

# INTERNATIONAL STANDARD

Information technology – Home electronic system (HES) architecture –  
Part 5-4: Intelligent grouping and resource sharing for Class 2 and Class 3 –  
Device validation  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INFORMATION TECHNOLOGY –  
HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –****Part 5-4: Intelligent grouping and resource sharing for HES  
Class 2 and Class 3 –  
Device validation**

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International Standard ISO/IEC 14543-5-4 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This International Standard has to be read in conjunction with ISO/IEC 14543-5-1.

The list of all currently available parts of the ISO/IEC 14543 series, under the general title *Information technology – Home electronic system (HES) architecture*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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## INTRODUCTION

ISO/IEC 14543-5, *Information technology – Home electronic system (HES) architecture – Part 5: Intelligent grouping and resource sharing (IGRS)* consists of the following parts:

### ➤ **Part 5-1: Core protocol**

- Specifies the TCP/IP protocol stack as the basis and the HTTP protocol as the message-exchanging framework among devices.
- Specifies a series of device and service interaction/invocation standards, including device and service discovery protocol, device and service description, service invocation, security mechanisms, etc.
- Specifies core protocols for a type of home network that supports streaming media and other high-speed data transport within a home.

### ➤ **Part 5-2#: Application profiles**

- Based on the IGRS Core Protocol.
- Defines a device and service interaction mechanism, as well as application interfaces used in IGRS Basic Applications.
- Multiple application profiles have been developed, including:
  - **Part 5-21: AV profile** (under consideration)
  - **Part 5-22: File profile** (under consideration)
- Additional application profiles are planned (part numbers to be assigned)
  - **Part 5-2w: DVD profile**
  - **Part 5-2x: QoS profile**
  - **Part 5-2y: DMCP profile**
  - **Part 5-2z: Universal control profile**

### ➤ **Part 5-3: Basic application** (under consideration)

- Includes an IGRS basic application list.
- Defines a basic application framework.
- Specifies addresses, operation details (device grouping, service description template, etc.), function definitions, and service invocation interfaces.

### ➤ **Part 5-4: Device validation**

- Defines a standard method to confirm that a device is IGRS-compliant.

### ➤ **Part 5-5: Device types** (under consideration)

- Defines IGRS Device types used in IGRS applications.

### ➤ **Part 5-6: Service types** (under consideration)

- Defines basic service types used in IGRS applications.



# INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

## Part 5-4: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Device validation

### 1 Scope

This part of ISO/IEC 14543 specifies device validation methods for information devices that implement ISO/IEC 14543-5-1. It defines an architecture framework for a device validation system used by test devices and devices under test. Also, it describes and specifies the device interaction process, message exchange requirements and conformance rules.

This part of ISO/IEC 14543 is applicable to resource sharing and service collaboration among computers, consumer electronics, and communication devices in a Local Area Network (LAN) or Personal Area Network (PAN) environment, especially in a wireless dynamic network.

### 2 Normative reference

The following referenced documents are indispensable for the application 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.

[ISO/IEC 14543-5-4:2010](http://www.iso.org/iso/standards/catalogue_tc/list.htm)

ISO/IEC 14543-5-1, *Information technology – Home electronic system (HES) architecture – Part 5-1: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Core protocol*

### 3 Terms, definitions, abbreviations and conventions

#### 3.1 Terms and definitions

For the purposes of this document the following terms and definitions apply. These terms are commonly used in other industry publications.

#### 3.2

##### **centralised device group**

set of IGRS devices with one IGRS device acting as the master

NOTE 1 The master is responsible for managing the setup, for dismissing a device group, and for processing a joint request from other devices.

NOTE 2 The master device and other IGRS devices in such a device group form a centralised or master-slave relationship.

#### 3.3

##### **client identifier**

unique identifier associated with a client on an IGRS device to which this client belongs

#### 3.4

##### **device group**

multiple IGRS devices that are organised into a logical group through the device group management mechanism specified in ISO/IEC 14543-5-1

NOTE Each IGRS device in a device group follows common interaction rules. Two types of device groups are defined: peer-to-peer device group and centralised (master-slave) device group.

**3.5  
device identifier**

globally unique device identifier associated with one IGRS device

**3.6  
device pipe**

channel used to transfer device interaction messages

NOTE This channel is set up through the pipe setup mechanism specified in ISO/IEC 14543-5-1.

