

# Indian Regional Navigation Satellite System (IRNSS)

Presentation By  
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# IRNSS

- IRNSS Refers to Indian Regional Navigation Satellite System.
- IRNSS is an independent Navigation Satellite System providing services in the Indian Region.
- IRNSS is being implemented by the Indian Space Research Organisation.
- The project is being managed by the lead centre viz., ISRO Satellite Centre, Bangalore with support from the other work centres viz., Space Application Centre, Ahmedabad, ISTRAC, Bangalore, MCF, Hassan, VSSC, Thiruvananthapuram.

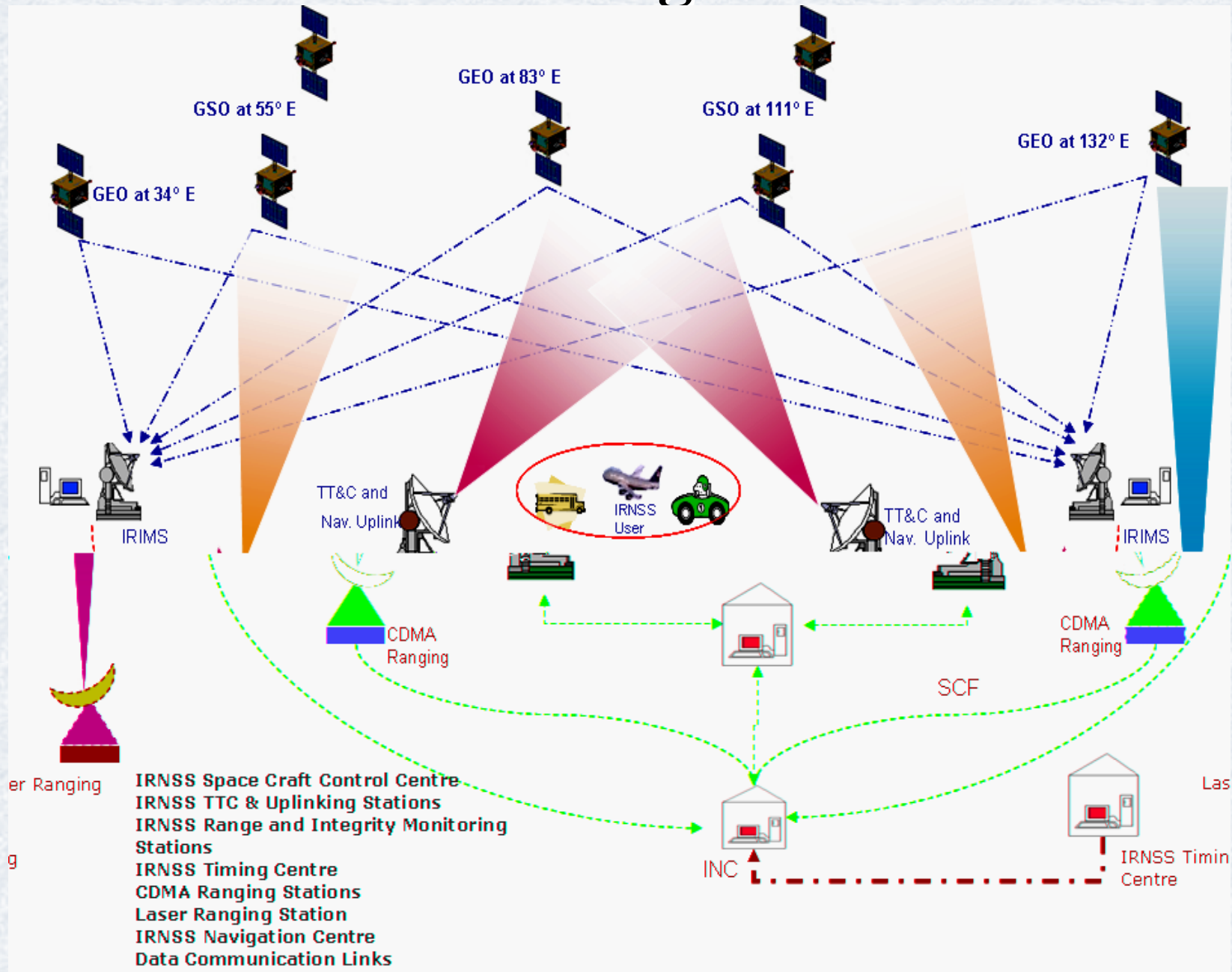
# IRNSS Applications

- IRNSS provides fairly good accuracy and the whole constellation is seen all the time. There are plans to send integrity and ionospheric correction messages to the user. A variety of applications taking the benefit of above will be catered by IRNSS.
- In view of the independent nature of the constellation it is planned to cater to specialized users.

