

Community concerns over 5G: Needless anxiety or wise precaution?

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Overview: The 5G revolution

5th generation (5G) wireless technology, as the name indicates, is the next generation wireless communication network from 4G and 4G LTE. Once fully implemented it would predominantly operate in the millimetre (mm) radiofrequency band (at 24-86+ GHz) but also will use the existing 4G LTE frequency band (600 MHz to 6 GHz). By shifting to the higher millimetre band, data transfer rates would be as much as 100 times faster than the existing 4G networks, necessary for driverless vehicle transport systems by enabling rapid data transfer between vehicles and nearby fixed infrastructure to avoid collisions or hit pedestrians.

5G also provides the foundation for the Internet of Things (IoT) by being able to support an estimated one million wireless connected devices per square kilometre,¹ including smart household appliances such as refrigerators, washing machines, dryers, entertainment equipment, TVs, lighting fixtures, thermostats, home security systems, etc.

Consumers will be able to download ultra high-resolution videos and movies on their 5G smartphones in seconds. It will enable virtual and augmented reality video games, which promises to immerse the viewer in a virtual world of high-resolution digital imagery.

In the industrial sphere, 5G has been referred to as ushering in the 4th industrial revolution which will be a game changer for the industrial sector.² 5G will enable industries to utilise artificial intelligence (AI) in the form of industrial robots and other systems to improve industrial efficiency, remotely monitor manufacturing and supply chains and communicate with external systems while keeping labour costs down³ by effectively removing the human element in much of the manufacturing process.

The downside of 5G mmWaves, however, is that the signals do not penetrate objects readily such as buildings and foliage, in comparison to the lower frequencies. This necessitates a far denser network of 5G small cell antennas which will be mounted on power poles, light poles, street furniture, bus shelters, etc. which in many cases will be close to homes, workplaces and public areas. In some cases internal antennas in buildings will also be used. This would result in higher chronic radiofrequency exposures to humans in these areas. The high number of small cells needed for an effective 5G network is causing community disquiet and that, combined with many scientific unknowns about the possible biological effects of prolonged exposure to 5G mm waves, is resulting in increasing community opposition in Australia and

¹ Fisher T., "5G Wireless Technology: 5G means more devices at ultrafast speeds and really low delays", Lifewire, Updated May 21, 2019. <https://www.lifewire.com/5g-wireless-4155905>

² NOKIA, "5G will power the 4th industrial revolution", <https://www.youtube.com/watch?v=bMaDhf0LKAY>

³ [1] IoT, Industrial applications,

Wikipedia, https://en.wikipedia.org/wiki/Internet_of_things#Industrial_applications

internationally. Counter to this, however, are a number of claims, examined in this paper, that assert that there is a total lack of risk with 5G technology and that community concerns are being fuelled by misinformation without any scientific validity.

This paper examines both sides of this controversy and suggests that the statements supportive of 5G by so-called 'experts', rather than being scientifically valid, are more illustrative of what is known as "technological fundamentalism". This, in itself, represents a threat to public health, because it inhibits much needed research to determine the extent of possible health risks from 5G technology.

A sampling of 5G community concerns in Australia

The Blue Mountains

On January 29, 2019, the Blue Mountains City Council in New South Wales, voted unanimously to acknowledge serious community concerns over the coming rollout of 5G technology and to investigate these 5G concerns further. Mayor Mark Greenhill said after the meeting that there was "significant community concern"⁴ and that the council would be writing to various government ministers in order to help clarify the issue.⁵

In response to this, Professor Simon Chapman from the University of Sydney, used a very 'broad brush' in dismissing community 5G concerns by bringing in other contentious issues in attempting to picture 5G concerns as just another example of anti-technology risk-phobic alarmism.

