ISO/IEC 14543-3-7

Edition 1.0 2007-01

INTERNATIONAL STANDARD

Information technology – Home electronic system (HES) architecture – Part 3-7: Media and media dependent layers – Radio frequency for network based control of HES Class 1

ISO/IEC 14543-3-7:2007-01(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 35.240.67

ISBN 2-8318-8957-X

CONTENTS

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 3-7: Media and media dependent layers – Radio frequency for network based control of HES Class 1

FOREWORD

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International Standard ISO/IEC 14543-3-7 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This International Standard is a product family standard. It shall be to be used in conjunction with ISO/IEC 14543-2-1, 14543-3-3, 14543-3-4, 14543-3-5 and 14543-3-6.

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 title page.

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

INTRODUCTION

The Reference model for Open System Interconnection (OSI), specified in ISO/IEC 7498, assigns the functions that are needed for communications between two entities that are connected by medium to seven logical layers. This International Standard specifies interconnection of entities used for home and building control via the medium radio frequency. According to the OSI reference model, the Physical Layer consists of the medium, the cable, the connectors, the transmission technology, etc., which are hardware requirements. However, the focus of this International Standard lies first and foremost on the description of the "communication medium".

Currently, ISO/IEC 14543, *Information technology – Home Electronic System (HES) architecture*, consists of the following parts:

Part 2-1: *Introduction and device modularity*
Part 3-1: *Communication layers – Application layer for network based control of HES Class 1*
Part 3-2: *Communication layers – Transport, network and general parts of data link layer for network based control of HES Class 1*
Part 3-3: *User process for network based control of HES Class 1*
Part 3-4: *System management – Management procedures for network based control of HES Class 1*
Part 3-5: *Media and media dependent layers – Power line for network based control of HES Class 1*
Part 3-6: *Media and media dependent layers – Twisted pair for network based control of HES Class 1*
Part 3-7: *Media and media dependent layers – Radio frequency for network based control of HES Class 1*
Part 4: *Home and building automation in a mixed-use building (technical report)*
Part 5-1: *Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Core protocol (under consideration)*
Part 5-2: *Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Device certification (under consideration)*

Additional parts may be added later.

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 3-7: Media and media dependent layers – Radio frequency for network based control of HES Class 1

1 Scope

This part of ISO/IEC 14543 defines the mandatory and optional requirements for the medium-specific Physical and Data Link Layers of radio frequency for network based control of HES Class 1 products and systems. It describes a multi-application bus system where the functions are decentralised, distributed and linked through a common communication process.

NOTE: Data Link Layer interface and general definitions, which are medium independent, are given in ISO/IEC 14543-3-1.

2 Normative References

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.

IEC 60870-5-1, *Telecontrol equipment and systems – Part 5-1: Transmission protocols – Transmission frame formats*

IEC 60870-5-2, *Telecontrol equipment and systems – Part 5-2: Transmission protocols – Link transmission procedures*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this International Standard, the definitions given in ISO/IEC 14543-3-1 apply.

3.2 Abbreviations

BER	bit error rate
DLL	Data Link Layer
ERP	effective radiated power
FSK	frequency shift keying
PhL	Physical Layer
RF	radio frequency
Rx	Receiver
TRx	Transceiver
Tx	Transmitter

4 Conformance

A device conforming to this International Standard shall support the physical medium as specified in clause 5 and provide transmission capability as specified in 6.1 to 6.4.

In addition to 6.1 to 6.4 retransmitters shall support 6.5.

In addition to 6.1 to 6.4 medium couplers shall support 6.6.

5 Physical layer type RF

5.1 General

Table 1 lists the general requirements for Physical Layer Type RF based on a centre frequency of 868,3 MHz.

NOTE 1 National regulatory authorities may require the use of other frequencies for HES Class 1 usage.

NOTE 2 Table 1 applies to network based control of HES Class 1 products and systems only.

Table 1 – General requirements for Physical Layer Type RF

Characteristic	Value or applicable standard
Tx centre frequency	f_C = 868,300 000 MHz
Maximum Tx frequency tolerance	± 35 ppm [a]
Maximum Tx duty cycle	1 %
Tx modulation type	FSK
FSK deviation	f_{DEV} = ± 40 kHz to ± 80 kHz typically 50 kHz
Tx chip rate	32 768 cps
Maximum Tx chip rate tolerance	± 1,5 %
Maximum Tx jitter per transition	± 1 µs
Minimum Tx ERP	0 dBm
Maximum Tx ERP	25 mW or the respective national limit
Rx blocking performance	according EN 300 220-1, 9.3.3 for class 2 receivers [b]
Rx centre frequency	f_C = 868,30 MHz
Rx frequency tolerance	± 35 ppm HES RF Tx to HES RF Rx [a, b] ± 60 ppm metering Tx to HES RF Rx [a, b]
Minimal Rx chip rate tolerance	±2,0 % [b]
Rx sensitivity	typical: −95 dBm [b] minimal: -80 dBm [b]
Operating temperature range	−5 °C to 45 °C [c]
[a] This frequency tolerance includes tolerances due to temperature variations within the operating temperature range and tolerances due to crystal aging. [b] At Bit Error Rate (BER) 10^{-4} in optimum antenna direction. [c] The tests according to EN 300 220-1 (see Bibliography) shall be performed at 55 °C upper limit (temperature classes, subclause 5.4.1.2).	
NOTE Compliance to the above requirements guarantees a link budget of minimum −80 dB. In typical cases, this will be –95 dB. A link budget of –100 dB is recommended.	

5.2 Frame structure related

Table 2 – Frame definition

Characteristics	Value	Notes
Data encoding	Manchester	chip "0" means f_{LO} (= f_C − f_{DEV}) chip "1" means f_{HI} (= f_C + f_{DEV}) bit "0" is coded as f_{HI} to f_{LO} transition, chip sequence "10" bit "1" is coded as f_{LO} to f_{HI} transition, chip sequence "01"
Preheader	consists of Preamble, Manchester violation, Sync word	see next three rows in this table
Preamble	min. 15x chip sequence "01" sent by Tx	learning sequence for Rx, number of preamble chips is not checked by Rx
Manchester violation	chip sequence "000111"	necessary for capture effect
Sync word	chip sequence "011010010110"	useful for synchronization on chip rate
Postamble	2 chips to 8 chips	software reasons, mandatory for all Tx, number of postamble not checked by Rx
Capture effect	optional	Preheader allows it; Rx may use it

6 Data Link Layer Type RF

6.1 Differences from existing (bi-directional) HES protocol

6.1.1 Extended Group Address

The Extended Group Address (8 octets) in a HES RF frame shall be the combination of the standard HES Group Address (2 octets) with the HES Serial Number of the sender of the frame (6 octets). Every group addressed HES RF frame shall contain an Extended Group Address.

