

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

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

REPORT AND ORDER

Adopted: October 14, 2004

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

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I. INTRODUCTION

1. In this Report and Order, we adopt new rules for Access Broadband over Power Line (Access BPL) systems, a new type of carrier current technology that provides access to high speed broadband services using electric utility companies' power lines. This new technology offers the potential for the establishment of a significant new medium for extending broadband access to American homes and businesses. Given that power lines reach virtually every residence and business in every community and geographic area in this country, Access BPL service could be made available nearly everywhere. This new broadband delivery medium could also serve to introduce additional competition to existing cable, DSL, and other broadband services. In addition, the National Telecommunications and Information Administration (NTIA) has undertaken a significant effort to both study Access BPL technology, including its operating characteristics and interference potential, and to make specific recommendations to the Commission for policies to encourage its implementation and to manage its interference potential.¹ Our staff has worked closely with NTIA on this matter and the policy decisions and rules we are adopting herein reflect this cooperation and embody many of NTIA's recommendations.

2. Along with NTIA, we recognize the concerns of authorized radio service users in both the private and government sectors for the need to ensure that radio frequency (RF) energy from BPL signals on power lines does not cause harmful interference to licensed radio services. The record and our investigations indicate that BPL network systems can generally be configured and managed to minimize and/or eliminate this harmful interference potential. Our goals in developing the rules for Access BPL set forth herein are therefore to provide a framework that will both facilitate the rapid introduction and development of BPL systems and protect licensed radio services from harmful interference. Specifically, we are adopting: 1) new operational requirements for Access BPL to promote avoidance and resolution of harmful interference; 2) new administrative requirements to aid in identifying Access BPL installations; and 3) specific measurement guidelines and certification requirements to ensure accurate and repeatable evaluations of emissions from Access BPL and all other carrier current systems. We believe these actions will promote the development of BPL systems by removing regulatory uncertainties for BPL operators and equipment manufacturers while ensuring that licensed radio services are protected from harmful interference.

¹ See comments of NTIA at 6. The Federal Communications Commission, which is an independent agency, administers non-Federal Government spectrum under the Communications Act of 1934, as amended, see 47 U.S.C. § 151, *et seq.* NTIA, which is an operating unit of the Department of Commerce, administers Federal Government spectrum and is responsible for administering the communications and information functions of the Executive branch of the Federal Government, see 47 C.F.R. § 2.105(a) and Executive Order 12046 of March 26, 1978. NTIA also approves the spectrum needs of new systems for use by Federal departments and agencies and maintains the Federal Government Table of Frequency Allocations in its *Manual of Regulations and Procedures for Federal Radio Frequency Management (NTIA Manual)*. In addition to its comments, NTIA has conducted an extensive technical study and analysis of Access BPL technology. This study is in two phases. Phase 1 examined the interference risks to radio reception in the immediate vicinity of overhead power lines used by Access BPL systems and suggests means for reducing these risks and techniques for mitigating local interference if it should occur. NTIA published the findings of its Phase 1 study in "Potential Interference From Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7 – 80 MHz, Phase 1 Study," NTIA Report 04-413, April 2004 (NTIA Phase 1 Study). In Phase 2, which is not yet complete, NTIA is evaluating the effectiveness of its Phase 1 recommendations and addressing potential interference via ionospheric propagation of BPL emissions from mature large-scale deployments of BPL networks. NTIA's comments make reference to the NTIA Phase 1 Study, as supplemented by the preliminary elements of its Phase 2 report, which are presented in a technical appendix to those comments. NTIA also provided pertinent results of its further studies of special protection requirements (NTIA letter of September 13, 2004) as well as transmission of identification codes and measurement details (NTIA letter of September 24, 2004).

II. BACKGROUND

3. Carrier current systems use alternating current (AC) electric power lines to carry communications by coupling very low power RF signals onto the AC electric wiring.² Traditionally, these systems have included amplitude modulated (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 Carrier current systems operate on an unlicensed basis under Part 15 of the Commission's rules.⁴ As a general condition of operation, Part 15 devices may not cause harmful interference to authorized radio services and must accept any interference that they receive.⁵

4. Until recently, carrier current devices generally operated on frequencies below 2 MHz and with relatively limited communications capabilities. In the last few years, the availability of faster digital processing capabilities and the development of sophisticated modulation schemes have allowed the development of new designs for carrier current devices that are capable of overcoming earlier technical obstacles caused by the inherent noise and impedance mismatch of power lines. These new designs have led to the development of BPL systems that use spread spectrum or multiple carrier techniques with highly adaptive algorithms to effectively counter the noise in the line.

5. The new low-power, unlicensed BPL systems provide high speed digital communications capabilities by coupling RF energy onto either the power lines inside a building ("In-House BPL") or onto the medium voltage power delivery lines ("Access BPL").⁶ 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, and hence facilitating the implementation of home networks.⁷ Access BPL systems deliver high speed Internet and other broadband

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 a campus' 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).

⁴ *See* 47 C.F.R. §§ 15.3(f), 15.5, 15.31(d), (f), (g) and (h), 15.33(b)(2), 15.101(a) and (f), 15.107(a)-(c), 15.109(a), (b), (e) and (g), 15.201(a), 15.207(c), 15.209(a) and 15.221.

⁵ 47 C.F.R. § 15.5. Under these rules, operators of Access BPL systems are responsible for eliminating any harmful interference that may occur or must cease operation upon notification by a Commission representative that the device is causing harmful interference.

⁶ In-House BPL uses the 110 volt power wiring inside a residence or business to carry information within a structure. Access BPL typically uses the medium voltage exterior power distribution network 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 from where they are delivered to users.

⁷ 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.

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. Because 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 access technologies.

6. Access BPL systems carry high speed data signals to neighborhoods from a point where there is a connection to a telecommunications network. The point of network connection may be at a power substation or at an intermediate point between a substation and network terminations, depending on the network topology. Within a residential neighborhood, some system implementations complete the connection between the medium voltage lines and subscriber homes or businesses by using wireless links.⁸ Other implementations employ a coupler or bridge circuit module at the low-voltage distribution transformers to transfer the Access BPL signals across (thereby bypassing) these devices.⁹ In such systems, the BPL signals are brought into homes or businesses over the exterior power supply cable from the coupler/bridges, either directly, or via Access BPL adaptor modules.¹⁰ Typically, the medium voltage lines are carried overhead on transmission poles or tower mountings; however, in a large number of locations, and in newer subdivisions and neighborhoods, these lines are enclosed in underground conduits and the distribution transformers are mounted above ground on a pad, inside a metal housing.

7. The interference concern regarding BPL operation arises from the fact that electric power lines are not shielded and therefore portions of any RF energy they may carry can be radiated. While the power distribution management devices, such as transformers, and sometimes underground placement of lines that are characteristic of many electric utility systems tend to substantially diminish the effectiveness of these systems as radiators of RF energy, the potential for significant radiation of RF energy from utility systems that carry RF signals nonetheless remains. This “signal leakage,” which has for years made possible the reception of carrier current radio stations at colleges, universities and other institutions without a connection to the power line, can become harmful interference if not carefully managed. That is, radio systems using the same frequency bands as those on which local Access BPL signals are transmitted could possibly receive harmful interference from such signal leakage if adequate safeguards are not in place.

8. Most Access BPL systems that are currently deployed operate in the range from 2 MHz to 50 MHz, with very low-power signals that are spread over a broad range of frequencies. These frequencies are also used by licensed radio services that must be protected from harmful interference under the Commission’s Part 15 rules for unlicensed devices. In the radio spectrum below 50 MHz, incumbent authorized radio services include fixed, land mobile, aeronautical mobile, maritime mobile, radiolocation, broadcast radio, amateur radio terrestrial and satellite, and radio-astronomy. Users of this spectrum include, for example, public safety and Federal government agencies, aeronautical navigation licensees, amateur radio operators, international broadcasting stations, and citizens band radio operators.

⁸ See e.g., <http://www.amperion.com/products.asp>.

⁹ Low voltage transformers are poor conduits for high-frequency digital signals, as they are intended to conduct 60 Hz electric power.

¹⁰ See e.g., <http://www.currenttechnologies.com/products.asp>; <http://www.mainnet-plc.com>.

9. The Part 15 rules for carrier current systems currently specify radiated and conducted emission limits for devices operating below 30 MHz and above 30 MHz.¹¹ Carrier current systems operating from 9 kHz to 30 MHz are subject to radiated emission limits on emissions from any part of the wiring or power network connected to the RF power source.¹² 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, there is no limit on conducted emissions.¹³ All other carrier current systems operating below 30 MHz are subject to a conducted emission limit only within the AM broadcast band.¹⁴ Carrier current devices operating above 30 MHz must meet the radiated emission limits of Section 15.109(a), (b) or (g) for digital devices, which are further divided into two types.¹⁵ Class A equipment includes devices marketed for use in a commercial, industrial or business environment, excluding devices which are marketed for use by the general public or are intended to be used in the home.¹⁶ Class B equipment includes devices marketed for use in a residential environment, notwithstanding use in commercial, business and industrial environments.¹⁷ The rules require Access BPL systems to comply with the limits for Class A or B devices depending on whether they are marketed for use in a commercial, industrial or business environment on the one hand or for use by the general public or in the home on the other.¹⁸ Under this Class A/Class B regime, Access BPL systems that operate on medium voltage lines external to residential environments are considered Class A devices. Carrier current devices that do not operate on frequencies below 30 MHz are subject to the general conducted emission limits below 30 MHz.¹⁹ The existing Part 15 rules also address power line carrier systems, which are low-speed carrier current systems operating between 10 kHz and 490 kHz, used by an electric public utility entity for protective relaying, telemetry, etc., for general supervision of the power

¹¹ 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 and 4.275.

¹² *See* 47 C.F.R. § 15.109(e). Radiated emission limits vary with frequencies; for example, in the 1705 kHz to 30 MHz region, the radiated emission limit is 30 μ V/meter, at a measurement distance of 30 meters.

¹³ 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 interference to AM radio service by operating on a frequency that is not used by a local AM station.

¹⁴ For the protection of the AM Broadcast service, the device is subject to a conducted emission limit of 1000 μ V in the AM broadcast band (from 535 to 1705 kHz). *See* 47 C.F.R. §§ 15.107(c)(2) and 15.221. This provision does not apply to power line carrier systems, which are subject to 47 C.F.R. § 15.113.

¹⁵ *See* 47 C.F.R. § 15.109(a), (b) and (e).

¹⁶ *See* 47 C.F.R. § 15.3(h).

¹⁷ *See* 47 C.F.R. § 15.3(i).

¹⁸ The radiated emission limits for Class A equipment are approximately 10 dB higher than the radiated emission limits for Class B equipment. *See* 47 C.F.R. § 15.109(a), (b) and (g).

¹⁹ *See* 47 C.F.R. § 15.107(a)-(c). Conducted limits are generally specified from 150 kHz to 30 MHz only, because signals below 30 MHz have wavelengths greater than 10 meters and lower propagation losses, and can take special advantage of long stretches of electrical wiring.

system.²⁰ Because of their specialized use and operating frequency range, power line carrier systems are not subject to specific emission limits as are general carrier current systems.²¹

10. In April 2003, the Commission issued a *Notice of Inquiry (Inquiry)* on BPL technologies and systems. The Commission solicited comments to assist in reviewing its Part 15 rules to encourage the deployment of BPL systems while ensuring protection to the licensed services.²² Based on comments received in response to the *Inquiry*, in February 2004, the Commission issued a *Notice of Proposed Rule Making (Notice)*, in which it proposed rules for Access BPL systems that were intended to 1) remove regulatory uncertainty for BPL operators, thereby facilitating the introduction and use of this promising new technology, and 2) ensure that licensed services are protected from harmful interference by BPL operations.²³ In the *Notice*, the Commission recognized the potential that Access BPL holds in terms of a new method of delivery of broadband services to residential, institutional, and commercial users. The Commission further noted that Access BPL is being developed worldwide, and stated that encouraging the deployment of this technology in the United States will support globalization of products and services, promote continued U.S. leadership in broadband technology, and bring important benefits to the American public.²⁴ The Commission sought comments on proposals in five broad areas related to Access BPL systems and protection of authorized services: 1) a definition of Access BPL; 2) the Part 15 emissions limits for Access BPL; 3) additional technical and operational requirements for interference mitigation and resolution; 4) the notification of Access BPL locations and operational characteristics in a database to facilitate interference mitigation and avoidance measures; and 4) the appropriate measurement procedures to accurately assess Access BPL emissions and emissions from all other carrier current systems.²⁵

11. Over a thousand comments and replies were received in response to the *Notice*. The NTIA has been particularly helpful in suggesting ways to have an orderly and timely deployment of BPL devices in a manner that mitigates harmful interference to licensed radio services. The NTIA submitted an extensive study on the interference potential of Access BPL systems to federal government systems.²⁶ This study helped confirm the localized nature of potential harmful interference from Access BPL systems and that aggregation of Access BPL emissions at ground-based radio receiver antennas will not increase interference risks. Subsequently, NTIA submitted comments accompanied by a Technical Appendix.²⁷

²⁰ See 47 C.F.R. § 15.3(t). A carrier current system operated by an electric utility to control the utility's electrical grid is defined as a power line carrier system in the rules.

²¹ Power line carrier systems are only subject to 47 C.F.R. § 15.113.

²² 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).

²³ See *In the Matter of Carrier Current Systems, including Broadband over Power Line Systems and Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems, Notice of Proposed Rulemaking (Notice)*, ET Docket Nos. 03-104 and 04-37, 19 FCC Rcd 3335 (2004).

²⁴ *Id.*, at ¶30 and footnote 87.

²⁵ *Id.*, at ¶31.

²⁶ See NTIA Report 04-413, *Potential Interference From Broadband Over Power Line (BPL) Systems To Federal Government Radiocommunications at 1.7-80 MHz, Phase 1 Study, Volume I*, National Telecommunications and Information Administration, filed April 27, 2004.

²⁷ See NTIA Comments, filed June 8, 2004.

NTIA focuses on the need for rules that responsibly address both interference concerns and BPL operational requirements. It urges the Commission to promptly adopt effective new technical rules that will enable BPL proponents to develop and implement the necessary new design features and operating practices for addressing interference concerns and to obtain new equipment authorizations so as to contribute significantly toward fulfillment of the President's vision for universal affordable broadband Internet access.²⁸ These comments and our decisions are discussed below.

III. DISCUSSION

12. The deployment of broadband delivery capabilities to provide all Americans with access to affordable high speed Internet and data services is one of the most important challenges currently facing the Commission and the communications industry. This challenge is being met by many different service providers with a wide variety of technologies and delivery media, including, for example, DSL service on conventional telephone lines, cable modem services, dedicated high speed lines, unlicensed wireless internet access services, and the fixed and mobile radio services. The different options for obtaining broadband services allow consumers and businesses to select the type(s) of service that best meet their individual needs. In addition, the open market for such services promotes competition that both makes service affordable and provides incentives for quality service and innovation in new technologies and service features.

13. We believe that the widespread introduction of Access BPL service would further our goals for broadband service consistent with the challenges indicated above. This new technology offers the potential to give rise to a major new medium for broadband service delivery. Services provided on Access BPL could offer high speed Internet and data communications that compete with, complement, or extend the broadband services provided on existing media. Given the ubiquitous nature of the electric power network, Access BPL could conceivably also offer these services to virtually every element of the broadband market, including residential, institutional, and commercial users. In addition, it is possible that Access BPL could provide a means to expedite the availability of broadband Internet service to consumers and business in rural and other underserved areas. We also find that encouraging the deployment of the technology in the United States will support globalization of products and services, promote continued U.S. leadership in broadband technology, and bring important benefits to the American public.²⁹

²⁸ See comments of NTIA at iv.

²⁹ On January 8, 2004, the European Commission (EC) requested 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 state of the art power line communication infrastructure, in the framework of Mandate M313 given in August 2001 to these organizations (see http://europa.eu.int/comm/enterprise/electr_equipment/emc/interrep313.htm.) This technical specification will be an intermediate step in defining the technical conditions for compliance with EC regulations. 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 2004, *Communications Daily*, Vol. 24, No. 24, February 5, 2004.

14. The supporting comments of parties with a wide range of business interests relating to broadband service reflect the potential benefits of BPL in providing Internet and data services to our citizens and economy. These parties represent communications, manufacturing, government and other interests, including current broadband service providers, rural telecommunications providers, public safety providers, local municipalities, Access BPL equipment manufacturers, consumer electronics manufacturers, electric power utility companies, home security monitoring services, and radio service licensees.³⁰ For example, AT&T Corp. (AT&T) and Current Technologies (Current) submit that Access BPL can bring an end to the broadband duopoly of cable modem and DSL service.³¹ Current specifically indicates that Americans need multiple ways to bring reliable economical broadband access to homes and businesses- not only to reach places that are not currently served, but also to accelerate competition in areas where broadband access is currently available. The Association of Public-Safety Communications Officials-International, Inc. and the National Public Safety Telecommunications Council (APCO/NPSTC) and the Central Station Alarm Association (CSAA) state that this new medium has the potential to bring Internet and high speed broadband access to persons and locations that currently have limited choice for such services.³² The Consumer Electronics Association (CEA) submits that Access BPL will advance consumer use of new technologies and products such as home networks.³³ It further states that Access BPL could facilitate less expensive and more convenient monitoring and other functions that may prove valuable to consumers and businesses. The National Rural Telecommunications Cooperative and the National Rural Electric Cooperative Association (NRTC/NRECA) in joint comments submit that they support our efforts to expedite the availability of rural broadband Internet service over multiple delivery platforms and the goal of rapid BPL build out.³⁴ At the same time, they caution that BPL deployment is years from economic feasibility in rural areas.

15. Electric utility services and Access BPL system developers, including Cinergy Corp. (Cinergy), Consolidated Edison Company of New York, Inc. (Con Edison), Current, Oncor Delivery Electric Company (Oncor), and Southern., Southern Telecom Inc., and Southern Company Services, Inc. (collectively “Southern”) anticipate that Access BPL will enable a variety of more sophisticated power distribution applications, including automated outage detection and restoration confirmation, remote monitoring and operation of switches and transformers, more efficient demand-side management programs and power quality monitoring to detect faulty components before they fail.³⁵ Southern offers that Access BPL offers a unique communication tool for utilities that will support functions such as remote reclosure operations of circuit breakers, power quality monitoring, automated meter reading, automatic connect and disconnect, system monitoring, and video surveillance of utility property. The

³⁰ Parties supporting the introduction of BPL and providing statements relating to its potential benefits include Ambient Corporation (Ambient), the American Petroleum Institute (API), AT&T, APCO/NPSTC, the CEA, the CSAA, Cinergy Corp. (Cinergy), the City of Manassas Virginia, Current, Duke Energy Corporation (Duke Energy), Main.Net Communications, Ltd. (Main.Net), the National Telecommunications and Information Administration, the National Rural Telecommunications Cooperative and the National Rural Electric Cooperative Association (NRTC/NRECA), Oncor Electric Delivery Company (Oncor), PPL Telcom LLC (PPL Telcom), Progress Energy, Inc. (Progress Energy) and Southern., Southern Telecom Inc., and Southern Company Services, Inc. (collectively “Southern”).

³¹ See comments of AT&T at 3; Current at 9.

³² See comments of APCO/NPSTC at 2; CSAA at 1.

³³ See comments of CEA at 4.

³⁴ See comments of NRTC/NRECA at 4-5.

³⁵ See comments of Cinergy at 2; Current at 1-2; Oncor at 1; Southern at 3-4.

NTIA similarly submits that widespread deployment of Access BPL will make it possible to speed detection and diagnosis of electrical system failures. It states that, indeed, the rules for Access BPL must anticipate the possibility that apart from providing commercial broadband services, many electric utilities will eventually deploy BPL technology in order to realize the associated infrastructure benefits. NTIA further states that deployment of Access BPL will also motivate electric power utilities to upgrade their power distribution plant so as to reduce power line noise levels.³⁶

16. Several parties do, however, express concern that the potential benefits of Access BPL not come at the cost of new interference to licensed radio service.³⁷ For example, APCO/NPSTC, APCO Region 21, and the International Municipal Signal Association (IMSA), which operates radio call boxes used by the public to call for fire, police, ambulance, road service or other assistance, submit that there are public safety systems in the HF (2-7 MHz), low VHF (30-50 MHz), and VHF (72-76 MHz) bands that must be protected from harmful interference.³⁸ Global2Way Acquisition, LLC (Global), which operates a low power communications service for intra/interstate trucking companies on HF frequencies under secondary licenses, asks that that we proceed carefully on Access BPL, balancing the laudable goal of providing new services against the potential harm to existing services. The International Municipal Signal Association (IMSA), which operates radio call boxes used by the public to call for fire, police, ambulance, road service or other assistance, requests that we exclude the 73-74 MHz and 75.4-76 MHz bands used by these facilities from Access BPL operation in order to protect them from harmful interference.³⁹

17. Aeronautical Radio, Inc. (ARINC) and the Boeing Company (Boeing) request that Access BPL not be permitted to operate in the frequency bands that are used by the aeronautical radio service. The North American Short Wave Association (NASWA) requests that we protect international broadcasting services in the 5.9-26.1 MHz frequency range.⁴⁰ Shipcom LLC (Shipcom), which operates several Maritime Public Coast (MPC) stations on frequencies in the 2-25 MHz range, submits that its facilities would be especially susceptible to BPL interference because the receiving antennas of its stations are mounted very high. To avoid such interference, it requests that we establish BPL-free zones around MPC stations. Bell South Corporation (Bell South) and Verizon Communications, Inc. (Verizon) are concerned that Access BPL could cause harmful interference with telephone network and DSL services because power lines are parallel to telephone wires, which are also unshielded, and so could receive harmful interference.⁴¹ Alan Dixon is concerned the BPL could cause harmful interference to Citizen's Band (CB) radio service on 27 MHz frequencies.

18. The Association for Maximum Service Television, Inc. (MSTV) urges the Commission to limit Access BPL to frequencies below 50 MHz, and avoid operations in the low VHF TV band.⁴² The Society

³⁶ See comments of NTIA at 4.

³⁷ See comments of APCO/NPSTC at 2; AT&T at 2; Global2Way Acquisition LLC (Global) at 2; International Municipal Signal Association (IMSA) at 5; Potomac Valley Radio Club (PVRC) at 3.

³⁸ See comments of APCO/NPSTC at 2; APCO Region 21 at 4. The High Frequency (HF) band covers frequencies from 3 to 30 MHz. The Very High Frequency (VHF) band covers frequencies from 30 to 300 MHz.

³⁹ See comments of IMSA at 5.

⁴⁰ See comments of NASWA at 2.

⁴¹ See comments of Bell South at 6; Verizon at 2-3.

⁴² See comments of MSTV at 2.

of Broadcast Engineers (SBE) is concerned that BPL operations could cause harmful interference to low VHF band DTV stations (channels 2-6) because the service threshold for those channels is just 28 dB μ , or 25.1 μ V/m.⁴³ It therefore submits that low band VHF DTV stations will not be able to serve viewers if Access BPL is allowed to operate on frequencies up to 80 MHz, and that even limiting BPL to a maximum of 50 MHz might not be satisfactory because of the likely generation of harmonics in BPL equipment. SBE further submits that BPL operations could interfere with Broadcast Auxiliary service (BAS) remote pickup stations and low power auxiliary stations operating on frequencies between 25.85 and 26.48 MHz. In addition, SBE expresses concern that BPL operations could adversely affect Emergency Alert System (EAS) transmissions by AM radio stations at 535 to 1705 kHz, by EAS Primary Entry Point (PEP) stations on frequencies between 2-20 MHz, and by low band VHF EAS stations in the 39.48 MHz (California) and 44.43 MHz (Illinois) bands. The National Academy of Sciences/National Research Council's Committee on Radio Frequency (NAS/CORF) submits that radio astronomy allocations in the HF and low VHF regions need to be protected from Access BPL operations.⁴⁴

19. NTIA recommends that we adopt several new Access BPL rule elements that would couple with our proposed rules to reduce risks of harmful interference from Access BPL systems. NTIA states that relative to existing BPL rules, these recommended new rules would shift emphasis away from elimination of harmful interference from BPL systems to prevention of harmful interference through adaptation of well-proven spectrum management practices. It further submits that the benefits of Access BPL warrant acceptance of a small and manageable degree of interference risk.

20. Some parties representing licensees of services that use frequencies in the 2-80 MHz region of the spectrum, particularly Amateur radio operators, are opposed to allowing the operation of Access BPL.⁴⁵ In statements generally reflecting the position of these parties, the National Association for Amateur Radio, also known as the American Radio Relay League (ARRL), submits that while it does not disagree with our efforts to permit additional competition in the offering of broadband services and to bring such services to rural and other underserved areas, it believes that Access BPL in frequency bands between 1.7 MHz and 80 MHz would be a mistake and that we should not authorize its operation without substantial further research.⁴⁶ The ARRL argues that it has shown in its comments and reply comments submitted in response to the *Inquiry* that Access BPL has substantial interference potential throughout communities due to the distributive nature of power line radiation of signals in the HF and VHF bands. ARRL further states that the technical study it has filed establishes that there is a significant interference potential from Access BPL systems to the Amateur HF allocations. It also states that there have been at least 27 interference complaints filed to date with the Commission by radio amateurs due to the operation of Access BPL systems at test locations and that some of these have persisted notwithstanding the good faith efforts of some of the Access BPL providers.

21. The ARRL contends that the tentative conclusions in the *Notice* that any interference to licensed radio services will be minimal are unsupported. It states that while the proposed interference mitigation techniques could have some after-the-fact benefit in interference reduction in some instances, they are

⁴³, See reply comments of SBE at 5.

⁴⁴ See comments of NAS/CORF at 3.

⁴⁵ See comments of the Academy of Model Aeronautics (AMA) at 1-3); ARRL at 1-5; Carl Stevenson at 1; CQ Communications, Inc. at 3; the Disaster Emergency Relief Association (DERA) at 1; the Radio Amateur Satellite Corp at 1. In addition, approximately 1500 amateur radio licensees submitted informal comments opposing the proposed rules for the reasons indicated in the ARRL's comments.

⁴⁶ See comments of ARRL at 2.

inappropriate as a means of authorizing a service that has the potential to interfere with radio services. CQ Communications, Inc. (CQ Communications) believes that the benefits to the public of BPL are overstated, that the damage that will be caused by BPL interference is understated, and that the HF/low VHF region is the wrong spectrum for BPL to utilize. Many individual amateur licensees state that their antennas cannot in most cases be redirected away from power lines because if they were moved, they would not be directed towards desired signals. Many individual amateurs also ask that we define “harmful interference” for purposes of Section 15.5 of the rules. Summarizing the position of the Amateur radio community, the ARRL urges that we not permit Access BPL at this time. It states that if we do proceed with Access BPL rules, we should preclude any use of Amateur radio allocations, or adopt radiated emission rules that are sufficient to predictably protect mobile radio stations from interference, and that we should require Access BPL operators to implement specific interference mitigation measures. The Academy of Model Aeronautics (AMA) submits that BPL operations could interfere with remote control radios in model aircraft that use HF and low VHF frequencies. ARRL also submits that there is no reason to act now on this proceeding, again arguing that we should put this matter on hold (for one year) in order to work out appropriate interference avoidance and resolution standards.