*The most elementary test of the hypothesis that mobile phone and other electronic appliances like WiFi may give you brain cancer has repeatedly fallen at the first and most obvious hurdle. If they cause brain cancer, where are all the bodies? Ever since the nineteenth century we have seen pockets of anxiety about health from train travel, ordinary phones, radio, computer screens, electric blankets, power lines, WiFi, smart meters and wind turbines. Meanwhile life expectancy is longer than it has ever been in history.*⁶

And quoting from Chapman's blog:

Mobile phone alarmists are a relentless (small) lobby group who are risk-phobic about almost every new form of communication. Every time there's a new generation of cell phone or electronic technology, they crank out the same fear-mongering stuff. Cult-like, they wake every morning, to spread the word about the deadly rays they believe are being foisted on the world by the evil telecommunications industry. They follow in the hallowed footsteps of those in history who raised health alarms about railway travel, electric light, ordinary phones, radio, TV, electric blankets, computers, microwave ovens, wind turbines

⁴ No 5G in the Blue Mountains, <https://www.no5gbluemountains.org/>

⁵ Lewis B.C., "No 5G in the Blue Mountains packs council chamber", *The Blue Mountains Gazette*, January 31, 2019, <https://www.bluemountainsgazette.com.au/story/5878465/move-to-stop-5g-in-the-mountains/>

⁶ *ibid.*

and solar roof cells etc. Some are also anti-vaccination (eg: this is one of their US queen bees).⁷

Ryde, Sydney

In early January 2019, a group of over 100 residents of the suburb of Ryde signed a petition to have small cell 4G antennas (which will later be upgraded to accommodate 5G infrastructure) removed from the Ryde residential area. Unlike larger towers, small cell antennas do not need planning approval under the Federal telecommunications act. Sue Cappadonna, spokesperson for the group, said “We don’t want it here, it causes us great anxiety that this thing is going to be running 24-7”.⁸

In response, Dr. Geza Benke from Monash University’s Department of Occupational and Environmental Health said that residents living near small cell boxes (antennas) had nothing to worry about. He then made a rather surprising statement that:

The exposure which people get from these antenna (small cells) is no more than you would get from a large antenna. . . over the next two years the small cell boxes would become commonplace, as they are considered a critical component of “filling in the gaps” for the high-speed 5G network...”⁹

As “these antenna” can be erected without local authority and community permission on bus shelters, light poles, power poles, etc. close to homes in residential areas, it is questionable whether concerned residents would be put at ease by Benke’s statement.

Responding to the above ABC News item about the Ryde community 5G concerns, Adam Verrender, a PhD Student, under the supervision of Rodney Croft at the Australian Centre for Electromagnetic Bioeffects Research (ACEBR), wrote a reply for the ABC News on January 9, 2019. His article started out with his claim that:

Decades of scientific research has found no evidence of any adverse health effects [from mobile phones] but still the public remains concerned. Even studies looking at long-term damage, such as brain cancer, have not found evidence of increased harm.¹⁰

Such a disingenuous claim of “no evidence” is at odds with the decision of the International Agency for Research on Cancer (IARC) which, in 2011, classified radiofrequency emissions from mobile phones as a possible human carcinogen, based on the 13 nation Interphone study on mobile phone use.¹¹

⁷ Chapman S., Whack-a-mole: Knocking the “mobile phones cause cancer” claim on the head, January 23, 2019, <https://simonchapman6.com/2019/01/23/whack-a-mole-knocking-the-mobile-phones-cause-cancer-claim-on-the-head/>

⁸ Raper A., Sas N., “Huawei-made ‘small cell’ boxes hit suburban Sydney, as residents raise health concerns”, ABC News, <https://www.abc.net.au/news/2019-01-07/huawei-small-cell-network-comes-to-sydney/10688124>

⁹ ibid.

¹⁰ Verrender A., “Phone tower anxiety is real and we’re worrying ourselves sick”, ABC News, January 9, 2019, <https://www.abc.net.au/news/2019-01-09/huawei-small-cell-boxes-fuelling-phone-radiation-anxiety/10701856>

¹¹ WHO, Interphone study on mobile phone use and brain cancer risk, July, 2010, <http://www.euro.who.int/en/health-topics/noncommunicable-diseases/cancer/news/news/2010/7/interphone-study-on-mobile-phone-use-and-brain-cancer-risk>

