Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Carrier Current Systems, including Broadband over Power Line Systems	)	ET Docket No. 03-104
	)	
	)	
Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems	)	ET Docket No. 04-37

NOTICE OF PROPOSED RULE MAKING

Adopted: February 12, 2004 **Released:** February 23, 2004

COMMENT DATE: [45 days from publication in Federal Register]
REPLY COMMENT DATE: [75 days from publication in Federal Register]

By the Commission: Chairman Powell, Commissioners Abernathy, Martin, and Adelstein issuing separate statements; Commissioner Copps approving in part and dissenting in part and issuing a separate statement.

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I. INTRODUCTION

1. By this action, we are proposing to amend Part 15 of our rules to adopt new requirements and measurement guidelines for a new type of carrier current system that provides access to broadband services using electric utility companies' power lines.[1] Because power lines reach virtually every home and community in the country, we believe that these new systems, known as Access broadband over power line or Access BPL, could play an important role in providing additional competition in the offering of broadband services to the American home and consumers, and in bringing Internet and high-speed broadband access to rural and underserved areas. At the same time, we are cognizant that the possibility of widespread operation of Access BPL raises interference concerns and that we must protect licensed radio services from any harmful interference that might occur. In this regard, we are proposing to require that BPL systems and devices incorporate capabilities to mitigate harmful interference should it occur. We are also proposing to adopt administrative requirements to aid in the identification and resolution of harmful interference from Access BPL systems. Finally, we are proposing to clarify certain measurement guidelines for all types of carrier current systems that use electric wiring and electrical outlets within homes and buildings to transfer information between computers and other electronic devices. With these proposals, we take an important step towards promoting the deployment of new broadband networks that are expected to enhance the economic, educational and social well-being of all Americans. Specifically, we believe that the proposed changes will remove regulatory uncertainties and facilitate the introduction and use of this promising new technology.

II. BACKGROUND

Description of BPL

2. Traditionally, various low-power, unlicensed devices or systems have used the alternating current (AC) power lines to carry information by coupling radio frequency (RF) energy to the AC electrical wiring.[2] These unlicensed devices include AM radio systems on school campuses and devices intended for the home, such as intercom systems and remote controls for electrical appliances and lamps.[3] Until recently, carrier current devices have operated generally on frequencies below 2 MHz with relatively limited communications capabilities. Because of the inherent impedance and attenuation variations of power lines and noise from devices such as dimmer switches, motorized electrical appliances, and

[1] Access BPL typically uses the medium voltage power lines (carrying between 1,000 to 40,000 volts) as a transmission medium to bring high-speed communications services, *e.g.*, the Internet and other broadband services, to neighborhoods. Medium voltage lines may be overhead or underground, depending on the power grid network topology.

[2] A carrier current system is defined as a system, or part of a system, that transmits radio frequency energy by conduction over an electric power line to a receiver also connected to the same power line. *See* 47 C.F.R. § 15.3(f).

[3] Campus radio systems have been operating for over fifty years in the United States at many universities as unlicensed broadcast radio stations in the AM Broadcast band, *see* 47 C.F.R. § 15.221. Initially, the receiver and signal source were attached to the same electric power line. After the advent of the transistor radio, receivers are sensitive enough to be able to pick up enough radiated signal for adequate reception when placed next to the electric power line in a dormitory or other locations on the electric power lines. *See also, e.g.*, X-10 products for home automation at <http://www.X10.com>, and products conforming to ANSI/EIA-600.31-97 *Power Line Physical Layer and Medium Specification* (CEBus Standard).

computers switching on and off, reliable high-speed communications over power lines have been difficult to achieve. However, the availability of faster digital processing capabilities and the development of sophisticated modulation schemes have produced new designs that can overcome these technical obstacles. These new designs have led to the development of new BPL systems that use spread spectrum or multiple carrier techniques and that incorporate adaptive algorithms to counter the noise in the line.

3. The new low-power, unlicensed BPL systems couple RF energy onto the existing electric power lines to provide high-speed communications capabilities. BPL systems may operate either inside a building ("In-House BPL") or over utility poles and medium voltage electric power lines ("Access BPL"). In-House BPL systems use the electrical outlets available within a building to transfer information between computers and between other home electronic devices, eliminating the need to install new wires between devices. Using this technology, consumers can readily implement home networks.[4] Access BPL systems can be used to provide high speed Internet and other broadband services to homes and businesses. In addition, electric utility companies can use Access BPL systems to monitor, and thereby more effectively manage, their electric power distribution operations. Given that Access BPL capability can be made available in conjunction with the delivery of electric power, it may provide an effective means for "last-mile" delivery of broadband services and may offer a competitive alternative to digital subscriber line (DSL), cable modem services and other high-speed Internet technologies.

4. As mentioned above, these new low-power Access BPL systems carry high-speed data and voice signals outdoors over the medium voltage line from a point where there is a connection to a telecommunications network. This point of connection may be at a power substation or at an intermediate point between substations, depending on the network topology. Within a residential neighborhood, most Access implementations employ a coupler or bridge circuit module at the low-voltage transformer to enable the transfer of high-frequency digital signals across the distribution transformer.[5] The high-speed communication signals are then brought into the home over the exterior service power cable from the coupler/bridge, either directly, or via an Access BPL adaptor module. Some Access BPL implementations use the medium voltage lines to bring the BPL signals to neighborhoods and employ a wireless link between a transceiver mounted on the power pole and a companion transceiver located inside the end user's premises to complete the connection.[6] Typically, the medium voltage lines are carried overhead on transmission poles or tower mountings; however, in some locations they are enclosed in underground conduits and only the distribution transformers are mounted above ground on a pad, inside a metal housing.

5. Most Access BPL systems today operate on frequencies up to 50 MHz with very low power signals spread over a broad range of frequencies. These frequencies are also used by licensed radio services that must be protected from harmful interference as BPL systems operate on an unlicensed basis under Part 15 of the Commission's rules. In the radio spectrum below 50 MHz, incumbent authorized operations include fixed, land mobile, aeronautical mobile, maritime mobile, radiolocation, broadcast

[4] Home networks allow information to be transferred among computers, set-top boxes, information appliances and consumer electronics devices. Applications of home networking include, for example, shared Internet access, shared printing, file sharing between personal computers, and device control.

[5] The low voltage transformer is a poor conduit for high-frequency digital signals, as it is intended to conduct 60 Hz signals.

[6] *See e.g.,* <http://www.amperion.com/products.asp>.

radio, amateur radio terrestrial and satellite, and radio-astronomy. Users of this spectrum also include, for example, public safety and Federal government agencies.

Existing Part 15 Rules for BPL

6. Carrier current devices, including BPL equipment, are subject to the Commission's existing Part 15 rules for low-power, unlicensed equipment that operates on a non-interference basis.[7] At the present time, the Part 15 rules provide specific radiated and conducted emission limits for carrier current systems operating below 30 MHz.[8] The radiated emission limits apply from 9 kHz and vary with frequency.[9] There is no limit on conducted emissions for carrier current systems that contain their fundamental emission within the standard AM broadcast band of 535 to 1705 kHz and are intended to be received using standard AM broadcast receivers.[10] All other carrier current systems operating below 30 MHz are subject to a conducted emission limit only within the AM broadcast band. Carrier current devices that do not operate at frequencies below 30 MHz are subject to the general conducted limits below 30 MHz.[11]

Notice of Inquiry

7. In April 2003, the Commission issued a *Notice of Inquiry (Inquiry)* on BPL technologies and systems.[12] The *Inquiry* was issued to solicit comments to assist the Commission in reviewing its Part 15 rules to facilitate the deployment of Access BPL while ensuring that licensed services continue to be protected. In the *Inquiry*, the Commission encouraged continued deployment of Access BPL systems that comply with the existing rules.[13]

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[7] *See* 47 C.F.R. §§ 15.3(f), 15.5, 15.31(d), (f), (g) & (h), 15.33(b)(2), 15.107(a)-(c), 15.109(a), (b), (e) & (g), 15.201(a), 15.207(c), 15.209(a) and 15.221.

[8] Radiated emissions consist of desired or undesired electromagnetic energy, in the form of electric and/or magnetic fields, propagated through space. Conducted emissions consist of desired or undesired electromagnetic energy propagated along a conductor. *See* the *American National Standard Dictionary for Technologies of Electromagnetic Compatibility (EMC), Electromagnetic Pulse (EMP), and Electrostatic Discharge (ESD)*,ANSI C63.14-1998, at §§ 4.62 & 4.275.

[9] *See* 47 C.F.R. §§ 15.109, 15.209 & 15.33. The applicable radiated limits are contained in Section 15.209 for frequencies below 30 MHz and Section 15.109 for frequencies above 30 MHz. To determine compliance with the radiated emission limits, if the highest frequency generated or used in the device, or on which the device operates or tunes is 10 MHz, the upper frequency to be examined is 500 MHz.

[10] A conducted limit was not considered practical when the rules were formulated for campus radio systems, since these systems intentionally couple RF energy onto the power line. *See* 47 C.F.R. § 15.107(c). Carrier current systems whose fundamental emission is intended for reception on AM broadcast receivers avoid harmful interference to AM radio service by operating on a frequency that is not used by a local AM station.

[11] 47 C.F.R. § 15.109(a), (b) & (e).

[12] *See Inquiry Regarding Carrier Current Systems, including Broadband over Power Line Systems, Notice of Inquiry (Inquiry)*, ET Docket No. 03-104, 18 FCC Rcd 8498 (2003).

[13] *Id.*, at ¶2.

