Performances of continuous and portable measuring devices: standardisation, certification or ETV verification?

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MEASUREMENT & STANDARDS
Keys to COMPETITIVENESS and A SAFER WORLD

Laboratoire national de métrologie et d'essais

Content

Standardisation

- With a focus on prEN 16479

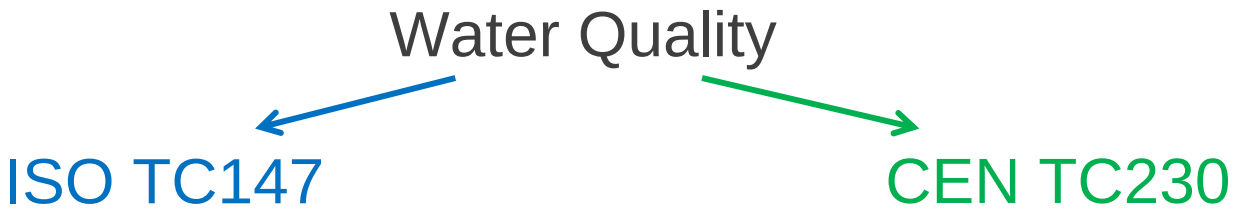
Certification

- Example of MCERT

ETV verification

- With a focus on ETV Europe

Standardisation



EN ISO 15839:2005

Water quality – On-line sensors/analysing equipment for water – Specifications and performance tests

prEN 16479-2 – Draft G (14/02/14)

Water quality – General requirements and performance test procedures for water monitoring equipment – Part2: continuous measuring devices (CMD)

prEN 16479-2

Reliability includes:

- The CMD's measurement repeatability, bias, linearity, drift and response time
- Operational influences arising from variations in supply voltage, output impedance, sample temperature, sample flow-rate and sample pressure
- Environmental influences arising from variations in ambient temperature, relative humidity, and incident light

Individual performance characteristics are combined together and expressed as measurement uncertainty.

Laboratory testing

used to determine each performance characteristic in turn in a highly controlled environment

Field testing

carried out to demonstrate that :

- the performance achieved in the laboratory can be repeated in a real application
- the performance does not degrade during normal operation.

Performance characteristics determined by laboratory test

- Bias
- Repeatability
- Linearity
- Drift
- Matrix effects

- Output impedance
- Supply voltage
- Ambient temperature
- Relative humidity
- Incident light
- Sample temperature
- Sample flow-rate
- Sample pressure

Combined performance

Performance characteristics determined by field test

- Error
  - by comparison between the measurement obtained with the CMD and a reference measurement
- Response time
- Up-time (% of recovered data)
- Maintenance log

Planning the field test

A documented plan for field testing shall be established and shall include details of:

(a) The description of the CMD to be tested

(b) The intended applications for the CMD

(c) The field test site description

(d) The proposed duration of the field testing. This should be a minimum of 3 months

(e) The timing of the field testing. The appropriate window of time for field testing should take account of seasonal aspects

(f) The reference method

(g) A sampling and analysis plan for the reference method measurements. A minimum of 24 pairs of reference measurements should be taken over the duration of the field test

prEN16479

(i) The arrangements for establishing and maintaining document traceability.

(j) The arrangements for determining the performance characteristics of the CMD under representative operational conditions.

(k) The continuous logging of the output of the CMD over the period of the field test.

(l) The arrangements for recording field test data and supported records of relevant data on and/or observations of process conditions, or variations in natural waters, and ambient conditions pertaining during the field test.

Performance evaluation

Performances in real conditions – in the field

Performances	SWIFT-WFD Prichard et al., 2007 Roig et al., 2007	EN ISO 15839	prEN 16479-2 MCERT Part 2	ETV EPA multiparameter probe	ACT Dissolved oxygen
Response time	X	X	X		
Bais	X	X	X		X
Long-term drift	X		X		X
Up-time		X	X		X
Duration of field trial			3 months	1 month	26 days
Nb of sites			1	3	7
Nb of reference measurements		> 30	12-24	> 80	48
QC for reference measurements			recommended	Blanks, replicates, spikes	Blanks, replicates

