

FCC PART 15.247
EMI MEASUREMENT AND TEST REPORT

For

AlphaSmart Inc.

973 University Ave.
Los Gatos, CA 95032

FCC ID: K2VDANA002

2004-02-20

This Report Concerns: <input checked="" type="checkbox"/> Class II Permissive Change	Equipment Type: Transceiver, Palm Powered Laptop
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Report No.: R0402171	
Test Date: 2004-02-17	
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Note: This test report is specially limited to the above client company and product model only. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *AlphaSmart Inc.* 's, model: *DANA WIRELESS*, or the "EUT" as referred to in this report is a transceiver, Palm Powered Laptop, which measures approximately 1.7"L x 1.2"W x 0.12"H. The EUT is a DTS device, which operates at the frequency range of 2412 – 2462 MHz, with the maximum conducted output power of 19.95dBm (98.7mW)

** The test data gathered are from a production sample, serial number WUUSRD-336097136 provided by the manufacturer.*

Objective

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

This is a C2PC application. The original application was granted on 8/12/03. The difference between the original device and the current one are as follows: A short (about 1") flex cable between the main PCB and the Wireless module was added. This flex cable simply extends the USB signals provided to the module, and does not affect the 802.11b radio. There is no change in mounting location of the module.

The objective of the manufacturer is to determine continued compliance with FCC rules, especially Conducted and Spurious Radiated Emission.

Related Submittal(s)/Grant(s)

The original application was originally granted on 8/12/03. Please refer to BACL report R0306181 for the details of the original application.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001, 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 and FCC97114 for Direct Sequence SS.

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.

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 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 C63.4-2001.

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 scope of the accreditation covers the FCC Method – CFR Title 47, Parts 2 and 15 , CISPR 22: (use right version and spelling!) Electromagnetic Interference – Limits and Methods of Measurement of Information Technology Equipment test methods.

SYSTEM TEST CONFIGURATION

Justification

The host system was configured for testing according to ANSI C63.4-2001.

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 and conducted testing was designed to exercise the system components. The test software, provided by the customer, is started the Windows terminal program under the Windows 98/2000/ME/XP operating system.

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. The host PC and the peripherals featured shielded metal connectors.

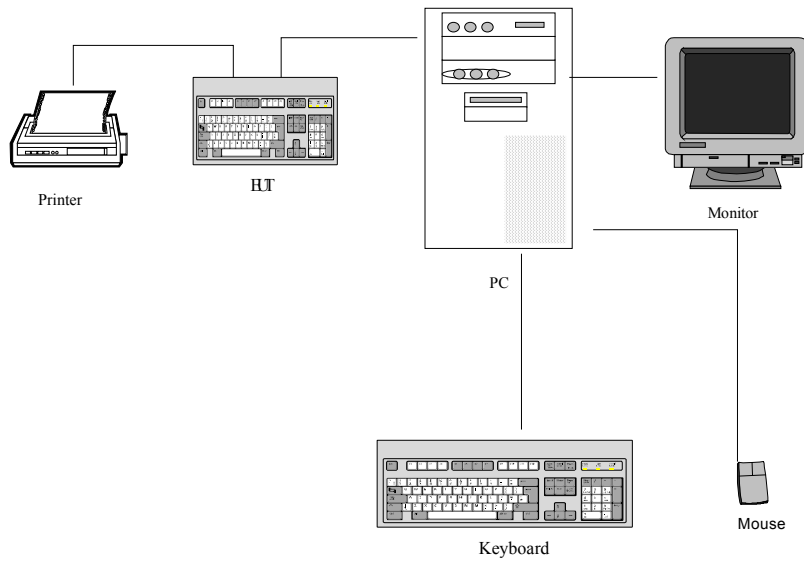
Schematics / Block Diagram

Please refer to Appendix A.

