

FCC PART 15.239

EMI MEASUREMENT AND TEST REPORT

For

Aerielle, Inc.

625 Ellis Street, Suite 206
Mountain View, CA 94043

FCC ID: RKVAB450K

This Report Concerns: ☒ Original Report	Equipment Type: Low Power FM Transceiver
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Report No.: R0512202	
Report Date: 2006-1-19	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Aerielle Inc.* product, FCC ID: *RKVAB450K*, or the “EUT” as referred to this report is a Low Power FM Transceiver, which measures approximately 45 mmL x 16 mmW x 38 mmH.

** The test data gathered are from typical production sample, serial number: #3 provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Aerielle Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A , B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules, section 15.209 & 15.239 rules.

Related Submittal(s)/Grant(s)

No Related Submittals.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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.

Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA with registration number: 90464.

Test site at BACL has 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 and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC 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>

SYSTEM TEST CONFIGURATION

Justification

The host system was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

EUT Exercise Software

The EUT exercise program used during radiated testing was designed to exercise the system components. Once loaded, set the Tx channel to low, mid and high for testing.

Special Accessories

As shown in following test block diagram, all interface cables used for compliance testing are shielded.

Schematics / Block Diagram

Please refer to Appendix A.

Equipment Modifications

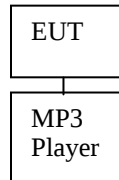
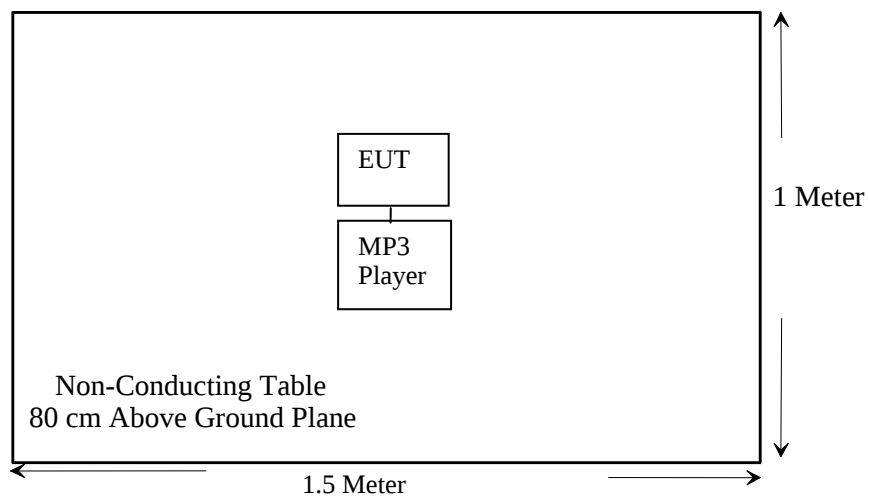
No modifications were made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Iriver	Mp3 player	H10	181402041200028	N/A

Interface Ports and Cabling

Cable Description	Length (M)	From	To
Cable	1.5	EUT	Iriver H10

Configuration of Test System**Test Setup Block Diagram**

SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Pass
§15.207	AC Line Conduction	N/A*
§15.205, §15.209, §15.239(b)	Radiated Emission	Pass**
§15.239(a)	Frequency Range	Pass

*: Due to the fact that the EUT does not include an AC adapter, AC Line conducted emission test is not applicable.

** The test data was within the measurement of uncertainty

§15.203 - ANTENNA REQUIREMENT

Standard Applicable

For intentional device, according to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The antenna used with the EUT is an integral antenna.

§15.205 & §15.209 - SPURIOUS RADIATED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are receiver, 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 best estimate of the uncertainty of a radiation emissions measurement at BACL is ± 4.0 dB.

According to §15.205, except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
¹ 0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2655 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.57725	240 – 285	3345.8 – 3358	36.43 – 36.5
13.36 – 13.41	322 – 335.4	3600 – 4400	(²)

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510MHz

² Above 38.6

Except as provided in paragraph (d) and (e), the filed strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

According to §15.209, the device shall meet radiated emission general requirements.

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency of Emission (MHz)	Field Strength (Microvolts/meter)	Measurement Distance (Meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected to the power adapter which is connected with 120Vac/60Hz power source.

Receiver Setup

According to FCC Rules, 47 CFR, Section 15.33, the frequency was investigated from 30 MHz to 1080 MHz.

