RADIOMETRICS Midwest Corporation

Electromagnetic Compatibility Test Report

Tests Performed on a Westell Technologies, Incorporated

Booster Amplifier, Model BDA610-S8

Radiometrics Document RP-8491A2

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, 20.21 CFR Title 47: 2016

Tests Performed For:	*Test Facility:*
Westell Technologies, Incorporated 750 Commons Dr. Aurora, IL 60504	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772

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

September 28, 2016 thru January 25, 2017

Document RP-8491A2 Revisions:

Rev.	Issue Date	Affected Sections	Revised By
0	February 10, 2017		
1	February 28, 2017	Cover, 2.0, 9.0, 12.2, 12.3, 14.3, 15.5	Joseph Strzelecki

Table of Contents

Notice: This report must not be reproduced (except in full) without the written approval of Radiometrics Midwest Corporation.

1.0 ADMINISTRATIVE DATA

Equipment Under Test: An Westell, Incorporated Booster Amplifier Model: BDA610-S8; Serial Number: CNH60713 This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) August 31, 2016	*Test Date(s): (Month-Day-Year)* September 28, 2016 thru January 25, 2017
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* The tests were not witnessed by personnel from Westell Technologies, Incorporated
Radiometrics' Personnel Responsible for Test: Joseph Strzelecki 02/10/2017 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Richard L. Tichgelaar EMC Technician	*Test Report Approved By* Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

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	3.2	Pass
Amplifier Bandwidth	806-869 MHz	3.3	Pass
Input-versus-output signal comparison		3.4	
Mean output power and amplifier gain	806-869 MHz	3.5	Pass
Out-of-band/out-of-block emissions conducted measurements	806-869 MHz	3.7.2	Pass
Spurious emissions conducted measurements	30-9,000 MHz	3.7.3	Pass
Frequency Stability	N/A	3.7	Note 1
Field Strength of Spurious Radiated emissions	30-9,000 MHz	3.8	Pass

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

The purpose of this report is to show compliance to the FCC section 20.21 in the 817-824 MHz & 862-869 MHz bands.

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
There is no frequency stability since it does not translate frequency.

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

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

* Type: E = EUT, S = Support Equipment

4.2 EUT Operating Modes

The following Modulations were used during the tests:

Modulation	Description
AWGN	Broadband modulation with an occupied bandwidth (OBW) of 4.1 MHz. This is representative of a 5 MHz LTE channel
MSK	Narrowband MSK modulation. It has a Gaussian Filter of 0.3 and a data rate of 270 kbps. This is representative of a GSM-TDMA signal.
CW	Continuous Wave; No Modulation

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.

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
ANT-48	RMC	Std Gain Horn	HW2020	1001	18-26 GHz	24 Mo.	12/15/15
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-47	HP	Attenuator(20dB)	8491A	53862	DC-23 GHz	24 Mo.	09/18/15
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 3.2.

11.2 Test procedures

a) A signal generator was connected to the input of the EUT.
b) A spectrum analyzer or power meter was connected to the output of the EUT using appropriate attenuation as necessary.
c) The signal generator was initially configured to produce either of the required test signals (i.e., broadband AWGN or narrowband MSK)
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 signals.

11.2.1 AGC Threshold Test Results

Model	BDA610-S8	Specifications	FCC KDB 935210 D05 Sec. 3.2
Serial Number	CPK63377	Test Date	January 24, 2017
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	Spectrum Analyzer (REC-21)		

The spectrum analyzer was set to Band power measurements using 100 trace average in the RMS peak mode.

	Generator Output		RMS Reading	EUT Output Change	Anal. ATT	Cab to Anal Loss	Output Power	Spec An settings		
Modul	MHz	dBm	dBm	dB	dB	dB	dBm	RBW MHz	Span MHz	Min # of points
MSK	820.5	-41.0	7.40	start ref	20.0	0.4	27.8	0.01	1	200
MSK	820.5	-40.5	7.90	0.5	20.0	0.4	28.3	0.01	1	200
MSK	820.5	-40.0	8.45	0.5	20.0	0.4	28.9	0.01	1	200
MSK	820.5	-39.5	8.33	-0.1	20.0	0.4	28.7	0.01	1	200
MSK	820.5	-39.0	8.70	0.4	20.0	0.4	29.1	0.01	1	200
MSK	865.5	-40.5	7.30	start ref	20.0	0.4	27.7	0.01	1	200
MSK	865.5	-40.0	7.80	0.5	20.0	0.4	28.2	0.01	1	200
MSK	865.5	-39.5	8.30	0.5	20.0	0.4	28.7	0.01	1	200
MSK	865.5	-39.0	8.70	0.4	20.0	0.4	29.1	0.01	1	200
MSK	865.5	-38.5	8.60	-0.1	20.0	0.4	29.0	0.01	1	200
MSK	865.5	-38.0	7.70	-0.9	20.0	0.4	28.1	0.01	1	200
AWGN	820.5	-42.0	6.14	start ref	20.0	0.4	26.5	0.1	8	160
AWGN	820.5	-41.5	6.62	0.5	20.0	0.4	27.0	0.1	8	160
AWGN	820.5	-41.0	7.14	0.5	20.0	0.4	27.5	0.1	8	160
AWGN	820.5	-40.5	7.63	0.5	20.0	0.4	28.0	0.1	8	160
AWGN	820.5	-40.0	8.10	0.5	20.0	0.4	28.5	0.1	8	160
AWGN	820.5	-39.5	8.60	0.5	20.0	0.4	29.0	0.1	8	160
AWGN	820.5	-39.0	8.50	-0.1	20.0	0.4	28.9	0.1	8	160
AWGN	820.5	-38.5	8.00	-0.5	20.0	0.4	28.4	0.1	8	160

Modul	Generator Output MHz	Generator Output dBm	RMS Reading dBm	EUT Output Change dB	Anal. ATT dB	Cab to Anal Loss dB	Output Power dBm	Spec An settings RBW MHz	Spec An settings Span MHz	Spec An settings Min # of points
AWGN	865.5	-41.0	6.6	start ref	20.0	0.4	27.0	0.1	8	160
AWGN	865.5	-40.5	7.10	0.5	20.0	0.4	27.5	0.1	8	160
AWGN	865.5	-40.0	7.60	0.5	20.0	0.4	28.0	0.1	8	160
AWGN	865.5	-39.5	7.47	-0.1	20.0	0.4	27.9	0.1	8	160
AWGN	865.5	-39.0	7.80	0.3	20.0	0.4	28.2	0.1	8	160

The Highlighted cells are the AGC Threshold. This is Level where a 1 dB change in increase in the input signal power no longer causes a 1 dB increase in the output signal power.

Note that there was a 20-dB attenuator between the Generator output and the EUT input.

12.0 OUT OF BAND REJECTION

12.1 Applicable Standard

The EUT shall comply with sections 3.3 of FCC KDB 935210 for passband gain.

12.2 Test Procedures

a) A signal generator was connected to the input of the EUT. A spectrum analyzer was connected to the output of the EUT using an external attenuator.
b) The swept CW signal was configured with the following parameters:
1) For each band, the analyzer and signal generator was set to a Frequency range ± 250 % of the passband, for each applicable band.
2) The generator level was set to a level so that the out-of-band rejection is > 20 dB above the noise floor and will not engage the AGC during the entire sweep
3) The Dwell time of each frequency step was at least 10 ms.
4) Number of points was set to at least SPAN/(RBW/2).
c) The resolution bandwidth (RBW) was set to 1 MHz and the video bandwidth (VBW) was set to 3 MHz.
d) The detector was set to Peak, Max-Hold and waited for the spectrum analyzer's spectral display to fill.
e) A marker was placed to the peak of the frequency response and record this frequency as f0.
f) Two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, were placed such that each marker was at or slightly below the −20 dB down amplitude, to determine the 20 dB bandwidth.
g) The frequency response of the EUT was captured.
h) The procedure was repeated for all frequency bands applicable for use by the EUT.

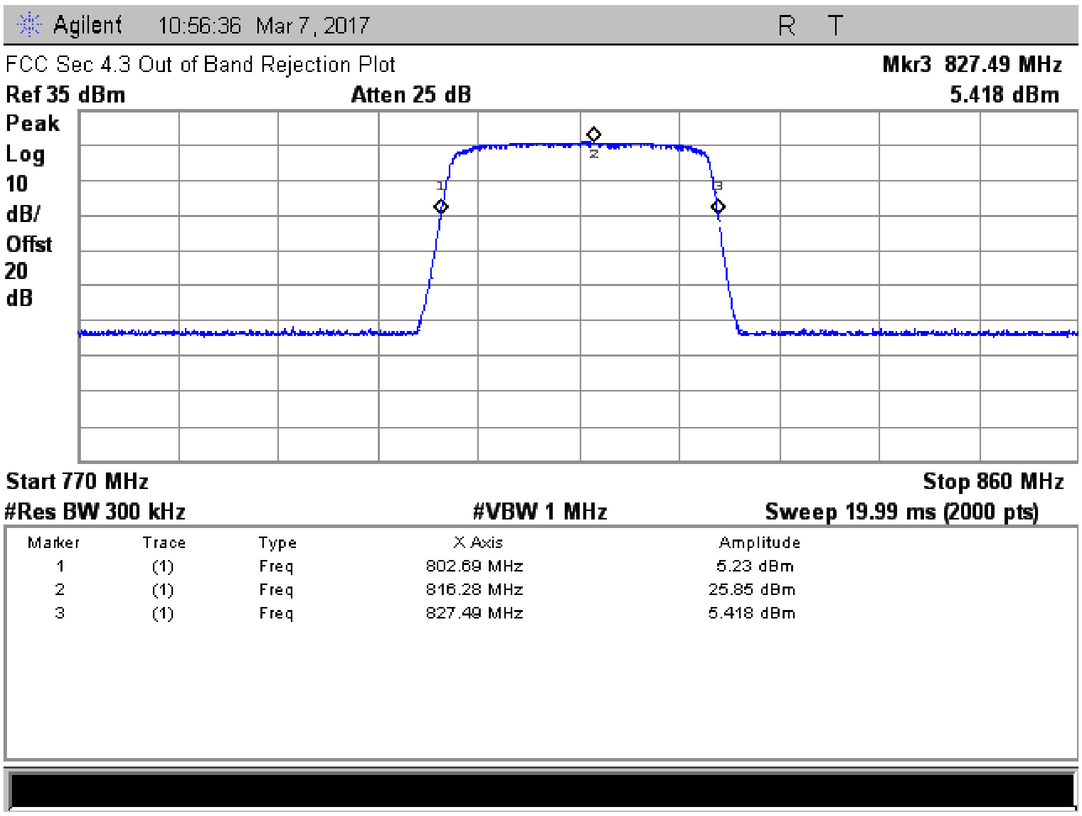
12.3 Passband Bandwidth Test Results

Model	BDA610-S8	Specification	KDB 935210 D05 Sec 3.3
Serial Number	CNH63377	Test Date	March 7, 2017
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-21)		

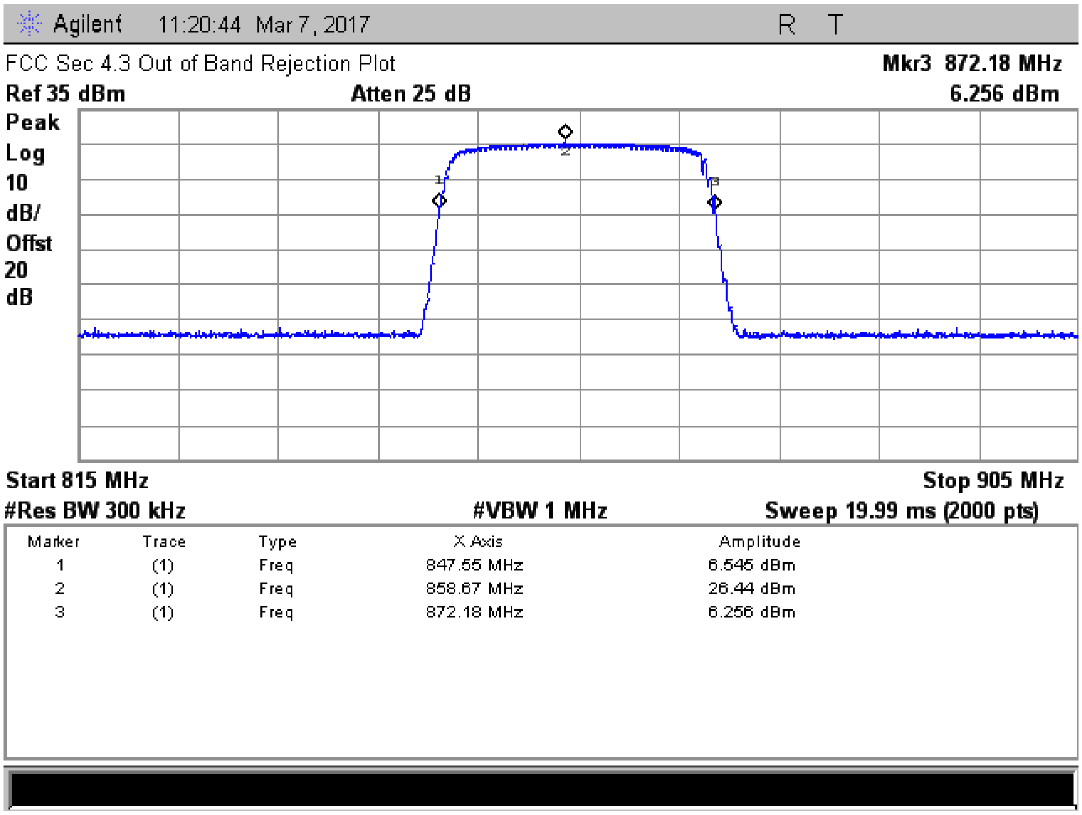
RBW MHz	VBW MHz	Mode	Display points	20 dB Down 1st Freq. MHz	20 dB Down 2nd Freq. MHz	20 dB BW MHz	Max Reading Max Rdg F0 MHz	Max Reading dBm
300	0.3	Up Link	2000	802.69	827.49	24.80	816.28	25.8
300	0.3	Down	2000	847.55	872.18	24.63	858.67	26.4

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

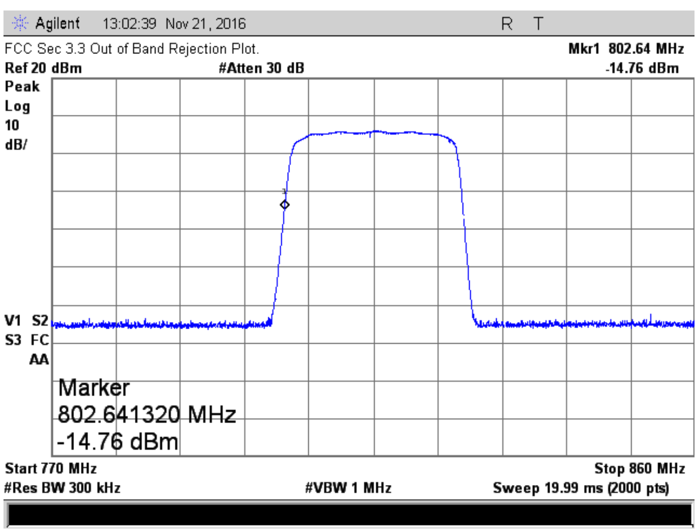
Judgement: Pass; the 20 dB bandwidth did not exceed the nominal bandwidth stated by the manufacturer. Outside of the 20 dB bandwidth, the gain did not exceed the gain at the 20 dB point.

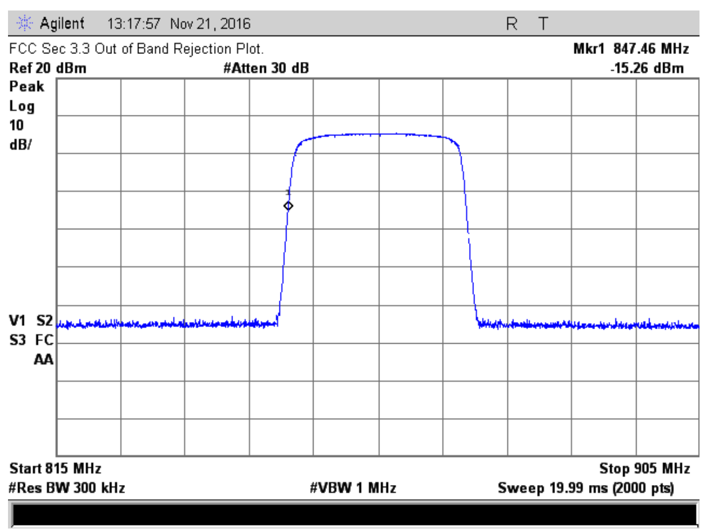


Up Link



Down link





The whole band of the amplifier was tested.

13.0 INPUT VS OUTPUT COMPARISON; WITH OCCUPIED BANDWIDTH

13.1 Applicable Standard

The EUT shall comply with FCC KDB 935210 section 3.4.

13.2 Test procedures

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

a) A signal generator was connected to the input of the EUT.
b) The signal generator was configured to transmit the AWGN signal.
c) The signal generator amplitude was configured to be zero to 0.5 dB below the AGC threshold level.
d) A spectrum analyzer was connected to the output of the EUT using an external attenuator.
e) The spectrum analyzer center frequency was set to the center frequency of the operational band under test. The span range of the spectrum analyzer was between 2 times to 5 times the occupied bandwidth (OBW).
f) The nominal RBW was in the range of 1 % to 5 % of the anticipated OBW, and the VBW was ≥ 3 × RBW.
g) The reference level of the instrument was set as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation.
h) The noise floor of the spectrum analyzer at the selected RBW was at least 36 dB below the reference level.
i) The spectrum analyzer detection function was set to positive peak.
j) The trace mode was set to max hold.
k) The reference value was determined by: Allowing the trace to stabilize, setting the spectrum analyzer marker to the highest amplitude level of the displayed trace (this is the reference value), and recording the associated frequency as f_0.
l) Two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, were placed such that each marker is at or slightly below the −26 dB down amplitude. The 26 dB OBW is the positive frequency difference between the two markers. If the spectral envelope crosses the −26 dB down amplitude at multiple points, the lowest or highest frequency was selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the −26 dB down amplitude point.
m) Steps e) to l) were repeated with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).
n) The spectral plot of the input signal (determined from step m) was compared to the output signal (determined from step l) to affirm that they are similar (in passband and roll off characteristic features and relative spectral locations).
o) The procedure [steps e) to n)] was repeated with the input signal amplitude set to 3 dB above the AGC threshold.
p) Steps e) to o) were repeated with the signal generator set to the narrowband signal.
q) Steps e) to p) were repeated for all frequency bands authorized for use by the EUT.

13.2.1 Input Vs Output Test Results

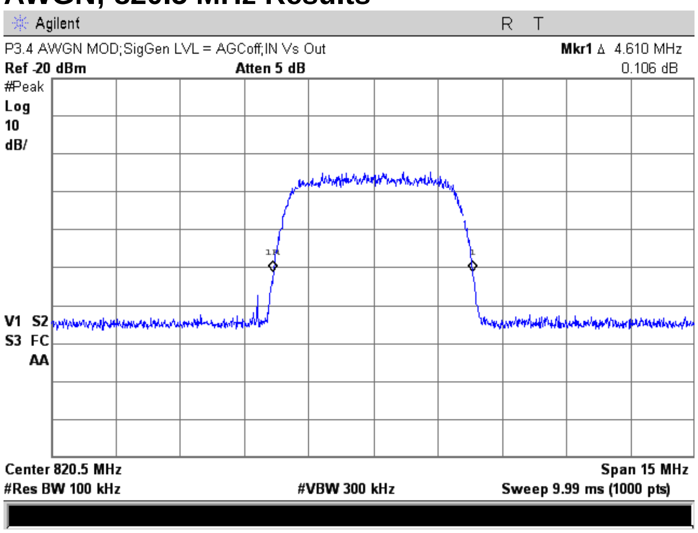
Model	BDA610-S8	Specifications	FCC KDB 935210 D05 Sec. 3.4
Serial Number	CPK63377	Test Date	01/24 & 25/2017
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	Spectrum Analyzer (REC-21)		

MOD Type	Plot #	Setting on Generator with 20 dB ATT on ouput MHz	dBm	Analyzer Settings RBW kHz	VBW kHz	Signal Below Ref lvl dB	Test Port	26db Reading MHz	EUT AGC Mode
AWGN	1	820.5	-40	100	300	16.7	**Generator**	4.6	N/A
AWGN	2	820.5	-40	100	300	16.7	Amp Out	4.6	Below
AWGN	3	820.5	-36.5	100	300	16.7	Generator	4.6	N/A
AWGN	4	820.5	-36.5	100	300	16.7	Amp Out	4.63	ON+3

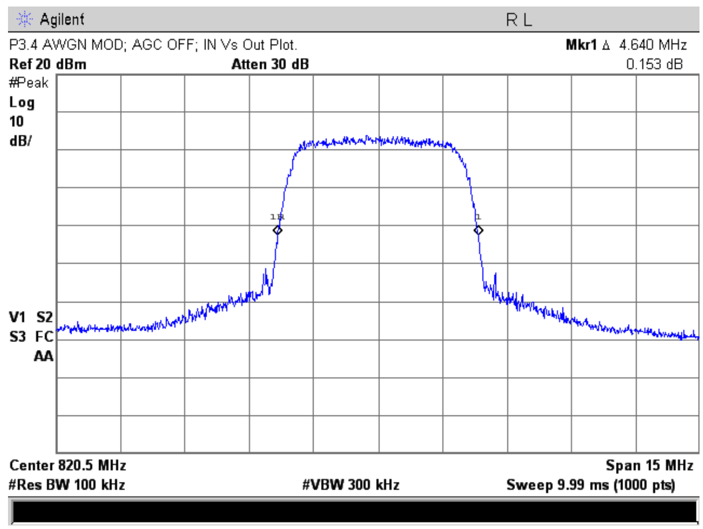
MSK	5	820.5	-40	10	30	14.8	**Generator**	0.318	N/A
MSK	6	820.5	-40	10	30	14.8	Amp Out	0.320	Below
MSK	7	820.5	-36.5	10	30	14.8	Generator	0.321	N/A
MSK	8	820.5	-36.5	10	30	14.8	Amp Out	0.319	ON+3
AWGN	9	865.5	-40	100	300	16.7	**Generator**	4.6	N/A
AWGN	10	865.5	-40	100	300	16.7	Amp Out	4.63	Below
AWGN	11	865.5	-36.5	100	300	16.7	Generator	4.6	N/A
AWGN	12	865.5	-36.5	100	300	16.7	Amp Out	4.58	ON+3
MSK	13	865.5	-39	10	30	14.8	**Generator**	0.318	N/A
MSK	14	865.5	-39	10	30	14.8	Amp Out	0.319	Below
MSK	15	865.5	-35.5	10	30	14.8	Generator	0.316	N/A
MSK	16	865.5	-35.5	10	30	14.8	Amp Out	0.323	ON+3

