GSMA

International Harmonisation of RF-EMF Policy

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GSMA

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Summary

The World Health Organization (WHO) is completing a health risk assessment for radiofrequency electromagnetic field (RF-EMF) exposure. Countries can use this as an opportunity to move towards international RF-EMF policy harmonisation.

The comprehensive RF-EMF exposure limit guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in 1998 and the updated version from 2020 are the basis for policy in most countries.

The consensus among independent scientific experts is that the ICNIRP limits provide protection for all people against all established health hazards from short- or long-term RF-EMF exposures.

Mobile technologies, including 5G, and the emerging 6G, are designed for compliance with the international RF-EMF limits. Therefore, services can be more efficiently delivered where countries adopt those limits. In countries with restrictive RF-EMF policies mobile network operators may have to use lower transmitter powers resulting in poor in-building service, gaps in coverage, and consequently more sites.

Many countries have adopted RF-EMF assessment methods from the International Electrotechnical Commission (IEC) or the related International Telecommunication Union (ITU) recommendations.

Modern mobile network base stations often support more than one mobile technology and multiple frequency bands. Historical approaches based on theoretical maximum site parameters lead to overestimation of RF-EMF levels. Countries should be using the actual maximum approach described in IEC and ITU technical standards. This approach is especially important to the accurate assessment of advanced antennas with beamforming capabilities.

While many in the community recognise the personal benefits of mobile services, some people may have concerns and national authorities should lead on providing trusted information based on credible sources, for example, the WHO and ICNIRP.

GSMA encourages countries to ensure that national RF-EMF policy includes:

- adoption of the ICNIRP (2020) international RF-EMF exposure limits
- regulatory frameworks for RF-EMF compliance based on the actual transmissions of base stations and using the IEC and ITU assessment methods
- effective public communication using information from credible sources, such as the WHO and ICNIRP



International RF-EMF policy harmonisation

The World Health Organization (WHO)[1] Task Group on Radiofrequency Fields and Health Risks is completing a health risk assessment that will be published as a monograph in the Environmental Health Criteria (EHC) series. The work of the WHO Task Group is expected to be completed in 2026 with subsequent publication of the EHC. Countries can use this opportunity to harmonise with international radio-frequency electromagnetic field (RF-EMF) policy good practice.

A national RF-EMF policy is needed to avoid the potential for fragmentation among policies at sub-national levels. National RF-EMF policy should incorporate three key elements: international exposure limits; modern compliance assessment methods; and effective public communication.

1 https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/non-ionizing/emf/radiofrequency-fields

International RF-EMF exposure limits

The comprehensive international RF-EMF exposure limit guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in 1998 and its updated version from 2020 are the basis for policy[2] in most countries [1, 2]. RF-EMF limits for mobile networks based on the ICNIRP guidelines are widely adopted in Africa, Asia, Europe and Latin America. North America uses limits that are similar.

Adoption of national RF-EMF limits based on the ICNIRP exposure guidelines[3] is consistent with the WHO promotion of standards that provide the same or similar level of health protection for all people [3].

The WHO notes that large disparities between national limits and international guidelines can foster confusion for regulators and policy makers, increase public anxiety and provide a challenge to manufacturers and operators of communications systems who need to tailor their products to each market.

ICNIRP guidelines provide health protection

The ICNIRP[4] is an independent scientific commission formally recognised as an official collaborating non-state actor by the WHO and the International Labour Organization (ILO).

The consensus of independent scientific experts[5] is that the ICNIRP limits provide protection for all people against all established health hazards from short- or long-term RF-EMF exposures.

> **"The main conclusion from the WHO reviews is that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health."**
>
> **WHO[6]**

The ICNIRP RF-EMF exposure guidelines are recommended by international organizations such as the ITU [4], World Bank [5], and the European Commission[7].