# IRNSS Elements

- Space Segment
- Ground Segment
- User Segment

# IRNSS Configuration



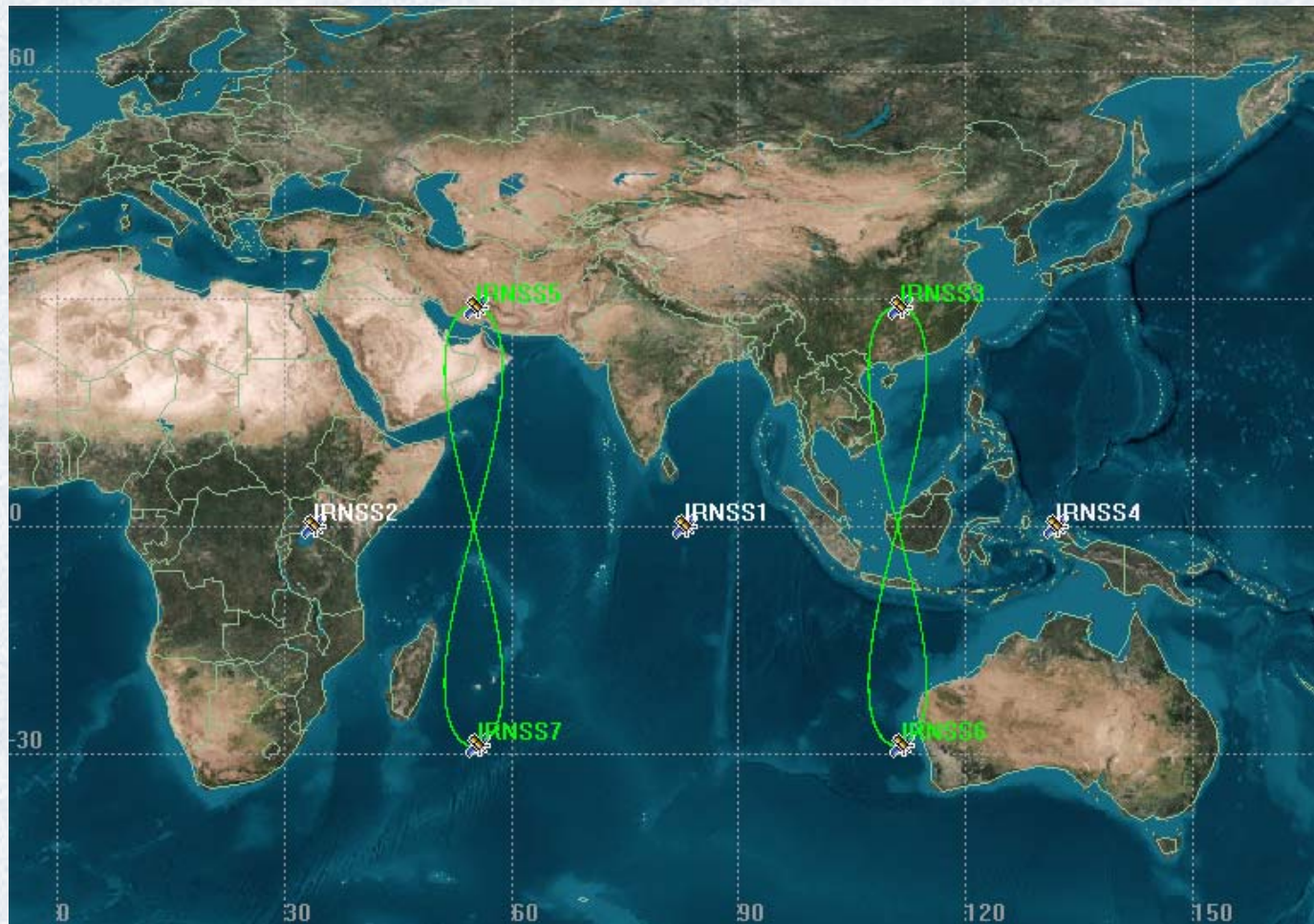
# Space Segment

- Space Segment consists of Seven satellites
- 3 Satellites in Geo-Stationary orbit at  $34^{\circ}$ ,  $83^{\circ}$  and  $132^{\circ}$  East.
- 4 Satellites in GEO Synchronous orbit placed at inclination of  $29^{\circ}$  with Longitude crossing at  $55^{\circ}$  and  $111^{\circ}$  East.
- The Satellites are specially configured for the Navigation.
- IRNSS Satellites are to be launched by the Indian launcher PSLV.

# Design Considerations for Constellation

- Minimizing the Maximum Dilution of precision “DOP” in the coverage region.
- Minimum satellite constellation
- Orbital slots for India

