Improving GNSS service quality with wideband signals

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Evolutions of positioning methods with GNSS signals

Global precise position, PPP,

Local Network, VRS RTK

Local region, DGPS, RTK

Global, Standalone

Before 2000 **2000-2010** **2010-2020** Years

Positioning with multi-system GNSS receivers

- - GIS;
- DGPS, RTK
- - Geodesy;
- RTK
- - Machine control application;

RTK

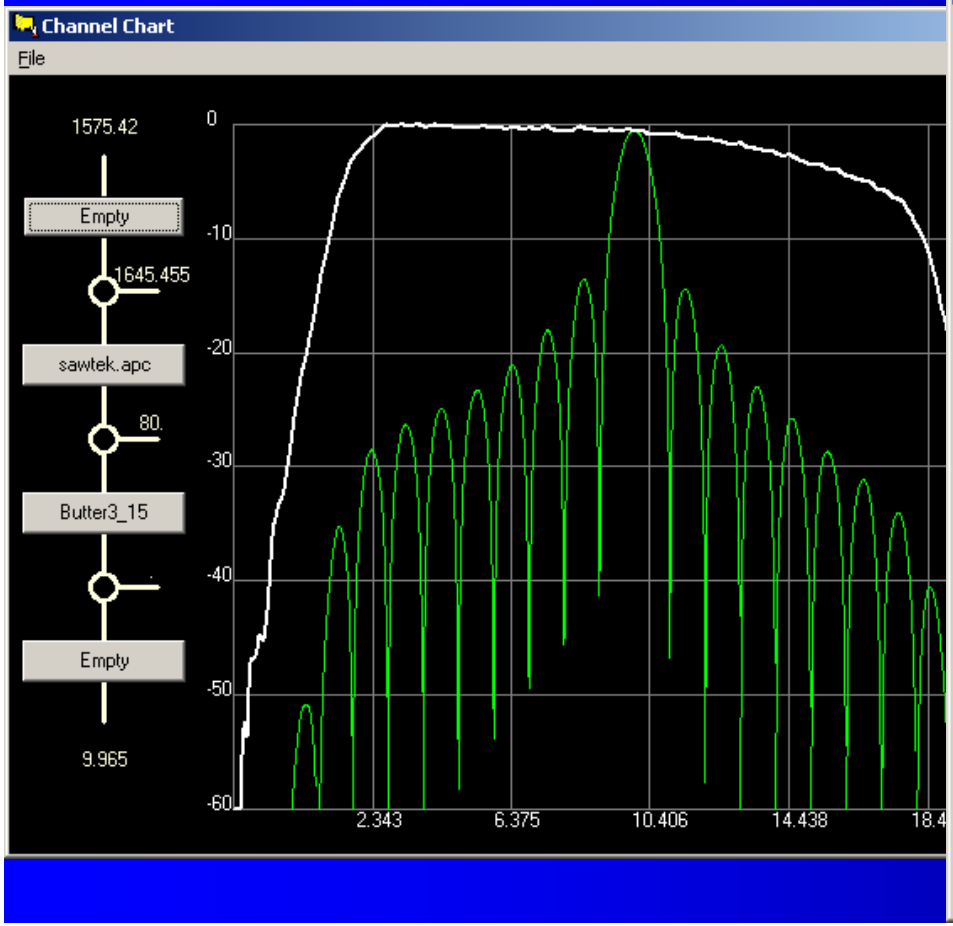
