

1601 North A.W. Grimes Blvd., Suite B Round Rock, TX 78665 e-mail: <u>info@ptitest.com</u> (512) 244-3371 Fax: (512) 244-1846

October 14, 2011

Behlul Poonawalla FreeFlight Systems 3700 Interstate 35 South Waco, Texas 76706

Dear Behlul:

Enclosed is the Wireless Test Report for the FDL-978-TX Transmitter by FreeFlight Systems. This report can be used to demonstrate compliance with FCC requirements for wireless devices in the United States.

If you have any questions, please contact me.

Sincerely,

Jeffrey A. Lenk President

Enclosure

Project 12679-10

FreeFlight Systems FDL-978-TX Transmitter

Wireless Certification Report

Prepared for: FreeFlight Systems 3700 Interstate 35 South Waco, Texas 76706

By

Professional Testing (EMI), Inc. 1601 N. A.W. Grimes Blvd., Suite B Round Rock, Texas 78665

> September 20, 2011 Revised October 14, 2011

Reviewed by

Jeffrey A. Lenk President

Written by

Layne Lueckemeyer Product Development Engineer

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THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF PROFESSIONAL TESTING (EMI), INC.

NOTICE: (1) This Report must not be used to claim product endorsement, by NVLAP, NIST, the FCC or any other Agency. This report also does not warrant certification by NVLAP or NIST.

(2) This report shall not be reproduced except in full, without the written approval of Professional Testing (EMI), Inc.

(3) The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.



Certificate of Compliance

Applicant:	FreeFlight Systems
Applicant's Address:	3700 Interstate 35 South Waco, Texas 76706
FCC ID:	T7YFDL978XXXX
Emission Designator	1M26F1D
Project Number:	12679-10
Test Dates:	June 17, 22, October 13, 14, 2011

The **FreeFlight Systems FDL-978-TX Transmitter** was tested to and found to be in compliance with FCC 47 CFR Part 87.

I, Layne Lueckemeyer, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

NO

Layne Lueckemeyer Product Development Engineer

This report has been reviewed and accepted by FreeFlight Systems. The undersigned is responsible for ensuring that this device will continue to comply with the FCC rules.

Representative of FreeFlight Systems

1.0 Introduction

1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of the United States.

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates, and expressions thereof for EMC testing. The procedure of ANSI C63.4: 2009 were utilized for making all emissions measurements.

1.2 EUT Description

The FDL-978-TX is designed to share aircraft position, velocity, and other flight data with other aircraft and ground station equipment. The FDL-978-TX satisfies the TSO-C154c requirements and the RTCA/DO-282B MOPS for UAT ADS-B class B1/B1S equipment. The FDL-978-TX collects position, velocity, and other aircraft information from an aircraft GPS, pressure altitude sensor, and pilot interface controller and transmits this data out once per second.

The GPS data, pressure altitude data, and pilot control inputs are received by the FDL-978-TX through configurable RS-232/422/485 serial, ARINC 429 serial, and/or discrete interfaces. Status information about the FDL-978-TX health and state are output on the configured serial links and/or discrete signals for display to the pilot. The EUT was tested while in a continuous transmit mode. The EUT was tuned to the transmit frequency 978 MHz to perform power, occupied bandwidth, spurious and harmonic tests, and frequency stability tests. The EUT continuously transmitted at maximum power. The system tested consisted of the following:

Manufacturer	Model	FCC ID Number
FreeFlight Systems	FDL-978-TX Transmitter	T7YFDL978XXXX

The following rules apply to the operation of the EUT:

Guidelines	Paragraph No.	Required	Result
RF Power Output	2.1046 / 87.131	Y	Pass
Modulation Characteristics	2.1047	Y	Pass
Occupied Bandwidth	2.1049(c) / 87.135	Y	Pass
Spurious Emissions at Antenna Terminals	2.1051 / 87.139 (1)	Y	Pass
Field Strength of Spurious Emissions	2.1053 / 87.139	Y	Pass
Frequency Stability	2.1055 / 87.133 / 87.147	Y	Pass

1.3 Modifications

No modifications were made to the EUT during the performance of the test program.

1.4 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. This site is registered with the FCC under Section 2.948 and Industry Canada per RS-212, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas, 78758, while the main office is located at 1601 N. A.W. Grimes Blvd., Suite B, Round Rock, Texas, 78665.