Certification

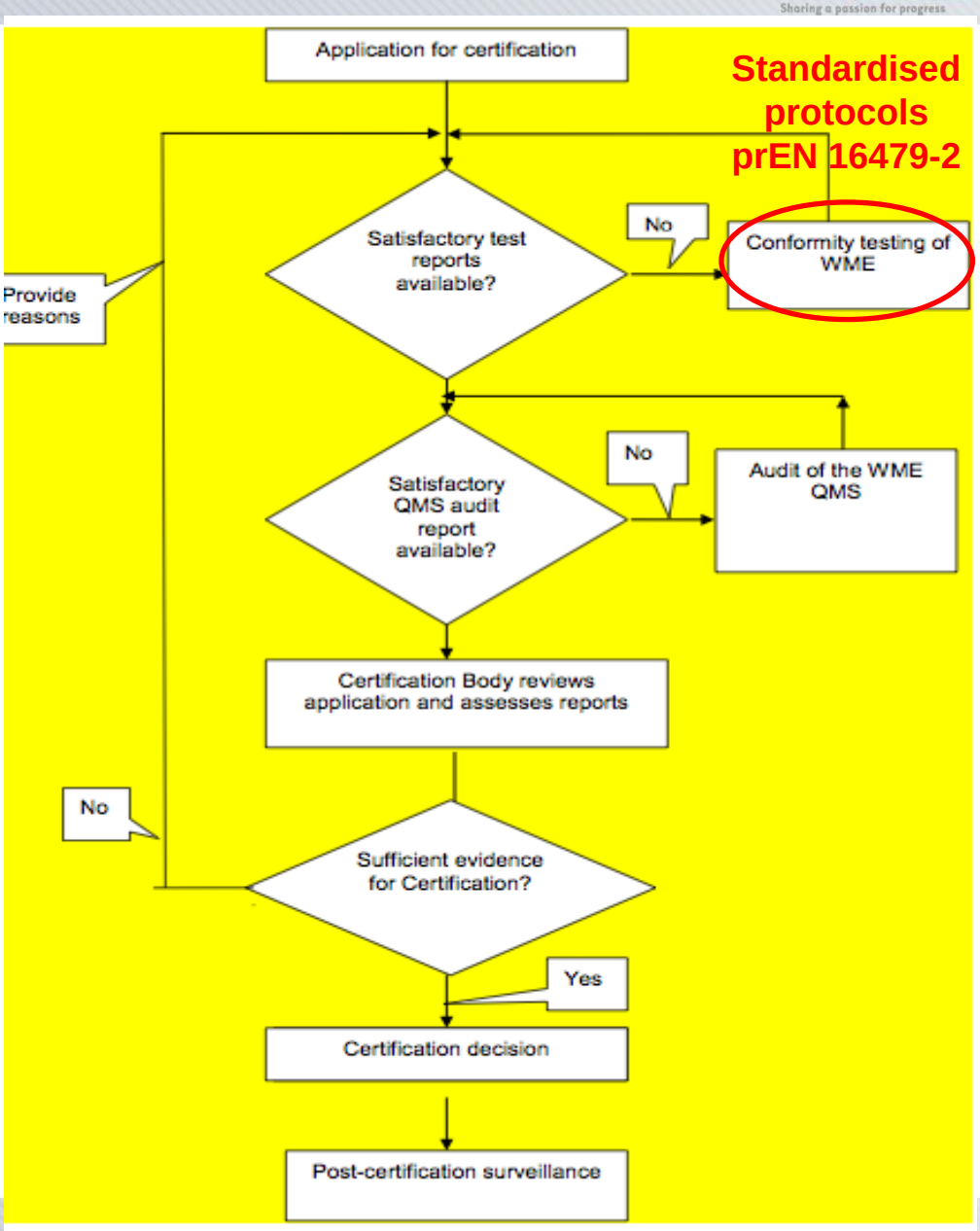
Certification scheme provides a framework within which (environmental) measurements can be made in accordance with regulator's quality requirements

It promotes public confidence in monitoring data and provides industry with a proven framework for choosing monitoring systems and services that meet the regulator's performance requirements.

