

**TEST REPORT**

Report Number: 3122294ATL-004

July 11, 2007

**Product Designation: BPL Repeater (Model #: BRU)**

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

Tested by:  
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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))	05/07/2007	PASS
5.0	BPL Radiated emission - Overhead power lines - Location 2 (FCC 15.611(b)(1))	05/10/2007	PASS
6.0	BPL Radiated emission - Overhead power lines - Location 3 (FCC 15.611(b)(1))	05/09/2007	PASS
7.0	BPL Radiated emission - Underground power lines - Location 4 (FCC 15.611(b)(2))	05/22/2007	PASS
8.0	BPL Radiated emission - Underground power lines - Location 5 (FCC 15.611(b)(2))	05/24/2007	PASS
9.0	BPL Radiated emission - Underground power lines - Location 6 (FCC 15.611(b)(2))	05/23/2007	PASS
10.0	Revision History (Revision History)		

### 3.0 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Broadband Over Power Line (BPL) Repeater	IBEC, Inc.	BRU	Not Available
Overhead Coupler	IBEC, Inc.	OHC18K	Not Available
Testing start date:	May 7 <sup>th</sup> , 2007		
EUT receive condition:	Good		

Description of EUT provided by Intertek:

The BRU is an integrated, weatherized unit that receives BPL signals in one mode and transmits those signals in a different mode.

Description of EUT exercising:

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

Data Duty Factor Requirement:

The EUT 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
Minimum frequency of band (MHz)	3	13.5	24
Maximum frequency of band (MHz)	13	23.5	34

BPL Test Site Locations:

All test locations were in the area of Lovingston, VA 22949

Location # (1) Napier Loop Road, Pole # AP62  
 (2) Tye River Depot, Pole # AP80  
 (3) Steven's Cove Road, Pole # AGAD2  
 (4) Rosewood Golf., Box # 170 10 A  
 (5) Rosewood Golf., Box # 170 5 A  
 (6) Rosewood Golf., Box # 170 2 A

## 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	NYM-EMC-36	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:
Cable E11, <18GHz	Huber-Suhner	Sucoflex 104PEA	E11 211266	05/17/2007	05/17/2008
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
EMI Receiver, Preselector section	Hewlett Packard	85460A	015762	10/20/2006	10/20/2007
Mast - Antenna	Sunol	TWR95	211264	VBU	VBU
Preamplifier, 20MHz to 2GHz, 30 dB	A.H. Systems	PAM-0202	200082	10/09/2006	10/09/2007
Tripod	EMCO	TR-4	213043	VBU	VBU

**Results: The sample tested was found to Comply.**

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

Date: 5/7/2007-5/8/2007

Test Distance (m): 10.0

Frequency Range (MHz): 2 to 30

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 8

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 1 (Overhead - Napier Loop Road - pole# AP62), Mode 1 (3-13 MHz), Time Domain repeater mode												
$\lambda, \text{m}$	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
37.5	CA	1	2.013	2.0	41.3	0.4	0.0	15.6	28.1	29.5	-1.4	QP / 9k / 30k
37.5	CP	1	3.112	1.4	38.2	0.4	0.0	15.6	24.4	29.5	-5.1	QP / 9k / 30k
0	CP	1	4.632	7.8	36.5	0.4	0.0	15.6	29.1	29.5	-0.4	QP / 9k / 30k
0	CP	1	5.219	8.5	35.3	0.4	0.0	15.6	28.6	29.5	-0.9	QP / 9k / 30k
0	CP	1	6.095	9.1	35.2	0.4	0.0	15.6	29.1	29.5	-0.4	QP / 9k / 30k
18.8	CA	1	6.718	8.8	35.2	0.4	0.0	15.6	28.8	29.5	-0.7	QP / 9k / 30k
18.8	CP	1	7.343	9.6	34.9	0.4	0.0	15.6	29.3	29.5	-0.2	QP / 9k / 30k
9.4	CP	1	7.890	9.4	34.9	0.4	0.0	15.6	29.1	29.5	-0.4	QP / 9k / 30k
9.4	CP	1	8.495	9.7	34.7	0.4	0.0	15.6	29.2	29.5	-0.3	QP / 9k / 30k
37.5	CP	1	8.898	9.8	34.7	0.4	0.0	15.6	29.3	29.5	-0.2	QP / 9k / 30k
37.5	CP	1	9.239	9.5	34.4	0.4	0.0	15.6	28.7	29.5	-0.8	QP / 9k / 30k
37.5	CP	1	9.549	9.4	34.4	0.4	0.0	15.6	28.6	29.5	-0.9	QP / 9k / 30k
9.4	CA	1	10.250	8.9	34.4	1.4	0.0	15.6	29.1	29.5	-0.4	QP / 9k / 30k
9.4	CA	1	10.470	8.2	34.4	1.4	0.0	15.6	28.4	29.5	-1.1	QP / 9k / 30k
37.5	CP	1	11.430	8.0	34.4	1.5	0.0	15.6	28.3	29.5	-1.2	QP / 9k / 30k
0	CA	1	11.719	9.0	34.4	1.5	0.0	15.6	29.3	29.5	-0.2	QP / 9k / 30k
9.4	CA	1	12.020	7.2	34.4	1.5	0.0	15.6	27.5	29.5	-2.0	QP / 9k / 30k
0	CA	1	13.580	6.1	34.4	1.5	0.0	15.6	26.4	29.5	-3.1	QP / 9k / 30k
9.4	CP	1	14.120	8.7	34.4	1.6	0.0	15.6	29.1	29.5	-0.4	QP / 9k / 30k
9.4	CP	1	14.540	6.9	34.4	1.6	0.0	15.6	27.3	29.5	-2.2	QP / 9k / 30k
18.8	CP	1	14.880	7.5	34.4	1.6	0.0	15.6	27.9	29.5	-1.6	QP / 9k / 30k
9.4	CP	1	15.510	6.9	34.7	1.7	0.0	15.6	27.7	29.5	-1.8	QP / 9k / 30k
18.8	CP	1	16.290	8.0	34.7	1.7	0.0	15.6	28.8	29.5	-0.7	QP / 9k / 30k
0	CP	1	16.890	8.2	34.7	1.8	0.0	15.6	29.1	29.5	-0.4	QP / 9k / 30k
18.8	CA	1	17.380	6.9	34.7	1.8	0.0	15.6	27.8	29.5	-1.7	QP / 9k / 30k
9.4	CP	1	18.010	8.5	34.7	1.8	0.0	15.6	29.4	29.5	-0.1	QP / 9k / 30k
18.8	CA	1	18.370	6.8	34.7	1.9	0.0	15.6	27.7	29.5	-1.8	QP / 9k / 30k
0	CA	1	19.167	8.2	34.7	2.0	0.0	15.6	29.2	29.5	-0.3	QP / 9k / 30k
9.4	CA	1	20.040	9.0	34.0	2.0	0.0	15.6	29.3	29.5	-0.2	QP / 9k / 30k
0	CA	1	20.865	7.7	34.0	1.9	0.0	15.6	28.0	29.5	-1.5	QP / 9k / 30k
0	CP	1	22.420	5.6	34.0	2.1	0.0	15.6	26.1	29.5	-3.4	QP / 9k / 30k
9.4	CP	1	25.750	2.7	34.5	2.2	0.0	15.6	23.8	29.5	-5.7	QP / 9k / 30k
0	CA	1	27.620	1.1	34.5	2.3	0.0	15.6	22.3	29.5	-7.2	QP / 9k / 30k
0	CA	1	29.702	1.0	34.5	2.4	0.0	15.6	22.3	29.5	-7.2	QP / 9k / 30k
Calculations				I=D+E+F+GH	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:**

