
# EURAMET Countries' Legal Time Regulations and Practices

EURAMET
European Association of National Metrology Institutes

TC-TF
Time and Frequency
EURAMET Technical Committee

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**EURAMET Countries' Legal Time Regulations and Practices**

**April 2011**

COVER

**The EURAMET region covers three time zones, whose relation to UTC is indicated by the three lower clocks.**

BY

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## SUMMARY

The information in this booklet covers legal time regulations and practices in European countries, being members of the European Association of National Metrology Institutes - EURAMET. General information about legal time, its connection to the International System of Units, and time zones used in Europe is given as an introduction. Following information was collected within the EURAMET Project 1117 “Survey on European countries' legal time regulations and practices”, conducted among EURAMET members in 2009 and 2010. This survey revealed that more than half of these countries have their legal time covered by legislation, while other countries use UTC related time as their de facto legal time. Typically, the National Metrology Institute (NMI) or a Designated Institute in a country is responsible for maintaining and disseminating legal time or de facto legal time. There is a significant number of countries, however, where this is not the case. The traceability of time in twenty-two European countries is covered through an ongoing international key comparison, maintained by BIPM, two countries obtain their traceability through another NMI, while a significant one fifth of surveyed countries have no traceability of time in place. Finally, comments and remarks of participating NMIs related to legal time issues are summarized at the end of this booklet.

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## FOREWORD

"Time measurement" is just as much a part of our daily lives today as it is a part of many fields of science and technology. This term is used for the measurement of the length of time intervals (keyword: stopwatch), for the recording of the frequency of events during a particular interval of time (keyword: frequency), and – maybe most prominently - for the dating of events on a time scale (keyword: time of day). The dating of events and the coordination of various activities in a modern society are recognized as being so important that in many countries it is regulated by legislation how legal time is to be stated. Border-crossing traffic and communications require that the thus determined times of day of the countries are to be coordinated with one another. The basics for such procedures were once laid down by the Washington Standard Time Conference, at which the position of the zero meridian and the system of the 24 time zones, extending over 15° geographic longitude each, were determined.

In this booklet the current status of existing national legislation in the EURAMET member countries is compiled. It is additionally documented by which means legal time is disseminated and which organizations are entrusted with this task. Dr. Rado Lapuh from the Metrology Institute of the Republic of Slovenia is to be congratulated for having launched the initiative, for carrying-out the survey among EURAMET members, and for analyzing the replies. A word of thanks of course also to those who responded timely and provided the requested information.

Dr. Andreas Bauch

Head of EURAMET Technical Committee Time and Frequency

January 2011

# 1 INTRODUCTION

During the meeting of the EURAMET Technical Committee for time and frequency, held in March 2009 in Brussels, a consultation project was proposed with the aim of gathering all relevant information related to legal time regulation and dissemination in European countries, covering topics related to legal time legislation, dissemination, responsibility, traceability and possibly other potentially related issues. In September 2009, a survey of European countries' legal time regulations and practices was launched and responses were collected in a one year time frame. All NMIs and DIs from EURAMET member states, including two associates (EC-IRMM and Montenegro) were surveyed.

This report on European countries' legal time regulations and practices with related accompanying information is addressed at national metrology institutes, legislatory bodies and the general public, interested in legal time issues, with the intent to expose established good practices related to national legal time legislation, realization and dissemination.

## 1.1 WHAT IS LEGAL TIME

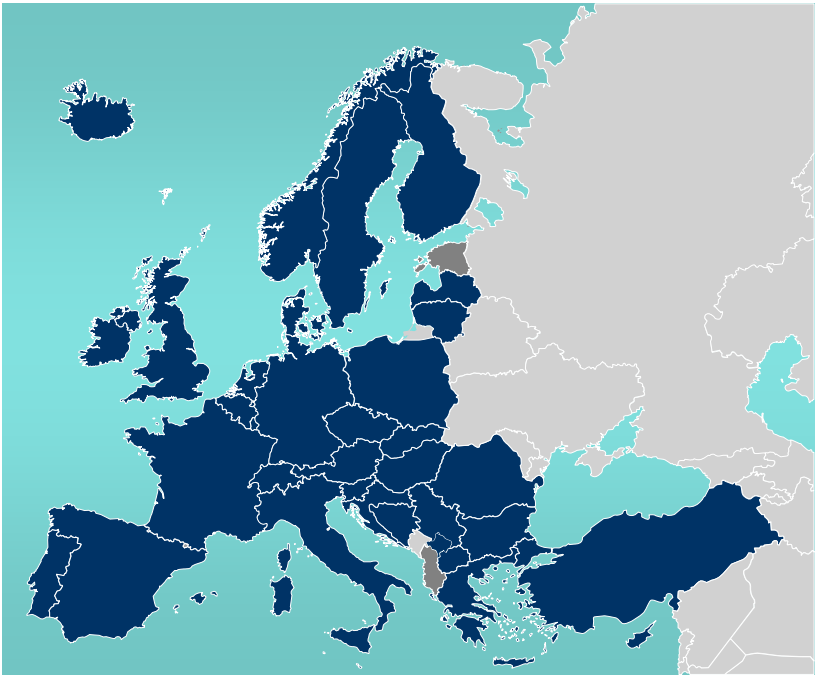
Official time in a particular country, including current date, hour, minute and second, is referred to as legal time in this booklet. It is usually defined by law or another state act in a particular country, in which case it is also defined who is responsible for keeping and disseminating time in that country. Typically, this is done by national metrology institutes and their national time laboratories, which have all required knowledge and technical equipment at their disposal to perform this task. Many of these laboratories send their clock data to the Bureau International des Poids et Mesures (BIPM) and BIPM calculates the actual international time scale based on this data. The realization of the international reference time scale is thus based on the best clocks of countries participating in the Metre Convention [1].