22. The Access BPL system proponents and several electric utility services counter these claims regarding interference potential with arguments that the currently available Access BPL systems have been designed to avoid interference to radio services and that BPL operators have been willing to work in tandem with public safety and other radio service users to prevent or eliminate interference.⁴⁷ These parties also point to experience in trials that shows no record of interference.⁴⁸ Others, such as PPL Telcom, LLC (PPL Telcom) and Progress Energy, Inc. (Progress Energy) state that they have received some complaints of interference and have resolved them.⁴⁹ PPL Telcom further states that in nearly 30 months of Access BPL operation it has received only four complaints of suspected interference, all from Amateur radio operators who were located in close proximity (a few hundred feet or less) from BPL devices. Progress Energy similarly states that in its most recent Access BPL tests no BPL site had any signal levels above S-0 in any Amateur band with a single exception in one subdivision at approximately 25 meters from the extractor and that the level of emissions at that site would cause no interference unless an Amateur were located practically on top of the BPL extractor.⁵⁰

23. We understand the significant concerns of licensed radio service users about the potential for Access BPL services to cause harmful interference to their operations. It is our intention to ensure that Access BPL operations do not become a source of harmful interference to licensed radio services. Based on extensive research, analyses, and practical experience, we also continue to believe that the interference concerns of licensed radio users can be adequately addressed and that Access BPL systems will be able to operate successfully on an unlicensed, non-harmful interference basis under the Part 15 model. In this regard and as discussed below, we find that the harmful interference potential from Access BPL systems operating in compliance with the existing Part 15 emission limits for carrier current systems is low in connection with the additional rules we are adopting. From the information provided by our field tests,

⁴⁷ See e.g., Duke Energy at 6; Hawaiian Electric Company, Inc. (HECO) at 5.

⁴⁸ See HECO at 3.

⁴⁹ See comments of PPL Telcom at 6; Progress Energy at 2-3.

⁵⁰ Meters or (S)ignal meters have been used by the military on most all of the receivers and discriminators and are being employed into receiver designs of all types today. The (S) meter measures a received voltage across a common load within the transceiver and consists of numbers ranging from S-1 to S-9. Each S unit is equivalent to 6 dB. S-0 is a level that is below the S-1 mark on the meter, thus indicating that the measured level is quieter than what the meter can read.

the tests conducted by NTIA, theoretical predictions by NTIA and ARRL, and experience of the several tests of Access BPL systems, we observe that the potential for any harmful interference is limited to areas within a short distance of the power lines used by this technology. As emphasized by NTIA's Phase 1 study and comments, interference can be rapidly eliminated through various means should it occur. We point out to the individual amateurs commenting in this proceeding that the definition of "harmful interference" as used in Section 15.5 of the rules is set forth in Section 2.1 of the rules.⁵¹ We disagree with ARRL's position that there is no reason to act now in this proceeding and that we should delay our decision on rules for Access BPL to provide more time to develop rules to prevent this technology from causing harmful interference. As indicated above, the broadband service capabilities of Access BPL systems offer important opportunities for establishing a new medium for broadband access and for introducing new competition in the broadband market. We believe that it is important to set forth rules that will promote this service now, rather than delay. In addition, the record provided in response to the *Inquiry* and the *Notice*, including the extensive studies conducted by NTIA, is more than sufficient assure us that the rules we are adopting will adequately protect licensed services from harmful interference. While some cases of harmful interference may be possible from Access BPL emissions at levels up to the Part 15 limits, we agree with NTIA that the benefits of Access BPL service warrant acceptance of a small and manageable degree of interference risk.

24. As stated in the *Notice*, we believe that, on balance, the benefits of Access BPL for bringing broadband services to the public are sufficiently important and significant so as to outweigh the limited potential for increased harmful interference that may arise. Moreover, we continue to believe that cases where interference may occur or where its possible occurrence would impact critical services can be addressed through additional regulatory measures. These additional measures will generally require Access BPL operators to reduce emissions or avoid operation on certain frequencies in order to protect licensed services, to use equipment that can alter its operation by changing operating frequencies to eliminate interference, to make available information that will assist the public in identifying locations where Access BPL operations are present, and to provide notice to radio users before commencing local BPL operations. In this way, the new rules provide effective means for preventing any interference and will ensure that any instances of interference that may occur can be quickly identified and resolved. We emphasize that Access BPL systems will continue be treated as unlicensed Part 15 devices and as such will be subject to the conditions that they not cause harmful interference and that they cease operation if they do cause such interference, as required by our rules.⁵² As discussed in paragraph 50, *infra*, except for a few specific frequencies that are reserved for international aeronautical safety operations, we do not believe that excluding BPL operations from frequencies used by any specific service, such as the low VHF TV bands, is necessary or appropriate.⁵³ Rather, we believe requiring BPL equipment to have the

⁵¹ See 47 C.F.R. § 2.1. Section 2.1 defines harmful interference as "[I]nterference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunications operating in accordance with these [international] Radio Regulations. (RR)" We note that this definition is consistent with Resolution 68 of the Radio Regulations.

⁵² 47 C.F.R. § 15.5(b).

⁵³ We do not believe that Access BPL presents a serious threat of interference to broadcast television service on channels 2 to 6. We note that in many instances all low VHF TV channels are not used within a particular area and those not in use for television service could be used for Access BPL operations without causing harmful interference to TV reception. In this regard, we also note that the effective Part 15 limit for Access BPL is more stringent for frequencies above 30 MHz than it is for frequencies below 30 MHz and that propagation losses are also more significant higher in the spectrum. We therefore do not find that special protections for broadcast television service are warranted.

capability to avoid any locally used frequency is the most effective approach to ensuring that harmful interference to licensed operations is avoided.

25. Accordingly, we are amending our Part 15 rules with changes intended to facilitate the deployment of Access BPL technology while protecting licensed users of the spectrum. Specifically, we are: 1) defining Access BPL for purposes of our rules; 2) maintaining the existing Part 15 emission limits for carrier current systems for Access BPL;⁵⁴ 3) requiring that Access BPL devices employ adaptive interference mitigation techniques; 4) requiring that Access BPL system operators provide information on the areas where their systems are installed and other technical parameters in a central data base that would be accessible by the public; and 5) adopting 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 actions are discussed more fully below.

A. Definition of Access BPL

26. In the *Notice*, we proposed to define Access BPL for purposes of the Part 15 rules as a carrier current system operating on any electric power transmission lines owned, operated, or controlled by an electric 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.⁵⁵

We also requested comment on whether there are entities that plan to own/operate Access BPL over electric power lines but would not be electric power providers or a subsidiary of the incumbent electric power provider.⁵⁶

27. Echelon Corporation (Echelon), the IEEE Power System Relaying Committee (IEEE/PSRC) and several others suggest that the proposed definition of Access BPL be modified to specifically apply to systems with operating frequencies above 1.705 MHz, or at least above 1 MHz.⁵⁷ These parties specifically request that the older power line carrier systems used by electric utilities, as defined in the existing rules, not be included within the definition of Access BPL.⁵⁸ The United Power Line Council (UPLC) recommends that we clarify that power lines as termed in the definition of Access BPL exclude lines within customer premises or in riser conduit within buildings, because these power lines are not owned or controlled by the electric utility.⁵⁹ Duke Energy Corporation (Duke Energy) submits that the definition should not incorporate BPL equipment used by a utility within its own building for the purpose

⁵⁴ We are, however, exempting Access BPL from the conducted emission limits contained in § 15.107(c).

⁵⁵ *Notice* at ¶32.

⁵⁶ *Id.*

⁵⁷ *See* comments of Echelon Corporation at 4; IEEE Power System Relaying Committee at 2; PPL Telecom at 4; Progress Energy at 2; Southern at 13; UPLC at 4.

⁵⁸ 47 C.F.R. §15.113 permits power line carrier systems to operate on power transmission lines using frequencies in the 9-490 kHz band for communications important to the reliability and security of electric service to the public. *See also* 47 C.F.R. §2.106, note US294.

⁵⁹ *See* comments of UPLC at 5.

of internal networking.⁶⁰ NTIA and Southern state that we should also adopt a definition for In-House BPL to properly frame the applicable rules and measurement procedures for BPL operation.⁶¹ Main.Net Communications Ltd. (Main.Net) comments that business models are being developed where the owner/operator of the Access BPL system will not be the electric power provider or its subsidiary (“landlord” model).⁶²

28. We are adopting a modified version of the proposed definition of Access BPL that includes changes as suggested by the commenting parties. In this regard, we agree that the definition of Access BPL should not include the low-speed power line carrier systems used by electric utilities as defined in our rules. Transmissions on these systems have very short duty cycles that pose very low interference potential as opposed to the constant operation that characterizes Access BPL. We also agree that the definition for Access BPL should limit the low frequency cut-off to above 1.705 MHz, which is the upper frequency for the AM broadcast band. We agree that the definition for Access BPL should not include power lines located within a customer’s premises or within a utility’s own premises. These lines generally carry low voltage power, are not under the ownership or integral control of the power service operator, are isolated from the medium voltage lines by a distribution transformer such that a bypass device must be used to reach them with BPL signals, and pose lower potential as sources of interference because their emissions are attenuated by the structure in which they are located. We also see no need to limit ownership or control of BPL operations to electric utility operators. We believe that an independent BPL provider can take the same steps and precautions as an electric utility operator in working with its equipment vendor, the power system, and licensed radio users to ensure that an Access BPL system does not cause harmful interference and to resolve any interference. We also see no need to specifically mention aerial or underground lines in the definition. Furthermore, we note that the record in this proceeding only addresses Access BPL systems operating over medium voltage and low voltage lines. Because the high voltage lines are located physically higher, can carry very high voltages, and have different configurations as well as characteristics with respect to potential harmful interference, we are excluding them from the definition for Access BPL at this time. Access BPL systems intended for high voltage lines can however operate under the requirements for experimental licensing in Part 5 of the Commission Rules.⁶³

29. We therefore are amending Section 15.3 of the rules to include the following definition for Access BPL:

Access Broadband Over Power Line (Access BPL). A carrier current system installed and operated on an electric utility service as an unintentional radiator that sends radio frequency energy on frequencies between 1.705 MHz and 80 MHz over medium voltage lines or low voltage lines to provide broadband communications and is located on the supply side of the utility service’s points of interconnection with customer premises. Access BPL does not include power line carrier systems as defined in Section 15.3(t) of this part or In-House BPL systems as defined in Section 15.3(gg) of this part.

30. While we are not generally addressing rules for In-House BPL systems, except for measurement procedures, we do find it useful and appropriate to set forth a definition of such systems in the rules

⁶⁰ See comments of Duke Energy at 4.

⁶¹ NTIA at 3-4, Southern at 14.

⁶² See comments of Main.Net at 5.

⁶³ See 47 C.F.R § 5.

herein. As NTIA and Southern point out, specifying a definition of In-House BPL systems will fully define all forms of BPL and help to clarify the differences between Access BPL and In-House systems. We find that the definition of In-House BPL suggested by NTIA properly identifies these systems. Accordingly, we are adopting the following definition for In-House BPL:

In-House Broadband Over Power line (In-House BPL). A carrier current system, operating as an unintentional radiator, that sends radio frequency energy to provide broadband communications on frequencies between 1.705 MHz and 80 MHz over low-voltage electric power lines that are not owned, operated or controlled by an electric service provider. The electric power lines may be aerial (overhead), underground, or inside walls, floors or ceilings of user premises. In-House BPL devices may establish closed networks within a user's premises or provide connections to Access BPL (as defined in Section 15.3(ff) of this part) networks, or both.

We also encourage industry efforts to develop standards for In-House BPL systems and devices that are complementary to and compatible with Access BPL operations.

31. *Access BPL Systems Above 80 MHz.* Corridor Systems (Corridor) asserts that it has developed an Access BPL technology that operates at 5.8 GHz and states that the proposed measurement guidelines of the *Notice* are not appropriate for the microwave frequency region where wavelengths are measured in small numbers of centimeters rather than meters or tens of meters. Corridor contends that its Access BPL technology is categorically different from the HF BPL systems from other vendors and that the definition as well as the test methods as proposed in the *Notice* would impose an inappropriate regulatory burden on its systems.⁶⁴ Satus, Inc. states that its Access BPL technology operates in several different bands from 2 MHz to several GHz.

32. We agree with Corridor that Access BPL systems operating in higher regions of the spectrum, such as the Corridor Access BPL system at 5.8 GHz, should not be subject to the rules adopted herein for Access BPL systems operating in the HF and low VHF spectrum. We find that the record in this proceeding does not provide sufficient information regarding Access BPL operating in spectrum above 80 MHz, hence a decision regarding this type of Access BPL technology cannot be effectively rendered at the present time; however, Access BPL systems not covered in the above definition are subject to existing applicable Part 15 rules for carrier current systems. However, we will monitor the development of Access BPL systems that operate on frequencies above 80 MHz and may consider additional requirements for Access BPL systems operating above 80 MHz in a future rulemaking if appropriate.

B. Emission Limits

33. *General Emission Limits.* Consistent with our stated intention to proceed cautiously in authorizing BPL systems, we proposed in the *Notice* to continue to apply the existing radiated emission limits for carrier current systems used as unintentional radiators, as set forth in Section 15.109(e) of the rules, to Access BPL systems.⁶⁵ While we recognized that there is some potential for Access BPL operations to cause interference, we tentatively concluded that the likelihood of harmful interference would be low under the current radiated emission limits as well as other provisions adopted herein, and that where such interference does occur, there are remedies that the Access BPL operator can employ to eliminate it. We also proposed to exempt Access BPL systems from the conducted emissions limits in

⁶⁴Comments of Corridor at 2-4.

⁶⁵ See 47 C.F.R. § 15.109(e).

15.107(c) of the rules.⁶⁶ In this regard, we observed that because Access BPL systems are generally installed on power lines that carry 1,000 to 40,000 volts, measuring the conducted emissions of these systems is very difficult and can also present safety hazards.⁶⁷ We stated that since Access BPL systems would still be required to comply with our radiated emission limits, we did not believe that this exemption would have any impact on BPL interference potential.⁶⁸ Finally, we requested comment on whether any additional measures are needed to protect particular operations, such as public safety agencies that use the HF bands for state-wide public safety communications.

34. *a) Emission Limits.* NTIA concurs with our proposal to continue to subject Access BPL systems to the existing radiated emission limits for carrier current systems and submits that interference risks can and should be suitably reduced through refinement of the compliance measurement provisions.⁶⁹ NTIA states that the current perceived risks of interference from BPL operations preclude relaxing the limits.⁷⁰

35. A number of parties generally representing the interests of entities favoring the introduction of BPL services support our proposals for emission limits on BPL operations. These parties, who include AT&T, Duke Energy, Main.NET, NTIA, PPL Telcom, Satius, Southern, and UPLC, generally agree that the existing Part 15 radiated emission limits are sufficient to limit the potential for interference.⁷¹ Southern states that the proposed limits are an acceptable compromise between the interests of those who believe that stricter limits are needed and the position of BPL manufacturers and providers who state that their systems do not cause harmful interference under the current limits. Duke Energy, PPL Telcom, Southern, and UPLC also submit that the Commission should revisit the emission limits at a later date after more information is developed on the interference potential of BPL operation to possibly relax the limits.⁷² Main.Net requests that we consider higher radiated emission limits in situations such as rural areas, where it argues an increase in emissions would not cause interference.

36. Others, including the AMA, the ARRL, Bob Lombardi, Carl Stevenson, and the IEEE USA, who represent the interests of licensed spectrum users, argue that the current emission limits are too high to protect nearby Amateur radio stations against interference.⁷³ These parties generally submit that the

⁶⁶ See 47 C.F.R. § 15.107(c). 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 μ V 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).

⁶⁷ 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 could affect both test equipment and test personnel.

⁶⁸ Notice at ¶38.

⁶⁹ See comments of NTIA at 7.

⁷⁰ See comments of NTIA at 7.

⁷¹ See comments of AT&T at 4; Duke Energy at 13; Main.NET at 5-6; NTIA at 7; PPL Telcom at 4; Satius at 4; Southern at 15; and UPLC at 7.

⁷² See comments of Duke Energy at 13; PPL Telcom at 4; Southern at 16; UPLC at 7.

⁷³ See comments of the AMA at 4; the ARRL at 9-10; Bob Lombardi at 7; Carl Stevenson at 8; and the IEEE USA at 10.

current limits were never designed for distributive radiating systems but rather were designed to address the interference potential of point source radiators. In statements representative of these parties, the ARRL contends that the limits should be reexamined for the context where the system architecture is a line source radiator that creates a situation in which the unshielded power lines act as efficient radiators throughout neighborhoods. It states that based on information from the NTIA Phase 1 Study and several additional studies, copies of which it attached to its comments, Access BPL, operated at the current Section 15.109 and Section 15.209 field strengths, will create substantial interference to nearby Amateur radio stations, whether fixed or mobile.⁷⁴ The ARRL argues that lower permissible field strengths are necessary to protect mobile radio stations.⁷⁵ It suggests that an acceptable radiated emission limit for Access BPL to protect typical amateur mobile stations is 0 dB μ V/m, measured at an antenna 10 meters from the power line.⁷⁶ In its reply comments, the ARRL argues that NTIA's findings establish that fixed Amateur stations can expect to receive interference at distances of 460 meters from a BPL device, even assuming that the device meets the radiated emission limits of existing Part 15 regulations and that mobile stations would be subject to interference at distances up to 75 meters from a BPL device on the power line.⁷⁷ Echelon further recommends requiring Access BPL systems to employ band-pass filters that offer at least 80 dB attenuation of emissions below 535 kHz and that Access BPL band-pass filter wiring be designed to separate low-voltage and medium-voltage mains wiring by at least 18 inches to prevent cross-mains inductive signal coupling.⁷⁸ On the other hand, PPL Telcom states that Access BPL operations will not operate as line source radiators because 1) equipment within the same network operates at different frequencies, thereby reducing the potential cumulative effect at any given frequency; 2) equipment is deployed in different orientations on power lines so that the polarization of emissions will vary; and 3) equipment operating on the same frequency will have differing phase displacements.⁷⁹

37. LecStar Telecom, Inc. and LecStar DataNet, Inc. (collectively "LecStar") recommends that we treat Access BPL systems as Class A devices in order to allow these systems to take advantage of the higher Class A emission limits.⁸⁰ LecStar submits that treatment of Access BPL systems as Class A equipment would allow equipment costs to be lower and thereby speed the deployment of systems and improve their economic viability. Satus, Inc. submits that it has developed Access BPL equipment that

⁷⁴ The ARRL argues that, based on information in the NTIA Phase 1 Study, at the current Part 15 limits, the interference contour of Access BPL systems to land vehicle, boat, and fixed stations receiving moderate to strong desired signals in the frequency range 1.7-80 MHz is likely in areas extending to 30 meters, 55 meters, and 230 meters, respectively. ARRL further contends that interference to aircraft reception of moderate to strong desired signals is likely to occur at heights up to 6 km altitude within 12 km of the center of the BPL deployment. The three additional technical studies ARRL appends to its comments are: 1) Exhibit A- "BPL Trial Systems Electromagnetic Emission Tests," by Metavox, Inc., of Dulles, Virginia ("Trial System Tests"); 2) Exhibit B- "Interference Assessment of PLC Compatibility with Allocated HF Systems," by Dr. David Cohen of the University of Maryland ("Interference Assessment"); and 3) Exhibit C- "Proposed Radiated Emission Limits and Extrapolation," by ARRL Chief Technology Officer Paul Rinaldo (ARRL Study).

⁷⁵ See comments of ARRL at 25-26 and Exhibit E.

⁷⁶ Comments of ARRL at 26.

⁷⁷ See reply comments of ARRL at 10.

⁷⁸ See comments of Echelon at 5.

⁷⁹ See comments of PPL Telcom at 5.

⁸⁰ See comments of LecStar Telecom, Inc. and LecStar DataNet, Inc. (collectively "LecStar") at 4-5.

can reduce emissions by more than 40 dB in certain bands where interference would otherwise occur.⁸¹ It requests that we provide an exception to the emission limits that would allow devices that are capable of reducing emissions by at least 40 dB for interference control to operate with emissions in other bands that are 10 dB higher than the Class A limits.

38. We continue to believe that it is appropriate to apply the existing Part 15 radiated emission limits to Access BPL systems. We are not persuaded by the arguments of ARRL and others representing licensed spectrum users that the current emission limits are insufficient to limit the general interference potential of these systems. The 0 dB μ V/m limit suggested by the ARRL is typically below the noise floor in the HF and low VHF bands and would be unnecessarily and prohibitively restrictive for Access BPL operators.⁸² Along with NTIA, we conclude that the current emission limits will restrict Access BPL systems to very low emitted power levels in comparison to the signals of licensed radio operations. The effect of these limits will be to constrain the harmful interference potential of these systems to relatively short distances from the power lines that they occupy. In fact, in most cases the level of emissions from Access BPL systems will be at or close to the noise floor at distances beyond a hundred meters of an installed power line. We recognize that some radio operations in the bands being used for Access BPL, such as those of Amateur radio licensees, may occur at distances sufficiently close to power lines as to make harmful interference a possibility. We believe that those situations can be addressed through interference avoidance techniques by the Access BPL provider such as frequency band selection, notching, or judicious device placement; the rules we are specifying herein facilitate such solutions. We do not see evidence that BPL operation will significantly contribute RF energy to generally raise the background noise level.⁸³ In addition, because power lines inherently can radiate significant noise emissions as noted by NTIA and ARRL, good engineering practice is to locate sensitive receiver antennas as far as practicable from power lines. This practice will also help prevent interference from Access BPL emissions. In fact, as stated by NTIA, power line noise emissions at frequencies up to 800 MHz may actually be reduced as Access BPL systems are deployed. Furthermore, we see no need to impose a strict band-pass filtering on Access BPL, and we deny Echelon's request in this regard.

39. 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. First, the Part 15 emission limits for carrier current systems have proven very effective at controlling interference from such systems. Also, for the reasons indicated by PPL Telcom, we believe that the design and configuration of Access BPL systems will be inconsistent with the development of cumulative emissions effects for nearby receivers.⁸⁴ Moreover, the NTIA Phase 1 Study and our own field measurements of Access BPL installations indicate that these systems are not efficient radiators, nor are their emissions cumulative such that they permeate areas in which they are located.⁸⁵ Rather, we find that emissions from Access BPL

⁸¹ See comments of Satus, Inc. at 4.

⁸² Comments of ARRL at 26.

⁸³ We would also advise ARRL that in cases where its members experience reception of RF noise, such noise can often be avoided by carefully locating their antennas; in many instances an antenna relocation of only a relatively short distance can resolve noise interference (*see* ARRL comments at 13).

⁸⁴ As we observed in the *Notice*, Current Technologies, Main.Net and other Access BPL equipment manufacturers similarly state that in their Access BPL equipment implementations only a limited number of devices transmit simultaneously on the same frequency in the same geographic area, *see Notice* at 16, recognizing the reply comments of Current Technologies at 11; Main.Net at 3; Ameren at 13.

⁸⁵ See NTIA Phase 1 Study, Volume 1, at 5-5 to 5-15.

systems tend to dissipate after a short distance from a coupler along a line, and then remain relatively the same for some distance. Along the line there also may be multiple points where emissions may be relatively higher but within the Part 15 limits.⁸⁶ However, because the signal level decreases significantly with distance perpendicular from the line, the potential for interference also decays rapidly with distance from the line. To ensure that the effects of the power line as a radiator are taken into consideration when testing for compliance with our Part 15 rules, the measurement procedures we are adopting for Access BPL systems, as discussed *infra*, and set forth in Appendix C, specify that emission measurements are to be made at several specific distances from the Access BPL equipment source, and that measurements are to be taken parallel to the power line to find the maximum emissions from the BPL system.

40. The technical studies submitted by ARRL as appendices to its comments do not provide any information which would lead us to alter our assessment that the current emission limits are appropriate. The first ARRL study, "Trial System Tests," merely reports the results of measurements of an Access BPL trial system, with findings that in some instances that system appears not to have complied with the emission limits. The second ARRL study, "Interference Assessment," argues that the more stringent German RegTP standard NB 30 emission level is sufficient to protect radio services. We find that this stringent emission limit is not necessary to protect against interference and that it would unjustifiably constrain the operation and manufacture of Access BPL systems. It is our understanding that the German standard has enabled deployment of Access BPL systems on underground power lines but we have no information indicating that such a standard could generally be met on overhead power lines that constitute much of America's power distribution system. We believe the approach that we are adopting is a more appropriate policy for balancing the concerns at issue in this matter. Finally, the third study, "ARRL Study" argues that overhead power lines are efficient line radiators and offers suggestions for measurement of emissions; it does not address the sufficiency of our emissions limits. We are requiring compliance with the protective Part 15 field strength limits regardless of whether the field strength is efficiently generated. For the reasons indicated above, we continue to believe that the existing Part 15 emission limits for carrier current systems, in conjunction with certain additional measures as discussed below, are adequate and appropriate to protect licensed radio operations from Access BPL operations. We disagree with Main.Net that there are situations where there is generally less likelihood that Access BPL systems operating at emission levels above the current limits would cause interference. Licensed services operate in rural as well as more densely populated areas. Accordingly, we will continue to apply the current Part 15 radiated emission limits to Access BPL operations. While we do not believe that there will be reason to revisit this decision in the near future to possibly consider allowing Access BPL systems to operate at higher emission levels, we would do so if information develops that raising the limits might be possible without incurring unacceptable risk of interference.

41. Notwithstanding our decision on emission limits, we do recognize that Access BPL systems present concerns for licensed users in the HF and low VHF bands, given the propagation characteristics of RF signals in the range of frequencies being used for these systems, the diversity of users of these frequencies, and the fact that Access BPL devices will be installed at many locations in an area. While we conclude, as discussed above, that the likelihood that interference from Access BPL operations will occur is low at the signal levels allowed under the current Part 15 emission limits, such interference could occur in limited situations despite the intentions of BPL operators. Moreover, even if interference were to occur to amateur operations at the distances indicated by the ARRL, as recommended by NTIA, there are additional interference mitigation techniques that we are requiring of BPL providers to address such interference potential. We believe that such steps should be taken, particularly in those cases where the occurrence of interference would affect critical services or where interference could be anticipated to

⁸⁶ The points of relatively higher emissions tend to occur at junctions and other points on a line where there are impedance mismatches.

occur. We will address such additional measures to mitigate and/or eliminate interference in the next section.