Date: 5/7/2007

Test Distance (m): 10.0

Frequency Range (MHz): 30 to 2000

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 5

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 1 (Overhead - Napier Loop Road - pole# AP62), Mode 1 (3 - 13 MHz), Time Domain repeater mode												
<b>λ, m</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>	<b>J</b>	<b>K</b>	<b>L</b>
	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	H	1	30.800	35.6	17.5	0.6	31.0	-1.7	24.4	39.1	-14.7	QP / 120k / 300k
56.3	V	1	32.718	38.8	17.3	0.6	31.0	-1.7	27.4	39.1	-11.7	QP / 120k / 300k
56.3	V	1	34.068	38.0	16.2	0.6	31.0	-1.7	25.5	39.1	-13.6	QP / 120k / 300k
28.1	V	1	35.426	37.1	15.0	0.6	31.0	-1.7	23.4	39.1	-15.7	QP / 120k / 300k
18.8	V	1	36.750	36.5	14.0	0.6	31.0	-1.7	21.8	39.1	-17.3	QP / 120k / 300k
56.3	V	1	49.538	47.8	8.1	0.6	31.0	-1.7	27.2	39.1	-11.9	QP / 120k / 300k
0	H	1	55.000	38.5	6.2	0.6	31.0	-1.7	16.0	39.1	-23.1	QP / 120k / 300k
56.3	V	1	65.675	48.5	5.9	0.6	31.0	-1.7	25.7	39.1	-13.4	QP / 120k / 300k
56.3	V	1	81.210	49.5	7.4	0.6	31.0	-1.7	28.2	39.1	-10.9	QP / 120k / 300k
56.3	V	1	99.395	44.4	9.5	0.6	31.0	-1.7	25.3	43.5	-18.2	QP / 120k / 300k
0	H	1	111.100	36.7	11.6	0.6	31.0	-1.7	19.6	43.5	-23.9	QP / 120k / 300k
28.1	V	1	148.000	35.6	10.8	0.6	31.0	-1.7	17.8	43.5	-25.7	QP / 120k / 300k
18.8	H	1	172.750	44.3	9.4	0.6	30.9	-1.7	25.0	43.5	-18.5	QP / 120k / 300k
18.8	V	1	186.670	40.0	9.9	0.6	30.9	-1.7	21.3	43.5	-22.2	QP / 120k / 300k
9.4	V	1	269.500	38.6	14.0	0.6	30.9	-1.7	24.0	46.0	-22.0	QP / 120k / 300k
37.5	H	1	275.000	26.9	13.2	0.6	30.9	-1.7	11.5	46.0	-34.5	QP / 120k / 300k
28.1	H	1	319.968	34.8	13.4	0.6	30.9	-1.7	19.6	46.0	-26.4	QP / 120k / 300k
9.4	V	1	379.500	29.6	15.4	0.6	30.9	-1.7	16.4	46.0	-29.6	QP / 120k / 300k
0	H	1	454.250	26.2	17.2	0.6	30.8	-1.7	14.8	46.0	-31.2	QP / 120k / 300k
28.1	H	1	495.250	30.4	17.4	0.6	30.8	-1.7	19.2	46.0	-26.8	QP / 120k / 300k
28.1	H	1	554.500	30.4	18.0	1.4	30.8	-1.7	20.6	46.0	-25.4	QP / 120k / 300k
28.1	H	1	641.000	31.1	18.8	1.4	30.8	-1.7	22.3	46.0	-23.7	QP / 120k / 300k
9.4	H	1	653.750	29.9	19.0	1.4	30.8	-1.7	21.2	46.0	-24.8	QP / 120k / 300k
37.5	H	1	668.340	28.4	18.8	1.4	30.7	-1.7	19.6	46.0	-26.4	QP / 120k / 300k
56.3	H	1	713.000	28.2	19.1	1.4	30.7	-1.7	19.7	46.0	-26.3	QP / 120k / 300k
37.5	H	1	766.340	28.9	19.8	1.4	30.7	-1.7	21.2	46.0	-24.8	QP / 120k / 300k
56.3	V	1	842.500	25.2	20.3	1.4	30.6	-1.7	18.0	46.0	-28.0	QP / 120k / 300k
18.8	H	1	871.000	28.6	20.5	1.4	30.6	-1.7	21.6	46.0	-24.4	QP / 120k / 300k
37.5	H	1	958.110	27.9	21.1	1.4	30.5	-1.7	21.6	46.0	-24.4	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 2 (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	NYM-EMC-36	07/11/2006	07/11/2007

**5.0 BPL Radiated emission - Overhead power lines - Location 2 (FCC 15.611(b)(1))****Test Equipment Used:**

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Cable E11, <18GHz	Huber-Suhner	Sucoflex 104PEA	E11 211266	05/17/2007	05/17/2008
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
EMI Receiver, Preselector section	Hewlett Packard	85460A	015762	10/20/2006	10/20/2007
Mast - Antenna	Sunol	TWR95	211264	VBU	VBU
Preamplifier, 60 Hz to 30 MHz	Com-Power	PA-010	211566	07/17/2006	07/17/2007
Spectrum Analyzer	Hewlett Packard	8595E	213060	03/21/2007	03/21/2008
Tripod	EMCO	TR-4	213043	VBU	VBU

**Results: The sample tested was found to Comply.**

**5.0 BPL Radiated emission - Overhead power lines - Location 2 (FCC 15.611(b)(1))****Data:**

Date: 5/10/2007

Test Distance (m): 10.0

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Frequency Range (MHz): 2 to 30

Limit Distance (&lt;30 MHz)(m): 30.0

Power Line Type (MV/LV): MV

Limit Distance (&gt;30 MHz)(m): 10.0

EUT Height (m): 9.8

Notes: Location 2 (Overhead - Tye River Depot - Pole #AP80), Mode 3 (24-34 MHz), Frequency Domain repeater mode