As the second is one of seven base units of the International System of Units (SI), the realisation and dissemination of legal time should follow the internationally agreed, uniform time scale [2]. This time scale is kept by BIPM as International Atomic Time (TAI), whose scale

unit is kept as close as possible to the SI second as realized on the geoid. For legal time purposes, Coordinated Universal Time (UTC) is actually used as the reference time practically all over the world. UTC is an atomic time scale derived from TAI, to provide a reference scale which follows the slightly irregular day-night period of the earth (caused by its variable rotation speed) on its terrestrial orbit around the sun with an accuracy of 0.9 second [3].

To follow the day-night pattern all over the globe, the countries adhere to certain time zones, and so-called summer times or daylight saving times are used in most countries in Europe. Time zones are offset from UTC by an integer number of hours. National time laboratories maintain their own time, known as UTC(k), which is generally an approximation of UTC to within no more than a few hundred nanoseconds.

Figure 1: EURAMET region countries



- EURAMET country, participating in the survey
- EURAMET country, not participating the survey
- non EURAMET country

This colour code is maintained throughout all figures

## 1.2 EURAMET REGION

The European Association of National Metrology Institutes (EURAMET) is the European Regional Metrology Organisation (RMO). It coordinates the cooperation of National Metrology Institutes (NMI) in Europe in fields like research in metrology, traceability of measurements to the SI units, international recognition of national measurement standards and the Calibration and Measurement Capabilities (CMC) of its members [4]. All current EURAMET Member States are marked in Figure 1.

Members of EURAMET are the respective NMIs from each country. EURAMET work is organized in 12 Technical Committees (TC), of which TC 11 deals with Time and Frequency (T&F) and is concerned with technical issues considered in this booklet [5]. Table 1 lists all current EURAMET members or associate members, responsible for time and frequency in their country. All 29 members of EURAMET TC TF responded to the Survey. Of the 36 EURAMET member states, 34 states (94.4%) responded to the survey. It is assumed that 34 countries participated in the survey.

Table 1: Current EURAMET members, responsible for time and frequency in their country. Their participation in EURAMET TC T&F is indicated under (a) and their participation in the survey under (b).

| INSTITUTE | COUNTRY | (a) | (b) |
|---|---|---|---|
| DPM | Albania | | |
| BEV | Austria | ✔ | ✔ |
| SMD | Belgium | ✔ | ✔ |
| IMBiH | Bosnia-Herzegovina | ✔ | ✔ |
| BIM | Bulgaria | ✔ | ✔ |
| HMI | Croatia | | ✔ |
| MCIT | Cyprus | | ✔ |
| ÚFE/IPE | Czech Republic | ✔ | ✔ |
| INSTITUTE | COUNTRY | (a) | (b) |

| | | | |
|---|---|---|---|
| DFM | Denmark | ✔ | ✔ |
| Metrosert | Estonia | | |
| MIKES | Finland | ✔ | ✔ |
| LNE-SYRTE | France | ✔ | ✔ |
| PTB | Germany | ✔ | ✔ |
| EIM | Greece | ✔ | ✔ |
| MKEH | Hungary | ✔ | ✔ |
| NEST | Iceland | | ✔ |
| NSAI NML | Ireland | ✔ | ✔ |
| INRIM | Italy | ✔ | ✔ |
| LATMB | Latvia | ✔ | ✔ |
| VMT/FTMC | Lithuania | ✔ | ✔ |
| CRP Henri Tudor | Luxembourg | | ✔ |
| BoM | FYR Macedonia | ✔ | ✔ |
| MSA-NMS | Malta | | ✔ |
| VSL | The Netherlands | ✔ | ✔ |
| JV | Norway | ✔ | ✔ |
| GUM | Poland | ✔ | ✔ |
| IPQ | Portugal | ✔ | ✔ |
| INM | Romania | ✔ | ✔ |
| DMDM | Serbia | ✔ | ✔ |
| SMU | Slovakia | ✔ | ✔ |
| MIRS/SIQ/Metrology | Slovenia | ✔ | ✔ |
| ROA | Spain | ✔ | ✔ |
| SP | Sweden | ✔ | ✔ |
| METAS | Switzerland | ✔ | ✔ |
| UME | Turkey | ✔ | ✔ |
| NPL | United Kingdom | ✔ | ✔ |

## 1.3 TIME ZONES IN THE EURAMET REGION

Three time zones are used in the EURAMET Region, as shown in Figure 2.

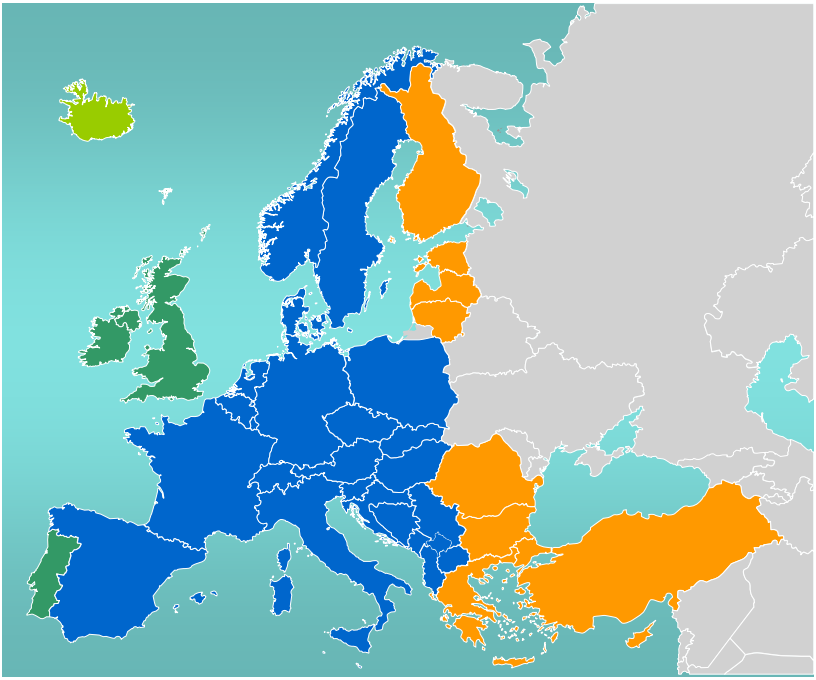
Western European Time (WET) has zero offset from Coordinated Universal Time (UTC). During the summertime, Western European Summer Time (WEST) is used instead, being one hour ahead of WET. In some countries, the designation British Summer Time (BST) is used. Iceland does not adopt Summer Time and is thus the only exception to this practice in the EURAMET region.