- - Automatic Agricaltural systems

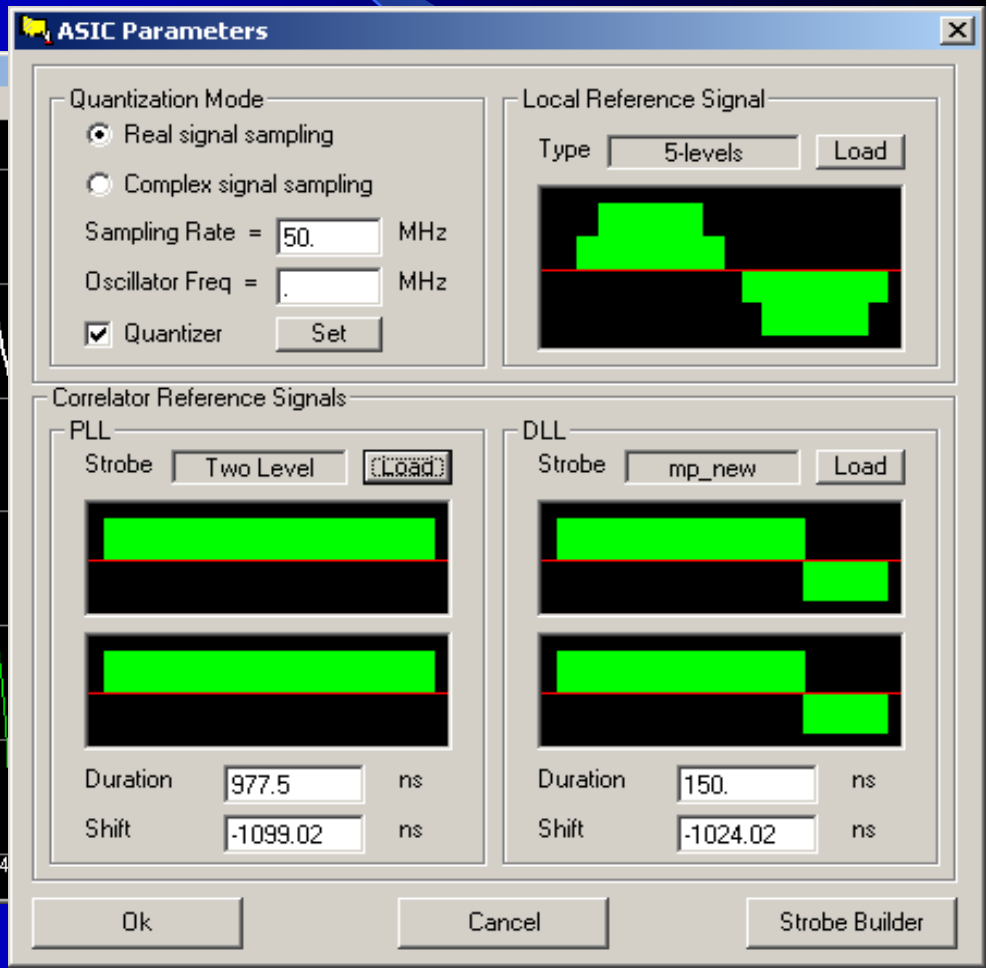
StandAlone, DGPS, RTK

Multipath error in GNSS

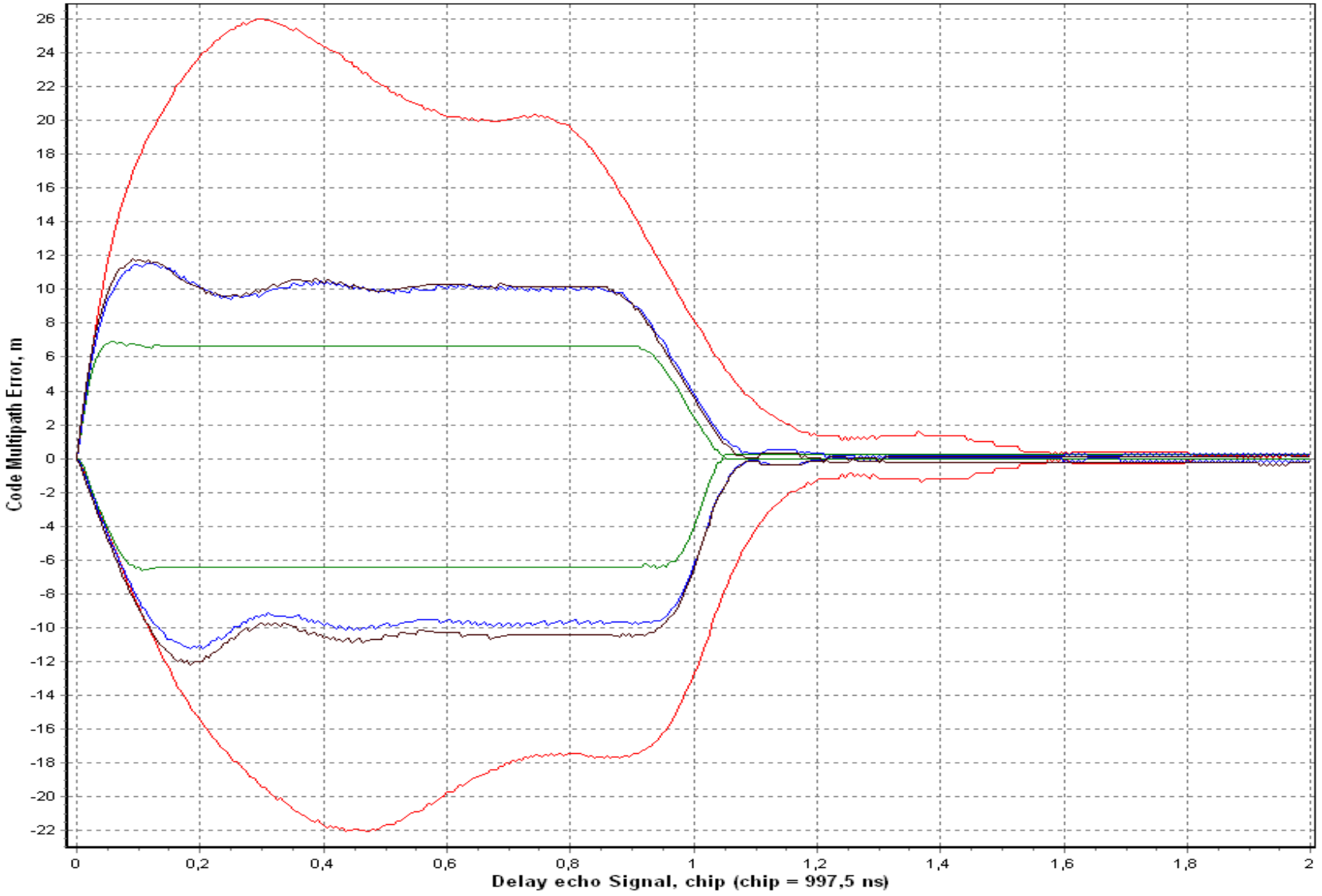
- Multipath mitigation methods
- - Antennas with special characteristics:
  Groundplane, choke-ring, multi-elements;
- - receiver with digital signal processing:
  correlators with special reference signals, smoothing, estimation;
- - with GNSS signals:
  special modulation (offset carrier), wideband signals

