

TEST REPORT

Report Number: 3119419ATL-002

May 18, 2007

Product Designation: LC CAU and OHC18K

Standard: FCC Part 15, Subpart G - Access Broadband Over Power Lines
(Access BPL)

Tested by:

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Client:

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1.0 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2.0 Test Summary

Section	Test Full Name	Test Date	Result
4.0	BPL Radiated emission - Overhead power lines - Location 1 (FCC 15.611(b)(1))	03/14/2007	PASS
5.0	BPL Radiated emission - Overhead power lines - Location 4 (FCC 15.611(b)(1))	03/22/2007	PASS
6.0	BPL Radiated emission - Overhead power lines - Location 6 (FCC 15.611(b)(1))	03/30/2007	PASS
7.0	BPL Radiated emission - Underground power lines - Location 2 (FCC 15.611(b)(2))	03/26/2007	PASS
8.0	BPL Radiated emission - Underground power lines - Location 3 (FCC 15.611(b)(2))	03/21/2007	PASS
9.0	BPL Radiated emission - Underground power lines - Location 5 (FCC 15.611(b)(2))	03/28/2007	PASS

3.0 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
BPL Customer Access Unit (CAU)	IBEC, Inc.	LC CAU	Not Available
Overhead Medium Voltage BPL Coupler	IBEC, Inc.	OHC18K	Not Available

Testing start date:	March 12 th , 2007
EUT receive condition:	Good

Description of EUT provided by Client:

The EUT consists of a customer access unit (CAU) and a coupler. The LC CAU is an integrated, weatherized unit consisting of two back-to-back BPL modems, one containing an Medium Voltage (MV) port of F-connector type and the other containing a Low Voltage (LV) port as a pig-tailed power cord. The OHC18K coupler consists of an integrated coupler/surge arrestor providing a means to couple standard BPL signals to an overhead, MV power line (20.7 kV – 26.4 kV). The coupler connection utilizes an F-connector type.

Description of EUT exercising:

The EUT was exercised by directing a manufacturer-determined data stream through the EUT that best simulated typical use of the equipment. The amount of data determined was noted as 'packet flooding'

Data Duty Factor Requirement:

The LC CAU / OHC18K coupler equipment was tested in situ with maximum RF injection duty factors achieving 50 bursts per second, exceeding the minimum 20 bursts per second threshold required for the use of quasi-peak detection methods.

Classification of Transmission Frequency Bands (Modes)				
Mode #	1	2	3	7
Minimum frequency of band (MHz)	3	13.5	24	2
Maximum frequency of band (MHz)	13	23.5	34	7

BPL Test Site Locations:

All test locations were near various streets within Lovington, VA 22949, with the exception of Rainbow Drive located in Arrington, VA 22922

Location # (1) Freshwater Cove Lane
 (2) Rainbow Drive
 (3) Ruckers Run Lane

4.0 BPL Radiated emission - Overhead power lines - Location 1 (FCC 15.611(b)(1))

Method:

Access BPL systems that operate in the frequency range of 1.705 kHz to 30 MHz over medium voltage power lines shall comply with the radiated emission limits for intentional radiators provided in §15.209.

Access BPL systems that operate in the frequency range above 30 MHz over medium voltage power lines shall comply with the radiated emission limits provided in §15.109(b).

Access BPL systems that operate over low-voltage power lines, including those that operate over low-voltage lines that are connected to the in-building wiring, shall comply with the radiated emission limits provided in §15.109(a) and (e).

1. General Measurement Principles for Access BPL, In-House BPL and CCS

- 1) Testing shall be performed with the power settings of the Equipment Under Test (EUT) set at the maximum level.
- 2) Testing shall be performed using the maximum RF injection duty factor (burst rate). Test modes or test software may be used for uplink and downlink transmissions.
- 3) Measurements should be made at a test site where the ambient signal level is 6 dB below the applicable limit. (See ANSI C63.4-2003, section 5.1.2 for alternatives, if this test condition cannot be achieved.)
- 4) If the data communications burst rate is at least 20 burst per second, quasi-peak measurements shall be employed, as specified in Section 15.35(a). If the data communications burst rate is 20 bursts per second or less, measurements shall be made using a peak detector.
- 5) For frequencies above 30 MHz, an electric field sensing antenna, such as a biconical antenna is used. The signal shall be maximized for antenna heights from 1 to 4 meters, for both horizontal and vertical polarizations, in accordance to ANSI C63.4-2003 procedures. For Access BPL measurements only, as an alternative to varying antenna height from 1 to 4 meters, these measurements may be made at a height of 1 meter provided that the measured field strength values are increased by a factor of 5 dB to account for height effects.
- 6) For frequencies below 30 MHz, an active or passive magnetic loop is used. The magnetic loop antenna should be at 1 meter height with its plane oriented vertically and the emission maximized by rotating the antenna 180 degrees about its vertical axis. When using active magnetic loops, care should be taken to prevent ambient signals from overloading the spectrum analyzer or antenna preamplifier.
- 7) The six highest radiated emissions relative to the limit and independent of antenna polarization shall be reported as stated in ANSI C63.4-2003, section 10.1.8.2.
- 8) All operational modes should be tested including all frequency bands of operation, as required by 47 C.F.R. § 15.31(i).

2. Access BPL Measurement Principles

a. Test Environment

- 1) The Equipment Under Test (EUT) includes all BPL electronic devices e.g., couplers, injectors, extractors, repeaters, boosters, concentrators, and electric utility overhead or underground medium voltage lines.
- 2) In-situ testing shall be performed on three typical installations for overhead line(s) and three typical installations for underground line(s).

b. Radiated Emissions Measurement Principles for Overhead Line Installations

- 1) Measurements should normally be performed at a horizontal separation distance of 10 meters from the overhead line. If necessary, due to ambient emissions, measurements may be performed a distance of 3 meters. Distance corrections are to be made in accordance with Section 15.31(f) of the Rules.
- 2) Testing shall be performed at distances of 0, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 wavelength down the line from the BPL injection point on the power line. Wavelength spacing is based on the mid-band frequency used by the EUT. In addition, if the mid-band frequency exceeds the lowest frequency injected onto the power line by more than a factor of two, testing shall be extended in steps of $\frac{1}{2}$ wavelength of the mid-band frequency until the distance equals or exceeds $\frac{1}{2}$ wavelength of the lowest frequency injected. (For example, if the device injects frequencies from 3 to 27 MHz, the wavelength corresponding to the mid-band frequency of 15 MHz is 20 meters, and wavelength corresponding to the lowest injected frequency is 100 meters. Measurements are to be performed at 0, 5, 10, 15, and 20 meters down line—corresponding to zero to one wavelength at the mid-band frequency. Because the mid-band frequency exceeds the minimum frequency by more than a factor of two, additional measurements are required at 10-meter intervals until the distance down-line from the injection point equals or exceeds $\frac{1}{2}$ of 100 meters. Thus, additional measurement points are required at 30, 40, and 50 meters down line from the injection point.)
- 3) Testing shall be repeated for each Access BPL component (injector, extractor, repeater, booster, concentrator, etc.)
- 4) The distance correction for the overhead-line measurements shall be based on the slant range distance, which is the line-of-sight distance from the measurement antenna to the overhead line. Slant range distance corrections are to be made in accordance with Section 15.31(f) of the Rules. (For example, if the measurement is made at a horizontal distance of 10 meters with an antenna height of 1 meter and the height of the BPL-driven power line is 11 meters, the slant range distance is 14.1 meters [10 meters vertical distance and 10 meters horizontal distance]. At frequencies below 30 MHz, the measurements are extrapolated to the required 30-meter reference distance by subtracting $40 \log(30/14.1)$, or 13.1 dB from the measured values. For frequencies above 30 MHz, the correction uses a 20 log factor and the reference distance is as specified in section 15.109 of the rules.)

Note: In cases where Access BPL devices are coupled to low-voltage power lines (i.e., Home-Plug or modem boosters), apply the overhead-line procedures as stated above along the low-voltage lines.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog (20MHz to 2GHz)	Chase	CBL6112A	211518	12/15/2006	12/15/2007
Antenna, Passive Loop (10 kHz - 30 MHz)	EMCO	6512	9810-1228	07/11/2006	07/11/2007

4.0 BPL Radiated emission - Overhead power lines - Location 1 (FCC 15.611(b)(1))**Test Equipment Used:**

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Coaxial Cable, 7 meters, N-N	Pasternack	RG214/U	TC-1	08/04/2006	08/04/2007
EMI Receiver	Hewlett Packard	8546A	211505	10/26/2006	10/26/2007
Mast - Antenna	Sunol	TWR95	211264	VBV	VBV
Preamplifier, 60 Hz to 30 MHz	Com-Power	PA-010	211566	07/17/2006	07/17/2007
Pre-selector Section	Hewlett-Packard	85460A	015762	10/20/2006	10/20/2007
Tripod	EMCO	TR-4	213043	VBV	VBV

Results: The sample tested was found to Comply.**Data:****Summary Of Results At This Location**

Frequency Test Range (MHz)	Power Line Type (LV/MV)	Mode (1,2,3, or 7)	Result (Pass/Fail)
2 - 30	LV	7	Pass
30-2000	LV	7	Pass
2 - 30	MV	2	Pass
30-2000	MV	2	Pass

NOTE: For the Low Voltage (LV) power line at this location, only the required antenna positions, that fit within the distance along the power line between the EUT and the residence, were tested due to limited length of the power line.

4.0 BPL Radiated emission - Overhead power lines - Location 1 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: FCC15 Class B
 EUT Height (m): 6.77 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 3.0

Notes: Location 1 (Overhead) O'Neil - Mode 7

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	3m Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
0	V	1	40.000	5.0	12.2	0.4	0.0	-11.7	29.3	40.0	-10.7	QP/120k/300k
0	V	1	75.000	6.0	6.1	0.4	0.0	-11.7	24.2	40.0	-15.8	QP/120k/300k
0	V	1	115.000	11.0	11.5	0.4	0.0	-11.7	34.6	43.5	-8.9	QP/120k/300k
0	V	1	150.000	12.0	9.9	0.4	0.0	-11.7	34.0	43.5	-9.5	QP/120k/300k
0	V	1	156.200	8.0	9.3	0.4	0.0	-11.7	29.4	43.5	-14.1	QP/120k/300k
0	V	1	238.400	10.0	11.5	0.4	0.0	-11.7	33.6	46.0	-12.4	QP/120k/300k
0	H	1	40.000	3.0	13.2	0.4	0.0	-11.7	28.3	40.0	-11.7	QP/120k/300k
0	H	1	75.000	11.0	6.6	0.4	0.0	-11.7	29.7	40.0	-10.3	QP/120k/300k
0	H	1	120.000	10.1	12.1	0.4	0.0	-11.7	34.3	43.5	-9.2	QP/120k/300k
0	H	1	150.000	6.7	10.5	0.4	0.0	-11.7	29.3	43.5	-14.2	QP/120k/300k
0	H	1	156.200	3.4	10.1	0.4	0.0	-11.7	25.6	43.5	-17.9	QP/120k/300k
16.67	H	1	40.000	1.0	13.2	0.4	0.0	-11.7	26.3	40.0	-13.7	QP/120k/300k
16.67	V	1	40.000	0.5	12.2	0.4	0.0	-11.7	24.8	40.0	-15.2	QP/120k/300k
16.67	V	1	75.000	6.6	6.1	0.4	0.0	-11.7	24.8	40.0	-15.2	QP/120k/300k
16.67	H	1	75.000	8.0	6.6	0.4	0.0	-11.7	26.7	40.0	-13.3	QP/120k/300k
16.67	H	1	115.000	6.0	12.1	0.4	0.0	-11.7	30.2	43.5	-13.3	QP/120k/300k
16.67	V	1	115.000	1.5	11.5	0.4	0.0	-11.7	25.1	43.5	-18.4	QP/120k/300k
16.67	V	1	238.000	6.0	11.5	0.4	0.0	-11.7	29.6	46.0	-16.4	QP/120k/300k
16.67	H	1	238.000	15.0	11.0	0.4	0.0	-11.7	38.1	46.0	-7.9	QP/120k/300k
Calculations				I=D+E+F-G-H			K=I-J					

Note: The distance from the EUT to the house was 16.67 meters (1/4 wavelength). Additional measurement positions were not possible.

Above 30 MHz Emissions of Low Voltage Line

4.0 BPL Radiated emission - Overhead power lines - Location 1 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: 15.209
 EUT Height (m): 6.77 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Note: Location 1 (Overhead) Oneal - Mode 2

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
0	--	1	13.850	1.5	34.4	0.4	0.0	16.6	19.7	29.5	-9.9	QP / 9k / 30k
0	--	1	15.080	2.0	34.7	0.4	0.0	16.6	20.5	29.5	-9.1	QP / 9k / 30k
0	--	1	16.080	4.5	34.7	0.4	0.0	16.6	23.0	29.5	-6.6	QP / 9k / 30k
0	--	1	20.710	1.9	34.0	0.4	0.0	16.6	19.7	29.5	-9.9	QP / 9k / 30k
0	--	1	21.860	3.7	34.0	0.4	0.0	16.6	21.5	29.5	-8.1	QP / 9k / 30k
0	--	1	22.625	9.7	34.0	0.4	0.0	16.6	27.5	29.5	-2.1	QP / 9k / 30k
0	--	1	23.470	2.4	34.0	0.4	0.0	16.6	20.2	29.5	-9.4	QP / 9k / 30k
4.1	--	1	21.860	1.9	34.0	0.4	0.0	16.6	19.7	29.5	-9.9	QP / 9k / 30k
4.1	--	1	22.625	4.4	34.0	0.4	0.0	16.6	22.2	29.5	-7.4	QP / 9k / 30k
4.1	--	1	23.470	3.1	34.0	0.4	0.0	16.6	20.9	29.5	-8.7	QP / 9k / 30k
8.1	--	1	20.550	2.6	34.0	0.4	0.0	16.6	20.4	29.5	-9.2	QP / 9k / 30k
8.1	--	1	22.625	2.9	34.0	0.4	0.0	16.6	20.7	29.5	-8.9	QP / 9k / 30k
12.2	--	1	21.860	2.5	34.0	0.4	0.0	16.6	20.3	29.5	-9.3	QP / 9k / 30k
12.2	--	1	23.470	2.0	34.0	0.4	0.0	16.6	19.8	29.5	-9.8	QP / 9k / 30k
16.2	--	1	22.625	2.8	34.0	0.4	0.0	16.6	20.6	29.5	-9.0	QP / 9k / 30k
16.2	--	1	23.202	2.9	34.0	0.4	0.0	16.6	20.7	29.5	-8.9	QP / 9k / 30k
Calculations				I=D+E+F-G-H			K-I-J					

Below 30 MHz Emissions of Medium Voltage Line

4.0 BPL Radiated emission - Overhead power lines - Location 1 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: FCC15 Class A
 EUT Height (m): 6.77 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 1 (Overhead) O'Neil - Mode 2