42. Most of the commenting parties that addressed the issue of conducted emission limits support our proposal to exempt Access BPL from compliance with such limits.⁸⁷ The IEEE/PSRC submits that requiring conducted emission tests on medium voltage power lines is a safety hazard to both test personnel and equipment and should be avoided.⁸⁸ For the reasons of safety and the fact that Access BPL systems will be required to comply with our radiated emission limits, we will not subject these systems to conducted emission limits. Dale G. Svetanoff and Cortland E. Richmond nonetheless believe that conducted emissions limits should still be applied to Access BPL systems in the laboratory before equipment is shipped and installed, in order to detect variations in equipment.⁸⁹ We find no need to subject Access BPL equipment to a conducted emission limit that would apply for compliance measurement purposes before the equipment is shipped and installed. We note that Access BPL manufacturers already test their equipment for the proper power levels in a laboratory as part of their manufacturing procedures, and in any case, as discussed below, the radiated emissions from a representative model of equipment would be measured *in-situ* at three sites as part of the equipment authorization process. We therefore find that requiring conducted emission tests in the laboratory would be a redundant and unnecessary procedure.

43. With regard to LecStar's request that we treat Access BPL systems as Class A devices in order to allow these systems to take advantage of the higher Class A emission limits, we note, as indicated above, that the medium voltage portions of such systems are already treated as Class A devices under our rules. The Class A limits are appropriate in this case because Access BPL devices are not marketed to the general public and operate on the medium voltage power lines as commercial facilities. Those portions of Access BPL systems that operate above 30 MHz on the low-voltage power lines from the distribution transformer to a residence and all in-house wiring connected to a BPL device are subject to Class B radiated emission limits. The Class B limits are appropriate for these operations because they are located within residential environments and are marketed for use by the general public. Although Access BPL systems are required to comply with the less stringent Class A limits, operators will nonetheless have a strong incentive to exercise the utmost caution in installing and operating their systems to avoid harmful interference and ensure uninterrupted service to their customers, given that there is significant investment in the deployment of the service. We do not find that a 10 dB increase in the allowable emissions levels is warranted or desirable for systems that can reduce emissions by 40 dB in selected bands, as suggested by Satus. We believe that it is important that Access BPL systems comply with the emission limits across their entire operating range in order to minimize the potential for interference in all bands, not just those where interference may be more likely at a particular location. Accordingly, we are denying Satus' request for such an exception.

44. *b) Other Protection Measures.* NTIA states in its comments that additional emission restrictions are needed in certain frequency bands and geographic areas in order to protect Federal Government and certain other radio operations. It states that these restrictions would have the form of geographic "coordination areas" wherein BPL deployments at any frequency in those areas must be "pre-coordinated" by BPL operators; excluded bands in which certain frequencies are not to be used by BPL in any geographic area; and small geographic "exclusion zones" wherein BPL emissions are forbidden at

⁸⁷ See comments of Progress Energy at 5; Southern at 17; Main.Net at 6; PowerWAN at 2.

⁸⁸ See comments of IEEE/PSRC at 3.

⁸⁹ See *e.g.*, comments of Dale G. Svetanoff at 3; Cortland E. Richmond at 13.

specified frequencies in accordance with protection requirements and electromagnetic compatibility studies. Under NTIA's plan, these coordination areas, excluded bands, and exclusion zones would be defined in the rules for Access BPL systems. NTIA submits that to protect Federal Government radio users, it plans to voluntarily provide BPL operators with site location and frequency band information to Access BPL users that would facilitate steps to prevent interference to these users. It states that these measures would virtually eliminate certain interference risks for even the most sensitive and vulnerable Federal Government and other radio services. NTIA has separately provided lists of the coordination areas and radio users therein that would be specially considered, the excluded bands, and the geographic exclusion zones that would be subject to these additional protections.⁹⁰

45. NTIA further recommends that we require Access BPL operators to consider frequency avoidance capabilities in conjunction with voluntary, *a priori* consultation regarding potentially affected receiving stations at known locations or service areas. It states that Access BPL operators would receive radio frequency usage data from concerned radio service licensees by e-mail and then use frequency avoidance capabilities (as discussed below) to preclude Access BPL operation on locally used frequencies where necessary. In contrast, within consultation areas and at the associated frequencies, the radio and BPL operators would mutually determine whether BPL deployment or operating constraints are needed. To make information available to local radio users, NTIA proposes that Access BPL operators be required to notify planned deployments to the Access BPL data base administrator (as discussed below) at least 30 days in advance of system implementation.⁹¹ It further suggests that Access BPL operators can extract local frequency assignment data from our data bases, identify the locations and frequencies used by local radio receivers, and plan their operational frequencies in a manner that avoids BPL interference to local radio receivers.⁹²

46. NAC/Amherst suggests that we establish "BPL-free" zones in which Access BPL would not be permitted within 20 miles of airports and antennas for ground-to-air communications and military bases, and within two miles of hospitals, police stations, and fire stations.⁹³ ARINC urges the Commission to refrain from authorizing Access BPL to operate in the Aeronautical Mobile [R] frequency bands.⁹⁴ In response to NTIA's comments on excluded bands and exclusion zones, ARRL also strongly urges that all Amateur HF and VHF allocations be included with other bands that NTIA determines require protection from BPL interference.⁹⁵

⁹⁰ The coordination areas, excluded bands, and geographic exclusion zones identified by NTIA are set forth in the new rules in Appendix B. When considered together, the excluded frequency bands listed in Section 15.615(f)(1), Table 1 in Appendix B are limited to those allocated to aeronautical mobile [R] and radionavigation services that are used to provide aeronautical safety of life services. The exclusion zones are limited to a radius of 1 km around coast station facilities located at the 106 coordinates listed in Section 15.615(f)(2)(i), Table 2 in Appendix B, and within a radius 29 km (for Access BPL using overhead medium voltage power lines) or 11 km (for other Access BPL implementations) of the coordinates for the ten Very Long Baseline Array facilities listed in allocation US311. To avoid confusion with "coordination" requirements specified elsewhere in the Commission's rules, we are adopting the term "consultation area" rather than "coordination area" in connection with the Access BPL rules. The frequency bands and areas for consultation are listed in Section 15.615(f)(3), Tables 3-6 of Appendix B.

⁹¹ See comments of NTIA at 11.

⁹² See comments of NTIA at 11.

⁹³ See reply comments of NAC/Amherst at 6.

⁹⁴ See reply comments of ARINC, Section IV.

⁹⁵ See reply comments of ARRL at 17-18.

47. Ameren, PLCA, and Southern recognize the benefits of NTIA's offer to make available to BPL operators information on Federal Government frequency assignments to assist in Access BPL frequency selection, but it opposes mandatory prior frequency coordination.⁹⁶ Southern argues that the mandatory prior coordination would effectively subject BPL to the same conditions as a licensed service without the benefits of licensing.⁹⁷ Ameren Energy Communications, Inc. (Ameren) and the Power Line Communications Association (PLCA) argue that a requirement for Access BPL operators to prior coordinate is not borne by other broadband service providers with equipment similarly subject to Part 15 of the Commission's rules.⁹⁸ The PLCA adds that, more undesirably, there would be no licensing process or procedure in place to determine whether a contested installation may proceed. Current and Duke Energy is concerned that NTIA's excluded bands and exclusion zone proposals could result in limitations on the deployment of Access BPL systems such that there would be gaps in coverage to the point where it would no longer make economic or operational sense to deploy.⁹⁹ Current contends that while there may be a few instances, such as locations very close to co-frequency radio astronomy receive sites, where coordination would be appropriate, the levels of BPL emissions should make such instances extremely uncommon.¹⁰⁰

48. APCO/NPSTC, APCO Region 21, the International Municipal Signal Association (IMSA), and the Missouri State Highway Patrol (MSHP) submit that there are public safety systems in the HF (2-7 MHz), low VHF (30-50 MHz), and VHF (72-76 MHz) bands that must be protected from interference.¹⁰¹ APCO/NPSTC states that considering the rural nature of public safety operations in the low VHF bands, the only way a public safety officer will know that interference is present in a given location is when the officer cannot communicate in an area. APCO Region 21 states, for example, that Access BPL could raise noise levels and overwhelm receiver circuits.¹⁰² The MSHP submits that because Access BPL is a distributed technology, it will be difficult to isolate interference locations. The MSHP therefore recommends that Access BPL be required to take steps to avoid interference with public safety operations before deployment, rather than wait for a public safety agency to find out about harmful interference by being unable to communicate with an originating distress call.¹⁰³ It argues that Access BPL systems should be required to prove *a priori* that they are not causing interference, rather than waiting until a public safety agency finds out that harmful interference is present in an area where a distress call originates. APCO/NPSTC also submits that it does not want to be in the position of demanding that

⁹⁶ See reply comments of Southern at 28.

⁹⁷ See reply comments of Southern at 35.

⁹⁸ See reply comments of Ameren at 12 and PLCA at 4.

⁹⁹ See reply comments of Current at 30 and reply comments of Duke Energy at 19.

¹⁰⁰ Reply comments of Current at 30.

¹⁰¹ See comments of APCO/NPSTC at 2; APCO Region 21 at 4. The High Frequency (HF) band covers frequencies from 3 to 30 MHz. The Very High Frequency (VHF) band covers frequencies from 30 to 300 MHz. APCO indicates that the HF band (2-7 MHz) is used by state emergency management agencies to coordinate disaster relief and that the low VHF (30-50 MHz) band is used by many first responder agencies (emergency medical systems (EMS), fire, and law enforcement) as well as public safety support agencies. APCO further indicates that the 30-50 MHz band is used significantly by thirteen states for state police operations, with nine states, including California, using it as their primary communications band.

¹⁰² See comments of APCO Region 21 at 4.

¹⁰³ See comments of the MSHP at 3.

Access BPL operators cease operating due to harmful interference to public safety radio after the operators have made large investments in BPL infrastructure.

49. We agree with NTIA and the parties representing public safety agencies that critical Federal Government and other services specified by NTIA and public safety warrant additional protection. These services, including national defense, maritime distress and safety, aeronautical navigation and communications, emergency response, radioastronomy, and others provide important safety and research services whose functions would be afforded additional protection against possible interference from Access BPL operations. We agree with and are adopting NTIA's approach for addressing additional protection to critical Federal Government and other radio operations. The excluded frequency bands amount only to a total of 1731 kHz, or 2% of the spectrum within the 1.7-80 MHz band. The exclusion zones are relatively few, on only the 2173.5 to 2190.5 kHz global maritime distress signaling band with prohibited distances of 1 km from coast station facilities, and 73.0 – 74.6 MHz band used by the ten Very Long Baseline Array facilities of radio astronomy observatories with prohibited distances of 29 km and 11 km for Access BPL systems using overhead medium voltage power lines and other Access BPL implementations, respectively.¹⁰⁴ We agree with NTIA that the potential for interference from Access BPL to the critical services in exclusion zones is somewhat greater for transmissions carried on overhead medium voltage lines than other Access BPL implementations, *i.e.* transmissions carried on underground lines or low voltage lines. In this regard, emissions from underground power lines are generally attenuated by the earth materials in which they are buried, while emissions from low voltage lines are generally lower because such lines are generally used only for short feeder links from a transformer to a customer service location and these lines are more closely spaced with an accompanying neutral line--and in fact are often twisted together with the neutral line. The close spacing--together with the shorter length--reduces radiated RF emissions relative to those from overhead medium voltage lines. In addition, the requirement to contact and work with the Federal Government in the 53 consultation areas is not generally expected to result in major impact on Access BPL operators' flexibility to use specific frequency bands.¹⁰⁵ We therefore find that avoiding operation on the frequencies excluded under these restrictions and requirements will not be burdensome for Access BPL operators and manufacturers in order to protect distress and safety communications. Indeed, several manufacturers and Access BPL operators have indicated that they are capable of, and already do, notch out certain frequency bands.¹⁰⁶ We disagree with Ameren, PLCA, and Southern that the mandatory consultation provisions imposed on Access BPL operators impose burdens on Access BPL operators not borne by other unlicensed broadband operators without countervailing benefits. For example, in Part 76, we require that cable operators conduct measurements annually to ensure that signal leakage does not create interference risks. Moreover, the distributive nature and other technical characteristics of Access BPL pose somewhat higher potential for interference than point-source wireless broadband systems that warrant additional protective measures. In addition, the consultation actions will benefit Access BPL operators by leading them to select frequencies at the beginning of their service so as to avoid interference to critical services that might have to be corrected later. Accordingly, we are adopting NTIA's list of consultation areas, excluded bands, and exclusion zones to which Access BPL equipment must adhere. For all other radio communication operations not addressed in these special provisions, radio operators have the opportunity

¹⁰⁴ See Section 15.615(f)(1), Table 1 and Section 15.615(f)(2)(i), Tables 2 and 2.1 in Appendix B

¹⁰⁵ We note that the operations in these coordination areas generally include Federal Government users in the 1.7-80 MHz spectrum that provide safety services (e.g. the Federal Emergency Management Agency (FEMA), the Department of Homeland Security (DHS), etc.).

¹⁰⁶ See, e.g., comments of PowerWAN at 1, indicating that it already notched amateur bands in its BPL system.

to inform local BPL operators of the pertinent details of their operations and BPL operators have the opportunity to apply that information as appropriate to prevent interference.

50. With regard to the consultation areas, we will require Access BPL operators to provide notification to the parties listed as Federal Government contact points, as designated in the rules set forth in Appendix B, for the area in which their systems will operate at least 30 days prior to initiation of service. The notification shall include: 1) the name of the Access BPL provider, 2) the frequencies of the Access BPL operation, 3) the postal zip codes served by the Access BPL operation, 4) the manufacturer of and type of Access BPL equipment being deployed (*i.e.*, FCC ID), 5) point of contact information (both telephone and e-mail address), and 6) the proposed or actual date of initiation of Access BPL operation. We will also require that systems located in consultation areas that were in operation prior to the effective date of these rules provide this notice to the appropriate contact point within 45 days of that date. NTIA has indicated that it plans to arrange to have information made available to BPL operators on Federal Government operations. We expect parties to consult in good faith to ensure that no harmful interference is caused to licensed operations and that any constraints on BPL deployments are minimized to those necessary to avoid harmful interference.

51. As indicated in the *Notice*, we believe that the risk of harmful interference to state and local public safety services, *i.e.*, EMS, fire, law enforcement, and emergency management agencies from Access BPL operations is essentially low.¹⁰⁷ In general, we believe that a properly designed and operated Access BPL system will pose little interference hazard to services such as aeronautical, maritime and public safety that are designed to operate with relatively high signal-to-noise ratios. 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 power line 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 a power line carrying Access BPL transmissions at a location where field strength is near the Part 15 limit; b) be tuned to a frequency radiated by an 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).¹⁰⁸ We therefore conclude that the interference protections set forth above will be adequate to foreclose harmful interference to public safety systems except perhaps under such unusual circumstances.

52. However, we also conclude that public safety systems merit additional protection because of the often critical and/or safety-of-life nature of the communications they provide. Given the importance and nature of public safety communications, we believe it is necessary to require Access BPL systems to notify the public safety agencies in their local areas, *i.e.*, state and local police, fire, emergency medical, any special emergency coordinators, call box operators, and other entities that are eligible for public safety licenses under Section 90.20 of the rules.¹⁰⁹ This advance notification will provide public safety

¹⁰⁷ See *Notice* at ¶37.

¹⁰⁸ 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.

¹⁰⁹ See 47.C.F.R. § 90.20.

operators with an opportunity to assess whether there are portions of its geographic area of responsibility about which it should make special arrangements with the Access BPL operator in order to avoid interference. Consistent with our decision on notifications for Federal Government consultation areas above, we will require that this notification be provided to local public safety agencies at least 30 days prior to a system's initial operation, the activation of any major extensions of the system, or any changes in its operating characteristics, *i.e.*, transmitting frequencies. The notification shall include: 1) the name of the Access BPL provider, 2) the frequencies of the Access BPL operation, 3) the postal zip codes served by the Access BPL operation, 4) the manufacturer of and type of Access BPL equipment being deployed (*i.e.*, FCC ID), 5) point of contact information (both telephone and e-mail address), and 6) the proposed or actual date of initiation of Access BPL operation. We will also require that systems in operation prior to the effective date of these rules provide this notice to local public safety agencies within 45 days of that date.

53. We do not see a need to establish Access BPL-free zones around airports, military bases, hospitals, police stations and fire stations, as requested by NAC/Amherst. To the extent that these services warrant special protection, they will be afforded protection through the excluded bands, exclusion zones and consultation areas specified by NTIA. We similarly do not find that amateur radio frequencies warrant the special protection afforded frequencies reserved for international aeronautical and maritime safety operations. We note that in many instances amateur frequencies are used for routine communications and hobby activities. While we recognize that amateurs may on occasion assist in providing emergency communications, we believe that the general Part 15 provisions and the specific provisions being adopted herein for Access BPL operations are sufficient to protect these amateur operations.

C. Interference Mitigation

54. In the *Notice*, we proposed to apply certain additional operational requirements to Access BPL systems and devices to address the interference concerns raised in the *Inquiry*.¹¹⁰ First, we proposed to require that Access BPL systems and devices incorporate capabilities that would allow operators to modify their systems' operations and performance to mitigate or avoid potential harmful interference to radio services. We stated that such adaptive techniques would include, for example, the capabilities to include or exclude, *i.e.*, "notch out," specific operating frequencies or bands, and to reduce power levels on a dynamic or remote controlled basis.¹¹¹ We further requested comment on whether we should require that each Access BPL device be capable of operating across a minimum range of frequencies and have the capability to remotely exclude a specific percentage of frequencies within this range. We also proposed to require that Access BPL devices incorporate a shut-down feature that would allow system operators to deactivate specific units found to actually cause harmful interference. We noted that several Access BPL equipment providers were already including these mitigation capabilities in their products and indicated our belief that such capabilities would enable Access BPL operators to avoid causing localized and site-specific harmful interference.

55. NTIA supports our proposals for Access BPL operational requirements.¹¹² It believes that Access BPL operators, as the parties responsible for eliminating harmful interference, will voluntarily implement equipment, organizational elements, and installation and operating practices that prevent interference and facilitate interference mitigation. NTIA submits that market appeal for Access BPL could quickly

¹¹⁰ *Notice* at ¶40.

¹¹¹ *Notice* at ¶37.

¹¹² *See* comments of NTIA at 8-10.

evaporate if these systems were to endemically cause interference and have to be shut down. Thus, it believes that Access BPL operators have strong incentives to prevent interference. However, it submits that to preserve the high degree of regulatory certainty enjoyed by licensed radio operators, the rules should require implementation of the most widely effective features for preventing interference, that is, local exclusion of BPL use of specific frequencies or bands, dynamic or commanded power reduction, and commanded shut-down.

56. The American Public Power Association (APPA), Current, Main.Net, NAS/CORF, PowerWAN, Progress Energy, and Southern, also support these proposals.¹¹³ The APPA, Current and PowerWAN state that a requirement 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 is desirable, but ask that we not adopt specific mitigation requirements. Southern similarly states that rules should allow for flexibility in the innovation of Access BPL equipment and systems. Though ARINC urges that we refrain from authorizing Access BPL to operate in the Aeronautical Mobile [R] frequency bands, it supports requiring Access BPL to have interference mitigation capabilities such as remote shut-off features and frequency agility.¹¹⁴

57. A number of parties representing users of HF and low VHF band radio services submit that our mitigation proposals are not sufficient to protect their operations from interference from Access BPL operations.¹¹⁵ These parties generally argue that the proposed operational requirements would not serve to prevent interference from occurring, but rather would only provide for after-the-fact remedies. For example, APCO/NPSTC, API, ARRL, and the MSHP argue that our interference mitigation proposals would improperly place the burden of initiation of actions to resolve interference on the victim licensed radio service.¹¹⁶ APCO/NPSTC and the MSHP express concern that the only way a public safety agency will know that interference is present in a given location will be when an officer cannot communicate in that area.¹¹⁷ ARRL states that any *post hoc* interference mitigation is impractical in the case of licensed mobile stations. Boeing argues that it would be impractical for an Access BPL system to reduce power levels or shut down operations in time to restore communications between a specific aircraft and a specific HF receiving station.¹¹⁸ The API also recommends that Access BPL providers be required to act immediately upon receipt of a complaint of interference and to resolve that interference in real time, 24 hours a day/7 days a week.¹¹⁹ Shipcom LLC, an operator of MPC stations, requests that we require Access BPL operators to shut down their systems within four hours of an interference complaint from MPC receiving stations, airports, airports, military bases, hospitals, and other sensitive facilities.¹²⁰ The API and the Potomac Valley Radio Club (PVRC) contend that BPL transmitters should be required to be

¹¹³ See comments of APPA at 6; Current at 3; Main.Net at 6; PowerWAN at 2; Progress Energy at 1-2; Southern at 17.

¹¹⁴ See reply comments of ARINC, Section IV.

¹¹⁵ See comments of APPI at 4-11; ARRL at 19-21.

¹¹⁶ See comments of ARRL at 17-21; APCO/NPSTC at 2; MSHP at 3.

¹¹⁷ See comments of APCO/NPSTC at 2.

¹¹⁸ See comments of Boeing at 10 and 12.

¹¹⁹ See comments of API at 4-11.

¹²⁰ See comments of Shipcom at 3.

shut off as soon as interference is reported.¹²¹ The NAC/Amherst recommend that we clarify the structure of the mitigation measures and how those measures are to be enforced in order that Access BPL operators will have a clearer sense of how they are to be held accountable for any interference they cause.¹²² Southern states that the Commission does not specify response times for resolution of interference involving other services and should not do so in the case of Access BPL either.¹²³

58. We continue to believe that it is important that Access BPL systems include capabilities that allow them to modify their operations to mitigate or avoid instances of harmful interference that may arise. These capabilities will allow Access BPL system operators to resolve interference found to occur at specific locations or in specific areas of their plant in an expeditious manner and without disrupting service to their broadband service subscribers. We agree with NTIA that Access BPL operators would have strong incentives to voluntarily implement such equipment and operating practices. We also agree with NTIA that, notwithstanding these incentives, it is necessary that we adopt requirements for interference mitigation capabilities to ensure that any interference can be resolved quickly without the need to address the tension that might arise over the possible disruption of service to BPL subscribers if mitigation capabilities were not available. The concerns of those commenting parties who argue that the mitigation requirements would not be sufficient to protect their operations from interference by BPL operations are misplaced. That protection will be provided by: 1) the emissions limits for Access BPL systems; 2) the provisions for consultation areas, excluded bands, and exclusion zones; and 3) the requirement that Access BPL systems not cause interference, as set forth above. The mitigation requirements are intended to ensure that Access BPL systems are designed with features that support interference mitigation, both during initial installation, if sensitive local communications systems are identified in advance, and after installation, when the newly required operational capabilities will allow Access BPL system operators to expeditiously resolve any instances of interference that may occur, without the need to cease operations and thereby disrupt the broadband data services they provide to their subscribers.

59. Accordingly, we are adopting requirements that Access BPL systems incorporate capabilities to modify their systems' operations and performance to mitigate or avoid potential harmful interference to radio services and to deactivate specific units found to actually cause harmful interference that cannot be remedied through modification of their operations as proposed, but with certain modifications. Our approach in specifying these requirements is to provide Access BPL equipment manufacturers and operators with flexibility to design and implement a broad range of products and system designs to meet particular service and operational needs while ensuring that systems have the capabilities to make operational changes to avoid any interference that may arise. The specific provisions of the mitigation requirements and the comments that concern them are addressed below. We also see no basis for subjecting Access BPL systems to requirements for addressing interference complaints that are different and more stringent than our procedures for addressing interference from other types of unlicensed devices. In this regard, we will continue to subject Access BPL systems to the procedures of Section 15.5(c) of the rules. Under this rule, parties who believe they are experiencing interference from an unlicensed device are first expected to bring the matter to the attention of the operator of the unlicensed device. If that action does not resolve the interference, the party may then seek intervention by the Commission.

¹²¹ See comments of API at 8 and reply comments of PVRC at 9.

¹²² See comments of NAC/Amherst at 14-17.

¹²³ See comments of Southern at 32.

60. To be more specific, in the event a BPL interference complaint is filed by a licensee with the Commission, the Commission will contact the complainant and/or the BPL provider to determine if they have first attempted to resolve the interference complaint among themselves. If they have not made such an attempt, the complaint will be forwarded to the BPL provider for action and the complainant notified that they will be contacted by the BPL provider concerning their interference complaint. The Commission may periodically monitor the resolution process to ensure that the parties are working in good faith and making appropriate progress in resolving the interference complaint. If the parties have attempted to address the complaint but the matter remains unresolved, the Commission, through its Enforcement Bureau with assistance from the Office of Engineering and Technology will review the complaint and take appropriate action. In general, the Commission will contact the BPL operator and request information on what steps they have taken to address the licensee's complaint. If these actions are deemed insufficient to resolve the interference complaint, the Commission will instruct the BPL operator to take immediate remedial actions, such as "notching" or avoiding specific frequencies, or ceasing operations.¹²⁴ In specific instances, the Commission may undertake field testing and measurements to address interference complaints and determine the most appropriate remedial action.

61. *Frequency Avoidance.* NTIA supports our assessment in the *Notice* that BPL frequency avoidance capabilities can be used to prevent or rapidly diagnose and eliminate interference.¹²⁵ It states that to quickly diagnose claims of interference while sustaining Access BPL service, a system operator could simply shift its operating frequency to determine whether its system was causing the interference. NTIA further states that if it is determined that a system is the source of the interference, the system's operation could be reset to use only non-interfering frequencies. NTIA submits that to achieve these benefits, Access BPL systems should be required to be capable of precluding transmissions in bands of at least 3 kHz at frequencies below 30 MHz and 30 kHz at frequencies above 30 MHz.

62. NTIA also suggests that use of adaptive or commanded power control could significantly reduce the risk of interference by maintaining Access BPL signals near the minimum power level needed for service in response to measured or predicted transmission channel.¹²⁶ It states that interference risks can be significantly reduced by adjusting power consistent with variations in noise power that cannot reasonably be eliminated prior to Access BPL deployment, rather than simply setting a BPL device's output power at a constant level that is high enough to yield the requisite BPL Signal-to-Noise ratio (S/N) during peak noise levels.¹²⁷ NTIA also recommends that Access BPL systems use blocking filters to limit the reach of their transmissions beyond where service is provided.

¹²⁴ See 47 C.F.R. § 15.5.

¹²⁵ See comments of NTIA at 9-10.

¹²⁶ See comments of NTIA at 9. NTIA notes that power line noise can vary by upwards of 20 dB throughout the day and seasonally, especially at frequencies below 12 MHz.

¹²⁷ See comments of NTIA at 9. NTIA also suggests that the Access BPL device multiple access technique and modulation details in addition to the method of power control would sufficiently describe the BPL emission waveforms to enable identification of BPL emissions using a spectrum analyzer. In a letter of September 21, 2004, from Frederick R. Wentland, Associate Chief, NTIA Office of Spectrum Management, to Ed Thomas, Chief of the Commission's Office of Engineering and Technology, NTIA states that it does not support a requirement for Access BPL systems to transmit identification codes or call signs. NTIA indicates that such codes would unacceptably increase interference risks.

