

Compliance Testing, LLC

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Test Report

Prepared for: Wilson Electronics, Inc.

Model: 460027

Description: Quint Band Signal Booster

FCC ID: PWO460027

То

FCC Part 20

Date of Issue: February 17, 2015

On the behalf of the applicant:

Wilson Electronics, Inc. 3301 E Deseret Drive St. George, UT 84790

Attention of:

Patrick Cook, Sr Research & Development Engineer Ph: (435) 673-5021 E-Mail: pcook@infowest.com

Prepared By Compliance Testing, LLC 1724 S. Nevada Way Mesa, AZ 85204 (480) 926-3100 phone / (480) 926-3598 fax <u>www.compliancetesting.com</u> Project No: p14b0014

Mike Graffeo Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	November 24, 2014	Mike Graffeo	Original Document
2.0	February 11, 2015	Mike Graffeo	Added EIRP results page 16, per new FCC Equipment Authorization requirements
3.0	February 17, 2015	Mike Graffeo	Updated 869-894 antenna kit information



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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <u>http://www.compliancetesting.com/labscope.html</u> for current scope of accreditation.

Testing Certificate Number: 2152.01



FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

Test and Measurement Data Sub-part

2.1033(c)(14):

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Part 2, Subpart J and the following individual Parts: 20.21 in conjunction with latest version of KDB 935210.

Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI/C63.4-2009, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F), unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Environmental Conditions								
Temp (ºC)	Humidity (%)	Pressure (mbar)						
24.9 - 31.0	33.5 - 63.0	985.5 - 943.0						

Measurement results, unless otherwise noted, are worst-case measurements.

EUT Description

Model: 460027

Description: Quint Band Signal Booster

Firmware: N/A

Software: N/A

Additional Information:

The EUT is an In-Building, fixed install bi-directional amplifier for the boosting of cellular phone signals and data communication devices.

The following frequency bands and emission types are utilized.

	Frequency Band (MHz)									
Uplink	698 - 716	776 - 787	824 - 849	1850 - 1915	1710 – 1755					
Downlink	728 - 746	746 - 757	869 - 894	1930 - 1995	2110 - 2155					
Modulation Type	L1	ΓE		MA, EDGE, VDO, LTE	CDMA, HSPA, LTE, EDGE, EVDO					

Emission Designators							
CDMA HSPA LTE EVDO EDGE GSM							
F9W	F9W	G7D	F9W	G7W	GXW		

The modulation types and emission designators listed in the tables represent the modulations that the cell phone providers use for each frequency band. GSM, CDMA, and WCDMA represent all the modulation types (phase and amplitude or a combination thereof) utilized within the industry. EDGE, HSPA, LTE etc. are all protocols or multiplexing techniques using the base modulations.

EUT Operation during Tests

The EUT was in a normal operating condition.



Accessories:

Qty	Description	Manufacturer	Model	S/N
1	50 to 75 ohm adaptor	MiniCircuits	SFMP-5075-3+	N/A
1	Power Supply, 5V, 3A	Toshiba	PA1650-21	N/A

Cables: N/A

Modifications: N/A



Test Result Summary

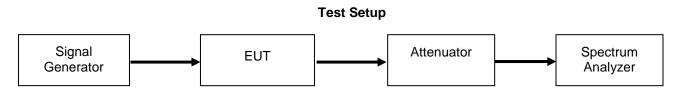
Specification	Test Name	Pass, Fail, N/A	Comments
20.21(e)(3)	Authorized Frequency Band	Pass	
20.21(e)(8)(i)(B) 20.21(e)(8)(i)(C) 20.21(e)(8)(i)(D)	Maximum Power and Gain	Pass	
20.21(e)(8)(i)(F)	Intermodulation	Pass	
20.21(e)(8)(i)(E)	Out-of-Band Emissions	Pass	
2.1051 22.917(a) 24.238((a) 27.53(c) 27.53(e) 27.53(f) 27.53(g)	Conducted Spurious Emissions	Pass	
20.21(e)(8)(i)(A)	Noise Limits	Pass	
20.21(e)(8)(i)(l)	Uplink Inactivity	Pass	
20.21(e)(8)(i)(C)(1) 20.21(e)(8)(i)(H) Choose: 20.21(e)(8)(i)(C)(2)(i) (Fixed)	Variable Gain	Pass	
2.1049	Occupied Bandwidth	Pass	
20.21(e)(8)(ii)(A)	Oscillation Detection	Pass	
2.1053	Radiated Spurious	Pass	
20.21(e)(8)(i)(B)	Spectrum Block Filtering	N/A	This only applies to devices utilizing spectrum block filtering



Authorized Frequency Band Engineer: Mike Graffeo Test Date: 11/19/14

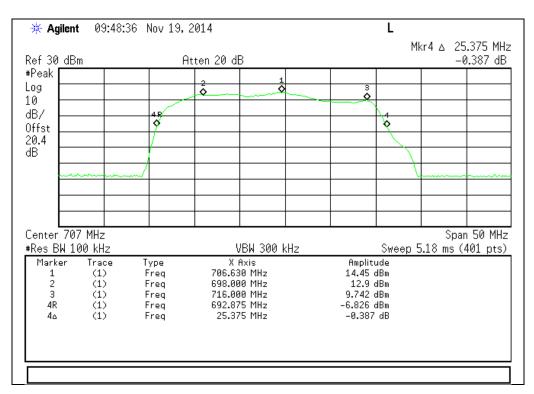
Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings. A signal generator was utilized to produce a CW input signal tuned to the center channel of the operational band. The RF input level was increased to a point just prior to the AGC being in control of the power. The Signal generator was set to sweep across 2X the operational band of the EUT while the spectrum analyzer was set to MAX HOLD. Two markers were placed at the edges of the operational band and a third marker was placed at the highest point within the band no closer than 2.5 MHz from the band edge.





Uplink Test Results

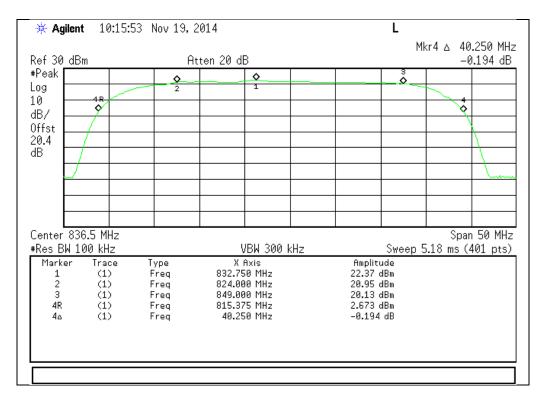


698 - 716 MHz Band

776 - 787 MHz Band

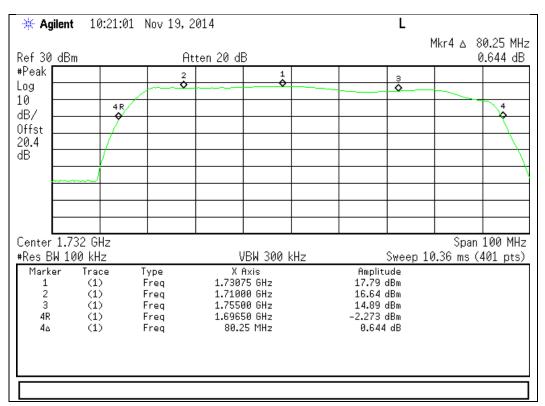
🔆 Agilen	t 10:01:2	0 Nov 19, 2	014				L		
Ref 30 dB	m	Att	ten 20 dB	:					22.9 MHz 0.415 dB
#Peak Log			2	L 		3			
10 dB/		4 R 0					5	4	
0ffst 20.4									
dB		\mathcal{A}							
								±	
Center 78 #Res BW 1	00 kHz			BW 300 I	<hz< td=""><td></td><td></td><td>אסס 4.144 ms (</td><td>n 40 MHz 401 pts)</td></hz<>			אסס 4.144 ms (n 40 MHz 401 pts)
Marker 1 2 3 4R 4A	Trace (1) (1) (1) (1) (1) (1)	Type Freq Freq Freq Freq Freq	776.0 787.0 770.4	xis 8 MHz 8 MHz 8 MHz 8 MHz 9 MHz		Amplitu 15.6 (16.55 (9.875 (-4.941 (-0.415	38m 38m 38m 38m		



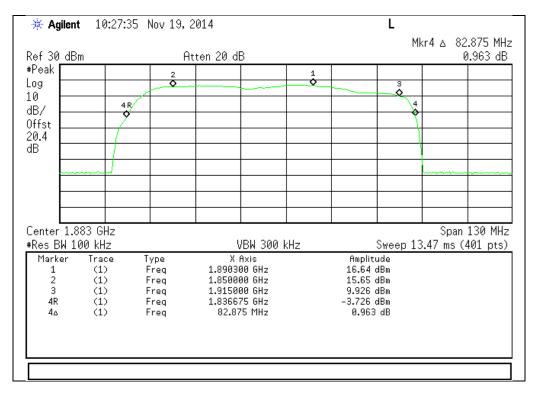


824 - 849 MHz Band

1710 - 1755 MHz Band







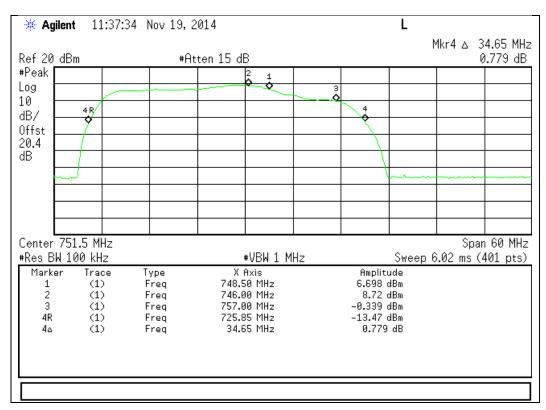
1850 - 1915 MHz Band

Downlink Test Results

728 - 746 MHz Band

🔆 Agile	mt 11:33	:54 Nov 19, 3	2014			L	ML	24.00 MU-
Ref 20 d	Bm	#A	tten 15 dB				MKr4 ∆	34.20 MHz 0.058 dB
#Peak Log			2					
10 -			4R				+	4
dB/ Offst			1					
20.4 dB			<u> </u>					\rightarrow
		·····						L
Center 7	37 MHz						Sp	an 60 MHz
#Res BW				3W1 MHz				(401 pts)
Marker 1	Trace (1) (1)	Type Freq Freq	X Axis 743.00 1 728.00 1	1Hz	Amplit 8.489 1.921	dBm		
2 3 4R	(1) (1)	Freq Freq Freq	746.00 1 746.00 1 726.05 1	1Hz	8.676 -11.28	dBm		
4K 46	(1)	Freq	34.201		0.058			



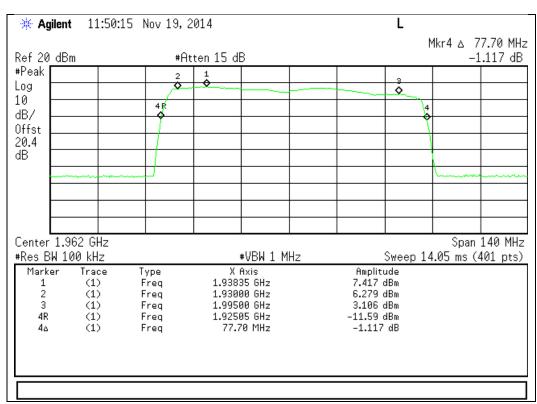


746 - 757 MHz Band

869 - 894 MHz Band

🔆 🔆 Ag	jilent 1	1:43:35	Nov 19, 2	014				L		
Ref 20	dBm		#At	ten 15 di	В				Mkr4 ∆ 3	37.05 MHz 0.3 dB
#Peak Log			2					3 Ø		
10 dB/		4 R	1						4	
Offst 20.4 dB										
QD.									han	m
Contor	881.5 N	 4⊔⇒							Sport Sport	n 60 MHz
#Res B	W 100 k	Hz			#VBW 1 N	1Hz			6.02 ms (
Mark 1 2 3 4R	0 0 0 0	L) L) L) L)	ype req req req req	878.0 869.0 894.0 862.1	Axis 00 MHz 00 MHz 00 MHz 15 MHz		Amplit 7.405 8.427 5.11 -12.74	dBm dBm dBm dBm		
40	(1		Freq	37.0)5 MHz		0.3	dB		





1930 - 1995 MHz Band

2110 - 2155 MHz Band

🔆 Ag	ilent 1	1:58:10	Nov 19,	2014				L		<u>_</u>
Ref 20	dBm		#F	Atten 15 d	В				Mkr4 ∆	84.975 MHz 0.75 dB
#Peak								8		
Log 10		ļ,							<u> </u>	~
dB/		4 R								4
Offst		\perp								
20.4 dB		+/-								\rightarrow
uВ		/							_	\rightarrow
		¥							_	— Ч
				_		+			_	
Center	2.132 0	」 汨z							Sr	oan 110 MHz
	W 100 kl				∗VBW 1 N	MHz		Sweep		s (401 pts)
Mark			Type		Axis		Amplit			
1	(1 (1		Freq Freq	2.1140 2.1100			8.987 9.277			
2	(1	Ú	Freq	2.1550			8.13			
4R 46	(1 (1		Freq Freq	2.0948 84.93	25 GHz 75 MHz		-11.71 0.75			



Maximum Power and Gain Engineer: Mike Graffeo Test Date: 11/19/14

Test Procedure

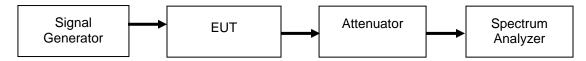
The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings. The spectrum analyzer and signal generator were tuned to the frequency with the highest power level in the band, as determined by the Authorized Frequency Band test. The RF input level was increased to a point just prior to the AGC being in control of the power for both pulsed single time slot GSM modulation and 4.1 MHz AWGN modulation. The maximum power was measured and verified to meet the minimum and maximum levels allowed, with the maximum gain being computed from these values. The uplink and downlink gain under each condition were verified to be within 9 dB of each other.

For Fixed installations the following formula was used for calculating the gain limits.

Gain Limit (dB) = 6.5 dB + $20Log(F_{MHz})$

F_{MHz} is the uplink mid-band frequency with the downlink gain limit being equivalent to the paired Uplink band gain limit.

Test Setup



Uplink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Lower Limit (dBm)	Upper Limit (dBm)	Result
698 - 716 MHz Pulsed GSM	-38.9	20.40	17	30	Pass
698 - 716 MHz AWGN	-41.1	17.23	17	30	Pass
776 - 787 MHz Pulsed GSM	-35.9	20.82	17	30	Pass
776 - 787 MHz AWGN	-37.5	20.09	17	30	Pass
824 - 849 MHz Pulsed GSM	-36.9	25.16	17	30	Pass
824 - 849 MHz AWGN	-35.2	23.88	17	30	Pass
1710 - 1755 MHz Pulsed GSM	-37.0	23.00	17	30	Pass
1710 - 1755 MHz AWGN	-39.0	19.87	17	30	Pass
1850 - 1915 MHz Pulsed GSM	-36.1	21.42	17	30	Pass
1850 - 1915 MHz AWGN	-37.3	18.75	17	30	Pass



Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Upper Limit (dBm)	Result
728 - 746 MHz Pulsed GSM	-50.8	8.88	17	Pass
728 - 746 MHz AWGN	-48.9	11.57	17	Pass
746 - 757 MHz Pulsed GSM	-52.1	6.77	17	Pass
746 - 757 MHz AWGN	-49.8	10.41	17	Pass
869 - 894 MHz Pulsed GSM	-53.6	6.67	17	Pass
869 - 894 MHz AWGN	-51.7	9.39	17	Pass
1930 - 1995 MHz Pulsed GSM	-59.1	7.18	17	Pass
1930 - 1995 MHz AWGN	-55.1	9.47	17	Pass
2110 - 2155 MHz Pulsed GSM	-55.2	8.72	17	Pass
2110 - 2155 MHz AWGN	-53.1	11.31	17	Pass

Downlink Power Test Results

Uplink and Downlink Gain Test Results

Modulation	Uplink Frequency (MHz)	Downlink Frequency (MHz)	Uplink Gain (dB)	Uplink Limit (dB)	Downlink Gain (dB)	Downlink Limit (dB)	Delta (dB)	Limit (dB)	Margin (dB)
Pulsed GSM	706.63	743	59.30	63.5	59.7	63.5	0.38	9	-8.62
AWGN	706.63	743	58.33	63.5	60.5	63.5	2.14	9	-6.86
Pulsed GSM	777.8	748.5	56.72	64.4	58.9	64.4	2.15	9	-6.85
AWGN	777.8	748.5	57.59	64.4	60.2	64.4	2.62	9	-6.38
Pulsed GSM	832.75	878	62.06	64.9	60.3	64.9	1.79	9	-7.21
AWGN	832.75	878	59.08	64.9	61.1	64.9	2.01	9	-6.99
Pulsed GSM	1730.75	2114	60.00	71.3	63.9	71.3	3.92	9	-5.08
AWGN	1730.75	2114	58.87	71.3	64.4	71.3	5.54	9	-3.46
Pulsed GSM	1890.3	1938.4	57.52	72	66.3	72	8.76	9	-0.24
AWGN	1890.3	1938.4	56.05	72	64.6	72	8.52	9	-0.48



EIRP Uplink Power Calculations

Frequency Band (MHz)	Antenna Kit	EIRP (Watts)	Limit (Watts	Result
698 - 716	314411-40075	0.3090	1.0	Pass
776 - 787	314411-40075	0.3177	1.0	Pass
824 - 849	311129-400100	1.0000	1.0	Pass
1710 - 1755	314453-40075	0.5741	1.0	Pass
1850 - 1915	3144473-0640	0.4130	1.0	Pass

EIRP Downlink Power Calculations

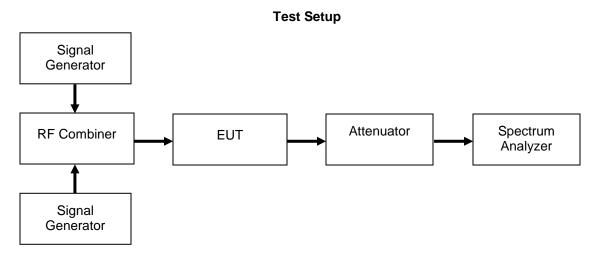
Frequency Band (MHz)	Antenna Kit	EIRP (Watts	Limit (Watts	Result
728 - 746	309900-50N	0.0374	1.0	Pass
746 - 757	309900-50N	0.0286	1.0	Pass
869 - 894	311115-1150	0.0353	1.0	Pass
1930 - 1995	309900-50N	0.0405	1.0	Pass
2110 - 2155	309900-50N	0.0302	1.0	Pass



Intermodulation Engineer: Mike Graffeo Test Date: 11/18/14

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator. Two signal generators were utilized to produce two CW signals 600 kHz apart and centered in the operational band. Attenuator and cable insertion loss correction factors were input to either the signal generator or the spectrum analyzer as required to ensure that accurate measurements were recorded. The input power was set at the maximum allowable power and the RMS intermodulation products were measured to ensure they were less than -19 dBm in a 3 kHz RBW. The uplink and downlink intermodulation products were plotted, with the levels being listed in the summary tables.



Uplink Test Results

Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
698 - 716 MHz	-20.63	-19	Pass
776 - 787 MHz	-20.70	-19	Pass
824 - 849 MHz	-20.67	-19	Pass
1710 - 1755 MHz	-21.39	-19	Pass
1850 - 1915 MHz	-23.37	-19	Pass

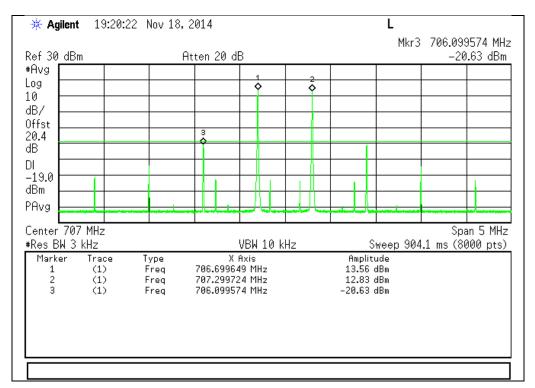
Downlink Test Results

Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
728 - 746 MHz	-37.01	-19	Pass
746 - 757 MHz	-40.53	-19	Pass
869 - 894 MHz	-38.50	-19	Pass
1930 - 1995 MHz	-37.94	-19	Pass
2110 - 2155 MHz	-30.24	-19	Pass

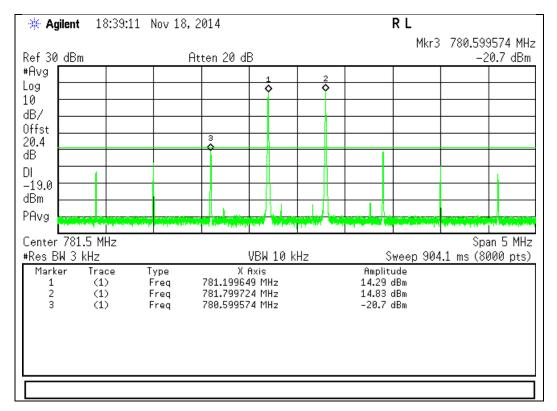


Uplink Test Results

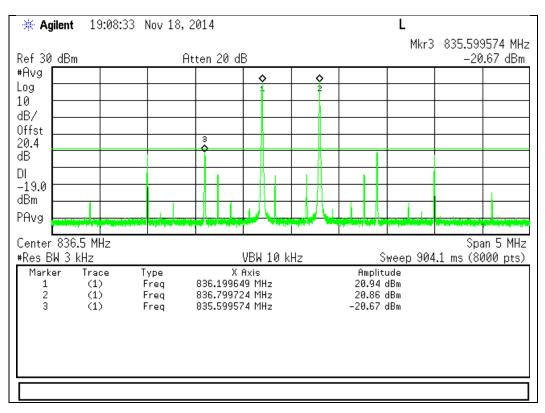




776 - 787 MHz Band

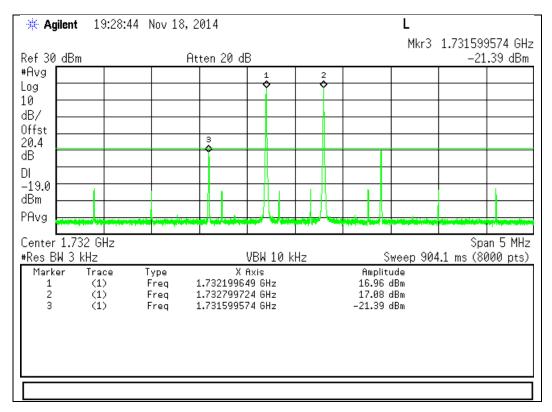




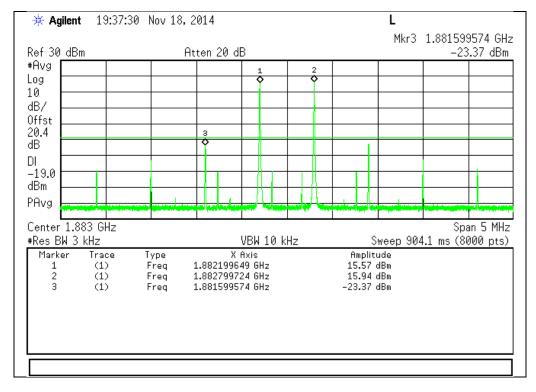


824 - 849 MHz Band

1710 - 1755 MHz Band



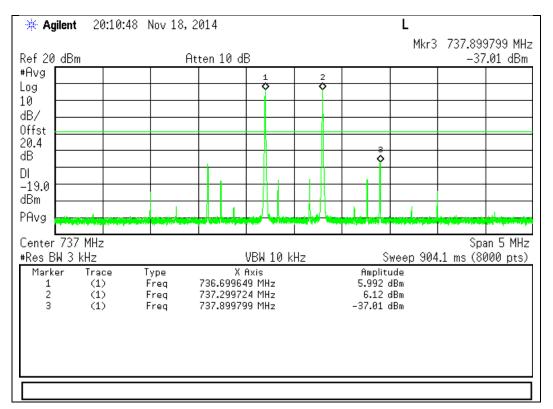




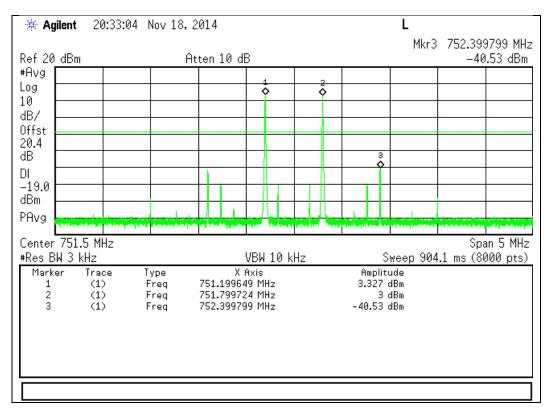
1850 - 1915 MHz Band

Downlink Test Results

728 - 746 MHz Band

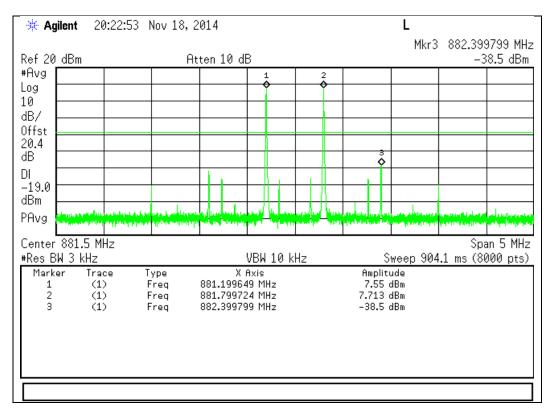




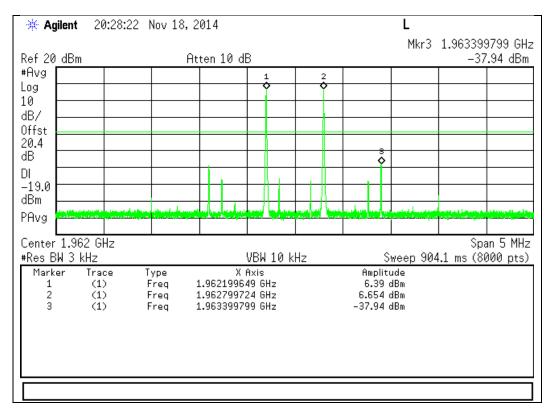


746 - 757 MHz Band

869 - 894 MHz Band

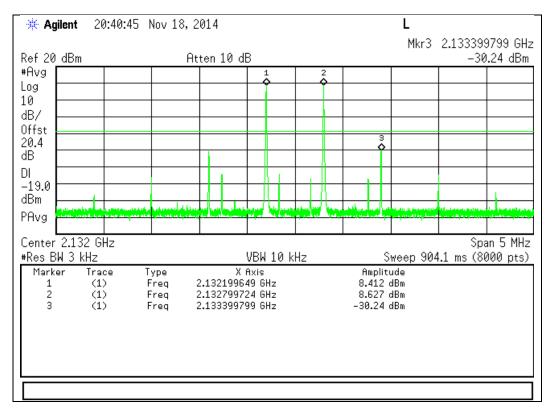






1930 - 1995 MHz Band

2110 - 2155 MHz Band





Out-of-Band Emissions Engineer: Mike Graffeo Test Date: 11/20/14

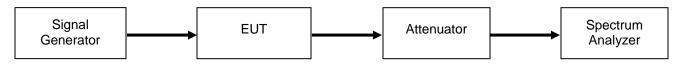
Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor in order to ensure accurate readings. A signal generator was utilized to produce the following signals: GSM, CDMA, and WCDMA. The signal generator was tuned to the lowest allowable upper and lower channel within the EUT operational band for each respective modulation type. The RF input level was increased to a point just prior to the AGC being in control of the power. For each modulation type the Out of Band Emissions were measured to ensure they met the limits.

