



**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



	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
<i>Support Equipment.....</i>		4
<i>Test Equipment.....</i>		4
<i>I/O Cable Configuration.....</i>		5
<i>Test Configuration Diagram.....</i>		6
6. TEST PROCEDURES AND TEST RESULTS		7
RADIATED EMISSIONS TEST REQUIREMENT: 15.109/15.209		7
<i>MODIFICATIONS MADE.....</i>		9
<i>Mod-1 : RJ-45 & Analog Ground</i>		10
<i>Mod 2 : Ferrite Bead.....</i>		11
AC LINE CONDUCTED EMISSIONS TEST REQUIREMENT: 15.207		12
<i>Test Set-up.....</i>		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
 TELEPHONE 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

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

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	 200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	 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	 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	 ELA-171
Taiwan	BSMI	CNS 13438	 SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	 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

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

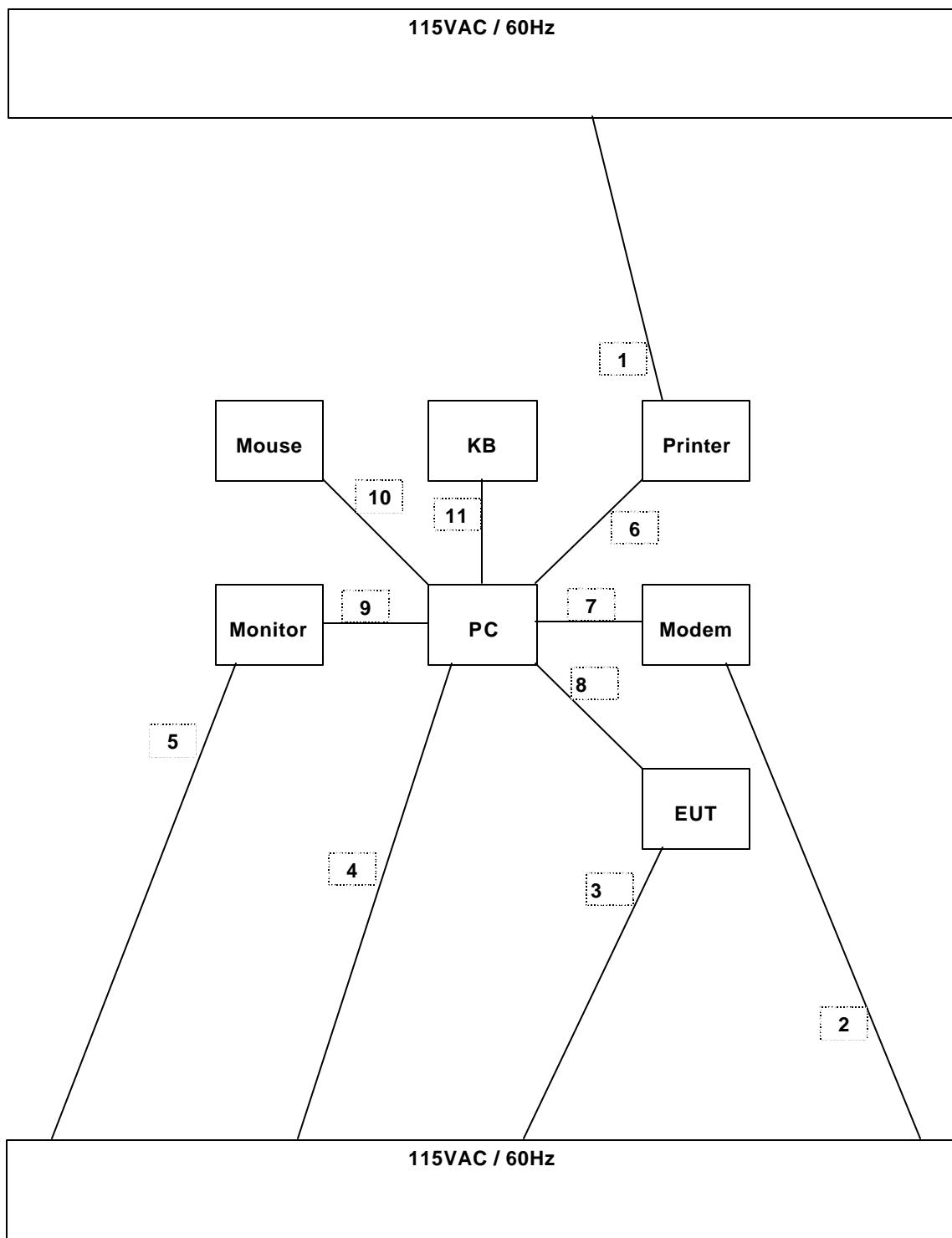
TEST EQUIPMENTS LIST				
Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Spectrum Analyzer	HP100Hz - 22GHz	8566B	2140A01296	5/4/02
Spectrum Display	HP	85662A	2152A03066	5/10/02
Quasi-Peak Detector	HP9K - 1GHz	85650A	2811A01155	5/4/02
RF Preselector	HP20Hz-2GHz	85685A	2817A00756	5/4/02
Antenna, 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.