1.5 Applicable Documents

Document	Title	Release
TIA/EIA 603D	Land Mobile FM or PM Communications Equipment, Measurement and Performance Standards	2010
47 CFR	Part 87 – Aviation Services	

2.0 **RF Power Output Measurements**

RF power output measurements were made on the selected fundamental transmit frequency of the EUT.

2.1 Test Procedure

The output of the EUT was connected directly to an attenuator and then to the measuring receiver. And either a peak or quasi-peak detector was used for the measurement, as indicated on the report. The detector selection was based on how closely the emission level approached the limit.

The transmitter was switched on, and the measurement receiver was tuned to the frequency of the transmitter under test.

If necessary, the input attenuator setting of the measuring receiver was adjusted in order to increase the sensitivity of the measuring receiver. A diagram showing the test setup is given as Figure 2.1.1.



Figure 2.1.1: RF Power Output Test Setup

2.2 Test Criteria

The specifications of CFR47 Paragraph 2.1046(a) and applicable Parts of 2 and 87.131 are met. There are no deviations to the specifications.

2.3 Test Results

RF Power Output measurements for the EUT were taken on June 17, 2011, and the EUT was found to be in compliance with applicable requirements.

Asset #	Manufacturer	Model #	Description	Calibration Due					
0856	Narda	702-60	Attenuator, Step, 60dB, DC-12.4GHz	CBU					
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer Display (high band)	December 22, 2012					
XXXX	Pasternack	LLS	1 section	CBU					

Table 2.3.1: RF Power Output Test Equipment

Tuble 2.5.5. M Tower Output Test Results										
Project #	Date	Rule	Distance	Antenna	RBW	VBW	Detector			
12679-10	June 17, 2011	87.131	N/A	Conducted	1 MHz	1 MHz	Peak			
COMMENT	Transmitt	ing								

Table 2.3.3: RF Power Output Test Results

RF Power Output

Frequency Measured (MHz)	Measured Power (dBm)	Measured Power (W)
978	45.97	39.54

Note: E.R.P(dBm) = RF Power Output (dBm) + Path Loss (dB)

3.0 Occupied Bandwidth

Occupied bandwidth measurements were performed on the EUT to determine compliance with FCC 87.135 and FCC 2.1049.

3.1 Test Procedure

The output of the EUT was connected directly to an attenuator and then to the measuring receiver. The transmitter was switched on, and the measurement receiver was tuned to the frequency of the transmitter under test. If necessary, the input attenuator setting of the measuring receiver was adjusted in order to increase the sensitivity of the measuring receiver. A diagram showing the test setup is given as Figure 3.1.1.



Figure 3.1.1: Occupied Bandwidth Test Setup

3.2 Test Criteria

According to FCC CFR 47 Part 87, Section 87.135, the necessary bandwidth for a given class of emission is the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

3.3 Test Results

Occupied bandwidth measurements were taken on October 14, 2011, and the EUT was found to be in compliance with applicable requirements. Test equipment used to perform this test is given in Table 3.3.1.

14510 5.5.1	able 5.5.1. Occupied Dana which Test Equipment									
Asset #	Manufacturer	Model #	Description	Calibration Due						
0856	Narda	702-60	Attenuator, Step, 60dB, DC-12.4GHz	CBU						
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer Display (high band)	December 22, 2012						
XXXX	Pasternack	LLS	1 section	CBU						

 Table 3.3.1: Occupied Bandwidth Test Equipment

Project #	Date	Rule	Distance	Antenna	RBW	VBW	Detector
12679-10	October 14, 2011	87.135	N/A	Direct	100 kHz	100 kHz	Peak
COMMENT Transmitting 20 dB Bandwidth – 1.26 MHz							





20 dB

162.025 MHz Date: 14.0CT.2011 13:19:04

Result = Pass

4.0 Spurious Emissions at Antenna Terminals

Spurious emissions at antenna terminals measurements were performed on the EUT to determine compliance with FCC 87.139 and FCC 2.1051.

4.1 Test Procedure

The output of the EUT was connected directly to an attenuator and then to the measuring receiver. The transmitter was switched on, and the measurement receiver was tuned to the frequency of the transmitter under test. If necessary, the input attenuator setting of the measuring receiver was adjusted in order to increase the sensitivity of the measuring receiver. A diagram showing the test setup is given as Figure 4.1.1.