# IRNSS CONSTELLATION



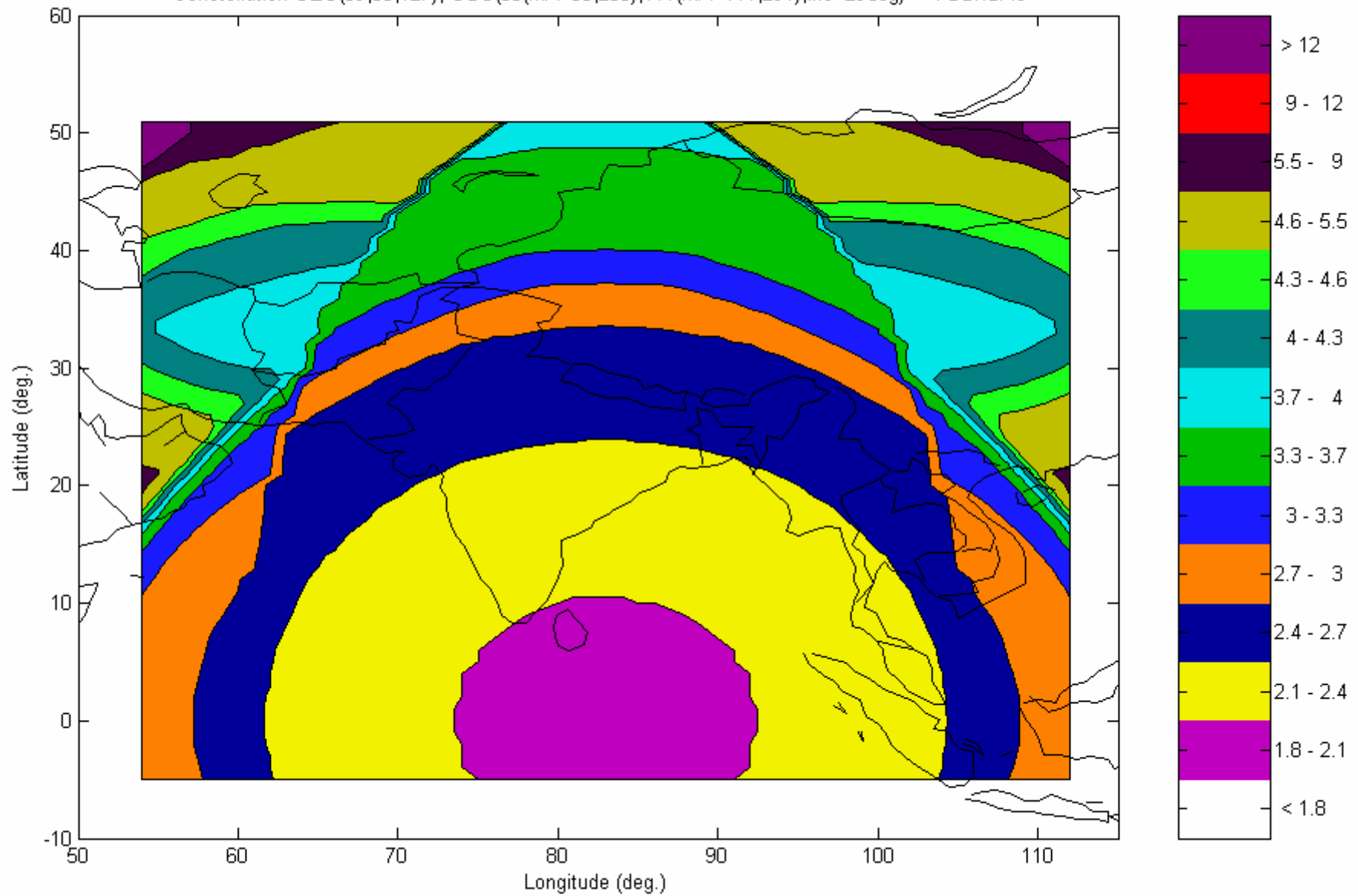


# IRNSS Coverage and Position

## Accuracy

- The intended service area for IRNSS is primarily the Indian Land Mass. The service area for IRNSS is in general specified as between longitude 40 deg East to 140 deg east and between latitude  $\pm 40$  deg.
- IRNSS system provides the Dual frequency user with a targeted position accuracy less than 20 meters in the coverage area.

IRNSS Max HDOP(95%) variation, User Mask Angle 15deg  
Constellation GEO(39,83,127), GSO(55(MA=55,235),111(MA=111,291),Inc=29deg) FDD/ISAC



Availability and Maximum HDOP for IRNSS

# Ground Segment

- **IRNSS Ranging & Integrity Monitoring stations (IRIM)**
  - Receive the data from the GEOs and GSOs.
  - Transmit the data to Navigation Control Centre.
  - Facilitate One way ranging of the GEOs & GSOs.
  
- **IRNSS Navigation Control Center(INC)**
  - Estimate and predict Ephemeris
  - Calculate corrections for SV Clock & Maintain IRNSS time
  - Determine Ionospheric corrections
  - Determine Integrity
  - Transmit the Clock and Ephemeris Corrections to the TTC Stations for Uplinking to the Satellites

# Ground Segment contd

- **Spacecraft Control Centre (SCC)**
  - Manage and maintain the Satellite Constellation
  
- **IRNSS Telemetry and Command stations**
  - Receiving telemetry from the IRNSS constellation.
  - Telecommand the IRNSS constellation.
  - Uplinking Navigation updates
  
- **CDMA Ranging Stations**
  - Facilitate accurate ranging of IRNSS Satellite and send the data to the Navigation Control Centre.