Judgement: Pass

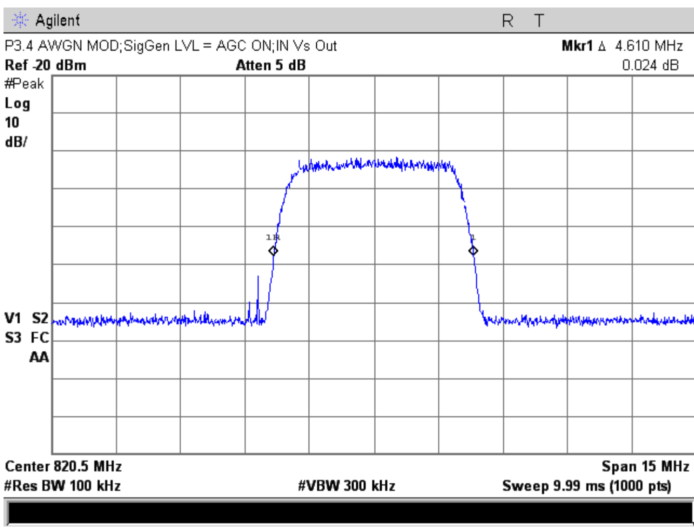
AWGN; 820.5 MHz Results



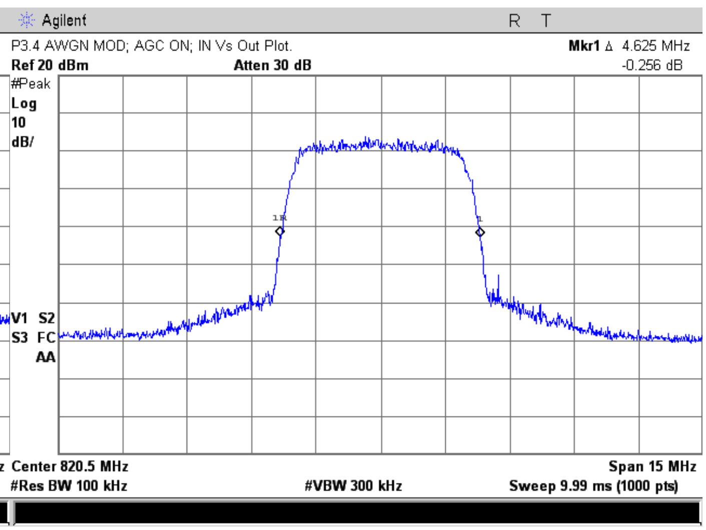
Generator output for AGC Off ; 820.5 MHz, AWGN



Amp output, no AGC; 820.5 MHz, AWGN

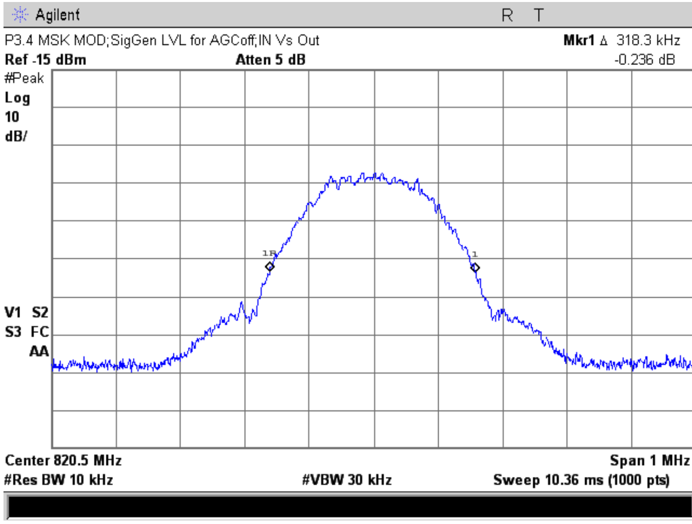


Generator output for AGC On ; 820.5 MHz, AWGN

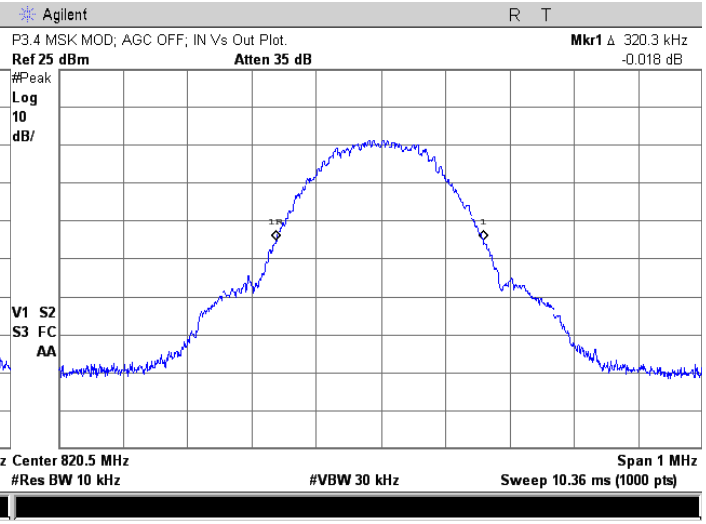


Amp output with AGC; 820.5 MHz, AWGN

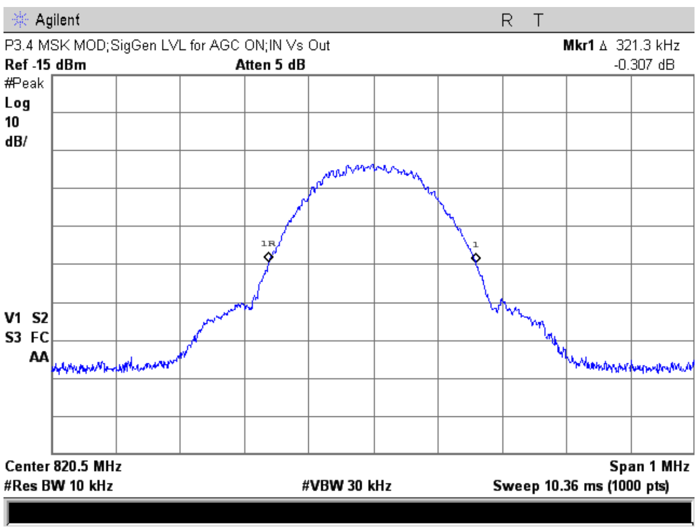
MSK; 820.5 MHz Results



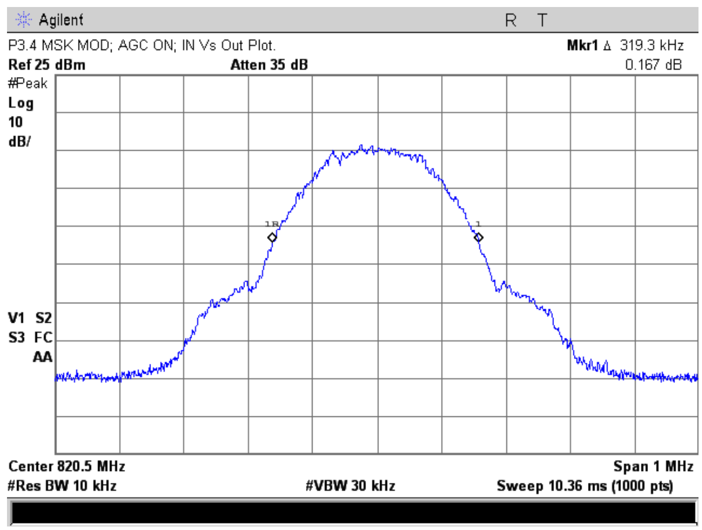
Generator output for AGC On ; 820.5 MHz, MSK



Amp output, no AGC; 820.5 MHz; MSK

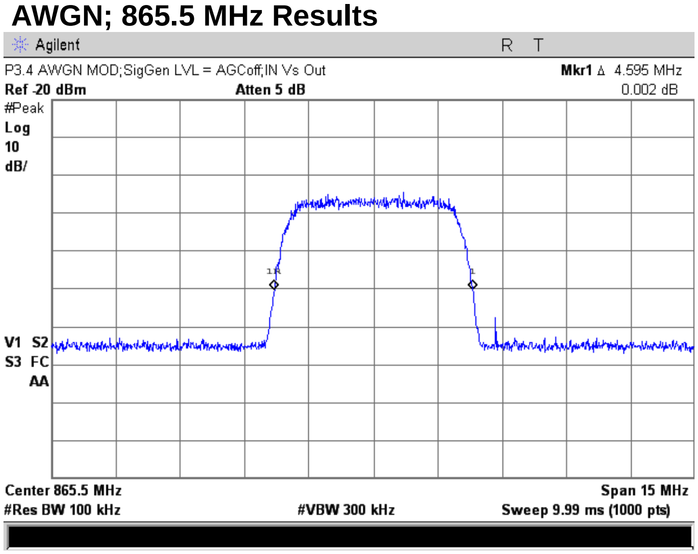


Generator output for AGC On ; 820.5 MHz, MSK

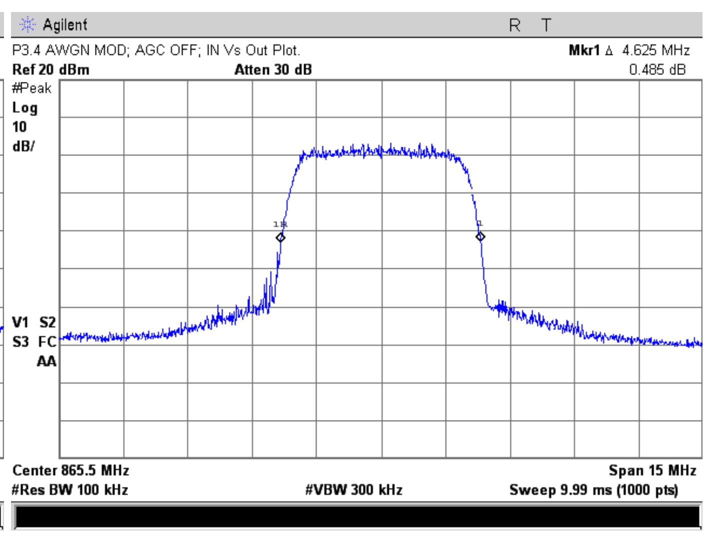


Amp output with AGC; 820.5 MHz, MSK

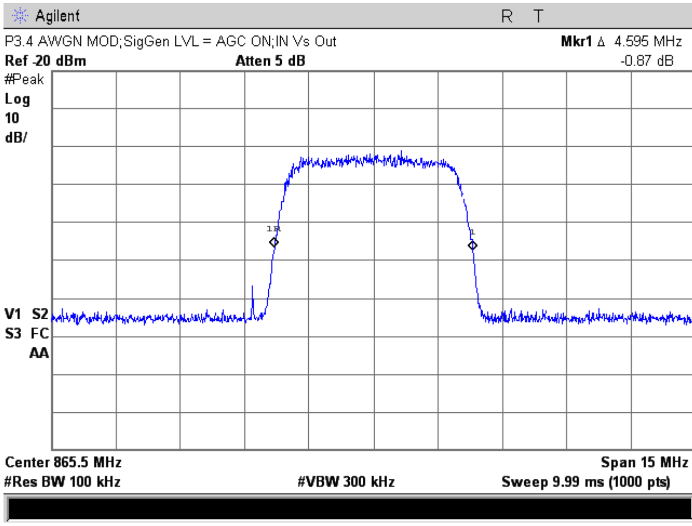
AWGN; 865.5 MHz Results



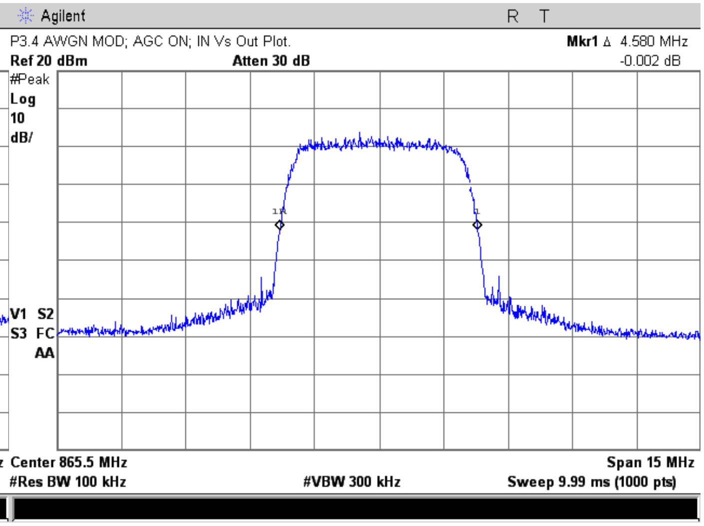
Generator output for AGC Off ; 865.5 MHz, AWGN



Amp output, no AGC; 865.5 MHz, AWGN

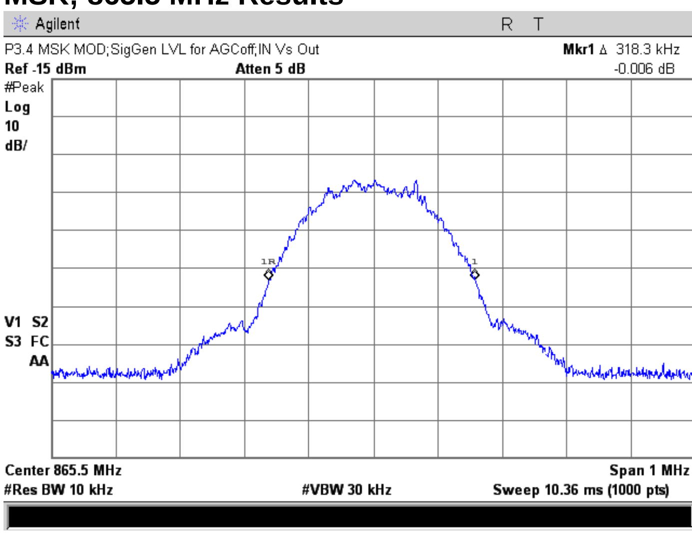


Generator output for AGC On ; 865.5 MHz, AWGN

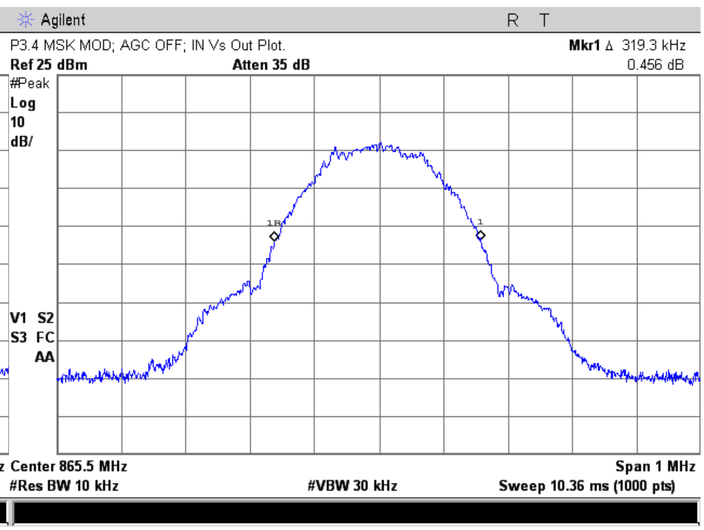


Amp output with AGC; 865.5 MHz, AWGN

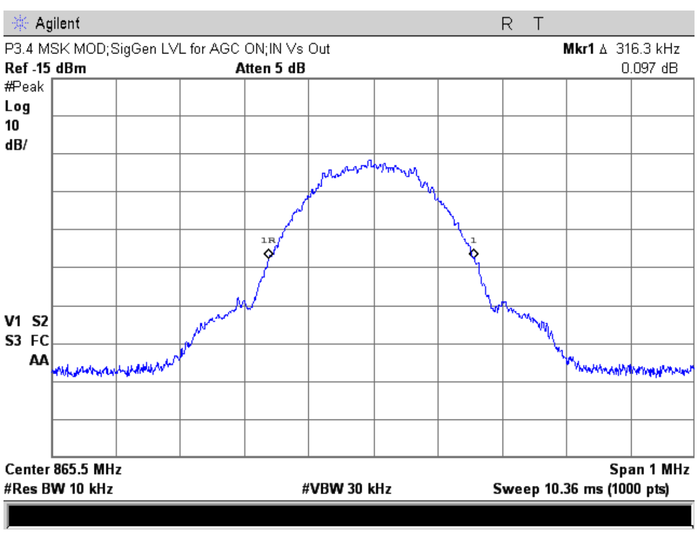
MSK; 865.5 MHz Results



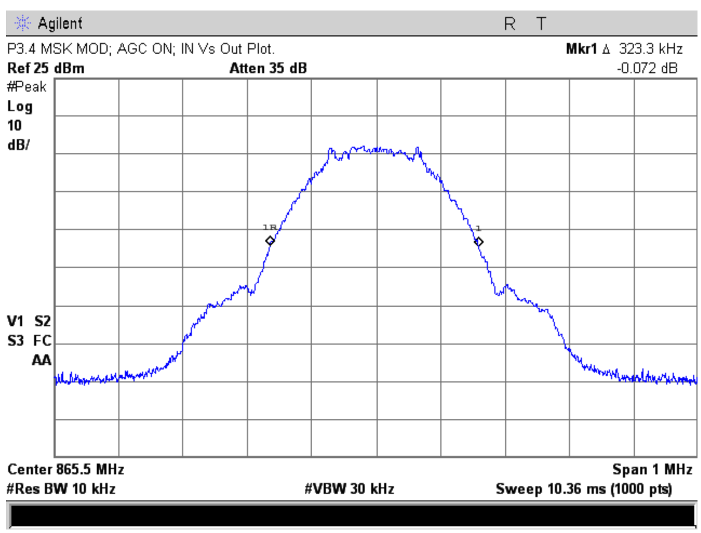
Generator output for AGC Off ; 865.5 MHz, MSK



Amp output, no AGC; 865.5 MHz, MSK



Generator output for AGC On ; 865.5 MHz, MSK



Amp output with AGC; 865.5 MHz, MSK

14.0 MEAN POWER OUTPUT AND AMPLIFIER GAIN

14.1 Applicable Standard

The EUT shall comply with FCC KDB 935210 section 3.5.

In accordance with section 3.5 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) A signal generator was connected to the input of the EUT.
b) The signal generator was configured to generate the AWGN (broadband) test signal.
c) The frequency of the signal generator was set to the frequency f0 as determined from 3.3 of KDB 935210.
d) A spectrum analyzer was connected to the output of the EUT using an external attenuator.
e) The signal generator amplitude was configured to be zero to 0.5 dB below the AGC threshold level.
f) The output power of the EUT measured and recorded; using 3.5.3 KDB 935210 for power measurement.
g) 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. EUT gain may be calculated as described in 3.5.5 KDB 935210.
h) Steps f) and g) were repeated with input signal amplitude set to 3 dB above the AGC threshold level.
i) Steps e) to h) were repeated with the narrowband test signal.
j) Steps e) to i) were repeated for all frequency bands authorized for use by the EUT.

The mean gain was reported for each authorized operating fre quency 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. 3.5
Serial Number	CPK63377	Test Date	01/24/2017
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-21)		

The spectrum analyzer was set to band power measurements using 100 trace average in the RMS peak mode. VBW>=3xRBW

Mode	See Sec 3.3 F0 MHz	Sec 3.2 Sig Gen dBm	Spec An settings RBW MHz	Span MHz	Reading at output of Gen dBm	Reading At Amp out dBm	Input Power dB	Cable Loss dB	pwr dBm	Power Watts	Gain dB
AWGN	820.5	**-39.0**	0.1	8	-50.0	8.5	20	0.4	28.9	0.7762	78.9
AWGN	820.5	-36.0	0.1	8	-46.8	8.0	20	0.4	28.4	0.6918	75.2

MSK	820.5	**-39.0**	0.01	1	-50.0	8.7	20	0.4	29.1	0.8128	79.1
MSK	820.5	-36.0	0.01	1	-46.7	8.6	20	0.4	29.0	0.7943	75.7
AWGN	865.5	**-39.5**	0.1	8	-50.2	7.5	20	0.4	27.9	0.6166	78.1
AWGN	865.5	-36.5	0.1	8	-46.8	7.0	20	0.4	27.4	0.5495	74.2
MSK	865.5	**-38.5**	0.01	1	-49.4	8.6	20	0.4	29.0	0.7943	78.4
MSK	865.5	-35.5	0.01	1	-45.6	8.3	20	0.4	28.7	0.7413	74.3

EUT output Power (dBm) = Amp out dBm + Output Atten (dB) + Cable Loss (dB)
EUT Gain (dB) = Amp out (dBm) – Input to Amp (dBm) + Output Atten (dB) + Input Atten (dB) + Cable Loss (dB)

Judgement: Pass; The passband gain did not exceed the nominal gain by more than 1.0 dB.

15.0 SPURIOUS EMISSIONS

15.1 Applicable Standard

The EUT shall comply with sections 3.6.2 and 3.6.3 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: $43+10xLog_{10}P$, or 70 dB, whichever is less stringent, where P is the total RF output power of the test tones in watts. Since $43 +10xLog_{10}P$ 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.

15.2 Test procedures for section 3.6.2

a) Two signal generators were connected to the input of the Device Under Test (EUT), via a combiner.
b) The signal generator was set to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW).
c) The center frequencies were set such that the AWGN signals occupy adjacent channels at the upper edge of the frequency band or block under test.
d) The composite power levels were set to be zero to 0.5 dB below the AGC threshold level.
e) A spectrum analyzer was connected to the output of the EUT using an external attenuator.
f) The RBW = reference bandwidth was set in accordance with the applicable rule section for the supported frequency band (typically 1 % of the OBW or 100 kHz or 1 MHz).
g) The RBW was set so that the VBW = 3 × RBW.
h) The detector was set to power averaging (rms) detector.
i) The sweep time was set so that sweep time = auto-couple.
j) The spectrum analyzer start frequency was set to the upper block edge frequency, and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively.
k) Trace averaged at least 100 traces in power averaging (rms) mode.
l) The marker function was used to find the maximum power level.
m) The spectrum analyzer trace of the power level was captured for inclusion in the test report.

n) Steps k) thru m) were repeated with the composite input power level set to 3 dB above the AGC threshold.
o) The frequencies of the input signals were reset to the lower edge of the frequency block or band under test.
p) The spectrum analyzer start frequency was reset to the lower block edge frequency minus 300 kHz or 3 MHz, for frequencies below and above 1 GHz, respectively, and the stop frequency to the lower band or block edge frequency.
q) Steps k) to n) were repeated.
r) Steps a) to q) were repeated with the signal generator configured for a single test signal tuned as close as possible to the block edges.
s) Steps a) to r) were repeated with the narrowband test signal.
t) Steps a) to s) were repeated for all authorized frequency bands or blocks used by the EUT.

On any frequency outside the authorized bandwidth shall be attenuated by at least 43 + 10 log (P) dB. This corresponds to an absolute level of -13 dBm.

15.3 Results for Section 3.6.2

Model	BDA610-S8	Specification	FCC KDB 935210 Sec. 3.6.2
Serial Number	CPK63377	Test Date	January 23, 2017
Test Personnel	Richard L. Tichgelaar	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-21)		

The spectrum analyzer was set to 100 trace average in the RMS mode.

