

KTL Test Report: 8R01318.1

Applicant: GN Netcom Inc.
77 North Eastern Blvd.
Nashua, New Hampshire
03062
USA

**Equipment Under Test:
(E.U.T.)** 2.4 GHz Frequency Hopping Wireless
Telephone Headset

FCC ID: BCE-ELLIPSE24

In Accordance With: **FCC Part 15, Subpart C**
Frequency Hopping Transmitters
2400 - 2483.5 MHz

Tested By: KTL Ottawa Inc.
3325 River Road, R.R. 5
Ottawa, Ontario K1V 1H2

Authorized By:

T. Tidwell, Laboratory Manager

Date:

Total Number of Pages: 62

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EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 1. Summary of Test Results

Manufacturer: KIRK Telecom A/S

Model No.: ELLIPSE

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 for Frequency Hopping Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

- | | | | | | | |
|--|----------------------------|-------------------------------------|---------------------|----------------|--------------------------|----------------|
| <input checked="" type="checkbox"/> | New Submission | <input checked="" type="checkbox"/> | Production Unit | | | |
| <input type="checkbox"/> | Class II Permissive Change | <input type="checkbox"/> | Pre-Production Unit | | | |
| <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>D</td><td>S</td><td>S</td></tr></table> | D | S | S | Equipment Code | <input type="checkbox"/> | Family Listing |
| D | S | S | | | | |

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



NVLAP LAB CODE: 100351-0

TESTED BY: _____ DATE: _____
Kevin Carr, Technologist

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EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT	
				BASE	HEADSET
Powerline Conducted Emissions	15.207(a)	48 dB μ V	Plot	Complies	Complies
Channel Separation	15.247(a)(1)	Greater of 25 kHz or 20 dB Bandwidth	967 kHz	Complies	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	15.247(a)(1)	Chart	Customer Supplied Data	Complies
Time of Occupancy	15.247(a)(1)(ii)	\leq 0.4 sec in 30 sec	Plot	Complies	Complies
20 dB Occupied Bandwidth	15.247(a)(1)	\leq 1 MHz	Plots	Complies	Complies
Peak Power Output	15.247(b)	1 Watt			
Spurious Emissions (Antenna Conducted)	15.247(c)	-20 dBc	Plots	Complies	Complies
Spurious Emissions (Radiated)	15.247(c)	Table 15.209(a)	Table	Complies	Complies

Footnotes For N/A's:

Test Conditions:

Indoor Temperature: 22 °C
 Humidity: 23 %

Outdoor Temperature: 10 °C
 Humidity: 23 %

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Range:	2400-2483.5
Tunable Bands:	1
Number of Channels:	79
Channel Spacing:	1.033570 MHz
Emissions Designator:	Not Applicable
User Frequency Adjustment:	Software Controlled

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FCC PART 15, SUBPART C
FREQUENCY HOPPING TRANSMITTERS
PROJECT NO.: 8R01318.1

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Description of Modification for Modification Filing

NOT APPLICABLE

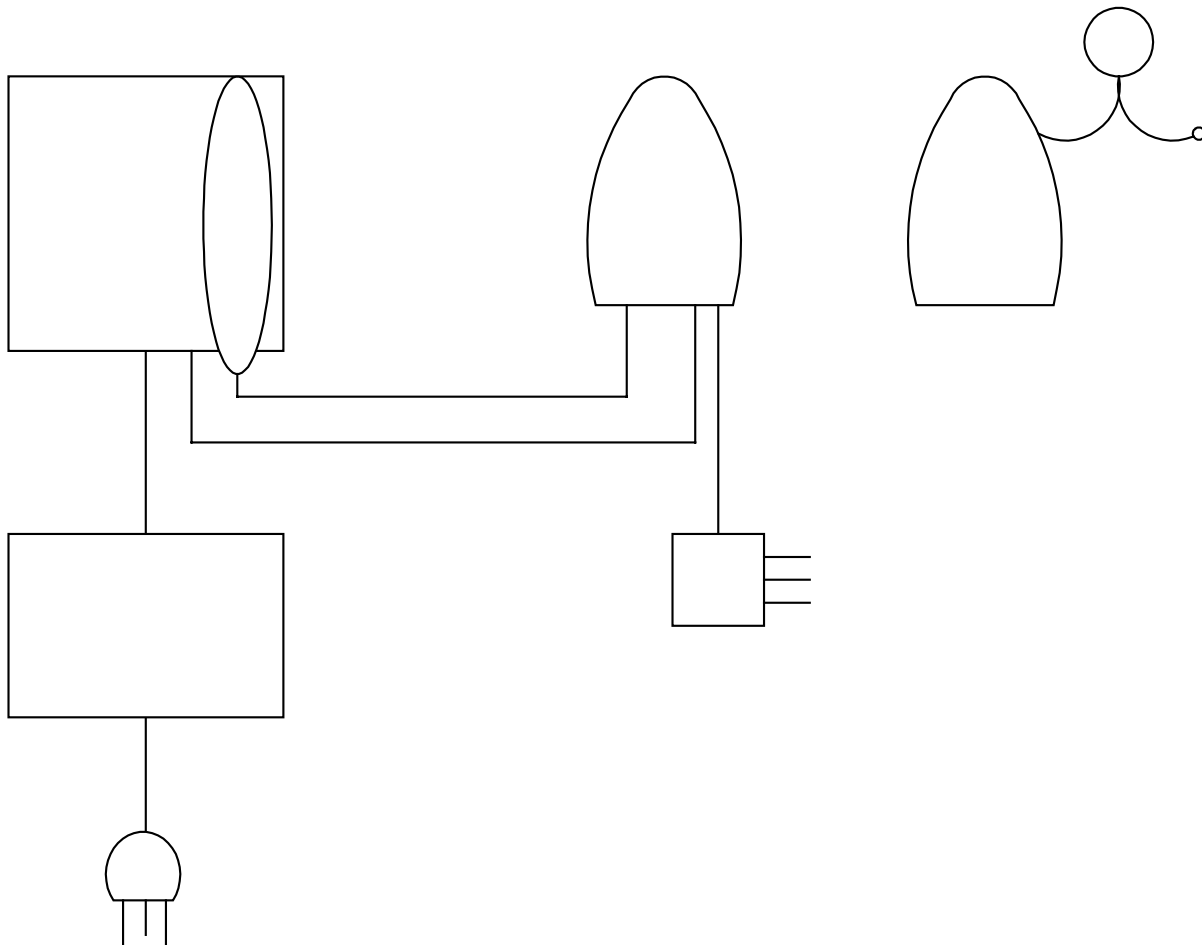
Family List Rational

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Theory of Operation

The MARS system is a frequency hopping cordless headset, operating in the 2.4 GHz to 2.4835 GHz band. The system works in conjunction with a hardwired telephone set. The system allows the operator to be in wireless communications with an already existing telephone set. The headset does not have any dial out capabilities of it's own and does not connect to a telephone line in.

System Diagram



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Kevin Carr	DATE: March 1, 1999

Test Results: Complies. See attached graph.

Measurement Data: See attached graph.

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset

FCC ID: BCE-ELLIPSE24

Measurement Data:

Conductor	Frequency (MHz)	CISPR (dBµV)	Average (dBµV)	BB/NB	BB Correction (dB)	Result (dBµV)

NOT APPLICABLE

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FCC PART 15, SUBPART C
FREQUENCY HOPPING TRANSMITTERS
PROJECT NO.: 8R01318.1

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

INSERT POWERLINE CONDUCTED EMISSIONS GRAPHS

KTL Ottawa

FCC PART 15, SUBPART C
FREQUENCY HOPPING TRANSMITTERS
PROJECT NO.: 8R01318.1

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset

FCC ID: BCE-ELLIPSE24

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Powerline Conducted Emissions Photographs

Front View



Side View



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 4. Channel Separation

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
TESTED BY: Kevin Carr	DATE: March 2, 1999

Test Results: Complies.

Measurement Data: Measured 20 dB bandwidth: 0.967 MHz
Channel Separation:

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 5. Pseudorandom Hopping Algorithm

NAME OF TEST: Pseudorandom Hopping Algorithm	PARA. NO.: 15.247(a)(1)
TESTED BY: Kevin Carr	DATE: March 2, 1999

Test Results: Complies.

