

For most people, using their phone for long periods without worrying about recharging is a smartphone's most important feature – which is why we put a lot of time and effort into the endurance test.

ENDURANCE IN THE TESTLAB

Such a test is basically simple: The necessary measurements of battery capacity and current flow through a resistance can be easily carried out by a first-semester student of electrical engineering. And yet the endurance measurement in the test lab is the most elaborate measurement of all. While the consumption of a car can be determined by the refuelling amount after a certain travel distance, it is not easy to ascertain from the outside how much energy a smartphone uses during operation. As most smartphones have a fixed battery, the first thing is to

open the housing, in order to install a meter between battery and electronic circuitry. This step alone requires plenty of experience, because the housing can be glued, or locked with plastic tabs, or have hidden screws at random positions. With finely metered heat from hot air gun or heat packs, guitar picks and plastic or metal spatulas of various thickness, but also watchmakers' screwdrivers, our specialist Rolf Korobka gets under the skin of every device.

Once the smartphone is open, new challenges await him. The connectors of the battery are so



The endurance test site consists out of several high precision power supplies, PC controlable and readable system multimeters and Wideband Radio Communication Testers for GSM, UMTS and LTE.

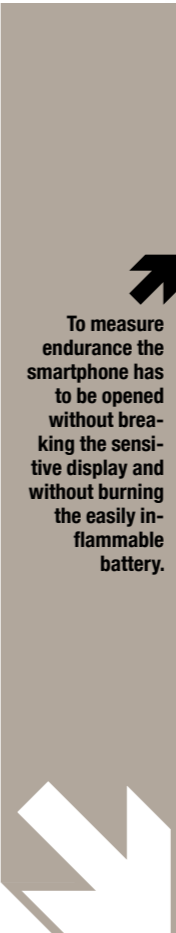
tiny that no measuring instrument can be connected. Korobka must therefore find alternative options, even by opening the battery itself. A short circuit could literally make the lithiumion power pack explode into flames. Once the measuring cables are installed, the smartphone must be mounted again, because the antennas needed for the measurement often sit in the housing cover. An opening is needed to lead the cables out, often the camera orifice is best placed to do so. Next, the smartphone is connected to a laboratory power supply via a high-precision

digital multimeter (DMM) that ensures the stable supply necessary for measuring. In many cases, so-called smart batteries communicate with the smartphone to confirm their authenticity and the smartphone will refuse to start without a confirmation. In such cases, the battery must be additionally connected so that he can communicate without disrupting the supply.

Next, the smartphone is booked into the test mobile network via the communication testers CMU 200 (GSM & LTE) and CMW 500 (LTE) of Rohde & Schwarz which function as base stations; then the program is executed. To do so, the DMM is connected to a PC that records the current consumption 1000 times per second. The test programme starts with telephone calls, where two performance classes, three frequency channels in each case with and without continuous speech transmission (DTX on/off), are measured on each GSM band. The 24 measurements take 15 seconds each. The test continues with UMTS and LTE. For 4G, we measure in three bands (1.8 GHz, 2.6 GHz, 800 MHz) at two performance levels each, in 5 MHz and where possible 20 MHz bandwidth, and for two types of modulation each (QPSK/16 QAM, 16 QAM/64 QAM) for upload and download.

This selection of performance levels parameters, bandwidth, modulation techniques, and others is based on studies by the Testlab to determine the influence of certain parameters on consumption. Typical sets of parameters were thus identified. In addition, the annual network test allows us evaluate how often smartphones are active with what type of connection. This allows us to predict what influence mobile connections have on endurance.

In addition to wireless communication, user behaviour largely determines consumption. Therefore consumption measurements for typical operating processes such as the swiping, typing, scroll-



To measure endurance the smartphone has to be opened without breaking the sensitive display and without burning the easily inflammable battery.



ling, and more are conducted. In 2008, connect first carried out a twomonth audit of the usage behaviour of over 400 mobile phone users in order to assess real, typical usage patterns that can be used as a basis for abstract consumption measurements.

Three other usage studies and a network test with parallel consumption measurement followed,

enabling a deeper understanding and adaptation to the recent developments. Ultimately, the test procedure must find a formula for typical smartphone usage, which evaluates all measurements performed in the individual disciplines in such a way that a typical endurance can be derived, which accurately reflects the average user. **BERND THEISS, HEAD OF TESTLAB**

SIMPLE THING

The test site to measure the endurance of a smartphone is relative simple. But the knowledge which operation states occurs how often in typical use is paramount to measure how long a smartphone will run on average on one battery charge.