The use of the term Greenwich Mean Time (GMT) is still popular, but it should be abandoned. GMT was the historical designation of mean solar time of the Greenwich meridian with the day in GMT starting at noon. The International Astronomical Union redefined GMT in 1925 so that the day began at midnight, but already in 1928 the term GMT was abandoned and replaced by UT for Universal Time.

Central European Time (CET) is one hour ahead of UTC. During the summertime, Central European Summer Time (CEST) is used which is two hours ahead of UTC.

Eastern European Time (EET) is two hours ahead of UTC. During the summertime, clocks are three hours ahead of UTC to follow Eastern European Summer Time (EEST).

Figure 2: Time zones in the EURAMET region



- UTC (WET)
- UTC (WET), BST (WEST) = UTC + 1 h during summertime
- CET (UTC + 1 h), CEST (UTC + 2 h) during summertime
- EET (UTC + 2 h), EEST (UTC + 3 h) during summertime

# 2 LEGAL TIME IN THE EURAMET REGION

## 2.1 LEGISLATION

### 2.1.1 Legal time defined by legislation

Legislation related to the time scale used in the EURAMET Region varies from country to country. Figure 3 shows 18 countries (or 52.9% of all countries participating in the survey) whose legal time is defined by legislation. It should be mentioned that these regulations cover the topic to a different extent, ranging from simply stating which time should be used as legal time, to clearly defining the time used for legal time, who is responsible for maintaining and disseminating it and where it shall be used. Approved text of the respective legislation in English language is available from HMI (Croatia), GUM (Poland), IPQ (Portugal), DMDM (Serbia) and NPL (United Kingdom).

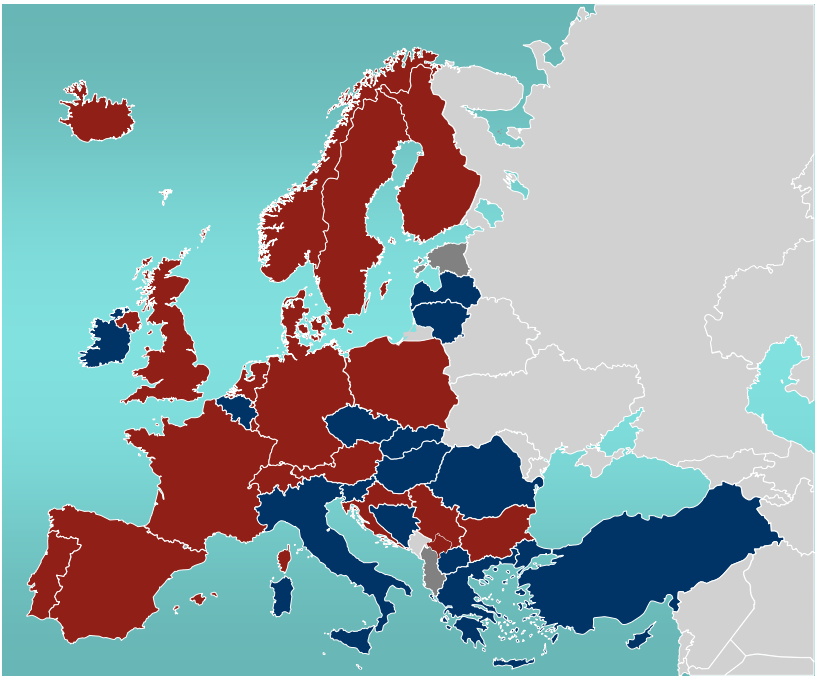
### 2.1.2 NMI/laboratory responsible for realisation of the country's legal time

In 11 of the 18 EURAMET countries in which legal time is defined by legislation, the responsibility for legal time realisation is with their National Metrology Institute or institutes designated by a national authority. These countries and their National Metrology Institutes/Designated Institutes are listed in Table 2.

Table 2: NMIs and DIs. which are responsible by legislation or by contract for legal time realisation.

| NMI/DI | COUNTRY | NMI/DI | COUNTRY |
|---|---|---|---|
| BEV | Austria | BIM | Bulgaria |
| LNE-SYRTE | France | PTB | Germany |
| VSL | The Netherlands | JV | Norway |
| GUM | Poland | ROA | Spain |
| DMDM | Serbia | SP | Sweden |
| METAS | Switzerland | | |

Figure 3: Countries in the EURAMET region where legal time is defined by legislation



- Countries where legal time is defined by legislation
- Countries without legal definition of their time