**3.7  
IGRS client**

application that draws upon the services of one or more connected IGRS devices

NOTE Multiple client instances can exist on a network at the same time.

**3.8  
IGRS device**

information device that conforms to ISO/IEC 14543-5-1

**3.9  
IGRS protocol**

communications protocol that conforms to ISO/IEC 14543-5-1

**3.10  
IGRS service**

sharable resource encapsulated in an IGRS device by implementing application interfaces and providing services for other IGRS devices

NOTE An IGRS service has an invocation interface that meets the requirements of ISO/IEC 14543-5-1. These invocation interfaces are described and announced on the network through the IGRS service description specification.

**3.11  
IGRS user**

owner of an IGRS device and client

**3.12  
peer-to-peer device group**

set of IGRS devices where each IGRS device in the set has a peer-to-peer relationship with each other

**3.13  
service identifier**

unique identifier assigned to a service provided by a specific IGRS device

NOTE The same type of service may be provided by multiple IGRS devices within the same network. Each instance of a service has a unique service identifier on the IGRS device providing that service.

**3.14  
service type**

category of IGRS service defined according to the set of resources encapsulated

NOTE The service type enables service applications in the same category to have common invocation interfaces.

### 3.15

#### **test device**

physical entity that can send, receive and validate network messages that conform to ISO/IEC 14543-5-1

### 3.16

#### **user identifier**

identifier of an IGRS user

### 3.17 Abbreviations

HTTP	Hypertext Transport Protocol
IGRS	Intelligent Grouping and Resource Sharing
IP	Internet Protocol
LAN	Local Area Network
PAN	Personal Area Network
TCP	Transmission Control Protocol
UDP	User Datagram Protocol

### 3.18 Conventions

Lower case is used for words having the normal English meaning. Certain words and terms used in this standard have a specific meaning beyond the normal English meaning and are written in upper case. These words and terms are defined either in this clause or in the text where they first appear.

## 4 Conformance: IGRS device validation

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### 4.1 Purpose

The IGRS core protocol (ISO/IEC 14543-5-1) shall be supported and implemented by all IGRS-compliant devices. Although different manufacturers may have different implementations, all implementations shall conform to the requirements defined in ISO/IEC 14543-5-1 in order to guarantee that all networked devices using the IGRS protocol can communicate properly with one another. Therefore, in order to ensure successful interoperability among devices manufactured by different vendors, IGRS protocol conformance tests specified in this International Standard shall be met.

IGRS device validation is a type of black-box test that defines a series of conformance test suites to analyse and determine whether required and optional interaction messages supported by IGRS devices, as well as response messages returned, have passed conformance rules.

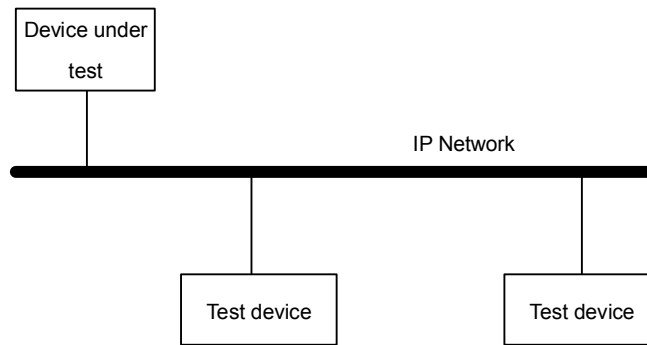
### 4.2 Conformance requirements

To be considered compliant with ISO/IEC 14543-5-1, each device shall meet the criteria defined by the IGRS device validation conformance test suite described in Clause 6.

In addition, to be considered in compliance with this International Standard, the test methods used shall meet all the mandatory requirements defined in the IGRS device grouping conformance test suites specified in 6.1 to 6.7, and the IGRS resource sharing conformance test suites specified in 6.8 to 6.13.

### 4.3 Test setup and method

In Figure 1, a device under test and one or more test devices are located in the same LAN IP broadcast domain.



**Figure 1 – IGRS conformance test setup**

For each test case, the test devices shall send appropriate IGRS messages to the device under test, receive response messages and determine the correctness of the response messages.

