Consultative Committee for Space Data Systems

DRAFT RECOMMENDATION FOR SPACE DATA SYSTEM STANDARDS

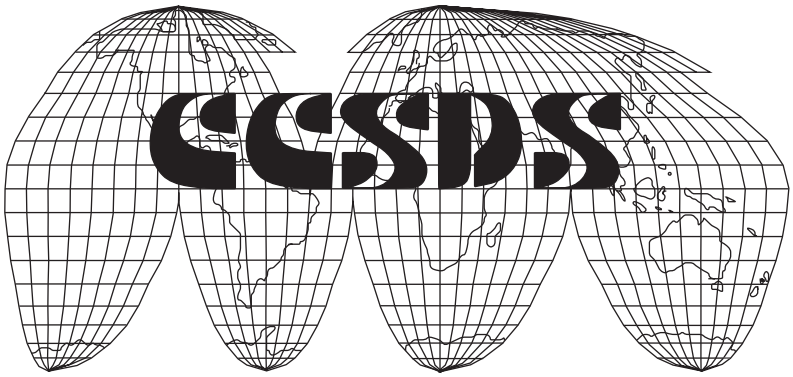
PROXIMITY-1 SPACE LINK PROTOCOL—

PHYSICAL LAYER

CCSDS 211.1-~~B~~P-2.1

~~BLUE BOOK~~PINK SHEETS

~~May 2004~~December 2004



3.4.4 KA-BAND FREQUENCIES

Ka-Band frequencies are intentionally left unspecified until a user need for them is identified.

NOTE – If such a need arises, users are requested to contact the CCSDS Secretariat at: ccsds@lists.hq.nasa.gov.

3.4.5 POLARIZATION

Both forward and return links shall operate with RHCP.

3.4.6 MODULATION

3.4.6.1 The PCM data shall be Bi-Phase-L encoded and modulated directly onto the carrier.

3.4.6.2 Residual carrier shall be provided with modulation index of 60° ± 5%.

3.4.6.3 The symmetry of PCM Bi-Phase-L waveforms shall be such that the mark-to-space ratio is between 0.98 and 1.02.

3.4.6.4 A positive-going signal shall result in an advance of the phase of the radio frequency carrier. For directly modulated Bi-phase-L waveform,

a) a symbol '1' shall result in an advance of the phase of the radio frequency carrier at the beginning of the symbol interval;

b) a symbol '0' shall result in a delay.

3.4.7 DATA RATES

3.4.7.1 Forward and Return Data Rates

The Proximity-1 link shall support one or more of the following 12 discrete forward and return data rates, shown in bits per second: 1000, 2000, 4000, 8000, 16000, 32000, 64000, 128000, 256000, 512000, 1024000, 2048000.

3.4.7.2 Short Term Data Rate Stability

The short term data rate stability as measured at the output of the Proximity-1 transmitter shall meet the requirements in table 3-3.

Table 3-3: Short Term Stability Requirements

Symbol Rate ($1/T_s$)	Short Term Stability Requirement
< 16 Ksps	$\|T_{avg}-T_s\|/T_s < 0.001$ where T_{avg} is the average symbol period over 10 symbols
≥ 16 Ksps	$\|T_{avg}-T_s\|/T_s < 0.001$ where T_{avg} is the average symbol period over 100 symbols

3.4.7.3 Data Rate Offset

Generated data symbol rate, measured over an interval greater than 10000 symbol periods, shall differ less than 0.1% from the defined Proximity-1 rates as measured at the output of the transmitter.

3.5 PERFORMANCE REQUIREMENTS

3.5.1 DELIVERED BIT STREAM ERROR RATE

Link margins shall be designed to provide a Bit Error Rate (BER) less than or equal to 1×10^{-6} for asynchronous links.

3.5.2 CARRIER FREQUENCY STABILITY REQUIREMENTS

3.5.2.1 The long term oscillator stability (over the life of the mission) including all effects and over all operating conditions shall be 10 ppm.

3.5.2.2 The short term oscillator stability over 1 minute shall be 1 ppm.

3.5.3 RESIDUAL AMPLITUDE MODULATION

Residual amplitude modulation of the phase modulated RF signal shall be less than 2% RMS.

3.5.4 CARRIER PHASE NOISE

The minimum specification for the oscillator phase noise at 437.1 MHz shall be limited by the template shown in figure 3-1. The figure shows normalized power in dBc (where dBc refers to the power relative to the carrier power) vs. frequency offset from the carrier in Hz.