International Telecommunication Union

ITU-R

Radiocommunication Sector of ITU

Recommendation ITU-R TF.686-3

(12/2013)

Glossary and definitions of time and frequency terms

TF Series

Time signals and frequency standards emissions

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from http://www.itu.int/ITU-R/go/patents/en where the Guidelines for Implementation of the Common Patent Policy for ITU-T/ITU-R/ISO/IEC and the ITU-R patent information database can also be found.

Series of ITU-R Recommendations

(Also available online at http://www.itu.int/publ/R-REC/en)

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	**Time signals and frequency standards emissions**
V	Vocabulary and related subjects

Note: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

Electronic Publication
Geneva, 2014

© ITU 2014

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without written permission of ITU.

RECOMMENDATION ITU-R TF.686-3*

Glossary and definitions of time and frequency terms

(1990-1997-2002-2013)

Scope

The terms listed in Annex 1 are taken from relevant ITU-R and ITU-T Recommendations, ITU-R Handbooks, the International Vocabulary of basic and general terms in Metrology (VIM) published by International Organization for Standardization (ISO), the Glossary of Time and Frequency Terms of the National Institute of Standards and Technology (NIST), and other noted references. Annex 1 also includes a number of related telecommunication terms in general usage in the field of frequency and time. Two types of terms are presented; those typically used within the standard-frequency and time-signal services and those in more general use, but specifically applicable to this field.

The ITU Radiocommunication Assembly,

considering

a) that it is essential for the work of the ITU that terms should be used in a clearly defined and uniform manner;

b) that there is a need for a common terminology for the unambiguous specification and description of frequency and time standard systems;

c) that there is a need to promote a consistent use of terminology across the growing community of users of frequency and time standard systems,

recommends

1 that Annex 1 be used as a glossary and as definitions of time and frequency terms for the users of standard-frequency and time-signal services.

References

ITU-R Recommendations

TF.457: Use of the modified Julian date by the standard-frequency and time-signal services

TF.460: Standard-frequency and time-signal emissions

TF.538: Measures for random instabilities in frequency and time (phase)

TF.768: Standard frequencies and time signals

TF.1010: Relativistic effects in a coordinate time system in the vicinity of the Earth

TF.1153: The operational use of two-way satellite time and frequency transfer employing pseudorandom noise codes

TF.2018: Relativistic time transfer in the vicinity of the Earth and in the solar system.

---

* This Recommendation should be brought to the attention of the Telecommunication Standardization Bureau (TSB) and the International Organization for Standardization (ISO).

ITU-R Handbooks

Selection and use of precise frequency and time systems

Satellite time and frequency transfer and dissemination.

ITU Radio Regulations

ITU-T Recommendations

G.810: Definitions and terminology for synchronization networks

G.811: Timing characteristics of primary reference clocks.

Other references

IEV: International electrotechnical vocabulary

ISO 8601: Representation of dates and times

NIST: Glossary of Time and Frequency Terms

NTP: Network time protocol (www.ntp.org)

PTP: Precision time protocol – IEEE 1588 Standard for a precision clock synchronization protocol for networked measurement and control systems

ANSI: American National Standards Institute

BIPM: VIM JCGM 200: 2012

BIPM: GUM – Guide to the expression of uncertainty in measurement JCGM100: 2008

BIPM: SI Brochure.

Annex 1

Glossary and definition of time and frequency terms

accuracy; *exactitude; exactitud*

Closeness of the agreement between the result of a measurement and the true value of the measurand. See GUM, VIM.

active frequency standard; *étalon de fréquence actif; patrón de frecuencia activo*

An atomic oscillator whose output signal is derived from the radiation emitted by the atomic species providing the atomic reference transition. The electronic system detects the transition, and servo controls the phase and frequency of a quartz oscillator on the received frequency. The most prominent example is the hydrogen maser. See Hydrogen Maser frequency standard.

ageing; *vieillissement; envejecimiento*

The systematic change in frequency with time due to internal changes in the oscillator.

NOTE 1 – It is the frequency change with time when factors external to the oscillator (environment, power supply, etc.) are kept constant.

Allan variance (AVAR)/Allan deviation (ADEV); *variance d'Allan (AVAR)/écart type d'Allan (ADEV); varianza/desviación típica de Allan (AVAR/ADEV)*

A standard method of characterizing the frequency instability of oscillators in the time domain, both short term and long term. See "two-sample deviation/variance".

all-in-view GNSS time transfer; *transfert de signaux horaires à partir de tous les satellites GNSS visibles; transferencia de señales horarias de todos los GNSS a la vista*

In this technique, data is collected from all GNSS satellites in view during a specified time interval to establish the offset of a local clock to each of the observed satellite clocks. The local clock offset to IGST can then be computed by using IGS precise satellite orbits and clock offset products. Then any two local clocks can be compared at any distance by a simple difference, with an uncertainty which is largely independent of the distance. This technique provides significant improvement in measurement precision over common view time transfer in case of baselines > 1 000 km.

atomic clock/frequency standard; *étalon de fréquence/horloge atomique; reloj atómico/patrón de frecuencia*

An atomic clock keeps time using an oscillator based on an electronic transition frequency in the microwave, optical or ultraviolet region of the electromagnetic spectrum of atoms.

atomic time-scale; *échelle de temps atomique; escala de tiempo atómico*

A time-scale based on atomic or molecular resonance phenomena. Elapsed time is measured by counting cycles of a frequency locked to an atomic or molecular transition.

bandwidth; *largeur de bande; anchura de banda*

Absolute value of the difference between the limiting frequencies of a frequency band.

beat frequency; *fréquence de battement; frecuencia de batido*

The interference between two different frequencies that results in a periodic variation in frequency whose rate is the difference between the two input frequencies.

bias; *biais; error sistemático*

Estimate of a systematic measurement error/uncertainty. See GUM.

