



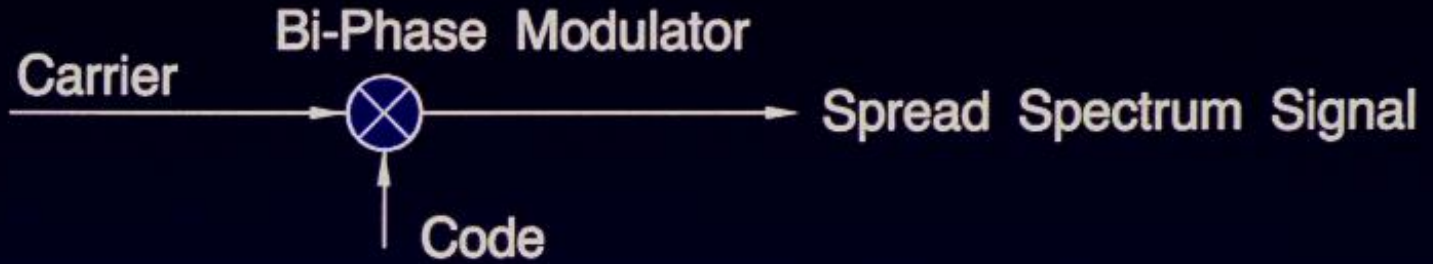
International Committee on
Global Navigation Satellite Systems

