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: Crescend Technologies LLC

Model: P25 Series 900MHz

Description: 928-942 MHz 250W Amplifier

Serial Number: 180886798

FCC ID: CWWP25XXL3

To

FCC Part 22
FCC Part 24
FCC Part 90-S

Date of Issue: May 14, 2019

On the behalf of the applicant:	**Crescend Technologies LLC** **140 East State Parkway** **Schaumburg, IL 60173**
Attention of:	**Jack Fischler, Program Manager** **Phone: 847-908-5400** **Email: jfischler@crescendtech.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: p1880019

Greg Corbin
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	April 19, 2019	Greg Corbin	Original Document
2.0	May 14, 2019	Greg Corbin	Added reference to rule section part 22E to table on page 5, Added reference to 90.635 and 90.669 to test summary table on page 7.

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**

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

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 v01r03, ANSI C63.26-2015FCC Part 2, Part 20.21, Part 22, Part 24, Part 90-S 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)**
21.9 – 25.3	28.4 – 40.8	959.2 – 974.4

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

EUT Description
Model: P25-XXL3-PS1-C8-001
Description: 928-942 MHz 250W Amplifier
Serial Number: 180886798

Additional Information:
The power amplifier is classified as an ERFPA (External Radio Frequency Power Amplifier) and is used to amplify the output of licensed transmitters in the frequency range of 928 – 942 MHz. The output is variable from 50 – 250 watts and can be adjusted via potentiometer located on the front panel.

FCC Rule Section_ Frequency Range_ Emission Designator Table

FCC Rule Section	Frequency Range (MHz)	Modulation	Emission Designator
Part 22E	928 – 929, 931 – 933, 941 - 942	FM	F1E, F1D, F3E, F3D
Part 24	930 – 931, 940 - 941	FM	F1E, F1D, F3E, F3D
Part 90-S	935 - 940	FM	F1E, F1D, F3E, F3D

EUT Operation during Tests
The output power was set to maximum output power for all tests.
An input signal in the range of 0.2 to 0.5 (23 to 27 dBm) watts is required in order for a signal to be present at the output.
The input signal was set to 24 dBm for all tests unless otherwise noted in this report.
This is a single channel amplifier and will never transmit 2 signals at the same time. This ERFPA is exempt from any tests requiring 2 signals per KDB 885618.
The input signal was FM modulated with a 2.5 kHz repetition rate at 1.5 kHz deviation for all test unless otherwise noted

Accessories: None

Modifications: None

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	NEMA 5-15P to IEC 60320 C13	1	N	N	None

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
KDB 935210 D05 (3.2)	AGC Threshold	Pass	
KDB 935210 D05 (3.3)	Out-of-Band Rejection	Pass	
2.1049 KDB 935210 D05 (3.4)	Input-Versus-Output Signal Comparison	Pass	
2.1046 22.535(a) 24.132 90.635 KDB 935210 D05 (3.5)	Mean Output Power and Amplifier gain	Pass	
KDB 935210 D05 (3.6.2)	Out-Of-Band/Block Emissions Conducted	Pass	The ERFPA is a single channel power amplifier that will never transmit to carriers at the same time. The EUT is exempt from this test per KDB 885618
2.1051 22.359(a) 24.133(a)(1) 90.669 KDB 935210 D05 (3.6.3)	Spurious Emissions Conducted	Pass	
2.1055 KDB 935210 D05 (3.7)	Frequency Stability	N/A	Does not have Frequency translation
2.1053 22.359(a) 24.133(a)(1) 90.669 KDB 935210 D05 (3.8)	Spurious Emissions Radiated	Pass	

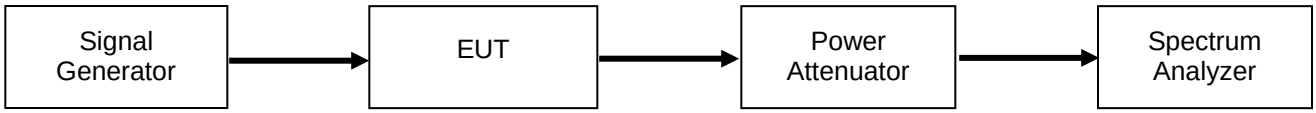
AGC Threshold
Engineer: Greg Corbin
Test Date: 4/12/2019

Test Procedure

The procedure in 935210 D05 v01r03 section 3.2 was used to measure AGC Threshold.
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 narrow band signal. 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



Test Results:

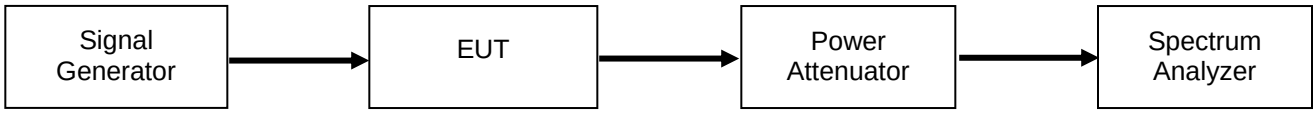
Band (MHz)	Tuned Frequency (MHz)	AGC Threshold (dBm)
928 – 929	928.5	+21.0
930 - 931	930.5	+21.0
931 - 932	931.5	+21.0
935 – 940	935.1	+21.0
940 - 941	940.5	+21.0
941 - 942	941.5	+21.0

Out-Of-Band Rejection
Engineer: Christian Pawlak
Test Date: 11/14/2018

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 the AGC Threshold level. The -20 dB bandwidth was 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 = 300 KHz
Video BW = 3x RBW

Test Setup



Test Results:

Out-of-band Rejection – All Bands

Input-Versus-Output Signal Comparison
Engineer: Greg Corbin
Test Date: 4/12/2019

Test Procedure

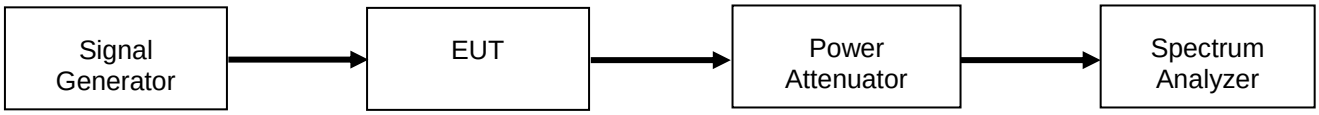
A signal generator was connected to the input of the EUT and was configured to transmit a GSM narrowband signal. The input amplitude was set at the AGC threshold level.

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
Positive Peak Detector
Max Hold

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

Test Setup



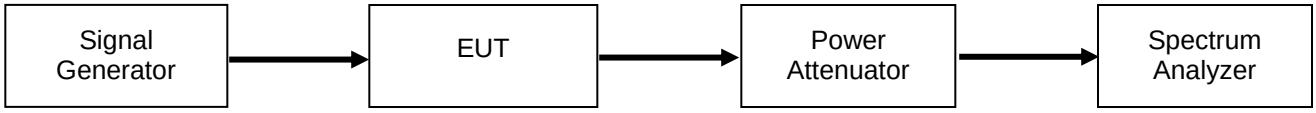
Refer to Annex A for Input vs Output plots.

Mean Output and Amplifier Gain
Engineer: Greg Corbin
Test Date: 4/18/2019

Test Procedure

The test procedure of ANSI C63.26-2016 section 5.2.4.4.1 was used to measure the Output Power.
A signal generator set to the frequency listed in the table below 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 a GSM narrow band signal.
The input power level was set to the AGC Threshold.
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 level was increased 3 dB and the output power was recorded.

Test Setup



Output Power and Gain Test Results

GSM

Frequency Range (MHz)	Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)	(Input Power +3dB) Output Power (dBm)
928 – 929	928.5125	+21.0	54.230	33.2	54.244
930 - 931	930.5	+21.0	54.525	33.5	54.537
931 - 932	931.5	+21.0	54.524	33.5	54.532
935 – 940	935.1	+21.0	54.560	33.6	54.566
935 - 940	939.8	+21.0	54.467	33.5	54.466
940 - 941	940.5	+21.0	54.579	33.6	54.553
941 - 942	941.5	+21.0	54.539	33.5	54.554

Out-Of-Band/Block Emission (Single Carrier)
Engineer: Greg Corbin
Test Date: 4/17/2019

Test Procedure

This procedure was modified to use the actual FM modulation used by this ERFPA. The bandwidth of the AWGN and GSM signals referenced in KDB 935210 section 3.6 is too wide for a 12.5 kHz channel spacing and not representative of the modulation used by the ERFPA.
The modulation was set to FM at 2.5 kHz repetition rate at 1.5 kHz deviation.

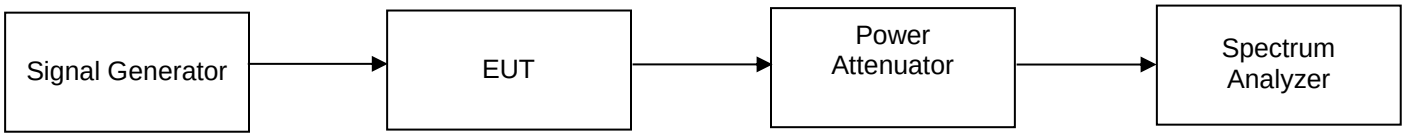
The input signal frequency was set to the lowest available frequency within the band and then to the highest possible frequency in the band. The input power level was set to the AGC threshold.

