

CBC COMMENTS ON SMSE-005-05

CONSULTATION PAPER ON BROADBAND OVER
POWER LINE (BPL) COMMUNICATION SYSTEMS

Technology by
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1 INTRODUCTION

The Corporation (CBC/Radio-Canada) would like to use this opportunity offered by the Department to comment on the "[Consultation Paper on Broadband over Power Line \(BPL\) Communication Systems](#)". CBC/Radio-Canada understands that BPL might open new opportunities for power companies to deliver broadband Internet services to regional Canada.

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The Corporation strongly believes, however, that in considering proposals to allow BPL Communication systems to operate in Canada, the principle of "no interference" to existing radiocommunication services, licensed or not, must be of paramount and primary importance. The documentation available on this subject indicates that it is highly probable that BPL systems will significantly interfere with existing broadcasting services to the public¹, as well as other essential and critical radiocommunication services. The Corporation stresses the need for the Department to **clearly** identify the frequency spectrum that BPL might use and the level of interference that BPL systems might produce in order to protect the existing services and spectrum users. The Corporation suggests that the limits applicable to BPL systems should be at least as stringent as the existing limits applicable Radio Standards Specifications (RSSs).

2 CBC/RADIO-CANADA'S CONCERNS ABOUT BPL SYSTEMS

Because of the nature of the types of cables, which transport power, BPL systems operation presents a special situation in regards to the creation of interference. Since the power cables are designed to transport efficiently power at a frequency of 60 Hz, they are consequently not suited for transmitting electromagnetic signals in higher frequencies such as the Radio-Frequency (RF) range. Advances in technology may overcome some of the challenges presented by the use of power cables to transport RF signals, but they will never compensate for their physical characteristics. Power cables are not shielded and will act as unintentional radiators. In addition to this fact, the nature of the power grid increases the complexity of the problems caused by this type of unintentional radiation. A power grid has the following characteristics:

- In the vast majority, distribution cables are in the air at around 10 m high;
- These cables reaches every dwelling and are installed inside walls of dwellings;
- The impedance at cable junctions is not matched for RF frequencies.
- Power cables are unbalanced;
- The characteristics of the power grid network changes in time with the load.

The other critical aspects of the BPL systems are the frequencies that are used to carry the information. If the BPL operators are granted the right to use the complete spectrum between 1.7 and 80 MHz, the type of propagations the BPL signals will be using are as follows:

- 1.7 MHz – 3MHz: Ground Waves and Ionosphere Reflection* (1 hop at night);
- 3 MHz – 30 MHz: Ionosphere Reflections* and Ground Wave over sea;
- 30 MHz – 80 MHz: Direct path and Ground Reflections
- Also known as ionospheric or "skywave propagation".

Ionosphere propagation poses a real difficult problem, as distances are long enough to create interferences in another country. The regulation process of BPL systems will require international coordination to assure that every country is included in the process and is aware of the BPL systems effects on the electromagnetic (EM) spectrum.

The frequencies used by exiting BPL systems pose a threat to the following services provided by CBC/Radio-Canada:

- HF Broadcasting (Radio-Canada International and its commercial clients)
- DRM Broadcasting (present and future)
- AM Broadcasting
- Low VHF NTSC TV Broadcasting
- Low VHF DTV Broadcasting (near future in rural areas)
- FM Broadcasting

¹ BBC R&D White Papers nos. 116, 114, 99, 67, 63, 55, 13, 12, 4
<http://www.ofcom.org.uk/research/technology/archive/cet/powerline/amperion.pdf>
http://www.abc.net.au/corp/pubs/ACA_paper_broadband_powerline.pdf

Some TV stations might be returning to their original channel in the low VHF spectrum after the DTV transition, especially in rural areas. As BPL systems are aimed to operate particularly in rural areas to provide broadband Internet access, the risk of collision/interference between DTV broadcast services and BPL systems will be high in rural areas. DTV service contours have lower field strength, exposing the DTV services to BPL interference even more than to existing NTSC TV services. Interference effects on DTV services are greater than on NTSC services. Interference on NTSC signals degrades gradually the picture quality as the interference level increases. On DTV, the effects are more dramatic and total loss of picture can happen very quickly.

3 CANADIAN STRATEGY REGARDING BPL SYSTEMS REGULATION

To assess if the previous concerns about the suitability of power lines to carry RF frequencies, field tests were put in place in countries all around the world. Field tests have shown harmful interferences creation to existing spectrum usages. Many of these trials have been ceased, some even before their completion.

Permitting BPL systems without consecutive successful BPL systems field trials is highly risky. In addition, the results of the Canadian field trials should be made public, for consultation by all spectrum users.

CBC/Radio-Canada stresses the fact that numerous standard development forums, field trials and regulatory processes related to BPL systems are still ongoing in several countries. CBC/Radio-Canada recommends that the Department should wait until these activities are completed and the results are known before any entity to go into operation in Canada using the current BPL technologies. The opposition that BPL systems are facing all around the world, the results of several field trials as well as field measurements that are available, justifies this conservative approach.

