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Information technology — Telecommunications and information exchange between systems — Coexistence mechanism for broadband powerline communication technologies

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

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Introduction

ISO/IEC 12139-1 was published in July 2009. There were also standardization activities on high speed powerline communication in other standards development organizations; IEEE P1901 WG and ITU-T SG15. IEEE Std 1901-2010 was approved in October 2010, and G.hn(G.9960/G.9961) consented in ITU-T in June 2010.

Since powerline is a shared medium of frequency, the different-standard-devices which use powerline could cause harmful interference to each other when used in the same vicinity. Therefore, it is important to study harmonized coexistence to prevent possible harmful interference between devices that adopt standards from different standards organizations.

An IEC SMB decision 135/18 in June 2009 requested that ISO/IEC JTC1/SC 6 initiate maintenance work rapidly to solve any coexistence problems with the G.hn(G.9960) series of ITU-T Recommendations and any other relevant standards from the IEC or elsewhere.

To solve the coexistence problem, ISO/IEC JTC1/SC 6 established a Study Group on High Speed PLC Harmonization (SGPLC) among High Speed PLC International Standards at their meeting in January 2010. The final goal of SGPLC was to achieve harmonized coexistence not only between ISO/IEC 12139-1 and ITU-T G.9960 but between ISO/IEC 12139-1 and IEEE Std 1901-2010. The study report was presented and was approved for its results.

In this document, to guarantee backward compatibility with the ISP (Inter System Protocol) of IEEE Std 1901-2010, time domain multiplex general resource allocation is extended to support another non-interoperable in-home system such as ISO/IEC 12139-1 based powerline communication system while the maximum number of non-interoperable systems supported at the same time remains unchanged as four.

Information technology — Telecommunications and information exchange between systems — Coexistence mechanism for broadband powerline communication technologies

1 Scope

This document specifies the coexistence mechanism for various broadband powerline communication systems. By using the coexistence mechanism, possible harmful interference between different standard-based high-speed powerline communication systems can be avoided.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEEE Std 1901-2010, *IEEE Standard for Broadband over Power Line Networks: Medium Access Control and Physical Layer Specifications*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Abbreviation

CP	coexistence protocol
FDM	frequency domain multiplex
IH	in-home
ISP	inter-system protocol
TDM	time domain multiplex

5 Coexistence protocol

5.1 General

This Clause specifies the coexistence protocol, which is part of the coexistence mechanism. The coexistence protocol (CP) is meant to share time or frequency domain resources for different non-interoperable systems, up to four on the same powerline at a time. Except for the number of non-interoperable systems and its related changes (see IEEE Std 1901-2010, 16.5.2), the rest of the CP is the same as the inter-system protocol (ISP) as specified in IEEE Std 1901-2010, 16 and ITU-T

G.99722010, 9.2. To share resources, the time domain multiplex (TDM) and the frequency domain multiplex (FDM) are used.

See IEEE Std 1901-2010, 16.5.2 for the case of a network status consisting of access systems IH-W, IH-O, and IH-G. The TDM general resource allocation is extended to support another non-interoperable in-home system, denoted by IH-A, such as an ISO/IEC 12139-1 system, while the maximum number of non-interoperable systems supported at the same time remains unchanged as four. The following two extended schemes guarantee backward compatibility with the ISP of IEEE Std 1901-2010.

5.2 Extended TDM resource allocation utilizing resource for an absent in-home system

The first extended TDM resource allocation procedure starts with the TDM general resource allocation map and then assigns the TDMs of an absent in-home system to IH-A. This extended TDM resource allocation can be used only when there are any absent in-home systems; IH-A uses the TDMs originally allocated to the first absent in-home system in the order of IH-W, IH-O, and IH-G as shown in Table 1, which is the extended TDM resource allocation map utilizing TDMs of an absent in-home system. Note that this first extension doesn't include utilizing resource for an access system even when all in-home systems are present.

