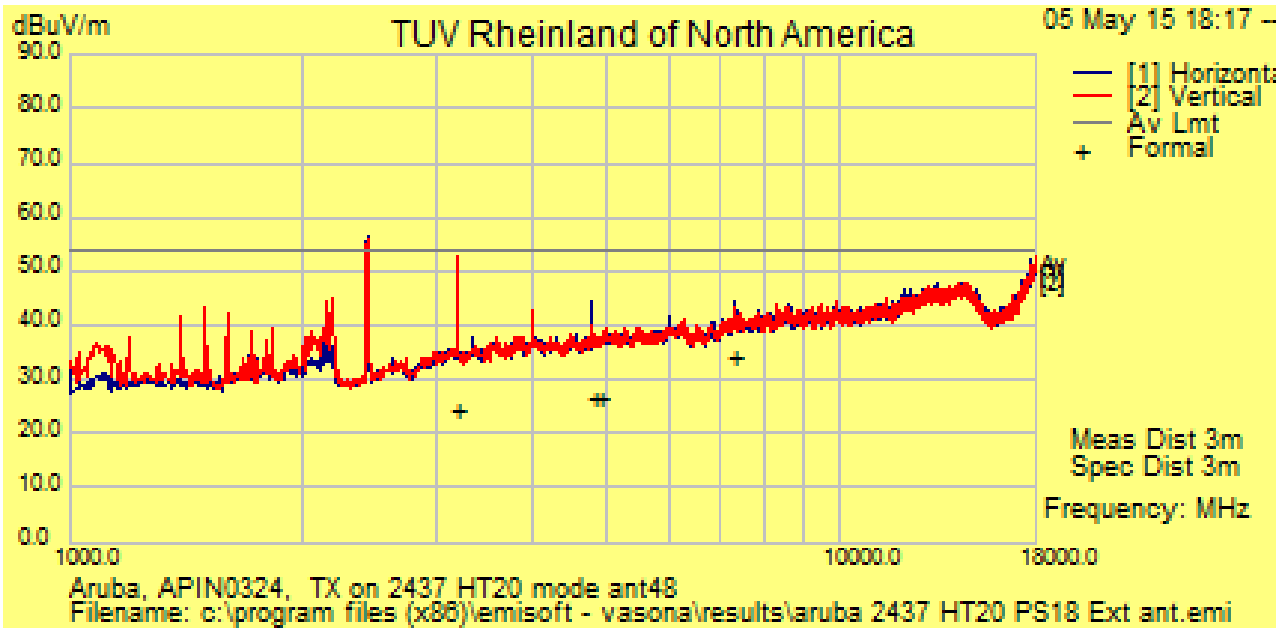
EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000510 External antenna	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 802.11n HT20 at 6.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	

Above 1GHz Plots for Transmit Mode HT20 at 2437 MHz



Notes: Evaluation was performed on three channels 2412, 2437 and 2462MHz. Limited number plots are placed in the report.

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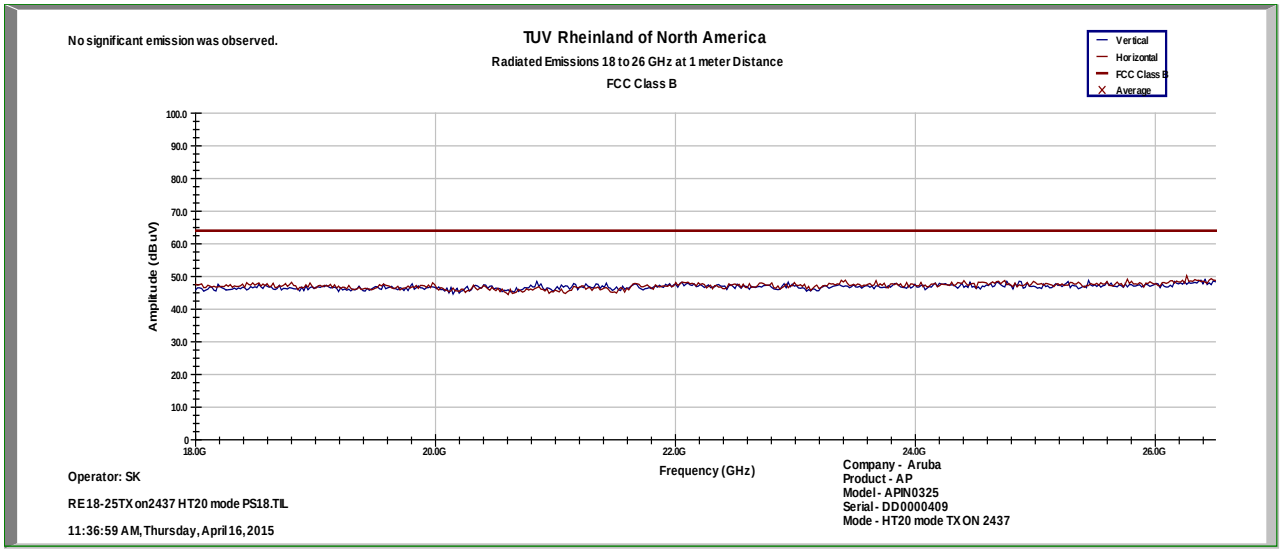
EUT Name	Wireless Access Point	**Date**	April 16, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000510 External antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n HT20 at 6.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	1m - RA42-K-F-4B-C	**Performed by**	Suresh K

18 to 26 GHz Plots for Transmit Mode HT20 at 2437 MHz



Notes: Limit was extrapolated to 1m distance for 18GHz – 26 GHz range. Mid channel was worst case Low, Mid and high channels were investigated.

