ELECTROMAGNETIC COMPATIBILITY (EMC) REPORT

EMISSIONS ONLY

Aerielle Inc.

Model: AB250

FCC ID: RKVAB250

June 23, 2004

Project No.: 04CA29397

Test Report No.: NC5311-062304

Underwriters Laboratories Inc.
1655 Scott Blvd
Santa Clara, CA 95050

EMC Services Department Tel: (408) 876-2905 Fax: (408)556-6071

REPORT DIRECTORY

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 endorsement by NVLAP 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

1.3 Test Results

Transmitter Requirements

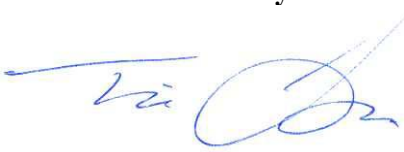
Environmental Phenomena	Frequency Range	FCC Section	Test Result
Conducted Emissions, AC Mains	0.15 – 30 MHz	15.207	Not Required
Spurious Radiated Emissions	30 – 1000 MHz	15.209,15.239(b)	Complies
Occupied Bandwidth (200 kHz)	88 – 108 MHz	15.239(a)	Complies
Antenna Requirements	88 – 108 MHz	15.203	Complies

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.	:	AB250
FCC ID	:	RKVAB250
Date of Issue	:	June 23, 2004
File No.	:	NC5311
Test Report No.	:	NC5311-062304
Project No.	:	04CA29397

Product Description

The Aerielle AB250 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. The device runs off a 3V lithium battery, type CR2, which provides about 40 hours of operation.

Equipment Size, Mobility, and Identification

Dimensions: 3.170 by 1.55 by 0.895 in.
Mobility: To be connected to an automobile cigarette lighter.
Serial No: M4

Electrical Ratings

	Voltage [Volts]	Current or Power	Frequency [Hz]	Phase
EUT	3 Vdc	Unknown	DC	--

Test Voltage & Frequency

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

Voltage	Frequency
3 Vdc	DC

Tunable Channels

The ATBPA6V100 can be tuned to the following channels:

88.1, 88.3, 88.5, and 88.7 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	AB250	M4
Flash MP3 player	RCA	RD1080B	QA001D274QCNQB

Cables

Cable Type	Shield	Length (meters)	Ferrite	Connector	Connection Point 1	Connection Point 2
I/O	No	1.5	No	Headphones	EUT	MP3 Player

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

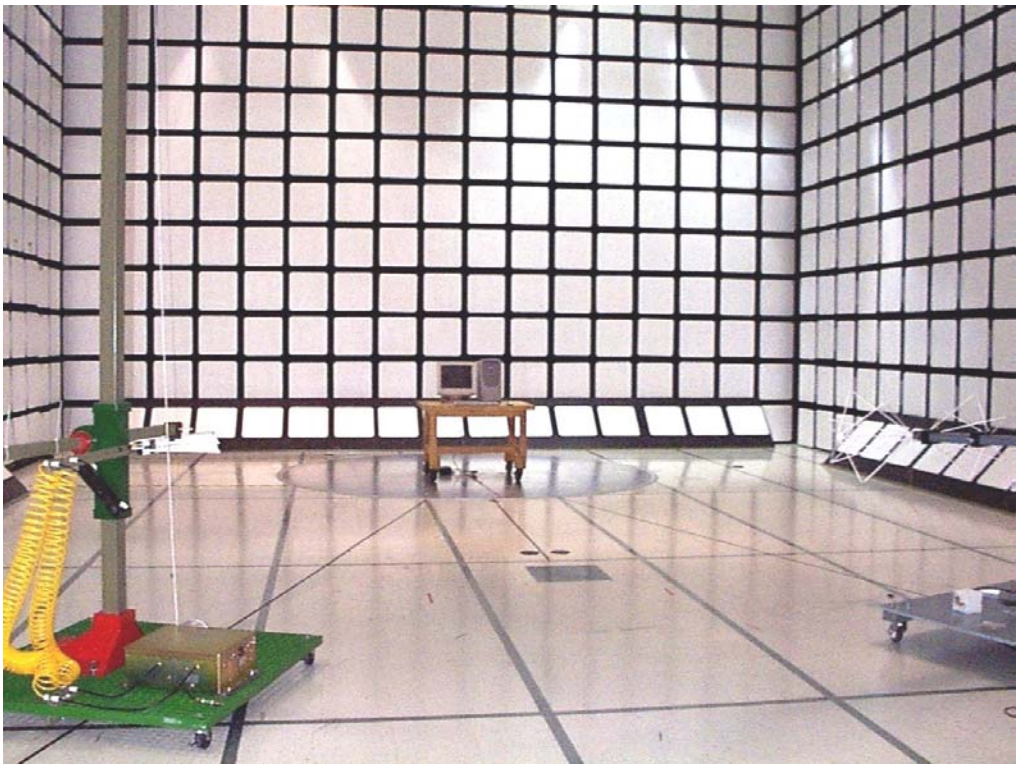
Temperature:	20-25 °C	Atmospheric Pressure:	680-1060 mbar
Relative Humidity:	30-60%		20.1-31.3 in. Hga