The consequence of this is that groups consist of one sender and n receivers, hence form a 1-to-n relationship. If several senders control a group of actuators, each of these actuators shall listen to the sending addresses of all senders.

The receiver shall only take a received frame into account if the receiver knows the Extended Group Address of the sender.

NOTE According to the HES RF frame definition, these 8 octets are not transmitted consecutively.

The HES RF frame shall contain the HES Serial Number of the sender for the following communication modes:

- point-to-multipoint, connectionless (multicast) and
- point-to-system, connectionless (system broadcast).

This shall be indicated by the value 0 of the field AddrExtensionType in the second block of the HES RF frame. Multicast frames received with the wrong value of the AddrExtensionType shall be discarded by the receiving Data Link Layer instance.

For other communication modes, the HES RF Domain Address shall be used.

In any frame in system broadcast communication mode the Destination Address shall be 0000h and the Address Type shall be “group”.

6.1.2 Predefined Extended Group Addresses for transmit-only devices

Transmit only devices shall use Extended Group Addresses. As transmit-only devices only have sending Datapoints (only one Group Address per Datapoint), all addresses can and shall be factory set.

- For Group Addresses:

  For all unidirectional sensors, Datapoint 1 shall have Group Address = 0001h, Datapoint 2 shall have Group Address = 0002h, Datapoint N shall have Group Address = N, with as result on the bus Extended Group Address (Serial Number of sensor, 0001h) , (Serial Number of sensor, 0002h) and (Serial Number of sensor, N). These Group Addresses shall be unique for each sender.

- For Individual Addresses:

  All devices shall have the default Individual Address (05FFh).

6.1.3 RF Domain Address

The RF Domain Address shall be a 6 octet number. The RF Domain Address in an RF installation shall always be identical to the HES Serial Number of one of the devices in the installation. This shall guarantee that the RF Domain Address is a unique number.

The RF frame shall contain the RF Domain Address for the following communication modes:

- point-to-point, connectionless,
- point-to-point, connection-oriented and
- point-to-all-points, connectionless (broadcast).

This shall be indicated by the value 1 of the field AddrExtensionType in the second block of the RF frame. Point-to-point connectionless and point-to-point connection-oriented frames received with the wrong value of the AddrExtensionType shall be discarded by the receiving Data Link Layer instance.

For other communication modes, the HES Serial Number shall be used.

In any frame in broadcast communication mode the Destination Address shall be 0000h and the Address Type shall be “group”.

6.1.4 RF Broadcast and RF System Broadcast

RF Broadcasts may be propagated beyond a given RF installation (= domain)can be broadcasts within an installation or system broadcasts. In this case broadcast becomes a system broadcast which shall be indicated by the AddrExtensionType field in the second block of the RF frame.

0: system broadcast (shall not be restricted to the RF installation = domain; the frame shall contain the Serial Number of the sender).

1: broadcast (shall be restricted to the installation = domain; the frame shall contain the Domain Address).

6.2 Data Link Layer Frame

6.2.1 General

This clause specifies the frame format of the HES-RF system.

6.2.2 Structure

The frame format builds on the FT3 Data Link Layer (see IEC 60870-5). The frame shall consist of a preamble (Physical Layer), several data blocks, each followed by 2 octets CRC, and a postamble (Physical Layer).

The first data block shall have a fixed length of 10 data octets. The following blocks shall contain 16 data octets, except the last block, which may contain less than 16 octets (the remainder).

The HES RF-Ctrl octet in the second data block contains the 4 bits “frame format”.

	10 octets	**2 octets**	**16 octets**	**2 octets**		**2 octets**	
preamble	data block 1	CRC	Data block 2	CRC	…	CRC	postamble

Figure 1 – Overview of the link layer frame

6.2.3 Bit and octet order

Data shall be transmitted most significant bit (msb) first.

For data fields consisting of multiple octets (e.g., HES Serial Number/Domain Address and Device Addresses) the most significant octet (MSB) shall be transmitted first.

6.2.4 First block

6.2.4.1 General

1 octet	**1 octet**	**1 octet**	**1 octet**	**6 octets**	**2 octets**	
Length	C-field	Esc	RF-Info	SN/DoA	CRC	CRC

Figure 2 – Structure of the first block

6.2.4.2 Significance of the fields in the first block

- Length: in accordance with IEC 60870-5, the total number of user octets counted from the C-field (excluding the CRCs).
- C-field: in accordance with IEC 60870-5, HES RF only uses SEND/NO REPLY (C = 44h).
- Esc: this field shall have the fixed value FFh.
- RF-Information shall be coded as specified in Table 3.

Table 3 – Coding of the RF info field

Bit	Name	Possible codings and their significance
7 (msb)	reserved	shall be set to 0
6		shall be set to 0b by the sender
4/5	-	shall be set to 00b by the sender
2/3	Received signal strength. May be filled in by the retransmitter with the lowest received signal strength. Senders always send 00h, Retransmitter shall not change the value if it cannot measure it.	00b void (no measurement) 01b weak 10b medium 11b strong
1	Battery state of the sender.	0: battery is weak 1: battery is ok
0 (lsb)	Unidir	0: frame sent by bidirectional device, 1: frame sent by unidirectional device

- SN/DoA: Serial Number or Domain Address of the sender. The field AddrExtensionType in the L/NPCI in the second block shall indicate whether this field contains the HES Serial Number or the Domain Address.
- CRC: according to IEC 60870-5-1

For information: The CRC according to FT3 of IEC 60870-5-1 uses

$$2^{16}+2^{13}+2^{12}+2^{11}+2^{10}+2^{8}+2^{6}+2^{5}+2^{2}+2^{0}$$

as a generator polynomial. It starts with zero and treats the data msb first. The CRC result is complemented. The MSB of the 16-Bit CRC is transmitted first.

Example: the sequence 01 02 03 04 05 06 07 08 has the CRC FCBC.

