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GSMA Response to the U.S. Department of Health and Human Services Request for Information on Electromagnetic Fields (EMFs), Radiofrequency (RF) Radiation, and Wireless Radiation Exposure, Federal Register, 21 September 2026

The GSMA welcomes the opportunity to provide information in response to the U.S. Department of Health and Human Services (HHS) Request for Information (RFI) on Electromagnetic Fields (EMFs), Radiofrequency (RF) Radiation, and Wireless Radiation Exposure published in the Federal Register, 21 September 2026.

We note that the US Federal RF exposure limits mandated by the Federal Communication Commission (FCC) and confirmed in 2019 provide a similar level of health protection to the international RF-EMF exposure limits. We make this point because as an international organization we will largely bring the perspectives of the non-US scientific community.

Our response to the questions in the RFI follow.

Question 2: In your response, please describe which perspective(s) your comments represent

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

The GSMA has a long history of activity on the topic of radiofrequency electromagnetic field (RF-EMF) exposure and health. The GSMA has supported independent high-quality research guided by World Health Organization (WHO) research priorities; advocates for the adoption of RF-EMF exposure limits based on substantiated evidence that provide protection against established hazards of RF-EMF exposure; and encourages the availability of fact-based information for the public and other

interested groups. More information our activities connected to RF-EMF is available from the GSMA[1] website.

It is the GSMA position, based on the consensus of independent experts, that government policies for RF-EMF should be evidence-based, harmonised internationally and draw on the recommendations by expert bodies such as the World Health Organization (WHO) and the International Telecommunication Union (ITU).

Both these organisations recommend the human exposure guidelines developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP guidelines are designed to provide protection for all people (including children) against all established health hazards.

Question 4: We invite healthcare professionals, researchers, and public health practitioners to describe observations from clinical practice, occupational settings, or research that may help identify patterns, if any, of reported potential adverse health effects associated with RF/EMF radiation and exposure.

The GSMA notes that the Directorate-General for Health (DGS) in France[2] mandated the French Society of Occupational Health (SFST) to produce a report[3] that answers practical questions for physicians concerning the care of patients who claim a perceived sensitivity to electromagnetic fields, generally termed electromagnetic hypersensitivity (EHS) or Idiopathic Environmental Intolerance attributed to electromagnetic fields (IEI-EMF). The SFST[4] advice for doctors explains that current studies indicate that the reported symptoms are not connected to EMF exposure:

> *['It therefore appears, in light of current scientific knowledge, that EHS symptoms can occur independently of actual exposure to EMFs. In this context, measuring EMF exposure in the general environment is, in most cases, pointless.']*

The SFST[5] also points out that it is not possible to provide a diagnosis of EHS:

> *['There is therefore, strictly speaking, no diagnosis of EHS; diagnostic qualification elimination is also not suitable when talking about EHS, given the physiological and physiopathological uncertainties.']*

The SFST[6] advice also adds that there is no scientific basis to recommend avoiding EMF exposures:

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[1] https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/regulatory-environment/emf-and-health/

[2] https://sante.gouv.fr/sante-et-environnement/activites-humaines/exposition-aux-ondes/article/l-electro-hypersensibilite-ehs

[3] "Personnes se déclarant électrohypersensibles - Repères pour la pratique médicale" [People who identify as electro-hypersensitive - Guidelines for medical practice.] Rapport de la société française de santé au travail (SFST), 13 December 2023 (in French), https://www.societefrancaisedesanteautravail.fr/_docs/actus/68/Fichier-68-1-083852.pdf

[4] Ibid. at p. 39, translated from French.

[5] Ibid at p. 59, translated from French.

[6] Ibid at p. 63, translated from French.

['In the current state of science, avoidance measures have not proven their effectiveness and cannot therefore be recommended in the current state of knowledge.']

