



TEST REPORT

Type / Model Name : WM3M4C

Product Description : Three-phase and single-phase electronic active energy meter

Applicant : ISKRA d.o.o

Address : Stegne 21

1000 Ljubljana, Slovenien

Manufacturer : ISKRA d.o.o

Address : Stegne 21

1000 Ljubljana, Slovenien

Test Result according to the standards listed in clause 1 test standards:

POSITIVE

Test Report No. : 80079721-01 Rev_0

15. October 2021

Date of issue

Contents

| | | |
|----------|--|-----------|
| 1 | <u>TEST STANDARDS</u> | 3 |
| 2 | <u>SUMMARY</u> | 3 |
| 2.1 | GENERAL REMARKS | 3 |
| 2.2 | CHARACTERISTICS OF THE TEST OBJECT | 4 |
| 2.3 | FINAL ASSESSMENT | 5 |
| 3 | <u>EQUIPMENT UNDER TEST</u> | 6 |
| 3.1 | PHOTO DOCUMENTATION OF THE EUT | 6 |
| 3.2 | INFORMATION PROVIDED BY THE CLIENT | 8 |
| 3.3 | SAMPLING | 8 |
| 3.4 | SHORT DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT) | 8 |
| 3.5 | PROVIDED DOCUMENTS | 8 |
| 3.6 | EXAMINATION PROCEDURE | 8 |
| 4 | <u>TEST ENVIRONMENT</u> | 9 |
| 4.1 | ADDRESS OF THE TEST LABORATORY | 9 |
| 4.2 | STATEMENT REGARDING THE USAGE OF LOGOS IN TEST REPORTS | 9 |
| 4.3 | ENVIRONMENTAL CONDITIONS | 9 |
| 4.4 | STATEMENT OF THE MEASUREMENT UNCERTAINTY | 9 |
| 4.5 | CONFORMITY DECISION RULE | 9 |
| 5 | <u>TEST CONDITIONS AND RESULTS</u> | 10 |
| 5.1 | CHECKLISTS TO SUPPORT THE SELECTION OF THE APPROPRIATE REQUIREMENTS | 10 |
| 5.2 | SPECIFIC CHECKLISTS FOR THE RESPECTIVE TECHNICAL PARTS | 11 |
| 5.3 | CHECKLIST FOR SPECIFIC SOFTWARE REQUIREMENTS (ACTIVE ELECTRICAL ENERGY METERS) | 25 |

1 TEST STANDARDS

The tests were performed according to following standards:

WELMEC 7.2 : 2015
Partly! Software Guide

2 SUMMARY

2.1 General remarks

The Measuring Instruments Directive (MID) gives the essential requirements for certain measuring instruments used in the European Union. The software of the measuring instrument was validated to show conformance with the essential requirements of the MID.

The validation was based on the report WELMEC MID Software Requirements Guide WELMEC Guide 7.2, where the essential requirements are interpreted and explained for software. This report describes the examination of software needed to state conformance with the MID.

2.2 Characteristics of the test object

The test object is a measuring instruments intended to measure electrical energy.

The basic functions of the instrument are:

- Measuring of active electrical energy
- Internal HW based cryptographic unit for digital signing

According to the WELMEC Guide 7.2, the meter is described as follows:

- A built-for-purpose Measuring instrument (an embedded system)
- Long-term storage of measurement data

| | |
|---|--------------|
| Model | WM3M4C |
| Serial number | W4134078 |
| Year of fabrication | 2020/06 |
| I_{ref} [A] | 5 |
| I_{max} [A] | 50 |
| U_{ref} [V] | 3x230(400) V |
| Frequency [Hz] | 50/60 Hz |
| Meter constant [imp./kWh] | 1000 |
| Temperature range | -25°C – 70°C |
| Accuracy class | B |
| Software version Register: 30013 | 2.05 |
| Checksum main processor Register: 30081 HI, 30097 LOW | EEC66478 |
| Checksum measuring modules Register: 30087, 30088, 30089 | B5E6 |

Remarks: The results as mentioned in this test report relate only to the meters which are tested.

The above-mentioned characteristics were stated on the watt-hour meters under test and are required by the IEC documents.

However, according to the Annex V of the MID and the EN 50470 documents, other parameters are used to define the meter characteristics. Therefore, in addition the following characteristics are used during the investigation.

