



FCC PART 27



TEST AND MEASUREMENT REPORT

For

ADC Telecommunications Inc.

P.O. Box 1101, Minneapolis, Minnesota 55440, USA

FCC ID: F8I-SP0700UH
Model: FWU-U6000HUDART

Report Type: Original Report
Product Type: FlexWave™ URH Host Card
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Report Number: R1102158-27
Report Date: 2011-03-03
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**DOCUMENT REVISION HISTORY**

<b>Revision Number</b>	<b>Report Number</b>	<b>Description of Revision</b>	<b>Date of Revision</b>
0	R1102158-27	Original Report	2011-03-03

## 1 General Information

### 1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *ADC Telecommunications, Inc.* and their product FCC ID: *F8I-SP0700UH*, Model: *FWU-U6000HUDART*; *FlexWave URH/Prism Host Rx* which will henceforth be referred to as the "EUT". The EUT is a wireless network card which operates in 700MHz LTE band C Uplink only. It operates in a multi-operator/multi-protocol single platform system supporting up to 8 Radio Frequency (RF) bands. It consists of a Host Unit, an Expansion Unit (comprised of a DART Remote Module (DRU), IF Expansion Module (IFEU), and Power Supply), and Remote Amplifiers Units (RAUs). The Host, DRU and IFEU are intended for telecom closet indoor use. The RAU is intended to be installed above a false ceiling in an environmentally controlled office. Its operating frequency is from 776MHz to 787MHz.

### 1.2 Mechanical Description

*EUT* measures approximately 195 mm (L) x 93 mm (W) x 27 mm (H), and weighs approximately 322g.

*The test data gathered are from production sample, serial number: BTW182100002 provided by the manufacturer.*

### 1.3 EUT Photo



*Please refer to Exhibit C for more EUT photographs.*

## **1.4 Objective**

This type approval report is prepared on behalf of ADC Telecommunications, Inc. in accordance with Part 2, Subpart J, Part 27, Subpart E, of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for RF output power, modulation characteristic, occupied bandwidth, spurious emissions at antenna terminal, field strength of spurious radiation, frequency stability, band edge, and conducted and radiated margin.

## **1.5 Related Submittal(s)/Grant(s)**

Refer to: FCC ID: F8I-SP851970H, BAACL Report: R1001143

## **1.6 Test Methodology**

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 27 - Miscellaneous Wireless Communications Services

Applicable Standards: TIA/EIA-603-C, ANSI C63.4-2003.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## **1.7 Measurement Uncertainty**

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from +2.0 dB for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BAACL Corp.

Detailed instrumentation measurement uncertainties can be found in BAACL Corp. report QAP-018.

## **1.8 Test Facility**

The test site used by BAACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BAACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and

December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: R-2463 and C-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

## 2 System Test Configuration

### 2.1 Justification

The EUT was configured for testing according to EIA/TIA-603-C.

The final qualification test was performed with the EUT operating at normal mode.

### 2.2 EUT Exercise Software

Signal was sent through EUT using a signal generator; device was set to normal operating mode.

### 2.3 Equipment Modifications

No modifications were made to the EUT.

### 2.4 Support Equipment List

Manufacturer	Description	Model	Serial Number
ADC Telecommunication	Master RAU	742784-0 Rev:1	MR101Y8C / Unit #9
ADC Telecommunication	Master RAU	-	Unit 3
Unipower Corporation	AC/DC Power Supply	TPCR1V3C-Z	24090T0019
ADC Telecommunication	IF Expansion Module	-	S/N7

### 2.5 Local Support Equipment and Software List and Details

Manufacturer	Description	Model	Serial Number
Rhode & Schwarz	Signal Generator	SMIQ 03	849192/0085

### 2.6 Internal Configurations of EUT

Manufacturer	Description	Model	Serial Number
ADC Telecommunication	URH Host 700UC1 RF Dart PCB Board	1661026G REV10	BTW182100002



## 2.7 Interface Ports and Cables

<b>Cable Description</b>	<b>Length (m)</b>	<b>To</b>	<b>From</b>
Shielded Cable (Duplex Fiber Optic)	3	Host Unit	DRU (Dart Remote Unit)
75 Ohm Coax Cable	3	IF Expansion Unit (IFEU)	SRAU
75 Ohm Coax Cable	50 x 2	IF Expansion Unit (IFEU)	MRAU
50 ohm CATV cable	< 1	DRU	IF Expansion Unit
RF Cable	< 1	Main Hub/RAU	Spectrum Analyzer
RF Cable	< 1	Main Hub/RAU	Signal Generator