Measurement Data: Number of Hopping Frequencies: 79
 Number of Hopping Patterns:

Hopping Sequence For North America And Most Of Europe

Frequency: $2400.983 + CN * 1.033570$ MHz

i	f(i)	i	f(i)	i	f(i)	i	f(i)	i	f(i)	i	f(i)	i	f(i)	i	f(i)
0	0	10	76	20	18	30	34	40	14	50	20	60	48	70	55
1	23	11	29	21	11	31	66	41	57	51	73	61	15	71	35
2	62	12	59	22	36	32	7	42	41	52	64	62	5	72	53
3	8	13	22	23	72	33	68	43	74	53	39	63	17	73	24
4	43	14	52	24	54	34	75	44	32	54	13	64	6	74	44
5	16	15	63	25	69	35	4	45	70	55	33	65	67	75	51
6	71	16	26	26	21	36	60	46	9	56	65	66	49	76	38
7	47	17	77	27	3	37	27	47	58	57	50	67	40	77	30
8	19	18	31	28	37	38	12	48	78	58	56	68	1	78	46
9	61	19	2	29	10	39	25	49	45	59	42	69	28		

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 6. Time of Occupancy

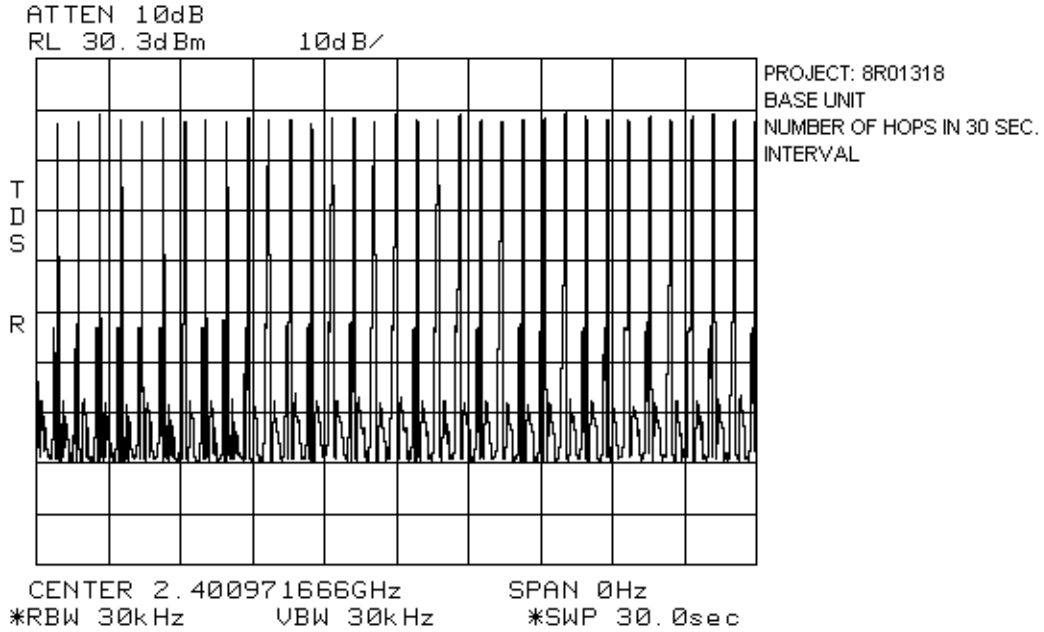
NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)
TESTED BY: Kevin Carr	DATE: March 2, 1999

Test Results: Complies.

Measurement Data: Maximum Dwell Time On Any Channel: 16.32 ms

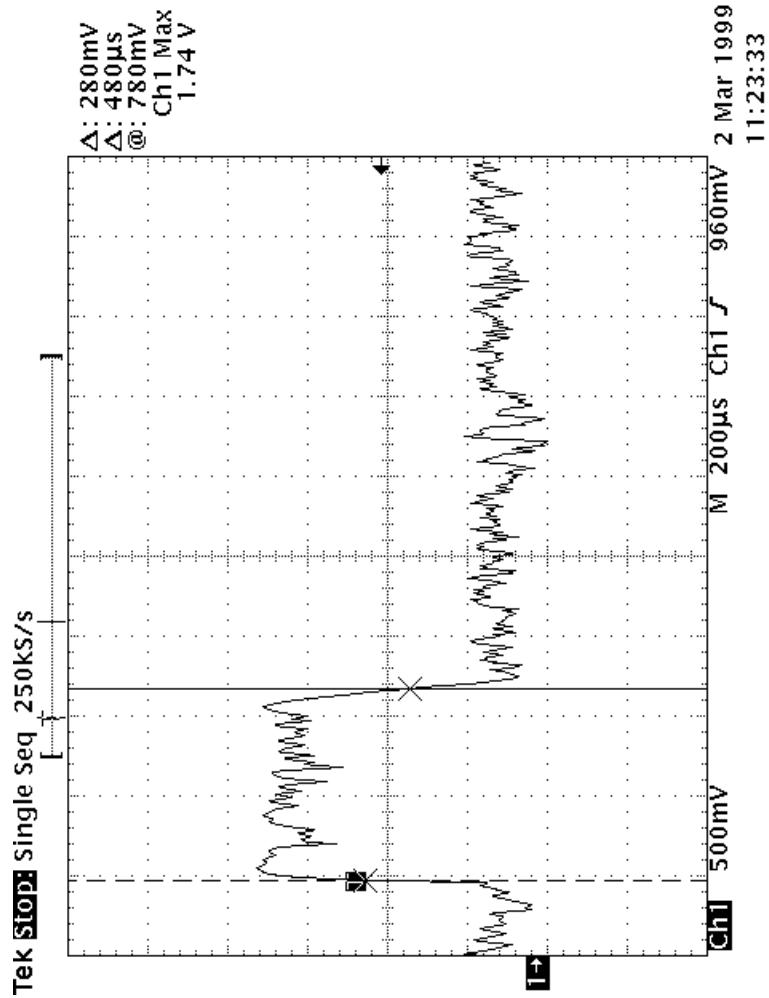
EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Time of Occupancy: Base



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Time of Occupancy: Base



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 7. Occupied Bandwidth

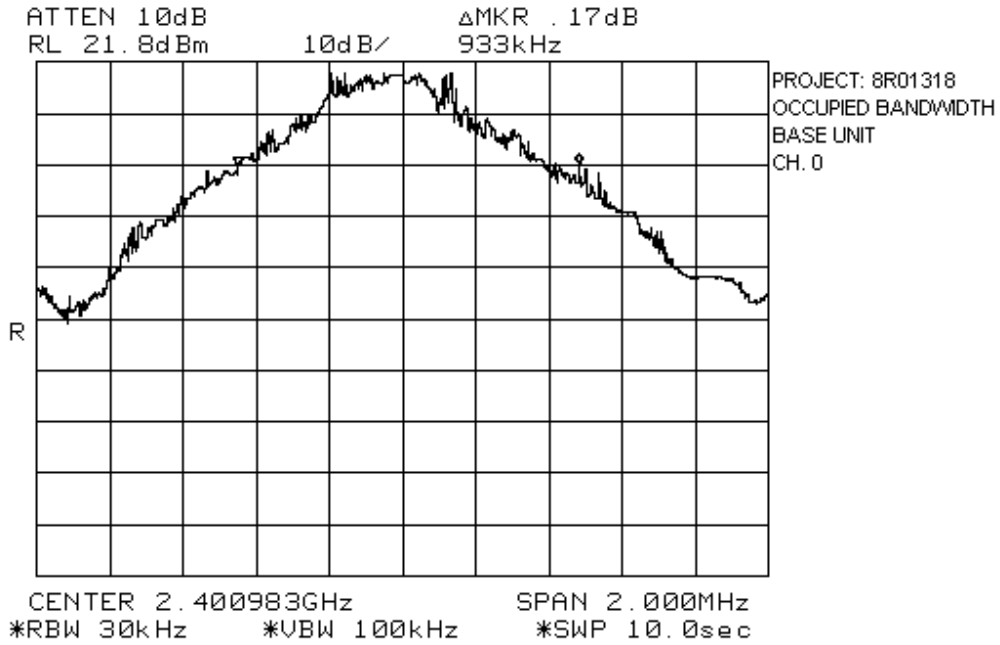
NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(1)(i)
TESTED BY: Kevin Carr	DATE: March 1, 1999

Test Results: Complies.

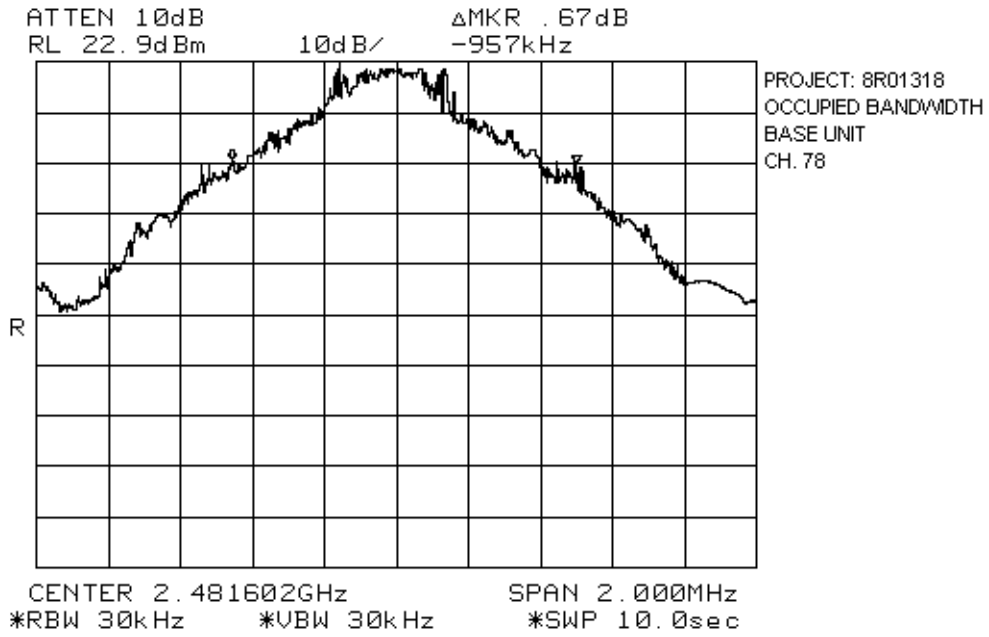
Measurement Data:

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Occupied Bandwidth: Base

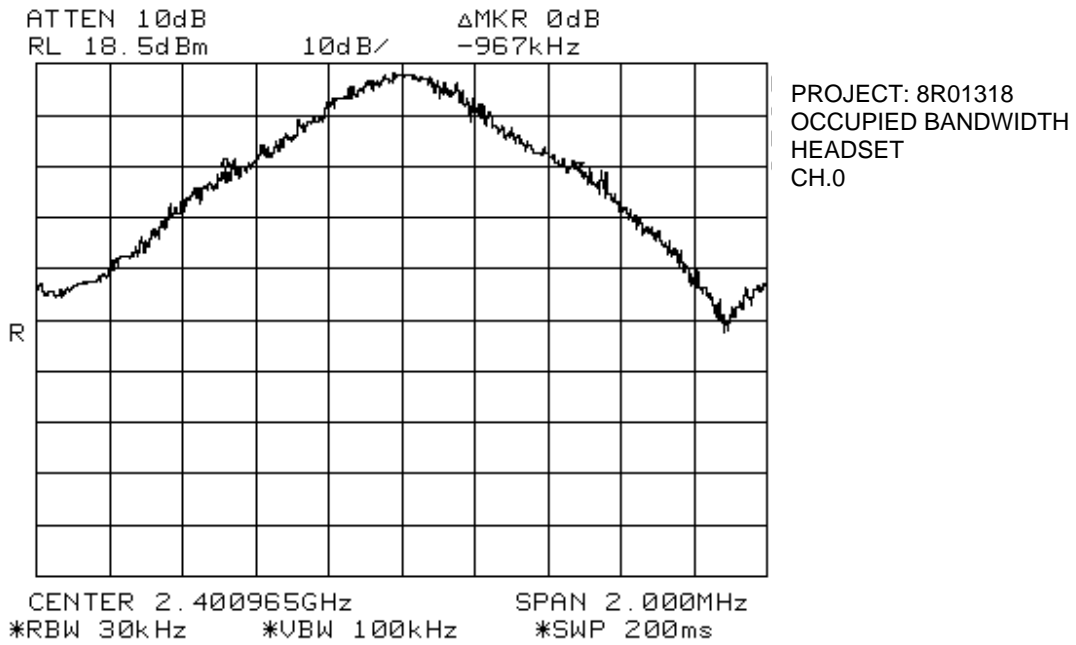


EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

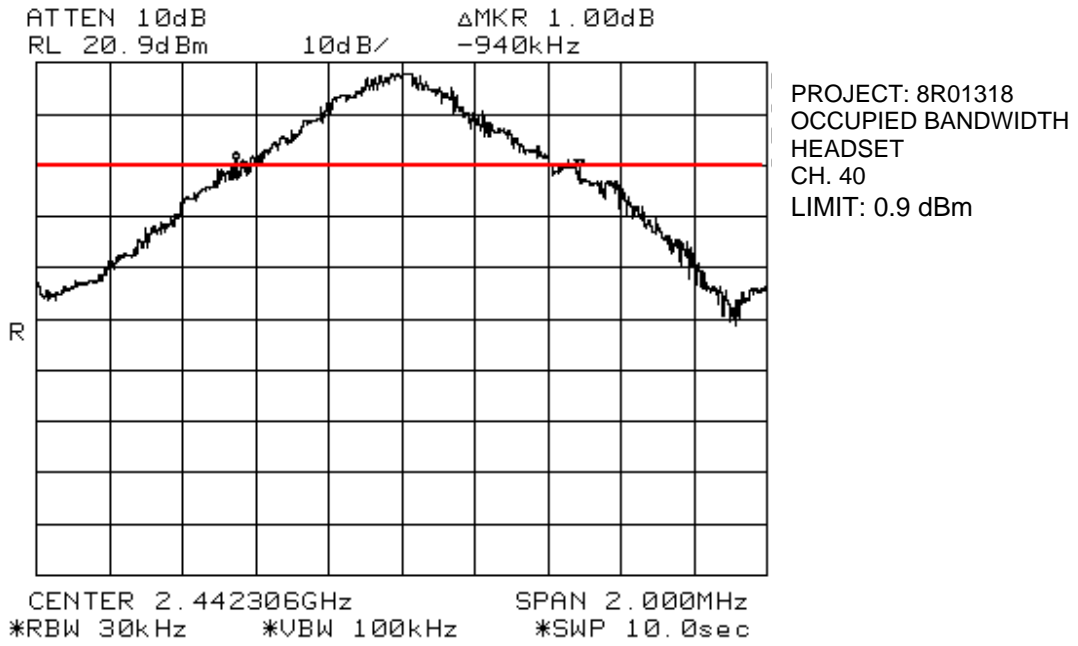


EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Occupied Bandwidth: Headset



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 8. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: Kevin Carr	DATE: March 3, 1999

Test Results: Complies. The maximum peak power output of the transmitter is 0.329 watts

Measurement Data: Detachable antenna? Yes No
If yes, state the type of non-standard connector used at the antenna port:

Directional Gain of Antenna: 0 dBi or 0 Numeric.
Peak Power Output: 0.329 watts.
Field Strength: 120.4 dB μ V/m @ 3m or 1.047 V/m @ 3m.

Antennas:

Model	Type	Manufacturer	Gain	E.I.R.P.

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
 FCC ID: BCE-ELLIPSE24

Test Data - Radiated Emissions: Carrier Peak Power

Test Distance (meters) : 3		Range: A Tower		Receiver: HP 8565E		RBW(kHz): 1MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
BASE: Antenna 0											
2400.7	H2				82.2	31.2			113.4		
2400.7	H2				86.2	31.2			117.4		
2442.3	H2				83.5	31.1			114.6		
2442.5	H2				86.8	31.1			117.9		
2481.5	H2				82.8	31.2			114.0		
2481.5	H2				87.8	31.2			119.0		
BASE: Antenna 1											
2400.8	H2				87.0	31.2			118.2		
2400.8	H2				86.3	31.2			117.5		
2442.1	H2				83.5	31.1			114.6		
2442.5	H2				84.5	31.1			115.6		
2481.2	H2				83.5	31.2			114.7		
2481.4	H2				89.2	31.2			120.4		
Headset:											
2400.7	H2				77.5	31.2			108.7		
2400.8	H2				77.3	31.2			105.5		
2442.2	H2				76.5	31.1			107.6		
2442.7	H2				78.5	31.1			109.6		
2478.8	H2				78.5	31.2			109.7		
2478.8	H2				77.8	31.2			109.0		
Notes:											
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole											
* Re-measured using dipole antenna.											
** Includes cable loss when amplifier is not used.											
*** Includes cable loss.											
() Denotes failing emission level.											

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

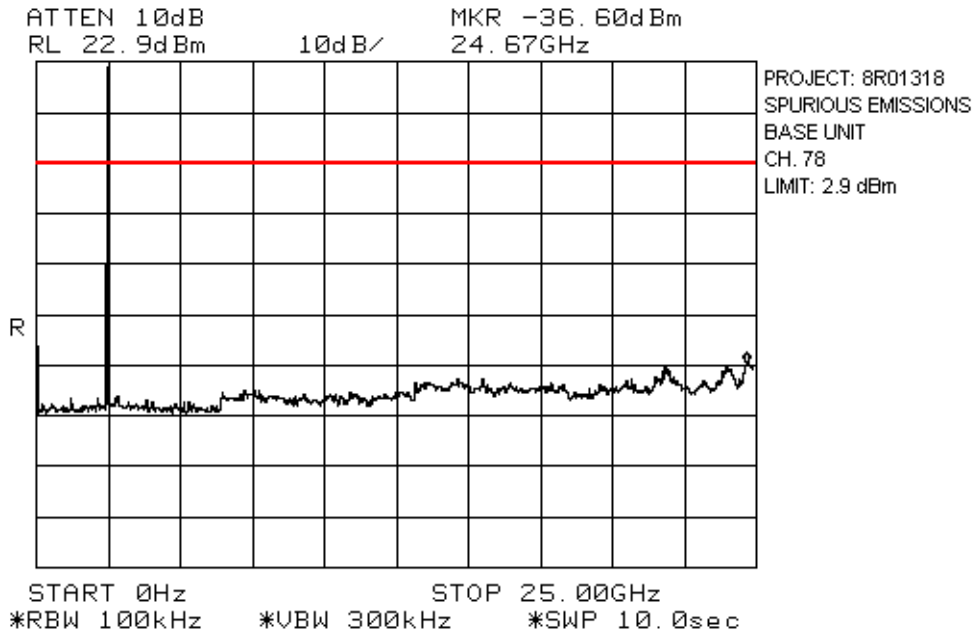
Section 9. Spurious Emissions (Antenna Conducted)

NAME OF TEST: Spurious Emissions (Antenna Conducted)	PARA. NO.: 15.247(c)
TESTED BY: Kevin Carr	DATE: March 2, 1999

Test Results: Complies.