Figure 4.1.1: Spurious Emissions at Antenna Terminals Test Setup

4.2 Test Criteria

According to CFR 47 section 87.139, Universal Access Transceiver transmitters with an output power of 5 Watts or more must limit their emissions by at least $43 + 10 \log (P) dB$ on any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth. Those emissions shall be measured with a bandwidth of 100 kHz. P in the above equation is the average transmitter power measured within the occupied bandwidth in Watts.

4.3 Test Results

Spurious emissions at the antenna terminals were taken on June 22, 2011, and the EUT was found to be in compliance with applicable requirements. Test equipment used to perform this test is given in Table 4.3.1.

			<u>, , , , , , , , , , , , , , , , , </u>	
Asset #	Asset # Manufacturer Model # Descrip		Description	Calibration Due
0856	Narda	702-60	Attenuator, Step, 60dB, DC-12.4GHz	CBU
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer Display (high band)	December 22, 2012
XXXX	Pasternack	LLS	1 section	CBU

 Table 4.3.1: Spurious Emissions at Antenna Terminals Test Equipment

10-1

Project #	Date		Rule	Distance	e	Antenna	RBW	VBW	Detector
12679-10	June 22, 2	011	87.139	N/A		Direct	10 kHz	10 kHz	Peak
COMMENT	Transm	itting (S	Span: 30 kH	Iz to 300 k	Hz)				
				*RBW 10	kHz N	Marker 1 [T1	1		
				* VBW 10	kHz	-30	0.21 dBm		
Ref	30 dBm	Att	: 60 dB	SWT 10	ms	251.400000	0000 kHz		
30									
-20-							^		
1 28									
VIEW 10-									
-10-									
-0									

 Table 4.3.2: Spurious Emissions at Antenna Terminals Test Results, Data Sheet 1

162.025 MHz Date: 22.JUN.2011 16:03:56

D1 -13

20

60 70 dBm-

Limit calculation explanations:

Maximum Transmitter Power (P) 45.97 dBm Required attenuation $43 + 10\log(P)(39.54) = 58.97$ dB Emission Limits P - [43 + 10log (P) (39.54)] = -13 dBm

					1 8) 2 111 8		
Project #	Date	Date Rule Distance Antenna		Antenna	RBW	VBW	Detector
12679-10	June 22, 2011	87.139	N/A	Direct	10 kHz	10 kHz	Peak
COMMENT	Transmitting (S	Span: 300 k	Hz to 30 MH	z)			
			*RBW 10 kHz	Marker 1 [T1]		

 Table 4.3.3: Spurious Emissions at Antenna Terminals Test Results, Data Sheet 2



162.025 MHz Date: 22.JUN.2011 16:07:12

Limit calculation explanations:

Maximum Transmitter Power (P) 45.97 dBm Required attenuation 43 + 10log (P) (39.54) = 58.97 dB Emission Limits P – [43 + 10log (P) (39.54)] = -13 dBm

Project #	Date	Rule	Distance	Antenna	RBW	VBW	Detector		
12679-10	June 22, 2011	87.139	N/A	Direct	100 kHz	100 kHz	Peak		
COMMENT	Transmitting (Span: 30 MHz to 10 GHz)								





162.025 MHz Date: 22.JUN.2011 17:26:33

Limit calculation explanations:

Maximum Transmitter Power (P) 45.97 dBm Required attenuation 43 + 10log (P) (39.54) = 58.97 dB Emission Limits P – [43 + 10log (P) (39.54)] = -13 dBm

5.0 Field Strength of Spurious Emissions

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to FCC sections 2.1053, 15.109, and 87.139.

5.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 10 meters from the measurement antenna.

For spurious emissions below 1 GHz, quasi-peak detection was used with a resolution bandwidth of 120 kHz. All measurements below 1 GHz were normalized to 3 meters using a 20 dB/decade distance extrapolation. The emissions were maximized by rotating the EUT and raising and lowering the measurement antenna from 1 to 4 meters.

Spurious/harmonic emissions above 1 GHz peak were measured with average and peak detection with a resolution bandwidth of 1 MHz and measured at a distance of 1 meter. Average detection was used to determine compliance of the EUT if the peak did not meet the average limit. Non-harmonic emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given as Figure 5.1.1. Above 1 GHz, testing was completed at the transmit frequency to determine compliance.



