

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1 AMENDEMENT 1

**Industrial networks –
Wireless communication network and communication profiles – ISA 100.11a**

**Réseaux industriels –
Réseau de communication sans fil et profils de communication – ISA 100.11a**

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

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

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FOREWORD

This amendment has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this amendment is based on the following documents:

FDIS	Report on voting
65C/965/FDIS	65C/970/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

GENERAL REPLACEMENTS

Throughout the document, replace references to IEEE 802.15.4:2011 as follows.

Location	Replace	With
4.6.10.2.8	"IEEE 802.15.4:2011"	"IEEE 802.15.4"
6.3.5.2, 6 th dash	"IEEE 802.15.4e"	"IEEE 802.15.4"
7.3.1.2, 1 st paragraph	"IEEE 802.15.4:2011, 7.4.1"	"IEEE 802.15.4-2015, 9.4.1"
7.3.1.2, 4 th paragraph	"IEEE 802.15.4:2011, Table 58"	"IEEE 802.15.4-2015, Table 9-6"
7.3.2.3.2, 1 st paragraph	"IEEE 802.15.4:2011, 7.4.3"	"IEEE 802.15.4-2015, 9.4.3"
7.3.2.4.10, 1 st bullet	"IEEE 802.15.4:2011, 7.3.2"	"IEEE 802.15.4-2015, 9.3.2.1"
7.3.2.5, step i), (4 times)	"IEEE 802.15.4:2011, 7.3.4"	"IEEE 802.15.4-2015, 9.3.4"
7.3.2.5, step i)1)	"IEEE 802.15.4:2011, Table 58"	"IEEE 802.15.4-2015, Table 9-6"
7.3.2.6, step f), (4 times)	"IEEE 802.15.4:2011, 7.3.5"	"IEEE 802.15.4-2015, 9.3.5"
7.3.2.6, step f)1)	"IEEE 802.15.4:2011, Table 58"	"IEEE 802.15.4-2015, Table 9-6"
7.3.2.6, step f)1)	"IEEE 802.15.4:2011, 5.2.2.2.2"	"IEEE 802.15.4-2015, 7.3.2.2"
7.3.2.6, step f)2)	"IEEE 802.15.4:2011, Table 57"	"IEEE 802.15.4-2015, Table 9-5"
7.3.3.8, step i), (4 times)	"IEEE 802.15.4:2011, 7.3.4"	"IEEE 802.15.4-2015, 9.3.4"
7.3.3.8, step i)1)	"IEEE 802.15.4:2011, Table 58"	"IEEE 802.15.4-2015, Table 9-6"
7.3.3.9, step g), (4 times)	"IEEE 802.15.4:2011, 7.3.5"	"IEEE 802.15.4-2015, 9.3.5"

Location	Replace	With
7.3.3.9, step g)1)	"IEEE 802.15.4:2011, Table 58"	"IEEE 802.15.4-2015, Table 9-6"
7.3.3.9, step g)1)	"IEEE 802.15.4:2011, 5.2.2.2.2"	"IEEE 802.15.4-2015, 7.3.2.2"
7.3.3.9, step g)2)	"IEEE 802.15.4:2011, Table 57"	"IEEE 802.15.4-2015, Table 9-5"
8.2.2.5, 3 rd paragraph	"IEEE 802.15.4:2011, 8.1.5"	"IEEE 802.15.4-2015, 10.1.5"
8.2.3.2, 1 st paragraph	"IEEE 802.15.4:2011, Table 66"	"IEEE 802.15.4-2015, Table 10-4"
9.3.2.1, NOTE	"IEEE 802.15.4:2011"	"IEEE 802.15.4-2015"
9.3.2.1, 5 th paragraph	"IEEE 802.15.4:2011"	"IEEE 802.15.4"
9.3.3.1, 1 st paragraph	"IEEE 802.15.4:2011, 5.2.2.2"	"IEEE 802.15.4-2015, 7.3.2"
9.3.3.1, 1 st paragraph	"IEEE 802.15.4:2011, 5.2.1 and 5.2.2.2"	"IEEE 802.15.4-2015, 7.2 and 7.3.2"
9.3.3.1, 2 nd paragraph	"IEEE 802.15.4:2011, 5.2.1.2"	"IEEE 802.15.4-2015, 7.2.2"
9.3.3.1, 3 rd paragraph	"IEEE 802.15.4:2011, 5.2.3"	"IEEE 802.15.4-2015, 7.3.3"
9.3.3.1, 3 rd paragraph	"IEEE 802.15.4:2011, 5.2.1.1.8"	"IEEE 802.15.4-2015, 7.2.1.10"
9.3.3.2, 1 st paragraph	"IEEE 802.15.4:2011, 5.2.1"	"IEEE 802.15.4-2015, 7.2"
9.3.3.2, 1 st paragraph	"IEEE 802.15.4:2011, Figure 35"	"IEEE 802.15.4-2015, Figure 7-1"
9.3.3.2, field a)	"IEEE 802.15.4:2011, 5.2.1.1"	"IEEE 802.15.4-2015, 7.2.1"
11.3.2, 3 rd paragraph	"IEEE 802.15.4:2011, Annex B"	"IEEE 802.15.4-2015, Annex B"
13.11.2.6, d)	"IEEE 802.15.4:2011"	"IEEE 802.15.4"
Table B.5, 3 rd column header	"IEEE 802.15.4:2011"	"IEEE 802.15.4-2015"
H.1.4, 1 st paragraph	"IEEE 802.15.4:2011, B.3.2"	"IEEE 802.15.4-2015, B.3.2"

OTHER REPLACEMENTS

0.3 Potentially relevant patents

In cell d) of the table providing coordinates for the Yokogawa Electric Corporation patent holder, replace "Musashina-shi" with "Musashino-shi".