GNSS Receiver Fundamentals

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PN MODULATION



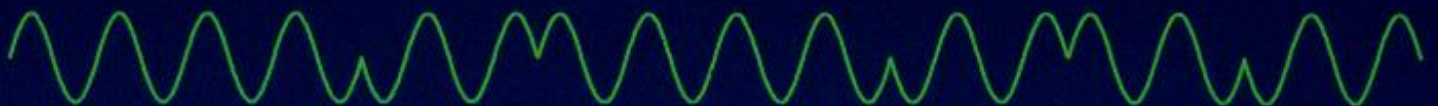
Carrier



Code



Spread
Spectrum
Signal



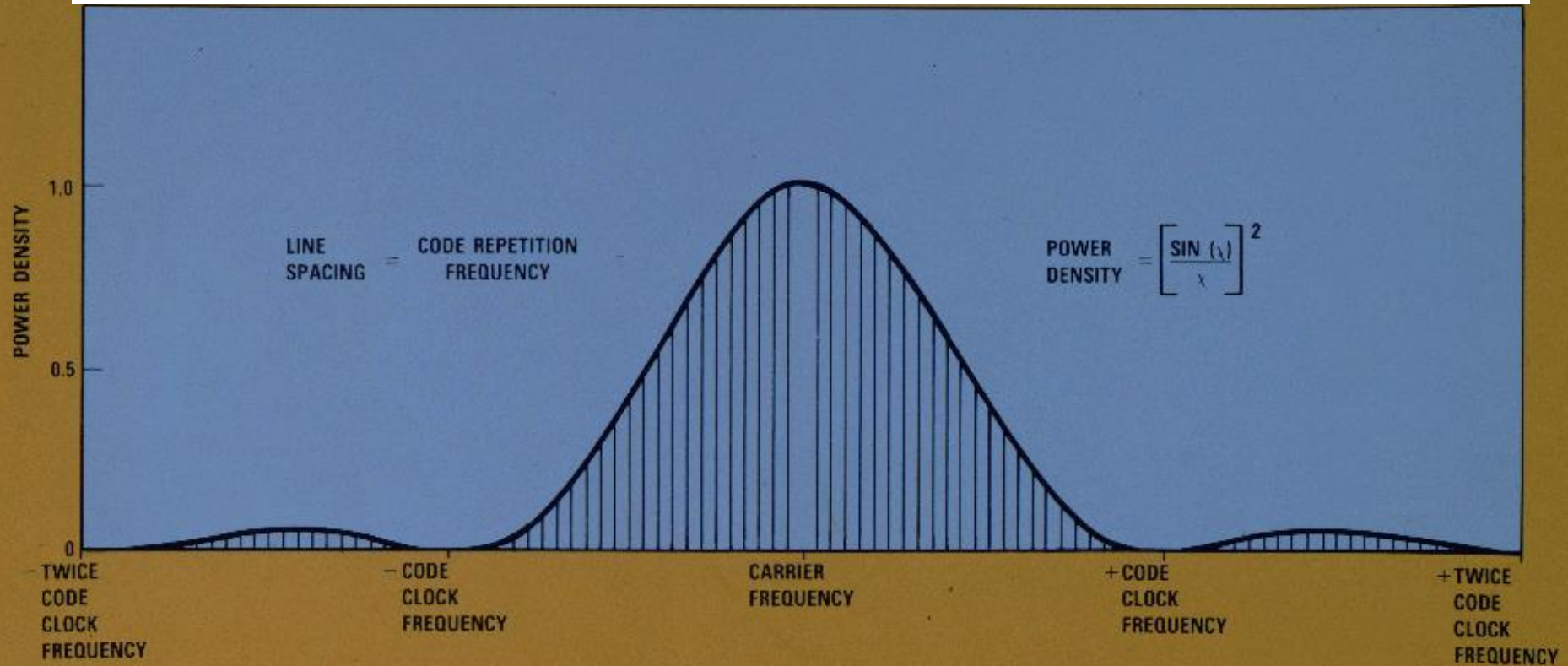
Code Clock Period





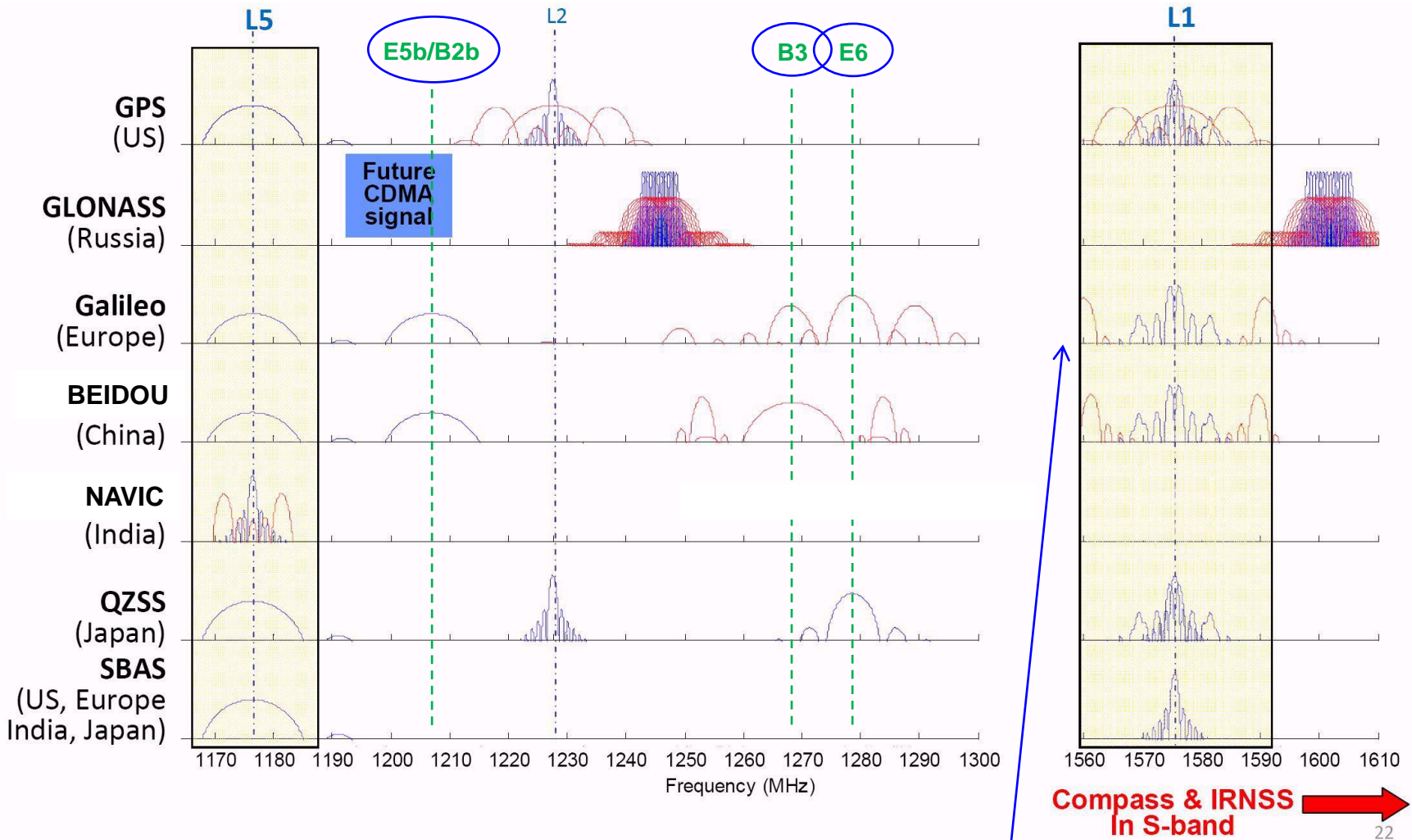