6.2.5 Second block

6.2.5.1 General

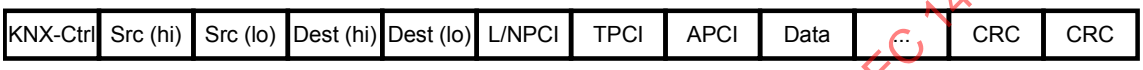


Figure 3 – Structure of the second block

6.2.5.2 Significance of the fields in the second block

Table 4 – Significance of fields of second block

Field	Name or Bit positions	Significance	Possible codings
HES RF-Ctrl	0 (lsb)...3	frame format	0000b = standard frames 01xxb = extended frames other combinations reserved.
	4...7(msb)	reserved	shall be set to 0
Src	source address	Individual address	-
Dest	Destination Address	Individual or group address	-
L/NPCI	7 (msb)	address type	0: Individual Address 1: Group Address
	4...6	routing counter	-
	1... 3	LFN (link layer frame number)	-
	0 (lsb)	AddrExtensionType	0: The field SN/DoA in the first block shall be interpreted as the Serial Number of the sender. 1: The field SN/DoA in the first block shall be interpreted as the RF Domain Address.
TPCI	Bits 6/7 (msb)	TL service	00b unnumbered data 01b numbered data 10b unnumbered control 11b numbered control
	bits 2...5	sequence number	-
	bits 0 (lsb)/1	APCI	-
APCI	bits 0 (lsb)... 7(msb)	APCI / Data (as in HES standard frame)	-
Data	up to 8 data octets in this block (16 octets max block length), subsequent data octets in following blocks (each block 16 octets, except the last block, which may contain less than 16 data octets.)		

6.3 Medium access

Medium access control serves to prevent collisions on the RF medium. Medium access cannot be completely controlled on RF for two reasons:

- Unidirectional senders access the medium at unpredictable times.
- Non-HES RF devices access the medium at unpredictable times.

Bidirectional devices are able to sense whether the medium is free before they transmit. The interframe time is the time interval a bidirectional device waits for a free medium (regardless of whether it was addressed by the previous frame). If no preamble is detected during this interframe time the device may start sending.

When a frame is received while the Physical Layer receives a request to send, the interframe time shall start after the frame reception is completed, i.e., after the last CRC has been received. The same applies for sending: if the Physical Layer receives a send request while it is sending, the interframe time shall start when the last CRC is transmitted.

As RF supports no collision avoidance, the transmission priorities are not coded in the message frame.

6.3.1 Medium access times

Table 5 – Medium access time

Type of device	Interframe time	Random time
Bi-directional devices	15 ms to 20 ms	0 ms to 10 ms
Retransmitters	5 ms	0 ms to 10 ms
Unidirectional devices	150 ms	random

The assumed typical ‘blind time’ for devices is 1 ms.

6.4 Data Link Layer protocol

6.4.1 RF Repeat Counter for end devices

The RF Repeat Counter shall be set to 6 for end devices.

6.4.2 AddrExtensionType

The AddrExtensionType bit shall be a parameter of the Data Link Layer instance.

In the transmission direction the sending Data Link Layer instance shall evaluate the AddExtensionType and set the correct data, either the device’s own Serial Number or the Domain Address, in the field SN/DoA in block 1 of the transmitted frame.

In the reception direction the receiving Data Link Layer instance shall use this bit for a correct interpretation of the field SN/DoA in block 1 of the received frame as either Serial Number or Domain Address.

This Data Link Layer parameter shall be set by the Application Layer and shall be passed through the communication stack by the other layers as input to the Data Link Layer.

6.4.3 Duplication prevention

6.4.3.1 General

In the presence of retransmitters in the system, frame duplications can occur in the receivers if both the original sender and repetitions sent by the retransmitters are received. Therefore a mechanism shall be foreseen in Layer-2 to prevent the evaluation of duplicated frames in receivers.

6.4.3.2 Transmitters

The Data Link Layer of each transmitter shall insert a Link layer Frame Number (LFN) into the LPCI of each sent frame (see subclause 6.2.5). The LFN shall be a 3 bit counter which shall be incremented for each transmitted frame. After 8 frames the counter wraps around and starts again at zero.

In order to decrease the probability of losing a frame, the frame with the same LFN can be resent.

6.4.3.3 Receivers

The receiver shall discard subsequent frames that contain the identical LFN from the same sender. If the LFN differs, the newly received LFN shall be stored.

Each receiver shall have a table to store the Serial Number and the LFN of previously received frames (no matter from where they are sent). The table length shall be less than or equal to 8, because the LFN counts from 0 to 7. This avoids unintentional discarding of frames, even if frames from only one device are received.

This mechanism ensures that repeated frames originating from the same sender up to within the following 8 frames are discarded.

6.5 Layer-2 of an RF retransmitter

6.5.1 History list

Senders shall set the LFN in the LPCI of each frame, as stated in subclause 6.4.3.2.

The Data Link Layer of every *Retransmitter* shall have a history list that shall store information about the previously received frames. The history list shall contain the Serial Number of the sender (not the Domain Addresses) and the LFN. When a Retransmitter receives a frame, its Data Link Layer shall check if the received Serial Number and LFN in this combination are contained in the history list. If this is the case, this frame shall be discarded, otherwise the processing shall continue.

The history list shall have

- a minimal length of 3 entries, and
- a maximum length of 7 entries or shall provide a deletion mechanism after a timeout (e.g., 3 s).

6.5.2 RF Repeat Counter

If the processing continues, the RF Repeater shall decrement the RF Repeat Counter and compare it with a limit value.

If the processing continues, the RF Repeat Counter of the received frame shall be compared with a limit value.

- If the received value of the RF Repeat Counter is larger than the limit value, then the RF Repeat Counter shall be decremented and the frame shall be repeated.
- If the received value of the RF Repeat Counter is equal to or smaller than the limit value, then the frame shall not be repeated and be ignored.

