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Conformance Test

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Data Link Layer

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Release

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1 Scope

The present document is part of the Conformance Test Specification used for certification of equipment according to the Open Metering System (OMS) specification.

This issue is applicable only together with [OMSCT-GEN].

- 5 This document specifies the tests to show conformance for the Data Link layer.

The parameters to be tested, and the test limits are based on OMS Specification Volume 2, Primary Communication [OMS-S2], section 4, Physical Layer, section 5, Data Link Layer, section 6, Authentication and Fragmentation Layer, section 7, Transport Layer, and the referenced Wireless M-Bus specification [EN 13757-4].

- 10 Note: This version of test specification does not cover all items of the current OMS Specification.

It is not the scope of this document to show conformance to the essential requirements of the R&TTE directive (1999/5/EC), Radio Equipment Directive 2014/53/EU (RED), or other national or international standards.

15

2 References

The references used are listed in [OMSCT-GEN].

3 Definitions, Symbols and Abbreviations

The term definitions, symbols and abbreviations used are defined in [OMSCT-GEN] (OMS Open Metering System – Conformance Test Volume 1 – General Part).

5

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Part 1:

Wireless M-Bus (wMBus)

4 Test Item

All tests shall be done in a low collision scenario. Transmissions of other devices than the DUT shall be less than 2 % channel occupation.

4.1 [T31-MAC1] MAC Test

5 The following items shall be tested:

- L-Field
- CRC
- Channel coding
- Bit Order
- 10 • Frame Format and Synchronization sequence
 - It shall be verified if the DUT is supporting the Frame Format A conform to [EN-13757-4:2019].
 - If the device does not support Frame Format A this test shall be failed.
 - If the device sends only one Frame Format B the test shall be failed.
 - 15 ○ Otherwise this test is passed.

- Preamble length
 - Mode T1, T2, S1, C1 and C2: short and long preamble
 - Mode S2: long preamble
- 20 • Preamble Pattern
 - It shall be verified if the DUT is supporting the Preamble Pattern “0101”.
 - Preamble Pattern “1010” is not accepted therefore datagrams with this pattern will not be received and therefore not used for further tests

25 All items shall be conforming to [EN 13757-4].

4.2 [T31-ADR1] Address Structure

Applies to: unidirectional meter, bidirectional meter, unidirectional repeater, GW

It shall be verified that the address of the Link Layer is compliant with the requirements given in Table 1:

5

Table 1: Valid range for parts of Link Layer meter address¹

Byte number	Content	remark
Byte 1..2	Manufacturer	Binary (binary coded 3-Letter Manufacture ID as listed by the Flag association) ²
Byte 3..6	Ident number	BCD only (from 00000001 to 99999999)
Byte 7	Version	Binary (from 00h to FEh)
Byte 8	Device type	Binary (all values from [EN 13757-3] Table 3 and [OMS-S2] Table 10)

4.3 [T31-C1] Supported C-Fields

Applies to: unidirectional meter, bidirectional meter

The devices shall support C-field 44h.

10 If installation datagrams are supported (see [OMSCT-ManDec]) C-Field 46h shall be used to transmit installation datagrams.

All C-Fields shall be used only in context with message types according [OMS-S2] Table 12 and Table 13.

4.4 [T31-DC1] Duty Cycle

Applies to: unidirectional meter

15 The duty cycle, as defined in [EN 300 220-1] subclause 5.4, shall comply with the following limits:

S1 mode (meter): Maximum 0,02 %

S2 mode (other): Maximum 1 %

T1 mode (meter): Maximum 0,1 %

20 T2 mode (other): Maximum 1 %

C1 mode (meter): Maximum 0,1 %

C2 mode (other): Maximum 10 %

The Duty Cycle of the meter shall be observed over a period of exact 1 h.

The Time Period shall be started with a datagram transmission.

25 The datagram length determination shall include preamble, coded message part and checksum's of all datagrams within the observation period.

