FCC TEST REPORT

for

THALES ATM, INC.

LOCALIZER

Model #: 098783-0001

GARWOOD LABORATORIES, INC.

TESTING AND ENGINEERING SERVICES

EMC TEST REPORT

47 CFR Ch.1 (10-1-03 Edition)
Parts 2, 15, & 87

Report for:

THALES ATM, INC.

Localizer

Model Number: 098783-0001

Prepared For: Thales ATM, Inc.
23501 West 84th Street
Shawnee, KS 66227

Prepared By: Garwood Laboratories, Inc
7829 Industry Avenue
Pico Rivera, CA 90660

Created: January 28, 2008

RESPONSIBLE SIGNATURES

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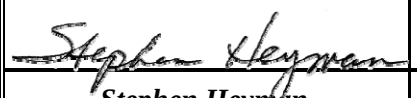		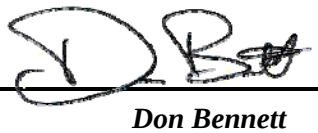
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DOCUMENT HISTORY

Revision	*Issue Date*	*Description Of Modifications*	*Revised By*	*Approved By*
NC	January 28, 2008	Initial release		
1	March 31, 2008	*Split the Localizer and the GlideSlope into separate FCC reports, added peripherals and setup drawing, and corrected various typos.*	SH	
2	April 28, 2008	*Corrected typos.*	SH	
3	March 3, 2009	Add limit lines to plots	SH	

CLIENT INFORMATION

Purchase Order	T95208
Quote Number	GLIQ2900-E
Company Name	Thales ATM, Inc.
Address	23501 West 84th Street
City, State Zip	Shawnee, KS 66227
Contact Name	Kevin L. McGahee
Phone	913-422-2739
Fax	N/A

GARWOOD INFORMATION

EMC Test Laboratory	Garwood Laboratories, Inc.
Address	950 Calle Negocio
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E-Mail Address	donb@garwoodlabs.com

TESTING INFORMATION

Test Personnel	Rod Gayutin – Test Engineer
Test Dates	3, 4, 5, 7 6 December 2007

Accreditations and Certifications

The Open Area Test Site (OATS) and measurement facilities used to collect the test data are located at Garwood Laboratories, Incorporated test facility in Pico Rivera, California. The test facility is recognized, certified, or accredited by the following organizations:

This site has been registered and fully described in a report filed with the **Federal Communications Commission** (FCC). The acceptance letter from the FCC is maintained in our files. Designation Number: US1035. The current accreditation is effective through June 30, 2008. **Garwood Laboratories** is an authorized test laboratory for the DoC process.

TESTING CERTS #0741.01, #0741.02, #0741.03

The **American Association for Laboratory Accreditation** is an independent organization that provides third-party accreditation to calibration and testing laboratories. A2LA is a signatory on two Mutual Recognition Arrangements, the International Laboratory Accreditation Cooperation (ILAC) and the Asia Pacific Laboratory Accreditation Cooperation (APLAC). **Garwood Laboratories'** accredited A2LA scope includes a full offering of test methods under Mil-Std-461 and RTCA DO-160, European commercial requirements, Telcordia/NEBS, Mil-Std-810, Mil-Std-202 and many other electromagnetic and environmental test standards. The certification is valid through June 30, 2008.

Garwood Laboratories, Inc. has been assessed in accordance with ISO 17025 and with ITI's assessment criteria. Based upon this assessment, Technology International (Europe), Ltd. has granted approval for specifications implementing the EU Directive on EMC (89/336/EEC). The scope of the approval was provided on a Schedule of Assessment supplied with a certificate and is available upon request. Cert 07-051, through June 14, 2008.

NVLAP LAB CODE 200713-0

The **National Voluntary Laboratory Accreditation Program** is an organization formed under NIST that provides third-party accreditation to calibration and testing laboratories. NVLAP is a signatory on two Mutual Recognition Arrangements, the International Laboratory Accreditation Cooperation (ILAC) and the Asia Pacific Laboratory Accreditation Cooperation (APLAC). **Garwood Laboratories'** accredited NVLAP scope includes a full offering of electromagnetic effects test methods under Mil-Std-461 and RTCA DO-160, European commercial requirements, Telcordia/NEBS, and many other electromagnetic test standards. The certification is valid through March 31, 2008.

TABLE OF CONTENTS

MEASUREMENT / TECHNICAL REPORT SUMMARY

Type of Authorization	47 CFR Ch.1 (10-1-03 Edition)
Applicable FCC Rules	PART 2 - FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 (10-1-03 Edition). The following subparts are applicable to the results in this test report: Part 2, Subpart J – Equipment Authorization Process (Certification) Paragraph 2.1046 – RF power output. Paragraph 2.1047 – Modulation Characteristics. Paragraph 2.1049 – Occupied bandwidth. Paragraph 2.1051 –Spurious emissions at antenna terminals. Paragraph 2.1053 –Field strength of spurious radiation. Paragraph 2.1055 –Frequency Stability. PART 15 – RADIO FREQUENCY DEVICES Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 (10-1-03 Edition), Part 15, Subpart C – Intentional Radiators PART 87 – AVIATION DEVICES Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 (10-1-03 Edition), Part 87, Subpart D – Technical Requirements

1.0 GENERAL INFORMATION

1.1 Product Description

Equipment Under Test Model Number	Localizer 098783-0001
Description	The Localizer subsystem radiates a signal from the ground providing azimuth (lateral) guidance for a landing aircraft. The signal is transmitted to a visual display on the aircrafts VOR-LOC receiver, to assist the aircraft in easily finding the runway centerline. The ground-to-aircraft signal depicts the aircraft's approach position relative to the runway centerline.
Clock Frequencies	*Please consult the manufacturer for the EUT's operating frequencies.*

Refer to the products data sheet, which has been included as an Attachment to this report for additional details about the EUT.

