



## **ELECTROMAGNETIC COMPATIBILITY (EMC) REPORT**

**EMISSIONS ONLY**

**Aerielle Inc.**

**Model ATBPA6V150M**

**FCC ID: RKVATBPA6V150M**

June 24, 2004

Project No.: 04CA29399

Test Report No.: NC5311-062404

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Underwriters Laboratories Inc.  
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quality service for over 100 years

## REPORT DIRECTORY

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## 1.0 General Information

### 1.1 Scope

Underwriters Laboratories Inc., authorizes the above named company to reproduce this Report, provided it is reproduced in it's entirety. The data in this Report reflects only the items tested in the configurations and mode of operations described. All data recorded and photographs represents testing under the worst case conditions permitted by the requirements applied to the product. It is the manufacturer's responsibility to assure that additional production units are manufactured with identical electrical and mechanical components. Any modifications necessary for compliance made during testing must be implemented in all production units for compliance to be maintained.

Underwriters Laboratories Inc., shall have no liability for any deductions, inferences or generalizations drawn from this report. This report shall not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the United States government.

### 1.2 Purpose

Testing was performed to the following regulations:

Emissions Standards used: CFR 47 Part 15 Subpart C

Except as noted below, all test methods and data contained in this report are covered by NVLAP accreditation.

Exceptions: None

## 1.3 Test Results

### In Compliance

Statements regarding compliance with requirements and criteria in the subsequent sections of this report are opinions and interpretations provided by Underwriters Laboratories Inc. technical staff.

#### Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	Test Result
Conducted Emissions, AC Mains	0.15 – 30 MHz	15.207	Not Required
Spurious Radiated Emissions	30 – 1000 MHz	15.209, 15.239(b)	Complies
Occupied Bandwidth (200 kHz)	88 – 108 MHz	15.239(a)	Complies
Antenna Requirements	88 – 108 MHz	15.203	Complies

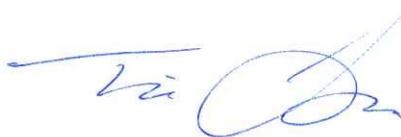
## 1.4 Documentation Review/Approval

#### Project Management:



Asim Tirmizi  
Project Engineer  
International EMC Services  
Department 3014A

#### Technical Review By:



Tim Lee  
Staff Engineer  
International EMC Services  
Department 3014A

## 2.0 General Product Description

Applicant	:	Aerielle Inc.
Manufactured By	:	Same as Applicant
License Holder	:	Not Applicable
Applicant Address	:	625 Ellis Street, Suite 206 Mountain View, CA 94043
Applicant Contact	:	Art Cohen
Model/Type No.	:	ATBPA6V150M
Date of Issue	:	June 24, 2004
File No.	:	NC5311
Test Report No.	:	NC5311-062404
Project No.	:	04CA29399

### Product Description

The Aerielle ATBPA6V150M is a low-powered FM Stereo Transmitter designed to operate in the commercial FM broadcast band used in many parts of the world and utilizes a standard 38 kHz L-R subcarrier signal format. Housed in a 'Cigarette Lighter Adaptor', it also incorporates a switching power supply to convert vehicle-supplied 12VDC to lower voltage to power portable audio devices such as MP3 and CD players.

### Equipment Size, Mobility, and Identification

Dimensions: 3.660 by 1.75 by 0.785 in.  
Mobility: To be connected to an automobile cigarette lighter.  
Serial No: None Provided

### Electrical Ratings

	<u>Voltage</u> <u>[Volts]</u>	<u>Current or</u> <u>Power</u>	<u>Frequency</u> <u>[Hz]</u>	<u>Phase</u>
EUT	12 Vdc	25 mA	--	--

### Test Voltage & Frequency

Unless indicated otherwise on the individual data sheet or test results, the test voltage and frequency was as indicated below.

<u>Voltage</u>	<u>Frequency</u>
12Vdc	--

### Tunable Channels

The ATBPA6V150M can be tuned to the following channels:

88.1, 88.3, 88.5, 88.7, 107.1, 107.3, 107.5, and 107.7 MHz

### Equipment Type

Pre-Production

## Model Differences

Any other model(s) represented by the models tested in this investigation will be documented by the manufacturer.

## Device Modifications

The following modifications were necessary for compliance: None

## EUT and Peripherals

Description	Manufacturer	Model/Part #	Serial Number
EUT	Aerielle	ATBP6V150	Unknown
CD Player	Panasonic	SL-MP80	FB3HB003098
Power System	MVP	I-6001	Unknown

## Cables

Cable Type	Shield	Length (meters)	Ferrite	Connector	Connection Point 1	Connection Point 2
I/O	No	1.5	No	Pwr & headphones	EUT	Power System

### 2.1 FCC Section 15.203 Antenna Requirements

The antenna is permanently attached to the PCB and the antenna is internal on the EUT. Therefore, it meets the 15.203 requirements.

### 2.2 Justification of Configuration

EUT was considered to be operating in a typical mode of operation.

