



Electromagnetic Compatibility Test Report

Tests Performed on a Westell Technologies, Incorporated

Booster Amplifier, Model BDA610-S8

Radiometrics Document RP-8491A

Product Detail:

FCC ID: NVRBDA610-S8

Equipment type: 806-824 & 851-869 MHz industrial Booster amplifier

Test Standards:

FCC KDB 935210: 2016

FCC Parts 2 and 90, and CFR Title 47: 2016

Tests Performed For:

Westell Technologies, Incorporated

750 Commons Dr.

Aurora, IL 60504

Test Facility:

Radiometrics Midwest Corporation

12 East Devonwood

Romeoville, IL 60446

Phone: (815) 293-0772

Test Date(s): (Month-Day-Year)

November 21, 2016 thru March 7, 2017

Document RP-8491A Revisions:

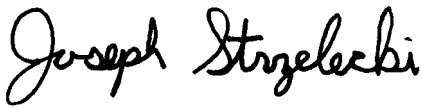
Rev.	Issue Date	Affected Sections	Revised By
0	December 21, 2016		
1	December 23, 2016	Cover	Joseph Strzelecki
2	February 10, 2017	9.0, 12.3, 13, 14.3, 16.3, 17.3	Joseph Strzelecki
3	March 8, 2017	Cover, 1.0, 12.3, 13, 16.3, 17.3	Joseph Strzelecki
4	March 13, 2017	13.2.1.2	Joseph Strzelecki

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Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

1.0 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i>	
An Westell, Incorporated Booster Amplifier Model: BDA610-S8; Serial Number: This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i>	<i>Test Date(s): (Month-Day-Year)</i>
August 31, 2016	October 21 thru February 9, 2017
<i>Test Report Written By:</i>	<i>Test Witnessed By:</i>
Joseph Strzelecki Senior EMC Engineer	The tests were not witnessed by personnel from Westell Technologies, Incorporated
<i>Radiometrics' Personnel Responsible for Test:</i>	<i>Test Report Approved By</i>
 02/10/2017 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Richard L. Tichgelaar EMC Technician	Chris W. Carlson Director of Engineering NARTE EMC-000921-NE
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2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Booster Amplifier, Model BDA610-S8, manufactured by Westell Technologies, Incorporated. The detailed test results are presented in a separate section. The following is a summary of the test results.

Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC KDB 935210 section	Test Result
AGC Threshold	806-869 MHz	4.2	Pass
Out of Band Rejection	806-869 MHz	4.3	Pass
Input vs Output Signal Comparison	806-869 MHz	4.4	Pass
Input/output power and amplifier/booster gain	806-869 MHz	4.5	Pass
Noise figure Measurements	806-869 MHz	4.6	Pass
Out-of-band/out-of-block emissions conducted measurements	806-869 MHz	4.7.2	Pass
EUT spurious emissions conducted measurements	30-9,000 MHz	4.7.3	Pass
Frequency Stability	N/A	4.7	Note 1
Field Strength of Spurious Radiated emissions	30-9,000 MHz	4.9	Pass

Note 1: Test not required since the amplifier, repeater does not alter the input signal in any way.

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Booster Amplifier, Model BDA610-S8, manufactured by Westell Technologies, Incorporated. The RF communications link is encrypted in both directions. The EUT was in good working condition during the tests, with no known defects.

The EUT was tested at 120 VAC 60 Hz input power.

The EUT has a gain of 80 dB, Power of 29 dBm, and a frequency range of 806-824 MHz for uplink

The EUT has a gain of 80 dB, Power of 29 dBm, and a frequency range of 851-869 MHz for uplink

The output signal coupling attenuation is 0 dB

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. The XCVR was tested as a stand-alone device. The TX/RX Module was used to terminate the receiver ports only. The identification for all equipment used in the tested system is:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Booster Amplifier	E	Westell Technologies	BDA610-S8	CPK63377

* Type: E = EUT, S = Support Equipment

4.2 EUT Operating Modes

The following are descriptions of the operating states of the amplifier. The mode number in the first column will be listed elsewhere in this report.

Mode	Description	Frequency MHz
1	CW Uplink	806-824
2	CW Downlink	851-869
3	FM 16 kHz OBW; Uplink	806-824
4	FM 16 kHz OBW; Downlink	851-869
5	FM 11 kHz OBW; Uplink	806-824
6	FM 11 kHz OBW; Downlink	851-869

4.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

5.0 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC KDB 935210 D05	2016	Measurements Guidance for Industrial and Non-Consumer Signal Booster, Repeater, and Amplifier Devices; v01r01
FCC KDB 971168	2014	Measurement Guidance for Certification of Licensed Digital Transmitters
TIA-603-D	2010	Land Mobile FM or PM Communications Equipment – Measurement and Performance Standards

6.0 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2005 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 20' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC3124A-1.

7.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8.0 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

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9.0 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
ANT-03	Tensor	Biconical Antenna	4104	2231	20-250MHz	24 Mo.	12/07/15
ANT-04	Tensor	Biconical Antenna	4104	2246	20-250MHz	24 Mo.	05/16/16
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 Mo.	11/25/15
ANT-07	RMC	Log-Periodic Ant.	LP1000	1001	200-1000MHz	24 Mo.	08/10/16
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	12/28/16
ANT-36	Ailtech-Eaton	Horn Antenna	96001	2013	1.0-18GHz	24 Mo.	11/02/16
ATT-27	Narda	Attenuator(6dB)	757B-6	3131	DC - 6 GHz	24 Mo.	12/01/15
ATT-28	Narda	Attenuator(6dB)	757B-6	3131	DC - 6 GHz	24 Mo.	12/01/15
ATT-45	Narda	Attenuator(10dB)	779C-10dB	03078	DC-18 GHz	12 Mo.	12/19/16
ATT-47	HP	Attenuator(20dB)	8491A	53862	DC-23 GHz	24 Mo.	09/04/16
ATT-51	China	Attenuator(20dB)	ATT-51 20dB	ATT-51	DC-3GHz	12 Mo.	08/29/16
ATT-53	Weinschel	Attenuator(20dB)	23-20-34	CG7857	DC-23 GHz	12 Mo.	09/26/16
ATT-MC	Mini-Circuits	Variable Attenuator	ZX73-2500M-S	RUU45501601	10-2500MHz	N/A	NCR
CAB-065A	Times Wire	Coaxial Cable	N/A	065A	DC-4 GHz	24 Mo.	04/19/16
CAB-069A	Storm	Coaxial Cable	N/A	069A	DC-18 GHz	24 Mo.	04/19/16
CAB-094A	Times Wire	Coaxial Cable	N/A	094A	DC-4 GHz	24 Mo.	04/19/16
CAB-110A	Times Wire	Coaxial Cable	N/A	110A	DC-4 GHz	24 Mo.	04/19/16
CAB-142G	Storm	Coaxial Cable	N/A	142G	DC-18 GHz	24 Mo.	04/21/16
CAB-142H	Storm	Coaxial Cable	N/A	142H	DC-18 GHz	24 Mo.	04/27/16
CAB-210B	Storm	Coaxial Cable	N/A	210B	DC-18 GHz	24 Mo.	04/21/16
CAB-418A	Times Wire	Coaxial Cable	N/A	418A	DC-4 GHz	24 Mo.	04/19/16
COM-01	Anaren	Coupler	10023-3	COM-01	250-1000MHz	N/A	NCR
COM-W1	CSI	Combiner/Splitter	CSI-S2BSC	None	500-3000MHz	12 Mo.	9/22/16
PWM-01	Boonton	Power Meter	4230	22503	50kHz-18GHz	24 Mo.	12/11/15
REC-11	HP / Agilent	Spectrum Analyzer	E7405A	US39110103	9kHz-26.5GHz	12 Mo.	03/23/16
REC-20	HP / Agilent	Spectrum Analyzer	85460A 84562A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	07/13/16
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9Hz-26.5 GHz	24 Mo.	12/22/15
SIG-28	Hittite	RF Synthesizer	HMC-T2240	0000426	10MHz-40GHz	12 Mo.	03/31/16
SIG-30	Rohde & Schwarz	Signal Generator	SMC100A	102914	9k-3.2GHz	24 Mo.	10/07/15
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	24 Mo.	08/03/15

Note: All calibrated equipment is subject to periodic checks.

NCR – No Calibration Required. Device monitored by calibrated equipment. N/A: Not Applicable.

10.0 TEST SECTIONS

The following sections are the detailed results in accordance to FCC KDB 935210 D05.

11.0 AGC THRESHOLD**11.1 Applicable Standard**

The EUT shall comply with FCC KDB 935210 section 4.2.

11.2 Test procedures

- a) A signal generator was connected to the input of the EUT.
- b) A power meter was connected to the output of the EUT using an external 20 dB attenuator.
- c) A signal generator was initially configured to produce a CW signal
- d) The signal generator frequency was set to the center frequency of the EUT operating band.
- e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 of KDB 935210, the input level was increased until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.
- f) This level was recorded as the AGC threshold level.
- g) The procedure was repeated with the remaining test signal bands.

11.2.1 AGC Threshold Test Results

Model	BDA610-S8	Specifications	FCC KDB 935210 D05 Sec. 4.2
Serial Number	CPK63377	Test Date	November 22, 2016
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	Power meter (PWM-01)		

Modulation	Mode	Generator Output		Power meter Reading	EUT Output Change	ATT
		MHz	dBm	dBm	dB	dB
CW	1	815.0	-42.0	7.05	N/A	20.0
CW	1	815.0	-41.0	8.05	1.0	20.0
CW	1	815.0	-40.5	8.55	0.5	20.0
CW	1	815.0	-40.0	9.05	0.5	20.0
CW	1	815.0	-39.5	8.91	-0.1	20.0
CW	1	815.0	-39.0	7.95	-1.0	20.0
CW	2	860.0	-42.0	7.25	N/A	20.0
CW	2	860.0	-41.0	8.25	1.0	20.0
CW	2	860.0	-40.5	8.75	0.5	20.0
CW	2	860.0	-40.0	8.59	-0.3	20.0
CW	2	860.0	-39.5	7.63	-1.0	20.0

The Highlighted cells are the AGC Threshold.

12.0 OUT OF BAND REJECTION

12.1 Applicable Standard

The EUT shall comply with sections 4.3 of FCC KDB 935210 for passband gain.

12.2 Test Procedures

The internal gain control of the EUT was adjusted to the maximum gain for which equipment certification is sought.

- a) A signal generator was connected to the input of the EUT.
- b) The swept CW signal was configured with the following parameters:
 - 1) Frequency range = ± 250 % of the manufacturer's specified pass band.

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

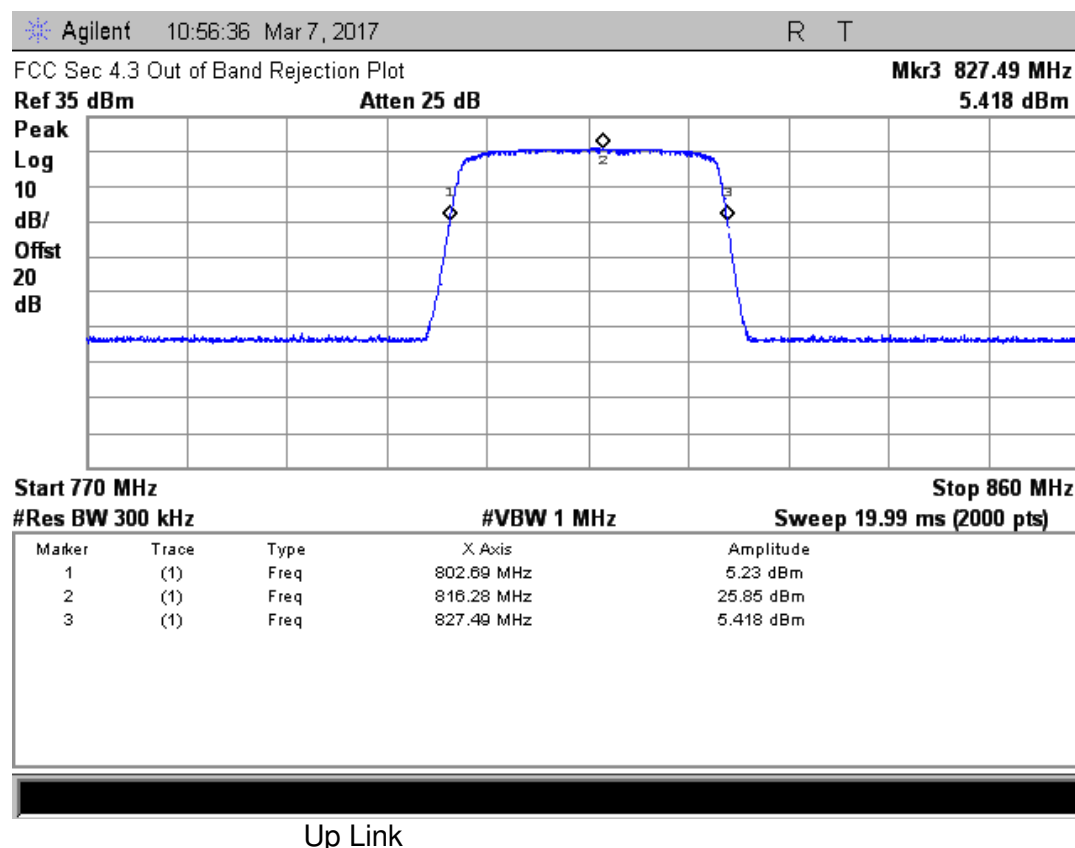
- 2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.
- 3) Dwell time = approximately 10 ms.
- 4) Frequency step = 50 kHz.
- c) A spectrum analyzer was connected to the output of the EUT using appropriate attenuation.
- d) The RBW of the spectrum analyzer was set to between 1 % and 5 % of the manufacturer's rated passband, and VBW = 3 × RBW.
- e) The detector was set to Peak and the trace to Max-Hold.
- f) After the trace was completely filled, a marker was placed at the peak amplitude, which is designated as f0, and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).
- g) The frequency response plot was captured for inclusion in the test report.

12.3 Passband Bandwidth Test Results

Model	BDA610-S8	Specification	KDB 935210 D05 Sec 4.3
Serial Number	CPK63377	Test Date	March 7, 2017
Test Personnel	Richard L. Tichelaar	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-21)		

RBW MHz	VBW MHz	Mode	Display points	20 dB Down 1st Freq. MHz	20 dB Down 2nd Freq. MHz	20 dB BW MHz	Max Reading Max Rdg F0 MHz	dBm
300	0.3	Up Link	2000	802.69	827.49	24.80	816.28	25.8
300	0.3	Down	2000	847.55	872.18	24.63	858.67	26.4

The above data shows the additional marker data from the plots below.



Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

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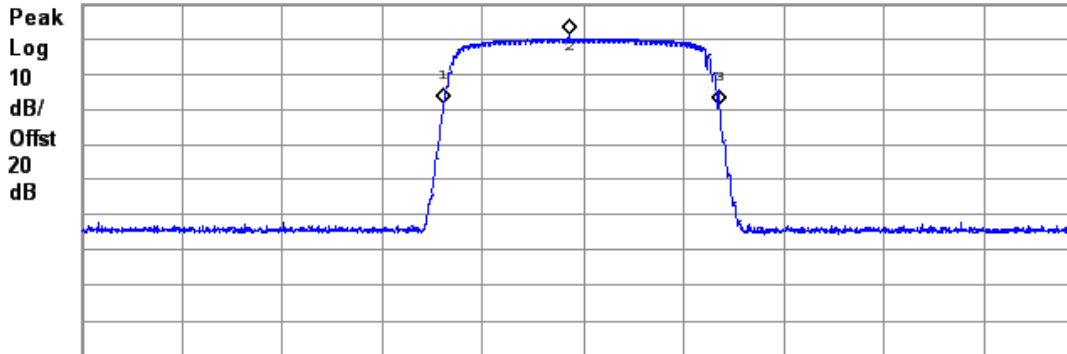
FCC Sec 4.3 Out of Band Rejection Plot

Mkr3 872.18 MHz

Ref 35 dBm

Atten 25 dB

6.256 dBm



Start 815 MHz

Stop 905 MHz

#Res BW 300 kHz

#VBW 1 MHz

Sweep 19.99 ms (2000 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	847.55 MHz	26.44 dBm
2	(1)	Freq	858.67 MHz	26.44 dBm
3	(1)	Freq	872.18 MHz	6.256 dBm

Down link

13.0 INPUT VS OUTPUT SIGNAL COMPARISON

13.1 Applicable Standard

The EUT shall comply with FCC KDB 935210 section 4.4.

13.2 Test procedures

A 26 dB bandwidth measurement was performed on the input signal and the output signal.

Refer to the applicable regulatory requirements (e.g., § 90.210) for emission mask specifications.

- A signal generator was connected to the input of the EUT.
- The signal generator was configured to transmit the appropriate test signal associated with the public safety emission designation (see Table 1).
- The signal level was configured to be just below the AGC threshold (see results from 4.2).
- A spectrum analyzer was connected to the output of the EUT using appropriate attenuation as necessary.
- The spectrum analyzer center frequency was set to the nominal EUT channel center frequency. The span range for the spectrum analyzer was between 2 times to 5 times the EBW (or OBW).
- The nominal RBW shall be 300 Hz for 16K0F3E, and 100 Hz for all other emissions types.
- The reference level of the spectrum analyzer was set to accommodate the maximum input amplitude level, i.e., the level at f0 per 4.2.
- The spectrum analyzer detection mode was set to peak, and trace mode to max hold.
- The trace was allowed to fully stabilize.
- The signal was confirmed to be contained within the appropriate emissions mask.

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

- k) The marker function was used to determine the maximum emission level and record the associated frequency as f0.
- l) The emissions mask plot was captured for inclusion in the test report (output signal spectra).
- m) The EUT input signal power (signal generator output signal) was measured directly from the signal generator using power measurement guidance provided in KDB Publication 971168 [R8] (input signal spectra).
- n) The spectral plot of the output signal (determined in step k) was compared to the input signal (determined in step l) to affirm they are similar (in passband and roll off characteristic features and relative spectral locations).
- o) Steps d) to n) were repeated with the input signal amplitude set 3 dB above the AGC threshold.
- p) Steps b) to o) were repeated for all authorized operational bands and emissions types (see applicable regulatory specifications, e.g., § 90.210).
- q) All accumulated spectral plots depicting EUT input signal and EUT output signal were included in the test report, and note any observed dissimilarities.

13.2.1 Input Vs Output Test Results

Model	BDA610-S8	Specifications	FCC KDB 935210 D05 Sec. 4.4
Serial Number	CPK63377	Test Date	November 30, 2016
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	Spectrum Analyzer (REC-21)		

Output Mode	Modul. Type	Plot #	Generator Settings with 20 dB Att		OBW kHz	Analyzer		Test Port	26 dB BW Reading MHz	EUT AGC Mode
			MHz	dBm		RBW Hz	VBW Hz			
3	FM 16k	1	815	-40.0	16	300	1000	Amp In	20.07	N/A
3	FM 16k	2	815	-40.0	16	300	1000	Amp Out	20.07	Below
3	FM 16k	3	815	-36.5	16	300	1000	Amp In	20.07	N/A
3	FM 16k	4	815	-36.5	16	300	1000	Amp Out	20.07	ON+3
5	FM 11k	5	815	-40.0	11	100	1000	Amp In	13.93	N/A
5	FM 11k	6	815	-40.0	11	100	1000	Amp Out	13.93	Below
5	FM 11k	7	815	-36.5	11	100	1000	Amp In	13.93	N/A
5	FM 11k	8	815	-36.5	11	100	1000	Amp Out	13.93	ON+3
4	FM 16k	9	860	-40.5	16	300	1000	Amp In	20.07	N/A
4	FM 16k	10	860	-40.5	16	300	1000	Amp Out	20.07	Below
4	FM 16k	11	860	-37.0	16	300	1000	Amp In	20.07	N/A
4	FM 16k	12	860	-37.0	16	300	1000	Amp Out	20.07	ON+3
6	FM 11k	13	860	-40.5	11	100	1000	Amp In	13.93	N/A
6	FM 11k	14	860	-40.5	11	100	1000	Amp Out	13.93	Below
6	FM 11k	15	860	-37.0	11	100	1000	Amp In	13.93	N/A
6	FM 11k	16	860	-37.0	11	100	1000	Amp Out	13.93	ON+3

Amp In is the generator output signal.

