International Committee on
Global Navigation Satellite Systems

GNSS Receiver Fundamentals

Disclaimer

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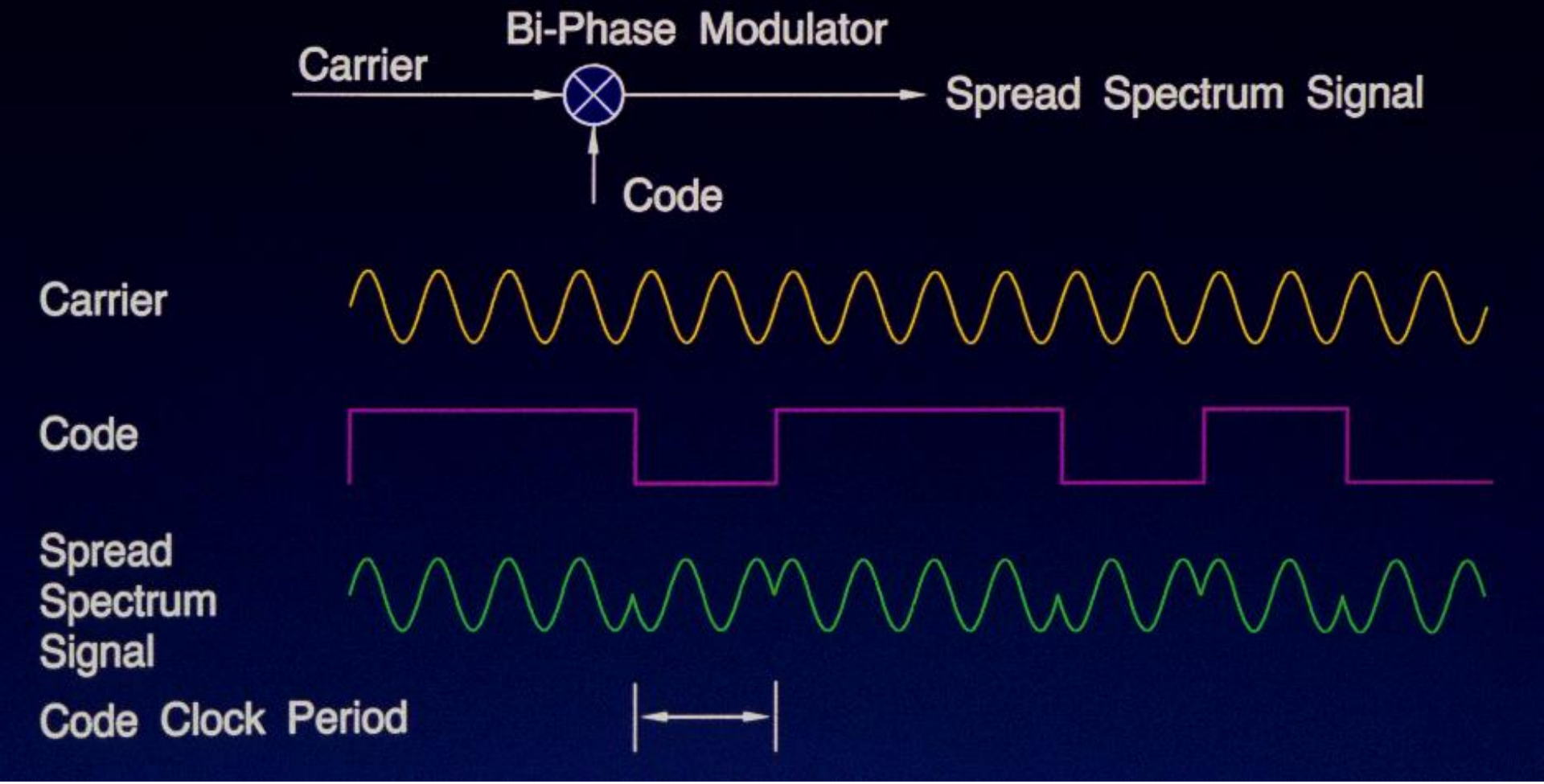
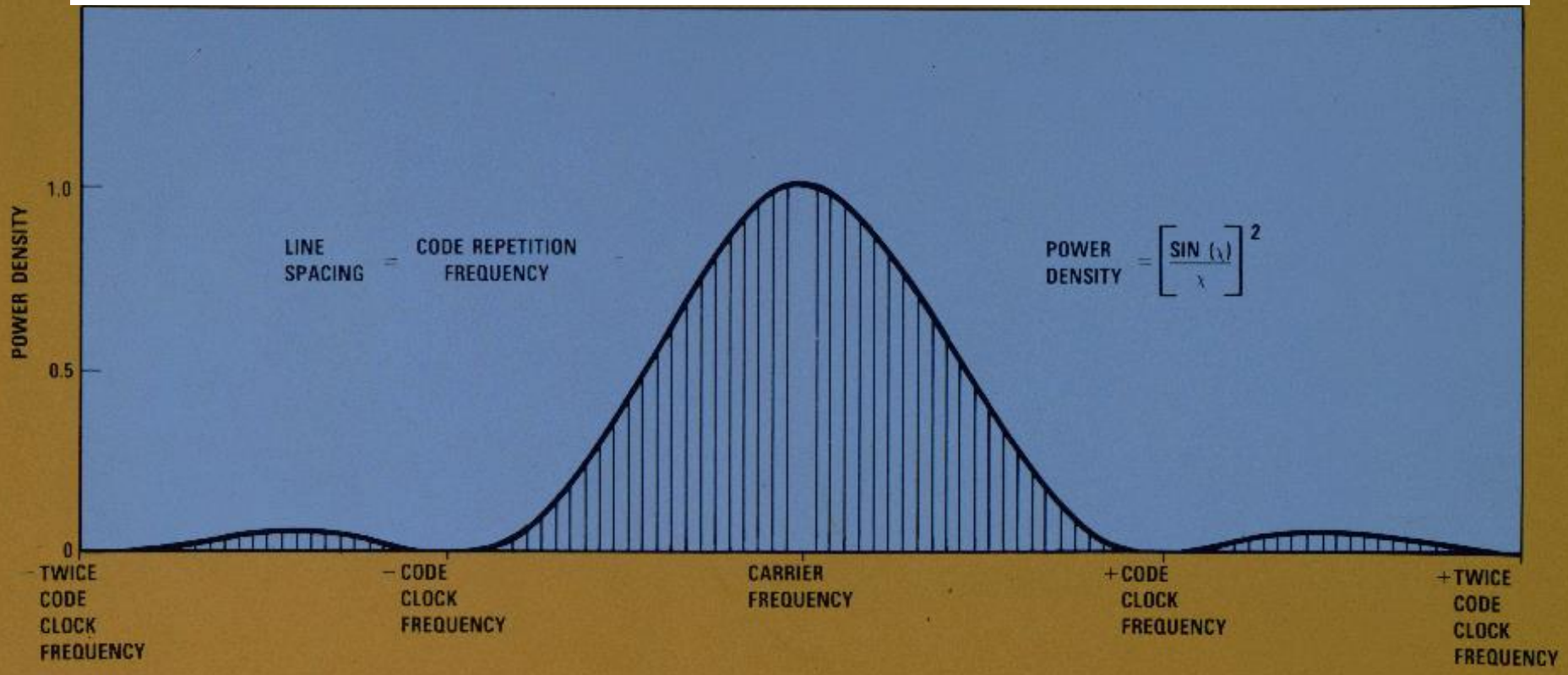
PN MODULATION