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	3m Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
0	V	1	40.000	5.0	12.2	0.4	0.0	-1.2	18.8	39.1	-20.4	QP/120k/300k
0	H	1	40.000	3.0	13.2	0.4	0.0	-1.2	17.8	39.1	-21.4	QP/120k/300k
0	V	1	75.000	6.0	6.1	0.4	0.0	-1.2	13.7	39.1	-25.5	QP/120k/300k
0	H	1	75.000	11.0	6.6	0.4	0.0	-1.2	19.2	39.1	-20.0	QP/120k/300k
0	V	1	115.000	11.0	11.5	0.4	0.0	-1.2	24.1	43.5	-19.5	QP/120k/300k
0	H	1	120.000	10.1	12.1	0.4	0.0	-1.2	23.8	43.5	-19.8	QP/120k/300k
0	V	1	150.000	12.0	9.9	0.4	0.0	-1.2	23.5	43.5	-20.1	QP/120k/300k
0	H	1	150.000	6.7	10.5	0.4	0.0	-1.2	18.8	43.5	-24.8	QP/120k/300k
0	V	1	156.200	8.0	9.3	0.4	0.0	-1.2	18.9	43.5	-24.7	QP/120k/300k
0	H	1	156.200	3.4	10.1	0.4	0.0	-1.2	15.1	43.5	-28.5	QP/120k/300k
0	V	1	238.400	10.0	11.5	0.4	0.0	-1.2	23.1	46.0	-22.9	QP/120k/300k
4.1	V	1	40.000	4.5	12.2	0.4	0.0	-1.2	18.3	39.1	-20.9	QP/120k/300k
4.1	H	1	40.000	4.0	13.2	0.4	0.0	-1.2	18.8	39.1	-20.4	QP/120k/300k
4.1	V	1	75.000	8.0	6.1	0.4	0.0	-1.2	15.7	39.1	-23.5	QP/120k/300k
4.1	H	1	75.000	10.0	6.6	0.4	0.0	-1.2	18.2	39.1	-21.0	QP/120k/300k
4.1	V	1	115.000	7.4	11.5	0.4	0.0	-1.2	20.5	43.5	-23.1	QP/120k/300k
4.1	H	1	115.000	4.1	12.1	0.4	0.0	-1.2	17.8	43.5	-25.8	QP/120k/300k
4.1	V	1	238.000	7.2	11.5	0.4	0.0	-1.2	20.3	46.0	-25.7	QP/120k/300k
8.1	V	1	40.000	0.5	12.2	0.4	0.0	-1.2	14.3	39.1	-24.9	QP/120k/300k
8.1	H	1	40.000	4.4	13.2	0.4	0.0	-1.2	19.2	39.1	-20.0	QP/120k/300k
8.1	V	1	75.000	5.0	6.1	0.4	0.0	-1.2	12.7	39.1	-26.5	QP/120k/300k
8.1	H	1	75.000	8.5	6.6	0.4	0.0	-1.2	16.7	39.1	-22.5	QP/120k/300k
8.1	V	1	115.000	5.0	11.5	0.4	0.0	-1.2	18.1	43.5	-25.5	QP/120k/300k
8.1	H	1	115.000	1.5	12.1	0.4	0.0	-1.2	15.2	43.5	-28.4	QP/120k/300k
8.1	V	1	238.000	5.4	11.5	0.4	0.0	-1.2	18.5	46.0	-27.5	QP/120k/300k
12.2	V	1	40.000	4.0	12.2	0.4	0.0	-1.2	17.8	39.1	-21.4	QP/120k/300k
12.2	H	1	40.000	2.1	13.2	0.4	0.0	-1.2	16.9	39.1	-22.3	QP/120k/300k
12.2	V	1	75.000	7.2	6.1	0.4	0.0	-1.2	14.9	39.1	-24.3	QP/120k/300k
12.2	H	1	75.000	8.8	6.6	0.4	0.0	-1.2	17.0	39.1	-22.2	QP/120k/300k
12.2	V	1	115.000	8.9	11.5	0.4	0.0	-1.2	22.0	43.5	-21.6	QP/120k/300k
12.2	V	1	238.000	4.0	11.5	0.4	0.0	-1.2	17.1	46.0	-28.9	QP/120k/300k
16.2	V	1	40.000	-2.0	12.2	0.4	0.0	-1.2	11.8	39.1	-27.4	QP/120k/300k
16.2	V	1	75.000	5.6	6.1	0.4	0.0	-1.2	13.3	39.1	-25.9	QP/120k/300k
16.2	H	1	75.000	3.6	6.6	0.4	0.0	-1.2	11.8	39.1	-27.4	QP/120k/300k
16.2	H	1	115.000	3.1	12.1	0.4	0.0	-1.2	16.8	43.5	-26.8	QP/120k/300k
16.2	H	1	238.000	3.7	11.0	0.4	0.0	-1.2	16.3	46.0	-29.7	QP/120k/300k
Calculations				I=D+E+F-G-H			K=I-J					

Above 30 MHz Emissions of Medium Voltage Line

4.0 BPL Radiated emission - Overhead power lines - Location 1 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: 15.209
 EUT Height (m): 6.77 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Note: Location 1 (Overhead) Oneal - Mode 7

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
0	--	1	2.147	3.6	41.3	0.4	0.0	16.6	28.7	29.5	-0.9	QP / 9k / 30k
16.67	--	1	2.147	3.6	41.3	0.4	0.0	16.6	28.7	29.5	-0.9	QP / 9k / 30k
0	--	1	2.305	3.2	41.3	0.4	0.0	16.6	28.3	29.5	-1.3	QP / 9k / 30k
16.67	--	1	2.305	4.2	41.3	0.4	0.0	16.6	29.3	29.5	-0.3	QP / 9k / 30k
16.67	--	1	2.305	2.5	41.3	0.4	0.0	16.6	27.5	29.5	-2.0	QP / 9k / 30k
0	--	1	2.408	3.4	41.3	0.4	0.0	16.6	28.5	29.5	-1.1	QP / 9k / 30k
16.67	--	1	2.408	3.4	41.3	0.4	0.0	16.6	28.5	29.5	-1.1	QP / 9k / 30k
0	--	1	2.918	44.8	41.3	0.4	40.8	16.6	29.1	29.5	-0.5	QP / 9k / 30k
16.67	--	1	2.918	1.3	41.3	0.4	0.0	16.6	26.4	29.5	-3.1	QP / 9k / 30k
0	--	1	3.406	44.3	38.2	0.4	40.8	16.6	25.5	29.5	-4.1	QP / 9k / 30k
16.67	--	1	3.406	3.4	38.2	0.4	0.0	16.6	25.4	29.5	-4.2	QP / 9k / 30k
0	--	1	4.489	46.2	36.5	0.4	40.8	16.6	25.7	29.5	-3.9	QP / 9k / 30k
0	--	1	4.806	47.9	36.5	0.4	40.8	16.6	27.4	29.5	-2.2	QP / 9k / 30k
0	--	1	5.274	47.4	35.3	0.4	40.8	16.6	25.7	29.5	-3.9	QP / 9k / 30k
0	--	1	6.215	49.0	35.2	0.4	40.6	16.6	27.3	29.5	-2.2	QP / 9k / 30k
0	--	1	8.474	49.4	34.7	0.4	40.6	16.6	27.3	29.5	-2.2	QP / 9k / 30k
Calculations				I=D+E+F-G-H			K=I-J					

Note: The distance from the EUT to the house was 16.67 meters (1/4 wavelength). Additional measurement positions were not possible.

Below 30 MHz Emissions of Low Voltage Line

5.0 BPL Radiated emission - Overhead power lines - Location 4 (FCC 15.611(b)(1))

Method:

Access BPL systems that operate in the frequency range of 1.705 kHz to 30 MHz over medium voltage power lines shall comply with the radiated emission limits for intentional radiators provided in §15.209.

Access BPL systems that operate in the frequency range above 30 MHz over medium voltage power lines shall comply with the radiated emission limits provided in §15.109(b).

Access BPL systems that operate over low-voltage power lines, including those that operate over low-voltage lines that are connected to the in-building wiring, shall comply with the radiated emission limits provided in §15.109(a) and (e).

1. General Measurement Principles for Access BPL, In-House BPL and CCS

- 1) Testing shall be performed with the power settings of the Equipment Under Test (EUT) set at the maximum level.
- 2) Testing shall be performed using the maximum RF injection duty factor (burst rate). Test modes or test software may be used for uplink and downlink transmissions.
- 3) Measurements should be made at a test site where the ambient signal level is 6 dB below the applicable limit. (See ANSI C63.4-2003, section 5.1.2 for alternatives, if this test condition cannot be achieved.)
- 4) If the data communications burst rate is at least 20 burst per second, quasi-peak measurements shall be employed, as specified in Section 15.35(a). If the data communications burst rate is 20 bursts per second or less, measurements shall be made using a peak detector.
- 5) For frequencies above 30 MHz, an electric field sensing antenna, such as a biconical antenna is used. The signal shall be maximized for antenna heights from 1 to 4 meters, for both horizontal and vertical polarizations, in accordance to ANSI C63.4-2003 procedures. For Access BPL measurements only, as an alternative to varying antenna height from 1 to 4 meters, these measurements may be made at a height of 1 meter provided that the measured field strength values are increased by a factor of 5 dB to account for height effects.
- 6) For frequencies below 30 MHz, an active or passive magnetic loop is used. The magnetic loop antenna should be at 1 meter height with its plane oriented vertically and the emission maximized by rotating the antenna 180 degrees about its vertical axis. When using active magnetic loops, care should be taken to prevent ambient signals from overloading the spectrum analyzer or antenna preamplifier.
- 7) The six highest radiated emissions relative to the limit and independent of antenna polarization shall be reported as stated in ANSI C63.4-2003, section 10.1.8.2.
- 8) All operational modes should be tested including all frequency bands of operation, as required by 47 C.F.R. § 15.31(i).

2. Access BPL Measurement Principles

a. Test Environment

- 1) The Equipment Under Test (EUT) includes all BPL electronic devices e.g., couplers, injectors, extractors, repeaters, boosters, concentrators, and electric utility overhead or underground medium voltage lines.
- 2) In-situ testing shall be performed on three typical installations for overhead line(s) and three typical installations for underground line(s).

b. Radiated Emissions Measurement Principles for Overhead Line Installations

- 1) Measurements should normally be performed at a horizontal separation distance of 10 meters from the overhead line. If necessary, due to ambient emissions, measurements may be performed a distance of 3 meters. Distance corrections are to be made in accordance with Section 15.31(f) of the Rules.
- 2) Testing shall be performed at distances of 0, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 wavelength down the line from the BPL injection point on the power line. Wavelength spacing is based on the mid-band frequency used by the EUT. In addition, if the mid-band frequency exceeds the lowest frequency injected onto the power line by more than a factor of two, testing shall be extended in steps of $\frac{1}{2}$ wavelength of the mid-band frequency until the distance equals or exceeds $\frac{1}{2}$ wavelength of the lowest frequency injected. (For example, if the device injects frequencies from 3 to 27 MHz, the wavelength corresponding to the mid-band frequency of 15 MHz is 20 meters, and wavelength corresponding to the lowest injected frequency is 100 meters. Measurements are to be performed at 0, 5, 10, 15, and 20 meters down line—corresponding to zero to one wavelength at the mid-band frequency. Because the mid-band frequency exceeds the minimum frequency by more than a factor of two, additional measurements are required at 10-meter intervals until the distance down-line from the injection point equals or exceeds $\frac{1}{2}$ of 100 meters. Thus, additional measurement points are required at 30, 40, and 50 meters down line from the injection point.)
- 3) Testing shall be repeated for each Access BPL component (injector, extractor, repeater, booster, concentrator, etc.)
- 4) The distance correction for the overhead-line measurements shall be based on the slant range distance, which is the line-of-sight distance from the measurement antenna to the overhead line. Slant range distance corrections are to be made in accordance with Section 15.31(f) of the Rules. (For example, if the measurement is made at a horizontal distance of 10 meters with an antenna height of 1 meter and the height of the BPL-driven power line is 11 meters, the slant range distance is 14.1 meters [10 meters vertical distance and 10 meters horizontal distance]. At frequencies below 30 MHz, the measurements are extrapolated to the required 30-meter reference distance by subtracting $40 \log(30/14.1)$, or 13.1 dB from the measured values. For frequencies above 30 MHz, the correction uses a 20 log factor and the reference distance is as specified in section 15.109 of the rules.)

Note: In cases where Access BPL devices are coupled to low-voltage power lines (i.e., Home-Plug or modem boosters), apply the overhead-line procedures as stated above along the low-voltage lines.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog (20MHz to 2GHz)	Chase	CBL6112A	211518	12/15/2006	12/15/2007
Antenna, Passive Loop (10 kHz - 30 MHz)	EMCO	6512	9810-1228	07/11/2006	07/11/2007

5.0 BPL Radiated emission - Overhead power lines - Location 4 (FCC 15.611(b)(1))**Test Equipment Used:**

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Coaxial Cable, 50 ft, BNC connectors	Radioshack	RG-58/U	TC-3	03/21/2007	03/21/2008
Coaxial Cable, 50 ft, BNC connectors	Radioshack	RG-58/U	TC-2	03/21/2007	03/21/2008
EMI Receiver	Hewlett Packard	8546A	211505	10/26/2006	10/26/2007
Mast - Antenna	Sunol	TWR95	211264	VBV	VBV
Pre-selector Section	Hewlett-Packard	85460A	015762	10/20/2006	10/20/2007
Tripod	EMCO	TR-4	213043	VBV	VBV

Results: The sample tested was found to Comply.**Data:****Summary Of Results At This Location**

Frequency Test Range (MHz)	Power Line Type (LV/MV)	Mode (1,2,3, or 7)	Result (Pass/Fail)
2 - 30	LV	7	Pass
30-2000	LV	7	Pass
2 - 30	MV	3	Pass
30-2000	MV	3	Pass

NOTE: For the Low Voltage (LV) power line at this location, only the required antenna positions, that fit within the distance along the power line between the EUT and the residence, were tested due to limited length of the power line.

5.0 BPL Radiated emission - Overhead power lines - Location 4 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: 15.209 (<30MHz) 15.109 Class B (>30 MHz)
 EUT Height (m): 6.5 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 3.0

Notes: Location 4 (Overhead) - Hughes, Mode 7

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
0	V	1	35.000	-4.0	15.0	1.3	0.0	-11.6	23.9	40.0	-16.1	QP / 120k / 300k
0	V	1	77.000	-2.7	6.6	2.1	0.0	-11.6	17.6	40.0	-22.4	QP / 120k / 300k
0	V	1	133.125	-5.5	11.9	2.9	0.0	-11.6	20.9	43.5	-22.6	QP / 120k / 300k
0	V	1	200.000	-6.4	10.0	3.6	0.0	-11.6	18.8	43.5	-24.7	QP / 120k / 300k
0	V	1	265.000	-7.0	14.0	4.2	0.0	-11.6	22.8	46.0	-23.2	QP / 120k / 300k
0	H	1	35.000	-4.1	15.0	1.3	0.0	-11.6	23.8	40.0	-16.2	QP / 120k / 300k
0	H	1	77.000	-0.2	6.6	2.1	0.0	-11.6	20.1	40.0	-19.9	QP / 120k / 300k
0	H	1	133.125	-4.7	11.9	2.9	0.0	-11.6	21.7	43.5	-21.8	QP / 120k / 300k
0	H	1	200.000	-4.6	10.0	3.6	0.0	-11.6	20.6	43.5	-22.9	QP / 120k / 300k
0	H	1	265.000	-5.1	14.0	4.2	0.0	-11.6	24.7	46.0	-21.3	QP / 120k / 300k
16.7	V	1	35.000	-4.7	15.0	1.3	0.0	-11.6	23.2	40.0	-16.8	QP / 120k / 300k
16.7	V	1	77.000	-5.0	6.6	2.1	0.0	-11.6	15.3	40.0	-24.7	QP / 120k / 300k
16.7	V	1	133.125	-6.7	11.9	2.9	0.0	-11.6	19.7	43.5	-23.8	QP / 120k / 300k
16.7	V	1	200.000	-5.5	10.0	3.6	0.0	-11.6	19.7	43.5	-23.8	QP / 120k / 300k
16.7	V	1	265.000	-4.9	14.0	4.2	0.0	-11.6	24.9	46.0	-21.1	QP / 120k / 300k
16.7	H	1	35.000	-4.8	15.0	1.3	0.0	-11.6	23.1	40.0	-16.9	QP / 120k / 300k
16.7	H	1	77.000	-3.1	6.6	2.1	0.0	-11.6	17.2	40.0	-22.8	QP / 120k / 300k
16.7	H	1	133.125	-5.3	11.9	2.9	0.0	-11.6	21.1	43.5	-22.4	QP / 120k / 300k
16.7	H	1	200.000	-6.1	10.0	3.6	0.0	-11.6	19.1	43.5	-24.4	QP / 120k / 300k
16.7	H	1	265.000	-5.2	14.0	4.2	0.0	-11.6	24.6	46.0	-21.4	QP / 120k / 300k
Calculations				I=D+E+F-G-H			K-I-J					

Note: The distance from the EUT to the house was 20 meters. Additional measurements beyond 16.7 meters were not possible.