Caesium beam frequency standard; *étalon de fréquence à jet de césium; patrón de frecuencia de haz de cesio*

An atomic frequency standard that is based on the ground state hyperfine transition in Cs133 atoms. It is a prominent example of a passive frequency standard.

calibration; *étalonnage; calibración*

The process of identifying and measuring offsets between the indicated value and the value of a reference standard used as the test object to some determined level of uncertainty.

NOTE 1 – In many cases, e.g. in a frequency generator, the calibration is related to the stability of the device and therefore its result is a function of time and of the measurement averaging time.

carrier frequency; *fréquence porteuse; frecuencia portadora*

The frequency of a signal upon which information (modulation) is impressed.

carrier phase measurements; *mesures de phase de la porteuse; mediciones de la fase de la portadora*

GNSS systems provide two types of direct measurements – code based pseudorange and the carrier phase. Due to their low noise, carrier phase measurements can be used for smoothing pseudoranges and in high precision positioning applications. Carrier phase measurements are ambiguous by an

unknown integer number of cycles presenting a problem that requires additional time and processing to solve.

clock; *horloge; reloj*

A device for time measurement and/or time display.

clock ensemble; *ensemble d'horloge, conjunto de relojes*

A collection of clocks, not necessarily in the same physical location, operated together in a coordinated way either for mutual control of their individual properties or to maximize the performance (time accuracy and frequency stability) and availability of a time-scale derived from the ensemble.

clock time difference; *différence entre temps d'horloge*; *diferencia de tiempo de reloj*

The difference between the readings of two clocks at the same instant.

NOTE 1 – To avoid confusion in sign, algebraic quantities should be given, applying the following convention. At a time T of a reference time-scale, let a denote the reading of clock A, and b the reading of clock B. The clock time difference is expressed by $A - B = a - b$ at the instant T. There is no universally accepted convention for the significance of the sign. If $A - B$ is measured electrically, a positive value usually implies that a given tick from clock A arrives before the corresponding tick from clock B, whereas, the reverse is usually true if A and B are calendar dates read from the two clocks.

NOTE 2 – In some situations relativistic effects can be significant and must be accounted for. See Recommendation ITU-R TF.2018.

coherence of frequency; *cohérence de fréquence; coherencia de frecuencia*

Same as coherence of phase (phase coherence).

coherence of phase; *cohérence de phase; coherencia de fase*

See “phase coherence”.

common-view (CV) time-transfer; *transfert de signaux horaires à partir de vues simultanées; transferencia con visión común (VC) de señales horarias*

Allows the direct comparison of two clocks at remote locations. In this technique, two stations, A and B, receive simultaneous one-way signals simultaneously from a single GNSS satellite and measure the time difference between the satellite clock and their own local clock. The time difference between clocks A and B is calculated by taking the difference between the simultaneous clock difference measurements, in which any error in the satellite clock is cancelled. In addition, some error sources such as orbit error and ionospheric error that are correlated with link geometry are reduced in CV time transfer. The CV technique thus performs quite well when the two stations are separated by short distances but the uncertainty gets larger as the distance increases (less cancellation of errors, less common visibility) until the point where common view observation is no longer possible.

coordinated clock; *horloge coordonnée; reloj coordinado*

A clock synchronized within stated limits to a reference clock that is spatially separated.

coordinate time; *temps-coordonnée; tiempo-coordenada*

The concept of time in a specific coordinate frame, valid over a spatial region with varying gravitational potential.

NOTE 1 – TAI is a coordinate time-scale defined in a geocentric reference frame. See International atomic time and terrestrial time.

coordinated time-scale; *échelle de temps coordonnée; escala de tiempo coordinada*

A time-scale synchronized within stated limits to a reference time-scale.

Coordinated Universal Time (UTC); *temps universel coordonné (UTC)*; *Tiempo Universal Coordinado (UTC)*

The time-scale maintained by the *Bureau International des Poids et Mesures* (BIPM) and the International Earth Rotation and Reference Systems Service (IERS), which forms the basis of a coordinated dissemination of standard frequencies and time signals. See Recommendation ITU-R TF.460.

It corresponds exactly in rate with TAI, but differs from it by an integer number of seconds. The UTC scale is adjusted by the insertion or deletion of seconds (positive or negative leap seconds) to ensure approximate agreement with UT1. See "universal time" and Recommendation ITU-R TF.460.

date; *date; fecha*

The reading of a specified time-scale, usually a calendar.

NOTE 1 – The date can be conventionally expressed in years, months, days, hours, minutes, seconds and fractions thereof.

disciplined oscillator; *oscillateur asservi; oscilador controlado*

An oscillator whose output is controlled to agree with signals obtained from a more accurate and/or stable source (e.g. GNSS broadcasts).

Doppler shift; *décalage Doppler; desplazamiento Doppler*

The apparent shift in frequency of an electromagnetic signal directly related to the relative speed between a transmitter and a receiver.

drift (frequency); *dérive; deriva*

See "frequency drift".

