

JOINT SCOPES ACTIVITY OF IMEKO AND INTERNATIONAL METROLOGICAL ORGANIZATIONS TECHNICAL COMMITTEES

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Abstract – The main scopes activities of international metrological organization are described. Correspondence of activity IMEKO TCs and CIPM CCs is analyzed. The main principles of harmonization of national standards with the OIML publications are defined. Possibility of interactions of IMEKO, OIML TCs and CIPM CCs are determined.

Keywords: international document, international recommendation, technical committee, consultative committee.

1. MAIN ACTIVITY OF INTERNATIONAL METROLOGICAL ORGANIZATIONS

The Convention of the Metre is a treaty that created the International Bureau of Weights and Measures (BIPM), an intergovernmental organization under the authority of the General Conference on Weights and Measures (CGPM) and the supervision of the International Committee for Weights and Measures (CIPM). The BIPM acts in matters of world metrology, particularly concerning the demand for measurement standards of ever increasing accuracy, range and diversity, and the need to demonstrate equivalence between national measurement standards [1, 2].

The CGPM receives the report of the CIPM on work accomplished; it discusses and examines the arrangements required to ensure the propagation and improvement of the International System of Units (SI); it endorses the results of new fundamental metrological determinations and various scientific resolutions of international scope; and it decides all major issues concerning the organization and development of the BIPM.

The Mutual Recognition Arrangement of CIPM (MRA CIPM) is a response to a growing need for an open, transparent and comprehensive scheme to give users reliable quantitative information on the comparability of national metrology services and to provide the technical basis for wider agreements negotiated for international trade, commerce and regulatory affairs.

The International Organization of Legal Metrology (OIML) is an intergovernmental treaty organization whose membership includes member states, countries which participate actively in technical activities, and corresponding members, countries which join the OIML as observers. It was established in order to promote the global harmonization of legal metrology (LM) procedures. The

OIML has developed a worldwide technical structure that provides its members with metrological guidelines for the elaboration of national and regional requirements concerning the manufacture and use of measuring instruments for LM applications [1, 3].

International consensus in the legal metrology community is reached through Technical Committees (TCs) and Subcommittees (SCs), the composition of which includes representatives from OIML member states, international standardization and technical organizations, manufacturers' associations and regional regulatory bodies. Under the coordination of a secretariat, experts establish international technical guidelines for the metrological performance and testing procedures of measuring instruments (MI) subject to legal controls.

The OIML develops model regulations, International Recommendations (OIML R) and International Documents (OIML D), which provide members with an internationally agreed-upon basis for the establishment of national legislation on various categories of MI. It coordinates and informs International Committee of Legal Metrology (CIPM) members of technical work undertaken by OIML TCs.

Cooperative agreements are established between the OIML and certain international organizations in field of standardization, with the objective of avoiding contradictory requirements; consequently, manufacturers and users of MI, test laboratories, etc. may simultaneously apply OIML Publications and those of other organizations. The main elements of an OIML R are: scope, application and terminology; metrological requirements; technical requirements; methods and equipment for testing and verifying conformity to requirements; and the test report format, etc.

2. CORRESPONDENCE OF ACTIVITY OF IMEKO AND OTHER INTERNATIONAL METROLOGICAL ORGANIZATIONS TECHNICAL COMMITTEES

Correspondence of activity IMEKO TCs, OIML TCs and CIPM Consultative Committees (CCs) is given in Table 1 [1–4].

The activity of IMEKO is basically carried out through the TCs which organize symposia, conferences, workshops, seminars on specific topics at regular intervals and publish proceedings of events, text-books, glossaries, studies, etc.

