

Emirate of Dubai Guideline on Electromagnetic Fields (EMF)



1 Introduction

In line with the Dubai Government's commitment centred on enhancing people's happiness and quality of life and reinforcing Dubai as a global destination for citizens, residents and visitors, this document provides necessary awareness and information about the best practices on electric and electromagnetic fields exposure.

Electric Fields (EF) and Electromagnetic fields (EMF) radiations occur naturally, but they can also be produced by human activities, most notably the use of electrical and communication devices.

EMF radiations are usually studied and classified based on the radiation frequency. In accordance with the International Commission on Non-Ionizing Radiation Protection (ICNIRP), non-ionizing electromagnetic radiation is generally considered to be between 3 kHz and 300 GHz.

This type of radiation do not have enough energy to ionize atoms or molecules, and includes radio frequency (RF) radiation, such as that emitted by power lines, cellular phones and other wireless devices, as well as ultraviolet (UV) radiation, visible light, and infrared radiation.

The electromagnetic spectrum and radiation frequencies, as explained above are presented in Figure 1. However, Power lines typically operate at frequencies in the very low frequency (VLF) range (usually 50 Hz or 60 Hz depending on the country or region of the world). While on the other hand, telecommunication towers transmit and receive signals that have frequencies up to 300 GHz.

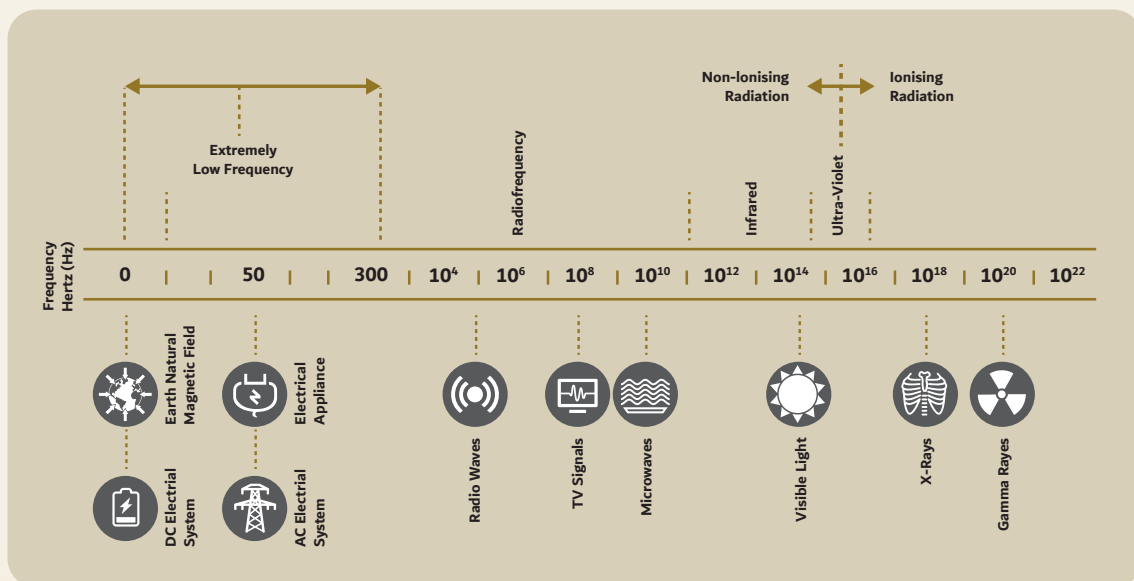


Figure 1: The electromagnetic spectrum (Source: ESB, 2017)

2 Objectives

The Guideline on EMF aims to:

- ◆ Provide awareness and information about the best practices on electric and electromagnetic fields (EF and EMF) exposure that are emitted by:
- ◆ High voltage overhead power transmission lines.
- ◆ Communication towers.
- ◆ Provide precautionary measures in consideration of these two specific sources.

3 Electric and electromagnetic fields (EF & EMF)

EF is created by the presence of an electric charge, whereas EMF is produced by the movement of electric charges. Both can be produced by any source of electricity, including power lines, telecommunications towers, mobile phones, appliances, and home wiring, which are all potential man-made sources of non-ionizing electromagnetic radiation.

