

CHINA SATELLITE NAVIGATION OFFICE

The 9th Meeting of International Committee on GNSS



Updates of Common Questions Analyze

--Inputs from CHN, JPN, RUS & USA WS

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Purpose of the Presentation

Interoperability Task Force focusing on the inputs for GNSS Providers to get the maximum GNSS Interoperability.

Feedback of the questionnaires from four providers should be analyzed and obtain some useful results.

Searching the viewpoint difference among the “Common Questions”, make an order to insure:

- What we agree on;
- What we have totally different ideas.



Evaluation method

For the same question, suppose the percent of different answers of three industry categories be three vectors.

Example: In the question

“What types of applications do receivers from your company (or receiver designs) support?”

The Answer:

	CHN	JPN	RUS	USA
Transportation and safety life	44.7%	50.0%	48.0%	18.2%
Medium/High Precision	28.3%	17.0%	24.0%	45.5%
Consumer Application	27.0%	33.0%	28.0%	36.4%

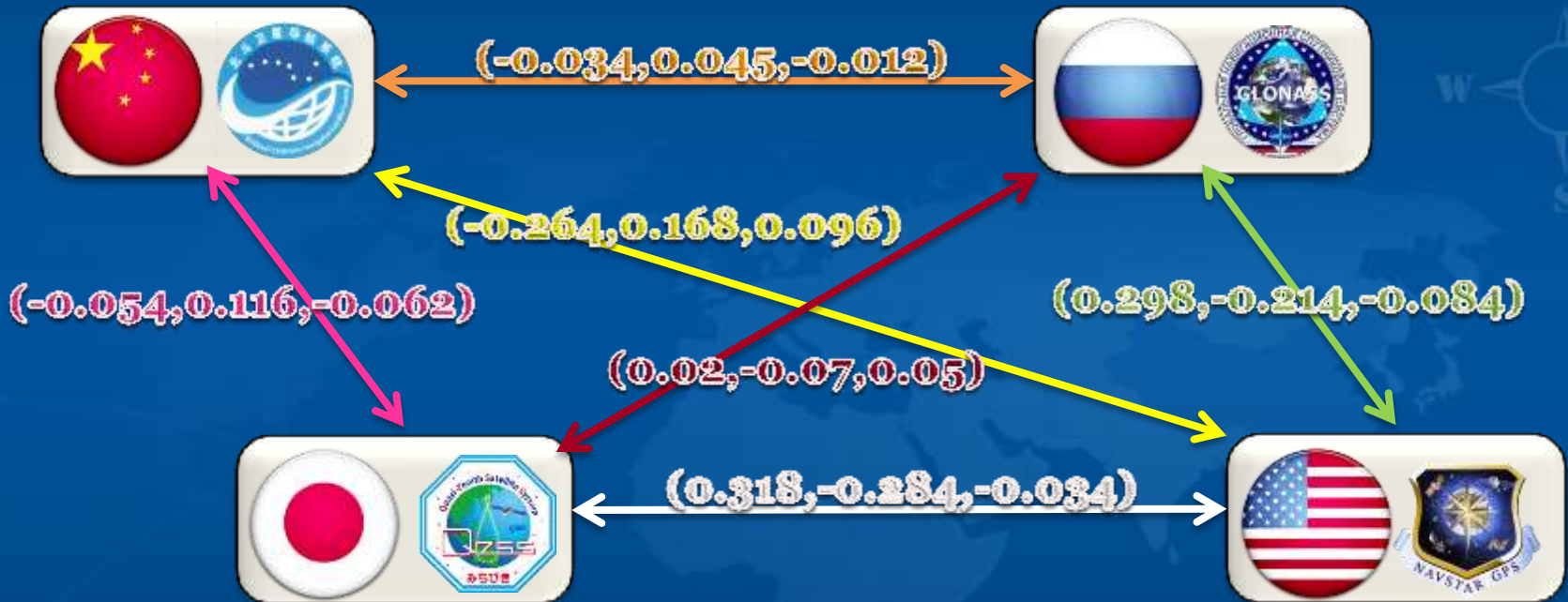
Then we have:

$$\begin{aligned} \overrightarrow{A_{1,C}} &= (0.447, 0.283, 0.270); & \overrightarrow{A_{1,J}} &= (0.500, 0.170, 0.330) \\ \overrightarrow{A_{1,R}} &= (0.480, 0.240, 0.280); & \overrightarrow{A_{1,U}} &= (0.182, 0.455, 0.364) \end{aligned}$$



Evaluation method

Subtraction:



Then we obtain the norm of the six vectors above:

0.142, 0.058, 0.327, 0.088, 0.428, 0.327

At last, the **MEAN** of the six scales could reflect the degree of difference of the four providers in the given question (**DDQ, Difference Degree of Question**):

