EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER

I. GENERAL INFORMATION

Requirement: Federal Communications Commissions

Test Requirements: 15.205, 15.207, 15.209, 15.247

Applicant: BreezeCom Ltd.

Product ID: FCC ID: LKT-SUR-24

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The Breezecom FCC ID: LKT-SUR-24 is a frequency hopping spread spectrum (FHSS) transceiver used for WLANs and similar applications. The product uses antenna diversity, a proprietary connector is used on the antenna. Only one antenna transmits at a time, both receive simultaneously. The following antennas were tested for use with this radio:

No	Antenna description	Breezecom name	MFR name
1	Flat panel patch antenna	UNI-8.5dBi (8.5 dBi - 1.5 dB cable loss = 7 dBi eff.)	Huber-Shuner SPA 2400/75/9/0/V 2300-2500MHz (comes with permanently attached cable)
2	Flat panel patch antenna	UNI-7dBi	M/A -Com
3	whip antenna	Omni-3dBi	NA
4	2 x antenna	Omni-6dBi	NA

III. TEST LOCATION

All conducted tests and radiated emissions for the 3dBi antenna were performed at:

Compliance Certification Services
561F Monterey Road
Morgan Hill, CA 95037

Radiated emissions tests for the patch antennas and 6 dBi omni were performed at

The Standards Institution
Of Israel
Industry Division
Telematics Laboratory
EMC Section

T.N. Cokenias 31 August 2001
EMC Consultant/Agent for Breezecom

- **Antenna connector requirement**

The EUT's antenna has a unique connector, a keyed bayonet type, that can only be inserted one way into the corresponding slots in the radio. Refer to the attached photographs for details.

15.204 Antenna description

No	Antenna description	Breezecom name	MFR name
1	Flat panel patch antenna	UNI-8.5dBi (7 dBi eff.)	Huber-Shuner SPA 2400/75/9/0/V 2300-2500MHz
2	Flat panel patch antenna	UNI-7dBi	M/A -Com
3	whip antenna	Omni-3dBi	NA
4	2 x antenna	Omni-6dBi	NA

15.247(a) Frequency hopping spread spectrum definition

Pseudorandom frequency hopping sequence:

The transmitter cannot coordinate its hopping sequence with the hopping sequence of other transmitters, or vice versa, for the purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters

Each access unit has an individual ID number and there is no link or association between two access units so there is no simultaneous occupancy of individual hopping frequency transmission of two or more access units.

Equal hopping frequency use:

The EUT supports 802.11 standard up to the channels defined by the out of band radiation.
For example here are the channels of one hopping sequence each channel is associated to a frequency (channel 2 is 2402MHz, channel 25 is 2425MHz etc.)
According to Table B.1 Hopping sequence Set 1:
2,25,64,10,45,18,73,49,21,63,78,31,61,24,54,65,28,33,4,20,13,38,74,56,71,23,
5,39,12,36,68,9,70,77,6,62,29,14,27,16,59,43,76, etc..

There is an implementation in the software of all sequences defined in the standard.

System receiver input bandwidth and receiver hopping capability:

The Access unit (base station) defines to all subscriber units the frequency sequence. The protocol is implemented according to 802.11.

The receiver band width is defined by a 440MHz SAW filter of 1MHz bandwidth. The frequency shift is defined by a frequency hop PLL synthesizer that sets the received frequency to a 440MHz IF frequency.

TEST DATA and TEST PROCEDURES - CCS Laboratory

Radiated Emissions
Test Requirement: 15.205

Measurement Equipment Used:

HP 8593EM Spectrum Analyzer
HP 8449 Microwave pre-amplifier, 1-26.5 GHz
EMCO 3115 Double Ridged Horn antenna, 1 - 18 GHz

1. The EUT was placed on a wooden table resting on a turntable on the open air test site. The search antenna was placed 3m 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. Radiated emissions were investigated for a LOW channel, a MID channel, and HIGH channel. Emissions were investigated to the 10^{th} harmonic.

4. Careful measurements were made at the restricted bands 2310-2390 MHz and 2483.5 – 2500 MHz for the LOW and HIGH channel respectively. The preamplifier was not used for these measurements.

5. 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.

Test Results: Worst case results are presented. Refer to data sheets, attached.

For bandedge measurements, received radiated emissions seemed to overload the spectrum analyzer, even though the frequency of operation (2474 MHz) was over 9 MHz removed from the restricted band, and said emission is only 1 MHz wide at the -20 dB points. In lieu of radiated measurements, radiated emissions levels at the bandedge were calculated from conducted measurements.

The relationship between transmitter power, antenna gain, and field strength at 3m is

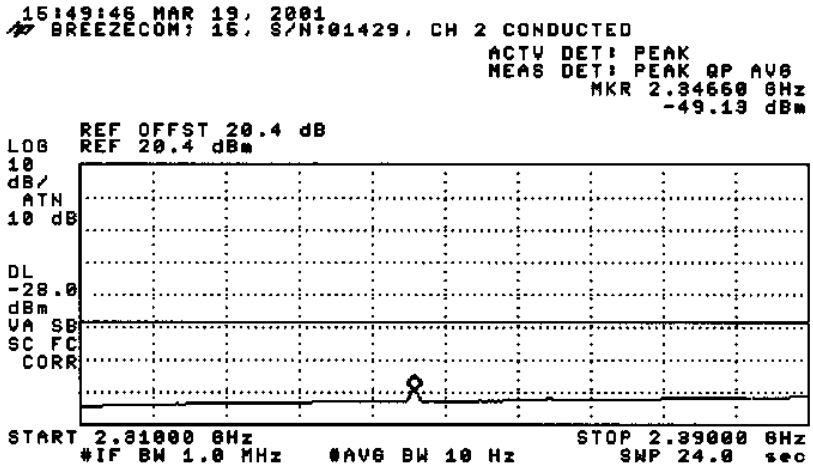
$E_{V/m}$ = (•(30*PW*G))/d meters (E in volts/m, P in watts, G numeric gain over isotropic)

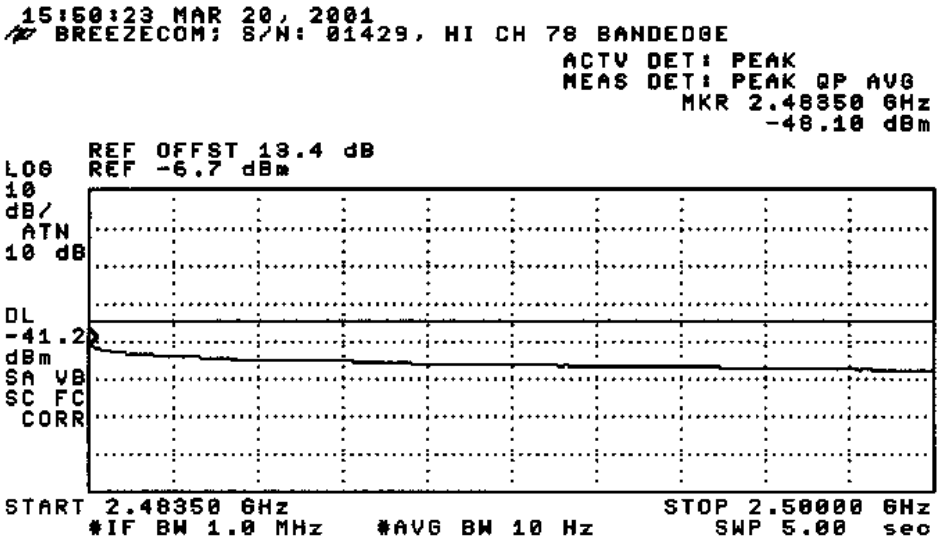
Converting to logarithms and combining terms,

