



LIETUVOS RESPUBLIKOS  
RYŠIŲ REGULIAVIMO TARNYBA

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# Quality of Service measurements

- a. testing 5G speeds
- b. report on mobile networks in rural areas

2021 – 09 – 21/22, Pärnu, Estonia



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# Testing 5G speeds





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- End of 2020 Telia announces a ready-for-testing live 5G network in Vilnius, Kaunas and Klaipėda
  - In January-February 2021 RRT performs data speed measurements in 5G

# RRT Measurement Equipment

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- Sony Xperia 1 II Smartphone
- G-NetTrack Pro app
- Telia SIM card with activated PRO Unlimited service plan





# 5G Coverage in Vilnius



Privatiems
Paslaugos
E. parduotuvė
Pagalba
Prisijungti

## RYŠIO ŽEMĖLAPIS

Sužinokite mobiliojo ryšio kokybę ir interneto spartą pasirinktu adresu

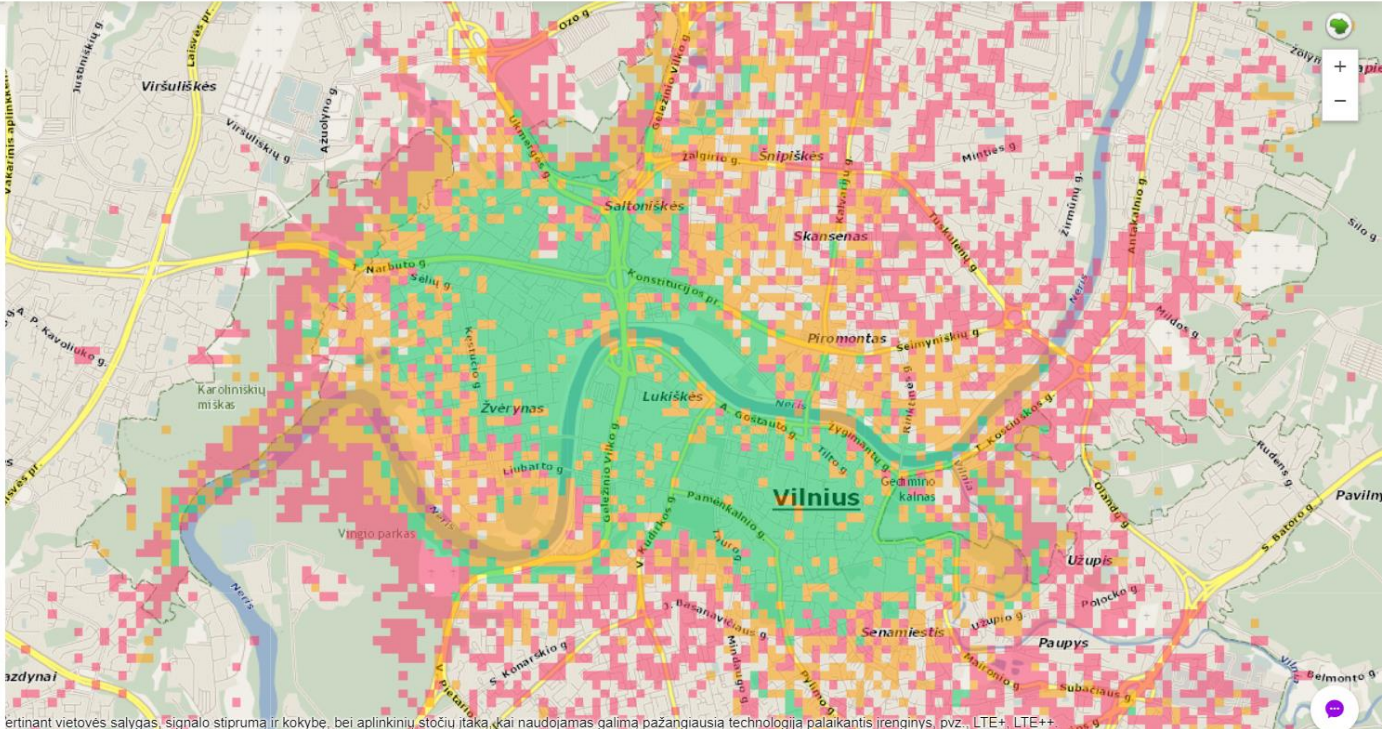
**Ryšio aprėpties žemėlapis**

- ☒ **5G**  
Sparčiausias mobilusis internetas.
- ☐ **4G**  
Spartusis mobilusis internetas.
- ☐ **3G**  
Mobilusis internetas, balso skambučiai, trumposios SMS žinutės.
- ☐ **2G**  
Balso skambučiai, trumposios SMS žinutės, el. paštas.


Stiprus ryšys


Vidutinis ryšys


Pakankamas ryšys



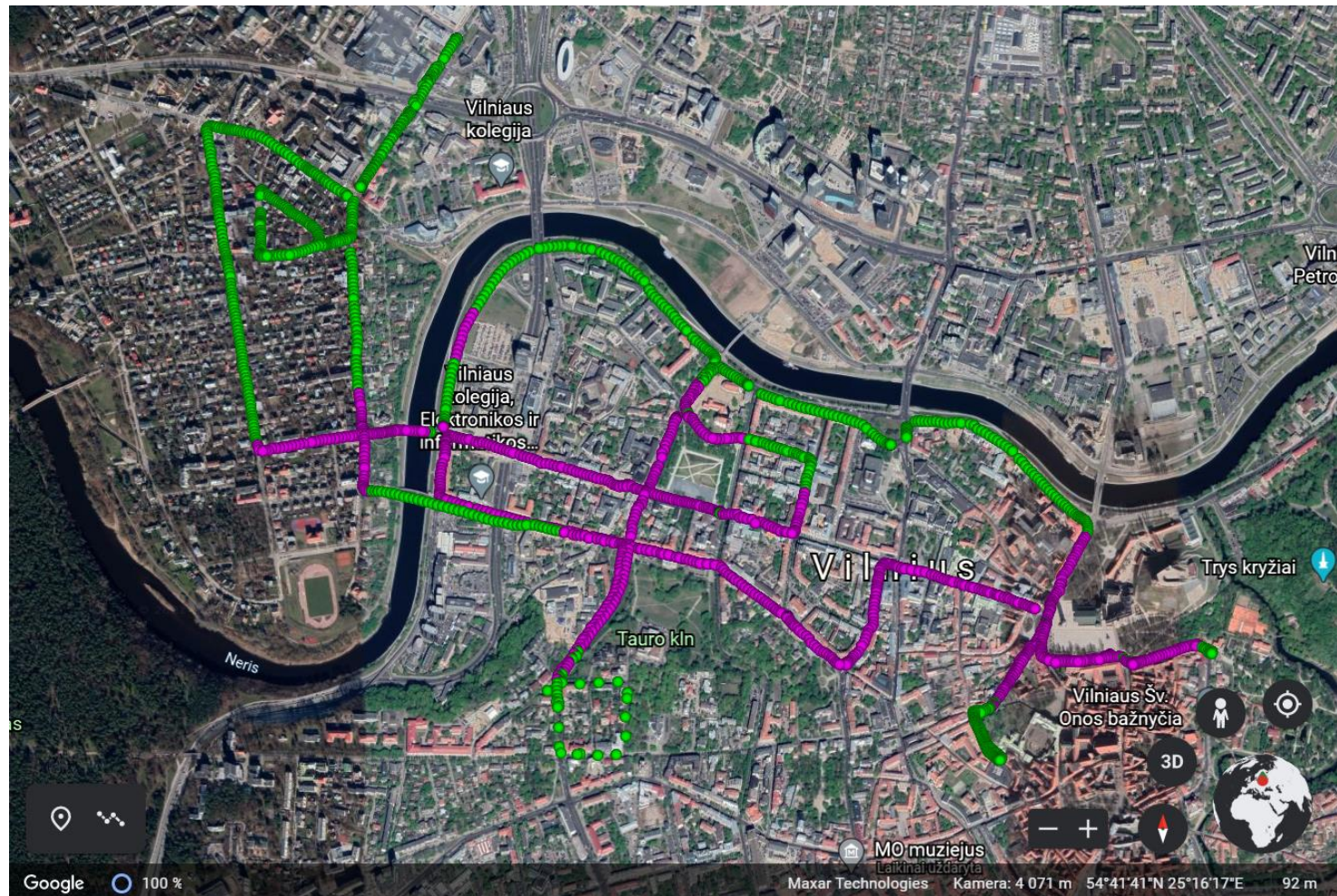
ertinant vietovės sąlygas, signalo stiprumą ir kokybę, bei aplinkinių stočių įtaką, kai naudojamas galima pažangiausia technologija palaikantis įrenginys, pvz., LTE+, LTE++