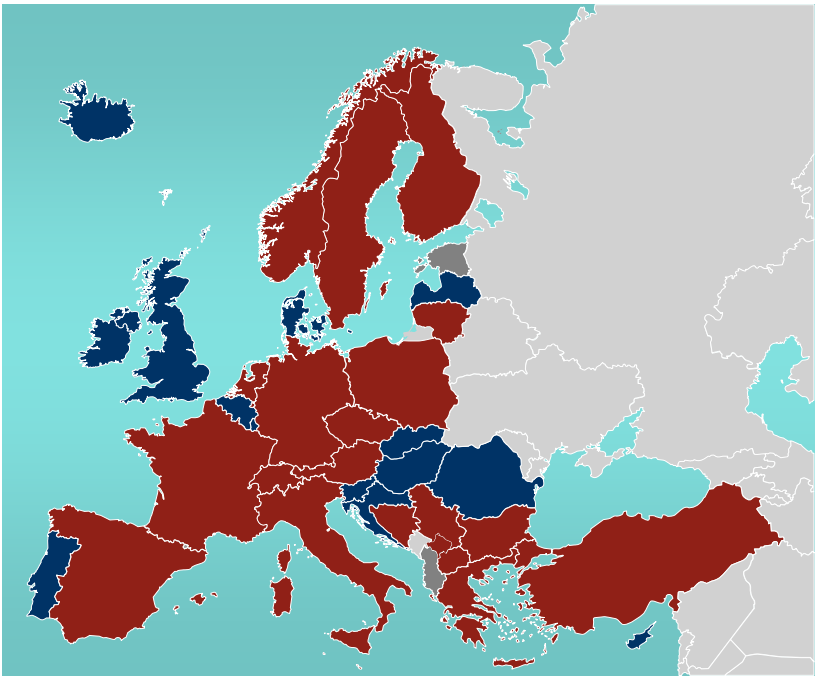
### 2.1.3 De facto legal time in other countries

As 16 other countries (marked blue in Figure 3) do not currently define legal time by legislation, they are using a de facto time for all their purposes. This time always refers to UTC, taking into account time zone and summer time used in that particular country (see Figure 2). Although the de facto legal time is not defined by legislation, it is mentioned in Latvia by Decree of Cabinet of Ministers, in Lithuania by the Procedure of Providing Services of Time Stamp Formation and in the Slovak Republic by Law of metrology.

### 2.1.4 Attempts to establish country's legal time

In 8 countries without a legislation defining legal time today, there are continuous attempts by their NMIs to have a law passed establishing that country's legal time. In Italy, there is a draft law already in Parliament. In Slovenia, MIRS is considering incorporating it within the Law of Metrology. In Bosnia-Herzegovina, Cyprus, Greece and FYR Macedonia their NMIs are setting up their laboratories and pursuing actions to be recognised as the NMI responsible for their country's legal time realisation. In Lithuania, VMT/FTMC is trying to establish it through government resolution. In Malta, MSA-NMS is trying to enforce GPS time as a legal time reference.

Figure 4: Countries in the EURAMET region in which the NMI or a DI is responsible for legal time dissemination



● Countries in which the NMI or a DI is responsible for the dissemination of legal time or the adopted de-facto official time

## 2.2 DISSEMINATION

Dissemination in a strict metrological sense means documented comparison of traceable measurement value with known uncertainty to other measurements which are or consequently become traceable to the original measurement value. The task of dissemination of measurement quantities is fundamental to the operation of any NMI.

Technically, there are many possibilities of disseminating time and, contrary to other SI units, it is both possible and practical to disseminate time and frequency remotely, without two measurements being performed at the same place. One of the most used time dissemination option is that through the US Global Positioning System (GPS). However, its use by itself is not considered providing traceability to UTC by many metrology authorities around the world.

### 2.2.1 NMIs responsible for legal time dissemination

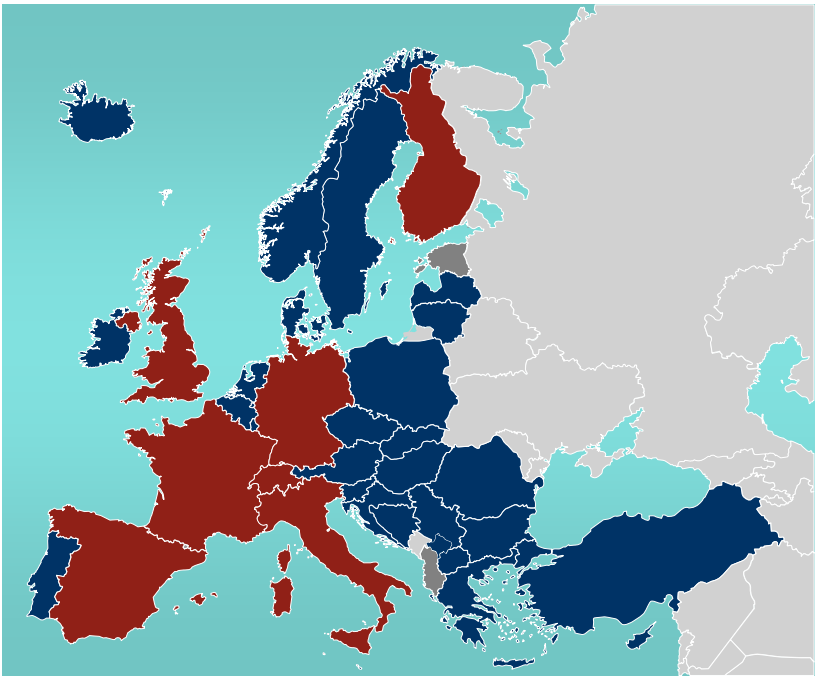
Although not all countries within the EURAMET region have their legal time defined by legislation, their NMIs or DIs might be responsible for legal time dissemination. The 20 countries (58.8%) in which this is the case are shown in Figure 4. Obviously, this includes both legal time defined by legislation and de facto legal time. By comparing Figure 4 with Figure 3, it is also clear that in not all countries where legal time is defined by legislation their NMIs are responsible for legal time dissemination. Also NMIs in certain countries are responsible for time dissemination although legal time in that country is not defined by legislation.

