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Russian Industry Views of the Outcomes of the Interoperability Workshop (April 2013)

Sergey Silin, NAVIS

Dubai, 9-14 November, 2013

In 2014 the Federal Space Agency plans to organize in Russia an open workshop, concerning interoperability of GNSS, similar to the workshop in Honolulu (USA) in April, 2013, with involvement of the international observers from ICG. Results of this workshop it is supposed to report at the 9th session of ICG in 2014.

For workshop preparation Agency suggested the Secretariat of Council of chief designers of the navigation equipment of consumers (NEC) to organize and interview developers and producers of the navigation equipment of consumers about advantages of interoperability of GNSS.

The working group A on compatibility and interoperability of ICG held the workshop in Honolulu (USA) in April, 2013 with a problem of achievement of higher level of interoperability between the new modernized signals.

For studying of public opinion organizers of a workshop asked providers of signals of GNSS to participate in formation of future GNSS to consider their councils when developing measures for increase of efficiency of use of GNSS by clients and consumers of their services.

ICG suggests to hold the similar workshops in other countries – providers of GNSS services, including Russia.

On the basis of the developed criteria of an assessment it is interviewed the enterprises of developers and producers of the navigation equipment of consumers of GLONASS system. The secretariat of Council of chief designers of NEC generalized the received materials and prepared the report concerning compatibility and interoperability of existing and perspective GNSS. The answers from the seven enterprises and organizations, making or using in the activity the equipment of satellite navigation, are received.

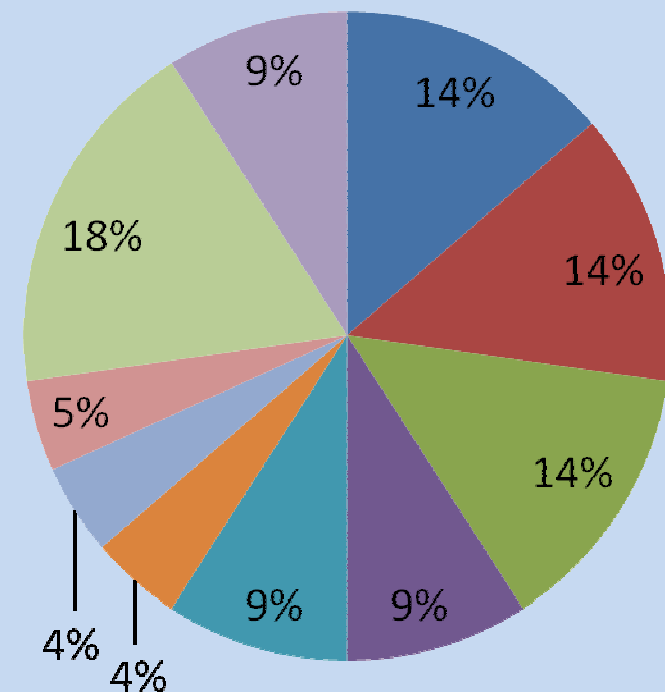
Results of interoperability assessment are given below.

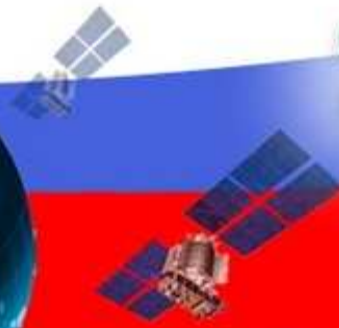
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What types of applications do your receivers
(or receiver designs) support?

- Marine
- Aviation
- Ground
- Space
- Differential stations
- Geodesy
- Sincronization
- Signal Simulators
- OEM chips
- Individual use

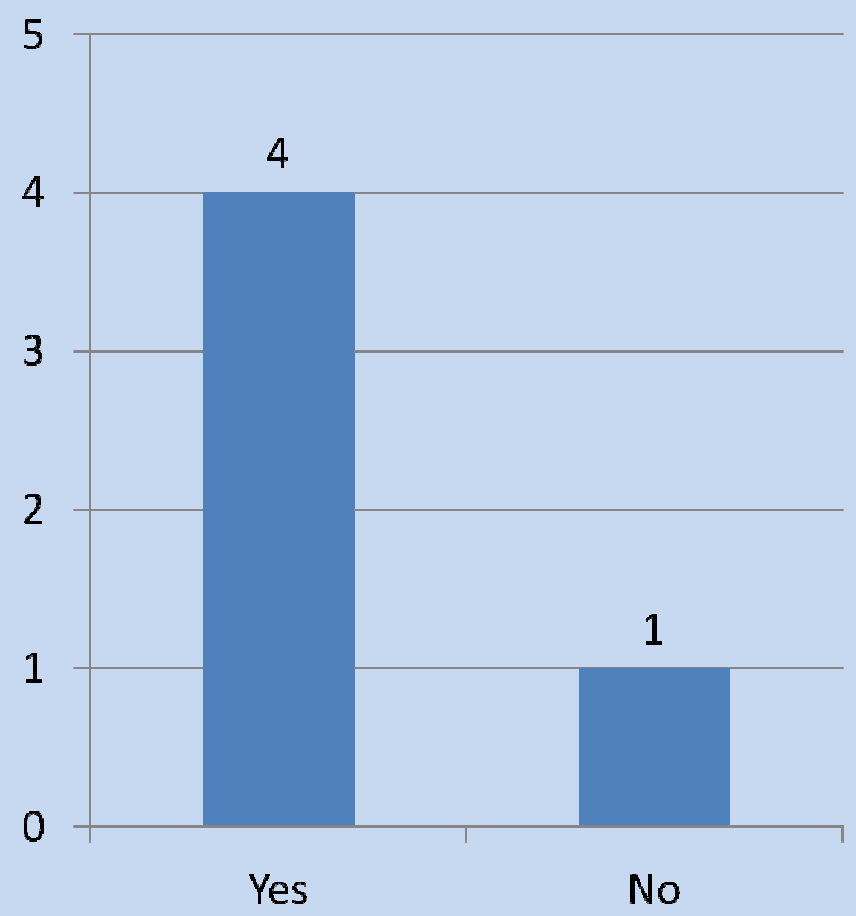




Главный конструктор
навигационной аппаратуры потребителей
системы ГЛОНАСС



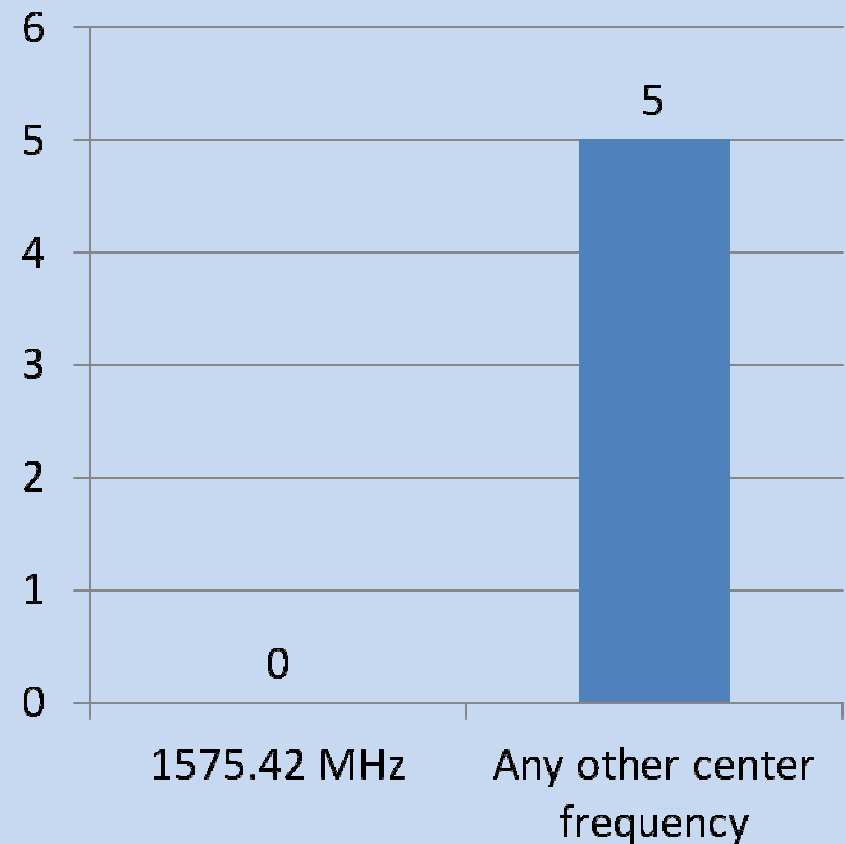
Do you see a threat to GNSS receivers due to many more GNSS signals centered at 1575.42 MHz?



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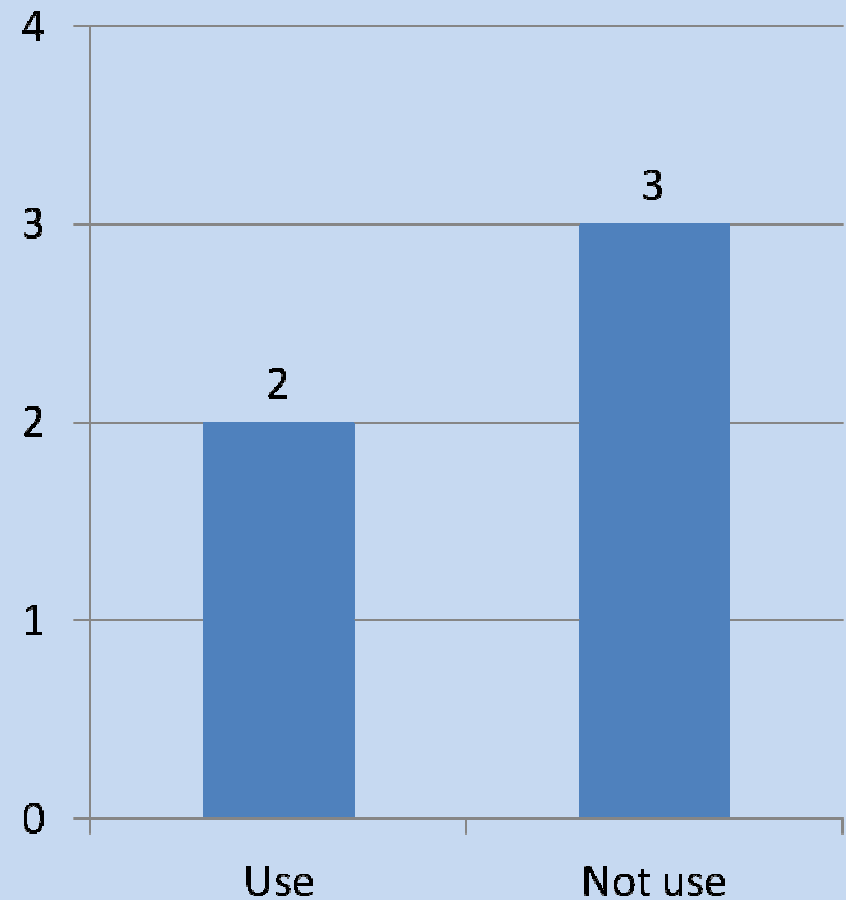
Whether you see a threat or not,
do you prefer all new
CDMA signals at “L1” to be
centered at 1575.42 MHz or
have some of them elsewhere,
e.g., at 1602 MHz?