8. In the *Inquiry*, the Commission asked for comments on the characteristics of BPL technology, the status of deployment of BPL and any standards work related to BPL.[14] The Commission also asked for comments on the probable interference environment and propagation patterns of BPL and the mitigation techniques used by BPL to avoid interference.[15] The Commission further asked whether it would be possible to develop a standardized measurement method for testing BPL, and if so, how to develop it. It requested input on whether there are any international standards that should be investigated for possible adoption in order to facilitate the development of BPL products for a global marketplace.[16] In addition, the Commission sought comments on issues related to the authorization of BPL and the types of components of Access BPL that would be subject to equipment authorization.[17] Finally, the Commission sought input on whether power line carrier systems currently deployed by the utility companies to control and monitor the electrical system would be replaced in the future with the new high speed BPL equipment and on any associated issues with the coexistence of the older control systems with the new BPL systems.[18]

9. Over five thousand comments and replies were received in response to the *Inquiry*. In general, the commenting parties addressed: 1) the potential benefits of Access BPL systems; 2) the potential for harmful interference from Access BPL to licensed services; and, 3) measurement procedures for evaluating emissions from Access BPL systems.[19]

10. *Benefits of Access BPL.* A number of parties express interest in BPL and suggest that BPL could offer a number of significant benefits in the delivery of broadband services to homes and businesses. A number of BPL proponents submit that this technology could increase the availability of broadband and improve the competitiveness of the broadband services market. For example, Cinergy Corp. (Cinergy) states that Access BPL could facilitate the "ubiquitous availability of broadband services" and "bring valuable new services to consumers, stimulate economic activity, improve national productivity, and advance economic opportunity for the American public."[20] Southern LINC., Southern Telecom Inc., and Southern Company Services, Inc. (Southern) states that the ubiquitous nature of BPL creates the opportunity for providing new and innovative services "to virtually any location served with electric outlets."[21] Southern further states that while broadband access appears to be increasing nationally, significant areas of the country today still lack any type of broadband access or any competition among broadband service providers.[22] The National Telecommunications and Information Administration

[14] *See Inquiry* at ¶¶15 & 17.

[15] *See Inquiry* at ¶20.

[16] *See Inquiry* at ¶23.

[17] *See Inquiry* at ¶26.

[18] *See Inquiry* at ¶28.

[19] Only a small number of comments address In-House BPL, and most of these comments advocate no change to the existing carrier current systems requirements that are applied to In-House BPL. Note that the international work on developing emission limits and measurement procedures for In-House BPL is still under way. *See* ¶47, *infra.*

[20] Comments of Cinergy at 3.

[21] Comments of Southern at 5.

[22] *Id.*

(NTIA) states that BPL holds great promise as a new source of innovation and competition in the broadband marketplace. It submits that Access BPL has the potential to open new avenues of Internet access, to enable new and expanded services for utility companies, and to create a new platform for further advances in communications technology.[23]

11. BPL proponents also argue that Access BPL will improve the competitiveness of the market for broadband services. Current Technologies, LLC (Current Technologies) states that BPL offers the "long-sought third wire" (along with telephone and cable) for last-mile delivery of broadband communications services to residences and small businesses.[24] The United Power Line Council (UPLC) similarly states that BPL offers a unique opportunity in the broadband marketplace and that there is widespread interest in BPL among utilities.[25] It further submits that in areas already served by other broadband providers, BPL will increase competition, which in turn will bring better service and lower prices.

12. A number of parties also state that the ubiquitous nature of the electric power grid will make it possible for Access BPL systems to bring broadband services to rural and other underserved locations. The American Public Power Association (APPA), for example, states that seventy five percent of its members serve communities with populations less than 10,000, many of which do not have access to broadband.[26] Current Technologies states that technical and economic considerations limit the deployment of cable and DSL. It submits that Access BPL is not constrained by these considerations and can deliver "broadband to many of those unserved by other broadband technologies" and "bring the advantages of the Internet to the people who need them most."[27] These parties also submit the availability of Access BPL will make it possible for those persons who currently do not have access to broadband to better participate and compete in the Information Age.[28] The Office of the People's Counsel, District of Columbia (OPC DC) supports our efforts to facilitate deployment of BPL because it has the potential to improve the District of Columbia's telecommunications landscape for consumers by providing a solution to the "digital divide" that currently exists in the District of Columbia and to increase the number of broadband service providers in the District.[29] The Alliance for Public Technology (APT) states that BPL may help accelerate the deployment of advanced services and bring the new and enhanced applications to all Americans. APT urges that the FCC use its full authority under Section 706 to remove barriers and create incentives for industry's rapid deployment of advanced services, such as BPL.[30]

13. BPL proponents also state that Access BPL technology will offer benefits to improve the provision of electric power service and advance homeland security. Several commenting utility companies point out that BPL will improve safety and efficiency of power distribution in the United

[23] *Comments of NTIA at 2.*

[24] Comments of Current Technologies at 6.

[25] *See* reply comments of UPLC at 1.

[26] Reply comments of APPA at 2.

[27] Comments of Current Technologies at 8.

[28] *See, e.g.*, reply comments of APPA at 8-9.

[29] Comments of OPC DC at 1-2.

[30] Comments of APT at 1-2.

States.[31] They indicate that Access BPL technology could be used to assist the utility companies by adding intelligent networking capabilities to the electric grid, thereby improving efficiency in activities such as energy management, power outage notification and automated meter reading. For example, Southern, Progress Energy, Inc. (Progress Energy), and UPLC state that Access BPL would allow electric utilities to better monitor and control electric system operations and thereby improve the reliability of their service and reduce costs to its customers.[32] PowerWAN, Inc. (PowerWAN) states that under the Mission Essential Voluntary Assets (MEVA) guidelines, utilities are responsible for ensuring secure infrastructure power for federal facilities, including military bases, and state, city and local government. It believes that Access BPL would enhance security and enable other security applications such as video surveillance consistent with the MEVA guidelines.[33]

14. *Interference Concerns.* There is significant disagreement among the commenting parties regarding the interference potential of Access BPL. A number of parties contend that Access BPL poses the potential for new interference to a variety of radio services.[34] Amateur operators and amateur organizations in general are opposed to Access BPL and advocate emission limits that are lower than the existing Part 15 limits.[35] For example, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL), expresses concern that Access BPL, if not appropriately restricted, will cause interference to amateur operations. ARRL states that amateurs use very sensitive receivers and high gain outdoor antennas that could be located in close proximity to electric power lines. ARRL submits that 53% of amateur respondents to a survey it conducted indicated that they deploy outdoor antennas located less than 30 meters from overhead power lines and that the current Part 15 limits are not sufficient to protect against interference in this situation.[36] In this regard, ARRL submits analyses that it argues show serious degradation of amateur communications when, for example, an amateur antenna is located 30 m from an overhead power line containing a single BPL device operating at the Part 15 limits.[37]

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[31] *See, e.g.,* Southern at 3-4; Cinergy at 3-4; Hawaiian Electric Company Inc. (HECO) at 2-3.

[32] Comments of Southern at 5; Progress Energy at 9; reply comments of UPLC at 3.

[33] Comments of PowerWAN at 6-7.

[34] *See, e.g.,* comments of the National Association of Shortwave Broadcasters (NASB) at 2; REC Networks at 1; the Wireless Communications Association International Inc. (WCA) at 2; Sprint Corporation (Sprint) at 2; The IEEE Power Systems Relaying Committee (IEEE) at 4; Verizon Telephone Companies (Verizon) at 4; Amateur Radio Research and Development Corporation (AMRAD) at 2; the National Association for Amateur Radio (ARRL) at 7; the National Academy of Sciences/National Research Council's Committee (CORF) at 4; the Radio Amateur Satellite Corporation at 2; reply comments of Harris Corporation (Harris) at 3.

[35] *See, e.g.,* comments of ARRL at 13; the Radio Amateur Satellite Corporation (AMSAT) at 3, the Amateur Radio Research and Development Corporation (AMRAD) at 2, reply comments of Potomac Valley Radio Club at 3; Roadrunners Microwave Group at 2; Central States VHF Society at 1.

[36] *See* ARRL survey at <http://www2.arrl.org/survey.php3?pollnr=195>. *See also,* comments of ARRL at 3. The 30-meter distance refers to the measurement distance specified in conjunction with the radiated emission limits below 30 MHz in 47 C.F.R. §15.209.

[37] *See* comments of ARRL, Exhibit C, *Impact of Man-Made Noise From Broadband Over Power Line Systems Operating at the FCC Part-15 Radiated Emissions Limits on Worldwide HF Communications.*

15. ARRL also contends that entire communities will be affected by radiated BPL emissions.[38] ARRL contends that in an Access BPL system, the power lines would act as an efficient antenna covering an entire city, causing widespread interference to amateur operations.[39] ARRL also conducted tests of radio reception using a mobile radio in residential test areas for Access BPL and submitted audio recordings of radio interference that it attributed to BPL. Based on these analytical and experimental results, ARRL contends that the potential interference from Access BPL would be so severe as to warrant its exclusion from all bands allocated for amateur use.[40] ARRL also states that today power line noise is the single most frequently identified source of High Frequency (HF) interference to licensed amateur operations.[41] ARRL further raises concerns that high-powered amateur operations could interfere with Access BPL.[42] A large number of individual amateur operators filed comments raising similar concerns. For example, Mickey D. Cox, an amateur operator, "strongly urge[s] the Commission to very carefully assess the electromagnetic interference (EMI) potential of BPL before large-scale deployment of the technology. This assessment, which should involve all stakeholders, must determine whether viable technical solutions can be found that reduce EMI to acceptable levels and at what cost."[43] Other amateur operators, such as Lee McVey, suggest "that the Commission deny the proposed adoption of Access BPL in favor of a more practical, reliable and universally deployable fiber optic alternative..."[44]

16. While NTIA recognizes the potential benefits of Access BPL, it also states that the Commission must ensure that other communications services, especially Federal Government operations, are adequately protected from unacceptable interference. It states that the Federal Government has extensive operations that potentially could be affected by BPL systems. It notes that there are over 18,000 Federal Government frequency assignments in the 1.7-80 MHz spectrum range. NTIA also indicates that it has initiated modeling, analysis and measurement efforts in order to develop means for accommodating BPL technologies while precluding unacceptable interference to Federal Government systems.[45] Similarly, the Federal Emergency Management Agency (FEMA) is supportive of our national goals of extensively deployed broadband facilities and of a more robust electrical utility infrastructure and states that it appreciates that BPL could be a major factor in achieving these objectives. FEMA indicates, however, that it has become aware that certain distinct approaches to BPL may have the potential to cause interference to its high frequency radio emergency communications system although it has not concluded at this time that there is a material interference problem or that all of the distinct technological approaches to BPL pose a risk of interference. FEMA states that it expects that there may be ways to provide the public with the benefits of BPL without compromising emergency communications.[46] The

[38] Comments of ARRL at 7.

[39] *See* reply comments of ARRL at 22, 26.

[40] Comments of ARRL at 10.

[41] *Id.*, at 3. The HF band covers frequencies from 3 to 30 MHz.

[42] *Id.*, at 19.

[43] Reply comments of Mickey D. Cox at 1-2.

[44] Comments of Lee McVey at 10.

[45] *See* comments of NTIA at 2-3.

[46] *See* letter, dated January 8, 2004, from Under Secretary Michael D. Brown to Honorable Michael K. Powell and reply comments of FEMA.

