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Test Report

Prepared for: Bird Technologies

Model: DDRXXX

Description: 33dBm Cellular Remotes

Serial Number: N/A

FCC ID: V5FDDR003

To

FCC Part 20
FCC Part 27

Date of Issue: December 8, 2016

On the behalf of the applicant:	**Bird Technologies** **30303 Aurora Road** **Cleveland, OH 44139**
Attention of:	**Tim O'Brien, Hardware Engineer** **Ph: (440)519-2194** **E-Mail: tobrien@bird-technologies.com**

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Project No: p1620031

Shawn McMillen
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	February 26, 2016	Shawn McMillen	Original Document
2.0	September 19, 2016	Amanda Reed	Corrected engineer information
3.0	December 2, 2016	Greg Corbin	Added test data for FCC rule parts 27.53(c) and 27.53 (f)

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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 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 http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

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IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The Applicant has been cautioned as to the following:

15.21: **Information to the User**

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): **Special Accessories**

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, KDB 935210 D05 Indus Booster Basic Measurements v01 and FCC Part 2, Part 20.21, Part 27 and C63-26D13 where appropriate.

Standard Test Conditions and Engineering Practices

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

In accordance with ANSI/TIA 603C, 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 specify 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)**
24.7 – 27.9	44.9 – 51.5	963.5 – 970.4

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

Model: DDRXXX
Description: 33dBm Cellular Remotes
Serial Number: N/A
Firmware: N/A
Software: N/A
Additional Information: N/A

EUT Operation during Tests
Note: the UL is directly connected to a base station and therefore does not radiate.
The EUT was setup in an end to end configuration. Signals were injected into the head end unit and measured from the remote unit.

Accessories: None

Cables: None

Modifications: None

The signal booster uses the following frequency bands.
The emission designators listed are representative emission designators used by transmitters whose signal is amplified by this booster.

Frequency Band (MHz)	
Uplink	698-787
Downlink	728-757
Modulation Type	GSM, CDMA, EDGE, HSPA. EVDO, LTE

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

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
935210 D05	AGC Threshold	Pass	
935210 D05	Out-of-Band Rejection	Pass	
935210 D05	Input-Versus-Output Signal Comparison	Pass	
935210 D05	Mean Output Power and Amplifier Gain	Pass	
935210 D05	Out-Of-Band/Block Emissions Conducted	Pass	
935210 D05	Spurious Emissions Conducted	Pass	
935210 D05	Frequency Stability	N/A	Does not have Frequency translation
935210 D05	Spurious Emissions Radiated	Pass	

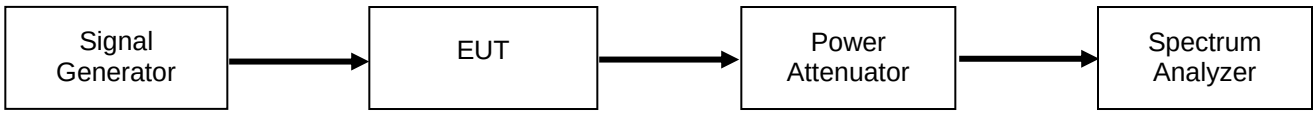
AGC Threshold
Engineer: Shawn McMillen
Test Date: 2/25/2016

Test Procedure

A signal generator was connected to the input of the EUT. A spectrum analyzer was connected to the EUT in order to monitor the output power levels. The Signal Generator was configured to produce the necessary broadband and narrow band signals. The input power level was increase in 1 dB increments until the power no longer increased. The input levels were recorded in the table below.

Spectrum Analyzer settings
Power Channel integration
RBW = 1-5% of EBW
Video BW = 3x RBW

Test Setup



Tuned Frequency (MHz)	AGC Threshold (dBm)
728	-49.0
742.5	-50.0
757	-50.0

Out-Of-Band Rejection
Engineer: Shawn McMillen
Test Date: 2/25/2016

Test Procedure

The test equipment was set with the following parameters:

Signal Generator:

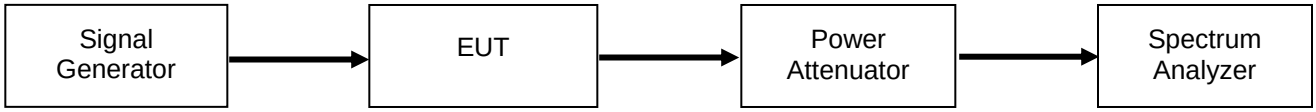
CW Signal
Dwell time = approx. 10 ms
Frequency range = ± 250 % of the passband from the center of the passband.

Spectrum analyzer:

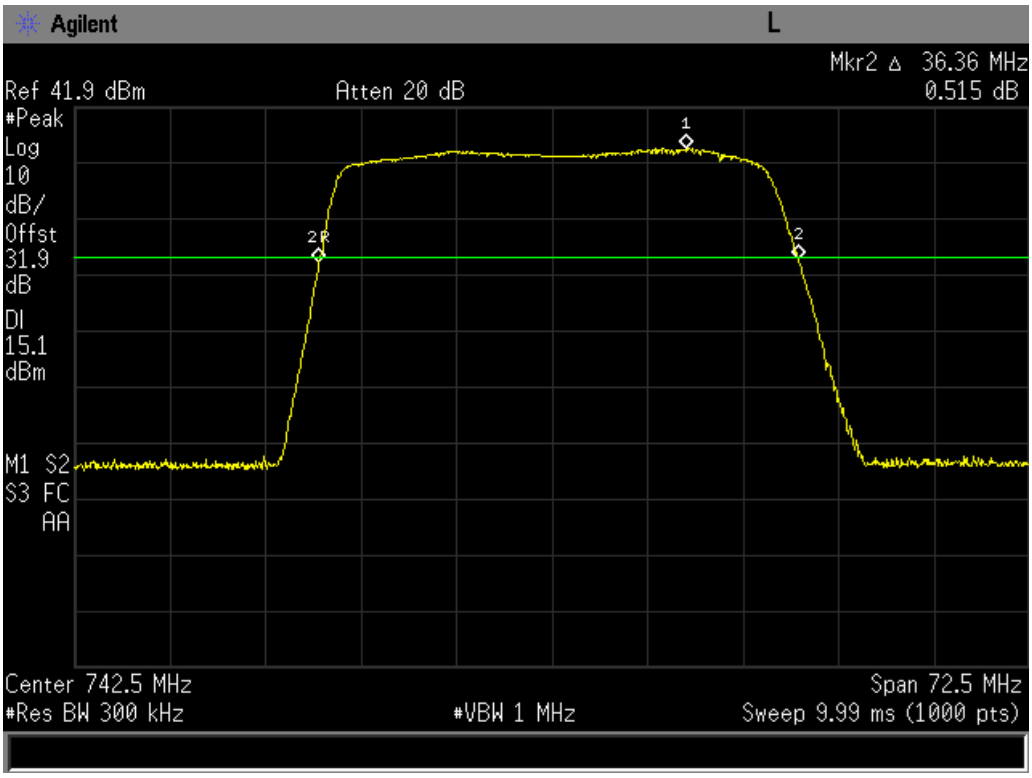
Span ± 250 % of the passband from the center of the passband
Level = a sufficient level to affirm that the out-of-band rejection is > 20 dB above the noise floor
Number of points = SPAN/(RBW/2)
RBW 1 % to 5 % of the passband
VBW to ≥ 3 × RBW
Peak detector with Max Hold

Procedure:
The peak of the frequency response was found and recorded below as f_0.
Two markers we placed at the −20 dB down amplitude point to determine the 20 dB bandwidth. The Band Pass width was recorded below:

Test Setup



f_0 (MHz)	Band Pass Width (MHz)
753.35	36.36


Agilent
L
Mkr2 Δ 36.36 MHz
Ref 41.9 dBm
Atten 20 dB
0.515 dB
#Peak
Log
10
dB/
Offst
31.9
dB
Dl
15.1
dBm
M1 S2
S3 FC
AA
Center 742.5 MHz
Span 72.5 MHz
#Res BW 300 kHz
#VBW 1 MHz
Sweep 9.99 ms (1000 pts)

Input-Versus-Output Signal Comparison
Engineer: Shawn McMillen
Test Date: 2/26/2016

Test Procedure

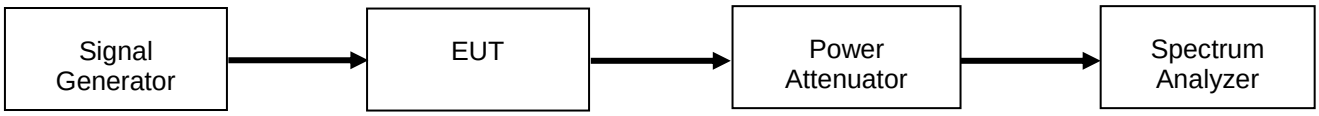
A signal generator was connected to the input of the EUT and was configured to transmit an AWGN signal.
The amplitude was set to be just below the AGC threshold level but not more than 0.5 dB.

Spectrum analyzer setting:

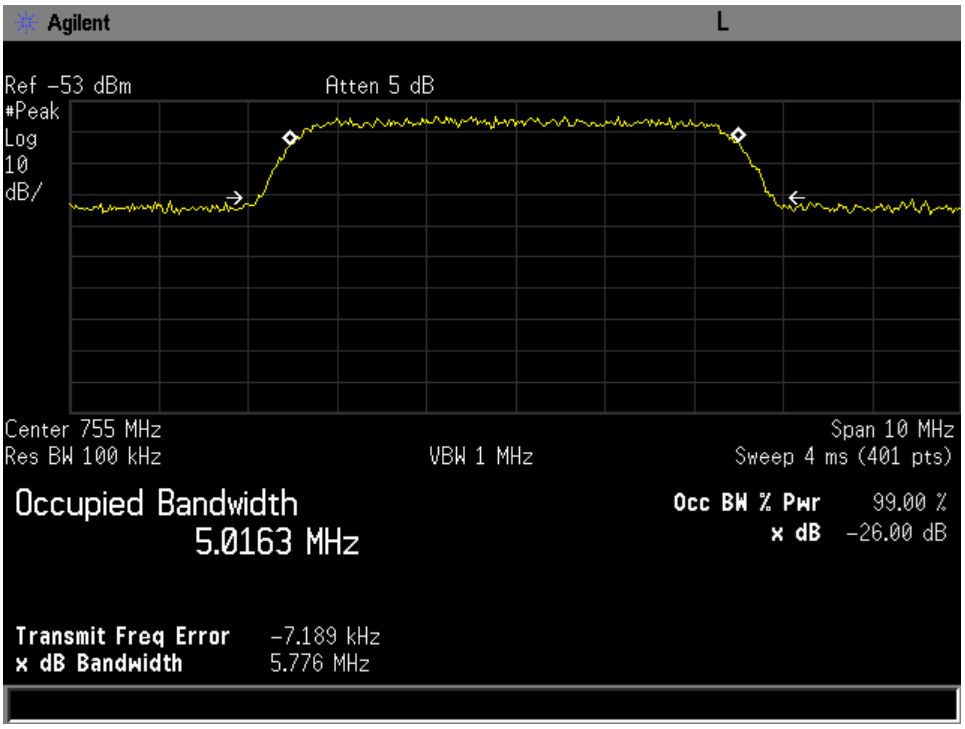
Span 2 times to 5 times the EBW or alternatively the OBW.
Frequency set to the center frequency of the operational band under test.
RBW to 1% to 5 % of the anticipated OBW
VBW ≥ 3 × RBW
Reference Level 10 log (OBW / RBW) below the reference level
Positive Peak Detector
Max Hold

The -26dB bandwidth was compared between the input and the output of the EUT. All carries applicable to the EUT were investigated. The input level was then increased by 3 dB above and the comparison repeated.

