



Latvian Geospatial
Information Agency

Latvian Geospatial Information agency national report

NKG Working Group for GNSS positioning

National Land Survey of Finland

04.-05.03.2025

Department of Geodesy
Geodetic measurements division
senior geodetic engineer Andris Priževīts



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Operating base
stations:

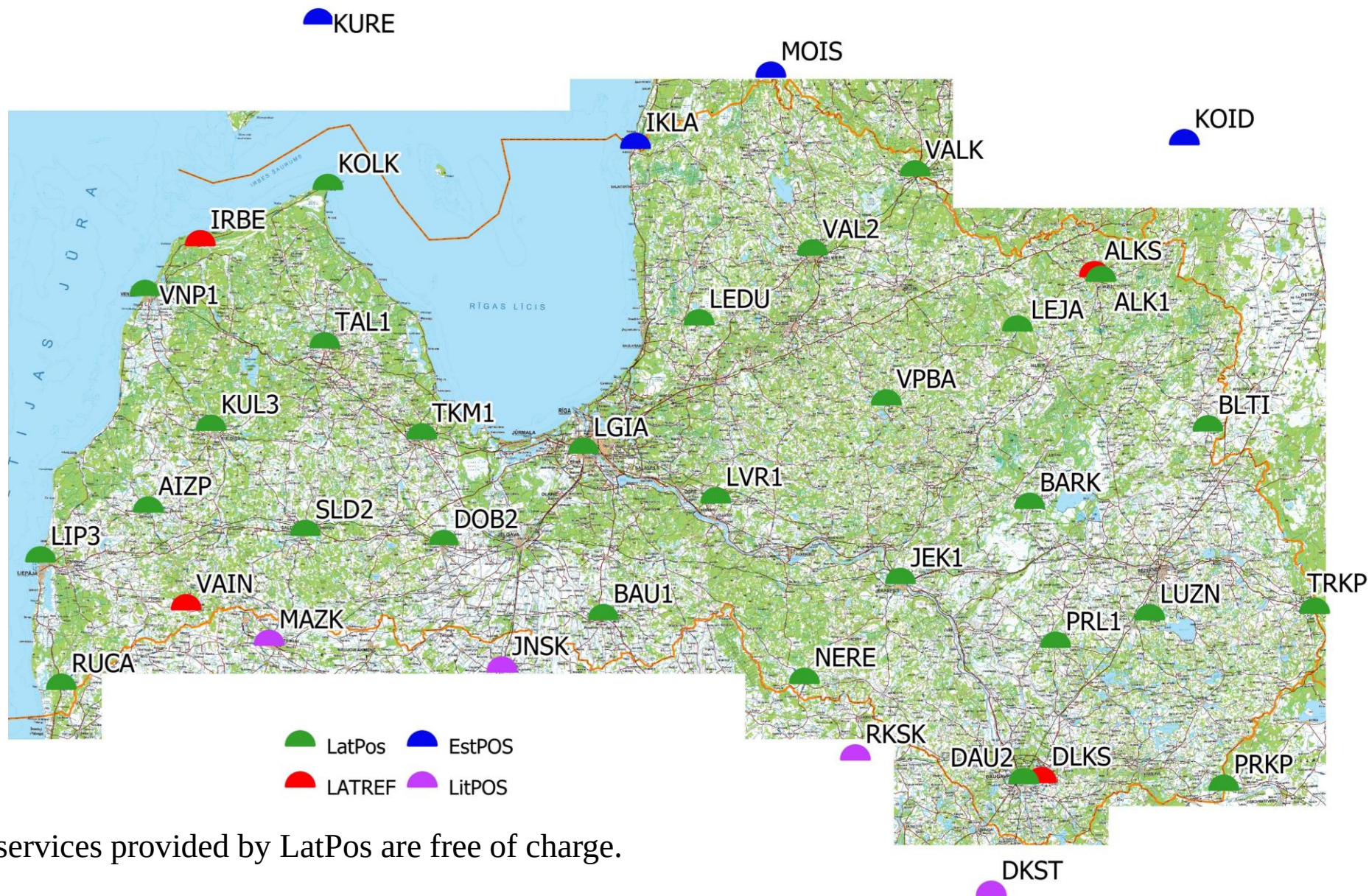
- LatPos 28
- +
•EstPOS 5
- +
•LitPOS 4

Received GNSS
systems:

