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SERIES K: PROTECTION AGAINST INTERFERENCE

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## **Immunity of home network devices to electromagnetic disturbances**

Recommendation ITU-T K.93

ITU-T



# Recommendation ITU-T K.93

## Immunity of home network devices to electromagnetic disturbances

### Summary

The introduction of high-speed data services to customer premises that rapidly adopt new technologies allows the distribution of such data within customer premises. This is leading to a number of different wireless (e.g., wireless local area network, LAN, and digital enhanced cordless telecommunications, DECT) and wireline technologies (e.g., LAN and technologies designed to exploit existing telephone extension and power distribution wiring) to interconnect a variety of in-home electronic and electrical equipment (such as set top box, STB), and PCs. Many types of broadband services are provided on IP networks, such as voice over Internet protocol (VoIP), video on demand (VoD) and broadcasting. Moreover, the electromagnetic environment in the home will change due to this situation. Therefore, new electromagnetic compatibility issues may occur in a home network environment. Recommendation ITU-T K.93 aims to ensure normal operation of home networking devices and to provide a new additional immunity test method for broadband services, especially for devices that are sensitive to broadband interferences.

### History

| Edition | Recommendation | Approval   | Study Group | Unique ID*                                                                |
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### Keywords

Broadband impulsive conducted disturbance, home networks, QoS and xDSL.

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## Table of Contents

|                                                                                                 | Page |
|-------------------------------------------------------------------------------------------------|------|
| 1 Scope.....                                                                                    | 1    |
| 2 References.....                                                                               | 1    |
| 3 Definitions .....                                                                             | 2    |
| 3.1 Terms defined elsewhere .....                                                               | 2    |
| 3.2 Terms defined in this Recommendation.....                                                   | 2    |
| 4 Abbreviations and acronyms .....                                                              | 2    |
| 5 Background.....                                                                               | 3    |
| 6 Immunity test method of broadband disturbance .....                                           | 3    |
| 6.1 Items to be tested .....                                                                    | 3    |
| 6.2 Test waveform .....                                                                         | 4    |
| 6.3 Test procedure .....                                                                        | 4    |
| 6.4 Test level .....                                                                            | 5    |
| 7 Immunity test method of impulsive disturbance .....                                           | 5    |
| 7.1 Specific EFT/B immunity test .....                                                          | 5    |
| 8 Performance criteria.....                                                                     | 6    |
| 8.1 General performance criteria .....                                                          | 6    |
| Annex A – Wireline data transmission or reception function.....                                 | 7    |
| A.1 Applicability .....                                                                         | 7    |
| A.2 Definitions for use within this annex.....                                                  | 7    |
| A.3 Mode of operation .....                                                                     | 7    |
| A.4 Performance criteria .....                                                                  | 9    |
| Appendix I – Experimental example of transparency between AC power port and Ethernet port ..... | 12   |
| I.1 Electromagnetic disturbance entering toward Ethernet port .....                             | 12   |
| I.2 IP-based communication devices .....                                                        | 13   |
| I.3 Modelling of IP-based communication devices .....                                           | 15   |
| I.4 Conclusions .....                                                                           | 17   |
| Bibliography.....                                                                               | 19   |

## Introduction

Along with the widespread use of the Internet, a number of broadband services, such as voice over IP (VoIP), music downloading, video on demand, and TV broadcasting over a telecommunication network, are provided by telecommunication operators and Internet service providers. These services require controlling quality of service (QoS) to ensure their reliability. Real-time services, such as Internet protocol TV (IPTV) or high-quality VoIP particularly require high quality performance.

On the other hand, there are many electric/electronic devices installed on customer premises that may be connected to networks. These devices may create an impulsive disturbance when they are turned on or off. In fact, quality degradation of IP-TV services caused by a repetitive impulsive disturbance has been reported by several telecommunication operators (see Appendices I-III of Recommendation ITU-T K.74). Therefore, new electromagnetic compatibility (EMC) problems caused by impulsive disturbances may occur in telecommunication networks.

# Recommendation ITU-T K.93

## Immunity of home network devices to electromagnetic disturbances

### 1 Scope

With the advent of Internet technologies, there are many telecommunication devices being used on customer premises. Therefore, new EMC problems may occur in such environments. These problems are caused by broadband disturbances, which are produced by electrical devices.

Many broadband services, such as Internet protocol TV and voice over IP, have been introduced to the home by telecommunication operators. These services require operators to be able to underwrite quality of service (QoS) levels, since both services are essentially streamed, and hence loss/delay of packets can be immediately apparent to the user as an interruption of the services. Resolving EMC issues of broadband services are one of the key factors for ensuring the QoS in home networks. Furthermore, use of the frequency band in the home is becoming wider and shifting to a higher frequency range.

This Recommendation provides an immunity test for home network devices against broadband disturbances. The purpose of this Recommendation is to ensure normal operation of telecommunication devices in home networks and to provide additional requirements that do not cover existing international standards. However, this Recommendation is not intended to replace or duplicate international/national regulations or laws.

