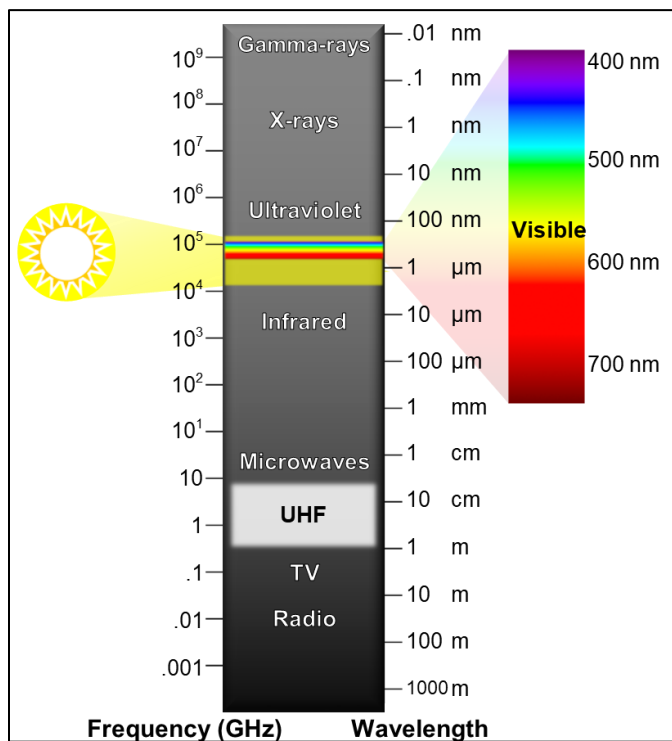


# Electromagnetic Shielding Effectiveness of Low-E Coatings

## Background

The electromagnetic spectrum is the entire distribution of electromagnetic radiation according to frequency or wavelength. The electromagnetic spectrum, from the lowest to the highest frequency, or longest to shortest wavelength, includes all radio waves (radio, television, microwaves, and radar), infrared radiation, visible light, ultraviolet, X-rays, and gamma rays.

Low emissivity (Low-E) window coatings are designed to control the transmission of ultraviolet, visible light, and infrared radiation.



Breakdown of electromagnetic spectrum

These coatings also interact with the ultra-high frequency band (UHF), which carries signals from cell phones, cordless phones, some broadcast television, GPS, Wi-Fi, Bluetooth, satellite radio, and public 2-way radio (police, fire, and ambulance).

## Low-E Coatings

Low-E coatings can attenuate or shield the transmission of wavelengths in the electromagnetic spectrum by reducing the signal intensity. This is usually expressed in units called decibels (dB). The higher the dB, the greater the signal attenuation of the electromagnetic energy.

Cardinal Low-E coatings are not intentionally designed to attenuate or transmit in the ultra-high frequency band (UHF).

Silver, found in Cardinal Low-E coatings, is very effective at attenuating electromagnetic energy. Typically, the more silver in a Low-E coating, the more UHF is shielded. Our coatings made with three layers of silver (LoE<sup>3</sup> 366 & LoE<sup>3</sup> 340), will attenuate the most, followed by our two silver layer products (LoE<sup>2</sup> 270 & LoE<sup>2</sup> 272), then our single silver layer product (LoE 180).

IGU Makeup	Signal Attenuation (dB)
LoE 180 / Clear	31.4
LoE <sup>3</sup> 366 / Clear	41.9
LoE <sup>3</sup> 340 / Clear	42.5
LoE <sup>3</sup> 366 / i89	55.0
LoE <sup>3</sup> 366/ Clear / LoE 180	55.8

Tested at 1.1-1.6 GHz

## Building Design

It is difficult to estimate what the overall attenuation of a building will be when using Low-E coatings in windows. The design of the building, materials used, and strength of the electromagnetic signals themselves (how close the building is to the transmitter), will all effect the attenuation.

Sometimes the attenuation of Low-E coatings in windows is unnoticed due to signals entering the building through walls, the roof, window frames, doors, etc. Most building materials such as brick, wood, concrete, non-foil insulation, etc. will all allow passage of electromagnetic waves with minimal attenuation. Aluminum, steel, or any building material with a metallic film will have higher attenuation.

### Summary

Low-E coatings have been around for decades and are used throughout the United States by millions of homeowners as a way to save money on heating and cooling costs.

Using multiple Low-E coatings in an IGU or coatings designed to offer maximum solar control (three layers of silver) will attenuate the most, but will still transmit some signal.

If there is a desire to maximize attenuation or transmission of UHF for your building please speak with a qualified engineer.

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