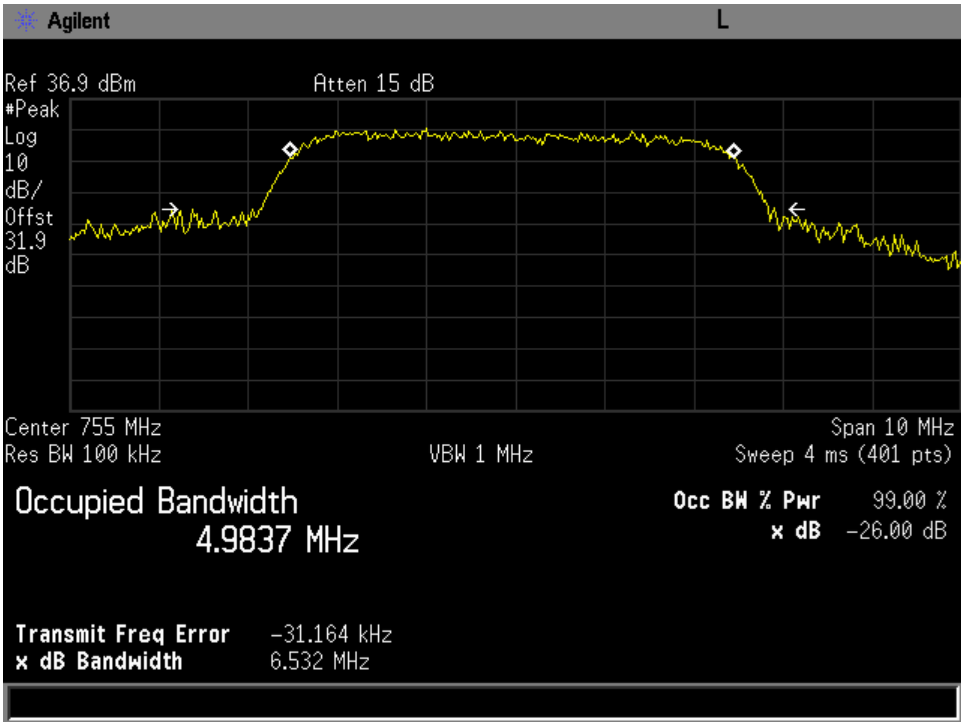
Test Setup



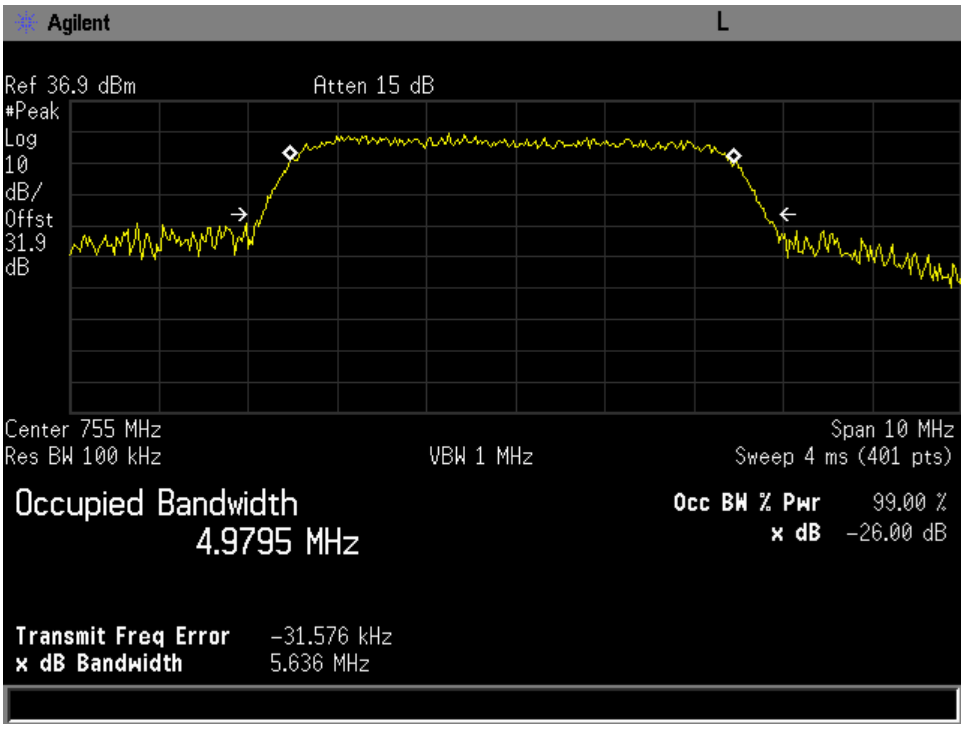
high ch AWGN Mod in



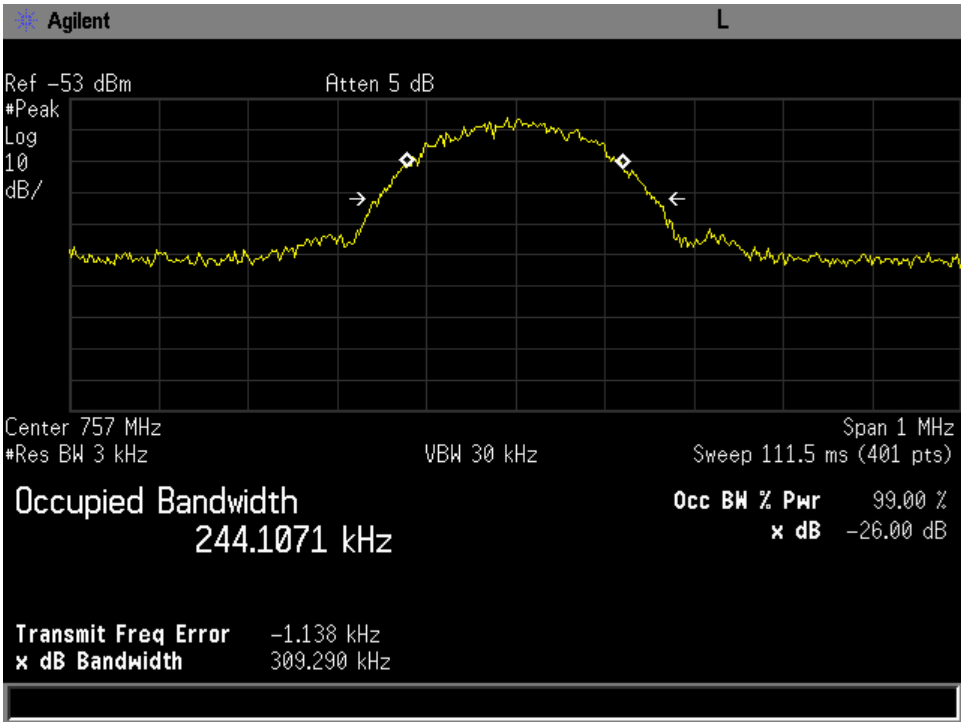
High ch AWGN Mod out +3dB



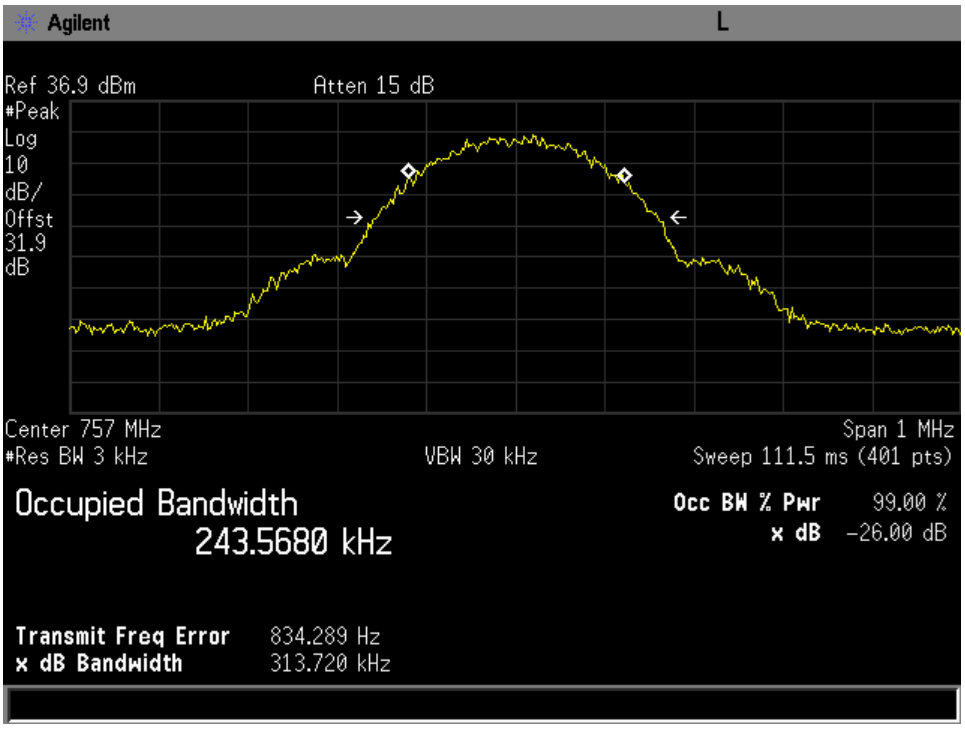
high ch AWGN Mod out



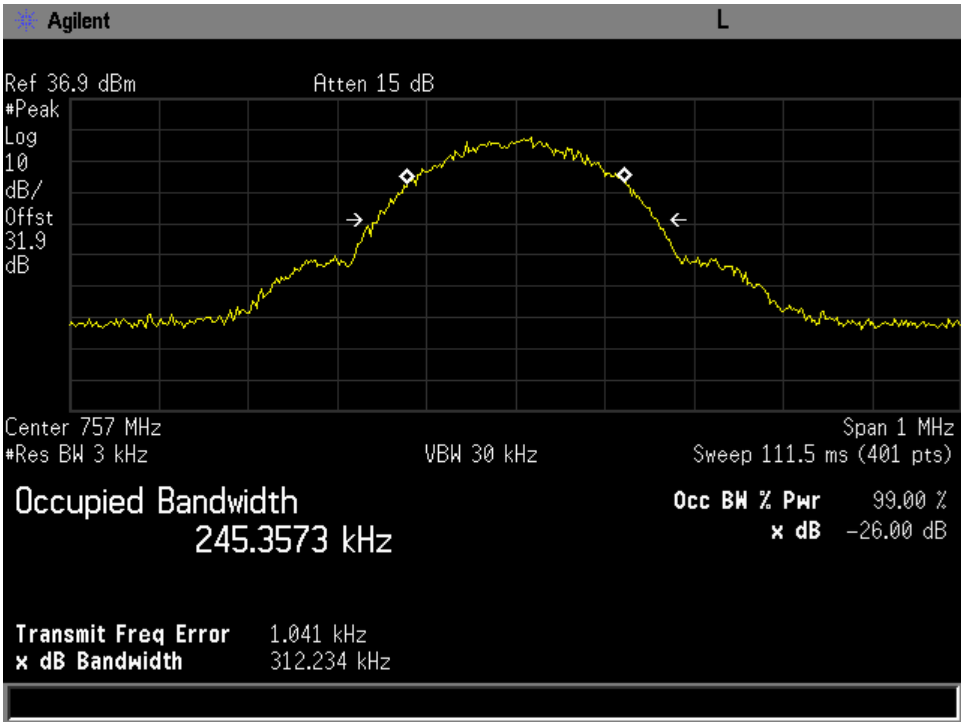
high ch GSM Mod in



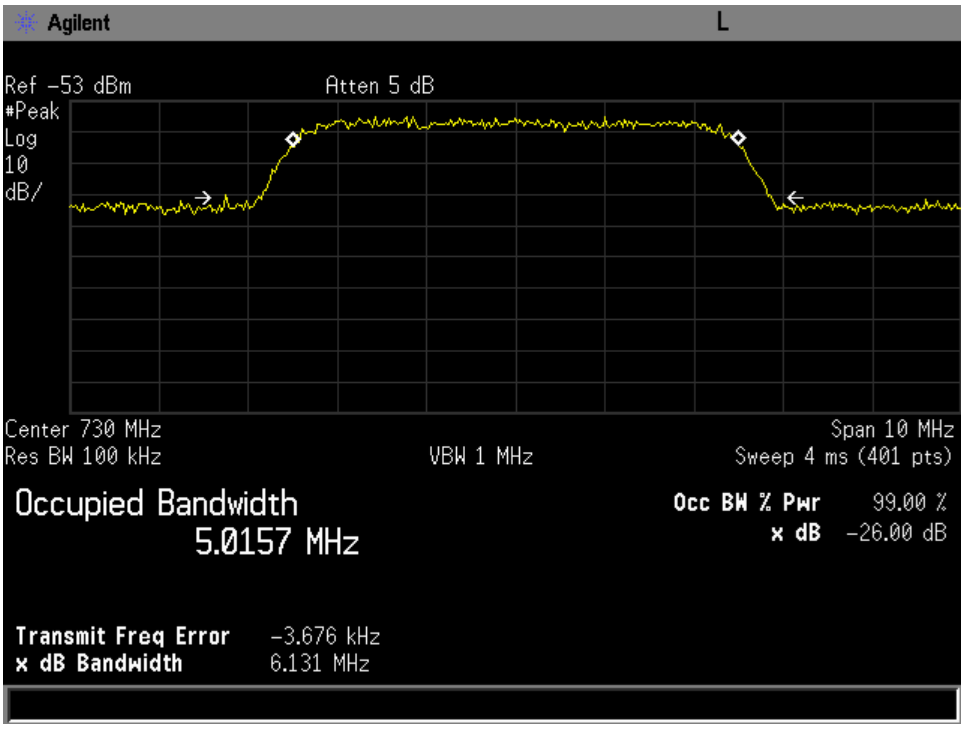
high ch GSM Mod out +3dB



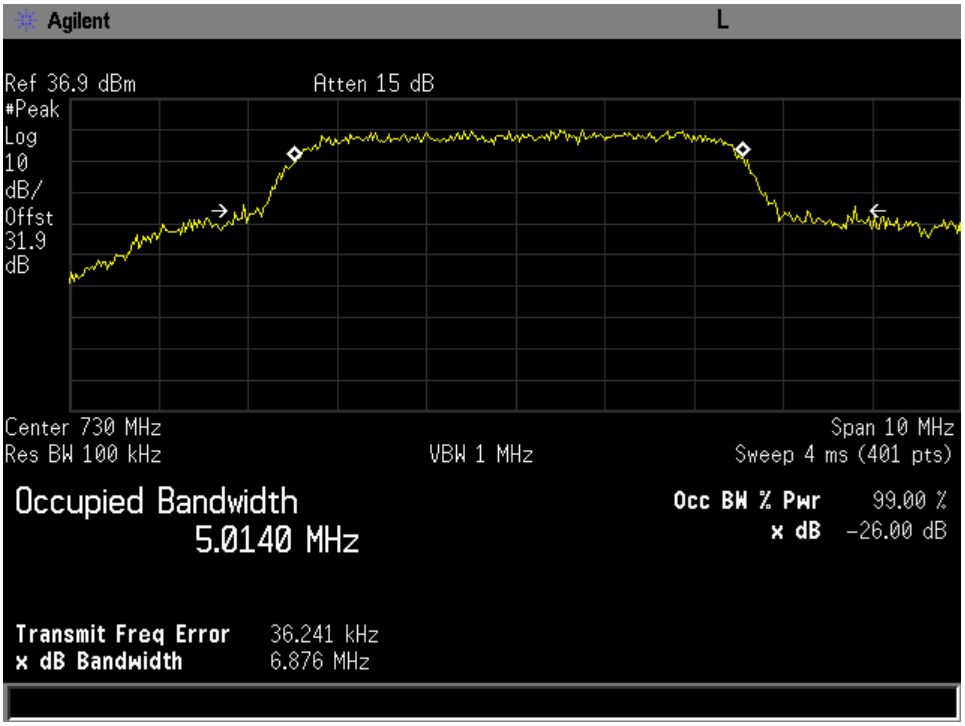
high ch GSM Mod out



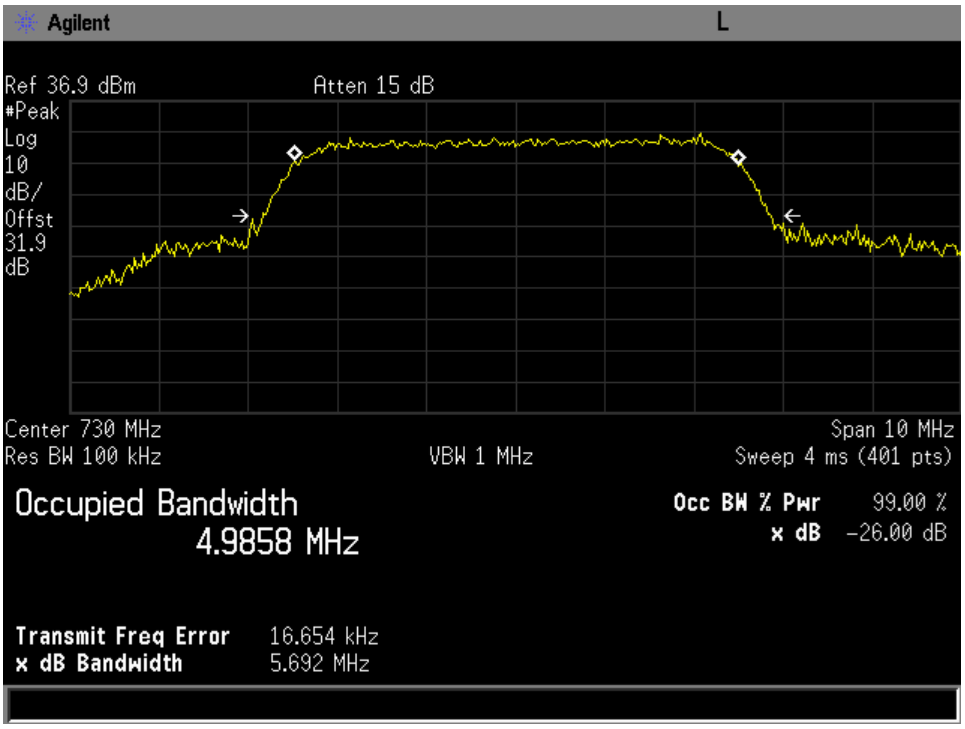
low ch AWGN Mod in



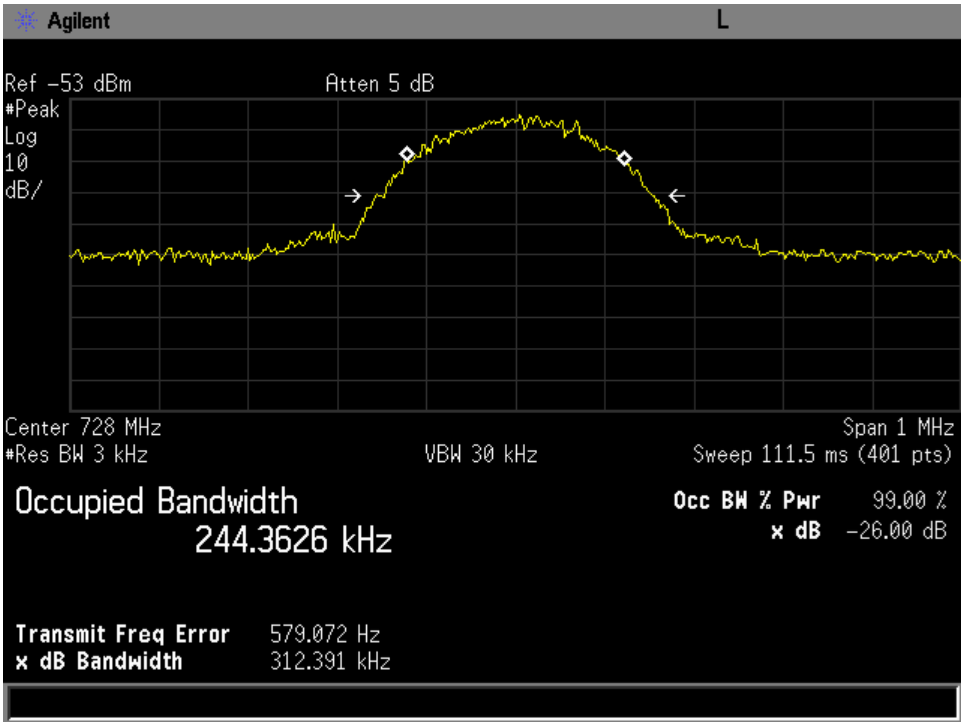
Low ch AWGN Mod out +3dB



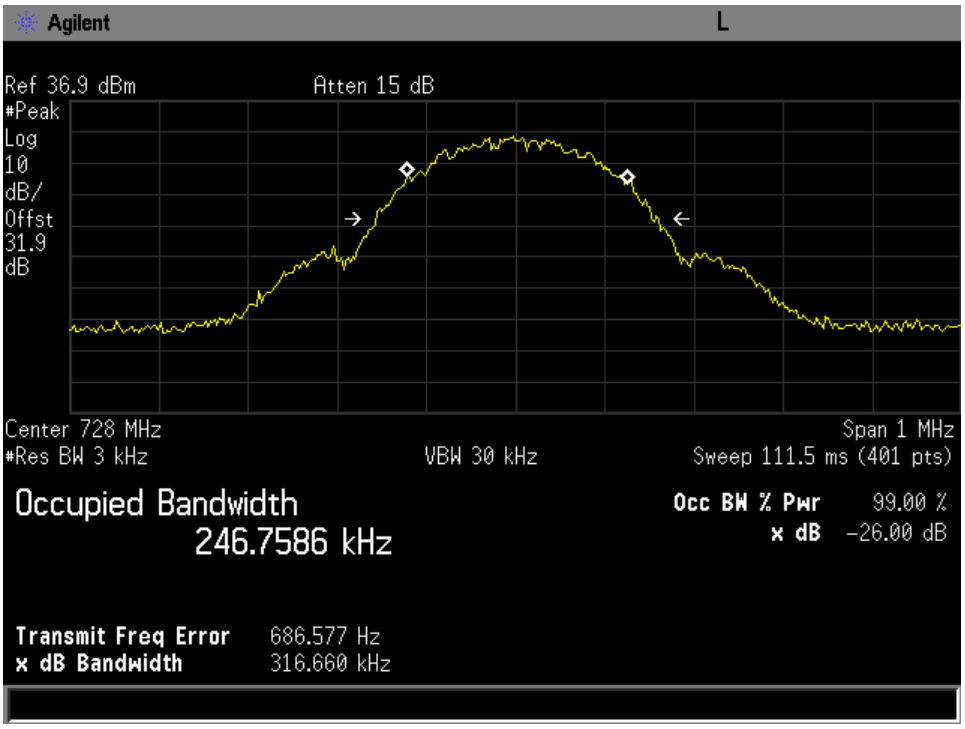
Low ch AWGN Mod out



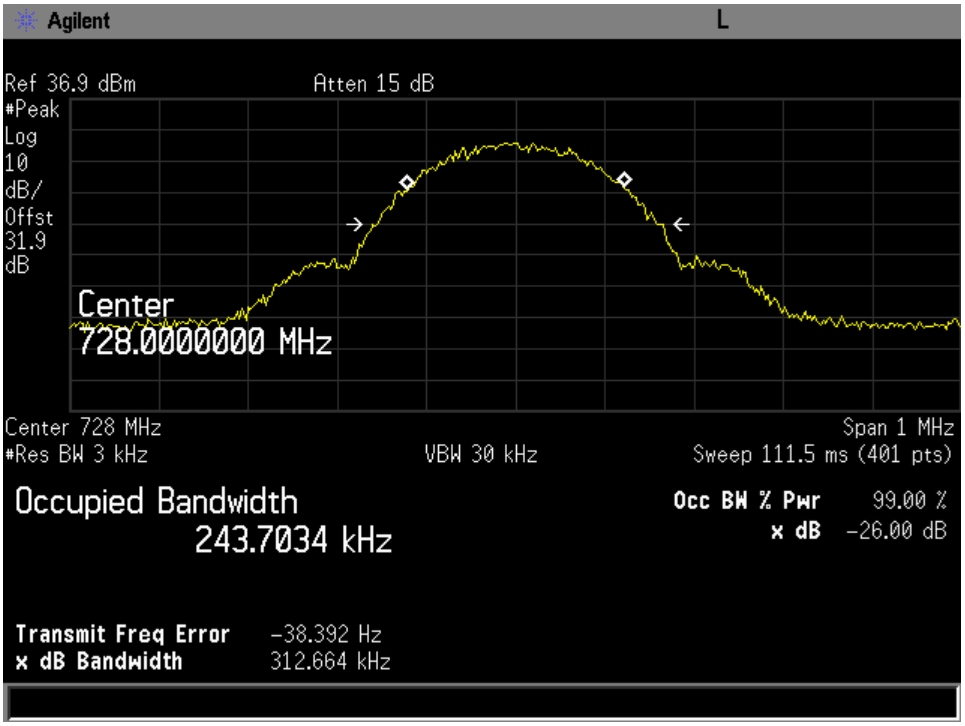
low ch GSM Mod in



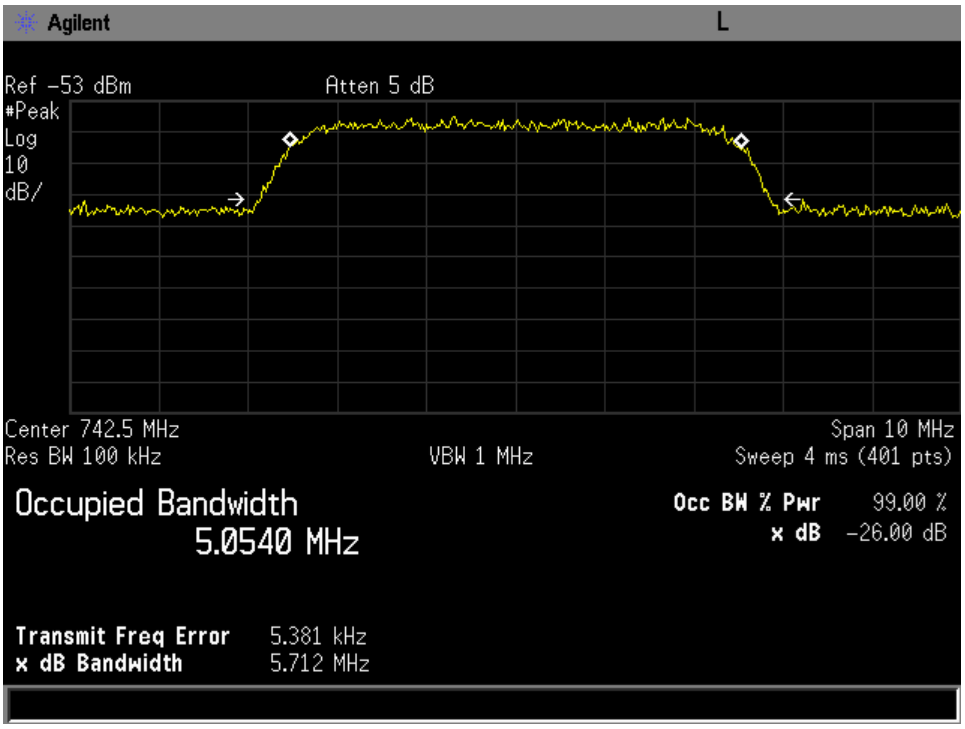
low ch GSM Mod out +3dB



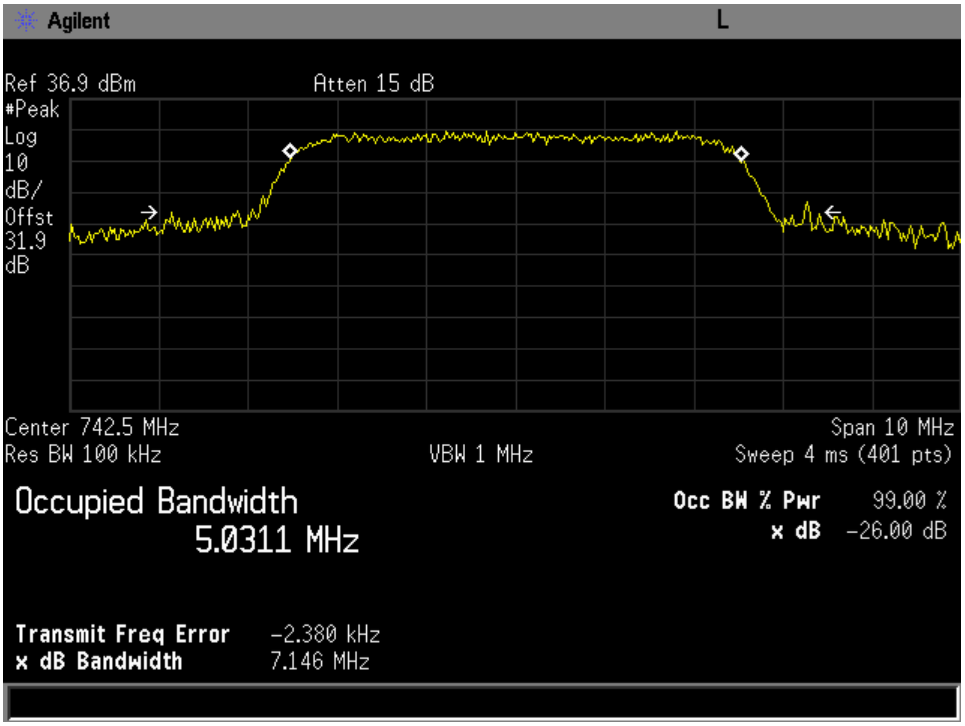
low ch GSM Mod out



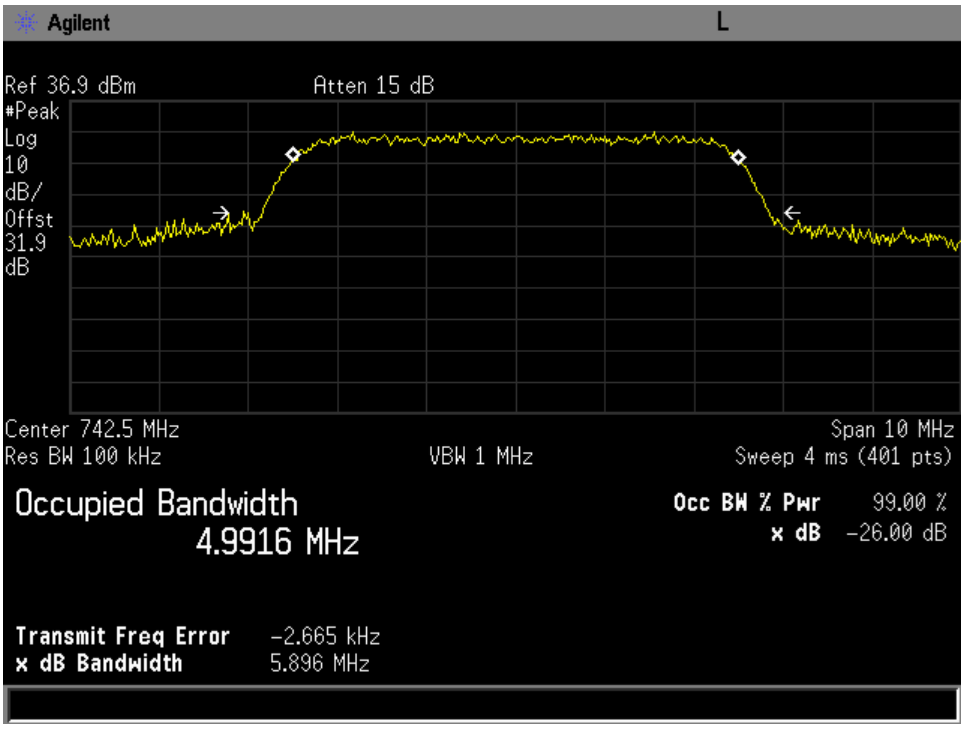
mid ch AWGN Mod in



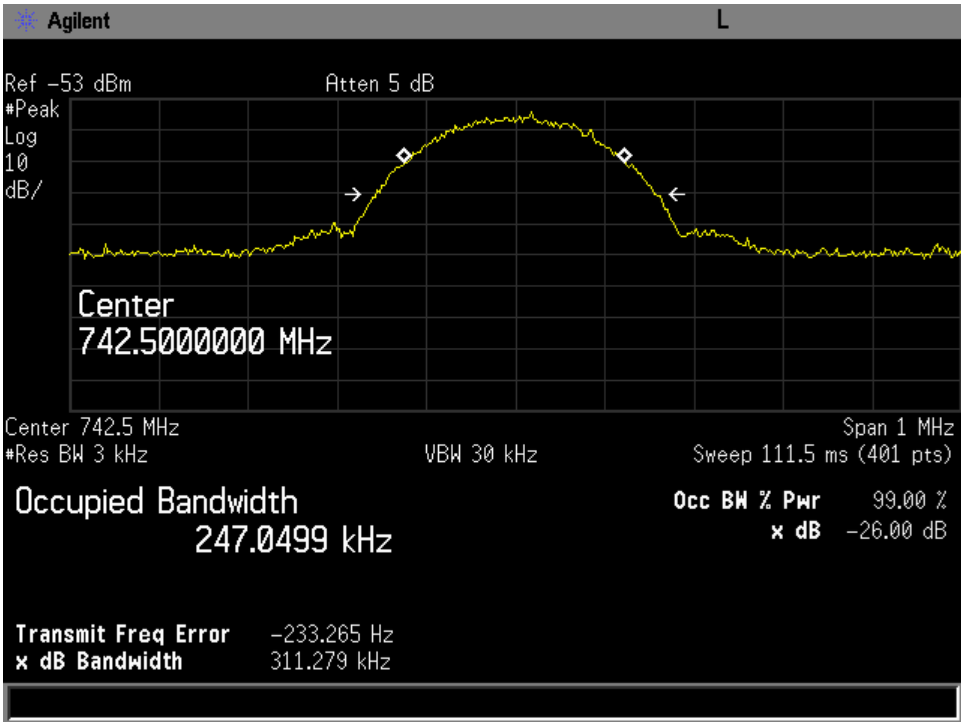
mid ch AWGN Mod out +3dB



