



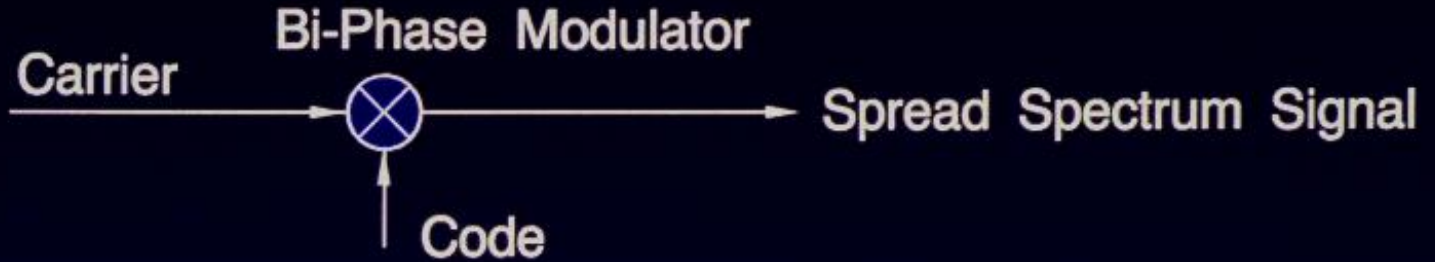
International Committee on  
Global Navigation Satellite Systems

# GNSS Receiver Fundamentals

# Disclaimer

*The views and opinions expressed herein do not necessarily reflect the official policy or position of any government agency*