### 2.2.2 Legal time dissemination via radio signals

When a legal time code is embedded in a transmitted radio signal, the receivers which are within the coverage of the transmitted signal can synchronize their own local clock to the transmitted legal time. The best-known radio signal in Europe is DCF77, through which German legal time (CET and CEST) is disseminated. It can be received in almost all European countries with an uncertainty of determination of the correct epoch of a few milliseconds. NMIs from 7 countries or 20.6% of all countries participating in the survey reported disseminating their legal or de facto legal time using radio signals, as

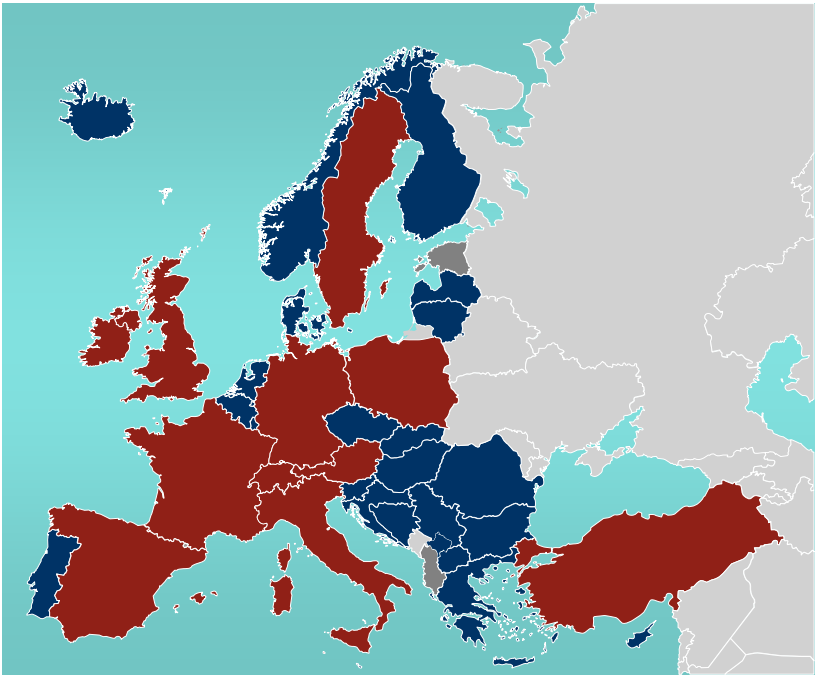
shown in Figure 5. Details on most services using radio signals can be found in [6].

Figure 5: Legal time dissemination via radio signals



● Countries in which legal time is disseminated via radio signals

Figure 6: Legal time dissemination via telephone signals



● Countries in which legal time is disseminated via telephone signals

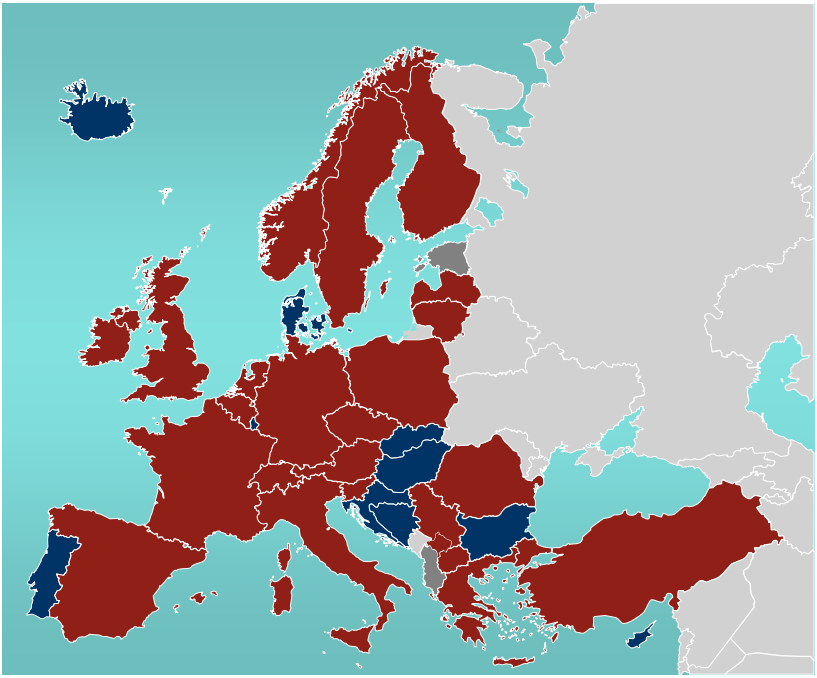
### 2.2.3 Legal time dissemination via telephone signals

A legal time code can be transmitted over the telephone network where modems are used to generate and receive the signal. With the appropriate software, the local clock can be synchronised with legal time with an uncertainty of a few ten milliseconds. Other less accurate methods may employ uncoded signals or even a speaking clock. The countries in which legal time dissemination via telephone signals is used are shown in Figure 6. 11 countries or 32.4% of countries participating in the survey use telephone signals for their legal or de facto legal time dissemination. Details on most services using telephone signals can be found in [7].