SPREAD SPECTRUM POWER DENSITY

Code Modulation Spreads the Spectrum



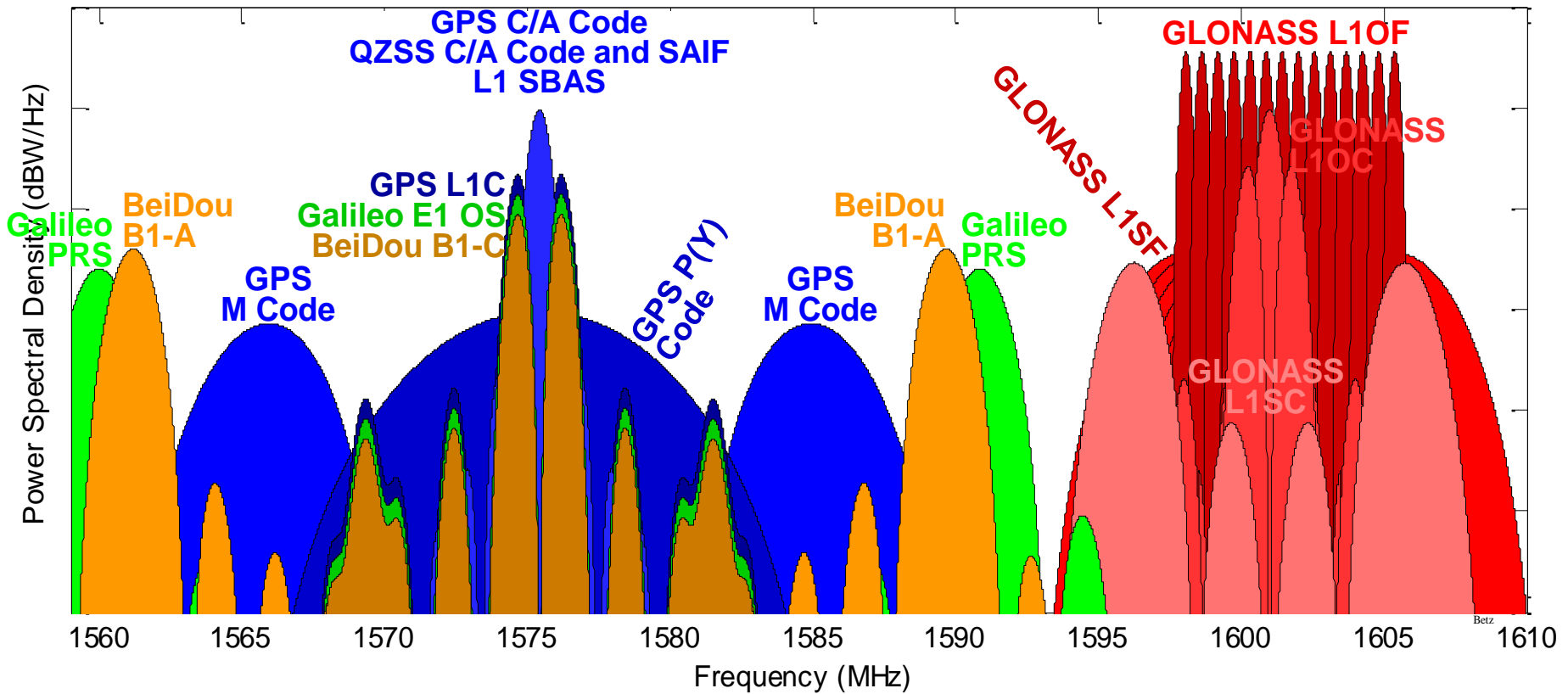
Frequency Domain

GNSS Spectra To Protect

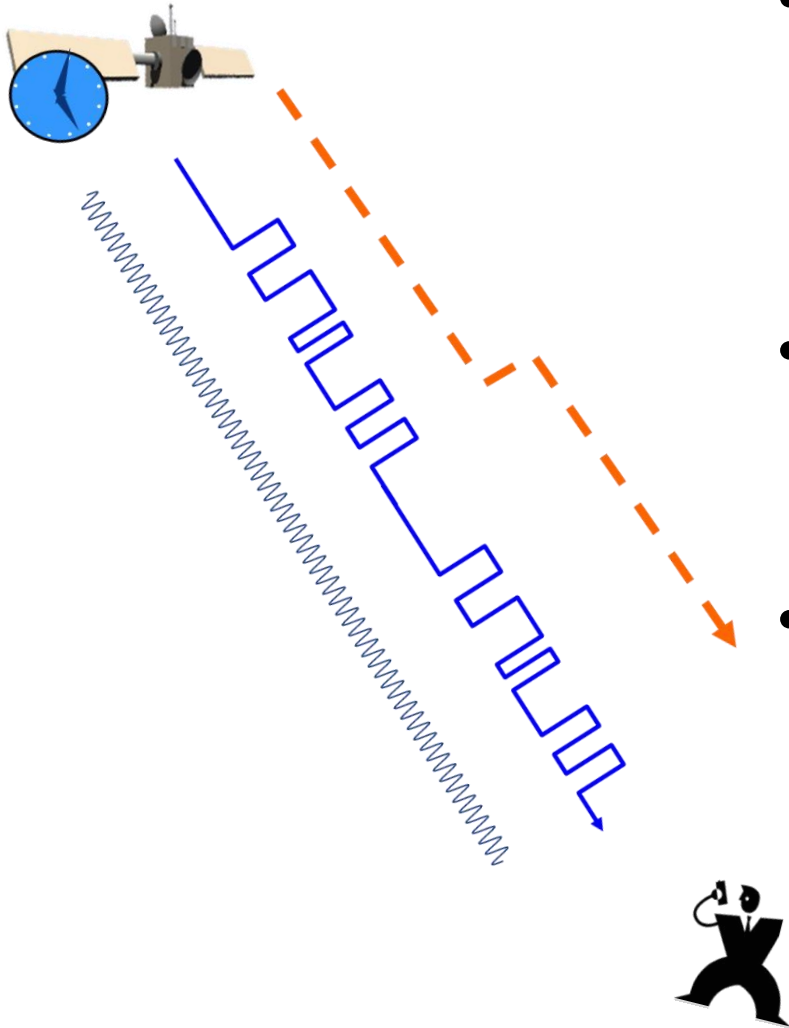


L1, L2, & L5 are paramount, but also GLONASS, PRS, E5b, B3, & E6

GNSS L1 Spectrum