m	A	B	C	D	E	F	G	H	I	J	K	L
	Ant. Pol. (CP/CA)	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
2.6	CA	1	2.000	40.9	41.3	0.2	40.7	14.1	27.6	29.5	-1.9	QP / 9k / 30k
0	CP	1	2.012	38.7	41.3	0.2	40.7	14.1	25.4	29.5	-4.1	QP / 9k / 30k
5.2	CP	1	2.294	38.8	41.3	0.2	40.7	14.1	25.5	29.5	-4.0	QP / 9k / 30k
10.3	CP	1	3.762	41.2	38.2	0.2	40.8	14.1	24.7	29.5	-4.8	QP / 9k / 30k
7.8	CP	1	4.260	44.5	36.5	0.2	40.8	14.1	26.3	29.5	-3.2	QP / 9k / 30k
10.3	CP	1	5.150	44.6	35.3	0.2	40.7	14.1	25.3	29.5	-4.2	QP / 9k / 30k
10.3	CP	1	6.016	44.3	35.2	0.2	40.7	14.1	24.9	29.5	-4.6	QP / 9k / 30k
2.6	CA	1	6.560	42.7	35.2	0.2	40.7	14.1	23.3	29.5	-6.2	QP / 9k / 30k
0	CP	1	7.645	45.3	34.9	0.2	40.6	14.1	25.7	29.5	-3.8	QP / 9k / 30k
5.2	CP	1	8.923	43.7	34.7	0.2	40.5	14.1	24.0	29.5	-5.5	QP / 9k / 30k
2.6	CP	1	9.383	44.2	34.4	0.2	40.4	14.1	24.2	29.5	-5.3	QP / 9k / 30k
5.2	CP	1	9.656	44.1	34.4	0.2	40.4	14.1	24.2	29.5	-5.3	QP / 9k / 30k
0	CP	1	10.782	44.2	34.4	0.7	40.4	14.1	24.8	29.5	-4.7	QP / 9k / 30k
10.3	CP	1	11.870	40.1	34.4	0.8	40.3	14.1	20.8	29.5	-8.7	QP / 9k / 30k
10.3	CP	1	12.200	42.2	34.4	0.8	40.1	14.1	23.1	29.5	-6.4	QP / 9k / 30k
10.3	CP	1	13.955	42.5	34.4	0.8	39.7	14.1	23.9	29.5	-5.6	QP / 9k / 30k
10.3	CP	1	14.980	46.0	34.4	0.8	39.7	14.1	27.4	29.5	-2.1	QP / 9k / 30k
10.3	CP	1	15.481	44.0	34.7	0.8	39.9	14.1	25.5	29.5	-4.0	QP / 9k / 30k
0	CA	1	15.868	43.0	34.7	0.8	39.9	14.1	24.5	29.5	-5.0	QP / 9k / 30k
10.3	CP	1	16.172	43.6	34.7	0.9	39.8	14.1	25.2	29.5	-4.3	QP / 9k / 30k
5.2	CA	1	16.733	43.2	34.7	0.9	39.8	14.1	24.8	29.5	-4.7	QP / 9k / 30k
0	CP	1	16.973	42.9	34.7	0.9	39.8	14.1	24.6	29.5	-4.9	QP / 9k / 30k
10.3	CA	1	17.427	45.8	34.7	0.9	39.7	14.1	27.6	29.5	-1.9	QP / 9k / 30k
0	CP	1	17.774	44.0	34.7	0.9	39.7	14.1	25.8	29.5	-3.7	QP / 9k / 30k
5.2	CP	1	18.577	45.3	34.7	0.9	39.7	14.1	27.2	29.5	-2.3	QP / 9k / 30k
5.2	CA	1	19.599	45.5	34.7	1.0	39.5	14.1	27.6	29.5	-1.9	QP / 9k / 30k
7.8	CP	1	20.380	45.0	34.0	1.0	39.3	14.1	26.5	29.5	-3.0	QP / 9k / 30k
10.3	CP	1	20.869	42.8	34.0	1.0	39.3	14.1	24.3	29.5	-5.2	QP / 9k / 30k
10.3	CP	1	21.950	41.3	34.0	1.0	39.2	14.1	23.0	29.5	-6.5	QP / 9k / 30k
7.8	CP	1	22.887	44.0	34.0	1.1	39.2	14.1	25.8	29.5	-3.7	QP / 9k / 30k
0	CP	1	24.942	41.3	34.0	1.1	38.9	14.1	23.4	29.5	-6.1	QP / 9k / 30k
2.6	CA	1	25.865	41.6	34.5	1.1	38.7	14.1	24.4	29.5	-5.1	QP / 9k / 30k
0	CP	1	26.026	43.2	34.5	1.1	38.7	14.1	26.0	29.5	-3.5	QP / 9k / 30k
0	CP	1	26.612	43.0	34.5	1.2	38.6	14.1	25.9	29.5	-3.6	QP / 9k / 30k
5.2	CP	1	27.274	42.6	34.5	1.2	38.4	14.1	25.8	29.5	-3.7	QP / 9k / 30k
2.6	CA	1	27.847	43.7	34.5	1.2	38.4	14.1	26.9	29.5	-2.6	QP / 9k / 30k
0	CP	1	28.030	42.3	34.5	1.2	38.4	14.1	25.5	29.5	-4.0	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 2 (FCC 15.611(b)(1))****Data:**

Date: 5/10/2007

Test Distance (m): 10.0

Frequency Range (MHz): 30 to 2000

Limit: 15.209 (&lt;30 MHz) and 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 9.8

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 2 (Overhead - Tye River Depot - Pole #AP80), Mode 3 (24 - 34 MHz), Frequency Domain repeater mode												
m	A Ant. Pol. (CP/CA)	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 10m Limit dB(uV/m)	K Margin dB	L Detectors / Bandwidths Det/RBW/VBW
2.6	V	1	30.000	17.1	17.5	1.8	0.0	-2.5	38.9	39.1	-0.2	QP / 120k / 300k
0	V	1	30.000	17.2	17.5	1.8	0.0	-2.5	39.0	39.1	-0.1	QP / 120k / 300k
0	V	1	31.120	17.0	17.7	1.8	0.0	-2.5	39.0	39.1	-0.1	QP / 120k / 300k
0	H	1	31.518	13.1	17.7	1.8	0.0	-2.5	35.1	39.1	-4.0	QP / 120k / 300k
2.6	V	1	31.750	16.8	17.7	1.8	0.0	-2.5	38.8	39.1	-0.3	QP / 120k / 300k
0	H	4	32.220	18.2	17.3	1.8	0.0	-1.3	38.6	39.1	-0.5	QP / 120k / 300k
0	V	1	32.953	16.7	17.3	1.9	0.0	-2.5	38.4	39.1	-0.7	QP / 120k / 300k
0	H	1	33.063	13.6	17.0	1.9	0.0	-2.5	35.0	39.1	-4.1	QP / 120k / 300k
2.6	V	1	33.450	17.0	17.0	1.9	0.0	-2.5	38.4	39.1	-0.7	QP / 120k / 300k
0	H	2	33.580	16.4	17.0	1.9	0.0	-2.1	37.4	39.1	-1.7	QP / 120k / 300k
0	V	1	34.003	17.3	16.2	2.0	0.0	-2.5	37.9	39.1	-1.2	QP / 120k / 300k
0	H	4	34.080	18.0	16.2	2.0	0.0	-1.3	37.4	39.1	-1.7	QP / 120k / 300k
0	H	1	381.000	14.8	15.2	6.0	0.0	-2.5	38.5	46.0	-7.5	QP / 120k / 300k
2.6	V	1	461.440	15.5	16.6	6.7	0.0	-2.5	41.3	46.0	-4.7	QP / 120k / 300k
2.6	V	1	581.000	12.5	18.8	8.7	0.0	-2.5	42.5	46.0	-3.5	QP / 120k / 300k
2.6	H	4	645.000	13.0	18.9	9.6	0.0	-1.3	42.7	46.0	-3.3	QP / 120k / 300k
2.6	H	4	746.840	12.6	19.6	10.6	0.0	-1.3	44.1	46.0	-1.9	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 3 (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	NYM-EMC-36	07/11/2006	07/11/2007

**6.0 BPL Radiated emission - Overhead power lines - Location 3 (FCC 15.611(b)(1))****Test Equipment Used:**

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Cable E11, <18GHz	Huber-Suhner	Sucoflex 104PEA	E11 211266	05/17/2007	05/17/2008
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
EMI Receiver, Preselector section	Hewlett Packard	85460A	015762	10/20/2006	10/20/2007
Mast - Antenna	Sunol	TWR95	211264	VBU	VBU
Preamplifier, 60 Hz to 30 MHz	Com-Power	PA-010	211566	07/17/2006	07/17/2007
Tripod	EMCO	TR-4	213043	VBU	VBU

**Results: The sample tested was found to Comply.**

**6.0 BPL Radiated emission - Overhead power lines - Location 3 (FCC 15.611(b)(1))****Data:**

Date: 5/9/2007

Test Distance (m): 10.0

Frequency Range (MHz): 2 to 30

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 9

Limit Distance (&gt;30 MHz)(m): 10.0

Notes: Location 3 (Overhead - Steven's cove Rd. - pole# AGAD2), Mode 2 (13.5 - 23.5 MHz), Time Domain repeater mode