2 Normative references

Replace reference to IEEE 802.15.4TM:2011 with "IEEE Std 802.15.4TM-2015², IEEE Standard for Low-Rate Wireless Networks".

4.6.11.1 Overview

For attribute 29, 4th column, replace “Default value: 30 s” with “Default value: 62 s”.

Table 19 – Proxy_System_Manager_Join method

Add Input Argument 11 as follows:

11	Consortium_Info	Type: Unsigned8	Provides Consortium-specific information from the joining device that is not specified by this document
----	-----------------	-----------------	---

Replace existing Output Arguments 7 and 8 with the following text:

7	Assigned_Max_TSDU_Size	Type: Unsigned16	Indicates the maximum TSDU supported in octets which can be converted by the source into max APDU size by taking into account the TL, security, AL headers and TMIC sizes
8	MIC	Type: OctetString4	This value is used for protecting argument 1 through 7 with Join key. This MIC value is generated by the Security Manager. The Advertisement router shall not overwrite this value. See 7.4.4.3.3.2

Table 23 – System_Manager_Join method

Add Input Argument 11 as follows:

11	Consortium_Info	Type: Unsigned8	Provides Consortium-specific information from the joining device that is not specified by this document
----	-----------------	-----------------	---

Replace existing Output Arguments 7 and 8 with the following text:

7	Assigned_Max_TSDU_Size	Type: Unsigned16	Indicates the maximum TSDU supported in octets which can be converted by the source into max APDU size by taking into account the TL, security, AL headers and TMIC sizes
8	MIC	Type: OctetString4	This value is used for protecting argument 1 through 7 with Join key. This MIC value is generated by the Security Manager. The Advertisement router shall not overwrite this value. See 7.4.4.3.3.2

Table 27 – SCO method for contract establishment, modification, or renewal

For Input Argument 16, 5th column, add “Valid range: –32 768 to 16”.

For Input Argument 17, 5th column, add “Valid range: –32 768 to 16”.

For Output Argument 13, 5th column, add “Valid range: –32 768 to 16”.

For Output Argument 14, 5th column, add “Valid range: –32 768 to 16”.

For Output Argument 24, 5th column, add “Valid range: –32 768 to 16”.

For Output Argument 25, 5th column, add “Valid range: –32 768 to 16”.

Table 30 – Contract_Data data structure

For element 15, 3rd column, add “Valid range: –32 768 to 16”.

For element 16, 3rd column, add “Valid range: –32 768 to 16”.

Table 31 – New_Device_Contract_Response data structure

For element 3, 3rd column, add “Valid range: –32 768 to 16”.

For element 4, 3rd column, add “Valid range: –32 768 to 16”.

7.3.2.6 Processing of received DPDUs

In step e), delete “Additionally, the procedure shall verify that the 8-bit MHR sequence number is not 0xFF. If the 8-bit MHR sequence number is 0xFF, the procedure shall return with a status of INVALID_SEQUENCE_NUMBER.”

7.3.3.9 Processing for received TPDUs

In step h), replace “may decrement” with “shall decrement”.

7.4.4.3.3.2 MIC generation for System_Manager_Join response

Replace the existing formula with the following:

MACTag = HMAC- $MMO_{K_{join}}$ [Output Argument number 1 .. number 7 in Table 23
|| EU1-64_{join_device} || Challenge_{join_device}]

Table 62 – Security_Sym_Join_Request data structure

Replace the elements in Table 62 with the following:

New_Device_EUI64	1	Type: EUI64Address Classification: Constant Accessibility: Read only
DL_Subnet_ID	2	Type: Unsigned16 Classification: Static Accessibility: Read/write
Comm_SW_Major_Version	3	Type: Unsigned8 Classification: Static Accessibility: Read only
Comm_SW_Minor_Version	4	Type: Unsigned8 Classification: Static Accessibility: Read only
128_Bit_Challenge_From_New_Device	5	Type: Unsigned128 Classification: Static Accessibility: Read/write
Algorithm_Identifier	6	Type: Unsigned8 Classification: Static Accessibility: Read only Default value: 1
MIC	7	Type: Unsigned32 Classification: Static Accessibility: Read only

7.4.5.2.2 Symmetric-key join request

In the text following Table 62, after the first bullet (New_Device_EUI64), insert the following three additional bullets:

- DL_Subnet_ID is the DL subnet that the new device is trying to join; it is also the DL subnet of the advertising router.
- Comm_SW_Major_Version is a copy of the DMO Comm_SW_Major_Version attribute; see Table 10, Attribute 20.
- Comm_SW_Minor_Version is a copy of the DMO Comm_SW_Minor_Version attribute; see Table 10, Attribute 21.

In the last bullet following Table 62, replace “The MIC-32 is computed over the elements 1 through 4” with “The MIC-32 is computed over the elements 1 through 6”.

7.5.4 Proxy security management object methods related to the session establishment

In the 7th bullet following Table 81, delete “assigned in the joining process”.

In the 2nd bullet following Table 82, delete “assigned during the joining process”.

7.6.3 Device security management object methods related to T-key update

In the 4th bullet following Table 84, delete “assigned in the joining process”.

In the 2nd bullet following Table 85, delete “assigned during the joining process”.

Table 95 – Delete key method

For Input Argument number 8, last column, delete “assigned in joining process”.