### 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.43] Recommendation ITU-T K.43 (2009), *Immunity requirements for telecommunication equipment*.
- [ITU-T K.74] Recommendation ITU-T K.74 (2008), *EMC, resistibility and safety requirements for home network devices*.
- [CISPR 24] CISPR 24:2010, *Information technology equipment – Immunity characteristics – Limits and methods of measurement*.  
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- [IEC 61000-4-4] IEC 61000-4-4 (2004), *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test – Basic EMC Publication Amendment 1 (2010)*.  
<[http://webstore.iec.ch/webstore/webstore.nsf/ArtNum\\_PK/46341?OpenDocument](http://webstore.iec.ch/webstore/webstore.nsf/ArtNum_PK/46341?OpenDocument)>
- [IEC 61000-4-6] IEC 61000-4-6 (2008), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*.  
<[http://webstore.iec.ch/webstore/webstore.nsf/ArtNum\\_PK/42065?OpenDocument](http://webstore.iec.ch/webstore/webstore.nsf/ArtNum_PK/42065?OpenDocument)>

## 3 Definitions

### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

**3.1.1 AC power port** [ITU-T K.43]: See clause 3.2.8 of [ITU-T K.43], ports in telecommunication equipment.

**3.1.2 DC power port** [ITU-T K.43]: See clause 3.2.8 of [ITU-T K.43], ports in telecommunication equipment.

**3.1.3 home network device** [ITU-T K.74]: A home network device is an electronic/electric equipment whose primary function is the distribution of data within the home, between the network termination point and one or more terminal devices.

### 3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

**3.2.1 wired network port:** Point of connection for voice, data and signalling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network (for example, PSTN, ISDN, xDSL, LAN and similar networks).

NOTE – These ports may support screened or unscreened cables and may also carry AC or DC power where this is an integral part of the telecommunication specification.

## 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

|       |                                              |
|-------|----------------------------------------------|
| AC    | Alternating Current                          |
| AE    | Auxiliary Equipment                          |
| CDN   | Coupling Decoupling Network                  |
| CRC   | Cyclic Redundancy Check                      |
| DC    | Direct Current                               |
| DECT  | Digital Enhanced Cordless Telecommunications |
| EFT/B | Electric Fast Transient/Burst                |
| EMC   | Electromagnetic Compatibility                |
| EMF   | Electromagnetic Field                        |
| EUT   | Equipment Under Test                         |
| FEXT  | Far End Crosstalk                            |
| INP   | Impulsive Noise Protection                   |
| IPTV  | Internet Protocol Television                 |
| ISDN  | Integrated Services Digital Network          |
| LAN   | Local Area Networks                          |
| LCL   | Longitudinal Conversion Loss                 |
| PC    | Personal Computer                            |
| PLT   | Power Line Telecommunications                |
| POTS  | Plain Old Telephone Service                  |

|      |                                   |
|------|-----------------------------------|
| PSTN | Public Switched Telephone Network |
| QoS  | Quality of Service                |
| RMS  | Root Mean Square                  |
| SES  | Severely Errored Seconds          |
| STB  | Set Top Box                       |
| STP  | Shielded Twisted Pair             |
| UTP  | Unshielded Twisted Pair           |
| VoD  | Video on Demand                   |
| VoIP | Voice over Internet Protocol      |
| xDSL | x-type Digital Subscriber Line    |

## 5 Background

The introduction of high-speed data services to customer premises that rapidly adopt technologies allows the distribution of such data on customer premises. This is leading to a number of different wireless (e.g., wireless LAN and DECT) and wireline technologies (e.g., LAN and technologies designed to exploit existing telephone extension and power distribution wiring) to interconnect a variety of in-home electronic and electrical equipment (such as STBs and PCs).

Moreover, telecommunication operators have introduced to homes many broadband services, such as Internet protocol TV (IPTV) and voice over IP (VoIP). These services require operators to be able to underwrite quality of service (QoS) levels, since both services are essentially streamed, and hence loss/delay of packets can be immediately apparent to the user as an interruption of the services. Resolving EMC issues of broadband services are one of the key factors for ensuring the QoS in home networks. Furthermore, use of the frequency band in the home is becoming wider and shifting to a higher frequency range.

These techniques introduce a new family of EMC issues, e.g., clarification of electromagnetic environment, cable characteristics, cabling on premises, immunity performance of services sensitive to interruption, and immunity performance against wideband disturbances.

This work contributes to reduction in climate change by developing specifications that allow equipment to operate within a home network environment without disturbance. The availability of such equipment avoids the unnecessary manufacture and distribution of equipment to replace existing equipment thought to be faulty. It also reduces subsequent engineer visits required to resolve ongoing issues.

## 6 Immunity test method of broadband disturbance

### 6.1 Items to be tested

The EUT considered in this Recommendation shall comply with, at least, relevant immunity standards, such as [ITU-T K.43], [ITU-T K.74] or CISPR publications such as [CISPR 24].

#### 6.1.1 Broadband impulsive conducted disturbances

This method is used to apply repetitive and isolated impulsive noise to xDSL ports of the EUT. The requirements for test level, burst duration and period for the two tests are given in Table 1.

The test procedure is based upon the CDN method defined and described in [IEC 61000-4-6], but with a signal generator replaced by a generator capable of producing a 1 ms burst of white noise every 10 ms or 8.3 ms for countries where the AC mains is 50 or 60 Hz, respectively (see Figure 1).