KSMW PA2502 Companion Standard P2P WAN Implementation Guide Rev 2.45

Revision 2.45

~~25.06~~13.09.2018

Content

1. Introduction

1.1. Scope

The objective of the supplemental standard is to ensure the interoperability between 1 and 3-phase meters and the central System for the KSMW project by defining the:

- network technology to be supported
- additional specific meter functionality
- additions to the object model described AKSMW-PA2502 - Companion Standard
- remote upgrading of NW module firmware
- additional specific event, alarm and error handling procedures,

but it is not in any respect a substitution for the specification published by KSMW.

In the case of already documented functionalities, reference is made only to the documents to be referred e.g. DLMS/CSEM functionality; AT commands; KSMW requirements (companion standards).

1.2. Revisions History

Version	Revisions	Date	Author
1.0	Initial Version	01.01.2018	Yangwei Yi, Ruediger Kellmann
1.1	Removed SNMP related content, Added message handler for SMS receiving Added descriptions for firmware upgrade via executing scripts	12.02.2018	Yangwei Yi
2.0	1. Modify the document name to KSMW PA2502 Companion Standard P2P WAN Implementation Guide Rev 2.0 2. Remove Notation of COSEM OBIS-Objects. The Notation of COSEM OBIS-Objects will be included in Data Model Excel file. 3. Modify IPv6 setup obis code to 0-0:25.7.0.255 to be consistent with IDIS. 4. Add IPv4v6 in IPv4 IPv6 selection object.	28.02.2018	Yangwei Yi

	5. Modify Modem setup obis code to 0-0:25.4.0.255 to be consistent with IDIS. 6. Active firmware signature 2 is added for P2P modems. 7. Remove event “PDP context establishment failure” duplicate with “PDP context failure event” in KSMW PA2502 Companion Standard Review List Rev 0.3. 8. Remove event “Absence of radio or data network” duplicate with “GSM registration failure” and “GPRS registration failure” in KSMW PA2502 Companion Standard Review List Rev 0.3. 9. Remove event “modem self check fails” duplicate with “Diagnostic failure event” in KSMW PA2502 Companion Standard Review List Rev 0.3. 10. Remove “network fault events log”. All P2P specified events will be registered in the already existed Communication Log. 11. Remove the alarms caused by network issues, since it is not possible to inform the HES when the network is down. 12. Add Communication Throughput Profile, which is a circular buffer to store communication volume. 13. The modem removed event is added. 14: Remove push objects in this document, since P2P meter will make use of all the objects described in the chapter 10 PUSH operations of KSMW PA2502 Companion Standard Main Document Rev 0.3 15. Modem Information object is added 16. Added Message_content in message_handler object. It allows a specific message to trigger a HW reset of modem. 17. Remove {3,1-0:2.8.0.255,2,0} in • Network condition profile. It was a typo. 18. Add default value for Periodical self-check timer 19. Add error code in Annex 1		
2.1	1. Set IP_reference of object TCP_UDP setup to empty, because it is not possible to refer to IPv4 setup object and IPv6 setup object at the same time. But the client requires to use dual mode. Selecting dual IP mode is done through the IPv4 IPv6 selection object.		Yangwei Yi

	2. Updated invalid obis codes 3. removed CSD calls.		
2.2	1. Modify module setup object attribute three and attribute four access right to read-only. 2. Removed IP data traffic statistic timer object. 3. Modify ppp setup object attribute four access right to read-only. 4. Modify communication session log obis code to 0-0:99.98.13.255 to be consistent with IDIS. 5. Modify bytes sent in latest communication session object value type to double-long-unsigned and access right to read-only. 6. Modify bytes received in latest communication session object value type to double-long-unsigned and access right to read-only. 7. Bytes sent in a configurable interval object value type to double-long-unsigned and access right to read-only. 8. Bytes received in a configurable interval object value type to double-long-unsigned and access right to read-only. 9. Add bytes sent total object. 10. Add bytes received total object. 11. Modify auto connect object class id to 29 and attribute two access right to RW and attribute three, attribute six access right to read-only. 12. Modify Ipv4 Ipv6 selection object attribute two access right to RW. 13. Add network condition profile capture object RSRP and RSRQ. 14. Add RSRP object and RSRQ object. 15. Modify network condition profile default capture period to 10min. 16. Modify periodic ping configuration object structure. 17. Add average RTT object. 18. Add number packet received object. 19. Add RTT session event log object. 20.Modify communication process image. 21.Add RTT session event code. 22.Add event log 204 and 205.		Yangwei Yi
2.3	1. Modify IPV4 setup object attribute 2 default value. 2.Modify IPV6 setup object attribute 2 default		Yangwei Yi