The following formula was used for calculating the limits:

Limit = P1 - 6 - (43+10Log(P2)) = -19dBmP1 = power in dBm P2 = power in Watts







Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-28.23	-19	Pass
698 - 716	Upper	-32.76	-19	Pass
776 - 787	Lower	-27.12	-19	Pass
776 - 787	Upper	-28.15	-19	Pass
824 - 849	Lower	-33.23	-19	Pass
824 - 849	Upper	-30.80	-19	Pass
1710 - 1755	Lower	-36.24	-19	Pass
1710 - 1755	Upper	-37.47	-19	Pass
1850 - 1915	Lower	-37.20	-19	Pass
1850 - 1915	Upper	-41.57	-19	Pass

GSM Uplink Test Results

CDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-48.36	-19	Pass
698 - 716	Upper	-55.82	-19	Pass
776 - 787	Lower	-38.15	-19	Pass
776 - 787	Upper	-44.56	-19	Pass
824 - 849	Lower	-30.24	-19	Pass
824 - 849	Upper	-35.96	-19	Pass
1710 - 1755	Lower	-41.85	-19	Pass
1710 - 1755	Upper	-41.56	-19	Pass
1850 - 1915	Lower	-43.66	-19	Pass
1850 - 1915	Upper	-48.29	-19	Pass



WCDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-54.48	-19	Pass
698 - 716	Upper	-55.96	-19	Pass
776 - 787	Lower	-40.91	-19	Pass
776 - 787	Upper	-47.81	-19	Pass
824 - 849	Lower	-32.56	-19	Pass
824 - 849	Upper	-29.63	-19	Pass
1710 - 1755	Lower	-37.87	-19	Pass
1710 - 1755	Upper	-37.56	-19	Pass
1850 - 1915	Lower	-40.46	-19	Pass
1850 - 1915	Upper	-44.89	-19	Pass

GSM Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-39.36	-19	Pass
728 - 746	Upper	-33.74	-19	Pass
746 - 757	Lower	-32.97	-19	Pass
746 - 757	Upper	-43.05	-19	Pass
869 - 894	Lower	-44.72	-19	Pass
869 - 894	Upper	-47.92	-19	Pass
1930 - 1995	Lower	-47.85	-19	Pass
1930 - 1995	Upper	-50.44	-19	Pass
2110 - 2155	Lower	-44.72	-19	Pass
2110 - 2155	Upper	-45.80	-19	Pass



CDMA Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-55.24	-19	Pass
728 - 746	Upper	-54.78	-19	Pass
746 - 757	Lower	-54.57	-19	Pass
746 - 757	Upper	-56.46	-19	Pass
869 - 894	Lower	-52.50	-19	Pass
869 - 894	Upper	-51.86	-19	Pass
1930 - 1995	Lower	-55.13	-19	Pass
1930 - 1995	Upper	-53.96	-19	Pass
2110 - 2155	Lower	-48.99	-19	Pass
2110 - 2155	Upper	-50.20	-19	Pass

WCDMA Downlink Test Results

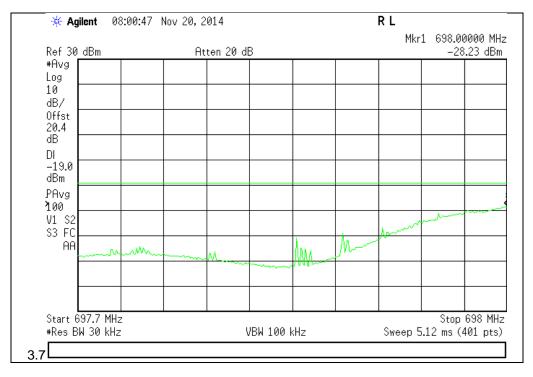
Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-55.29	-19	Pass
728 - 746	Upper	-55.03	-19	Pass
746 - 757	Lower	-54.22	-19	Pass
746 - 757	Upper	-55.60	-19	Pass
869 - 894	Lower	-46.92	-19	Pass
869 - 894	Upper	-46.73	-19	Pass
1930 - 1995	Lower	-48.13	-19	Pass
1930 - 1995	Upper	-48.06	-19	Pass
2110 - 2155	Lower	-44.79	-19	Pass
2110 - 2155	Upper	-44.27	-19	Pass



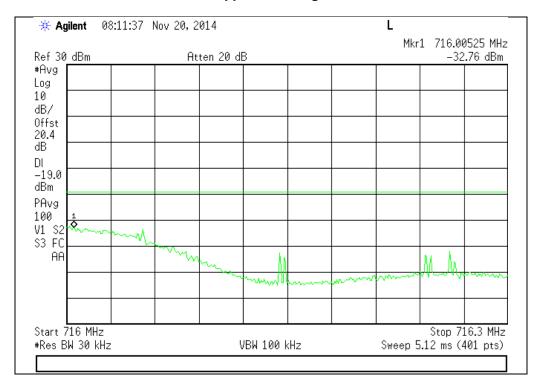
GSM Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge

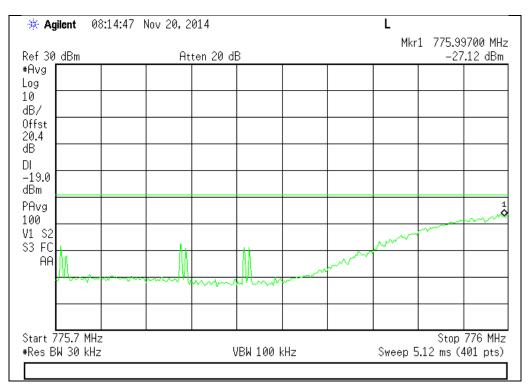


Upper Band Edge

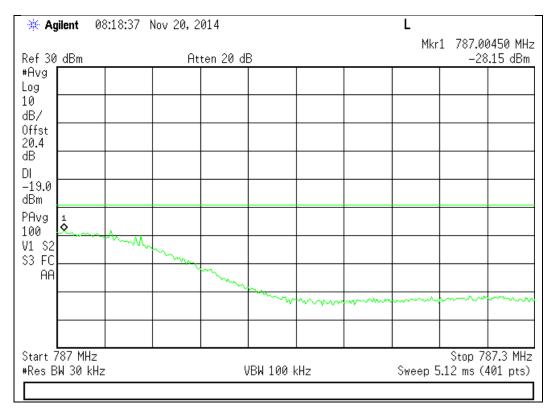




776 - 787 MHz Band

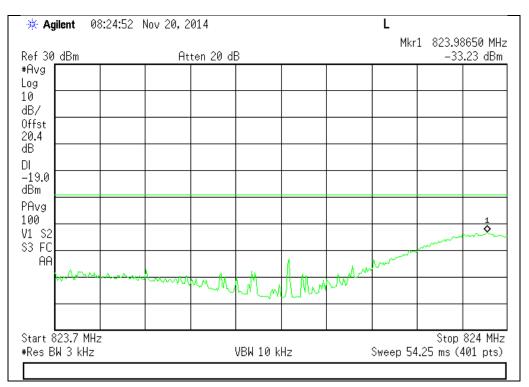


Lower Band Edge

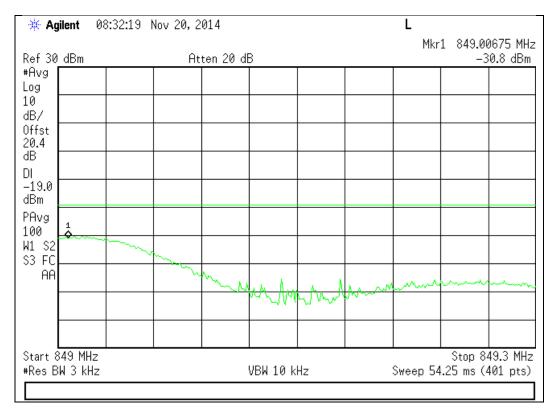




824 - 849 MHz Band

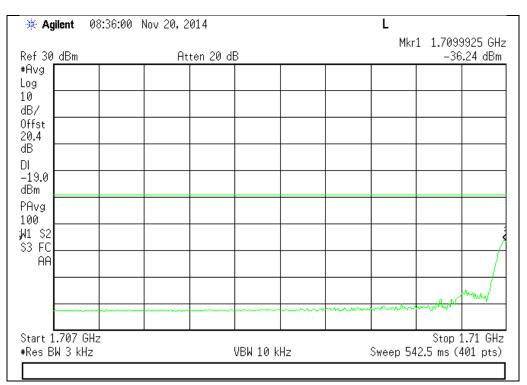


Lower Band Edge

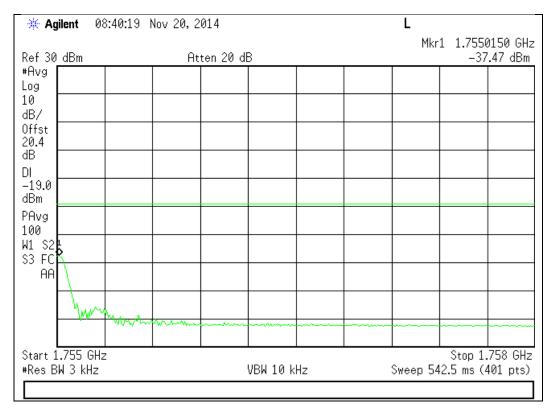




1710 - 1755 MHz Band

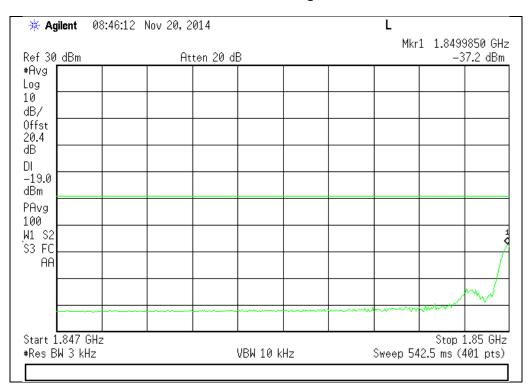


Lower Band Edge





1850 - 1915 MHz Band



Lower Band Edge

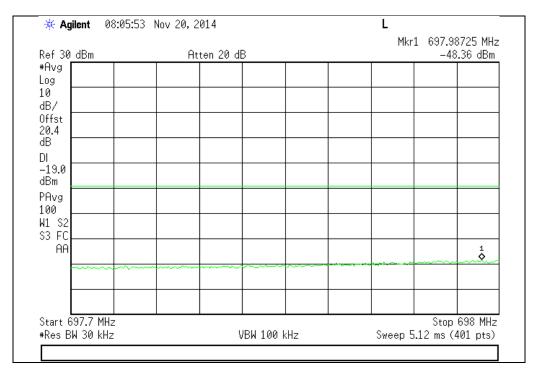
🔆 Agilent 08:50:10 N	ov 20, 2014		L	04 50000 011
Ref 30_dBm	Atten 20 dB		Mkri i	.9150000 GHz -41.57 dBm
#Avg Log				
10 dB/				
Offst 20.4				
dB				
DI -19.0				
dBm PAvg				
100 W1 S2				
S3 FC				
hanna				
Start 1.915 GHz #Res BW 3 kHz	VBW 10) kHz	St Sweep 542.5	op 1.918 GHz ms (401 pts)
			, ·	

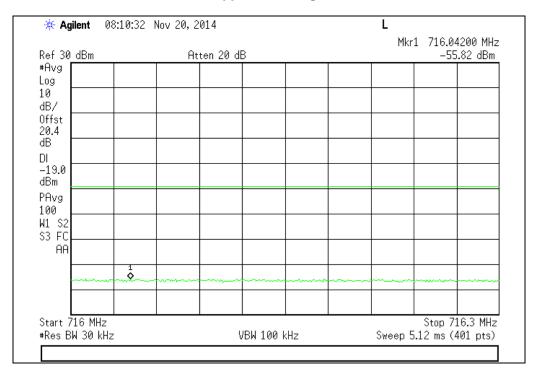


CDMA Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge

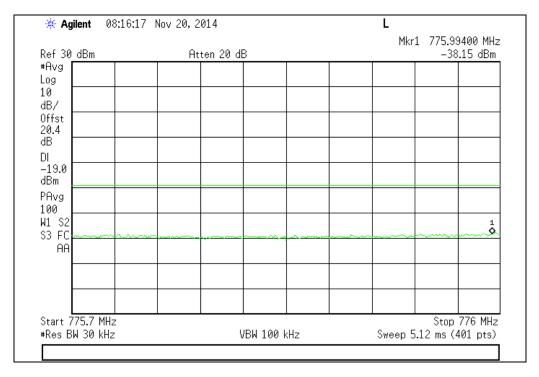






776 - 787 MHz Band

Lower Band Edge

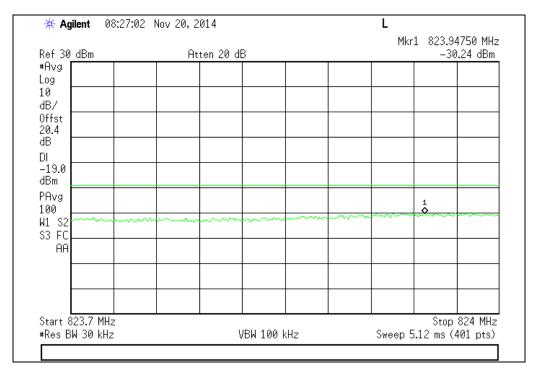


₩ Agilent 08:20:28 Nov	20,2014		L Mkr1 7	787.00825 MH	
Ref 30 dBm	Atten 20 dB		11611 7	-44.56 dBm	
#Avg					
Log 10					
dB/					
Offst 20.4					
dB					
DI L					
-19.0 dBm					
PAvg					
100					
W1 S2					
S3 FC 4					
Start 787 MHz #Res BW 30 kHz	VBW 100 kHz		Stop 787.3 MHz Sweep 5.12 ms (401 pts)		



824 - 849 MHz Band

Lower Band Edge

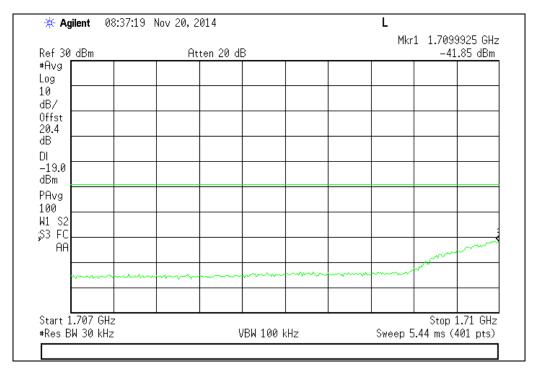


🔆 Agilent 🛛 🕅	8:28:54 Nov 20, 20	14		L Mkr	1 849.08925 MHz		
Ref 30 dBm	Atte	en 20 dB			-35.96 dBm		
#Avg							
Log 10							
dB/							
Offst							
20.4							
dB							
-19.0 dBm							
PAvg							
100							
W1 S2	4						
S3 FC							
AA							
Start 849 MHz					Stop 849.3 MHz		
#Res BW 30 kHz	VBW 100 kHz		Hz	Sweep 5.12 ms (401 pts)			

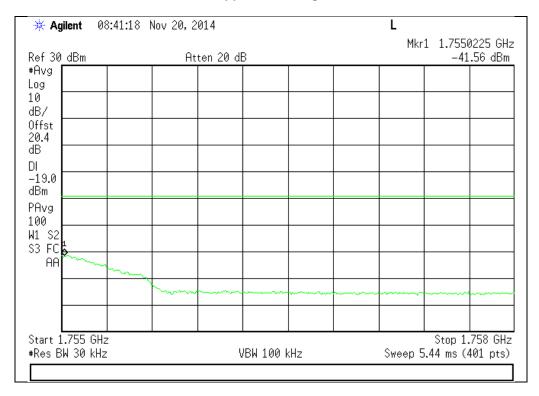


1710 - 1755 MHz Band

Lower Band Edge



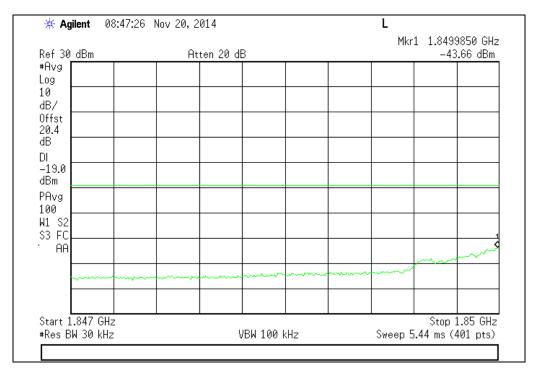
Upper Band Edge





1850 - 1915 MHz Band

Lower Band Edge

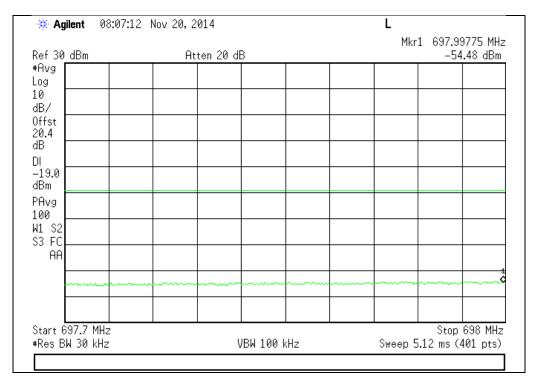


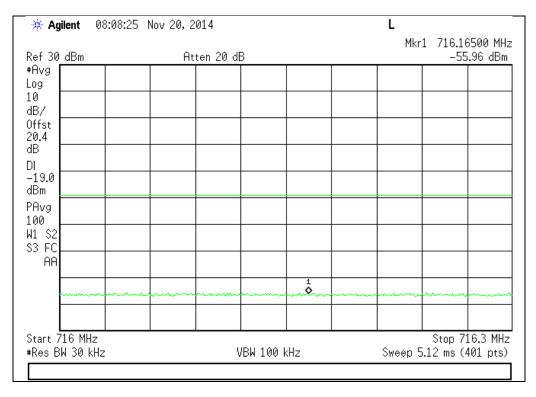
Upper Band Edge

-	Nov 20, 2014			L Mkr		4950 GHz
Ref 30_dBm	Atten 20 dl	B			-48	.29 dBm
#Avg						
Log 10				 		
dB/						
Offst						
20.4 dB				 		
DI						
-19.0						
dBm				 		
PAvg						
100 V1 S2				 		
\$3 FC						
AA 1						
	man and a second	v		 	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
Start 1.915 GHz		I I			Stop 1.	.918 GHz
#Res BW 30 kHz	(/BW 100 kl	Hz	Sweep 5	.44 ms (4	



WCDMA Uplink Test Plots 698 - 716 MHz Band Lower Band Edge

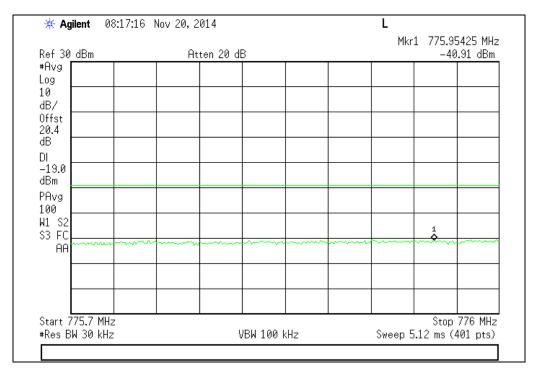






776 - 787 MHz Band

Lower Band Edge

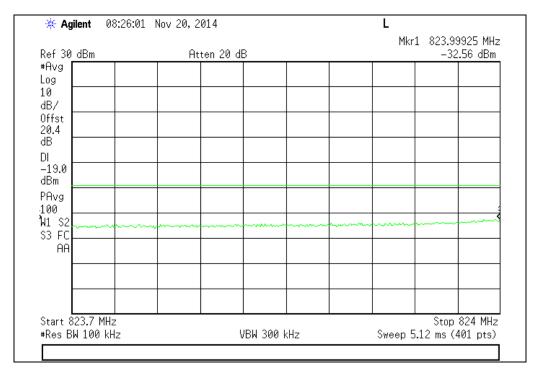


☆ Agilent 08:21:32 Nov 20, 2014	L Mkr1 787.02475 MHz
Ref 30_dBm Atten 20 dB	-47.81 dBm
#Avg	
Log 10	
dB/	
0ffst 20.4	
dB	
-19.0 dBm	
PAvg	
100	
W1 S2	
S3 FC	
······································	
	Cham 707.2 MU-
Start 787 MHz #Res BW 30 kHz VBW 100 kHz	Stop 787.3 MHz Sweep 5.12 ms (401 pts)



824 - 849 MHz Band

Lower Band Edge

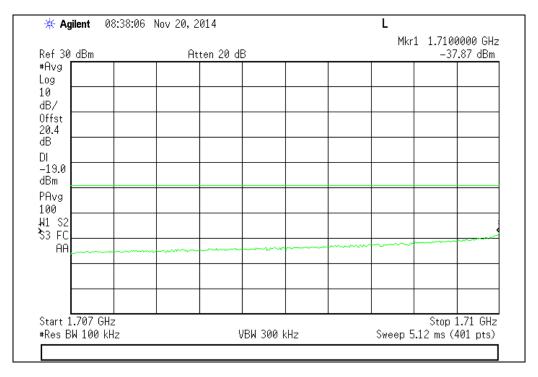


🔆 Agilent 08:30:01 N	ov 20, 2014		L	kr1 849.00375 MHz
Ref 30 dBm	Atten 20 dB		יין	–29.63 dBm
#Avg Log				
10				
dB/ Offst				
20.4				
dB DI				
-19.0				
dBm PAvg ₁				
100 호				
W1 S2 S3 FC				
AA				
Start 849 MHz #Res BW 100 kHz	VBW	300 kHz	Sweep	Stop 849.3 MHz 5.12 ms (401 pts)



1710 - 1755 MHz Band

Lower Band Edge

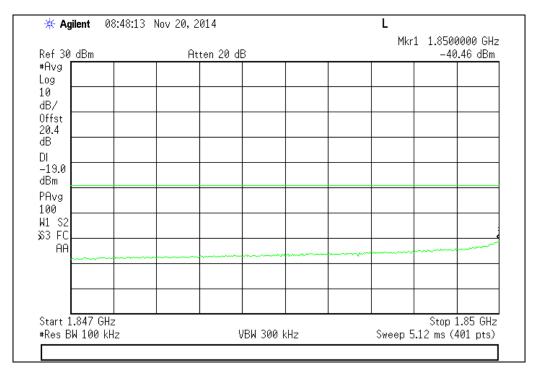


★ Agilent 08:42:20 N			L	1 7550	1000 GHz	
Ref 30_dBm	Atten 20 dE	3		MKL		.56 dBm
#Avg Log						
10 dB/						
Offst						
20.4 dB						
DI -19.0						
dBm						
PAvg 100						
W1 S2						
S3 FC		~~~~~		~~~~	~~~~~	
					0	750.00
Start 1.755 GHz #Res BW 100 kHz	V	BW 300 kHz	Ś	Sweep 5.	.12 ms (4	758 GHz 01 pts)