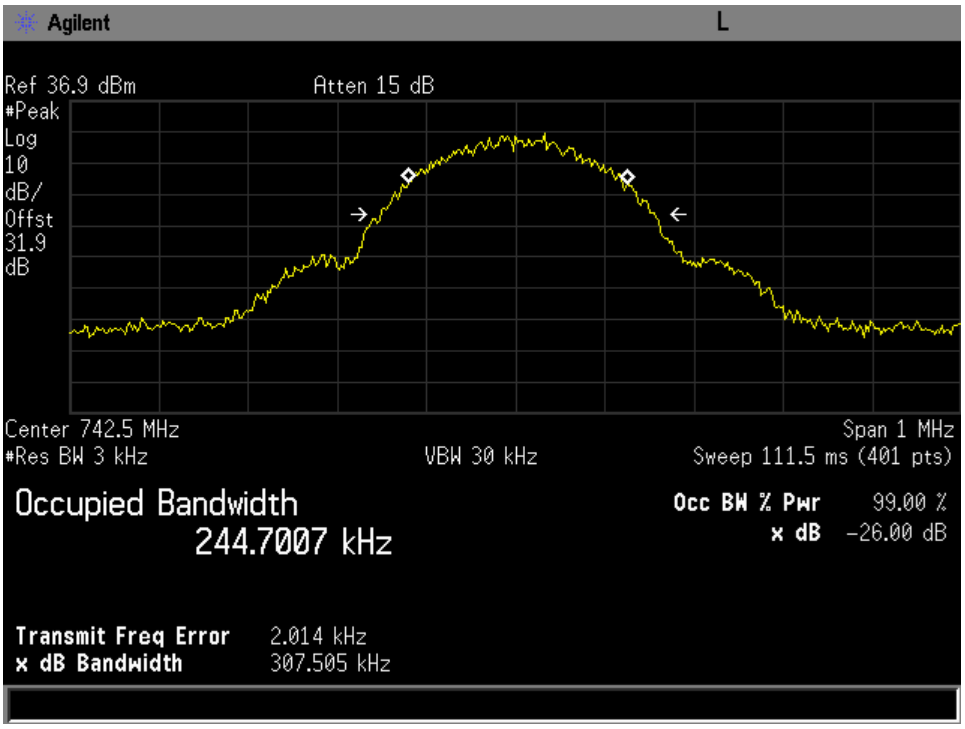
mid ch AWGN Mod out



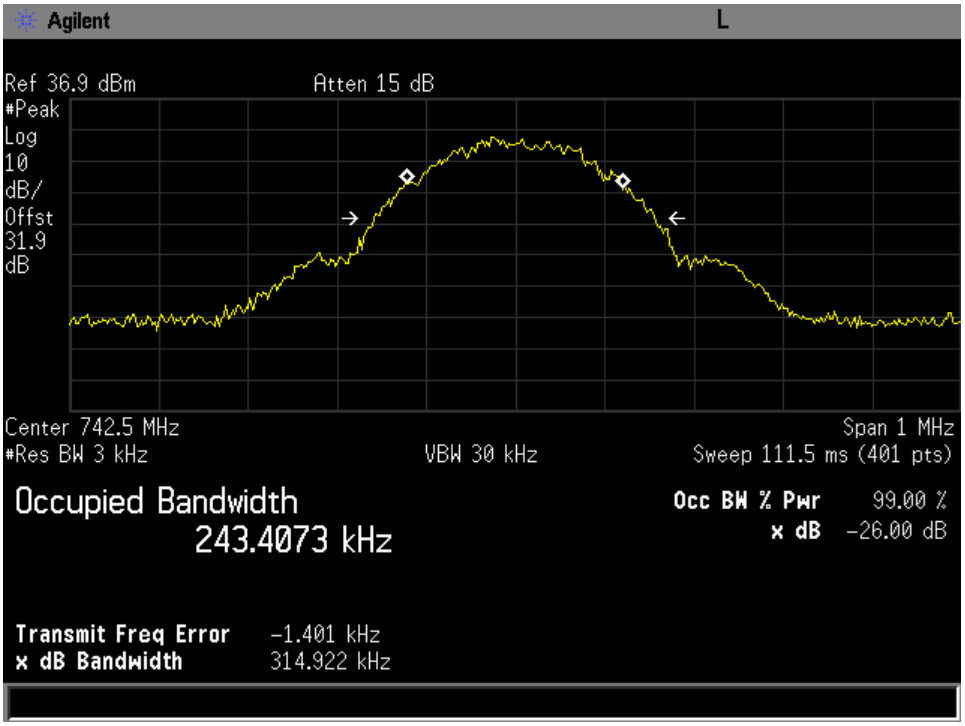
mid ch GSM Mod in



mid ch GSM Mod out +3dB



mid ch GSM Mod out



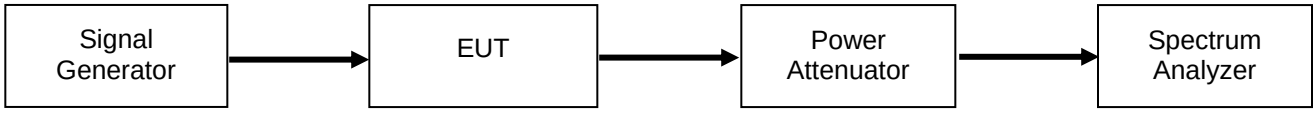
Mean Output and Amplifier Gain
Engineer: Shawn McMillen
Test Date: 2/26/2016

Test Procedure

A signal generator was connected to the input of the EUT. A spectrum analyzer was connected to the EUT in order to monitor the output power levels. The Signal Generator was configured to produce the necessary broadband and narrow band signals. The input power level was increase in 1 dB increments until the power no longer increased. The input and output levels were recorded in the table below. The amplifier gain was determined from the delta between the input and output levels.

Spectrum Analyzer settings
Power Channel integration
RBW = 1-5% of EBW
Video BW = 3x RBW

Test Setup



Downlink Output Power and Gain

728-757 MHz Band
GSM