In addition, CBC/Radio-Canada suggests that the Canadian Government be proactive in the regulations of BPL systems and initiates activities and studies within international committees. This way the work could be started soon and help interested countries to reach agreements in this domain. In addition this would help countries in their own regulatory process.

A sound approach to assure harmonious relation between BPL systems operators and other spectrum users would be to consider the BPL systems also as spectrum users. Since the frequencies used and the propagation of the unwanted emissions is similar to other spectrum usages, BPL operation should be treated the same way. This way, current spectrum users and BPL operators would be treated as equals. In addition, the regulatory framework is already in place and well defined, this enabling a smooth addition of BPL transmissions in the EM spectrum.

Finally, historically, the ability to receive radiocommunication signals has been dependent on the noise floor, which varies depending on the type of location (i.e. urban versus rural), and also varies by frequency band. Generally, there has been no authorized spectrum usage, which increases the noise floor in frequency bands other than those specifically identified for unlicensed devices. BPL systems operation would set a precedent.

4 RESPONSES TO INQUIRIES IN SMSE-005-05

The following numbering is the same as used in the Gazette Notice.

Q - 3.2.1 Access BPL

At this time, the Department is proposing to adopt the following definition for Access BPL systems:

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.

The Department seeks comment on the above definition and its suitability for describing Access BPL.

CBC/Radio-Canada does not agree with this definition. BPL systems should not be considered as unintentional radiators. The Corporation believes that BPL operators should be considered and treated like other spectrum users. In addition, the frequency range employed by BPL systems should be limited to below 54 MHz, to avoid harmful interference with TV channels.

Q - 3.3 In-house BPL

At this time, the Department is proposing to adopt the following definition⁷ for In-house BPL systems:

In-house broadband over power line (In-house BPL): A carrier current system, operating as an unintentional radiator, which 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.

The Department seeks comment on the above definition and its suitability for describing In-house BPL.

CBC/Radio-Canada does not agree with this definition. BPL systems should not be considered as unintentional radiators. The Corporation believes that BPL operators should be considered and treated like other spectrum users. In addition, the frequency range employed by BPL systems should be limited to below 54 MHz, to avoid harmful interference with TV channels.

Q - 6.1 Equipment Standard and Approval Process

The Department seeks comment on the proposed certification process and what, if any, alternative approaches could be used to authorize BPL equipment and systems. Please provide rationale.

A complete certification process, similar to the certification of broadcast transmitters for example, should be established to assure that all installed equipments protect correctly the other spectrum users. Past field trials have shown that harmful interferences are produced and transmitted by BPL systems.

The certification process must include all the tests required to assure that the system is able to protect adequately the spectrum users, including the possibility of that BPL systems may likely create inter-modulation products in frequency bands outside their authorized frequency range of operation. All means necessary to adapt the system quickly when interferences are reported should also be included in the certification and approval process. This must include monitoring and total control of the operating parameters of the system as part of the certification conditions.

Q - 6.2 Prospective Technical Requirements

(a) Emission Limits

Access BPL systems operating below 30 MHz will be subject to following limits:

Frequency (MHz)	Field strength (microvolts/metre)	Measurement Distance (metres)
1.705-30.0	30	30

Access BPL systems operating above 30 MHz will be subject to the following limits:

Frequency (MHz)	Field strength (microvolts/metre)	Measurement Distance (metres)
30-80	90	3

The Department seeks comment on the above limits and their suitability for Access BPL systems in Canada.

Please provide technical rationale.

The limits should follow the limits already in place in Canada for other spectrum users. This would insure equality and fairness for all spectrum users. Due to their unintentional radiation, BPL systems become spectrum users. In this sense, BPL systems should comply with existing regulation and protect adequately the protected services.

In addition, the measurement method and signal levels should take in account the fact that the power lines act as distributed radiators. The measurement methods and levels used should not be based on point-source radiators.

Finally, studies and measurement in other countries proved that the interference levels currently proposed by the FCC are too high to protect existing spectrum users. The current proposed limits are very similar to the FCC limits, so it can be inferred that they will not be suitable to prevent harmful interference.

Consider the following example:

A HF broadcast listener needs a signal with a field strength of 50 dBuV/m or more to get an adequate reception.

The signal must be protected from interference by a ratio of 30 dB.

The proposed limits at 30m, allows for an interference level of 29.5 dBuV/m.

$50 \text{ dBuV/m} - 30 \text{ dB} = 20 \text{ dBuV/m}$

The proposed limit is 9.5dBuV/m too high for an adequate reception of HF broadcast.

The example is done at 30m from the power line, many receiving antennas will be closer than 30m from a power line.

In those cases the situation will worsen as the distance shortens.

(b) Interference Mitigation Requirements for Access BPL Systems

The Department seeks comment on whether:

*(1) Access BPL equipment should incorporate adaptive interference mitigation techniques as described above; and,
(2) additional or alternative interference mitigation techniques, if any, should be used to minimize the potential for interference to authorized services.*

Please provide rationale.

