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A first glance at connectivity and infotainment in the all-new electric sportscar



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Dear readers,

what we are accustomed to from our smart phones, now also shapes our expectations towards the functionality and user friendliness of other devices and systems which we utilize in our every day routines. This also applies to cars. So, it is hard to accept why we should lower our standards when it comes to controlling navigation, infotainment and connected car services in comparison to the operation of a tablet or smart phone.

This is exactly our credo, when the experts of connect and umlaut assess the connectivity and user experience of modern vehicles. On the following pages, you will read what we so far accumulated in terms of test results. Thus you can find out, which car models are ahead in this discipline – a discipline constantly growing more and more important.

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Manager und publisher:
Dirk Waasen
Editor in chief: Marc-Oliver Bender
Project management and English translation: Hannes Rügheimer

Editors and authors: Joachim Bley, Michael Peuckert, Bernd Theiss
Final editing: Astrid Hilmer-Bruer, Gerlinde Dalder, Sabine Schmitt, Irmhild Tieck

Layout and concept:
Matthias Herlitze
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Head of ad sales: Vasilii Tsiolos

Managing director of publishing house:
Kurt Skupin
Address of publishing house:
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STRONG DEBUT

The Audi A6 Avant meets the connectivity and user experience testing procedure of connect and umlaut. Learn what the Ingolstadt-based car maker gets going in terms of connected driving.

Modern cars get smarter all the time and offer a variety of functions which users have grown accustomed to in other areas of their everyday routines. This obviously raises the expectations towards their vehicles, because smartphones and speech assistants such as Alexa have set standards regarding voice activation and connectivity. Therefore, users expect

exactly the same experience while driving in their cars.

In order to accommodate this fast progressing change, connect and umlaut have teamed up and developed

a testing procedure which takes a closer look at the user experience as opposed to the sheer functionality of connected car services.

Our first candidate in this series of tests is the Audi A6 Avant which has inherited the strong connectivity genes of its big brother A8 and thus should be well equipped for our demanding assessment. Let's see whether this assumption is met by the reality. **Michael Peuckert**

AUDI A6 AVANT SPORT 50 TDI QUATTRO

Performance kW/hp:	210/286
Maximum torque:	620 Nm
Maximum speed:	250 km/h
Acceleration:	
(0-100 km/h)	5,7 s
Test consumption:	6,1-9,3 l/100 km
Price:	from 62 850 Euros





Infotainment

With three displays, a well working user guidance and plenty of entertainment options, the Audi has a lot to offer.

■ Provided that the Audi A6 Avant is equipped with the „MMI Navigation Plus with MMI Touch Response including Audi Virtual Cockpit“ (2200 Euros), the the car from Ingolstadt boasts with three high resolution displays. Behind the steering wheel, a 12.3 inch screen performs its duties and presents any selected information crisp and sharp. In the center console, a 12.3 inch high definition touch screen serves as a media display, however for our taste, it is located a tad to low in the console.

In the test car, the duo is complemented by a head up display (1400 Euros) as well as an additional display with a size of 8.6 inches located below the media display. Under normal conditions, this display provides the settings for the climate control in the A6 Avant. However, the driver can use part of its surface to place shortcuts in order to directly access radio stations or contacts. This works even over multiple layers. On demand, a QWERTY keyboard is overlaid, with the system also recognizing handwritten letters or complete words – which worked well in practical usage.

Controlling the infotainment system is done via the touch displays, buttons on the steering wheel or using the voice recognition which understands natural language

and even covers vehicle functions such as the temperature control (“I’m cold.”). For volume control, a control dial is placed on the center console, complementing the steering wheel buttons.

As a specialty, the media and climate control displays offer a haptic feedback upon operation. The user can also disable this function or configure it as a button replacement. In the latter case, a higher pressure must be applied to the display in order to trigger a function – in this mode, a simple touch will not suffice.

All in all, the user interface is great and can be operated intuitively. However, some functions are hidden in deep menu levels. In the side area on the left, there is a column with five functions, four of which can be assigned with individual shortcuts to favorite functions. The order of the menu items can also be rearranged via drag-and-drop.

The Audi successfully completed the entertainment part without any problems. If the vehicle is equipped with a DAB+ receiver (430 Euros) it supports all variants of radio reception. A DVD drive (120 Euros) and media playback via USB or WiFi are also present. However, there is one feature we missed: streaming services which are directly embedded in the system. >>



The main menu is well-arranged and can be customized by the user – much the same as the feature column on the left-hand side.



Depending on the chosen options and the integration of streaming services via the „myAudi“ app, the media selection can be opulent.



The climate control display not only accomodates the user's shortcuts, but also serves as an input area for text, depending on the current functions.

Navigation

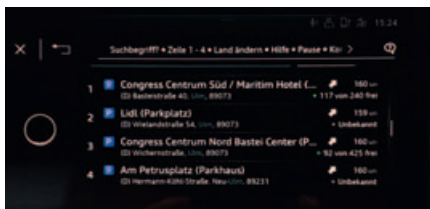
In each disciplines of navigation, the A6 Avant earned top grades. It gives its user a treat with great visualizations, helpful live information and well working route guidance.



Google Earth navigation within the 12.3 inch cockpit display presents itself in a more than impressive manner.

■ When it comes to navigation, the Audi rolls out some heavy artillery. It is simply brilliant to enjoy the guidance through the traffic jungle with the large cockpit display's Google Earth view. Naturally, the head up display cuts back considerably in comparison – but it makes sure that the driver's eyes do not have to wander to one of the other displays.

Also, the further aspects of optical route guidance leave nothing to be desired. For example, the system presents a tour overview with alternative routes. Also, lane suggestions, motorway exits or crossroad details are shown comprehensibly. As a special feature, the Audi even offers positioning on a lane level in larger cities. This means that the driver can see on the dis-



Thanks to the live information, the driver knows in advance, how many parking spaces are available in his or her favorite car park.

play on which lane the vehicle is currently travelling – for example on the left-most of four. This is a big advantage in unknown cities. Here, also the detailed 3D view of buildings well supports finding one's way.

Entering destinations did not pose any difficulties at any time. As the Audi system understands natural language, even colloquial commands such as "Let's dine Italian" or "Find a car park nearby" work reliably. In the first case, the driver is provided with a selection of restaurants which is even amended by online Yelp ratings. For the car parks, the number of currently available parking spaces is reported. In the category of live information, we only missed „On-street parking“ – a reporting of parking opportunities located directly at the roadside.



High resolution maps, here with 3D buildings, allow the A6 Avant to present streets as well as the vehicle itself with a lane-level precision.

In practice, the A6 Avant's navigation is entirely convincing. During the two-week testing period, the Ingolstadt-made car did not show any weak spots. The test team awarded top grades for route calculation and guidance. The acoustic guidance offers the right detail level of information and never annoyed the testers with telling too much. When a traffic jam was about to come up, the system informed the driver in an adequate manner and offered bypasses which corresponded to our test references Google Maps and Waze in most of the times. For a dream result, there were only some extras missing – such as an augmented reality mod. But the grade "very good" in this discipline is a considerable achievement.





Connectivity

The networking functions leave nothing to be desired. The grade “very good” in this category is a logical result.

■ Being one of the most modern vehicles in the current upper middle class, the test car offers all important services and interfaces. The installed infotainment system provides for the complete portfolio of „Audi connect Navigation & Infotainment“ services. It does not only contain Google Earth navigation and live traffic information, but also includes a Wi-Fi hotspot and plenty of other goodies.

In addition to the eSIM for LTE installed in the car, there are a SIM slot for a user’s own SIM card, two USB A connectors for data and charging connections, as well as a slot for SD memory cards. WiFi and Bluetooth complement the ample connectivity features of the A6 Avant.

In the middle arm rest, a placement area for wireless charging can be found, which will provide energy to compatible smart phones. If the mobile phone is placed in the according storage area, it is also connected to the vehicle’s antenna in order to reduce the electromagnetic exposure in the interior.

So, the A6 Avant also gathers the full amount of possible points in the “Telephony” category. Voice calls were clear and very well intelligible in both directions. Furthermore, SMS text messages are shown and read aloud on demand. With text-to-speech it is even possible to dictate new messages. The same functions are also applicable for e-mails. This is complemented by news, weather information and even fuel prices. However, it is a small pity that the A6 Avant does not offer a web browser – thus, surfing the internet is not possible.

The “myAudi” app again gave a superb impression. Here, the driver is informed about current vehicle data, he or she can send destinations to the car’s satnav system, and can open or close its doors. Also the current status of the various systems can be found here. By request, the “myAudi” app also guides the driver towards the car or after arriving at a car park from there to the final destination. With this strong performance, the Audi deserves the grade “very good“. >>



The “myAudi” app gives a full status report of the vehicle.

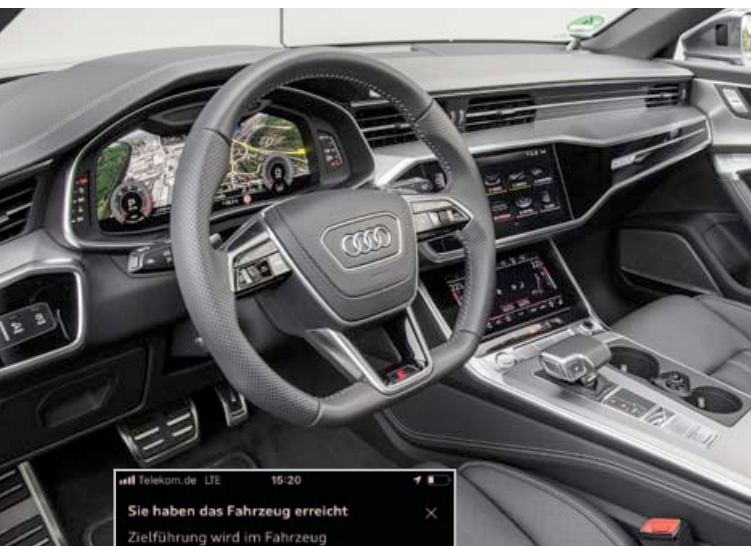
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SMS text messages and e-mails can be shown on the display and also be read aloud.



The menu contains all settings for cellular connectivity, WiFi and Bluetooth.



User experience

The Audi A6 Avant showed good results in our user tests of connected car services. Still, we discovered some potential room for improvements.

■ In the UX test, the A6 Avant had to face the expert team from umlaut and prove how the app and connectivity features can be used in everyday life – which mostly worked well. So, for example in the “navigation” category, the Audi received top grades. The integrated search for parking spaces turned out to be particularly convincing. Also the haptic feedback was favored – even if it was no longer available when the user turned to Apple Carplay or Android Auto.

with the voice control system rather difficult.

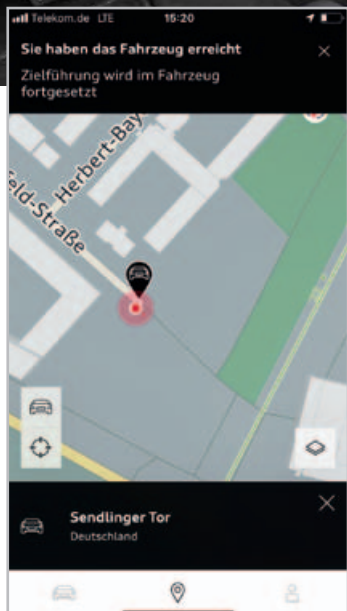
Also, the testing team was not overly happy when it came to streaming services. They are fundamentally available, but must be registered via the “my-Audi” app – which is not very intuitive. Also, the top dog Spotify is missing from the portfolio.

Speaking of the “myAudi” app: The app itself gathered the grade “very good” among the experts. It is conveniently possible to send POIs to the car, which will then turn up as messages in the infotainment system. Only the door opening via app takes a lot of time in practice, which might cause the user to revert back to the classic car key.

However, the experts also found some weaknesses. Thus, they deducted some points in the categories “Voice control” and “Entertainment”. If the user issues a voice command which the system can not carry out, there is no according feedback – instead, sometimes just a different action will be performed. Also, certain dialects made the communication

But all in all, in the handling of the Audi A6 Avant by umlaut’s experts good impressions prevailed. Thus, the vehicle safeguards the grade “good” in the “User Experience” category.

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Does the Audi A6 Avant’s “User Experience” keep what its looks are promising? umlaut’s experts accurately checked it.

The “myAudi” app is great and offers navigation also before and after driving – including seamless handovers to and from the vehicle.

Driver’s assistance

The driver assistance systems are not part of the car connect assessment – but we still do not want to keep quiet about the numerous possibilities of the Audi A6 Avant.

■ Some drivers love them, others do not even touch them during the whole lifetime of a vehicle. We are talking about driver’s assistance systems – of which the test vehicle had plenty on board.

The car was equipped with the “Assistance package Tour” (in this case part of the “Business package” for 4240 Euros), the “Assistance package City” (1200 Euros), “Surround cameras” (370 Euros) as well as the “Night view assistant” (2150 Euros). Combined with the

standard automatic transmission, particularly the adaptive cruise control and the track guiding assistant performed very well on long-distance routes. Especially in traffic jams, the stop and go functionality provided a lot of comfort.

Also impressive is the night view assistant. It turns the night into day within the cockpit display thanks to a thermal camera. If the system recognizes people or animals on the street, they are marked in yellow on the screen.



The surround cameras of the Audi A6 Avant provide an impressive panorama view. Additionally, the user can select between different viewing angles.



Methodology of umlaut's und connect's testing

While connect takes care of the infotainment, navigation and connectivity topics, umlaut tests the user experience of the connected car services of modern vehicles. Here you learn all the details.

■ Four experts assess the connected car services (CCS) of the tested vehicles. Each of these distinguished experts has several years of professional expertise in the areas of car connectivity and user experience.

The assessment of connected services relies on a two-stage testing procedure. First, pre-defined use cases (tasks) are performed independently by the professionals. Then, the holistic usability as well as the visual aesthetics of the connect app and the vehicle's HMI are rated (object-oriented testing). In order to prepare themselves for the testing, the experts make themselves familiar with the innovations of the manufacturer-specific connected car services – for example via the manufacturers web page.

In the first part of the testing procedure, the experts execute the pre-defined use cases. In order

to have a reference value for the assessment of each use case, the professional identify and rate reference systems beforehand. After each use case, the tester answers a so-called After Scenario Questionnaire (ASQ). In the second part of the procedure, the object-oriented test, the expert rates the overall usability and visualization of the connected car app and the vehicle's HMI based on the forms UMUX (Usability Metrics for User Experience) and VisAWI-S (Visual Aesthetics of Websites Inventory).

The rating of all three questionnaires is based on a seven-stage Likert scale, out of which the average assessment of all four experts is calculated. Next, the UX score for each category is determined from the averages of all the use cases of this category. And finally the overall use case is calculated. It thus represents the average of all tested categories.

Conclusion

Michael Peuckert,
editor



With 421 points, the Audi A6 Avant only narrowly misses the overall grade "very good" and thus shows a convincing debut. This is no surprise – after all, the model from Ingolstadt belongs to the current infotainment and connectivity elite which it could impressively demonstrate in this test. Given its basic price of about 63 000 Euros, the necessary additional investment of scarcely 5000 Euros is also quite okay. Furthermore, the Audi performs nicely in our user experience test and thus proves that a multitude of functions does not necessarily have to lead into usability hell. Quite on the contrary, the concept of operations makes sure that also drivers who are not so deeply interested in technology, still can drive and use this car without any serious problems.



Test Results

Brand	Audi	
Model	A6 Avant Sport 50 TDI Quattro	
Infotainment system	MMI Navigation Plus with MMI Touch Response incl. Audi Virtual Cockpit	
Basic price/Price of test vehicle ¹	(Euros)	62 850/108 020
Extras relevant for assessment ¹	(Euros)	4810


Features

Display	
Main display/resolution (inch/pixel)	10.1/1540x720
Additional display/diagonal/cockpit display (inch)	1/8,6/12,3
Touch/haptic feedback/head up display	+/-/+
Connectivity Interfaces	
eSIM/user SIM(format)/LTE/5G/Car2X	+/-/Nano-SIM/+/-/+
WiFi/WiFi hotspot/Bluetooth	+/-/+
USB type/number/memory card slot	USB-A/2/SD
coupling external antenna/wireless charging	+/-
Digital key	Smartphone with NFC
User Interface	
Voice control/infotainment/POI/vehicle	natural speech/+/-/+
Controller/wheel buttons/function buttons/vol.	+/-/+/-/+
Handwriting recognition touchpad/display	+/-
User profiles/customizable main menu	+/-
Shortcuts/for radio stations/for telephony	Add. display/+/-
Entertainment	
DAB+/web /hybrid radio/CD/DVD drive	+/-/+/-/+
USB/WiFi/Bluetooth media playback	+/-/+
Streaming services	via Smartphone app
Apple Carplay/Android Auto/Mirrorlink	+/-/+
Navigation	
Dest. entry: controller/touch/voice/map/phone	+/-/+/-/+
Dynamic navigation	Live traffic onboard
View display arrow/2D/3D/Google Earth/AR	+/-/+/-/+
Map visualization/3D building representation	very fine/+
Route selection/alternative route	+/-
Visual. current street/next street/speed limits	+/-/+
Maneuver info: Arrow/signs/lane/pos. on lane	+/-/+/-/+
Live infos praking/fuel prices/ratings	+/-/+
Telephony & Productivity	
Contacts/favorites/quick access	+/-/+
SMS view/TTS announcement/STT entry	+/-/+
E-Mail view/TTS announcement/STT entry	+/-/+
Calendar/browser/Skype	+/-/+
News/weather/fuel prices	+/-/+
Smartphone app	
Open/close doors/ start/stop air condition	+/-/+/-/+
Location/driver's log	+/-
Send address/POI/first/last mile navigation	+/-/+/-/+
Vehicle infos/push infos/alarm infos	+/-/+

Test results

Infotainment	max. 100	very good (88)
Display	(50)	44
User Interface	(30)	28
Entertainment	(20)	16
Navigation	max. 100	very good (93)
Features	(40)	36
Route calculation	(20)	19
Guidance	(40)	38
Connectivity	max. 150	very good (127)
Interfaces	(40)	33
Telephony	(30)	30
Productivity	(30)	23
Smartphone app	(50)	41
User Experience	max. 150	good (113)
connect	VERDICT max. 500	421 good

¹ at time of testing



In the left-hand area of the steering wheel, the driver finds the handy volume control roller and can also skip titles or radio stations or activate voice control. However, the selection of a music source requires using the menu in the digital instrument cluster.

SHORTCOMINGS

The Skoda Karoq belongs to the most popular compact SUVs and sells very well. But what about its abilities in areas such as infotainment, connectivity and the like? The testing by connect and umlaut sheds some light on these questions.

Skoda without a doubt is part of the more successful stories in the heavily changing automotive industry. So, the models of the Czech car maker are constantly growing more popular among buyers. An important role in this success story is certainly played by the very popular compact SUV Karoq, which this time faces our infotainment and connectivity test.

As Skoda is part of the Volkswagen group, the car maker obviously makes use of the group's own

modular infotainment building kit, in short MIB. So it is no surprise that some of its functions can also be found in models of the mother company Volkswagen or the sister

brand Seat. However, Skoda is ahead within the group by already using the third generation of the MIB.

connect and umlaut have tested the Skoda Karoq considering infotainment, navigation, connectivity and not least user experience. In doing so, we have unfortunately determined some catching up to do compared to the current offerings of premium car makers in the league of Audi, BMW and Mercedes. On the following pages, you can read in detail, where we think the problems are.