Table 1. Correspondence of activity of IMEKO, OIML TCs and CIPM CCs

IMEKO TCs	OIML TCs	CIPM CCs
TC 6 Vocabulary Committee	TC 1 Terminology	-
TC 8 Traceability in Metrology	TC 2 Units of measurement TC 4 Measurement standards and calibration and verification devices	CCU Units
TC 11 Metrological Infrastructures	TC 3 Metrological control	-
TC 14 Measurement of Geometrical Quantities	TC 7 Measuring instruments for length and associated quantities	CCL Length CCTF Time and Frequency
TC 9 Flow Measurement	TC 8 Measurement of quantities of fluids	-
TC 3 Measurement of Force, Mass and Torque TC 16 Pressure and Vacuum Measurement	TC 9 Instruments for measuring mass and density TC 10 Instruments for measuring pressure, force and associated quantities	CCM Mass and Related Quantities
TC 12 Temperature and Thermal Measurements	TC 11 Instruments for measuring temperature and associated quantities	CCT Thermometry
TC 4 Measurement of Electrical Quantities	TC 12 Instruments for measuring electrical quantities	CCEM Electricity and Magnetism
TC 22 Vibration Measurement	TC 13 Measuring instruments for acoustics and vibration	CCAUV Acoustics, Ultrasound and Vibration
TC 2 Photonics	TC 14 Measuring instruments for used for optics	CCPR Photometry and Radiometry
TC 24 Chemical Measurements	TC 17 Instruments for physical-chemical measurements	CCQM Amount of Substance – Metrology in Chemistry
TC 13 Measurements in Biology and Medicine	TC 18 Medical measuring instruments	-
TC 19 Environmental Measurements	TC 16 Instruments for measuring pollutants	-
TC 21 Mathematical Tools for Measurements	TC 5 Electronic instruments and software	-
-	TC 6 Prepackaged products	-
-	TC 15 Measuring instruments for ionizing radiations	CCRI Ionizing Radiation

IMEKO has friendly working contacts with OIML, BIPM and regional metrological organizations [4, 5]:

- APMP (Asia-Pacific Metrology Programme) [6];
- COOMET (Euro-Asia cooperation of national metrological institutions) [7];
- EURAMET (European Association of National Metrology Institutes,) [8];
- SIM (Inter-American Metrology System) [9];
- AFRIMETS (An Intra-Africa System For Metrology) [10].

Correspondence of activity CIPM CCs and TCs of Euro-Asian regional metrological organizations (RMO) is given in Table 2 [6–10]. Practically all CCs have TCs analogues in regional metrological organizations.

The IMEKO TC 1 “Education and Training in Measurement and Instrumentation”, TC 5 “Hardness Measurement”, TC 7 “Measurement Science”, TC 10 “Technical Diagnostics”, TC 15 “Experimental Mechanics”, TC 17 “Measurement in Robotics”, TC 18 “Measurement of Human Functions”, TC 20 “Measurement Techniques for the Construction Industry”, TC 23 “Metrology in Food and Nutrition” are not analog in OIML TCs as for specific fields.

International consensus in the LM community is reached through TCs and SCs, the composition of which includes

representatives from OIML member states, international standardization and technical organizations, manufacturers’ associations and regional regulatory bodies. Under the coordination of OIML Secretariat, experts establish international technical guidelines for the metrological performance and testing procedures of MI subject to legal controls.

Draft OIML R and OIML D are developed by TCs or their SCs, which are formed by the OIML member states. The OIML TC 6 “Prepackaged products”, OIML TC 15 “Measuring instruments for ionizing radiations” and CIPM CC for “Ionizing Radiation” (CCRI) are not analog in IMEKO TC.

The CIPM has set up a number of CCs, which bring together the world’s experts in their specified fields as advisers on scientific and technical matters. Among the tasks of these CCs are the detailed considerations of advances in physics that directly influence metrology, the preparation of recommendations for discussion at the CIPM, the identification, planning and execution of key comparisons of national measurement standards, and the provision of advice to the CIPM on the scientific work in the laboratories of the BIPM. Since the beginning of 2004 the reports of the CCs are only published electronically.