### 2.2.4 Legal time dissemination using NTP servers

NTP servers are computer servers using the Network Time Protocol to disseminate time codes according to UTC over the Local Area Network (LAN) or Wide Area Network (WAN). This is one of the most popular methods of disseminating time, as the majority of today's personal computers synchronise their clocks using NTP. With the widespread availability of required hardware equipment, a number of operating NTP servers exist in virtually every country and use a hierarchical system to obtain and disseminate time codes. However, legal or de facto legal time dissemination using NTP servers at the highest hierarchical level is the task of the NMI or appointed time laboratory in the country. There are 24 countries or 70.6% of countries participating in the survey in which the NMI or appointed time laboratory disseminates time codes using NTP servers, as shown in Figure 7. Details on most services using NTP servers can be found in [7].

Figure 7: Legal time dissemination using NTP servers



● Countries in which legal time is disseminated using NTP servers

### 2.2.5 Legal time dissemination by other means

There are other means by which NMIs in the EURAMET region disseminate legal or de facto legal time in their countries. These means are summarised in Table 3.

Table 3: NMIs which use other means to disseminate their country's legal time.

| NMI (COUNTRY) | DISSEMINATION |
|---|---|
| BEV (Austria) | Qualified time stamp appliance |
| BIM (Bulgaria) | Frequency modulated pulses by Bulgarian National Radio, broadcasted every hour |
| MCIT (Cyprus) | Optical links |
| ÚFE/IPE (Czech Republic) | Common-view GPS links |
| DFM (Denmark) | Legal time (mean solar time) is not disseminated; end-users acquire themselves UTC from GPS or DCF77 signals as available |
| MIKES (Finland) | Time signals by Finnish Broadcasting Company monitored by MIKES |
| LNE-SYRTE (France) | Common-view GPS links |
| INRIM (Italy) | Remote calibration of synchronised clocks |
| BoM (FYR Macedonia) | Optical links |
| VSL (The Netherlands) | Weekly publishing the difference of GPS and DCF77 signals from local time |
| GUM (Poland) | Acoustic signals in the Polish public radio (every hour) |
| SP (Sweden) | National Common-view GPS links |

## 2.3 TRACEABILITY

Traceability in a metrological sense is a property of a measurement whereby the result can be related to a reference through an unbroken chain of calibrations, each contributing to the measurement uncertainty [8]. The reference for time is UTC as maintained by BIPM, therefore all legal time clocks should be traceable to UTC time, realised by BIPM. Direct traceability to this reference time is provided through the key comparison CCTF-K001.UTC for which participants send their clock measurements and time transfer data to the BIPM [9]. Each month, BIPM processes the clock measurements from the preceding month and produces UTC as a smooth and highly stable international reference time scale. The deviations of each participating time laboratory are published each calendar month by BIPM in the Circular T. Another possibility is to obtain the traceability through the comparison of local clocks with another NMI, which is participating in CCTF-K001.UTC.

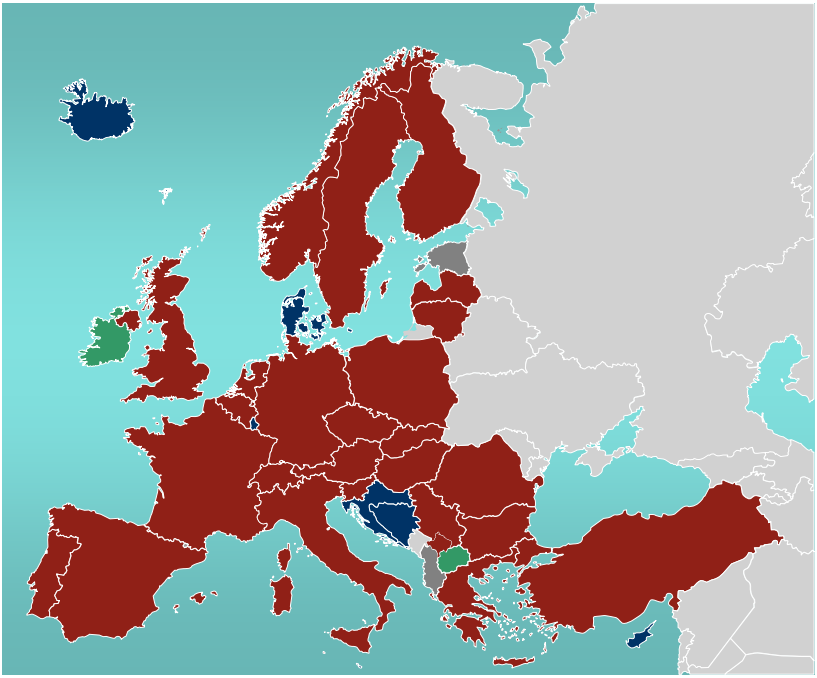
### 2.3.1 Traceability path

Of 27 countries which reported their traceability path, 25 or 92.6% are represented in Circular T and 2 countries (7.4%) obtain their traceability through another NMI (see Figure 8). 7 countries out of 34 participating in the survey (20.6%) reported that traceability for their national time scale is currently not provided through their NMI or elsewhere.