### 2.3 EUT Operating Mode(s)

Equipment under test was operated during the measurement under the following conditions:

The EUT was connected to an MP3 player and operated both with and without 1 kHz tone depending on the test performed.

### **3.0 Environmental Conditions in Test Lab**

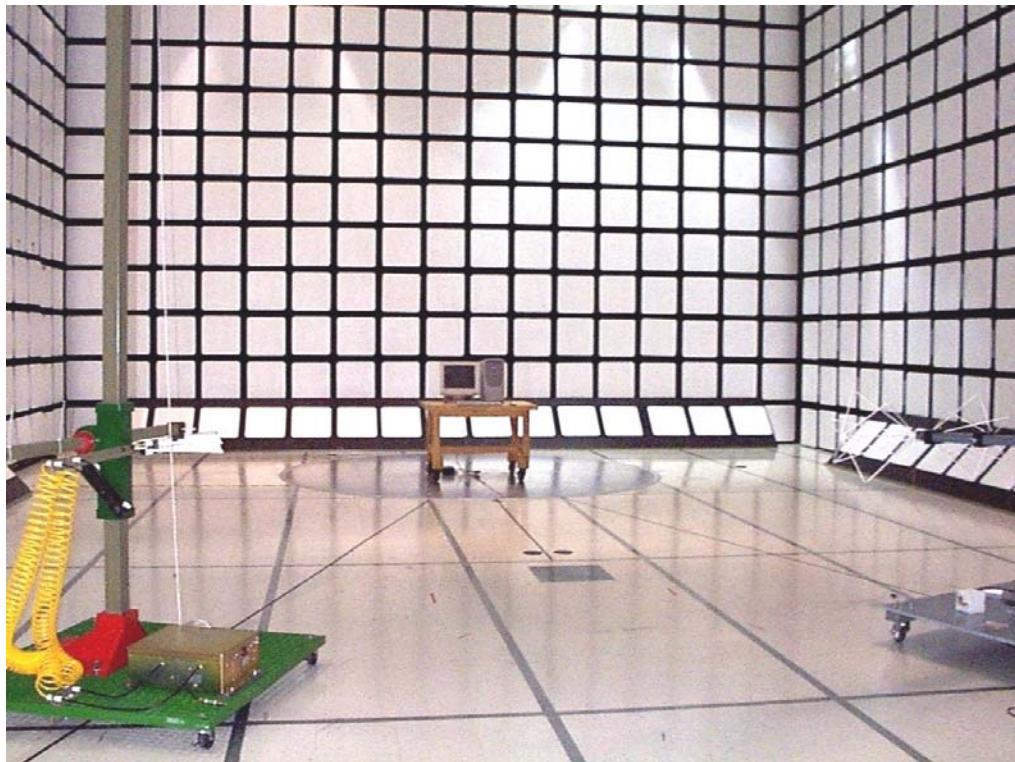
Temperature: 20-25 °C      Atmospheric Pressure: 680-1060 mbar  
Relative Humidity: 30-60%      20.1-31.3 in. Hga

### **4.0 Calibration Details of Equipment Used for Measurement**

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST), therefore, all test data recorded in this report is traceable to NIST.

## 5.0 Test Facility

Underwriters Laboratories Inc.  
1655 Scott Blvd.  
Santa Clara, CA 95050  
Phone: (408) 876-2905 Fax: (408) 556-6071



## 6.0 Accreditations and Authorizations



NVLAP Lab code: 200252-0

**NVLAP:** Recognized under the National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. The specific scope includes IEC/CISPR 22:1997, Amendment 1:1995, Amendment 2:1997, EN 55022:1998, AS/NZS 1044, CNS 13438:1997, ANSI C63.4, FCC Method - 47 CFR Part 15, AS/NZS 3548, AS/NZS CISPR 22, CISPR 14-1, EN 55014-1, CNS 13783-1, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11, RSS-112, RSS-117, RSS-118, RSS-119, RSS-123, RSS-125, RSS-128, RSS-129, RSS-130, RSS-131, RSS-132, RSS-133, RSS-134, RSS-135, RSS-136, RSS-137, RSS-139, RSS-141, RSS-142, RSS-170, RSS-181, RSS-182, RSS-187, RSS-188, RSS-191, RSS-192, RSS-193, RSS-210, RSS-212, RSS-213, RSS-215, GR-1089-CORE, SBC-TP-76200 Issue 4, and GR-63-CORE testing.



**FCC:** Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland and accepted in a letter dated September 24, 1997 (Ref. No. 31040/SIT 1300F2).



**Industry of Canada:** Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3.  
File #: IC 2704



**VCCI:** Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8.  
Registration Nos.: (Radiated Emissions) R-672, (Conducted Emissions) C-689.



**ICASA:** ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).



**NIST/CAB:** Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 89/336/EEC, Article 10 (2). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.