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: 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, IEC 61000-3-2, EN 61000-3-2, CISPR 14-1, EN 55014-1, CNS 13783-1, CISPR 22, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, and IEC 61000-4-11 testing.
NVLAP Lab code: 200252-0.

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 dBuV 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 dBuV.

FS = 53.2 + 5.1 + (-31) = 27.3 dBuV

Use the following formula to convert dBµV to µV: $x = 10^{(y/20)}$, where x is the value in µV and y is the value in dBµV.

Level in uV = 10^(27.3/20) = 23.2 uV

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 $\mathbf{u_c(y)}$	Normal	±1.24	±1.25	±1.29	±1.14	±1.13	±1.9
Expanded uncertainty **U** (level of confidence = 95%)	Normal (k = 2)	±2.47	±2.49	±2.59	±2.28	±2.27	±2.76

Conducted Voltage Emissions	Probability Distribution	
Combined Standard Uncertainty $\mathbf{u_c(y)}$	Normal	±1.08
Expanded uncertainty **U** (level of confidence = 95%)	Normal (k = 2)	±2.16

$\mathbf{u_c(y)}$ = 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)
0.01 - 0.15	**1**	**3**	**0.2**
0.15 - 30	**10**	**9**	**100**
30 - 1000	**100**	**120**	**120**
Above 1000	**1000**	**N/A**	**1000**

7.5 Conducted Voltage Emissions; Section 15.207

UL Procedure

3314-LPG-004

Conducted voltage emissions are performed using a calibrated line impedence 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 Spurious Radiated Electric Field Emissions; Section 15.209, 15.239(b)(c)

Test Location Date Tested: 3/25/04

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

Test Instruments

Instrument	Manufacturer	Model	ID#	Cal Last	Cal Next
Spectrum Analyzer	Hewlett-Packard	8566B	8034	5/6/03	5/6/04

Test Accessories

Instrument	Manufacturer	Model	ID#	Cal Last	Cal Next
Biconical Antenna	Electro-Metrics	EM-6912A	8082	7/8/03	7/8/04
Log Periodic Antenna	Electro-Metrics	EM-6950	8083	7/10/03	7/10/04
6dB Res Band Display	Hewlett-Packard	85662A	8031	5/6/03	5/6/04
Quasi-Peak Detector	Hewlett-Packard	85650A	8030	5/6/03	5/6/04
Switch Driver	Hewlett-Packard	11713A	8036	5/6/03	5/6/04
Preselector	Hewlett-Packard	85685A	8037	5/6/03	5/6/04
Pre-amplifier	Sonoma Instruments	310N	8085	11/27/03	11/27/04

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 μV/m @ 3m, or 37.5 dBμV/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 (30MHz to 1 GHz)

