Report on the Results of Load Testing of the Moscow Exchange Trading and Clearing Systems on August 2, 2025

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Testing objectives

To verify the operational capability of the Moscow Exchange's trading and clearing systems (TCS) under increased load and high number of orders and trades. Trading was concluded in the systems of the following markets with the following target numbers of orders and trades per session:

    a. Securities Market – 400 million orders and over 20 million trades;
    b. FX Market – 110 million orders and over 3 million trades;
    c. Derivatives Market – 300 million orders and over 7 million trades.

Key results

Moscow Exchange Securities Market Trading/clearing system

Testing was performed on the production version and configuration of the Securities Market TCS hardware and software complex, with independent trading and clearing engines.

The testing priority was to verify the TCS information capacity compliance with the forecasted growth in the number of orders and trades for the coming years.

Achieved information capacity and performance parameters compared to the maximum numbers of orders and trades in production environment and in the 2024 load testing are presented in the table.
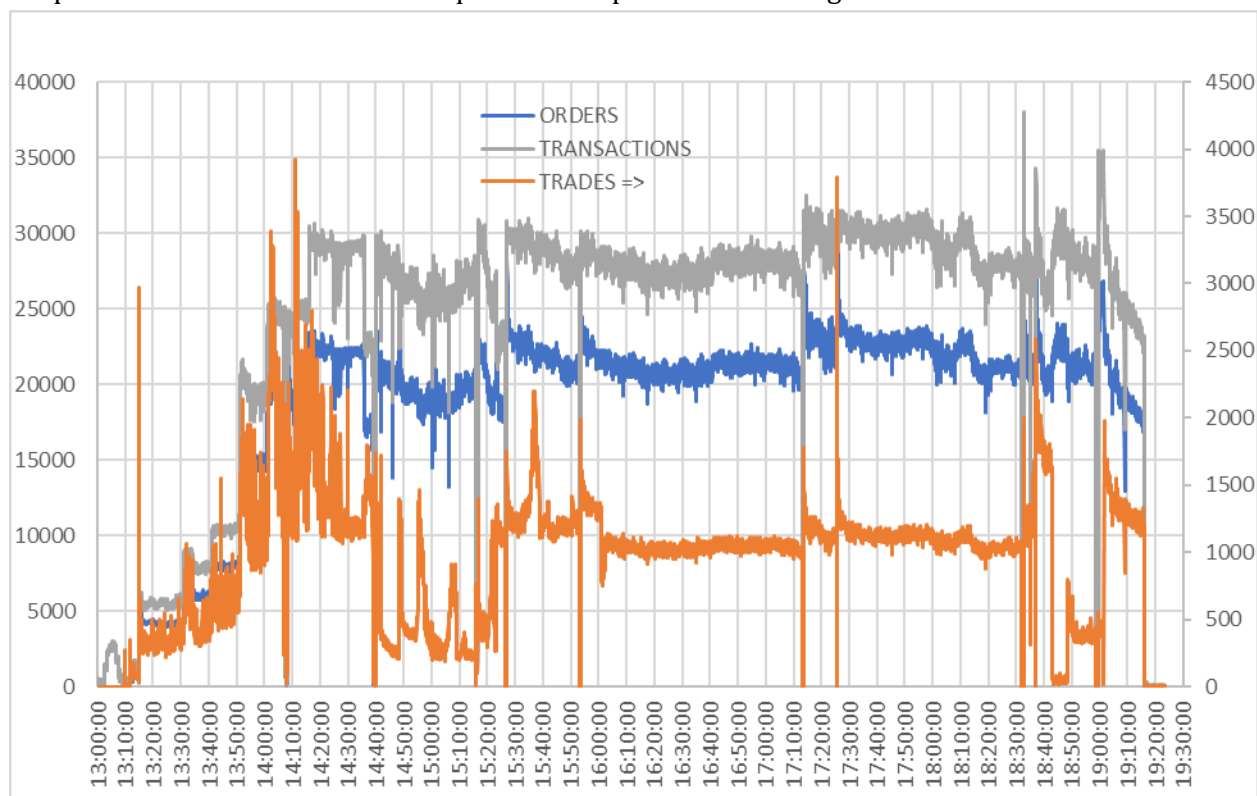
Accepted transactions are defined as incoming orders resulting in the registration of a new order or the cancellation of a previously registered order.