**NIST/CAB:** Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).

**NIST/CAB:** Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6.

U.S. Identifier Number: US0114

## 7.0 Emissions Test Regulations

The emissions tests were performed according to following regulations:

----- United States -----

CFR 47 Part 15 Subpart C : 2003

Code of Federal Regulations, Part 15, Subpart C, Radio Frequency Devices - Intentional Radiators

## 7.1 Equipment Classifications

**Class A Digital Device:** *A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.*

**Class B Digital Device:** *A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computer, calculators, and similar electronic devices that are marketed for use by the general public.*

## 7.2 Field Strength Calculations

The field strength is calculated by adding the Transducer Factor (Antenna Factor) and Gain/Loss (Cable Loss, Preamp Gain) Factor to the Meter Reading. The basic equation with a sample calculation is as follows:

Field Strength = Meter Reading + Transducer Factor + Gain/Loss

Assume a receiver reading of 53.2 dB<sub>u</sub>V is obtained. The Transducer Factor of 5.1 dB and a Gain/Loss of -31 dB is added, giving a field strength of 27.3 dB<sub>u</sub>V.

$$FS = 53.2 + 5.1 + (-31) = 27.3 \text{ dB}_uV$$

Use the following formula to convert dB<sub>u</sub>V to  $\mu$ V:  $x = 10^{(y/20)}$ , where  $x$  is the value in  $\mu$ V and  $y$  is the value in dB<sub>u</sub>V.

$$\text{Level in } \mu\text{V} = 10^{(27.3/20)} = 23.2 \mu\text{V}$$

## 7.3 Measurement Uncertainty

When a measurement is made the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. The following statement of measurement uncertainty is used to reflect the accuracy of the measured result as compared with its “true” value.

		Uncertainty (dB)					
		Biconical Antenna			Log Periodic Antenna		
Test Distance	Probability Distribution	10m +18 deg	10m -14 deg	3m	10m +18 deg	10m -14 deg	3m
Combined Standard Uncertainty $u_c(y)$	Normal	$\pm 1.24$	$\pm 1.25$	$\pm 1.29$	$\pm 1.14$	$\pm 1.13$	$\pm 1.9$
Expanded uncertainty $U$ (level of confidence = 95%)	Normal (k = 2)	$\pm 2.47$	$\pm 2.49$	$\pm 2.59$	$\pm 2.28$	$\pm 2.27$	$\pm 2.76$

Conducted Voltage Emissions	Probability Distribution
Combined Standard Uncertainty $u_c(y)$	Normal
Expanded uncertainty $U$ (level of confidence = 95%)	$\pm 1.08$ $\pm 2.16$

$u_c(y)$  = square root of the sum of squares of the individual standard deviation uncertainties.

$U$  = combined standard uncertainty multiplied by the coverage factor:  $k$ . This defines an interval about the measured result that will encompass the true value with a confidence level of approximately 95%. If a higher level of confidence is required then  $k=3$  (CL=97%) can be used.

“ISO Guide to the Expression of Uncertainty in Measurements” and ‘NIS81: The Treatment of Uncertainty in EMC Measurements’ were the basis for determining the uncertainty levels of our measurements. Details of those calculations are available upon request.

## 7.4 Measurement Bandwidths

Frequency Range (MHz)	Peak Data BW (kHz)	Quasi-Peak Data BW (kHz)	Average Data BW (kHz)
<b>0.01 - 0.15</b>	<b>1</b>	<b>3</b>	<b>0.2</b>
<b>0.15 - 30</b>	<b>10</b>	<b>9</b>	<b>100</b>
<b>30 - 1000</b>	<b>100</b>	<b>120</b>	<b>120</b>
<b>Above 1000</b>	<b>1000</b>	<b>N/A</b>	<b>1000</b>

## 7.5 Conducted Voltage Emissions; Section 15.207

### UL Procedure

3314-LPG-004

Conducted voltage emissions are performed using a calibrated line impedance stabilization network (LISN), which isolates product emissions. The LISN is connected to a spectrum analyzer which scans the frequency range of measurement.

### Remarks

The EUT is powered by A 3V lithium battery, type CR2, therefore, would not connect to the ac mains. This test was not performed.

## 7.6 Radiated Electric Field Emissions

### Test Location

10 Meter Semi-Anechoic Chamber (Test Station 2) (Last NSA: 1/8/2004; Next NSA 1/8/2005)

Date Tested: 6/23/04

### Test Instruments

Instrument	Manufacturer	Model	ID#	Last	Cal	Next
Spectrum Analyzer	Hewlett-Packard	8566B	8034	6/10/04		6/10/05

### Test Accessories

Instrument	Manufacturer	Model	ID#	Last	Cal	Next
Biconical Antenna	Electro-Metrics	EM-6912A	8018	12/17/03		12/17/04
Log Periodic Antenna	Electro-Metrics	EM-6950	8017	12/16/03		12/16/04
6dB Res Band Display	Hewlett-Packard	85662A	8031	6/10/04		6/10/05
Quasi-Peak Detector	Hewlett-Packard	85650A	8030	6/10/04		6/10/05
Switch Driver	Hewlett-Packard	11713A	8036	6/10/04		6/10/05
Preselector	Hewlett-Packard	85685A	8037	6/10/04		6/10/05
Pre-amplifier	Sonoma Instruments	310N	8085	12/17/03		12/17/04

### UL Procedure

3314-LPG-013

Radiated spurious emissions applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in 15.209. The limit for the fundamental emission is listed in 15.239(b) to be 250  $\mu$ V/m @ 3m, or 37.5 dB $\mu$ V/m @ 10m. Radiated spurious emissions tests were performed in a semi-anechoic chamber using a remote controlled turntable and the appropriate measuring antenna. Both antenna and turntable are adjusted to determine maximum emissions levels. The spectrum analyzer scanned up to 1 GHz.