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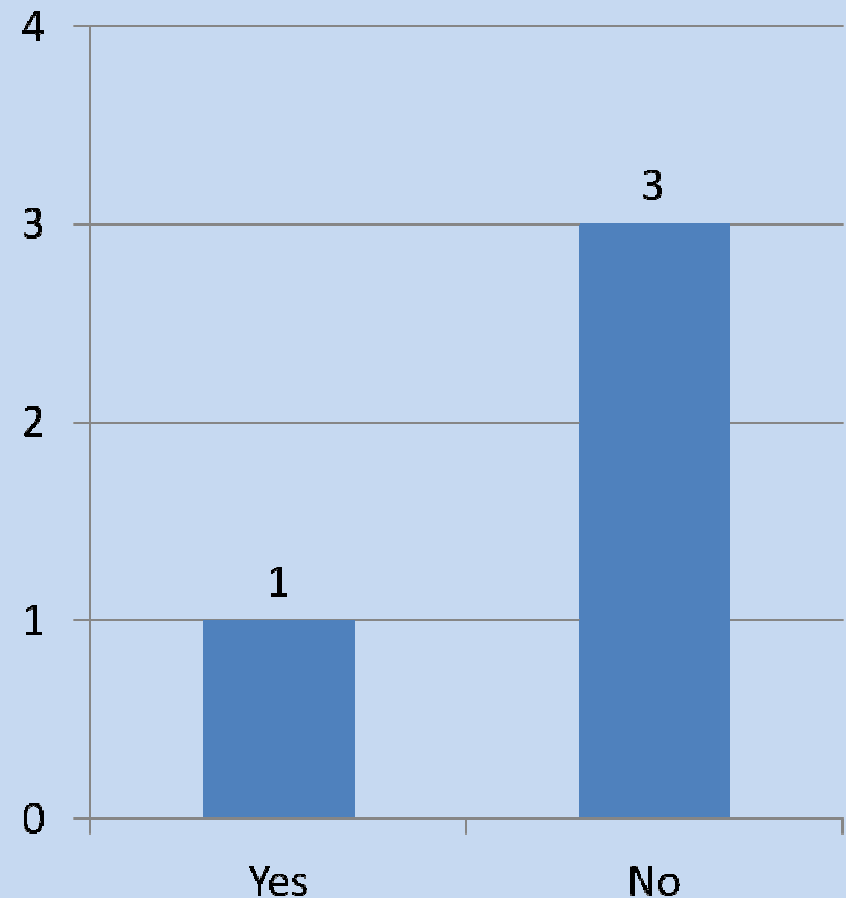
Given that most GNSS providers plan to transmit a “modernized” signal at 1575.42 MHz, what is your long term perspective on whether you will continue to use C/A?



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Whether the conclusion of the intergovernmental Agreement on conditions of granting open signals in L1 and L5 ranges for GLONASS system has to be provided?

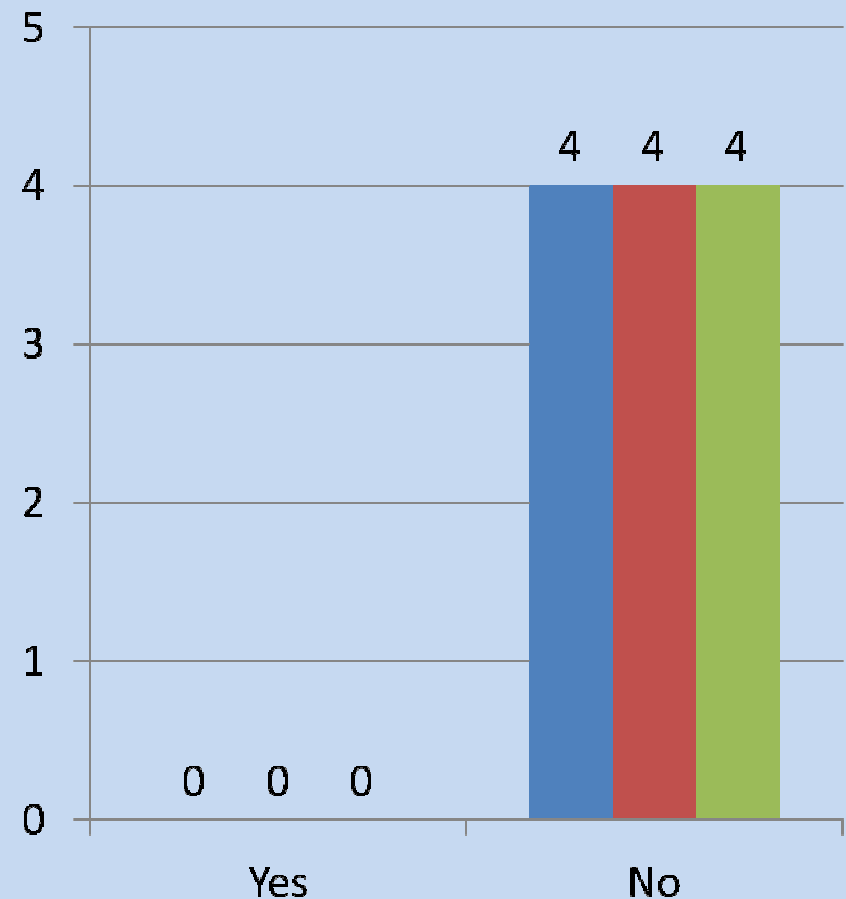


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If yes, what the following aspects
have to be reflected in this
Agreement:

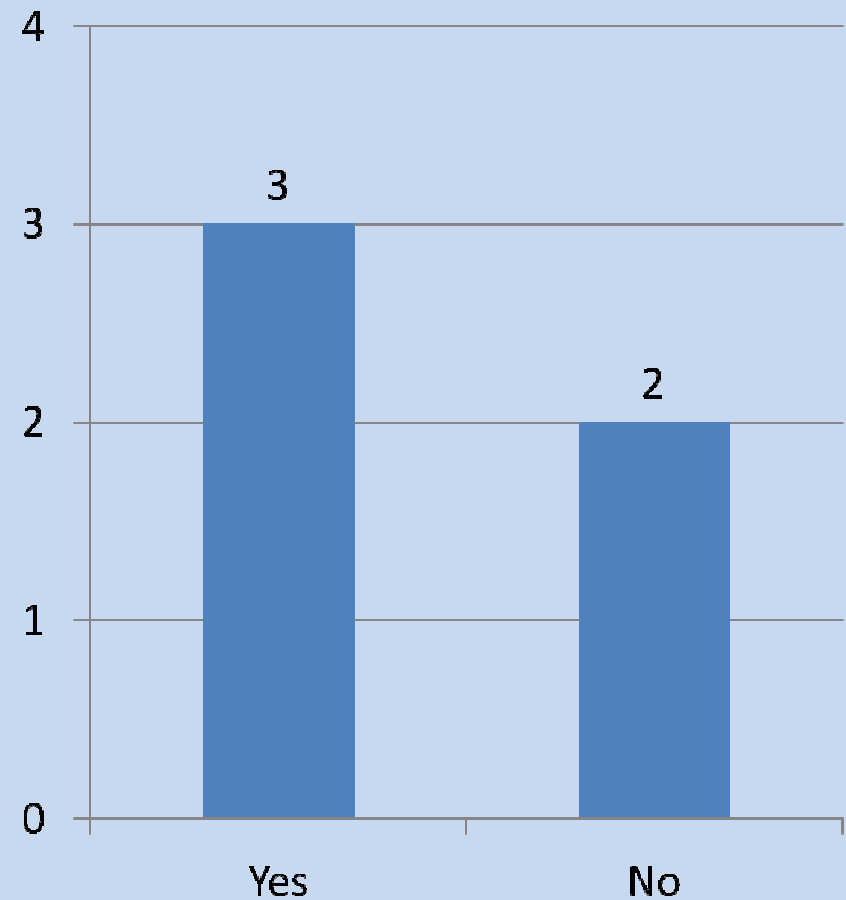
- possibility of use in an open signal of GLONASS in the ranges of L1 and L5 of structure, other than GPS signal;
- conditions of production the Russian industry of the transferring and reception equipment functioning with open signals in the ranges of L1 and L5 of GLONASS system (for example, whether acquisition of licenses, patents, etc. is necessary);
- guarantees on the international coordination of open signals in the ranges of L1 and L5 of GLONASS system with the AC of the USA and other foreign administrations.



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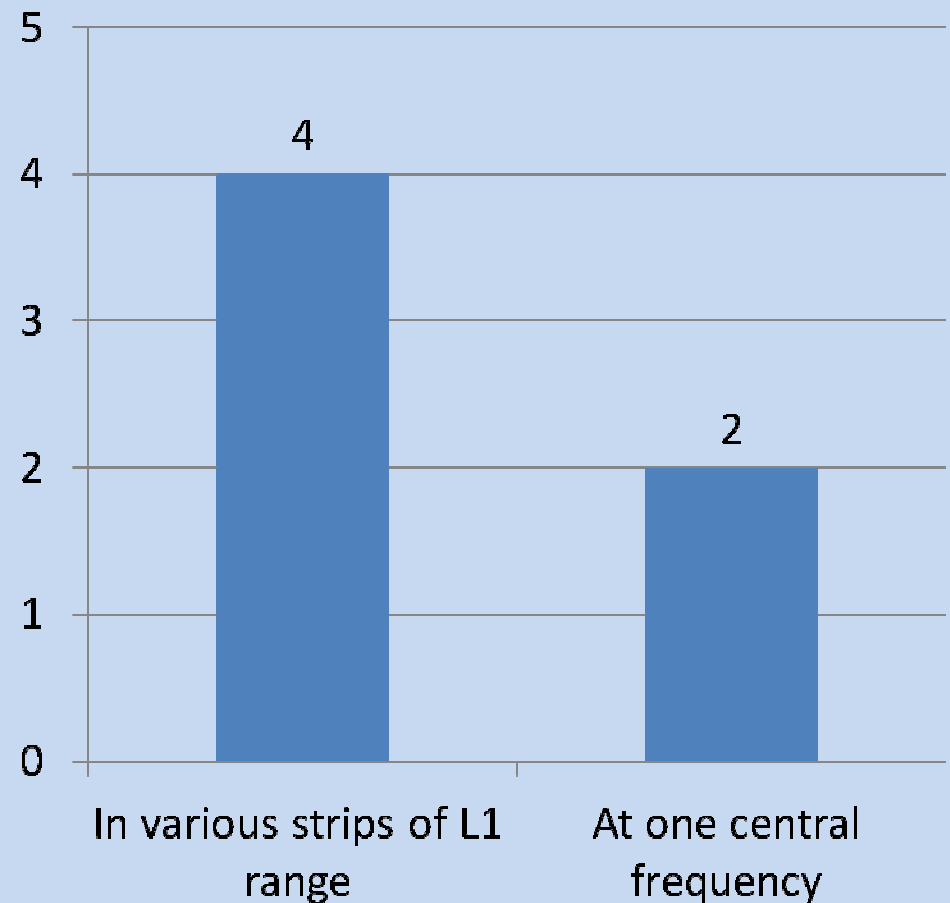
Once there are a large number of good CDMA signals, will there be continuing commercial interest in FDMA signals?