The ICNIRP RF-EMF guidelines are not technology specific and apply to mobile communications devices and network antennas, whatever the technology used (2G, 3G, 4G, and 5G). Mobile networks and devices are designed to comply with the ICNIRP RF-EMF exposure guidelines as 5G evolves to 6G. The ICNIRP guidelines also apply to the frequencies used for radio and television, and other sources such as Wi-Fi.

ICNIRP undertakes periodic guideline reviews. In March 2020, the ICNIRP published updated RF-EMF exposure guidelines covering the frequency range 100 kHz to 300 GHz and providing protection 'against all potential adverse health effects relating to exposure to RF EMF' [2].

> **"The ICNIRP 2020 RF EMF guidelines protect against all potential adverse health effects relating to exposure to RF EMF, including from 5G technologies."**
>
> **ICNIRP[8]**

ICNIRP concluded that while the 1998 limits provide protection for all mobile technologies, the 2020 guidelines introduce better and more detailed guidance, in particular, for frequencies above 6 GHz.

2 https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/regulatory-environment/emf-and-health/emf-policy/
3 The WHO notes that the IEEE International Committee on Electromagnetic Safety (ICES) also produces exposure limits. The ICNIRP (2020) guidelines and the ICES (2019) standard differ in some terminology but are broadly harmonised in numerical values. See https://sagroups.ieee.org/ices/
4 https://www.icnirp.org/en/about-icnirp/aim-status-history/index.html
5 https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/regulatory-environment/emf-and-health/expert-reports/
6 https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/protection-norms
7 https://digital-strategy.ec.europa.eu/en/policies/5g-and-electromagnetic-fields
8 https://www.icnirp.org/en/frequencies/radiofrequency/index.html



ICNIRP (2020) - mobile devices

'... trends in brain cancer incidence rates from a large number of countries or regions, which have not found any increase in the incidence since mobile phones were introduced.'

ICNIRP (2020) - mobile networks

'Studies of exposure to environmental radiofrequency EMFs, for example from radio and television transmitters, have not provided evidence of an increased cancer risk either in children or in adults.'

ICNIRP strongly recommends that countries update their regulatory limits, including those based on the ICNIRP (1998) guidelines, to the ICNIRP (2020) guidelines that apply to current and future mobile technologies.

As can be seen on the GSMA[9] website this process is underway in countries around the world.

Adoption of ICNIRP (2020) does not require reassessment of sites

For countries using ICNIRP (1998) limits, adoption of ICNIRP (2020) does not require reassessment of existing base stations. Analysis of the influence of ICNIRP (1998) versus ICNIRP (2020) on RF-EMF compliance boundaries showed that base stations that currently comply with ICNIRP (1998) will remain compliant under ICNIRP (2020) [6]. The analysis covered low-power small cells and macro cell equipment, operating in frequency bands above and below 6 GHz, and is of relevance for 2G to 5G mobile technologies.

Key features of the ICNIRP (2020) RF-EMF exposure limits are presented in Annex 1 and further information can be found in the GSMA[10] publication *International EMF Exposure Guidelines*.

9 https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/regulatory-environment/emf-and-health/emf-policy/
10 https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/gsma_resources/emf-exposure-guidelines/

Other RF-EMF policy restrictions

Unlike ionizing radiation there are no legally binding international basic standards for RF-EMF exposure and countries can adopt their own limits. Most countries follow the ICNIRP RF-EMF exposure guidelines. However, some countries retain older restrictive limits or have adopted restrictive policies as a response to public concern or perceived scientific uncertainty.

ICNIRP[11] makes clear that: *'There is no evidence that additional precautionary measures will result in a benefit to the health of the population.'*

The report of a WHO survey of RF-EMF policies concludes [7]:

> *'... attention should be given to unjustified impediments in the development of RF communication technologies due to restrictions that would go beyond compliance with well-grounded health and safety requirements. Such undue restrictions would have important consequences because these technologies contribute heavily to health, economic and social development in all parts of the world, especially in less-industrialised countries and in remote areas.'*

Several countries that previously adopted additional RF-EMF policy restrictions have updated their rules to align with the international guidelines. See Annex 3 of this report for selected case studies.