A $\lambda, \text{m}$	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
8.1	CA	1	2.057	22.9	41.3	20.3	40.7	14.8	29.0	29.5	-0.5
8.1	CP	1	2.271	22.1	41.3	20.3	40.7	14.8	28.1	29.5	-1.4
12.2	CP	1	3.061	24.7	38.2	20.3	40.8	14.8	27.5	29.5	-2.0
12.2	CP	1	3.980	22.2	38.2	20.3	40.8	14.8	25.1	29.5	-4.4
0	CA	1	4.742	5.8	36.5	0.4	0.0	14.8	27.9	29.5	-1.6
0	CA	1	5.132	7.5	35.3	0.4	0.0	14.8	28.4	29.5	-1.1
0	CA	1	5.455	6.2	35.3	0.4	0.0	14.8	27.1	29.5	-2.4
0	CP	1	6.032	28.0	35.2	20.3	40.7	14.8	28.0	29.5	-1.5
0	CA	1	6.835	6.9	35.2	0.4	0.0	14.8	27.7	29.5	-1.8
0	CP	1	7.220	29.1	34.9	20.3	40.6	14.8	28.9	29.5	-0.6
0	CP	1	8.165	29.4	34.7	20.3	40.5	14.8	29.1	29.5	-0.4
4.1	CP	1	8.858	28.6	34.7	20.3	40.5	14.8	28.3	29.5	-1.2
0	CA	1	9.545	7.4	34.4	0.4	0.0	14.8	27.4	29.5	-2.1
0	CA	1	10.200	7.2	34.4	1.5	0.0	14.8	28.3	29.5	-1.2
12.2	CP	1	11.165	23.5	34.4	21.2	40.3	14.8	24.0	29.5	-5.5
4.1	CA	1	11.589	26.9	34.4	21.3	40.3	14.8	27.5	29.5	-2.0
4.1	CA	1	12.540	28.1	34.4	21.3	40.1	14.8	29.0	29.5	-0.5
4.1	CA	1	13.650	23.4	34.4	21.3	39.7	14.8	24.5	29.5	-5.0
0	CA	1	14.226	26.6	34.4	21.4	39.7	14.8	27.9	29.5	-1.6
0	CP	1	15.085	26.3	34.7	21.4	39.9	14.8	27.7	29.5	-1.8
0	CP	1	15.940	26.3	34.7	21.5	39.9	14.8	27.8	29.5	-1.7
0	CP	1	16.487	26.3	34.7	21.5	39.8	14.8	27.8	29.5	-1.7
0	CA	1	17.028	26.7	34.7	21.6	39.8	14.8	28.4	29.5	-1.1
0	CA	1	17.503	27.5	34.7	21.6	39.7	14.8	29.2	29.5	-0.3
0	CA	1	18.128	27.0	34.7	21.6	39.7	14.8	28.8	29.5	-0.7
0	CA	1	18.505	25.9	34.7	21.6	39.7	14.8	27.7	29.5	-1.8
0	CA	1	19.228	26.5	34.7	21.7	39.5	14.8	28.6	29.5	-0.9
0	CA	1	19.710	27.1	34.7	21.8	39.5	14.8	29.2	29.5	-0.3
12.2	CP	1	20.930	22.2	34.0	21.7	39.3	14.8	23.8	29.5	-5.7
0	CA	1	21.100	24.6	34.0	21.8	39.2	14.8	26.3	29.5	-3.2
0	CA	1	22.030	23.0	34.0	21.7	39.2	14.8	24.7	29.5	-4.8
16.2	CP	1	24.200	19.2	34.0	21.9	38.9	14.8	21.5	29.5	-8.0
16.2	CP	1	25.030	19.6	34.5	22.0	38.9	14.8	22.4	29.5	-7.1
16.2	CA	1	27.173	20.9	34.5	22.0	38.6	14.8	24.0	29.5	-5.5
16.2	CP	1	28.489	20.7	34.5	22.1	38.2	14.8	24.3	29.5	-5.2
16.2	CA	1	29.528	19.6	34.5	22.2	38.0	14.8	23.5	29.5	-6.0
Calculations			I=D+E+F+G+H	K=I-J							

Below 30 MHz Emissions of Medium Voltage Line

**6.0 BPL Radiated emission - Overhead power lines - Location 3 (FCC 15.611(b)(1))****Data:**

Date: 5/9/2007

Test Distance (m): 10.0

Frequency Range (MHz): 30 to 2000

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 9

Limit Distance (&gt;30 MHz)(m): 10.0

Notes: Location 3 (Overhead - Steven's Cove Road - pole# AGAD2), Mode 2 (13.5 - 23.5 MHz), Time Domain repeater mode												
<b><math>\lambda, \text{m}</math></b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>	<b>J</b>	<b>K</b>	<b>L</b>
	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
8.1	H	1	30.610	12.0	17.5	0.7	0.0	-2.1	32.3	39.1	-6.8	QP / 120k / 300k
0	H	1	30.960	14.5	17.5	0.7	0.0	-2.1	34.8	39.1	-4.3	QP / 120k / 300k
8.1	V	1	31.300	11.9	17.7	0.7	0.0	-2.1	32.4	39.1	-6.7	QP / 120k / 300k
0	V	1	31.910	11.7	17.7	0.7	0.0	-2.1	32.2	39.1	-6.9	QP / 120k / 300k
16.2	V	1	32.275	9.6	17.3	0.6	0.0	-2.1	29.6	39.1	-9.5	P / 120k / 300k
16.2	H	1	33.050	10.0	17.0	0.6	0.0	-2.1	29.7	39.1	-9.4	QP / 120k / 300k
4.1	V	1	33.930	12.2	17.0	0.6	0.0	-2.1	31.9	39.1	-7.2	QP / 120k / 300k
12.2	V	1	34.160	8.8	16.2	0.6	0.0	-2.1	27.7	39.1	-11.4	QP / 120k / 300k
4.1	V	1	36.740	13.1	14.0	0.6	0.0	-2.1	29.8	39.1	-9.3	QP / 120k / 300k
4.1	H	1	36.810	17.7	14.0	0.6	0.0	-2.1	34.4	39.1	-4.7	QP / 120k / 300k
0	V	1	38.490	10.7	12.4	0.7	0.0	-2.1	25.9	39.1	-13.2	QP / 120k / 300k
4.1	V	1	41.500	18.0	12.1	0.6	0.0	-2.1	32.8	39.1	-6.3	QP / 120k / 300k
12.2	H	1	44.230	18.3	10.0	0.6	0.0	-2.1	31.0	39.1	-8.1	QP / 120k / 300k
4.1	V	1	51.730	15.0	7.8	0.6	0.0	-2.1	25.5	39.1	-13.6	QP / 120k / 300k
0	H	1	52.940	19.8	7.3	0.7	0.0	-2.1	30.0	39.1	-9.1	QP / 120k / 300k
4.1	H	1	54.410	18.3	6.5	0.6	0.0	-2.1	27.5	39.1	-11.6	QP / 120k / 300k
4.1	H	1	65.230	20.8	5.9	0.6	0.0	-2.1	29.4	39.1	-9.7	QP / 120k / 300k
8.1	V	1	71.630	21.9	6.2	0.7	0.0	-2.1	31.0	39.1	-8.1	QP / 120k / 300k
4.1	V	1	76.520	21.0	6.6	0.6	0.0	-2.1	30.3	39.1	-8.8	QP / 120k / 300k
4.1	H	1	85.040	17.9	7.6	0.6	0.0	-2.1	28.2	39.1	-10.9	QP / 120k / 300k
0	H	1	99.220	12.4	9.5	0.8	0.0	-2.1	24.8	43.5	-18.7	QP / 120k / 300k
8.1	V	1	110.700	17.1	11.6	0.8	0.0	-2.1	31.6	43.5	-11.9	QP / 120k / 300k
0	V	1	132.600	15.0	11.9	0.8	0.0	-2.1	29.8	43.5	-13.7	QP / 120k / 300k
16.2	V	1	238.800	11.2	11.5	0.6	0.0	-2.1	25.4	46.0	-20.6	P / 120k / 300k
12.2	V	1	340.800	18.1	14.1	0.6	0.0	-2.1	34.9	46.0	-11.1	QP / 120k / 300k
16.2	V	1	452.000	13.2	17.2	0.6	0.0	-2.1	33.1	46.0	-12.9	P / 120k / 300k
0	H	1	480.000	19.0	17.4	1.1	0.0	-2.1	39.6	46.0	-6.4	QP / 120k / 300k
0	V	1	525.300	13.8	17.8	1.9	0.0	-2.1	35.7	46.0	-10.3	QP / 120k / 300k
12.2	V	1	546.700	12.0	17.7	1.4	0.0	-2.1	33.2	46.0	-12.8	QP / 120k / 300k
0	H	1	633.300	12.3	18.8	2.0	0.0	-2.1	35.3	46.0	-10.7	QP / 120k / 300k
4.1	H	1	687.200	10.7	18.9	1.4	0.0	-2.1	33.1	46.0	-12.9	QP / 120k / 300k
12.2	V	1	720.000	10.1	19.2	1.4	0.0	-2.1	32.8	46.0	-13.2	QP / 120k / 300k
8.1	V	1	847.900	5.8	20.3	2.3	0.0	-2.1	30.6	46.0	-15.4	QP / 120k / 300k
8.1	H	1	929.600	12.4	20.9	2.5	0.0	-2.1	37.9	46.0	-8.1	QP / 120k / 300k
0	V	1	958.100	6.1	21.1	2.5	0.0	-2.1	31.8	46.0	-14.2	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 4 (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	NYM-EMC-36	07/11/2006	07/11/2007
Cable TC-1, 7 meters, N-N	Pasternack	RG214/U	TC-1	05/17/2007	05/17/2008
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
EMI Receiver, Preselector section	Hewlett Packard	85460A	015762	10/20/2006	10/20/2007
Mast - Antenna	Sunol	TWR95	211264	VBU	VBU
Preamplifier, 60 Hz to 30 MHz	Com-Power	PA-010	211566	07/17/2006	07/17/2007
Tripod	EMCO	TR-4	213043	VBU	VBU