63. Access BPL proponents generally argue that Access BPL providers should have the flexibility in designing their own mitigation techniques.¹²⁸ These parties generally hold that while the specific techniques and practices suggested by NTIA are desirable features for mitigating interference from Access BPL systems, we should not mandate them by rule. For example, the APPA, AT&T, PowerWAN, Progress Energy, and Southern submit that particular specifications for range of frequencies and other specific control mechanisms are not necessary because the modulation techniques that make Access BPL operation feasible are by their nature adaptable. Southern agrees with NTIA that power reduction at specific devices and or specific frequencies should be considered as an option for mitigating interference. It also agrees with NTIA that techniques such as frequency avoidance, using balanced differential BPL signal injection, and using blocking filters to limit the reach of BPL signals beyond where service is provided could also be useful components in interference mitigation. However, its states that the viability of any of these techniques will depend on the type of technology and network and that we should therefore provide flexibility for system operators.¹²⁹ AT&T similarly states that requiring specific mitigation techniques and procedures would not be appropriate because each system will have different operational parameters, including the frequencies used, the equipment deployed, the geographic scope of the deployment, and the surrounding topographies. AT&T, Duke Energy and PowerWAN also argue that any requirements for frequency notching and remote control power reduction should be applied prudently, as the cost and complexity of equipment will be affected as more requirements are specified. Duke Energy states that mandating all or even some specific interference mitigation capabilities be available on every piece of BPL equipment could result in wasted resources.¹³⁰

64. NAS/CORF supports the use of notching of Access BPL signals to protect radio astronomy stations. It states that such notching should ensure that Access BPL emissions in the HF and low VHF radio astronomy bands do not exceed 100 $\mu\text{V}/\text{m}$ at 3 meters. The ARRL contends that dynamic frequency selection capabilities will not work because that technology only responds to transmitted signals heard, and these capabilities are not sensitive enough to hear the weak signals that a licensed station is attempting to receive.¹³¹ The ARRL, API, Boeing, IMSA, MSHP and SBE request that Access BPL systems be required to notch the bands used by their services, and REC Networks asks that we require Access BPL systems to notch all licensed radio bands in the 2-80 MHz bands.¹³² Anthony Good, Boeing, and Tracy K. Wood recommend that we require Access BPL devices to incorporate "marker beacons" that carry identifying data for use in tracing interference.¹³³ Boeing states that absent such markers, there is no way for aeronautical operators to identify the source of Access BPL signals.¹³⁴

¹²⁸ See comments of AT&T at 5-6, APPA at 5, PowerWAN at 2, Progress Energy at 6, and Southern at 18-19; *see also*, reply comments of Ameren at 11 and Con Edison at 5; *see also* reply comments of Current at 21-25.

¹²⁹ See reply comments of Southern at 34.

¹³⁰ See reply comments of Duke Energy at 15-16. For example, it would not be cost-effective or necessary to require underground devices to incorporate a host of mitigation capabilities, as interference concerns are greatly reduced due to the shielding that would naturally or inherently occur.

¹³¹ See comments of ARRL at 21.

¹³² See comments of ARRL at 21, API at 7, Boeing at 2, IMSA at 4, MSHP at 6, REC Networks at ¶¶ 3-4., and reply comments of SBE at 5.

¹³³ See comments of Tracy K. Wood at 4-5, Anthony Good at 2.

¹³⁴ See comments of Boeing at 13.

65. We conclude that the most appropriate approach regarding mitigation techniques that involve altering system operation is to require that Access BPL systems incorporate the capability to avoid the use of specific frequency bands. The ability to alter a system's operation to notch-out transmissions from specific frequencies where interference is occurring is a necessary feature for resolving interference without disrupting service to BPL subscribers. While other mitigation capabilities, such as adaptive or commanded power control, are desirable system features that can serve to reduce interference potential, they generally would provide a much lower degree of benefit in eliminating interference than frequency avoidance. Limiting the requirement for operational modification capabilities to frequency avoidance is also consistent with our intent to minimize the impact of these requirements on manufacturers and system operators so as preserve their flexibility to design products and systems that will best meet the needs of Access BPL subscribers.

66. In considering specifications for the notching requirement, we find that the most important consideration is to ensure that the notch provides enough filtering to effectively reduce the potential for interference. Our experience in examining the field performance of various Access BPL operations indicates that at frequencies below 30 MHz, a notching capability that provides at least a 20 dB reduction of Access BPL emissions below the current applicable Part 15 emission limits is adequate to resolve interference occurrences that might result to mobile reception from such operations. In this regard, we will generally assume that a 20 dB notch is sufficient to resolve any harmful interference that might occur to mobile operations, given the low signal levels allowed under the Part 15 emission limits and the fact that a mobile transceiver can readily be re-positioned to provide some separation from the Access BPL operation. The interference potential from emissions at this low level would be limited to a very short range from an Access BPL device or a power line on which Access BPL transmissions are carried. We also believe that notching at this level with some distance separation will generally avoid interference to fixed operations, including those that use more sensitive receivers.¹³⁵ Above 30 MHz we believe that a notching capability of at least 10 dB is sufficient to provide the same level of protection, given the more stringent Part 15 emission limits that apply to Access BPL transmissions above 30 MHz and the increased attenuation of emissions that occurs from propagation losses as the frequency of operation increases.¹³⁶ With regard to NAS/CORF's requests for protection of radioastronomy, we note that special protections are provided for radioastronomy in the exclusion zones and consultation requirements for Access BPL as set forth above.

67. We do not believe it is necessary to specify the bandwidth over which the notching capability must function. Rather, we will adopt the more general requirement that Access BPL systems must be capable of avoiding transmissions in any frequency band or bands in order to eliminate any instances of interference with the operations of licensed radio services. We therefore are amending our rules to require that Access BPL devices have the capability to reduce emissions by at least 20 dB below the Part 15 emission limits in frequency bands below 30 MHz and 10 dB below those limits in frequency bands 30 MHz and above. We believe that these provisions adequately set forth the structure of the required capabilities for modifying the operation of an Access BPL system. We are not specifying requirements for use of the frequency avoidance capabilities. Rather, we believe that system operators should have the discretion to use this capability or any other alternative available to them as they might deem appropriate

¹³⁵ Under this requirement, Access BPL systems will have to be able to limit their emissions in bands selected for frequency avoidance to 50 dB μ V/m at frequencies from 1.705 to 30 MHz and 30 dBuV/m at frequencies above 30 MHz. These values apply for measurements at 3 meters.

¹³⁶ For example, the free space propagation loss between two isotropic antennas separated by 100 meters is approximately 18.5 dB at 2 MHz, 32 dB at 10 MHz, 38 dB at 20 MHz, 42 dB at 30 MHz, and 50 dB at 80 MHz.

to resolve specific situations involving interference that they may encounter in the course of their operations.

68. We do not find any justification for a requirement that Access BPL operators notch the frequencies of any or all of those services that use frequencies in the HF and low VHF bands. As stated above, we believe that the emission limits, consultation areas, excluded bands, exclusion zones, and the requirement that Access BPL systems not cause interference, as set forth above, are generally sufficient to control the interference potential of these systems. The required notching capability will enable a system operator to address any specific instances of interference that might otherwise arise. We also decline to adopt a rule requiring transmission of identification codes. As NTIA states, such codes could increase the potential for interference from Access BPL operations. We also do not believe that it would be practicable for ARINC or any other operator to identify an Access BPL system as the source of interference and contact its operator on a real time basis to resolve the interference. As NTIA indicates in its letter of September 24, 2004, no practical method has been identified for Access BPL systems to transmit an identifying code. We believe that the Access BPL notification requirements, as described below, will provide sufficient information to locate and mitigate interference.

69. *Shut Down Requirement.* NTIA submits that in addition to providing a means for final resolution of interference, a shut-down feature could be used to rapidly test whether the system is causing interference. It states that a simple on-off test using the shut-down feature would serve to indicate whether the system was the source of observed interference. NTIA states that a shut-down requirement is also practicable and effective. In this regard, NTIA submits that in the course of conducting its BPL measurements, its personnel requested shut-downs and confirmations of BPL frequency usage via telephone and these requests were executed within a matter of seconds under pre-arranged conditions. It states that while such speedy responses may not be routinely practicable in response to complaints of suspected interference, a requirement to be capable of shut-down of Access BPL network elements coupled with system operators' incentives to preclude filings of interference complaints with the Commission should yield prompt resolution of cases of Access BPL interference. NTIA also indicates that shut down should be the last resort if other mitigation techniques are ineffective in resolving interference.¹³⁷

70. The AMA, ARINC, ARRL, API, and Boeing support our proposal to require that Access BPL systems incorporate a shut-down feature that would allow deactivation of units found to cause harmful interference. For example, ARINC and Boeing recommend that the rules require, at a minimum, that Access BPL system devices incorporate circuitry allowing operators to remotely turn their devices on and off.¹³⁸ Boeing notes, however, that it would be impractical to expect an Access BPL network to shut down operations in sufficient time to restore communications between a specific aircraft and a specific HF receive station on a case-by-case basis.¹³⁹ The ARRL, API and AMA also ask that we require Access BPL operators to notify their customers in advance of possible service interruptions resulting from interference mitigation.¹⁴⁰

71. Other parties ask that we clarify that interference mitigation techniques may be implemented in the first instance and that the shut-off feature should be used as a last resort. In their reply comments,

¹³⁷ See comments of NTIA at viii.

¹³⁸ See reply comments of ARINC at 7.

¹³⁹ See comments of Boeing at 10 and 12.

¹⁴⁰ See comments of ARRL at 24, API at 11 and AMA at 6-7. See also reply comments of PVRC at 13.

Con Edison, Duke Energy, Southern, and the UPLC submit that Access BPL operators should be permitted to correct harmful interference by notching or shifting frequencies prior to having to shut down an Access BPL device.¹⁴¹ Progress Energy suggests that any mandatory shut-down capability be specified as manually controlled because any automated shut-down capability could have detrimental effects on a power utility service's operations in addition to disrupting broadband service to its Access BPL customers.¹⁴² Ameren opposes the proposed requirement that Access BPL equipment include a shut-down feature that allows deactivation of units found to be causing interference.¹⁴³ It argues that this feature would add unnecessary cost and complexity to equipment and suggests that we instead rely on the requirements for no interference in Section 15.5 to address interference.

72. We continue to believe that Access BPL equipment and systems should have the capability to deactivate individual system components. This feature will allow systems to deactivate limited portions of their plant so that localized interference problems can be addressed without affecting service to all of their subscribers. As a secondary benefit, the shut-down feature will allow system operators to rapidly diagnose whether their operations are causing reported interference. We are also requiring that the shut-down feature in individual devices be remote-controllable from the central system operations facility or other appropriate location. This will allow rapid response to resolve interference in any emergency or other urgent situation that might arise. We also agree with Progress Energy the required shut-down capability should be manually controlled. Moreover, we have no record on which to base a decision on the conditions under which an automated capability would be activated. We also recognize that, depending on how it would be triggered, an automated shut-down capability could unnecessarily have detrimental effects on a power utility service's operations in addition to disrupting broadband service to its Access BPL customers.

73. It is not our intention that a service shut-down be the first step in a system operator's response to a valid interference complaint. As suggested by several of the commenting parties, we would anticipate that shut-down would be a last resort when all other efforts to satisfactorily reduce interference have failed. We disagree with Ameren that the shut-down requirement will add unnecessary costs and complexity to Access BPL equipment. As NTIA and our own field testing indicate, most Access BPL systems and equipment already include the capability to shut-down specific components of their operation. Accordingly, we are requiring that Access BPL systems incorporate features that will allow the deactivation of individual components on a remote controlled basis, to be implemented and used as discussed above. We reiterate, however, that the Commission, through a duly authorized representative, is the sole authority that may direct an Access BPL operator to cease operating any of its devices to eliminate interference.¹⁴⁴

D. Access BPL Notification and Database Requirements

74. In the *Notice*, we proposed to subject Access BPL systems to a notification requirement similar to the notification requirements in our rules for power line carrier (PLC) systems.¹⁴⁵ Under this requirement,

¹⁴¹ See reply comments of Con Edison at 4, Duke Energy at 46, Southern at 17 and 31, and UPLC at 10.

¹⁴² See comments of Progress Energy at 6.

¹⁴³ See comments of Ameren at 8-9.

¹⁴⁴ See 47 C.F.R. § 15.5(c).

¹⁴⁵ See 47 C.F.R. § 15.113 and 47 C.F.R. § 2.106, Note US294. Under the existing rules, information on power line carrier systems must be entered into a database administered by United Telecom Council (UTC).

an Access BPL system operator would submit information on its system to an industry-operated entity. This entity would establish a publicly accessible database for Access BPL information to ensure that the location of Access BPL systems and their operating characteristics can be identified if harmful interference occurs and to facilitate the activation of interference mitigation and avoidance measures. As proposed, this notification would include information on the location of the installation, the type of modulation used, and the frequency bands of operation. We sought comment on these proposals including suggestions on the appropriate industry-operated entity that should be selected to receive the notifications and maintain the Access BPL data base. In addition, we asked for suggestions regarding other approaches for making this information available and for input on whether it would be more reasonable to allow each Access BPL operator to maintain a database of its own rather than require a more centralized data base. We further sought input on the burden that the proposed notification requirement would 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.¹⁴⁶

75. NTIA supports a requirement that BPL operators notify key BPL system parameters to an industry database. NTIA states that the database will serve to facilitate prior consultation of Access BPL deployments with licensed radio users.¹⁴⁷ NTIA suggests that by entering planned new Access BPL deployments in the data base at least 30 days in advance of consultation, concerned radio operators could inform BPL system operators of local radio operations that may be affected and that the system operators could consult with potentially affected parties as necessary in order to prevent interference. NTIA recommends that notification of the earliest anticipated date of actual operation within each deployment area should be included in any notification so that NTIA can properly prioritize its responses to Access BPL notifications. NTIA states that in response to each advance notification, it plans to provide the BPL operator with information that will enable prevention of interference to local federal radio operations.

76. NTIA recommends for each deployment area that Access BPL operators specify the maximum number of each type of Access BPL device to be deployed in the specified area and that subsequent notifications should be submitted at least quarterly for each deployment area, as needed, to report the total numbers of each type of device that have been deployed and to update other advance notification parameters.¹⁴⁸ NTIA also indicates that Access BPL system notifications should include information on the modulation type(s), number(s) of carriers, minimum and maximum carrier spacing, symbol rate(s) per carrier, range of transmission duty cycle, and the multiple access technique.¹⁴⁹ NTIA also recommends that planned BPL system locations be notified in the form of one or more geographic coordinates (in decimal degrees) and associated radii (in kilometers). Finally, NTIA recommends that each notification of BPL deployment include a single telephone point of contact for each deployment area and an e-mail address. NTIA asserts that the telephone point of contact should be required to receive complaints of suspected interference and be capable of accomplishing rapid diagnosis during the same telephone session, or shortly thereafter, by a mutually agreed schedule.¹⁵⁰

¹⁴⁶ Notice at ¶43.

¹⁴⁷ See comments of NTIA at 9-11.

¹⁴⁸ See comments of NTIA at 11-12. NTIA states that over time this data would assist in updating its predictions of increases in ambient radio noise due to ionospheric propagation and aggregation of emissions from BPL devices.

¹⁴⁹ See comments of NTIA at 12.

¹⁵⁰ See comments of NTIA at 13.

77. A number of potential Access BPL providers and proponents generally support the creation of a publicly accessible database, as proposed in the *Notice*. Southern recommends that each BPL operator provide to an industry-operated entity a list of zip codes where BPL is deployed, the range of frequencies over which its BPL system operates and a point of contact to whom interference complaints should be sent. Anyone experiencing interference could query the database which would return general information on deployed BPL systems and direct the complainant to a contact name and phone number at the BPL operator's company.¹⁵¹ Main.Net and Earthlink recommend that the information submitted to the database include only the city or town where the BPL system is deployed, the responsible power utility or BPL operator, and a toll free contact number.¹⁵² Duke Energy recommends that disclosures and database access be limited to the minimum necessary to place a licensee in touch with the appropriate BPL operator to cooperatively diagnose and remedy harmful interference issues.¹⁵³

78. Some parties raise concerns that a publicly available BPL database, or the inclusion of more detailed information in the database, could compromise sensitive or critical information about the electric power grid. UPLC supports the FCC's proposal of a notification database, but only to the extent that public disclosure of information is limited to that which is necessary to effectively resolve interference without providing sensitive information that could compromise critical infrastructure.¹⁵⁴ APPA states, for example, that the database proposal raises serious national security issues and it urges the Commission to adopt a notification rule that does not require the disclosure of sensitive information.¹⁵⁵ HECO recommends the use of a secure, independent database custodian to guard potential risks of disclosure of critical infrastructure, as defined by FEMA.¹⁵⁶ PPL Telcom argues that in the near future, BPL may be used for electric utility supervisory control and data acquisition (SCADA) communications and public disclosure of BPL locations and operating frequencies would expose electric utility operations to risk through deliberate degradation or interruptions of the SCADA communications carried by BPL.

79. Other parties argue that providing detailed information on BPL deployment also raises competitive issues. Cinergy, for example, states that creating a publicly accessible database would provide entrenched broadband providers with free competitive intelligence about a BPL provider's network build-out, and would permit them to target marketing and promotion efforts in an attempt to pre-empt BPL provider's offers.¹⁵⁷ Cinergy is also concerned that the database could lead to abuses and be used to file meritless interference complaints against access BPL operations.¹⁵⁸ Similarly, PLL Telecom is concerned that broadband competitors would obtain an unfair advantage in the marketplace through access to a database that would reveal BPL growth plans and marketing strategies.

80. A number of parties, on the other hand, recommend that the database contain more detailed information on BPL operations. AMA supports making public information on the location of all BPL

¹⁵¹ See comments of Southern at 10-11.

¹⁵² See comments of Main.Net at 8. See reply comments of Earthlink at 2.

¹⁵³ See reply comments of Duke Energy at 12.

¹⁵⁴ See comments of UPLC at 10.

¹⁵⁵ See reply comment APPA at 2 and comments at 9.

¹⁵⁶ See comments of HECO at 4.

¹⁵⁷ See comments of Cinergy at 4.

¹⁵⁸ See comments of Cinergy at 4.

transmitters, and argues that such information would not disclose critical infrastructure facility locations or present competitive concerns.¹⁵⁹ It notes vendors in the market readily disclose where they offer service and commonly do so on their internet web sites. AMA adds that a database that is not public is of little use in planning operations and avoiding interfering conditions.¹⁶⁰ CEA believes that it is prudent to include the power spectral density mask that represents the maximum power transmitted by the system for any given frequency in addition to location, modulation and frequency band of the BPL operations.¹⁶¹ The PVRC also asserts that information on Access BPL would constitute the same information typically available in equipment brochures or websites and should not be viewed as a source of competitive disadvantage.¹⁶² Anthony Good states that having a public database of BPL systems will enable interference victims to properly identify the operators of interfering BPL systems and file complaints.¹⁶³ SBT recommends that the database include mapping software that is sufficiently detailed to show the exact locations of the lines over which BPL is traveling.¹⁶⁴

81. ARRL supports NTIA's proposal that BPL operators provide a single point of contact for each deployment area that can effectuate immediate interference diagnosis and resolution. ARRL notes, however, that the single point of contact would not facilitate resolution of interference to mobile stations.¹⁶⁵ ARRL, ARINC and others assert that Access BPL operators should be required to provide points of contact fluent in all major languages that are reachable 24 hours a day/seven days a week in order to allow parties using international broadcast services to report interference complaints.¹⁶⁶ ARINC also states that those points of contact must be capable of remotely initiating the steps needed to ascertain whether the interference complaints are likely due to Access BPL operations and be empowered to dispatch personnel to troubleshoot any complaints that cannot be resolved remotely.¹⁶⁷ Southern, in its reply comments, objects to a requirement to have multilingual employees so that BPL operators could address interference complaints from non-English speaking shortwave radio listeners. It states that such a requirement is unreasonable and would place it and other BPL providers at a disadvantage to other communications service providers.¹⁶⁸ Duke Energy states that it is unreasonable and unnecessary to require BPL operators to staff a hotline and maintain field personnel to address interference concerns instantaneously during non-business hours on a non-emergency basis.¹⁶⁹

¹⁵⁹ See reply comments of AMA at 3-4.

¹⁶⁰ *Id.*

¹⁶¹ See comments of CEA at 7.

¹⁶² See reply comments of PVRC at 10.

¹⁶³ See reply comments of Anthony Good at 2.

¹⁶⁴ See comments of SBT at 8.

¹⁶⁵ See reply comments of ARRL at 21.

¹⁶⁶ See reply comments of ARINC at 2 and comments of ARRL at 23; North American Shortwave Association at 5; Small Business in Telecommunications at 7-9; and Tracy K. Wood at 5.

¹⁶⁷ See reply comments of ARINC at 8.

¹⁶⁸ *Id.* at 32.

¹⁶⁹ See reply comments of Duke Energy at 12.

82. At least two parties, UPLC and Comsearch, offer to provide BPL notification database administration services.¹⁷⁰ UPLC states that it has the resources and the experience from its relationship with the United Telecom Council (UTC) to effectively serve as the BPL database administrator.¹⁷¹ Comsearch states that it has extensive experience in maintaining state of the art software and databases for mobile, microwave and satellite communications systems.¹⁷² Comsearch also states that its position as an independent third party would address concerns raised by certain parties that the database administrator not be associated with the utilities providing BPL service. Comsearch indicates that it is feasible for a third-party entity to perform the database notification functions as well as interference analyses and interference resolution without releasing information in bulk.¹⁷³ NAC/Amherst agrees with Comsearch that the proposed BPL database should be administered by a third party rather than the BPL service industry itself or its members. It states that the FCC should permit interested non-profit organizations as well as private sector parties that have no connection to the BPL industry to compete for the position. NAC/Amherst recognize that such an entity would need to be compensated for its services and suggests that the Commission establish a surcharge on the sale or lease of BPL services, facilities and/or equipment to provide revenue for the third party entity.¹⁷⁴

83. *Decision.* We continue to believe that the Access BPL notification and database requirements proposed in the *Notice* are appropriate and sufficient to ensure that any potential interference to licensed services from BPL operations can be adequately identified and quickly addressed. The primary intent of our notification and database requirements is to ensure that licensed users of the spectrum have a publicly accessible and centralized source of information on BPL operations to determine whether there may be Access BPL operations on particular frequencies within their local area so that any incident of harmful interference can be resolved should it occur. The information contained in the notification database need only be sufficient to determine whether there may be a BPL operation in the local area, the nature of the BPL operations, whether the BPL system is operating on frequencies that could potentially be a source of harmful interference to the licensed user and to identify an appropriate contact person who can work directly with the complainant to resolve the harmful interference if it is determined to be caused by the local BPL operations. Additional or more detailed relevant information needed by a radio operator could be requested via the contact person indicated in the data base, as appropriate.

84. We therefore are adopting rules that will require the BPL industry to establish within 180 days from publication of this item in the *Federal Register* a centralized publicly accessible Access BPL notification database.¹⁷⁵ We note that two organizations have indicated their willingness to perform this task and that the issue of “independence” of the database manager has been raised by some of the commenting parties. The responsibilities and duties of the database manager are to maintain complete,

¹⁷⁰ See comments of UPLC at 12 and reply comments of Comsearch at 3.

¹⁷¹ 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 footnote 58 and comments of UPLC at 12-13.

¹⁷² See reply comments of Comsearch at 3.

¹⁷³ *Id.*, at 2-3.

¹⁷⁴ See reply comments of NAC/Amherst at 5 and additional reply comments at 2-3.

¹⁷⁵ Prior to the time the Access BPL industry database manager is established and the database operational, we encourage Access BPL operators to make available the notification information on an individual basis.

accurate and timely records of FCC-mandated information. We are not requiring, as some parties have suggested, that the database manager be involved in, monitor, or manage the interference resolution process. The party responsible for avoiding interference is clearly the Access BPL operator and his responsibilities are clearly set forth in the existing procedures under Section 15.5(c) of the Commission rules. We therefore do not find that the database manager need be an “independent” third-party with no relationship to the BPL or utility industry and are not adopting such a requirement.

85. With regard to the information to be included in the database, we are adopting rules that require the Access BPL operator to provide the BPL industry designated database manager with the following information 30 days prior to initiation of any operation or service: 1) the name of the Access BPL provider; 2) the frequencies of the Access BPL operation; 3) the postal zip codes served by the specific Access BPL operation; 4) the manufacturer and type of Access BPL equipment being deployed (i.e., FCC ID); 5) point of contact information (both telephone and e-mail address) for interference inquiries and resolution; and 6) the proposed/or actual date of Access BPL operation.¹⁷⁶ The database manager shall be required to enter this information into the publicly accessible database within 3 business days of receipt. This will allow some period of time for the database manager and BPL provider to address any questions with regard to information submitted and to ensure that information entered into the database is correct. We believe that the above information provides sufficient specificity for identifying potential interference while at the same time avoiding valid concerns that sensitive information on critical infrastructure not be revealed.

86. We believe that using zip codes, as suggested by Southern, would sufficiently identify the area of Access BPL deployment without revealing specific sensitive information and would facilitate a more organized approach to identification and resolution of harmful interference. We note that zip codes are easily understood and can be identified by both licensees and BPL operators. With regard to those parties that request more comprehensive information, we do not find that benefits of providing such information in the database would outweigh the substantial cost of collecting and reporting this additional information. We note, for example, that NTIA’s proposals to require information on modulation types, number of carriers, range of transmission duty cycle, minimum and maximum carrier spacing, symbol rates per carrier, etc., would provide little additional guidance on whether interference were being caused in a particular instance as compared to the more simple requirement of identifying BPL operating frequencies. In addition, we are requiring herein that BPL equipment must be certified and therefore more detailed technical information will be available through our equipment authorization files for those parties desiring such information. We also are not requiring Access BPL operators to have multi-lingual contact persons. We believe that requiring both telephone and e-mail contact information is sufficient to address interference inquiries. We are also not requiring that telephone contact positions be staffed 24 hours per day and seven days a week. We believe that our emission requirements and other mitigation rules will ensure that interference is generally avoided. We believe that telephone contact staffing during normal business hours is sufficient and also note that e-mail would generally allow interference reports to be filed at any time.

87. We expect the Access BPL operators and licensees to cooperate in good faith to identify and resolve instances of harmful interference. We require the notification database for Access BPL operators to notify the operation of its devices and systems to facilitate the speedy resolution of interference. Speedy resolution of interference will not result if the database information on Access BPL deployments is abused and the BPL operators are deluged with frivolous interference complaints. We expect the

¹⁷⁶ Once the 30-day advance notification timeframe is over, the Access BPL operator can begin operations. However, the Access BPL operator must notify the database manager of the date of commencement of actual operations for inclusion in the database.