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

Test Configuration Diagram



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

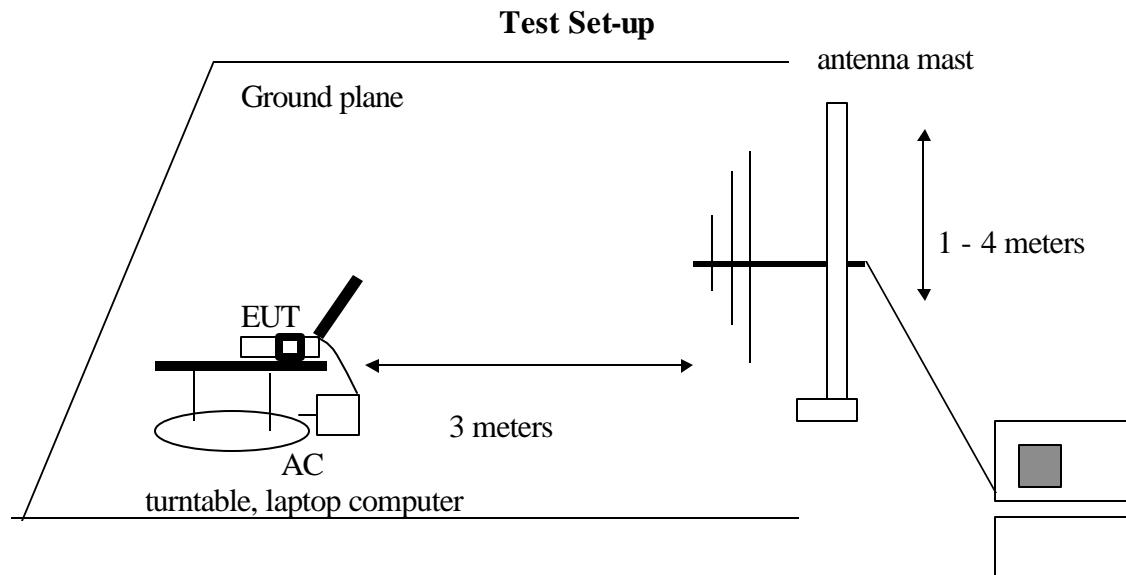


Fig.1

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.



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											

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:

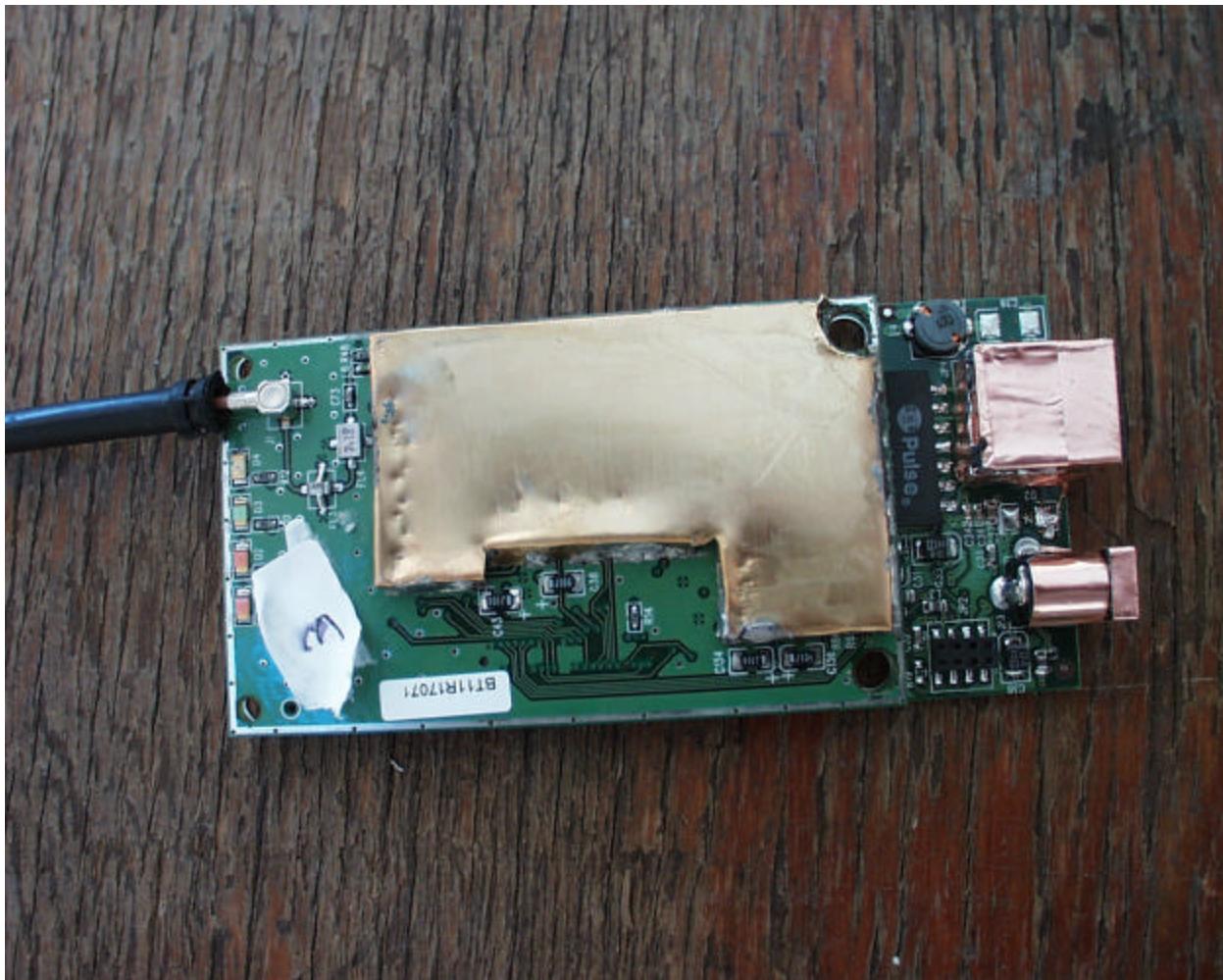
The RJ-45 port was plastic. Copper tape was used to cover the case.
See MOD-1, picture for more detail.