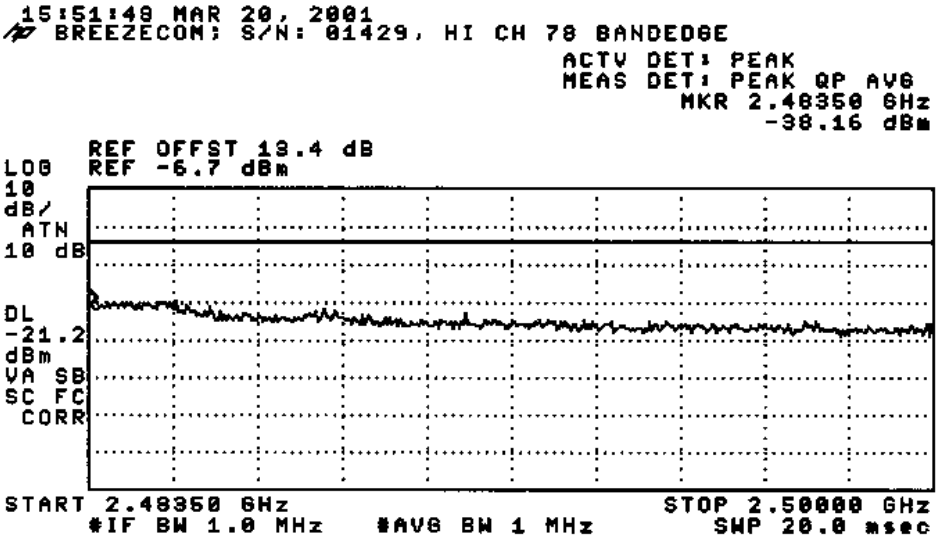
E@3m, dBuV/m = (95.1 + PdBm + GdBi) dBuV/m = 54 dBuV/m for 15.205 limits

Maximum conducted reading in restricted band: -48.1 dBm at 2483.5 MHz
Antenna gain = 3 dBi

-48.1 dBm + 3 dBi + 95.2 = 50.1 dBuV/m calculated at 3 m.


15:49:46 MAR 19, 2001
BREEZECOM; 15, S/N:01429, CH 2 CONDUCTED
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.34660 GHz
-49.13 dBm
REF OFFST 20.4 dB
LOG REF 20.4 dBm
10
dB/
ATN
10 dB
DL
-28.0
dBm
VA SB
SC FC
CORR
START 2.31000 GHz
STOP 2.39000 GHz
#IF BW 1.0 MHz
#AVG BW 10 Hz
SWP 24.0 sec


15:50:23 MAR 20, 2001
BREEZECOM; S/N: 01429, HI CH 78 BANDEDGE
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.48350 GHz
-48.10 dBm
REF OFFST 13.4 dB
LOG
10
dB/
ATN
10 dB
REF -6.7 dBm
DL
-41.2
dBm
SA VB
SC FC
CORR
START 2.48350 GHz
STOP 2.50000 GHz
#IF BW 1.0 MHz
#AVG BW 10 Hz
SWP 5.00 sec


15:51:48 MAR 20, 2001
BREEZECOM; S/N: 01429, HI CH 78 BANDEDGE
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.48350 GHz
-38.16 dBm
REF OFFST 13.4 dB
LOG
10
dB/
ATN
10 dB
REF -6.7 dBm
DL
-21.2
dBm
VA SB
SC FC
CORR
START 2.48350 GHz
STOP 2.50000 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SWP 20.0 msec

COMPLIANCE CERTIFICATION SERVICES, INC.

Radiated Emissions
15.205

03/20/01
Kerwin Corpuz
A-site (1.0 Meter)

BREEZECOM
2402 - 2478 MHz FHSS,M/N: SU-R, S/N: 01429

fo= 2478 MHz (HIGH)

F(MHz)	READING (dBuV)		AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	HPF (dB)	TOTAL (dBuV/m)		LIMIT (dBuV/m)		MARGIN (dB)	
	Pk	Avg						Pk	Avg	Pk	Avg	Pk	Avg
4956*	43.2	31.6	33.65	5.28	35	9.5	1	38.63	27.03	74	54	-35.37	-26.97
7434V*	47.3	34.8	37.36	6.51	35	9.5	1	47.67	35.17	74	54	-26.33	-18.83
7434H	49.4	39.2	37.36	6.51	35	9.5	1	49.77	39.57	74	54	-24.23	-14.43
9912*	45.6	32.7	38.1	7.7	35	9.5	1	47.9	35	74	54	-26.1	-19
12390*	48.2	35.3	39.29	8.6	35	9.5	1	52.59	39.69	74	54	-21.41	-14.31
14868*	49.5	37.6	40.86	9.9	35	9.5	1	56.76	44.86	74	54	-17.24	-9.14
17346*	51.9	39.3	43.39	11.26	35	9.5	1	63.05	50.45	74	54	-10.95	-3.55
19824*	51.6	39.2	32.11	12.38	35	9.5	1	52.59	40.19	74	54	-21.41	-13.81
22302*	55.3	42.9	32.5	13.42	35	9.5	1	57.72	45.32	74	54	-16.28	-8.68
24780*	55.9	43.2	32.43	14.45	35	9.5	1	59.28	46.58	74	54	-14.72	-7.42

*** Measured noise floor (worse case vertical)**
NOTE: MEASURED HORIZONTAL (H) AND VERTICAL (V)
DIST: Correction to extrapolate reading to 3m specification distance
1.0M measurement distance= **-9.5dB**
AF: Antenna Factor
ANTENNA: EMCO, 3115, S/N:2238 & ARA, MWH-1826/B, S/N:1013
AMP: Pre-amp gain
PRE-AMP: HP 8449B, S/N:3710A00205
CL: Cable loss (17ft)
HPF: FSY High pass filter insertion loss (4.57GHz; S/N:003)

COMPLIANCE CERTIFICATION SERVICES, INC.
Radiated Emissions
15.205

03/20/01
Kerwin Corpuz
A-site (1.0 Meter)

BREEZECOM
2402 - 2478 MHz FHSS,M/N: SU-R, S/N: 01429

*f*o= 2441 MHz (MID)

F(MHz)	READING (dBuV)		AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	HPF (dB)	TOTAL (dBuV/m)		LIMIT (dBuV/m)		MARGIN (dB)	
	Pk	Avg						Pk	Avg	Pk	Avg	Pk	Avg
4882*	43.2	31.6	33.65	5.28	35	9.5	1	38.63	27.03	74	54	-35.37	-26.97
7323V	51.6	43.8	37.36	6.51	35	9.5	1	51.97	44.17	74	54	-22.03	-9.83
7323H*	47.3	34.8	37.36	6.51	35	9.5	1	47.67	35.17	74	54	-26.33	-18.83
9764*	45.6	32.7	38.1	7.7	35	9.5	1	47.9	35	74	54	-26.1	-19
12205*	48.2	35.3	39.29	8.6	35	9.5	1	52.59	39.69	74	54	-21.41	-14.31
14646*	49.5	37.6	40.86	9.9	35	9.5	1	56.76	44.86	74	54	-17.24	-9.14
17087*	51.9	39.3	43.39	11.26	35	9.5	1	63.05	50.45	74	54	-10.95	-3.55
19528*	51.6	39.2	32.11	12.38	35	9.5	1	52.59	40.19	74	54	-21.41	-13.81
21969*	55.3	42.9	32.5	13.42	35	9.5	1	57.72	45.32	74	54	-16.28	-8.68
24410*	55.9	43.2	32.43	14.45	35	9.5	1	59.28	46.58	74	54	-14.72	-7.42

*** Measured noise floor (worse case vertical)**
NOTE: MEASURED HORIZONTAL (H) AND VERTICAL (V)
DIST: Correction to extrapolate reading to 3m specification distance
1.0M measurement distance= **-9.5dB**
AF: Antenna Factor
ANTENNA: EMCO, 3115, S/N:2238 & ARA, MWH-1826/B, S/N:1013
AMP: Pre-amp gain
PRE-AMP: HP 8449B, S/N:3710A00205
CL: Cable loss (17ft)
HPF: FSY High pass filter insertion loss (4.57GHz: S/N:003)