Access BPL operators to take every complaint of interference seriously and to diagnose the possible cause of interference quickly. At the same time, we expect the complainant to have first taken reasonable steps to confirm that interference rather than a receiver system malfunction is occurring and, to the extent practicable, to determine that the interference source is located outside the complainant's premises. We expect both parties to cooperate to determine a mutually acceptable schedule to diagnose and resolve the interference complaint, recognizing that the Access BPL operator may have to prioritize any complaints of interference that it receives (e.g. from a public safety agency). With regard to public safety operations, however, we will require that the BPL operator respond to complaints of harmful interference from public safety users within 24 hours; the BPL provider shall be required to immediately cease the operations causing the public safety complaint if it fails to respond to such complaint within 24 hours. Any complaints of interference that are not resolved in accordance with the mutually agreed schedule may be filed with the Commission along with the particulars of the interference case. Upon receipt of the interference complaint, the Commission will investigate the complaint and take action against the Access BPL operator if it is found to be causing harmful interference. If, on the other hand the Commission uses its resources to investigate an interference complaint that is found to be frivolous, the Commission will impose appropriate sanctions for abuse of its administrative process.

E. Measurement Guidelines

88. In order to ensure that emissions from Access BPL systems are accurately measured, in the *Notice*, we proposed specific measurement guidelines for both Access BPL and all other carrier current systems. In doing so, the Commission also fulfills a deferred promise from another docket.¹⁷⁷

1. Access BPL Systems

89. In the *Notice*, we proposed to require that Access BPL systems, including all of their component 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. As proposed, such measurements would be made at a minimum of three overhead and three underground representative locations, using the measurement guidelines in Appendix C of the *Notice*.¹⁷⁸ For Access BPL systems 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 systems installed on overhead lines, in order to take into account the effect of the long power line, the proposed guidelines specify measurements at fixed horizontal distances from the power line where the Access BPL signal injection source is installed. Thus, rather than finding the maximum emissions across a number of radials, - as currently performed for other Part 15 emitters - the proposed guidelines specify that the receive antenna be moved down-line, parallel to the power line, starting from the Access BPL signal injection equipment location, to find the maximum emissions at each frequency within the requisite frequency range of the Access BPL device; the minimum down-line distances at which measurements are to be taken in this sequence are specified in terms of the wavelength of the Access BPL mid-band frequency.¹⁷⁹

¹⁷⁷ See *1998 Biennial Regulatory Review - Conducted Emission Limits Below 30 MHz for Equipment Regulated under Parts 15 and 18 of the Commission's Rules*, ET Docket 98-80, *Report and Order*, 17 FCC Rcd 10806 (2002) at ¶2. In that proceeding, the Commission deferred the measurement procedures for carrier current systems to a future proceeding.

¹⁷⁸ *Notice* at ¶45 and Appendix C, *Notice* at 30-33.

¹⁷⁹ *Id.*

The proposed guidelines also allow the use of the existing distance extrapolation factors for measurements made at distances other than the specified distance in the rules.¹⁸⁰

90. In addition, we specifically solicited comments on the height of the receive antennas used for measuring radiated emissions from Access BPL systems operating on overhead power lines and on the possible use of correction factors to account for the height of these antennas. The proposed guidelines in Appendix C of the *Notice* recommend measuring with a fixed *loop* antenna at 1 meter height for frequencies below 30 MHz and varying the height of electric field sensing antennas (*e.g.*, a dipole) from 1 to 4 meters for measurements at frequencies above 30 MHz. We stated that 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 of the *Notice*, this issue was addressed by proposing that distance extrapolations for emission measurements on overhead lines be based on slant-range distance from the overhead power line to the measuring antenna, rather than on horizontal distance.¹⁸¹ We remarked however that this technique does not account for field strength reductions caused by ground effects, and sought comment on whether it is necessary to require that emission measurements be conducted at antenna heights greater than those proposed in Appendix C. We also asked whether it is practical and safe to make *in situ* emission measurements with an antenna 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 measurements at higher antenna locations, we asked whether we should specify that measurements that are performed at heights significantly lower than the power line are subject to a correction factor to estimate the maximum field strength that would have been observed at a higher measurement height; and how should such a correction factor be determined.¹⁸²

91. *NTIA Phase 1 Study, Comments and Follow-Up Letters*. As mentioned, *supra*, NTIA submitted an extensive report on BPL (the NTIA Phase 1 Study), addressing several issues dealing with emission measurements for Access BPL. This study addressed interference risks to radio services, and suggested means of reducing these risks and identifying techniques for local interference mitigation.¹⁸³ In this study, NTIA conducted testing at locations of actual Access BPL installations and performed theoretical modeling using the Numerical Electromagnetic Code (NEC) software. Using the NEC software, NTIA evaluated interference risks in terms of the geographic extent of locations where interference may occur to radio reception. These evaluations were performed at four frequencies for outdoor, overhead Access BPL systems conforming to existing Part 15 rules.¹⁸⁴

¹⁸⁰ The rules allow using a 20 dB per decade distance extrapolation factor for frequencies above 30 MHz and 40 dB per decade distance extrapolation for frequencies below 30 MHz. Thus, if the rules specify a radiated emission limit of 100 μ V/m at 10 meters, if the measurement was made at 3 meters for a frequency of 20 MHz, a correction factor of 20.9 dB ($40 \log(10/3)$) would be subtracted from the measurement data to account for the difference in measurement distances. See 47 C.F.R. § 15.31(f)(1) and (2). See also, footnote 181, *infra*.

¹⁸¹ See 47 C.F.R. § 15.31(f)(1) and (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.

¹⁸² *Notice* at ¶46 and *Notice*, Appendix C at 31-33.

¹⁸³ See footnote 1.

¹⁸⁴ *NTIA Phase 1 Study*, at v and vi.

92. The NTIA Phase 1 Study concludes that the most effective approach for reducing BPL interference risks would be to establish proper compliance measurement procedures, and that measuring Access BPL emissions in accordance with the existing Part 15 measurement provisions can mistakenly indicate compliance with field strength limits when the limits actually are substantially exceeded. NTIA recommends several modifications to the proposed emission measurement guidelines to ensure that maximum emissions are measured. In its study, NTIA recommends: 1) measuring an Access BPL device at a fixed measurement distance of 10 meters; 2) using a measurement height approximately equal to the power line height, however, it also suggests that a small adjustment factor would still be necessary to account for higher emissions at even higher elevation angles; 3) making measurements below 30 MHz with a rod antenna rather than the FCC and industry practice of using a loop antenna. NTIA also provides some recommendations for the selection of the three representative measurement sites, including requirements for a variety of power line configurations (*e.g.* single phase, three-phase, sharp turns, transitions to underground cables, etc.). NTIA also indicates that these recommendations are still under study, and that additional suggestions will be presented in the Phase 2 of the study. The study also contains a recommendation for a smaller distance extrapolation factor than that specified by the existing Part 15 rules, but which is also under study.¹⁸⁵

93. Subsequently, NTIA submitted comments that were accompanied by a Technical Appendix containing preliminary results and recommendations from Phase 2 of its study. In those comments, NTIA modifies some of the assessments in the NTIA Phase 1 Study, and supersedes them with specific recommendations, aiming at shifting emphasis away from eliminating interference and toward preventing it, premised on the fact that BPL operators have a market incentive to prevent interference.¹⁸⁶ In its letter of September 24, 2004, NTIA reported the findings of its further studies of measurement guidelines.

94. *a) Measurement Distance.* NTIA stated that its measurements and modeling indicate that the change in BPL field strength with increasing distance from a BPL device and overhead power lines is not well approximated by the existing Part 15 distance extrapolation factor when measuring distances horizontally (rather than using slant range to the power line as proposed in Appendix C of the *Notice*). NTIA's recommended solution to this anomaly is to uniformly apply a ten-meter standard measurement distance to such installations, present explicit equivalent field strength limits for those distances, and provide an appropriate distance extrapolation factor. We note that while NTIA, in its comments, indicated that it was still developing equivalent field strength limits and distance extrapolation factors on the basis of the radiation and propagation properties of Access BPL emissions, it subsequently informed the Commission that it has now completed its studies of these issues and it has arrived at the same conclusions as we arrive at below.¹⁸⁷

95. *b) Receive Antenna Height and Height Correction Factor.* NTIA's initial analysis of radiated emissions from overhead Access BPL systems shows that relatively high emissions can occur at various distances from a BPL device along a power line, in some cases at regular distance intervals. Thus, the peak field strength level can occur at any fraction or multiple of a wavelength from the BPL emitter.¹⁸⁸

¹⁸⁵ See 47 C.F.R. § 15.31(f)(1) and (2). 47 CFR 15.31(f) applies 20 dB per decade for frequencies above 30 MHz and 40 dB per decade for frequencies below 30 MHz as distance extrapolation factors to adjust field strength measured at a distance other than the specified measurement distance. See also, footnote 181.

¹⁸⁶ See NTIA Comments at 8-9.

¹⁸⁷ See NTIA Comments at 16-17; see also letter of September 24, 2004 from Frederick R. Wentland, Associate Chief, NTIA Office of Spectrum Management, to Ed Thomas, Chief of the Commission's Office of Engineering and Technology.

¹⁸⁸ See Technical Appendix of NTIA Comments at § 3.

NTIA therefore submits in its comments that measurements taken at distances along the power lines that are fractions of a wavelength, as proposed in the *Notice*, will fail to reveal the peak field strength in many cases. To prevent underestimation of peak field strength during compliance measurements, in its comments NTIA recommends a comprehensive search for the peak field strength along the power lines at a height of one-meter. In its September 24, 2004 follow-up letter, NTIA supports the procedure in the *Notice* because it will not significantly underestimate the peak field strength.¹⁸⁹

96. c) *Height Correction Factor.* To avoid the need to search for the peak field in the height dimension as well, NTIA recommends use of a 5 dB height correction factor. Using NEC models, NTIA evaluated the distributions of heights and the magnitudes of peak field strength from over one-thousand combinations of nineteen power line configurations, polarization and location, at each of twenty-five BPL operating frequencies. This analysis revealed that 80 percent of the local field strength peaks at any height will be within 5 dB of the peak electric field strength measured along the power line at a height of one meter. In the large number of potential cases modeled by NTIA, the maximum field strength at any polarization over all cases exceeded the peak value measured one-meter height by up to 20 dB in small spatial regions. NTIA believes that the use of the 80 percentile value of 5 dB rather than the 100 percentile value of about 20 dB would avoid undue constraint on BPL systems without significant impact on interference risks. Thus NTIA states that use of a 5 dB height correction factor with the peak field strength measured at a one-meter height is a good estimate of the electric field strength not exceeded at 80% of the heights above one-meter.¹⁹⁰ Based on its further studies, NTIA reported in its September 24, 2004 letter that this height correction is not needed below 30 MHz and that above 30 MHz, the 5 dB height correction could serve as an alternative to varying the measurement antenna height as proposed in the *Notice*.

97. d) *Type of Antenna Used for Testing.* NTIA concurs with our proposal to use a loop antenna at frequencies below 30 MHz and an electric field antenna at higher frequencies.¹⁹¹ NTIA further recommends that an appropriate magnetic-to-electric field strength conversion factor be applied to enable correct comparisons of magnetic field measurements with the electric field strength limit, because a loop antenna measures magnetic field strength and the measurements are performed in the near-field.¹⁹² In its comments, NTIA indicated that it was continuing to study the issue of an appropriate conversion factor;

¹⁸⁹ See NTIA letter dated September 24, 2004.

¹⁹⁰ See NTIA Comments at vii and 20.

¹⁹¹ The NTIA Comments modify the position in the NTIA Phase 1 Study regarding the use of a loop antenna below 30 MHz by concurring with the FCC proposed position.

¹⁹² The issue here is the accuracy of the measured data. Most radiated emission specifications are given in terms of electric field strength (volts per meter), however, at low frequencies, the fields may be predominantly magnetic or electric. Many common antennas are more sensitive to one or the other type of fields; for example, dipole-based antennas are sensitive to electric fields but are not substantially affected by magnetic fields, which are sensed more readily by magnetic loop antennas. 47 C.F.R. Part 15 requires the use of a magnetic loop antenna below 30 MHz, because the Commission has found that calibrated loop antennas provide more accurate and repeatable field strength measurements below 30 MHz. However, the radiated emission limits are specified in terms of electric field, in volts per meter. To convert a measured magnetic field strength in dB μ A/m to an associated electric field strength in dB μ V/m in the far field region, one would add 20 log (377 ohms), or 51.2 dB, to the measured magnetic field strength.

however NTIA subsequently informed the Commission that it has now completed those studies and has arrived at the same conclusions as we arrive at below.¹⁹³

98. *e) Effects of Power Lines on the Radiated Emissions of BPL Devices.* NTIA found that its measurements and analyses show in most cases that peak field strength levels are not centered on the BPL device, and that multiple segments of the power lines and impedance discontinuities are the most significant BPL signal radiating elements.¹⁹⁴ Thus, NTIA recommends that BPL compliance measurements address both the BPL device and the power lines to which it is connected. It submits that field strength measurements should be performed at a 10 meter horizontal distance from the power line to which a BPL device is connected, and all along the connected power line wiring. Furthermore, because power lines have frequency selective radiation properties and BPL device frequencies are, or should be, tunable in frequency, NTIA states that Access BPL radiation characteristics are not uniform across all possible operating frequencies. Thus, to properly address frequency-selective radiation characteristics, NTIA recommends that measurements be made sequentially with the Access BPL devices operating at all frequencies at which they are capable; and should be accomplished using the maximum possible BPL device output power and operational duty factor.¹⁹⁵

99. *f) Selection of Representative Installations.* In order to ensure that the highest representative field strength levels are measured and that these levels do not exceed the limits, NTIA further recommends adoption of guidelines for selection of the three Access BPL deployments for *in situ* measurements and a rule specifying how those measurements are to be applied. In its comments, NTIA does not address rules and guidelines for the selection of test sites. However, the NTIA Phase 1 Study specifies that 1) the BPL device should be located near the center of a straight section of power lines at least 600 meters in length that is devoid of significant impedance discontinuities; and 2) a variety of representative medium voltage (MV) power line configurations should be present in the test site; for example, the site should include single and three-phase power line segments, sharp turns in the power line, and risers that connect overhead lines to underground lines.¹⁹⁶

100. *g) Other Requirements.* NTIA recommends that representative spectral power distributions of Access BPL signals be measured and included in the measurement report to facilitate identification of the BPL signals in the event they cause interference. NTIA also recommends that the locations and magnitudes of the six highest field strength levels measured at one meter height (plus 5 dB correction) should be recorded in the measurement report.¹⁹⁷ Furthermore, NTIA indicates that the measurement bandwidth to be used for testing BPL emissions, the measurement height correction, and the measurement

¹⁹³ See NTIA Comments at 20; see also letter of September 24, 2004 from Frederick R. Wentland, Associate Chief, NTIA Office of Spectrum Management, to Ed Thomas, Chief of the Commission's Office of Engineering and Technology, *supra*.

¹⁹⁴ See NTIA Phase 1 study, §5 and Appendixes D and E.

¹⁹⁵ For example, a BPL system that has 5 MHz bandwidth and can be tuned between 5 MHz and 30 MHz would be measured while tuned to 5 MHz, 10 MHz, 15 MHz...and 30 MHz. This principle should not be confused with the requirement to adjust measurement frequencies throughout frequency ranges specified in §15.33. See NTIA Comments at 21.

¹⁹⁶ See NTIA Phase 1 Study, §7.9.

¹⁹⁷ *Id.*, at 21.

distances should be embodied in the rules and not merely as guidelines, as BPL compliance measurement provisions are deemed most important to limitation of interference risks.¹⁹⁸

101. *Comments.* BPL providers strongly disagree with most of NTIA's findings and recommendations. Current states that NTIA's study is based on both computer simulations and field measurements of three distinct technologies of Access BPL systems, that these two types of studies did not yield consistent results, and that the discrepancies have not been reconciled. Current believes that a major weakness in the NTIA simulations is a set of starting assumptions that do not reflect actual Access BPL practice or specific system design or implementation. As a consequence, Current believes that any attempt to apply the NTIA simulation results to real-world BPL systems becomes inaccurate and unreliable. For example, Current contends that NTIA's simulations use a pure tone on the power line whereas real Access BPL uses a broadband signal having a far lower propensity to cause interference. Current further contends that while NTIA's simulations place the BPL signal on the power line by creating a differential voltage signal in the middle of the line, in practice that is all but impossible to do without cutting the line; and that, in reality, the couplers used by Current (and other Access BPL vendors) display very different characteristics, resulting in different propagation along the line. Current asserts that NTIA's interference model uses frequencies and line lengths that create a phase mismatch equal to 1/3 of a wavelength at each end of the line, thereby setting up standing waves; thus, the results are not representative of emissions from actual BPL devices using noise-like signals, which would not cause standing waves.¹⁹⁹ Finally, Current submits that each of NTIA's recommendations would unduly and unnecessarily burden BPL by impairing one or both of its core attributes for economic success, *i.e.*, transmission range and data capacity, because the proposals rest on NTIA's study which overestimates the interference potential of Access BPL.²⁰⁰ Ambient Corporation (Ambient) also echoed the concerns of Current regarding NTIA's simulations and measurements.²⁰¹ Southern states that many of NTIA's conclusions appear to have been based on its computer modeling, which even NTIA concedes had to be simplified due to the number of variables involved in modeling an electric power system and the limits on computer access memory.²⁰²

102. Duke Energy also argues that NTIA's recommendations are overly burdensome and unnecessary. Duke Energy believes that NTIA's suggestions that measurements be taken at the center of lines at least 600 m in length, devoid of discontinuities, and measuring at a variety of representative lines are impractical. Duke Energy further disagrees with NTIA's recommendation that Access BPL be measured sequentially across the entire band of operations, because it believes that this will create excessive testing burden.²⁰³ PPL Telcom states that it opposes use of the adjustment factor proposed by NTIA as an attempt to predict how measurements may increase with increasing height. PPL Telcom asserts that in its experience in deployment of Access BPL systems, it has found little and inconsistent increase in emissions with increasing height. It states that other factors in distribution power line construction, such as the type of construction, phase spacing, grounding configuration, age of equipment and type and number of electrical devices connected to the line appear to have as much, or more, influence on radiated

¹⁹⁸ See NTIA Comments at 23.

¹⁹⁹ Reply comments of Current Technologies at 18-19.

²⁰⁰ *Id.*, at 4-5.

²⁰¹ Reply comments of Ambient at 3.

²⁰² Reply comments of Southern at 26-27.

²⁰³ Reply comments of Duke Energy at 20-21.

emissions as measurement height. PPL Telecom also objects to NTIA's recommendation for measurements taken along distribution power lines that are at least 600 meters in length and devoid of impedance continuities because such lines are extremely rare and would make such a requirement impossible to fulfill.²⁰⁴

103. Progress Energy suggests that emission measurements should be performed with the Access BPL equipment power levels set for normal operations at the site being examined, not at the maximum levels as proposed in the *Notice*. Progress Energy also recommends that testing be performed during data transfer at a sustained rate that would be similar to, or slightly greater, than the expected usage at that site. It argues that performing the test with the equipment operating with the maximum power and duty cycle it is capable of generating, as proposed in the *Notice*, may not represent the normal operation of the equipment.²⁰⁵ Progress Energy furthers requests clarification regarding how to test if the Access BPL equipment installed at a site is from more than one vendor, which vendor's equipment should be used in testing and should three tests be conducted for each vendor's equipment?²⁰⁶ Ambient disagrees with NTIA's recommendation that a 5 dB correction factor should be added to emission measurement data taken with an antenna at one meter high. Southern disagrees with NTIA's recommendation that measurements be taken sequentially across the entire frequency range over which the BPL device could operate and states that such a requirement could greatly increase the costs of verifying BPL compliance without significantly improving the confidence that the device under test complies with the Part 15 limits.²⁰⁷ Southern further states that once a network is up and operating, conducting sequential testing across a large number of frequencies would be extremely difficult due to the need to coordinate frequency usage among all the devices on the same line as the device under test. In fact, Southern states that it might be necessary to take the network down in order to conduct such testing; hence NTIA's proposals are overly burdensome.²⁰⁸

104. The UPLC advocates measurements on overhead installations parallel to the power line at various distances from each BPL device and on underground installations at various radials from the devices. The UPLC recommends that all measurements be taken in accordance with the Part 15 rules, at one to four meters above ground and at a distance of 10 meters away from the line. The UPLC specifically opposes measuring for peak field strength at every frequency all along the power line and taking measurements at the height of the power line, or alternatively, using an adjustment factor for estimated increased signal strength at that height.²⁰⁹

105. Ameren states that its main concern with any search procedure for finding the peak field strength along the line is the upper bound of the number of necessary measurements. Ameren agrees, however, in general terms with the NTIA's study findings concerning the field variability with respect to observation (measurement) height. Ameren has performed its own theoretical modeling and submits that its model shows that the maximum field seen from zero to 15 meters above ground at any distance from the BPL

²⁰⁴ NTIA Phase 1 Study at 7-6, reply comments of PPL at 15. NTIA did not repeat this recommendation in the NTIA Comments, submitted after the NTIA Phase 1 Study.

²⁰⁵ Comments of Progress at 3.

²⁰⁶ *Id.*, at 4.

²⁰⁷ *Id.*, at 39.

²⁰⁸ *Id.*, at 40.

²⁰⁹ Reply comments of UPLC at 23.

device along the line is at most 3.5 dB greater than the maximum field seen at 1 meter above ground at any distance from the BPL device along the power line.²¹⁰ Ameren therefore affirms that NTIA's proposed 5 dB height correction factor is close to Ameren's proposed 3.5 dB; and that until better correlation can be established, Ameren urges we to allow the more lenient factor of 3.5 dB proposed by Ameren.

106. In its comments, the ARRL concurs with our proposed measurement guidelines, but states that measurements should be made at a fixed 10 meter distance.²¹¹ In its reply comments, the ARRL states that the 5 dB correction factor recommended by NTIA makes sense and that use of the 5 dB correction factor is a far simpler mechanism than to attempt to find field strength peaks at various distances from the lines and at various heights as well. The ARRL nonetheless believes that any combination of NTIA's well-intentioned technical operating requirements would still be insufficient to avoid widespread interference to Amateur Radio stations in residential areas, or in vehicles.²¹² This concern is echoed in filings from individual Amateur operators.²¹³

107. *Decision.* We find the extensive measurement and modeling efforts presented in the NTIA Phase 1 Study and the Technical Appendix to NTIA's comments to be highly useful in our efforts to develop appropriate measurement procedures for Access BPL. The scientific engineering in those submissions clarifies the interference potential of Access BPL on radio reception and the recommended techniques for measurement of Access BPL emissions provide us with a well thought-out plan on which to base our decisions on measurement issues. Our decision, discussed below, takes into account NTIA's research and adopts a modified version of its recommendations.

108. We find that our proposed measurement procedure for testing Access BPL systems including the presence and testing of all of their electronic components to be reasonable as each component is part of the Access system of that installation. We do not agree with Southern that the testing should be limited to three representative signal injection points.²¹⁴ Southern believes that the highest levels of emissions on overhead systems are found at the signal injection point, and it states that the biggest variable affecting emissions is impedance mismatch between the signal injection system and the power system at the point of injection, which could be a coupler or a repeater. We agree with Southern that each injection point affects the radiated emissions. However, Southern's suggestion of selecting only representative signal injection points precludes the presence of other components, *e.g.*, booster, concentrator, extractor, etc. if they should be together at an installation to make up the complete Access BPL system. Our requirement for a typical installation takes into account the topology of the power lines and of all Access BPL devices at that installation, thus choosing only representative injection points, as Southern recommends, does not cover the installation as a whole.²¹⁵ Accordingly, we will keep our proposed *in-situ* requirements for including and testing all components of an Access BPL system. We also find that our measurement procedure for testing Access BPL systems *in situ* at three typical underground locations along a number of radials consistent with testing other Part 15 carrier current devices. The selection of three typical

²¹⁰ Reply comments of Ameren at 5.

²¹¹ ARRL comments at 25.

²¹² Reply comments of ARRL at 24.

²¹³ *See, e.g.*, comments of David Garnier; Edwin S. Toal; John E. Matz; Richard E. Polivka; Thomas D. Cox, etc.

²¹⁴ *See* comments of Southern at 21.

²¹⁵ *See* 47 C.F.R. § 15.31(j) and (k).

underground installations is a streamlined procedure, compared to testing each and every installation, as recommended by some parties;²¹⁶ therefore we do not agree with Main.Net that only one underground location should be tested.²¹⁷ We discuss below the issues with respect to measuring radiated emissions from Access BPL systems on overhead power lines.

109. *Measurement Distance.* Despite the stated aversion of NTIA and ARRL to distance extrapolation, we recognize that at many *in situ* test locations, it may not be possible or practicable to measure at the proposed fixed distances of 10 and 3 meters. If a 10-meter distance places the measurement antenna on a roadway, safety may dictate increasing the distance to, *e.g.*, 14 meters in order to position the testers out of harm's way. Hence, we expect that distance extrapolation will be necessary for *in situ* testing. We note that NTIA's latest computer modeling results show that the variation of field strength with distance is consistent with the existing Part 15 distance extrapolation when used with the slant range distance to the power line as was proposed in Appendix C of the *Notice*. We also note that although the ARRL and ARINC recommend the use of a 20 dB per decade extrapolation factor rather than the existing 40 dB per decade in Part 15 for frequencies below 30 MHz, Ameren states that it has determined the characteristics of the fields near the line support the case for assuming a 40 dB per decade decay rate of the field away from the line and recommends the use of the existing 40 dB per decade extrapolation factor.²¹⁸ Given the lack of conclusive experimental data pending large scale Access BPL deployments, we will continue the use of the existing Part 15 distance extrapolation factors in our rules, but with the slant range rather than horizontal distance.²¹⁹ If new information becomes available that alternative emission limit/distance standards or extrapolation factors would be more appropriate, we will revisit this issue at another time.

110. *Receive Antenna Height and Correction Factor.* NTIA expresses a possible need for "adjustments" to measured data due to three factors: 1) effect of antenna height, 2) effect of distance (extrapolation methods), and 3) effect of using an H-field sensing antenna to predict E-fields in the near-field region. However, NTIA initially provided a specific recommendation regarding only one of these issues—correction for the effect of antenna height. Our modeling suggests that there is a linkage between these factors. We believe that all three areas must be considered together in order to develop appropriate measurement procedures. Furthermore, NTIA's recommendation for a 5 dB correction factor is based on a constant measurement antenna height of 1 meter. On the other hand, for frequencies above 30 MHz, our current measurement guidelines require varying the receive antenna height from 1 to 4 meters, hence higher peaks at a higher antenna height would be found with our test procedure, obviating the need for a height correction factor at those frequencies. However, we recognize that NTIA's method of keeping the antenna height constant and applying a height correction factor is aimed at simplifying the measurement procedure; hence, this might be an alternative testing procedure that BPL providers may actually prefer. The Commission's rules have historically allowed the use of alternative methods for compliance measurements, based on good engineering practices. In deference to NTIA's extensive work culminating in the NTIA recommendations in this proceeding, we will adopt NTIA's recommendations for antenna height and correction factor as an alternative method within the measurement guidelines of Appendix C. We note however that the methods are mutually exclusive, *i.e.*, the BPL tester must choose either the NTIA alternative method or the FCC method, and cannot mix and match the two.