DUT1; *DUT1; DUT1*

The value of the predicted difference UT1 – UTC, as disseminated with the time signals. DUT1 may be regarded as a correction to be added to UTC to obtain a better approximation to UT1. The values of DUT1 are given by the International Earth Rotation and Reference Systems Service (IERS) in multiples of 0.1 s. See "universal time".

Earth rotation angle; *angle de rotation de la Terre; ángulo de rotación de la Tierra*

A measure of the angle through which the Earth has turned in a given period of time. This angle refers to the angular difference between the 0° meridian on the Earth and an astronomically defined point in space. See UT1.

ephemeris time; *temps des éphémérides; tiempo de efemérides*

An astronomical time-scale based on the orbital motion of the Earth around the sun. It was used to define the SI second between 1960 and 1967, and continued in use for astronomical applications until 1977 when it was replaced by terrestrial dynamical time (TDT). TDT in turn was replaced by terrestrial time (TT) in 1991. See "terrestrial time".

epoch; *époque; época*

Epoch signifies the beginning of an era (or event) or the reference date of a system of measurements.

error; *erreur; error*

Result of a measurement minus the true value of the measurand. See “uncertainty” and GUM.

flicker noise; *bruit de scintillation; ruido de centelleo*

See Recommendation ITU-T G.810.

flicker frequency modulation (FFM); *scintillation fréquentielle (FFM); modulación de frecuencia por centelleo (MFC)*

See Recommendation ITU-T G.810.

flicker phase modulation (FPM); *scintillation de phase (FPM); modulación de fase por centelleo (FPM)*

See Recommendation ITU-T G.810.

fractional frequency deviation; *écart fréquentiel relatif; desviación fraccional de frecuencia*

See Recommendation ITU-T G.810.

frequency; *fréquence; frecuencia*

If T is the period of a repetitive phenomenon, then the frequency $f = 1/T$. In SI units the period is expressed in seconds, and the frequency is expressed in hertz.

frequency departure; *écart de fréquence non intentionnel; desajuste de frecuencia*

An unintentional change in frequency away from the nominal frequency value.

frequency deviation; *écart de fréquence; desviación de frecuencia*

The term frequency deviation is used in three distinct ways:

– it is sometimes used in place of the term “frequency departure”;
– it can be used to describe the stochastic variations in frequency i.e. the difference between frequency values of the same signal at two different times or the difference between the instantaneous signal frequency and the average signal frequency;
– it is also used to describe the frequency shifts applied in some modulation schemes (see “frequency offset”).

Given the multiplicity of conventions, it is generally better to avoid using the term when less ambiguous alternatives are available.

frequency difference; *différence de fréquence; diferencia de frecuencia*

The algebraic difference between the values of two frequency values.

frequency drift; *dérive de fréquence; deriva de frecuencia*

A systematic undesired change in frequency of an oscillator over time. Drift is due to ageing plus changes in the environment and other factors external to the oscillator. See “ageing”.

frequency instability; *instabilité de fréquence; inestabilidad de frecuencia*

The spontaneous and/or environmentally-caused frequency change of a signal within a given time interval.

NOTE 1 – Generally, there is a distinction between systematic effects such as frequency drift and stochastic frequency fluctuations. Special variances have been developed for the characterization of these fluctuations. Systematic instabilities may be caused by radiation, pressure, temperature, and humidity. Random or stochastic instabilities are typically characterized in the time domain or frequency domain. They are typically dependent on the measurement system bandwidth or on the sample time or integration time. See Recommendation ITU-R TF.538.

frequency offset; *décalage de fréquence; separación de frecuencia*

The frequency difference between the realized value and the reference frequency value.

NOTE 1 – The reference frequency may or may not be the nominal frequency value.

frequency shift; *déplacement de fréquence; desplazamiento de frecuencia*

An intentional frequency change used for modulation purposes or unintentional frequency change due to physical effects.

frequency stability; *stabilité de fréquence; estabilidad de frecuencia*

See "frequency instability".

frequency standard; *étalon de fréquence; patrón de frecuencia*

An accurate stable oscillator generating a fundamental frequency used in calibration and/or reference applications. See Recommendation ITU-T G.810.

geocentric coordinated time (TCG); *temps coordonnée géocentrique (TCG); tiempo geocéntrico coordinado (TCG)*

Geocentric coordinated time (TCG) is a measure of the proper time at the centre of the Earth and differs from terrestrial time (TT) by a constant scale factor resulting from the different gravitational potentials at the two reference points. See "proper time".

global navigation satellite system (GNSS); *système mondial de navigation par satellite (GNSS); sistema mundial de navegación por satélite (GNSS)*

Systems of satellites providing autonomous geo-spatial positioning and time/frequency recovery with global coverage allowing receivers to determine their latitude, longitude, altitude and time using time signals transmitted line-of-sight by radio from the satellites. Current GNSS systems include GPS and GLONASS with others in development.

Greenwich Mean Time (GMT); *temps moyen de Greenwich (TMG); tiempo medio de Greenwich (GMT)*

Mean solar time as measured with reference to the meridian passing through the Royal Observatory, Greenwich. GMT was adopted as the world's first global time-scale in 1884. However, while the term remains in popular usage, GMT is no longer maintained and has been replaced by universal time (UT) and coordinated universal time (UTC) for precise applications.