Test Results

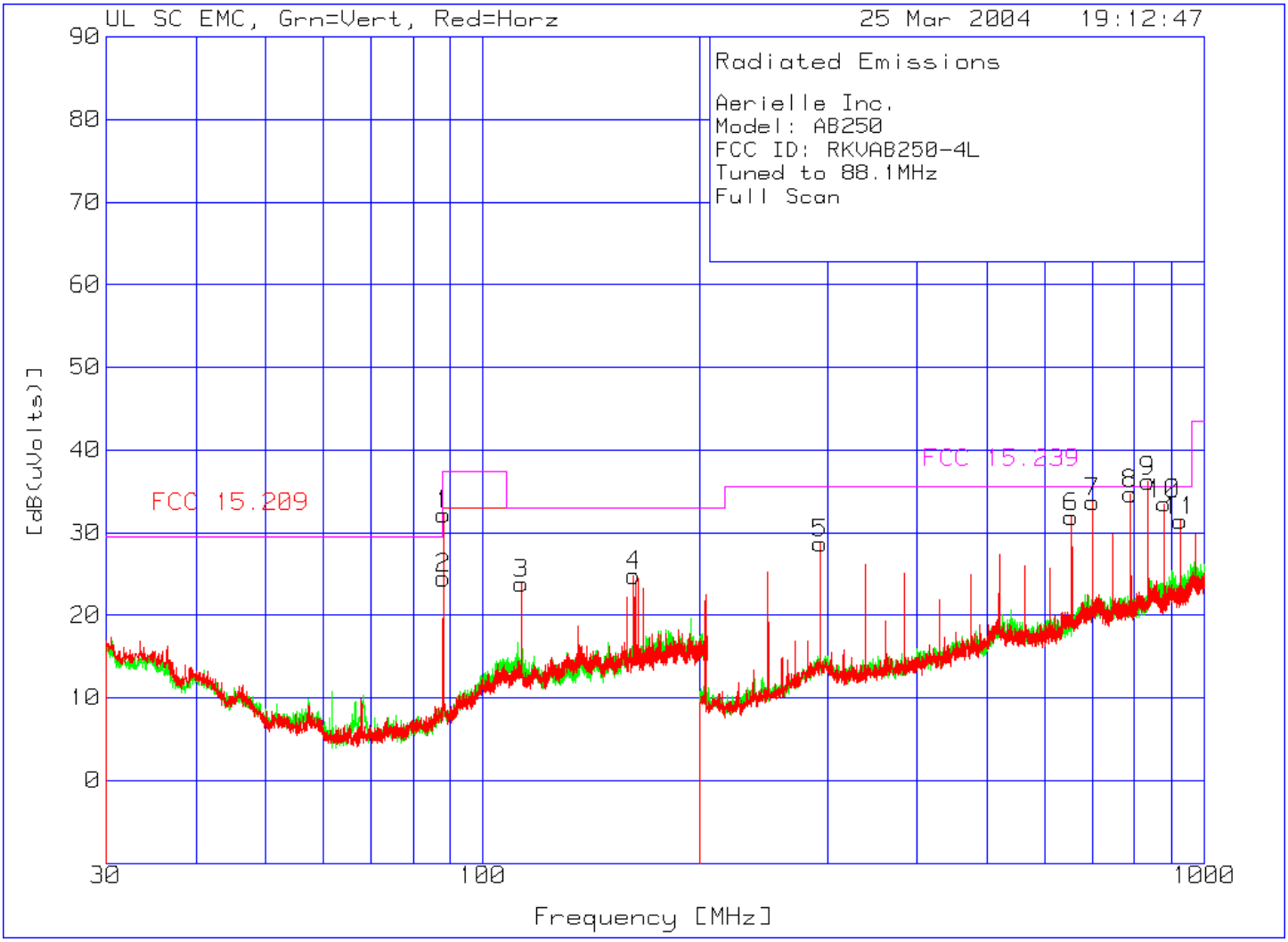
The requirements are MET.

Tuned Frequency (MHz)	Margin to 15.239		Margin to 15.209	
	dB (μV/m)	Frequency (MHz)	dB (μV/m)	Frequency (MHz)
88.1	5.3	88.1439	1.8	700.2248

Remarks

None

Test Data


UL SC EMC, Grn=Vert, Red=Horz
25 Mar 2004 19:12:47
Radiated Emissions
Aerielle Inc.
Model: AB250
FCC ID: RKVAB250-4L
Tuned to 88.1MHz
Full Scan
FCC 15.209
FCC 15.239
dB(uVolts)
Frequency [MHz]
90
80
70
60
50
40
30
20
10
0
30
100
1000

Aerielle Inc.
Model: AB250
FCC ID: RKVAB250-4L
Tuned to 88.1MHz
Full Scan

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2
Range: 1 30 - 205MHz							
2	88.122	42.2 pk	-27	9.3	24.5	33	37.5
	Azimuth:258	Height:399 Vert		Margin [dB]		-8.5	-13
Range:2 30 - 205MHz							
1	88.1439	49.9 pk	-27	9.3	32.2	33	37.5
	Azimuth:157	Height:299 Horz		Margin [dB]		-.8	-5.3
3	113.019	37.6 pk	-26.7	12.9	23.8	33	33
	Azimuth:182	Height:400 Horz		Margin [dB]		-9.2	-9.2
4	161.8511	35.7 pk	-26.2	15.3	24.8	33	33
	Azimuth:256	Height:299 Horz		Margin [dB]		-8.2	-8.2
Range:4 200 - 1000MHz							
5	293.5299	40.8 pk	-26.8	14.7	28.7	35.5	35.5
	Azimuth:358	Height:300 Horz		Margin [dB]		-6.8	-6.8
6	655.0587	38.5 pk	-26	19.4	31.9	35.5	35.5
	Azimuth:214	Height:100 Horz		Margin [dB]		-3.6	-3.6
7	700.2248	38.7 pk	-25.9	20.9	33.7	35.5	35.5
	Azimuth:214	Height:100 Horz		Margin [dB]		-1.8	-1.8
8	790.5571	39.3 pk	-25.5	20.9	34.7	35.5	35.5
	Azimuth:136	Height:100 Horz		Margin [dB]		-.8	-.8
9	835.7232	39.9 pk	-25.3	21.6	36.2	35.5	35.5
	Azimuth:241	Height:100 Horz		Margin [dB]		.7	.7
10	880.6895	37.3 pk	-24.9	21.1	33.5	35.5	35.5
	Azimuth:74	Height:100 Horz		Margin [dB]		-2	-2
11	925.6558	33.7 pk	-24.5	22.2	31.4	35.5	35.5
	Azimuth:241	Height:100 Horz		Margin [dB]		-4.1	-4.1