11 Page 485 in ICNIRP (2020)

Restrictive limits

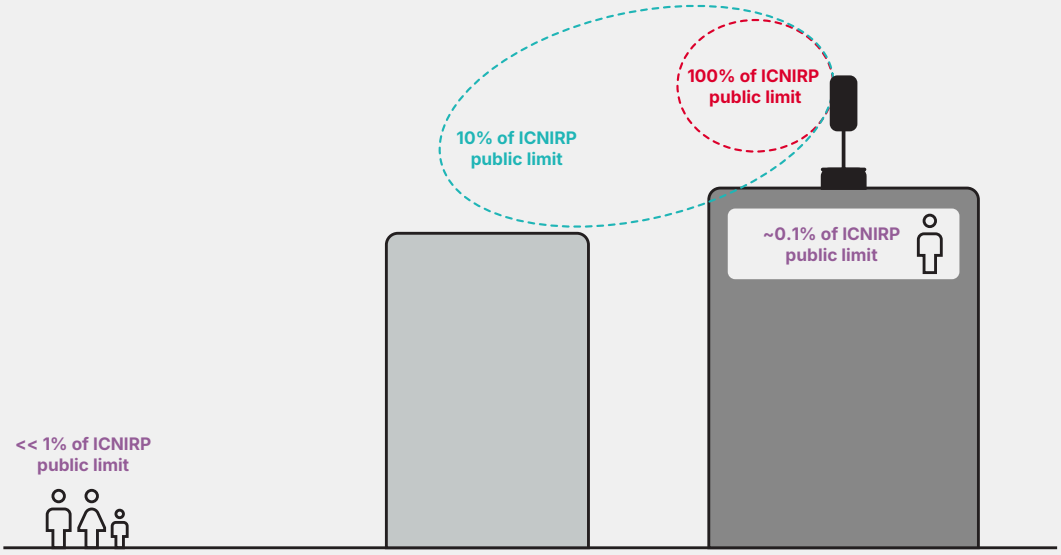
Some jurisdictions (cities, provinces or countries) have applied arbitrary factors without scientific basis[12] to the ICNIRP limits. These more restrictive values are linked to increased public concern [8] and constrain new mobile technology deployments [9]. Restrictive limits are often described as *'precautionary' and can be understood as a political response to societal risk perception* [7, 10].

As shown in Figure 1 restrictive RF-EMF limits based on arbitrary reductions to the ICNIRP values result in larger antenna compliance boundaries that can extend onto rooftops or nearby buildings. In order to reduce the size of the compliance boundary the transmitter power may be reduced. When transmitter powers are reduced this usually results in poor in-building service, gaps in coverage and potentially more sites.

Thus, it is not a surprise that countries are increasingly moving to adopt the ICNIRP guidelines because restrictive RF-EMF limits create additional constraints without bringing any *'benefit to the health of the population'* as stated by ICNIRP.

Figure 1

Restrictive RF-EMF limits mean larger compliance boundaries for the same transmit power



Note: power density limits represented. Figure adapted from [11].

12 Health Canada says that these restrictive limits 'have no scientific basis to support them' and 'are not consistently applied to other wireless devices within these same jurisdictions', https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/occupational-exposure-regulations/safety-code-6-radiofrequency-exposure-guidelines.html#International_standards_for_2

Minimum distances

Another type of restriction implemented by some countries is the imposition of minimum distances between base stations (BSs) and specified community facilities. On that point ITU[13] makes clear that [4]:

> *'With respect to human exposure, currently there is no technical requirements for any special consideration for locating BSs close to areas such as hospitals and schools due to the fact that existing exposure guidelines incorporate in the exposure limits safety margins that are applicable to all locations.'*

Arbitrary minimum distances impact the coverage and capacity of mobile services in nearby areas. ITU also points out that under such policies new schools or health facilities cannot be built in locations near an existing base station site [11].