¹ The content is in different sequence as in [T41-AD1] of [OMSCT-APL]

² The manufacturer shall be listed in [FLAG]. The three letters of the Manufacturer ID can be derived by calculation given in [EN13757-7] clause 7.5.2.

4.5 Transmission Intervals of Meters

4.5.1 [T31-TIM1] Data Datagram

Obsolete, used in earlier OMS-CT generations.

It shall be verified by using a sniffer tool that:

- 5 ▪ the DUT sends meter data (C-field = 44h) at least every {7,5, 30 or 240} minutes (depending on media) (refer to [OMS-S2], Tab 1)
- The maximum tolerance of 10 received individual transmissions are $\leq 40\%$ of the stated transmission interval (refer to [OMSCT-ManDec]):

$$\frac{MAX(T_{-1}..T_{-9}) - MIN(T_1..T_9)}{T_{-set}} \leq 40\%$$

- 10 • The typical tolerance of 10 received individual transmissions is $\geq 1\%$ of the stated transmission interval (refer to [OMSCT-ManDec]):

$$\frac{\sum_{i=1}^9 T_i}{9} * \frac{1}{T_{-set}} \geq 1\%$$

- The standard deviation of 10 received individual transmissions is $\geq 12\%$ of the stated transmission interval (refer to [OMSCT-ManDec]):

$$15 \quad StdDev(T_{-1}..T_{-n}) * \frac{1}{0,2 * T_{-set}} \geq 12\%$$

Abbreviation's for all calculations of [T31-TIM1]:

T_{-set}: stated transmission interval in [OMSCT-ManDec]

T_{-n}: measured transmission interval (n= 1...9)
 (over 10 transmissions)

StdDev: standard deviation

MIN: minimal value

MAX: maximal value

4.5.2 [T31-TIM2a] Installation Datagram

25 **Applies to: unidirectional meter, bidirectional meter**

Reference:

- [OMS-S2] subclause 4.3.2.3
- [CEN/TR 17167] Annex E
- [EN 13757-4:2019] subclause 12.6.1

- 30 ▪ The manufacturer has to define whether the DUT transmit installation datagrams or not [OMSCT-ManDec] and how to start the transmission of installation datagrams
- Initialize DUT and set it to begin with transmissions

It shall be verified by using a sniffer tool that:

- the DUT transmits at least 6 installation datagrams (C-field = 46h) with an interval of 30 to 60 seconds
- transmit of installation datagrams stopping not later than 60 minutes after the manual start event
- installation datagrams shall be transmitted asynchronous
- the configuration field shall be set to static message ([OMS-S2] ch.7.2.4.6 Tab.22.) if the installation datagram contains fixed data for meter management. [EN 13757-3:2018] Annex H.3)

Otherwise → ERROR

The verifying has to be performed if no installations datagrams declared by manufacturer although the device transmits those. The information has to be notified in the test report.

4.5.3[T31-TIM3a] Synchronous Transmission

Applies to: unidirectional meter, bidirectional meter

Reference:

- [OMS-S2] subclause 4.2.3.1
- [EN 13757-4] subclause 12.6.2

Test of Manufacturer Declaration:

- t_{NOM} must be defined by manufacturer (in Manufacturer Declaration)
- t_{NOM} must be $N \times 2$ seconds with $N > 1$ and

Table 2: Maximal transmission period per mode

Mode	max t_{NOM}
S-Mode	90 min
T-Mode	15 min
C-Mode	15 min

- Min and max test-temperatures are the operation temperatures, and must be declared in the RED test report.
- For device types 04h (heat), 05h (steam), and 0Ch (heat, volume measured at flow temperature inlet) the manufacturer must state whether the device is used for “district heating” or “sub metering”. Depending on this information the maximum average update interval is set.

The following steps shall be run through for the test:

1. Initialize DUT and set it to begin with transmissions
2. Place DUT in temperature chamber. Set start-temperature to 20 °C.
3. Wait until temperature in chamber has stabilized.
4. Set Ident. No., manufacturer, version, and device type of DUT in test-tool. Using this information the test-tool shall only monitor the DUT. Other devices shall not be monitored.