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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000501 External antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802. HT40 mode	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

30 MHz 1 GHz Transmitted at 802.11 HT40 MHz 13.5Mbps/chain TX On 2422, 2437 and 2452MHz

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	
480.03	24.72	4.63	-14.93	14.42	QP	H	135	72	46.00	-31.58	Pass
43.82	53.85	2.72	-20.98	35.59	QP	V	103	234	40.00	-4.41	Pass
47.78	54.49	2.76	-23.11	34.14	QP	V	126	136	40.00	-5.86	Pass
66.24	52.71	2.90	-24.69	30.92	QP	V	185	139	40.00	-9.08	Pass
101.88	51.10	3.14	-21.83	32.41	QP	V	105	98	43.50	-11.09	Pass
240.02	35.22	3.81	-20.69	18.34	QP	V	128	203	46.00	-27.67	Pass
1 to 18GHz Transmitted at 802.11 HT40 MHz 13.5Mbps/chain TX On 2422, 2437 and 2452MHz											
2198.69	43.81	1.17	-22.69	22.28	Avg	H	150	-8	54.00	-31.72	Pass
4873.51	40.03	1.88	-15.88	26.04	Avg	V	115	-8	54.00	-27.96	Pass
7310.75	39.12	2.30	-11.37	30.04	Avg	V	119	169	54.00	-23.96	Pass

Mid channel was worst case Low, Mid and high channels were investigated.

SOP 1 Radiated Emissions

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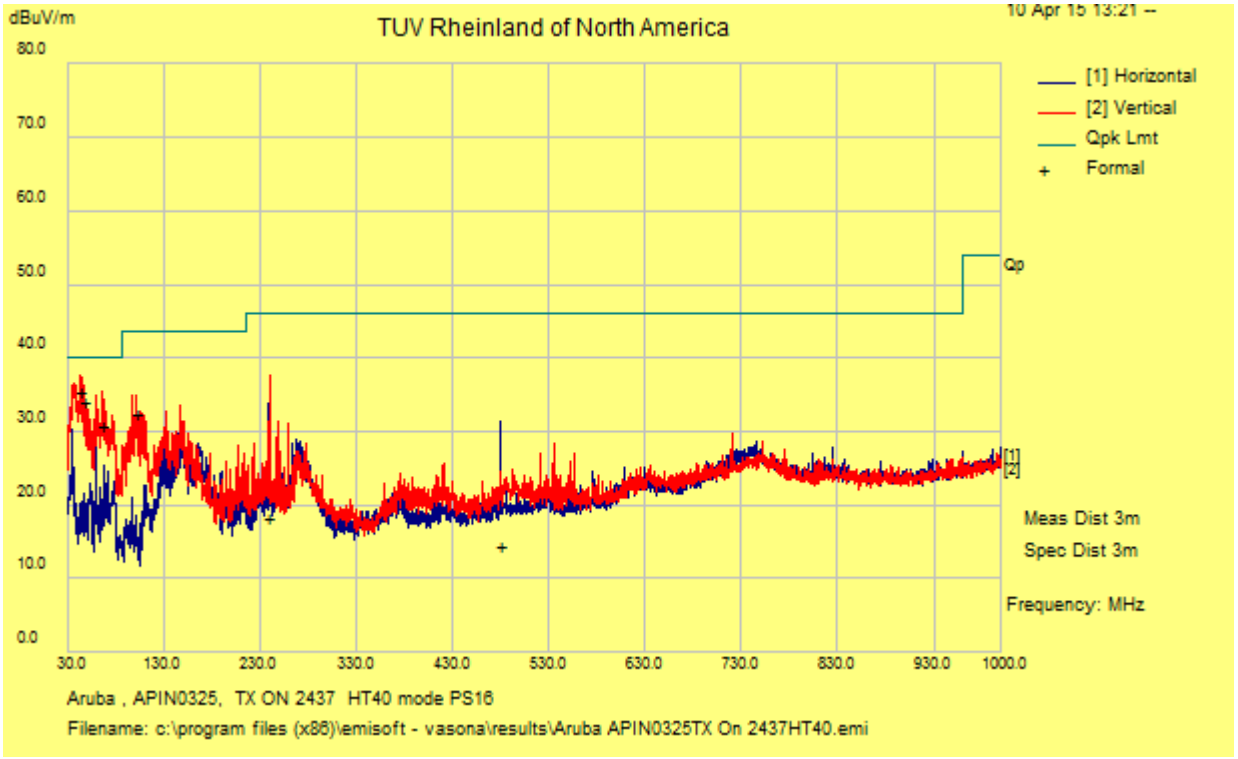
EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000501 External antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT40 at 13.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

30 MHz to 1GHz Plots for Transmit Mode at 2437 MHz



Notes: Mid channel was worst case Low, Mid and high channels were investigated.