# PN MODULATION



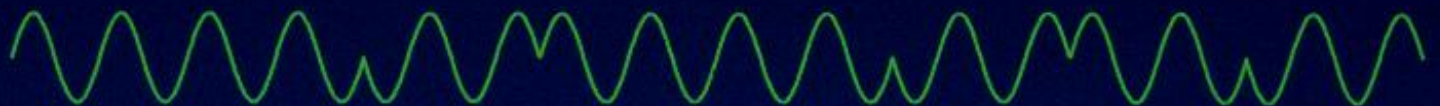
Carrier



Code



Spread  
Spectrum  
Signal



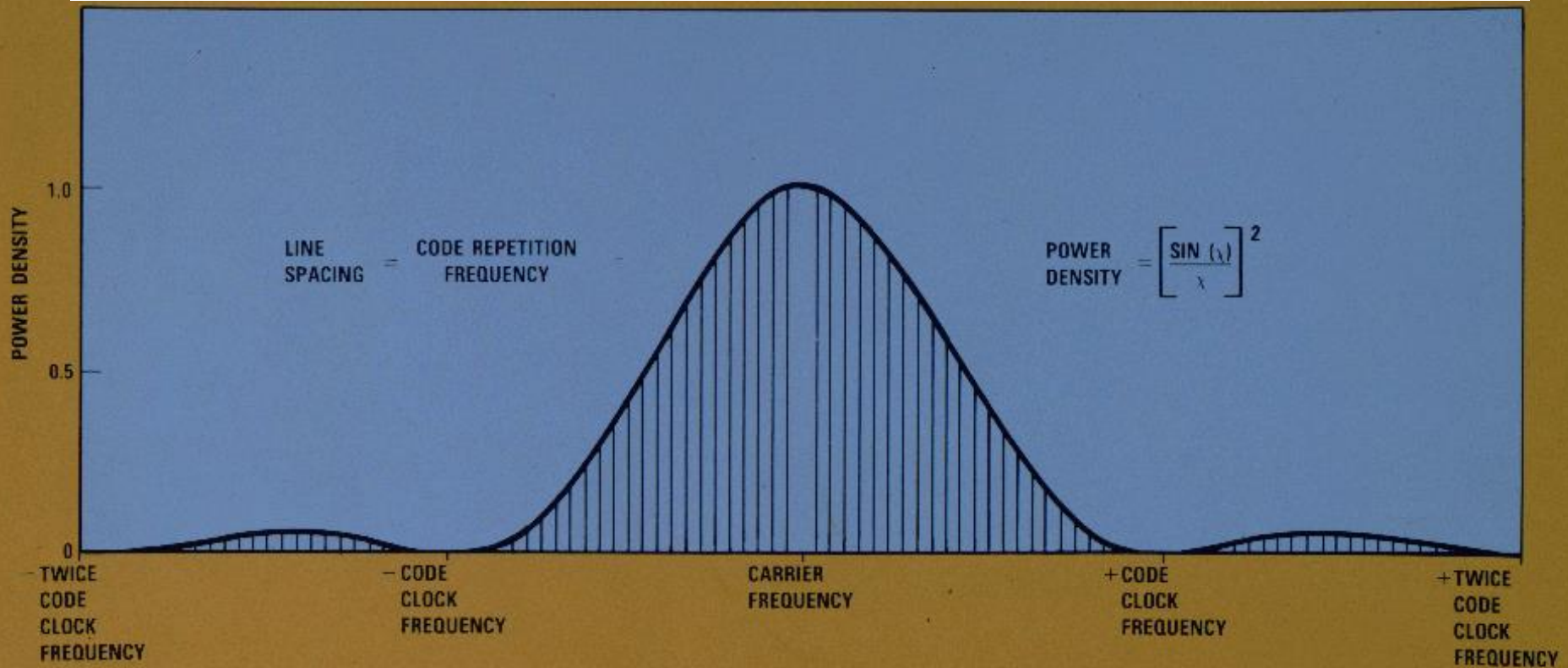
Code Clock Period