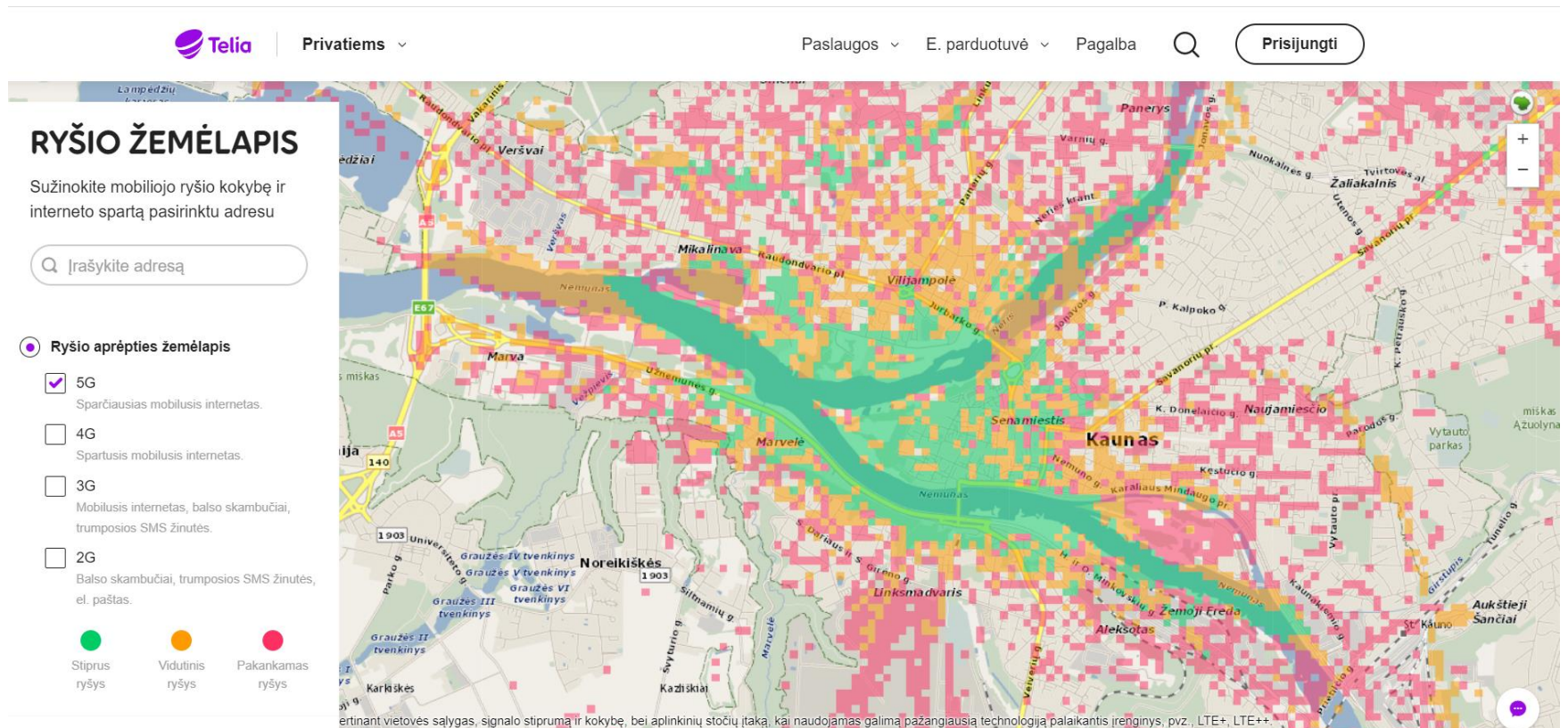
# 5G Coverage in Vilnius

- 5G – purple
- 4G – green



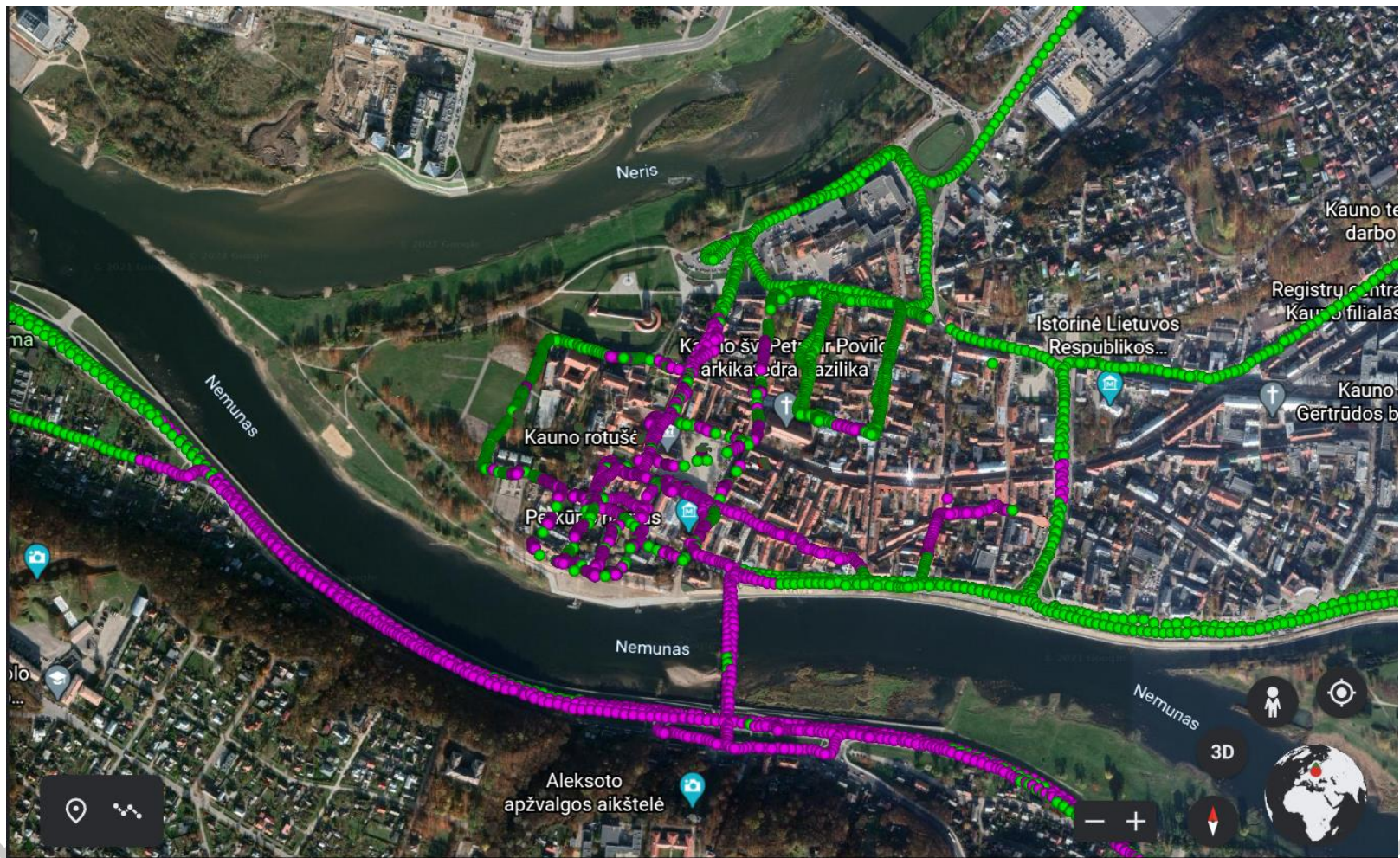


# 5G Coverage in Kaunas



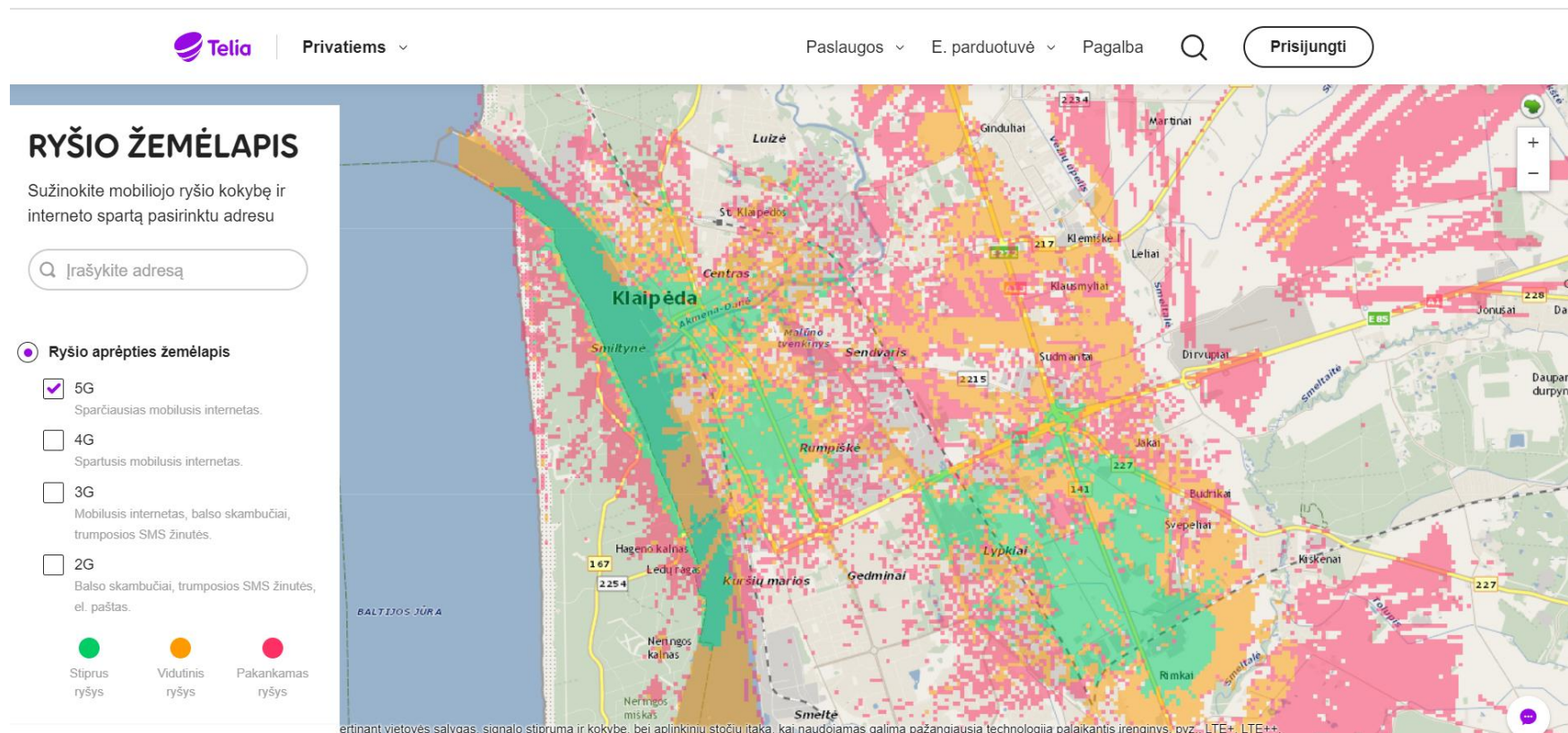


# 5G Coverage in Kaunas



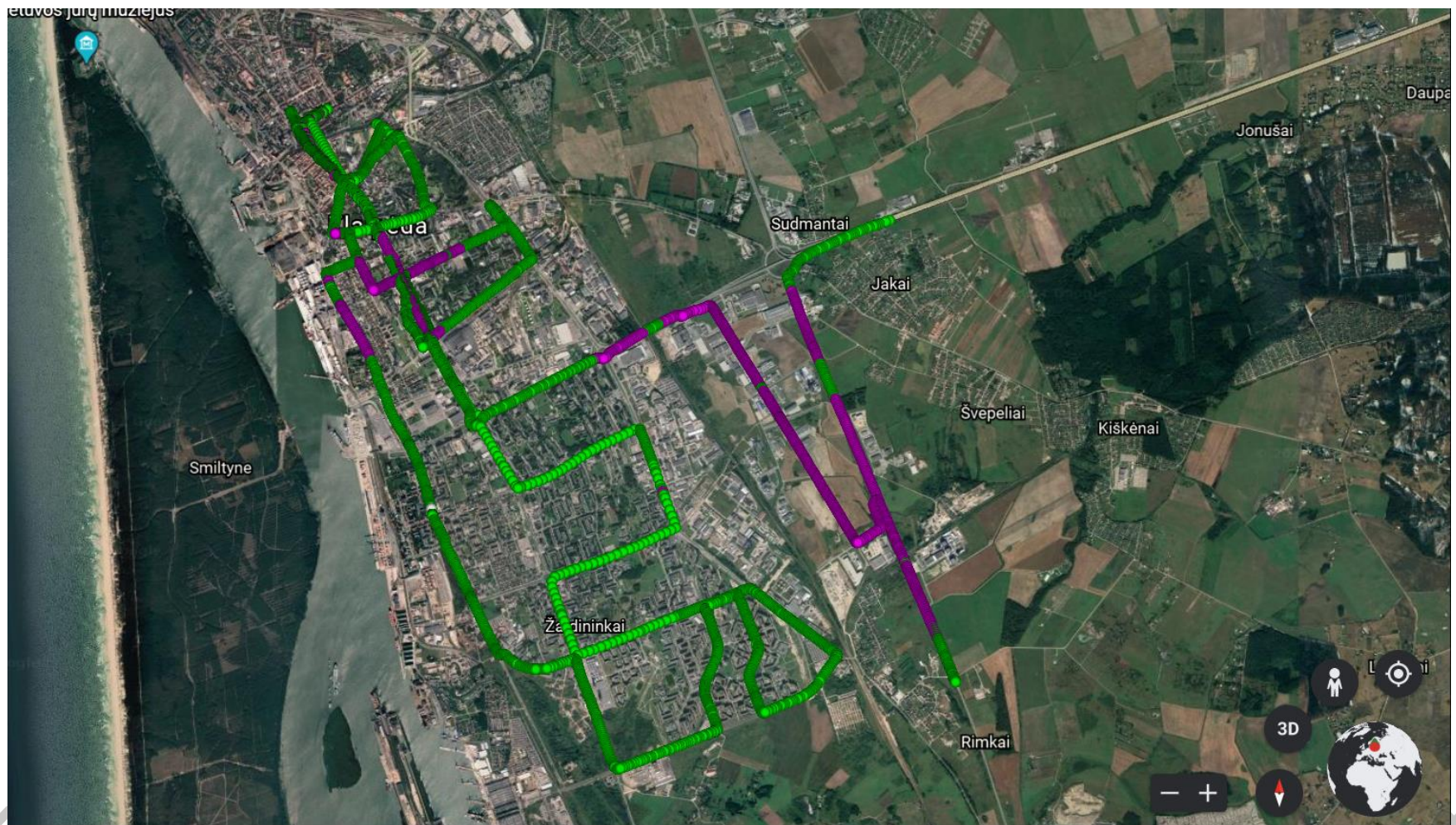


# 5G Coverage in Klaipėda





# 5G Coverage in Klaipėda





# SPEED RESULTS

|          | Average<br>Download<br>Speed, Mb/s | Average<br>Upload Speed,<br>Mb/s | Measurement<br>count (DL/UL) |
|----------|------------------------------------|----------------------------------|------------------------------|
| Vilnius  | 665,0                              | 41,1                             | 121/111                      |