5. Start the test-tool and monitor the transmissions for at least 24 hours.
 - Accept only devices with the defined identification and message types SND_NR (44h), ACC-DMD³ (48h) or ACC-NR (47h)
 - Transmissions must be monitored with a time-resolution of 1 ms or better.
 - Deviation of the time of the test-system compared to world-time must not exceed 0.1 s over 24 h.
6. During test, cool and heat the DUT using the following ramp:

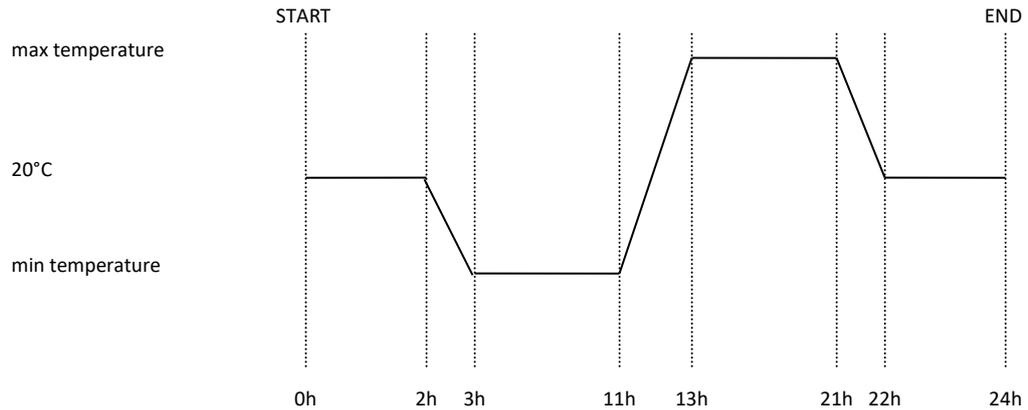


Figure 1 – Temperature profile during testing

Min and max temperatures are taken from the RED report.

Keep relative humidity below 10 %.

7. After monitoring, analyse received transmissions:
 - a. Check the allowed tolerance by the following scheme over the observation period (informative – not relevant for approval):

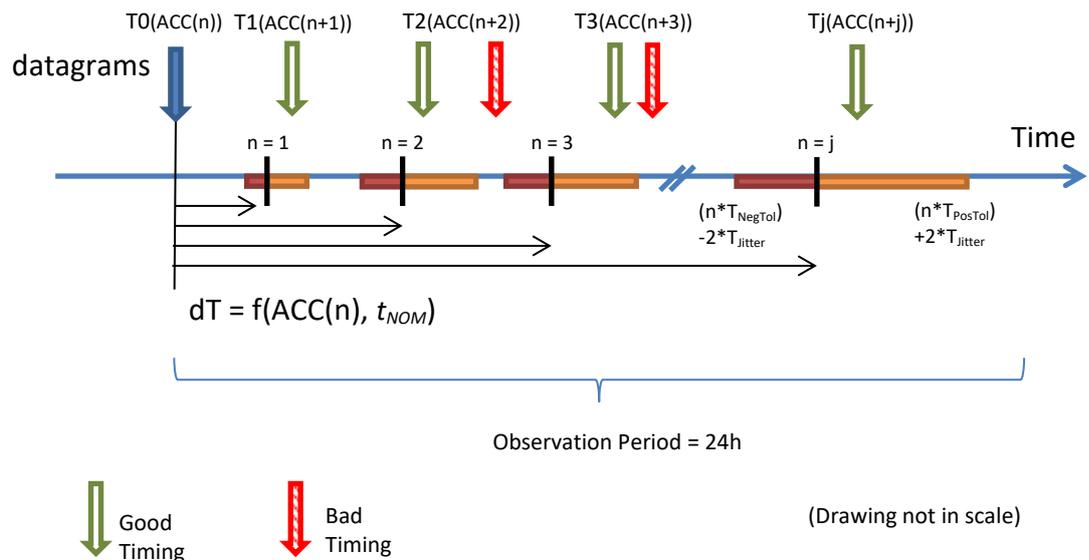


Figure 2 – Allowed tolerances over the observation period

³ ACC-DMD can only be used for bidirectional devices

The time between synchronous transmissions with set S-bit in configuration Field shall be:

$$t_{TX}(n+1) = t_{TX}(n) + t_{ACC}(n+1)$$

$$t_{ACC}(n+1) = (1 + (|ACC(n)-128| - 64) / 2048) \times t_{NOM}$$

The tolerance for t_{TX} must be

- $t_{PosTol} = +130$ ppm
 $t_{NegTol} = -50$ ppm
 for meters operating in the temperature range $-15 \dots +65$ °C
- $t_{PosTol} = +250$ ppm
 $t_{NegTol} = -50$ ppm
 for all other meters

The tolerance is accumulated over the observation period.

The t_{PosTol} , t_{NegTol} shall be in tolerance for two following transmissions.

The operating temperature is taken from the test report according to [EN 300 220-2].

The additional jitter for t_{TX} must be:

- non accumulative
- $t_{Jitter} = +/-1$ ms for $t_{NOM} < 300$ sec
- $t_{Jitter} = +/-3$ ms otherwise

- b. Check the tolerances between adjacent transmissions using the tolerances described above.

If time-interval is out of tolerance → ERROR

- c. Check whether for every synchronous transmission the access counter has been incremented by one.
 Otherwise → ERROR

If a synchronous transmission is omitted by the device under test or missed by the sniffer tool, then the access counter must be incremented by one as if the transmission had occurred.

- d. If the OMS-CT Tool detects asynchronous transmissions (S-bit not set in configuration field) then:

Confirm that asynchronous transmissions do not alter the access counter.
 Otherwise → ERROR

- e. Check whether the rate of omitted synchronous transmissions over a (sliding) 24 hour period does not exceed 6.25 %.
 Otherwise → ERROR

During test no other transmitters shall interfere with the test condition.

- f. Check whether a synchronous transmission with message type SND-NR is transmitted in a time-interval less or equal to T_{update} (depending on metering media, see Table 3)
 Otherwise → ERROR

g. If synchronous transmissions with message types ACC-NR (or ACC-DMD) are transmitted in between of synchronous transmissions with message type SND-NR then:

- Count the number of transmissions with types ACC-NR (or ACC-DMD) that are transmitted in between of synchronous transmissions with message type SND-NR.
- Check whether the ratio n/1 for ACC-NR (or ACC-DMD) to SND-NR datagrams does not change and is within 0/1 to 15/1. Otherwise → ERROR

Table 3: Update interval of consumption data for different media

Metering media	Media number	Average update interval maximum [min], T _{update}
Electricity	02h	7,5
Gas	03h	30,0
Heat (district heating)	04h, 05h, 0Ch	30,0
Water / Warm water	06h, 07h, 15h, 16h, 17h	240,0
Heat cost allocators	08h	240,0
Heat / Cold (sub metering)	04h, 05h, 0Ah, 0Bh, 0Ch, 0Dh	240,0
Repeater	32h	240,0

4.5.4[T31-TIM4a] Transmission of Static Messages

Currently not applicable, prepared for future OMS-CT generations.

Reference:

- [OMS-S2], subclause 4.3.2.4

- The manufacturer has to define whether the DUT transmits static messages or not [OMSCT-ManDec]

If the manufacturer stated that static datagrams are used, then it shall be verified by using a sniffer tool that:

- the DUT transmit at least two static datagrams within a test period of 24 hours
- the DUT transmit not more than five static datagrams within a test period of 24 hours
- the DUT transmits the static datagrams in the timeslot of the synchronous transmission scheme
- the static messages are signalled by the configuration field according to [OMS-S2] subclause 7.2.4.6 Tab.22.

Otherwise → ERROR

If the manufacturer does not state that static datagrams are used, but static datagrams are received during the test, then the verifying and reporting has to be performed as if static datagrams had been stated by the manufacturer.