Above 30 MHz Emissions of Low Voltage Line

5.0 BPL Radiated emission - Overhead power lines - Location 4 (FCC 15.611(b)(1))**Data:**

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: 15.209 (<30MHz) 15.109 Class A (>30 MHz)
 EUT Height (m): 6.5 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 4 (Overhead) - Hughes, Mode 3

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
7.8	--	1	24.060	8.0	34.0	2.2	0.0	16.8	27.4	29.5	-2.1	QP / 9k / 30k
10.3	--	1	24.060	7.9	34.0	2.2	0.0	16.8	27.3	29.5	-2.2	QP / 9k / 30k
0	--	1	24.200	6.8	34.0	2.2	0.0	16.8	26.2	29.5	-3.3	QP / 9k / 30k
2.6	--	1	24.220	8.9	34.0	2.2	0.0	16.8	28.3	29.5	-1.2	QP / 9k / 30k
10.3	--	1	24.330	6.7	34.0	2.2	0.0	16.8	26.1	29.5	-3.4	QP / 9k / 30k
5.2	--	1	24.520	6.9	34.0	2.3	0.0	16.8	26.4	29.5	-3.1	QP / 9k / 30k
0	--	1	24.650	6.5	34.0	2.3	0.0	16.8	26.0	29.5	-3.5	QP / 9k / 30k
2.6	--	1	24.650	5.8	34.0	2.3	0.0	16.8	25.3	29.5	-4.2	QP / 9k / 30k
2.6	--	1	24.820	7.9	34.0	2.3	0.0	16.8	27.4	29.5	-2.1	QP / 9k / 30k
0	--	1	24.938	8.1	34.0	2.3	0.0	16.8	27.6	29.5	-1.9	QP / 9k / 30k
10.3	--	1	25.180	7.7	34.5	2.3	0.0	16.8	27.7	29.5	-1.8	QP / 9k / 30k
2.6	--	1	25.190	7.1	34.5	2.3	0.0	16.8	27.1	29.5	-2.4	QP / 9k / 30k
5.2	--	1	25.250	5.8	34.5	2.2	0.0	16.8	25.7	29.5	-3.8	QP / 9k / 30k
10.3	--	1	25.340	5.0	34.5	2.2	0.0	16.8	24.9	29.5	-4.6	QP / 9k / 30k
7.8	--	1	25.360	7.1	34.5	2.2	0.0	16.8	27.0	29.5	-2.5	QP / 9k / 30k
0	--	1	25.480	7.5	34.5	2.2	0.0	16.8	27.4	29.5	-2.1	QP / 9k / 30k
7.8	--	1	25.540	5.7	34.5	2.2	0.0	16.8	25.6	29.5	-3.9	QP / 9k / 30k
2.6	--	1	25.620	7.5	34.5	2.2	0.0	16.8	27.4	29.5	-2.1	QP / 9k / 30k
10.3	--	1	25.620	7.5	34.5	2.2	0.0	16.8	27.4	29.5	-2.1	QP / 9k / 30k
5.2	--	1	25.940	7.5	34.5	2.2	0.0	16.8	27.4	29.5	-2.1	QP / 9k / 30k
0	--	1	26.100	7.6	34.5	2.3	0.0	16.8	27.6	29.5	-1.9	QP / 9k / 30k
2.6	--	1	26.100	7.8	34.5	2.3	0.0	16.8	27.8	29.5	-1.7	QP / 9k / 30k
0	--	1	26.250	5.5	34.5	2.3	0.0	16.8	25.5	29.5	-4.0	QP / 9k / 30k
5.2	--	1	26.250	7.4	34.5	2.3	0.0	16.8	27.4	29.5	-2.1	QP / 9k / 30k
7.8	--	1	26.410	6.5	34.5	2.3	0.0	16.8	26.5	29.5	-3.0	QP / 9k / 30k
5.2	--	1	26.480	4.0	34.5	2.3	0.0	16.8	24.0	29.5	-5.5	QP / 9k / 30k
2.6	--	1	26.570	6.2	34.5	2.3	0.0	16.8	26.2	29.5	-3.3	QP / 9k / 30k
2.6	--	1	26.710	7.5	34.5	2.3	0.0	16.8	27.5	29.5	-2.0	QP / 9k / 30k
0	--	1	26.720	6.9	34.5	2.3	0.0	16.8	26.9	29.5	-2.6	QP / 9k / 30k
5.2	--	1	26.720	8.0	34.5	2.3	0.0	16.8	28.0	29.5	-1.5	QP / 9k / 30k
7.8	--	1	26.810	4.9	34.5	2.3	0.0	16.8	24.9	29.5	-4.6	QP / 9k / 30k
0	--	1	26.870	7.7	34.5	2.3	0.0	16.8	27.7	29.5	-1.8	QP / 9k / 30k
10.3	--	1	26.870	6.8	34.5	2.3	0.0	16.8	26.8	29.5	-2.7	QP / 9k / 30k
0	--	1	27.400	7.1	34.5	2.3	0.0	16.8	27.1	29.5	-2.4	QP / 9k / 30k
2.6	--	1	27.440	7.1	34.5	2.3	0.0	16.8	27.1	29.5	-2.4	QP / 9k / 30k
10.3	--	1	27.570	7.5	34.5	2.3	0.0	16.8	27.5	29.5	-2.0	QP / 9k / 30k
0	--	1	27.660	6.3	34.5	2.3	0.0	16.8	26.4	29.5	-3.1	QP / 9k / 30k
2.6	--	1	27.660	6.8	34.5	2.3	0.0	16.8	26.9	29.5	-2.6	QP / 9k / 30k
5.2	--	1	27.690	3.9	34.5	2.3	0.0	16.8	24.0	29.5	-5.5	QP / 9k / 30k
2.6	--	1	27.760	5.9	34.5	2.3	0.0	16.8	26.0	29.5	-3.5	QP / 9k / 30k
5.2	--	1	27.890	3.6	34.5	2.4	0.0	16.8	23.7	29.5	-5.8	QP / 9k / 30k
2.6	--	1	27.900	6.6	34.5	2.4	0.0	16.8	26.7	29.5	-2.8	QP / 9k / 30k
0	--	1	28.000	6.0	34.5	2.4	0.0	16.8	26.1	29.5	-3.4	QP / 9k / 30k
Calculations			I=D+E+F-G-H			K=I-J						

Below 30 MHz Emissions of Medium Voltage Line

5.0 BPL Radiated emission - Overhead power lines - Location 4 (FCC 15.611(b)(1))**Data:**

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: 15.209 (<30MHz) 15.109 Class A (>30 MHz)
 EUT Height (m): 6.5 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 4 (Overhead) - Hughes, Mode 3

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths De/RBW/VBW
5.2	V	1	30.000	16.3	17.5	1.2	0.0	-1.1	36.2	39.1	-2.9	QP / 120k / 300k
7.8	V	1	30.000	16.4	17.5	1.2	0.0	-1.1	36.3	39.1	-2.8	QP / 120k / 300k
2.6	V	1	30.000	17.0	17.5	1.2	0.0	-1.1	36.9	39.1	-2.2	QP / 120k / 300k
2.6	V	1	30.570	18.1	17.5	1.3	0.0	-1.1	38.0	39.1	-1.1	QP / 120k / 300k
10.3	V	1	30.580	17.5	17.5	1.3	0.0	-1.1	37.4	39.1	-1.7	QP / 120k / 300k
7.8	V	1	30.590	18.3	17.5	1.3	0.0	-1.1	38.2	39.1	-0.9	QP / 120k / 300k
2.6	H	1	30.780	16.5	17.5	1.3	0.0	-1.1	36.4	39.1	-2.7	QP / 120k / 300k
5.2	H	1	30.910	16.2	17.5	1.2	0.0	-1.1	36.0	39.1	-3.1	QP / 120k / 300k
7.8	V	1	31.110	17.5	17.7	1.3	0.0	-1.1	37.6	39.1	-1.5	QP / 120k / 300k
2.6	V	1	31.280	17.6	17.7	1.3	0.0	-1.1	37.7	39.1	-1.4	QP / 120k / 300k
10.3	V	1	31.380	16.0	17.7	1.3	0.0	-1.1	36.1	39.1	-3.0	QP / 120k / 300k
2.6	H	1	31.480	17.1	17.7	1.3	0.0	-1.1	37.2	39.1	-1.9	QP / 120k / 300k
5.2	H	1	31.500	14.8	17.7	1.3	0.0	-1.1	34.9	39.1	-4.2	QP / 120k / 300k
7.8	V	1	31.870	18.0	17.7	1.3	0.0	-1.1	38.1	39.1	-1.0	QP / 120k / 300k
10.3	V	1	31.900	16.0	17.7	1.3	0.0	-1.1	36.1	39.1	-3.0	QP / 120k / 300k
2.6	V	1	31.960	15.5	17.7	1.3	0.0	-1.1	35.6	39.1	-3.5	QP / 120k / 300k
5.2	V	1	31.970	15.5	17.7	1.3	0.0	-1.1	35.6	39.1	-3.5	QP / 120k / 300k
2.6	H	1	32.070	16.9	17.3	1.3	0.0	-1.1	36.6	39.1	-2.5	QP / 120k / 300k
0	V	1	32.458	16.6	17.3	1.4	0.0	-1.1	36.4	39.1	-2.7	QP / 120k / 300k
2.6	V	1	32.520	15.9	17.3	1.4	0.0	-1.1	35.7	39.1	-3.4	QP / 120k / 300k
0	H	1	32.658	15.9	17.3	1.4	0.0	-1.1	35.7	39.1	-3.4	QP / 120k / 300k
7.8	H	1	32.700	17.0	17.3	1.4	0.0	-1.1	36.8	39.1	-2.3	QP / 120k / 300k
10.3	V	1	32.720	15.5	17.3	1.4	0.0	-1.1	35.3	39.1	-3.8	QP / 120k / 300k
5.2	H	1	32.780	15.7	17.3	1.4	0.0	-1.1	35.5	39.1	-3.6	QP / 120k / 300k
7.8	V	1	33.210	16.6	17.0	1.4	0.0	-1.1	36.1	39.1	-3.0	QP / 120k / 300k
10.3	V	1	33.210	18.1	17.0	1.4	0.0	-1.1	37.6	39.1	-1.5	QP / 120k / 300k
2.6	H	1	33.400	17.6	17.0	1.3	0.0	-1.1	37.1	39.1	-2.0	QP / 120k / 300k
0	V	1	33.700	17.5	17.0	1.4	0.0	-1.1	37.0	39.1	-2.1	QP / 120k / 300k
5.2	H	1	33.860	16.5	17.0	1.4	0.0	-1.1	36.0	39.1	-3.1	QP / 120k / 300k
0	H	1	33.898	17.3	17.0	1.4	0.0	-1.1	36.8	39.1	-2.3	QP / 120k / 300k
2.6	H	1	33.900	17.4	17.0	1.4	0.0	-1.1	36.9	39.1	-2.2	QP / 120k / 300k
7.8	V	1	33.920	18.2	17.0	1.4	0.0	-1.1	37.7	39.1	-1.4	QP / 120k / 300k
2.6	H	1	34.000	16.8	16.2	1.4	0.0	-1.1	35.5	39.1	-3.6	QP / 120k / 300k
5.2	V	1	34.000	17.5	16.2	1.4	0.0	-1.1	36.2	39.1	-2.9	QP / 120k / 300k
10.3	V	1	35.000	-1.2	15.0	1.3	0.0	-1.1	16.3	39.1	-22.8	QP / 120k / 300k
7.8	V	1	77.000	4.1	6.6	2.1	0.0	-1.1	13.9	39.1	-25.2	QP / 120k / 300k
10.3	V	1	77.000	7.2	6.6	2.1	0.0	-1.1	17.0	39.1	-22.1	QP / 120k / 300k
2.6	H	1	133.125	2.5	11.9	2.9	0.0	-1.1	18.4	43.5	-25.1	QP / 120k / 300k
10.3	V	1	133.125	4.0	11.9	2.9	0.0	-1.1	19.9	43.5	-23.6	QP / 120k / 300k
2.6	V	1	200.000	-3.6	10.0	3.6	0.0	-1.1	11.1	43.5	-32.4	QP / 120k / 300k
10.3	V	1	200.000	-3.4	10.0	3.6	0.0	-1.1	11.3	43.5	-32.2	QP / 120k / 300k
5.2	V	1	265.000	-4.4	14.0	4.2	0.0	-1.1	15.0	46.0	-31.0	QP / 120k / 300k
10.3	V	1	265.000	-4.0	14.0	4.2	0.0	-1.1	15.4	46.0	-30.6	QP / 120k / 300k
Calculations			I=D+E+F-G-H			K=I-J						

Above 30 MHz Emissions of Medium Voltage Line

5.0 BPL Radiated emission - Overhead power lines - Location 4 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: 15.209 (<30MHz) 15.109 Class B (>30 MHz)
 EUT Height (m): 6.5 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 4 (Overhead) - Hughes, Mode 7

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
16.7	--	1	2.148	4.1	41.3	0.4	0.0	16.8	29.0	29.5	-0.5	QP / 9k / 30k
16.7	--	1	2.202	2.6	41.3	0.4	0.0	16.8	27.5	29.5	-2.0	QP / 9k / 30k
0	--	1	2.307	2.2	41.3	0.4	0.0	16.8	27.1	29.5	-2.4	QP / 9k / 30k
0	--	1	3.166	7.2	38.2	0.4	0.0	16.8	29.0	29.5	-0.5	QP / 9k / 30k
0	--	1	3.295	5.2	38.2	0.4	0.0	16.8	27.0	29.5	-2.5	QP / 9k / 30k
0	--	1	3.558	4.7	38.2	0.4	0.0	16.8	26.5	29.5	-3.0	QP / 9k / 30k
0	--	1	4.181	7.0	36.5	0.4	0.0	16.8	27.1	29.5	-2.4	QP / 9k / 30k
0	--	1	4.502	7.7	36.5	0.4	0.0	16.8	27.8	29.5	-1.7	QP / 9k / 30k
0	--	1	4.565	4.9	36.5	0.4	0.0	16.8	25.0	29.5	-4.5	QP / 9k / 30k
0	--	1	5.195	-2.1	35.3	0.4	0.0	16.8	16.8	29.5	-12.7	QP / 9k / 30k
16.7	--	1	5.539	-0.9	35.3	0.4	0.0	16.8	18.0	29.5	-11.5	QP / 9k / 30k
0	--	1	5.745	6.8	35.3	0.4	0.0	16.8	25.7	29.5	-3.8	QP / 9k / 30k
16.7	--	1	5.958	-2.9	35.3	0.4	0.0	16.8	16.0	29.5	-13.5	QP / 9k / 30k
0	--	1	6.177	-2.9	35.2	0.4	0.0	16.8	15.9	29.5	-13.6	QP / 9k / 30k
0	--	1	6.255	-2.1	35.2	0.4	0.0	16.8	16.7	29.5	-12.8	QP / 9k / 30k
16.7	--	1	6.343	-2.3	35.2	0.4	0.0	16.8	16.5	29.5	-13.0	QP / 9k / 30k
16.7	--	1	6.856	3.8	35.2	0.4	0.0	16.8	22.6	29.5	-6.9	QP / 9k / 30k
Calculations				I=D+E+F-G-H			K=I-J					

Note: The distance from the EUT to the house was 20 meters. Additional measurements beyond 16.7 meters were not possible.