**Results: The sample tested was found to Comply.**

**7.0 BPL Radiated emission - Underground power lines - Location 4 (FCC 15.611(b)(2))****Data:**

Date: 05/22/2007

Test Distance (m): 10.0

Frequency Range (MHz): 2 to 30

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 1

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 4 (Underground - Rosewood Golf. - Box #170 10 A), Mode 3 (24 - 34 MHz), Time Domain repeater mode

$\lambda, \text{m}$	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
112.5	CP	1	2.328	38.2	41.3	0.1	40.7	19.1	19.8	29.5	-9.7	QP / 9k / 30k
135	CA	1	2.500	40.9	41.3	0.1	40.7	19.1	22.6	29.5	-6.9	QP / 9k / 30k
67.5	CA	1	2.940	41.7	41.3	0.1	40.7	19.1	23.3	29.5	-6.2	QP / 9k / 30k
67.5	CA	1	3.105	41.2	38.2	0.1	40.8	19.1	19.7	29.5	-9.8	QP / 9k / 30k
135	CP	1	4.450	48.2	36.5	0.1	40.8	19.1	25.0	29.5	-4.5	QP / 9k / 30k
135	CP	1	5.550	48.9	35.3	0.1	40.7	19.1	24.6	29.5	-4.9	QP / 9k / 30k
135	CP	1	6.155	48.2	35.2	0.1	40.7	19.1	23.8	29.5	-5.7	QP / 9k / 30k
135	CP	1	12.845	47.3	34.4	0.8	40.1	19.1	23.3	29.5	-6.2	QP / 9k / 30k
135	CA	1	18.052	42.9	34.7	0.9	39.7	19.1	19.7	29.5	-9.8	QP / 9k / 30k
157.5	CA	1	24.995	46.9	34.0	1.2	38.9	19.1	24.2	29.5	-5.3	QP / 9k / 30k
67.5	CA	1	25.200	46.0	34.5	1.2	38.7	19.1	23.9	29.5	-5.6	QP / 9k / 30k
315	CA	1	25.465	44.8	34.5	1.2	38.7	19.1	22.7	29.5	-6.8	QP / 9k / 30k
135	CA	1	25.775	46.9	34.5	1.2	38.7	19.1	24.8	29.5	-4.7	QP / 9k / 30k
157.5	CA	1	25.887	46.4	34.5	1.2	38.7	19.1	24.3	29.5	-5.2	QP / 9k / 30k
67.5	CA	1	26.000	47.2	34.5	1.2	38.7	19.1	25.1	29.5	-4.4	QP / 9k / 30k
0	CA	1	26.250	45.9	34.5	1.2	38.6	19.1	23.9	29.5	-5.6	QP / 9k / 30k
270	CA	1	26.410	45.1	34.5	1.2	38.6	19.1	23.1	29.5	-6.4	QP / 9k / 30k
315	CA	1	26.720	44.7	34.5	1.2	38.6	19.1	22.7	29.5	-6.8	QP / 9k / 30k
135	CA	1	26.852	47.3	34.5	1.2	38.6	19.1	25.3	29.5	-4.2	QP / 9k / 30k
0	CA	1	26.880	47.9	34.5	1.2	38.6	19.1	25.9	29.5	-3.6	QP / 9k / 30k
157.5	CA	1	26.930	46.8	34.5	1.2	38.6	19.1	24.8	29.5	-4.7	QP / 9k / 30k
45	CA	1	27.022	46.0	34.5	1.2	38.6	19.1	24.0	29.5	-5.5	QP / 9k / 30k
292.5	CA	1	27.695	44.6	34.5	1.3	38.4	19.1	22.9	29.5	-6.6	QP / 9k / 30k
90	CA	1	27.820	49.4	34.5	1.3	38.4	19.1	27.7	29.5	-1.8	QP / 9k / 30k
22.5	CA	1	27.920	45.7	34.5	1.3	38.4	19.1	24.0	29.5	-5.5	QP / 9k / 30k
247.5	CA	1	28.117	45.3	34.5	1.3	38.2	19.1	23.8	29.5	-5.7	QP / 9k / 30k
90	CA	1	28.600	49.5	34.5	1.3	38.2	19.1	28.0	29.5	-1.5	QP / 9k / 30k
45	CA	1	28.760	49.8	34.5	1.3	38.2	19.1	28.3	29.5	-1.2	QP / 9k / 30k
67.5	CA	1	28.907	49.6	34.5	1.3	38.2	19.1	28.1	29.5	-1.4	QP / 9k / 30k
67.5	CA	1	29.167	49.9	34.5	1.3	38.2	19.1	28.4	29.5	-1.1	QP / 9k / 30k
90	CA	1	29.378	49.3	34.5	1.3	38.0	19.1	28.0	29.5	-1.5	QP / 9k / 30k
180	CA	1	29.417	49.3	34.5	1.3	38.0	19.1	28.0	29.5	-1.5	QP / 9k / 30k
112.5	CA	1	29.612	49.6	34.5	1.3	38.0	19.1	28.3	29.5	-1.2	QP / 9k / 30k
135	CA	1	29.678	49.2	34.5	1.3	38.0	19.1	27.9	29.5	-1.6	QP / 9k / 30k
67.5	CA	1	29.680	50.0	34.5	1.3	38.0	19.1	28.7	29.5	-0.8	QP / 9k / 30k
22.5	CA	1	29.687	49.3	34.5	1.3	38.0	19.1	28.0	29.5	-1.5	QP / 9k / 30k
90	CA	1	29.731	49.6	34.5	1.3	38.0	19.1	28.3	29.5	-1.2	QP / 9k / 30k
45	CA	1	29.792	49.9	34.5	1.3	38.0	19.1	28.6	29.5	-0.9	QP / 9k / 30k
135	CA	1	29.850	48.4	34.5	1.3	38.0	19.1	27.1	29.5	-2.4	QP / 9k / 30k

