Test Report for Unlicensed Low Power Transmitter

Description of device: Biometric sensor operating at 2.4 GHz ISM band
Applicable Rule Parts: 15.205, 15.207, 15.249

Applicant: Aliph
410 Jessie Street - Unit 601
San Francisco, CA 94103
tel 415 512 9191
fax 415 512 9190

FCC ID: QSA ALIPH-RAV-REVB

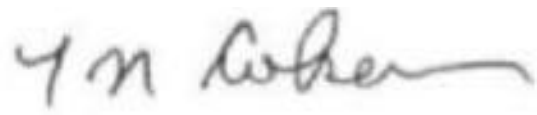
TEST REQUIREMENTS

The referenced device is subject to certification under Part 2 of FCC Rules. The specific emissions limits and test requirements are found in Part 15 of FCC Rules. In addition to the device specific requirements listed in 15.249 (re-printed below), the following Part 15 requirements are universal to all unlicensed transmitters and would also apply:

15.19 Labeling requirements
15.20 Accessories
15.21 Information to user
15.31 Measurement standards
15.33 Frequency range of measurements
15.35 Measurement detector functions and bandwidths
15.109 Radiated Emissions (unintentional radiators)
15.203 Antenna requirement
15.204 External radio frequency power amplifiers and antenna modifications.
15.205 Restricted bands of operation.
15.207 Conducted limits
15.209 Radiated emission limits, general requirements.

Emissions limits and test data are found below.

The Aliph GEMS biometric sensor meets all emissions requirements for certification under Parts 2 and 15 of FCC Rules.



THOMAS N. COKENIAS 8 December 2002
EMC and Radio Regulatory Consultant

15.205 Restricted bands of operation.

Only spurious emissions are permitted in any of the frequency bands listed below: The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209.

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
10.495 - 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 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	
13.36 - 13.41			

15.109 Radiated emission limits, general requirements.

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

Frequency (MHz)	Field Strength uV/m	Measurement distance, m
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

15.249 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following table. Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Fundamental Frequency	Field Strength, fundamental emission at 3 meters	Field Strength, harmonics and spurious emissions at 3m
902-928 MHz	50,000 uV/m (94 dBuV/m)	500 uV/m (54 dBuV/m)
2400 - 2483.5 MHz	**50,000 uV/m (94 dBuV/m)**	**500 uV/m (54 dBuV/m)**
5725-5875 MHz	50,000 uV/m (94 dBuV/m)	500 uV/m (54 dBuV/m)
24.0 - 24.25 GHz	250,000uV/m (104 dBuV/m)	2500 uV/m (68 dBuV/m)