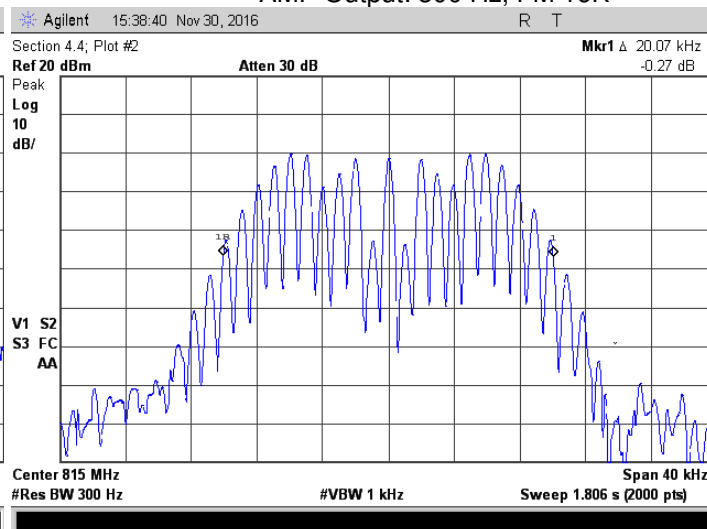
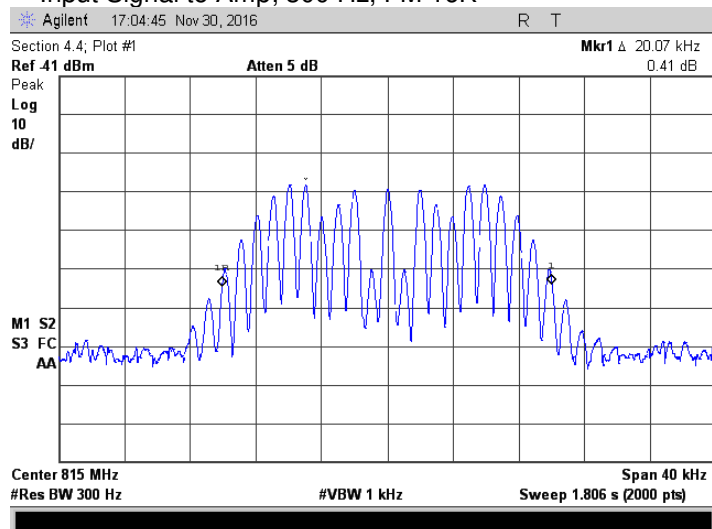
13.2.1.1 Occupied Bandwidth Results

FM; 815 MHz Results

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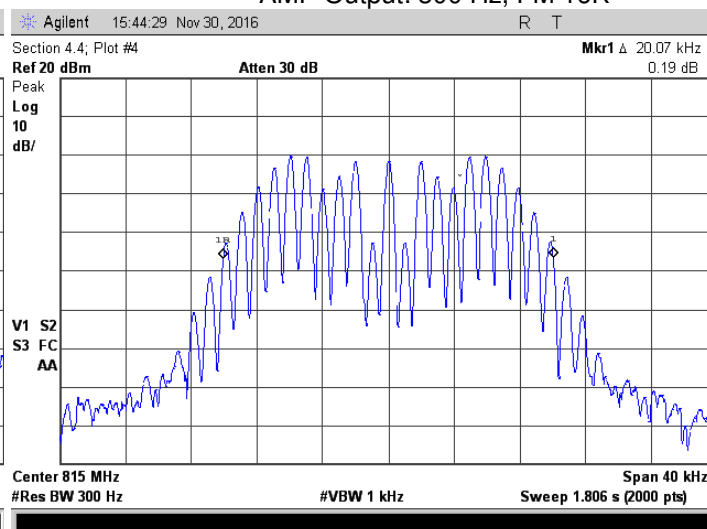
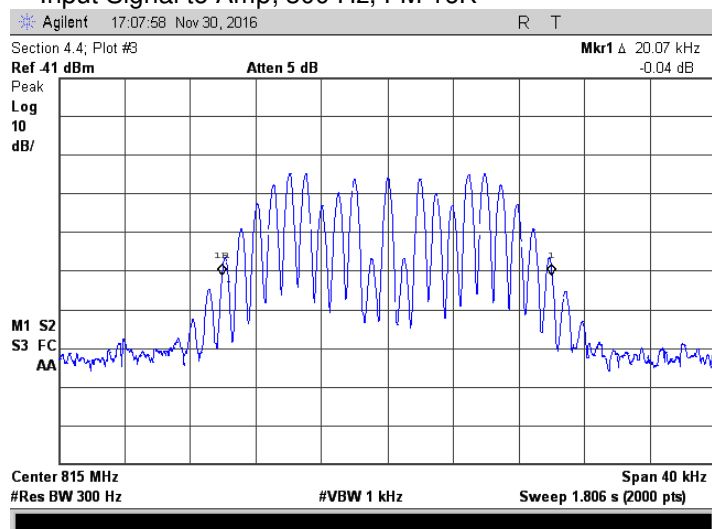
Input Signal to Amp; 300 Hz, FM 16K

AMP Output: 300 Hz, FM 16K



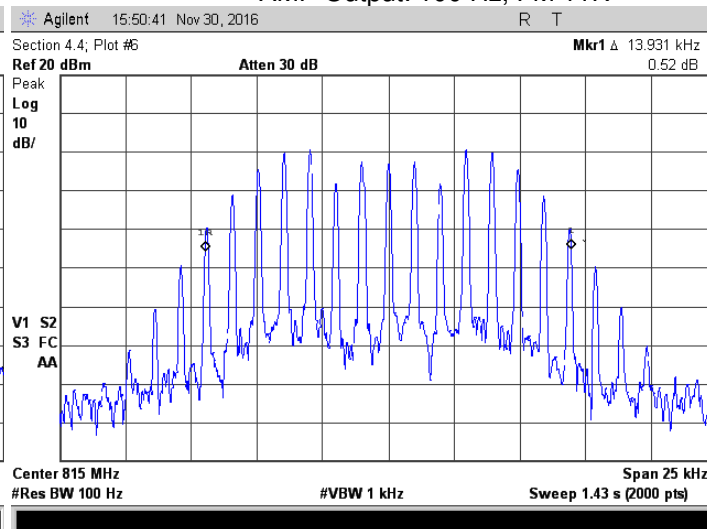
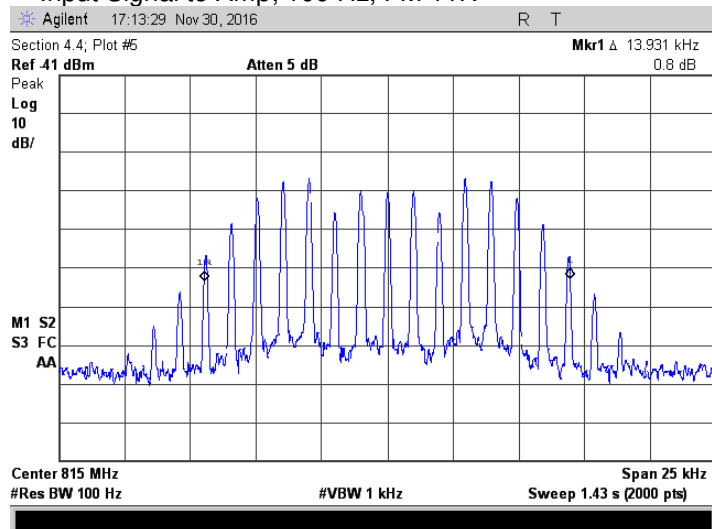
Input Signal to Amp; 300 Hz, FM 16K

AMP Output: 300 Hz, FM 16K



Input Signal to Amp; 100 Hz, FM 11K

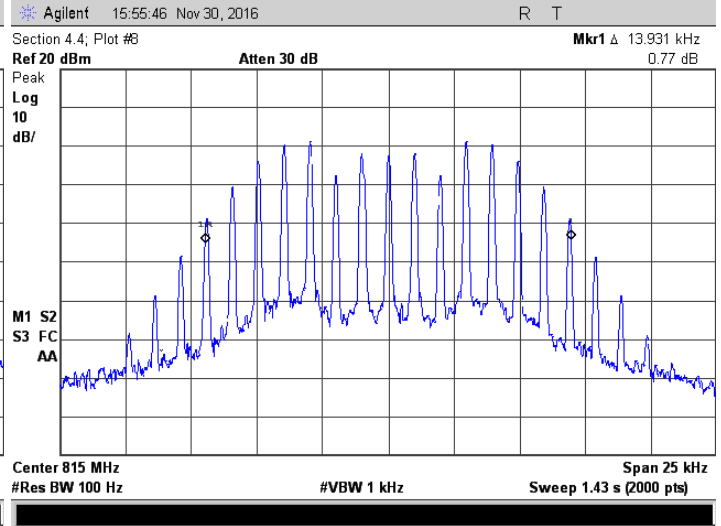
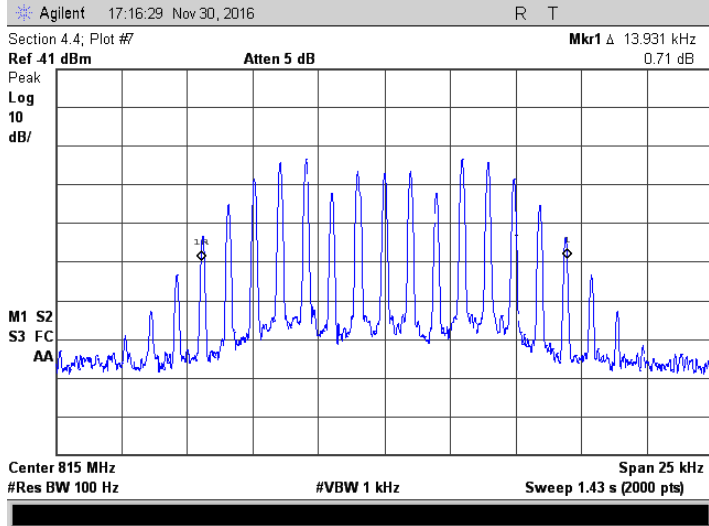
AMP Output: 100 Hz, FM 11K



Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

Input Signal to Amp; 100 Hz, FM 11K

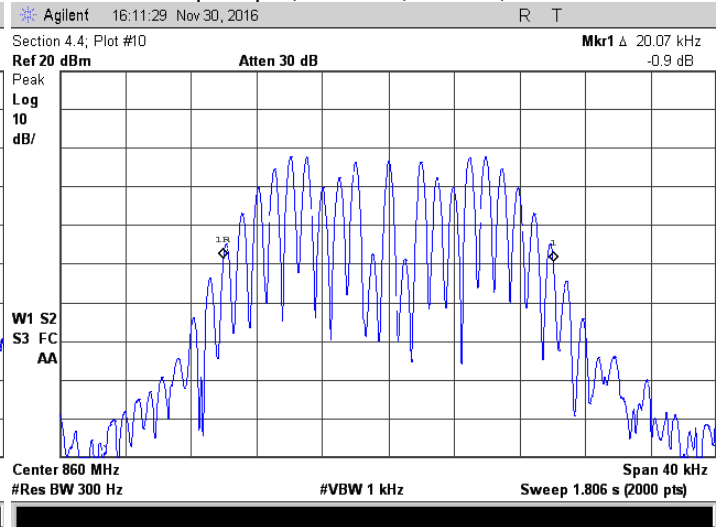
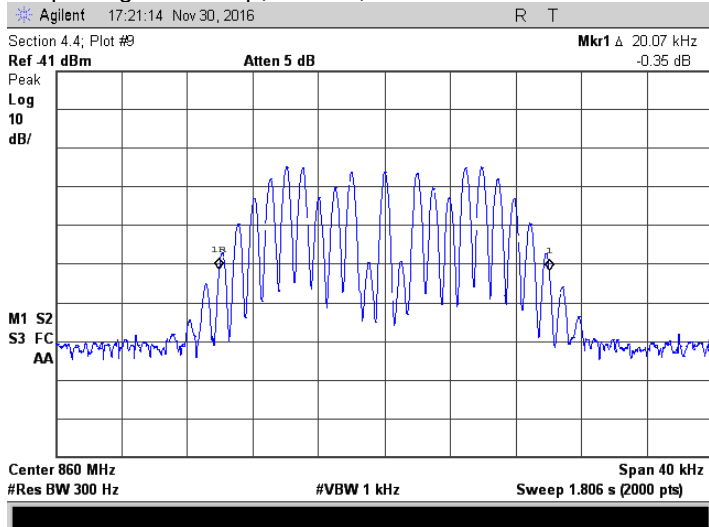
AMP Output: 100 Hz, FM 11K



FM; 860 MHz Results

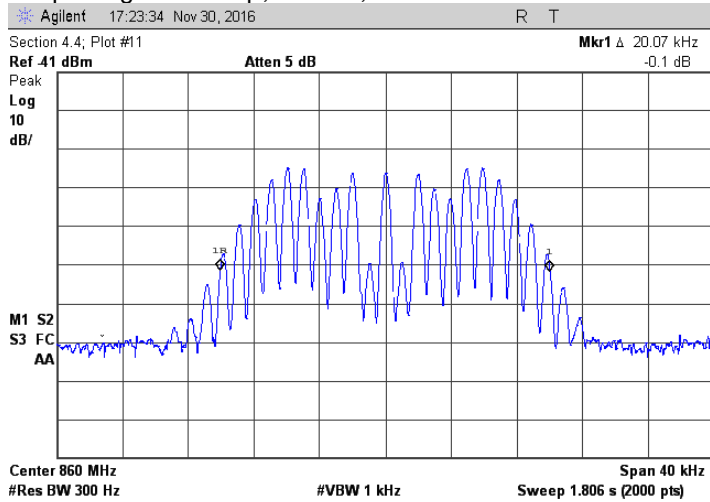
Input Signal to Amp; 300 Hz, FM 16K

Amp output, no AGC; 300 Hz, FM 16K

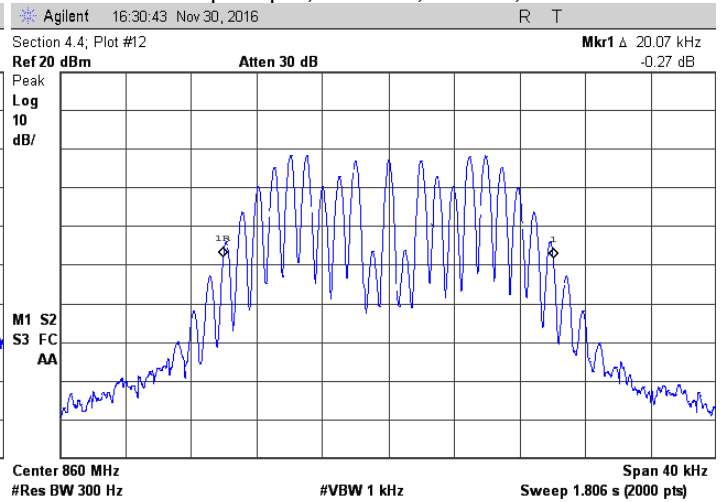


Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

Input Signal to Amp; 300 Hz, FM 16K



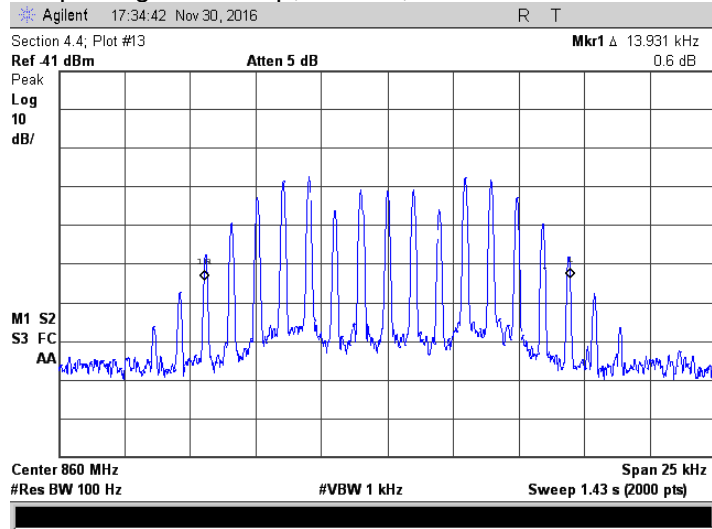
Amp output, no AGC; 300 Hz, FM 16K



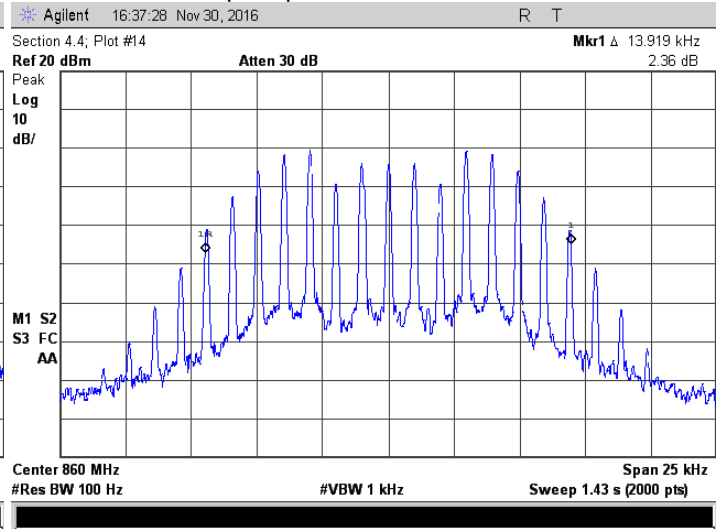
Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

FM; 860 MHz Results

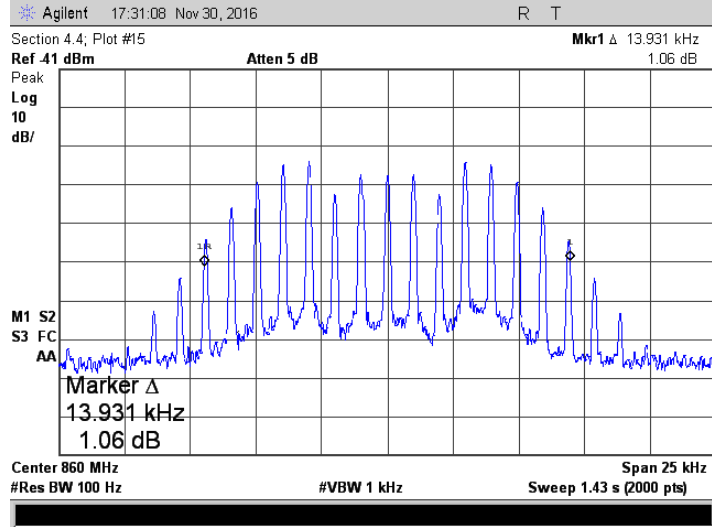
Input Signal to Amp; 100 Hz, FM 11K



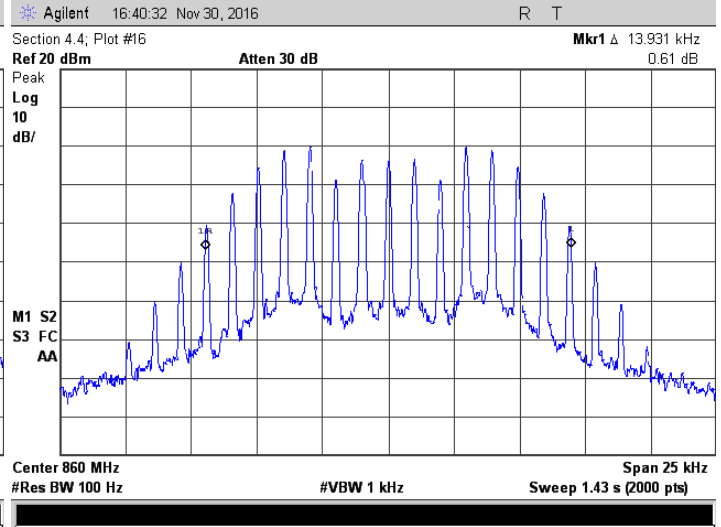
Amp output, no AGC; 100 Hz, FM 11K



Input Signal to Amp; FM 2. 100 Hz, FM 11K



Amp output, no AGC; 100 Hz, FM 11K



Judgement: Pass

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

13.2.1.2 Emissions Masks per 90.210

Since the EUT does not have an audio low pass filter, Mask G or H are applied.