The WHO[7] also points out that '*Whatever its cause, EHS can be a disabling problem for the affected individual. EHS has no clear diagnostic criteria and there is no scientific basis to link EHS symptoms to EMF exposure. Further, EHS is not a medical diagnosis, nor is it clear that it represents a single medical problem.*'

Question 5: Existing national and international exposure standards, guidelines, or regulatory frameworks

The consensus among experts[8] over decades is that there are no established health risks from exposure to low-level radiofrequency electromagnetic fields (RF-EMFs) typically encountered in everyday life, such as those from radio transmitters and devices.

The WHO[9] states that:

'A number of national and international organizations have formulated guidelines establishing limits for occupational and residential EMF exposure. The exposure limits for EMF fields developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - a non-governmental organization formally recognised by WHO, were developed following reviews of all the peer-reviewed scientific literature, including thermal and non-thermal effects. The standards are based on evaluations of biological effects that have been established to have health consequences. 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.'

Furthermore, the WHO[10] encourages the adoption of the ICNIRP[11] guidelines:

'WHO encourages the establishment of exposure limits and other control measures that provide the same or similar level of health protection for all people. It endorses the guidelines

[7] https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/non-ionizing/hypersensitivity
[8] https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/regulatory-environment/emf-and-health/
[9] https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/protection-norms
[10] Framework for developing health-based EMF standards, World Health Organization (WHO), 14 April 2006, https://www.who.int/publications/i/item/9241594330
[11] The ICNIRP is formally recognized as an official collaborating non-state actor by the WHO and the International Labour Organization (ILO). ICNIRP is consulted by the European Commission. See https://www.icnirp.org/en/about-icnirp/aim-status-history/index.html
'ICNIRP Commission members are independent experts in the scientific disciplines relevant to non-ionizing radiation protection such as biology, epidemiology, physics and engineering, bio-physics, and medicine. In carrying out their voluntary work for the Commission they do not represent either their countries of origin or their institutes. ICNIRP members are required to declare any personal interests in relation to their activities for ICNIRP. Members' declarations of personal interests are available below along the member's profile.'
See https://www.icnirp.org/en/about-icnirp/commission/index.html

> *of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and encourages Member States to adopt these international guidelines.'*

The WHO[12] notes that the Institute of Electrical and Electronics Engineers (IEEE), through the International Committee on Electromagnetic Safety (ICES) also develops EMF exposure limits. For RF-EMF exposures, the ICNIRP[13] (2020) and IEEE[14] (2019) limits are based on similar scientific approaches[15].

The Federal Communication Commission (FCC)[16] RF-EMF limits that were reaffirmed in 2019 are based on a similar underlying assessment of the established hazards of RF-EMF exposure and therefore provide a similar level of health protection as the international guidelines.

As stated by the ICNIRP[17] the updated 2020 guidelines '*protect against all potential adverse health effects relating to exposure to RF EMF*.' ICNIRP[18] explains in the 2020 guidelines that:

> *'The only substantiated adverse health effects caused by exposure to radiofrequency EMFs are nerve stimulation, changes in the permeability of cell membranes, and effects due to temperature elevation.'*

ICNIRP also states that there is '*no evidence of an interaction mechanism that would predict that adverse health effects could occur due to radiofrequency EMF exposure below those restriction levels*.'

Many official expert national and international organisations have also examined the scientific literature on RF-EMF exposures and health and the consensus[19] supports the ICNIRP conclusions.

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[12] Radiation: 5G mobile networks and health, WHO Questions and answers, 27 February 2020, https://www.who.int/news-room/questions-and-answers/item/radiation-5g-mobile-networks-and-health

[13] https://www.icnirp.org/en/frequencies/radiofrequency/index.html

[14] https://ieeexplore.ieee.org/browse/standards/get-program/page/series?id=82

[15] IEEE Committee on Man and Radiation—COMAR Technical Information Statement: Health and Safety Issues Concerning Exposure of the General Public to Electromagnetic Energy from 5G Wireless Communications Networks, Bushberg et al., *Health Physics*, 119(2):236–246, August 2020, https://dx.doi.org/10.1097/hp.0000000000001301

[16] 2019 Resolution of Notice of Inquiry, Second Report and Order, and NPRM, 34 FCC Rcd at 11692, para. 10; see also Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies; Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields, ET Docket Nos. 13-84 and 03-137, First Report and Order, Further Notice of Proposed Rulemaking, and Notice of Inquiry, 28 FCC Rcd 3498, 3501-02, 3570-89, paras. 5-7, 205-52 (2013) (2013 R&O, FNPRM, and NOI).