TEST RESULTS

15.205, 15.209, 15.249 Radiated Emissions

Test Equipment Used

HP8593EM Analyzer
Miteq NSP2600-44 Preamp
EMCO 3115 Antenna

Test Set-up, 1-40 GHz

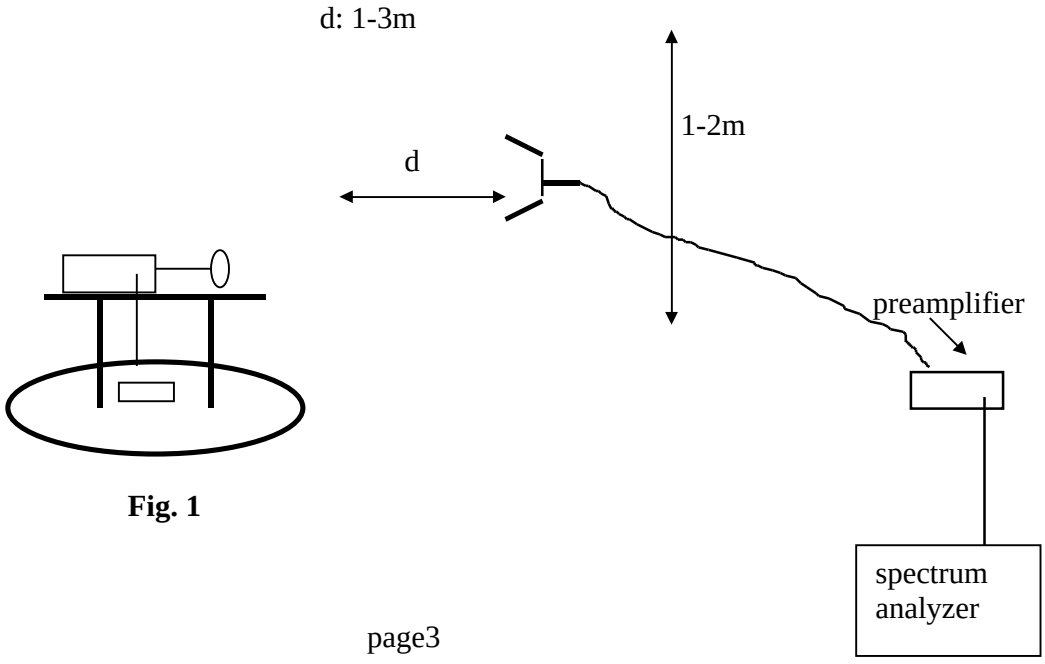


Fig. 1

Test Procedure

The EUT was placed on a wooden turntable located 3m from the search antenna. The EUT was activated to transmit continuously. Radiated emissions from fundamental operating frequency to the 10th harmonic, for search antenna in both vertical and horizontal polarities.

The test was repeated for each of the patch antennas sold with the product. For all tests the battery eliminator was plugged into the EUT, and a set of earphones was connected to the audio output jack.

Test Results

Data shows the EUT meets all radiated requirements specified in 15.205 and 15.249. Measurements were made for each antenna from 1-25 GHz for each of four antenna types supplied with the EUT:

Antenna Model/Type	Gain, dBi
9p6+6_80	-23.8
9p6+7_80	-16.6
9p6+8_80	-14.4
SPIRAL	-34.2

Harmonic and spurious measurements indicated that radiated levels were independent of antenna used, emissions were the same for each antenna, and regardless of whether an antenna was connected. Radiated spurs and harmonics seemed to be leaking from the rear of the unit. Measured levels were well within limits, most were at instrument noise floor.

11/13/02 **FCC Measurement**

Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: Thanh Nguyen
Project #:
Company: Aliph
EUT Descrip.: Biometric sensor
EUT M/N:
Test Target: 15.249

Equipment for 1-22 GHz:
HP8566B Analyzer
HP8449 Pre- amp
EMCO 3115 Antenna
Cable: 16.0 feet

Equipment for 22 - 58 GHz:
HP8566B Analyzer
HP 11975A Amplifier (LO)
HP 11970K External mixer/antenna
Cable: IF Only (321 MHz)

