

# omnitele

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## experience

Customer Experience Benchmark, the  
Netherlands

Mobile voice and data services

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# Introduction

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## Scope of Work

Omnitele has measured and analysed the customer experience of mobile voice and data services in the Netherlands. Measurements were conducted in February 2017. The investigated service providers were KPN, Vodafone, T-Mobile and Tele2.



## About Omnitele Ltd.

Omnitele provides consulting and expert services for telecom operators and regulators in network strategy, design and quality assurance. The company was founded in 1988 to set up world's first GSM network. Since then we have completed over 1000 projects in over 80 countries around the globe. Omnitele has ample experience from benchmark campaigns and network quality audits globally. Omnitele's methodology for investigating the customer experience of mobile services is applied in numerous countries in addition to the campaign in the Netherlands.

More information available at [www.omnitele.com](http://www.omnitele.com)

## 4G Telephony (VoLTE) added to benchmark

This customer experience benchmark is a repetition of the benchmark that Omnitele has carried out in 2016. Last year's survey focused on the testing of nationwide coverage of 4G (LTE) mobile services.

Last year though, the Dutch mobile providers did not offer the possibility of telephony using the 4G network. 2G and 3G network were still used for the handling of telephony calls. The technology that is used for 4G telephony is called VoLTE (Voice of LTE). VoLTE is presently offered by most of the Dutch mobile providers. VoLTE is the mobile version of Voice over IP (VoIP) services, which for example have been used for fixed telephony for a considerable amount of time already.

Beside the measurement of 4G data services and so called legacy 2G and 3G telephony service, this survey was focused on the measurement of this new 4G telephony service. The objective was to find out what the VoLTE customer experience was rendered by the Dutch mobile providers and how this would compare to the customer experience of the traditional legacy 2G and 3G voice services.

For the traditional telephony service, a call is handed back to the 3G or 2G network to process the call further there according to the so-called circuit switched technology. VoLTE is a packet switched technology that enables the transmission of a voice call as a stream of data packages, similar to for example the way in which data is send through the internet.

## Project Principles

Omnitele executes its benchmarks according to an internally standardised method that guarantees the independent character of the benchmarks. Further information on project method and accountability can be found at <http://omnitele-com.s3.amazonaws.com/2017/04/Method-and-accountability-page-EN.pdf>

The benchmark was conducted with Omnitele's internally standardised *be-the-customer* methodology. Instead of evaluating the technical network performance (data rate, signal strength), the analysis focuses primarily on the usability of mobile services and smartphone applications.

In this project the scope consisted of Mobile Voice, Web browsing, Twitter, Facebook, YouTube and DropBox customer experience measurements. Omnitele has furthermore taken measures to ensure reliable and objective results:

- Measurement routes and locations were independently selected by Omnitele
- Each network was measured in the very same locations simultaneously with identical measurement equipment.
- Measurements have been executed where (location), when (time) and how (services, devices) real subscribers typically use mobile services
- To measure the VoLTE service voice calls have been made from and to VoLTE capable terminals, whereas legacy voice services have been made from and to standard non-VoLTE capable terminals.

Omnitele emphasizes that the measurement results and conclusions provided by the benchmark depict the performance of the operators/services on the measured route at the time and date of the measurements. Results may vary depending on the location, time and date. However, given the extent of the measurements, the results provide a reliable indication on the overall service level offered by the operators.

# Conclusion

**VoLTE** Omnitele concludes, based on the observed results – and within the time and location context of the benchmark campaign – that the VoLTE telephony service represents a significant improvement in customer experience compared to the legacy 2G and 3G telephony services. VoLTE was offered by Tele2, Vodafone and KPN at the moment of execution of this survey in February. The VoLTE measurement results of these mobile providers show both a decrease in the call set up time as well as an improvement of the voice quality of the conducted voice calls.

When comparing the VoLTE customer experience of the measured mobile providers, it shows that on average the VoLTE voice quality is equal for all measured mobile providers. However, KPN is on average approximately half-a-second faster in the call setup times than Vodafone and Tele2.

**LEGACY MOBILE VOICE** Traditional 2G and 3G legacy voice results indicate that the KPN voice quality results are marginally higher than T-Mobile and Vodafone with a more clear difference to Tele2. The improvement in voice quality between the VoLTE and legacy voice services is therefore most noticeable for Tele2.

In call setup times T-Mobile is on average two seconds faster than KPN and Tele2, who both are on average two seconds faster than Vodafone. However, overall the call setup times are considerably longer than the VoLTE call setup times.