[17] https://www.icnirp.org/en/frequencies/radiofrequency/index.html

[18] p. 523 in International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz), ICNIRP, *Health Physics*, 118(5):483–524, May 2020, https://www.icnirp.org/en/frequencies/radiofrequency/index.html

[19] The GSMA website lists over 200 reports, statements, and RF-EMF standards produced by official expert national and international organisations. The consensus among experts is that there are no established health risks from exposure to low-level radiofrequency electromagnetic fields (RF-EMFs) typically encountered in everyday life, such as those from radio transmitters and devices. https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/regulatory-environment/emf-and-health/expert-reports/



Question 5.o: Is additional research needed to develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation?

A large amount of RF-EMF research[20] has been conducted in the past three decades since the WHO[21] published the first EMF research agenda in 1997. The most recent WHO[22] research agenda for RF-EMF was published in 2010. The WHO[23] states that since 1997 over US$200 million of research has been conducted to complete the WHO EMF research agendas. The WHO[24] is nearing completion of a health risk assessment of RF-EMF, to be published as a monograph in the Environmental Health Criteria Series. The health risk assessment is supported by a Task Group and one of their activities is '*identifying research gaps*.' The GSMA encourages the HHS and US Federal authorities to examine the RF-EMF research gaps identified by the WHO Task Group before determining what further US action is appropriate.

In addition, the ICNIRP identified gaps in knowledge for low frequencies (1 Hz to 100 kHz)[25] and high frequencies (100 kHz to 300 GHz)[26] that could assist future guideline development.

GSMA notes that is no credible scientific evidence that minimizing RF-EMF exposure has any health benefits, pointing out that the ICNIRP[27] states that due to the conservativeness of RF-EMF limits:

> *'There is no evidence that additional precautionary measures will result in a benefit to the health of the population.*

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[20] As of 16 October 2026 the EMF-Portal of the RWTH Aachen University contains an extensive literature database with an inventory of 51,132 publications and 7,012 summaries of individual scientific studies on the effects of electromagnetic fields.

[21] https://www.who.int/publications/i/item/WHO-EHG-98-13

[22] https://www.who.int/publications/i/item/who-research-agenda-for-radiofrequency-fields

[23] https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/non-ionizing/emf/research-agenda

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

[25] ICNIRP states:
'Although some areas provide sufficient information and do not suggest that any specific deficiencies exist related to low frequency electric and magnetic fields and health, there are clear gaps in knowledge in other areas.'
Gaps in Knowledge Relevant to the "Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz–100 kHz)", International Commission on Non-Ionizing Radiation Protection (ICNIRP), *Health Physics*, 118(5):533–542, May 2020, https://dx.doi.org/10.1097/hp.0000000000001261

[26] ICNIRP states:
'Literature available both in biology and dosimetry has been analyzed to set the guidelines for limiting exposure to radiofrequency EMF (100 kHz to 300 GHz) (ICNIRP 2020a). In terms of biology, although sufficient information was available as the basis for that guideline development, we have identified some gaps in knowledge that, if addressed with the above specified research, would greatly assist ICNIRP and others in the future development of radiofrequency EMF exposure guidelines …'
Gaps in Knowledge Relevant to the "ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (100 kHz to 300 GHz)", International Commission on Non-Ionizing Radiation Protection, *Health Physics*, 128(2):190–202, February 2025, https://dx.doi.org/10.1097/HP.0000000000001944

[27] P.485 in International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz), ICNIRP, *Health Physics*, 118(5):483–524, May 2020, https://www.icnirp.org/en/frequencies/radiofrequency/index.html

