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An improved signal penetration path loss model for GSM network

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GSM signals have the capability of penetrating through walls and other obstacles. These obstacles cause drop in the signal quality especially during communication and is known as penetration loss. To predict this loss, a simple model of a residential room was designed using AUTOCAD to analyze the attenuation suffered by radio signals going through buildings. The model involved the combination of three mechanisms of signal propagation; refraction, reflection and diffraction. The penetration through building wall was modeled as refraction using Fresnel Refraction Coefficient and the propagation through the roof was modeled using the principle of knife-edge diffraction. The total losses from the transmitter to the receiver were modeled as a combination of three different effects; losses due to free-space propagation from the transmitter to building; the penetration loss as a combination of the wall penetration loss and the diffraction loss. Measurements were also conducted in four different locations in Rivers State on buildings made with different material using MTN, Etisalat, Airtel and Globacom networks. The modeled results showed that the total losses in GSM transmission were 124.07dB of which the penetration loss was 37.95dB which accounts for 30.59% of the total losses. The free-space loss has a value of 86.12dB which accounts for 69.41% of the total losses and all corresponded with the measured results. The developed path loss model was also compared to the Log-Normal, Okumura, HATA and COST-231 models and the results showed that the values corresponded to the Okumura and the log normal path loss models. Hence, in all the models compared, it can be proved that the developed penetration path loss model can be used to predict signal attenuation in an urban environment.

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Development of printed antennas for the internet of everything

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Printed antennas are printed conductive pattern on flexible or rigid substrates/materials like polymer films, paper, cardboard, glass, ceramic and many more. Printed antennas are flexible shaped objects which can be integrated in almost all commercial wireless communication systems. Antenna types like dipoles, slot antennas, patch antennas, fractal antennas and three-dimensional antennas can be printed customized to the application e.g. WLAN, Bluetooth or RFID. The development of such antennas is based on several technologies like advanced radio frequency antenna design, short time antenna design validation by simulation, printing technologies, functionalization of printed silver or copper pattern and antenna characterization by measurements. Our experience and developed antenna solutions can be shown on the basis of specific applications for the internet of everything. Challenges like radio frequency interference effects due to the dielectric properties of different objects of the internet of everything and the cost-effective production of printed antennas have been overcome scientifically and will be shown.

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