COMPLIANCE CERTIFICATION SERVICES, INC.
Radiated Emissions
15.205

03/20/01
Kerwin Corpuz
A-site (1.0 Meter)

BREEZECOM
2402 - 2478 MHz FHSS,M/N: SU-R, S/N: 01429

*f*o= 2402 MHz (LOW)

F(MHz)	READING (dBuV)		AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	HPF (dB)	TOTAL (dBuV/m)		LIMIT (dBuV/m)		MARGIN (dB)	
	Pk	Avg						Pk	Avg	Pk	Avg	Pk	Avg
4802*	43.2	31.6	33.65	5.28	35	9.5	1	38.63	27.03	74	54	-35.37	-26.97
7206V	52.5	45.7	37.36	6.51	35	9.5	1	52.87	46.07	74	54	-21.13	-7.93
7206H*	47.3	34.8	37.36	6.51	35	9.5	1	47.67	35.17	74	54	-26.33	-18.83
9608*	45.6	32.7	38.1	7.7	35	9.5	1	47.9	35	74	54	-26.1	-19
12010*	48.2	35.3	39.29	8.6	35	9.5	1	52.59	39.69	74	54	-21.41	-14.31
14412*	49.5	37.6	40.86	9.9	35	9.5	1	56.76	44.86	74	54	-17.24	-9.14
16814*	51.9	39.3	43.39	11.26	35	9.5	1	63.05	50.45	74	54	-10.95	-3.55
19216*	51.6	39.2	32.11	12.38	35	9.5	1	52.59	40.19	74	54	-21.41	-13.81
21618*	55.3	42.9	32.5	13.42	35	9.5	1	57.72	45.32	74	54	-16.28	-8.68
24020*	55.9	43.2	32.43	14.45	35	9.5	1	59.28	46.58	74	54	-14.72	-7.42

*** Measured noise floor (worse case vertical)**
NOTE: MEASURED HORIZONTAL (H) AND VERTICAL (V)
DIST: Correction to extrapolate reading to 3m specification distance
1.0M measurement distance= **-9.5dB**
AF: Antenna Factor
ANTENNA: EMCO, 3115, S/N:2238 & ARA, MWH-1826/B, S/N:1013
AMP: Pre-amp gain
PRE-AMP: HP 8449B, S/N:3710A00205
CL: Cable loss (17ft)
HPF: FSY High pass filter insertion loss (4.57GHz; S/N:003)

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

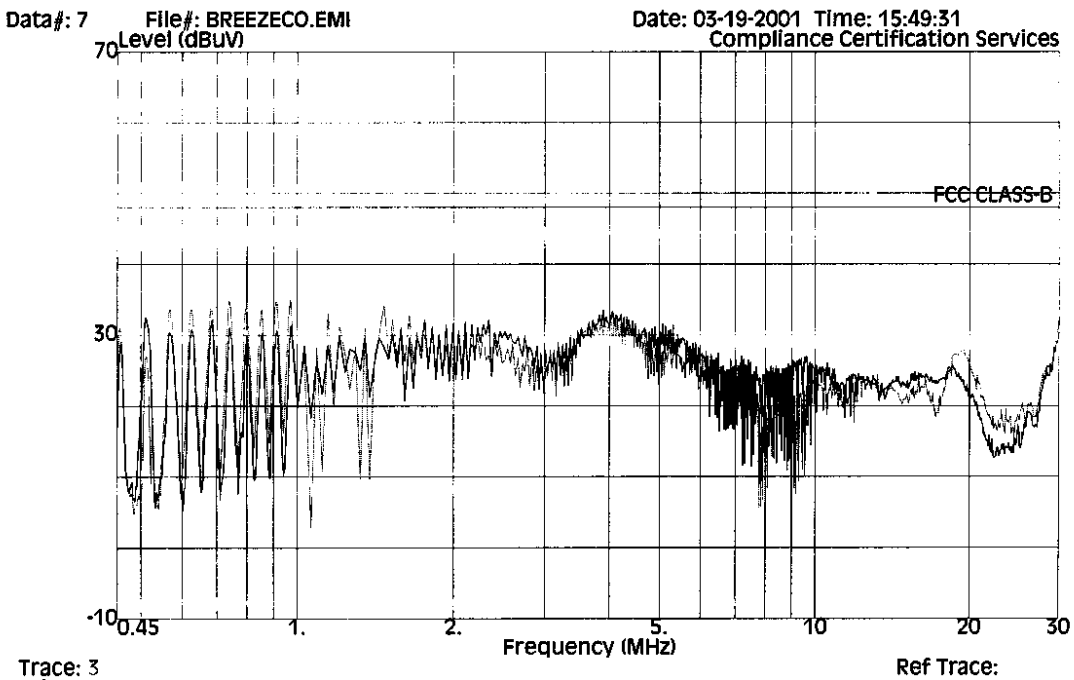
Test Procedure

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 sheet below.

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



Trace: 3 Ref Trace:
Project No. :
Report No. : 010319LC
Test Engr : KERWIN CORPUZ
Company : BREEZECOM
EUT Description : 2.4 GHz FHSS, S/N:01429
Model : SU-R
EUT Config. : EUT with POWER ADAPTOR
Type of Test : FCC Class B
Mode of Operation: NORMAL HOPPING
: Peak: L1(Green), L2(Black)
: 115Vac, 60Hz

Minimum 20 dB Bandwidth for FHSS
Test Requirement: 15.247

Measurement Equipment Used:

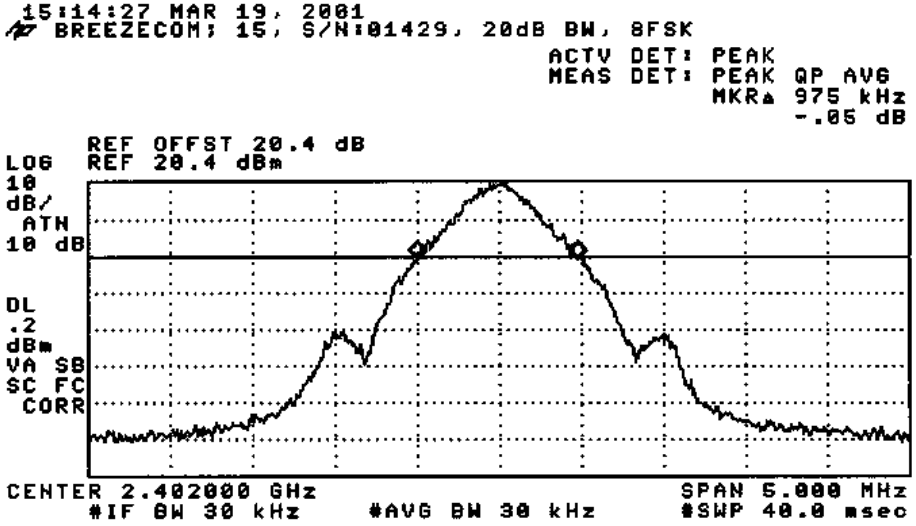
HP 8593EM Spectrum Analyzer
6' length low loss coaxial cable

Test Procedures

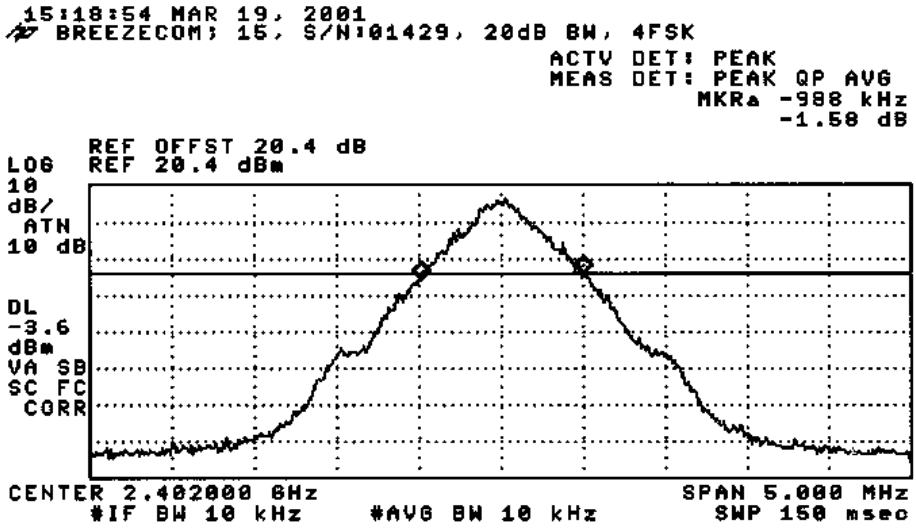
The EUT was configured on a test bench. The EUT's hopping function was stopped, transmission was continuous at 2.400 GHz (LOW channel). While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission occupied bandwidth.