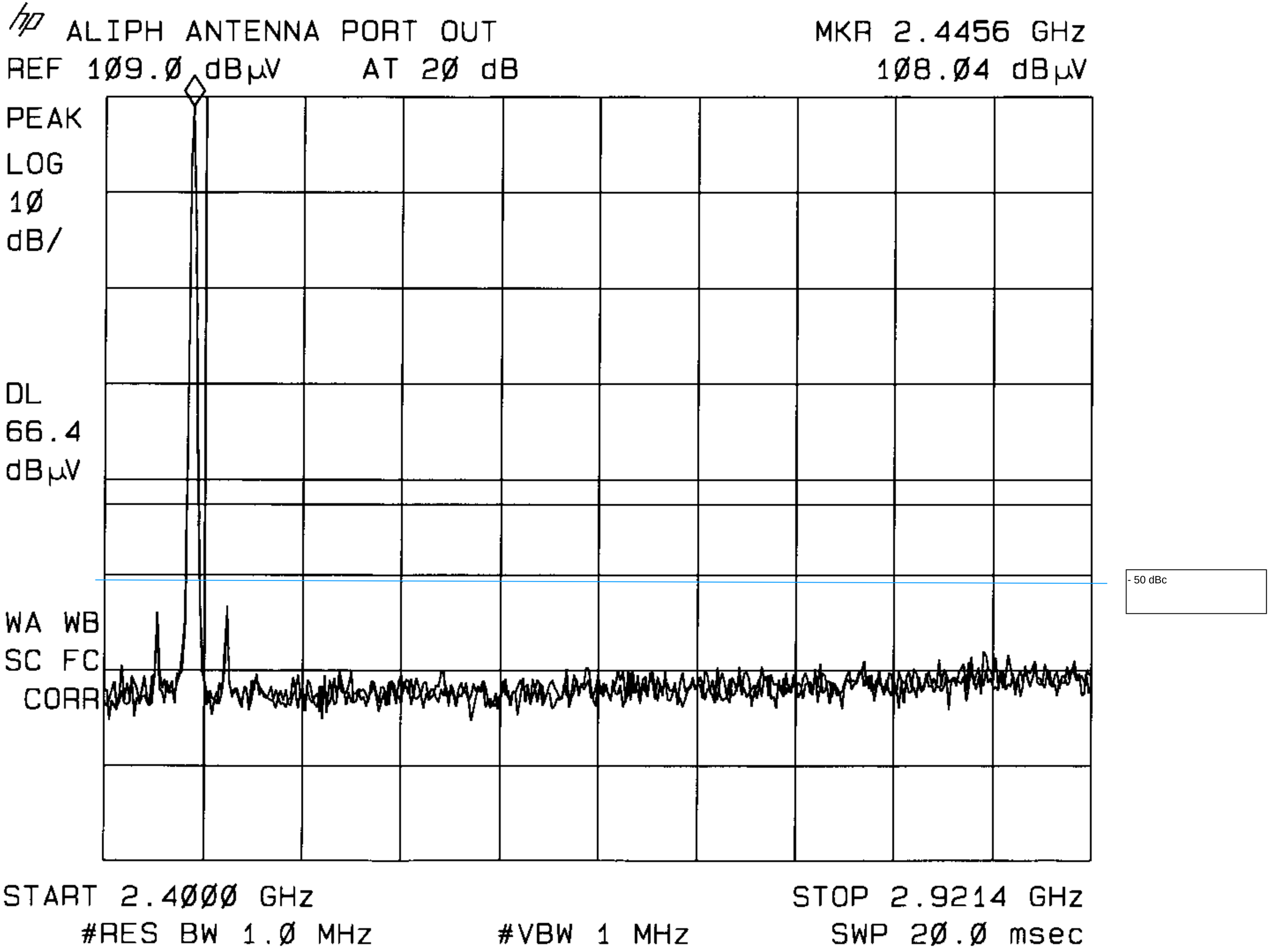
Peak Measurements:
1 MHz Resolution Bandwidth
1MHz Video Bandwidth