Two input signals to amplifier

Plot #	RBW MHz	VBW MHz	Sig Gen Modul.	Sig Gen MHz 1	Sig Gen MHz 2	dBm	Start MHz	Stop MHz	Max reading Freq MHz	Max reading dBm
1	0.1	0.3	AWGN	819.4	819.5	-39.5	816.7	817	816.9	-29.94
2	0.1	0.3	AWGN	819.4	819.5	-36.5	816.7	817	817	-28.6
3	0.1	0.3	AWGN	821.5	821.6	-39.5	824	824.3	824.3	-30.7
4	0.1	0.3	AWGN	821.5	821.6	-36.5	824	824.3	824	-33.8
5	0.01	0.03	MSK	817.2	817.4	-39.0	816.7	817	816.98	-21.82
6	0.01	0.03	MSK	817.2	817.4	-36.0	816.7	817	816.98	-22.08
7	0.01	0.03	MSK	823.6	823.8	-39.0	824	824.3	824.02	-22.14
8	0.01	0.03	MSK	823.6	823.8	-36.0	824	824.3	824.01	-22.96
9	0.1	0.3	AWGN	864.4	864.5	-39.5	861.7	862	861.8	-30.3
10	0.1	0.3	AWGN	864.4	864.5	-36.5	861.7	862	861.7	-29.4
11	0.1	0.3	AWGN	866.5	866.6	-39.5	869	869.3	869	-26.55
12	0.1	0.3	AWGN	866.5	866.6	-36.5	869	869.3	869	-27.94
13	0.01	0.03	MSK	862.2	862.4	-39.0	861.7	862	816.98	-21.57
14	0.01	0.03	MSK	862.2	862.4	-36.0	861.7	862	861.99	-34
15	0.01	0.03	MSK	868.6	868.8	-39.0	869	869.3	869	-22.94
16	0.01	0.03	MSK	868.6	868.8	-36.0	869	869.3	869	-21.42

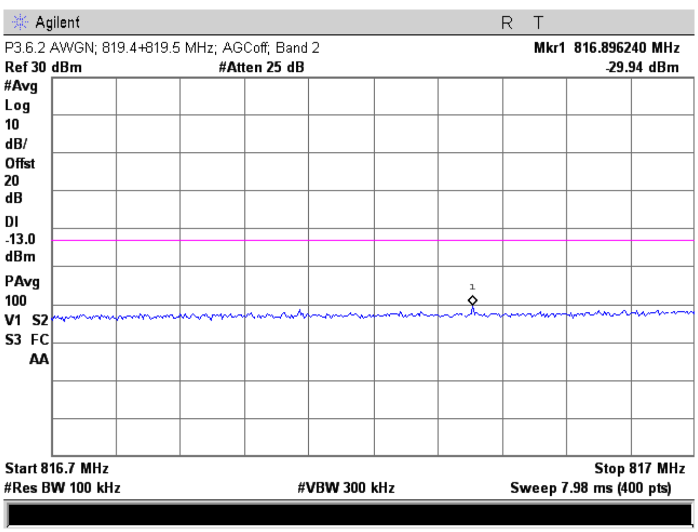
Single input to amplifier.

Plot #	RBW MHz	VBW MHz	Sig Gen Modul.	Sig Gen MHz 1	Sig Gen MHz 2	dBm	Start MHz	Stop MHz	Max reading Freq MHz	Max reading dBm
17	0.1	0.3	AWGN	819.4	None	-40.0	816.7	817	817	-33.5
18	0.1	0.3	AWGN	819.4	None	-37.0	816.7	817	817	-34.33

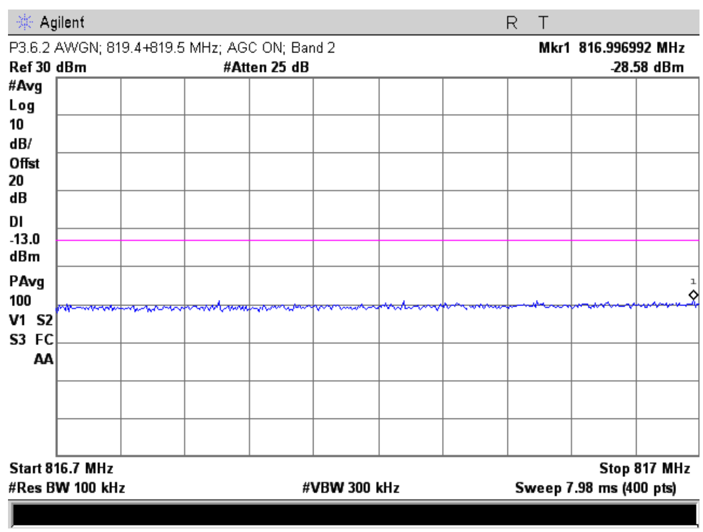
Plot	RBW	VBW	Sig Gen				Start	Stop	Max reading	
									Freq	
#	MHz	MHz	Modul.	MHz 1	MHz 2	dBm	MHz	MHz	MHz	dBm
19	0.1	0.3	AWGN	821.6	None	-40.0	824	824.3	824	-32.4
20	0.1	0.3	AWGN	821.6	None	-37.0	824	824.3	824	-31.2
21	0.01	0.03	MSK	817.2	None	-40.0	816.7	817	861.95	-44.61
22	0.01	0.03	MSK	817.2	None	-37.0	816.7	817	816.8	-48.5
23	0.01	0.03	MSK	823.8	None	-40.0	824	824.3	824.04	-44.97
24	0.01	0.03	MSK	823.8	None	-37.0	824	824.3	824.05	-44.83
25	0.1	0.3	AWGN	864.4	None	-40.0	861.7	862	862	-33.39
26	0.1	0.3	AWGN	864.4	None	-37.0	861.7	862	862	-34.5
27	0.1	0.3	AWGN	866.6	None	-40.0	869	869.3	869	-33.7
28	0.1	0.3	AWGN	866.6	None	-37.0	869	869.3	869	-33.6
29	0.01	0.03	MSK	862.2	None	-40.0	861.7	862	861.95	-44.99
30	0.01	0.03	MSK	862.2	None	-37.0	861.7	862	861.95	-44.9
31	0.01	0.03	MSK	868.8	None	-40.0	869	869.3	869.05	-46
32	0.01	0.03	MSK	868.8	None	-37.0	869	869.3	869.05	-44.66

Judgement: Pass

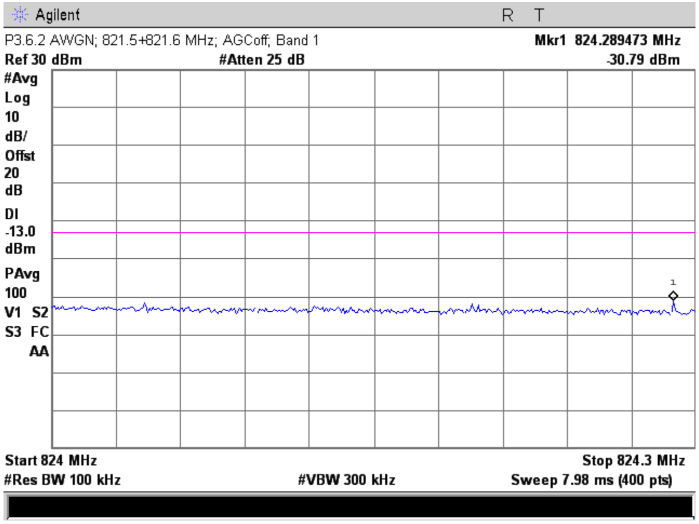
15.3.1 Combined Output Results



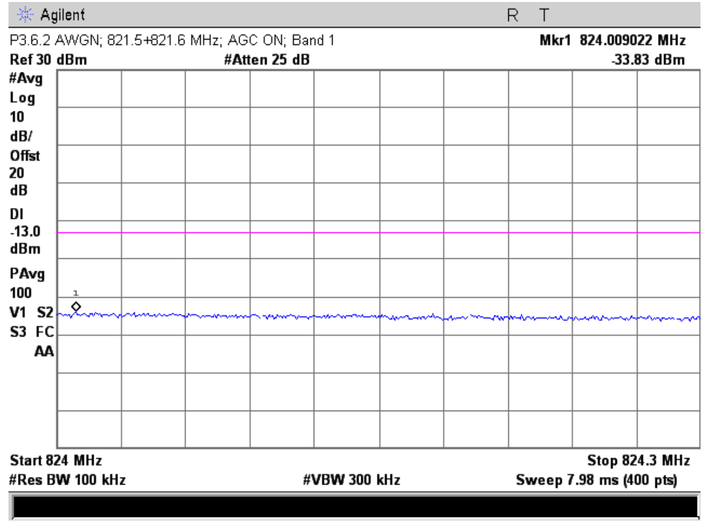
AWGN; 819.4 + 819.5 MHz Injected Signals; AGC off



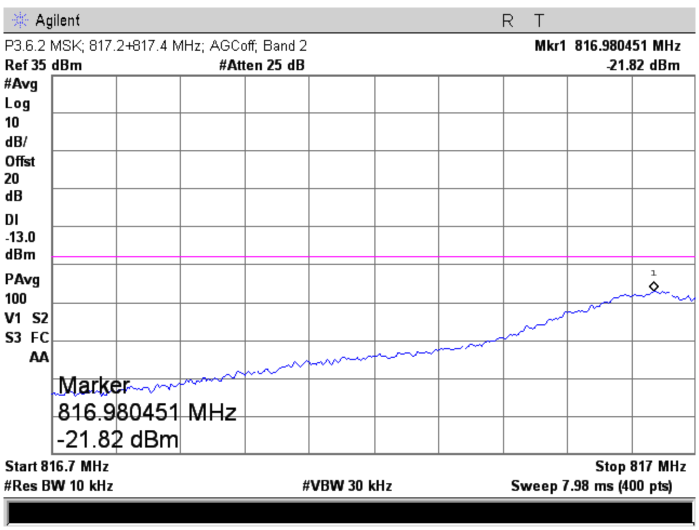
AWGN; 819.4 + 819.5 MHz Injected Signals; AGC on



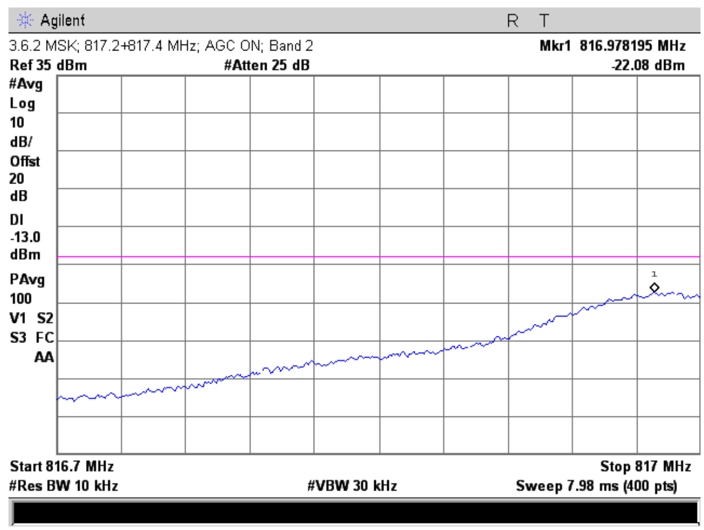
AWGN; 821.5 + 821.6 MHz Injected Signals; AGC off



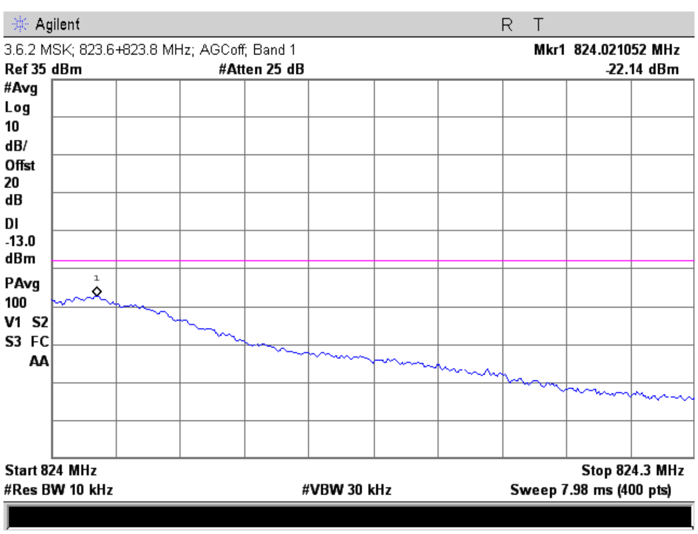
AWGN; 821.5 + 821.6 MHz Injected Signals; AGC on



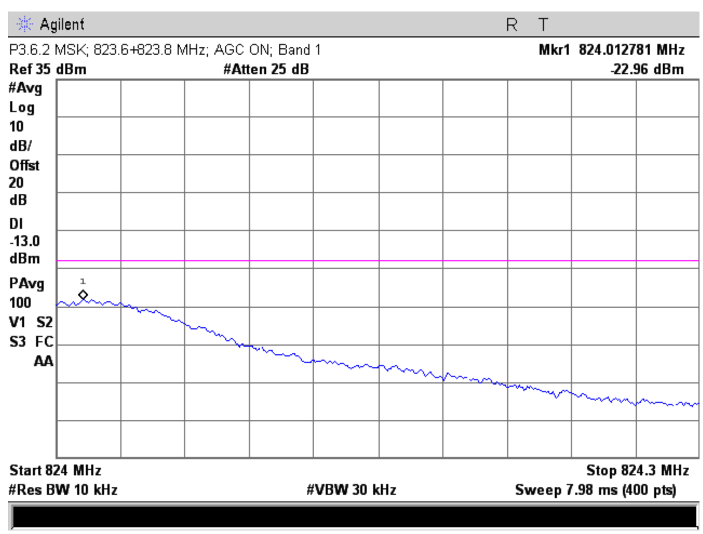
MSK; 817.2 + 817.4 MHz Injected Signals; AGC off



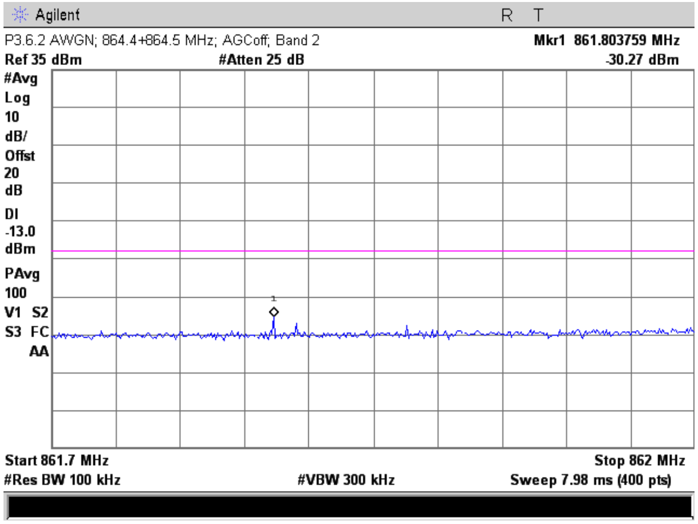
MSK; 817.2 + 817.4 MHz Injected Signals; AGC on



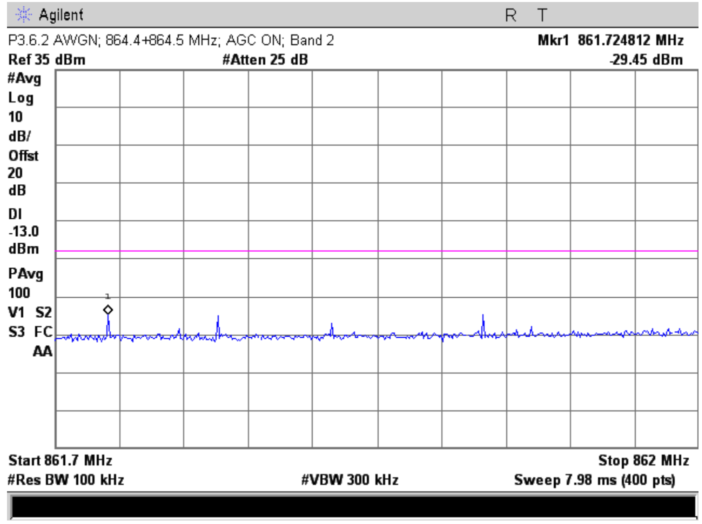
MSK; 823.6 + 823.8 MHz Injected Signals; AGC off



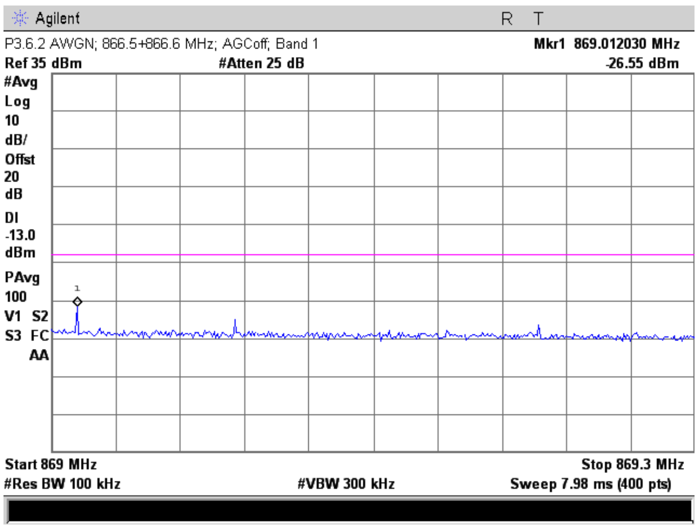
MSK; 823.6 + 823.8 MHz Injected Signals; AGC on



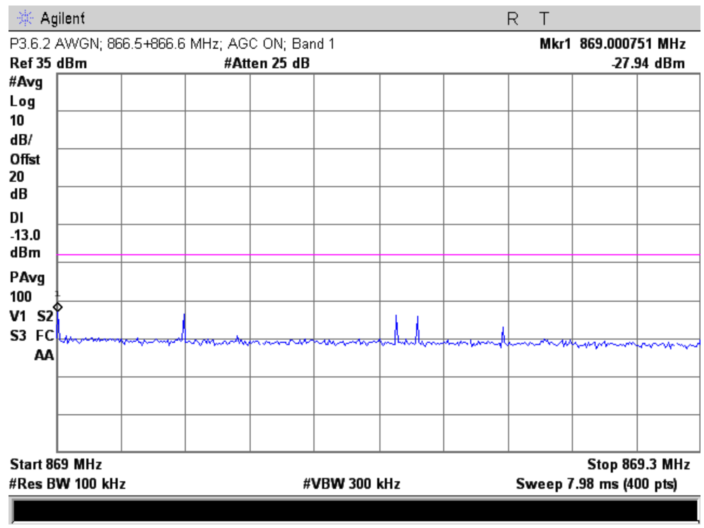
AWGN; 864.4 + 864.5 MHz Injected Signals; AGC off



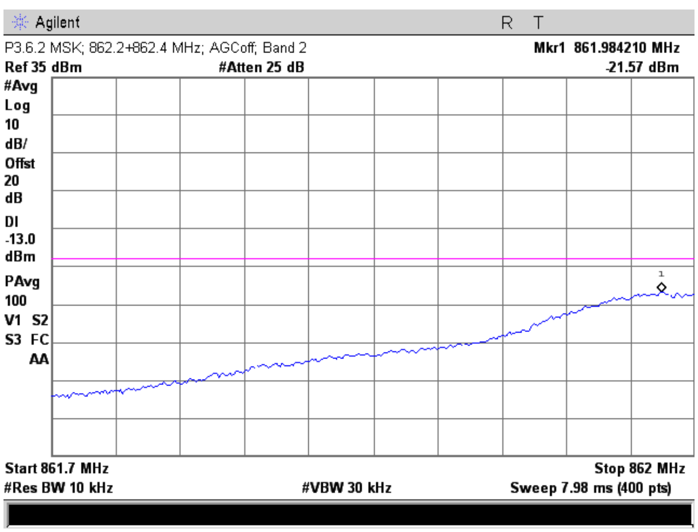
AWGN; 864.4 + 864.5 MHz Injected Signals; AGC on



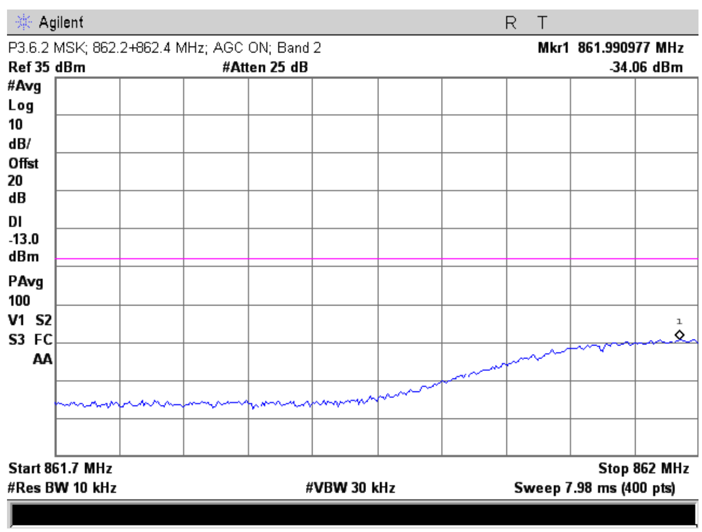
AWGN; 866.5 + 866.6 MHz Injected Signals; AGC off



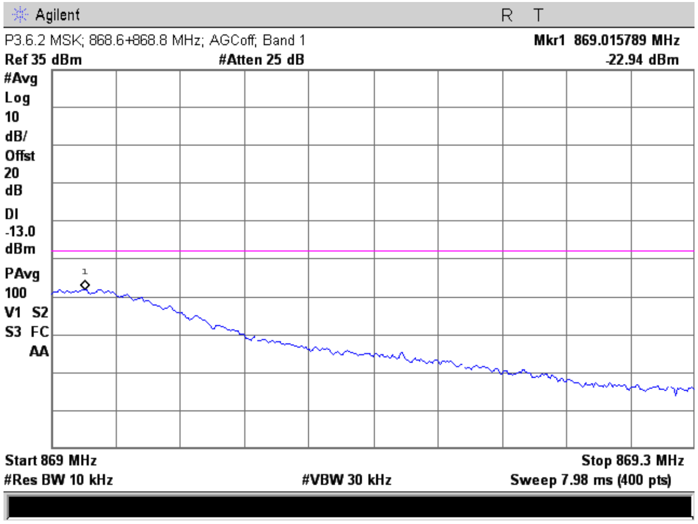
AWGN; 866.5 + 866.6 MHz Injected Signals; AGC on



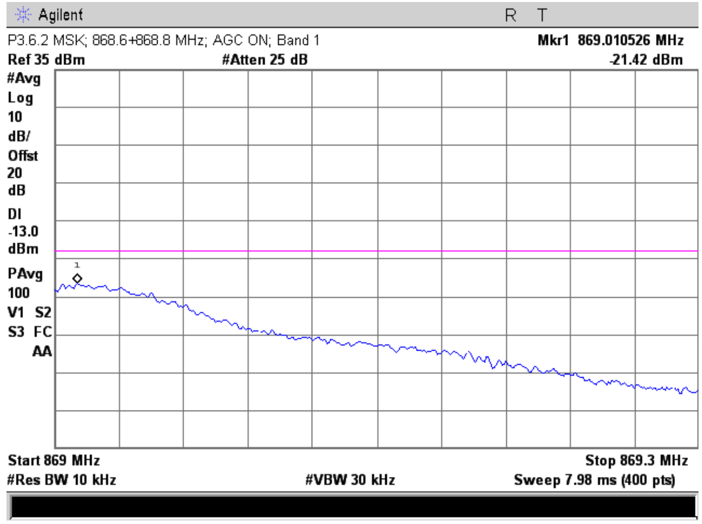
MSK; 862.2 + 862.4 MHz Injected Signals; AGC off