Verrender also claimed in his article that the continuing debate over adverse health effects from “phone tower anxiety” is being “fuelled by misinformation, scepticism and a complex psychological phenomenon known as the nocebo effect”. As a result of this according to Verrender “it’s little wonder this contentious issue persists, particularly given wireless technologies are so pervasive”.¹²

As for evidence that any adverse effects from radiofrequency exposure, such as electro-hyper-sensitivity (EHS) are purely psychological, Verrender mentions in his article the provocation study designed by ACEBR which supported the view that a complex psychological phenomenon, the nocebo effect, could explain the condition (EHS). What he failed to mention was that the ACEBR study finding was based only on three subjects and therefore lacked sufficient statistical significance to back up his claim.^{13, 14}

As for the scientific validity of the ACEBR provocation study, in 2013 CSIRO scientist and statistician, Dr. David McDonald conducted an analysis of the proposed ACEBR provocation study. He concluded in part:

*As it stands the proposed experimental design and statistical analysis cannot be used to achieve the stated aim. The scientific and statistical shortcomings of the proposed [study] are each serious flaws in themselves and their cumulative impact and interaction render the proposal scientifically indefensible. All of them need to be corrected in a major revision of the proposal.*¹⁵

According to Dariusz Leszczynski¹⁶ who has studied McDonald’s full critique and later versions of the ACEBR test protocol, he saw no changes and considered it as an exact repetition of the earlier design.¹⁷ Leszczynski has written extensively about the many weaknesses on provocation testing, including that designed by ACEBR, and has published an open letter on the weaknesses of EHS provocation research.¹⁸

Examples of growing international concern and opposition to 5G network rollouts

In 2017 an international 5G Appeal was launched by scientists and doctors who are calling for the EU to halt the roll out of 5G due to serious potential health effects from the technology. As of April 24, 2019, 231 scientists and medical doctors have signed the appeal.¹⁹

¹² Verrender A., “Phone tower anxiety is real and we’re worrying ourselves sick”, *ABC News*, Jan 8, 2019, <https://www.abc.net.au/news/2019-01-09/huawei-small-cell-boxes-fuelling-phone-radiation-anxiety/10701856>

¹³ Maisch D., The sad state of affairs with Bioelectromagnetics Research in Australia, <https://www.emfacts.com/2016/11/the-sad-state-of-affairs-with-bioelectromagnetics-research-in-australia/>

¹⁴ Leszczynski D., Open Letter on the Electromagnetic Hypersensitivity Research, February 4, 2018, <https://betweenrockandhardplace.wordpress.com/2018/02/04/open-letter-on-the-electromagnetic-hyper-sensitivity-research/>

¹⁵ Maisch D., A historical revisit to ACEBR’s questionable provocation testing, March 27, 2019, <https://www.emfacts.com/2019/03/a-historical-revisit-to-acebrs-very-questionable-provocation-testing/>

¹⁶ Adjunct Professor of Biochemistry, University of Helsinki Finland (retired), and Chief Editor of “Radiation and Health” specialty, *Frontiers in Public Health*, Lausanne, Switzerland.

¹⁷ Maisch D., as above.

¹⁸ Leszczynski D. *ibid*.

¹⁹ The 5G Appeal, <http://www.5gappeal.eu/scientists-and-doctors-warn-of-potential-serious-health-effects-of-5g/>

February 7, 2019: Speaking in the U.S. Senate Commerce, Science, and Transportation Committee hearing, U.S. Senator Richard Blumenthal raised concerns with the lack of any scientific research and data on 5G technology's potential health risks. Blumenthal specifically criticized the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA) for failing to conduct any research into the safety of 5G technology but instead, just deferring to the industry. At the hearing, Blumenthal asked the industry, *"How much money has the industry committed to supporting additional independent research – I stress independent research? Is that independent research ongoing? Has any been completed? Where can consumers look for it? And we're talking about research on the biological effects of this new technology."* At the end of the exchange with industry representatives at the hearing, Blumenthal concluded: *"So there really is no research ongoing. We're kind of flying blind here, as far as health and safety is concerned."*²⁰