	value. 3. Add GSM diagnostic object. 4. Removed average RTT object. 5. Removed number packet received object. 5. Removed bytes sent in latest communication session object. 6. Removed bytes received in latest communication session object. 7. Removed event log 204 and 205. 8. Removed RTT session event code.		
2.4	1. Modify network condition profile capture object 2. Modify the access right of modem setup attribute 3th to NA. 3. Modify the object name represented by obis 1.2.0.2.8.255 to checksum. 4. Modify the description of PHY periodic ping configuration object index 5th. 5. Modify the description of watchdog timer object. 6. Add the description of GSM diagnostic object 7. Add average RTT object. 8. Add number packet received object. 9. Add RTT session event log object. 10. Modify the description of Ping timer object. 11. Modify the obis code of modem device id. 12. Add event log 37 and 38. 13. Delete the error code in communication event log		Yangwei Yi
2.5	1. Add chapter 8.3 FOTA Upgrading Events 2. Correct the event code in PDP context destroyed, PDP context failure, Diagnostic failure, Ping_response_not_received 3. Modify the ping object elements setting range to be consistent with model object. 4. Modify the PHY randomization object forth element data type to Boolean. 5. Add RTT related event.		Chucen Li, Deng Li

1.3. Normative references

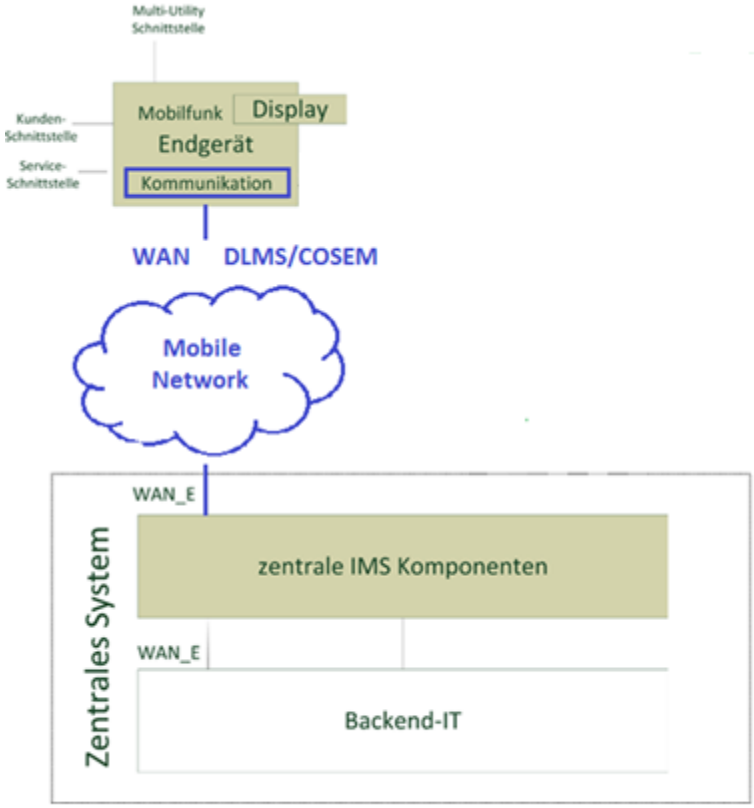
Blue Book Edition 12th

05_PA2502_Requirements Description_IMS_V3_EN.docx

IDIS-S02-001 E2 0 IDIS Pack2 IP profile 140903

2. WAN interface

The P2P communication modem shall act as a bridge between meters and Central Systems by enabling IP based transfers of meter data through mobile networks. On the network side, the modem shall be responsible for establishing and maintaining reliable IP connections to the customer's network. Contrary on the meter side, the modem shall act as a server towards the meter, enabling the meter to have full control over the data that are sent or retrieved from the modem (through a set of AT-commands defined by the modem supplier)



3. Communication Objects

The communication profile shall be based on the standard COSEM TCP/UCP profile as described in the chapter 4.9.1 of the DLMS Blue Book [12th]. The lower layers concerning the physical interface, the data link and the network are considered as IP compatible and therefore not be part of the scope of this document. Collection of data from meter shall be possible via pull and push operation.

Layer		
Application		COSEM Application layer as specified in clause 9 [xx]
Transport		COSEM Transport layer as specified in clause 7 [xx]
		Wrapper
		TCP (RFC 793), UDP (RFC 768)
Network		IPv6 (RFC xxx), IPv4 (RFC 791)
Data	LLC	
	MAC	2G, 3G, LTE
Physical		2G, 3G, LTE

The following are the set/up objects for TCP/UDP, IPv4,IPv6 and PPP required to establish a connection between meter and central system.

3.1. TCP-UPD setup

The required TCP-UPD setup is configured and managed via the COSEM object [TCP-UDP setup]. The attributes and methods are described in detail in the chapter 4.9.1 of the DLMS Blue Book [12th].

TCP_UDP setup (Class ID:41)				P	M
1	Logical_name	Octet-string	0-0:25.0.0.255	NA	R
2	TCP-UDP_port	long--unsigned	Default 4059	NA	R
3	IP_reference	octet-string	Empty	NA	R
4	MSS	long--unsigned	Min=40,max=65535, default =576	NA	RW
5	nb_of_sim_conn	octet-string	Value=1	NA	R
6	inactivity_time_out	long--unsigned	Default=300	NA	RW

3.2. IPv4 setup

The required IPv4 setup is configured and managed via the COSEM object [IPv4 setup]. The attributes and methods are described in detail in the chapter 4.9.2 of the DLMS Blue Book [12th].