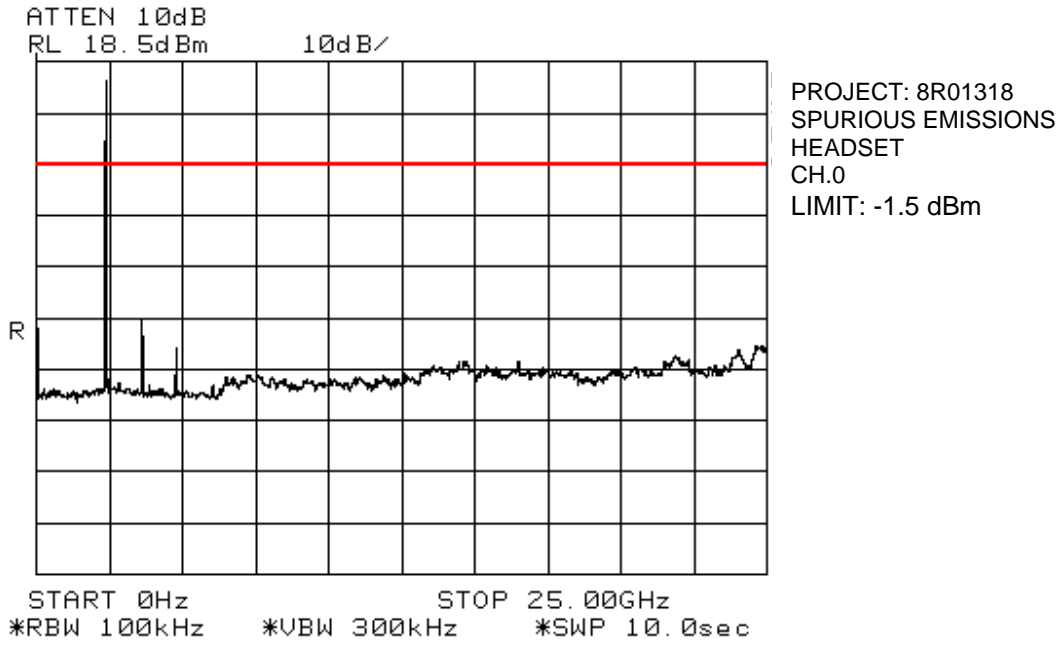
Measurement Data:

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

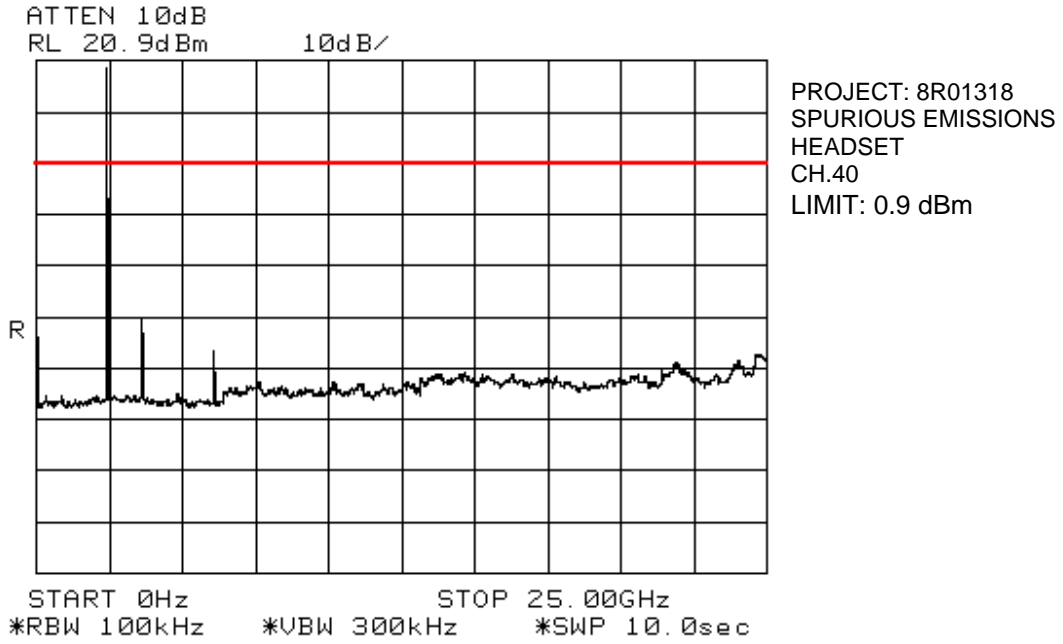


EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

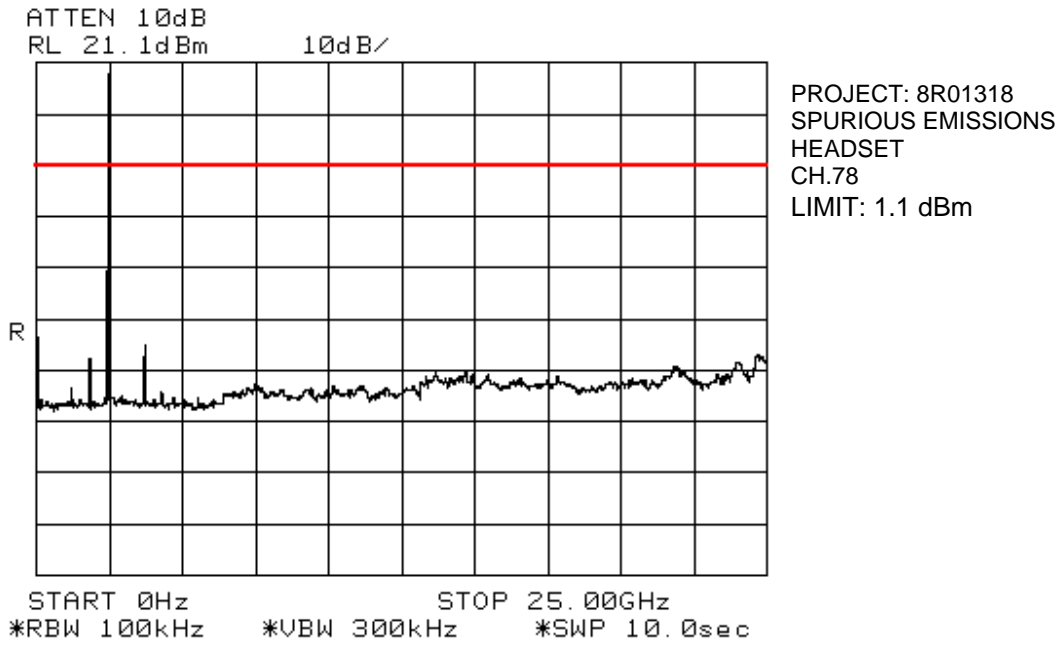
Spurious Emissions (Antenna Conducted): Headset