Calculation multipath error with characteristics of navigation receiver

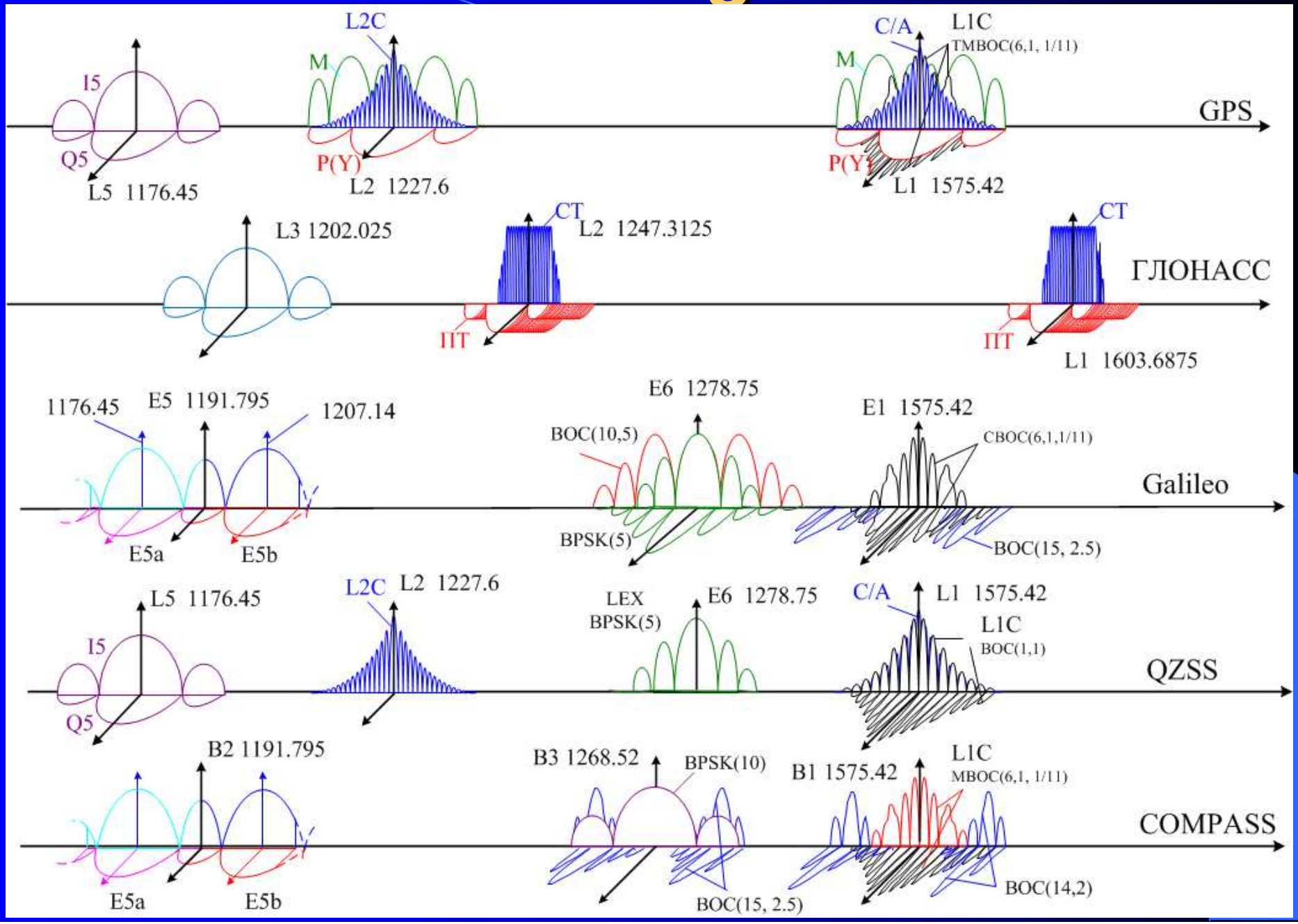