A WHO[28] survey of national EMF risk management policies concludes that there are potential negative consequences when restrictions '*go beyond compliance with well-grounded health and safety requirements*':

> *'... 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-industrialized countries and in remote areas.'*

Question 5.p: How, if at all, should a classification system account for exposure-related characteristics, including operating frequency, power density, specific absorption rate (SAR), electric- and magnetic-field strength, modulation and pulse characteristics, duty cycle, beamforming, simultaneous exposure to multiple frequencies, duration of exposure, distance from the source, proximity to the body, and cumulative exposure over time?

Operating frequency, power density, specific absorption rate (SAR), electric- and magnetic-field strength, modulation and pulse characteristics, duty cycle, beamforming, simultaneous exposure to multiple frequencies are all considered in the existing international (ICNIRP, IEEE ICES) and national (FCC) exposure requirements.

As the established effects of RF-EMF exposures at mobile communication frequencies are based on heating mechanisms the duration of exposure has limited relevance beyond the averaging times specified in the existing international (ICNIRP, IEEE ICES) and national (FCC) exposure requirements.

Regarding '*cumulative exposure over time*,' the CLUE-H[29] group of European researchers explains how this should be understood in the context of RF-EMF research:

> *'The use of a cumulative dose metric in research should not be mistaken as an indication or proof that cumulative exposure to very low levels can be harmful to health. It just serves as the currently best metric to analyse if there could be effects on health, outside of a known biological mechanism.'*

CLUE-H adds:

> *'For regulation purposes, the suitable metric depends on the exposure situation (e.g., external electric field strength or power density for far field sources or spatially averaged SAR for localized near field exposures).'*

[28] Risk Management Policies and Practices Regarding Radio Frequency Electromagnetic Fields: Results from a WHO Survey, Dhungel et al., *Radiation Protection Dosimetry*, 164(1-2):22–27, April 2015, https://doi.org/10.1093/rpd/ncu324

[29] The use of different exposure metrics in the research about the health impacts of electromagnetic fields, CLUE-H Policy Brief, 2024, https://www.emf-health-cluster.eu/wp-content/uploads/2024/06/CLUE-H_First_Policy_Brief_DEF_approved.pdf



Separation distances alone for fixed transmitters are not a good proxy for actual RF-EMF levels in nearby communities (Neubauer et al., 2007[30]; Frei et al., 2010[31]). Indeed, the WHO-commissioned systematic review of RF-EMF and cancer excluded studies using measured distance from base stations as it is a '*poor indicator*' of exposure (Lagorio et al., 2021[32]). They also excluded studies '*based on self-estimated distance to an antenna … as self-reported distance to transmitters is strongly affected by risk perception*.'

Question 6: What scientific evidence exists about potential adverse health effects caused by current exposure limits?

Both the ICNIRP (2020) and IEEE ICES C95.1:2019 standard have documented the rationale for their recommended exposure limits and provide extensive lists of references. Most RF-EMF research in the last two decades has focused on levels at or below the limits in those standards. As noted above, the consensus of expert reviews is that there are no established health hazards below the limit values. However, a simple count of studies is of limited relevance, and it is important that study quality is assessed as it is known that low study quality is associated with finding effects in EMF studies (Simkó et al., 2025[33]).

[30] Feasibility of future epidemiological studies on possible health effects of mobile phone base stations, Neubauer et al., *Bioelectromagnetics*, 28(3):224–230, April 2007, https://doi.org/10.1002/bem.20298

[31] Classification of personal exposure to radio frequency electromagnetic fields (RF-EMF) for epidemiological research: Evaluation of different exposure assessment methods, Frei et al., *Environment International*, 36(7):714–720, October 2010, http://dx.doi.org/10.1016/j.envint.2010.05.005

[32] The effect of exposure to radiofrequency fields on cancer risk in the general and working population: A protocol for a systematic review of human observational studies, Lagorio et al., *Environment International*, 157:106828, December 2021, https://doi.org/10.1016/j.envint.2021.106828