Test Results: Refer to attached spectrum analyzer charts. Data taken with RES BW of 30 kHz shows 20 dB BW of 988 kHz, below the 1 MHz limit in the Rules.

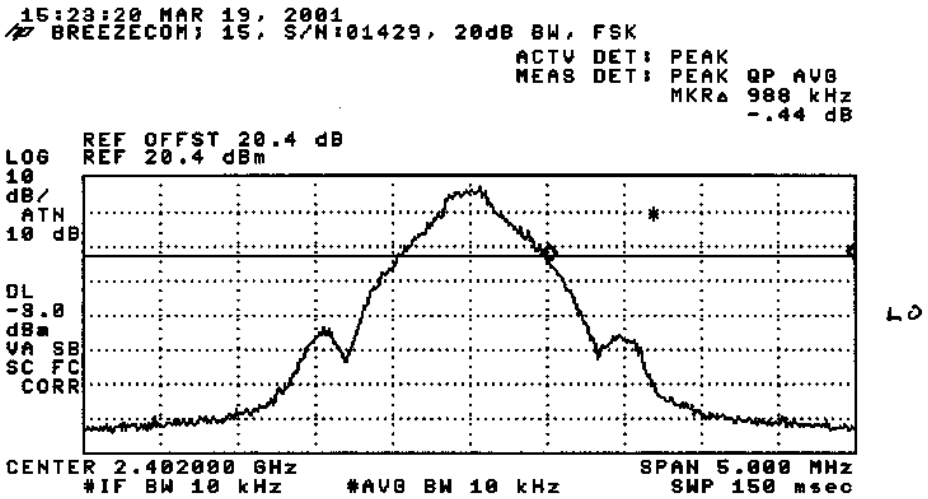
15.247 Minimum 20 dB FHSS Channel Bandwidth

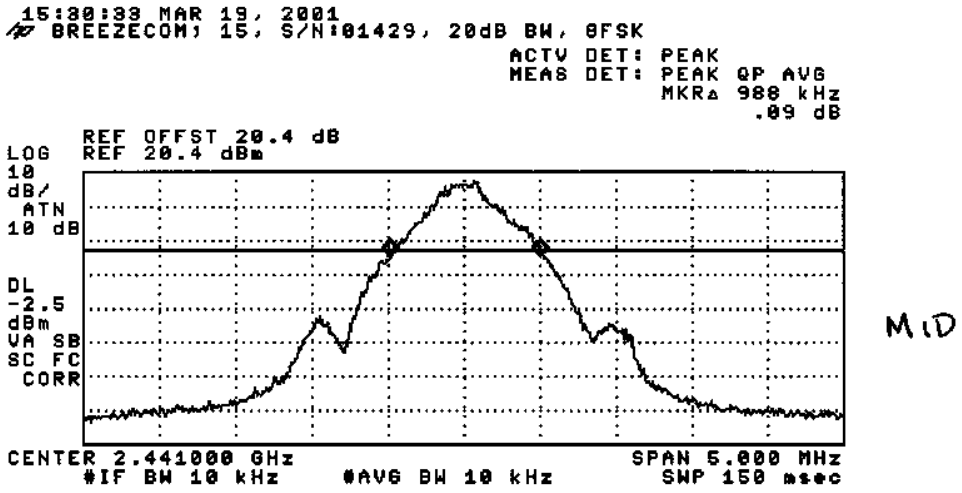


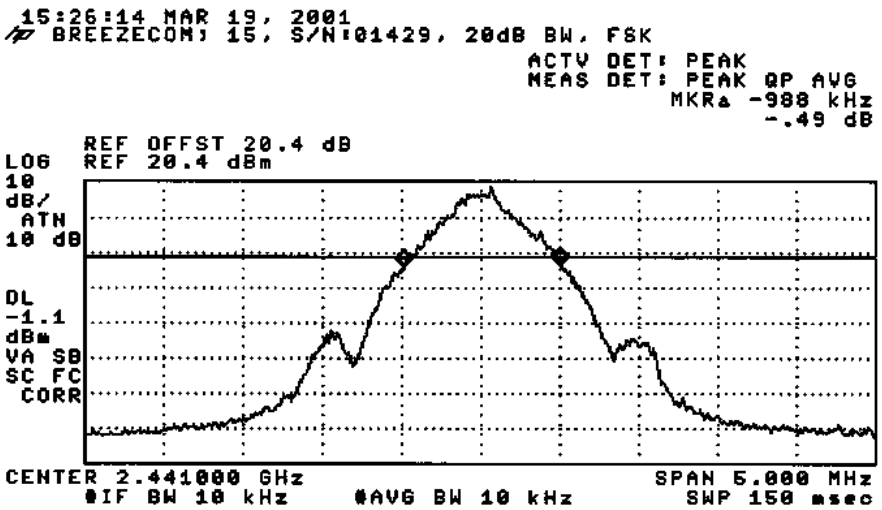
Lo



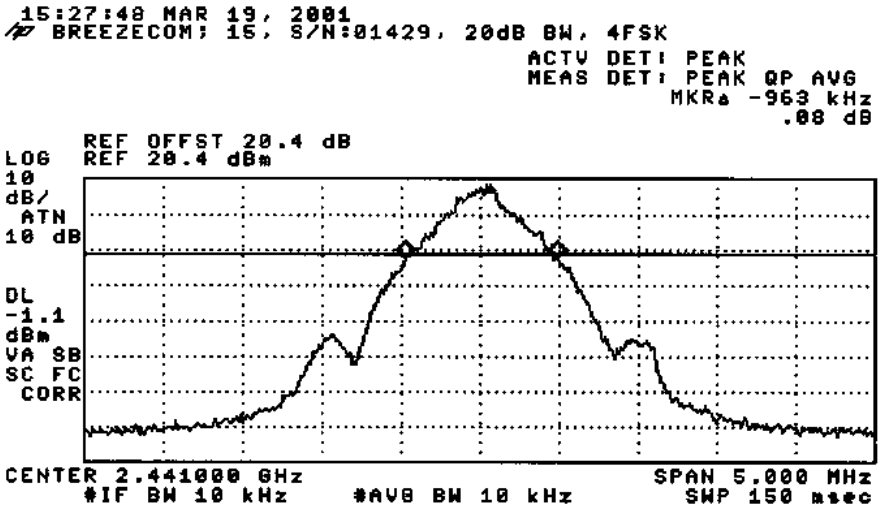
Lo


15:23:20 MAR 19, 2001
BREEZECOM; 15, S/N:01429, 20dB BW, FSK
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 988 kHz
-.44 dB
REF OFFST 20.4 dB
LOG REF 20.4 dBm
10
dB/
ATN
10 dB
DL
-3.0
dBm
VA SB
SC FC
CORR
CENTER 2.402000 GHz
SPAN 5.000 MHz
#IF BW 10 kHz
#AVG BW 10 kHz
SWP 150 msec
LO

