

SU-ICEIT2019: Erbil, Kurdistan

At the age of AI

Design for Energy and Electromagnetic Friendly Buildings

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the message: to reduce building energy consumption while maintaining or improving the quality of the living environment.

Artificial Intelligence Shining in Architecture

“Computers are not good at open-ended creative solutions; that’s still reserved for humans. But through automation, we’re able to save time doing repetitive tasks, and we can reinvest that time in design,” **Mike Mendelson, Nvidia Deep Learning Institute**

Big Data, Machine Learning, and Design Tools

Parametric Architecture

Construction and Planning

Smart Cities

THz Wireless World

Buildings for the THz age (wavelengths of 1 millimeter down to 30 micrometers)

- THz radiation does have some attractive qualities: For example, it can yield high resolution images and transmits high amounts of data.
- However, it is **nonionizing**, meaning its photons are not energetic enough to knock electrons off atoms and molecules in biological tissue, which could trigger harmful chemical reactions and cause serious health effects.

- Next generations of 5G and 6G systems involving electromagnetic (EM) fields will require a paradigm shift in how buildings are structured and managed.
- Today, the performance of building design is not fully understood and the construction industries while engaging approaches and technologies for sustainable and energy efficient buildings, do not really consider EM system performance in their designs or specification as well occupant health.

