Compliance Testing, LLC
Previously Flom Test Lab
EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268
fax: (480) 926-3598
http://www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: Bird Technologies

Model: 3-25999-XX

Description: 800MHz Public Safety/CMRS Class B Signal Booster Module

Serial Number: N/A

FCC ID: EZZ25999

To

FCC Part 20 (CMRS 90-S)

Date of Issue: October 24, 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**

Prepared By
Compliance Testing, LLC
1724 S. Nevada Way
Mesa, AZ 85204
(480) 926-3100 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p1680007

Alex Macon
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	August 17, 2016	Alex Macon	Original Document
2.0	October 13, 2016	Alex Macon	Added modular approval note on page 16
3.0	October 24, 2016	Alex Macon	Updated note on page 16 regarding radiated emissions testing

Table of Contents

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**

ACCREDITED
TESTING CERT
#2152.01

FCC Site Reg. #349717

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, 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)**
25.7 – 27.1	27.8 – 31.1	964.2 – 967.8

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

Model: 3-25999-XX
Description: 800MHz Public Safety/CMRS Class B Signal Booster Module
Firmware: N/A
Serial Number: N/A
Additional Information:
The EUT is classified as a Part 20 (CMRS 90-S) **Class B** industrial signal booster.

The EUT is a Bi-directional Amplifier that operates from 817 – 824 MHz (Mobile to Base) and 862 – 869 MHz (Base to Mobile).

System Power is 120 VAC @ 60 Hz. The device also has a selection for battery backup at 12 VDC

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

Frequency	Emission Designators
817 - 824 MHz 862 - 869 MHz	F3E, G1D, G1E, G7W

EUT Operation during Tests

The EUT was tested under normal operating conditions with the software attenuators set to 0 dB for all measurements.

30 dB, 50 watt attenuators were installed on both RF ports for all tests.

Accessories: None

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	AC Power Cable	2	N	N	N/A

Modifications: None

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
KDB 935210 D05	AGC Threshold	Pass	
KDB 935210 D05	Out-of-Band Rejection	Pass	
KDB 935210 D05	Input-Versus-Output Signal Comparison	Pass	
2.1046 KDB 935210 D05	Mean Output Power and Amplifier gain	Pass	
KDB 935210 D05	Out-Of-Band/Block Emissions Conducted	Pass	
2.1051 KDB 935210 D05	Spurious Emissions Conducted	Pass	
KDB 935210 D05	Frequency Stability	N/A	Does not have Frequency translation
2.1053 KDB 935210 D05	Spurious Emissions Radiated	Pass	

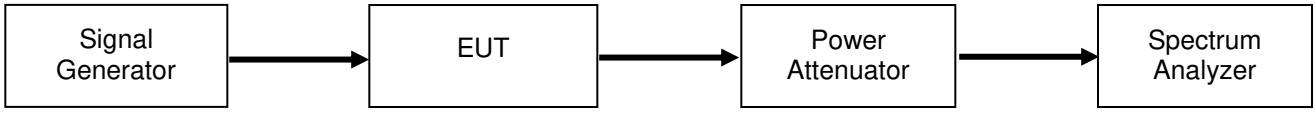
AGC Threshold
Engineer: Alex Macon
Test Date: 8/9/16

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



Downlink

Tuned Frequency (MHz)	AGC Threshold (dBm)	
	AWGN	GSM
865.5	-45.42	-44.85

Uplink

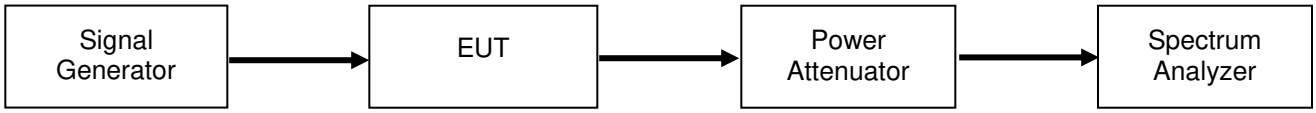
Tuned Frequency (MHz)	AGC Threshold (dBm)	
	AWGN	GSM
820.5	-44.01	-43.72