Table 1 — Extended resource allocation utilizing resource for an absent in-home system

Index	ISP field					TDM slot number							
	ACC	IH-W	IH-O	IH-G	BW	0	1	2	3	4	5	6	7
1	—	IH-A	—	—		IH-A	IH-A	IH-A	IH-A	IH-A	IH-A	IH-A	IH-A
2	—	IH-A	—	IH-G		IH-A	IH-A	IH-G	IH-A	IH-A	IH-G	IH-G	IH-G
3	—	IH-W	IH-A			IH-W	IH-W	IH-A	IH-A	IH-A	IH-W	IH-W	IH-A
4	—	IH-A	IH-O	—		IH-A	IH-A	IH-O	IH-O	IH-O	IH-A	IH-A	IH-O
5	—	IH-W	IH-A	IH-G		IH-W	IH-W	IH-A	IH-A	IH-A	IH-G	IH-G	IH-G
6	—	IH-W	IH-O	IH-A		IH-W	IH-W	IH-O	IH-O	IH-O	IH-A	IH-A	IH-A
7	—	IH-A	IH-O	IH-G		IH-A	IH-A	IH-O	IH-O	IH-O	IH-G	IH-G	IH-G
8	ACC	IH-A	—	—	PB	IH-A	IH-A	IH-A	IH-A	ACC	ACC	IH-A	IH-A
9	ACC	IH-A	—	—	FB	IH-A	IH-A	IH-A	ACC	ACC	ACC	ACC	IH-A
10	ACC	IH-A	—	IH-G	PB	IH-A	IH-A	IH-G	IH-A	ACC	ACC	IH-G	IH-G
11	ACC	IH-A	—	IH-G	FB	IH-A	IH-A	IH-G	ACC	ACC	ACC	ACC	IH-G
12	ACC	IH-W	IH-A	—	PB	IH-W	IH-W	IH-A	IH-A	ACC	ACC	IH-W	IH-A
13	ACC	IH-W	IH-A	—	FB	IH-W	IH-W	IH-A	ACC	ACC	ACC	ACC	IH-A
14	ACC	IH-A	IH-O	—	PB	IH-A	IH-A	IH-O	IH-O	ACC	ACC	IH-A	IH-O
15	ACC	IH-A	IH-O	—	FB	IH-A	IH-A	IH-O	ACC	ACC	ACC	ACC	IH-O
16	ACC	IH-W	IH-A	IH-G	PB	IH-W	IH-W	IH-A	IH-A	ACC	ACC	IH-G	IH-G
17	ACC	IH-W	IH-A	IH-G	FB	IH-W	IH-W	IH-A	ACC	ACC	ACC	ACC	IH-G
18	ACC	IH-W	IH-O	IH-A	PB	IH-W	IH-W	IH-O	IH-O	ACC	ACC	IH-A	IH-A
19	ACC	IH-W	IH-O	IH-A	FB	IH-W	IH-W	IH-O	ACC	ACC	ACC	ACC	IH-A
20	ACC	IH-A	IH-O	IH-G	PB	IH-A	IH-A	IH-O	IH-O	ACC	ACC	IH-G	IH-G
21	ACC	IH-A	IH-O	IH-G	FB	IH-A	IH-A	IH-O	ACC	ACC	ACC	ACC	IH-G

IH-A shall use the phase vectors of the first absent in-home system; if the first absent in-home system is IH-W/IH-O/IH-G, IH-A shall use phase vectors in IEEE Std 1901-2010, Tables 16.5, 16.6 and 16.7, respectively. The IH-A system shall transmit the ISP signals in the ISP window allocated to the first absent in-home system. However, to distinguish the IH-A system from the absent in-home system, the IH-A system transmits ISP signals with a periodicity of 8 × T_{ISP} while the IH-W, IH-O, and IH-G systems transmit their ISP signals with a periodicity of 4 × T_{ISP}. This differentiation enables the IH-A system to detect the newly connected absent in-home system. Note that the ISP signals transmitted by IH-A system shall be synchronized as shown in Step 1 of Figure 1.

When the IH-A system detects the newly connected absent in-home system, it stops utilizing the resource for the absent in-home system and starts utilizing the resource for the next absent in-home system if there is another absent in-home system. For example, consider the case of index = 10 or 11 in Table 1 when there are two absent in-home systems, IH-W and IH-O as in Step 1 of Figure 1. Later when the IH-W system is newly connected, the IH-A system detects the IH-W system's presence since the periodicity of its ISP window become 4 × T_{ISP} as shown in Step 2 of Figure 1. Then, the IH-A system shall stop utilizing the resource for the IH-W system and start transmitting the ISP signals of IH-O with a periodicity of 8 × T_{ISP} to utilize the resource for IH-O as shown in Step 3 of Figure 1.