### 3 Summary of Test Results

FCC Rules	Description of Tests	Results
§2.1046, §27.50 (i)	RF Output Power	Note <sup>1</sup>
§2.1047	Modulation Characteristics	N/A
§2.1049 (h), §27.53 (c)	Occupied Bandwidth	Note <sup>1</sup>
§2.1053, §27.53 (c)	Spurious Radiated Emissions	Note <sup>1</sup>
§2.1051, §27.53 (c)	Spurious Emissions at Antenna Terminals	Note <sup>1</sup>
§27.53 (c)	Band Edge	Note <sup>1</sup>
§27.54	Frequency Stability	Note <sup>1</sup>
§27.52, §2.1091	RF Exposure Info	Compliant

Note<sup>1</sup>:

Please refer to FCC ID: F8I-SP851970H, BA CL Report: R1001143.

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## **4 FCC §2.1046 & §27.50 – RF Output Power**

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### **4.1 Applicable Standard**

According to §27.50, the maximum effective radiated power (ERP) of fixed and base station must not exceed 1000 Watts.

### **4.2 Test Procedure**

*Conducted:*

The RF output of the transmitter was connected to the signal generator and the spectrum analyzer through sufficient attenuation.

### **4.3 Test Results**

Please refer to FCC ID: F8I-SP851970H, BAACL Report: R1001143.

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## **5 FCC §2.1047 - Modulation Characteristic**

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### **5.1 Applicable Standard**

According to FCC §2.1047(d) and Part 27, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

### **5.2 Test Result**

N/A

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## **6 FCC §2.1049 & §27.53 – Occupied Bandwidth**

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### **6.1 Applicable Standard**

Requirements: FCC §2.1049 and §27.53.

### **6.2 Test Procedure**

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 kHz and the 26 dB & 99% bandwidth was recorded.

### **6.3 Test Results**

Please refer to FCC ID: F8I-SP851970H, BAACL Report: R1001143.

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## **7 FCC §2.1053 & §27.53 – Spurious Radiated Emissions**

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### **7.1 Applicable Standard**

Requirements: FCC §2.1053, §27.53.

### **7.2 Test Procedure**

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB =  $10 \log (\text{TX Power in Watts}/0.001)$  – the absolute level

Spurious attenuation limit in dB =  $43 + 10 \text{Log}_{10} (\text{power out in Watts})$

### **7.3 Test Results**

Please refer to FCC ID: F8I-SP851970H, BA CL Report: R1001143.

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## **8 FCC §2.1051 & §27.53 - Spurious Emissions at Antenna Terminals**

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### **8.1 Applicable Standard**

Requirements: CFR 47, § 2.1051. § 27.53.

The spectrum shall be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB

### **8.2 Test Results**

Please refer to FCC ID: F8I-SP851970H, BAACL Report: R1001143.

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## **9 FCC §27.53 – Band Edge**

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### **9.1 Applicable Standard**

According to FCC §27.53, the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

### **9.2 Test Procedure**

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency.

### **9.3 Test Results**

Please refer to FCC ID: F8I-SP851970H, BAACL Report: R1001143.



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## 10 FCC §2.1055 & §27.54 – Frequency Stability

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### 10.1 Applicable Standard

According to FCC §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

### 10.2 Test Procedure

The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from - 30 °C to + 50 °C using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification — the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within  $\pm 0.00025$  % ( $\pm 2.5$  ppm) of the center frequency.

### 10.3 Test Results

Please refer to FCC ID: F8I-SP851970H, BA CL Report: R1001143.

## 11 FCC §1.1307(b), §27.52 & §2.1091 - RF Exposure Information

### 11.1 Applicable Standard

According to §1.1310 and §2.1091 (Mobile Devices) RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
<b>Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Note: f = frequency in MHz

\* = Plane-wave equivalent power density

### 11.2 MPE Prediction

Predication of MPE limit at a given distance, equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

### 11.3 Test Result

Maximum peak output power at antenna input terminal (dBm): -10.81  
 Maximum peak output power at antenna input terminal (mW): 0.0829  
 Prediction distance (cm): 20  
 Prediction frequency (MHz): 782  
 Antenna Gain, typical (dBi): 8.0  
 Maximum Antenna Gain (numeric): 6.310  
 Power density at predication frequency and distance (mW/cm<sup>2</sup>): 0.000104  
 MPE limit for uncontrolled exposure at predication frequency (mW/cm<sup>2</sup>): 5.213