$DDQ_1 = 0.229$



Common Questions

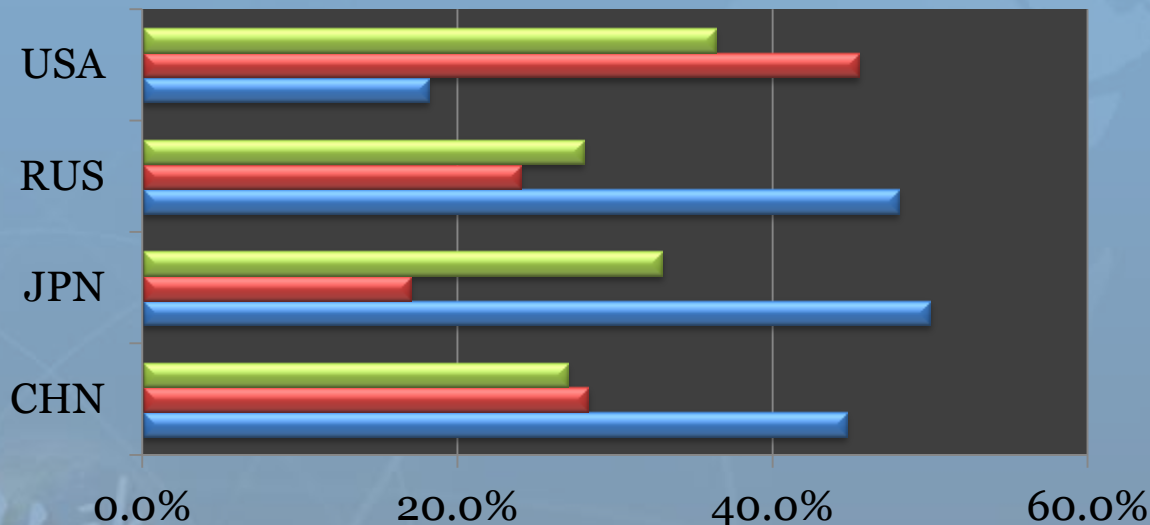
1	What types of applications do receivers from your company (or receiver designs) support?
2	Do you prefer new CDMA signals at "L1" to be centered at 1575.42 MHz or have some of them elsewhere, e.g., at 1602 MHz?
3	Once there are a large number of good CDMA signals, do see any commercial interest in FDMA signals? Why or Why Not?
4	Given that L5/E5a/B2a will be transmitted by most GNSS providers, do you intend to use the E5b signal? --If so, for what purpose?
5	Assuming signal quality is acceptable from every provider, would you limit the number of signals used by provider or by other criteria? What criteria?
6	For best interoperability, how important is a common center frequency? How important is a common signal spectrum (PSD)?
7	Will you provide "tri-lane" capability in the future? If so, do you prefer : B3 (1268.52MHz)? E6 (1278.75 MHz)? L2 (1227.6 MHz)? L2+B3+E6? S Band? C Band?
8	Does a wider satellite transmitter bandwidth help with multipath mitigation?
9	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?
10	Should the international community strive to protect all GNSS signal bands from terrestrial signal interference?



Common Questions

CQ* 1: What types of applications do receivers from your company (or receiver designs) support?

	CHN	JPN	RUS	USA
Transportation and safety life	44.7%	50.0%	48.0%	18.2%
Medium/High Precision	28.3%	17.0%	24.0%	45.5%
Consumer Application	27.0%	33.0%	28.0%	36.4%



$$DDQ_1 = 0.229$$

- Consumer Application
- Medium/High Precision
- Transportation and safety life

*: CQ=Common Questions

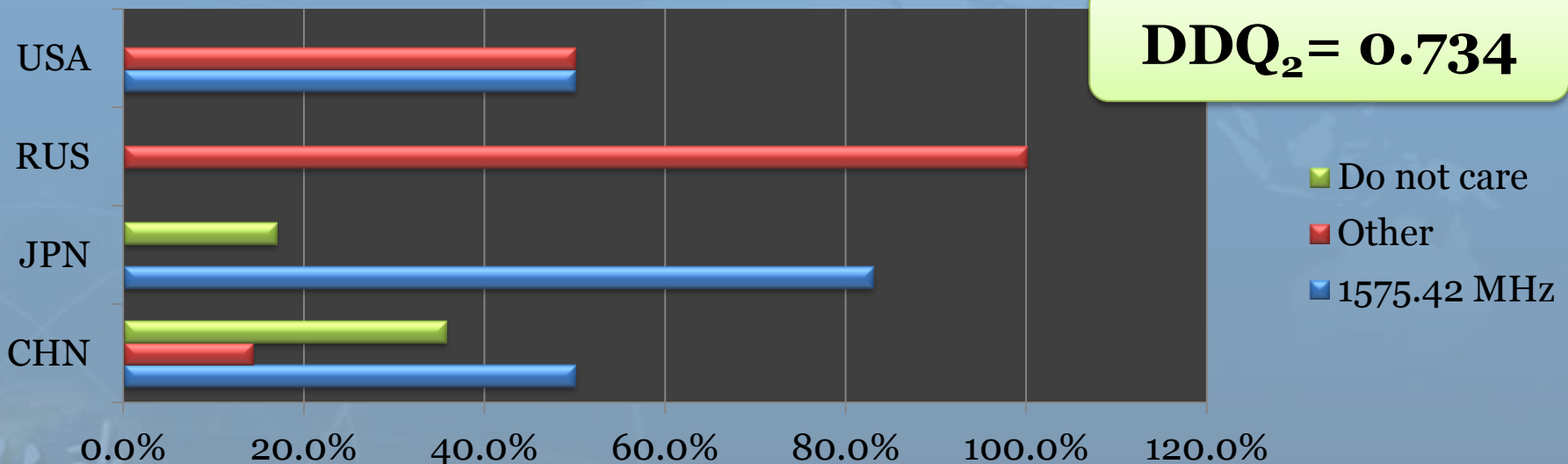


Common Questions

CQ 2:

Do you prefer new CDMA signals at “L1” to be centered at 1575.42 MHz or have some of them elsewhere, e.g., at 1602 MHz?

