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GPS Fact Sheet

Constellation/System: The NAVSTAR GPS (Navigation Satellite Timing and Ranging Global Positioning System) is all weather, continuously available, satellite-based RF positioning system providing highly accurate 3D PVT (Position Velocity & Time)

- The baseline system is specified for 24 satellites; however the system currently employs more than 24 satellites.
- The constellation contains 6 orbital planes inclined 55 degrees to the equator. Each plane contains 4-5 active satellites.
- Satellite altitude is 10,898 nmi. or 20,183 Km or 12,500 statute miles from mean surface of the Earth.
- Satellites are in an 11 hour 58 minute orbital periods.
- The system is implemented and operated by the U.S. DoD. FOC (Full Operation Constellation) was declared on 27 April 95.
- Navigation parameters are based in the NIMA (National Imaging and Mapping Agency) (formerly DMA) ECEF (Earth Centered Earth Fixed)
- WGS (World Geodetic System) 84 datum; A world wide common grid reference system.
- Transmissions are a CDMA spread spectrum signals.
- Time base for system is UTC (USNO United States Naval Observatory).
- The current system consists mainly of Boeing (formerly Rockwell Collins) Block II/IIA satellites.
- Lockheed Martin Block IIR satellites are currently being launched into the configuration.

Satellite: Common features of the Block II/IIA satellites:

- Runs from 700W EOL (End of Life) power source of solar panels and batteries.
- 12 L-band right hand circularly polarized helical elements form the phased array antenna.
- 2 Rubidium and 2 Cesium atomic clocks onboard II/IIA S/C. 3 Rubidium on IIR's. UTC time to better than 30ns.
- Two Navigation carrier signals for transmission: L1 at 1575.42MHz and L2 at 1227.6MHz.
- 36 available unique PRN (Pseudo Random Noise) codes, 4 of these are reserved.
- 7.5 year design lifetime



Engineering & Manufacturing of Splitters, , Combiners, Amplifiers, LNAs, Attenuators, Filters, Repeaters & Antenna Hoods

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Signal characteristics Message: Navigation message is at 50bps. Message structure format, 1500-bit frame made up of 5 sub-frames (30 seconds). Each sub-frame is 300 bits long. Superframe consists of 25 subframes.

Transmit Power Levels:

| | | |
|----------------|----------|--------------------------|
| - L1 SPS (C/A) | 14.25dBW | ERIP 25.0dBW |
| - PPS (PY) | 11.25dBW | ERIP 22.0dBW |
| - L2 PPS (PY) | 6.35dBW | ERIP 17.0dBW |
| | | ERIP 23.0dBW |
| - L5 | 24.20dBW | ERIP 31.0dBW L1; 29.0dBW |
| - M-CODE | 19.00dBW | L2 |

(M-Code values estimated)
All levels as per ICD-GPS-705 March 20, 2002

Carriers:

L1

- L1 C/A-Code (Coarse/Acquisition) or SPS (Standard Positioning Service)
- Center Frequency 1575.42 MHz
- Bandwidth +/-10.23MHz to 1st sinc nulls
- Bandwidth +/-12MHz (ITU International Telecommunications Union authorized)
- C/A-Code chipping rate of 1.023 Mbps with code period of 1ms
- 19cm wavelength (7.48in)

L5

- L5 uses codes in-phase (I) and quadrature (Q); (I) has data message; (Q) does not
- Bandwidth +/- 10.23MHz to 1st sinc nulls
- Bandwidth +/-12MHz (ITU)
- Chipping rate of 10.23 Mbps with a 1ms code period
- Center Frequency 1176.45MHz

Other Services Frequency listing

WAAS

- 1575.42 MHz

CHINA CNSS

- E1: 1589.74 Modulation Type: QPSK(2)
- E2: 1561.1 Modulation Type: QPSK(2)
- E6: 1268.52 Modulation Type: Q/BPSK(10)
- E5b: 1207.14 Modulation Type: BPSK(2), PSK(10)