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Output Power +3dB (dBm)	Gain (dB)
728	-49.1	33.12	33.13	82.22
742.5	-49.8	32.3	32.32	82.1
757	-50.01	32.33	32.33	82.41

728-757 MHz Band
AWGN

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Output Power +3dB (dBm)	Gain (dB)
728	-49.0	33.02	33.12	82.02
742.5	-50.0	32.12	32.12	83.12
757	-50.0	32.33	32.30	82.3

Out-Of-Band/Block Emission (Dual Carrier)
Engineer: Shawn McMillen
Test Date: 2/26/2016

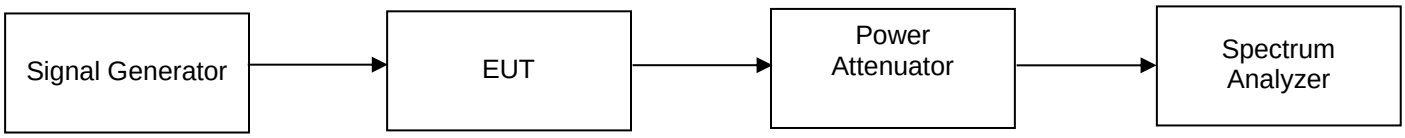
Test Procedure

A signal generator to the input of the EUT which was configured to produce two modulated AWGN carriers simultaneously. The center frequencies used were determined by the 3GPP standards and set to the lowest band edge and then to the highest band edge of each applicable band. The input power level was set to just below the AGC threshold but not more than 0.5dB. The composite power can be measured using the procedures provided in KDB 971168.

