GENERAL NOTICE

NOTICE 214 OF 2008

INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

NOTICE OF INTENTION TO MAKE REGULATIONS IN RESPECT OF TECHNICAL STANDARDS FOR POWER LINE TELECOMMUNICATIONS

Notice is hereby given that the Independent Communications Authority of South Africa (ICASA) intends making the following regulation in terms of section 35(1) and 36(1) of the Electronic Communications Act (Act No. 36 of 2005).

Interested persons are invited to submit written comments or written representations with regard to the proposed regulations, to be received **by no later than 16h00 on 06 March 2008** by post, hand delivery, facsimile transmission or by an electronic version in Microsoft Word for the attention of

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ICASA

PLT Standard for South Africa

PLT Standard for South Africa

1. INTRODUCTION

Power Line Telecommunications (PLT) is a technology that provides a broadband access communication channel to the internet and other similar services by means of using low-voltage (LV) or Medium-voltage (MV) power lines.

This standard aims to provide the necessary EMC requirements to enable the roll out of PLT systems without causing harmful interference to other devices and systems operating in the 1.705 MHz to 30 MHz frequency band.

This standard will be implemented on an interim basis until a relevant CISPR standard is published and adopted.

Compliance with this standard does not waive any requirement for licencing of PLT networks and services as required in terms of Chapter 3 of the Electronic Communication Act (Act No. 36 of 2005).

This standard is not applicable to the current-carrier systems used by power utilities that operate at frequencies below 2 MHz with limited communication capabilities.

2. SCOPE

This standard sets out the minimum operational requirements for Power Line Telecommunications (PLT) systems operating in the 1.705 MHz to 30 MHz frequency band over medium- and low-voltage power distribution networks, in order to protect radiocommunication systems from harmful interference.

3. DEFINITIONS

"**Dwellings**" means habitation, a place of residence or house;

"**Electromagnetic Compatibility" (EMC)** means a measure of the performance of an item or system of electronic equipment, in respect of its ability to operate correctly in a given electromagnetic environment, without affecting, or being adversely affected by, that environment;

"**Geographic exclusion zone**" means a geographic area within which PLT operations are not permitted;

"**Frequency band exclusions**" means a band of frequencies within which PLT operations are not permitted;

"**Low-voltage (LV) distribution**" means power lines carrying low-voltage from a distribution transformer to customer's premises. Low-voltage lines may be overhead or underground, depending on the power grid network topology;

"**Medium-voltage (MV) distribution" means** power lines carrying between 1000 and 40000 volts from a power substation to neighbourhoods. Medium-voltage lines may be overhead or underground, depending on the power grid network topology;

"**Power Line Telecommunications (PLT) System**" means a system or part of a system that transmits and receives electromagnetic energy by conduction over medium- and/or low-voltage electric power lines, with the purpose of carrying information;

"**PLT Port**" means a port connecting to either low- or medium-voltage distribution networks supporting communications.

"**Signal port" means a** point of connection for voice, data and signalling transfers intended to interconnect widely dispersed systems via such means as direct connection to multi-user telecommunications networks and similar networks.

4. LIMITS

PLT systems must meet the CISPR Class B limits as specified in terms of sections 4.1 and 4.2. of these standards.

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4.1 Conducted disturbance at mains ports, PLT ports and signal ports

The equipment under test (EUT) must meet the limits in tables 2 and 4 (Class B). .

For PLT ports, the limits in tables 2 and 4 (Class B) apply. .

Signal ports must meet the limits given in table 4 (Class B).

Table 1

Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1 The lower limit must apply at the transition frequency Note 2 The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

Table 2 – Limits for conducted disturbance at mains ports (Class B)

Frequency range MHz	Voltage Limits dB(μV)		Current Limits dB(μA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0.5	84 to 74	74 to 64	40 to 30	30 to 20
0.5 to 30	74	64	30	20
Note 1 The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. Note 2 The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150 Ω to the telecommunication port under test (conversion factor is $20\log_{10}$ 150 / I = 44 dB Note 3 PLT ports must be tested using an Artificial Mains Network as specified in CISPR 22.				

Table 4 – Limits for conducted common mode (asymmetric mode) disturbance at PLT port and signal ports the frequency range 0.15 to 30 MHz for Class B equipment

4.2 Radiated limits

4.2.1 Below 30 MHz

Frequency range MHz	Voltage Limits dB(μV/m)
1.705 to 30 MHz	30
Note Measured at 30 meter distance,	

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Table 5 – Limits for radiated disturbances below 30 MHz

4.2.2 Above 30 MHz

Frequency range MHz	Quasi-peak limits dB(μV/m)
30 to 230	30
230 to 1000	37
Note 1 The lower limit applies at the transition frequency Note 2 Additional provisions may be required for cases where interference occurs.	

Table 7 – Limits for radiated disturbance of class B at a measuring distance of 10m

5. MEASUREMENT TECHNIQUES

5.1 Conducted disturbance measurements

The measurement method must be in accordance with CISPR 22 Ed. 5. Both mains- and PLT port conducted measurements must be done using the artificial mains network (AMN) specified within CISPR 22. The other signal ports must be measured using the Impedance Stabilization Network (ISN) specified within CISPR 22.