Michael Peuckert

SKODA KAROQ STYLE 2,0L TDI 4X4 DSG

Performance kW/hp:	110/150
Maximum torque:	340 Nm
Maximum speed:	193 km/h
Acceleration: (0-100 km/h)	9,2 s
Test consumption:	5,8-8,9 l/100 km
Price:	from 35 240 Euros



connect



Scan the QR-Code, and learn how umlaut and connect test connected services in vehicles.

The 9.2 inch touch screen has a resolution of 1280 x 640 pixels and presents its contents quite crisply. The home screen offers a useful split screen view with three elements. The contents of the two smaller elements can be chosen by the user. However, using the sensor buttons for volume control is tedious in everyday life.



In the center console in front of the gear shift lever, the user finds even two USB-A connectors which charge devices, play back the contents of storage media or integrate the smart phone via Android Auto, Apple Carplay or Mirrorlink into the Columbus infotainment system of the Skoda Karoq.



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Infotainment

In spite of the convincing entertainment features of the Karoq, a weak voice control and the not always coherent operation concept based on sensor keys only allow for an average result.

■ Skoda offers multiple infotainment systems for the Karoq, of which the largest variant Columbus was integrated in the test car as part of the „Feature Package Business Columbus“ for 2390 Euros. The system offers a 9.2 inch touch screen with a glass front and sensor keys, hard disk navigation, Bluetooth, a DVD drive, voice control as well as „SmartLink+“ for smart phone connectivity. However, a head up display can not be found in the Karoq. Still the „Digital Instrument Cluster“ (390 Euros) provides much convenience and multiple display options for navigation, telephony and music playback. User profiles board the SUV with the “Customizable Key“ (40 Euros).

As a special feature, the driver can access about 10 GB of hard disk space for his or her own needs – filling it with music, photos

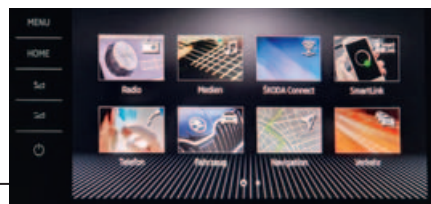
or even videos. However, some important features are regrettably missing. For example, there is no direct integration of streaming services or web radio in the system. These features can only be brought into the Skoda by taking detours via Bluetooth or „SmartLink+“ using Android Auto, Apple Carplay or Mirrorlink.

However, the testers liked the user interface. For example, its home screen offers three elements, two of which can be customized with individual function assignments. Also, the main menu is designed with ele-

gant icons and offers a “carousel view“ alternatively to the standard grid view.

Controlling the infotainment system is primarily done via the touch screen or the steering wheel buttons. As the Columbus system does not offer any hard keys at all, selecting a different music source is a little complicated – the user always has to use the main menu for this task. Also, we were missing a volume controller – for this setting, the sensor keys are not totally convincing.

Much the same can be said about the weak voice control, which is invoked via a button on the steering wheel. Its recognition rate in the test was simply bad. Still, the Karoq’s gesture recognition somewhat makes up for this. For example, a swiping gesture will change the menu level or skip music titles contactless and reliably. >>



The menu presents all functions of the system on two levels. Thanks to gesture control, the levels can be changed contactless.

Navigation

On the numerous test kilometers, the Skoda Karoq made a good impression. The testers found it appealing both in terms of route selection and guidance. Although it is awarded the grade “good“, there is still room for improvement in some areas.



The main screen can show additional information such as for example an overview of the next driving maneuvers.



In addition to the lane recommendations in the upper area, the system also presents turn indications including traffic signs.



If the Karoq is connected to the internet, it informs the driver about current fuel prices or the remaining capacity of car parks.

■ In order to start the navigation, the driver must invoke it via the menu, send a destination to the Karoq via the smart phone app or alternatively tell the desired address using voice control, which is activated by pressing a button on the steering wheel. However, the latter did not often lead to the expected result during the test, so the testing team ultimately reverted to entering addresses on the touch screen.

If requested, the Columbus system can calculate several routes, from which the driver can choose the preferred one directly on the display. If the Skoda is connected to the internet, the calculation considers real time traffic information. In terms of visualization, Skoda Karoq drivers must be content with 2D and 3D route depictions,

because photo realistic representations are only available via non-native navigation such as via Android Auto with Google Maps. However, the Skoda’s own system can show 3D buildings depending on the selected zoom level, which can be very helpful in unknown cities.

An additional benefit is provided by the digital instrument cluster. On its 10.2 inch screen, the Karoq offers several visualizations in navigation mode. This ranges up to a full screen view (see image below). If it is selected, the driver can save the effort of turning his or her eyes to the central display, even more so as the cockpit display also shows the helpful lane recommendations.

In our practical testing, the Skoda Karoq had it prove itself as a reliable route guide on

a total of 800 kilometers. Most of the time, it made a good impression in this domain. Once the destination is entered via voice control (which, as already mentioned, did not work convincingly during the test) or via the touch screen, the Skoda Columbus system tends to deliver somewhat restrained acoustic and nicely implemented visual guidance, leading the driver dependably to his or her destination.

The main weakness which we found in the navigation part concerns the estimated time of arrival. Here, the gap in comparison to our reference Google Maps amounted up 18 minutes on a 180 km test drive. In spite of this small deficit, the Skoda Karoq overall was awarded the grade “good“ in the navigation category.

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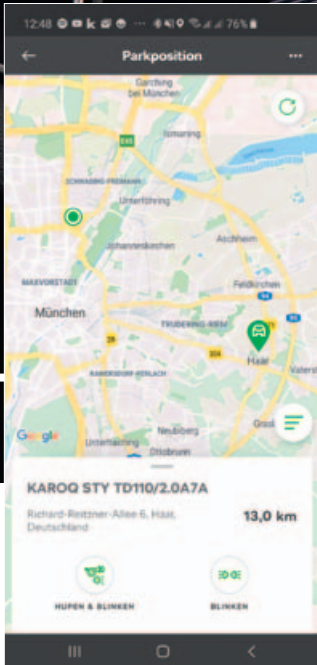




Connectivity

The Karoq's standard configuration is okay, but in terms of productivity and app functionality we see a certain backlog.

CAR CONNECT



We did not discover any further remote services apart from honking the horn or activating the direction indicators.

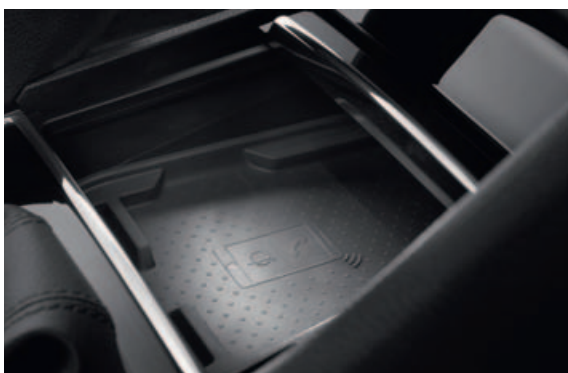
■ Thanks to the “Feature Package Business Columbus”, the Karoq offers a number of connectivity features. The car provided for our testing contained an LTE modem, the optional “Phone box” with external antenna coupling and a Qi wireless charging zone as well as the “Premium Handsfree Speakerphone rSAP” – and the smart phone interface „SmartLink+“ which supports Android Auto, Apple Carplay and Mirrorlink. Two USB A ports in the center console provide smart phone connectivity, while two SD memory card slots are ready to play back media files. They are located in the glove compartment next to the DVD drive, accompanied by the SIM card slot for the built-in LTE modem. The Karoq's connectivity features are completed by WiFi, a WiFi Hotspot and of course Bluetooth.

the Columbus system to the smart phone's own WiFi hotspot. When a data connection is present, the driver will find a lot of useful features in the main menu under the item “Skoda Connect”. For example, not online latest news, weather information and points of interest can be accessed – but also real time information about fuel prices and the available capacity of car parks. As a specialty, the system can even download and install software updates such as refreshing the map data over the air.

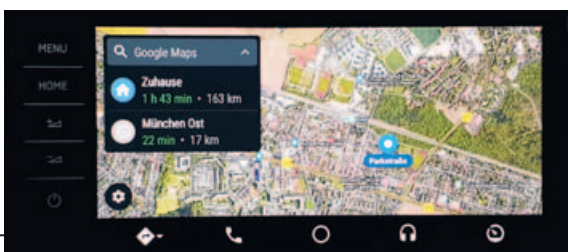
However, the chapter “productivity” unfortunately only earns weak results. E-Mail and a web browser are simply not present. The “Skoda Connect” app stands out with its gorgeous design, but when it comes to remote services such as opening or closing the car's doors from the distance, there was not much to be discovered.

In order to have the Skoda Karoq make its online services – including realtime traffic information – available to the driver, the user must either insert a SIM card with a suitable data subscription into the LTE modem or connect

All in all, the Skoda Karoq passes up on many potential points, and so our assessment in the “Connectivity” discipline can only be the grade “sufficient”. >>



In the front area of the center console, there is an inductive charging zone for compatible smart phones. It also offers a coupling to the car's external antenna.



Smart phone integration works flawlessly in the Karoq via a USB cable, as can be seen here on the basis of Android Auto.

User Experience

Showing some shortcomings in voice control and navigation, the Karoq only receives the grade “satisfactory” in the UX rating.

■ The Czech SUV had to prove its everyday performance in umlaut’s user experience test. In this context, the navigation shows some highs and lows. On one hand, the testers liked the fast consideration of realtime traffic data for automatic routing adjustment. On the other hand, there were enormous differences in the estimated time of arrival in comparison to our reference system Google Maps.

The test team also sees a lot of potential for improvement concerning the Karoq’s voice control. The system only accepts predefined commands and thus can almost not be used intuitively. Generally, the voice control feature demands much attention from the driver, as he or she is often forced to look at the display in order to confirm commands or choose findings from a list. During the test period, these were often recognized wrong or not at all.

Smartphone integration looks a lot better. It only works in tethered mode, but at least Android Auto and Apple Carplay are seamlessly integrated into the system. However, the testers criticized that during usage another Bluetooth connection to a different smart phone was not accepted.

The “Skoda Connect” app features a modern, attractive design and offers some means of customization as well as intuitive operation. Regrettably,

common functions such as locking or unlocking the car’s doors are not available in the app. Still, its integrated breakdown management and fast connection establishment deserve kudos, as well as the friendly service personnel. However, all in all, the testers would have wished for a broader scope of functionality in the Skoda Karoq.



Touch screen operation in the Karoq worked flawlessly.

Conclusion

Michael Peuckert,
editor



Looking at the Skoda Karoq’s results shows opportunities for improvement of the Czech SUV in almost all disciplines. This is of course also due to the tough testing procedure of umlaut and connect. In the “Infotainment” part we miss a head up display, a better usage concept and most of all a well working voice control. In the “navigation” part, there is

potential for improvement in the map and guidance presentations. However, the biggest challenges can be found in the “Connectivity” area. Here we miss all productivity features, and even the nicely designed app could still offer a wider scope of functions. In the end, all of these shortcomings pop up again in the user experience assessment.





Test Results

Brand	Skoda	
Model	Karoq Style 2,0l 4x4 DSG	
Infotainment system	Columbus Sat nav system	
Basic price ¹ /Price of test vehicle ¹	(Euros)	35 240/45 259
Extras relevant for assessment ¹	(Euros)	2 820

Features

Display	
Main display/resolution (inch/pixel)	9.2/1280 x 640
Additional display/diagonal/cockpit display (inch)	+/-/-
Touch/haptic feedback/head up display	-/10,2
User Interface	
Voice control/infotainment/POI/vehicle Controller/wheel buttons/function buttons/vol.	Predefined/+/-/+/-
Handwriting recognition touchpad/display	-/-/-
User profiles/customizable main menu	+/+
Shortcuts/for radio stations/for telephony	+/-/+
Entertainment	
DAB+/web /hybrid radio/CD/DVD drive	+/-/-/+/-
USB/WiFi/Bluetooth media playback	+/-/+
Streaming services	-
Apple Carplay/Android Auto/Mirrorlink	+/-/+
Navigation	
Dest. entry: controller/touch/voice/map/phone	-/+/-/+/-
Dynamic navigation	Live traffic onboard
View display arrow/2D/3D/Google Earth/AR	+/+/-/+/-
Map visualization/3D building representation	fine/+
Route selection/alternative route	+/+
Visual. current street/next street/speed limits	+/-/+
Maneuver info: Arrow/signs/lane/pos. on lane	+/-/+/-
Live infos parking/fuel prices/ratings	+/-/-
Connectivity Interfaces	
eSIM/user SIM(format)/LTE/5G/Car2X	-/Standard SIM/+/-/+
WiFi/WiFi hotspot/Bluetooth	+/-/+
USB type/number/memory card slot	USB-A/2/2x SD
coupling external antenna/wireless charging	+/-
Digital key	-
Telephony & Productivity	
Contacts/favorites/quick access	+/-/+
SMS view/TTS announcement/STT entry	+/-/+
E-Mail view/TTS announcement/STT entry	-/-/-
Calendar/browser/Skype	-/-/-
News/weather/fuel prices	+/-/+
Smartphone app	
Open/close doors/ start/stop air condition	-/-/-/-
Location/driver's log	+/-
Send address/POI/first/last mile navigation	+/-/+/-/+
Vehicle infos/push infos/alarm infos	+/-/+

CAR CONNECT

Test results

Infotainment	max. 100	satisfactory (67)
Display	(50)	30
User Interface	(30)	19
Entertainment	(20)	18
Navigation	max. 100	good (82)
Features	(40)	27
Route calculation	(20)	18
Guidance	(40)	37
Connectivity	max. 150	sufficient (94)
Interfaces	(40)	26
Telephony	(30)	28
Productivity	(30)	9
Smartphone app	(50)	31
User Experience	max. 150	satisfactory (101)
connect	VERDICT max. 500	satisfactory 344

¹ at time of testing



Operation of the steering wheel buttons works well in everyday situations. Still, we missed keys for changing the radio station or skipping music titles as well as a source selector. At least, the diamond key on the right-hand side can be customized with one function of the driver's own choice.

The "Porsche Communication Management" in the current Cayenne model offers a nice user interface and powerful navigation. But there are some details where improvements are still left to be desired.

UNTAPPED POTENTIAL



CAR CONNECT

There is hardly any other big car manufacturer whose public image is so closely linked to sports cars as Porsche. This is no surprise, as the model 911 in this category of vehicles is the icon, bar none. But the portfolio of the Zuffenhausen-based car maker has included not only sports cars for many years – with the Panamera it also offers a limousine, and with the Cayenne for an even longer time also a large SUV.

At least for the mentioned models, the focus of buyers and testers rests not only on the sheer driving dynam-

ics, but also at travelling and long-range convenience. And this aspect also includes topics such as entertainment, navigation and car connectivity.

Thus, we have once more teamed up with our partner umlaut in order to have a closer look at the current

Porsche Cayenne E-Hybrid. We were intrigued by the superior driving characteristics of this Plug-in-Hybrid, to which the many well working driver's assistant systems clearly contribute. Of course, we have put our main attention during the test on our core competencies of infotainment and related aspects. Regrettably, in doing so we realized that Porsche shows very good concepts, but in detail there are still some points left to be desired. On the following pages, you can read in detail, which we think they are.

Michael Peuckert

PORSCHE CAYENNE E-HYBRID

System perf. kW/hp	340/462
Max. system torque:	700 Nm
Maximum speed:	253 km/h
Acceleration:	
(0-100 km/h)	5,0 s
Test consumption:	8,1-12,6 l/100 km
Price:	from 89 822 Euros



The 12.3 inch touch screen offers Full HD resolution and a freely configurable start screen. The user can choose the contents, number and also the size of the individual tiles.

On the center console, there is a handy roller for volume control. However, operating the "Porsche Communication Management" with the push and turn control knob can be cumbersome. Also the sensor keys located around it which provide haptic feedback for the Cayenne's various functions, are rather complicated to use while driving.

CAR CONNECT

Infotainment

The gorgeous full HD displays and the well designed user interface with many options for customization are appealing. Still, we have some points to criticize concerning entertainment and advanced depictions.

■ The "Porsche Communication Management", in short PCM, is the hub of the Cayenne's infotainment functions. It is equipped as standard and features a 12.3 inch touch screen with fine HD resolution. The main screen is complemented by two additional displays, each sized 7 inches and also providing high definition, which are placed in the cockpit on the left-hand and right-hand side of the rev counter. As an option, a head up display is available for the Cayenne – but it was not built-in in the vehicle provided for testing, which is why we could not assess it or award points for it.

Porsche earns much kudos for the gorgeous and easily useable visual interface in the touch screen. On the left-hand side of the screen, all functional levels for entertainment and connectivity, but also vehicle functions can be found. It is amended by a

function band in the upper display area, which gives access to options or a device manager.

The main area of the start screen is designed in a tile design (see picture above) and can be freely configured concerning the function, layout and size of the tiles. From each functional level, the user can transform the right-hand area of the screen into a split screen view by simply swiping. From here, additional functions can be reached by further swipes.



A swipe to the left invokes the split screen view. From there, swiping up or down accesses the following contents.

However, we were less impressed by the touch keys on the center tunnel, as they are not all easily reached while driving. Also, we missed the possibility to skip the current music title with a button on the steering wheel. A programmable button on the wheel remedies this flaw at least in one direction. We had no complaints about the voice control supporting natural speech which also allows to adjust the temperature inside the vehicle. Still, activating it with a button on the direction indicator lever takes some getting used to.

In the area of entertainment, the Cayenne offers all variants of radio reception, including DAB+ (476 Euros), but a DVD drive is only available as an option. Other than Apple Carplay, Android Auto is not available. Furthermore, direct music streaming via WiFi is also not supported. >>

Navigation

When it comes to routing, the Porsche Cayenne is totally in its element. It satisfied the testers with many live services, gorgeous visualization and well designed visual and acoustic guidance.



Information is well visualized in the display. Destination entry, recent destinations or important POIs can be directly accessed.



The digital maps used by the Porsche Cayenne are very detailed and present many buildings as 3D objects if activated.



In the options, there is not only an "intelligent bypass" of a route section available, but also a selection of completely alternative routes.

■ In the area of Navigation the Porsche Cayenne really has to offer a lot. This starts with the destination entry: It can be done (a little complicated) with the push and turn controller on the center console, via touch screen, via handwriting recognition or – most conveniently – via voice control. During testing, we clearly preferred the voice entry, even if occasionally some minor misunderstandings occurred. For example, the system would now and then understand "Darmstadt" instead of "Dornstadt" – even if the tester made an extra effort to pronounce the name clearly, the recognition did not always work perfectly.

But all in all, the voice control of the Porsche Cayenne can still be evaluated as

reliable. A real highlight is the visual representation of control elements and of the map on the high-resolution display. The menu structure is logical and clear-cut. Above that, the Cayenne offers an impressive satellite view in addition to its 2D and 3D visualizations, which can also be shown in the cockpit display. Then, the left-hand screen will show the turn-by-turn arrows, while the right-hand display presents the map. We particularly liked that the turn-by-turn references are automatically shown in the cockpit, even if the drivers uses the displays for other functions at the moment. So the user does not miss important information. Subsequently, the display switches back to the original view. Great!

The Porsche shone with its route selection and guidance during testing. There was no noteworthy glitch on our reference routes. A nitpicker might criticize that some traffic events are indicated a tad too early. Even if an incident was still 100 kilometers away, the system would start a recalculation. If the user is continually bothered by this, he or she can select to receive only an information about traffic events and then decide himself or herself how to proceed.