IPv4 setup (Class ID:42)				P	M
1	Logical_name	octet-string	0-0:25.1.0.255	NA	R
2	DL_reference port	octet-string	0-0:25.3.0.255	NA	R
3	IP_address	double-long-unsigned	Assigned by the network	NA	R
4	multicast_IP_address	array	Not used	NA	R
5	IP-option	array	Empty	NA	R
6	Subnet_mask	double-long-unsigned	Empty	NA	R
7	gateway_IP-address	double-long-unsigned	Not used	NA	R
8	use_DHCP_flag	boolean	Default 1	NA	RW
9	primary_DNS_address	double-long-unsigned	Assigned by the network	NA	R
10	secondary_DNS_address	double-long-unsigned	Assigned by the network	NA	R

3.3. IPv6 setup

The required IPv6 setup is configured and managed via the COSEM object [IPv6 setup]. The attributes and methods are described in detail in the chapter 4.9.3 of the DLMS Blue Book [12th].

IPv6 setup (Class ID:48)				P	M
1	Logical_name	octet-string	0-0:25.7.0.255	NA	R
2	DL_reference port	octet-string	0-0:25.3.0.255	NA	R
3	address_config_mode	enum	(0) Auto-configuration (default)	NA	R
4	unicast_IPv6_addresses	array	Assigned by the network	NA	R
5	multicast_IPv6_addresses	array	Not used	NA	R
6	gateway_IPv6_address	array	Not used	NA	R
7	primary_DNS_address	IPv6_address	Assigned by the network	NA	R
8	secondary_DNS_address	IPv6_address	Assigned by the network	NA	R
9	traffic_class	unsigned	Not used	NA	R
10	neighbor_discovery_setup	array	Not used	NA	R

3.4 IPv4 IPv6 selection

The internet protocol mode is configured and managed via the COSEM object [IPv4 IPv6 selection].

IPv4 IPv6 selection (Class ID:1)				P	M
1	logical_name	Octet string	0-0:96.5.0.255	NA	R
2	value	enum	Internet_Protocol_mode Enum IPv4 = 1, IPv6 = 2 IPv4v6 = 3 (default)	NA	RW

3.5 PPP setup

The required PPP setup is configured and managed via the COSEM object [PPP setup]. The attributes and methods are described in detail in the chapter 4.9.5 of the DLMS Blue Book [12th].

PPP setup (Class ID:44)				P	M
1	Logical_name	octet-string	0-0:25.3.0.255	NA	R
2	PHY_reference	octet-string	0-0:25.4.0.255	NA	RW
3	LCP_options	LCP_options_type	LCP-option-type: 1 LCP-option-length: 2 LCP-option-data (Maximum Receive Unit): 1500 LCP-option-type: 3 LCP-option-length: 2 LCP-option-data (Auth-Protocol): 0xC023(PAP)	NA	RW
4	IPCP_options	IPCP_options_type	Not used	NA	R
5	PPP_authentication	PPP_auth_type	See below	NA	RW

When the PAP authentication protocol is used, the user name and PAP password are all configured in attribute PPP_authentication as below structure shows.

PAP_login ::= structure

{

user-name: octet-string,

PAP-password: octet-string

}

4. Modem related objects

4.1. Modem Setup

The modem is configured and managed via the COSEM object [GPRS modem setup]. The attributes and methods are described in detail in the chapter 4.7.7 of the DLMS Blue Book [12th].

Modem setup (Class ID:45)				P	M
1	logical_name	Octet string	0-0:25.4.0.255	NA	R
2	APN	octet-string	Preconfigured value provided by the client	NA	RW
3	PIN_code	long-unsigned	Preconfigured value provided by the client	NA	NA
4	quality_of_service	structure	Not used	NA	R

4.2. Modem Firmware version

The Firmware version of the modem is obtainable by querying the COSEM object [Modem firmware version].

Active firmware identifier 2 (Class ID: 1)				P	M
1	logical_name	Octet string	1-2:0.2.0.255	NA	R
2	value	Octet string		NA	R

Modem checksum (Class ID: 1)				P	M
1	logical_name	Octet string	1-2:0.2.8.255	NA	R
2	value	Octet string		NA	R

4.3. Modem Hardware version

The Hardware version of the modem is obtainable by querying the COSEM object [Modem Hardware version].

Modem hardware version (Class ID: 1)				P	M
1	logical_name	Octet string	0-5:96.1.0.255	NA	R
2	value	Octet string		NA	R

4.4. Modem Device ID

The device ID of the modem is obtainable by querying the COSEM object [Modem device ID].

Modem device ID (Class ID: 1)				P	M
1	logical_name	Octet string	0-0:96.1.1.255	NA	R
2	value	Octet string		NA	R

4.5. Modem Manufacturer

The manufacturer of the modem is obtainable by querying the COSEM object [Modem manufacturer].