March 24, 2019: Portland Oregon city officials in the US stated their opposition to the installation of 5G networks around the city, supported by the mayor and two commissioners. The city officials considered that 5G health risks were not well enough understood to warrant installations.²¹

March 28, 2019: Florence, Italy, applied the precautionary principle by refusing permission for 5G infrastructure and referring to "the ambiguity and the uncertainty of supranational bodies and private bodies (like ICNIRP)", which "have very different positions from each other, despite the huge evidence of published studies".²²

March 28, 2019: The Roman district "XII Municipality of Rome" voted against allowing 5G trials, with other districts expected to follow. Other motions to stop 5G are expected in the four regional councils, one provincial council and other municipal councils of Italy.²³

April 1, 2019: Plans for a pilot project to provide high-speed 5G wireless internet in Brussels were suspended due to fears for the health of citizens. Environment Minister Céline Fremault said that "The people of Brussels are not guinea pigs whose health I can sell at a profit. We cannot leave anything to doubt".²⁴

April 4, 2019: The House of Representatives of the Netherlands expressed its concern over the possible health risks of radiation from the new 5G network.

²⁰ Blumenthal R., "At Senate Commerce Hearing, Blumenthal Raises Concerns of 5G Wireless Technology's Potential Health Risks", Press release, February 7, 2019,

<https://www.blumenthal.senate.gov/newsroom/press/release/at-senate-commerce-hearing-blumenthal-raises-concerns-on-5g-wireless-technologys-potential-health-risks>

²¹ Satney J., "Portland Official's Attempt To Block 5G Network Installation Over Health Risks", *PrepForThat*, March 24, 2019, <https://prepforthat.com/portland-blocking-5g-networks-over-health-risks/>

²² Oasi Sana, "Florence brakes on 5G and applies the Precautionary Principle", 28 March 2019, <https://oasisana.com/2019/04/05/provoca-danni-al-corpo-firenze-frena-sul-5g-e-applica-il-principio-di-precauzione-approvata-con-voto-quasi-unanime-la-mozione-in-difesa-della-salute-notizia-esclusiva-oasi-sana/>

²³ *Terra Nuova Italy*, "A Municipality of Rome votes against 5G: what will the Giunta do?", <https://www.terranuova.it/News/Attualita/Un-Municipio-di-Roma-vota-contro-il-5G-cosa-fara-la-Giunta>

²⁴ *The Brussels Times*, "Radiation concerns halt Brussels 5G development, for now", 01 April 2019, <http://www.brusselstimes.com/brussels/14753/radiation-concerns-halt-brussels-5g-for-now>

Political parties want to know as a matter of urgency what the dangers are before 5G is rolled out on a large scale.²⁵

April 5, 2019: The California Supreme Court Justices unanimously upheld a 2011 San Francisco ordinance requiring telecommunications companies to **get permits before placing small cell antennas on city infrastructure**.²⁶

April 8, 2019: A petition asking the German Parliament to stop the award of 5G frequencies has reached 54,643 signatures, surpassing the quorum, according to an environmental campaign group called 'Diagnose: Funk'. The German Parliament may decide to suspend the procedure to award 5G frequencies based on "scientifically justified doubts about the safety of this technology", according to the petition.²⁷

April 9, 2019: Switzerland's 3rd largest region, Canton of Vaud, adopted a resolution calling for a moratorium on 5G antennas until the publication of a report on 5G by the Swiss Federal Office for the Environment.²⁸ Other cantons may follow with further moratoriums.²⁹

April 11, 2019: Geneva adopted a motion for a moratorium on 5G, calling on the Council of State to request WHO to monitor independent scientific studies to determine any possible harmful effects of 5G.³⁰

April 20, 2019: Switzerland announced that it will monitor 5G health risks as a result of a pushback from citizens who claim that 5G emissions present dire health risks.³¹ Four cantons have now stopped 5G networks, Jura, Geneva, Vaud and Neuchâtel, comprising 1.5 million people. However, the majority state-owned Swisscom defied these cantons by activating 5G stations in 102 locations by upgrading existing antennas installed for previous generations of wireless technology.^{32, 33}