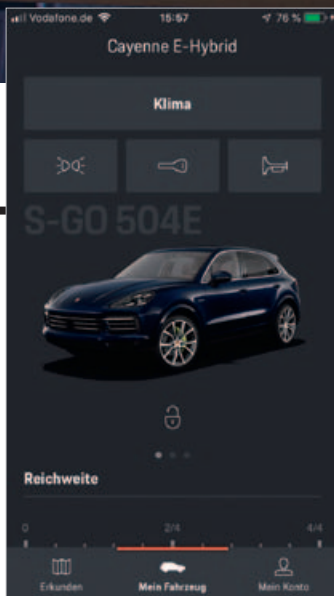
The top performance of the Porsche is completed by useful live information. The Cayenne not only provides real time traffic information, but also advice about car park availability, fuel prices and even restaurant ratings.

CAR CONNECT





Connectivity



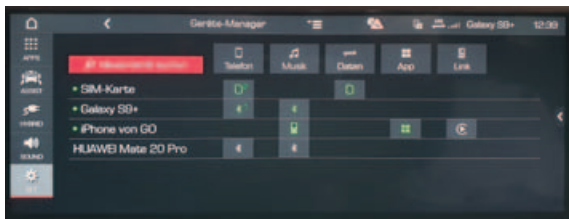
Via the “Porsche Connect“ app the users can access vehicle data, lock the Cayenne or set the timer for the climatization function.

In spite of some smaller gaps regarding connectivity, the Porsche Cayenne also shines in this chapter.

■ Generally, the Porsche has all important connectivity functions on board. They include an integrated LTE phone module, a WiFi hotspot and Bluetooth. As a basic principle, the Cayenne can be connected to two smart phones at the same time. They can be linked to the vehicle via Bluetooth, or the user inserts a SIM card into the designated slot in the car’s glove compartment, while in the center arm rest, two USB A connectors can be found which provide charging and connectivity functions such as Apple Carplay. The car provided for testing also was equipped with the “Smart phone rest“ (a premium of 476 Euros), which does not only offer USB ports but also a coupling to the car’s external antenna.

“device manager“ which presents all connections to media, telephony and data communication devices in a well-arranged manner. Thanks to the very good hands-free function, the Porsche also earns top grades in the telephony chapter. The same is valid for the productivity part – provided that a smart phone is connected to the Porsche. Then, it is even possible to have the car read aloud e-mails or listen to dictations.

The “Porsche Connect Plus“ service package was a standard option in the Cayenne. It not only contains traffic information, but also weather information and news. The user finds all of these conveniently in the main menu under the “Apps“ item. However, a browser which would allow for surfing the web, is not present. Speaking of apps: The “Porsche Connect“ app offers various status information about the vehicle. Furthermore it allows the integration of streaming services into the PCM. Also, it is possible to unlock and lock the doors via the smart phone – and there is a timer for the climatization function. >>



A symbol in the upper menu band leads the user to the “device manager“ where all device connections can be seen at a glance.



The center arm rest provides two USB A ports and the smart phone rest for antenna coupling.

User Experience

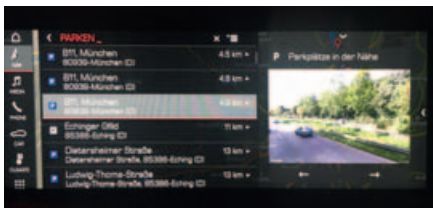
In the user experience assessment, the Porsche performs well. But all in all it only achieves the grade “satisfactory”, which is the result of numerous minor flaws in the various categories.



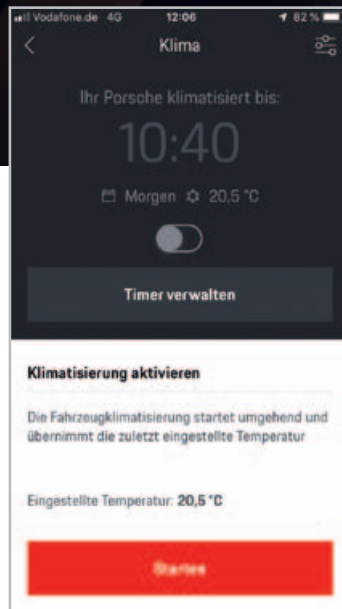
CAR CONNECT

In spite of the Porsche system’s impressive appearance, umlaut’s team of experts identified a number of flaws.

The Cayenne’s climatization can be activated via the “Porsche Connect” app.



For some POIs, such as a parking lot in this example, even Google Street View visualizations can be accessed.



After connect’s testing, the Cayenne had to meet the expert team from umlaut which took a closer look into the user experience provided by the vehicle. The “Porsche Connect“-App left a mixed impression with the testers. The most important information is present – and also, sending destinations to the car was fast and convenient. But there came up some problems when sending more than one destination, and also the handling of the digital map within the app did not work very intuitively.

However, the “navigation” category was very well received, due to the additional information and payment functions when looking for a parking lot – even if the selection of the two flags “Parking” and “Parking Plus” is not clearly understandable. Also, the “entertainment” category achieved a very good rating. Here, the testers praised the streaming services and the online radio – although the top dog Spotify is missing. A highlight is the practical overview over all currently available media sources, which can be accessed via an icon in the upper menu area of the media screens.

What impressed umlaut’s testers less was the placement of the activation button for voice control in the direction indicator lever of the Porsche. And also the success rate of voice command recognition shows some potential for improvement – in some cases the system even interrupts the speaker. But simple commands are well understood and quickly executed.

The experts missed Android Auto – and Apple Carplay can only be used in tethered mode. The calendar function is only available, when the smartphone and its “Porsche Connect” app is connected to the PCM via WiFi – a Bluetooth connection is not sufficient. In contrast, the experts praised the emergency call and breakdown services.

Still, in the end some missing points add up – thus, the Porsche Cayenne E-Hybrid has to be content with the grade “satisfactory” in the “User Experience” category.



Methodology of umlaut's und connect's testing

While connect takes care of the infotainment, navigation and connectivity topics, umlaut tests the user experience of the connected car services of modern vehicles. Here you learn all the details.

■ Four experts assess the connected car services (CCS) of the tested vehicles. Each of these distinguished experts has several years of professional expertise in the areas of car connectivity and user experience.

The assessment of connected services relies on a two-stage testing procedure. First, pre-defined use cases (tasks) are performed independently by the professionals. Then, the holistic usability as well as the visual aesthetics of the connect app and the vehicle's HMI are rated (object-oriented testing). In order to prepare themselves for the testing, the experts make themselves familiar with the innovations of the manufacturer-specific connected car services – for example via the manufacturers web page.

In the first part of the testing procedure, the experts execute the pre-defined use cases. In order

to have a reference value for the assessment of each use case, the professional identify and rate reference systems beforehand. After each use case, the tester answers a so-called After Scenario Questionnaire (ASQ). In the second part of the procedure, the object-oriented test, the expert rates the overall usability and visualization of the connected car app and the vehicle's HMI based on the forms UMUX (Usability Metrics for User Experience) and VisAWI-S (Visual Aesthetics of Websites Inventory).

The rating of all three questionnaires is based on a seven-stage Likert scale, out of which the average assessment of all four experts is calculated. Next, the UX score for each category is determined from the averages of all the use cases of this category. And finally the overall use case is calculated. It thus represents the average of all tested categories.

Conclusion

Michael Peuckert,
editor



In the end, the Porsche Cayenne E-Hybrid achieves the grade "good" in connect's and umlaut's great car connectivity test. While the Zuffenhausen-made car achieves a "very good" in the navigation category and a "good" in the infotainment section, there is some catching up to do regarding the user experience. A number of smaller flaws ultimately results in the grade "satisfactory" in this category.

Still, the Porsche presents a number of great concepts – such as its appealing user interface based on a tile design. It allows for intuitive operated and many aspects of customization. The testers found the device manager equally convincing as it gives an excellent overview over all devices currently connected to the Porsche.



Test Results

Brand	Porsche	
Model	Cayenne E-Hybrid	
Infotainment system	Porsche PCM	
Basic price ¹ /Price of test vehicle ¹	(Euros)	89 822/130 436,70
Extras relevant for assessment ¹	(Euros)	952

Features

Display		
Main display/resolution	(inch/pixel)	12.3/1920 x 720
Additional display/diagonal/cockpit display	(inch)	+/-/0
Touch/haptic feedback/head up display		-/2 x 7
Connectivity Interfaces		
eSIM/user SIM(format)/LTE/5G/Car2X		+/-/0/+
WiFi/WiFi hotspot/Bluetooth		+/-/0/+
USB type/number/memory card slot		USB-A/2/SD
coupling external antenna/wireless charging		+/-/0
Digital key		-
User Interface		
Voice control/infotainment/POI/vehicle		natural speech/ +/-/0/+
Controller/wheel buttons/function buttons/vol.		+/-/0/+
Handwriting recognition touchpad/display		-/0/+
User profiles/customizable main menu		+/-/0/+
Shortcuts/for radio stations/for telephony		+/-/0/+
Entertainment		
DAB+/web /hybrid radio/CD/DVD drive		+/-/0/+/-
USB/WiFi/Bluetooth media playback		+/-/0/+
Streaming services		via Smartphone app
Apple Carplay/Android Auto/Mirrorlink		+/-/0/-
Navigation		
Dest. entry: controller/touch/voice/map/phone		+/-/0/+/-/0
Dynamic navigation		Live traffic onboard
View display arrow/2D/3D/Google Earth/AR		+/-/0/+/-/0
Map visualization/3D building representation		very fine/+
Route selection/alternative route		+/-/0/+
Visual. current street/next street/speed limits		+/-/0/+
Maneuver info: Arrow/signs/lane/pos. on lane		+/-/0/+/-/0
Live infos praking/fuel prices/ratings		+/-/0/+
Telephony & Productivity		
Contacts/favorites/quick access		+/-/0/-
SMS view/TTS announcement/STT entry		+/-/0/+
E-Mail view/TTS announcement/STT entry		+/-/0/+
Calendar/browser/Skype		+/-/0/-
News/weather/fuel prices		+/-/0/+
Smartphone app		
Open/close doors/ start/stop air condition		+/-/0/+/-/0
Location/driver's log		+/-/0
Send address/POI/first/last mile navigation		+/-/0/+/-/0
Vehicle infos/push infos/alarm infos		+/-/0/+

Test results

Infotainment	max. 100	good (75)
Display	(50)	36
User Interface	(30)	28
Entertainment	(20)	11
Navigation	max. 100	very good (90)
Features	(40)	33
Route calculation	(20)	19
Guidance	(40)	38
Connectivity	max. 150	good (125)
Interfaces	(40)	26
Telephony	(30)	30
Productivity	(30)	24
Smartphone app	(50)	45
User Experience	max. 150	satisfactory (110)
connect	VERDICT max. 500	good 400

¹ at time of testing



While driving, the user can conveniently control the MBUX with the buttons and the mini touch pads on the steering wheel. Additionally, the voice control can be manually activated here as well as directly accessing the interface for the user's favorite functions.

CAR CONNECT

The “Mercedes Benz User Experience“, in short MBUX, is one of the most modern infotainment systems in the marketplace. Do the Swabians have everything under control?

FULLY DIGITAL

Somewhat unusually, the “Mercedes Benz User Experience“ system gave its debut in the smallest vehicle class of the car maker from Stuttgart – in their “A class“. From there, it conquered further Mercedes derivatives and car lines. Now we get to the core of the matter: In a Mercedes CLA 200 Coupé, the MBUX now must face our elaborate connectivity and usability test and prove its capabilities. Can it keep up with the infotainment and connectivity solutions of Audi and BMW – and perhaps even top them?

The MBUX’s central hub is the display cluster which fuses the car’s cockpit and media function into one entity. Depending on the configuration ordered by the buyer, two screens with a size of up to 10.25 inches welcome the user and support

him or her in the everyday operation of the vehicle as well as keeping track of each and every car and infotainment function.

As is frequently the case, all of this comes at a price – and so, the many smaller and bigger extras which substantiate the complete infotainment and connectivity experience add up to the considerable premium of 6158 Euros in the test vehicle. This leaves the question whether Mercedes can seize the crown in the ranking of our tests with the thus upgraded MBUX. Let’s have a closer look ...

Michael Peuckert

MERCEDES CLA 200 COUPÉ

Performance kW/hp:	120/163
Maximum torque:	250 Nm
Maximum speed:	229 km/h
Acceleration:	
(0-100 km/h)	8,5 s
Test consumption:	5,6-9,3 l/100 km
Price:	from 33 587 Euros



connect



Scan the QR-Code, and learn how umlaut and connect test connected services in vehicles.

Both displays feature a size of 10.25 inches and a sharp resolution. The order of MBUX's user-optimized main menu can be rearranged per drag and drop. Furthermore, most of the operation is self-explanatory.



The useful touch pad in the center console offers a large area for entering letters and words and even features a haptic feedback. It is accompanied by a roller for volume control, buttons for accessing the home screen, skipping music titles and getting back within the menu structure as well as hard keys for favorites, navigation, radio and multimedia.



CAR CONNECT

Infotainment

In the area of infotainment, the Mercedes goes strong with its impressive displays, the good voice control and ample of entertainment features, securing the grade "very good" in this partial assessment.

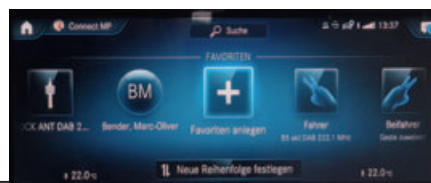
■ The CLA provided for testing was equipped with the largest infotainment implementation, the "Navigation Premium Package" for a considerable 3016 Euros. For this money, it features even two high-resolution screens with a size of 10.25 inches each – serving as an instrument cluster and as a media screen. This is amended by hard disk navigation with live traffic information, traffic sign recognition, extended MBUX functionalities such as user profiles or a WiFi hot-spot as well as a useful touch pad in the center console. In the test car, all of this is complemented by the "MBUX Innovation Package" for another 1368 Euros. It does not only contain the useful head-up display which further increases convenience and driving safety, but also the "MBUX Interior Assistant" which allows for gesture recognition with its 3D camera in the roof assembly.

The entertainment section in the tested CLA was covered by analogue and digital radio (DAB+ for 238 Euros) as well as by the well-known web radio service Tuneln. This is joined by bluetooth streaming with cover display, USB playback of audio and even video files as well as the integration of the streaming service Tidal. In this respect, we would have hoped for a larger variety of offerings, for example including Spotify and Deezer.

The cockpit display can show all contents except videos, but including cover graphics. Navigating the menus and visualizations is conveniently possible via the steering wheel

buttons. Speaking of operating the features: This can be done particularly convenient using natural speech, which can be activated with the key phrase "Hey Mercedes" or by pressing a button on the steering wheel. The control options include some of the vehicle's functions. Alternatively, the user can access these functions via the touch screen of the media display or by using the steering wheel buttons. During our test, this worked flawlessly across the board. In addition to the voice control, we also favoured the handling via the large touchpad.

MBUX's user interface is mostly self-explanatory and features large icons. The order of items on the home screen is customizable. Additionally, there is a menu level for favorites. Here, it is even possible to assign gestures to these functions. So this car plays the favorite radio station just by a hand signal. Great! >>



Via the "Favourites", the user can quickly access frequently used vehicle, communications and infotainment functions or contacts.

Navigation

Mercedes offers a great augmented reality navigation as an extra. But even without it, the route guidance presented itself in top condition during the tests.



3D maps and maneuver info in split screen style as well as lane recommendations are displayed in a well-arranged manner.



The CLA provides live data for traffic, parking and fuel prices to its driver. The latter can be directly integrated into the map view.



The clearly readable presentation of navigation instructions in the head up display impressed the testers.

■ Being equipped with the “Premium Navigation Package“, the Mercedes could shine in the assessment of its route guidance functions. On the media display there is even a satellite view available in addition to the common 2D and 3D visualizations. However, it is only activated above a zoom level of about two kilometers. If the user zooms closer into the map – which by the way works brilliantly via the touch pad, the regular view appears instead. But in cities, this view at least provides numerous beautiful 3D buildings.

In the cockpit display, the user can choose between an arrow rendition and 2D or 3D map visualizations. On request, the navigation view can also fill the complete

cockpit display (as shown on our lead picture on page 22).

But the absolute highlight in the provided test car was without any doubt “MBUX Augmented Reality for Navigation“ (297 Euros). If this mode is activated in the navigation settings, distinct maneuvers are shown as animated arrows and symbols within a live image of the front camera (see picture below). Especially in complex situations such as in urban traffic, this offers a clear additional value, which you soon do not want to miss any more – even if it slightly increases distraction.

Apart from that, we have nothing to criticize regarding the satnav of the CLA. During our testing, the voice entry of desti-

nations worked perfectly even with strong dialects. The letter and word recognition of touchpad entries also will lead to the desired destination without any problems. This is completed by live infos about parking lots and fuel prices as well as ratings from Yelp and Tripadvisor for restaurants and hotels.

So the MBUX navigation in the CLA leaves little to be desired – particularly as the route guidance presented an almost perfect picture in terms of route selection, detours around traffic jams and directing the driver to his or her destination. We liked the somewhat restrained acoustic instructions much the same as the efficient visual guidance – which particularly impressed the testers with its augmented reality mode.

CAR CONNECT



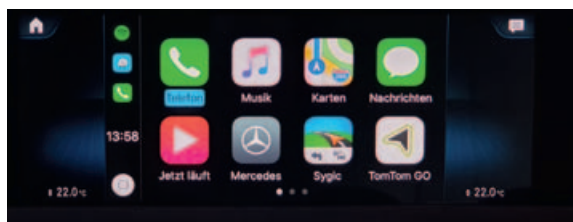


Connectivity

The connectivity features of the reviewed CLA are top. But some flaws in detail cost the Mercedes important points.



Apart from locking and unlocking the doors, the “Mercedes me” app does not offer any remote services. Instead, there is intermodal routing, first and last mile navigation as well as optional private car sharing.



The optional “Smart Phone Integration Package” brings Apple Carplay and Android Auto into the Mercedes CLA.



The integrated browser provides access to the mobile internet. Operating it via the touchpad works quite well.

■ The MBUX in the CLA offers an LTE Modem with an eSIM and thus enables the use of the „Mercedes me connect“ services. The most important services are free within the first three years, after this they can be prolonged at a fee in the Mercedes me portal.

The connectivity features of the test vehicle left nothing to be desired – with Bluetooth, WiFi, a WiFi hotspot and NFC, all important standards are covered. The latter was on board thanks to the “Multifunctional Telephony” (583 Euros), which also provides a tray for inductive charging and a coupling to the car’s external antenna. The handsfree speakerphone is also working convincingly.

With the “Smart phone Integration Package” for 357 Euros, smart phones can be connected to the MBUX. For this purpose, a USB-C plug is provided directly at the smart phone tray, while there are two additional USB-C interfaces in the center arm rest for media playback and charging. This way, the CLA supports Android Auto and Apple Carplay.

However, only Apple’s variant can be controlled via the touchpad. Android owners must use the touch screen.

In the main menu under “Mercedes me & Apps” the user finds all services and apps. Here there is also a web browser to be discovered. What we missed in the CLA: an e-mail and calendar function, which was not activated in the test car. This is a pity, as “In Car Office” is available as an optional service and could bring exactly those functions into the car. This costs the CLA some points, because we can only examine and assess what has been activated during our test period.

