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Test Report

Prepared for: Bird Technologies

Model: DDRXXX

Description: Public Safety Fiber DAS Remote (33dBm)

Serial Number: 10636

FCC ID: V5FDDR002

To

FCC Part 90

Date of Issue: November 20, 2015

On the behalf of the applicant:	**Bird Technologies** **30303 Aurora Road** **Solon, OH 44139**
Attention of:	**Amy Sanvido, RF Engineer** **Ph: (440)519-2179** **E-Mail: asanvido@bird-technologies.com**

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Project No: p1580020

Shawn McMillen
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	September 24, 2015	Shawn McMillen	Original Document
2.0	November 5, 2015	Shawn McMillen	Addition of configuration

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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

The Applicant has been cautioned as to the following:

15.21: **Information to the User**

The user's manual or instruction manual for an intentional 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.

15.27(a): **Special Accessories**

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations Part 90.219, KDB 935210 D05 Booster, and FCC Part 2, 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)**
24.7 – 27.9	44.9 – 51.5	963.5 – 970.4

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

EUT Description
Model: DDRXXX
Description: Public Safety Fiber DAS Remote (33dBm)
Firmware: N/A
Software: N/A
S/N: 10636
Additional Information: N/A

EUT Operation during Tests
Note: the UL is directly connected to a base station and therefore does not radiate.
The EUT was setup in an end to end configuration. Signals were injected into the head end unit and measured from the remote unit.

AGC Threshold
Several tests reference the AGC Threshold level.
The AGC Threshold was measured as follows:

- Connect a signal generator to the input of the EUT.
- Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- Use a CW signal.
- While monitoring the output of the EUT, increase the input level until the output stops increasing or drops a few 10th's of a dB.
- This is the AGC threshold level of the EUT.
- When the procedure calls out to set the RF Input to just below the AGC Threshold, The AGC Threshold is measured using the procedure listed above, and then the RF Input is backed off 0.2 dB below this threshold level.

Band	RF path	Frequency Range (MHz)	Emission Designators
VHF	Downlink	150 - 174	16K0F3E 11K0F3E 4K00F1E
VHF	Uplink	150 - 174	16K0F3E 11K0F3E 4K00F1E
UHF	Downlink	450 - 512	16K0F3E 11K0F3E 4K00F1E
UHF	Uplink	450 - 512	16K0F3E 11K0F3E 4K00F1E
700MHz	Downlink	763 - 775	16K0F3E 11K0F3E 4K00F1E
700MHz	Uplink	793 - 805	16K0F3E 11K0F3E 4K00F1E
800MHz	800MHz	851 - 869	16K0F3E 11K0F3E 4K00F1E
800MHz	Uplink	806 - 817	16K0F3E 11K0F3E 4K00F1E

Accessories: None

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	RF Cable	2	N	N	N/A

Modifications: None

Test Result Summary

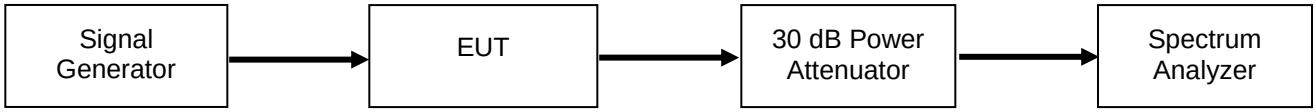
Specification	Test Name	Pass, Fail, N/A	Comments
KDB 935210-D03	Out of Band Rejection	Pass	
2.1046	Output Power (Conducted)	Pass	
90.210 2.1049	Occupied Bandwidth (Emission Masks)	Pass	
2.1051	Spurious Emissions (Transmitter Conducted)	Pass	
KDB 935210-D03	Intermodulation	Pass	
90.219(e)(2)	Noise Figure	Pass	
90.543	Emissions Limits	Pass	
90.213	Frequency Stability (Temperature Variation)	N/A	Does not have frequency translations
90.213	Frequency Stability (Voltage Variation)	N/A	Does not have frequency translations

Out of Band Rejection
Engineer: Shawn McMillen
Test Date: 9/23/2015

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 3 dB below the AGC Threshold level. The Uplink and Downlink filter response and the -20 dB bandwidth were 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 = 100 KHz
Video BW = 3x RBW

Test Setup



Refer to Annex A for Out of Band Rejection plots.

