ITS33S Coherent Receiver System
Characteristics and Specifications

INPUT: Mutually coherent (i.e. OSCAR/NIMS) signals at 150, 400 and 1066.67 MHz (nominal). Frequency range (offset) is nominal -220 ppm to +110 ppm. This covers NIMS Operational, NIMS Maintenance, Geodetic, Cosmic and some Russian Navigation satellites.

ANTENNA: Three 90 degree phased, crossed dipoles (turnstile-type) at UHF, VHF and L-band, above a user-supplied ground screen: intended to receive -116 dBm of UHF power from an overhead and -132 dBm from a 10° elevation satellite. Enclosed 30 dB preamplifier and signal combiner, with a single cable to receiver. (Specifications are for this antenna over a user-supplied 3 m x 6 m ground screen.)

RECEIVER NOISE FIGURE: 2.0 dB plus preselector filter insertion loss (nominally an additional 3.5 dB all bands).

CARRIER SYNCHRONIZATION: Analog loop phase-locked to computer selected VHF, UHF or L-band signal.

BASEBAND: 50 kHz, with 25-Hz bandwidth. (see optional filtering, digitization, below)

SAMPLING: 6 channels: I and Q of VHF, UHF and L-band. Baseband signals are multiplied by 50-kHz (I and Q) reference signals in analog four-quadrant multiplier, alias filtered at 25 Hz and sampled at 50 Hz. Optionally, the receiver can be built with filtering (sampling) from 20 Hz (40 Hz) to 1000 Hz (2000 Hz).

PROCESSOR - Primitive: VHF intensity, UHF intensity, L-band intensity and phase relative to the lock signal, each at 50 sps. Phase vectors at all frequencies are computed at each sample point from I and Q values. Relative phase is computed from those phase vectors, thereby canceling the tracking loop effect.

PROCESSOR OUTPUT: VHF - UHF Relative TEC once per second, averaged over two-second overlapping blocks with triangular weighting. UHF and VHF Scintillation indices and RMS dispersive-phase fluctuation, computed in ten-second blocks. Data-quality flags. Satellite azimuth & elevation. Coordinates of F-layer (350-km) and E-layer (110-km) ionospheric penetration points.

SIGNAL + NOISE to NOISE RATIO (at 50 sps): For elevation angle ranging from 90° to 10°: 46 to 28 dB (41 to 22 dB) at UHF (VHF) for OSCAR-type satellites at a quiet site; up to 16 dB lower at an RF-noisy urban site.

DISPERSIVE-PHASE PRECISION (at 50 sps): 53 mrad (useful) for OSCAR above 30° elevation at a urban site; 391 mrad (marginal) at 20° elevation, 580 mrad at 10°. Better at a quiet site.

Operation and Hardware:

SATELLITE SELECTION: The receiver searches and records only at times and frequency offsets determined by the user via an integral pass-planner. Input to the pass-planner are NORAD Two Line Elements (TLEs) supplied by the user.

STATION OPERATION: Operation is automatic, continuous and unattended. Input of NORAD TLEs are required for satellite selection and TLE updates are required for correct processing of geometrical parameters. (Inputs may be done remotely.) Data is typically downloaded via telephone or Internet, and backup storage is on station hardware.

RECEIVER POWER: 100 – 240 VAC, 50 / 60 Hz. Approximately 30 Watts.

SYSTEM COMPONENTS: **ITS33S coherent receiver**, data collection and processing software, Windows-based desktop computer (including keyboard and mouse), antenna and antenna preamplifier assemblies, and all necessary cables and connectors.

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