NOTE 1 – GMT corresponds most closely to UT1 in terms of definition but in common parlance it is used most often to indicate UTC, the time-scale broadcast in standard time signals. See "solar time", "universal time", "UT1" and "coordinated universal time".

ground-wave; *onde de sol; onda de superficie*

A low frequency radio wave that propagates following the surface curvature of the Earth.

Hadamard variance (HVAR); *variance d'Hadamard (HVAR); varianza de Hadamard (HVAR)*

A three sample variance, commonly used in the frequency control community, with binomially-weighted coefficients similar to the 2-sample Allan variance. It examines the 2^{nd} difference of the fractional frequencies and the 3^{rd} difference of the phase variations. It is based on the Hadamard transform, adapted by Baugh as the basis of a time-domain measure of frequency stability. As a spectral estimator, the Hadamard transform has higher resolution than the Allan variance.

Hertz (Hz); *hertz (Hz); hercio (Hz)*

The SI unit of frequency defined as the number of cycles per second of a periodic phenomenon.

hydrogen maser frequency standard; *étalon de fréquence à maser à hydrogène; patron máser de hidrógeno*

Hydrogen masers operate on the principle that when hydrogen atoms are excited to resonance they emit radiation at a precise frequency in the region of 1 420 MHz. In the active maser, phase locking a high performance crystal oscillator to a small sample of the emitted maser energy, produces a frequency reference with exceptional short-term stability. In the passive model the transition is excited using synthesized radiation at 1 420 MHz.

instant; *instant; instante*

A point in time, not necessarily with reference to a time-scale.

International Atomic Time (TAI); *temps atomique international (TAI); Tiempo Atómico Internacional (TAI)*

The time-scale established and maintained by the BIPM on the basis of data from atomic clocks operating in a number of establishments around the world. Its epoch was set so that TAI was in approximate agreement with UT1 on 1 January 1958. The rate of TAI is explicitly related to the definition of the SI second as measured on the geoid. See “second”, “universal time”, “UT1” and SI Brochure.

International GNSS service (IGS); *service GNSS international (IGS); servicio GNSS Internacional (IGS)*

Formerly the International GPS service, the IGS is a voluntary federation of more than 200 worldwide agencies that pool resources and permanent GPS & GLONASS station data to generate GPS & GLONASS information products – precise orbits and satellite clock offsets. The IGS provides data and information products in support of Earth science research, multidisciplinary applications, and education. IGS coordinates a global network of several hundred GNSS satellite tracking stations.

IGS time scale (IGST); *échelle de temps IGS (IGST); escala de tiempo IGS (IGST)*

The IGS rapid and final clock products are aligned to a highly stable time-scale derived from a weighted ensemble of selected GNSS satellite clocks and clocks in the IGS network.

Inter Range Instrumentation Group (IRIG); *Inter Range Instrumentation Group (IRIG); Grupo de instrumentación entre gamas (IRIG)*

A family of ASCII time code formats for use in transferring time over conventional asynchronous telecommunications circuits. IRIG is also typically used as a source for NTP service/servers. The IRIG standard supports time transfer in the low milliseconds to 1 second resolution range.

jitter; *fluctuation; inestabilidad de fase*

The short-term phase variations of the significant instants of a timing signal from their ideal position in time (where short-term implies here that these variations are of frequency greater than or equal to 10 Hz). See also “wander”.

Julian Date; *date julienne; Fecha Juliana*

The Julian Day number followed by the fraction of the day elapsed since the preceding noon (12:00 UT).

Julian Day number; *numéro de jour julien; número de día juliano*

A number of a specific day from a continuous day count having an initial origin of 12:00 UT on 1 January 4713 BC, Julian calendar (start of Julian Day zero).

NOTE 1 – The Julian Date is conventionally referred to UT1, but may be used in other contexts, if so stated.

leap second; *seconde intercalaire; segundo intercalar*

An intentional change in the number of seconds per minute, to extend a designated minute by one extra second (a positive leap second) or to finish the minute early by one second (a negative leap second). The leap second is used to adjust coordinated universal time (UTC) to ensure approximate agreement with UT1. A description of the procedures associated with UTC, including leap seconds, is given in Recommendation ITU-R TF.460. See "coordinated universal time", "universal time" and "UT1".

maximum time interval error (MTIE); *erreur maximale d'intervalle de temps (MTIE); error máximo de intervalo de tiempo (MTIE)*

The maximum time interval error (MTIE) characterizes frequency offsets and phase transients. It is the largest peak-to-peak time interval error (TIE) that occurs in an observation interval of duration *t*. See "time interval error" and Recommendation ITU-T G.810.

mean solar time; *temps solaire moyen; tiempo solar medio*

A measure of time defined by the apparent diurnal motion of the sun. Two types of solar time are used: apparent solar time and mean solar time, where the latter takes account of the Earth's elliptical orbit and the tilt of the Earth's axis relative to the ecliptic plane to provide a more uniform time-scale. The mathematical formula to convert the local apparent solar time into local mean solar time is known as the equation of time.

modified Allan deviation (MDEV); *écart d'Allan modifié (MDEV); desviación de Allan modificada (MDEV)*

See Recommendation ITU-T G.810.

modified Allan variance (MVAR); *variance d'Allan modifiée (MVAR); varianza de Allan modificada (MVAR)*

The modified Allan variance (MVAR) was introduced to remove an ambiguity in AVAR. See Recommendation ITU-R TF.538 and Recommendation ITU-T G.810.