Modem manufacturer (Class ID: 1)				P	M
1	logical_name	Octet string	0-5:96.1.2.255	NA	R
2	value	Octet string		NA	R

4.6. Modem Information

Network Information (Class: 1)				P	M
1	logical_name	Octet string	0-1:94.31.4.255	NA	R
2	value	Structure	See below	NA	R

Attribute description

Value ::= structure

```
{
   signal_strength        integer,
   bit_error_rate          integer,
   number_of_base_stations    integer,
   IMSI           octet string,
   IMEI           octet string,
   MSISDN      octet string,
   ICCID         octet string,
   Main_Cell_ID      double-long-unsigned,
}
```

signal_strength	Current signal strength in dBm for the currently connected base station.
bit_error_rate	The number of received bits of a data stream over a communication channel that have been altered due to noise, interference, distortion or bit synchronization errors.
number_of_base_stations	The currently reachable number of base stations
IMSI	International Mobile Subscriber Identification Number.
IMEI	International Mobile Equipment Identity
MSISDN	Mobile subscription identification number
ICCID	Integrate circuit card identity
Main_Cell_ID	The cell ID that the meter attaches on

4.7. PHY Randomization

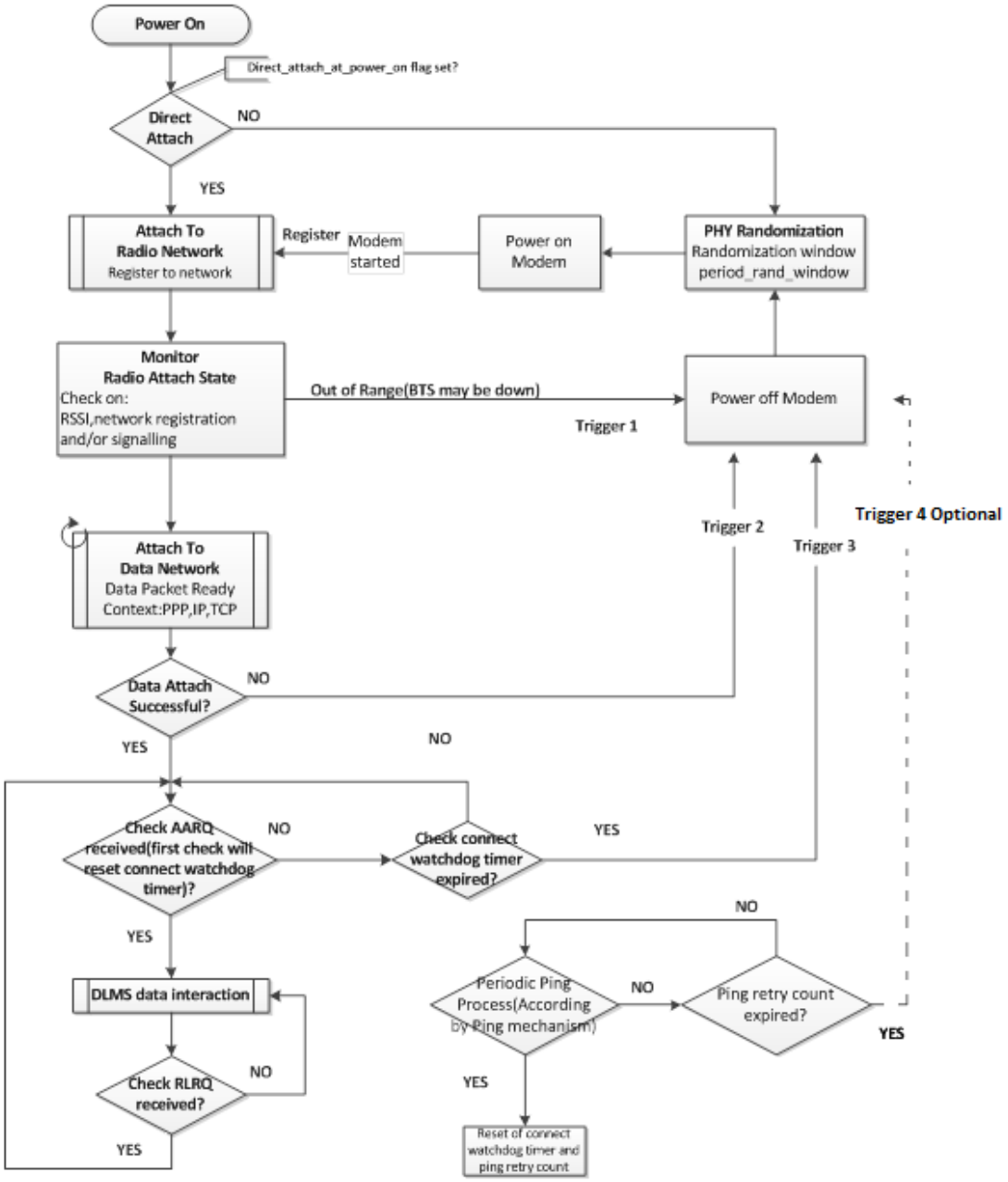
The waiting time procedure for re-registration of the modem to the network is configured and managed via the COSEM object [PHY Randomization].