The limit value could optionally be a parameter for the RF Repeater, to limit the number of RF Repeater levels. It shall be used by the RF Repeater in the following way:

```
if rf_repeat_counter(rec_frame) > 0 and
    rf_repeat_counter(rec_frame) > rf_repeat_counter_limit(repeater)
    rf_repeat_counter(rec_frame) --
else
    discard(rec_frame)
endif
```

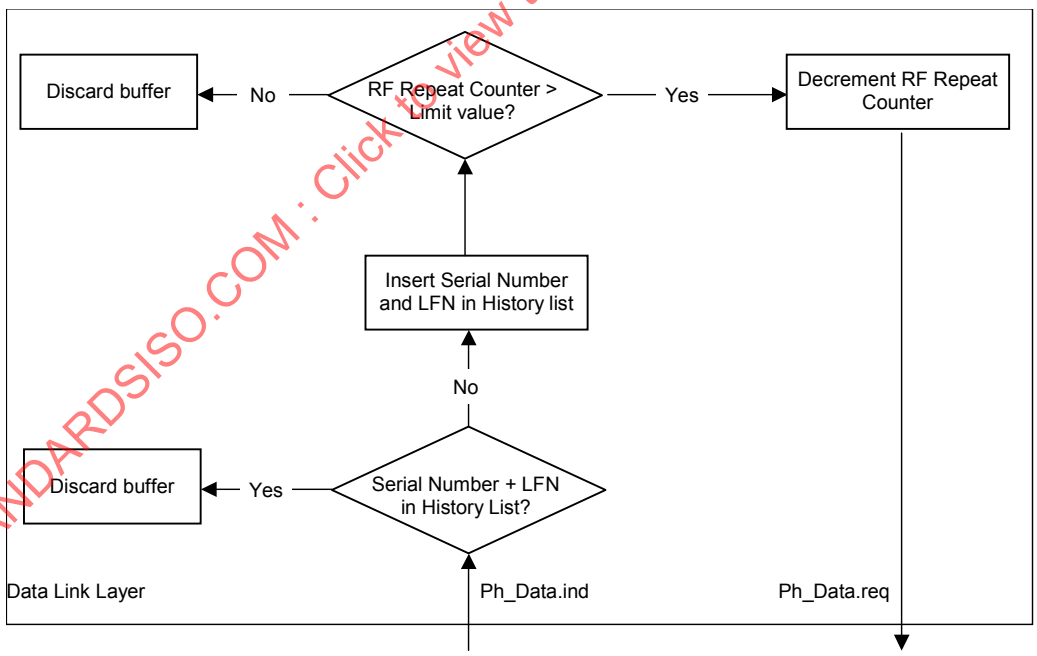
6.5.3 Filtering

Filtering is optional in the retransmitter.

In case of filtering the filter tables can be generated in two ways:

- generation in the retransmitter,
- download into the retransmitter by a management client.

6.5.4 Retransmitter flowchart



NOTE This flowchart only describes the handling of received messages for repeating. The handling of messages to the internal management of the retransmitter is not shown.

Figure 4 – Flowchart of the Data Link Layer and Network Layer of the retransmitter

6.6 The Layer-2 of an RF-TP Media Coupler

6.6.1 Introduction

The RF-TP Media Coupler shall perform a bijective translation between the 8 octet RF Extended Group Address and the 2 octet standard Group Address and Individual Address.

Note that each device that is required to receive messages from the Media Coupler shall store the Serial Number of the Media Coupler.

Two translations are foreseen.

- **Translation configured by a tool**

The translation of the addresses uses a bijective downloadable table in the Media Coupler. It is the responsibility of the installer and tool by means of which the table is downloaded to make sure that the translated Group Addresses are unique in the TP system.

- **Automatic translation**

The association between an Individual Address or a Group Address and an Extended Address shall be done by using an index number. The index number shall be associated with a Serial Number, an Individual or a Group Address. In order to build a bijective relation between an Extended Address and one Individual Address or one Group Address and to enable more than one Media Coupler in an installation and according to the requirements, the fields shall have the following size:

- coupler number: 2 bit
- index: 6 bit

In order to enable more than 2^6 translated Extended Group Addresses, the Group Address part of the Extended Address shall be logically divided into two fields.

- The first one called @bank with a length of 12 bits shall be used in association with the Serial Number and shall be translated in the index part.
- The second one called @link with a length of 4 bits shall be directly copied into the lower part of the TP translated Group Address. This coding shall provide the possibility of having more than 16 Extended Group Addresses translated per Serial Number.

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	….	Octet 7								Octet 8							
							15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Serial Number							@bank												@link			

Figure 5 – Logical Interpretation of Extended Group Address in automatic translation