²¹⁶ See *e.g.*, comments of API at 9-10; reply comments of ARINC at 7.

²¹⁷ See comments of Main.Net at 9.

²¹⁸ See reply comments of ARINC at 2 and Ameren at 8; comments of ARRL at 15.

²¹⁹ See 47 C.F.R. § 15.31(f)(1) and (2).

111. *Type of Antenna Used for Testing.* Given NTIA's concurrence with the use of a magnetic loop antenna for emission measurements below 30 MHz and electric field sensing antennas above 30 MHz, we are adopting our proposal to use these antenna types in Access BPL emission measurements. This decision is consistent with the use of such antennas for testing other types of Part 15 devices.

112. *Effects of Power Lines on the Radiated Emissions of a BPL Device.* We are concerned that NTIA's recommendation for performing field strength measurements all along a 1200-meter section of the connected power line wiring would be difficult and burdensome for Access BPL system operation. In this regard, we note that such a process could be time-consuming and would require many individual measurements, when power wiring may be many miles long, and the interval between measurements may have to be a small fraction of a wavelength in order to ensure that the true peak is captured. It is clear from the modeling results presented by NTIA that the maximum emission from the system often occurs further down-line from the coupler than the one-wavelength maximum distance proposed in Appendix C of the *Notice*. However, it is also clear from the NTIA data that the true maximum is not significantly larger than the maximum that would be found over the limited search space that we proposed. We understand the concerns of Ameren, Southern, and other BPL providers regarding an overly large number of necessary measurements, which could increase the costs of compliance testing. We therefore believe that the approach in our proposed measurement guidelines strikes an appropriate balance in avoiding a potentially very large number of measurements by allowing the use of the mid-band frequency in determining measurement distances down-line for a given frequency band of operation. We also note that, at each of the five specified down-line points, measurements must be made at all operating frequencies of the Access BPL device, in order to find the peaks.²²⁰

113. We concur with NTIA's recommendation that measurements be made sequentially with the Access BPL devices operating at all frequencies at which they are capable. This is consistent with existing Part 15 requirements, and with our proposed measurement guidelines.²²¹ It is important that radiated emissions be measured at all operating frequencies to find the peaks.²²² We also concur with NTIA's recommendation that measurements be made using the maximum possible BPL device output power and operational duty factor. We disagree with Progress Energy that emission measurements should be performed with the Access BPL equipment power levels set for normal operations at that site, and not at the maximum levels.²²³ Testing at the BPL maximum output power and operational duty factor is necessary to ensure identification of the maximum field strength that the device is capable of generating. The measurement report and operating instructions must clearly state the maximum output power and duty factor settings necessary to certify that the installed device will comply with our limits. However, because the same device might be used on either overhead or underground power lines having different radiating properties, we are not requiring that the device be modified to prevent operation at higher power levels and duty cycle settings. Furthermore, Access BPL devices must comply with our limits upon power-up following a fault condition, or during a start-up operation after a shut-off procedure,

²²⁰ The specified down-line points are at distances of 0, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 wavelength down the line from the BPL injection point on the power line. Wavelength spacing is calculated based on the mid-band frequency of each operating frequency band used by the Access BPL device.

²²¹ 47 C.F.R. § 15.31(i) requires emission tests to be performed with the device and accessories configured in a manner that tends to produce maximized emissions within the range of variations that can be expected under normal operating conditions. Appendix C of the *Notice* proposed to require testing at all frequencies, but allows the use of five points based on the wavelength of the mid-band frequency

²²² *Id.*

²²³ Comments of Progress Energy at 3. *See also* ¶102.

by the use of a non-volatile memory, or some other method, to immediately restore previous settings with programmed notches and excluded bands. This is necessary to avoid the situation where programmed protection schemes, such as excluded bands and notches, have to be restored manually, thus leaving protected licensed services vulnerable during the time delay caused by a manual re-programming procedure.

114. Based on the foregoing, we believe that our proposed measurement guidelines that require selection of fractional wavelengths based on mid-band frequency for down-line measurements strike an appropriate balance between the need to ensure compliance with the rules and practical considerations of the burden and degree of measurement difficulty placed on system operators, and that our requirements for testing at maximum output power and operational duty factor and requirement for clear identification of maximum compliant operating levels will ensure that devices comply under all conditions. Accordingly, we are adopting the measurement guidelines in Appendix C of the *Notice*, modified to incorporate some of NTIA's recommendations, as discussed *supra*.

115. *Selection of Representative Installations.* Although we concur with NTIA that the selection of typical Access BPL installations for *in situ* measurements must be made in a careful manner, taking into account the various configurations of the power lines to select a typical, representative installation, we will not require specific criteria for site selection process, because this may limit the number of test sites which may actually be more typical in a specific provider's service area than those recommended by NTIA.²²⁴ We find that our proposed guidelines for three typical overhead installations and three typical underground installations are reasonable to cover a number of test sites in deployment.²²⁵ We also find that by requiring Access BPL devices to be certified by the equipment manufacturer, the concerns of Progress Energy regarding Access BPL installation sites with multiple vendors' equipment no longer exist because the responsibility for site selection to test for equipment certification purposes rests with the Access BPL manufacturer and not with the utility.²²⁶ We are however recommending that the utility operator verify that each representative Access BPL site complies following the installation of a separately certified Access BPL equipment. In such cases, the selection of the test site should be based on the characteristics of the installation and not on vendor's equipment types. Additionally, we concur with Southern and UPLC that NTIA's recommendation in the NTIA Phase 1 Study of requiring a representative power line of 600 meters devoid of discontinuities is impractical, because of the difficulty of finding such a line. Accordingly, in the absence of more specific input, we will not require the selection of such a specific type of power line.

116. *Other requirements.* We find that NTIA's recommendations regarding the various reporting requirements for the test report are satisfied by our adoption of the certification procedure for Access BPL equipment authorization, discussed *infra*.²²⁷ Information regarding the test conditions, spectrum distribution and other relevant technical specifications will be required in the certification report for the equipment, which will be accessible through our equipment authorization database. We further find that NTIA's recommendation to embody requirements such as measurement distance, measurement

²²⁴ See *NTIA Phase 1 Study*, §7.9. NTIA recommends to select a test site with a variety of representative medium power line configurations, *i.e.*, the site should include single and three-phase power line segments, sharp turns in the power line and risers that connect overhead lines to underground lines.

²²⁵ Appendix C, *Notice*, at §2.

²²⁶ See comments of Progress Energy at 4. See also ¶103.

²²⁷ See ¶124.

bandwidth, etc. directly into the rules and not merely as guidelines, would not be consistent with our current practice of including measurement specifications in a separate guideline.²²⁸

2. In-House Carrier Current Systems

117. In the *Notice*, we noted 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 *Emissions from Information Technology Equipment* has been developing conducted emission limits for new BPL technologies.²²⁹ We observed that this work on an international standardized measurement method for In-House BPL is still under way, including the definition of a line impedance stabilization network (LISN),²³⁰ associated injection methods, and conducted emission limits for systems using the power line port as a communication port.²³¹ We proposed 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 of the *Notice*. We sought comments on using these guidelines for In-House BPL and other carrier current systems.²³²

118. The HomePlug PowerLine Alliance (HomePlug) supports application of the existing rules for *in situ* testing of In-House BPL and other carrier current systems, but disagrees with the proposal to require testing along the outside service lines at specified distances because it contends that in many instances it will be impractical to find test sites suitable for the proposed measurements.²³³ HomePlug argues that the detailed guidelines would require test sites with low voltage service wires longer than 110 feet with 33 feet of clear space along both sides of the wire (66 feet total) for its entire length, and that finding such sites would limit choices of tests sites to those not necessarily representative of typical In-House BPL installations. HomePlug contends that application of the proposed test guidelines to In-House BPL systems with respect to the points along the service wires would be overly burdensome and serve no useful purpose.²³⁴

119. *Decision*. We note that although CISPR is continuing to work on addressing emission issues that will apply to In-House BPL, no final recommendation has been adopted.²³⁵ We also note that most

²²⁸ See e.g., *Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, 18 FCC Rcd 24484 (2003).

²²⁹ *Notice* at 47.

²³⁰ 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.

²³¹ See the work of IEC CISPR Subcommittee I on *Interference Relating To Multimedia Equipment*, Working Group 3 on *Emissions from Information Technology Equipment*, at < <http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=sea1112.p&committee=CIS%2FI&class=&refno=&type=&date> >.

²³² See *Notice* at ¶47 and *Notice*, Appendix C at 31-33.

²³³ Comments of HomePlug at 1-2.

²³⁴ *Id.*, at 6-7.

²³⁵ CISPR is working on a committee draft (CD) for power line communications (PLC), but the draft is far from being finalized as an international standard. See <http://www.iec.ch/cgi-> (continued....)

commenters in this proceeding address Access BPL, and not In-House BPL, issues. Measurements along the service wire leading to the house have been proposed because this wire can be one of the conduits for radiation coming from In-House BPL devices. We are sympathetic to HomePlug's concerns, however. To address HomePlug's concerns, we will allow measurements to be made at three different points along the wire, where the highest radiated emissions are found; these points would not need to be associated with specific wavelengths of the device's operating frequencies, if the installation under test does not include a service wire with a sufficient length for the required measurements.²³⁶ Moreover, testing is required on only one side of the service wire because radiation is nearly symmetrical on either side of the wire. The test report must provide documentation explaining the test configuration. As for the required clear space along the service wire, the guidelines do allow the test to be performed at 3 meters with a distance extrapolation factor when a 10-meter clearance is not available, hence we would expect that most residence configurations would not pose any clearance problem. Accordingly, we partially grant HomePlug's request and hereby adopt the guidelines for In-House BPL and all other in-house types of carrier current systems in Appendix C of this Report and Order.

F. Equipment Authorization

120. In the *Notice*, we proposed to retain the Verification procedure for Access BPL equipment. Section 302 of the Communications Act of 1934, as amended, authorizes the Commission to make reasonable regulations, consistent with the public interest, governing the interference potential of equipment that emits radio frequency energy. Under Section 302, we establish technical regulations for transmitters and other equipment to minimize their potential for causing interference to radio services, and administer an equipment authorization program to ensure that equipment reaching the market complies with the technical requirements.²³⁷ The authorization program requires that equipment be tested either by the manufacturer or at an independent test laboratory to ensure that it complies with the technical requirements. The authorization program specifies several procedures for demonstrating equipment compliance. The procedure to which a device is subject depends on the risk of interference that the equipment poses to licensed radio services.

121. *Certification* is an equipment authorization issued by the Commission or its designated entities²³⁸ based on representations and test data submitted by the applicant.²³⁹ *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

(Continued from previous page) _____
bin/procgi.pl/www/iecwww.p?wwwlang=E &wwwprog=seal112.p&committee=
CIS%2FI&class=&refno=&type=&date=.

²³⁶ In addition to testing radials around the building, testing for In-House BPL shall be performed at three positions along the overhead line connecting to the building (*i.e.* the service wire), where the maximum emissions are found. It is recommended that these measurements be performed starting at a distance 10 meters down the line from the connection to the building. If this test cannot be performed due to insufficient length of the service wire, a statement explaining the test condition and configuration shall be included in the technical report. *See* Appendix C, § 3(b)(1).

²³⁷ *See* 47 U.S.C. § 302(a).

²³⁸ In 1999, the Commission made changes to Part 2 of the rules to allow designated private organizations, called Telecommunication Certification Bodies (TCBs), to approve equipment in the same manner as the Commission, *see Report and Order* in GEN Docket 98-68, 13 FCC Rcd 24687 (1999).

²³⁹ *See* 47 C.F.R. § 2.907.

other necessary steps to ensure that the equipment complies with the appropriate technical standards.²⁴⁰ The laboratory performing the measurements, either the manufacturer's laboratory or an independent test laboratory, must be accredited.²⁴¹ A copy of the DoC, listing the party responsible for compliance, must be included in the literature supplied with the product. *Verification* is 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.²⁴² However, unlike the DoC procedure, verification does not require that measurements be made by an accredited laboratory and does not require a DoC to be supplied with the equipment.

122. In the *Notice*, we recognized that administrative burdens and the need to ensure compliance with the rules must be balanced in order to ensure that regulatory requirements keep pace with Access BPL technology development.²⁴³ We therefore proposed to keep the authorization procedure for Access BPL equipment the same as for all unintentional radiators, including traditional types of carrier current systems. We noted that 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 that the verification procedure has been adequate to ensure that such systems comply with the rules.²⁴⁴

123. BPL providers strongly support retaining verification as the equipment authorization procedure for Access BPL equipment.²⁴⁵ On the other hand, amateurs and some other organizations recommend that we apply the certification procedure because they believe that the Commission should maintain close oversight of Access BPL technology.²⁴⁶ The ARRL believes that use of the verification procedure for Access BPL devices is unreasonable, because of its concerns that Access BPL devices pose more substantial interference potential than other Part 15 unintentional radiators.²⁴⁷ NTIA recommends certification by the operator, rather than by the manufacturer, because Access BPL is deployed by utilities operators who receive the BPL service revenue benefit and have strong incentives to ensure that interference risks are properly limited and that technical standards are not violated.²⁴⁸ In its reply comments, Current states that a provider cannot rationally assume responsibility for products over whose manufacture it has no control, thus, a provider, purchasing equipment from a vendor cannot make compliance representations based on its own knowledge.²⁴⁹

²⁴⁰ See 47 C.F.R. § 2.906.

²⁴¹ See 47 C.F.R. § 2.948(d). The laboratory must be accredited by the American Association for Laboratory Accreditation (A2LA), the National Voluntary Laboratory Accreditation Program (NVLAP) or a Designating Authority of a trading partner having a Mutual Recognition Agreement/Arrangement (MRA) with the United States

²⁴² See 47 C.F.R. § 2.902.

²⁴³ See *Notice* at ¶44.

²⁴⁴ *Id.*

²⁴⁵ See comments of Ameren at 10; UPLC at 13; Main.Net at 8; Current Technologies at 24; PPL Telcom at 8; Duke Energy at 13-14; HECO at 5.

²⁴⁶ See *e.g.*, comments of AMA at 9; ARRL at 24; David Garnier; Gary C. Sutcliffe.

²⁴⁷ See comments of ARRL at 23.

²⁴⁸ See comments of NTIA at 14.

²⁴⁹ See reply comments of Current Technologies at 37-38.

124. Upon careful consideration of the record, we find that Access BPL systems are not typical unintentional radiators, and that emission measurements for such systems *in situ* are critical in determining their interference potential. We are persuaded by NTIA that the newness of the Access BPL measurement procedures warrants review of measurement reports.²⁵⁰ We therefore conclude that the Certification procedure is appropriate for this new technology to allow us to maintain oversight until additional operational experience is obtained from its wide deployment. While we appreciate NTIA's concerns for assigning responsibility with respect to Access BPL compliance, we do not find that the operator, rather than the Access BPL equipment manufacturer, should bear the burden of the certification requirement. Since a system operator does not control the manufacture of the equipment, it will not be in a position to control production to ensure that each unit marketed conforms to the unit tested for compliance.²⁵¹ We believe that the legal and business relationship between the system operator and the BPL manufacturer will be sufficient to ensure that Access BPL equipment installed on a power line be in compliance with our rules. We do, however, strongly recommend that operators perform initial installation and subsequent periodic testing on their systems in order to ensure that the systems maintain compliance with our emission limits.

125. Based on the foregoing, we are subjecting Access BPL to the certification procedure to be carried out by the equipment manufacturer. We are also clarifying that we are retaining the verification procedure for all carrier current systems other than Access BPL, because the verification procedure has been adequate to ensure that other types of carrier current systems comply with the Part 15 rules.

126. We also specify that Access BPL certification will be initially performed by the Commission. In General Docket 98-68, we established the requirements for Telecommunication Certification Bodies (TCBs) that are allowed to approve equipment in the same manner as the Commission.²⁵² In that proceeding, we stated that while we intended to use TCBs to certify a broad range of equipment, we found that certain functions should continue to be performed by the Commission.²⁵³ The functions included certifying new or unique equipment for which the rules or requirements do not exist or for which the application of the rules is not clear.²⁵⁴ Because Access BPL is a new technology and many questions about the application of the rules may arise, we believe that TCBs should not be permitted to certify Access BPL systems or approve permissive changes to Access BPL systems until the Chief of the Office of Engineering and Technology acting under the existing delegated authority announces that TCBs may certify Access BPL systems.²⁵⁵

²⁵⁰ NTIA at ix.

²⁵¹ 47 C.F.R. §2.931.

²⁵² *See In the Matter of 1998 Biennial Regulatory Review – Amendment of Parts 2, 25 and 68 of the Commission's Rules to Further Streamline the Equipment Authorization Process for Radio Frequency Equipment, Modify the Equipment Authorization Process for Telephone Terminal Equipment, Implement Mutual Recognition Agreements and Begin Implementation of the Global Mobile Personal Communications by Satellite (GMPCS) Arrangements*, Report and Order, FCC 98-338, 13 FCC Rcd 24687 (1999).

²⁵³ We currently do not allow TCBs to certify equipment requiring measurements of the specific absorption rate (SAR) of RF radiation by the body.

²⁵⁴ *Id.* at ¶ 33.

²⁵⁵ *See* 47 C.F.R. § 0.241(g).

G. Miscellaneous

127. *Transition Period and Grandfathering of Existing Access BPL Equipment.* In the *Notice*, we sought comment on the appropriate period of time that should be allowed for BPL systems to come into compliance with any new requirements that may be adopted pursuant to this rule making proceeding. We further requested 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.²⁵⁶

128. Some parties recommend that existing Access BPL systems be grandfathered indefinitely, stating that early adopters of new technologies should not be required to bear the burden of after-the-fact revisions to the technical standards, as long as the installations cause no harmful interference.²⁵⁷ Others believe that 18 to 36 months would be an appropriate period of time for existing systems to come into compliance with the new rules, citing the fact that technology is advancing so rapidly that early equipment is likely to be replaced on a rapid schedule. These parties contend that mandating premature replacement of Access BPL equipment would cause economic burden with little or no regulatory benefit.²⁵⁸ The City of Manassas, a municipal BPL provider, states that a 30-day period for bringing equipment into compliance would be practical and appropriate, if the new requirements do not require the addition of new facilities or significant software modifications.²⁵⁹ The CEA states that it is not necessary to require existing Access BPL systems to be brought into compliance with the adopted rules, however, it believes that all systems, even systems currently deployed, should be required to comply with the notification requirements of section 15.109(g).²⁶⁰ Amateurs and other groups recommend retroactive application of the adopted rules.²⁶¹

129. We note that the major differences between the existing Part 15 rules for carrier current systems and the newly adopted rules in subpart G for Access BPL are 1) the type of equipment authorization procedure, --Verification for existing carrier current systems, Certification for Access BPL systems; 2) the requirement for interference mitigation techniques and avoidance of excluded bands and exclusion zones for Access BPL systems; and 3) the requirement for an Access BPL database concurrent with consultation with licensed spectrum users. Insofar as existing deployed Access BPL systems can satisfy (2) and (3) above by working with licensed spectrum users to avoid co-channel operations, and by being listed in the Access BPL database, the requirements of (1) above can be satisfied by having compliance test data available for inspection during the transition period. We clarify that after the transition period, all Access BPL devices that are manufactured, imported, marketed or installed shall comply with the requirements specified in subpart G of Part 15, including certification of the equipment.

130. We believe that it would be an undue burden on those operators who have deployed Access BPL systems to require their systems to come into compliance with the rules adopted herein, as long as the deployed equipment does not cause harmful interference and the operator takes the necessary steps to eliminate occurrences of harmful interference. We agree with Progress Energy that once a system has

²⁵⁶ *Notice* at ¶42.

²⁵⁷ *See* comments of Duke Energy at 11-12; Southern at 19-20; APPA at 6.

²⁵⁸ *See* comments of Sprint at 4; Current Technologies at 20; UPLC at 9.

²⁵⁹ *See* comments of City of Manassas at 4.

²⁶⁰ *See* comments of the Consumer Electronics Association at 7.

²⁶¹ *See e.g.*, comments of the Potomac Valley Radio Club at 10.

been installed and is operating within the limits and requirements in place when it was installed, the system should be allowed to remain in operation.²⁶² We will, of course, require that all Access BPL systems and equipment comply with the non-interference rule of Part 15, that is, there is not transition period for compliance with the emission limits, which we are not changing herein.²⁶³ We find that Access BPL equipment should be allowed a transition period for compliance with new rules, in the manner that we typically provide for other Part 15 devices. This will minimize economic hardships on manufacturers by allowing them, during the transition period, to continue producing and selling existing equipment while modifying their products to meet the new requirements. If an Access BPL device does not cause harmful interference, it can continue to operate until its natural replacement, unless the equipment is subsequently modified, at which time it must be brought into compliance with the new rules. We believe that a transition time frame of 18 months is adequate as this represents the typical high tech equipment life cycle. Accordingly, we are adopting a cut-off date of 18 months from the date of publication of this Report and Order. All Access BPL devices that are manufactured, imported, marketed or installed 18 months after the publication of this Report and Order in the Federal Register shall comply with the requirements specified in subpart G of this part, including certification of the equipment. Access BPL equipment manufactured, imported, marketed and installed prior to this date shall comply with the requirements that were in effect immediately prior to the effective date of this Report and Order.

131. *Separate Rule Part for Access BPL Systems.* NTIA and IEEE 802.18 advocate the creation of a new, dedicated rule part or a separate subpart of Part 15 for Access BPL systems, because many of the adopted rules will be unique to Access BPL.²⁶⁴ We find that the complete separation of the rules for Access BPL equipment from Part 15 inadvisable due to possible confusion and repetition of requirements in two places, as Access BPL equipment must comply with the general requirements for unlicensed devices of Subparts A-C of the existing Part 15 rules. We do, however, find that requirements specific to Access BPL equipment warrant the creation of a separate subpart of Part 15. Accordingly, we are adding subpart G to Part 15 of our rules which will contain unique requirements for Access BPL equipment, with cross reference to other applicable subparts.

132. *Motions and Requests.* We have received several motions and requests for additional extensions of time and for reiteration of proposals to take into account information added to the record since the *Notice*. We are generally considering the substance of these motions and requests as filed comments, and denying the specific procedural remedies requested, as they offer no new information or arguments sufficient to justify procedural delays, nor do they raise issues beyond those already explicitly or implicitly included in the record and capable of full consideration in this Order.

133. On May 8, 2004, James E. Whedbee filed a Motion to Dismiss and to Dismiss Notice of Proposed Rulemaking for Want of Supplemental Jurisdiction, alleging lack of jurisdiction from the Commission over the transmission of energy by wire.²⁶⁵ As Access BPL systems use radio frequencies for interstate

²⁶² See comments of Progress Energy at 7.

²⁶³ See 47 C.F.R. § 15.5. Under these rules, operators of Access BPL systems are responsible for eliminating any harmful interference that may occur or must cease operation upon notification by a Commission representative, even if the equipment otherwise complies with the rules. We also point out to Access BPL system operators that ARRL's measurements appear to show that in some cases systems operating to date have exceeded the Part 15 emissions limits. We again urge that Access BPL operators undertake to verify that their systems are in compliance throughout their areas of operation and where necessary make changes to bring them into compliance.

²⁶⁴ NTIA Comments at 24-25; reply comments of IEEE 802.18 at 3.

²⁶⁵ James E. Whedbee, Motion to Dismiss and to Dismiss Notice of Proposed Rulemaking for Want of Supplemental Jurisdiction, filed May 8, 2004.

communications purposes over wire, this Commission has full jurisdiction over such transmissions.²⁶⁶ Accordingly, we deny Whedbee's motion.

134. On June 22, 2004, NAC/Amherst filed an Amended Motion for Re-issuance of Certain Proposed Rule Provisions, in which it requested a re-issuance of proposed interference provisions that feature "greater clarity and completeness" than the language in the current version of the proposed rule.²⁶⁷ In its motion, NAC/Amherst submitted a request for re-issuance of the text of the proposed Part 15 rules to set forth more specific standards for adaptive interference techniques, special procedures and criteria for dealing with potential BPL interference that violates international treaties, requirements for public access to the database, and other specific explanations for the proposed rules, etc, in conjunction with new dates for comments and reply comments to the re-issued proposed rules. This motion follows other similar motions and requests from NAC/Amherst.²⁶⁸ NAC/Amherst's motions are denied. The Administrative Procedure Act (APA) requires that an agency publish general notice of proposed rules in the Federal Register, and that interested parties are sufficiently informed to reasonably divine the possible outcome of the proceeding.²⁶⁹ An additional round of comments is not required where changes from the proposals represent a logical outgrowth of the proposals.²⁷⁰ Our *Notice* clearly indicated that performance standards and interference resolution procedures would be determined in the proceeding, and indicated what parameters – e.g., notification requirements, equipment capabilities, time frames, and appeals – would be included. While it did not propose specific quantification for several of those elements, parties were able to comment on those factors and to reply to the proposals of others. The Commission's decision, as indicated in the substantive discussion above, is based on the information provided by and available to all parties in this proceeding. NAC/Amherst's substantive points regarding the definition of Access BPL to clarify whether it encompasses other Access BPL technologies, such as the Corridor Access BPL system, are considered in our disposition of that issue.²⁷¹ NAC/Amherst's substantive point regarding the details of adaptive interference mitigation techniques and performance standards for interference mitigation and shut down provisions, as well as notification requirements are considered in our disposition of those issues.²⁷² NAC/Amherst's substantive points regarding eligibility/selection of an "industry-operated" entity are considered in our disposition of that issue.²⁷³ NAC/Amherst's substantive points regarding a requirement for Access BPL to transmit an identification code are considered in our disposition of that issue.²⁷⁴ NAC/Amherst's substantive point regarding BPL-free zones and mobile emergency

²⁶⁶ See 47 U.S.C § 152.

²⁶⁷ See National Antenna Consortium and the Amherst Alliance (NAC/Amherst), Amended Motion for Re-issuance of Certain Proposed Rule Provisions, filed June 22, 2004.

²⁶⁸ See also, Motion for Extension of the Reply Comments Deadline and for Re-Issuance of Certain Proposed Rule Provisions from NAC/Amherst, filed May 21, 2004; and Letter from NAC/Amherst, filed June 23, 2004.

²⁶⁹ 5 U.S.C. § 553(b).

²⁷⁰ See, e.g., *Public Service Commission of the District of Columbia v. FCC*, 906 F. 2d 713, 717 (D.C. Dir. 1990).

²⁷¹ See discussion in ¶¶32-33, *supra*.

²⁷² See discussion in ¶¶65-68, ¶¶49-53 and ¶¶72-73, *supra*.

²⁷³ See discussion in ¶¶83-87, *supra*.