Average Measurements:
1MHz Resolution Bandwidth
10Hz Video Bandwidth

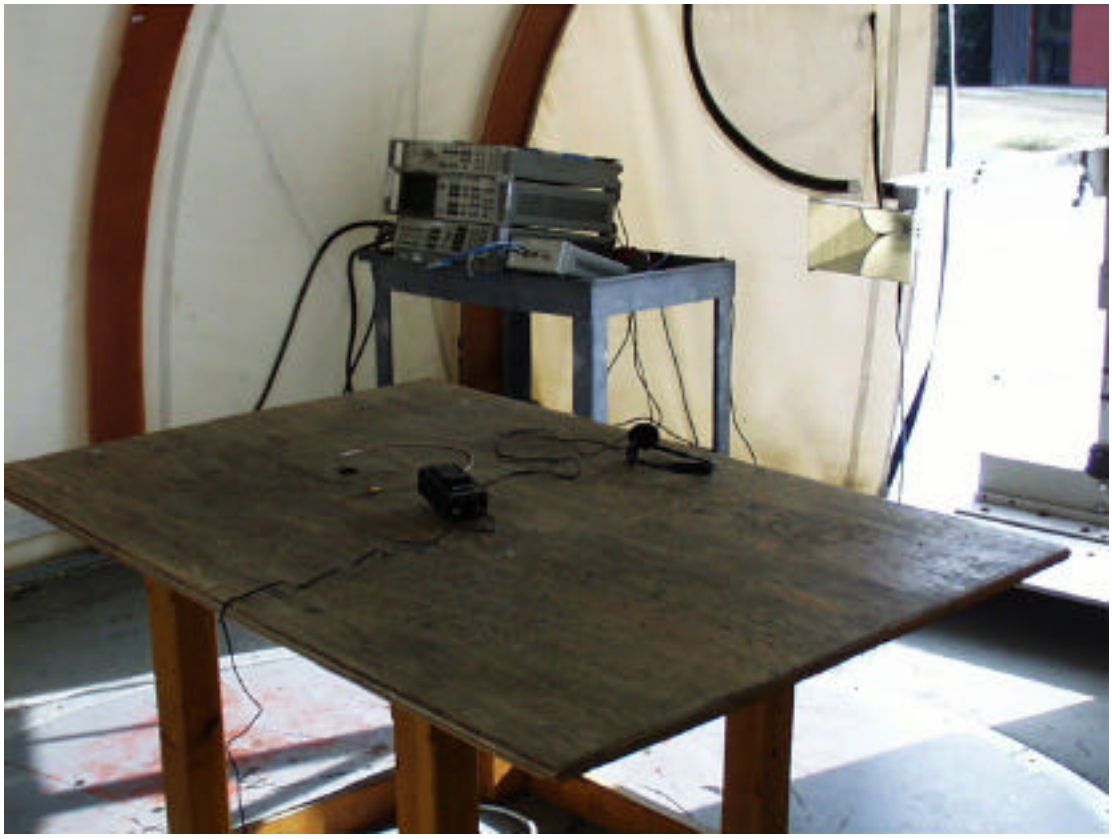
f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
2.448	3.3	84.4	84.1	29.0	4.1	-36.3	-9.5	0.0	71.7	71.4	114.0	94.0	-42.3	-22.6	V 9p6+6_80
2.448	3.3	80.5	80.6	29.0	4.1	-36.3	-9.5	0.0	67.8	67.9	114.0	94.0	-46.2	-26.1	H 9p6+6_80
2.448	3.3	92.0	91.3	29.0	4.1	-36.3	-9.5	0.0	79.3	78.6	114.0	94.0	-34.7	-15.4	V 9p6+7_80
2.448	3.3	88.5	88.5	29.0	4.1	-36.3	-9.5	0.0	75.8	75.8	114.0	94.0	-38.2	-18.2	H 9p6+7_80
2.448	3.3	93.7	93.5	29.0	4.1	-36.3	-9.5	0.0	81.0	80.8	114.0	94.0	-33.0	-13.2	H 9p6+8_80
2.448	3.3	87.2	87.3	29.0	4.1	-36.3	-9.5	0.0	74.5	74.6	114.0	94.0	-39.5	-19.4	V 9p6+8_80
2.448	3.3	73.7	73.7	29.0	4.1	-36.3	-9.5	0.0	61.0	61.0	114.0	94.0	-53.0	-33.0	V SPIRAL
2.448	3.3	68.3	68.3	29.0	4.1	-36.3	-9.5	0.0	55.6	55.6	114.0	94.0	-58.4	-38.4	H SPIRAL
4.896	3.3	56.6	51.5	34.1	6.2	-34.5	-9.5	0.0	52.8	47.7	74.0	54.0	-21.2	-6.3	H 9p6+6_80
4.896	3.3	57.9	46.4	34.1	6.2	-34.5	-9.5	0.0	54.1	42.6	74.0	54.0	-19.9	-11.4	V 9p6+6_80
7.344	3.3	56.8	45.2	37.2	7.8	-34.6	-9.5	0.0	57.7	46.1	74.0	54.0	-16.3	-7.9	V 9p6+6_80
7.344	3.3	57.9	46.4	37.2	7.8	-34.6	-9.5	0.0	58.8	47.3	74.0	54.0	-15.2	-6.7	H 9p6+6_80
9.790	3.3	56.9	45.2	38.6	9.2	-34.6	-9.5	0.0	60.6	48.9	74.0	54.0	-13.4	-5.1	V 9p6+6_80
9.790	3.3	57.1	45.0	38.6	9.2	-34.6	-9.5	0.0	60.8	48.7	74.0	54.0	-13.2	-5.3	H 9p6+6_80
12.240	1.0	54.5	43.2	39.2	10.2	-33.3	-19.9	0.0	50.8	39.5	74.0	54.0	-23.2	-14.5	NF V9p6+6_80
14.688	0.5	59.6	48.1	40.9	11.6	-33.0	-25.9	0.0	53.3	41.8	74.0	54.0	-20.7	-12.2	NF V9p6+6_80
17.140	0.5	58.4	48.1	42.9	13.2	-32.9	-25.9	0.0	55.8	45.5	74.0	54.0	-18.2	-8.5	NF V9p6+6_80
19.580	0.5	63.7	52.1	32.1	14.6	-32.7	-25.9	0.0	51.7	40.2	74.0	54.0	-22.3	-13.8	NF V9p6+6_80
22.030	0.5	63.5	51.5	32.0	15.9	-33.6	-25.9	0.0	51.9	39.9	74.0	54.0	-22.1	-14.1	NF V9p6+6_80