All measurements are to be performed with the communication functions active.

5.2 Radiated measurements below 30 MHz

Radiated measurements below 30 MHz will be needed for the investigation of interference complaints. The measurement method given in Appendix A must be used.

5.3 Radiated measurements above 30 MHz

The measurement methods as specified in CISPR 22 must be used for above 30 MHz measurements.

6. INTERFERENCE MITIGATION AND AVOIDANCE TECHNIQUES

Power Line Telecommunication licensees must adhere to the following interference mitigation and avoidance techniques.

6.1 Attenuation of Conducted signals

Attenuation filters may be installed on the mains network if and when a PLT system interferes with an HF broadcast receiver in adjacent dwellings. The filter could be inserted between a radio receiver's mains power plug and the electrical wall socket where it is connected.

6.2 Frequency Band exclusions

To protect Aeronautical (land) stations, aircraft receivers and Maritime coast stations, PLT operations using overhead power lines are prohibited in the frequency bands listed in Table 8 and 9 of these standards..

PLT systems must not operate within the frequency bands listed hereunder:

Frequency Band
2 850 – 3 025 kHz
3 400 – 3 500 kHz

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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

Table 8 – Exclusion Aeronautical Frequency Bands

Frequency Band
2 173.5-2 190.5 kHz

Table 9 – Exclusion maritime frequency band

6.3 Geographic exclusion zones

The operation of PLT systems will not be allowed where geographic exclusion zones around maritime coast stations exist. No PLT system is allowed to operate within 1 km of the boundary of maritime coast stations located at the coordinates listed in Table 10.

Location	Latitude	Longitude
DURBAN BLUFF	295346	310225
CAPE AGULHAS	344949	200024
CAPE COLUMBINE	324932	175100
CAPE ST MARTIN	324252	175519
CAPE TOWN RADIO	335246	183019
CHELSEA RADIO PE	340014	252848
CONSTANTIABERG	340318	182309
KLIPHEUWEL RADIO	334057	184301
DURBAN KLOOF	294821	304856
KWELEGA (EAST LONDON)	325443	280444
MOSSEL BAY	341107	220913
PINE TOWN	294805	305220
PORT EDWARD	310341	301318
PORT NOLLOTH	291732	165242
SCHOENMAKERSKOP PE	340211	253320
ST LUCIA	282209	322512
STRUISBAAI	344825	200252
YZERFONTEIN	332008	181133

Table 10 – Maritime Coast Stations

6.4 Consultation area requirements

A licensee operating a PLT system must notify and consult with the relevant authorities (e.g. Metros, Eskom) in the area where it plans to deploy a PLT system, at least 30 days prior to initiation of any operation or service. The licensee must design or implement the PLT system such that it does not cause harmful interference in those frequency bands used by the public safety agencies in the area serviced by the PLT system. The notice must include, as a minimum, the information listed in regulation 8 of these standards.

6.5 Adaptive interference techniques

PLT systems must 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 as used by licensed radio services. These techniques may include adaptive or "notch" filtering, or complete avoidance of frequencies, or bands of frequencies, locally used by licensed radio operations.

When a notch filter is used to avoid interference to specific frequency band, the PLC system must be capable of attenuating emissions within that band to a level at least 20 dB below the applicable emission limit.

PLT systems must comply with applicable 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.

PLT systems must 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.

7. COMPLAINT- RESOLUTION PROCESSES

7.1 A licensed spectrum user experiencing harmful interference that is suspected to be caused by a PLT system must inform the local PLT licensee's contact person designated in the PLT database.

7.2 The investigation of the reported interference and the resolution of confirmed harmful interference from the PLT system must be successfully completed by the PLT licensee 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.

7.3 The PLT licensee must respond to complaints of harmful interference from public safety users within 24 hours.

7.4 With regard to public safety complaints, if the interference cannot be resolved within 24 hours, the PLT licensee is required to immediately cease the operations causing such interference.

7.5 In addition to the above, the standard ICASA complaints resolution processes must be used for reporting cases of interference.

8. PLT DATABASE

Licensees planning to operate PLT systems must supply to the Authority, information on all planned PLT systems for inclusion into a publicly available database, no later than 10 days prior to initiation of the service. Such information must include the following:

1. The name of the PLT licensee
2. The frequencies of the PLT operation
3. The suburb served by the specific PLT operation
4. The manufacturer and type of PLT equipment and its associated ICASA Type Approval number
5. The contact information, including phone number, mobile number and email address of a person at, or

associated with, the PLT licensee, to facilitate the resolution of any interference complaint.

6. The proposed date of PLT operation

The Authority will enter the said information into the publicly accessible database within three (3) working days of receipt of such information.

8.1 APPENDIX A: Measurement Guidelines for Power Line Telecommunication (PLT) SYSTEMS

This appendix is intended to provide general guidance for radiated measurements of PLT systems. For PLT systems, the measurement principles are based on the current understanding of PLT technology.

