RECOMMENDATION ITU-R TF.686-2*

Glossary and definitions of time and frequency terms

(1990-1997-2002)

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) the need to promote a consistent use of terminology in a 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.

NOTE 1 – The terms listed in Annex 1 are taken from various ITU-R and ITU-T Recommendations, the ITU-R Handbook – Selection and use of precise frequency and time systems, the International Vocabulary of basic and general terms in Metrology (VIM) published by ISO, the Glossary of Time and Frequency Terms of the National Institute of Standards and Technology (NIST), and other noted references. It 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 of more general use, but specifically relevant to this field. For the latter, an attempt has been made to provide substantial agreement with the definitions contained in the International Electrotechnical Vocabulary (IEV). The equivalence of each of the terms is also presented in French and Spanish (terms printed in italics).

Precise time measurements may often be affected by relativity effects. The terms and definitions in the following list imply incorporation of, or indicate the need for, the consideration of these effects.

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

References

Recommendations ITU-R

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.536: Time-scale notations

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

ITU-R Handbook

Selection and use of precise frequency and time systems

The Radio Regulations

ITU-T Recommendations

G.810: Definitions and terminology for synchronization networks

G.811: Timing characteristics of primary reference clock

Other references

IEV: International electrotechnical vocabulary

ISO8601: Representation of dates and times

NIST: Glossary of time and frequency terms

Abbreviations and acronyms

ADEV: Allan Deviation, *écart type d'Allan, desviación típica de Allan*

AVAR: Allan Variance, *variance d'Allan, varianza de Allan*

BIPM: *Bureau International des Poids et Mesures*

CCTF: *Comité Consultatif du Temps et des Fréquences*

CGPM: *Conférence Générale des Poids et Mesures*, General Conference of Weights and Measures, *Conferencia General de Pesos y Medidas*

CIPM: *Comité International des Poids et Mesures*

IAU: International Astronomical Union, *Union astronomique internationale, Unión Astronómica Internacional*

IERS: International Earth Rotation Service

MDEV: Modified Allan Deviation, *écart type d'Allan modifié, desviación de Allan modificada*

MTIE: Maximum Time Interval Error, *erreur maximale d'intervalle de temps, error máximo de intervalo de tiempo*

MVAR: Modified Allan Variance, *variance d'Allan modifiée, varianza de Allan modificada*

RNSS: Radionavigation-Satellite Service, *service de radionavigation par satellite, servicio de radionavegación por satélite*

SI: *Système International d'Unités*, International System of Units

TDEV: Time deviation, *écart type temporel, desviación de tiempo*

TIE: Time interval error, *erreur d'intervalle de temps, error de intervalo de tiempo*

TVAR: Time variance, *variance de temps, varianza de tiempo*

ANNEX 1

Glossary and definition of time and frequency terms

accuracy; *exactitude; exactitud*

Closeness of the agreement between the result of a measurement and a true value of the measurand. Accuracy is generally characterized by the overall uncertainty of a measured value. See also "uncertainty".

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 stability of oscillators in the time domain, both short term and long term. See "two-sample deviation/variance".

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.

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.

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.

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 to maximize the performance (time accuracy and frequency stability) and availability of a time-scale.

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 same 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.1010.

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”.

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 with the SI second as realized on the rotating geoid as the scale unit.

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 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”.

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.

drift (frequency); *dérive; deriva*

See “frequency drift”.

DTAI; *DTAI; DTAI*

The value of the difference TAI – UTC, as disseminated with time signals is denoted DTAI. DTAI = TAI – UTC may be regarded as a correction to be added to UTC to obtain TAI.

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 Service (IERS) in multiples of 0.1 s. See "universal time".

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 also "uncertainty".

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*

See "frequency stability".

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*

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 standard; *étalon de fréquence; patrón de frecuencia*

A generator, the output of which is used as a frequency reference.

NOTE 1 – See "primary frequency standard" and "secondary frequency standard".

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".