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.

Mod-1 : RJ-45 & Analog Ground

Mod 2 : Ferrite Bead

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

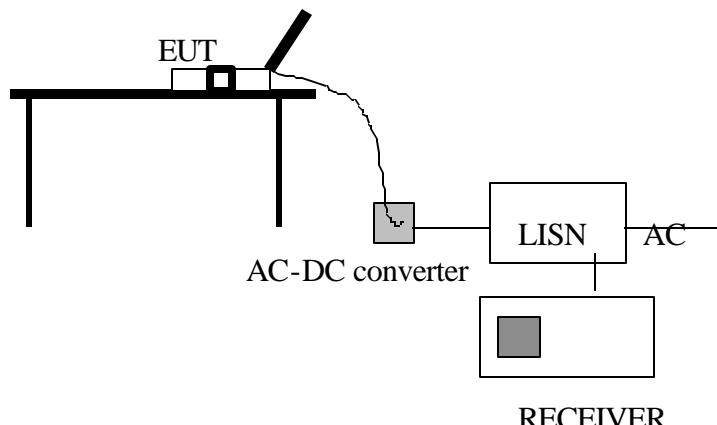


Fig. 2

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

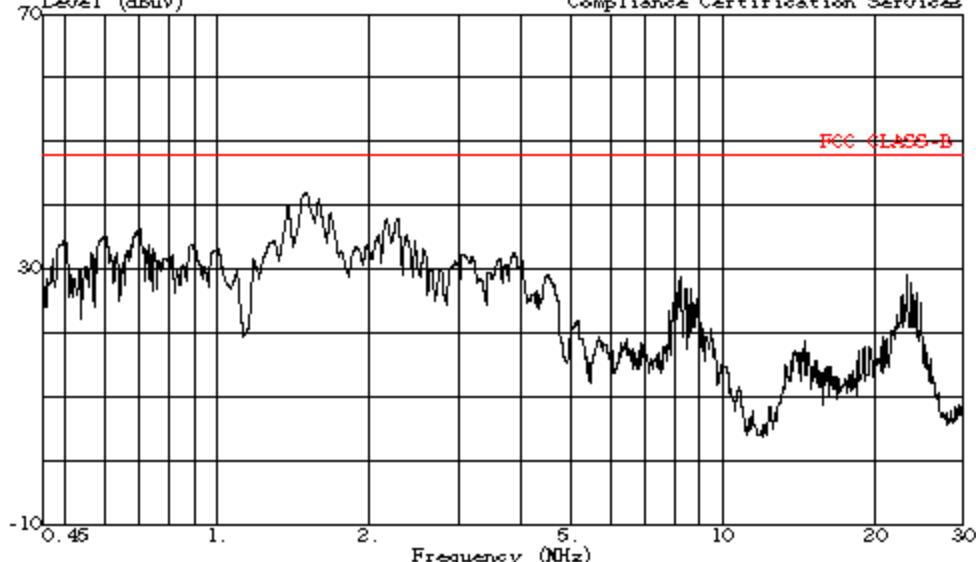
Refer to attached graph

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Closs (dB)	Limit QP	ECC_B AV	Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP (dB)	AV (dB)	
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									



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

Data#: 6 File#: 01U08341.EMI Date: 08-16-2001 Time: 10:40:42
Level1 (dBuV) Compliance Certification Services



Trace:

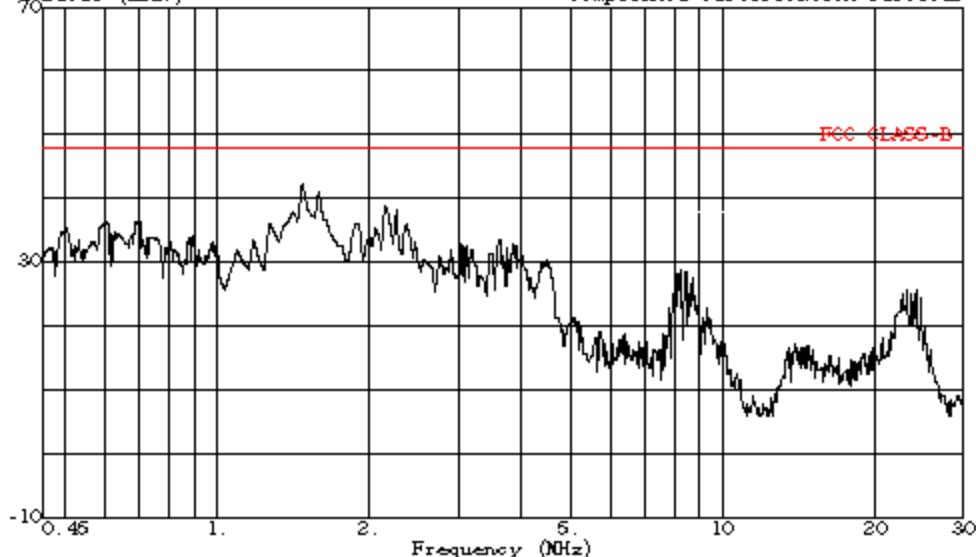
Project No. : 01U0834-1
Report No. : 010816-11-fcc
Test Engr : Hue Ly Vang
Company : OTC Wireless INC.
EUT Description : 2.4GHz Client Radio
Model : AirEZY-2411-BT
EUT Config. : EUT/PC/MONITOR/KB/.MOUSE/
: PRINTER/MODEN
Type of Test : FCC CLASS B
Mode of Operation: IDLE/BATTERY CHARGING
: PEAK: L1(Black)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