2.3 Final assessment

The software of the typ **fulfils** the essential requirements of the Measuring Instruments Directive 2014/32/EU. The result applies to the tested item only.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 1 December 2020

Testing concluded on : 10 September 2021

Checked by:

Tested by:

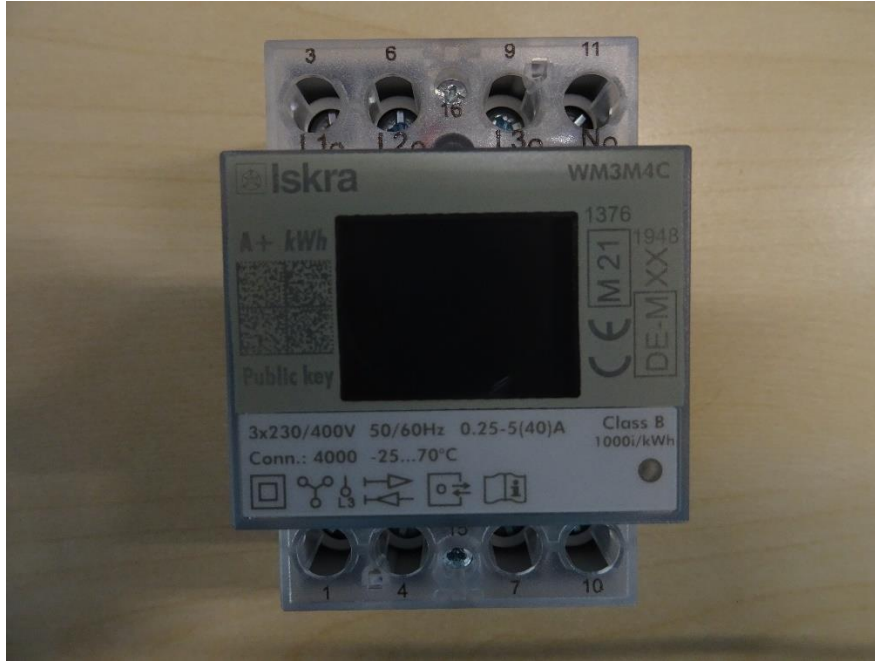
Eduard Stangl
Dipl. Ing. (FH)
Technical Director

Georg Harpaintner
Dipl. Ing. (FH)

