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Conducted and radiated electromagnetic environment in home networking

Recommendation ITU-T K.92



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Recommendation ITU-T K.92

Conducted and radiated electromagnetic environment in home networking

Summary

Recommendation ITU-T K.92 describes the home networking electromagnetic environment. It gives the typical conducted and radiated phenomena in the home networking environment, the attributes of the home networking environment and the specification of disturbance characteristics and levels. This Recommendation also provides guidance on how to evaluate the electromagnetic (EM) environment in home networking.

This Recommendation also provides several case studies about the home networking environment and information on how to evaluate the electromagnetic (EM) environment in home networking.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T K.92	2012-05-29	5

Keywords

Electromagnetic environment, home networking.

FOREWORD

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Conducted and radiated electromagnetic environment in home networking

1 Scope

This Recommendation defines the electromagnetic environmental conditions in home environments where home networking devices are installed. This Recommendation applies to telecommunication equipment installed in home networking.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T K.34] Recommendation ITU-T K.34 (2003), *Classification of electromagnetic environmental conditions for telecommunication equipment – Basic EMC Recommendation*.
- [ITU-T K.37] Recommendation ITU-T K.37 (1999), *Low and high frequency EMC mitigation techniques for telecommunication installations and systems – Basic EMC Recommendation*.
- [ITU-T K.74] Recommendation ITU-T K.74 (2008), *EMC, resistibility and safety requirements for home network devices*.
- [CISPR 11] CISRP 11 (2009), *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*.
<http://webstore.iec.ch/webstore/webstore.nsf/ArtNum_PK/43918>
- [IEC 60050-161] IEC 60050-161-Amd. 2 (1999), *International Electrotechnical Vocabulary. Chapter 161: Electromagnetic compatibility*.
<http://webstore.iec.ch/webstore/webstore.nsf/ArtNum_PK/22945?OpenDocument>
- [IEC 61000-2-5] IEC/TR 61000-2-5 (2011), *Electromagnetic compatibility (EMC) – Part 2-5: Environment – Description and classification of electromagnetic environments*.
<http://webstore.iec.ch/webstore/webstore.nsf/ArtNum_PK/45165?OpenDocument>

3 Definitions

3.1 Term defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 electromagnetic environment [IEC 60050-161]: Totality of electromagnetic phenomena existing at a given location.

NOTE – In general, this totality is time-dependent and its description might need a statistical approach.

3.2 Term defined in this Recommendation

This Recommendation defines the following term:

3.2.1 EM source: The object that may be at the origin of electromagnetic waves.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AC	Alternating Current
ASDL	Asymmetric Digital Subscriber Line
ATM	Automatic Teller Machine
CATV	Cable Television
CB	Citizen Band
DC	Direct Current
DVD	Digital Video Disc
EFT/B	Electrical Fast Transients/Bursts
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
FFT	Fast Fourier Transformation
FM	Frequency Modulation
IP	Internet Protocol
ISDN	Integrated Services Digital Networks
ISM	Industrial, Scientific and Medical
ITE	Information Technology Equipment
LAN	Local Access Network
ONU	Optical Network Unit
PC	Personal Computer
PLT	Power Line Telecommunication
PSTN	Public Switched Telephone Network
RADAR	Radio Detection And Ranging
REIN	Repetitive Electrical Impulsive Noise
STB	Set-Top Box
TE	Transverse Electric
TM	Transverse Magnetic
VCR	Video Cassette Recorder
VDSL	Very high speed Digital Subscriber Line
VDU	Visual Display Unit
Wi-Fi	Wireless Fidelity
xDSL	X-type Digital Subscriber Line

5 Home networking environment

5.1 Description of home networking environment

With the recent advances in telecommunication technologies, high-speed access networks, by which users can easily access networks, have been introduced in home environments. As a result, many users can now enjoy many network-based services, and many electronic devices are connected to the network so that home networks can be easily constructed.

On the other hand, there are many wired and wireless technologies that have appeared on the market, and these kinds of technologies could be introduced in a home network environment. In these network configurations, several kinds of network-related equipment are introduced in the home and are set in close proximity to each other.