Modified Julian Date (MJD); *date julienne modifiée (DJM); Fecha Modificada del Calendario Juliano (MJD)*

Julian Date less 2 400 000.5 days. See Recommendation ITU-R TF.457.

NOTE 1 – The origin of the modified Julian Date is 00:00 UT on 17 November 1858.

Modified Julian Day; *jour julien modifié; día juliano modificado*

Integer part of modified Julian Date.

network time protocol (NTP); *protocole de temps réseau (NTP); protocolo de tiempo de red (NTP)*

The network time protocol (NTP) is used to synchronize the time of a computer client or server to another server or reference time source, such as a terrestrial or satellite broadcast service or modem. NTP provides distributed time accuracies on the order of one millisecond on local area networks (LANs) and tens of milliseconds on wide area networks (WANs). NTP is widely used over the Internet to synchronize network devices to national time references. See www.ntp.org.

nominal frequency; *fréquence nominale; frecuencia nominal*

The desired frequency of an oscillator. The difference between the nominal frequency and the actual output frequency of an oscillator is the frequency offset. See Recommendation ITU-T G.810.

nominal value; *valeur nominale; valor nominal*

A specified or intended value independent of any uncertainty in its realization.

NOTE 1 – In a device that realizes a physical quantity, it is the value of such a quantity specified by the manufacturer. It is an ideal quantity expressed as an exact value.

normalized value; *valeur normée; valor normalizado*

The ratio of a value to its nominal value.

NOTE 1 – This definition can be used in connection with: frequency, frequency deviation, frequency difference, frequency drift, frequency offset, etc.

NOTE 2 – In place of the term "normalized", the term "relative" is acceptable.

offset; *décalage; separación*

The difference between the realized value and a reference value.

optical frequency standard; *étalon de fréquence optique; patrón de frecuencia óptico*

Spectrally narrow optical transitions in atoms and ions probed by stable lasers are used to produce high-accuracy, high-stability frequency standards. The principal advantage of optical standards over microwave devices is the higher operating frequency with the potential for orders of magnitude better frequency stability, in principle, by the ratio of the operating frequencies, and also reduced systematic uncertainty.

oscillator; *oscillateur; oscilador*

An electronic device producing a repetitive electronic signal, usually a sine wave or a square wave.

passive frequency standard; *étalon de fréquence passif; patrón de frecuencia pasivo*

An atomic oscillator whose output signal is derived from an external oscillator frequency locked to the atomic resonance frequency, instead of being directly output by the atoms. The most popular examples are the caesium beam clock and the rubidium gas cell clock.

path delay; *temps de propagation; retardo del trayecto*

The delay in propagation of a signal between a source (input point) and a destination (output point).

period; *période; periodo*

The period T of a waveform is the reciprocal of its frequency, $T = 1/f$. The period is the time required for one complete cycle of the wave to occur.

phase; *phase; fase*

A measure of a fraction of the period of a repetitive phenomenon, measured with respect to some distinguishable feature of the phenomenon itself. In the standard frequency and time signal service, phase time differences such as time differences between two identified phases of the same phenomenon or of two different phenomena are mainly considered.

phase coherence; *cohérence de phase; coherencia de fase*

Phase coherence exists if two periodic signals of frequency M and N resume the same phase difference after M cycles of the first and N cycles of the second, where M/N is a rational number, obtained through multiplication and/or division from the same fundamental frequency.

phase deviation; *décalage de phase; desviación de fase*

The difference of the phase from a reference.

phase jump; *saut de phase; salto de fase*

A sudden phase change in a signal.

phase noise; *bruit de phase; ruido de fase*

See Recommendation ITU-T G.810.

phase shift; *déphasage; desplazamiento de fase*

An intentional or unintentional change in phase from a reference.

NOTE 1 – A phase shift refers to a systematic change rather than any stochastic variations.

phase signature; *signature de phase; sintonía de fase*

A deliberate phase offset for the purpose of radio signal identification.

precision; *précision; precisión*

The degree of mutual agreement among a series of individual measurements; often, but not necessarily, expressed by the standard deviation. See "uncertainty".

precise point positioning (PPP); *localisation précise (PPP); posicionamiento de punto preciso (PPP)*

A GNSS data collection and signal processing technique in which phase and code measurements of one station are used with IGS precise orbits and clock offset information to solve for the geodetic position and the clock offset of the station with respect to the IGS time scale.

precision time protocol (PTP); *protocole de temps de précision (PTP); protocolo de tiempo de precisión (PTP)*

A time protocol originally designed for use in instrument LANs now finding its way into WAN and packet based Ethernet network applications. PTP performance can exceed NTP by several orders of magnitude depending on the network environment. See IEEE 1588.

primary clock; *horloge primaire; reloj primario*

A time standard whose rate corresponds to the adopted definition of the second. The clock achieves its specified accuracy independently of calibration.

NOTE 1 – In telecommunications the term "primary reference clock" refers to a clock with a specific function and accuracy as identified in Recommendation ITU-T G.811.

primary frequency standard; *étalon primaire de fréquence; patrón primario de frecuencia*

A frequency standard whose frequency corresponds to the adopted definition of the second, with its specified accuracy achieved independently of calibration. See "second".

proper time; *temps propre; tiempo propio*

The local time, as indicated by a clock. If a time-scale is realized according to the proper time concept, it is called a proper time-scale.

Examples:

proper time: the second is defined in the proper time of the caesium atom;

proper time-scale: a time-scale produced by a continuously-running primary frequency standard that is not compensated for gravitational frequency shift.