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

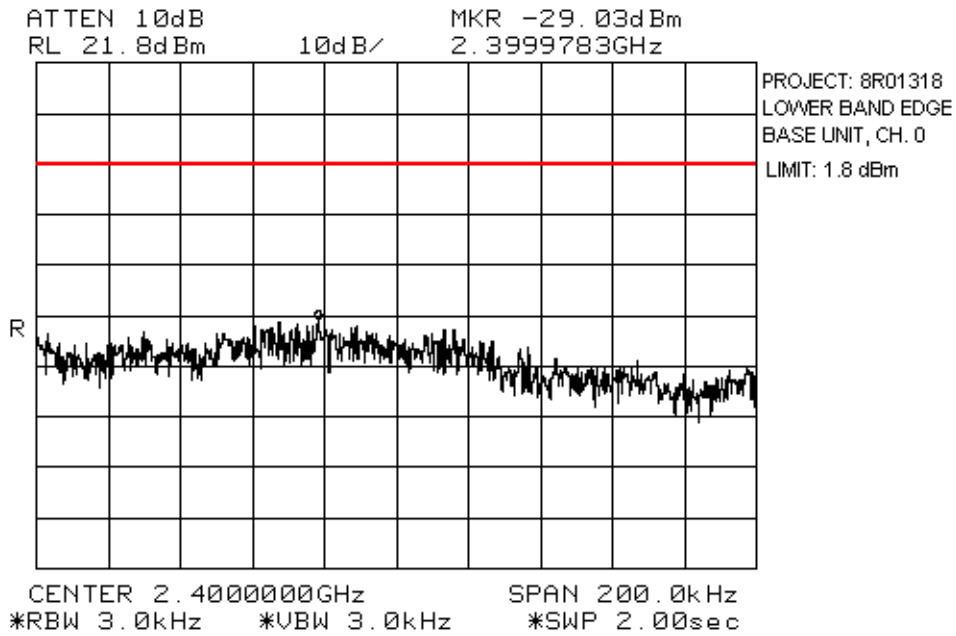


EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24



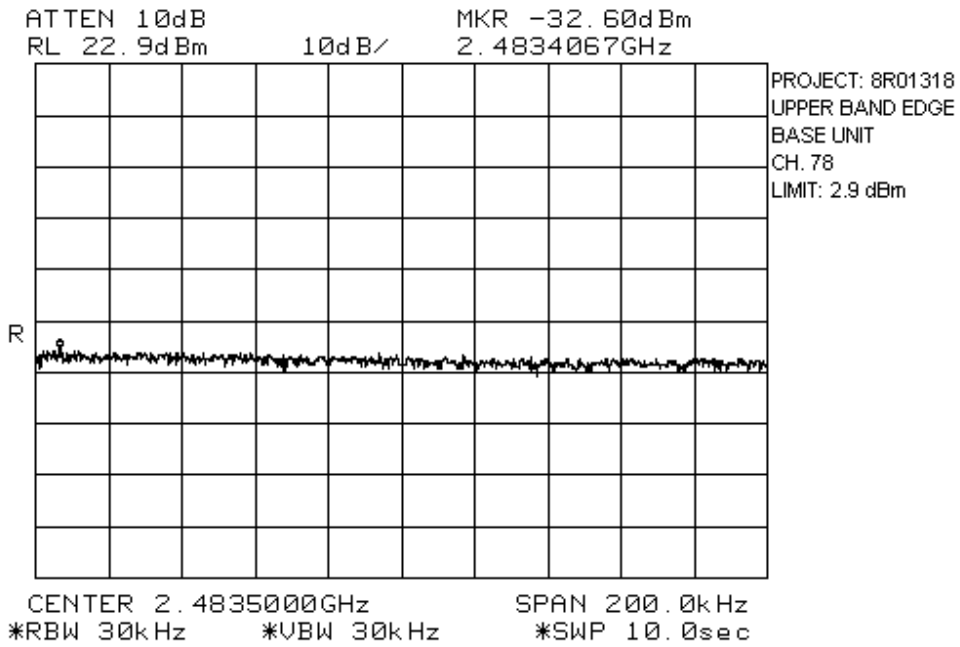
EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Spurious Emissions (Lower Band Edge): Base



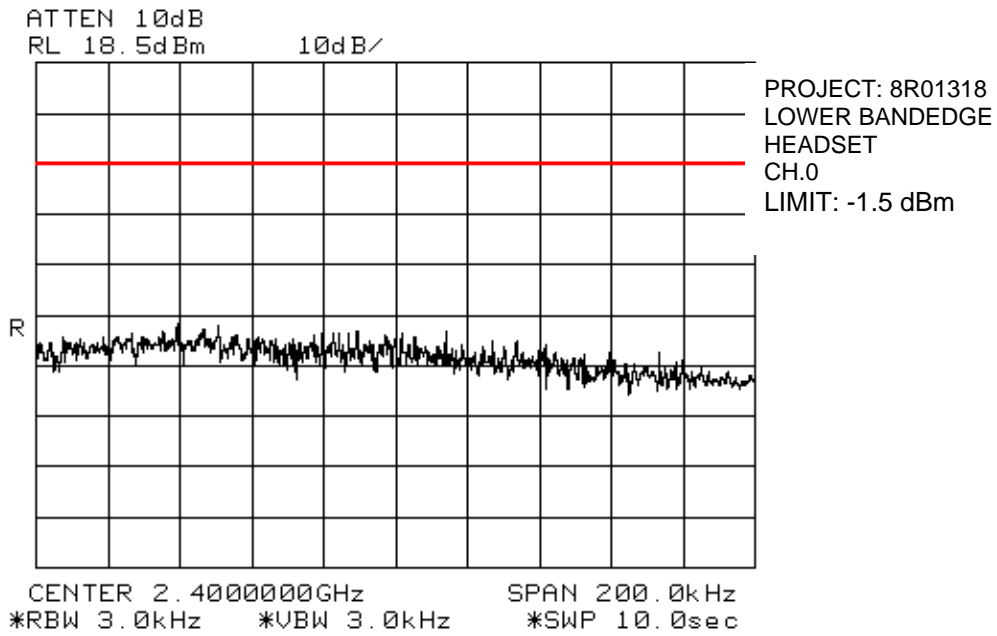
EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Spurious Emissions (Upper Band Edge): Base



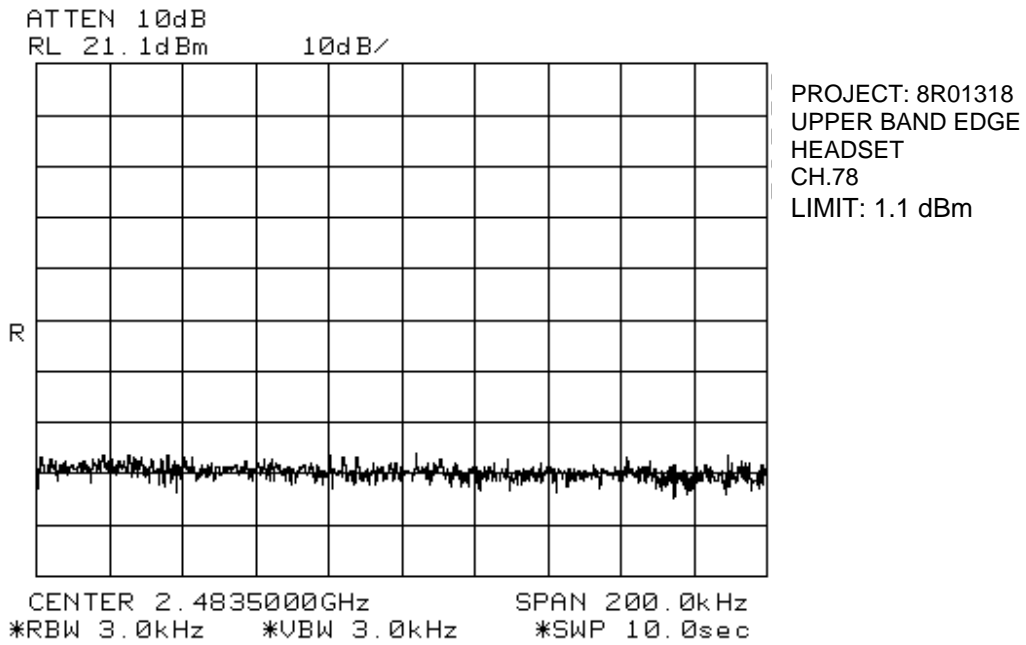
EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Spurious Emissions (Lower Band Edge): Headset



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Spurious Emissions (Upper Band Edge): Headset



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 10. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
TESTED BY: Kevin Carr	DATE: March 3, 1999

Test Results: Complies. The worst case emission level is 52.8 dB μ V/m @ 3m at 4802.5 MHz. This is 1.2dB below the specification limit.

Measurement Data: See attached table.

Duty Cycle Calculation: Worst Case
Hopping To Single Channel (*unrealistic*)

$$20 \text{ Log } \frac{480\mu s \times 9}{100ms} = -27.29 \text{ dB}$$

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
 FCC ID: BCE-ELLIPSE24

Test Data - Radiated Emissions (Peak): Base

Test Distance (meters) : 3/1		Range: A Tower		Receiver: HP 8565E		RBW(kHz): 1MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Antenna 0: Channel 0											
4802.6	Hrn2	V			76.5	38.4	-44.1		70.8	74.0	3.2
4802.9	Hrn2	H			72.0	38.4	-44.1		66.3	74.0	7.7
12005.8	Hrn2	V			32.5	38.9		-9.5	61.9	74.0	12.1
12005.8	Hrn2	H			33.0	38.9		-9.5	62.4	74.0	11.6
19209.0	Sh50-1	V			33.3	40.4		-9.5	64.2	74.0	9.8
19209.0	Sh50-1	H			34.6	40.4		-9.5	65.5	74.0	8.5
Antenna 0: Channel 40											
4885.6	Hrn2	V			73.6	38.8	-44.3		68.1	74.0	5.9
4885.2	Hrn2	H			67.3	38.8	-44.3		61.8	74.0	12.2
7323.2	Hrn2	V			67.7	44.6	-44.6		67.7	74.0	6.3
7323.2	Hrn2	H			62.0	44.6	-44.6		62.0	74.0	12.0
12214.0	Hrn2	V			34.0	38.9		-9.5	63.4	74.0	10.6
12214.0	Hrn2	H			33.8	38.9		-9.5	63.2	74.0	10.8
19540.8	Sh50-1	V			31.8	40.5		-9.5	62.8	74.0	11.2
19540.8	Sh50-1	H			34.7	40.5		-9.5	65.7	74.0	8.3
Antenna 0: Channel 78											
4963.6	Hrn2	V			72.0	39.1	-44.4		66.7	74.0	7.3
4963.6	Hrn2	H			69.8	39.1	-44.4		64.5	74.0	9.5
7445.5	Hrn2	V			65.5	44.7	-42.0		68.2	74.0	5.8
7445.7	Hrn2	H			59.5	44.7	-42.0		62.2	74.0	11.8
12393.0	Hrn2	V			38.0	38.9		-9.5	67.4	74.0	6.6
12393.0	Hrn2	H			36.5	38.9		-9.5	65.9	74.0	8.1
19828.0	Sh50-1	V			34.0	40.5		-9.5	65.0	74.0	9.0
19828.0	Sh50-1	H			34.2	40.5		-9.5	65.2	74.0	8.8
22332.0	Sh50-1	V			33.7	40.6		-9.5	64.8	74.0	9.2
22332.0	Sh50-1	H			33.8	40.6		-9.5	64.9	74.0	9.1
Notes:											
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole											
* Re-measured using dipole antenna.											
** Includes cable loss when amplifier is not used.											
*** Includes cable loss.											
() Denotes failing emission level.											

