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Komunikacija sosednjega polja (NFC) IP-1 - Vmesnik in protokol (NFCIP-1)

Near Field Communication (NFC) IP-1; Interface and Protocol (NFCIP-1)

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Technical Specification

Near Field Communication (NFC) IP-1; Interface and Protocol (NFCIP-1)

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

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

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse 06 N° 7303/88

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Contents

Intellectual Property Rights	7
Foreword.....	7
Brief History	7
1 Scope	8
2 Conformance	8
3 References	8
4 Definitions	8
4.1 Active communication mode.....	8
4.2 ASK modulation.....	8
4.3 Binary Coded Decimal (BCD)	8
4.4 Collision	9
4.5 Frame.....	9
4.6 Initiator	9
4.7 Load modulation	9
4.8 lsb first.....	9
4.9 LSB first	9
4.10 Manchester coding	9
4.11 Modulation index	9
4.12 msb first.....	9
4.13 MSB first	9
4.14 NFCIP-1 device.....	9
4.15 NFC IDentifier (NFCID n)	10
4.16 Passive communication mode	10
4.17 RF Collision Avoidance (RFCA).....	10
4.18 SEL_PAR	10
4.19 Sensing	10
4.20 Single Device Detection (SDD)	10
4.21 Subcarrier	10
4.22 Target	10
4.23 Time Period	10
4.24 Time Slot	10
4.25 transaction	10
5 Conventions and notations	11
5.1 Representation of numbers	11
5.2 Names.....	11
6 Acronyms	11
7 General	12
8 RF field.....	13
8.1 Passive Communication Mode	13
8.2 Active Communication Mode	13
9 RF Signal Interface.....	13
9.1 Bit duration.....	13
9.2 Active communication mode.....	14
9.2.1 106 kbps.....	14
9.2.1.1 Bit rate.....	14
9.2.1.2 Modulation.....	14
9.2.1.3 Bit representation and coding.....	15
9.2.1.4 Byte encoding	15
9.2.2 212 kbps and 424 kbps.....	15
9.2.2.1 Bit rate.....	15

9.2.2.2	Modulation	15
9.2.2.3	Bit representation and coding.....	16
9.2.2.4	Byte encoding	16
9.3	Passive communication mode	17
9.3.1	106 kbps Initiator to Target	17
9.3.1.1	Bit rate.....	17
9.3.1.2	Modulation.....	17
9.3.1.3	Bit representation and coding.....	17
9.3.1.4	Byte encoding	17
9.3.2	106 kbps Target to Initiator	17
9.3.2.1	Bit rate.....	17
9.3.2.2	Modulation	17
9.3.2.3	Subcarrier Frequency	17
9.3.2.4	Subcarrier modulation.....	17
9.3.2.5	Bit representation and coding.....	17
9.3.2.6	Byte encoding	18
9.3.3	212 kbps and 424 kbps Initiator to Target	18
9.3.3.1	Bit rate.....	18
9.3.3.2	Modulation.....	18
9.3.3.3	Bit representation and coding.....	18
9.3.3.4	Byte encoding	18
9.3.4	212 kbps and 424 kbps Target to Initiator	18
9.3.4.1	Bit rate.....	18
9.3.4.2	Modulation	18
9.3.4.3	Bit representation and coding.....	18
9.3.4.4	Byte encoding	18
10	General Protocol flow..... iTeh STANDARD PREVIEW	19
11	Initialization	20
11.1	RF Collision Avoidance	20
11.1.1	Initial RF Collision Avoidance	21
11.1.2	Response RF Collision Avoidance	21
11.2	Passive communication mode	22
11.2.1	Initialization and Single Device Detection at 106 kbps	22
11.2.1.1	Frame format and timing.....	22
11.2.1.2	Frame Response Time Initiator to Target.....	22
11.2.1.3	Frame Response time Target to Initiator.....	23
11.2.1.4	Sense Guard Time	23
11.2.1.5	Frame formats	23
11.2.1.5.1	Short frame	23
11.2.1.5.2	Standard frame.....	23
11.2.1.5.3	Bit oriented Single Device Detection frame	24
11.2.1.6	CRC for 106 kbps	25
11.2.1.7	Target States.....	25
11.2.1.8	POWER-OFF State	25
11.2.1.9	SENSE State	25
11.2.1.10	RESOLUTION State.....	25
11.2.1.11	SELECTED State.....	26
11.2.1.12	SLEEP State.....	26
11.2.1.13	RESOLUTION* State.....	26
11.2.1.14	SELECTED* State.....	26
11.2.1.15	Command Set.....	26
11.2.1.16	SENS_REQ and ALL_REQ Command	27
11.2.1.17	SENS_RES.....	27
11.2.1.18	Coding of SENS_RES.....	27
11.2.1.19	SDD_REQ and SEL_REQ Command	28
11.2.1.20	Coding of SEL_CMD	28
11.2.1.21	Coding of SEL_PAR.....	28
11.2.1.22	Coding of SEL_RES	29
11.2.1.23	Select sequence	29
11.2.1.24	Select sequence flowchart	30