1.2 Test Procedures

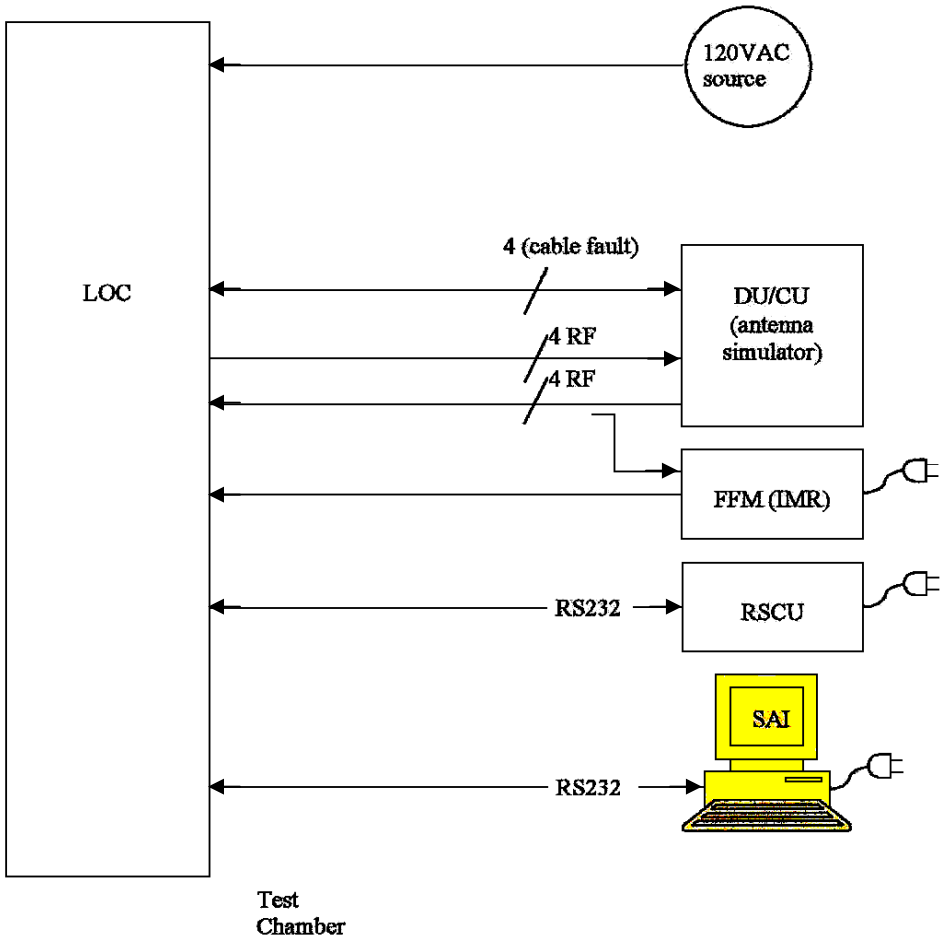
The Localizer were tested to Part 2, Subpart J of test standard 47 CFR Ch.1 (10-1-03 Edition). Part 87, Subpart D. and Part 15, Subpart C was verified pursuant to the procedures in Part 2, Subpart J (Ref: Part 15, Subpart C, Section 15.201 and Part 87, Subpart D, section 87.147).

1.3 Tested System Description

The Tested System was configured with all typical terminations and operated to generate the maximum emissions during the test.

Item No.	***Manufacturer***	***Description***	***Identification Numbers***
1.	Thales ATM	Remote Status Control Unit	**Model #:** 098767-0002 **Serial #:** 003
2.	Thales ATM	Farfield Monitor	**Model #:** 098794-0001 **Serial #:** N/A
3.	Acer	RMS (Laptop Computer)	**Model #:** 708180-0001 **Serial #:** N/A
4.	Thales ATM	Distribution Unit/Combining Unit	**Model #:** 120676-0001 **Serial #:** N/A

Test Setup



1.4 Block Diagram of EUT

The manufacturer has all block diagrams, circuit layout and component information on file at the manufacturing facility.

2.0 PRODUCT LABELING

2.1 FCC Compliance Labeling

The manufacturer (or importer) is responsible for having the compliance label produced, and for having it affixed to each unit that is marketed or imported. See the FCC website and applicable FCC documentation for labeling information

2.2 Location of Label on EUT

The label shall be located in a conspicuous location on the device. When the device is so small or for such use that it is not practicable to place the compliance label on it, the information required should be placed in a prominent location in the instruction manual or pamphlet supplied to the user. Alternatively, the label can be placed on the container in which the device is marketed.

2.3 Information to the User

The users manual or instruction manual for an intentional or unintentional 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.

3.0 SYSTEM TEST CONFIGURATION

3.1 Justification

The EUT was used in a system configured for testing in a typical fashion, as a customer would normally use it.

3.2 EUT Exercise Software/Equipment

The Localizer was connected to power, activated, and then operated continuously per its normal functional parameters. A customer-supplied program, pre-installed into the EUTs was run continuously testing.

3.3 Special Accessories

The EUT requires no special accessories to comply with the 47 CFR Ch.1, Part 87, Subpart D limits and requirements.

3.4 Equipment Modifications

No modifications were made to achieve the required specification limit.

4.0 SUMMARY OF TEST RESULTS

4.1 RF Power Output Test Summary

4.1.1 Test Description

Measurements shall be made to establish the radio frequency power delivered by the transmitter into the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted.

If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

The R.F. power output was measured at the antenna terminals by connecting a directional coupler to the antenna port and measuring the output power with a spectrum analyzer. The directional coupler had an impedance of 50Ω to match the impedance of the standard antenna and had a 50Ω load for termination.

4.1.2 RF Power Output Test Summary

Localizer Channel (MHz)	Frequency (MHz)	PdBm	Pmw	P_{pk} (Watts)	$P_{carr\ ave}$ (Watts)	Modulation
108.5 MHz	108.5 MHz	44.12	25,822	25.8	13.2	40%
111.5 MHz	111.5 MHz	43.86	24,332	24.3	12.4	40%

The specifications of Paragraph 2.1046 and applicable Parts of 87 are met. There are no deviations to the specifications.

4.2 Modulation Characteristics Test Summary

4.2.1 Test Description

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed shall be submitted.

The R.F. output was coupled to a Spectrum Analyzer and a modulation meter. The spectrum analyzer was used to observe the R.F. spectrum with the transmitter operating in its various modes.

