

International Telecommunication Union

ITU-R
Radiocommunication Sector of ITU

Recommendation ITU-R BT.808
(03/1992)

**The broadcasting of time and date
information in coded form**

BT Series
Broadcasting service
(television)



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, 2011

© ITU 2011

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

RECOMMENDATION ITU-R BT.808*, **, ***

**The broadcasting of time and date information
in coded form**

(1992)

The ITU Radiocommunication Assembly,

considering

- a) that there are cases, notably in HF and satellite broadcasting, where a transmission is received over a large geographical area containing many time zones;
- b) that there should occur further time differences during the year due to the practice of implementing “daylight-saving” time in some countries;
- c) that there would be advantages in adopting a standard time reference independent of time zones and daylight-saving discontinuities;
- d) that the transmission of the local time offset at the source from a standardized time reference might be desirable in some cases;
- e) that there is an increasing interest to convey time and date information in a coded form particularly suitable for controlling the operation of equipment;
- f) that standardized encoding methods for broadcasting time and date would also permit operating economy and simplify the calculation of relative timings;
- g) that common worldwide time and date conventions have already been defined in Recommendations ITU-R TF.457 and ITU-R TF.460,

recommends

1 that all coded broadcast time and date signals should be expressed only in Coordinated Universal Time (UTC) and Modified Julian Date (MJD) in accordance with Recommendations ITU-R TF.457 and ITU-R TF.460;

2 that a coded local time offset, expressed in multiples of half an hour with range –12 h to +15 h should be appended when required to indicate the difference between UTC and the time currently applicable locally within a particular time zone.

NOTE 1 – Additional information on the conventions for the expression of standard time and date, and a method for conversion between date conventions are given in Annex 1.

* This Recommendation should be brought to the attention of Radiocommunication Study Group 7.

** Radiocommunication Study Group 6 made editorial amendments to this Recommendation in 2002 in accordance with Resolution ITU-R 44.

*** Radiocommunication Study Group 6 made editorial amendments to this Recommendation in October 2010 in accordance with Resolution ITU-R 1.

Annex 1

A note on standard time and date conventions

1 Introduction

There are already international standards concerning the distribution of time and date information. This Annex indicates how these standards relate to each other, and to the needs of broadcasting.

Time and date information is used to label the actual or nominal point of origin of material (a document, a television or radio programme) or the actual or anticipated point of receipt. The difference represents the propagation delay. There is also a requirement for indicating local clock-time and date in their own right, or for use together with such labels for assisting decisions or controlling processes associated with broadcasting.

The broadcasting and telecommunications environment provides the possibility of sending signals worldwide within 1 s of time. It is therefore necessary to accommodate the variations in local time (and date) in any method of coding intended to be consistent worldwide. There are also known discontinuities in local time (the duplicated hour at the end of “summer time”, and the “leap second”) to be taken into account.

2 Standard time

The standard unit of time is the second, obtained by defining the frequency of the caesium atomic transition as 9 192 631 770 Hz. For the purpose of creating a regular time scale these seconds are counted to give days, hours and minutes since 1 January 1958. This is known as International Atomic Time (TAI). This time scale, based on a physical property, drifts out of step with a time scale, such as Universal Time (UT) or Greenwich mean time (GMT), obtained from astronomical observation. Since the origin of TAI was set in agreement with UT at the beginning of 1958, TAI has advanced by about 21 s with respect to UT. In order to provide a time scale with seconds coincident to those of TAI, but within a close tolerance (± 0.8 s) of UT, a version of TAI offset by a whole number of seconds is maintained by the Bureau international des poids et mesures (BIPM). This is known as Coordinated Universal Time (UTC). The tolerance is maintained by occasionally adding (or, in principle, deleting) a single second to make a 61 s (or 59 s) minute. The preferred occasions are at the end or middle of the year, with at least eight weeks' notice. For example, one of these “leap seconds” occurred at 0000 h UTC on 1 July 1982 when the UTC seconds marker sequence was:

30 June 1982	23 h 59 min 59 s
	23 h 59 min 60 s
1 July 1982	00 h 00 min 00 s

All of the standard time signals used by broadcasters worldwide are derived from the UTC time scale, and the times are often, wrongly, referred to in terms of Greenwich mean time (GMT) and an offset. For reasons given above, the UTC time signal known in the UK as “the Greenwich time signal”, will sometimes differ from true GMT by more than half a second. This confusion of name is of little practical consequence in everyday life, but it is significant to astronomers, navigators and lawyers.