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT

Front view

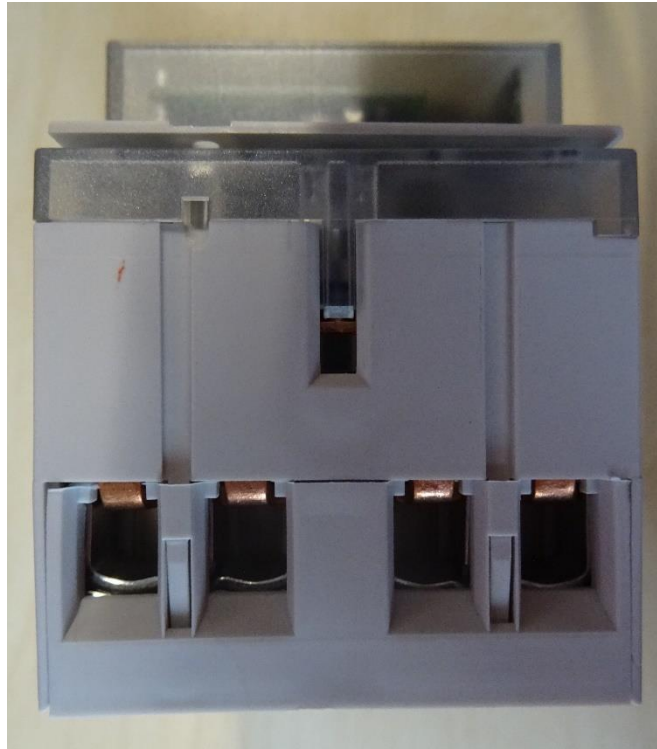


Side view

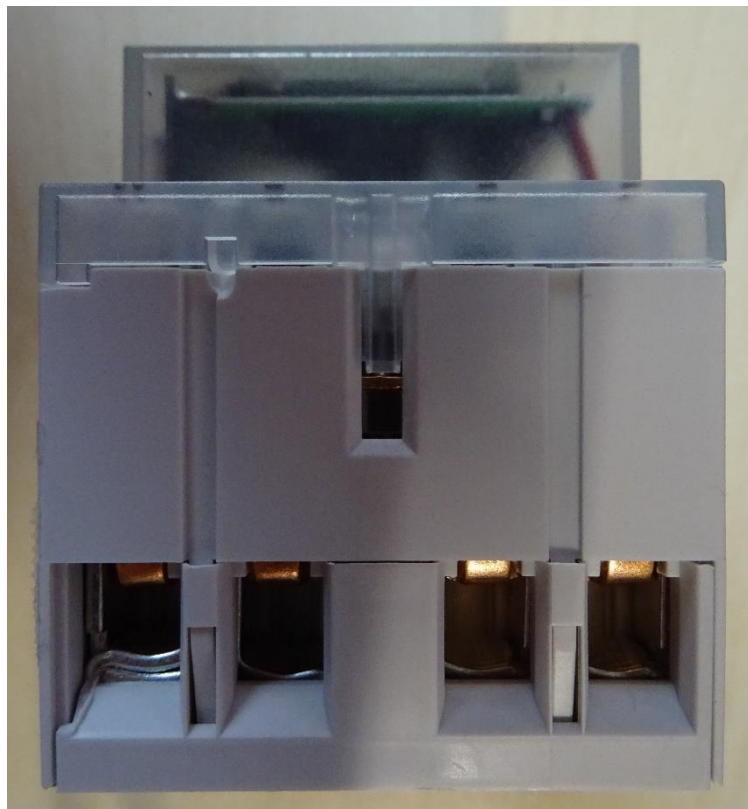


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

Terminal view



Terminal view



The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

3.2 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

3.3 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according to his/her instructions.

3.4 Short description of the Equipment under Test (EuT)

Number of tested samples : 1
Serial number : W413407880

3.5 Provided documents

The validation has been supported by following documents from the manufacturer:

- K_WM3M4_EN_22433922_Users_manual_Ver_1.07.pdf
226023xx_NAVODILA_ZGIB_WM3M4_DE_SL_Ver_1.00.pdf
D_WM3M4_EN_22433922_TEHNICNI_OPIS_Ver_1.03.pdf,
D_WM3M4_EN_22433922_TEHNICNI_OPIS_Ver_1.06
- K_WM3M4_DE_22433922_Benutzerhandbuch_Ver_1.10Energy counter crypto functions_v8.pdf
- Report WM3M4-FW-9_2020.pdf, Report WM3M4C-FW2_05-9_2021
- WM3M4__A.pdf, WM3M4C_F.pdf
- WM3M4C cryptographic description_v1.pdf
- CryptoLab-Short instruction.pdf
- PTB-8.51-PB-2020.35-ISKRA-WM3M4C

3.6 Examination Procedure

The validation has been performed according to the WELMEC 7.2, 2015: Software Guide (downloaded at www.welmec.org).

Following requirements have been validated:

- Specific requirements for embedded software for a built-for-purpose measuring instrument **type P**
- Extension L: specific software requirements for Long-term Storage
- Extension T: Transmission of Measurement Data via communication networks

Risk class C for instruments of type P has been applied to this instrument according to 10.3.6 Assignment of risk class of WELMEC 7.2, 2015: Software Guide.

Following validation methods have been applied:

- completeness of the documentation
- examination of the operating manual
- software design review
- review of software documentation
- identification of the software

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

**CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY**

4.2 Statement regarding the usage of logos in test reports

The accreditation and notification body logos displayed in this test report are only valid for standards listed in the accreditation or notification scope of CSA Group Bayern GmbH.

4.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Exceptions are described in the detailed test conditions.

Temperature: 21 - 25 °C

Humidity: 30 - 60 %

Atmospheric pressure: 86 - 106 kPa

The environmental conditions are recorded by data logger in the test locations.
All data loggers used are regularly calibrated and verified.

4.4 Statement of the measurement uncertainty

The uncertainty is the standard deviation multiplied by the coverage factor $k = 2$, which gives a level of confidence of approximately 95 %.

The standard deviation was calculated from the contribution of uncertainties originating from the measurement standards, calibration methods and from any short-term contribution of the equipment under test, in accordance with the "Guide to Uncertainty in measurement".

The measurement uncertainty is documented in the quality system according to EIN EN ISO/IEC 17025.

Measurement uncertainty with LED (k = 2) = 0.029 %

4.5 Conformity Decision Rule

The conformity decision rule is based on the ILAC G8 published at the time of reporting.

5 TEST CONDITIONS AND RESULTS

5.1 Checklists to support the selection of the appropriate requirements

The first checklist supports the user to decide which of basic configuration P or U applies for the instrument under test.

| Decision on Instrument Type | | | |
|-----------------------------|--|---|---------|
| | | P | Remarks |
| 1 | Is the entire application software constructed for the measuring purpose? | Y | |
| 2 | Are the requirements for the inclusion of an operating system or subsystems of it fulfilled? | N | |
| 3 | Is the user prevented from accessing the operating system if it is possible to switch to an operating mode not subject to legal control? | Y | |
| 4 | Are the implemented programs and the software environment invariable (apart from updates)? | Y | |
| 5 | Are there any means for programming? | N | |

If and only if all answers to the 5 questions can be given as in the (P) column, then the requirements of the part P (Chapter 0) apply. In all other cases the requirements of the part U (Chapter 5) are necessarily to apply.