Modifications may be necessary as measurement experience is gained.

8.2 General Measurement Principles for Outdoor PLT and Indoor PLT

1) Testing must be performed with the power settings of the Equipment Under Test (EUT) set at the maximum level.

2) Testing must 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 must be made at a test site where the ambient signal level is at least 6 dB below the applicable limit.

4) If the data communications burst rate is at least 20 burst per second, quasi-peak measurements must be employed, as specified in CISPR 16. If the data communications burst rate is 20 bursts per second or less, measurements must be made using a peak detector.

5) The signal must be maximized for antenna heights from 1 to 4 meters, for both horizontal and vertical polarization procedures. For Outdoor PLT 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 should be 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 must be reported.

8) All operational modes must be tested including all frequency bands of operation, by using the following procedure:

   If the device under test provides for the connection of external accessories, including external electrical input signals, the device must be tested with the accessories attached. The device under test must be fully exercised with these external accessories.

   The emission tests must 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. In the case of multiple accessory external ports, an external accessory must be connected to one of each type of port. Only one test using peripherals or external accessories that are representative of the devices that will be employed with the equipment under test is required.

   All possible equipment combinations do not need to be tested. The accessories or peripherals connected to the device being tested must be unmodified, commercially available equipment which complies with the CISPR 22 limits.

8.3 Outdoor PLT Measurement Principles

8.3.1 Test Environment

1) The Equipment Under Test (EUT) includes all PLT system devices e.g., couplers, injectors, extractors, repeaters, boosters, concentrators, and electric utility overhead or underground low- and medium-voltage lines or cables.

8.3.2 Radiated Emissions Measurement Principles for Overhead Line Installations

1) Measurements must 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 the following requirements:

   At frequencies below 30 MHz, measurements may be performed at a distance closer than specified; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results must be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

2) Testing must be performed at distances of 0, ¼, ½, ¾, and 1 wavelength down the line from the PLT 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 must be extended in steps of ½ wavelength of the mid-band frequency until the distance equals or exceeds ½ wavelength of the lowest frequency injected. (For example, if the device injects frequencies from 3 to 27 MHz, the wavelength corresponding to the midband frequency of 15 MHz is 20 meters, and the wavelength corresponding to the lowest injected frequency is 100 meters.

   Measurements are to be performed at 0, 5, 10, 15, and 20 meters down the line—corresponding to zero to one wavelength at the mid-band frequency. Because the mid-band frequency exceeds the minimum frequency by more than a factor of two, additional measurements are required at 10-meter intervals until the distance down-line from the injection point equals or exceeds ½ of 100 meters. Thus, additional measurement points are required at 30, 40, and 50 meters down line from the injection point.)

3) Testing must be repeated for each Outdoor PLT component (injector, extractor, repeater, booster, concentrator, etc.)

4) The distance correction for the overhead-line measurements must 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 the requirements given in point 1. (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 PLT-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.

   Note: In cases where Outdoor PLT 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.

8.3.3 Radiated Emissions Measurement Principles for Underground Line Installations

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

2) Measurements must be performed at a separation distance of 10 meters from the in-ground power transformer that contains the PLT 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 the following requirements:

   At frequencies below 30 MHz, measurements may be performed at a distance closer than specified; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results must be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

3) Measurements must be made at positions around the perimeter of the in-ground power transformer where the maximum emissions occur. A minimum of 16 radial angles surrounding the EUT (In-ground transformer that contains the PLT device(s)). If directional radiation patterns are suspected, additional azimuth angles must be examined.

8.4 Indoor PLT Measurement Principles

8.4.1 Test Environment and Radiated Emissions Measurement Principles for In-Situ Testing

1) The Equipment under Test (EUT) includes Indoor PLT modems used to transmit and receive carrier PLT 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 must be performed with the EUT installed in a building on an outside wall on the ground floor or first floor. Testing must be performed on three typical installations. The three installations must include a combination of buildings with overhead-line(s) and underground line(s). The buildings must not have aluminium or other metal siding, or shielded wiring (e.g.: wiring installed through conduit, or Norse cable).

3) Measurements must be made at positions around the building perimeter where the maximum emissions occur. A minimum of 16 radial angles surrounding the EUT (building perimeter). If directional radiation patterns are suspected, additional azimuth angles must be examined.

4) Measurements must 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 the following requirements:

   At frequencies below 30 MHz, measurements may be performed at a distance closer than specified; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results must be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor

(40 dB/decade).

8.4.2 Additional Measurement Principles for In-Situ Testing With Overhead Lines

1) In addition to testing radials around the building, testing must 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 of 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 must be included in the technical report.

2) Measurements must 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 9.2.2 (4), above.

3) The distance correction for the overhead-line measurements must 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 9.2.2 (4), above.

9. AMENDMENT AND REPEAL

The Authority may amend or repeal these standards by notice in the Gazette.

10. SHORT TITLE AND COMMENCEMENT

These regulations will be known as the Power Line Telecommunications (PLT) Standard Regulations and will come into force by notice in the Gazette.