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Access, Terminals, Transmission and Multiplexing (ATTM); Benefit Analysis of Ethernet and power over coaxial cables - IP Video Surveillance Case Studies

Reference

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

Traditionally, short- and medium- range Video Surveillance Systems (VSS) have used point-to-point coaxial cables for the transmission of the video signals from the camera to, and the camera control signals from, a monitoring centre with power supplied to the cameras via a separate and local Low Voltage (LV) AC power supply.

Longer transmission lengths and/or the need to support high resolution cameras require the replacement of the coaxial cable with optical fibre cable.

VSS are now able to take advantage of balanced pair cabling and the standards developed by IEEE, ISO/IEC and CENELEC which allow the signals and DC power to be delivered over the same cable, once again on a point-to-point basis.

The provision of signal and DC power within a single cable construction has clear advantages in terms of cost and flexibility of installed configuration, avoiding the need to re-provision LV power and associated infrastructure.

The present document considers the opportunities offered by employing a combined signal and DC powering solution using coaxial cable which not only avoids the replacement of the installed cable but, dependent on the performance of the coaxial cable, can also offer extended distance of support beyond that offered by the balanced cable solution.

Equally importantly, the combined signal and DC powering solution using coaxial cable offers the opportunity to connect multiple cameras in a linear bus configuration.

The present document:

a) presents the basic principles of, and describes in detail the coaxial cabling solution for, Video Surveillance Systems (VSS) using IP technology;

b) describes in detail the implementation of VSS using IP signalling and remote powering using the coaxial cabling solution;

c) provides a benefit analysis (both of cost-of-ownership and environmental impact) of coaxial cabling, balanced cabling and wireless approaches to IP-based VSS;

d) contains a number of use cases for transportation systems and other surveillance applications.

1 Scope

The present document reviews the benefit analyses and environmental impact for selected use cases (such as mass transit systems) of using coaxial cables to support both Ethernet and power over coaxial equipment for IP Video Surveillance Systems (VSS) when:

a) upgrading existing analogue VSS using legacy coaxial cables as compared with installation of alternative transmission media; and

b) building new VSS by installing coaxial cables as compared with other transmission media.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] CENELEC EN 50173-1: "Information technology - Generic cabling systems - General requirements".

[i.2] ETSI TS 105 176-2: "Access, Terminals, Transmission and Multiplexing (ATTM); Ethernet and power over cables; Part 2: Ethernet and power over coaxial cables for IP video surveillance".

[i.3] IEEE 802.3™: "IEEE Standard for Ethernet".

[i.4] IEEE 802.3cg™: "IEEE Standard for Ethernet - Amendment 5:Physical Layer Specifications and Management Parameters for 10 Mb/s Operation and Associated Power Delivery over a Single Balanced Pair of Conductors".

[i.5] ISO/IEC 11801-1: "Information technology - Generic cabling for customer premises - General requirements".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI TS 105 176-2 [i.2] and the following apply:

low voltage: voltage exceeding extra-low voltage but not exceeding 1 000 V a.c. or 1 500 V d.c. between conductors, or 600 V a.c. or 900 V d.c. between conductors and earth

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI TS 105 176-2 [i.2] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 105 176-2 [i.2] and the following apply:

AC	Alternating Current
DC	Direct Current
E&PoC	Ethernet and Power over Coax(ial cabling)
EMI	ElectroMagnetic Interference
ISM	Industrial, Scientific and Medical
LV	Low Voltage
PSU	Power Supply Unit
QoS	Quality of Service
UPS	Uninterruptible Power System
VDC	Volts Direct Current
VSS	Video Surveillance System
WAP	Wireless Access Point

4 Design solutions for VSS using IP and remote powering over coaxial cables

4.1 General

This clause provides a general description of the Ethernet & Power over Coax (E&PoC) technology which is the subject of the present document.

Clause 4.2 describes the basic principles of the various design solutions for VSS.

For E&PoC solutions:

- clause 4.3 provides further details of the models for remote powering of devices within VSS;
- clause 4.4 addresses the upgrade of VSS constructed from legacy coaxial cabling;
- clause 4.5 addresses the design and installation of new build VSS installations.

4.2 Basic principles

4.2.1 Alternative design solutions

4.2.1.1 Coaxial cabling signal transmission with LV AC power to cameras

Traditionally, VSS have used point-to-point coaxial cables for the transmission of the analogue video signals from the camera to, and the camera control signals from, a monitoring centre with power supplied to the camera Power Supply Unit (PSU) via a separate and local LV AC power supply, typically directly fed by the energy grid.

