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The European Union assessments of radiofrequency radiation health risks – another hard nut to crack (Review)

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Abstract

In 2017 an article was published on the unwillingness of the WHO to acknowledge the health effects associated with the use of wireless phones. It was thus stated that the WHO is 'A Hard Nut to Crack'. Since then, there has been no progress, and history seems to be repeating in that the European Union (EU) is following in the blind man's footsteps created by the WHO. Despite increasing evidence of serious negative effects from radiofrequency radiation on human health and the environment, the EU has not acknowledged that there are any risks. Since September 2017, seven appeals by scientists and medical doctors have been sent to the EU requesting a halt to the roll-out of the fifth generation of wireless communication (5G). The millimeter waves (MMW) and complex waveforms of 5G contribute massively harmful additions to existing planetary electromagnetic pollution. Fundamental rights and EU primary law make it mandatory for the EU to protect the population, especially children, from all kinds of harmful health effects of wireless technology. However, several experts associated with the WHO and the EU have conflicts of interest due to their ties to industry. The subsequent prioritizing of economic interests is resulting in human and planetary health being compromised. Experts must make an unbiased evaluation with no conflicts of interest. The seven appeals to the EU have included requests for immediate protective action, which have been ignored. On the issue of wireless radiation and the health of citizens, the EU seems to be another hard nut to crack.

Keywords: electromagnetic fields; European Union; health risks; Human Rights; precautionary principle; wireless EMF guidelines

Introduction

The 5G appeal regarding the next generation for wireless communication [1] has been endorsed by 430 scientists and MDs [2] and sent to the EU seven times. These appeals have requested the EU to take appropriate measures to protect humans and the environment from the harmful effects of electromagnetic fields used for wireless communications (wireless EMF). The first appeal was sent in September 2017. The most recent 7th Appeal was sent to the EU January 12, 2023 [3]. Unfortunately, there has not been any positive response from the EU to this latest submission or any subsequent preventive measures put in place.

Politicians seem to have set their course for deployment of this technology, regardless of detrimental effects. In an email dated January 30, 2023 by Ralph Kuhne regarding the 7th Appeal and on behalf of Ms Stella Kyriakides, Commissioner for Health and Food Safety, it was stated that: *We take note of your position on the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and on the Scientific Committee on Health, Environmental and Emerging Risks – SCHEER (previously SCENHIR). However, we must recall that these bodies are well recognised at national and international level for their scientific excellence and independence from commercial, national, and vested interests.* In the following sections of this paper we discuss the legal aspects of this reply, as well as the updated science on this issue.

EU decision-makers are mandated to protect the EU population, especially children, from all kinds of harmful health effects, including those from wireless technology. Such mandates are given in The European Convention of Human Rights [4], The Charter of Fundamental Rights [5], primary law [6] and case law from the European Court of Justice. Table 1 summarizes the main EU policies and statements that are being violated by the unfettered rollout of 5G, based on the blind adherence to ICNIRP guidelines.

Table 1:

EU Rights, principles and statements violated in the rollout of wireless communications technology.

Law/charter/principle	Rights/principles/statements
The consolidated version of the Treaty on the Functioning of the European Union (**TFEU**) [6, 64]	**Article 3(o)** The objectives of the Community include *'a contribution to a high level of health protection'.* ***Article 168 (Public Health)*** *A high level of human health protection shall be ensured in the definition and implementation of all Union policie*
Charter of fundamental rights of the European Union (2012/C 326/02) [5]	**Article 3 Right to the integrity of the person** 1. Everyone has the right to respect for his or her physical and mental integrity. 2. In the fields of medicine and biology, the following must be respected in particular: (a) The free and informed consent of the person concerned, according to the procedures laid down by law; **Article 8 Protection of personal data** 1. Everyone has the right to the protection of personal data concerning him or her. 2. Such data must be processed fairly for specified purposes and on the basis of the consent of the person conce **Article 31 Fair and just working conditions** 1. Every worker has the right to working conditions which respect his or her health, safety and dignity
European Convention on Human Rights [4]	**Article 1** Obligation to respect Human Rights
United Nations General Assembly Convention on the Rights of the Child [97]	**Article 3** 1. *In all actions concerning children, whether undertaken by public or private social welfare institutions, courts c*
EU ITRE committee 2019 in-depth analysis, *5G Deployment: State of Play in Europe, USA and Asia* [62]	*Complex beam formed signals have unpredictable propagation patterns that could result in unacceptable levels c*
2021 EPRS/STOA *Health impact of 5G* report [63]	Sufficient evidence for cancer from wireless EMF in animals, sufficient evidence for adverse effects from wireless E
EU Energy Efficiency Action Plan [94]	*… the 2020 20% energy efficiency target as agreed by the June 2010 European Council, which is presently not on tr*
European Green Deal [95]	*… protect the health and well-being of citizens from environment-related risks and impacts … must be just and inc*
Application of The EU Treaty into EU Case law	**Mad Cow Disease Case 157/96**, ***National Farmers Union*** [105], paragraph 22: *public health requirements are indiv* **Case 183/95** ***Affish*** [104], paragraph 43 and **Case 136/95** ***Industria del Frio Auxiliar Conservera*** [106], paragraph 58 *the protection of public health which the contested decision is intended to guarantee must take precedence over*

