



# Compliance Testing, LLC

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toll-free: (866) 311-3268

fax: (480) 926-3598

<http://www.ComplianceTesting.com>

[info@ComplianceTesting.com](mailto:info@ComplianceTesting.com)

## Test Report

Prepared for: Bird Technologies Group

Model: 614 Series/450-470MHz

Description: UHF Digital Signal Booster

FCC ID: EZZ61470

To

FCC Part 1.1310

Date of Issue: May 14, 2015

On the behalf of the applicant:

Bird Technologies Group  
30303 Aurora Road  
Solon, OH 44139

Attention of:

Amy Sanvido, RF Engineer  
Ph: (440) 519-2179  
E-Mail: [asanvido@bird-technologies.com](mailto:asanvido@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](http://www.compliancetesting.com)  
Project No: p1460007

**Greg Corbin**  
Project Test Engineer

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All results contained herein relate only to the sample tested



### Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	August 11, 2014	Greg Corbin	Original Document
2.0	September 18, 2014	Mike Graffeo	Corrected antenna gain/loss to -4dBi
3.0	October 29, 2014	Greg Corbin	Corrected report to show power spectral density calculations in place of minimum safe distance
4.0	April 27, 2015	Greg Corbin	Changed exposure environment from Controlled to Uncontrolled and calculated new limits.
5.0	May 12, 2015	Greg Corbin	Added MPE calculations for all modes of operation, including mfr rated power + 20%



## ILAC / A2LA

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The tests results contained within this test report all fall within our scope of accreditation, unless 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**

### **EUT Description**

**Model:** 614 Series/450-470MHz

**Description:** UHF Digital Signal Booster

**Firmware:** R21.D6

**Software:** N/A

### **Additional Information:**

The EUT is a Class B industrial UHF digital signal booster operating from 450 – 470 MHz. The downlink operates from 450 – 465 MHz and the uplink operates from 455 – 470 MHz.

Each band has a low power and high power output, configurable in software but not available to the end user, the selection of either low or high power is a factory setting only.

MPE calculations were performed for the downlink at low and high power using an antenna with – 4 dBi gain.

MPE calculations were performed on the uplink at low and high power using an antenna with – 1.28 dBi gain.

MPE calculations were performed at the manufacturer's rated output of +37 dBm +20 % using an antenna with 0 dBi gain.



**MPE Evaluation**

This is a Fixed device used in an **Uncontrolled** Exposure environment.

**Limits Uncontrolled Exposure**  
**47 CFR 1.1310**  
**Table 1, (B)**

0.3-1.234 MHz:	Limit [mW/cm <sup>2</sup> ] = 100
1.34-30 MHz:	Limit [mW/cm <sup>2</sup> ] = (180/f <sup>2</sup> )
30-300 MHz:	Limit [mW/cm <sup>2</sup> ] = 0.2
300-1500 MHz:	Limit [mW/cm <sup>2</sup> ] = f/1500
1500-100,000 MHz	Limit [mW/cm <sup>2</sup> ] = 1.0

**Test Data**

**Uplink Output Power set to manufacturer's (Mfr) rated output power (+37 dBm) + 20 % using an antenna with 0 dBi gain**

Test Frequency, MHz	455
Power, Mfr rated, mW (P)	5012
Power, Mfr rated + 20%, mW (P)	6014.4 mw (37.79 dBm)
Antenna Gain Isotropic	0 dBi
Antenna Gain Numeric (G)	1
Distance (R)	20 cm

$S = \frac{P * G}{4\pi r^2}$			
Power Density (S) mw/cm <sup>2</sup>	Power mW (P)	Numeric Gain (G)	Distance (r <sup>2</sup> ) cm
1.197	6014.4	1	20

Power Density (S) = 1.197 mw/cm <sup>2</sup>
Limit =(from above table) = 0.303mw/cm <sup>2</sup>

With the Uplink output power set to **(Mfr) rated output power (+37 dBm) + 20 %** using a 0 dBi antenna, the EUT does not meet the power density requirements at 20 cm, so the minimum safe distance was calculated below.