| Kaunas   | 961,0                              | 51,2                             | 148/143                      |
| Klaipėda | 645,3                              | 33,8                             | 57/54                        |



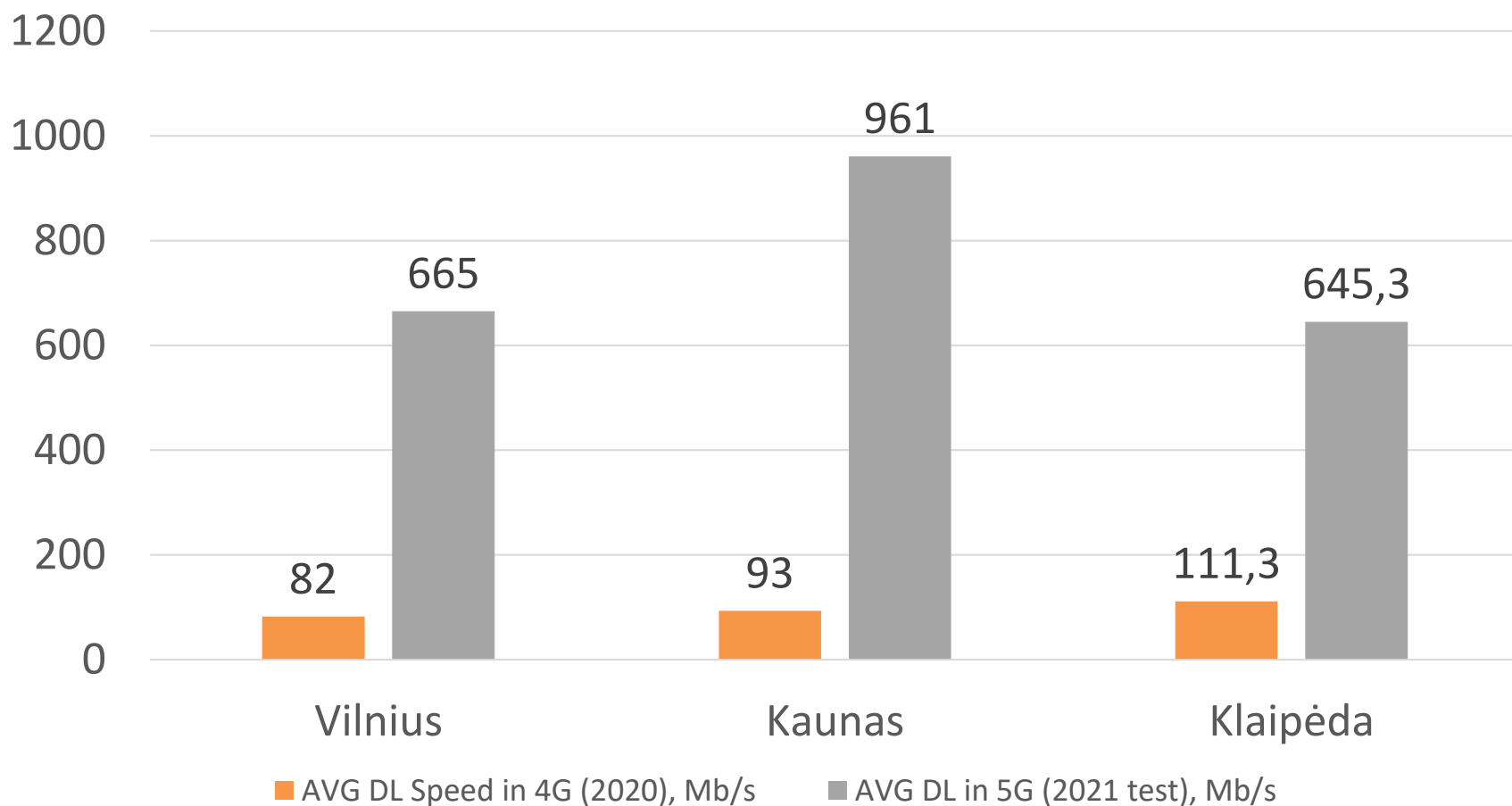
# SPEED RESULTS

|          | Maximum<br>Download Speed,<br>Mb/s | Maximum Upload<br>Speed, Mb/s |
|----------|------------------------------------|-------------------------------|
| Vilnius  | 1401,5                             | 100,6                         |
| Kaunas   | 1394,5                             | 94,8                          |
| Klaipėda | 1158,8                             | 85,5                          |