Since 2017, the world has not seen any evidence of the EU prioritizing human health protection over economics. In the seven replies to the 5G Appeals there has not been any clear recognition of the need to adhere to the EUs foundational principles. Instead, The EU has continued to consider the flawed International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines as protective of human and environmental health, including children and the most vulnerable. The EU refuses to accept or to even investigate the possibility that these advisory groups are inappropriately limited in their scope. The history of EU responses to consecutive 5G Appeals has been published in recent reviews [7, 8].

The EU continues to refer to the ICNIRP guidelines because ICNIRP was previously endorsed by Council Recommendation 1999/519/EC [9] as the EU's main external advisory group concerning wireless EMF protection. At that time, in the face of thousands of studies stating the contrary, ICNIRP and Council Recommendation 1999/519/EC denied that there was enough scientific evidence of non-thermal, biological effects to warrant government intervention. Given the state of play of independent science today, there are increasing questions about the continued legality of Council Recommendation 1999/519/EC when compared with EU EMF-health protection policy in general and with EU primary law.

ICNIRP guidelines are an inadequate basis for EU policy

There is now clear evidence that the ICNIRP guidelines are not an adequate scientific basis for EU policy regarding wireless electromagnetic fields (EMF). ICNIRP guidelines have been shown to be flawed by several scientists [10], [11], [12], [13]. Two recent ICBE-EMF reviews [14, 15], made by 14 prominent scientists and based on 230 and 144 scientific sources respectively, speak to the weakness of the thermal hypothesis on which the current guidelines are constructed. The consistent message from all of these industry-independent scientists is that current radiation guidelines for cell phones and other wireless equipment are totally inadequate.

On top of this, 258 Scientists in the EMF Scientists Appeal [16] attest that ICNIRP guidelines do not protect human health against the types of everyday exposures to which citizens are exposed. In addition, 430 scientists and medical doctors have endorsed the 5G Appeal. All have asked the EU to apply the Precautionary Principle in such a way that EU policy takes into account effects that are due to heating (thermal) as well as detrimental effects due to other biophysical and biochemical processes (non-thermal). More urgently, a recent review of the literature [17] identifies serious physical, mental and behavioural health risks for the current generation of children, who are exposed from before birth to a continuous array of wireless EMF signals from baby monitors, smart phones, tablets, wearables and other wireless devices. The article calls for the ALARA principle (As Low As Reasonably Achievable) to be adopted for the protection of children.

The acknowledgement of harmful non-thermal biological effects has been increasingly supported by a number of successful lawsuits in USA [18], Germany [19], Italy [20] and elsewhere in the European Union, which have recognised that mobile communication causes several kinds of harmful effects such as acoustic neuroma in people exposed to cell phones.

Evidence of harm from wireless EMF provided to EU

The European Commission has been provided with several thousand scientific studies revealing a range of harmful effects caused by everyday levels of wireless EMF, which sit far below the ICNIRP guidelines. Earlier 5G appeals have referred to thousands of peer-reviewed research reports [21], [22], [23], [24], [25], [26], and over 100 extensive research reviews [27], showing harmful effects from wireless EMF well below ICNIRP limits. BioInitiative colour charts [21] list negative biological effects found at levels more than one million times below ICNIRP guidelines. Evidence of these effects clearly contradicts the ICNIRP and EU position.