[33] For example: '*The strong negative association between study quality (presently assessed in terms of RoB criteria) and the likelihood of reporting effects has an important implication for reviews of literature in this field: "vote counting", i.e. comparing numbers of positive vs. negative effects without attention to risk of bias and other quality issues, will yield unreliable and quite likely misleading results about the possible effects of RF-EMF on biological systems*.' In the Discussion section of Exposure to radiofrequency electromagnetic fields and IARC carcinogen assessment: Risk of Bias preliminary literature assessment for 10 key characteristics of human carcinogens, Simkó et al., *Mutation Research - Reviews in Mutation Research*, 796:108545, July–December 2025, https://doi.org/10.1016/j.mrrev.2025.108545. Here RoB means Risk of Bias, a low RoB means a higher quality study.

Question 7: What scientific methods are currently available for accurately characterizing individual and population-level RF radiation exposure?

Extensive measurement (for example, Bhatt et al., 2016[34]; Manassas et al., 2023[35]; Thielens et al., 2026[36]); calculation (for example, Liorni et al., 2020[37]); and recently machine learning (for example, Zhang et al., 2026[38]) approaches exist for RF-EMF characterizing exposure. Evaluation of RF-EMF environmental levels show that typical levels continue to be a small fraction of exposure limits (Iakovidis et al., 2022[39]; Beláčková et al., 2025[40]).

Beláčková et al., 2026[41] point out that '*personal RF-EMF exposure from mobile phones is strongly determined by the technology and the associated signal quality*' and that '*near field exposure represents the main contribution to overall brain dose in most situations*.' Their study showed that '*even a few minutes of calling under suboptimal signal quality conditions resulted in higher brain dose than 24 h environmental exposures.*'

It follows that policies that allow for the efficient deployment of mobile network antennas will support both better services for customers and lower RF-EMF levels from devices, the main source of personal exposure.

Question 8: What, if any, improvements in exposure assessment methodologies are needed to better evaluate real-world exposure conditions?

Please see the discussion in the papers that are cited in our response to question 7.

[34] Instruments to assess and measure personal and environmental radiofrequency-electromagnetic field exposures, Bhatt et al., *Australasian Physical & Engineering Sciences in Medicine*, 39(1):29–42, March 2016, http://dx.doi.org/10.1007/s13246-015-0412-z

[35] A study of the long term changes in the electromagnetic environment using data from continuous monitoring sensors in Greece, Manassas et al., *Scientific Reports*, 13(1):13784, 23 August 2023, https://doi.org/10.1038/s41598-023-41034-3

[36] Urban Radio-Frequency Electromagnetic Field Exposure in New York City, Thielens et al., *Environmental Research*, 125040, 17 June 2026, https://doi.org/10.1016/j.envres.2026.125040

[37] Evaluation of Specific Absorption Rate in the Far-Field, Near-to-Far Field and Near-Field Regions for Integrative Radiofrequency Exposure Assessment, Liorni et al., *Radiation Protection Dosimetry*, 190(4):459–472, July 2020, https://doi.org/10.1093/rpd/ncaa127

[38] ExposNet: A Deep Learning Framework for EMF Exposure Prediction in Complex Urban Environments, Zhang et al., *IEEE Transactions on Machine Learning in Communications and Networking*, 4:1229–1243, 17 July 2026, https://doi.org/10.1109/TMLCN.2026.3714431

[39] Electromagnetic Fields Exposure Assessment in Europe Utilizing Publicly Available Data, Iakovidis et al., *Sensors*, 22(21):8481, 4 November 2022, https://doi.org/10.3390/s22218481

[40] Temporal Change of Outdoor RF-EMF levels in four European Countries: a Microenvironmental Measurement Study, Beláčková et al., *Environmental Research*, Part 1(122315, 15 November 2025, https://doi.org/10.1016/j.envres.2025.122315

[41] RF-EMF brain dose from mobile phones and the role of reception quality – a simulation study using the ETAIN 5G Scientist App, Beláčková et al., *Environmental Research*, 309:125736, 15 November 2026, https://doi.org/10.1016/j.envres.2026.125736

Question 9: What, if any, technical and exposure-related information should be disclosed to consumers, residents, workers, schools, healthcare providers, and local governments?