Recommendation ITU-R TF.460 recommends “that all . . . time signal emissions conform as closely as possible to Coordinated Universal Time (UTC)”.

2.1 Time offsets

In practice all countries refer their national time or times to UTC with an offset. There are 38 different offsets currently in use. Except for Nepal (+5 h 40 min) all the offsets are multiples of half an hour and range from –11 h (Samoa) to +14 h (Anadyr, Russian Federation, in summer time). Many countries advance their time by one hour during local summer (dependent on hemisphere); exceptionally Cook Islands advance by half an hour. There are various dates and times for summer time changes. Within some countries (Australia, Canada) there are some time zones differing by half an hour. There are some states (Queensland, Australia; Arizona and Indiana, USA) which, unlike their neighbours, do not adopt summer time.

It would probably be sufficient to provide a method of signalling a local time offset with a six-bit code giving half an hour steps in a range –12 to +15 h. In some applications, the local offset of the programme source or of the transmitter would be signalled; in other cases, the local offset applicable to the receiver site would be required.

3 Date

The change of date varies, of course, with local time, so a common broadcast standard for date would be referred to UTC and it would be corrected, if necessary, by the operation of the local offset.

There are several calendars in use world-wide but a simple common reference, the Modified Julian Date (MJD), has been defined for this purpose. This is a five-digit decimal number increasing by one at midnight UTC. The origin of the count is 17 November 1858, because at midday on that date the Julian Day (used by astronomers to give continuity from 4713 BC) reached the figure 2 400 000. A more convenient reference is 31 January 1982, when the MJD was 45 000. It is a simple matter to calculate time intervals, even over many days, by use of MJD and UTC (provided the occasional leap second is known or can be neglected).

Recommendation ITU-R TF.457 recommends that for modern timekeeping and dating requirements, a decimal day count should be used wherever necessary; the calendar day should be counted from 0000 h TAI, UTC or UT, and be specified by a number with five significant figures.

Although not defined in any standards, it is convenient to use the idea of a local day number which is advanced or delayed by the local time offset and which changes at local midnight.

3.1 Week number

For many commercial purposes, and for planning broadcast programme schedules, it is convenient to work in terms of day of the week, week number and year.

There is an international standard (ISO 8601:2004) for the numbering of weeks. This can be summarized by saying that weeks begin on Mondays, and that week 1 of a year contains the first Thursday of January. The week number can be associated with a day of the week (conventionally, Monday = 1 to Sunday = 7) and a year to specify a particular date. Note that occasional years (about 5 in 28) have 53 weeks, and that the “week-year” of a date in the inclusive range 29 December to 3 January may differ from the “calendar” year. The relation between week number and MJD is given in § 4.

Although the ISO week numbering system is in general use worldwide, other week number systems remain within certain organizations. In some cases, the week number of Monday accords with ISO but the week is taken to run from Saturday to Friday for example. In other cases, even the years containing 53 weeks are different.

3.2 Calendar date

The various calendar systems in use are well known and, in most cases, well defined. In these cases, it is possible to generate a formula for conversion between calendar systems, the convenient intermediate standard being the MJD. The information for conversion between MJD and the Gregorian calendar is given in § 4.