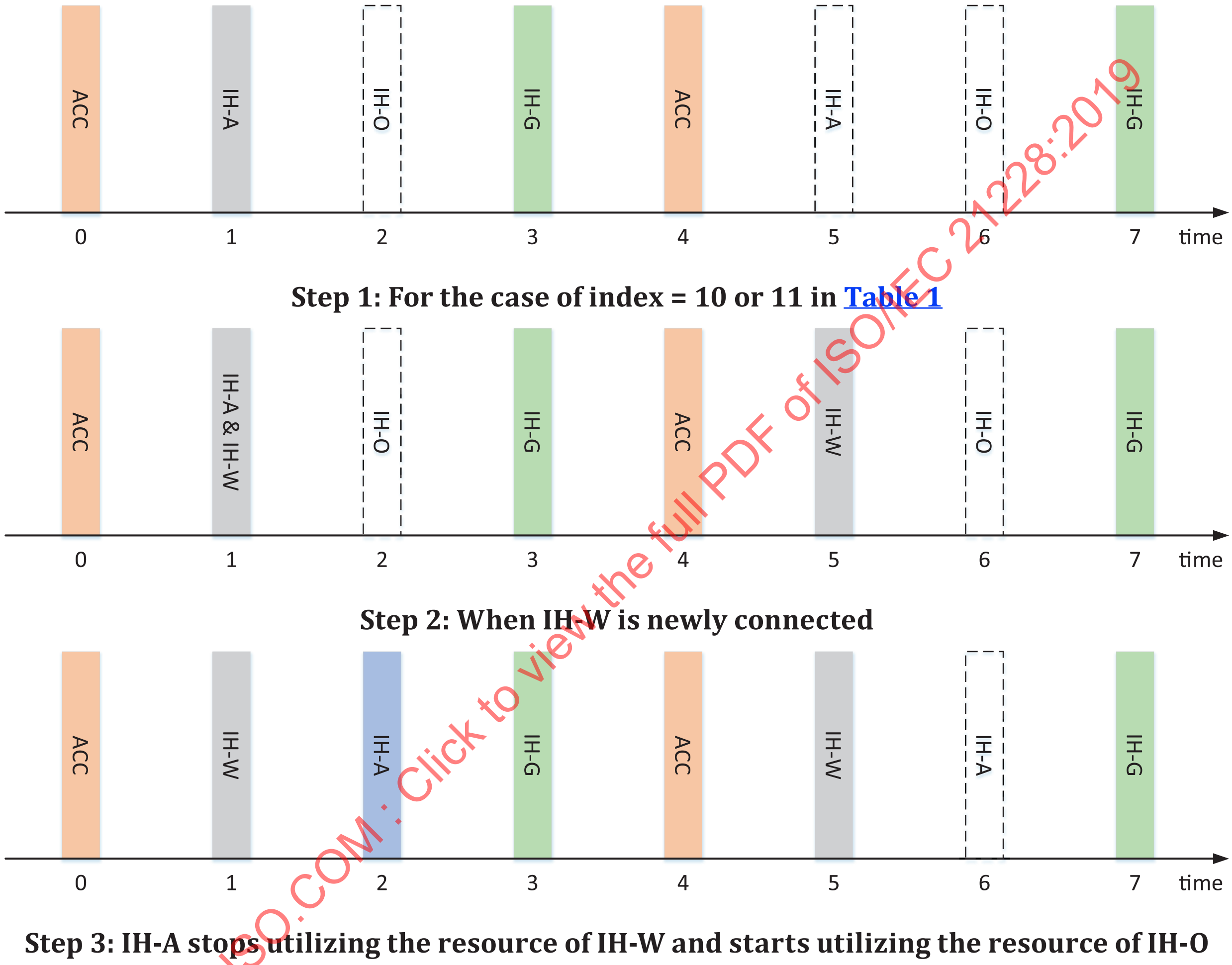


Figure 1 — When IH-W is newly connected for the case of index = 10 or 11 in Table 1

5.3 Extended TDM resource allocation utilizing resource for access system

The second extended TDM resource allocation procedure starts with the TDM general resource allocation map and then assigns the TDMs of the access system to IH-A. This extended TDM resource allocation can be used only when there is no access system and no absent in-home system. Table 2 gives the extended TDM resource allocation map utilizing TDMs of access system.

