The Consultative Committee for Space Data Systems

Draft Recommendation for
Space Data System Standards

TIME CODE FORMATS

PROPOSED DRAFT RECOMMENDED STANDARD

CCSDS 301.0-B-3.0

PROPOSED PINK SHEETS

April 2007

2.2 CCSDS UNSEGMENTED TIME CODE (CUC)

2.2.1 T-FIELD DESCRIPTION

~~For the unsegmented binary time codes described herein, the T-field consists of a selected number of contiguous time elements, each element being one octet in length. An element represents the state of 8 consecutive bits of a binary counter, cascaded with the adjacent counters, which rolls over at a modulo of 256.~~

~~The basic time unit is the second. The T-field consists of 1 to 4 octets of coarse time (seconds) and 0 to 3 octets of fine time (subseconds). The coarse time code elements are a count of the number of seconds elapsed from the epoch. Four octets of coarse time results in a maximum ambiguity period of approximately 136 years. This allows a time code representation of time through the year 2094 for those which are referenced to the TAI epoch of 1958 January 1.~~

~~Zero to three octets of fine code elements result in a resolution of, respectively: 1 second; 2^{-8} second (about 4 ms); 2^{-16} second (about 15 μs); or 2^{-24} second (about 60 ns).~~

~~The CCSDS-Recommended epoch is that of 1958 January 1 (TAI), but other Agency-defined epochs may be accommodated as a Level 2 code.~~

~~This time code **is not** UTC-based and leap second corrections do not apply.~~

The T-field consists of a selected number of contiguous octets representing an integrated number of basic time units from a defined epoch along with an optional integer number of octets representing the elapsed binary fraction of the basic time unit. Each octet within the T-field represents the state of 8 consecutive bits of a binary counter, cascaded with the adjacent counters, which rolls over at a modulo of 256. The time code represented by the T-field shall increase monotonically without reversion.

The basic unit of time intended for correlation with Earth-based clocks is the second. The basic unit of time represented by the value of the T-Field is required to be defined in the metadata. The metadata also defines the epoch of the time and the number of octets of basic and fractional time units. This metadata can be provided by the P-field if self-identification is employed or by metadata external to the P-field.

The CCSDS-Recommended epoch is that of 1958 January 1 (TAI) and the recommend time unit is the TAI second for use as a level 1 time code. This time code is not UTC-based and leap-second corrections do not apply.

2.2.2 P-FIELD DESCRIPTION

Octet 1

Bit 0 = P-Field Extension (‘zero’: no extension; ‘one’: field is extended)

Bit 1 - 3 = Time code identification

001 — 1958 January 1 epoch (Level 1 Time Code)
010 — Agency-defined epoch (Level 2 Time Code)

Bit 4 - 5 = ~~(number of octets of coarse time)~~ Number of octets of the basic time unit minus one~~*~~

Bit 6 - 7 = ~~(number of octets of fine time)~~Number of octets of the fractional time unit

Octet 2

Bit 0 = P-Field Extension (‘zero’: no extension; ‘one’: field is extended)

Bit 1 = ‘zero’: Time Code is within specification limits; ‘one’: out of limits

Bits 2-3 = Number of additional octets of the basic time added to that specified in Octet 1

Bits 4-6 = Number of additional octets of the fractional time added to that specified in Octet 1

Bit 7 = Spare

~~*For the 1958 epoch, bits 4-5 must be "11" to ensure a long enough ambiguity period. The value in this field may be variable and shall be in the range of 0 to 3, corresponding to 1 to 4 octets.~~