Table 2. Correspondence of activity of CIPM CCs and TCs of Euro-Asian regional metrological organizations

CIPM CCs	COOMET TCs	EURAMET TCs	APMP TCs
CCU Units	TC 1.1 General Questions Concerning Measurements (General Metrology)	TC-IM Interdisciplinary Metrology	-
CCL Length	TC 1.5 Length and Angle	TC-L Length	TCL Length
CCTF Time and Frequency	TC 1.11 Time and Frequency	TC-TF Time and Frequency	TCTF Time and Frequency
CCM Mass and Related Quantities	TC 1.6 Mass and Related Quantities	TC-CM Mass and Related Quantities	TCM Mass and Related Quantities
CCT Thermometry	TC 1.10 Thermometry and Thermal Physics	TC-T Thermometry	TCT Thermometry
CCEM Electricity and Magnetism	TC 1.3 Electricity and Magnetism	TC-EM Electricity and Magnetism	TCEM Electricity and Magnetism
CCAUV Acoustics, Ultrasound and Vibration	TC 1.2 Acoustics, Ultrasound and Vibration	TC-AUV Acoustics, Ultrasound and Vibration	TCAUV Acoustics, Ultrasound and Vibration
CCPR Photometry and Radiometry	TC 1.7 Photometry and Radiometry	TC-PR Photometry and Radiometry	TCPR Photometry and Radiometry
CCQM Amount of Substance – Metrology in Chemistry	TC 1.8 Physical Chemistry	TC-MC Metrology in Chemistry	TCQM Amount of Substance
CCRI Ionizing Radiation	TC 1.9 Ionising Radiation and Radioactivity	TC-RI Ionizing Radiation	TCRI Ionizing Radiation
-	TC 1.4 Flow Measurement	TC-F Flow	TCFF Fluid Flow

The brochure entitled The International System of Units (SI) is the essential reference for all those who wish to use the SI correctly. It contains the official definitions of the base units of the SI, and all the decisions of the CIPM and CGPM related to the SI, its formalism and use. The brochure is periodically updated after detailed discussion by the CC for Units (CCU).

3. HARMONIZATION OF NATIONAL STANDARDS WITH OIML PUBLICATIONS

The principles of technical harmonization in Europe are specified by the decisions of the European Union (EU), but its directives set out only some main conditions, required for the provision of measurements reliability, but technical requirements are based on OIML recommendations. Dominating aim for harmonization in EU is to ensure free trade relations that is why it is important to harmonize procedures of type approval of MI, order of dissemination of the units value from measurement standards to operating MI, and some others reasons. As an essential element of ensuring a quality the international and european standards in the area of systems quality assurance contain requirement for calibration of MI and for referencing all the results of measurements to units, which are reproduced by national measurement standards.

From 1997 Ukraine has become the OIML associate member. Such membership in this organization enables to get regularly the documents, recommendations and other printed matters of OIML and to use them for harmonization of the national standards with international documents and recommendations.

General structure of the OIML Publications in the field of metrology and corresponding harmonization of the national standards of Ukraine (DSTU OIML) is given in Fig. 1 and Table 3 [3, 11, 12].

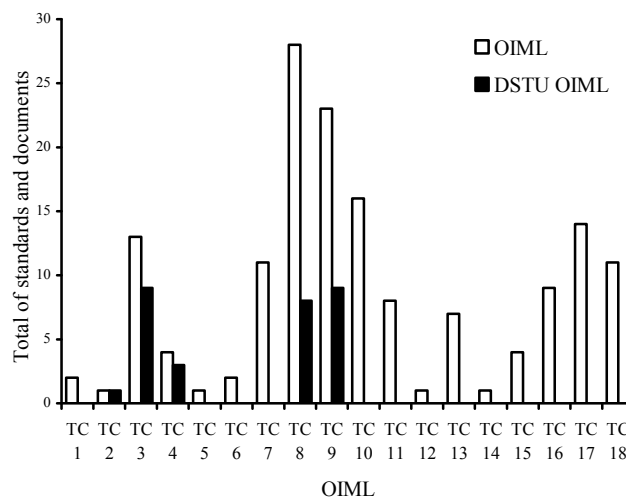


Fig. 1. General structure of the OIML Publications

As shown in Table 4 the system of international standards, documents and recommendations, national standards in field of metrology includes the following main blocks of standards:

- terminology;
- traceability;
- units of measurements;
- measurement standards of units;

- state and local verification schemes;
- general requirements for MI;
- MI metrological characteristics;
- MI tests;
- MI verification and calibration;
- metrological inspection and supervision;
- metrological supervision for prepackaged goods;
- accreditation of measurement and calibration laboratories.

Table 3. General structure of national standards of Ukraine in fields of metrology

Name of OIML TCs	Total Publications	
	OIML (D/R/V)	DSTU OIML
TC 1 Terminology	0/0/2	-
TC 2 Units of measurement	1/0/0	1
TC 3 Metrological control	11/2/0	9
TC 4 Measurement standards and calibration and verification devices	4/0/0	3
TC 5 Electronic instruments and software	1/0/0	-
TC 6 Prepackaged products	0/2/0	-
TC 7 Measuring instruments for length and associated quantities	0/11/0	-
TC 8 Measurement of quantities of fluids	4/24/0	8
TC 9 Instruments for measuring mass and density	1/21/0	9
TC 10 Instruments for measuring pressure, force and associated quantities	0/15/1	-
TC 11 Instruments for measuring temperature and associated quantities	1/7/0	-
TC 12 Instruments for measuring electrical quantities	0/1/0	-
TC 13 Measuring instruments for acoustics and vibration	0/7/0	-
TC 14 Measuring instruments for used for optics	0/1/0	-
TC 15 Measuring instruments for ionizing radiations	1/3/0	-
TC 16 Instruments for measuring pollutants	1/8/0	-
TC 17 Instruments for physical-chemical measurements	1/13/0	-
TC 18 Medical measuring instruments	0/11/0	-
Total:	26/126/3	30

Thus, in Ukraine there are 12 national standards and 10 drafts of standards are harmonized to some extent with 27 OIML dictionaries, documents or recommendations. The main way for harmonization of national standards is a direct introducing of the OIML documents or recommendations (translation on Ukrainian with some national revision or additions, if needed). It is planned to harmonize 6 national standards with OIML recommendations in the near future.

The general analysis of normative base on questions of metrology shows that in Ukraine, in spite of the availability of sufficient complex of basic national standards, still it is

required both the development of new standards and revision of some valid standards.

Taking into consideration the international practice on metrology would allow to draw nearer the metrological system of Ukraine to requirements generally accepted in the world and hereunder it would ensure both the acceptance of the results of measurements, which are carried out in Ukraine, and the results of the industrial product testing all over the world. This would contribute to a rising of competitiveness of Ukrainian enterprises on markets of the world.

Table 4. System of general international standards, documents, recommendations and national standards of Ukraine in fields of metrology

Object of standardization	OIML (D, R, V)	DSTU OIML
Terminology	OIML V1 OIML V2	- -
Traceability	OIML D1 OIML D13	- DSTU OIML D13
Units of measurement	OIML D2	DSTU OIML D2*
Measurement standards	OIML D8	DSTU OIML D8
Verification hierarchy schemes	OIML D5	DSTU OIML D5*
General requirements for MI	OIML D3 OIML D11 OIML D15 OIML R34 OIML R99/ ISO 3930	DSTU OIML D3 - - - -
Metrological control	OIML D16 OIML D19	DSTU OIML D16 DSTU OIML D19
Verification and calibration for MI	OIML D12 OIML D20 OIML D23 OIML R42	DSTU OIML D12* DSTU OIML D20 DSTU OIML D23 -
Certified reference materials	OIML D18	DSTU OIML D18
Metrological supervision	OIML D9	DSTU OIML D9
Prepackaged products	OIML R79 OIML R87	- -
Accreditation of calibration labs	ILAC-G24/ OIML D10	-
* Standards under development (included in National Plan of Standardization on 2008–2009 and planned for harmonization)		