7.11.3.2 Additional device security management object methods to support key management

At the end of the paragraph before Table 96, add the following:

Use of the Key_Policy_Update method shall be limited to changes to SoftLifespan_Ratio. More general changes of key policy are accomplished by key replacement, as described in 7.6.

Table 96 – Key_Policy_Update method

For Input Argument number 10, last column, delete “assigned in joining process”.

9.1.9.4.3 Unicast transaction

Delete the 5th paragraph, beginning with “IEEE 802.15.4 permits CCA Mode 3”.

9.1.15.6 Country code

Delete NOTE 1, change “NOTE 2” to “NOTE” (i.e., delete the number), and replace the paragraph after the deleted NOTE 1 with the following:

When Bit11, Bit13 and Bit14 (ETSI, LBT and FHSS) are all true, operation may need to switch momentarily to the non-adaptive rules of ETSI EN 300 328 v2.1.1 while sending a near-maximal-size ACK/NAK DPDU (as short control signaling) within a transaction and for the immediately following Tx-gap-time of EN-mandated non-transmission, thus

supporting mode V.4 category 6), where the exact requirements for such momentary mode-switching are specified.

Table 117 – ACK/NAK DPDU DHR

In the last row, first column, replace "0..3" with "0 or 3".

9.3.5.2.4.2 Advertisement join links

In the text after Table 128, replace the text of item a) as follows:

DauxJoinBackoff. During the join process, DauxJoinBackoff shall be used instead of MaxBackoffExp, following the exponential backoff procedure described in 9.1.8.2.

Table 129 – Defaults for links created from advertisements

In the intersection of DauxJoinRx and Type_SelectiveAllowed, replace 1 with 0 as shown:

Field name	DauxJoinTx	DauxJoinRx	DauxAdvRx (when DauxJoinFldXmit.Bit3 =1)
Type-SelectiveAllowed	1	0	1

9.3.5.3.1 General

In the penultimate paragraph, after "a solicitation's DMIC shall be built using a security key of K_global and a nominal TAI time of zero", add "and a source address of zero".

Table 141 – DLMO attributes

For attribute 5, 4th column, replace "Default value: Null" with "Default value: 0x80".

For attribute 12, 4th column, replace "Default value: 120 (30 s)" with "Default value: 248 (62 s)".

Table 148 – dlmo.DeviceCapability OctetString structure

Replace the row for Energy Design with the following:

5-8	EnergyDesign (see Table 146)
-----	------------------------------

9.4.2.23 DLMO device capabilities

In the text following Table 148, in the description of • dlmo.DeviceCapability.ClockStability (2nd bullet), replace "absence" with "presence".

9.4.2.27.1 General

In the 5th paragraph, replace "Such skipped links should be treated as equivalent to NAK for the applicable channel" with "Such skipped links should be counted as a NoACK for the applicable channel, that is, they should be counted as unacknowledged DL transmissions in the ChannelDiag diagnostic".

9.4.3.5.3 Superframe current timeslot state

Replace the formula for ChOffset (after " The timeslot offset into that channel-hopping cycle is") with the following:

$$\text{ChOffset} = ((\text{SlotNumAbs} - \text{ChBirth}) \bmod \text{ChCycle}) / \text{ChRate}$$

Table 184 – Values for dlmo.Link[].Schedule

For Element encoding, 2nd column, replace "BooleanArray32" with "32-bit BitString".

Table 188 – Diagnostic summary OctetString fields

For ClockSigma, 2nd column, replace "Type: Integer16" with "Type: Unsigned16".

Table 229 – TLMO attributes

For attribute 2, 3rd column, replace in the description "Number of active ports" with "Maximum number of ports available".

Add attribute 11 as follows:

TPDUoutOfSecurityPolicies AlertDescriptor	11	Used to change the priority of the TPDUoutOfSecurityPolicies alert; this alert can also be turned on or turned off	Type: Alert report descriptor	–
			Classification: Static	
			Accessibility: Read/write	
			Initial default value: Alert report disabled = True Alert report priority = 2 (journal)	
			Valid value set: See type definition	

Table 368 – Device provisioning object

In the latter part of Table 368, replace, in the 2nd column, attribute identifiers as follows:

Attribute name	Attribute identifier
PKI_Certificate_Type	22
PKI_Root_Certificate	18
Number of PKI_Certificates	19
PKI_Certificate	20
Current_UTC_Adjustment	21

For attribute 11, in the 4th column, replace "Default value: 0" with "Default value: 1".

For attribute 13, in the 4th column, replace "Default value: 1" with the following:

Default value:

0: if asymmetric key join not supported

1: if asymmetric key join supported

For attribute 16, in the 4th column, replace "Type: BitArray16" with "Type: Unsigned16".

Table 371 – Device provisioning service object

For attribute 8, in the 4th column, replace "Type: BitArray16" with "Type: Unsigned16".

Table B.18 – Routing table size

For Item number RTS3, 3rd column, replace “15” with “5”.

Table B.19 – Address table size

For Item number ATS3, 3rd column, replace “15” with “5”.

Annex V – Compliance with ETSI EN 300 328 v1.8.1

In the annex heading, replace “v1.8.1” with “v2.1.1”.

In the 3rd paragraph, replace “at least 15 channels” with “at least NC channels, where NC = 5 for non-adaptive FHSSM and NC = 15 for adaptive FHSSM”.

