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## North American Broadcasters Association (NABA)

DRAFT NEW RECOMMENDATION ITU R BS.[Doc. 6/229(Rev.1)]

### **Protection requirements for broadcasting systems operating in the LF, MF, HF and VHF bands below 80 MHz against the impact of power line telecommunication (PLT) Systems**

The North American Broadcasters Association (NABA, [www.nabanet.com](http://www.nabanet.com)) is an association of broadcasters in Canada, Mexico, and the United States, and the NABA Technical Committee is its standing technical body. NABA is thus in a position to present the technical viewpoints of the most authoritative association of professional North American Broadcasters in television and sound programme production, post-production, and distribution for terrestrial, satellite, and cable broadcasting.

NABA is a Sector Member of ITU-R and a long-time participant in ITU-R Study Groups, Working Parties, Task Groups, Rapporteur groups, etc. NABA numbers among its members Chairmen, Vice-Chairmen and members of the above groups. NABA also participates widely in the ITU work on radio, television and multimedia services and has a strong interest in spectrum management studies including spectrum engineering techniques, spectrum management fundamentals, spectrum monitoring, and inter-service sharing, interference and compatibility.

In this context, NABA notes that the ITU-R Radiocommunication Assembly RA-07 decided to send the draft new Recommendation (Document 6/229(Rev.1)) back to Study Group 6 for further consideration. This draft new Recommendation provides detailed information on the tolerable levels of interference to broadcast services in the bands below 80 MHz, caused by radiation from power lines when they are used to also carry digital signals that are delivered all the way into consumers' houses over the electric power lines infrastructure.

The draft new Recommendation specifies the permissible interference field strength generated by this use of power lines, on the basis of the consumer receiver sensitivity, receiver noise level, external noise including man-made noise, keeping into account the noise characteristics of consumer radio receivers, the level of man-made noise, atmospheric noise and galactic noise. These factors are used to deduce interference criteria for PLT systems.

NABA takes note that the Recommendations ITU-R BS.1786, ITU-R BT.1786, and ITU-R BO.1773 provide a similar criterion to protect the broadcasting services from interference caused by emissions of non-broadcasting radiocommunication devices. These devices such as Ultra Wideband (UWB) equipment and FM modulators are readily available to consumers. NABA also notes that the criterion proposed in Document 6/229(Rev.1) is consistent with the existing ITU-R Recommendations. Since the broadcasting services are afforded protection from interference caused by the emission of UWB devices and short-range modulators, it is appropriate to provide similar protection from interference caused by PLT.

NABA continues to support the adoption of draft new Recommendation ITU-R BT.[6/229(Rev.1)]. To this end, NABA presents an additional study in Annex 1 that illustrates the need for this Recommendation in order to provide protection to the Broadcasting Service operating in the bands below 80 MHz.

## Annex 1

### Measurements of the radiated emissions from in-house power line telecommunications systems into the residential environment

#### 1 Introduction

Kitagawa and Ohishi<sup>1</sup> recently measured the radiated electric field strength emanating from a residential house while various Power Line Telecommunication (PLT) devices were being operated within the house. The measurements illustrate the need to provide protection to the Broadcasting Service through an ITU-R Recommendation as contained in Document 6/229(Rev.1). Their measurements were performed in an actual residential environment using a two-story wooden house. The measurement point was 10 meters from the outer wall of the house with a shielded small loop antenna for measuring the radiated electric field strength at a height of two meters. The antenna beam direction was fixed towards the centre of the house. The antenna output was measured by a spectrum analyzer over a frequency span of 2 to 26 MHz with a resolution bandwidth of 8 kHz.

Various PLT devices were tested. Table 1 tabulates the devices by manufacturer, model, and modem standard. A pair of PLT devices was plugged into two outlets. Each device was connected to a personal computer. Data was transmitted by sending a large file from one computer to the other through the PLT devices. Measurements of the radiated electric field strength were made during the file transfer. The measurements were made during file transfers between two outlets on the second floor.

TABLE 1

**PLT devices tested for radiated emissions**

Manufacturer	Model	Modem Standard
Hikarinetworks	CNC-1000	HomePlug 1.0 Turbo
Panasonic	BL-PA100	HD-PLC
Sharp	HN-VA10/40	HomePlug AV1.1
Netgear	PL-NTGR-300	UPA
Logitech	LPL-TX	UPA
Logitech	LPL-TXA	UPA

#### 2 Measurement results

The following figures illustrate the radiated electric field strength (REF) as a function of frequency measured at a distance of 10 meters from the outer wall of the house. The red lines correspond to the measurement of REF with the PLT devices not plugged in. These measurements correspond to the ambient noise level. Sharp spikes represent either broadcast signals or other radiocommunication signals. The black lines correspond to the measurement of electric field strength with the PLT device plugged in and transferring files between computers.