NOTE 1 – This is distinguished from coordinate time which involves theory and computations to include the effects of relativity.

pseudorange; *pseudodistance; pseudoalcance*

The apparent distance between a satellite and a receiver obtained from measuring the time of flight of the signal transmitted by the satellite to the receiver. This differs from the true range because of the unknown receiver clock offset from the satellite clock.

quartz oscillator; *oscillateur à quartz; oscilador de cuarzo*

An oscillator whose frequency is controlled by a quartz crystal.

radionavigation-satellite service (RNSS); *service de radionavigation par satellite (SRNS); servicio de radionavegación por satélite (SRNS)*

A satellite service used for the purpose of radionavigation. This service may also include feeder links necessary for its operation (Radio Regulations (RR) No. **1.43**).

The Global Positioning System (GPS), the Global Navigation Satellite System (GLONASS), Galileo System, and Beidou System are examples of radionavigation-satellite service (RNSS) systems used in both the space-to-Earth and space-to-space directions for position determination and the dissemination of high accuracy time and frequency.

random error; *erreur aléatoire; error aleatorio*

See GUM.

random walk; *marche aléatoire; recorrido aleatorio*

See Recommendation ITU-T G.810 and GUM.

random walk frequency modulation (RWFM); *marche aléatoire fréquentielle (RWFM); modulación de frecuencia de recorrido aleatorio (RWFM)*

See Recommendation ITU-T G.810.

relative value; *valeur relative; valor relativo*

See “normalized value”.

repeatability; *répétabilité; repetibilidad*

Closeness of agreement between the results of successive measurements of the same measurand carried out under the same conditions as follows:

– with respect to a single device when specified parameters are independently adjusted to a stated set of conditions of use, it is the standard deviation of the values produced by this device. It could also be termed “resettability”;

– with respect to a single device put into operation repeatedly without readjustment, it is the standard deviation of the values produced by this device;

– with respect to a set of independent devices of the same design, it is the standard deviation of the values produced by these devices used under the same conditions.

See “reproducibility” and “resettability”.

reproducibility; *reproductibilité; reproductibilidad*

– With respect to a set of independent devices of the same design, it is the ability of these devices to produce the same value.

– With respect to a single device, put into operation repeatedly, it is the ability to produce the same value without adjustments.

NOTE 1 – The standard deviation of the values produced by the device(s) under test is the usual measure of reproducibility.

resettability; *fidélité; reposicionabilidad*

The ability of a device to produce the same value when specified parameters are independently adjusted to a set stated condition of use.

NOTE 1 – The standard deviation of the values produced by the device under test is the usual measure of resettability.

resolution; *résolution; resolución*

The smallest difference that can be measured and/or displayed by a given instrument. See GUM.

retrace; *retrace; volver a trazar*

See “repeatability”.

satellite based augmentation systems (SBAS); *systèmes complémentaires à satellites (SBAS); Sistema de aumento basado en satélite (SBAS)*

Systems that support wide-area or regional GNSS augmentation (performance and/or availability improvement) using additional satellite-broadcast messages. SBAS systems typically comprise multiple ground stations making measurements of the GNSS satellite signals and other environmental factors which may affect the user received signal. The measurements are used to form correction messages sent to one or more satellites for broadcast to the end users (e.g. Wide Area Augmentation System (WAAS), European Geostationary Navigation Overlay Service EGNOS and MTSAT (Multi-functional Transport Satellite) Satellite-Based Augmentation System (MSAS)).

second; *seconde*; *segundo*

The basic unit of time or time interval in the International System of Units (SI) that is equal to the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of Cs-133 as defined at the 1967 General Conference on Weights and Measures (CGPM) meeting.

NOTE 1 – The internationally recognized metrological authority is the CGPM, and at present the adopted reference is the frequency corresponding to a specific transition of Cs-133. See SI Brochure.

secondary frequency standard; *étalon secondaire de fréquence; patrón secundario de frecuencia*

A frequency standard that must be calibrated with respect to a primary frequency standard. The term “secondary” thus describes the position of the standard in a hierarchy, it does not necessarily refer to the quality of its performance.

sidereal time; *temps sidéral, tiempo sideral*

A measure of time defined by the apparent diurnal motion of the vernal equinox; hence, a measure of the rotation of the Earth with respect to the stars rather than the sun. Two types of sidereal time are used in astronomy: apparent sidereal time and mean sidereal time (the difference is known as the equation of the equinoxes), where the latter takes account of the Earth’s nutation to provide a more uniform time-scale. One mean sidereal day is equal to about 23 h, 56 min, and 4 s of mean solar time. Also, 366.2422 mean sidereal days equal 365.2422 mean solar days.

sky-wave; *onde ionosphérique; onda ionosférica*

In the frequency range of 2-30 MHz radio waves propagated by reflection off (bending) of the ionosphere and the ground. The ground and the ionosphere act as a waveguide for radio waves in this portion of the spectrum.

NOTE 1 – Under certain conditions LF, MF and VHF signals (ITU frequency bands) may also be propagated via sky-wave.

solar time; *temps solaire; tiempo solar*

See “mean solar time”.

stability; *stabilité; estabilidad*

Property of a measuring instrument or standard, whereby its metrological properties remain constant in time.

standard frequency; *fréquence étalon; frecuencia patrón*

A frequency with a known relationship to the output signal of a frequency standard.