Certification

Example of a certification procedure

A certification committee should be assigned to each project to ensure that the evidence submitted by the manufacturer is technically robust



Informative performances taken from prEN16479-2

	Symbol	Test	Temperature °C	pH pH units	Conductivity % error	Turbidity % error	Dissolved oxygen % error
Bias	b	8.2.3	0,3	0,2	2 (or 0.01% range or 10 µS/cm)	5 (or 1 NTU)	5 (or 0,2 mg/L or 2% sat)
Linearity	X_L	8.2.3	0,2	0,1	0,4	2,5	2,5 (or 0,1 mg/l or 1% sat)
Repeatability	Sr	8.2.3	0,2	0,1	1	2,5 (or 0,5 NTU)	2,5 (or 0,1 mg/L or 1% sat)
Sample matrix effects [1]	X_{IN}	8.2.4	-	-	-	2,5	2,5
Drift	X_D	8.2.5	0,2	0,1	1	2,5	2,5
Output impedance	X_O	8.2.6	0,2	0,05	1	1	1
Supply voltage	X_V	8.2.7	0,2	0,05	0,5	1	1
Ambient temperature	X_T	8.2.8	0,2	0,1	1	2,5	2,5
Relative humidity	X_{RH}	8.2.8	0,2	0,1	1	2,5	2,5
Incident light	X_{LX}	8.2.4.3	0,2	0,05	0,5	1	1
Sample temperature	X_{ST}	8.2.9	-	0,1	1	2,5	2,5
Sample flow-rate	X_{SQ}	8.2.10	-	0,05	0,4	1	1
Sample pressure	X_{SP}	8.2.11	-	0,05	0,4	1	1
Combined performance characteristic	U_C	Annex C	0,5	0,3	3	6	6
Response time	8.2.2	Values achieved in tests shall be reported					
Initial warm up	8.1	Values achieved in tests shall be reported					
Interferents can be physical, e.g. colour, or chemical. When interference effects are not included in the combined uncertainty, this should be stated in the test report.							

Certification

UK Environmental Agency MCERTS Scheme for emission monitoring (air, water, soil)

Example for Water Monitoring

- Continuous water monitoring equipment must be of an acceptable standard to ensure that the environment remains properly protected.
- Regulations such as the Environmental Permitting Regulations (EPR) require industrials to use MCERTS approved products.
- Equipment is certified and tested under the MCERTS Continuous Water Monitoring Equipment scheme, which covers three types of equipment:
  - automatic waste water samplers
  - online analysers
  - flow meters

Certification

MCERTS – Examples of certification carried out for DO probes

Certificate holder	Model	Certified range	Certificate No.
Hach Lange GmbH	SC100 controller unit SC1000 controller unit Probes: SOLITAX sc, pHD sc, LDO	pH : 1 to 13 DO : 0 to 200% saturation 0 to 20 mg/L Turbidity 0 to 1000 NTU	Sira MC120214/00
YSI Inc.	6820, 6820V2, 6920 and 6920V2 Multiparameter Sonde with 6500 Environmental process Monitor	pH : 2 to 12 DO : 0 to 200% saturation Turbidity : 0 to 500 NTU	Sira MC080133/02

