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Exploring Potential RF Hot Spot Locations in Confined Spaces of Large Wave Guide Dimensions

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Abstract: *Radio-Frequency (RF) waves belong to the non-ionizing region of the electromagnetic spectrum and as such do not possess sufficient energy to ionize particles. They may however cause heating especially of human tissue which can therefore render them a potential hazard for workers and the public at large. International authorities have recognised the potential threat and have developed RF exposure guidelines to ensure some level of safety. These guidelines are developed for the electromagnetic spectrum but with a special interest in the Specific Absorption Rate (SAR) region (i.e., 30 to 1,000 MHz) where the strictest limits are set. In this part of the spectrum, a standing man can absorb most RF energy causing tissue within the body to resonate and generate heat. Therefore, while RF waves are used in modern technology in manufacturing, medical diagnosis and treatment, communications and navigation, there is some danger associated with its use that needs further investigation. The standards generally address RF propagating in free space and set limits for these but there also needs to be consideration for propagation in confined spaces where the waves store and build up their energies after reflecting off of inside surfaces and interfering with each other. The RF in the SAR region of the spectrum is of concern since most of our broadcasting towers operate between these frequencies and are within the public domain which contain confined spaces that may act as waveguides for these wavelengths. This paper focuses on quantifying location characteristics and intensities of RF propagating within empty rectangular structures likened to those of communication waveguide structures, through the proposal of a theoretical model for predicting the locations and intensities of RF hot zones containing RF hot spots. The significance of this work lies in being a tool for RF safety practitioners who can, without the use of cumbersome equipment and necessary skills for measuring RF, use a less expensive and user friendly method for determining the level of RF safety in a confined space by simply knowing its internal dimensions and material of the surfaces; and the RF source characteristics. The work can provide the IEEE standard body with useful information to include in its guidelines.*

Keywords: *RF hazard, SAR, confined space, reflection, waveguide*