

NWRA ITS30S COHERENT RECEIVER

ITS20S RECEIVER WITH ADDITIONAL CHANNEL OF RECEPTION

Characteristics and Specifications:

INPUT: Mutually coherent (i.e. OSCAR/NIMS) signals at 150 and 400 MHz (nominal). Frequency range (offset) is nominal -220 ppm to +110 ppm. This covers NIMS Operational, NIMS Maintenance, Geodetic, and some Russian Navigation satellites. ITS30 adds the capability to receive and lock to similar-strength signals at L-band (nominally 1066.67 Mhz. i.e. the planned CERTO beacon).

ANTENNA: Three-each phased, crossed dipoles (turnstile-type), UHF, VHF and L-band, above a 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: 4.2 dB.

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

BASEBAND: 50 kHz, with 25-Hz bandwidth.

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 an analog four-quadrant multiplier, alias filtered at 25 Hz and sampled at 50 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: Relative TEC once per second, averaged over two-second overlapping blocks with triangular weighting. UHF, VHF and L-band S4 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.

SYSTEM COMPONENTS: ITS30s coherent receiver, Windows-based desktop computer, antenna and antenna preamp assembly, and cables and connectors.