IGRS device validation shall not consider the following test scenarios: lost message sent by test devices and the device under test due to network link layer transport issues, multicast message across subnets and conformance testing of IGRS devices over non-IP network.

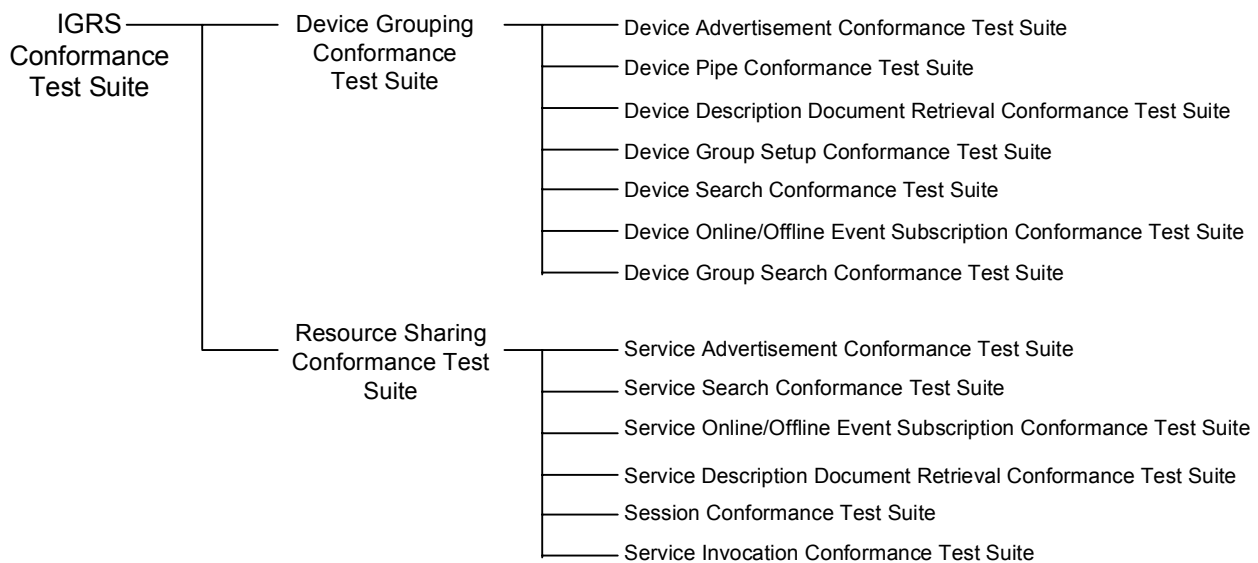
#### 4.4 Device validation requirements

The test cases that comprise a test suite test the various implementation requirements of the IGRS core protocol feature specifications (see Clauses 5, 6, 7, 8, 9 and 10 of ISO/IEC 14543-5-1). The test suite is divided into two categories: mandatory and optional. Every IGRS device shall pass all mandatory reference test cases. If an IGRS device implements one or more optional features defined in ISO/IEC 14543-5-1, that device shall also pass relevant reference test cases of the test suite.

### 5 IGRS test suite overview

#### 5.1 Test suite structure

As shown in Figure 2, the IGRS conformance test suite structure is divided into two categories: device grouping and resource sharing. The device grouping test suite is further divided according to the primary functions of the IGRS core protocol (see Clauses 9 and 10 of ISO/IEC 14543-5-1). The resource sharing test suite specifies each primary function of IGRS core protocol in detailed sub-function test suites.



**Figure 2 – IGRS conformance test suite structure**

## 5.2 Test suite description

### 5.2.1 IGRS device grouping test suite

This test suite focuses on the device grouping capabilities of IGRS devices. It is divided into seven sub-function test suites, each of which is specified in the subclause listed below.

- a) Device advertisement conformance test suite (see 6.1).
- b) Device pipe conformance test suite (see 6.2).
- c) Device description document retrieval conformance test suite (see 6.3).
- d) Device group setup conformance test suite (see 6.4).
- e) Device search conformance test suite (see 6.5).
- f) Device online/offline event subscription conformance test suite (see 6.6).
- g) Device group search conformance test suite (see 6.7).

