ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENT
Test Report

For

2.4GHz 802.11B CLIENT RADIO
DIRECT SEQUENCE SPREAD SPECTRUM DATA TRANSCEIVER

FCC ID: MKZAZY2411BT

MODEL NO: AirEZY2411-BT

REPORT NO: 01U0834-1

AUGUST 15, 2001

Prepared for
OTC WIRELESS, INC.
48507 MILMONT DRIVE
FREMONT, CA. 94538 USA

Prepared by
COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD,
MORGAN HILL, CA. 95037, U.S.A.
TEL: (408) 463-0885

LAB CODE:200065-0

TABLE OF CONTENTS PAGE

1. VERIFICATION OF COMPLIANCE 1

2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT) 2

3. TEST LOCATION 2

4. LABORATORY ACCREDITATIONS AND LISTINGS 3

5. SUPPORT/ TEST EQUIPMENT 4

Support Equipment 4
Test Equipment 4
I/O Cable Configuration 5
Test Configuration Diagram 6

6. TEST PROCEDURES AND TEST RESULTS 7

RADIATED EMISSIONS TEST REQUIREMENT: 15.109/15.209 7
MODIFICATIONS MADE 9
Mod-1 : RJ-45 & Analog Ground 10
Mod 2 : Ferrite Bead 11
AC LINE CONDUCTED EMISSIONS TEST REQUIREMENT: 15.207 12
Test Set-up 12
RADIATE EMISSION TEST REQUIMENT: 15:205/15.247(C) 16
RF POWER OUTPUT TEST REQUIREMENT: 15.247(B) 23
DSSS POWER DENSITY TEST REQUIREMENT: 15.247(D) 24
PROCESSING GAIN OF A DSSS TEST REQUIREMENT: 15.247(E) 26

7. TEST SETUP PHOTO 32

RADIATED EMISSSION SETUP PHOTOS 32
CONDUCTED EMISSION SETUP PHOTOS 33
HI FREQUENCY SETUP PHOTOS 34
ANTENNA PORT MEASUREMENT PHOTOS 35

ATTACHEMENT:

Attachment #1 Proposed FCC ID Label Format
Attachment #2 Schematic Diagram and Block Diagram
Attachment #3 User Manual

1. VERIFICATION OF COMPLIANCE

COMPANY NAME	:	OTC WIRELESS, INC. 48507 MILMONT DRIVE FREMONT, CA 94538
CONTACT PERSON	:	MS. YAN ZHENG
TELPHONE NO	:	510-490-8288 ext.215
EUT DESCRIPTION	:	2.4GHz DIRECT SEQUENCE SPREAD SPECTRUM CLIENT RADIO
MODEL NAME	:	AirEZY-2411-BT
DATE TESTED	:	AUGUST 14, 2001

LIMIT APPLY TO: FCC PART 15 SECTION 15.247	
TECHNICAL LIMITS	**TEST RESULT**
Minimum 6dB Bandwidth@ > 500kHz	Passed
RF Power Output < 1 Watt	Passed
Out of Band Measurements	Passed
DSSS Power Density < 8dBm @ 3kHz bandwidth	Passed
Processing Gain of a DSSS > 10dB	Passed
LIMIT APPLY TO: FCC PART 15 SECTION 15.205/SECTION 15.209	
Restricted Band of Operation	Passed
LIMIT APPLY TO: FCC PART 15 SECTION 15.109	
Radiated Emission Limits	Passed
LIMIT APPLY TO: FCC PART 15 SECTION 15.207	
AC Line Conducted Emission	Passed
The above equipment was tested by Compliance Engineering Services Inc. for compliance with the requirements set forth in CFR 47 PART 15 SUBPART C. This said equipment in the configuration described in this report show that maximum emission levels emanating from equipment are within the compliance requirements.	

Tested By:

HUE LY VANG
ASSOCIATE EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Approved & Released By:

THU CHAN
SENIOR EMC ENGINEER
COMPLIANCE CERTIFICATION

This report shall not be reproduced except in full, without the written approval of CCS.

2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

CHASSIS TYPE	**PLASTIC**
Frequency Range	**2412-2462 MHz**
Local Osc./Location	**20.0MHz Main / 24.7 MHz Top**
Channel Spacing	**5 MHz**
Transmit Power	**25mW**
Modulation Technique	**CCK**
Radio Technique	**Direct Sequence Spread Spectrum**
Number of Channels	**11**
Operating Mode	**Point-to-Point**
Air Data Rate	**11Mbps**
Antenna	**Permanently Attached (2dBi Gain)**
DC voltage	**5V Power Adaptor**
External Interface	**RJ45**
Emission Type	**F2D**

3. TEST LOCATION

All emissions tests were performed at:

Compliance Engineering Services, Inc.
561F Monterey Road
Morgan Hill, CA 95037

CCS has site descriptions on file with the FCC for 10 and 3 meter site configurations. CCS is a NVLAP accredited facility.

Measurement Uncertainty.

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Radiated Emission	
30MHz – 200 MHz	+/- 3.3dB
200MHz – 1000MHz	+4.5/-2.9dB
1000MHz – 2000MHz	+4.6/-2.2dB
Power Line Conducted Emission	
150kHz – 30MHz	+/-2.9

This report shall not be reproduced except in full, without the written approval of CCS.

4. LABORATORY ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	FCC Part 15, CISPR 22, AS/NZS 3548,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, CNS 13438	NVLAP 200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	FC 1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	VCCI R-1014, R-619, C-640
Norway	NEMKO	EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1	N ELA 117
Norway	NEMKO	EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC	N ELA-171
Taiwan	BSMI	CNS 13438	SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	Canada IC2324 A,B,C, and F

*No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government

This report shall not be reproduced except in full, without the written approval of CCS.

5. SUPPORT/ TEST EQUIPMENT

Support Equipment

DEVICE TYPE	MANUFACTURER	MODEL NAME	SERIAL NO	FCC ID
PC	**GATEWAY**	**G6-350**	**0011501002**	**DoC**
MONITOR	**DELL**	**E551**	**09E-21911**	**DoC**
MOUSE	**H.P.**	**M-S34**	**LZB81100298**	**DZL211029**
KEYBOARD	**H.P.**	**FDA-104EB**	**8019633**	**F42FDA104EB**
AC ADAPTOR	**AK II**	**LAD1512D52**	**20470101**	**DoC**
PRINTER	**HP**	**2225C**	**2541S41679**	**BS46XU2225C**
MODEM	**ACCEX**	**1414**	**9013538**	**IFAXDM1414**

Test Equipment

TEST EQUIPMENTS LIST				
Name of Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Due Date**
Spectrum Analyzer	**HP100Hz - 22GHz**	**8566B**	**2140A01296**	**5/4/02**
Spectrum Display	**HP**	**85662A**	**2152A03066**	**5/10/02**
Quasi-Peak Detector	**HP9K - 1GHz**	**85650A**	**2811A01155**	**5/4/02**
RF Preselector	**HP20Hz-2GHz**	**85685A**	**2817A00756**	**5/4/02**
Antenna, BiLog	**Chase 30 - 2000MHz**	**CBL6112**	**2049**	**12/11/01**
LISN	**Fisher Cus. Comm.**	**LISN-50/250-25-**	**2023**	**8/5/02**
EMI Test Receiver	**Rohde & Schwarz**	**ESHS 20**	**827129/006**	**2/28/02**
EMC Receiver (9K-26.5GHz)	**HP**	**8593EM**	**3710A00205**	**6/20/02**
Horn Antenna(1 - 18GHz)	**EMCO**	**3115**	**9001-3245**	**7/26/02**
Horn Antenna,(18 - 26GHz)	**Antenna Research Associate**	**MWH 1826/B**	**1013**	**7/26/02**
Pre-amplifier,35.5 dB (1 - 26.5GHz)	**HP**	**8449B**	**3008A00369**	**5/30/02**
High Pass Filter , Fo=4600MHz	**FSY Microwave**	**FSY**	**1**	**N.C.R.**

The measuring equipment which was utilized in performing the tests documented herein has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment which is traceable to recognized national standards.

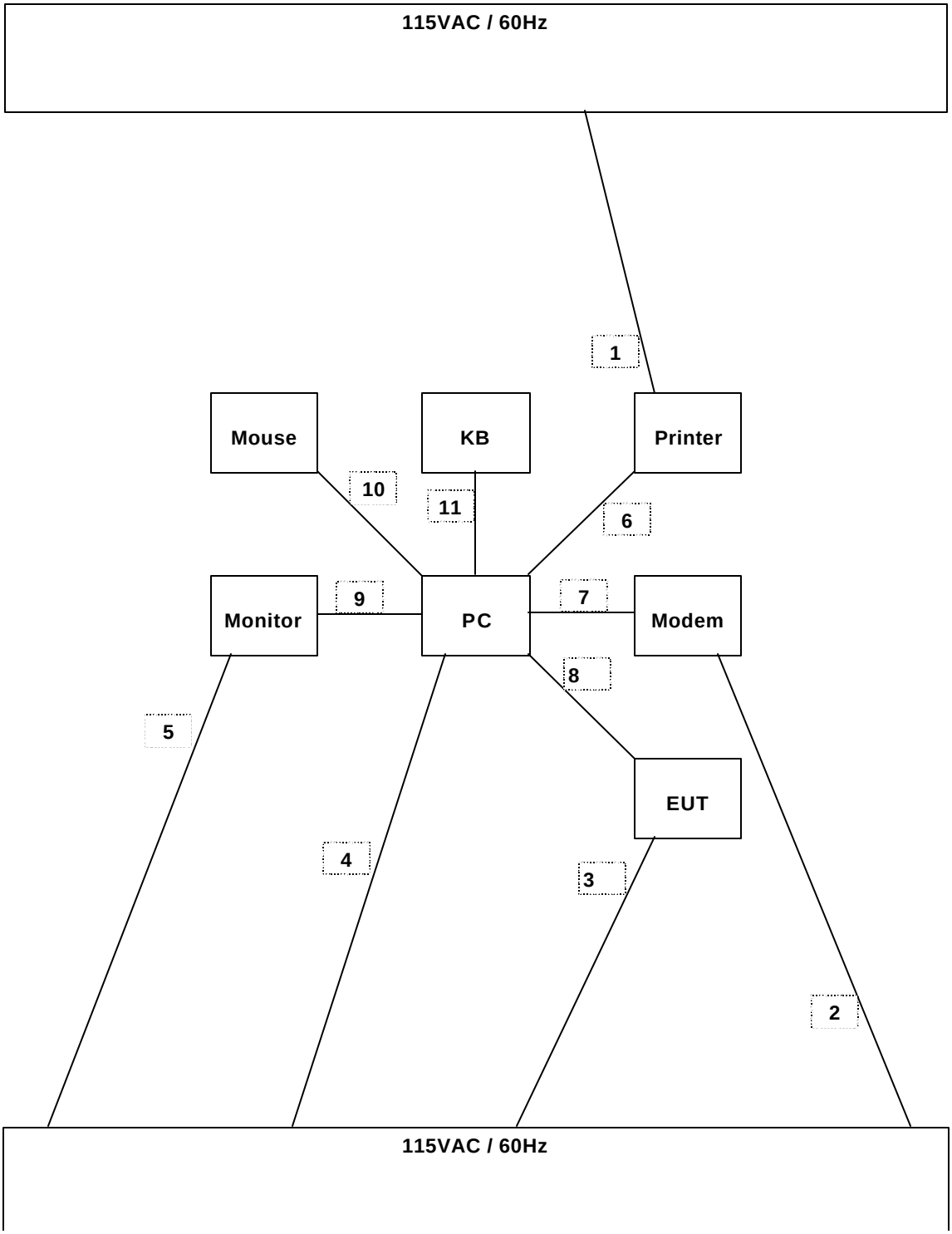
This report shall not be reproduced except in full, without the written approval of CCS.