Replace existing NOTE 3 with the following:

NOTE 3 ETSI 300 328:2016 v2.1.1 4.3.1.4 permits “blacklisting” (i.e. blocking) operation on some of the channels specified in a FHSSM frequency-hopping schedule, but does not permit the number of different hopping channels to be reduced to fewer than NC channels. Therefore inclusion of fewer than NC channels in a channel map that determines the frequency-hopping cycle of selected channels means that the only possible remaining operating regimes are those under WBM.

In NOTE 4, replace the first sentence with: “These requirements are ETSI EN 300 328:2016 v2.1.1 4.3.1.7.2 (FHSSM) and 4.3.2.6.3.2.2 (WBM) and related text.”

Under the 5th paragraph, first bullet, replace “≤ 1 ms” with “≤ 1,056 ms”.

Under the 5th paragraph, third bullet, replace “a given channel” with “a given channel, whether transmitting or not,”.

Replace existing NOTE 5 with the following:

NOTE 5 Tx-sequence-time and Tx-gap-time are defined in ETSI EN 300 328:2016 v2.1.1, 4.3.1.3 (FHSSM) and 4.3.2.4 (WBM). Dwell time, which applies to FHSSM, is defined in ETSI EN 300 328 v2.1.1, 3.1. Dwell time is necessarily at least as large as Tx-sequence-time. Dwell time need never be larger than the duration of one timeslot.

Replace existing 6th, 7th and 8th paragraphs with the following:

ETSI EN 300 328:2016 v2.1.1, 4.3.2.3.3 (WBM) imposes a power spectral density limit for WBM of 10 dBm/MHz EIRP. Due to the spectrum of the IEEE 802.15.4:2015 2,4 GHz DSSS modulation, this constraint limits equipment operating under ETSI EN 300 328 v2.1.1's WBM regulations to a maximum transmit power (total for all active transmit chains after any antenna and beam-forming gain) of 20 mW (+13 dBm) EIRP.

ETSI EN 300 328:2016 v2.1.1, 4.3.1.2 (FHSSM) and 4.3.2.2 (WBM) limit maximum transmit power, after any antenna and beamforming gain, to 100 mW (+20 dBm) EIRP.

ETSI EN 300 328:2016 v2.1.1, 4.3.1.6 (FHSSM) and 4.3.2.5 (WBM) limit the Medium Utilization of non-adaptive equipment, and of adaptive equipment operating in a non-adaptive mode, so that the total energy transmitted over any observation interval as specified by EN 300 328 averages ≤ 10 mW (+10 dBm) EIRP. Use of adaptivity removes this restriction on average transmit power.

In the 9th paragraph, replace “2012 v1.8.1, 4.3.2.3” with “2016 v2.1.1, 4.3.2.4”.

In the 10th paragraph, replace “2012 v1.8.1, 4.3.1.2” with “2016 v2.1.1, 4.3.1.3”.

Replace existing 11th, 12th and 13th paragraphs as follows:

The ACK/NAK DPDU's that are sent by D-transaction respondents as immediate responses (within the same slot) to the Data DPDU sent by the D-transaction initiator can be considered as "short control signaling" (SCS, ETSI EN 300 328:2016 v2.1.1 4.3.1.7.4 (FHSSM) and 4.3.2.6.4 (WBM)). While LBT is not required before transmitting SCS, ETSI EN 300 328:2016 v2.1.1, 4.3.1.7.4.2 (FHSSM) and 4.3.2.6.4.2 (WBM) constrain each instance of SCS to occupy no more than 10 % of the claimed dwell time. That restriction has an inverse impact on the minimum timeslot duration for the system, requiring the timeslot duration to be increased (and aggregate system throughput correspondingly decreased) relative to that otherwise required, just so that the channel occupancy of each SCS instance (i.e., an ACK/NAK DPDU) is never greater than 10 % of the claimed dwell time.

In devices claiming conformance to adaptive-mode FHSSM, the recommended alternative approach to meeting ETSI EN 300 328:2016 v2.1.1, 4.3.1.7.4.2 is to have each D-transaction-respondent dynamically mode-switch to operation in a non-adaptive mode while sending any ACK/NAK DPDU that is too lengthy to meet the 10 % of-dwell-time restriction, and for 5 ms thereafter (the mandated minimum Tx-gap-time), after which the responding device reverts to the adaptive mode of operation. It appears that the only significant consequence of such a temporary non-adaptive operating mode is that the responding device is not permitted to initiate a D-transaction in the immediately following timeslot unless the intervening period of non-transmission meets the minimum Tx-gap-time requirement.

ETSI EN 300 328:2016 v2.1.1, 4.3.1.4.3 (FHSSM) requires that each cyclic channel-hopping sequence contain a minimum of NC channels, whether idle or active, where $NC = 5$ for non-adaptive FHSSM and $NC = 15$ for adaptive FHSSM. In terms of this document, this requirement means that only $dlmo.Ch$ entries (Table 160) whose size field has a value of NC or greater are suitable for use in FHSSM mode under ETSI EN 300 328 v2.1.1. Therefore, when channel-hopping sequences with cycle lengths less than NC are used, operation under ETSI EN 300 328 v2.1.1 necessarily conforms to the EN's WBM regulations.

In the 14th paragraph, replace "v1.8.1" with "v2.1.1".

In the 15th paragraph, replace "v1.8.1" with "v2.1.1".

Under the 15th paragraph, replace existing item 6) and its existing NOTE 7 with the following:

- 6) adaptive FHSSM equipment that may momentarily mode-switch to non-adaptive operation when operating as a D-transaction responder (i.e. to send an ACK/NAK DPDU that is too lengthy to qualify as SCS) with $dlmo.CountryCode.mode=0b"x1101x"$.