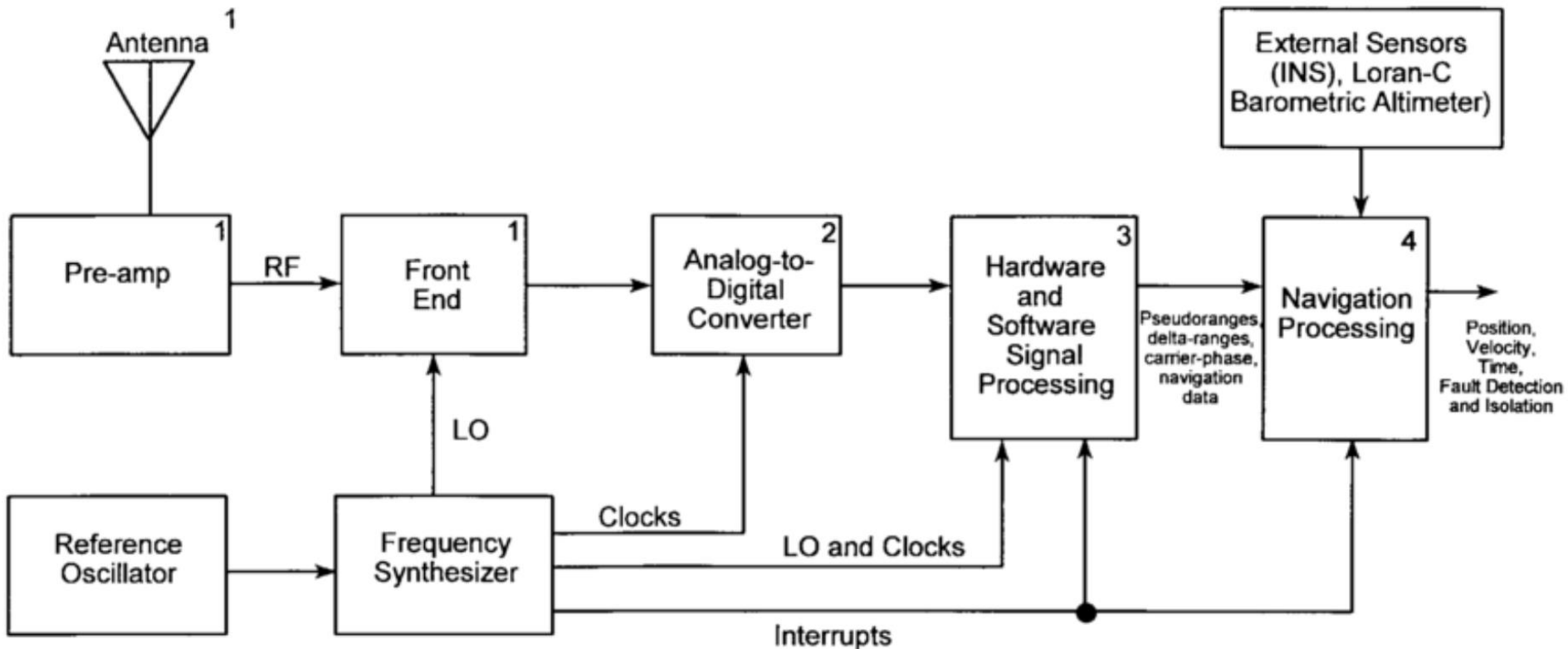
GNSS signal power



- 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	✓	←	Direct civil access to C/A code	
L1 P(Y)	✓			
L1 M		↙ ↘	Indirect civil access by codeless and semi-codeless means	
L1C				
L2 P(Y)	✓			
L2C				
L2 M				
L5				

**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		✓	←	Direct civil access to L2C code
L2 M		✓		
L5				

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	Better performance			✓
L2 P(Y)	✓	✓	✓	✓
L2C		✓	✓	✓
L2 M		✓	✓	✓
L5			✓	✓

**1978 to
2005**

2005

2010

2018

Thank You

Questions?