- GPS NAVSTAR
- GLONASS
- Galileo
- BeiDOU

Software: GNSS Spider

Technical characteristics of LatPos, till 25.02.2025

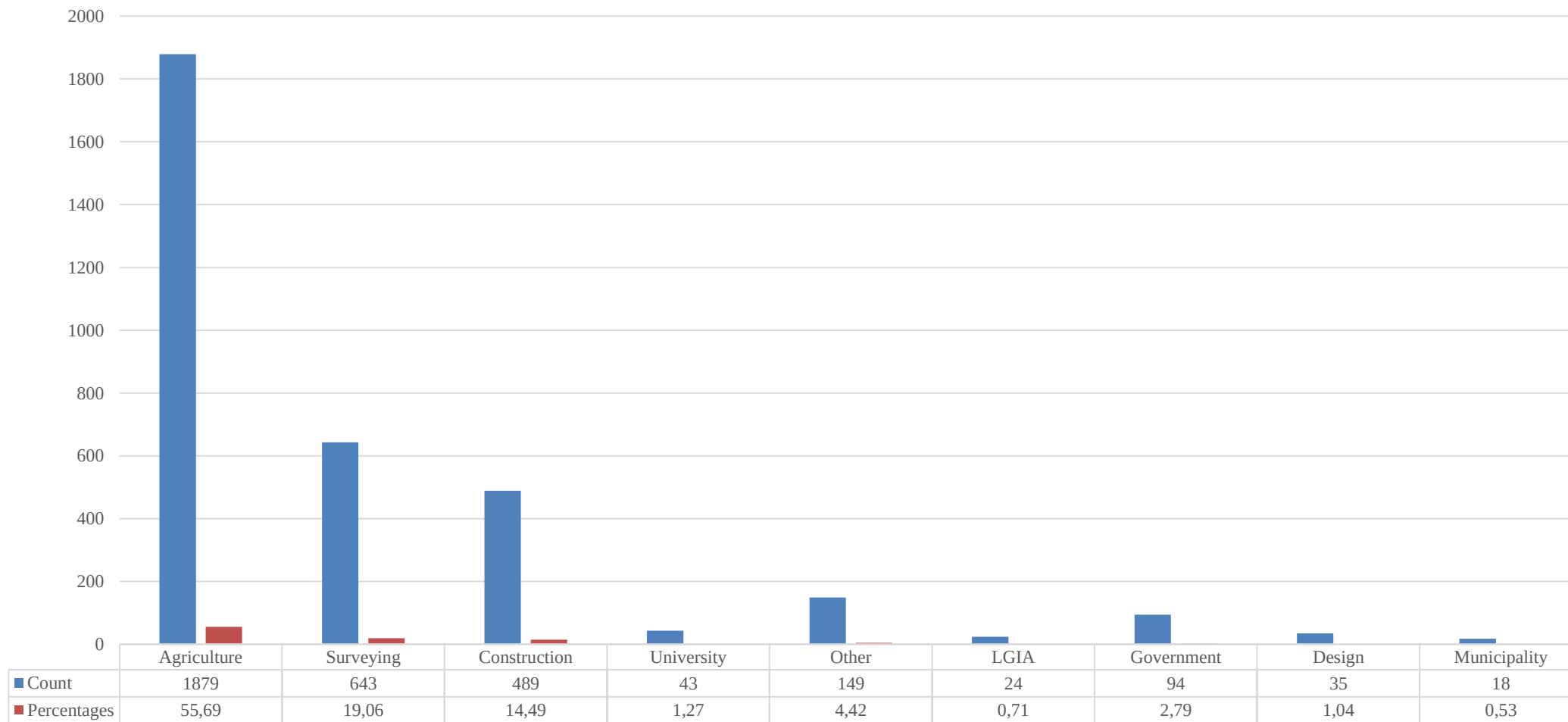


Since July 1, 2018, all services provided by LatPos are free of charge.



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Distribution of LatPos users by group, till 25.02.2025

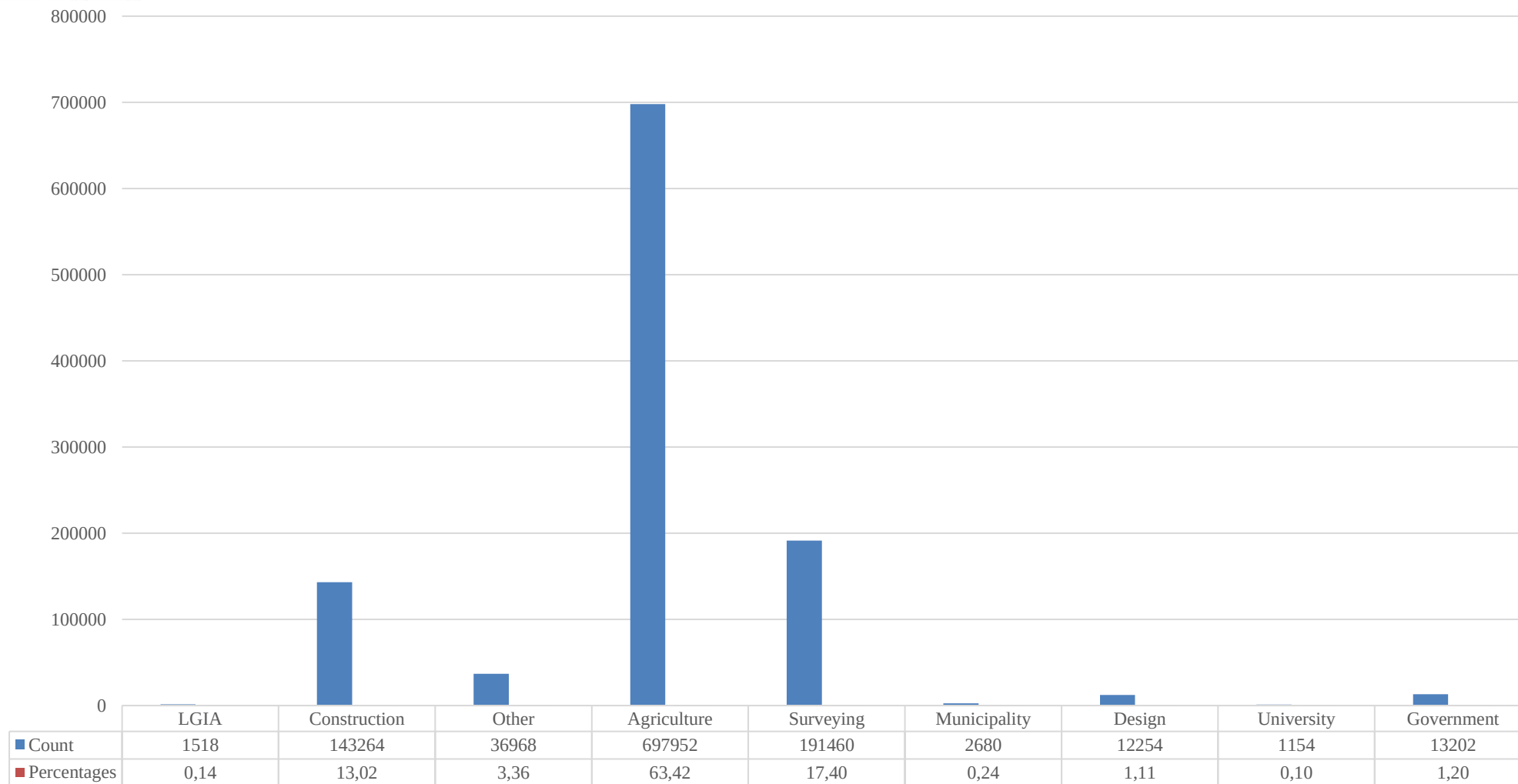


Users themselves choose which field of activity is most suitable for them, based on the LatPos terms of use



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Number of RTK connections by group, 2024