ETV Verification

ETV verification

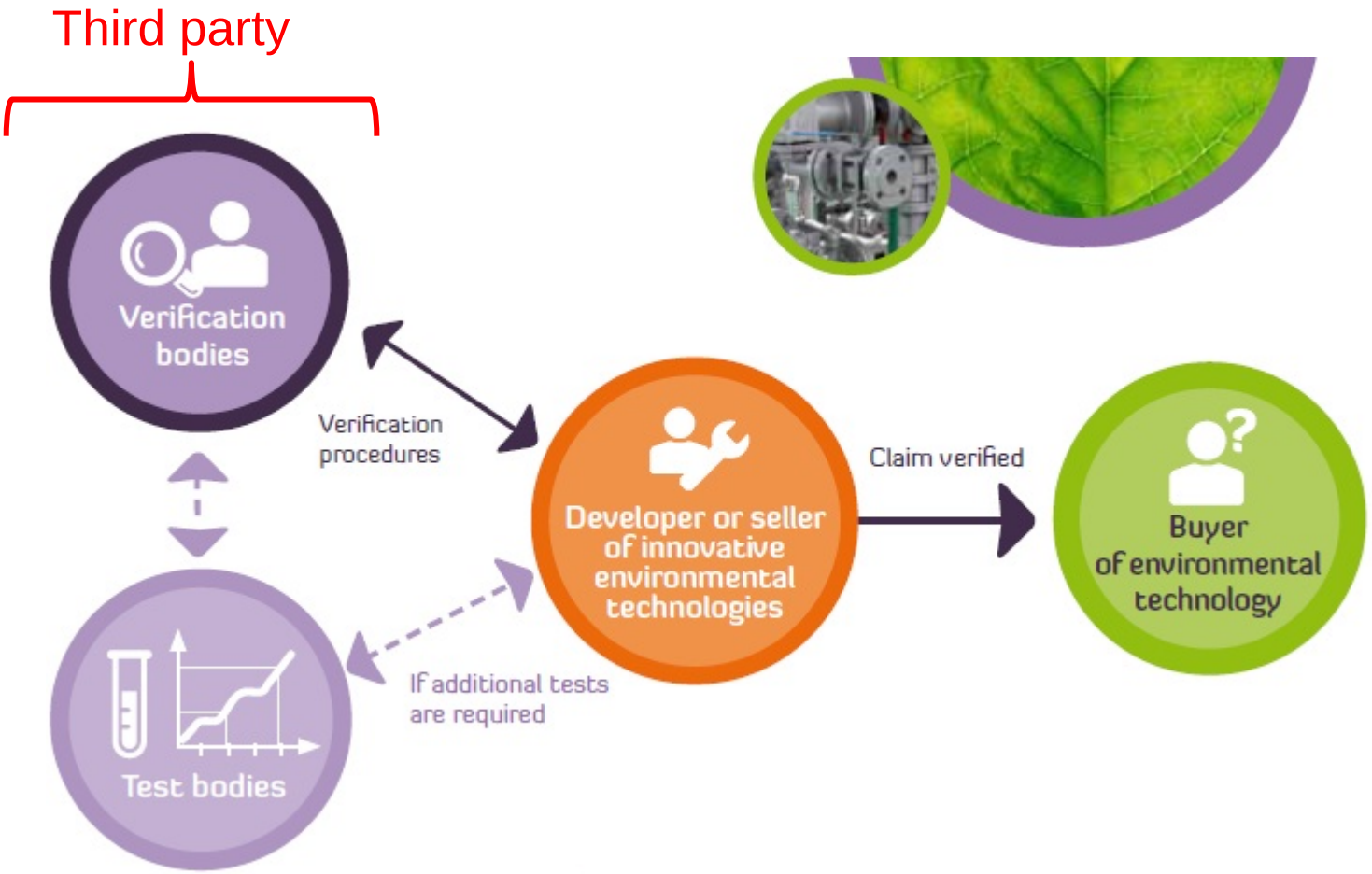
European Environmental Technology Verification programme

- EU has launched an EU ETV Pilot Programme in December 2011.
- 7 countries are participating in the pilot programme : France, United Kingdom, Poland, Finland, Czech Republic, Belgium and Denmark, while Germany, Slovakia and Sweden are observers.

- The verification bodies in each country are contact points for suppliers of environmental technology, who want to implement a verification of one of more of their products.
- The verification bodies have to be accredited according to the requirements in ISO 17020 and EU ETV General Verification Protocol

ETV verification

European Environmental Technology Verification programme



ETV verification

European Environmental Technology Verification programme

- An independent assessment and validation of the manufacturer's claims on the performance and environmental benefits of their technology.

- The information produced by the verification is public

- ETV ensures that the claims are a clear assessment of the entire technology's potential and value

  but it does not evaluate the technology's performance against standard or pre-defined criteria

ETV verification

What kind of technology can be verified?

- Is it an innovative technology (design, raw material, production process, use, recyclability of final disposal etc.)?
- Is it less environmentally harmful than relevant alternatives?
- Is it ready for market?
- Does it show potential to meet user needs and to perform in line with legal requirements?
- Are the performance characteristics not fully covered by existing regulations/standards?

ETV verification

Does it fit within the Technology Area scope of the EU programme?