SOP 1 Radiated Emissions

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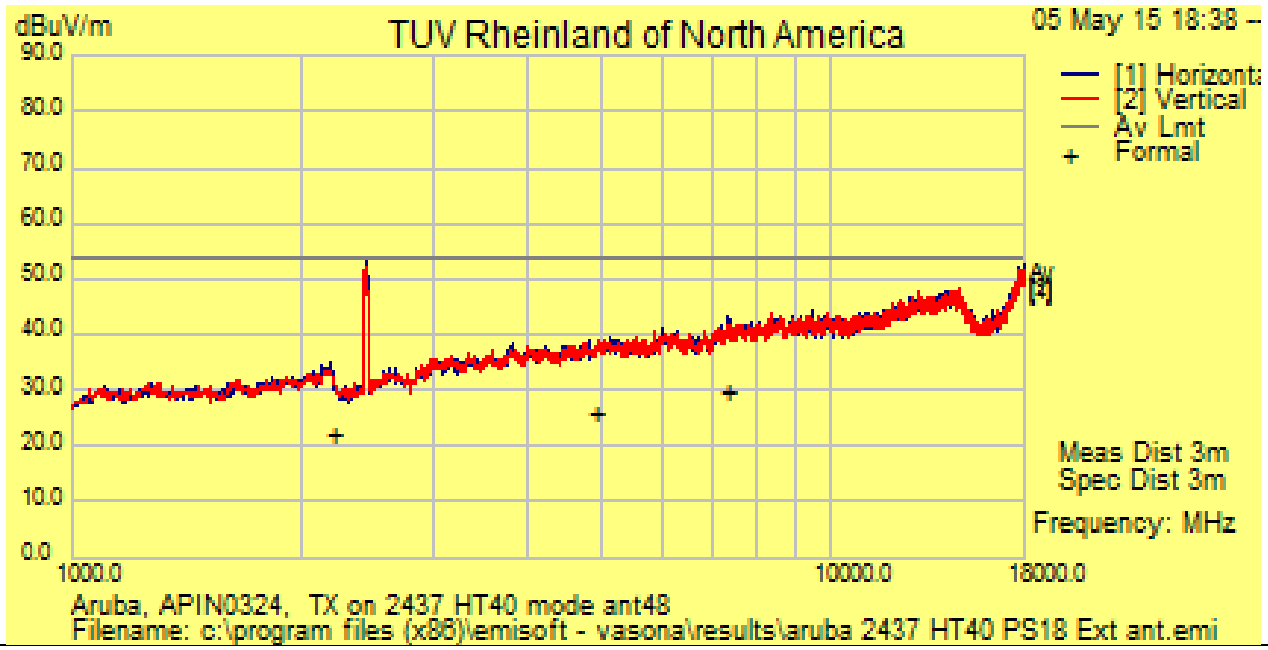
EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000510 External Antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT40 at 13.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	1m - RA42-K-F-4B-C	**Performed by**	Suresh K

Above 1GHz Plots for Transmit Mode at 2437MHz



Notes: Limit was extrapolated to 1m distance for 18GHz – 26 GHz range. Mid channel was worst case Low, Mid and high channels were investigated.

SOP 1 Radiated Emissions

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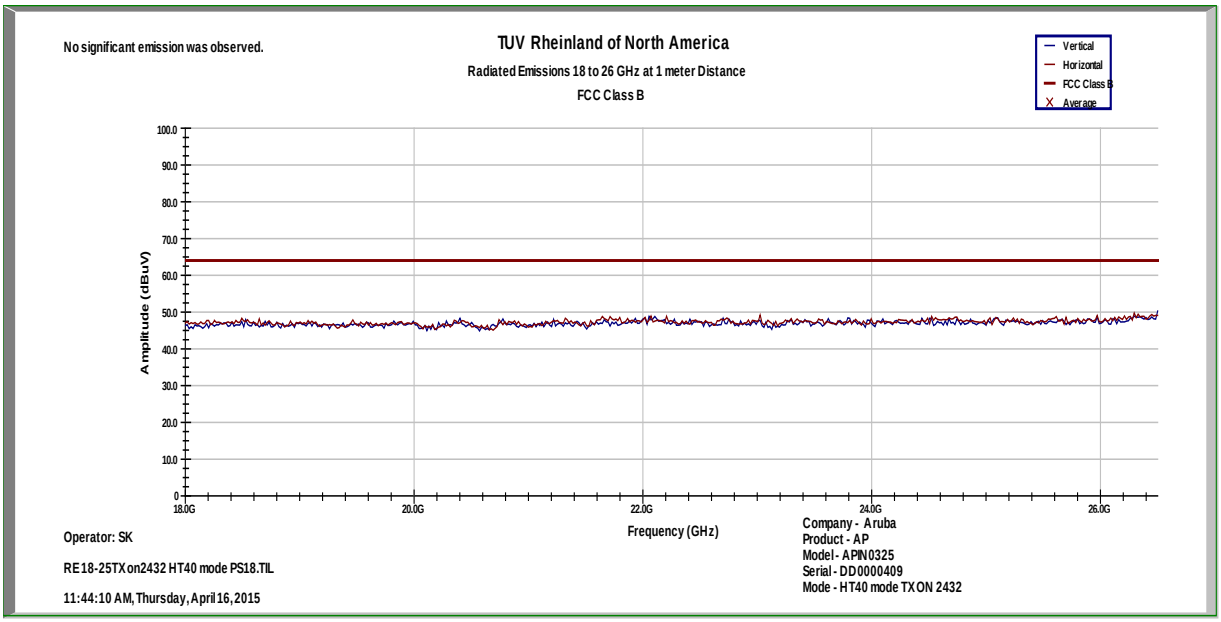
EUT Name	Wireless Access Point	**Date**	April 16, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000510 External antenna	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 802.11 HT40 at 13.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

18 to 26 GHz Plots for Transmit Mode HT40 at 2432 MHz



Notes: Limit was extrapolated to 1m distance for 18GHz – 26 GHz range.
1GHz – 26 GHz Setting: RBW = 1 MHz/ VBW = 3MHz Notes. Mid channel was worst case Low, Mid and high channels were investigated.