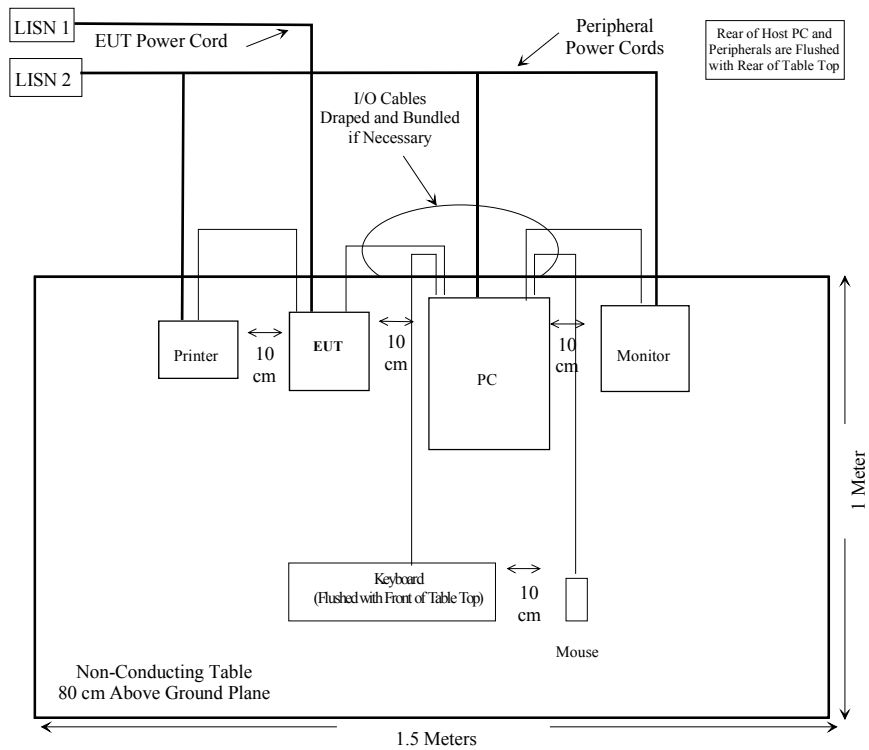
Equipment Modifications

No modifications were made to the EUT.

Configuration of Test System



Test Setup Block Diagram



Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
SMILE INT'L	Monitor	CA1716DS	ALKKU65431034	GBVCA1716DS
HP	Computer	Pavilion 8660c	Us00412593	DOC
Key Tronics	Keyboard	J9813	E0301QCMTPS2C	DOC
Logitech	Mouse	m-s34	LZB95225500	DOC
HP	Printer	C8415a	MYCOLO140Y7	DOC
ALPHA SMART	PDA host	N/A	N/A	DOC

External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Non-shielded monitor Cable	1	Monitor	PC
Non-shielded keyboard Cable	1	Keyboard	PC
Non-shielded mouse Cable	1	Mouse	PC
Non-shielded USB Cable	1	PC	EUT
Non-shielded printer cable	1	Printer	EUT

Power Supply Information

Manufacturer	Description	Model	Serial Number	FCC ID
ALPHA SMART	AC/DC ADAPTER	41-7.5-500D	N/A	DOC

SUMMARY OF TEST RESULTS

Results reported relate only to the product tested, serial number: WUUSRD-336097136.

FCC RULES	DESCRIPTION OF TEST	RESULT
§2.1093	RF Exposure	Unchanged
§15.203	Antenna Requirement	Unchanged
§ 15.207 (a)	Conducted Emissions	Pass
§15.209 (a)	Spurious Emission	Unchanged
§15.209 (f)	Radiated Emission	Pass
§15.247 (a)(2),	6 dB Bandwidth	Unchanged
§15.247 (b)(3),	Maximum Peak Output Power	Unchanged
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edge	Unchanged
§15.247 (d),	Peak Power Spectral Density	Unchanged