### 5.2.2 IGRS resource sharing test suite

This test suite focuses on resource sharing capabilities of IGRS services. It is divided into six sub-function test suites, each of which is specified in the subclause listed below:

- a) Service advertisement conformance test suite (see 6.8).
- b) Service search conformance test suite (see 6.9).
- c) Service online/offline event subscription conformance test suite (see 6.10).
- d) Service description document retrieval conformance test suite (see 6.11).
- e) Session conformance test suite (see 6.12).
- f) Service invocation conformance test suite (see 6.13).

### 5.2.3 Test suite description rules

The description of each IGRS sub-function test suite is divided into two parts:

- a) reference messages related to the test suite;

- b) test case suite; includes pre-conditions and test cases. The pre-condition lists prerequisite test conditions used by each test case of that test suite. The test case consists of the test purpose, reference, test procedure, conformance category and the pass criteria, called the pass verdict condition.

## 6 IGRS conformance test suite

### 6.1 Device advertisement conformance test suite

#### 6.1.1 Reference messages

Device Online Advertisement refers to Table 7 of ISO/IEC 14543-5-1.

Device Offline Advertisement refers to Table 8 of ISO/IEC 14543-5-1.

#### 6.1.2 Test case suite

##### 6.1.2.1 Pre-condition

Pre-condition 1, applicable to test case 1:

- the test device and the device under test are located in the same LAN IP broadcast domain;
- the test device is listening to multicast port 239.255.255.250:3880.

Pre-condition 2, applicable to test case 2 through 5:

- the test device and the device under test are located in the same LAN IP broadcast domain;
- the test device is listening to multicast port 239.255.255.250:3880;
- the IGRS protocol on the device under test is initiated and running normally.

##### 6.1.2.2 Test case 1

- Test purpose

The test purpose is to ensure that the device under test can automatically send a correct Device Online Advertisement message to the multicast address port 239.255.255.250:3880 when the IGRS protocol is initiated.

- Reference

Device Online Advertisement; see 9.1.1 of ISO/IEC 14543-5-1.

- Conformance category

Mandatory

- Test procedure

The device under test initiates the IGRS protocol.

- Pass verdict condition

The following conditions are required so that the device passes this test.

- a) The test device can listen for a Device Online Advertisement message sent from the device under test on multicast address port.
- b) The Device Online Advertisement message received by the test device shall conform to the definitions of the HTTP command and the required fields shown in Table 7 of ISO/IEC 14543-5-1.

### 6.1.2.3 Test case 2

– Test purpose

The test purpose is to ensure that the device under test can resend a Device Online Advertisement message to the multicast address 239.255.255.250:3880 before the maximum advertising valid time defined in the cache-control: max-age field is reached.

– Reference

Device Online Advertisement; see 9.1.1 of ISO/IEC 14543-5-1.

– Conformance category

Mandatory

– Test procedure

The test device receives the Device Online Advertisement message sent by the device under test at the multicast address and retrieves cache-control: max-age field value to be  $n$  (maximum advertising valid time in seconds); at the same time, the test device listens to multicast address 239.255.255.250:3880 for  $n$  s.

– Pass verdict condition

The following conditions are required so that the device passes this test.

- a) The test device can receive another Device Online Advertisement message less than  $n$  s after receiving the first Device Online Advertisement message from the device under test.
- b) The Device Online Advertisement message received by the test device shall conform to the definitions of the HTTP command and the required fields shown in Table 7 of ISO/IEC 14543-5-1.

### 6.1.2.4 Test case 3

– Test purpose

The test purpose is to ensure that, when there is configuration data change on the device under test, a new Device Online Advertisement will be sent to multicast address 239.255.255.250:3880. If 01-ConfigId field value is at maximum value (see Table 7 of ISO/IEC 14543-5-1), then 01-ConfigId will be reset to 1; otherwise 01-ConfigId will be incremented by 1.

– Reference

Device Online Advertisement; see 9.1.1 of ISO/IEC 14543-5-1.

– Conformance category

Mandatory

– Test procedure

- a) The test device receives a Device Online Advertisement sent from the device under test at multicast address 239.255.255.250:3880. The value in 01-ConfigId field is c1.
- b) A new service is added or a service is terminated on the device under test.
- c) The test device receives another Device Online Advertisement sent from the device under test at multicast address 239.255.255.250:3880. The value in 01-ConfigId field is c2.

– Pass verdict condition

The following conditions are required so that the device passes this test.