Figure 5.1.1: Radiated Emission Test Setup

5.2 Test Criteria

The radiated limits of FCC 15.209 are shown below. The limits specified are at 3 meters. The limits are quasi-peak for emissions below 1 GHz and average for emissions above 1 GHz. Also above 1 GHz, the peak limit is 20 dB above the average limit.

Frequency MHz	Specification Distance (Meters)	Field Strength (dBuV/m)	Test Distance (Meters)	Field Strength (dBuV/m)
30 to 88	3	40.0	10	29.5
88 to 216	3	43.5	10	33
216 to 960	3	46.0	10	35.5
Above 960	3	54.0	1	63.5

5.3 Test Results

Out of band spurious emissions measurements were taken on June 17, 2011, and the EUT was found to be in compliance with applicable requirements. Test equipment used to perform this test is given in Table 5.3.1.

Asset #	Manufacturer	Model #	Description	Calibration Due
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	8/10/2011
85	HP	85650A	Quasi-Peak Adapter CISPR	7/28/2011
0949	HP	85662A	Spec Anal Dsply for AN	N/A
1525	HP	8566B	Spectrum Analyzer 100Hz-22GHz	6/7/2012
238	HP	85685A	RF Preselector	7/27/2011
1497	EMCO	3108	Antenna, Bi Con, 30-300MHz	8/4/2011
1278	HP	85650A	Quasi Peak Adapter	7/28/2011
1834	HP	85662A	Spec Anal Dsply	N/A
1145	HP	8568B	Spectrum Analyzer 100Hz-1.5GHz	7/28/2011
1035	HP	85685A	RF Preselector	4/13/2012
1486	EMCO	3147	Antenna, Log Periodic, .2-5GHz	8/4/2011
1497	EMCO	3108	Antenna, Bi Con, 30-300MHz	8/4/2011
C026	N/A	RG214	Cable Coax, N-N, 25m	8/10/2011
C027	N/A	RG214	Cable Coax, N-N, 25m	8/10/2011
1414	HP	8447D	Preamp	7/15/2011
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	4/7/2012
1594	Miteq	AFS4- 01001800	Amplifier, 1-26.5GHz, 42dB	1/28/2012
1529	Miteq	AFS4- 01001800	Amplifier, 1-26.5GHz, 36dB	7/16/2011
C030	N/A	0	Cable Coax, N-N, 30m	3/21/2012
1780	ETS-Lindgren	3117	Antenna, DRG Horn, 1 - 18 GHz	1/14/2012
948	EMCO	3301B	Antenna, Rod, Active, 30Hz-50MHz	9/15/2011

Table 5.3.1: Field Strength of Spurious Emissions Test Equipment

Project #	# I	Date	Rule	Distance	e Ante	enna	RBW	VBW	Detector
12679-10) June	17, 2011	87.139	10 m	Bicon	Log	CISPR 120 kH	z 1 MHz	Quasi Peak
COMME	NT	Transm	itting		•				•
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Correcte Level (dBµV/n	d Limit Level (dBµV/m)	Margin (dB)	Test Results
54.72	10	50	4	Quasi-peak	29.3	14.5	94.0	-79.5	Pass
100.031	10	99	4	Quasi-peak	41.9	26.7	94.0	-67.3	Pass
123.57	10	197	4	Quasi-peak	37.5	25.2	94.0	-68.8	Pass
500.035	10	336	4	Quasi-peak	28.5	25.2	94.0	-68.8	Pass
520.042	10	210	4	Quasi-peak	32.8	29.9	94.0	-64.1	Pass
100.0 - 90.0 - 80.0 -	PROFESSIONAL TESTING						Project # - 12679-10 Voltage - 12 VDC		
(100- (10- (1					k ar 111				
20.0- 10.0- 0- 10		۸۰ (~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	«المراسم			a marked and a state of the sta	1.0G	
07:27:06	1000M 1.06 Operator: Layne Lueckemeyer Frequency (Hz) — Horizontal Data 07:27:06 AM, Friday, June 17, 2011 Transmit Normal Operation — Part 87 Limit								
			30MH	Iz to 1GHz, H	Horizontal Po	olarity			

Table 5.3.2: Field Strength of Spurious Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