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
 FCC ID: BCE-ELLIPSE24

Test Data - Radiated Emissions (Peak): Base

Test Distance (meters) : 3/1		Range: A Tower		Receiver: HP 8565E		RBW(kHz): 1MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Antenna 1: Channel 0											
4802.6	Hrn2	V			70.7	38.4	-44.1		65.0	74.0	9.0
4802.9	Hrn2	H			78.5	38.4	-44.1		72.8	74.0	1.2
12005.8	Hrn2	V			32.8	38.9		-9.5	62.2	74.0	11.8
12005.8	Hrn2	H			33.1	38.9		-9.5	62.5	74.0	11.5
19209.0	Sh50-1	V			33.5	40.4		-9.5	64.4	74.0	9.6
19209.0	Sh50-1	H			34.6	40.4		-9.5	65.5	74.0	8.5
Antenna 1: Channel 40											
4885.6	Hrn2	V			70.0	38.8	-44.3		64.5	74.0	9.5
4885.2	Hrn2	H			74.5	38.8	-44.3		69.0	74.0	5.0
7323.2	Hrn2	V			70.3	44.6	-44.6		70.3	74.0	3.7
7323.2	Hrn2	H			65.2	44.6	-44.6	-9.5	65.2	74.0	8.8
12214.0	Hrn2	V			33.7	38.9		-9.5	63.1	74.0	10.9
12214.0	Hrn2	H			32.7	38.9		-9.5	62.1	74.0	11.9
19540.8	Sh50-1	V			34.7	40.5		-9.5	65.7	74.0	8.3
19540.8	Sh50-1	H			34.8	40.5		-9.5	65.8	74.0	8.2
Antenna 1: Channel 78											
4963.6	Hrn2	V			76.8	39.1	-44.4		71.5	74.0	2.5
4963.6	Hrn2	H			74.2	39.1	-44.4		68.9	74.0	5.1
7445.5	Hrn2	V			67.5	44.7	-42.0		70.2	74.0	3.8
7445.7	Hrn2	H			62.0	44.7	-42.0		64.7	74.0	9.3
12393.0	Hrn2	V			37.0	38.9		-9.5	66.4	74.0	7.6
12393.0	Hrn2	H			35.3	38.9		-9.5	64.7	74.0	9.3
19828.0	Sh50-1	V			33.3	40.5		-9.5	64.3	74.0	9.7
19828.0	Sh50-1	H			34.0	40.5		-9.5	65.0	74.0	9.0
22332.0	Sh50-1	V			33.3	40.6		-9.5	64.4	74.0	9.6
22332.0	Sh50-1	H			34.2	40.6		-9.5	65.3	74.0	8.7
Notes:											
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole											
* Re-measured using dipole antenna.											
** Includes cable loss when amplifier is not used.											
*** Includes cable loss.											
() Denotes failing emission level.											

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
 FCC ID: BCE-ELLIPSE24

Test Data - Radiated Emissions (Average): Base

Test Distance (meters) : 3/1		Range: A Tower		Receiver: HP 8565E		RBW(kHz): 1MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Dist. Corr.	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Duty Cycle (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Antenna 0: Channel 0											
4802.6	Hrn2	V			76.5	38.4	-44.1	-20	50.8	54.0	3.2
4802.9	Hrn2	H			72.0	38.4	-44.1	-20	46.3	54.0	7.7
12005.8	Hrn2	V	-9.5		32.5	38.9		-20	41.9	54.0	12.1
12005.8	Hrn2	H	-9.5		33.0	38.9		-20	42.4	54.0	11.6
19209.0	Sh50-1	V	-9.5		33.3	40.4		-20	44.2	54.0	9.8
19209.0	Sh50-1	H	-9.5		34.6	40.4		-20	45.5	54.0	8.5
Antenna 0: Channel 40											
4885.6	Hrn2	V			73.6	38.8	-44.3	-20	48.1	54.0	5.9
4885.2	Hrn2	H			67.3	38.8	-44.3	-20	41.8	54.0	12.2
7323.2	Hrn2	V			67.7	44.6	-44.6	-20	47.7	54.0	6.3
7323.2	Hrn2	H			62.0	44.6	-44.6	-20	42.0	54.0	12.0
12214.0	Hrn2	V	-9.5		34.0	38.9		-20	43.4	54.0	10.6
12214.0	Hrn2	H	-9.5		33.8	38.9		-20	43.2	54.0	10.8
19540.8	Sh50-1	V	-9.5		31.8	40.5		-20	42.8	54.0	11.2
19540.8	Sh50-1	H	-9.5		34.7	40.5		-20	45.7	54.0	8.3
Antenna 0: Channel 78											
4963.6	Hrn2	V			72.0	39.1	-44.4	-20	46.7	54.0	7.3
4963.6	Hrn2	H			69.8	39.1	-44.4	-20	44.5	54.0	9.5
7445.5	Hrn2	V			65.5	44.7	-42.0	-20	48.2	54.0	5.8
7445.7	Hrn2	H			59.5	44.7	-42.0	-20	42.2	54.0	11.8
12393.0	Hrn2	V	-9.5		38.0	38.9		-20	47.4	54.0	6.6
12393.0	Hrn2	H	-9.5		36.5	38.9		-20	45.9	54.0	8.1
19828.0	Sh50-1	V	-9.5		34.0	40.5		-20	45.0	54.0	9.0
19828.0	Sh50-1	H	-9.5		34.2	40.5		-20	45.2	54.0	8.8
22332.0	Sh50-1	V	-9.5		33.7	40.6		-20	44.8	54.0	9.2
22332.0	Sh50-1	H	-9.5		33.8	40.6		-20	44.9	54.0	9.1
Notes:											
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole											
* Re-measured using dipole antenna.											
** Includes cable loss when amplifier is not used.											
*** Includes cable loss.											
() Denotes failing emission level.											

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
 FCC ID: BCE-ELLIPSE24

Test Data - Radiated Emissions (Average): Base

Test Distance (meters) : 3/1		Range: A Tower		Receiver: HP 8565E		RBW(kHz): 1MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Dist. Corr.	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Duty Cycle (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Antenna 1: Channel 0											
4802.6	Hrn2	V			70.7	38.4	-44.1	-20	45.0	54.0	9.0
4802.9	Hrn2	H			78.5	38.4	-44.1	-20	52.8	54.0	1.2
12005.8	Hrn2	V	-9.5		32.8	38.9		-20	42.2	54.0	11.8
12005.8	Hrn2	H	-9.5		33.1	38.9		-20	42.5	54.0	11.5
19209.0	Sh50-1	V	-9.5		33.5	40.4		-20	44.4	54.0	9.6
19209.0	Sh50-1	H	-9.5		34.6	40.4		-20	45.5	54.0	8.5
Antenna 1: Channel 40											
4885.6	Hrn2	V			70.0	38.8	-44.3	-20	44.5	54.0	9.5
4885.2	Hrn2	H			74.5	38.8	-44.3	-20	49.0	54.0	5.0
7323.2	Hrn2	V			70.3	44.6	-44.6	-20	50.3	54.0	3.7
7323.2	Hrn2	H			65.2	44.6	-44.6	-20	45.2	54.0	8.8
12214.0	Hrn2	V	-9.5		33.7	38.9		-20	43.1	54.0	10.9
12214.0	Hrn2	H	-9.5		32.7	38.9		-20	42.1	54.0	11.9
19540.8	Sh50-1	V	-9.5		34.7	40.5		-20	45.7	54.0	8.3
19540.8	Sh50-1	H	-9.5		34.8	40.5		-20	45.8	54.0	8.2
Antenna 1: Channel 78											
4963.6	Hrn2	V			76.8	39.1	-44.4	-20	51.5	54.0	2.5
4963.6	Hrn2	H			74.2	39.1	-44.4	-20	48.9	54.0	5.1
7445.5	Hrn2	V			67.5	44.7	-42.0	-20	50.2	54.0	3.8
7445.7	Hrn2	H			62.0	44.7	-42.0	-20	44.7	54.0	9.3
12393.0	Hrn2	V	-9.5		37.0	38.9		-20	46.4	54.0	7.6
12393.0	Hrn2	H	-9.5		35.3	38.9		-20	44.7	54.0	9.3
19828.0	Sh50-1	V	-9.5		33.3	40.5		-20	44.3	54.0	9.7
19828.0	Sh50-1	H	-9.5		34.0	40.5		-20	45.0	54.0	9.0
22332.0	Sh50-1	V	-9.5		33.3	40.6		-20	44.4	54.0	9.6
22332.0	Sh50-1	H	-9.5		34.2	40.6		-20	45.3	54.0	8.7
Notes:											
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole											
* Re-measured using dipole antenna.											
** Includes cable loss when amplifier is not used.											
*** Includes cable loss.											
() Denotes failing emission level.											