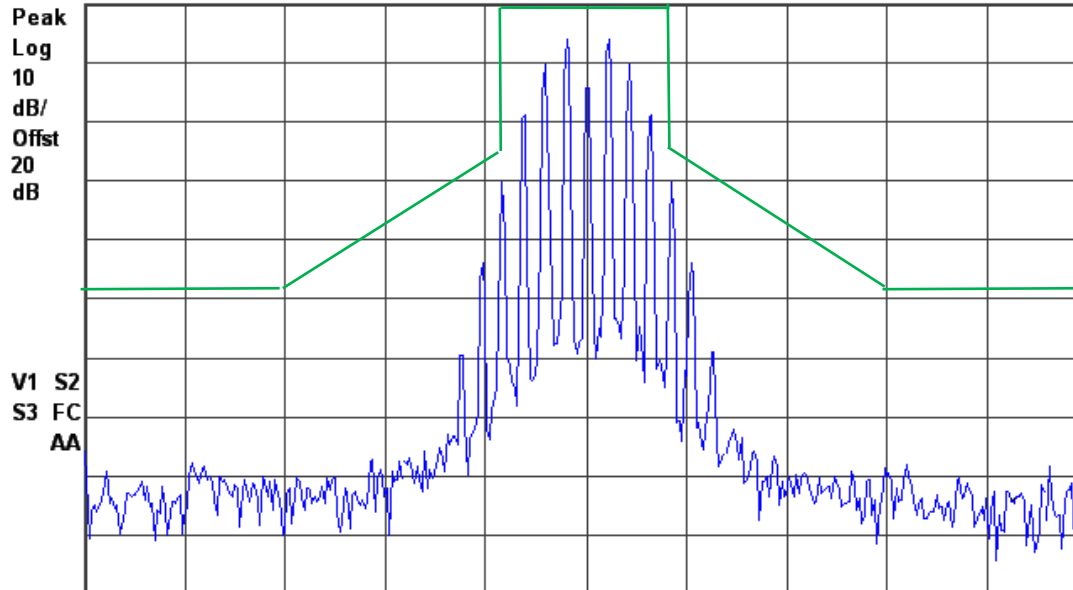
Agilent 11:09:02 Jan 11, 2017

R T

Uplink Out; FM Mask B; AGC ON +3dB.

Ref 29 dBm

Atten 20 dB



Center 815 MHz

#Res BW 300 Hz

#VBW 1 kHz

Span 120 kHz

Sweep 5.334 s (401 pts)

25 kHz channel G mask; Note on plot is incorrect, it is not Mask B

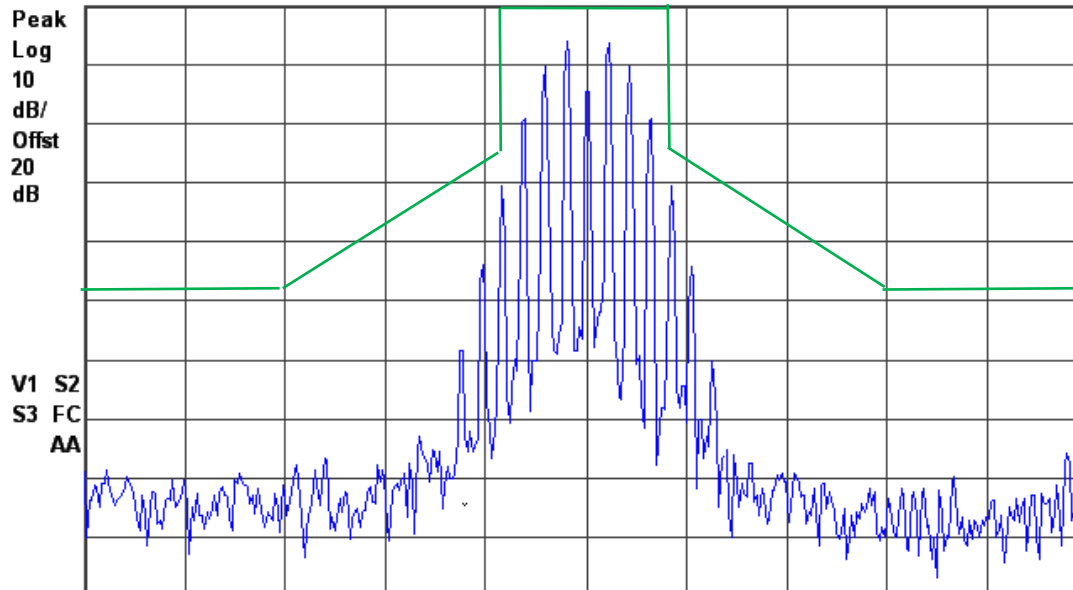
Agilent 11:06:51 Jan 11, 2017

R T

Uplink Out; FM Mask B; AGC OFF.

Ref 29 dBm

Atten 20 dB



Center 815 MHz

#Res BW 300 Hz

#VBW 1 kHz

Span 120 kHz

Sweep 5.334 s (401 pts)

25 kHz channel G mask; Note on plot is incorrect, it is not Mask B

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

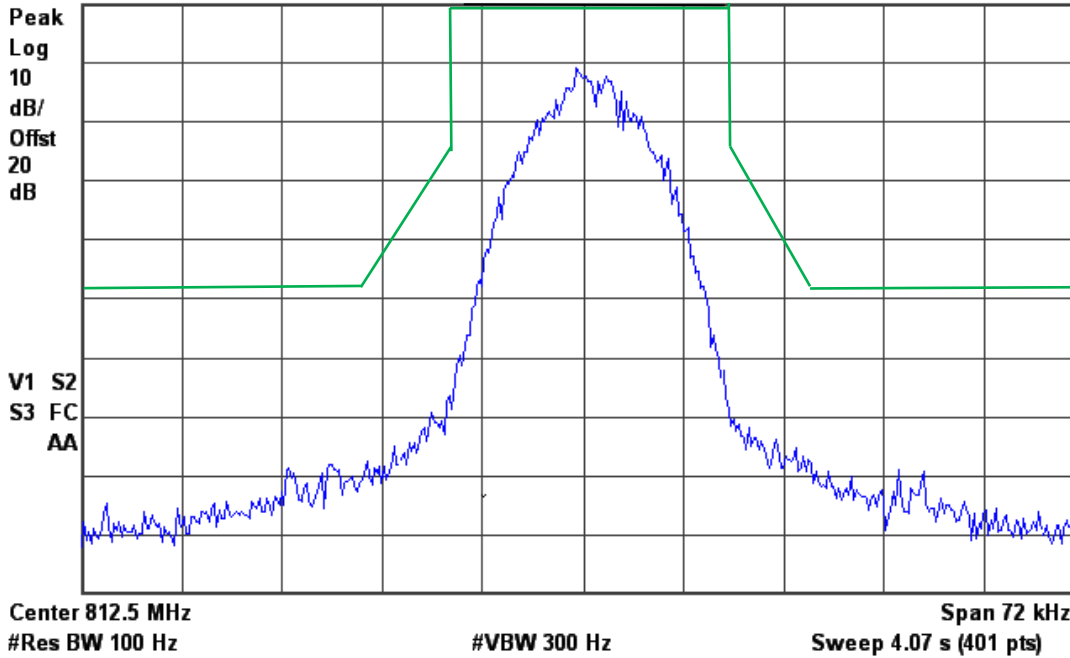
Agilent 09:55:40 Jan 12, 2017

R T

UpLink Out; C4FM Mask G; AGC On +3dB.

Ref 29 dBm

Atten 20 dB



12.5 kHz channel G mask

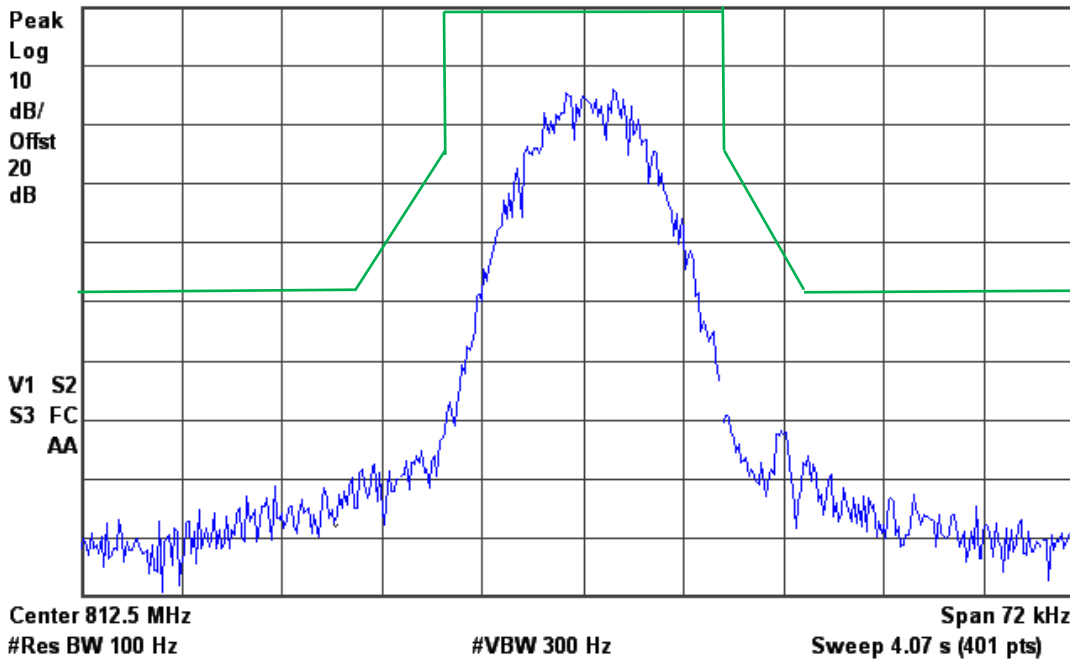
Agilent 09:57:52 Jan 12, 2017

R T

UpLink Out; C4FM Mask G; AGC Off.

Ref 29 dBm

Atten 20 dB



12.5 kHz channel G mask

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

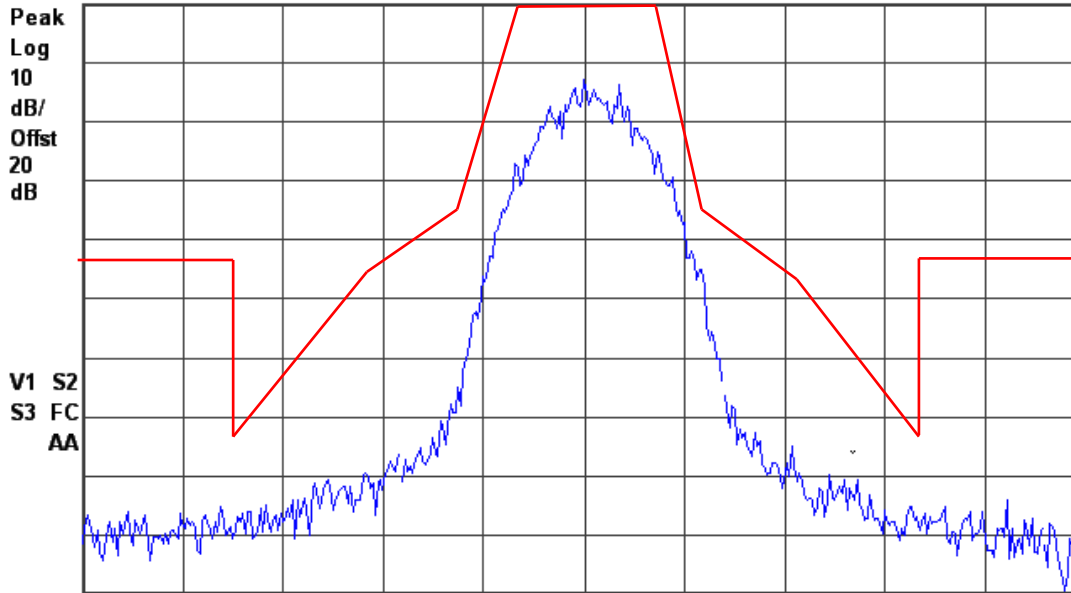
Agilent 10:02:58 Jan 12, 2017

R T

UpLink Out; C4FM Mask H; AGC On +3dB.

Ref 29 dBm

Atten 20 dB



Center 807.5 MHz

Span 72 kHz

#Res BW 100 Hz

#VBW 300 Hz

Sweep 4.07 s (401 pts)

H mask

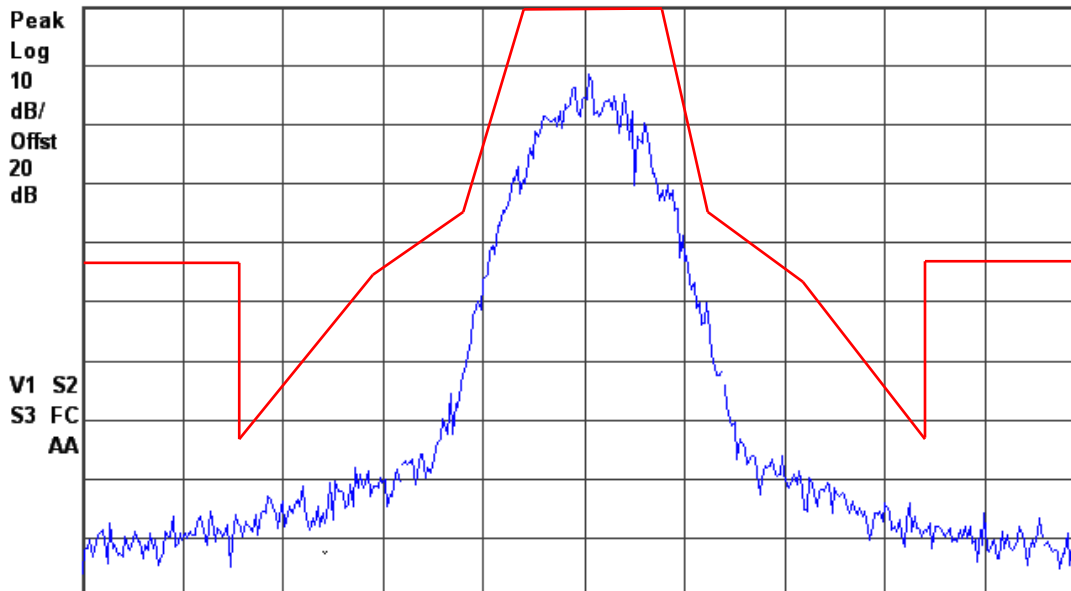
Agilent 10:04:58 Jan 12, 2017

R T

UpLink Out; C4FM Mask H; AGC OFF.

Ref 29 dBm

Atten 20 dB



Center 807.5 MHz

Span 72 kHz

#Res BW 100 Hz

#VBW 300 Hz

Sweep 4.07 s (401 pts)

H mask

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

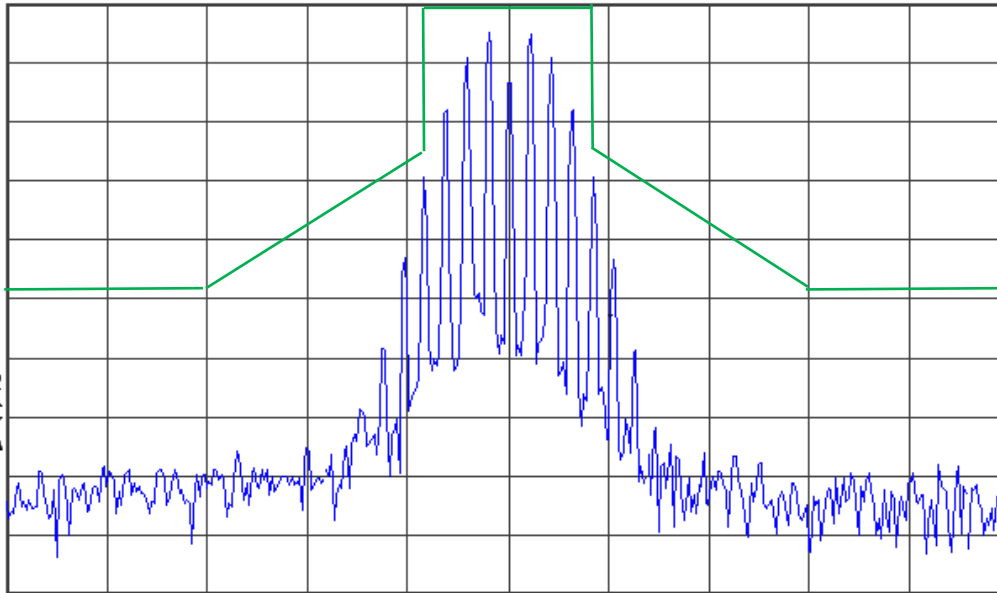
Agilent 10:28:04 Jan 12, 2017

R T

Sig Gen Out to Server Port for FM Mask B.

Ref -27.5 dBm

Atten 5 dB

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 815 MHz

Span 120 kHz

#Res BW 300 Hz

#VBW 1 kHz

Sweep 5.334 s (401 pts)

25 kHz channel; Mask G; Signal from Generator; Note on plot is incorrect, it is not Mask B

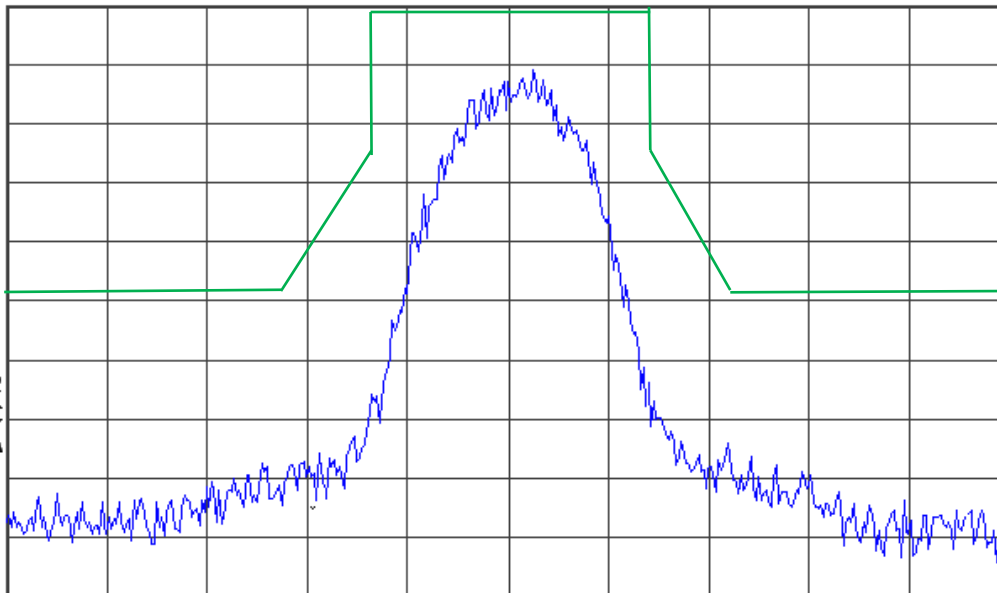
Agilent 10:14:56 Jan 12, 2017

R T

Sig Gen Out to Server Port for C4FM Mask G.

Ref -26.5 dBm

Atten 5 dB

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 812.5 MHz

Span 72 kHz

#Res BW 100 Hz

#VBW 300 Hz

Sweep 4.07 s (401 pts)

12.5 kHz channel G mask; Signal from Generator

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

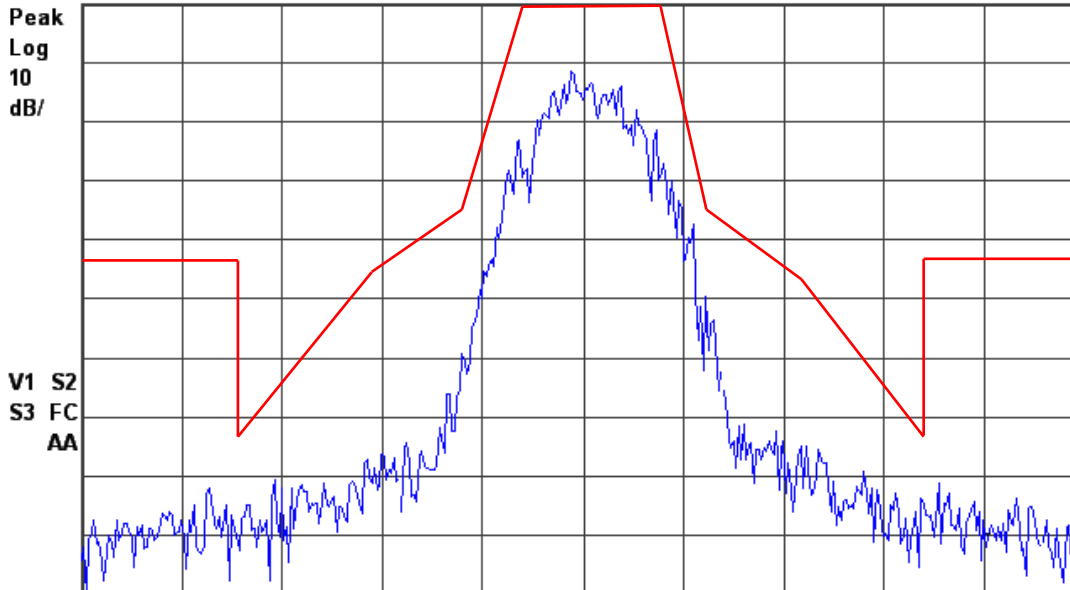
Agilent 10:13:06 Jan 12, 2017

R T

Sig Gen Out to Server Port for C4FM Mask H.