MSK; 862.2 + 862.4 MHz Injected Signals; AGC on

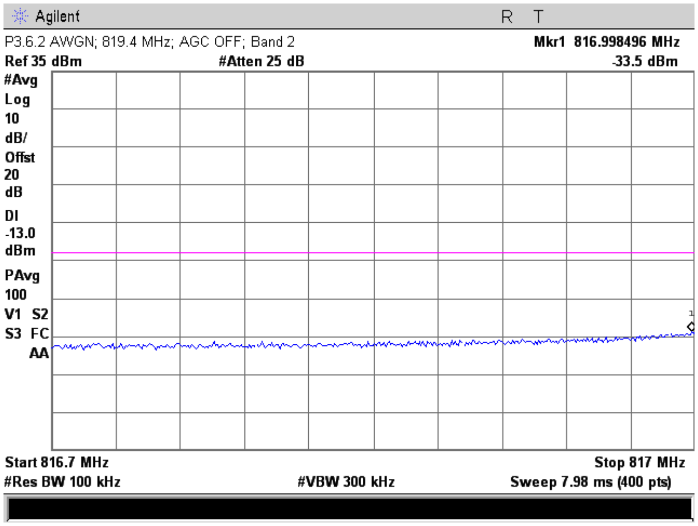


MSK; 868.5 + 868.8 MHz Injected Signals; AGC off

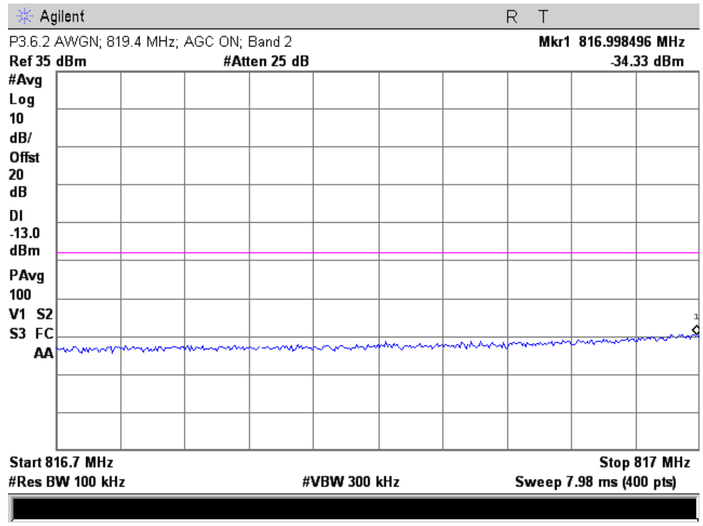


MSK; 868.6 + 868.8 MHz Injected Signals; AGC on

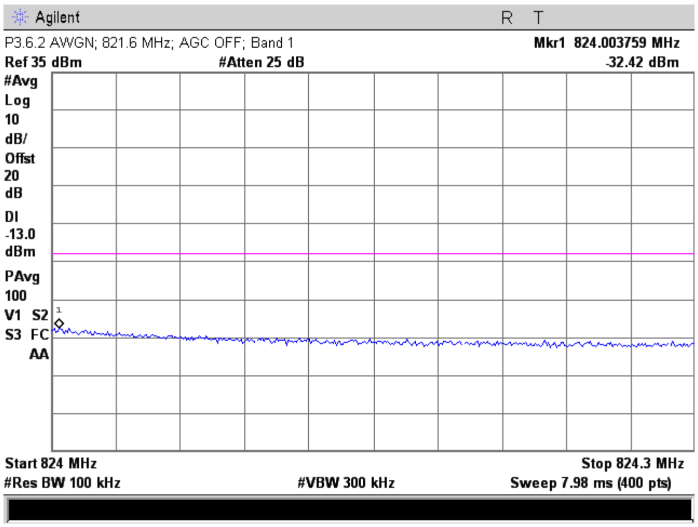
Single Signal Results



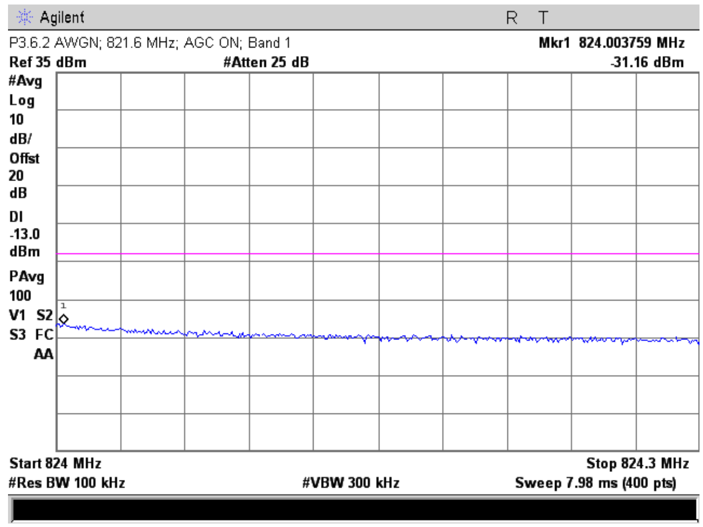
AWGN; 819.4 MHz Injected Signal; AGC off



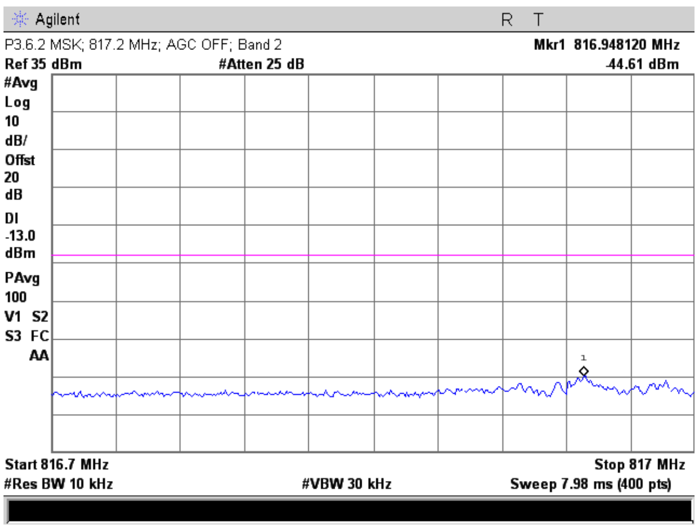
AWGN; 819.4 MHz Injected Signal; AGC on



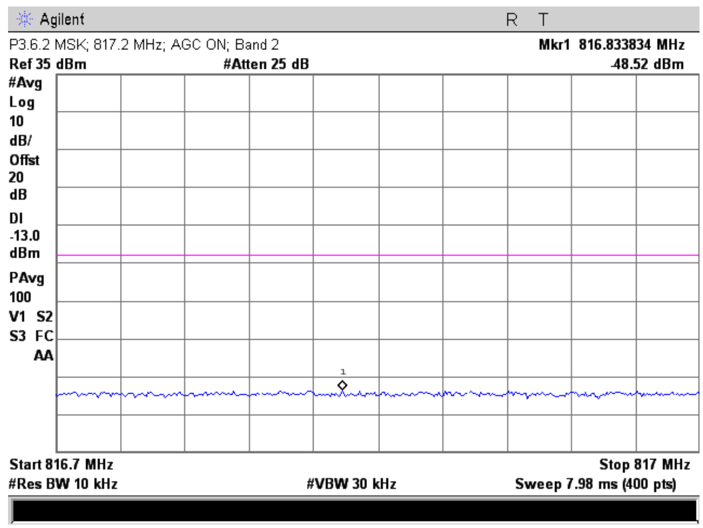
AWGN; 821.6 MHz Injected Signal; AGC off



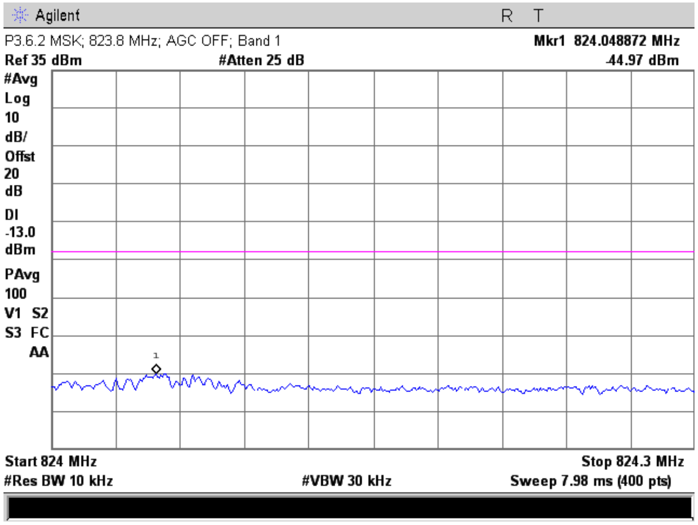
AWGN; 821.6 MHz Injected Signal; AGC on



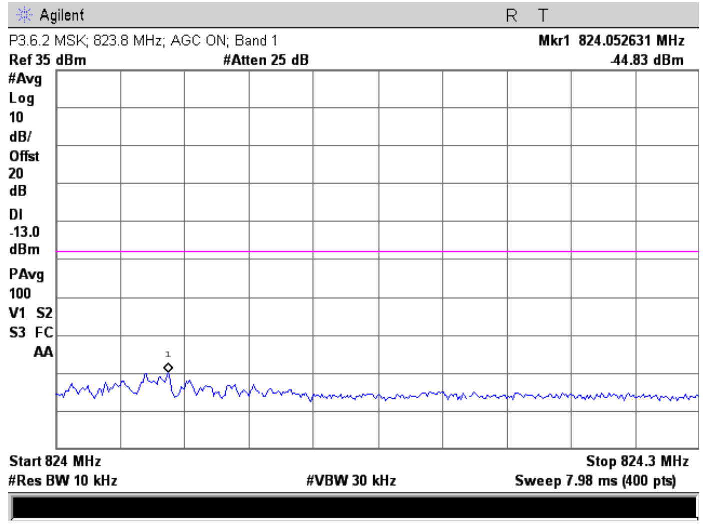
MSK; 817.2 MHz Injected Signal; AGC off



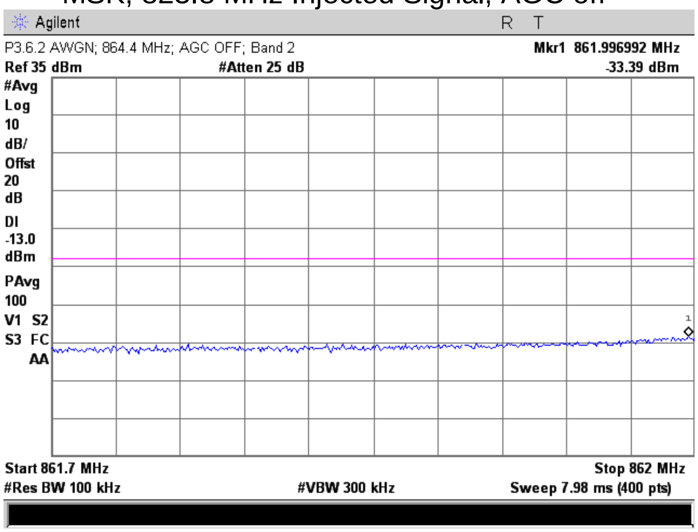
MSK; 817.2 MHz Injected Signal; AGC on



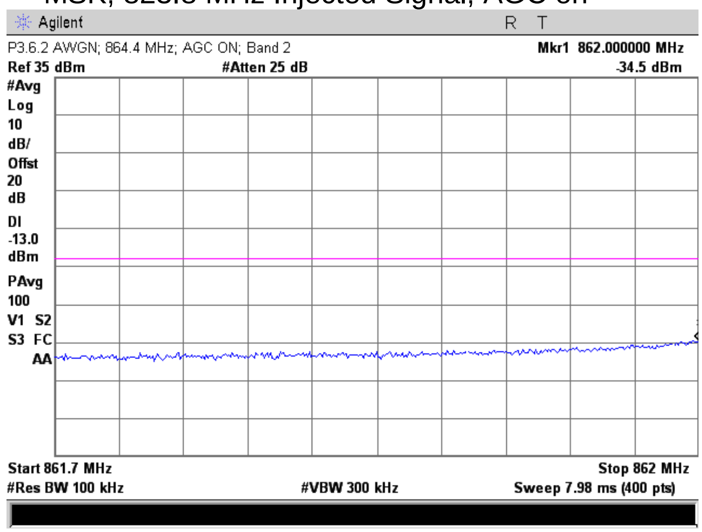
MSK; 823.8 MHz Injected Signal; AGC off



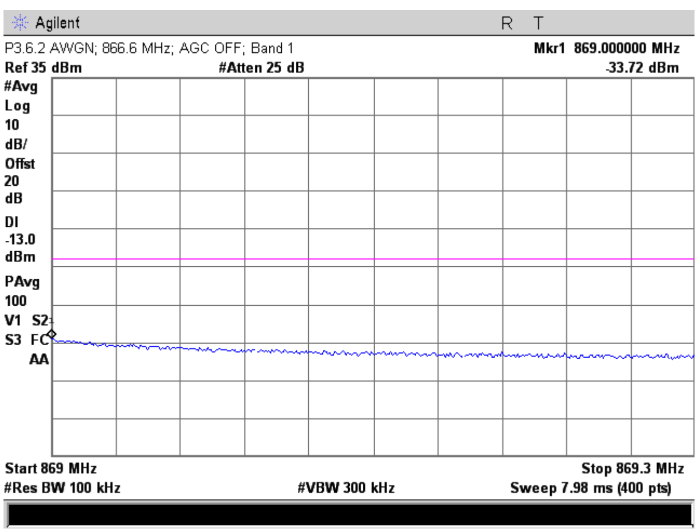
MSK; 823.8 MHz Injected Signal; AGC on



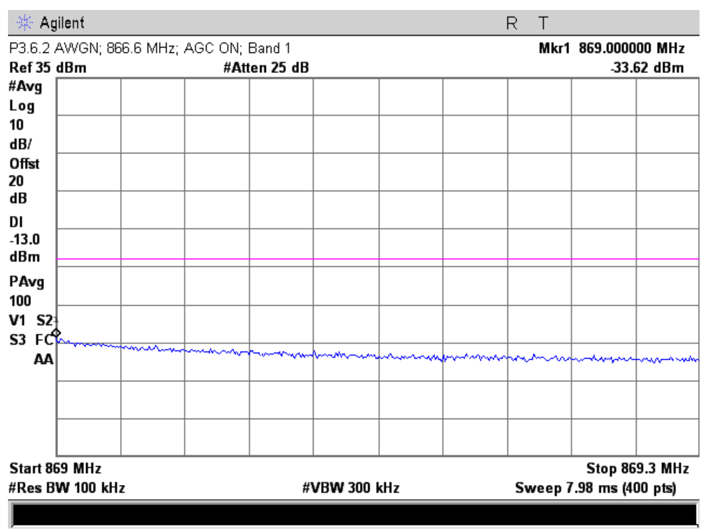
AWGN; 864.4 MHz Injected Signal; AGC off



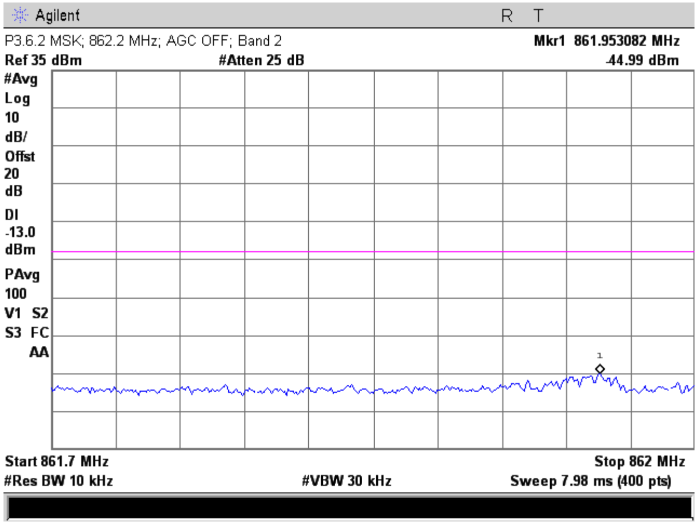
AWGN; 864.4 MHz Injected Signal; AGC on



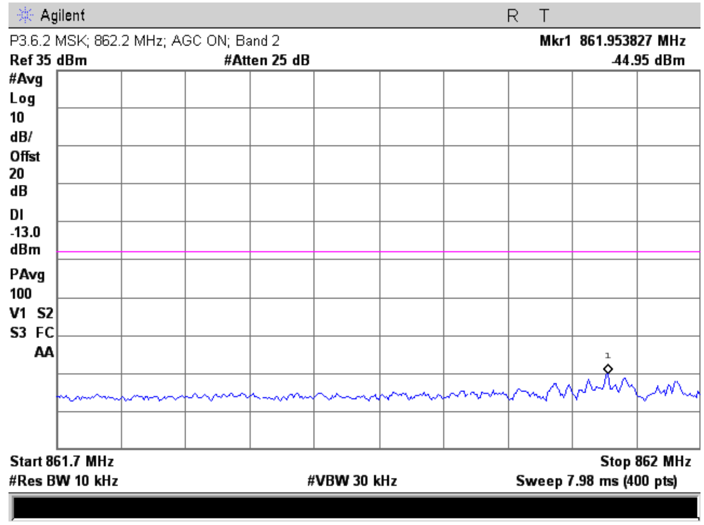
AWGN; 866.6 MHz Injected Signal; AGC off



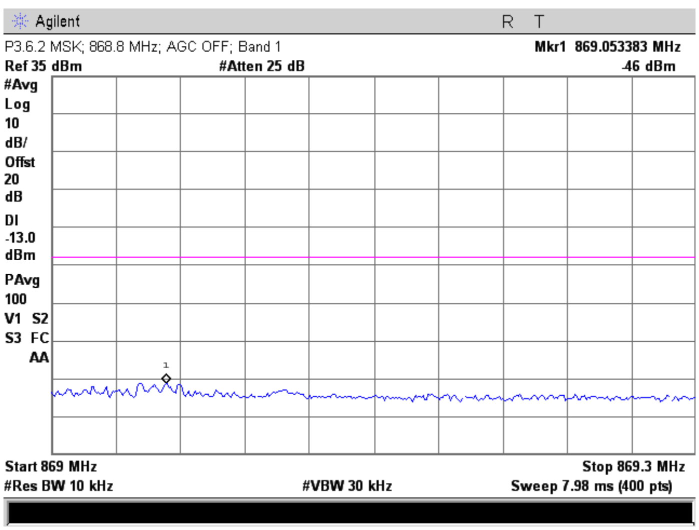
AWGN; 866.6 MHz Injected Signal; AGC on



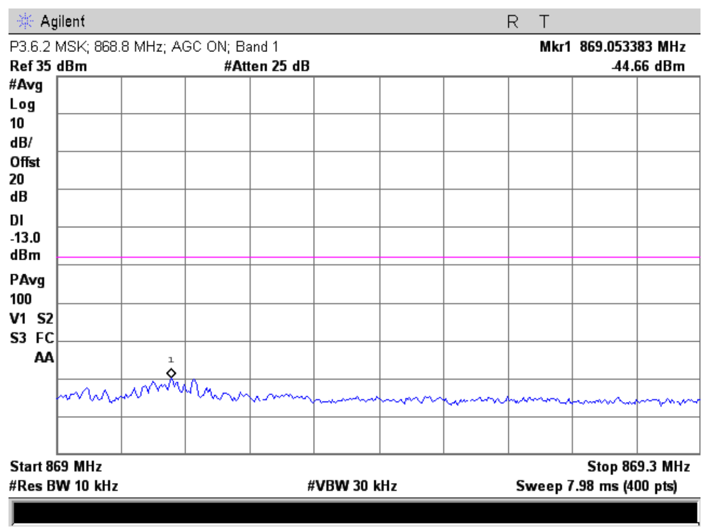
MSK; 862.2 MHz Injected Signal; AGC on



MSK; 862.2 MHz Injected Signal; AGC on



MSK; 868.8 MHz Injected Signal; AGC off



MSK; 868.8 MHz Injected Signal; AGC on

15.4 Test procedures 3.6.3

a) A signal generator was connected to the input of the EUT.
b) The signal generator was set to produce the broadband test signal as previously described (i.e., 4.1 MHz OBW AWGN).
c) The center frequency of the test signal was set to the lowest available channel within the frequency band or block.
d) The EUT input power was set to zero to 0.5 dB below the AGC threshold level.
e) A spectrum analyzer was connected to the output of the EUT using appropriate attenuation as necessary.
f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).
g) The VBW was set as ≥ 3 × RBW.
h) The Sweep time was set to equal auto-couple.
i) The spectrum analyzer start frequency was set to the lowest RF signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part. The number of measurement points in each sweep must be ≥ (2 ×

span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.
j) The power averaging (rms) detector function was selected.
k) A trace average measurement with at least 10 traces in power averaging (rms) mode was performed.
l) The peak marker function was used to identify the highest amplitude level over each measured frequency range. The frequency and amplitude were recorded and captured in a plot.
m) The spectrum analyzer start frequency was reset to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the spectrum analyzer stop frequency to 10 times the highest frequency of the fundamental emission. The number of measurement points in each sweep was ≥ (2 × span/RBW), which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.
n) Trace averages were at least 10 traces in power averaging (rms) mode.
o) The peak marker function was used to identify the highest amplitude level over each of the measured frequency ranges. The frequency and amplitude were recorded and captured in a plot for inclusion in the test report; also providing tabular data, if required.
p) Steps i) to o) were repeated with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.
q) Steps b) to p) were repeated with the narrowband test signal.
r) Steps b) to q) were repeated for all authorized frequency bands/blocks used by the EUT.

On any frequency outside the authorized bandwidth shall be attenuated by at least 43 + 10 log (P) dB. This corresponds to an absolute level of -13 dBm.