SOP 1 Radiated Emissions

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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000501 External antenna ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 b mode	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

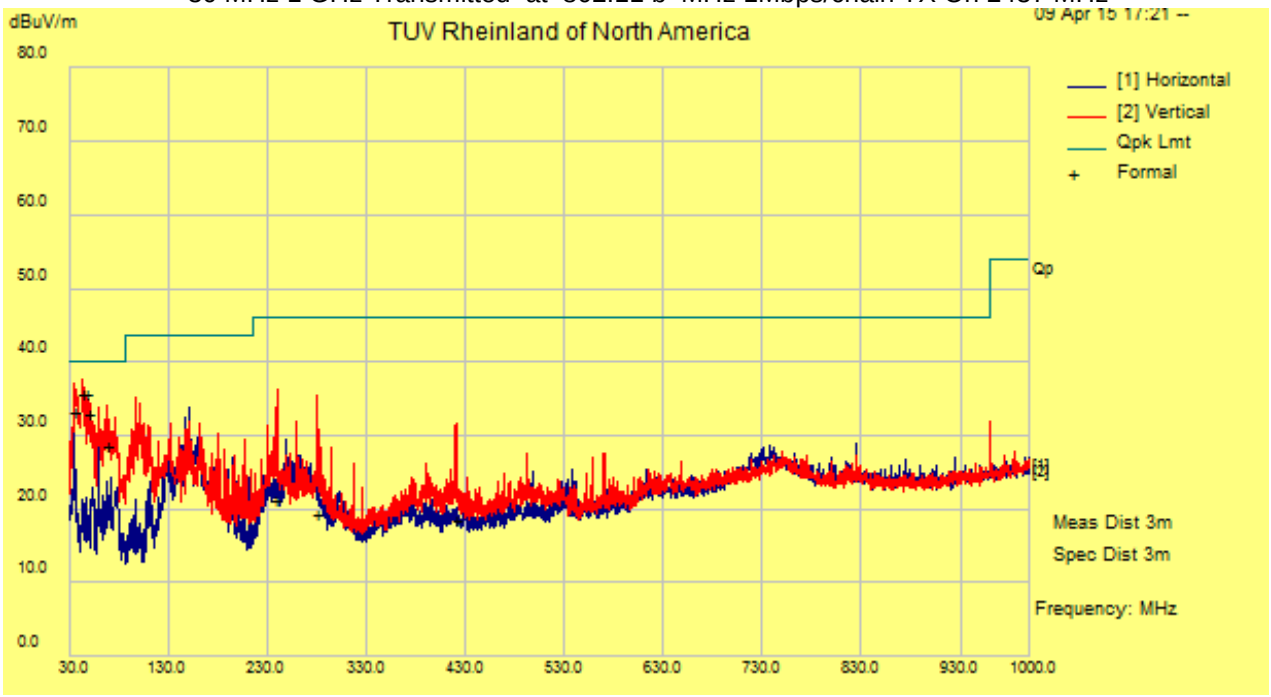
30 MHz 1 GHz Transmitted at 802.11 b MHz 1Mbps/chain TX On 2437 MHz

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	
36.09	46.04	2.66	-15.46	33.24	QP	V	134	6	40.00	-6.76	Pass
49.43	54.61	2.78	-24.24	33.15	QP	V	117	356	40.00	-6.85	Pass
248.96	33.67	3.84	-20.39	17.11	QP	V	123	-2	46.00	-28.89	Pass
239.02	38.18	3.81	-20.69	21.30	QP	V	157	-9	46.00	-24.70	Pass
420.12	30.25	4.45	-16.12	18.59	QP	V	121	229	46.00	-27.41	Pass

Notes. Mid channel was worst case Low, Mid and high channels were investigated.

SOP 1 Radiated Emissions		Tracking # 31560844.001 Page 27 of 29	
EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000501 External antenna ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 b mode	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

30 MHz 1 GHz Transmitted at 802.11 b MHz 1Mbps/chain TX On 2437 MHz



Notes. Mid channel was worst case Low, Mid and high channels were investigated.

SOP 1 Radiated Emissions

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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000501 External antenna ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 b mode	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

1 MHz 18GHz Transmitted at 802.11 b MHz 1Mbps/chain TX On 2437 MHz

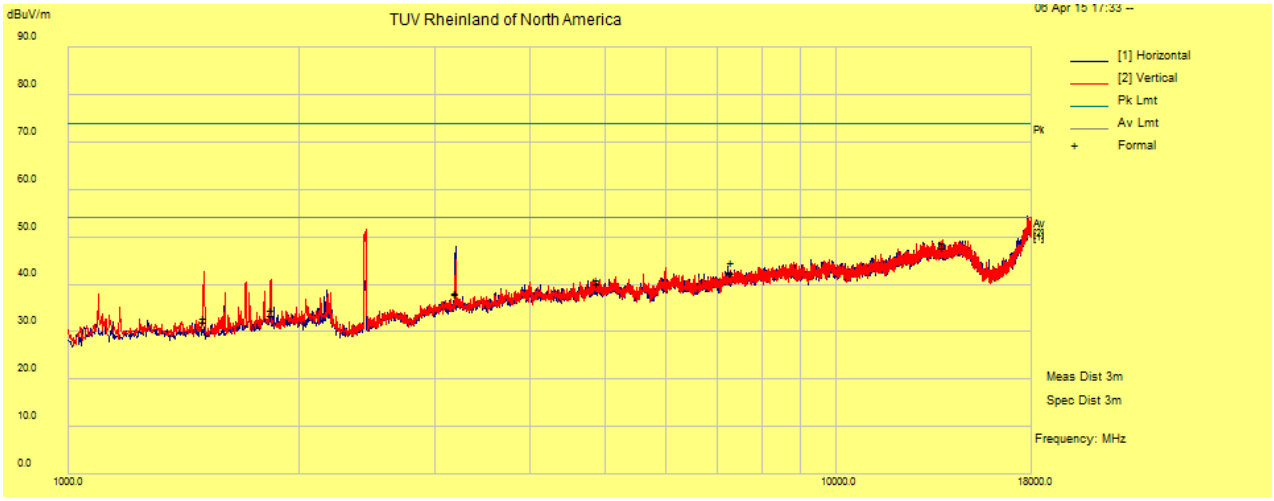
Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
1120.53	55.63	0.82	-25.39	31.06	Avg	V	133	193	54.00	-22.94	Pass
4870.77	55.89	1.88	-15.88	41.90	Avg	V	128	152	54.00	-12.10	Pass
7311.38	52.05	2.30	-11.37	41.97	Avg	V	125	187	54.00	-11.03	Pass
14558.91	54.49	3.42	-7.37	50.54	Avg	V	155	143	54.00	-3.47	Pass

Notes. Mid channel was worst case Low, Mid and high channels were investigated.

