

RECOMMENDATION ITU-R M.1088

**CONSIDERATIONS FOR SHARING WITH SYSTEMS OF OTHER SERVICES
OPERATING IN THE BANDS ALLOCATED TO THE
RADIONAVIGATION-SATELLITE SERVICE**

(Question ITU-R 83/8)

(1994)

The ITU Radiocommunication Assembly,

considering

- a) that the Global Positioning System (GPS) provides worldwide precision navigation information in three dimensions to air, land and sea-based stations;
- b) that the bands 1 215-1 240 MHz and 1 559-1 610 MHz are allocated on a primary basis respectively to the radiolocation and radionavigation-satellite services and to the aeronautical radionavigation and radionavigation-satellite services in all three Regions;
- c) that many administrations additionally allocate the 1 215-1 240 MHz band on a primary basis to the fixed, mobile and radionavigation services, and the 1 559-1 610 MHz band on a primary basis to the fixed service;
- d) that any properly equipped earth station may receive navigation information from the GPS on a worldwide basis;
- e) that because the GPS provides a radionavigation function, it is recognized as performing a safety service and thus requires special measures to ensure its freedom from harmful interference,

recommends

- 1. that the characteristics and system description of Annexes 1 and 2 be used in assessing sharing with the GPS.

ANNEX 1

**GPS receiver characteristics
(for typical, low-cost air-navigation receivers)**

L1 carrier frequency:	1 575.42 MHz
L2 carrier frequency:	1 227.6 MHz
P code chip rate:	10.23 Mbit/s
C/A code chip rate:	1.023 Mbit/s
Navigation data rate:	50 bit/s
Undetected bit-error rate:	10 ⁻⁵
Minimum received power level (L2, P):	-136 dBm
Minimum received power level (L1, P):	-133 dBm
Minimum received power level (L1, C/A):	-130 dBm
Preamplifier limiting level:	-40 dBm
Preamplifier burnout level:	30 dBm, ave. 40 dBm, peak
Overload recovery time:	1 s
RF 3-dB filter bandwidth:	± 17 MHz



<i>RF</i> 45-dB filter bandwidth:	± 50 MHz
Isolation between <i>L1</i> and <i>L2</i> :	40 dB
Receiver noise figure:	3 dB
Normal acquisition I/S margin (<i>L1</i> , <i>C/A</i>):	24 dB
State 5 tracking I/S margin (<i>L1</i> , <i>C/A</i>):	31 dB
State 5 tracking I/S margin (<i>L1</i> , <i>P</i>):	41 dB

ANNEX 2

**Technical description and characteristics
of the Global Positioning System (GPS)**

1. GPS system**1.1 Introduction**

The Global Positioning System (GPS) will consist of 24 satellite positions with four satellite positions in each of six 55° inclined equally spaced orbital planes. Each satellite will transmit the same two frequencies for navigational signals. These navigational signals are modulated with a predetermined bit stream, containing coded ephemeris data and time, and having a sufficient bandwidth to produce the necessary navigation precision without recourse to two-way transmission or Doppler integration. The system will provide accurate position determination in three dimensions anywhere on or near the surface of the Earth.

1.1.1 Frequency requirements

The frequency requirements for the GPS system are based upon an assessment of user accuracy requirements, space-to-Earth propagation delay resolution, multipath suppression, and equipment cost and configurations. Two channels were selected for GPS operations: 1 575.42 MHz (*L1*) and 1 227.6 MHz (*L2*). The *L1* channel will be used to resolve a user's location to within 150 m. A second signal transmitted on both *L1* and *L2* channels, provides the necessary frequency diversity and wider bandwidth for increased range accuracy for Earth-to-space propagation delay resolution and for multipath suppression to increase the total accuracy by an order of magnitude. Telemetry and maintenance signals from United States based control facilities to the satellite and return will be accommodated in the allocated telemetry band in the United States of America.

GPS will provide a worldwide navigation service. The requirement for navigation safety (refer to Radio Regulation No. 953) demanded by such a service underscores the critical importance that other radio services not cause harmful interference to GPS receivers.

1.2 System overview

GPS is a space-based, all-weather, continuous radionavigation, positioning and time-transfer system which will provide extremely accurate three-dimensional position and velocity information together with a precise common time reference to suitably equipped users anywhere on or near the surface of the Earth.

The system operates on the principle of passive triangulation. The GPS user equipment first measures the pseudo-ranges to four satellites, computes their positions, and synchronizes its clock to GPS by the use of the received ephemeris and clock correction parameters. It then determines the three-dimensional user position in a Cartesian Earth-centred, Earth-fixed (ECEF) WGS-84 coordinate system, and the user clock offset from GPS time by essentially calculating the simultaneous solution of four range equations.