I/O Cable Configuration

TEST I / O CABLES								
Cable No	I/O Port	# of I/O Port	Connector Type	Type of Cable	Cable Length	Data Traffic	Bundled	Remark
1	AC	1	US 115V	Un-shielded	2m	No	No	N/A
2	AC	1	US 115V	Un-shielded	2m	No	No	N/A
3	AC	1	US 115V	Un-shielded	2m	No	Yes	Yes, in LC test only
4	AC	1	US 115V	Un-shielded	2m	No	No	N/A
5	AC	1	US 115V	Un-shielded	2m	No	No	N/A
6	Parallel	1	DB25	Shielded	2m	Yes	Yes	N/A
7	Serial	1	DB9	Shielded	1m	Yes	No	N/A
8	Ethernet	1	RJ45	Un-shielded	3m	Yes	Yes	N/A
9	Video	1	DB15	Shielded	2m	Yes	Yes	N/A
10	Mouse	1	PS/2	Un-shielded	2m	Yes	No	N/A
11	KB	1	PS/2	Shielded	2m	Yes	No	N/A

This report shall not be reproduced except in full, without the written approval of CCS.

Test Configuration Diagram



This report shall not be reproduced except in full, without the written approval of CCS.

6. TEST PROCEDURES AND TEST RESULTS

RADIATED EMISSIONS TEST REQUIREMENT: 15.109/15.209

Section 15.209 Radiated emission limits, general requirements.
(a) Except for Class A digital devices, the field 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 (microvolts/meter)	dB (dBuV/meter)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

Test Set-up

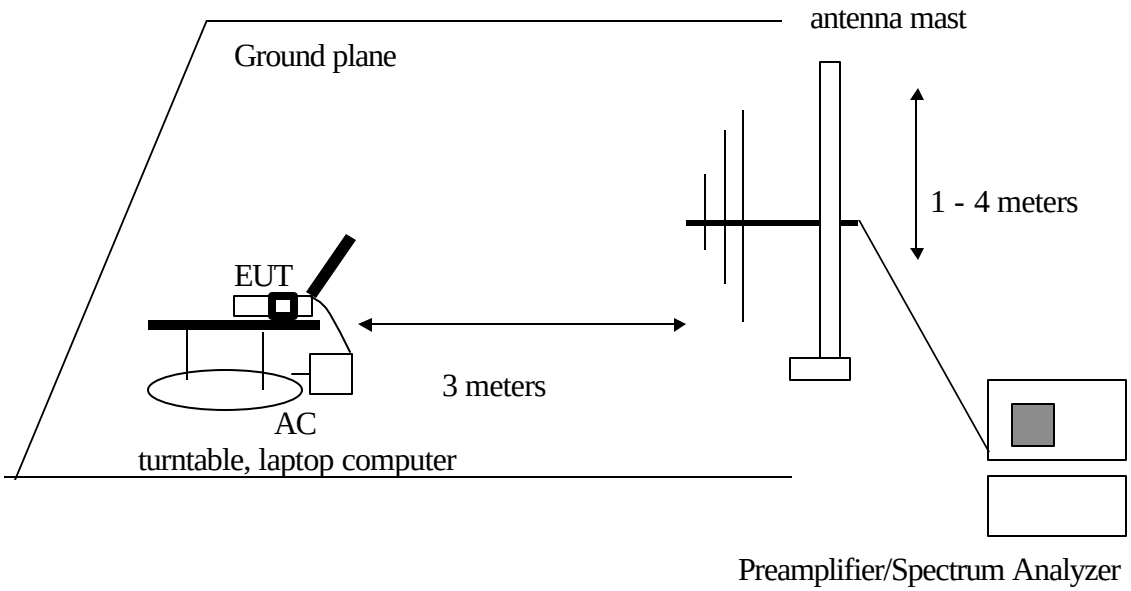


Fig.1

The EUT was placed on a turntable at a distance of 3 meters from a BiLog search antenna. The antenna was raised and lowered, the EUT rotated on the turntable, until the EUT azimuth, antenna elevation, and antenna polarity were found which yielded maximum received emission levels on the spectrum analyzer.

Test Result: Refer to attached tabular data sheets.

This report shall not be reproduced except in full, without the written approval of CCS.

COMPLIANCE Certification Services

FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885 FAX: (408) 463-0888

Project #: 01U0834-1
Report #: 010810a
Date& Time: 08/10/01 4:59 PM
Test Engr: Hue Ly Vang

Company: OTC Wireless INC.
EUT Description: 2.4GHz 802.11B Client Radio
Test Configuration : EUT/PC/KB/Mouse
Type of Test: FCC Class B
Mode of Operation: Normal-waiting for signal-Talking to PC

<< Main Sheet

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit FCC_B	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
440.00	25.00	17.52	3.01	0.00	45.53	46.00	-0.05	3mH	90.00	1.00	QP
220.00	58.10	12.52	1.98	0.00	45.23	46.00	-0.77	3mV	90.00	1.00	QP
616.00	21.70	19.76	3.60	0.00	45.06	46.00	-0.94	3mV	90.00	1.00	QP
440.00	24.50	17.52	3.01	0.00	45.03	46.00	-0.97	3mV	90.00	1.00	QP
660.00	20.50	19.94	3.80	0.00	44.24	46.00	-1.76	3mV	90.00	1.00	QP
836.00	18.00	21.32	4.51	0.00	43.83	46.00	-2.17	3mV	90.00	1.00	QP

6 Worst Data

This report shall not be reproduced except in full, without the written approval of CCS.

MODIFICATIONS MADE

While testing the EUT to FCC 15.209 Radiated Emission limits, some modifications were made to the EUT, because of high RF radiating from the EUT.

Section 15.209 Radiated emission limits.

(a) Except for Class A digital devices, the field 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 (microvolts/meter)	dB (dBuV/meter)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

Modification 1:

The RJ-45 port was plastic. Copper tape was used to cover the case.
See MOD-1, picture for more detail.

Modification 2:

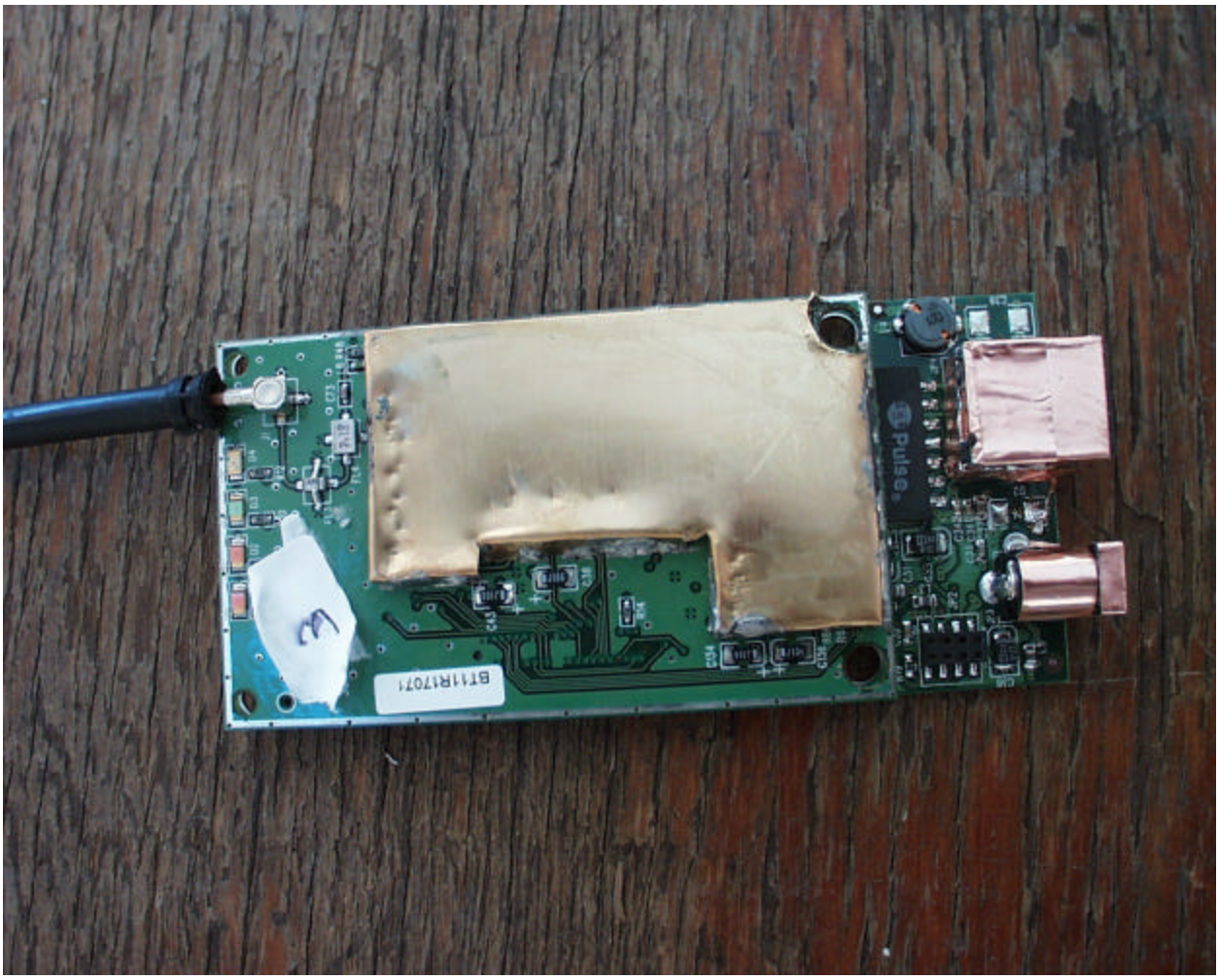
The copper taped covered RJ-45 port was then tied to analog ground.
See MOD-1, picture for more detail.