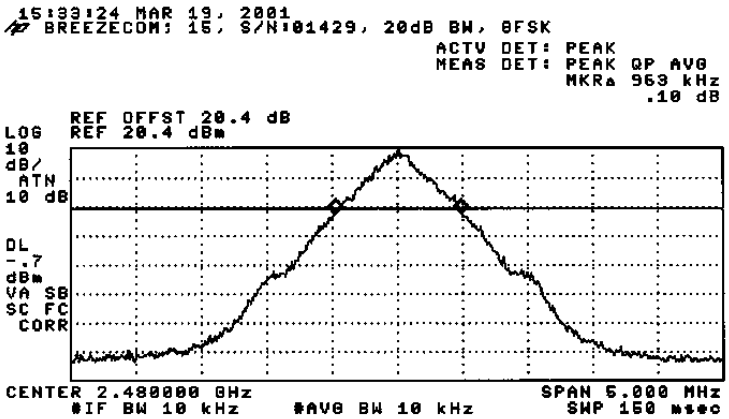

15:30:33 MAR 19, 2001
BREEZECOM; 15, S/N:01429, 20dB BW, 8FSK
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 988 kHz
.09 dB
REF OFFST 20.4 dB
LOG REF 20.4 dBm
10
dB/
ATN
10 dB
DL
-2.5
dBm
VA SB
SC FC
CORR
CENTER 2.441000 GHz
SPAN 5.000 MHz
#IF BW 10 kHz
#AVG BW 10 kHz
SWP 150 msec
MID

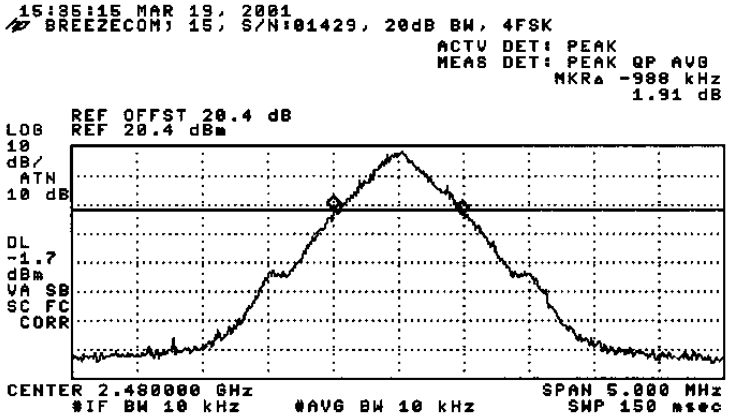

15:26:14 MAR 19, 2001
BREEZECOM; 15, S/N:01429, 20dB BW, FSK
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRa -988 kHz
-.49 dB
REF OFFST 20.4 dB
LOG REF 20.4 dBm
10 dB/
ATN 10 dB
DL -1.1 dBm
VA SB
SC FC
CORR
CENTER 2.441000 GHz
SPAN 5.000 MHz
#IF BW 10 kHz
#AVG BW 10 kHz
SWP 150 msec

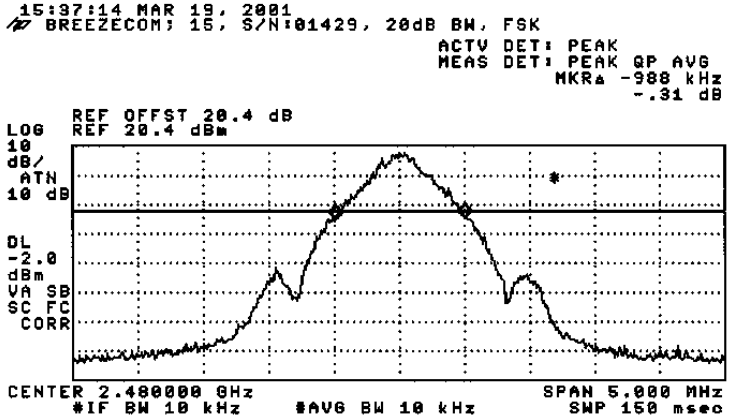
MID


15:27:48 MAR 19, 2001
BREEZECOM; 15, S/N:01429, 20dB BW, 4FSK
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRa -963 kHz
.08 dB
REF OFFST 20.4 dB
LOG REF 20.4 dBm
10 dB/
ATN 10 dB
DL -1.1 dBm
VA SB
SC FC
CORR
CENTER 2.441000 GHz
SPAN 5.000 MHz
#IF BW 10 kHz
#AVG BW 10 kHz
SWP 150 msec

MID


15:33:24 MAR 19, 2001
BREEZECOM; 15; S/N:01429, 20dB BW, 8FSK
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 963 kHz
.10 dB
REF OFFST 20.4 dB
LOG
10
dB/
ATN
10 dB
REF 20.4 dBm
DL
-.7
dBm
VA SB
SC FC
CORR
CENTER 2.480000 GHz
SPAN 5.000 MHz
#IF BW 10 kHz
#AVG BW 10 kHz
SWP 150 msec


15:35:15 MAR 19, 2001
BREEZECOM; 15; S/N:01429, 20dB BW, 4FSK
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -988 kHz
1.91 dB
REF OFFST 20.4 dB
LOG
10
dB/
ATN
10 dB
REF 20.4 dBm
DL
-1.7
dBm
VA SB
SC FC
CORR
CENTER 2.480000 GHz
SPAN 5.000 MHz
#IF BW 10 kHz
#AVG BW 10 kHz
SWP 150 msec


15:37:14 MAR 19, 2001
BREEZECOM; 15; S/N:01429, 20dB BW, FSK
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -988 kHz
-.31 dB
REF OFFST 20.4 dB
LOG
10
dB/
ATN
10 dB
REF 20.4 dBm
DL
-2.0
dBm
VA SB
SC FC
CORR
CENTER 2.480000 GHz
SPAN 5.000 MHz
#IF BW 10 kHz
#AVG BW 10 kHz
SWP 150 msec

RF Power Output
Test Requirement: 15.247

Measurement Equipment Used:

HP 8593EM Spectrum Analyzer
2 ft length low loss A coaxial RF cable

Test Procedures

1. The EUT was configured on a test bench. The cable was connected between the EUT antenna port and the spectrum analyzer input port.

The EUT's hopping function was stopped, transmission was continuous at the LOW channel. While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission.

2. The process in (1) was repeated for MID channel and HIGH channel.

Test Results

Power level readings converted to dBm are shown below.

Channel	Frequency, MHz	Output Power, dBm	Limit, dBm
Low	2402	27.0	30.0
Mid	2445	27.0	30.0
High	2778	27.4	30.0

Maximum output power output is within design maximum 27.5 dBm, ± 0.5 dB.

Out of Band Measurements
Test Requirement: 15.247

Measurement Equipment Used:

HP 8593EM Spectrum Analyzer
2 ft length low loss A coaxial RF cable

Test Procedure

1. The EUT was configured on a test bench. The cable was connected between the EUT antenna port and the spectrum analyzer input port.

Spectrum analyzer RES BW was set to 100 kHz. The EUT's hopping function was stopped, transmission was continuous at the LOW channel. While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission.

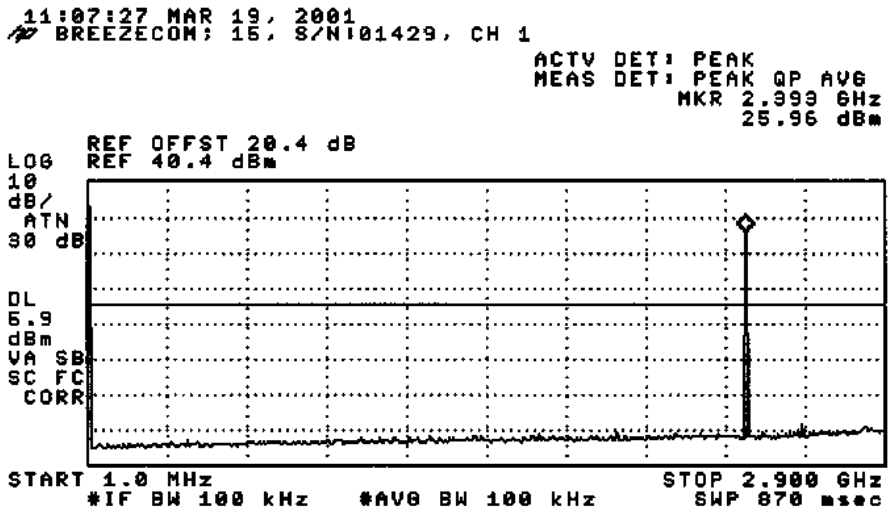
Readings were taken out to 10fo.