During the radiated emission test, the receiver was set with the following configurations:

<u>Frequency Range</u>	<u>RBW</u>	<u>Video B/W</u>
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

For Average measurement: RBW = 1MHz, VBW = 10Hz (above 1000MHz)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Amplifier, Pre	8447D	2944A10187	2005-08-25
Rohde & Schwarz	Receiver, EMI Test	ESCI1166.5950K03	100044	2005-09-29
Sunol Science	30Mhz ~ 2 GHz Antenna	JB1	A03105-3	2005-02-11

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**Qp**" in the data table.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC 15.209 Limit}$$

Environmental Conditions

Temperature:	18°C
Relative Humidity:	60%
ATM Pressure:	1018mbr

**Testing was performed by Snell Leong on 2005-11-28.*

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.209 & 15.239, and had the worst margin of:

Low Channel: -15.7 dB at 176.60MHz in the **Horizontal** polarization, Spurious Emission 30MHz-1080MHz

Middle Channel: -15.3 dB at 196.60MHz in the **Vertical** polarization, Spurious Emission 30MHz-1080MHz

High Channel: -13.1 dB at 215.80MHz in the **Vertical** polarization, Spurious Emission 30MHz-1080MHz

Spurious Emission 30MHz-1080MHz @ 3 Meter

Frequency	Reading	Detector	Direction	Height	Polar	Antenna	Cable	Amplifier	Corrected	15.209	Margin
MHz	dBuV/m		Degree	Meter	H / V	dB/m	dB	dB	dBuV/m	dBuV/m	dB
Low Channel											
176.60	41.1	Peak	270	3.2	H	13.4	1.0	27.7	27.8	43.5	-15.7
176.60	40.9	Peak	75	1.8	V	13.4	1.0	27.7	27.6	43.5	-15.9
264.90	29.4	Peak	270	1.5	H	11.7	1.2	27.1	15.2	46.0	-30.8
264.90	27.5	Peak	330	1.2	V	11.7	1.2	27.1	13.3	46.0	-32.7
Middle Channel											
196.60	40.5	Peak	75	1.8	V	14.4	1.0	27.7	28.2	43.5	-15.3
196.60	39.3	Peak	270	3.2	H	14.4	1.0	27.7	27.0	43.5	-16.5
294.90	34.3	Peak	270	1.5	H	12.6	1.2	27.4	20.7	46.0	-25.3
294.90	33.2	Peak	330	1.2	V	12.6	1.2	27.4	19.6	46.0	-26.4
High Channel											
215.80	46.9	Peak	75	1.8	V	10.1	1.0	27.6	30.4	43.5	-13.1
215.80	45.5	Peak	270	3.2	H	10.1	1.0	27.6	29.0	43.5	-14.5
323.70	32.0	Peak	330	1.2	V	13.9	1.3	27.4	19.8	46.0	-26.2
323.70	30.0	Peak	270	1.5	H	13.9	1.3	27.4	17.8	46.0	-28.2

§15.239 (a) – FREQUENCY RANGE & OCCUPIED BANDWIDTH**Measurement Uncertainty**

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 field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in §15.209.

Test Procedure

With the EUT's antenna attached, the EUT's radiated emission power was received by the test antenna which was connected to the spectrum analyzer with the START and STOP frequencies set to the EUT's operation band.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Plot(s) of Test Data