**MOBILE DATA** The differences between the mobile providers are negligible with respect to the customer experience of the measured data applications Web browsing, Facebook, Twitter, YouTube and Dropbox. An average difference of 0.3 seconds is measured between the fastest and slowest providers for the completion of the various application sessions. The biggest differences can be seen in Dropbox data throughput performance, where KPN and T-Mobile come out on top, followed by Tele2 and Vodafone.

**4G LTE COVERAGE** Looking at the investigated 4G coverage, it may be concluded that Tele2 is now on equal par with the other three providers. It may now be stated that nationwide 4G coverage has been completed for all four operators (which does not mean that no 4G coverage problems may occur locally in for example indoor locations). Not only Tele2, but all mobile providers show an improvement in their 4G LTE coverage levels when comparing this year's results with last year's results.

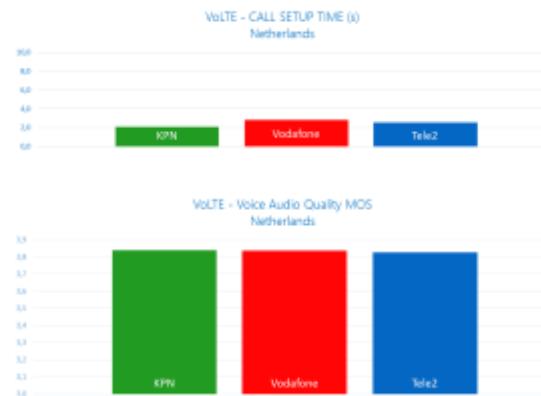
**INTERNATIONAL COMPARISON** Similar to 2016, the results show that the customer experience of mobile services in Netherlands is in general terms again on a very good level. The VoLTE voice quality results are equal to the results of measurement which Omnitele has carried out in similar European markets. The average call setup times in the Dutch survey appear to be a bit faster in comparison with the results obtained from these similar markets.

# Key Results

In this chapter, we illustrate our key observations and most important results of the conducted customer experience benchmark campaign.

## Whole Country Survey

**VoLTE** For the VoLTE telephony service the investigation has focused on finding the differences in customer experience between VoLTE and traditional circuit switched voice services. Significant improvements are achieved with faster call setup times and to a lesser extend also for voice quality. The measured VoLTE call setup times are almost 4 seconds faster than with traditional mobile voice calls. The average voice quality for VoLTE increases from a MOS score of 3.6 to 3.8. KPN and Vodafone reach maximal values of 4.5 and Tele2 a maximal value of 4.2. The improvement in voice quality is the most pronounced for Tele2, who improves from a MOS score of 3.1 to a MOS score of 3.8. KPN is on average approximately half-a-second faster in call setup times than Vodafone and Tele2, with the average call setup time for VoLTE being equal to 2.4 seconds.



**LEGACY MOBILE VOICE** Similar to last year's results, this year's results show that none of the operators had problems with delivering consistent mobile voice accessibility, retainability and quality.

All four operators show a relatively high *Call Success Rates* (% of calls without call setup or call continuation problems): T-Mobile, KPN and Tele2 all score again above 99% and difference between them fall into the

margin of error of the measurements. Vodafone was only marginally behind the other three with 98.4%.



*Call Setup Time* analysis revealed that on average T-Mobile (4.4s) achieved clearly faster call setups compared to Tele2 (6.0s), KPN (6.4s), and Vodafone (8.1s). T-Mobile has an advantage over KPN and Tele2 of about 2 seconds. Vodafone is on average 2 seconds slower than KPN and Tele2.



*Voice Quality MOS* analysis shows that KPN (3.8) achieved marginally higher average voice quality over T-Mobile and Vodafone (both 3.7). However, the difference can be considered to be negligible from typical end-user perspective. Difference to Tele2 (3.1) is more clear due to the fact that Tele2 is not using Wideband AMR codecs whereas the others are.



Based on the test results Omnitele concludes that overall all the Dutch operators provide good and consistent mobile voice service.

**MOBILE DATA** The differences between the mobile providers are negligible with respect to the customer experience of the measured data applications Web browsing, Facebook, Twitter, YouTube and Dropbox. A maximal difference of 0.3 seconds is measured between the fastest and slowest providers for the completion of the various application sessions. The biggest differences can be seen in Dropbox data throughput performance, where KPN (31.5 Mbps) and T-Mobile (31.1 Mbps) come out on top, followed by Tele2 (29.1 Mbps) and Vodafone (23.8 Mbps).