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

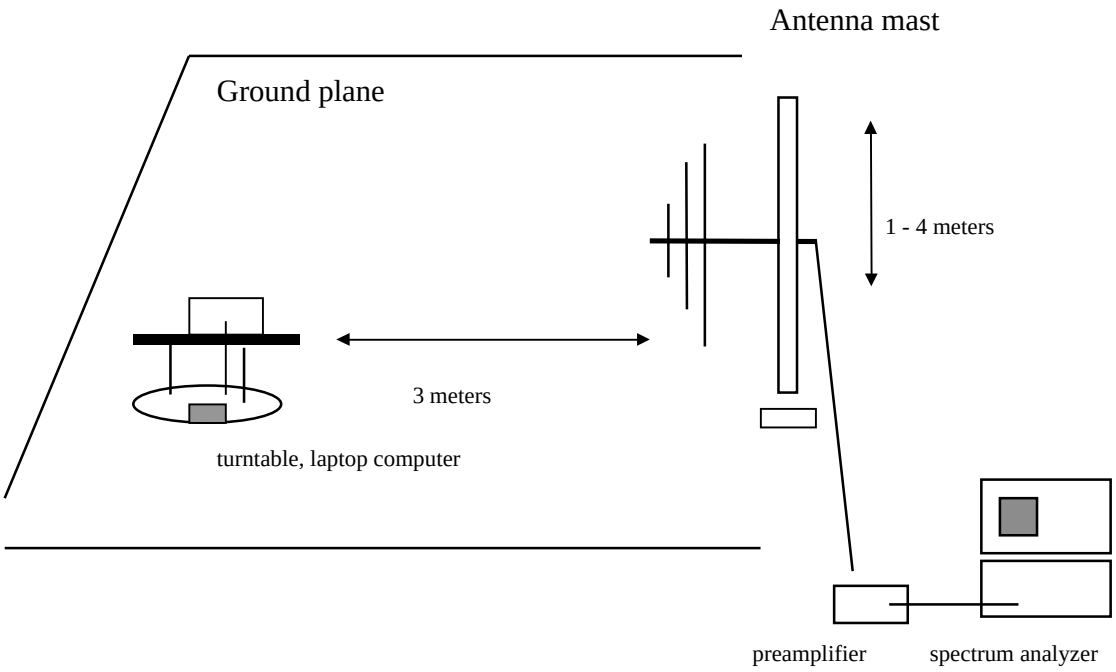
NOTE: Harmonic emissions 4.896 to 24.48 GHz were measured for each antenna. Levels were not affected by antenna used, all harmonic emissions appeared to be emanating from rear case. Emissions recoreded for antenna model 9p6+6-80 is applicable to all 4 antennas.


ALIPH ANTENNA PORT OUT
MKR 2.4456 GHz
REF 109.0 dBµV
AT 20 dB
108.04 dBµV
PEAK
LOG
10
dB/
DL
66.4
dBµV
- 50 dBc
WA WB
SC FC
CORR
START 2.4000 GHz
STOP 2.9214 GHz
#RES BW 1.0 MHz
#VBW 1 MHz
SWP 20.0 msec

Test Set-up Photograph



Radiated Test Set-up, 30 - 1000 MHz



Test Procedures, 30 -1000 MHz

The EUT was set to normal operating conditions (constantly transmitting). Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4.

Test Results

Refer to tabulated data sheet.