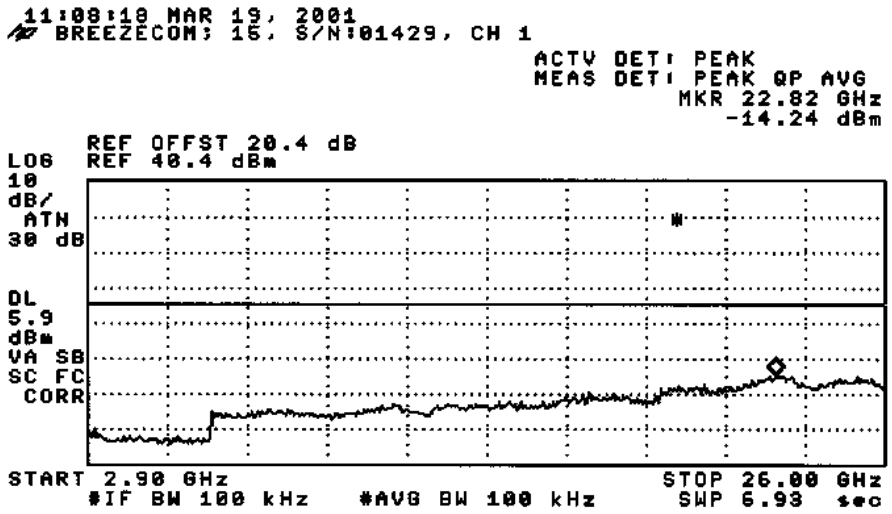
2. The process in (1) was repeated for MID channel and HIGH channel.

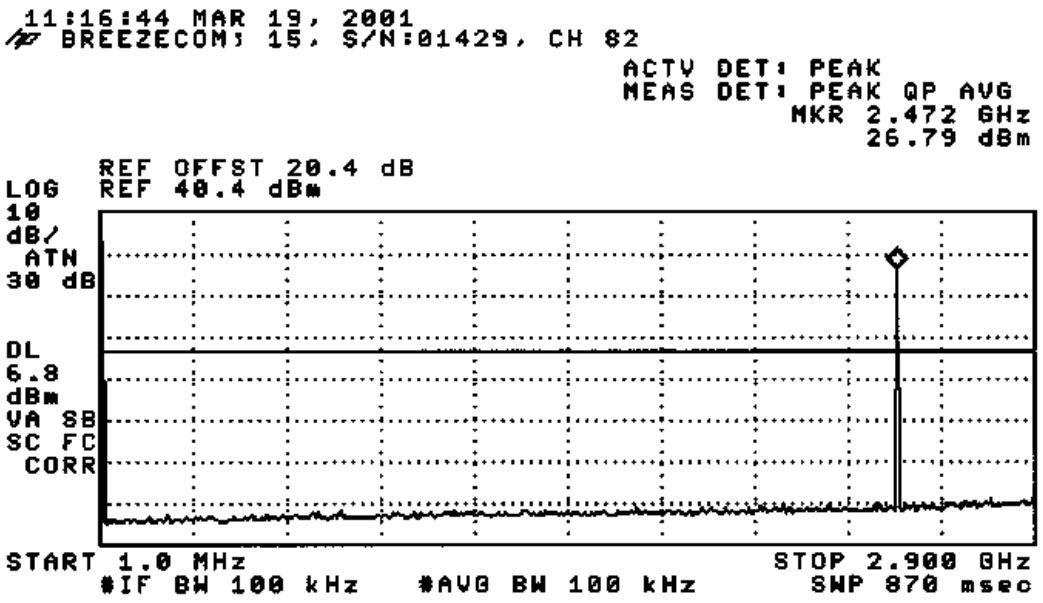
Test Results

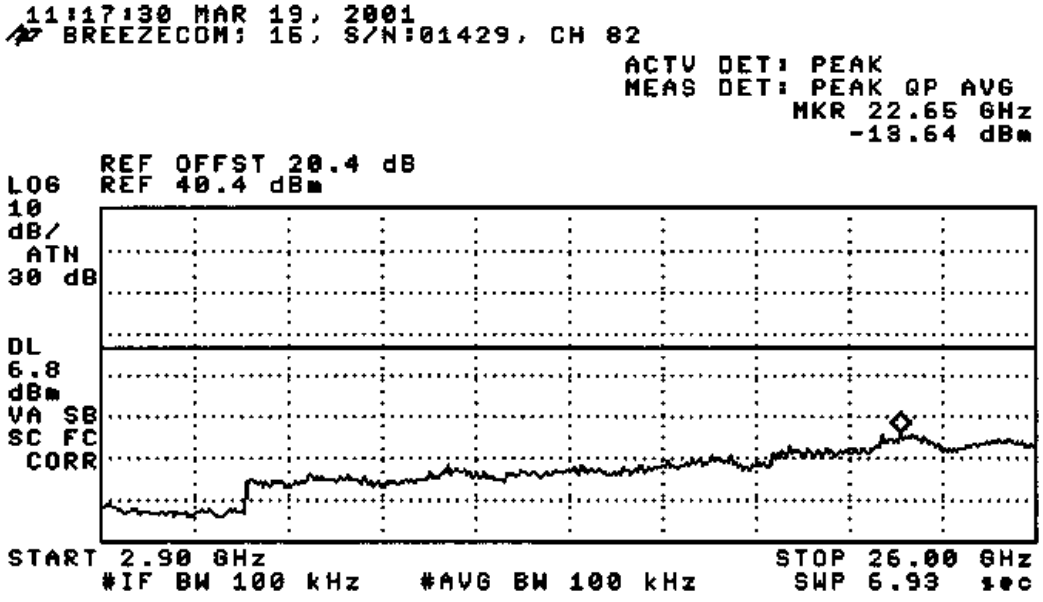
Refer to attached data sheets. Data shows out of band emissions are suppressed well below the -20 dBc minimum required by the Rules.

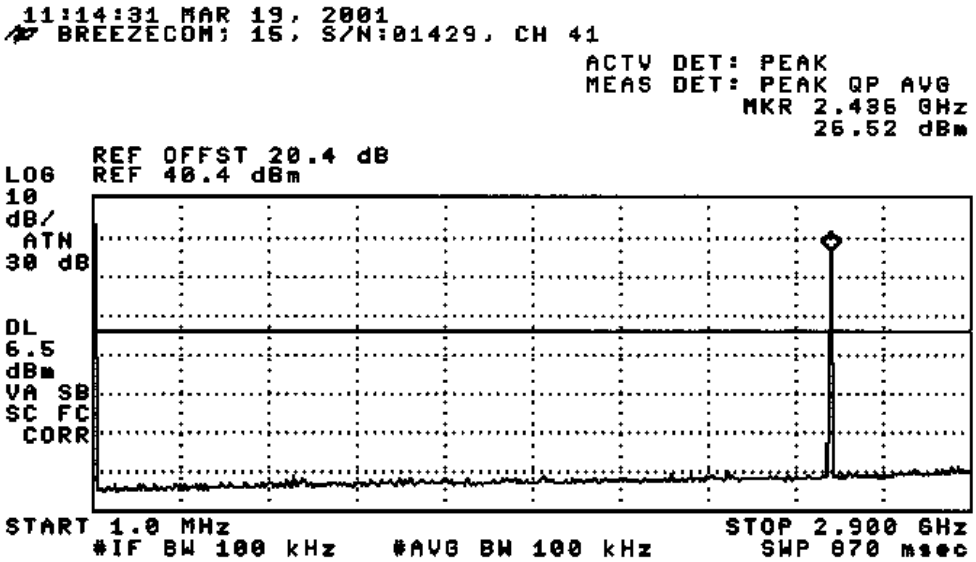
15.247 Spurious Emissions, Antenna conducted