Below 30 MHz Emissions of Low Voltage Line

6.0 BPL Radiated emission - Overhead power lines - Location 6 (FCC 15.611(b)(1))

Method:

Access BPL systems that operate in the frequency range of 1.705 kHz to 30 MHz over medium voltage power lines shall comply with the radiated emission limits for intentional radiators provided in §15.209.

Access BPL systems that operate in the frequency range above 30 MHz over medium voltage power lines shall comply with the radiated emission limits provided in §15.109(b).

Access BPL systems that operate over low-voltage power lines, including those that operate over low-voltage lines that are connected to the in-building wiring, shall comply with the radiated emission limits provided in §15.109(a) and (e).

1. General Measurement Principles for Access BPL, In-House BPL and CCS

- 1) Testing shall be performed with the power settings of the Equipment Under Test (EUT) set at the maximum level.
- 2) Testing shall be performed using the maximum RF injection duty factor (burst rate). Test modes or test software may be used for uplink and downlink transmissions.
- 3) Measurements should be made at a test site where the ambient signal level is 6 dB below the applicable limit. (See ANSI C63.4-2003, section 5.1.2 for alternatives, if this test condition cannot be achieved.)
- 4) If the data communications burst rate is at least 20 burst per second, quasi-peak measurements shall be employed, as specified in Section 15.35(a). If the data communications burst rate is 20 bursts per second or less, measurements shall be made using a peak detector.
- 5) For frequencies above 30 MHz, an electric field sensing antenna, such as a biconical antenna is used. The signal shall be maximized for antenna heights from 1 to 4 meters, for both horizontal and vertical polarizations, in accordance to ANSI C63.4-2003 procedures. For Access BPL measurements only, as an alternative to varying antenna height from 1 to 4 meters, these measurements may be made at a height of 1 meter provided that the measured field strength values are increased by a factor of 5 dB to account for height effects.
- 6) For frequencies below 30 MHz, an active or passive magnetic loop is used. The magnetic loop antenna should be at 1 meter height with its plane oriented vertically and the emission maximized by rotating the antenna 180 degrees about its vertical axis. When using active magnetic loops, care should be taken to prevent ambient signals from overloading the spectrum analyzer or antenna preamplifier.
- 7) The six highest radiated emissions relative to the limit and independent of antenna polarization shall be reported as stated in ANSI C63.4-2003, section 10.1.8.2.
- 8) All operational modes should be tested including all frequency bands of operation, as required by 47 C.F.R. § 15.31(i).

2. Access BPL Measurement Principles

a. Test Environment

- 1) The Equipment Under Test (EUT) includes all BPL electronic devices e.g., couplers, injectors, extractors, repeaters, boosters, concentrators, and electric utility overhead or underground medium voltage lines.
- 2) In-situ testing shall be performed on three typical installations for overhead line(s) and three typical installations for underground line(s).

b. Radiated Emissions Measurement Principles for Overhead Line Installations

- 1) Measurements should normally be performed at a horizontal separation distance of 10 meters from the overhead line. If necessary, due to ambient emissions, measurements may be performed a distance of 3 meters. Distance corrections are to be made in accordance with Section 15.31(f) of the Rules.
- 2) Testing shall be performed at distances of 0, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 wavelength down the line from the BPL injection point on the power line. Wavelength spacing is based on the mid-band frequency used by the EUT. In addition, if the mid-band frequency exceeds the lowest frequency injected onto the power line by more than a factor of two, testing shall be extended in steps of $\frac{1}{2}$ wavelength of the mid-band frequency until the distance equals or exceeds $\frac{1}{2}$ wavelength of the lowest frequency injected. (For example, if the device injects frequencies from 3 to 27 MHz, the wavelength corresponding to the mid-band frequency of 15 MHz is 20 meters, and wavelength corresponding to the lowest injected frequency is 100 meters. Measurements are to be performed at 0, 5, 10, 15, and 20 meters down line—corresponding to zero to one wavelength at the mid-band frequency. Because the mid-band frequency exceeds the minimum frequency by more than a factor of two, additional measurements are required at 10-meter intervals until the distance down-line from the injection point equals or exceeds $\frac{1}{2}$ of 100 meters. Thus, additional measurement points are required at 30, 40, and 50 meters down line from the injection point.)
- 3) Testing shall be repeated for each Access BPL component (injector, extractor, repeater, booster, concentrator, etc.)
- 4) The distance correction for the overhead-line measurements shall be based on the slant range distance, which is the line-of-sight distance from the measurement antenna to the overhead line. Slant range distance corrections are to be made in accordance with Section 15.31(f) of the Rules. (For example, if the measurement is made at a horizontal distance of 10 meters with an antenna height of 1 meter and the height of the BPL-driven power line is 11 meters, the slant range distance is 14.1 meters [10 meters vertical distance and 10 meters horizontal distance]. At frequencies below 30 MHz, the measurements are extrapolated to the required 30-meter reference distance by subtracting $40 \log(30/14.1)$, or 13.1 dB from the measured values. For frequencies above 30 MHz, the correction uses a 20 log factor and the reference distance is as specified in section 15.109 of the rules.)

Note: In cases where Access BPL devices are coupled to low-voltage power lines (i.e., Home-Plug or modem boosters), apply the overhead-line procedures as stated above along the low-voltage lines.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog (20MHz to 2GHz)	Chase	CBL6112A	211518	12/15/2006	12/15/2007
Antenna, Passive Loop (10 kHz - 30 MHz)	EMCO	6512	9810-1228	07/11/2006	07/11/2007

6.0 BPL Radiated emission - Overhead power lines - Location 6 (FCC 15.611(b)(1))**Test Equipment Used:**

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Coaxial Cable, 50 ft, BNC connectors	Radioshack	RG-58/U	TC-2	03/21/2007	03/21/2008
EMI Receiver	Hewlett Packard	8546A	211505	10/26/2006	10/26/2007
Mast - Antenna	Sunol	TWR95	211264	VBU	VBU
Pre-selectro Section	Hewlett-Packard	85460A	015762	10/20/2006	10/20/2007
Tripod	EMCO	TR-4	213043	VBU	VBU

Results: The sample tested was found to Comply.**Data:**Summary Of Results At This Location

Frequency Test Range (MHz)	Power Line Type (LV/MV)	Mode (1,2,3, or 7)	Result (Pass/Fail)
2 - 30	MV	1	Pass
30-2000	MV	1	Pass
2 - 30	LV	7	Pass
30-2000	LV	7	Pass

NOTE: For the Low Voltage (LV) power line at this location, only the required antenna positions, that fit within the distance along the power line between the EUT and the residence, were tested due to limited length of the power line.

Summary of results

6.0 BPL Radiated emission - Overhead power lines - Location 6 (FCC 15.611(b)(1))**Data:**

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: 15.209 (<30MHz) 15.109 Class B (>30 MHz)
 EUT Height (m): 3.5 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 6 (Overhead) - Douglas Long, Mode 7

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
16.7	--	1	2.148	3.5	41.3	0.2	0.0	18.6	26.5	29.5	-3.0	QP / 9k / 30k
16.7	--	1	2.308	-4.6	41.3	0.2	0.0	18.6	18.4	29.5	-11.1	QP / 9k / 30k
16.7	--	1	2.731	-1.3	41.3	0.2	0.0	18.6	21.7	29.5	-7.8	QP / 9k / 30k
16.7	--	1	2.919	3.4	41.3	0.2	0.0	18.6	26.4	29.5	-3.1	QP / 9k / 30k
16.7	--	1	2.921	3.9	41.3	0.2	0.0	18.6	26.9	29.5	-2.6	QP / 9k / 30k
16.7	--	1	3.087	2.7	38.2	0.2	0.0	18.6	22.6	29.5	-6.9	QP / 9k / 30k
16.7	--	1	3.592	8.4	38.2	0.2	0.0	18.6	28.3	29.5	-1.2	QP / 9k / 30k
16.7	--	1	3.708	7.6	38.2	0.2	0.0	18.6	27.5	29.5	-2.0	QP / 9k / 30k
16.7	--	1	3.862	9.3	38.2	0.2	0.0	18.6	29.2	29.5	-0.3	QP / 9k / 30k
16.7	--	1	3.866	8.7	38.2	0.2	0.0	18.6	28.6	29.5	-0.9	QP / 9k / 30k
16.7	--	1	3.891	4.9	38.2	0.2	0.0	18.6	24.8	29.5	-4.7	QP / 9k / 30k
16.7	--	1	3.907	6.4	38.2	0.2	0.0	18.6	26.3	29.5	-3.2	QP / 9k / 30k
16.7	--	1	4.086	7.1	36.5	0.2	0.0	18.6	25.3	29.5	-4.2	QP / 9k / 30k
16.7	--	1	4.636	2.1	36.5	0.2	0.0	18.6	20.3	29.5	-9.2	QP / 9k / 30k
16.7	--	1	4.690	5.8	36.5	0.2	0.0	18.6	24.0	29.5	-5.5	QP / 9k / 30k
16.7	--	1	5.581	8.8	35.3	0.2	0.0	18.6	25.8	29.5	-3.7	QP / 9k / 30k
16.7	--	1	5.658	7.0	35.3	0.2	0.0	18.6	24.0	29.5	-5.5	QP / 9k / 30k
16.7	--	1	5.740	6.5	35.3	0.2	0.0	18.6	23.5	29.5	-6.0	QP / 9k / 30k
16.7	--	1	6.395	6.9	35.2	0.2	0.0	18.6	23.8	29.5	-5.7	QP / 9k / 30k
16.7	--	1	6.527	3.0	35.2	0.2	0.0	18.6	19.9	29.5	-9.6	QP / 9k / 30k
Calculations				I=D+E+F-G-H			K=I-J					

Note: The distance from the EUT to the house along the Low Voltage line was ~21 meters. Additional measurement positions were not possible.

Below 30 MHz Emissions of Low Voltage Line

6.0 BPL Radiated emission - Overhead power lines - Location 6 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: 15.209 (<30MHz) 15.109 Class B (>30 MHz)
 EUT Height (m): 3.5 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 3.0

Notes: Location 6 (Overhead) - Douglas Long, Mode 7

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths
16.7	H	1	55.850	14.7	6.2	1.7	0.0	-10.7	33.3	40.0	-6.7	QP / 120k / 300k
16.7	V	1	57.410	21.1	6.2	1.7	0.0	-10.7	39.8	40.0	-0.2	QP / 120k / 300k
16.7	H	1	59.840	19.7	6.1	1.7	0.0	-10.7	38.2	40.0	-1.8	QP / 120k / 300k
16.7	V	1	63.650	19.8	5.8	1.8	0.0	-10.7	38.2	40.0	-1.8	QP / 120k / 300k
16.7	H	1	64.430	19.9	5.8	1.8	0.0	-10.7	38.3	40.0	-1.7	QP / 120k / 300k
16.7	V	1	66.390	21.2	6.0	1.9	0.0	-10.7	39.9	40.0	-0.1	QP / 120k / 300k
16.7	H	1	77.040	17.9	6.6	2.1	0.0	-10.7	37.3	40.0	-2.7	QP / 120k / 300k
16.7	V	1	77.080	16.6	6.6	2.1	0.0	-10.7	36.0	40.0	-4.0	QP / 120k / 300k
16.7	V	1	111.300	10.6	11.6	2.6	0.0	-10.7	35.5	43.5	-8.0	QP / 120k / 300k
16.7	H	1	125.700	11.4	11.3	2.7	0.0	-10.7	36.1	43.5	-7.4	QP / 120k / 300k
16.7	V	1	154.800	8.7	10.6	3.1	0.0	-10.7	33.1	43.5	-10.4	QP / 120k / 300k
16.7	H	1	162.500	6.8	9.9	3.2	0.0	-10.7	30.6	43.5	-12.9	QP / 120k / 300k
16.7	V	1	171.600	9.0	9.4	3.3	0.0	-10.7	32.4	43.5	-11.1	QP / 120k / 300k
Calculations				I=D+E+F-G-H			K=I-J					

Note: The distance from the EUT to the house along the Low Voltage line was ~21 meters. Additional measurement positions were not possible.

Above 30 MHz Emissions of Low Voltage Line

6.0 BPL Radiated emission - Overhead power lines - Location 6 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: 15.209 (<30MHz) 15.109 Class A (>30 MHz)
 EUT Height (m): 5.74 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 6 (Overhead) - Douglas Long, Mode 1

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths
37.5	V	1	34.140	15.4	16.2	1.4	0.0	-0.9	33.9	39.1	-5.2	QP / 120k / 300k
0	V	1	35.570	17.3	15.0	1.3	0.0	-0.9	34.5	39.1	-4.6	QP / 120k / 300k
18.8	V	1	53.090	24.9	7.0	1.6	0.0	-0.9	34.4	39.1	-4.7	QP / 120k / 300k
9.4	V	1	55.900	25.6	6.2	1.7	0.0	-0.9	34.4	39.1	-4.7	QP / 120k / 300k
0	V	1	57.850	24.2	6.2	1.7	0.0	-0.9	33.0	39.1	-6.1	QP / 120k / 300k
37.5	V	1	57.900	23.4	6.2	1.7	0.0	-0.9	32.2	39.1	-6.9	QP / 120k / 300k
56.3	V	1	59.030	20.4	6.1	1.7	0.0	-0.9	29.1	39.1	-10.0	QP / 120k / 300k
0	V	1	70.790	20.3	6.1	1.9	0.0	-0.9	29.2	39.1	-9.9	QP / 120k / 300k
18.8	V	1	72.530	15.9	6.2	2.0	0.0	-0.9	25.0	39.1	-14.1	QP / 120k / 300k
0	V	1	94.630	20.8	9.1	2.3	0.0	-0.9	33.1	43.5	-10.4	QP / 120k / 300k
0	H	1	137.900	18.6	11.1	2.9	0.0	-0.9	33.5	43.5	-10.0	QP / 120k / 300k
9.4	H	1	155.900	23.3	10.3	3.0	0.0	-0.9	37.5	43.5	-6.0	QP / 120k / 300k
18.8	H	1	161.300	6.9	9.9	3.1	0.0	-0.9	20.8	43.5	-22.7	QP / 120k / 300k
9.4	H	1	240.000	3.2	12.0	4.0	0.0	-0.9	20.1	46.0	-25.9	QP / 120k / 300k
37.5	V	1	372.900	1.9	15.0	5.2	0.0	-0.9	23.0	46.0	-23.0	QP / 120k / 300k
56.3	H	1	383.100	-3.8	15.2	5.4	0.0	-0.9	17.7	46.0	-28.3	QP / 120k / 300k
37.5	H	1	687.300	4.4	18.9	8.6	0.0	-0.9	32.8	46.0	-13.2	QP / 120k / 300k
56.3	V	1	736.600	-3.6	19.6	9.1	0.0	-0.9	26.0	46.0	-20.0	QP / 120k / 300k
18.8	V	1	790.900	-3.4	20.1	9.9	0.0	-0.9	27.5	46.0	-18.5	QP / 120k / 300k
Calculations				I=D+E+F-G-H			K=I-J					