Ref -26.5 dBm

Atten 5 dB



Center 807.5 MHz

Span 72 kHz

#Res BW 100 Hz

#VBW 300 Hz

Sweep 4.07 s (401 pts)

H mask; Signal from Generator

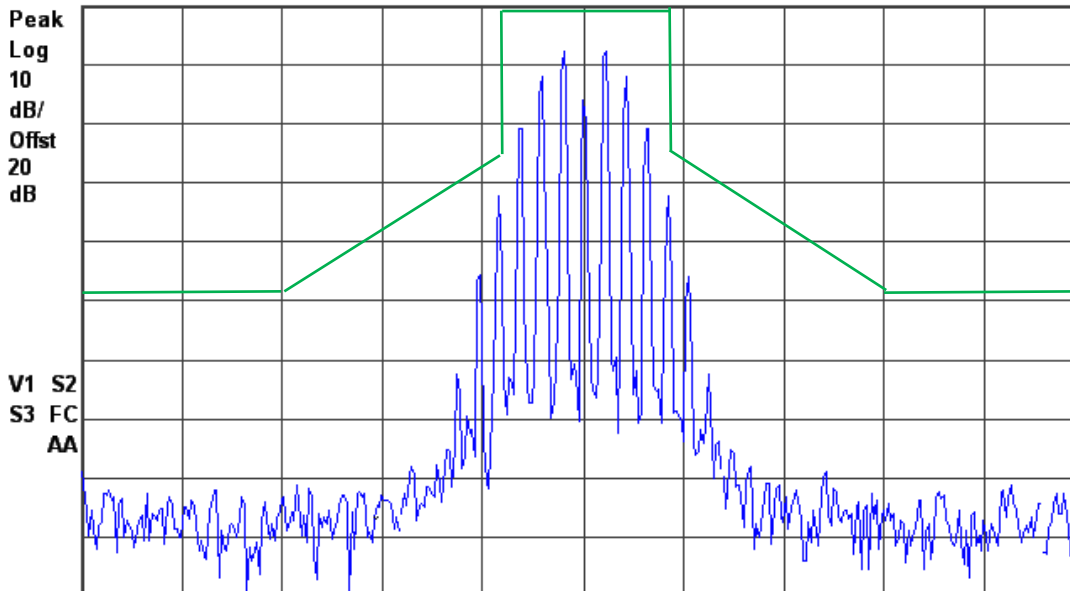
Agilent 11:46:55 Jan 11, 2017

R T

Down Link Out; FM Mask B; AGC ON + 3dB.

Ref 29 dBm

Atten 20 dB



Center 860 MHz

Span 120 kHz

#Res BW 300 Hz

#VBW 1 kHz

Sweep 5.334 s (401 pts)

25 kHz channel; Mask G; Note on plot is incorrect, it is not Mask B

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

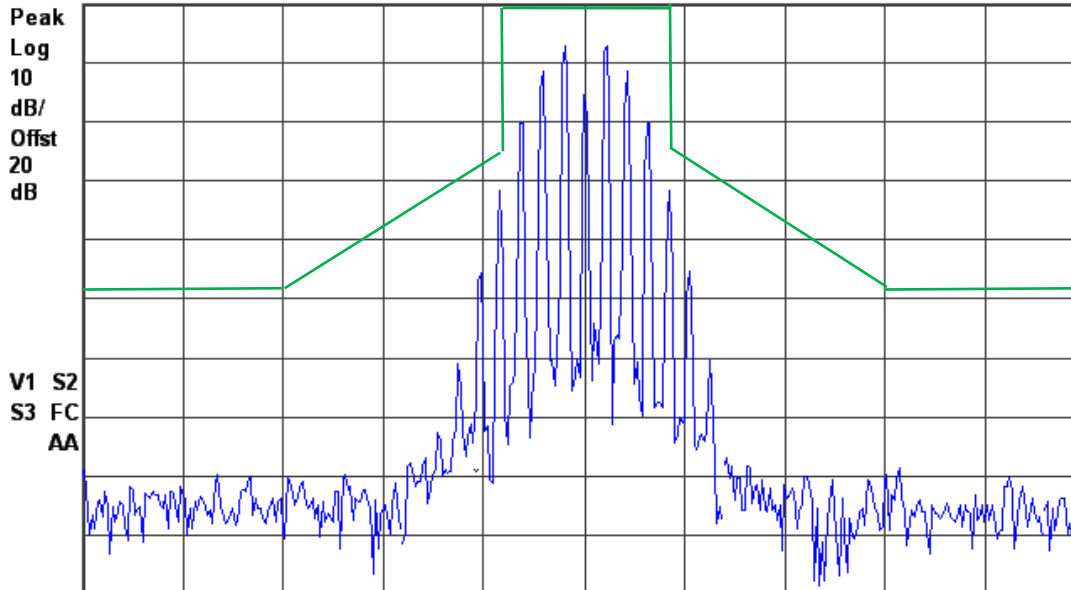
Agilent 11:48:19 Jan 11, 2017

R T

Down Link Out; FM Mask B; AGC OFF.

Ref 29 dBm

Atten 20 dB



Center 860 MHz

Span 120 kHz

#Res BW 300 Hz

#VBW 1 kHz

Sweep 5.334 s (401 pts)

25 kHz channel G mask; Note on plot is incorrect, it is not Mask B

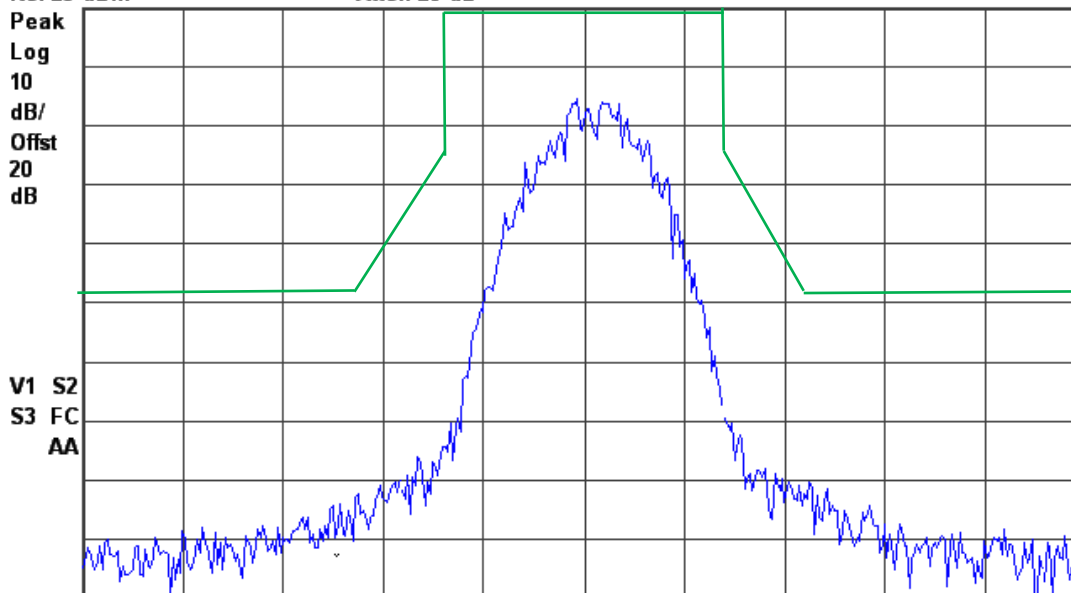
Agilent 11:28:13 Jan 12, 2017

R T

Down Link Out; C4FM Mask G; AGC ON + 3dB.

Ref 29 dBm

Atten 20 dB



Center 860 MHz

Span 72 kHz

#Res BW 100 Hz

#VBW 300 Hz

Sweep 4.07 s (401 pts)

12.5 kHz channel G mask

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

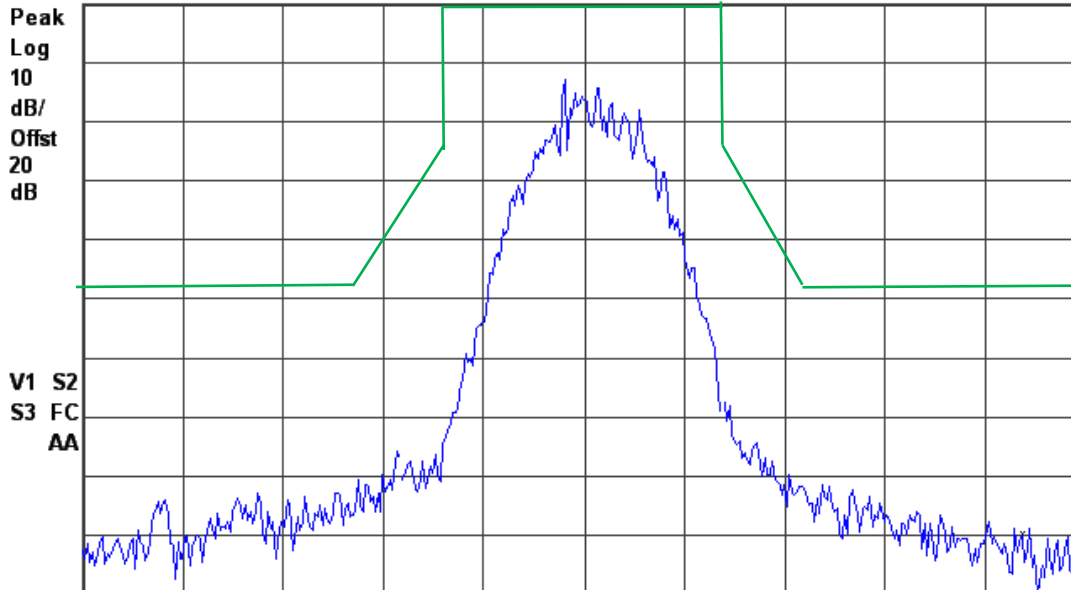
Agilent 11:30:20 Jan 12, 2017

R T

Down Link Out; C4FM Mask G; AGC OFF.

Ref 29 dBm

Atten 20 dB



Center 860 MHz

Span 72 kHz

#Res BW 100 Hz

#VBW 300 Hz

Sweep 4.07 s (401 pts)

12.5 kHz channel G mask

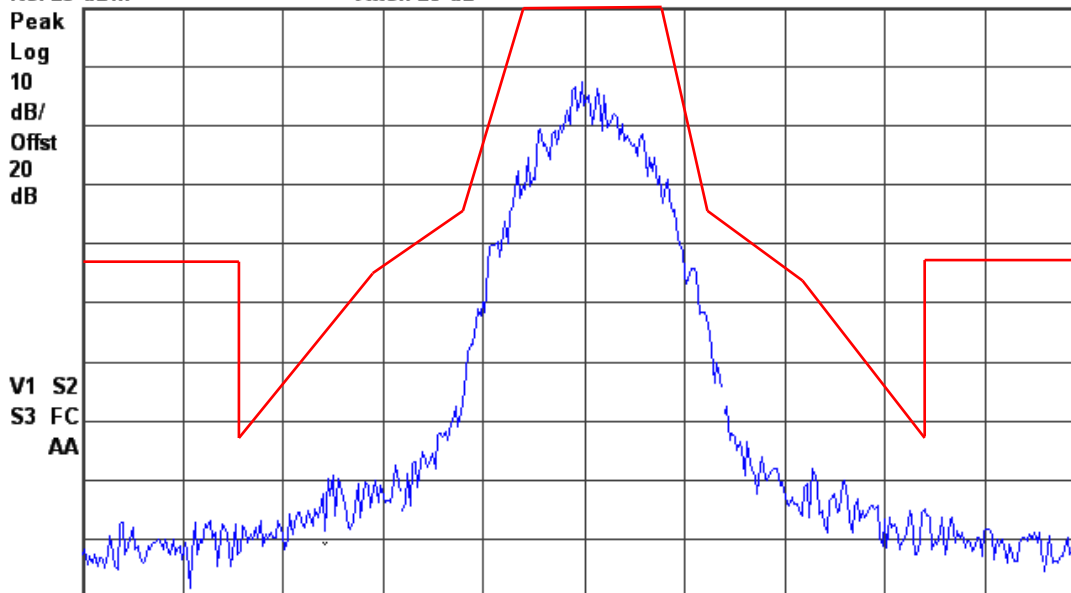
Agilent 11:37:24 Jan 12, 2017

R T

Down Link Out; C4FM Mask H; AGC ON +3dB.

Ref 29 dBm

Atten 20 dB



Center 852.5 MHz

Span 72 kHz

#Res BW 100 Hz

#VBW 300 Hz

Sweep 4.07 s (401 pts)

H mask

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

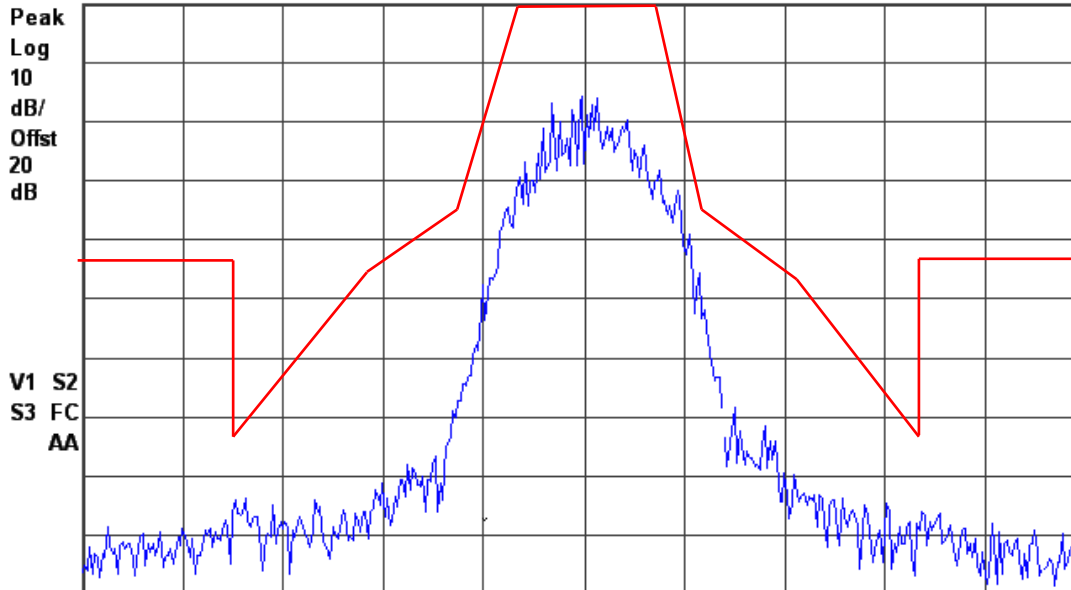
Agilent 11:39:46 Jan 12, 2017

R T

Down Link Out; C4FM Mask H; AGC OFF.

Ref 29 dBm

Atten 20 dB



Center 852.5 MHz

Span 72 kHz

#Res BW 100 Hz

#VBW 300 Hz

Sweep 4.07 s (401 pts)

H mask

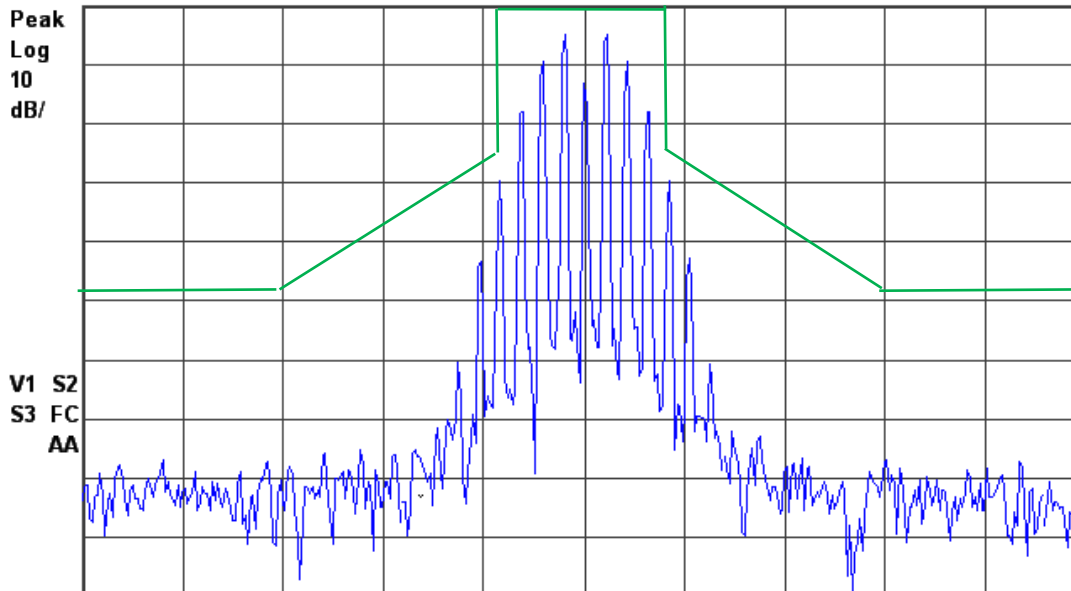
Agilent 11:56:53 Jan 11, 2017

R T

Sig Gen out to Donor port for FM mask B.

Ref -28.5 dBm

Atten 5 dB



Center 860 MHz

Span 120 kHz

#Res BW 300 Hz

#VBW 1 kHz

Sweep 5.334 s (401 pts)

25 kHz channel G mask; Signal from Generator; Note on plot is incorrect, it is not Mask B

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

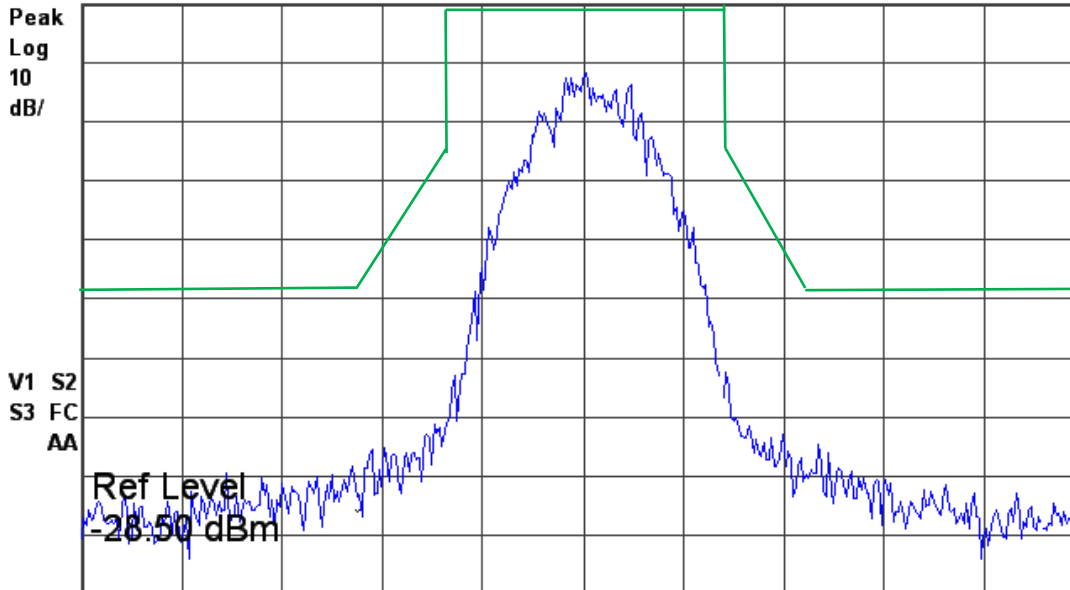
Agilent 11:51:29 Jan 12, 2017

R T

Sig Gen Out to Donor Port for C4FM Mask G.

Ref -28.5 dBm

Atten 5 dB

Center 860 MHz
#Res BW 100 Hz

#VBW 300 Hz

Span 72 kHz
Sweep 4.07 s (401 pts)

12.5 kHz channel G mask; Signal from Generator

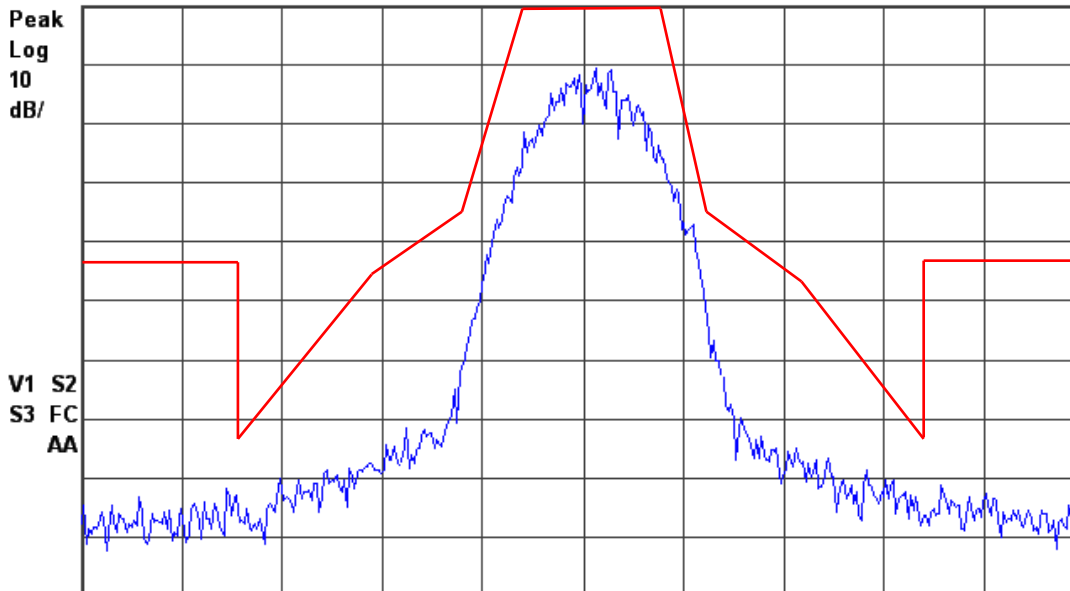
Agilent 11:48:48 Jan 12, 2017

R T

Sig Gen Out to Donor Port for C4FM Mask H.