1850 - 1915 MHz Band

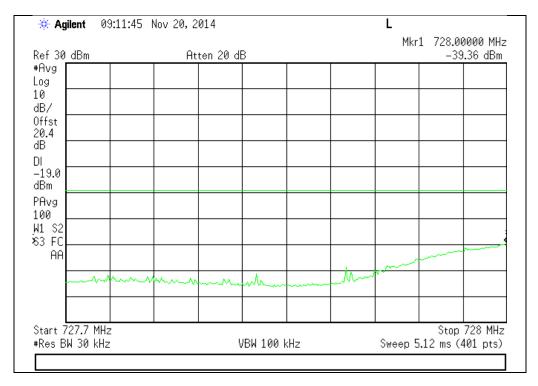
Lower Band Edge

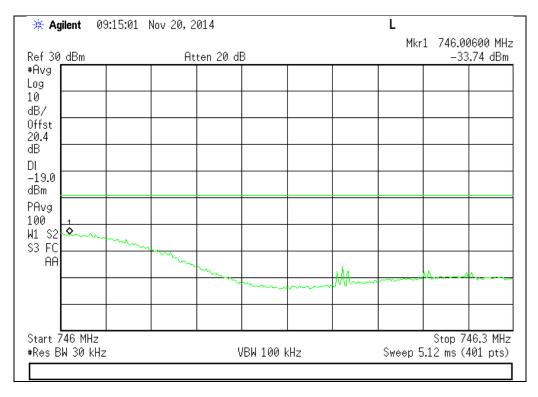


Agilent 08:52:25 N	ov 20, 2014		L	Mkr1 1.9150	3150 GHz
Ref 30 dBm	Atten 20 dB				.89 dBm
#Avg					
Log					
dB/					
Offst					
20.4 dB					
DI					
-19.0 JDn					
dBm PAvg					
100					
W1 S2					
S3 FC					
Start 1.915 GHz		200 111-	¢		.918 GHz
#Res BW 100 kHz	VDM	1 300 kHz	J₩ee	p 5.12 ms (4	401 pts)



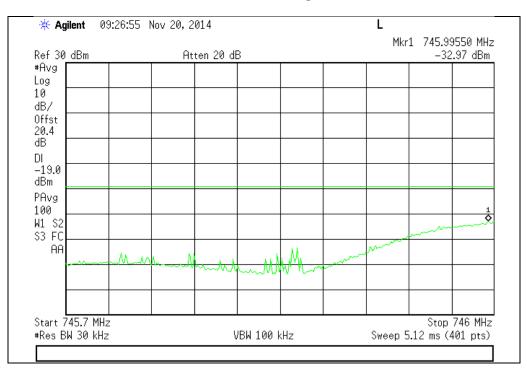
GSM Downlink Test Plots 728 - 746 MHz Band Lower Band Edge



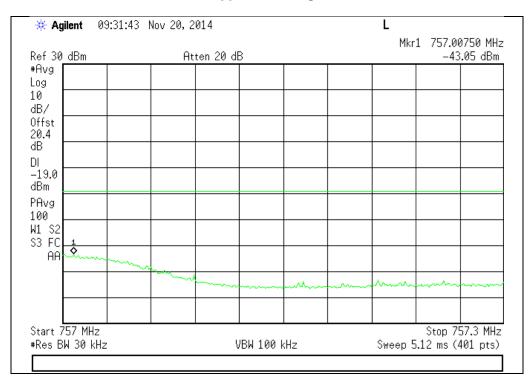




746 - 757 MHz Band

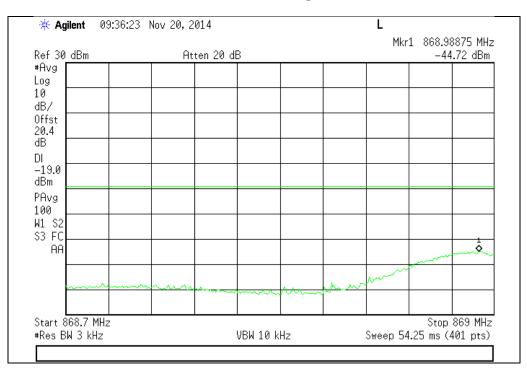


Lower Band Edge

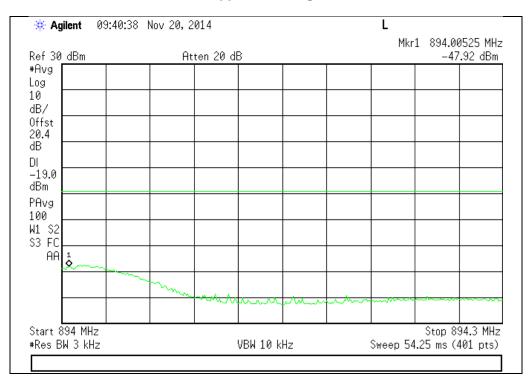




869 - 894 MHz Band

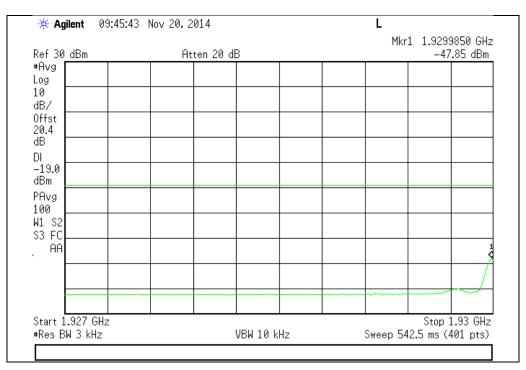


Lower Band Edge

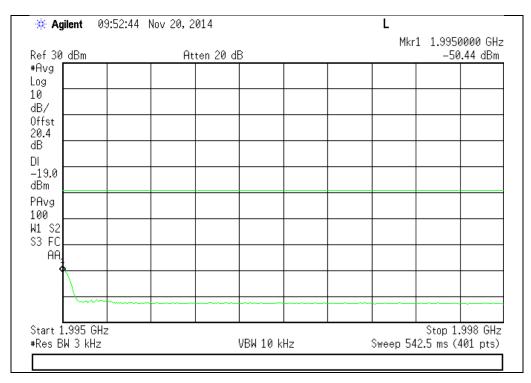




1930 - 1995 MHz Band

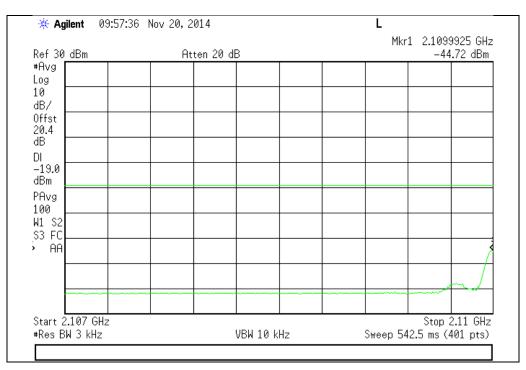


Lower Band Edge

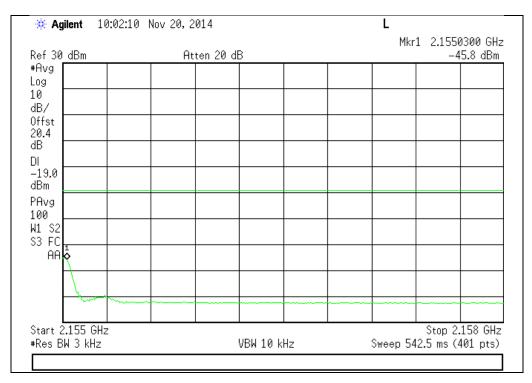




2110 - 2155 MHz Band



Lower Band Edge

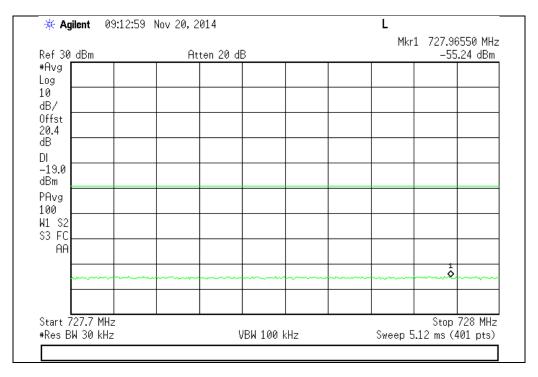




CDMA Downlink Test Plots

728 - 746 MHz Band

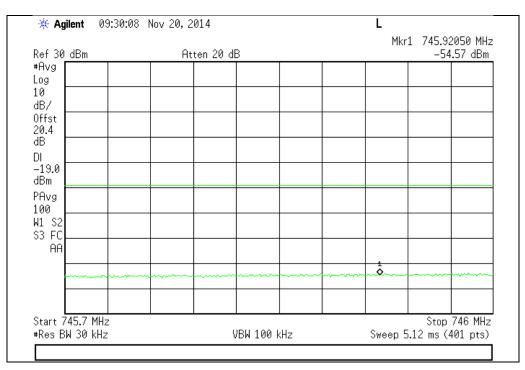
Lower Band Edge



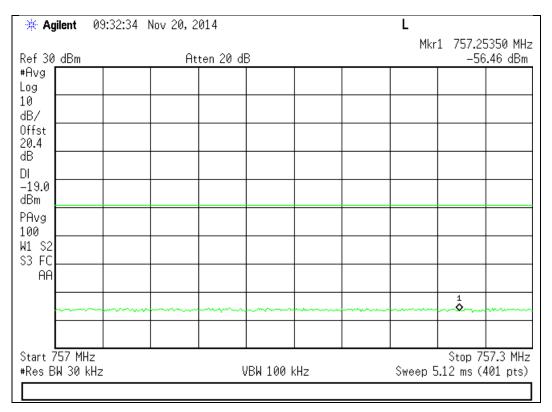
★ Agilent 09:16:09 Nov 20,			L Mkr1	746.12825 MHz
	Atten 20 dB			-54.78 dBm
#Avg Log				
10			+ +	
Offst				
20.4				
dB				
DI				
dBm				
PAvg				
100				
W1 S2				
\$3 FC				
AA				
	marine and the second		•••••••	
				Stee 740.2 MIL
Start 746 MHz #Res BW 30 kHz	VBW 100	<hz< td=""><td>Sweep 5.</td><td>Stop 746.3 MHz 12 ms (401 pts)</td></hz<>	Sweep 5.	Stop 746.3 MHz 12 ms (401 pts)



746 - 757 MHz Band



Lower Band Edge

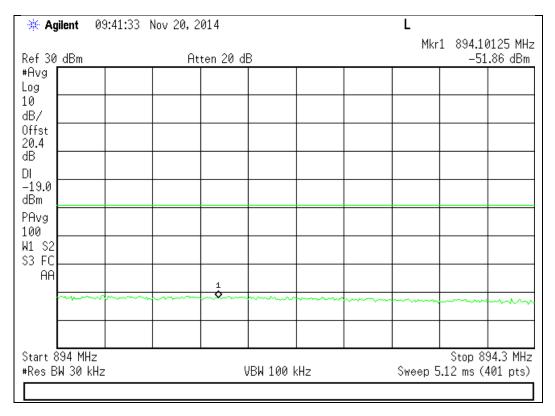




869 - 894 MHz Band

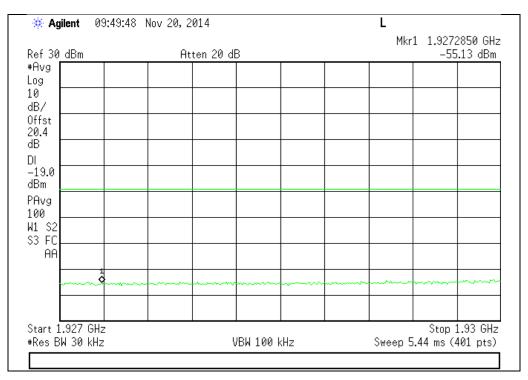


L 🔆 Agilent 09:38:13 Nov 20, 2014 Mkr1 868.94150 MHz -52.5 dBm Ref 30 dBm Atten 20 dB #Avg Log 10 dB/ Offst 20.4 dB DI -19.0 dBm PAvg 100 W1 S2 S3 FC AA Start 868.7 MHz Stop 869 MHz #Res BW 30 kHz VBW 100 kHz Sweep 5.12 ms (401 pts)

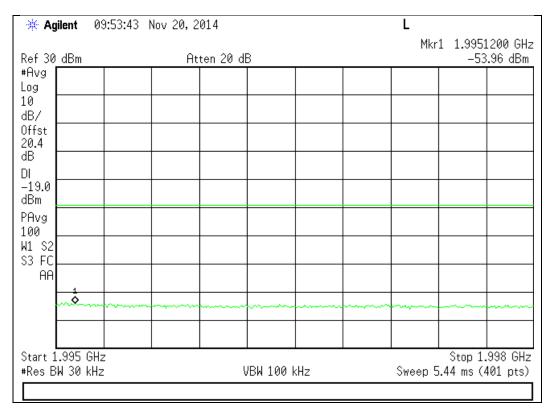




1930 - 1995 MHz Band

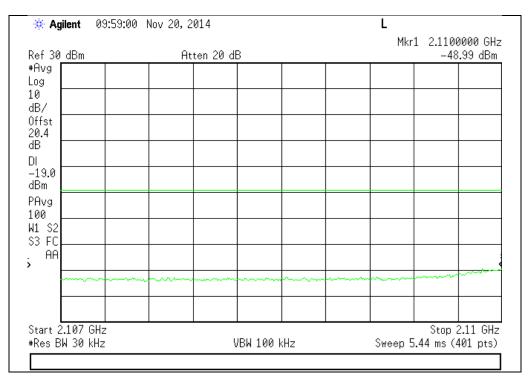


Lower Band Edge

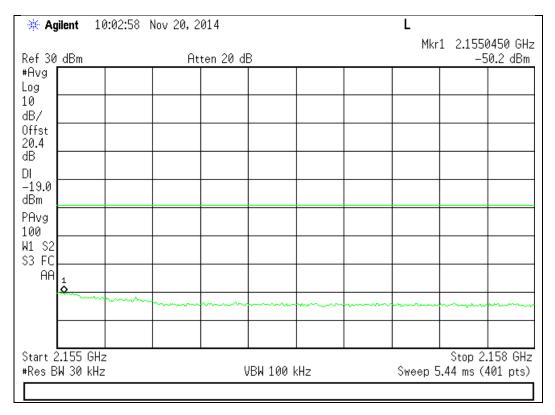




2110 - 2155 MHz Band



Lower Band Edge

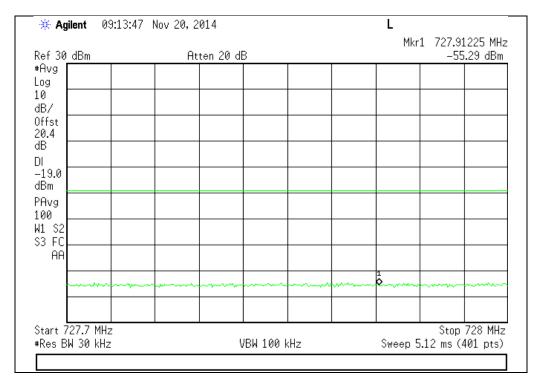




WCDMA Downlink Test Plots

728 - 746 MHz Band

Lower Band Edge

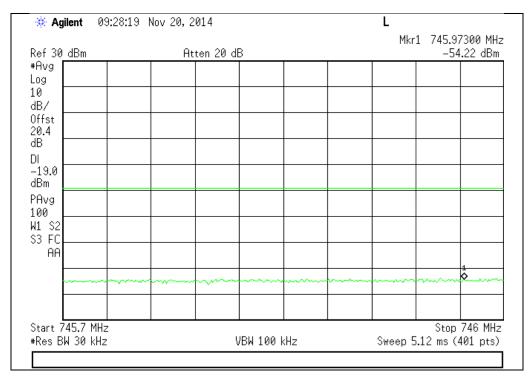


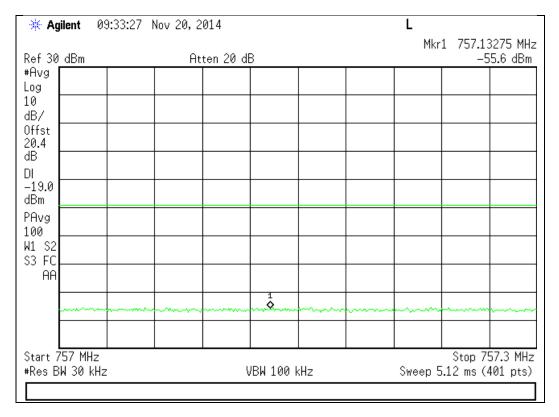
🔆 Agilent	09:17:02	Nov 20, 20	14				L		
Ref 30_dBm		Atten 20 dB				Mkr		5275 MHz 5.03 dBm	
#Avg Log									
10 dB/									
Offst 20.4									
dB DI									
-19.0 dBm									
PAvg									
100 W1 S2									
S3 FC									
			·····	, mark	mm	~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	\$	
Start 746 MH #Res BW 30 I		<u> </u>	ι	I /BW 100	/H-7		Sween 5		46.3 MHz 401 pts)
	511 2			/DM 100	112		<u>опоор</u> 2	.IC ΠΟ (401 p(3)



746 - 757 MHz Band









869 - 894 MHz Band

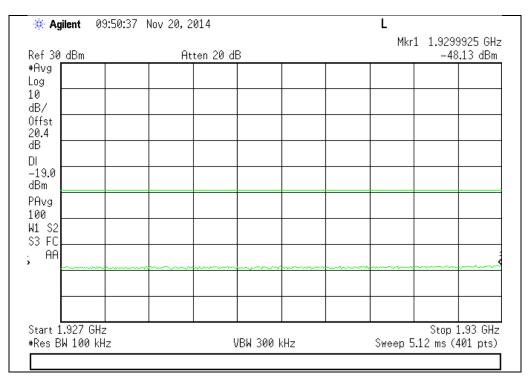
Lower Band Edge

09:39:10 Nov 20, 2014 L 🔆 Agilent Mkr1 868.98200 MHz Ref 30 dBm Atten 20 dB -46.92 dBm #Avg Log 10 dB/ Offst 20.4 dB DI -19.0 dBm PAvg 100 W1 S2 S3 FC $\diamondsuit{1}{\diamondsuit{}}$ AA Stop 869 MHz Sweep 5.12 ms (401 pts) Start 868.7 MHz #Res BW 100 kHz VBW 300 kHz

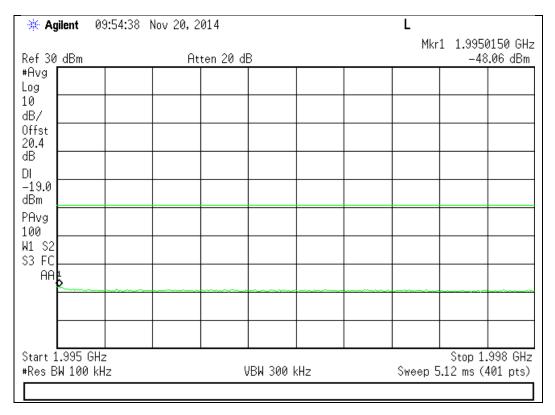
🔆 🔆 Agilent 09:42:23 Nov	/ 20, 2014	L Mkr1 894.00075 MHz
Ref 30_dBm	Atten 20 dB	-46.73 dBm
#Avg		
Log 10		
dB/		
Offst		
20.4 dB		
DI		
-19.0 dBm		
PAvg		
100		
W1 S2		
S3 FC		
Start 894 MHz #Res BW 100 kHz	VBW 300 kHz	Stop 894.3 MHz Sweep 5.12 ms (401 pts)
*NG3 DM 100 KHZ	VDM 200 KHZ	3meeh 3.15 ms (401 h(2)



1930 - 1995 MHz Band

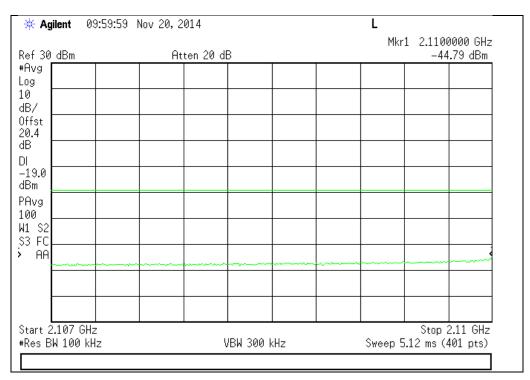


Lower Band Edge

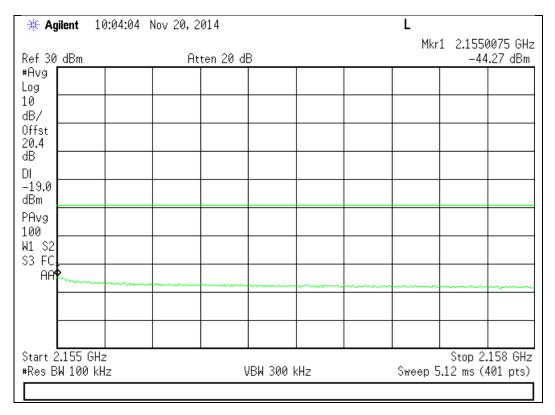




2110 - 2155 MHz Band



Lower Band Edge





Conducted Spurious Emissions Engineer: Mike Graffeo Test Date: 11/20/14

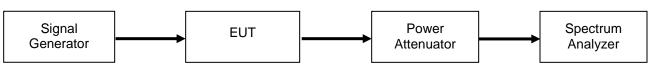
Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator, with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings. A signal generator was utilized to produce a 4.1 MHz AWGN signal operating at the maximum allowable power. The conducted spurious emissions from 9 kHz to 10 times the highest tunable frequency for each operational band were measured (excluding the band defined by the Out of band emissions test). The emissions were plotted and the highest level was recorded in the summary table.

The following formulas are used for calculating the limits.

Conducted Spurious Emissions Limit = P1 - (43 + 10Log(P2)) = -13 dBmP1 = power in dBm P2 = power in Watts

Test Setup



Uplink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	1894.6	-33.77	-13	Pass
776 - 787	787.1	-21.95	-13	Pass
824 - 849	1729.6	-32.36	-13	Pass
1710 - 1755	3465.2	-39.61	-13	Pass
1850 - 1915	3764.7	-28.92	-13	Pass

Downlink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	1950.2	-33.51	-13	Pass
746 - 757	1980.6	-33.25	-13	Pass
869 - 894	1973.4	-32.33	-13	Pass
1930 - 1995	2148.5	-34.76	-13	Pass
2110 - 2155	1950.6	-33.06	-13	Pass



For the 746 – 758 downlink and 776 – 788 Uplink bands of operation, the following additional spurious emissions requirements apply.

FCC 27.53(c)

For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(3)On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

The test is performed using a 10 kHz RBW. Since the limit is referenced to a 6.25 kHz BW, the following correction factor is applied to the measured data.

BW correction Factor = 10Log B1/B2 BW correction Factor =10Log 6.25 / 10 = - 2.0 dB

Final Value (dBm) = conducted measurement +BW correction factor

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	Bandwidth Correction Factor (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	774.61	-54.1	-2.0	-56.14	-46	-10.14
793 – 805	793.17	-75.6	-2.0	-77.64	-46	-31.64

776 – 787 MHz Uplink Band

746 - 757 MHz Downlink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	Bandwidth Correction Factor (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	763.09	-84	-2.0	-86.04	-46	-40.04
793 – 805	798.08	-83.99	-2.0	-86.03	-46	-40.03



FCC 27.53(f)

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Since the limit is referenced to EIRP, the final data is computed using the Conducted Spurious Emission data and adding the BW correction factor plus the final gain/loss data from the antenna kitting information supplied by the manufacturer.

For the Narrowband measurement, the test is performed using a 10 kHz RBW. Since the limit is referenced to a 700 Hz BW, the following correction factor is applied to the measured data.

BW correction Factor = 10Log B1/B2 BW correction Factor =10Log 700 / 10000 = -11.55 dB

Final Value (dBm) = conducted measurement +BW correction factor + final gain/loss from Antenna Kitting document

The Limit for discreet (narrowband) emissions is -80dBW (-50 dBm) in 700 MHz BW. The Limit for (wideband Emissions) is -70 dBW (-40 dBm) in a 1 MHz BW.