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
 FCC ID: BCE-ELLIPSE24

Test Data - Radiated Emissions (Peak): Headset

Test Distance (meters) : 3/1		Range: A Tower		Receiver: HP 8565E		RBW(kHz): 1MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Channel 0											
4801.8	Hrn2	V			64.8	38.4	-44.1		59.1	74.0	14.9
4802.5	Hrn2	H			64.3	38.4	-44.1		58.6	74.0	15.4
12005.8	Hrn2	V			33.7	38.9		-9.5	63.1	74.0	10.9
12005.8	Hrn2	H			32.0	38.9		-9.5	61.4	74.0	12.6
19209.0	Sh50-1	V			32.5	40.4		-9.5	63.4	74.0	10.6
19209.0	Sh50-1	H			33.3	40.4		-9.5	64.2	74.0	9.8
Channel 40											
4885.3	Hrn2	V			62.2	38.8	-44.3		56.7	74.0	17.3
4885.2	Hrn2	H			60.5	38.8	-44.3		55.0	74.0	19.0
7326.9	Hrn2	V			61.5	44.6	-44.6		61.5	74.0	12.5
7326.9	Hrn2	H			56.7	44.6	-44.6		56.7	74.0	17.3
12215.0	Hrn2	V			33.5	38.9		-9.5	62.9	74.0	11.1
12215.0	Hrn2	H			32.2	38.9		-9.5	61.6	74.0	12.4
19540.8	Sh50-1	V			33.0	40.5		-9.5	64.0	74.0	10.0
19540.8	Sh50-1	H			33.3	40.5		-9.5	64.3	74.0	9.7
Channel 78											
4957.2	Hrn2	V			58.5	39.1	-44.4		53.2	74.0	20.8
4957.2	Hrn2	H			65.7	39.1	-44.4		60.4	74.0	13.6
7434.7	Hrn2	V			56.5	44.7	-42.0		59.2	74.0	14.8
7434.8	Hrn2	H			55.0	44.7	-42.0		57.7	74.0	16.3
12393.0	Hrn2	V			37.7	38.9		-9.5	67.1	74.0	6.9
12393.0	Hrn2	H			38.2	38.9		-9.5	67.6	74.0	6.4
19828.0	Sh50-1	V			38.0	40.5		-9.5	69.0	74.0	5.0
19828.0	Sh50-1	H			39.0	40.5		-9.5	70.0	74.0	4.0
22332.0	Sh50-1	V			39.5	40.6		-9.5	70.6	74.0	3.4
22332.0	Sh50-1	H			37.8	40.6		-9.5	68.9	74.0	5.1
Notes:											
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole											
* Re-measured using dipole antenna.											
** Includes cable loss when amplifier is not used.											
*** Includes cable loss.											
() Denotes failing emission level.											

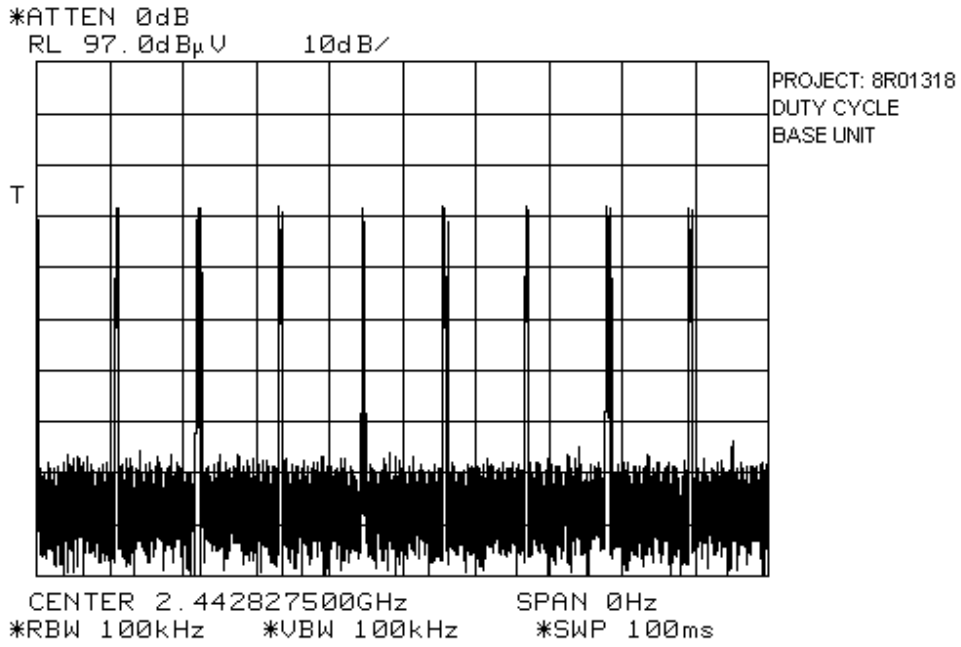
EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
 FCC ID: BCE-ELLIPSE24

Test Data - Radiated Emissions (Average): Headset

Test Distance (meters) : 3/1		Range: A Tower		Receiver: HP 8565E		RBW(kHz): 1MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Dist. Corr.	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Duty Cycle (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Channel 0											
4801.8	Hrn2	V			64.8	38.4	-44.1	-20	39.1	54.0	14.9
4802.5	Hrn2	H			64.3	38.4	-44.1	-20	38.6	54.0	15.4
12005.8	Hrn2	V	-9.5		33.7	38.9		-20	43.1	54.0	10.9
12005.8	Hrn2	H	-9.5		32.0	38.9		-20	41.4	54.0	12.6
19209.0	Sh50-1	V	-9.5		32.5	40.4		-20	43.4	54.0	10.6
19209.0	Sh50-1	H	-9.5		33.3	40.4		-20	44.2	54.0	9.8
Channel 40											
4885.3	Hrn2	V			62.2	38.8	-44.3	-20	36.7	54.0	17.3
4885.2	Hrn2	H			60.5	38.8	-44.3	-20	35.0	54.0	19.0
7326.9	Hrn2	V			61.5	44.6	-44.6	-20	41.5	54.0	12.5
7326.9	Hrn2	H			56.7	44.6	-44.6	-20	36.7	54.0	17.3
12215.0	Hrn2	V	-9.5		33.5	38.9		-20	42.9	54.0	11.1
12215.0	Hrn2	H	-9.5		32.2	38.9		-20	41.6	54.0	12.4
19540.8	Sh50-1	V	-9.5		33.0	40.5		-20	44.0	54.0	10.0
19540.8	Sh50-1	H	-9.5		33.3	40.5		-20	44.3	54.0	9.7
Channel 78											
4957.2	Hrn2	V			58.5	39.1	-44.4	-20	33.2	54.0	20.8
4957.2	Hrn2	H			65.7	39.1	-44.4	-20	40.4	54.0	13.6
7434.7	Hrn2	V			56.5	44.7	-42.0	-20	39.2	54.0	14.8
7434.8	Hrn2	H			55.0	44.7	-42.0	-20	37.7	54.0	16.3
12393.0	Hrn2	V	-9.5		37.7	38.9		-20	47.1	54.0	6.9
12393.0	Hrn2	H	-9.5		38.2	38.9		-20	47.6	54.0	6.4
19828.0	Sh50-1	V	-9.5		38.0	40.5		-20	49.0	54.0	5.0
19828.0	Sh50-1	H	-9.5		39.0	40.5		-20	50.0	54.0	4.0
22332.0	Sh50-1	V	-9.5		39.5	40.6		-20	50.6	54.0	3.4
22332.0	Sh50-1	H	-9.5		37.8	40.6		-20	48.9	54.0	5.1
Notes:											
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole											
* Re-measured using dipole antenna.											
** Includes cable loss when amplifier is not used.											
*** Includes cable loss.											
() Denotes failing emission level.											

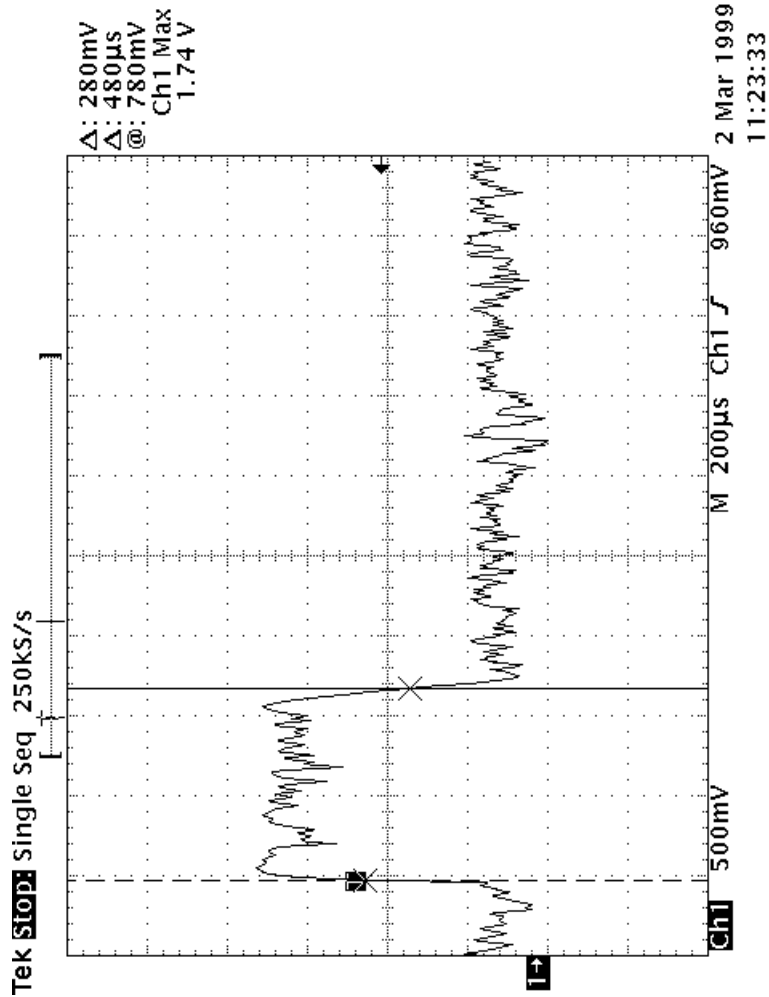
EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Duty Cycle: Base