Modification 3:

A Ferrite bead was placed on the Ethernet cable at the EUT end.
The Ferrite was a model number: 0444164951 from FAIR- RITE.
See MOD-2, picture for more detail.

This report shall not be reproduced except in full, without the written approval of CCS.

Mod-1 : RJ-45 & Analog Ground



This report shall not be reproduced except in full, without the written approval of CCS.

Mod 2 : Ferrite Bead

This report shall not be reproduced except in full, without the written approval of CCS.

AC LINE CONDUCTED EMISSIONS TEST REQUIREMENT: 15.207

Section 15.207 Conducted limits.

(a) For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

Conducted Emission Limits	
Frequency range(MHz)	FCC Limits (dBuV)
.45-5	48
5-30	48

Test Set-up

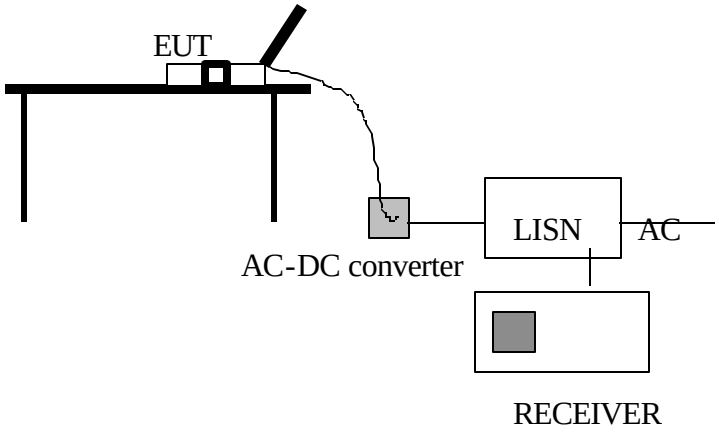


Fig. 2

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 a normal mode.

2. Line conducted data was recorded for both NEUTRAL and HOT lines.

Test Results

Refer to attached graph

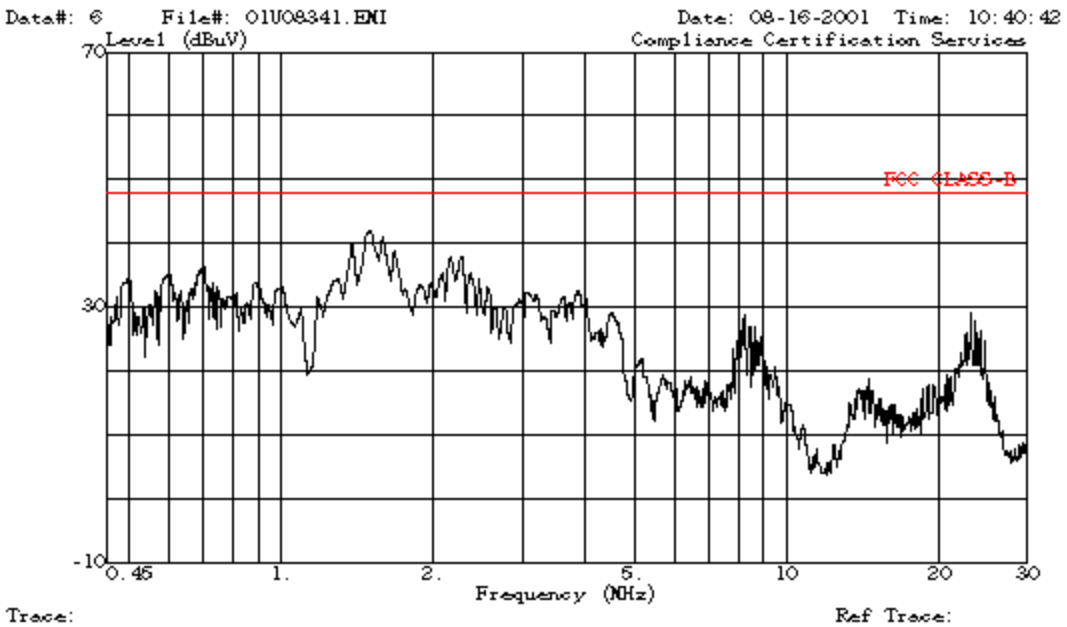
This report shall not be reproduced except in full, without the written approval of CCS.

CONDUCTED EMISSIONS DATA (115VAC 60Hz)

Freq.	Reading			Closs	Limit FCC_B		Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.49	24.00	--	--	0.00	48.00	--	-24.00	--	L1
0.69	26.20	--	--	0.00	48.00	--	-21.80	--	L1
1.48	29.40	--	--	0.00	48.00	--	-18.60	--	L1
0.50	26.60	--	--	0.00	48.00	--	-21.40	--	L2
0.60	27.30	--	--	0.00	48.00	--	-20.70	--	L2
1.51	27.50	--	--	0.00	48.00	--	-20.50	--	L2
6 Worst Data									

This report shall not be reproduced except in full, without the written approval of CCS.

561 F Monterey Road, Route 2
Morgan Hill, CA 95037-9001 USA
Tel: (408) 463-0885
Fax: (408) 463-0888

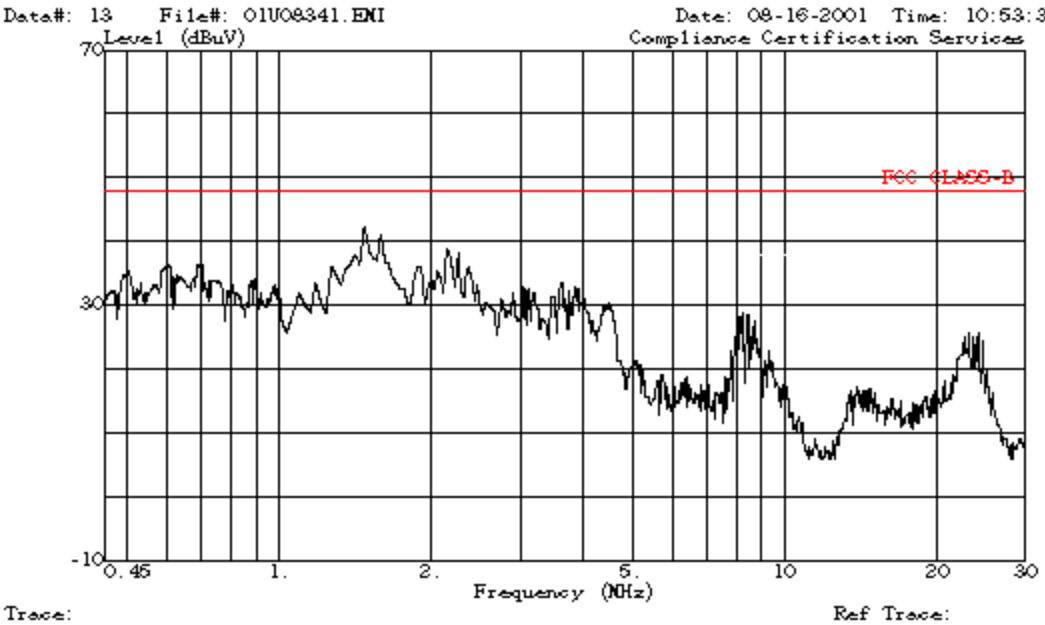


Trace: Ref Trace:

Project No.	:	01U0834-1
Report No.	:	010816-11-fcc
Test Engr	:	Hue Ly Vang
Company	:	OTC Wireless INC.
EUT Description	:	2.4GHz Client Radio
Model	:	AirEZY-2411-BT
EUT Config.	:	EUT/PC/MONITOR/KB/MOUSE/
	:	PRINTER/MODEM
Type of Test	:	FCC CLASS B
Mode of Operation	:	IDLE/BATTERY CHARGING
	:	PEAK: L1(Black)
	:	115Vac, 60Hz

This report shall not be reproduced except in full, without the written approval of CCS.

561 F Monterey Road, Route 2
Morgan Hill, CA 95037-9001 USA
Tel: (408) 463-0885
Fax: (408) 463-0888



Trace: Ref Trace:

Project No.	:	01U0834-1
Report No.	:	010816-12-fcc
Test Engr	:	Hue Ly Vang
Company	:	OTC Wireless INC.
EUT Description	:	2.4GHz Client Radio
Model	:	AirEZY-2411-BT
EUT Config.	:	EUT/PC/MONITOR/KB/MOUSE/
	:	PRINTER/MODEM
Type of Test	:	FCC CLASS B
Mode of Operation	:	IDLE/BATTERY CHARGING
	:	PEAK: L2(Black)
	:	115Vac, 60Hz

This report shall not be reproduced except in full, without the written approval of CCS.