The second checklist supports to decide which of the IT configuration applies for the instrument under test.

| Decision on Required Extensions | | | | | |
|---|---|-----|----|----------------|--|
| Req. Extension | | Yes | No | Not applicable | Remarks |
| L | Does the device have the ability to store the measurement data either on an integrated storage or on a storage of universal computer or on a remote or removable storage? | X | | | The legal relevant energy register will be store on the integrated storage |
| T | Is measurement data transmitted via communication networks to a distant device where it is further processed and/or used for legally relevant purposes? | X | | | |
| S | Are there software parts with functions not subject to legal control AND are these software parts desired to be changed after type approval? | | X | | |
| D | Is loading of software possible or desired after putting the measuring instrument into use? | | X | | |
| Questions answered with YES are part of the examination and has to be considered. | | | | | |

5.2 Specific checklists for the respective technical parts

5.2.1 Checklist of basic requirements for type P instrument

| Requirement | Fulfilled | Not fulfilled | Not applicable | Remarks |
|--|-----------|---------------|----------------|--|
| Documentation Does the required manufacturer documentation fulfil the requirement P1 (a-f)? | X | | | |
| a) Description of the legally relevant software | X | | | D_WM3M4_technical description, Chapter 4 |
| b) Description of the accuracy of the measuring algorithms (e.g. price calculation and rounding algorithms) | | | X | Measuring algorithm STM32L073 |
| P1 c) Description of the user interface, menus and dialogues | X | | | D_WM3M4_technical description, Chapter 4 MiQen setting K_WM3M4_EN_22433922_Users_manual_Chapter 4, K_WM3M4_DE_22433922_Benutzerhandbuch_Ver_1.07.pdf |
| d) Software identifier(s) of the legally relevant software | X | | | D_WM3M4_technical description, Chapter 4, 5.1, K_WM3M4_DE_22433922_Benutzerhandbuch_Ver_1.07.pdf |
| e) Overview of the system hardware, e.g. topology block diagram, type of computer(s), type of network | X | | | D_WM3M4_EN_22433922_TEHNICNI_OPIS_Ver_1.03.pdf |
| f) Operating manual | X | | | K_WM3M4_EN_22433922_Users_manual_Ver_1.07.pdf |
| Software identification The legally relevant software shall be clearly identified. The identifier(s) shall be permanently presented by the instrument or presented on command or during operation. | X | | | A checksum with a CRC-32 algorithm is generated from the entire flash contents (WM3M4C has 128K flash) each time the instrument is run. CRC is calculated also for separate phase measuring modules. They can be read via communication and are displayed on LCD at start up of the meter. They can be displayed on LCD for a specified period also using MODBUS command. Only one software part is available. |
| P2 1.) Legally relevant software identifiers may be independent or part of well-structured identifiers. In the second case, the legally relevant software identifier(s) shall be clearly distinguishable. | X | | | |
| 2.) If different software versions are valid | X | | | |

| | | | | |
|---|--|--|---|--------------------------------------|
| implementations of the same type (e.g., for instruments in risk class B), then the legally relevant software identifier(s) shall be unique for each version | | | | |
| 3.) The legally relevant software identifiers are considered to be type-specific parameters. If the identifier is inextricably linked to the software itself, the securing means for software apply (see P5 and P6). If not, other securing means are required. | | | X | Only one software part is available. |
| 4.) The legally relevant software identifiers shall be easily presented without requiring an additional tool. | | | X | |

| Requirement | Fulfilled | Not fulfilled | Not applicable | Remarks |
|--|-----------|---------------|----------------|--|
| Influence via user interfaces Commands entered via the user interface shall not inadmissibly influence the legally relevant software, devicespecific parameters and measurement data. | | | X | No user interface available |
| | | | | |
| | | | | |
| | | | | |
| Influence via communication interfaces Commands inputted via communication interfaces of the instrument shall not inadmissibly influence the legally relevant software, device-specific parameters and measurement data. | X | | | Two interfaces: RS-485 interface on the terminal block and the optical interface on the right side. There are no commands that influence to device specific parameters and measurement data. Parameter: WM3M4__A.pdf, WM3M4C_F.pdf |
| | X | | | Parameter: WM3M4__A.pdf, WM3M4C_F.pdf |
| | X | | | |
| | X | | | |

