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6G Technologies; Radio Waves and Health

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- ✓ Public Health England (PHE) is the expert national public health agency with a mission to:

Protect and improve the nation's health and reduce health inequalities

- ✓ PHE has operational autonomy. It has an Advisory Board with a non-executive Chairman and non-executive members
- ✓ The Centre for Radiation, Chemical and Environmental Hazards (CRCE) is the focus of PHE's expertise on ionising and non-ionising radiations


1970
National Radiological Protection Board
nrpb


2013
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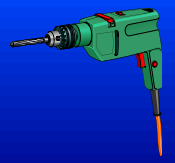
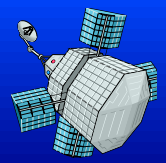
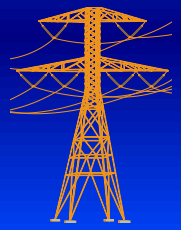
2003
Centre for Radiation, Chemical and Environmental Hazards


UK Health Security Agency
2021
UK Health Security Agency

The Electromagnetic Spectrum

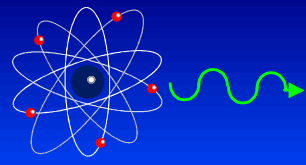








Slow time-varying fields

ELF VF VLF LF

RF fields

Radio waves Microwaves

Optical radiation

(Infra Red) (Ultra Violet)

X-ray → Gamma Rays

Non Ionising Radiation | Ionising

100 000 km | 100 km | 100 m | 10 cm | 0.1 mm

750 nm | 400 nm

Wavelength

3 Hz | 3 kHz 3 x10^3 Hz | 3 MHz 3 x 10^6 Hz | 3 GHz 3 x 10^9 Hz | 3 THz 3 x 10^{12} Hz

Frequency

Energy of RF fields is too small to cause ionisation in matter

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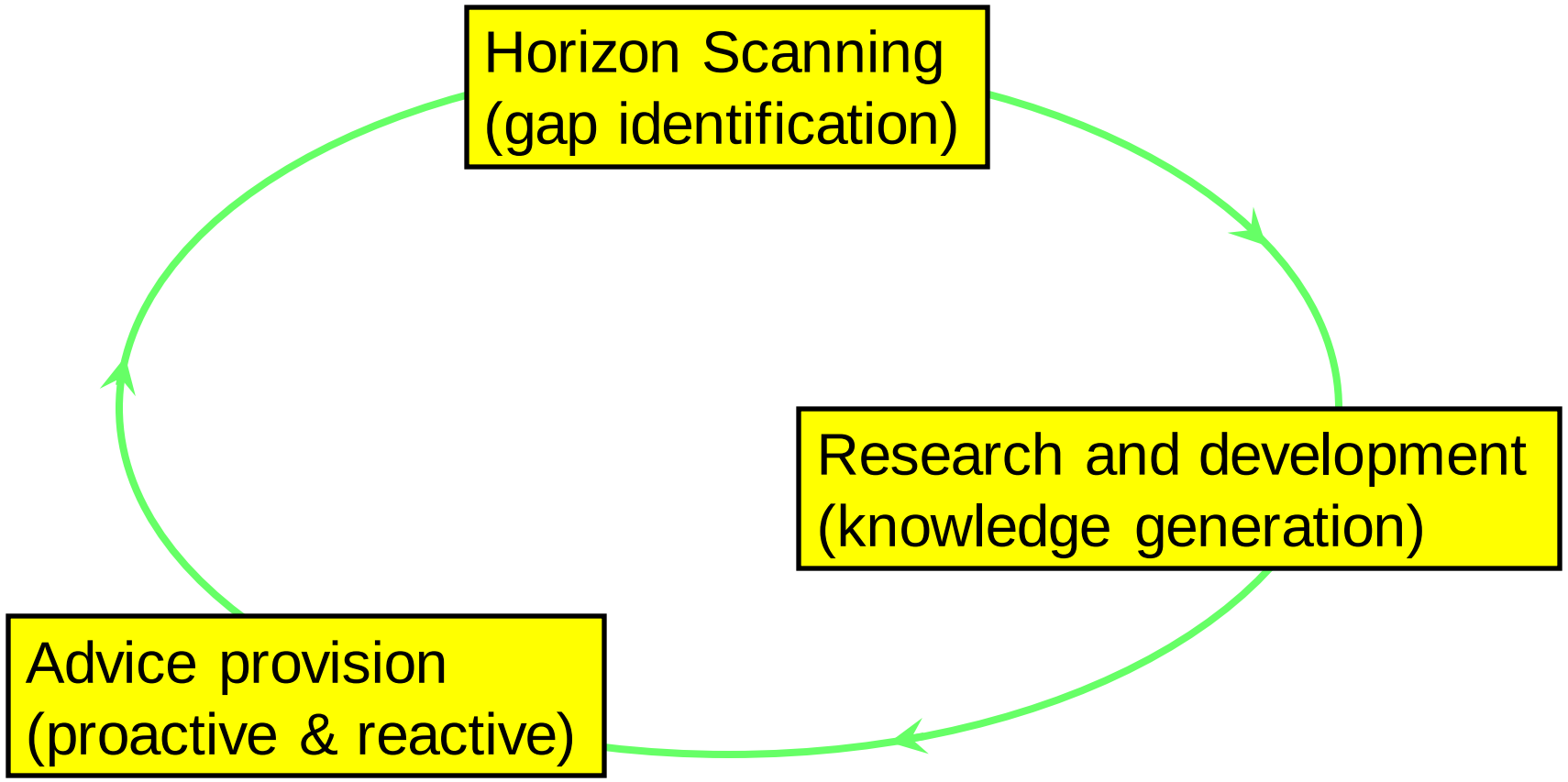
Non-ionising Radiation