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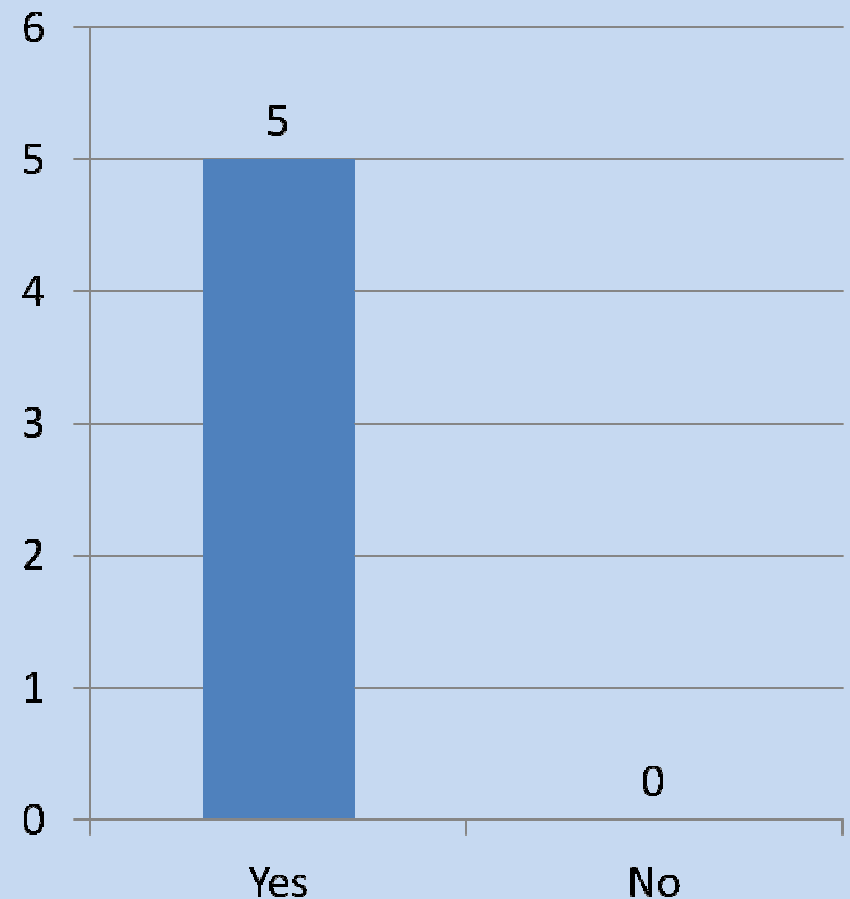
You will prefer to use signals
in various strips of L1 range
in interests of increase of noise
immunity or at one central
frequency in interests
of ensuring interoperability?



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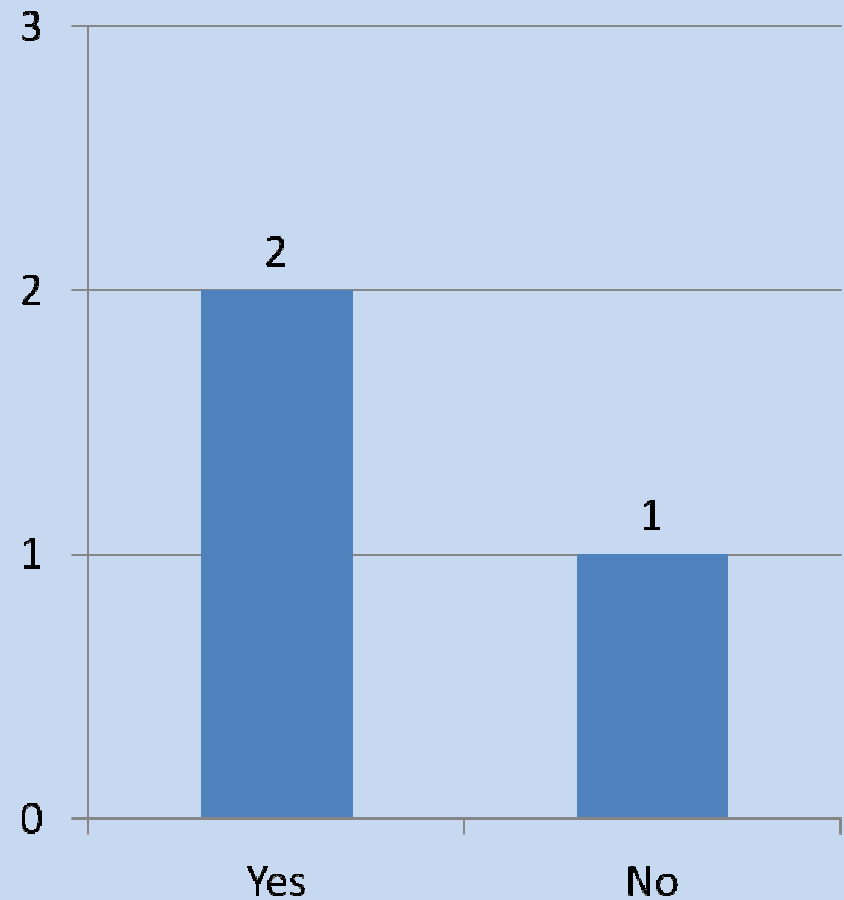
To assure only “good” signals, should GNSS providers agree on minimum international signal quality standards and agree to provide only signals meeting the standard?



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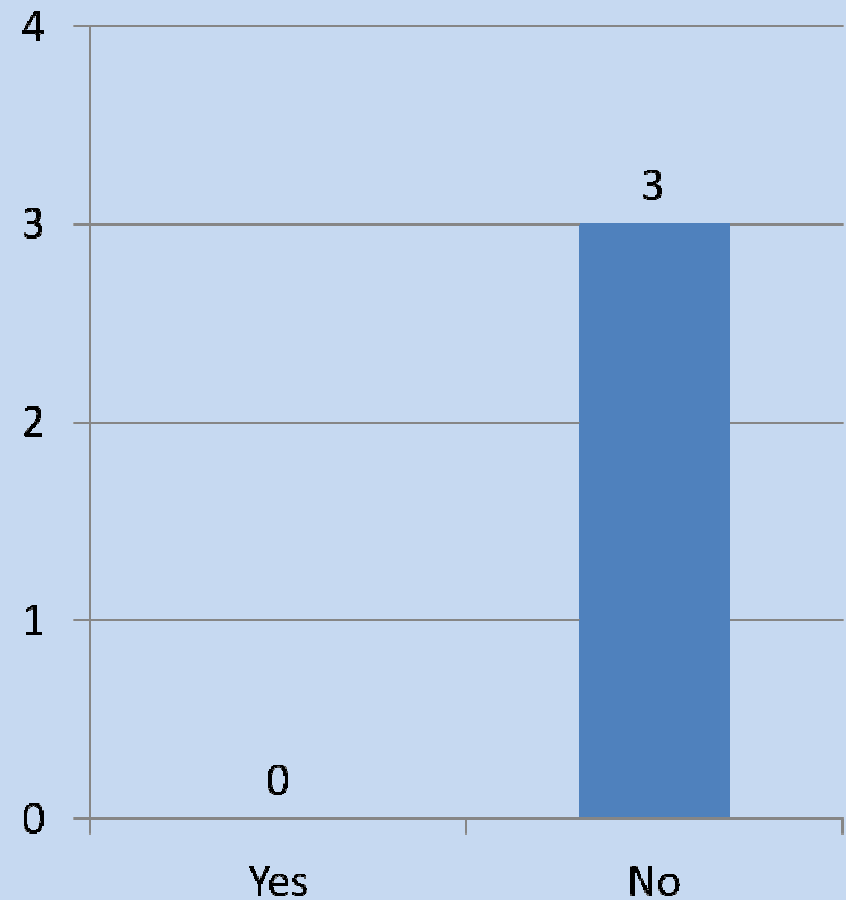
Given that L5/E5a will be transmitted by most GNSS providers, do you intend to use the E5b signal?



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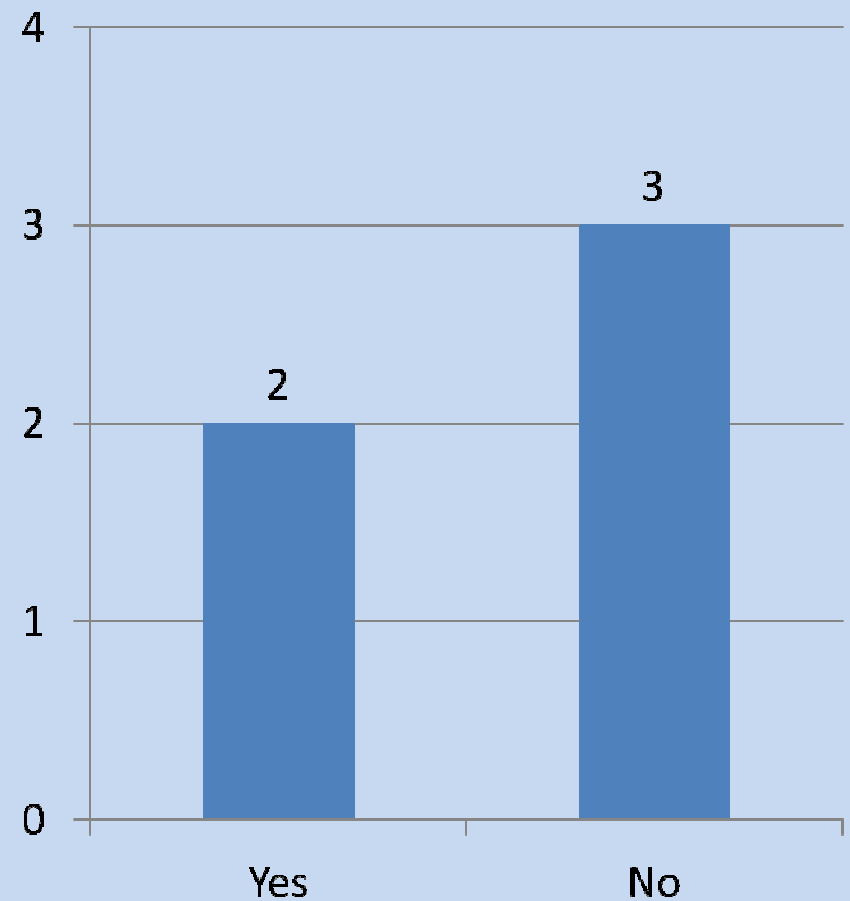
For your applications, are small satellite “frequency steps” (Δf) a problem?