NOTE 7 Such momentarily mode-switching is only required when the ACK/NAK PPDU to be transmitted will occupy more than 10 % of a timeslot, which can only occur when the timeslot is $< 10,56$ ms and the ACK/NAK DPDU's MHR conveys an EUI-64 source address, or when the timeslot is $< 9,28$ ms.

From item d) to the end of Annex V, replace all existing text with the following:

- d) for operation in mode 2), limiting the total number of transmissions, both of Data DPDU's and of ACK/NAK DPDU's, such that the mean output power, P_{outAvg} , is ≤ 10 mW (+10 dBm) EIRP over each possible 1,0 s measurement interval;
- e) for operation in mode 5), limiting the total number of transmissions, both of Data DPDU's and of ACK/NAK DPDU's, such that the mean output power, P_{outAvg} , is ≤ 10 mW (+10 dBm) EIRP over each possible of 100-timeslot measurement interval;
- f) for operation in modes 2) and 5), meeting the required Tx-gap-time of non-transmission after transmission of a Data DPDU;

- g) for operation in modes 2) and 5), and in mode 6) when momentarily operating under non-adaptive rules, meeting the required Tx-gap-time interval of non-transmission after transmission of an ACK/NAK DPDU.

NOTE 10 For operation in mode 6), EN 300 328 v2.1.1:2015 4.3.1.6.3 limits the medium utilization for transmissions of ACK/NAK DPDUs sent while the device is momentarily operating under non-adaptive FHSSM rules to $\leq 10\%$, as measured over any possible 100-timeslot interval. That constraint is met automatically due to the small percentage of timeslots in which the device could be sending ACK/NAK DPDUs that require momentary non-adaptive operation, and the relatively short length of those ACK/NAK DPDUs.

For d), e), f), and g), the equipment dynamically monitors its recent activity to avoid transmitting whenever doing so would violate any of those constraints.

NOTE 11 While a system manager can schedule device activity pessimistically to ensure that d), e), f), and g) are always met, it is the device's own responsibility to monitor its recent activity and inhibit transmission when doing so would violate regulatory constraints. Thus the ultimate responsibility for operation of a collection of devices rests with the individual devices themselves, not some remote manager that could be subverted by a successful cyberattack on a single device.

EN 300 328 v2.1.1:2016 specifies Receiver Categories (4.2.3) based on maximum and mean transmitter output power, P_{outMax} and P_{outAvg} . Equipment designed to operate under this document typically will fall under Receiver Category 1 (4.2.3.2.1) or Receiver Category 2 (4.2.3.2.2). The claimed receiver category impacts the Receiver Blocking requirements, EN 300 328 v2.1.1:2016 4.3.1.12 (FHSSM) and 4.3.2.11 (WBM), that apply to mandated rejection of out-of-band signals.

For FHSSM, EN 300 328 v2.1.1:2016 specifies requirements on Accumulated Transmit Time and Frequency Occupation of each frequency in the hopping schedule (4.3.1.4). This document specifies schedules in terms of virtual channels and provides a knowable, fixed, time-based cyclic mapping of those virtual channels to real channels. Schedule construction for networks claiming conformance to this document and operating under categories 4, 5 or 6 of Annex V of this document take that known cyclic mapping into account when allocating timeslots to transaction initiators, so that the requirements of EN 300 328 v2.1.1:2016 4.3.1.4 are met.

Bibliography

Replace existing reference "IEEE Std 802.15.4e-2012" with the following:

IEEE Std 802.15.4™-2015, *IEEE Standard for Low-Rate Wireless Networks*

Replace existing reference "ETSI EN 300 328" with the following:

ETSI EN 300 328 v2.1.1 (2016-11), *Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU*

AVANT-PROPOS

Le présent amendement a été établi par le sous-comité 65C: Réseaux industriels, du comité d'études 65 de l'IEC: Mesure, commande et automation dans les processus industriels.

Le texte de cet amendement est issu des documents suivants:

FDIS	Rapport de vote
65C/965/FDIS	65C/970/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cet amendement.

Le comité a décidé que le contenu de cet amendement et de la publication de base ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. À cette date, la publication sera:

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

REPLACEMENTS GÉNÉRAUX

Dans l'ensemble du document, remplacer les références à l'IEEE 802.15.4:2011 comme suit.

Emplacement	Remplacer	Par
4.6.10.2.8	"IEEE 802.15.4:2011"	"IEEE 802.15.4"
6.3.5.2, 6 ^e tiret	"IEEE 802.15.4e"	"IEEE 802.15.4"
7.3.1.2, 1 ^{er} alinéa	"IEEE 802.15.4:2011, 7.4.1"	"IEEE 802.15.4-2015, 9.4.1"
7.3.1.2, 4 ^e alinéa	"IEEE 802.15.4:2011, Tableau 58"	"IEEE 802.15.4-2015, Tableau 9-6"
7.3.2.3.2, 1 ^{er} alinéa	"IEEE 802.15.4:2011, 7.4.3"	"IEEE 802.15.4-2015, 9.4.3"
7.3.2.4.10, 1 ^{ère} puce	"IEEE 802.15.4:2011, 7.3.2"	"IEEE 802.15.4-2015, 9.3.2.1"
7.3.2.5, étape i), (4 fois)	"IEEE 802.15.4:2011, 7.3.4"	"IEEE 802.15.4-2015, 9.3.4"
7.3.2.5, étape i)1)	"IEEE 802.15.4:2011, Tableau 58"	"IEEE 802.15.4-2015, Tableau 9-6"
7.3.2.6, étape f), (4 fois)	"IEEE 802.15.4:2011, 7.3.5"	"IEEE 802.15.4-2015, 9.3.5"
7.3.2.6, étape f)1)	"IEEE 802.15.4:2011, Tableau 58"	"IEEE 802.15.4-2015, Tableau 9-6"
7.3.2.6, étape f)1)	"IEEE 802.15.4:2011, 5.2.2.2.2"	"IEEE 802.15.4-2015, 7.3.2.2"
7.3.2.6, étape f)2)	"IEEE 802.15.4:2011, Tableau 57"	"IEEE 802.15.4-2015, Tableau 9-5"
7.3.3.8, étape i), (4 fois)	"IEEE 802.15.4:2011, 7.3.4"	"IEEE 802.15.4-2015, 9.3.4"
7.3.3.8, étape i)1)	"IEEE 802.15.4:2011, Tableau 58"	"IEEE 802.15.4-2015, Tableau 9-6"
7.3.3.9, étape g), (4 fois)	"IEEE 802.15.4:2011, 7.3.5"	"IEEE 802.15.4-2015, 9.3.5"