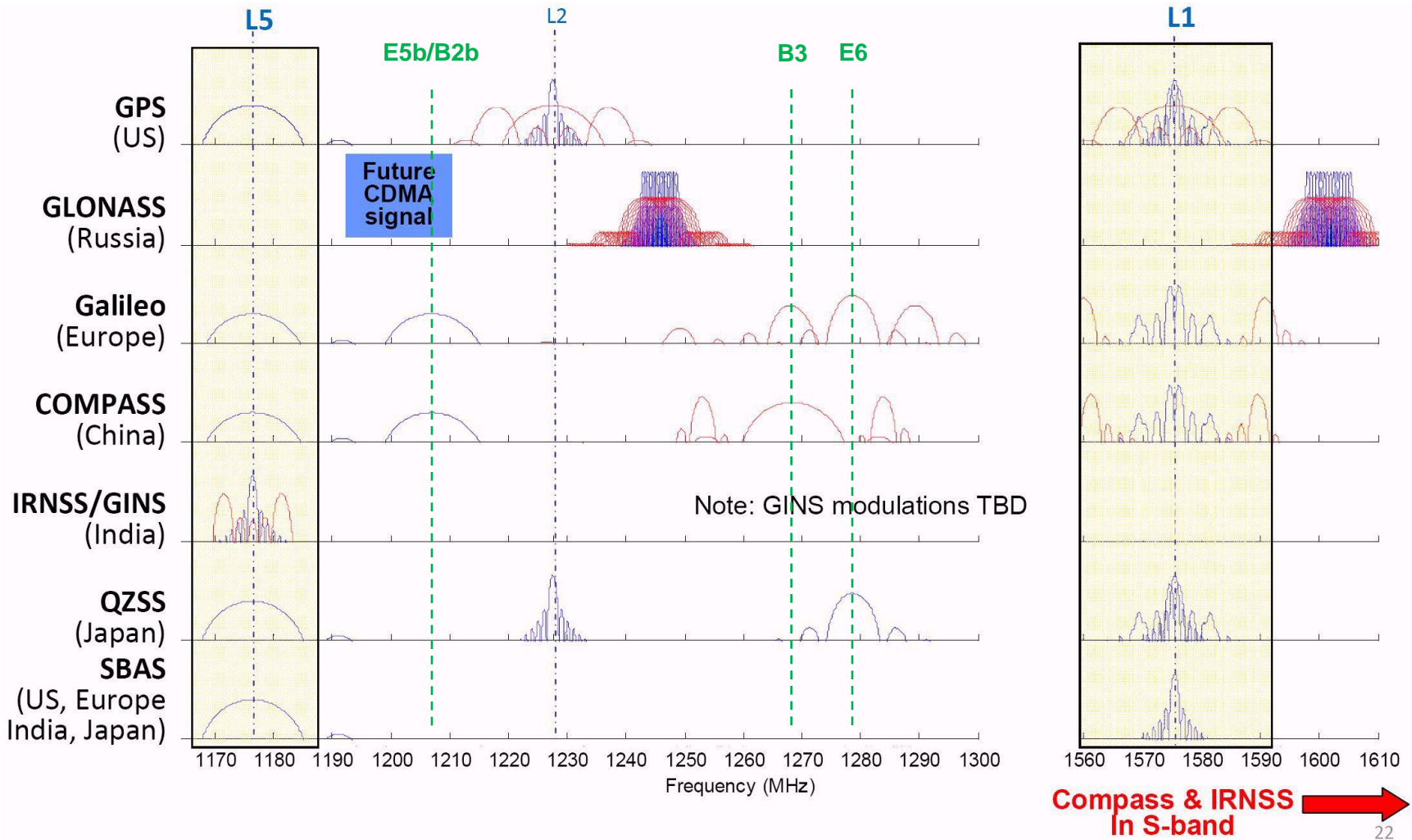
# SPREAD SPECTRUM POWER DENSITY

Code Modulation Spreads the Spectrum



Frequency Domain

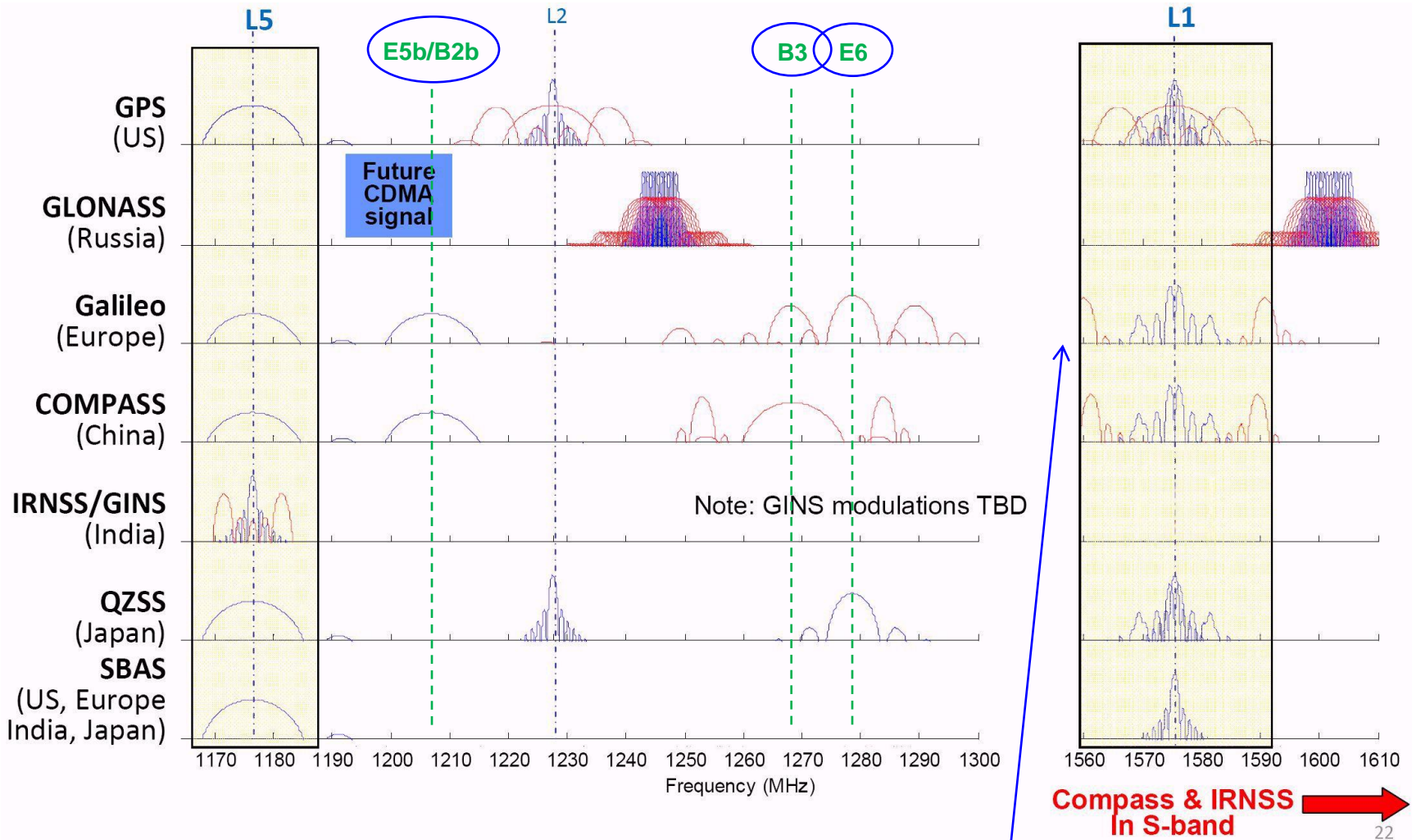
# GNSS Spectra To Protect