4.6 Access Number

4.6.1 [T31-ACN1] Access Number Meter Generic

Applies to: unidirectional meter, bidirectional meter

5 It shall be verified using a sniffer tool that the access number of at least 6 transmissions in a row of the device under test is incremented by 1 from one new synchronous transmission to the next.

It has to be verified that the Access Number is increased by at least one at least once in the visualisation interval given in [OMS-S2] Table 7.

10 It shall be verified using a sniffer tool that all SND-IR messages sent after a manual installation start event are using the same access number as used in the latest new datagram.

4.7 Extended Link Layer

4.7.1 [T31-ELL1] Extended Link Layer

15 In case the ELL is present at least in one transmission within the observation period, [T31-ELL2] to [T31-ELL4] shall be applied.

In case the ELL is never present in the transmissions within the observation period [T31-ELL2] to [T31-ELL4] shall be skipped.

4.7.2 [T31-ELL2] Consistency of ELL Usage

20 The CT Tool shall check for each transmission within the observation period if it contains an ELL.

The CT Tool shall test if the ELL is present in any (all) transmissions in the observation period. Otherwise the test shall fail.

4.7.3 [T31-ELL3] Structure of ELL

25 To test the validity of the ELL structure as defined in [OMS-S2] subclause 5.3.2 the tests in the flow chart shall be applied:

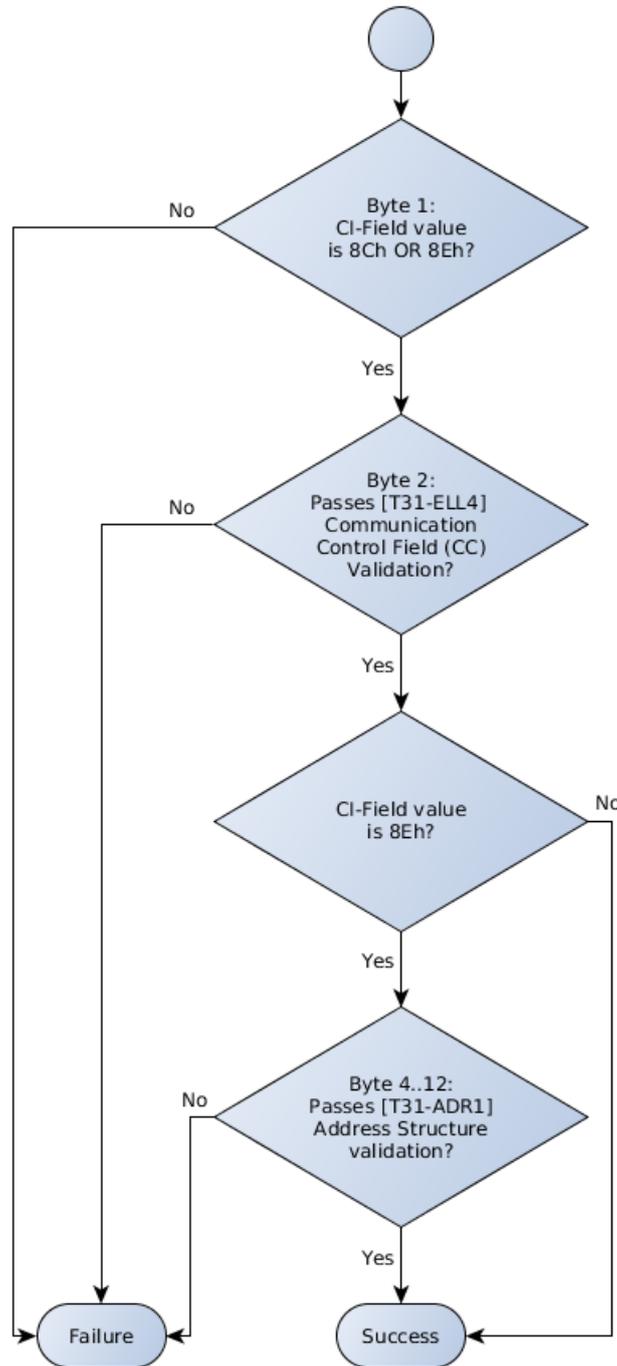


Figure 3 – Test for the validation of the ELL structure

4.7.4[T31-ELL4] Communication Control Field (CC)