### Frequency Range of Measurement

30 MHz to 1 GHz

### Measurement Distance

10 meters

### Test Results

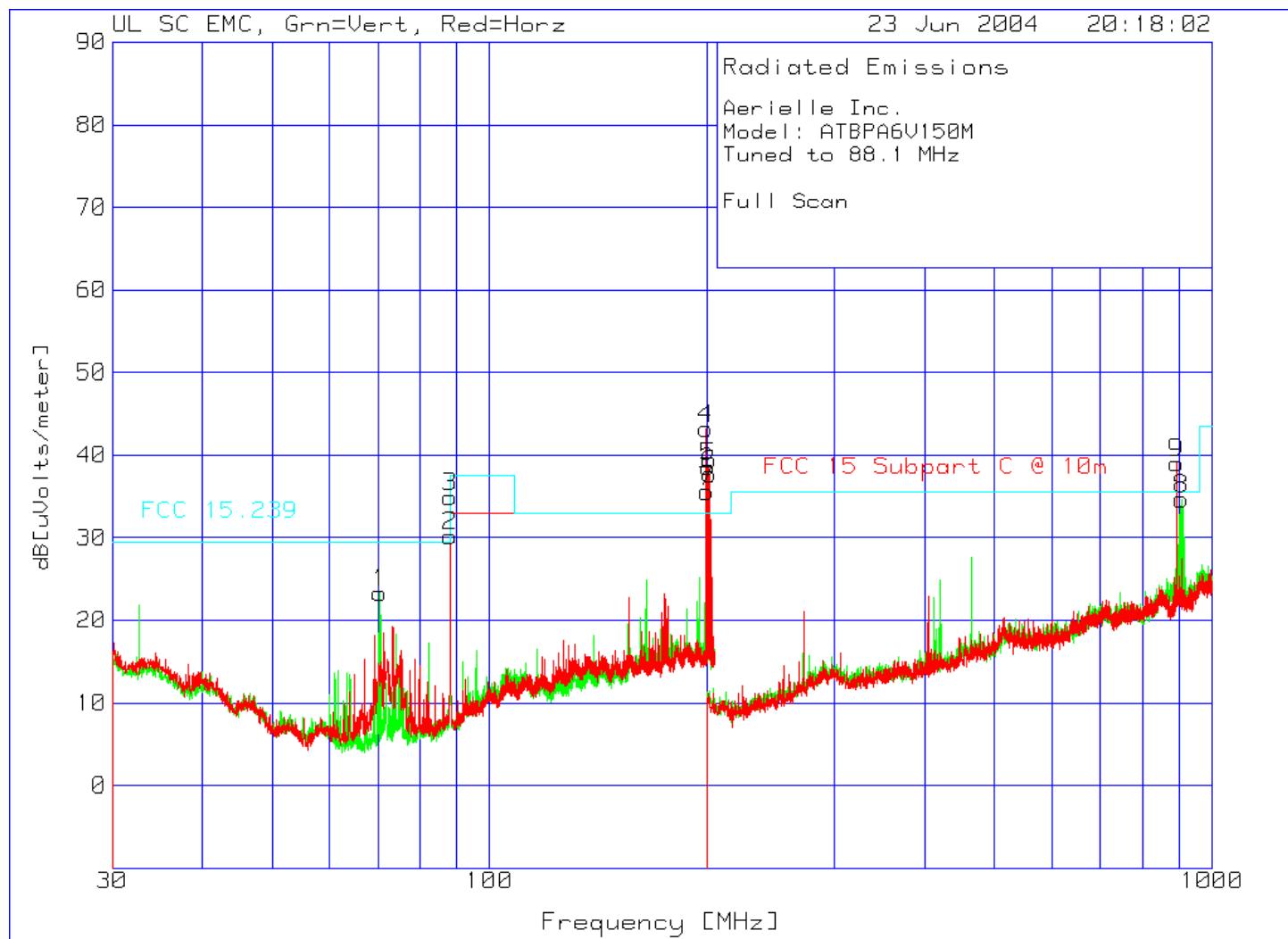
The requirements are MET.

Tuned Frequency (MHz)	Margin to 15.239		Margin to 15.209	
	dB ( $\mu$ V/m)	Frequency (MHz)	dB ( $\mu$ V/m)	Frequency (MHz)
88.1	2.23	88.0773	6.2	70.4819
107.7	2.26	107.6759	6.5	180.6051

### Remarks

None

## Test Data



Aerielle Inc.