NOTE 1 – The term standard frequency is often used for a frequency that is one of a set of ITU-R approved values, i.e. 1 MHz, 5 MHz, etc.

standard-frequency and/or time-signal station; *station de fréquences étalon et/ou de signaux horaires; estación de frecuencias patrón y/o de señales horarias*

A radio station whose primary purpose is to broadcast standard-frequency and/or time-signal emissions.

NOTE 1 – Recommendation ITU-R TF.768 contains a list of these stations and their operating characteristics.

standard-frequency emission; *émission de fréquences étalon; emisión de frecuencias patrón*

An emission which disseminates a standard frequency at regular intervals with a specified frequency accuracy value.

NOTE 1 – The ITU-R Recommendation for normalized frequency departure is found in Recommendation ITU-R TF.460.

standard frequency and time signal service; *service de fréquences étalon et de signaux horaires; servicio de frecuencias patrón y de señales horarias*

A radiocommunication service for scientific, technical and other purposes, providing the transmission of specified frequencies, time signals, or both, of stated high precision, intended for general reception (RR No. **1.53**).

standard frequency and time signal-satellite service; *service des fréquences étalon et des signaux horaires par satellite; servicio de frecuencias patrón y de señales horarias por satélite*

A radiocommunication service using space stations on earth satellites for the same purposes as those of the standard frequency and time signal service (RR No. **1.54**).

stratum clocks; *horloges de strate; relojes de estrato*

See the American National Standards Institute (ANSI) standard entitled “Synchronization Interface Standards for Digital Networks” (ANSI/T1.101). This standard defines clock stratum levels and minimum performance requirements for digital network synchronization.

synchronization; *synchronisation; sincronización*

The relative adjustment of two or more sources of time with the purpose of cancelling their time differences. See “time-scales in synchronization”.

syntonization; *syntonisation; sintonización*

The relative adjustment of two or more frequency sources with the purpose of cancelling their frequency differences but not necessarily their phase difference.

systematic error; *erreur systématique; error sistemático*

The mean value that would result from an infinite number of measurements of the same measurand carried out under repeatable conditions minus the true value of the measurand. Systematic error is equal to error minus random error and like the true value of the measurand systematic error and its causes cannot be completely known. The term bias is often used as a synonym for systematic error, but systematic error is defined in a more broadly applicable way while bias is generally defined only in connection with a measuring instrument. See GUM.

terrestrial time (TT); *temps terrestre (TT); tiempo terrestre (TT)*

The International Astronomical Union (IAU) replaced ephemeris time (ET) with terrestrial dynamical time (TDT) for geocentric phenomena in 1977, and in turn renamed TDT as terrestrial time (TT) in 1991. TT is a coordinate time with a scale unit (the TT second) initially chosen so that

it agreed with the SI second on the geoid. In 2000, the IAU redefined TT so that its scale unit has a fixed relation to that of geocentric coordinated time (TCG). The new definition ensures continuity of TT as both definitions are equivalent within a few parts in 10^{17}. See Recommendation ITU-R TF.2018.

The International System of Units (SI); *système international d'unités (SI); sistema internacional de unidades (SI)*

See SI Brochure – "The International System of Units".

time; *temps; tiempo*

"Time" may be used to specify an instant (time of day) on a selected time-scale. In a time-scale it is a measure of time interval between two events or the duration of an event. Time is an apparently irreversible continuum of ordered events.

time base; *base de temps; base de tiempo*

A fixed frequency or a fixed period of time used as a comparison against which other frequencies or timed events are calculated.

time code; *code horaire; código horario*

A system of digital or analogue symbols used in a specified format to convey time information i.e. date, time of day or time interval.

time comparison; *comparaison de temps; comparación de tiempo*

The determination of the difference between two time-scales at a given epoch.

time deviation (TDEV); *écart type de temps (TDEV); desviación de tiempo (TDEV)*

Time deviation is the square root of time variance (TVAR). It is a measure of root mean square (RMS) wander that characterizes its spectral content. It is a function of the observation interval. See "time variance".

time interval; *intervalle de temps; intervalo de tiempo*

The duration between two instants read on the same time-scale.

time interval error (TIE); *erreur d'intervalle de temps (TIE); error de intervalo de tiempo (TIE)*

Time interval error (TIE) is a measure of wander and expressed in units of time. It is defined as the phase difference between the signal being measured and a reference clock. TIE is conventionally set to zero at the beginning of a total measurement period and therefore is a measure of the phase change since the measurement began. See "maximum time interval error".

time marker; *repère de temps; marca de tiempo*

A signal identifying a specific instant on a time-scale.

time reference; *référence temporelle; referencia temporal*

The basic repetition rate chosen to be the common time reference for a given measurement system, e.g. 1 pulse per second (1 pps).

time-scale; *échelle de temps; escala de tiempo*

A family of time codes for a particular coordinate time that provide an unambiguous time ordering of events.

time-scale difference; *différence entre échelles de temps; diferencia entre escalas de tiempo*

The difference between the readings of two time-scales at the same instant.

NOTE 1 – To avoid confusion in sign, algebraic quantities should be given, applying the following convention. At a time T of a reference time-scale, let a denote the reading of a time-scale A, and b the reading of a time-scale B. The time-scale difference is expressed by $A – B = a – b$ at the instant T. The same convention applies to the case where A and B are clocks. See "clock time difference".

time-scales in synchronization; *échelles de temps synchrones; escalas de tiempo en sincronismo*

Two time-scales are in synchronization, when they, within the uncertainties inherent in each, assign the same date to an event and have the same time-scale unit.