	CHN	JPN	RUS	USA
1575.42 MHz	50.0%	83.0%	0.0%	50.0%
Other	14.3%	0.0%	100.0%	50.0%
Do not care	35.7%	17.0%	0.0%	0.0%



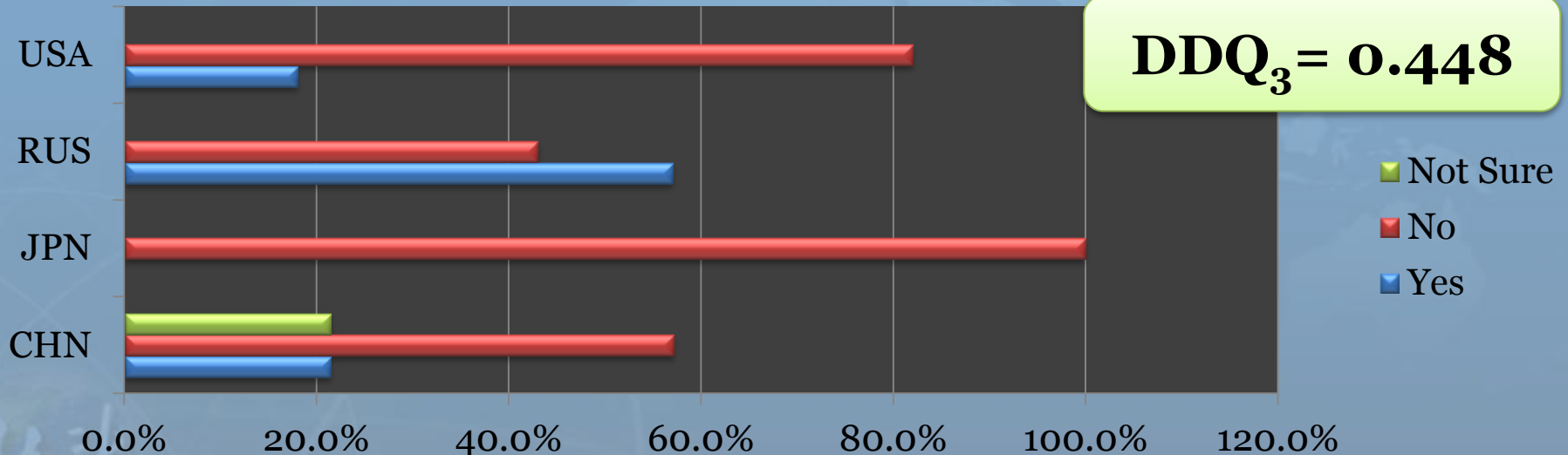


Common Questions

CQ 3:

Once there are a large number of good CDMA signals, do see any commercial interest in FDMA signals? Why or Why Not?

	CHN	JPN	RUS	USA
Yes	21.4%	0.0%	57.0%	18.0%
No	57.1%	100.0%	43.0%	82.0%
Not Sure	21.5%	0.0%	0.0%	0.0%



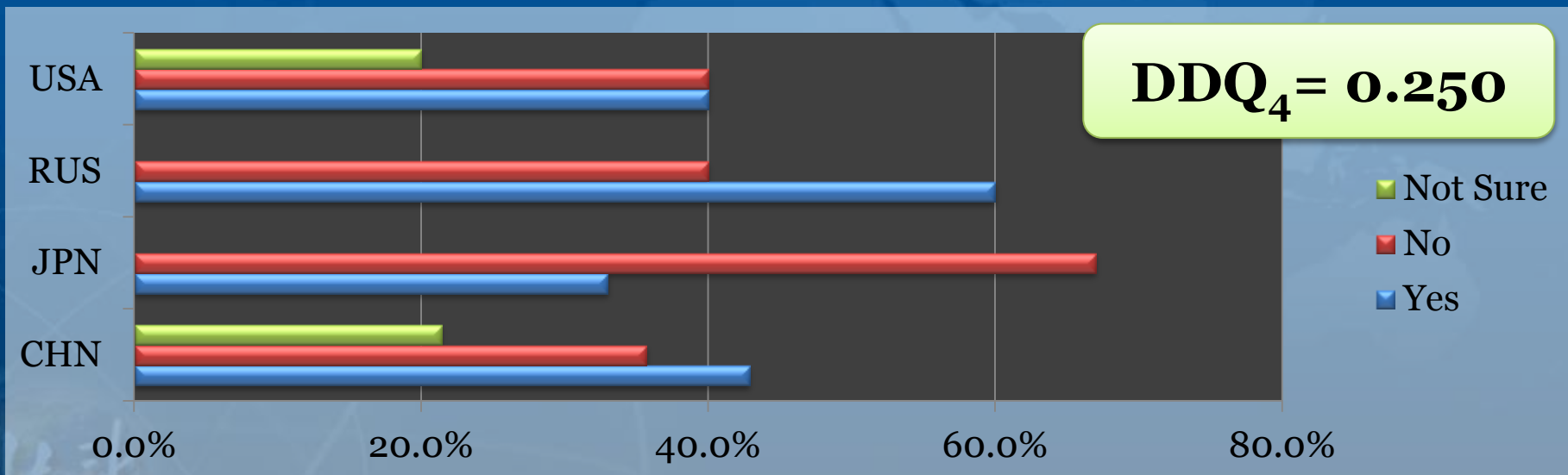


Common Questions

CQ 4:

Given that L5/E5a/B2a will be transmitted by most GNSS providers, do you intend to use the E5b signal?