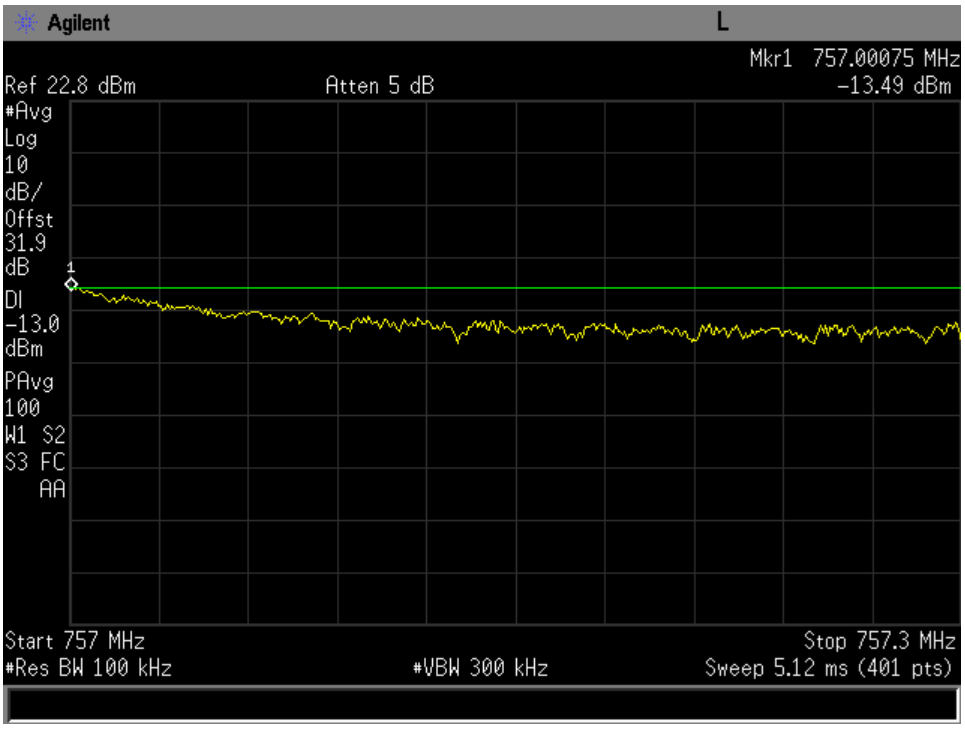
The spectrum analyzer was set with the following parameters
RBW = 1 % of the emission bandwidth, 100 kHz, or 1 MHz
VBW = 3 × RBW
Average power detector
Sweep time = auto-couple
Trace average at least 100 traces in power averaging

Start frequency was set to the upper block edge frequency and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz for frequencies below and above 1 GHz, respectively. The traces were captured and recorded. The input level was increased by 3dB and recorded again. This was repeated for all carriers being used with the EUT. The stop frequency was then set to the lower block edge and the start frequency set to 300 kHz or 3 MHz for frequencies below and above 1 GHz respectively. This was repeated for all carriers being used with the EUT. This was applied to all bands being used with the EUT.