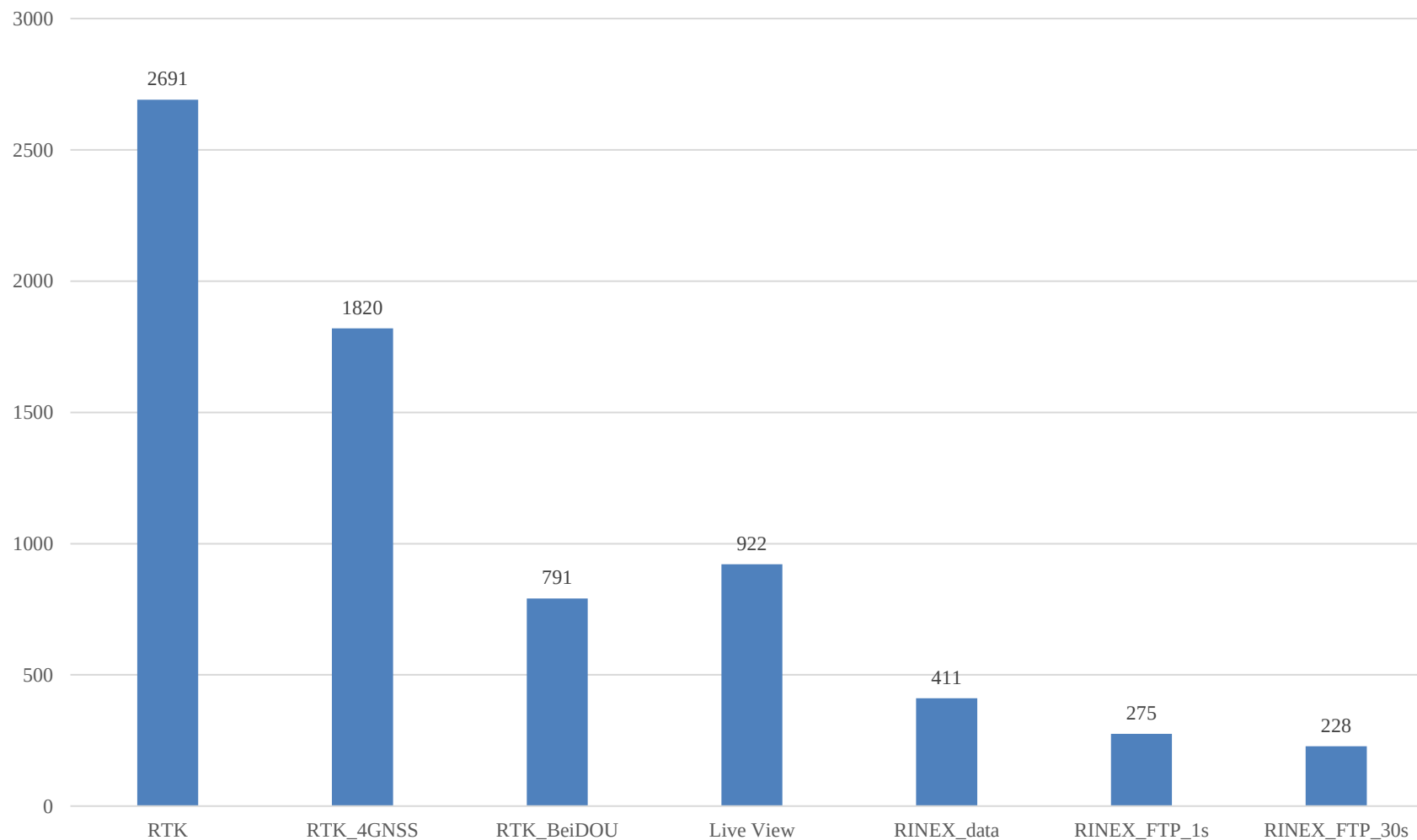


Total of 1 100 452 connections to the LatPos network were registered



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Number of applied services, till 25.02.2025

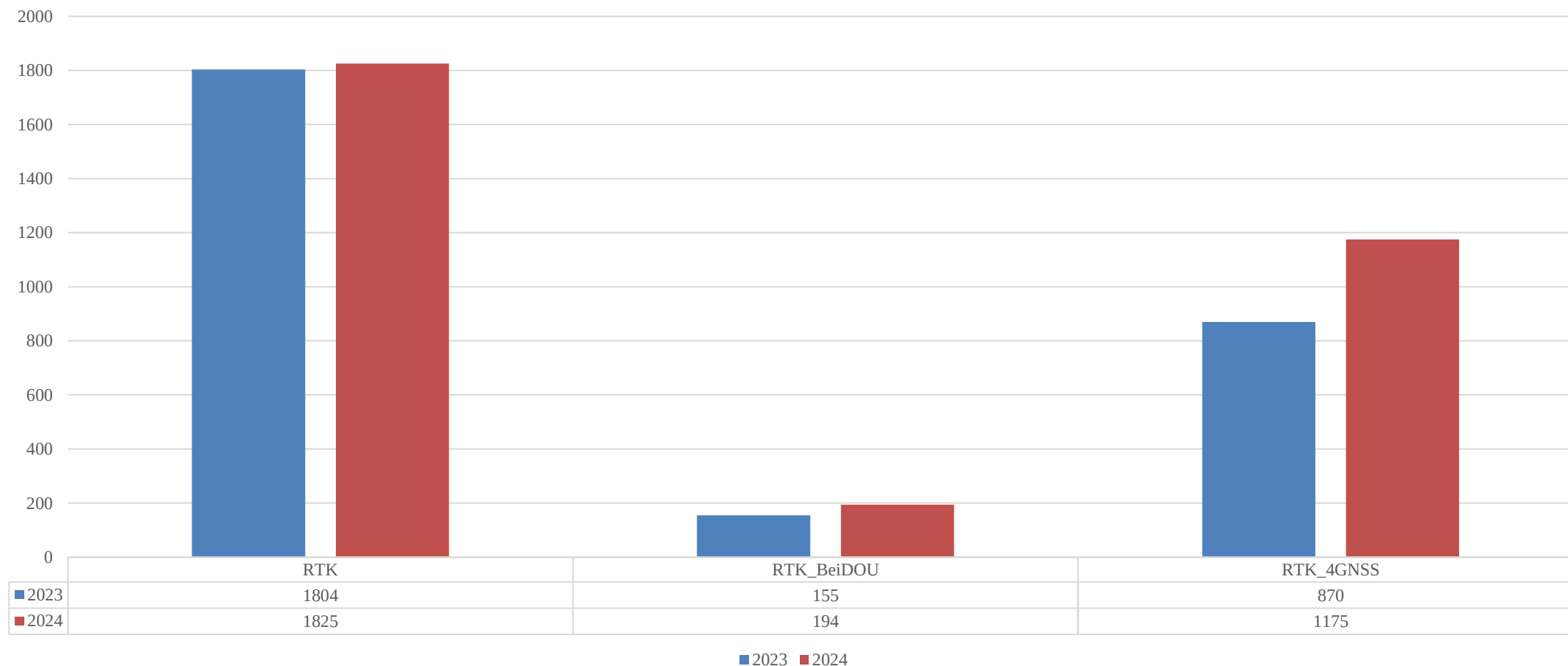


According to available data, RTK service is mostly used by farmers



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Distribution of users of real-time services