Model: ATBPA6V150M

Tuned to 88.1 MHz

Full Scan

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB [uVolts/meter]	Limit:1	2
=====							
Range: 1	30 - 205MHz						
1	70.4819	44.5 pk	-27.1	5.9	23.3	29.5	29.5
	Azimuth:190	Height:100	Vert	Margin [dB]		-6.2	-6.2
2	88.0999	47.9 pk	-27	9.3	30.2	33	37.5
	Azimuth:102	Height:198	Vert	Margin [dB]		-2.8	-7.3
7	199.7968	45 pk	-25.9	16.5	35.6	33	33
	Azimuth:58	Height:298	Vert	Margin [dB]		2.6	2.6
Range: 2							
3	88.0999	52.6 pk	-27	9.3	34.9	33	37.5
	Azimuth:30	Height:299	Horz	Margin [dB]		1.9	-2.6
4	199.2722	53.2 pk	-26	16	43.2	33	33
	Azimuth:268	Height:100	Horz	Margin [dB]		10.2	10.2
5	200.54	48.5 pk	-25.9	16	38.6	33	33
	Azimuth:103	Height:198	Horz	Margin [dB]		5.6	5.6
6	201.6329	47.5 pk	-25.8	16	37.7	33	33
	Azimuth:301	Height:299	Horz	Margin [dB]		4.7	4.7
Range: 3							
8	906.0701	36.2 pk	-24.7	23.2	34.7	35.5	35.5
	Azimuth:99	Height:101	Vert	Margin [dB]		-.8	-.8
Range: 4							
9	892.2804	41.4 pk	-24.9	22.5	39	35.5	35.5
	Azimuth:322	Height:100	Horz	Margin [dB]		3.5	3.5

LIMIT 1: FCC 15 Subpart C @ 10m

LIMIT 2: FCC 15.239

pk - Peak detector

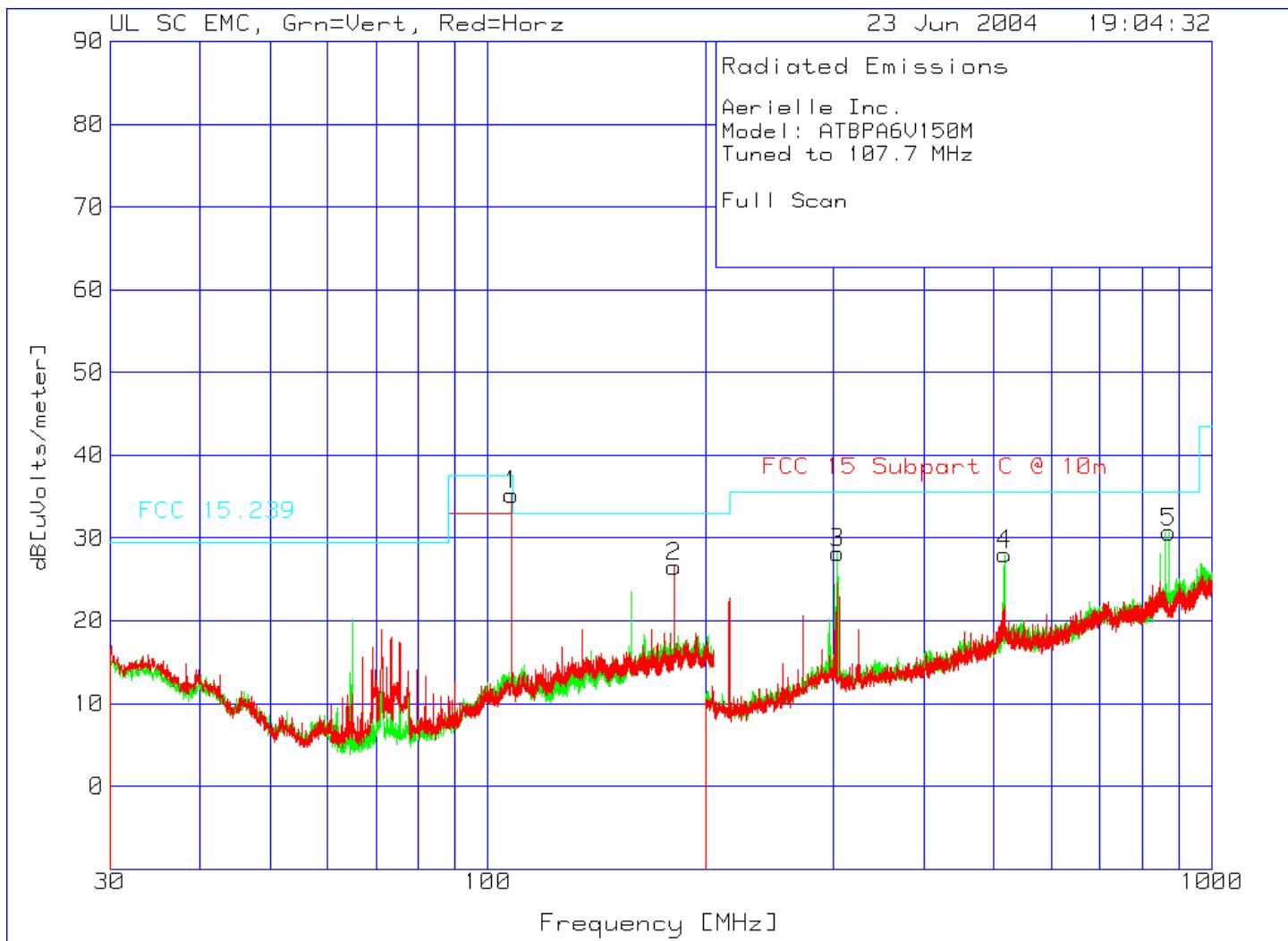
Aerielle Inc.  
Model: ATBPA6V150M  
Tuned to 88.1 MHz