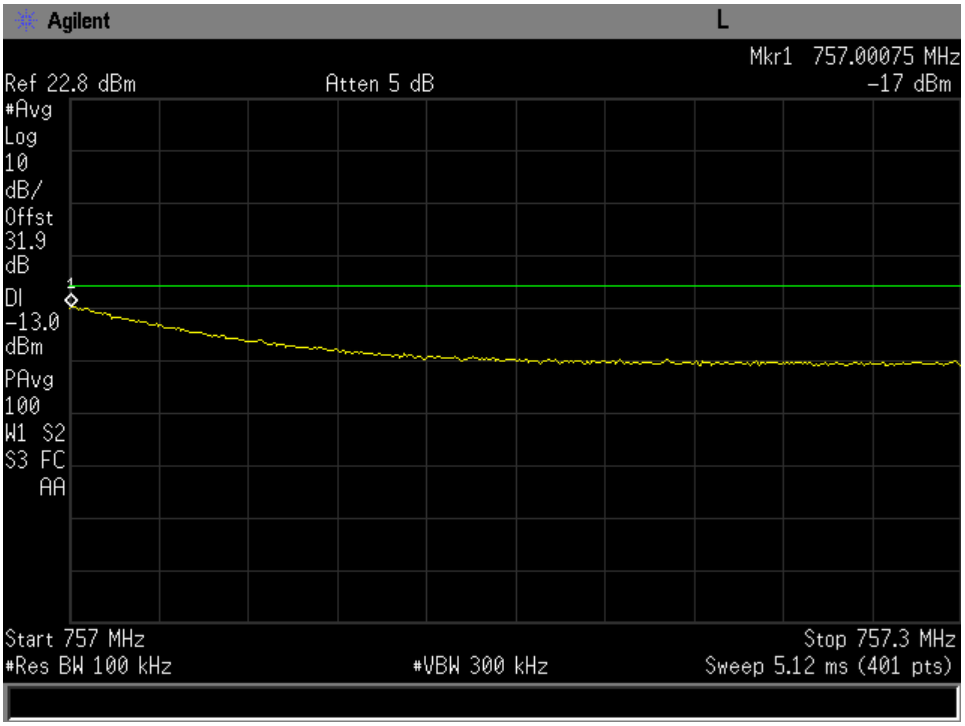
Test Setup



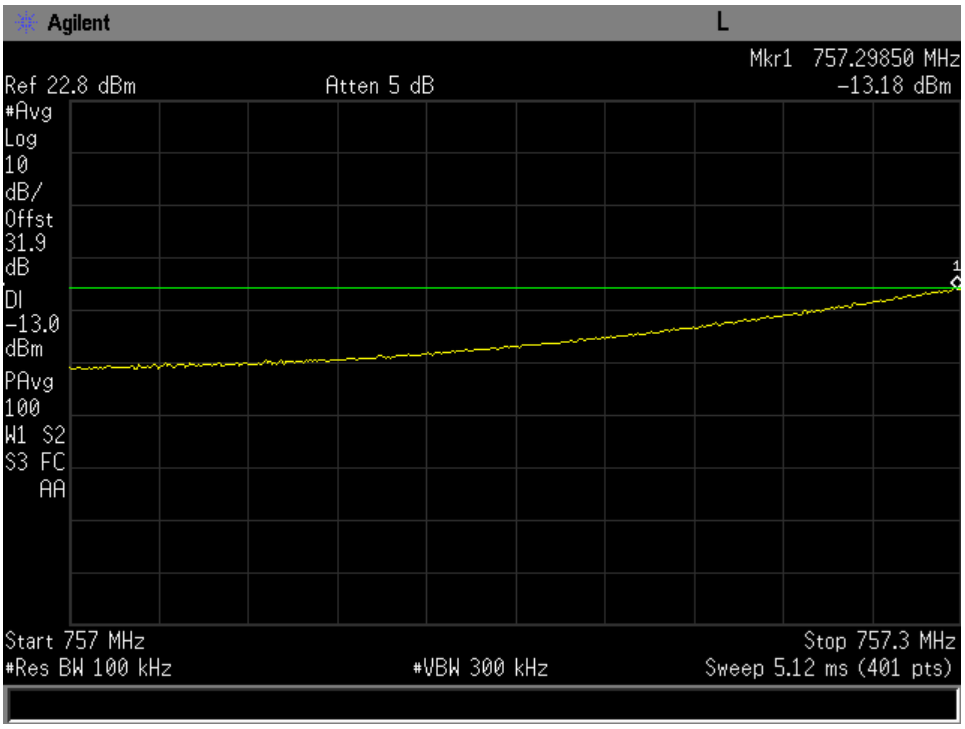
high band edge AWGN +3dB



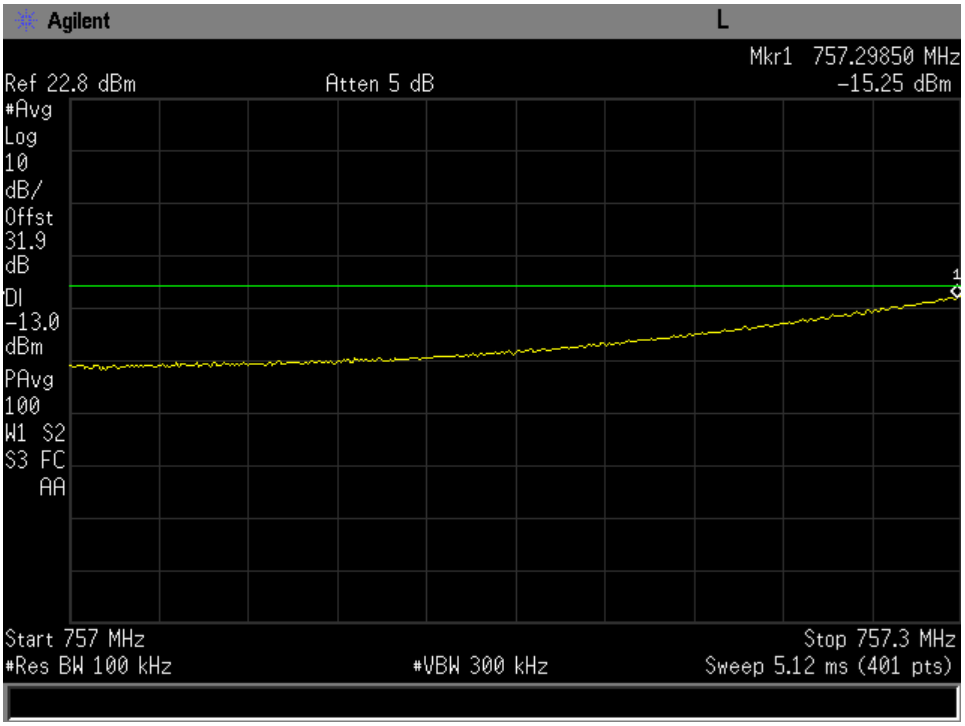
high band edge AWGN



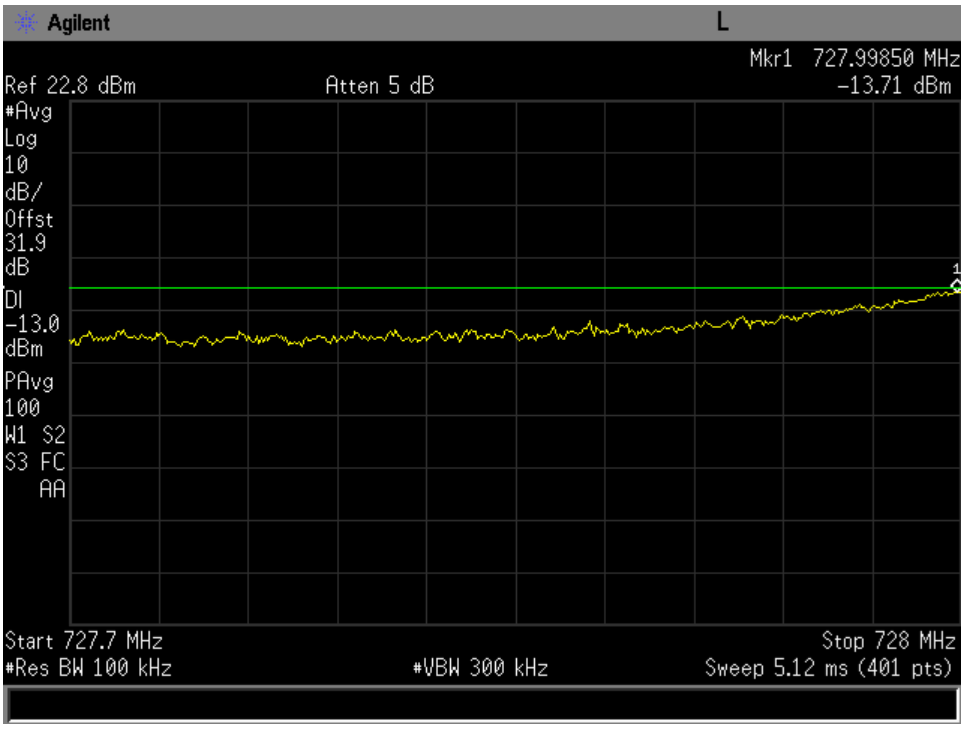
high band edge GSM +3dB



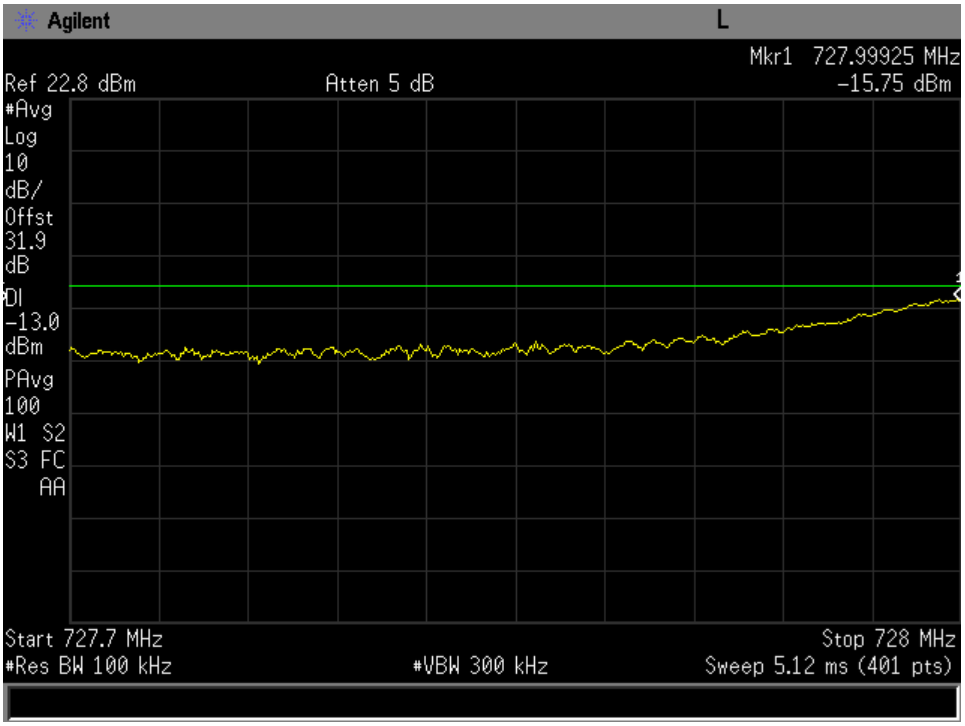
high band edge GSM



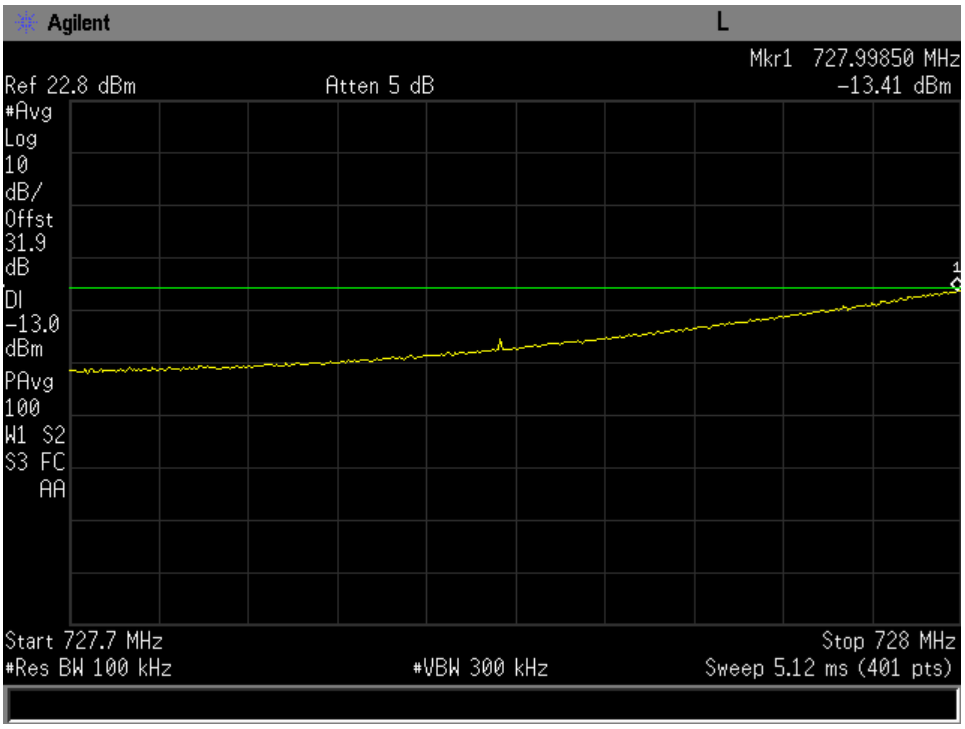
low band edge AWGN +3dB



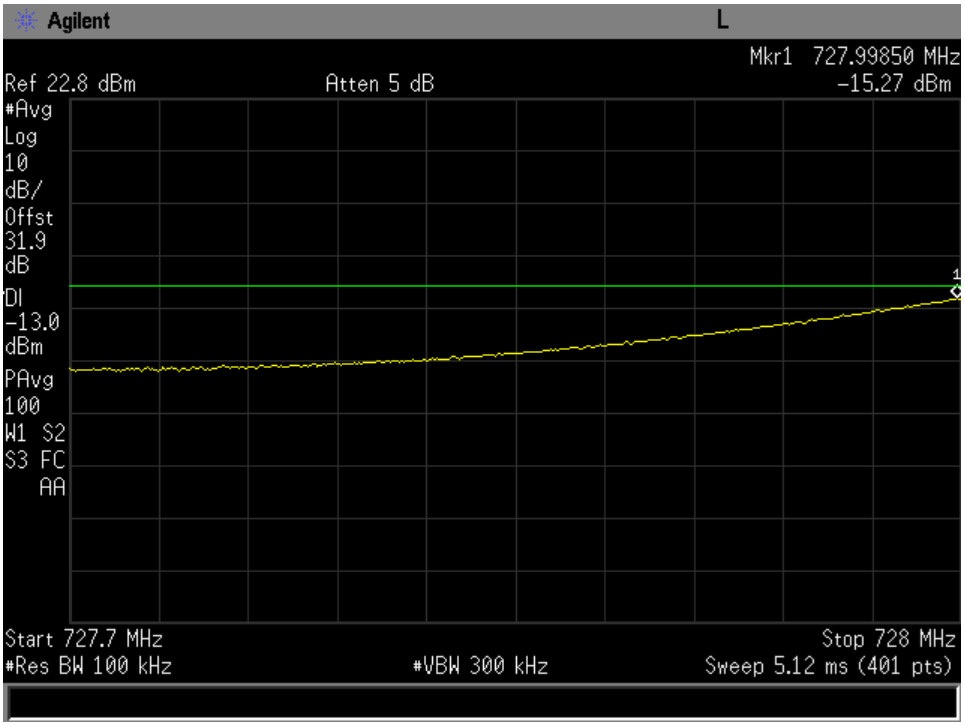
low band edge AWGN



low band edge GSM +3dB



low band edge GSM



Out-Of-Band/Block Emission (Single Carrier)
Engineer: Shawn McMillen
Test Date: 2/26/2016

Test Procedure

A signal generator was connected to the input of the EUT which was configured to produce one modulated AWGN carrier. The center frequencies was set to the lowest available frequency within the band and then to the highest possible frequency in the band. The input power level was set to just below the AGC threshold but not more than 0.5dB.

The spectrum analyzer was set with the following parameters:

RBW = 1 % of the emission bandwidth, 100 kHz, or 1 MHz
VBW = 3 × RBW.
Detector to power averaging (rms)
Sweep time = auto-couple
Number of points ≥ (2 × span/RBW)
Trace average at least 10 traces in power averaging mode

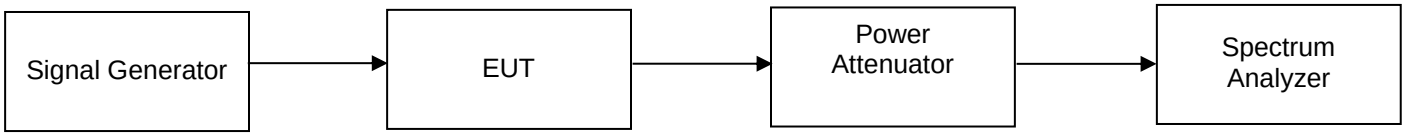
The start frequency was set to the lowest radio frequency signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part.

The start frequency was set to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part and the analyzer stop frequency to 10 times the highest frequency of the fundamental emission

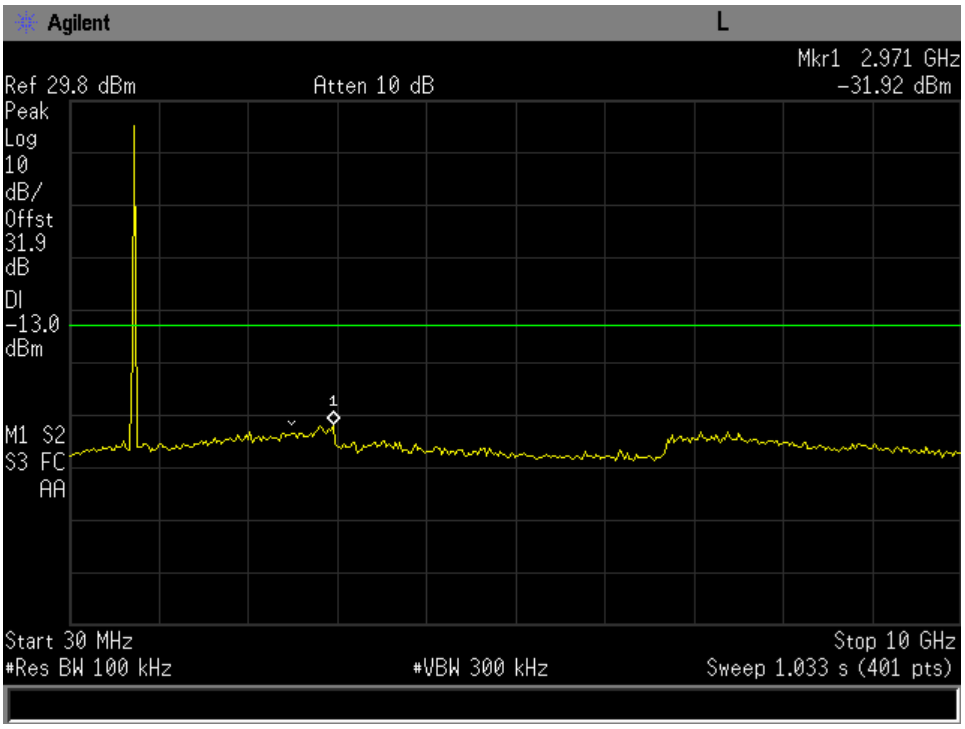
All carriers and bands being used with the EUT were investigated.

The traces were captured and recorded.

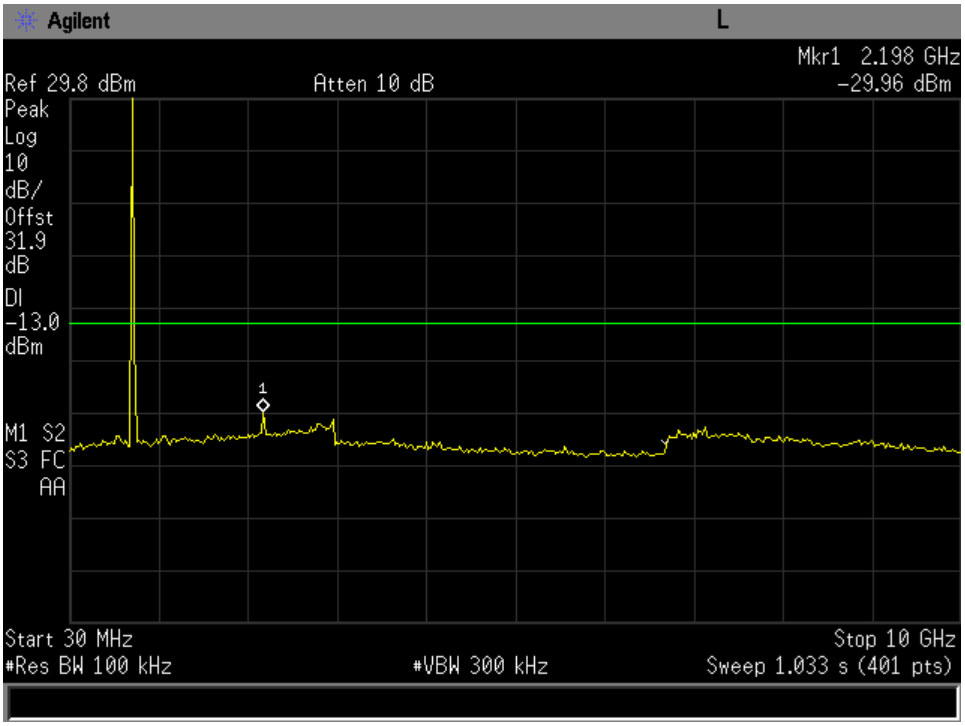
Test Setup



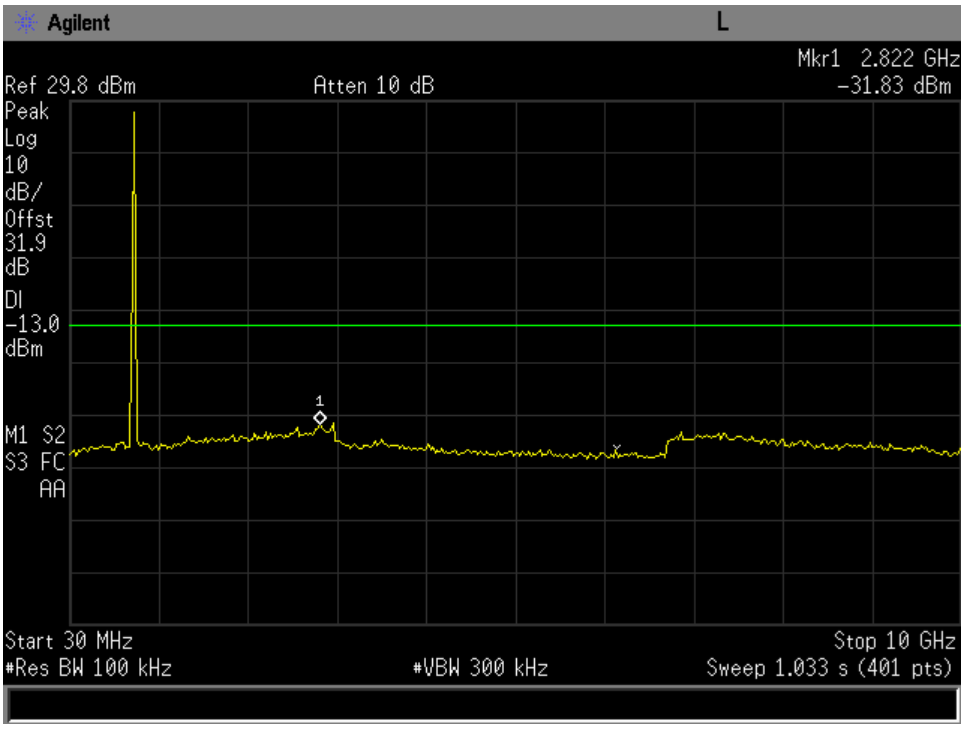
high ch 30-10000MHz



Low ch 30-10000MHz



mid ch 30-10000MHz



Conducted Spurious Emissions
Engineer: Greg Corbin
Test Date: 12/2/2016

Test Procedure

The conducted spurious test data in this section of the test report is to cover the additional requirements of the FCC rules Part 27.53(c) and 27.53(f).

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

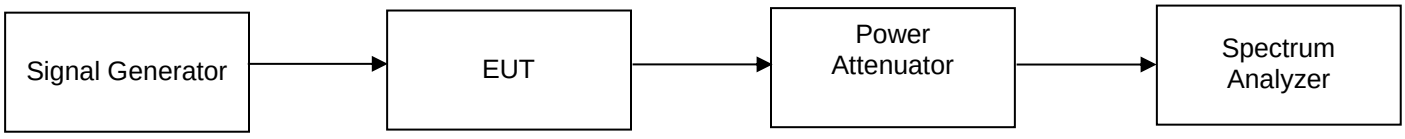
FCC 27.53(c)
For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(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;

A CW signal was at the center frequency of the passband was injected into the RF input. The input level was set to be 0.2 dB below the AGC threshold. The output was measured across the required Spurious Frequency range listed in the table below.
Only the downlink was recorded as the uplink is a direct connection to a base station and does not radiate.