4.2.2 Test Summary Table for RF Power Output

The Localizer transmitter incorporates a unique 90 and 150 Hz modulation scheme solely for use in the aviation services. Therefore, no modulation characteristics were measured for the Localizer. The specifications of 2.1047 and applicable paragraphs of Part 87 are met. There are no deviations to the specifications.

4.3 Occupied Bandwidth Test Summary

4.3.1 Test Description

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

4.3.2 Test Summary Table for Occupied Bandwidths

Localizer:

Signal	Center Frequency (MHz)	Occupied Bandwidth (kHz)
CRS	108.5	2
CLR	108.5	2
Combined	108.5	9.5
CRS	111.5	1.5
CLR	111.5	1.5
Combined	111.5	9.5

Data was taken for the different signal paths. The Localizer produced no deviations to the specifications. Requirements of 2.1049 and applicable parts of Paragraph 87 were met. Refer to Section 6.2 for data sheet and test plots.

4.4 Spurious Emissions At Antenna Terminals Test Summary

4.4.1 Test Description

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna.

The R.F. output was coupled to a Spectrum Analyzer. The spectrum analyzer was used to observe the R.F. spectrum with the transmitter operated in all of the available modes. The frequency spectrum from 0 to 5 GHz was observed and plots produced of the frequency spectrum.

4.4.2 Test Summary Table for Spurious Emissions At Antenna Terminals

Localizer:

Frequency (MHz)	Spurious Frequency (MHz)	Level Below Carrier (dB)
111.5	223	64.48
	334.5.	64.06
	446	64.08
	557.5	63.92
	669	63.55
	780.5	62.88
	892	62.48
	1003.5	63.15
	1115	62.57

There are no deviations to the specifications. Data was taken per 2.1051 and applicable parts of Part 87.135. Requirements of 2.1051 and applicable parts of Paragraph 87 were met. Refer to Section 6.3 for data sheet and test plots.

4.5 Field Strength of Spurious Radiation Test Summary

4.5.1 Test Description

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation.

The transmitter was placed on a wooden turntable 0.1 meters above the ground plane and at a distance of 3 meters from the antenna. The transmitter was activated and the frequency spectrum of the fundamental was observed. The turntable was rotated though 360 degrees to locate the position registering the highest amplitude emission. The amplitude of the fundamental frequency was measured and recorded. The frequency spectrum was then searched for spurious emissions generated from the transmitter. The amplitude of each spurious emission was maximized by raising and lowering the FSM antenna and rotating the turntable before data was recorded. A log periodic antenna was used for frequencies of 200 MHz to 5 GHz and pyramidal horn antennas were used for frequencies of 5 GHz to 40 GHz. Emission levels were measured and recorded from the spectrum analyzer in dBµV.

4.5.2 Field Strength of Spurious Radiation Test Summary

Note: *The table limit calculation for table 4.5.2 was constructed using the following equations. E=[5.5 * (PG)^1/2]/d, values of P=10.1, G=1.64, d=3. This results in a value of 7.64E6 uV. Converting to dBuV required calculation of 20*log(7.64E6) resulting in 137.45 dBuV. Using the emission mask requirement of 43+10logP (43+10log(10.1) = 53.05 dB produces the limit of 84.4 dBuV (137.45-53.05=84.4).*

Localizer (Channel 111.5)

Frequency (MHz)	FSM Horizontal (dBµV)	FSM Vertical (dBµV)	CFS Horizontal @ 3m (dBµV/m)	CFS Vertical @ 3m (dBµV/m)	Limit
223	73.28	72.01	58.81	57.54	84.4
334.5	67.22	66.84	55.24	54.86	84.4
446	52.76	53.47	45.82	46.53	84.4
557.5	47.94	43.62	42.19	37.87	84.4
669	50.5	59.27	46.61	55.38	84.4
780.5	72.11	72.27	69.51	69.67	84.4
892	41.55	36.02	39.09	33.56	84.4
1003.5	35.62	35.11	34.21	33.7	84.4
1115	34.3	34.2	26.8	26.7	84.4

Localizer (Channel 108.5)

Frequency (MHz)	FSM Horizontal (dBµV)	FSM Vertical (dBµV)	CFS Horizontal @ 3m (dBµV/m)	CFS Vertical @ 3m (dBµV/m)	Limit
220	73.15	72.16	58.68	57.69	84.4
328.5	66.8	65.98	54.82	54	84.4
437	52.9	53.43	45.96	46.49	84.4
545.5	47.5	45.27	41.65	39.42	84.4
654	53	58.17	49.01	54.18	84.4
762.5	71.52	71.23	68.92	68.63	84.4
871	42.64	36.9	40.18	34.44	84.4
979.5	35.79	35.03	34.38	33.62	84.4
1088	32	33.76	24.4	26.16	84.4

There are no deviations to the specifications. Specifications of Paragraph 2.1053 and 87.139 were met. Refer to Section 6.4 for data sheet and test plots.

4.6 Frequency Stability Test Summary

4.6.1 Test Description

The frequency stability shall be measured with variations of ambient temperature from -30° to +50° centigrade. Measurements shall be made at the extremes of the temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. In addition to temperature stability the frequency stability shall be measured with variation of primary supply voltage as follows:

1. Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

2. For hand carried, batteries powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

3. The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

4.6.2 Frequency Stability Test Summary

No Frequency Stability test was performed on Localizer per the customer's request. The test data will be supplied by the customer, and will be attached in the Appendix of this test report

5.0 TEST MEASUREMENT PHOTOS

Localizer Test Setup Photo

Localizer Test Setup Photo

Localizer Test Setup Photo

6.0 – Detailed Test Results

General Comments Section 6 pertains to the detailed test results for each of the test types applied to the EUT as summarized in section 4. All test equipment information is located in Appendix A.