02U1417-1
020802A1
08/02/02 3:36 PM
thanhnguyen

Alexis Networks
2.4 GHz Radio
EUT only
FCC part 15.249
Normal TX

08/02/02

Freq.	Reading	AF	Closs	Pre-amp	Level	Limit	Margin	Pol	Az	Height	Mark
(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	FCC_B	(dB)	(H/V)	(Deg)	(Meter)	(P/Q/A)
36.33	43.90	12.86	0.94	27.65	30.05	40.00	-9.95	3mV	180.00	1.00	P
36.33	38.70	12.86	0.94	27.65	24.85	40.00	-15.15	3mH	90.00	1.70	P
39.38	40.90	12.88	0.95	27.64	27.08	40.00	-12.92	3mH	90.00	1.70	P
These noise signals from the charger.											
Measure with the LAB power suplly.											
36.35	36.10	12.86	0.94	27.65	22.25	40.00	-17.75	3mV	180.00	1.00	P
48.26	38.60	11.36	1.08	27.62	23.42	40.00	-16.58	3mV	180.00	1.00	P
68.26	40.00	6.09	1.32	27.62	19.79	40.00	-20.21	3mV	180.00	1.00	P
110.26	39.60	10.56	1.63	27.53	24.26	43.50	-19.24	3mV	180.00	1.00	P
All signals above are the noise floor.											
211.30	41.20	10.34	2.30	27.19	26.65	43.50	-16.85	3mV	180.00	1.50	P
245.30	39.20	11.65	2.50	27.06	26.29	46.00	-19.71	3mV	180.00	1.00	P
322.23	40.10	14.91	2.90	27.23	30.69	46.00	-15.31	3mV	180.00	1.50	P
353.01	39.20	15.19	3.04	27.46	29.97	46.00	-16.03	3mV	180.00	1.50	P
414.02	38.01	15.95	3.31	27.89	29.38	46.00	-16.62	3mV	180.00	1.00	P
502.00	40.90	17.99	3.69	28.40	34.18	46.00	-11.82	3mV	180.00	1.50	P
All signals above are the noise floor.											
No noise signal detected fro EUT up to 1 GHz both Vertical and Horizontal antenna.											
Total data #: 13											
V.2a											

AC Line Conducted Emissions
Test Requirement: 15.107, 15.207

Measurement Equipment Used:

Rohde & Schwarz EMI Receiver ESHS-20
Fischer Custom Communication LISN, FCC-LISN-50/250-25-2

Test Set-up

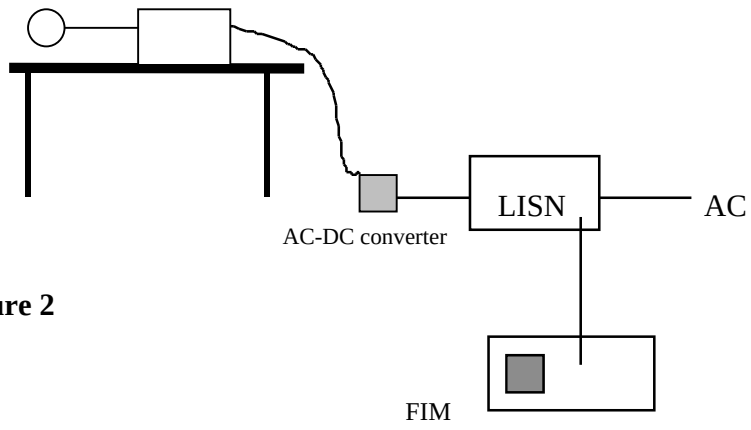


Figure 2

Test Procedure

1. The EUT was placed on a wooden table 40 cm from a vertical ground plane and approximately 80 cm above the horizontal ground plane on the floor. The EUT was set to transmit in normally.
2. Line conducted data was recorded for both NEUTRAL and HOT lines.