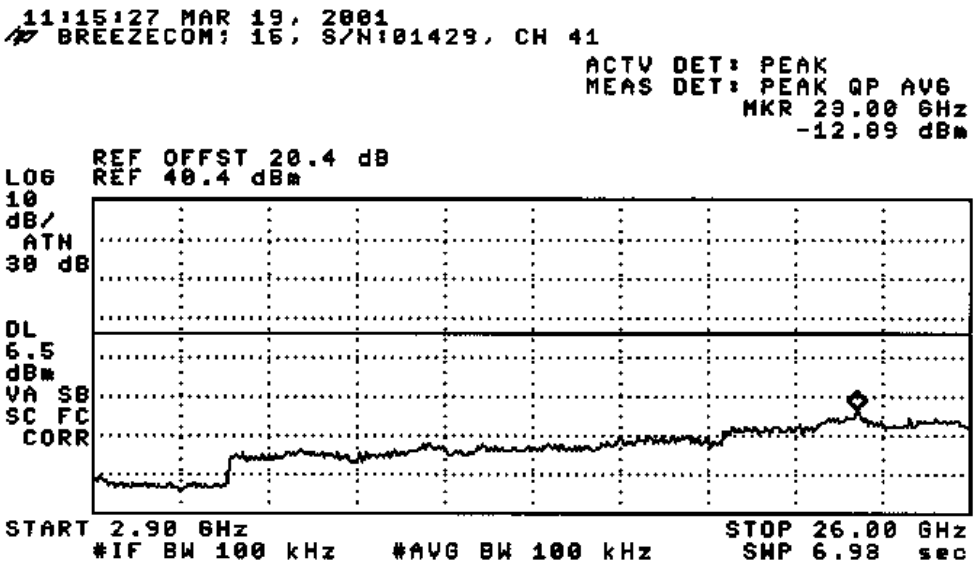

11:07:27 MAR 19, 2001
BREEZECOM; 15, S/N:01429, CH 1
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.399 GHz
25.96 dBm
REF OFFST 20.4 dB
LOG
10
dB/
ATN
30 dB
REF 40.4 dBm
DL
5.9
dBm
VA SB
SC FC
CORR
START 1.0 MHz
STOP 2.900 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
SWP 870 msec


11:08:18 MAR 19, 2001
BREEZECOM; 15, S/N:01429, CH 1
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 22.82 GHz
-14.24 dBm
REF OFFST 20.4 dB
LOG
10
dB/
ATN
30 dB
REF 40.4 dBm
DL
5.9
dBm
VA SB
SC FC
CORR
START 2.90 GHz
STOP 26.00 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
SWP 6.93 sec


11:16:44 MAR 19, 2001
BREEZECOM; 15; S/N:01429, CH 82
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.472 GHz
26.79 dBm
REF OFFST 20.4 dB
LOG REF 40.4 dBm
10
dB/
ATN
30 dB
DL
6.8
dBm
VA SB
SC FC
CORR
START 1.0 MHz
STOP 2.900 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
SWP 870 msec


11:17:30 MAR 19, 2001
BREEZECOM; 15; S/N:01429, CH 82
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 22.65 GHz
-13.64 dBm
REF OFFST 20.4 dB
LOG REF 40.4 dBm
10
dB/
ATN
30 dB
DL
6.8
dBm
VA SB
SC FC
CORR
START 2.90 GHz
STOP 26.00 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
SWP 6.93 sec


11:14:31 MAR 19, 2001
BREEZECOM; 15, S/N:01429, CH 41
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.486 GHz
26.52 dBm
REF OFFST 20.4 dB
LOG REF 40.4 dBm
10
dB/
ATN
30 dB
DL
6.5
dBm
VA SB
SC FC
CORR
START 1.0 MHz
STOP 2.900 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
SWP 870 msec


11:15:27 MAR 19, 2001
BREEZECOM; 15, S/N:01429, CH 41
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 23.00 GHz
-12.09 dBm
REF OFFST 20.4 dB
LOG REF 40.4 dBm
10
dB/
ATN
30 dB
DL
6.5
dBm
VA SB
SC FC
CORR
START 2.90 GHz
STOP 26.00 GHz
#IF BW 100 kHz
#AVG BW 100 kHz
SWP 6.98 sec

Minimum Number of Hopping Channels
Test Requirement: 15.247(a)(1)(ii)

Measurement Equipment Used:

HP 8593EM Spectrum Analyzer
2 ft length low loss A coaxial RF cable

Test Procedure

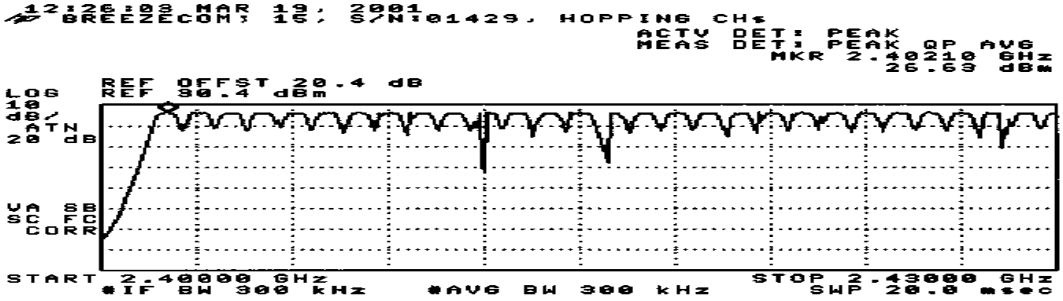
The EUT was set to transmit in normal hopping mode. The spectrum analyzer was set to MAX HOLD and swept continuously for 5 - 10 minutes so as to capture all the hopping channels.

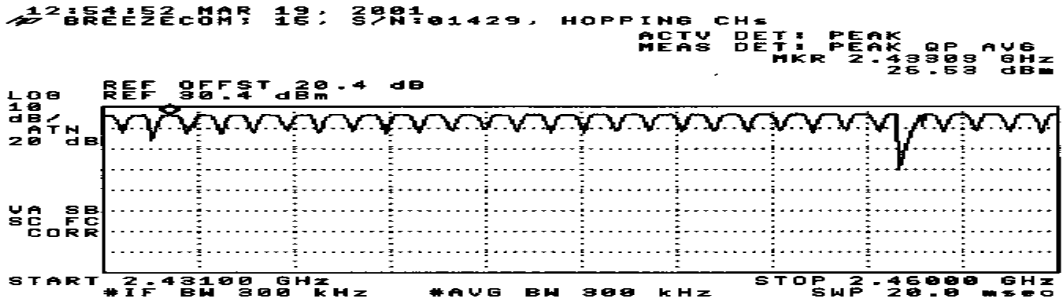
Test Results

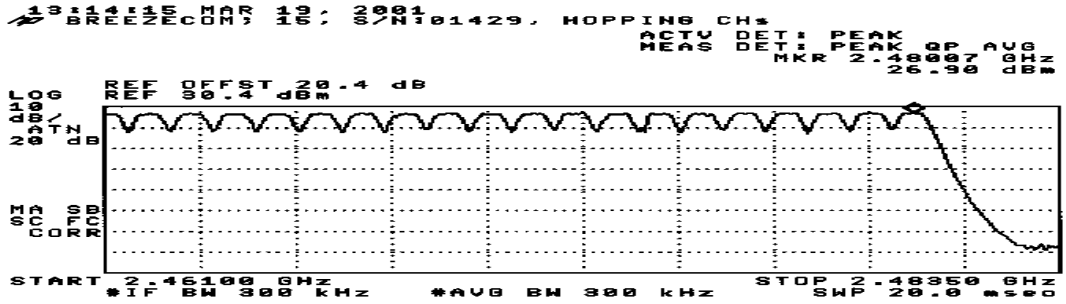
A total of 79 hopping channels were counted. This corresponds to design. Refer to attached data sheet.