4. JOINT OIML AND CIPM ACTIVITY

On behalf of the BIPM, the OIML and the International Laboratory Accreditation Cooperation (ILAC), we draw your attention to the joint declaration produced by these three bodies. In preparing the declaration, the CIPM recognized that its MRA was complemented by similar Arrangements drawn up by OIML and ILAC. Indeed all three are interlinked and all support the equivalence and acceptability of SI-traceable measurements world-wide. The aim of this international measurement system is to provide

users with measurement results which can be accepted everywhere without the need for further measurements.

The BIPM works in close cooperation with several other international bodies concerned with metrology. Relations are also maintained through representation of the bodies on relevant CCs, and through the activities of the BIPM staff on external committees.

The OIML and BIPM participate in the Joint Committee for Guides in Metrology (JCGM), and the Joint Committee on Coordination of Assistance to Developing Countries in Metrology, Accreditation and Standardization (JCDCMAS).

The JCGM has responsibility for the following two important for metrology documents: Guide to the Expression of Uncertainty in Measurement (GUM) [13]; and International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (VIM) [14]. The JCGM-WG1 has recently completed its first Supplement to the GUM. The JCGM-WG2 has recently completed a revised edition of the VIM (VIM-3).

5. MODELS OF INTERACTION TECHNICAL COMMITTEES SYSTEMS OF IMEKO AND OTHER ORGANIZATIONS

The TCs systems of international metrological organization S_{IMTC} can be show:

$$S_{IMTC} \equiv \langle SB_{OIMLTC}, SB_{CIPMCC}, SR_{IMEKOTC}, R_{IMTC}, Z_{IMTC}, \Delta T \rangle,$$

$$SB_{OIMLTC} \subseteq TC_1 \cup TC_2 \cup \dots \cup TC_{18},$$

$$SB_{CIPMCC} \subseteq CC_1 \cup CC_2 \cup \dots \cup CC_9,$$

$$R_{IMTC} \subseteq SB_{OIMLTC} \cap SB_{CIPMCC} = JCGM,$$

where:

- SB_{OIMLTC} – OIML TCs subsystems;
- SB_{CIPMCC} – CIPM CCs subsystems;
- R_{IMTC} – OIML and CIPM subsystem for joint activity;
- $SR_{IMEKOTC}$ – IMEKO TCs subsystem of external action for OIML TCs and CIPM CCs;
- Z_{ISTTC} – OIML TCs and CIPM CCs aims of activity;
- ΔT – OIML TCs and CIPM CCs aims activity period (typically 10–20 years).

The IMEKO TCs systems S_{IMTC} can be show:

$$S_{IMEKOTC} \equiv \langle SB_{IMEKOTC}, SR_{IMTC}, Z_{IMEKOTC}, \Delta T \rangle,$$

$$SB_{IMEKOTC} \subseteq TC_1 \cup TC_2 \cup \dots \cup TC_{22},$$

where:

- $SR_{IMEKOTC}$ – IMEKO TCs subsystem;
- SR_{IMTC} – OIML and CIPM subsystem of external action for IMEKO TCs;
- $Z_{IMEKOTC}$ – IMEKO TCs aims of activity;
- ΔT – IMEKO TCs aims activity period.

Interaction of subsystems of IMEKO, OIML TCs and CIPM CCs is given in Fig. 2.