PHY Randomization object (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.12.255	NA	R
2	value	structure	See below	NA	RW

Attribute description
Value ::= structure

randomisation_start_window double-long-unsigned Min. 1 Max. 65535	in seconds. A window of 0 means no randomization; i.e. immediate start. The Meter selects a random moment within this window.. One registration attempt is done within a window. Min. 1, Max. 65535
multiplication_factor long-unsigned Min. 1 Max. 7	In case of an unsuccessful WAN registration, a next randomization window is calculated as the randomization_start_window multiplied with the multiplication_factor. Min. 1, Max. 7
number_of_retries long-unsigned Min. 1 Max. 7	After this number of retries (with a different randomization window per attempt) the modem is reset and the process is started again.
direct_attach_at_power_on_flag ~~Enum~~ Boolean 0: Not Set 1: Set	If this flag is set, the randomized waiting would be disabled at the first time powering on the meter.

The meter has the ability to perceive that the communication modem is suffering from network induced problems or broken connections and take the necessary steps to restore to normal operation, without Central System (CS) intervention, by means of the implemented modem reset mechanism which is equivalent of turning off the power of the modem and turning it back on.



As the flow chart shows above, the meter monitors RSSI, network registration status and PDP context constantly. Once an issue is found, the meter will turn off the modem, and enter a waiting procedure called “PHY randomization”, during which the meter will randomly wait a period of time before turning on the modem and reattach on the network again. The “PHY randomization” procedure can significantly reduce the possibility of network congestion in case of massive scale of network break down, when thousands of modems try to attach on the network at the same time.

4.8. Modem Reset Timer

The power-off-on reset cycle of the modem when the timer expires is configured and managed via the COSEM object [Modem Reset timer].

Modem reset timer (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.2.255	NA	R
2	value	long-unsigned	**Unit=Hours (Default: 24 hours)** When the timer expires, the modem will be reset.	NA	RW

Setting to the maximum value(0xFFFF) equals to disable the timer.

4.9. Network Status Check Timer

The time interval for checking the network status of the modem is configured and managed via the COSEM object [Network Status Check Timer].

Network Status Check Timer (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.3.255	NA	R
2	value	long-unsigned	Unit=minutes (Default 1 minute) When the timer expires, network attachment status will be checked.	NA	RW

Setting to the maximum value(0xFFFF) equals to disable the timer.

4.10. Periodic Ping Configuration

The time interval for sending between modem and central system can be configured and managed via the COSEM object [Periodic Ping Configuration].

Periodic Ping Configuration (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.5.255	NA	R
2	value	structure	See below	NA	RW

Attribute description
Value ::= structure

Ping Destination Octet string	The destination address that the modem pings
Ping Timer long-unsigned Unit=minutes	The modem sends a ping message to the destination address when the timer expires. Setting to the maximum value (0xFFFF) equals to disable the timer. (Default 30 minutes) It must be possible to disable both, HW reset and timer, but it has to be independent from each other
Num-pings long-unsigned Min. 1 Max. 100	Number of times the ping request is send in one session (default value 3)
multiplication_factor long-unsigned Min. 1 Max. ~~7~~ 100	In case of no ping success (0 out of 3 (default)), a retry_interval is calculated to define the number of "Ping timer" to wait before scheduling a re-check of the connection.
number_of_retries long-unsigned Min. 1 Max. ~~7~~100	After this number of retry interval before the modem is reset and the process is started again. ~~Setting to the maximum value(0xFFFF) equals to disable the HW reset.~~

When the meter fails to receive the Ping response, event ~~200~~34 "ping_response_not_received" will be registered in the event log alarm will be triggered.

4.11. Average RTT

Average RTT (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.13.255	NA	R
2	value	long-unsigned	Indicates the round-trip time interval Unit=millisecond	NA	R

Indicates the total delay that begin to the data is sent from the module to the server and end in the module receives an ack frame from the server (the server sends an ack frame immediately after receiving the data).

4.12. Number Packets Received

Number of ping responses that were received (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.14.255	NA	R
2	value	long-unsigned	Indicate the number of reply frames received	NA	R

4.13. Periodical self-check timer

The time interval for initiating a self-check of the modem can be configured and managed via the COSEM object [Periodical self-check timer IP].

Periodical self-check timer (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.10.255	NA	R
2	value	long-unsigned	Unit=minutes (default 1440 minutes (= 24 hours)) When the timer expires, modem will perform a self-check.	NA	RW

Setting to the maximum value(0xFFFF) equals to disable the timer.

Event ~~154~~30 “Diagnostic failure” will be registered, when the meter found the modem self-check fails

4.14. Reference Signal Receiving Power

Reference Signal Receiving Power (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.18.255	NA	R
2	value	long	Indicates the signal strength of the LTE network	NA	R

4.15. Reference Signal Receiving Quality

Reference Signal Receiving Quality (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.19.255	NA	R
2	value	long	Indicates the quality of LTE reference signal reception, and mainly used for cell reselection and sorting in LTE networks	NA	R

4.16. Network Condition Profile

The time interval for initiating a self-check of the modem can be configured and managed via the COSEM object [Periodical self-check timer IP].