Emplacement	Remplacer	Par
7.3.3.9, étape g)1)	"IEEE 802.15.4:2011, Tableau 58"	"IEEE 802.15.4-2015, Tableau 9-6"
7.3.3.9, étape g)1)	"IEEE 802.15.4:2011, 5.2.2.2.2"	"IEEE 802.15.4-2015, 7.3.2.2"
7.3.3.9, étape g)2)	"IEEE 802.15.4:2011, Tableau 57"	"IEEE 802.15.4-2015, Tableau 9-5"
8.2.2.5, 3 ^e alinéa	"IEEE 802.15.4:2011, 8.1.5"	"IEEE 802.15.4-2015, 10.1.5"
8.2.3.2, 1 ^{er} alinéa	"IEEE 802.15.4:2011, Tableau 66"	"IEEE 802.15.4-2015, Tableau 10-4"
9.3.2.1, NOTE	"IEEE 802.15.4:2011"	"IEEE 802.15.4-2015"
9.3.2.1, 5 ^e alinéa	"IEEE 802.15.4:2011"	"IEEE 802.15.4"
9.3.3.1, 1 ^{er} alinéa	"IEEE 802.15.4:2011, 5.2.2.2"	"IEEE 802.15.4-2015, 7.3.2"
9.3.3.1, 1 ^{er} alinéa	"IEEE 802.15.4:2011, 5.2.1 et 5.2.2.2"	"IEEE 802.15.4-2015, 7.2 et 7.3.2"
9.3.3.1, 2 ^e alinéa	"IEEE 802.15.4:2011, 5.2.1.2"	"IEEE 802.15.4-2015, 7.2.2"
9.3.3.1, 3 ^e alinéa	"IEEE 802.15.4:2011, 5.2.3"	"IEEE 802.15.4-2015, 7.3.3"
9.3.3.1, 3 ^e alinéa	"IEEE 802.15.4:2011, 5.2.1.1.8"	"IEEE 802.15.4-2015, 7.2.1.10"
9.3.3.2, 1 ^{er} alinéa	"IEEE 802.15.4:2011, 5.2.1"	"IEEE 802.15.4-2015, 7.2"
9.3.3.2, 1 ^{er} alinéa	"IEEE 802.15.4:2011, Figure 35"	"IEEE 802.15.4-2015, Figure 7-1"
9.3.3.2, champ a)	"IEEE 802.15.4:2011, 5.2.1.1"	"IEEE 802.15.4-2015, 7.2.1"
11.3.2, 3 ^e alinéa	"IEEE 802.15.4:2011, Annexe B"	"IEEE 802.15.4-2015, Annexe B"
13.11.2.6, d)	"IEEE 802.15.4:2011"	"IEEE 802.15.4"
Tableau B.5, 3 ^e en-tête de colonne	"IEEE 802.15.4:2011"	"IEEE 802.15.4-2015"
H.1.4, 1 ^{er} alinéa	"IEEE 802.15.4:2011, B.3.2"	"IEEE 802.15.4-2015, B.3.2"

AUTRES REMPLACEMENTS

0.3 Droits de propriété potentiellement applicables

Dans la cellule d) du tableau qui renseigne les coordonnées du détenteur des droits de propriété de Yokogawa Electric Corporation, remplacer "Musashina-shi" par "Musashino-shi".

2 Références normatives

Remplacer la référence à l'IEEE 802.15.4TM:2011 par "IEEE Std 802.15.4TM-2015², IEEE Standard for Low

Pour l'attribut 27, 4^e colonne, ajouter "Valeur par défaut: 248 s".

Pour l'attribut 29, 4^e colonne, remplacer "Valeur par défaut: 30 s" par "Valeur par défaut: 62 s".