National Academy of Sciences, through the National Research Council's Committee on Radio Frequencies (CORF), indicates its concern regarding BPL emissions into the bands allocated to the Radio Astronomy Service (RAS). It urges that, at the very least, the level of protection currently provided under Part 15 in RAS bands should be maintained.[47]

17. Commenting parties representing other services also raise potential interference concerns. The North American Shortwave Association (NASWA) recommends that "all BPL signals be confined to the 30 to 47 MHz region of the spectrum to minimize interference to international broadcast services."[48] Verizon Telephone Companies (Verizon), Qwest Communications International, Inc. (Qwest) and Sprint Corporation (Sprint) express concern that BPL operations could interfere with voice and data services (*i.e.* VDSL and ADSL2+) on twisted pair telephone cables located on the same utility poles as the BPL systems.[49] The Aeronautical Radio Inc. (ARINC) states that Access BPL could "exacerbate interference" to its HF communications and that "the FCC should not take actions that would result in any increase in the noise floor in the HF radio spectrum, because any noise increase would inevitably diminish the ability of aviation to maintain communications with aircraft operating over oceans and in remote areas of the world."[50]

18. The Michigan Public Service Commission (MPSC) agrees that BPL providers could potentially provide the public with a ubiquitous third broadband pipe to compete with cable modem, DSL and other technologies, but believes that it is important to ensure that there is no interference to already well-established services.[51] Similarly, the Public Safety Wireless Network (PSWN) is optimistic that the development of broadband service using existing electrical lines holds promise for providing additional resources to members of the public that are currently underserved or may be unable to secure access to that technology because of geographic or other limitations. However, it urges the Commission to "...balance the potential benefits of this service, and increased competition among incumbent access providers, with the need to thoroughly test this service offering to ensure that no interference or other damage will result to existing incumbent services, particularly wireless public safety communications."[52] In addition, the Region 21 Frequency Advisory Committee of the Association of Public Safety Communications Officials International, Inc. (APCO Region 21) expresses concern about BPL interference to public safety communications.[53]

19. The Telecommunications for the Deaf, Inc. (TDI) supports the development of BPL technology and states that BPL has the potential to increase broadband access and competition. However, it states

[47] Comments of CORF at 1.

[48] Comments of NASWA at 1.

[49] *See, e.g.,* comments of Sprint at 3.

[50] Reply comments of ARINC at 3.

[51] Reply comments of MPSC at 6.

[52] Comments of PSWN at 1.

[53] *See* comments of the APCO Region 21, at 2.

that BPL systems must not interfere with hearing aids, telecommunications equipment, and visual signaling technology commonly used by the deaf and hearing-impaired.[54]

20. On the other hand, BPL equipment manufacturers and service providers state that Access BPL does not pose an unacceptable risk of increased interference to licensed radio services. They note that there have been no complaints of interference from BPL and that the existing Part 15 rules adequately protect incumbent spectrum users.[55] The BPL industry in general believes that Part 15 rules are not only adequate to protect other users of the spectrum,[56] but that higher emission limits are warranted in the 30-50 MHz band.[57] Some parties propose higher emission limits especially at frequencies above 200 MHz.[58] Parties advocating higher power argue that operation of Access BPL under power levels higher than currently allowed in Part 15 would enable utility companies to serve more homes, thereby bringing broadband access to a greater number of people.[59]

21. Southern indicates that it is unaware of any reported cases of harmful interference from use of its Access BPL technology.[60] The HomePlug Powerline Alliance (HomePlug) states that its member companies have widely deployed In-Home BPL equipment in the consumer market over the last 2 years and there have not been complaints of interference. HomePlug contends that joint testing by the ARRL and HomePlug has demonstrated a very low probability of interference between its devices and amateur radio use.[61] The In-House BPL industry advocates no change to Part 15.[62]

22. A number of BPL proponents argue that the technical assumptions used by opponents of Access BPL to predict interference are incorrect. They dispute claims that the electric power lines will act like an efficient antenna and that signals from Access BPL devices will aggregate to raise the noise floor. Southern states that there is a high degree of variability in the ability of power lines to radiate BPL signals and that signals on power lines will tend to cancel each other out.[63] It argues that its research to date would suggest that a BPL signal injection point can appear like a point-source radiator, with the

[54] Reply comments of TDI at 2.

[55] *See* comments of Progress Energy at 5; PowerWAN at 7-8; Ameren Energy Communications, Inc. (AEC) at 9; UPLC at 9; Southern at 19; Amperion, Inc. (Amperion) at 5; Ambient Corporation (Ambient) at 5; Electric Broadband at 3; Enikia LLC (Enikia) at 3.

[56] *See* comments of Enikia at 3; Florida Power and Light Company (FPL) at 11; UPLC at 7-8.

[57] *See* comments of Current Technologies at 16-17; Electric Broadband at 8; and, comments of xG Technology, LLC (xGT) at 7. *See also,* reply comments of Southern at 24.

[58] *See* comments of Satius, Inc. (Satius) at 3-4.

[59] *See* reply comments of Southern at 24; comments of Current Technologies at 16-17; Electric Broadband at 8; xGT at 7.

[60] Comments of Southern at 19.

[61] *See* comments of HomePlug at 5. *See also,* HomePlug & ARRL Joint Test Report, January 24, 2001, <http://www.arrl.org/tis/info/HTML/plc/files/HomePlug_ARRL_Dec_2000.pdf>.

[62] *See* comments of Phonex Broadband Corporation (Phonex) at 2; HomePlug at 5.

[63] Reply comments of Southern at 17.

power line having characteristics somewhere between a waveguide and an antenna.[64] Thus, Southern contends that ARRL erred in depicting the power line as an efficient antenna for a single, discrete frequency.[65]

23. Current Technologies submits that its data indicate that BPL emissions drop off very rapidly away from the BPL source and that emissions fall off in point-source fashion.[66] Ameren Energy Communications Inc. (AEC) states that the notion that the power lines will act as efficient antennas and pollute their surroundings with harmful interference is not supported by scientific measurements.[67] AEC asserts that because of impedance mismatch in real-world power lines, a single power line is expected to be a rather inefficient radiator.[68]

24. Current Technologies states that aggregation of BPL signals is unlikely since in its system only two BPL devices in the same area can operate simultaneously, and even those two devices would operate on different frequencies, so they cannot affect the same receiver.[69] Main.Net Communications Ltd. (Main.Net) similarly indicates that in its technology only one unit is transmitting on any given frequency at any given time in any given area.[70] AEC also states that its BPL implementation does not lead to noise aggregation because its systems are broken into several cells and within a single cell, modems cannot transmit signals simultaneously. It argues that therefore only a single RF source will exist within the cell and no combined radiated emissions from multiple sources can occur.[71] Main.Net further indicates that it has successfully implemented its technology in trials and commercial operations in over 60 locations in 25 countries throughout the world.[72]

25. In response to CORF's concerns with BPL emissions, BPL proponents submit that their systems would comply with the current Part 15 requirements. Southern states that emissions from its system are compliant with Part 15 requirements and, in fact, tend to be in the noise floor.[73] Southern also points out that its Access BPL devices do not even operate in three out of the seven frequency bands allocated for RAS as Access BPL operate only on frequencies below 50 MHz.[74]

26. Finally, Ambient Corporation (Ambient) states that it is possible to avoid interference to nearby transceivers using the inherent frequency agile characteristics of advanced Orthogonal Frequency

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[64] *Id. See also,* comments of Current Technologies at 14.

[65] Reply comments of Southern at 17.

[66] Reply comments of Current Technologies at 10-11.

[67] Reply comments of AEC at 2.

[68] *Id.,* at 8.

[69] Reply comments of Current Technologies at 12.

[70] Comments of Main.Net at 6.

[71] Reply comments of AEC at 13.

[72] Comments of Main.Net at 2.

[73] *See* reply comments of Southern at 20.

[74] Reply comments of Southern at 19-20. *See also,* comments of CORF at 2-3.

Division Multiplexing (OFDM) technology.[75] Ambient states that if a sub-band is being used by a nearby transceiver, the BPL modem transmitter can be programmed to avoid transmitting on that sub-band, or "notch" it out.[76]

27. *BPL Equipment Authorization and Measurement Procedures.* In the *Inquiry*, we requested comment on authorization and compliance measurements for BPL equipment. Under section 302 of the Communications Act of 1934, as amended, the Commission carries out its responsibilities by establishing technical regulations for transmitters and other equipment to minimize their potential for causing harmful interference to radio services, and by administering an equipment authorization program to ensure that devices reaching the market comply with the technical requirements.[77] The equipment authorization program specifies several procedures for demonstrating equipment compliance.[78] Currently, equipment operating as carrier current systems, such as power line intercom systems, lamp remote controls, low speed power line telephone adaptors, as well as Access BPL, are subject to the verification procedure under our equipment authorization program.

28. There is a general consensus that all components of an Access BPL system should be part of the equipment authorization process.[79] With the exception of parties representing amateur interests, most commenting parties recommend retaining the verification procedure for Access BPL equipment authorization as it is currently applied to both BPL and traditional narrow-band carrier current systems.[80] These parties contend that Access BPL is sold only to utilities and service providers and only qualified utility line personnel will install the units on the power lines.[81] Amateurs argue that Access BPL equipment should be subject to the more stringent certification process.

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[75] OFDM is a variation of the frequency-division multiplexing (FDM) technique, used in analog telephone line data transmission, where the frequency range of the transmission channel is divided into narrower bands, each of which can carry a different voice or data transmission signal. In OFDM, the available range of frequencies in a given frequency band of operation is split into a number of separate carriers. OFDM sends packets of data simultaneously along several of the carrier frequencies, allowing for increased speed and reliability. If noise disrupts one of the frequencies, the control circuit senses it and switches that data to another carrier.

[76] Comments of Ambient at 7-8.

[77] *See* 47 U.S.C. § 302(a).

[78] *Certification* is an equipment authorization issued by the Commission or its designated entities,[78] based on representations and test data submitted by the applicant. A *Declaration of Conformity* (DoC) is a manufacturer's self-approval procedure where the responsible party, who could be the manufacturer, the grantee or the importer of the equipment, as defined in 47 C.F.R. § 2.909, makes measurements or takes other necessary steps to ensure that the equipment complies with the appropriate technical standards. *Verification* is also a manufacturer's self-approval procedure where the manufacturer makes measurements or takes the necessary steps to ensure that the equipment complies with the appropriate technical standards; however, unlike the DoC procedure, it does not require the use of an accredited laboratory and does not require a declaration of conformity to be supplied with the equipment.