RBW = 6.25 kHz

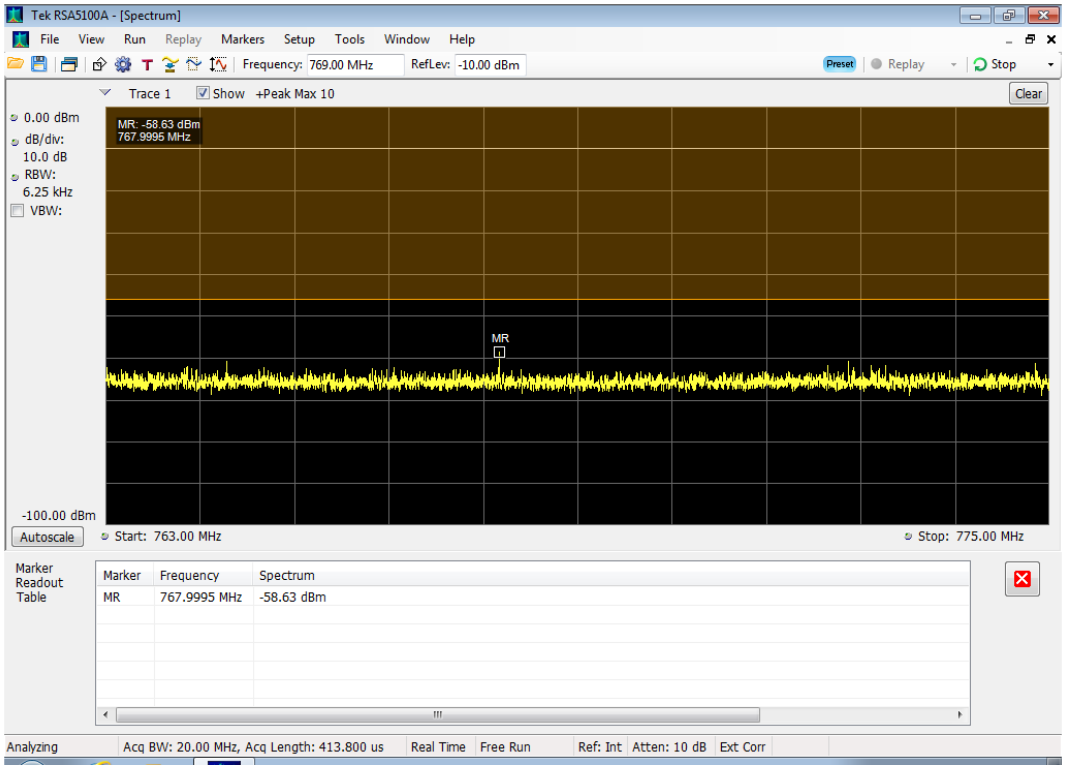
Test Setup



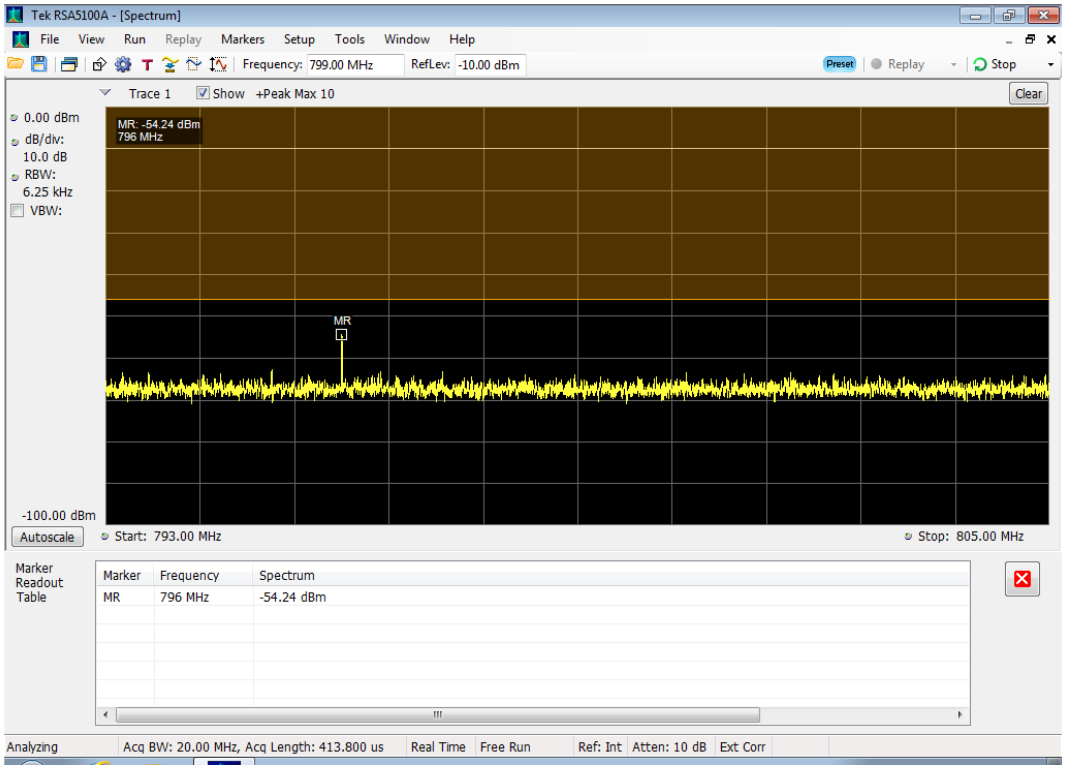
746 - 757 MHz Downlink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	767.9995	-58.6	-46	-12.6
793 – 805	796	-54.2	-46	-8.2

763 – 775 MHz



793 – 805 MHz



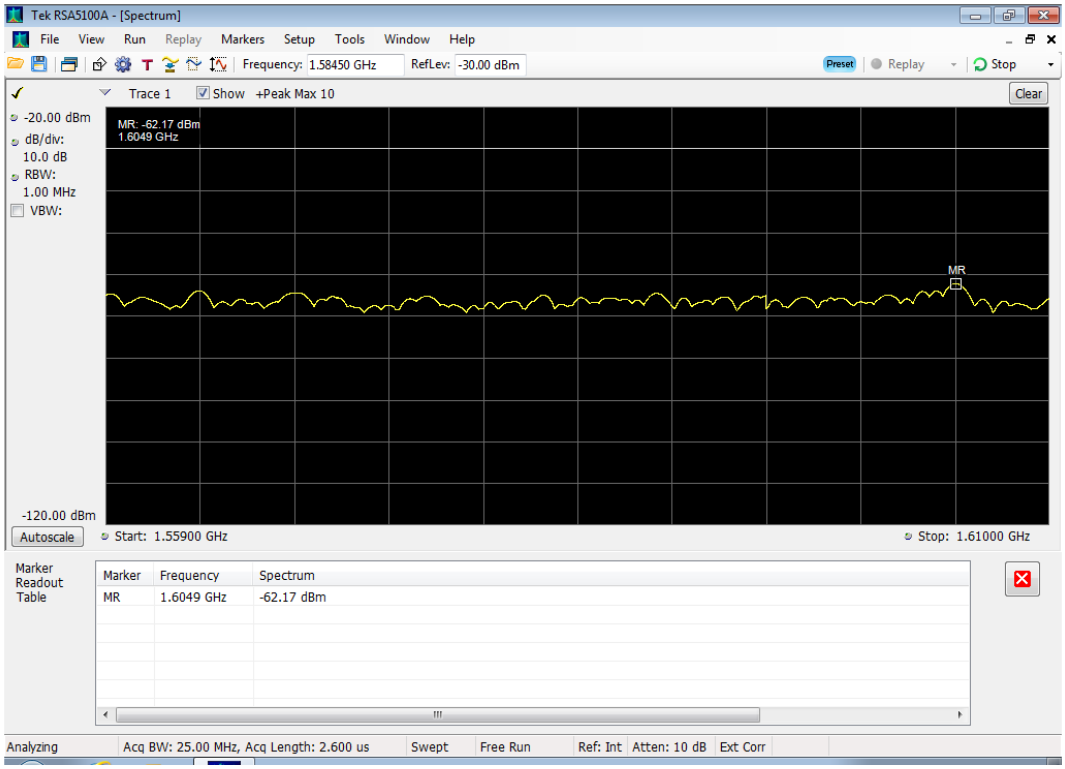
FCC 27.53(f)
For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose 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.

The antenna gain was obtained from the user manual.

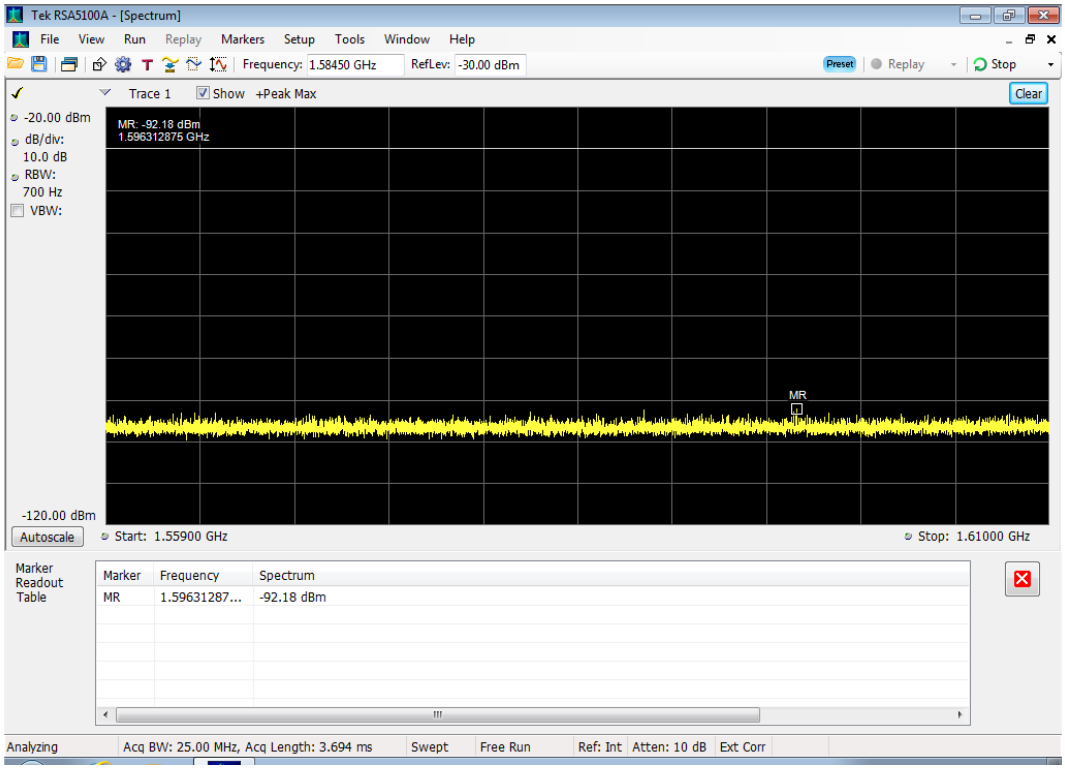
746 - 757 MHz Downlink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	RBW	Gain/Loss from Antenna Kitting Information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Wideband)	1604.9	-62.2	1 MHz	5.5	-57.2	-40	-17.2
1559 – 1610 (Narrowband)	1596.3	-92.2	700 Hz	5.5	-87.2	-50	-37.2

1559 – 1610 MHz _ RBW = 1 MHz



1559 – 1610 MHz _ RBW = 700 Hz



Radiated Spurious Emissions
Engineer: Shawn McMillen
Test Date: 2/25/2016

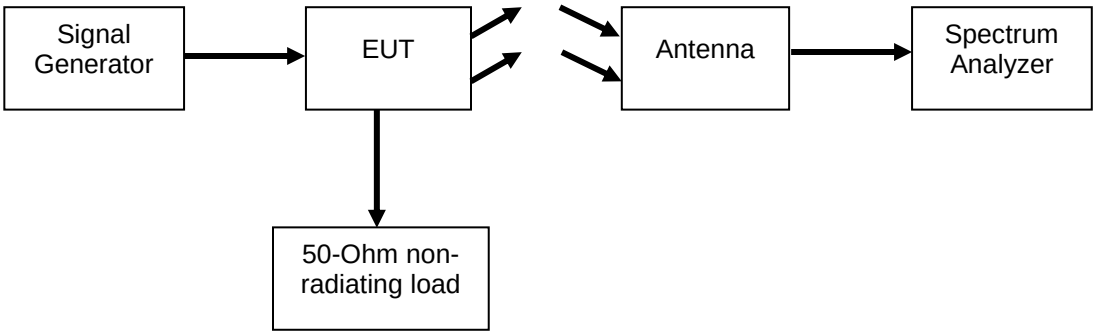
Test Procedure

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. The EUT output was terminated into a 50 Ohm non-radiating load.