There are some gaps in the “Mercedes me” app as well. It is possible to lock and unlock the CLA this way, but apart from this, there are no more remote services. However, it is very easy to send destinations to the MBUX. The feature list is completed by intermodal routing. In the end, the CLA narrowly misses the grade “good”. Too bad, as a better result would have well been possible. >>



User Experience

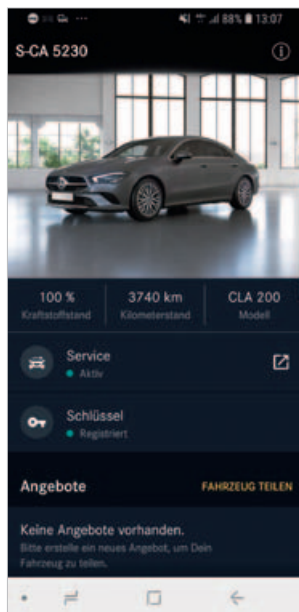
The CLA shines with innovative functions. However, the provided user experience shows some potential for optimization.

umlaut's experts were curious how well the CLA would do in terms of user experience. Voice control shines with a good recognition rate and also gives feedback in natural language. However, during testing particularly simple commands such as calling a contact did not always work reliably. In the realm of entertainment, the testers missed Spotify, while the streaming service Tidal and internet radio via TuneIn received an honorable mention. Regrettably, the connection to Apple Carplay and Android Auto is only available in tethered mode. Furthermore, other than Apple Carplay, Android Auto can not be operated via the touch pad.

The navigation presented itself without any flaws. It considers realtime traffic data reliably in its route calculation and even comes up with an AR function. POIs sent via app appear on the display directly upon entering the car. However, depending on the phone's operating system – Android or iOS –, the received destinations either appear in the "message center" or in a separate pop up window.

The "Mercedes me" app also left a good impression with the testers, although the interaction is not always completely intuitive. For example, umlaut's experts praised the integration of intermodal routing via "Reach now" (formerly moovel) and "Free Now" (formerly myTaxi). Another highlight is the private car sharing mode, which allows to share the CLA with friends and family. Unfortunately, the initial setup of this service is not really user-friendly. The many small flaws add up to missing points which result only in the grade "satisfactory" for the Mercedes CLA in this category.

The Mercedes CLA even allows for private car sharing among friends and family.



Conclusion

Michael Peuckert, editor



The Mercedes CLA with the MBUX exhibits a great performance in our test. Particularly the navigation of the Swabian car lifts route guidance to an absolute top level – and for the first time, a car achieves the grade "outstanding" in this category. Also, we had little to criticise in the infotainment part. The fact that the points "only" add up to 397 in the

end, can be explained with the missing e-mail and calendar functions which were not activated in the test car, and also with some shortcomings in the user experience, identified by our partner umlaut. Still, Mercedes did a great job with the MBUX – and the reported minor flaws will certainly be resolved in the next development stage of the system.

Test Results

Brand	Mercedes	
Model	CLA 200 Coupé	
Infotainment system	MBUX Multimedia System	
Basic price/Price of test vehicle ¹	(Euros)	33 587/56 495
Extras relevant for assessment ¹	(Euros)	6 158

Features

Display	
Main display/resolution (inch/pixel)	10.25/1920 x 720
Additional display/diagonal/cockpit display (inch)	+/-/+
Touch/haptic feedback/head up display	+/-/10,25
User Interface	
Voice control/infotainment/POI/vehicle	Natural speech/+/-/+
Controller/wheel buttons/function buttons/vol.	+/-/+/-/+
Handwriting recognition touchpad/display	+/-/+
User profiles/customizable main menu	+/-/+
Shortcuts/for radio stations/for telephony	+/-/+/-/+
Entertainment	
DAB+/web /hybrid radio/CD/DVD drive	+/-/+/-/+/-/+
USB/WiFi/Bluetooth media playback	+/-/+
Streaming services	+/-/+
Apple Carplay/Android Auto/Mirrorlink	+/-/+/-/+
Navigation	
Dest. entry: controller/touch/voice/map/phone	+/-/+/-/+/-/+
Dynamic navigation	Live traffic onboard
View display arrow/2D/3D/Google Earth/AR	+/-/+/-/+/-/+
Map visualization/3D building representation	very fine/+
Route selection/alternative route	+/-/+
Visual. current street/next street/speed limits	+/-/+/-/+
Maneuver info: Arrow/signs/lane/pos. on lane	+/-/+/-/+
Live infos parking/fuel prices/ratings	+/-/+/-/+
Connectivity Interfaces	
eSIM/user SIM(format)/LTE/5G/Car2X	+/-/+/-/+/-/+
WiFi/WiFi hotspot/Bluetooth	+/-/+/-/+
USB type/number/memory card slot	USB-C/3/-/+
coupling external antenna/wireless charging	+/-/+
Digital key	+/-/+
Telephony & Productivity	
Contacts/favorites/quick access	+/-/+/-/+
SMS view/TTS announcement/STT entry	+/-/+/-/+
E-Mail view/TTS announcement/STT entry	+/-/+/-/+
Calendar/browser/Skype	+/-/+/-/+
News/weather/fuel prices	+/-/+/-/+
Smartphone app	
Open/close doors/ start/stop air condition	+/-/+/-/+/-/+
Location/driver's log	+/-/+
Send address/POI/first/last mile navigation	+/-/+/-/+/-/+
Vehicle infos/push infos/alarm infos	+/-/+/-/+

Test results

Infotainment	max. 100	very good (85)
Display	(50)	43
User Interface	(30)	27
Entertainment	(20)	15
Navigation	max. 100	outstanding (95)
Features	(40)	37
Route calculation	(20)	19
Guidance	(40)	39
Connectivity	max. 150	satisfactory (109)
Interfaces	(40)	29
Telephony	(30)	30
Productivity	(30)	11
Smartphone app	(50)	39
User Experience	max. 150	satisfactory (108)
connect	VERDICT max. 500	good 397

¹ at time of testing



CAR CONNECT



The right-hand area of the steering wheel buttons controls the infotainment system, activates voice control, starts phone calls and selects the contents of the head up display.

CAR CONNECT

THE BENCHMARK?

BMW is considered to be one of the pioneers of car connectivity. What is the current status of connectivity, entertainment and navigation in cars made by the Bavarian company? The current X5 had to prove itself in our test.

Without a doubt, the Bavarian car maker BMW is among the pioneers of car connectivity solutions. While a couple of years ago a Bluetooth connection was as good as it gets in terms of connectivity for many car makers (for some, this has not really changed since), BMW had already integrated music streaming via Napster in its 2015 5-series. An app allowed to unlock and lock the doors or activate the horn – which was suited to make its owners feel clearly ahead of their time.

Meanwhile, some time has passed. So we were eager to learn whether BMW is still the leader in terms of car connectivity, or whether competitors such as Audi or Porsche may even have surpassed the Bavarian company by now – in an area which

grows ever more relevant for buyers. To answer this question, we had a current BMW X5 available which we could put through its paces. As usual, in doing so we have put our focus on connectivity, entertainment offerings, navigation as well as on the user experience – that is to say the usability of the ample functions.

To be somewhat up front about the result: There was a neck-and-neck race between Audi and BMW. But in order to get more into the details, read for yourself how the current X5 performed in our test.

Michael Peuckert

BMW X5 XDRIVE 30D

Performance kW/hp:	195/265
Maximum torque:	620 Nm
Maximum speed:	230 km/h
Acceleration:	
(0-100 km/h)	6,5 s
Test consumption:	6,2-9,8 l/100 km
Price:	from 69 200 Euros



connect



Scan the QR-Code, and learn how umlaut and connect test connected services in vehicles.

The 12.3 inch touch screen of the BMW X5 offers full HD resolution and brilliantly sets the stage for contents. The home screen can be customized with functional widgets – similar to a smart phone, this even supports multiple layers.

The controller made a very good impression in the test. As its surface also serves as a touch pad, the user can simple draw characters with his or her finger in order to enter text. The keys above the turn-push knob offer direct access to specific functions of the infotainment system.



CAR CONNECT

Infotainment

The BMW X5 earns the grade “very good” with a fine touch screen, excellent voice control, a modern user interface and many entertainment offerings. Still, we identified some gaps in the details.

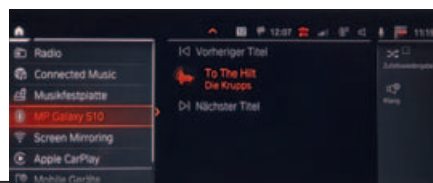
■ The standard infotainment system “BMW Live Cockpit Professional” in the X5 consists of a conveniently visible 12.3 inch full HD touch screen, a 12.3 inch instrument cluster and an easily reachable controller on the center console. Placed in front of it, there are keys which give direct access to the main functions such as communications or apps. The test vehicle was additionally equipped with a head up display (1390 Euros), which shows navigation, media and telephony information and which delivered a top performance.

The concept of operations is amended by a natural voice recognition, which worked outstandingly in the test. It also allows accessing optional settings and vehicle functions such as the air conditioning. The voice control is activated by a button on the steering wheel or simply by saying

„Hey BMW“. As another highlight, the BMW supports a gesture control which worked neatly during our testing.

The user interface is well arranged and can be operated intuitively. Using widgets which can be customized in contents and size, the driver can set up an individual home screen over multiple levels, similar to smart phones. The eight keys beside the volume control knob also serve as shortcuts for directly accessing radio stations or contacts.

The X5 provided for testing also had a lot to offer in terms of entertainment. The confi-



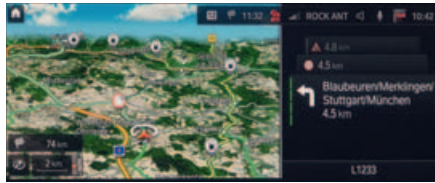
Fulfilling almost every wish: In terms of entertainment, the BMW X5 offers almost everything that a music or technology fan’s heart desires.

guration included DAB radio (390 Euros), bluetooth and WiFi streaming, wireless Apple Carplay, 20 GB available hard disk space and even music streaming via Napster or Deezer directly integrated into the system. Furthermore, really good sound was provided by the “Harman Kardon Surround Sound System” installed in the test vehicle for 990 Euros. This speaker system is well worth the money.

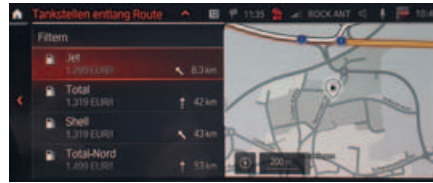
In spite of the multitude of supported media, the BMW loses some points in the entertainment part – of all things. For example, we were missing a CD/DVD drive, which is not even available as an option. Also, the system lacks a cover view in bluetooth streaming mode as well as an integrated web radio. This can be invoked via detours such as Apple Carplay, but we would have expected an integrated solution for this. >>

Navigation

The BMW X5 delivers excellent route guidance. Also, the testers were excited about its navigation which is accurate down to the lane level.



The BMW's navigation offers a customizable split screen display and a satellite view, which however is only available down to a scale of 2 km.



The system also shows additional information along with POIs such as restaurant ratings or current fuel prices.



The presentations in the head up display are just perfect. The X5 even knows exactly, on which lane it is driving (shown by red symbol).

■ The route guidance of the X5 is a great solution, with we found totally convincing in our tests. Along with the usual 2D and 3D views, it also offers a satellite view, which however only appears from a map scale of 2 kilometers upwards. Thus it is not really helpful while driving within cities. 3D buildings are shown at the user's will too. In addition, the large screen offers a useful split screen view in order to present for example the complete route overview, upcoming maneuvers or traffic information along the road. They are part of the live information offerings much the same as current gas station prices or detailed parking lot advice. However, the latter turned out to be one of the few weak points of the system during our testing.

While the navigation view in the instrument cluster (see picture below) is limited to a bird's view, in the head up display the X5 boasts with the best navigational information rendition we know of. This solution is simply perfect – it is definitely not necessary to turn one's eyes to any of the other screens while driving, because the BMW offers a route guidance accurate down lane level on all of its displays. On the autobahn or in cities, all screens show which lane the car is currently driving on – and which lane the driver should head for. It goes without saying that this is particularly helpful in the head up display.

Destination entry in the BMW X5 is either done via touch, via voice, using the smart phone or based on the letter recognition of

the touch pad built into the controller. A distinctive and clever feature is the possibility to transfer the navigation destination directly from "Apple Maps", if an iPhone is connected to the BMW via Apple Carplay.

All variants worked fine during our tests, also we had no complaints concerning the handling of the test routes. In its acoustic guidance, the BMW always presented itself informative, but not annoying. The optical guidance with lane-level accuracy was impressive in every aspect and secured the maximum number of points for the BMW. This is completed by a well-working route selection, both inside and outside of cities. A good strategy in traffic jams is the icing on the cake – so the overall assessment of the BMW's navigation is simply "very good".

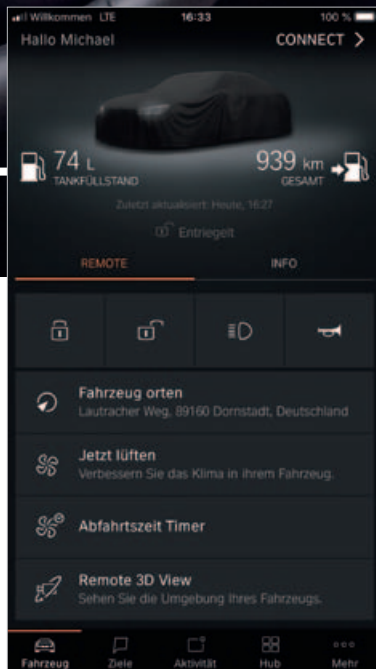
CAR CONNECT





Connectivity

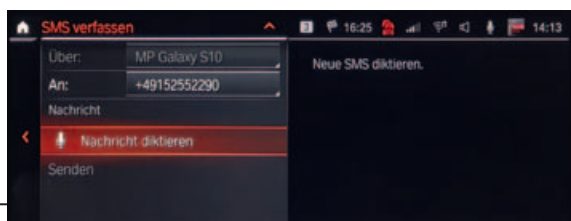
The BMW rocks in the connectivity discipline, and thus secures itself a very good result.



The “BMW Connected“ app is clearly structured and offers remote functions such as unlocking the doors in addition to a lot of vehicle information.



The X5 displays smart phone contents via “screen mirroring“, bringing videos or a browser to the large central display.



The BMW is not only capable of reading e-mails and text messages aloud, it also understand text entry via dictation.

■ In the area of connectivity, the X5 was very much in its element. The system offers a built-in LTE SIM card, a WiFi hotspot, both USB-A and USB-C connectors and supports both Bluetooth as well as Wi-Fi Direct. In combination with the package “Connected Drive Professional“, the driver can additionally use plenty of connected services.

They do not only comprise the live services for navigation, but for example also wireless Apple Carplay. Android Auto is not supported in the X5, but thanks to “Screen Mirroring“ the content of the smart phone display can be reflected in the car’s display. Connected this way, the BMW allows for video playback or web surfing via the phone’s browser while the car is stationary. This is useful as the X5 regrettably does not offer a web browser of its own.

But there are other highlights, as for example in the area of productivity. Via the BMW system, users of Microsoft Office 365 can conveniently access e-mails, the

calendar and a task list. Even Skype calls can be conducted directly from the calendar. Also, it is possible to have the system read e-mails aloud or accept text input via dictation. The same is also available for SMS messages.

The test vehicle also provided “Telephony with Wireless Charging“ for 490 Euros. Equipped with this feature, the X5 offers a wireless charging area near the cup holders as well as a coupling to the external antenna. In practice, the handsfree function earned top grades as well, as all calls arrived clearly and well understandable in both directions.

This strong performance is completed by the “BMW Connected“ app, which made an excellent impression to the testers and did not only present vehicle information, but also can navigate the user to the car, activate the ventilation and lock or unlock the vehicle on demand. A peculiarity is the “Remote 3D View“ which presents the current surrounding of a parked X5 on the smart phone’s display. >>

User Experience

While the voice control is convincing in every aspect, the BMW X5 shows some weaknesses in parts of its connected services.

■ The car from Bavaria also had to exhibit its everyday qualities in the user experience test of our partner umlaut. The large SUV earned an outstanding evaluation in the area of voice control – this function worked very well and fast without any exceptions. The experts were equally pleased with the direct interaction between voice operation and the infotainment system. For example, the Bluetooth menu can be directly invoked by a voice command. The productivity features of the BMW earn kudos as well, as the integration of Microsoft Office 365 offers e-mail and calendar functions as well as Skype telephony. Further good assessments were ensured by the availability of the streaming services Deezer and Napster directly within the infotainment system. umlaut's experts only would have wished to find Spotify here as well.

But they identified also some aspects of the X5 worth criticizing, for example in the area of navigation. This feature generally worked well and very reliable, but the parking functions were less convincing in the test. For example, the features "ParkNow" and "On-Street-Parking" were available to only one of four testers, and this even only for a short period of time. There were also highs and lows in the functionality of the vehicle logbook. Although this optional feature was subscribed to during the test period, no information about our test drives was transferred to the according BMW web portal – and thus neither into the logbook. However, the BMW Connected App made a good impression due to its many functions and informations. All in all, this performance resulted in the grade "satisfactory" in the User Experience category.



The "BMW Connected" app offers various remote functions and info about the BMW. It even includes a 3D view of the X5 in its current surrounding.

Conclusion

Michael Peuckert,
editor



With the X5's test results, BMW can once again prove its preeminence in the area of car connectivity. At the moment of testing, we knew of no better connected car than the Bavarian SUV. The logical consequence is the grade "very good" in this discipline. The X5 achieves the same very good assessment in the categories of navigation and entertain-

ment. Here, there is little left to be desired, although we have identified some minor gaps in the entertainment discipline.

However, in the user experience chapter, the BMW has some catching up to do – because the multitude of functions and services still must be easy to use. And unfortunately, this was not always the case during our test.





Test Results

Brand	BMW	
Model	X5 xDrive 30d	
Infotainment system	BMW Live Cockpit Professional	
Basic price ¹ /Price of test vehicle ¹	(Euros)	69 200/98 550
Extras relevant for assessment ¹	(Euros)	2 270

Features

Display	
Main display/resolution (inch/pixel)	12.3/1920 x 1080
Additional display/diagonal/cockpit display (inch)	+/-/+
Touch/haptic feedback/head up display	-/12.3
Connectivity Interfaces	
eSIM/user SIM(format)/LTE/5G/Car2X	+/-/+/-/+
WiFi/WiFi hotspot/Bluetooth	+/-/+
USB type/number/memory card slot	USB-A+C/2/-
coupling external antenna/wireless charging	+/-
Digital key	+
User Interface	
Voice control/infotainment/POI/vehicle	natural speech/ +/-/+
Controller/wheel buttons/function buttons/vol.	+/-/+/-/+
Handwriting recognition touchpad/display	+/-
User profiles/customizable main menu	+/-
Shortcuts/for radio stations/for telephony	+/-/+
Entertainment	
DAB+/web /hybrid radio/CD/DVD drive	+/-/+/-/+
USB/WiFi/Bluetooth media playback	+/-/+
Streaming services	+
Apple Carplay/Android Auto/Mirrorlink	+/-/-
Navigation	
Dest. entry: controller/touch/voice/map/phone	+/-/+/-/+
Dynamic navigation	Live traffic onboard
View display arrow/2D/3D/Google Earth/AR	+/-/+/-/+
Map visualization/3D building representation	fine/+
Route selection/alternative route	+/-
Visual. current street/next street/speed limits	+/-/+
Maneuver info: Arrow/signs/lane/pos. on lane	+/-/+/-/+
Live infos parking/fuel prices/ratings	+/-/+
Telephony & Productivity	
Contacts/favorites/quick access	+/-/+
SMS view/TTS announcement/STT entry	+/-/+
E-Mail view/TTS announcement/STT entry	+/-/+
Calendar/browser/Skype	+/-/+
News/weather/fuel prices	+/-/+
Smartphone app	
Open/close doors/ start/stop air condition	+/-/+/-/+
Location/driver's log	+/-
Send address/POI/first/last mile navigation	+/-/+/-/+
Vehicle infos/push infos/alarm infos	+/-/-

Test results

Infotainment	max. 100	very good (85)
Display	(50)	43
User Interface	(30)	28
Entertainment	(20)	14
Navigation	max. 100	very good (91)
Features	(40)	33
Route calculation	(20)	19
Guidance	(40)	39
Connectivity	max. 150	very good (130)
Interfaces	(40)	28
Telephony	(30)	30
Productivity	(30)	25
Smartphone app	(50)	47
User Experience	max. 150	satisfactory (110)
connect	VERDICT	good
	max. 500	416

¹ at time of testing



The steering wheel buttons which control the infotainment systems have a generous size. They are joined by additional keys: one for voice control, and one which invokes the menu for the content of the 12.3 inch cockpit display.