[79] *See* comments of Enikia at 4; xGT at 7, Amperion at 8.

[80] *See* comments of Phonex at 1; Southern at 5; Amperion at 8; Enikia at 4.

[81] *See* comments of Amperion at 8; UPLC at 14.

29. A number of parties advocate deleting conducted emissions measurements,[82] and retaining the existing radiated measurements for Access BPL.[83] Most parties also recommend that emission measurement of Access BPL be conducted on location, *i.e., in-situ.* Several parties advocate development of a standardized measurement procedure by an industry technical committee.[84] HomePlug and other In-House BPL proponents recommend retaining the existing radiated emissions measurement and favor *in-situ* testing, and are not against a laboratory test method but do not want it to be the only method.[85]

III. DISCUSSION

30. As indicated in the *Notice of Inquiry* and supported by the responsive comments, we believe that Access BPL offers the promise of a new method for delivery of broadband services to residential, institutional, and commercial users. Because power lines reach virtually every home, school, and business in the United States, Access BPL technology could play an important role in providing high-speed Internet and broadband services to rural and remote areas of the country.[86] Thus, significant areas of the country still lack broadband access and many others lack competition for such services, and we believe that Access BPL could serve as a means to reach those areas. Since Access BPL uses the same power lines that carry electricity virtually everywhere, much of the infrastructure needed to operate this technology is already in place, so that major savings in deployment costs and capital may be realized in its deployment. Access BPL could also serve to provide new competition to existing broadband services, such as cable and DSL. In addition, Access BPL may allow electric utilities to improve the safety and efficiency of the electric power distribution system and also further our national homeland security by protecting this vital element of the U.S. critical infrastructure. Moreover, Access BPL is being developed worldwide, and encouraging the deployment of the technology in the United States will support

[82] *See e.g.,* reply comments of Current Technologies at 17. Because Access BPL systems are installed on power lines that can carry 1,000 volts to 40,000 volts, conducted emission measurements are very difficult to measure, and present safety hazards in connecting test equipment to these lines. *See also,* discussion in ¶38.

[83] *See* comments of Southern at 23-24; comments of AEC at 13-15, PowerWAN at 4; Current Technologies at 16; Enikia at 3.

[84] *See* comments of Amperion at 7-8; Current Technologies at 18-19; Main.Net at 8-10; reply comments of Southern at 29.

[85] *See* comments of HomePlug at 4; Intellon at 4; Phonex at 5.

[86] In this regard, we observe that, according to the June 30, 2003 data reported to the Commission, there were no subscribers to high-speed connections to the Internet in 9 percent of Zip Codes, where about 1 percent of the U.S. population resides. Only one service provider reported having any high-speed subscribers in an additional 16 percent of Zip Codes, where about 2 percent of the U.S. population resides. Further, such providers may have offered service in only a portion of the Zip Code, or may have supplied a type of high-speed service (*e.g.*, T-1/DS1) not typically purchased by residential or small business end users. *See High-Speed Services for Internet Access: Status as of June 30, 2003*, Industry Analysis and Technology Division, Wireline Competition Bureau, FCC, Table 12 (Dec 2003). This report summarizes data collected on FCC Form 477, which must be filed semiannually by facilities-based providers of at least 250 high-speed lines (or wireless channels) that are in service connecting end-user premises to the Internet in a state. (Facilities-based providers that do not meet the mandatory reporting threshold may file on a voluntary basis, and some do so.) High-speed lines (or wireless channels) provide services at speeds exceeding 200 kbps in at least one direction. *See Local Competition and Broadband Reporting*, CC Docket No. 99-301, Report and Order, 15 FCC Rcd 7717 (2000).

globalization of products and services, promote continued U.S. leadership in broadband technology, and bring important benefits to the American public.[87]

31. We recognize the significant concerns of existing radio users regarding the potential for harmful interference from Access BPL operations. After careful consideration, however, we believe that these interference concerns can be adequately addressed. We believe that Access BPL systems can operate successfully under the non-interference requirements of the Part 15 rules. Under these rules, operators of Access BPL systems will be responsible for eliminating any harmful interference that may occur.[88] Furthermore, we believe that the current Part 15 emission limits for carrier current systems in conjunction with certain additional requirements specific to Access BPL operations will be adequate to ensure that existing radio operations are protected against harmful interference from such operations. We therefore are proposing changes to our Part 15 rules that we believe will facilitate the deployment of Access BPL technology while protecting licensed users of the spectrum. Specifically, we are proposing to: 1) define Access BPL for purposes of our rules; 2) maintain the existing Part 15 emission limits for Access BPL; 3) require that Access BPL devices employ adaptive interference mitigation techniques; 4) require that Access BPL providers maintain a database of installation locations and technical information; and 5) adopt specific measurement guidelines for both Access BPL and other carrier current systems to ensure that measurements are made in a consistent manner and provide for repeatable results in determining compliance with our rules. These proposals are discussed more fully below.

Definition of Access BPL

32. We propose to define Access BPL as a carrier current system operating on any electric power transmission lines owned, operated or controlled by an electrical power provider, as follows:

> Access Broadband over power line (Access BPL): A carrier current system that transmits radio frequency energy by conduction over electric power lines owned, operated, or controlled by an electric service provider. The electric power lines may be aerial (overhead) or underground.

We believe that this definition is consistent with the concept of Access BPL and the current and planned deployment of this technology. We request comment on this definition of Access BPL. Interested parties are invited to submit suggestions for alternative definitions. Such submissions should include a complete description of what would be included in the definition of Access BPL and why. We also request comment on whether there are entities that plan to own/operate Access BPL over the electric

[87] On January 8, 2004, the European Commission (EC) issued a mandate to the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standard Institute (ETSI) to define a technical specification providing test methods and limits for radiated (and possibly consistent conducted) emissions compatible with power line communication infrastructure. This technical specification should be made available by March 31, 2004. *See European Commission's letter to CENELEC, Request to develop a technical specification under Mandate M313, Jan. 8, 2004*, at <http://europa.eu.int/comm/enterprise/electr_equipment/emc/interep313.htm>. In addition, on January 21, 2004, the Japanese Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT) issued a press release announcing a new policy that will permit the establishment of experimental high-speed power line communications facilities in Japan. *See MPHPT decides on policy concerning permits for establishing experimental high-speed power line communications facilities, Press Release, Jan. 21, 2004* at <http://www.soumu.go.jp/s-news/2004/040121_1.html> and <http://www.soumu.go.jp/joho_tsusin/eng/Releases/Telecommunications/news040121_2.html>. We further note that in Canada, the City of Sault Ste. Marie, Ontario, had initiated a program to deploy BPL service, beginning in March of this year, *Communications Daily, Vol. 24, No. 24, February 5, 2004.*

[88] 47 C.F.R. § 15.5.

power lines but would not be electrical power providers or a subsidiary of the incumbent electric power provider.

Access BPL Emission Limits

33. As indicated above, the commenting parties strongly disagree on the interference potential of Access BPL.[89] Existing spectrum users are concerned that emissions from Access BPL systems and devices could adversely affect their operations. BPL proponents, on the other hand, suggest that any impact from Access BPL would be minimal and some argue that emission levels higher than the current Part 15 limits would be acceptable and allow more cost-effective system implementations. At this time, we believe that we should proceed cautiously. We recognize that unlicensed operations in the HF band presents a number of unique challenges given the propagation characteristics of this range of frequencies and the diversity of licensed users. Accordingly, in order to better ensure protection of existing radio services, we are proposing to continue to apply the existing Part 15 emission limits for carrier current systems to Access BPL systems. While we agree that there is some potential for Access BPL to cause harmful interference to radio services, we also tentatively conclude that the likelihood of such harmful interference is low under the current limits and that where such interference does occur, there are remedies that the Access BPL operator can employ to eliminate such interference. On balance, we believe that the benefits of Access BPL for bringing broadband services to the public are sufficiently important and significant as to outweigh the potential for increased harmful interference that may arise. Furthermore, as indicated above, we are proposing to subject Access BPL operations to the existing Part 15 radiated emission limits for carrier current systems.[90] In addition, as discussed in the next section herein, we are proposing that Access BPL devices include technical capabilities and administrative procedures to ensure that the potential for harmful interference is minimized and that any instances of harmful interference are quickly resolved.

34. While we appreciate the interference concerns raised by existing radio users, we note that Access BPL will operate in compliance with the current Part 15 rules that limit emissions from unlicensed carrier current systems to very low power levels in comparison to licensed radio operations. We believe that the current Part 15 levels will limit the harmful interference potential of Access BPL devices to relatively short distances around these devices. In this regard, we note that hundreds of kinds of unlicensed devices are successfully operating under the current Part 15 limits without causing harmful interference to licensed operations. Furthermore, all unlicensed devices operating under Part 15 are subject to the condition that they not cause harmful interference and that they cease operation if they do cause such interference.[91]

35. We recognize that amateur operations are likely to present a difficult challenge in the deployment of Access BPL in cases where amateurs use high gain outdoor antennas that are located near power lines. In considering this interference potential, we note that ARRL acknowledges that noise from power lines, absent any Access BPL signals, already presents a significant problem for amateur communications.[92]

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[89] *See* ¶14, *supra.*

[90] We are however proposing to exempt Access BPL from the conducted emission limits contained in § 15.107(c), as explained below. *See* ¶38, *infra.*

[91] 47 C.F.R. § 15.5(b).

[92] Comments of ARRL at 3. *See also* ¶15.

We therefore would expect that, in practice, many amateurs already orient their antennas to minimize the reception of emissions from nearby electric power lines. Further, we note that many Access BPL technologies have the capability to avoid using specific frequencies, if necessary, to avoid interference. This would permit Access BPL devices to avoid the use of amateur frequencies when in close proximity to amateur outdoor antennas.

36. We also disagree with ARRL and others that suggest that interference caused to amateur and other radio operations by Access BPL systems complying with our Part 15 limits will be widespread. Although we agree with ARRL that Access BPL on overhead lines is not a traditional point-source emitter, we do not believe that Access BPL devices will cause the power lines to act as countless miles of transmission lines all radiating RF energy along their full length. Rather, the primary source of emissions will be the individual couplers, repeaters and other devices and, to a lesser extent, the power line immediately adjacent thereto. Regarding the cumulative interference effect of Access BPL across wide geographic areas, data submitted by Access BPL proponents, such as AEC and Current Technologies, show that radiation would be the highest in the vicinity of an Access BPL emissions source.[93] In addition, as indicated above, Current Technologies, Main.Net and other Access BPL equipment manufacturers state that in their implementations only a limited number of devices transmit simultaneously on the same frequency in the same geographic area and that there is no cumulative effect from multiple Access BPL devices transmitting at the same time in the same area.[94] Nevertheless, to ensure that any effect of the power line is taken into consideration when testing for compliance with our Part 15 rules, we are proposing to modify the measurement procedures for Access BPL systems, as set forth in Appendix C, to specify that emission measurements be made at several specific distances from the Access BPL equipment source, and that measurements be taken parallel to the power line to find the maximum emissions from the BPL system. We seek comment on our proposed measurement guidelines.