Result = Pass

Project #	¥ I	Date	Rule	Distance	e Ante	enna	RBW	VBW	Detector
12679-10) June	17, 2011	87.139	10 m	Bicon	Log (CISPR 120 kH	z 1 MHz	Quasi Peak
COMME	NT	Transm	itting		•				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m	d Limit Level (dBµV/m)	Margin (dB)	Test Results
54.72	10	50	4	Quasi-peak	29.3	14.5	94.0	-79.5	Pass
100.031	10	99	4	Quasi-peak	41.9	26.7	94.0	-67.3	Pass
123.57	10	197	4	Quasi-peak	37.5	25.2	94.0	-68.8	Pass
500.035	10	336	4	Quasi-peak	28.5	25.2	94.0	-68.8	Pass
520.042	10	210	4	Quasi-peak	32.8	29.9	94.0	-64.1	Pass
599.67	10	108	4	Quasi-peak	30.1	29.0	94.0	-65.0	Pass
100.0 90.0- 80.0-	PROFESSIONAL		Prote SSIONAL Lesting 10 Meter Radiated Emissions 30-1000MHz Horizontal Plot Project # - 12679-10 Voltage - 12 VDC						
(LL/NBC) (LL	om r: Layne Luecken	Peyer	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰	om cy (Hz)		landallah	1.0g — Horizo	ntal Data
07:27:00	6 AM, Friday, June	17,2011	30MH	Iz to 1GHz, F	Horizontal Pe	olarity		— Part8	7 Limit

Table 5.3.3: Field Strength of Spurious Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

Result = Pass

Project #	Date		Rule	Distance	Antenna	RBW	VBW
12679-10	October 13, 2011		87.139	3 m	Horn	1 MHz	1 MHz
COMMENT Transm			itting				

Table 5.3.4: Field Strength	of Spurious Emissions	Test Results , 1	GHz to 10 GHz,
Horizontal Polarization	_		

Frequency Measured (MHz)	Meter Reading (dBm)	Substitution Level (dBm)	Substitution Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
1956	-71.7	-55.9	6.2	-49.7	-13.0	-36.7
2934	-84.3	-46.1	7.1	-39.0	-13.0	-26.0
3912	-84.7	-40.5	8.0	-32.5	-13.0	-19.5
4890	-83.2	-36.6	9.1	-27.5	-13.0	-14.5
5868	-77.1	-39.6	8.4	-31.2	-13.0	-18.2
6846	-82.9	-35.9	9.6	-26.3	-13.0	-13.3
7827	-81.2	-37.4	9.0	-28.4	-13.0	-15.4
8802	-80.3	-34.8	9.6	-25.2	-13.0	-12.2
9780	-81.8	-33.2	9.8	-23.4	-13.0	-10.4

Result = Pass

Table 5.3.5: Field Strength of Spurious Emissions Test Results, 1 GHz to 10 GHz, Vertical Polarization

Project #	Date		Rule	Distance	Antenna	RBW	VBW
12679-10	October 13, 2011		87.139	3 m	Horn	1 MHz	1 MHz
COMMENT Trans		Transm	itting				

Frequency Measured (MHz)	Meter Reading (dBm)	Substitution Level (dBm)	Substitution Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
1956	-82.4	-53.5	6.2	-47.3	-13.0	-34.3
2934	-84.3	-49.4	7.1	-42.3	-13.0	-29.3
3912	-84.7	-49.1	8.0	-41.1	-13.0	-28.1
4890	-83.2	-36.6	9.1	-27.5	-13.0	-14.5
5868	-77.9	-39.6	8.4	-31.2	-13.0	-18.2
6846	-82.7	-38.9	9.6	-29.3	-13.0	-16.3
7827	-81.5	-38.6	9.0	-29.6	-13.0	-16.6
8802	-81.1	-33.6	9.6	-24.0	-13.0	-11.0
9780	-81.8	-33.2	9.8	-23.4	-13.0	-10.4