CAR CONNECT

PROBLEMS ABOARD

The attractive Volvo V60 shows highs and lows in our connectivity test. Read in which areas the smart Swede manages to score, and where it has deficits.



Vehicles made by Volvo are associated with safety. In the spring of 2019, the Swedish car maker has even announced to limit the top speed of all its models to 180 km/h starting in 2020 – thus promoting this topic even further.

Backlog demand

Utmost safety? Without a doubt. Great scandinavian design? Definitely, in the interior as well as on the outside. But what about the important aspects of connectivity, navigation, entertainment and their usability? To answer this, we made the

Volvo V60 T5 R Design face connect's and umlaut'a big connectivity test.

To be up front about the results: There remains some work to do for Volvo in these areas. This is reflected by a quite unflattering assessment. But the candidates from Audi, Porsche, BMW which also underwent our demanding test procedures

simply delivered a better performance – in some parts even much better. This is a pity, because the testers had a lot of sympathy for the elegant Swedish car.

On the following pages you can read, where the Volvo V60 has its sticking points in detail. One note about the mentioned prices: They have been revised in the meantime, so the exact configuration of the vehicle provided for testing is no longer available. However, this does not change anything regarding the performance of the features – it remains absolutely unaltered by the revised price list.

Michael Peuckert

VOLVO V60 T5 R DESIGN

Performance kW/hp:	184/250
Maximum torque:	350 Nm
Maximum speed:	235 km/h
Acceleration:	
(0-100 km/h)	6,7 s
Test consumption:	6,7-10,2 l/100 km
Price ¹:	from 49 650 Euros

¹ price at the time of build



connect



Scan the QR-Code, and learn how umlaut and connect test connected services in vehicles.

A touch screen (which at a size of 9 inches seems a little small) serves as the main display in the V60. Also, it features the unusual portrait format and a less-than-HD resolution of 768 x 1024 pixels. But its user interface is nice and its operation works intuitively.

The volume controller has an ideal size, is slip-proof and easily reachable. Next to it, the keys for skipping music titles are located.

CAR CONNECT

Infotainment

In the area of entertainment, the V60 scores well with Spotify, a great user interface and a strong sound system. But the small size and the relatively low resolution of the center display as well as a weak voice control prevent a better grade.

■ The V60 T5 R Design comes with the "Sensus Connect with High Performance Sound" infotainment system and a 9 inch touchscreen in the center console as a standard. This is amended by a 12.3 inch display in the cockpit, which presents the route guidance and information about the current music playback including cover art as well as telephony options. In addition, the test car was equipped with the "Business Package Pro" (1900 Euros) and thus included the Sensus sat nav system, a CD player in the middle arm rest, Apple Carplay, Android Auto as well as the great sounding "High Performance Sound Pro by Harman/Kardon" sound system. Thanks to the "Xenium Package Pro" (3000 Euros), the V60 also features a very good head up display.

Sensus Connect can be controlled conveniently via the steering wheel buttons, the

easily accessible central touch screen or via voice control which is activated with a key on the steering wheel. Unfortunately, the voice option was not at all convincing in every day use and annoyed all testers with its bad recognition rate.

However, the user interface of the Sensus system is appealing. The home screen shows up to four elements: Navigation, music sources, telephony as well as apps.



A swipe to the left will direct the user to the Volvo V60's function overview, which shows all music sources and the apps.

It has three levels, which can be accessed by a swipe to the left or to the right. Swiping to the right leads to the vehicle options, while swiping to the left invokes music sources and apps. Their order can be customized by the user. As part of the apps, the V60 also offers the streaming top dog Spotify as well as internet radio via TuneIn – provided that the user supplies a data connection to the Volvo via a smart phone or his or her own SIM card. Strong points are the display of cover art while streaming via Bluetooth and the playback even of video files via the two USB connectors.

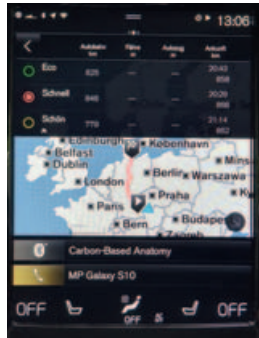
However, we were missing a DAB+ receiver which must be paid for as an extra. Also, there is no possibility to quickly access radio stations or contacts via shortcuts. And finally, a better and larger display would also have been well received in the Volvo V60. >>

Navigation

With the exception of a minor failure to process the real time traffic information, the Volvo V60 presents itself as a quite reliable route guide.



The two columns on the left-hand side of the screen contain the navigation options. The 3D view shows an unnecessarily large amount of sky.



The route options which are part of the route overview, does not only offer the variants „Fast“ and „Eco“, but also „Beautiful“.



The navigation view of the optional head up displays is great. It makes turning the driver's eyes to the cockpit or central display obsolete.

Navigation has a fixed location as the upmost entry on the home screen of the V60. If it is selected, a window with the map and destination entry appears, which still leaves the elements “music” and “telephony” visible. However, an arrow icon on the map allows utilizing the full screen for the nav display. Regarding map views, the drive can only choose between 2D and 3D, with the latter showing a large amount of sky. When travelling in cities, important buildings are shown in 3D on request of the driver.

As usual, destination entries can be made via the touch screen, directly on the map or via voice commands. Regrettably, here again the weak voice control is quite annoying.

Care for an example? No problem: The destination of the city of “Ulm” was shown only on the eighth position in the list of findings. On the higher positions, all sorts of entries such as the town “Ulmen” or an Ulm-based contact from the tester’s address book appeared. Munich’s central station was also not found by the Volvo. By the way, the most convenient way to enter an address was using the “Volvo On Call” app – no matter whether we looked for a POI or an address within a city.

What we also missed was live information. Only after the driver treated the V60 with a data connection, live traffic information would pour in. Even then, there were no fuel prices

available – and real time parking information is only accessible via an extra app.

While driving we liked the clear, precise voice cues as well as the good representation of lane suggestions. The latter make a really great job in cooperation with the nice head up display. However, when processing the traffic data, the Volvo was not always up to the mark. For example, while travelling on the autobahn with the parameter “fast”, the system suggested a detour, which was not only 28 kilometers longer but also took 22 minutes more – this is hard to understand. Despite this, the route calculation inside and outside of cities worked flawlessly, resulting in the overall grade “good” for navigation.

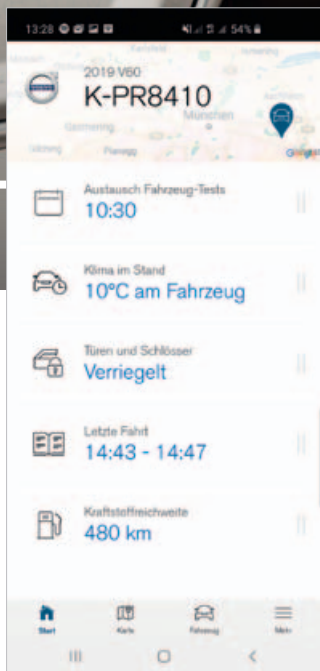
CAR CONNECT





Connectivity

Smaller and im terms of productivity larger gaps led to an overall weaker result in the connectivity chapter.



The "Volvo On Call" app is a highlight both in terms of design as well as functionality and thus strongly impressed the testers.

In order to connect the Volvo V60 to the outside world, the driver has to provide a smart phone hotspot or insert his or her own SIM card into the integrated 4G modem. Once this is accomplished, there is also a WiFi hotspot available to the passengers. The SIM slot can be found in the co-drivers legroom. If this hurdle is cleared, there are some nice things to discover – such as quite a few apps which can be downloaded to the infotainment system. Among them are Spotify, Wiki Location, Yelp, Glypse and a couple more. If required, system updates can be installed in the same way.

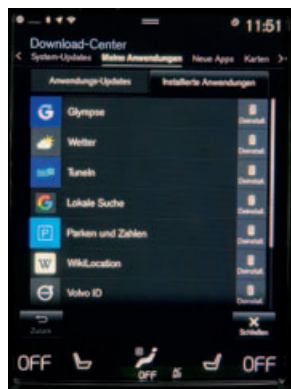
The hands free function made a good impression to the testers as well. It can read SMS messages aloud, and if an Android phone is connected it even supports dictation. But on the subject of productivity, the Volvo is totally not up to date. Functions like e-mail or calendar were either forgotten or deemed unimportant. In this light, it is subsequent that a browser is missing too. But with gaps of this size, there is little to be won in the car connect test – and so, the Volvo loses ample of points in this chapter.

The V60 supports tethering of Apple and Android smart phones via an USB connector. The integration of Apple Carplay and Android Auto is nicely done. The respective user interface appears as a fourth element on the main screen (see image above). A long press on the talk button of the steering wheel will start Siri or the Google Assistant. This way, the Volvo obtains a strong voice control function in the end.

However, the "Volvo On Call" app is really great. For the in-car functions, it can access the e-SIM integrated in the car and thus also works without a dedicated internet connection provided by the driver. Via the app, the driver can remotely unlock the doors or control the air condition. Furthermore, the driver can use a log-book, access vehicle infos as well as invoke a first mile and last mile navigation. Also, it is possible to send navigation destinations from the smart phone's calendar directly to the V60. >>



If the driver's own SIM card is used as a data supplier, it must be activated under the menu entry "vehicle modem – internet".



In the download center, the user can install apps and system updates to the Sensus Connect system.



User Experience

In the user experience assessment, the Volvo showed some distinct weaknesses, especially concerning its voice control.

■ In umlaut's user experience test, the Volvo V60 revealed many highs, but also some lows. In three out of six disciplines, the Swede achieved the grade "very good". Here, the testers were impressed by the great integration of Apple Carplay and Android Auto as well as by the embedding of the internet radio Tuneln and the streaming service Spotify into the infotainment system. There is also a concierge service which shone with extensive offerings.

The biggest shortcoming of the V60 concerns voice control. During testing, this function understood and executed only a fraction of the commands issued by the testers. Even simple navigation destinations such as the Brandenburg Gate were not recognized. In this area, the V60 unfortunately did not convince the testers at all and thus had to accept the maximum penalty – the grade "insufficient".

In navigation, the V60 also showed some flaws. Real time traffic information was presented but not respected in the route calculations. In the tests, this led to enormous deviations compared to our reference Google Maps.

A much better impression was given by Volvo's app. Although the testers criticized the missing route guidance in first mile navigation mode, the "Volvo On Call"-App could shine with great features such as the well structured driver's log and with an intuitive user interface featuring a really nice design. In the end, the V60's overall grade was "sufficient". What a pity – as the car would have had the potential for more.



Destinations, POIs and even appointments from the smart phone's calendar can be sent via the "Volvo On Call" app to the Sensus Connect system in the V60.



Conclusion

Michael Peuckert,
 editor

The Volvo V60 is a great car which we only returned reluctantly. Considered subjectively, the smart Swede impressed during every day, and its smaller or bigger flaws might be regarded as charming quirks. But our testing is based on points, and of these the Volvo V60 T5 R Design loses simply too many in the final assessment.

There is a lot of room for improvement regarding its connectivity features and voice control, as was also determined in umlaut's user experience test. However, the integration of the great "Volvo On Call" app into the infotainment system particularly deserves kudos. It gave an impressive performance all along the line.

Test Results

Brand	Volvo	
Model	V60 T5 R-Design	
Infotainment system	Sensus Connect & Navigation System	
Basic price ¹ /Price of test vehicle ¹	(Euros)	49 650/67 040
Extras relevant for assessment ¹	(Euros)	4900

Features

Display	
Main display/resolution (inch/pixel)	9/768 x 1024
Additional display/diagonal/cockpit display (inch)	+/-/+
Touch/haptic feedback/head up display	-/12,3
Connectivity Interfaces	
eSIM/user SIM(format)/LTE/5G/Car2X	+/-/+/-/+/-/+
WiFi/WiFi hotspot/Bluetooth	+/-/+
USB type/number/memory card slot	USB-A/2/-
coupling external antenna/wireless charging	-/+
Digital key	-
User Interface	
Voice control/infotainment/POI/vehicle	natural speech/ +/-/+
Controller/wheel buttons/function buttons/vol.	+/-/+/-/+
Handwriting recognition touchpad/display	+/-
User profiles/customizable main menu	+/-
Shortcuts/for radio stations/for telephony	+/-/+
Entertainment	
DAB+/web /hybrid radio/CD/DVD drive	+/-/+/-/+/-
USB/WiFi/Bluetooth media playback	+/-/+
Streaming services	+/-
Apple Carplay/Android Auto/Mirrorlink	+/-/+/-
Navigation	
Dest. entry: controller/touch/voice/map/phone	+/-/+/-/+/-/+
Dynamic navigation	Live traffic offboard
View display arrow/2D/3D/Google Earth/AR	+/-/+/-/+/-
Map visualization/3D building representation	normal/+
Route selection/alternative route	+/-
Visual. current street/next street/speed limits	+/-/+/-/+
Maneuver info: Arrow/signs/lane/pos. on lane	+/-/+/-/+/-
Live infos parking/fuel prices/ratings	+/-/+
Telephony & Productivity	
Contacts/favorites/quick access	+/-/+/-
SMS view/TTS announcement/STT entry	+/-/+/-/+
E-Mail view/TTS announcement/STT entry	+/-/+/-
Calendar/browser/Skype	+/-/+/-
News/weather/fuel prices	+/-/+/-
Smartphone app	
Open/close doors/ start/stop air condition	+/-/+/-/+/-/+
Location/driver's log	+/-
Send address/POI/first/last mile navigation	+/-/+/-/+/-/+
Vehicle infos/push infos/alarm infos	+/-/+/-

Test results

Infotainment	max. 100	satisfactory (72)
Display	(50)	36
User Interface	(30)	23
Entertainment	(20)	13
Navigation	max. 100	good (81)
Features	(40)	26
Route calculation	(20)	18
Guidance	(40)	37
Connectivity	max. 150	satisfactory (100)
Interfaces	(40)	19
Telephony	(30)	28
Productivity	(30)	6
Smartphone app	(50)	47
User Experience	max. 150	satisfactory (107)
connect	VERDICT max. 500	satisfactory 360

¹ at time of testing



The 12.3 inch large digital instrument cluster with full HD resolution plays in the top league. Above that, controlling the car via the steering wheel buttons worked perfectly during the test. This also applies to voice control system which can be activated with a key here.

MASTERPIECE

With the e-tron, Audi enters the stage with an all-electric car and also gives a strong debut regarding connectivity, user experience and infotainment. The Audi is the first car in connect's and umlaut's tests achieving the grade "very good". Learn how it accomplished this.

The first all-electric vehicle from Audi is named e-tron and turned out as a real blast in terms of looks, haptics and functionality. The opulently sized SUV comes with a 95 kWh battery, which has a considerable share in the tare weight of a whopping 2565 kg. Equally awe-inspiring is the price: The Audi e-tron costs at least 80 900 Euros. Under the hood, two powerful electric engines are operating, which muster an impressive 300 kW in boost mode and a maximum torque of 664 Nm, massively accelerating the SUV on request.

But in the testing of connect and umlaut, instead of the driving and acceleration characteristics, other properties are in our focus – topics such as user experience, infotainment and connectivity. So we were curious how Audi managed to inte-

grate the aspect of charging into the navigation system of the e-tron. Because other than gas stations for petrol and diesel, charging stations for electric cars are not yet available around every corner – particularly not when the driver is looking for a high charging capacity to obtain short charging times. In this respect and regarding the many other strong points of the Audi e-tron, we were positively surprised. So in the end, this car managed to secure the hitherto top position in connect's ranking of car connectivity assessments.

Michael Peuckert

AUDI E-TRON 55 QUATTRO

Performance kW/hp:	265/360
Maximum torque:	561 Nm
Maximum speed:	200 km/h
Acceleration:	
(0-100 km/h)	6,6 s
Test consumption	26,4-22,9 kWh/100 km
Price:	from 80 900 Euros



connect



Scan the QR-Code, and learn how umlaut and connect test connected services in vehicles.



Both touch screens offer a high resolution and an impressive image quality. The control panel and the icons on the sides of the main screen can be sorted at the user's discretion. During operation, "Touch Response" delivers haptic feedback.

All interfaces are located in the storage compartment in the center console. Besides two USB A ports and a slot for SD cards, there is a SIM card slots which can be used to connect the e-tron to the internet via the user's own SIM. This allows applications such as for example web radio.



CAR CONNECT

Infotainment

The Audi e-tron offers a very complete entertainment and infotainment programme. We have only minor criticisms concerning the display size and some missing streaming services. Still, the grade "very good" is a logical consequence.

■ With regards to entertainment and information presentation, the e-tron comes with top features already in its standard configuration. For example, the electric SUV arrives off-the-shelf with the infotainment system "MMI Navigation plus with MMI touch Response". The digital cockpit display "Audi virtual cockpit" is standard as well. It informs the driver via a 12.3 inch full HD display and includes the useful profile management for different drivers. In the plus version (150 Euros) which was installed in the test vehicle, this fully digital instrument cluster offers additional view options.

This is amended by two additional screens in the center of the dashboard. The main display measures 10.1 inches and supports touch operation. Directly below, the 8.6 inch climate control display is located. It can be configured with shortcuts of any

kind on multiple levels – for example with navigation destinations, phone numbers or radio stations. It is even used as an input area for the handwriting recognition. In the test car, this armada of displays was complemented by a very good head up display for 1390 Euros.

Entertainment in the E-SUV is provided by a radio supporting DAB+ (430 Euros), FM and web stations. Regrettably, streaming services only reach the e-tron when a smart phone is connected via WiFi. Even then, they are limited to Amazon Music and Napster.



The media menu also shows streaming services, as soon as the smart phone is connected via WiFi to the e-tron.

Spotify users must revert to Bluetooth streaming or alternatively Android Auto or Apple Carplay. Both features are again supported by the Audi off-the-shelf. In addition, the e-tron plays back music and even video files from external media such as USB storage or SD memory cards. So there is actually something in there for everyone.