Network Condition Profile (Class ID:7)				P	M
1	Logical_name	Octet-string	0-0:99.12.0.255	NA	R
2	buffer	Array		NA	R
3	capture_objects	Array	{8,0-0:1.0.0.255,2,0}; {1, 0-1:94.31.4.255,2,1}; {1, 0-1:94.31.4.255,2,2}; {1, 0-1:94.31.18.255,2,0}; {1, 0-1:94.31.19.255,2,0}; (= clock; signal_strength; bit_error_rate; RSRP; RSRQ)	NA	R
4	capture_period	double-long-unsigned	Default: 600(10 minutes), configurable when the timer expires, the network condition will be checked and stored. Minimum 10 minutes (the capture period must >= refresh rate of GSM diagnostic).	NA	RW
5	sort_method	enum	1(unsorted (FIFO)	NA	R
6	sort_object	object definition	none	NA	R
7	entries_in_use	double-long-unsigned			R
8	profile_entries	double-long-unsigned	60	NA	R

4.17. Connection watchdog timer

Connection watchdog timer (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.7.255	NA	R
2	value	long-unsigned	**Unit=Hours (default 6 hours)**	NA	RW

The connection watchdog timer object in the electricity meter (obis code 0-1:94.31.7.255) holds an attribute with the value of the watchdog timer in hours. A watchdog timer makes sure that the modem is reset after a defined period of no contact with the CS and Ping not be received. The count will be recount after communication with CS or Ping has been received.
Setting to the maximum value(0xFFFF) equals to disable the timer.

4.18. GSM diagnostic

The cellular network is undergoing constant changes in terms of registration status, signal quality etc. It is necessary to monitor and log the relevant parameters in order to obtain diagnostic information that allows identifying communication problems in the network.

GSM diagnostic (Class ID:47)				P	M
1	Logical_name	octet-string	0-0:25.6.0.255	NA	R
2	operator	visible-string	empty	NA	R
3	status	enum	empty	NA	R
4	cs_attachment	enum	empty	NA	R
5	ps_status	enum	empty	NA	R
6	cell_info	structure	empty	NA	R
7	Adjacent_cells	array	empty	NA	R
8	Capture_time	date-time	empty	NA	R

Operator: Holds the name of the network operator

Status: Indicates the registration status of the modem.

enum:

(0) not registered,

(1) registered, home network,

(2) not registered, but MT is currently searching a new operator to register to,

(3) registration denied,

(4) unknown,

(5) registered, roaming

(6) ... (255) reserved

Cs_attachment Indicates the current circuit switched status.

enum:

(0) inactive,

(1) incoming call,

(2) active,

(3) ... (255) reserved

Ps_status The ps_status value field indicates the packet switched status of the modem.

enum:

(0) inactive,

(1) GPRS,

(2) EDGE,

(3) UMTS,

(4) HSDPA,

(5) LTE,

(6)CDMA,

(7) ...(255) reserved

Cell_info Represents the cell information:

cell_info_type ::= structure

{

cell_ID: double-long-unsigned,

location_ID: long-unsigned,

signal_quality: unsigned,

ber: unsigned,

}

- cell_ID: Four-byte cell ID in hexadecimal format;
- location_ID: Two-byte location area code (LAC) in hexadecimal format
- signal_quality: Represents the signal quality:

(0) –113 dBm or less,

(1) –111 dBm,

(2...30) –109…-53 dBm,

(31) –51 or greater,

(99) not known or not detectable;

- ber: Bit error (BER) measurement in percent:

(0…7) as RXQUAL_n values.

(99) not known or not detectable.

Adjacent_cells Represents the Adjacent cells information:

array adjacent_cell_info

adjacent_cell_info ::= structure

{

cell_ID: double-long-unsigned,

signal_quality: unsigned,

}

- cell_ID: Four-byte cell ID in hexadecimal format;
- signal_quality: Represents the signal quality:

(0) –113 dBm or less,

(1) –111 dBm,

(2...30) –109…-53 dBm,

(31) –51 or greater,

(99) not known or not detectable.

Capture_time Holds the date and time when the data have been last captured.

5. P2P Related Communication events

Following is the required events that should be implemented according to the description in 05_PA2502_Requirements Description_IMS_V3_EN.

P2P Related Communication events		
Number	Name	Description
16	No connection timeout	There has been no remote communication on application layer for a predefined period of time; i.e. meter could not be reached remotely.