> *'However, measurement studies in countries with and without restrictive policies show that exposure from all RF-EMF sources remains significantly below the ICNIRP limits. This suggests that such policies are not required to achieve low RF-EMF exposure levels and may restrict the development of community infrastructure.'*

Good RF-EMF policy linked to better mobile service quality

Mobile technologies are designed for compliance with the international RF-EMF limits. Therefore, services can be more efficiently delivered where countries adopt those limits.

Real-world measurements show better 4G quality, fewer base stations and fewer coverage holes in Madrid (Spain) that has ICNIRP limits, when compared to Rome (Italy) that has restrictive RF-EMF limits and specifies minimum distances between antennas and certain community facilities [12].

Madrid (ICNIRP)	Rome (restrictions)
About three times more good or excellent RSRP values	Approximately double the number of base station sites in survey area

Note: RSRP = Reference Signal Received Power. Good or excellent RSRP >-90 dBm.

An analysis of 3G networks showed that restrictive RF-EMF limits reduce indoor coverage because of the resulting requirement to operate base stations at lower transmit powers [13]. Reduced indoor 4G signal strength was also reported[14] in Italy and Switzerland (restrictive limits) where levels were two to four times lower than the rest of Europe.

13 Paragraph 5.10 in ITU-T K.91, which also notes that 'using the mobile telephone within areas of good reception also decreases exposure as it allows the telephone to transmit at reduced power.'

14 Ookla, September 2026, https://www.linkedin.com/posts/luke-kehoe_measuring-and-visualising-indoor-cellular-ugcPost-7502856138304937984-1VTc/

International standards for RF-EMF assessments

Countries should also modernise the rules used to assess RF-EMF compliance of base stations to better reflect the actual transmissions from antennas. Older methods using conservative assumptions lead to unrealistic estimates of RF-EMF levels in nearby communities and large overestimations of the size of base station compliance boundaries[15].

Improved RF-EMF assessment methods (calculations and measurements) specified in international technical standards for base stations from the International Electrotechnical Commission (IEC) or the related recommendations from the International Telecommunication Union (ITU) should be adopted.

Mobile network antennas are typically directional, meaning that compliance boundaries extend in front of the antenna and a small distance above and below. The antennas are positioned so the public cannot access these areas. These precise real-world aspects of the deployed antennas are crucial to the assessment of realistic RF-EMF compliance boundaries.

Modern mobile networks may support more than one mobile technology in multiple frequency bands. This can make the RF-EMF assessment of a single operator base station site complex. Shared sites increase the complexity of assessments due to differing combinations among operators of technologies, frequencies, antennas, and beam directions.

With 5G and more use of active antenna systems, the antenna beam direction, gain and transmit power[16] vary dynamically in response to traffic resulting in lower time-averaged RF-EMF levels when measured in commercial networks [14].

New antenna technologies reduce RF-EMF levels

A theoretical study modelled the number of antennas required and the downlink RF-EMF levels for a suburban area of Ghent, Belgium for the reference case of a 4G LTE network of 75 base stations operating at 2.6 GHz without MIMO compared to a 5G network operating at 3.7 GHz with massive MIMO (MaMIMO) antennas. More base station antenna elements resulted in a smaller number of antenna sites. The optimal 5G MaMIMO network was obtained for 37 sites using 64-element antennas. In addition, the downlink exposure from the 5G network was five times lower than the 4G reference [15].

Actual base station transmissions

Studies show that the actual transmitted power of 2G, 3G, 4G and 5G base stations during operation is well below the theoretical maximum time-averaged configured power [16-20]. This is also true for multi-technology base station sites where the realistic maximum exposure is lower than the summation of the individual technology theoretical maximums [21].

Improved accuracy for base station RF-EMF assessments is possible by using methods that consider the actual transmission patterns of sites rather than theoretical maximums. The actual maximum approach is described in the IEC 62232 international standard [22], the related implementation guide IEC TR 62669 [23], and the ITU K.52 [24] and K.100 [25] recommendations.