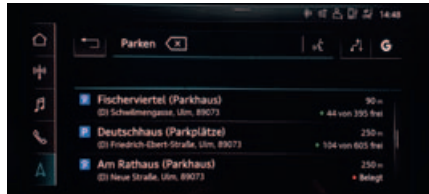
Operation is mostly self-explanatory and worked flawlessly most of the time during our testing. The infotainment system in the Audi e-tron can be controlled easily and conveniently via natural speech or with the steering wheel buttons. Particularly the voice control clearly impressed the testers. The driver can arrange the large tiles of the user interface according to his or her own preferences. This also applies to the icons on the left-hand side of the screen, except for the home button. >>

Navigation

The Audi e-tron offers navigation on the utmost level. Its outstanding route selection combined with a very strong acoustic and visual guidance result in the grade “very good“.



Besides the usual 2D and 3D views, the e-tron offers an astounding Google Earth view for the route guidance.



The online parking information tells the driver whether there are still enough spaces available in the desired car park.



The e-tron's head up display offers a very precise representation of the next maneuver including an accurate lane recommendation.

■ In the important area of navigation, the Audi e-tron really goes strong. Its excellence already can be seen in the manifold view options. The combination of a large-scale map view in the digital cockpit (see image below) and the information in the head up display in the driver's field of vision turned out to be really great in every day use and leaves nothing to be desired. Among the further highlights is the Google Earth navigation mode with its impressive satellite view, which is available in addition to the classic 2D and 3D views. This is completed by additional goodies such as a detailed 3D city view, lane recommendations, autobahn exits and crossroads details.

Operation also turned out to be very easy in our tests – particularly if the driver activa-

tes the voice control with its natural language vocabulary via the according steering wheel button. Alternatively, it is also possible to enter destinations or POIs traditionally via the central touch screen or even using handwriting recognition in the lower display. Thanks to the online connectivity of the e-tron's “Audi connect Navigation & Infotainment“ services, the user is not only shown the satellite maps but also real time traffic information. On request, the system shows how many spaces are still available in the driver's favourite car park or delivers on street parking info and even presents user ratings for example for restaurants.

While the diversity of features already is impressive, there is also not much to be

criticized about the traditional navigation functions, the route selection and the acoustic and visual guidance. The performance was often on the same level as Google Maps.

The processing of real time information – for example about traffic jams – resulted in reasonable bypasses. We were particularly impressed with the Audi system as it not only informed us about necessary charging breaks on the route, but also considered the necessary charging time as well as the topography of the route in its calculation of the estimated time of arrival. The map overview also shows the theoretical maximum range of the Audi e-tron based on its current charging level – so the system showed a great overall performance in every respect.

CAR CONNECT



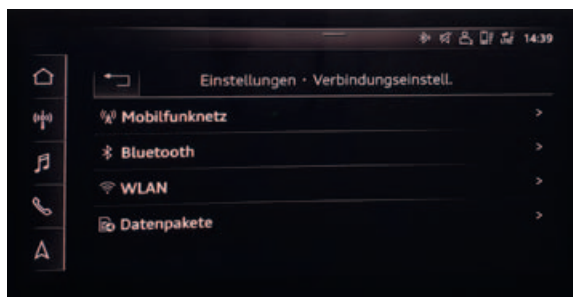


Connectivity

With its extensive connectivity package, the Audi e-tron covers almost all tasks in this chapter perfectly.



In the WiFi services section of the “myAudi” app, the user can activate services such as music streaming.



With the menu item “Data packages” the driver can buy new data credits for the e-tron’s internal e-SIM. Alternatively, the user can provide his or her own SIM card for the same purpose.



The e-tron does not only offer a useful calendar function but can also access the user’s e-mail account.

■ The Audi also delivered a really successful performance in terms of connectivity. An integrated e-SIM is standard in the e-tron and can be charged with different data packages for user functions such as web radio streaming. Furthermore, there is a SIM card slot for the user’s own card in the oddsments compartment, located next to the USB and SD memory card interfaces. WiFi, a WiFi hotspot and Bluetooth are also standard features of the e-tron.

In order to offer extensive smart phone connectivity, our test vehicle was equipped with the “Audi smartphone interface” for 275 Euros, bringing tethered Android Auto and Apple Carplay into the SUV. Additionally, maximum telephone convenience was provided in the e-tron by the “Audi phone box” (500 Euros). It not only couples a smart phone placed in the center console’s tray to the car’s external antenna, but also serves as a wireless charging station according to the Qi

standard with compatible mobile phones.

The e-tron also shines when it comes to productivity. For example, SMS messages and e-mails are not only shown on the display, but also read aloud via text-to-speech. The opposite direction, speech-to-text, is equally supported. Furthermore, the Audi offers a useful calendar function. However, we missed a web browser which would have completed the already abundant feature list. But weather and news services are aboard.

The “myAudi” app impressed the testers with its many functions and informations. Among other features, it offers useful remote services such as for example locking and unlocking the doors or controlling the aircondition of the SUV from a distance. Above that, it is possible to send navigation destinations of any kind from the app to the SUV. So all in all, the Audi gathers the grade “very good” in this discipline as well. >>

User Experience

The User Experience in the Audi is “good“ with very few exceptions. We see room for improvement mainly regarding streaming services.

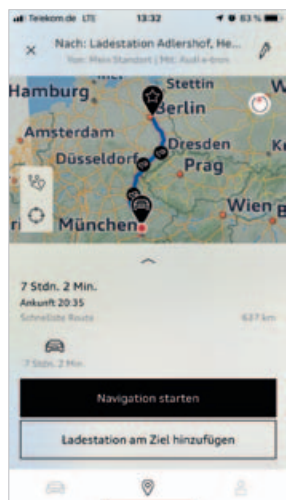
umlaut's experts investigated how well the opulent features of the Audi e-tron can be used in every day situations. They praised the useful user profiles which can be customized at a high degree of detail. Even the latest navigation destinations are only shown in the respective user profile. Sharing the car with other users via the app is also working very easily. The voice control of the Audi does an excellent job as well. The testers found it very natural, the recognition rates were high, and the system was even able to combine subsequent queries. Alternatively, the driver can talk to Amazon's Alexa – for this, it is only necessary to register the according Amazon account in the “myAudi“ app.

Speaking of the app: “myAudi“ shines with numerous informations, but still shows some potential for improvements in the areas of design and functionality. For example, it is only possible to fill the logbook manually – and sometimes it is difficult to discern informational and interactional panels in its user interface. In terms of entertainment, the testers only criticized that the offering of streaming services is limited to Amazon Music and Napster – and even

these are only available if the smart phone is connected to the Audi via WiFi. This also applies to the useful calendar function of the e-tron: it requires a WiFi connection between the smart phone and the car.

The testers likes the e-tron's navigation. Routes are calculated under consideration of of the remaining range and including necessary charging breaks and times. Traffic jams and construction areas from the live traffic info are also considered. All in all, the level of information is very high. There are only some points deducted for a gap between the estimated time of arrival in comparison to the reference Google Maps. But this did not diminish the overall good assessment much.

The route planning also considers charging breaks and charging times.



Conclusion

Michael Peuckert,
editor



The Audi e-tron is the first car to achieve the overall grade “very good“ in connect's and umlaut's car connectivity test. This deserves much kudos, as our test is really challenging and demands a great deal from a car's features and usability.

Even at very close inspection, the impressive electric SUV just showed no flaws in any of our

test's disciplines. It shines with extensive functionality and intuitive operation in each category. However, in order to benefit from all of this, a buyer has to pay a small fortune. So we are curious whether Audi will offer this convincing concept also in more affordable vehicle categories. If so, we are already looking forward to the next test.

Test results

Brand	Audi	
Model	e-tron 55 Quattro	
Infotainment system	MMI Navigation Plus w/ MMI Touch Response	
Basic price/Price of test vehicle ¹	(Euros)	80 900/107 310
Extras relevant for assessment ¹	(Euros)	2 745

Features

Display		
Main display/resolution	(inch/pixel)	10,1/1540 x 720
Additional display/diagonal/cockpit display	(inch)	+/0/+
Touch/haptic feedback/head up display		0/12,3
User Interface		
Voice control/infotainment/POI/vehicle Controller/wheel buttons/function buttons/vol.		natural/+/0/+
Handwriting recognition touchpad/display		+/0/+
User profiles/customizable main menu		+/0/+
Shortcuts/for radio stations/for telephony		+/0/+
Entertainment		
DAB+/web /hybrid radio/CD/DVD drive		+/0/+/-
USB/WiFi/Bluetooth media playback		+/0/+
Streaming services		via smart phone app
Apple Carplay/Android Auto/Mirrorlink		+/0/+
Navigation		
Dest. entry: controller/touch/voice/map/phone		-/+0/+0/+
Dynamic navigation		Live traffic onboard
View display arrow/2D/3D/Google Earth/AR		+/0/+0/+
Map visualization/3D building representation		very fine/+
Route selection/alternative route		+/0/+
Visual. current street/next street/speed limits		+/0/+
Maneuver info: Arrow/signs/lane/pos. on lane		+/0/+0/+
Live infos parking/fuel prices/ratings		+/0/+
Connectivity Interfaces		
eSIM/user SIM(format)/LTE/5G/Car2X		+/Standard SIM/+/0/+
WiFi/WiFi hotspot/Bluetooth		+/0/+
USB type/number/memory card slot		USB-A/2/SD
coupling external antenna/wireless charging		+/0/+
Digital key		-
Telephony & Productivity		
Contacts/favorites/quick access		+/0/+
SMS view/TTS announcement/STT entry		+/0/+
E-Mail view/TTS announcement/STT entry		+/0/+
Calendar/browser/Skype		+/0/+
News/weather/fuel prices		+/0/+
Smartphone app		
Open/close doors/ start/stop air condition		+/0/+0/+
Location/driver's log		+/0/+
Send address/POI/first/last mile navigation		+/0/+0/+
Vehicle infos/push infos/alarm infos		+/0/+


Test results

Infotainment	max. 100	very good (87)
Display	(50)	44
User Interface	(30)	28
Entertainment	(20)	15
Navigation	max. 100	outstanding (95)
Features	(40)	37
Route calculation	(20)	19
Guidance	(40)	39
Connectivity	max. 150	very good (131)
Interfaces	(40)	29
Telephony	(30)	30
Productivity	(30)	23
Smartphone app	(50)	49
User Experience	max. 150	good (117)
connect	VERDICT max. 500	very good 430

¹ at time of testing



CAR CONNECT



The I-Pace's multi-function steering wheel offers multiple possibilities to make adjustments to the cockpit display, the head unit and the driving assistant.

SUCCESSFUL ENTRY

Jaguar recently managed to enrich the automotive market with a diversified model range. In order to find out what the manufacturer has to offer in the areas of connectivity and the like, we have taken a close look at the I-Pace.

Without a doubt, the traditional car maker Jaguar provided plenty of positive input for conversation in the automotive industry since it was absorbed by the Indian enterprise Tata Motors. And it has definitely enriched the automotive market with its emotionalising models since. With the introduction of the luxurious I-Pace, the car maker proved a lot of courage and demonstrates presence in the area of all-electric cars.

Since then, there was much good to read about the I-Pace, which

received several awards. All the more reason to take a closer look at the inner values of this vehicle together with our partners from umlaut.

We were certainly curious how the Jaguar would fare in our demanding test procedure investigating the

areas of infotainment, connectivity, navigation and user experience. At least, the list of options did not show any gaps concerning these focus areas. In this context, it is particularly good news that Jaguar already implemented many elements of the I-Pace's connectivity as standard options. This treats customers' wallets at least with some care – however, at a base price of 79 450 Euros this “Performance SUV” is not exactly a bargain. Thus it might probably remain a dream for many of its prospective clients.

Marc-Oliver Bender

JAGUAR I-PACE

Performance kW/hp:	294/400
Maximum torque:	696 Nm
Maximum speed:	200 km/h
Acceleration:	
(0-100 km/h)	4,8 s
Consumption:	24,8–22,0 kWh/100 km
Price:	from 79 450 Euros



connect



Scan the QR-Code, and learn how umlaut and connect test connected services in vehicles.

The home screen of the 10 inch touch display can be configured by the driver to his or her liking. The menu structure is mostly logical and thus allows for quick selections.

The 5 inch display of the Touch Pro Duo infotainment system is designated for controlling the air condition, media playback and telephony, among other functions.



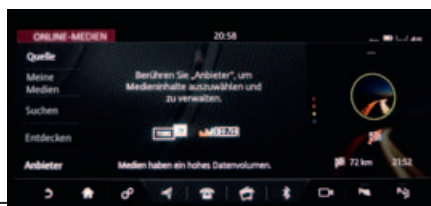
CAR CONNECT

Infotainment

The infotainment system in the I-Pace shows minor impairments in the area of voice control. Here, the car only accepts pre-defined commands – and this also only to a limited extent.

■ The Jaguar I-Pace offers many features off-the-shelf which makes hearts beat faster when it comes to infotainment. The heart of the system are the two Touch Pro Duo screens with HD resolution which are located in the center console. The head unit offers a convenient overview with its diagonale of 10 inches and can be easily operated. The smaller screen below measures five inches and is provided to additionally controlling functions such as setting the air condition, the temperature of seat heating, operating media playback or telephony. Both screens can be directly controlled by touch operation. The visual presentation in the passenger area is completed by a 12.3 inch digital instrument cluster, which offers various modes of showing information to the driver. A profile manager supports the user in storing his or her personal settings.

In the vehicle provided for testing, all of this was amended by a head up display, which is available at an extra charge of 600 Euros. Entertainment is provided in the I-Pace by an FM radio as well as pre-installed streaming services such as Deezer or Tuneln. As soon as the driver has activated the integrated SIM card, these services can be used even without an active smart phone connection. A prerequisite remains of course that the user owns and enters a valid account for the mentioned offerings.



The I-Pace supports the services of Deezer and Tuneln off-the-shelf and thus permits full musical enjoyment even without a smart phone connection.

The digital radio DAB+ is only available at a surcharge of 350 Euros. In addition, the car can play back the user's own music via Bluetooth streaming or via Apple Carplay or Android Auto. The media playback options are completed by four available USB ports which even support the presentation of photos and videos in the vehicle. Operation of all these features works mostly intuitively. It is possible to customize the home screen of the center display according to the user's choices. The only aspect which is not quite up-to-date is the voice control system which can be activated via a steering wheel button. The main point of our criticism is that the system only supports pre-defined voice commands. After all, other manufacturers such as Audi or Mercedes-Benz meanwhile allow the user to have a free conversation with their vehicles. >>

Navigation

In the area of navigation we especially liked the manifold view options of the split screen, which can be widely customized by the driver.



The split screen offers a variety of view options to the I-Pace's passengers which can be combined in many ways.



The navigation worked very well, and the system was mostly spot on when it estimated times of arrival.



The head up display supports safe travelling with its well-designed and easily readable navigation visualizations.

■ The Jaguar I-Pace offers a complete navigation package as standard equipment which actively supports the driver to reach his or her destinations without unnecessarily losing time. The system includes live traffic data which is considered immediately in the route calculation as well as being presented on the main screen. Above that, the I-Pace considers the course of the road as well as speed limits in the calculation in order to estimate the time of arrival as precisely as possible. But the clou of the "Navigation Pro" is its Commute Mode. It is based on artificial intelligence which for example internalizes the drivers' journey to work in order to henceforth suggest optimal route alternatives.

Generally, entering destinations is done by touch via the head unit or with the separate "Jaguar InControl" route planning app on the smart phone. The latter option includes first mile and last mile navigation. Of course, also the implemented voice control can be invoked for destination entry. Possible charging breaks are also considered in the route calculation. Map presentation is available either as 2D or 3D view, a satellite view based on an active internet connection can also be selected. In the settings, autozoom can be activated – in addition, the shown section of the map can also be directly adjusted by pinching the fingers on the touch screen. It is up to the driver whether the navigation information is displayed on

the main screen or in the digital instrument cluster. However, the least amount of distraction is provided by the nicely working head up display. Also, the acoustic guidance is accurate and allows for following the route suggestions without mistakes. The system provides additional information about nearby POIs. A very useful detail is also the possibility to keep pre-selected contacts informed about the calculated time of arrival via SMS or e-mail. An online parking service at the destination is also offered and can possibly help to save valuable time. So, in the end, there is hardly anything left to be wished for, as far as the I-Pace's navigation functions are concerned.

CAR CONNECT





Connectivity

We particularly missed a wireless charging function in the current I-Pace.

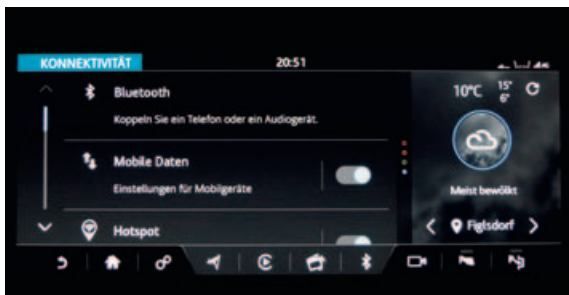
CAR CONNECT



The Jaguar InControl apps can enhance the functionalities of the I-Pace.

■ The micro SIM card installed by the car manufacturer offers a monthly data volume of 500 MB from the moment of activation over a period of three years. Considering the many interfaces which support internet connectivity, this contingency seems rather limited. But it is possible to upgrade to more suitable options via the car dealer, or to insert one's own SIM card into the according slot. The car's integrated LTE modem supplies real time traffic data as well as the already mentioned services Deezer and Tuneln. The modem also allows for installing updates as well as connecting the vehicle to the associated smart phone app. The Connect Pro Package, which is installed as a standard option, includes a 4G WiFi hotspot which can connect up eight devices to the internet. Part of this package are also the "Smart Settings". When this feature has been activated, the vehicle can learn the driver's personal preferences in terms of temperatur settings, media selection and the like.

For this feaure, the user is identified either via the car key or the smart phone. More than enough interfaces for one's own phone can also be found. Bluetooth, Apple Carplay or Android Auto provide direct connections to the I-Pace. The Jaguar InControl apps add functions such as accessing the calendar or contacts and can be conveniently operated via the head unit. In order to use this option, there must be a tethered connection to one of the car's USB ports – much the same as for using Apple Carplay or Android Auto. However, the choice of applications is still a little limited at the moment. The Internet can be navigated via an integrated web browser. Jaguar's remote app enables the driver to access the I-Pace from afar. It transmits various informations such as the car's current range or location. In addition, the user can monitor the progress of charging the battery, precondition the climate control system or remotely lock the vehicle. >>



Bluetooth enables easy connections to the smart phone. The menu item "Mobile Data" offers preferences for the micro SIM card.



A local hotspot can connect up to eight devices to the World Wide Web.

CAR CONNECT



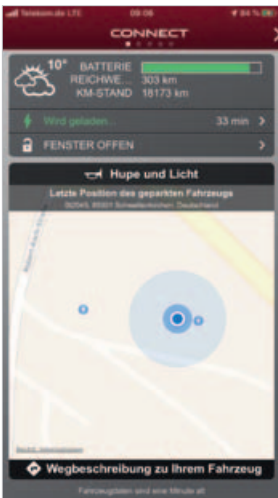
User Experience

In the User Experience chapter of our test, the Jaguar only achieves the grade “satisfactory”.