Ref Trace:



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

Data#: 13 File#: 01U08341.EMI Date: 08-16-2001 Time: 10:53:38
Level (dBuV) Compliance Certification Services



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

Ref Trace:

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:

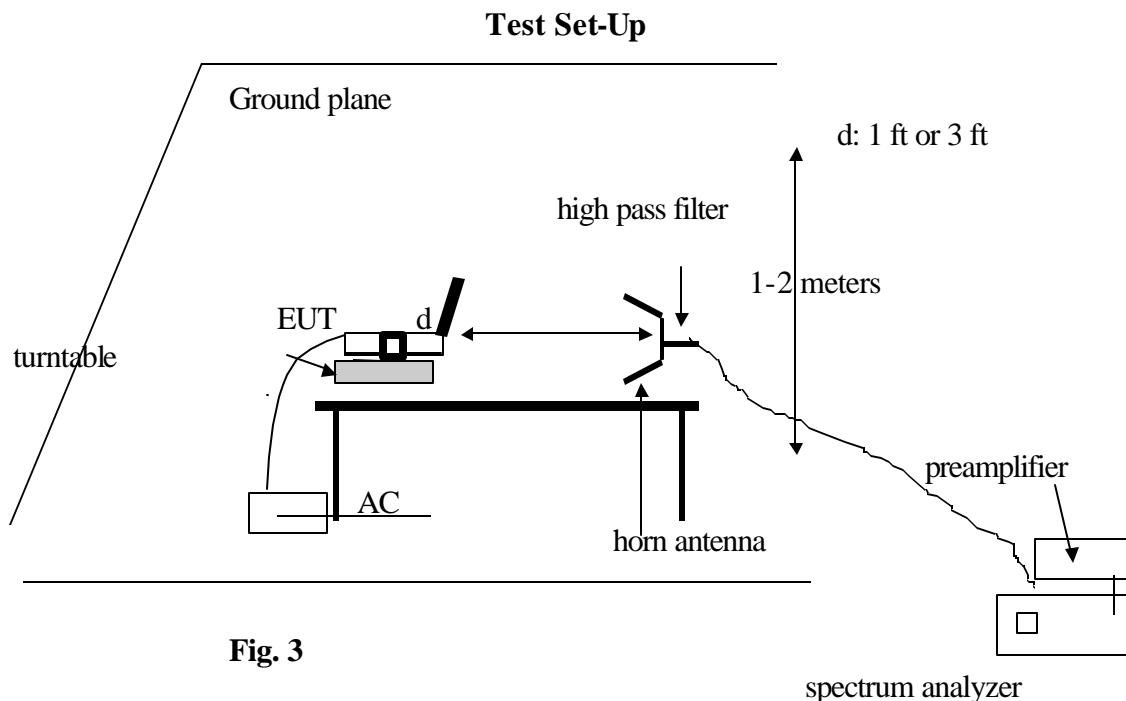
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 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.

**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

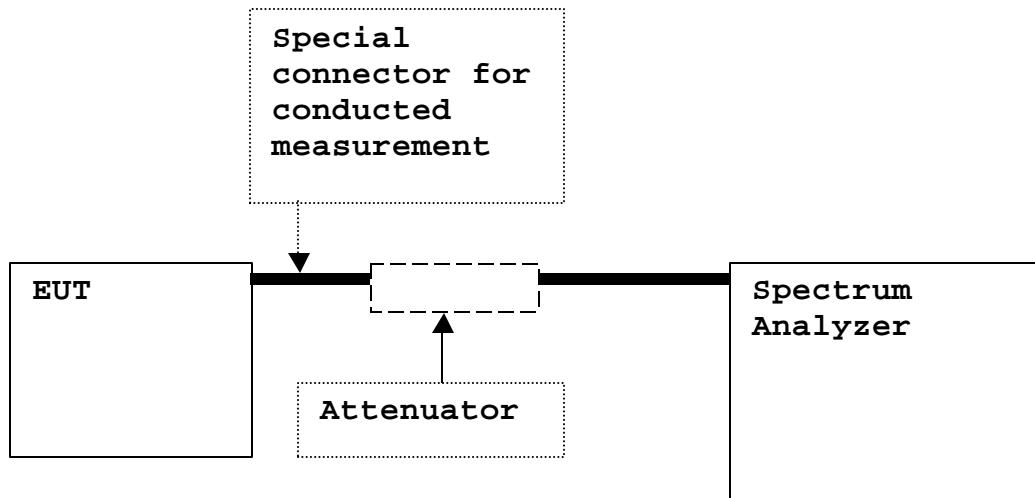
COMPLIANCE ENGINEERING SERVICES, INC.										
Harmonic Emissions										
OTC Wireless		6/1/01								
Channel 1 : 2412 MHz		Pete Krebill/hue Vang A site (1.0 Meter)								
F(MHz)	READING	AF	CL	AMP	DIST	HPF	TOTAL	LIMIT	MARGIN	
	(dBuV)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)		
	Pk	Avg					Pk	Avg	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
7236	50.85	39.85	36.6	6.4	-35.5	-9.5	1	49.85	38.85	74
9648	39.2	31.1	37.65	9.05	-35.5	-9.5	1	41.9	33.8	74
12060	38.9	30.42	39.18	9.07	-35.5	-9.5	1	43.15	34.67	74
14472	38.5	34.8	40.12	11.66	-35.5	-9.5	1	46.28	42.58	74
16884	39.9	34.77	43.26	13.26	-35.5	-9.5	1	52.42	47.29	74
19298	40.2	34.98	32.09	14.54	-35.5	-9.5	1	42.83	37.61	74
21708	41.6	35	32.5	15.76	-35.5	-9.5	1	45.86	39.26	74
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										
AMP: Pre-amp gain										
CL: Cable loss										
HPF: High pass filter insertion loss										
R = Restricted Band Measurement(2310-2390MHz)										
PEAK(Pk): Res_bw Avg_bw										
Below 1GHz 100KHz 100KHz										
Above1GHz 1MHz 1MHz										
For all Average Used Video Average										