| | | | | | |
|----|--|---|--|---|--|
| | 4.) Interfaces that allow commands with inadmissible effects on the legally relevant software, device-specific parameters and measurement data shall be sealed or protected in another appropriate way. This also applies for interfaces that cannot be completely assessed. | | | X | |
| | 5.) This special requirement does not apply to software download according to Extension D. | | | X | no software download possible |
| P5 | Protection against accidental or unintentional changes Legally relevant software and device-specific parameters shall be protected against accidental or unintentional changes | X | | | A checksum with a CRC-32 algorithm is generated from the entire flash contents (WM3M4C has 128K flash) each time the instrument is run. CRC is calculated also for separate phase measuring modules. They can be read via communication and are displayed on LCD at start up of the meter. They can be displayed on LCD for a specified period also using MODBUS command. D_WM3M4_EN_22433922_TEHNICNI_OPIS_Ver_1.03.pdf, items 5.1, D_WM3M4_EN_22433922_TEHNICNI_OPIS_Ver_1.06.pdf, items 5.1 |
| | 1.) The software shall be capable to detect changes caused by physical effects (electromagnetic interference, temperature, vibration, etc). | X | | | |
| | 2.) Means shall be implemented to protect from unintentional misuse of the user interfaces. | X | | | |

| Requirement | Fulfilled | Not fulfilled | Not applicable | Remarks |
|--|-----------|---------------|----------------|--|
| P6 Protection against inadmissible intentional changes Legally relevant software shall be secured against the inadmissible modification, loading or swapping of hardware memory. | X | | | D_WM3M4_technical description, Chapter 4.6.1 , 5.1 |
| 1.) Instrument without interface: Manipulation of program code could be possible by manipulating the physical memory, i.e. the memory is physically removed and substituted by one containing fraudulent software or data. To prevent this happening, either the housing of the instrument should be secured or the physical | | | X | |

| | | | | | |
|----|---|---|--|---|---|
| | memory itself is secured against unauthorised removal. | | | | |
| | 2.) Instrument with interface: The interface shall include only functions, which are subject to examination. All functions in the interface shall be subject to examination (see P4). Where the interface is to be used for software download, extension D must be complied with. | X | | | |
| | 3.) Data are considered to be sufficiently protected if only legally relevant software processes them. If legally non-relevant Software is intended to be changed after approval, requirements of extension S have to be followed. | X | | | Only one software part. Legal relevant |
| | 4.) A checksum or an alternative method with the same level of requirements shall be provided in order to support the detection of software modifications. | X | | | Checksum main processor Register: HIGH 30081, LOW 30097 : EEC6 6478 Checksum measuring modules Register: 30087, 30088, 30089: B5E6 |
| | 5. The calculated checksum or an alternative indication of software modification shall be made visible on command for control purposes | | | | The checksums are displayed on the meter display during the start sequence or using MODBUS command. |
| | 6. The checksum or the alternative indication is calculated over the legally relevant software. The software that organizes the generation of checksums or alternative indications is part of the legally relevant software. | | | | Only one software part is available. |
| P7 | Parameter protection Parameters that fix legally relevant characteristics of the measuring instrument shall be secured against unauthorised modification. | X | | | D_WM3M4_technical description, Chapter 4, 5.1 |
| | 1.) Type specific parameters are identical for each specimen of the type and are in general part of the program code. Therefore, requirement P6 applies to them. | X | | | |
| | 2.) Device specific secured parameters may be changed using an on-board keypad or switches or via interfaces, but only before they have been secured. | | | X | |
| | 3.) Settable device-specific parameters may be changed after securing. | X | | | |

5.2.2 Extension L: Long-term storage of measurement data

| Technical configurations for long-term storage | Applies (Y / N) |
|--|-----------------|
| A) Integrated storage Simple instrument, built-for-purpose, no externally usable tools or means available for editing or changing data, integrated storage for measurement data or parameters, e.g. RAM, flash memory, hard disk. | Y |
| B) Storage for universal computer Universal computer, graphical user interface, multitasking operating system, tasks subject to legal control and not subject to legal control exist in parallel, storage can be removed from the device or contents can be copied anywhere inside or outside the computer. | N |
| C) Removable or remote (external) storage | N |

| | |
|---|--|
| Arbitrary basic instrument (built-for-purpose instrument or instrument using universal computer), storage can be taken from the instrument. These can be, for example, USB stick, flash cards, or remote databases connected via network. | |
|---|--|