§15.209 - SPURIOUS RADIATED EMISSION

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 BAEL 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 for Class A device, the filed strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength	
	(uV/m)	(dBµV/m)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2001. 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.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR, Section 15.33, the frequency was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the spectrum analyzer 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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Amplifier, Microwave	8449B	3147A00400	3/14/2003
HP	Amplifier, Pre	8447E	1937A01057	8/4/2003
HP	Amplifier, Pre	8447E	1937A01046	8/2/2003
HP	Analyzer, Spectrum	8565EC	3946A00131	6/30/2003
ETS	Antenna, Biconical	3110B	9603-2315	10/11/2003
A.R.A.	Antenna, Horn, DRG	DRG-118/A	1132	9/30/2003
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	2455-261	8/1/2003
ETS	Antenna, logperiodic	3148	0004-1155	10/11/2003
EMCO	Antenna, Loop, H-Field Gain/AF	6512	00029604	2/12/2004

* **Statement of Traceability: BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the 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 μ V 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 μ V means the emission is 7dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

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

Summary of Test Results

According to the data in section 12.7, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207 and 15.247, and had the worst margin of:

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

-13.03 dB at 7236 MHz in the **Vertical** polarization, Low Channel

-13.26 dB at 7311 MHz in the **Vertical** polarization, Middle Channel

-14.40 dB at 7386 MHz in the **Vertical** polarization, High Channel

-10.96 dB at 123.468 MHz in the **Vertical** polarization, Unwanted Emission

Radiated Emission Test Result

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED	FCC 15	
Frequency	Ampl.	Comments		Angle	Height	Polar	Antenna	Cable	Amp.	AMPLITUDE	Limit
MHz	dB μ V/m			Degree	Meter	H/V	dB μ V/m	DB	DB	dB μ V/m	dB μ V/m
Low Channel, 1-25GHz											
2412	107.17	Fund/Peak	220	1.7	v	28.1	3.35	35.6	103.02		
2412	106	Fund/Peak	220	1.2	h	28.1	3.35	35.6	101.85		
2412	103.7	Fund/Ave	220	1.7	v	28.1	3.35	35.6	99.55		
2412	102.33	Fund/Ave	220	1.2	h	28.1	3.35	35.6	98.18		
7236	34.4	Ave	100	1.5	v	36.3	5.97	35.7	40.97	54	-13.03
7236	33.83	Ave	0	1.4	h	36.3	5.97	35.7	40.4	54	-13.60
4824	33.5	Ave	270	2	v	32.5	4.91	34.75	36.16	54	-17.84
4824	32.83	Ave	330	1.5	h	32.5	4.91	34.75	35.49	54	-18.51
7236	47.17	Peak	100	1.5	v	36.3	5.97	35.7	53.74	74	-20.26
7236	47.17	Peak	0	1.4	h	36.3	5.97	35.7	53.74	74	-20.26
4824	46.33	Peak	330	1.5	h	32.5	4.91	34.75	48.99	74	-25.01
4824	46	Peak	270	2	v	32.5	4.91	34.75	48.66	74	-25.34
Middle Channel, 1-25GHz											
2437	107.5	Fund/Peak	220	1	v	28.1	3.35	35.6	103.35		
2437	107.33	Fund/Peak	220	1.4	h	28.1	3.35	35.6	103.18		
2437	104.2	Fund/Ave	220	1	v	28.1	3.35	35.6	100.05		
2437	103.67	Fund/Ave	220	1.4	h	28.1	3.35	35.6	99.52		
7311	34.17	Ave	250	1.4	v	36.3	5.97	35.7	40.74	54	-13.26
7311	33.83	Ave	180	1.3	h	36.3	5.97	35.7	40.4	54	-13.60
4874	35	Ave	150	1	v	32.5	4.91	34.75	37.66	54	-16.34
4874	32.67	Ave	180	1	h	32.5	4.91	34.75	35.33	54	-18.67
7311	47.67	Peak	250	1.4	v	36.3	5.97	35.7	54.24	74	-19.76
7311	47.33	Peak	180	1.3	h	36.3	5.97	35.7	53.9	74	-20.10
4874	47	Peak	150	1	v	32.5	4.91	34.75	49.66	74	-24.34
4874	45.17	Peak	180	1	h	32.5	4.91	34.75	49.66	74	-24.34

