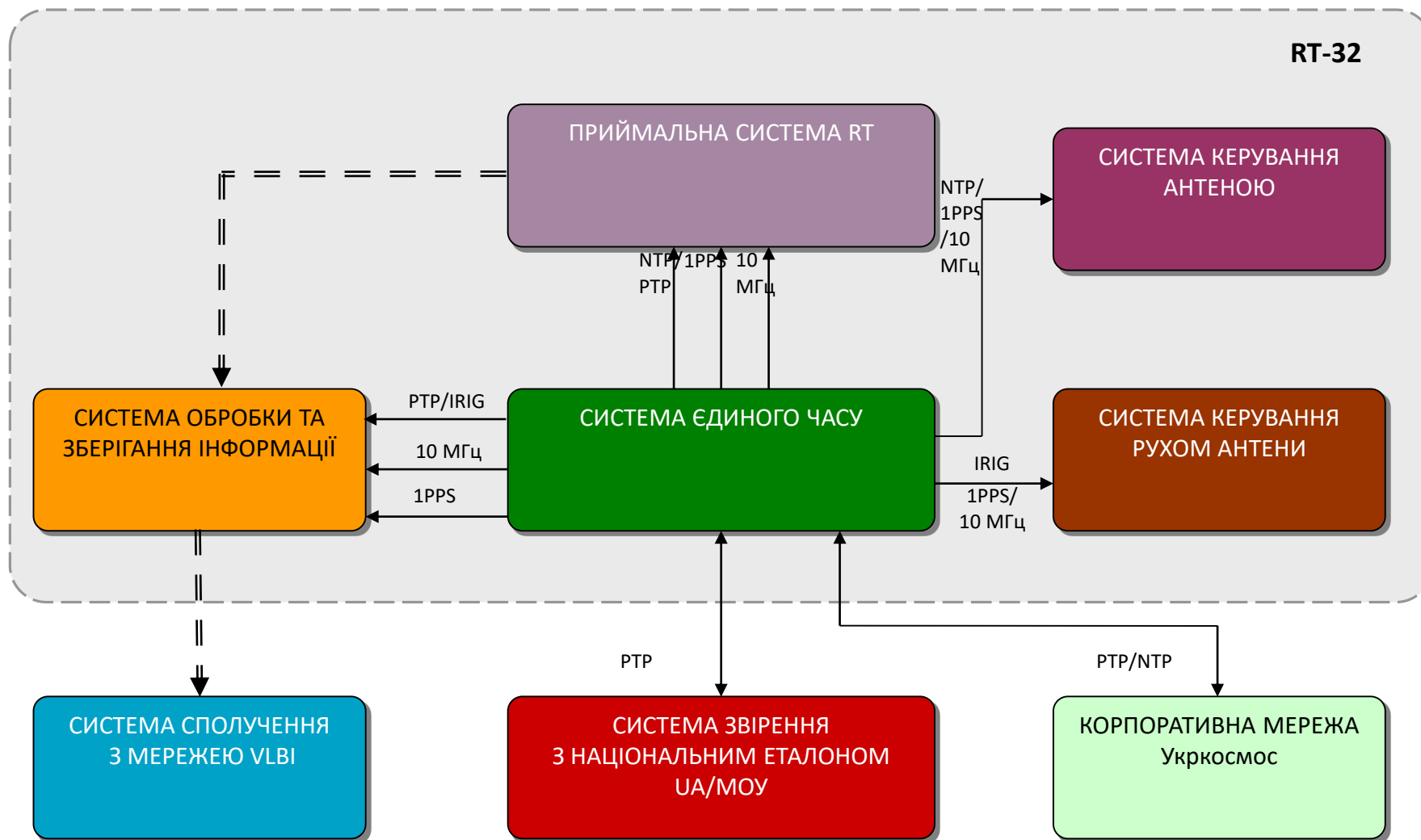




Results of Development VLBI Time Scale System RT-32 Zolochiv

Viktor Gaidamanchuk
Wircom Co (Ukraine)





