Quality of Service parameters for DVB-T reception: An experimental study

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Significant research has been reported on the performance of the Digital Video Broadcasting – Terrestrial (DVB-T) under different propagation conditions and over different propagation channels. However, very few measurement results are available to define and understand the Quality of Service (QoS) parameters such as; the signal spatial variation, height gain measurements and minimum field strength, MER, BER,C/N and the delay spead required for error free reception. Chester 97 report and other studies provide details of these parameters for different modulations. However, these are simulated results in the laboratories and are not compared with any experimental results.

To study the QoS parameters for DVB-T reception an experimental campaign was made. The main objective of this experimental campaign is to characterize the spatial variations of mobile DTV signals in Singapore. It has been reported earlier that analog propagation models assume lognormal signal spatial variation. The standard deviation parameter for this distribution varies from 9 to 15dB (ITUrecommendation

PN.370-5). Broadband signals have been measured in countries like UK, Sweden and France under the VALIDATE program and the shape of their statistical variation has been proven to lognormally

distributed. The standard deviation observed for such digital signals is smaller compared to analog and is 5.3 dB for mobile- urban and 6.7 dB mobile- suburban depending, to some extent, on the clutter factor or the environment surrounding the receiver location. However, the measurements are limited; the methods as well as the procedures for estimating the standard deviation of the measured signals have often not properly described. The classification of urban, suburban and open conditions by ITU-R varies from country to country. These classifications probably are not applicable to countries like Singapore and Hong Kong where the building heights are very high compared to ITU-R prescribed values. ITU-R prescribes a height of 30 meters for dense urban environment, however, in Singapore 75% of the population lives in high-rise housing units developed by the Housing Development Board (HDB). Buildings in the HDB estates are very high, typically 50-60 meters and are clustered together in large estates.

The target of the measurement campaign is to characterize the standard deviations of location variation for digital terrestrial TV reception. Experimental campaign is undertaken in 48 sectors to study the location variation of the DTV signals and the results are compared with the ITU-R values. Measurements carried out in 48 sectors confirm that the results are in close agreement with the ITU-R recommendations in some sectors. However, in majority of sectors the standard deviations are much smaller than the recommended value. A relationship between the height of the buildings and standard deviation of signal variation has been proposed. These results will be very useful for DTV predictions in built-up areas as the ITUR classification of urban, sub-urban conditions are different for different countries. Detailed study on the height-gain measurements and picture quality assessment is also made. BER, MER, C/N ratio and delay spread are recorded in different locations and the minimum field strength required for error free reception is studied for different modulations. The results are presented in detail in the paper. The results are quite useful to ITU-R and others for planning of future DTV systems.