Out-Of-Band Rejection
Engineer: Alex Macon
Test Date: 8/9/16

Test Procedure

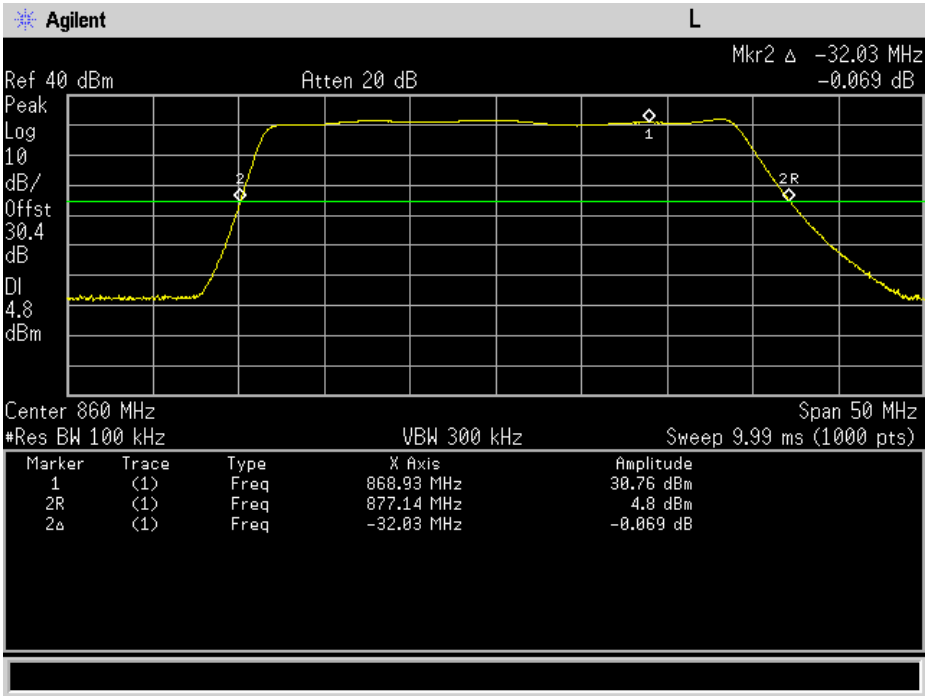
The EUT was connected to a spectrum analyzer through a 30 dB power attenuator. A signal generator was utilized to produce a swept CW signal with the RF input level set to 3 dB below the AGC Threshold level. The Uplink and Downlink filter response and the -20 dB bandwidth were measured. The marker table function of the spectrum analyzer was used to show the peak amplitude in the passband and the -20 dB bandwidth of the pass band filter.
RBW = 100 KHz
Video BW = 3x RBW