# COMPARISON OF RESULTS 4G/5G



# PING RESULTS

| Server    | Average<br>PING in<br>4G, ms | Median<br>PING in<br>4G, ms | Average<br>PING in<br>5G, ms | Median<br>PING in<br>5G, ms |
|-----------|------------------------------|-----------------------------|------------------------------|-----------------------------|
| Matuok.lt | 19,4                         | 20                          | 10,9                         | 11                          |





# KEY TAKEAWAYS

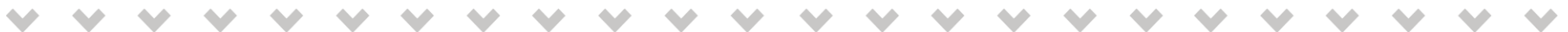
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- Not in all locations that have 5G coverage provide 5G connection and service
- Average download speeds in 5G are a factor greater than 4G (hundreds of Mb/s instead of tens of Mb/s)
- Maximum download speed of 1,4 Gb/s reached
- PING is lower in 5G but not at full potential, because 5G network setup is not stand-alone



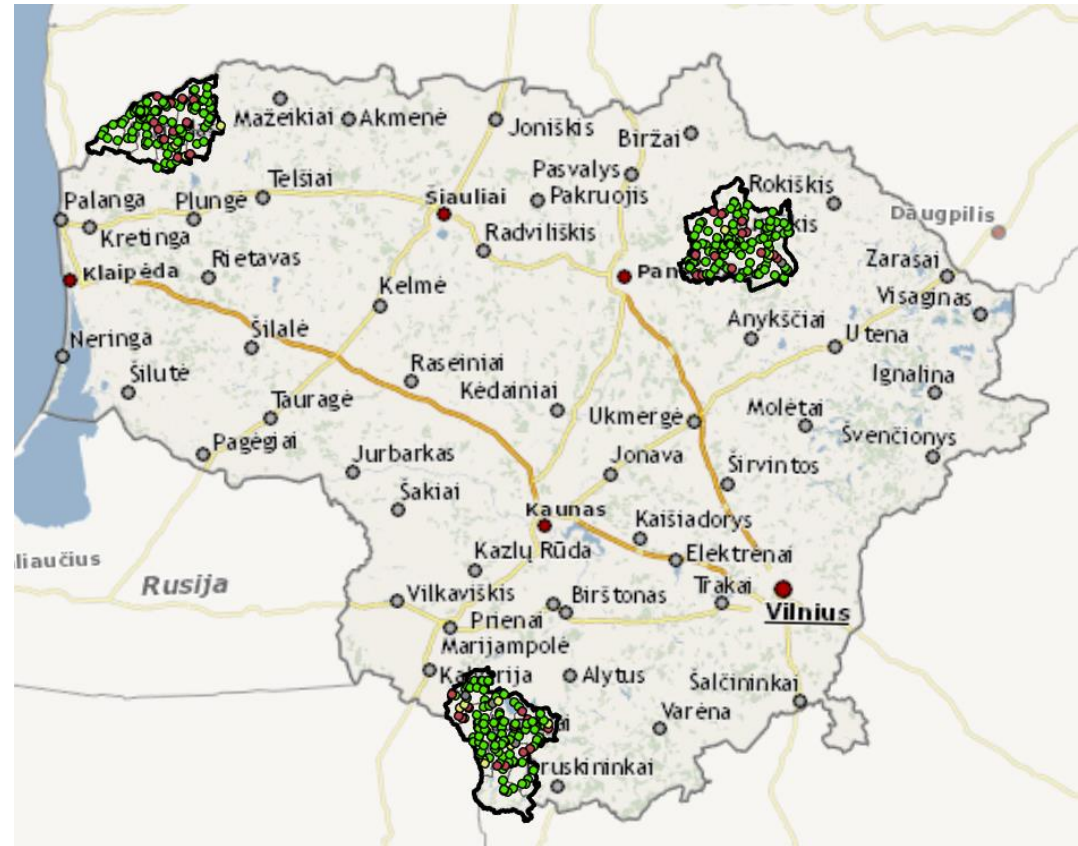
B

# Report on mobile networks in rural areas



# MEASUREMENT LOCATIONS

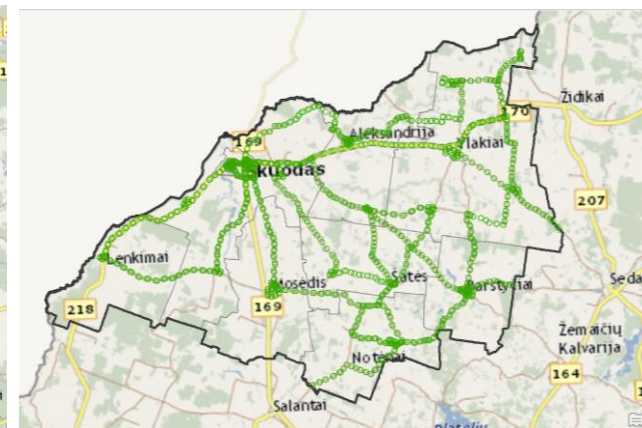
- 3 District Municipalities
- Further from major cities
- Approx. size and population
- In different parts of Lithuania





# DISTRICT MUNICIPALITIES

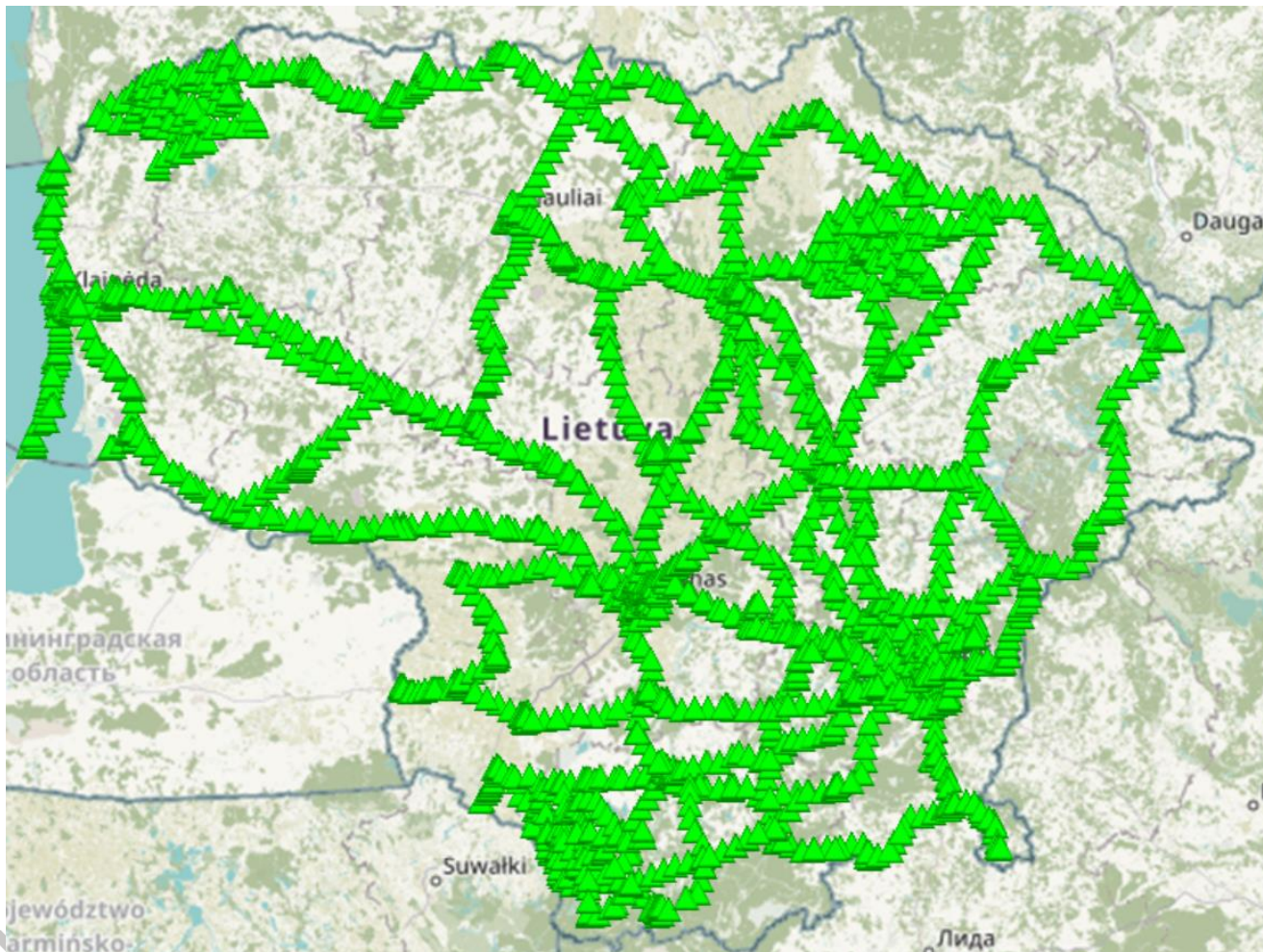
- Kupiškis (northeast)
- Lazdijai (south)
- Skuodas (northwest)