RT 32 Zolochiv





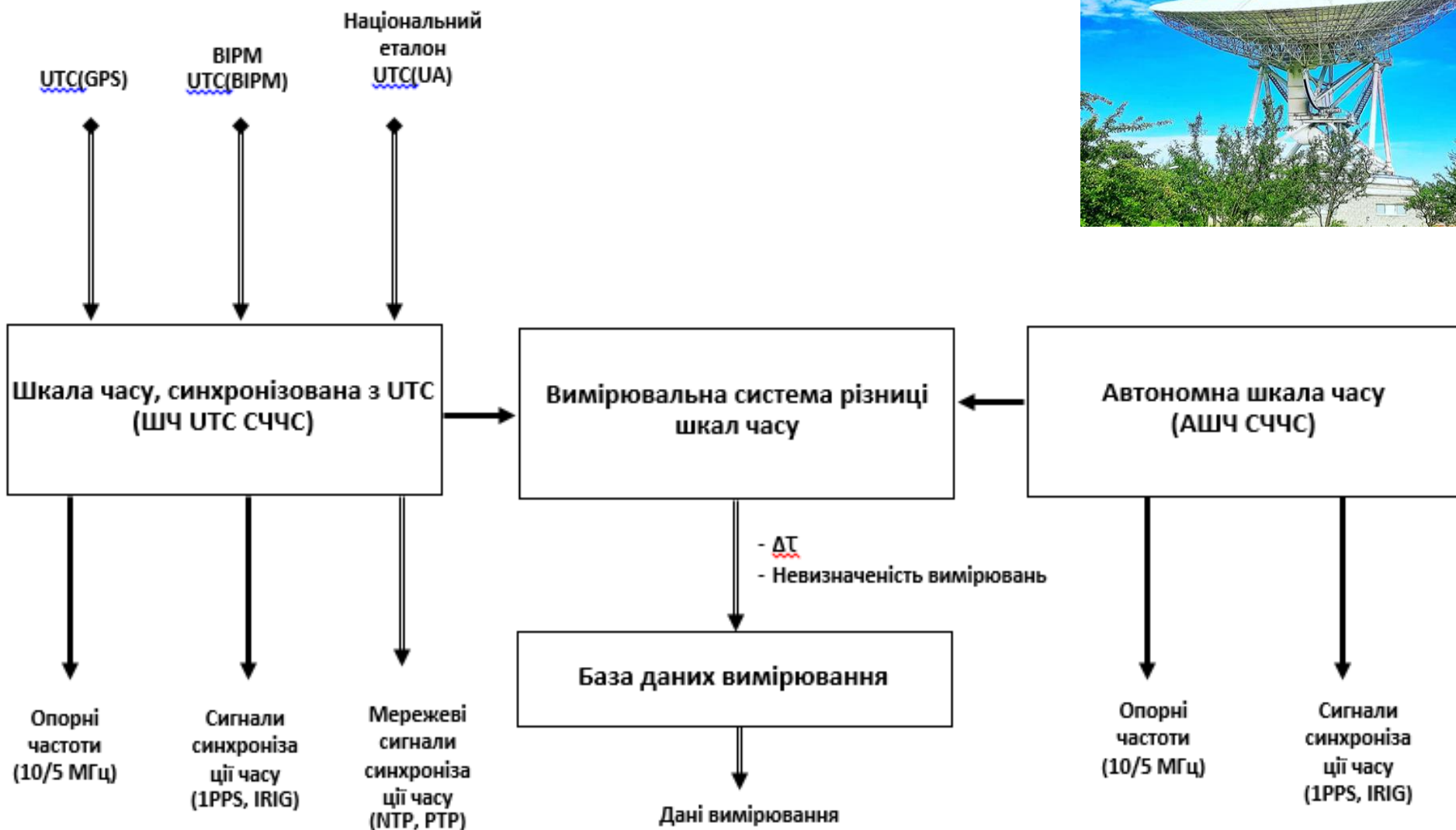
VLBI Time Scale System

Overview – Typical Solutions and Requirements



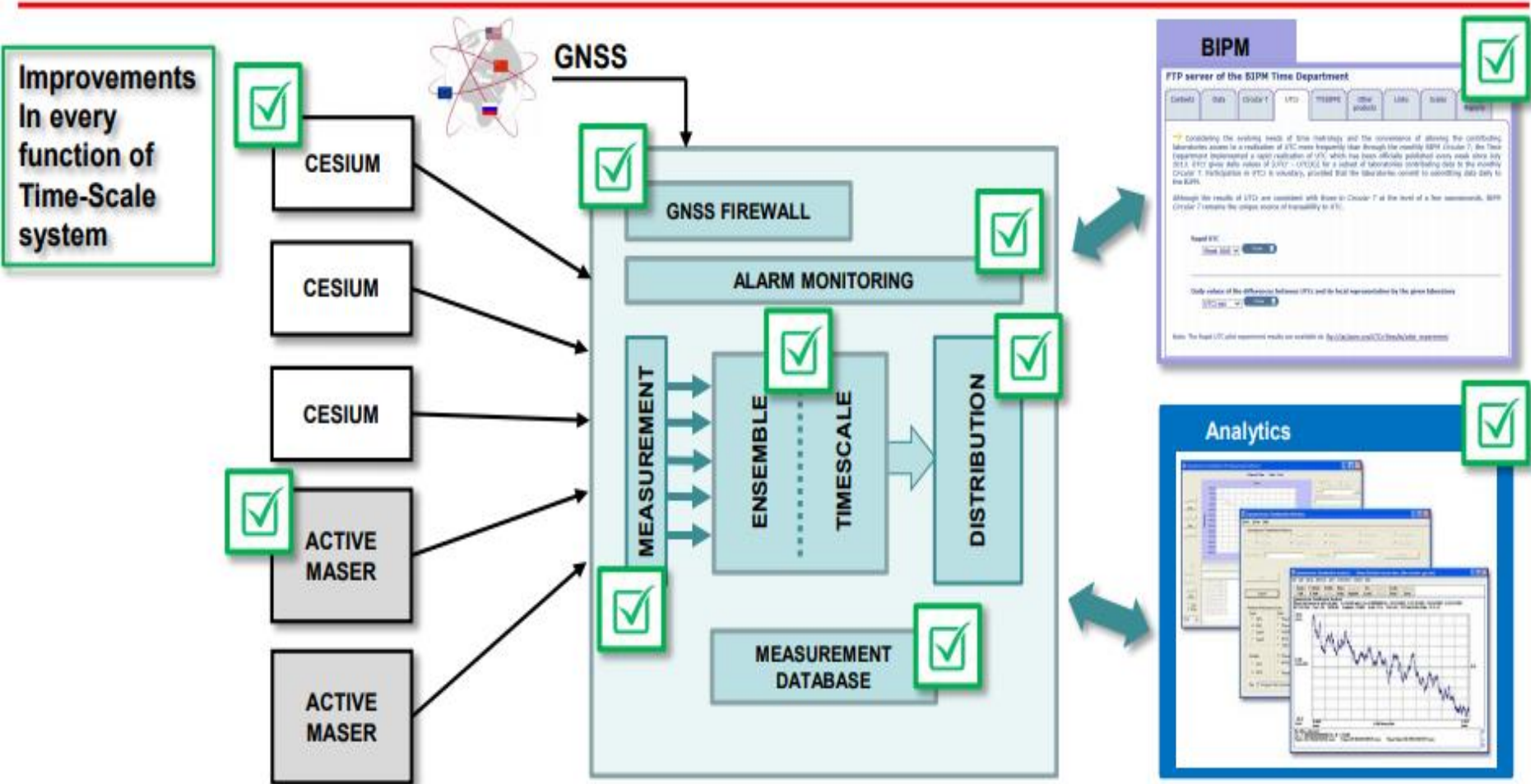


VLBI Time Scale System



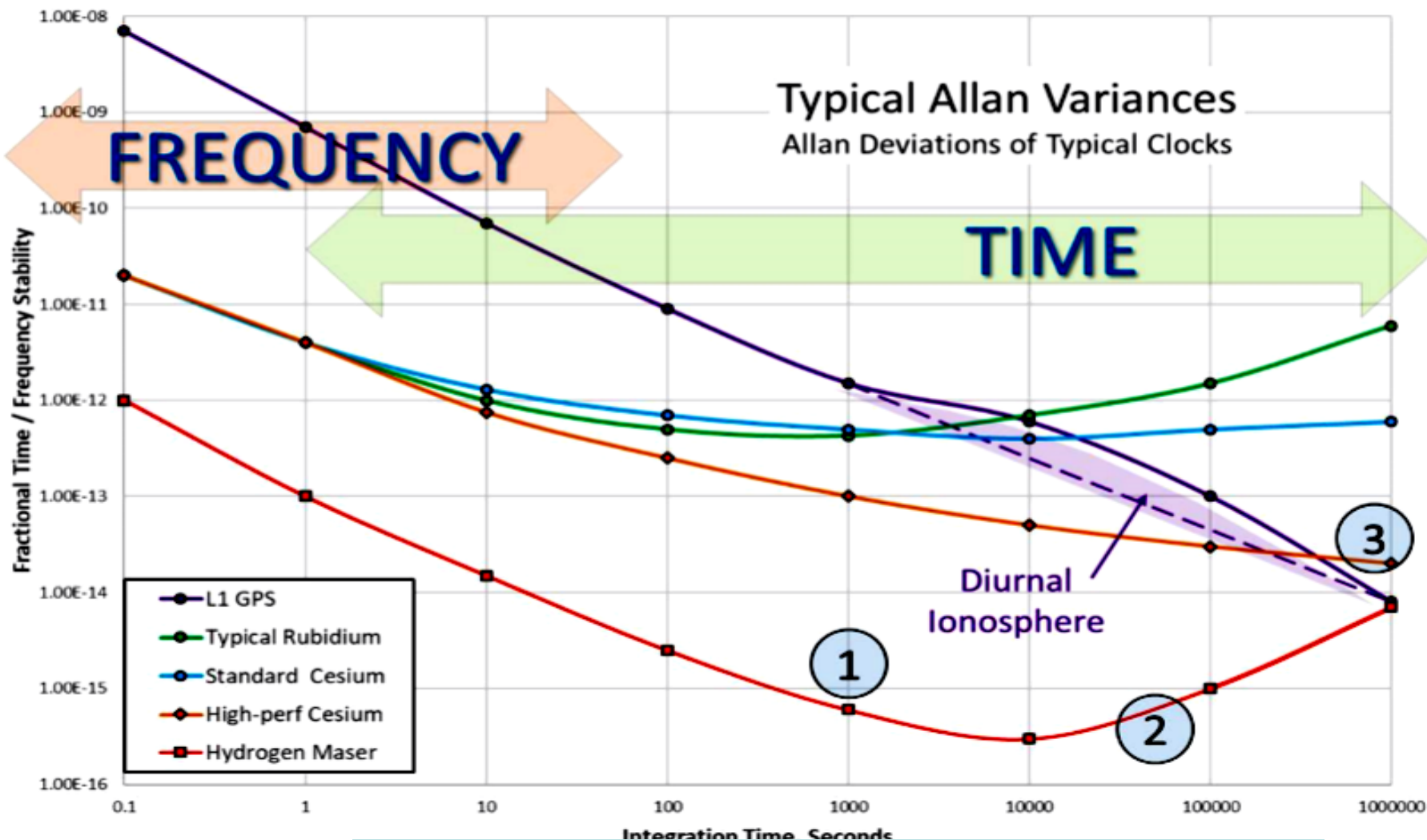


Time-Scale Overview



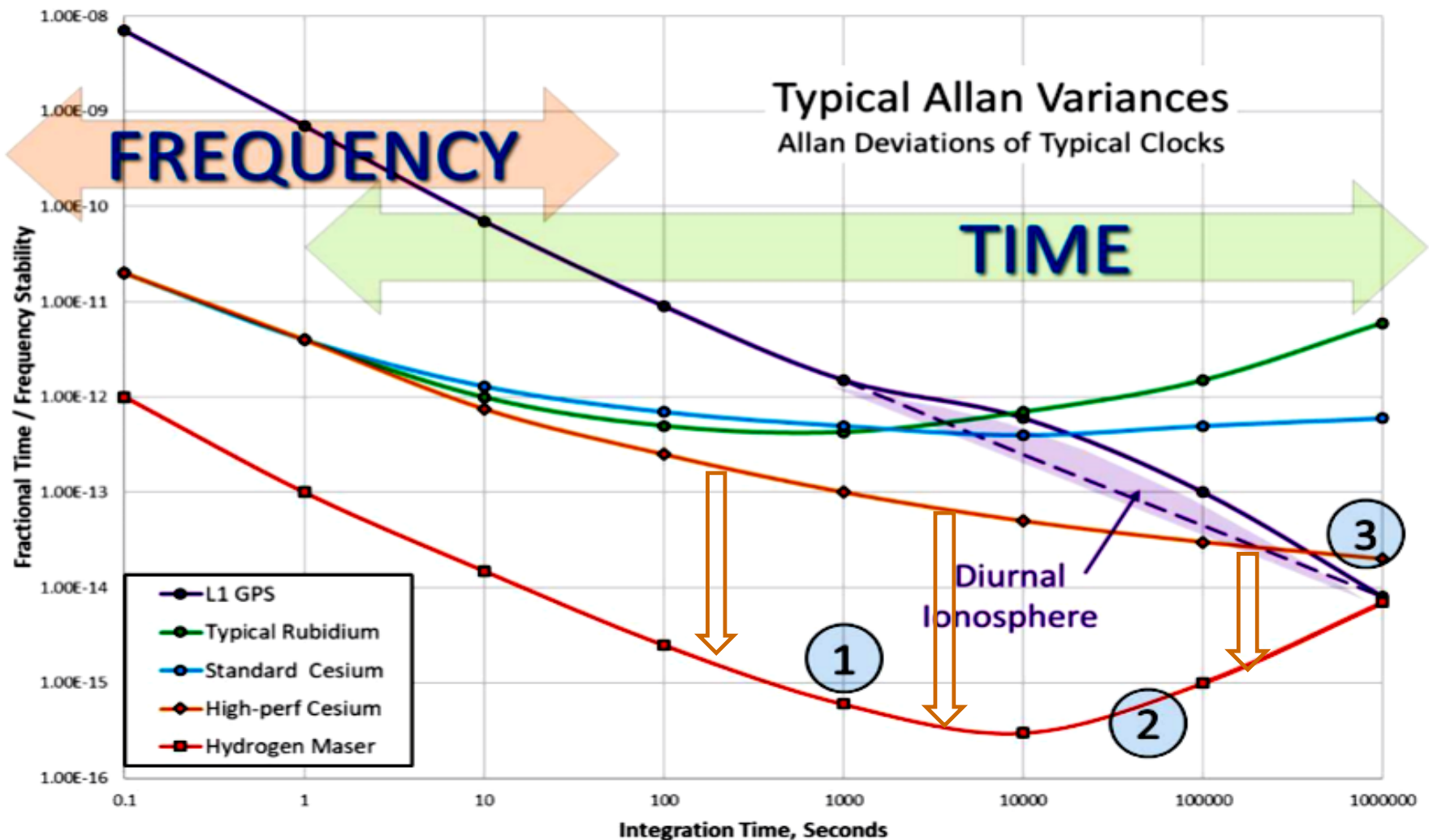


Time and Frequency in VLBI





Time and Frequency VLBI (Cesium/Hydrogen Maser)



