

## WHAT IS EME? (Part 1)

Dr Karl:

G'day, Dr. Karl here. Welcome to our little series of three videos on wireless communications and how they are actually really safe. There's a lot of misconceptions, but to counteract that, there's a lot of facts.

So in this episode, let's dive into the facts.

Wireless technology covers everything from radio and TV to the satellites that tell you where you are via GPS, to mobile phones, to precision agriculture, and much more. We have been constantly bathed in EME—that's electromagnetic emissions—since we evolved from the primates in Africa some 7 million years ago. That's right. There is more EME than just what we humans generate. There is also EME from the sun, black holes, pulsars, cosmic rays, and in fact, from the Big Bang.

If you tune your TV slightly away from a free-to-air TV channel, you'll see static on your screen. About 1% of that static is EME left over from the Big Bang. It's been bouncing across the entire universe for the last 13.88 billion years. We humans sent and received our very first radio communications only recently, around 1900. So our human contribution to EMC is much more recent than the universe's contribution.

To understand the safety aspect of electromagnetic emissions, we need to look at the entire electromagnetic spectrum. That spectrum is huge, but our sun broadcasts practically all of its power concentrated into a narrow band, roughly in the middle of the electromagnetic spectrum. On one side of that narrow band is radiation that definitely causes cancer, known for over a century, and on the other side is radiation that does not cause cancer.

Down here on the ground, at the bottom of our atmosphere, the sun delivers about one kilowatt of power per square metre when it's directly overhead. That's 1000 watts per square metre. About half of that is infrared light, which does not cause cancer. A bit less than half is visible light, which also does not cause cancer. A tiny amount, about 30 to 50 watts, is ultraviolet, and that does cause skin cancer. But violet light does not. The electromagnetic radiation in violet light does not have enough energy, no matter how bright it is, to knock electrons off atoms. So it's non-ionising radiation, which means it's safe and does not cause cancer. Ultraviolet light, with just a slightly higher frequency, does have enough energy to knock off electrons, so it's unsafe. Ultraviolet causes cancer. So, fellow Australians, wear hats, sunblock, and long sleeves.

Let's look at the electromagnetic spectrum again. Going down in frequency from violet to red and infrared, and then to microwaves, mobile phones, Wi-Fi, Bluetooth, and radio waves, the frequency gets lower, and the energy carried gets lower. This is non-ionising radiation, which has not been proven to cause cancer. But if you go up in frequency from violet, to ultraviolet, and then to X-rays and gamma rays, each of these radiations has been proven to cause cancer.

But here's something interesting: Even though X-rays are known to cause cancer, about 10 million X-rays are done every day worldwide. Why? It's the risk-benefit ratio. The benefit of getting a low-dose X-ray and then a diagnosis far outweighs the tiny, tiny risk of getting a cancer.

Well, we've covered a lot of ground. So now that we've got some solid knowledge, let's dive into part two and look at some of the myths.

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