RADIATE EMISSION TEST REQUIMENT: 15:205/15.247(C)

Section 15.205 Restricted bands of operation.

(a) 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 - 13.41	322 - 335.4		

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field 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 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, 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.

Section 15.247 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.

This report shall not be reproduced except in full, without the written approval of CCS.

Test Set-Up

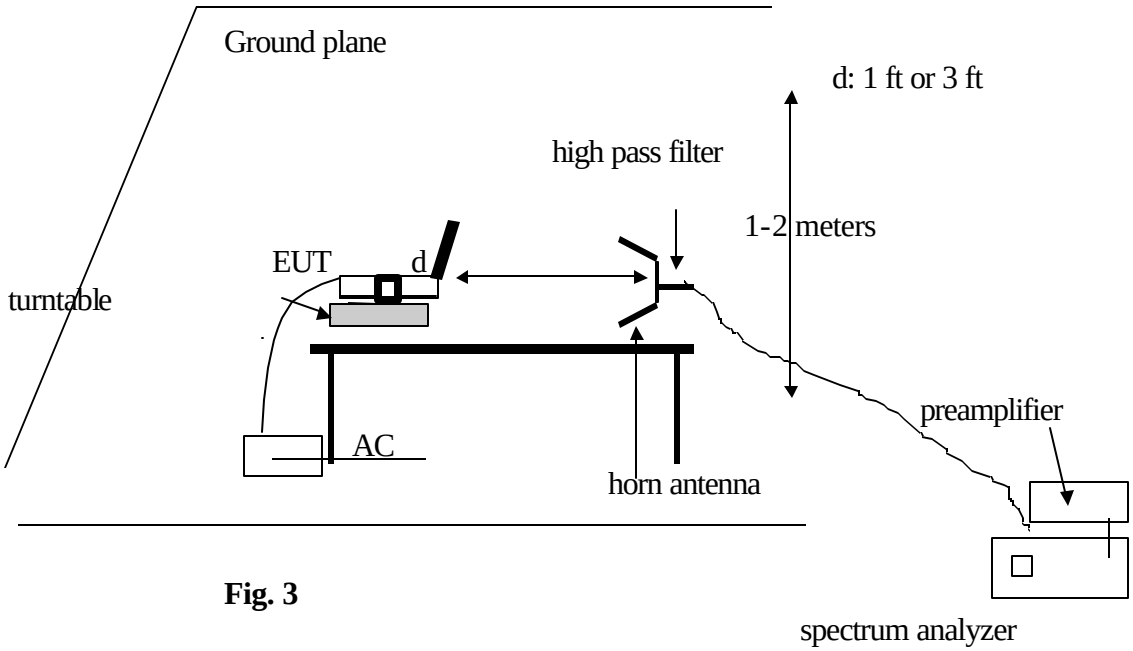


Fig. 3

Test Procedures

1. The EUT was placed on a wooden table on the outdoor ground plane. The search antenna was placed 3 ft from the EUT. The EUT antenna was mounted vertically as per normal installation.

2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205.

3. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.

Radiated emissions from the transmitter were compared against the radiated field strength of the fundamental frequency. The only emissions detected up to the 10th harmonic of the operating frequency were harmonics of the fundamental. All harmonics were at levels less than 54 dBuV/m, as per measurements taken to show compliance with 15.205.

Test Results: Refer to attached tabular data sheets

This report shall not be reproduced except in full, without the written approval of CCS.

COMPLIANCE ENGINEERING SERVICES. INC.														
Harmonic Emissions														
OTC Wireless										6/1/01				
Channel 1 : 2412 MHz										Pete Krebill/hue Vang				
										A site (1.0 Meter)				
F(MHz)	**READING**		**AF**	**CL**	**AMP**	**DIST**	**HPF**	**TOTAL**		**LIMIT**		**MARGIN**		
	(dBuV)		(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)		(dBuV/m)		(dB)		
	~~Pk~~	**~~Avg~~**						**~~Pk~~**	**~~Avg~~**	**~~Pk~~**	**~~Avg~~**	**~~Pk~~**	**~~Avg~~**	
2389.5R	57.4	39.9	31.5	4.2	-35.5	-9.5	1	49.1	31.6	74	54	-24.9	-22.4	
4824	59.27	47.7	34.2	5	-35.5	-9.5	1	54.47	42.9	74	54	-19.5	-11.1	
7236	50.85	39.85	36.6	6.4	-35.5	-9.5	1	49.85	38.85	74	54	-24.2	-15.2	
9648	39.2	31.1	37.65	9.05	-35.5	-9.5	1	41.9	33.8	74	54	-32.1	-20.2	
12060	38.9	30.42	39.18	9.07	-35.5	-9.5	1	43.15	34.67	74	54	-30.9	-19.3	
14472	38.5	34.8	40.12	11.66	-35.5	-9.5	1	46.28	42.58	74	54	-27.7	-11.4	
16884	39.9	34.77	43.26	13.26	-35.5	-9.5	1	52.42	47.29	74	54	-21.6	-6.71	
19298	40.2	34.98	32.09	14.54	-35.5	-9.5	1	42.83	37.61	74	54	-31.2	-16.4	
21708	41.6	35	32.5	15.76	-35.5	-9.5	1	45.86	39.26	74	54	-28.1	-14.7	
24120	42	35.6	32.6	15.88	-35.5	-9.5	1	46.48	40.08	74	54	-27.5	-13.9	
NOTE: ALL READINGS MEASURED AT 1 METER.														
DIST: Correction to extrapolate reading to 3m specification distance														
											ANALYZER SETTINGS			
AF: Antenna Factor										**PEAK(Pk):**	Res bw		Avg. bw	
AMP: Pre-amp gain										Below 1GHz	**100KHz**		**100KHz**	
CL: Cable loss										Above1GHz	**1MHz**		**1MHz**	
HPF: High pass filter insertion loss										For all Average Used Video Average				
R = Restricted Band Measurement(2310-2390MHz)														

This report shall not be reproduced except in full, without the written approval of CCS.

COMPLIANCE ENGINEERING SERVICES, INC.														
Harmonic Emissions														
OTC Wireless										6/1/01				
Channel 6 : 2437 MHz										Pete Krebill/Hue Vang				
										A site (1.0 Meter)				
F(MHz)	**READING**		**AF**	**CL**	**AMP**	**DIST**	**HPF**	**TOTAL**		**LIMIT**		**MARGIN**		
	(dBuV)		(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)		(dBuV/m)		(dB)		
	~~Pk~~	**~~Avg~~**						**~~Pk~~**	**~~Avg~~**	**~~Pk~~**	**~~Avg~~**	**~~Pk~~**	**~~Avg~~**	
4874	57.59	47	34.2	5	-35.5	-9.5	1	52.79	42.2	74	54	-21.2	-11.8	
7311	50.5	39.5	36.6	6.4	-35.5	-9.5	1	49.5	38.5	74	54	-24.5	-15.5	
9748	39.5	32.3	37.65	9.05	-35.5	-9.5	1	42.2	35	74	54	-31.8	-19	
12185	39.9	31.5	39.18	9.07	-35.5	-9.5	1	44.15	35.75	74	54	-29.9	-18.3	
14622	39.7	35.6	40.12	11.66	-35.5	-9.5	1	47.48	43.38	74	54	-26.5	-10.6	
17059	40.1	34.5	43.26	13.26	-35.5	-9.5	1	52.62	47.02	74	54	-21.4	-6.98	
19498	40.6	34.9	32.09	14.54	-35.5	-9.5	1	43.23	37.53	74	54	-30.8	-16.5	
21933	41.2	38.9	32.5	15.76	-35.5	-9.5	1	45.46	43.16	74	54	-28.5	-10.8	
24370	41.5	39.1	32.6	15.88	-35.5	-9.5	1	45.98	43.58	74	54	-28	-10.4	
NOTE: ALL READINGS MEASURED AT 1 METER.														
DIST: Correction to extrapolate reading to 3m specification distance														
											~~ANALYZER SETTINGS~~			
AF: Antenna Factor									**PEAK(Pk):**		**~~Res bw~~**		**~~Avg. bw~~**	
AMP: Pre-amp gain									Below 1GHz		**100KHz**		**100KHz**	
CL: Cable loss									Above1GHz		**1MHz**		**1MHz**	
HPF: High pass filter insertion loss									For all Average used Video Average					

This report shall not be reproduced except in full, without the written approval of CCS.