Time and Frequency in VLBI

Background

7



- 2021

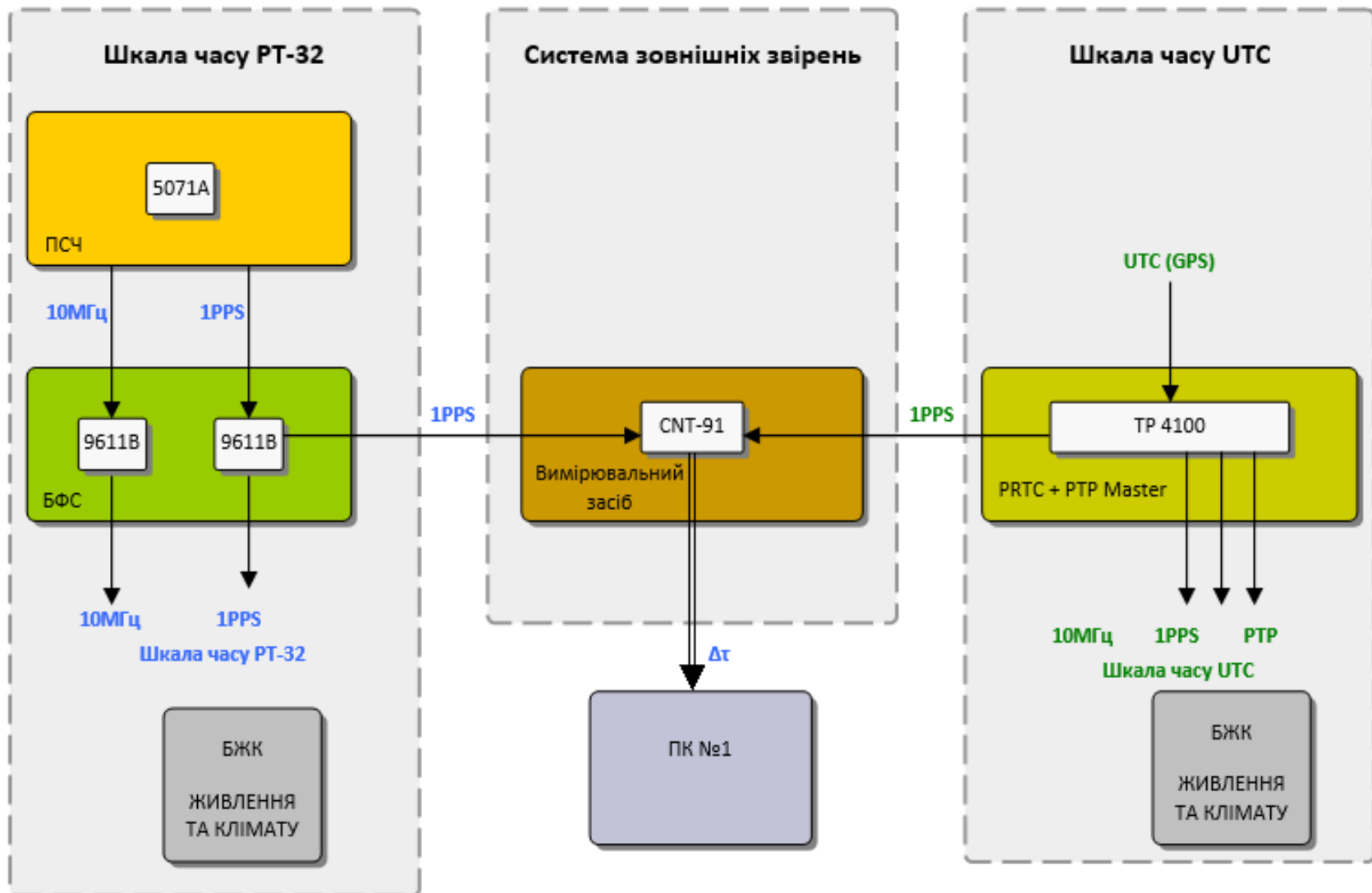


RT 32 VLBI Time Scale System

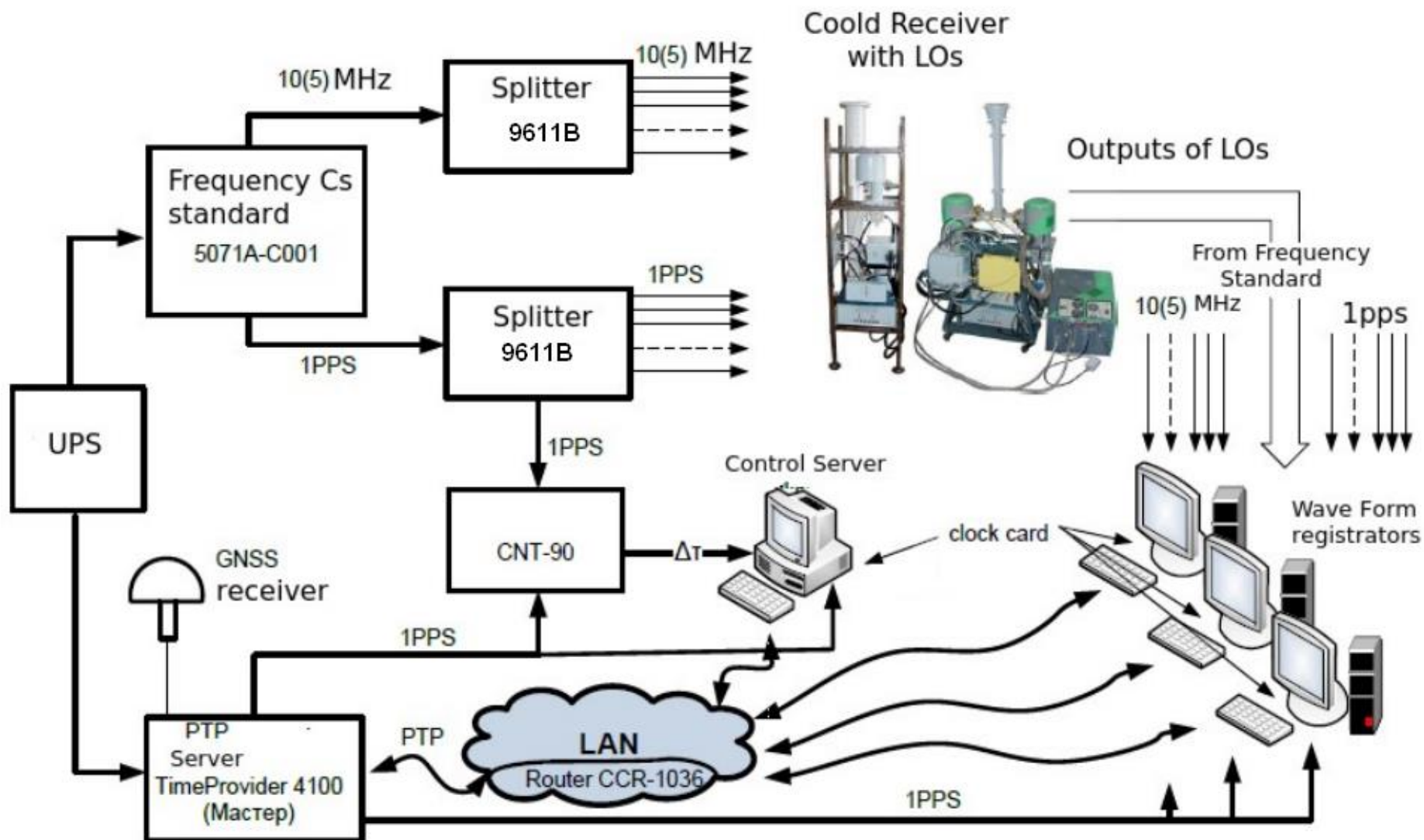
Stage 1 (version 1.0) 2020



Time Scale System v.1.0



Time Scale System v.1.0



Primary Frequency Standard 5071A-C001



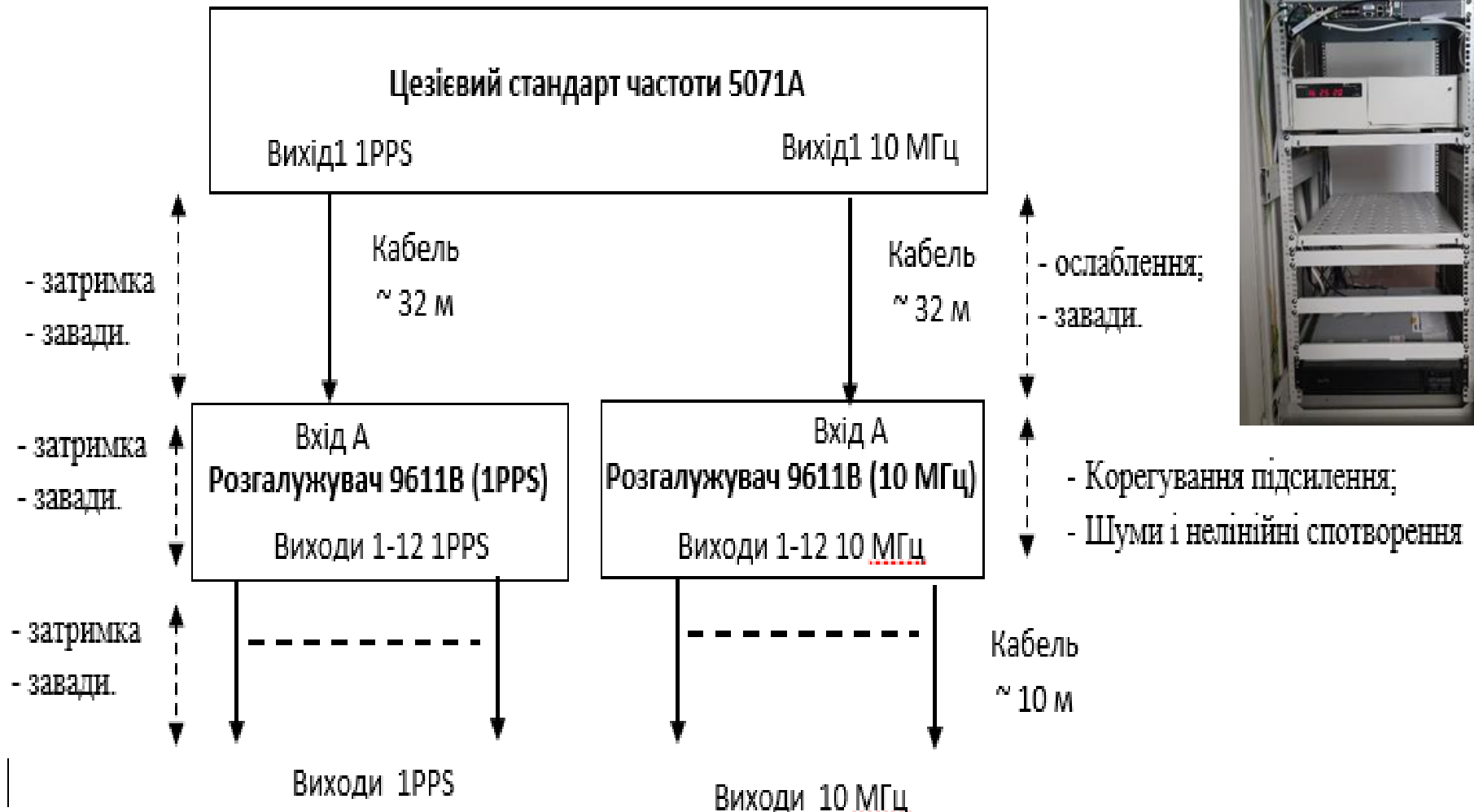
Ordering Information

Part Number	Description
5071A-C001	High-performance tube
5071A-C002	Standard performance tube
5071A-C007	High-performance tube with 48 VDC option
5071A-C008	Standard performance tube with 48 VDC op

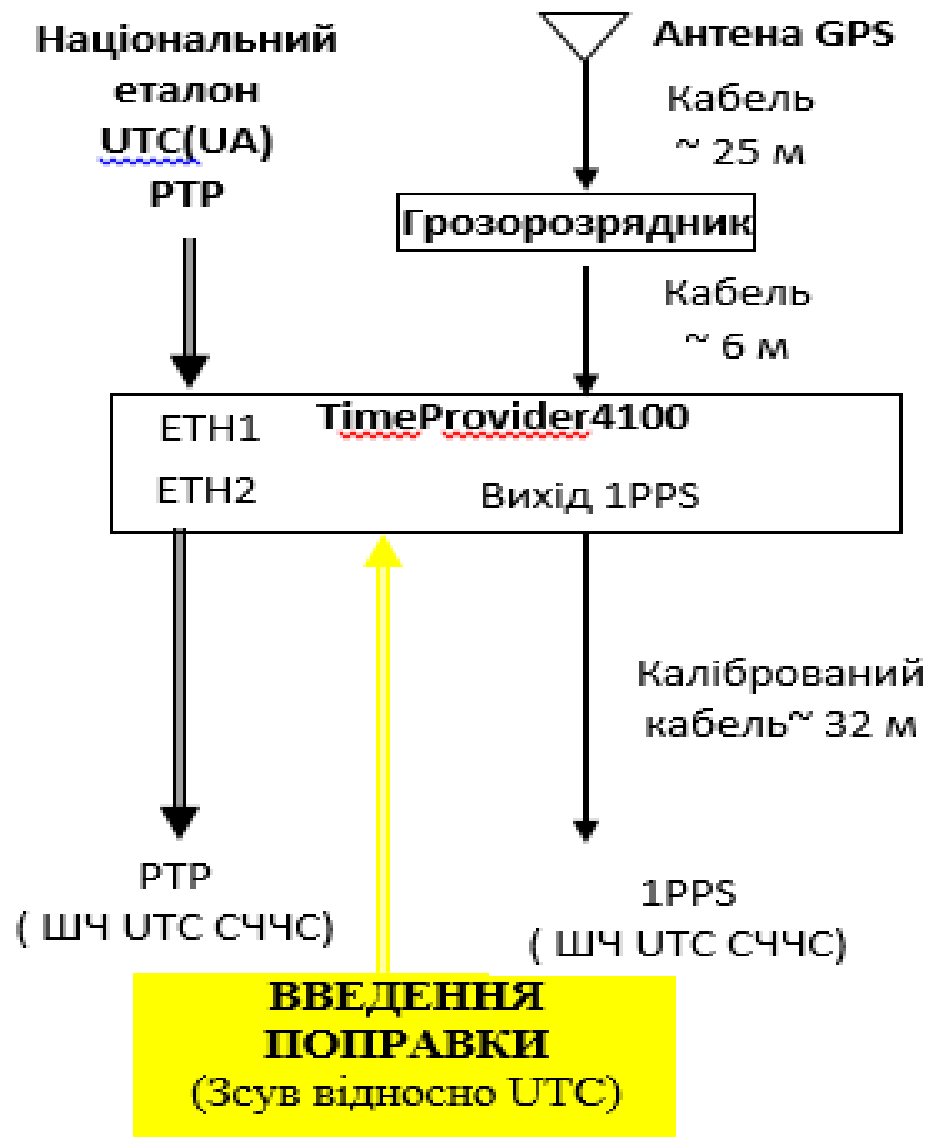
Stability (Allan Deviation)

Average Time (s)	Standard Performance	High Performance
0.01	$\leq 7.5 \times 10^{-11}$	$\leq 7.5 \times 10^{-11}$
0.1	$\leq 1.2 \times 10^{-11}$	$\leq 1.2 \times 10^{-11}$
1	$\leq 1.2 \times 10^{-11}$	$\leq 5.0 \times 10^{-12}$
10	$\leq 8.5 \times 10^{-12}$	$\leq 3.5 \times 10^{-12}$
100	$\leq 2.7 \times 10^{-12}$	$\leq 8.5 \times 10^{-13}$
1,000	$\leq 8.5 \times 10^{-13}$	$\leq 2.7 \times 10^{-13}$
10,000	$\leq 2.7 \times 10^{-13}$	$\leq 8.5 \times 10^{-14}$
100,000	$\leq 8.5 \times 10^{-14}$	$\leq 2.7 \times 10^{-14}$
5 days	$\leq 5.0 \times 10^{-14}$	$\leq 1.0 \times 10^{-14}$
30 days	$\leq 5.0 \times 10^{-14}$	$\leq 1.0 \times 10^{-14}$
Flicker floor: Guaranteed	$\leq 5.0 \times 10^{-14}$	$\leq 1.0 \times 10^{-14}$
Typical	$\leq 1.5 \times 10^{-14}$	$\leq 5.0 \times 10^{-15}$