However, in some countries existing technical requirements for RF-EMF assessments are based on theoretical approaches that impact the efficient deployment of mobile network base stations – especially in urban areas. These theoretical approaches limit the potential benefits for citizens, industries and public administrations and impose regulatory burdens on operators, local authorities and national bodies. These limitations can be reduced by implementing more accurate approaches based on actual transmissions.

15 The compliance boundary is defined in international standards as the 'surface defining a volume outside which the radio frequency (RF) exposure from the equipment under test (EUT) is below the applicable exposure limit.' The compliance distance is defined as the 'distance from the EUT antenna to the compliance boundary for a stated direction and set of transmission conditions.'

16 The antenna gain and transmit power are combined in the EIRP – Effective Isotropic Radiated Power.

Effective public communication

While many in the community recognise the benefits of mobile services, some people may have concerns about the RF-EMF from mobile networks and devices. Research also shows that a significant percentage of the population has a poor understanding of the need for nearby base stations and how locations are selected; the operation of mobile phones; and how RF-EMF levels are regulated.

It is important that national regulatory authorities take the leading role to inform the public and address misinformation about RF-EMF. The information provided by authorities should be based on credible sources, such as, the WHO and ICNIRP.

Poorly designed communication messages can increase public concern and reduce trust in authorities [8].

UK: Only 1 in 7 have a good understanding of mobile connectivity

A Mobile UK[17] survey in 2024 found that only 14% of people felt confident in their knowledge of mobile connectivity, with 42% admitting to no understanding at all. Additionally, when shown photos 45% could not identify a rooftop antenna installation, and 35% failed to recognise a mobile phone mast.

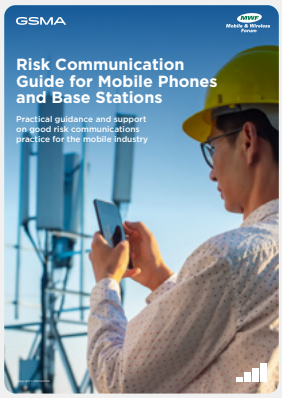
Risk communication

Where stakeholders are concerned about RF-EMF exposure the techniques of risk communication should be applied to support effective communications. Risk communication is based on anticipating possible reactions, understanding the audience and conveying clear information that addresses people's concerns and establishes an organisation as responsible and trustworthy.

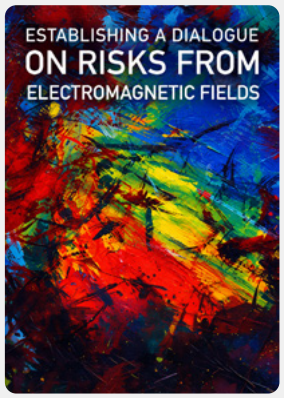
Guidance on effective communications is available from both the mobile industry [26] and the WHO [27].

When communicating it is important to take account of the prevailing social, political and administrative traditions and regulatory frameworks in a country. It also important to match initiatives to the needs of stakeholders.

GSMA and the MWF



WHO



17 https://www.mobileuk.org/how-connected-are-you



Recommendations for policymakers

GSMA encourages policymakers to use the completion of the WHO RF-EMF health risk assessment as an opportunity for harmonisation of national RF-EMF policy with international good practice.

The legal basis for RF-EMF policy may differ between countries and more than one national authority may be involved [11]. In some countries the same legal rule or authority may adopt limits for both workers and the public. In other countries there may be separate rules. The WHO has developed model legislation for countries considering adoption of EMF exposure limits [28].

For mobile network base stations, the telecommunications authority (ministry or regulator) is often responsible for setting the national RF-EMF policy and monitoring compliance. Adopting a national RF-EMF policy provides for the application of consistent rules throughout a country.

National RF-EMF policy should be based on the health risk assessment and risk management recommendations of the WHO and ICNIRP, which are informed by established scientific evidence. Referencing the IEC standards and ITU recommendations for RF-EMF assessments in national rules ensures that the technical methods to evaluate the exposure against the regulatory limits imposed by the national policy evolve appropriately for each new mobile technology generation. Recognising the importance of mobile communications national authorities should inform the public about the operation of networks and the need for antennas, and address misinformation about RF-EMF.