ETV verification

Example of performances for monitoring technologies

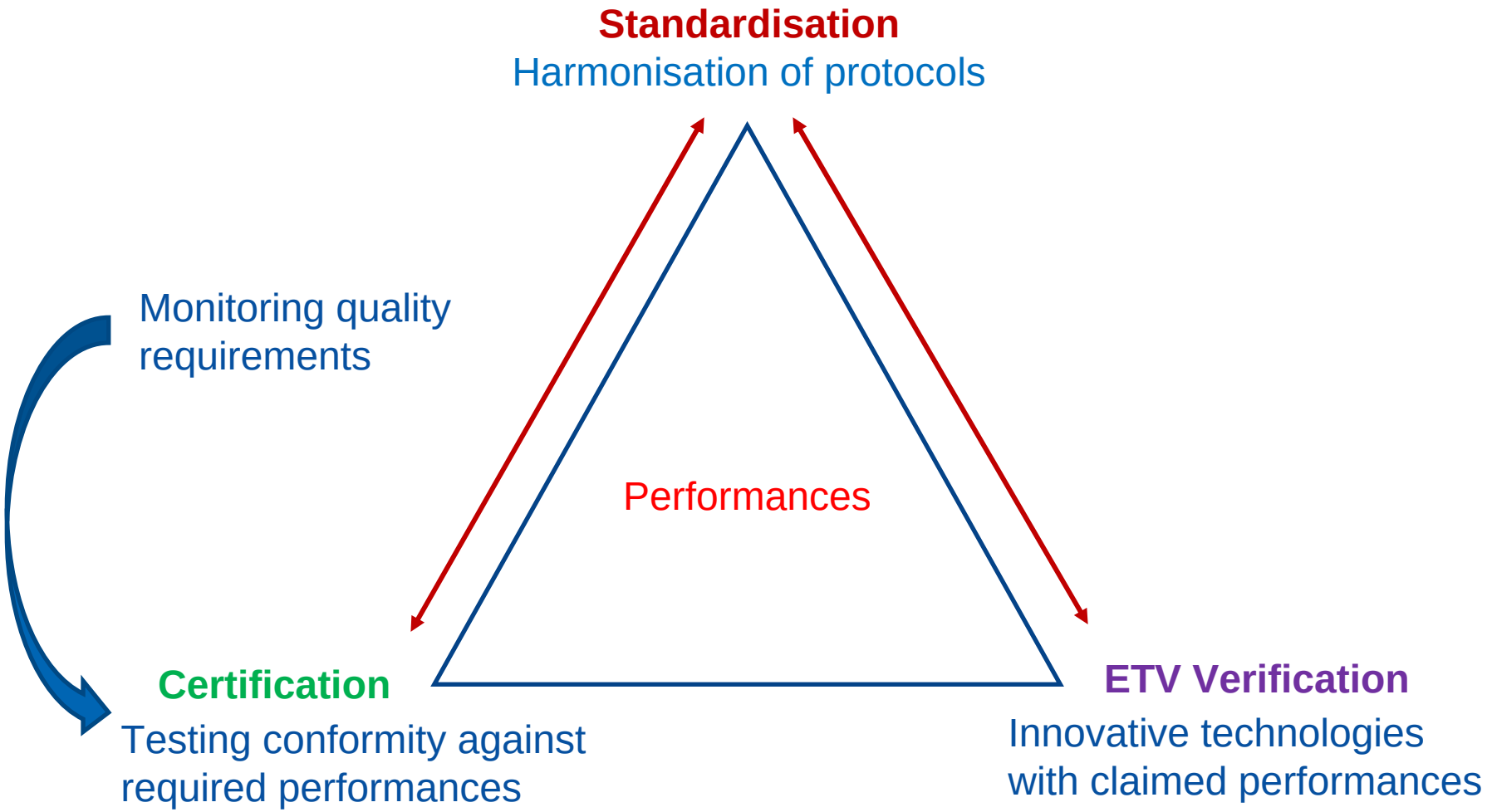
- Operational parameters
  - Limit of detection
  - Range of application
  - Precision and bias
  - Robustness
  - Temperature and pressure ranges

ETV verification

Example of performances for monitoring technologies

- Additional parameters
  - Power supply
  - Energy consumption
  - Chemical consumption, waste products
  - Quality of user manual
  - Man power needed (maintenance)
  - Life cycle : raw material, production processes, recycling, end-of-life disposal

Standardisation, certification or ETV verification



Thank you for your attention