Full Scan

Test Frequency	Meter Reading	Gain/Loss Factor	Transducer Factor	Level dB [uVolts/meter]	Limit:1	2
[MHz]	[dB (uV)]	[dB]	[dB]			
<hr/>						
Range: 1	30 - 205MHz					
88.0747	47.7 qp	-27	9.2	29.9	33	37.5
Azimuth: 125	Height:400	Vert		Margin [dB]:	-3.1	-7.6
200	15.11 qp	-25.8	16.5	5.81	33	33
Azimuth: 125	Height:400	Vert		Margin [dB]:	-27.19	-27.19
Range: 2	30 - 205MHz					
88.0773	52.97 qp	-27	9.3	35.27	33	37.5
Azimuth: 23	Height:330	Horz		Margin [dB]:	2.27	-2.23
199.27	20.64 qp	-26	16	10.64	33	33
Azimuth: 23	Height:330	Horz		Margin [dB]:	-22.36	-22.36
201.6329	20.99 qp	-25.8	16	11.19	33	33
Azimuth: 23	Height:330	Horz		Margin [dB]:	-21.81	-21.81
Range: 3	200 - 1000MHz					
906	20.35 qp	-24.7	23.2	18.85	35.5	35.5
Azimuth: 360	Height:101	Vert		Margin [dB]:	-16.65	-16.65
Range: 4	200 - 1000MHz					
892.2804	20.3 qp	-24.9	22.5	17.9	35.5	35.5
Azimuth: 0	Height:101	Horz		Margin [dB]:	-17.6	-17.6

LIMIT 1: FCC 15 Subpart C @ 10m  
LIMIT 2: FCC 15.239

qp - Quasi-Peak detector



Company: Aerielle Inc.  
Project: 04CA29399

Model #: ATBPA6V150M  
Report #: NC5311-062404

Aerielle Inc.

Model: ATBPA6V150M

Tuned to 107.7 MHz

Full Scan

No.	Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB [uVolts/meter]	Limit:1	2
1	107.7288	49.6 pk	-26.6	12.2	35.2	33	37.5
	Azimuth:358	Height:399	Horz	Margin [dB]		2.2	-2.3
2	180.6051	36.6 pk	-26	15.9	26.5	33	33
	Azimuth:206	Height:100	Horz	Margin [dB]		-6.5	-6.5

Range: 2 30 - 205MHz -----

1	107.7288	49.6 pk	-26.6	12.2	35.2	33	37.5
	Azimuth:358	Height:399	Horz	Margin [dB]		2.2	-2.3
2	180.6051	36.6 pk	-26	15.9	26.5	33	33
	Azimuth:206	Height:100	Horz	Margin [dB]		-6.5	-6.5

Range: 3 200 - 1000MHz -----

3	303.922	39.8 pk	-26.7	15.1	28.2	35.5	35.5
	Azimuth:52	Height:400	Vert	Margin [dB]		-7.3	-7.3
4	517.162	35.7 pk	-26.1	18.4	28	35.5	35.5
	Azimuth:172	Height:300	Vert	Margin [dB]		-7.5	-7.5
5	871.6959	33.2 pk	-25	22.5	30.7	35.5	35.5
	Azimuth:132	Height:200	Vert	Margin [dB]		-4.8	-4.8

LIMIT 1: FCC 15 Subpart C @ 10m

LIMIT 2: FCC 15.239

pk - Peak detector

qp - Quasi-Peak detector

av - Average detector

avlg - denotes average log detection

avem - denotes EMI average detection

tm - Trace Math Result

Company: Aerielle Inc.  
Project: 04CA29399

Model #: ATBPA6V150M  
Report #: NC5311-062404

Aerielle Inc.  
Model: ATBPA6V150M  
Tuned to 107.7 MHz  
Full Scan

Test	Meter	Gain/Loss	Transducer	Level	Limit:1	2
Frequency	Reading	Factor	Factor	dB[uVolts/meter]		
[MHz]	[dB(uV)]	[dB]	[dB]			

---

Range: 2 30 - 205MHz  
107.6759 49.64 qp -26.6 12.2 35.24 33 37.5  
Azimuth: 346 Height:397 Horz Margin [dB]: 2.24 -2.26