²⁷⁴ See discussion in ¶68, *supra*.

communications are considered in our disposition of that issue.²⁷⁵ Finally, we disagree with NAC/Amherst's contention that there was insufficient time allotted for parties to respond to NTIA's Phase 2 report, as evidenced by the ample comments received in the record, and as evidenced by NTIA comments that were submitted subsequent to the NTIA Phase 1 Study, in which, NTIA affirms that although its Phase 2 Study will be devoted to ionospheric propagation and aggregation of emissions from Access BPL systems, this is not a potential near-term issue that should delay adoption of Access BPL rules.²⁷⁶ While we indicated, in establishing a new reply comment date, that the date was based in anticipation of the filing by NTIA, we also indicated that the reply comment date was not firmly tied to the NTIA filing. We retained the prerogative to further extend the reply comment date if necessary and, based on the date of filing and the substance of the Phase 2 Report, such a further extension was not warranted. Moreover, in its comments, NTIA urged the Commission to promptly adopt effective new technical rules that will enable BPL proponents to develop and implement the necessary new design features and operating practices for addressing interference concerns.²⁷⁷ Accordingly, we deny the NAC/Amherst's motions.

135. On June 9, 2004, Steven E. Matda filed a Motion for Re-issuance of the *Notice*, if recommendations are added to the eventual rule based on the NTIA's findings, asserting that because NTIA suggested several additional rules to remedy BPL interference, it is impossible for parties to know how they will be affected by the final rule.²⁷⁸ As discussed *supra*, the NTIA findings were appropriately placed in the record, and parties have had ample opportunity to consider and respond to them. Accordingly, we deny Matda's motion.

136. On July 8, 2004, W. Lee McVey submitted a Motion Requesting a Second Notice of Proposed Rulemaking in this proceeding, asserting that additional relevant data and findings have been entered into the record that offer compelling reasons for both modifications and additions to Part 15 that would be substantially different than those that formed the basis for the proposed codified language in the *Notice*.²⁷⁹ This Motion follows a similar motion filed on June 3, 2004, requesting additional time for re-issuance of proposed rules.²⁸⁰ McVey's motions are denied as there is ample information in the *Notice* and the subsequent record to have provided opportunity for informed and pertinent comment on the rules as ultimately adopted, as indicated in the analysis supporting our conclusions regarding adaptive control requirements.²⁸¹ The substance of McVey's remarks, which are similar to the NAC/Amherst substantive points in its motions, was taken into consideration as comments in reaching our decisions. Accordingly, we deny McVey's motions.

137. On October 12, 2004, the ARRL filed a Motion for Recusal of Chairman Michael K. Powell from this proceeding, alleging that the presence of the chairman at a BPL demonstration in the city of

²⁷⁵ See discussion in ¶¶51-53, *supra*.

²⁷⁶ See NTIA Comments, filed June 8, 2004, at ix.

²⁷⁷ NTIA Comments, at iv.

²⁷⁸ See Steven E. Matda, Motion for Re-issuance of the *Notice*, filed June 9, 2004.

²⁷⁹ W. Lee McVey, Motion Requesting a Second Notice of Proposed Rulemaking, filed July 8, 2004.

²⁸⁰ W. Lee McVey, Motion Requesting an Extension of time for Re-issuance of Proposed Rules and Data Requests, filed June 3, 2004.

²⁸¹ See discussion in ¶¶65-68, *supra*.

Manassas, Virginia, violates the Sunshine prohibition of Section 1.1203 of the Commission rules.²⁸² ARRL's motion was addressed in a response letter dated October 14, 2004, in which the FCC Office of General Counsel concluded that no violation occurred because the prohibition of Section 1.1203 does not apply to presentations deemed exempt.²⁸³

IV. PROCEDURAL MATTERS

138. *Final Regulatory Flexibility Analysis.* The Final Regulatory Flexibility Analysis for this Report and Order, pursuant to the Regulatory Flexibility Act, *see* 5 U.S.C. § 604, is contained in Appendix A.

139. *Paperwork Reduction Act.* This Report and Order contains new or modified information collections subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies are invited to comment on the new or modified information collection(s) contained in this proceeding.

140. To make cited sources more easily available to the readers, we are testing the use of hyperlinks to some FCC documents that are cited in this document. The World Wide Web addresses/URLs that we give here were correct at the time this document was prepared but may change over time. We do not have staff dedicated to updating these URLs, however, so readers may find some URLs to be out of date as time progresses. We also advise that the only definitive text of FCC documents is the one that is published in the FCC Record. In case of discrepancy between the electronic documents cited here and the FCC Record, the version in the FCC Record is definitive.

V. ORDERING CLAUSES

141. Accordingly, IT IS ORDERED that Part 15 of the Commission's Rules ARE AMENDED as specified in Appendix B, effective 30 days after publication in the Federal Register. This action is taken pursuant to the authority contained in Sections 4(i), 301, 302, 303(e), 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 301, 302, 303(e), 303(f), and 303(r).

142. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Report and Order, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

²⁸² See ARRL, Motion for Recusal of Chairman Michael K. Powell from the BPL proceeding, filed October 12, 2004. See also, 47 C.F.R. § 1.1203.

²⁸³ See Letter from the FCC to ARRL, dated October 14, 2004. See also, 47 C.F.R. § 1.1204(a).

APPENDIX A

FINAL REGULATORY FLEXIBILITY ANALYSIS

As required by the Regulatory Flexibility Act ("RFA"),²⁸⁴ an Initial Regulatory Flexibility Analysis ("IRFA") was incorporated in the *Notice of Proposed Rule Making* ("Notice") in this proceeding, ET Docket Nos. 04-37 & 03-104. The Commission sought written public comment on the proposals in the *Notice*, including comment on the IRFA. This Final Regulatory Flexibility Analysis ("FRFA") conforms to the RFA.²⁸⁵

A. Need for, and Objectives of, the Report and Order

By this action, the Commission amends Part 15 of the rules for radio frequency (RF) devices regarding Access Broadband over Power Line (Access BPL), a new type of carrier current system that operates 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. Given that power lines reach virtually every residence and business in every community and geographic area in this country, Access BPL service could be made available nearly everywhere. This new broadband delivery medium could also serve to introduce additional competition to existing cable, DSL, and other broadband services. At the same time, we recognize the concerns of authorized radio services in both the private and government sectors for the need to ensure that RF energy from BPL signals on power lines does not cause harmful interference to licensed radio services. Our goals in developing the rules for Access BPL therefore are to provide a framework that will both facilitate the rapid introduction and development of BPL systems and protect licensed radio services from harmful interference. Specifically, we adopt in this Report and Order: 1) new operational requirements for Access BPL to promote avoidance and resolution of harmful interference, 2) new administrative requirements to aid in identifying Access BPL installations; and 3) specific measurement guidelines and certification requirements to allow accurate and repeatable evaluations of emissions from Access BPL and all other carrier current systems. These actions will further the development of BPL systems by removing regulatory uncertainties for BPL operators and equipment manufacturers and facilitate the continued deployment of these new broadband networks while ensuring that licensed radio services are protected from harmful interference. The record and our investigations indicate that BPL network systems can generally be configured and managed to minimize and/or eliminate this interference potential.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

No comments were filed in response to the IRFA.

C. Description and Estimate of the Number of Small Entities To Which the 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 rules adopted herein.²⁸⁶ The RFA generally defines the

²⁸⁴ See 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 - 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

²⁸⁵ See 5 U.S.C. § 604.

²⁸⁶ 5 U.S.C. § 604(a)(3).

term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”²⁸⁷ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.²⁸⁸ A “small business concern” is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).²⁸⁹

The rules adopted in this Report and Order 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.²⁹⁰ Under this standard, firms are considered small if they have 750 or fewer employees.²⁹¹ Census Bureau data for 1997 indicate that, for that year, there were a total of 1,215 establishments²⁹² in this category.²⁹³ Of 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%,²⁹⁴ so the Commission estimates that the number of wireless equipment manufacturers with employment under 500 was actually closer to 706, with an 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.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

Although a large number of Part 15 radio frequency devices are already required to be authorized under the Commission's Certification, Declaration of Conformity, or Verification procedures as a prerequisite to marketing and importation, the adopted rules add a slight amount of new testing and reporting requirements, to ensure protection of licensed spectrum users from harmful interference. These requirements include the proposed technical requirement for adaptive interference mitigation capabilities

²⁸⁷ 5 U.S.C. § 601(6).

²⁸⁸ 5 U.S.C. § 601(3) (incorporating by reference the definition of “small-business concern” in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

²⁸⁹ 15 U.S.C. § 632.

²⁹⁰ NAICS code 334220.

²⁹¹ *Id.*

²⁹² 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 location 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 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.

²⁹³ U.S. Census Bureau, 1997 Economic Census, Industry Series: Manufacturing, “Industry Statistics by Employment Size,” Table 4, NAICS code 334220 (issued August 1999).

²⁹⁴ *Id.* Table 5, “Industry Statistics by Industry and Primary Product Class Specialization: 1997.”

and the proposed notification of Access BPL systems in a database similar to the one required for existing Power Line Carrier systems. The major differences between the existing Part 15 rules for carrier current systems and the newly adopted rules in subpart G for Access BPL are (1) the type of equipment authorization procedure, --Verification for existing carrier current systems, Certification for Access BPL systems; (2) the requirement for interference mitigation techniques and avoidance of excluded bands and exclusion zones for Access BPL systems; and (3) the requirement for an Access BPL database concurrent with consultation with licensed spectrum users. Because Access BPL systems operate in the High Frequency (HF) and in the low Very High Frequency (VHF) of the spectrum, they must co-exist with numerous private and governmental authorized radio services. As such, they present concerns for these licensed users, given the propagation characteristics of radio frequency signals in these ranges of frequencies, the diversity of users of these frequencies, and the fact that Access BPL devices will be installed at many locations in an area, primarily over unshielded power lines. However, the record and our own investigations indicate that BPL network systems can generally be configured and managed to minimize and/or eliminate this interference potential, through the use of consultation with licensed services and identification of installed Access BPL equipment in a database, as well as the adoption of precise measurement procedures. The adopted certification procedure for Access BPL systems will therefore help provide a more detailed record of their characteristics toward this objective.

Although the adopted rules 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: (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.

In this Report & Order, we have maintained the existing Part 15 emission limits, which are applicable to all Part 15 devices, including BPL. We have adopted 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 carrier current systems (CCS), which will help in eliminating confusion and repetitive and costly compliance testing. Although we changed the equipment authorization procedure from Verification to Certification for Access BPL systems, this is because Access BPL systems operate in a different environment than other unlicensed Part 15 devices and to avoid overburdening the information that would otherwise be required to be submitted into the Access BPL database. We have adopted a simple Access BPL database format for the notification of Access BPL systems, rather than a complex one with all-inclusive and more comprehensive information. We have narrowed down the list of absolutely necessary licensed entities that Access BPL providers must consult with prior to operating in their bands, as well as the list of exclusion zones and excluded frequency bands in which Access BPL are prohibited from operating. We have provided a generous time frame for a transition period, thus allowing existing systems to continue to operate, as long as they do not cause harmful interference to other authorized radio services. Finally, the rules will apply equally to large and small entities. Therefore, there is no inequitable impact on small entities.

We believe that the rules adopted herein are equitable, balancing the critical needs of licensed

radio users for protection against harmful interference, with facilitating the development of Access BPL by removing regulatory uncertainties. For the reasons stated above we find that the rule changes contained in this Report and Order will not present a significant economic burden to small entities.

Report to Congress. The Commission will send a copy of the Report and Order, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.²⁹⁵ In addition, the Commission will send a copy of the Report and Order, including the FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the Report and Order and FRFA (or summaries thereof) will also be published in the Federal Register.²⁹⁶

²⁹⁵ See 5 U.S.C. § 801(a)(1)(A).

²⁹⁶ See 5 U.S.C. § 604(b).

APPENDIX B
FINAL RULE

Title 47 of the Code of Federal Regulations, Part 15, is amended as follows:

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 amended by adding paragraphs (ff) and (gg) to read as follows:

Section 15.3 Definitions.

* * * * *

(ff) Access Broadband over Power Line (Access BPL). A carrier current system installed and operated on an electric utility service as an unintentional radiator that sends radio frequency energy on frequencies between 1.705 MHz and 80 MHz over medium voltage lines or over low voltage lines to provide broadband communications and is located on the supply side of the utility service's points of interconnection with customer premises. Access BPL does not include power line carrier systems as defined in Section 15.3(t) of this part or In-House BPL as defined in Section 15.3(gg) of this part.

(gg) In-House Broadband over power line (In-House BPL). A carrier current system, operating as an unintentional radiator, that sends radio frequency energy by conduction over electric power lines that are not owned, operated or controlled by an electric service provider. The electric power lines may be aerial (overhead), underground, or inside the walls, floors or ceilings of user premises. In-House BPL devices may establish closed networks within a user's premises or provide connections to Access BPL networks, or both.

3. Section 15.15 is amended by revising paragraph (b), to read as follows:

Section 15.15 General Technical Requirements

* * * * *

(b) Except as specified in paragraph (c), an intentional or unintentional radiator must be constructed such that the adjustments of any control that is readily accessible by or intended to be accessible to the user will not cause operation of the device in violation of the regulations.

(c) Access BPL equipment shall comply with the applicable standards at the control adjustment that is employed. The measurement report used in support of an application for Certification and the user instructions for Access BPL equipment shall clearly specify the user- or installer-control settings that are required for conformance with these regulations.

4. Section 15.31 is amended by revising paragraph (f)(5), to read as follows:

Section 15.31 Measurement standards.

* * * * *

(f) * * *

* * * * *

(5) Measurements shall be performed at a sufficient number of radials around the equipment under test to determine the radial at which the field strength values of the radiated emissions are maximized. The maximum field strength at the frequency being measured shall be reported in the report. This paragraph shall not apply to Access BPL equipment on overhead medium voltage lines. In lieu thereof, the measurement guidelines established by the Commission for Access BPL shall be followed.

* * * * *

5. Section 15.37 is amended by adding paragraph (l) to read as follows:

Section 15.37 Transition provisions for compliance with the rules.

* * * * *

(l) All Access BPL devices that are manufactured, imported, marketed or installed on or after *[insert date 18 months from date of publication in the Federal Register]* shall comply with the requirements specified in subpart G of this part, including certification of the equipment.

6. Section 15.101 is amended by revising paragraph (a) to read as follows:

(a) * * * * *

Type of device	Equipment authorization required
TV broadcast receiver.....	Verification
FM broadcast receiver.....	Verification
CB receiver.....	Declaration of Conformity or Certification
Superregenerative receiver.....	Declaration of Conformity or Certification
Scanning receiver.....	Certification
Radar detector.....	Certification
All other receivers subject to Part 15.....	Declaration of Conformity or Certification
TV interface device.....	Declaration of Conformity or Certification
Cable system terminal device.....	Declaration of Conformity
Stand-alone cable input selector switch.....	Verification
Class B personal computers and peripherals.....	Declaration of Conformity or Certification**
CPU boards and internal power supplies used with Class B personal computers.....	Declaration of Conformity or Certification**
Class B personal computers assembled using authorized CPU boards or power supplies.....	Declaration of Conformity

Type of device	Equipment authorization required
Class B external switching power supplies.....	Verification
Other Class B digital devices & peripherals.....	Verification
Class A digital devices, peripherals & external switching power supplies.....	Verification
Access Broadband over Power Line (Access BPL)	Certification
All other devices.....	Verification

7. Part 15 is amended by adding a new Subpart G, to read as follows:

SUBPART G – ACCESS BROADBAND OVER POWER LINE (Access BPL)

Section 15.601 Scope.

This subpart sets out the regulations for Access Broadband over Power Line (Access BPL) devices operating in the 1.705-80 MHz band over medium or low voltage lines.

Section 15.603 Definitions.

- (a) Excluded Band: A band of frequencies within which Access BPL operations are not permitted.
- (b) Exclusion Zone: A geographical area within which Access BPS operations are not permitted in certain frequency bands.
- (c) Consultation. The process of communication between an entity operating Access BPL and a licensed public safety or other designated point of contact for the purpose of avoiding potential harmful interference.
- (d) Consultation area: A designated geographical area within which consultation with public safety users or other designated point of contact is required before an Access BPL may be operated at designated frequencies.
- (e) Low Voltage power line. A power line carrying low voltage, e.g., 240/120 volts from a distribution transformer to a customer’s premises.
- (f) Medium Voltage power line. A power line carrying between 1,000 to 40,000 volts from a power substation to neighborhoods. Medium voltage lines may be overhead or underground, depending on the power grid network topology.
- (g) Access BPL Database. A database operated by an industry-sponsored entity, recognized by the Federal Communications Commission and the National Telecommunications and Information Administration (NTIA), containing information regarding existing and planned Access BPL systems, as required in Section 15.615(a) of this subpart.

Section 15.605 Cross reference.

(a) The provisions of subparts A and B of this part apply to Access BPL devices, except where specifically noted. The provisions of subparts C-F of this part do not apply to Access BPL devices except where specifically noted.

(b) The requirements of this subpart apply only to the radio circuitry that is used to provide carrier current operation for the Access BPL device. Other aspects of the operation of an Access BPL device may be subject to requirements contained elsewhere in this chapter. In particular, an Access BPL device that includes digital circuitry that is not used solely to enable the operation of the radio frequency circuitry used to provide carrier current operation also is subject to the requirements for unintentional radiators in subpart B.

Section 15.607 Equipment Authorization of Access BPL equipment

Access BPL equipment shall be subject to Certification as specified in Section 15.101 of this part.

Section 15.609 Marketing of Access BPL equipment

The marketing of Access BPL equipment must be directed solely to parties eligible to operate the equipment. Eligible parties consist of AC power line public utilities, Access BPL service providers and associates of Access BPL service providers. The responsible party, as defined in Section 2.909 of this chapter, is responsible for ensuring that the equipment is marketed only to eligible parties. Marketing of the equipment in any other manner may be considered grounds for revocation of the grant of certification issued for the equipment.

Section 15.611 General technical requirements.

(a) Conducted emission limits. Access BPL is not subject to the conducted emission limits of Section 15.107.

(b) Radiated emission limits

(1) Medium voltage power lines

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

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

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

(c) Interference Mitigation and Avoidance.

(1) Access BPL systems shall incorporate adaptive interference mitigation techniques to remotely reduce power and adjust operating frequencies, in order to avoid site-specific, local use of the

same spectrum by licensed services. These techniques may include adaptive or “notch” filtering, or complete avoidance of frequencies, or bands of frequencies, locally used by licensed radio operations.

(i) For frequencies below 30 MHz, when a notch filter is used to avoid interference to a specific frequency band, the Access BPL system shall be capable of attenuating emissions within that band to a level at least 20 dB below the applicable Part 15 limits.

(ii) For frequencies above 30 MHz, when a notch filter is used to avoid interference to a specific frequency band, the Access BPL system shall be capable of attenuating emissions within that band to a level at least 10 dB below the applicable Part 15 limits.

(2) Access BPL systems shall comply with applicable radiated emission limits upon power-up following a fault condition, or during a start-up operation after a shut-off procedure, by the use of a non-volatile memory, or some other method, to immediately restore previous settings with programmed notches and excluded bands, to avoid time delay caused by the need for manual re-programming during which protected services may be vulnerable.

(3) Access BPL systems shall incorporate a remote-controllable shut-down feature to deactivate, from a central location, any unit found to cause harmful interference, if other interference mitigation techniques do not resolve the interference problem.

Section 15.613 Measurement Procedures.

Compliance measurements for Access BPL shall be made in accordance with the Guidelines for Access BPL systems specified by the Commission.

Section 15.615 General administrative requirements.

(a) *Access BPL Database.* Entities operating Access BPL systems shall supply to an industry-recognized entity, information on all existing Access BPL systems and all proposed Access BPL systems for inclusion into a publicly available data base, within 30 days prior to initiation of service. Such information shall include the following:

- (1) The name of the Access BPL provider
- (2) The frequencies of the Access BPL operation
- (3) The postal zip codes served by the specific Access BPL operation
- (4) The manufacturer and type of Access BPL equipment and its associated FCC ID number, or, in the case of Access BPL equipment that has been subject to verification, the Trade Name and Model Number, as specified on the equipment label.
- (5) The contact information, including both phone number and email address of a person at, or associated with, the BPL operator’s company, to facilitate the resolution of any interference complaint.
- (6) The proposed/or actual date of Access BPL operation.

(b) The Access BPL database manager shall enter this information into the publicly accessible database within three (3) business days of receipt.

(c) No notification to the Commission is required.

(d) A licensed spectrum user experiencing harmful interference that is suspected to be caused by an Access BPL system shall inform the local BPL operator's contact person designated in the Access BPL database. The investigation of the reported interference and the resolution of confirmed harmful interference from the Access BPL system shall be successfully completed by the BPL operator within a reasonable time period according to a mutually acceptable schedule, after the receipt of an interference complaint, in order to avoid protracted disruptions to licensed services. The Access BPL operator shall respond to complaints of harmful interference from public safety users within 24 hours. With regard to public safety complaints, the BPL provider shall be required to immediately cease the operations causing such complaint if it fails to respond within 24 hours.

(e) *Consultation with public safety users.* An entity operating an Access BPL system shall notify and consult with the public safety users in the area where it plans to deploy Access BPL, at least 30 days prior to initiation of any operation or service. This entity shall design or implement the Access BPL system such that it does not cause harmful interference in those frequencies or bands used by the public safety agencies in the area served by the Access BPL system. The notification shall include, at a minimum, the information in paragraph (a) of this section.

(f) *Federal government spectrum users and other radio service users.* An entity operating an Access BPL system shall ensure that, within its Access BPL deployment area, its system does not operate on any frequencies designated as excluded bands or on identified frequencies within any designated exclusion zones.

(1) *Excluded Bands.* To protect Aeronautical (land) stations and aircraft receivers, Access BPL operations using overhead medium voltage power lines are prohibited in the frequency bands listed in Table 1. Specifically, such BPL systems shall not place carrier frequencies in these bands.

Table 1. Excluded Frequency Bands

FREQUENCY BAND
2,850 – 3,025 kHz
3,400 – 3,500 kHz
4,650 – 4,700 kHz
5,450 – 5,680 kHz
6,525 – 6,685 kHz
8,815 – 8,965 kHz
10,005 – 10,100 kHz
11,275 – 11,400 kHz
13,260 – 13,360 kHz
17,900 – 17,970 kHz
21,924 – 22,000 kHz
74.8 – 75.2 MHz

(2) *Exclusion zones.* Exclusion zones encompass the operation of any Access BPL system within 1km of the boundary of coast station facilities at the coordinates listed in Tables 2 and 2.1. Exclusion zones also encompass the operation of Access BPL systems using overhead medium voltage power lines within 29 km of the coordinates for the ten Very Long Baseline Array facilities listed in

Allocation US311. Exclusion zones further encompass the operation of Access BPL systems using overhead low voltage power lines or underground power lines within 11 km of the coordinates for the ten Very Long Baseline Array facilities listed in Allocation US311. Within the exclusion zones for coast stations, Access BPL systems shall not use carrier frequencies within the band of 2173.5-2190.5 kHz. Within the exclusion zone for Very Long Baseline Array radio astronomy observatories, Access BPL systems shall not use carrier frequencies within the 73.0-74.6 MHz band.

(i) *Existing coast station facilities.* Access BPL systems shall not operate in the frequency band 2,173.5 – 2,190.5 kHz, within 1 kilometer (km) of the boundary of coast station facilities at the coordinates listed in Tables 2 and 2.1. BPL operators planning to deploy Access BPL devices at these frequencies in areas within these exclusion zones as defined above shall consult with the appropriate point of contact for these coast stations to ensure harmful interference is prevented at these facilities.

