

# RF Characteristics of the QualiPoc Freerider III

Subject: Information and Communication Technologies

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External project partner: SwissQual AG, Zuchwil

QualiPoc Freerider III is a backpack-based mobile network benchmarking system that has been designed for indoor, urban, and rural use. It supports up to six smartphones, a radio frequency scanner, and three generations of cellular technology, that is, GSM, UMTS, and LTE.

This Master's thesis examines the internal and external antenna configurations for QualiPoc Freerider III as well as their impact on radio frequency characteristics and Quality Of Service (QoS) measurements.

SwissQual AG originally entered the mobile network benchmarking market with vehicle-based measurement systems that used external antennas. The cellular devices were kept in a shielded environment and were modified to allow for the connection of external antennas, which were placed on the roof of the vehicle. SwissQual still use this approach for benchmarking drive tests.

Advances in cellular technologies have resulted in increased mobile network capability and traffic in areas that are inaccessible by vehicle such as shopping malls, stadiums, event halls, airports, trains, pedestrian zones, or hiking trails. The portable nature of the QualiPoc Freerider III backpack is ideally suited to measure QoS in such environments.

QualiPoc Freerider III can use the internal antennas of unmodified smartphones as well as external antennas with modified smartphones. This Master thesis investigates the implications of these two types of antennas for the QualiPoc Freerider III system and QoS measurements. Of special interest is whether the internal antenna approach is a feasible solution for future designs.

The first part of this thesis investigates the RF-Characteristics of the QualiPoc Freerider III system. To determine the radiation and irradiation performance the Rohde and Schwarz Over-the-Air (OTA) measurement chamber in Memmingen, Germany was used. A series of reference measurements, including free space environment and environments with human hand and head models, were taken on a single, unmodified smartphone. Each smartphone position in the QualiPoc Freerider III system was measured with internal antennas and compared to the reference measurements and with each other. The same approach was used for external antennas.

The second part of the thesis involves a series of tests that were performed in the Swisscom mobile cellular network with internal and external antennas. The QualiPoc Freerider III backpack was used for these tests. The focus was placed on voice tests in GSM and UMTS technologies and data tests in UMTS and LTE technologies. These campaigns were performed in urban (Bern city), rural (between Bern and Biel), and indoor (main train station Bern) environments.

The results and findings of the Master thesis are confidential.



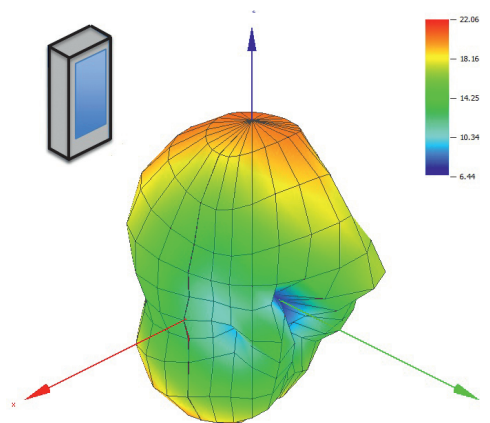
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S4 inside OTA-Chamber, reference Beside Head Hand Right (BHHR)



Radiation Pattern, Samsung Galaxy S4 - I9506, Beside Head Hand Right (BHHR), GSM900 (902.4 MHz)