The spectrum analyzer was set with the following parameters:

RBW = 100 Hz
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 300 kHz just outside of the lower and upper band edge was measured.
The test was repeated with the input signal level set to 3 dB above the AGC threshold.

Test Setup



Refer to Annex B for Out of Band/Block emission plots (single carrier)

Conducted Spurious Emissions
Engineer: Greg Corbin
Test Date: 4/15/2019

Test Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 30 dB Power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings were obtained.

The test is performed with a narrowband GSM signal.

The RF input signal level was set at the AGC Threshold.
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.
An rms power averaging detector was used.
Trace averaging was utilized and the peak marker function was used.

The spectrum analyzer start frequency was set to the lowest RF signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part.
A peak marker was placed at the highest amplitude and the trace was recorded.

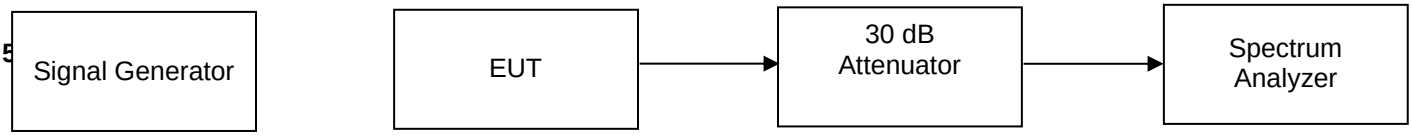
The spectrum analyzer start frequency was set to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the spectrum analyzer stop frequency to 10 times the highest frequency of the fundamental emission
A peak marker was placed at the highest amplitude and the trace was recorded.

The frequency range from 9 kHz to the 10th harmonic of the passband frequency was observed and plotted.

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: Greg Corbin
Test Date: 4/14/2019

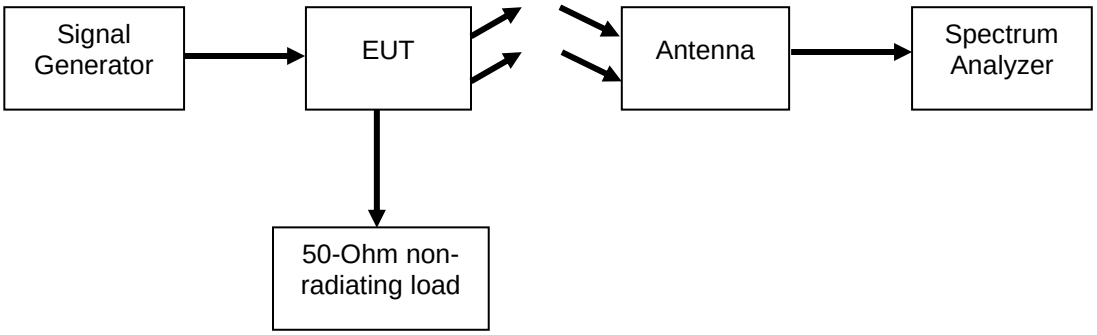
Test Procedure

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



Refer to Annex D for Radiated Spurious Emission plots

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Preamplifier	HP	8447D	i00055	NCR	NCR
Non-radiating load	Termaline	8201	i00134	Verified on: 4/10/2019	
Attenuator_30 dB 2000 watt	Bird	8329	i00172	Verified on: 4/10/2019	
Bi-Log antenna	Chase	CBL6111C	i00267	3/8/18	3/8/20
Horn Antenna	ARA	DRG-118/A	i00271	6/16/18	6/16/20
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	6/29/18	6/29/19
Voltmeter	Fluke	87III	i00319	5/1/18	5/1/19
Filter	Trilithic	3VNF 1500/2000-50-KK	i00410	Verified on: 4/10/2019	
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
Signal Generator	Keysight (Agilent)	E4438C	i00457	10/15/18	10/15/19
PSA Spectrum Analyzer	Agilent	E4445A	i00471	10/16/18	10/16/19
Preamplifier for 1-18GHz horn antenna	Miteq	AFS44 00101 400 23-10P-44	i00509	NCR	
Coupler	Narda	27002SC-40	i01546	Verified on: 4/10/2019	
Amplifier	Mini - Circuits	ZHL-42W	S/N: D020501-21	Verified on: 4/10/2019	
Notch Filter	Wainwright	WRCT 946.1/949.1-943.6/951.6-30/5SS	S/N: 19	Verified on: 4/10/2019	
Notch Filter	Wainwright	WRCG 1920/1980-1900/2000-80/14SS	S/N: 19	Verified on: 4/10/2019	

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