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Development and Provision of Advice

- Proactive work
  - Lead and support scientific reviews
  - Develop advice on exposure guidelines
  - Develop advice on specific sources/situations
  - Contribute to the development of technical standards
  - Support government in the implementation of regulations

- Reactive work
  - Respond to enquiries and requests for information

Work nationally and internationally on the above

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Health-related Studies

- The public health implications of exposure to radio waves is a topic on which a large number of studies have been published over several decades and on which a range of opinions can be found

- Results of these studies are published in scientific journals and form the basis of health-related advice from independent expert groups

- Types of studies
  - ✓Human experimental studies (short term/reversible effects)
  - ✓Human observational (workplace, environment, device use)
  - ✓Animal studies (whole life assays)

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The Work of Expert Groups

- The views of expert groups are better than those of individuals
  - ✓ Multidisciplinary perspective
  - ✓ Consistent approach to gathering and evaluating studies
  - ✓ Challenge and review within the group to forge consensus
- Critical factors to consider when evaluating the science
  - ✓ Study quality – *not all studies are well designed*
  - ✓ Relevance – *some studies are more relevant to human health*
  - ✓ Consistency – *evaluated across groups of studies*
- Counting studies is not an adequate way of assessing where the overall balance of evidence lies
- Difficult to identify the contribution of individual or small groups of studies in isolation from the rest of the accumulated evidence