Given all the evidence presented to the European Commission since 2017, the EU has been advised beyond any doubt that radiofrequency radiation not only causes tissue heating, as ICNIRP claims, but many other serious biological effects far below ICNIRP's tissue heating thresholds. Such harmful effects include oxidative stress, as demonstrated in a review of 93 of 100 available studies [28] and in a review of animal and cell studies [29], damage to DNA [30], heart and blood [31], sperm [32], brain cells [33] and cancer [34], [35], [36], [37]. Note that these effects have been explained by mechanisms other than heating, e.g., disruption of voltage gated calcium (and other) channels in cells [38], reactive oxygen species, and changes in cell signaling. All of this was recently, yet again, stressed in a recent article by the International Commission on the Biological Effects of EMF [14], demonstrating that the ICNIRP guidelines are obsolete.

The EU has also been advised that the current wireless EMF exposures, at levels far below the ICNIRP guideline, are presenting a serious threat to the environment and to everything that lives, including plants [39], trees [40], birds and bees [41, 42], insects [43], [44], [45], mammals [46], rats [47, 48] and cows [49].

Complex real-world exposures not addressed by ICNIRP

Earlier 5G Appeals have consistently clarified how ICNIRP guidelines do not relate to the everyday exposures experienced by EU citizens. Real world radiofrequency signals are complex combinations of many simultaneous frequencies. They are totally polarised, pulsed and modulated at frequencies that have been shown to be extremely bioactive. Pulsed radiating sources can aggregate to instantaneous values that can be thousands of times higher than values averaged over 6 or 30 min [50]. None of these complexities are addressed by the ICNIRP guidelines [51]. Only average radiation values, calculated over 6 or 30 min of heating of liquid in a plastic phantom head [52], are considered. ICNIRP guidelines consider radiation from only one source during some minutes, but not the total radiation from all simultaneous radiating sources during months and years. This is in stark contrast with current exposures, where the radiation to human tissue starts before conception (affecting genes in sperm and egg cells) and continues every day until death. Additionally, the greater penetration of radiation into children's brains is not considered in this testing [53]. ICNIRP guidelines thus do not address real world scenarios experienced each day by the general public. For these reasons, ICNIRP guidelines cannot be deemed protective of public health.

5G science consistent with previous wireless EMF science, warning the EU of harm

Although there is a limited number of studies on health effects from the new 5G MMW technologies; e.g. on skin [54], the existing papers are suggesting harm [55]. Furthermore, biological harm has already been established. Two extensive scientific reviews from over 20 years ago found that: *Profound MMW effects were established at all biological levels, from cell-free systems through cells, organs, and tissues, to animal and human organisms* [56] (p. 409) and that: *The experimental data provided strong support for nonthermal MMW effects …* [that] *depend on a number of physical, physiological, and genetic parameters.* [57] (p. 2177).

More recently, three case studies on health effects from exposure to RF microwave radiation from 5G base stations have been published [58], [59], [60]. All three studies showed that the study persons rather rapidly developed symptoms known as *the microwave syndrome* or *microwave illness* after the installation of 5G base stations close to their apartments or offices. Spot measurements showed that the deployment of 5G caused very high peak levels of microwave radiation in the study persons' dwellings. Their health symptoms rapidly declined and were alleviated after moving to places with no 5G base station exposure. After returning to the initial place with 5G exposure their symptoms reappeared. The conditions in these studies seem to be similar to those of a classical provocation study with clearly positive results; i.e., where the onset and offset of symptoms mirrors the onset and offset patterns of the individual's trigger exposure signals, but when the individual is not consciously aware of the exposures, nor expecting any particular effect from them.

Altogether, there is now a red flag from the MMW literature sitting on top of the mountain of scientific evidence showing harmful effects from previous generations of mobile phone technology, as described above. Together this evidence is alerting governments to the need for protective policy and active risk reduction. As concluded in the Nordic Appeal, *More stringent regulatory framework on microwave radiation from wireless technologies is urgently needed. In the meantime, further rollout of 5G must be stopped* [61]. The EU appears to be blinded to these warning messages.