37. With regard to potential interference to the non-amateur radio services, such as public safety, maritime and other operations, we believe that the risk of harmful interference from Access BPL operations is low. In general, we believe that a properly designed and operated BPL system will pose little interference hazard to non-amateur services such as aeronautical, maritime and public safety. However, we recognize in our analysis that public safety systems merit particular attention because of the often critical nature of their communications. In analyzing the potential for harmful interference to public safety systems we took into account the fact that low-level Part 15 signals from Access BPL devices attenuate rapidly as the distance from the device increases; and that most public safety systems are designed so that mobile and portable units receive a signal level significantly above the noise floor. From an interference analysis standpoint, this latter characteristic distinguishes public safety systems from amateur radio stations using high-sensitivity receivers to receive signals from transmitters often thousands of miles away. However, it is foreseeable that under certain rare circumstances a public safety unit could: (a) operate in close proximity to an Access BPL device; (b) be tuned to a frequency radiated by the Access BPL device; and (c) be receiving a weak signal from a distant, or obstructed, public safety base station. In general, potential harmful interference under these conditions would be limited to public safety units operating on systems using low-band VHF channels (25-50 MHz).[95] Therefore, it appears

[93] *See* comments of AEC at 12; reply comments of Current Technologies at 10-11.

[94] *See* reply comments of Current Technologies at 11; Main.Net at 3; AEC at 13.

[95] The Commission's records reflect that there are approximately 18,237 Public Safety licenses (Radio Service Code - PW) for systems operating between 25-50 MHz. The historical trend in public safety systems is use of higher frequency bands. Although we are not imposing operating frequency limitations on Access BPL devices, we note that the equipment available to date operates on frequencies below 50 MHz.

that the interference protections we propose herein -- and the strict "no interference" restriction inherent in the Part 15 rules -- will be adequate to foreclose such rare instances of harmful interference to public safety systems. While we tentatively conclude that the measures proposed herein are adequate, we request comment on whether any additional measures are needed to protect particular operations, such as public safety. For example, should we require Access BPL system to coordinate with public safety agencies that use the HF band for state-wide public safety communications?

38. Accordingly, we are proposing to maintain the existing Part 15 radiated emission limits for Access BPL systems and devices. In addition, we are proposing to exempt Access BPL systems from the existing conducted emission limits of Section 15.107(c).[96] Because Access BPL systems are installed on power lines that can carry 1,000 volts to 40,000 volts, conducted emission measurements are very difficult to measure, and present safety hazards in connecting test equipment to these lines.[97] We do not believe that this exemption would have any impact on interference potential since Access BPL would still be required to comply with our radiated emissions rules. We seek comment on these proposals. We further seek comment on whether Access BPL would in some instances operate in the AM broadcast band (from 535 to 1705 kHz), and whether specific conducted requirements are needed in such situations.

Access BPL Operational Requirements

39. Notwithstanding compliance with the Part 15 emission limits, we wish to emphasize that Access BPL would also operate under our Part 15 non-interference conditions. Thus, operations must cease if harmful interference to licensed services is caused. Given that there is significant investment in the deployment of the service, we agree with several commenters that Access BPL providers would have a strong incentive to exercise the utmost caution in installing their systems to avoid harmful interference and ensure uninterrupted service to their customers.[98] In addition, given the typical attachment of BPL products to medium voltage lines and the possible use of BPL systems to control and monitor the electrical system, we believe that Access BPL systems likely will be managed on a more controlled basis as compared to other typical Part 15 operations.

40. To further address the interference concerns raised in the *Inquiry*, we are proposing certain additional technical and administrative requirements for Access BPL. First, we are proposing to require that Access BPL systems and devices incorporate capabilities that would allow the operator to modify system performance to mitigate or avoid harmful interference to radio services. Such adaptive interference mitigation techniques would include, for example, the capability to reduce power levels on a dynamic or remote controlled basis, and the ability to include or exclude specific operating frequencies or bands. This capability would allow operators to avoid localized and site-specific harmful interference.

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[96] For the protection of the AM Broadcast service, existing carrier current systems operating below 30 MHz are subject to a conducted emission limit of 1000 μV in the AM broadcast band (from 535 to 1705 kHz). *See* 47 C.F.R. §§ 15.107(c)(2) and 15.221. However, carrier current systems operating above 30 MHz are subject to the general conducted emission limits that apply to frequencies below 30 MHz. *See* 47 C.F.R. § 15.107(a)-(c).

[97] Conducted emissions are measured by connecting the Equipment under Test (EUT) to a Line Impedance Stabilization Network (LISN) that simulates the impedance of the power network while sourcing power to the EUT. Such a LISN would have to be capable of sourcing 1,000 volts to 40,000 volts to an Access BPL system. Furthermore, measuring instruments such as spectrum analyzers, voltmeters, etc. would also be connected to this LISN, thus high voltage hazards can affect both test equipment and test personnel.

[98] *See e.g.*, comments of Ambient at 9 and reply comments of Southern at 5.

41. We believe that this requirement is reasonable and practicable for Access BPL operators and equipment manufacturers to implement. We observe that a number of Access BPL devices currently employ OFDM modulation techniques, which facilitate the ability to dynamically select the specific frequencies used to provide service and to avoid use of specific frequencies where operation might result in harmful interference. In this regard, we note that PowerWAN states that "notching" of specific frequency is technically feasible.[99] Ambient indicates that its equipment will be able to notch out individual frequencies "on the fly," in response to short term changes in the RF environment.[100] Main.Net states that it already has the capability to remotely control the operating frequencies and power of their installations.[101]

42. Second, we propose to require that Access BPL devices incorporate a shut-down feature that would deactivate units found to cause harmful interference, and thereby allow speedy implementation of interference mitigation measures. It is our understanding that most Access BPL devices already possess this capability. We seek comment on these proposals and invite suggestions for alternative approaches. In particular, we request comment on whether we should have specific requirements regarding the above mitigation approaches. For example, should we require that each Access BPL device be capable of operating across a minimum range frequencies and have the capability to remotely exclude a specific percentage of frequencies within this range. We also seek comment on the cost and effectiveness of these or alternative approaches. To the extent possible, we encourage potential BPL providers and BPL equipment manufacturers to work with amateurs and other existing licensed services to develop such appropriate mitigation requirements. We seek comment on the appropriate period of time that we should allow for BPL systems to come into compliance with any new requirements that we may adopt pursuant to this rule making proceeding. We further seek comment on whether Access BPL systems currently deployed should be required to be brought into compliance with the new rules, and if so, what period of time should be afforded for them to come into compliance.

43. Finally, we propose to subject Access BPL systems to a notification requirement similar to the notification requirements in our rules for power line carrier (PLC) systems.[102] Under this requirement, an Access BPL system operator would submit information on its system to an industry-operated entity. The objective of the proposed notification would be to establish a publicly accessible database for Access BPL information to ensure that the location of Access BPL systems and their operating characteristics are identified if harmful interference occurs and to facilitate interference mitigation and avoidance measures. We propose that this notification includes information on the location of the installation, the

[99] *See* comments of PowerWAN at 3.

[100] *See* comments of Ambient at 7-8.

[101] *See* comments of Main.Net at 4; Ambient at 8; AEC at 19; reply comments of Mitsubishi Electric Power Products, Inc., Mitsubishi Electric Europe B.V. and Mitsubishi Electric Corporation (Mitsubishi Companies) at 5.

[102] 47 C.F.R. §15.113 permits Power Line Carrier systems to operate on power transmission lines for communications important to the reliability and security of electric service to the public in the 9-490 kHz band. *See also* 47 C.F.R. §2.106, Note US294. Under the existing rules, information on power line carrier systems must be entered into a database coordinated by the United Telecom Council, formerly Utilities Telecommunications Council, (UTC), the designated coordinator and database operator for power line carrier systems. *See* 47 C.F.R. §§ 15.113 and 90.35(f). *See also Memorandum Of Understanding of the Purpose, Requirements, and Procedures for a Power Line Carrier Notification Activity between the Federal Communications Commission, National Telecommunications and Information Administration, and Utilities Telecommunications Council*, Reference IRAC DOC. 26177, approved December 13, 1988, revised July 13, 2003.

type of modulation used and the frequency bands of operation. We seek input on these proposals. We also request comment and suggestions on the appropriate industry-operated entity that we should select to receive the notifications and maintain the Access BPL data base. We also seek comment on other approaches for making this information available. For example, would it more reasonable to allow each Access BPL operator to maintain a database of its own rather than require a more centralized data base?. Commenting parties are requested to submit information on the benefits of such approaches. We further seek input on any resulting burdens that the proposed notification requirement may place on entities operating Access BPL systems, and any impact of a notification system on the availability of customer data as well as how any concerns regarding the proprietary nature of that data can be addressed.

Equipment Authorization and Measurement Guidelines

44. *Equipment Authorization.* We propose to retain the Verification procedure for Access BPL. Consistent with the objective that our regulatory requirements keep pace with technology development, we recognize that we must balance administrative burdens and the need to ensure compliance with our rules. We agree with commenting parties such as Phonex Broadband Corporation (Phonex) and UPLC that the authorization procedure for BPL should be the same as for all unintentional radiators, including traditional types of carrier current systems.[103] Low-speed carrier current systems, which for a number of years have been operating inside buildings, have rarely been a source of harmful interference to radio communications, and the use of the verification procedure has been adequate to ensure that such systems comply with the rules. We seek comment on this proposal.