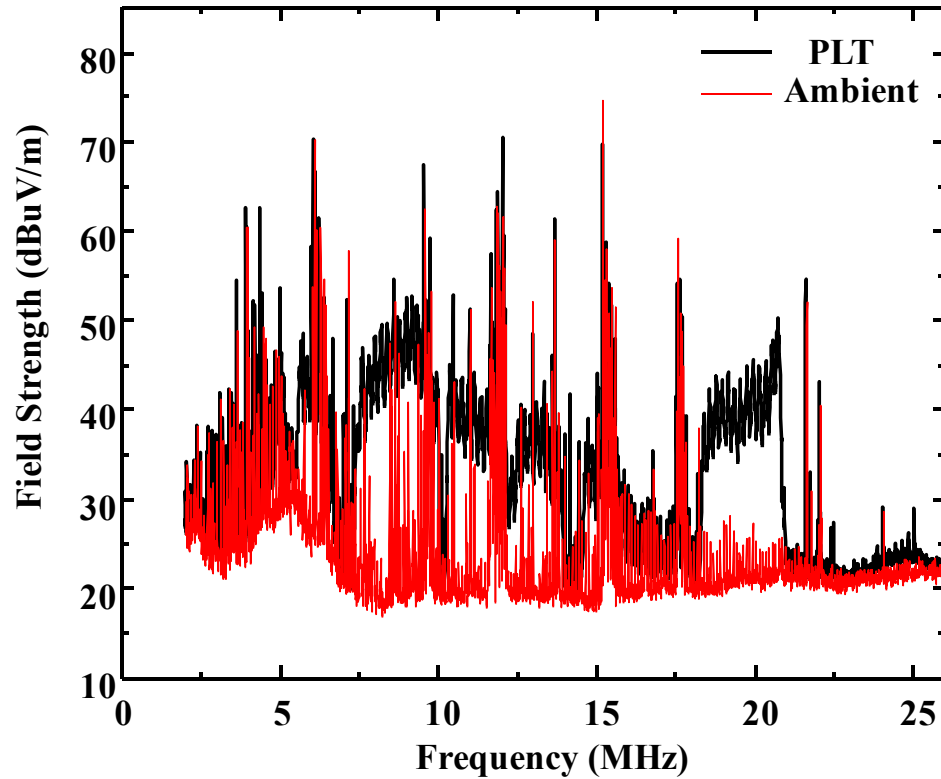
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<sup>1</sup> Masahiro Kitagawa and Masatoshi Ohishi, "Measurements of the Radiated Electric Field and the Common Mode Current from the In-house Broadband Power Line Communications in Residential Environment I", *IEICE Tech. Rep.*, vol. 107, no. 533, EMCJ2007-117, pp. 1-6, March 2008.

Figure 1 illustrates the radiated electric field strength for a Hikarinetworks<sup>2</sup> CNC-1000 PLT device using the HomePlug 1.0 Turbo standard. Note that the REF reaches 50 dB $\mu$ V/m at 9.4 MHz nearly 32 dB above the ambient level during a file transfer.

FIGURE 1

**Radiated Electric Field Strength (dB $\mu$ V/m) as a function of frequency (MHz) for the Hikarinetworks CNC-1000 PLT device (HomePlug 1.0 Turbo standard) showing a substantial increase in the interference level above ambient across the frequency band<sup>1</sup>**



<sup>2</sup> The devices measured were claimed by Hirkarinetworks to be not for domestic use in Japan.

Figure 2 illustrates the radiated electric field strength for a Panasonic BL-PA100 device using the HD-PLC standard. The REF reaches 44 dB $\mu$ V/m at 9.4 MHz exceeding the ambient noise level by about 26 dB during a file transfer.