Architectural rendering of the building complex



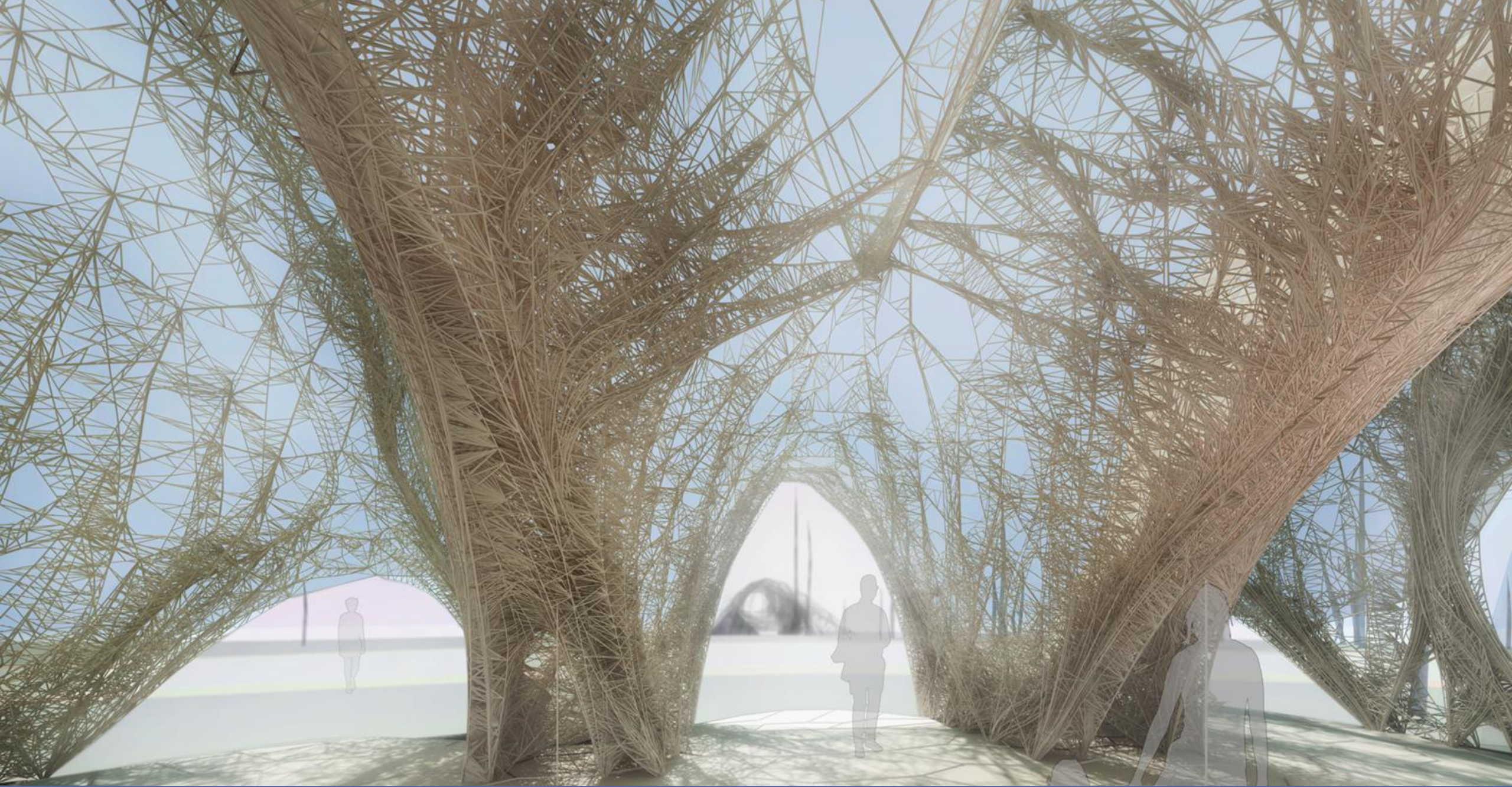
Future Building Materials

Building materials of the future are in development today. From graphene to stronger concrete to metamaterials that rethink the form and purpose of typical construction modes with the potential to change architecture.

Nanomaterials: Newly shaped material, scaling from thermal