May 15, 2019: The organisation, Americans for Responsible Technology (ART), coordinated a nationwide day of action to protest the deployment of 5G in the

²⁵ AD Netherlands, "Chamber wants radiation research first, then 5G network", 4 April 2019, <https://www.ad.nl/tech/kamer-wil-eerst-stralingsonderzoek-dan-pas-5g-netwerk~ab567cd6/>

²⁶ Egelko B., "California Supreme Court Sides with Cities in Small Cell Faceoff", *San Francisco Chronicle*, April 5, 2019, <https://zero5g.com/2019/california-supreme-court-sides-with-cities-in-small-cell-faceoff/>

²⁷ *Telecompaper*, "Germans petition Parliament to stop 5G auction on health grounds", <https://www.telecompaper.com/news/germans-petition-parliament-to-stop-5g-auction-on-health-grounds--1287962>

²⁸ del sol Beaulieu J., "5G moratorium in Switzerland", *Take Back Your Power*, 9 April 2019, <https://takebackyourpower.net/5g-vaud-switzerland-adopts-moratorium/>

²⁹ *LE TEMPS*, "5G: after the Vaud moratorium, the storm", 9 April 2019, <https://translate.google.com/translate?sl=fr&tl=en&u=https%3A%2F%2Fwww.letemps.ch%2Fsuissse%2F5g-apres-moratoire-vaudois-tempete>

³⁰ *LE TEMPS*, "Geneva adopts motion for a moratorium on 5G", 11 April, 2019, <https://www.letemps.ch/suisse/geneve-adopte-une-motion-un-moratoire-5g>

³¹ Satney J., "Switzerland Says It Will Monitor 5G Health Risks" April 20, 2019, *Prefotthat.com*, <https://prepforthat.com/switzerland-to-monitor-5g-health-risks/>

³² Hardell L., "Deployment of 5G stopped in Switzerland, Lennart Hardell's blog", <https://lennarthardellenglish.wordpress.com/2019/04/24/deployment-of-5g-stopped-in-switzerland/>

³³ del sol Beaulieu J., "5G: Swiss Telcos Ignore Official Laws and Launch 5G; Rule Of Law Under Attack", *Take Back Your Power*, 23 April 2019, <https://takebackyourpower.net/5g-swiss-telcos-ignore-laws-and-launch-5g-rule-of-law-under-attack/>

United States. ART and over 30 local community wireless safety groups in 14 states called on Verizon, Sprint, AT&T and T-Mobile, Crown Castle, American Tower, and ExteNet Systems to suspend the deployment of small cell antennas until chronic, low level exposure to 5G emissions can be proven safe for humans.³⁴

So, what are we to make of all this? Are there valid concerns over the rollout of 5G technology, or is this all needless worry from a misled public, as suggested by those connected with ACEBR and Prof. Simon Chapman?

Validating community concerns

The European Commission (EC): In early 2019 the Policy Department for Economic, Scientific and Quality of Life Policies Directorate-General for Internal Policies of the EC, was commissioned by the EC's Committee on Industry, Research and Energy (ITRE) to prepare an in-depth analysis on the deployment of 5G technology in the EU, the USA, China, Japan, the Republic of Korea, Singapore and Taiwan.

This report, titled *5G Deployment: State of Play in Europe, USA and Asia*, was published in April 2019. The authors point out that the global roll out of 5G is not a short-term race and that “5G is more complex than previous wireless technologies and should be considered as a long-term project to solve technical challenges and develop a clear business case”.

As for those “technical challenges” this is mentioned in the executive summary (excerpt):

As 5G is driven by the telecoms supply industry, and its long tail of component manufacturers, a major campaign is under way to convince governments that the economy and jobs will be strongly stimulated by 5G deployment. However, we are yet to see significant “demand-pull” that could assure sales. These campaign efforts are also aimed at the MNOs but they have limited capacity to invest in the new technology and infrastructure as their returns from investment in 3G and 4G are still being recouped. The notion of a “race” is part of the campaign but it is becoming clear that the technology will take much longer than earlier generations to perfect. China, for instance, sees 5G as at least a ten-year programme to become fully working and completely rolled out nationally. This is because the technologies involved with 5G are much more complex. One aspect, for example, that is not well understood today is the unpredictable propagation patterns that could result in unacceptable levels of human exposure to electromagnetic radiation.³⁵

Unpredictable propagation patterns

To visually understand what is meant by those unpredictable propagation patterns mentioned in the EC-5G report it is worthwhile examining an Ericsson Powerpoint presentation, titled *Impact of EMF limits on 5G network roll-out*.