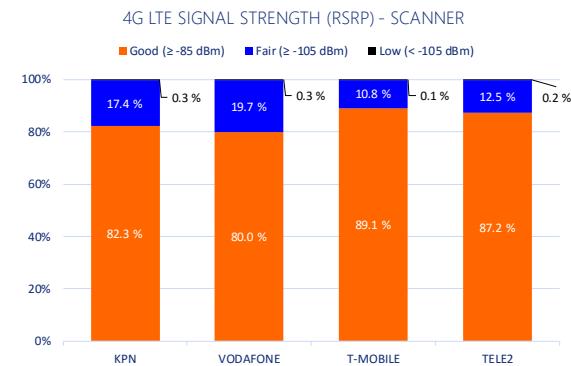
*Mobile Data Test Case Success Rate* gives the % of successful tests of all Web browsing, Facebook, Twitter, YouTube and Dropbox tests. With exception of the YouTube service, all providers show a success rate of way beyond 99.5%, with mutual differences being negligible. All providers demonstrate a higher success rate for mobile data applications in comparison to last year's survey. Again, the increase is most noticeable for Tele2, who now performs on equal level with the other three providers.

The success rates for the YouTube application are a bit lower with an average value of 96%. KPN (97.6%) and T-Mobile (96.4%) shows values a bit above this average. Vodafone trails with 95.9% and Tele2 just behind with 95.5%.

Based on the test results Omnitele concludes that KPN, Vodafone, T-Mobile and Tele2 provide consistently good mobile data service. All of the providers show an improvement in customer experience compared to the 2016 survey. Differences in customer experience for the tested data applications will hardly be noticeable.

**4G LTE COVERAGE** The results of this survey indicate that the Dutch providers render widespread 4G coverage. 4G LTE coverage is provided by the Dutch mobile operators by means of radio frequencies in the 800 MHz, 1800 MHz and 2600 MHz spectrum bands. The combination of these three spectrum bands is considered when determining the level of the 4G LTE coverage. (Tele2 only provides services via the 800 MHz and 2600 MHz spectrum bands).

The results show that KPN, Vodafone, T-Mobile and Tele2, all have a coverage level of above 99,7% on the routes that have been measured in this survey. Since these routes were the same as the routes in the 2016 survey, it may be concluded that all mobile providers show an increased 4G LTE coverage level. KPN, Vodafone and T-Mobile show improvements of on average 0.4 %-points, whereas Tele2 demonstrates an increase of 5.5 %-points.



The 4G LTE coverage was measured with frequency scanners. The resulting coverage plots are included in this report.

Based on the test results Omnitele concludes that the 4G LTE coverage of KPN, Vodafone, T-Mobile and Tele2 is equally good in the areas that have been measured within the time and location context of the benchmark campaign.

## International Benchmark

Omnitele has vast experience from auditing mobile network customer experience globally. In this section we discuss how Dutch mobile operators compare to international references. This is broadly a repetition of the results of the 2016 survey.

**VoLTE** The VoLTE customer experience results show a large degree of conformity with the measurement results that Omnitele has obtained from similar markets. These markets also show average voice quality MOS scores of 3.8 with maximums of 4.3, which are in line with the results in the Netherlands. The call setup times appear to be slightly faster in the Netherlands compared to results from similar markets, where values of around 3 seconds have been measured.

**LEGACY MOBILE VOICE** results show that the voice call accessibility and retainability in Netherlands is very high (almost 100% with all measured operators) compared to any reference markets globally. The voice quality MOS values measured for T-Mobile, KPN and Vodafone are again among the best results Omnitele has measured on a country average level.

**MOBILE DATA** Mobile data measurements were carried out using Omnitele's *be-the-customer* approach. Given the nature of the tests (web sites,

YouTube videos, according to country specific market trends), a direct apples-to-oranges comparison against reference markets measured by Omnitele is not possible. The measurement results however suggest that the customer experience for mobile data services in the Netherlands is on par with results from other European markets.

**4G LTE COVERAGE** 4G LTE coverage in the Netherlands is also well aligned with other European countries at least in the sampled area.

Based on the results Omnitele concludes that the quality of mobile services in Netherlands is generally on a very good level. The investigated customer experience performance indicators of KPN, Vodafone T-Mobile and Tele2 have relatively high KPI values compared to reference markets. With regards to VoLTE, KPN, Vodafone and Tele2 offer a customer experience level that is equal if not better to results from similar markets.