Table 2 — Extended resource allocation utilizing resource for access system

Index	ISP field						TDM slot number							
	ACC	IH-W	IH-O	IH-G	BW		0	1	2	3	4	5	6	7
1	IH-A	IH-W	IH-O	IH-G	PB		IH-W	IH-W	IH-O	IH-O	IH-A	IH-A	IH-G	IH-G

IH-A shall use Ph1 and Ph4 according to IEEE Std 1901-2010, Table 16.4. The IH-A system shall transmit the ISP signals in the ISP window allocated to the access system. However, to distinguish the IH-A system from the access system, the IH-A system transmits ISP signals with a periodicity of 8 × T_{ISP} as in Step 1 of Figure 2. This differentiation again enables the IH-A system to detect the newly connected access system as in Step 2 of Figure 2. Once the IH-A system detects the newly connected access system, it shall stop utilizing the resource for access system as in Step 3 of Figure 2.

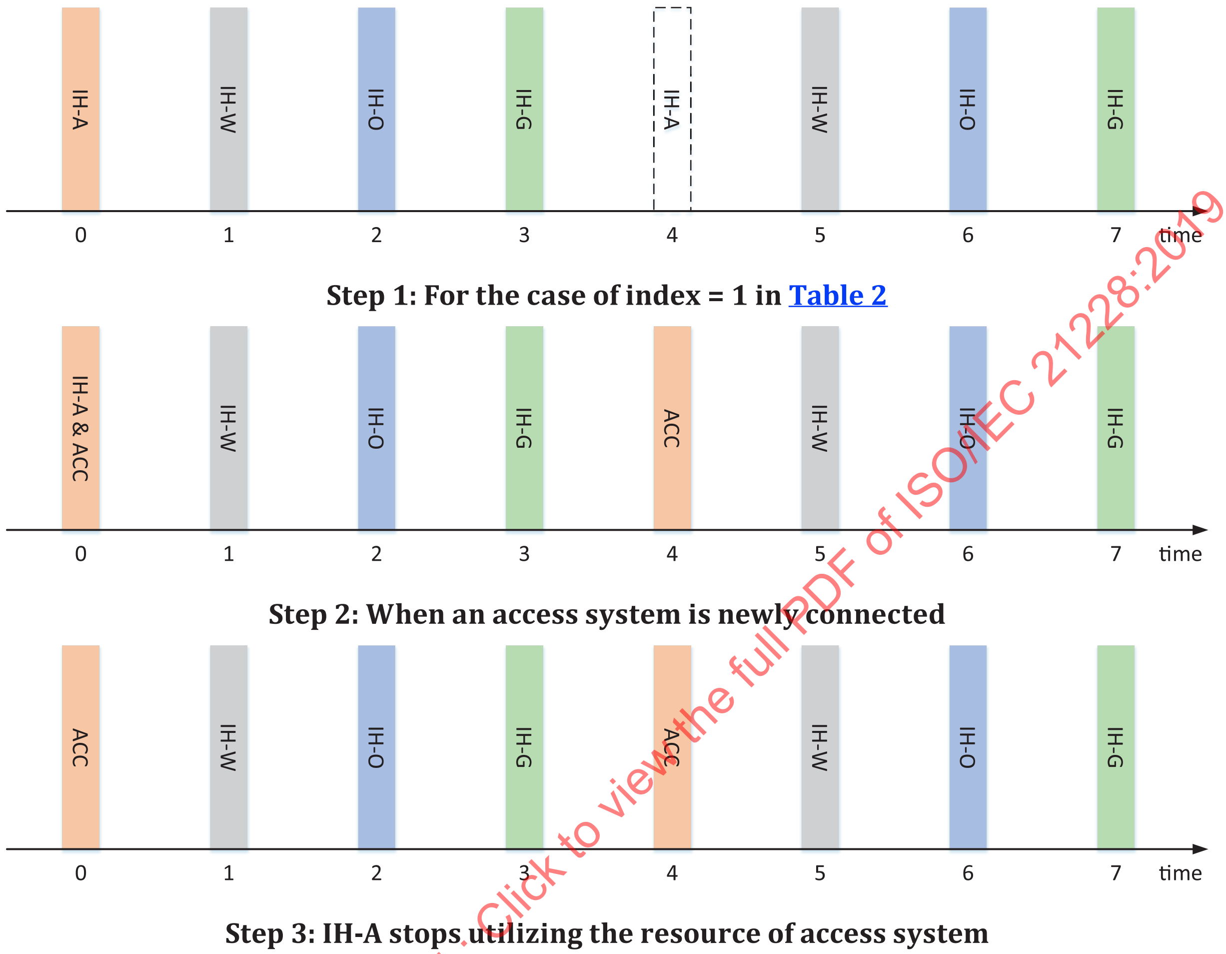
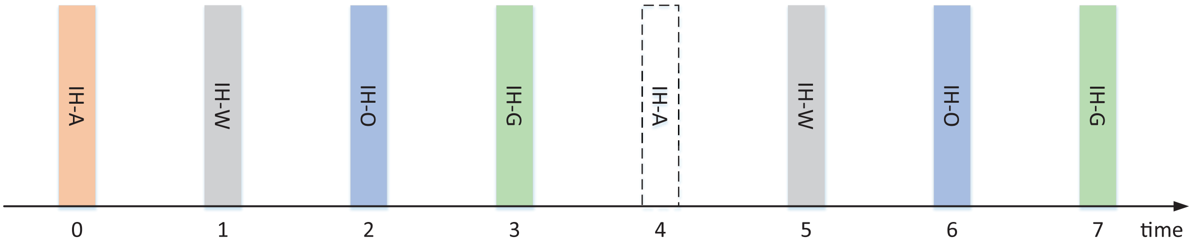
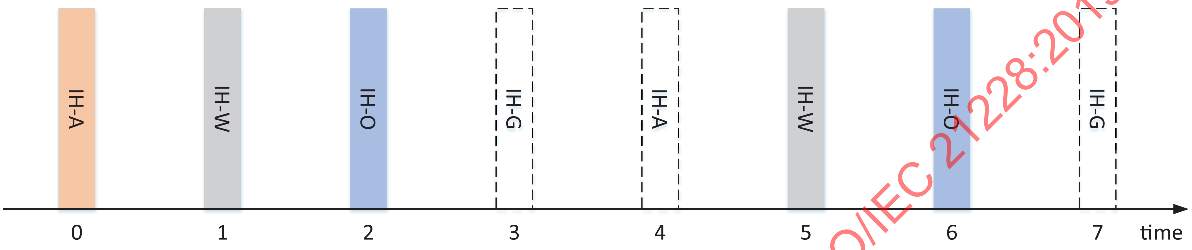