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

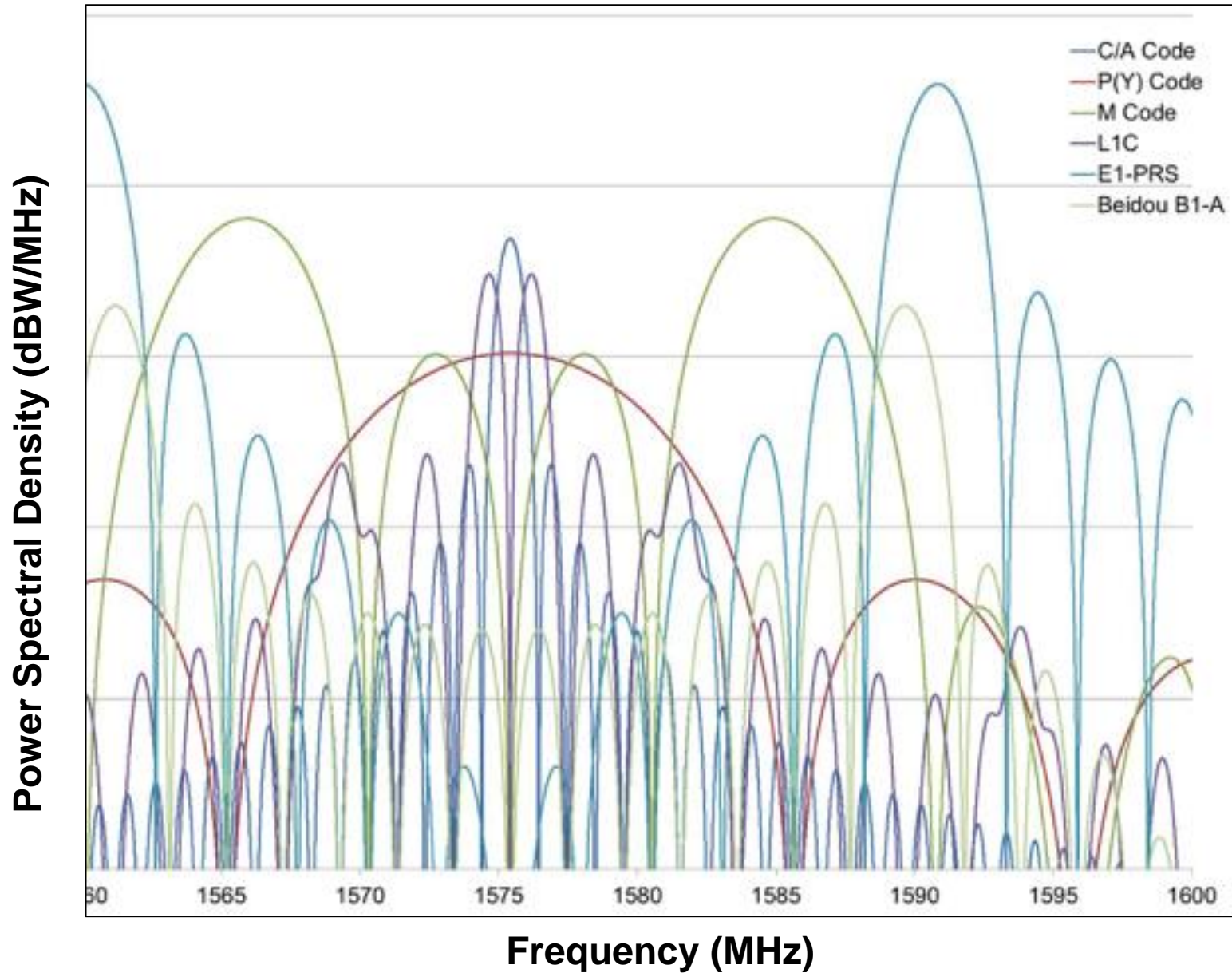


# GNSS Spectra To Protect

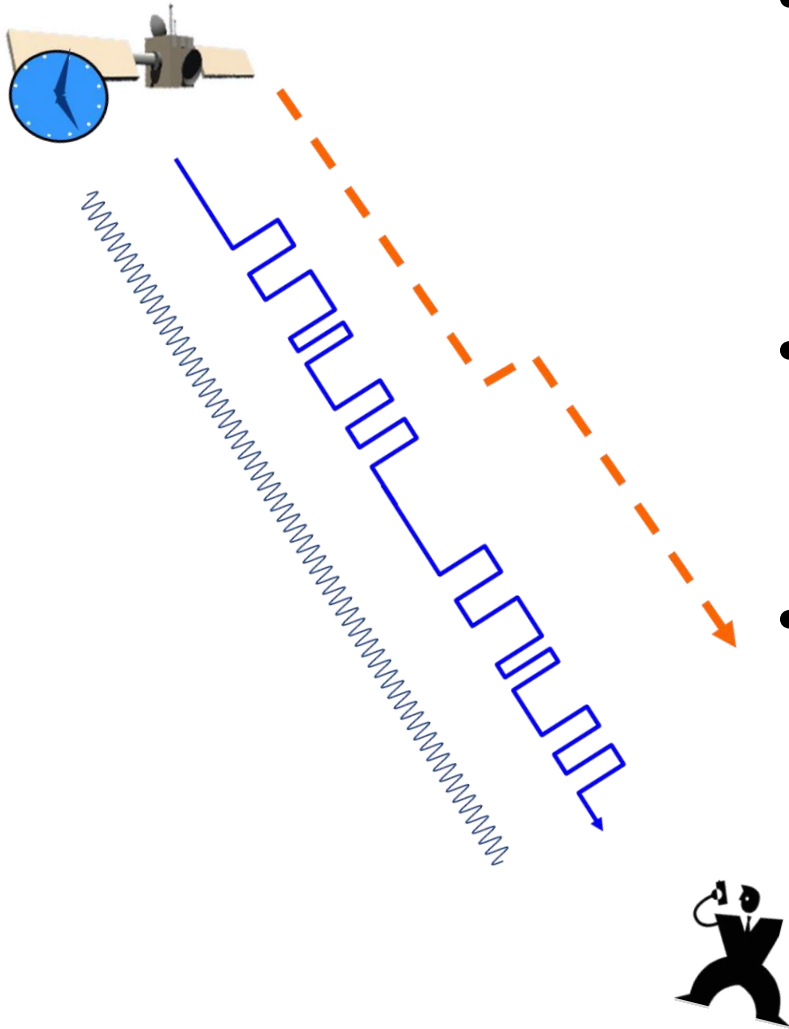