11.2.1.25	SDD loop within each cascade level	30
11.2.1.26	NFCID1 contents and cascade levels	31
11.2.1.27	SLP_REQ Command	33
11.2.2	Initialization and SDD at 212 kbps and 424 kbps	33
11.2.2.1	Start and end of communication	33
11.2.2.2	Frame format	33
11.2.2.3	Single Device Detection at 202 kbps and 424 kbps	34
11.2.2.4	NFCID2 contents	35
11.2.2.5	Polling Request Frame format	35
11.2.2.6	Polling Response Frame format	35
11.3	Active communication mode	36
11.3.1	Initialization at 106 kbps, 212 kbps and 424 kbps	36
11.3.2	Active communication mode RF Collision Avoidance	36
11.3.2.1	Collision Avoidance for Active communication mode	36
12	Transport Protocol	37
12.1	Transport Data	37
12.2	Passive communication mode Activation flow	37
12.3	Active communication mode Activation flow	40
12.4	Commands	42
12.5	Activation of the protocol	42
12.5.1	Attribute Request and Response Commands	42
12.5.1.1	Attribute Request (ATR_REQ)	42
12.5.1.1.1	Definition of the ATR_REQ bytes	42
12.5.1.2	Attribute Response (ATR_RES)	44
12.5.1.2.1	Definition of the ATR_RES bytes	44
12.5.1.3	Handling of ATR_REQ and ATR_RES	46
12.5.1.3.1	Initiator rules	46
12.5.1.3.2	Target rules	46
12.5.1.4	Handling of timeout TO	46
12.5.1.4.1	Handling in active mode	46
12.5.1.4.2	Handling of timeout in passive mode	46
12.5.1.5	Handling of DID	46
12.5.1.5.1	Handling of DID in active and in passive mode	46
12.5.2	Wakeup Request and Response Commands	47
12.5.2.1	Wakeup Request (WUP_REQ)	47
12.5.2.1.1	Definition of the WUP_REQ bytes	47
12.5.2.2	Wakeup Response (WUP_RES)	47
12.5.2.2.1	Definition of the WUP_RES bytes	48
12.5.2.3	Handling of WUP_REQ and WUP_RES	48
12.5.2.3.1	Initiator rules	48
12.5.2.3.2	Target rules	48
12.5.3	Parameter Selection Request and Response Commands	48
12.5.3.1	Parameter Selection Request (PSL_REQ)	48
12.5.3.1.1	Definition of the PSL_REQ bytes	48
12.5.3.2	Parameter Selection Response (PSL_RES)	49
12.5.3.2.1	Definition of the PSL_RES bytes	50
12.5.3.3	Handling of PSL_REQ and PSL_RES	50
12.5.3.3.1	Initiator rules	50
12.5.3.3.2	Target rules	50
12.6	Data Exchange Protocol	51
12.6.1	Data Exchange Protocol Request and Response	51
12.6.1.1	Data Exchange Protocol Request (DEP_REQ) and Response (DEP_RES)	51
12.6.1.1.1	Definition of the Data Exchange Protocol Header bytes	51
12.6.1.2	Handling of Pdu number information	53
12.6.1.2.1	Initiator rules	53
12.6.1.2.2	Target rules	53
12.6.1.3	Handling of Blocks	53
12.6.1.3.1	General rules	53
12.6.1.3.2	Initiator rules	53
12.6.1.3.3	Target rules	54
12.6.2	Response timeout extension	54