45. *Access BPL Measurement Guidelines.* Because Access BPL is a new implementation of carrier current techniques, as discussed, *supra,* there are no existing measurement guidelines for this type of equipment. We tentatively propose that Access BPL systems, including all BPL electronic devices, *e.g.*, couplers, injectors, extractors, repeaters, boosters, concentrators installed on the electric utility overhead or underground medium voltage lines etc., be measured *in-situ* to demonstrate compliance with our Part 15 rules, at a minimum of three overhead and three underground representative locations, using the measurement guidelines in Appendix C. Consistent with existing FCC measurement procedures, measurements below 30 MHz must be performed with a magnetic loop antenna, while those above 30 MHz are performed using an electric field sensing antenna. For Access BPL in underground installations, the proposed guidelines employ the common principle of measuring radiated fields along a number of radials at a specified distance from the periphery of the pad-mounted above-ground transformer where the Access BPL equipment is located, to find the maximum emissions. For Access BPL installed on overhead lines, in order to take into account the effect of the long power line associated with the Access BPL equipment, our proposed guidelines specify measurements at fixed horizontal distances from the power line where the Access BPL source is installed. Thus, rather than finding the maximum emissions across a number of radials, - as currently performed for other Part 15 emitters - the receive antenna is moved down-line, parallel to the power line, starting from the Access BPL equipment location, to find the maximum emissions. Down-line distances used in this sequence of measurements are specified in terms of wavelength of the Access BPL mid-band frequency. We seek comment on these guidelines.

46. In addition, we specifically solicit comments on the height of receive antennas used for radiated emissions measurements for Access BPL systems operating on overhead power lines and on the possible use of correction factors to account for antenna height. The proposed guidelines in Appendix C

[103] *See* comments of Phonex at 3; UPLC at 14.

recommend a fixed *loop* antenna height at 1 meter and scanning the height of electric field sensing antennas from 1 to 4 meters. While these recommendations correspond to standard practice for other types of devices (especially when measured on a test site), these heights may not capture the maximum emissions from an overhead power line. In Appendix C, we address this issue by specifying that distance extrapolation for emission measurements on overhead lines be based on slant-range distance from the Access BPL location on the pole to the measuring antenna, rather than on horizontal distance.[104] However, this technique does not account for field strength reductions caused by ground effects. We seek comment on the following:

(a) Is it necessary to require that emission measurements be conducted at antenna heights greater than those proposed in Appendix C?

(b) Is it practical and safe to make *in-situ* emission measurements at antenna heights up to the height of an overhead medium voltage power line (typically 11 meters) when operating 10 meters from the power line? As an alternative to requiring higher antenna heights, should we specify that measurements that are performed at heights significantly lower than the power line be subjected to a correction factor to estimate the maximum field strength that would have been observed at a higher measurement height? How should such a correction factor be determined?

47. *Measurement Guidelines for Other Carrier Current Systems.* In the *Inquiry*, the Commission observed that the International Electrotechnical Commission (IEC), International Special Committee on Radio Interference (CISPR) Subcommittee I on *Interference Relating To Multimedia Equipment*, Working Group 3 on *Emission from Information Technology Equipment* is developing conducted emission limits for new BPL technologies.[105] We note however that this international work on a standardized measurement method for In-House BPL is still under way, including work on the definition of a line impedance stabilization network (LISN),[106] associated injection methods, and conducted emission limits for systems using the power line port as a communication port.[107] We tentatively propose in the interim, pending the completion of such work, to retain the three-installation radiated emissions method for In-House BPL and traditional CCS, using the measurement guidelines in Appendix C, which clarify principles used regarding *in-situ* test buildings, device installation location within a building, measurement distances from the building, measurement of emissions from overhead power feed lines to the building, and device operation. We seek comment on the measurement guidelines of Appendix C for In-House BPL and CCS.

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[104] *See* 47 C.F.R. § 15.31(f)(1) & (2). The extrapolation factor is used to address the difficulty of making measurements at large distances. "Decade", a 10:1 range, refers to the ratio of the specified measurement distance to the actual measurement distance. For example, in the 1.705-30 MHz band, measurements are specified at a distance of 30 meters. If however, actual measurements were made at a distance of 3 meters, the ratio of the distances is a decade (30/3=10) and the field strength result must be corrected by subtracting 40 dB.

[105] *See Inquiry* at ¶15.

[106] A line impedance stabilization network (LISN) is an artificial power line network that provides a specified load impedance in a given frequency range. This device is also used to isolate the equipment from the AC supply and to facilitate measurements. *See also,* footnote 97.

[107] *See* the work of IEC CISPR Subcommittee I on *Interference Relating To Multimedia Equipment*, Working Group 3 on *Emission from Information Technology Equipment*, at <http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=dirwg.p&ctnum=2333>. *See also* <http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6515082641>.

IV. CONCLUSION

48. In conclusion, we believe that Access BPL has the potential to offer a number of significant benefits, such as 1) increasing the availability of broadband services to homes and businesses; 2) improving the competitiveness of the broadband services market; 3) improving the quality and reliability of electric power delivery; and, 4) advancing homeland security. We believe that our proposals contained herein to adopt new Part 15 technical and administrative rules for Access BPL will help promote and foster the development of this new technology with its concomitant benefits while at the same time ensuring that existing licensed operations are protected from harmful interference. We further believe that our proposed measurement guidelines for Access BPL and CCS will ensure that emission measurements for determining the compliance of these systems with FCC requirements are made in a consistent manner, and with repeatable results. We request comments on these conclusions and on all aspects of the proposals contained herein.

V. PROCEDURAL MATTERS

Initial Regulatory Flexibility Analysis

49. As required by Section 603 of the Regulatory Flexibility Act, 5 U.S.C. § 603, the Commission has prepared an Initial Regulatory Flexibility Analysis ("IRFA") of the possible significant economic impact on small entities of the proposals suggested in this document. The IRFA is set forth in Appendix A. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines as comments filed in this Notice of Proposed Rule Making. Comments must have a separate and distinct heading designating them as responses to the IRFA.

Initial Paperwork Reduction Act of 1995 Analysis

50. This Notice contains a proposed information collection subject to the Paperwork Reduction Act of 1995 (PRA). As part of its continuing effort to reduce paperwork burdens, we invite the general public and the Office of Management and Budget ("OMB") to take this opportunity to comment on the information collections contained in this Notice, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. Public and agency comments are due at the same time as other comments on this Notice.

51. In addition to filing comments with the Secretary, a copy of any comments on the information collection(s) contained herein should be submitted to Judith B. Herman, Federal Communications Commission, Room 1-C804, 445 12th Street, SW, Washington, DC 20554, or via the Internet to jboley@fcc.gov and to Kristy L. Lalonde, OMB Desk Officer, Room 10236, 725 17th Street, NW, Washington, DC 20503 or via the Internet to Kristy L. Lalonde@omb.eop.gov.

A. *Ex Parte* Rules - Permit-But-Disclose Proceeding.

52. This is a permit-but-disclose notice and comment rulemaking proceeding. *Ex parte* presentations are permitted, except during the Sunshine Agenda period, provided they are disclosed as provided in the Commission's rules. *See* generally 47 C.F.R. §§ 1.1202, 1.1203, and 1.2306(a).

A. Comments

53. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415 and 1.419, interested parties may file comments on or before **[45 days from date of publication in the Federal**

Register] and reply comments on or before [**75 days from date of publication in the Federal Register**]. Comments may be filed using the Commission's Electronic Comment Filing System ("ECFS"), http://www.fcc.gov/e-file/ecfs.html, or by filing paper copies. *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 Fed. Reg. 23,121 (1998).

54. Comments filed through the ECFS can be sent as an electronic file via the Internet to http://www.fcc.gov/e-file/ecfs.html. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, U.S. Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form <your e-mail address." A sample form and directions will be sent in reply. Parties who choose to file by paper must file an original and four copies of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number.

55. Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail (although we continue to experience delays in receiving U.S. Postal Service mail). The Commission's contractor, Vistronix, Inc., will receive hand-delivered or messenger-delivered paper filings for the Commission's Secretary at 236 Massachusetts Avenue, N.E., Suite 110, Washington, D.C. 20002. The filing hours at this location are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes must be disposed of before entering the building. Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743. U.S. Postal Service first-class mail, Express Mail, and Priority Mail should be addressed to 445 12th Street, SW, Washington, D.C. 20554. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

56. Parties who choose to file by paper should also submit their comments on diskette. Such a submission should be on a 3.5-inch diskette formatted in an IBM compatible format using Microsoft Word or compatible software. The diskette should be accompanied by a cover letter and should be submitted in "read only" mode. The diskette should be clearly labeled with the commenter's name, proceeding (including the lead docket number, type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase "Disk Copy – Not an Original." Each diskette should contain only party's pleading, preferably in a single electronic file. In addition, commenters must send diskette copies to the Commission's copy contractor, Natek, Inc., Portals II, 445 12th Street, SW, Room CY-B402, Washington, DC, 20554.

57. Alternative formats (computer diskette, large print, audio cassette and Braille) are available to persons with disabilities by contacting Brian Millin at (202) 418-7426, TTY (202) 418-2555, or via e-mail to bmillin@fcc.gov. This Notice can also be downloaded at http://www.fcc.gov/oet.

B. Contact Person

58. For further information concerning this rule making proceeding contact Anh Wride at (202) 418-0577, Anh.Wride@fcc.gov.

VI. ORDERING CLAUSES

59. Accordingly, IT IS ORDERED that pursuant to Sections 1, 4, 301, 302(a), 303, 307, 309, 316, and 332 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 151, 154, 301, 302(a), 303, 307, 309, 316, 332, 334, and 336, the Notice of Proposed Rule Making is hereby adopted.

60. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Notice of Proposed Rule Making, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch

Marlene H. Dortch
Secretary

APPENDIX A: INITIAL REGULATORY FLEXIBILITY ANALYSIS

Initial Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act of 1980 as amended,[108] the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the policies and rules proposed in this Notice of Proposed Rulemaking ("NPRM"). Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments provided in paragraph 53 of the NPRM. The Commission will send a copy of this NPRM, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).[109] In addition, the NPRM and IFRA (or summaries thereof) will be published in the Federal Register.[110]

A. Need for, and Objectives of, the Proposed Rules.

A number of parties are currently operating Access BPL under our Part 15 rules. Access BPL systems are new types of carrier current system that operate on an unlicensed basis under Part 15. Access BPL systems use existing electrical power lines as a transmission medium to provide high-speed communications capabilities by coupling RF energy onto the power line. Because power lines reach virtually every community in the country, we believe that Access BPL could play an important role in providing additional competition in the offering of broadband infrastructure to the American home and consumers. In addition, BPL could bring Internet and high-speed broadband access to rural and underserved areas, which often are difficult to serve due to the high costs associated with upgrading existing infrastructure and interconnecting communication nodes with new technologies. We propose to amend Part 15 of our rules to adopt new requirements and measurement guidelines for Access broadband over power line (BPL). Specifically, we propose new Part 15 requirements for Access BPL to promote its growth while continuing to protect licensed spectrum users. We further propose to adopt new measurement guidelines for Access BPL, both in aerial (overhead) and underground configurations. For In-House BPL and traditional CCS, we propose to clarify the measurement guidelines to ensure that measurements are made in a consistent manner and provide for repeatable results in determining compliance with our rules. These actions will remove regulatory uncertainties, promote the deployment of BPL to bring the necessary competition in the provisioning of broadband applications to the American public as well as new high speed broadband access to underserved areas of the country, while ensuring that licensed users continue to be protected from harmful interference.