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

Mean solar time as it was measured at 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. In practical terms, the time difference between GMT and UTC at any moment will be less than 2 s. Also see "solar time", "universal time", "UT1" and "coordinated universal time".

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 that is defined as the duration of 9 192 631 770 periods of the radiation corresponding to the transition between two hyperfine levels of the ground state of the caesium-133 atom. Also see "second", "universal time" and "UT1".

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 (12h00 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 12h00 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 time step of one second used to adjust coordinated universal time (UTC) to ensure approximate agreement with UT1. An inserted second is called positive leap second, and an omitted second is called negative leap second. A description of the procedures associated with UTC, including leap seconds, is given in Recommendation ITU-R TF.460. See also "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 also "time interval error".

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 solar time into local mean solar time is known as the equation of time.

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.

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 LANs and tens of milliseconds on WANs. NTP is widely used over the Internet to synchronize computer clocks to national time references.

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.

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 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 also "uncertainty".

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 ITU-T Recommendation 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.

NOTE 1 – The internationally recognized metrological authority is the General Conference of Weights and Measures (CGPM), and at present the adopted reference is the frequency corresponding to a specific transition of the caesium atom 133. See "second".

proper time; *temps propre; tiempo propio*

The local time, as indicated by an ideal 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.

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

A radiodetermination 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 United States' Global Positioning System (GPS), the Russian Global Navigation Satellite System (GLONASS) and the planned European Galileo 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.

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.

NOTE 1 – See also "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*

It is 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.

retrace; *retrace; volver a trazar*

See "repeatability".

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 caesium-133 as defined at the 1967 CGPM meeting. In 1997 the CIPM affirmed that: "*This definition refers to a caesium atom at rest at a temperature of 0 K.*" This was intended to make it clear that the definition of the SI second is based on a Cs atom unperturbed by black-body radiation, that is, in a 0 K environment, and therefore the frequencies of primary frequency standards should be corrected for the shift due to ambient radiation, as further stated at the CCTF meeting in 1999.

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, 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.

solar time; *temps solaire; tiempo solar*

See "mean solar 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.

NOTE 1 – ITU-R recommends a normalized frequency departure of less than 1×10^{-10} for these signals. See 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).

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”.

syntonisation; *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.

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) chosen so that it agrees 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}. TT differs from TAI by 32.184 s.

time; *temps; tiempo*

In English "time" is 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.

NOTE 1 – In the many languages of the world, the word time is used with several different meanings.

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 RMS wander that characterizes its spectral content. It is a function of the observation interval t. 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 nanoseconds. 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 also "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 system of unambiguous 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 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, TAI, etc.) followed, in parenthesis, by the clock name, transmitting station, astronomical observatory, institution, or standards laboratory such as UTC (k). See Recommendation TF.460.

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 timesignals be emitted within 1 ms with reference to UTC and that they contain DUT1 information in a specified code.

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 (nanoseconds) squared. See also “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-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, also see “Allan variance”.

uncertainty; *incertitude; incertidumbre*

Parameter associated with the result of a measurement that characterizes 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.

NOTE 1 – For a more detailed treatment of this subject see "Guide to the Expression of Uncertainty in Measurement", International Organization for Standardization (ISO), 1993 (corrected and reprinted 1995), Geneva, Switzerland, ISBN 92-67-10188-9.

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. When UT0 is corrected for the shift in longitude of the observing station caused by polar motion, the time-scale UT1 is obtained. A further level of refinement is provided with UT2 that corrects UT1 empirically for annual and semiannual variations in the rotation rate of the Earth.

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 also "universal time", "UT1" and "UT2".

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 also "universal time".

UT2; *UT2; UT2*

UT2 is a form of universal time that accounts both for polar motion and is further corrected empirically for annual and semiannual 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 also "universal time".

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

universal time coordinated (UTC); *temps universel coordonné (UTC); Tiempo Universal Coordinado (UTC)*

See "coordinated universal time", which is an equivalent expression.

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 also "jitter".

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 centred at the prime meridian. Also see "coordinated universal time" and "universal time".