17	Modem Initialization failure	Modem's response to initialization AT command(s) is invalid or ERROR or no response received
18	SIM Card failure	SIM card is not inserted or is not recognized
19	SIM Card ok	SIM card has been correctly detected
20	GSM registration failure	Modem's registration on GSM network was not successful
21	GPRS registration failure	Modem's registration on GPRS network was not successful
22	PDP context established	PDP context is established
23	PDP context destroyed	PDP context is destroyed
24	PDP context failure	No Valid PDP context(s) retrieved
25	Modem SW reset	Modem restarted by SW reset
26	Modem HW reset	Modem restarted by HW reset (this event is not issued after a general power resume)
30	Diagnostic failure	Modem's response to diagnostic AT command(s) ("+CPIN?", "+CSQ", "+CREG?", "+CGREG?", "+COPS?", "+CGACT?", "+CPMS?") is invalid or ERROR or no response received.
31	User initialization failure	Modem's initialization AT command(s) – specified in attribute 3 of the modem configuration object - is invalid. Error message or no response from the modem.
32	Signal quality low	Signal strength too low, not known, or not detectable
34	ping_response_not_received start	the modem fails to receive the response (Requirement REQ-ZTK-02375 Service Level Management)
35	TCP/IP_connection_establishment_failure	the modem fails to establish the TCP connection with the head end system (Requirement REQ-ZTK-02375 Service Level Management)
36	Ack_not_received	modem fails to receive the acknowledgement of a frame which has been sent (Requirement REQ-ZTK-02375 Service Level Management)
37	Signal quality low end	Signal strength becomes normally after event 32 occurs.
38	ping_response_not_received end	Ping response start to receive after after event 34 occurs.

Event 27,28,29,33 were deleted, because they are all related to the call function, but the call function was not required in the requirements.

In addition to the error event described above, a detailed error code regarding the reason of the error will also be registered. Please refer to Annex 1 for the details of the error codes.

P2P Communication Error Code(Class ID: 1)				P	M
1	logical_name	Octet string	0-0:97.98.3.255	NA	R
2	value	long-unsigned	Default 0 (no error)	NA	R

6. RTT Related event

Following is the required events that should be implemented according to the description in 05_PA2502_Requirements Description_IMS_V3_EN.

1	RTT_session_event	Record the round trip delay and result of the packet collection for each PING process.

~~6.~~7. Communication Throughput Profile

Communication Throughput Profile					
1	Logical_name	Octet-string	0-0:99.98.12.255	NA	R
2	buffer	Array		NA	R
3	capture_objects	Array	{8,0-0:1.0.0.255,2,0}; {1, 0-0:96.12.132.255,2,0}; {1, 0-0:96.12.133.255,2,0}; (= clock; bytes sent in a configurable interval(IP traffic), bytes received in a configurable interval(IP traffic))	NA	R
4	capture_period	double-long-unsigned	60 minutes	NA	R
5	sort_method	enum	1, (FIFO)	NA	R
6	sort_object	object definition	None	NA	R
7	entries_in_use	double-long-unsigned			R
8	profile_entries	double-long-unsigned	60	NA	R

bytes sent in a configurable interval (Class ID: 1)				
logical_name	Octet string	0-0:96.12.132.255	NA	R
value	double-long-unsigned		NA	R

IP traffic: Counter bytes sent in a configurable interval.

bytes received in a configurable interval (Class ID: 1)				
logical_name	Octet string	0-0:96.12.133.255	NA	R
value	double-long-unsigned		NA	R

IP traffic: Counter bytes received in a configurable interval.

bytes sent total (Class ID: 1)				
logical_name	Octet string	0-0:96.12.134.255	NA	R
value	long64-unsigned		NA	R

IP traffic: Counter bytes sent in the entire life cycle of the meter.

bytes received total (Class ID: 1)				
logical_name	Octet string	0-0:96.12.135.255	NA	R
value	long64-unsigned		NA	R

IP traffic: Counter bytes received in the entire life cycle of the meter.

~~7.~~8. RTT Session Event

RTT Sessions Event Log					
1	Logical_name	Octet-string	0-0:99.98.14.255	NA	R
2	buffer	Array		NA	R
3	capture_objects	Array	{8,0-0:1.0.0.255,2,0}; {1, 0-1:94.31.13,255,2,0}; {1, 0-1:94.31.14,255,2,0}; (= clock; Average RTT <avg_rtt>; Number of ping responses that were received <num_pkts_recvd>)	NA	R
4	capture_period	double-long-unsigned	0, asynchronously	NA	R
5	sort_method	enum	1, (FIFO)	NA	R
6	sort_object	object definition	None	NA	R
7	entries_in_use	double-long-unsigned			R
8	profile_entries	double-long-unsigned	60	NA	R

~~8.~~9. Firmware Upgrade P2P modems

9.1.Firmware Upgrade Basic Configuration

The communication modem is able to acquire the firmware upgrade image from a specific FTPS server, and perform the firmware upgrade automatically. When the firmware upgrade script is executed, the modem will retrieve both firmware image from the FTPS server, and finish the firmware upgrade without the inference from the central system.

FOTA image FTPS Server Address (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.15.255	NA	R

2	value	structure	{
			FSTP Server IP Address octet-string,
			FSTP Server TCP Port long-unsigned
			}
				NA	RW

FOTA image FTPS Server Access Credential (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.16.255	NA	R

2	value	structure	{
			User name Octet string,
			Password Octet string,
			}
				NA	RW

Firmware Upgrade Image File Name (Class ID: 1)				P	M
1	logical_name	Octet string	0-1:94.31.17.255	NA	R

2	value	structure	{
			New Image File Name Octet string,
			Fallback Image File Name Octet string,
			}
				NA	RW

9.2.Firmware Upgrade Script Table

The required Push setup is configured and managed via the COSEM object [Script table]. The attributes and methods are described in detail in the chapter 4.5.2 of the DLMS Blue Book [edition 12].