Magnavox

SPREAD SPECTRUM POWER DENSITY

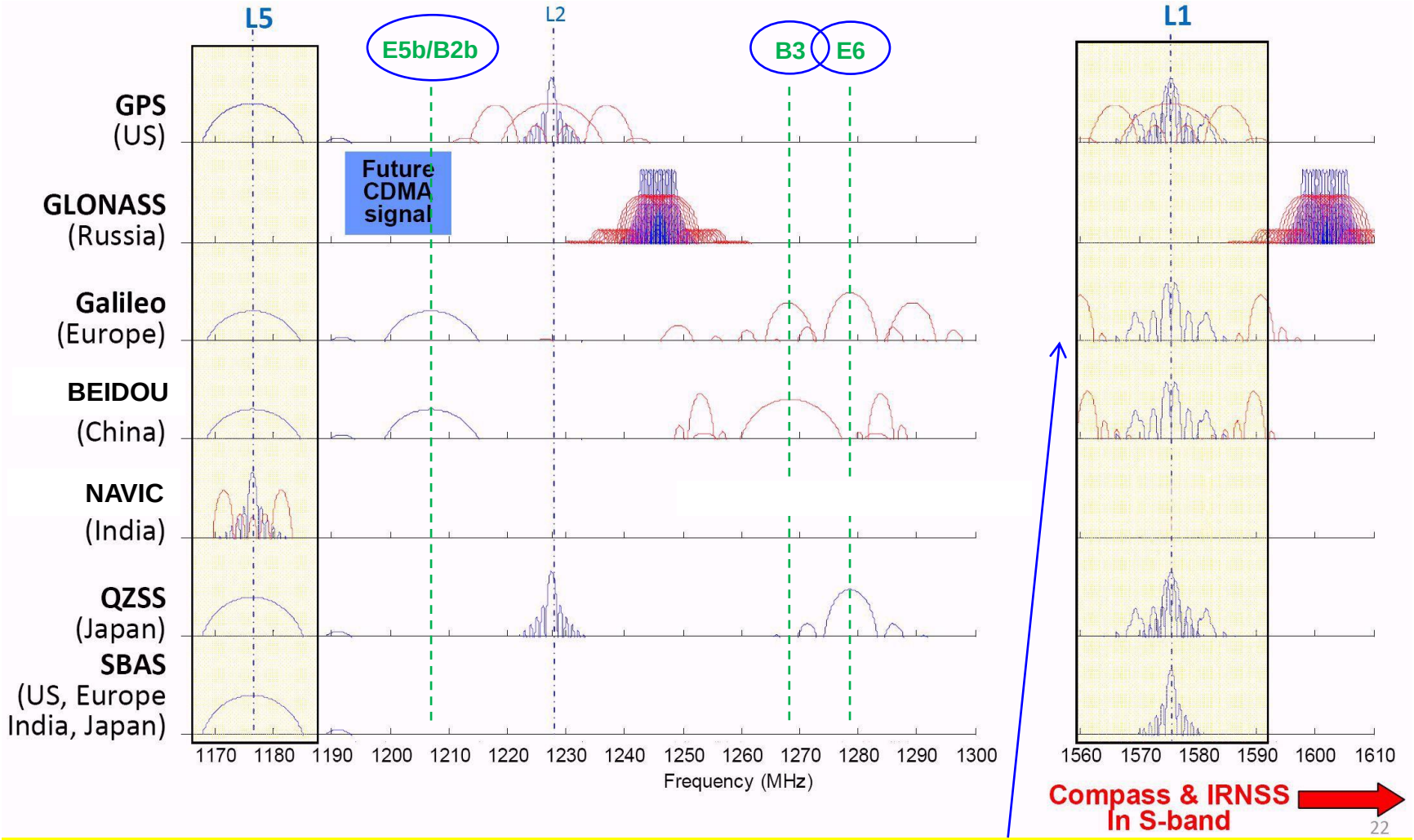
Code Modulation Spreads the Spectrum



Frequency Domain

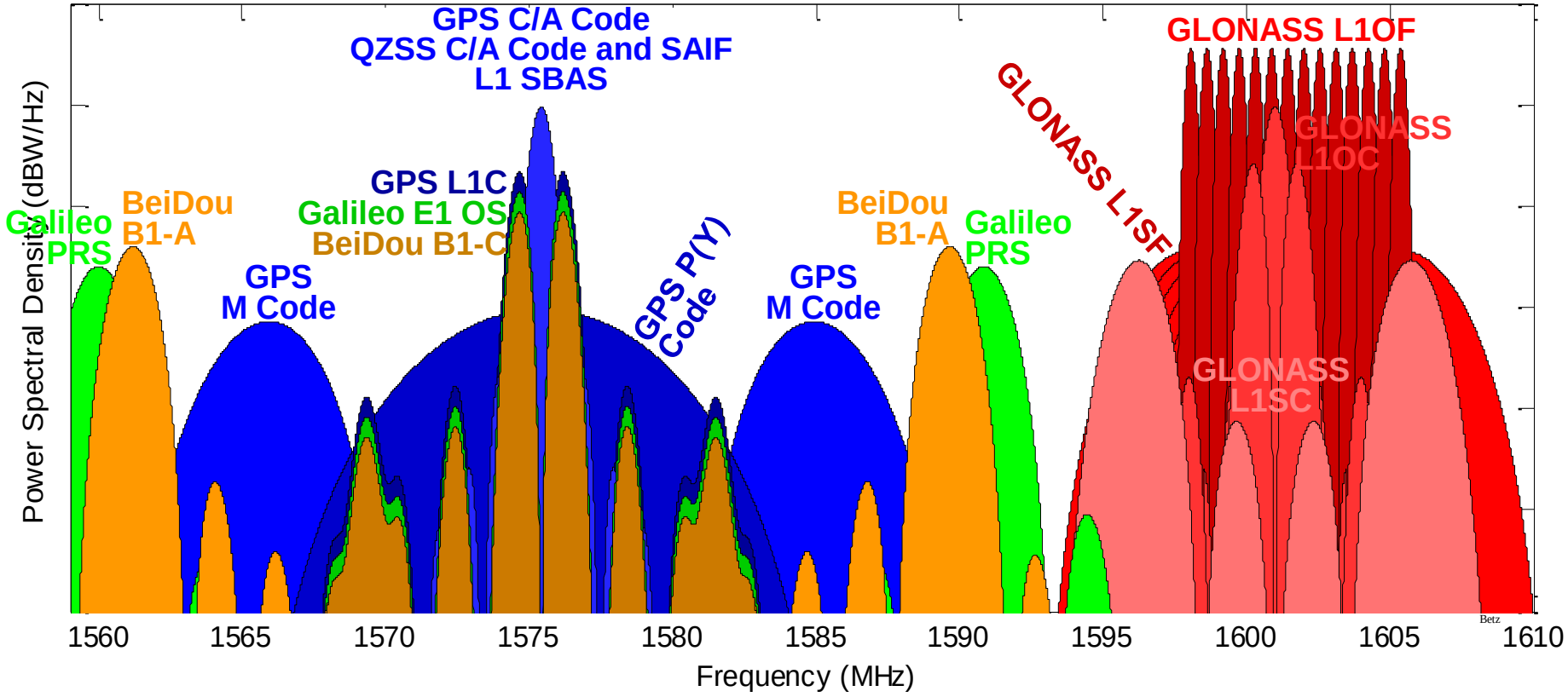
1188-3313

GNSS Spectra To Protect

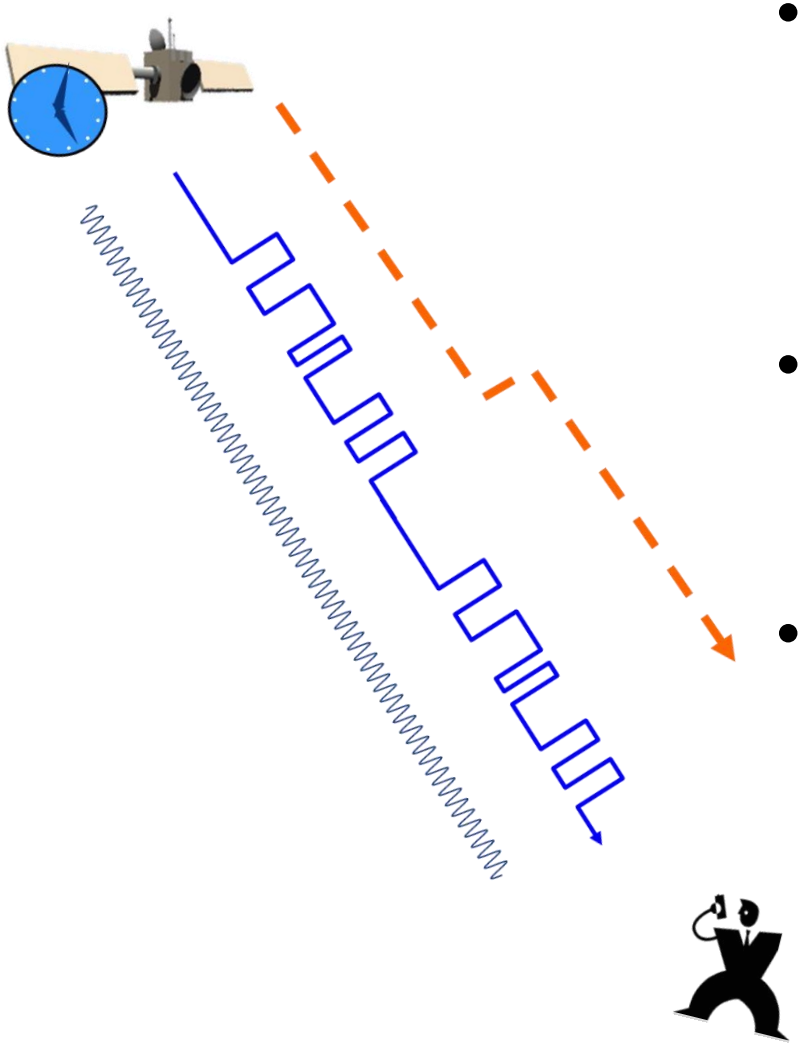


L1, L2, & L5 are paramount, but also GLONASS, PRS, E5b, B3, & E6

GNSS L1 Spectrum

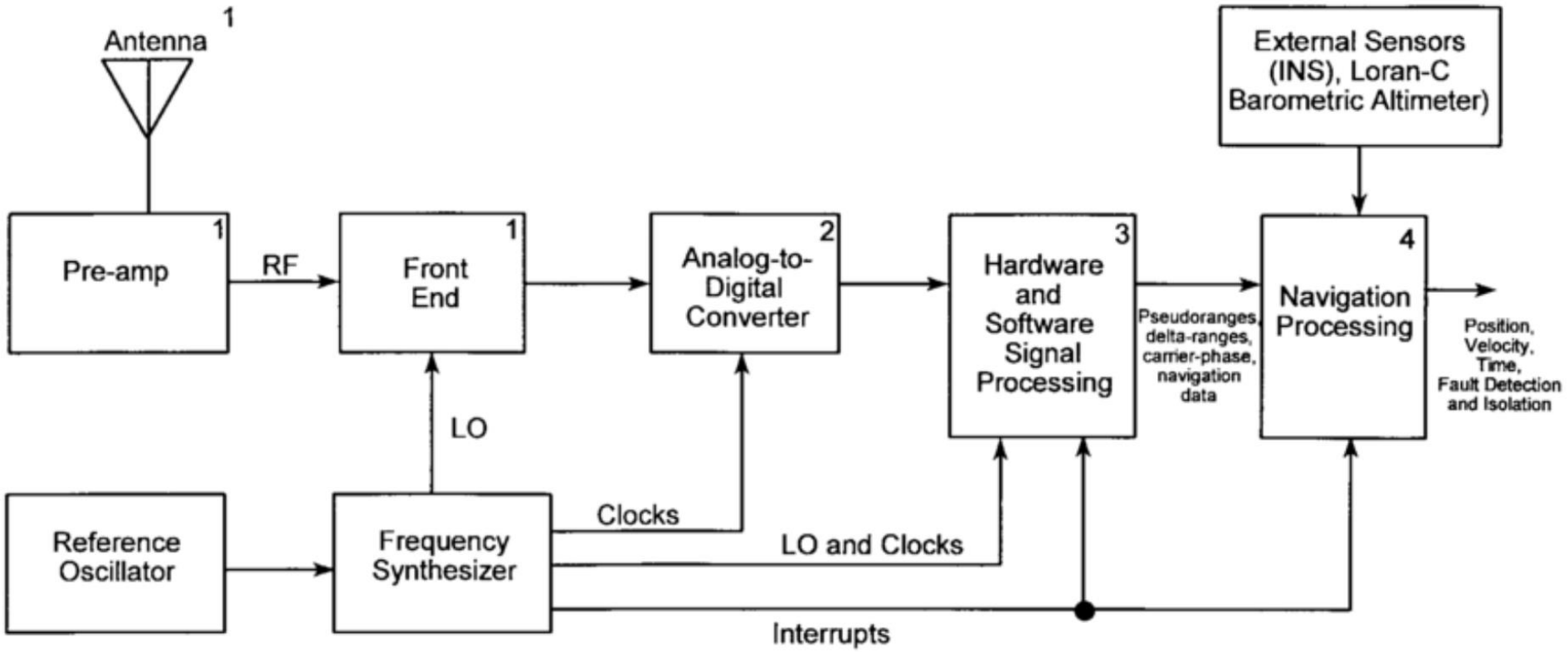


GNSS signal power



- Signals generated in satellites travel more than 23,000 km to reach receivers on the Earth
