

 Eskom	Report	Technology
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Title: **EVALUATION CRITERIA FOR
SMART METERS**

Unique Identifier: **240-97225295**

Alternative Reference Number: **n/a**

Area of Applicability: **Engineering**

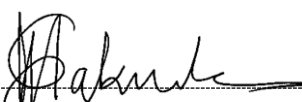


Documentation Type: **Report**

Revision: **5**

Total Pages: **14**

Next Review Date: **n/a**

Disclosure Classification: **Controlled
Disclosure**

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Date: 13/03/2024	Date: 13/02/2024	Date: 14/03/2024

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1. Introduction

This document provides an overview of Eskom's technical evaluation criteria for the Request for Proposal (RFP) for Data Concentrators and single & three phase smart meters with associated customer interface units (CIUs) and embedded cellular modems. It is supplementary to the Eskom standard for smart metering systems, i.e., *Eskom 240-126910106 Particular requirements for Eskom smart metering system*.

An Excel sheet titled "Technical Schedule for Smart Meters" is provided with this document for the purpose of capturing product data required to fulfil requirements of this technical criteria and for conducting technical evaluations described herein. This Excel sheet is referred to as the *Technical Schedule* in the rest of this document.

2. Supporting clauses

2.1 Scope

The technical evaluation criteria detailed in this document is for an RFP for the manufacturing, supply, evaluation, testing and acceptance of smart metering devices for the purpose of listing manufactures on the Technically Evaluated and Accepted Products (TEAP) database as per Eskom 240-170001064.

The RFP is for the manufacturing, supply, technical evaluation, testing, and acceptance of the following smart metering systems components:

Table 1: List of items for enquiry

	Items
1.	Single Phase DIN Rail PLC Split Smart Meter with CIU
2.	Single Phase BS Split PLC Smart Meter with CIU
3.	Single Phase BS Split Smart Meter with CIU + Internal/Plug-in GSM Modem
4.	Three Phase BS PLC Split Smart Meter with CIU
5.	Three Phase BS Split Smart Meter with CIU + Internal/Plug-in GSM Modem
6.	Gateway/Data Concentrators (DCU) + Internal/Plug-in GSM Modem

Smart meter manufacturers and/or suppliers shall respond to the RFP by providing information and samples for any one or all the items numbered 1 to 5 in Table 1 above. Information and samples for Item 6 shall be provided with every response offering Items 1, 2 and/or 4. Furthermore, the submitted Item 6 samples shall be compatible with the offered Items 1, 2 and/or 4 test samples.

2.2 Normative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

- [1] Eskom 240-126910106, *Particular requirements for smart metering system*
- [2] Eskom 240-170001064, *Governance Rules and Processes for Managing the Technically Evaluated and Accepted Products (TEAP) Database in Eskom Distribution*
- [3] DLMS UA 1000-1 Ed 15 Part 2:2021, *COSEM Interface Classes*, Blue Book Part 2
- [4] IDIS Interoperability Specification, *Package 2 IP Profile*, Edition 2.0 (including G3-PLC), 2014
- [5] IDIS Interoperability Specification, *Package 2 IP Smart Metering Objects*, Edition 2.0 (including G3-PLC), 2014

- [6] ITU-T G.9903 (2017) Amd.2 (03/2023), Series G: Transmission systems and media, digital systems and networks Access networks – In premises networks, Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks.

2.3 Informative references

- [1] Great Britain Companion Specification (GBCS) v0.8.1: complete Word version with embedded HTML and Excel files [Access: https://assets.publishing.service.gov.uk/media/5a7e41a840f0b6230268a2d4/GBCS_v0.8.1.docx].
- [2] DNV DLMS Test Suite [Access: [DLMS test suite for smart meters DNV](#)]

3. Technical Returnables for RFP

Suppliers shall provide the following information:

- 1) All submissions and/or documents required for compliance with mandatory requirements outlined in section 4.1 of this document.
- 2) Excel files (mandatory requirements and functional evaluation sheet) shall be completed and returned to Eskom in Excel format (electronic) and in Acrobat PDF format for auditing purposes (named “Technical Schedule for Smart Meters”)
- 3) Details regarding the make, model number and firmware version of all items offered shall be fully completed in the Excel file named “Technical Schedule for Smart Meters”.
- 4) Data sheets, brochures and detailed product manuals for all offered devices.
- 5) Suppliers shall provide **2 sample meters** (per item as listed in Table 1 above) of products to be evaluated and tested when submitting RFP documents.
- 6) All submitted test samples shall be configured with the following LLS password (Table 2 below).