B. Legal Basis.

This action is taken pursuant to Sections 1, 4, 301, 302(a), 303, 307, 309, 316, 332, 334, and 336 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 151, 154, 301, 302(a), 303, 307, 309, 316, 332, 334, and 336.

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[108] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et. seq.* has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-112, 110 Stat. 847 (1996)("CWAAA"). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 ("SBREFA").

[109] *See* 5 U.S.C. § 603(a).

[110] *See* 5 U.S.C. § 603(a).

C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules Will Apply.

The RFA directs agencies to provide a description of, and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.[111] The RFA defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small business concern" under Section 3 of the Small Business Act.[112] Under the Small Business Act, a "small business concern" is one that: (1) is independently owned and operated; (2) is not dominant in its field of operations; and (3) meets may additional criteria established by the Small Business Administration (SBA).[113]

A small organization is generally "any not-for-profit enterprise which is independently owned and operated and is not dominant in its field."[114] Nationwide, as of 1992, there were approximately 275,801 small organizations.[115] The term "small governmental jurisdiction" is defined as "governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand."[116] As of 1997, there were approximately 87,453 governmental jurisdictions in the United States.[117] This number includes 39,044 counties, municipal governments, and townships, of which 27,546 have populations of fewer than 50,000 and 11,498 counties, municipal governments, and townships have populations of 50,000 or more. Thus, we estimate that the number of small governmental jurisdictions is approximately 75,955 or fewer.

The proposed rules pertain to manufacturers of unlicensed communications devices. The appropriate small business size standard is that which the SBA has established for radio and television broadcasting and wireless communications equipment manufacturing. This category encompasses entities that primarily manufacture radio, television, and wireless communications equipment.[118] Under this standard, firms are considered small if they have 750 or fewer employees.[119] Census Bureau data for 1997 indicate that, for that year, there were a total of 1,215 establishments[120] in this category.[121] Of

[111] *See* U.S.C. § 603(b)(3).

[112] *Id.* § 601(3).

[113] *Id.* § 632.

[114] 5 U.S.C. § 601(4).

[115] 1992 Economic Census, U.S. Bureau of the Census, , Table 6 (special tabulation of data under contract to Office of Advocacy of the U.S. Small Business Administration).

[116] 5 U.S.C. § 601(5).

[117] 1995 Census of Governments, U.S. Census Bureau, United States Department of Commerce, Statistical Abstract of the United States (2000).

[118] NAICS code 334220.

[119] Id.

[120] The number of "establishments" is a less helpful indicator of small business prevalence in this context than would be the number of "firms" or "companies," because the latter take into account the concept of common ownership or control. Any single physical locations for an entity is an establishment, even though that location may be owned by a different establishment. Thus, the numbers given may reflect inflated numbers of businesses in (continued....)

those, there were 1,150 that had employment under 500, and an additional 37 that had employment of 500 to 999. The percentage of wireless equipment manufacturers in this category is approximately 61.35%,[122] so the Commission estimates that the number of wireless equipment manufacturers with employment under 500 was actually closer to 706, with and additional 23 establishments having employment of between 500 and 999. Given the above, the Commission estimates that the great majority of wireless communications equipment manufacturers are small businesses. We do not believe this action would have a negative impact on small entities that manufacture unlicensed BPL devices. Indeed, we believe the actions should benefit small entities because it should make available increased business opportunities to small entities. We request comment on these assessments.

D. Description of Projected Reporting, Record keeping and Other Compliance Requirements.

Part 15 carrier current devices are already required to be authorized under the verification procedure as a prerequisite to marketing and importation. The reporting and recordkeeping requirements associated with the equipment authorization procedures would not be changed by the proposals contained in this Notice.

We propose to adopt new requirements for Access BPL to ensure protection of licensed spectrum users from harmful interference. These requirements include the proposed technical requirement for adaptive interference mitigation capabilities and the proposed notification of Access BPL systems in a database similar to the one required for existing Power Line Carrier systems. Although these proposals do somewhat increase the reporting and record keeping requirements for Access BPL systems, the benefit of ensuring protection to critical systems operated by law enforcement groups, government users and emergency operations outweighs this small cost that will permit the growth of Access BPL in the shared spectrum.

E. Steps taken to Minimize Significant Economic Impact on Small Entities and Significant Alternatives Considered.

The RFA requires an agency to describe any significant alternatives that it has considered in *reaching its proposed approach, which may include the following four alternatives (among others): (1)* the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.[123]

In this Notice, we have maintained the existing Part 15 emission limits, which are applicable to all Part 15 devices, including BPL. We have also maintained the Verification method for equipment authorization of BPL, which is the least burdensome equipment authorization procedure, wherein the

(Continued from previous page)
this category, including the numbers of small businesses. In this category, the Census breaks-out data for firms or companies only to give the total number of such entities for 1997, which was 1,089.

[121] U.S. Census Bureau, 1997 Economic Census, Industry Series: Manufacturing, "Industry Statistics by Employment Size," Table 4, NAICS code 334220 (issued August 1999).

[122] Id. Table 5, "Industry Statistics by Industry and Primary Product Class Specialization: 1997."

[123] 5 U.S.C. § 603(c).

manufacturer conducts his own testing and retains the compliant test data in his file. We have proposed to adopt new measurement guidelines for BPL and existing carrier current systems, to assist manufacturers and testing entities to follow clearer and more precise measurement procedures in the testing of BPL and CCS.

F. Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rules.

None.

APPENDIX B: PROPOSED RULES

For the reasons discussed in the preamble, the Federal Communications Commission proposes to amend 47 C.F.R. part 15 as follows:

PART 15 – RADIO FREQUENCY DEVICES

1. The authority citation for part 15 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302, 303, 304, 307 and 544A.

2. Section 15.3 is proposed to be amended by adding paragraph (ff) to read as follows:

§15.3 Definitions.

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(ff) Access Broadband over power line (Access BPL): A carrier current system that transmits radio frequency energy by conduction over electric power lines owned, operated, or controlled by an electric service provider. The electric power lines may be aerial (overhead) or underground.

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3. Section 15.107 is proposed to be amended by adding paragraph (e) to read as follows:

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(e) The limits shown in paragraphs (a) and (b) of this section shall not apply to Access BPL systems.

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4. Section 15.109 is proposed to be amended by modifying paragraph (e); adding paragraphs (f) and (g); and re-designating paragraphs (f), (g) and (h) as (h), (i) and (j), to read as follows:

Section 15.109 Radiated emission limits.

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(e) Carrier current systems, including BPL systems, used as unintentional radiators or other unintentional radiators that are designed to conduct their radio frequency emissions via connecting wires or cables and that operate in the frequency range of 9 kHz to 30 MHz, including devices that deliver the radio frequency energy to transducers, such as ultrasonic devices not covered under Part 18 of this Chapter, shall comply with the radiated emission limits for intentional radiators provided in Section 15.209 for the frequency range of 9 kHz to 30 MHz. As an alternative, carrier current systems used as unintentional radiators and operating in the frequency range of 525 kHz to 1705 kHz may comply with the radiated emission limits provided in Section 15.221(a). At frequencies above 30 MHz, the limits in paragraph (a), (b) or (i) of this Section, as appropriate, continue to apply. For all BPL systems, the requirements of this paragraph and paragraph (a) of this section shall also apply to the emissions from all low-voltage lines from the distribution transformer to all in-building wiring.

(f) Access BPL systems shall incorporate adaptive interference mitigation techniques such as dynamic or remote reduction in power and adjustment in operating frequencies, in order for Access BPL installations to avoid site-specific, localized use of the same spectrum by licensed services. Access BPL systems shall incorporate a shut-down feature to deactivate units found to cause harmful interference.

(g)) Entities operating Access Broadband over Power Line systems shall supply to a Federal Communications Commission/National Telecommunications and Information Administration recognized industry-operated entity, information on all existing, changes to existing and proposed Access BPL systems for inclusion in a data base. Such information shall include the installation locations, frequency bands of operation, and type of modulation used. No notification to the FCC is required.

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APPENDIX C: PROPOSED MEASUREMENT GUIDELINES

This appendix is intended to provide general guidance for compliance measurements of Broadband over power line (BPL) devices and carrier current systems (CCS). For BPL systems, the measurement principles are based on the Commission's current understanding of BPL technology. Modifications may be necessary as measurement experience is gained.

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

1) Testing shall be performed with the BPL system power settings set at the maximum level used by the EUT.

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 C63.4-2001, section 5.1.2 for alternatives, if this test condition cannot be achieved.)

4) The data communications burst rate shall be at least 20 Hz as specified in the note at the end of Section 15.35(a) for Quasi-Peak measurements. Otherwise, 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 C63.4-2001 procedures.

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 pre-amplifier.

7) The six highest radiated emissions relative to the limit and independent of antenna polarization shall be reported as stated in ANSI C63.4-2001, section 10.1.8.2.

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.

2) Testing shall be performed at distances of 0, ¼, ½, ¾, 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 ½ wavelength of the mid-band frequency until the distance equals or exceeds ½ 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 ½ 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.

Note: In cases where pole mounted low-voltage boosters are used (*i.e.*, Home-Plug and modem boosters), apply the overhead-line procedures as stated above along the low-voltage lines.

c. Radiated Emissions Measurement Principles for Underground Line Installations

1) 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.

2) Measurements shall be made at positions around the perimeter of the in-ground power transformer where the maximum emissions occur. ANSI C63.4-2001, 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.

d. Conducted Emissions Measurement Principles

1) Conducted emissions testing is not required for Access BPL.

3. In-House BPL and Carrier Current Systems Measurement Principles

1) In-House BPL devices are typically composite devices consisting of two equipment classes (Carrier current system and personal computer peripheral (Class B)). While carrier current systems require Verification, personal computer peripherals require Declaration of Conformity (DoC) or Certification, as specified in Section 15.101 of the Rules. Appropriate tests to determine compliance with these requirements shall be performed.

2) *In-situ* testing is required for testing of the carrier current system functions of the In-House BPL device.