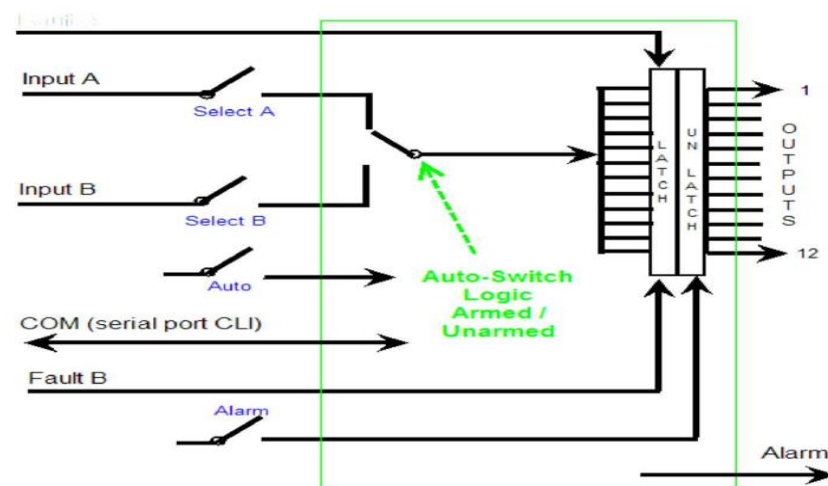
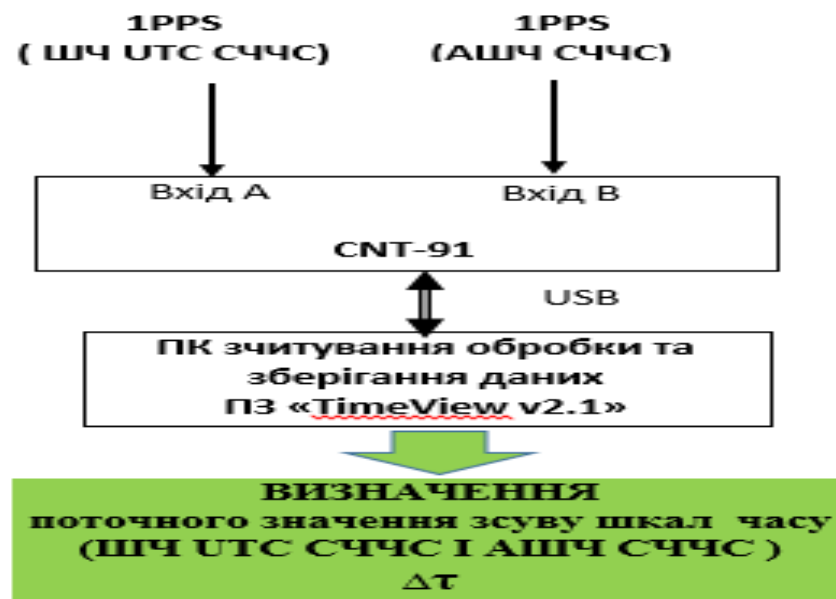
Rack #1/ Master Time Scale



Rack #1/UTC Time Scale



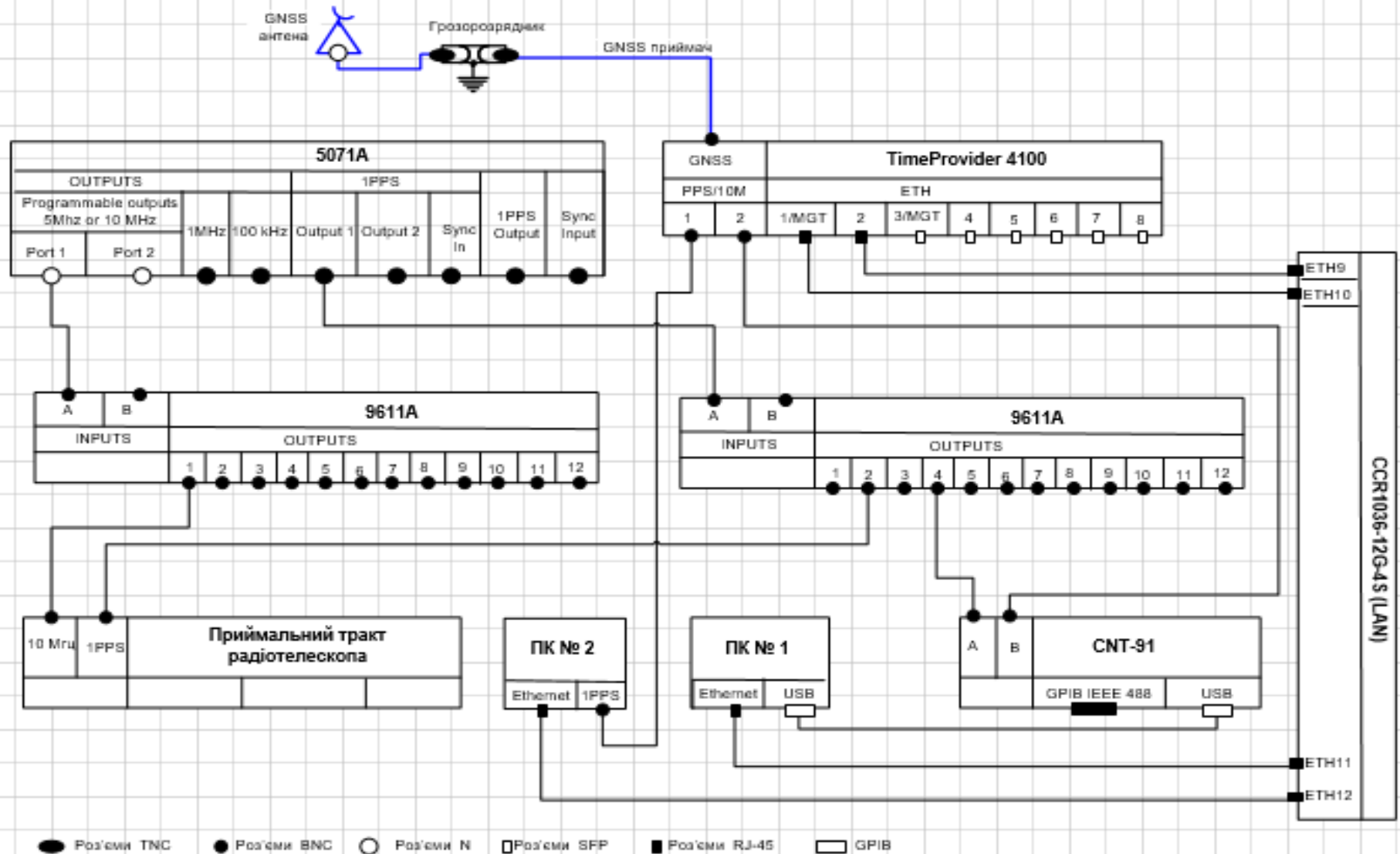
Time Scale Measurement System





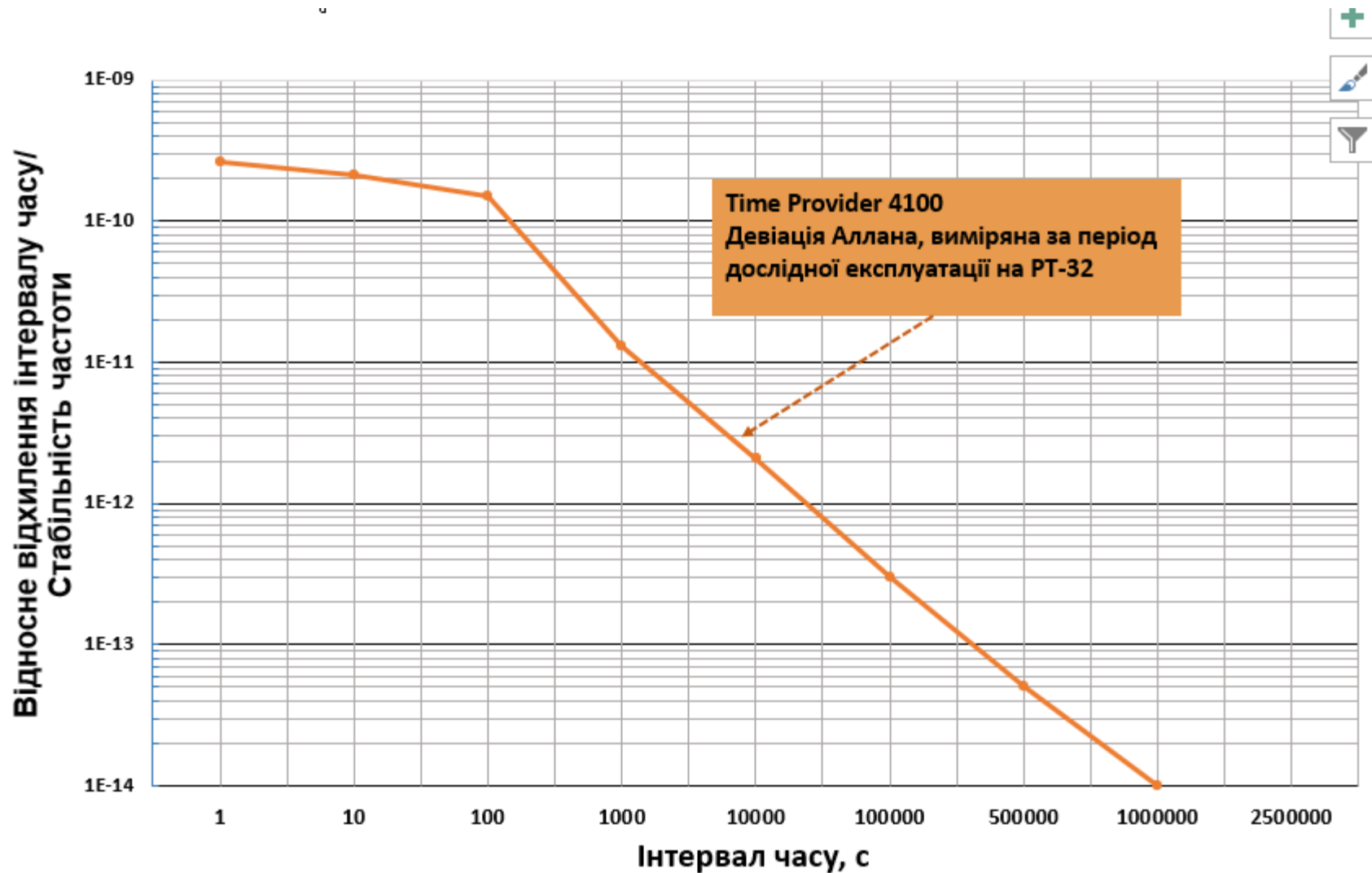
Time Scale v.1.0 Diagram

Схема сигнальних з'єднань обладнання.