Ref -26.5 dBm

Atten 5 dB

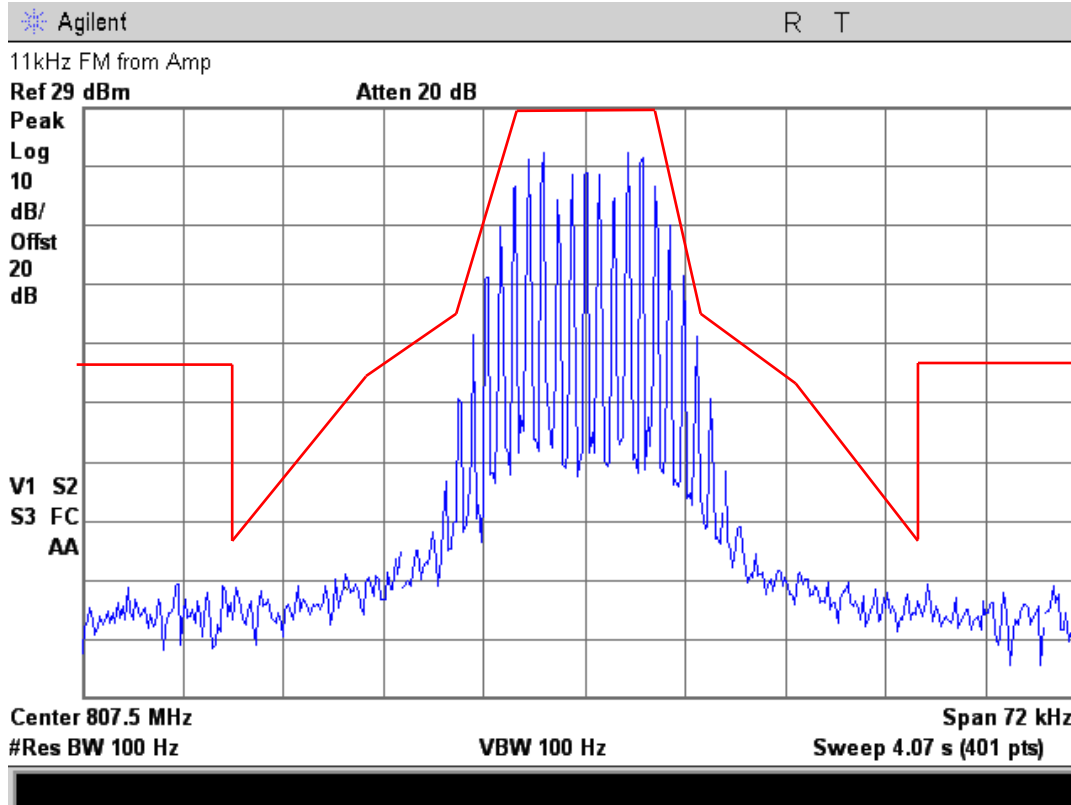
Center 852.5 MHz
#Res BW 100 Hz

#VBW 300 Hz

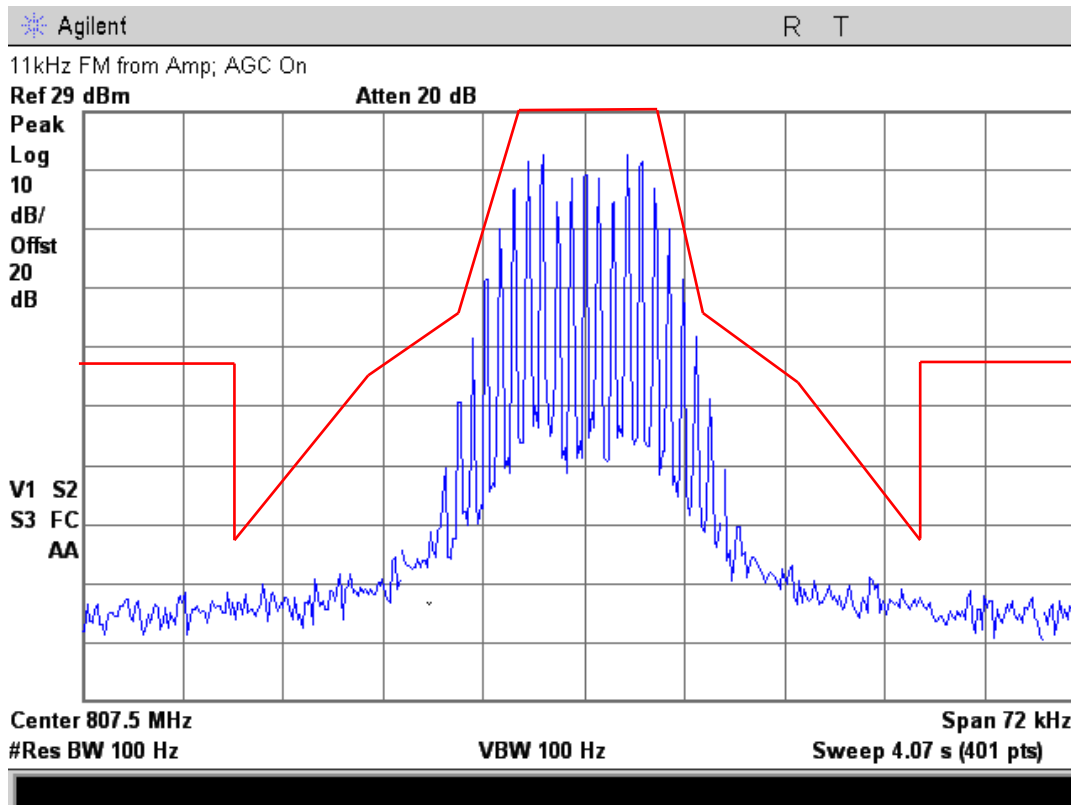
Span 72 kHz
Sweep 4.07 s (401 pts)

H mask; Signal from Generator

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8



H mask; From amp; AGC Off



H mask; From amp; AGC On

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

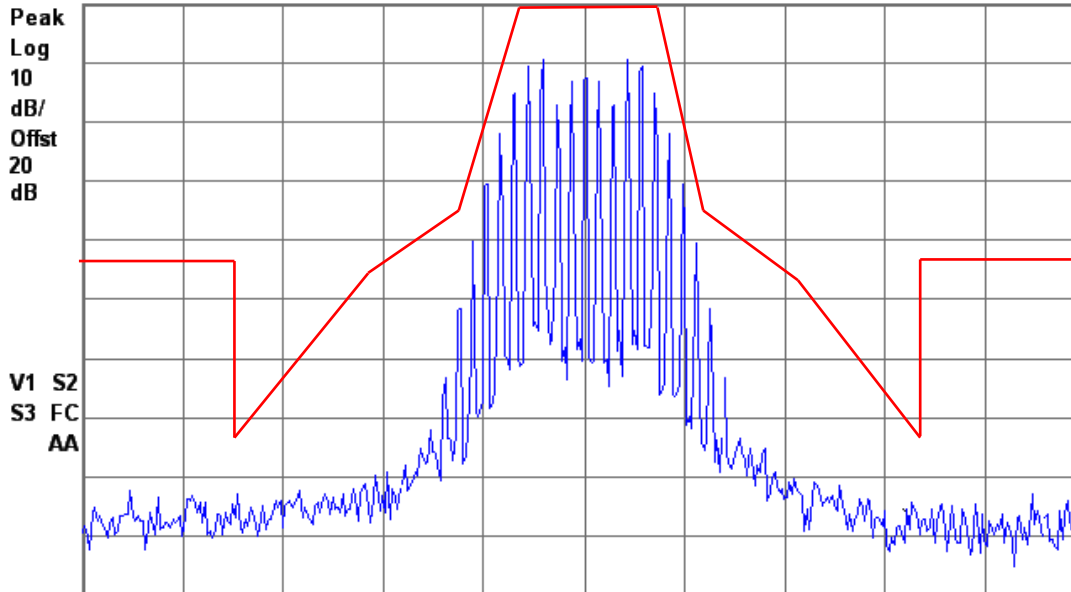
Agilent

R T

11kHz FM from Amp; AGC On

Ref 29 dBm

Atten 20 dB



Span 72 kHz

#Res BW 100 Hz

VBW 100 Hz

Sweep 4.07 s (401 pts)

H mask; From amp; AGC On

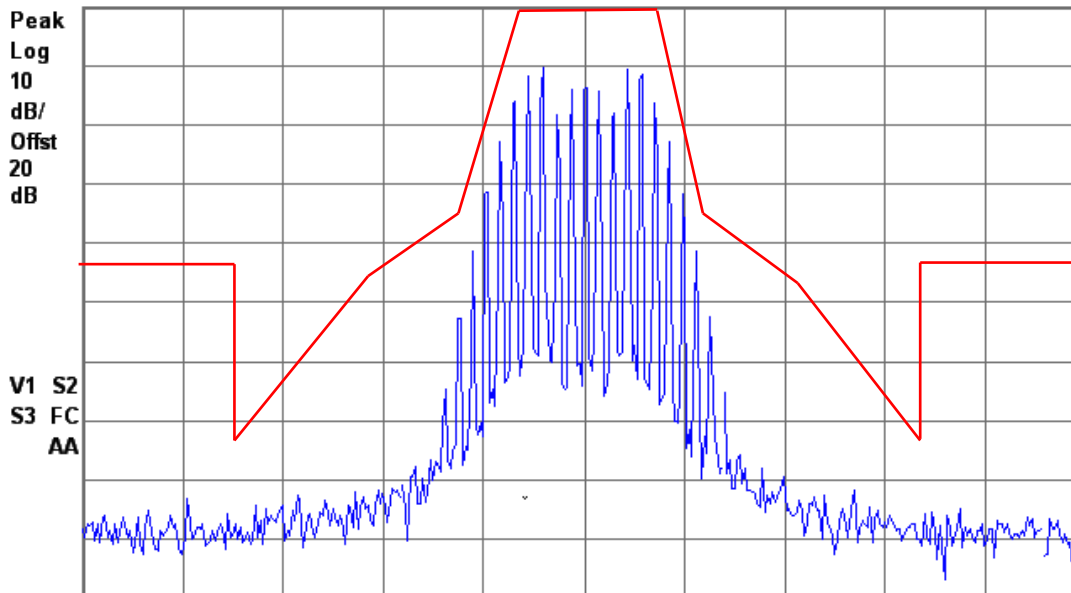
Agilent

R T

11kHz FM from Amp; AGC Off

Ref 29 dBm

Atten 20 dB



Span 72 kHz

#Res BW 100 Hz

VBW 100 Hz

Sweep 4.07 s (401 pts)

H mask; From amp; AGC Off

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

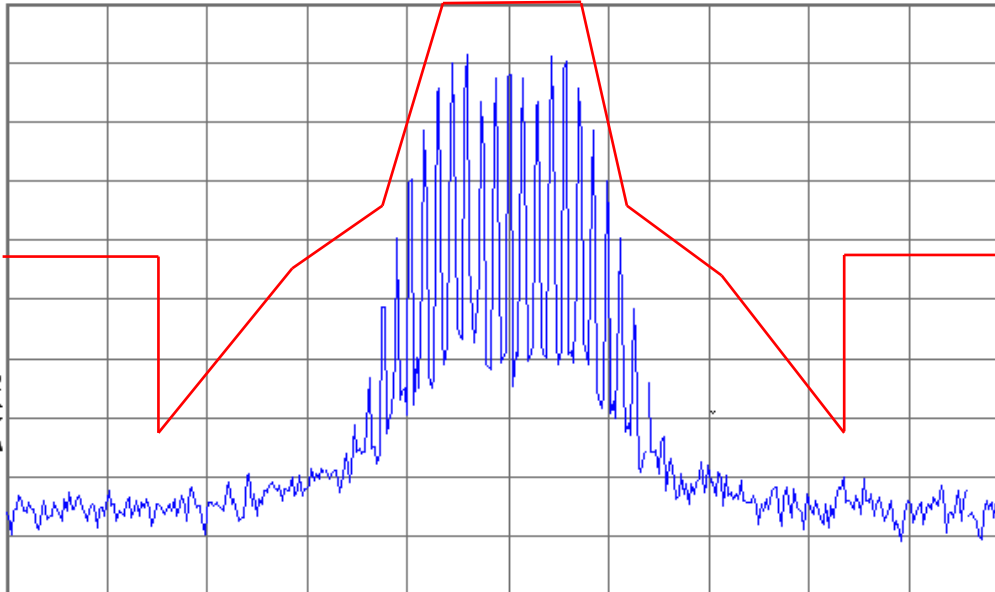
Agilent

R T

11kHz FM from Sig Gen

Ref -30 dBm

Atten 5 dB

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 807.5 MHz

Span 72 kHz

#Res BW 100 Hz

VBW 100 Hz

Sweep 4.07 s (401 pts)

H mask; Signal from Generator

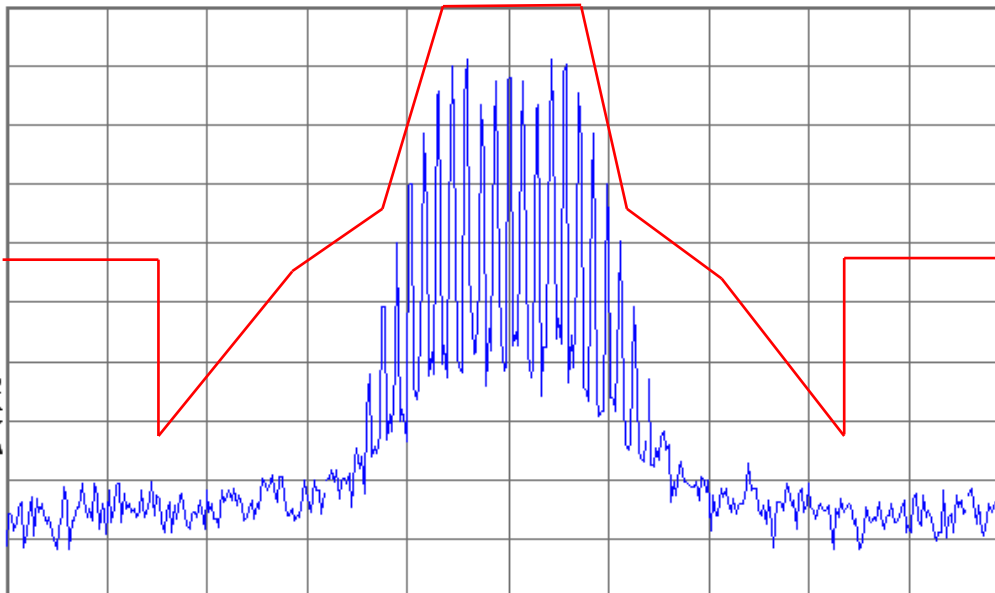
Agilent

R T

11kHz FM from Sig Gen

Ref -30 dBm

Atten 5 dB

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 852.5 MHz

Span 72 kHz

#Res BW 100 Hz

VBW 100 Hz

Sweep 4.07 s (401 pts)

H mask; Signal from Generator

14.0 INPUT/OUTPUT POWER AND AMPLIFIER GAIN

14.1 Applicable Standard

The EUT shall comply with FCC KDB 935210 section 4.5.

In accordance with section 4.5 of KDB 935210 D05, the mean input and output power and the amplifier gain was measured by adjusting the internal gain control of the EUT to the maximum gain for which equipment certification is sought. Any EUT attenuation settings were set to their minimum value.

Input power levels (uplink and downlink) were set to maximum input ratings while confirming that the device is not capable of operating in saturation (non-linear mode) at the rated input levels, including during the performance of the input/output power measurements.

14.2 Test procedures

- A signal generator was connected to the input of the EUT.
- The frequency of the signal generator was set to the frequency f_0 as determined from 3.3 of KDB 935210.
- A power meter was connected to the output of the EUT using an external attenuator.
- The signal generator amplitude was configured to be zero to 0.5 dB below the AGC threshold level.
- The output power of the EUT measured and recorded.
- The EUT was removed from the measurement setup. Using the same signal generator settings, the power measurement was repeated at the signal generator port, which was used as the input signal to the EUT, and recorded as the input power.
- Steps e) and f) were repeated with input signal amplitude set to 3 dB above the AGC threshold level.
- Steps d) to f) were repeated for all frequency bands authorized for use by the EUT.

The mean gain was reported for each authorized operating frequency band and each test signal stimulus.

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) – input power (dBm).

14.3 Gain Test Results

Model	BDA610-S8	Specification	FCC KDB 935210 Sec. 4.5
Serial Number	CPK63377	Test Date	November 30, 2016
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	Power meter (PWM-01)		

The reading at the Generator output and Amplifier output was performed with a power meter. A CW signal was used.

EUT Mode	Fo Generator MHz	Type	Gen out dBm	Amp out dBm	Ext Atten. dB	Cable Loss dB	EUT Pwr. dBm	EUT Pwr. Watts	Gain dB
1	815.5	-40.0	-49.1	9.0	20	0	29.0	0.79433	78.1
1	815.5	-36.5	-45.9	8.7	20	0	28.7	0.74131	74.6
2	860.0	-40.5	-49.3	8.8	20	0	28.8	0.75858	78.1
2	860.0	-37.0	-46.6	7.6	20	0	27.6	0.57544	74.2

Judgement: Pass; The passband gain did not exceed the nominal gain.

15.0 NOISE FIGURE MEASUREMENTS

15.1 Applicable Standard

The EUT shall comply with sections 4.6 of KDB 935210 D05.

§ 90.219(e)(2) limits the noise figure of a signal booster to ≤ 9 dB in either direction.

15.2 Test procedures for section 4.6

- A spectrum analyzer was connected to the downlink output of the amplifier.
- The uplink was unterminated.
- The spectrum analyzer was set to 100 trace average in the RMS average mode.
- A peak reading was recorded
- The noise figure was calculated using the following formula

$$NF = P_{NOUT} - (-174\text{dBm/Hz} + 10 \cdot \text{LOG}_{10}(\text{RBW}) + \text{Gain})$$

Notes

P_{NOUT} = Output noise of the amplifier in dBm

174 = Thermal noise for 1 Hz RBW at room temperature

The Thermal noise for 1 MHz RBW = $-174 + 10 \cdot \text{LOG}_{10}(1\text{E6})$

RBW = Resolution Bandwidth of Spectrum analyzer in Hz

Gain = Gain of amplifier in dB

- Steps a) to e) were repeated with the analyzer connected to the uplink output of the amplifier

15.3 Results for Section 4.6

Model	BDA610-S8	Specification	FCC KDB 935210 Sec. 4.6
Serial Number	CPK63377	Test Date	December 1, 2016
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-21)		

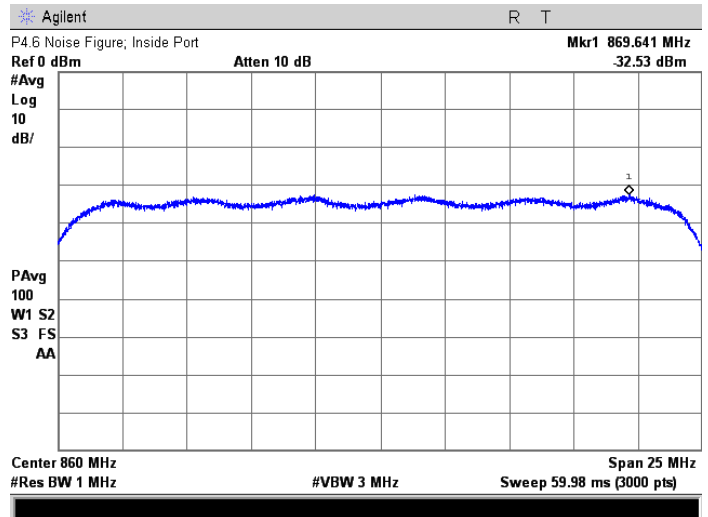
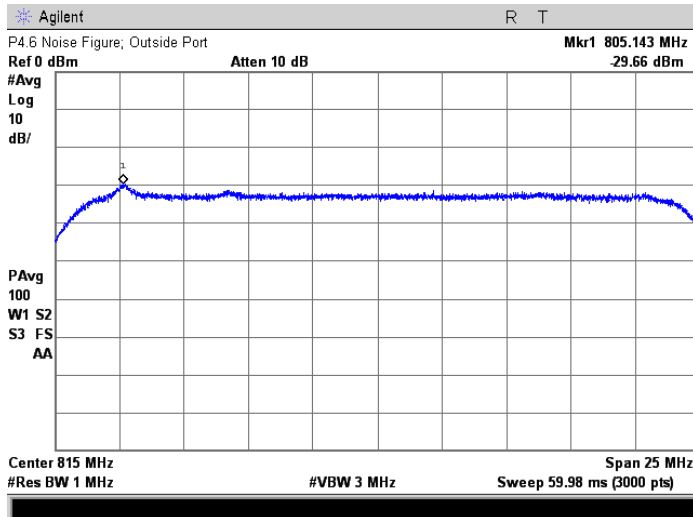
Analyzer Settings				Max Reading dBm	Gain dB	Thermal Noise dB	Cable Loss dB	Noise Figure dB	Limit NF dB
Center MHz	Span MHz	RBW kHz	VBW kHz						
806	25	1000	3000	-29.6	78.1	-114.0	0.5	6.9	9.0
851	25	1000	3000	-32.5	78.0	-114.0	0.5	4.4	9.0

Judgement: Pass

UpLink

Downlink

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8



16.0 OUT-OF-BAND/OUT-OF-BLOCK EMISSIONS

16.1 Applicable Standard

The EUT shall comply with sections 4.7.2 of KDB 935210 D05.