FIGURE 2

**Radiated Electric Field Strength (dB $\mu$ V/m) as a function of frequency (MHz) for the Panasonic BL-PA100 PLT device using the HD-PLC standard. An increased interference level above ambient is evident across the frequency band<sup>1</sup>**

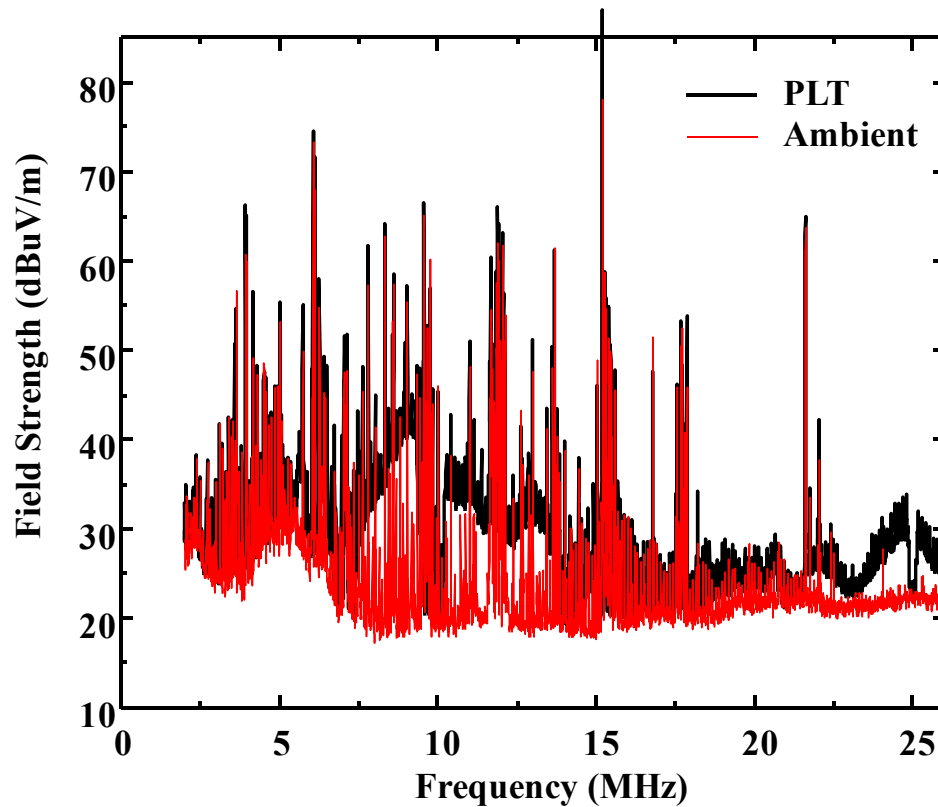


Figure 3 illustrates the radiated electric field strength for a Sharp HN-VA PLT device using the HomePlug AV 1.1 modem standard. The REF reaches 45 dB $\mu$ V/m at 9.4 MHz exceeding the ambient noise level by about 27 dB during a file transfer.

FIGURE 3

**Radiated Electric Field Strength (dB $\mu$ V/m) as a function of frequency (MHz) for a Sharp HN-VA PLT device using the HomePlug AV 1.1 modem standard. An increased interference level above ambient is evident across the band<sup>1</sup>**