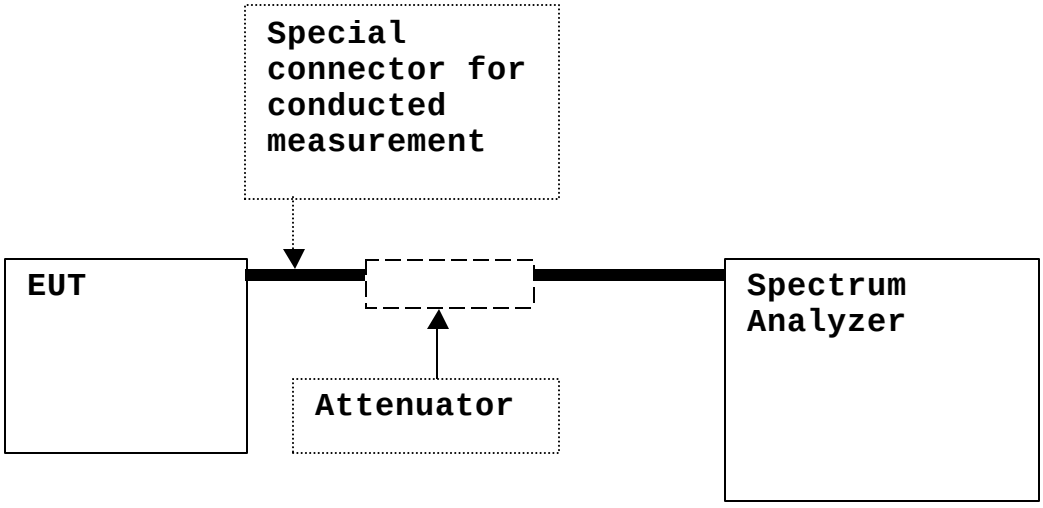
COMPLIANCE ENGINEERING SERVICES. INC.														
Harmonic Emissions														
OTC Wireless										6/1/01				
Channel 11 : 2462 MHz										Pete Krebill/Hue Vang				
										A site (1.0 Meter)				
F(MHz)	**READING**		**AF**	**CL**	**AMP**	**DIST**	**HPF**	**TOTAL**		**LIMIT**		**MARGIN**		
	(dBuV)		(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)		(dBuV/m)		(dB)		
	Pk	**Avg**						**Pk**	**Avg**	**Pk**	**Avg**	**Pk**	**Avg**	
2484R	67.5	45.7	30	4.2	-35.5	-9.5	1	57.7	35.9	74	54	-16.3	-18.1	
4924	56.01	46.1	34.2	5	-35.5	-9.5	1	51.21	41.3	74	54	-22.8	-12.7	
7386	50.6	39.72	36.6	6.4	-35.5	-9.5	1	49.6	38.72	74	54	-24.4	-15.3	
9848	39.9	32.6	37.65	9.05	-35.5	-9.5	1	42.6	35.3	74	54	-31.4	-18.7	
12310	40.1	32.4	39.18	9.07	-35.5	-9.5	1	44.35	36.65	74	54	-29.7	-17.4	
14772	40.6	35.9	40.12	11.66	-35.5	-9.5	1	48.38	43.68	74	54	-25.6	-10.3	
17234	40.9	35.1	43.26	13.26	-35.5	-9.5	1	53.42	47.62	74	54	-20.6	-6.38	
19696	41.7	36.5	32.09	14.54	-35.5	-9.5	1	44.33	39.13	74	54	-29.7	-14.9	
22158	42.1	36.9	32.5	15.76	-35.5	-9.5	1	46.36	41.16	74	54	-27.6	-12.8	
24620	42.4	37	32.8	15.8	-35.5	-9.5	1	47	41.6	74	54	-27	-12.4	
NOTE: ALL READINGS MEASURED AT 1 METER.														
DIST: Correction to extrapolate reading to 3m specification distance														
											ANALYZER SETTINGS			
AF: Antenna Factor									**PEAK(Pk):**		Res bw		Avg. bw	
AMP: Pre-amp gain									Below 1GHz		**100KHz**		**100KHz**	
CL: Cable loss									Above1GHz		**1MHz**		**1MHz**	
HPE: High pass filter insertion loss									For all Average used Video Average					
R = Restricted band Measurement (2483.5-2500MHz)														

This report shall not be reproduced except in full, without the written approval of CCS.

MINIMUM 6 dB BANDWIDTH for DSSS TEST REQUIREMENT: 15.247(a)1(i)-(ii)

(2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

Test Set-up



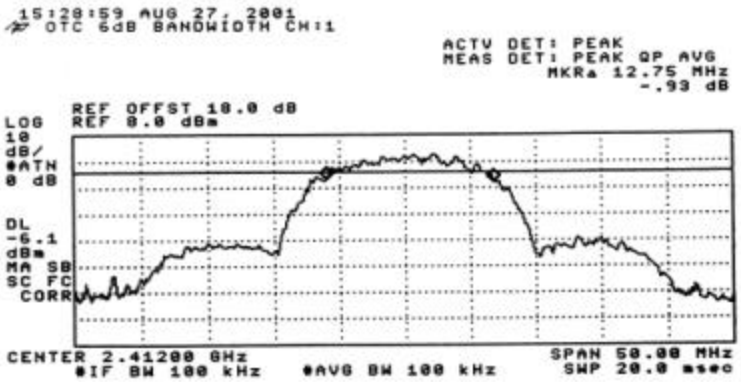
Test Procedure

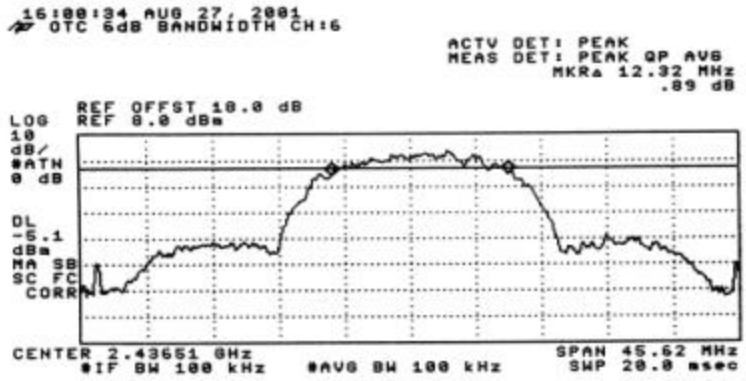
For this test, the EUT's antenna was removed and replaced with an 50 ohm connector, so output power levels were calculated from conducted emission levels

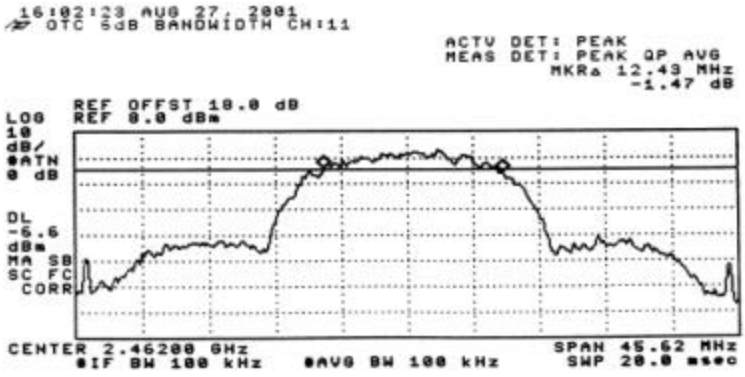
The analyzer center frequency was set to the EUT carrier frequency. The resolution and video bandwidth were set to 100khz. Using MAX HOLD, then PEAK SEARCH the signal was taken. Using the peak signal subtract 6dB down. Using the analyzer DISPLAY LINE and MARKER DELTA functions, the 6 dB bandwidth of the emission was determined.

Test Results: Refer to attached spectrum analyzer data chart.

This report shall not be reproduced except in full, without the written approval of CCS.





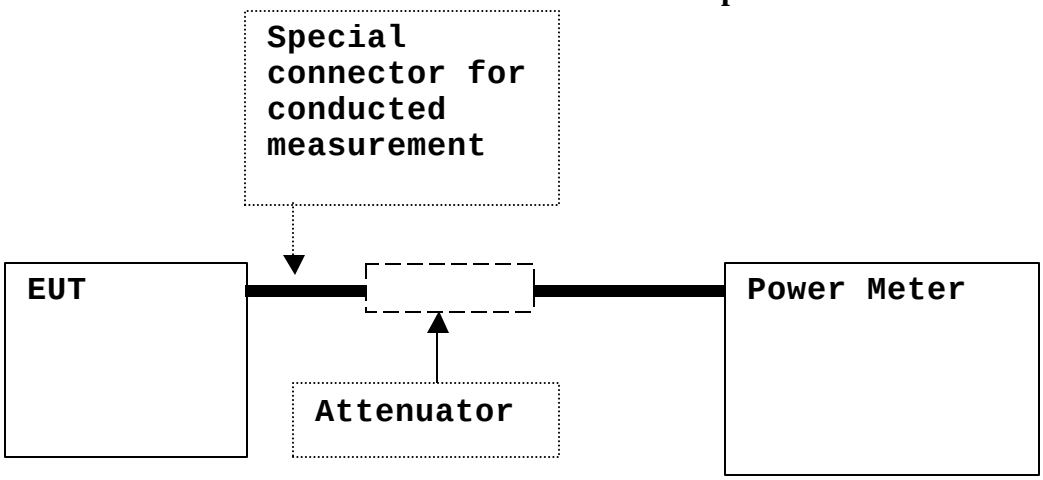


This report shall not be reproduced except in full, without the written approval of CCS.

RF POWER OUTPUT TEST REQUIREMENT: 15.247(B)

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, all frequency hopping systems in the 5725-5850 MHz band, and all direct sequence systems: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Test Set-up



Test Procedure

For this test, the EUT's antenna was removed and replaces with an alternated antenna, so output power levels were calculated from conducted emission levels.

The peak output power was attain by a power meter.

Test Results

TX Freq.(MHz)	Power Output(dBm)	LIMIT(dBm)
2412(LOW)	13.59	30
2432(MID)	13.50	30
2462(HIGH)	13.51	30

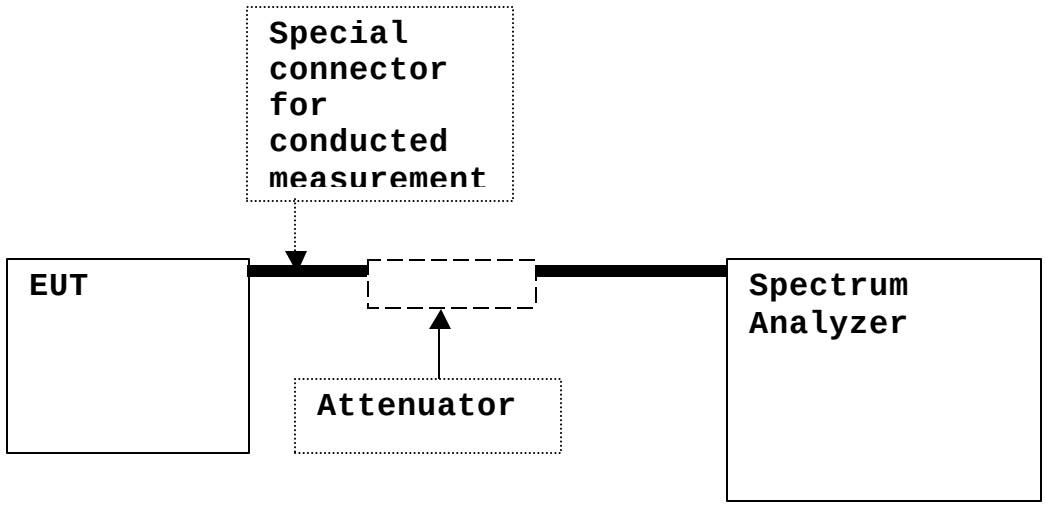
Design goal for transmitter output power: 25 mW(14dBm) output.
Refer to plots:

This report shall not be reproduced except in full, without the written approval of CCS.

