



849 NW STATE ROAD 45  
 NEWBERRY, FL 32669 USA  
 PH: 888.472.2424 OR 352.472.5500  
 FAX: 352.472.2030  
 EMAIL: [INFO@TIMCOENGR.COM](mailto:INFO@TIMCOENGR.COM)  
[HTTP://WWW.TIMCOENGR.COM](http://WWW.TIMCOENGR.COM)

## FCC PART 87 TEST REPORT

<b>APPLICANT</b>	ROCKWELL COLLINS
	COLLINS BUSINESS AND REGIONAL SYSTEMS 1300 WILSON BLVD, SUITE 200 ARLINGTON VIRGINIA 2209
<b>FCC ID</b>	AJK6229210
<b>MODEL NUMBER</b>	500PN622-9210
<b>PRODUCT DESCRIPTION</b>	TRANSPONDER
<b>DATE SAMPLE RECEIVED</b>	SEPTEMBER 5, 2012
<b>DATE TESTED</b>	SEPTEMBER 6, 2012
<b>TESTED BY</b>	NAM NGUYEN
<b>APPROVED BY</b>	MARIO R. DE ARANZETA
<b>TIMCO REPORT NO.</b>	2288UT12TestReport.doc
<b>TEST RESULTS</b>	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL  
 WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**





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**STATEMENT OF COMPLIANCE**

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards. No modifications were made to the equipment during testing in order to demonstrate compliance with these standards.

I attest that the necessary measurements were made by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.

**Authorized by:** Mario de Aranzeta



**Signature:**

**Function:** Engineer

**Date:** 9/20/2012

**GENERAL INFORMATION**

**DUT Specification**

The test results relate only to the items tested.	
<b>DUT Description</b>	TRANSPONDER
<b>FCC ID</b>	AJK6229210
<b>Model Number</b>	500PN622-9210
<b>Serial Number</b>	N/A
<b>Operating Frequency</b>	
<b>No. of Channels</b>	Single
<b>Type of Emission</b>	13M5M1D
<b>Modulation</b>	pulsed
<b>DUT Power Source</b>	<input type="checkbox"/> 110-120Vac/50- 60Hz
	<input checked="" type="checkbox"/> DC Power
	<input type="checkbox"/> Battery Operated Exclusively
<b>Test Item</b>	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
<b>Type of Equipment</b>	<input type="checkbox"/> Fixed
	<input checked="" type="checkbox"/> Mobile (aircraft)
	<input type="checkbox"/> Portable



**Test Facility:** The test sites used by Timco Engineering Inc. for collecting radiated and conducted emission data is located at 849 NW State Road 45 Newberry, FL 32669 USA.

**Test Condition:** The DUT was tested in the laboratory in an environment with normal temperature and humidity.

**Modification to the DUT:** No modification was made to the DUT during testing.

**Test Exercise (e.g software description, test signal, etc.):** The DUT was placed in continuous transmit mode of operation.

**Applicable Standards:** ANSI/ TIA 603-C: 2004  
FCC CFR 47 Part 87

**EMC EQUIPMENT LIST**

<b>Device</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Cal/Char Date</b>	<b>Due Date</b>
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 12/31/11	12/31/13
AC Voltmeter	HP	400FL	2213A14499	CAL 6/12/11	6/12/13
Antenna: Active Loop	ETS-Lindgren	6502	00062529	CAL 9/23/10	9/23/13
Frequency Counter	HP	5385A	2730A03025	CAL 8/17/11	8/17/13
Hygro-Thermometer	Extech	445703	0602	CAL 6/15/11	6/15/13
Modulation Analyzer	HP	8901A	3435A06868	CAL 7/18/11	7/18/13
Digital Multimeter	Fluke	FLUKE-77	35053830	CAL 9/9/11	9/9/13
Power Meter	Boonton Electronics	4531	11793	CAL 11/12/2010	11/12/2012
EMI Receiver	Rohde & Schwarz	ESIB40	100274	CAL 3/16/2012	3/16/2014
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 10/28/11	10/28/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 10/28/11	10/28/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 10/28/11	10/28/13
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 10/28/11	10/28/13
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 2/22/12	2/22/13
Antenna	ETS	3117	35923	12/7/2011	12/7/2013
Antenna	Electro metrics	LPA-25	1122	5/04/2011	5/04/2013
Antenna	Electro metrics	BIA-25	1096	5/04/2011	5/04/2013