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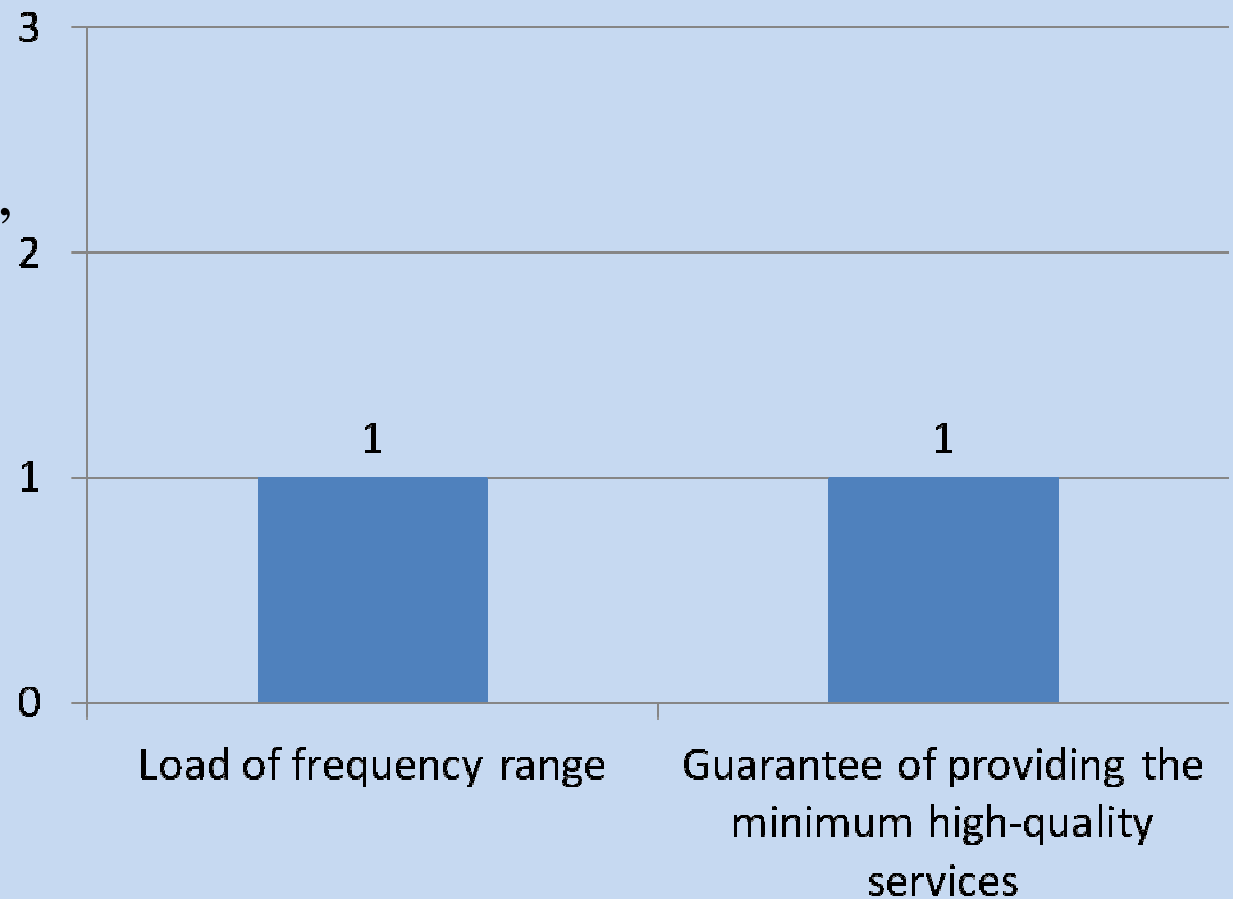
Assuming signal quality is acceptable from every provider, would you limit the number signals used by provider?



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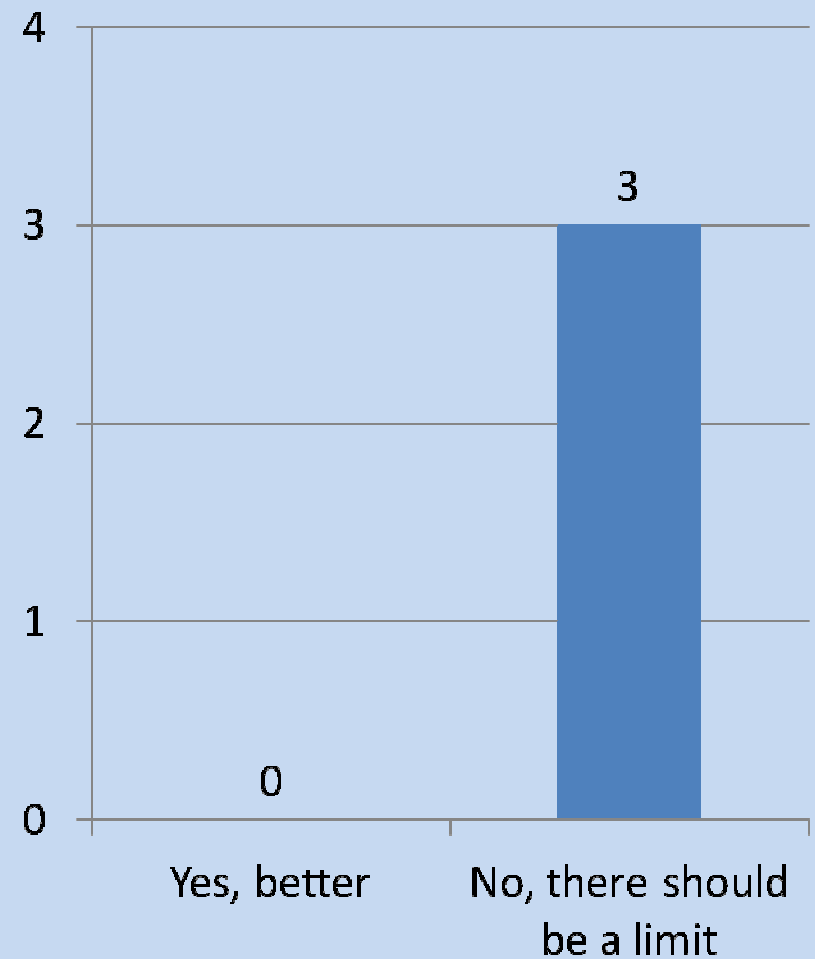
If limit the number
signals used by provider,
according what criteria?



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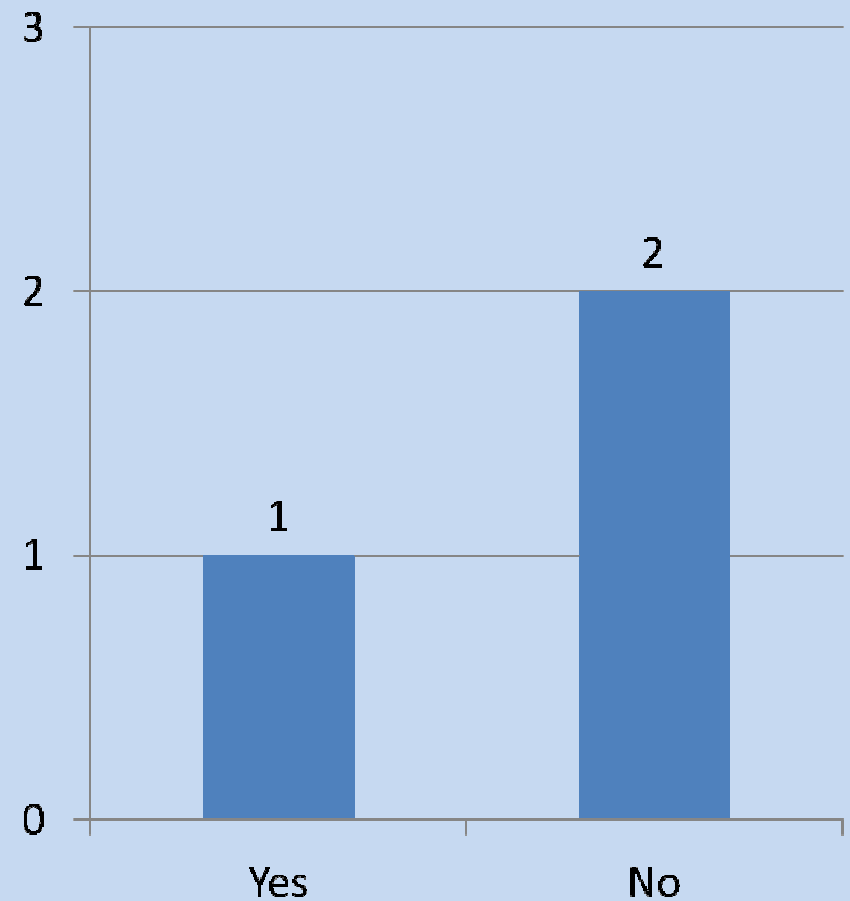
Is having more signals inherently better or do you think there should be a limit?



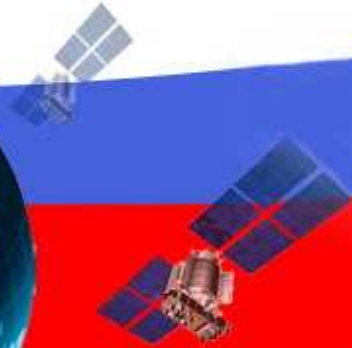
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Will the marketplace “force” you to make use of every available signal?



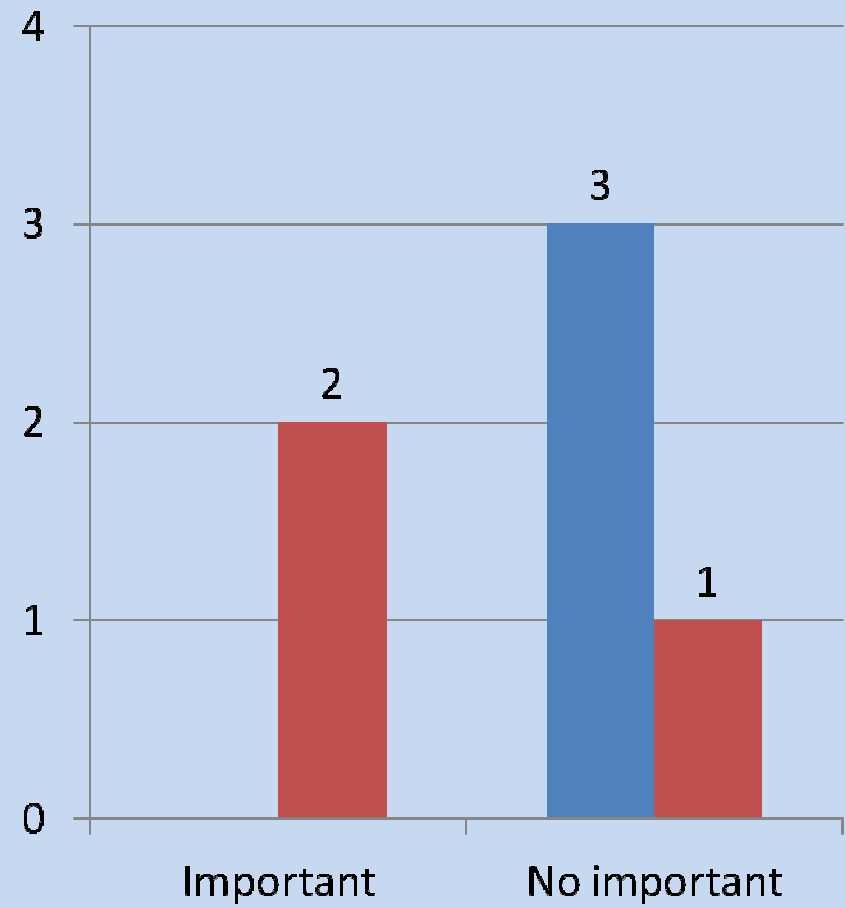
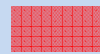
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For best interoperability, how important is a common center frequency?