Conducted Output Power and Amplifier Gain

Engineer: Shawn McMillen

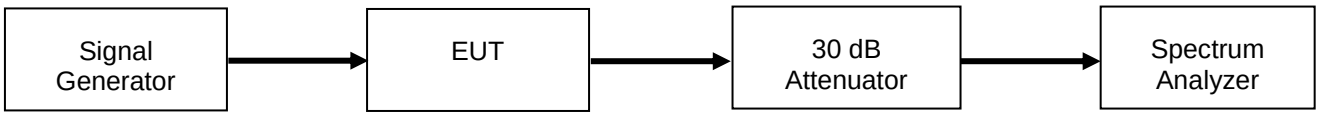
Test Date: 9/23/2015

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 reference level offset to ensure accurate readings were obtained.
A CW signal was utilized, set to the frequency of the peak amplitude measured in the Out of Band Rejection test.
The RF input signal level was set to 0.2 dB below the AGC Threshold.
RBW = 100 kHz
Video BW = 3x RBW
The Input and Output power levels were recorded and the gain was calculated using the following formula:

Gain (dB) = Output Power (dBm) – Input Power (dBm)

Test Setup



Output Power and Gain Test Results

Band	Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
VHF	150	-33.28	29.50	62.78
	162	-34.17	29.21	63.38
	174	-36.18	28.20	64.38
UHF	450	-33.32	33.40	66.72
	470	-33.56	33.45	67.01
	490	-32.36	33.14	65.50
	512	-31.64	32.94	64.58
700	763	-39.38	32.94	71.89
	769	-39.38	32.45	71.83
	775	-40.08	32.37	72.45
800	851	-26.7	32.38	59.08
	860	-27.8	32.34	60.17

Conducted Spurious Emissions
Engineer: Shawn McMillen
Test Date: 9/8/2015

Test Procedure

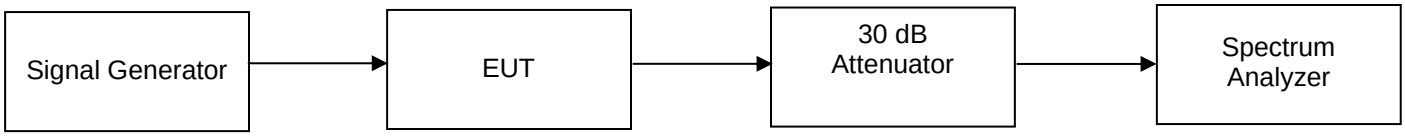
The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 30 dB Power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings were obtained.
A CW signal was utilized, set to the center frequency of the passband.
The RF input signal level was set to 0.2 dB below 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.

The frequency range from 30 MHz to the 10^{th} 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 B for Conducted Spurious Emissions Plots

Radiated Spurious Emissions
Engineer: Shawn McMillen
Test Date: 9/3/2015

Test Procedure

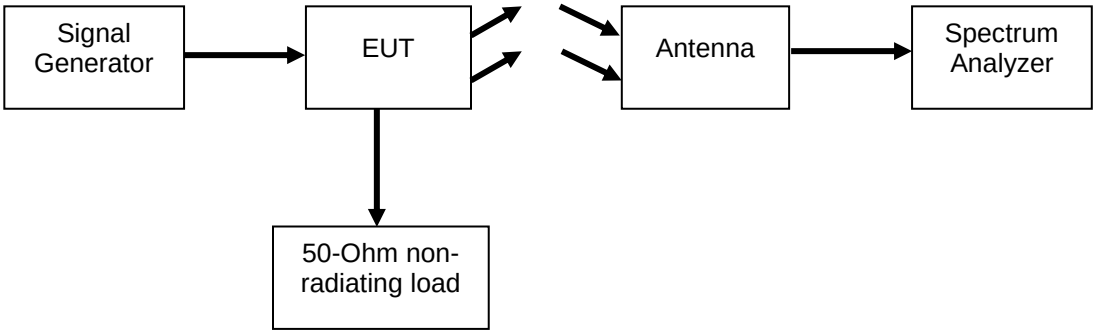
The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation 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
P1 = power in dBm
P2 = power in Watts