## TEST PROCEDURE

**Power Line Conducted Interference:** The procedure used was TIA 603 using a 50uH LISN. Both lines were observed with the UUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

**Bandwidth 20 dB:** The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

**Power Output:** The RF power output was measured at the antenna feed point using a peak power meter.

**Antenna Conducted Emissions:** The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10<sup>th</sup> Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

**Radiation Interference:** The test procedure used was ANSI STANDARD C63.4-2003 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

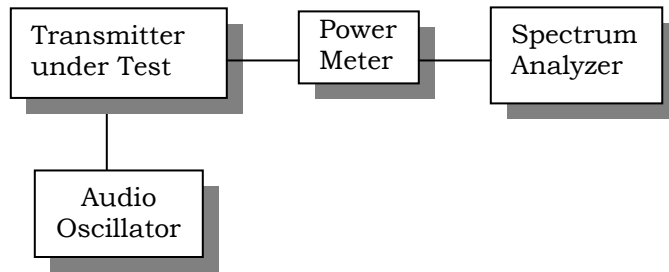
**RF POWER OUTPUT**

**Rule Part No.:** Part 2.1046(a), Part 87.131

**Test Requirements:**

**Method of Measurement:** RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a transmitter properly adjusted the RF output measures:

**Test Setup Diagram:**



**Test Data:**

OUTPUT POWER:

Format	Description	Output power (dBm)	Output power (W)
1	450 ATCRBS replies each second	56.36	432.5
2	50 Mode-S long replies each second	56.35	431.5
3	450 ATCRBS and 50 Mode-S long replies each second	56.19	416



**MODULATION CHARACTERISTICS**

**Rule Part No.:** Part 2.1047(a)(b)

The EUT was forced to reply with formats listed below:

Format	Description
1	450 ATCRBS replies each second
2	50 Mode-S long replies each second
3	450 ATCRBS and 50 Mode-S long replies each second

The emission type as defined in 2.201 is M1D. The necessary bandwidth as defined in 2.202 is computed in accordance with the procedures of Report 836 of the International Radio Consultative Committee, Recommendations and Reports of the CCIR, 1982. Considering the spectrum of a group of pulses to fall within the envelope defined by a spectrum of a single pulse, the formula  $B_n = 1.79/\text{SQRT}(t \cdot p)$  is used, where:

B<sub>n</sub> = the necessary bandwidth

t = the pulse width (50 % amplitude points)

p = the pulse rise time (10 to 90 % amplitude points) which is assumed to equal the fall time.

The narrowest pulse permitted by RTCA DO-181 has t=350 ns, and the p of the pulse is not expected to be less than 50 ns. The necessary bandwidth then becomes 13.5 MHz. Thus, the complete emission designation according to 2.201 and 2.202 is 13M5M1D.

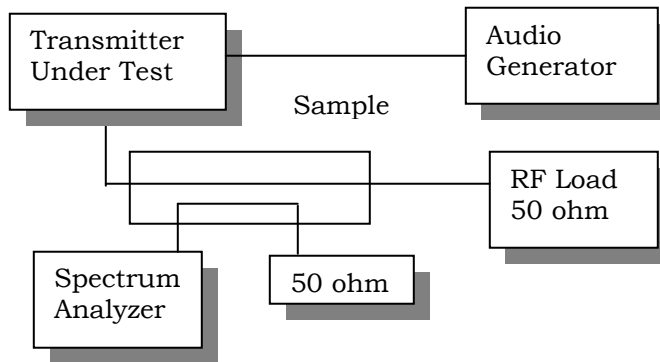
## OCCUPIED BANDWIDTH

**Rule Part No.:** Part 2.1049, Part 87.137

**Test Requirements:** Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 150%: At least 25dB. On any frequency removed from the assigned frequency by more than 150%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least  $43 + 10\log(P)$ dB.