Test Results

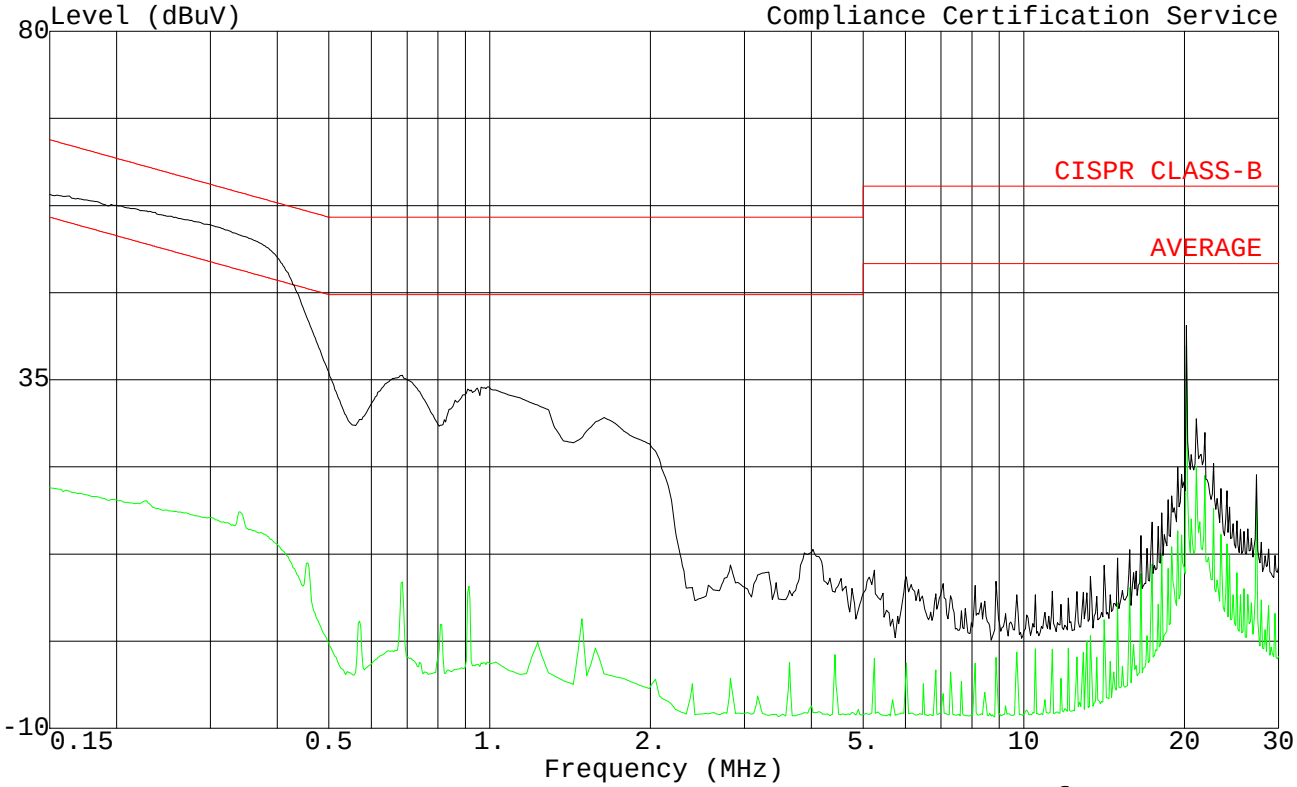
PASS. Refer to data sheets below.

AC Line conducted test set-up

COMPLIANCE Engineering Service, Inc.
FCC,VCCI,CISPR,CE
UL,CSA,TUV

561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 7 File#: 02U1587.EMI Date: 11-13-2002 Time: 10:59:04