For a multi-channel enhancer, any intermodulation product level must be attenuated, relative to P, by at least: $43+10\log_{10}P$, or 70 dB, whichever is less stringent, where P is the total RF output power of the test tones in watts. Since $43 + 10\log_{10}P$ is less stringent than 70 dB, that limit was used.

Spurious emissions shall be measured using a single test signal sequentially tuned to the low, middle, and high channels or frequencies within each authorized frequency band of operation.

Out-of-band/out-of-block emissions (including intermodulation products) was measured under each of the following two stimulus conditions:

- a) two adjacent test signals sequentially tuned to the lower and upper frequency band/block edges;
- b) a single test signal, sequentially tuned to the lowest and highest frequencies or channels within the frequency band/block under examination.

16.2 Test procedures for section 4.7.2

- a) A signal generator was connected to the input of the EUT.

Note; If the signal generator is not capable of producing two independent modulated carriers simultaneously, then two discrete signal generators can be connected, with an appropriate combining network to support the two-signal test.

- b) The two signal generators were configured to produce CW on frequencies spaced consistent with 4.7.1, with amplitude levels set to just below the AGC threshold (see 4.2).

- c) A spectrum analyzer was connected to the EUT output.

- d) The span was set to 100 kHz.

- e) RBW was set = 300 Hz with VBW $\geq 3 \times$ RBW.

- f) The detector was set to power averaging (rms).

- g) A marker was placed on the highest intermodulation product amplitude.

- h) The plot was captured for inclusion in the test report.

- i) Steps c) to h) were repeated with the composite input power level set to 3 dB above the AGC threshold.

- j) Steps b) to i) were repeated for all operational bands.

Any frequency outside the authorized bandwidth was attenuated by at least $43 + 10 \log (P)$ dB. This corresponds to an absolute level of -13 dBm.

16.3 Results for Section 4.7.2

Model	BDA610-S8	Specification	FCC KDB 935210 Sec. 4.7.2
Serial Number	CPK63377	Test Date	February 9, 2017
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-21)		

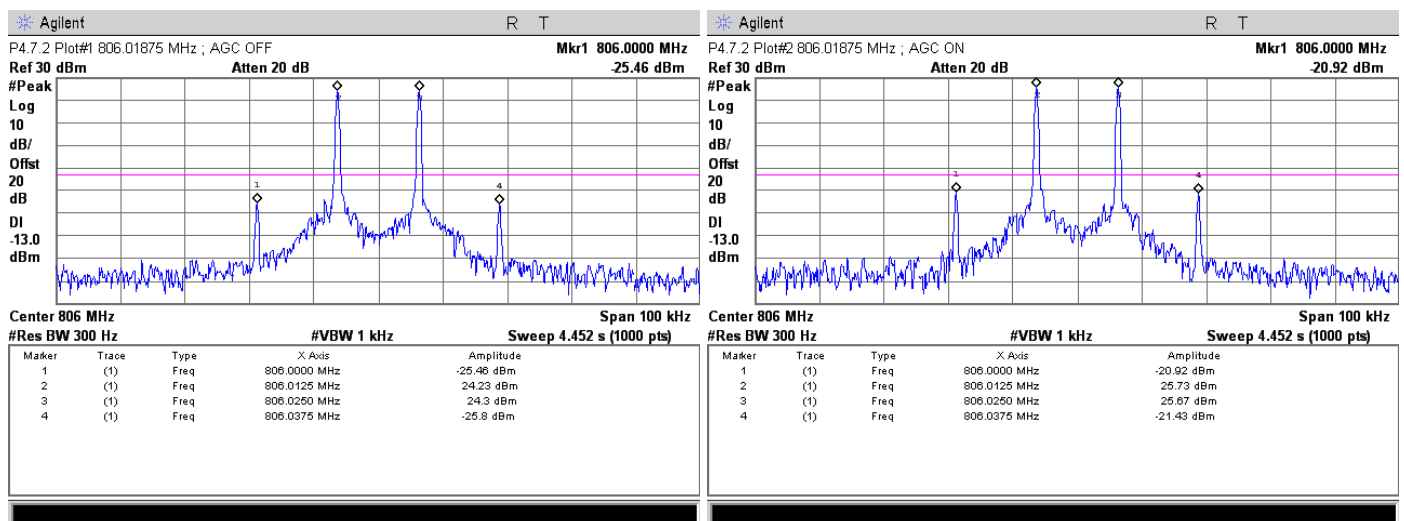
The spectrum analyzer was set to max hold mode.

Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

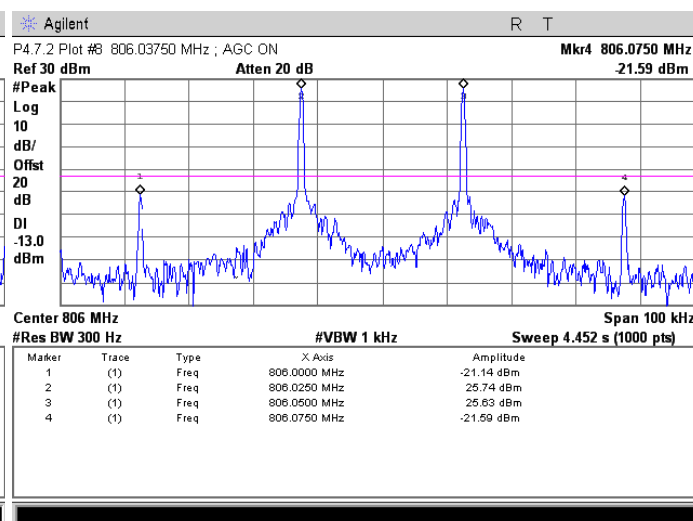
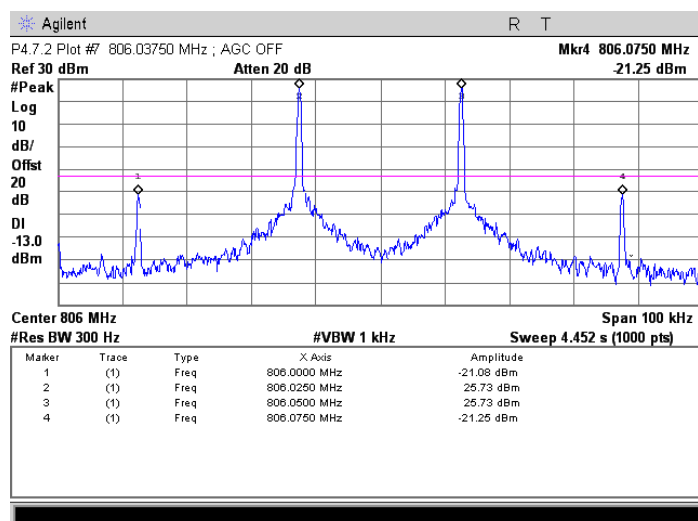
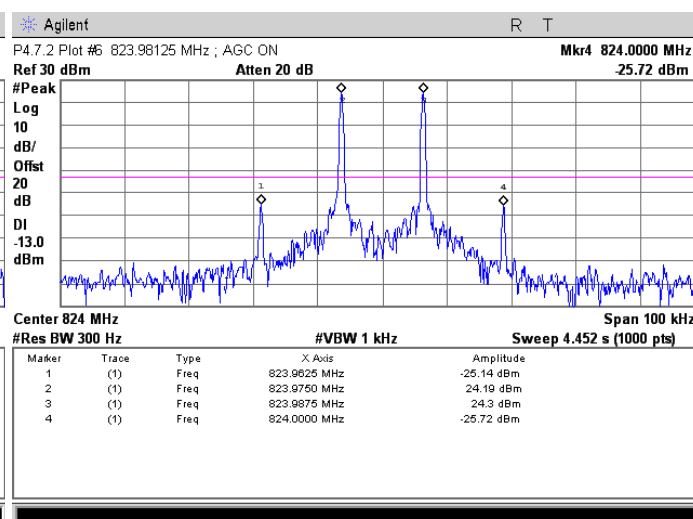
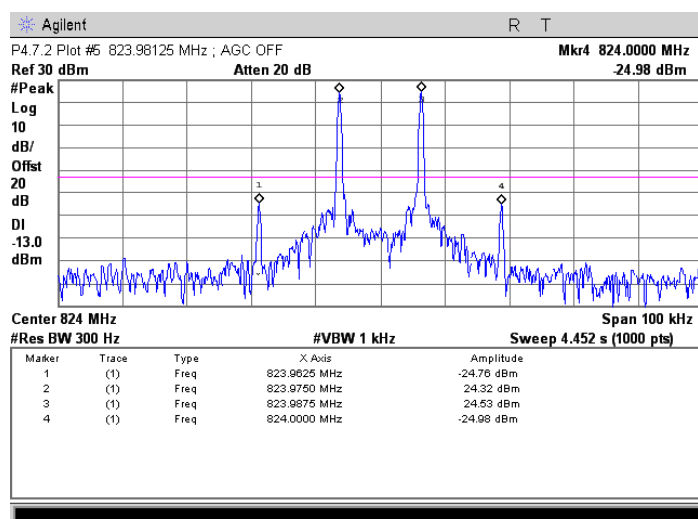
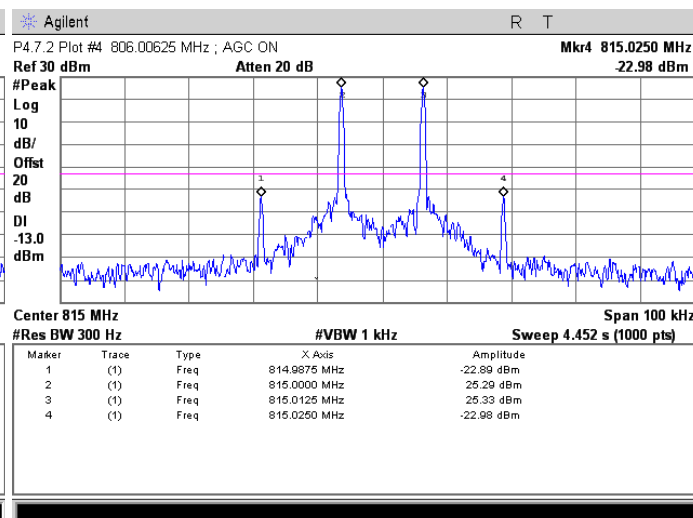
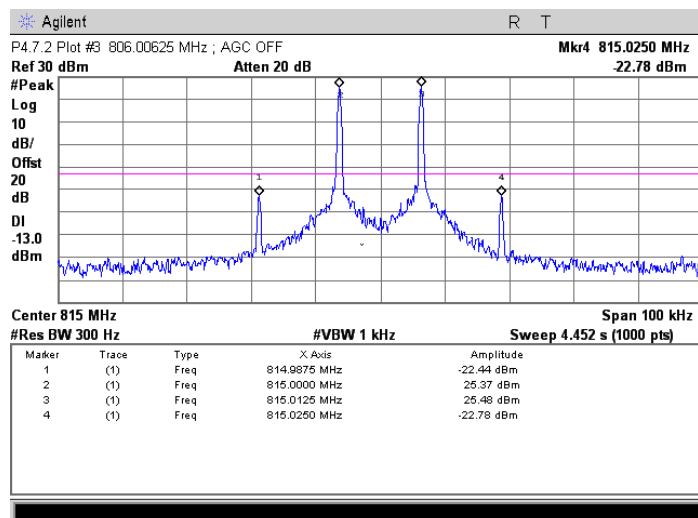
P4.7.2 Plot #	RBW Hz	VBW Hz	Signal Generator				input to Combine dBm	AGC	Analyzer Center MHz	Freq MHz	Max Reading dBm
			Modul	Channel kHz	#1 MHz	#2 MHz					
1	300	1000	CW	12.5	806.0125	806.025	-27.0	off	806.01875	806.00	25.46
2	300	1000	CW	12.5	806.0125	806.025	-23.0	on	806.01875	806.00	20.92
3	300	1000	CW	12.5	815	815.0125	-27.0	off	815.00625	815.025	22.78
4	300	1000	CW	12.5	815	815.0125	-23.0	on	815.00625	815.025	22.98
5	300	1000	CW	12.5	823.975	823.9875	-27.0	off	823.98125	824.00	24.98
6	300	1000	CW	12.5	823.975	823.9875	-23.0	on	823.98125	824.00	25.72
7	300	1000	CW	25	806.025	806.05	-27.0	off	806.03750	806.375	21.25
8	300	1000	CW	25	806.025	806.05	-23.0	on	806.03750	806.375	21.59
9	300	1000	CW	25	815	815.025	-27.0	off	815.01250	815.0125	23.07
10	300	1000	CW	25	815	815.025	-23.0	on	815.01250	815.0125	23.32
11	300	1000	CW	25	823.95	823.975	-27.0	off	823.96250	823.9625	24.84
12	300	1000	CW	25	823.95	823.975	-23.0	on	823.96250	823.9625	25.35
13	300	1000	CW	12.5	851.0125	851.025	-27.0	off	851.01875	851.01875	24.22
14	300	1000	CW	12.5	851.0125	851.025	-23.0	on	851.01875	851.01875	24.61
15	300	1000	CW	12.5	860	860.0125	-27.0	off	860.00625	860.00625	26.3
16	300	1000	CW	12.5	860	860.0125	-23.0	on	860.00625	860.00625	26.09
17	300	1000	CW	12.5	868.975	868.9875	-27.0	off	868.98125	868.98125	22.89
18	300	1000	CW	12.5	868.975	868.9875	-23.0	on	868.98125	868.98125	23.58
19	300	1000	CW	25	851.025	851.05	-27.0	off	851.03750	851.0375	23.99
20	300	1000	CW	25	851.025	851.05	-23.0	on	851.03750	851.0375	24.03
21	300	1000	CW	25	860	860.025	-27.0	off	860.01250	860.0125	28.4
22	300	1000	CW	25	860	860.025	-23.0	on	860.01250	860.0125	26.38
23	300	1000	CW	25	868.95	868.975	-27.0	off	868.96250	868.9625	23.06
24	300	1000	CW	25	868.95	868.975	-23.0	on	868.96250	868.9625	23.43

The table shows the highest spurious noise from the amplifier.

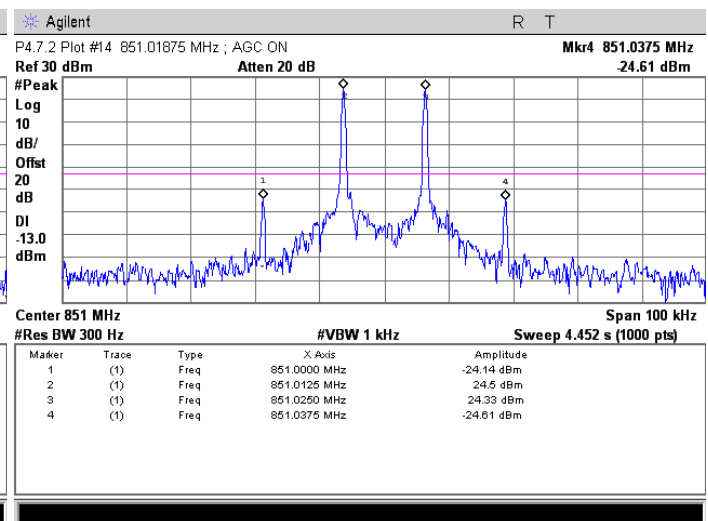
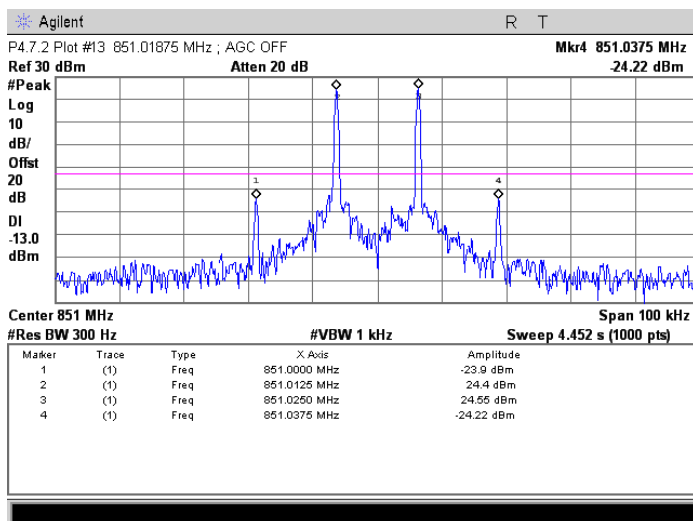
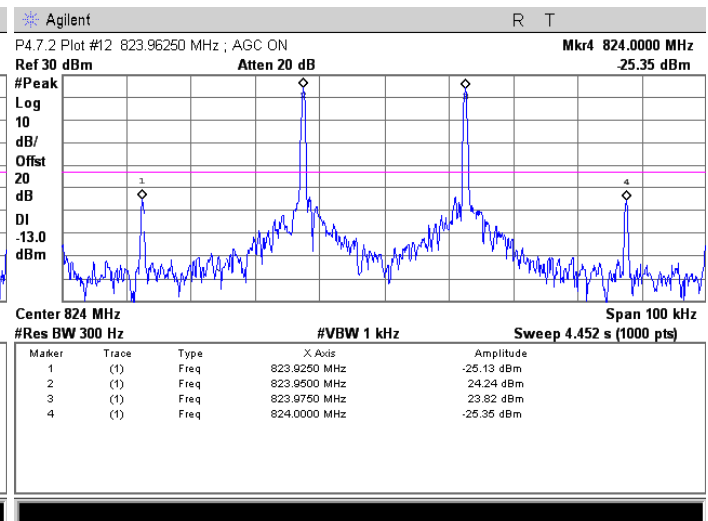
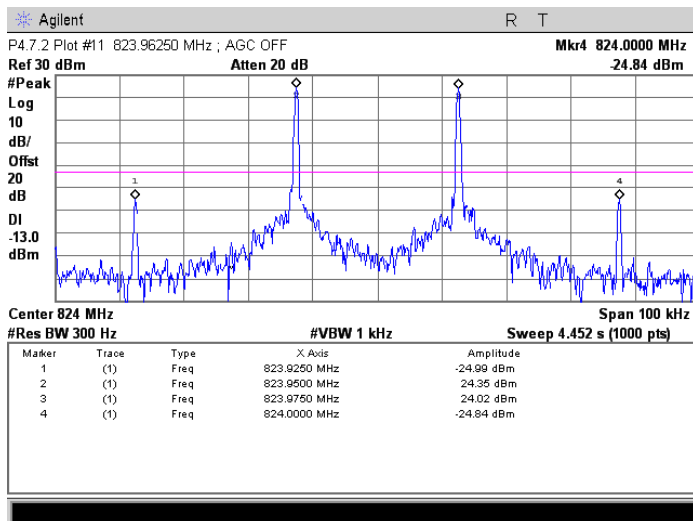
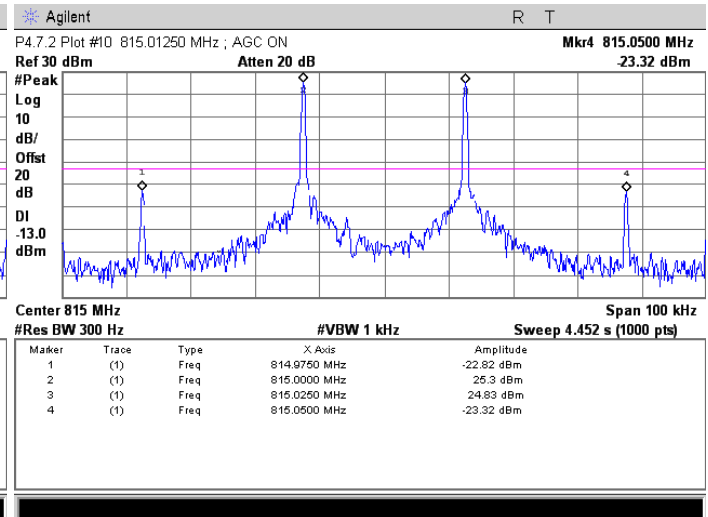
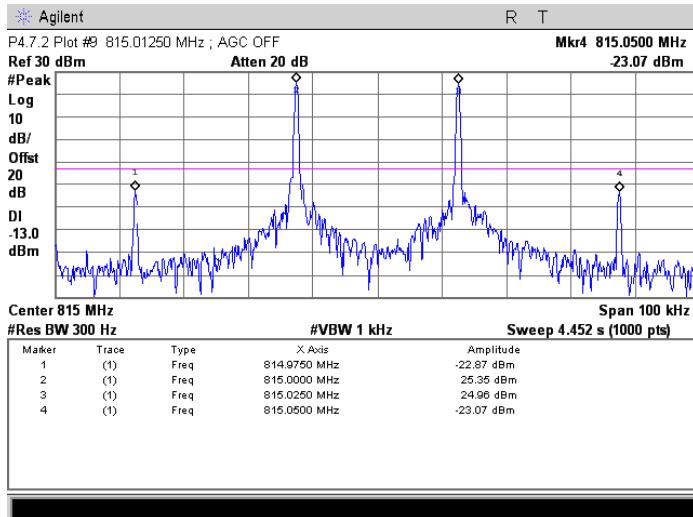
16.3.1 Combined Output Results; Out-of-band/out-of-block emissions