| Requirement | | Fulfilled | Not fulfilled | Not applicable | Remarks |
|-------------|---|-----------|---------------|----------------|---|
| L1 | Completeness of measurement data stored The measurement data stored must contain all relevant information necessary to reconstruct an earlier measurement. | X | | | are applicable for storage of measurement data. The measurement data are stored with the appropriate resolution and units. MODBUS table, D_WM3M4_technical description, item 4.3., 4.6 |
| | 1.) The stored measurement data may be needed for reference at a later date e.g. for checking invoices. All data necessary for legal and metrological reasons shall be stored together with the measurement value. | X | | | |
| L2 | Protection against accidental or unintentional changes Stored data shall be protected against accidental and unintentional changes. | X | | | The unintentional changes or deletion of measurement data is protected by algorithm. Additional protection for correct data storage with CRC calculation D_WM3M4_technical description, item 4.3. |
| | 1.) Accidental changes of data can be caused by physical effects. | | | X | |
| | 2.) Unintentional changes are caused by the user of the device. Data housekeeping duties may require data belonging to paid-up or time-expired invoices to be deleted from time-to-time. Automatic or semi-automatic means should be used to ensure that only specified data is deleted and that the accidental deletion of "live" data is avoided. This is particularly important on networked systems and remote or removable storage where users might not realise the significance of the data. | | | X | |
| | 3.) A checksum shall be calculated by the receiver and compared with the attached nominal value. If the values match, the data set is valid and may be used; otherwise it must be deleted or marked invalid. | | | X | |

| Requirement | Fulfilled | Not fulfilled | Not applicable | Remarks |
|-------------|--|---------------|----------------|--|
| L3 | Integrity of data The measurement data stored must be protected against intentional changes. | X | | |
| | 1.) This requirement applies to all types of storages except integrated storages. | X | | Integrated storage |
| | 2.) The protection must apply against intentional changes carried out by simple common software tools. | | | X |
| | 3.) Simple common software tools are understood as tools, which are easily available and manageable as e.g. office packages. | | | X |
| L4 | Traceability of stored measurement data The measurement data stored must be capable of being authentically traced back to the measurement that generated them. | X | | The CRC calculation is generated over the entire data set during reading and writing to EEPROM. |
| | 1.) The authenticity of measurement data may be needed for reference at a later date, e.g., for checking invoices. | X | | X |
| | 2.) Authenticity requires the correct assignment (linking) of measurement data to the measurement that has generated the data. | X | | |
| | 3.) Authenticity presupposes an identification of data sets. | | | X |
| | 4.) Ensuring authenticity does not necessarily require an encryption of the data. | X | | |
| L5 | Confidentiality of keys Keys and accompanying data must be treated as legally relevant data and must be kept secret and be protected against compromise by software tools. | X | | Cryptographic functions on WM3M4 are performed with HW based secure element: Type: ATECC608A Manufacturer: Microchip Cryptographic standard: ECDSA: FIPS186-3 Elliptic Curve Digital Signature Cryptographic functions: Hardware based asymmetric sign, verify, key generation, Internal high-quality FIPS 800-90 A/B/C Random Number Generator (RNG)Energy counter crypto functions_v8.pdf, WM3M4C cryptographic description_v1.pdf |
| | 1.) This requirement only applies if a secret key is used. | X | | This is one-time procedure made at production of energy meter. Generation of key pair is HW based with dedicated crypto chip. Private key is stored internally within the crypto chip and there is no way of reading it. |
| | 2.) This requirement applies to measurement data storage, which are external from the measuring instrument or realised on universal computers. | | | X |

| | | | | | |
|--|---|---|--|---|--|
| | 3.) The protection must apply against intentional changes carried out by common simple software tools. | | | X | |
| | 4.) If the access to the secret keys is prevented, e.g., by sealing the housing of a built for purpose device, no additional software protection means are necessary. | X | | | The secret key is stored in a hardware part which is physically sealed. The software does not offer any features to view or edit these data. |

| Requirement | Fulfilled | Not fulfilled | Not applicable | Remarks | |
|--|-----------|---------------|----------------|---|--|
| L6 Retrieval of stored data The software used for verifying measurement data sets stored shall display or print the data, check the data for changes, and warn if a change has occurred. Data that are detected as having been corrupted must not be used. | X | | | Redundant storage location used for the case of corrupted data. D_WM3M4_technical description, item 4.3. The transparency software is not part of this certification process. | |
| | X | | | | |
| | X | | | | |
| | X | | | | |
| | | | | X | The transparency software is not part of this certification process. |
| | | | | X | |
| L7 Automatic storing The measurement data must be stored automatically when the measurement is concluded. | X | | | The measurement data is stored in EEPROM each 5 minutes at charging or 60 minutes when idle or when supply voltage drops below 2.8V. Energy meter has Modbus registers to store users billing dataset. Main EV charger SW must write billing dataset to energy meter. Energy meter will fill in measured energy and timestamp to complete billing information. Billing dataset is compatible with OCMF 1.0. JSON and binary format is supported. To each start and stop transaction of an charging process a legal relevant dataset will be generated. | |
| | X | | | | |
| | | | | X | |