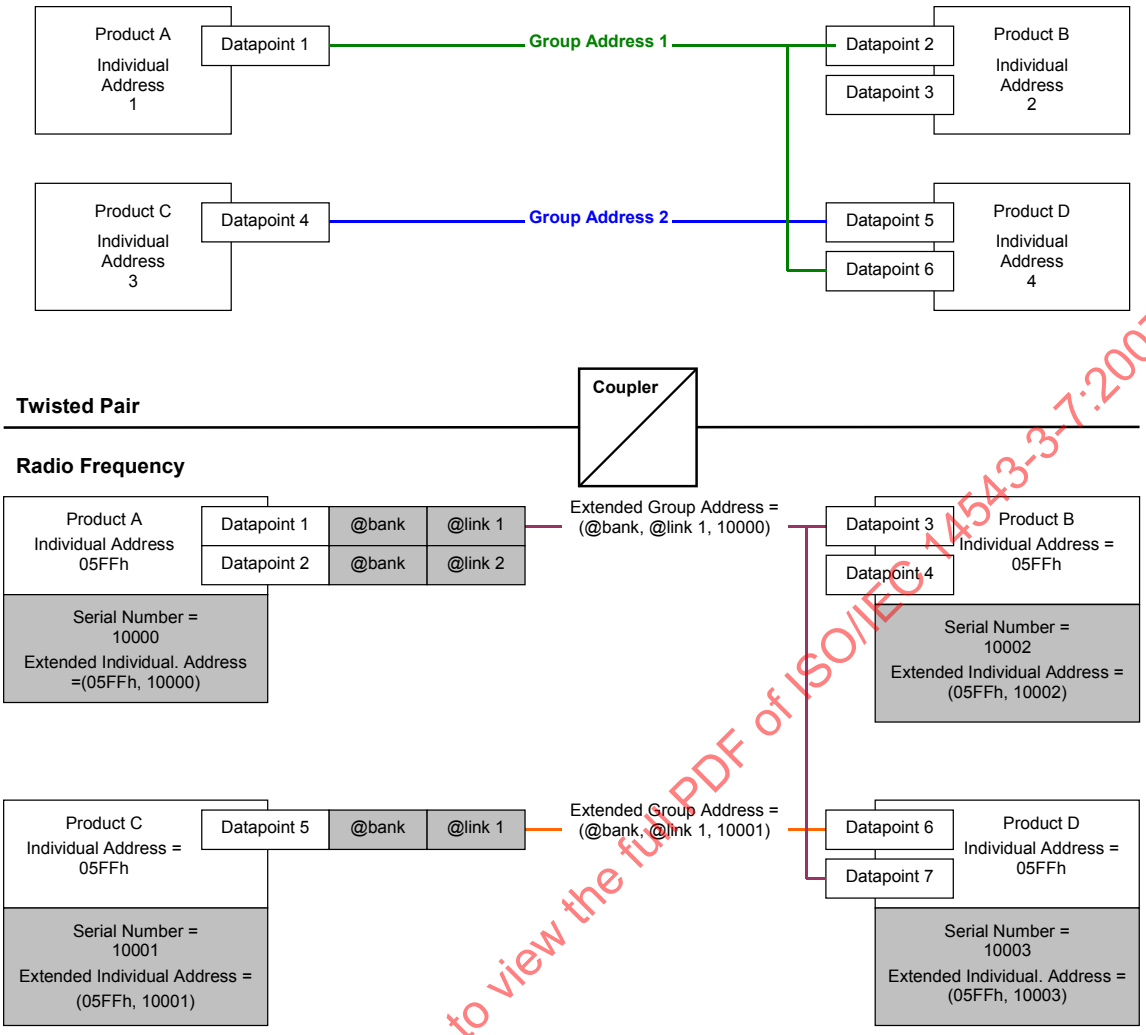


Figure 6 – Coupling a HES TP and RF system

The different cases of translation are detailed in the next subclauses.

6.6.2 Automatic translation

6.6.2.1 Messages coming from RF to TP

For all messages coming from RF, the Source Address shall be translated according the rule specified below. Then, if the Destination Address is a Group Address, the additional Group Address translation from RF to TP shall be used.

6.6.2.1.1 Source Address translation from RF to TP

The Source Address shall be replaced by a concatenation of the Coupler Subnetwork Address, the Media Coupler Number and the index.

RF message:

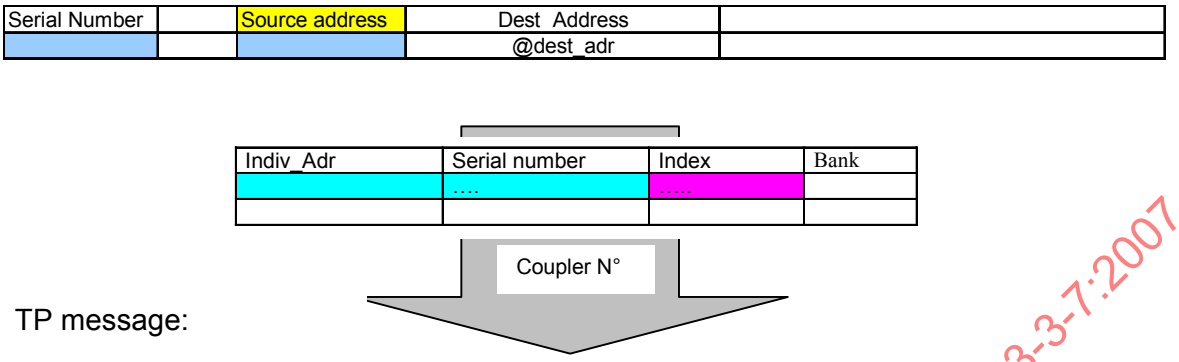


Figure 7 – Automatic translation principle from RF to TP of the source Individual Address

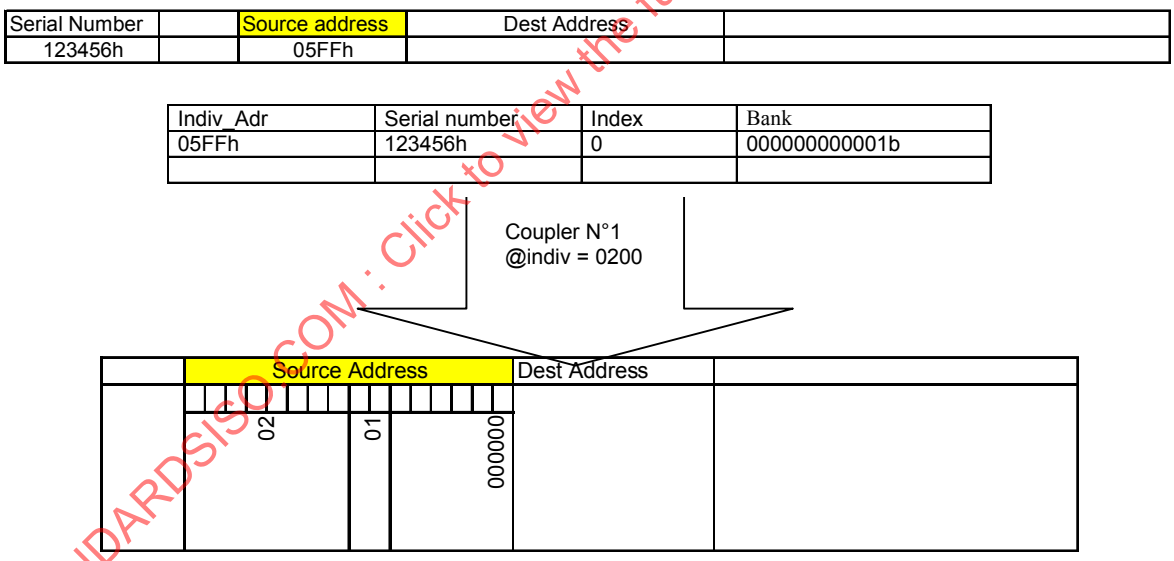


Figure 8 – Example for translation of an Individual Source Address from RF to TP

6.6.2.1.2 Group Addresses messages from RF to TP

For Group Address messages sent from RF to TP the Source Address shall be translated according to the general rule of translation from RF to TP. The Destination Group Address is in the range E000h to EFFFh, reserved for this purpose, and shall be translated from RF addressing scheme to TP group address as shown in Figure 9.