	CHN	JPN	RUS	USA
Yes	42.9%	33.0%	60.0%	40.0%
No	35.7%	67.0%	40.0%	40.0%
Not Sure	21.4%	0.0%	0.0%	20.0%



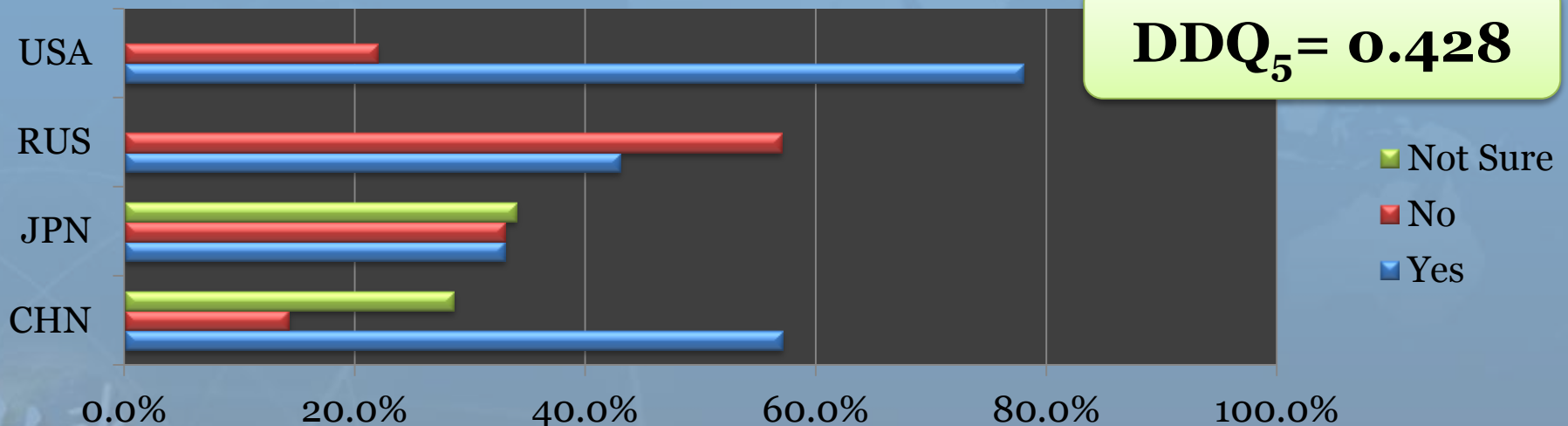


Common Questions

CQ 5:

Assuming signal quality is acceptable from every provider, would you limit the number of signals used by provider or by other criteria? What criteria?

	CHN	JPN	RUS	USA
Yes	57.1%	33.0%	43.0%	78.0%
No	14.3%	33.0%	57.0%	22.0%
Not Sure	28.6%	34.0%	0.0%	0.0%



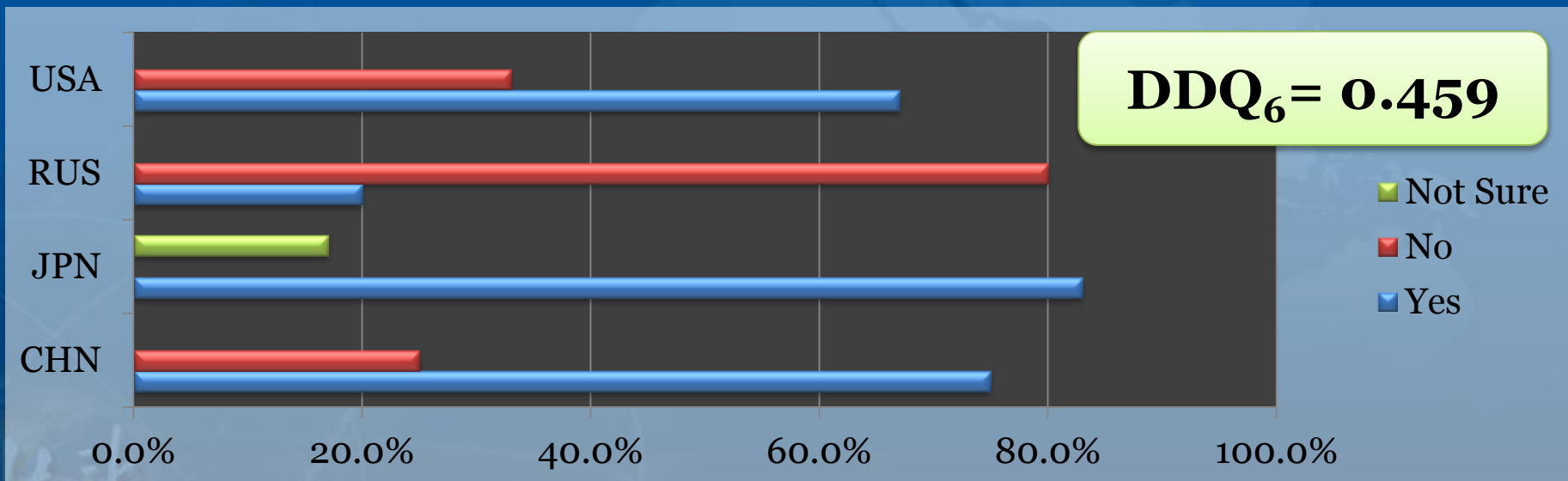


Common Questions

CQ 6:

For best interoperability, how important is a common center frequency? How important is a common signal spectrum (PSD)?