	Transactions	Orders	Trades
Achieved values (units), 2025	548 599 105	416 441 099	21 534 788
Achieved values (units), 2024	193 335 233	143 369 861	13 258 761
Maximum values in production environment	241 883 032	179 411 854	10 664 761
Maximum processing rate of accepted transactions (units/sec), 2025	38 022	35 795	3 929
Maximum processing rate of accepted transactions (units/sec), 2024	62 215	41 803	4 223

Peak numbers of orders and trades were not reached during testing. Peak frequencies of the continuous transaction, order, and trade flows during testing exceeded the peak values in one-second intervals observed in production environment by 1.5-2 times.

The Security Market access servers, FIX, FAST, SIMBA, FIFO TWIME ASTS services operated normally, with no issues identified.

Graphs of transaction and trade frequencies are provided in the figure:

Clients generated 1.17% of the transactions, which is 3 times less than in 2024.

Moscow Exchange FX Market Trading/clearing system

Testing was performed on the production version and configuration of the FX Market TCS hardware and software complex, with independent trading and clearing engines.

Achieved data capacity and performance parameters compared to the maximum numbers of orders and trades in production environment and in the 2024 load testing are presented in the table.

Accepted transactions are defined as incoming orders resulting in the registration of a new order or the cancellation of a previously registered order.

	Transactions	Orders	Trades
Achieved values (units), 2025	183 237 258	118 396 134	3 601 911
Achieved values (units), 2024	169 827 222	124 728 799	2 944 171
Maximum values in production environment	120 000 000	85 000 000	1 500 000
Maximum processing rate of accepted transactions (units/sec), 2025	37 334	25 141	843
Maximum processing rate of accepted transactions (units/sec), 2024	59 628	44 537	4 468

Peak frequencies and numbers of orders and trades were not reached during testing.

Peak frequencies of transactions, orders and trades during testing exceeded the peak values in one-second intervals observed in production environment by 2-3 times.

The FX Market access servers, FIX, FAST, SIMBA, FIFO TWIME ASTS services operated normally, with no issues identified.