■ As usual, the experts from umlaut also investigated the Jaguar I-Pace. The testers deemed some need of improvement in the fact that with Jaguar Remote, Jaguar Route and Jaguar Apps a total of three InControl apps were to be used – each with their own setup processes. After all, this multitude rather aggravates a holistic experience. An additional shortcoming was discovered by the umlaut testers: The alleged current vehicle positions did not match within the three different applications. However, the experts were impressed by the driver’s log which automatically imports all route details from the vehicle. Real time traffic data facilitate a speedy route optimization and provide estimated times of arrival which mostly coincided with our reference Google Maps. Looking for a parking spot also worked intuitively and straightforward. There is some need for catching up concerning voice control. The communication is limited to pre-defined commands and a constricted area of applications, which results in a non-satisfying user experience. Users are already accustomed to a higher standard from the digital worlds of Amazon Alexa or the Google Assistant.

However, integration of the user’s calendar via the InControl app worked nicely. It is even possible to invoke the navigation directly from a calendar appointment. In the event of an emergency, the driver finds buttons for contacting a breakdown service or for issuing an SOS call in the roof. However, umlaut would have wished for a possibility to cancel an emergency call after it was issued. Above that, the breakdown service could not be reached by two of the four testers. This is the kind of situations which does not satisfy the user. All in all, umlaut assesses the user experience provided by the I-Pace with the partial grade “satisfactory”.

Jaguar’s remote app enables permanent access to the I-Pace.



Conclusion

Marc-Oliver Bender,
 editor-in-chief



In our demanding test, the Jaguar I-Pace all in all achieved the grade “good”. The electric car particularly gathers many points in the area of navigation. We were also impressed by the interaction with the car provided by the Jaguar InControl app. However, we see some potential for improvement in the operation of the infotainment system, the

connectivity options and the overall user experience. The dependence of the voice control on pre-defined commands also was a less convincing factor. Above that, the absence of hard keys limit the input possibilities mostly to the ten inch central touch display, which can quickly distract the driver from the current traffic situation.

Test results

Brand	Jaguar	
Model	I-Pace	
Infotainment system	Navigation Pro	
Basic price/Price of test vehicle ¹	(Euros)	79 450/94 400
Extras relevant for assessment ¹	(Euros)	950


Features

Display	
Main display/resolution (inch/pixel)	10/HD
Additional display/diagonal/cockpit display (inch)	+/+/+
Touch/haptic feedback/head up display	+/12,3
User Interface	
Voice control/infotainment/POI/vehicle	pre-defined commands/+/+/-
Controller/wheel buttons/function buttons/vol.	+/+/+/+
Handwriting recognition touchpad/display	-/-
User profiles/customizable main menu	+/+
Shortcuts/for radio stations/for telephony	+/+/+
Entertainment	
DAB+/web /hybrid radio/CD/DVD drive	+/+/+/-/+
USB/WiFi/Bluetooth media playback	+/-/+
Streaming services	via Deezer or Tuneln
Apple Carplay/Android Auto/Mirrorlink	+/+/-
Navigation	
Dest. entry: controller/touch/voice/map/phone	+/-/+/+/+
Dynamic navigation	Live traffic onboard
View display arrow/2D/3D/Google Earth/AR	+/+/+/+/-
Map visualization/3D building representation	fine/+
Route selection/alternative route	+/+
Visual. current street/next street/speed limits	+/+/+
Maneuver info: Arrow/signs/lane/pos. on lane	+/+/+/-
Live info parking/fuel prices/ratings	+/-/+
Connectivity Interfaces	
eSIM/user SIM(format)/LTE/5G/Car2X	-/Micro SIM/+/-
WiFi/WiFi hotspot/Bluetooth	+/+/+
USB type/number/memory card slot	USB-A/2/-
coupling external antenna/wireless charging	-/-
Digital key	-
Telephony & Productivity	
Contacts/favorites/quick access	+/+/+
SMS view/TTS announcement/STT entry	+/-/+
E-Mail view/TTS announcement/STT entry	-/+/-
Calendar/browser/Skype	+/+/-
News/weather/fuel prices	+/+/+
Smartphone app	
Open/close doors/ start/stop air condition	+/+/+/+
Location/driver’s log	+/+
Send address/POI/first/last mile navigation	+/+/+/+
Vehicle infos/push infos/alarm infos	+/+/+

Test results

Infotainment	max. 100	satisfactory (74)
Display	(50)	42
User Interface	(30)	20
Entertainment	(20)	12
Navigation	max. 100	very good (86)
Features	(40)	31
Route calculation	(20)	19
Guidance	(40)	36
Connectivity	max. 150	satisfactory (106)
Interfaces	(40)	18
Telephony	(30)	23
Productivity	(30)	18
Smartphone app	(50)	47
User Experience	max. 150	satisfactory (111)
connect	VERDICT max. 500	good 377

¹ at time of testing



The control elements on the steering wheel are well laid-out. The two touch pads actually make navigating the cockpit display and the home screen a little easier.

LEADING THE WAY

The Mercedes EQC is the first all-electric car in the product line of the Swabian brand. In cooperation with the MBUX, the car maker with the star delivers a neat package.

Daimler uses the claim “the Mercedes among electric cars“ to advertise its first all-electric vehicle. After having reviewed the electric cars Audi e-tron and Jaguar I-Pace, we were very curious to find out whether this boastful advertising promise would be reflected in the areas of infotainment, connectivity, navigation and user experience.

At 90975 Euros, the price of the all-electric test vehicle matches the market environment shaped by these competitors. Its central control unit is the Mercedes-Benz User

Experience (MBUX). By implementing this platform, Mercedes-Benz originally had made a large step in the direction of a connected car which is acting mostly independent from a linked smart phone. This technological concept makes it

possible today to upgrade to additional features such as remote services, live traffic data, remote navigation or the smart phone integration solutions Apple CarPlay or Android Auto even after the purchase of the vehicle. This can be done easily via a store in the car or via the PC. In cooperation with the Mercedes me app and an individual ID which allows for managing the purchased services and functions, handling the car gives the user an all-new feeling – which we already know quite well from using our smart phones in our every day lives.

Marc-Oliver Bender

MERCEDES EQC 400 4MATIC

Performance kW/hp:	300/408
Maximum torque:	760 Nm
Maximum speed:	180 km/h
Acceleration: (0-100 km/h)	5,1 s
Consumption:	19,7 kWh/100 km
Price:	from 71 281 Euros



connect



Scan the QR-Code, and learn how umlaut and connect test connected services in vehicles.

The MBUX is supported by two displays, each 10.25 inch in size. The home screen can be controlled conveniently via touch operation and also offers a high degree of functionality.

The useful touch pad on the center console featured a large area for letter and word input and even provides haptic feedback.



CAR CONNECT

Infotainment

Be it the crystal clear displays or the convenient user interface of the MBUX – in the discipline of infotainment, the EQC offers a lot and thus deserves the grade “very good” for this category.

■ The EQC certainly does not miss out in terms of infotainment. Its cockpit display and the screen of the head unit measure 10.25 inches each and both offer a crystal clear resolution of 1920x720 pixels. The main screen which can be conveniently reached, can be controlled by touch as is up-to-date. But other than the touch pad in the center console, it does not provide a haptic feedback. When arranging the applications for example for navigation or telephony, the user can change the order simply via drag and drop. In order to allow the driver to keep his or her hands on the steering wheel when making use of the multiple information view options, the wheel is equipped with two touch-sensitive pads. They allow “swiping” through the menus. Another method of input is the cen-

tral touch pad. But it does not stop there. The key words “Hey Mercedes” make the native voice control come alive, which can be used very extensively for navigation and partially for controlling the vehicle’s other functions. For example, the statement “I’m cold” makes the MBUX immediately rise the interior temperature and activate the seat heating. With an account of the streaming service Tidal, any song or playlist can be accessed. At a surcharge of 297,50 Euros, the digital radio DAB+ can be added. The “smart

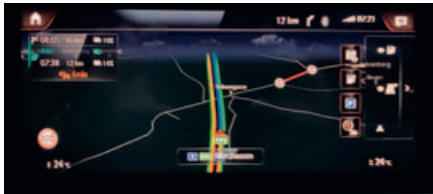
phone integration” is also offered in the EQC at a surcharge of 416,50 Euros. It adds the possibility of integrating one’s own smartphone via Apple CarPlay or Android Auto and control it via the head unit. For media playback, a classic Bluetooth interface is available which also supports the rendition of cover art. A USB port enables the playback of audio and video files. The testers also found the MBUX Interior Assistant fascinating. It facilitates gesture control using a 3D camera which is mounted in the roof assembly. This is based on a complex artificial intelligence which can discern the hands of the driver and co-driver any time. As a result of our test cycle, we awarded the EQC’s infotainment system with the grade “very good”. >>



In the “favourites” menu, frequently used vehicle, telecommunications and infotainment functions can be quickly accessed.

Navigation

Navigation is the prime discipline of the EQC – and “outstanding“ in any respect, when it comes to travelling efficiently and arriving at the planned destination in time.



The visual representation of the route guidance in the Mercedes EQC is clearly structured and also looks very nice.



It is almost impossible to lose one’s way – Autobahn exits are precisely shown on the split screen, providing optimal orientation.



The headup display is offered at a surcharge, but gives reliable information about speed, traffic signs and navigation maneuvers.

■ The EQC features a preliminary setup of the navigation unit. However, in order to fully benefit from the modern route guide, the extras “Harddisk navigation“ for 654 Euros and the “Navigation services“ package for 59 Euros must be ordered. If the budget does not allow this at the moment of purchase, this is not a problem: These functions can be added later by the user via the PC and a subsequent software update in the car. As a result, the EQC offers a surprisingly convenient navigation unit, which can be operated via voice control or the central screen. Entering navigation destinations can also be done via the touch pad. There are various options for the visual representation of the maps, ranging from

the classic 2D view via a 3D view up to a Google Earth view. Another option can be added with “MBUX Augmented Reality for Navigation“ (297 Euros): This upgrade will show the front camera’s live image on the main screen – for example in looking at crossways or roundabouts. MBUX Augmented Reality adds graphic guidance information into this image which accurately describes the upcoming manoeuvre. During our test drives, this extra definitely proved its value, providing an additional aid for orientation. But the cockpit display can also show the route guidance. In this case, the driver can select different view modus with the left-hand pad on the steering wheel. The navigation features are completed by a

head up display (1178 Euros) which offers reliable information about speed, traffic signs and navigation maneuvers. Furthermore, the driver receives current information about the traffic situation, parking lots and charging stations, as well as restaurant and hotel ratings from Yelp and Tripadvisor. Route recommendations and arrival times were very accurate during our tests in comparison to Google Maps. Also, the testers were more than once impressed by the voice dialogue system. The MBUX immediately answered questions about restaurants or charging stations and considered them in the route guidance at the driver’s request. So the in end, none of our navigation wishes remained unfulfilled.

CAR CONNECT





Connectivity

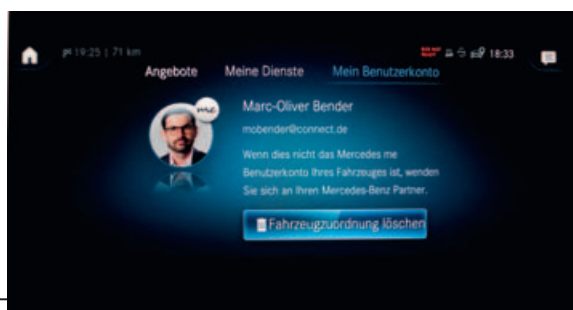
For its connectivity functions, the EQC could achieve the grade “good”.



The Mercedes me app offers various services in order to control the car remotely.



Apple CarPlay as well as Android Auto can be seamlessly integrated. However, these services only work over a tethered connection between the smart phone and the vehicle.



With a Mercedes me ID, the user can define and manage personal preferences and settings in the EQC – very much the same way as already know from the smart phone.

■ The MBUX in the EQC includes an LTE modem with an e-SIM as a standard option, making the “Mercedes me connect” services accessible. The most important of these services are free during the first three years and can later be prolonged at a fee via the Mercedes me portal.

The test vehicle’s connectivity features left nothing to be desired. Bluetooth, WiFi, a WiFi hotspot and NFC cover all important standards. The latter is included thanks to the “Multifunction Telephony” (583 Euros), which features a tray facilitating wireless charging of compatible smart phones as well as coupling the phone to the car’s external antenna. The testers also appreciated the hands free function.

With the “Smart phone integration package”, phones can also be linked directly to the MBUX. For this purpose, there is a USB C port placed directly besides the smart phone tray area. In addition, two more USB-C interfaces in the center arm rest support media playback and charging the phone.

The EQC also uses them for Android Auto and Apple Carplay. However, only the Apple variant can be conveniently operated via the touch pad – Android users must employ the touch screen for this cause. In the main menu, all services and apps can be found under the item “Mercedes me & Apps”. In addition, a web browser can also be found here.

What we missed in the EQC: an e-mail and calendar function, which was not activated in the test car. This is a pity, as “In Car Office” is available as an optional service and could deliver exactly those functions into the car. This costs the electric car valuable points, because we can only examine and assess what has been activated during our test period.

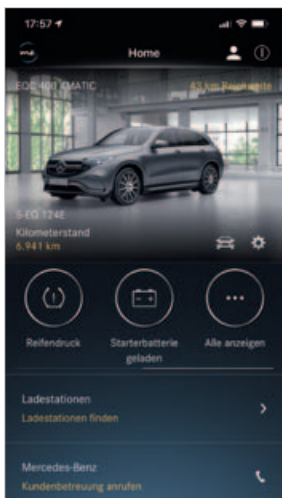
With the “Mercedes me” app, the user can for example lock or unlock the EQC or precondition the climate control. Destinations can be sent easily to the MBUX. The functionality is completed by intermodal routing. For the overall package in the connectivity discipline, we award the grade “good” to the EQC. >>>



User Experience

The experts from umlaut rated the user experience in the EQC with the overall grade “good”.

■ In modern cars such as the Mercedes EQC, the user experience plays a very important role. So, together with our partner umlaut we have elaborately reviewed the EQC also in this discipline. All in all we can already reveal that the electric car also managed to show an overall good performance in this respect. The corresponding app delivers many ostensive details about the parked vehicle. Remote commands such as locking or unlocking the car worked fast, reliably and straightforward. The route guidance also works accurately and precisely regarding the estimated time of arrival in comparison to our reference Google Maps. Looking for a parking spot also was possible concisely and intuitively. The voice dialogue system is another highlight – the MBUX recognized the commands well and put them into effect speedily. However, the testers criticized that the voice control system only supports limited commands for the vehicle’s settings. In the test of the SOS hotline, this function scored well due to its detailed information about the car’s interior such as the number of passengers. When it came to the emergency breakdown service, the testers had to cope with longer waiting times and a confusing preselection. Another point criticized by the experts was the limitation of the smart phone connection to tethering when Apple CarPlay or Android Auto were to be used. For first mile and last mile navigation, the Mercedes me app hands over the navigation to Google Maps (when an Android phone is used) or to Apple Maps (when using an iPhone). It would be more coherent if Mercedes me was used continuously. The experts were also astonished that the valuable test car did not feature an alarm system. This is at the least unusual for a vehicle of this price range.



Remote commands were speedily transferred into the vehicle.

Conclusion

Marc-Oliver Bender, editor-in-chief



All in all, the Mercedes EQC made a good impression to the testers. The MBUX is convincing in many areas and thus establishes an important basis for future steps of development. In connection with the Mercedes me app, this technology already enables great applications today, offering a maximum of flexibility

and functionality. The navigation leaves nothing to be desired and impressed us in almost all aspects. Having this in mind, it is something of an annoyance that in the vehicle provided for our testing the e-mail and calendar functions were not activated. Due to this shortcoming, the EQC unnecessarily lost valuable points.

Test results

Brand	Mercedes-Benz	
Model	EQC 400 4MATIC	
Infotainment system	Mercedes-Benz User Experience (MBUX)	
Basic price/Price of test vehicle ¹	(Euros)	71 281/90 975
Extras relevant for assessment ¹	(Euros)	2 190

Features

Display		
Main display/resolution (inch/pixel)		10,25/120 x 720
Additional display/diagonal/cockpit display (inch)		+/-/+
Touch/haptic feedback/head up display		+/-/10,25
User Interface		
Voice control/infotainment/POI/vehicle		natural speech/+/-/+
Controller/wheel buttons/function buttons/vol.		+/-/+/-/+
Handwriting recognition touchpad/display		+/-/+
User profiles/customizable main menu		+/-/+
Shortcuts/for radio stations/for telephony		+/-/+/-/+
Entertainment		
DAB+/web /hybrid radio/CD/DVD drive		+/-/+/-/+/-
USB/WiFi/Bluetooth media playback		+/-/+
Streaming services		+/-
Apple Carplay/Android Auto/Mirrorlink		+/-/+/-
Navigation		
Dest. entry: controller/touch/voice/map/phone		+/-/+/-/+/-/+
Dynamic navigation		Live traffic onboard
View display arrow/2D/3D/Google Earth/AR		+/-/+/-/+/-/+
Map visualization/3D building representation		very fine/+
Route selection/alternative route		+/-/+
Visual. current street/next street/speed limits		+/-/+/-/+
Maneuver info: Arrow/signs/lane/pos. on lane		+/-/+/-/+
Live infos parking/fuel prices/ratings		+/-/+/-/+
Connectivity Interfaces		
eSIM/user SIM(format)/LTE/5G/Car2X		+/-/+/-/+/-/+
WiFi/WiFi hotspot/Bluetooth		+/-/+/-/+
USB type/number/memory card slot		USB-C/3/-
coupling external antenna/wireless charging		+/-/+
Digital key		+/-
Telephony & Productivity		
Contacts/favorites/quick access		+/-/+/-/+
SMS view/TTS announcement/STT entry		+/-/+/-/+
E-Mail view/TTS announcement/STT entry		+/-/+/-/+
Calendar/browser/Skype		+/-/+/-/+
News/weather/fuel prices		+/-/+/-/+
Smartphone app		
Open/close doors/ start/stop air condition		+/-/+/-/+/-/+
Location/driver’s log		+/-/+
Send address/POI/first/last mile navigation		+/-/+/-/+/-/+
Vehicle infos/push infos/alarm infos		+/-/+/-/+

Test results

Infotainment	max. 100	very good (85)
Display	(50)	43
User Interface	(30)	27
Entertainment	(20)	15
Navigation	max. 100	outstanding (99)
Features	(40)	39
Route calculation	(20)	20
Guidance	(40)	40
Connectivity	max. 150	good (113)
Interfaces	(40)	30
Telephony	(30)	30
Productivity	(30)	11
Smartphone app	(50)	42
User Experience	max. 150	good (126)
connect	VERDICT max. 500	good 423

¹ at time of testing



Sajjad Khan, member of the managing board of Mercedes-Benz AG. Since October 2018, he is head of the complete CASE organisation (Connected, Autonomous, Shared & Services, Electric).

■ **Mr. Khan, when will the car finally become the equivalent of a smart phone?**

This question has been discussed for more than 15 years now. Modern smart phones are not only individual devices for conducting phone calls. Instead they offer a whole ecosystem which allows users to do much more – for example listening to music, surfing the internet oder working while travelling. And at this point the car comes into play. Because as long as we ourselves are physical entities, we need another physical object – which today we call “car” – in order to move us from one place to another.

The question is: How will this look in the future? There are some fundamental elements which we cannot dispense of, such as seats, the chassis or the undercarriage. But this is amended by something else. We call this additional layer “CASE” – which stands for better connectivity, increasing autonomous driving, shared services as well as the engine – in other words, the kind of drive, be it petrol, diesel or a battery. Those are the four parameters which will be added to the way we drive today.

