Smart meter requirements and tests in harmonized standards

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Contents

- Introduction
- Critical functions in smart metering
- Collected information from recommendations and some standards
- Some observations on lacking requirements
- Impact on future OIML recommendation development

My background

Expert on EM Fields and EMC since 1985

Involved in development of OIML D11

At present (since January 2009):

OIML secretary TC 8/SC 7 (gas metering)

OIML secretary TC 5/SC 1 (D11)

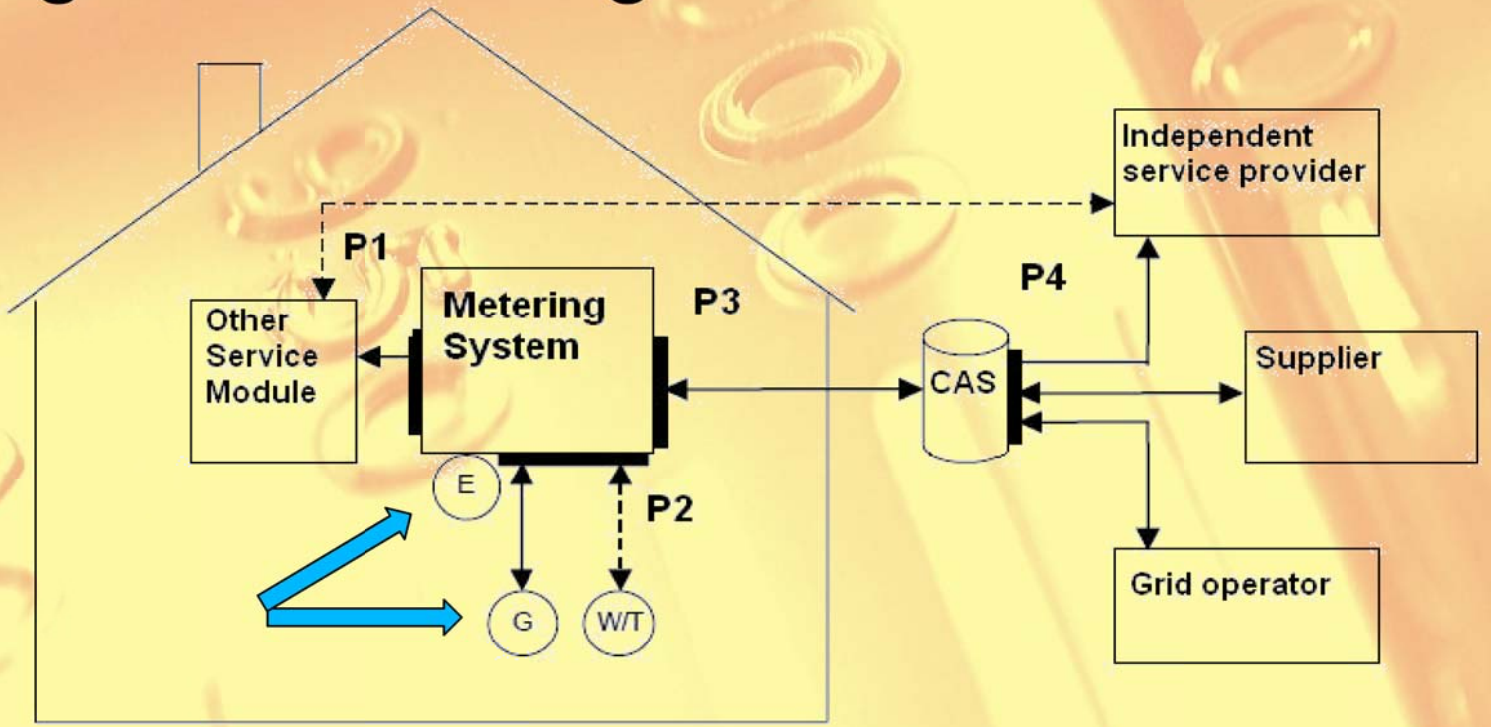
OIML contactperson in NL

Introduction

Smart metering implies:

⇒ extra communication connections

⇒ unchanged measuring devices



Introduction

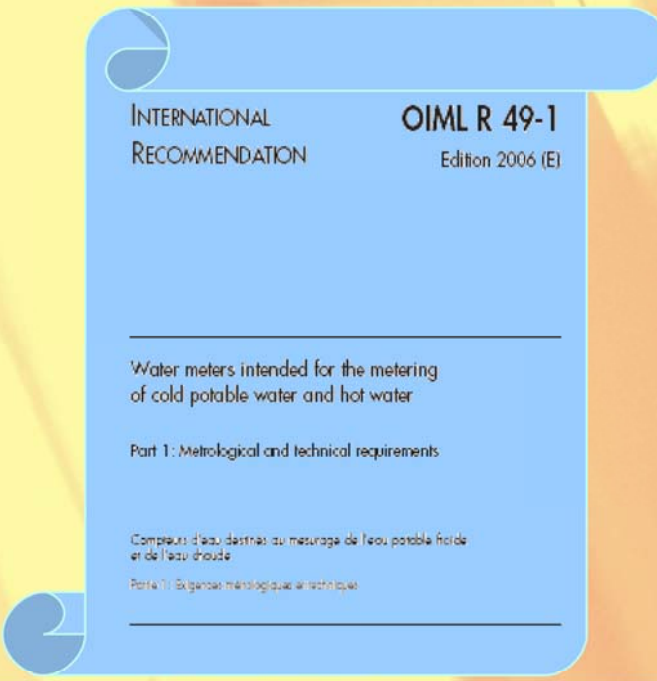
Consequences implementation smart metering

In general:

- Basic measurement part does not change:
  - ➢local metrological functionalities will be maintained
- Requirements and tests on these are well prescribed
  - ➢this including sensitivity

  to environmental conditions

  Why add requirements ?


INTERNATIONAL RECOMMENDATION

OIML R 49-1

Edition 2006 (E)

Water meters intended for the metering of cold potable water and hot water

Part 1: Metrological and technical requirements

Critical functions in smart metering

Need for transparency in:

- calculation and presentation of the measurant
- calculation of the transaction parameter

(= a value based on the measurant)

Risks:

- Influence or disturbance of
  - the measurand
  - the transaction parameter

Critical functions

Risk of influence or disturbance:

- Hardware type interventions
  - electronics
  - interventions on transmission lines
- Software type interventions

How ?

Intended

- hardware: user influence
- software: e.g. hacking

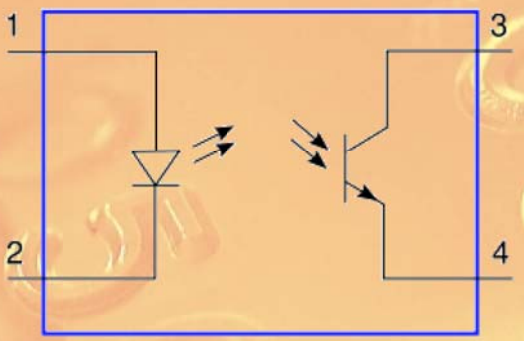
Unintended (accidental)

- hardware: EM interference
- software : bugs

Examples of solutions

Standardisation of:

- specific hardware and software
- communication protocols



Eliminating of EM or other interference:

e.g. opto-coupling and optical transmission lines

How to deal with this in recommendations:

- Description of devices/functions required
- Prescription of specific tests

Is this yet dealt with in utility metering ?

Survey of documents
(recommendations and standards)

Survey of documents

I reviewed on integrity and communication aspects the Recommendations:

OIML R 137-1 (gas meters)

OIML R 46 (active electrical energy meters)

OIML R 49 (water meters)

OIML R 75 (heath meters)

Survey of documents

Netherlands Technical Agreement

NTA 8130

(e)

Minimum set of functions for metering of electricity, gas and thermal energy for domestic customers

Basisfuncties voor de meetinrichting voor elektriciteit, gas en thermische energie voor kleinverbruikers

Survey of documents

A survey on integrity aspects and data transmission requirements on Standards

EN 1359
gas meters
(diaphragm meter)

EN 1434
heath meters

EN 12261
gas meters
(turbine)

ISO 4064
water meters

EN 14154
water meters

R 137-1 (gas meters)

The subject is tackled mostly in general terms and in different ways:

e.g. draft R137-1 4.6.15

Metrological requirements for software:

“ Gas meters provided with software shall be designed such that all the functions of the software do not affect the metrological behaviour”.

R 46 (electrical energy)

In R46 (3.6.2) protection of hardware and firmware it is mentioned:

“f) The meter shall be capable of recording all interventions which could potential result in alteration of any metrological parameters, including the contents of any register(s) which store(s) energy measurements.”