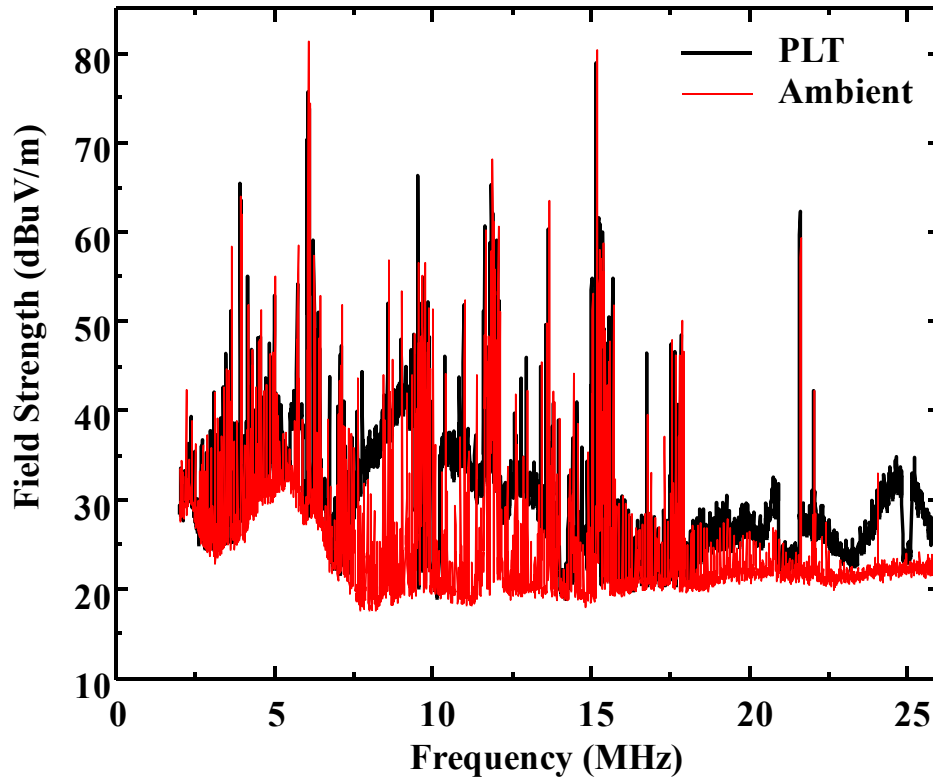


Figure 4 illustrates the radiated electric field strength for a Netgear PL-NTGR-300 PLT device using the UPA standard. The REF reaches 45 dB $\mu$ V/m at 9.4 MHz exceeding the ambient noise level by about 27 dB during a file transfer.

FIGURE 4

**Radiated Electric Field Strength (dB $\mu$ V/m) as a function of frequency (MHz) for a Netgear PL-NTGR-300 PLT device using the UPA standard. An increased interference level above ambient is evident across the band<sup>1</sup>**

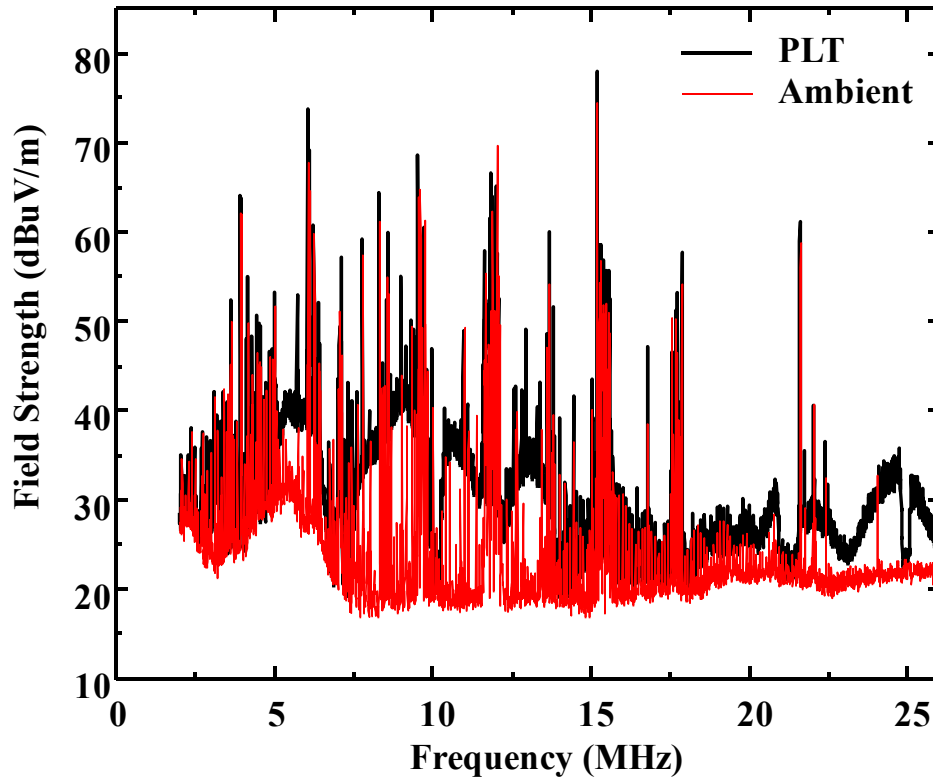


Figure 5 illustrates the radiated electric field strength for a Logitech TX PLT device using the UPA standard. The REF reaches 54 dB $\mu$ V/m at 6 MHz and 9.4 MHz exceeding the ambient noise level by about 36 dB and 50 dB $\mu$ V/m at 25.5 MHz exceeding the ambient noise level by about 28 dB during a file transfer.