15.5 Test Results for Section 3.6.3

Model	BDA610-S8	Specifications	FCC KDB 935210 Secs. 3.6.2, 3.6.3
Serial Number	CNH60713	Test Date	Jan. 23 thru 25, 2017
Test Personnel	Richard L. Tichgelaar, Joseph Strzelecki	Test Location	Chamber C
Test Equipment	EMI Receiver (REC-21)		

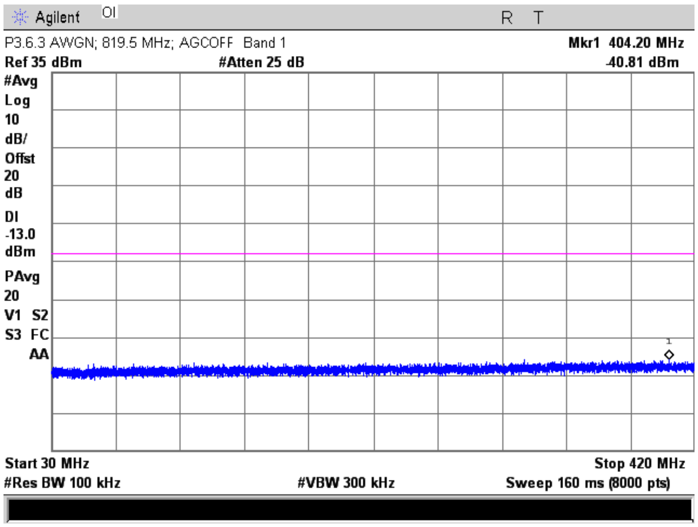
* The reading has a +20 dB offset due to an external attenuator.
The spectrum analyzer was set to 20 trace average in the RMS mode.

Spur				Sig Gen					Max reading	
3.6.3 Plot #	RBW MHz	VBW MHz	EUT Mode	Modul	MHz	Start MHz	Stop MHz	Min # points	Freq MHz	Reading dBm
1	0.1	0.3	1	AWGN	819.5	30	420	7800	404.2	-40.81
2	0.1	0.3	1	AWGN	819.5	420	816.9	7938	816.9	-34.8
3	0.1	0.3	1	AWGN	819.5	824	1000	3520	824.6	-37.5
4	1	3	1	AWGN	819.5	1000	5000	8000	2973	-29.4
5	1	3	1	AWGN	819.5	5000	9000	8000	7425.8	-31.8
6	0.1	0.3	1	AWGN	820.5	30	420	7800	351.2	-40.5
7	0.1	0.3	1	AWGN	820.5	420	817	7940	805.2	-34.1
8	0.1	0.3	1	AWGN	820.5	824	1000	3520	824	-36.1
9	1	3	1	AWGN	820.5	1000	5000	8000	2989	-29.55
10	1	3	1	AWGN	820.5	5000	9000	8000	7421	-31.4
11	0.1	0.3	1	AWGN	821.5	30	420	7800	322.4	-40.6
12	0.1	0.3	1	AWGN	821.5	420	817	7940	805.2	-35
13	0.1	0.3	1	AWGN	821.5	824.1	1000	3518	824.45	-36
14	1	3	1	AWGN	821.5	1000	5000	8000	2997	-29.8

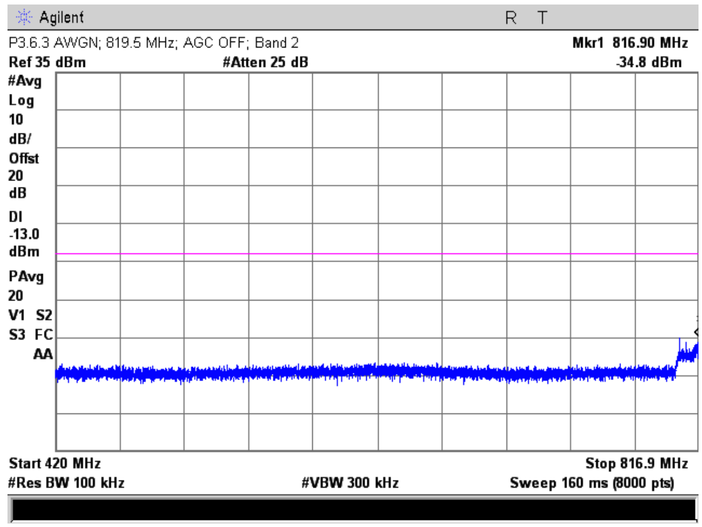
Spur				Sig Gen					Max reading	
3.6.3 Plot #	RBW MHz	VBW MHz	EUT Mode	Modul	MHz	Start MHz	Stop MHz	Min # points	Freq MHz	Reading dBm
15	1	3	1	AWGN	821.5	5000	9000	8000	7346	-31.7
16	0.1	0.3	2	AWGN	864.5	30	350	6400	337.5	-40.4
17	0.1	0.3	2	AWGN	864.5	350	550	4000	408.8	-41.1
18	0.1	0.3	2	AWGN	864.5	550	861.9	6238	861.5	-35.8
19	0.1	0.3	2	AWGN	864.5	869	1000	2620	869.6	-37.7
20	1	3	2	AWGN	864.5	1000	5000	8000	2894	-29.8
21	1	3	2	AWGN	864.5	5000	9000	8000	7418	-31.8
22	0.1	0.3	2	AWGN	865.5	30	350	6400	319.2	-40.67
23	0.1	0.3	2	AWGN	865.5	350	550	4000	429.1	-41.3
24	0.1	0.3	2	AWGN	865.5	550	862	6240	861.9	-33
25	0.1	0.3	2	AWGN	865.5	869	1000	2620	869.6	-36.7
26	1	3	2	AWGN	865.5	1000	5000	8000	2893	-29.5
27	1	3	2	AWGN	865.5	5000	9000	8000	7331	-31.8
28	0.1	0.3	2	AWGN	866.5	30	350	6400	259.2	-32.6
29	0.1	0.3	2	AWGN	866.5	350	550	4000	399.5	-41.8
30	0.1	0.3	2	AWGN	866.5	550	862	6240	861.9	-36.2
31	0.1	0.3	2	AWGN	866.5	869.1	1000	2618	869.4	-30.8
32	1	3	2	AWGN	866.5	1000	5000	8000	2901	-29.3
33	1	3	2	AWGN	866.5	5000	9000	8000	7441	-31.5
34	0.1	0.3	1	MSK	817.2	30	420	7800	418.6	-40.58
35	0.1	0.3	1	MSK	817.2	420	816.7	7934	816.7	-20.91
36	0.1	0.3	1	MSK	817.2	824	1000	3520	825.3	-37.5
37	1	3	1	MSK	817.2	1000	5000	8000	2888	-29.5
38	1	3	1	MSK	817.2	5000	9000	8000	7385	-31.9
39	0.1	0.3	1	MSK	820.5	30	420	7800	402.1	-41
40	0.1	0.3	1	MSK	820.5	420	817	7940	804.4	-34
41	0.1	0.3	1	MSK	820.5	824	1000	3520	825.5	-37.9
42	1	3	1	MSK	820.5	1000	5000	8000	2908	-29.7
43	1	3	1	MSK	820.5	5000	9000	8000	7428	-32
44	0.1	0.3	1	MSK	823.8	30	420	7800	402.7	-41.6
45	0.1	0.3	1	MSK	823.8	420	817	7940	807.7	-34.6
46	0.1	0.3	1	MSK	823.8	824.3	1000	3514	824.3	-21.67
47	1	3	1	MSK	823.8	1000	5000	8000	2897	-29.8
48	1	3	1	MSK	823.8	5000	9000	8000	6940	-31.7
49	0.1	0.3	2	MSK	862.2	30	350	6400	335.1	-40.9
50	0.1	0.3	2	MSK	862.2	350	550	4000	365	-41.5
51	0.1	0.3	2	MSK	862.2	550	861.7	6234	861.7	-22.43
52	0.1	0.3	2	MSK	862.2	869	1000	2620	869.6	-37.1
53	1	3	2	MSK	862.2	1000	5000	8000	2900	-29.4
54	1	3	2	MSK	862.2	5000	9000	8000	7326	-31.5
55	0.1	0.3	2	MSK	865.5	30	350	6400	338.4	-40
56	0.1	0.3	2	MSK	865.5	350	550	4000	416.5	-40.98
57	0.1	0.3	2	MSK	865.5	550	862	6240	849.4	-35.6
58	0.1	0.3	2	MSK	865.5	869	1000	2620	869.6	-36.4
59	1	3	2	MSK	865.5	1000	5000	8000	2910	-29.3
60	1	3	2	MSK	865.5	5000	9000	8000	7395	-31.3
61	0.1	0.3	2	MSK	868.8	30	350	6400	331.7	-39.9
62	0.1	0.3	2	MSK	868.8	350	550	4000	429.7	-41.3

Spur				Sig Gen					Max reading	
3.6.3 Plot #	RBW MHz	VBW MHz	EUT Mode	Modul	MHz	Start MHz	Stop MHz	Min # points	Freq MHz	Reading dBm
63	0.1	0.3	2	MSK	868.8	550	862	6240	852.7	-34
64	0.1	0.3	2	MSK	868.8	869.3	1000	2614	869.3	-21.6
65	1	3	2	MSK	868.8	1000	5000	8000	2906	-29.4
66	1	3	2	MSK	868.8	5000	9000	8000	7447	-31.8