RF message:

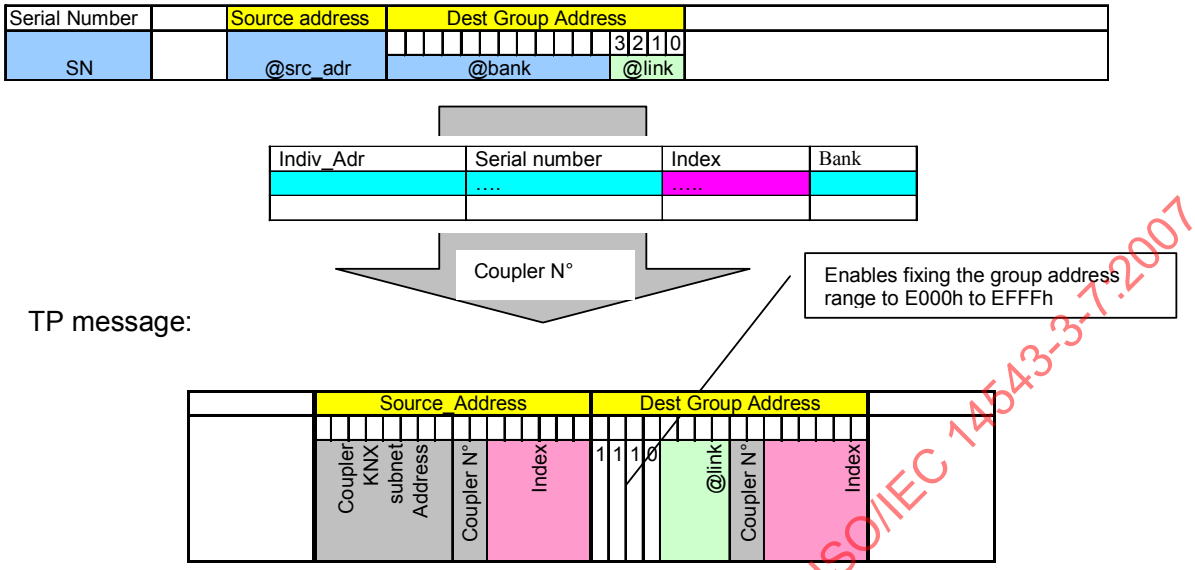


Figure 9 – Automatic translation principle from RF to TP of the Group Address

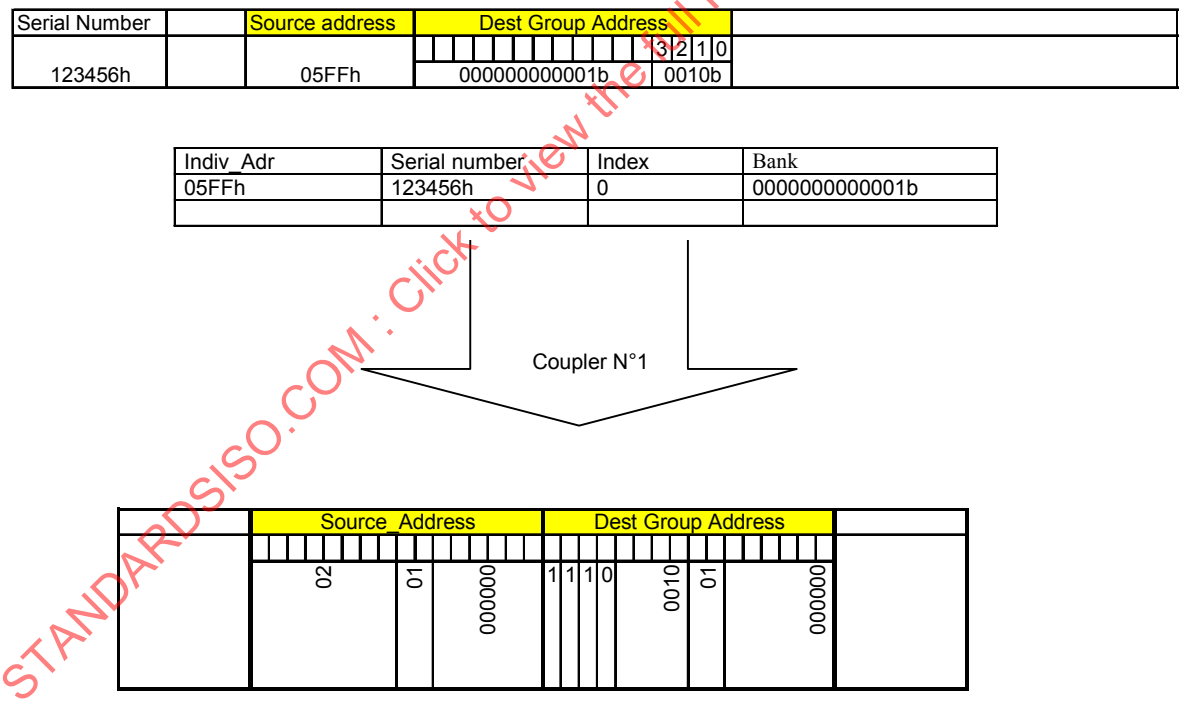


Figure 10 – Example for translation of a Group Address from RF to TP

6.6.2.2 Messages coming from TP to RF

6.6.2.2.1 General

All messages coming from TP shall keep the Source Address.

6.6.2.2.2 Group Address translation from TP to RF

If the destination Group Address used on TP is already in the address range E000h to EFFFh reserved as RF Group Addresses the destination Group Address shall be translated as shown

in Figure 11. The Group Address shall be replaced by a concatenation of the corresponding Serial Number and the bank number.