Test Setup

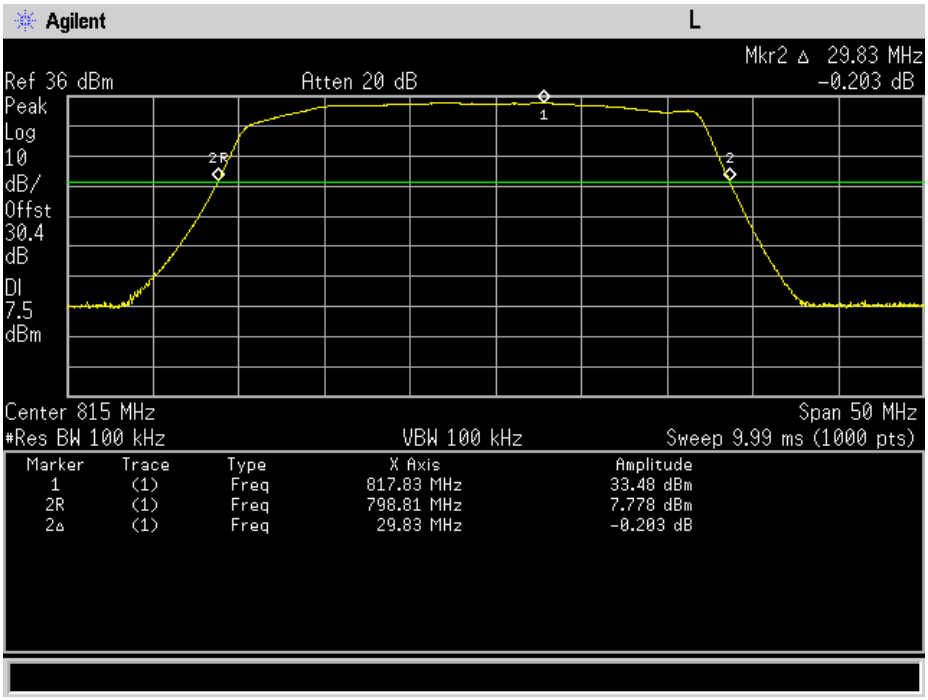


Frequency Band (MHz)	f_0 (MHz)	Band Pass Width (MHz)
817 - 824	817.83	29.83
862 - 869	868.93	32.03

Downlink Band



Uplink Band



Input-Versus-Output Signal Comparison
Engineer: Alex Macon
Test Date: 8/9/16

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.

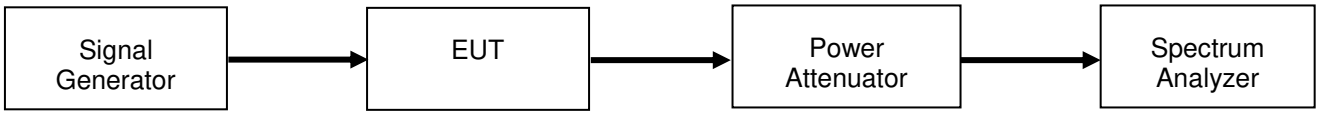
Spectrum analyzer setting:

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.

The test was repeated with the input power set to 3 dB above the AGC Threshold.
The test was repeated with a GSM narrowband signal.

Test Setup



Refer to Annex A for Input vs Output plots.

Mean Output and Amplifier Gain
Engineer: Alex Macon
Test Date: 8/9/16

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.

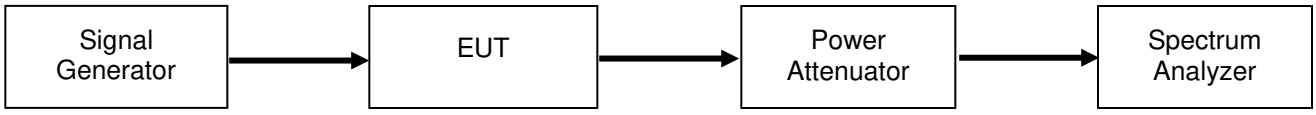
The input and output levels were recorded in the table below.

The amplifier gain was determined from the delta between the input and output levels.

The input power was increased 3 dB and the output level was recorded.

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

Test Setup



Output Power and Gain

Frequency Band (MHz)	Modulation	Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)	Output Power (dBm) (Pin + 3 dB)
817 - 824	AWGN	817.83	-44.21	33.26	77.47	33.18
817 - 824	GSM	817.83	-43.92	36.18	80.10	36.31
862 - 869	AWGN	868.93	-45.62	31.31	76.93	31.25
862 - 869	GSM	868.93	-45.05	34.42	79.47	34.12

Out-Of-Band/Block Emission
Engineer: Alex Macon
Test Date: 8/9/16

Test Procedure

A signal generator connected to the input of the EUT was configured to produce two modulated carriers simultaneously. The center frequencies used were 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 was measured using the procedures provided in KDB 971168.