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	Bandwidth Correction Factor (dB)	Gain/Loss from Antenna Kitting Information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Wideband)	1563.4	-53.16	0	2.13	-51.03	-40	-11.03
1559 – 1610 (Narrowband)	1562.3	-77.5	-11.55	2.13	-86.92	-50	-36.92

776 – 787 MHz Uplink Band

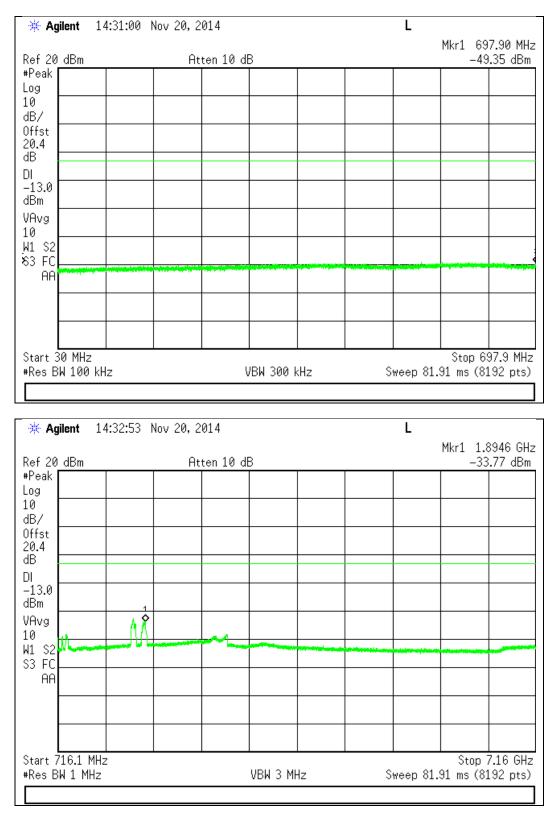
746 - 757 MHz Downlink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	Bandwidth Correction Factor (dB)	Gain/Loss from Antenna Kitting information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Wideband)	1593.1	-58.83	0	2.13	-56.70	-40	-16.70
1559 – 1610 (Narrowband)	1597.1	-80.95	-11.55	2.13	-90.37	-50	-40.37

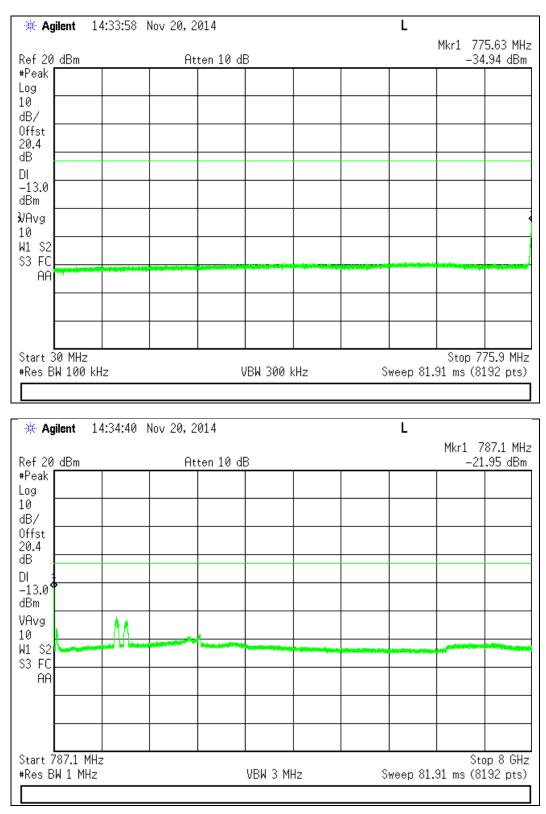


Uplink Test Plots

698 - 716 MHz Band

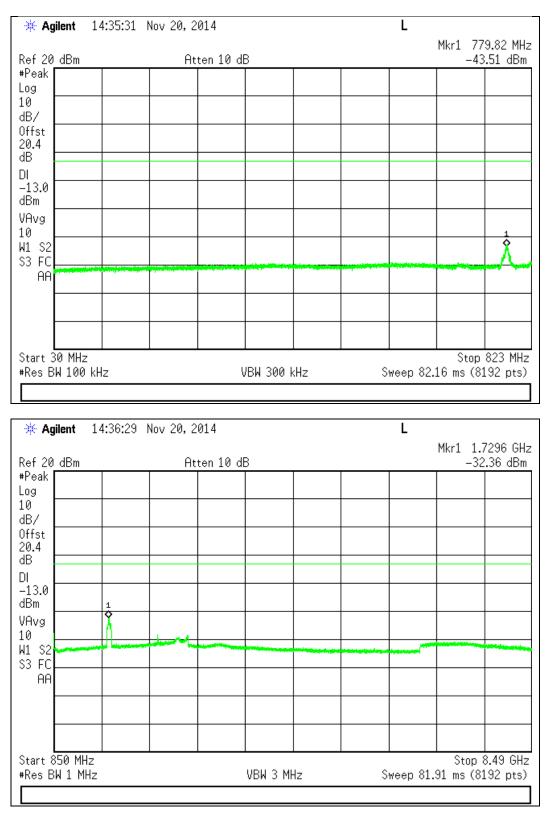






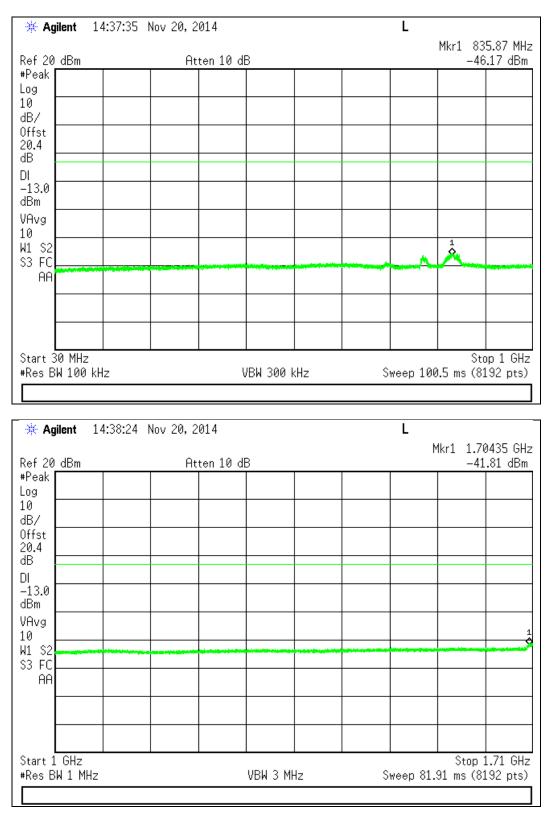
776 - 787 MHz Band





824 - 849 MHz Band





1710 - 1755 MHz Band



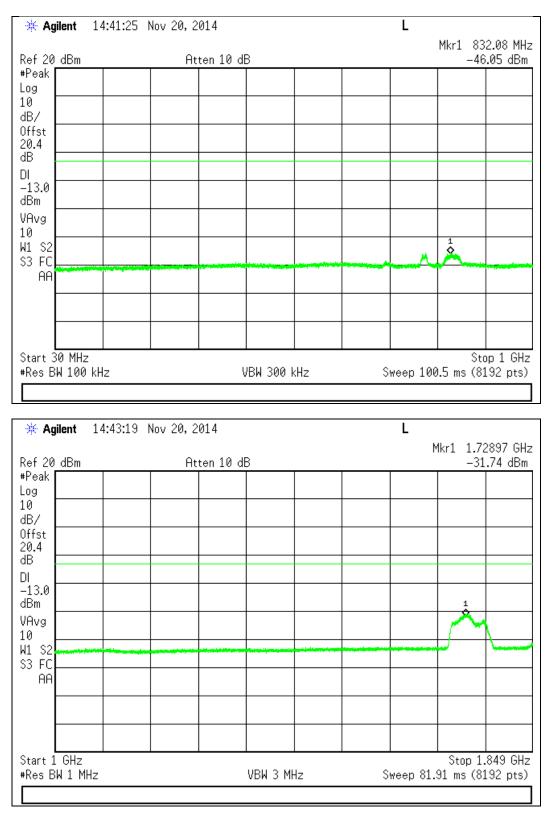
🔆 Agilent	14:39:09	Nov 20, 21	014				L		
Ref 20 dBm		0		D					4652 GHz 0.61 dBm
#Peak			ten 10 d					-33	
Log 10									
dB/									
Offst									
20.4 dB									
-13.0 dBm									
VAvg		1							
8 W1 S2									
\$3 FC									
AA									
Start 1.755	CU-7							C+1	op 8 GHz
#Res BW 1 M	1Hz			VBW 3 M	Ηz	S	weep 81.	91 ms (8	192 pts)
M. Autout	14.40.00	No. 20 21	Q1 /						
🔆 Agilent	14:40:09	Nov 20, 20	014				L	Mkr1 81	7400 GHz
Ref 20 dBm	14:40:09		014 ten 10 d	B			L		0400 GHz .11 dBm
Ref 20 dBm #Peak	14:40:09			B			L		
Ref 20 dBm #Peak Log 10	14:40:09			B			L		
Ref 20 dBm #Peak Log 10 dB/	14:40:09			B			L		
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4	14:40:09			B			L		
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB	14:40:09			B					
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0	14:40:09			B					
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0 dBm				B					
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0 dBm VAvg 10 10				B					
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0 dBm VAvg 10 \$ VAvg 10 \$ W1 \$2				B			L		
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0 dBm VAvg 10 10				B					
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0 dBm VAvg 10 VAvg 10 S3 FC				B					
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0 dBm VAvg 10 VAvg 10 S3 FC				B					
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0 dBm VAvg 10 \$ VAvg 10 \$ S3 FC AA				B				-41	.11 dBm
Ref 20 dBm #Peak Log 10 dB/ Offst 20.4 dB DI -13.0 dBm VAvg 10 VAvg 10 S3 FC				B				-41	.11 dBm



🔆 Agilent	14:40:38	Nov 20, 2014			L	Mkr1 21.	10/1 GI
ef 20 <u>d</u> Bm		Atten	10 dB				1.21 dBr
Peak og							
0							
B/ ffst							
0.4							
B							
13.0							
Bm							
Avg 0						1	
1 S2							
3 FC AA							
tart 16 GHz Res BW 1 MH	7	II	VBW 3	 ≷ MH≂	 Ween 81	Stoj .91 ms (8	и р 22 GH 192 ртя
NGO DM I PID.	<u>~</u>		VDN .	2.002	weeh or	.01 1113 (0	τυς μιο

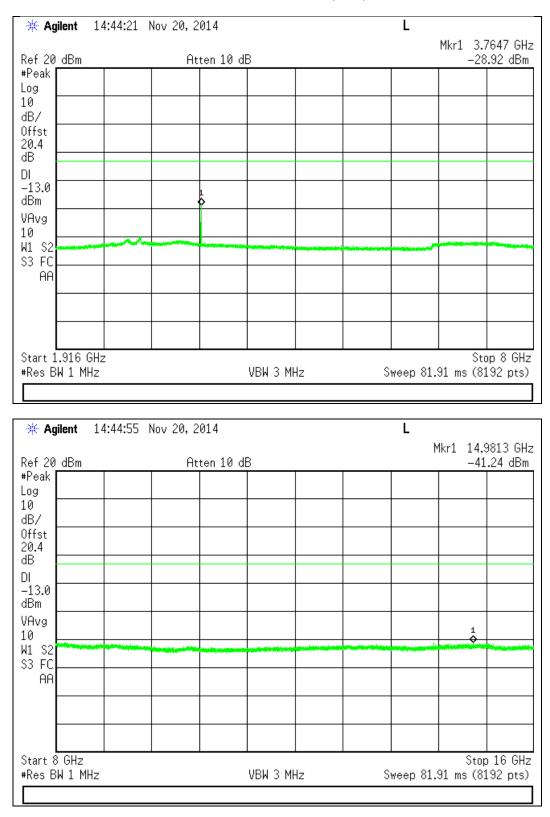
1710 - 1755 MHz Band (cont)





1850 - 1915 MHz Band





1850 - 1915 MHz Band (cont)



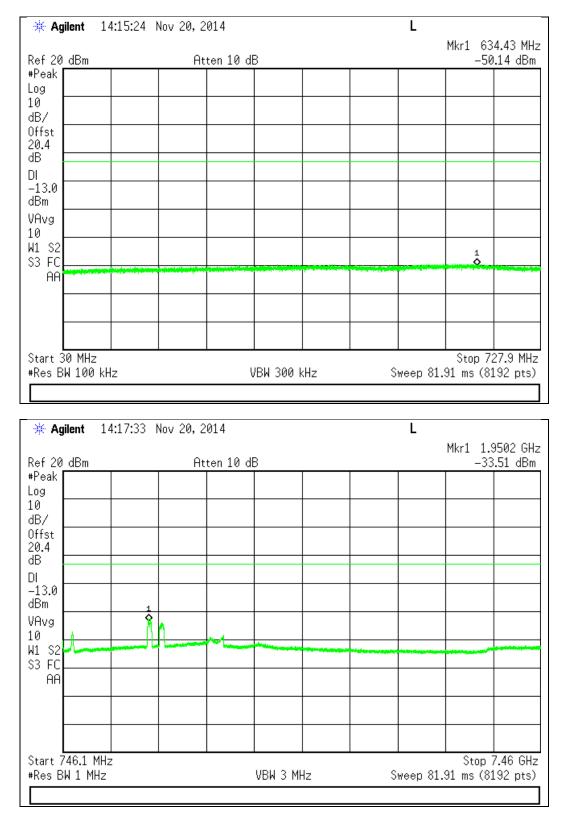
🔆 Agilent	14:45:38	Nov 20, 2014				L		
Ref 20 dBm		Atten 10	dB			١		8608 GHz 0.94 dBm
#Peak Log								
10								
dB/ Offst								
20.4 dB								
DI								
-13.0 dBm								
VAvg								1
10 W1 S2								
S3 FC AA	_							
Start 16 GHz #Res BW 1 MH		I I	VBW 3 Mł	lz	S۲	veep 81.	Sto 91 ms (8	p 22 GHz 192 pts)

1850 - 1915 MHz Band (cont)

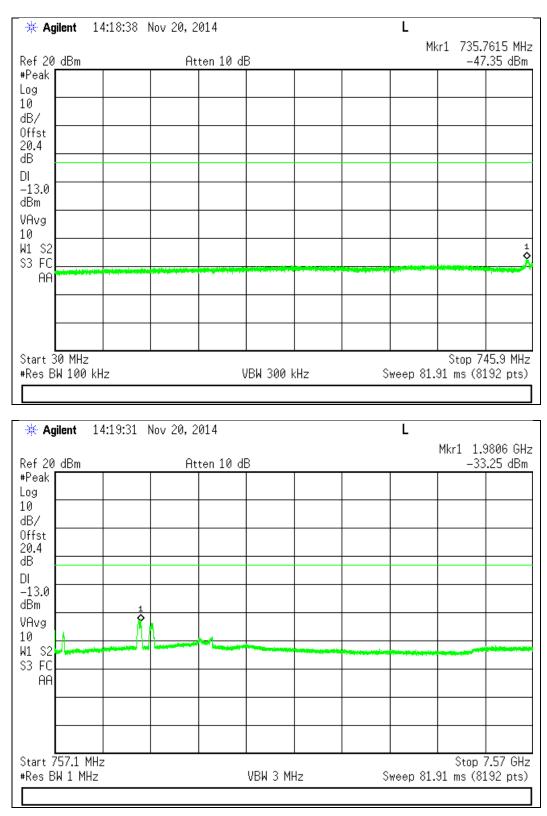


Downlink Test Plots



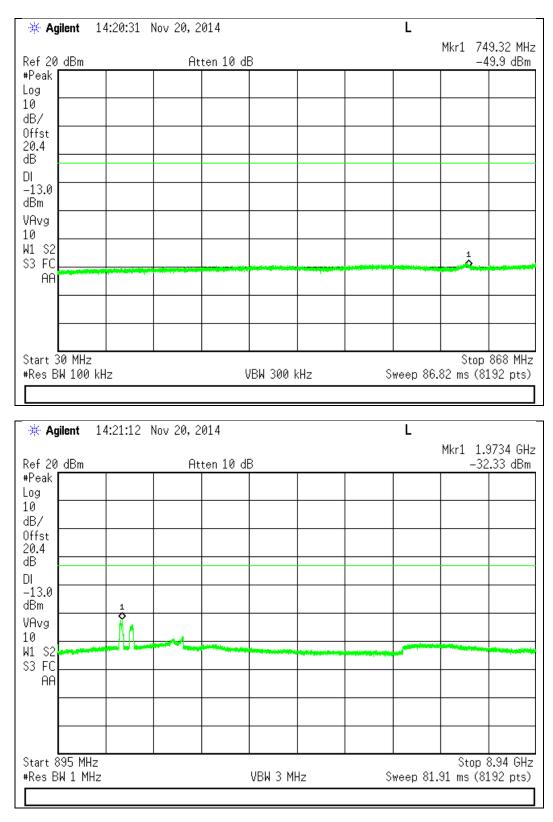






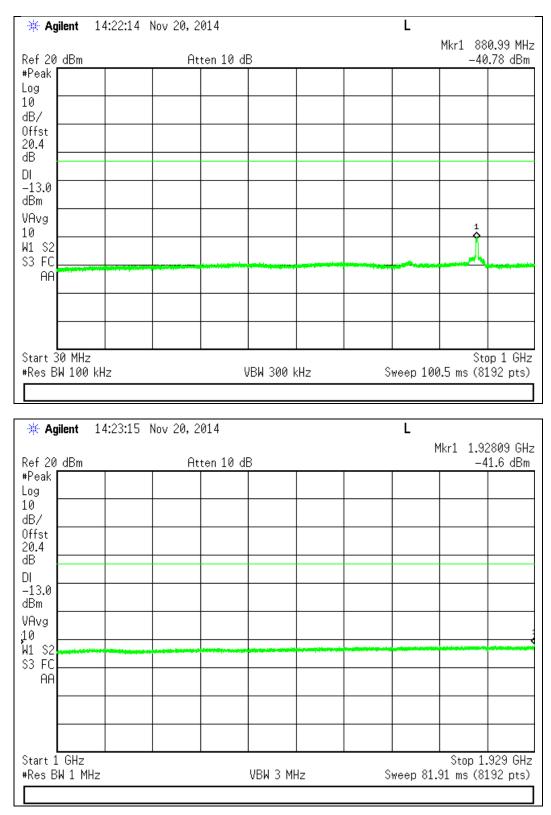
746 - 757 MHz Band





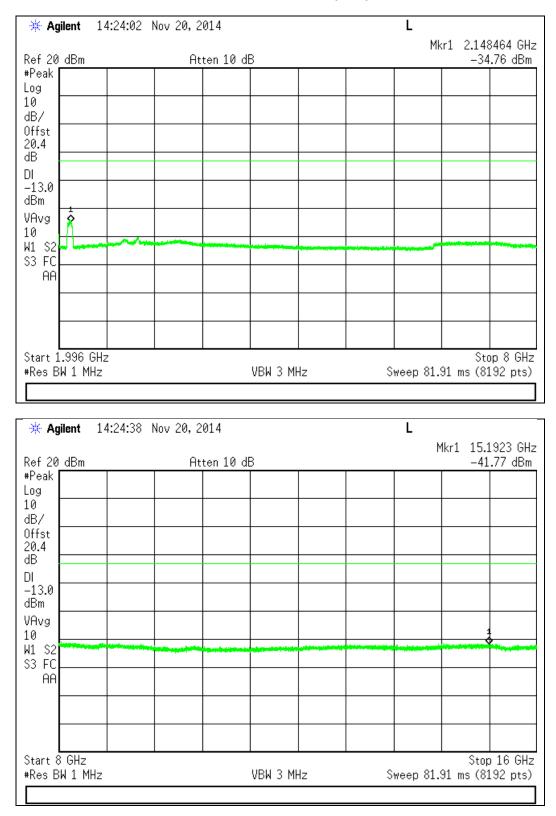
869 - 894 MHz Band





1930 - 1995 MHz Band





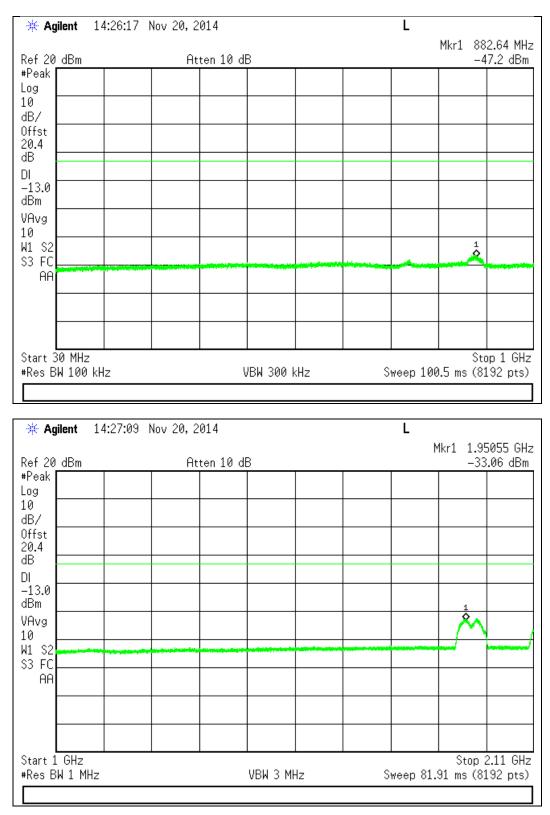
1930 - 1995 MHz Band (cont)



🔆 Agilent 14	:25:10 Nov 20, 20	14		L	01 00 41 011
Ref 20 dBm	Atte	en 10 dB		MKLT	21.9941 GH: -40.31 dBm
#Peak Log					
10					
dB/ Offst					
20.4					
dB DI					
-13.0					
dBm VAvg					
10					
W1 S2 S3 FC					
AA					
Start 16 GHz #Res BW 1 MHz		VBW 3 MHz	<u></u>	on 91 01 m	Stop 22 GHz
*NUS DW I MHZ		VDW 3 MHZ	зwe	eh or'ar Wa	s (8192 pts)

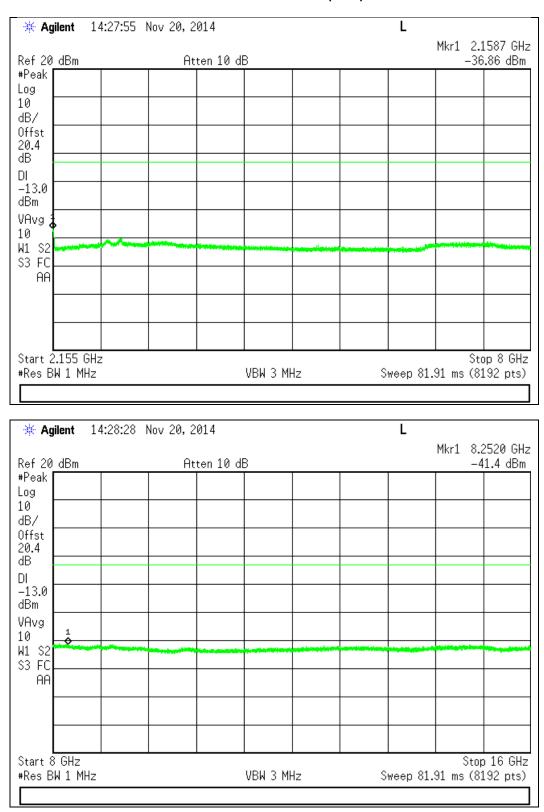
1930 - 1995 MHz Band (cont)





2110 - 2155 MHz Band





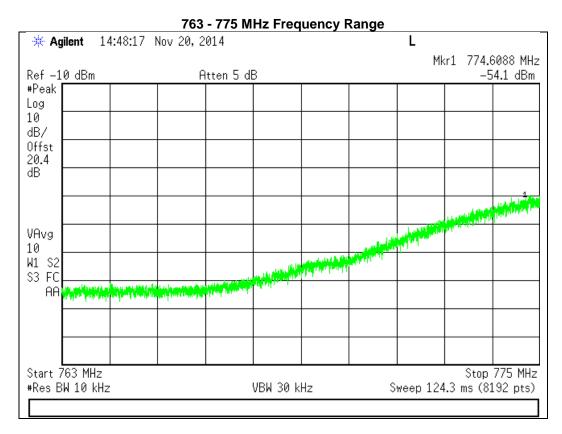
2110 - 2155 MHz Band (cont)



🔆 Agilent 🛛 14:29:0	01 Nov 20, 2014		L	
ef 20 dBm	Atten 10	dB		Mkr1 21.3503 GF -39.82 dBr
Peak og				
0				
B/ ffst				
0.4 B				
13.0				
Bm				
Avg 0				1
1 S2				
3 FC				
tart 16 GHz Res BW 1 MHz		VBW 3 MHz	Sweep 8	Stop 22 GH 1.91 ms (8192 pts)
				· · ·

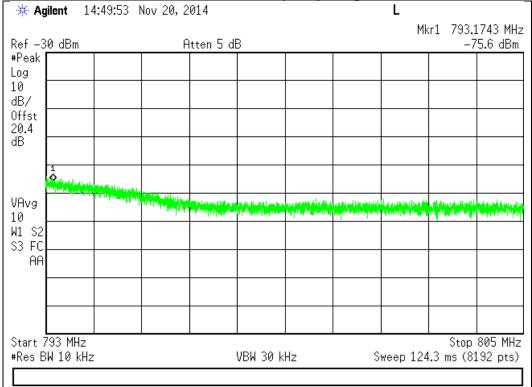
2110 - 2155 MHz Band (cont)



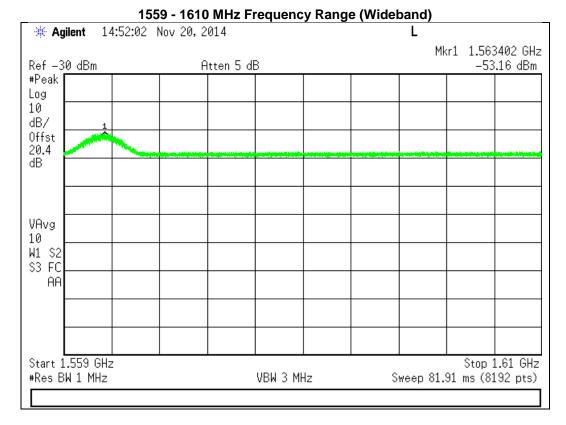


776 - 787 MHz Uplink Test Plots for the

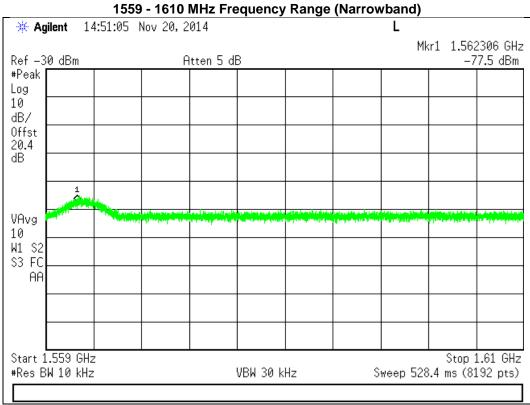
793 - 805 MHz Frequency Range



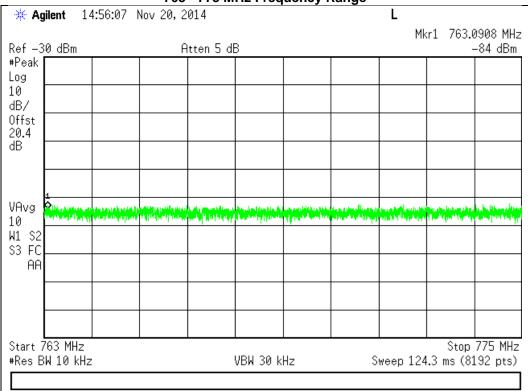




776 - 787 MHz Uplink Test Plots for the



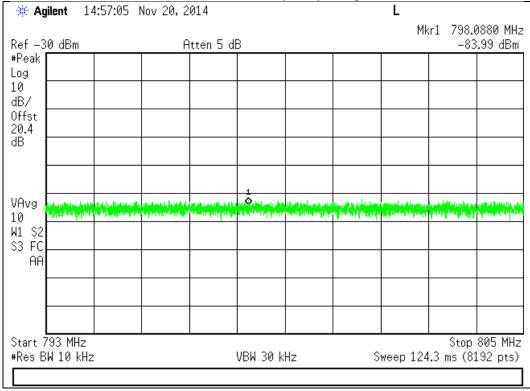




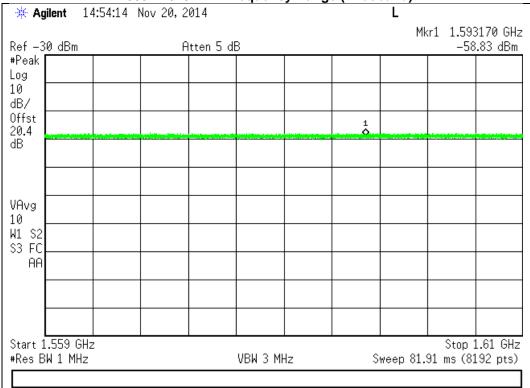
746 - 757 MHz Downlink Test Plots for the



793 - 805 MHz Frequency Range



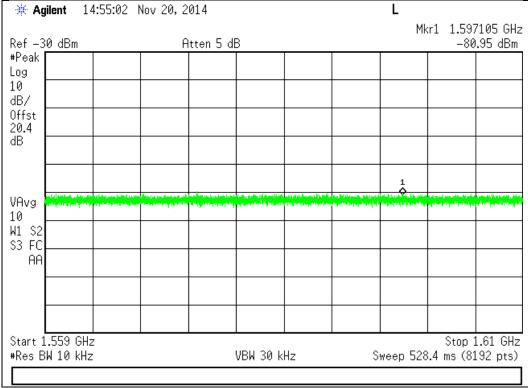




746 - 757 MHz Downlink Test Plots for the

1559 - 1610 MHz Frequency Range (Wideband)

1559 - 1610 MHz Frequency Range (Narrowband)





Noise Limits Engineer: Mike Graffeo Test Date: 11/19/14

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure that accurate readings were obtained. A series of three tests were performed: the maximum uplink noise, the variable noise for the uplink in the presence of a downlink signal, and the variable uplink noise timing. The detailed procedures from KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516c were followed.