Countries should streamline RF-EMF compliance rules for base stations to reduce administrative burden and delays as set out in the GSMA[18] recommendations for *EMF Exposure Compliance Policies for Mobile Network Sites*.

18 https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/gsma_resources/emf-exposure-compliance-policies-for-mobile-network-sites/

Annex 1: ICNIRP (2020) RF-EMF exposure guidelines

Some key features of the ICNIRP (2020) guideline are summarised in this annex, and further information can be found in the GSMA[19] publication *International EMF Exposure Guidelines*. For frequencies below 10 MHz the ICNIRP (2010) guideline should also be consulted [29].

The ICNIRP (2020) RF-EMF exposure guidelines were developed following reviews of peer-reviewed scientific literature, including research on thermal and nonthermal effects.

After several decades of research, ICNIRP concludes that the only established mechanism relevant to human health at the frequencies used by mobile technologies is heating of exposed tissue due to absorption of RF-EMF energy and this is the basis of the limits. The lowest exposure levels that can cause confirmed adverse health effects are due to thermal mechanisms, and so limits have been set based on the thermal effects, as these will protect against any other effects that could occur at higher exposure levels. The RF-EMF levels from wireless technologies in everyday use result in negligible temperature rise in the human body.

According to ICNIRP the RF-EMF exposure limits in the 2020 guidelines provide protection against all established hazards.

Reduction factors

The ICNIRP (2020) RF-EMF guidelines contain differing limits for the public and for persons who are occupationally exposed. The whole-body limits incorporate a 50-fold reduction factor for the public and a 10-fold reduction factor for workers. The substantial reduction factors mean that the allowable exposure levels are much lower than the threshold for scientifically-established adverse health effects.

The limits for the public are protective of all persons regardless of their age and health status (including children and pregnant women), as well as for continuous 24 hours a day/7 days a week exposure up to the limits.

The higher limits for workers are applicable for occupationally exposed individuals where appropriate screening and training is provided. ITU-T K.145 sets out an approach to classification of workers under the control of a site operator [30].

RF-EMF exposure limits

The RF-EMF exposure limits of the ICNIRP (2020) guidelines are defined as *Basic Restrictions* and *Reference Levels*. ICNIRP (2020) says that the Basic Restrictions and Reference Levels provide equivalent protection.

Basic restrictions

Basic Restrictions are formulated in metrics which quantify RF-EMF exposure inside or at the surface of the body and are closely related to established biological effects mechanisms. An example Basic Restriction is the Specific Absorption Rate (SAR with units of W/kg) used for RF-EMF compliance of mobile devices.

Reference levels

Reference Levels that are easier to assess are derived conservatively from the Basic Restrictions. An example Reference Level is incident power density (S_{inc} with units of W/m^2).

As the Reference Levels are derived conservatively in some cases use of Basic Restrictions results in smaller compliance boundaries. For example, a small cell where the compliance boundary could be determined to be inside the antenna cover when Basic Restrictions are evaluated.

It is important that national regulatory frameworks for RF-EMF compliance assessment allow for the use of either type of limit as appropriate to base station equipment. International technical standards provide methods for RF-EMF assessments using calculation or measurement for both types of limits.

19 https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/gsma_resources/emf-exposure-guidelines/

Annex 2: RF-EMF limits FAQs

This annex addresses some common questions and misunderstandings about the ICNIRP RF-EMF limits.

Do the ICNIRP guidelines consider mechanisms other than heating?

Yes, ICNIRP considers all potential adverse health effects, and sets restrictions to ensure that none occur, regardless of the mechanism of interaction between the exposure and the body. ICNIRP concludes that at mobile communication frequencies the lowest RF-EMF exposure levels that can cause adverse health effects are due to thermal mechanisms, and so restrictions have been set based on the thermal effects, as these will protect against any other effects that could occur at higher exposure levels.