³⁴ Moskowitz., JM, “5G day of Action”, Center for Family and Community Health, School of Public Health, University of California, Berkeley, <https://www.saferemr.com/2019/05/5g-day-of-action-2019.html>

³⁵ Blackman C., Forge S., “5G Deployment –State of Play in Europe, USA and ASIA’ *European Parliament*, April 2019, [http://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA\(2019\)631060_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA(2019)631060_EN.pdf)

The presentation was prepared by Christer Törnevik, Senior Expert, EMF and Health, Ericsson Research, Stockholm Sweden. The presentation was given at The International Telecommunications Union's (ITU) Workshop on 5G, EMF & Health, Warsaw, Poland on December 5, 2017.

In part, the presentation concluded that with increased human exposure levels from 5G antennas, EMF exposure compliance in some nations will be difficult. To quote: "In countries with EMF limits significantly below the international science-based ICNIRP limits the roll-out of 5G networks will be a major problem".³⁶

The 5th Asian and Oceanic IRPA Regional Congress on Radiation Protection (AOCRP-5) Melbourne, Australia, May 20 – 23, 2018

At a recent scientific conference by the Australian Radiation Protection and Nuclear Safety Agency two expert presentations gave reason to pause in the rapid roll out of 5G millimetre waves. The first was by Dr. Dariusz Leszczynski, adjunct professor of biochemistry, University of Helsinki, Finland and chief editor of *Frontiers in Radiation & Health*, Lausanne, Switzerland. In his presentation, titled *5G Millimetre-Waves Health & Environment*, Leszczynski examined the serious limitations of biomedical research on millimetre waves but from what studies that are available, it should cause great concern. He specifically called for the urgent need for research on 5G millimetre waves because of the rapidly ongoing deployment of 5G technology.³⁷

Another presentation was by Dr. Andrew Wood, School of Health Sciences, Swinburne University of Technology, Melbourne. Titled *What is the current status of research on mm-Wave frequencies*, Wood mentioned two areas of uncertainty with 5G radiation:

* *Skin and eyes are regions of concern in regard to 5G frequencies (6-60 GHz) and beyond.*

* *Could be resonant enhancement absorption due to skin structures.*³⁸

Possible effects on trees and foliage

Another possible problem specific to 5G millimetre emissions is that they can be disrupted or blocked by trees and foliage, especially after rain. This creates a potential problem for suburban streetscapes. Will residents have to choose whether they prefer a pleasant green environment or great download speeds?³⁹

The potential problem of trees and 5G reception has not escaped Telstra's notice. To quote from Mike Wright, Telstra's managing director of networks:

³⁶ Tornevik C., "Impact of EMF limits on 5G network roll-out, *ITU Workshop on 5G, EMF & Health* Ericsson Research, Stockholm, December 5, 2017, https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20171205/Documents/S3_Christer_Tornevik.pdf

³⁷ Leszczynski D., Report from the AOCRP-5, May 20-23, 2018, <https://betweenrockandhardplace.files.wordpress.com/2018/07/leszczynski-report-from-the-aocrp-5.pdf>

³⁸ Wood A., "What is the current status of research on mm-wave frequencies?-in relation to health". May 18, 2018, https://betweenrockandhardplace.files.wordpress.com/2018/06/emerg_may18_wood_wide_no-pics.pptx

³⁹ Wooding D., "5G TREE THREAT, New 5G phone system could face reception problems from trees with too many leaves, *The Sun*, March 18, 2018, <https://www.thesun.co.uk/news/5838497/5g-phone-system-reception-problems-trees/>