### 2.3.2 Technical means of maintaining time traceability

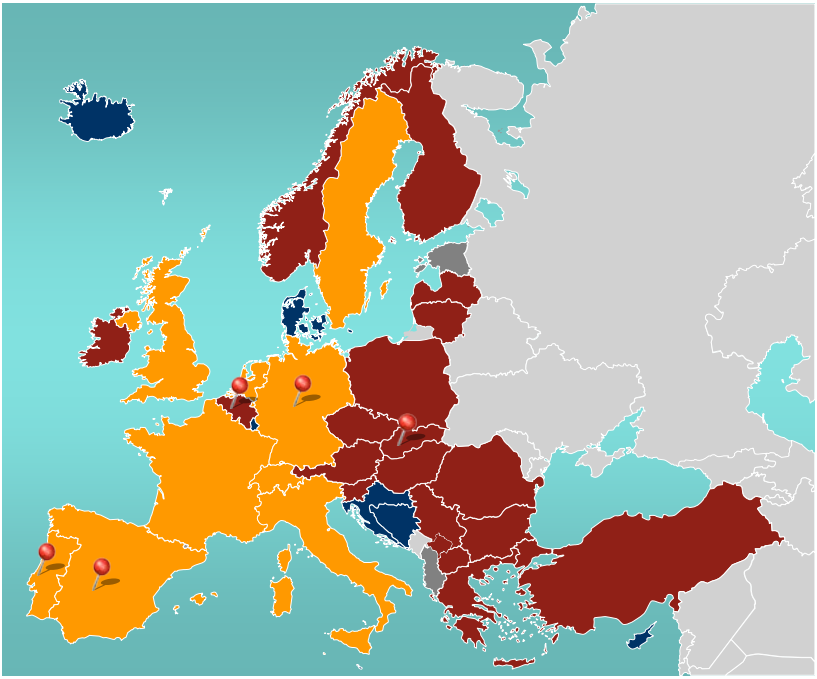
As traceability for time is obtained by remote comparisons, the technical means used to either transfer time codes between two time laboratories or through which they can compare their own local clocks with that of another institute are relevant. These technical means currently include Two-Way Satellite Time and Frequency Transfer (TWSTFT), Global Positioning System (GPS) and Global Navigation Satellite System (GLONASS). Their use in the EURAMET region is shown in Figure 9. Of 27 countries maintaining time traceability, all are using GPS, 9 (33.3%) are using TWSTFT and 5 (18.5%) are using GLONASS.

Figure 8: Traceability through Circular-T or through another NMI



- Circular-T
- through another NMI

Figure 9: Technical means of maintaining time traceability



- GPS
- TWSTFT & GPS
- GLONASS

## 2.4 OTHER ISSUES

Surveyed NMIs were asked to add any comments they feel relevant to the issue of European countries legal time, but not covered in the

survey on European countries' legal time regulations and practices. Observations received are listed by each NMI:

**SMD (Belgium):** SMD has only been responsible by law since 1971 for the time interval unit and for frequency. SMD has been accredited by RvA (The Netherlands) according to the ISO/IEC 17 025 standard, from August 2010 until January 2011. This accreditation has been transferred to BELAC (Belgium) afterwards in agreement with the EC Regulation 765/2008. The introduction of leap seconds in UTC is considered as a problem by SMD.

**MCIT (Cyprus):** MCIT will construct a new laboratory and expects to be included in Circular-T.

**PTB (Germany):** Responsibility for decisions regarding the adoption of summer time lies with the Federal Ministry of Economics and Technology. The realization of the unit of time is based on the operation of PTB's primary clocks.

**DFM (Denmark):** DFM has been trying to change the situation on legal time in Denmark, without success. "UTC+1 hour" is used as de-facto legal time, although there is no control at all over people or companies disseminating time. For example, the NTP servers on the Danish Internet eXchange (DIX) are run by a private person as a hobby project.

**MIKES (Finland):** Considering the seasonal deviations of the apparent solar time and the one-hour steps in time caused by time zones, leap seconds introduced to UTC are of minor importance to the general public. In a modern society, there are relatively few applications that require time synchronized to Universal Time (mean solar time), while leap seconds may create problems in data logging, time stamping, telecommunication systems and time distribution services. Thus, a serious consideration should be given to stop corrections to UTC. Energy savings from daylight saving time are likely insignificant compared to the effort needed in the society to adjust to the changed time twice a year. Therefore, a consideration to the usefulness of the daylight saving time should be given.

**LNE-SYRTE (France):** French law (Decree no. 78-855) specifies that legal time is derived from "coordinated universal time (UTC) established by the Bureau International de l'Heure (BIH).

**NEST (Iceland):** No demand for dissemination, GPS time is always at hand.

**MSA-NMS (Malta):** European legislation talks about standard time and no European time is defined.

**VSL (The Netherlands):** Besides the law that defines legal time in the Netherlands, there is a separate law that specifies the maintenance of the national time standard. This law states that the realisation of the national measurement standard for time should be based on three caesium clocks.

**GUM (Poland):** The current Polish law on legal time does not solve the problem of synchronization, accuracy, verification and responsibility for the correctness of time used in time-stamping (some ideas were proposed in the new project of law on electronic signatures) in banking, in financial operations, etc. Probably it is a common problem within the European community.

**SMU (Slovakia):** SMU plans to establish time dissemination through NTP.

**METAS (Switzerland):** Operation of the Swiss longwave radio time emitter HBG will be stopped at the end of 2011.

# 3 GLOSSARY

**BEV** (Austria) Bundesamt für Eich- und Vermessungswesen.
**BIH** Bureau International de l'Heure.
**BIM** Bulgarian Institute of Metrology.
**BIPM** Bureau International des Poids et Mesures, International Bureau of Weights and Measures.
**BoM** (FYR Macedonia) Bureau of Metrology.
**BST** British Summer Time. BST is 1 hour ahead of UTC (UTC + 1 h).
**CEST** Central European Summer Time. CEST is 2 hours ahead of UTC (UTC + 2 h).
**CET** Central European Time. CET is 1 hour ahead of UTC (UTC + 1 h).
**CMC** Calibration and Measurement Capabilities.
**CRP Henri Tudor** (Luxemburg) Centre de Recherche Public Henri Tudor.
**DFM** Danish Fundamental Metrology.
**DMDM** (Serbia) Directorate of Measures and Precious Metals.
**DPM** (Albania) General Directorate of Metrology.
**DI** Designated Institute, designated by its NMI or a national authority to hold specific national standards.
**EC-IRMM** (EC) Institute for Reference Materials and Measurements.
**EEST** Eastern European Summer Time. EEST is 3 hours ahead of UTC (UTC + 3 h).
**EET** Eastern European Time. EET is 2 hours ahead of UTC (UTC + 2 h).
**EIM** (Greece) Hellenic Institute of Metrology.
**EURAMET** European Association of National Metrology Institutes.
**GLONASS** Global Navigation Satellite System.
**GMT** Greenwich Mean Time.
**GPS** US Global Positioning System.
**GUM** (Poland) Central Office of Measures/Glówny Urzad Miar.
**HMI** Croatian Metrology Institute.
**IMBiH** Institute of Metrology of Bosnia-Herzegovina.
**INM** (Romania) National Institute of Metrology.
**INRIM** (Italy) Istituto Nazionale di Ricerca Metrologica.
**IPQ** Instituto Português da Qualidade.
**JV** Norwegian Metrology Service.
**LATMB** (Latvia) SAMC Metrology Bureau.
**LNE-SYRTE** (France) Observatoire de Paris - Laboratoire national de métrologie et d'essais.