FIGURE 5

**Radiated Electric Field Strength (dB $\mu$ V/m) as a function of frequency (MHz) for a Logitech TX PLT device using the UPA standard. A significant increase in the interference level above ambient is evident across the entire band<sup>1</sup>**

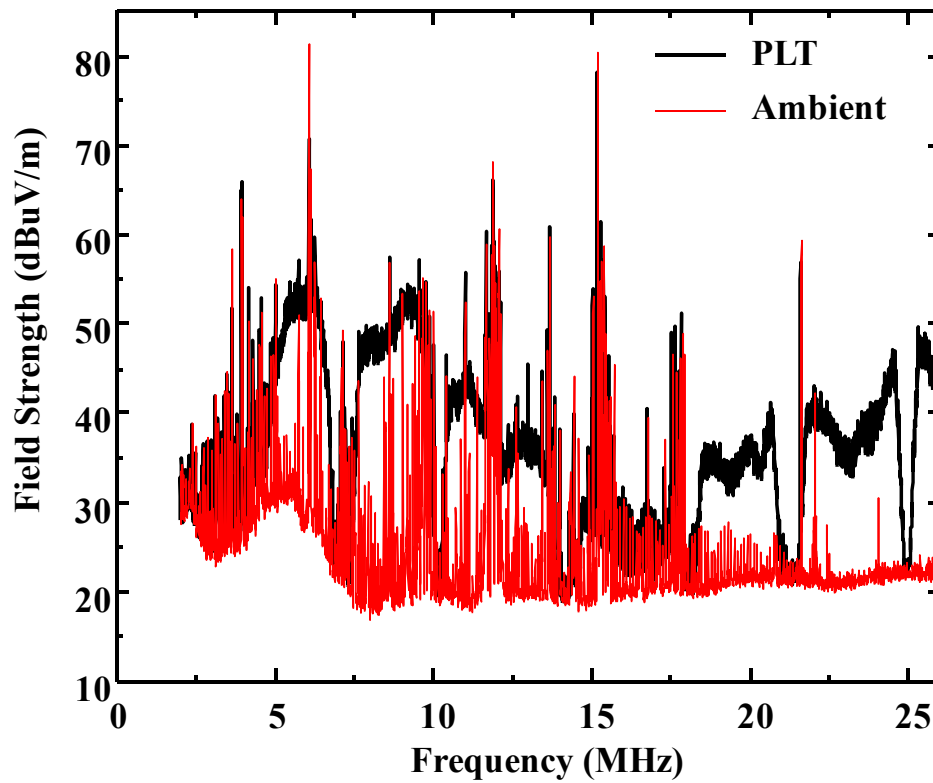




Figure 6 illustrates the radiated electric field strength for a Logitech TXA PLT device using the UPA standard. The REF is improved over the TX model by about 10 dB above 15 MHz. However, the REF of the TXA model still exceeds the ambient noise level by about 36 dB at 9.4 MHz during a file transfer.

FIGURE 6

**Radiated Electric Field Strength (dB $\mu$ V/m) as a function of frequency (MHz) for a Logitech TXA PLT device using the UPA standard. A significant increase in the interference level above ambient is still evident across the entire band<sup>1</sup>**