For Ant 19, spurious Emissions on g, HT20 and HT40 modes were investigated only worst case of b mode are placed in the report.

SOP 1 Radiated Emissions		Tracking # 31560844.001 Page 29 of 29	
EUT Name	Wireless Access Point	**Date**	May 05, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23°C / 33%rh
EUT Serial	DD0000510, with External antenna 19	**Temp / Hum out**	N/A
EUT Config.	x-Axis, 802.11b at 1Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh

1 to 18 GHz Plots for Transmit Mode b at 2437MHz



Notes: Mid channel was worst case with max TX power Low, Mid and High channel were investigated. Spurious emissions with ANT-19, frequency range 1 to 26GHz for g, HT20 and HT 40 modes were investigated were found be less than results presented above.

4.5.4 Sample Calculation

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) = FIM - AMP + CBL + ACF

Where: FIM = Field Intensity Meter (dBµV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

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

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: 2014 and RSS 247: 2015.

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 either performed in Lab 2. 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).

Table 8: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at Normal Conditions only		
Antenna Type: Attached	**Power Level:** See Test Plan	
AC Power: 120 Vac/60 Hz	**Configuration:** Tabletop	
Ambient Temperature: 22° C	**Relative Humidity:** 37% 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 # 31560844.001 Page 1 of 4

EUT Name	Wireless Access Point	**Date**	April 20, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 34% rh
EUT Serial	DD0000501	**Temp / Hum out**	N/A
EUT Config.	External Antenna TX ON 2437MHz HT20	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #2 /Com-Power, Line 1	**Performed by**	Suresh K

Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB	
0.15	33.56	9.96	-0.10	43.42	QP	Live	66.00	-22.58	Pass
0.15	18.45	9.96	-0.10	28.31	Avg	Live	56.00	-27.69	Pass
0.16	34.04	9.96	-0.10	43.90	QP	Live	66.00	-22.10	Pass
0.16	14.82	9.96	-0.10	24.68	Avg	Live	56.00	-31.32	Pass
0.19	43.13	9.96	-0.08	53.02	QP	Live	63.83	-10.81	Pass
0.19	26.02	9.96	-0.08	35.91	Avg	Live	53.83	-17.93	Pass
0.26	35.90	9.98	-0.06	45.82	QP	Live	61.44	-15.63	Pass
0.26	24.84	9.98	-0.06	34.76	Avg	Live	51.44	-16.69	Pass
0.53	25.06	9.99	-0.04	35.01	QP	Live	56.00	-20.99	Pass
0.53	14.74	9.99	-0.04	24.69	Avg	Live	46.00	-21.31	Pass
16.48	24.56	10.18	0.09	34.84	QP	Live	60.00	-25.16	Pass
16.48	18.43	10.18	0.09	28.71	Avg	Live	50.00	-21.29	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

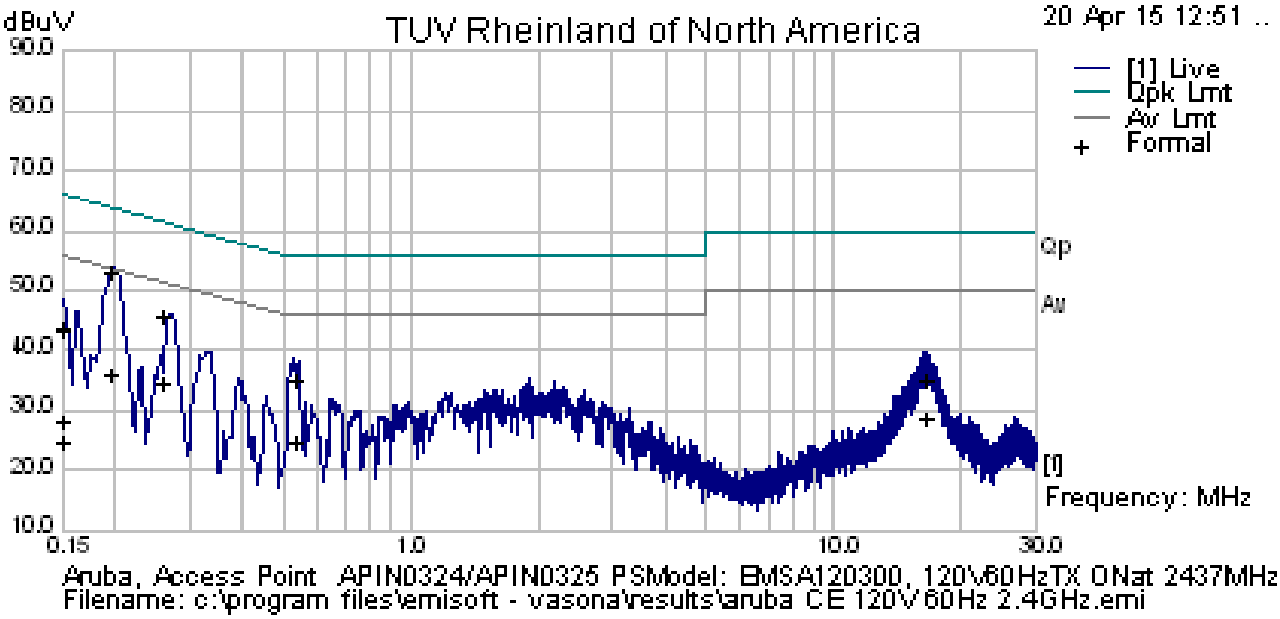
Notes: EUT was setup as table top equipment and transmitted at 5785 MHz in HT20 at 6.5Mbps

SOP 2 Conducted Emissions

Tracking # 31560844.001 Page 2 of 4

EUT Name	Wireless Access Point	**Date**	April 20, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 34% rh
EUT Serial	DD0000510	**Temp / Hum out**	N/A
EUT Config.	External Antenna TX ON 2437MHz HT20	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #2 /Com-Power, Line 1	**Performed by**	Suresh

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



Notes: Meet FCC Class B limit.