12.6.3	Attention - Target present	54
12.6.4	Protocol operation.....	54
12.6.5	Multi Activation.....	55
12.6.6	More information (Chaining).....	55
12.7	Deactivation of the protocol	56
12.7.1	Deselect Request and Response command	56
12.7.1.1	Deselect request (DSL_REQ)	56
12.7.1.1.1	Definition of DSL_REQ bytes	56
12.7.1.2	Deselect response (DSL_RES).....	57
12.7.1.2.1	Definition of Deselect Response bytes	57
12.7.1.3	Handling of DSL_REQ and DSL_RES.....	57
12.7.1.3.1	Initiator rules	57
12.7.1.3.2	Target rules.....	57
12.7.2	Release Request and Response commands	57
12.7.2.1	Release Request (RLS_REQ).....	57
12.7.2.1.1	Definition of RLS_REQ bytes.....	58
12.7.2.2	Release response RLS_RES.....	58
12.7.2.2.1	Definition of RLS_RES bytes	58
12.7.2.3	Handling of RLS_REQ and RLS_RES	58
12.7.2.3.1	Initiator rules	58
12.7.2.3.2	Target rules.....	58
Annex A (normative):	CRC calculation	59
A.1	CRC for Active and Passive communication mode at 106 kbps.....	59
A.2	Example of CRC calculation at 106 kbps.....	59
A.3	CRC for Active and Passive communication mode at 212 kbps and 424 kbps.....	60
A.4	Example of CRC calculation at (212 kbps and 424 kbps.....)	60
History	61

SIST-TS ETSI/TS 102 190 V1.1.1:2005

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Foreword

This Technical Specification (TS) has been produced by ECMA on behalf of its members and those of the European Telecommunications Standards Institute (ETSI).

Brief History

The present document specifies the interface and protocol for simple wireless communication between close coupled devices. These Near Field Communication (NFC) devices communicate with transfer rates of 106 kbps , 212 kbps and 424 kbps.

The present document allows, but does not specify, applications in network products and consumer equipment.

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1 Scope

The present document defines communication modes for Near Field Communication Interface and Protocol (NFCIP-1) using inductive coupled devices operating at the centre frequency of 13,56 MHz for interconnection of computer peripherals. It also defines both the Active and the Passive communication modes of Near Field Communication Interface and Protocol (NFCIP-1) to realize a communication network using Near Field Communication devices for networked products and also for consumer equipment. The present document specifies, in particular, modulation schemes, codings, transfer speeds, and frame format of the RF interface, as well as initialization schemes and conditions required for data collision control during initialization. Furthermore, the present document defines a transport protocol including protocol activation and data exchange methods.

Information interchange between systems also requires, at a minimum, agreement between the interchange parties upon the interchange codes and the data structure.

2 Conformance

A system implementing the Active and the Passive communication mode shall be in conformance with the present document if it meets all the mandatory requirements specified herein.

3 References

The following standards contain provisions which, through reference in this text, constitute provisions of the present document. All standards are subject to revision, and parties to agreements based on the present document are encouraged to investigate the possibility (standardstech.iah) of applying the most recent editions of the standards indicated below.

In the case of references to ECMA Standards that are aligned with ISO/IEC International Standards, the number of the appropriate ISO/IEC International Standard is given in brackets after the ECMA reference.

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ITU-T Recommendation V.41 (1988): "Code-independent error-control system".

4 Definitions

For the purposes of the present document, the following terms and definitions apply:

4.1 Active communication mode

Both the Initiator and the Target use their own RF field to enable the communication. This is the scheme of the Active communication mode.

4.2 ASK modulation

ASK stands for Amplitude Shift Keying. The amplitude of the carrier frequency is modulated according to the logic of the data to be transmitted. The degree of modulation is expressed by $(a - b)/(a + b) \times 100 [\%]$, where a and b respectively represent the maximum and minimum amplitudes of the modulated signal waveform.

4.3 Binary Coded Decimal (BCD)

A system for representing each of the decimal numbers 0 to 9 by a four-bit binary code. The bits, from left to right, are worth 8, 4, 2 and 1 respectively in decimal, so for example the number 6 in BCD is 0110.

4.4 Collision

Transmission by two or more Targets or Initiators during the same time period, such that the Initiator or the Target is unable to distinguish from which Target the data originated.

4.5 Frame

Sequence of data bits and optional error detection bits, with frame delimiters at start and end.

4.6 Initiator

Generates the RF field and starts the NFCIP-1 communication.

4.7 Load modulation

Process of amplitude modulating a radio frequency field by varying the properties of a resonant circuit placed within the radio frequency field.

4.8 lsb first

least significant bit first. Indicates a serial data transmission system that sends lsb before all other bits.

4.9 LSB first iTeh STANDARD PREVIEW
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Least Significant Byte first. Indicates a serial data transmission system that sends LSB before all other bytes.