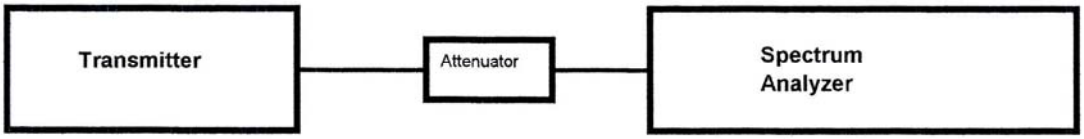
6.1 RF Power Output Test Results

Part 2.1046 RF Power Output

EUT: Localizer

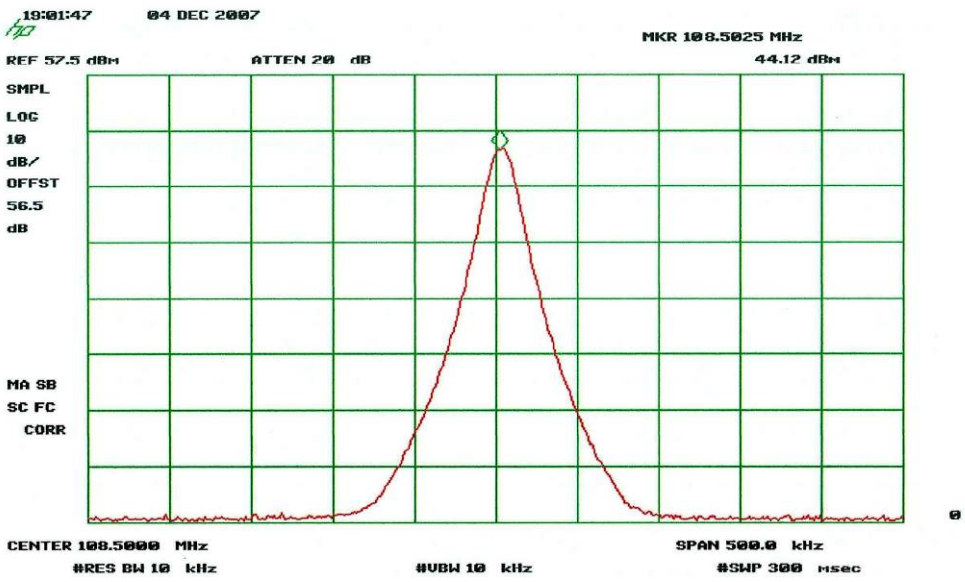
Localizer Frequency (MHz)	Frequency	PdBm	Pmw	$P_{pk.}$ (Watts)	$P_{carr\ avs.}$ (Watts)	Modulation
108.5MHz	108.5MHz	44.12	25,822	25.8	13.2	40%
111.5MHz	111.5MHz	43.86	24,332	24.3	12.4	40%

Test Configuration:

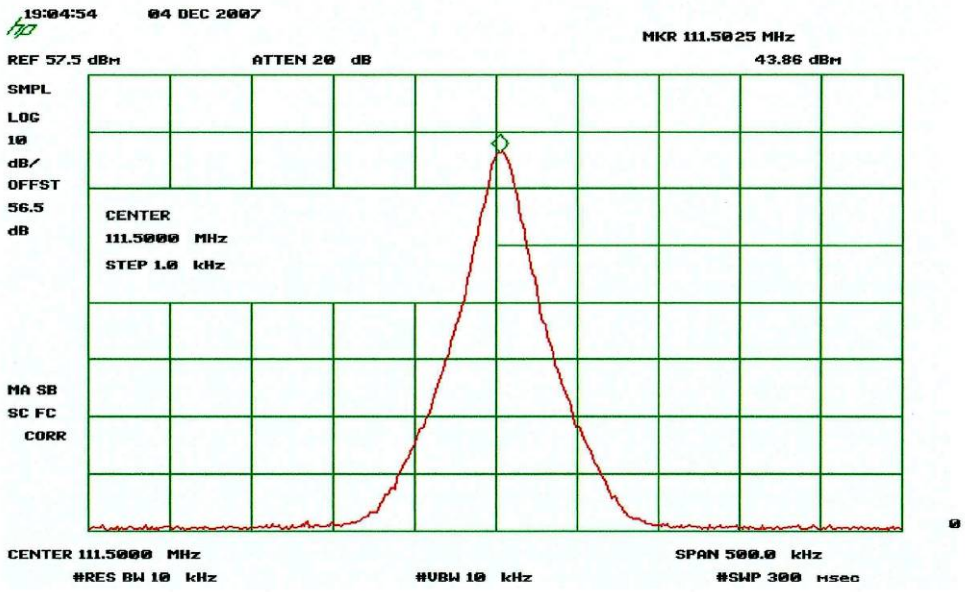


Section 2.1046 RF Power Output

Output Power 108.5MHz modulated @ 40%



Output Power 111.5MHz modulated @ 40%



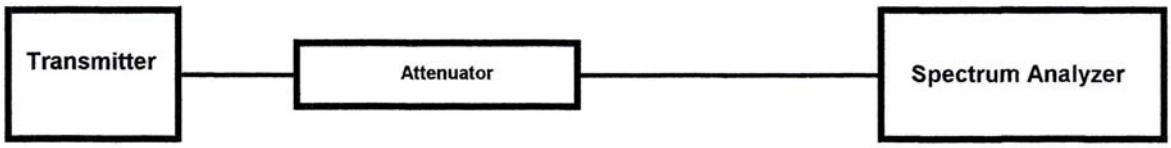
6.2 Occupied Bandwidth Test Results

Part 2.1049 Occupied Bandwidth

EUT: Localizer
Results:

		Center Frequency (MHz)	Occupied Bandwidth (kHz)
Signal	CRS	108.5	2
	CLR	108.5	2
	Combined	108.5	9.5
	CRS	111.5	1.5
	CLR	111.5	1.5
	Combined	111.5	9.5

Test Configuration:



Section 2.1049: Occupied Bandwidth

Figure 1: Occupied Bandwidth Combined @ 111.5MHz

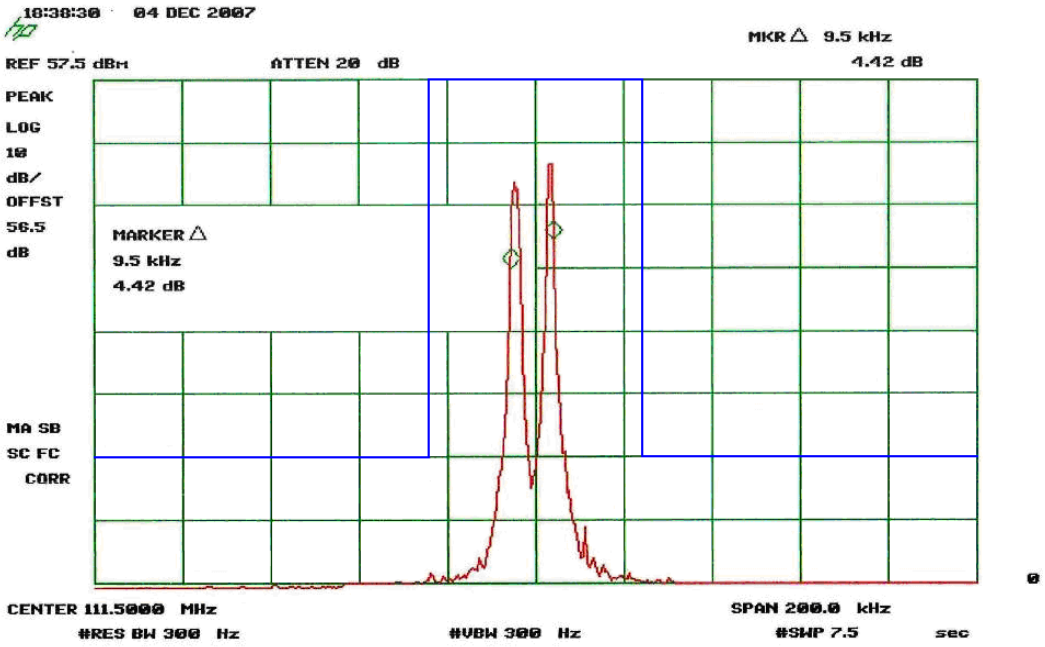


Figure 2: Occupied Bandwidth CLR @ 111.5MHz

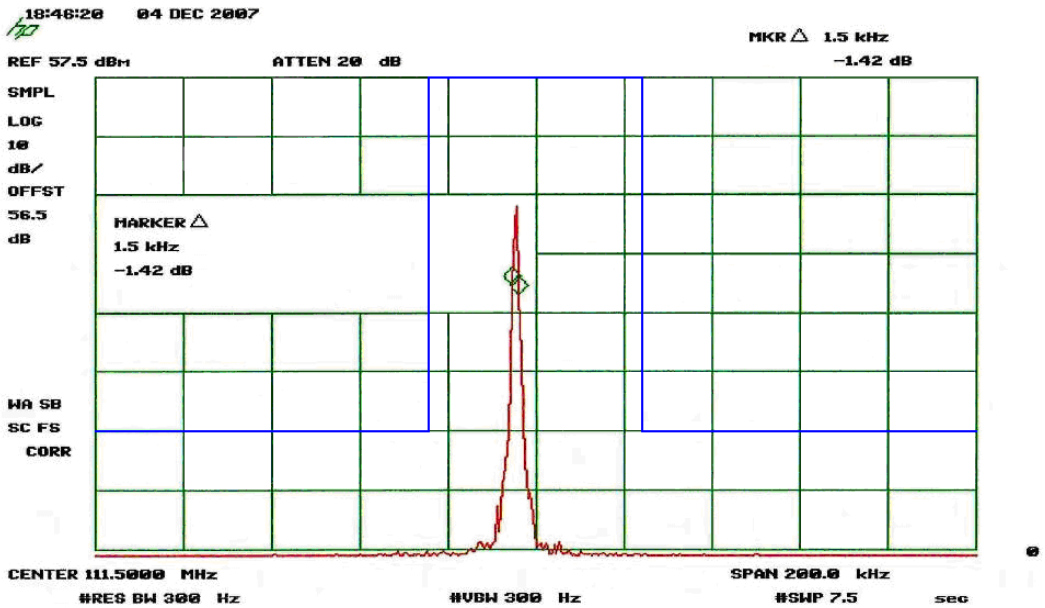


Figure 3: Occupied Bandwidth CRS @ 111.5MHz

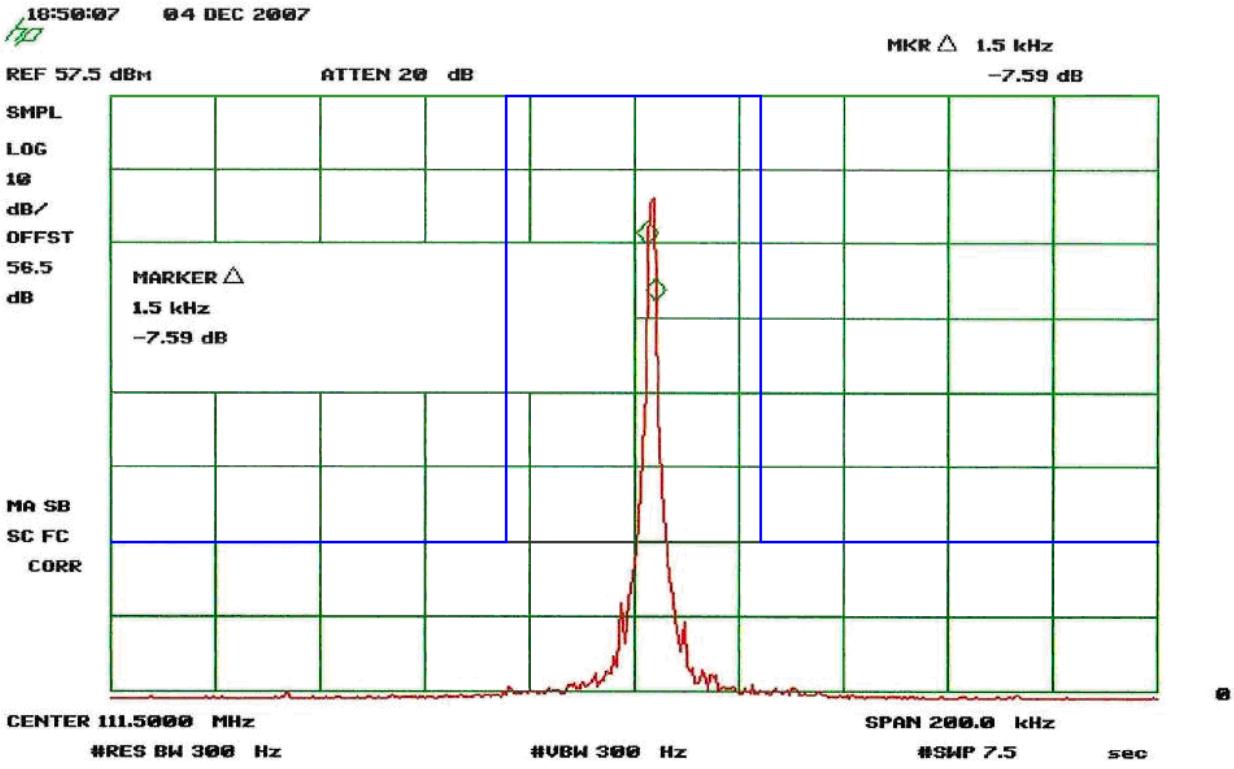