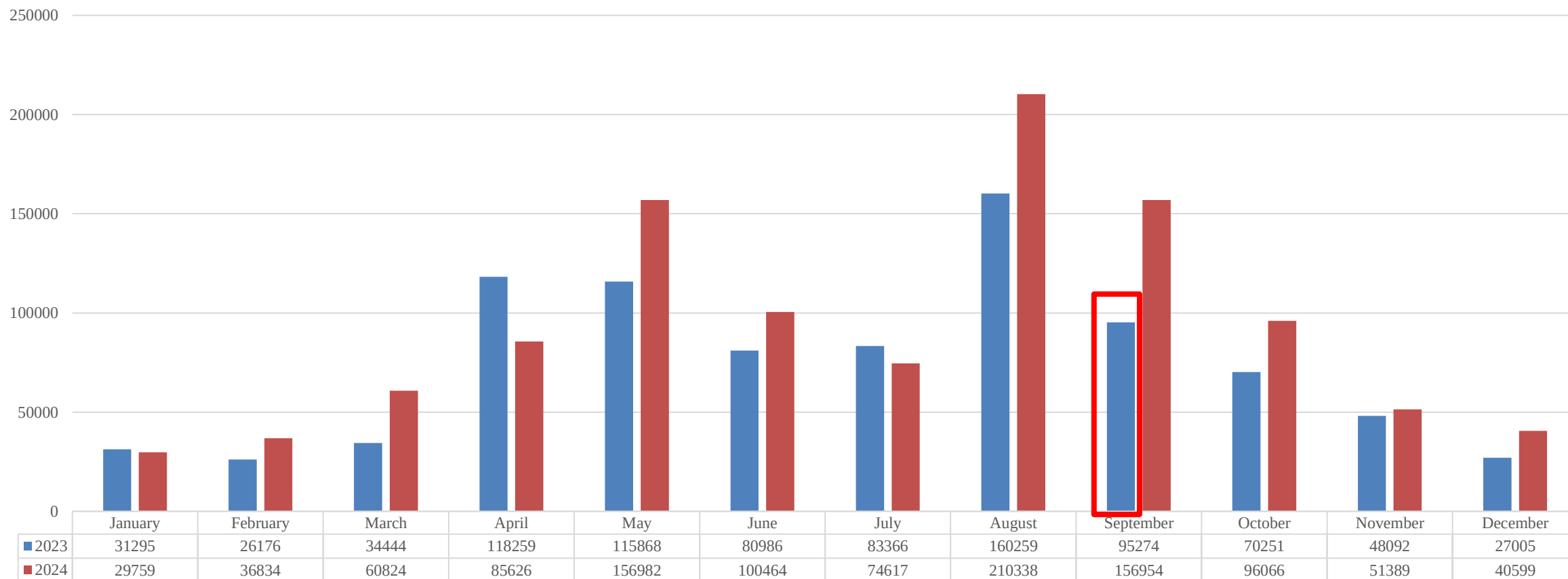


Current number of RTK service users. The number may differ from the number of services applied for (Slide No. 5),
as one user can apply for and use all services.



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Activity of LatPos users (RTK) connections



The data for September 2023 is incomplete, so the number of connections is not exact

In 2023, a total of 891 275 connections to the LatPos network were registered.

In 2024, a total of 1 100 452 connections to the LatPos network were registered.



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RTK monitoring (1)

TestRTK is additional tool for GNSS Spider

- NMEA are indicated from GNSS Spider.
- Connection to the LatPos network is simulated.
- We see:
 - Received RTCM messages.
 - Frequencies
 - Which GNSS satellites are being received
 - Carrier to noise

TestRTK

From server: Get RT products Buffer Size: ☐ Disable Decoding Close/Cancel

Log/Status File Path: ... File Name (name_XX_XX):

Default NMEA GGA: NMEA GGA ☐ Enable NMEA GGA ☒ Enable Heartbeat Frequ.: sec ☐ Enable Loose Ntrip

Default GPUD: GPUD ☐ Enable GPUD

Show Messages Type(s): ☐ Enable Message Type Filter AutoReconnect: ☐ Rand Lgth

Coordinate File: ... Run coord. file ☐ Show coord output info ☐ Log Binary ☐ Log ASCII Frequ.: sec

Channel ID	Communication channel name	Conn. Media	Port	NTRIP Mntp	Conn. status	Received Size	Last Received Data	Last error
4	VIRTUAL-RS	NTRIP-Client	5001	VIRTUAL-RS	Disconnect...	0		
13	SITE-BeiDOU	NTRIP-Client	5001	SITE-BeiDOU	Disconnect...	0		
14	NETW-iMAX-BeiDOU	NTRIP-Client	5001	NETW-iMAX-BeiDOU	Disconnect...	0		
15	VRS-BeiDOU	NTRIP-Client	5001	VRS-BeiDOU	Disconnect...	0		
16	NTRIP-Client (WindowsClient2.0)	NTRIP-Client	5002	NETW-iMAX-4GNSS	Connected	25373	25.02.2025 18:48:12	
17	VRS-4GNSS	NTRIP-Client	5002	VRS-4GNSS	Disconnect...	0		
18	SITE-4GNSS	NTRIP-Client	5002	SITE-4GNSS	Disconnect...	0		
24	VRS-GAL	NTRIP-Client	5002	VRS-GAL	Disconnect...	0		
25	NETW-iMAX-GAL	NTRIP-Client	5002	NETW-iMAX-GAL	Disconnect...	0		
26	SITE-GAL	NTRIP-Client	5002	SITE-GAL	Disconnect...	0		

NETW-iMAX-4GNSS

LATPOS-GNSS Received Latency relative to PC time [sec]: Min: Current: Max: Variation:

G10; Freq: L5 / B3; Track mode: Q; Phase: 83091827.5933200; Range: 21174076.4703211 m; Doppler: 1204.1425638 m/s; CNO: 57.0000000 dBHz
G15; Freq: L1CA / E1 / B1I; Track mode: C; Phase: 121074511.7654876; Range: 23039700.7118004 m; Doppler: -1617.4825756 m/s; CNO: 44.0000000 dBHz
G15; Freq: L2P(Y) / E5ab (Alt-BOC; Track mode: W; Phase: 94343809.6112497; Range: 23039700.7118004 m; Doppler: -1260.3748045 m/s; CNO: 45.0000000 dBHz
G15; Freq: L2C / E6 / B2Q; Track mode: S; Phase: 94343809.6066765; Range: 23039701.1227879 m; Doppler: -1260.3748045 m/s; CNO: 45.0000000 dBHz
G16; Freq: L1CA / E1 / B1I; Track mode: C; Phase: 124012103.5148176; Range: 23598709.2758663 m; Doppler: -3643.6193059 m/s; CNO: 43.0000000 dBHz
G16; Freq: L2P(Y) / E5ab (Alt-BOC; Track mode: W; Phase: 96632840.3207883; Range: 23598710.3480077 m; Doppler: -2839.1904265 m/s; CNO: 39.0000000 dBHz
G18; Freq: L1CA / E1 / B1I; Track mode: C; Phase: 122911440.3070233; Range: 23389236.5092060 m; Doppler: -3172.3077868 m/s; CNO: 43.0000000 dBHz
G18; Freq: L2P(Y) / E5ab (Alt-BOC; Track mode: W; Phase: 95775240.8817999; Range: 23389236.7236343 m; Doppler: -2471.9285551 m/s; CNO: 42.0000000 dBHz
G18; Freq: L2C / E6 / B2Q; Track mode: S; Phase: 95775240.8795133; Range: 23389236.559316 m; Doppler: -2471.9285551 m/s; CNO: 48.0000000 dBHz
G18; Freq: L5 / B3; Track mode: Q; Phase: 91784638.9228659; Range: 23389242.4417216 m; Doppler: -2368.8263630 m/s; CNO: 50.0000000 dBHz
G18; Freq: L1C / G3 / B1C; Track mode: L; Phase: 122911440.3070233; Range: 23389236.5806821 m; Doppler: -3172.2625935 m/s; CNO: 43.0000000 dBHz
G23; Freq: L1CA / E1 / B1I; Track mode: C; Phase: 110246716.9292635; Range: 20979229.0343634 m; Doppler: -1322.3214219 m/s; CNO: 52.0000000 dBHz
G23; Freq: L2P(Y) / E5ab (Alt-BOC; Track mode: W; Phase: 85906599.8519674; Range: 20979228.1409123 m; Doppler: -1030.3791003 m/s; CNO: 50.0000000 dBHz
G23; Freq: L2C / E6 / B2Q; Track mode: S; Phase: 85906599.8588271; Range: 20979228.2838644 m; Doppler: -1030.3778719 m/s; CNO: 54.0000000 dBHz
G23; Freq: L5 / B3; Track mode: Q; Phase: 82327236.2875261; Range: 20979233.1621077 m; Doppler: -987.4862724 m/s; CNO: 57.0000000 dBHz
G23; Freq: L1C / G3 / B1C; Track mode: L; Phase: 110246716.9321980; Range: 20979229.0701015 m; Doppler: -1322.3182689 m/s; CNO: 52.0000000 dBHz
G27; Freq: L1CA / E1 / B1I; Track mode: C; Phase: 106520452.4871779; Range: 20270143.5854753 m; Doppler: -476.5760136 m/s; CNO: 55.0000000 dBHz
G27; Freq: L2P(Y) / E5ab (Alt-BOC; Track mode: W; Phase: 83003015.5166231; Range: 20270144.5146645 m; Doppler: -371.3583422 m/s; CNO: 56.0000000 dBHz
G27; Freq: L2C / E6 / B2Q; Track mode: S; Phase: 83003015.5143365; Range: 20270144.8899140 m; Doppler: -371.3583422 m/s; CNO: 55.0000000 dBHz
G27; Freq: L5 / B3; Track mode: Q; Phase: 79544579.1028627; Range: 20270145.4081157 m; Doppler: -355.8780143 m/s; CNO: 59.0000000 dBHz