Firmware Upgrade Script Table (Class ID: 9)				P	M
1	logical_name	Octet string	0-0:10.1.107.255	NA	R
2	scripts	array	Script 1 initiates the firmware upgrade process Script 2 initiates the firmware fallback process	NA	R
	Specific methods				
1	execute(data)		Data contains the entry in the script table (1 or 2)	NA	E

When script 1 is executed, the meter will finish the firmware upgrade process based on the parameters configured automatically.
When script 2 is executed, the meter will finish the firmware fallback process based on the parameters configured automatically

9.3.FOTA Upgrade Events

The events and alarms which is used to indicate the FOTA upgrading status are defined below.

P2P FOTA upgrading events			Alarm
Number	Name	Description	Name
30	FOTA upgrading initial	Indicates FOTA upgrading has been started.	NA
31	FOTA upgrading successfully	Indicates FOTA upgrading is finished successfully.	FOTA upgrading successfully
31	FOTA upgrading failed	Indicates FOTA upgrading is failed.	FOTA upgrading failed

9. Push Mechanism

P2P meters will make use of all push operations described in the chapter 10 PUSH operations of KSMW PA2502 Companion Standard Main Document Rev 0.3.
The objects only designated for P2P communication will be explicitly described below.

Mode Selection

Auto Connect (Class ID: 29)				P	M
1	logical_name	Octet string	0-0:2.1.0.255	NA	R
2	mode	enum	101 (default)	NA	RW
3	repetitions	unsigned	Not used	NA	R
4	repetition_delay	long-unsigned	Not used	NA	R
5	calling_window	array	empty	NA	R
6	destination_list	array	empty	NA	R

Mode:
(101) The meter is permanently connected to the IP network and can be reached by the central system via its known IP address.

(104) The meter is usually disconnected. It connects to the IP network when the connect method is invoked. If the HES needs to communicate to the meter the HES shall wake-up the meter via SMS.

SMS Handling

Message Handler (Class ID: 8192)				P	M
1	logical_name	Octet string	0-0:2.130.0.255	NA	R
2	Listening_window	structure	In case SMS wakeup is used: Listening_window is always active. In case SMS wakeup is not used: Listening window is never active.	NA	RW
3	Message_content	Octet string	Empty (default)		RW
4	list_of_senders_and_actions	array	Array of senders with associated scripts. The script contains the push method invocation of the Push Setup on connectivity	NA	RW

When the mode in Auto Connect object is configured as 104 (on demand), the modem is not permanently online. The modem will get online upon receiving an SMS message from designated senders, and push a message to inform the central system triggered by push on connectivity.

Listening_window decides in which period when the meter is able to receive SMS. Only when the meter is in the listening window, will the meter get online upon receiving an SMS.

```
Listening_window ::= structure
{
        start_time:    octet string
        end_time:    octet string
}
```

Message_content: default (empty) wakes up the modem only; optional content “HW reset” wakes up the modem and initiates a HW reset

list_of_senders_and_actions limits the number of senders allowed, and indicates the push object. The meter will only respond to the SMS from the senders in the list.

```
list_of_senders_and_actions::= array senders_and_actions
Listening_window ::= structure
{
        caller_id:    octet string
        executed_script::= structure script
```

}

script::= structure
{
	script_logical_name : octet string
	script_selector: long-unsigned
}

Annex 1

When the event ~~147~~23 PDP context destroyed and event ~~148~~24 PDP context failure occurred, the reason for their occurrence can be inquiry. The following reasons will lead to ~~147~~23 and ~~148~~24 events.

PS internal cause	
1	Invalid connection identifier
2	Invalid NSAPI
3	Invalid Primary NSAPI
4	Invalid field
5	SNDCP failure
6	RAB setup failure
7	No GPRS context
8	PDP establish timeout
9	PDP activate timeout
10	PDP modify timeout
11	PDP inactive max timeout
12	PDP lowerlayer error
13	PDP duplicate
14	Access technology change
15	PDP unknown reason
PS network cause	
16	LLC or SNDCP failure
17	Insufficient resources
18	Missing or unknown APN
19	Unknown PDP address or PDP type
20	User Aauthentication failed
21	Activation rejected by GGSN
22	Activation rejected, unspecified
23	Service option not supported

24	Requested service option not subscribed
25	Service option temporarily out of order
26	NSAPI already used (not sent)
27	Regular deactivation
28	QoS not accepted
29	Network failure
30	Reactivation required
31	Feature not supported
32	Semantic error in the TFT operation
33	Syntactical error in the TFT operation
34	Unknown PDP context
35	PDP context without TFT already activated
36	Semantic errors in packet filter
37	Syntactical errors in packet filter
38	Invalid transaction identifier
39	Semantically incorrect message
40	Invalid mandatory information
41	Message non-existent/not implemented
42	Message type not compatible with state
43	IE non-existent/not implemented
44	Conditional IE error
45	Message not compatible with state
46	Protocol error, unspecified