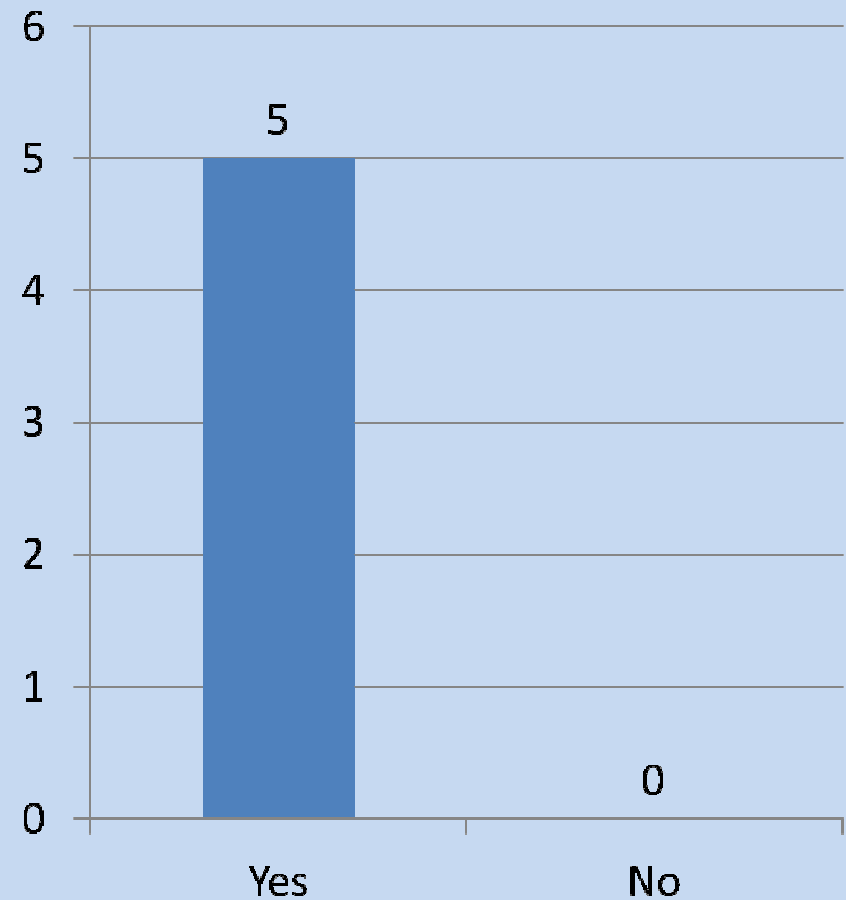
How important is a common signal spectrum?



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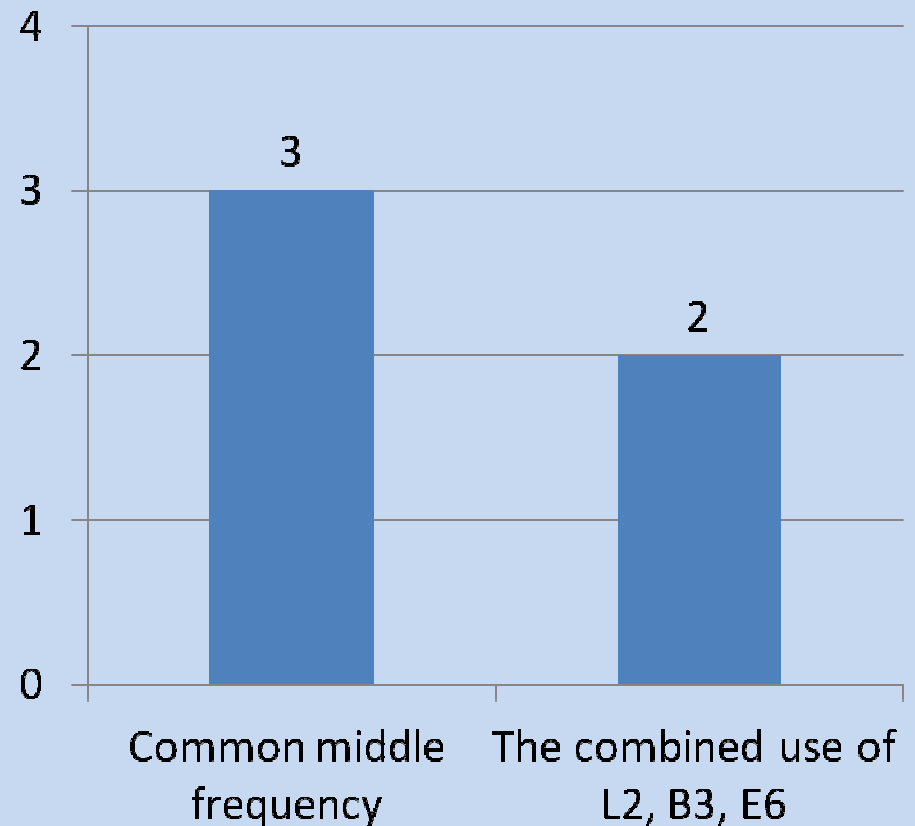
Will you provide “three-signals navigation” capability in the future?



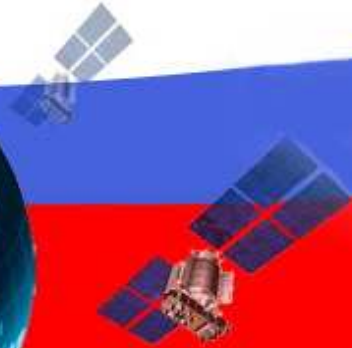
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If so, do you prefer a common middle frequency or the combined use of L2 (1227.6), B3 (1268.52), and E6 (1278.75) if B3 and E6 open access is available?



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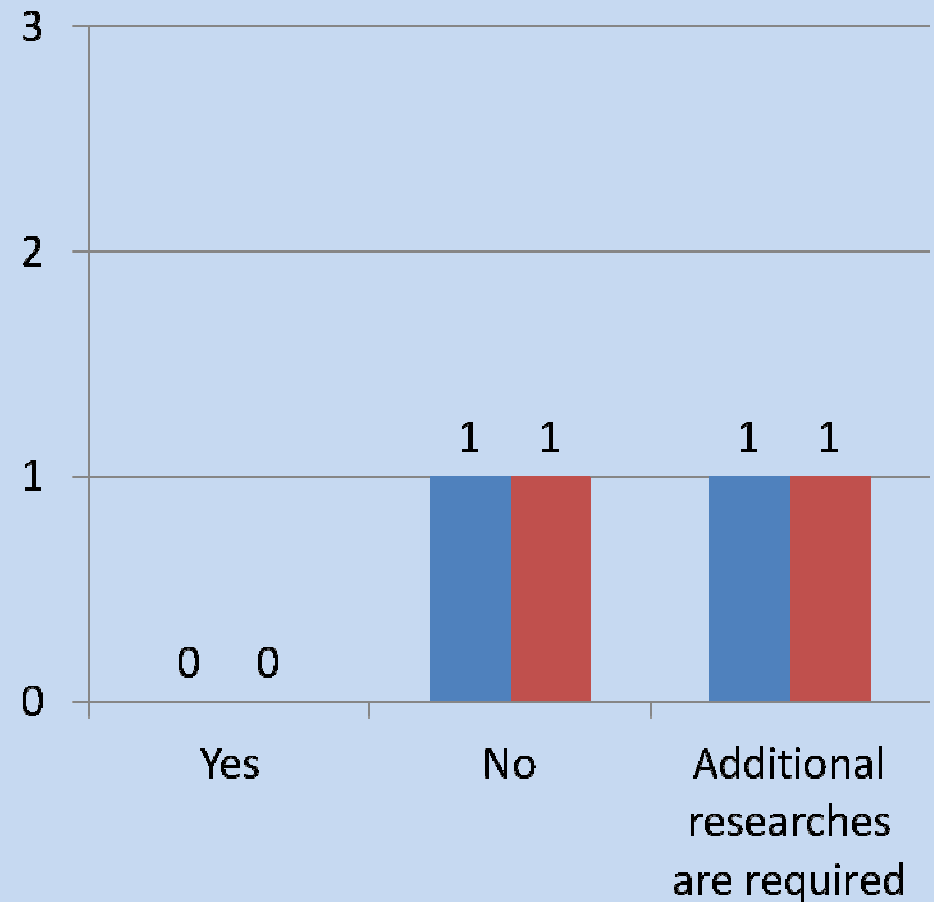


Would you prefer a common
open signal?

In S Band?



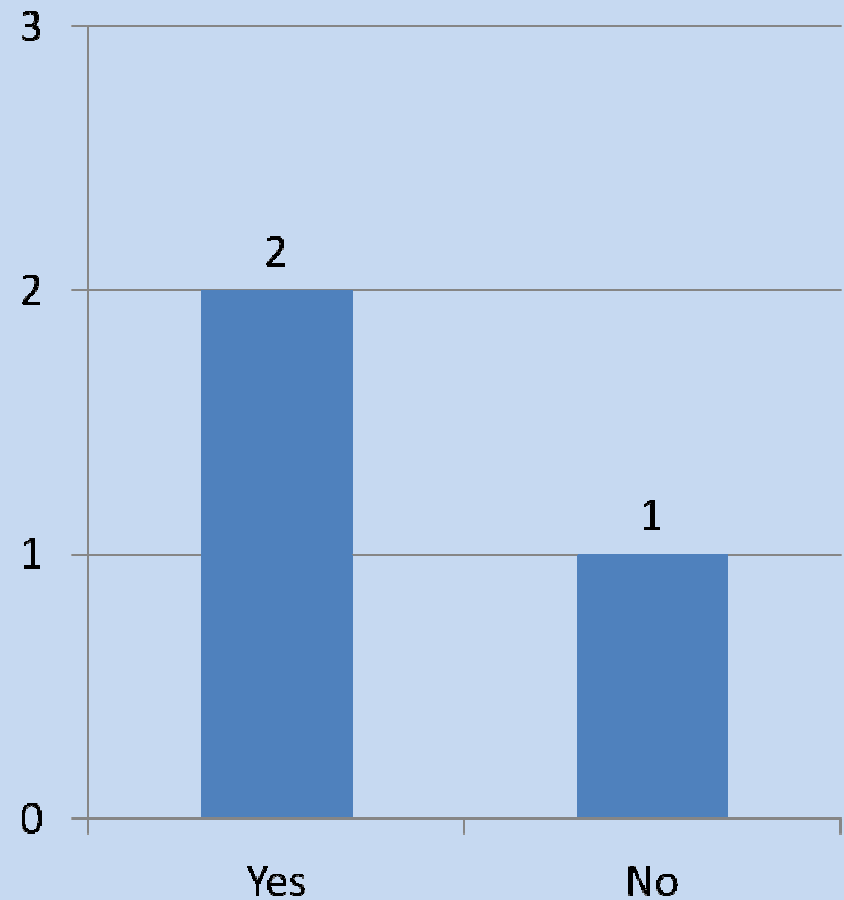
In C Band?