Below 30 MHz Emissions of Medium Voltage Line

**7.0 BPL Radiated emission - Underground power lines - Location 4 (FCC 15.611(b)(2))****Data:**

Date: 05/22/2007

Test Distance (m): 10.0

Frequency Range (MHz): 30 to 2000

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 1

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 4 (Underground - Rosewood Golf. - Box #170 5 A), Mode 3 (24 - 34 MHz), Time Domain repeater mode												
$\lambda, \text{m}$	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
337.5	V	1	30.285	18.6	17.5	1.3	0.0	0.0	37.3	39.1	-1.8	P / 120k / 300k
112.5	V	1	30.410	19.6	17.5	1.3	0.0	0.0	38.4	39.1	-0.7	P / 120k / 300k
315	V	1	30.499	18.7	17.5	1.3	0.0	0.0	37.4	39.1	-1.7	P / 120k / 300k
0	V	1	30.600	18.9	17.5	1.3	0.0	0.0	37.7	39.1	-1.4	P / 120k / 300k
337.5	H	1	30.756	18.1	17.5	1.3	0.0	0.0	36.9	39.1	-2.2	P / 120k / 300k
157.5	V	1	30.805	18.5	17.5	1.2	0.0	0.0	37.2	39.1	-1.9	P / 120k / 300k
22.5	V	1	30.895	19.4	17.5	1.2	0.0	0.0	38.1	39.1	-1.0	P / 120k / 300k
202.5	V	1	31.254	19.2	17.7	1.3	0.0	0.0	38.2	39.1	-0.9	P / 120k / 300k
135	V	1	31.470	19.1	17.7	1.3	0.0	0.0	38.1	39.1	-1.0	P / 120k / 300k
247.5	V	1	31.538	16.7	17.7	1.3	0.0	0.0	35.7	39.1	-3.4	P / 120k / 300k
45	V	1	31.577	18.3	17.7	1.3	0.0	0.0	37.3	39.1	-1.8	P / 120k / 300k
67.5	V	1	31.577	18.3	17.7	1.3	0.0	0.0	37.3	39.1	-1.8	P / 120k / 300k
315	V	1	31.596	18.8	17.7	1.3	0.0	0.0	37.8	39.1	-1.3	P / 120k / 300k
157.5	V	1	31.673	19.2	17.7	1.3	0.0	0.0	38.2	39.1	-0.9	P / 120k / 300k
112.5	V	1	31.980	19.3	17.7	1.3	0.0	0.0	38.3	39.1	-0.8	P / 120k / 300k
112.5	V	1	32.180	19.7	17.3	1.3	0.0	0.0	38.3	39.1	-0.8	P / 120k / 300k
22.5	V	1	32.270	19.6	17.3	1.3	0.0	0.0	38.2	39.1	-0.9	P / 120k / 300k
135	V	1	33.233	19.9	17.0	1.4	0.0	0.0	38.3	39.1	-0.8	P / 120k / 300k
180	V	1	33.780	19.8	17.0	1.4	0.0	0.0	38.2	39.1	-0.9	P / 120k / 300k
22.5	V	1	33.820	19.8	17.0	1.4	0.0	0.0	38.2	39.1	-0.9	P / 120k / 300k
135	V	1	33.958	20.2	17.0	1.4	0.0	0.0	38.6	39.1	-0.5	P / 120k / 300k
315	H	1	34.123	17.5	16.2	1.4	0.0	0.0	35.1	39.1	-4.0	P / 120k / 300k
135	V	1	578.800	12.7	18.8	7.3	0.0	0.0	38.8	46.0	-7.2	P / 120k / 300k
157.5	V	1	633.500	12.5	18.8	8.2	0.0	0.0	39.5	46.0	-6.5	P / 120k / 300k
270	H	1	668.300	13.2	18.8	8.7	0.0	0.0	40.7	46.0	-5.3	P / 120k / 300k
135	H	1	693.820	13.1	18.9	8.6	0.0	0.0	40.6	46.0	-5.4	P / 120k / 300k
22.5	V	1	715.300	12.1	19.1	9.0	0.0	0.0	40.1	46.0	-5.9	P / 120k / 300k
112.5	H	1	745.970	12.3	19.6	9.3	0.0	0.0	41.2	46.0	-4.8	P / 120k / 300k
180	V	1	763.500	12.1	19.7	9.6	0.0	0.0	41.4	46.0	-4.6	P / 120k / 300k
270	H	1	777.300	13.6	20.0	9.7	0.0	0.0	43.3	46.0	-2.7	P / 120k / 300k
90	H	1	786.330	10.3	20.1	10.0	0.0	0.0	40.4	46.0	-5.6	P / 120k / 300k
112.5	V	1	854.000	11.9	20.4	10.7	0.0	0.0	43.1	46.0	-2.9	P / 120k / 300k
90	H	1	864.300	11.9	20.5	10.9	0.0	0.0	43.3	46.0	-2.7	P / 120k / 300k
270	V	1	873.220	11.9	20.5	10.9	0.0	0.0	43.3	46.0	-2.7	P / 120k / 300k
112.5	H	1	875.440	11.1	20.6	10.9	0.0	0.0	42.6	46.0	-3.4	P / 120k / 300k
67.5	H	1	887.300	12.3	20.9	11.1	0.0	0.0	44.2	46.0	-1.8	P / 120k / 300k
270	H	1	901.800	11.9	20.8	11.4	0.0	0.0	44.1	46.0	-1.9	P / 120k / 300k
112.5	H	1	921.750	11.3	20.8	11.5	0.0	0.0	43.6	46.0	-2.4	P / 120k / 300k
247.5	H	1	948.500	10.2	21.1	11.4	0.0	0.0	42.7	46.0	-3.3	P / 120k / 300k
135	H	1	951.240	10.9	21.0	11.4	0.0	0.0	43.3	46.0	-2.7	P / 120k / 300k
202.5	H	1	955.000	10.2	21.1	11.7	0.0	0.0	43.0	46.0	-3.0	P / 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 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	NYM-EMC-36	07/11/2006	07/11/2007
Cable TC-1, 7 meters, N-N	Pasternack	RG214/U	TC-1	05/17/2007	05/17/2008
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
EMI Receiver, Preselector section	Hewlett Packard	85460A	015762	10/20/2006	10/20/2007
Mast - Antenna	Sunol	TWR95	211264	VBU	VBU
Preamplifier, 60 Hz to 30 MHz	Com-Power	PA-010	211566	07/17/2006	07/17/2007
Tripod	EMCO	TR-4	213043	VBU	VBU