Multipath error for different navigation receivers

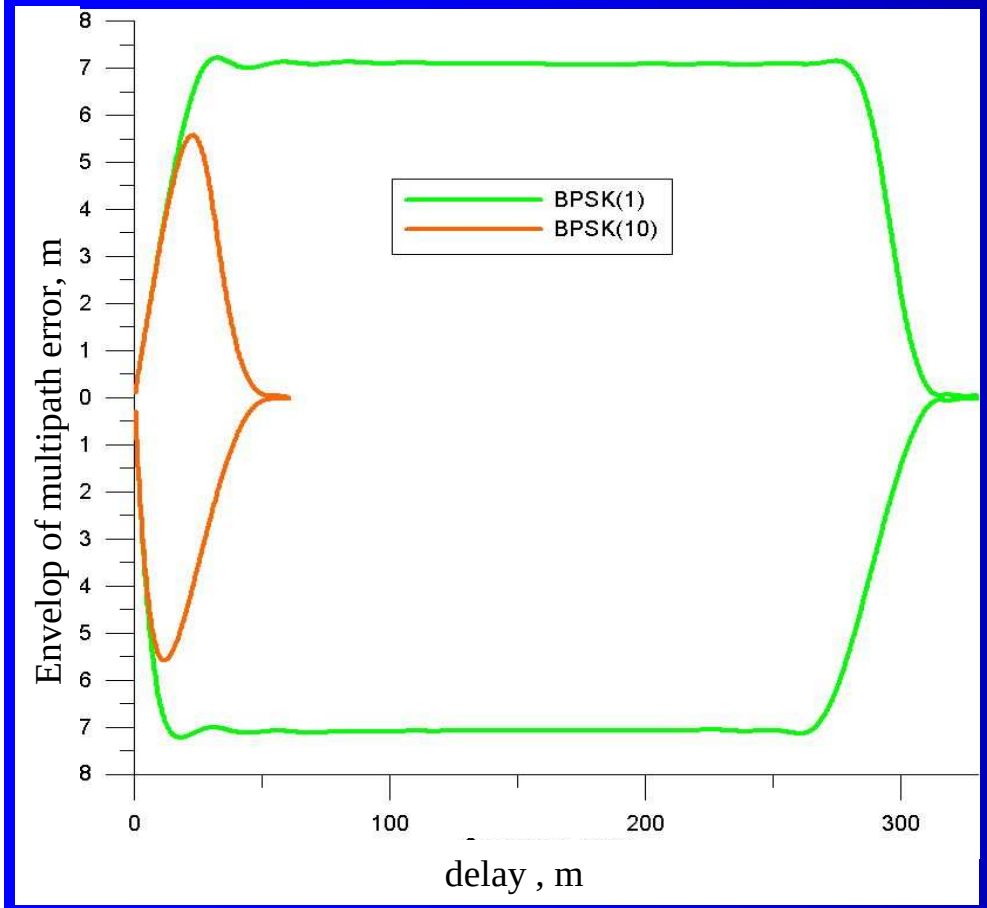


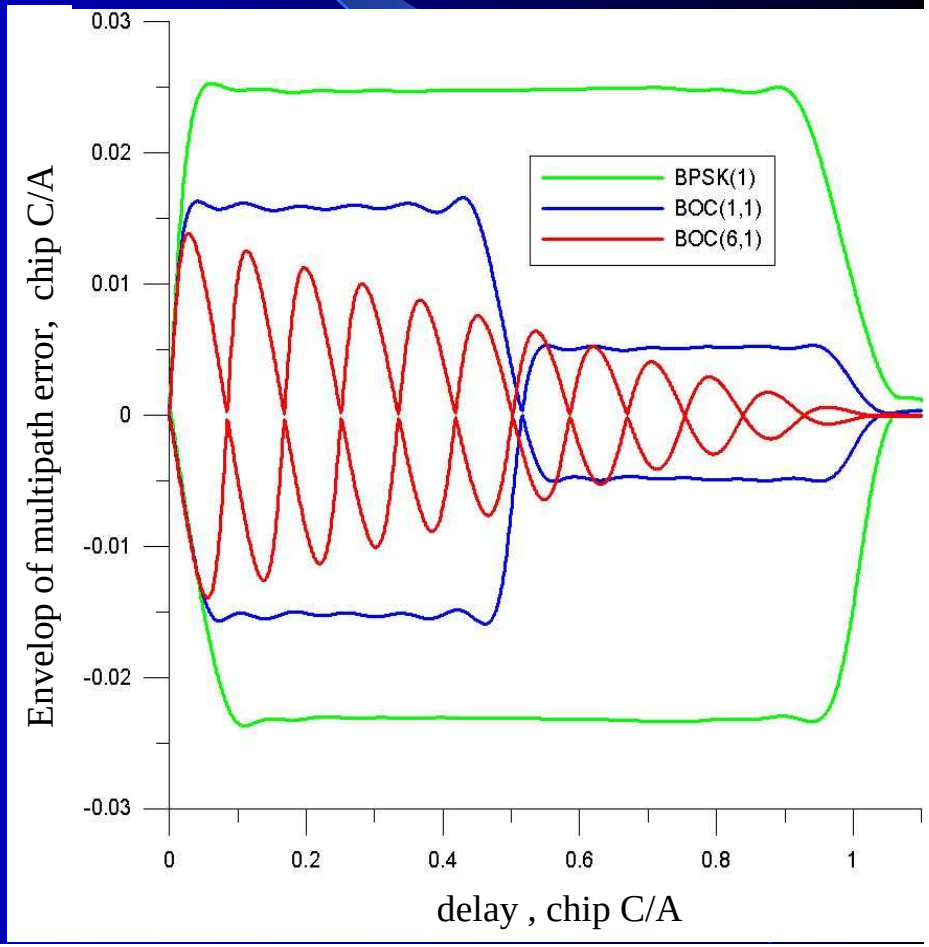