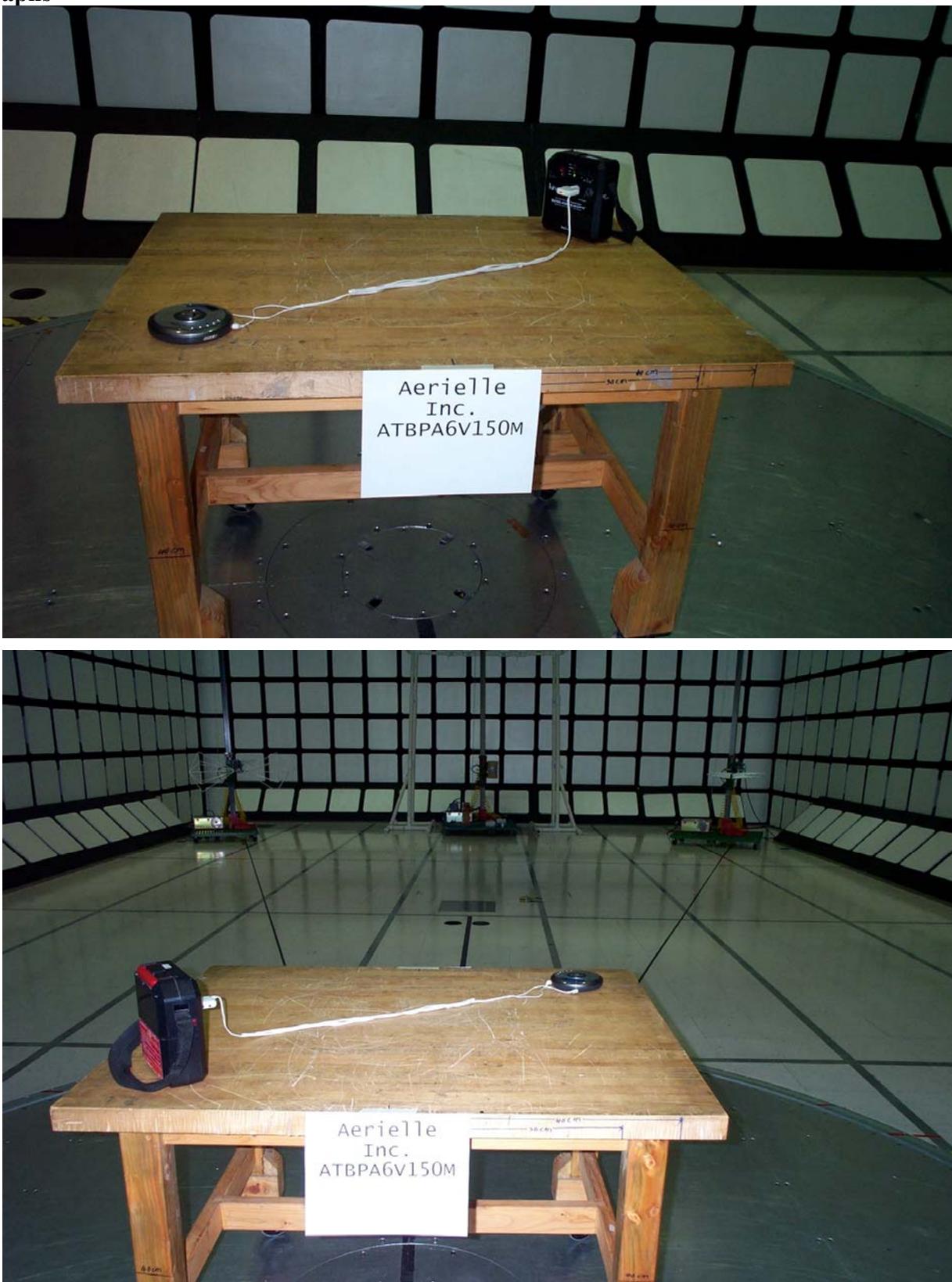
Range: 3 200 - 1000MHz  
867.9038 21.29 qp -25 22.6 18.89 35.5 35.5  
Azimuth: 284 Height:187 Vert Margin [dB]: -16.61 -16.61

LIMIT 1: FCC 15 Subpart C @ 10m

LIMIT 2: FCC 15.239

pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector  
avlg - Average log detector  
avem - EMI Average detector

## Photographs



## 7.7 Occupied Bandwidth; Section 15.239(a)

### Test Location

Ground Plane #1 (Test Station 5)

Date Tested: 6/23/04

### Test Instruments

Instrument	Manufacturer	Model	ID#	Last	Cal	Next
Spectrum Analyzer	Hewlett-Packard	8546A	8098	10/24/03		10/24/04

### UL Procedure

Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz. The measurement was made with the spectrum analyzer's resolution bandwidth set to (RBW) = 10 kHz. The VBW = RBW. The frequency difference of two frequencies that are attenuated 26 dB from the peak of the unmodulated signal down the slopes of the modulated signal envelope are recorded. The difference of these two frequencies gives the occupied bandwidth.

