Europe's Leading Professional GNSS Receiver Manufacturer

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ir. Peter A. GROGNARD,
Founder & CEO

Septentrio
satellite navigation

Septentrio Company Introduction

- Europe's leading manufacturer of professional GNSS receivers, offering a comprehensive portfolio of multi-system, multi-frequency GNSS receivers for the most demanding applications

http://www.septentrio.com/products

- Recognized Pioneer & World Leader for Galileo Receiver R&D

Some key messages

- System reliability and completeness of the ICD is key, above all other considerations
  - ICD with full technical details
  - Clear commitments on signal quality (ICD/MOPS)
  - Full compliance to ICD in practice !
  - System transparency, e.g. by means of “Notices Advisory to Users” (NA*x*U)

Some key messages

- From the perspective of interoperability and for high-accuracy carrier-phase positioning, common carrier frequency and spectrum is preferred:
  - Avoid intersystem group and phase delays
  - Same wavelength → seamless intersystem double-differencing in RTK

Some key messages

- Plethora of signals and complex modulations good for product differentiation, but detrimental to interoperability:
  - No guarantee that manufacturer A does the same thing as manufacturer B (pilot vs data, MBOC vs BOC)
  - Difficulty for the user to understand the differences between all the signal options (biases, etc)

Some key messages

- Use consistent time definition
  - Same leap-second reference
    - Otherwise nuisances such as different day boundaries
- Do not apply leap seconds!

- Do you see a threat to GNSS receivers due to many more GNSS signals centered at 1575.42 MHz?
- Whether you see a threat or not, do you prefer all new CDMA signals at "L1" to be centered at 1575.42 MHz or have some of them elsewhere, e.g., at 1602 MHz?
- Given that most GNSS providers plan to transmit a "modernized" signal at 1575.42 MHz, what is your long term perspective on whether you will continue to use C/A?
  - Why and How?

- For high-accuracy, preference for common carrier, to allow for inter-system double differences, and to avoid intersystem group delays
- No plan to discontinue use of C/A code

- Once there are a large number of good CDMA signals, will there be continuing commercial interest in FDMA signals?

  - Probably not

- Do you prefer signals in different "L1" frequency bands for interference mitigation rather than at one center frequency for interoperability?

  - For high-accuracy, preference for a single L1 carrier for carrier phase double differencing and group delay issues

- If a satellite's signals do not meet quality standards, should they:
  - Be set unhealthy
  - Transmit with a nonstandard code
  - Transmit with reduced signal power (reduce interference)
  - Be switched off
  - What combination of the above"
- To assure only "good" signals, should GNSS providers agree on minimum international signal quality standards and agree to provide only signals meeting the standard?
  - Preference for switching off.
  - "healthy bit" not optimal because it takes time for the receiver to receive the "health bit", and during that time, the receiver is unprotected
  - Nonstandard code not optimal because it still causes cross-correlation interference without a means for the receiver to detect

- Given that L5/E5a will be transmitted by most GNSS providers, do you intend to use the E5b signal?
  - TBD

- For your applications, are small satellite “frequency steps” (Δf) a problem?
- If so, what interval between “frequency steps” and what Δf magnitude would be excessive?

- TBD

- Assuming signal quality is acceptable from every provider, would you limit the number signals used by provider or by other criteria? What criteria?
- Is having more signals inherently better or do you think there should be a limit?
- Will the marketplace "force" you to make use of every available signal?
- For best interoperability, how important is a common center frequency? How important is a common signal spectrum?

- In general:
  - More satellites is more important than more signals
  - Common center frequency is more important than common spectrum.

- Will you provide “tri-lane” capability in the future?
  - Why?
- If so, do you prefer a common middle frequency or the combined use of L2 (1227.6), B3 (1268.52), and E6 (1278.75) if B3 and E6 open access is available
- Would you prefer a common open signal in S Band? In C Band? Why?

  - TBD

- Does a wider satellite transmitter bandwidth help with multipath mitigation?
- What minimum transmitter bandwidth would you recommend for future GNSS signals in order to achieve optimum code precision measurements?

- TBD

- Would you recommend GNSS or SBAS services provide interoperability parameters
  - System clock offsets
  - Geodesy offsets
  - ARAIM parameters
  - Others
- Should they be provided by other means so as not to compromise TTFF or other navigation capabilities

  - That would greatly help, but only if this info is reliable and up to date

- For your applications and for each signal, what amount of drift between code and carrier over what time frame would be excessive?
- For your applications and for two or more signals in different frequency bands, e.g., L1 and L5 (when scaled properly), what amount of relative drift in code and carrier between the signals would be excessive?

- No opinion

- Should the international community strive to protect all GNSS signal bands from terrestrial signal interference?

  - Yes

- Do the current differences (~10 cm) in Geodesy pose a problem for your users? Why or why not?
- If geodesy differences are a problem, what is the preferred method of compensation:
  - Published values (e.g., on websites)
  - Satellite messages

  - TBD

- Do you want each system to cross reference the other's time (e.g., with a GGTO type of message) or compare itself to a common international GNSS ensemble time? To what precision?
- Will your future receivers calculate a time offset between systems based on signal measurements or use only external time offset data?
- What is the preferred method of receiving time offsets: Satellite messages, Internet messages, or internally calculated?
  - Yes
  - Preference for satellite message

Thank You!