If BPL operators are treated as spectrum users, they will have to follow the coordination processes already established in each bands. This includes all the mitigation measures available. In addition, the use of mitigation techniques should not remove the responsibility to fully protect the present and future incumbent users of the spectrum. If all mitigation techniques prove to be inadequate to remedy interferences, the BPL operator should cease the use of the frequencies causing interference. This should be applicable even if it means a complete shut down of the BPL system.

Rationale: Broadcasting is a protected service to the Canadian public. In addition, as mentioned, there are also some critical public safety services, which may be interfered by BPL systems, including aeronautical navigation and military usages. .

The Department seeks comment on any additional technical requirements for Access BPL systems.

Please provide supporting technical rationale.

Spurious emissions, out-of-band emissions, inter-modulation products and harmonics should be kept low. The same criteria as other spectrum users should be applicable.

Rationale: Broadcasting is a protected service to the Canadian public. In addition, as mentioned, there are also some critical public safety services, which may be interfered by BPL systems, including aeronautical navigation and military usages.

Q - 6.3 Operational Requirements

(a) Prohibited Frequency Bands

The Department seeks comment on:

(1) the suitability of the above approach to protect safety-related services;

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- (2) what other approaches, if any, should be taken to protect safety-related radiocommunications; and
 (3) what bands, if any, should be excluded from use by Access BPL systems.

Please provide rationale.

Table 1 lists the frequencies used by CBC/Radio-Canada for HF Broadcasting and Low VHF Television Broadcasting. They must be excluded from the frequency range used by BPL operations, to protect the broadcasting services.

Service	Frequency Bands Used
HF Broadcasting – Shortwave Radio and DRM	5900 - 6200 kHz
	7100 - 7350 kHz
	9400 - 9900 kHz
	11600 - 12100 kHz
	13600 - 13800 kHz
	17480 - 17900 kHz
	18900 - 19020 kHz
	21450 - 21850 kHz
	25670 - 26100 kHz
Television	54 - 88 MHz

TABLE 1: EXCLUDED FREQUENCIES TO PROTECT BROADCASTING OPERATIONS

Table 2 lists the frequencies used by CBC/Radio-Canada that require protection from BPL harmonic frequencies, spurious emissions and inter-modulation frequencies.

Service	Frequency Bands Used
AM Broadcasting	535 - 1705 kHz
FM Broadcasting	88 - 108 MHz

TABLE 2: ADDITIONAL FREQUENCIES REQUIRING PROTECTION

Rationale: Broadcasting is a protected service to the Canadian public.

(b) Geographical Frequency Restrictions and Coordination Requirements

The Department seeks comment on:

- (1) What specific geographic locations, if any, should Access BPL systems be prohibited from operating?
 (2) As opposed to total ban, should Access BPL systems be able to operate in these locations if specific frequencies were avoided?
 (3) What procedure, if any, should be used to facilitate coordination between BPL operators and specific authorized users?

Please provide rationale.

The same process as the other services in the spectrum should be enforce for the BPL operators.

When a BPL network is ready to go in operation, the BPL operator should go on a test phase, like the on-air testing phase for broadcasters. This would include notification to the public, similar to those required by the new Antenna and Tower policy, e.g. in newspaper with a telephone number to report any problems. Notification of the public in a simple and clear language will enable non-technical audience of the broadcasters to understand the cause of the new interference. In addition, audience will more likely report interference if they are aware of the upcoming of the BPL operator. Without this notification to the public, the average listener or TV viewer may attribute the poor signal to weather condition or bad receiver and will not report the situation.

The operator should be granted the right to operate only after a successful test phase.

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The heavily populated area should be excluded. These areas are well covered with existing communication infrastructure and have already high spectrum utilization in all bands. In addition, the interferences and noise floor is already high in these areas. Finally, the density of potentially affected users is greater in these areas.

(c) Interference Resolution

The Department seeks comments on:

- (1) its proposal that individuals and organizations refer problems to BPL operators to investigate and resolve matters on a timely basis; and*
- (2) what other approaches could be taken to ensure the resolution of interference complaints?*

Please provide rationale.

The principle of the interference resolution must follow the same practices of the existing spectrum users, since BPL systems should be considered like a spectrum user.

The complaints mechanism should include an entry in a centralized point, to facilitate tracking of the interferences encountered by BPL systems for the whole country. This kind of database could facilitate the diagnostic of problematic equipments and operators.

An important aspect of the mitigation process is the response time. A response time grid should be created and used to assure the complaints are remedied in an adequate timeframe. This implies that emergency services would have a very short response time to remedy interference.

The Department seeks comment on the establishment of a publicly accessible database and its potential to ensure the timely resolution of interference complaints. In particular:

- (1) What specific information should be included in the database?*
- (2) How could the information be accessed and who should have access to the database?*
- (3) Who should develop, maintain and manage the database?*

Please provide rationale

(1) The database should include, for all valid complaints filed, the following:

- Provider
- Equipment used
- Date and time of complaints
- Date and time of remedial measures
- Solutions used
- Any relevant information on the interference and the solutions put in place.

(2) The database should be available on the Internet for general access. A general access can facilitate quick resolutions of complaints.

(3) The entity responsible of the BPL licenses issuing process. This is to assure independent data handling, reporting and access.