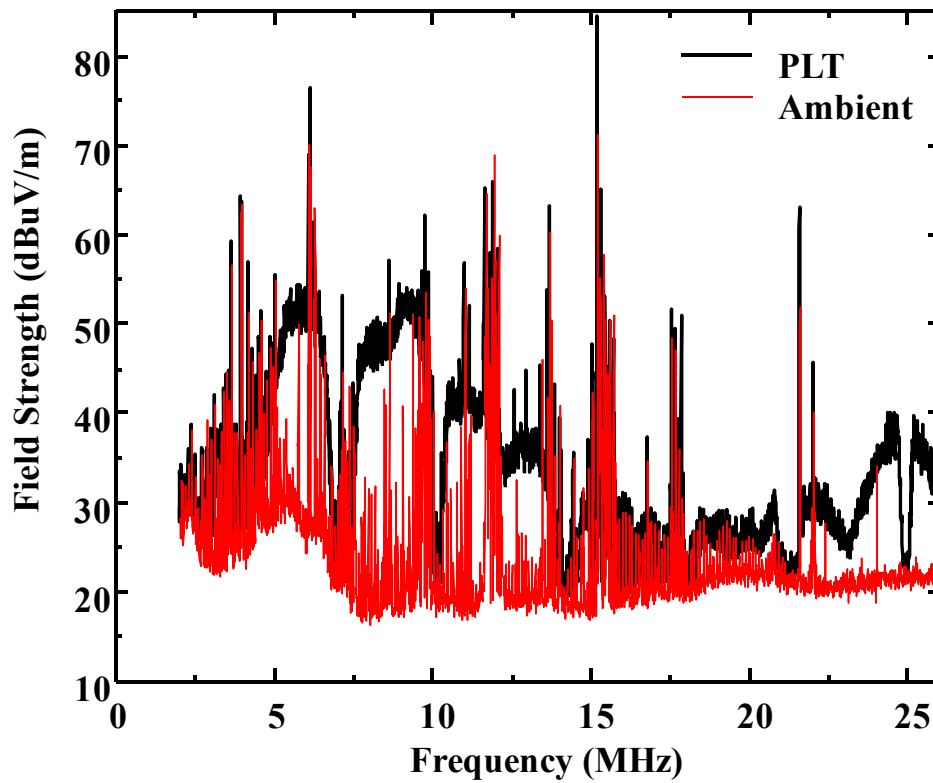
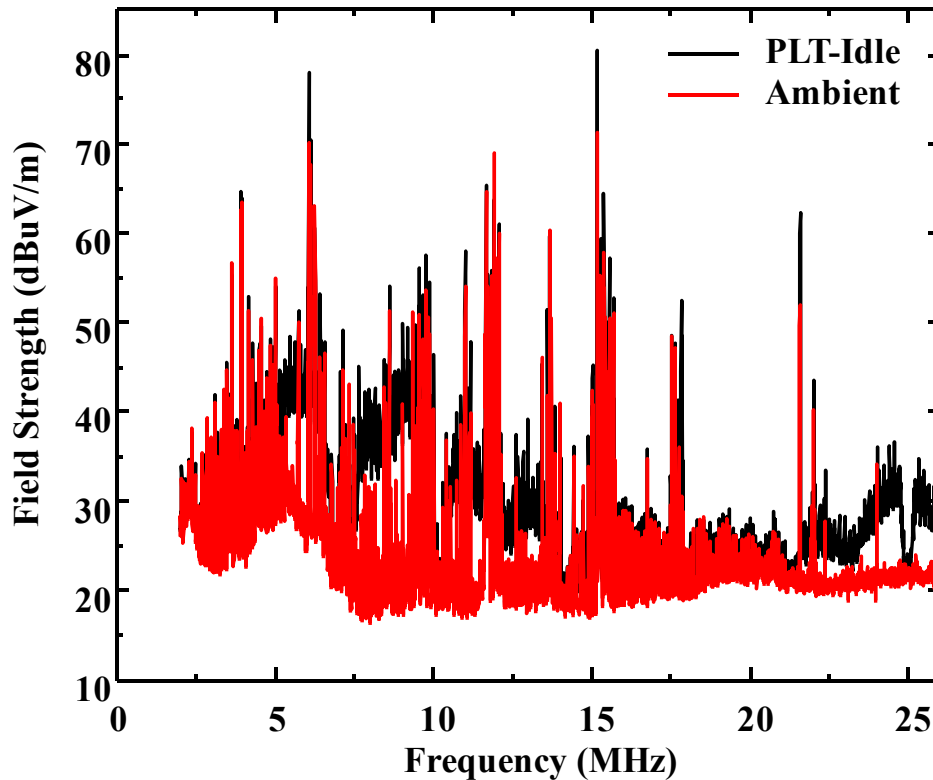


Figure 7 illustrates the radiated electric field strength for the Logitech TXA PLT device in the idle state (no file transfer). The REF still reaches 45 dB $\mu$ V/m at 6 and 9.4 MHz exceeding the ambient noise level by about 17 dB.

FIGURE 7

**Radiated Electric Field Strength (dB $\mu$ V/m) as a function of frequency (MHz) for an idle Logitech TXA PLT device. An increase in the interference level above ambient is evident across the entire band even though the PLT device is not transmitting information<sup>3</sup>**



### 3 Conclusions

The work of Kitagawa and Ohishi clearly shows that all measured radiated electric field strengths caused by individual PLT devices exceed ambient noise levels to varying degrees. It is quite evident that the antenna characteristics of in-house power lines make it difficult to control radiated emissions from PLT devices. Consequently, PLT devices for in-house use must be substantially improved in order that their interference will not exceed the protection requirement contained in Recommendation ITU-R BT.1786. It is therefore, reasonable to reconsider the DNR contained within Document 6/229(Rev.1) as a viable recommendation for in-house PLT applications.

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<sup>3</sup> Masahiro Kitagawa and Masatochi Ohishi, private communication.