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A STUDY OF WIFI ACCESS TO HIGH-SPEED RAIL BASED ON KA-BAND SATELLITE  
COMMUNICATION

**Abstract**

By the end of 2014, China's railway operating mileage reached 112,000 km, of which High-Speed Rail (HSR) with speed of more than 200km/h reached 16,000 kilometers. Most of the railway passes through the region of poor infrastructure and mountain tunnel. And rail travel is characteristic for a long time and big traffic, along with smart phones as the representative of the terminal development, the demand for Internet access during travel is very strong. The current railway passenger entertainment system is relatively backward, just short-time of the radio program mainly including train information. During the 2014 Spring Festival, one of the passengers use the wireless card with wireless hotspot service, providing dozen kbps wireless Internet access service with income 500 Yuan of which passengers are flocking to. China is currently being studied or small-scale test of two train-car entertainment systems: the train LAN system to provide visitor information, travel guides and other content, similar to the current civil aviation flight entertainment systems; another 3G/4G access through certain measures, to provide Internet services. The first way is non real-time, interactive and with high difficulty maintenance. It is basically one-way content distribution system and can not be called network access services. The second way, in the low-speed railway passenger can achieve simple Internet browsing needs, but it is need to set up along the railway station and ancillary facilities and the base station coverage is limited with low capacity. Especially for the HSR, the signal is seriously affected by the Doppler shift, attenuation caused by carriage and frequent handoff issues. This paper proposed a Internet access with WiFi supported by Ka-band communication satellite which typically is a GEO satellites with wide coverage area and small signal switching frequency; with high-capacity to meet the needs of a large number of passengers access Internet; with in-vehicle satellite receiver antenna to avoid signal attenuation through the carriage; with satellite reception equipment at the tunnel exit / entrance to keep the uninterrupted signal; with small Doppler shift because of small inclination between GEO satellite and train. This paper analyzed the current Internet access of the train, especially HSR network access problems and proposed using Ka-band satellite communications to provide WIFI access to the train scene. Then we analyzed the Doppler shift, the signal attenuation and handoff problems. The simulation results proved the performance of this architecture is better to 3G/4G network.