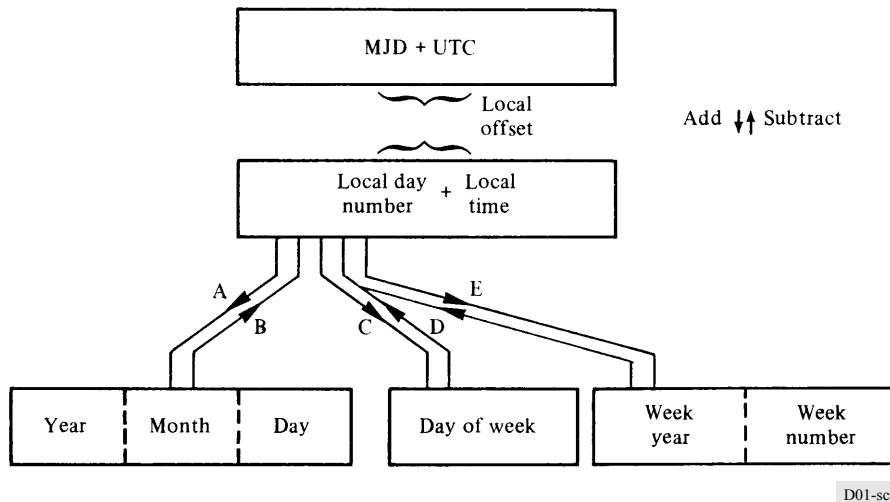
Certain calendar systems depend on a suitably qualified person witnessing an event (e.g. the first sighting of a crescent moon, or the sighting of a particular type of fish off a Pacific Island) and these can only be related to the MJD after the event.

4 Conversion between time and date conventions

The types of conversion which may be required are summarized in the following diagram.

The conversion between MJD + UTC and the local day number + local time is simply a matter of adding or subtracting the local offset. This process may of course involve a “carry” or “borrow” from the UTC affecting the MJD. The other five conversion routes shown in the diagram are as follows:

NOTE 1 – These formulae are applicable from 1 March 1900 to 28 February 2100 inclusive.



D01-sc

Symbols used:

MJD :	Modified Julian Date
Y :	year from 1900 (e.g. for 2003, Y = 103)
M :	month from January = 1 to December = 12
D :	day of month from 1 to 31
WY :	“week number” year from 1900
WN :	week number according to ISO 8601:2004
WD :	day of the week from Monday = 1 to Sunday = 7
K, L, M', W, Y' :	intermediate variables

INT : integer part, ignoring remainder
 MOD 7 : remainder (0-6) after dividing integer by 7
 * : multiplication

A: To find Y, M, D from MJD:

$$Y' = \text{INT}((\text{MJD} - 15\,078.2)/365.25)$$

$$M' = \text{INT}((\text{MJD} - 14\,956.1 - \text{INT}(Y' * 365.25))/30.6001)$$

$$D = \text{MJD} - 14\,956 - \text{INT}(Y' * 365.25) - \text{INT}(M' * 30.6001)$$

If $M' = 14$ or $M' = 15$ then $K = 1$ else $K = 0$

$$Y = Y' + K$$

$$M = M' - 1 - K * 12$$

B: To find MJD from Y, M, D:

If $M = 1$ or $M = 2$ then $L = 1$ else $L = 0$

$$\text{MJD} = 14\,956 + D + \text{INT}((Y - L) * 365.25) + \text{INT}((M + 1 + L * 12) * 30.6001)$$

C: To find WD from MJD:

$$\text{WD} = ((\text{MJD} + 2) \text{MOD } 7) + 1$$

D: To find MJD from WY, WN, WD:

$$\text{MJD} = 15\,012 + \text{WD} + 7 * (\text{WN} + \text{INT}((\text{WY} * 1\,461/28) + 0.41))$$

E: To find WY, WN from MJD:

$$W = \text{INT}((\text{MJD}/7) - 2\,144.64)$$

$$\text{WY} = \text{INT}((W * 28/1\,461) - 0.0079)$$

$$\text{WN} = W - \text{INT}((\text{WY} * 1\,461/28) + 0.41)$$

Example:

MJD = 45 218	W = 4 315
Y = (19)82	WY = (19)82
M = 9 (September)	WN = 36
D = 6	WD = 1 (Monday)