Draft R49-1 (water meters)

For R 49-1 (draft revision) the following technical requirement has been suggested:

"*The water meter shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal*"

"The water meter shall be designed to reduce as far as possible the effect of a defect that would lead to an inaccurate measurement result, unless the presence of such a defect is obvious."

R 75 (heat meters)

In R 75 no specific requirements for integrity or data transmission were found

Some Standards

Coverage in standard		integrity/ security	data comm.	remark
Gas meter				
EN 1359	Diaphragm	-	--	reference to MID
EN 12261	Turbine	--	--	not realy touched
ISO 9951	Turbine	--	--	
EN 12405	Volume Conversion	?		
EN 12480	Rotary Displacement	?		
EN 14236	Ultrasonic	?		
Water meter				
EN 14154-1; -2; -3	General	+	+	at checking facilities
ISO 4064-1; -2; -3	General	+	+	
Heath meter				
EN 1434-1; -2; -3	General	--	--	not touched
Electrical energy meter				
EN 50470-1; -2;	Dynamic meter	+	-	at protection against corruption
EN 50470-3	Static meter	++	++	

NTA 8130

Netherlands Technical Agreement

NTA 8130

(e)

Minimum set of functions for metering of electricity, gas and thermal energy for domestic customers

Basisfuncties voor de meetinrichting voor elektriciteit, gas en thermische energie voor kleinverbruikers

NTA 8130

Produced August 2007 by NEN; commissioned by Min. of Economic Affairs in NL

Interesting document describing possible functions

"smart metering system"

describes minimum requirements:

Rather strict in:

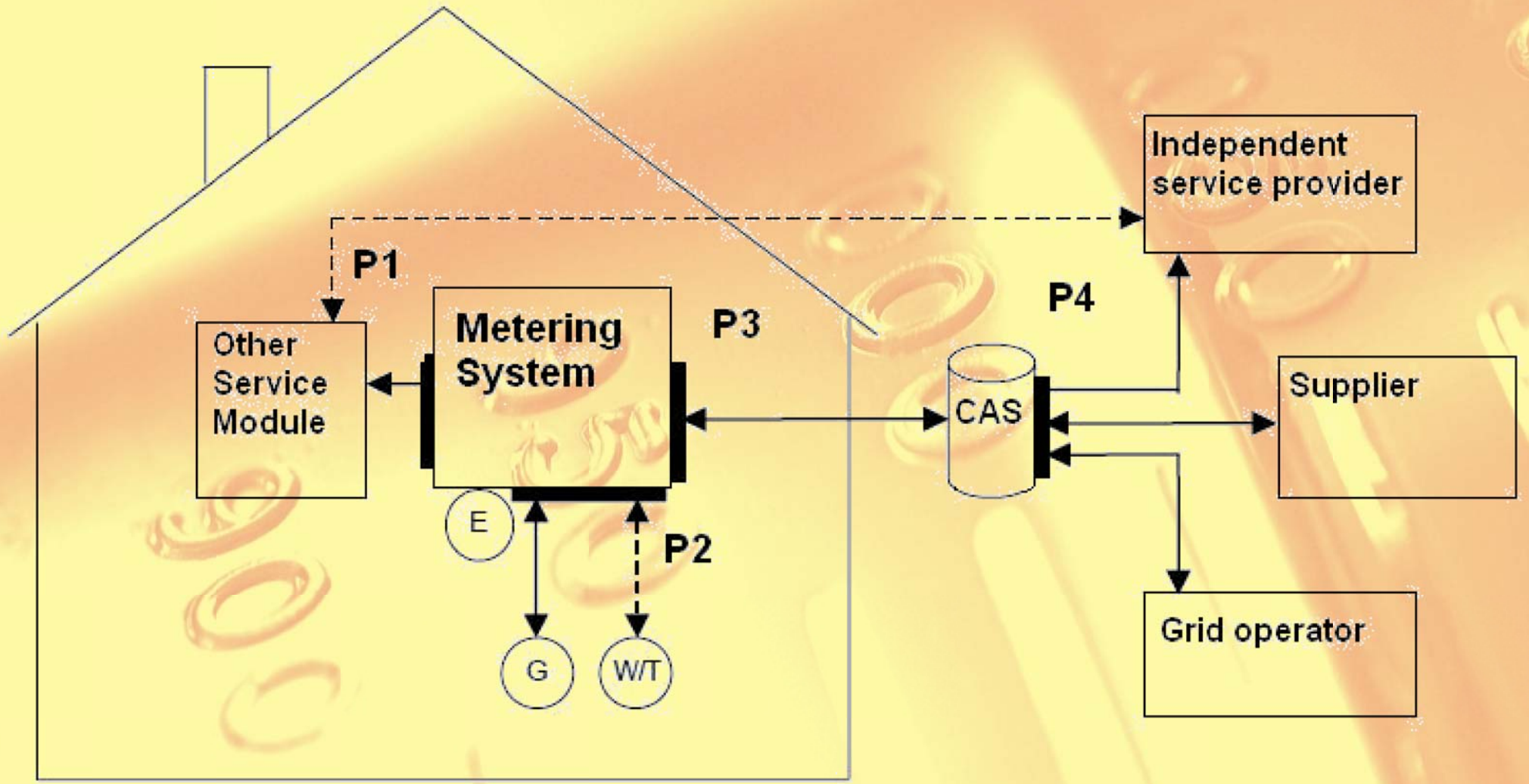
- Configuration smart grid
- Transmission requirements: parameters,sequence,logging, availability of data