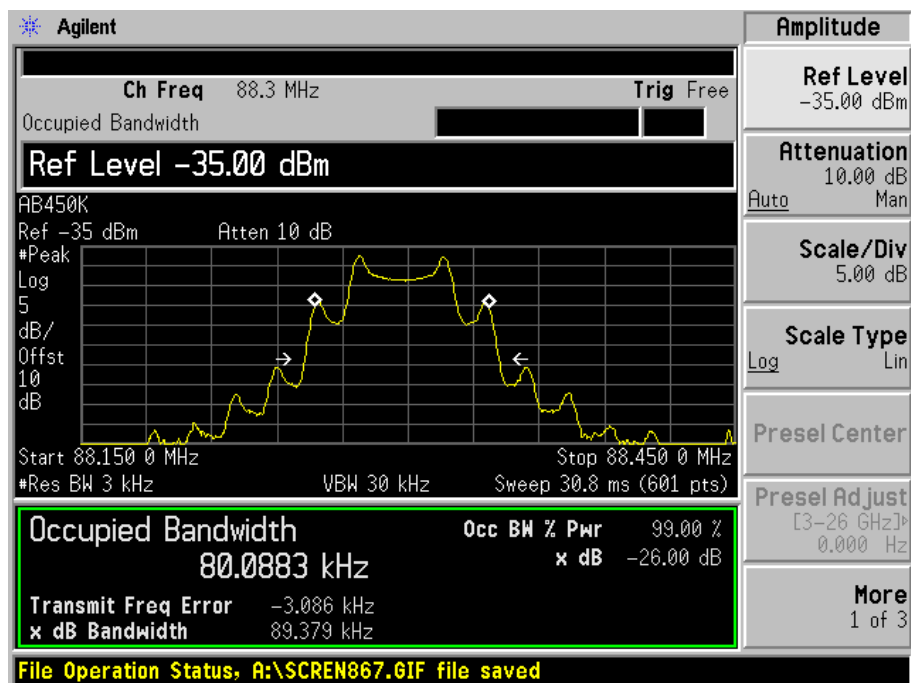
Plot(s) of Test Data is presented hereinafter as reference.

Test Result: Pass

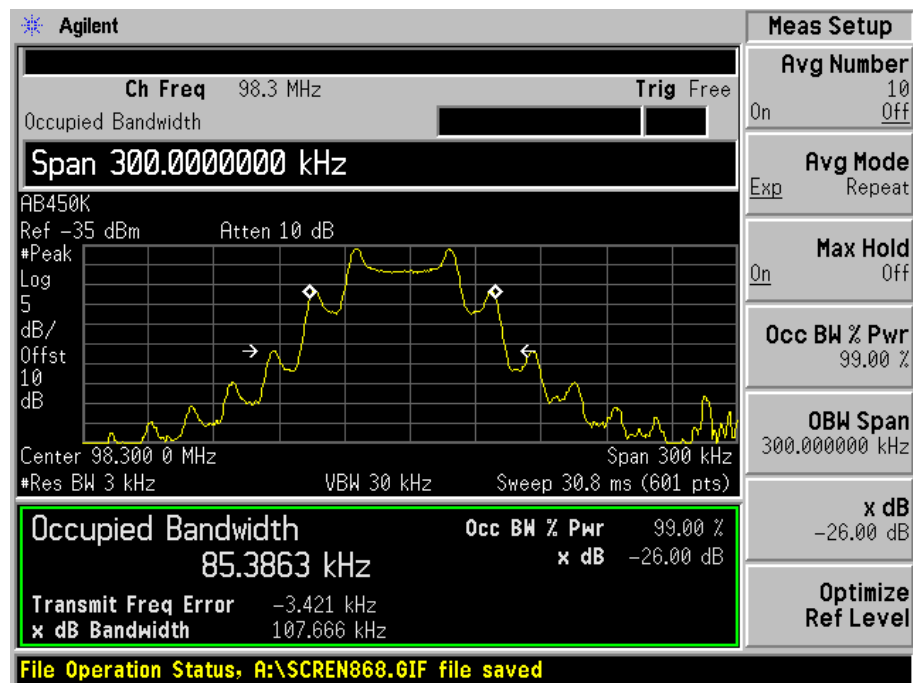
FREQ MHz	Measured BW KHz	Limit KHz
88.3	80.1	200
98.3	85.4	200
107.9	90.8	200

Note: Due to nearby radio station operating at 88.1 MHz, 88.3 MHz was tested instead of 88.1 MHz.