L1, L2, & L5 are paramount, but also GLONASS, PRS, E5b, B3, & E6

# GNSS L1 Spectrum



# GNSS signal power

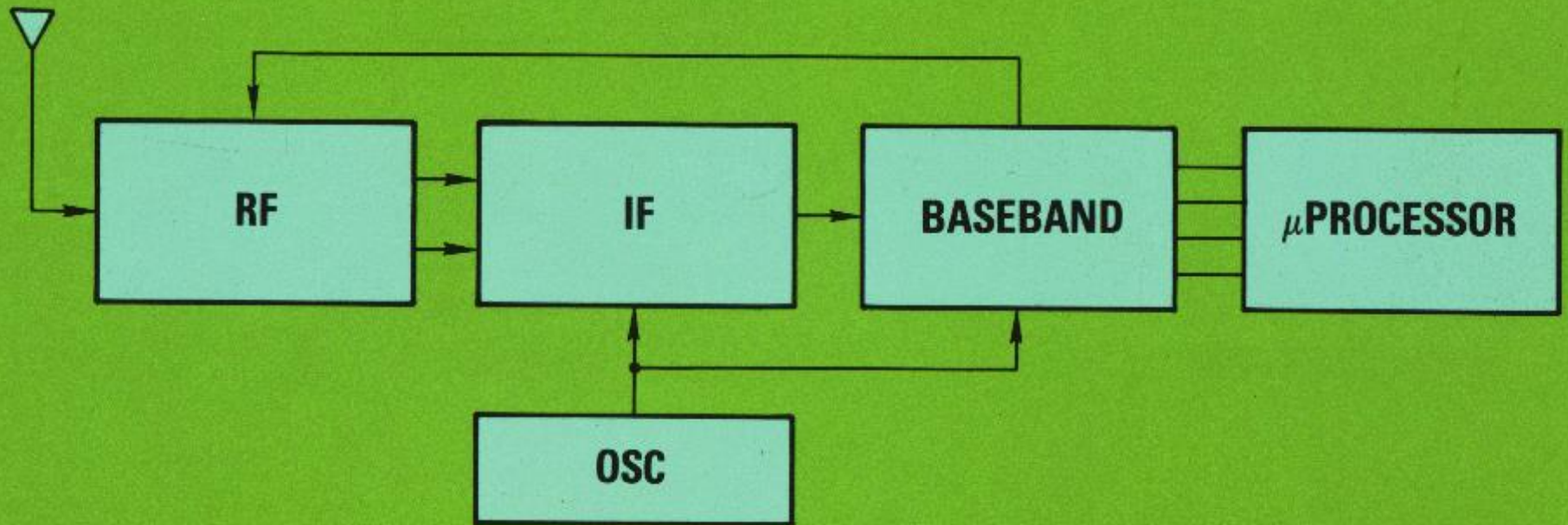


- Signals generated in satellites travels for more than 23,000 km until receivers on the Earth
- Receivers will have to decode/demodulate signals and the contained messages
- For this purpose, signals must be received with certain level of strength