**Minimum Safe Distance Evaluation**

**Test Data**

**Uplink Output Power set to manufacturer's (Mfr) rated output power (+37 dBm) + 20 % using an antenna with 0 dBi gain**

Test Frequency, MHz	455
Power, Mfr rated, mW (P)	5012
Power, Mfr rated + 20%, mW (P)	6014.4 mw (37.79 dBm)
Antenna Gain Isotropic	0 dBi
Antenna Gain Numeric (G)	1
Limit (L)	0.303

$R = \sqrt{(PG/4\pi L)}$			
Distance (R) cm	Power mW (P)	Numeric Gain (G)	Limit (L)
39.8	6014.4	0	0.303

With the Uplink Output Power set to the manufacturer's (Mfr) rated output power (+37 dBm) + 20 % using an antenna with 0 dBi gain , the minimum safe distance is 39.8 cm.



**MPE Evaluation**

This is a Fixed device used in an **Uncontrolled** Exposure environment.

**Limits Uncontrolled Exposure**  
**47 CFR 1.1310**  
**Table 1, (B)**

0.3-1.234 MHz:	Limit [mW/cm <sup>2</sup> ] = 100
1.34-30 MHz:	Limit [mW/cm <sup>2</sup> ] = (180/f <sup>2</sup> )
30-300 MHz:	Limit [mW/cm <sup>2</sup> ] = 0.2
300-1500 MHz:	Limit [mW/cm <sup>2</sup> ] = f/1500
1500-100,000 MHz	Limit [mW/cm <sup>2</sup> ] = 1.0

**Test Data**

**Downlink high power mode using a - 4.0 dBi antenna**

Test Frequency, MHz	450.5
Power, Conducted, mW (P)	4266
Antenna Gain Isotropic	- 4.0 dBi
Antenna Gain Numeric (G)	0.4
Distance (R)	20 cm

$S = \frac{P * G}{4\pi r^2}$			
Power Density (S) mw/cm <sup>2</sup>	Power mW (P)	Numeric Gain (G)	Distance (r <sup>2</sup> ) cm
0.339	4266	0.4	20

Power Density (S) =0.339 mw/cm <sup>2</sup>
Limit =(from above table) = 0.300 mw/cm <sup>2</sup>

In the Downlink high power operating mode, the EUT does not meet the power density requirements at 20 cm, so the minimum safe distance was calculated below.

**Minimum Safe Distance Evaluation**

**Test Data**

**Downlink high power operating mode using a - 4.0 dBi antenna**

Test Frequency, MHz	450.5
Power, Conducted, mW (P)	4266
Antenna Gain Isotropic	- 4.0 dBi
Antenna Gain Numeric (G)	0.4
Limit (L)	0.300

$R = \sqrt{(PG/4\pi L)}$			
Distance (R) cm	Power mW (P)	Numeric Gain (G)	Limit (L)
21.28	4266	0.4	0.300

The minimum safe distance with a – 4.0 dBi antenna is 21.3 cm In the Downlink high power operating mode.



**MPE Evaluation**

This is a Fixed device used in an **Uncontrolled** Exposure environment.

**Limits Uncontrolled Exposure**  
**47 CFR 1.1310**  
**Table 1, (B)**

0.3-1.234 MHz:	Limit [mW/cm <sup>2</sup> ] = 100
1.34-30 MHz:	Limit [mW/cm <sup>2</sup> ] = (180/f <sup>2</sup> )
30-300 MHz:	Limit [mW/cm <sup>2</sup> ] = 0.2
300-1500 MHz:	Limit [mW/cm <sup>2</sup> ] = f/1500
1500-100,000 MHz	Limit [mW/cm <sup>2</sup> ] = 1.0

**Test Data**

**Downlink low power operating mode using a - 4.0 dBi antenna**

Test Frequency, MHz	451
Power, Conducted, mW (P)	354.8
Antenna Gain Isotropic	- 4.0 dBi
Antenna Gain Numeric (G)	0.4
Distance (R)	20 cm

$S = \frac{P * G}{4\pi r^2}$			
Power Density (S) mw/cm <sup>2</sup>	Power mW (P)	Numeric Gain (G)	Distance (r <sup>2</sup> ) cm
0.028	354.8	0.4	20

Power Density (S) = 0.028 mw/cm <sup>2</sup>
Limit =(from above table) = 0.301 mw/cm <sup>2</sup>

The EUT power density at 0.028 mw/cm<sup>2</sup> is below the power density limit of 0.301 mw/cm<sup>2</sup> in the low power operating mode.