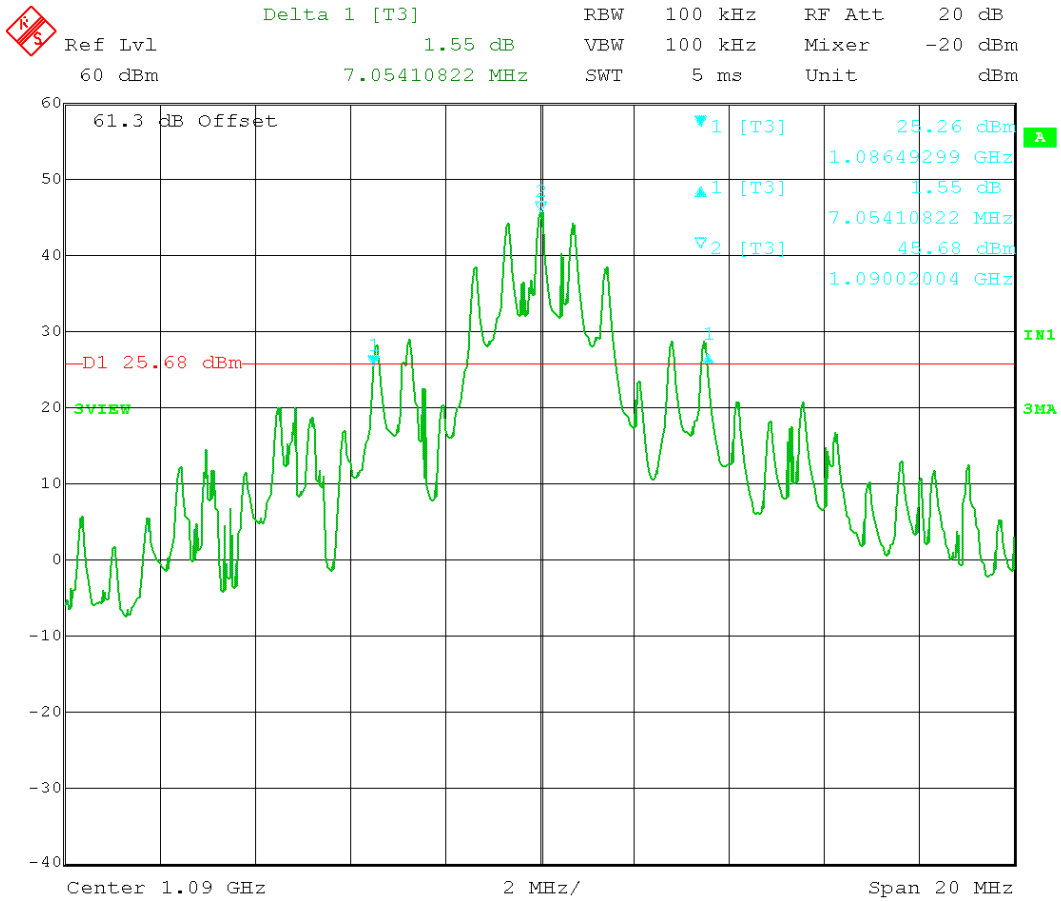
**Method of Measurement:**

**Test Setup Diagram:**



**Test Data:** See the plots below

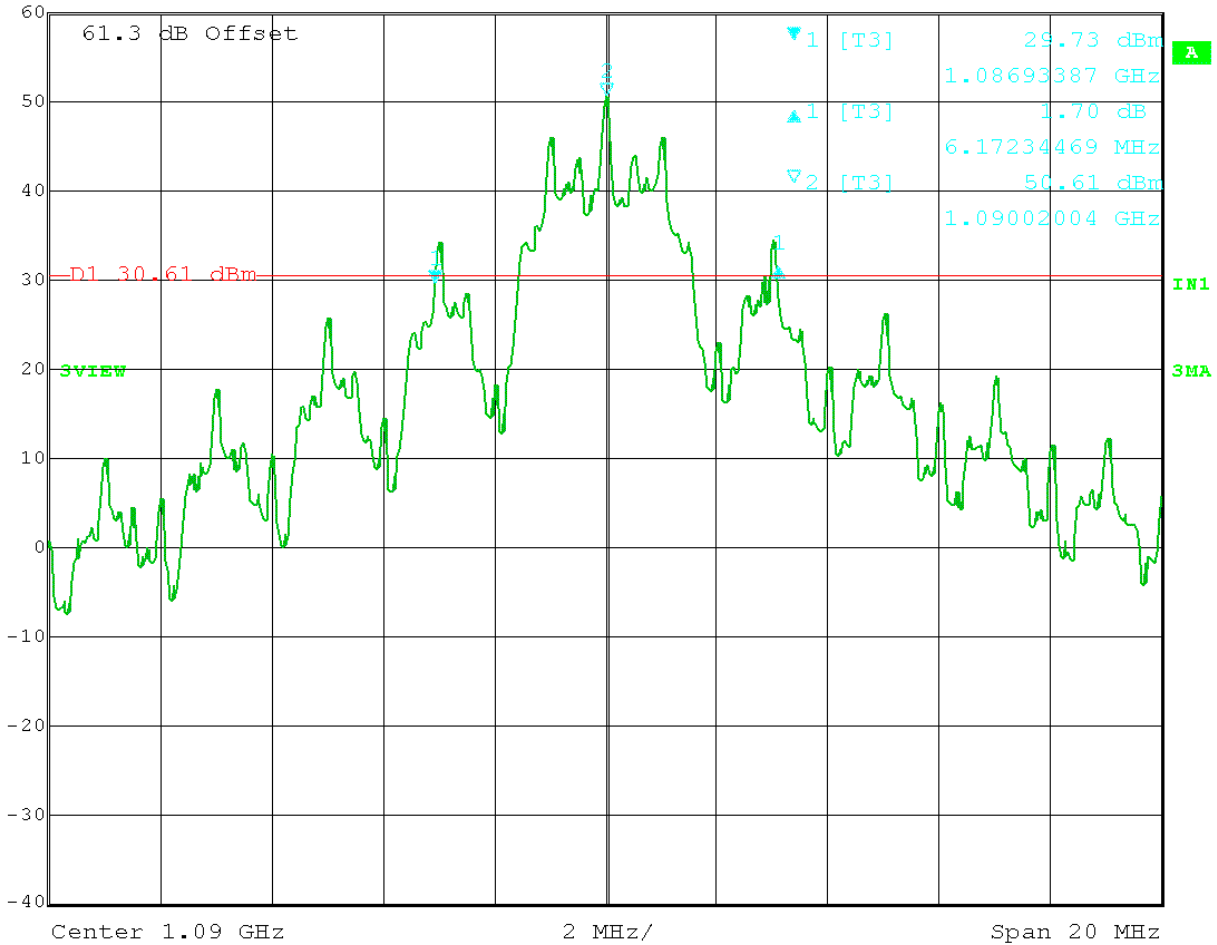
**Format 1: 450 ATCRBS**



Date: 5.SEP.2012 11:53:45

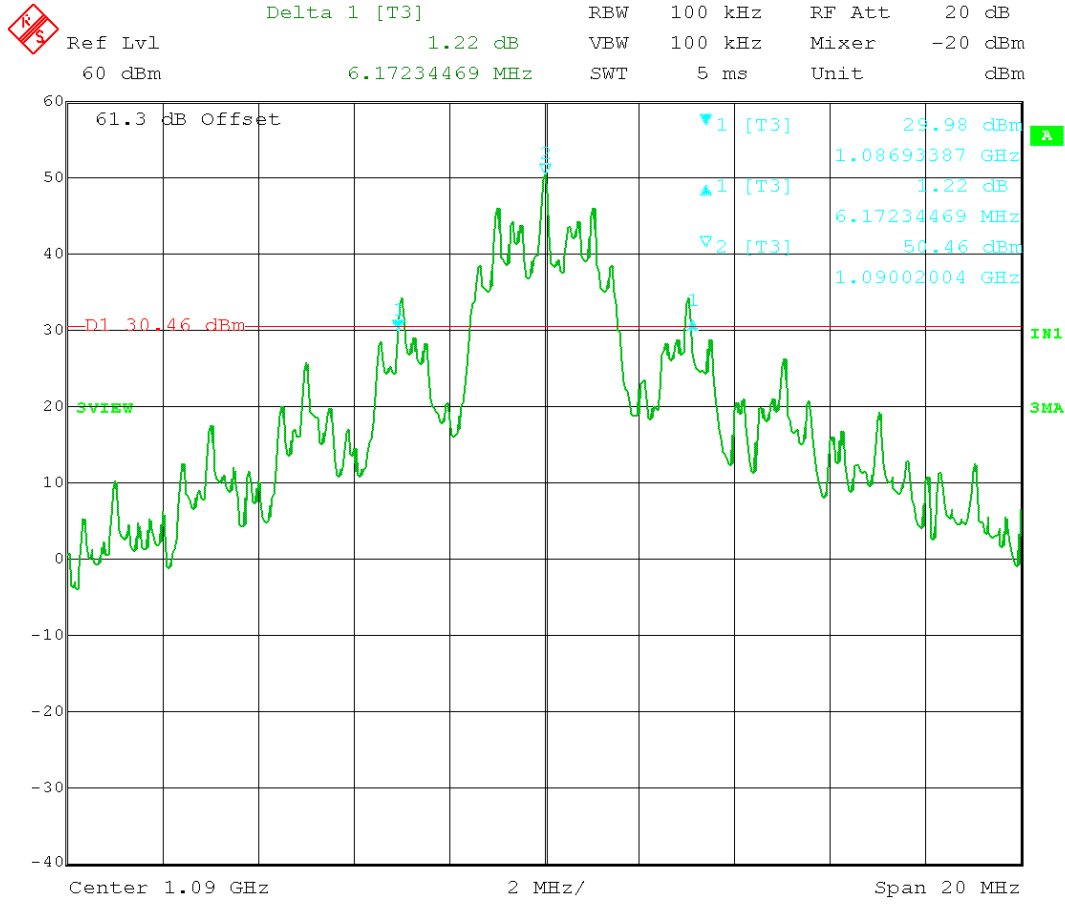
**Format 2: 50 Mode-S long**

	Delta 1 [T3]	RBW	100 kHz	RF Att	20 dB	
	Ref Lvl	1.70 dB	VBW	100 kHz	Mixer	-20 dBm
	60 dBm	6.17234469 MHz	SWT	5 ms	Unit	dBm



Date: 5.SEP.2012 11:33:21

**Format 3: 450 ATCRBS and 50 Mode-S long**



Date: 5.SEP.2012 11:41:58

**SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)**

**Rule Part No.:** Part 2.1051(a)

**Requirements:**

Emissions at frequencies removed from the assigned frequency by more than 250% of the authorized bandwidth must be down at least  $43 + 10 \log pY$ .