Populations around 20k, areas about 1000 km<sup>2</sup>, over 300 km driven for tests in each



# MEASUREMENT LOCATIONS IN 2021



# RRT Measurement Equipment

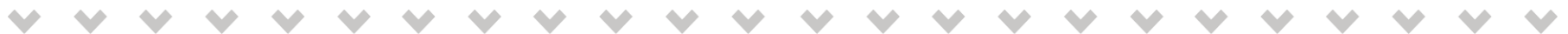
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## FOR DATA MEASUREMENTS

- Samsung SM-G973F smartphones
- G-NetTrack Pro app
- Publicly available service plans from all operators

## FOR VOICE MEASUREMENTS

- Rohde&Schwarz SmartBenchmarker

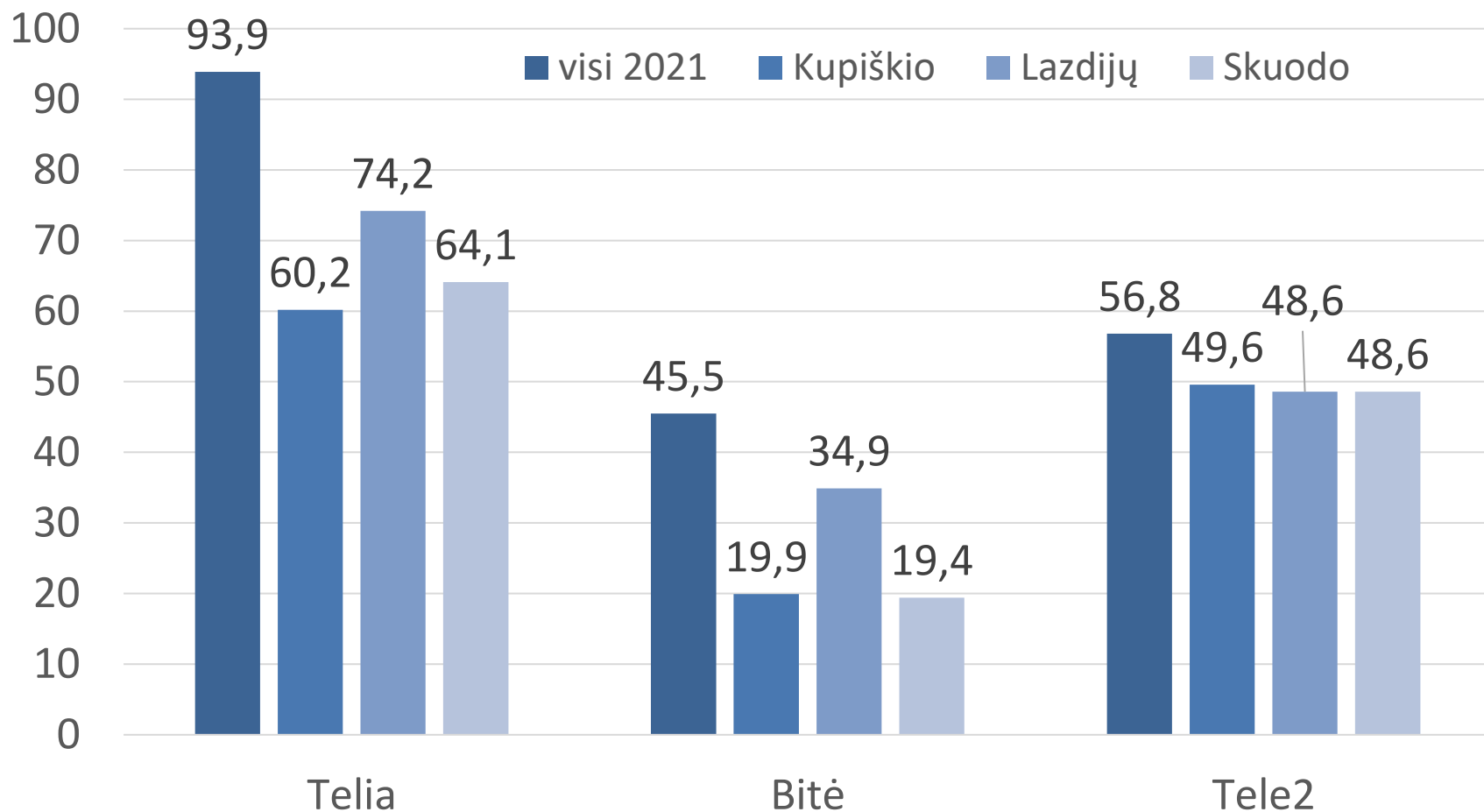




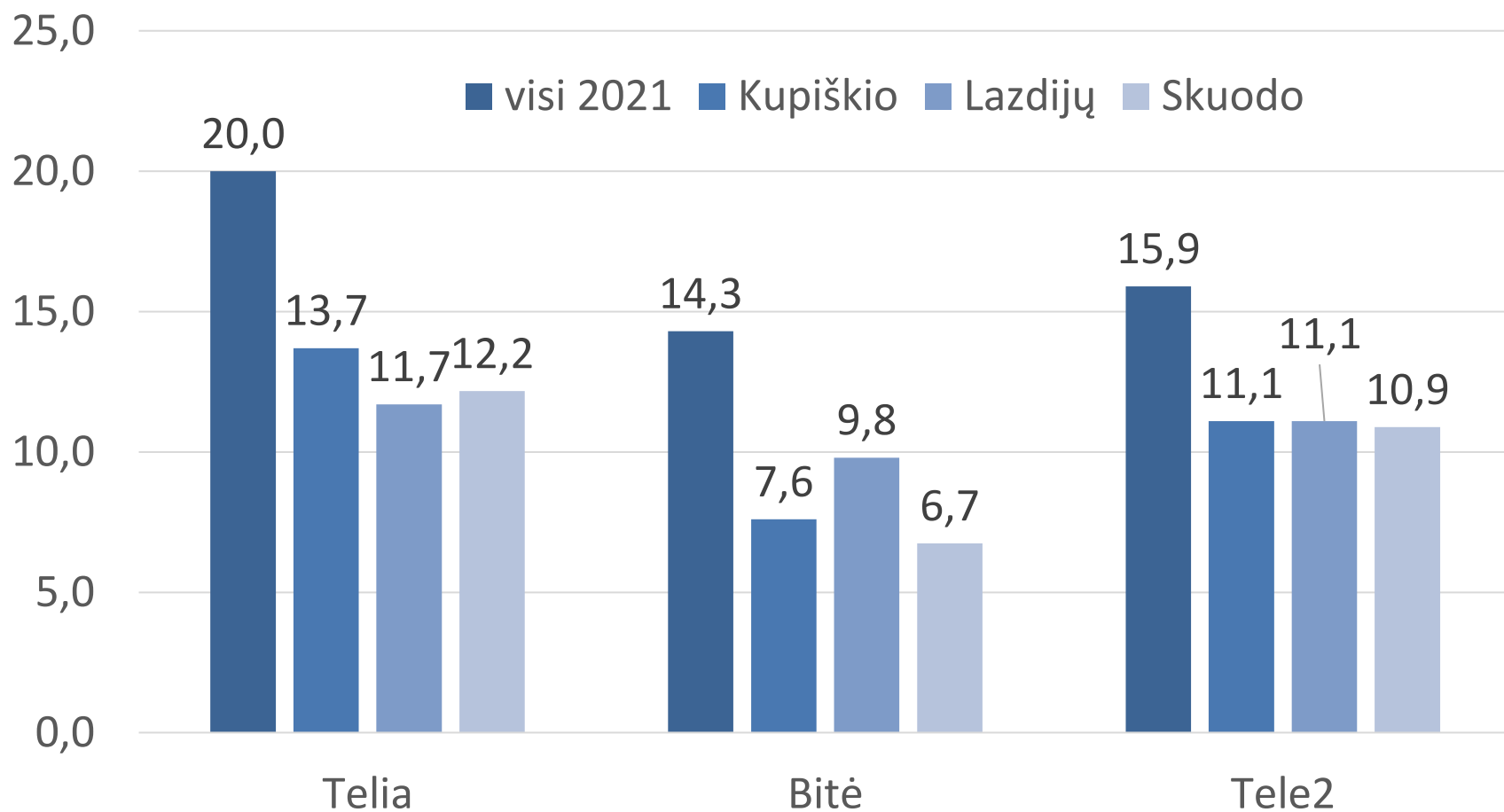
# DATA QoS RESULTS

|                 | AVG DL<br>Speed,<br>Mb/s | Median DL<br>Speed,<br>Mb/s | Count of<br>Meas. | AVG UL<br>Speed,<br>Mb/s | Median UL<br>Speed,<br>Mb/s | Count of<br>Meas. |
|-----------------|--------------------------|-----------------------------|-------------------|--------------------------|-----------------------------|-------------------|
| <b>Kupiškis</b> |                          |                             |                   |                          |                             |                   |
| <b>Telia</b>    | 60,2                     | 53,8                        | 545               | 13,7                     | 8,2                         | 554               |
| <b>Bitė</b>     | 19,9                     | 12,4                        | 539               | 7,6                      | 3,9                         | 553               |
| <b>Tele2</b>    | 49,6                     | 38,4                        | 546               | 11,1                     | 5                           | 555               |
| <b>Lazdijai</b> |                          |                             |                   |                          |                             |                   |
| <b>Telia</b>    | 74,2                     | 58,1                        | 639               | 11,7                     | 6,1                         | 651               |
| <b>Bitė</b>     | 34,9                     | 22,2                        | 658               | 9,8                      | 6,6                         | 668               |
| <b>Tele2</b>    | 48,6                     | 37,4                        | 655               | 11,1                     | 7                           | 660               |
| <b>Skuodas</b>  |                          |                             |                   |                          |                             |                   |
| <b>Telia</b>    | 64,1                     | 52,8                        | 553               | 12,2                     | 7,4                         | 562               |
| <b>Bitė</b>     | 19,4                     | 12,4                        | 540               | 6,7                      | 3,7                         | 559               |
| <b>Tele2</b>    | 48,6                     | 37,3                        | 572               | 10,9                     | 6,7                         | 572               |