Table 2: DLMS configuration

Security parameter	Value	DLMS Client
LLS password	12345678	1 (Management)

- 7) The STS application layer implemented for all submitted test samples shall be configured as per table below to enable the use of test tokens:

Table 3: STS parameters

Meter Key	6caf f4b5 4a37 76a6
Key Type	Unique
Tariff Index (TI)	01
Key Revision no.	1
Supply Group Code (SGC)	333 333
Meter no.	Defined by smart meter manufacturer.
Key Change Flags	8
Current Limit	20 A or 60 A (for single phase meters) 80 A (for polyphase meters)

- 8) All samples NOT configured according to Table 2 and 3 above shall be disqualified from further testing.

4. Technical Evaluation and Testing of Meters and Data Concentrators

The Technical Evaluation is comprised of the following two phases:

- Phase I: Mandatory Requirements (Desktop evaluation)
- Phase II: Functional Evaluation (Laboratory testing)

The evaluation process to be followed is given below, a) to g), and illustrated in the flowchart diagram given in Annex A.

- a) Eskom will compile technical requirements and RFP Document taking into consideration the TEAP process as per 240-170001064 and proceed to issue RFP to the market.
- b) On the prescribed closing date, Eskom will receive bids and test samples from suppliers responding to the RFP.
- c) After receiving the bids, the mandatory requirements phase of the evaluation process will be conducted. This is to ensure that suppliers meet basic requirements in preparation for the functional evaluation phase using the DLMS Test Suite software.
- d) Where a product does not meet mandatory requirements, the product will not be evaluated further. The feedback report for such a product will be compiled accordingly.
- e) Submissions that fully comply with the requirements (Phase I) will be subjected to the functional evaluation (Phase II) using the DLMS Test Suite software.
- f) If a product does not meet the functional evaluation threshold, a report will be compiled, and the supplier will be given feedback for the supplier to correct or develop all functionally non-compliant aspects of their products and resubmit the product within **3 months**.
- g) During the development period, the supplier will be required to demonstrate functionality of the use cases in Table 7 using his own HES before resubmitting the products for final testing with the DMLS test suite. During this session, the supplier shall provide all DMLS traces of the use cases for Eskom to give inputs and guidance in cases where some use cases are not yet fully developed. This session will take place anytime as and when the supplier is ready provided it is still within the specified 3 months development phase as stated in 4 (f).
- h) If the product meets the functional evaluation threshold, the product will be recommended for contract award subject to the supplier meeting the commercial evaluation threshold.
- i) Furthermore, if the product meets the functional evaluation threshold, the product will be listed on the TEAP Database on condition that all applicable certificates and type test reports listed in Table 4 are submitted.
- j) Where a product is resubmitted [see f) above] and meets the functional evaluation threshold, such a product shall be listed on the TEAP Database that all applicable certificates and type test reports listed in Table 4 are submitted.

Table 4: Certificates and type test reports required for contract award and TEAP listing.

DLMS UA certificate (for Eskom approved firmware version)
G3-PLC certificate (for meters with G3-PLC modems only)
STS certificate for currency and energy (for Eskom approved firmware version)
IDIS 2 certificate or object model listing (for Eskom approved firmware version)

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Type test reports (SANS/IEC62055-31 or SANS1524-1 and SANS/IEC 62053-23 or SANS/IEC62053-24)
ICASA Radio Equipment Type Approval Certificate (for Cellular Network modem)

- k) Where the supplier has implemented a firmware change on a product such that the product requires re-certification from the relevant certification bodies, the supplier will be given 6 months to provide such certificates if the product is recommended for TEAP listing and contract award.
- l) While the product that have gone through this process should seamlessly integrate with existing HES's, contracted suppliers or TEAP listed suppliers will be allowed a further 2 months to integrate their meters with exiting HES's.

4.1 Phase I: Mandatory Requirements

Each tender shall pass all Mandatory Requirements of technical evaluation. Tenderers not meeting any of the Mandatory Requirements shall be excluded from further evaluation.