For an assumed output power of 400 Watts and a transmitting duty cycle factor of 2% (rarely would 1 % be exceeded in normal operation), mean power would be 8 Watts, and the specification for spurious emissions becomes -52 dBc.

**Method of Measurement:** The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from the lowest frequency generated or 9 kHz to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA-603-C: 2004.

**Test Data:**

<b>TF MHz</b>	<b>EF MHz</b>	<b>dB below carrier</b>
1090.00	2180.00	78.1
	3270.00	95.2
	4360.00	94
	5450.00	92.8
	6540.00	90.4
	7630.00	91.4
	8720.00	91.8
	9810.00	93.2
	10900.00	92.8

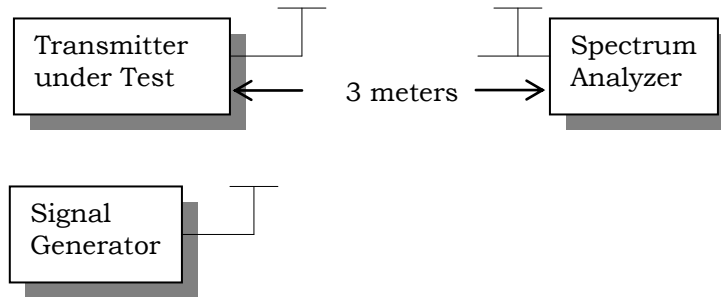
## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Rule Parts. No.:** Part 2.1053

**Test Requirements:** The FCC limits for radiated emissions are the same as previously stated for the conducted emissions.

**Method of Measurements:** The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603-C: 2004 using the substitution method.

**Test Setup Diagram:**



**Test Data:**

Tuned Frequency MHz	Emission Frequency MHz	Ant. Polarity	dBc dB
1,090.00	2,180.00	V	89.7
	3,270.00	V	105.2
	4,360.00	V	86.7
	5,450.00	V	102.4
	6,540.00	V	98.5
	7,630.00	V	100.3
	8,720.00	V	102.1
	9,810.00	V	100.3
	10,900.00	V	99.1

**Test Data continued:**

Tuned Frequency MHz	Emission Frequency MHz	Ant. Polarity	dBc
1,090.00	47	V	115.3
	60.1	V	119.8
	60.3	H	131.9
	66	V	123.9
	66.2	H	131.3
	78.3	H	131.9
	95.6	V	123.2
	105.1	H	127.9
	105.1	V	121.2
	120.3	V	122.6
	120.3	H	122.3
	186.7	H	123.1
	200.2	V	118.8
	200.2	H	117
	220	H	118.8
	232	H	116.8
	240	V	116.5
	240	H	112.5
	419.6	V	121.3
	520.4	H	124.6