Industry-independent scientists sounding the alarm have observed, on the one hand, a consistent adherence by the EU to the questionable guidelines provided by ICNIRP, and on the other hand, a consistent dismissal of the EU's own internally commissioned reports [62, 63], and of the advice of hundreds of independent scientists [1, 2, 16] whenever they contradict the ICNIRP narrative. This conduct violates European primary law [64] and it constitutes a serious crime against humanity.

Conflicts of interests in ICNIRP and SCENIHR

Two prominent EU government advisory bodies ICNIRP and SCENIHR [65] have been compromised towards promoting industry interests instead of the public interest. Two EU parliamentarians, Rivasi and Buchner have published a documented account of ICNIRP as being captured by industry and having a questionable ability to provide trusted leadership on wireless EMF and health [66].

ICNIRP is a self-selected, industry supportive body comprised of only 14 persons with limited biophysics or medical training, and no industry-independent views. Its members elect like-minded colleagues ensuring the perpetuation of the wireless industry's need for maximum exposure guidelines [51]. ICNIRP exposure guidelines are a million times too high to protect children and our most vulnerable. By following the ICNIRP guidelines, the EU has effectively prioritized economics, even though the EU Treaty and primary law lay down that protection of health must take precedence over economic gain. Indeed, the EU has failed to take action against the telecommunications and wireless industry whose phones and other products exceed the allowed, unrealistically high SAR values [67, 68] set by ICNIRP. EU has supported industry products and standards, irrespective of the health and environmental consequences. To remedy the situation, we suggest that industry admits to violations and health effects from exposures lower than ICNIRP limits, and to trust that this admission would not severely limit economic growth. Rather, the telecommunications industry would flourish even under much stricter exposure limits. However, it would need to achieve this goal in a smarter way.

In 2020, ICNIRP issued new limits (or guidelines), that allowed for even higher exposure of microwave radiation [51], in striking contrast to the demands of the majority of field scientists [10], [11], [12], [13, 66, 69, 70].

In the same year, the chair of ICNIRP at the time, Eric van Rongen, claimed that: *people need to remember that the 5G technologies will not have any negative impact if the new guidelines are followed* [71] and that: *The most important thing for people to remember is that 5G technologies will not be able to cause harm when these new guidelines are adhered to* [72]. Such statements are not consistent with the scientific evidence, and mislead both the public and government decision makers. In continuing to follow the distorted ICNIRP opinion, the EU infringes its Charter of Fundamental Rights [5], and primary law.

SCHEER is misleading EU

Soon after the new ICNIRP guidelines were announced, the EU Commission asked its expert group SCHEER if there was a need for a revision of the Council Recommendation 1999/519/EC annexes and of the annexes of Directive 2013/35/EU *in view of the latest scientific evidence available, in particular the ICNIRP guidelines updated in 2020 with regard to radio frequency (100 kHz to 300 GHz).* Notably, during the formation of the SCHEER expert group, none of the vast majority of experts who agree that ICNIRP guidelines are insufficient for the protection of human health were invited. The SCHEER presented a preliminary Opinion in August 2022 [73] that advised positively on the adoption of the ICNIRP 2020 guidelines, concluding that: *The SCHEER could not identify moderate or strong level of evidence for adverse health effects resulting from chronic or acute RF EMF exposure at levels below the limits set in the annexes of Council Recommendation 1999/519/EC and Directive 2013/35/EU. The SCHEER advises positively on the need of a technical revision of the annexes in Council Recommendation 1999/519/EC and Directive 2013/35/EU with regard to radiofrequency electromagnetic fields (100 kHz to 300 GHz), because there is a need to recognize the recently introduced dosimetric quantities and establish limits for them* (p. 2).

It seems that the positive advice on the 2020 ICNIRP guidelines was a predetermined outcome as a consequence of the selected experts. A report prepared by two EMF NGO organizations [74] concluded that *the SCHEER Opinion is biased and appears to be designed to find no risks and to greenlight the adoption of exposure limits that benefits industry …* and that *… the SCHEER working group members belong to a small self-referencing circle of no-risk pro-ICNIRP advocates, with ties to the telecom industry. The SCHEER panel does not meet the basic requirement for risk assessors: The SCHEER methodology for assessing the scientific evidence is insufficient, severely biased, and unscientific. A central thread throughout the SCHEER report is the manufacture of doubt about harmful effects instead of an objective assessment of the science* (p. 5).