2355, 233290035RTCM 3.0 -1085

MSM: 5, System: GLONASS

Sat mask: 0xe080e00000000000; R01; R02; R03; R09; R17; R18; R19

Signal mask: 0x41800000; 02: G1 C/A (1C); 08: G2 C/A (2C); 09: G2 P (2P)

Cell mask: 0x000000000001ffff

R01: G1 C/A (1C); G2 C/A (2C); G2 P (2P)

R02: G1 C/A (1C); G2 C/A (2C); G2 P (2P)

R03: G1 C/A (1C); G2 C/A (2C); G2 P (2P)

R09: G1 C/A (1C); G2 C/A (2C); G2 P (2P)

R17: G1 C/A (1C); G2 C/A (2C); G2 P (2P)

R18: G1 C/A (1C); G2 C/A (2C); G2 P (2P)

R19: G1 C/A (1C); G2 C/A (2C); G2 P (2P)

Observation GPS Week: 2355; GPS Milliseconds: 233290000; Status: 180 (FineSteering)

Status: Static; TimeSync; Phase; Range; Doppler

Station Type: 1 (Reference)

Station Id: 0

Clock Offset: -1.000000e+100 s

R01; Freq: L1CA / E1 / B1I; Track mode: C; Phase: 123520968.3013474; Range: 23107133.3118004 m; Doppler: -3781.3445524 m/s; CNO: 39.0000000 dBHz



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Paid license.
Currently we are using evaluation period
licenses.

Recommendations on what to pay more
attention to during RTCM monitoring?

SNIP, the simple NTRIP Caster (EVALUATION wEVAL 3.17) www.Use-SNIP.com

File Edit SetUp Reports Misc Help

StatusCaster and ClientsSerial StreamsRelay StreamsPushed-In StreamsPushed-Out Streams

RTCM 3 Message Content Viewer

MountPt	VRS-4GNSS	SITE-4GNSS	VIRTUAL-RS	VRS-BeiDOU	VRS-BeiDOU
Connected	100.0%	100.0%	100.0%	100.0%	100.0%
UpTime	01:57 M:S Up	01:58 M:S Up	01:56 M:S Up	01:57 M:S Up	01:57 M:S Up
Connections	1st	1st	1st	1st	1st
Input	159,63 KB [~11035bps]	214,96 KB [~14750bps]	37,48 KB [~2617bps]	98,99 KB [~6846bps]	91,11 KB [~6458bps]
Output	0 Bytes	0 Bytes	0 Bytes	0 Bytes	0 Bytes
Clients	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0

Filter Log

Types Streams Log Threshold

RTCM3 Type 1075 (391 bytes), the 113rd message of this type found so far.
RTCM3 Type 1085 (268 bytes), the 113rd message of this type found so far.
RTCM3 Type 1095 (486 bytes), the 113rd message of this type found so far.

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 2 RTCM3 messages decoded, of 660 so far.
RTCM3 Type 1125 (290 bytes), the 227th message of this type found so far.
RTCM3 Type 1125 (368 bytes), the 228th message of this type found so far.

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 4 RTCM3 messages decoded, of 664 so far.
RTCM3 Type 1075 (391 bytes), the 114th message of this type found so far.
RTCM3 Type 1085 (268 bytes), the 114th message of this type found so far.
RTCM3 Type 1095 (517 bytes), the 114th message of this type found so far.
RTCM3 Type 1125 (277 bytes), the 229th message of this type found so far.

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 1 RTCM3 messages decoded, of 665 so far.
RTCM3 Type 1125 (368 bytes), the 230th message of this type found so far.

Initial Caster Tables being created (2 sets).

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 3 RTCM3 messages decoded, of 668 so far.
RTCM3 Type 1075 (391 bytes), the 115th message of this type found so far.
RTCM3 Type 1085 (268 bytes), the 115th message of this type found so far.
RTCM3 Type 1095 (517 bytes), the 115th message of this type found so far.

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 2 RTCM3 messages decoded, of 670 so far.
RTCM3 Type 1125 (290 bytes), the 231st message of this type found so far.
RTCM3 Type 1125 (368 bytes), the 232nd message of this type found so far.

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 4 RTCM3 messages decoded, of 674 so far.
RTCM3 Type 1006 (027 bytes), the 24th message of this type found so far.
RTCM3 Type 1075 (404 bytes), the 116th message of this type found so far.
RTCM3 Type 1085 (268 bytes), the 116th message of this type found so far.
RTCM3 Type 1095 (517 bytes), the 116th message of this type found so far.

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 2 RTCM3 messages decoded, of 676 so far.
RTCM3 Type 1125 (298 bytes), the 233rd message of this type found so far.
RTCM3 Type 1125 (368 bytes), the 234th message of this type found so far.

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 3 RTCM3 messages decoded, of 679 so far.
RTCM3 Type 1075 (412 bytes), the 117th message of this type found so far.
RTCM3 Type 1085 (268 bytes), the 117th message of this type found so far.
RTCM3 Type 1095 (517 bytes), the 117th message of this type found so far.