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		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													
AMP: Pre-amp chain													
CL: Cable loss													
HPF: High pass filter insertion loss													
PEAK(Pk): Res_bw Avg_bw													
Below 1GHz 100KHz 100KHz													
Above1GHz 1MHz 1MHz													
For all Average used Video Average													

COMPLIANCE ENGINEERING SERVICES, INC.													
Harmonic Emissions													
OTC Wireless													
Channel 11 : 2462 MHz													
6/1/01													
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													
PEAK(Pk): Res bw													
Below 1GHz 100KHz													
Above1GHz 1MHz													
For all Average used Video Average													
R = Restricted band Measurement (2483.5-2500MHz)													

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

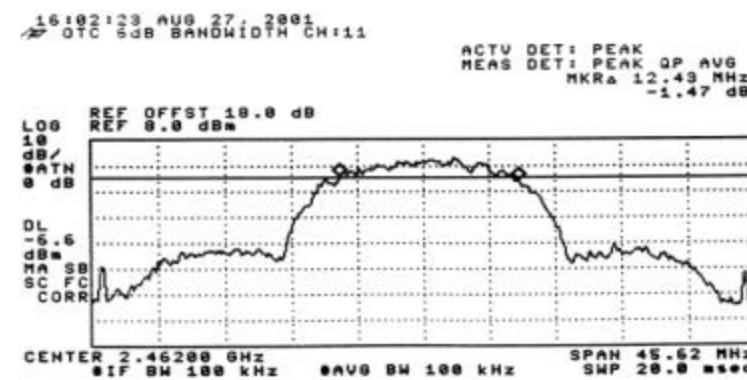
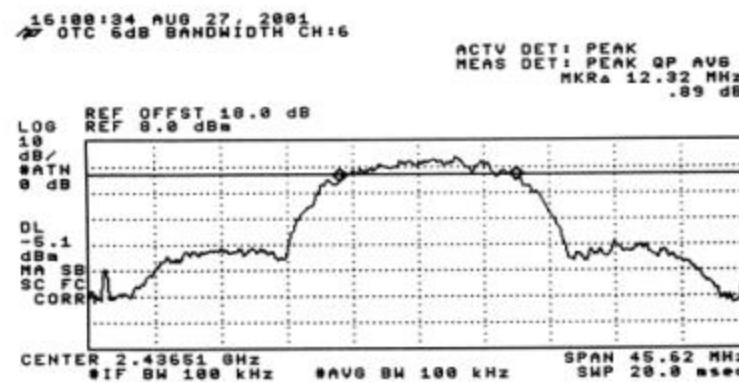
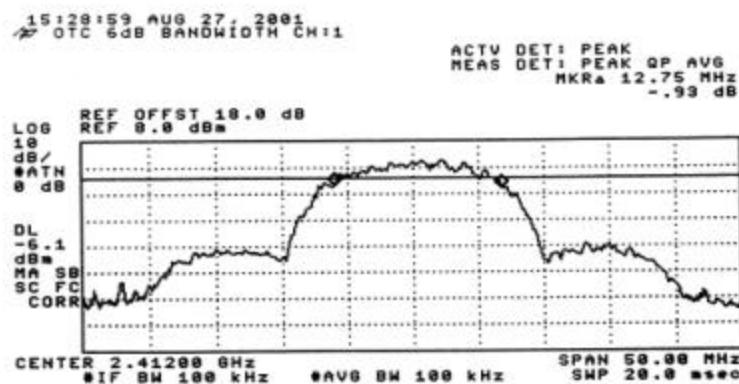
(2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

