OPTIMUM PULSE ENERGY IN AN ULTRAWIDEBAND COMMUNICATIONS SYSTEM SUBJECT TO PART 15 LIMITS

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The FCCs recent approval of UWB underlay communications systems subject to Part 15 radiation limitations poses a new point of view for transmitter design. Traditionally, transmitter power limitations are defined in terms of average power delivered to the input port of the antenna through which the system radiates. In contrast, Part 15 specifies the total power in the radiated field. Thus, the new situation requires one who wishes to optimize the power radiated by an UWB transmitter to take into account the frequency response of the transmit antenna as well as the pulse source. One would adjust the spectral distribution of the source to act in concert with the antenna to provide a flat radiated spectrum that fits snugly within the bounds of the Part 15 template.

We present a design approach for a UWB transmitter, taking into account the radiated field limit as the FCC defines it. Specifically, we employ a fast impulse generator to produce a quasi-Gaussian pulse in the transmitter. A transversal filter follows the pulse source, and the output of the filter is delivered to the transmitting antenna. The filter allows the coloration of the impulse source so that the *radiated* spectrum is nearly flat over the operating bandwidth. The powers are quite low in such a system, and there is no need to be unduly concerned about losses internal to the pulser and filter. Indeed, at least one attenuator is likely to be present to set the final output power in such a system.

We have implemented such a filter using microstrip fabrication. We have operated it with an off-the-shelf instrumentation pulser and delivered power to an electrically short monopole antenna, which is known to act as a differentiator. We obtain sensibly flat frequency response over a frequency range from 5.1 to 8.3 GHz. The Part 15 template specifies -41.3 dBm/MHz maximum EIRP over this band. Thus we are able to radiate .23 mW average power, while remaining within the template. The filter design employed limits the ratio of upper to lower frequency to a value of 1.63. This filter design consequently could yield a filter between 6.5 and 10.6 GHz. Such a filter would provide radiated power of .30 mW average power. We report the design and detailed results in this presentation.

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