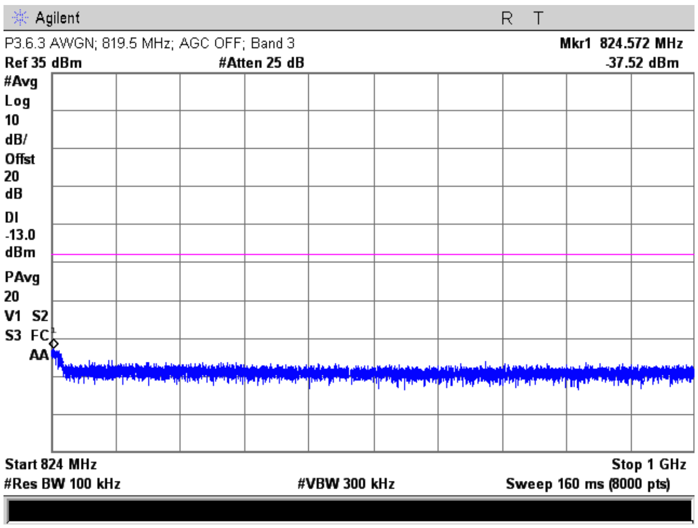
Judgement: Pass



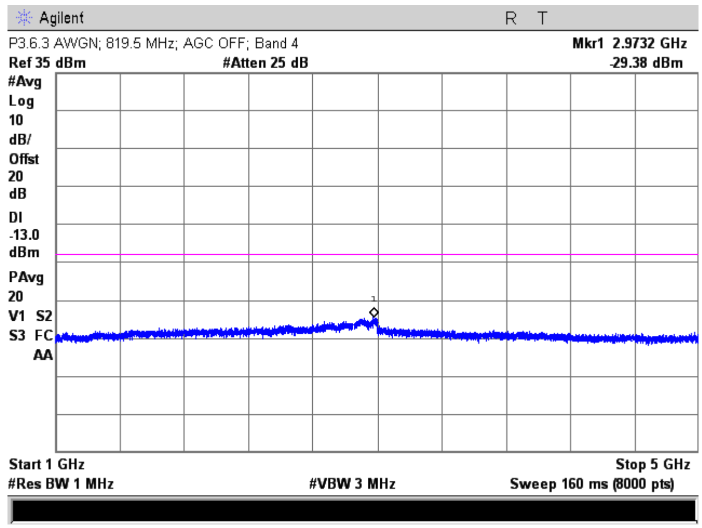
AWGN; 819.5 MHz Injected Signal



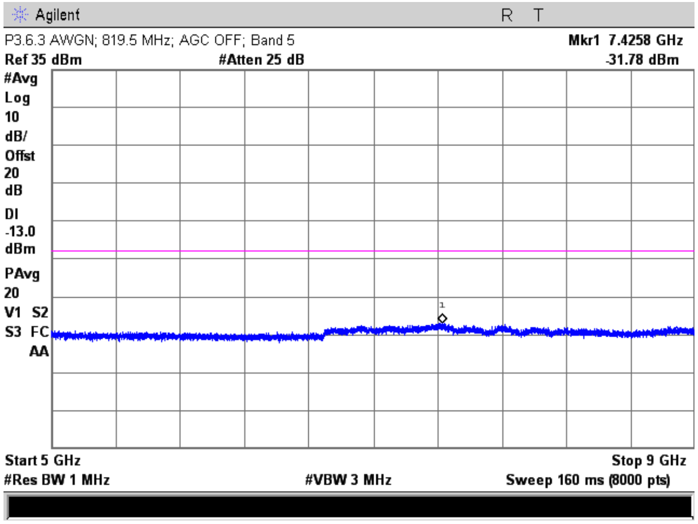
AWGN; 819.5 MHz Injected Signal



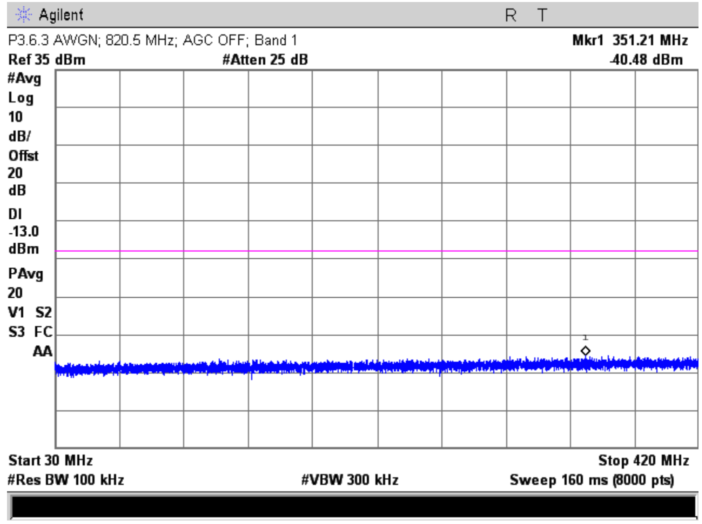
AWGN; 819.5 MHz Injected Signal



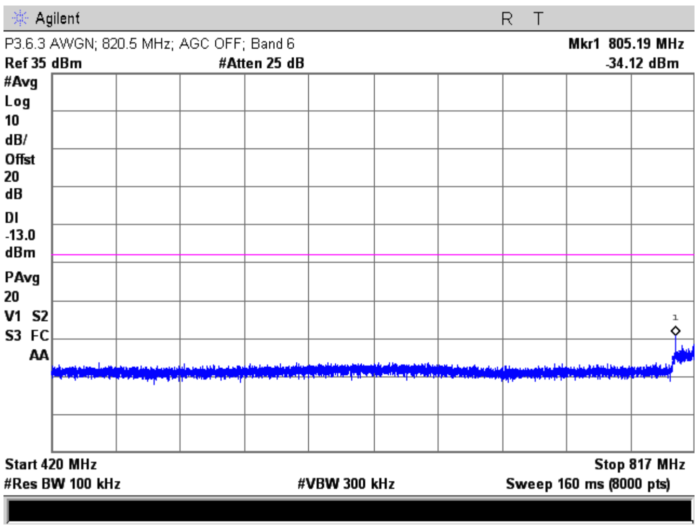
AWGN; 819.5 MHz Injected Signal



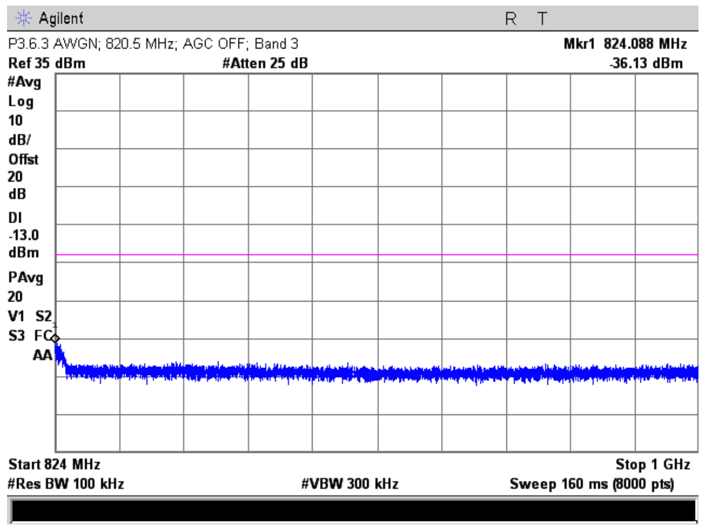
AWGN; 819.5 MHz Injected Signal



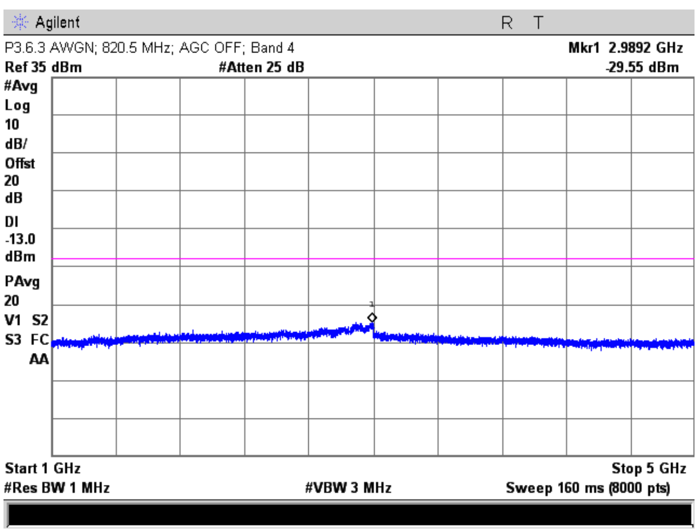
AWGN; 820.5 MHz Injected Signal



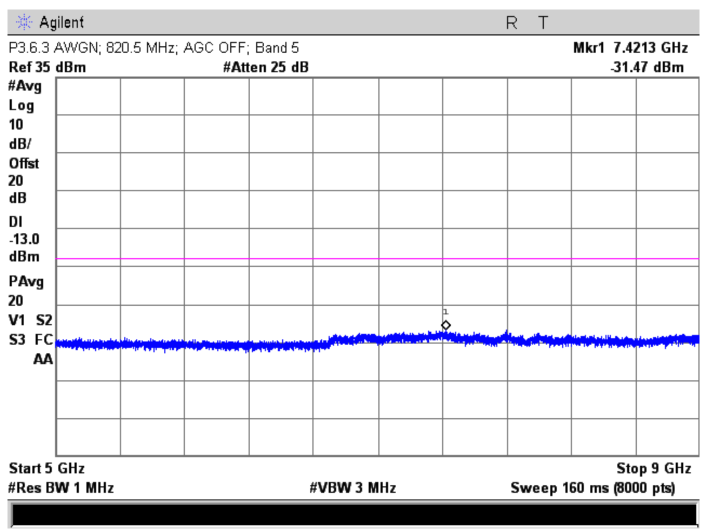
AWGN; 820.5 MHz Injected Signal



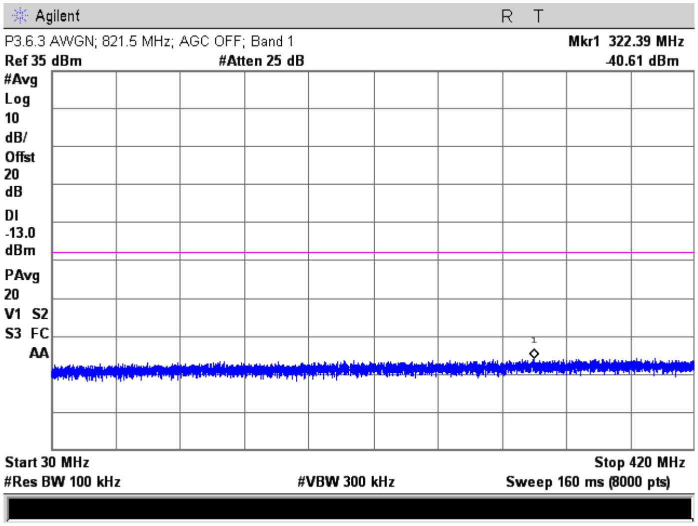
AWGN; 820.5 MHz Injected Signal



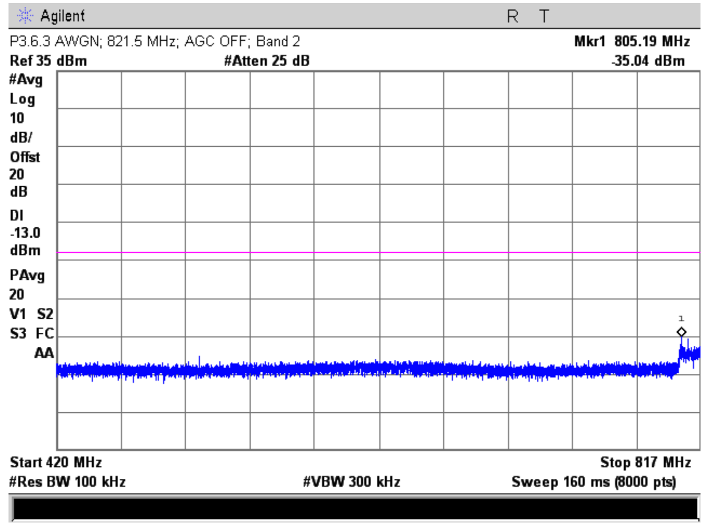
AWGN; 820.5 MHz Injected Signal



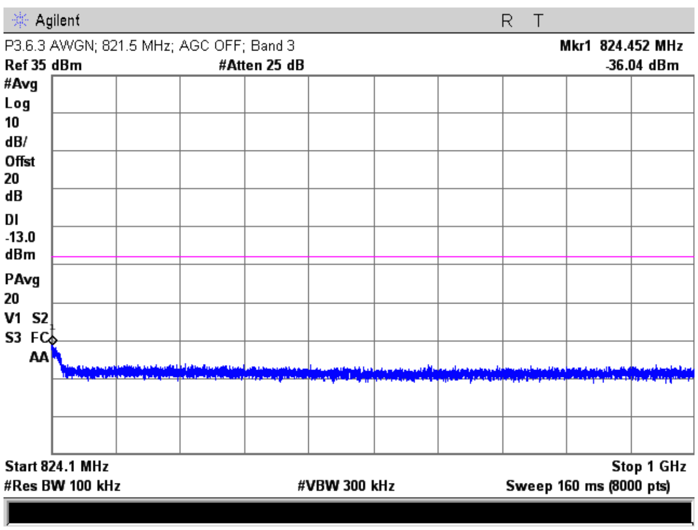
AWGN; 820.5 MHz Injected Signal



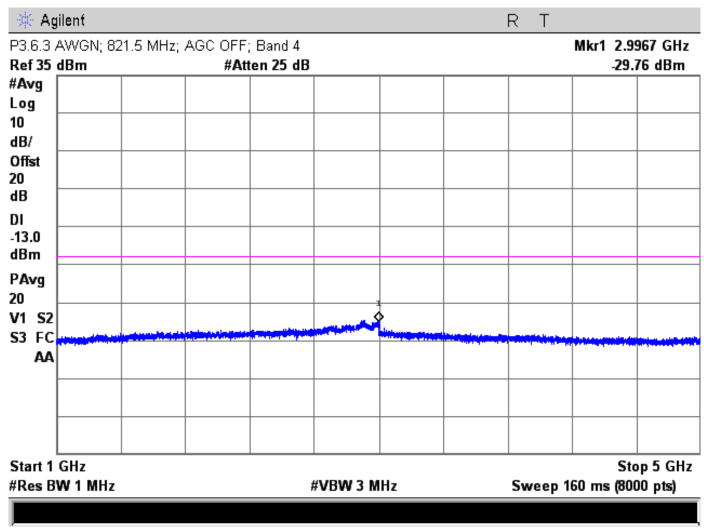
AWGN; 821.5 MHz Injected Signal



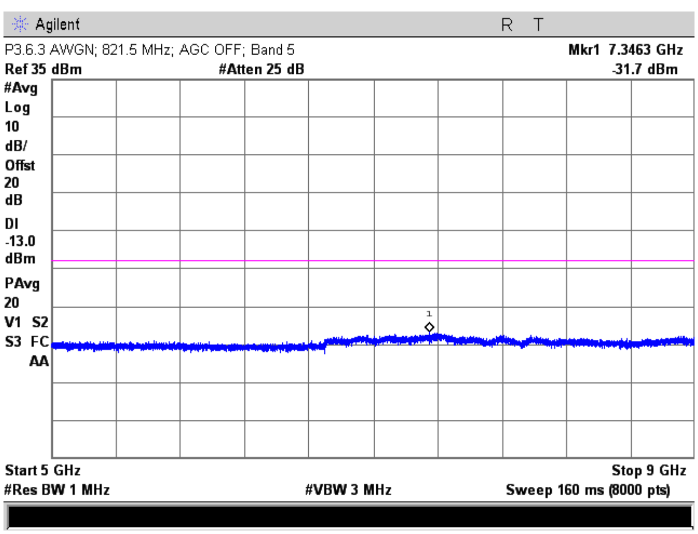
AWGN; 821.5 MHz Injected Signal



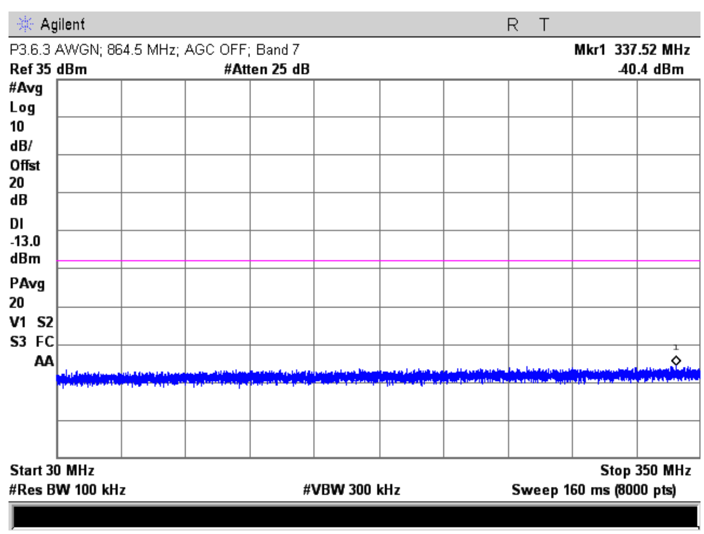
AWGN; 821.5 MHz Injected Signal



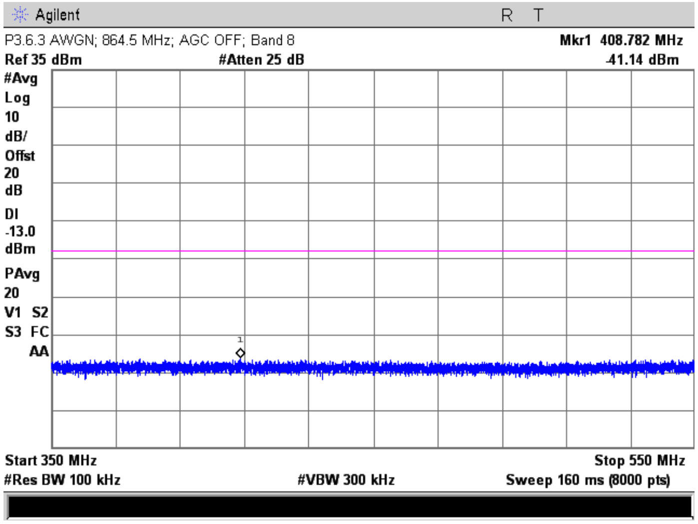
AWGN; 821.5 MHz Injected Signal



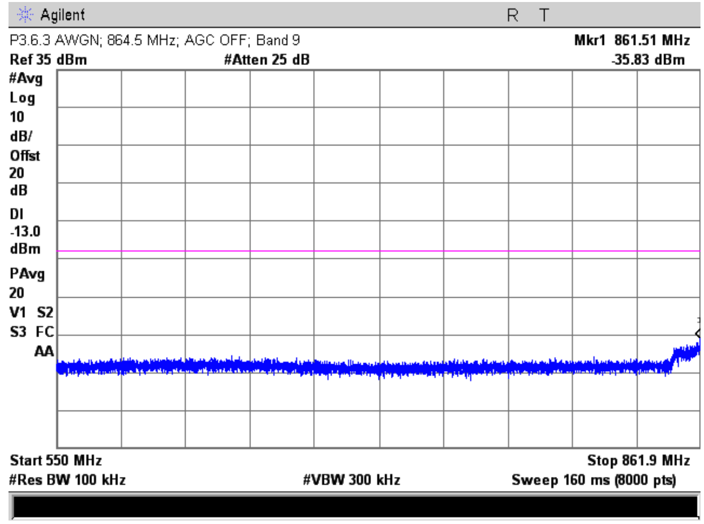
AWGN; 821.5 MHz Injected Signal



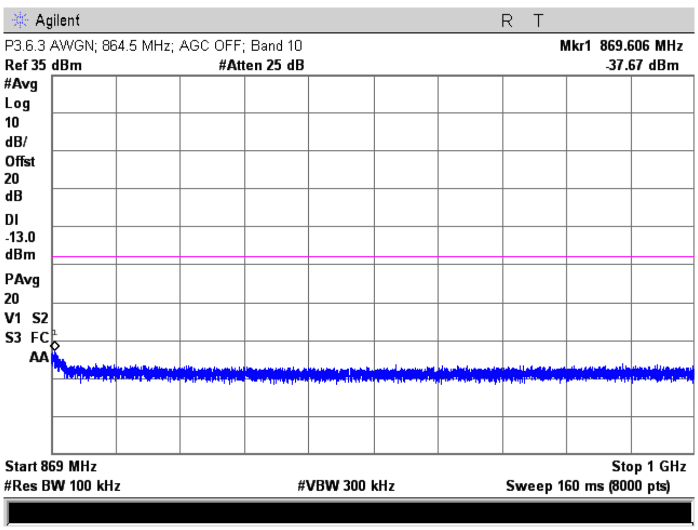
AWGN; 864.5 MHz Injected Signal



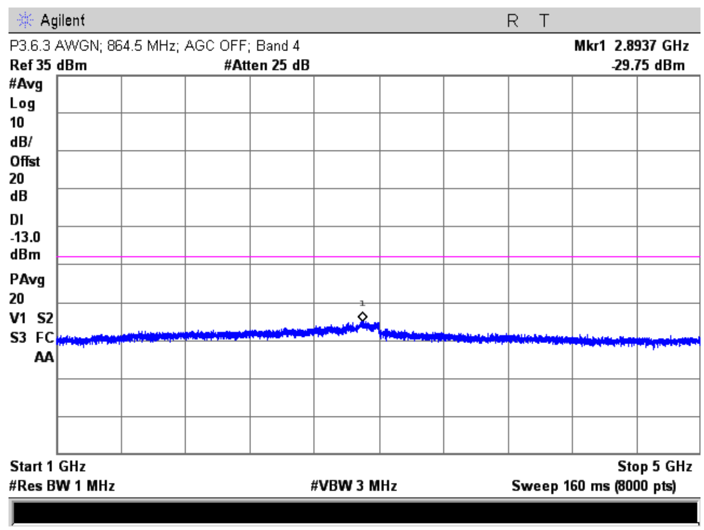
AWGN; 864.5 MHz Injected Signal



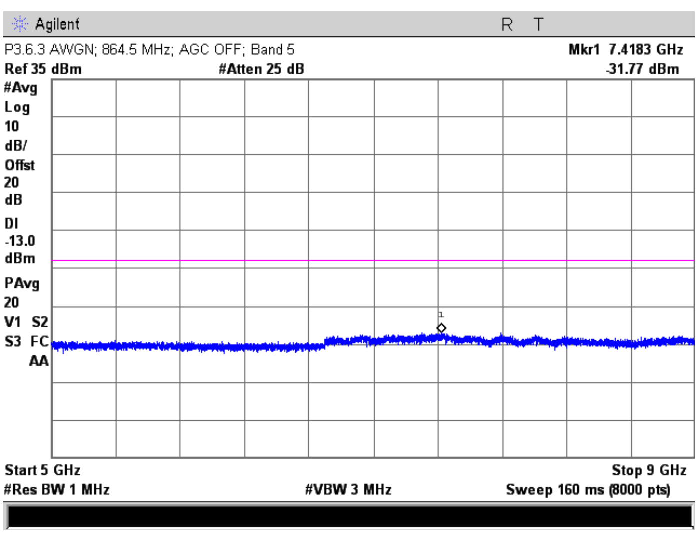
AWGN; 864.5 MHz Injected Signal



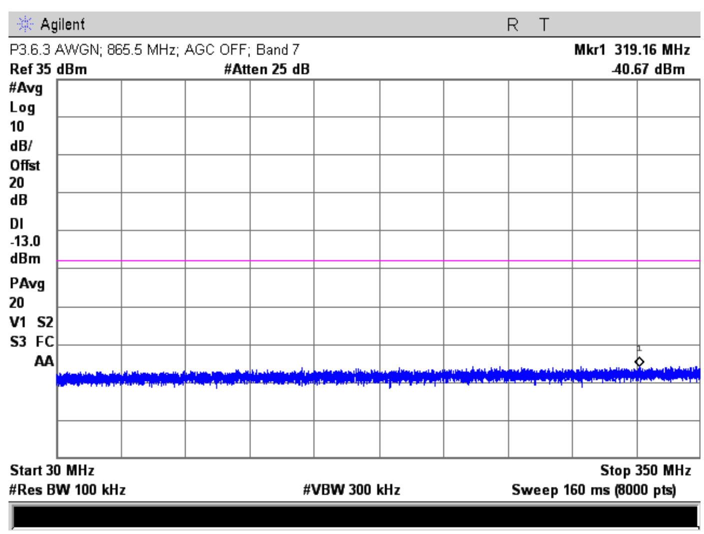
AWGN; 821.5 MHz Injected Signal



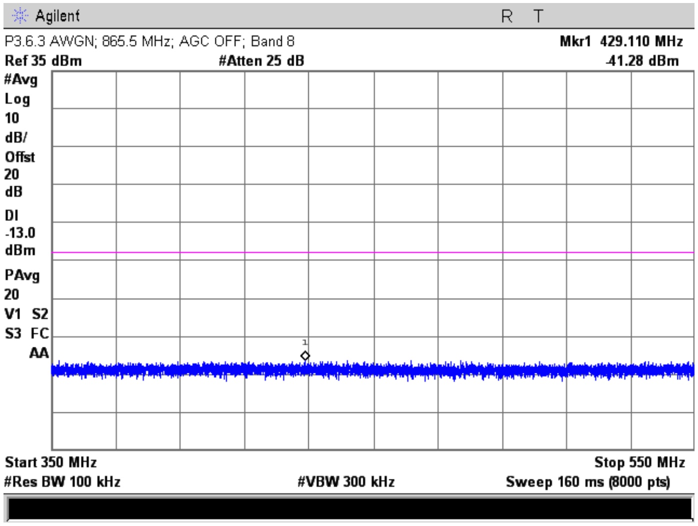
AWGN; 864.5 MHz Injected Signal



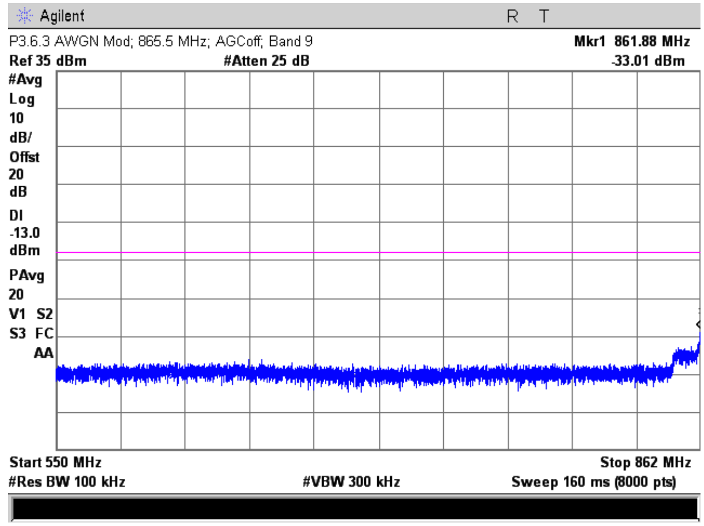
AWGN; 864.5 MHz Injected Signal



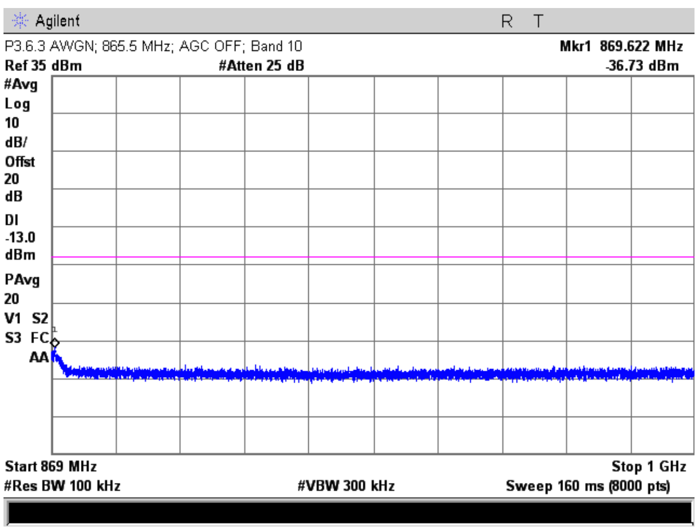
AWGN; 865.5 MHz Injected Signal



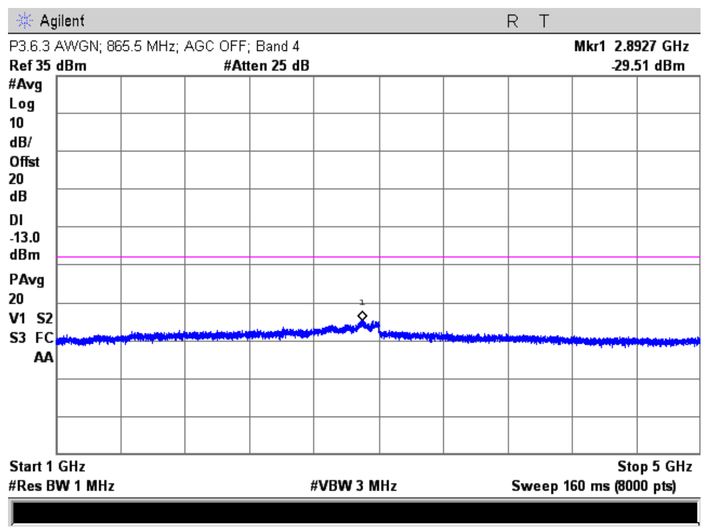
AWGN; 865.5 MHz Injected Signal



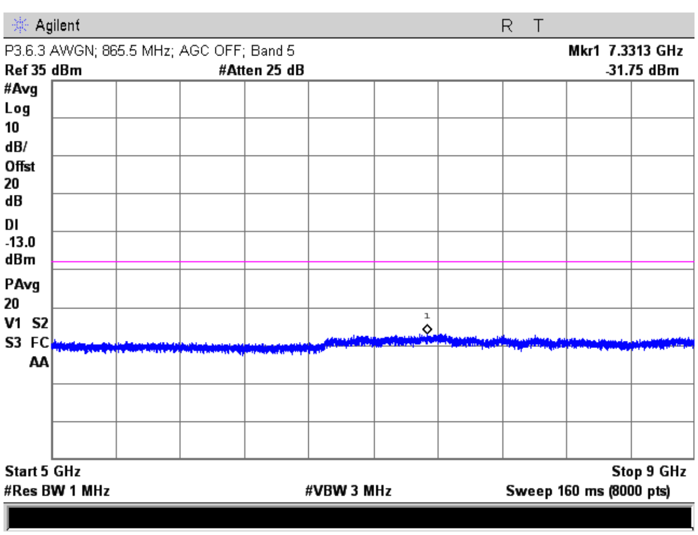
AWGN; 865.5 MHz Injected Signal



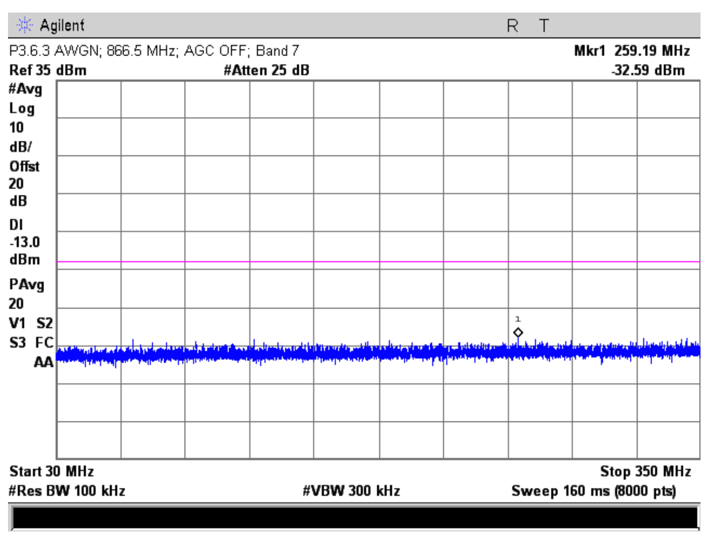
AWGN; 865.5 MHz Injected Signal



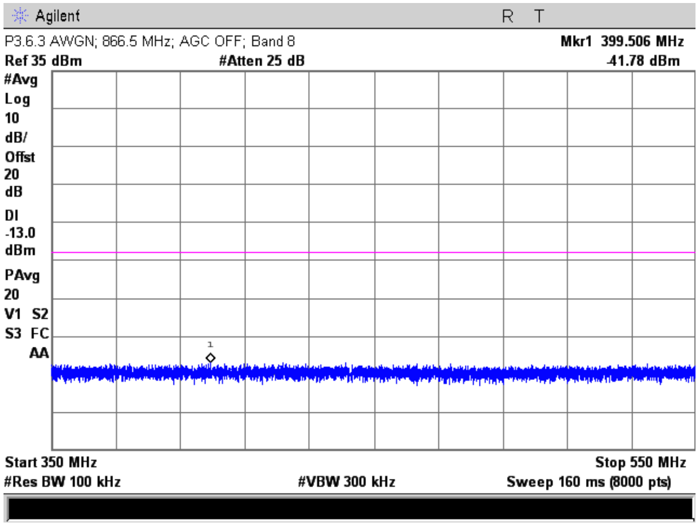
AWGN; 865.5 MHz Injected Signal



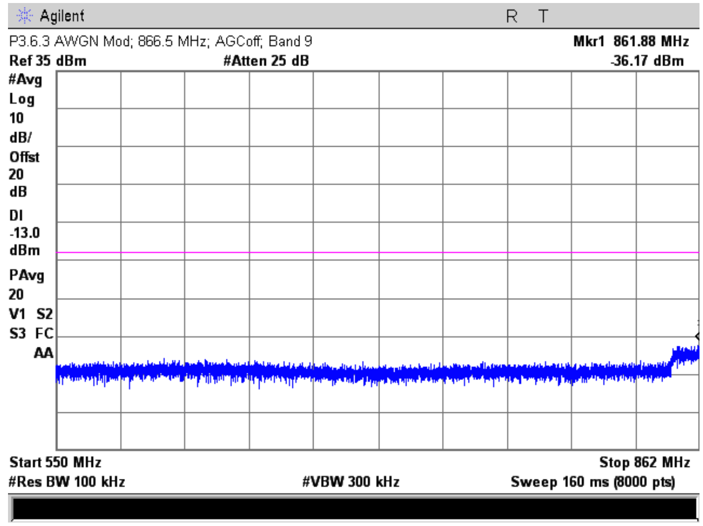
AWGN; 865.5 MHz Injected Signal



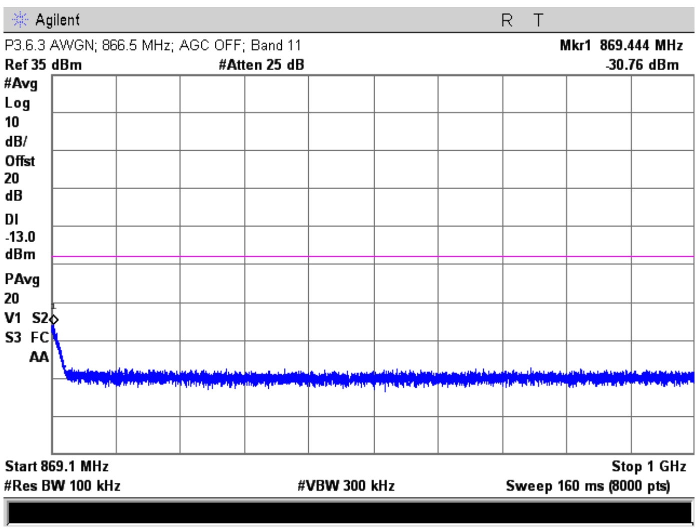
AWGN; 865.5 MHz Injected Signal



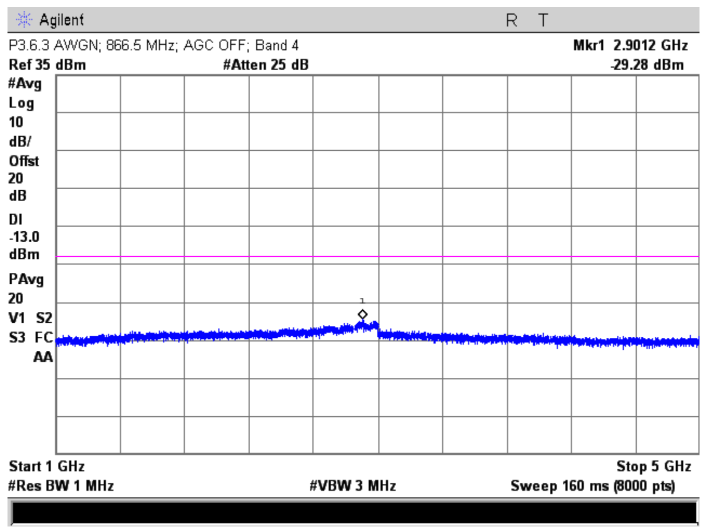
AWGN; 865.5 MHz Injected Signal