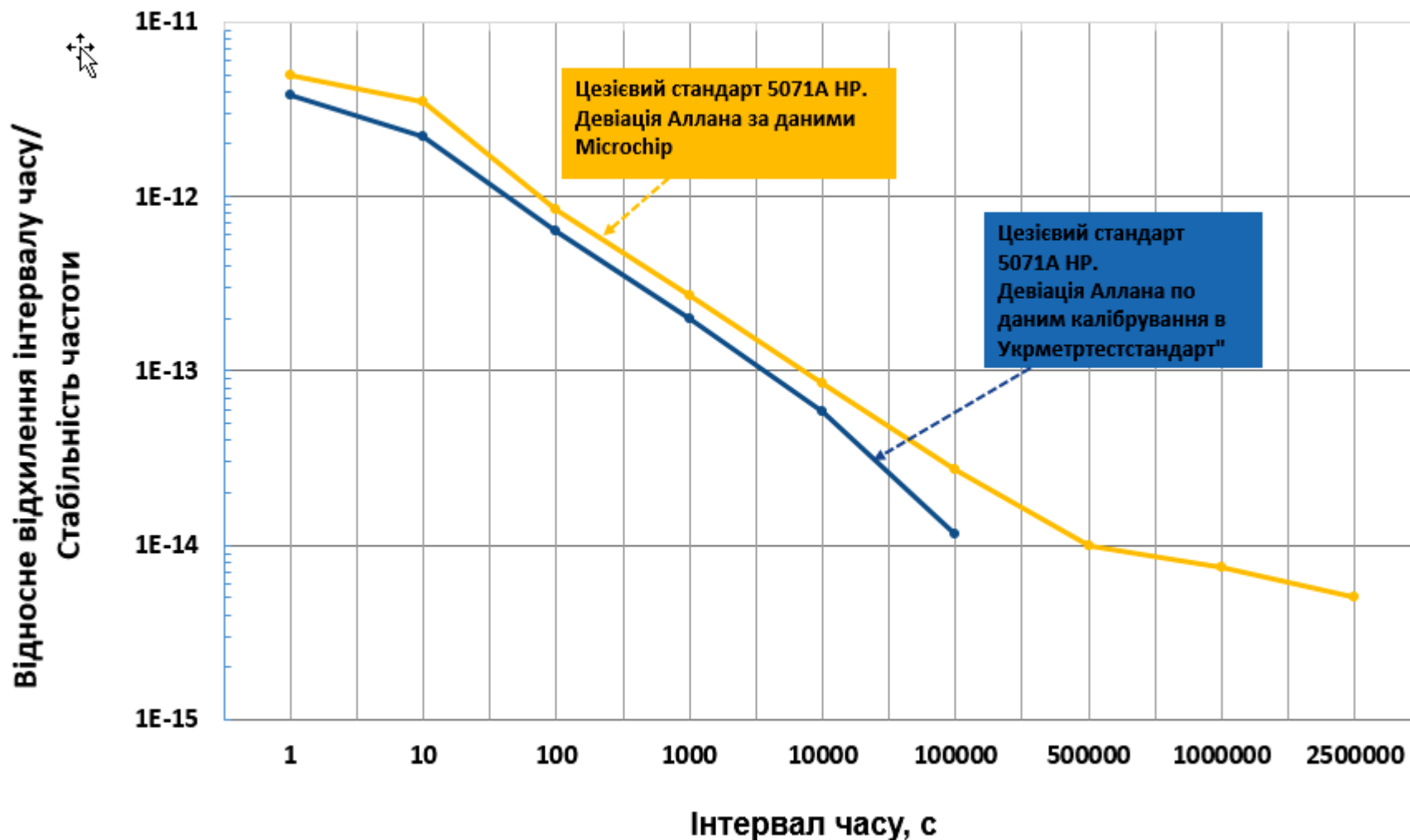


UTC Time Scale

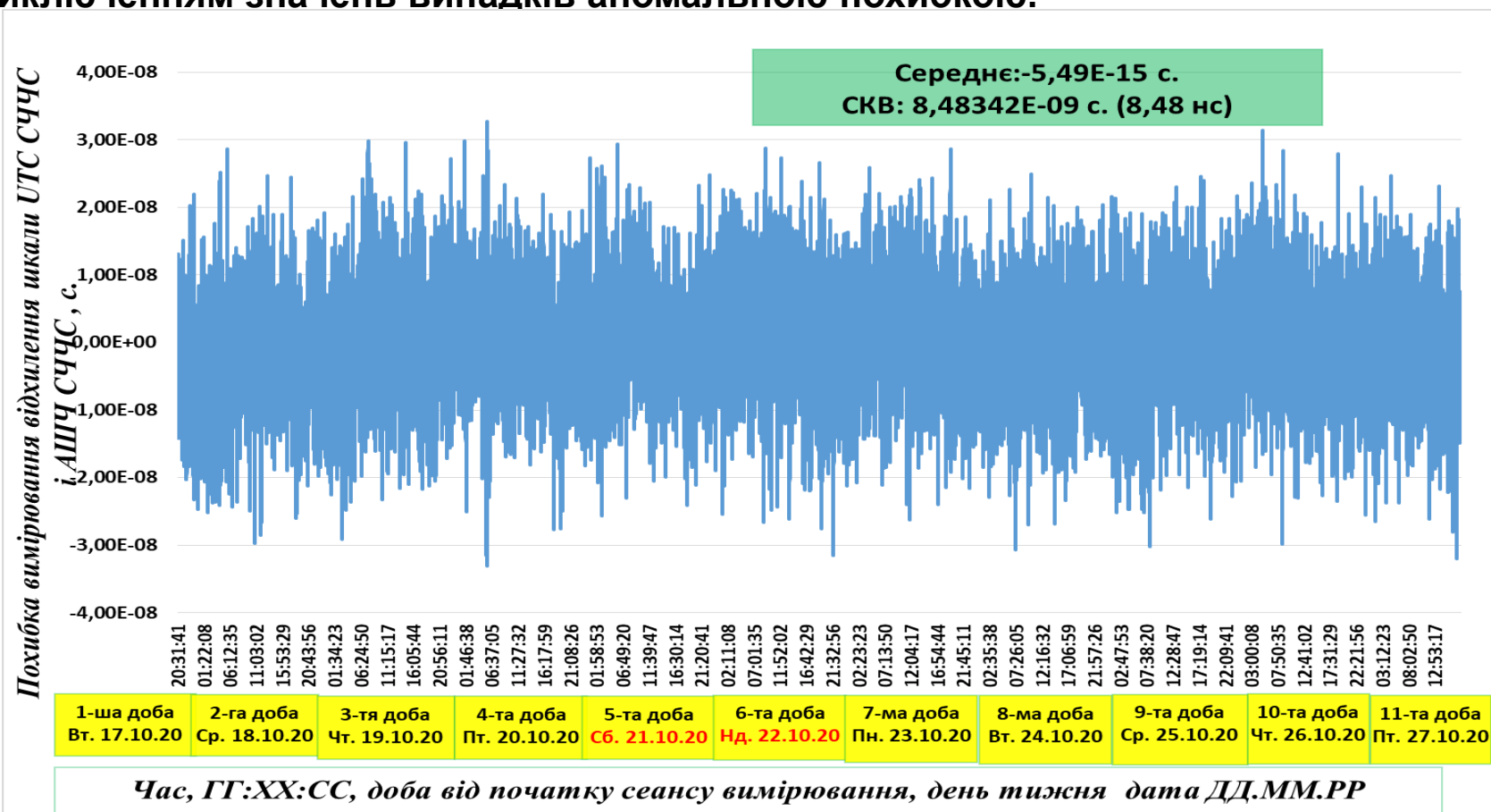




Stability of Frequency Master Scale (Reference Cs 5071A High Perform.)



Результати визначення похибки вимірювання розходження автономної шкали часу СЧЧС (шкали часу Цезієвого стандарту 5071A) та шкали часу UTC, сформованої РТР сервером TimeProvider 4100 (вихід 1PPS) на протязі 11-ти діб в процесі дослідної експлуатації в 2020 р. СКВ похибки складає 8, 48 нс. З виключенням значень випадків аномальною похибкою.





RT 32 VLBI Time Scale System

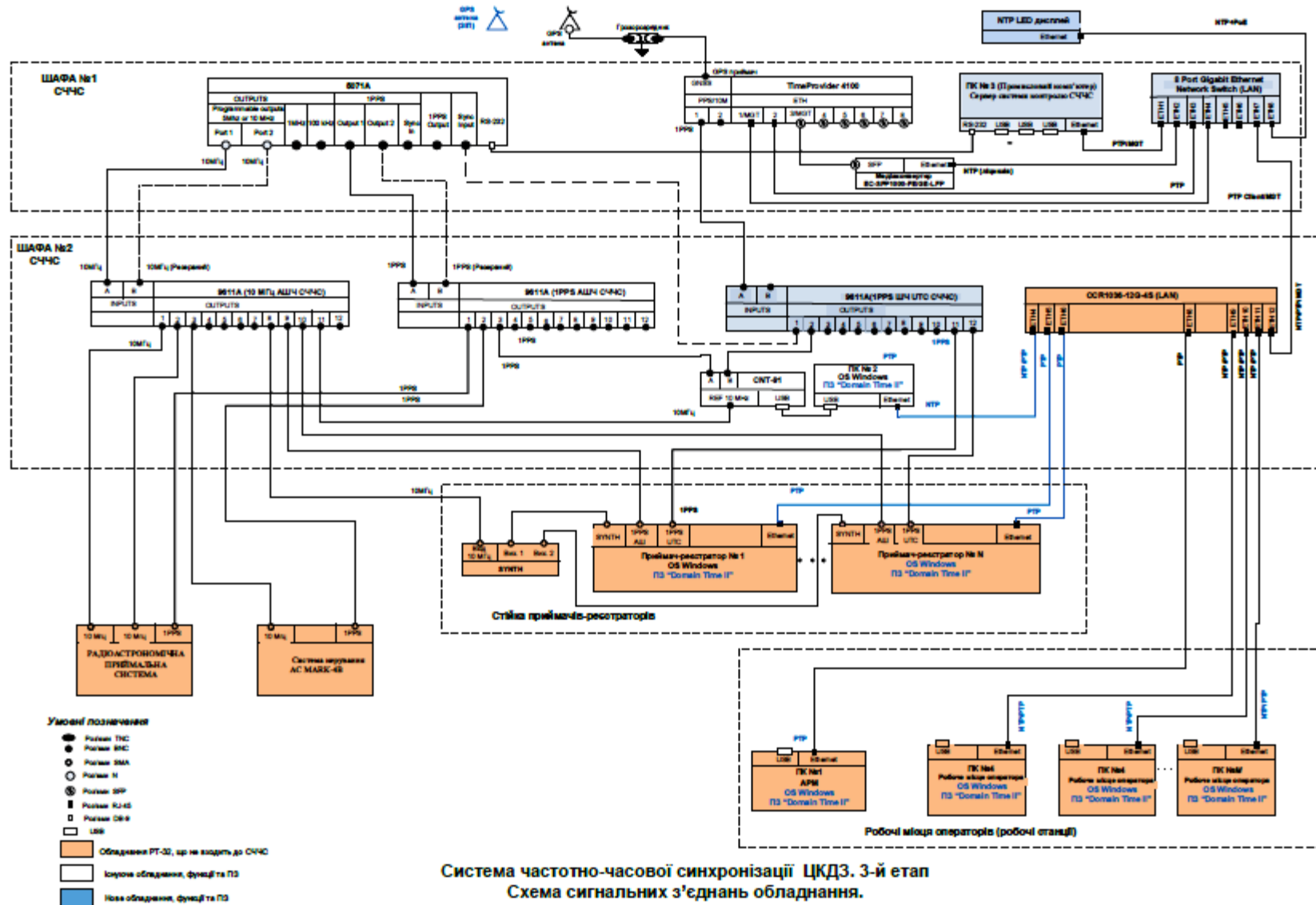
Stage 2 (version 1.1)

2021





Time Scale v 1.1 (2021)