DSSS POWER DENSITY TEST REQUIREMENT: 15.247(D)

(d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Set-up



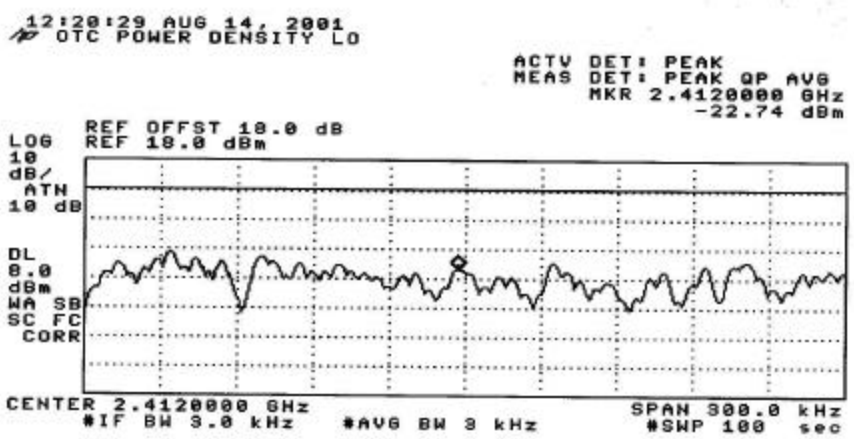
Test Procedure

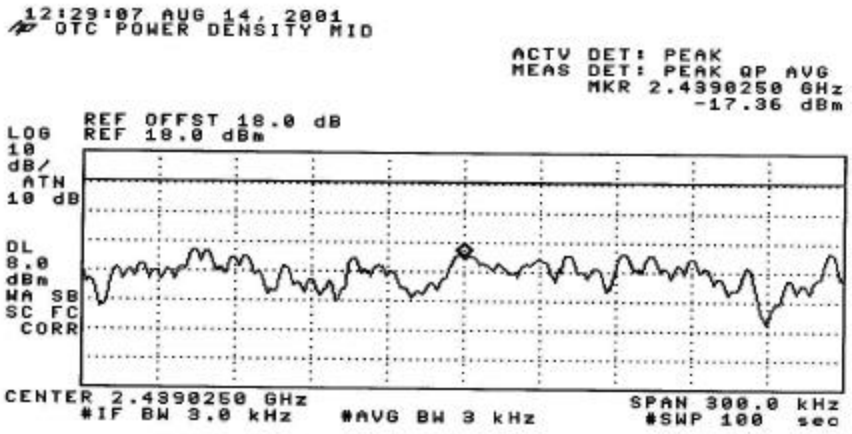
For this test, the EUT's antenna was removed and replaces with an alternated antenna, so output power levels were calculated from conducted emission levels.

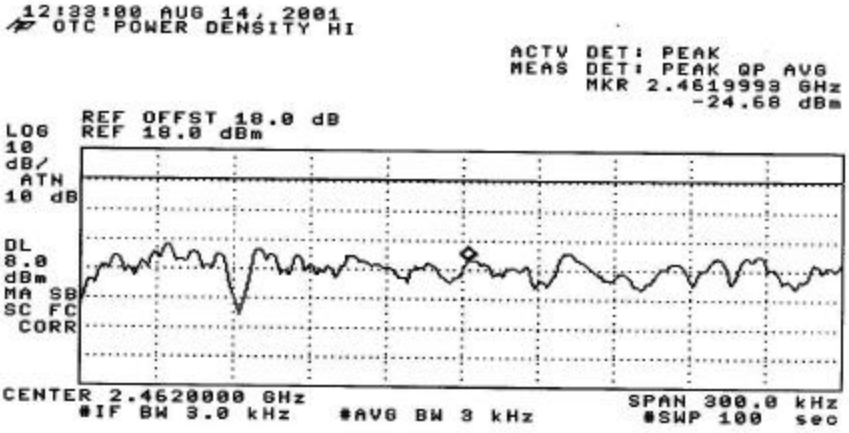
The analyzer center frequency was set to the EUT carrier frequency. The analyzer resolution and video bandwidth were set to 3kHz. The sweep time was set to 100 second. The 3kHz point was attain by slowly reducing the bandwidth then peak search to capture the peak. This was performed step by step until 3kHz was reached.

The transmitter emissions so measured were compared to the 8 dBm limit in the Rules.

This report shall not be reproduced except in full, without the written approval of CCS.







This report shall not be reproduced except in full, without the written approval of CCS.

PROCESSING GAIN OF A DSSS TEST REQUIREMENT: 15.247(E)

(e) The processing gain of a direct sequence system shall be at least 10 dB. The processing gain represents the improvement to the received signal-to-noise ratio, after filtering to the information bandwidth, from the spreading/despreading function. The processing gain may be determined using one of the following methods:

The customer provided processing Gain.
Worst case emission was found to be 13.6 dB.
Gp= 17dB(Signal to Noise Ratio) + 2dB(System Loss) – 5.49dB(J/S) =13.6dB
After the worst 20% were taken out.

PROCESSING GAIN MEASUREMENT

1.1 Measurement Setup

Figure 1 shows the setup for measuring the processing gain of AirEzy2411-BT. A Transmitting Computer A and a Receiving Computer B are used to execute a Bit Error Rate (BER) Testing Computer Program. The BER is determined by repetitively transmitting a testing data file from Computer A to Computer B. At Computer B the received data file is compared with a pre-stored version of the testing data file to compute the bit error rate. An HP 8648C Signal Generator is used to generate interference or jamming signal.

Data signal from the Transmitting Computer is sent to the Transmitting AirEzy2411-BT unit for modulation. It is then combined with the interference signal from the Signal Generator through a equal power (3 dB) combiner. The combined signal is fed into a Receiving AirEzy2411-BT, the Device Under Test (DUT), for demodulation, and the demodulated signal is sent into the Receiving Computer for Bit Error Rate computation.

1.2 Measurement Procedure

The data signal level at the input of the Receiving AirEzy2411-BT, point P in Figure 1, is determined. With Attenuator A set at 60 dB attenuation, the data signal level at point P is measured to be -35 dBm.

Then the Signal Generator is set at a certain CW frequency between 2434 MHz and 2450 MHz. The interference level at the input of the Receiving AirEzy2411-BT, the DUT, can be varied by adjusting the output level of the Signal Generator.

The measurement of processing gain is carried out by adjusting the output level of the Signal Generator such that the Bit Error Rate is maintained at no higher than 10^{-5}. The interference level at the input of the DUT, the point P, is then measured. In the AirEzy2411-BT receiving chain a Surface Acoustic Wave (SAW) IF filter which has a nominal 3-dB bandwidth of $\pm$7.5 MHz centered at 374 MHz (see Fig. 2) is used. Jamming signals outside the 2442$\pm$7.5 MHz frequency band will be heavily attenuated. The measurement is performed from 2434 MHz to 2450 MHz at 50 KHz interval. The measured interference power level at point P with BER $\leq 10^{-5}$ at each frequency is shown in the following:

This report shall not be reproduced except in full, without the written approval of CCS.