**Results: The sample tested was found to Comply.**

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

Date: 05/24/2007

Test Distance (m): 10.0

Frequency Range (MHz): 2 to 30

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 1

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 5 (Underground - Rosewood Golf, - box# 170 5 A), Mode 2 (13.5- 23.5MHz), Time Domain repeater mode												
<b>λ, m</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>	<b>J</b>	<b>K</b>	<b>L</b>
	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
67.5	CP	1	2.500	44.1	41.3	0.1	40.7	19.1	25.7	29.5	-3.8	QP / 9k / 30k
180	CP	1	6.500	48.0	35.2	0.1	40.7	19.1	23.6	29.5	-5.9	QP / 9k / 30k
202.5	CP	1	14.287	47.1	34.4	0.8	39.7	19.1	23.6	29.5	-5.9	QP / 9k / 30k
180	CP	1	14.850	48.0	34.4	0.8	39.7	19.1	24.5	29.5	-5.0	QP / 9k / 30k
112.5	CA	1	15.470	47.3	34.7	0.8	39.9	19.1	23.9	29.5	-5.6	QP / 9k / 30k
135	CA	1	15.697	48.6	34.7	0.9	39.9	19.1	25.2	29.5	-4.3	QP / 9k / 30k
202.5	CP	1	15.959	46.7	34.7	0.9	39.9	19.1	23.3	29.5	-6.2	QP / 9k / 30k
180	CP	1	16.437	51.0	34.7	0.9	39.8	19.1	27.7	29.5	-1.8	QP / 9k / 30k
180	CA	1	16.705	50.1	34.7	0.9	39.8	19.1	26.8	29.5	-2.7	QP / 9k / 30k
135	CA	1	16.945	51.0	34.7	0.9	39.8	19.1	27.7	29.5	-1.8	QP / 9k / 30k
247.5	CA	1	17.630	51.8	34.7	0.9	39.7	19.1	28.6	29.5	-0.9	QP / 9k / 30k
202.5	CA	1	17.997	50.7	34.7	0.9	39.7	19.1	27.5	29.5	-2.0	QP / 9k / 30k
247.5	CA	1	18.342	50.6	34.7	0.9	39.7	19.1	27.5	29.5	-2.0	QP / 9k / 30k
270	CA	1	19.050	49.2	34.7	1.0	39.7	19.1	26.1	29.5	-3.4	QP / 9k / 30k
112.5	CA	1	19.400	47.7	34.7	1.0	39.5	19.1	24.8	29.5	-4.7	QP / 9k / 30k
90	CA	1	19.845	47.5	34.7	1.0	39.5	19.1	24.6	29.5	-4.9	QP / 9k / 30k
270	CA	1	20.782	52.2	34.0	1.1	39.3	19.1	28.8	29.5	-0.7	QP / 9k / 30k
292.5	CA	1	21.252	51.9	34.0	1.1	39.2	19.1	28.7	29.5	-0.8	QP / 9k / 30k
270	CA	1	22.027	48.7	34.0	1.1	39.2	19.1	25.5	29.5	-4.0	QP / 9k / 30k
<b>Calculations</b>				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 5 (FCC 15.611(b)(2))****Data:**

Date: 05/24/2007

Test Distance (m): 10.0

Frequency Range (MHz): 30 to 2000

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 1

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 5 (Underground - Rosewood Golf. - box# 170 5 A), Mode 2 (13.5 - 23.5 MHz), Time Domain repeater mode

<b>λ, m</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>	<b>J</b>	<b>K</b>	<b>L</b>
	<b>Ant. Pol. (V/H)</b>	<b>Ant. Height (m)</b>	<b>Frequency MHz</b>	<b>Reading dB(uV)</b>	<b>Antenna Factor dB(1/m)</b>	<b>Cable Loss dB</b>	<b>Pre-amp Factor dB</b>	<b>Slant Factor dB</b>	<b>Net dB(uV/m)</b>	<b>Limit dB(uV/m)</b>	<b>Margin dB</b>	<b>Detectors / Bandwidths Det/RBW/VBW</b>
202.5	V	1	35.000	10.2	15.0	1.3	0.0	0.0	26.6	39.1	-12.5	P / 120k / 300k
135	H	1	35.000	10.7	15.0	1.3	0.0	0.0	27.0	39.1	-12.1	P / 120k / 300k
67.5	V	1	120.000	9.1	12.1	2.6	0.0	0.0	23.8	43.5	-19.7	P / 120k / 300k
180	H	1	120.000	9.8	12.1	2.6	0.0	0.0	24.5	43.5	-19.0	P / 120k / 300k
157.5	H	1	240.000	9.0	12.0	4.0	0.0	0.0	25.0	46.0	-21.0	P / 120k / 300k
67.5	H	1	240.000	9.7	12.0	4.0	0.0	0.0	25.6	46.0	-20.4	P / 120k / 300k
270	H	1	350.000	9.5	14.8	4.9	0.0	0.0	29.2	46.0	-16.8	P / 120k / 300k
247.5	H	1	350.000	9.5	14.8	4.9	0.0	0.0	29.2	46.0	-16.8	P / 120k / 300k
292.5	H	1	450.000	9.1	17.2	6.1	0.0	0.0	32.4	46.0	-13.6	P / 120k / 300k
112.5	H	1	450.000	9.3	17.2	6.1	0.0	0.0	32.7	46.0	-13.3	P / 120k / 300k
337.5	V	1	550.000	9.4	18.0	7.0	0.0	0.0	34.4	46.0	-11.6	P / 120k / 300k
67.5	V	1	550.000	9.6	18.0	7.0	0.0	0.0	34.5	46.0	-11.5	P / 120k / 300k
67.5	V	1	650.000	9.6	19.0	8.2	0.0	0.0	36.8	46.0	-9.2	P / 120k / 300k
270	H	1	650.000	10.1	19.0	8.2	0.0	0.0	37.3	46.0	-8.7	P / 120k / 300k
247.5	V	1	750.000	9.7	19.6	9.3	0.0	0.0	38.6	46.0	-7.4	P / 120k / 300k
157.5	H	1	750.000	9.9	19.6	9.3	0.0	0.0	38.7	46.0	-7.3	P / 120k / 300k
180	H	1	850.000	9.4	20.4	10.7	0.0	0.0	40.6	46.0	-5.4	P / 120k / 300k
225	V	1	850.000	9.9	20.4	10.7	0.0	0.0	41.0	46.0	-5.0	P / 120k / 300k
270	H	1	950.000	9.8	21.0	11.4	0.0	0.0	42.2	46.0	-3.8	P / 120k / 300k
337.5	H	1	950.000	9.8	21.0	11.4	0.0	0.0	42.2	46.0	-3.8	P / 120k / 300k
<b>Calculations</b>				<b>I=D+E+F+G-H</b>	<b>K=I-J</b>							

Above 30 Mhz Emissions of Medium Voltage Line

## 9.0 BPL Radiated emission - Underground power lines - Location 6 (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	NYM-EMC-36	07/11/2006	07/11/2007
Cable TC-1, 7 meters, N-N	Pasternack	RG214/U	TC-1	05/17/2007	05/17/2008
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
EMI Receiver, Preselector section	Hewlett Packard	85460A	015762	10/20/2006	10/20/2007
Mast - Antenna	Sunol	TWR95	211265	VBU	VBU
Preamplifier, 60 Hz to 30 MHz	Com-Power	PA-010	211566	07/17/2006	07/17/2007
Tripod	EMCO	TR-4	213043	VBU	VBU