Above 30 MHz Emissions of Medium Voltage Line

6.0 BPL Radiated emission - Overhead power lines - Location 6 (FCC 15.611(b)(1))

Data:

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: 15.209 (<30MHz) 15.109 Class A (>30 MHz)
 EUT Height (m): 5.74 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>30 MHz)(m): 10.0

Notes: Location 6 (Overhead) - Douglas Long, Mode 1

	A	B	C	D	E	F	G	H	I	J	K	L
λ , m	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
37.5	--	1	3.710	1.7	38.2	0.2	0.0	17.3	22.8	29.5	-6.7	QP / 9k / 30k
56.3	--	1	4.063	6.1	36.5	0.2	0.0	17.3	25.5	29.5	-4.0	QP / 9k / 30k
18.8	--	1	4.692	5.5	36.5	0.2	0.0	17.3	24.9	29.5	-4.6	QP / 9k / 30k
0	--	1	5.580	8.7	35.3	0.2	0.0	17.3	26.9	29.5	-2.6	QP / 9k / 30k
9.4	--	1	6.088	8.8	35.2	0.2	0.0	17.3	26.9	29.5	-2.6	QP / 9k / 30k
0	--	1	6.525	11.2	35.2	0.2	0.0	17.3	29.3	29.5	-0.2	QP / 9k / 30k
0	--	1	6.684	10.1	35.2	0.2	0.0	17.3	28.2	29.5	-1.3	QP / 9k / 30k
18.8	--	1	7.250	11.1	34.9	0.2	0.0	17.3	28.9	29.5	-0.6	QP / 9k / 30k
18.8	--	1	7.340	11.4	34.9	0.2	0.0	17.3	29.2	29.5	-0.3	QP / 9k / 30k
0	--	1	7.685	11.3	34.9	0.2	0.0	17.3	29.1	29.5	-0.4	QP / 9k / 30k
0	--	1	7.871	10.0	34.9	0.2	0.0	17.3	27.8	29.5	-1.7	QP / 9k / 30k
0	--	1	8.274	11.5	34.7	0.2	0.0	17.3	29.1	29.5	-0.4	QP / 9k / 30k
0	--	1	8.311	10.9	34.7	0.2	0.0	17.3	28.5	29.5	-1.0	QP / 9k / 30k
0	--	1	8.697	8.4	34.7	0.2	0.0	17.3	26.0	29.5	-3.5	QP / 9k / 30k
0	--	1	8.905	11.0	34.7	0.2	0.0	17.3	28.6	29.5	-0.9	QP / 9k / 30k
0	--	1	9.071	10.7	34.4	0.2	0.0	17.3	28.0	29.5	-1.5	QP / 9k / 30k
28.1	--	1	9.311	11.6	34.4	0.2	0.0	17.3	28.9	29.5	-0.6	QP / 9k / 30k
37.5	--	1	9.632	12.1	34.4	0.2	0.0	17.3	29.4	29.5	-0.1	QP / 9k / 30k
9.4	--	1	10.470	11.3	34.4	0.7	0.0	17.3	29.1	29.5	-0.4	QP / 9k / 30k
56.3	--	1	10.700	10.5	34.4	0.7	0.0	17.3	28.3	29.5	-1.2	QP / 9k / 30k
0	--	1	10.940	9.7	34.4	0.7	0.0	17.3	27.5	29.5	-2.0	QP / 9k / 30k
0	--	1	10.980	10.8	34.4	0.7	0.0	17.3	28.6	29.5	-0.9	QP / 9k / 30k
9.4	--	1	11.260	11.4	34.4	0.7	0.0	17.3	29.2	29.5	-0.3	QP / 9k / 30k
0	--	1	11.860	11.2	34.4	0.8	0.0	17.3	29.0	29.5	-0.5	QP / 9k / 30k
28.1	--	1	11.990	11.1	34.4	0.8	0.0	17.3	28.9	29.5	-0.6	QP / 9k / 30k
0	--	1	12.320	11.6	34.4	0.8	0.0	17.3	29.5	29.5	-0.0	QP / 9k / 30k
18.8	--	1	12.660	11.3	34.4	0.8	0.0	17.3	29.2	29.5	-0.3	QP / 9k / 30k
0	--	1	12.660	11.0	34.4	0.8	0.0	17.3	28.9	29.5	-0.6	QP / 9k / 30k
0	--	1	12.820	10.1	34.4	0.8	0.0	17.3	28.0	29.5	-1.5	QP / 9k / 30k
28.1	--	1	12.940	10.8	34.4	0.8	0.0	17.3	28.6	29.5	-0.9	QP / 9k / 30k
18.8	--	1	12.970	11.5	34.4	0.8	0.0	17.3	29.3	29.5	-0.2	QP / 9k / 30k
Calculations				I=D+E+F-G-H			K=I-J					

Below 30 MHz Emissions of Medium Voltage Line

7.0 BPL Radiated emission - Underground power lines - Location 2 (FCC 15.611(b)(2))**Method:**

Access BPL systems that operate in the frequency range of 1.705 kHz to 30 MHz over medium voltage power lines shall comply with the radiated emission limits for intentional radiators provided in §15.209.

Access BPL systems that operate in the frequency range above 30 MHz over medium voltage power lines shall comply with the radiated emission limits provided in §15.109(b).

Access BPL systems that operate over low-voltage power lines, including those that operate over low-voltage lines that are connected to the in-building wiring, shall comply with the radiated emission limits provided in §15.109(a) and (e).

1. General Measurement Principles for Access BPL, In-House BPL and CCS

- 1) Testing shall be performed with the power settings of the Equipment Under Test (EUT) set at the maximum level.
- 2) Testing shall be performed using the maximum RF injection duty factor (burst rate). Test modes or test software may be used for uplink and downlink transmissions.
- 3) Measurements should be made at a test site where the ambient signal level is 6 dB below the applicable limit. (See ANSI C63.4-2003, section 5.1.2 for alternatives, if this test condition cannot be achieved.)
- 4) If the data communications burst rate is at least 20 burst per second, quasi-peak measurements shall be employed, as specified in Section 15.35(a). If the data communications burst rate is 20 bursts per second or less, measurements shall be made using a peak detector.
- 5) For frequencies above 30 MHz, an electric field sensing antenna, such as a biconical antenna is used. The signal shall be maximized for antenna heights from 1 to 4 meters, for both horizontal and vertical polarizations, in accordance to ANSI C63.4-2003 procedures. For Access BPL measurements only, as an alternative to varying antenna height from 1 to 4 meters, these measurements may be made at a height of 1 meter provided that the measured field strength values are increased by a factor of 5 dB to account for height effects.
- 6) For frequencies below 30 MHz, an active or passive magnetic loop is used. The magnetic loop antenna should be at 1 meter height with its plane oriented vertically and the emission maximized by rotating the antenna 180 degrees about its vertical axis. When using active magnetic loops, care should be taken to prevent ambient signals from overloading the spectrum analyzer or antenna preamplifier.
- 7) The six highest radiated emissions relative to the limit and independent of antenna polarization shall be reported as stated in ANSI C63.4-2003, section 10.1.8.2.
- 8) All operational modes should be tested including all frequency bands of operation, as required by 47 C.F.R. § 15.31(i).

2. Access BPL Measurement Principles**a. Test Environment**

- 1) The Equipment Under Test (EUT) includes all BPL electronic devices e.g., couplers, injectors, extractors, repeaters, boosters, concentrators, and electric utility overhead or underground medium voltage lines.
- 2) In-situ testing shall be performed on three typical installations for overhead line(s) and three typical installations for underground line(s).

Radiated Emissions Measurement Principles for Underground Line Installations

- 1) Underground line installations are those in which the BPL device is mounted in, or attached to, a padmounted transformer housing or a ground-mounted junction box and couples directly only to underground cables.
- 2) Measurements should normally be performed at a separation distance of 10 meters from the in-ground power transformer that contains the BPL device(s). If necessary, due to ambient emissions, measurements may be performed a distance of 3 meters. Distance corrections are to be made in accordance with Section 15.31(f) of the Rules.
- 3) Measurements shall be made at positions around the perimeter of the in-ground power transformer where the maximum emissions occur. ANSI C63.4-2003, section 8.1, specifies a minimum of 16 radial angles surrounding the EUT (In-ground transformer that contains the BPL device(s)). If directional radiation patterns are suspected, additional azimuth angles shall be examined.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog (20MHz to 2GHz)	Chase	CBL6112A	211518	12/15/2006	12/15/2007
Antenna, Passive Loop (10 kHz - 30 MHz)	EMCO	6512	9810-1228	07/11/2006	07/11/2007
Coaxial Cable, 50 ft, BNC connectors	Radioshack	RG-58/U	TC-2	03/21/2007	03/21/2008
EMI Receiver	Hewlett Packard	8546A	211505	10/26/2006	10/26/2007
Mast - Antenna	Sunol	TWR95	211264	VBV	VBV
Pre-selector Section	Hewlett-Packard	85460A	015762	10/20/2006	10/20/2007
Tripod	EMCO	TR-4	213043	VBV	VBV

Results: The sample tested was found to Comply.

7.0 BPL Radiated emission - Underground power lines - Location 2 (FCC 15.611(b)(2))**Data:**Summary Of Results At This Location

Frequency Test Range (MHz)	Power Line Type (LV/MV)	Mode (1,2,3, or 7)	Result (Pass/Fail)
2 - 30	LV	7	Pass
2 - 30	MV	2	Pass
30-2000	LV/MV	7/2	Pass

Summary of results

7.0 BPL Radiated emission - Underground power lines - Location 2 (FCC 15.611(b)(2))**Data:**

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: 15.209 (<30MHz) 15.109 Class A (>30 MHz)
 EUT Height (m): 1 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 2 (Underground) - Umbarger, Mode 2

Angle	A	B	C	D	E	F	G	H	I	J	K	L
	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
0	--	1	13.720	-1.1	34.4	0.8	0.0	19.1	15.0	29.5	-14.5	QP / 9k / 30k
157.5	--	1	13.820	-0.6	34.4	0.8	0.0	19.1	15.5	29.5	-14.0	QP / 9k / 30k
112.5	--	1	13.820	1.0	34.4	0.8	0.0	19.1	17.1	29.5	-12.4	QP / 9k / 30k
292.5	--	1	14.240	-2.4	34.4	0.8	0.0	19.1	13.7	29.5	-15.8	QP / 9k / 30k
180	--	1	15.440	-4.5	34.7	0.8	0.0	19.1	12.0	29.5	-17.5	QP / 9k / 30k
270	--	1	16.400	-5.7	34.7	0.9	0.0	19.1	10.8	29.5	-18.7	QP / 9k / 30k
180	--	1	16.840	-6.3	34.7	0.9	0.0	19.1	10.2	29.5	-19.3	QP / 9k / 30k
202.5	--	1	17.630	-1.5	34.7	0.9	0.0	19.1	15.0	29.5	-14.5	QP / 9k / 30k
180	--	1	17.660	-0.6	34.7	0.9	0.0	19.1	15.9	29.5	-13.6	QP / 9k / 30k
180	--	1	18.070	-5.7	34.7	0.9	0.0	19.1	10.8	29.5	-18.7	QP / 9k / 30k
337.5	--	1	18.810	-1.9	34.7	0.9	0.0	19.1	14.7	29.5	-14.8	QP / 9k / 30k
315	--	1	18.860	-5.0	34.7	0.9	0.0	19.1	11.6	29.5	-17.9	QP / 9k / 30k
337.5	--	1	19.220	0.9	34.7	1.0	0.0	19.1	17.5	29.5	-12.0	QP / 9k / 30k
270	--	1	19.260	1.1	34.7	1.0	0.0	19.1	17.7	29.5	-11.8	QP / 9k / 30k
292.5	--	1	19.420	-3.2	34.7	1.0	0.0	19.1	13.4	29.5	-16.1	QP / 9k / 30k
337.5	--	1	19.680	-1.7	34.7	1.0	0.0	19.1	14.9	29.5	-14.6	QP / 9k / 30k
0	--	1	19.740	-4.2	34.7	1.0	0.0	19.1	12.4	29.5	-17.1	QP / 9k / 30k
0	--	1	20.200	-4.5	34.0	1.0	0.0	19.1	11.4	29.5	-18.1	QP / 9k / 30k
337.5	--	1	21.720	-1.3	34.0	1.0	0.0	19.1	14.7	29.5	-14.8	QP / 9k / 30k
337.5	--	1	22.180	-2.4	34.0	1.1	0.0	19.1	13.6	29.5	-15.9	QP / 9k / 30k
247.5	--	1	23.108	0.4	34.0	1.1	0.0	19.1	16.4	29.5	-13.1	QP / 9k / 30k
Calculations				I=D+E+F-G-H			K=I-J					

Below 30 MHz Emissions of Medium Voltage Line

7.0 BPL Radiated emission - Underground power lines - Location 2 (FCC 15.611(b)(2))**Data:**

Frequency Range (MHz): 30 to 2000

Test Distance (m): 10.0

Power Line Type (MV/LV): MV/LV

Limit: 15.209 (<30MHz) 15.109 Class B (>30 MHz)