# DOWNLOAD SPEEDS, Mb/s



# UPLOAD SPEEDS, Mb/s





# KEY TAKEAWAYS. DATA SPEEDS

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- Average Download and Upload speeds in all 3 chosen district municipalities were lower than speeds measured in the whole country in 2021 for all operators.
- Biggest drop in speed was in network of Bite
- Telia speeds in all district municipalities were the highest
- Tele2 had the most stable performance in all municipalities that were measured

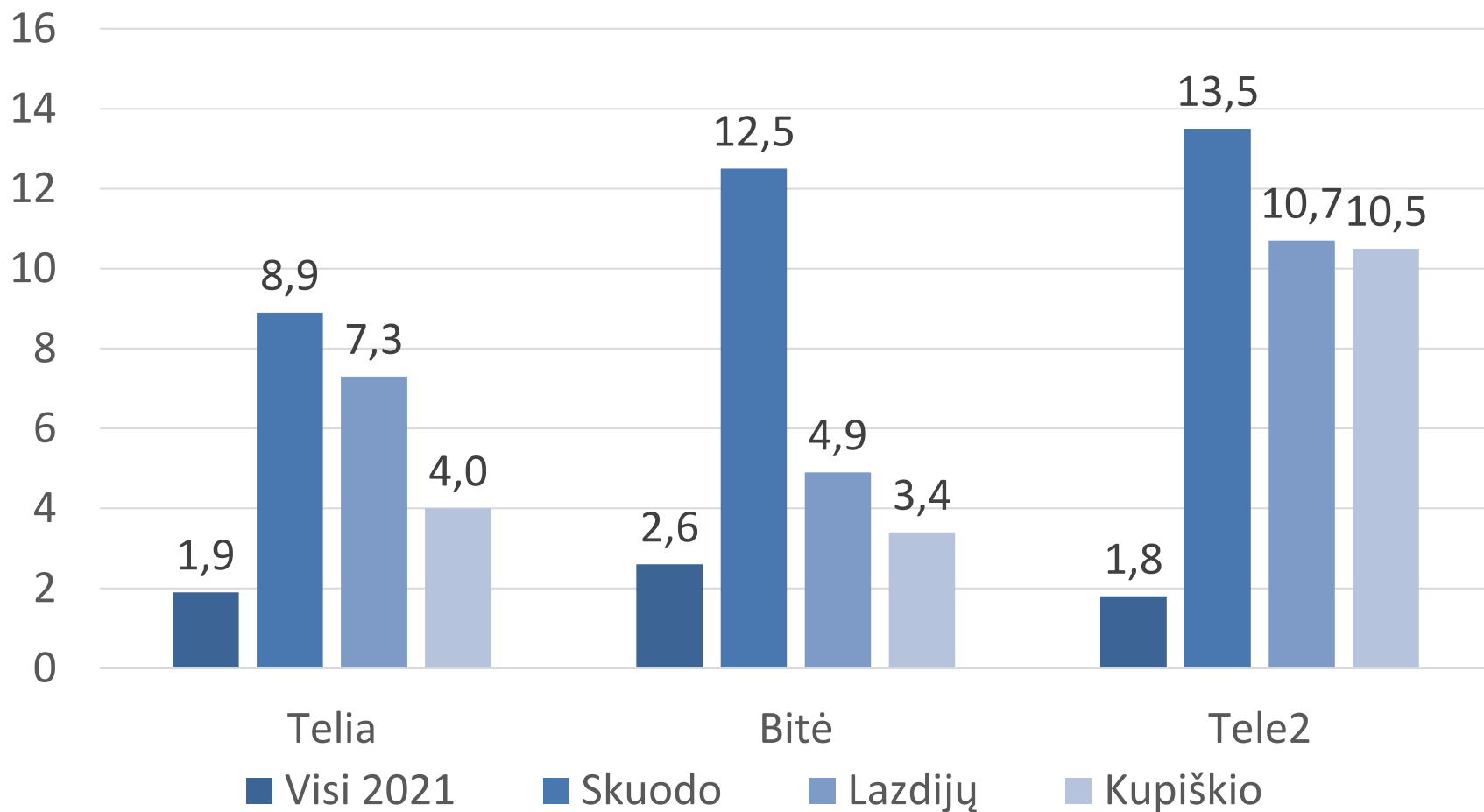


# VOICE QoS RESULTS

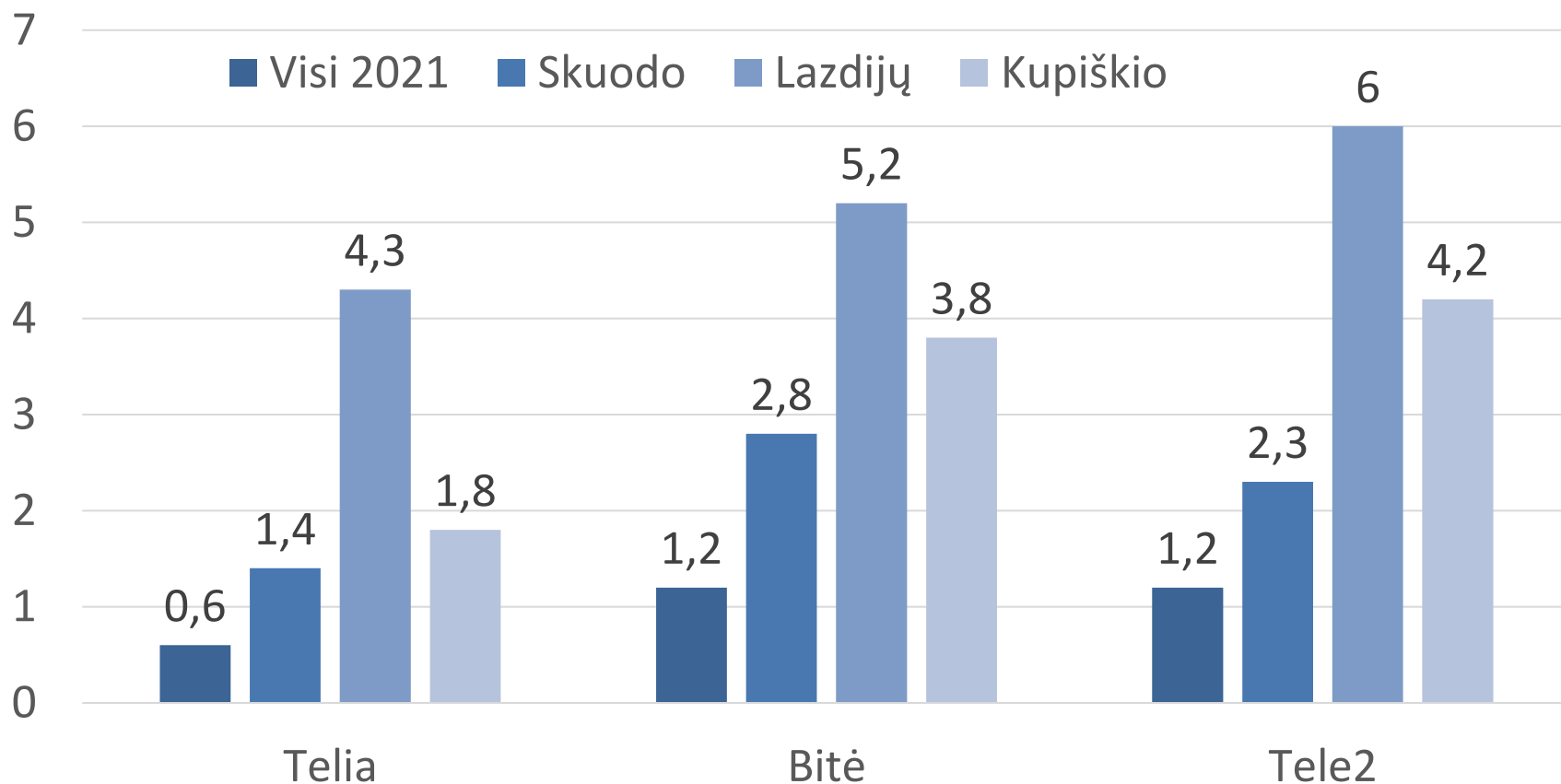
|                 | Failed % | Setup Time, s | Speech Quality, MOS | Dropped % | Total count of meas. |
|-----------------|----------|---------------|---------------------|-----------|----------------------|
| <b>Kupiškis</b> |          |               |                     |           |                      |
| <b>Telia</b>    | 4,0%     | 4,3           | 4,49                | 1,4%      | 149                  |
| <b>Bitė</b>     | 3,4%     | 8,4           | 3,57                | 2,8%      | 148                  |
| <b>Tele2</b>    | 10,5%    | 6,4           | 3,42                | 2,3%      | 143                  |
| <b>Lazdijai</b> |          |               |                     |           |                      |
| <b>Telia</b>    | 7,3%     | 4,4           | 4,43                | 4,3%      | 150                  |
| <b>Bitė</b>     | 4,9%     | 8             | 3,52                | 5,2%      | 142                  |
| <b>Tele2</b>    | 10,7%    | 5,9           | 3,38                | 6,0%      | 131                  |
| <b>Skuodas</b>  |          |               |                     |           |                      |
| <b>Telia</b>    | 8,9%     | 4,5           | 4,27                | 1,8%      | 123                  |
| <b>Bitė</b>     | 12,5%    | 8,6           | 3,49                | 3,8%      | 120                  |
| <b>Tele2</b>    | 13,5%    | 5,3           | 3,48                | 4,2%      | 111                  |