	CHN	JPN	RUS	USA
Yes	75.0%	83.0%	20.0%	67.0%
No	25.0%	0.0%	80.0%	33.0%
Not Sure	0.0%	17.0%	0.0%	0.0%



Show the *common center frequency* results only.

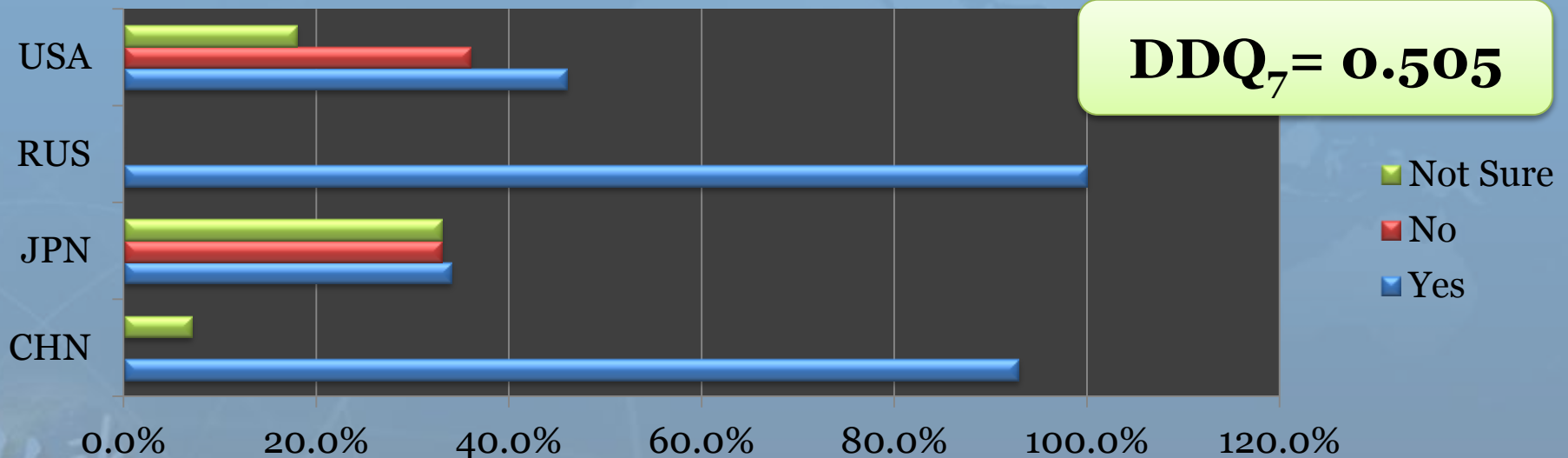


Common Questions

CQ 7:

Will you provide “tri-lane” capability in the future?

	CHN	JPN	RUS	USA
Yes	92.9%	34.0%	100.0%	46.0%
No	0.0%	33.0%	0.0%	36.0%
Not Sure	7.1%	33.0%	0.0%	18.0%



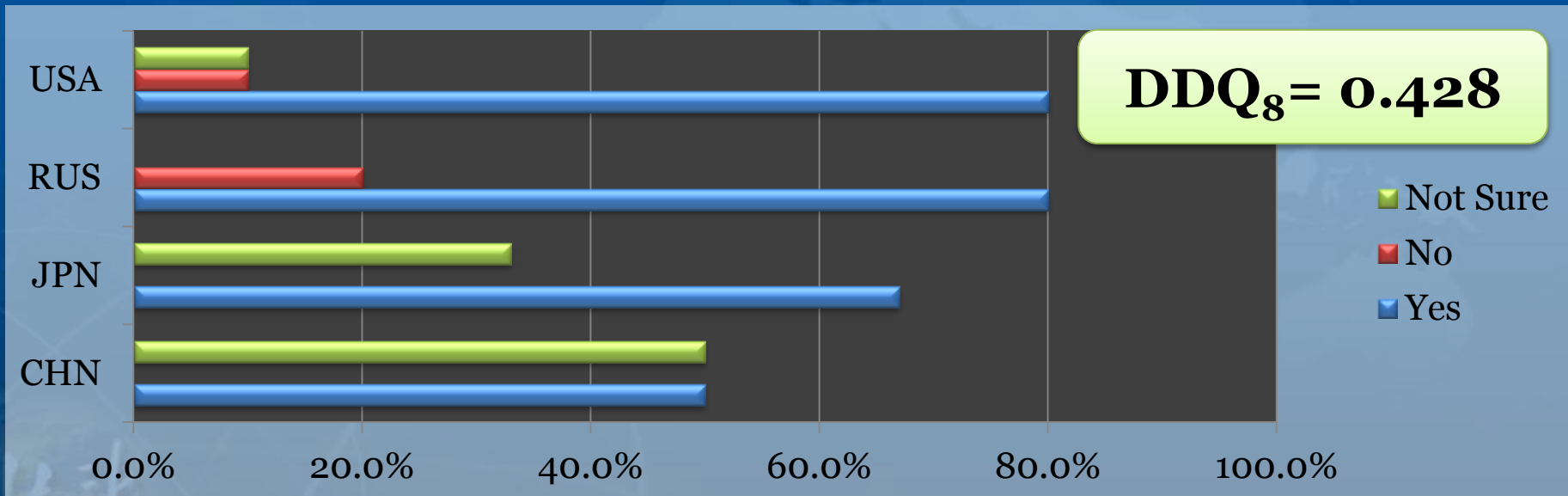


Common Questions

CQ 8:

Does a wider satellite transmitter bandwidth help with multipath mitigation?