Do the ICNIRP limits apply for continuous 24-hour exposure?

Yes, the ICNIRP guidelines apply for continuous exposure to RF-EMF. ICNIRP states that the guidelines provide *'protection against all adverse health effects, regardless of whether they are due to acute or chronic exposures, regardless of age or health status, and regardless of the biophysical mechanism responsible for the effect.'*

Health Canada[20], which has similar limits, explains that the limits *'provide protection for people of all ages and sizes, from exposure to all forms of radiofrequency EMF on a continuous (24 hours a day/7 days a week) basis.'*

The ICNIRP averaging times for whole-body (30-min) or local (6-min) exposure assessment are based on the time taken for body temperature to change in response to absorbed RF energy. They are not a specification for a duration of use or exposure. The averaging time accounts for temporal variations to show whether there is overall compliance with the limit. Similar types of limits occur in exposure standards for other agents[21].

Do differing RF-EMF limits between countries mean different levels of safety?

No, the ICNIRP limits provide protection against all established health hazards. Analysis of environmental RF-EMF measurements conducted between 2016 and 2023 in the Netherlands, Switzerland, Belgium and Spain found that the levels remained a small fraction of the limit values and were comparable in countries with restrictive limits (Belgium/Switzerland) and in countries with the international limits (the Netherlands/Spain) [31].

Some countries of the former Soviet Union continue to apply restrictive RF-EMF limits based on a different philosophy to that of ICNIRP [32]. Many of the underlying Soviet studies are several decades old and attempts to confirm key findings were unsuccessful [33].

Moscow: Restrictive limits mean many more base stations needed for 5G

The Russia Federation and some other Eurasian countries retain RF-EMF limits and compliance procedures from the former Soviet Union that are substantially more restrictive than the ICNIRP RF-EMF limits and international technical standards for compliance assessment. GSMA[22] analysis with Russian operators showed that about three-times more antennas would be needed to provide urban 5G coverage in Moscow at 3.5 GHz than would be the case if the ICNIRP limits were in place. The restrictive RF-EMF limits mean that all the existing Moscow sites must be modified, whereas with ICNIRP limits less than half of sites would need modification. Existing RF-EMF limit restrictions also meant that it was not possible to ensure indoor 5G coverage.

20 https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/occupational-exposure-regulations/safety-code-6-radiofrequency-exposure-guidelines.html

21 For example, workplace exposure standards for airborne agents may include time weighted average limits specified for a work shift; short term exposure limits if an acute effect is possible; and peak limits to limit acute dangerous exposures.

22 https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/gsma_resources/adopting-international-rf-emf-exposure-guidelines-benefits-for-5g-network-deployment-in-russia/

Annex 3: Country case studies of RF-EMF limits

Selected countries that have moved from restrictive RF-EMF limits are shown in Table 1.

New Zealand and Australia made the change after determining that the scientific basis of the ICNIRP guidelines was more robust than their pre-existing standards; the Czech Republic, Slovakia, Hungary and North Macedonia changed as part of discussions with the European Union about harmonisation of regulations. Other countries in the table made the change after recognising that the previous restrictive RF-EMF limits do not provide any additional health benefit and were a barrier to successful mobile network deployment. Some other countries are still on the path towards international RF-EMF limit harmonisation.

Table 1:

Selected countries that moved to the ICNIRP RF-EMF limits for the public

Country	Prior Limit (>2 GHz) W/m²	Year of ICNIRP Adoption	International Limit (> 2GHz) W/m²
New Zealand	2.0	1999	10
Czech Republic	0.05	2000	10
Australia	2.0	2003	10
Slovakia	0.1	2004	10
Hungary	0.1	2004	10
North Macedonia	2.0	2014	10
Lithuania	1.0 (0.1 before 2015)	2020	10
Poland	~0.1	2020	10
India	5 (1 from 2012)	2026	10

Brief case studies of RF-EMF limit histories for Belgium, India, Lithuania, and Poland follow.