LIMIT 1: FCC 15.209
LIMIT 2: FCC 15.239

pk - Peak detector

Aerielle Inc.
Model: AB250
FCC ID: RKVAB250-4L
Tuned to 88.1MHz
Full Scan

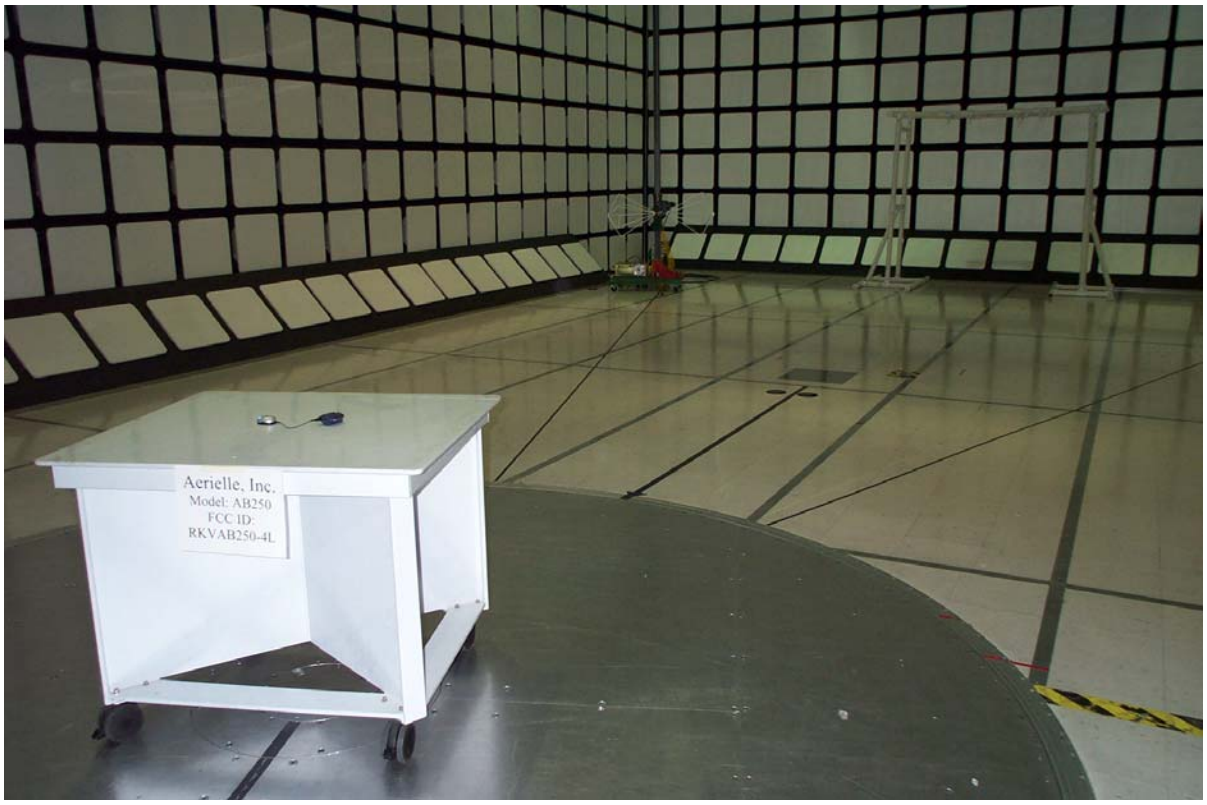
Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2
Red MP3 player						
RCA KAz00						
Model: RD1060						
Range:4 200 - 1000MHz						
655.008	19.73 qp	-26	19.4	13.13	35.5	35.5
Azimuth: 229	Height:131 Horz		Margin [dB]:	-22.37	-22.37	
790.519	39.21 qp	-25.5	20.9	34.61	35.5	35.5
Azimuth: 234	Height:128 Horz		Margin [dB]:	-.89	-.89	
835.689	40.39 qp	-25.3	21.6	36.69	35.5	35.5
Azimuth: 232	Height:116 Horz		Margin [dB]:	1.19	1.19	
Grey Mp3 player						
Audio Bug						
Model: AB250						
654.8215	32.43 qp	-26.1	19.3	25.63	35.5	35.5
Azimuth: 232	Height:134 Horz		Margin [dB]:	-9.87	-9.87	
790.519	21.97 qp	-25.5	20.9	17.37	35.5	35.5
Azimuth: 232	Height:127 Horz		Margin [dB]:	-18.13	-18.13	
835.0485	34.96 qp	-25.3	21.6	31.26	35.5	35.5
Azimuth: 232	Height:117 Horz		Margin [dB]:	-4.24	-4.24	