**MCIT** (Cyprus) Weights and Measures Service / Ministry of Commerce, Industry and Tourism.
**METAS** (Switzerland) Federal Office of Metrology.
**Metrosert** (Estonia) AS Metrosert.
**MIKES** (Finland) Centre for Metrology and Accreditation.
**MIRS** Metrology Institute of the Republic of Slovenia.
**MIRS/SIQ/Metrology** Slovenian Institute of Quality and Metrology.
**MKEH** Hungarian Trade Licensing Office.
**MSA-NMS** Malta Standards Authority - National Metrology Services.
**NEST** (Iceland) Neytendastofa.
**NMI** National Metrology Institute (generic).
**NPL** (UK) National Physical Laboratory.
**NSAI-NML** (Ireland) NSAI National Standards Authority of Ireland.
**NTP** Network Time Protocol.
**OAL** (Portugal) Observatório Astronómico de Lisboa.
**PTB** (Germany) Physikalisch-Technische Bundesanstalt.
**ROA** (Spain) Real Instituto y Observatorio de la Armada.
**Second** Base unit of the SI.
**SI** International System of Units.
**SMD** (Belgium) FPS Economy, DG Quality and Safety, Metrology Service.
**SMU** Slovak Institute of Metrology.
**SP** Technical Research Institute of Sweden.
**Summer time** Time scale which is one hour ahead of the regular time zone time, used in many countries during the summertime; also known as Daylight Saving Time.
**TAI** Temps atomique international, International Atomic Time.
**Time zone** A geographical zone with the same legal time.
**Traceability** Property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty.
**TWSTFT** Two-Way Satellite Time and Frequency Transfer.
**UME** (Turkey) Ulusal Metroloji Enstitüsü.
**UTC** Coordinated Universal Time.
**UTC(k)** Local realisation of UTC.
**ÚFE/IPE** (Czech Republic) Institute of Photonics and Electronics.
**VMT/FTMC** (Lithuania) Centre for Physical Sciences and Technology.
**VSL** (The Netherlands) Dutch Metrology Institute.
**WEST** Western European Summer Time. WEST is 1 hour ahead of UTC (UTC + 1 h).

**WET** Western European Time. WET is in the same time zone as UTC.

## 4 LINKS TO FURTHER INFORMATION

| INFO ABOUT ... | SOURCE | CONTACT |
|---|---|---|
| World time | BIPM | www.bipm.org/en/scientific/tfg/ |
| Time dissemination services | BIPM | ftp://ftp2.bipm.org/pub/tai/scale/TIMESERVICES/timeservices.pdf |
| Radio time signals | BIPM | ftp://ftp2.bipm.org/pub/tai/scale/TIMESIGNALS/timesignals.pdf |
| Circular-T supplementary data | BIPM | www.bipm.org/jsp/en/ kcdb_data.jsp |
| Atomic clocks, time scales, time dissemination | PTB | www.ptb.de/time/ |
| Time research, applications, services, history and more | NPL | www.npl.co.uk/science-technology/time-frequency/time/research/the-world-time-system |
| A Walk through Time | NIST | www.nist.gov/pml/general/time/index.cfm |
| World time zones map | WorldTime Zone.com | www.worldtimezone.com |
| Daylight saving time map | WorldTime Zone.com | www.worldtimezone.com/daylight.html |
| About Daylight Saving Time | IDEA | www.webexhibits.org/daylightsaving/i.html |

# 5 REFERENCES


[1] BIPM: Member States and Associates of the Metre Convention, www.bipm.org/en/convention/member_states/

[2] BIPM: The International System of Units (SI), 8th edition, Appendix 2, Practical realisation of the definition of the unit of time, www.bipm.org/utils/en/pdf/SIApp2_s_en.pdf

[3] BIPM: International Atomic Time, www.bipm.org/en/scientific/tai/tai.html

[4] EURAMET: EURAMET e.V. - In Short, www.euramet.org/index.php?id=euramet-in-short

[5] EURAMET: EURAMET Technical Committee for Time and Frequency, www.euramet.org/index.php?id=tc-tf

[6] BIPM: Time Signals, www.bipm.org/utils/common/documents/tar2009/timesignals.pdf

[7] BIPM: Time Dissemination Services, www.bipm.org/utils/common/documents /tar2009/timeservices.pdf

[8] BIPM, IEC, IFCC, ILAC, ISO, IUPAC, IUPAP, OIML: International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (VIM), 3rd edition, 2008, JCGM 200:2008, also published by ISO as ISO/IEC Guide 99-12:2007 International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (VIM)

[9] BIPM: The BIPM key comparison database, http://kcdb.bipm.org

"Man measures time and time measures man."
*Italian proverb*

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