Graphs of transaction and trade frequencies are provided in the figure:
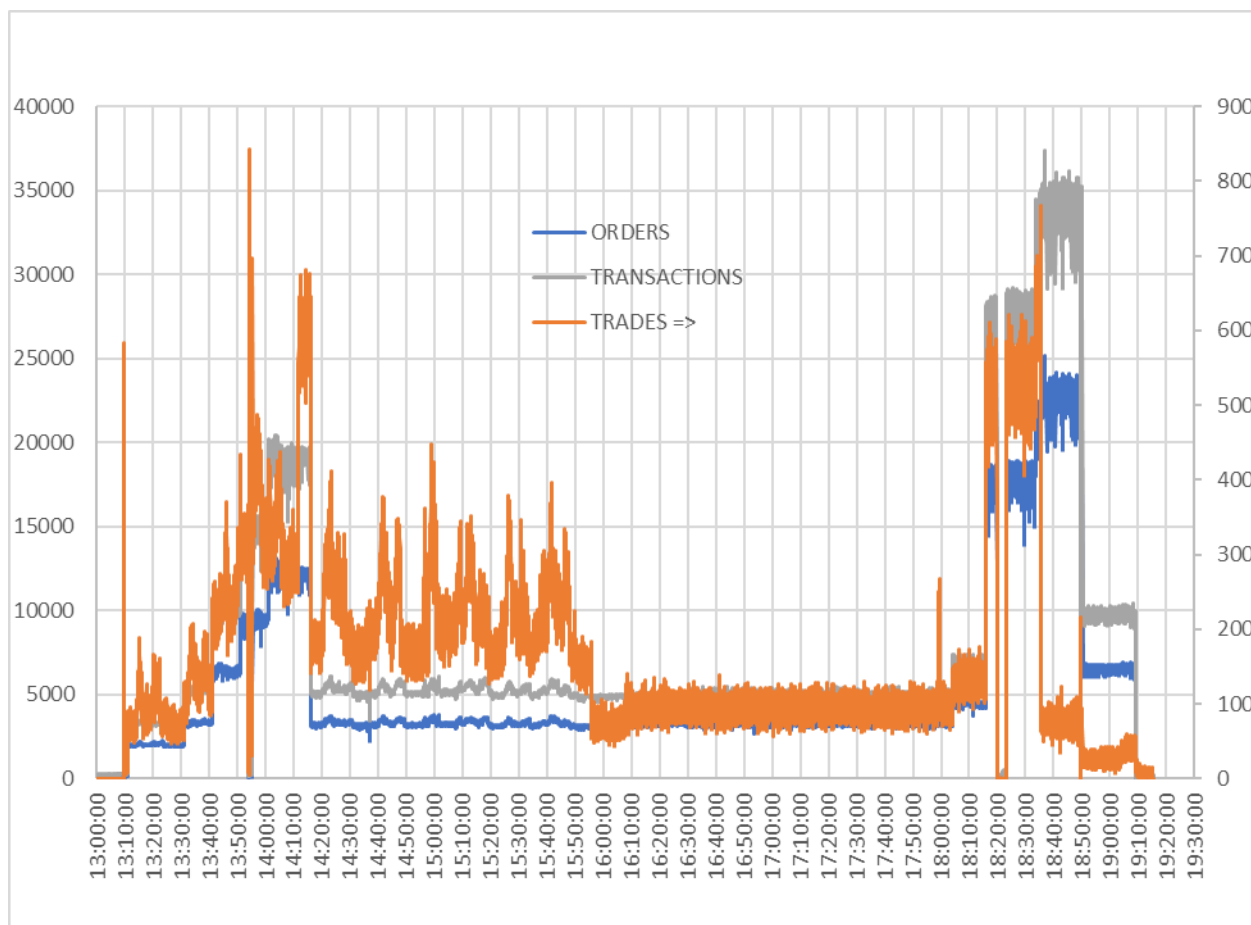
Clients generated 2.65% of the transactions, which is 47% higher in 2023.

Moscow Exchange Derivatives Market Trading/clearing systems

Testing was conducted on the SPECTRA system version 8.3, which was put into production on June 21, 2025, on servers installed in the Data Space and Nord data centers.

Testing focused on the following aspects:

- Confirming the TCS complex's capability for sustained operation under loads comparable to short-term peak loads in production environment.

- Verifying the operability of the entire TCS complex under the forecasted 2028 data volumes.

- Checking the TCS post-trading infrastructure – measuring the time for clearing session calculations, and the time for generating reports for clients and the regulator.

To test the system's capacity characteristics, the data volumes in the main reference tables were doubled: an additional 10 million clients were added (a 2-fold increase compared to actual data).

The ratio of orders to trades in the conducted testing was also adjusted to be closer to production environment. During the testing, 362.8 million accepted orders were submitted and 13.9 million trades were executed. **The peak transaction processing rate during the testing reached 114 thousand transactions per second**.

	Transactions	Orders	Trades
Achieved values (units), 2025	525 487 657	362 752 328	13 926 464
Achieved values (units), 2024	133 949 925	65 608 305	3 643 536
Peak performance (transactions/sec), 2025	114 000	54 027	3 976
Peak performance (transactions/sec), 2024	72 000	-	-
Performance in production environment (transactions/sec), 2024-2025	25 000		

Clients generated 0.9% of transactions.