Result = Pass

Project # Date Class Distance Antenna **RBW** VBW Detector 12679-10 June 17, 2011 FCC B 10 m CISPR 120 kHz 1 MHz Quasi-Peak Bicon | Log COMMENT Standby Mode Frequency Test EUT Antenna Recorded Corrected Limit Level Margin Detector Test Measured Distance Direction Height Amplitude Level Function $(dB\mu V/m)$ (**dB**) Results (MHz) (Meters) (dBµV) $(dB\mu V/m)$ (Degrees) (Meters) 54.72 10 50 29.3 14.5 4 29.5 -15.0 Pass Quasi-peak 100.031 10 99 4 Quasi-peak 41.9 26.7 33.0 -6.3 Pass 123.57 10 197 4 Quasi-peak 37.5 25.2 33.0 -7.8 Pass 10 4 500.035 336 Quasi-peak 28.5 25.2 35.5 -10.3 Pass 520.042 10 210 4 Quasi-peak 32.8 29.9 35.5 -5.6 Pass 599.67 10 108 4 30.1 29.0 35.5 Pass Quasi-peak -6.5 Company - FreeFlight Systems, Inc. **Professional Testing** Model#-RANGRADS-B 10 Meter Radiated Emissions 30-1000MHz Class B Horizontal Plot Description - 978 MHz Transmitter Project # - 12679-10 PROFESSIONAL Voltage - 12 VDC 100 80.0 70.0 Amplitude(dBuMm) 60.0 50.0 40.0 30.0 11. 20.0 un 10.0 0∔ 10.01 100.0N 1.0G Frequency (Hz) Operator: Layne Lueckemeyer Hor izontal Data Standby Mode - FCC B 30M-1GHz 08:44:48 AM, Friday, June 17, 2011 **30MHz to 1GHz, Horizontal Polarity**

Table 5.3.6: Field Strength of Spurious Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

Result = Pass

Project #	¥ I	Date	Class	Distance	e Ante	enna	RBW	VBW	Detector
12679-10) June	17, 2011	FCC B	10 m	Bicon	Log	CISPR 120 kH	z 1 MHz	Quasi Peak
COMME	NT	Standby	/ Mode						
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Correct Level (dBµV/1	ed Limit Level (dBµV/m)	Margin (dB)	Test Results
54.72	10	239	1	Quasi-peak	31.9	17.1	29.5	-12.4	Pass
100.031	10	152	1.5	Quasi-peak	37.9	22.7	33.0	-10.3	Pass
123.57	10	214	1.3	Quasi-peak	30.6	18.3	33.0	-14.7	Pass
500.035	10	35	2.6	Quasi-peak	28.5	25.2	35.6	-10.4	Pass
520.042	10	146	1	Quasi-peak	32.9	30.0	35.6	-5.6	Pass
599.67	10	91	1	Quasi-peak	29.8	28.7	35.6	-6.9	Pass
100.0	PROFESSIONAL 10.001 10.002								
900- 80.0- (LV N B00- 9500- 9500- 30.0- 200-								F	
10.0- 0- 10. Operato 08:49:59	om r: Layne Luecken) AM, Friday, June	neyer 17,2011		100 Frequer Standby Mode	.om ncy(Hz)			1.0G — Vertic — FCC B	al Data 30M-1GHz
			30N	IHz to 1GHz,	Vertical Pol	larity			

Table 5.3.7: Field Strength of Spurious Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

Result = Pass

Project #	· I	Date	Class	Distance	e Ant	enna	RBW	VBW	Detector
12679-10	June	17, 2011	FCC B	3 m	Н	orn	1 MHz	1 MHz	Average
COMME	NT	Standby	v Mode						-
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Correct Level (dBµV/	m) Limit Level (dBµV/m)	Margin (dB)	Test Results
1997	3	1	1	Average	48.9	15.6	54.0	-38.4	Pass
4376	3	1	1	Average	45.1	16.9	54.0	-37.1	Pass
5995	3	1	1	Average	50.1	23.9	54.0	-30.1	Pass
7184	3	1	1	Average	47.3	23.4	54.0	-30.6	Pass
8018	3	1	1	Average	40.4	18.0	54.0	-36.0	Pass
9122	3	1	1	Average	31.3	11.3	54.0	-42.7	Pass
80.0	PROFESSIONAL TESTING	AL Project # - 12679-10 Voltage - 12 VDC							
70.0									
(W/MB) mude (dBu/M)									
40.0	Alista south south the state of the	an a	Andread Annual Station		han proget had not be press		in the second		
300 100 100 1000 Operator: Layne Lueckemeyer Frequency (Hz) 09:29:26 AM, Friday, June 17, 2011 Standby Mode									
1GHz to 10GHz, Horizontal Polarity									