NOTE 1 – If the time-scales are produced in spatially separated locations, the propagation time of transmitted time signals and relativistic effects are to be taken into account.

time-scale reading; *lecture d'une échelle de temps; lectura de una escala de tiempo*

The value read on a time-scale at a given instant. To avoid ambiguity the reading of a time-scale should be denoted by giving the time-scale name (e.g. UTC) followed, in parenthesis, by the clock name, transmitting station, astronomical observatory, institution, or standards laboratory such as UTC (k).

time-scale unit; *unité d'une échelle de temps; unidad de escala de tiempo*

The basic time interval in a time-scale.

time-signal emission; *émission de signaux horaires; emisión de señales horarias*

A broadcast that disseminates a sequence of time signals at regular intervals with a specified accuracy.

NOTE 1 – Recommendation ITU-R TF.460 recommends that standard time signals be emitted within a specified tolerance with respect to UTC and that they contain DUT1 information in a specified code.

time stamp; *horodate; indicación de tiempo*

An unambiguous time code value registered to a particular event using a specified clock.

time standard; *étalon de temps; patrón de tiempo*

– A device used for the realization of the time unit.

– A continuously operating device used for the realization of a time-scale in accordance with the definition of the second and with an appropriately chosen origin.

time step; *saut de temps; salto de tiempo*

A discontinuity in a time-scale at some instant.

NOTE 1 – A time step is positive (+) if the time-scale reading is increased, and negative (–) if the reading is decreased at that instant.

time variance (TVAR); *variance de temps (TVAR); varianza de tiempo (TVAR)*

The time variance (TVAR) is a statistical characterization of jitter representing jitter magnitude as a function of frequency, or equivalently, as a function of time between TIE samples. TVAR values are typically expressed in units of time squared. See "time deviation" and "time interval error".

traceability; *traçabilité; trazabilidad*

The property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties.

two-way satellite time and frequency transfer (TWSTFT); *transfert bidirectionnel de signaux horaires et de fréquences par satellite (TWSTFT); transferencia bidireccional por satélite de señales horarias y frecuencias (TWSTFT)*

A technique utilizing the two-way exchange of clock measurement data between two stations via geostationary satellite. The method provides highly accurate and stable time/frequency transfer because both transmit and receive paths are symmetric to first order. See Recommendation ITU-R TF.1153.

two-sample deviation/variance; *écart type/variance à deux échantillons; varianza/desvío estándar*

A standard method of characterizing the frequency stability of oscillators in the time domain, both short term and long term.

See Recommendation ITU-R TF.538 and "Allan variance".

uncertainty; *incertitude; incertidumbre*

Parameter associated with the result of a measurement that describes the dispersion of the values that could reasonably be attributed to the measurand. Frequently it is possible to distinguish two components, the random component (also known as Type A error) and the component due to systematic (also known as Type B error) effects. The random uncertainty is often expressed by the standard deviation or by a multiple of the standard deviation for repeated measurements. The component due to systematic effects is generally estimated on the basis of all available information about relevant parameters. See GUM.

universal time (UT); *temps universel (UT); Tiempo Universal (UT)*

Universal time is a measure of time that conforms, within a close approximation, to the mean diurnal motion of the sun as observed on the prime meridian. UT is formally defined by a mathematical formula as a function of Greenwich mean sidereal time. Thus UT is determined from observations of the diurnal motions of the stars. The time-scale determined directly from such observations is designated UT0; it is slightly dependent on the place of observation See Recommendation ITU-R TF.460.

UT0; *UT0; UT0*

UT0 is a direct measure of universal time as observed at a given point on the Earth's surface. In practice, the observer's meridian (position on Earth) varies slightly because of polar motion, and so observers at different locations will measure different values of UT0. Other forms of universal time, UT1 and UT2, apply corrections to UT0 in order to establish more uniform time-scales. See "universal time", "UT1" and "UT2" and Recommendation ITU-R TF.460.

UT1; *UT1; UT1*

UT1 is a form of universal time that accounts for polar motion and is proportional to the rotation of the Earth in space. See "universal time" and Recommendation ITU-R TF.460.

UT2; *UT2; UT2*

UT2 is a form of universal time that accounts both for polar motion and is further corrected empirically for annual and semi-annual variations in the rotation rate of the Earth to provide a more uniform time-scale. The seasonal variations are primarily caused by meteorological effects. See "universal time" and Recommendation ITU-R TF.460.

NOTE 1 – The UT2 time-scale is no longer determined in practice.

wander; *variation erratique; variación errática*

The long-term phase variations of the significant instants of a timing signal from their ideal position in time (where long-term implies here that these variations are of frequency less than 10 Hz). See "jitter".

white frequency modulation (WFM); *bruit blanc fréquentiel (WFM); modulación de frecuencia de ruido blanco (WFM)*

See Recommendation ITU-T G.810.

white phase modulation (WPM); *bruit blanc de phase (WPM); modulación de fase de ruido blanco (WPM)*

See Recommendation ITU-T G.810

ZULU time; *temps Z; tiempo Z*

Some communications conventions use (Z) or (Zulu) time as the designator for UTC. This derives from use of the letter Z to designate the time zone centered at the prime meridian. See “coordinated universal time” and ISO standard 8601.