Figure 4: Occupied Bandwidth Combined @ 108.5MHz

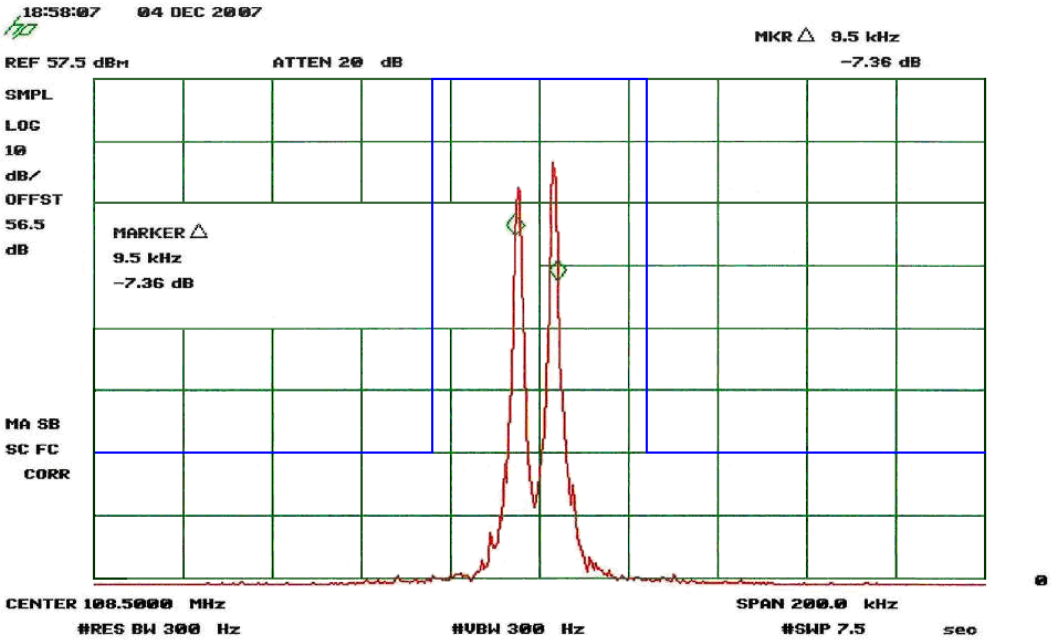


Figure 5: Occupied Bandwidth CRS @ 108.5MHz

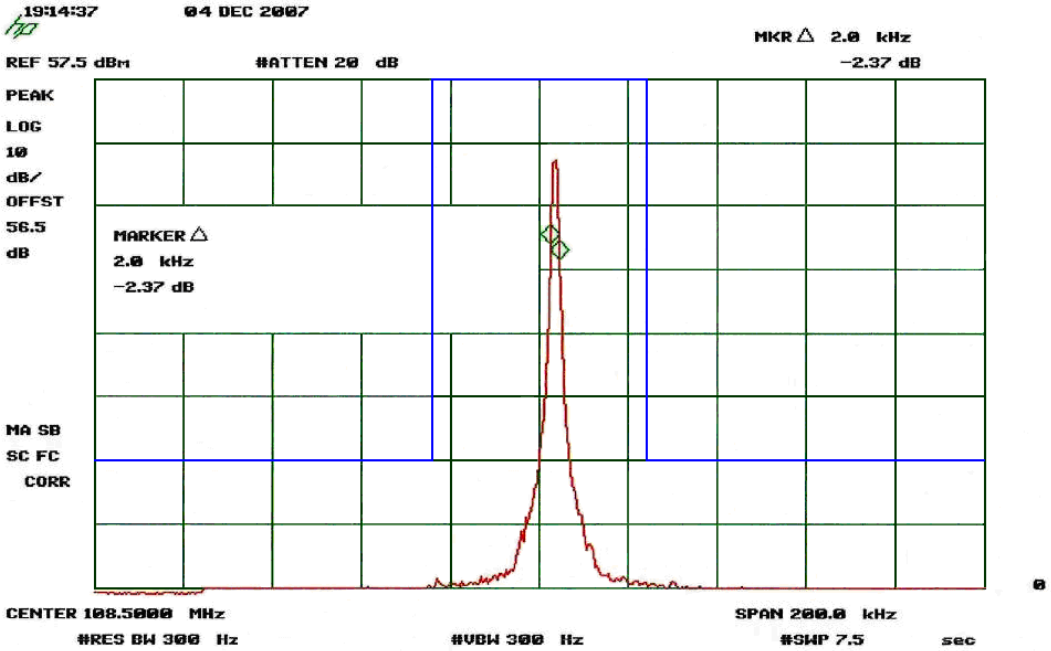
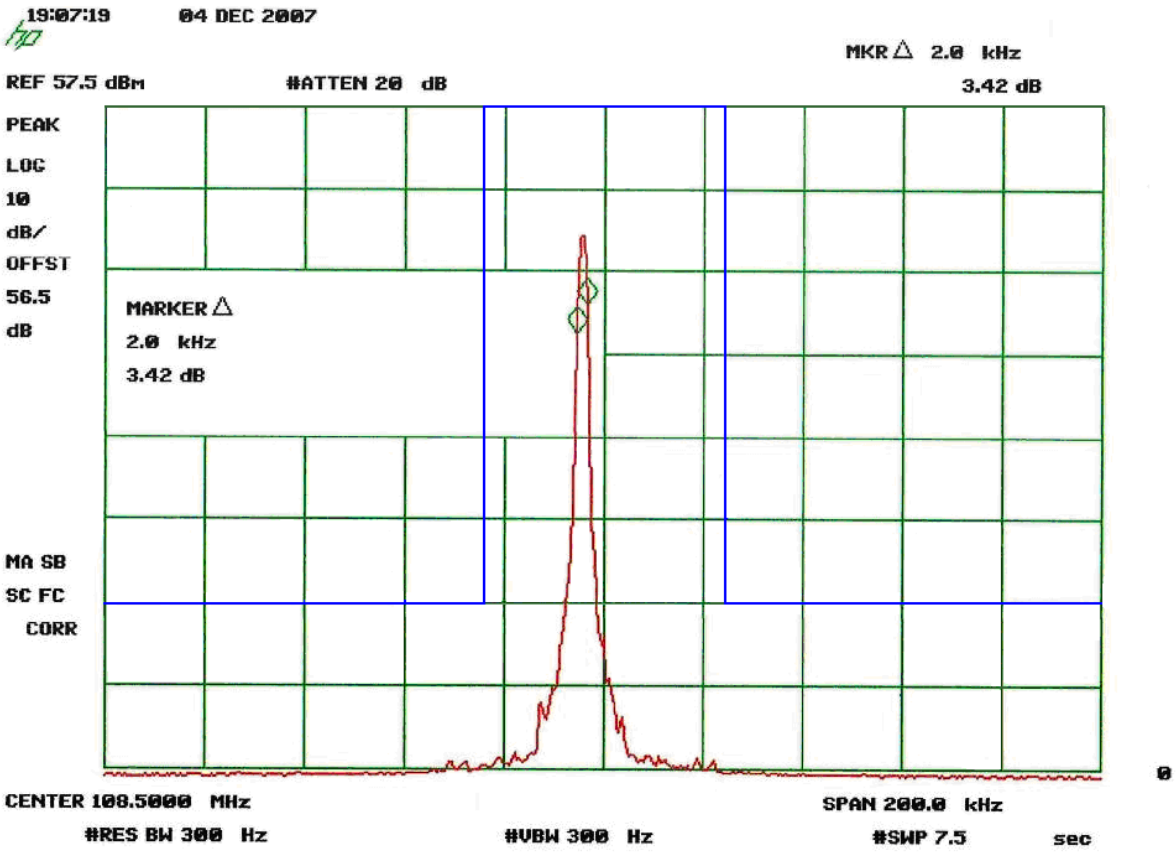


Figure 6: Occupied Bandwidth CLR @ 108.5MHz



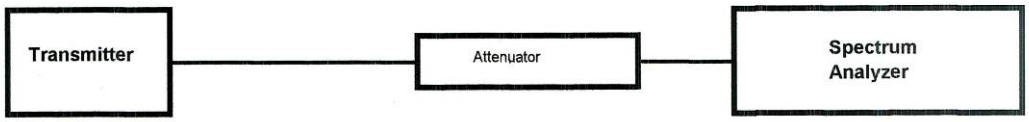