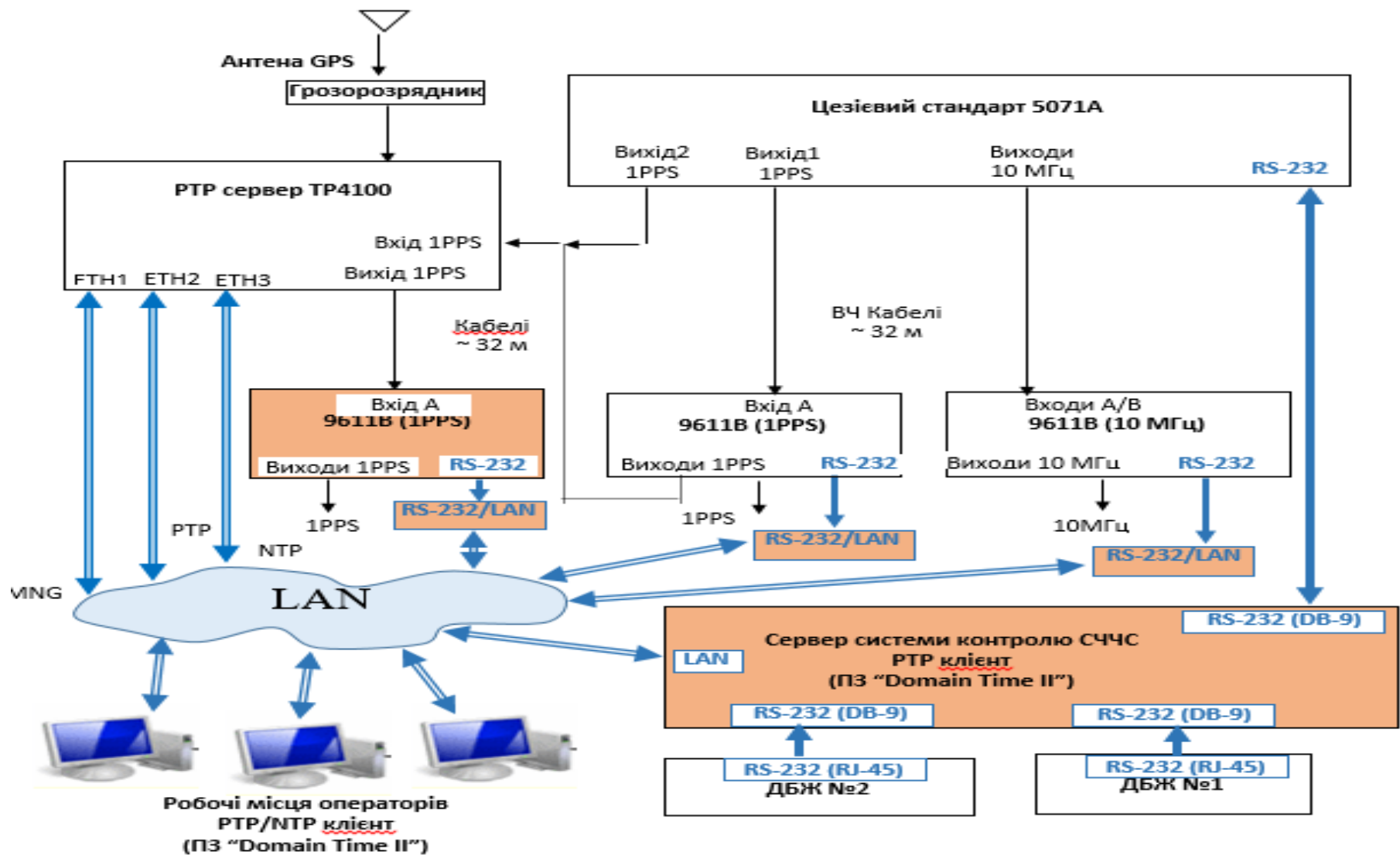


Time Scale v 1.1 (2021)