insulation, fire-proof and anti-graffiti to heat-absorbing and solar protection to EM blocking to antibacterial self-healing and self-cleaning, couple the structural properties of its medium to acquire several characteristics.

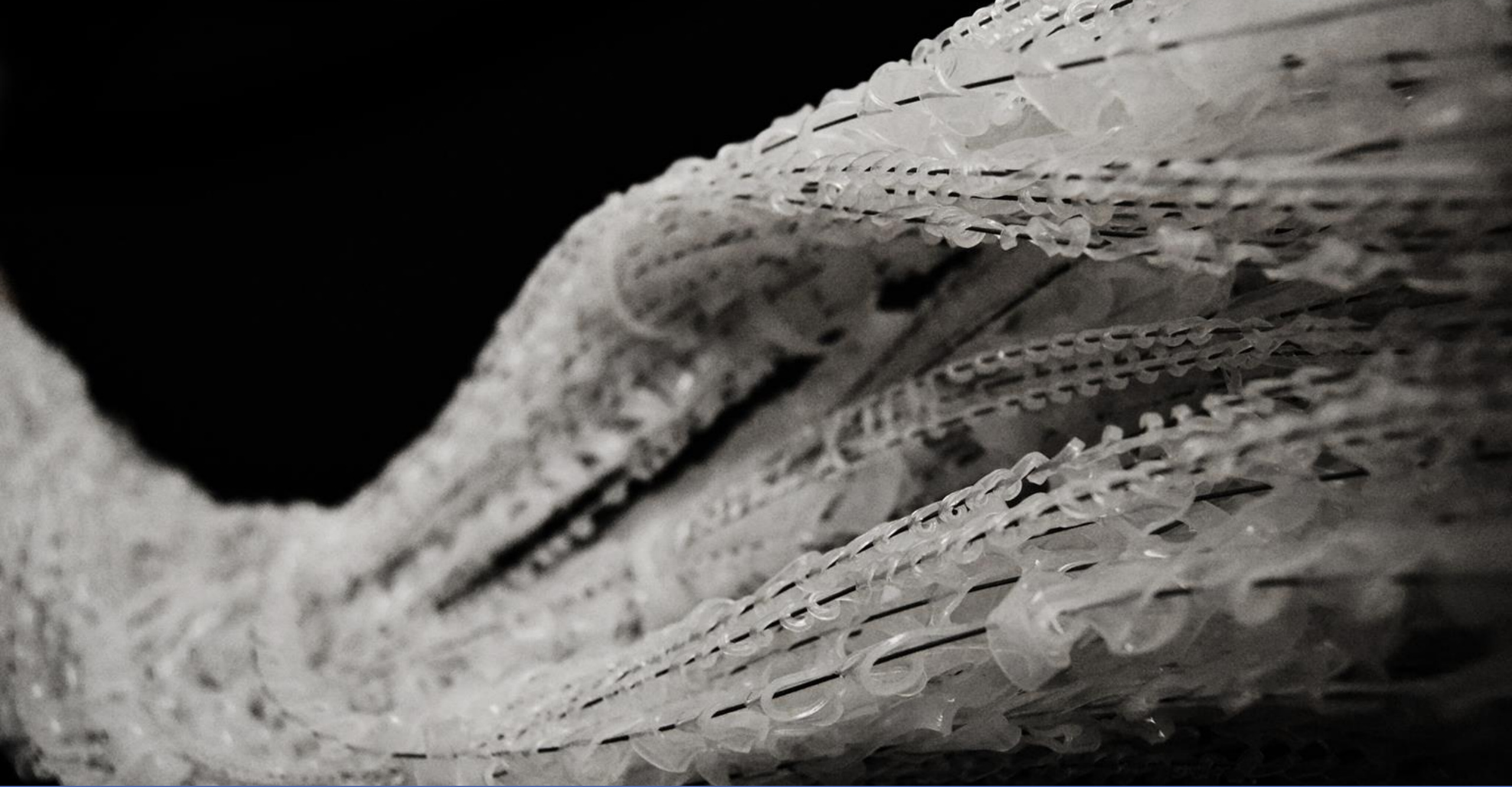
Metamaterials: EM, acoustic or seismic in nanoscale structure, engineered for manipulating waves by blocking, absorbing, or bending.