The TCs systems of RMO S_{RMOTC} can be show:

$$S_{RMOTC} \equiv \langle SB_{RMOITC}, \dots, SR_{CIPMCC}, R_{RMOTC}, Z_{RMOTC}, \Delta T \rangle,$$

$$SB_{RMOITC} \subseteq TC_1 \cup TC_2 \cup \dots \cup TC_N,$$

where:

- SB_{RMOITC} – RMOi TCs subsystems;

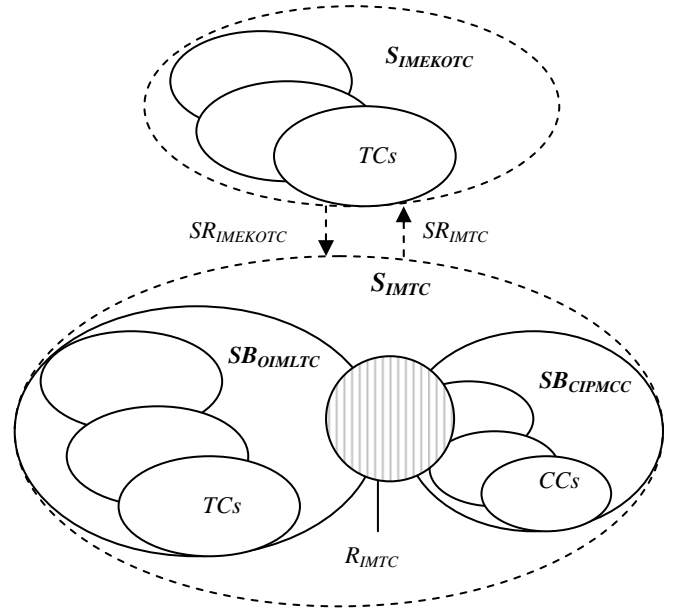


Fig. 2. Interaction of subsystems of IMEKO, OIML TCs and CIPM CCs

SR_{CIPMCC} – CIPM CCs subsystem of external action for RMOi TCs;

Z_{RMOTC} – RMOi TCs aim of activity;

ΔT – RMOi TCs aim activity period (typically 5 years).

Interaction of subsystems of CIPM CCs and RMO TCs is given in Fig. 3.

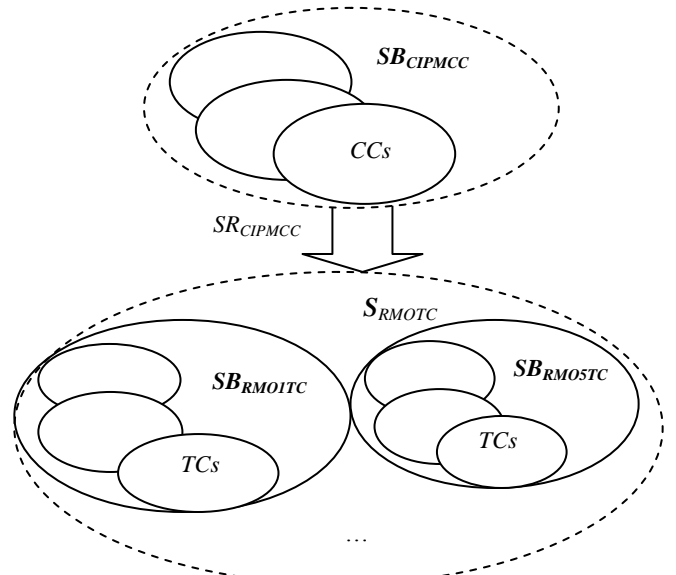


Fig. 3. Interaction of subsystems of CIPM CCs and RMO TCs

5. CONCLUSIONS

Analyses activity of IMEKO and international metrological organization technical or consultative committees has shown commonness interest and aims on different levels of works.

OIML membership enables to get regularly the documents, recommendations and other printed matters of OIML and to use them for harmonization of the national standards in field of metrology with international documents and recommendations.

Many conducted studies and its results which provide of IMEKO TCs members can be basis for prepared draft of OIML international documents and recommendations. Development of framework agreements between IMEKO and OIML and CIPM enhancement of international co-operation is recommended.

IMEKO TCs members can be participating in projects of regional metrological organization for adoption of their theoretical and practical results.

In paper analytical and schematic models of interaction of TCs subsystems of international and regional organization are proposed. Those models are very useful for analyzing possibilities of joint activity in some technical fields.

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