Table 2. Exclusion zones for U.S. Coast Guard Coast Stations

Point of Contact

Commandant (CG 622)
U.S. Coast Guard
2100 2nd Street, S.W.
Washington, DC 20593 – 0001
Telephone: (202) 267 – 2860
E-Mail: cgcomms@comdt.uscg.mil

Locale	Latitude	Longitude
Group Guam	13° 35' 23" N	144° 50' 24" E
GANTSEC	18° 18' 00" N	65° 46' 59" W
Puerto Rico	18° 28' 11" N	66° 07' 47" W
Honolulu	21° 18' 21" N	157° 53' 23" W
Group Key West	24° 33' 35" N	81° 47' 59" W
Trumbo Point CG Base	24° 33' 58" N	81° 47' 57" W
Miami	25° 37' 28" N	80° 23' 07" W
Everglades Park	25° 50' 10" N	81° 23' 13" W
Group Saint Petersburg (Everglades)	25° 51' 00" N	81° 23' 24" W
Station Ft. Lauderdale	26° 05' 21" N	80° 06' 40" W
Station Ft. Myers Beach	26° 27' 34" N	81° 57' 15" W
Group Miami (Ft. Pierce)	27° 27' 36" N	80° 18' 36" W
Station Ft. Pierce	27° 27' 50" N	80° 18' 27" W
Group Corpus Christi	27° 42' 01" N	97° 16' 11" W
Group Corpus Christi	27° 42' 06" N	97° 16' 45" W
ESD Saint Petersburg	27° 45' 21" N	82° 37' 32" W
Group Saint Petersburg	27° 46' 11" N	82° 37' 47" W
Station Port O'Connor	28° 26' 03" N	96° 25' 39" W
S. Padre Island	28° 26' 22" N	97° 09' 56" W
Freeport	28° 55' 59" N	95° 16' 59" W
Group Galveston (Freeport)	28° 56' 24" N	95° 17' 59" W
Station YANKEETOWN	29° 01' 51" N	82° 43' 39" W

Locale	Latitude	Longitude
Station Ponce De Leon Inlet	29° 03' 50" N	81° 55' 01" W
Group New Orleans (Grand Isle)	29° 15' 53" N	89° 57' 26" W
Galveston	29° 19' 59" N	94° 46' 18" W
Kapalan	29° 20' 04" N	94° 47' 17" W
Sabine	29° 43' 42" N	93° 52' 14" W
New Orleans	30° 01' 17" N	90° 07' 24" W
Panama City	30° 10' 01" N	85° 45' 04" W
Group Mobile (Panama City)	30° 10' 12" N	85° 45' 36" W
ANT Jacksonville Beach	30° 17' 16" N	81° 24' 10" W
Pensacola	30° 20' 24" N	87° 18' 17" W
Group Mayport	30° 23' 10" N	81° 26' 01" W
Group Mayport	30° 23' 24" N	81° 25' 48" W
Ft. Morgan	30° 39' 07" N	88° 03' 12" W
Tybee Lighthouse	32° 01' 15" N	80° 50' 39" W
Point Loma Lighthouse	32° 39' 56" N	117° 14' 34" W
Point Loma	32° 40' 07" N	117° 14' 14" W
Activities San Diego	32° 43' 59" N	117° 11' 13" W
Group Charleston (Sullivan's Island)	32° 45' 00" N	79° 49' 47" W
Sullivan's Island Lights	32° 45' 02" N	79° 50' 03" W
Group Charleston	32° 46' 25" N	79° 56' 37" W
Group San Diego	32° 52' 48" N	118° 26' 23" W
San Pedro	33° 45' 00" N	118° 15' 58" W
Group Fort Macon	33° 53' 24" N	78° 01' 48" W
Point Mugu	33° 59' 32" N	119° 07' 18" W
Group LA / Long Beach	34° 07' 11" N	119° 06' 35" W
Channel Island	34° 09' 17" N	119° 13' 11" W
Station Oxnard Channel Island	34° 09' 43" N	119° 13' 19" W
Group Ft. Macon	34° 41' 48" N	76° 40' 59" W
Group Cape Hatteras	35° 13' 59" N	75° 31' 59" W
Group Cape Hatteras	35° 15' 35" N	75° 31' 48" W
Morro Bay (Cambria)	35° 31' 21" N	121° 03' 21" W
San Clemente Island	32° 50' 24" N	118° 23' 15" W
Point Pinos	36° 38' 12" N	121° 56' 06" W
CAMSLANT	36° 43' 47" N	76° 01' 11" W
Group Hampton Roads	36° 53' 01" N	76° 21' 10" W
Point Montara	37° 31' 23" N	122° 30' 47" W
Point Montara Lighthouse	37° 32' 09" N	122° 31' 08" W
Group San Francisco	37° 32' 23" N	122° 31' 11" W
Group San Francisco	37° 48' 34" N	122° 21' 55" W
Point Bonita	37° 49' 00" N	122° 31' 41" W
Group Eastern Shores	37° 55' 47" N	75° 22' 47" W
Group Eastern Shore	37° 55' 50" N	75° 22' 58" W
CAMSPAC	38° 06' 00" N	122° 55' 48" W
Point Arena Lighthouse	38° 57' 18" N	124° 44' 28" W
Point Arena	38° 57' 36" N	123° 44' 23" W
	39° 20' 59" N	
Group Atlantic City	N	74° 27' 42" W
Activities New York	40° 36' 06" N	74° 03' 36" W

Locale	Latitude	Longitude
Activities New York	40° 37' 11" N	74° 04' 11" W
ESD Moriches Hut	40° 47' 19" N	72° 44' 53" W
Group Moriches	40° 47' 23" N	72° 45' 00" W
Group Humboldt Bay	40° 58' 41" N	124° 06' 31" W
Group Humboldt Bay	40° 58' 47" N	124° 06' 35" W
Trinidad Head	41° 03' 15" N	124° 09' 02" W
Group Long Island Sound	41° 16' 12" N	72° 54' 00" W
Station New Haven	41° 16' 12" N	72° 54' 06" W
Station Brant Point	41° 17' 21" N	70° 05' 31" W
Group Woods Hole	41° 17' 23" N	70° 04' 47" W
Station Castle Hill	41° 27' 46" N	71° 21' 42" W
Group Woods Hole	41° 17' 29" N	70° 40' 07" W
Boston Area	41° 40' 12" N	70° 31' 48" W
Station Provincetown	42° 01' 48" N	70° 12' 42" W
Eastern Point	42° 36' 24" N	70° 39' 26" W
Cape Blanco	42° 50' 16" N	124° 33' 52" W
Group North Bend	43° 24' 16" N	124° 13' 22" W
Group North Bend	43° 24' 35" N	124° 14' 23" W
Cape Elizabeth	43° 33' 28" N	70° 12' 00" W
Group South Portland	43° 38' 24" N	70° 15' 00" W
Group South Portland	43° 38' 45" N	70° 14' 51" W
Group SW Harbor	44° 16' 19" N	68° 18' 27" W
Group Southwest Harbor	44° 16' 48" N	68° 18' 36" W
Fort Stevens, Oregon	46° 09' 14" N	123° 53' 07" W
Group Astoria	46° 09' 29" N	123° 31' 48" W
Group Astoria	46° 09' 35" N	123° 53' 24" W
La Push	47° 49' 00" N	124° 37' 59" W
Station Quillayute River	47° 54' 49" N	124° 38' 01" W
Port Angeles	48° 07' 59" N	123° 25' 59" W
Group Port Angeles	48° 08' 24" N	123° 24' 35" W
Juneau (Sitka)	57° 05' 24" N	135° 15' 35" W
Kodiak	57° 40' 47" N	152° 28' 47" W
Valdez (Cape Hinchinbrook)	60° 26' 23" N	146° 25' 48" W

Note: Systems of coordinates conform to NAD 83

**Table 2.1 Exclusion zones for Maritime Public Coast Stations
(Points of Contact are identified in the Commission's License Database)**

Licensee Name	Location	Latitude	Longitude
Shipcom LLC	Marina Del Ray, CA	33° 56' 21" N	118° 27' 14" W
Globe Wireless	Rio Vista, CA	38° 11' 55" N	121° 48' 34" W
Avalon Communications Corp	St. Thomas, VI	18° 21' 19" N	64° 56' 48" W
Globe Wireless	Bishopville, MD	38° 24' 10" N	75° 12' 59" W

Licensee Name	Location	Latitude	Longitude
Shipcom LLC	Mobile, AL	30° 40' 07" N	88° 10' 23" W
Shipcom, LLC	Coden, AL	30° 22' 35" N	88° 12' 20" W
Globe Wireless	Pearl River, LA	30° 22' 13" N	89° 47' 26" W
Globe Wireless	Kahalelani, HI	21° 10' 33" N	157° 10' 39" W
Globe Wireless	Palo Alto, CA	37° 26' 44" N	122° 06' 48" W
Globe Wireless	Agana, GU	13° 29' 22" N	144° 49' 39" E

Note: Systems of coordinates conform to NAD 83

(ii) *New or relocated Coast stations.* In the unlikely event that a new or relocated coast station is established for the 2.173.5 – 2.190.5 kHz band at a coordinate not specified in Table 2 or 2.1, Access BPL operations in that frequency band shall also be excluded within 1 km of the new coast station facility;

(iii) *Very Long Baseline Array (VLBA) radio astronomy observatories.* Access BPL systems using overhead medium voltage power lines shall not operate in the frequency band 73.0 – 74.6 MHz, within 29 km of the coordinates of the ten (10) Very Long Baseline Array facilities listed in 47 C.F.R § 2.106, Note US311. Access BPL systems using overhead low voltage power lines or underground power lines shall not operate in the 73.0 – 74.6 MHz band within 11 km of those coordinates.

(3) *Consultation areas.* Access BPL operators shall provide notification to the appropriate point of contact specified below regarding Access BPL operations at any frequencies of potential concern in the following consultation areas, at least 30 days prior to initiation of any operation or service. The notification shall include, at a minimum, the information in paragraph (a) of this section. We expect parties to consult in good faith to ensure that no harmful interference is caused to licensed operations and that any constraints on BPL deployments are minimized to those necessary to avoid harmful interference.

(i) For frequencies in the 1.7–30 MHz frequency range, the areas within 4 km of facilities located at the following coordinates:

- A. the Commission's protected field offices listed in 47 C.F.R. §0.121, the point-of-contact for which is specified in that section;
- B. (ii) the aeronautical stations listed in Tables 3a and 3b;
- C. (iii) the land stations listed in Tables 4 and 5;

(ii) For frequencies in the 1.7–38.25 MHz frequency range, the areas within 4 km of facilities located at the coordinates specified for radio astronomy facilities in 47 C.F.R. § 2.106, Note US 311.

(iii) For frequencies in the 1.7–80 MHz frequency range, the area within 1 km of the Table Mountain Radio Receiving Zone, the coordinates and point of contact for which are specified in 47 C.F.R. § 21.113(b).

(iv) For frequencies in the 1.7–30 MHz frequency range, the areas within 37 km of

radar receiver facilities located at the coordinates specified in Table 6.

Table 3a. Consultation Area Coordinates for Aeronautical (OR) Stations (1.7 – 30 MHz)

Point of contact
US Coast Guard HQ
Division of Spectrum Management CG-622
2100 Second St., SW. Rm. 6611
Washington, DC 20593
Tel: 202-267-6036
Fax: 202-267-4106
Email: jtaboada@comdt.uscg.mil

Command Name	Location	Latitude	Longitude
Washington	Arlington, VA	38° 51' 07" N	77° 02' 15" W
Cape Cod	Cape Cod, MA	41° 42' 00" N	70° 30' 00" W
Atlantic City	Atlantic City, NJ	39° 20' 59" N	74° 27' 42" W
Elizabeth City	Elizabeth City, NC	36° 15' 53" N	76° 10' 32" W
Savannah	Savannah, GA	32° 01' 30" N	81° 08' 30" W
Miami	Opa Locka, FL	25° 54' 22" N	80° 16' 01" W
Clearwater	Clearwater, FL	27° 54' 27" N	82° 41' 29" W
Borinquen	Aguadilla, PR	18° 18' 36" N	67° 04' 48" W
New Orleans	New Orleans, LA	29° 49' 31" N	90° 02' 06" W
Traverse City	Traverse City, MI	44° 44' 24" N	85° 34' 54" W
San Diego	San Diego, CA	32° 43' 33" N	117° 10' 15" W
Sacramento	McClellan AFB, CA	38° 40' 06" N	121° 24' 04" W
Astoria	Warrenton, OR	46° 25' 18" N	123° 47' 46" W
North Bend	North Bend, OR	43° 24' 39" N	124° 14' 35" W
Barbers Point	Kapolei, HI	21° 18' 01" N	158° 04' 15" W
Kodiak	Kodiak, AK	57° 44' 19" N	152° 30' 18" W
Houston	Houston, TX	29° 45' 00" N	95° 22' 00" W
Detroit	Mt. Clemens, MI	42° 36' 05" N	82° 50' 12" W

Command Name	Location	Latitude	Longitude
		N	
San Francisco	San Francisco, CA	37° 37' 58" N	122° 23' 20" W
Los Angeles	Los Angeles, CA	33° 56' 36" N	118° 23' 48" W
Humboldt Bay	McKinleyville, CA	40° 58' 39" N	124° 06' 45" W
Port Angeles	Port Angeles, WA	48° 08' 25" N	123° 24' 48" W
Sitka	Sitka, AK	57° 05' 50" N	135° 21' 58" W

Note: Systems of coordinates conform to NAD 83

Table 3b. Consultation Area Coordinates for Aeronautical Receive Stations (1.7 – 30 MHz)

Point of contact
 ARINC
 2551 Riva Road
 Annapolis, MD 21401
 Tel: 1-800-633-6882
 Fax: 410-266-2329
 Email: arincmkt@arinc.com
 www.arinc.com

Locale	Latitude	Longitude
Southampton, NY	40° 55' 15" N	72° 23' 41" W
Molokai, HI	21° 12' 23" N	157° 12' 30" W
Oahu, HI	21° 22' 27" N	158° 05' 56" W
Half Moon Bay, CA	37° 39' 00" N	122° 41' 00" W
Pt. Reyes, CA	38° 06' 00" N	122° 56' 00" W
Barrow, AK	71° 17' 24" N	156° 48' 12" W
Guam	13° 25' 00" N	144° 44' 57" E (note: Eastern Hemisphere)
NY Comm Center, NY	40° 46' 48" N	73° 05' 46" W
Cedar Rapids, IA	42° 02' 05.0" N	91° 38' 37.6" W
Beaumont, CA	33° 54' 27.1" N	116° 59' 49.1" W
Fairfield, TX	31° 47' 02.6" N	96° 47' 03.0" W
Houston, TX	29° 36' 35.8" N	95° 16' 54.8" W
Miami, FL	25° 49' 05" N	80° 18' 28" W

Note: Systems of coordinates conform to NAD 83

Table 4. Consultation Area Coordinates for Land Stations, Set 1 (1.7–30 MHz)

Point Of Contact
 US Coast Guard HQ
 Division of Spectrum Management CG-622
 2100 Second St., SW. Rm. 6611
 Washington, DC 20593
 Tel: 202-267-6036

Fax: 202-267-4106
 Email: jtaboada@comdt.uscg.mil

Command Name	Location	Latitude	Longitude
COMMSTA Boston	Maspee, MA	41° 24' 00" N	70° 18' 57" W
Camlant	Chesapeake, VA	36° 33' 59" N	76° 15' 23" W
COMMSTA Miami	Miami, FL	25° 36' 58" N	80° 23' 04" W
COMMSTA New Orleans	Belle Chasse, IA	29° 52' 40" N	89° 54' 46" W
Campac	Pt. Reyes Sta, CA	38° 06' 00" N	122° 55' 48" W
COMMSTA Honolulu	Wahiawa, HI	21° 31' 08" N	157° 59' 28" W
COMMSTA Kodiak	Kodiak, AK	57° 04' 26" N	152° 28' 20" W
Guam	Finegayan, GU	13° 53' 08" N	144° 50' 20" E

Note: Systems of coordinates conform to NAD 83

Table 5. Consultation Area Coordinates for Land Stations, Set 2 (1.7 – 30 MHz)

Point of contact
 COTHEN Technical Support Center
 COTHEN Program Manager
 Tel: (800) 829-6336

Site Name	Latitude	Longitude
Albuquerque, NM	35° 05' 02" N	105° 34' 23" W
Arecibo, PR	18° 17' 26" N	66° 22' 33" W
Atlanta, GA	32° 33' 06" N	84° 23' 35" W
Beaufort, SC	34° 34' 22" N	76° 09' 48" W
Cape Charles, VA	37° 05' 37" N	75° 58' 06" W
Cedar Rapids, IA	42° 00' 09" N	91° 17' 39" W
Denver, CO	39° 15' 45" N	103° 34' 23" W
Fort Myers, FL	81° 31' 20" N	26° 20' 01" W
Kansas City, MO	38° 22' 10" N	93° 21' 48" W
Las Vegas, NV	36° 21' 15" N	114° 17' 33" W
Lovelock, NV	40° 03' 07" N	118° 18' 56" W
Memphis, TN	34° 21' 57" N	90° 02' 43" W
Miami, FL	25° 46' 20" N	80° 28' 48" W
Morehead City, NC	34° 34' 50" N	78° 13' 59" W

Site Name	Latitude	Longitude
	N	
Oklahoma City, OK	34° 30' 52" N	97° 30' 52" W
Orlando, FL	28° 31' 30" N	80° 48' 58" W
Reno, NV	38° 31' 12" N	119° 14' 37" W
Sarasota, FL	27° 12' 41" N	81° 31' 20" W
Wilmington, NC	34° 29' 24" N	78° 04' 31" W

Note: Systems of coordinates conform to NAD 83

Table 6. Consultation Area Coordinates for Radar Receiver Stations (1.7 – 30 MHz)

Point Of Contact
ROTHR Deputy Program Manager
(540) – 653 – 3624

LATITUDE / LONGITUDE
18° 01' N / 66° 30' W
28° 05' N / 98° 43' W
36° 34' N / 76° 18' W

Note: Systems of coordinates conform to NAD 83

APPENDIX C**GUIDELINES****Measurement Guidelines for Broadband Over Power Line (BPL) Devices Or Carrier Current Systems (CCS) and Certification Requirements For Access BPL Devices**

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

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

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

b. Radiated Emissions Measurement Principles for Overhead Line Installations

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

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

c. Radiated Emissions Measurement Principles for Underground Line Installations

- 1) Underground line installations are those in which the BPL device is mounted in, or attached to, a pad-mounted transformer housing or a ground-mounted junction box and couples directly only to underground cables.

- 2) Measurements should normally be performed at a separation distance of 10 meters from the in-ground power transformer that contains the BPL device(s). If necessary, due to ambient emissions, measurements may be performed a distance of 3 meters. Distance corrections are to be made in accordance with Section 15.31(f) of the Rules.
- 3) Measurements shall be made at positions around the perimeter of the in-ground power transformer where the maximum emissions occur. ANSI C63.4-2003, section 8.1, specifies a minimum of 16 radial angles surrounding the EUT (In-ground transformer that contains the BPL device(s)). If directional radiation patterns are suspected, additional azimuth angles shall be examined.

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 C63.4-2003.

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 C63.4-2003, 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 at three positions along the overhead line connecting to the building (*i.e.* the service wire). It is recommended that these measurements be performed starting at a distance 10 meters down the line from the connection to the building. If this test cannot be performed due to insufficient length of the service wire, a statement explaining the situation and test configuration shall be included in the technical report.
- 2) Measurements should normally be performed at a horizontal separation distance of 10 meters from the overhead line connecting to the building. 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 using the slant range distance (see paragraph 2.b.4, above).
- 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 C63.4-2003 (Section 7 and Annex E).
- 3) 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 C63.4-2003 (Section 8 and Annex D)

4. Certification Technical Report Requirements for Access PBL Devices

- 1) Certification applications shall be accompanied by a technical report in accordance with Section 2.1033 of the Rules. Each device used in an Access BPL system requires its own Certification.
- 2) For Access BPL devices, the statement describing how each device operates shall include the following information: modulation type, number of carriers, carrier spacing, channel bandwidth, notch capability/control, power settings/control, and range of signal injection duty factors.
- 3) For Access BPL devices, the measurement report shall include representative emissions spectrum plot(s) of the reported data.

5. Responsibility of BPL operator

It is recommended that a BPL operator perform initial installation and periodic testing of Access BPL systems on his power lines. These tests shall be performed to ensure that the system in conjunction with the installation site complies with the appropriate emission limits using the measurement procedures outlined in Section 3 of this document. The BPL operator should use typical installation sites within his

service area as outlined in section 2(a) of this document. Selection of typical sites shall be made according to the characteristics of the installation as a whole. The BPL operator is not required to submit the test results. In the instance that the Access BPL system was tested on the operator's network for certification purposes, the initial installation tests do not need to be repeated. However, periodic testing of installed Access BPL systems is recommended to ensure that the system maintains compliance with Part 15 emission limits.

**JOINT STATEMENT OF
CHAIRMAN MICHAEL K. POWELL
AND
COMMISSIONER KATHLEEN Q. ABERNATHY**

Re: Amendment of Part 15 Regarding New Requirements and Measurement Guidelines for Access over Power Line Systems, ET Docket No. 04-37 & In the Matter Regarding Carrier Current Systems, including Broadband over Power Line Systems, ET Docket No. 03-104, Report and Order

A strategic goal of this Commission is to promote the availability of broadband to all Americans irrespective of platform. Today, the Commission takes another important step towards achieving this goal through adoption of this Report and Order adopting final rules on broadband over power line (BPL) communications technologies.

The technology behind BPL is both fascinating and revolutionary. Just a few short years ago, critics argued that competition for the “last mile” would never become a reality because no one could duplicate or bypass the telephone line that ran from the curb into the home. With the advent of the 1996 Act, the Commission’s focus on fostering facilities-based competition, and the development of new technologies, the market for last-mile connectivity for broadband services in the United States has become increasingly competitive. Today we see viable competition from multiple platforms including cable modem services, satellite, Wi-Fi, Wi-Max, and DSL. BPL provides us with a new potential competitor in the broadband market. BPL technology also holds promise in improving the provision and management of electric power systems, homeland security, and protecting vital elements of the Nation’s critical infrastructure. This is one of the reasons our colleagues at the Federal Energy Regulatory Commission (FERC) have joined us in supporting this new technology.

By crafting a minimal regulatory framework for BPL we are advancing Congress’s goal of creating a pro-competitive, deregulatory framework, and the Commission’s goal of deploying broadband to every American. Because BPL is a nascent technology and the broadband market has no dominant incumbent service provider, only minimal regulations are appropriate. However, this does not mean that we have not been cognizant of the need to protect existing licensed services from interference. To address this issue, the Office of Engineering and Technology (OET) has done thorough testing of BPL systems to ensure the rules we are adopting protect existing governmental uses, amateur radio operators, and other licensees from interference. We have also closely coordinated with the National Telecommunications and Information Administration (NTIA) to make sure that their concerns have been addressed. We believe the new requirements we are imposing will help minimize harmful interference that may occur and, to the extent any harmful interference does occur, to quickly resolve any issues.

We have both had the opportunity to witness BPL services first hand and we believe that this new technology holds great promise as a low cost broadband competitor. The pervasiveness of the utility grid means that almost every home in America can be accessed by this type of service. Moreover, the presence of a third universal broadband connection will mean a robust choice for consumers and strong, healthy competition. Additionally, unlike some other technologies, there is no need for consumers to purchase supplemental broadband connectors in order to receive a broadband connection. The consumer simply plugs a device of choice into an electrical outlet to receive a broadband connection from the BPL service provider.

The benefits and advantages of BPL are just beginning to be recognized. That is why it is important for regulators to exercise restraint and avoid heavy-handed regulations. We must allow the marketplace to develop the full potential of this technology. In the long run, this approach should result in Americans receiving the full benefits of this new technology and the applications it supports.

**STATEMENT OF
COMMISSIONER MICHAEL J. COPPS
APPROVING IN PART, DISSENTING IN PART**

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

I want to welcome our colleagues from FERC to the FCC as we work to move forward on BPL. I think we all agree that a wide deployment of BPL would benefit broadband consumers. This is a market desperate for more competition. We all know by now that our country is now Number 11 in broadband penetration. That's pretty hard to take. Some argue that all we should worry about is broadband availability, and not bother ourselves worrying about whether the price is too high or the data rates too low for people to actually buy it. But when we consider that consumers in other countries are getting magnitudes more of capacity at prices far lower than we are getting, it's time to get concerned. I'm not arguing that every country has the same broadband market, but consider that in countries like Japan, Korea and Canada, consumers get much more bang for their buck—like 8,000-10,000 kilobits for \$10-\$15 a month. Should we be surprised that consumers in those countries are signing up in droves?

I'm not alone in my concern. *Business Week* recently called our country a "broadband backwater." Its article concluded: "If the U.S. is not to lose out in the global race of the next-generation Internet and the new businesses it can spawn, change is needed." I agree. We simply don't have a game plan. Nearly all of the industrialized nations, except the U.S., have national broadband plans. Where is our comprehensive strategy? We're late to the game, other countries are far ahead, and we just have to get down on the field with a game plan of our own.

I hope that someday BPL will help us improve the situation for U.S. consumers. This is a powerful and exciting new technology that is at its inception and just beginning to be deployed. In the future I hope that it will substantially increase broadband competition, force prices lower, and force investments in innovation. Also, while today BPL deployments are occurring in urban and suburban communities, I hope that in the future BPL will serve rural America as well. So we can certainly use the innovation and new competition BPL may bring, and I am happy to support the vast majority of this item. But I do have some worries that I want to note.

I remain concerned with the question of interference to amateur radio users. I take the concerns of this community very seriously, and believe that the FCC has an obligation to work hard to monitor, investigate, and take quick action where appropriate to resolve harmful interference. If interference occurs, we must have a system in place to resolve it immediately. If an amateur radio user makes a complaint and an agreement between the BPL provider and the amateur radio user cannot be reached, the FCC should step in and resolve the matter. These cases must not take years to resolve.

I'm also disappointed that today's item dodges some of the hardest BPL questions. If we want investment in BPL, we need certainty and predictability. But issues such as universal service, disabilities access, E911, pole attachments, competition protections, and, critically, how to handle the potential for cross-subsidization between regulated power businesses and unregulated communications businesses remain up in the air. Is it right to allow electricity rate payers to pay higher bills every month to subsidize an electric company's foray into broadband? I'm glad our FERC colleagues are here today, because this last part needs to be a fully collaborative effort.

Some will argue that we don't know enough about what this technology will look like yet, so we shouldn't impose any obligations lest we 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. I don't yet know how these issues will play out for powerline broadband or what rules the Commission should adopt. But we should have used this proceeding to start giving investors and consumers some certainty on the matter. Having understandable rules of the road is what investors, as well as consumers, are looking for.

So we have a promising technology, maybe even a significant new broadband pipe if everything goes really well. We've got some good technical rules in this item. They can work or be adjusted if we have good monitoring and enforcement. But we just have to get to the big picture and confront the challenges I have mentioned if BPL is going to have a shot at realizing its full potential. Putting it all together, I will vote to approve in part and to dissent in part. And I thank the Bureau, my colleagues, and the many parties who shared their ideas with us, for working so hard and constructively on this promising technology.

**STATEMENT OF
COMMISSIONER KEVIN J. MARTIN**

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

I am pleased to support this item, which adopts new rules for 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. BPL systems also serve an important homeland security function, providing a redundant data network. For these reasons, the President has explicitly encouraged the introduction of BPL technology.²⁹⁷

I have seen a BPL system first hand, and I came away very impressed. Using BPL, I was able to watch a DVD-quality movie, play a video game on the Internet, and print pages from a news web site – all simultaneously. I was impressed not only with the fast transmission speed, but also with the ease with which the home could be networked. Simply plugging a device into an electrical outlet enabled it to communicate with devices plugged into outlets in other rooms, as well as connect to the Internet. There is no question that this technology has terrific potential.

In this Order, we have attempted to facilitate deployment of BPL while ensuring that existing users are protected from harmful interference. Working closely with NTIA, we have taken strides to address interference concerns of both Government and private users. Nevertheless, I recognize that Amateur radio operators still have concerns that they will experience interference from BPL systems. In addition, broadcasters are concerned that BPL systems will cause interference in the low VHF band. I take these concerns – as well as the other concerns expressed about BPL systems causing interference – very seriously. I am confident that the Commission will continue to monitor these concerns and will take steps, where needed, to address interference problems going forward.

²⁹⁷ See President George W. Bush, *Remarks on Innovation at the U.S. Department of Commerce*, Washington, D.C. (June 24, 2004); *Remarks at the American Association of Community Colleges Annual Convention*, Minneapolis Convention Center, Minneapolis, Minnesota (April 26, 2004).

**STATEMENT OF
COMMISSIONER JONATHAN S. ADELSTEIN**

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

This has been a challenging proceeding. We have before us an exciting new technology in Access Broadband over Power Line (Access BPL) that has the potential to be a new broadband pipe into the home, which is so critical to pushing the deployment of broadband services across the country. It could provide badly needed competition in the provision of broadband services, which will spur all providers to improve their offerings. But we also have an existing user base that includes public safety licensees, federal Government users, and amateur radio operators – important services that we need to protect from harmful interference.

I take seriously our obligation under Section 157 of the Communications Act 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 in this case, though, we must ensure that sufficient protections are in place to limit interference concerns.

Recent Access BPL test deployments have been very useful in developing techniques to address interference issues. It is clear that some Access BPL systems can co-exist very well with existing licensees in the HF and VHF bands. In the limited cases of increased interference, the Access BPL operators were able to quickly resolve and address the interference problem. Other Access BPL systems, though, have not fared so well, and these systems should not be deployed on a commercial basis if they will continue to result in harmful interference.

We have put in place on Access BPL some special rules that are not normally required of Part 15 operators. However, I believe that these restrictions and requirements, such as adaptive frequency selection, remote shut down control, and a publicly available Access BPL database, are critical to providing an operational environment that safeguards existing licensees from harmful interference. I am also pleased to support our specific requirement for Access BPL providers to promptly respond to complaints of harmful interference from public safety licensees.

Access BPL can work side by side with existing licensees provided that Access BPL operators respond appropriately to harmful interference concerns. I encourage all affected parties to work together in a cooperative manner to address legitimate complaints of harmful interference in a timely manner.