3) If applicable, the device shall also be tested in a laboratory environment, as a computer peripheral, for both radiated and conducted emissions tests per the measurement procedures in C63.4-2001.

a. Test Environment and Radiated Emissions Measurement Principles for *In-Situ* Testing

1) The Equipment under Test (EUT) includes In-House BPL modems used to transmit and receive carrier BPL signals on low-voltage lines, associated computer interface devices, building wiring, and overhead or underground lines that connect to the electric utilities.

2) *In-situ* testing shall be performed with the EUT installed in a building on an outside wall on the ground floor or first floor. Testing shall be performed on three typical installations. The three installations shall include a combination of buildings with overhead-line(s) and underground line(s). The buildings shall not have aluminum or other metal siding, or shielded wiring (e.g.: wiring installed through conduit, or BX electric cable).

3) Measurements shall be made at positions around the building perimeter where the maximum emissions occur. ANSI C63.4-2001, section 8.1, specifies a minimum of 16 radial angles surrounding the EUT (building perimeter). If directional radiation patterns are suspected, additional azimuth angles shall be examined.

4) Measurements should normally be performed at a separation distance of 10 meters from the building perimeter. 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.

b. Additional Measurement Principles for *In-Situ* Testing With Overhead Lines

1) In addition to testing radials around the building, testing shall be performed opposite the overhead line; ¼ wavelength, ½ wavelength, 1 wavelength, and 1 ¼ wavelength down the line from the building connection. Wavelength spacing is based on the mid-band frequency used by the EUT.

2) 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.

3) 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.

c. Measurement Principles for Testing as a Computer Peripheral

1) The data rate shall be set at the maximum rate used by the EUT. Test modes or test software may be used to simulate data traffic.

2) For In-House BPL devices operating as unintentional radiators below 30 MHz, the conducted emissions shall be measured in the 535 – 1705 kHz band as specified in Section 15.107(c). For In-House BPL devices operating as unintentional radiators above 30 MHz, the conducted emissions shall be measured as specified in Section 15.107(a). Conducted emissions measurements shall be performed in accordance with ANSI C63.4-2001 (Section 7 and Annex E).

4) For In-House BPL devices operating as unintentional radiators either below 30 MHz or above 30 MHz, the radiated emissions limits of Section 15.109(a) apply. The radiated emissions from the computer peripheral shall be measured at an Open Area Test Site (OATS) in accordance with the measurement procedures in C63.4-2001 (Section 8 and Annex E)

STATEMENT OF CHAIRMAN MICHAEL K. POWELL

Re: Carrier Current Systems, including Broadband over Power Line Systems; ET Docket No. 03-104; Amendment of Part 15 Regarding New Requirements and Measurements for Access Broadband over Power Line; ET Docket No. 04-37, Notice of Proposed Rule Making

Another broadband pipe is coming closer to reality. Despite increasing access to broadband services, significant areas of the country still lack any type of broadband access or competition among broadband service providers. The NPRM we adopt today takes an important step towards promoting the deployment of a promising new technology – Broadband over Power Line or BPL. I have witnessed first-hand the potential of BPL to provide a new platform for the deployment of high-speed access operating under the Commission's existing Part 15 rules. Even today almost a dozen companies are conducting field tests around the country. BPL is currently being studied and deployed in a number of these communities, including in our own backyard in Manassas, Virginia.

Companies have struggled for years to make BPL a success and I am struck by the recent advancements and hurdles that have been overcome to provide enhanced services, more choices, and lower prices for our Nation's consumers.

BPL technology could also improve the provision and management of electric power systems, homeland security, and protect vital elements of our Nation's critical infrastructure. Moreover, BPL is being developed worldwide, and encouraging the deployment of the technology in the U.S. will promote continued U.S. leadership in broadband technology, and bring important benefits to the American public.

I am confident that the proposals we adopt today balance the potential benefits of BPL services and give careful consideration of the potential interference from BPL operations by establishing new requirements that will help minimize harmful interference that may occur and guidelines for measurement of radio frequency (RF) emissions from carrier current systems.

I am optimistic and welcome the day when every electrical outlet will have the potential to offer high-speed broadband and a plethora of high-tech applications to all Americans.

STATEMENT OF COMMISSIONER KATHLEEN Q. ABERNATHY

Re: Carrier Current Systems, including Broadband over Power Line Systems; ET Docket No. 03-104; Amendment of Part 15 Regarding New Requirements and Measurement Guidelines for Access Broadband over Power Line Systems; ET Docket No. 04-37, Notice of Proposed Rulemaking

This Notice of Proposed Rulemaking on broadband over power line systems (BPL) is an important step forward in promoting the Commission's goal of facilitating the deployment of broadband services to all Americans. Moving toward commercial deployment of BPL systems also will further our goal of developing robust facilities-based competition. I want consumers to have a choice of multiple, facilities-based providers, such as cable, DSL, wireless, satellite, and to the extent possible, power line. We will not get there overnight, but the continuing development of BPL technology is a step in the right direction.

One of the key issues in this proceeding is the potential for harmful interference by BPL systems to licensed spectrum users. Based on the record, it is appropriate that we are proceeding cautiously. I support our tentative conclusion to craft technical rules that minimize the potential for harmful interference to existing licensees and also ensure that any instances of interference are quickly resolved. I look forward to reviewing the comments on these technical proposals and am hopeful that we will be able to develop rules that protect existing licensees from harmful interference, while enabling a promising new technology to move forward.

STATEMENT OF
COMMISSIONER MICHAEL J. COPPS
DISSENTING IN PART AND APPROVING IN PART

Re: Carrier Current Systems, including Broadband over Power Line Systems; ET Docket No. 03-104; Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems; ET Docket No. 04-37, Notice of Proposed Rule Making

Last month I was lucky enough to join Commissioner Adelstein at a demonstration of powerline broadband, and I've been watching the technology develop over the time I've been at the Commission with much interest. Today this technology is just being deployed. Tomorrow I hope it will substantially increase broadband competition. Today companies plan to deploy it in urban and suburban communities. But I hope power lines will someday, sooner rather than later, deliver broadband to rural America as well. So we are at the beginning, and we all have high hopes.

Because of this, I strongly support the technical inquiries and proposals we make today. We need to set the technological rules of the game early and transparently, so that the entrepreneurs in this industry can make investments with confidence. As regards interference, I believe we make another step in that direction today, so I'm happy to support the technical side of our item.

Today's item dodges some of the hardest questions, however. For the same reasons it is important to provide certainty for industry and consumers as concerns interference, it is important to provide certainty on the policy implications that we will surely face as powerline broadband expands. These questions are hard and uncomfortable ones. But we should never shy away from asking the hard questions. Avoiding questions today only makes it harder for a future Commission to move ahead once architectures are in place and investments are being made.

So I would tackle now issues such as CALEA, universal service, disabilities access, E911, pole attachments, competition protections, and, critically here, how to handle the potential for cross-subsidization between regulated power businesses and unregulated communications businesses. Is it right to allow electricity rate payers to pay higher bills every month to subsidize an electric company's foray into broadband?

Some will argue that we don't know enough about what this technology will look like yet. Or that we shouldn't regulate an infant technology out of existence. Or that we shouldn't saddle a new technology with long-standing policy objectives. I disagree. Just because these policy goals are long standing doesn't mean that they are out of date. Public safety, rural service, competition, and disabilities access never go out of date. These are the same things complicating our ability to move ahead on the VOIP issues that we discussed earlier today.

STATEMENT OF COMMISSIONER KEVIN J. MARTIN

Re: Carrier Current Systems, including Broadband over Power Line Systems; ET Docket No. 03-104; Amendment of Part 15 Regarding New Requirements and Measurement Guidelines for Access Broadband Over Power Line Systems; ET Docket No. 04-37, Notice of Proposed Rulemaking,

I am pleased to support this item, which opens a rulemaking on issues related to Broadband over Power Line (BPL) systems. BPL systems use existing electric power lines to provide high-speed communications. Because power lines are ubiquitous – reaching virtually every community and every home – BPL systems have the potential to become a last-mile solution throughout the United States. As such, they would not only provide competition to cable broadband and DSL, they could bring Internet access and high-speed broadband to rural and isolated areas, which have been difficult to serve because of the high infrastructure costs of reaching those areas. BPL systems also serve an important homeland security function, providing a redundant data network.

In this proceeding, we are considering how to facilitate deployment of BPL while ensuring that existing users are protected against interference. Most importantly, NTIA and FEMA have raised concerns about interference to Government operations, including some emergency communications. In addition, many amateur operators fear that they will experience unacceptable interference from BPL systems. I take these concerns very seriously. I am optimistic, however, that we can craft rules that will fully address these concerns and still allow BPL to flourish. I thus look forward to receiving comments in this proceeding.

STATEMENT OF COMMISSIONER JONATHAN S. ADELSTEIN

Re: Carrier Current Systems, including Broadband over Power Line Systems; ET Docket No. 03-104; Amendment of Part 15 Regarding New Requirements and Measurement Guidelines for Access Broadband over Power Line Systems; ET Docket No. 04-37, Notice of Proposed Rule Making

I recently had the opportunity to visit the demonstration of a Broadband over Power Line (BPL) system and was impressed by its potential. I believe that the Commission must do what it can to extend the benefits of the latest broadband technologies – such as broadband over power line – to all Americans, no matter where they live. I support our consideration of proposed changes to certain of our Part 15 rules to promote future BPL deployments. This is an important look at the technical issues and challenges posed by BPL. And I am encouraged by some of the proposals set forth in the NPRM to ensure that BPL systems do not cause harmful interference to existing services.

I have outlined an approach to spectrum management that promotes continued industry development and recognizes the unique traits of the electromagnetic radio spectrum as a national resource. It also reflects my belief that, in dealing with spectrum, the Commission has a responsibility to establish ground rules for issues such as interference and availability. Though power line broadband may not fall within the traditional scope of spectrum management, BPL systems use existing electrical power lines as a transmission medium to provide communications by coupling RF energy onto the power line.

While we must be mindful of harmful interference, we cannot let unsupported claims stand in the way of such an innovation as BPL systems. Provided that the engineering bears out, I believe that we need to push the boundaries to accommodate new technologies. A little noticed provision of the Communications Act, Section 157, reads that "[i]t shall be the policy of the United States to encourage the provision of new technologies and services to the public." I am fully committed to that mission to promote new technologies, and to provide a framework for innovation so they can succeed. In order to do so, we must first resolve the technical interference issues addressed in this NPRM.