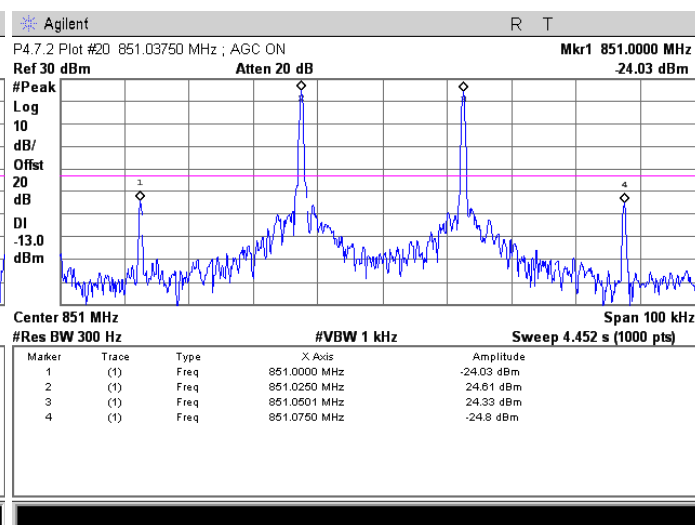
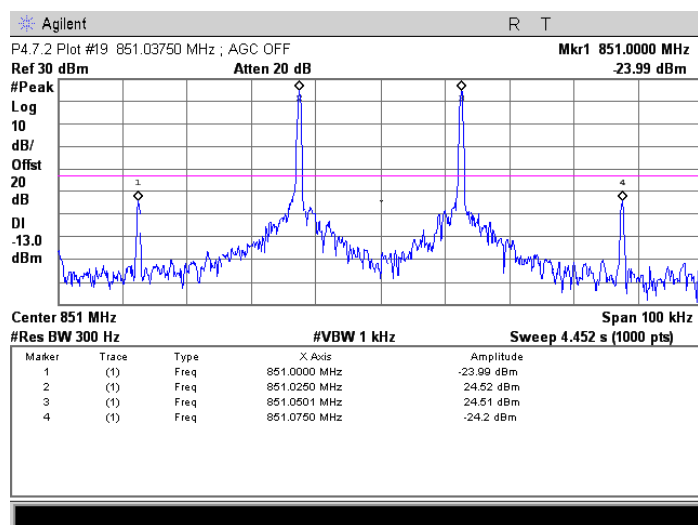
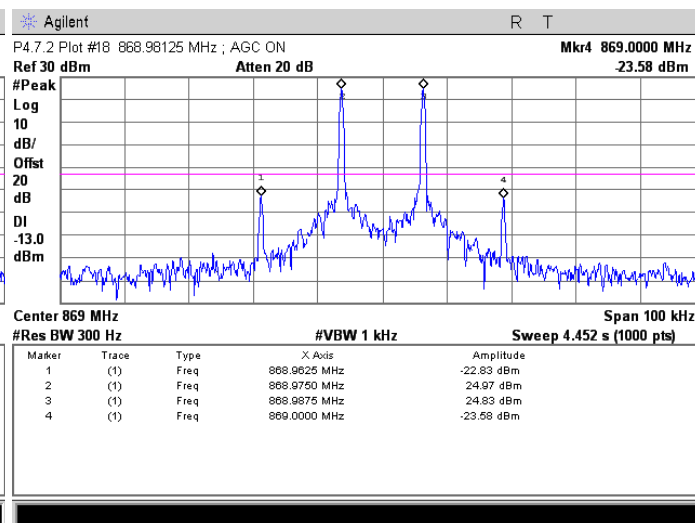
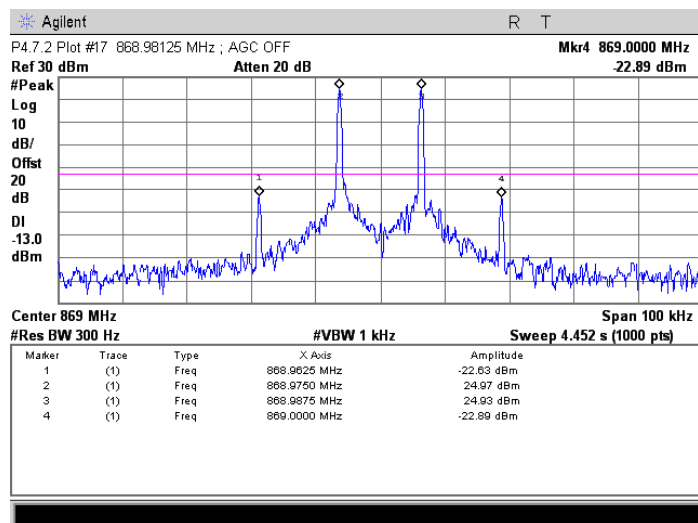
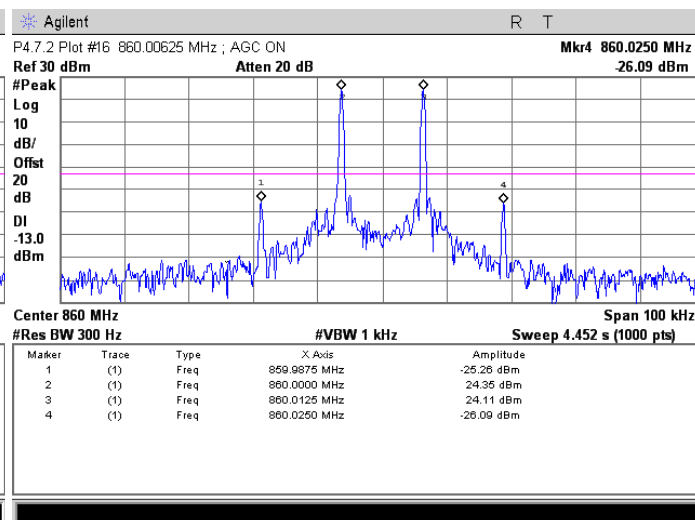
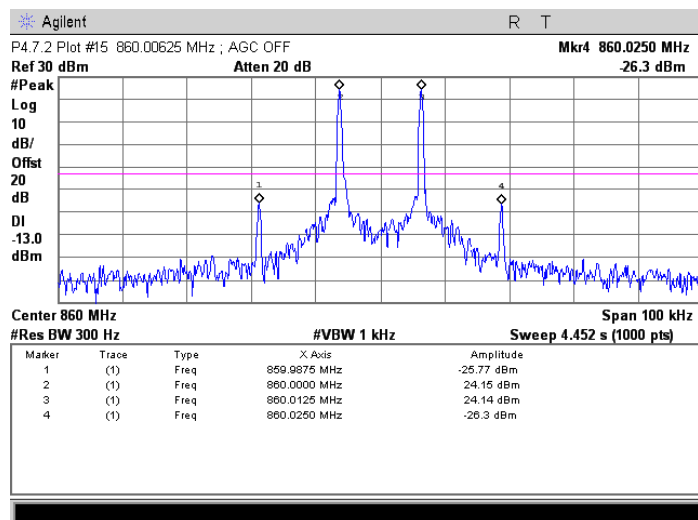
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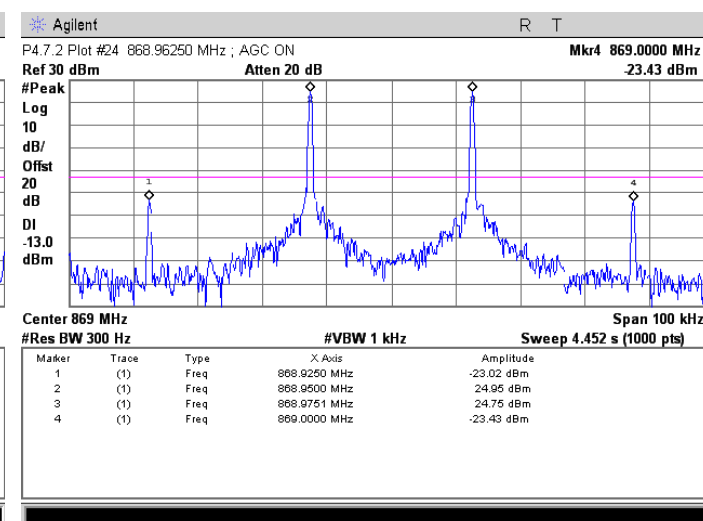
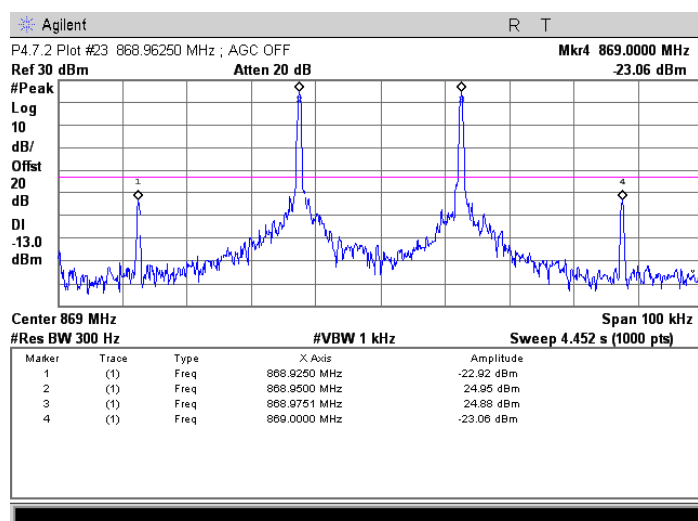
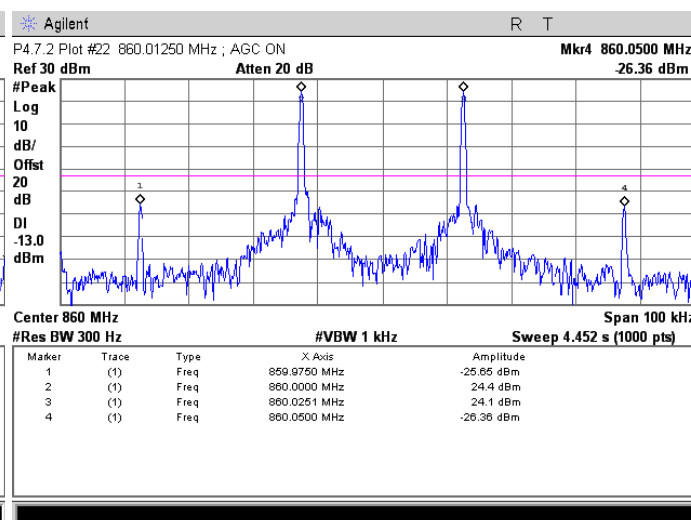
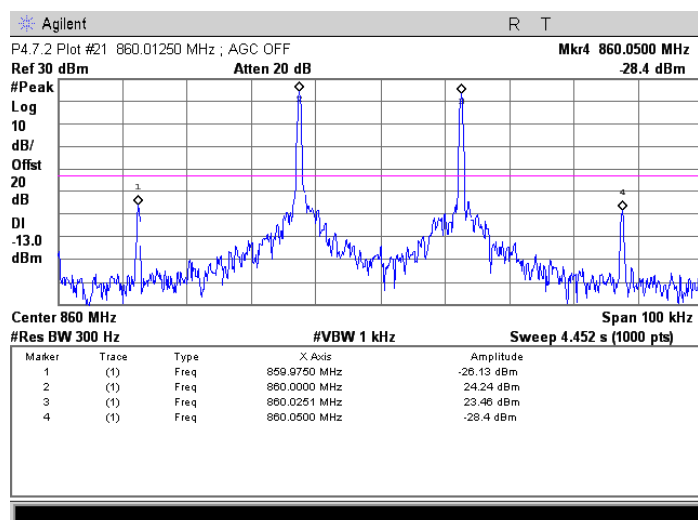
Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8



Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8



Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8



17.0 SPURIOUS EMISSIONS CONDUCTED MEASUREMENTS

17.1 Applicable Standard

The EUT shall comply with sections 4.7.3 of KDB 935210 D05, since it is a Multi-Channel Enhancer.

For a multi-channel enhancer, any intermodulation product level must be attenuated, relative to P, by at least: $43 + 10 \times \log_{10} P$, or 70 dB, whichever is less stringent, where P is the total RF output power of the test tones in watts. Since $43 + 10 \times \log_{10} P$ is less stringent than 70 dB, that limit was used.

Spurious emissions shall be measured using a single test signal sequentially tuned to the low, middle, and high channels or frequencies within each authorized frequency band of operation.

Out-of-band/out-of-block emissions (including intermodulation products) was measured under each of the following two stimulus conditions:

a) two adjacent test signals sequentially tuned to the lower and upper frequency band/block edges;

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b) a single test signal, sequentially tuned to the lowest and highest frequencies or channels within the frequency band/block under examination.

17.2 Test procedures for section 4.7.3

- a) A signal generator was connected to the input of the EUT.
- b) The signal generator was configured to produce a CW signal.
- c) The frequency of the CW signal was set to the center channel of the EUT passband.
- d) The output power level was set so that the resultant signal is just below the AGC threshold (see 4.2).
- e) A spectrum analyzer was connected to the output of the EUT, using appropriate attenuation as necessary.
- f) The RBW was set = 100 kHz. (i.e., for 30 MHz to 1 GHz PLMRS and/or PSRS booster devices)
- g) The VBW was set = $3 \times \text{RBW}$.
- h) The Sweep time was set = auto-couple.
- i) The detector was set to PEAK.
- j) The spectrum analyzer start frequency was set to 30 MHz (or the lowest radio frequency signal generated in the EUT, without going below 9 kHz if the EUT has additional internal clock. frequencies), and the stop frequency to 10 times the highest allowable frequency of the EUT passband.
- k) MAX HOLD was selected, and the marker peak function was used to find the highest emission(s) outside the passband. (This could be either at a frequency lesser or greater than the passband frequencies.)
- l) A plot was captured for inclusion in the test report.
- m) Steps c) to l) were repeated for each authorized frequency band/block of operation.

Any frequency outside the authorized bandwidth was attenuated by at least $43 + 10 \log (P)$ dB. This corresponds to an absolute level of -13 dBm.

17.3 Results for Section 4.7.3

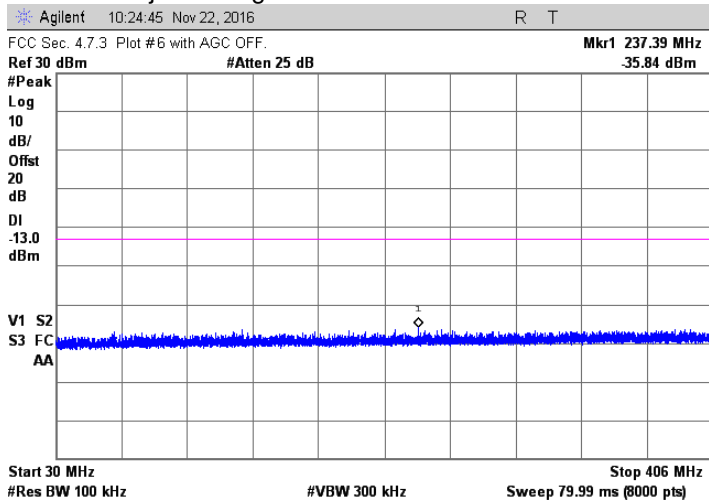
Model	BDA610-S8	Specification	FCC KDB 935210 Sec. 4.7.3
Serial Number	CPK63377	Test Date	November 22, 2016
Test Personnel	Richard L. Tichelaar	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-21)		

The spectrum analyzer was set to max hold mode.

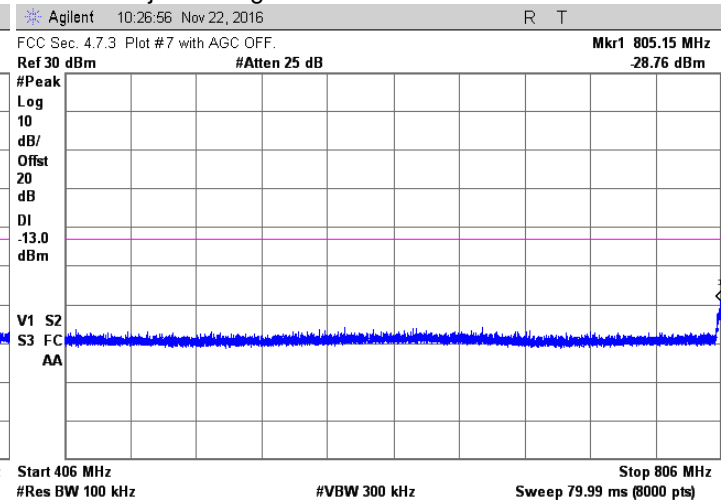
Plot #	RB W MHz	VB W MHz	Mode				Start MHz Stop MHz		Max reading	
				Sig Gen					Freq MHz	dBm
				Modul	MHz	dBm				
6	0.1	0.3	1	CW	815.000	-40	30	406	237.39	-35.84
7	0.1	0.3	1	CW	815.000	-40	406	806	805.15	-28.76
8	0.1	0.3	1	CW	815.000	-40	824	1000	825.78	-32.8
9	1	3	1	CW	815.000	-40	1000	5000	2904	-24.6
10	1	3	1	CW	815.000	-40	5000	9000	7623	-27
22	0.1	0.3	2	CW	860.000	-41	30	350	145.1	-31.95
23	0.1	0.3	2	CW	860.000	-41	350	550	375.5	-32.5
24	0.1	0.3	2	CW	860.000	-41	550	851	850.2	-30
25	0.1	0.3	2	CW	860.000	-41	869	1000	869.8	-29.1
26	1	3	2	CW	860.000	-41	1000	5000	2891	-24.98
27	1	3	2	CW	860.000	-41	5000	9000	7404	-27