[SITE-4GNSS]: MountPt SITE-4GNSS [R001], 2 RTCM3 messages decoded, of 681 so far.
RTCM3 Type 1125 (290 bytes), the 235th message of this type found so far.
RTCM3 Type 1125 (368 bytes), the 236th message of this type found so far.

SITE-4GNSS

Options

Stream Display Style

Expanding Table ViewString list View

Remove Stale MessagesRemove Filtered MessagesUse Tight Layout Style

View Message Tables

Messages from 91.216.2.20:5002/SITE-4GNSS

Type	Time of Last Message	Size	Satellites	Station	Count
1006	Otrd. 18:36:43.073	27	32	60	12
1008	Otrd. 18:36:40.167	26	31	60	12
1013	Otrd. 18:35:47.272	15	31	60	1
1033	Otrd. 18:36:40.167	50	31	60	12
1075	Otrd. 18:36:44.067	412	12	60	60
1085	Otrd. 18:36:44.073	268	9	60	60
1095	Otrd. 18:36:44.073	517	11	60	60
1125	Otrd. 18:36:44.130	368	16	60	120
1230	Otrd. 18:36:40.167	18	9	60	12

View Message Lists

Pause

Message Hints

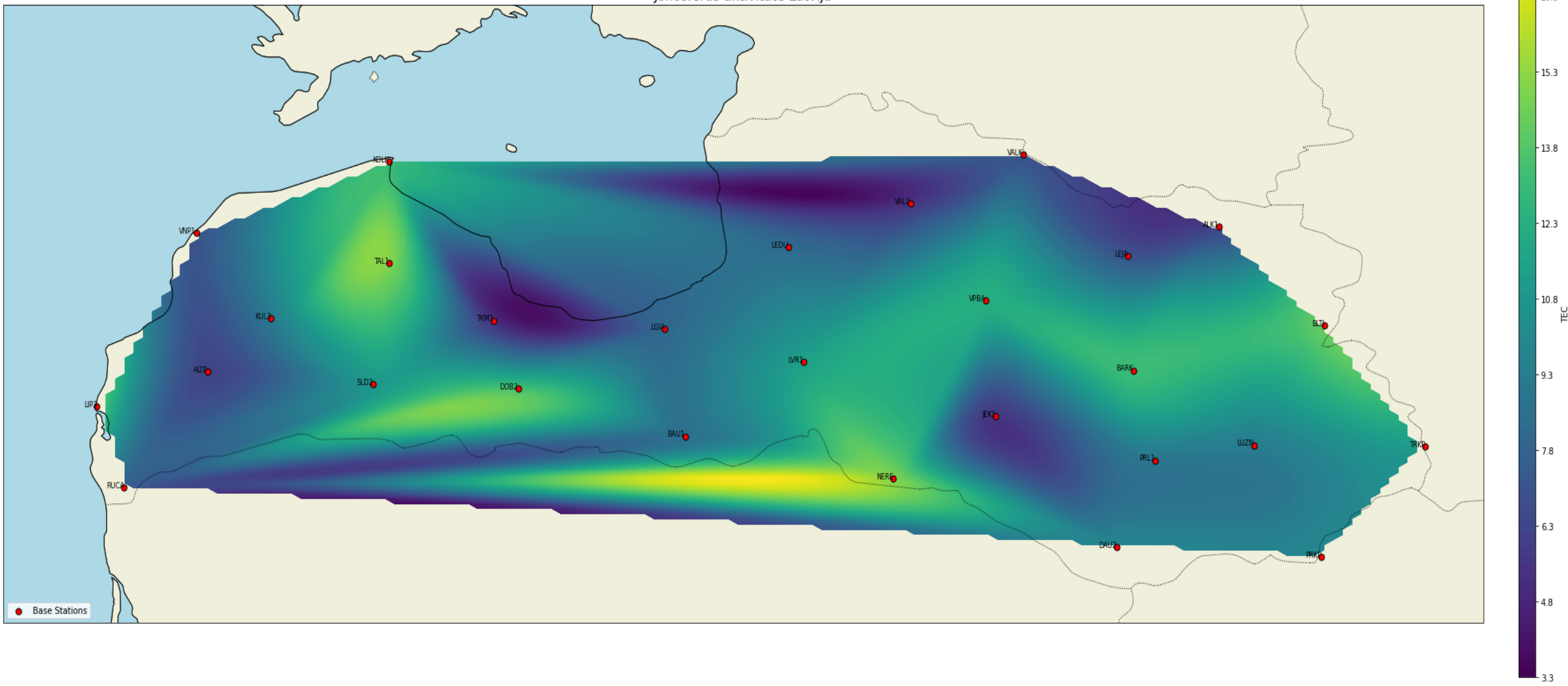
Tables: 0, Banned Connections: 0/0

Server is Offline, No Inbound Client Connections can occur, Local Time: 06:36:43 PĒCP, App UpTime: 02:02.883 MIN:SEC