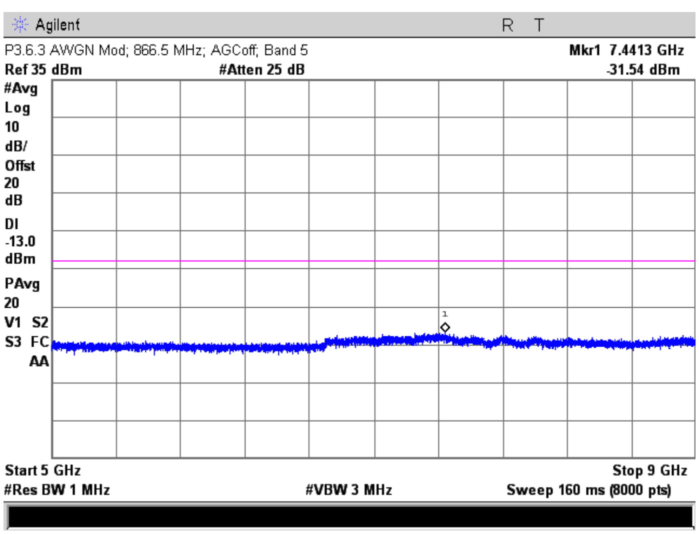
AWGN; 865.5 MHz Injected Signal



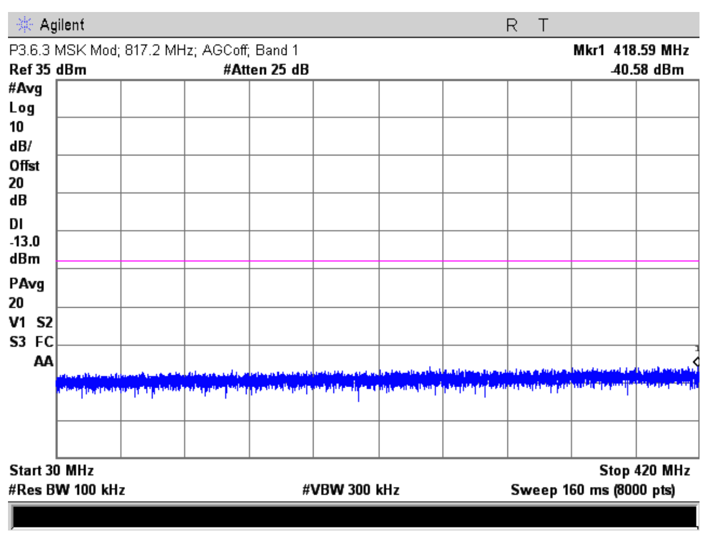
AWGN; 866.5 MHz Injected Signal



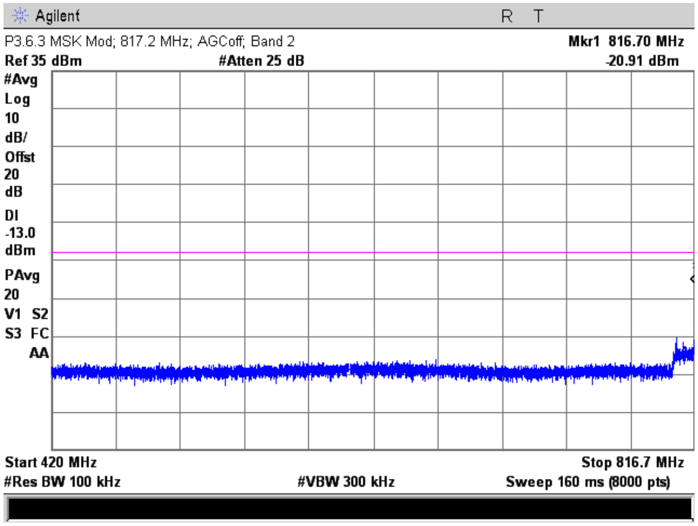
AWGN; 866.5 MHz Injected Signal



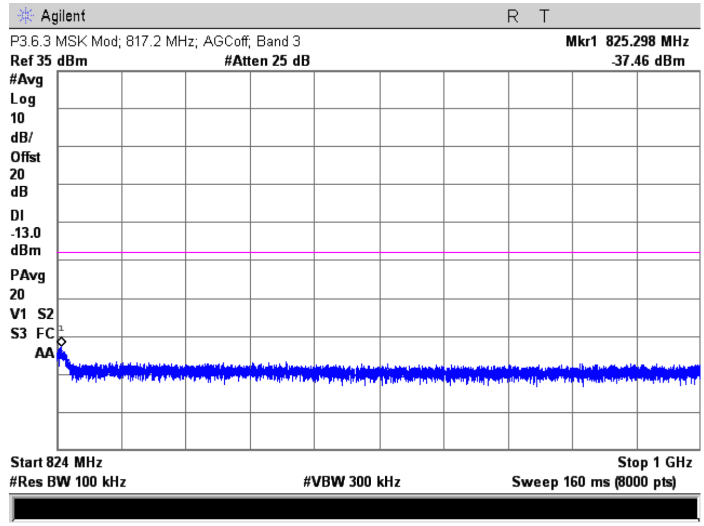
AWGN; 866.5 MHz Injected Signal



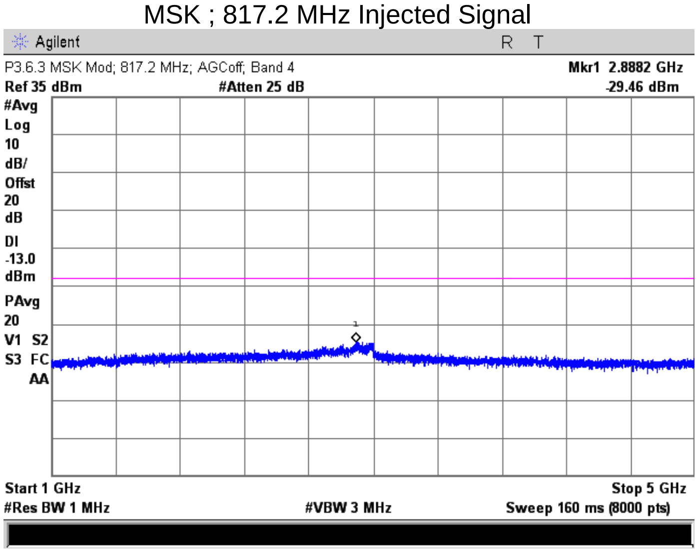
MSK ; 817.2 MHz Injected Signal



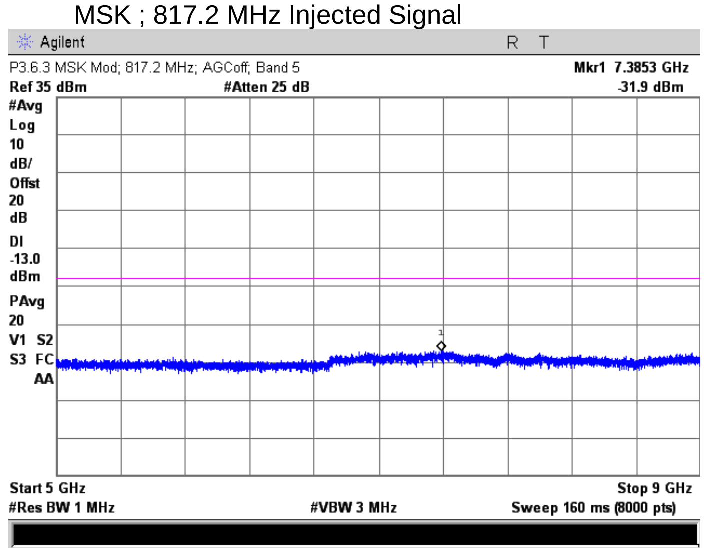
MSK ; 817.2 MHz Injected Signal



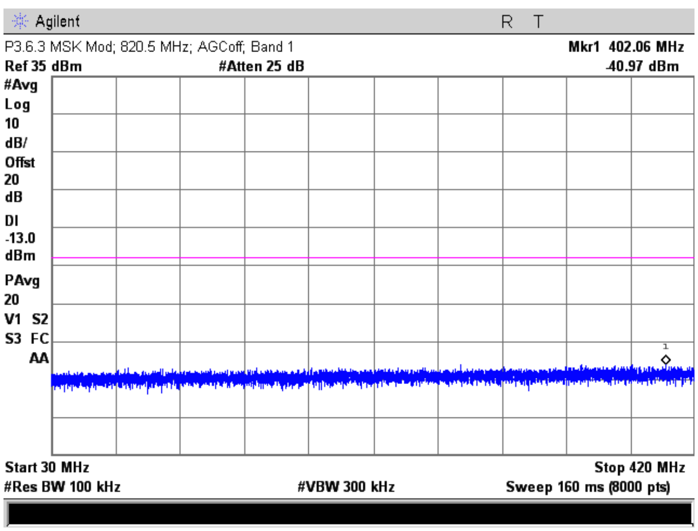
MSK ; 817.2 MHz Injected Signal



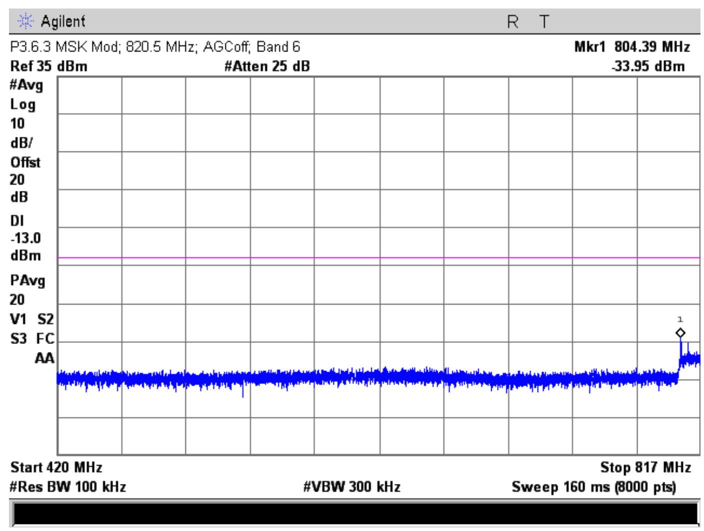
MSK ; 817.2 MHz Injected Signal



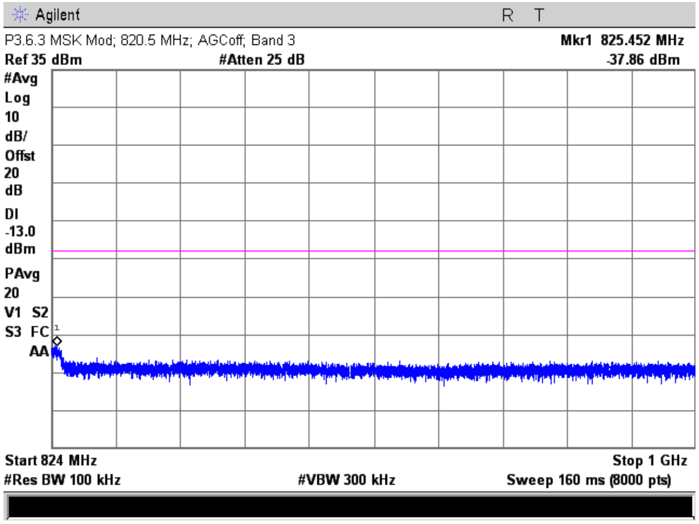
MSK ; 817.2 MHz Injected Signal



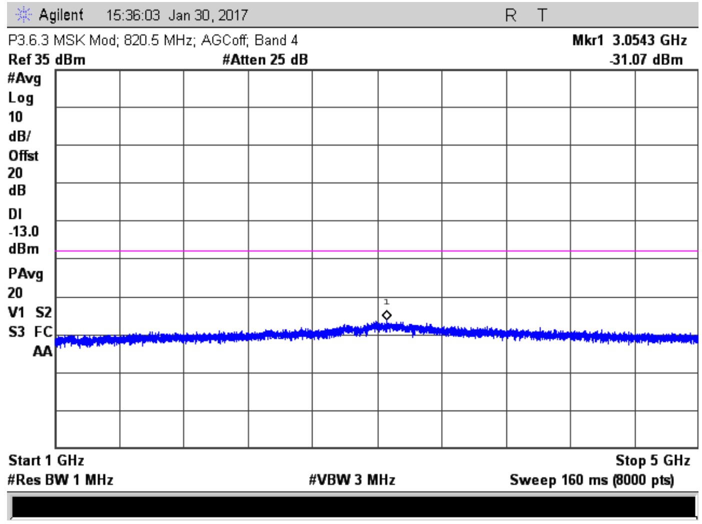
MSK ; 820.5 MHz Injected Signal



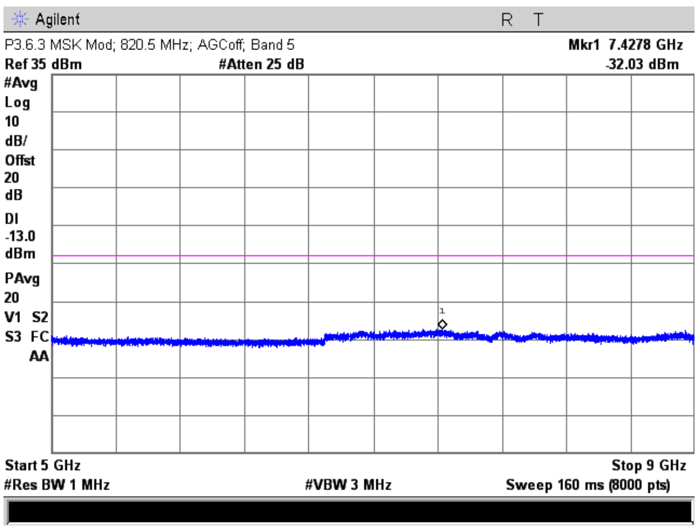
MSK ; 820.5 MHz Injected Signal



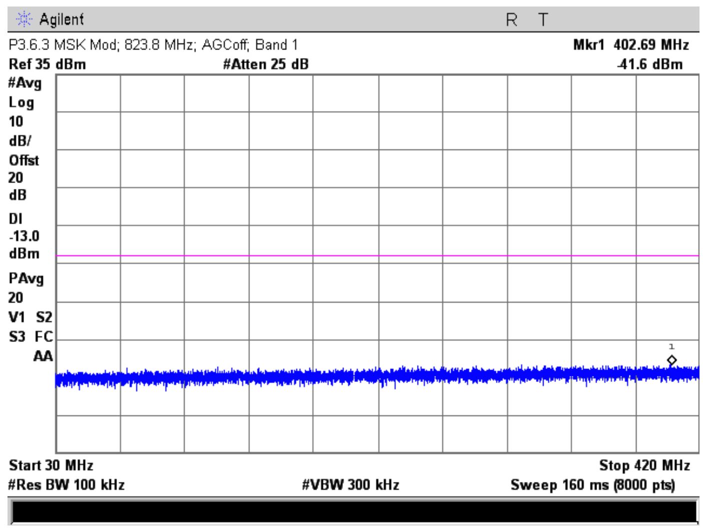
MSK ; 820.5 MHz Injected Signal



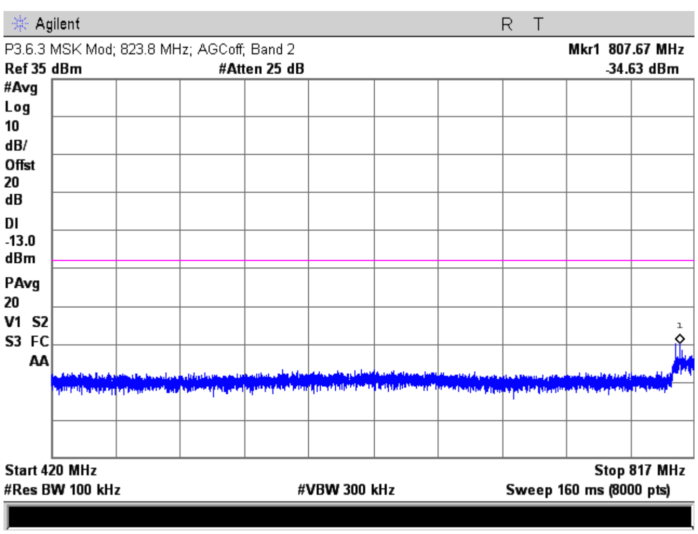
MSK ; 820.5 MHz Injected Signal



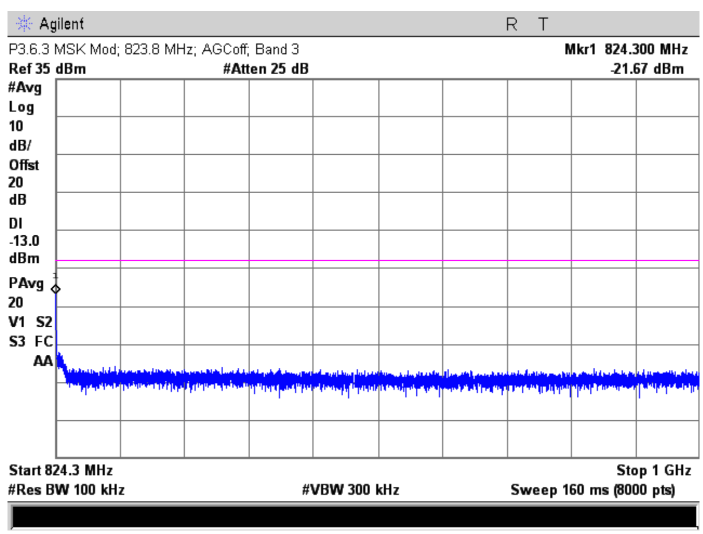
MSK ; 820.5 MHz Injected Signal



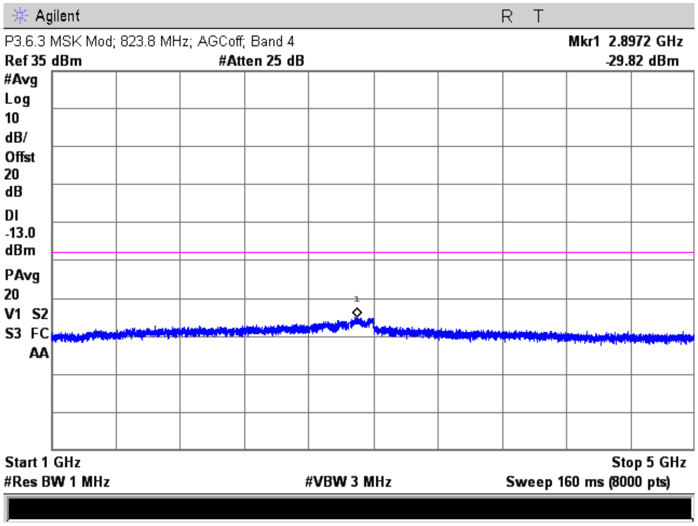
MSK ; 823.8 MHz Injected Signal



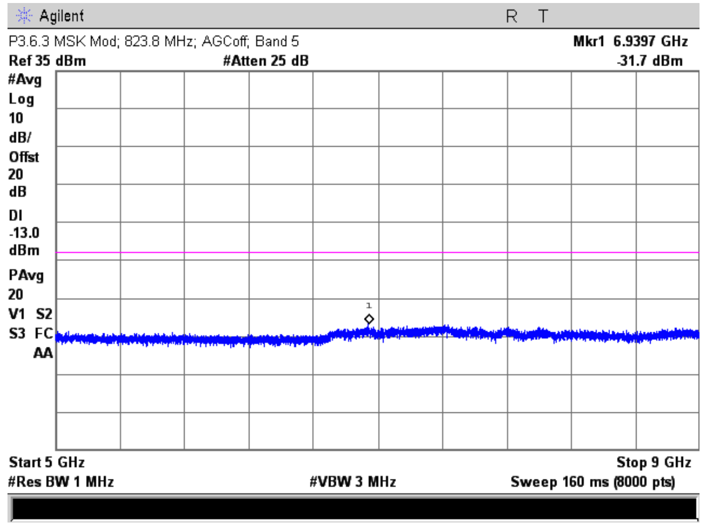
MSK ; 823.8 MHz Injected Signal



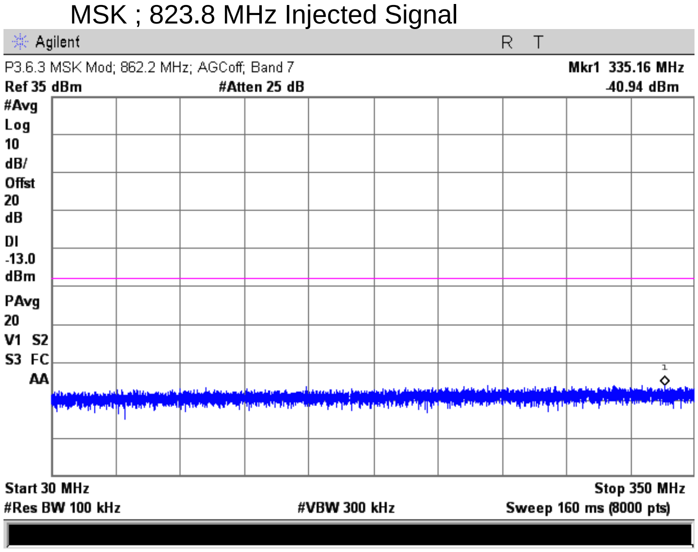
MSK ; 823.8 MHz Injected Signal



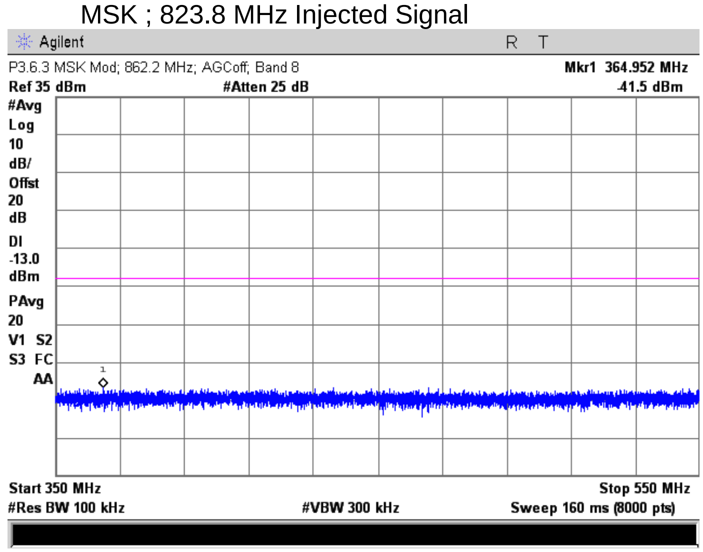
MSK ; 823.8 MHz Injected Signal



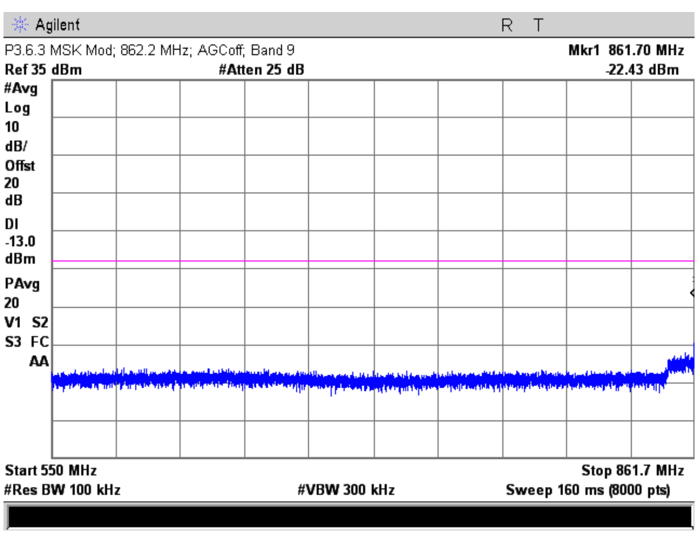
MSK ; 823.8 MHz Injected Signal



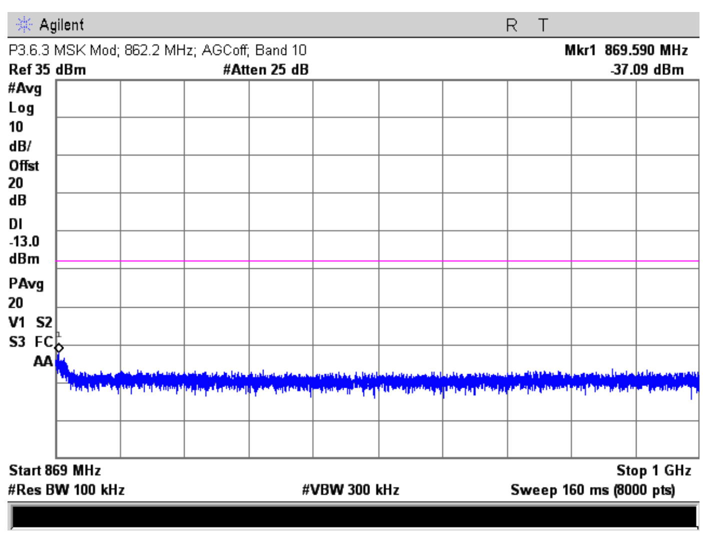
MSK ; 862.2 MHz Injected Signal



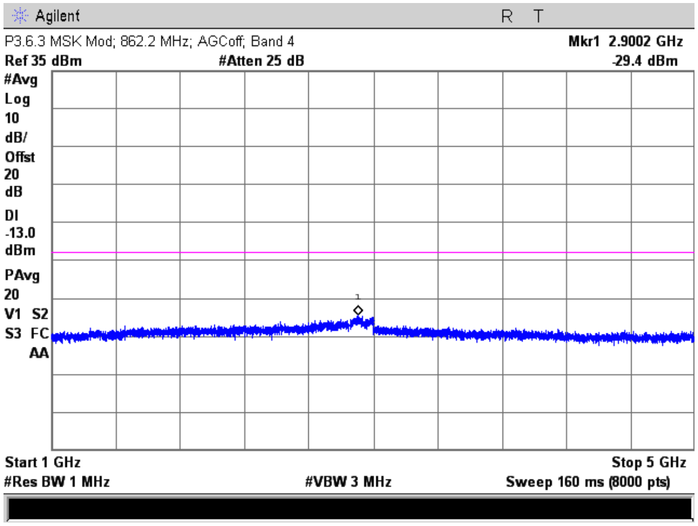
MSK ; 862.2 MHz Injected Signal



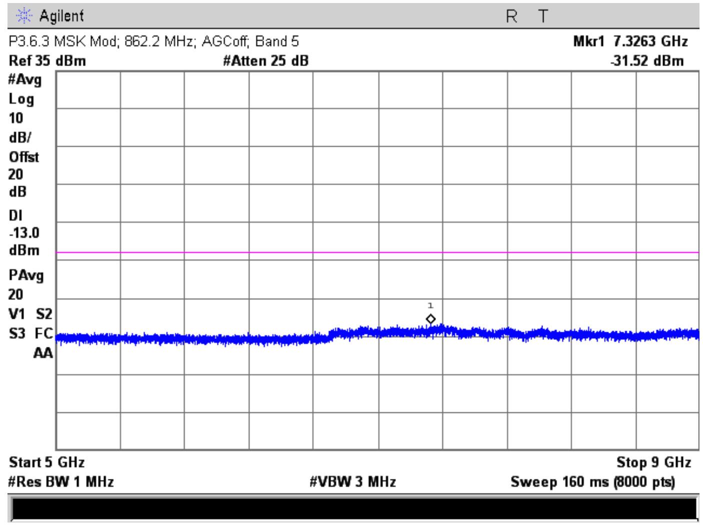
MSK ; 862.2 MHz Injected Signal



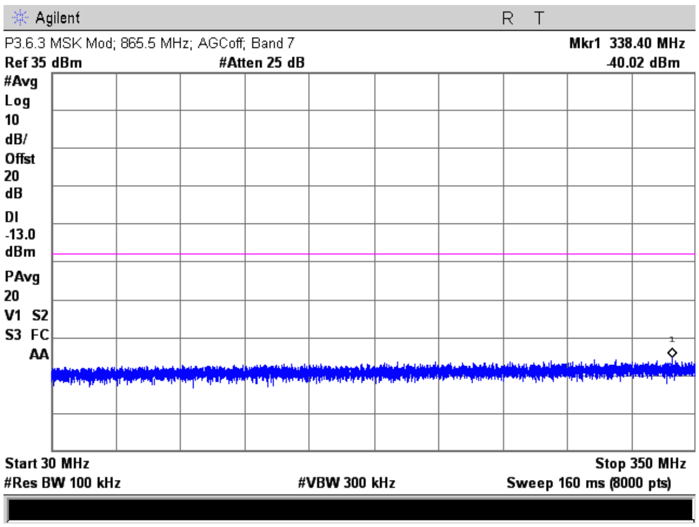
MSK ; 862.2 MHz Injected Signal



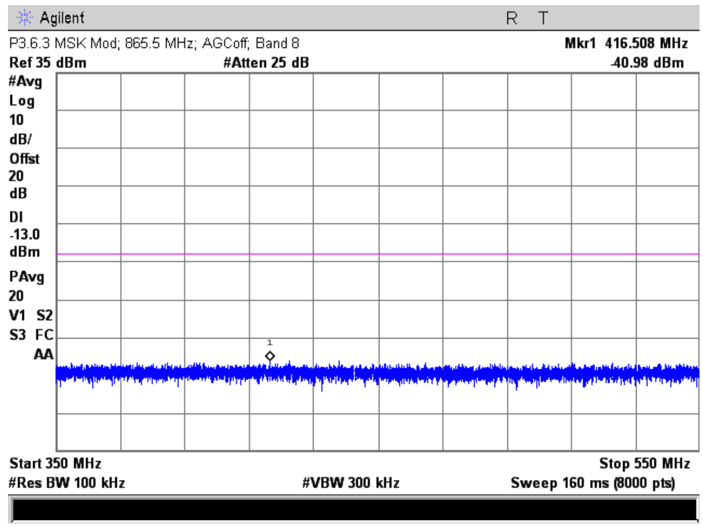
MSK ; 862.2 MHz Injected Signal



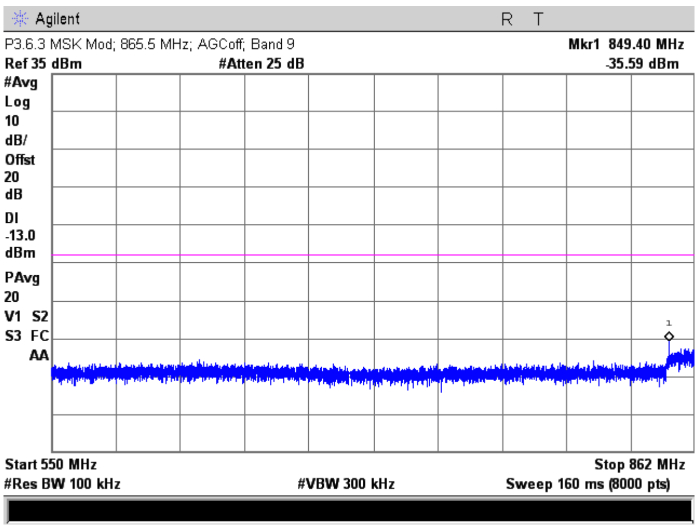
MSK ; 862.2 MHz Injected Signal



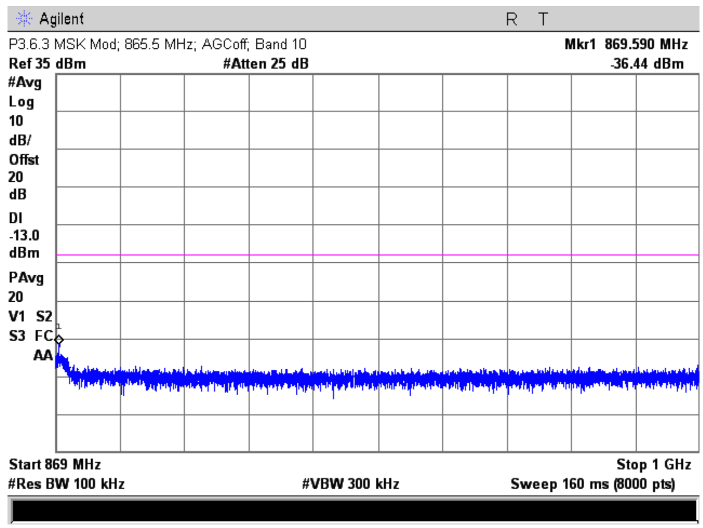
MSK ; 865.5 MHz Injected Signal



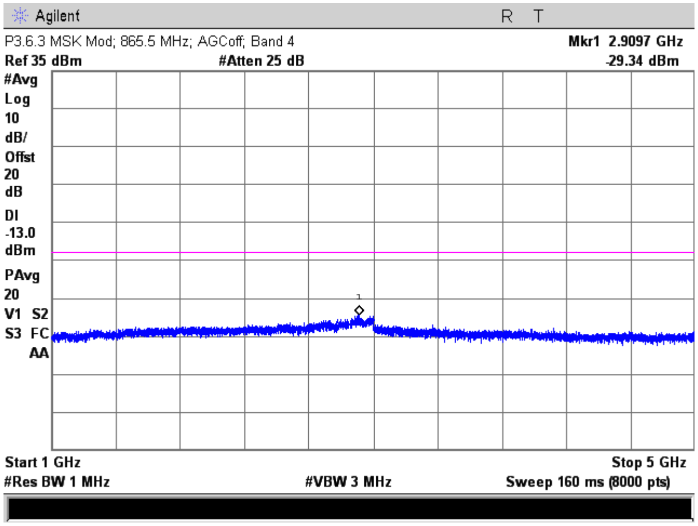
MSK ; 865.5 MHz Injected Signal



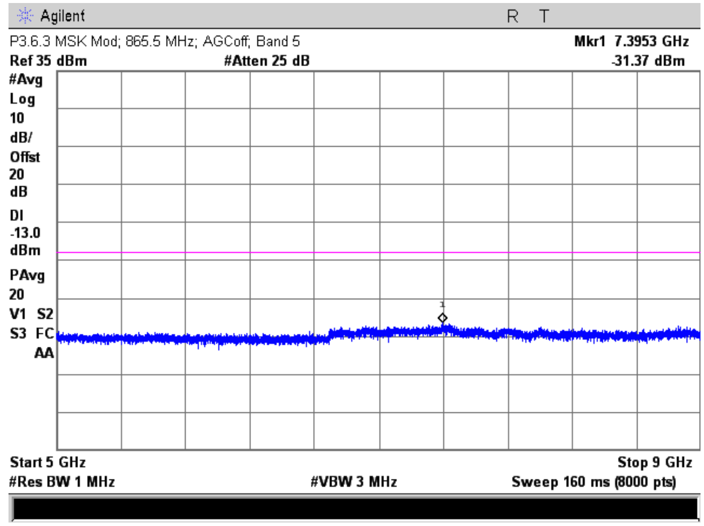
MSK ; 865.5 MHz Injected Signal



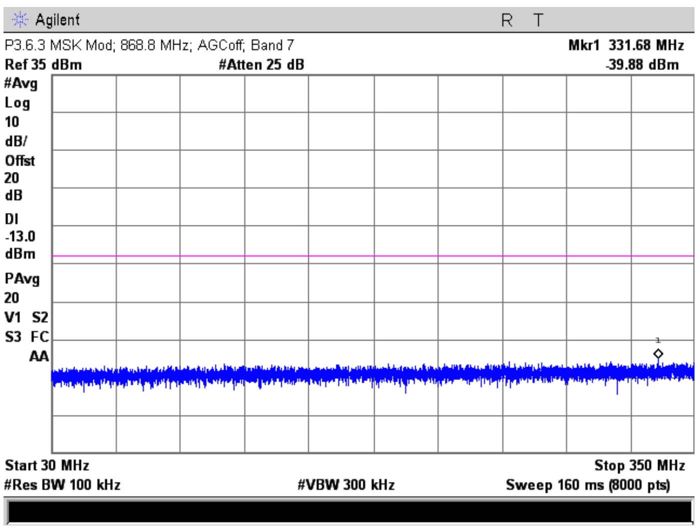
MSK ; 865.5 MHz Injected Signal



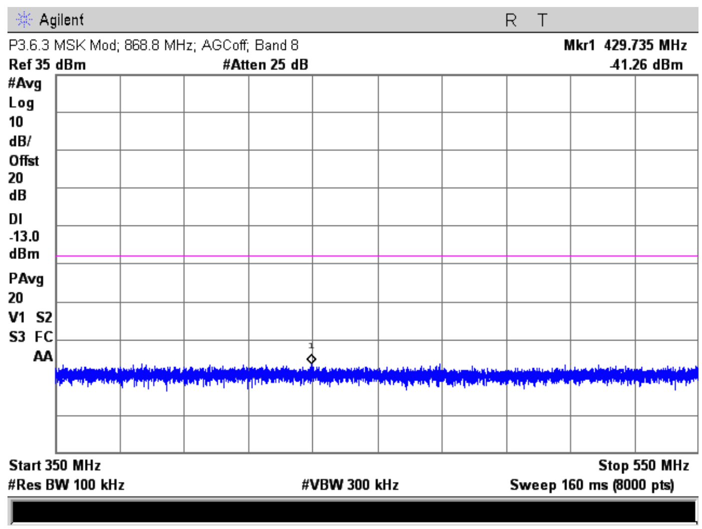
MSK ; 865.5 MHz Injected Signal