# IRNSS SERVICES

<b>Service Type</b>	<b>Signals</b>	<b>Frequency Band</b>
Standard Positioning Service	1.023 Mcps	L5(1191.795Mhz) S(2491.005Mhz)
Precise Positioning Service	10.23 Mcps	L5 S
Restricted Services for Special Users	10.23 Mcps	L5

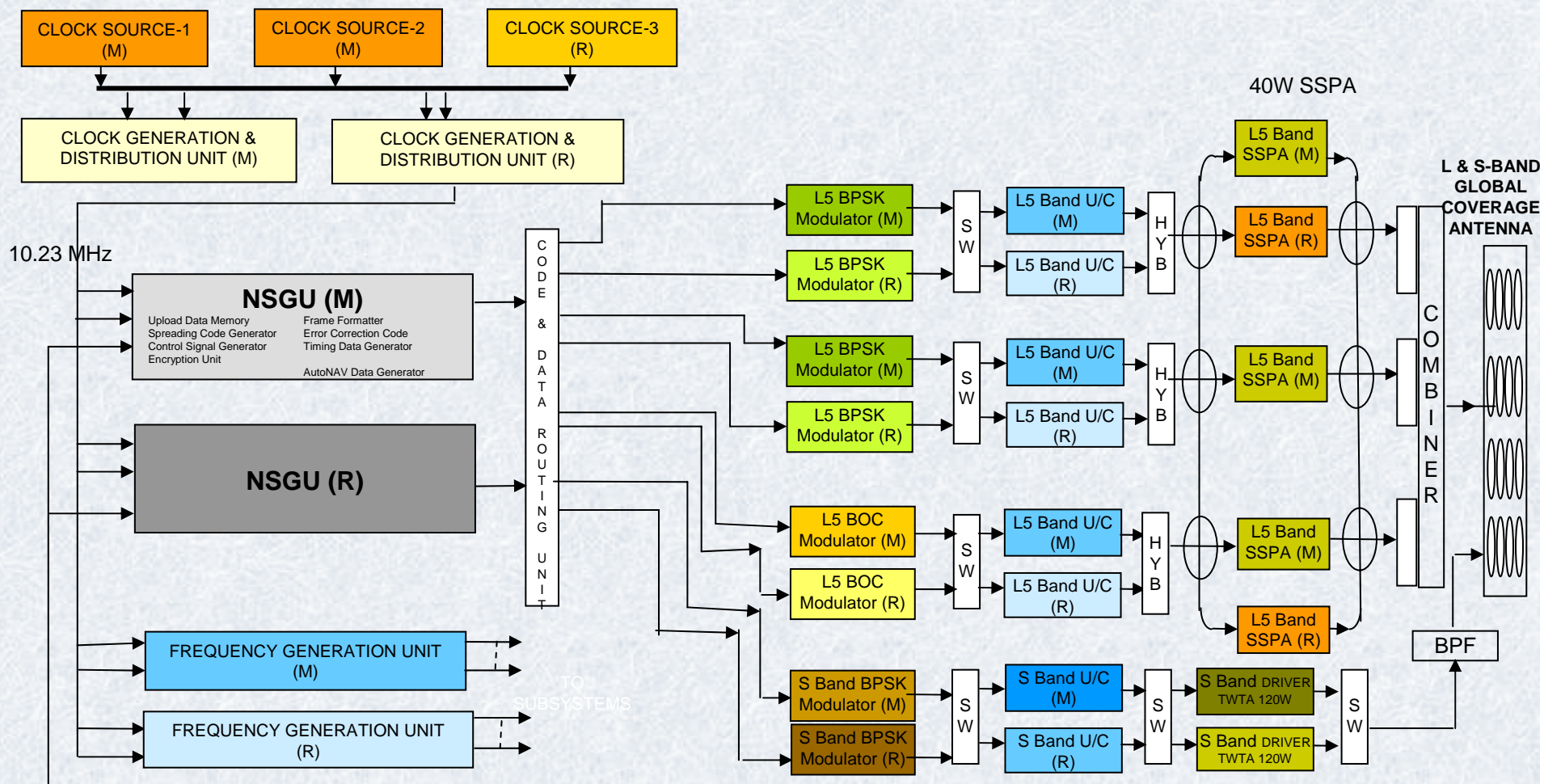
S Band frequency : 2491.75 MHz

# USER Segment

- The user segment consists of a specially designed dual frequency receiver.
- Several types of receivers are planned with single and dual frequency reception. Single frequency receivers may be provided with capability to receive ionospheric corrections.
- The user receiver may receive other constellations in addition to IRNSS.
- All the seven IRNSS satellites will be continuously tracked by the user receiver.
- The user receiver will have minimum G/T of -27 dB/K similar to GPS user receiver.