- Receivers will have to decode/demodulate signals and the contained messages
- For this purpose, signals must be received with certain level of strength

Receiver Processing Flow



Michael Braasch and A.J. van Dierendonck, GPS Receiver Architectures and Measurements, Proceeding of the IEEE, Vol. 87, No 1. Jan 1999

Various Receivers

- There are various types of receivers as follows:
  - Receiving only one signal from one system
  - Receiving multiple signals from one system in the same frequency range
  - Receiving signals from multiple systems in the same frequency range
  - Receiving multiple signals from one system in multiple frequency ranges
  - Receiving multiple signals from multiple systems in multiple frequency ranges

27 Years with Just 3 GPS Signals

Signal/SV	IIR
L1 C/A	✓
L1 P(Y)	✓
L1 M	
L1C	
L2 P(Y)	✓
L2C	
L2 M	
L5	

Direct civil access to C/A code

Indirect civil access by codeless and semi-codeless means

1978 to 2005

GPS IIR-M Satellites Add Three More

Signal/SV	IIR	IIR-M
L1 C/A	✓	✓
L1 P(Y)	✓	✓
L1 M		✓
L1C		
L2 P(Y)	✓	✓
L2C		✓
L2 M		✓
L5		

Direct civil access to L2C code

1978 to 2005

2005

GPS IIF Satellites Add L5

Signal/SV	IIR	IIR-M	IIF
L1 C/A	✓	✓	✓
L1 P(Y)	✓	✓	✓
L1 M		✓	✓
L1C			
L2 P(Y)	✓	✓	✓
L2C		✓	✓
L2 M		✓	✓
L5			✓

Safety service in ARNS band

1978 to 2005 | **2005** | **2010**

GPS III Satellites Add L1C

Signal/SV	IIR	IIR-M	IIF	III
L1 C/A	✓	✓	✓	✓
L1 P(Y)	✓	✓	✓	✓
L1 M		✓	✓	✓
L1C				✓
L2 P(Y)	✓	✓	✓	✓
L2C		✓	✓	✓
L2 M		✓	✓	✓
L5			✓	✓

Better performance

1978 to 2005	2005	2010	2018

Thank You

Questions?