The information on RF-EMF levels provided to different groups varies by countries (Dhungel et al., 2015[42]). The level of understanding and the influence on risk perception of providing RF-EMF exposure information is generally unclear, but there is evidence that precautionary advice increases concern (Boehmert et al., 2020[43]).

Question 10: What data sources or surveillance systems currently exist to monitor potential adverse health effects associated with RF radiation exposure?

The rationale for establishing a specific health surveillance system for adverse effects of RF-EMF exposure is lacking as the consensus of experts is that there is an absence of evidence for adverse health effects at levels below current RF-EMF exposure limits. Reported symptomatic complaints at RF-EMF below guideline levels are linked to prior beliefs and not RF-EMF exposure (Bosch-Capblanch et al., 2024[44]; Röösli et al., 2024[45]).

Authorities in Australia operated a Health Complaints Register from 2003 to 2022 when it was closed after gathering only 180 complaints. The alternative Talk to a Scientist programme operating since 2026 responded to over 6,546 enquires up to August 2022 and is regarded by the Australian authorities as '*much more successful*' (Brzozek et al., 2023[46]).

In Switzerland, the MedNIS[47] service operated with the Institute of Family Medicine at the University of Friborg commenced in 2022 and is funded to 2027. MedNIS allows self-declared electrosensitive people to request a specialist consultation with the agreement of their family doctor. The annual report for 2025 shows that 20 consultations were carried out, lower than in the previous year.

In the UK, the National Register of RF Workers cohort allows for studies of potentially adverse health outcomes from occupational RF exposure. A preliminary analysis of cancer incidence in the cohort found '*no cases of malignant brain tumours or an excess of leukaemia (significant or otherwise), both*

[42] See above for full citation.
[43] A systematic review of health risk communication about EMFs from wireless technologies, Boehmert et al., *Journal of Risk Research*, 23(5):571–597, May 2020, https://doi.org/10.1080/13669877.2019.1592211
[44] The effects of radiofrequency electromagnetic fields exposure on human self-reported symptoms: A systematic review of human experimental studies, Bosch-Capblanch et al., *Environment International*, 108612, May 2024, https://doi.org/10.1016/j.envint.2024.108612
[45] The effects of radiofrequency electromagnetic fields exposure on tinnitus, migraine and non-specific symptoms in the general and working population: a systematic review and meta-analysis on human observational studies, Röösli et al., *Environment International*, 108338, January 2024, https://doi.org/10.1016/j.envint.2023.108338
[46] Community engagement programs on radiation and health: addressing public concerns, Brzozek et al., *Public Health Research & Practice*, 33(3):e3332325, 13 September 2023, https://doi.org/10.17061/phrp3332325
[47] https://www.mednis.ch/de/koordinationsteam-institut-fuer-hausarztmedizin-der-universitaet-freiburg

are cancer sites previously linked with RF,' however, there was an '*excess*' of skin cancer that is '*highly likely*' due to UV exposure (Litchfield, 2026[48]).

Question 11: Should exposure assessment or risk evaluation differ for sensitive populations such as those noted below?

The international RF-EMF limits set out in the ICNIRP (2020)[49] guidelines are intended to provide protection for all people and they do not identify any 'sensitive populations' requiring additional protection:

> *'... provide a high level of protection for all people against substantiated adverse health effects from exposures to both short- and long-term, continuous and discontinuous radiofrequency EMFs.'*

The ICNIRP RF-EMF exposure guidelines include different limits for workers and the public. The limits included reduction factors and are set at levels the threshold for established health hazards. ICNIRP[50] explains:

> *'Consistent with previous guidelines from ICNIRP, reduction factors were then applied to the resultant thresholds (or operational thresholds) to provide exposure restriction values. Reduction factors account for biological variability in the population (e.g., age, sex), variation in baseline conditions (e.g., tissue temperature), variation in environmental factors (e.g., air temperature, humidity, clothing), dosimetric uncertainty associated with deriving exposure values, uncertainty associated with the health science, and as a conservative measure more generally.'*

As noted above the FCC limits provide similar levels of protection to the ICNIRP guidelines.