The EUT meets the power density requirements at 20 cm.



**MPE Evaluation**

This is a Fixed device used in an **Uncontrolled** Exposure environment.

**Limits Uncontrolled Exposure**  
**47 CFR 1.1310**  
**Table 1, (B)**

0.3-1.234 MHz:	Limit [mW/cm <sup>2</sup> ] = 100
1.34-30 MHz:	Limit [mW/cm <sup>2</sup> ] = (180/f <sup>2</sup> )
30-300 MHz:	Limit [mW/cm <sup>2</sup> ] = 0.2
300-1500 MHz:	Limit [mW/cm <sup>2</sup> ] = f/1500
1500-100,000 MHz	Limit [mW/cm <sup>2</sup> ] = 1.0

**Test Data**

**Uplink high power mode using a – 1.28 dBi antenna**

Test Frequency, MHz	455.1
Power, Conducted, mW (P)	4677
Antenna Gain Isotropic	- 1.28 dBi
Antenna Gain Numeric (G)	0.74
Distance (R)	20 cm

$S = \frac{P * G}{4\pi r^2}$			
Power Density (S) mw/cm <sup>2</sup>	Power mW (P)	Numeric Gain (G)	Distance (r <sup>2</sup> ) cm
0.689	4677	0.74	20

Power Density (S) =0.689 mw/cm <sup>2</sup>
Limit =(from above table) = 0.303 mw/cm <sup>2</sup>

In the Uplink high power operating mode, the EUT does not meet the power density requirements at 20 cm, so the minimum safe distance was calculated below.

**Minimum Safe Distance Evaluation**

**Test Data**

**Uplink high power operating mode using a – 1.28 dBi antenna**

Test Frequency, MHz	455.1
Power, Conducted, mW (P)	4677
Antenna Gain Isotropic	- 1.28 dBi
Antenna Gain Numeric (G)	0.74
Limit (L)	0.303

$R = \sqrt{(PG/4\pi L)}$			
Distance (R) cm	Power mW (P)	Numeric Gain (G)	Limit (L)
30.2	4677	0.74	0.303

The minimum safe distance with a – 1.28 dBi antenna is 30.2 cm in the Uplink high power operating mode.



**MPE Evaluation**

This is a Fixed device used in an **Uncontrolled** Exposure environment.

**Limits Uncontrolled Exposure**  
**47 CFR 1.1310**  
**Table 1, (B)**

0.3-1.234 MHz:	Limit [mW/cm <sup>2</sup> ] = 100
1.34-30 MHz:	Limit [mW/cm <sup>2</sup> ] = (180/f <sup>2</sup> )
30-300 MHz:	Limit [mW/cm <sup>2</sup> ] = 0.2
300-1500 MHz:	Limit [mW/cm <sup>2</sup> ] = f/1500
1500-100,000 MHz	Limit [mW/cm <sup>2</sup> ] = 1.0

**Test Data**

**Uplink low power operating mode using a – 1.28 dBi antenna**

Test Frequency, MHz	455.9
Power, Conducted, mW (P)	346.7
Antenna Gain Isotropic	- 1.28 dBi
Antenna Gain Numeric (G)	1.34
Distance (R)	20 cm

$S = \frac{P * G}{4\pi r^2}$			
Power Density (S) mw/cm <sup>2</sup>	Power mW (P)	Numeric Gain (G)	Distance (r <sup>2</sup> ) cm
0.092	346.7	1.34	20

Power Density (S) = 0.092 mw/cm <sup>2</sup>
Limit =(from above table) = 0.304 mw/cm <sup>2</sup>

The EUT power density at 0.092 mw/cm<sup>2</sup> is below the power density limit of 0.304 mw/cm<sup>2</sup> in the uplink low power operating mode.

The EUT meets the power density requirements at 20 cm in the uplink low power operating mode.

END OF TEST REPORT