High Channel, 1-25GHz											
2462	108	Fund/Peak	220	1.5	v	28.1	3.35	35.6	103.85		
2462	106.5	Fund/Peak	150	1.4	h	28.1	3.35	35.6	102.35		
2462	104.5	Fund/Ave	220	1.5	v	28.1	3.35	35.6	100.35		
2462	102.83	Fund/Ave	150	1.4	h	28.1	3.35	35.6	98.68		
7386	33.03	Ave	150	1.6	v	36.3	5.97	35.7	39.6	54	-14.40
7386	32.8	Ave	150	1.5	h	36.3	5.97	35.7	39.37	54	-14.63
4924	34.87	Ave	250	1.8	v	32.5	4.91	34.75	37.53	54	-16.47
4924	33.03	Ave	330	1.8	h	32.5	4.91	34.75	35.69	54	-18.31
7386	47.37	Peak	150	1.5	h	36.3	5.97	35.7	53.94	74	-20.06
7386	46.37	Peak	150	1.6	v	36.3	5.97	35.7	52.94	74	-21.06
4924	46.7	Peak	250	1.8	v	32.5	4.91	34.75	49.36	74	-24.64
4924	45.7	Peak	330	1.8	h	32.5	4.91	34.75	49.36	74	-24.64

Frequency MHz	Indicated		Table Height Meter	Antenna		Correction Factor			FCC 15 Subpart B	
	Ampl. dB μ V/m	Direction Degree		Polar H/V	Antenna dB μ V/m	Cable Loss dB μ V/m	Amp. dB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
123.468	47.83	180	1	v	11.7	1.57	28.556	32.54444	43.5	-10.96
170.73	43.67	270	1.2	h	13	1.86	28.333	30.19664	43.5	-13.30
123.5	45.17	30	1.8	h	11.7	1.57	28.556	29.88444	43.5	-13.62
230.368	44.17	45	1.6	v	12.6	2.17	28.08	30.86	46	-15.14
230.323	41.5	100	2	v	12.6	2.17	28.08	28.19	46	-17.81
308.257	36.83	270	1.6	v	14.4	2.3	27.8	25.73	46	-20.27
226.453	37.67	150	1.8	v	11.8	2.17	28.12	23.52	46	-22.48

§15.207(a) - CONDUCTED EMISSIONS

Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ± 2.4 dB.

EUT Setup

The measurement was performed in the shield room, using the same setup per ANSI C63.4-2001 measurement procedure. The specification used was FCC 15 Subpart B 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.

Spectrum Analyzer Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30Mhz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Artificial LISN	ESH2-Z5	871884/039	2003-03-28
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2003-05-06

* **Statement of Traceability:** BACL Corp. certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

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

Summary of Test Results

According to the recorded data in following table, the EUT complies with the FCC Conducted margin for a Class B device, with the *worst* margin reading of:

-24.0dB at 0.15 in the Neutral mode

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.15	42.0	QP	Neutral	66	-24.0
0.15	41.7	QP	Line	66	-24.3
25.20	32.5	QP	Neutral	60	-27.5
9.90	20.1	AVG	Line	50	-29.9
25.20	29.4	QP	Line	60	-30.6
8.40	18.8	AVG	Neutral	50	-31.2
28.70	16.2	AVG	Neutral	50	-33.8
9.90	23.9	QP	Line	60	-36.1
8.40	22.0	QP	Neutral	60	-38.0
25.20	9.4	AVG	Line	50	-40.6
0.15	14.2	AVG	Neutral	56	-41.8
0.15	12.3	AVG	Line	56	-43.7