	CHN	JPN	RUS	USA
Yes	50.0%	67.0%	80.0%	80.0%
No	0.0%	0.0%	20.0%	10.0%
Not Sure	50.0%	33.0%	0.0%	10.0%



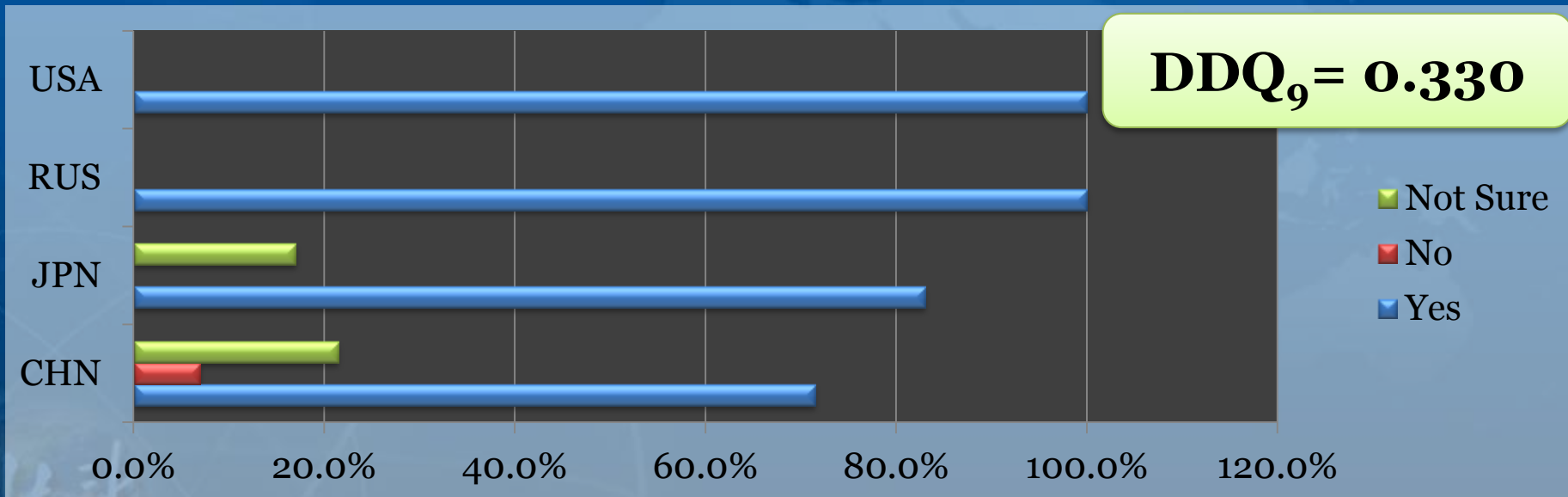


Common Questions

CQ 9:

Would you recommend GNSS or SBAS services provide interoperability parameters?

	CHN	JPN	RUS	USA
Yes	71.5%	83.0%	100.0%	100.0%
No	7.0%	0.0%	0.0%	0.0%
Not Sure	21.5%	17.0%	0.0%	0.0%

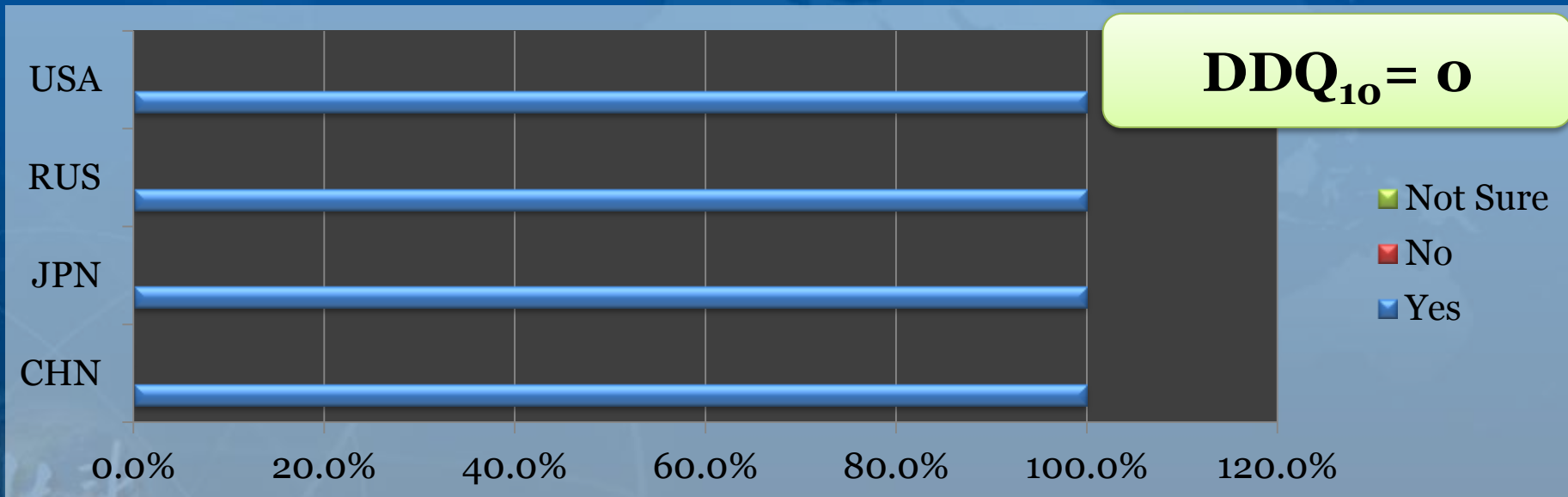




Common Questions

CQ 10: Should the international community strive to protect all GNSS signal bands from terrestrial signal interference?