The manufacture of doubt seems to be a common theme when regulators such as ICNIRP, SCHEER and the WHO are discussing the evidence linking wireless EMF exposures to health. Distorting official communications using logical fallacies leads to false conceptions such as the assumption of safety [55]. It is the responsibility of SCHEER and ICNIRP to ensure that their communications are truthful and unable to be misconstrued by the public or by policy makers.

EU is condoning an unethical mass experiment

Over the past five years, the EU has relied on fraudulent and biased science from ICNIRP, SCENIHR, and SCHEER. Faced with over 100 scientific reviews and thousands of peer-reviewed articles to the contrary, these groups continue to claim that no conclusive evidence has been found of harmful health effects occurring below tissue heating power densities.

The EU's adoption of the ICNIRP guidelines has given operators and producers of digital equipment the right to expose all citizens including children to continually increasing harmful radiation, without being certain of the outcomes of this exposure. This is equivalent to conducting a mass experiment with serious health consequences, without gaining consent from the experimental subjects. That is a crime against the EU Charter of Fundamental Rights [5] and the Nuernberg Code [75], which requires that, *before the acceptance decision by the experimental subject, there should be made known to him the nature … of the experiment … all inconveniences and hazards … and the effects upon his health or person, which may possibly come from his participation in the* [5G] *experiment… During the course of the experiment the human subject should be at liberty to bring the experiment to an end if he has reached the physical or mental state where continuation of the experiment seems to him to be impossible.* This principle of informed consent forms the basis of the International Ethical Guidelines for Biomedical Research Involving Human Subjects and has been adopted by the World Health Organisation [76]. By accepting the EU Council Recommendation 1999/519/EC which relies on the ICNIRP guidelines the EU is infringing several laws and international recommendations as shown in Table 1.

Safe, energy efficient alternatives exist

Earlier 5G Appeals have provided recommendations for alternative and accessible technologies such as the use of appropriately wired[1] cable and fiber connections (as proposed in the ERPS/STOA report [63]). Such innovations are readily available and provide far superior speed, reliability, health protection and data security. Wired internet speeds are 100 times faster than typical wireless connections [77], and much more energy efficient.

The 5G rollout requires three times more base stations than the existing number and a typical 5G base station uses 2–3 times more power than a 4G base station according to China Mobile [78] and Huawei [79].

Wireless streaming via the cloud is a main contributor to current energy consumption, with an estimated growth rate of 4–5 times from 2012 to 2015 [80]. For example, using a tablet or phone *to watch an hour of video weekly consumes annually more electricity in the remote networks than two new refrigerators use in a year* [81] (p. 3), and one Google search uses as much electricity as a lightbulb left on for 35 min [82]. Streaming increased during the coronavirus pandemic by 30 percent [83].

The best alternatives are Passive Optical Networks (PON) because they are the fastest and least energy consuming technology available today, using nearly 50 times less energy than UMTS/3G and about 6 times less energy than LTE/4G [83, 84]. An article published by the Institute of Electrical and Electronics Engineers (IEEE) predicted that by 2030, wireless networks will continue to consume 10 times more power than wired networks, with PON being the most energy efficient [84]. PON therefore provides a vastly superior alternative to the current wireless methods which are continuously increasing the levels of planetary energy consumption and electromagnetic pollution [85]. It could therefore be worthwhile to "reinvent wires" as suggested by Schoechle [77] and use appropriate wiring and fiber optics instead of irradiating humans, children and the environment.

Smart utility meters need to be wired

Signals from smart meters [86] have been shown to be harmful for health [87]. A single smart meter emitting intensities below the ICNIRP limits can create sleep, heart, immune system and reproduction problems, and lead to DNA damage, oxidative stress and cancer [88]. Nevertheless, according to the EU Directive 2018/2002 [89] remotely readable utility meters for water and electricity consumption are required in all apartments. They can be wired or wireless. While there is variation across smart meters, some send a series of pulses every second i.e., about 83,100 series per day [86], making 2.49 million per month. Why such an exorbitant number of signals are sent is hard to fathom, given that one meter reading per month is all that is necessary for invoicing consumers. An apartment building can have over 100 water meters, each of which can radiate as much wireless EMF as 160 cell phones [90]. Thus, a full apartment house set of smart meters in a "mesh network" produces immense wireless EMF, which can cause many harmful health effects [91]. To prevent such harm, governments need to mandate that all utility meters should be appropriately wired.[2]