| | | | | | |
|--|--|---|--|--|--|
| | measurements that will not be stored (for example during loading or before the quantity of product requested is on the load receptor). However, even in this case, the result will be stored automatically when the operator accepts the result. | | | | |
| | 3.) For the case of full storage, refer to requirement L8. | X | | | |

| Requirement | | Fulfilled | Not fulfilled | Not applicable | Remarks |
|-------------|--|-----------|---------------|----------------|---|
| L8 | Storage capacity and continuity The long-term storage must have a capacity which is sufficient for the intended purpose. | X | | | The billing charging datasheet will send as soon as possible to the backend system. |
| | 1.) When a storage is full or removed/disconnected from the instrument, a warning shall be given to the operator. A warning is not necessary, if it is assured by construction that only outdated data can be overwritten. For further necessary actions refer to the measuring instrument-specific requirements (Extension I). | | | X | In terms of the use in a charging station, the assessment lies by the notify body for charging station. |
| | 2.) The regulation concerning the minimum period for storing measurement data is beyond the scope of this requirement and is left to national regulations. It is the responsibility of the owner to have an instrument with sufficient storage capacity to fulfil the requirements applicable to his activity. The notified body for EC type examination will check only that the data are stored and retrieved correctly and whether new transactions are inhibited when the storage is full. | | | X | |
| | 3.) It is also beyond the scope of this requirement to require certain inscriptions on the device as concerning the capacity of the storage the capacity or other accompanying information that allow calculating the capacity. However, the manufacturer shall make available the information on the capacity. | | | X | |

5.2.3 Extension T: Transmission of measurement data via communication networks

| Technical description of communication networks | Applies (Y / N) |
|---|-----------------|
| A) Only a fixed number of participants with clear identity, functionality and location are connected. All devices in the network are subject to legal control. | N |
| B) Arbitrary participants (devices with arbitrary functions) can be connected to the network. The identity and functionality of a participating device and its location may be unknown to other participants. Any network that contains legally controlled devices with infrared or wireless network communications interfaces shall be considered to be an open network. | Y |

| Requirement | Fulfilled | Not fulfilled | Not applicable | Remarks |
|-------------|-----------|---------------|----------------|---|
| T1 | | | X | Completeness of transmitted data The transmitted data must contain all relevant information necessary to present or further process the measurement result in the receiving unit. |
| | | | | 1.) The metrological part of a transmitted data set comprises one or more measurement values with correct resolution, the legally correct unit of measure and depending on the application the unit price or the price to pay and the place of the measurement. |
| T2 | X | | | After completing billing dataset, meter calculates hash of complete message with SHA-256 algorithm documented in the following site: http://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.180-4.pdf . Hash is 32 bytes long identification of message and is used as an input for signature generation. |
| T3 | X | | | Integrity of data The legally relevant transmitted data must be protected against intentional changes with software tools. Signing of previously prepared hash is cryptographic procedure with ECDSA NIST P256 prime curve. Crypto chip generates signature in less than a second. Algorithm is documented in: FIPS 186-4 specification http://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.186-4.pdf |
| | X | | | 1.) This requirement only applies to open networks, not to closed networks. |
| | X | | | 2.) The protection shall apply against intentional changes carried out by easily available and manageable software tools. |
| | X | | | 3.) The protection shall also apply against intentional changes carried out by special sophisticated software tools |
| | | | | will use in an open network |

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

| Requirement | Fulfilled | Not fulfilled | Not applicable | Remarks |
|--|-----------|---------------|----------------|--|
| Authenticity of transmitted data This requirement only applies to open networks, not to closed networks. | | | X | The Display- or Transparency software is not part of this certification process. |
| | | | X | Each data set has a sequential identification number. OCMF: Key: PG |
| | | | X | signature |
| | | | X | Each data set contains information about the origin of the measurement data OCMF: Key: MV: manufacturer OCMF: Key: MM: Modell identification OCMF: Key: MS: Meter serial number |
| | | | X | The Display- or Transparency software is not part of this certification process. |
| Confidentiality of keys Keys and accompanying data must be treated as legally relevant data and must be kept secret and be protected against compromise by software tools. | X | | | The secret key is stored in a hardware part which is physically sealed. The software does not offer any features to view or edit these data. |
| | X | | | |
| | X | | | |
| | X | | | The housing of the meter is sealed |
| Handling of corrupted data Data that are detected as having been corrupted must not be used. | | | X | The Display- or Transparency software is not part of this certification process |
| | | | X | |
| T7 Transmission delay | | | X | This is not part of this evaluation |