## Annexes

### A1: Data Application Measurements

#### Web browsing



#### Facebook



 Twitter



 YouTube



 Dropbox



## A2: 4G LTE Coverage

The coverage plots of the various mobile providers are depicted on the following pages. The legend of these Scanner-coverage plots of KPN, Vodafone, T-Mobile and Tele2 is as follows:

- Orange: Good signal strength ( $\geq -85$  dBm)
- Blue: Reasonable signal strength ( $\geq -105$  dBm and  $< -85$  dBm)
- Black: No signal strength ( $< -105$  dBm)









# A3: City List

#	City	Inhabitants [x1000]	#	City	Inhabitants [x1000]
<b>1</b>	<b>Amsterdam</b>	805	<b>37</b>	<b>Amstelveen</b>	85
<b>2</b>	<b>Rotterdam</b>	615	<b>38</b>	<b>Hengelo</b>	81
<b>3</b>	<b>Den Haag</b>	508	<b>39</b>	<b>Purmerend</b>	80
<b>4</b>	<b>Utrecht</b>	325	<b>40</b>	<b>Roosendaal</b>	77
<b>5</b>	<b>Eindhoven</b>	220	<b>41</b>	<b>Schiedam</b>	77
<b>6</b>	<b>Tilburg</b>	209	<b>42</b>	<b>Lelystad</b>	76
<b>7</b>	<b>Groningen</b>	196	<b>43</b>	<b>Alphen aan den Rijn</b>	73
<b>8</b>	<b>Almere</b>	196	<b>44</b>	<b>Leidschendam-Voorburg</b>	73
<b>9</b>	<b>Breda</b>	179	<b>45</b>	<b>Almelo</b>	73
<b>10</b>	<b>Nijmegen</b>	167	<b>46</b>	<b>Spijkenisse</b>	72
<b>11</b>	<b>Enschede</b>	158	<b>47</b>	<b>Hoorn</b>	72
<b>12</b>	<b>Apeldoorn</b>	158	<b>48</b>	<b>Gouda</b>	71
<b>13</b>	<b>Haarlem</b>	154	<b>49</b>	<b>Vlaardingen</b>	71
<b>14</b>	<b>Amersfoort</b>	150	<b>50</b>	<b>Assen</b>	67
<b>15</b>	<b>Zaanstad</b>	150	<b>51</b>	<b>Heerhugowaard</b>	66
<b>16</b>	<b>Arnhem</b>	150	<b>52</b>	<b>Bergen op Zoom</b>	66
<b>17</b>	<b>Hoofddorp-Nieuw Vennep</b>	144	<b>53</b>	<b>Capelle aan den IJssel</b>	66
<b>18</b>	<b>'s Hertogenbosch</b>	143	<b>54</b>	<b>Veenendaal</b>	63
<b>19</b>	<b>Zoetermeer</b>	124	<b>55</b>	<b>Katwijk</b>	63
<b>20</b>	<b>Zwolle</b>	123	<b>56</b>	<b>Zeist</b>	61
<b>21</b>	<b>Maastricht</b>	121	<b>57</b>	<b>Nieuwegein</b>	61
<b>22</b>	<b>Leiden</b>	120	<b>58</b>	<b>Roermond</b>	57
<b>23</b>	<b>Dordrecht</b>	119	<b>59</b>	<b>Den Helder</b>	57
<b>24</b>	<b>Ede</b>	110	<b>60</b>	<b>Doetinchem</b>	56
<b>25</b>	<b>Emmen</b>	108	<b>61</b>	<b>Hoogeveen</b>	55
<b>26</b>	<b>Westland</b>	103	<b>62</b>	<b>Terneuzen</b>	55
<b>27</b>	<b>Venlo</b>	100	<b>63</b>	<b>Barendrecht</b>	50
<b>28</b>	<b>Delft</b>	99	<b>64</b>	<b>Oosterhout (NB.)</b>	48
<b>29</b>	<b>Deventer</b>	98	<b>65</b>	<b>Middelburg</b>	48
<b>30</b>	<b>Leeuwarden</b>	96	<b>66</b>	<b>Bussum</b>	47
<b>31</b>	<b>Alkmaar</b>	95	<b>67</b>	<b>Huizen</b>	45
<b>32</b>	<b>Sittard-Geleen</b>	94	<b>68</b>	<b>Vlissingen</b>	44
<b>33</b>	<b>Helmond</b>	89	<b>69</b>	<b>Drachten</b>	44
<b>34</b>	<b>Heerlen</b>	88	<b>70</b>	<b>Zutphen</b>	43
<b>35</b>	<b>Hilversum</b>	86	<b>71</b>	<b>Houten (U.)</b>	43
<b>36</b>	<b>Oss</b>	85			
<b>Total #cities</b>		71			
<b>Total inhabitants</b>		8 671 000			