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815 MHz Injected Signal

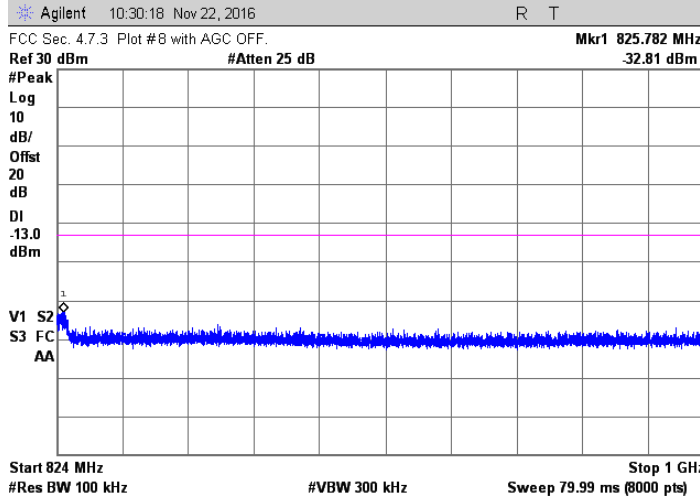


815 MHz Injected Signal

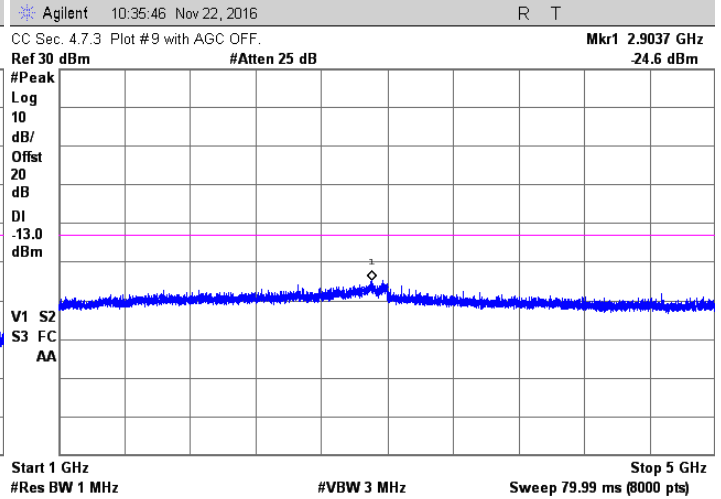


Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

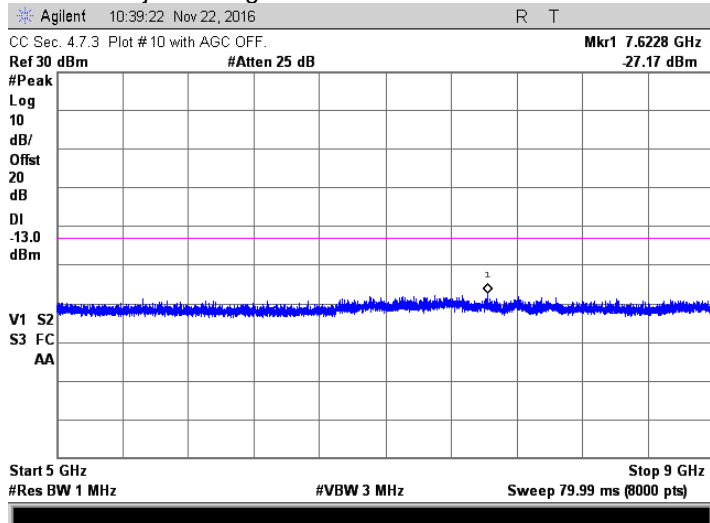
815 MHz Injected Signal



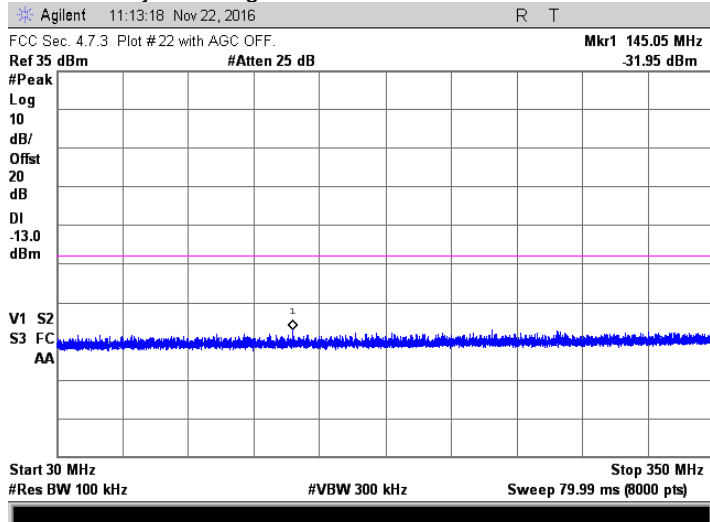
815 MHz Injected Signal



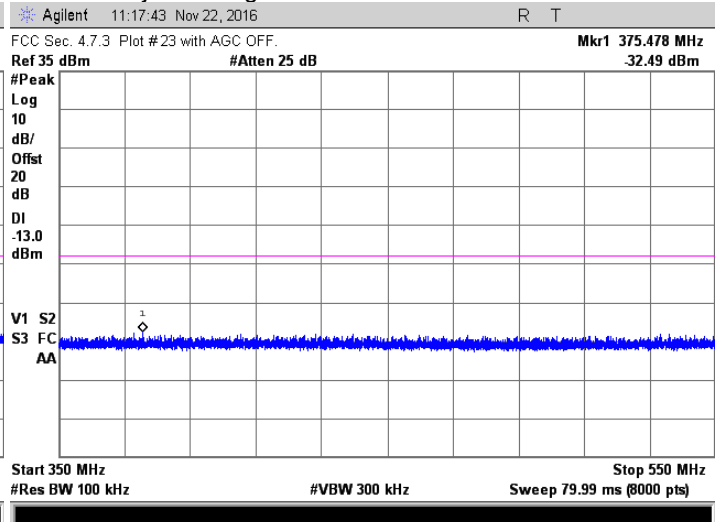
815 MHz Injected Signal



860 MHz Injected Signal

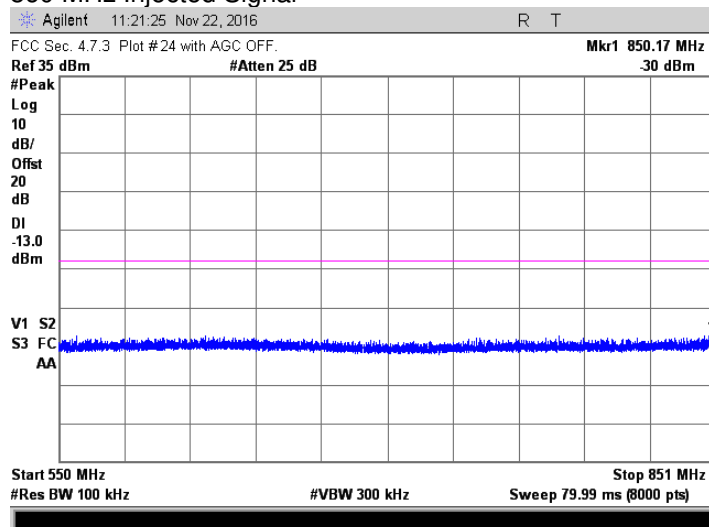


860 MHz Injected Signal

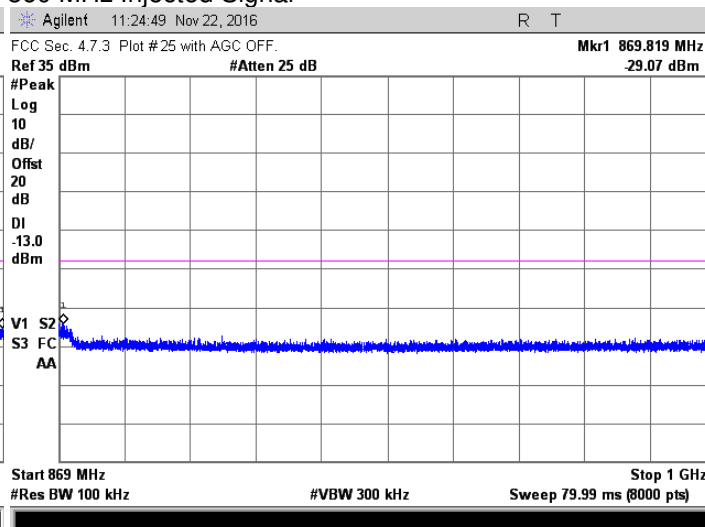


Test Report for the Westell, Incorporated, Booster Amplifier, Model BDA610-S8

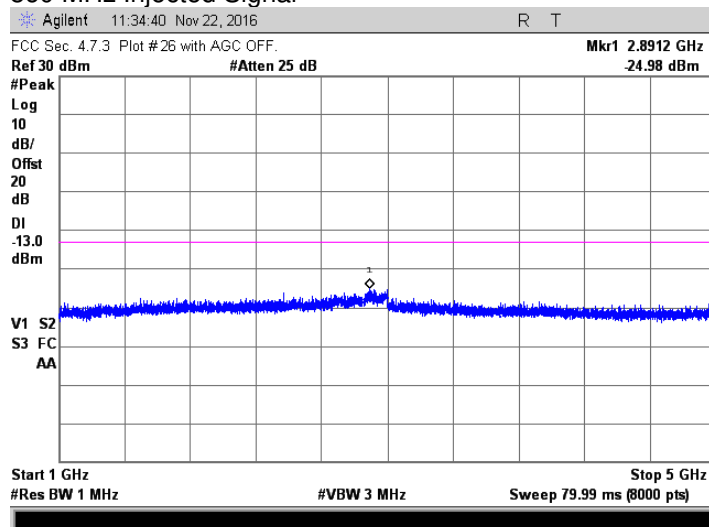
860 MHz Injected Signal



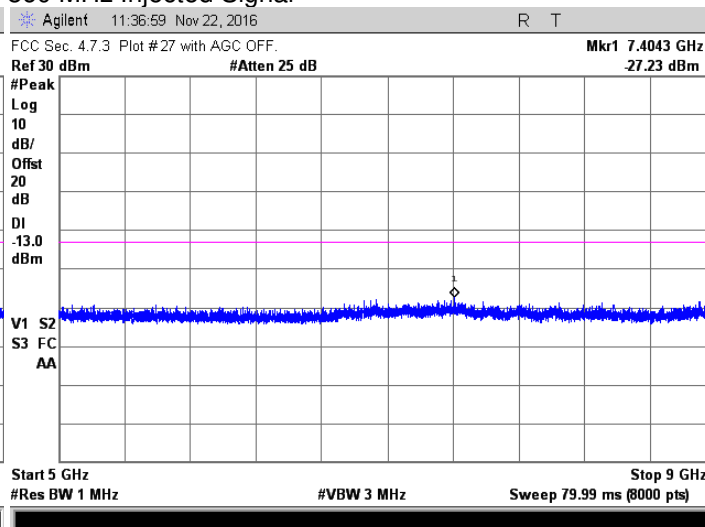
860 MHz Injected Signal



860 MHz Injected Signal



860 MHz Injected Signal



18.0 SPURIOUS RADIATED EMISSIONS

18.1 Applicable Standard

The EUT shall comply with section 4.9 of FCC KDB 935210 D05 and FCC Part 2.1053. This test is intended to capture any emissions that radiate directly from the case, cabinet, control circuits, etc., instead of via the antenna output port, and thus would not be captured in conducted spurious emission measurements.

Spurious emissions of zone enhancers shall be suppressed as much as possible. Any emission must be attenuated below the power (P) of the highest emission contained within the authorized band, by at least: $43 + 10 \times \log_{10} P$, or 70 dB, whichever is less stringent, where P is the total RF output power of the test tones in watts. Since $43 + 10 \times \log_{10} P$ is less stringent than 70 dB, that limit was used.

18.2 Test Procedures

Radiated emission measurements in the restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. Radiated emissions measurements were performed in the anechoic chamber at a test distance of 3 meters. The entire frequency range from 30 to 7500 MHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function.

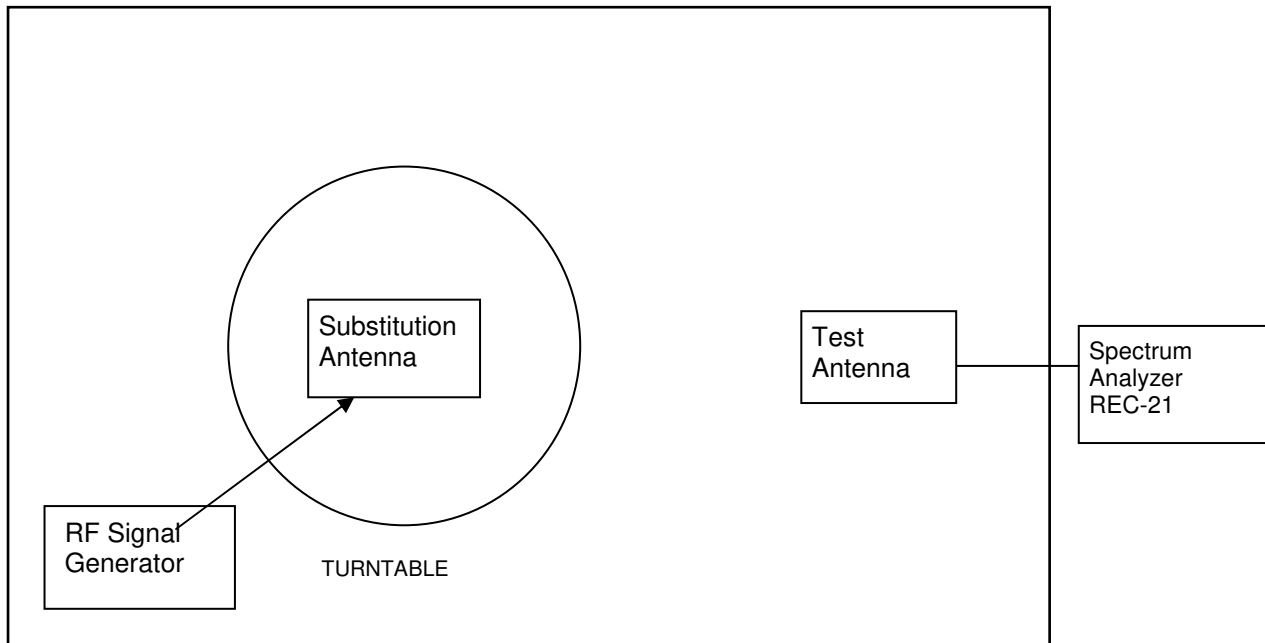
The spectrum analyzer was adjusted for the following settings:

- 1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
- 2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.
- 3) Sweep Speed slow enough to maintain measurement calibration.
- 4) Detector Mode = Positive Peak.

The transmitter to be tested was placed on the turntable in the standard test site, or an FCC listed site compliant with ANSI C63.4. The transmitter is transmitting into a non-radiating load that is placed on the turntable (except for the fundamental reading which had an antenna). Since the transmitter has an integral antenna, the tests are to be run with the unit operating into the integral antenna. Measurements were made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier. The transmitter was keyed during the tests.

For each spurious frequency, the test antenna was raised and lowered from 1 m to 4m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable was rotated 360° to determine the maximum reading. This procedure was repeated to obtain the highest possible reading. This maximum reading was recorded.

Each measurement was repeated for each spurious frequency with the test antenna polarized vertically.

Figure 1. Drawing of Radiated Emissions Setup

ANSI C63.4 Listed Test Site

Notes:

- Test Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale

Frequency MHz	Test Antenna	Substitution Antenna	Receiver	Signal Generator
30 - 200	ANT-03	ANT-04	REC-21	SIG-28
200 - 1000	ANT-06	ANT-07	REC-21	SIG-28
1000-9,000	ANT-13	ANT-36	REC-21	SIG-28

The transmitter was removed and replaced with a broadband substitution antenna. The substitution antenna is calibrated so that the gain relative to a dipole is known. The center of the substitution antenna was approximately at the same location as the center of the transmitter.

The substitution antenna was fed at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, the test antenna was raised and lowered to obtain a maximum reading at the spectrum analyzer. The level of the signal generator output was adjusted until the previously recorded maximum reading for this set of conditions was obtained. The measurements were repeated with both antennas horizontally and vertically polarized for each spurious frequency.

The power in dBm into a reference ideal half-wave dipole antenna was calculated by reducing the readings obtained in steps k) and l) by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

$$Pd(\text{dBm}) = Pg(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

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where:

P_d is the dipole equivalent power and

P_g is the generator output power into the substitution antenna.

The P_d levels record in step m) are the absolute levels of radiated spurious emissions in dBm.

Since by mathematical definition, $P(\text{dBm}) - (43 + 10 \times \text{LOG } P(\text{W})) = -13 \text{ dBm}$, the limit for spurious emissions was set to -13 dBm equivalent radiated power.

18.2.1 Spurious Radiated Emissions Test Results

Model	BDA610-S8	Specification	FCC KDB 935210
Serial Number		Test Date	09/29/2016 & 10/3/16
Test Distance	3 Meters	Notes	Transmit Mode

Note	Transmit at 806-824 MHz
------	-------------------------

Freq. MHz	Dect.	Ant. Pol.	EUT dBm	Limit dBm	Margin Under Limit dB
59.7	P	H	-62.2	-13.0	49.2
81.2	P	H	-59.9	-13.0	46.9
99.8	P	H	-50.8	-13.0	37.8
129.0	P	H	-55.9	-13.0	42.9
203.3	P	H	-52.5	-13.0	39.5
253.8	P	H	-58.3	-13.0	45.3
967.5	P	H	-57.2	-13.0	44.2
2435.0	P	H	-53.5	-13.0	40.5
2965.0	P	H	-51.3	-13.0	38.3
3510.0	P	H	-53.3	-13.0	40.3
3942.5	P	H	-51.9	-13.0	38.9
4502.5	P	H	-50.8	-13.0	37.8
5165.0	P	H	-47.8	-13.0	34.8
5952.5	P	H	-47.8	-13.0	34.8
6142.5	P	H	-47.5	-13.0	34.5
6490.0	P	H	-47.2	-13.0	34.2
6942.5	P	H	-48.0	-13.0	35.0
7107.5	P	H	-46.2	-13.0	33.2
7940.0	P	H	-43.6	-13.0	30.6
48.7	P	V	-49.3	-13.0	36.3
97.1	P	V	-47.8	-13.0	34.8
124.6	P	V	-47.4	-13.0	34.4
378.8	P	V	-53.7	-13.0	40.7
816.3	P	V	-46.0	-13.0	33.0
1150.0	P	V	-48.9	-13.0	35.9
1227.5	P	V	-49.6	-13.0	36.6
1465.0	P	V	-48.2	-13.0	35.2
1555.0	P	V	-44.4	-13.0	31.4
1767.5	P	V	-45.7	-13.0	32.7
2437.5	P	V	-42.6	-13.0	29.6
3115.0	P	V	-51.1	-13.0	38.1
4580.0	P	V	-48.5	-13.0	35.5

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Freq. MHz	Dect.	Ant. Pol.	EUT dBm	Limit dBm	Margin Under Limit dB
4897.5	P	V	-49.1	-13.0	36.1
6052.5	P	V	-46.3	-13.0	33.3
7605.0	P	V	-43.2	-13.0	30.2
8065.0	P	V	-42.6	-13.0	29.6

Note	: Transmit at 851-869 MHz
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Freq. MHz	Dect.	Ant. Pol.	EUT dBm	Limit dBm	Margin Under Limit dB
100.9	P	H	-57.2	-13.0	44.2
125.2	P	H	-56.4	-13.0	43.4
203.3	P	H	-54.8	-13.0	41.8
495.0	P	H	-58.7	-13.0	45.7
861.3	P	H	-49.6	-13.0	36.6
2440.0	P	H	-53.7	-13.0	40.7
3197.5	P	H	-52.2	-13.0	39.2
3597.5	P	H	-52.6	-13.0	39.6
4160.0	P	H	-50.4	-13.0	37.4
5057.5	P	H	-49.1	-13.0	36.1
6515.0	P	H	-45.9	-13.0	32.9
7957.5	P	H	-41.8	-13.0	28.8
8477.5	P	H	-43.4	-13.0	30.4
48.7	P	V	-55.5	-13.0	42.5
61.9	P	V	-57.8	-13.0	44.8
80.6	P	V	-51.6	-13.0	38.6
124.6	P	V	-48.4	-13.0	35.4
223.6	P	V	-61.8	-13.0	48.8
861.3	P	V	-51.0	-13.0	38.0
863.8	P	V	-55.5	-13.0	42.5
977.5	P	V	-55.8	-13.0	42.8
1180.0	P	V	-53.3	-13.0	40.3
2437.5	P	V	-43.9	-13.0	30.9
3620.0	P	V	-51.9	-13.0	38.9
4505.0	P	V	-50.4	-13.0	37.4
5530.0	P	V	-48.1	-13.0	35.1
6182.5	P	V	-46.1	-13.0	33.1
7547.5	P	V	-42.1	-13.0	29.1
8625.0	P	V	-41.5	-13.0	28.5

Judgment: Passed by at least 15 dB.

19.0 MEASUREMENT INSTRUMENTATION UNCERTAINTY

Measurement	Uncertainty
Radiated Emissions, E-field, 3 meters, 30 to 200 MHz	3.3 dB
Radiated Emissions, E-field, 3 meters, 200 to 1000 MHz	4.9 dB
Radiated Emissions, E-field, 3 meters, 1 to 18 GHz	4.8 dB
Bandwidth using marker delta method	1% of frequency span
Conducted power	0.8 dB
Amplitude measurement 1-9000 MHz;	1.5 dB

The uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k=2$ in accordance with CISPR 16-4-2.