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

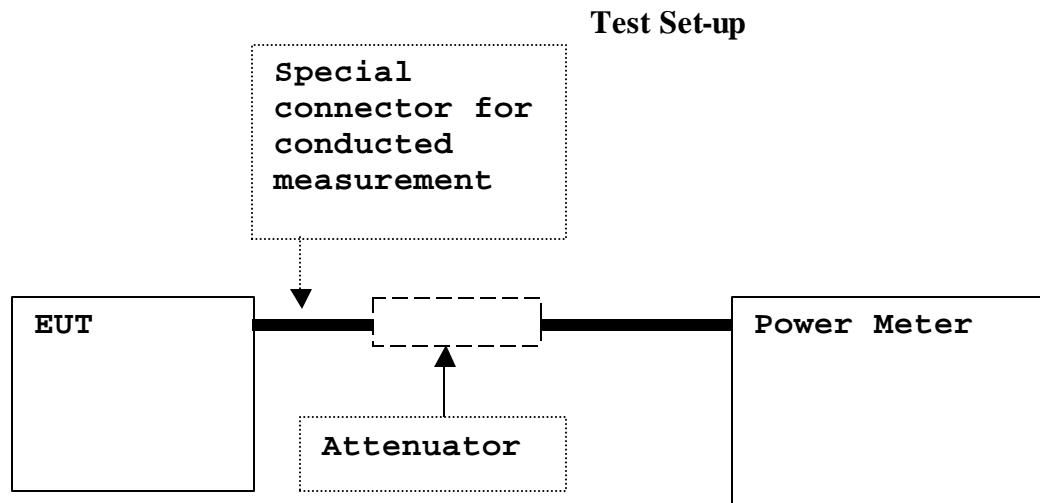
The analyzer center frequency was set to the EUT carrier frequency. The resolution and video bandwidth were set to 100khz. Using MAX HOLD, then PEAK SEARCH the signal was taken. Using the peak signal subtract 6dB down. Using the analyzer DISPLAY LINE and MARKER DELTA functions, the 6 dB bandwidth of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

Test Results: Refer to attached spectrum analyzer data chart.



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 Procedure

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

The peak output power was attain by a power meter.

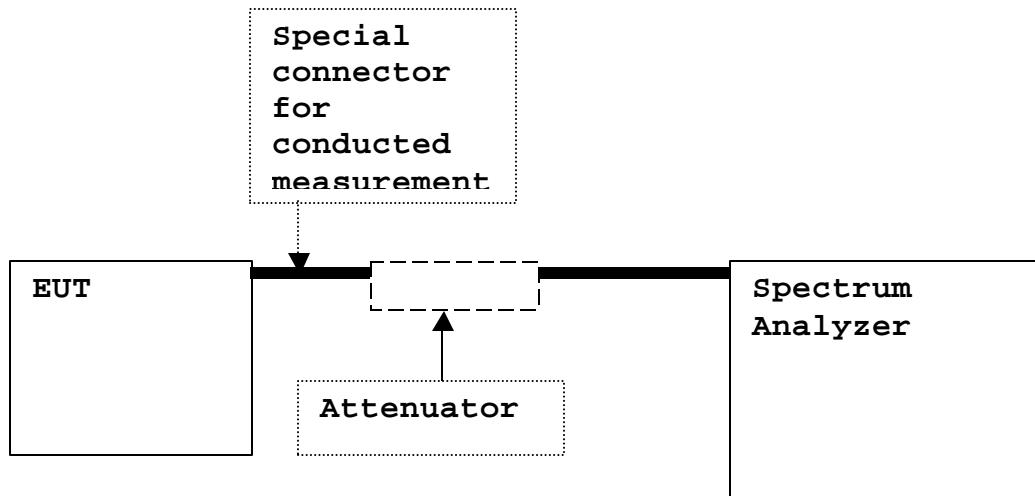
Test Results

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:

DSSS POWER DENSITY TEST REQUIREMENT: 15.247(D)

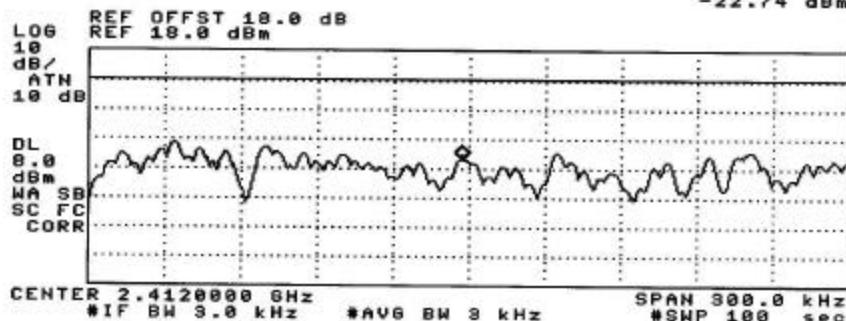
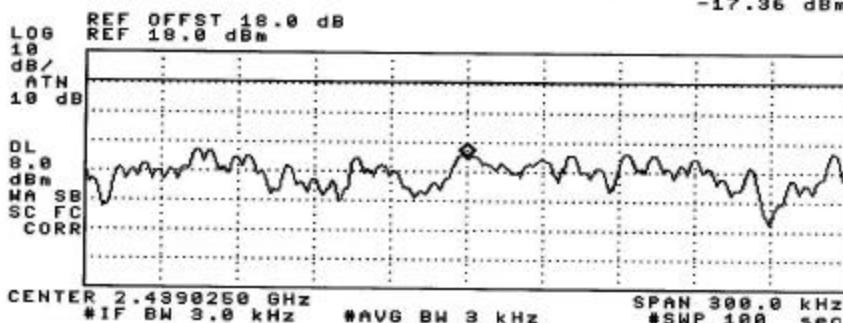
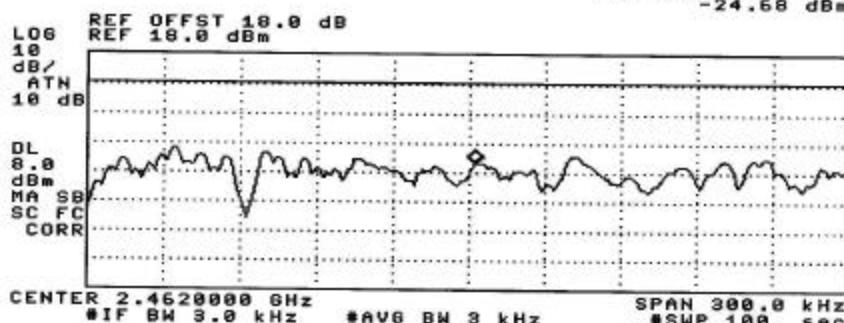
(d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Set-up**Test Procedure**