6.3 Spurious Emissions At Antenna Terminals Test Results

Part 2.1051 Spurious Emissions

EUT: Localizer

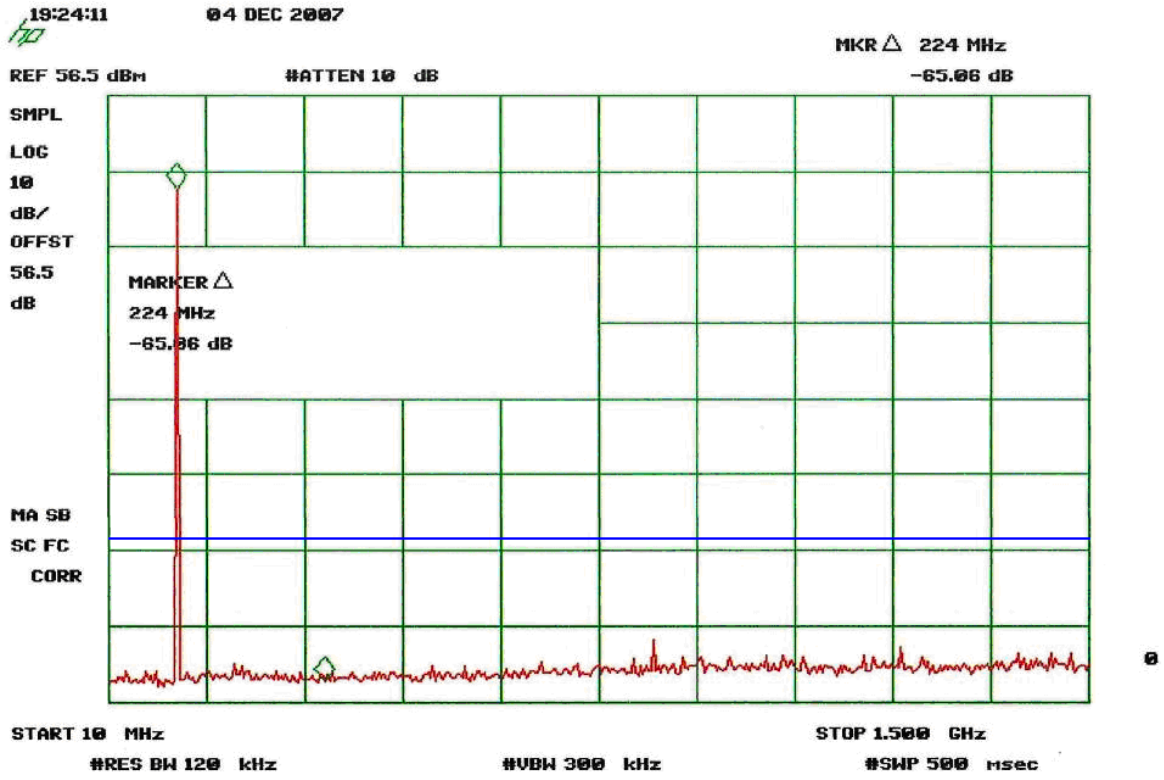
Frequency (MHz)	Spurious Frequency (MHz)	Level Below Carrier (dB)
111.5	223	64.48
	334.5	64.06
	446	64.08
	557.5	63.92
	669	63.55
	780.5	62.88
	892	62.48
	1003.5	63.15
	1115	62.57