GNSS signals



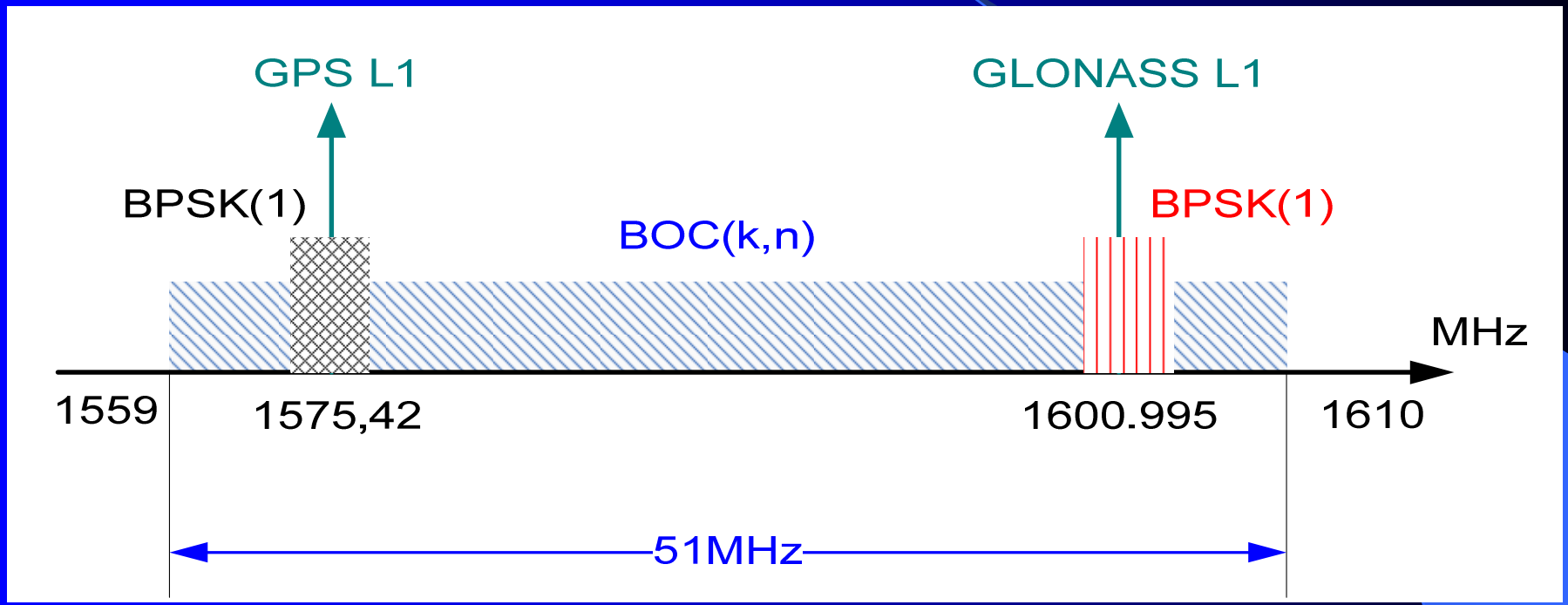
Multipath error for different GNSS signals