Table 5: Mandatory Requirements

Mandatory Requirements		Evidence required
1.	<i>Technical Schedule</i> (mandatory requirements and functional evaluation sheet) are completed	Completed <i>Technical Schedule</i> submitted
2.	2 (two) Samples of each tendered product submitted	Samples submitted
3.	All meters shall be of the split meter design as defined in Eskom standard 240-126910106 clause 2.3.1	This will be determined from the submitted samples.
4.	Meters shall be capable of bi-directional energy metering and be able to measure and record active energy (import and export) and reactive energy (Q1, Q2, Q3 & Q4). Accuracy for active energy shall be class 1 according to SANS/IEC 62055-31 or SANS 1524-1 and accuracy for reactive energy shall be class 2 according to SANS/IEC 62053-23 or SANS/IEC 62053-24. Meter shall have markings and test outputs required for active and reactive energy measured as defined and referenced in SANS/IEC 62055-31 or SANS 1524-1 and SANS/IEC 62053-23 or SANS/IEC 62053-24.	This will be determined from the submitted samples.
5.	Commitment and declaration to fully integrate field devices (smart meters and DCUs) with Eskom approved HESs within 3 month of contract award.	Declaration in signed company letterhead.
6.	The dimension of the meters shall be according to 8.2 of NRS049 (BS Single phase & Three Phase) and Annex C of NRS049 for Single Phase DIN-Rail meters.	This will be determined from the submitted samples.
7.	Meter terminal connections shall be according to NRS049.	This will be determined from the submitted samples.
8.	All submitted test samples shall be with the LLS password stipulated in Section 3 (6)	Supplier to confirm and submitted samples will be verified
9.	HDLC optical port is used for PHASE II testing. This port is mandatory for all smart meter samples, IEC 1107 (Mode E) shall not be accepted for PHASE II testing	Supplier to confirm that the HDLC optical port is implemented
10.	Where a data concentrator/gateway sample is submitted, the following information shall be declared: <ul style="list-style-type: none"> G3-PLC pre-shared key (PSK), 	Data concentrator/gateway and meter sample(s) G3-PLC

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Mandatory Requirements	Evidence required
<ul style="list-style-type: none"> G3-PLC MAC address G3-PLC frequency (Cenelec A or FCC) Data concentrator/gateway web interface log in credentials (at least with administrator account) 	information provided in <i>Technical Schedule</i> .

The Mandatory Requirements above are included in the *Technical Schedule for Smart Meters* Excel document as a separate Tab/Sheet and shall be completed in full by all tenderers.

Note! One sample per product tendered for is acceptable. However, the recommendation is for two samples to be submitted so that if the first sample fails to power up, the second sample will be used.

4.2 Phase II: Functional Evaluation

The minimum qualification threshold for Phase II evaluations shall be **85 %**.

The scoring of different use cases under the functional evaluation phase shall be as follows:

Table 6: Scoring of items in Functional Evaluation Sheet

Criteria	Score
Fully compliant (Indicated as Y in A&B Schedules)	3
Partially compliant - minor deviation (Indicated as P in A&B Schedules)	1
Non-compliant - major deviation (Indicated as N in A&B Schedules)	0

4.2.1 Testing approach

Each smart meter sample's communication interface is connected to a common DLMS Client (i.e., a software application that simulates a Head End System or Central Acquisition System or Data Concentrator).

The simulated system then generates a sequence of DLMS messages that invoke the smart meter's functionality that supports Eskom test cases specified in Table 5 below.

This enables the evaluation team to determine the smart meter's compliance to the Eskom's smart meter specification at use case level and, at communication protocol level.

The DNV GV Test Facility is used as the common DLMS Client (or simulated Head End System), informative reference [1].

Primarily, the HDLC optical port is used for PHASE II testing. This port is mandatory for all smart meter samples, IEC 1107 (Mode E) will not be accepted for PHASE II testing.

The Management Client association is used over the HDLC optical port to ensure access to the entirety of the object model implemented in the smart meter under test.

For test case number TC01, a G3-PLC sniffer is used to monitor and capture G3-PLC traffic between the smart meter under test and its data concentrator. The evaluation team uses the captured G3-PLC traffic to determine compliance with security requirements defined in the G3-PLC specification.

During the development phase, the supplier will be required to demonstrate functionality of the use cases in Table 7 using his own HES before resubmitting the products for final testing with the DMLS test suit. This test, specified in 4 (g) above shall be conducted by the supplier with the Eskom team witnessing the test.