Figure 1 is a schematic of the basic solution.

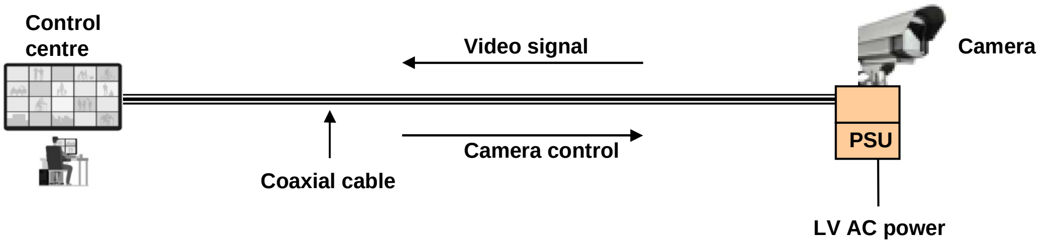

Figure 1: Traditional coaxial cabling solution for video surveillance

The length of coaxial cable is limited by the bandwidth and attenuation of the coaxial cable in relation to the delivery for the required video reception quality.

4.2.1.2 Optical fibre cabling signal transmission with LV AC power to cameras

Where the achievable transmission length using coaxial cable is inadequate, optical fibre may be used in either simplex or duplex mode.

Figure 2 is a schematic of the basic solution.

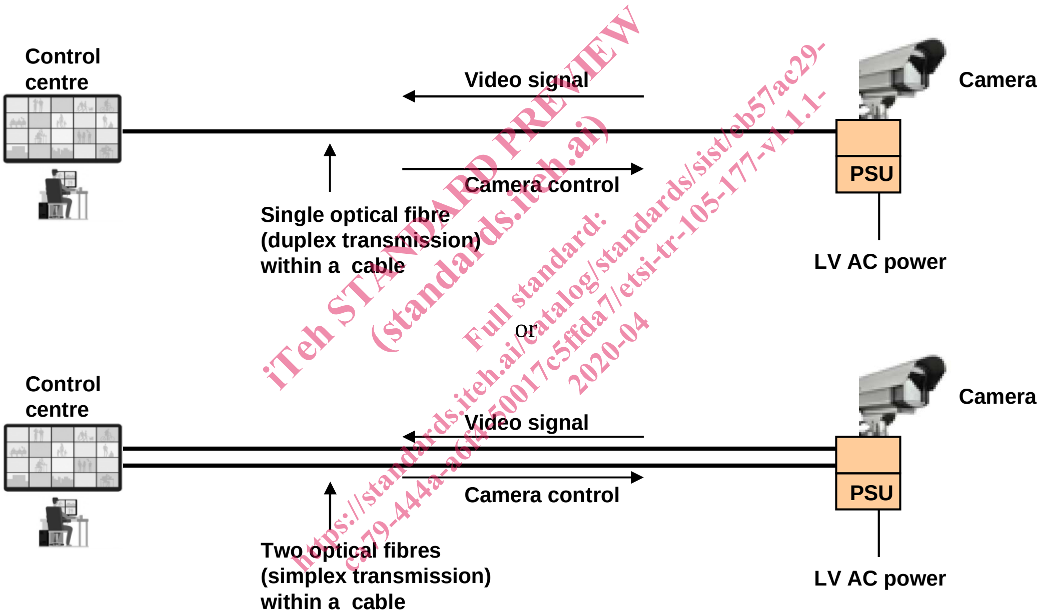

Figure 2:Traditional optical fibre cabling solutions for video surveillance

Depending on the optical fibre technology used (single-mode, multi-mode or plastic) it can offer transmission distances of many kilometres with single-mode optical fibres to just tens of meters with plastic optical fibres.

There may be other technical factors for selecting optical fibre technology in specific situations such as safety and security concerns.

4.2.1.3 Balanced cabling signal transmission and remote powering of cameras

4-pair balanced cabling components of Category 5 and above (as specified in ISO/IEC 11801-1 [i.5] and CENELEC EN 50173-1 [i.1]) enable both the signal transmission (using Ethernet protocols of IEEE 802.3 [i.3]) and the delivery of DC power of up to 90 W to the camera. This allows the replacement of the local LV AC power supply and the associated Power Supply Unit (PSU) with a DC/DC convertor which converts the remote powering voltages to those needed by the cameras (typically 12 V DC). Figure 3 is a schematic of the basic solution.