NTA 8130

Describes possible applications:

- Improvement administrative processes
- Awareness customer
- Safe remote activation/deactvation
- Change in threshold
- Different tariffs
- Prepayment
- Monitoring the distribution network

Communication ports



NTA 8130

Communication ports:

P1: local, one way communication from metering system to service modules

P2: communication between metering instruments and metering system (read/write)

P3: port to Central Access Server (CAS) (read/write)

P4: from CAS to Supplier, service provider, grid operator (read/write)

NTA 8130

Communication (data) contents and availability (chapt. 5.2)

- Which port
- Which parameters

Those parameters include e.g. :

Actual delivery and additional

- status information of metering installation;
- number of dips/peaks;
- errors;
- fraud detection and registration !

Can NTA 8130 be useful for OIML as document ?

NTA 8130 contents

Comparison NTA 8130 with OIML recommendation template

Contents	scope	terminology	describtion	units of measurement	metrological requirements	technical requirements	inscribtions	instruction manual	sealing and stamping	suiteability for testing	sealing and stamping	performance tests
Applicability	A.	A.	A.	A.	P.	A.	P.	A.	P.	A.	A.	A.
Covered by NTA 8130 (chapt.)	1	3	pref. + 5	5	N.C.	P.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

Not Applicable	Applicable	Partly	Not covered
N.A.	A.	P.	N.C.

NTA 8130 contents (cont.)

Metrological requirements

metrological requirements	accuracy classes	measuring range	MPE	scale interval	significant fault	apportioning of errors	repeatability	multiple indic. devices	discrimination	rated operating conditions	significant fault	disturbances	durability	presumption of compliance
Applicability	N.A.	N.A.	N.A.	A.	N.A.	N.A.	N.A.	A.	N.A.	A.	A.	A.	A.	A.
Covered by NTA 8130				N.C.				P.		N.C.	N.C.	N.C.	N.C.	N.C.

Not Applicable	Applicable	Partly	Not covered
N.A.	A.	P.	N.C.

NTA 8130 contents (cont.)

Technical requirements

Technical requirements	construction	presentation of measurement value	adjustment facilities	protection against fraude	checking facilities	Durability protection	Battery powered	software	durable recording	data tarnsmission
Applicability	A.	A.	P.	A.	P.	N.A.	N.A.	A.	A.	A.
Covered by NTA 8130 (chapt.)			N.C.	5.2.8.6	N.C.			N.C.	5.2	N.C.

Not Applicable	Applicable	Partly	Not covered
N.A.	A.	P.	N.C.

NTA 8130

Referred to (in EU) as basic material for producing standard for smart meters

NTA 8130 useful but is **not sufficient** because:

- Focus primarily on functionality
- Focus only on existing functionalities, based on practice in The Netherlands
- Sometimes goes into deep detail
- Rather strict (e.g. 4 ports) and static document
- Does not deal with metrological requirements or (metrological) integrity nor privacy aspects

Example of possible Unintentional interference

- Use of different ways of data communication:

GPRS; PLC; Ethernet; etc.