The tests defined for PHASE II shall be conducted by the Eskom technical team and not the tenderers.

Table 7: DLMS Test Cases for functional evaluation.

Test Case No.	Test case name	Description	References
TC01	Meter registration	<p>Test that meter implements all COSEM objects and functionality that supports automatic meter registration.</p> <p>Check that <i>System Title</i> and <i>COSEM Logical Device Name</i> formats are according to IDIS 2.</p> <p>Check that DLMS security is implemented in meter firmware is at least <i>Suite 0</i>.</p> <p>For Items 1, 2 and/or 4 only - Check that smart meter and Data Concentrator comply with G3-PLC specification join process.</p>	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3
TC02	Remote tariff programming	<p>Load Eskom approved tariff (e.g., Homeflex) into meter, and set energy rate (Rand/kWh) in prepayment charge tables according to tariff.</p>	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3
TC03	Meter reading (On demand)	<p>Read import and export total energy registers and rate registers.</p> <p>NOTE 1: At its discretion, the Eskom technical team may inject import and export energy into smart meter to verify four quadrant measurement capability.</p> <p>Read available credit.</p> <p>Read STS data elements (i.e., DRN, TI, KRN, KT and SGC) from IEC 62055-41 attributes IC.</p> <p>Read Load Profile 1 and Load Profile 2, default profile entries, capture objects and capture period.</p> <p>Set LP1 and LP2 integration period to 5, 10-, 15-, 30- and 60-minutes capture period.</p>	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3 DLMS UA 1000-1 Part 2 clause 4.6.6
TC4	Meter reading (For billing)	<p>Read Billing Profile, default profile entries, capture objects and capture period.</p>	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3

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Test Case No.	Test case name	Description	References
TC5	Disconnection and reconnection	Disconnect meter and re-connect it. NOTE 2: Disconnect Arbitrator or IDIS 2 disconnecter objects may be implemented. Set smart meter power limit and verify that it disconnects when limit is exceeded.	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3
TC6	Clock synchronisation	Synchronize meter's clock to a preselected date and time.	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3
TC7	Quality of supply reporting	Test that meter implements all objects and functionality that supports quality of supply reporting.	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3
TC9	Firmware update	Test that meter implements all objects and functionality that supports firmware upgrade.	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3
TC10	Meter supervision	Test that meter implements all objects and functionality that supports event / alarm detection and reporting.	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3
TC11	Consumer information	Check that CIU provides relevant information during all test cases.	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3
TC21	Prepayment	Change meter to post-payment (credit) mode. Change meter to prepayment mode (monetary currency and energy). Insert STS credit token via communication interface (monetary and energy credit). Set period and amount for standing charge collection.	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.2 and 3.3.3 Annex B and C herein
TC100	Object list	Read meter's object list using <i>Management Client</i> and check that all objects specified in Eskom 240-126910106 clause are implemented in the meter firmware.	<ul style="list-style-type: none"> Eskom 240-126910106 clause 3.3.3

Test Case No.	Test case name	Description	References
TC200	Data concentrator administration	Log into data concentrator web interface using admin password via local interface (e.g., LAN port). View list of meters connected to data concentrator.	

5. Accelerated Environmental Stress Testing

Eskom may choose to subject approved/accepted meter types and DCUs with associated modems which have passed the evaluation, to Accelerated Environmental Stress Testing (AEST). If Eskom decides to conduct AEST on such products, Eskom will contact successful supplier(s) to arrange for the supply of thirty (30) encoded meters and six (6) data concentrators within four weeks. The AEST consists of a variety of tests to simulate the life of the equipment under test in an accelerated fashion. The AEST tests are conducted by Eskom technical staff, covering the tests indicated below which are described in detail in the Procedure for Accelerated Environmental Stress Testing of solid-state metering equipment.

- Vibration and drop tests
- Temperature and humidity cycling
- Supply voltage / load current profile
- Voltage interruptions
- Voltage dips
- Fast transient bursts
- Electrostatic discharges
- Lightning impulses

Meters and DCUs with its associated modems that are subjected to the above tests are required to pass the above tests without compromising any of its functionality. If any serious failures or deficiencies are detected in the accelerated environmental stress testing, the supplier shall, at his cost, address the deficiency to Eskom's satisfaction and replace the equipment that may have been installed already.

6. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Aletta Mashao	PTM&C Senior Manager
Deon van Rooi	Metering, DC and Security Technologies Manager
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7. Revisions

Date	Rev	Compiler	Remarks
June 2015	1	J O'Kennedy	New document required for the issue of enquiry
September 2017	2	M E Makwarela	<ul style="list-style-type: none">Revise document to align with the requirements of NRS049Included a section for the HES and development phase for 1 year
September 2022	3	M E Makwarela	Remove development phase and HES evaluation from the document since HES is already in place
February 2023	4	ME Makwarela	Document revised to include TEAP listing of products
March 2023	5	ME Makwarela	Document revised to include comments from Gauteng Cluster to strengthen supplier development.

8. Development team

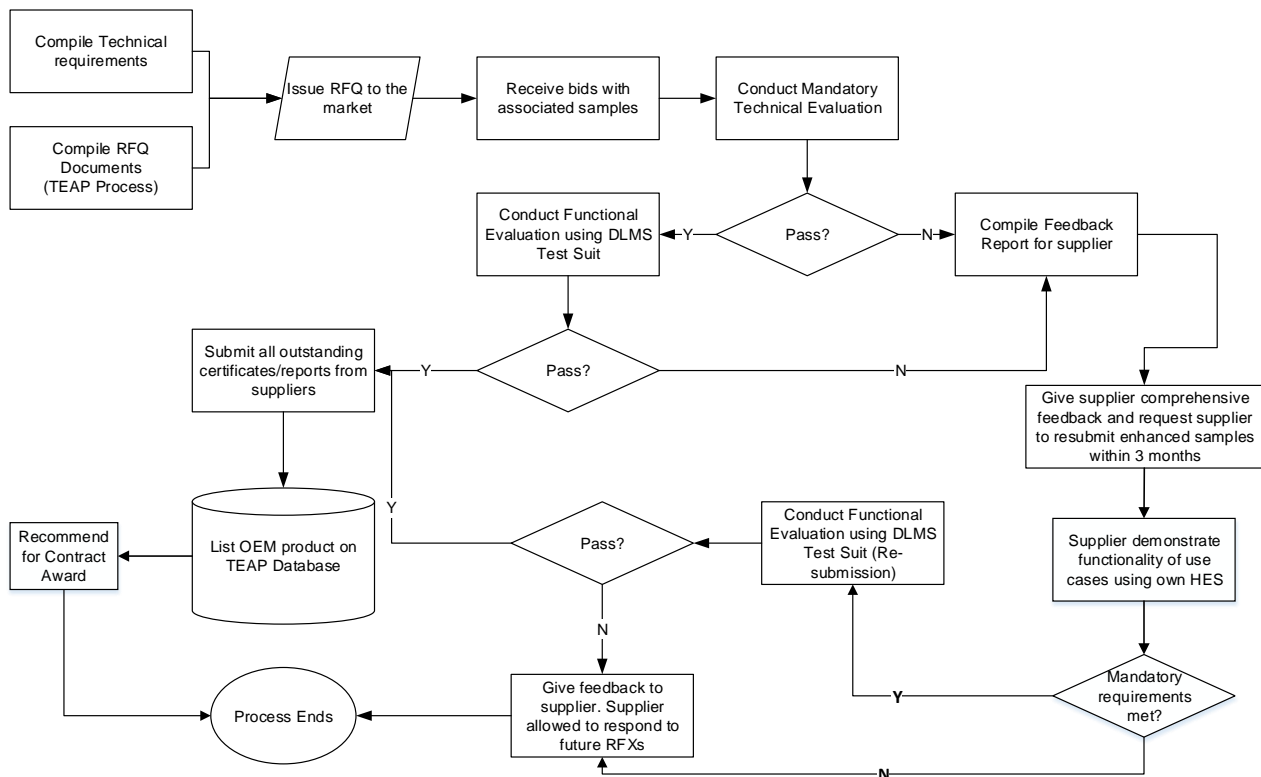
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9. Acknowledgements