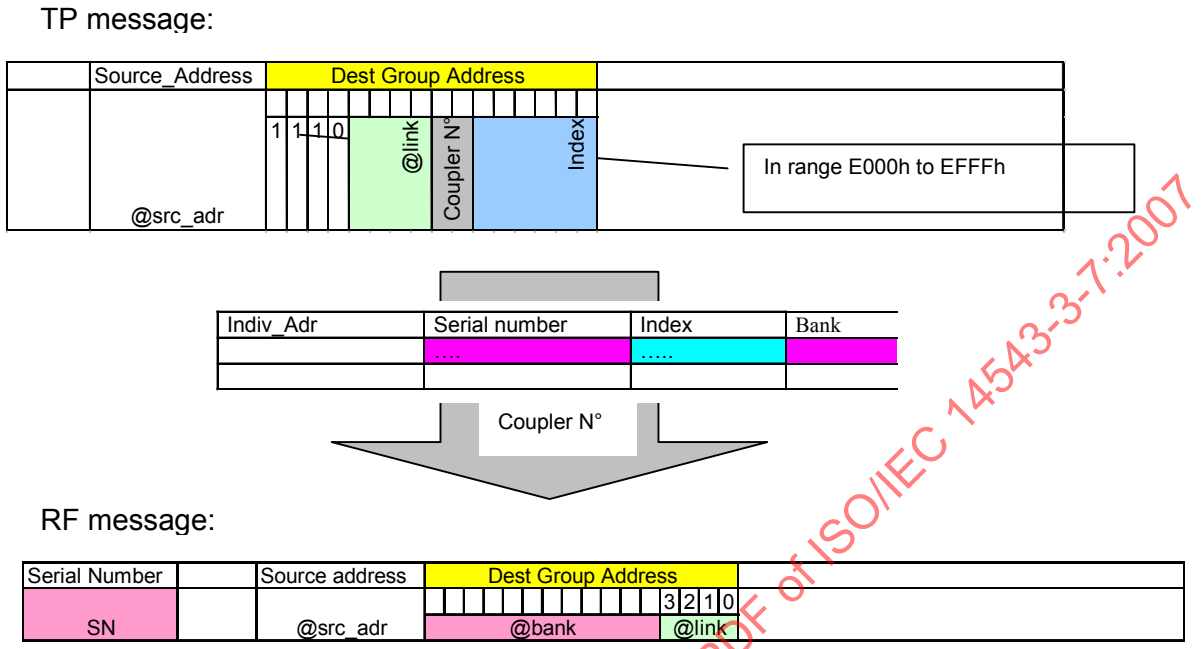


Figure 11 – Automatic translation principle from TP to RF of the Group Address

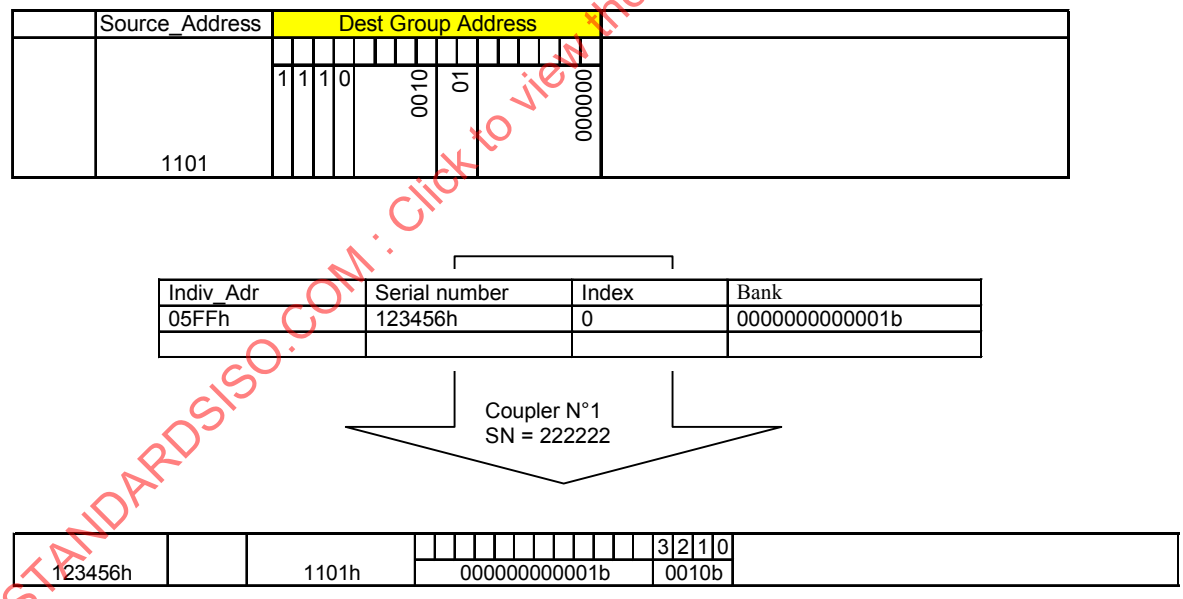
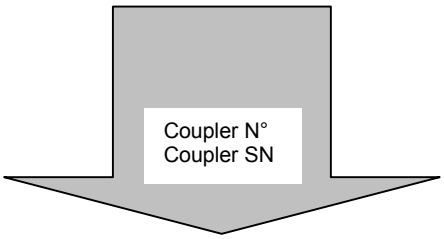


Figure 12 – Example for translation of a Group Address from TP to RF

If the destination Group Address **is not** in the address range E000h to EFFFh reserved as RF Group Addresses the translation shall consist of adding the coupler Serial Number as shown in Figure 13.

TP message:

	Source_Address	Dest Group Address	
	@src_adr	@grp_adr	

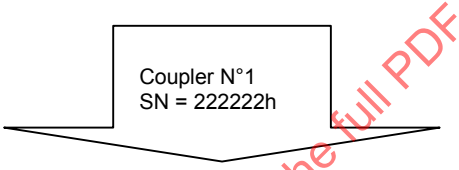


RF message:

Serial Number		Source address	Dest Group Address	
Coupler SN		@src_ard	@grp_adr	

Figure 13 – Automatic translation principle from TP to RF if the Group Address is not in the range of RF Group Addresses E000h to EFFFh

	Source_Address	Dest Group Address	
	1101h	8001h	



Serial Number		Source address	Dest Group Address	
222222h		1101h	8001h	

Figure 14 – Example for translation of a Group Address from TP to RF if the Group Address is not in the range of RF Group Addresses

6.6.2.2.3 Individual addressing coming from TP to RF

If the subnetwork address of the Destination Individual Address is equal to the coupler subnetwork address, the destination Individual Address shall be replaced by the one corresponding to the index as shown in Figure 15.