4.10 Manchester coding

Method of bit coding whereby a logic level during a bit duration is represented by a

Method of bit coding whereby a logic level during a bit duration is represented by a sequence of pulses. The length of each pulse is proportional to the logic level.

The medium state, which divides signal from noise, is maintained by the middle section of the self-organizing map.

makes the direction of the changes correspond to two logic value.

4.11 Modulation Index

Defined as $(a - b)/(a + b)$ where a and b are the peak and the minimum signal amplitude respectively with the value of the index possibly expressed as a percentage. When the maximum amplitude of the modulated signal waveform is set to a and the minimum value is set to b , the degree of abnormal conditions is usually expressed as a percent.

4.12 msb first

most significant bit. Indicates a serial data transmission system that sends the msb before all other bits.

4.13 MSB first

Most Significant Byte. Indicates a serial data transmission system that sends the MSB before all other bytes.

4.14 NFCIP-1 device

General term for either an Initiator or a Target communicating in the Active or the Passive communication mode.

4.15 NFC IDentifier (NFCID n)

NFCID n is a randomly generated number used by the RF Collision Avoidance and Single Device Detection sequence for both the Active and the Passive communication modes.

4.16 Passive communication mode

The Initiator is generating the RF field and the Target responds to an Initiator command in a load modulation scheme.

4.17 RF Collision Avoidance (RFCA)

Method to detect the presence of a RF field based on the carrier frequency and method to detect and resolve collisions on protocol level.

4.18 SEL_PAR

Total number of valid bits of NFCID1 CL n including SEL_CMD and SEL_PAR transmitted by the Initiator.

4.19 Sensing

An NFCIP-1 device in the Active communication mode expects a Response to a Request it has sent on the RF field to detect the start of communication to receive the Request.

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4.20 Single Device Detection (SDD) (standards.iteh.ai)

SDD is an algorithm used by the initiator to detect one out of several Targets in its RF field.

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4.21 Subcarrier

Signal of frequency f_s used to modulate a carrier of frequency f_c .

4.22 Target

Target responds to Initiator command either using load modulation scheme (RF field generated by Initiator) or using modulation of self generated RF field.

4.23 Time Period

The Time Period defines the number of slots used for RF Collision Avoidance.

4.24 Time Slot

Method of preparing a time window when a Target answers, and assign and identify two or more logic channels.

4.25 transaction

A transaction includes the initialization and the transparent data exchange between an Initiator and a Target either in the Active or the Passive communication mode.

5 Conventions and notations

5.1 Representation of numbers

The following conventions and notations apply in the present document unless otherwise stated.

- Letters and digits in parentheses represent numbers in hexadecimal notation.
- The setting of bits is denoted by ZERO or ONE.
- Numbers in binary notation and bit patterns are represented by strings of digits 0 and 1 shown with the most significant bit to the left. Within such strings, X may be used to indicate that the setting of a bit is not specified within the string.

5.2 Names

The names of basic elements, e.g. specific fields, are written with a capital initial letter.

6 Acronyms

ALL_REQ	Wake up ALL Request
ASK	Amplitude Shift Keying
ATTR	Attribute Request and Attribute Response
ATTR_REQ	Attribute Request
ATTR_RES	Attribute Response
BCC	NFCID1 CLn check byte, calculated as exclusive-or over the 4 previous bytes
BCD	Binary Coded Decimal
bd	Bit duration
BRI	Receiving bit duration supported by Initiator
BRT	Receiving bit duration supported by Target
BSi	Sending bit duration supported by Initiator
BSt	Sending bit duration supported by Target
CLn	Cascade Level n, $3 \geq n \geq 1$
CMD	Command
CRC	Cyclic Redundancy Check
CT	Cascade Tag
D	Divisor
DEP	Data Exchange Protocol Request and Data Exchange Protocol Response
DEP_REQ	Data Exchange Protocol Request
DEP_RES	Data Exchange Protocol Response
DIDI	Initiator Device ID
DIDt	Target Device ID
DRI	Data rate Received by initiator
DRt	Data rate Received by target
DSi	Data rate Send by initiator
DSL	Deselect Request and Deselect Response
DSL_REQ	Deselect Request
DSL_RES	Deselect Response
DSt	Data rate Send by Target
fc	Frequency of operating field (carrier frequency)
fd	Baseband frequency of Manchester coding
FRT	Frame Response Time
fs	Frequency of subcarrier (fc/16)
Gi	Optional information field for Initiator
Gt	Optional information field for Target
ID	Identification number
lsb	least significant bit