# FAILED CALL ATTEMPT %

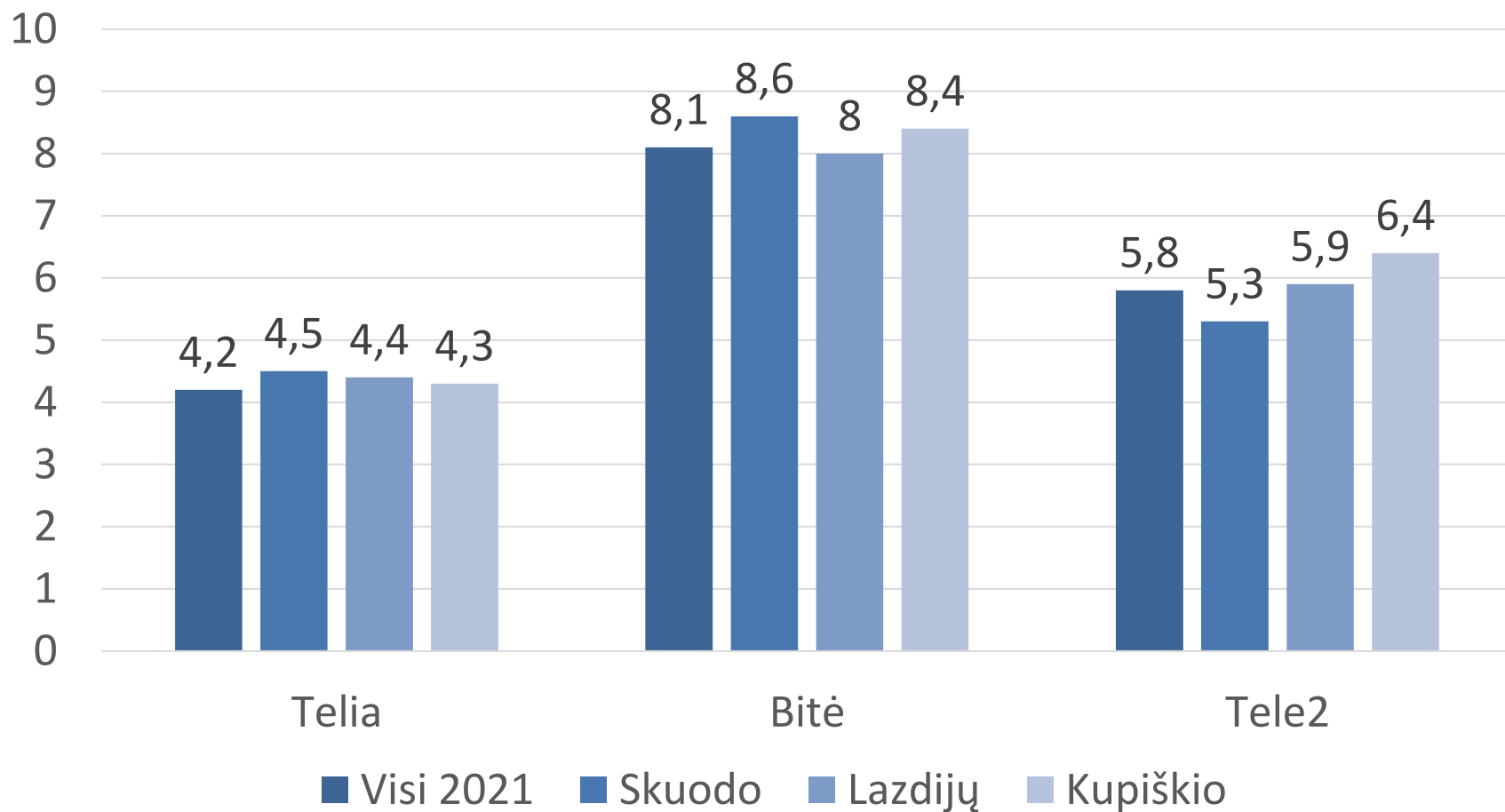


# DROPPED CALL %

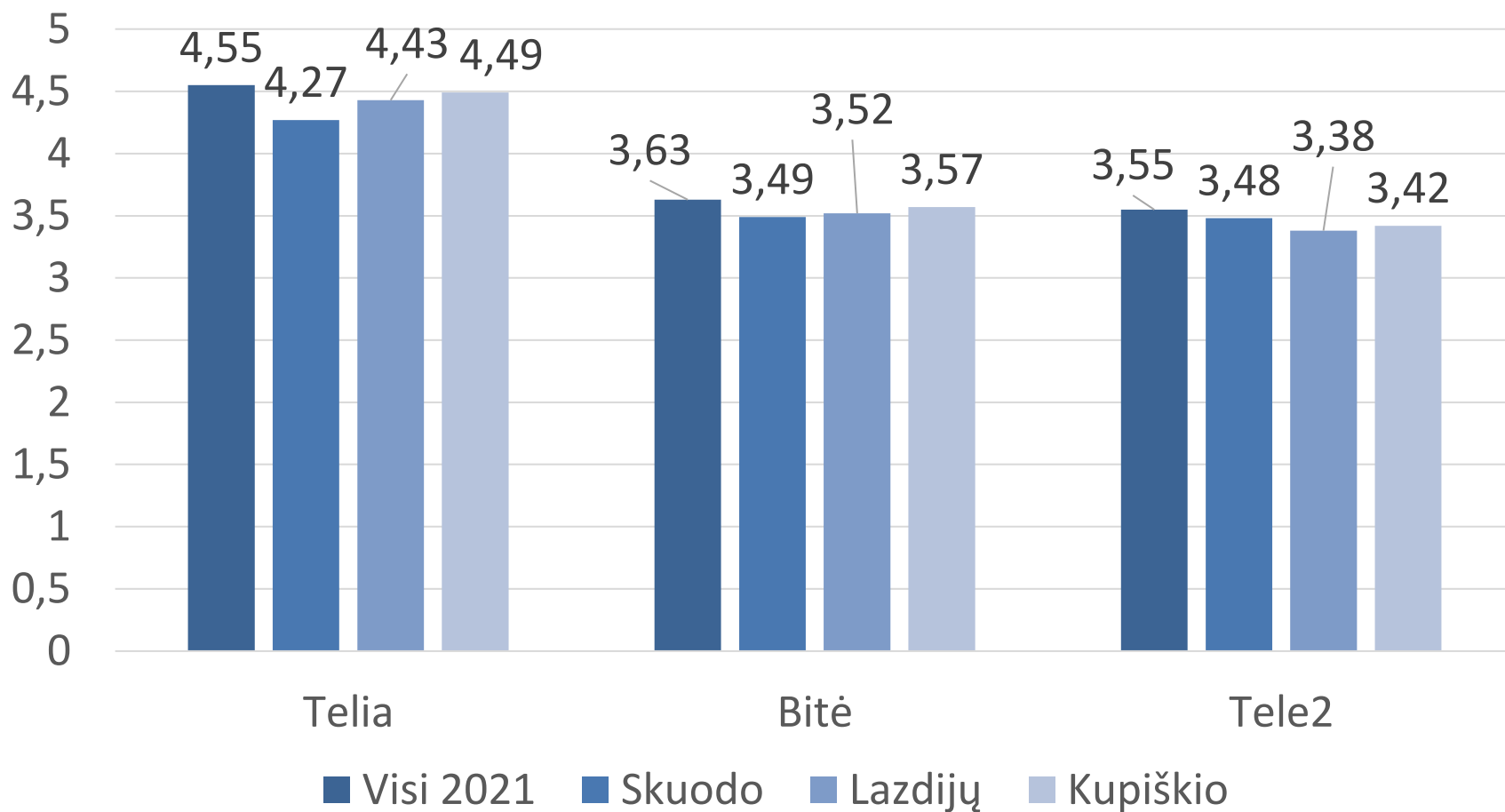




# SETUP TIME



# SPEECH QUALITY, MOS



# KEY TAKEAWAYS. TELEPHONY

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- Biggest difference comparing measurements in selected district municipalities are for parameters Failed Call Attempts and Dropped Calls (Poor radio coverage)
- If the calls were completed successfully, the quality (Setup Time, Speech Quality) is very similar to the levels registered across the country