For this test, the EUT's antenna was removed and replaced with an alternate 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 attained 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.

12:28:29 AUG 14, 2001
OTC POWER DENSITY LOACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4120000 GHz
-22.74 dBm12:29:07 AUG 14, 2001
OTC POWER DENSITY MIDACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4390250 GHz
-17.36 dBm12:33:09 AUG 14, 2001
OTC POWER DENSITY HIACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4619993 GHz
-24.68 dBm

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/despread 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.

$G_p = 17 \text{ dB}(\text{Signal to Noise Ratio}) + 2 \text{ dB}(\text{System Loss}) - 5.49 \text{ dB}(J/S) = 13.6 \text{ dB}$

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 ± 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 $\text{BER} \leq 10^{-5}$ at each frequency is shown in the following:

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	2440.05 -40.1	-5.1		
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				

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

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

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:

$$G_p = SNRN + L_s - SNRS \text{ (in dB)},$$

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 achieve 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

$$G_p = 17 + 2 - 5.4 = 13.6 \text{ dB}$$

Reference

[1] Intersil Product Data Sheet HFA3861B

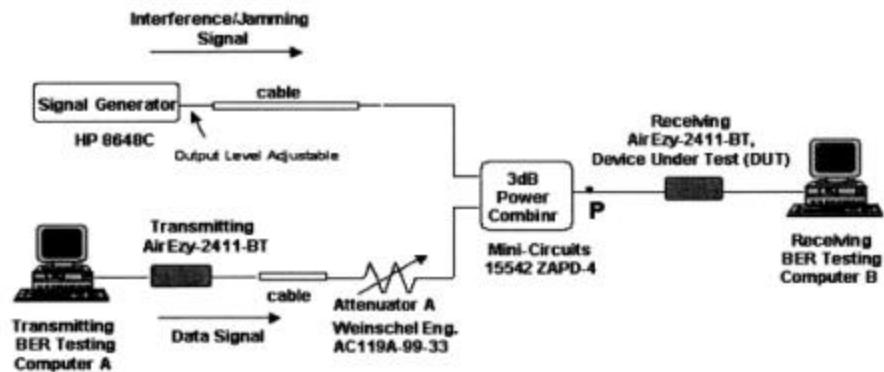
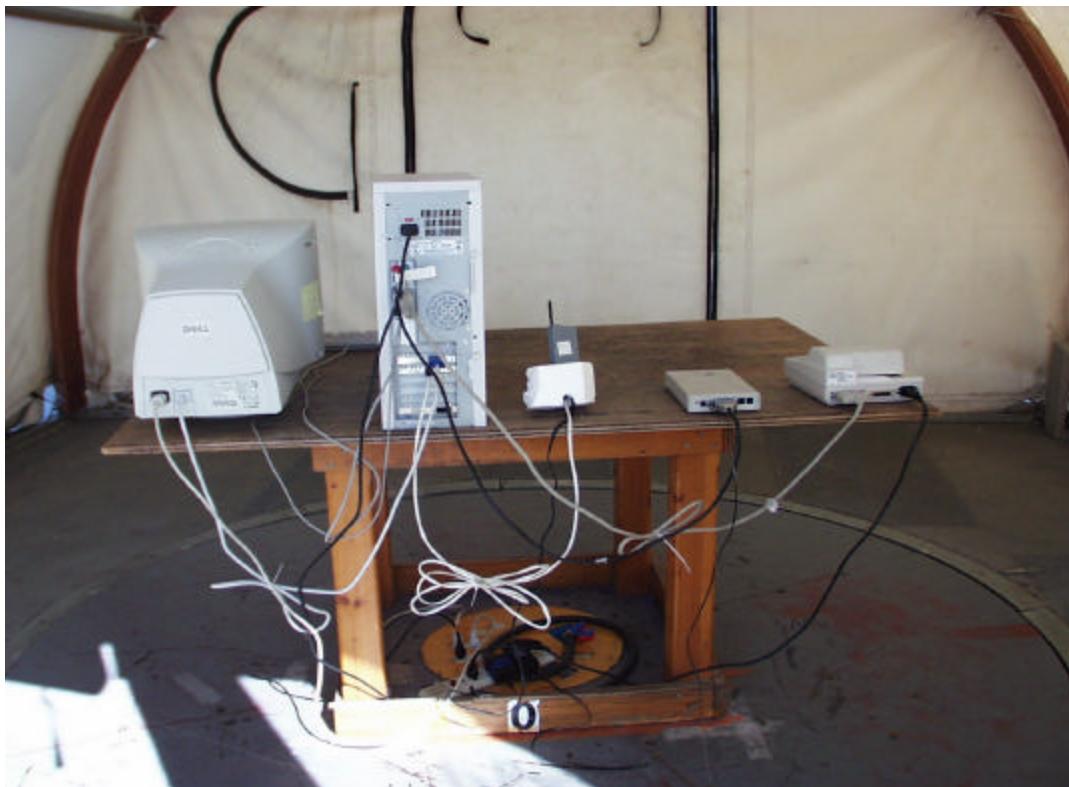