SOP 2 Conducted Emissions

Tracking # 31560844.001 Page 3 of 4

EUT Name	Wireless Access Point	**Date**	April 20, 2013
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 34% rh
EUT Serial	DD0000510	**Temp / Hum out**	N/A
EUT Config.	External Antenna TX ON 2437MHz HT20	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #2 /Com-Power, Line 2	**Performed by**	Suresh

Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB	
0.19	43.04	9.96	-0.08	52.92	QP	Neutral	63.95	-11.03	Pass
0.19	25.70	9.96	-0.08	35.58	Avg	Neutral	53.95	-18.37	Pass
0.19	43.29	9.96	-0.08	53.17	QP	Neutral	63.87	-10.70	Pass
0.19	26.77	9.96	-0.08	36.65	Avg	Neutral	53.87	-17.22	Pass
0.26	35.78	9.98	-0.06	45.70	QP	Neutral	61.51	-15.81	Pass
0.26	25.59	9.98	-0.06	35.51	Avg	Neutral	51.51	-16.00	Pass
0.34	24.37	9.98	-0.05	34.30	QP	Neutral	59.16	-24.86	Pass
0.34	3.34	9.98	-0.05	13.28	Avg	Neutral	49.16	-35.89	Pass
0.58	23.81	10.00	-0.04	33.77	QP	Neutral	56.00	-22.23	Pass
0.58	13.94	10.00	-0.04	23.90	Avg	Neutral	46.00	-22.10	Pass
16.81	29.72	10.19	0.10	40.00	QP	Neutral	60.00	-20.00	Pass
16.81	22.44	10.19	0.10	32.73	Avg	Neutral	50.00	-17.27	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

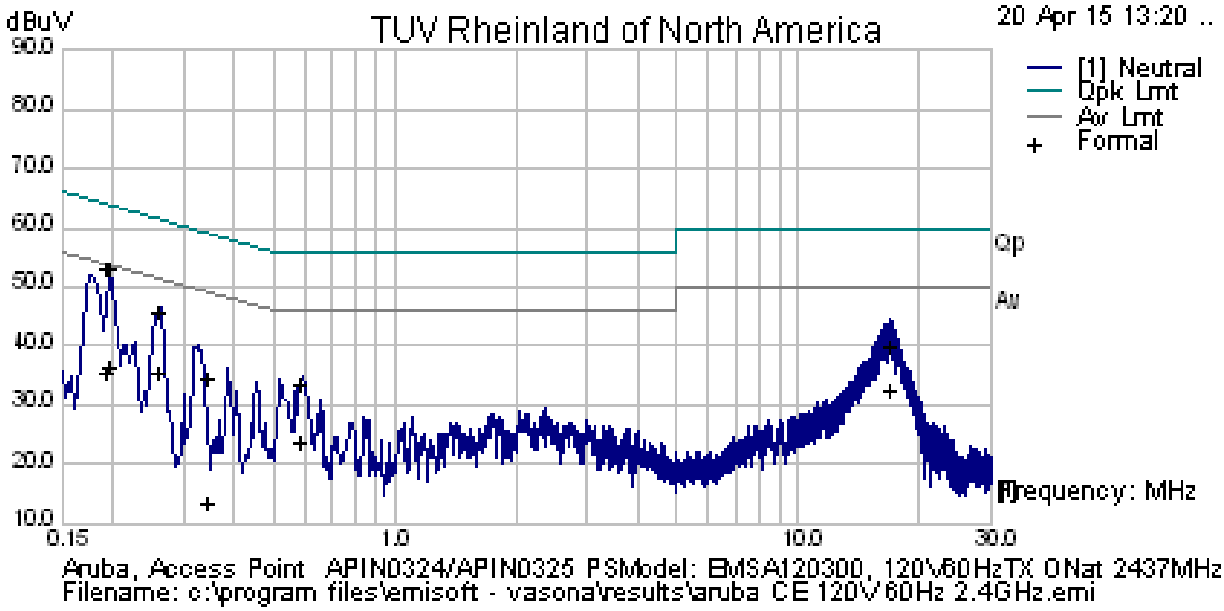
Notes: EUT was setup as table top equipment and transmitted at 2437 MHz in b mode at 1Mbps

SOP 2 Conducted Emissions

Tracking # 31560844.001 Page 4 of 4

EUT Name	Wireless Access Point	**Date**	April 20, 2013
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 34% RH
EUT Serial	DD0000510	**Temp / Hum out**	N/A
EUT Config.	External Antenna TX ON 2437MHz HT20	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #2 /Com-Power, Line 2	**Performed by**	Suresh

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



Note: Meet FCC Class B Limit.

4.7 Maximum Permissible Exposure

4.7.1 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 and RSS 102 was 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.

4.7.2 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/cm^2)	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

4.7.3 EUT Operating Condition

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

4.7.4 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**.

4.7.5 Test Results

4.7.5.1 Antenna Gain

The transmitting antenna was integrated. The directional antenna gain was +11.5dBi or 14.12 (numeric).

These calculations based 2.4GHz band power and antenna gains

4.7.5.2 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 total power is +24.39 dBm or 275mW

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

Pd = (275*14.12) / (1600π) = 0.772 mW/cm2, which is 0. 227 mW/cm2 below to the limit.