Time Scale System

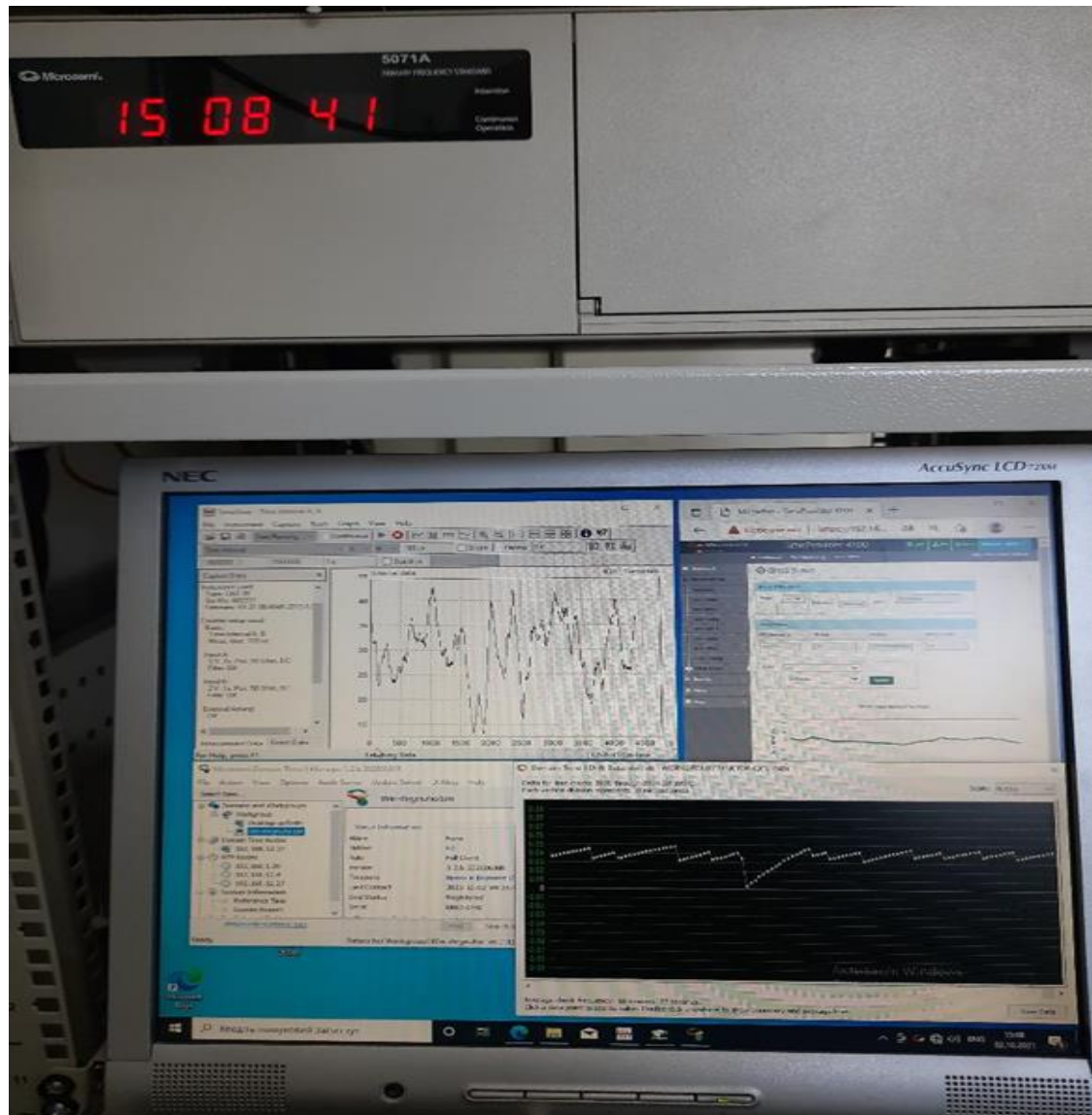
Control, measurement, monitoring





Time Scale System

Control, measurement, monitoring





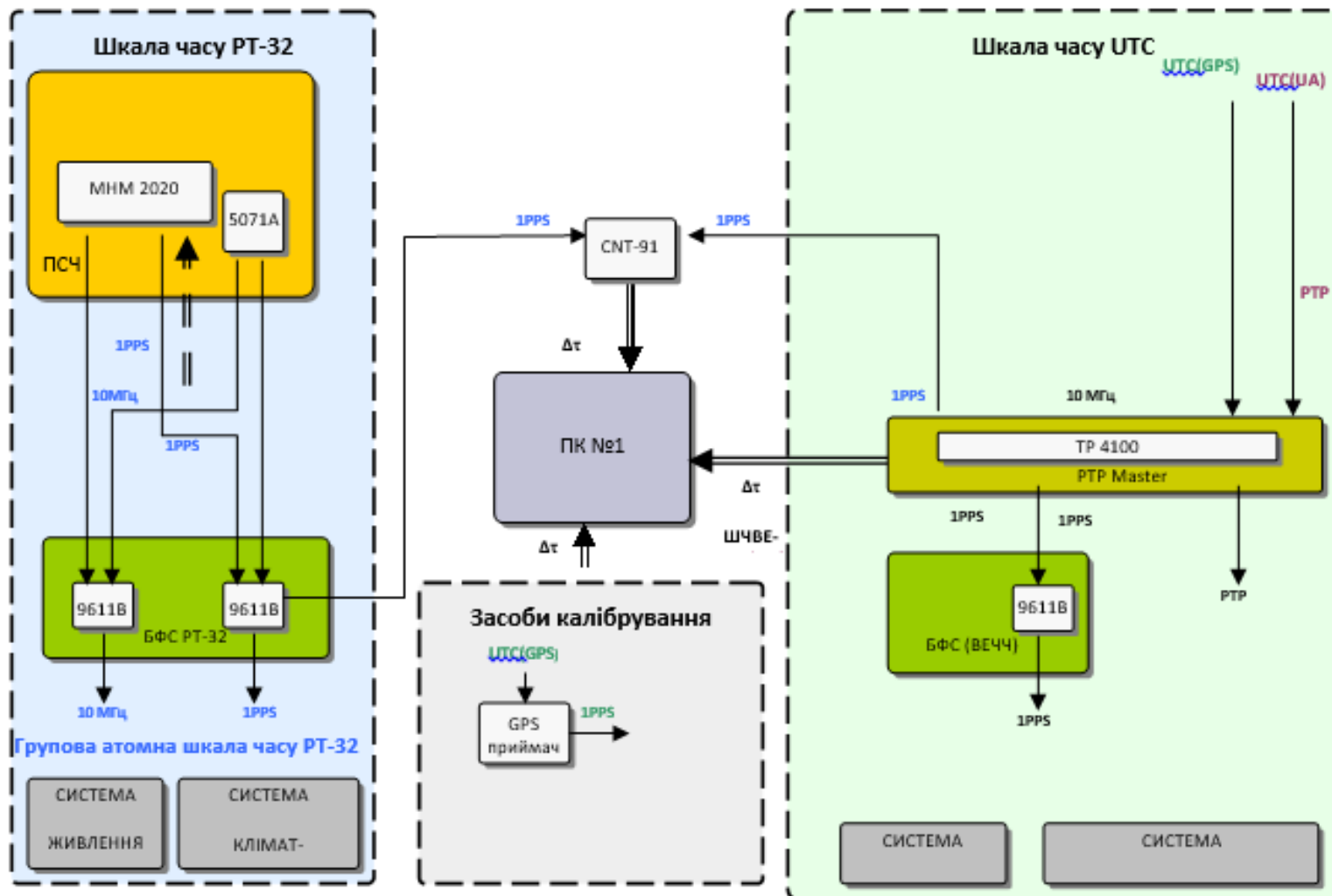
Time Scale System RT32

Next Steps



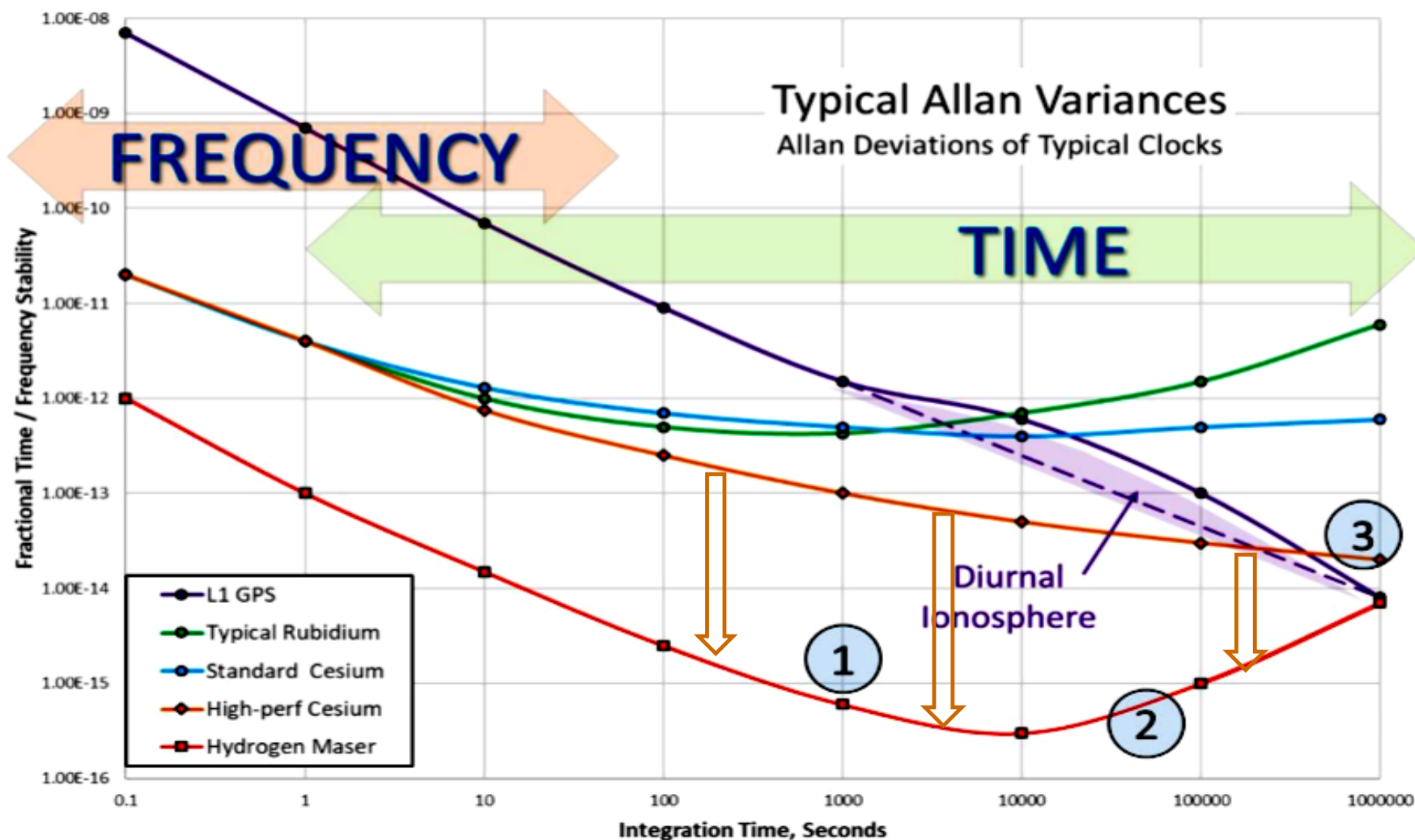


Time Scale v 2.0 (2022) (+Mazer)





Time and Frequency VLBI (Time Scale System v. 2.0)



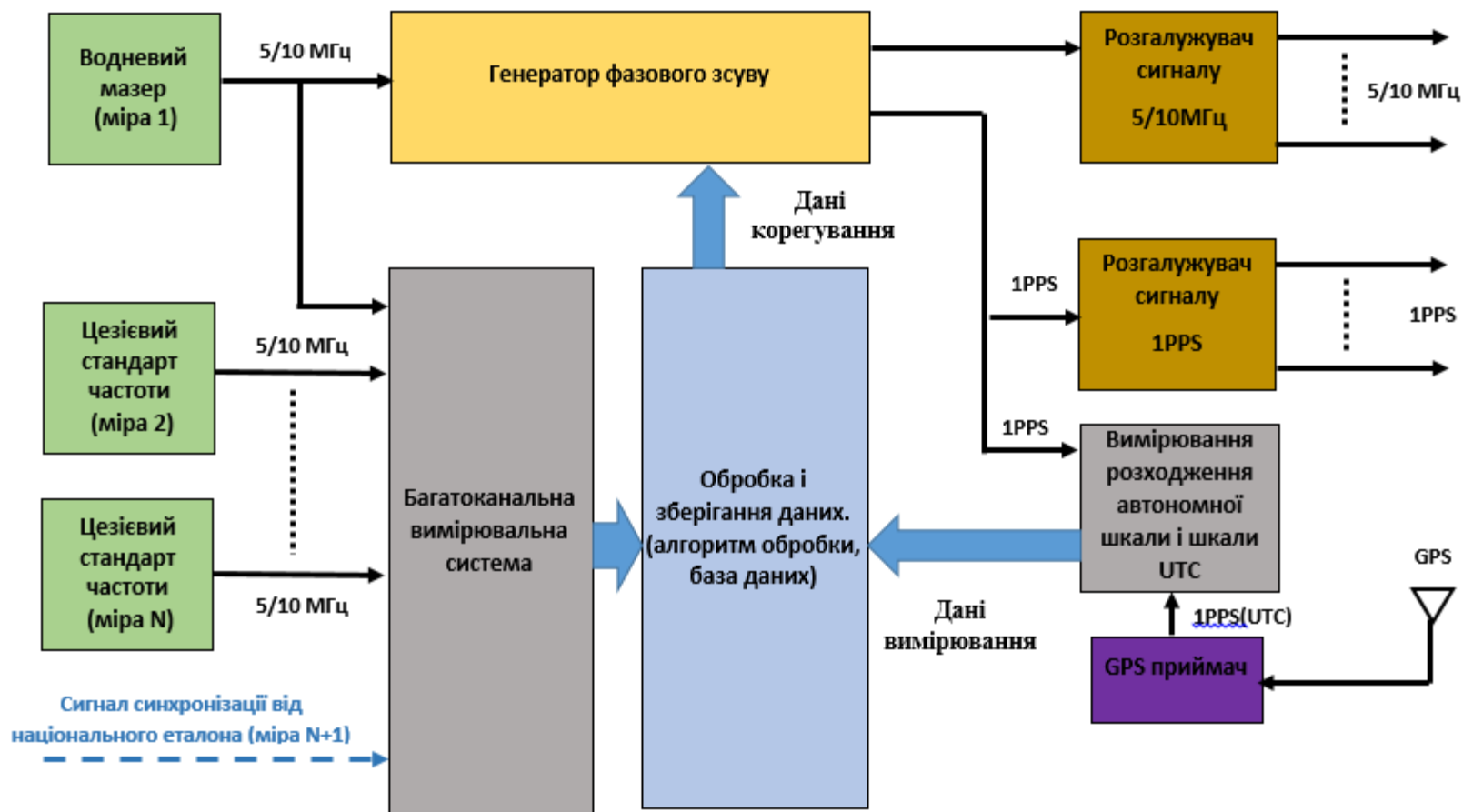
Time and Frequency in VLBI

Background

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Group Time Scale System

Структурна схема формування групової атомної шкали часу

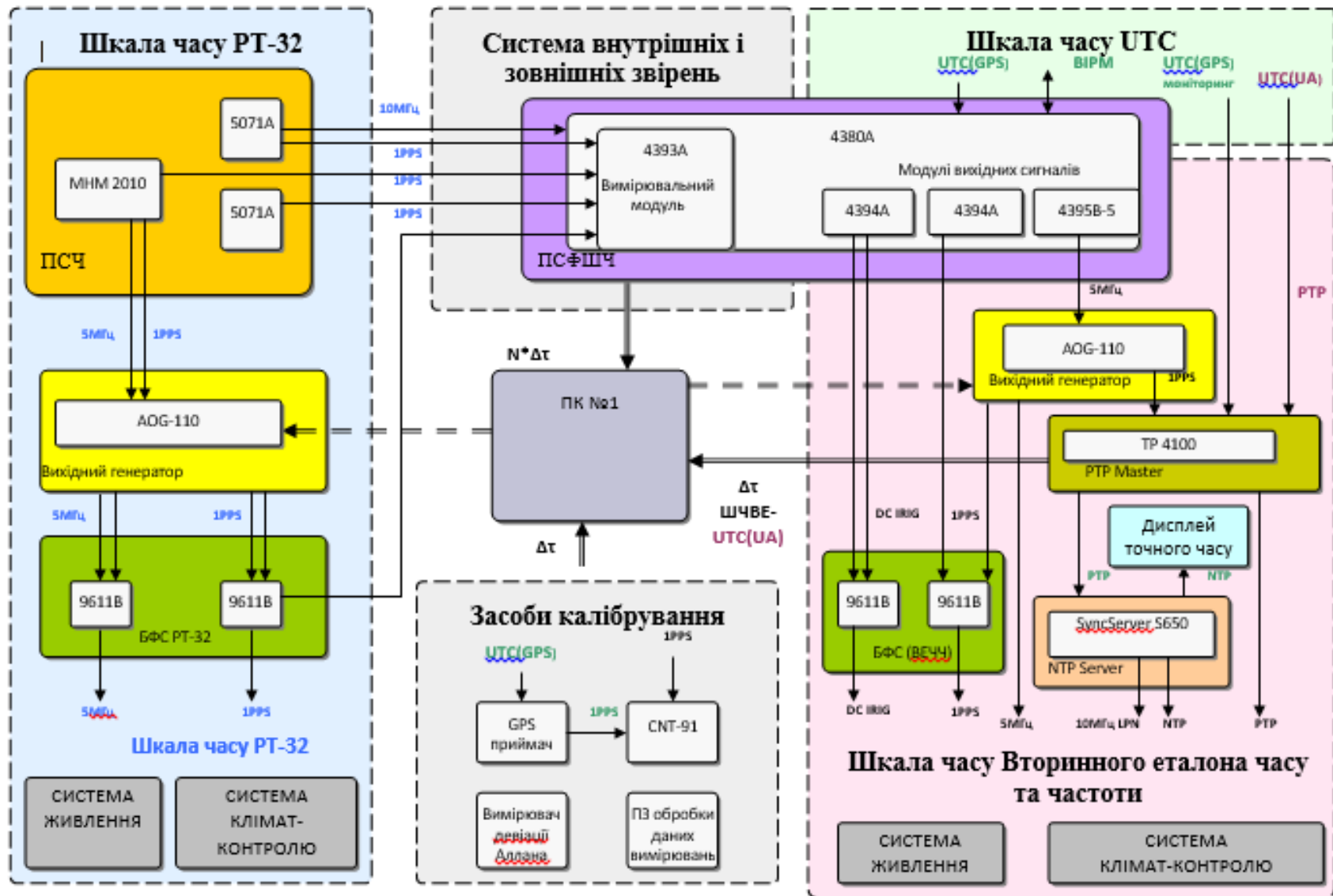




- **Національні еталони часу та частоти**
(в Україні первинний національний еталон - «Інститут метрології» , м. Харків і вторинний національний еталон – «Укрметртестстандарт», м. Київ.
- **Радіотелескопи:**
 - ✓ **Onsala Space Observatory**
 - ✓ **Sardinia Radio Telescope**
 - ✓ **Observatory Wettzell**
 - ✓ **SKA1-MID**
 - ✓ **.....**