Table 5.3.8: Field Strength of Spurious Emissions Test Results, 1 GHz to 10 GHz, Horizontal Polarization

Result = Pass

Project #	E E	Date	Class	Distanc	e Ai	ntenna		RBW	VBV	V Detector
12679-10	June	17, 2011	FCC B	3 m		Horn		1 MHz	1 MF	Iz Average
COMME	COMMENT Standby Mode									
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorde Amplitud (dBµV)	d Corred le Leve (dBµV	cted el /m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
2067	3	1	1	Average	46.3	13.2	2	54.0	-40.8	Pass
4376	3	1	1	Average	45.1	16.9)	54.0	-37.1	Pass
5995	3	1	1	Average	48.9	22.7	7	54.0	-31.3	Pass
7184	3	1	1	Average	47.3	23.4	1	54.0	-30.6	Pass
8018	3	1	1	Average	40.4	18.0)	54.0	-36.0	Pass
)122	5	1	1	Tivelage	51.5	11.	, I	54.0	-42.7	1 435
80.0	PROFESSIONAL T E S T I N G	Model # - RANGR ADS-B 3 Meter Radiated Emissions 1-10GHz Class B Vertical Plot Project # - 12679-10 Voltage - 12 VDC								
70.0 (LLI/N 60.0 9 00 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1										-
40.0 300	erge hetterlik im der staterliker h	ndadistational and the	an a	a tagahi tana dina ^{ka} ti				liman	ngin ^{terest} atives	
1.0s 100G Operator: Layne Lueckemeyer Frequency (Hz) 09:36:22 AM, Friday, June 17, 2011 Standby Mode										
1GHz to 10GHz, Vertical Polarity										

Table 5.3.9: Field Strength of Spurious Emissions Test Results, 1 GHz to 10 GHz, Vertical Polarization

Result = Pass

6.0 Frequency Stability

Frequency stability measurements were performed on the EUT to determine compliance to FCC sections 87.133, 87.147, and 2.1055.

6.1 Test Procedure

The temperature stability of the frequency-generating components of the transmitter were observed. The transmitter was placed in a temperature chamber with a programming coil that enables a transmission to be requested from outside the chamber. A receiving antenna outside the chamber picked up the transmitted signal, which was fed to the spectrum analyzer. With the transmitter programmed to transmit at 978 MHz, the chamber temperature was set to 20° C.

After reaching the set temperature, the transmitter was allowed to stabilize. The transmitted signal was captured by the spectrum analyzer, and the frequency was determined. The temperature in the chamber was then increased to 30° C. At each temperature, at least 20 minutes were allowed for stabilization of the transmitter, a transmission was made, and the frequency determined.

The temperature was increased in 10° C intervals to $+50^{\circ}$ C. The temperature was then returned to 20° C, stabilized, and then decreased to -30° C in 10° intervals. The temperature was stabilized at each 10° interval before a reading was made. The frequency at each temperature was recorded, compared to the 978 MHz tuned frequency, and recorded in Table 6.3.1. As evidenced by the data in the table, all readings are within the deviation limit of ± 2.5 ppm at 978 MHz.

A diagram showing the test setup is shown in Figure 6.1.1



Figure 6.1.1: Frequency Stability Test Setup

6.2 Test Criteria

According to FCC Part 2, Section 2.1055(a) (1), the frequency stability shall be measured with variation of ambient temperature from -30° C to $+50^{\circ}$ C.

6.3 Test Results

Frequency stability measurements were taken on June 22, 2011, and the EUT was found to be in compliance with applicable requirements.

Project #	Date	Rule	Distance	Antenna	RBW	VBW	Detector	
12679-10	June 22, 2011	87.133	Direct	Direct	100 kHz	100 kHz	Peak	
COMMENT Reference Frequency = 978.000000 MHz								

Table 6.3.1: Frequency Stability Test Results

Temperature (°C)	Measured Frequency (MHz)	Deviation (Hz)	Deviation (PPM)
-30	978.000105	105	.110
-20	978.000010	10	.010
-10	978.000196	196	.200
0	977.999999	1	.001
10	978.000167	167	.171
20	978.000000	0	0
30	978.000990	990	1.012
40	978.000020	20	.020
50	978.000081	81	.083

Result = Pass

End of Report

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