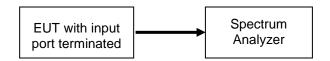
The following formulas are used for calculating the limits. Note – Downlink noise power limit is calculated with the center frequency of the associated uplink band.

Noise Power =-102.5+LOG10(Band Center Frequency)*20

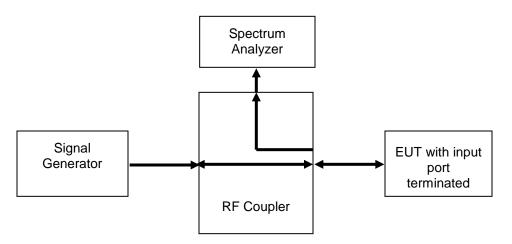
Variable Noise =-103 dBm/MHz-RSSI

Test Setup

Maximum Noise Power



Variable Uplink Noise Power and Timing





Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
698 - 716	-49.05	-45.5	-3.5	Pass
776 - 787	-45.7	-44.6	-1.1	Pass
824 - 849	-47.09	-44.1	-3.0	Pass
1710 - 1755	-38.87	-37.7	-1.1	Pass
1850 - 1915	-40.16	-37.0	-3.2	Pass

Maximum Uplink Noise Test Results

Maximum Downlink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
728 - 746	-47.89	-45.5	-2.4	Pass
746 - 757	-48.16	-44.6	-3.5	Pass
869 - 894	-44.33	-44.1	-0.3	Pass
1930 - 1995	-38.87	-37.0	-1.9	Pass
2110 - 2155	-40.56	-37.7	-2.8	Pass

Uplink Noise Timing Test Results

Frequency Band (MHz)	Measured Timing (ms)	Limit (ms)	Result
698 - 716	38.91	3000	Pass
776 - 787	334.60	3000	Pass
824 - 849	365.70	3000	Pass
1710 - 1755	303.50	3000	Pass
1850 - 1915	108.50	3000	Pass



Variable Uplink Noise Limit Test Results

	698 - 716 MHz						
RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)				
-56.0	-47.0	-57.7	-10.7				
-57.0	-46.0	-56.6	-10.6				
-67.0	-45.5	-50.1	-4.6				
-66.0	-45.5	-50.1	-4.6				
-65.0	-45.5	-50.1	-4.6				
-64.0	-45.5	-50.1	-4.6				

600 716 MU-

776 - 787 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)		
-47.0	-56.0	-62.2	-6.2		
-46.0	-57.0	-63.2	-6.2		
-71.0	-44.6	-45.5	-0.9		
-70.0	-44.6	-45.5	-0.9		
-69.0	-44.6	-45.5	-0.9		
-68.0	-44.6	-45.5	-0.9		

824 - 849 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)	
-41.0	-62.0	-71.7	-9.7	
-40.0	-63.0	-71.71	-8.7	
-69.0	-44.05	-47.2	-3.1	
-68.0	-44.05	-47.2	-3.1	
-67.0	-44.05	-47.2	-3.1	
-66.0	-44.05	-47.2	-3.1	

1710 - 1755 MHz

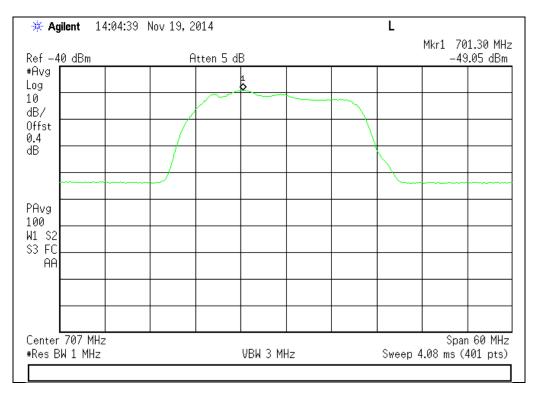
RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-71.0	-37.7	-43.2	-5.5
-70.0	-37.7	-43.2	-5.5
-69.0	-37.7	-43.2	-5.5
-68.0	-37.7	-43.2	-5.5
-44.0	-59.0	-61.1	-2.1
-43.0	-60.0	-61.1	-1.1

RSSI Noise Limit **Measured Noise** Margin (dBm) (dB) (dBm) (dBm) -59.0 -44.0 -53.2 -9.2 -58.0 -45.0 -54.2 -9.2 -73.0 -37.0 -42.4 -5.4 -72.0 -37.0 -42.4 -5.4 -71.0 -37.0 -42.4 -5.4 -70.0 -37.0 -42.4 -5.4

1850 - 1915 MHz

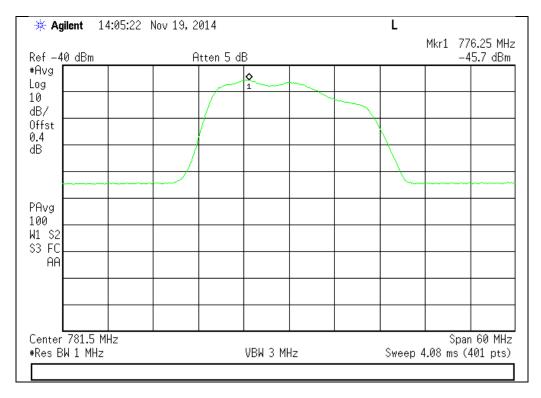


Maximum Uplink Noise Test Plots

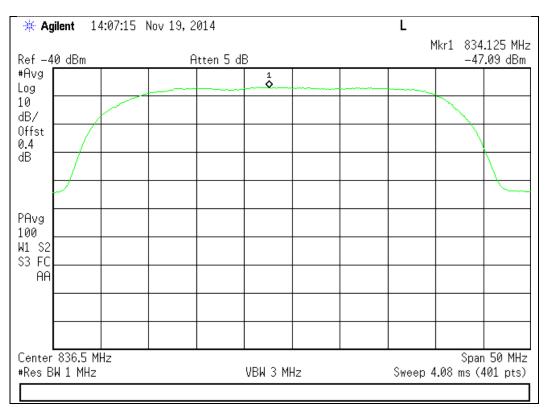


698 - 716 MHz Band

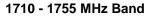
776 - 787 MHz Band

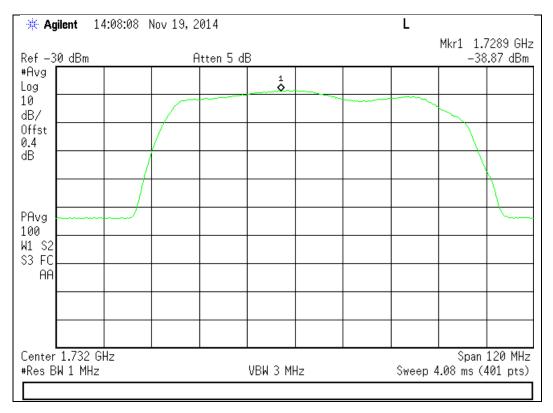




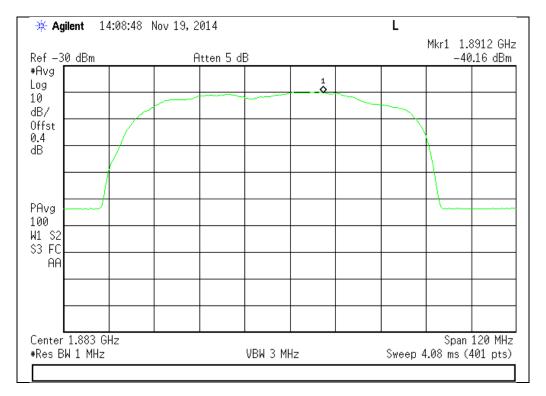


824 - 849 MHz Band





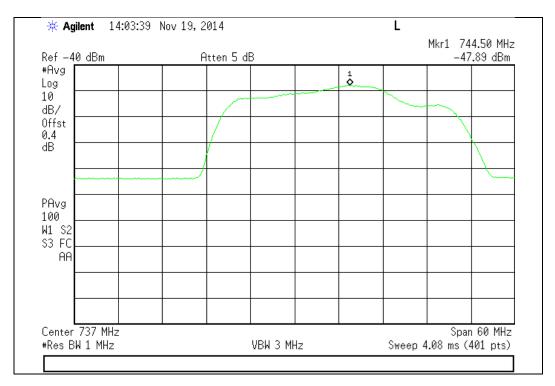




1850 - 1915 MHz Band



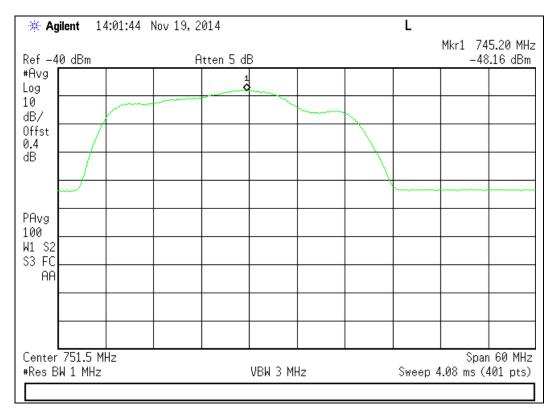
Maximum Downlink Noise Test Plots



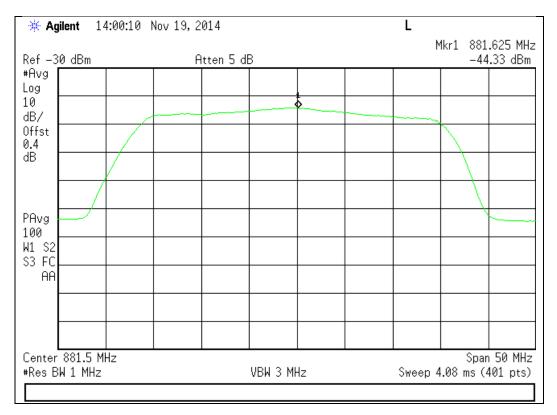
728 - 746 MHz Band



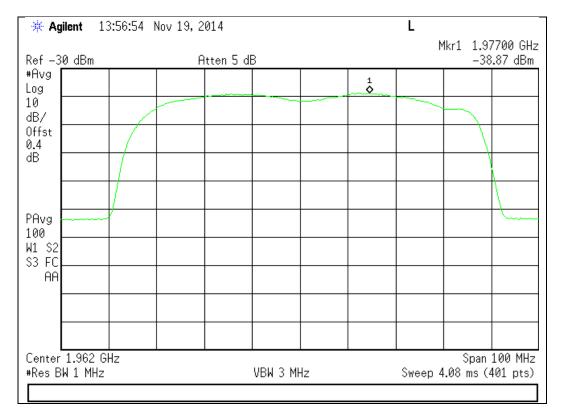
746 - 757 MHz Band



869 - 894 MHz Band

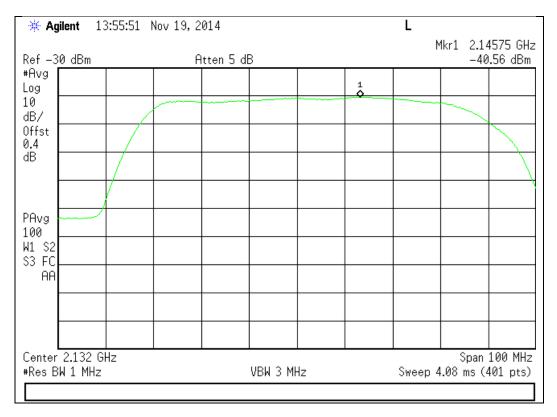






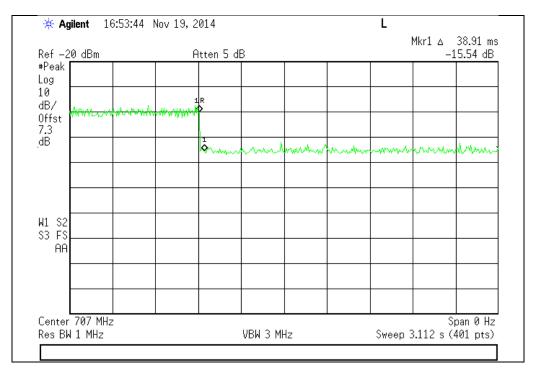
1930 - 1995 MHz Band

2110 - 2155 MHz Band



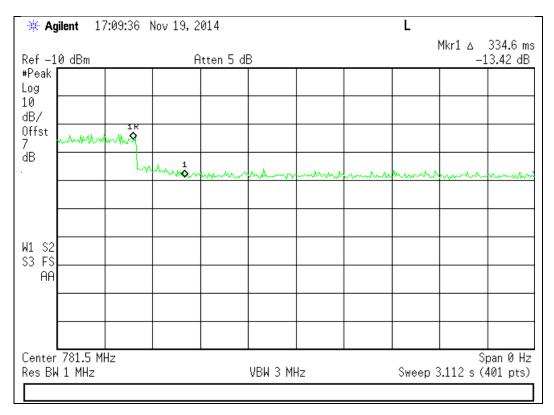


Uplink Noise Timing Test Plots

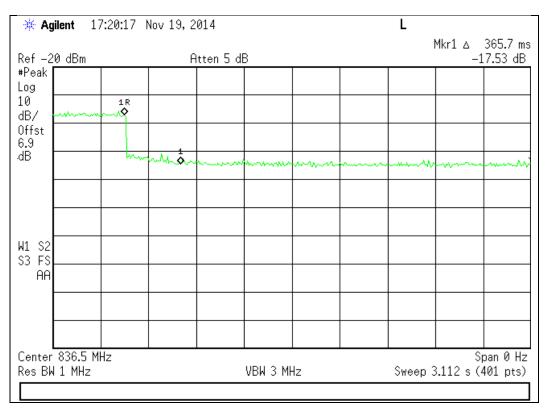


698 - 716 MHz Band

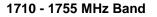
776 - 787 MHz Band

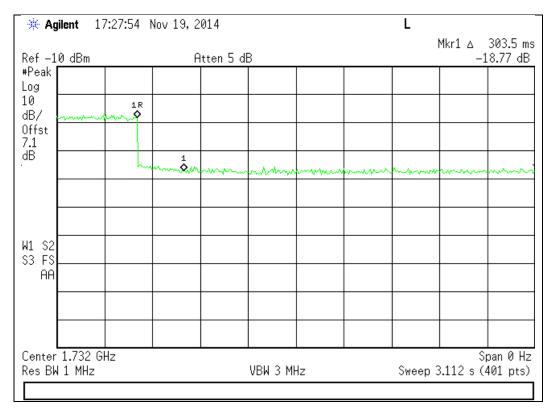




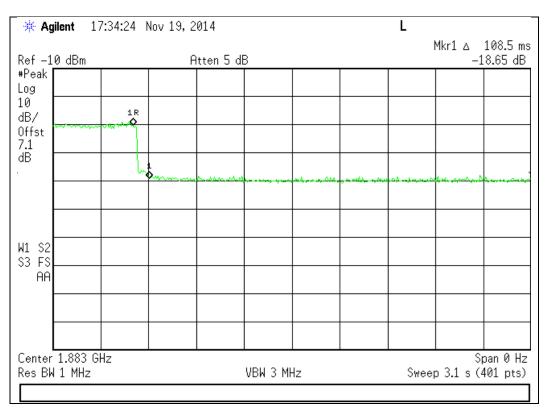


824 - 849 MHz Band









1850 - 1915 MHz Band

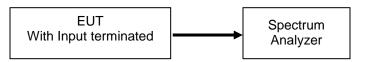


Uplink Inactivity Engineer: Mike Graffeo Test Date: 11/19/14

Test Procedure

The EUT was connected directly to a spectrum analyzer set to operate in the center of the EUT operational uplink and downlink bands. The span was set to 0 Hz with a sweep time of 330 seconds and MAX HOLD operation. The EUT was powered on and the time for the uplink to return to an inactive state was measured using the DELTA MARKER method to ensure that it was less than 300 seconds. The noise level after the return to an inactive state was less than -70 dBm/MHz

Test Setup



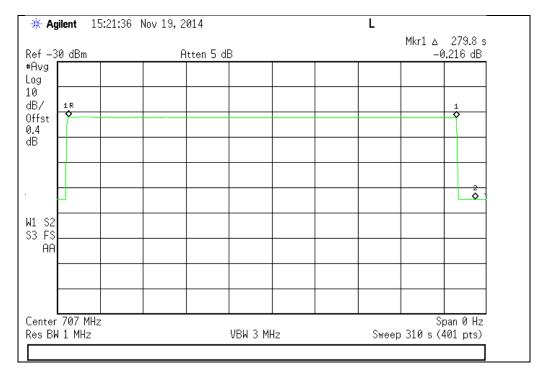
Uplink Test Results

Frequency Band (MHz)	Measured Time (Seconds)	Limit (Seconds)	Result
698 - 716	279.8	300	Pass
776 - 787	280.5	300	Pass
824 - 849	280.5	300	Pass
1710 - 1755	279.0	300	Pass
1850 - 1915	279.8	300	Pass

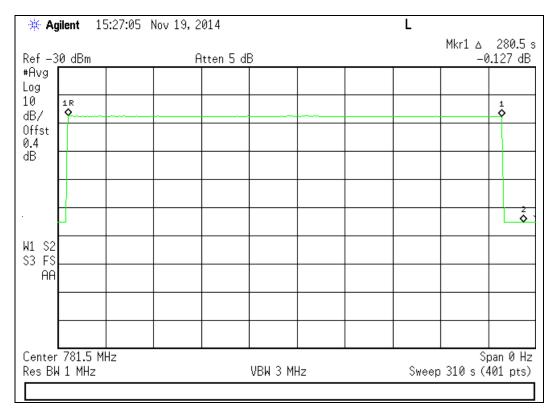


Uplink Inactivity Test Results



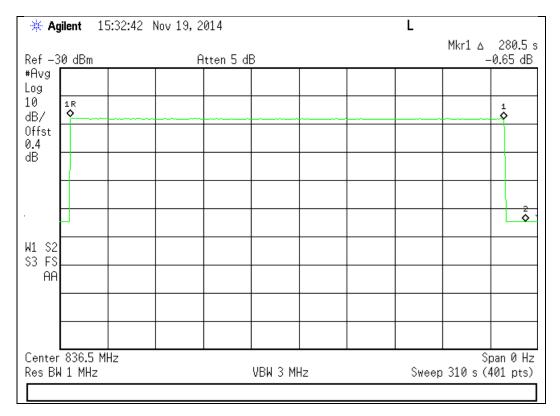


776 - 787 MHz

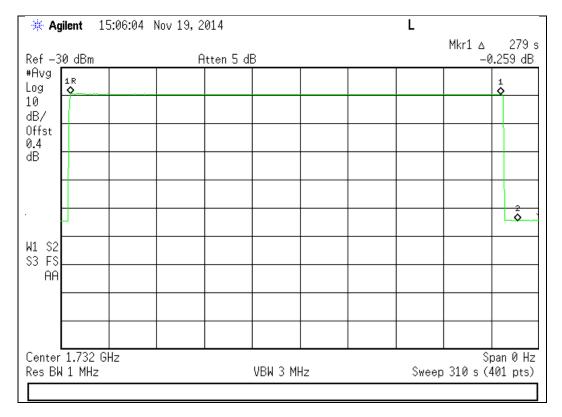




824 - 849 MHz



1710 - 1755 MHz





1850 - 1915 MHz

🔆 Agilent 14:22:48 Nov 19,	2014	L	
	Atten 5 dB		Mkr1 ∆ 279.8 s -0.24 dB
HAVG 1R Log 10 dB/			
Offst 0.4 'dB			2
Center 1.883 GHz			Span 0 Up
Res BW 1 MHz	VBW 3 MHz	Sweep	Span 0 Hz 310 s (401 pts)
Marker Trace Type 1R (1) Time 1 (1) Time 2 (1) Time 2 (1) Time	X Axis 5.425 s 279.8 s 293.7 s	Amplitude -40.86 dBm -0.24 dB -84.03 dBm	



Variable Gain Engineer: Mike Graffeo Test Date: 11/19/14

Test Procedure

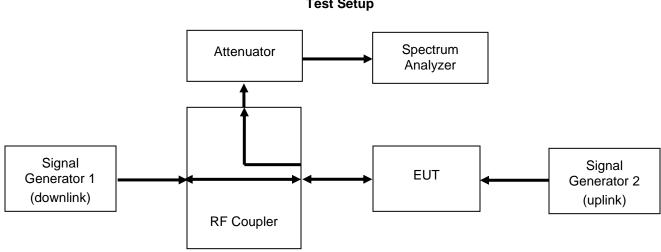
The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor in order to ensure accurate readings were obtained. The uplink gain in the presence of a downlink signal was measured for each operational uplink band using the detailed procedures from KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516.

The following formula is used for calculating the limits:

Variable Gain = -34 dB - RSSI +MSCL

Fixed booster maximum gain = 6.5 dB + 20*LOG10(mid-band of uplink band)

Downlink fixed booster maximum gain is identical to the corresponding fixed booster maximum gain for uplink.