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

4.7.6 Sample Calculation

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

Where;

Pd = power density in mW/cm^2
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
Bilog Antenna	Sunol Sciences	JB3	A020502	04/30/2015	04/30/2017
Horn Antenna	EMCO	3115	9710-5301	09/04/2013	09/04/2015
Antenna (18-26GHz)	CMT	RA42-K-F-4B-C	020131-004	07/24/2014	07/24/2015
Spectrum Analyzer	Rohde & Schwarz	FSL6	100169	01/13/2015	01/13/2016
Spectrum Analyzer	Agilent	N9038A	MY51210195	01/12/2015	01/12/2016
Spectrum Analyzer	Agilent	N9030A	MY51380689	01/19/2015	01/19/2016
Spectrum Analyzer	Rohde Schwarz	ESIB	832427/002	01/13/2015	01/13/2016
Amplifier	Sonoma Instruments	310	213221	09/30/2014	09/30/2015
Amplifier	Miteq	TTA1800-30-4G	1842452	01/13/2015	01/13/2016
Amplifier	Rohde & Schwarz	TS-PR26	100011	07/24/2014	07/24/2016
Amplifier	Rohde & Schwarz	TS-PR40	100012	02/21/2015	02/21/2016
Power Meter	Agilent	E4418B	MY45103902	01/15/2015	01/15/2016
Power Sensor	Hewlett Packard	8482A	US37295801	01/15/2015	01/15/2016
Thermometer	Fluke	52II	96480032	06/28/2014	06/28/2015
Thermal Chamber	Espec	BTZ-133	0613436	03/16/2015	03/16/2016
DC Power Supply	Agilent	E3634A	MY400004331	01/12/2015	01/12/2016
Notch Filter	Micro-Tronics	BRM50716	003	01/30/2015	01/30/2016
Signal Generator	Anritsu	MG3694A	42803	01/13/2015	01/13/2016
Signal Generator	Rohde & Schwarz	SMF100A	1167.0000K02	10/14/2014	10/14/2015
Signal Generator	Rohde & Schwarz	SMBV100A	1407.6004K02	12/04/2014	12/04/2015
Power Sensors	Rohde & Schwarz	OSP120	1520.9010.02	12/19/2014	12/14/2015

* 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 9: Customer Information

Company Name	Aruba Networks
Address	1344 Crossman Ave.
City, State, Zip	Sunnyvale CA 94089
Country	USA
Phone	(408) 990-2557

Table 10: Technical Contact Information

Name	Rob Hastings
E-mail	rhastings@arubanetworks.com
Phone	(408) 990-2557

6.3 Equipment Under Test (EUT)

Table 11: EUT Specifications

EUT Specifications	
Dimensions	180mm x 180mm x 45mm (W x D x H)
AC Adapter (EMSA120300, S/N:)	Input Voltage: 100-240Vac 50-60Hz Input Current: 1A Output Voltage: 12VDC Output Current: 3.0A Power over Ethernet (PoE): 48 Vdc (nominal)
Environment	Indoor
Operating Temperature Range:	0 to 50 degrees C
Multiple Feeds:	☒ Yes and how many 4 ☐ No
Hardware Version	3
Part Number	APIN0324 & APIN0325
RF Software Version	QSPR Version 5.0.0 RF Test Image used with QSPR: ipq806xrd_2gpcie11_78hex_5gpcie_50hex.ari
802.11-radio modules	
Operating Modes	802.11a, b, g, nHT 20, HT40, VHT20, VHT40,
Transmitter Frequency Band	2.4GHz 2400-2483.5MHz 5.15 GHz to 5.25 GHz (Indoor Use) 5.25GHz to 5.35GHz 5.47GHz to 5.725GHz 5.725 GHz to 5.85 GHz
Max. Rated Power Output	See Channel Planning Table.
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	4 integrated internal Antennas and several External Antennas see attached sheet
Antenna Gain	See details below
Modulation Type	☐ AM ☐ FM ☒ DSSS ☒ OFDM ☒ Other describe: 16-QAM, 64-QAM, 128-QAM
Data Rate	802.11b: 1, 2, 5.5, 11 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54 802.11n: 6.5 to 450 (MCS0 to MCS23) 802.11ac: 6.5 to 1,733 (MCS0 to MCS9, NSS = 1 to 4)

EUT Specifications	
TX/RX Chain (s)	MIMO (4x4)
Directional Gain Type	☒ Correlated ☒ Beam-Forming ☐ Other describe:
Type of Equipment	☐ Table Top ☒ Wall-mount ☐ Floor standing cabinet ☒ Other Ceiling Mounted
Note: 1. All four chains will be on / transmitted at all time. 2.This report only documents the radio characteristics for 2400 – 2483.5MHz band	

Internal Antennas

Model:	Type	Gain dBi	Frequency MHz	Beam Forming Gain (dBi)
Metal Sheet	Omni	4	2400 - 2500	4.6
		5.5	5150 - 5875	3.5

External Antennas

Model:	Type	Gain dBi	Frequency MHz	Beam Forming Gain (dBi)
AP-ANT-1W	Omnidirectional	3.8	2400 - 2500	6
		5.8	4900 - 5875	
AP-ANT-13B	Downtilt Omni	4.4	2400 - 2500	6
		3.3	4900 - 5900	
AP-ANT-19	Dual Band Omnidirectional	3	2400 - 2500	6
		6	5150 - 5875	
AP-ANT-20W	Omnidirectional	2	2400 - 2500	6
		2	4900 - 5875	
AP-ANT-40	Downtilt Omni	3.9	2400 - 2500	3
		4.7	4900 - 5900	
AP-ANT-45	Multipolarized	5	2400 - 2500	3
		5	4900 - 6000	
AP-ANT-48	Multipolarized	8.5	2400 - 2500	3
		8.5	4900 - 6000	