Test Setup



Test Results

Refer to Annex C for Radiated Spurious Emissions Plots

Emission Masks (Occupied Bandwidth)
Engineer: Shawn McMillen
Test Date: 9/25/2015

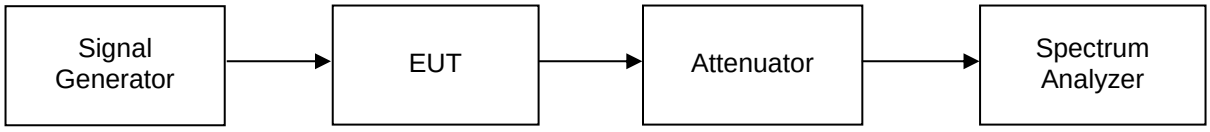
Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask.
A reference level plot is provided to verify that the peak power was established prior to testing the mask.
The EUT is a booster amplifier that does not contain a transmitter; representative emission designators used in the industry were used for the emission masks and are listed in Table 1.
Emission Masks were measured in both the low power and high power modes of operation.

Emission Designator	Emission Mask	Type of Modulation	Occupied Bandwidth (kHz)	Channel Spacing (kHz)	Audio Frequency (kHz)	Deviation (kHz)	RBW (Hz)
16K0F3E	B	FM	16.0	25	2.5	5.0	300
11K3F3E	D	FM	11.3	12.5	1.0	2.5	100
4K00F1E	E	FM	4	6.25	1.0	1.0	100

Note: Masks H and G were also used for 806-809/851-854 and 809-824/854-869
Note: C4FM modulation was also used against masks B, D and E for low and high data rates.

Test Setup



Refer to Annex D1 for VHF Emission Mask plots
Refer to Annex D2 for UHF Emission Mask plots
Refer to Annex D3 for 700 Emission Mask plots
Refer to Annex D4 for 800 Emission Mask plots

Intermodulation

Engineer: Shawn McMillen

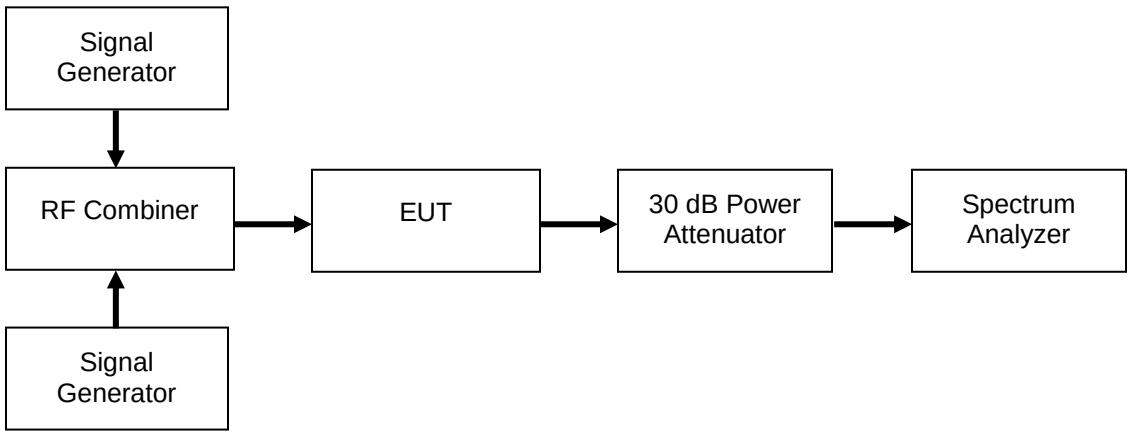
Test Date: 9/23/2015

Test Procedure

The EUT was connected to a spectrum analyzer through a 30 dB power attenuator. Two signal generators were utilized to produce a two tone signal with the 12.5 KHz channel spacing set so the intermodulation products fell within the operational band. Frequency at the maximum power from out of band rejection was utilized.