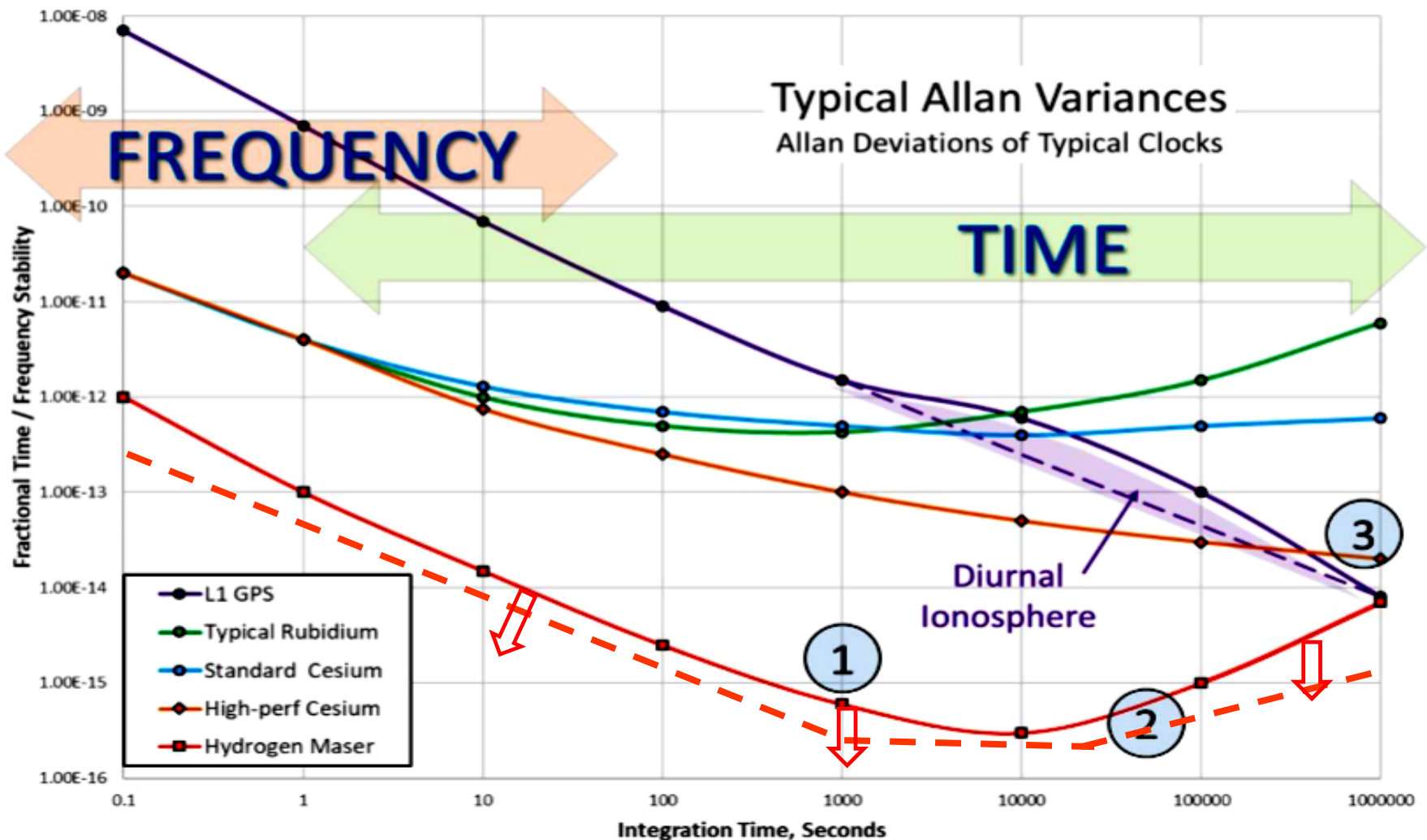


Group Time Scale System





Group Time Scale System



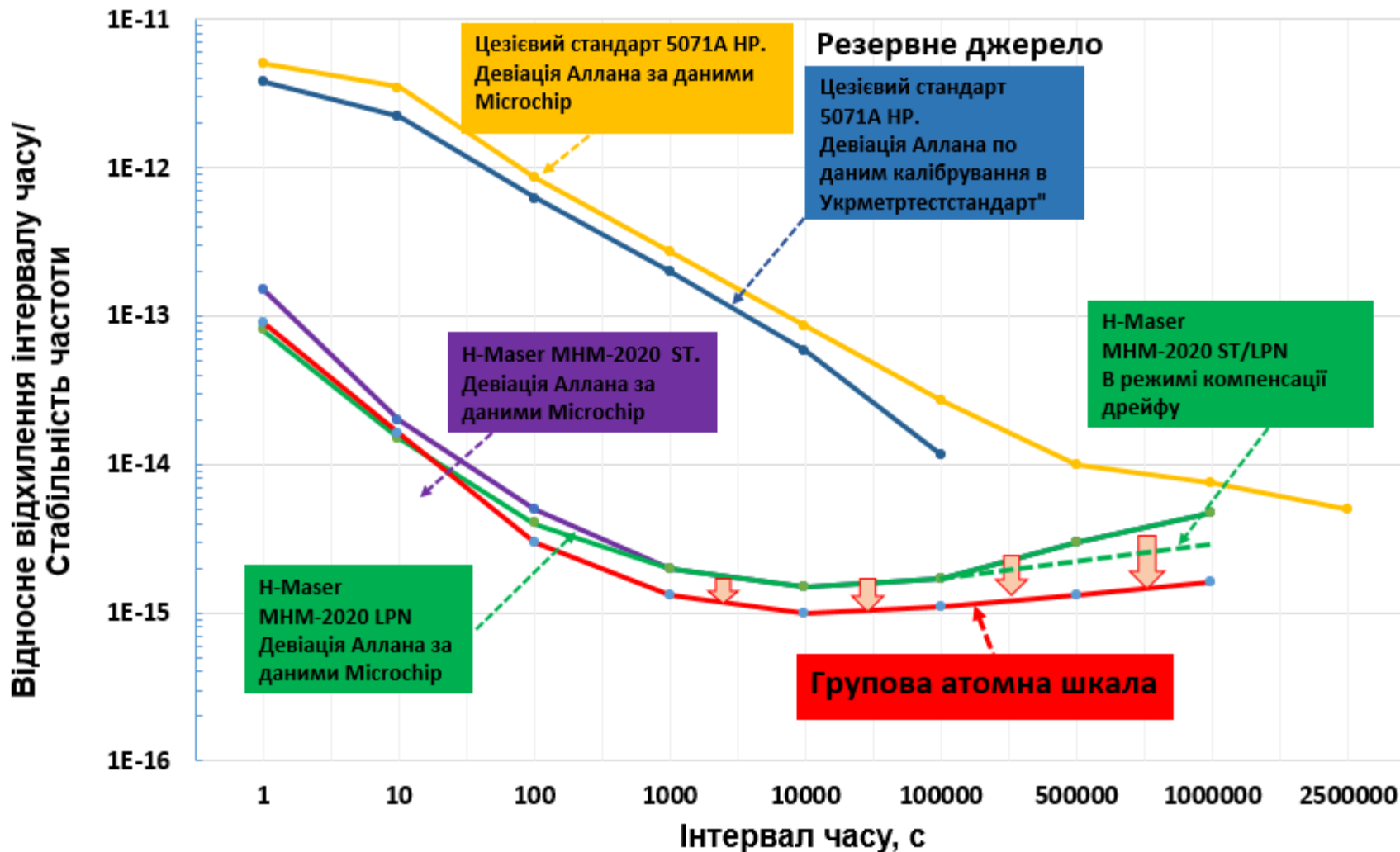
Time and Frequency in VLBI

Background

7



Time and Frequency (Cs+Maser+Group)





- Quantum Technologies
- Radioastronomy
- Ultracold atoms Physics
- Space - Galileo
- Finance

7 Research Institutes linked:
 CNR – National Research Council
 ASI – Italian Space Agency
 INAF – Italian Astrophysics Institute

3 Industrial Users
 Thales Alenia Space Italy
 Telespazio;
 Consortium Top-IX

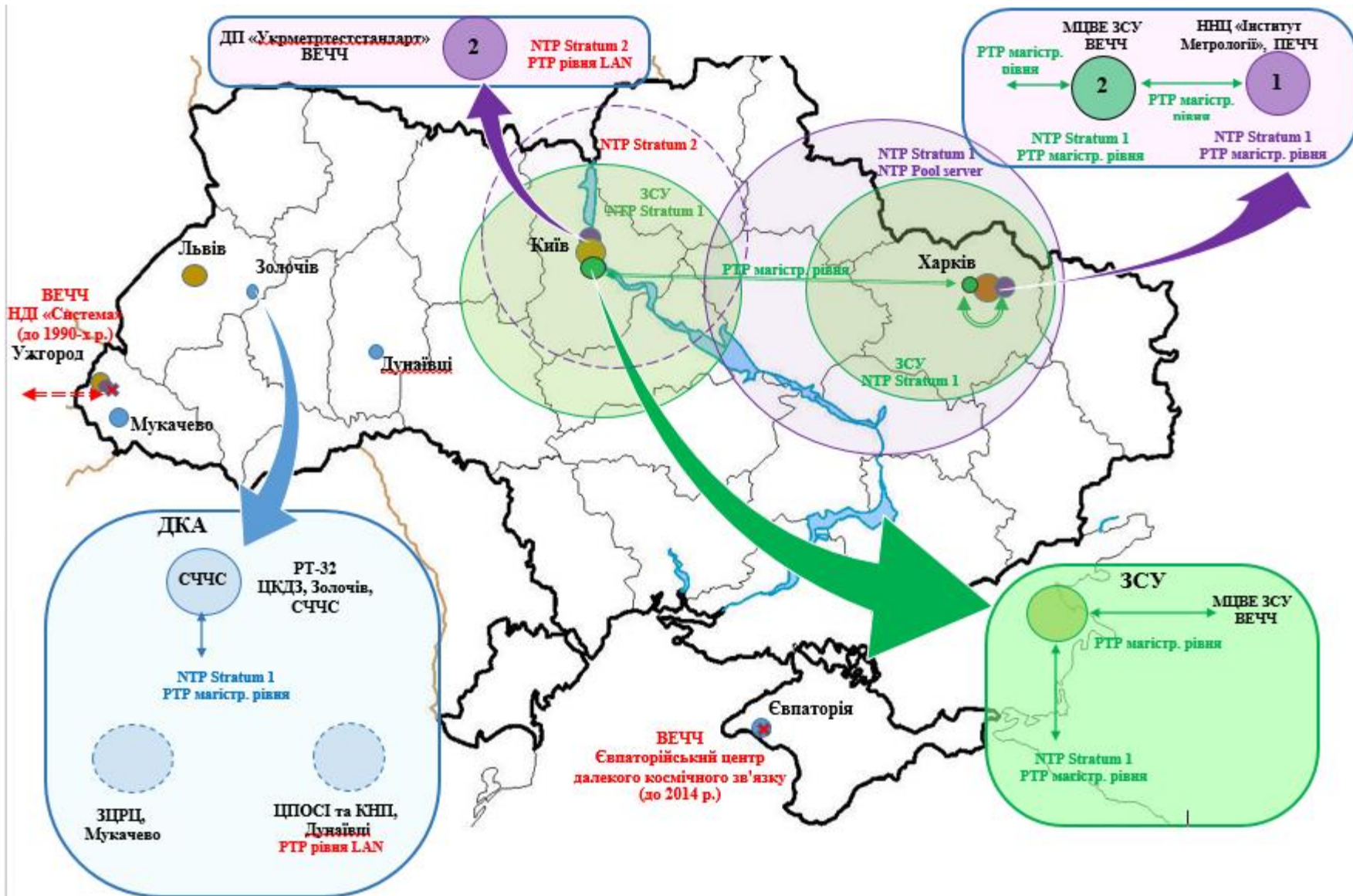
Coherent Technique (now)
 To be added: WR-PTP

TF_15-05_INRiM_report.pdf





Time Scale System VLBI RT-32 Zolochiv and Ukraine National Time Keeping Service





Thank you!

Viktor Gaidamanchuk

WIRCOM Co.

Kyiv, Ukraine

gva@wircom.ua