ILAA RTCM Radio Beacons (USCG type Beacons)

- 283.5-325.0 KHz

Receive Power Levels:

| | |
|--------------------------------------|-----------------------|
| - L1 (SPS) -160.00 dBW (-130.00 dBm) | Min. guaranteed power |
| - L1 (PPS) -163.50 dBW (-133.50 dBm) | Avg. received power |
| - L2 / -166.00 dBW (-136.00 dBm) | Min. guaranteed power |
| - L2 / -157.50 dBW (-127.50 dBm) | Avg. received power |
| - L5 / -161.60 dBW (-131.60 dBm) | Min. guaranteed power |
| - L5 / -157.60 dBW (-127.60 dBm) | Avg. received power |
| - L5 / -150.00 dBW (-120.00 dBm) | Max. power level |

L2

- L2 P-Code or PPS (Precise Positioning Service)
- Center Frequency 1227.60MHz
- Bandwidth +/-10.23MHz to 1st sinc nulls
- Bandwidth +/-12MHz (ITU)
- Chipping rate of 10.23Mbps with a code period of 7 days
- 24.4cm. wavelength (9.61in)
- 267 day pseudo random code generator (37-7 day segments)

M-CODE

- M-Code: split spectrum signal with 30MHz bandwidth to 1st sinc nulls
- Center of split spectrum signals are at L1 & L2 frequencies.

Galileo

- E1 1559 MHz, bandwidth 4 MHz - E2 1561.098 MHz, bandwidth 4 MHz
- E5a 1202.025 MHz, - E5b 1207.140MHz
- E6 1278.750 MHz - L6 1544-1545 MHz

GLONASS

- L1 1602.5625 - 1615.5 MHz; SPS: bandwidth ~1 MHz to 1st sinc nulls, centered at SV frequency
- L2 1240 - 1260 MHz; PPS (on L1 & L2) bandwidth 10 MHz centered at SV frequency or 1250 MHz

NOTE: frequencies are allocated but not final to date

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Signal characteristics Message: Navigation message is at 50bps. Message structure format, 1500-bit frame made up of 5 sub-frames (30 seconds). Each sub-frame is 300 bits long. Superframe consists of 25 subframes.

Transmit Power Levels:

| | | |
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| - PPS (PY) | 11.25dBW | ERIP 22.0dBW |
| - L2 PPS (PY) | 6.35dBW | ERIP 17.0dBW |
| | | ERIP 23.0dBW |
| - L5 | 24.20dBW | ERIP 31.0dBW L1; 29.0dBW |
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(M-Code values estimated)
All levels as per ICD-GPS-705 March 20, 2002

Carriers:

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L5

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- Bandwidth +/- 10.23MHz to 1st sinc nulls
- Bandwidth +/-12MHz (ITU)
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Other Services Frequency listing

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- E1: 1589.74 Modulation Type: QPSK(2)
- E2: 1561.1 Modulation Type: QPSK(2)
- E6: 1268.52 Modulation Type: Q/BPSK(10)
- E5b: 1207.14 Modulation Type: BPSK(2), BPSK(10)

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| - L5 / -161.60 dBW (-131.60 dBm) | Min. guaranteed power |
| - L5 / -157.60 dBW (-127.60 dBm) | Avg. received power |
| - L5 / -150.00 dBW (-120.00 dBm) | Max. power level |

L2

- L2 P-Code or PPS (Precise Positioning Service)
- Center Frequency 1227.60MHz
- Bandwidth +/-10.23MHz to 1st sinc nulls
- Bandwidth +/-12MHz (ITU)
- Chipping rate of 10.23Mbps with a code period of 7 days
- 24.4cm. wavelength (9.61in)
- 267 day pseudo random code generator (37-7 day segments)

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- Bandwidth +/-12MHz (ITU)
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- Center Frequency 1176.45MHz

Other Services Frequency listing

WAAS

- 1575.42 MHz

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