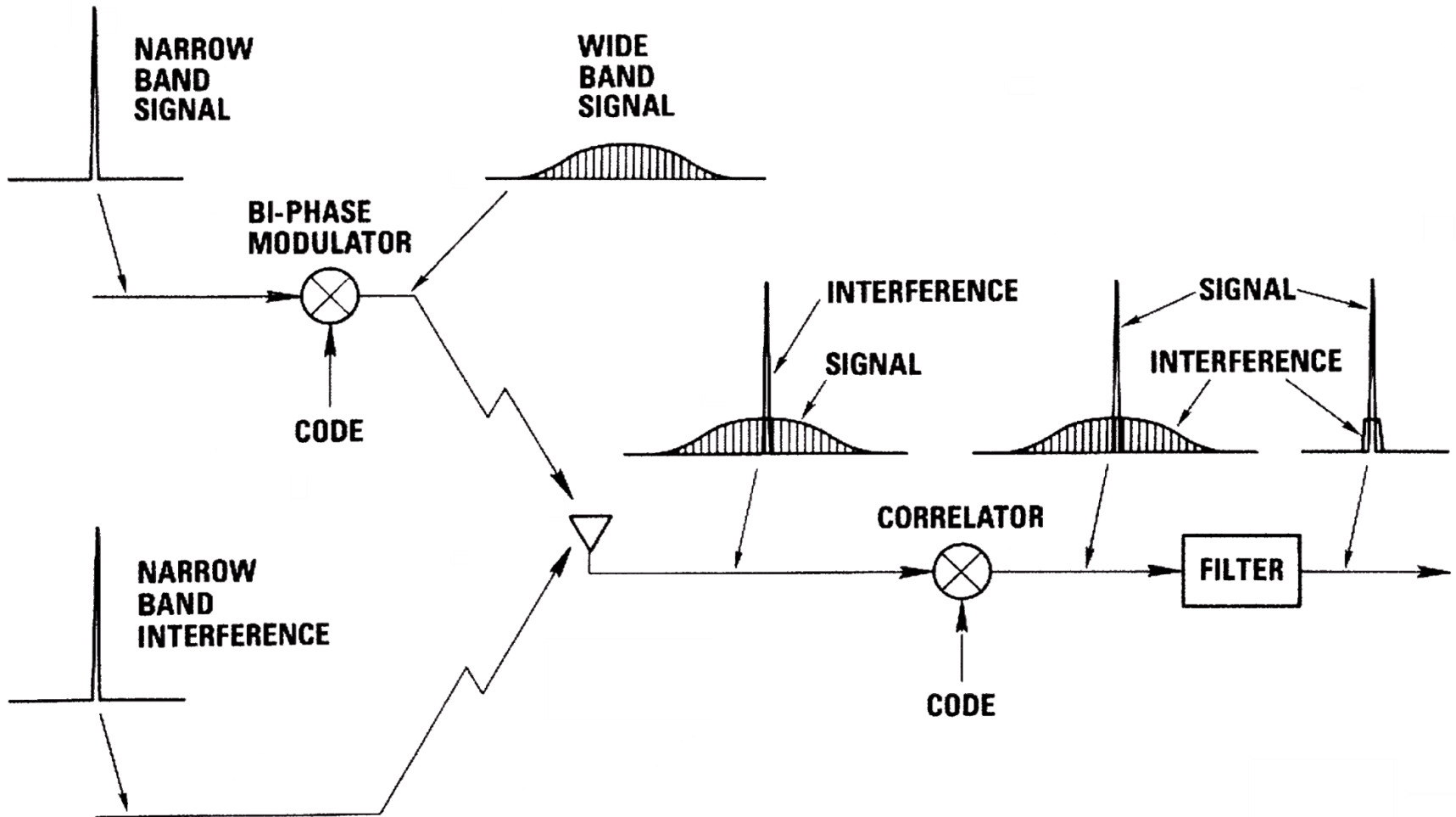




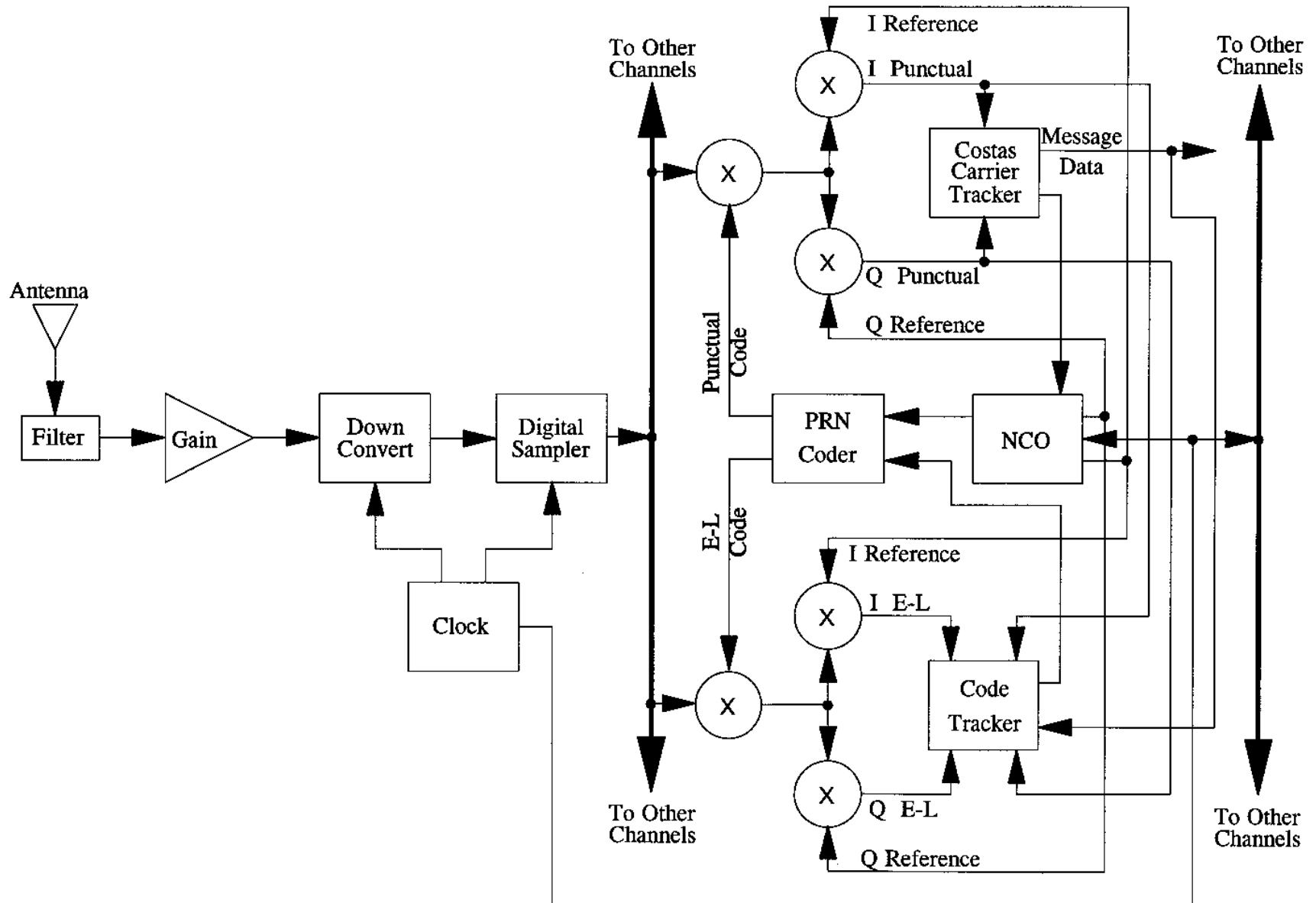
# CORE GPS CHIP SET



# Receiver Signal Processing



# Multi-Channel Digital Receiver



# Various Receivers

- There are various types of receivers as follows;
  - Receiving only one signal of one system
  - Receiving multiple signals in one system in the same frequency ranges
  - Receiving signals of multiple system in the same frequency ranges
  - Receiving multiple signals in one systems in multiple frequency ranges
  - Receiving multiple signals of multiple systems in multiple frequency ranges
- It would be important to know which signal in which frequency range is affected when you suspect interference potentials.



# 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**



# 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

# 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 Will 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**

**2023?**

Thank You

Questions?