Tableau 19 – Méthode Proxy_System_Manager_Join

Ajouter l'argument d'entrée 11 comme suit:

11	Consortium_Info	Type: Unsigned8	Fournit des informations spécifiques au Consortium provenant de l'appareil de rattachement, qui ne sont pas spécifiées dans le présent document
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Remplacer les arguments de sortie 7 et 8 existants par les suivants:

7	Assigned_Max_TSDU_Size	Type: Unsigned16	Indique la TSDU maximale prise en charge en octets qui peut être convertie par la source en taille d'APDU maximale en prenant en compte les tailles de la TL, de la sécurité, des en-têtes d'AL et du TMIC
8	MIC	Type: OctetString4	Cette valeur est utilisée pour protéger les arguments 1 à 7 avec la clé de rattachement. Cette valeur de MIC est générée par le gestionnaire de sécurité. Le routeur d'annonce ne doit pas écraser en écriture cette valeur. Voir 7.4.4.3.3.2

Tableau 23 – Méthode System_Manager_Join

Ajouter l'argument d'entrée 11 comme suit:

11	Consortium_Info	Type: Unsigned8	Fournit des informations spécifiques au Consortium provenant de l'appareil de rattachement, qui ne sont pas spécifiées dans le présent document
----	-----------------	-----------------	---

Remplacer les arguments de sortie 7 et 8 existants par les suivants:

7	Assigned_Max_TSDU_Size	Type: Unsigned16	Indique la TSDU maximale prise en charge en octets qui peut être convertie par la source en taille d'APDU maximale en prenant en compte les tailles de la TL, de la sécurité, des en-têtes d'AL et du TMIC
8	MIC	Type: OctetString4	Cette valeur est utilisée pour protéger les arguments 1 à 7 avec la clé de rattachement. Cette valeur de MIC est générée par le gestionnaire de sécurité. Le routeur d'annonce ne doit pas écraser en écriture cette valeur. Voir 7.4.4.3.3.2

Tableau 27 – Méthode du SCO pour l'établissement, la modification ou le renouvellement de contrat

Pour l'argument d'entrée 16, 5^e colonne, ajouter "Plage valide: –32 768 à 16".

Pour l'argument d'entrée 17, 5^e colonne, ajouter "Plage valide: –32 768 à 16".

Pour l'argument de sortie 13, 5^e colonne, ajouter "Plage valide: –32 768 à 16".

Pour l'argument de sortie 14, 5^e colonne, ajouter "Plage valide: –32 768 à 16".

Pour l'argument de sortie 24, 5^e colonne, ajouter "Plage valide: –32 768 à 16".

Pour l'argument de sortie 25, 5^e colonne, ajouter "Plage valide: –32 768 à 16".

Tableau 30 – Structure de données Contract_Data

Pour l'élément 15, 3^e colonne, ajouter "Plage valide: –32 768 à 16".

Pour l'élément 16, 3^e colonne, ajouter "Plage valide: –32 768 à 16".

Tableau 31 – Structure de données New_Device_Contract_Response

Pour l'élément 3, 3^e colonne, ajouter "Plage valide: –32 768 à 16".

Pour l'élément 4, 3^e colonne, ajouter "Plage valide: –32 768 à 16".

7.3.2.6 Traitement des DPDU reçues

A l'étape e), supprimer "En plus, la procédure doit vérifier que le numéro de séquence du MHR de 8 bits n'est pas 0xFF. Si le numéro de séquence du MHR de 8 bits est 0xFF, la procédure doit retourner avec un statut INVALID_SEQUENCE_NUMBER."

7.3.3.9 Traitement pour les TPDU reçues

A l'étape h), remplacer "peut décrémenter" par "doit décrémenter".

7.4.4.3.3.2 Génération de MIC pour la réponse de System_Manager_Join

Remplacer la formule existante par la suivante:

MACTag = HMAC-MMOK_{join}[Argument de sortie numéro 1 .. numéro 7 dans le Tableau 23
|| EUI-64_{join_device} || Challenge_{join_device}]

Tableau 62 – Structure de données Security_Sym_Join_Request

Remplacer les éléments du Tableau 62 par les suivants:

New_Device_EUI64	1	Type: EUI64Address Classification: Constant Accessibilité: Lecture seule
DL_Subnet_ID	2	Type: Unsigned16 Classification: Static Accessibilité: Lecture/écriture
Comm_SW_Major_Version	3	Type: Unsigned8 Classification: Static Accessibilité: Lecture seule
Comm_SW_Minor_Version	4	Type: Unsigned8 Classification: Static Accessibilité: Lecture seule
128_Bit_Challenge_From_New_Device	5	Type: Unsigned128 Classification: Static Accessibilité: Lecture/écriture

Algorithm_Identifier	6	Type: Unsigned8 Classification: Static Accessibilité: Lecture seule Valeur par défaut: 1
MIC	7	Type: Unsigned32 Classification: Static Accessibilité: Lecture seule

7.4.5.2.2 Demande de rattachement à clés symétriques

Dans le texte qui suit le Tableau 62, après la première puce (New_Device_EUI64), insérer les trois puces supplémentaires suivantes:

- DL_Subnet_ID est le sous-réseau DL que le nouvel appareil tente de rattacher; il s'agit également du sous-réseau DL du routeur d'annonce.
- Comm_SW_Major_Version est une copie de l'attribut de DMO Comm_SW_Major_Version; voir Tableau 10, attribut 20.
- Comm_SW_Minor_Version est une copie de l'attribut de DMO Comm_SW_Minor_Version; voir Tableau 10, attribut 21.

Dans la dernière puce après le Tableau 62, remplacer "Le MIC-32 se calcule sur les éléments 1 à 4" par "Le MIC-32 se calcule sur les éléments 1 à 6".

7.5.4 Méthodes d'objet proxy de gestion de sécurité relatives à l'établissement de session

Dans la 7^e puce après le Tableau 81, supprimer "assigné dans le processus de rattachement".

Dans la 2^e puce après le Tableau 82, supprimer "assigné au cours du processus de rattachement".

7.6.3 Méthodes de l'objet de gestion de sécurité d'appareil relatives à la mise à jour de clé T

Dans la 4^e puce après le Tableau 84, supprimer "assigné dans le processus de rattachement".

Dans la 2^e puce après le Tableau 85, supprimer "assigné au cours du processus de rattachement".