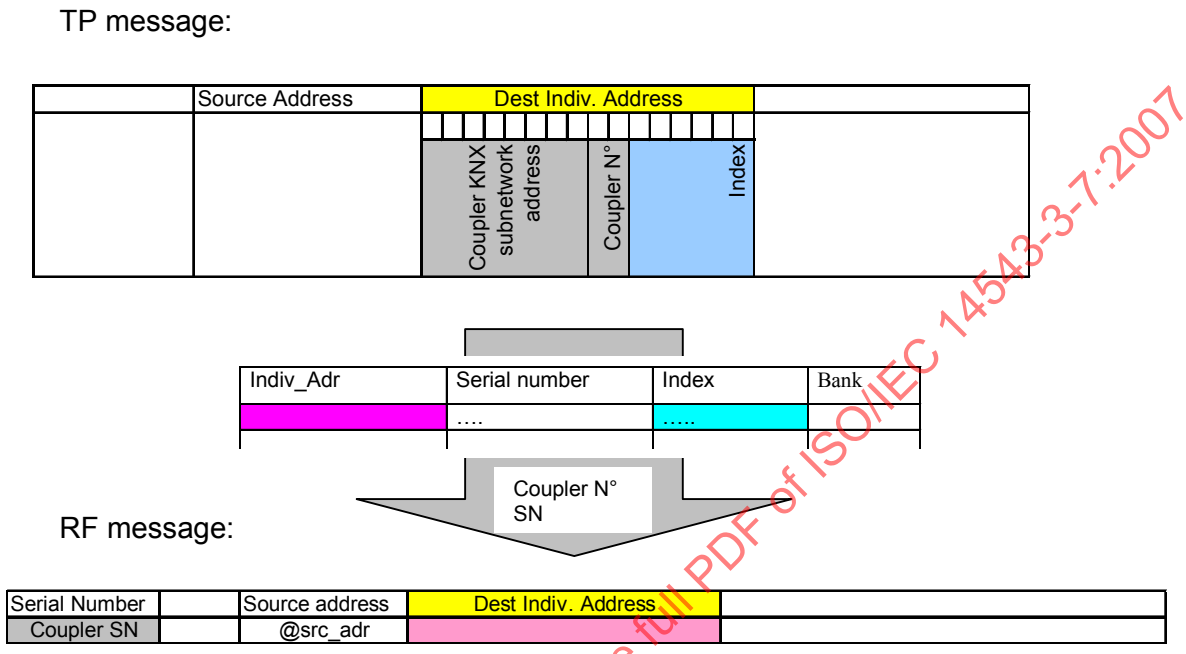


Figure 15 – Automatic translation principle form TP to RF for Individual Addresses

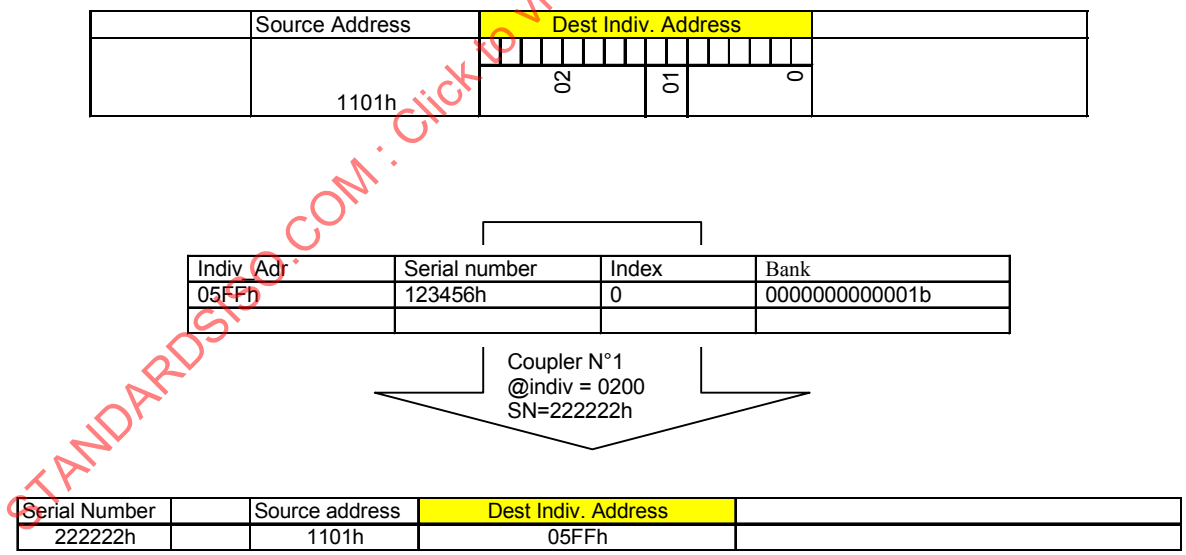
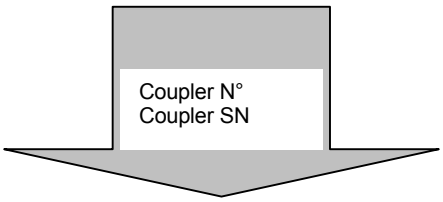


Figure 16 – Example for translation of an Individual Address from TP to RF

If the subnetwork address of the Destination Individual Address is not equal to the coupler subnetwork address, the translation shall consist of adding the coupler Serial Number as shown in Figure 17.

TP message:

	Source Address	Dest Indiv. Address	
	@src_adr	@dest_adr	

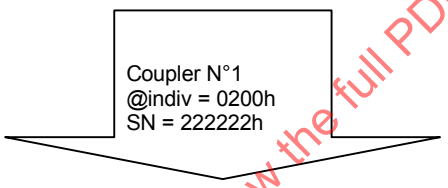


RF message:

Serial Number		Source address	Dest Indiv. Address	
Coupler SN		@src_adr	@dest_adr	

Figure 17 – Automatic translation principle from TP to RF for Individual Addresses if the destination Individual Address is not equal to the coupler Subnetwork Address

	Source Address	Dest Indiv. Address	
	1101h	1102h	



Serial Number		Source address	Dest Indiv. Address	
222222h		1101h	1102h	

Figure 18 – Example for translation of an Individual Address from TP to RF if the destination Individual Address is not equal to the coupler Subnetwork Address

6.6.3 Configuration by a tool

Alternatively to the automatic translation described in subclause 6.6.2, it is also possible to configure the media coupler using a tool.

6.6.4 Translation between standard and extended frames and RF frames

Translation from other media to RF

- 2 octets Ctrl field and extended Ctrl field in the L_Data-Extended Frame shall be replaced by the HES RF-Ctrl field (extended frame format + 4 reserved).

- The length octet in the L_Data-Extended frame shall be replaced by the L/NPCI.