Table 12: EUT Channel Power Specifications

APIN0325 with Internal antennas

No.	Frequency (MHz)	Power Setting			
		802.11b	802.11g	802.11n HT20	802.11n HT40
				4 Streams	4 Streams
1	2412	18	15.5	15.5	
2	2417	18	17.5	17.0	
3	2422	18	18	17.5	12
4	2427	18	18	18	15
5	2432	18	18	18	16
6	2437	18	18	18	16
7	2442	18	18	18	15.5
8	2447	18	18	18	15.5
9	2452	18	18	18	14.5
10	2457	18	17.5	17.5	
11	2462	18	15.5	15.5	

APIN0324 with Highest gain External antenna AP-ANT-48

No.	Frequency (MHz)	Power Setting			
		802.11b	802.11g	802.11n HT20	802.11n HT40
				4 Streams	4 Streams
1	2412	18	13.5	15.5	
2	2417	18	17.0	16.5	
3	2422	18	18	18	11.5
4	2427	18	18	18	13.5
5	2432	18	18	18	13
6	2437	18	18	18	16
7	2442	18	18	18	15.5
8	2447	18	18	18	15.0
9	2452	18	18	18	14.5
10	2457	18	17.0	17.5	
11	2462	18	14.0	16.0	

Table 13: 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?
RJ45	CAT-5 Ethernet	☐ No	☒ Metric: 10 m	☒ M

Table 14: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Dell	PP23LB	9271001233	Setup EUT operating channel
Note: None.				

Table 15: Description of Sample used for Testing

Device	Serial	RF Connection	CFR47 Part 15.247
APIN0325	DD0000409	Integrated Antenna	Radiated Emissions and Band edges
APIN0324	DD0000510	External Antennas	Radiated Emissions and Band edges Test was performed with AP-ANT-48Multipolarized (max gain 10.5dBi). Highest spurious emissions were verified with highest gain antenna of each type. AP-ANT-19Dual Band Omnidirectional were used. Only highest spurious emissions are placed in the report.
		Direct via reverse SMA ports for External Antenna Connection	Output Power, Peak Power Spectral Density, Occupied Bandwidth Conducted Spurious Emission

Table 16: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
APIN0325	Integrated	Transmit	 EUT laid flat.	 EUT UP Right	Na.
APIN0324	**AP-ANT-48** External Antennas **AP-ANT-19**	Transmit	 EUT laid flat Antennas configured for maximum gain. 	 EUT stood upright Antennas configured for maximum gain 	NA
Note: Pre-scans were performed in 2 supporting axis Wall mounted or Ceiling mounted and X-axis simulating ceiling mounted was worst.					

Table 17: Final Test Mode for 2412 - 2462 Bands

Test	802.11b	802.11g	802.11n HT20/VHT20	802.11n HT40/VHT40
Occupied Bandwidth CFR47 15.247 (a2),	Band : 2412, 2437, 2462 MHz 4 Streams – 1Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6.5Mbps/ stream	Band : 2422, 2437 and 2452 MHz 4 Streams – 13.5Mbps/ stream
Output Power CFR47 15.247 (b3),	Band : 2412, 2437, 2462 MHz 4 Streams – 1Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6.5Mbps/ stream	Band : 2422, 2437 and 2452 MHz 4 Streams – 13.5Mbps/ stream

Test	802.11b	802.11g	802.11n HT20/VHT20	802.11n HT40/VHT40
Peak Power Spectral Density CFR47 15.247 (e),	Band : 2412, 2437, 2462 MHz 4 Streams – 1Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6.5Mbps/ stream	Band : 2422, 2437 and 2452 MHz 4 Streams – 13.5Mbps/ stream
Out-of-Band (-30 dBr). CFR47 15.247 (d),	Band : 2412, 2437, 2462 MHz 4 Streams – 1Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6.5Mbps/ stream	Band : 2422, 2437 and 2452 MHz 4 Streams – 13.5Mbps/ stream
Band-Edge (Radiated) FCC Part 15.205, 15.209	Band : 2412, 2437, 2462 MHz 4 Streams – 1Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6.5Mbps/ stream	Band : 2422, 2437 and 2452 MHz 4 Streams – 13.5Mbps/ stream
Transmitted Spurious Emission (30 MHz – 1GHz) FCC Part 15.205, 15.209	Band : 2437, MHz 4 Streams – 1Mbps/ stream	Band : 2437, MHz 4 Streams – 6Mbps/ stream	Worst Case: 2437 MHz 4 Streams – 6.5Mbps/ stream (X-Axis)	Worst Case: 2437 MHz 4 Streams – 13.5Mbps/ stream (X-Axis)
Transmitted Spurious Emission (Above 1GHz) FCC Part 15.205, 15.209	Band : 2412, 2437, 2462 MHz 4 Streams – 1Mbps/ stream	Band : 2412, 2437, 2462 MHz 4 Streams – 6Mbps/ stream	Band : 2422MHz 4 Streams – 6.5Mbps/ stream	Band : 2422, 2452 MHz 4 Streams – 13.5Mbps/ stream
AC Conducted Emission FCC Part 15.207			2437 MHz at 4 Data Stream: 6.5Mbp	

Note: 1. Band 2400 MHz – 2483.5MHz does not support VHT 80 and this device supports Transmission on 1 x 4 and 4x4 streams only. It does not support 2x2, 3x3 streams
2. All radiated emission performed on X-Axis; worst axis
3. All four chains will be on at all time during the EUT's deployment.
4. All tests were pre-scanned for worst case before final testing.

6.4 Test Specifications

Testing requirements

Table 18: Test Specifications

Emissions and Immunity	
Standard	**Requirement**
CFR 47 Part 15.407: 2014	All

END OF REPORT