Multipath envelops for reflection signal with amplitude of 0.5

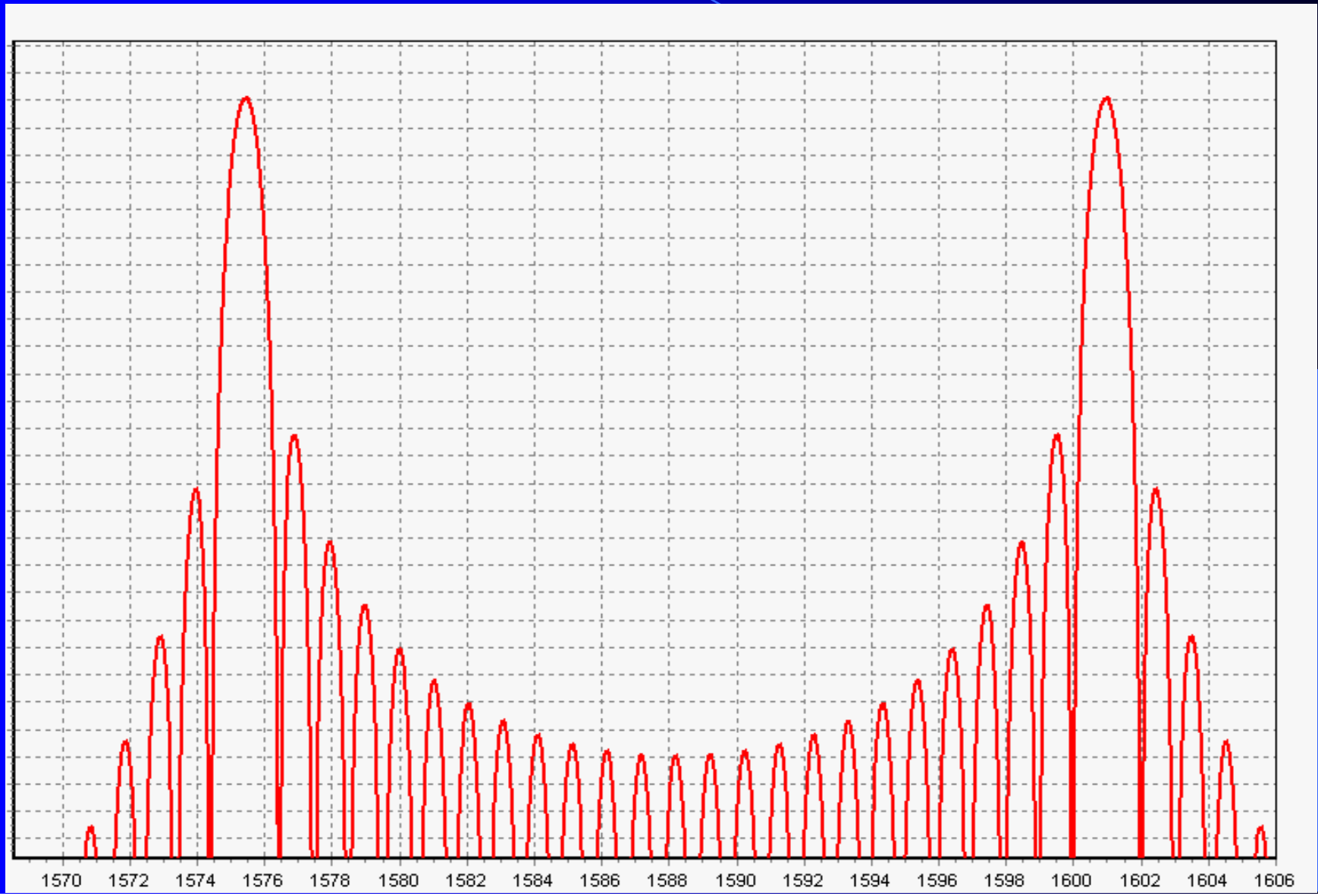




GNSS signals for L1 frequency band

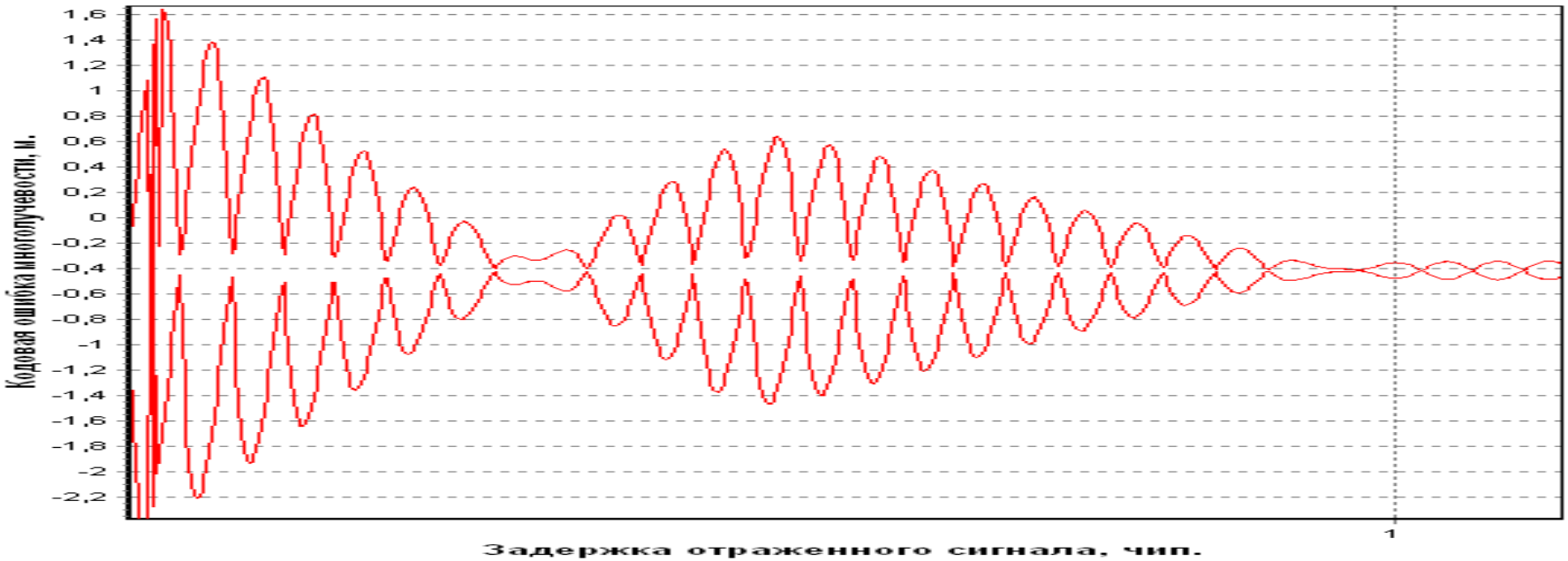


Spectrum in L1 frequency band (GPS/GALILEO L1 and GLONASS L1)