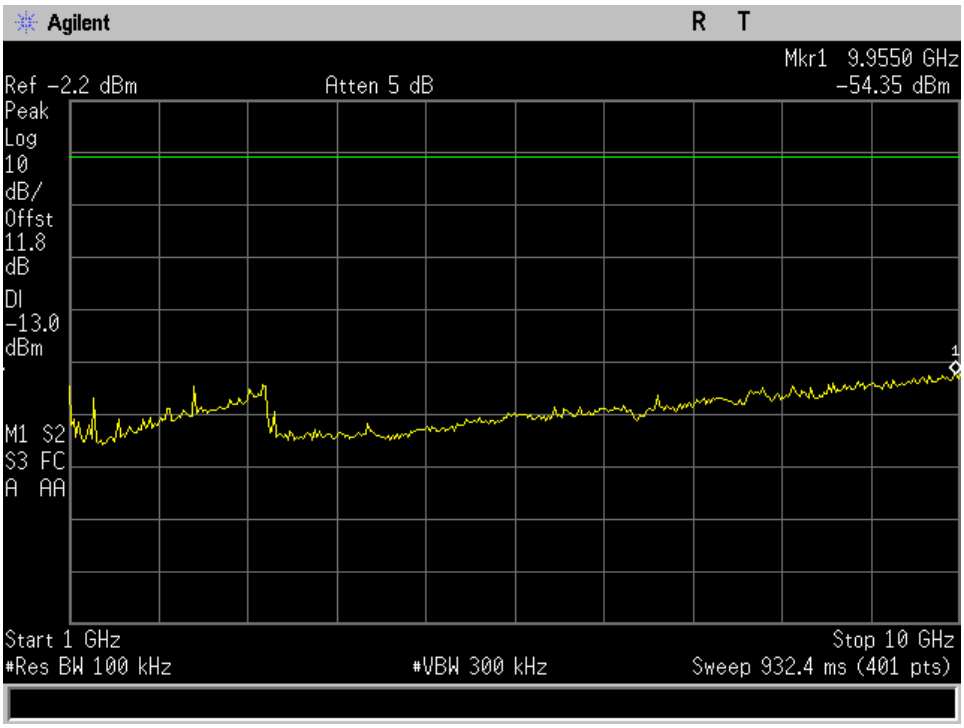
The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz.
The VBW was set to 3 times the RBW.

The following formula was used for calculating the limits:
Radiated Spurious Emissions Limit = P1 – (43+ 10Log(P2)) = -13dBm

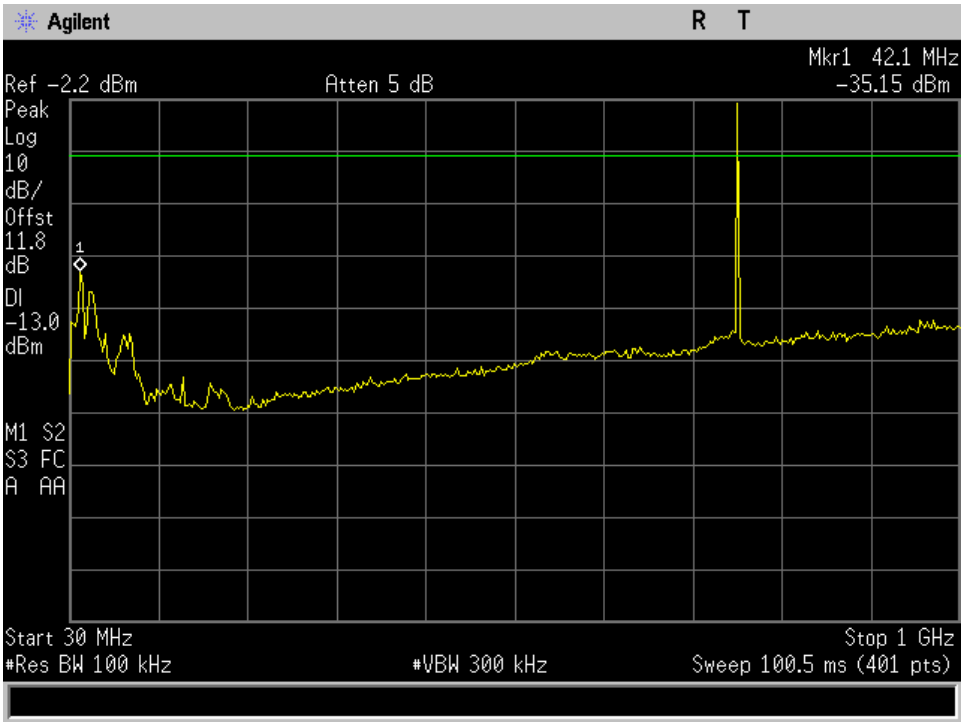
Test Setup



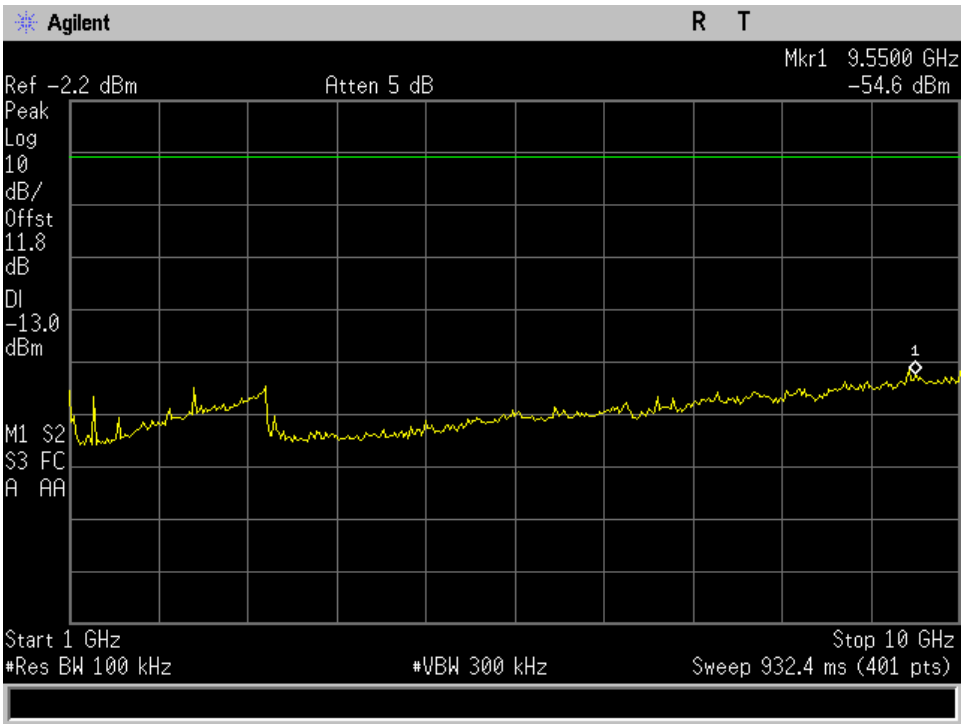
high ch 1-10GHz



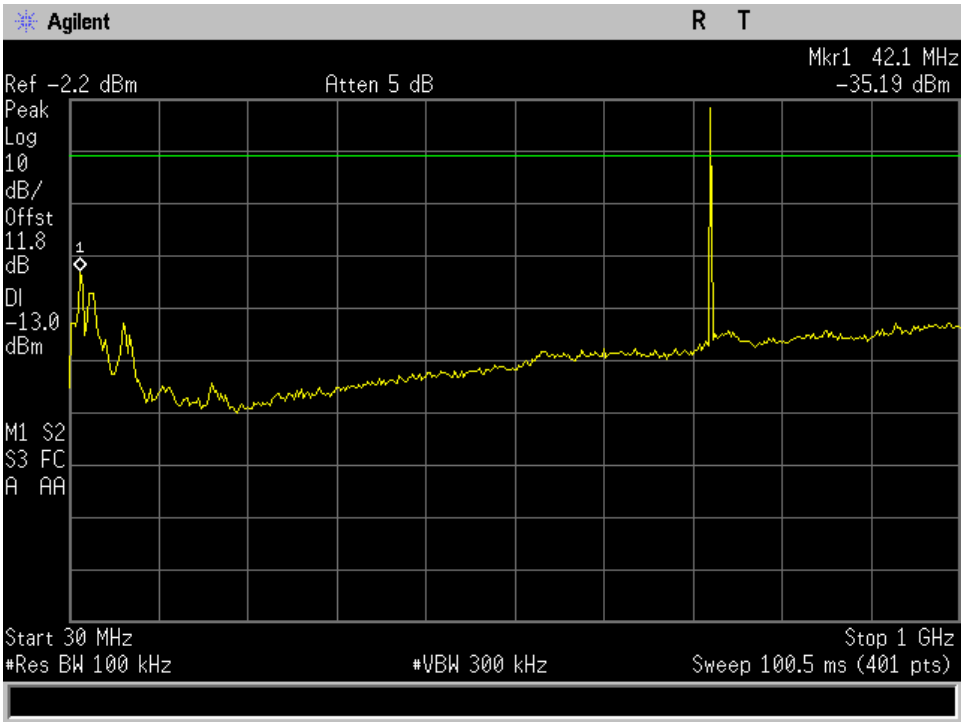
high ch 30-1000MHz



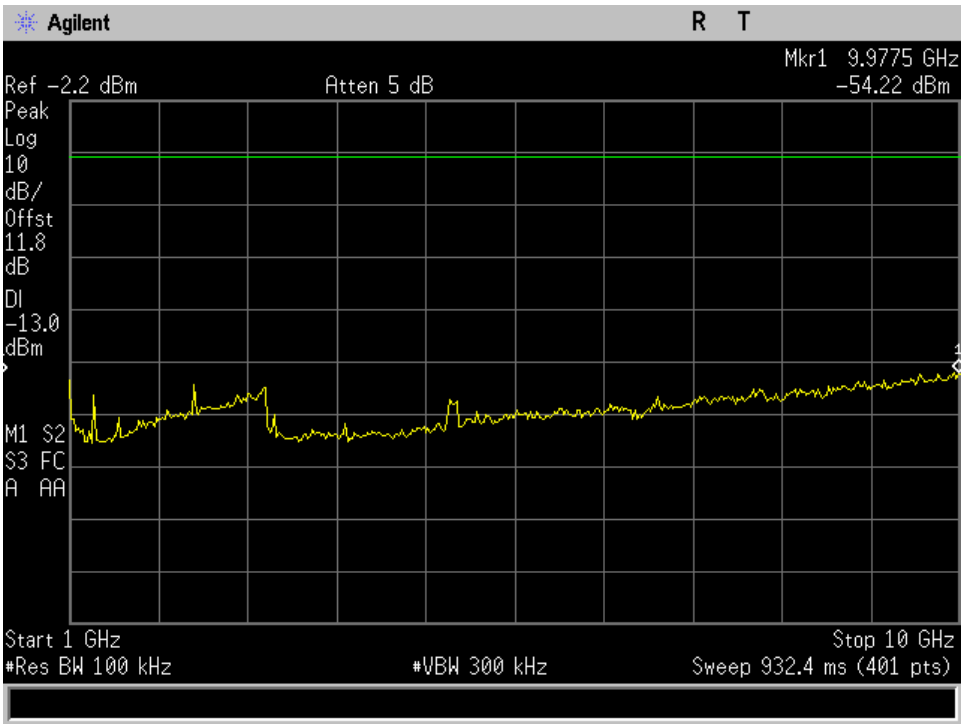
low ch 1-10GHz



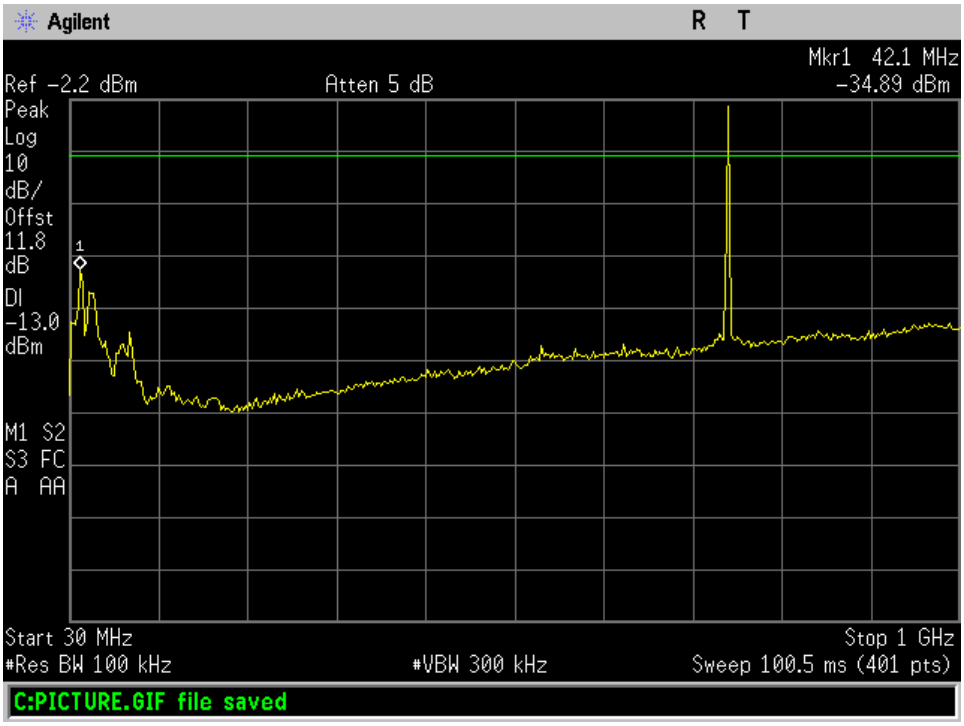
low ch 30-1000MHz



mid ch 1-10GHz



mid ch 30-1000MHz



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
Bilog Antenna	Teseq	CBL 6111Dk	i00349	10/8/15	10/8/16
EMI Analyzer	Agilent	E7405A	i00379	2/5/15	2/10/16
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	11/26/13	11/26/16
Horn Antenna	ETS Lindgren	3115	i00273	05/08/14	05/08/16
Horn Antenna	ETS Lindgren	3116	i00085	01/29/15	01/29/17
Signal Generator	Agilent	E4438C	I00457	09/26/14	09/26/16
Spectrum Analyzer	Agilent	E4407B	I00331	09/18/15	09/18/16

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.

END OF TEST REPORT