See also our response to question 10 regarding claims for the existence of sensitive populations.

Question 12: What scientific evidence exists regarding potential adverse health effects associated with RF radiation exposure at levels below current federal exposure limits?

See our response to Question 6.

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[48] Cancer incidence in telecommunication and broadcasting workers in the United Kingdom: Preliminary analysis of the National Register of RF Workers, Litchfield, *International Journal of Hygiene and Environmental Health*, 274(114785, May 2026, https://doi.org/10.1016/j.ijheh.2026.114785

[49] p. 483 in ICNIRP (2020), see above for full reference. ICNIRP says that medical procedures and metallic implants are outside the scope of the guidelines '*As medical procedures rely on medical expertise to weigh potential harm against intended benefits, ICNIRP considers such exposure managed by qualified medical practitioners*.' Also excluded are volunteer research participants due to oversight of ethics committees; and the ICNIRP (2020) guidelines do not deal with electromagnetic compatibility matters as these are subject of other standards.

[50] p. 484 in ICNIRP (2020), see above for full reference.



Question 13: According to scientific evidence, how do the technologies below affect cumulative exposure patterns?

In our response to question 5.p (above) we explained why scientists say that there are no '*cumulative exposure patterns*' in terms of accumulated exposure over time, but there can be simultaneous exposure from several RF-EMF sources. RF-EMF exposure in smart homes involving internet of things (IoT) devices is a small fraction of public limits (Joyner et al., 2024[51]). This is also shown in measurements of smart meters and other residential RF sources (Aerts et al., 2019[52]). Changes in the mix of RF-EMF technologies in Switzerland between 2014 and 2021 did not significantly change levels (Loizeau et al., 2023[53]).

See our response to Question 7 regarding other studies of RF-EMF exposure trends.

Question 14: What scientific evidence exists regarding potential adverse environmental effects associated with RF radiation?

A systematic evidence map of research on possible flora and fauna impacts of anthropogenic RF-EMF exposure produced by Australian[54] authorities found that '*the majority of the studies were methodologically poor*' and recommends further research. A related Australian review of RF-EMF effects on flora and fauna showed that poor quality studies were more likely to report effects and called for high-quality research (Brzozek et al., 2024[55]).

The position of Australian[56] authorities is that '*an assessment of existing research indicates that the exposure limits set within the Standard are adequate in providing protection to the environment*.' Australia applies RF-EMF limits based on ICNIRP (2020).

[51] Estimates and measurements of radiofrequency exposures in smart-connected homes, Joyner et al., *Bioelectromagnetics*, 45(7):329–337, October 2024, https://doi.org/10.1002/bem.22518
[52] Emissions from smart meters and other residential radiofrequency sources, Aerts et al., *Health Physics*, 116(6):776–788, June 2019, https://doi.org/10.1097/hp.0000000000001032
[53] Comparison of ambient radiofrequency electromagnetic field (RF-EMF) levels in outdoor areas and public transport in Switzerland in 2014 and 2021, Loizeau et al., *Environmental Research*, 237:116921, 15 November 2023, https://doi.org/10.1016/j.envres.2023.116921
[54] What evidence exists on the impact of anthropogenic radiofrequency electromagnetic fields on animals and plants in the environment: A systematic map. Karipidis et al., *Environmental Evidence*. 12(1):9. 11 May 2023, https://doi.org/10.1186/s13750-023-00304-3
[55] Investigating the impact of anthropogenic radiofrequency electromagnetic fields on animals and plants in the environment: analysis from a systematic map, Brzozek et al., *International Journal of Environmental Studies*, 81(5):2343–2358, 2024, https://doi.org/10.1080/00207233.2024.2375861
[56] ARPANSA (Australian Radiation Protection and Nuclear Safety Agency) is the primary authority on radiation protection and nuclear safety for the Federal government. ARPANSA adopted ICNIRP (2020) based limits in 2021, https://www.arpansa.gov.au/regulation-and-licensing/regulatory-publications/radiation-protection-series/codes-and-standards/rpss-1-qa#the-environment-animals-and-plants