With the multimedia system Mercedes-Benz User Experience (MBUX) you have set a strong mark. Are we Germans able to develop great software after all? We are absolutely convinced that this is possible. MBUX was a global project,

Interview

„Start with the customer“

The decisive factor in a connected car is its user interface. Talking with connect, Mercedes-Benz executive Sajjad Khan explains why this is so and why he thinks that the company is well positioned in this area.

as we are a global company. But control of the project was completely managed from Sindelfingen. However, your question is of course valid. Apart from SAP we have no significant software industry in Germany. We have a lot of technological know-how, for example in our universities. But we lack successful business ideas which derive from this. Size is a relevant criteria here, but all in all, quality is more important than sheer quantity.

How will the further development of this system look like?

It will definitely build on the existing foundation. But we will integrate new features. In doing so, we will continue to follow the principles which we have put into place with MBUX – which is placing the customer and his or her needs at the very start of all considerations. Our main focus will remain on the question what the customer needs and what he or she would like to do when they sit in a car.

As well received as MBUX is – without an internet connection, the functionality looks much like ten years ago. Then, things seem to not have changed a lot.

Regarding voice recognition, things do have changed a lot – however not in the computation of the complexity of speech. We simply do not have the storage space on board to do such computations locally. It is not possible to put this complexity isolated into a vehicle. Therefore,

connectivity is so important to us. Therefore we also strongly support the roll-out of 5G. This is the only way how we can get the necessary bandwidth and also the coverage.

Will the user interface of a vehicle be an important competitive advantage in the future?

Yes. Being able to offer the driver a mode of interaction with the vehicle, which he or she is familiar with, will definitely be a decisive point. Users familiar with Android will struggle with iOS at first – and vice versa. This also applies to cars and was no different in the past. Drivers familiar with a Mercedes could board their new vehicle and immediately knew where to find which button. The user interface is basically a new level of this – but one which grows ever more important. At the same time, we are delighted when we can enthuse people who never drove a Mercedes-Benz for our vehicles on the basis of MBUX alone.

Let’s talk about autonomous driving. When will it become a reality?

We are cautious about giving timelines, as much is still unanswered. But it is certain that autonomous driving will come. Still, up to now nobody can build a car which is able to drive as well or better and safer than a human driver. A 100 per cent safety is essential. A car which drives safely in 70 per cent of the cases is not an option. But the degree of maturity of this technology is already quite high.



Handing over the connect innovation award for Mercedes’ Mobile SDK. From the left to the right: Sajjad Khan, Linda Stelte, Marco Scheuermann, Miroslav Juric, Stefanie Oesteritz, Marc-Oliver Bender.



E-SPORTS STAR

Porsche is taking off with its first all-electric vehicle model. We threw a first glance at the new Taycan's connectivity and infotainment package.

CAR CONNECT

Now things are really heating up: Until 2022, by its own account Porsche will invest six billion Euros into electric mobility. And on the roads? There the Stuttgart-based sports car manufacturer also steps on the pedal. The all-new Taycan, which is produced in the Zuffenhausen main factory, makes a sprint in 9.8 seconds – from zero to 200 km/h. In any case, the all-wheel driven, four door sedan has every property of a trump card. Or to put it differently: With its real driving performance, the almost 2300 kilogram Taycan will fulfill the highest expectations – especially in its “Turbo S” variant.

As a novelty at Porsche, it uses two highly efficient electric engines. Fully charged, the 93.4 kWh battery promises a WLTP range of approximately 400 kilometers. As another first in a serial car, the drive system is powered with 800 instead of 400 Volts. One of the

advantages of this are shorter charging times. The battery of the e-sports car is supposed to accept the enormous DC charging power of up to 270 kW. Under ideal conditions, fast charging stations from Ioney can boost the charge level from 5 to 80 per cent in about 23 minutes.

Let's have a look at the electronic interior: A slightly curved display serves as an instrument cluster, offering various views. Among others, it simulates the three typical dials. Classic buttons and switches are scarce in the Taycan. The opulent functional and infotainment offerings are most conveniently controlled by the clever (online) voice

assistant, which even understands colloquial wording and can be addressed with “Hey Porsche“. The main hub for touch operation is the 10.9 inch full had display. In the Porsche Connect application package which is included for free within the first three years, there is an online search function as well as calendar integration (Office 365 or Google). One tile in the well-designed, customizable user interface is reserved for the sophisticated navigation system. Its “Charging Planner“ considers not only the car's charge level but also the locations of suitable charging stations in the overall route calculation.

Even third party services such as the streaming service Apple Music are seamlessly integrated into the onboard infotainment system. Thus, in order to listen to music, the iPhone does not have to be tethered to the car's Apple CarPlay support. However, apps of other smart phone

PORSCHE TAYCAN TURBO S

Performance kW/hp:	560/761
Maximum torque:	1050 Nm
Maximum speed:	260 km/h
Acceleration (0-100 km/h)	2,8 s
Consumption:	25,7-24,5 kWh/100 km
Price:	from 185 456 Euros





Co-Pilot goes DJ: Via an optional touch display (top right), the co-driver can conveniently control the infotainment offerings.

brands can not be controlled via the car's displays due to a lack of support for Android Auto.

A connection to the internet is provided by a LTE modem and an according e-SIM. The data volume needed for Apple Music and further Porsche Connect applications is already included.

Interim conclusion: With the new Taycan, Porsche heads for an all-new electric era. Still, the sports car maker stays true to the core of its brand. This includes details such as the start button: It can be found on the left-hand side behind the steering wheel – as usual in any Porsche car.

Joachim Bley



Map view in the cockpit: The presentation in the elegantly curved 16.8 inch display can be customized.



THIS NAME

With its new name, connect's partner in network and automotive testing emphasizes that the performance of this cross-industry enterprise far exceeds the usual.

REFLECTS THE AIM

With a yearly turnover of 400 million Euros and 50 locations all over the world, umlaut is a giant among technological management consultancies. This is all the more astonishing, as umlaut emanated within 20 years from a three person engineering company. But this development is less surprising when it becomes clear that the name umlaut – the two dots above the vowel are a metaphor for performance that adds something on top – actually reflects the aim of the company. This is reflected in the intensity

which the experts from 80 nations apply to fulfilling their tasks in the areas of consulting, engineering, testing and much more.

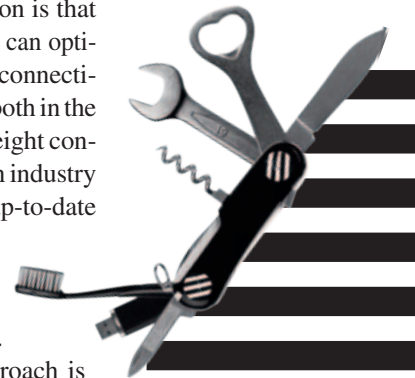
Cross-industry answers

Care for an example? Many are knowledgeable about aeroplay, certainly even more about WiFi. This also applies to the teams of umlaut which originally were structured in the divisions Automotive, Aviation, Telecommunication, Energy and Public Sector. But the experts from the different sections are positioned so agile and are so deeply interconnected that they for example get hired when a company such as Airbus

plans to equip its aircraft with ubiquitous WiFi. The reason is that the specialists from umlaut can optimize the so-called inflight connectivity with their knowledge both in the security aspects and the weight concerns of the classic aviation industry as well as with the most up-to-date insights into high frequency technology with multi path radiowave propagation, MIMO and similar factors.

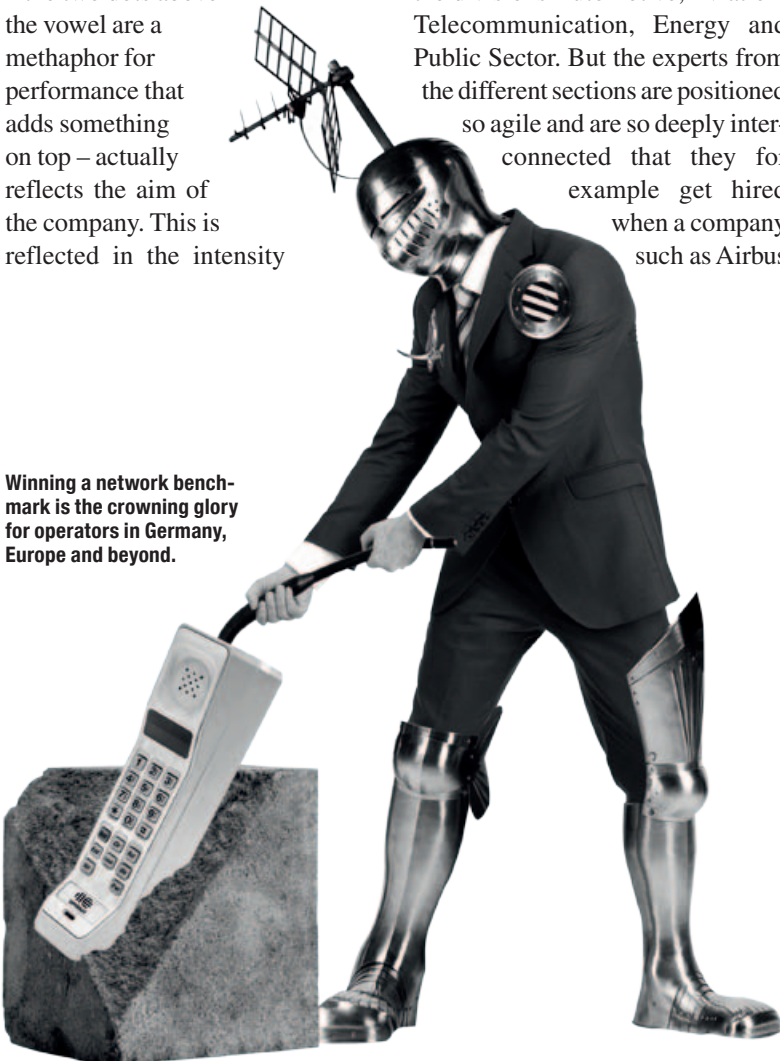
This cross-industry approach is supported by an interdisciplinary team with members from the telecommunications, energy, automotive and aviation industries as well as from the public sector. These masterminds developed the intersectoral approach as a main strategy of the company. So, nowadays their fields of activity comprise closing security loopholes in cars or developing a remote emergency medical service. The latter connects an ambulance equipped via a highly available mobile broadband connection to a knowledge database and specialized doctors in an emergency center for example via video calls.

In early 2019, the group split up into two units in the course of a generational change and a realignment. From this, the 4300 employee company emerged – now operating under the name of umlaut and continuing to act globally in various industries. With its new name, the company emphasizes its commitment to outstanding performance, multidisciplinary, networking and globality. These strong points have long found their way into the coope-



The broad competences of umlaut provide perfect tools for each task in a digitally connected world.

Winning a network benchmark is the crowning glory for operators in Germany, Europe and beyond.



Interview

P3 becomes umlaut. What is the reason?

Hakan Ekmen: In the course of the last 20 years we have grown from a three-person spin off into a multinational, globally acting company with thousands of highly specialized, experienced experts. Our industry focus helped us grow. Still, we recognize the increasing demand of our customers for cross-industry cooperation as well as crosslinking processes and products. This is our focus, this is what umlaut stands for – and this is how we “add something on top“.

**What is the main focus of umlaut?
What topics are on your agenda?**

Hakan Ekmen: We consolidate the extensive know-how and cultural diversity of our employees into ONE company. With our new brand introduced in fall 2019, we facilitate exchange and accomplish a lot more together. We are convinced that umlaut will be a widely acknowledged international brand, which stand always at the side of our customers covering all technological and economical requirements – and which will always find the best possible solution. We accompany our customers from the beginning to the end of each project, paying attention to every detail and every step, in order to make the most from a situation together. Standard solutions are not an option for us. We only offer individual solutions, tailor-made for each customer. This shall result in each customer's utter satisfaction and beyond.

We see that the world grows together, and that industries such as telecommunications, automotive, aviation, railways and energy no longer stand alone, but are interconnected – much the same as our new brand umlaut. This becomes evident in future topics such as connected cars, inflight connectivity, electromobility, autonomous driving and intelligent networks.

Especially in the telecommunications area, we face exciting challenges which will be the foundation for things like smart home or smart working. We are particularly excited about the integration of 5G and the technologies building on it. We will more and more count on



ration with connect, as is proven by the many jointly conducted vehicle tests and many other common projects.

Globality has been an important characteristic of our teamwork for a long time, as is documented by our network test which had been extended to cover Austria and Switzerland in 2009 as well as the United Kingdom and Spain since 2015.

This also shows another strong point of umlaut: Advancing and refining the most important mobile network test over the years, so that it stayed not only relevant in Germany. It serves as an orientation guide for consumers far beyond the German borders – and mobile network

operators acknowledge it to be the most relevant assessment of their performances, elevating our benchmark to a de-facto standard in the mobile communications industry.

Part of this success is the high degree of comparability which also exceeds international borders. The framework which we define early in each year is valid for all benchmarked countries from then on. So operators can also make internal comparisons such as for example between Vodafone Germany and Vodafone UK. Furthermore, the scope of our benchmarks' methodology is beyond doubt. It combines crowdsourcing for the determination

umlaut's CEO Hakan Ekmen and connect's editor in chief Marc-Oliver Bender in close discussion.

of network coverage and stability with drive tests and partially also walk tests measuring transmission speeds and service performance.

The company owes its broad competence to the fast growing team, expanding the former three-person spin-off P3 founded in 1996 with a division of telecommunications. In 1999, it approached connect, which had tested mobile networks since 1993, and offered to cooperate in this area. It is well known what emerged from this coalition up to today. You do not have to be a prophet to foresee that we will certainly hear a lot more about umlaut in the future.

Bernd Theiss



Hakan Ekmen, CEO telecommunications of umlaut

future-oriented topics such as crowdsourcing, AI-based analyses or next generation network intelligence. This will be the key to ignite the next technological revolution. It will bring the world and the various industries even closer together. umlaut leads the way in regard to this trend.

What is happening in the field of the worldwide network tests?

Hakan Ekmen: Our network tests, the “umlaut connect Mobile Benchmarks“ will of course continue to exist. However, they will appear with a fresh face. They are the de-facto industry standard and will continue to be the benchmark for the whole industry. Our utmost focus is on fairly and transparently assessing the global evolution of the networks, to advance their quality and performance – and thus in the end to facilitate improvements for each and every customer.

Interview

CONNECTIVITY

THE KEY TO SUCCESS?

Currently, the car industry experiences a transformation which can definitely be described as disruptive. In addition to electric mobility, the increasingly complex networking and connectivity of vehicles play an important role. connect and umlaut (formerly known as P3) developed a testing procedure in order to benchmark vehicles in the areas of infotainment, navigation, connectivity and user experience. In this process, umlaut covers the subject of user experience.

Which know-how does umlaut contribute in the area of vehicle development, especially regarding fully connected passenger cars?

Hakan Ekmen: umlaut has more than 20 years of expertise in the automotive industry, based on multiple consulting projects – covering process and quality management, the administration of large-scale projects reaching up to technological and strategic projects. When it comes to connected cars, umlaut is involved as a strong partner in the development of software and hardware, but also performs professional testing during and after the development

process. The goal is to ensure highest quality standards in technology, digital services and user experience. In doing so, we always take a cross-industry approach, thinking our projects end-to-end. Therefore, our automotive consultants cooperate closely with our telecommunications experts.

Our customers work on a variety of issues in the area of connected cars – typical questions are for example: How can we offer cross-border connected services, which telecommunication-specific peculiarities must be considered? How can we ensure an optimal user journey for our end customers with our services?

Which parameters have to be adjusted, or which concept can guarantee optimal customer satisfaction? Which strategy in terms of technology should we follow over the next years? What is the significance of new technologies such as 5G for the development of the next generation of cars? How well and reliable do infotainment services work? How reliable are the driving instructions of the satnav system?

The spectrum spans from consulting over the development of digital services and business models including the selection of suitable technologies reaching all the way to user-centric development with



prototyping as well as MVP, UX testing and design. Orchestrating implementation is also a frequent topic. Here, we apply our project management methods combined with our deep technological understanding and know-how in areas such as AI, telecommunications and automotive. Due to our experience from other industries, we are often the driving force for introducing new approaches.

What exactly is considered in the tests?

We have developed 25 task-related tests, which we have divided into six categories: App/smartphone, navigation, voice operation, productivity, entertainment and miscellaneous. The latter category comprises functions such as breakdown management, digital keys and private car sharing. In addition, we have defined two object-related tests, in order to test and assess the touchpoints InCar HMI as well as OEM apps according to their user experience and presentation.

From your point of view, which are the biggest challenges for car makers?

Car connectivity constantly gains in importance, as it provides advantages for drivers, manufacturers, dealers and traffic safety alike. Car drivers do no longer want to go without internet access and the services connected to it. Manufacturers can offer a variety of services to their customers and collect telemetry data, which provides valuable insights into the functioning and utilization of a car. Dealers can access a car's data, solve problems remotely and communicate with their customers. Software updates can be distributed at any time over the network to the cars.

And last but not least, car connectivity enables the connection to other cars and other road users, traffic signs and urban infrastructure, which will contribute to traffic safety, better control of traffic flows and the reduction of congestion. Furthermore, connectivity is an important premise for autonomous driving. But connecting cars is a big challenge for car manufacturers. A comprehensive coverage with the necessary high data



umlaut's CEO Hakan Ekmen and connect's editor-in-chief Marc-Oliver Bender in conversation.

rates is key for making full use of the emerging possibilities. With the increasing interconnectedness, technology companies such as Google, Apple or Amazon are pushing into the market and competing with the traditional car makers by offering mobile online services. Due to their cloud-based services for smartphones and other applications, which have been established for years, they have clear a advantage over the automotive companies in this area.

Customers increasingly demand „Over the Air Updates“ and are no longer willing to accept product cycles of six years for their infotainment systems, which are still common in the automotive industry, while their smartphones are getting replaced each year. With increasing connectivity, data security also gains heavily in importance – in order to protect cars from cyber attacks. And finally, the customers expect transparency and control concerning the utilization of their data, which could oppose the further use or even monetization of data representing vehicles use.

Which potential for optimization do you see based on the vehicles which have been tested so far?

Each car manufacturer has individual strengths, but none of them really offers a holistic concept. Here, other industries in the digital space and in the mobility context can offer important stimulations. The catchword is “cross-industry“. We can take derivatives from smartphones, railways or aviation. The “overload“ of cars by too many technological features is definitely a problem. So the focus should always stay on those functions which users actually need – with a consistent activation concept. But for this, we

have no common standards in the automotive industry – which means that each manufacturer offers their own streaming app, their own nav system. It would be desirable for the users if they could choose apps which they already familiar with.

What is the benefit for the readers from you teaming up with connect on a professional level?

We clearly focus on connectivity, not on the driving characteristics. Connectivity is examined completely detached from all other technical properties of a car. In doing so, we are completely objective and independent. We investigate all brands equally and we report a car's weaknesses the same as we tell its strong points. Our tests clearly indicate a gap between the users' expectations and the current status quo. As our testers know the technological potential, they can assess in their reviews how a realistic improvement might look like.

Why do you estimate connect to be an optimal partner for these testing activities?

connect is one of the most accomplished experts when it comes to connectivity. This aspect is declaredly the main focus of the magazine – irrespective of the test object. We have been successfully working together for many years conducting mobile network tests, which are well known as the “umlaut connect mobile benchmarks“. Our partnership is based on transparency, fairness and impartiality. Our testing is performed due to clearly defined criteria. Evaluation and rating also follow a clearly defined framework. Together, we make sure that the user always remains in the focus.

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