The Communication Control Field (CC) shall be conforming to [OMS-S2] subclause 5.3.3 according to Table 4:

5

Table 4: Bit values of Communication Control Field (CC)

Bit Nr	Bit(s)	Description	Test specification
7	B	Bidirectional Communication	This bit shall always be 0b. ⁴
6	0	Delay	This bit shall always be 0b.
5	S	Synchronous	This bit shall be 0b or 1b
4	H	Hop Counter	This bit shall always be 0b ⁵
3	0	Priority	This bit shall always be 0b
2	A	Accessibility	This bit shall always be 0b ⁶
1	R	Repeated Access	This bit shall always be 0b ⁷
0	0	Reserved	This bit shall always be 0b

If at least one of the tests fails this test shall fail.

4.7.5[T31-ACN2] Access Number BiDi Meter

Applies to: bidirectional meter

10 It shall be verified using a packet generator generating messages of types SND-NKE, REQ-UD1 and REQ-UD2, that:

- 15
 - the device under test uses the access number in the TPL of the received message in its response, if an ELL exists ([OMS-S2] subclause 7.2.2.1).
 - the device under test ignores the second message of same type and access number that is sent by the packet generator less than 30 seconds after the first message of the same type and access number
 - the device under test responds to the second message of same type and access number that is sent by the packet generator more than 30 seconds after the first message of the same type and access number (and not other packets between sent by the packet generator)

20

⁴ Currently only unidirectional meters are tested.

⁵ The bit H is used as a Hop Counter to indicate a repeated transmission. The meter, actuator or gateway shall transmit bit H always with zero.

⁶ Currently only unidirectional meters are tested.

⁷ The bit R is reserved for use in repeated messages. The meter or actuator shall transmit bit R always with zero. A meter/actuator may ignore a received bit R.

4.7.6 [T31-SB1] Status Byte

Applies to: bidirectional meter

5 It shall be verified using a packet generator sending a message SND_UD with invalid application content, that the device under test responds with an ACK with a status byte with the bit “any application error” set.

It shall be verified by sending a message REQ_UD2 after receiving the ACK that the device under test then answers with RSP_UD containing data about the application error, CI-field 70h.

Appendix A: Applicable Test Cases of OMS-CT (Normative)

1. Test Cases of Wireless M-Bus Devices

Table 5: Test Cases related to DUT type

5

Test case	Description	UDM ¹⁾	BDM ²⁾	UDR ³⁾	GW ⁴⁾
[T31-MAC1]	MAC Test	X	X	X	X
[T31-FR1]	Frame Format	X	X	X	X
[T31-PR1]	Preamble	X	X	X	X
[T31-ADR1]	Address structure	X	X	X	X
[T31-C1]	Supported C fields	X	X		
[T31-DC1]	Duty Cycle	X			
[T31-TIM1]	Transmission intervals of meters: Data datagram				
[T31-TIM2a]	Transmission intervals of meters: Installation datagram	X	X		
[T31-TIM3a]	Transmission intervals of meters: Synchronous Transmission	X	X		
[T31-TIM4a]	Transmission of static messages				
[T31-ACN1]	Access number generic	X	X		X
[T31-ELL1]	Extended Link Layer	X	X		X
[T31-ELL2]	Extended Link Layer - Consistency	X	X		X
[T31-ELL3]	Extended Link Layer – Structure	X	X		X
[T31-ELL4]	Extended Link Layer – Control Field	X	X		X
[T31-ACN2]	Access number BiDi		X		
[T31-SB1]	Status Byte		X		
Note: X This Test case is mandatory 1) UDM = Unidirectional Meter 2) BDM = Bidirectional Meter 3) UDR = Unidirectional Repeater 4) GW = Gateway					