### Test Data

Fundamental Frequency (MHz)	Bandwidth (kHz)
88.1	174.5
107.7	179.5

### Test Results

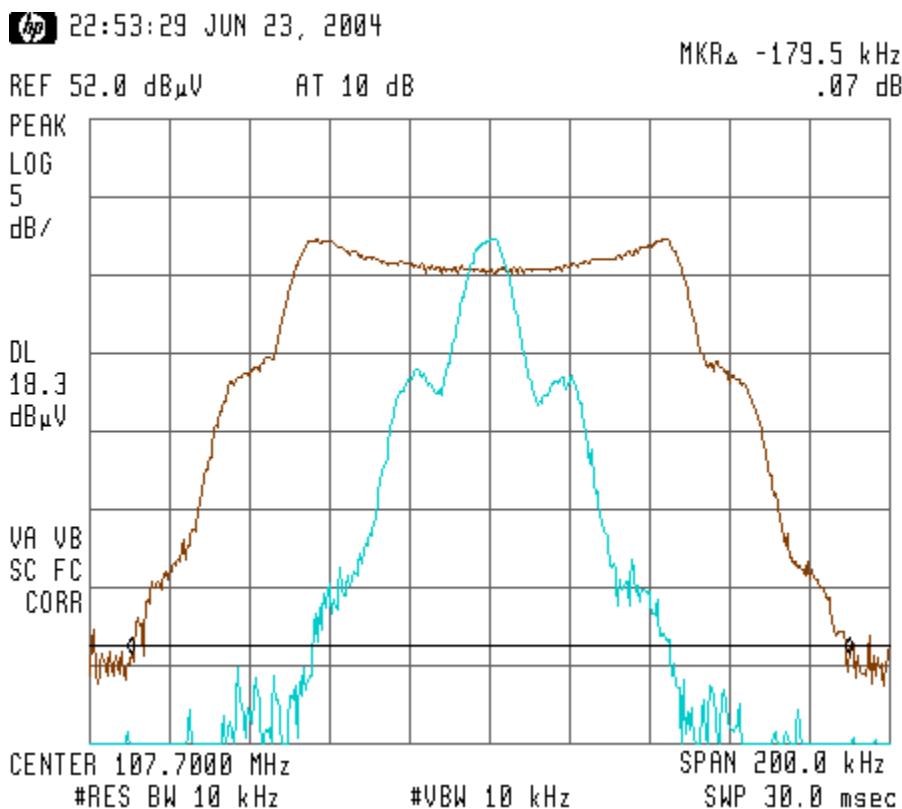
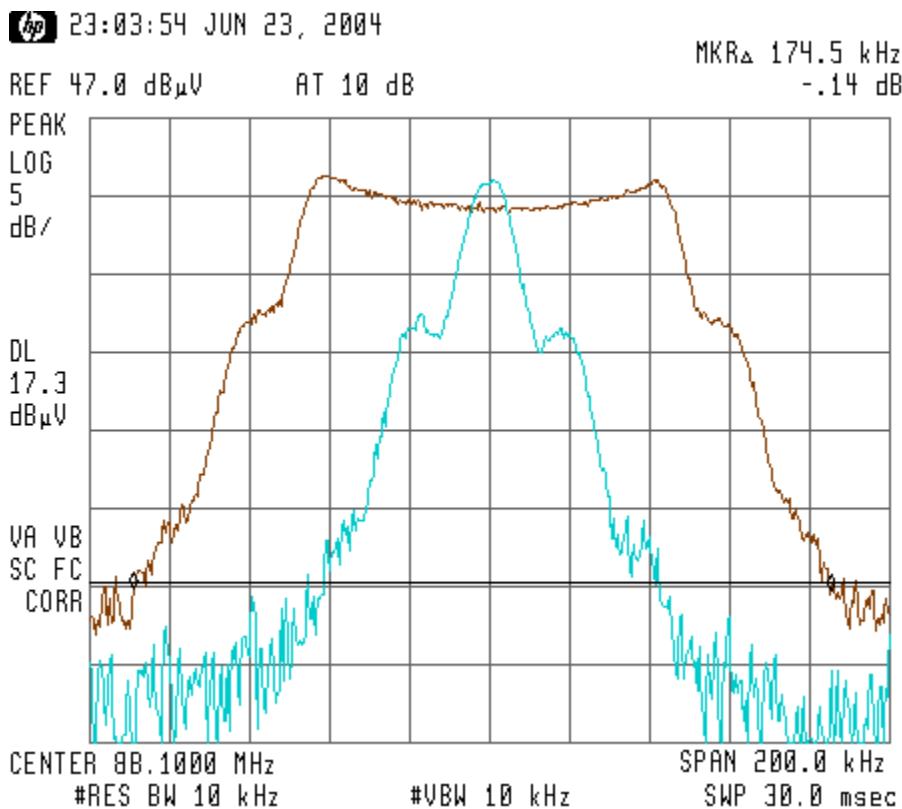
The requirements are:

MET maximum emission bandwidth is 179.5 kHz.

### Remarks

None

## Test Data



## Photographs

