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# ON THE FEASIBILITY OF LTE FOR HIGH SPEED MOBILE COMMUNICATIONS ON THE MOON.

**Abstract**

One of the important challenges for future Moon explorations is to provide reliable, long range, and low cost high capacity wireless mobile communication networks. Such networks are required for multiple applications e.g. for remote control of lunar vehicles, video links, data connectivity for remote experimental setups, and in the long term even for crewed missions. Nokia is working with PTScientists and Vodafone on the establishment of such a network on the lunar surface. The goal is to cover ranges of up to 5 km in the region of Taurus Litttrow valley, including the Apollo 17 landing site. The base station is mounted on a lunar lander, while the terminals are placed on several rovers. The link is supposed to provide both high reliability control information and HQ-video streams.

LTE (Long Term Evolution) was chosen as the wireless standard since it is a well understood and a readily available technology and is standardized in the 3GPP. The LTE standard also has several desirable advantages such as scalable bandwidth, high throughput, low latency, link reliability, quality of service, robustness against multi-path and allows for seamless mobility, so a variety of use scenarios can be accommodated. In addition, its relative low power consumption makes it suitable to be used in power constrained deployments. Having been broadly deployed on Earth, it is expected that, with the needed modifications for space operation, LTE performs substantially better, and at a reasonable cost, compared to other communication standards.

The moon itself is a challenging propagation environment for large propagation distances: low grazing angles make penetration through hills and ridges negligible despite low intrinsic loss of lunar soils. The main propagation mechanism is thus reflection from and diffraction over the lunar surface. Analytic solutions using digital terrain maps are used to produce coverage maps over lunar surface to determine operating frequency, antenna height, antenna gain, and transmit power needed to meet rate and range goals. Detailed digital terrain maps are used to extract terrain curvature between the source and receiver, allowing use of an analytic solution in terms of modes of propagation over a locally parabolic surface.

We are going to present a comprehensive wave propagation study and system performance analysis for the lunar LTE network including the required antenna solution, proving the feasibility of LTE as an appropriate communication standard for this and future missions.