Test Setup



Uplink Test Results

698 - 716 MHz						
RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-46.0	35.61	47.6	-46.1	-1.0	45.1	-2.5
-45.0	35.61	46.6	-46.1	-2.0	44.1	-2.5
-70.0	35.61	63.5	-46.1	16.0	62.1	-1.4
-69.0	35.61	63.5	-46.1	16.0	62.1	-1.4
-68.0	35.61	63.5	-46.1	16.0	62.1	-1.4
-67.0	35.61	63.5	-46.1	16.0	62.1	-1.4

698 - 716 MH

776 - 787 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-65.0	36.44	64.4	-42.5	16.4	58.9	-5.5
-64.0	36.44	64.4	-42.5	16.4	58.9	-5.5
-63.0	36.44	64.4	-42.5	16.4	58.9	-5.5
-62.0	36.44	64.4	-42.5	16.4	58.9	-5.5
-48.0	36.44	50.4	-42.5	3.2	45.7	-4.7
-47.0	36.44	49.4	-42.5	2.2	44.7	-4.7

824 - 849 MHz

024 - 045 10112						
RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-47.0	37.04	50.0	-40.2	2.2	42.4	-7.6
-46.0	37.04	49.0	-40.2	1.2	41.4	-7.6
-70.0	37.04	64.9	-40.2	23.0	63.2	-1.7
-69.0	37.04	64.9	-40.2	23.0	63.2	-1.7
-68.0	37.04	64.9	-40.2	23.0	63.2	-1.7
-67.0	37.04	64.9	-40.2	23.0	63.2	-1.7

1710 - 1755 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-69.0	40.39	71.3	-44.0	18.3	62.3	-9.0
-68.0	40.39	71.3	-44.0	18.3	62.3	-9.0
-67.0	40.39	71.3	-44.0	18.3	62.3	-9.0
-66.0	40.39	71.3	-44.0	18.3	62.3	-9.0
-57.0	40.39	63.4	-44.0	11.8	55.8	-7.6
-56.0	40.39	62.4	-44.0	10.8	54.8	-7.6

1850 - 1915 MHz

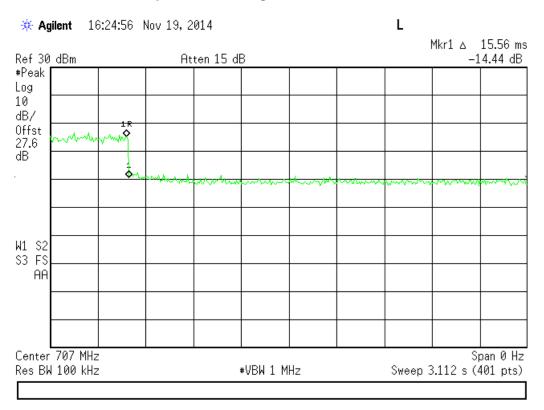
RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-71.0	38.72	72.0	-42.3	19.2	61.5	-10.5
-70.0	38.72	72.0	-42.3	19.2	61.5	-10.5
-69.0	38.72	72.0	-42.3	19.2	61.5	-10.5
-68.0	38.72	72.0	-42.3	19.2	61.5	-10.5
-51.0	38.72	55.7	-42.3	4.8	47.1	-8.6
-50.0	38.72	54.7	-42.3	3.8	46.1	-8.6



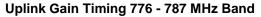
Frequency Band (MHz)	Measured Timing (milliseconds)	Limit (milliseconds)	Result
704 - 716	15.56	3000.0	Pass
776 - 787	389.10	3000.0	Pass
824 - 849	404.60	3000.0	Pass
1710 - 1755	46.69	3000.0	Pass
1850 - 1915	116.70	3000.0	Pass

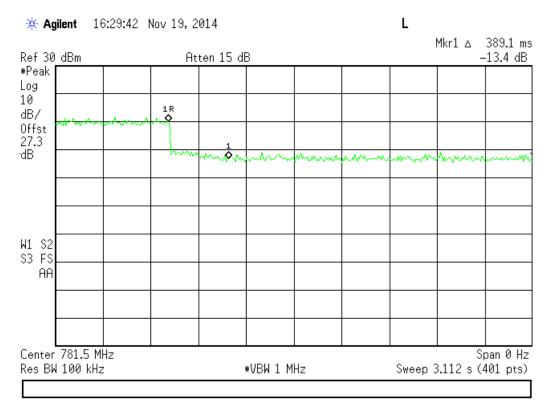
Uplink Gain Timing Test Results



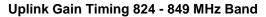


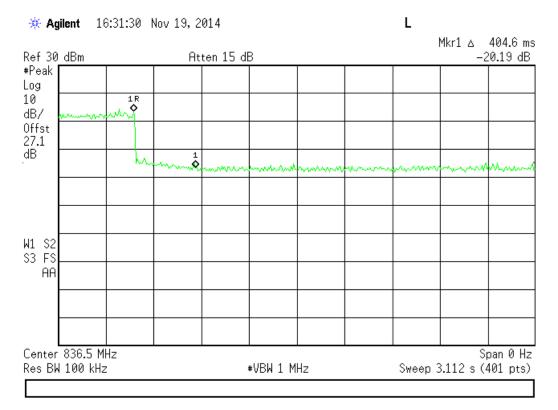
Uplink Gain Timing 704 - 716 MHz Band

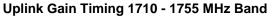


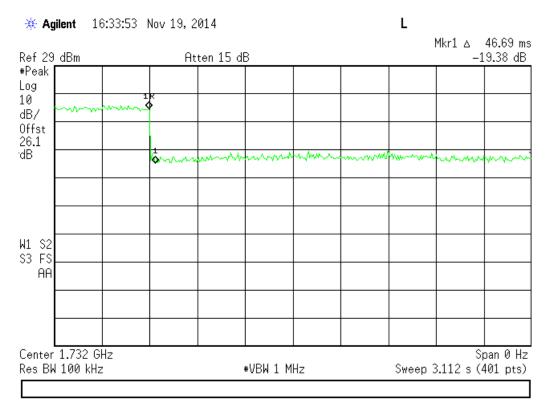




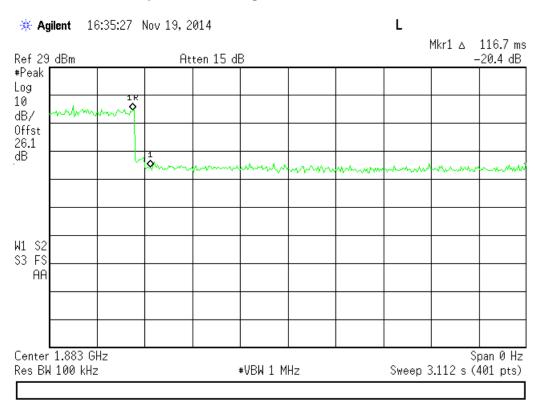












Uplink Gain Timing 1850 - 1915 MHz Band

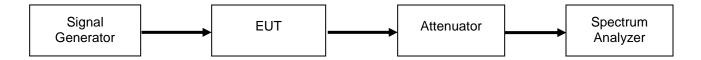


Occupied Bandwidth Engineer: Mike Graffeo Test Date: 11/20/14

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as required to ensure that accurate readings were obtained. A signal generator was utilized to produce the following signals: GSM, CDMA, and WCDMA. The signal generator was tuned to the center channel of each of the EUT operational uplink and downlink bands with the RF level set at a point just prior to the AGC being in control of the power. For each modulation type, the input and output signal was measured and plotted to ensure that the signals were similar.