The home networking environment refers to customer premises (residential location) environments. In accordance with Figure 1, the residential location exists in an area of land designated for the construction of domestic dwellings. The function of a domestic dwelling is to provide a place for one or more people to live in.

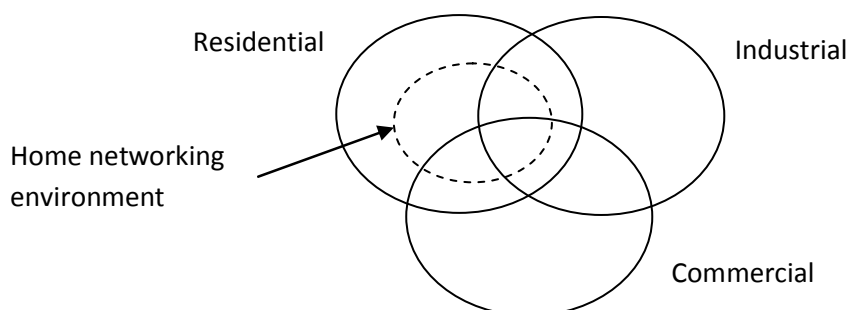


Figure 1 – Concept of location classes

5.2 Equipment installed in the home networking environment

Any equipment within the home networking environment is connected to the telecommunication networks (e.g., public switched telephone networks (PSTNs), integrated services digital networks (ISDN), x-type digital subscriber lines (xDSL), etc.), local area networks (e.g., Ethernet, token ring, etc.) and similar networks.

The home networking environment is characterized by the ad hoc location of telecom, electrical and electronic equipment used by the residents. Equipment items can therefore be placed in very high density. The typical locations include:

- the home office desk, with PC located on/below the desk; VDU, speakers, printer, wireless keyboard and wireless mouse located on the desktop; laptops, portable telephone handset and/or cellular telephone handset located on the desktop, near to or in physical contact with one of the items;
- the 'adolescent's bedroom', which may contain the above described home office desk in addition to a TV set with DVD/VCR and games console. High-density locations typically access the internal low voltage power supply network via a single outlet socket that is fitted with a distribution board/power strip.

A non-exhaustive list of the types of equipment present and operated within the home networking environment is presented below.

- 1) Home network devices [ITU-T K.74]:
 - a) telecommunication devices, such as ONUs, routers, or broadband modems;
 - b) controlling devices with telecommunication ports, such as STBs;
 - c) information technology equipment (ITE), such as PCs, with telecommunication ports.
- 2) Multimedia equipment, household equipment and ITE devices operate with home networking devices.

At the boundary of the home networking environment, there is the following wireline infrastructure:

- extension wiring of telecom network;
- coaxial distribution network;
- low-voltage power supply distribution network.

6 Typical phenomena in home networking environment

The typical phenomena in home networking environment are:

- a) Conducted low-frequency phenomena:
 - harmonics of the fundamental power frequency;
 - power supply network voltage amplitude and frequency changes;
 - power supply network common-mode voltages;
 - signalling voltages in power supply networks (0.1-3 kHz);
 - induced low-frequency voltages;
 - DC voltage in AC networks;
 - lighting.
- b) Radiated low-frequency phenomena:
 - magnetic fields (DC, railway, power system, power system harmonics, etc.);
 - electric fields (DC lines, railway (16 2/3 Hz), power system (50-60Hz)).
- c) Conducted high-frequency phenomena:
 - direct-conducted continuous wave;
 - induced continuous wave;
 - transients.
- d) Radiated high frequency phenomena:
 - radiated (continuous wave) oscillatory disturbances;
 - radiated (modulated) signal disturbances;
 - radiated (transient) pulsed disturbances.
- e) Electrostatic discharge (ESD) phenomena
 - conducted;
 - radiated.

Some of these phenomena may be generated by home networking, such as induced continuous wave. Some of these phenomena are generated by others but may interface with the home networking, such as ESD. The details of these phenomena are described in the basic EMC Recommendation, [ITU-T K.34] and in [IEC 61000-2-5]. In the context of the Recommendation and in accordance with the IEC EMC approach, the term "low frequency" applies to frequencies up to and including 9 kHz; the term "high frequency" applies to frequencies above 9 kHz.