EUT Height (m): 1

Limit Distance (<30 MHz)(m): 30.0

Limit Distance (>=30 MHz)(m): 3.0

Notes: Location 2 (Underground) - Umbarger, Mode 7 & 2

Angle	A Ant. Pol. (V/H)	B Ant. Height (m)	C Frequency MHz	D Reading dB(uV)	E Antenna Factor dB(1/m)	F Cable Loss dB	G Pre-amp Factor dB	H Slant Factor dB	I Net dB(uV/m)	J 3m Limit dB(uV/m)	K Margin dB	L Detectors / Bandwidths Det/RBW/VBW
337.5	V	1	30.350	4.9	17.5	1.3	0.0	-10.5	34.1	40.0	-5.9	QP / 120k / 300k
270	V	1	30.560	6.1	17.5	1.3	0.0	-10.5	35.3	40.0	-4.7	QP / 120k / 300k
157.5	H	1	30.790	5.1	17.5	1.2	0.0	-10.5	34.2	40.0	-5.8	QP / 120k / 300k
180	V	1	30.830	5.2	17.5	1.2	0.0	-10.5	34.3	40.0	-5.7	QP / 120k / 300k
112.5	V	1	30.960	5.4	17.5	1.2	0.0	-10.5	34.5	40.0	-5.5	QP / 120k / 300k
292.5	V	1	31.020	5.6	17.7	1.2	0.0	-10.5	34.9	40.0	-5.1	QP / 120k / 300k
157.5	V	1	31.170	5.4	17.7	1.3	0.0	-10.5	34.8	40.0	-5.2	QP / 120k / 300k
135	V	1	31.290	5.3	17.7	1.3	0.0	-10.5	34.7	40.0	-5.3	QP / 120k / 300k
247.5	V	1	31.560	4.9	17.7	1.3	0.0	-10.5	34.3	40.0	-5.7	QP / 120k / 300k
270	V	1	31.850	5.3	17.7	1.3	0.0	-10.5	34.7	40.0	-5.3	QP / 120k / 300k
90	V	1	32.040	0.3	17.3	1.3	0.0	-10.5	29.3	40.0	-10.7	QP / 120k / 300k
67.5	V	1	32.140	2.4	17.3	1.3	0.0	-10.5	31.4	40.0	-8.6	QP / 120k / 300k
180	V	1	32.390	5.8	17.3	1.4	0.0	-10.5	34.9	40.0	-5.1	QP / 120k / 300k
292.5	H	1	32.430	5.5	17.3	1.4	0.0	-10.5	34.6	40.0	-5.4	QP / 120k / 300k
202.5	V	1	32.550	5.4	17.3	1.4	0.0	-10.5	34.5	40.0	-5.5	QP / 120k / 300k
225	V	1	32.730	5.3	17.3	1.4	0.0	-10.5	34.4	40.0	-5.6	QP / 120k / 300k
315	V	1	32.800	6.6	17.3	1.4	0.0	-10.5	35.7	40.0	-4.3	QP / 120k / 300k
22.5	V	1	32.940	-2.6	17.3	1.4	0.0	-10.5	26.5	40.0	-13.5	QP / 120k / 300k
247.5	V	1	33.060	5.3	17.0	1.4	0.0	-10.5	34.1	40.0	-5.9	QP / 120k / 300k
270	V	1	33.310	6.1	17.0	1.4	0.0	-10.5	34.9	40.0	-5.1	QP / 120k / 300k
45	V	1	33.450	-1.2	17.0	1.3	0.0	-10.5	27.6	40.0	-12.4	QP / 120k / 300k
337.5	V	4	33.514	6.4	17.0	1.3	0.0	-10.8	35.6	40.0	-4.4	QP / 120k / 300k
0	V	1	33.710	3.2	17.0	1.4	0.0	-10.5	32.0	40.0	-8.0	QP / 120k / 300k
67.5	V	1	33.920	1.5	17.0	1.4	0.0	-10.5	30.3	40.0	-9.7	QP / 120k / 300k
157.5	V	1	33.990	7.2	17.0	1.4	0.0	-10.5	36.0	40.0	-4.0	QP / 120k / 300k
112.5	V	1	34.030	6.2	16.2	1.4	0.0	-10.5	34.2	40.0	-5.8	QP / 120k / 300k
202.5	H	1	34.430	5.2	16.2	1.4	0.0	-10.5	33.2	40.0	-6.8	QP / 120k / 300k
180	V	1	34.790	5.6	16.2	1.3	0.0	-10.5	33.6	40.0	-6.4	QP / 120k / 300k
180	V	1	41.440	10.1	12.1	1.4	0.0	-10.5	34.1	40.0	-5.9	QP / 120k / 300k
225	V	1	44.000	10.5	10.0	1.5	0.0	-10.5	32.5	40.0	-7.5	QP / 120k / 300k
45	V	1	49.850	7.6	8.1	1.7	0.0	-10.5	27.8	40.0	-12.2	QP / 120k / 300k
0	H	1	61.240	14.5	6.1	1.9	0.0	-10.5	32.9	40.0	-7.1	QP / 120k / 300k
22.5	V	1	137.500	5.8	11.1	2.9	0.0	-10.5	30.3	43.5	-13.2	QP / 120k / 300k
270	V	1	152.600	10.1	10.6	3.1	0.0	-10.5	34.2	43.5	-9.3	QP / 120k / 300k
315	H	1	162.500	10.4	9.9	3.2	0.0	-10.5	33.9	43.5	-9.6	QP / 120k / 300k
202.5	H	1	198.300	11.5	10.1	3.5	0.0	-10.5	35.6	43.5	-7.9	QP / 120k / 300k
292.5	H	1	396.000	5.9	15.6	5.4	0.0	-10.5	37.4	46.0	-8.6	QP / 120k / 300k
Calculations			I=D+E+F-G-H			K=I-J						

Above 30 MHz Emissions of Medium Voltage Line

7.0 BPL Radiated emission - Underground power lines - Location 2 (FCC 15.611(b)(2))**Data:**

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: 15.209 (<30MHz) 15.109 Class A (>30 MHz)
 EUT Height (m): 1 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 3.0

Notes: Location 2 (Underground) - Umbarger, Mode 7

Angle	A	B	C	D	E	F	G	H	I	J	K	L
	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
202.5	--	1	2.143	3.5	41.3	0.2	0.0	19.1	25.9	29.5	-3.6	QP / 9k / 30k
247.5	--	1	2.320	2.1	41.3	0.2	0.0	19.1	24.5	29.5	-5.0	QP / 9k / 30k
202.5	--	1	2.340	3.9	41.3	0.2	0.0	19.1	26.3	29.5	-3.2	QP / 9k / 30k
202.5	--	1	2.611	2.9	41.3	0.2	0.0	19.1	25.3	29.5	-4.2	QP / 9k / 30k
202.5	--	1	2.763	4.0	41.3	0.2	0.0	19.1	26.4	29.5	-3.1	QP / 9k / 30k
202.5	--	1	2.839	4.9	41.3	0.2	0.0	19.1	27.3	29.5	-2.2	QP / 9k / 30k
225	--	1	2.840	1.9	41.3	0.2	0.0	19.1	24.3	29.5	-5.2	QP / 9k / 30k
247.5	--	1	2.848	1.0	41.3	0.2	0.0	19.1	23.4	29.5	-6.1	QP / 9k / 30k
225	--	1	3.239	8.4	38.2	0.2	0.0	19.1	27.7	29.5	-1.8	QP / 9k / 30k
0	--	1	3.248	3.1	38.2	0.2	0.0	19.1	22.4	29.5	-7.1	QP / 9k / 30k
202.5	--	1	3.408	6.3	38.2	0.2	0.0	19.1	25.6	29.5	-3.9	QP / 9k / 30k
0	--	1	3.416	5.5	38.2	0.2	0.0	19.1	24.8	29.5	-4.7	QP / 9k / 30k
247.5	--	1	3.439	6.9	38.2	0.2	0.0	19.1	26.2	29.5	-3.3	QP / 9k / 30k
202.5	--	1	3.441	6.4	38.2	0.2	0.0	19.1	25.7	29.5	-3.8	QP / 9k / 30k
225	--	1	3.441	7.2	38.2	0.2	0.0	19.1	26.5	29.5	-3.0	QP / 9k / 30k
247.5	--	1	3.446	5.7	38.2	0.2	0.0	19.1	25.0	29.5	-4.5	QP / 9k / 30k
157.5	--	1	3.455	5.4	38.2	0.2	0.0	19.1	24.7	29.5	-4.8	QP / 9k / 30k
202.5	--	1	3.458	4.8	38.2	0.2	0.0	19.1	24.1	29.5	-5.4	QP / 9k / 30k
157.5	--	1	3.461	4.3	38.2	0.2	0.0	19.1	23.6	29.5	-5.9	QP / 9k / 30k
202.5	--	1	3.507	5.9	38.2	0.2	0.0	19.1	25.2	29.5	-4.3	QP / 9k / 30k
247.5	--	1	3.547	6.4	38.2	0.2	0.0	19.1	25.7	29.5	-3.8	QP / 9k / 30k
225	--	1	3.548	5.7	38.2	0.2	0.0	19.1	25.0	29.5	-4.5	QP / 9k / 30k
202.5	--	1	3.561	8.9	38.2	0.2	0.0	19.1	28.2	29.5	-1.3	QP / 9k / 30k
225	--	1	3.624	6.8	38.2	0.2	0.0	19.1	26.1	29.5	-3.4	QP / 9k / 30k
247.5	--	1	3.625	6.4	38.2	0.2	0.0	19.1	25.7	29.5	-3.8	QP / 9k / 30k
225	--	1	3.651	5.9	38.2	0.2	0.0	19.1	25.2	29.5	-4.3	QP / 9k / 30k
225	--	1	3.696	5.6	38.2	0.2	0.0	19.1	24.9	29.5	-4.6	QP / 9k / 30k
112.5	--	1	3.808	2.8	38.2	0.2	0.0	19.1	22.1	29.5	-7.4	QP / 9k / 30k
180	--	1	3.999	7.2	38.2	0.2	0.0	19.1	26.5	29.5	-3.0	QP / 9k / 30k
270	--	1	4.000	7.3	36.5	0.2	0.0	19.1	24.9	29.5	-4.6	QP / 9k / 30k
202.5	--	1	4.244	2.2	36.5	0.2	0.0	19.1	19.8	29.5	-9.7	QP / 9k / 30k
112.5	--	1	4.348	4.4	36.5	0.2	0.0	19.1	22.0	29.5	-7.5	QP / 9k / 30k
225	--	1	4.637	8.3	36.5	0.2	0.0	19.1	25.9	29.5	-3.6	QP / 9k / 30k
247.5	--	1	4.649	2.7	36.5	0.2	0.0	19.1	20.3	29.5	-9.2	QP / 9k / 30k
135	--	1	4.845	5.0	36.5	0.2	0.0	19.1	22.6	29.5	-6.9	QP / 9k / 30k
135	--	1	4.984	0.8	36.5	0.2	0.0	19.1	18.4	29.5	-11.1	QP / 9k / 30k
247.5	--	1	5.919	11.1	35.3	0.2	0.0	19.1	27.5	29.5	-2.0	QP / 9k / 30k
202.5	--	1	6.341	1.4	35.2	0.2	0.0	19.1	17.7	29.5	-11.8	QP / 9k / 30k
135	--	1	6.425	1.9	35.2	0.2	0.0	19.1	18.2	29.5	-11.3	QP / 9k / 30k
Calculations			I=D+E+F-G-H			K=I-J						

Below 30 MHz Emissions of Low Voltage Line

8.0 BPL Radiated emission - Underground power lines - Location 3 (FCC 15.611(b)(2))**Method:**

Access BPL systems that operate in the frequency range of 1.705 kHz to 30 MHz over medium voltage power lines shall comply with the radiated emission limits for intentional radiators provided in §15.209.

Access BPL systems that operate in the frequency range above 30 MHz over medium voltage power lines shall comply with the radiated emission limits provided in §15.109(b).

Access BPL systems that operate over low-voltage power lines, including those that operate over low-voltage lines that are connected to the in-building wiring, shall comply with the radiated emission limits provided in §15.109(a) and (e).

1. General Measurement Principles for Access BPL, In-House BPL and CCS

- 1) Testing shall be performed with the power settings of the Equipment Under Test (EUT) set at the maximum level.
- 2) Testing shall be performed using the maximum RF injection duty factor (burst rate). Test modes or test software may be used for uplink and downlink transmissions.
- 3) Measurements should be made at a test site where the ambient signal level is 6 dB below the applicable limit. (See ANSI C63.4-2003, section 5.1.2 for alternatives, if this test condition cannot be achieved.)
- 4) If the data communications burst rate is at least 20 burst per second, quasi-peak measurements shall be employed, as specified in Section 15.35(a). If the data communications burst rate is 20 bursts per second or less, measurements shall be made using a peak detector.
- 5) For frequencies above 30 MHz, an electric field sensing antenna, such as a biconical antenna is used. The signal shall be maximized for antenna heights from 1 to 4 meters, for both horizontal and vertical polarizations, in accordance to ANSI C63.4-2003 procedures. For Access BPL measurements only, as an alternative to varying antenna height from 1 to 4 meters, these measurements may be made at a height of 1 meter provided that the measured field strength values are increased by a factor of 5 dB to account for height effects.
- 6) For frequencies below 30 MHz, an active or passive magnetic loop is used. The magnetic loop antenna should be at 1 meter height with its plane oriented vertically and the emission maximized by rotating the antenna 180 degrees about its vertical axis. When using active magnetic loops, care should be taken to prevent ambient signals from overloading the spectrum analyzer or antenna preamplifier.
- 7) The six highest radiated emissions relative to the limit and independent of antenna polarization shall be reported as stated in ANSI C63.4-2003, section 10.1.8.2.
- 8) All operational modes should be tested including all frequency bands of operation, as required by 47 C.F.R. § 15.31(i).

2. Access BPL Measurement Principles**a. Test Environment**

- 1) The Equipment Under Test (EUT) includes all BPL electronic devices e.g., couplers, injectors, extractors, repeaters, boosters, concentrators, and electric utility overhead or underground medium voltage lines.
- 2) In-situ testing shall be performed on three typical installations for overhead line(s) and three typical installations for underground line(s).

Radiated Emissions Measurement Principles for Underground Line Installations

- 1) Underground line installations are those in which the BPL device is mounted in, or attached to, a padmounted transformer housing or a ground-mounted junction box and couples directly only to underground cables.
- 2) Measurements should normally be performed at a separation distance of 10 meters from the in-ground power transformer that contains the BPL device(s). If necessary, due to ambient emissions, measurements may be performed a distance of 3 meters. Distance corrections are to be made in accordance with Section 15.31(f) of the Rules.
- 3) Measurements shall be made at positions around the perimeter of the in-ground power transformer where the maximum emissions occur. ANSI C63.4-2003, section 8.1, specifies a minimum of 16 radial angles surrounding the EUT (In-ground transformer that contains the BPL device(s)). If directional radiation patterns are suspected, additional azimuth angles shall be examined.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog (20MHz to 2GHz)	Chase	CBL6112A	211518	12/15/2006	12/15/2007
Antenna, Passive Loop (10 kHz - 30 MHz)	EMCO	6512	9810-1228	07/11/2006	07/11/2007
Coaxial Cable, 50 ft, BNC connectors	Radioshack	RG-58/U	TC-3	03/21/2007	03/21/2008
Coaxial Cable, 50 ft, BNC connectors	Radioshack	RG-58/U	TC-2	03/21/2007	03/21/2008
EMI Receiver	Hewlett Packard	8546A	211505	10/26/2006	10/26/2007
Mast - Antenna	Sunol	TWR95	211264	VBU	VBU
Pre-selector Section	Hewlett-Packard	85460A	015762	10/20/2006	10/20/2007
Tripod	EMCO	TR-4	213043	VBU	VBU

Results: The sample tested was found to Comply.