Freq. (MHz	Jammer Power(dBm)	J/S (dB)	Freq. (MHz)	Jammer Power(dBm)	J/S (dB)	Freq. (MHz)	Jammer Power(dBm)	J/S (dB)	Freq. (MHz)	Jammer Power(dBm)	J/S (dB)
2434	-39.4	-4.4	2436	-40.4	-5.4	2438	-40.3	-5.3	2440	-40.2	-5.2
2434.05	-39.6	-4.6	2436.05	-40.4	-5.4	2438.05	-40.2	-5.2	2440.05	-40.1	-5.1
2434.1	-39.7	-4.7	2436.1	-40.3	-5.3	2438.1	-40.2	-5.2	2440.1	-40.2	-5.2
2434.15	-39.7	-4.7	2436.15	-40.2	-5.2	2438.15	-40.2	-5.2	2440.15	-40.3	-5.3
2434.2	-39.8	-4.8	2436.2	-40.1	-5.1	2438.2	-40.2	-5.2	2440.2	-40.1	-5.1
2434.25	.39.8	-4.8	2436.25	-40.1	-5.1	2438.25	-40.1	-5.1	2440.25	-40.2	-5.2
2434.3	-39.8	-4.8	2436.3	-40.2	-5.2	2438.3	-40.1	-5.1	2440.3	-40.3	-5.3
2434.35	-39.7	-4.7	2436.35	-40.3	-5.3	2438.35	-40.1	-5.1	2440.35	-40.3	-5.3
2434.4	-39.7	-4.7	2436.4	-40.2	-5.2	2438.4	-40.3	-5.3	2440.4	-40.2	-5.2
2434.45	-39.8	-4.8	2436.45	-40.1	-5.1	2438.45	-40.2	-5.2	2440.45	-40.2	-5.2
2434.5	-39.9	-4.9	2436.5	-40.2	-5.2	2438.5	-40.1	-5.1	2440.5	-40.3	-5.3
2434.55	-39.9	-4.9	2436.55	-40.2	-5.2	2438.55	-40.3	-5.3	2440.55	-40.2	-5.2
2434.6	-39.8	-4.8	2436.6	-40.1	-5.1	2438.6	-40.1	-5.1	2440.6	-40.2	-5.2
2434.65	-39.9	-4.9	2436.65	-40	-5	2438.65	-40.2	-5.2	2440.65	-40.3	-5.3
2434.7	-40	-5	2436.7	-40.1	-5.1	2438.7	-40.2	-5.2	2440.7	-40.3	-5.3
2434.75	-40.1	-5.1	2436.75	-40	-5	2438.75	-40.2	-5.2	2440.75	-40.2	-5.2
2434.8	-40.2	-5.2	2436.8	-39.9	-4.9	2438.8	-40	-5	2440.8	-40.3	-5.3
2434.85	-40.2	-5.2	2436.85	-39.9	-4.9	2438.85	-40.1	-5.1	2440.85	-40.2	-5.2
2434.9	-40.3	-5.3	2436.9	-39.9	-4.9	2438.9	-40	-5	2440.9	-40.4	-5.4
2434.95	-40.4	-5.4	2436.95	-40.1	-5.1	2438.95	-40	-5	2440.95	-40.3	-5.3
2435	-40.5	-5.5	2437	-40	-5	2439	-40.2	-5.2	2441	-40.4	-5.4
2435.05	-40.5	-5.5	2437.05	-40	-5	2439.05	-40.1	-5.1	2441.05	-40.4	-5.4
2435.1	-40.4	-5.4	2437.1	-39.9	-4.9	2439.1	-40.2	-5.2	2441.1	-40.5	-5.5
2435.15	-40.5	-5.5	2437.15	-40	-5	2439.15	-40.1	-5.1	2441.15	-40.5	-5.5
2435.2	-40.4	-5.4	2437.2	-40.1	-5.1	2439.2	-40.1	-5.1	2441.2	-40.6	-5.6
2435.25	-40.3	-5.3	2437.25	-40	-5	2439.25	-40.2	-5.2	2441.25	-40.8	-5.8
2435.3	-40.4	-5.4	2437.3	-39.9	-4.9	2439.3	-40.3	-5.3	2441.3	-41.1	-6.1
2435.35	-40.5	-5.5	2437.35	-40	-5	2439.35	-40.3	-5.3	2441.35	-41.5	-6.5
2435.4	-40.4	-5.4	2437.4	-40.1	-5.1	2439.4	-40.2	-5.2	2441.4	-42.1	-7.1
2435.45	-40.4	-5.4	2437.45	-40.2	-5.2	2439.45	-40.1	-5.1	2441.45	-42.2	-7.2
2435.5	-40.3	-5.3	2437.5	-40.2	-5.2	2439.5	-40	-5	2441.5	-42.4	-7.4
2435.55	-40.3	-5.3	2437.55	-40.1	-5.1	2439.55	-40.2	-5.2	2441.55	-42.7	-7.7
2435.6	-40.4	-5.4	2437.6	-40.1	-5.1	2439.6	-40.1	-5.1	2441.6	-43	-8
2435.65	-40.4	-5.4	2437.65	-40.2	-5.2	2439.65	-40.3	-5.3	2441.65	-43.1	-8.1
2435.7	-40.5	-5.5	2437.7	-40.2	-5.2	2439.7	-40.3	-5.3	2441.7	-43.3	-8.3
2435.75	-40.5	-5.5	2437.75	-40.3	-5.3	2439.75	-40.3	-5.3	2441.75	-43.6	-8.6
2435.8	-40.5	-5.5	2437.8	-40.3	-5.3	2439.8	-40.2	-5.2	2441.8	-43.8	-8.8
2435.85	-40.4	-5.4	2437.85	-40.4	-5.4	2439.85	-40.2	-5.2	2441.85	-43.8	-8.8
2435.9	-40.3	-5.3	2437.9	-40.3	-5.3	2439.9	-40.1	-5.1	2441.9	-43.9	-8.9
2435.95	-40.3	-5.3	2437.95	-40.3	-5.3	2439.95	-40.1	-5.1	2441.95	-43.9	-8.9

This report shall not be reproduced except in full, without the written approval of CCS.

Freq. (MHz	Jammer Power(dBm)	J/S (dB)	Freq. (MHz)	Jammer Power(dBm)	J/S (dB)	Freq. (MHz)	Jammer Power(dBm)	J/S (dB)	Freq. (MHz)	Jammer Power(dBm)	J/S (dB)
2442	-43.7	-8.7	2444	-40.1	-5.1	2446	-39.7	-4.7	2448	-39.8	-4.8
2442.05	-43.6	-8.6	2444.05	-40.1	-5.1	2446.05	-39.6	-4.6	2448.05	-39.7	-4.7
2442.1	-43.5	-8.5	2444.1	-40.2	-5.2	2446.1	-39.7	-4.7	2448.1	-39.7	-4.7
2442.15	-43.3	-8.3	2444.15	-40.3	-5.3	2446.15	-39.7	-4.7	2448.15	-39.8	-4.8
2442.2	-43.1	-8.1	2444.2	-40.2	-5.2	2446.2	-39.6	-4.6	2448.2	-39.9	-4.9
2442.25	-43	-8	2444.25	-40.3	-5.3	2446.25	-39.8	-4.8	2448.25	-39.7	-4.7
2442.3	-42.9	-7.9	2444.3	-40.2	-5.2	2446.3	-39.7	-4.7	2448.3	-39.9	-4.9
2442.35	-42.7	-7.7	2444.35	-40.4	-5.4	2446.35	-39.9	-4.9	2448.35	-40	-5
2442.4	-42.7	-7.7	2444.4	-40.4	-5.4	2446.4	-39.9	-4.9	2448.4	-40.1	-5.1
2442.45	-42.6	-7.6	2444.45	-40.3	-5.3	2446.45	-40	-5	2448.45	-40.1	-5.1
2442.5	-42.5	-7.5	2444.5	-40.4	-5.4	2446.5	-40	-5	2448.5	-40	-5
2442.55	-42.3	-7.3	2444.55	-40.3	-5.3	2446.55	-40.1	-5.1	2448.55	-40	-5
2442.6	-42.1	-7.1	2444.6	-40.2	-5.2	2446.6	-40.1	-5.1	2448.6	-39.9	-4.9
2442.65	-41.9	-6.9	2444.65	-40.2	-5.2	2446.65	-40.1	-5.1	2448.65	-39.9	-4.9
2442.7	-41.8	-6.8	2444.7	-40.2	-5.2	2446.7	-40.2	-5.2	2448.7	-39.8	-4.8
2442.75	-41.6	-6.6	2444.75	-40.1	-5.1	2446.75	-40.1	-5.1	2448.75	-39.9	-4.9
2442.8	-41.5	-6.5	2444.8	-40.2	-5.2	2446.8	-40.1	-5.1	2448.8	-39.8	-4.8
2442.85	-41.3	-6.3	2444.85	-40.2	-5.2	2446.85	-40.2	-5.2	2448.85	-39.9	-4.9
2442.9	-41.1	-6.1	2444.9	-40	-5	2446.9	-40.3	-5.3	2448.9	-39.9	-4.9
2442.95	-40.8	-5.8	2444.95	-39.9	-4.9	2446.95	-40.3	-5.3	2448.95	-40	-5
2443	-40.7	-5.7	2445	-39.9	-4.9	2447	-40.4	-5.4	2449	-40.1	-5.1
2443.05	-40.6	-5.6	2445.05	-39.9	-4.9	2447.05	-40.4	-5.4	2449.05	-40	-5
2443.1	-40.5	-5.5	2445.1	-39.9	-4.9	2447.1	-40.4	-5.4	2449.1	-40.1	-5.1
2443.15	-40.3	-5.3	2445.15	-39.9	-4.9	2447.15	-40.4	-5.4	2449.15	-40.1	-5.1
2443.2	-40.2	-5.2	2445.2	-39.9	-4.9	2447.2	-40.3	-5.3	2449.2	-40.2	-5.2
2443.25	-40.2	-5.2	2445.25	-39.8	-4.8	2447.25	-40.3	-5.3	2449.25	-40.2	-5.2
2443.3	-40.1	-5.1	2445.3	-39.8	-4.8	2447.3	-40.3	-5.3	2449.3	-40.1	-5.1
2443.35	-40.2	-5.2	2445.35	-39.8	-4.8	2447.35	-40.2	-5.2	2449.35	-40.2	-5.2
2443.4	-40	-5	2445.4	-39.8	-4.8	2447.4	-40.2	-5.2	2449.4	-40.1	-5.1
2443.45	-40	-5	2445.45	-39.8	-4.8	2447.45	-40.2	-5.2	2449.45	-40.2	-5.2
2443.5	-40	-5	2445.5	-39.7	-4.7	2447.5	-40.1	-5.1	2449.5	-40	-5
2443.55	-40.1	-5.1	2445.55	-39.7	-4.7	2447.55	-40.2	-5.2	2449.55	-40	-5
2443.6	-40.1	-5.1	2445.6	-39.7	-4.7	2447.6	-40.1	-5.1	2449.6	-40.1	-5.1
2443.65	-40	-5	2445.65	-39.6	-4.6	2447.65	-40	-5	2449.65	-40.2	-5.2
2443.7	-39.9	-4.9	2445.7	-39.7	-4.7	2447.7	-40	-5	2449.7	-40.2	-5.2
2443.75	-39.9	-4.9	2445.75	-39.7	-4.7	2447.75	-39.9	-4.9	2449.75	-40.2	-5.2
2443.8	-40	-5	2445.8	-39.7	-4.7	2447.8	-39.9	-4.9	2449.8	-40.1	-5.1
2443.85	-40.1	-5.1	2445.85	-39.7	-4.7	2447.85	-39.8	-4.8	2449.85	-40.1	-5.1
2443.9	-40	-5	2445.9	-39.6	-4.6	2447.9	-39.7	-4.7	2449.9	-40	-5
2443.95	-40.1	-5.1	2445.95	-39.7	-4.7	2447.95	-39.8	-4.8	2449.95	-40	-5

This report shall not be reproduced except in full, without the written approval of CCS.

Freq. (MHz)	Jammer Power(dBm)	J/S (dB)
2450	-40.1	-5.1

This report shall not be reproduced except in full, without the written approval of CCS.