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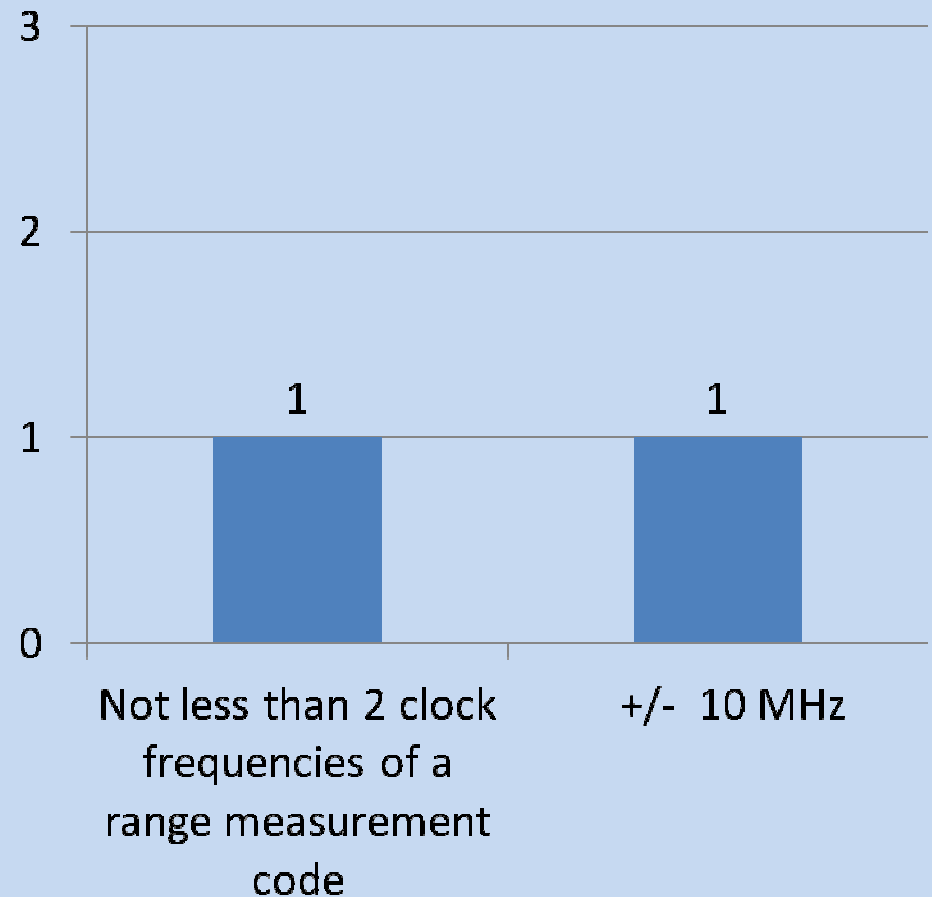
Does a wider satellite transmitter bandwidth help with multipath mitigation?



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What minimum transmitter bandwidth would you recommend for future GNSS signals in order to achieve optimum code precision measurements?

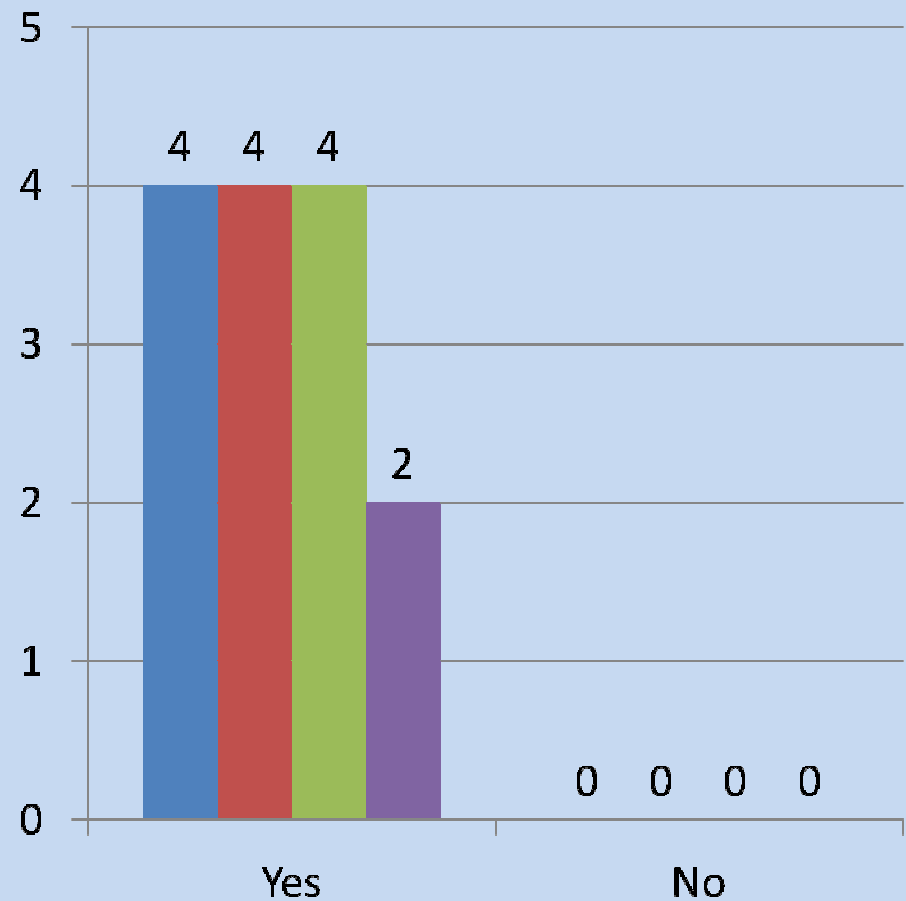


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Would you recommend GNSS or SBAS services provide interoperability parameters:

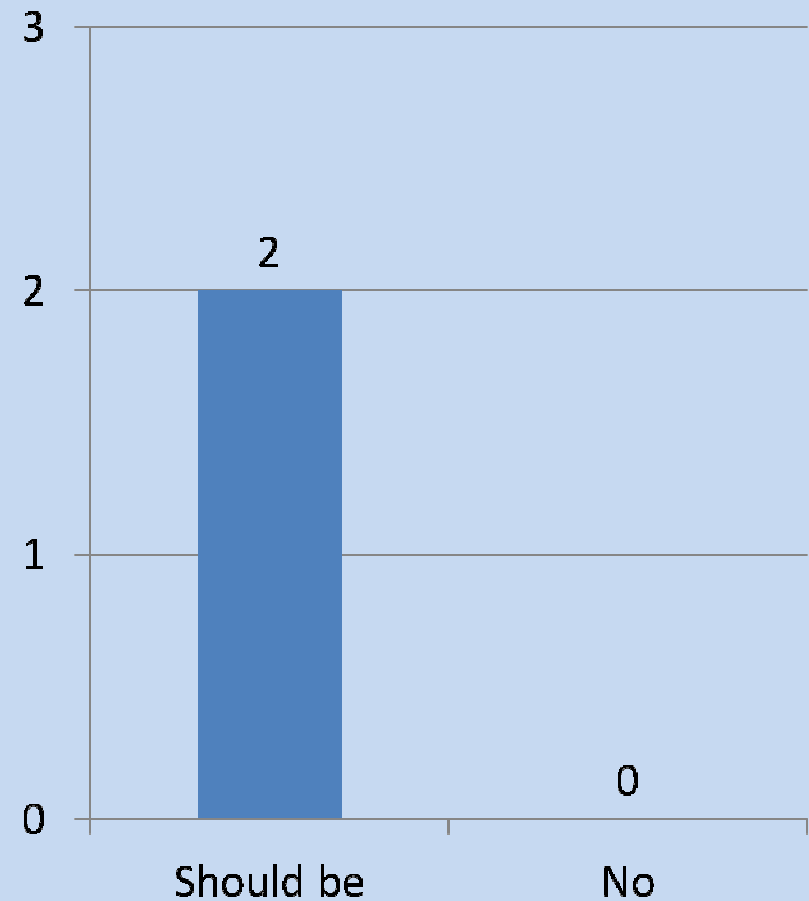
- System clock offsets
- Geodesy offsets
- ARAIM parameters
- Others



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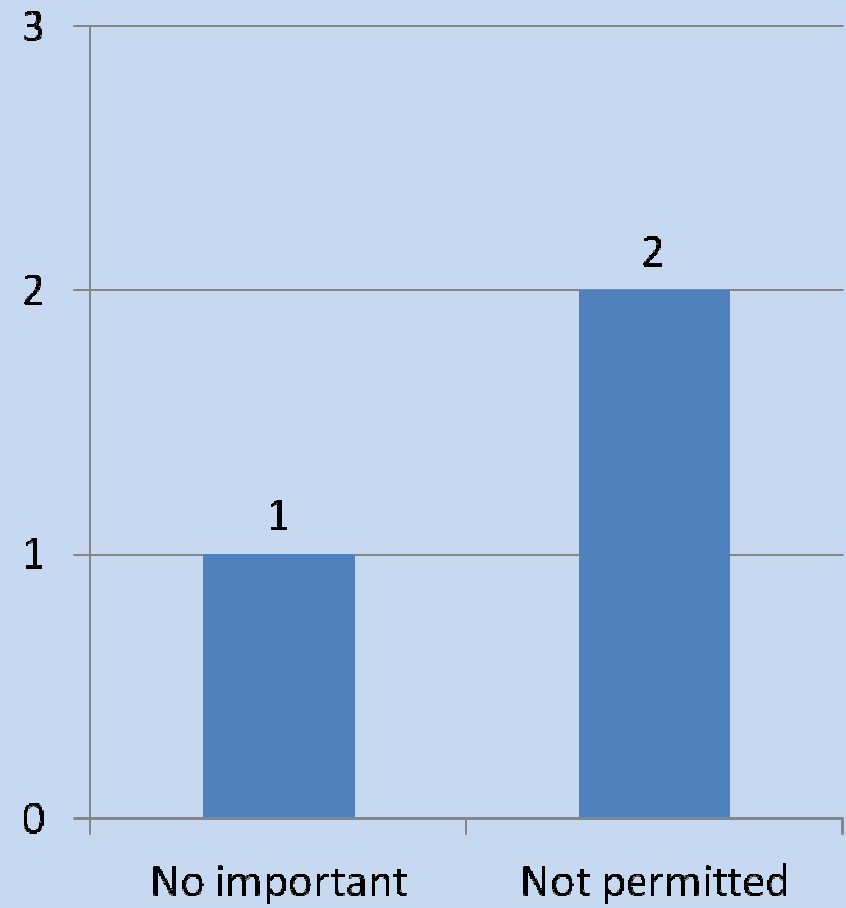
Should they be provided by other means so as not to compromise TTFF or other navigation capabilities?