Monitoring of ionospheric activity

Jonosfēras aktivitāte Latvijā

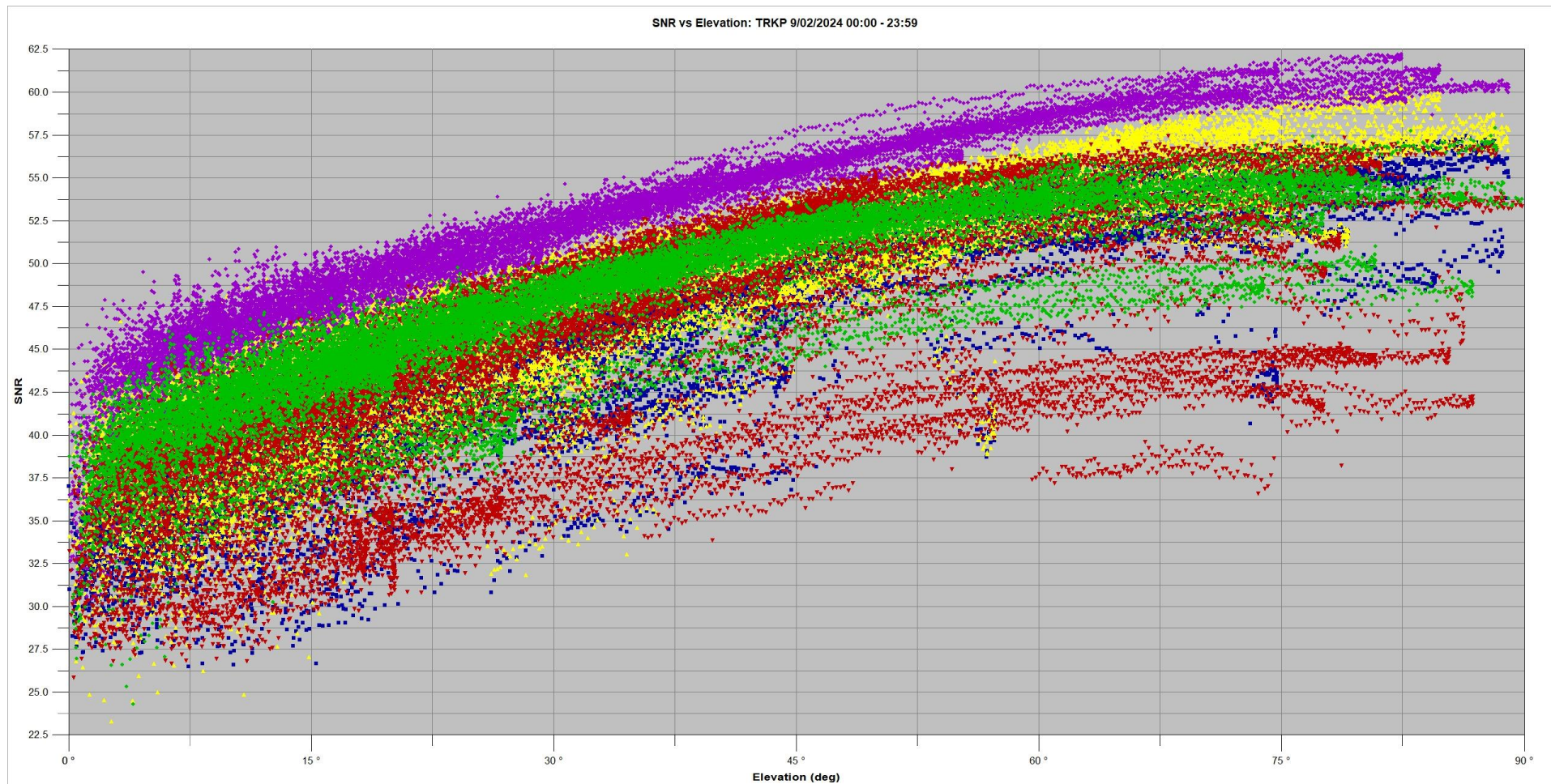




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RINEX file quality control

- Gnut/Anubis Real Time software will be used to monitor RINEX data quality.





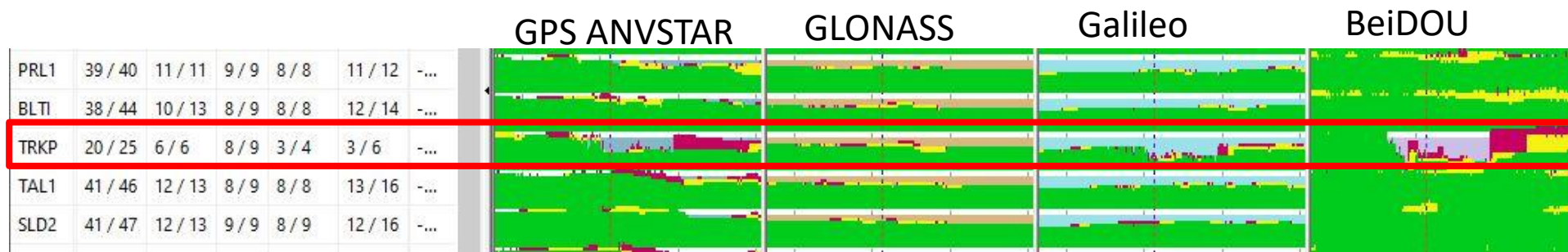
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Interference detection

All LatPos base station receivers use Interference Detection Tool built into LEICA GR30 receivers, potential GNSS signal interference is stored.

date_time	system	signal	bandwidth	power	density	MHz
2024-02-09 09:13:59	GPS	L1 C/A	1,17	-73,31	-128,74	1575,78
2024-02-09 10:04:41	Galileo	E6	0,59	-65,36	-118,33	1278,23
2024-02-09 10:26:41	Galileo	E6	1,03	-59,77	-111,39	1278,38
2024-02-09 11:34:12	Galileo	E6	0,73	-54,82	-105,04	1280,8
2024-02-09 11:57:55	GPS	L1 C/A	41,24	-56,73	-129,15	1588,71
2024-02-09 12:48:06	GPS	L1 C/A	14,94	-54,28	-122,02	1576,15
2024-02-09 13:13:46	Galileo	E6	0,37	-71,55	-122,97	1282,08
2024-02-09 13:48:34	GPS	L1 C/A	1,54	-73,66	-133,45	1575,16
2024-02-09 13:53:48	Galileo	E6	0,29	-72,53	-122,74	1277,87
2024-02-09 14:48:34	GPS	L1 C/A	58,67	-46,32	-117,5	1588,2
2024-02-09 14:56:27	Galileo	E6	0,44	-71,43	-125,36	1282,63
2024-02-09 15:48:34	GLONASS	L1 C/A	1,25	-72,46	-131,75	1602,11
2024-02-09 16:41:49	Galileo	E6	0,59	-64,69	-118,46	1282,11
2024-02-09 16:48:34	GLONASS	L1 C/A	6,81	-64,45	-128,56	1601,16
2024-02-09 17:00:19	Galileo	E6	0,29	-71,53	-122,14	1280,5
2024-02-09 17:48:34	GPS	L1 C/A	4,1	-69,26	-133,19	1574,54

Interference with GPS NAVSTAR, Galileo and BeiDOU GNSS signals on 09.02.2024 in the period from 11:20 to 11:40