There is no scientific evidence found to show that EF produce any physical effects on the human body, or pose any known health risks. On the other hand, there is ongoing debate and research about the potential health effects of non-ionizing electromagnetic fields, nevertheless, studies have not provided enough evidence to support such connection.

Furthermore, electric fields and magnetic fields rapidly decrease in intensity as distance from an electrical source increases. This is known as the inverse square law, which states that the intensity of a field (such as an electric or magnetic field) is inversely proportional to the square of the distance from the source of the field. This means that if you double the distance from the source of the field, the intensity of the field will be four times weaker. If you triple the distance, the intensity of the field will be nine times weaker, and so on.

The strength of an electric field is typically measured in units of kilovolts per meter (kV/m), and the strength of a magnetic field is typically measured in units of microtesla (μT). Both electric and magnetic fields can be generated by a variety of sources, including power lines, electrical appliances, and wireless communication devices. The intensity of these fields can vary significantly depending on the distance from the source and the strength of the field.

4 Guidelines on EF and EMF exposure

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an independent scientific organization that provides guidelines and recommendations for safe levels of exposure to RF radiation for the general public and for workers.

ICNIRP recommendations are based on the frequency of the radiation and the duration of exposure which are set considering scientific evidence (the organization only looks at studies that are well-done and have been reviewed by other experts in the field) and safe levels of exposure (based on the available evidence, the ICNIRP determines the levels of exposure that are likely to be safe for human health; these are called reference levels).

Other organizations that provide information and recommendations on the use of non-ionizing electromagnetic fields include the World Health Organization (WHO). However, for the purpose of this guideline, the recommendations of the ICNIRP are adopted.

5 EMF from Power Transmission Lines

High voltage overhead power transmission lines are a vital part of the modern electrical infrastructure of Dubai. High voltage overhead power transmission lines are used to transmit electricity from generation plants to load centers throughout the emirate as well as to connect with other emirates.

5.1. Design considerations

These lines and their components are designed, tested, and maintained in line with the best international standards and world-class practices to ensure the safe and reliable transmission of electricity in the Emirate, including the recommendations in relation to non-ionized EMF radiations.

The power transmission voltages adopted in the Emirate of Dubai grid are the 132kV and the 400kV at the frequency of 50Hz.

5.2. Effect from EMF produced by high voltage overhead power transmission lines

There are many studies that are conducted to see if there are any health effects of EMF exposure from high voltage power lines.

A review of these studies published in the American Journal of Epidemiology in 2010, concluded that the evidence did not support the idea that EMF exposure from power lines was harmful to human health.

Similarly, studies on the health impacts of long-term exposure to extremely low-frequency EMF and its link to the development of malignancy is not supported by scientific evidence (Government of Canada, 2020).

Additionally, It is important to note that the levels of electricity and EMFs produced by high-voltage power transmission lines are typically much lower than the levels produced by other sources, such as household appliances and electronic devices. In addition, the levels of electric and EMFs produced by power transmission lines decrease rapidly with distance from the line, so people who live or work near these lines are generally exposed to relatively low levels of these fields.

5.3. Recommendations on the EMF exposure from high voltage overhead power transmission lines in the emirate of Dubai

According to ICNIRP's guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz - 100 kHz) Table 1, the recommended maximum exposure levels for 50Hz high voltage overhead power transmission lines are as follows:

- ♦ Electric fields: The recommended maximum exposure level for electric fields is 5 kV/m.
- ♦ Magnetic fields: The recommended maximum exposure level for magnetic fields is 200 μ T.

It is important to note that these recommended maximum exposure levels are based on the principle of precaution.

The maximum measured values at the edge of the lines corridors in Dubai for both 400kV and 132kV transmission voltages were found to be far less than the limits recommended.

Table 1: Reference levels for general public exposure to time varying electric and magnetic fields (1 Hz to 100 kHz (ICNIRP, 2010))

Frequency range	E-field strength E (kV m1)	Magnetic field strength H (A m1)	Magnetic flux density B (T)
1 Hz-8 Hz	5	$3.2 \times 10^4 / f^2$	$4 \times 10^{-2} / f^2$
8 Hz-25 Hz	5	$4 \times 10^3 / f$	$5 \times 10^{-3} / f$
25 Hz-50 Hz	5	1.6×10^2	2×10^{-4}
50 Hz-400 Hz	$2.5 \times 10^2 / f$	1.6×10^2	2×10^{-4}
400 Hz-3 kHz	$2.5 \times 10^2 / f$	$6.4 \times 10^4 / f$	$8 \times 10^{-2} / f$
3 kHz-10 MHz	8.3×10^{-2}	21	2.7×10^{-5}

Notes:

- ♦ f in Hz.
- ♦ See separate sections below for advice on non sinusoidal and multiple frequency exposure.
- ♦ In the frequency range above 100 kHz, RF specific reference levels need to be considered additionally.

6 EMF from Telecommunications Structures

Energy from the radio frequency (RF) of typical telecommunication network and apparatus can be absorbed by the body and may lead to heating of body tissue. Risk of developing RF shocks or burns may also arise from physical contact with large, non-grounded conductor that is exposed to EMFs. The levels of RF absorption are dependent on transmission frequency and field strength, the latter being dependent on distance from the source (UK HSE, 2001). WHO (2016) reports that the levels of transmission from a base station or telecommunication tower vary depending on the numbers of calls and callers' distance from the tower. Normally, any EMF limits or guidelines will be exceeded only if a person is within a meter or two directly in front of the antennas.

ICNIRP has established safety levels of EMFs at frequencies of 100 kHz to 300 GHz for both general public and occupational exposures (Table 2). Cellular bands are typically within this frequency range.

Table 2: Reference levels for local exposure, averaged over 6 min, to electromagnetic fields from 100 kHz to 300 GHz (ICNIRP, 2020)

Exposure	Frequency Range	Incident Electric Field Strength, V/m	Incident H-Field Strength, A/m	Incident Power Density, W/m ²
General Public	0.1 – 30 MHz	671/fM ^{0.7}	4.9/fM	NA
	>30 – 400 MHz	62	0.163	10
	>400 – 2000 MHz	4.72fM ^{0.43}	0.0123fM ^{0.43}	0.058fM ^{0.86}
	>2 – 6 GHz	NA	NA	40
	>6 – 300 GHz	NA	NA	55/fG ^{0.177}
	300 GHz	NA	NA	20
Occupational	0.1 – 30 MHz	1504/fM ^{0.7}	10.8/fM	NA
	>30 – 400 MHz	139	0.36	50
	>400 – 2000 MHz	10.58fM ^{0.43}	0.0274fM ^{0.43}	0.29fM ^{0.86}
	>2 – 6 GHz	NA	NA	200
	>6 – <300 GHz	NA	NA	275/fG ^{0.177}
	300 GHz	NA	NA	100

Notes:

- "NA" signifies "not applicable" and does not need to be taken into account when determining compliance
- f_M is frequency in MHz; f_G is frequency in GHz
- Refer to ICNIRP Guidelines (2020) for additional reference levels for other exposure scenarios

7 Best Practices

The Emirate of Dubai already adopts measures that consider public safety, such as:

- ◆ Allocating right of way for services including power transmission lines with clearance distances to any nearby buildings that ensure safe exposure limits in accordance with ICNIRP recommendations and related worldwide best practices in this field.
- ◆ Compliance with international standards in design, construction, operation, and maintenance of this critical asset.
- ◆ Regular monitoring and evaluating EMF levels.
- ◆ Providing information and awareness to the public.
- ◆ Setting up safety signboards in appropriate and visible locations for the awareness of the public and prevent unauthorized entry (where applicable).
- ◆ Install barriers around EMF sources to prevent unauthorized access to areas where exposure limits may be exceeded.
- ◆ Set up warning or safety signs in conspicuous areas to avoid unauthorized access to areas with strong EMF sources.

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