Figure 2 — When an access system is newly connected for the case of index = 1 in Table 2

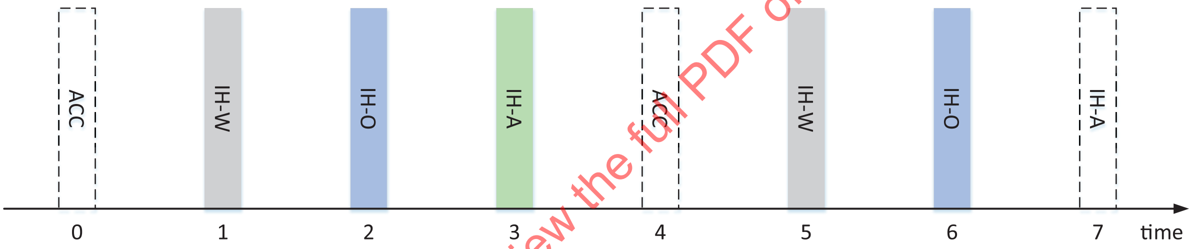
When the IH-A system detects a newly absent in-home system, it shall stop utilizing the resource for the access system and start to utilize the resource for the newly absent in-home system. For example, consider the case of index = 1 in Table 2 when there is no absent in-home system as in Step 1 of Figure 3. Later when the IH-G system becomes absent, the IH-A system detects the IH-G system's absence since its ISP signals are not detected as shown in Step 2 of Figure 3. Then, the IH-A system shall stop utilizing the resource for the access system and start to transmit the ISP signals of IH-G with a periodicity of 8 × T_{ISP} to utilize the resource for IH-G as shown in Step 3 of Figure 3. Note that the ISP signals transmitted by the IH-A system shall be synchronized as shown in Figure 1.



Step 1: For the case of index = 10 or 11 in Table 1



Step 2: When an in-home system becomes newly absent



Step 3: IH-A stops utilizing the resource of access system

Figure 3 — When an in-home system becomes absent for the case of index = 1 in Table 2