Test Configuration:



Section 2.1051: Spurious Emissions at Antenna Terminals

Spurious Emissions @ 111.5MHz



Range: 10MHz to 1.5GHz

6.4 Field Strength of Spurious Radiation Test Results

Localizer

Part 2.1053 Field Strength Spurious Response

EUT: Localizer

Channel 111.5

Frequency (MHz)	FSM Horizontal (dBuV)	FSM Vertical (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Amp. Gain (dB)	CFS Horz. @ 3m (dBuV/m)	CFS Vert. @ 3m (dBuV/m)	Limit	Horizontal Height meters	Horizontal Azimuth degrees	Vertical Height meters	Vertical Azimuth degrees
223	73.28	72.01	12.67	1	28.14	58.81	57.54	84.4	2.5	135	1.6	135
334.5	67.22	66.84	14.77	1.2	27.95	55.24	54.86	84.4	2.5	135	1.1	180
446	52.76	53.47	19.31	1.5	27.75	45.82	46.53	84.4	2.5	90	1	180
557.5	47.94	43.62	19.96	2	27.71	42.19	37.87	84.4	2.8	135	1.5	170
669	50.5	59.27	21.25	2.5	27.64	46.61	55.38	84.4	1.8	180	2.5	135
780.5	72.11	72.27	22.73	2.3	27.63	69.51	69.67	84.4	3	90	1.4	180
892	41.55	36.02	23.07	2.1	27.63	39.09	33.56	84.4	1.5	135	1.9	180
1003.5	35.62	35.11	23.4	2.8	27.61	34.21	33.7	84.4	1.8	180	1.8	180
1115	34.3	34.2	24	3	34.5	26.8	26.7	84.4	1	180	1	180

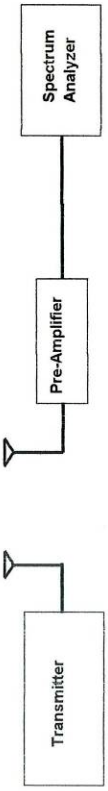
Frequency (MHz)	FSM Horizontal (dBuV)	FSM Vertical (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Amp. Gain (dB)	CFS Horz. @ 3m (dBuV/m)	CFS Vert. @ 3m (dBuV/m)	Limit	Horizontal Height meters	Horizontal Azimuth degrees	Vertical Height meters	Vertical Azimuth degrees
220	73.15	72.16	12.67	1	28.14	58.68	57.69	84.4	2.5	135	1.6	135
328.5	66.8	65.98	14.77	1.2	27.95	54.82	54	84.4	2.5	135	1.1	180
437	52.9	53.43	19.31	1.5	27.75	45.96	46.49	84.4	2.5	90	1	180
545.5	47.5	45.27	19.96	1.9	27.71	41.65	39.42	84.4	2.8	135	1.5	170
654	53	58.17	21.25	2.4	27.64	49.01	54.18	84.4	1.8	180	2.5	135
762.5	71.52	71.23	22.73	2.3	27.63	68.92	68.63	84.4	3	90	1.4	180
871	42.64	36.9	23.07	2.1	27.63	40.18	34.44	84.4	1.5	135	1.9	180
979.5	35.79	35.03	23.4	2.8	27.61	34.38	33.62	84.4	1.8	180	1.8	180
1088	32	33.76	24	2.9	34.5	24.4	26.16	84.4	1	180	1	180

Ambient

Calculations made are as follows:

CFS = Calculated Field Strength
FSM = Field Strength Measurement
CFS = FSM+Antenna Factor+Cable Loss - Pre Amplifier Gain
CFS = 73.28 + 12.67 +1 - 28.14
CFS = 58.81

Test Configuration:



APPENDIX A - TEST EQUIPMENT USED

The absolute performance calibration of equipment requiring calibration is performed on an as needed basis in accordance with ANSI/NCSL Z540-1-1994. The test equipment is capable of making measurements within tolerances of at least +/- 2dB amplitude and +/- 2% frequency deviation. Equipment certifications showing traceability to NIST (National Institute of Standards and Technology) are maintained on file at Garwood Laboratories, Inc. Pico Rivera, California. All equipment is checked and verified for proper operation before and after each series of tests.

A.1 Specific Equipment Used

Asset Number	Description	Manufacturer	Model Number	Serial Number	Calibration Due Date
20033	Pre Amplifier	Hewlett Packard	8447D	2443A03585	30-Aug-09
20090	Signal Generator	Marconi	2024	112257/58	18-Jul-08
40129	Spectrum Analyzer	Hewlett Packard	8593A	3044A0083	10-Oct-09
20003	Pre Amplifier	Hewlett Packard	8449B	3008A00357	12-Apr-09
N/A	Attenuator (10dB)	Narda	766-10	103758	UWCE
N/A	Attenuator (6dB)	Narda	766-6	105487	UWCE
8511	DRG Horn Antenna	Ailtech	3115	9607-4882	8-Jun-08
20089	Biconolog Antenna	AH Systems Inc.	SAS-521F-2	166	2-Jul-08
7940	Attenuator (20dB)	Pasternack	PE7021-20	N/A	8-Jan-08
7941	Attenuator (40dB)	Pasternack	PE7021-40	N/A	8-Jan-08

**UWCE = Use With Calibrated Equipment.*

APPENDIX B –ATTACHMENTS

INDEX OF ATTACHMENTS