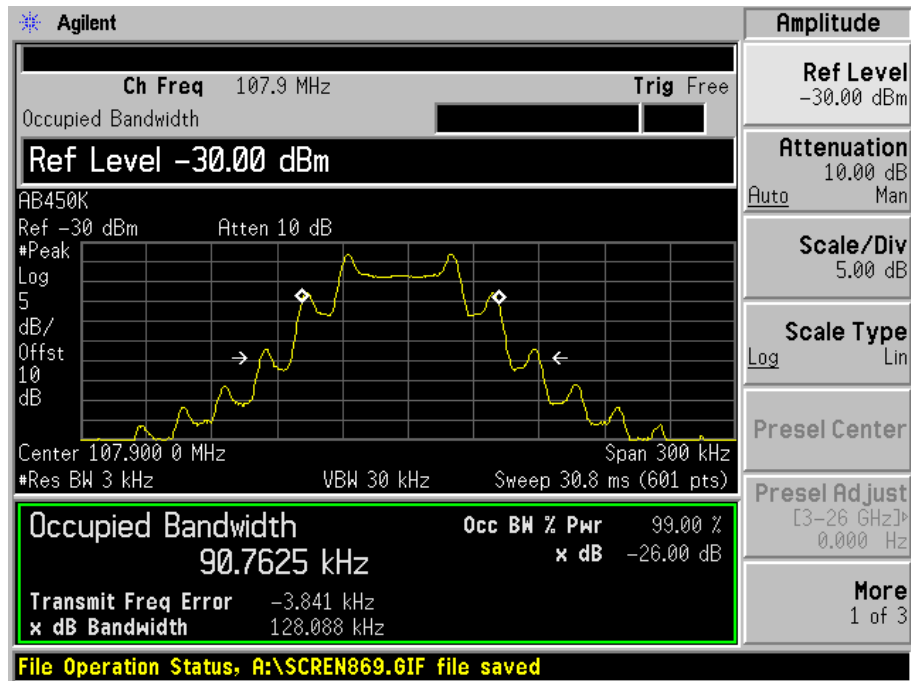
Low Channel



Middle Channel



High Channel



§15.239 (b) – FUNDAMENTAL FIELD STRENGTH EMISSIONS

Standard Applicable

According to §15.239(b) the field strength of any emissions within the permitted 200kHz band shall not exceed $250\mu\text{V/m} = 48\text{dB}\mu\text{V/m}$ microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

Measurement Uncertainty

All measurements involve certain levels of uncertainties. 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 best estimate of the uncertainty of a radiation emissions measurement at BACL is ± 4.0 dB.

Receiver Setup

According to FCC Rules, 47 CFR, Section 15.33, the frequency was investigated from 108 MHz to 1080 MHz.

During the radiated emission test, the receiver was set with the following configurations:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

For Average measurement: RBW = 1MHz, VBW = 10Hz (above 1000MHz)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Amplifier, Pre	8447D	2944A10187	2005-08-25
Rohde & Schwarz	Receiver, EMI Test	ESCI1166.5950K03	100044	2005-09-29
Sunol Science	30Mhz ~ 2 GHz Antenna	JB1	A03105-3	2005-02-11

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**Qp**" in the data table.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC 15.239 Limit}$$

Environmental Conditions

Temperature:	18°C
Relative Humidity:	60%
ATM Pressure:	1018mbr

**Testing was performed by Snell Leong on 2005-11-21.*

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.239, and had the worst margin of:

-1.8 dB at 107.9MHz in the Vertical polarization, Fundamental Field Strength*

** The test data was within the measurement of uncertainty.*

Fundamental Field Strength @ 3M

Frequency	Reading	PK/AV	Direction	Height	Polar	Antenna Factor	Cable loss	Amplifier	Corrected Factor Reading	15.239	Margin
MHz	dBuV/m		Degree	Meter	H / V	dB/m	dB	dB	dBuV/m	dBuV/m	dB
107.90	62.4	AVE	270	2.1	V	11.4	0.7	28.3	46.2	48	-1.8*
98.30	61.7	AVE	250	1.0	V	10.4	0.7	28.3	44.5	48	-3.5*
88.30	58.5	AVE	330	1.2	H	9.7	0.7	28.3	40.6	48	-7.4
98.30	56.5	AVE	280	2.8	H	10.4	0.7	28.3	39.3	48	-8.7
107.90	52.6	AVE	270	3.2	H	11.4	0.7	28.3	36.4	48	-11.6
88.30	52.3	AVE	280	2.8	V	9.7	0.7	28.3	34.4	48	-13.6
88.30	63.5	Peak	240	3.1	V	9.7	0.7	28.3	45.6	68	-22.4
98.30	62.5	Peak	250	1.0	V	10.4	0.7	28.3	45.3	68	-22.7
107.90	59.6	Peak	270	1.0	V	11.4	0.7	28.3	43.4	68	-24.6
98.30	57.1	Peak	240	3.1	H	10.4	0.7	28.3	39.9	68	-28.1
107.90	53.6	Peak	240	3.1	H	11.4	0.7	28.3	37.4	68	-30.6
88.30	53.7	Peak	270	1.0	H	9.7	0.7	28.3	35.8	68	-32.2

* The test data was within the measurement of uncertainty.