

CLASSIFICATION AND EXAMPLES OF HIGH-POWER ELECTROMAGNETIC (HPEM) SYSTEMS

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ABSTRACT

Diverse activities of civilized societies such as civil defense, air traffic safety and control, police, ambulance, communication and internet commerce are becoming increasingly dependent on advancements in computer and electronic systems. While this dependence results in enhanced quality of service, it comes at the price of increased vulnerability to a wide variety of threats to the society's infrastructure. One of the ways of classifying potential intentional electromagnetic environments (IEME) is based on frequency of coverage of the threat environment. In this paper, we will outline this classification, which is also consistent with current and emerging technologies in HPEM generation.

One way of classifying the HPEM environments is based on the frequency content of their spectral densities as "narrowband", "moderate band", "ultra-moderate band" and "hyperband". To characterize these environments, we consider the *bandratio* of the EM spectrum as $br = (f_h / f_\ell)$. Using the inherent features of br in a manner consistent with the emerging EM field production technologies, the definitions for bandwidth classification presented in Table 1 has been proposed.

TABLE 1
IEME CLASSIFICATION BASED ON BANDWIDTH

Band type	Percent bandwidth $pbw = 200 \left(\frac{br - 1}{br + 1} \right) (\%)$	Bandratio br
Narrow	$< 1\%$	< 1.01
Moderate	$1\% \leq pbw \leq 100\%$	$1.01 \leq br \leq 3$
Ultra-moderate	$100\% < pbw < 163.64\%$	$3 < br < 10$
Hyperband	$163.64\% \leq pbw < 200\%$	$br \geq 10$

Note that this terminology is consistent with the formal IEC 61000-2-13 Standard, entitled "EMC, High-power electromagnetic (HPEM) environments -- radiated and conducted". We observe that the definition of upper and lower significant frequencies as the 3 dB frequency points are not always feasible. We address the issue of how to choose the upper and lower frequencies when the spectrum is uneven. We will provide examples of HPEM generators that employ current and emerging technologies, for each category of the four-band classification.