Feasibility of a System Using Cell Phone Signals to Locate Trapped Survivors after a Building Collapse

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In a collapsed building, a system to find cell phone signals elicited from a cell site simulator could be used to detect and help locate the cell phones of trapped people if the signal cannot reach a cell phone tower. I designed and built a radio test range to study the effects of building materials on radio propagation. The amateur radio 23-cm band (approximately 1300 MHz) was used to simulate typical cell phone signals. The 2m and 70-cm bands were also tested for comparison. Dielectric materials such as plywood had only small effects on signal strength. Four-inch thick concrete resulted in 4.9-dB attenuation (power reduction factor of 3.1). Conductors can reflect radio signals. A 4x8-foot aluminum reflector resulted in 21-dB attenuation. Rebar had a substantial effect on the longer wavelength signals at 2m and 70cm. However, the 23cm wavelength is sufficiently small that, even with 6-inch spacing, the signal was only reduced 3.4 dB. Cell phone signals can clearly penetrate many common building materials. I designed a dipole antenna, attached to the end of coaxial cable, that could be lowered between voids to better reach signals from under debris. Three enclosures were used. The thickest, a 2-inch diameter PVC pipe, was least affected by surrounding materials. The narrowest, a ½-inch CPVC pipe, could fit into smaller spaces but was easily detuned by adjacent conductors. Therefore, the largest antenna was more reliable but also more cumbersome than the smallest antenna. A cellphone locator system is feasible and can save lives.

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