

Presentation “**Terahertz Commercial Opportunities 2026-2046: An Industry View**”.

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Abstract

This presentation gives an industry view of terahertz opportunities emerging 2026-2046. Terahertz frequencies attract for many reasons. Fusion MW-level gyrotrons are more efficient and smaller above 0.1THz. 6G Communications can only meet most of its promises such as Tbps data rates and sub mS latency if it moves far beyond the 5G frequencies at launch 2030. Can we achieve 0.1-0.3THz for one kilometer in all-weather conditions? Can THz compete with optical wireless transmission for highest performance?

The military/ security/ non-destructive testing THz market is largest, notably body scanners at 0.1-0.3 THz. However, Medical is the biggest THz opportunity: research, pharmaceuticals, diagnostics, therapies, notably cancer. This involves sensors, imaging, spectrometry. Biomacromolecules have strong 3–6 THz absorbance. We can mediate cellular morphology or function by exciting nonlinear resonance effects in proteins, DNA etc. but this is little understood.

In general, it is not good enough to say, “THz is non-ionising so it is safe”. The effects of THz on the human body are complex, inadequately understood and some may be after a long delay. Work is needed. Industrialists worry that you use many toxigens and toxigen intermediaries such as PTFE and radicals and elements such as Pb, As, Hg, Cd, cyanide.

The THz Gap partly overcome with plasmonic graphene, quantum cascade lasers and several other options but there are very few low-loss dielectrics. Please provide more. In latest medically-related THz research, most popular are graphene, GaAs-based, aluminas, silicas, PTFE, silicon-based, polyethylenes then polypropylenes. The metamaterials will easily be mass-produced. Patterning in active material such as vanadium dioxide progresses the THz industry from components-in-a-box to structural electronics, reducing size, cost, inductive losses and failure modes. Industrialists approve of that.