**FREQUENCY STABILITY**

**Rule Parts. No.:** Part 2.1055, Part 87.133

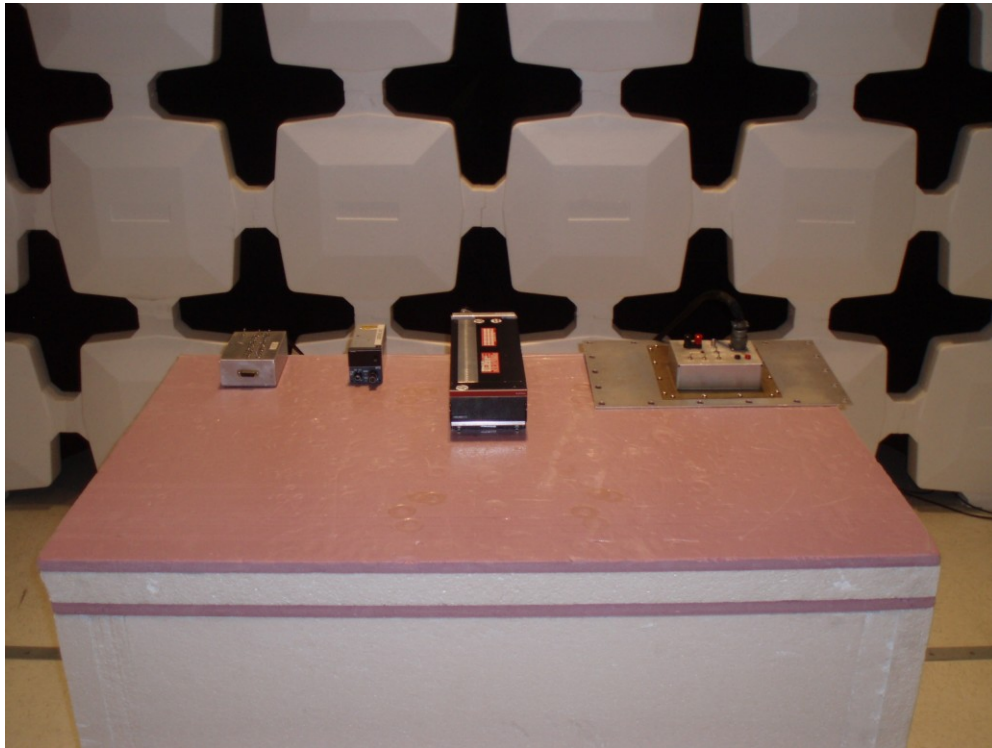
**Requirements:** Temperature range requirements: -30 to +50° C.  
Voltage Variation +, -15%  
±20 PPM

**Method of Measurements:** TIA/EIA Specification 603

**Test Data:**

<b>Assigned Frequency (Ref. Frequency) (MHz)</b>		<b>1089.997982</b>
<b>Temperature (°C)</b>	<b>Frequency (MHz)</b>	<b>Frequency Stability (PPM)</b>
-20	1090.013026	13.80
-10	1090.013015	13.79
0	1090.013002	13.78
+10	1090.011022	11.96
+20	1090.007014	8.29
+30	1090.003006	4.61
+40	1089.992986	-4.58
+50	1089.986974	-10.10

<b>Assigned Frequency (Ref. Frequency) (MHz)</b>		
<b>% Battery</b>	<b>Frequency (MHz)</b>	<b>Frequency Stability (PPM)</b>
-15%	1089.997952	-0.03
0	189.997982	0.00
+15%	189.997974	-0.01



APPLICANT: ROCKWELL COLLINS-COLLINS BUSINESS REGIONAL SYSTEMS

FCC ID: AJK6229210

REPORT #: O:\R\ROCKWELL\_AJL\2288UT12\2288UT12TestReport\_Rev.doc

**POWER LINE CONDUCTED INTERFERENCE**

**Rules Part No.:** Part 15.107 Class B

**Requirements:**

<b>Frequency (MHz)</b>	<b>Quasi Peak Limits (dB<math>\mu</math>V)</b>	<b>Average Limits (dB<math>\mu</math>V)</b>
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50

**Test Procedure:** ANSI C63.4-2003. The spectrum was scanned from 0.15 to 30 MHz.

Not applicable – 27.5Vdc (aircraft) operated device