8.0 BPL Radiated emission - Underground power lines - Location 3 (FCC 15.611(b)(2))

Data:

Summary Of Results At This Location

Frequency Test Range (MHz)	Power Line Type (LV/MV)	Mode (1,2,3, or 7)	Result (Pass/Fail)
2 - 30	LV	7	Pass
30-2000	LV	7	Pass
2 - 30	MV	3	Pass
30-2000	MV	3	Pass

Summary of results

8.0 BPL Radiated emission - Underground power lines - Location 3 (FCC 15.611(b)(2))

Data:

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: 15.209 (<30MHz) 15.109 Class B (>30 MHz)
 EUT Height (m): 0 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 3.0

Notes: Location 3 (Underground) Krebs - Mode 7

	A	B	C	D	E	F	G	H	I	J	K	L
Angle	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
22.5	V	1	35.000	8.0	15.0	1.3	0.0	-10.5	34.8	40.0	-5.2	QP / 120k / 300k
90	H	1	35.000	3.9	15.0	1.3	0.0	-10.5	30.7	40.0	-9.3	QP / 120k / 300k
90	H	1	55.000	14.2	6.2	1.7	0.0	-10.5	32.6	40.0	-7.4	QP / 120k / 300k
0	V	1	55.000	14.0	6.2	1.7	0.0	-10.5	32.4	40.0	-7.6	QP / 120k / 300k
67.5	H	1	80.000	18.4	7.4	2.1	0.0	-10.5	38.4	40.0	-1.6	QP / 120k / 300k
67.5	H	4	80.000	16.5	7.4	2.1	0.0	-10.5	36.5	40.0	-3.5	QP / 120k / 300k
0	V	1	80.000	15.7	7.4	2.1	0.0	-10.5	35.7	40.0	-4.3	QP / 120k / 300k
0	V	4	80.000	13.8	7.4	2.1	0.0	-10.5	33.8	40.0	-6.2	QP / 120k / 300k
247.5	H	1	170.000	10.3	9.4	3.2	0.0	-10.5	33.4	43.5	-10.1	QP / 120k / 300k
67.5	V	1	170.000	6.6	9.4	3.2	0.0	-10.5	29.7	43.5	-13.8	QP / 120k / 300k
0	H	1	200.000	4.6	10.0	3.6	0.0	-10.5	28.7	43.5	-14.8	QP / 120k / 300k
292.5	V	1	200.000	4.4	10.0	3.6	0.0	-10.5	28.5	43.5	-15.0	QP / 120k / 300k
270	H	1	265.000	5.2	14.0	4.2	0.0	-10.5	33.9	46.0	-12.1	QP / 120k / 300k
292.5	V	1	265.000	5.1	14.0	4.2	0.0	-10.5	33.8	46.0	-12.2	QP / 120k / 300k
Calculations				I=D+E+F-G-H			K=I-J					

Above 30 MHz Emissions of Low Voltage Line

8.0 BPL Radiated emission - Underground power lines - Location 3 (FCC 15.611(b)(2))

Data:

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: 15.209
 EUT Height (m): 0 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 3 (Underground) Krebs - Mode 3

	A	B	C	D	E	F	G	H	I	J	K	L
Angle	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
90	--	1	25.820	8.3	34.5	2.2	0.0	19.1	25.9	29.5	-3.6	QP / 9k / 30k
135	--	1	26.491	6.0	34.5	2.3	0.0	19.1	23.7	29.5	-5.8	QP / 9k / 30k
157.5	--	1	26.491	6.0	34.5	2.3	0.0	19.1	23.7	29.5	-5.8	QP / 9k / 30k
90	--	1	26.758	11.1	34.5	2.3	0.0	19.1	28.8	29.5	-0.7	QP / 9k / 30k
112.5	--	1	26.758	8.7	34.5	2.3	0.0	19.1	26.4	29.5	-3.1	QP / 9k / 30k
135	--	1	26.758	7.4	34.5	2.3	0.0	19.1	25.1	29.5	-4.4	QP / 9k / 30k
157.5	--	1	26.758	7.0	34.5	2.3	0.0	19.1	24.7	29.5	-4.8	QP / 9k / 30k
180	--	1	26.758	7.1	34.5	2.3	0.0	19.1	24.8	29.5	-4.7	QP / 9k / 30k
202.5	--	1	26.758	10.0	34.5	2.3	0.0	19.1	27.7	29.5	-1.8	QP / 9k / 30k
90	--	1	26.852	6.6	34.5	2.3	0.0	19.1	24.3	29.5	-5.2	QP / 9k / 30k
0	--	1	27.855	6.2	34.5	2.3	0.0	19.1	24.0	29.5	-5.5	QP / 9k / 30k
112.5	--	1	27.855	10.6	34.5	2.3	0.0	19.1	28.4	29.5	-1.1	QP / 9k / 30k
135	--	1	27.855	10.3	34.5	2.3	0.0	19.1	28.1	29.5	-1.4	QP / 9k / 30k
157.5	--	1	27.855	9.1	34.5	2.3	0.0	19.1	26.9	29.5	-2.6	QP / 9k / 30k
202.5	--	1	27.855	8.0	34.5	2.3	0.0	19.1	25.8	29.5	-3.7	QP / 9k / 30k
67.5	--	1	28.040	6.2	34.5	2.4	0.0	19.1	24.0	29.5	-5.5	QP / 9k / 30k
90	--	1	28.040	6.0	34.5	2.4	0.0	19.1	23.8	29.5	-5.7	QP / 9k / 30k
112.5	--	1	28.040	7.1	34.5	2.4	0.0	19.1	24.9	29.5	-4.6	QP / 9k / 30k
135	--	1	28.040	11.6	34.5	2.4	0.0	19.1	29.4	29.5	-0.1	QP / 9k / 30k
157.5	--	1	28.040	11.1	34.5	2.4	0.0	19.1	28.9	29.5	-0.6	QP / 9k / 30k
202.5	--	1	28.040	5.8	34.5	2.4	0.0	19.1	23.6	29.5	-5.9	QP / 9k / 30k
180	--	1	28.046	6.8	34.5	2.4	0.0	19.1	24.7	29.5	-4.8	QP / 9k / 30k
90	--	1	28.865	6.5	34.5	2.5	0.0	19.1	24.4	29.5	-5.1	QP / 9k / 30k
112.5	--	1	29.000	8.5	34.5	2.5	0.0	19.1	26.4	29.5	-3.1	QP / 9k / 30k
135	--	1	29.000	9.7	34.5	2.5	0.0	19.1	27.6	29.5	-1.9	QP / 9k / 30k
157.5	--	1	29.000	7.5	34.5	2.5	0.0	19.1	25.4	29.5	-4.1	QP / 9k / 30k
90	--	1	29.025	5.7	34.5	2.5	0.0	19.1	23.6	29.5	-5.9	QP / 9k / 30k
Calculations				I=D+E+F-G-H			K=I-J					

Below 30 MHz Emissions of Medium Voltage Line

8.0 BPL Radiated emission - Underground power lines - Location 3 (FCC 15.611(b)(2))

Data:

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): MV Limit: 15.209 (<30MHz) 15.109 Class A (>30 MHz)
 EUT Height (m): 0 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 3 (Underground) Krebs - Mode 3

	A	B	C	D	E	F	G	H	I	J	K	L
Angle	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
90	V	1	30.000	16.7	17.5	1.2	0.0	0.0	35.5	39.1	-3.6	QP / 120k / 300k
0	V	1	30.000	16.0	17.5	1.2	0.0	0.0	34.8	39.1	-4.3	QP / 120k / 300k
45	V	1	31.000	19.7	17.7	1.2	0.0	0.0	38.6	39.1	-0.5	QP / 120k / 300k
45	V	4	31.000	17.8	17.7	1.2	0.0	0.0	36.7	39.1	-2.4	QP / 120k / 300k
22.5	V	1	31.000	19.0	17.7	1.2	0.0	0.0	37.9	39.1	-1.2	QP / 120k / 300k
0	V	1	31.000	18.4	17.7	1.2	0.0	0.0	37.3	39.1	-1.8	QP / 120k / 300k
45	V	1	32.000	19.3	17.3	1.3	0.0	0.0	37.9	39.1	-1.2	QP / 120k / 300k
67.5	V	1	32.000	19.1	17.3	1.3	0.0	0.0	37.7	39.1	-1.4	QP / 120k / 300k
22.5	V	1	32.000	19.0	17.3	1.3	0.0	0.0	37.6	39.1	-1.5	QP / 120k / 300k
45	V	1	33.000	18.8	17.0	1.4	0.0	0.0	37.2	39.1	-1.9	QP / 120k / 300k
67.5	V	1	33.000	18.6	17.0	1.4	0.0	0.0	37.0	39.1	-2.1	QP / 120k / 300k
22.5	V	1	33.000	18.0	17.0	1.4	0.0	0.0	36.4	39.1	-2.7	QP / 120k / 300k
0	V	1	33.138	18.6	17.0	1.4	0.0	0.0	37.0	39.1	-2.1	QP / 120k / 300k
0	V	1	33.295	18.6	17.0	1.4	0.0	0.0	37.0	39.1	-2.1	QP / 120k / 300k
0	V	1	33.315	18.3	17.0	1.4	0.0	0.0	36.7	39.1	-2.4	QP / 120k / 300k
0	V	1	33.345	18.1	17.0	1.3	0.0	0.0	36.5	39.1	-2.6	QP / 120k / 300k
67.5	V	1	34.000	19.0	16.2	1.4	0.0	0.0	36.6	39.1	-2.5	QP / 120k / 300k
45	V	1	34.000	18.4	16.2	1.4	0.0	0.0	36.0	39.1	-3.1	QP / 120k / 300k
22.5	V	1	34.000	18.0	16.2	1.4	0.0	0.0	35.6	39.1	-3.5	QP / 120k / 300k
0	V	1	34.110	19.0	16.2	1.4	0.0	0.0	36.6	39.1	-2.5	QP / 120k / 300k
0	V	4	34.110	17.1	16.2	1.4	0.0	0.0	34.7	39.1	-4.4	QP / 120k / 300k
90	H	1	55.000	14.2	6.2	1.7	0.0	0.0	22.1	39.1	-17.0	QP / 120k / 300k
67.5	H	1	80.000	18.4	7.4	2.1	0.0	0.0	27.9	39.1	-11.2	QP / 120k / 300k
247.5	H	1	170.000	10.3	9.4	3.2	0.0	0.0	23.0	43.5	-20.5	QP / 120k / 300k
0	H	1	200.000	4.6	10.0	3.6	0.0	0.0	18.2	43.5	-25.3	QP / 120k / 300k
270	H	1	265.000	5.2	14.0	4.2	0.0	0.0	23.5	46.0	-22.5	QP / 120k / 300k
Calculations				I=D+E+F-G-H			K=I-J					

Above 30 MHz Emissions of Medium Voltage Line

8.0 BPL Radiated emission - Underground power lines - Location 3 (FCC 15.611(b)(2))**Data:**

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV Limit: 15.209 (<30MHz) 15.109 Class B (>30 MHz)
 EUT Height (m): 1 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 3 (Underground) Krebs - Mode 7												
	A	B	C	D	E	F	G	H	I	J	K	L
Angle	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/ RBW/ VBW
0	--	1	2.150	6.7	41.3	0.4	0.0	19.1	29.3	29.5	-0.2	QP / 9k / 30k
45	--	1	2.150	5.8	41.3	0.4	0.0	19.1	28.4	29.5	-1.1	QP / 9k / 30k
180	--	1	2.150	5.3	41.3	0.4	0.0	19.1	27.9	29.5	-1.6	QP / 9k / 30k
270	--	1	2.150	5.7	41.3	0.4	0.0	19.1	28.3	29.5	-1.2	QP / 9k / 30k
292.5	--	1	2.150	6.8	41.3	0.4	0.0	19.1	29.4	29.5	-0.1	QP / 9k / 30k
315	--	1	2.150	6.1	41.3	0.4	0.0	19.1	28.7	29.5	-0.8	QP / 9k / 30k
337.5	--	1	2.150	6.6	41.3	0.4	0.0	19.1	29.2	29.5	-0.3	QP / 9k / 30k
337.5	--	1	2.336	5.0	41.3	0.4	0.0	19.1	27.6	29.5	-1.9	QP / 9k / 30k
180	--	1	2.456	6.5	41.3	0.4	0.0	19.1	29.1	29.5	-0.4	QP / 9k / 30k
67.5	--	1	2.932	5.6	41.3	0.4	0.0	19.1	28.2	29.5	-1.3	QP / 9k / 30k
90	--	1	2.932	6.7	41.3	0.4	0.0	19.1	29.3	29.5	-0.2	QP / 9k / 30k
135	--	1	2.932	6.8	41.3	0.4	0.0	19.1	29.4	29.5	-0.1	QP / 9k / 30k
247.5	--	1	2.932	5.7	41.3	0.4	0.0	19.1	28.3	29.5	-1.2	QP / 9k / 30k
292.5	--	1	2.932	6.6	41.3	0.4	0.0	19.1	29.2	29.5	-0.3	QP / 9k / 30k
157.5	--	1	3.088	9.4	38.2	0.4	0.0	19.1	28.9	29.5	-0.6	QP / 9k / 30k
292.5	--	1	3.224	9.2	38.2	0.4	0.0	19.1	28.7	29.5	-0.8	QP / 9k / 30k
337.5	--	1	3.224	9.0	38.2	0.4	0.0	19.1	28.5	29.5	-1.0	QP / 9k / 30k
135	--	1	3.241	8.4	38.2	0.4	0.0	19.1	27.9	29.5	-1.6	QP / 9k / 30k
337.5	--	1	3.444	8.3	38.2	0.4	0.0	19.1	27.8	29.5	-1.7	QP / 9k / 30k
0	--	1	3.484	8.3	38.2	0.4	0.0	19.1	27.8	29.5	-1.7	QP / 9k / 30k
180	--	1	3.819	9.3	38.2	0.4	0.0	19.1	28.8	29.5	-0.7	QP / 9k / 30k
180	--	1	3.920	8.6	38.2	0.4	0.0	19.1	28.1	29.5	-1.4	QP / 9k / 30k
180	--	1	3.999	9.9	38.2	0.4	0.0	19.1	29.4	29.5	-0.1	QP / 9k / 30k
180	--	1	4.010	11.2	36.5	0.4	0.0	19.1	29.0	29.5	-0.5	QP / 9k / 30k
180	--	1	4.021	11.1	36.5	0.4	0.0	19.1	28.9	29.5	-0.6	QP / 9k / 30k
180	--	1	4.478	10.0	36.5	0.4	0.0	19.1	27.8	29.5	-1.7	QP / 9k / 30k
180	--	1	4.500	10.2	36.5	0.4	0.0	19.1	28.0	29.5	-1.5	QP / 9k / 30k
180	--	1	4.645	10.4	36.5	0.4	0.0	19.1	28.2	29.5	-1.3	QP / 9k / 30k
180	--	1	4.804	10.7	36.5	0.4	0.0	19.1	28.5	29.5	-1.0	QP / 9k / 30k
180	--	1	4.984	10.0	36.5	0.4	0.0	19.1	27.8	29.5	-1.7	QP / 9k / 30k
180	--	1	5.121	12.7	35.3	0.4	0.0	19.1	29.3	29.5	-0.2	QP / 9k / 30k
0	--	1	5.275	12.5	35.3	0.4	0.0	19.1	29.1	29.5	-0.4	QP / 9k / 30k
180	--	1	5.439	11.0	35.3	0.4	0.0	19.1	27.6	29.5	-1.9	QP / 9k / 30k
180	--	1	5.579	12.4	35.3	0.4	0.0	19.1	29.0	29.5	-0.5	QP / 9k / 30k
180	--	1	5.591	12.8	35.3	0.4	0.0	19.1	29.4	29.5	-0.1	QP / 9k / 30k
180	--	1	5.714	12.3	35.3	0.4	0.0	19.1	28.9	29.5	-0.6	QP / 9k / 30k
180	--	1	6.052	12.4	35.2	0.4	0.0	19.1	28.9	29.5	-0.6	QP / 9k / 30k
180	--	1	6.058	12.5	35.2	0.4	0.0	19.1	29.0	29.5	-0.5	QP / 9k / 30k
180	--	1	6.089	11.8	35.2	0.4	0.0	19.1	28.3	29.5	-1.2	QP / 9k / 30k
180	--	1	6.522	12.5	35.2	0.4	0.0	19.1	29.0	29.5	-0.5	QP / 9k / 30k
Calculations			I=D+E+F-G-H			K=I-J						

Below 30 MHz Emissions of Low Voltage Line

9.0 BPL Radiated emission - Underground power lines - Location 5 (FCC 15.611(b)(2))

Method:

Access BPL systems that operate in the frequency range of 1.705 kHz to 30 MHz over medium voltage power lines shall comply with the radiated emission limits for intentional radiators provided in §15.209.