The RF input signal level was set to 0.2 dB below the AGC Threshold.
RBW = 300 Hz
Video BW = 3x RBW

Test Setup



Refer to Annex E for Intermodulation plots

Noise Figure Test
Engineer: Shawn McMillen
Test Date: 9/23/2015

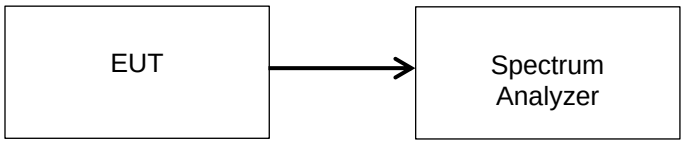
Test Procedure

The test equipment was connected as shown in the test set-up below.

Note: The allowance per KDB 935210 D02 Signal Boosters Certification v03 was used to demonstrate compliance for Noise Figure.

“For the remote unit of a conventional fiber-connected host/remote DAS booster system, it is acceptable to submit compliance information and test data consistent with 90.219(d)(6)(ii) (i.e., ERP of noise ≤ −43 dBm in 10 kHz RBW) for the downlink path only, in place of 90.219(e)(2) noise figure test data (i.e., NF ≤ 9 dB for both UL and DL). Test reports must provide explicit details about instrumentation and procedure used for 90.219(d)(6)(ii) testing.”

Test Setup



Band	Noise Figure (dBm)	ERP Limit	Max Antenna System Gain (dBd)
VHF	-51.41	≤43	8.41
UHF	-37.43	≤43	-5.57
700	-46.43	≤43	3.43
800	-41.39	≤43	-1.61

Refer to Annex F Noise Figure results

Additional §90.543 Emissions limits
Engineer: Shawn McMillen
Test Date: 9/25/2015

Test Requirements

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

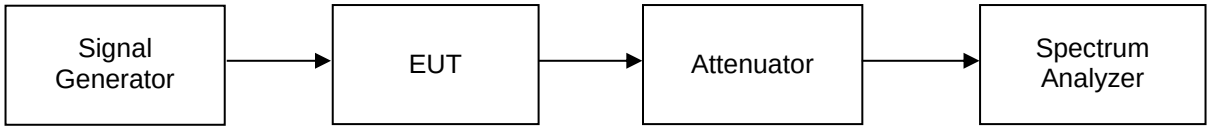
(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

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 EUT was set to transmit a CW carrier within the band 758-768 MHz and the spectrum investigated per above

Test Setup



Test Results

Frequency Band (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
769-775	-47.98	-46	1.98
799-805	-74.60	-46	28.6
775-788	-48.24	-13	35.24
below 758	-48.62	-13	35.62
above 805	-68.13	-13	55.13

Frequency Band (MHz)	Emission Level (dBm)	EIRP Limit (dBm)	Max Antenna/ System Gain (dBi)
1559-1610	-52.47	-40	12.47

See Annex G for §90.543 Emission Test Data

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	EMCO	3115	i00103	01/20/15	01/20/16
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/8/13	10/8/15
EMI Analyzer	Agilent	E7405A	i00379	2/5/15	2/5/16
Signal Generator	Agilent	E4438C	i00457	9/26/14	9/26/16
Signal Generator	Agilent	E4438C	i00348	09/01/14	09/01/16
Spectrum Analyzer	Agilent	E4445A	i00471	3/20/15	12/1/16
Spectrum Analyzer	Agilent	E4407B	i00331	6/13/14	6/13/16
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	11/26/13	11/26/15

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