| | | | | | |
|--|---|--|--|---|--|
| | The measurement must not be inadmissibly influenced by a transmission delay. | | | | |
| | 1.) The manufacturer shall investigate the timing of the data transmission and shall guarantee that under worst case conditions the measurement is not inadmissibly influenced. | | | X | |

| Requirement | | Fulfilled | Not fulfilled | Not applicable | Remarks |
|-------------|---|-----------|---------------|----------------|--|
| T8 | Availability of transmission services If network services become unavailable, no measurement data must get lost. | X | | | Meter does not have network connection, only RS485 communication. EV charger controller unit is responsible for storing data. Meter is storing only data of last charging. When new charging starts, old data is deleted. New charging can be started only via communication if the previous charging was stopped. |
| | 1.) The user of the measuring system must not be able to corrupt measurement data by suppressing transmission. | X | | | |
| | 2.) Transmission disturbances happen accidentally and cannot be excluded. The sending device must be able to handle this situation. | X | | | |
| | 3.) The reaction of the instrument if transmission services become unavailable depends on the measuring principle (see Part I). | X | | | |

5.3 Checklist for specific software requirements (Active electrical energy meters)

| Requirement | | Fulfilled | Not fulfilled | Not applicable | Remarks |
|-------------|--|-----------|---------------|----------------|--|
| I3-1 | Fault Recovery The software shall recover from a disturbance to normal processing. | X | | | A hardware watchdog is reset by cyclically processed microprocessor subroutine in order to inhibit the firing of the watchdog. If any function has not been processed or in the worst case –the microprocessor hangs in an arbitrary endless loop, the watchdog resets the microprocessor. |

| | | | | | |
|------|---|---|--|---|---|
| I3-2 | Back-up Facilities There shall be a facility that provides for the periodic back-up of legally relevant data, such as measurement values, and the current status of the process in case of a disturbance. This data shall be stored in non-volatile storage. | X | | | Energy registers are periodically saved in EEPROM every 5 minutes during charging event or every 60 minutes on standby to maintain back-up values in case of watchdog activation. During the saving procedure in EEPROM CRC is calculated over the stored data and for storage 3 locations are provided using FIFO system. CRC is checked at reading from EEPROM. In case of one corrupted set the previous stored data are used. |
| | 1.) If the back-up facility is used for fault recovery, the minimum interval has to be calculated to ensure the critical change value is not exceeded. | X | | | |
| I3-3 | MI-003, 5.2 (indication suitability) The display of the total energy shall have a sufficient number of digits to ensure that when the meter is operated for 4000 hours at full load ($I = I_{max}$, $U = U_n$ and $PF = 1$) the indication does not return to its initial value. | | | X | This is not part of this evaluation |

| Requirement | | Fulfilled | Not fulfilled | Not applicable | Remarks |
|-------------|---|-----------|---------------|----------------|---|
| I3-4 | MID-Annex I, 8.5 (Inhibit resetting of cumulative measurement values) For utility measuring instruments the display of the total quantity supplied or the displays from which the total quantity supplied can be derived, whole or partial reference to which is the basis for payment, shall not be able to be reset during use. | | | X | This is not part of this evaluation |
| | 1.) Cumulative registers of a measuring instrument may be reset prior to being put into use. | | | | |
| I3-5 | Dynamic behaviour The legally non-relevant software shall not adversely influence the dynamic behaviour of a measuring process. | X | | | The interrupt hierarchy is designed in a way that avoids adverse influences. Measures are taken that interrupts don't influence either metering process or saving the metering registers to EEPROM. Interrupts for energy registration have the first priority. |
| | 1.) This requirement applies in addition to S-1, S-2 and S-3 if software separation has been realised in accordance with extension S. | | | | |
| | 2.) The additional requirement ensures that for real time applications of meters the dynamic behaviour of the legally relevant software is not inadmissibly influenced by legally non-relevant software, i.e. the resources of the legally | | | | |

| | | | | | |
|------|--|--|--|---|--|
| | relevant software are not inadmissibly reduced by the non-legal part. | | | | |
| I3-6 | Imprinted Software Identification The software identification is usually presented on a display. As an exception for active electrical energy meters, an imprint of the software identification on the name plate of an instrument shall be an acceptable solution if the following conditions A, B and C are fulfilled: | | | X | |
| | A.) The user interface does not have any control capability to activate the indication of the software identification on the display or the display does not allow technically showing the identification of the software (mechanical counter). | | | X | |
| | B.) The instrument does not have any interface to communicate the software identification. | | | X | |
| | C.) After production of a meter a change of the software is not possible or only possible if also the hardware or a hardware part is changed. | | | X | |