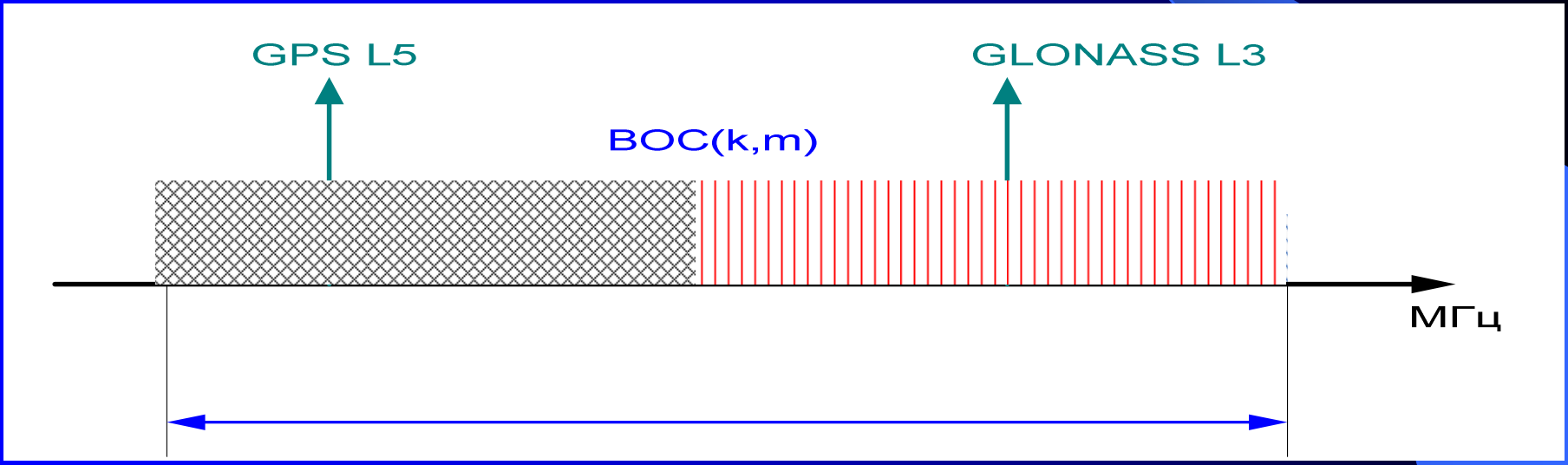
Multipath error for wideband signal in L1 frequency band

Multipath error for DBOC signal

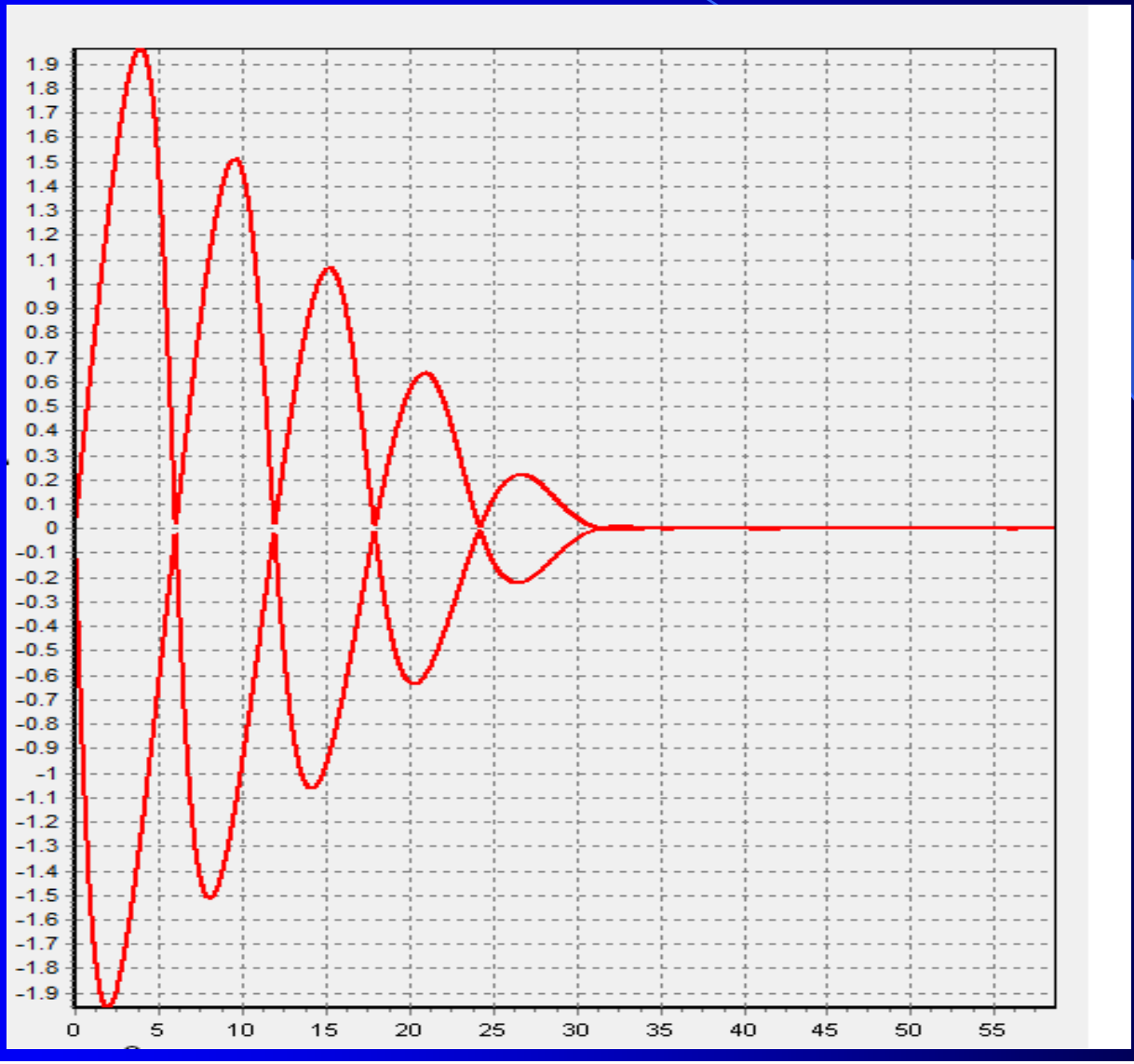


Signal	Maximum code multipath error, m.	
C/A BPSK(1)	7,284	
BOC(1,1)	3,86	
BOC(10, 5)	2,8	
DBOC	***2,341***	