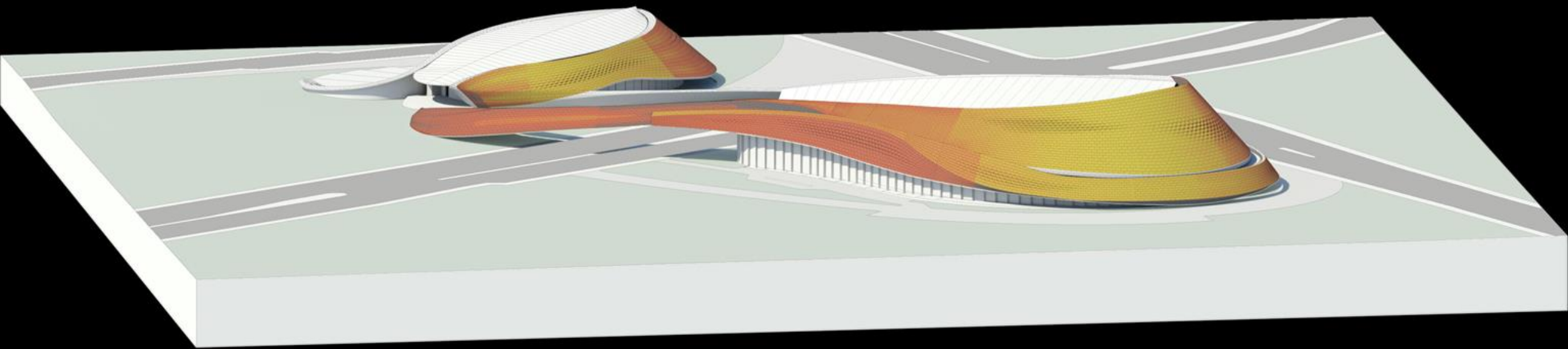


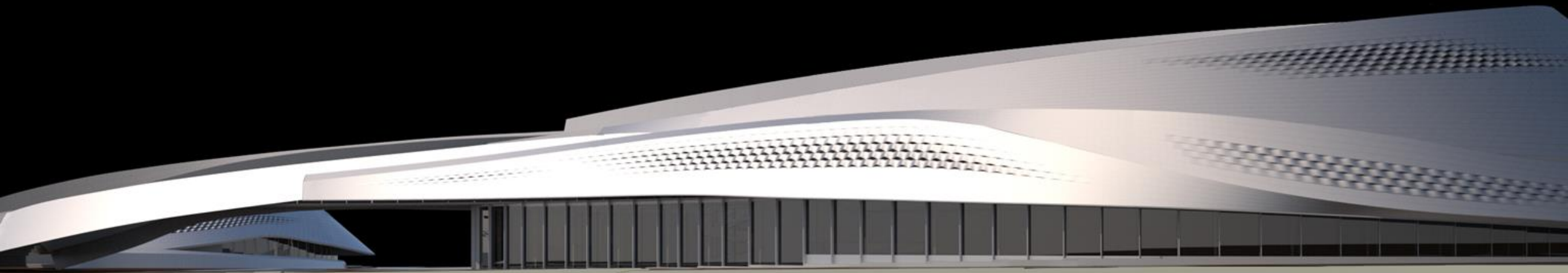


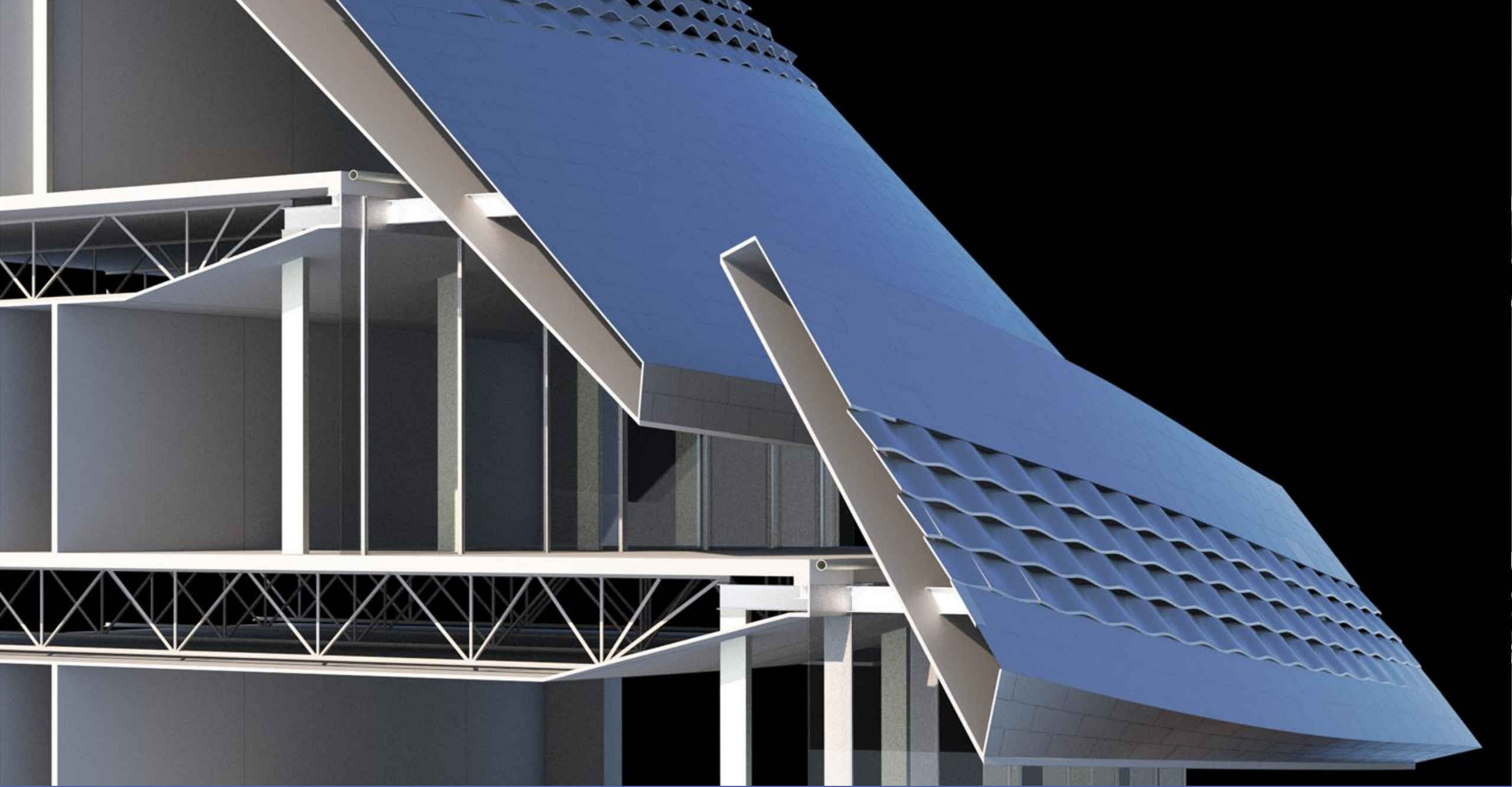




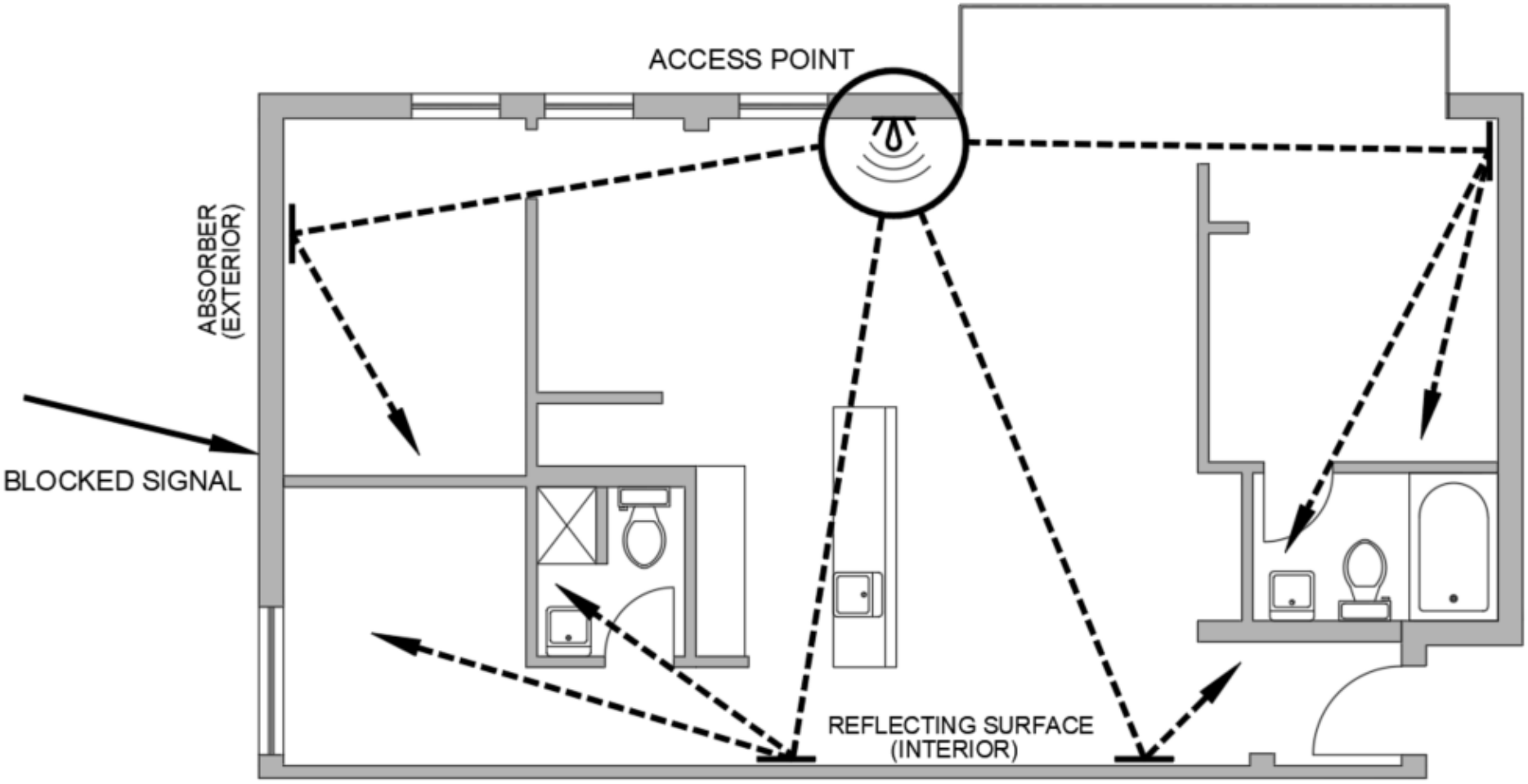








Wireless connectivity within and outside one unit of the building



Exposure limits for uncontrolled ELF environments according to three protection guidelines

Code	Frequency	Electric Field Strength (V/m)	Magnetic Field Strength μT¹
Safety Code 6	0.0903-1 MHz	280	2.73 μT
ICNIRP ²	50 and 60 Hz	5000 (50 Hz) 4200 (60 Hz)	100 μT (50 Hz) 83 μT (60 Hz)
IEEE ³ 2002	50 and 60 Hz	5000	904 μT

¹ 1 μT = 10 mG

² International Non-Ionizing Radiation Committee

³ Institute of Electrical and Electronic Engineers

Arial view of the proposed building complex divided into four zones for magnetic field measurements