- In case of PLC
  - Roll-out of many smart meters

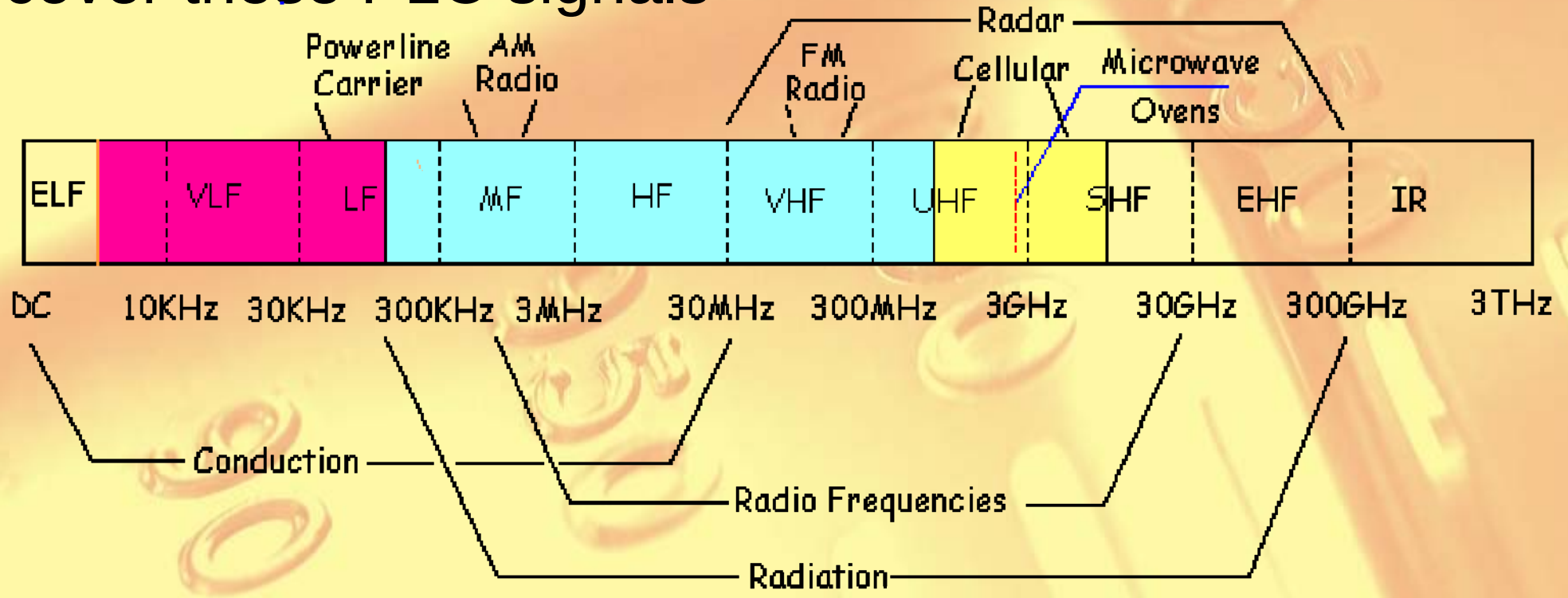
  ⇒Interference reported on touch dimmer lamps; (Cenelec SC 205A/Sec0228/RM)

  Open structure of PLC could introduce unexpected interference

  Could work out both directions

Lacking interference test

Present EMC requirements and tests OIML do not cover these PLC signals



Immunity below 150 kHz is not covered

(Emission covered by EN 50065-1)

Impact on future OIML recommendation development

Impact on OIML Recommendations ?

Choices to be made:

- Should requirements and tests for new functionalities be added to each recommendation ?
- Should specific tests be developed ?
- Should a Dxx on smart metering be produced ?
- Should TC / SC ´s (utility) work be combined ?

Opinion:

A specific document (similar to D11 or D31) on requirements and tests for remote measurement (registration) could be of great help to TC´s and SC´s

Some references

Lot of information can be found in the study:

Security analysis of Dutch smart metering systems

by Sander Keeming & Bart Roos (University of Amsterdam)

http://staff.science.uva.nl/~delaat/sne-2007-2008/p33/report.pdf

also in the presentation:

Security, Privacy and AMR Systems: Small Issues or Sources of Future Problems ?

by Engelbert Hubbers & Marco van Eekelen

(Radboud University Nijmegen)

Inventory performed by CLC TC 13

Additional information:

Cenelec TC 13 has also performed an inventury on standarization needed.

This was presented in Brussels on 25 May 2009 in Brussels by the chairman Bernd Schultz

Thank you for your attention
Questions

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