	CHN	JPN	RUS	USA
Yes	100.0%	100.0%	100.0%	100.0%
No	0.0%	0.0%	0.0%	0.0%
Not Sure	0.0%	0.0%	0.0%	0.0%



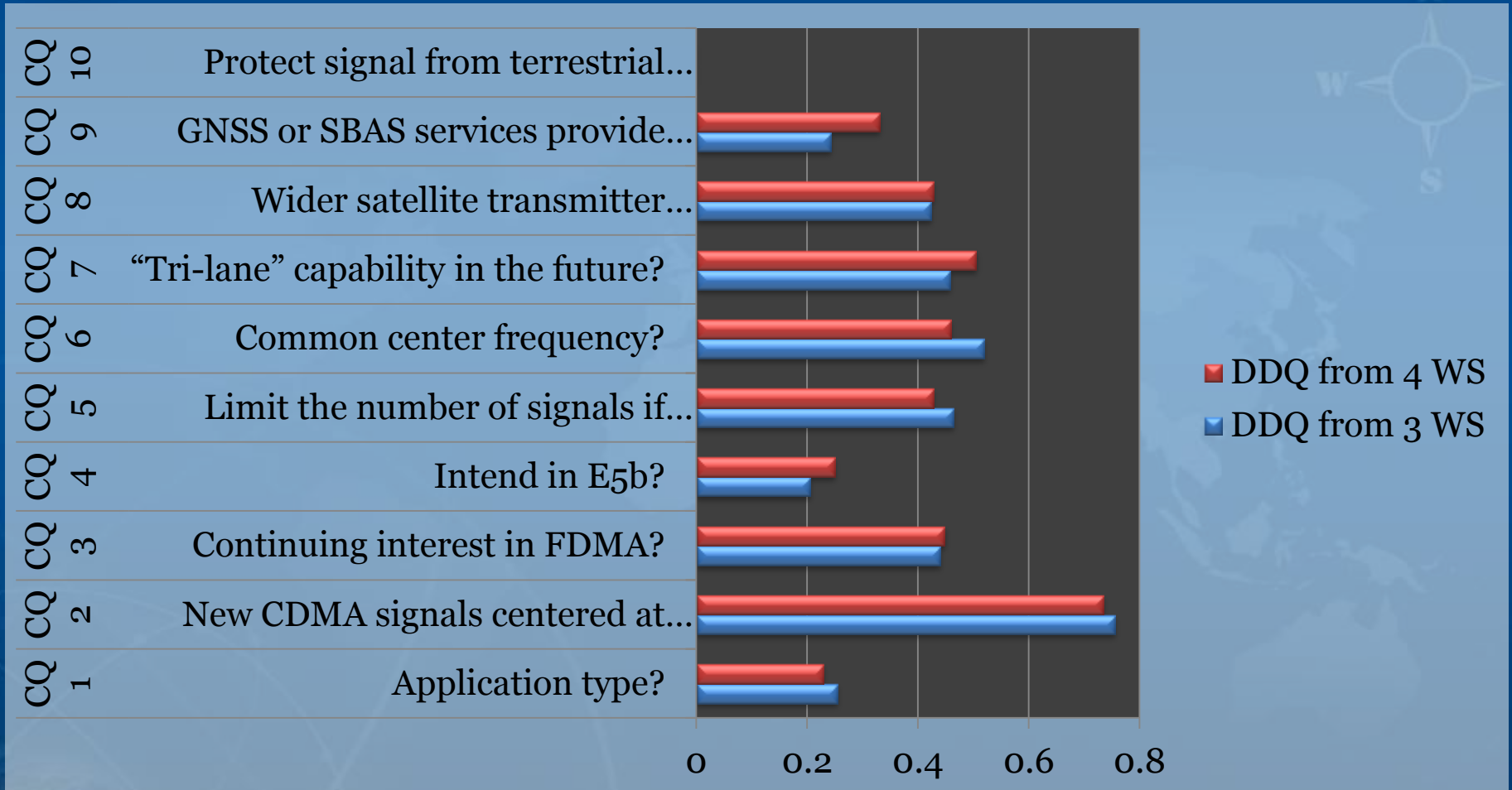


DDQ Change

	Questions (simplified)	DDQ from 3 WS	DDQ from 4 WS
CQ 1	Application type?	0.254	0.229
CQ 2	New CDMA signals centered at 1575.42 MHz?	0.756	0.734
CQ 3	Continuing interest in FDMA?	0.440	0.448
CQ 4	Intend in E5b?	0.205	0.250
CQ 5	Limit the number of signals if signal quality is acceptable?	0.464	0.428
CQ 6	Common center frequency?	0.519	0.459
CQ 7	“Tri-lane” capability in the future?	0.458	0.505
CQ 8	Wider satellite transmitter bandwidth will mitigate multipath?	0.423	0.428
CQ 9	GNSS or SBAS services provide interoperability parameters?	0.243	0.330
CQ 10	Protect signal from terrestrial interference?	0	0



DDQ Change



DDQ change is limited, 3/4 WS shows the similar viewpoint.