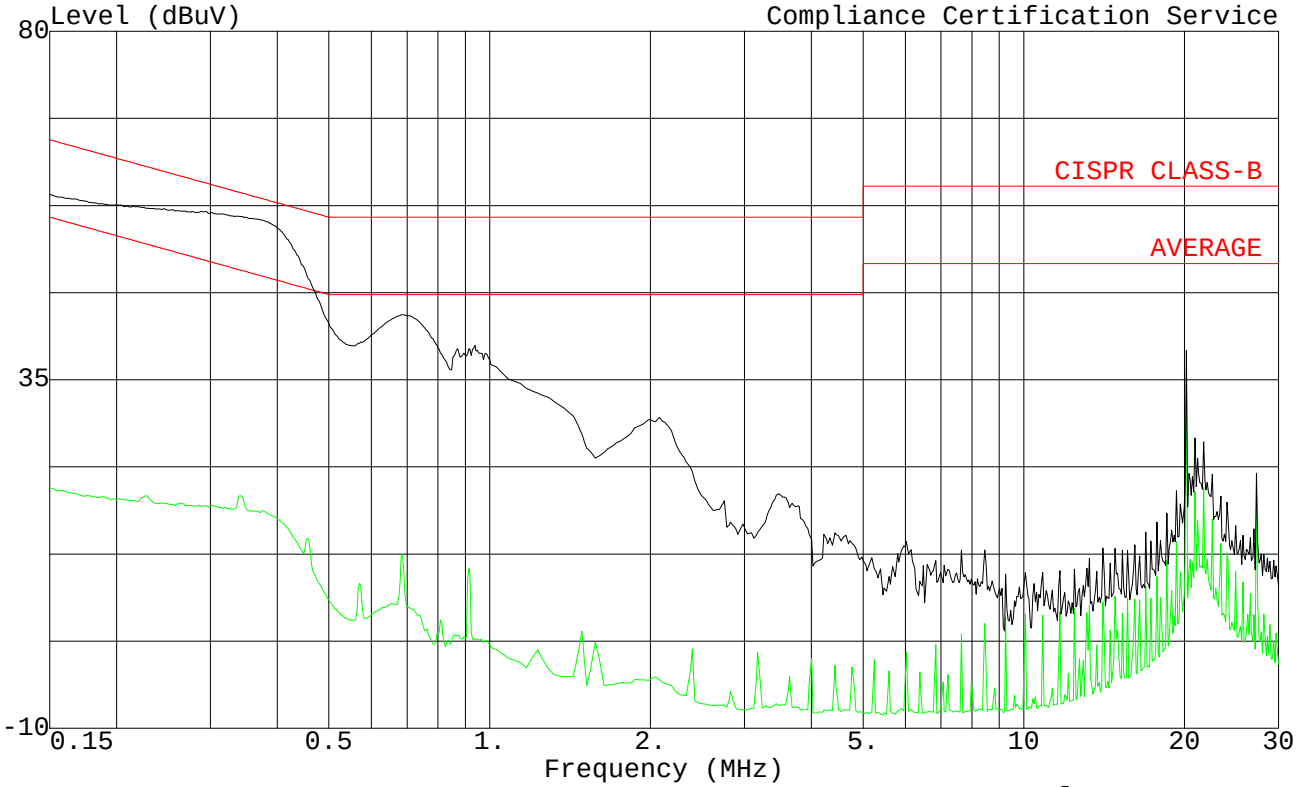
Trace: 5 Ref Trace:

Project # : 02U1587-1
Test Engineer : Thanh Nguyen
Company : ALIPH (TOM's Project)
EUT : Aliph Radio
Model Name : TBD
Test Config. : EUT w/ Battery Charger
Test of Target: FCC Part15 Class B, EN55022 B
Mode of Op. : Normal TX
: 115VAC@60Hz
: L1: Peak (Black), AVE (Green)

COMPLIANCE Engineering Service, Inc.
FCC,VCCI,CISPR,CE
UL,CSA,TUV

561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 14 File#: 02U1587.EMI Date: 11-13-2002 Time: 11:11:22



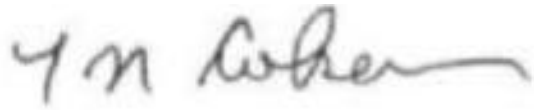
Trace: 12 Ref Trace:

Project # : 02U1587-1
Test Engineer : Thanh Nguyen
Company : ALIPH (TOM's Project)
EUT : Aliph Radio
Model Name : TBD
Test Config. : EUT w/ Battery Charger
Test of Target: FCC Part15 Class B, EN55022 B
Mode of Op. : Normal TX
: 115VAC@60Hz
: L2: Peak (Black), AVE (Green)

Human Hazard RF Exposure Considerations

FCC requirements concerning measuring and reporting human RF exposure hazards are found in section 1.1307 and 2.1091 of the Rules. There are no requirements for measurement or reporting RF exposure hazard potential for 2.4 GHz devices operating under 15.249; per the referenced rules, this type of equipment is categorically exempt from having to meet the requirements, as the GEMS unit is very low power and presents no known RF hazard potential.

THOMAS N. COKENIAS 8 December 2002



EMC and Radio Regulatory Consultant