# PAYLOAD SPECIFICATIONS

Parameters	Unit	Specifications		
		L-Band	S-Band	C-Band
Transmit Frequency	MHz	1191.795±12	2491.005±8.25	3400-3425
Receive Frequency	MHz	-	-	6700-6725
Polarization		RHCP	RHCP	RHCP/LHCP
EIRP (EOC)	dBW	30.5	35.5	19.0
G/T	dB/°K	-	-	-12
Beam width		global	global	global
Antenna Gain (EOC)	dB	15.8	16	16
Data Rate	bps	50	50	
Code Rate	Mcps	1.023/10.23	1.023 (TBD)	10
Modulation / Access scheme		BPSK/BOC / CDMA	BPSK / CDMA	BPSK/CDMA

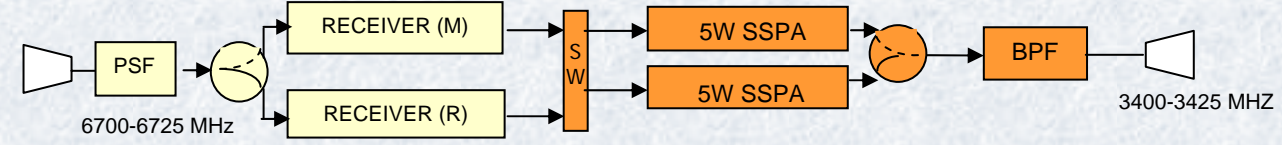


**NAV DATA  
UPLOADED  
THROUGH TTC**

3400-3425 MHz

NAVIGATION PAYLOAD

C-BAND  
Rx GLOBAL HORN ANTENNA



RANGING PAYLOAD

# PAYLOAD CONFIGURATION OF IRNSS



# TYPICAL USER LINK

<b>USER D/L S-BAND</b>		<b>USER D/L L5-BAND</b>	
<b>Frequency (MHz)</b>	<b>2491.005</b>	<b>Frequency (MHz)</b>	<b>1191.795</b>
<b>Power (W)</b>	<b>120</b>	<b>Transmit Power (W)</b>	<b>40.00</b>
<b>Satellite EIRP (dBW)</b>	<b>35.29</b>	<b>Satellite EIRP (dBW)</b>	<b>30.32</b>
<b>Terminal G/T (dB/k)15 El</b>	<b>-27</b>	<b>Terminal G/T (dB/k)15 El.</b>	<b>-27</b>
<b>Path loss (dB)</b>	<b>-192.54</b>	<b>Path loss (dB)</b>	<b>-186.13</b>
<b>Atm. &amp; other loss (dB)</b>	<b>-0.30</b>	<b>Atm. &amp; other loss (dB)</b>	<b>-1</b>
<b>Received Power (dBw)</b>	<b>-157.55</b>	<b>Received Power (dBw)</b>	<b>-156.81</b>
<b>Received PSD (dBw/m2)</b>	<b>-127.87</b>	<b>Received PSD (dBw/m2)</b>	<b>-132.84</b>
<b>C/No/Carrier (dBHz)</b>	<b>44.05</b>	<b>C/No/Carrier (dBHz)</b>	<b>44.79</b>

# IRNSS Schedule

- The first Satellite will be launched by mid 2009.
- The next three satellites will be launched by end of 2010.
- The entire constellation will be in place by 2011.

**THANK YOU**