Access BPL systems that operate in the frequency range above 30 MHz over medium voltage power lines shall comply with the radiated emission limits provided in §15.109(b).

Access BPL systems that operate over low-voltage power lines, including those that operate over low-voltage lines that are connected to the in-building wiring, shall comply with the radiated emission limits provided in §15.109(a) and (e).

1. General Measurement Principles for Access BPL, In-House BPL and CCS

- 1) Testing shall be performed with the power settings of the Equipment Under Test (EUT) set at the maximum level.
- 2) Testing shall be performed using the maximum RF injection duty factor (burst rate). Test modes or test software may be used for uplink and downlink transmissions.
- 3) Measurements should be made at a test site where the ambient signal level is 6 dB below the applicable limit. (See ANSI C63.4-2003, section 5.1.2 for alternatives, if this test condition cannot be achieved.)
- 4) If the data communications burst rate is at least 20 burst per second, quasi-peak measurements shall be employed, as specified in Section 15.35(a). If the data communications burst rate is 20 bursts per second or less, measurements shall be made using a peak detector.
- 5) For frequencies above 30 MHz, an electric field sensing antenna, such as a biconical antenna is used. The signal shall be maximized for antenna heights from 1 to 4 meters, for both horizontal and vertical polarizations, in accordance to ANSI C63.4-2003 procedures. For Access BPL measurements only, as an alternative to varying antenna height from 1 to 4 meters, these measurements may be made at a height of 1 meter provided that the measured field strength values are increased by a factor of 5 dB to account for height effects.
- 6) For frequencies below 30 MHz, an active or passive magnetic loop is used. The magnetic loop antenna should be at 1 meter height with its plane oriented vertically and the emission maximized by rotating the antenna 180 degrees about its vertical axis. When using active magnetic loops, care should be taken to prevent ambient signals from overloading the spectrum analyzer or antenna preamplifier.
- 7) The six highest radiated emissions relative to the limit and independent of antenna polarization shall be reported as stated in ANSI C63.4-2003, section 10.1.8.2.
- 8) All operational modes should be tested including all frequency bands of operation, as required by 47 C.F.R. § 15.31(i).

2. Access BPL Measurement Principles

a. Test Environment

- 1) The Equipment Under Test (EUT) includes all BPL electronic devices e.g., couplers, injectors, extractors, repeaters, boosters, concentrators, and electric utility overhead or underground medium voltage lines.
- 2) In-situ testing shall be performed on three typical installations for overhead line(s) and three typical installations for underground line(s).

Radiated Emissions Measurement Principles for Underground Line Installations

- 1) Underground line installations are those in which the BPL device is mounted in, or attached to, a padmounted transformer housing or a ground-mounted junction box and couples directly only to underground cables.
- 2) Measurements should normally be performed at a separation distance of 10 meters from the in-ground power transformer that contains the BPL device(s). If necessary, due to ambient emissions, measurements may be performed a distance of 3 meters. Distance corrections are to be made in accordance with Section 15.31(f) of the Rules.
- 3) Measurements shall be made at positions around the perimeter of the in-ground power transformer where the maximum emissions occur. ANSI C63.4-2003, section 8.1, specifies a minimum of 16 radial angles surrounding the EUT (In-ground transformer that contains the BPL device(s)). If directional radiation patterns are suspected, additional azimuth angles shall be examined.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog (20MHz to 2GHz)	Chase	CBL6112A	211518	12/15/2006	12/15/2007
Antenna, Passive Loop (10 kHz - 30 MHz)	EMCO	6512	9810-1228	07/11/2006	07/11/2007
Coaxial Cable, 50 ft, BNC connectors	Radioshack	RG-58/U	TC-3	03/21/2007	03/21/2008
Coaxial Cable, 50 ft, BNC connectors	Radioshack	RG-58/U	TC-2	03/21/2007	03/21/2008
EMI Receiver	Hewlett Packard	8546A	211505	10/26/2006	10/26/2007
Mast - Antenna	Sunol	TWR95	211264	VBU	VBU
Pre-selector Section	Hewlett-Packard	85460A	015762	10/20/2006	10/20/2007
Tripod	EMCO	TR-4	213043	VBU	VBU

Results: The sample tested was found to Comply.

9.0 BPL Radiated emission - Underground power lines - Location 5 (FCC 15.611(b)(2))

Data:

Summary Of Results At This Location

Frequency Test Range (MHz)	Power Line Type (LV/MV)	Mode (1,2,3, or 7)	Result (Pass/Fail)
2 - 30	LV/MV	7/1	Pass
30-2000	LV/MV	7/1	Pass

Summary of results

9.0 BPL Radiated emission - Underground power lines - Location 5 (FCC 15.611(b)(2))**Data:**

Frequency Range (MHz): 2 to 30 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV/MV Limit: 15.209 (<30MHz) 15.109 Class A (>30 MHz)
 EUT Height (m): 1 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 10.0

Notes: Location 5 (Underground) - Alan Scruggs, Mode 7 & 1

Angle	A Ant. Pol. (V/H)	B Ant. Height (m)	C Frequency MHz	D Reading dB(uV)	E Antenna Factor dB(1/m)	F Cable Loss dB	G Pre-amp Factor dB	H Slant Factor dB	I Net dB(uV/m)	J Limit dB(uV/m)	K Margin dB	L Detectors / Bandwidths Det/RBW/VBW
135	--	1	2.140	2.4	41.3	0.2	0.0	19.1	24.8	29.5	-4.7	QP / 9k / 30k
247.5	--	1	2.146	2.9	41.3	0.2	0.0	19.1	25.3	29.5	-4.2	QP / 9k / 30k
0	--	1	2.147	2.5	41.3	0.2	0.0	19.1	24.9	29.5	-4.6	QP / 9k / 30k
247.5	--	1	2.293	4.3	41.3	0.2	0.0	19.1	26.7	29.5	-2.8	QP / 9k / 30k
337.5	--	1	2.461	3.0	41.3	0.2	0.0	19.1	25.4	29.5	-4.1	QP / 9k / 30k
292.5	--	1	2.573	2.0	41.3	0.2	0.0	19.1	24.4	29.5	-5.1	QP / 9k / 30k
337.5	--	1	2.619	5.3	41.3	0.2	0.0	19.1	27.7	29.5	-1.8	QP / 9k / 30k
337.5	--	1	2.733	5.1	41.3	0.2	0.0	19.1	27.5	29.5	-2.0	QP / 9k / 30k
202.5	--	1	2.836	4.6	41.3	0.2	0.0	19.1	27.0	29.5	-2.5	QP / 9k / 30k
22.5	--	1	3.442	5.5	38.2	0.2	0.0	19.1	24.8	29.5	-4.7	QP / 9k / 30k
22.5	--	1	3.548	8.2	38.2	0.2	0.0	19.1	27.5	29.5	-2.0	QP / 9k / 30k
0	--	1	3.637	8.4	38.2	0.2	0.0	19.1	27.7	29.5	-1.8	QP / 9k / 30k
45	--	1	3.641	8.6	38.2	0.2	0.0	19.1	27.9	29.5	-1.6	QP / 9k / 30k
337.5	--	1	3.673	9.6	38.2	0.2	0.0	19.1	28.9	29.5	-0.6	QP / 9k / 30k
337.5	--	1	3.693	9.3	38.2	0.2	0.0	19.1	28.6	29.5	-0.9	QP / 9k / 30k
0	--	1	3.702	8.8	38.2	0.2	0.0	19.1	28.1	29.5	-1.4	QP / 9k / 30k
292.5	--	1	3.704	9.9	38.2	0.2	0.0	19.1	29.2	29.5	-0.3	QP / 9k / 30k
90	--	1	3.707	9.0	38.2	0.2	0.0	19.1	28.3	29.5	-1.2	QP / 9k / 30k
22.5	--	1	3.708	9.3	38.2	0.2	0.0	19.1	28.6	29.5	-0.9	QP / 9k / 30k
67.5	--	1	3.708	9.6	38.2	0.2	0.0	19.1	28.9	29.5	-0.6	QP / 9k / 30k
270	--	1	3.709	9.3	38.2	0.2	0.0	19.1	28.6	29.5	-0.9	QP / 9k / 30k
337.5	--	1	3.717	9.7	38.2	0.2	0.0	19.1	29.0	29.5	-0.5	QP / 9k / 30k
315	--	1	3.724	9.1	38.2	0.2	0.0	19.1	28.4	29.5	-1.1	QP / 9k / 30k
337.5	--	1	3.749	10.0	38.2	0.2	0.0	19.1	29.3	29.5	-0.2	QP / 9k / 30k
45	--	1	3.819	9.8	38.2	0.2	0.0	19.1	29.1	29.5	-0.4	QP / 9k / 30k
337.5	--	1	3.823	9.8	38.2	0.2	0.0	19.1	29.1	29.5	-0.4	QP / 9k / 30k
0	--	1	3.828	9.3	38.2	0.2	0.0	19.1	28.6	29.5	-0.9	QP / 9k / 30k
337.5	--	1	3.845	7.2	38.2	0.2	0.0	19.1	26.5	29.5	-3.0	QP / 9k / 30k
292.5	--	1	4.000	11.0	36.5	0.2	0.0	19.1	28.6	29.5	-0.9	QP / 9k / 30k
315	--	1	4.033	10.0	36.5	0.2	0.0	19.1	27.6	29.5	-1.9	QP / 9k / 30k
337.5	--	1	4.034	10.3	36.5	0.2	0.0	19.1	27.9	29.5	-1.6	QP / 9k / 30k
337.5	--	1	4.074	10.9	36.5	0.2	0.0	19.1	28.5	29.5	-1.0	QP / 9k / 30k
22.5	--	1	4.088	8.4	36.5	0.2	0.0	19.1	26.0	29.5	-3.5	QP / 9k / 30k
337.5	--	1	4.188	10.1	36.5	0.2	0.0	19.1	27.7	29.5	-1.8	QP / 9k / 30k
315	--	1	4.272	9.2	36.5	0.2	0.0	19.1	26.8	29.5	-2.7	QP / 9k / 30k
0	--	1	4.337	10.1	36.5	0.2	0.0	19.1	27.7	29.5	-1.8	QP / 9k / 30k
337.5	--	1	4.338	10.3	36.5	0.2	0.0	19.1	27.9	29.5	-1.6	QP / 9k / 30k
0	--	1	4.636	9.3	36.5	0.2	0.0	19.1	26.9	29.5	-2.6	QP / 9k / 30k
337.5	--	1	5.596	8.8	35.3	0.2	0.0	19.1	25.2	29.5	-4.3	QP / 9k / 30k
0	--	1	5.747	10.9	35.3	0.2	0.0	19.1	27.3	29.5	-2.2	QP / 9k / 30k
337.5	--	1	6.208	11.4	35.2	0.2	0.0	19.1	27.7	29.5	-1.8	QP / 9k / 30k
337.5	--	1	6.368	12.3	35.2	0.2	0.0	19.1	28.6	29.5	-0.9	QP / 9k / 30k
0	--	1	6.369	12.7	35.2	0.2	0.0	19.1	29.0	29.5	-0.5	QP / 9k / 30k
Calculations			I=D+E+F-G-H			K=I-J						

Below 30MHz Emissions of Low & Medium Voltage Line

9.0 BPL Radiated emission - Underground power lines - Location 5 (FCC 15.611(b)(2))

Data:

Frequency Range (MHz): 30 to 2000 Test Distance (m): 10.0
 Power Line Type (MV/LV): LV/MV Limit: 15.209 (<30MHz) 15.109 Class B (>30 MHz)
 EUT Height (m): 1 Limit Distance (<30 MHz)(m): 30.0
 Limit Distance (>=30 MHz)(m): 3.0

Notes: Location 5 (Underground) - Alan Scruggs, Mode 7 & 1

	A	B	C	D	E	F	G	H	I	J	K	L
Angle	Ant. Pol. (V/H)	Ant. Height (m)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Slant Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
0	V	1	32.120	8.9	17.3	1.3	0.0	-10.5	37.9	40.0	-2.1	QP / 120k / 300k
135	V	1	32.130	8.4	17.3	1.3	0.0	-10.5	37.4	40.0	-2.6	QP / 120k / 300k
337.5	V	1	32.140	7.4	17.3	1.3	0.0	-10.5	36.4	40.0	-3.6	QP / 120k / 300k
202.5	V	1	32.940	8.4	17.3	1.4	0.0	-10.5	37.5	40.0	-2.5	QP / 120k / 300k
292.5	H	1	32.970	6.3	17.3	1.4	0.0	-10.5	35.4	40.0	-4.6	QP / 120k / 300k
225	V	1	75.520	16.8	6.6	2.0	0.0	-10.5	35.9	40.0	-4.1	QP / 120k / 300k
247.5	V	1	75.570	18.4	6.6	2.0	0.0	-10.5	37.5	40.0	-2.5	QP / 120k / 300k
180	V	1	77.040	17.1	6.6	2.1	0.0	-10.5	36.2	40.0	-3.8	QP / 120k / 300k
157.5	V	1	77.090	18.6	6.6	2.1	0.0	-10.5	37.7	40.0	-2.3	QP / 120k / 300k
315	V	1	78.620	16.8	6.6	2.1	0.0	-10.5	35.9	40.0	-4.1	QP / 120k / 300k
22.5	V	1	78.960	13.1	6.6	2.1	0.0	-10.5	32.2	40.0	-7.8	QP / 120k / 300k
0	V	1	79.120	14.0	6.6	2.1	0.0	-10.5	33.1	40.0	-6.9	QP / 120k / 300k
292.5	V	1	81.640	14.1	7.4	2.1	0.0	-10.5	34.0	40.0	-6.0	QP / 120k / 300k
22.5	H	1	126.000	11.1	11.3	2.7	0.0	-10.5	35.5	43.5	-8.0	QP / 120k / 300k
180	H	1	126.200	12.2	11.3	2.7	0.0	-10.5	36.6	43.5	-6.9	QP / 120k / 300k
202.5	H	1	157.800	7.6	10.3	3.1	0.0	-10.5	31.4	43.5	-12.1	QP / 120k / 300k
112.5	H	1	158.700	12.3	10.3	3.1	0.0	-10.5	36.1	43.5	-7.4	QP / 120k / 300k
337.5	H	1	159.900	6.7	10.3	3.1	0.0	-10.5	30.5	43.5	-13.0	QP / 120k / 300k
202.5	H	1	201.000	4.9	10.0	3.6	0.0	-10.5	28.9	43.5	-14.6	QP / 120k / 300k
225	V	1	205.300	8.9	10.3	3.6	0.0	-10.5	33.2	43.5	-10.3	QP / 120k / 300k
67.5	V	1	227.800	6.0	10.3	3.7	0.0	-10.5	30.5	46.0	-15.5	QP / 120k / 300k
247.5	V	1	228.000	5.7	10.3	3.7	0.0	-10.5	30.2	46.0	-15.8	QP / 120k / 300k
270	H	1	229.300	6.1	10.3	3.7	0.0	-10.5	30.6	46.0	-15.4	QP / 120k / 300k
157.5	H	1	388.300	6.4	15.0	5.5	0.0	-10.5	37.3	46.0	-8.7	QP / 120k / 300k
45	H	1	389.000	6.3	15.0	5.5	0.0	-10.5	37.2	46.0	-8.8	QP / 120k / 300k
22.5	V	1	389.700	6.2	15.0	5.5	0.0	-10.5	37.2	46.0	-8.8	QP / 120k / 300k
Calculations				I=D+E+F-G-H			K=I-J					

Above 30MHz Emissions of Low & Medium Voltage Line