Figure 1. Processing Gain Measurement Setup for AirEzy-2411-BT.

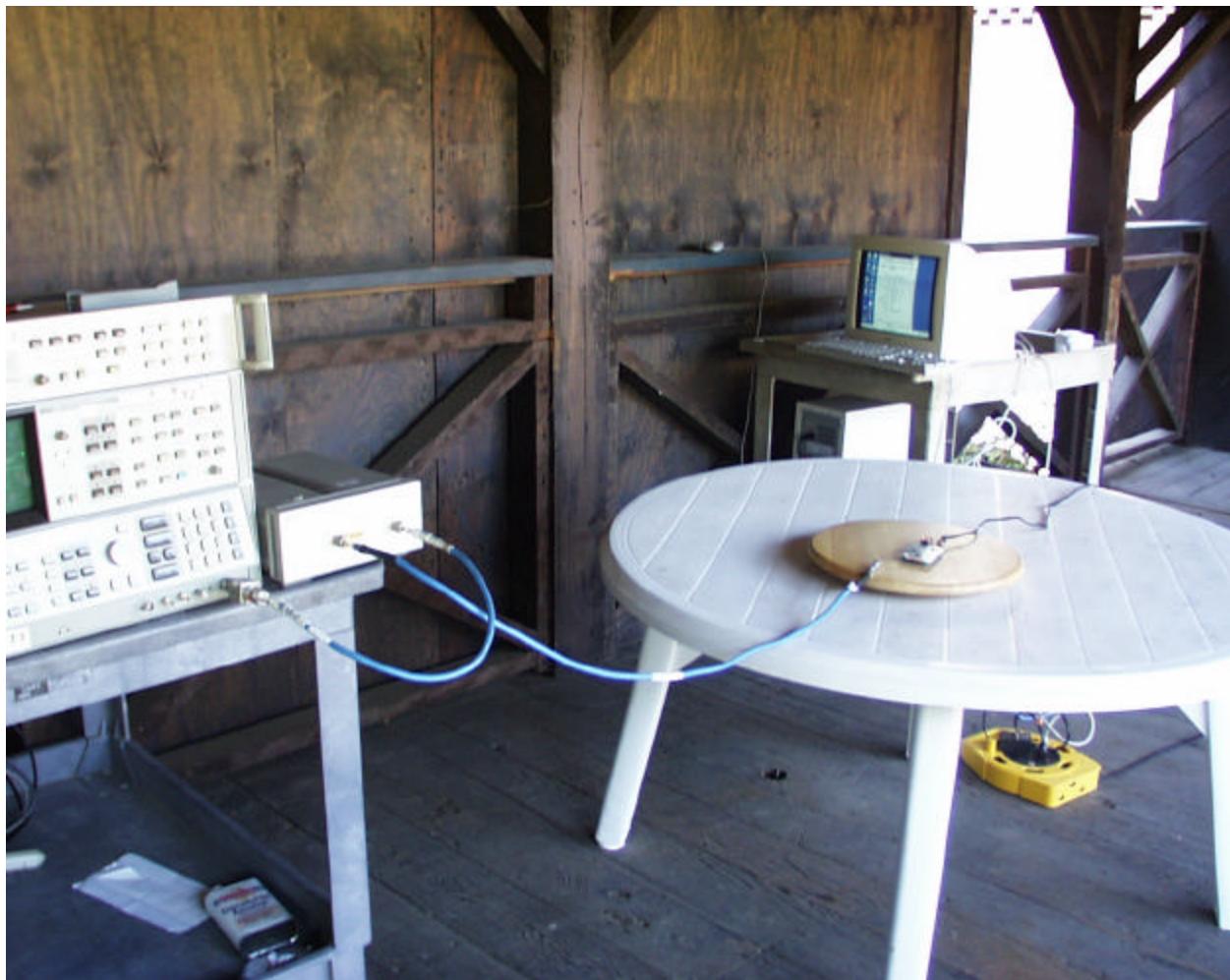
7. TEST SETUP PHOTO

RADIATED EMISSIONS SETUP PHOTOS



CONDUCTED EMISSION SETUP PHOTOS

HI FREQUENCY SETUP PHOTOS

ANTENNA PORT MEASUREMENT PHOTOS

ATTACHMENT

PROPOSED FCC ID LABEL

PAGE NO: 37 0 f 39

SCHEMATIC DIAGRAM & BLOCK DIAGRAM

USER MANUAL