NOTE: For operation in the United States, channel hopset will be between Ch 2 - Ch 78, in order to meet emissions limits in paragraphs 15.205 and 15.209 at the bandedges.

15.247(a)(1)(ii) Minimum number of hopping channels







Average Time of Channel Occupancy
Test Requirement: 15.247

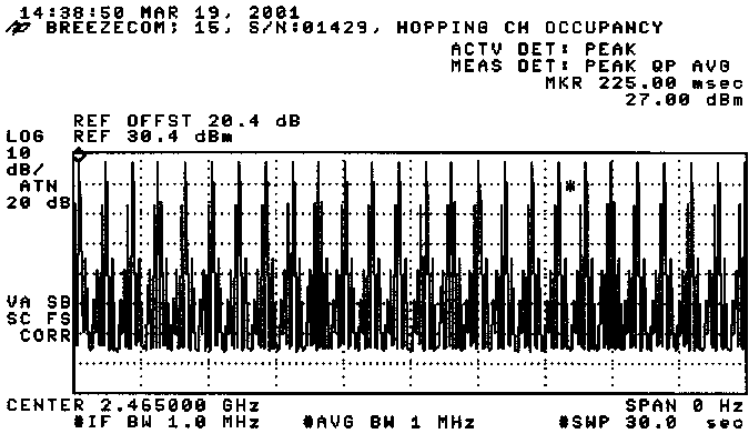
Measurement Equipment Used:

HP 8593EM Spectrum Analyzer
2 ft length low loss A coaxial RF cable

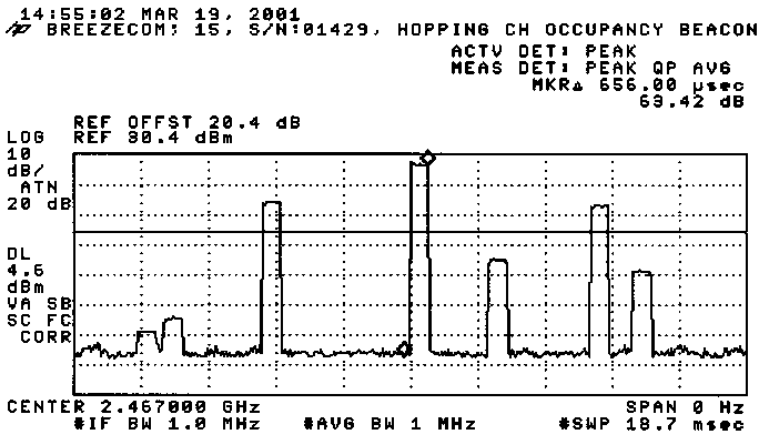
Test Procedure

1. The EUT was set to transmit in normal hopping mode.
2. The analyzer was center tuned to 2465 MHz. Analyzer frequency SPAN was set to ZERO SPAN. SWEEP TIME was set to 30 seconds, MAX HOLD function was engaged.
3. A total of 10 different 30 second sweeps were performed and the maximum time of channel occupancy was determined by the maximum number of transmissions detected in any 30 second period, times the duration of each transmission.

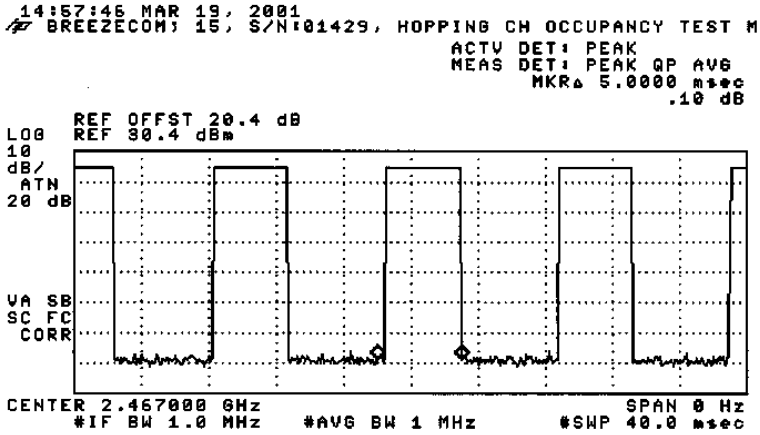
Test Results
Maximum channel occupancy time was determined to be 6.8 msec x 26 hits/30sec = 176.8 msec, well below the 400 msec (0.4 sec) maximum allowed. Refer to attached spectrum analyzer charts.



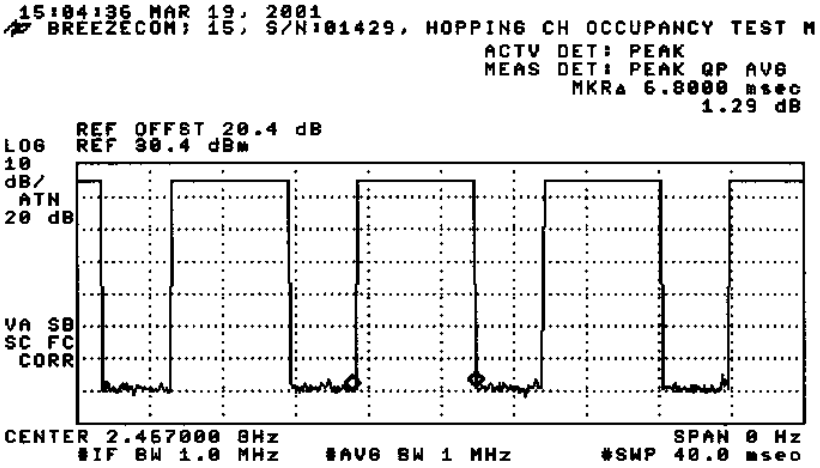
26 hits/30 sec



FSK



8fsk


15:04:36 MAR 19, 2001
BREEZECOM; 15, S/N:01429, HOPPING CH OCCUPANCY TEST M
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 6.8000 msec
1.29 dB
REF OFFST 20.4 dB
LOG REF 30.4 dBm
10
dB/
ATN
20 dB
VA SB
SC FC
CORR
CENTER 2.467000 GHz
SPAN 0 Hz
#IF BW 1.0 MHz
#AVG BW 1 MHz
#SWP 40.0 msec

4FSK

RF Exposure (MPE) Calculations

Applicant: Breezecom Ltd.
FCC ID: LKT-SUR-24
2.4 GHz Frequency Hopping Spread Spectrum

RF Hazard Distance Calculation

mW/cm2 from Table1: 1.00

Max RF Power P, dBm	TX Antenna G, dBi	MPE Safe Distance, cm
27.4	**7.0**	**14.8**

Basis of Calculations:

E^2/3770 = S, mW/cm2
E, V/m = (Pwatts*Ggain*30)^.5/d, meters
d = ((Pwatts*G*30)/3770*S))^0.5 Pwatts*Ggain = 10^(PdBm-30+GdBi)/10)

NOTE: For mobile or fixed location transmitters, minimum separation distance is 20 cm, even if calculations indicate MPE distance is less

*Worst case antenna : Huber-Shuner SPA 2400/75/9/0/V (Breezecom model UNI-8.5 dBi).

As stated previously, this antenna has a permanently attached cable with 1.5 dB loss at 2400 MHz. The effective antenna gain is therefore 8.5 dBi - 1.5 dB = 7.0 dBi.