**Results: The sample tested was found to Comply.**

**9.0 BPL Radiated emission - Underground power lines - Location 6 (FCC 15.611(b)(2))****Data:**

Date: 05/23/2007

Test Distance (m): 10.0

Frequency Range (MHz): 2 to 30

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 1

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 6 (Underground - Rosewood Golf, - box# 170 2 A), Mode 1 (3 - 13 MHz), Time Domain repeater mode												
$\lambda$ , m	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	CA	1	2.500	42.8	41.3	0.1	40.7	19.1	24.4	29.5	-5.1	QP / 9k / 30k
112.5	CP	1	3.202	49.9	38.2	0.1	40.8	19.1	28.4	29.5	-1.1	QP / 9k / 30k
247.5	CP	1	3.950	50.1	38.2	0.1	40.8	19.1	28.6	29.5	-0.9	QP / 9k / 30k
270	CP	1	3.960	49.5	38.2	0.1	40.8	19.1	28.0	29.5	-1.5	QP / 9k / 30k
247.5	CP	1	4.890	50.4	36.5	0.1	40.8	19.1	27.2	29.5	-2.3	QP / 9k / 30k
180	CP	1	4.920	51.9	36.5	0.1	40.8	19.1	28.7	29.5	-0.8	QP / 9k / 30k
180	CP	1	5.705	52.4	35.3	0.1	40.7	19.1	28.1	29.5	-1.4	QP / 9k / 30k
202.5	CA	1	6.397	53.0	35.2	0.1	40.7	19.1	28.6	29.5	-0.9	QP / 9k / 30k
202.5	CP	1	6.537	52.0	35.2	0.1	40.7	19.1	27.6	29.5	-1.9	QP / 9k / 30k
202.5	CA	1	7.093	52.9	34.9	0.1	40.6	19.1	28.3	29.5	-1.2	QP / 9k / 30k
180	CP	1	7.207	52.9	34.9	0.1	40.6	19.1	28.3	29.5	-1.2	QP / 9k / 30k
180	CA	1	8.205	53.6	34.7	0.1	40.5	19.1	28.9	29.5	-0.6	QP / 9k / 30k
180	CP	1	8.670	51.4	34.7	0.1	40.5	19.1	26.7	29.5	-2.8	QP / 9k / 30k
157.5	CP	1	8.712	50.4	34.7	0.1	40.5	19.1	25.7	29.5	-3.8	QP / 9k / 30k
180	CA	1	9.800	53.4	34.4	0.1	40.4	19.1	28.4	29.5	-1.1	QP / 9k / 30k
157.5	CP	1	10.225	47.2	34.4	0.8	40.4	19.1	22.9	29.5	-6.6	QP / 9k / 30k
180	CA	1	11.186	45.8	34.4	0.7	40.3	19.1	21.6	29.5	-7.9	QP / 9k / 30k
112.5	CP	1	11.590	45.9	34.4	0.8	40.3	19.1	21.7	29.5	-7.8	QP / 9k / 30k
180	CP	1	15.500	43.4	34.7	0.9	39.9	19.1	20.0	29.5	-9.5	QP / 9k / 30k
180	CA	1	28.803	41.9	34.5	1.3	38.2	19.1	20.4	29.5	-9.1	QP / 9k / 30k
45	CA	1	29.500	42.7	34.5	1.3	38.0	19.1	21.4	29.5	-8.1	QP / 9k / 30k
Calculations			I=D+E+F+G-H			K=I-J						

Below 30 MHz Emissions of Medium Voltage Line

**9.0 BPL Radiated emission - Underground power lines - Location 6 (FCC 15.611(b)(2))****Data:**

Date: 05/23/2007

Test Distance (m): 10.0

Frequency Range (MHz): 30 to 2000

Limit: 15.209 (&lt;30MHz) 15.109 Class A (&gt;30 MHz)

Power Line Type (MV/LV): MV

Limit Distance (&lt;30 MHz)(m): 30.0

EUT Height (m): 1

Limit Distance (&gt;=30 MHz)(m): 10.0

Notes: Location 6 (Underground - Rosewood Golf. - box# 170 2 A), Mode 1 (3 - 13 MHz), Time Domain repeater mode												
<b><math>\lambda, \text{m}</math></b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>	<b>J</b>	<b>K</b>	<b>L</b>
	<b>Ant. Pol. (V/H)</b>	<b>Ant. Height (m)</b>	<b>Frequency MHz</b>	<b>Reading dB(uV)</b>	<b>Antenna Factor dB(1/m)</b>	<b>Cable Loss dB</b>	<b>Pre-amp Factor dB</b>	<b>Slant Factor dB</b>	<b>Net dB(uV/m)</b>	<b>Limit dB(uV/m)</b>	<b>Margin dB</b>	<b>Detectors / Bandwidths Det/RBW/VBW</b>
270	H	1	35.000	9.6	15.0	1.3	0.0	0.0	26.0	39.1	-13.1	P / 120k / 300k
225	V	1	35.000	9.9	15.0	1.3	0.0	0.0	26.2	39.1	-12.9	P / 120k / 300k
0	V	4	120.000	8.0	12.1	2.6	0.0	-0.4	23.0	43.5	-20.5	P / 120k / 300k
202.5	H	1	120.000	8.6	12.1	2.6	0.0	0.0	23.2	43.5	-20.3	P / 120k / 300k
45	H	1	240.000	9.9	12.0	4.0	0.0	0.0	25.9	46.0	-20.1	P / 120k / 300k
0	V	1	240.000	10.4	12.0	4.0	0.0	0.0	26.3	46.0	-19.7	P / 120k / 300k
112.5	V	1	350.000	9.7	14.8	4.9	0.0	0.0	29.5	46.0	-16.5	P / 120k / 300k
337.5	V	1	350.000	10.2	14.8	4.9	0.0	0.0	29.9	46.0	-16.1	P / 120k / 300k
22.5	H	1	450.000	9.2	17.2	6.1	0.0	0.0	32.5	46.0	-13.5	P / 120k / 300k
315	V	1	450.000	9.3	17.2	6.1	0.0	0.0	32.6	46.0	-13.4	P / 120k / 300k
90	H	1	550.000	9.9	18.0	7.0	0.0	0.0	34.8	46.0	-11.2	P / 120k / 300k
225	V	1	550.000	10.0	18.0	7.0	0.0	0.0	35.0	46.0	-11.0	P / 120k / 300k
112.5	V	1	650.000	10.0	19.0	8.2	0.0	0.0	37.1	46.0	-8.9	P / 120k / 300k
135	V	1	650.000	10.1	19.0	8.2	0.0	0.0	37.2	46.0	-8.8	P / 120k / 300k
45	V	1	750.000	9.5	19.6	9.3	0.0	0.0	38.3	46.0	-7.7	P / 120k / 300k
157.5	V	1	750.000	9.6	19.6	9.3	0.0	0.0	38.4	46.0	-7.6	P / 120k / 300k
22.5	V	1	850.000	9.3	20.4	10.7	0.0	0.0	40.4	46.0	-5.6	P / 120k / 300k
0	V	1	850.000	9.9	20.4	10.7	0.0	0.0	41.0	46.0	-5.0	P / 120k / 300k
0	H	1	950.000	9.5	21.0	11.4	0.0	0.0	41.9	46.0	-4.1	P / 120k / 300k
45	H	1	950.000	9.6	21.0	11.4	0.0	0.0	42.0	46.0	-4.0	P / 120k / 300k
0	V	1	950.000	10.1	21.0	11.4	0.0	0.0	42.5	46.0	-3.5	P / 120k / 300k
<b>Calculations</b>			<b>I=D+E+F+G-H</b>			<b>K=I-J</b>						

Above 30 Mhz Emissions of Medium Voltage Line

## **10.0 Revision History (Revision History)**

### **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).

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### 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.

**10.0 Revision History (Revision History)****Data:**

<b>Revision Level</b>	<b>Date</b>	<b>Report Number</b>	<b>Notes</b>
Original issue	July 2, 2007	3122294ATL-004	--
1	July 10, 2007	3122294ATL-004	Added the OHC18K as part of the EUT Corrected the test start date to May 27, 2007 Changed descriptors to Time Domain repeater mode and Frequency Dome repeater mode.