The Order

Questions (simplified)	DDQ
Protect signal from terrestrial interference?	Agreement / Almost Agreement
Application type?	
Intend in E5b?	
GNSS or SBAS services provide interoperability parameters?	0.330
Wider satellite transmitter bandwidth will mitigate multipath?	Limited Agreement
Limit the number of signals if signal quality is acceptable?	
Continuing interest in FDMA?	
Common center frequency?	0.459
“Tri-lane” capability in the future?	Totally different
New CDMA signals centered at 1575.42 MHz?	



Conclusion

In the “**Agreement / Almost Agreement**” questions, User/Industry hold the similar viewpoint:

- Composition of the User/Industry type from the three workshops are similar;
- Providers should protect signal from terrestrial interference;
- E5b signal has its specific users;

This may form the conclusion of the first round investigation.



Conclusion

In the “**Limited Agreement**” questions:

- Wider satellite transmitter bandwidth will mitigate multipath?
- Continuing interest in FDMA?
- “Tri-lane” capability in the future?
- Limit the number of signals if signal quality is acceptable?
- GNSS or SBAS services should provide interoperability parameters.

Task Force should:

- **Find out how the different opinions come from;**
- **Discuss how to deal with these questions;**
- **Hold additional workshops focus on these questions.**



Conclusion

In the “**Totally different**” questions, User/Industry hold the different viewpoints:

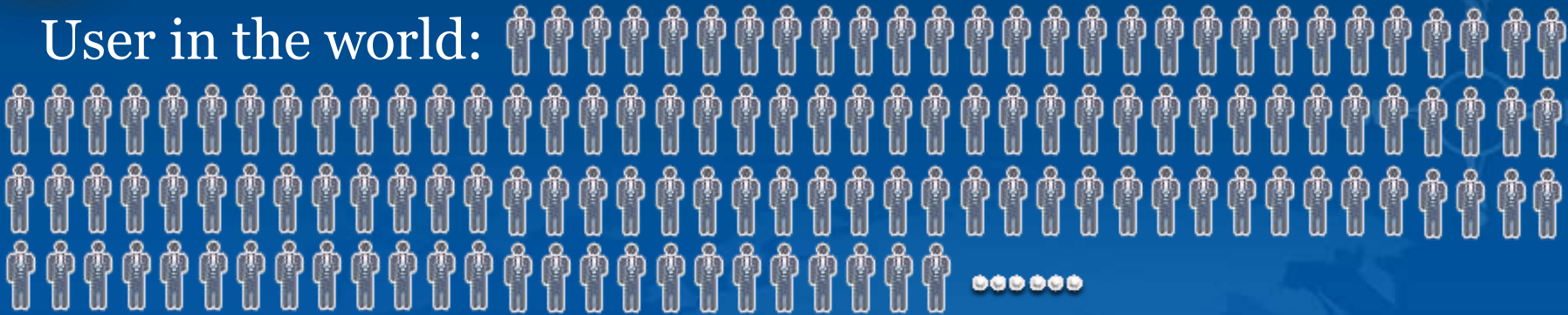
- Common center frequency is not very important;
- New CDMA signals may not centered at 1575.42 MHz .

Frequency variety is both the reality and the user requirement.



Discuss

User in the world:



Sample we get: 

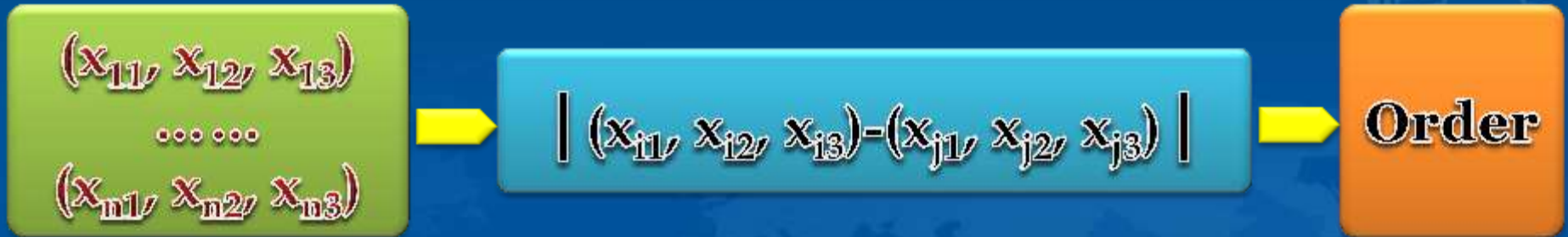
More sample is necessary.

**Provider should investigate more user/industry to obtain sufficient inputs;
Research the requirement differences between user category is necessary.**



Discuss

Evaluation method



If there is other evaluation method?
If there will be some novel results obtain?

Task force should discuss other evaluation method and make an agreement on one or two accepted method.



Proposal

To receive more inputs
To refer more to providers
To raise up GNSS interoperability

- Task force should encourage provider to investigate more user/industry for making sufficient inputs;
- Task force should research the requirement differences between user category;
- Task force should discuss potential evaluation method;
- Task force feedback the results to the providers.





Thank you!

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