

TRANSMISSION SERVICES OF TIME SIGNALS  
AND FREQUENCIES STANDARD  
OF THE MILAN OBSERVATORY CHRONOMETRIC CENTER

(1) The transmission services of time signals and frequencies standard operated by the Chronometric Center of the Milan (Brera) Astronomical Observatory give at present a very important contribution to the scientific and technical needs of several operators, particularly in wide sectors of the research, of the applied chronometry, of telecommunications and of professional electronics.

At present the following transmission services are working in the Chronometric Center of the Observatory:

- (a) Frequency standard MF transmission service of 1 Kc/s at the frequency of 163,35 Mc/s.
- (b) Time signals transmission service over telephone city lines once a second and frequencies standard of 1 Kc/s.
- (c) MF transmission service of « time signals », emitted continuously at the frequency of 31,75 Mc/s.

(2) The frequency standard MF transmission service of 1 Kc/s by means of circular radio-link at the frequency of 163,35 Mc/s permits to make very accurate comparisons as regards the scale of uniform time (TUU) of the Brera Observatory. This time is based on the frequency of the fundamental quartz oscillator of the Observatory (Frequency Standard) synchronized with the carrying frequency (16 Kc/s) of GBR station.

The deviation in frequency of the frequency standard of the Observatory from the carrying frequency (16 Kc/s) of the GBR station is maintained within a tolerance limit of  $\pm 5 \cdot 10^{-10}$ . So the deviation in frequency of the TUU time scale of the Observatory as regards the A. 1 scale of atomic time of the anglo-american group, based on the conventional value of caesium frequency of  $f(\text{Cs}) = 9\ 192\ 631\ 770\ \text{Hz}$ , will be given by:

$$\frac{\Delta\bar{F}}{\bar{F}} = \frac{\Delta f}{f} + \frac{\Delta F}{F} \quad , \quad (\text{in unity of } 10^{-10})$$

where:

$\Delta F/F$  is the deviation in frequency of the Frequency Standard of the Observatory as regards the basic frequency (16 Kc/s) of the GBR station,  
 $\Delta f/f$  is the deviation in frequency (offset) of the basic frequency of the GBR station as regards A. 1 frequency.

The daily values of  $\Delta F/F$  are periodically given to all concerned who ask for and published monthly in the Bulletin of the Chronometric Center.

The  $\Delta \bar{F}/\bar{F}$  values are periodically published in the Circulars of the Time Service of the Brera Observatory.

(3) The time signals and frequencies standards transmission service over telephone lines SIP-STIPEL <sup>(1)</sup> assures at present a frequency accuracy at the emission of  $\pm 5.10^{-9}$  as regards the scale of uniform time (TUU) of the Observatory. The real stability of the interval of a second at the emission of time signals is  $\pm 10/\mu\text{s}$ .

The daily values of time signals adjustment at the emission as regards the TUU time scale of the Observatory are periodically given to all concerned who ask for.

As the TUU time scale differs from the Universal Time scale (TU2) of the Observatory obtained by the astronomical observations and based upon the rotation of the Earth, the time signals emissions in the TUU scale are periodically adjusted in phase of 100 ms according to a plan whereby the times of emission of Universal Time signals are synchronized to 100 ms of the Universal Time scale, UT2 <sup>(2)</sup>.

The values of the adjustment in phase of the time signals emission as regards the Universal Time scale (TU2) are periodically published by the Bulletin of the Chronometric Center.

(4) The MF radiotransmission service of the «time signal» by circular transmission on the frequency of 31,75 Mc/s gives a time reference of high precision for technical and scientific purposes within a range of 50-75 Km from Milan <sup>(3)</sup>, very useful for the people interested not included in the telephone city lines and who cannot receive the signals of the telephone transmission service.

The time code, reproducing the succession of radio time signals broadcast by RAI (Radio Audizioni Italiane), differs from it because the beginning of the last time signal of the code transmitted represents the 58th (instead of the 60th) second, before the hour.

The accuracy at the emission as regards the TUU time scale is at present

$\pm 5 \cdot 10^{-4}$  sec., while the intrinsic stability of the interval of a second is about  $\pm 1 \cdot 10^{-4}$  sec.

The emission of the « time signal » is effected continuously once every full hour or, in particular cases, every half or quarter of hour.

The adjustment in phase of the « time signal » as regards the TU2 time scale are periodically published in the Bulletin of the Chronometric Center. The MF transmission service of the « time signal » is also used for the radio control and resetting of electrical clocks (4).

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