Belgium

The RF-EMF limits in Belgium differ between the sub-national regions (Brussels, Flanders and Wallonia) following a constitutional court decision in 2009. The limits in the Brussels capital region are the most restrictive and have gone through several changes including increases in 2014 and 2023 to allow the launch of 4G and 5G respectively but are still substantially below the ICNIRP values. A study by the regulator BIPT[23] reported in 2018 that:

> *'The standards in Brussels forced operators to reduce the power of most of their base stations, impacting the coverage of networks (particularly indoors) and their ability to simultaneously cover the needs of a large number of users.'*

A further BIPT[24] analysis in 2021 showed that 19% of 4G sites in Brussels were at medium or high risk of saturation and that this could nearly double to about 33% sites within a year if the limits were not increased. 5G launched in the other regions of Belgium in 2020, and in Brussels in late 2023. By 2025, the industry association Agoria[25] warned of emerging capacity problems on the 5G networks unless the limits were aligned with ICNIRP.

India

The Department of Telecommunications (DoT) adopted ICNIRP public limits for base stations in 2008, including audit and self-certification by mobile network operators. ICNIRP limits for workers applied in occupational exposure settings. However, public concern led to a 10-fold limit reduction in 2012. Subsequently, the DoT undertook several initiatives to address public concern. A 2018 report[26] recognised that the ICNIRP guidelines *'include substantial margins of safety to protect all people.'* The Indian mobile industry[27] continued to call for RF-EMF limit harmonisation to support 5G rollouts. Noting that according to the WHO all reviews indicate that exposures below the ICNIRP guidelines *'do not produce any known adverse health effect,'* in early 2025 the DoT[28] changed the base station RF-EMF limit to 50% of ICNIRP. In 2026 DoT[29] returned to the full ICNIRP limits for base stations *'in order to ensure quality of service in view of increased 5G traffic and upcoming technologies in the future.'*

Lithuania

Lithuania inherited restrictive RF-EMF limits from former Soviet times that were approximately 1% of the ICNIRP public limits. In 2015 RF-EMF limits were increased to 10% of ICNIRP recognising that no health risks had been demonstrated and that there were difficulties deploying full 4G capacity at sites. In the lead up to 5G launch, analysis showed that more than 75% of single operator sites and 90% of shared sites would not be available for 5G deployment due to the restrictive limits. The Ministry of Health adopted the ICNIRP public limits in 2020 emphasising harmonisation of limits with European Union recommendations and that the ICNIRP limits contain a significant safety margin.

Poland

The former Polish limits were based on the Soviet limits and equivalent to about 1% of the ICNIRP public limits. These restrictive RF-EMF limits meant that it was not possible to use all available spectrum[30] at 4G base station sites [34]. It also implied that most of the existing sites would not be available for 5G deployment. The Digital Ministry identified the restrictive RF-EMF limits as a deployment barrier in a 5G consultation paper[31] in January 2018. The Ministry of Health[32] adopted the ICNIRP public limits with effect from 1 January 2020. The regulatory impact assessment explained that the revised limits are in line with the European Union Recommendation and are expected to mean more efficient base station deployment and may lower exposures from mobile devices. Measurements[33] conducted since the change in limits show that despite 20% more base stations, including 15,000 5G sectors, the average RF-EMF level is not significantly changed.

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Abbreviations

2G/3G/4G/5G/6G`	2nd to 6th generation mobile communication technologies
EHC	Environmental Health Criteria
EIRP	Equivalent or Effective isotropic radiated power
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electrotechnical Commission
IEEE ICES	IEEE International Committee on Electromagnetic Safety
ILO	International Labour Organization
ITU	International Telecommunication Union
MIMO/MaMIMO	Multiple Input Multiple Output / Massive MIMO
MWF	Mobile & Wireless Forum
RF-EMF	Radiofrequency electromagnetic field
RSRP	Reference Signal Received Power
SAR	Specific Absorption Rate (unit of W/kg)
WHO	World Health Organization

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