Tableau 95 – Méthode Delete_key

Pour l'argument d'entrée numéro 8, dernière colonne, supprimer "assigné dans le processus de rattachement".

7.11.3.2 Méthodes complémentaires d'objet de gestion de sécurité d'appareil pour prendre en charge la gestion de clé

A la fin de l'alinéa avant le Tableau 96, ajouter ce qui suit:

L'utilisation de la méthode Key_Policy_Update doit se limiter aux modifications apportées à SoftLifespan_Ratio. Les modifications d'ordre général de la politique de clé sont effectuées par remplacement de clé, comme décrit en 7.6.

Tableau 96 – Méthode Key_Policy_Update

Pour l'argument d'entrée numéro 10, dernière colonne, supprimer "assigné dans le processus de rattachement".

9.1.9.4.3 Transaction en monodiffusion

Supprimer le 5^e alinéa, commençant par "L'IEEE 802.15.4 permet au Mode 3 CCA".

9.1.15.6 Code de pays

Supprimer la NOTE 1, remplacer la "NOTE 2" par "NOTE" (supprimer le numéro), et remplacer l'alinéa après la NOTE 1 supprimée par le suivant:

Lorsque le bit 11, le bit 13 et le bit 14 (ETSI, LBT et FHSS) se vérifient tous, l'exploitation peut nécessiter de basculer momentanément vers les règles non adaptatives de l'ETSI EN 300 328 v2.1.1 pendant l'envoi d'une DPUD ACK/NAK de taille presque maximale (en tant que short control signaling) au sein d'une transaction et pour le Tx-gap-time d'une non-émission mandatée-EN suivant immédiatement, prenant ainsi en charge le mode décrit en V.4 catégorie 6), où sont spécifiées les exigences pour une telle modification de mode momentanée.

Tableau 117 – DHR de DPDU ACK/NAK

A la dernière ligne, première colonne, remplacer "0..3" par "0 ou 3".

9.3.5.2.4.2 Liaisons de rattachement d'annonce

Dans le texte qui suit le Tableau 128, remplacer le texte du point a) comme suit:

DauxJoinBackoff. Au cours du processus de rattachement, le DauxJoinBackoff doit être utilisé à la place du MaxBackoffExp, en suivant la procédure de repli exponentiel décrite en 9.1.8.2.

Tableau 129 – Valeurs par défaut pour les liaisons créées à partir d'annonces

A l'intersection de DauxJoinRx et Type_SelectiveAllowed, remplacer 1 par 0 comme indiqué:

Nom de champ	DauxJoinTx	DauxJoinRx	DauxAdvRx (lorsque DauxJoinFldXmit.Bit3 =1)
Type-SelectiveAllowed	1	0	1

9.3.5.3.1 Généralités

Dans l'avant-dernier alinéa, après "le DMIC d'une sollicitation doit être construit en utilisant une clé de sécurité de K_global et un temps TAI nominal de zéro", ajouter "et une adresse de source de zéro".

Tableau 141 – Attributs du DLMO

Pour l'attribut 5, 4^e colonne, remplacer "Valeur par défaut: Null" par "Valeur par défaut: 0x80".

Pour l'attribut 12, 4^e colonne, remplacer "Valeur par défaut: 120 (30 s)" par "Valeur par défaut: 248 (62 s)".

Tableau 148 – Structure de l'OctetString dlmo.DeviceCapability

Remplacer la ligne EnergyDesign par la suivante:

5-8	EnergyDesign (voir Tableau 146)
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9.4.2.23 Capacités de l'appareil de DLMO

Dans le texte qui suit le Tableau 148, dans la description de • dlmo.DeviceCapability.ClockStability (2^e puce), remplacer “absence” par “présence”.

9.4.2.27.1 Généralités

Au 5^e alinéa, remplacer “Il convient que de telles liaisons sautées soient traitées comme l'équivalent du NAK pour la voie applicable” par “Il convient que de telles liaisons sautées soient comptées comme NoACK pour la voie applicable, c'est-à-dire qu'il convient qu'elles soient comptées comme des transmissions DL non acquittées dans le diagnostic ChannelDiag”.

9.4.3.5.3 Etat courant des intervalles de temps de supertrame

Remplacer la formule pour ChOffset (après “Le décalage d'intervalle de temps dans ce saut de voie est”) par la suivante:

$$\text{ChOffset} = ((\text{SlotNumAbs} - \text{ChBirth}) \bmod \text{ChCycle}) / \text{ChRate}$$

Tableau 184 – Valeurs pour dlmo.Link[].Schedule

Pour Codage d'élément, 2^e colonne, remplacer “BooleanArray32” par “BitString de 32 bits”.

Tableau 188 – Champs de l'OctetString “Summary” de diagnostic

Pour ClockSigma, 2^e colonne, remplacer “Type: Integer16” par “Type: Unsigned16”.

Tableau 229 – Attributs de TLMO

Pour l'attribut 2, 3^e colonne, remplacer dans la description “Nombre de ports actifs” par “Nombre maximal de ports disponibles”.

Ajouter l'attribut 11 comme suit:

TPDUoutOfSecurityPolicies AlertDescriptor	11	Utilisé pour modifier la priorité de l'alerte TPDUoutOfSecurityPolicies; cette alerte peut également être activée ou désactivée	Type: Alert report descriptor	–
			Classification: Static	
			Accessibilité: Lecture/écriture	
			Valeur par défaut initiale: Alert report disabled = True Alert report priority = 2 (journal)	
			Ensemble de valeurs valides: Voir définition de type	