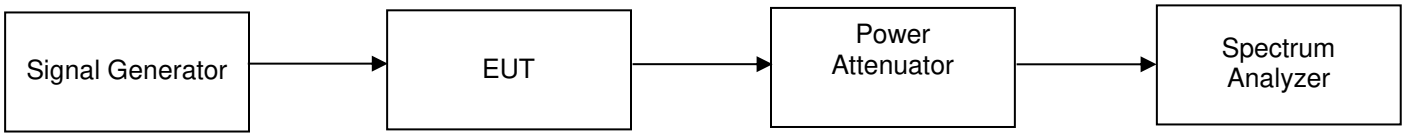
A CDMA test signal was used in place of the AWGN test signal in order to fit 2 carriers in the passband.
The CDMA test frequencies were set at 0.8 and 2.64 MHz from the band edge.
The signal amplitudes were set to equal levels using signal generator offsets.
The signal level inputs were increased until the EUT output stopped increasing.
The lower and upper band edges were recorded per KDB 935210 D05 v01.
The input power was increased 3 dB and the lower and upper band edges were recorded again.

The test was repeated with 2 GSM test signals.

The test was repeated using a single carrier test signal per KDB 935210 D05 v01.

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

Test Setup



Refer to Annex B for Out of Band/Block emission plots (dual Carrier)

Conducted Spurious Emissions
Engineer: Alex Macon
Test Date: 8/9/10

Test Procedure

A signal generator was connected to the input of the EUT and 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 = 100 kHz < 1 GHz, 1 MHz > 1 GHz
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

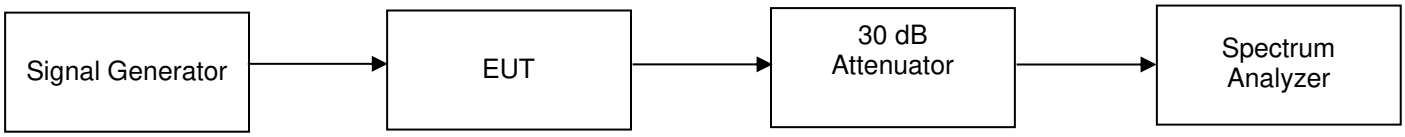
All carriers and bands being used with the EUT were investigated.

The traces were captured and recorded.

The following formula was used for calculating the limits.

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

Test Setup



Refer to Annex C for the Conducted Spurious Emissions Plots

Radiated Spurious Emissions
Engineer: Alex Macon
Test Date: 8/9/16

Test Procedure

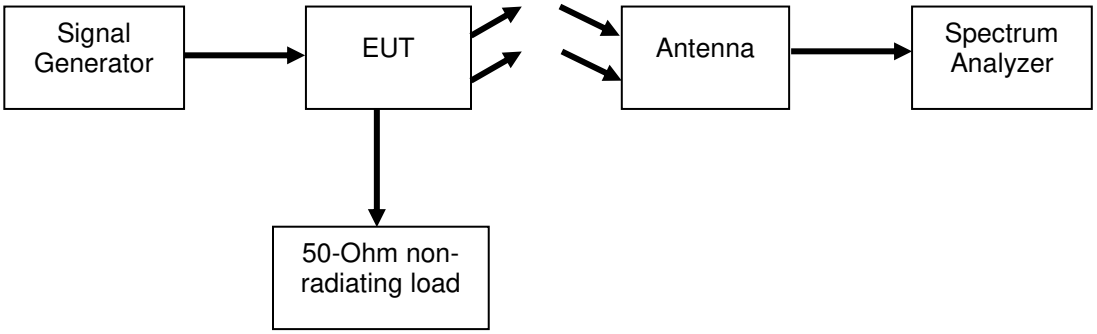
The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation 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 EUT was tested outside of the host in order to ascertain the worst case emissions.

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



Refer to Annex D for Radiated Spurious Emission plots

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Bi-Log Antenna	Schaffner	CBL611C	i00267	3/1/16	3/1/18
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	5/26/16	5/26/17
Spectrum Analyzer	Agilent	E4407B	i00331	9/18/15	9/18/16
EMI Analyzer	Agilent	E7405A	i00379	2/11/16	2/11/17
*3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/27/14	7/27/16
Noise Figure Meter	HP	8970B	i00444	8/13/15	8/13/17
Noise Source	HP	346A	i00445	8/13/15	8/13/17
Signal Generator	Agilent	E4438C	i00457	9/26/15	9/26/16
Signal Generator	Agilent	E4437B	i00489	3/18/16	3/18/17

*30-day cal extension with lab manager's approval

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