Wired meters prevent household data from being misused, consistent with the intent of Directive (EU) 2018/2002 [89], to *promote cybersecurity and ensure the privacy and data protection of final users in accordance with applicable Union law* (Article 10a, 2 (d)). Furthermore, the EU GDPR [92] regulation lays down that sending any information that relates to an identifiable natural individual can infringe the data protection of the individual, which can occur when sending wireless in all directions. The EU directive 2002/58/EC [93] demands that service providers *must secure their services by at least – ensuring that personal data are accessed by authorised persons only;* and *must ensure the confidentiality … – prohibit the listening, tapping, storage or any type of surveillance.* However, such assurance of data privacy is only possible if data transmission is over wired connections. Privacy cannot be guaranteed when data is sent over wireless.

EU Green Deal compromised by wireless deployment

The EU Energy Efficiency Action Plan [94] declares: *The European Council … 2011 emphasised that the 2020 20% energy efficiency target as agreed by the June 2010 European Council, which is presently not on track, must be delivered.* We assert that the goals of the Energy Efficiency Action Plan cannot possibly be realised if the EU continues to waste energy on the infrastructure and operation of billions of wireless connections, which can just as easily be wired. The wired alternatives described above make it obvious that wireless is no green deal, but rather, a senseless waste of energy. On top of that, all wired meter consumption readings could be requested by the managing director only and exactly when they are needed, which would save lots of energy and would be safer for avoiding surveillance and ensuring the inhabitant's privacy, as required by law.

The President of the Commission has made the European Green Deal the top political priority. It aims *to protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts. At the same time, this transition must be just and inclusive. It must put people first …* [95]. We assert that the health and privacy of the people, as well as the stability of the environment are all in dire jeopardy if the strategy that the EU adopts for ostensibly conserving energy is ubiquitous wireless connectivity, including smart utility meters. Indeed, Kostoff et al. [96] warn that the effects of multipe sources have not been considered: *Neither 4G nor 5G have been tested for safety in credible real-life scenarios. Alarmingly, many of the studies conducted in more benign environments show harmful effects from this radiation* (p. 35–36) *… When real-life considerations are added …. the adverse effects associated with wireless radiation are increased substantially* (p. 38–39).

Fundamental rights, new policy needed

As a result of the increased consumption of energy, the harm to people and the environment, and the potential misuse of data, we consider current EU policy to grossly infringe EU primary law and citizens' and children's fundamental rights [97]. It also infringes EU promises of energy savings as well as the EU Council's top priority: "a Green Deal".

Table 1 summarises how, over the last decade, the EU has infringed its own and international laws and ignored its own commissioned reports. It has ignored its obligation to protect people physically and mentally, to protect children from potential harm, and to provide safe working conditions. The EU has prioritised convenient wireless smart meter connections over the need to protect private data and the need to protect the bodies and minds of adults and children. It continues to prioritise wireless technologies in spite of the increases in energy burden and the existence of safe wired energy saving alternatives. It has ignored its obligations to provide citizens with the information they need to make informed choices about their use of technologies. Furthermore, the EU has condoned mobile phone testing that does not reflect real life exposures, and has failed to take appropriate action against companies whose phones violate the ICNIRP guidelines for head exposures [67].

These failings have all stemmed from the EU illegitimately deferring its responsibility to three small committees, ICNIRP, SCENIHR and SCHEER, that are made up of the same people who support industry interests. The EU has thus allowed higher and higher levels of radiation into the environment, which are potentially harmful to humans, animals, insects and plants. In contradiction to EU Treaty and laws, EU officials give precedence to economics instead of health and environmental protection.