The conclusion of the report of the German Federal Office for Radiation Protection (BfS) international workshop "Environmental effects of electric, magnetic and electromagnetic fields: flora and fauna" held in Munich, 5 – 7 November 2019 for frequencies above 100 MHz is that (Pophof et al., 2026[57]):

> *'The results presented at the workshop did not show any sound scientific evidence of adverse effects of low-level anthropogenic RF-EMFs at frequencies exceeding 100 MHz on animals or plants under realistic environmental conditions. Extrapolations from laboratory animal studies, often performed at higher exposure levels, do not allow conclusions on ecological effects of RF-EMFs at low levels. Field studies of an appropriate quality are scarce in both animals and plants and so far do not show clear evidence supporting adverse effects of RF-EMFs. Some correlations between RF-EMFs and adverse biological effects were observed, but bias and confounding factors cannot be excluded. If the effects of weak RF-EMFs were confirmed independently by high quality studies, a logical next step would be to seek the corresponding biophysical mechanism(s).'*

It is the position of German[58] authorities that '*according to the current state of scientific knowledge, the recommendations established for the protection of humans also provide protection for animals and plants.*'

There is evidence[59] from laboratory studies that low frequency RF-EMF (below 116 MHz) may affect the navigation of some bird species but not at higher RF frequencies.

It has been pointed out by Indian[60] researchers that ecological changes (such as the impact of urbanization on habitat) are more likely explanations than RF-EMF for reported observations of declines in bird numbers in urban areas.

Question 15: What types of scientific evidence should be considered when evaluating RF exposure associated with wireless infrastructure?

Evaluations should be based on assessments of RF-EMF levels relative to existing national exposure limit requirements.

See also our responses to questions 5.o; 5.p; 9; 11; 13; and 14.

[57] Biological Effects of Radiofrequency Electromagnetic Fields above 100 MHz on Fauna and Flora: Workshop Report, Pophof et al., *Health Physics*, 124(1):31–38, January 2023, https://dx.doi.org/10.1097/HP.0000000000001625

[58] https://www.bfs.de/EN/topics/emf/competence-centre-emf/reports/reports-emf/living-environment.html

[59] Upper bound for broadband radiofrequency field disruption of magnetic compass orientation in night-migratory songbirds. Leberecht et al., *Proceedings of the National Academy of Sciences*. 120(28):e2301153120. 3 July 2023, https://doi.org/10.1073/pnas.2301153120

[60] Correlation does not imply causation: decline of house sparrow overshadowed by electromagnetic radiation, Nath et al., *Urban Ecosystems*, 25(1279–1295, August 2022, https://doi.org/10.1007/s11252-022-01227-6

Question 16: What are the highest priority research gaps regarding EMF and RF radiation and public health that the federal health agencies should address?

See our response to question 5.o.

Conclusion

In conclusion, I restate the GSMA view is that based on the consensus of expert reviews by the WHO, European Commission, and national bodies there are no established human health risks or impacts on flora or fauna of RF-EMF levels up to the limits defined in the international guidelines of ICNIRP and IEEE ICES. The US Federal RF exposure limits mandated by the Federal FCC provide a similar level of protection.

The HHS follow-up to responses received during this RFI should be based on the consensus of authoritative reviews and the weight of peer-reviewed scientific evidence.

GSMA remains available to provide additional information in support of this RFI response.

Yours sincerely,



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GSMA