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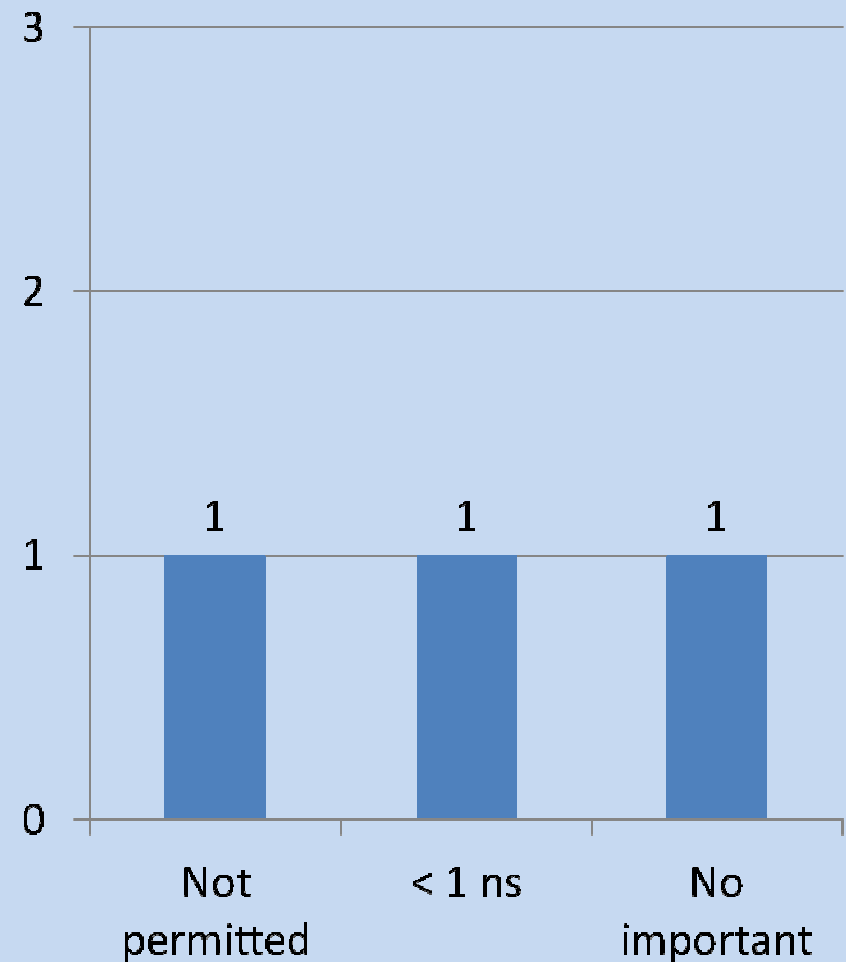
For your applications and for each signal, what amount of drift between code and carrier over what time frame would be excessive?



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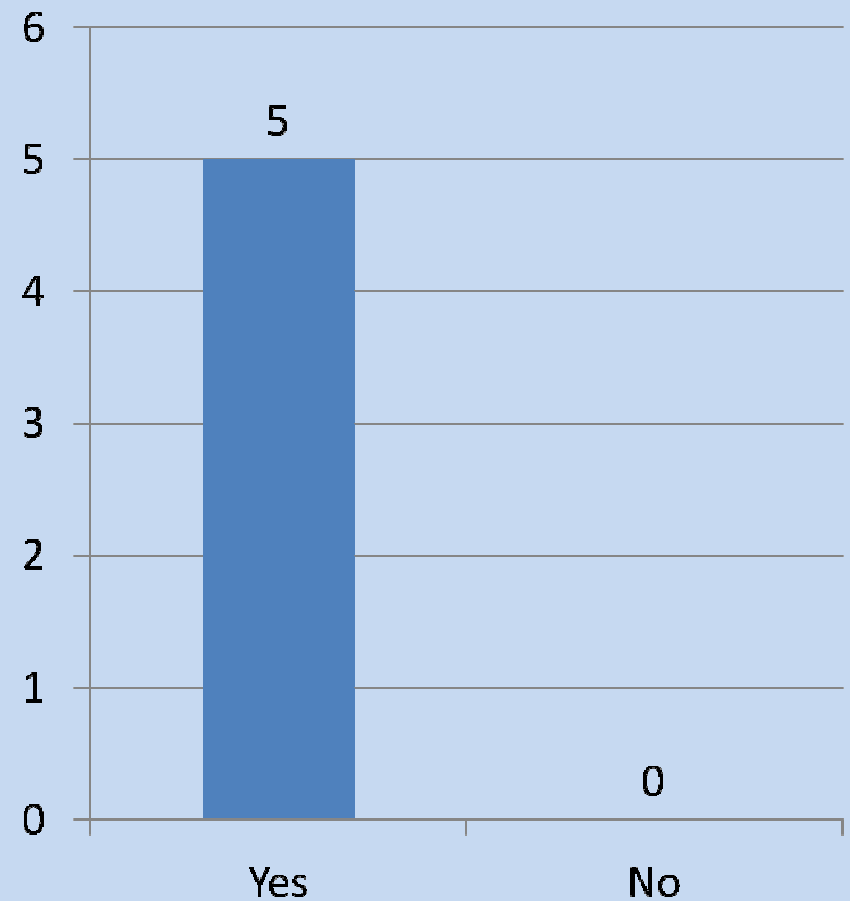
For your applications and for two or more signals in different frequency bands, e.g., L1 and L5 (when scaled properly), what amount of relative drift in code and carrier between the signals would be excessive?



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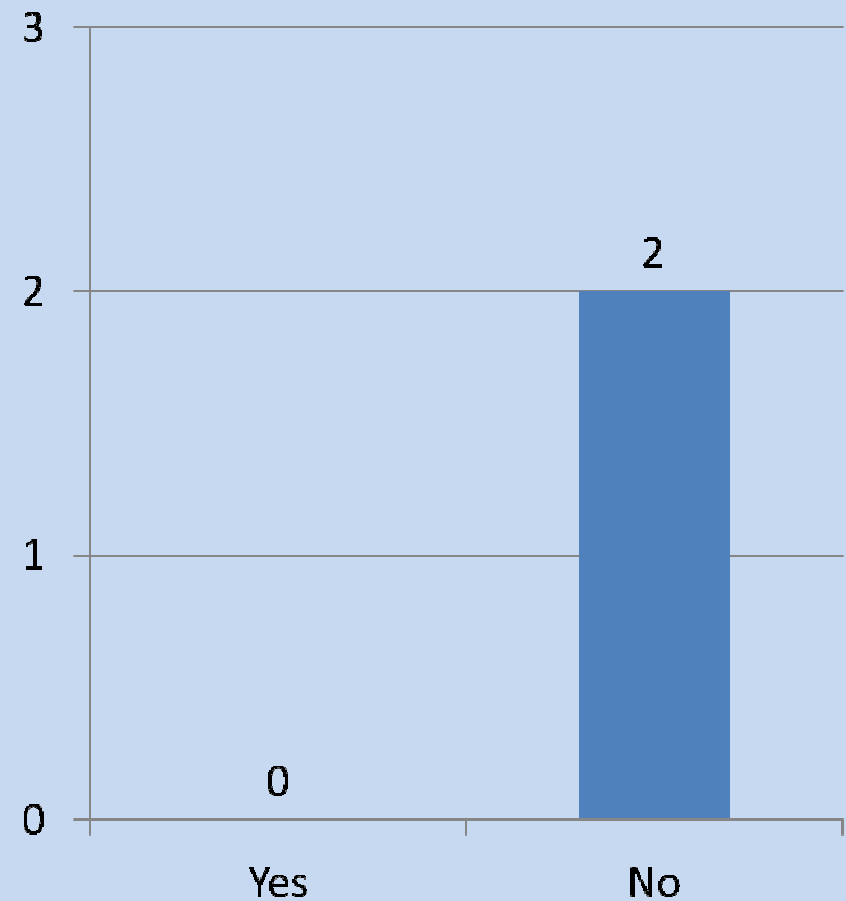
Should the international community strive to protect all GNSS signal bands from terrestrial signal interference?



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Do the current differences
(~10 cm) in Geodesy pose
a problem for your users?
Why or why not?



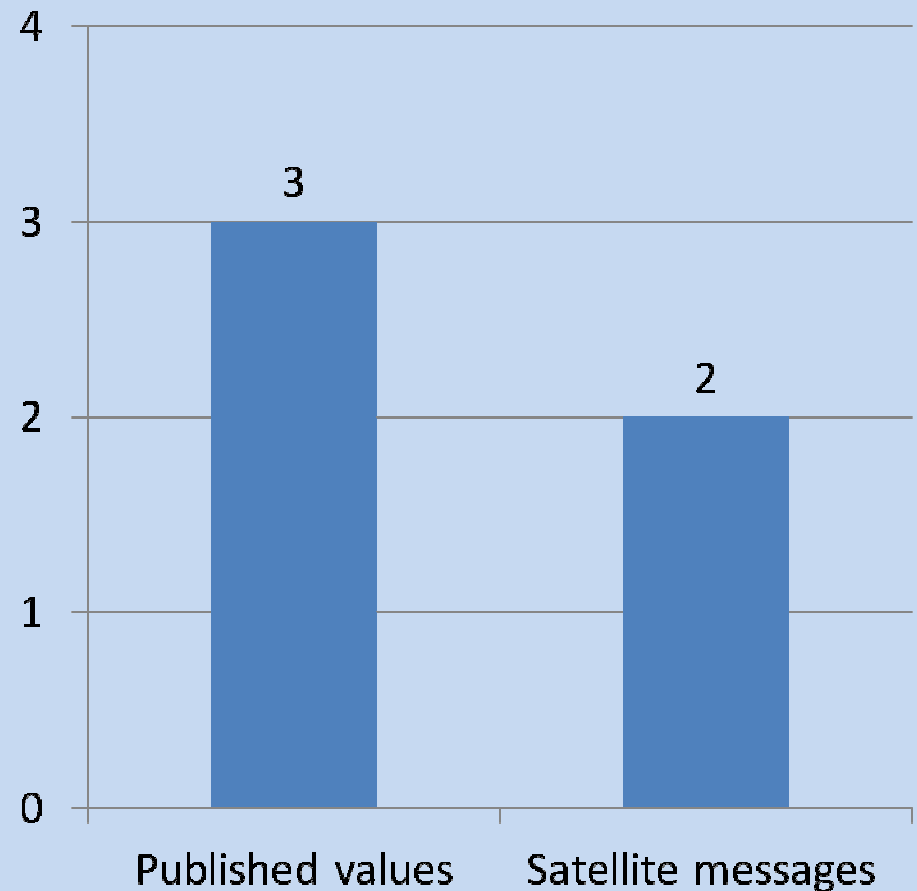
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If geodesy differences are a problem, what is the preferred method of compensation:

Published values
(e.g., on websites);