LIMIT 1: FCC 15.209
LIMIT 2: FCC 15.239

qp - Quasi-Peak detector

* 835 MHz was a result of the RCA Kaz00 peripheral, not the AB250.

Photographs



7.7 Occupied Bandwidth; Section 15.239(a)

Test Location Date Tested: 3/25/04

Ground Plane #1 (Test Station 5)

Test Instruments

Instrument	Manufacturer	Model	ID#	Cal 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	126

Test Results

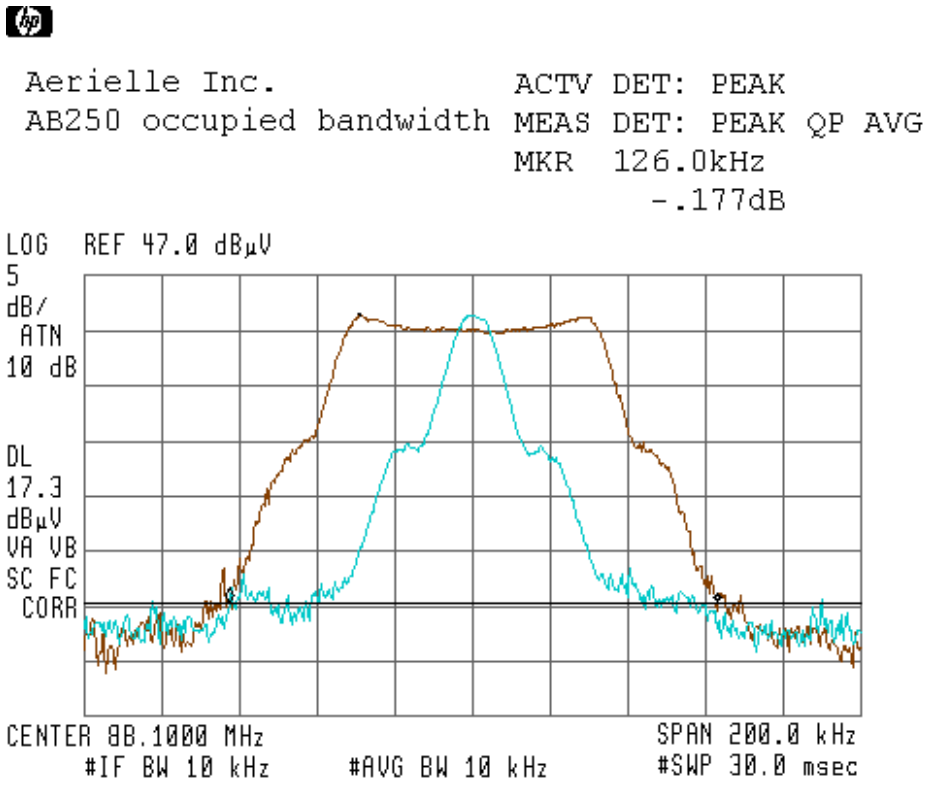
The requirements are:

MET maximum emission bandwidth is 126 kHz.

Remarks

None

Test Data


Aerielle Inc.
AB250 occupied bandwidth
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 126.0kHz
-.177dB
LOG REF 47.0 dBµV
5
dB/
ATN
10 dB
DL
17.3
dBµV
VA VB
SC FC
CORR
CENTER 88.1000 MHz
#IF BW 10 kHz
#AVG BW 10 kHz
SPAN 200.0 kHz
#SWP 30.0 msec

Photographs