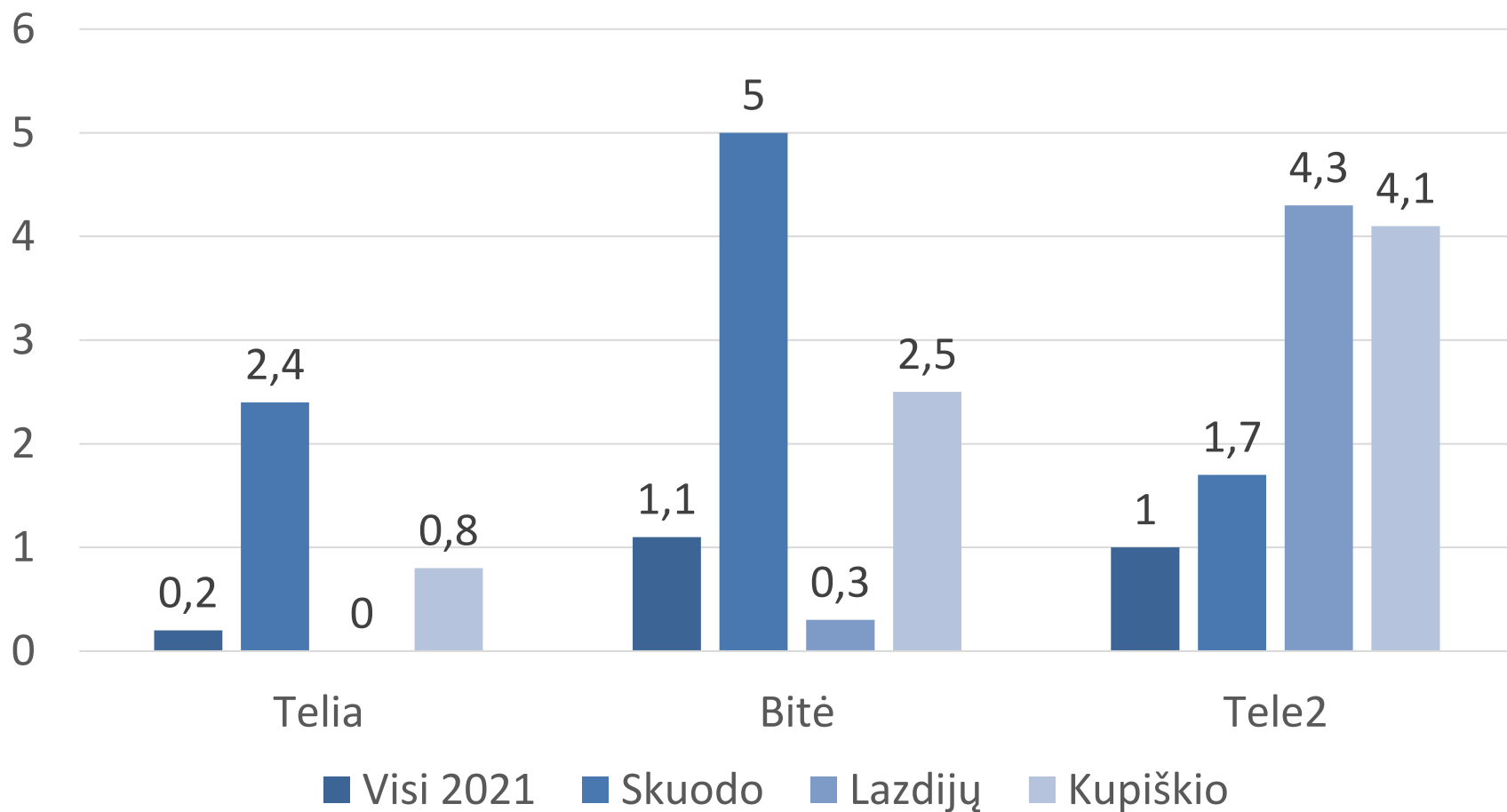


# SMS QoS RESULTS

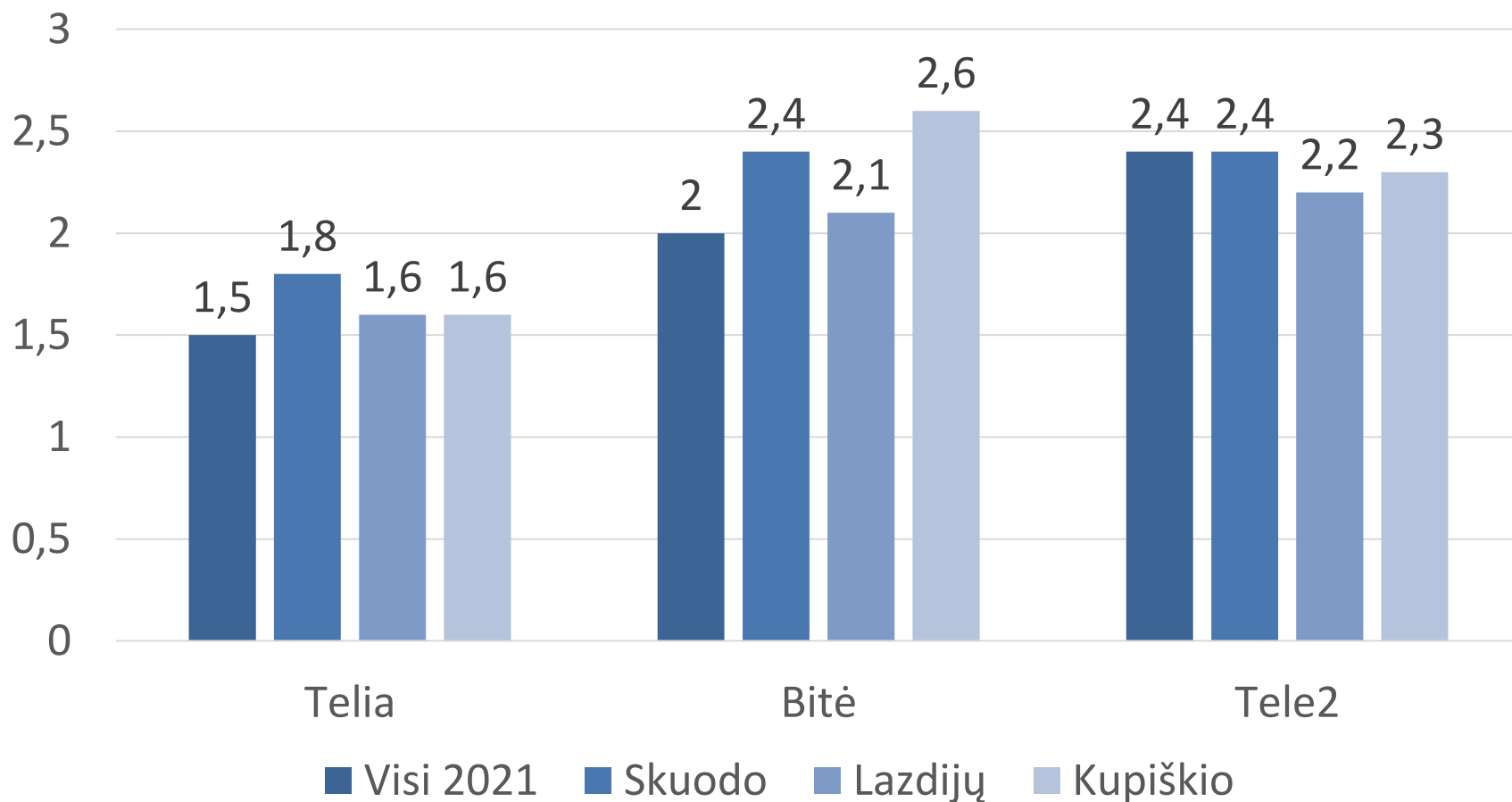
|                 | Service<br>Accessibility<br>MO, % | Avg Access<br>Delay MO, s | Unsuccessful SMS<br>Delivery, % | End-to-End<br>Delivery<br>Time, s | Count of<br>Meas. |
|-----------------|-----------------------------------|---------------------------|---------------------------------|-----------------------------------|-------------------|
| <b>Kupiškis</b> |                                   |                           |                                 |                                   |                   |
| <b>Telia</b>    | 0,8                               | 0,9                       | 0,8                             | 1,6                               | 125               |
| <b>Bitė</b>     | 0,8                               | 1,3                       | 2,5                             | 2,6                               | 122               |
| <b>Tele2</b>    | 0,8                               | 0,5                       | 4,1                             | 2,3                               | 121               |
| <b>Lazdijai</b> |                                   |                           |                                 |                                   |                   |
| <b>Telia</b>    | 0                                 | 0,8                       | 0                               | 1,6                               | 147               |
| <b>Bitė</b>     | 0,3                               | 1,1                       | 0,3                             | 2,1                               | 141               |
| <b>Tele2</b>    | 0                                 | 0,6                       | 4,3                             | 2,2                               | 138               |
| <b>Skuodas</b>  |                                   |                           |                                 |                                   |                   |
| <b>Telia</b>    | 0                                 | 0,9                       | 2,4                             | 1,8                               | 123               |
| <b>Bitė</b>     | 5                                 | 1,3                       | 5                               | 2,4                               | 120               |
| <b>Tele2</b>    | 0,9                               | 0,7                       | 1,7                             | 2,4                               | 116               |



# UNSUCCESSFUL SMS DELIVERY %



# SMS END-TO-END DELIVERY TIME



# KEY TAKEAWAYS. SMS

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- Similar as for calls, the biggest difference comparing measurements in selected district municipalities are for Unsuccessful SMS Delivery (Poor radio coverage)
- The End-to-End Delivery Time parameter didn't see notable degradation





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COMMUNICATIONS REGULATORY AUTHORITY OF THE REPUBLIC OF LITHUANIA  
Infrastructure and Equipment Control Department,  
Infrastructure Surveillance Division  
Vaidotas Radzevičius