The transaction load graph for the Derivatives Market TCS is provided in the figure:
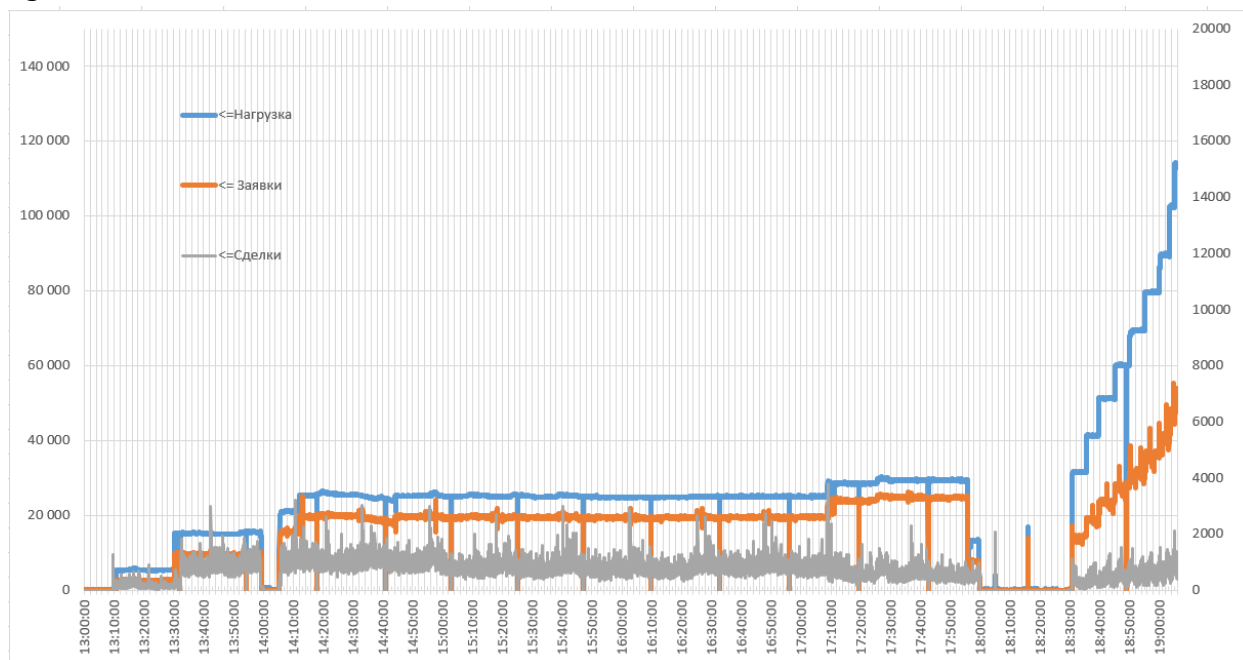
An intra-day clearing was performed during the load testing. The intra-day clearing completed successfully, taking 2 minutes 24 seconds.

An evening clearing was performed during the testing. The data volumes at the start of the evening clearing were 12.8 million trades and 312.7 million submitted orders.

The evening clearing operations were completed in 15 minutes 36 seconds.

The generation of the main report package after the evening clearing, including crypto transformations, was completed in 1 hour 8 minutes. The generation and crypto transformation of order report packages took 1 hour 50 minutes.

The specified time corresponds to expectations, considering the increased volumes of reference data and transactions.

During testing, a fluctuating latency of 0 to 370 milliseconds was observed in the Cgate/Plaza2 data dissemination infrastructure, due to incorrect configuration of the number of threads and CPU

cores allocated on the system's central nodes for the task of publishing data to the Plaza2 network. The settings will be corrected in the planned Spectra system releases in 2025.

Transaction latency, SPECTRA trading/clearing systems, TWIME and SIMBA severs, FAST UDP Multicast Marketdata

The Corvil system was used to measure latency of the Derivatives Market TCS by logging of transaction flows from sell-side trading robots, along with a traffic analysis system and Grafana for graph visualization. The robot was located on a server in the colocation zone and generated a load of 1-10 orders per second.

In the transaction frequency range of 5,000 to 20,000 per second, the median RTT values for the TWIME gateway ranged from 160 to 200 microseconds. The absence of the graph from 15:15 to 15:57 is due to the lack of transaction flow from the robot on the TWIME gateway.

The configuration of the Derivatives Market TWIME, SIMBA, and FAST servers corresponded to the production configuration. Normal operation was maintained throughout the entire range of market transaction frequencies.