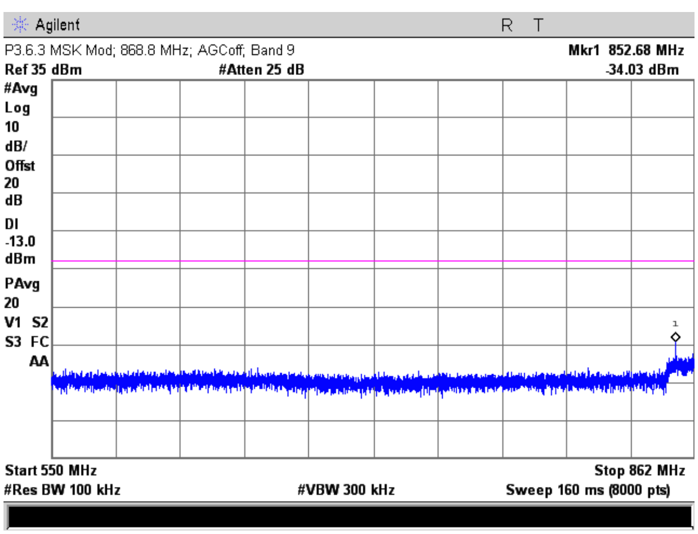
MSK ; 865.5 MHz Injected Signal



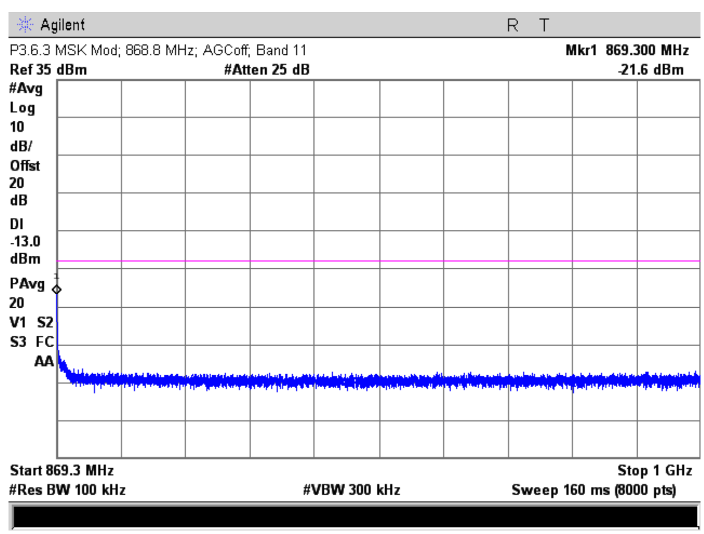
MSK ; 868.8 MHz Injected Signal



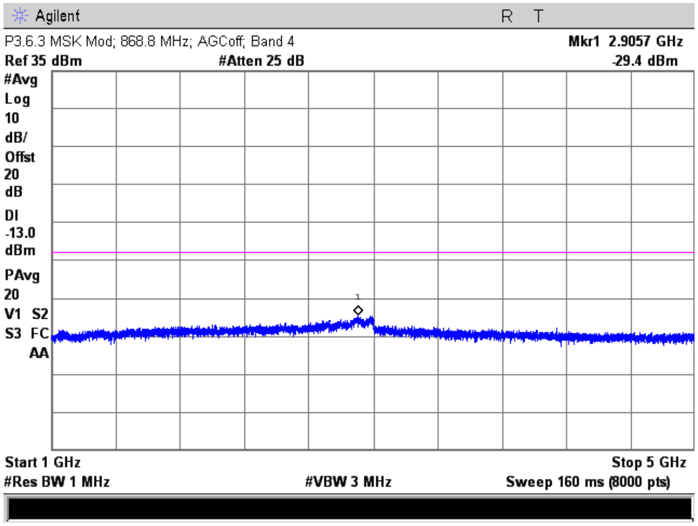
MSK ; 868.8 MHz Injected Signal



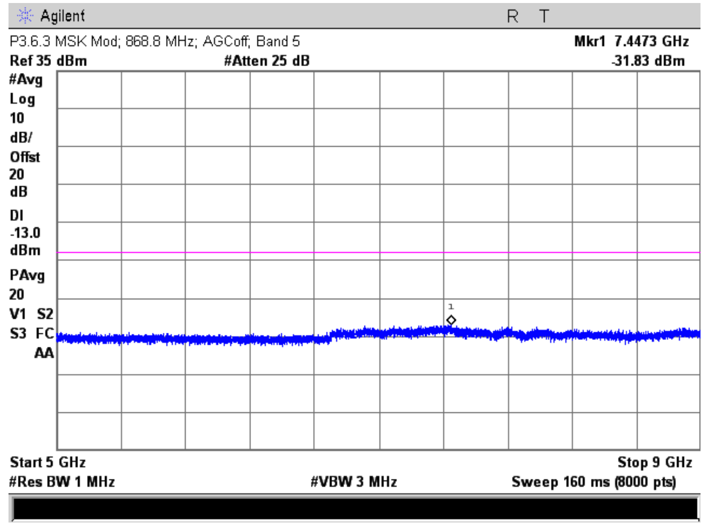
MSK ; 868.8 MHz Injected Signal



MSK ; 868.8 MHz Injected Signal



MSK ; 868.8 MHz Injected Signal



MSK ; 868.8 MHz Injected Signal

16.0 FIELD STRENGTH OF SPURIOUS RADIATED EMISSIONS

16.1 Applicable Standard

The EUT shall comply with section 3.8 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: $43+10x\text{Log}_{10}P$, or 70 dB, whichever is less stringent, where P is the total RF output power of the test tones in watts. Since $43 + 10x\text{Log}_{10}P$ is less stringent than 70 dB, that limit was used.

16.2 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:

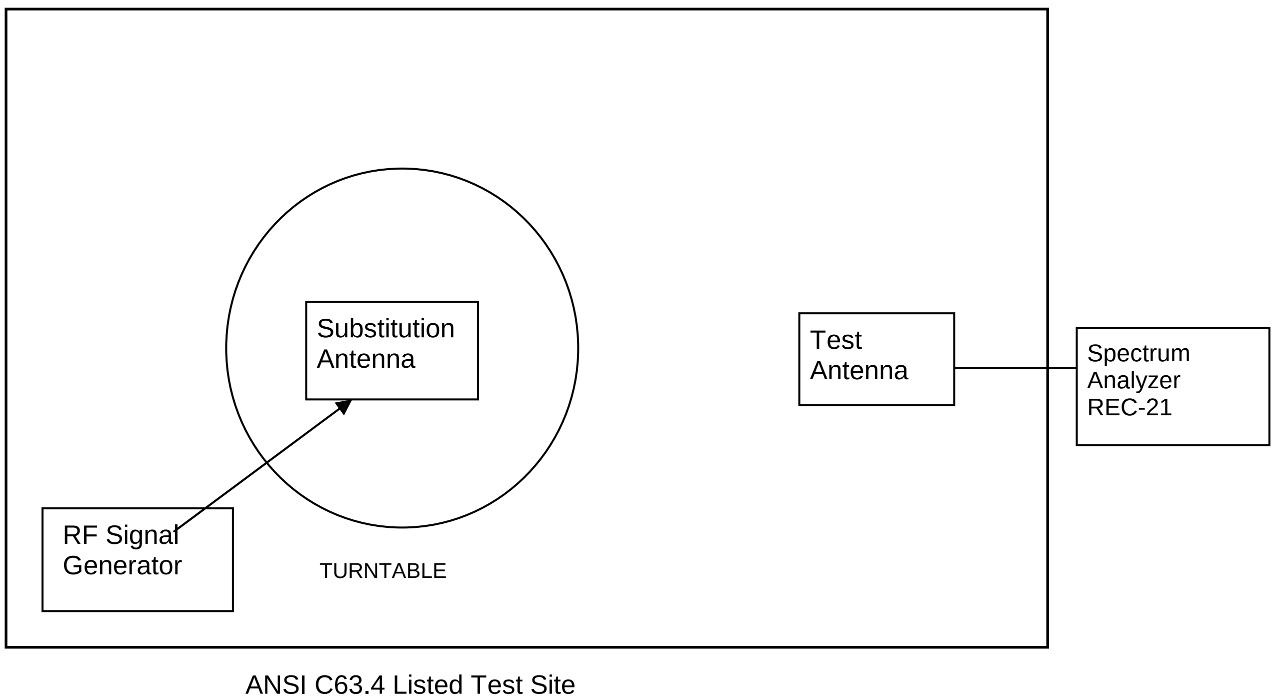
1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.
2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.
3) Sweep Speed slow enough to maintain measurement calibration.
4) Detector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



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(dBm) = *Pg*(dBm) – *cable loss* (dB) + *antenna gain* (dB)

where:
Pd is the dipole equivalent power and
Pg is the generator output power into the substitution antenna.
The *Pd* levels record in step m) are the absolute levels of radiated spurious emissions in dBm.

Since by mathematical definition, P(dBm) – (43+10xLOG P(W)) = -13 dBm, the limit for spurious emissions was set to -13 dBm equivalent radiated power.

16.2.1 Spurious Radiated Emissions Test Results

Model	BDA610-S8	Specification	FCC KDB 935210 FCC Part 90
Serial Number	CPK63377	Test Date	11/29/2016
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

Freq. MHz	Dect.	Ant. Pol.	EUT dBm	Limit dBm	Margin Under Limit dB
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
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

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

Freq. MHz	Dect.	Ant. Pol.	EUT dBm	Limit dBm	Margin Under Limit dB
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.

17.0 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 1-8000 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.