1.3 Determination of Processing Gain

Let the required theoretical signal to noise ratio for achieving a certain BER, say 10^{-5} , in a non-spread-spectrum receiver be SNRN and that for achieving the same BER in a spread-spectrum receiver be SNRS, the processing gain G_p achieved by this spread-spectrum receiver can be computed using the following formula:

G_p = SNRN + L_s -SNRS (in dB),

where L_s is the system loss due to the difference between a practical system and the ideal system such as the non-ideal filter characteristic.

AirEZY2411-BT uses DQPSK CCK modulation scheme that converts each 8-bit symbol into one of 256 complex code words of 8-bit chip sequences and transmits each sequence through the I and the Q channels. It is known that the theoretical signal to noise ratio required to achieve a 10^{-5} BER for such a DQPSK receiver with CCK modulation is 17 dB[1]. The system loss L_s for AirEzy-2411-BT is estimated to be approximately 2 dB.

The signal to noise ratio required by AirEzy2411-BT in the presence of a CW jamming signal to achieved a BER $\leq 10^{-5}$ can be computed by the measured data listed in the preceding section. The data signal level at the input of the DUT is -35 dBm. The lowest interference power level for maintaining a BER of 10^{-5} , after the worst 20% data points being discarded, is -40.4 dBm. The lowest interference to signal power ratio is -5.4 dB

The Processing Gain is therefore

G_p = 17 +2 -5.4 = 13.6 dB

Reference

[1] Intersil Product Data Sheet HFA3861B

This report shall not be reproduced except in full, without the written approval of CCS.

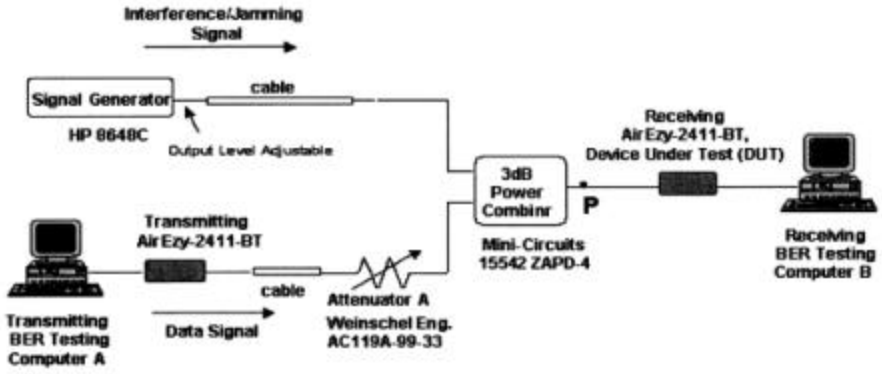
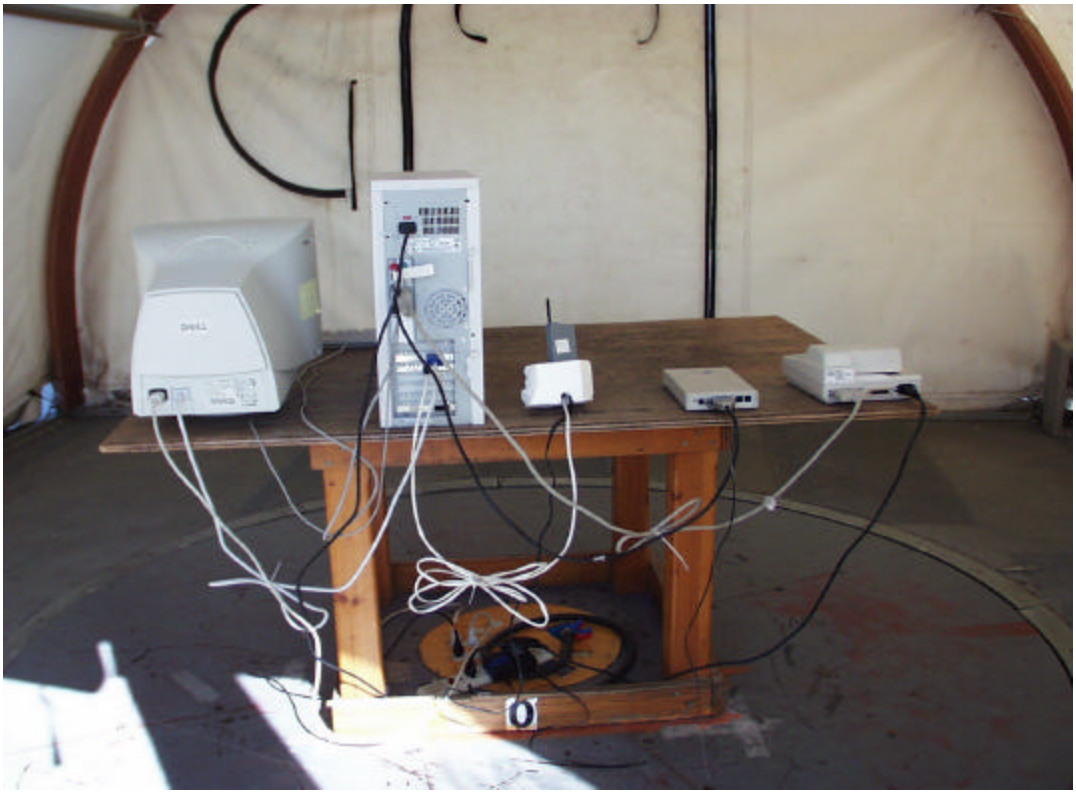


Figure 1. Processing Gain Measurement Setup for AirEzy-2411-BT.

This report shall not be reproduced except in full, without the written approval of CCS.

7. TEST SETUP PHOTO

RADIATED EMISSSION SETUP PHOTOS



This report shall not be reproduced except in full, without the written approval of CCS.

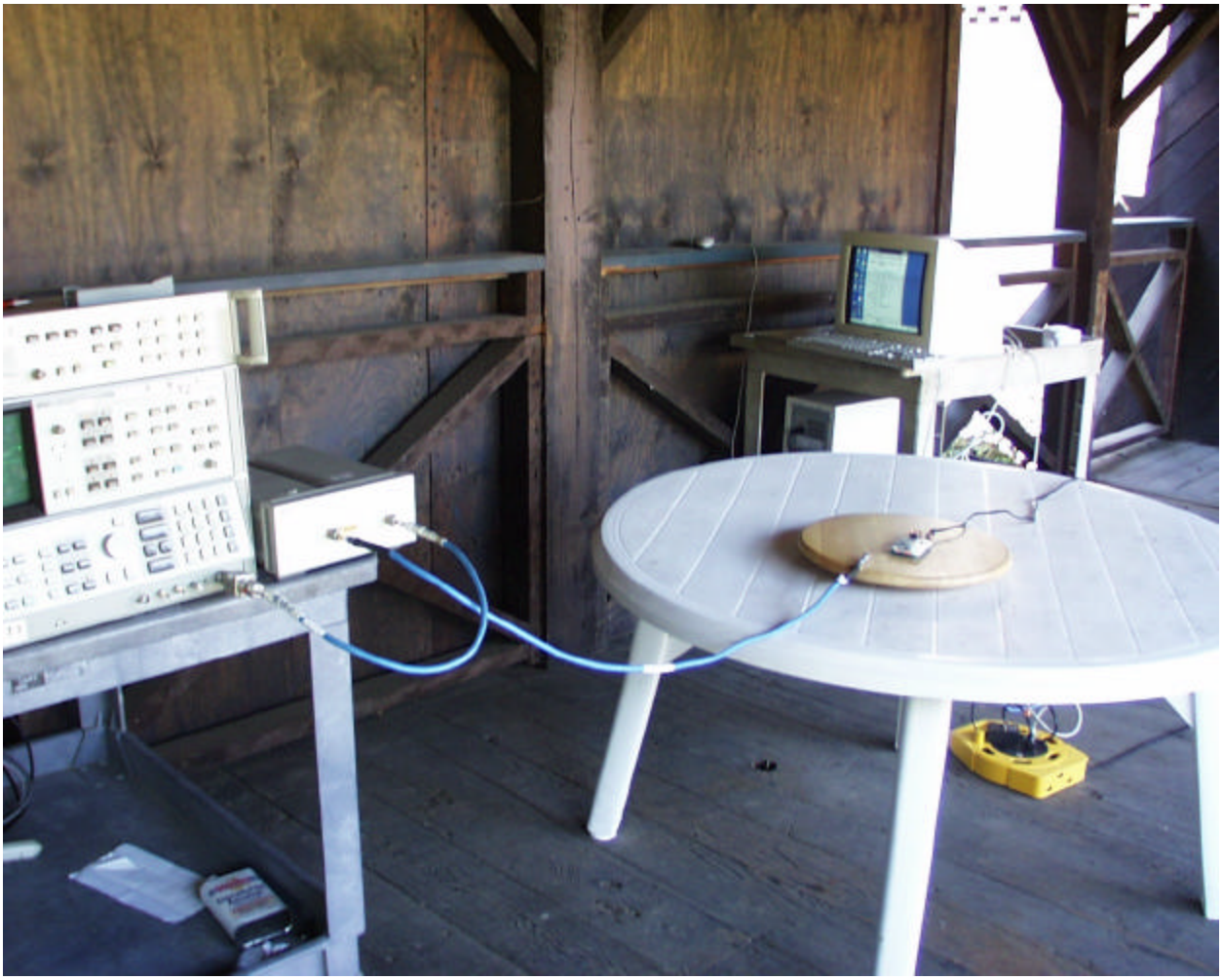
CONDUCTED EMISSION SETUP PHOTOS

This report shall not be reproduced except in full, without the written approval of CCS.

HI FREQUENCY SETUP PHOTOS

This report shall not be reproduced except in full, without the written approval of CCS.

ANTENNA PORT MEASUREMENT PHOTOS



This report shall not be reproduced except in full, without the written approval of CCS.

ATTACHMENT

This report shall not be reproduced except in full, without the written approval of CCS.

PROPOSED FCC ID LABEL

This report shall not be reproduced except in full, without the written approval of CCS.

SCHEMATIC DIAGRAM & BLOCK DIAGRAM

This report shall not be reproduced except in full, without the written approval of CCS.

USER MANUAL

This report shall not be reproduced except in full, without the written approval of CCS.