Traffic capture was performed using equipment from Corvil. Statistical data on TWIME protocol order accepted messages (NewOrderSingleResponse) relative to new order messages from the trading/clearing system (Order log feed) in SIMBA protocol was collected using the traffic analysis system and Grafana. The graphs below show the median difference "TWIME timestamp minus SIMBA timestamp"; a positive value indicates that SIMBA was faster than TWIME by 37 microseconds on median.

Statistics of this type are collected continuously during normal trading.

The absence of data from 15:15 to 15:57 is due to the lack of transaction flow from the robot on the TWIME gateway.
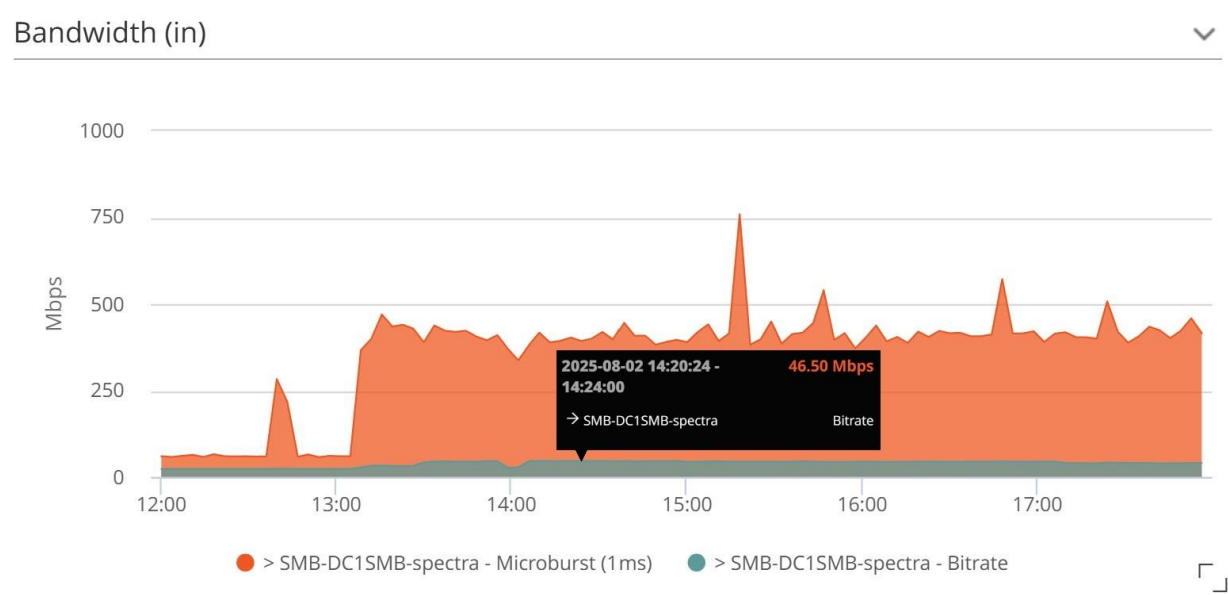
SIMBA vs. TWIME Comparison:

In 99% of cases, the SIMBA market data for orders was published faster than the TWIME transactional latency by at least 33 microseconds.

The median SIMBA publication time in the 20,000 tr/sec mode was around 45 microseconds.

Graph of SIMBA UDP multicast traffic in Copy A and millisecond interval peaks:

Graph of FAST UDP multicast traffic in Copy A and millisecond interval peaks:

Bandwidth (in)
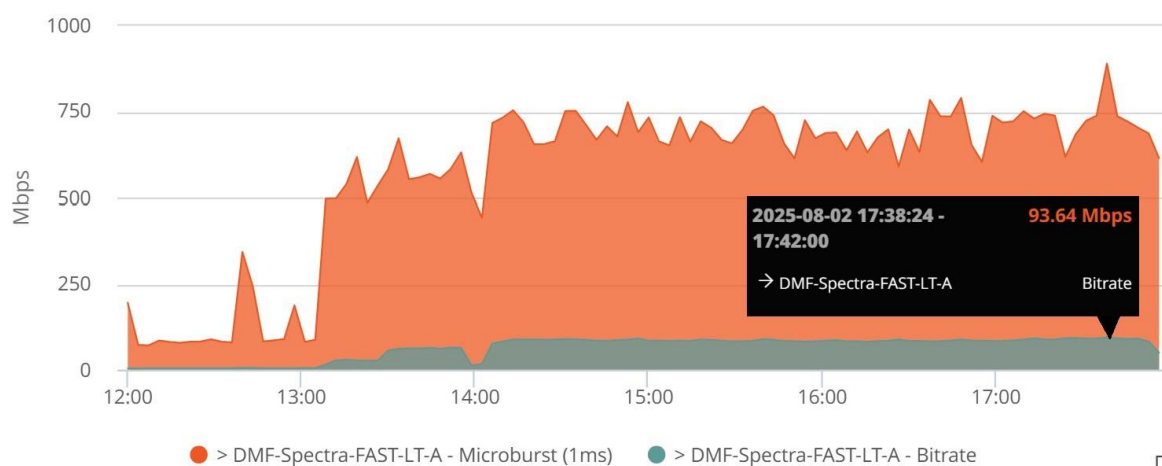
FAST UDP multicast traffic in the testing reached up to 94 Mbps in each Copy A and B, with peaks on millisecond intervals up to 750 Mbps.

SIMBA UDP multicast traffic in the testing reached up to 46.5 Mbps in each Copy A and B, with peaks on millisecond intervals up to 750 Mbps.

The bandwidth requirements for channels for clients using the FAST service to receive ORDERS-LOG in real-time are at least 100 Mbps per feed. When receiving two feeds (FEED A and FEED B) or data from multiple markets, a 1-10 Gbps channel is recommended.

Exchange Network and Colocation Zone Network

Monitoring of the network status within the exchange perimeter and in the colocation zone (up to and including the colocation zone core) showed no deviations from normal operation. No network retransmissions, packet loss, or deviations in packet delivery speed from the indicators of the current load level in production environment were recorded.

We remind you that the recommendations and requirements for bandwidth channels to the exchange are available at the following link: https://www.moex.com/a1873.

Conclusions

The Securities and FX Markets

1. Load testing confirmed that the Securities and FX Markets trading/clearing systems have a significant margin in terms of peak numbers of orders and trades relative to the peak numbers in production environment.

2. **Planned replacement of the TCS servers will be carried out in 2025, which may lead to an increase in the peak traffic values of the FAST UDP multicast marketdata service by 1.5 times relative to the current values achieved in production environment. The testing on August 2, 2025, was conducted on the servers of the current production infrastructure**.

Derivatives Market

Load testing confirmed the readiness of both the trading and post-trading components of the TCS, including end-of-day calculations and report generation, to handle data volumes for orders, trades, and the number of clients that are multiples higher than the peak volumes in current trading.

Testing revealed issues in the configuration of some modules of the CGate/Plaza2 data dissemination network, which will be fixed in the planned system releases.

Comparison of load testing parameters and peak load/data volume metrics in production environment

This section provides a table comparing load testing parameters with the maximum values of similar parameters in production environment.

The Securities and FX Market systems implement a mechanism for automatic expansion of information tables. For this reason, the concepts of peak numbers of orders and trades are not defined by the initial table sizes. The RAM size limitations on the TCS central servers are at least twice as high as the measured values.

Parameter	FX Market	Derivatives Market	Securities Market
Peak number of trades per day	1 500 000	5 774 168	12 000 000
Trades in load testing	3 601 911	13 926 464	21 534 788
Peak number of orders per day	85 000 000	108 959 109	179 000 000
Orders in load testing	118 396 134	362 752 328	416 441 099
Peak numbers of orders, trades, transactions, production configuration	Not applicable		
Peak number of transactions in one-second intervals, production environment	12 000	25 000	21 000
Peak transaction frequency, load testing	37337	114 000	38 022