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Duty Cycle: Base



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Radiated Photographs Base (Worst Case Configuration)

Front View



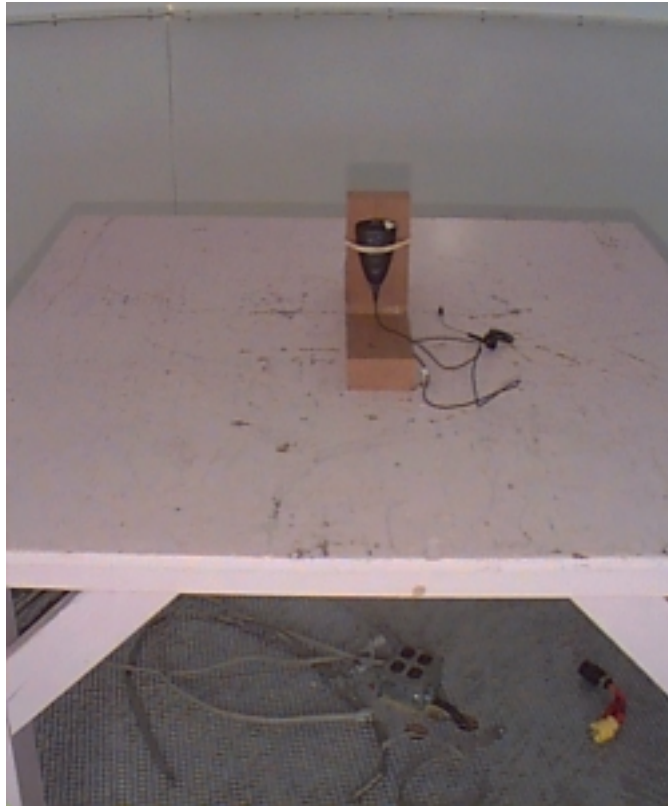
Rear View



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Radiated Photographs Headset (Worst Case Configuration)

Front View



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Section 11. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	May 20/98	May 20/99	
1 Year	Spectrum Analyzer-1	Hewlett Packard	8566B	2311A02238	Oct. 22/98	Oct. 22/99	
1 Year	Spectrum Analyzer Display-1	Hewlett Packard	8566B	2314A04759	Oct. 22/98	Oct. 22/99	
1 Year	Quasi-peak adapter-1	Hewlett-Packard	85650A	2043A00302	Oct. 22/98	Oct. 22/99	
1 Year	Attenuator	Narda	765-20	9510	July 24/98	July 24/99	
1 Year	Attenuator	Narda	768-10	9704	July 24/98	July 24/99	
1 Year	LISN	Tegam	95300-50	T-12855/56	July 24/98	July 24/99	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
1 Year	Digital Storage Oscilloscope	Tektronix	TDS544A	B012005	July 23/98	July 23/99	
1 Year	Low Noise Amplifier	Avantek	AWT-8035	1005	Aug. 4/98	Aug. 4/99	
3 Year	Standard Gain Horn	Electro-Metrics	SH-50/60-1	FA000479	July 29/97	July 29/00	
3 Year	Highpass Filter	K&L Microwave Inc.	11SH10-4000	FA1340	Feb. 26/99	Feb. 26/02	

NA: Not Applicable
 NCR: No Cal Required

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

ANNEX A
TEST METHODOLOGIES

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
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Minimum Standard: The R.F. that is conducted back onto the AC power line on any frequency within the band 0.45 to 30 MHz shall not exceed 250 μ V (48 dB μ V) across 50 ohms.

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
----------------------------------	-------------------------

Minimum Standard: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

NAME OF TEST: Pseudorandom Hopping Algorithm	PARA. NO.: 15.247(a)(1)
--	-------------------------

Minimum Standard:

The system shall hop to channel frequencies that are selected from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 75 hopping frequencies.

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)(ii)
---------------------------------	-----------------------------

Minimum Standard: The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
----------------------------------	-------------------------

Minimum Standard: The maximum allowed 20 dB bandwidth of the hopping channel is 1 MHz for 2400-2483.5 MHz transmitters.

Method Of Measurement:

The spectrum analyzer is set as follows:

- RBW: At least 1% of span/div.
- VBW: >RBW
- Span: Sufficient to display 20 dB bandwidth
- LOG dB/div.: 10 dB
- Sweep: Auto

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247(b)
---------------------------------	----------------------

Minimum Standard: The maximum peak power output shall not exceed 1 watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load.

Calculation Of EIRP For Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 20 dB occupied bandwidth of the E.U.T.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 15.247(c)
---	----------------------

Minimum Standard: In any 100kHz bandwidth outside the 2400-2483.5 MHz bands emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

Method Of Measurement:

30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Lower Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 2400 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level below 2400 MHz

Upper Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 2483.5 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level above 2483.5 MHz

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

NAME OF TEST: Radiated Spurious Emissions	PARA. NO.: 15.247(c)
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Minimum Standard: In any 100kHz bandwidth outside the 2400-2483.5 MHz bands emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits.
Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
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
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

KTL Ottawa

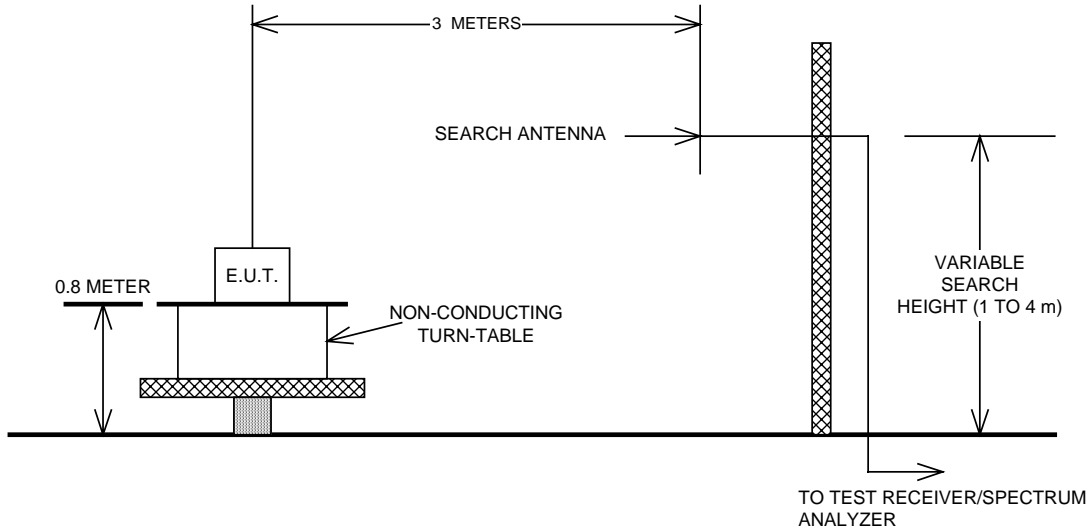
FCC PART 15, SUBPART C
FREQUENCY HOPPING TRANSMITTERS
PROJECT NO.: 8R01318.1
ANNEX B

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

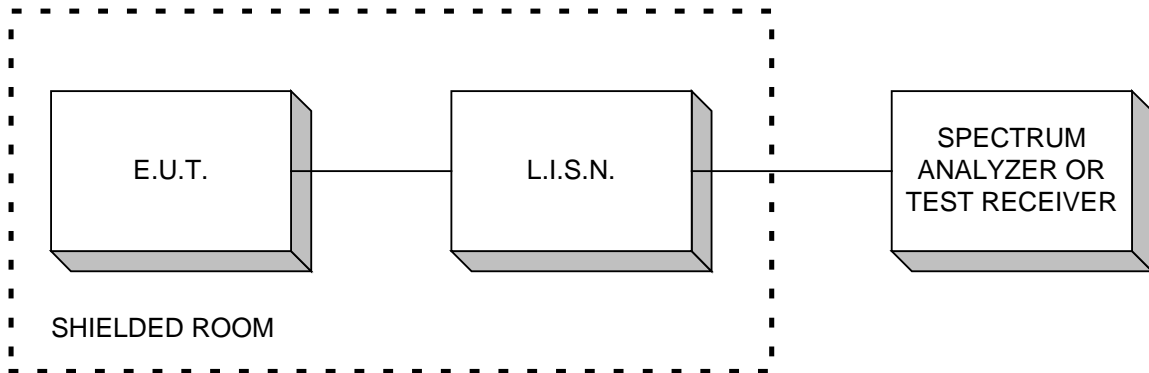
ANNEX B
BLOCK DIAGRAMS

EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Test Site For Radiated Emissions



Conducted Emissions



EQUIPMENT: 2.4 GHz Frequency Hopping Wireless Telephone Headset
FCC ID: BCE-ELLIPSE24

Peak Power At Antenna Terminals