GNSS signals in frequency band of GPS L5, GALILEO E5, GLONASS L3



Multipath error wideband signal in L5/E5/L3 frequency band



Signals with high rate of symbol information

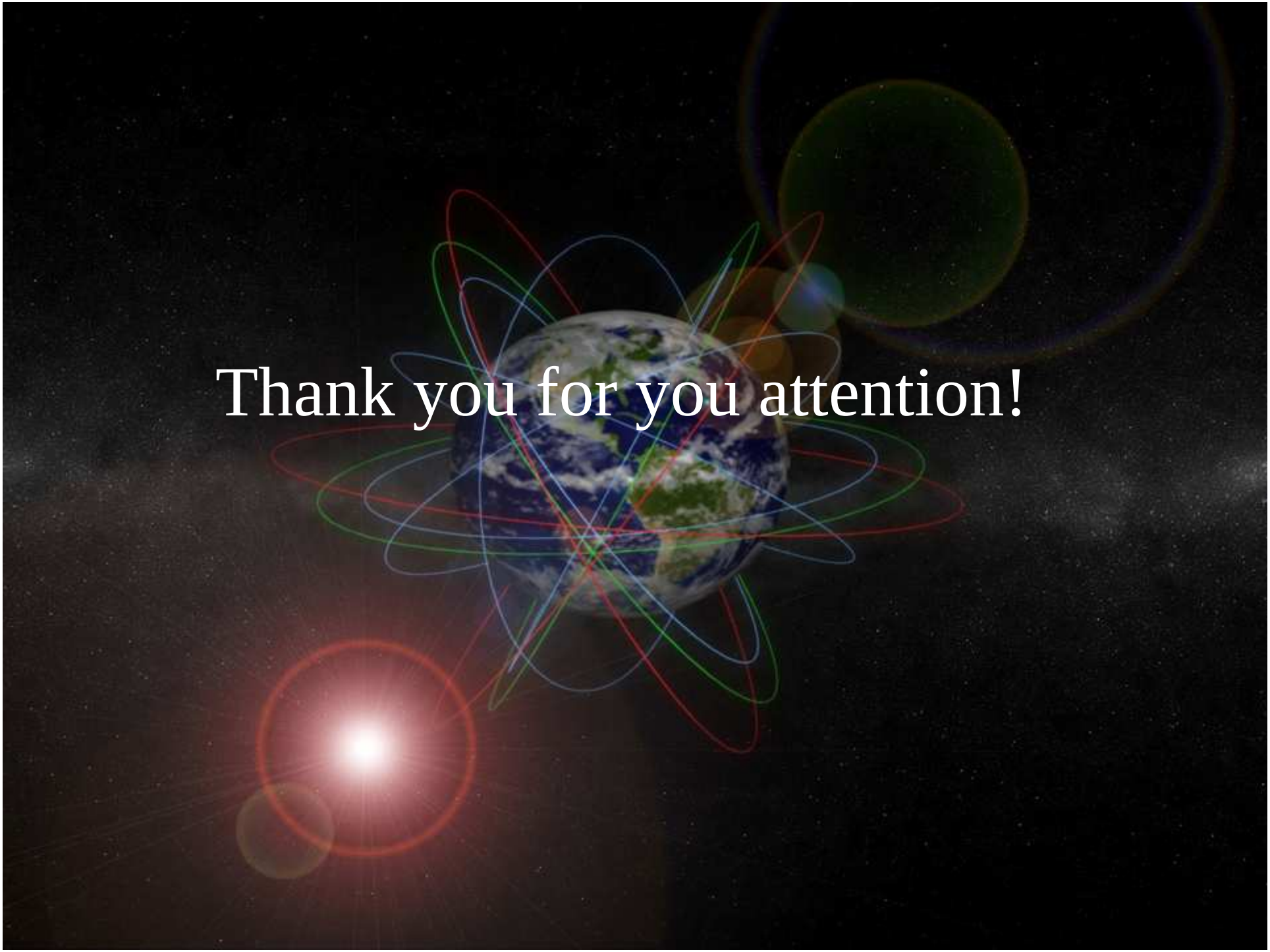
Transmitting of information with precise orbit and clocks with high rate for global coverage.

1. Different orthogonal code sequences for word transmitting

2. The one code sequence with different shifts as QZSS LEX.

Summary

1. **The one of the way to improve of GNSS service with using wideband signals in L1 band and L5/L3 band for minimize the multipath errors and compatibility for low-cost receivers with narrow analog channel and high end receivers with wide analog channel.**
2. **Possibility to global transmitting of precise orbit and clock corrections with high rate will be improve of accuracy positioning with PPP methods in receivers.**


Thank you for you attention!