Plot of Conducted Emissions Test Data

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

Bay Area Compliance Laboratory Corp Class B

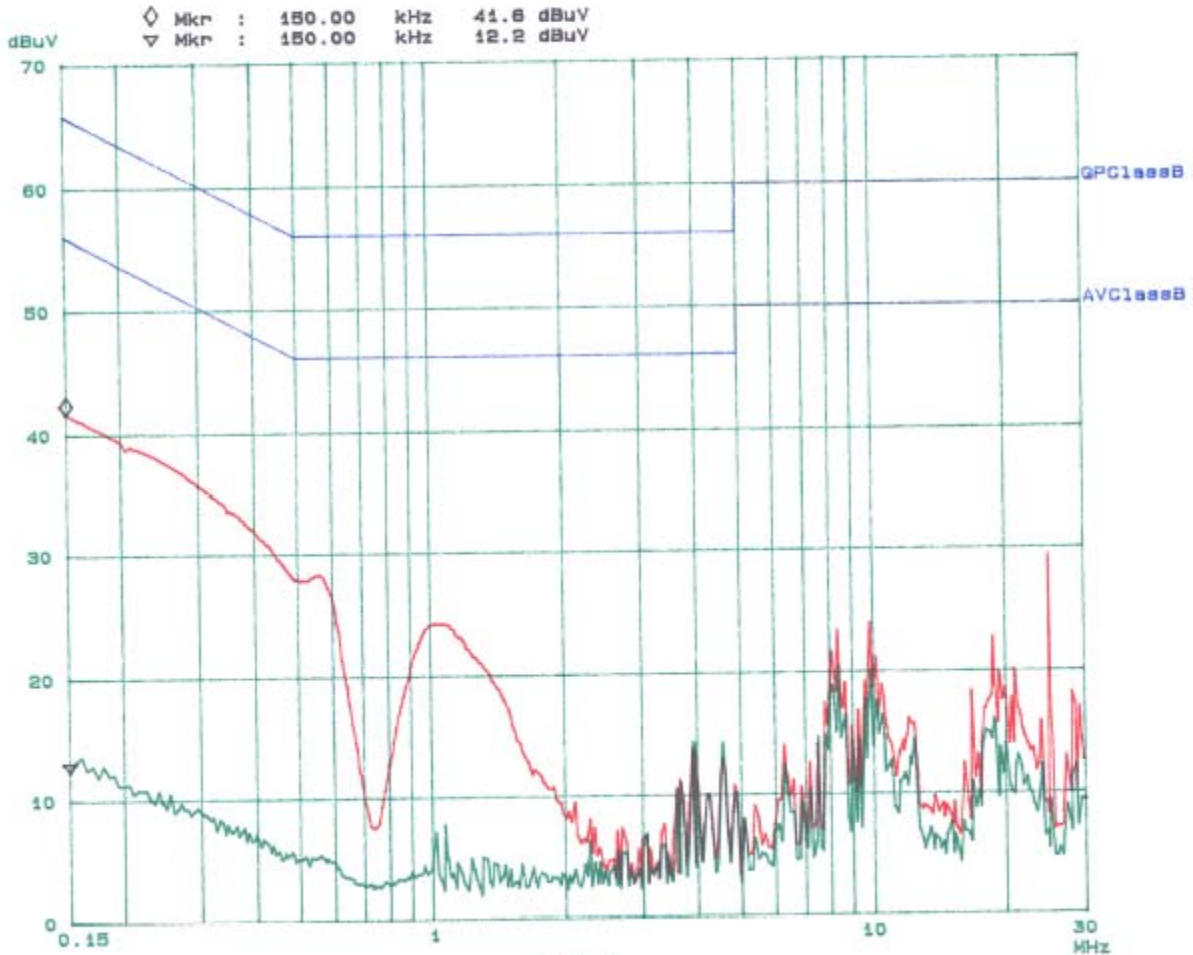
17. Feb 04 17:30

EUT: DANA WIRELESS
Manuf: ALPHA SMART
Op Cond: Normal
Operator: LING
Comment: L
US

Scan Settings (3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	
150k	1M	5k	9k	QP+AV	20ms	15dB LN	OFF	
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF	
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF	

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



Bay Area Compliance Laboratory Corp Class B

17. Feb 04 18:27

EUT: DANA WIRELESS
Manuf: ALPHA SMART
Op Cond: Normal
Operator: LING
Comment: N
US

Scan Settings (3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	
150k	1M	5k	9k	QP+AV	20ms	15dB LN	OFF	
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF	
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF	

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB