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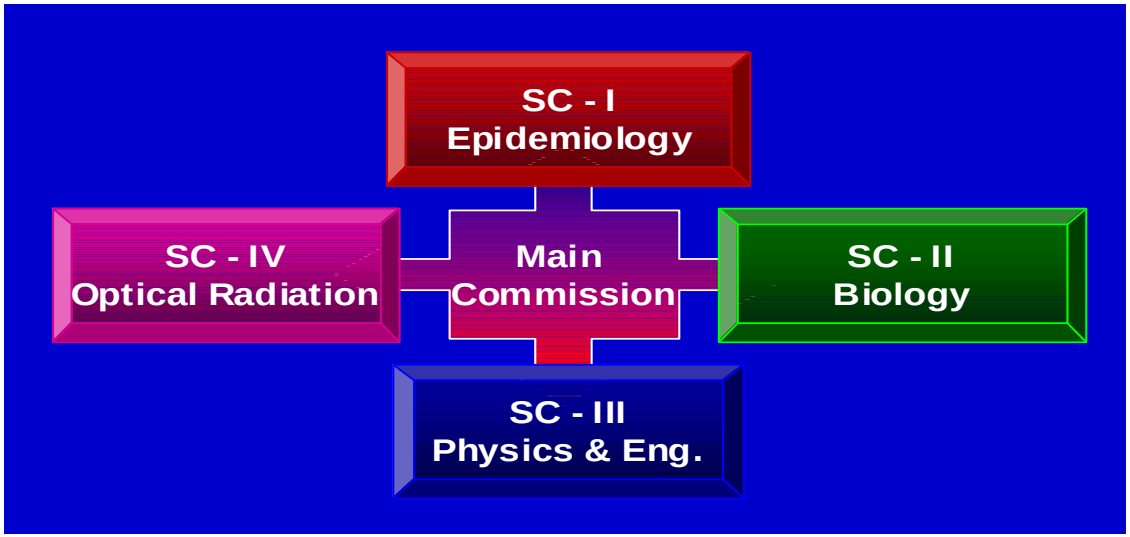
International Guidelines

ICNIRP
INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION



- ICNIRP is an independent international scientific organisation
- Officially recognised by WHO
- Members are invited (none from industry)
- Publishes guidelines and statements
- UK adopted ICNIRP guidelines in 2004 and maintained since

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Basis of ICNIRP Guidelines

- ICNIRP's guidelines are based on known, or established, adverse health effects. Such effects:
  - ✓ have to be replicable,
  - ✓ the studies revealing the effects have to be of sufficient quality,
  - ✓ the effects found have to be explicable generally, based on scientific knowledge

- National health authorities have considered whether further precautions should be taken based on evidence that is too weak to meet the above criteria
  - ✓ These generally differ from country to country – see WHO's Global Health Observatory (https://www.who.int/peh-emf/standards/en/)

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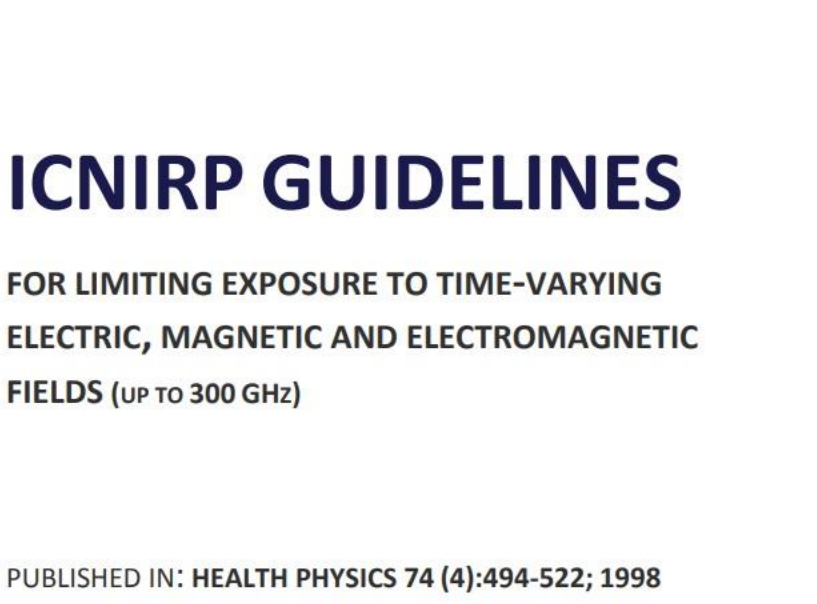
Guidelines up to 300GHz

INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION

- Limits are based on the avoidance of excessive localised and whole-body heating



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Guidelines for > 300GHz

- The guideline is developed for exposure to infrared sources
- limits are not defined from 3 µm to 1 mm (no source developed at this region so far)
- Aversion response limits the duration of exposure
- Injury thresholds to radiant exposure are defined for skin and eyes (dose related)
- Limits are set for products emission (they are source dependent)

INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION

ICNIRP STATEMENT

ON FAR INFRARED RADIATION EXPOSURE

PUBLISHED IN: **HEALTH PHYSICS 91(6):630-645; 2006**

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New ICNIRP Guidelines?

- Unofficial correspondence with ICNIRP suggests that there is a will to review the current guideline >300 GHz for radiation (telecommunication) sources
- Possible time line within the next 3-4 years

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Current Advice on RF

GOV.UK

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Home > Radiation

Collection
Electromagnetic fields

Advice on exposure to electromagnetic fields in the everyday environment, including electrical appliances in the home and mobile phones.

Published 9 July 2013
Last updated 3 October 2019 — see all updates
From: Public Health England

Contents
- Static fields
- Low frequency electric and magnetic fields
- Radio waves

These documents cover:

Related content

Radiofrequency electromagnetic fields: health effects

Mobile phone base stations: radio waves and health

Wireless networks (wi-fi): radio waves and health

Radio waves

Sources of radio waves in homes and offices include mobile phones, wi-fi, smart meters. Other sources of radio waves include TV and radio transmissions, radar and satellite communications, which use radio waves to operate.

Radio waves belong to the category of non-ionising radiation (NIR). This is the term given to the part of the electromagnetic spectrum where there's insufficient quantum energy to cause ionisations in living matter.

5G technologies: radio waves and health
3 October 2019 Guidance

Radiofrequency electromagnetic fields: health effects
1 April 2012 Research and analysis

Mobile phone base stations: radio waves and health
16 May 2019 Guidance

Wireless networks (wi-fi): radio waves and health
1 November 2013 Guidance

Smart meters: radio waves and health
28 June 2017 Guidance

Radio waves: reducing exposure
1 December 2013 Guidance

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5G and Health Webpage

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Guidance

5G technologies: radio waves and health

Information on exposure to radio signals from 5G technologies.

Published 3 October 2019
From: Public Health England

Documents

HTML

5G technologies: radio waves and health

Ref: PHE publication gateway reference: GW-739
HTML

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Guidance

5G technologies: radio waves and health

Published 3 October 2019

Contents

Public exposure
5G frequencies
Research studies
Summary

Mobile telecommunications technology has developed through several generations and there are now many 2G, 3G and 4G base stations installed throughout the environment providing services to users of mobile phones and other devices.

Public exposure

Over the decades, since the networks were first introduced, there has been a general trend towards increasing numbers of smaller transmitters that individually provide services to smaller geographical areas and have reducing radiated powers.

Against this background, many measurements have been made and these continue to show that exposures of the general public to radio waves are well within the international health-related guideline levels that are used in the UK. These guidelines are from the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and underpin health protection policies at UK and European levels.

In relation to the implementation of 5G devices and networks, this technology is at an

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Assessments of the Evidence

- Main advice from PHE is that ICNIRP guidelines should be adopted, and that there is no convincing evidence that exposures below these guidelines result in adverse health effects for the general population
  - ✓ This conclusion was reached in the 2012 (UK) report from the independent Advisory Group on Non-ionising Radiation (AGNIR)
  - ✓ Evidence reviews by other national and international expert groups since 2012 have reached conclusions broadly in line with those of AGNIR
  - ✓ A report from the EU Commission's Scientific Committee on Emerging and Newly Identified Health Risks was published in 2015
- Precautionary advice on use of mobile phones
- Should there be another review now?
  - ✓ The World Health Organization (WHO) is presently developing a major systematic review of the evidence on this topic since 1992

https://www.who.int/peh-emf/research/rf_ehc_page/en/

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Monitoring The Evidence

- PHE keeps up-to-date with the latest evidence in a number of ways, including:

  - ✓having its own specialist staff that carry out in-house and collaborative research.
  - ✓contributing to and learning from the work of other organisations that are active in reviewing the evidence and developing health-related guidance on this topic, including WHO and ICNIRP
  - ✓PHE has a formal collaborating role in WHO's international EMF Project

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Thank You!