In order to avoid legal action because of breaking the EU Treaty, EU GDPR, EU energy goals and demands for health and environmental protection, and on behalf of all EU citizens, we invite EU institutions to immediately pay attention to reports independent of industry; e.g. the report from The Commission to Study The Environmental and Health Effects of Evolving 5G Technology to the General Court of New Hampshire [98] as well as the warmings that have been given outside of ICNIRP and SCHEER, as summarised above. Then, take measures to ensure that EU policy protects not only against short-term heating but also against all long-term biological effects; i.e., by drastically reducing the exposure of plants, insects, animals, and humans (especially children) to wireless EMF.

This involves notably the following actions:

1. Basing policy on truly industry-independent science and scientists;
2. Establishing EU scientific committees that are fully independent from industry;
3. Revoking Council Recommendation 1999/519/EC [9] and replacing it with a new legal instrument that fully takes into account the long term, non-thermal, biological effects of wireless EMF, as stressed in Resolution 1815 of the Council of Europe and numerous other recommendations by various international governing bodies and hundreds of independent scientists;
4. Drastically sharpening both the meaning and the application of the Precautionary Principle to wireless EMF to arrive at EU guidelines that are health and environment-centered, with primary consideration for the wellbeing of humans, plants, insects and animals;
5. Re-interpreting Directive EU 2018/1972 to include full protection of humans, especially children against all long-term biological effects from wireless EMF (not only 6–30 min heating) thereby aligning this directive with EU primary law, fundamental rights and the Nuremberg Code [75].
6. Stipulating that data transmission from utility meters (i.e., water, gas, and electricity) must be appropriately wired and transmissions allowed only when necessary for consumer invoicing (maximum one per month).

Towards a health protective and energy saving EU policy

The EU must respect the EU Charter of Fundamental Rights [5] and EU primary law, which consistently point to the importance of public health and environmental protection as a prime policy imperative. Based on a correct reading of the Precautionary principle [99] and other principles of EU law we ask the EU to impose a moratorium on the 5G roll-out, because it causes massively harmful additions to existing planetary electromagnetic pollution [26].

New EU policy that takes full account of long term, non-thermal biological effects is needed. To establish such policy, the EU needs new committees, comprised of qualified scientists independent of industry, like the International Commission on the Biological Effects of EMF [14].

New EU policy should consider long term total radiation and signal complexity, including polarizations and aggregations of pulses from all simultaneously radiating wireless meters and other wireless equipment, for example in apartment houses. The total radiation, taking into account not only mean values and heating but most of all the most damaging aggregations of pulses, should be based on new, far lower guidelines already proposed by four groups of truly industry independent scientists [22, 100], [101], [102]. Their guidelines range from recommendations of 0.1 μW/m² by the Building Biology Institute to 100 μW/m² by the Council of Europe. Thus, all groups recommend exposure limits considerably stricter than ICNIRPs industry-friendly guidelines of 10,000,000 μW/m² or 40,000,000 μW/m². New guidelines are urgent if health is to have precedence over economy, consistent with EU law [8].

Concluding remarks

In 2017 an article was published on the lack of WHO willingness to acknowledge health effects from use of wireless phones. It was stated that WHO is a *hard nut to crack* [69]. This statement now seems to be true of the EU. In spite of being provided with increasing evidence of the negative effects on human health, no measures have been taken to reduce exposure or to educate people on the risks. On the contrary, ambient exposure has increased [103]. Protests and comments by scientific experts and several organisations including non-governmental organization (NGOs) have been ignored. Instead, the EU has heeded only the opinions of a handful of experts, associated with WHO, ICNIRP, and SCHEER, with conflicts of interest due to ties with industry. Therefore, any opinion these "experts" may give on wireless EMF and human health is compromised. It is urgent that unbiased evaluations of risks be made by experts with no conflicts of interest. In spite of thousands of scientific reports proving harmful effects of wireless EMF, all seven appeals sent to the EU since 2017 have been neglected. These reviews have requested immediate action from the EU on its mandated responsibilities; i.e., to protect humans and the environment instead of promoting industry interests.

The EU's current course of action is in direct conflict with the foundations on which the EU was built (see Table 1). By maintaining its course to support the industry-led rollout of 5G, 6G and smart meters, the EU is violating the EU Convention on Human Rights [4], the EU Charter of Fundamental Rights [5], the EU Treaty [64], and EU Case law [104], [105], [106], which all agree that: *The protection of health and the environment takes precedence over economic considerations.* On this issue, the EU seems to be another hard nut to crack.

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