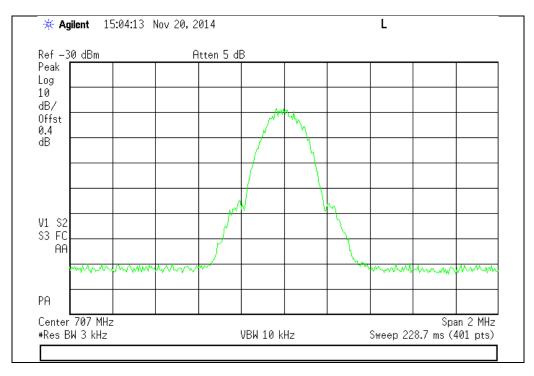




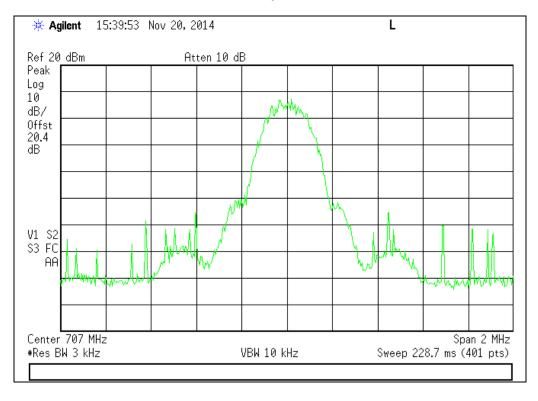
GSM Uplink Test Plots

698 - 716 MHz Band

Input



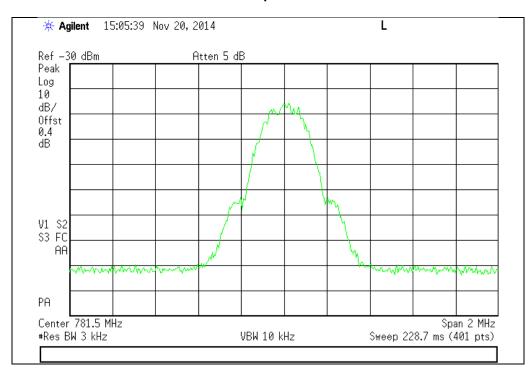




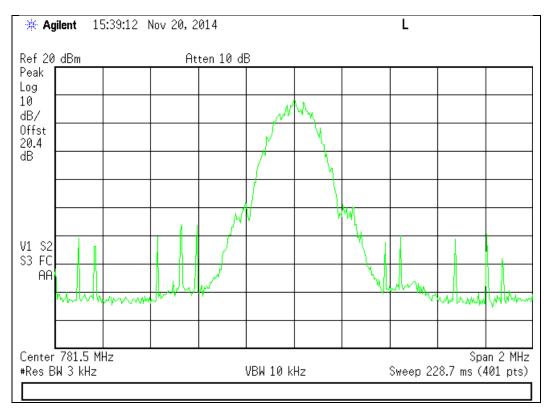


776 - 787 MHz Band





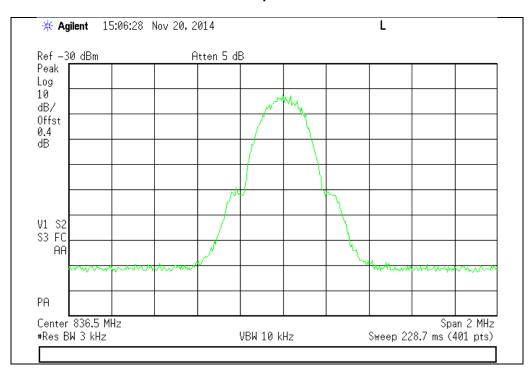




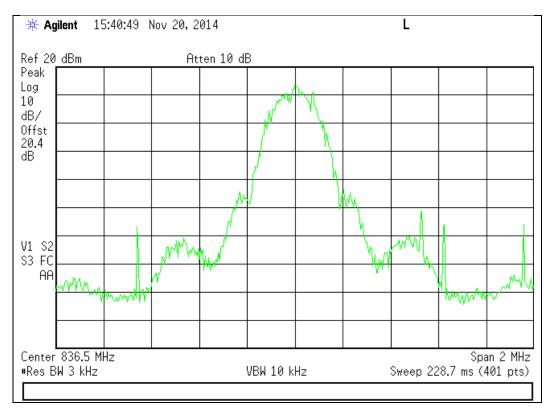


824 - 849 MHz Band





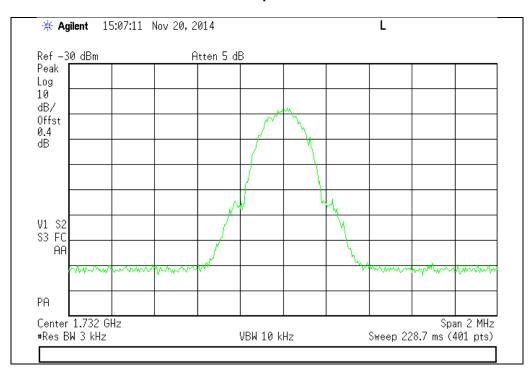




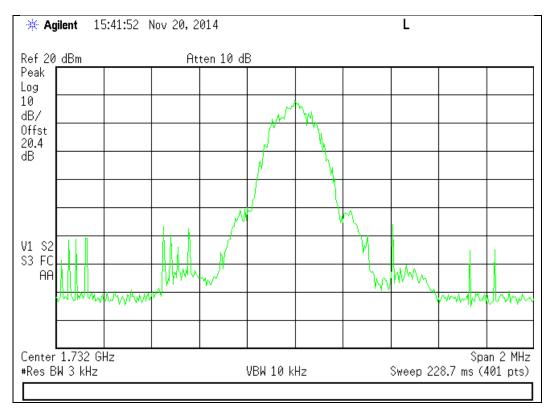


1710 - 1755 MHz Band





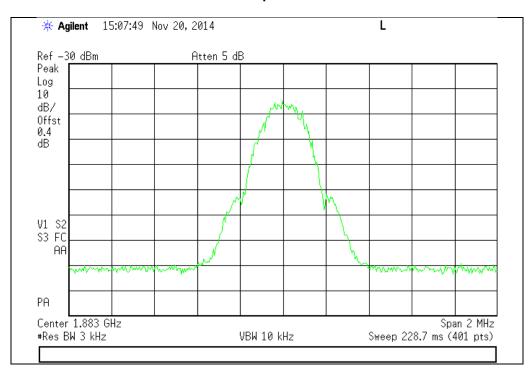




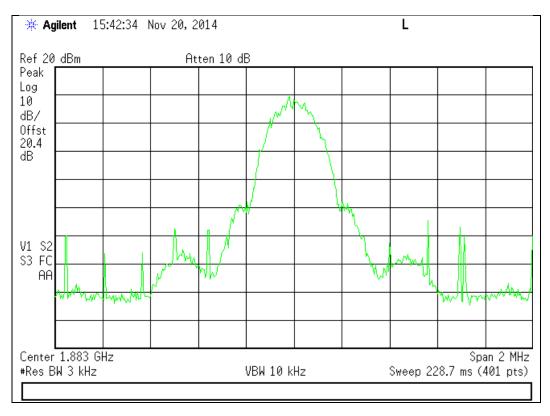


1850 - 1915 MHz Band







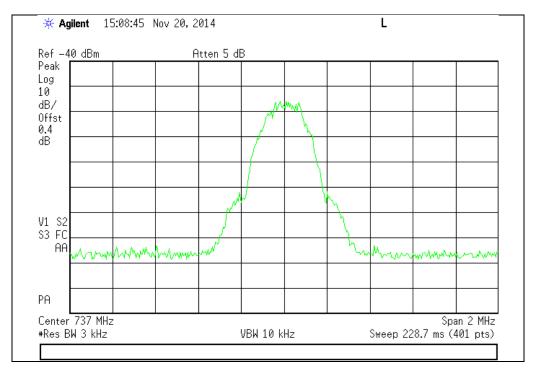




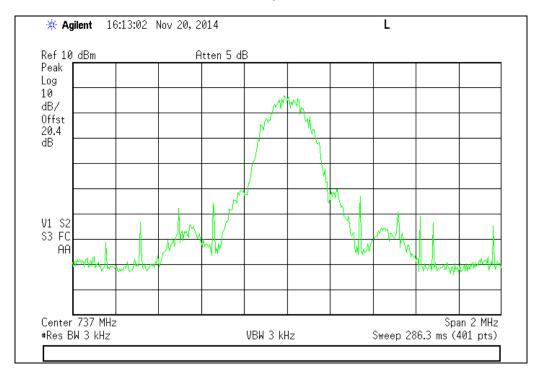
GSM Downlink Test Plots

728 - 746 MHz Band





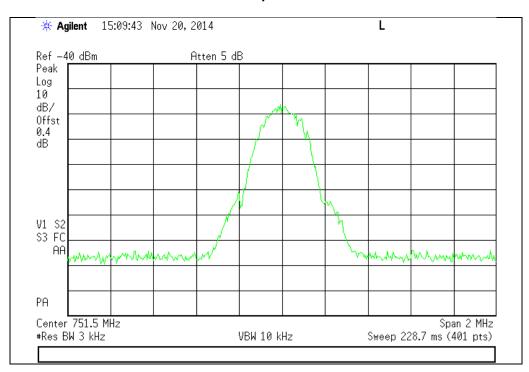




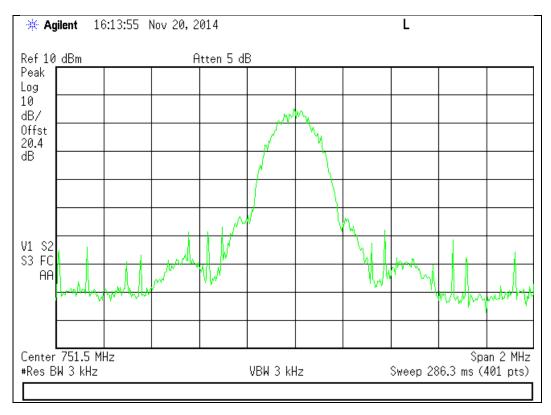


746 - 757 MHz Band





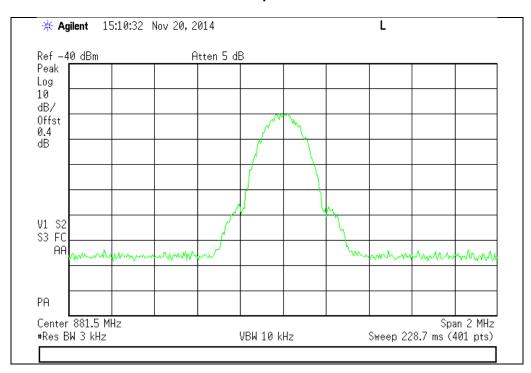




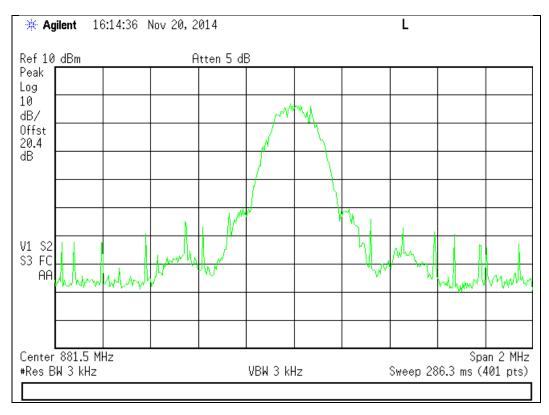


869 - 894 MHz Band





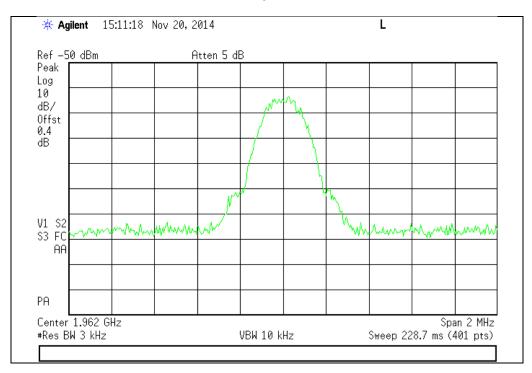




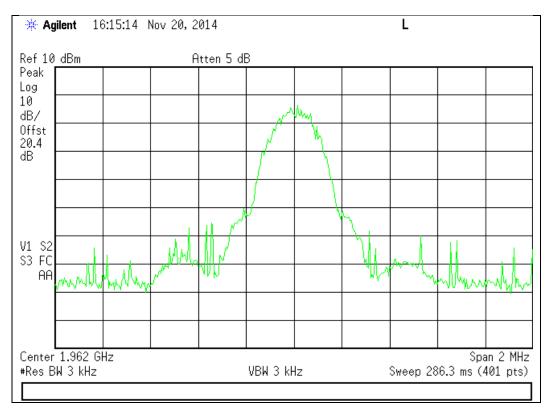


1930 - 1995 MHz Band





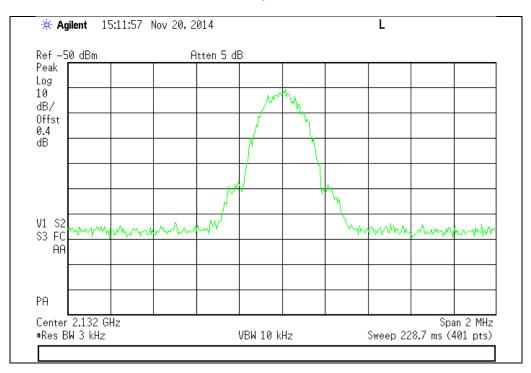




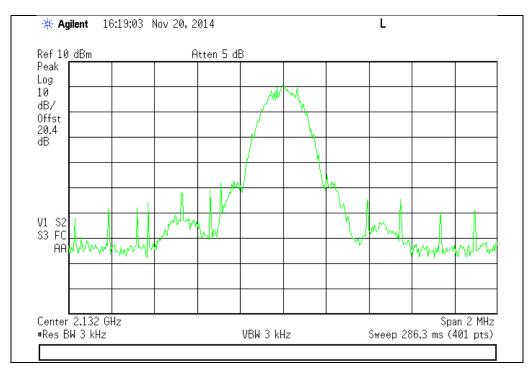


2110 - 2155 MHz Band







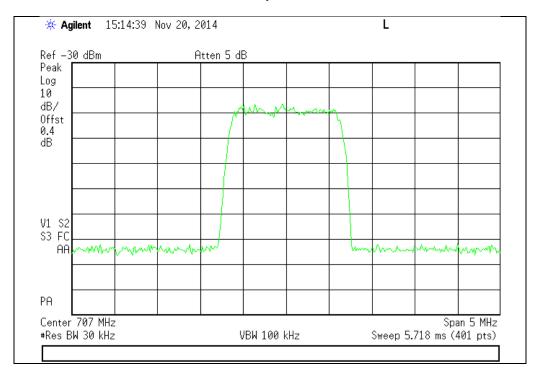




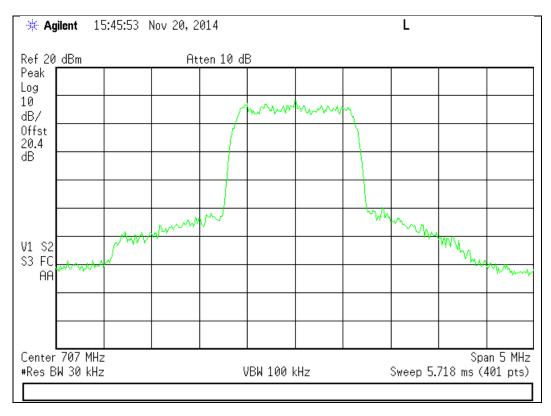
CDMA Uplink Test Plots

698 - 716 MHz Band





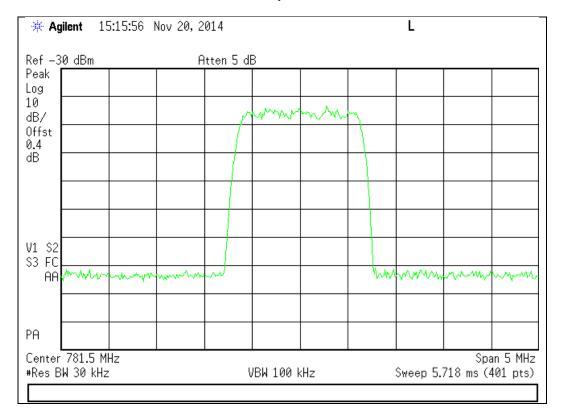


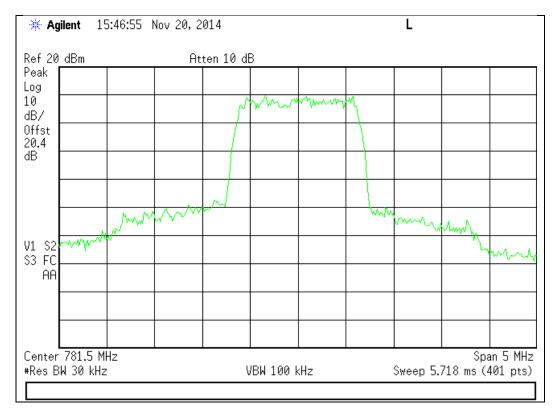




776 - 787 MHz Band



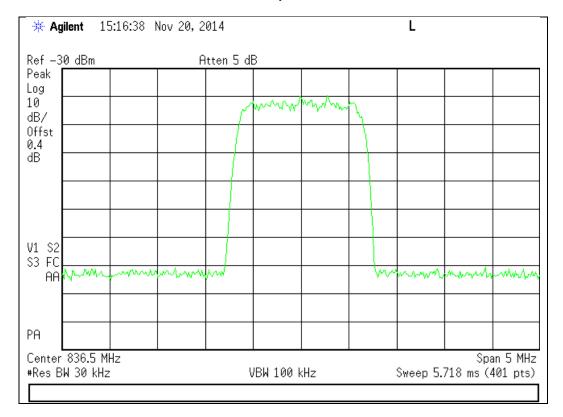


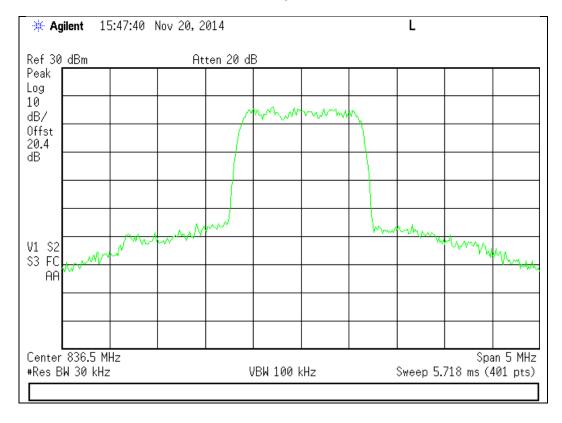




824 - 849 MHz Band



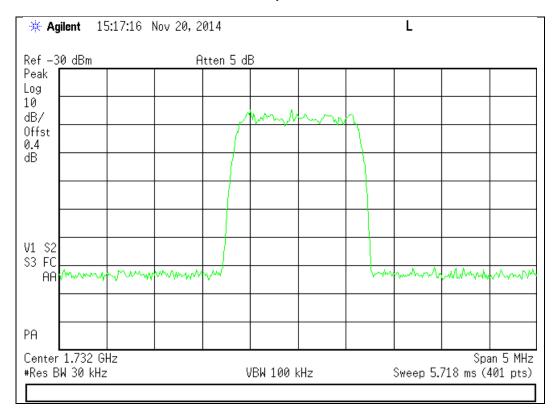


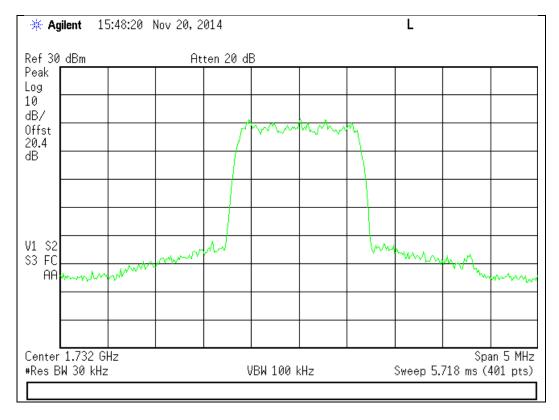




1710 - 1755 MHz Band



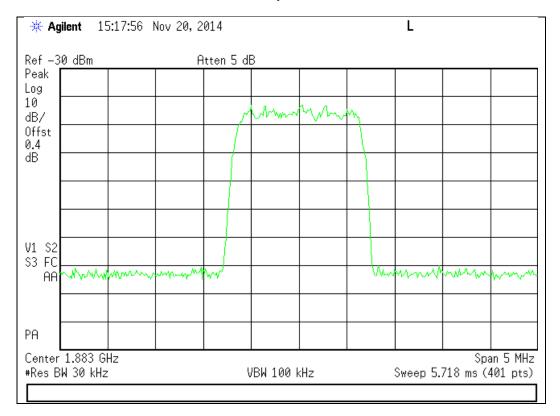


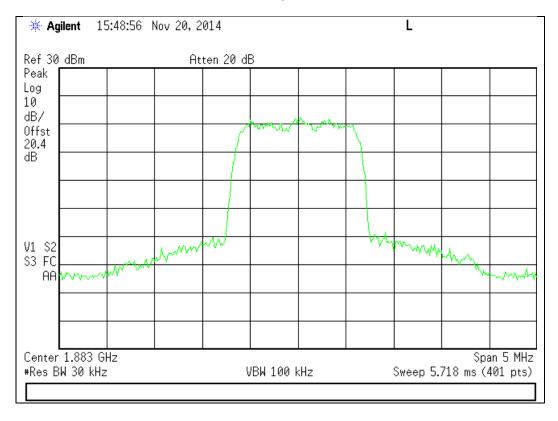




1850 - 1915 MHz Band





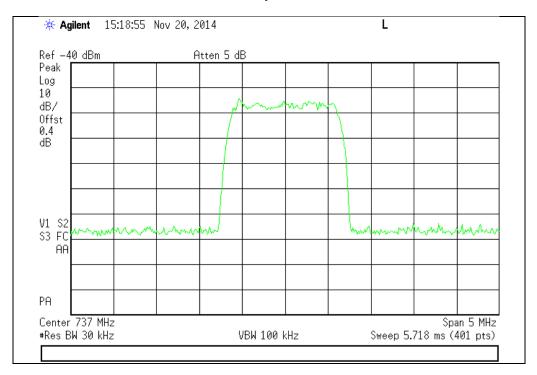


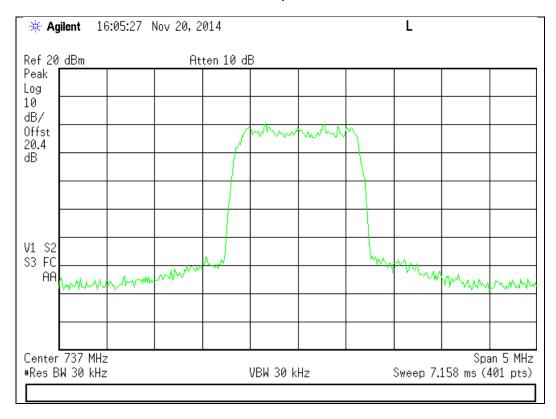


CDMA Downlink Test Plots

728 - 746 MHz Band



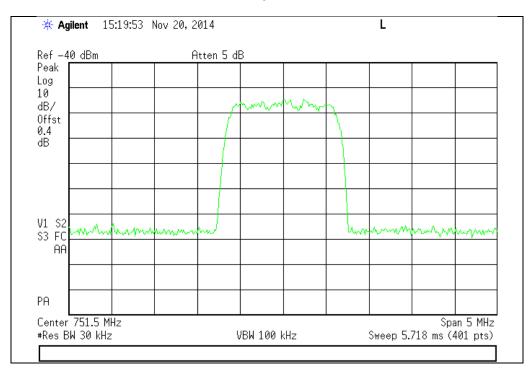




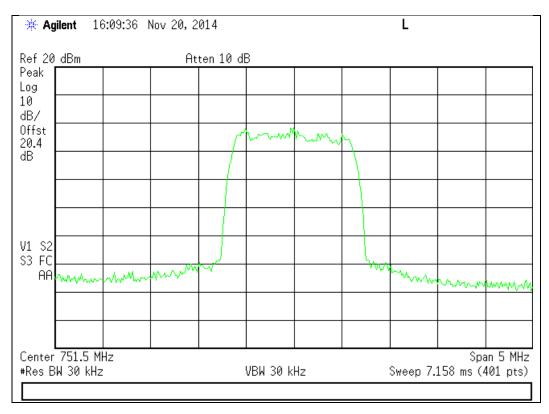


746 - 757 MHz Band





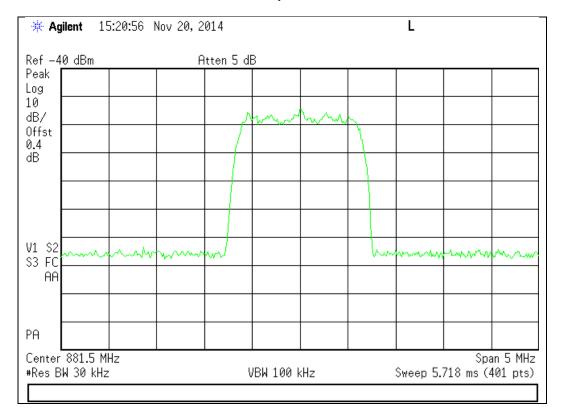


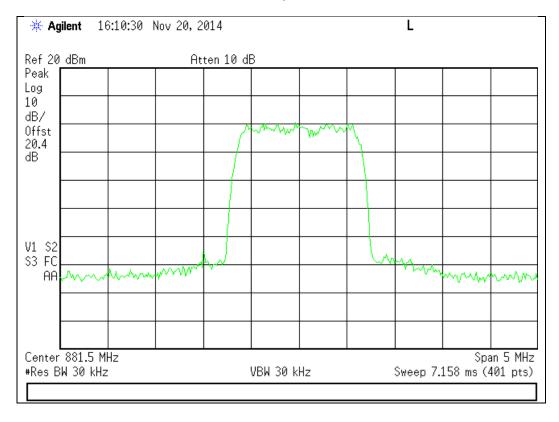




869 - 894 MHz Band



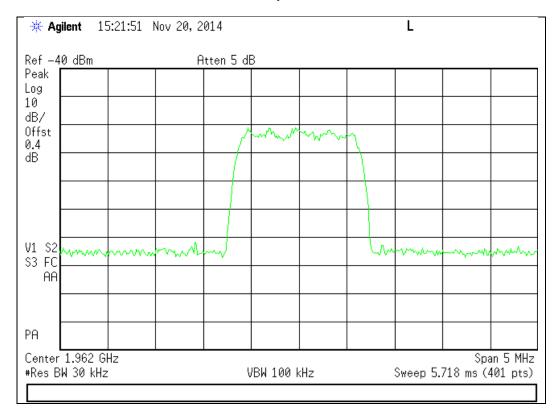


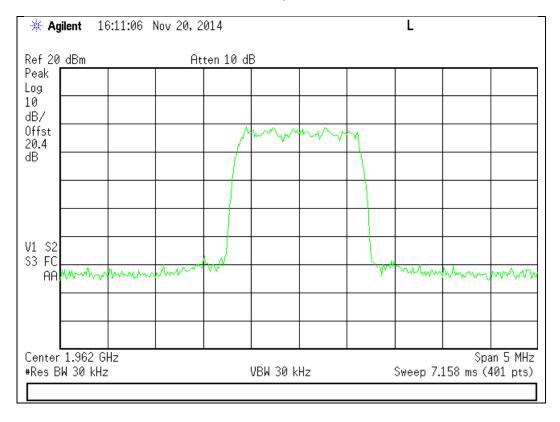




1930 - 1995 MHz Band



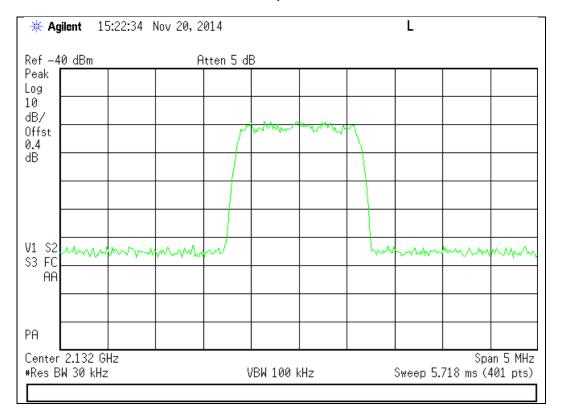


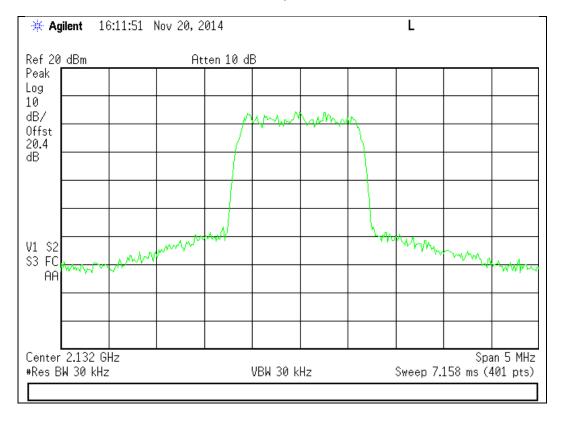




2110 - 2155 MHz Band





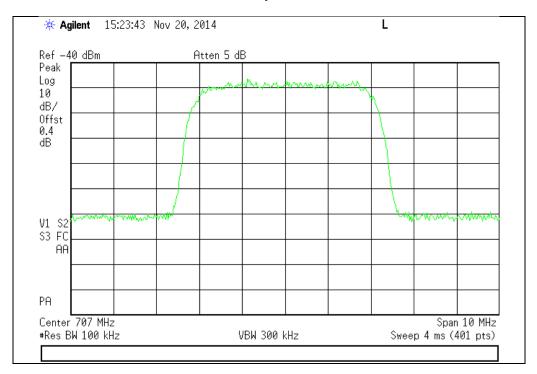




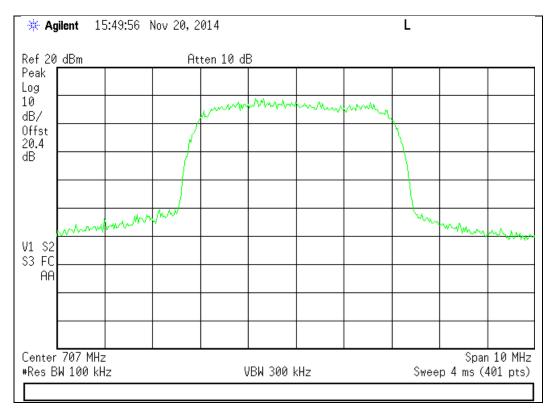
WCDMA Uplink Test Plots

698 - 716 MHz Band





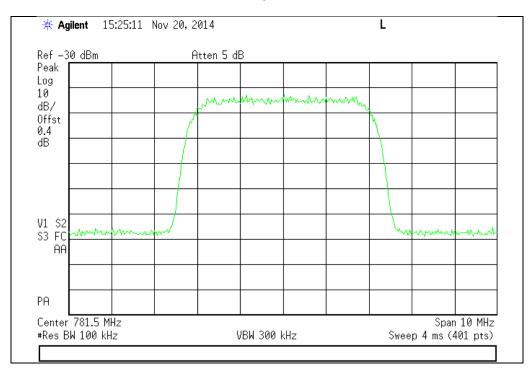




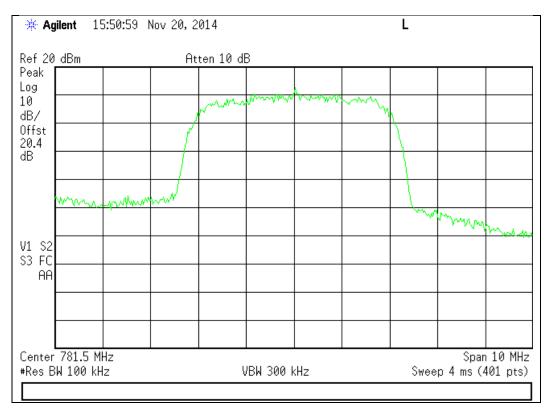


776 - 787 MHz Band





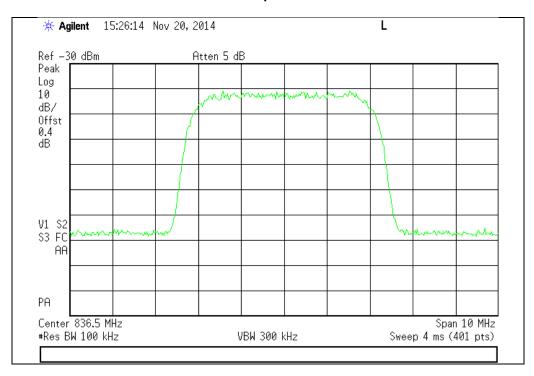




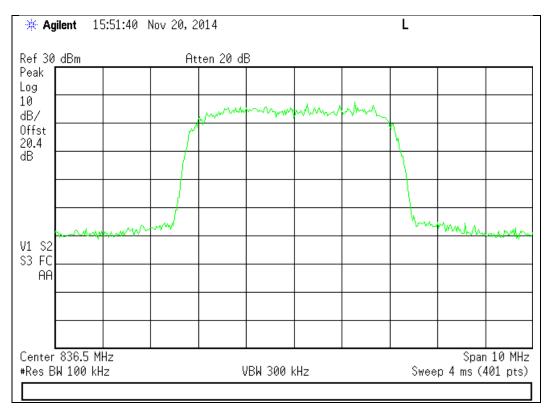


824 - 849 MHz Band





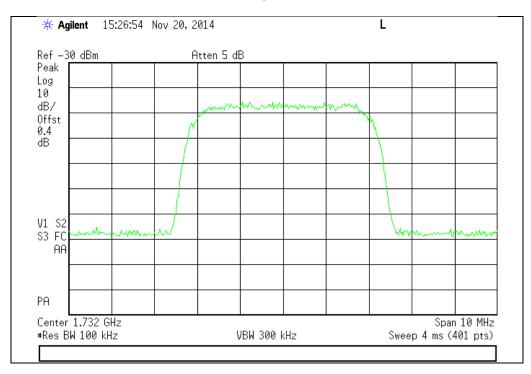




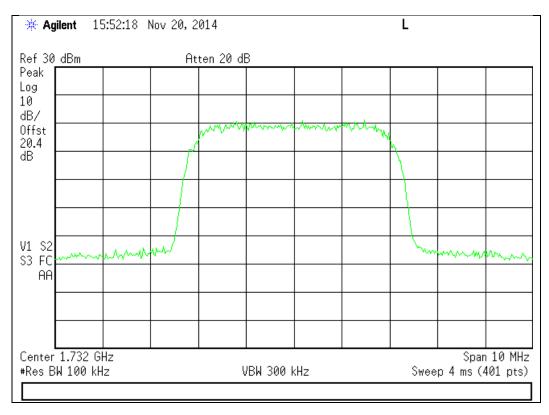


1710 - 1755 MHz Band





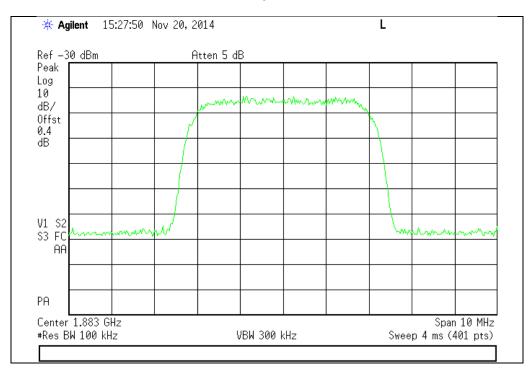




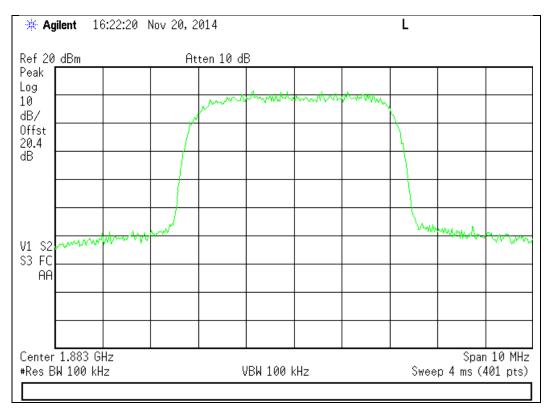


1850 - 1915 MHz Band







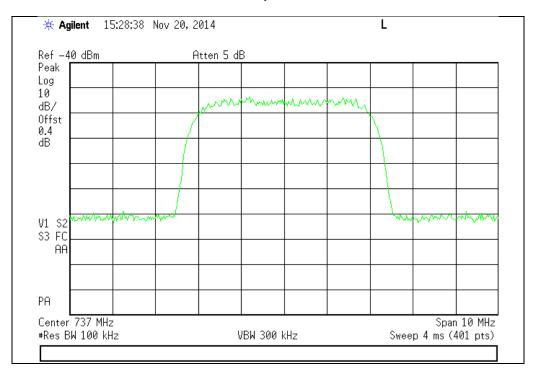




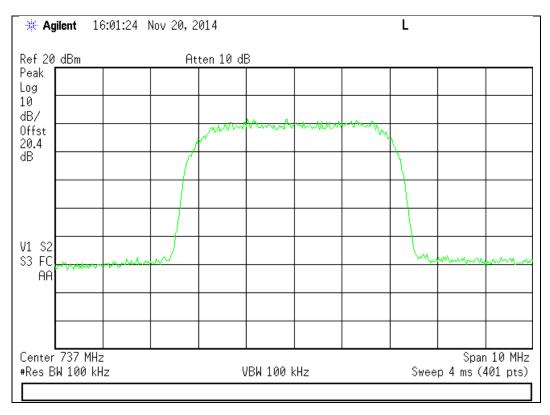
WCDMA Downlink Test Plots

728 - 746 MHz Band





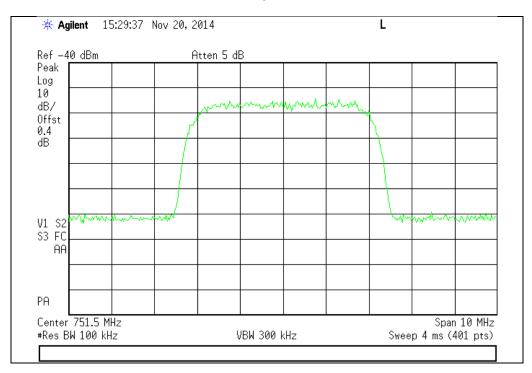




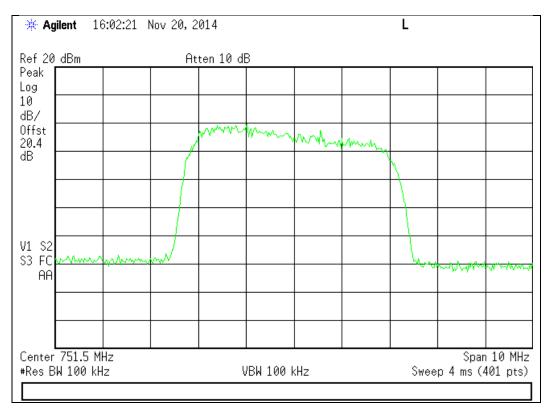


746 - 757 MHz Band





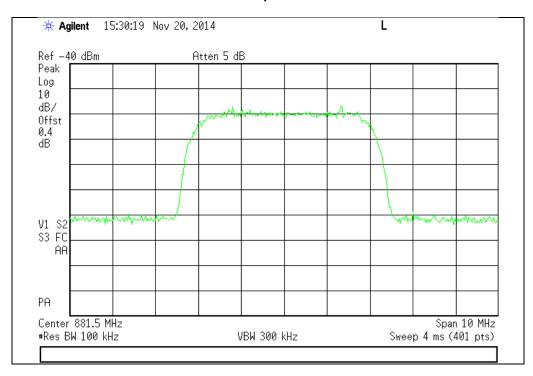




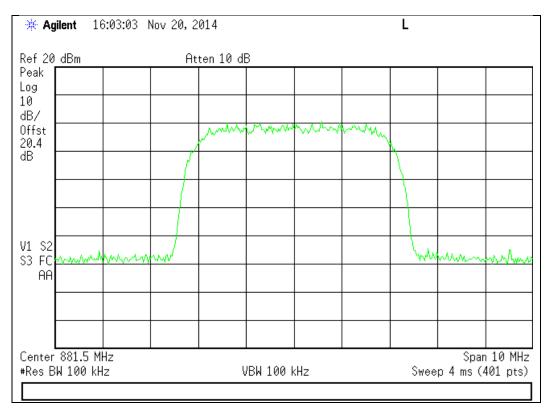


869 - 894 MHz Band





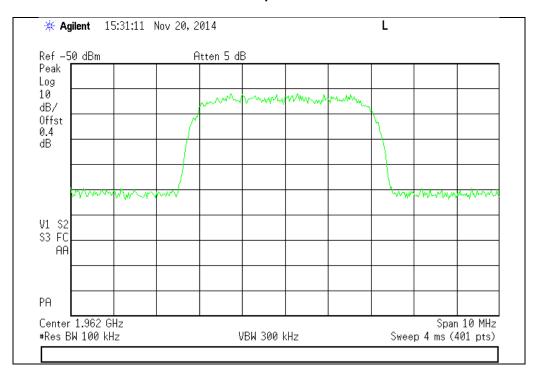




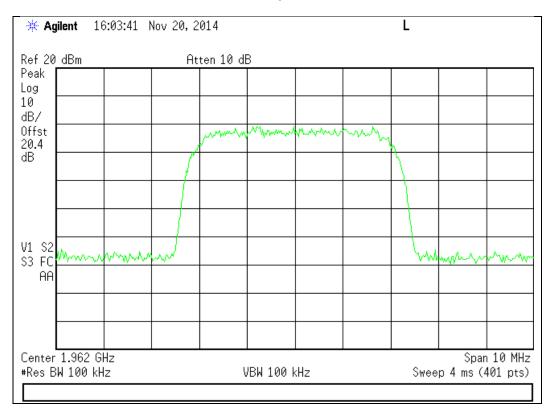


1930 - 1995 MHz Band





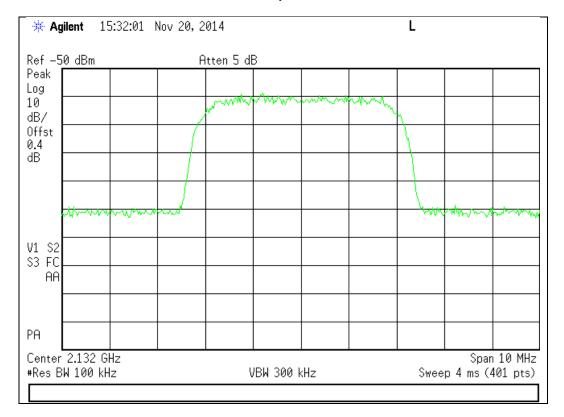
Output

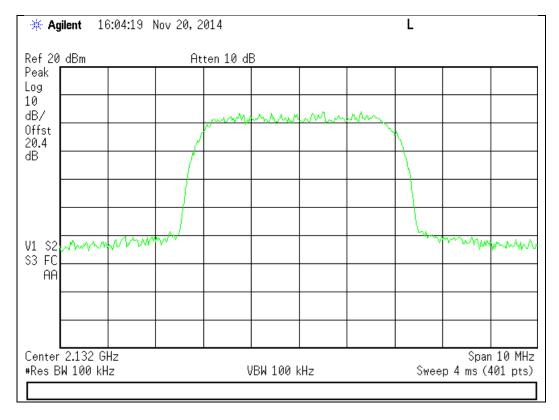




2110 - 2155 MHz Band







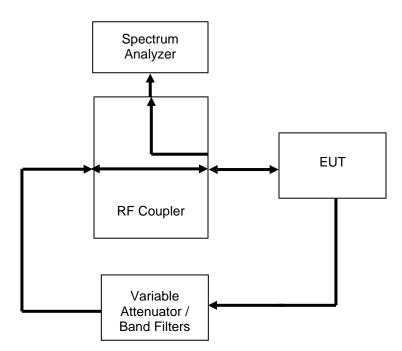


Oscillation Detection Engineer: Mike Graffeo Test Date: 11/20/14

Test Procedure

The EUT was connected to a spectrum analyzer set for 0 Hz operation. The EUT uplink and downlink were fed back upon each other through a selectable band pass filter and variable attenuator. The EUT uplink and downlink were tested to ensure that the presence of oscillation was detected and that the EUT output turned off within 300 mS for the Uplink and 1 second for the Downlink and remained off for 1 minute. A EUT with test software was utilized to ensure that the EUT only had a maximum of 5 attempts at restart from oscillation before permanently shutting off.