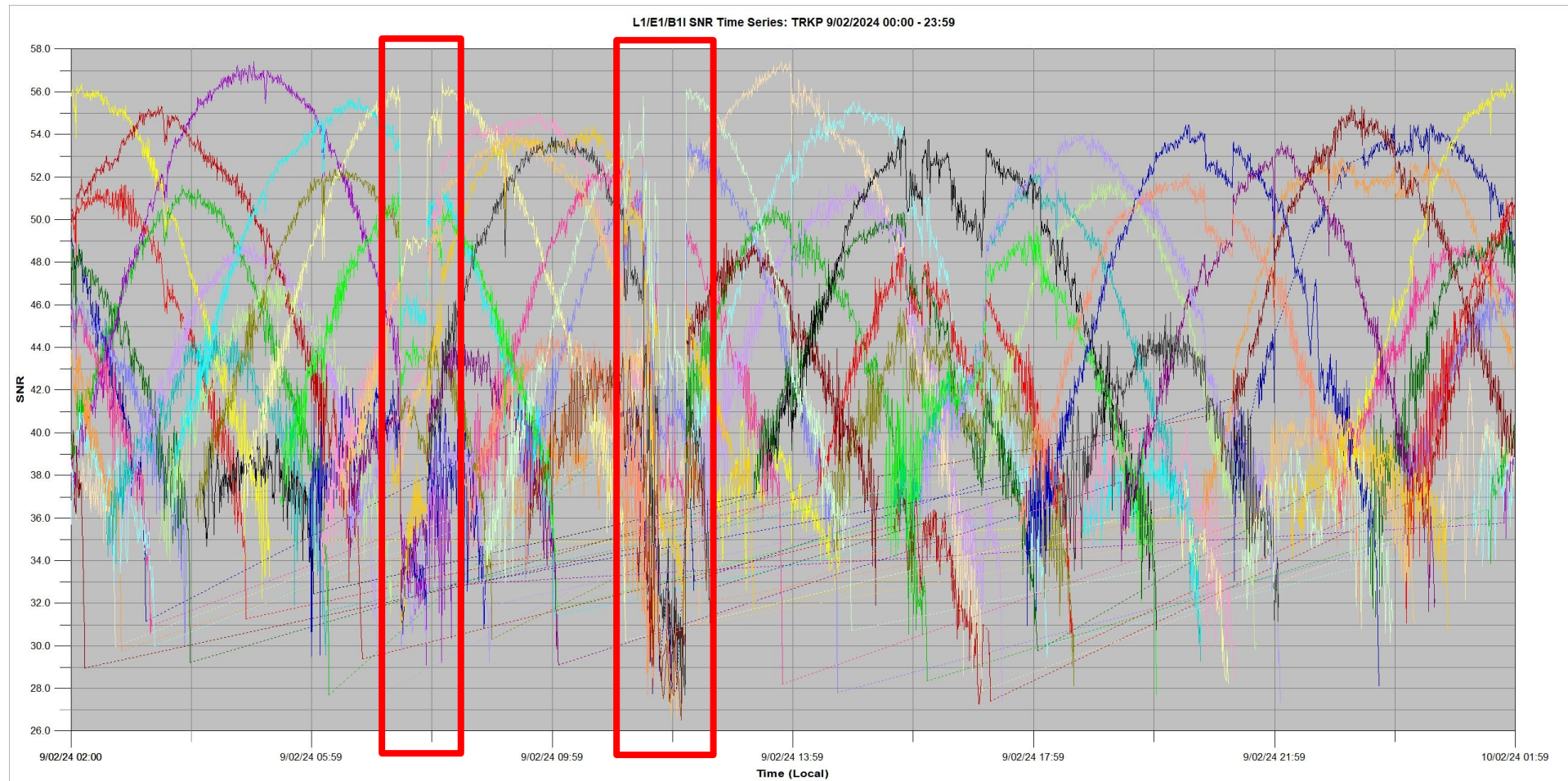




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Interference detection (2)

A similar picture is in the L2/B1C and L5/E5a/B2a SNR times series





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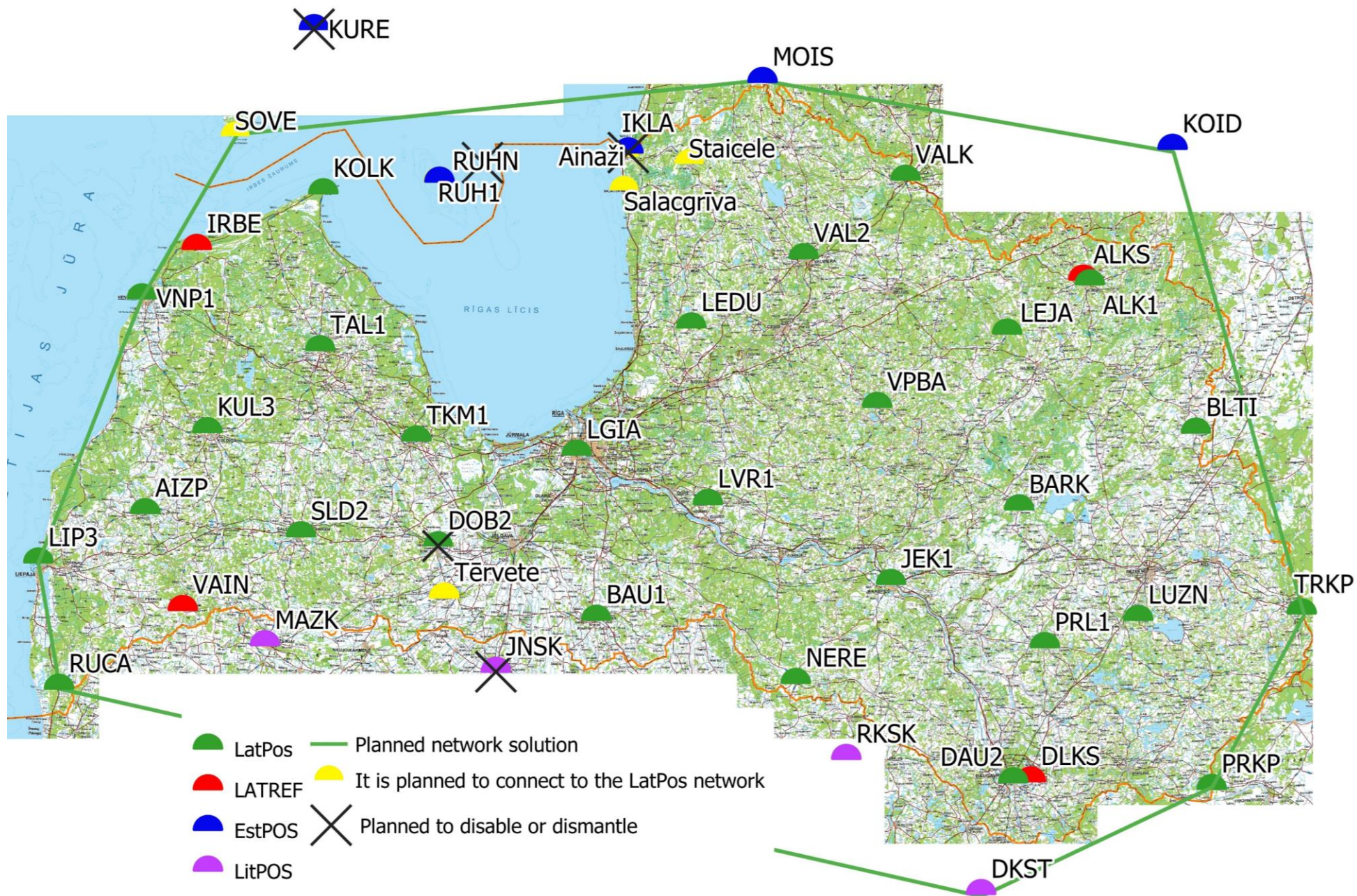
Future plans (1)

- Fully learn G-Nut/Anubis Real Time software for data analysis
- Improving ionospheric monitoring
- Ensure continuous operation of base stations, data stream and provide RTK correction without interruption
- Improvement of RTCM monitoring
- New base station in Ainaži, Staicele or Salacgrīva (we'll see which will be the most suitable place for installation)
- It is also planned to include two EstPOS base stations in the LatPos network - RUH1 and SOVE which will replace KURE
- New more powerful server in the near future



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Future plans (2)





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Thank you for your attention!
Paldies par uzmanību!