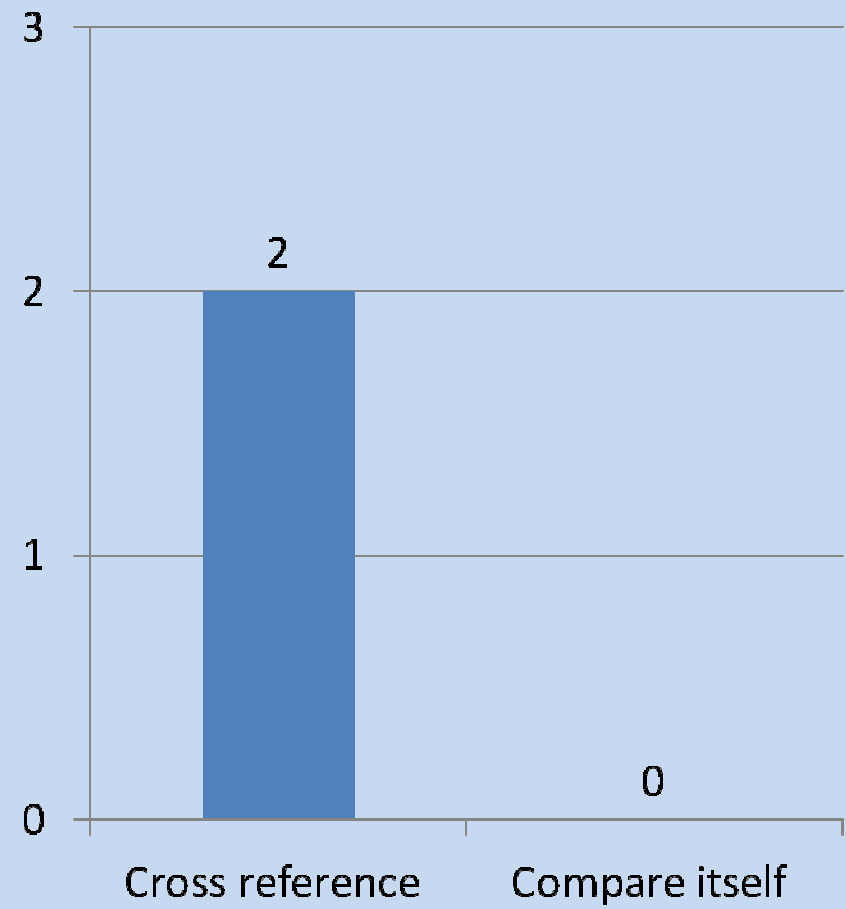
Satellite messages.



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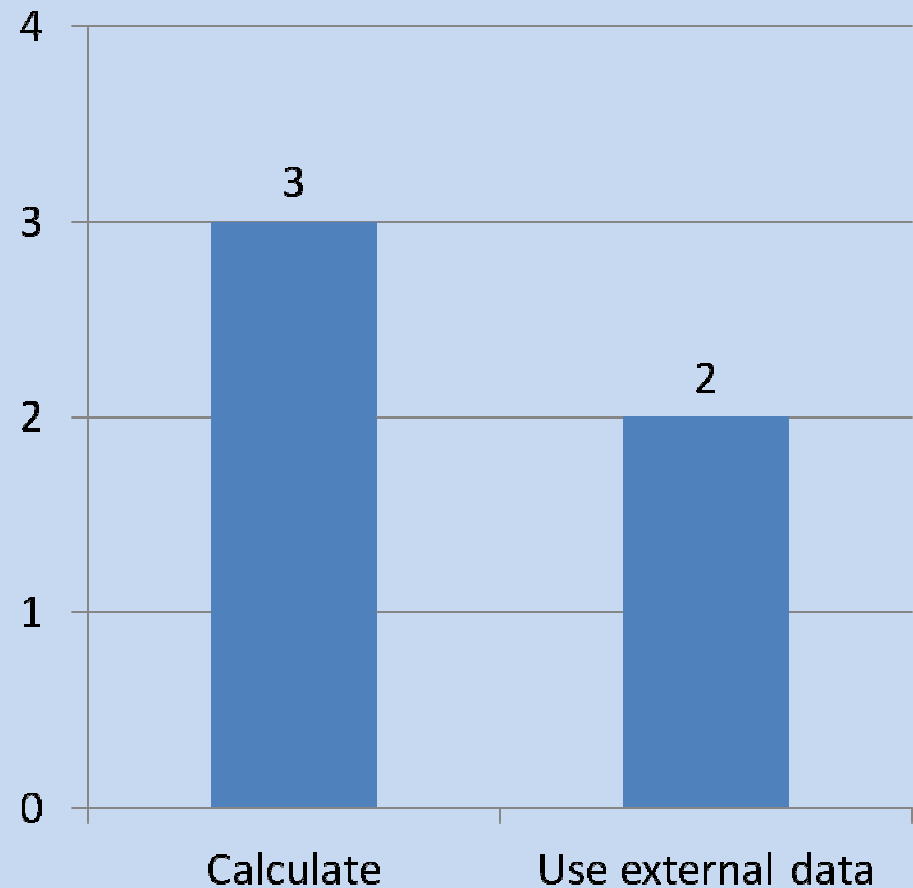
Do you want each system to cross reference the other's time (e.g., with a GGTO type of message) or compare itself to a common international GNSS ensemble time?



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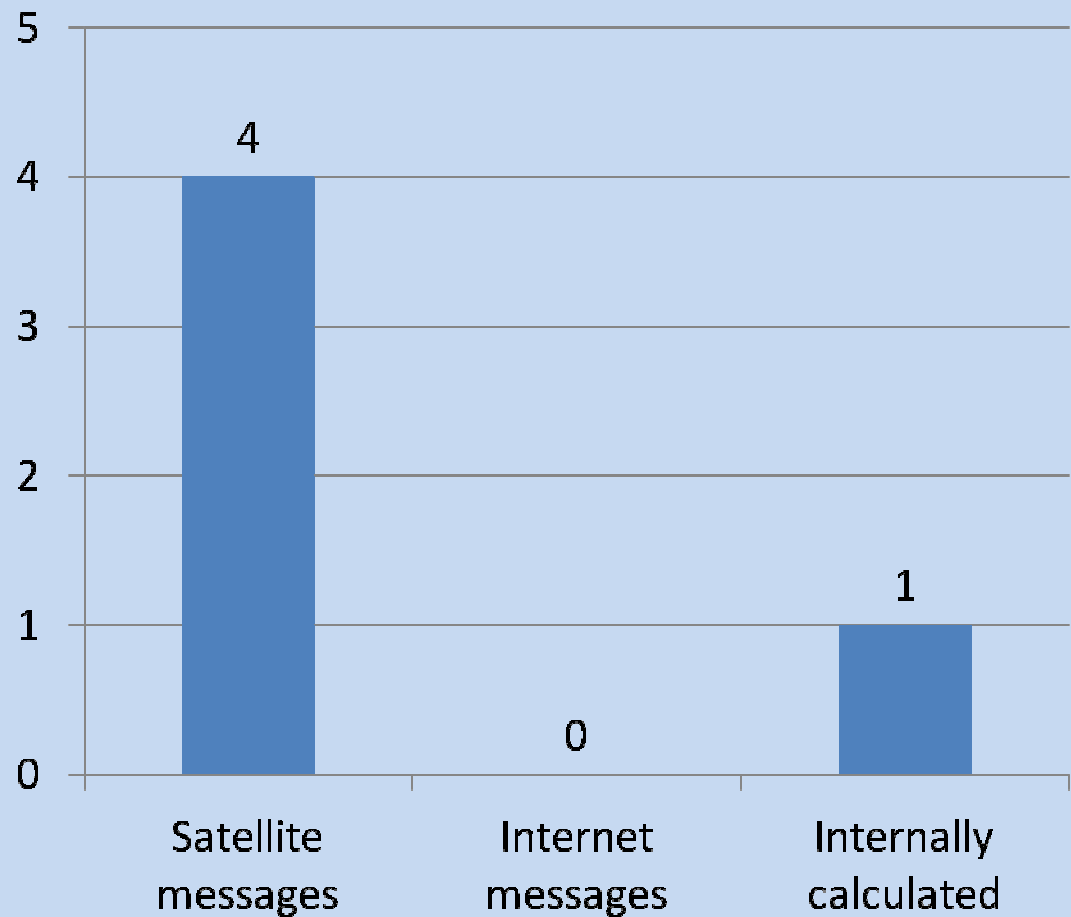
Will your future receivers calculate a time offset between systems based on signal measurements or use only external time offset data?



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What is the preferred method of receiving time offsets: Satellite messages, Internet messages, or internally calculated?



Conclusions

Analyzing answers to the questions posed, it is possible to draw a conclusion that the majority presented answers recognize threat existence for NEC because of a large number of navigation signals with the central frequency of 1575.42 MHz. Thus the vast majority supported use in L1 range, except the frequency of 1575.42 MHz, and other central frequencies.

Choosing between the solution of questions of increase of noise immunity or ensuring interoperability, the priority is given to use of signals in various strips of range of L1 in interests of increase of noise immunity. The majority of respondents considers that the general central frequency isn't so important, more value has the general range. Also the majority of respondents are sure of lack of need of the conclusion of the intergovernmental Agreement on conditions of granting open signals in L1 and L5 ranges for GLONASS. Opinions of respondents concerning prospect of use of a C/A-code were shared.

Besides, part of respondents recognized the commercial prospect for the signals with frequency division regardless of a large number of signals with code division. It is thus noted that in this question crucial importance will be had by inquiries of the consumer.

Use of E5b signal under a condition that a signal of L5/E5a will be given by the majority of providers, didn't cause a big interest. Only three from respondents expressed readiness to use a signal of E5b and one declared absence at its company of plans concerning this signal.

Conclusions

Practically all respondents note readiness in the future to provide possibility of navigation on three signals, is thus planned both use of the general central frequency and combined use of L2, B3 and E6.

The general open signal in S and the C ranges didn't cause any interest of respondents.

The unanimous opinion is expressed that to quantity of signals broadcast by providers the limit has to be set, but nevertheless the majority considers inexpedient artificially to limit their quantity. Thus a half of respondents notes, what even the market won't be able to force producers to use all available signals.

All respondents agreed in opinion that providers of signals have to agree about the minimum international quality standards, and provide the signals conforming to these standards. Besides, it is declared that the international community has to protect all ranges of signals of GNSS from interference from signals of ground based means.

It is noted that small shifts of frequency (Δf) aren't a problem.

There is an opinion that wider working range of the transmitter helps to reduce effect of a multipath.

All respondents supported transfer by providers of services GNSS and SBAS of parameters of interoperability. It is thus noted that such parameters have to be provided with other means not to increase TTFF or not to influence other navigation characteristics.

Conclusions

Existing divergences in systems of coordinates (~ 10 cm) are recognized for the consumer as the insignificant. For compensation of such divergences it is offered both publication of amendments on websites and their transfer in the navigation message (opinions here were shared).

Concerning a size of drift between a code and a carrier the opinion prevails that such drift is inadmissible. As for drift for two and more signals, here opinions are opposite.

For coordination of time scales of various systems of GNSS are considered it is more preferable mutual checking (type of the message of GGTO), than checking of the scale with uniform international time of GNSS. The majority of respondents supported that the equipment carried out independent calculation of shift between system time of various systems. The navigation message is called a preferable method of transfer of shift of time scales.

RECOMMENDATION

On the basis of the obtained data of poll we support idea of carrying out an open workshop for developers/producers of navigation equipment in the Russian Federation in 2014 with involvement of the international ICG observers.

We suggest to organize a working group to develop the general specified list of questions which the industry has to answer and by results of answers the series of workshops will be held.

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Thank You for Attention!