Uplink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result
698 - 716	111.6	300	Pass
776 - 787	79.2	300	Pass
824 - 849	82.8	300	Pass
1710 - 1755	34.2	300	Pass
1850 - 1915	104.2	300	Pass

Downlink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result	
728 - 746	38.7	1000	Pass	
746 - 757	108.0	1000	Pass	
869 - 894	51.3	1000	Pass	
1930 - 1995	87.3	1000	Pass	
2110 - 2155	86.4	1000	Pass	



Frequency Band (MHz)	Measured Time (S)	Limit (S)	Result		
698 - 716	shut off	≥60	Pass		
776 - 787	shut off	≥60	Pass		
824 - 849	shut off	≥60	Pass		
1710 - 1755	shut off	≥60	Pass		
1850 - 1915	shut off	≥60	Pass		

Uplink Restart Time Test Results

Downlink Restart Time Test Results

-			
Frequency Band (MHz)	Measured Time (S)	Limit (S)	Result
728 - 746	shut off	≥60	Pass
746 - 757	shut off	≥60	Pass
869 - 894	shut off	≥60	Pass
1930 - 1995	shut off	≥60	Pass
2110 - 2155	shut off	≥60	Pass

Uplink Restart Count Test Results

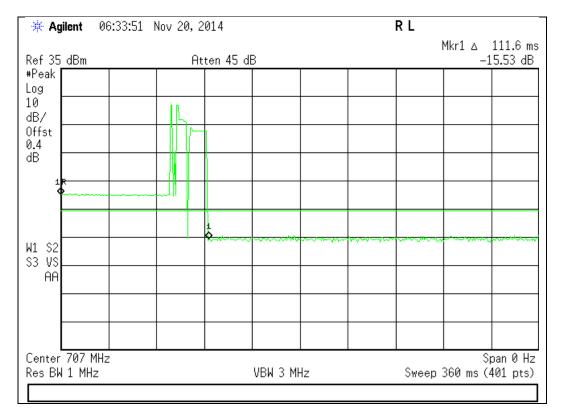
Frequency Band (MHz)	Restarts	Limit	Result
698 - 716	shut off	≤5	Pass
776 - 787	shut off	≤5	Pass
824 - 849	shut off	≤5	Pass
1710 - 1755	shut off	≤5	Pass
1850 - 1915	shut off	≤5	Pass

Downlink Restart Count Test Results

Frequency Band (MHz)	Restarts	Limit	Result
728 - 746	shut off	≤5	Pass
746 - 757	shut off	≤5	Pass
869 - 894	shut off	≤5	Pass
1930 - 1995	shut off	≤5	Pass
2110 - 2155	shut off	≤5	Pass

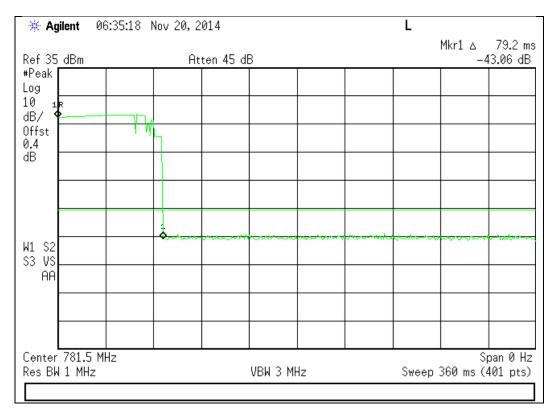


Uplink Detection Time Test Results

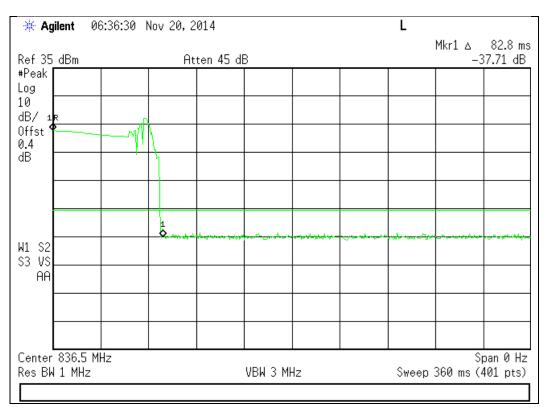


698 - 716 MHz Band

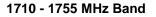
776 - 787 MHz Band

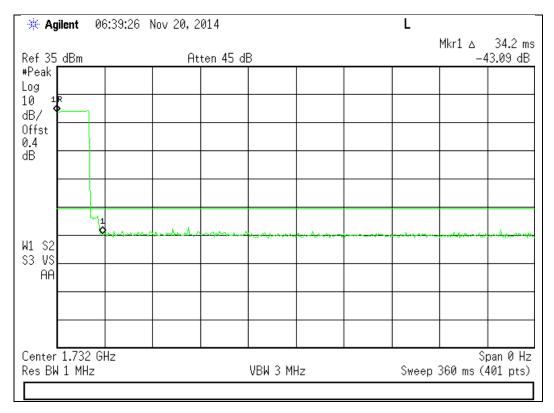




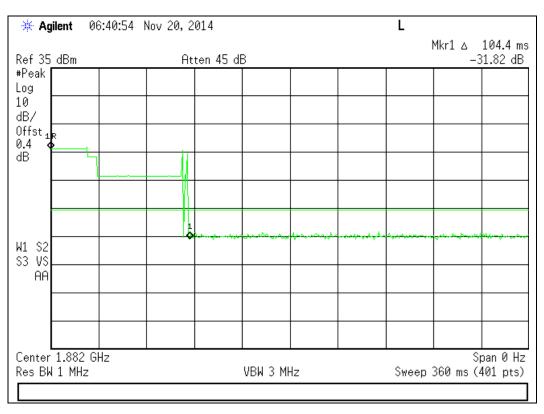


824 - 849 MHz Band





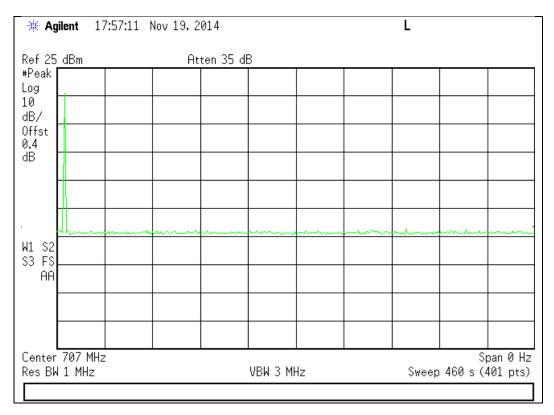




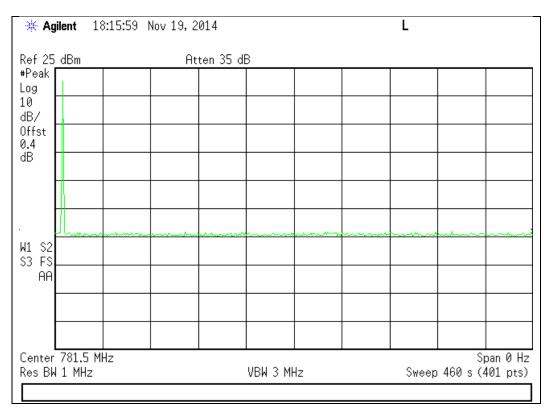
1850 - 1915 MHz Band

Uplink Restart Time Test Results

698 - 716 MHz Band

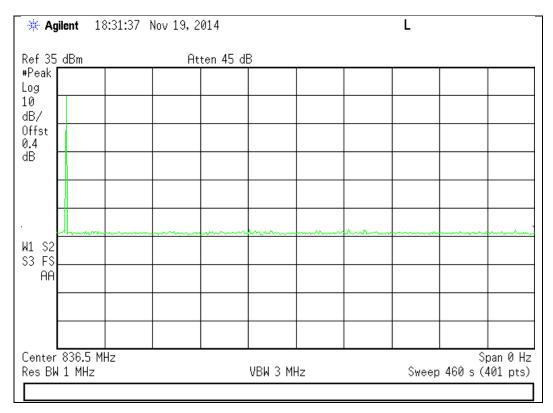




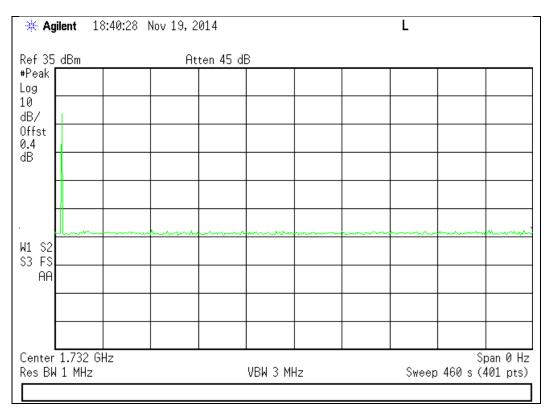


776 - 787 MHz Band

824 - 849 MHz Band

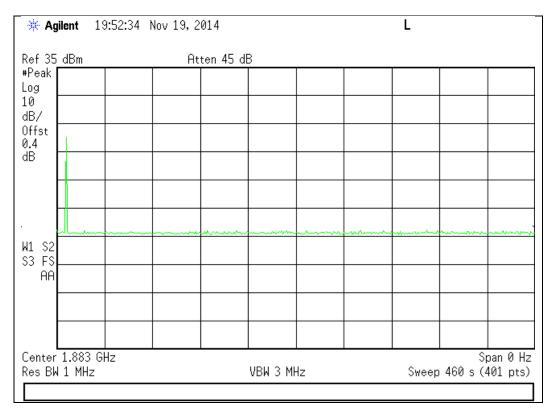






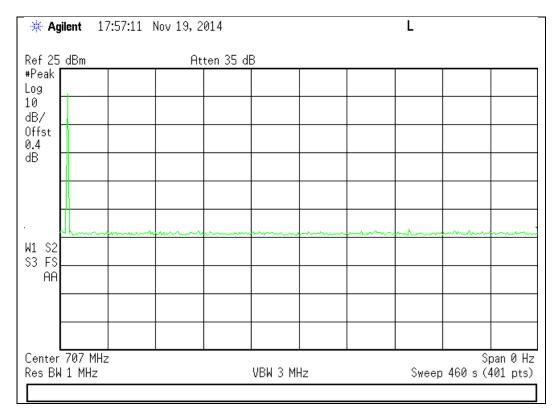
1710 - 1755 MHz Band

1850 - 1915 MHz Band



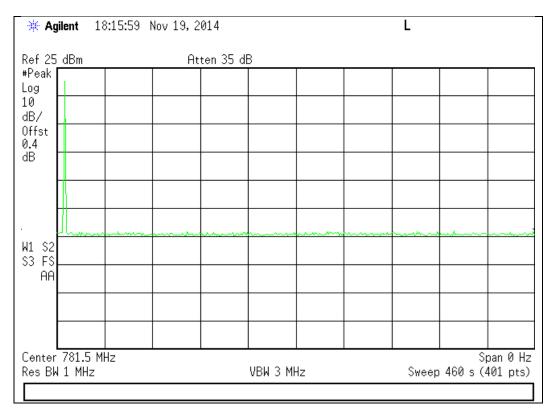


Uplink Restart Count Test Results

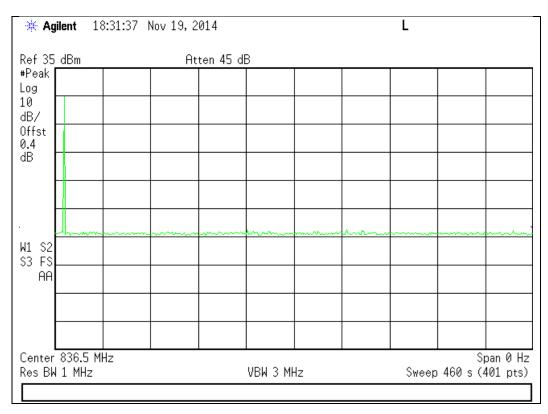


698 - 716 MHz Band

776 - 787 MHz Band

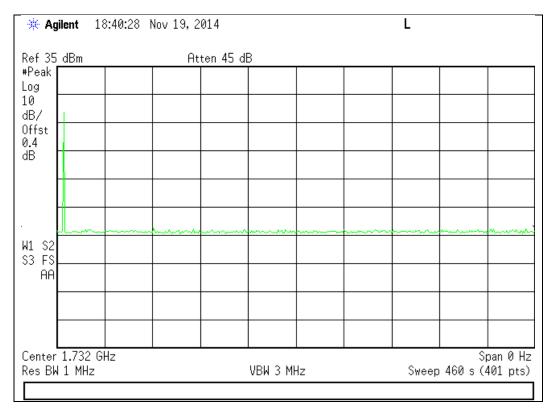






824 - 849 MHz Band





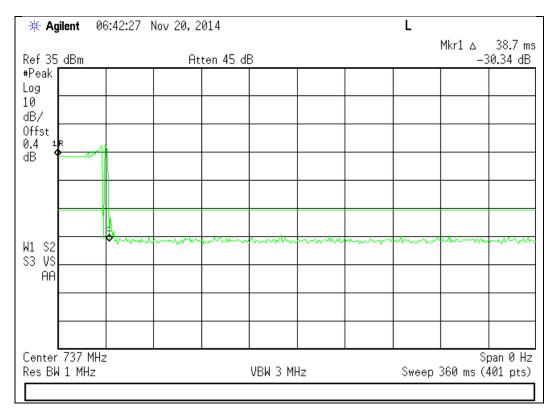


Ref 35 dBm Atten 45 dB #Peak	
Log 10 dB/ Offst 0.4 dB W1 S2	
10 dB/ Offst 0.4 dB W1 S2	
0.4 dB W1 \$2	
0.4 dB	
W1 S2	
W1 \$2	m
\$3 F\$	
AA	
Center 1.883 GHz Spa Res BW 1 MHz VBW 3 MHz Sweep 460 s (40	an 0 Hz a1 p+s)
Nes DM 1 Pinz 3meet 400 3 (40)T p(S)

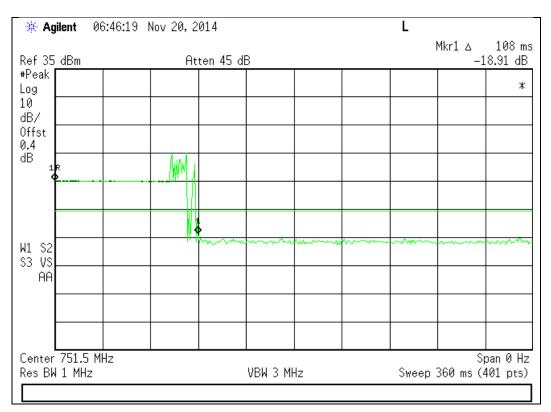
1850 - 1915 MHz Band

Downlink Detection Time Test Results

728 - 746 MHz Band

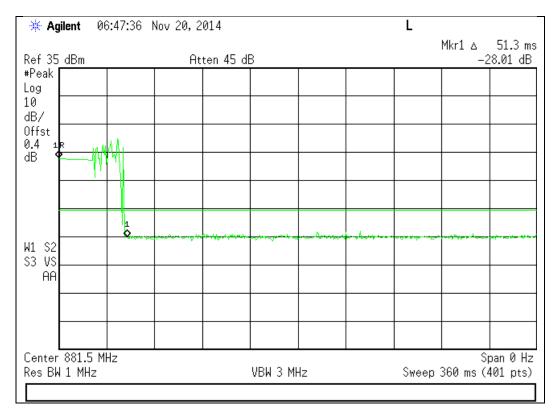




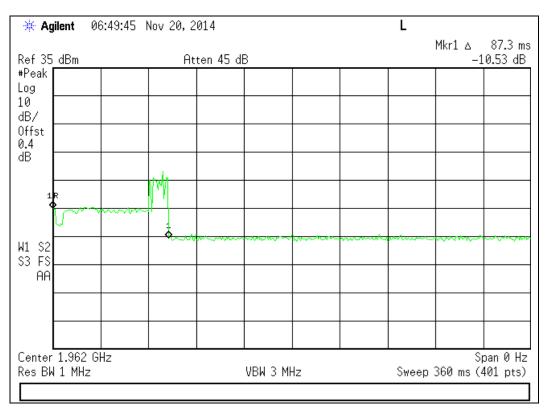


746 - 757 MHz Band

869 - 894 MHz Band

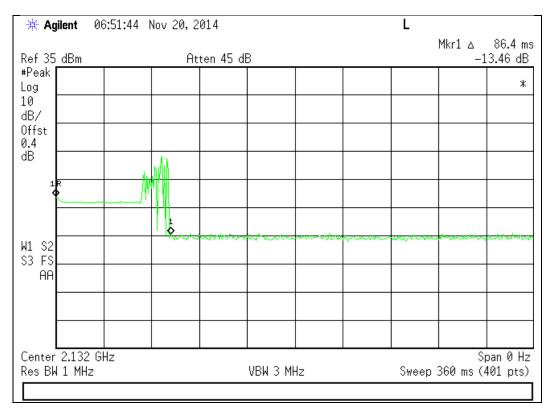






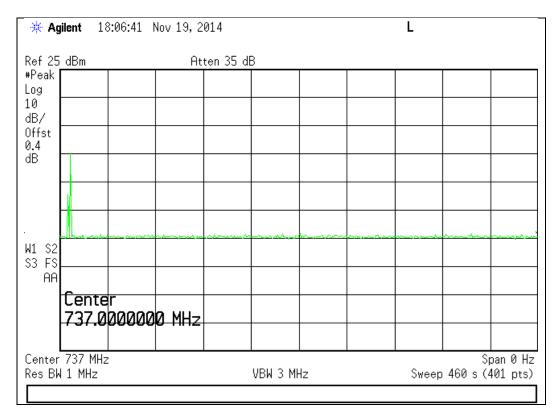
1930 - 1995 MHz Band

2110 - 2155 MHz Band



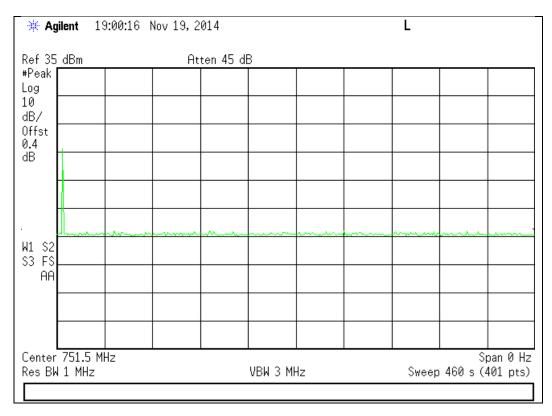


Downlink Restart Time Test Results

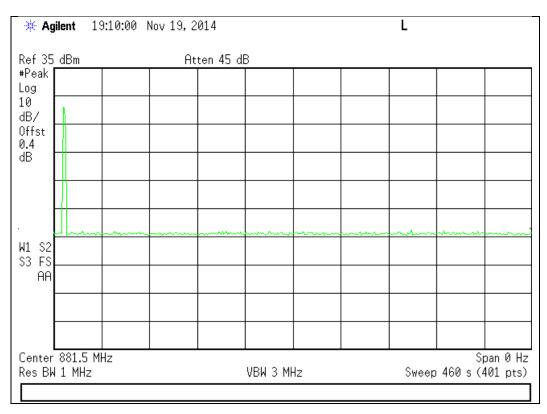


728 - 746 MHz Band

746 - 757 MHz Band

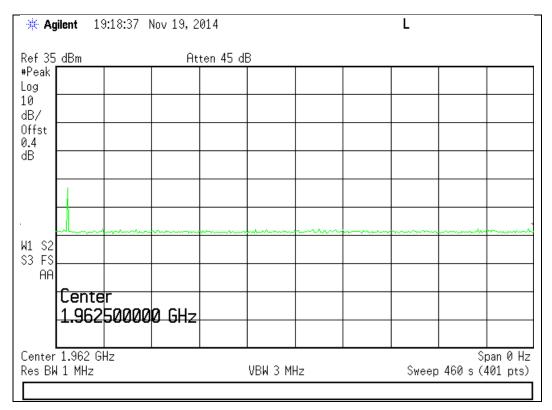






869 - 894 MHz Band





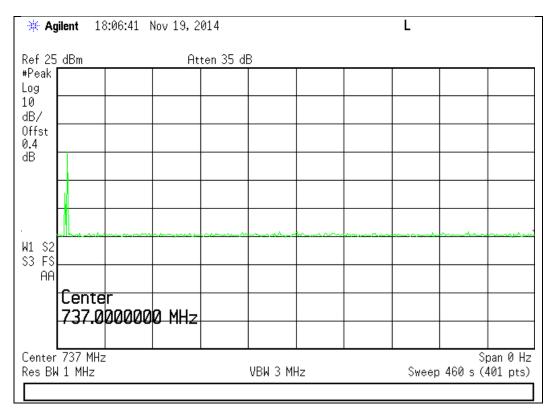


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Res BW					VBW 3 M	Hz		Sweep	1460 s (4	401 pts)

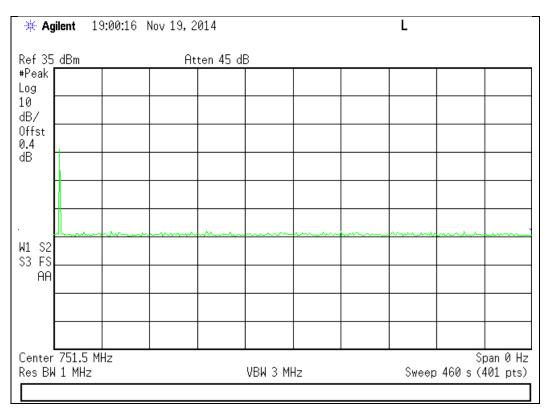
2110 - 2155 MHz Band

Downlink Restart Count Test Results

728 - 746 MHz Band

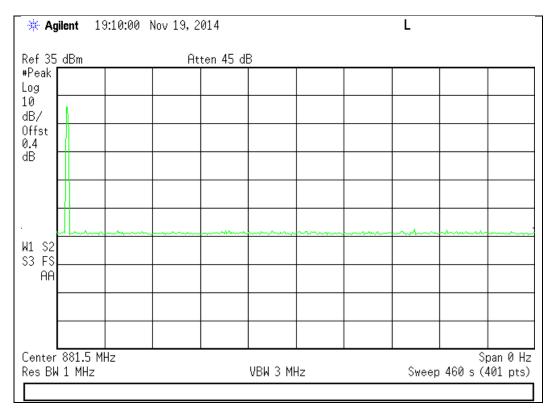




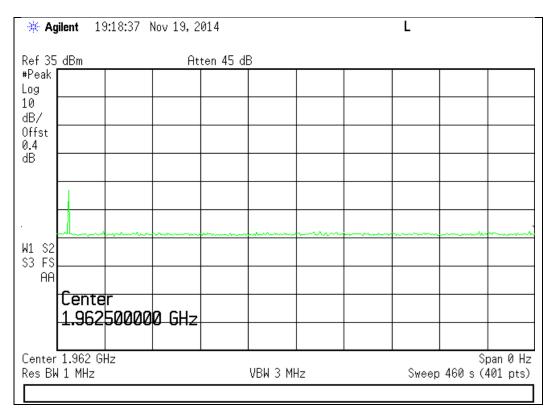


746 - 757 MHz Band

869 - 894 MHz Band

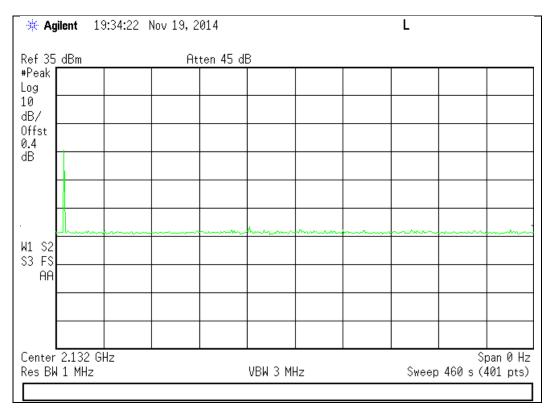






1930 - 1995 MHz Band

2110 - 2155 MHz Band





Radiated Spurious Engineer: Mike Graffeo Test Date: 11/21/14

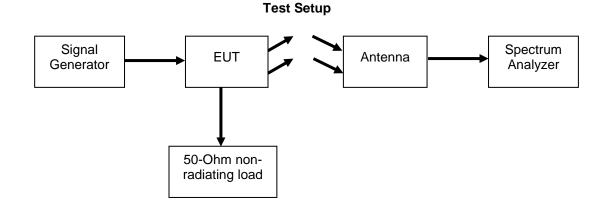
Test Procedure

The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure that the signal levels were maximized. All cable and antenna correction factors were input into the spectrum analyzer ensuring an accurate measurement in ERP/EIRP with the resultant power in dBm. A signal generator was used to provide a CW signal centered in each operational uplink and downlink band. The EUT output was terminated into a 50 Ohm non-radiating load.

The following formula was used for calculating the limits:

Radiated Spurious Emissions Limit = P1 - (43 + 10Log(P2)) = -13dBmP1 = power in dBm

P2 = power in Watts





Uplink Test Results

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1414	-56.18	-13	Pass
2121	-51.65	-13	Pass
2828	-45.26	-13	Pass

698 - 716 MHz Band 707 MHz Tuned Frequency

776 - 787 MHz Band 781.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1563	-64.32	-13	Pass
2344.5	-62.44	-13	Pass
3126	-45.81	-13	Pass

824 - 849 MHz Band 836.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1673	-66.69	-13	Pass
2509.5	-61.88	-13	Pass
3346	-43.84	-13	Pass

1710 - 1755 MHz Band 1732.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3465	-61.44	-13	Pass
5197.5	-42.16	-13	Pass
6930	-46.21	-13	Pass

1850 - 1915 MHz Band 1882.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3765	-46.73	-13	Pass
5647.5	-40.57	-13	Pass
7530	-29.65	-13	Pass



Downlink Test Results

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1474	-70.08	-13	Pass
2211	-64.6	-13	Pass
2948	-56.77	-13	Pass

728 - 746 MHz Band 737 MHz Tuned Frequency

746 - 757 MHz Band 751.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1503	-66.83	-13	Pass
2254.5	-61.71	-13	Pass
3006	-46.7	-13	Pass

869 - 894 MHz Band 881.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1763	-61.07	-13	Pass
2644.5	-60.31	-13	Pass
3526	-42.28	-13	Pass

1930 - 1995 MHz Band 1962.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3925	-44.59	-13	Pass
5887.5	-39.59	-13	Pass
7850	-27.61	-13	Pass

2110 - 2155 MHz Band 2132.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
4265	-37.94	-13	Pass
6397.5	-36.67	-13	Pass
8530	-29.36	-13	Pass

No other emissions were detected. All emissions were lower than -13 dBm. All emissions were system noise floor.



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	5/8/14	5/8/16
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/8/13	10/8/15
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	3/24/14	3/24/15
Voltmeter	Fluke	75111	i00320	3/24/14	3/24/15
EMI Analyzer	Agilent	E7405A	i00379	1/14/14	1/14/15
Spectrum Analyzer *	Tektronix	RSA5126A	i00424	9/22/13	9/22/14
Non-radiating load	Termaline	8201	i00334	Verified on: 9/1/14	
Signal Generator	Rohde & Schwarz	SMU200A	i00405	12/11/13	12/11/14
RF Directional Coupler	Меса	CS06-1.500V	i00412	Verified c	on: 9/1/14

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

* Lab Manager has approved a 60 day extension on this piece of equipment

END OF TEST REPORT