LSB	Least Significant Byte
MI	Multiple Information link for Data Exchange Protocol
msb	most significant bit
MSB	Most Significant Byte
NAD	Node Address
NFCID1	Random Identifier for single device detection in the Passive communication mode at 106 kbps
nfcid1 n	Byte number n of NFCID1
NFCID2	Random ID for SDD in the Passive communication mode at 212 kbps and 424 kbps
nfcid2 n	Byte number n of the Random Identifier NFCID2
NFCID3	Random ID for transport protocol activation
nfcid3 n	Byte number n of the Random Identifier NFCID3
P	Odd parity bit
PA	Preamble
pdu	protocol data unit
PFB	Control information for transaction
PNI	Packet Number Information
PPi	Protocol Parameters used by Initiator
PPt	Protocol Parameters used by Target
PSL	Parameter Selection Request and Parameter Selection Response
PSL_REQ	Parameter Selection Request
PSL_RES	Parameter Selection Response
RF	Radio Frequency
RFCA	RF Collision Avoidance
RFU	Reserved for Future Use
RLS	Release Request and Release Response
RLS_REQ	Release Request
RLS_RES	Release Response
RWT	Response Waiting Time
SB	Start byte for data exchange protocol at 106 kbps
SDD	Single Device Detection
SDD_REQ	Single Device Detection Request command
SEL_CMD	Select Command byte
SEL_PAR	Select Parameter byte
SEL_REQ	Select Request command
SENS_REQ	Sense Request command
SENS_RES	Sense Response command
SLP_REQ	Sleep Request command
SYNC	Synchronous pattern
TO	Timeout value
WT	Waiting Time
WUP	Wakeup Request and Wakeup Response
WUP_REQ	Wakeup Request
WUP_RES	Wakeup Response

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7 General

The present document defines both the Active and the Passive communication modes as follows:

In the Active communication mode, both the Initiator and the Target shall use their own RF field to enable communication. The Initiator starts the NFCIP-1 communication. The Target responds to an Initiator command in the Active communication mode using self-generated modulation of self-generated the RF field.

In the Passive communication mode, the Initiator generates the RF field and starts the communication. The Target responds to an Initiator command in the Passive communication mode using a load modulation scheme.

The communication over the RF interface in the Active and the Passive communication mode shall include modulation schemes, transfer speed and bit coding. In addition it shall include the start of communication, the end of communication, the bit and byte representation, the framing and error detection, the single device detection, the protocol and parameter selection and the data exchange and de-selection of Near Field Communication Interface and Protocol (NFCIP-1) devices.

All NFCIP-1 devices shall have communication capability on 106 kbps and may switch to another transfer speed or stay at 106 kbps. All NFCIP-1 devices shall have communication capability on 212 kbps and may switch to another transfer speed or stay at 212 kbps. All NFCIP-1 devices shall have communication capabilities on 424 kbps and may switch to another transfer speed or stay at 424 kbps.

The mode (Active or Passive) shall not be changed during one transaction until the deactivation of the Target or removal of the Target, even though the transfer speed of Initiator to Target and the transfer speed of the Target to the Initiator may not be the same. The change of transfer speed during one transaction may be performed by a parameter change procedure.

The transaction is started by device initialization and terminated by device de-selection (or equivalent).

8 RF field

The carrier frequency of the RF field shall be 13,56 MHz.

The minimum unmodulated RF field shall be H_{\min} and has a value of 1,5 A/m rms.

The maximum unmodulated RF field shall be H_{\max} and has a value of 7,5 A/m rms.

This field shall be modulated during communication.

8.1 Passive Communication Mode

An Initiator shall produce a RF field to energize the target.

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A Target shall operate continuously between H_{\min} and H_{\max} .

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8.2 Active Communication Mode

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An Initiator and a Target shall alternately generate a RF field of at least H_{\min} and not exceeding H_{\max} at manufacturer specified positions (operating volume).

9 RF Signal Interface

9.1 Bit duration

The bit duration bd is calculated by the following formula:

$$1 \quad bd = 128/(D \times fc)$$

The values of the divisor D depend on the bit rate and are given by table 1. The fc is the carrier frequency as defined in clause 8.

Table 1: Definition of Divisor D

Communication Mode	kbps	Divisor D
active or passive	106	1
active or passive	212	2
active or passive	424	4
Active	848	8
Active	1 667	16
Active	3 390	32
Active	6 670	64