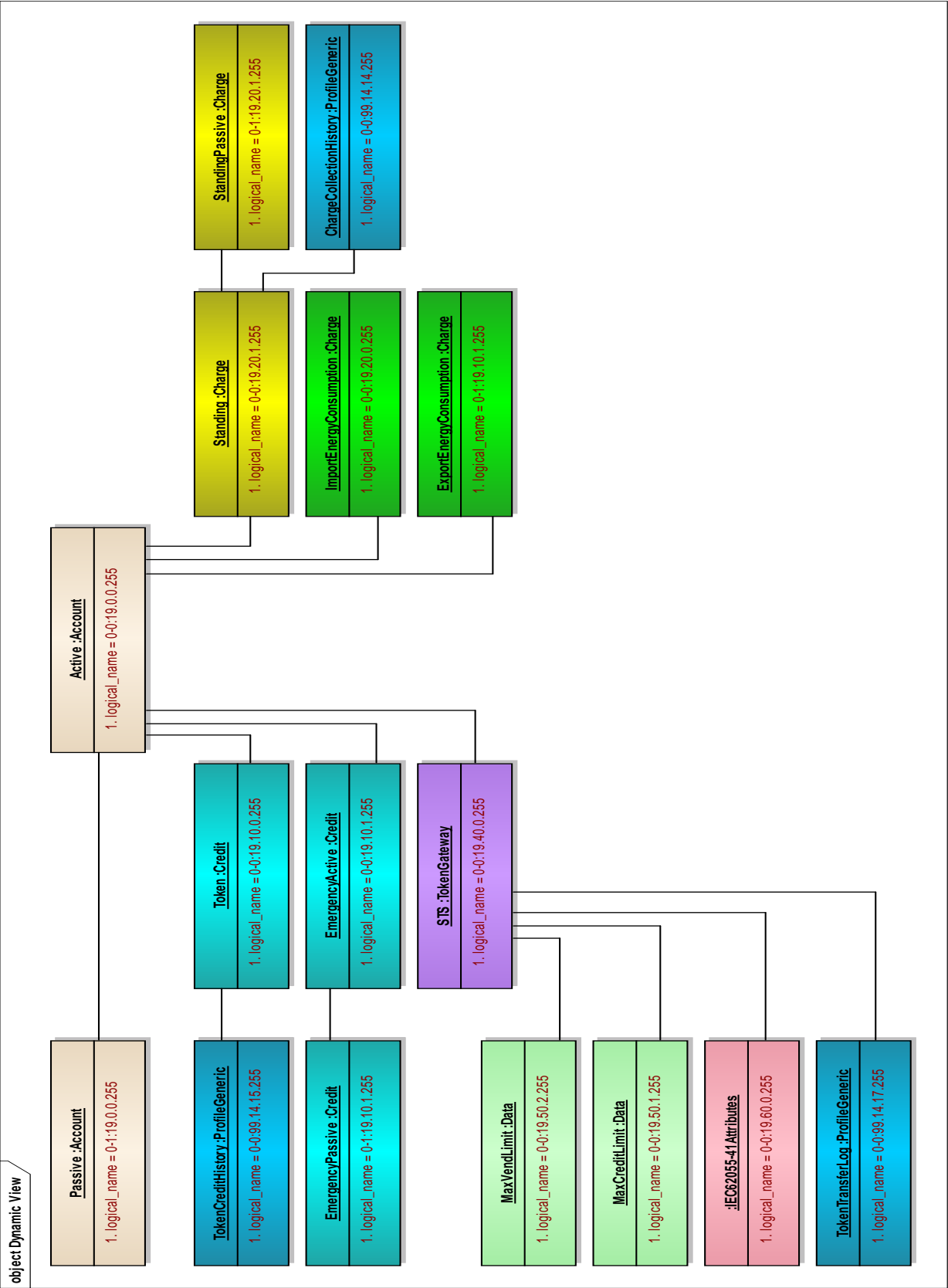
Not applicable.

Annex A – Technical evaluation process



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Annex B – Payment metering object model (Eskom 240-126910106)



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Annex C – Payment mode change

When either (1) a DLMS command successfully sets the 'passive' Account object's account_activation_time (attribute ID 13, OBIS code 0-1:19.0.0.255) to 0x00000000000000000800FF or (2) the ESME's clock reaches the value in that attribute or (3) the activate_account method is invoked, the smart meter shall not activate *Account passive* object, as detailed in the Blue Book, but shall set the attributes in the *Account* object (OBIS code 0-0:19.0.0.255) as follows:

- set the payment_mode part of the account_mode_and_status attribute (attribute ID 2) to the payment_mode value in the *Account passive* object; and
- set each of the other static attributes (as defined in the Blue Book) to the corresponding value in the *Account passive* object.