“Telstra is also funding research into whether uniquely Australian obstacles – including flora - will disrupt 5G signals, which occupy a higher frequency and don't travel as far as other mobile signals. "Something that seems to be unique to Australia, and we found with earlier standards, is how gumtrees impact those radio signals and the way they get from the radio tower to the end user”.⁴⁰

In a September 2018 New Zealand court case the judge ruled, in relation to a property owner's trees blocking a neighbour's wi-fi reception, that *“undue interference with a wi-fi signal caused by trees could constitute an undue interference with the reasonable use and enjoyment of an applicant's land for the purposes of s335 (1)(vi) of the {property law} Act.”* Lawyer and IT specialist Rick Shera said of the case: *“This decision is interesting because it finds that, in some circumstances, neighbour A can require tree trimming, or removal, repair or alteration of a structure, on neighbour B's land, where the trees or structure unduly interfere with the neighbour A's wireless connectivity.”⁴¹*

As 5G transmissions may be more prone to being blocked by trees than wi-fi signals what will be the legal implications if this turns out to be an issue?

An important question: Can 5G phased array antennas generate Brillouin precursors?

In early 2002 the New York based technical publication, *Microwave News* published an examination of a rather arcane topic: Brillouin precursors. The issue at that time was non-ionising radiation from the phased array PAVE PAWS radar facility at Cape Cod , Massachusetts, USA. A Brillouin precursor is a very fast pulse of radiation, which when it enters the human body, may generate a burst of energy that can travel much deeper than predicted by conventional models.

In a *Microwave News* interview with Professor Kurt Oughstun⁴², he explained how Brillouin precursors are generated by phased array radar antennas. When asked, “Are Brillouin precursors unique to PAVE PAWS radiation?”, Oughstun replied:

“No - not at all. As data transmission rates continue to increase, wireless communication systems will approach closer to and may, at some time in the not-too-distant future, exceed the conditions necessary to produce Brillouin precursors in living tissue.”⁴³

On April 15, I sent an email to Oughstun and asked if there was a possibility of Brillouin precursors being created by 5G technology. His detailed reply, dated May 5, said, in part:

⁴⁰ Hatch P., ‘Telstra pushes for 5G that Works in Australia, *The Sydney Morning Herald*, January 9, 2017, <https://www.smh.com.au/business/telstra-pushes-for-5g-that-works-in-australia-20170109-gto0gz.html>

⁴¹ Keall C., Property owner can be forced to cut trees if they interfere with a neighbour's Wi-Fi, judge says, *New Zealand Herald*, September 18, https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12127228

⁴² Dr. Kurt Oughstun is a professor of electrical engineering and mathematics at the University of Vermont, Burlington. He has done extensive work on the propagation of extremely short electromagnetic pulses through different types of materials, and is the author of more than 50 published papers, as well as the textbook *Electromagnetic Pulse Propagation in Causal Dielectrics* with G.C. Sherman (Berlin: Springer-Verlag, 1994).

⁴³ Slesin, L., Brillouin Precursors 101 with Professor Kurt Oughstun, *Microwave News*, Vol 22, No. 2, March/April 2002, pp. 10-11, <https://microwavenews.com/news/backissues/m-a02issue.pdf>

“ This condition is likely not met, but again is close. A 10 Gbps (gigabits per second) data rate or higher would, however, be sufficient [to create Brillouin precursors], and that would be worrisome.”⁴⁴

In November 2018, GSMA the industry organization representing the interests of mobile operators worldwide, published its policy position on the 5G spectrum. To quote, in part from page 3:

5G will be defined in a set of standardized specifications that will be agreed by international bodies- most notably the 3GPP and ultimately by the ITU in 2020. The ITU [International Telecommunications Union] has outlined specific criteria for IMT-2020 – commonly regarded as 5G – which will support the following use cases:

1. Enhanced mobile broadband: Including peak download speeds of at least 20 Gbps...

It must be pointed out that no research has been carried out on Brillouin precursor creation with 5G phased array antennas - but it looks like a distinct possibility, considering the download speeds, which are implicated with the creation of Brillouin precursors.

The need for such research is urgent considering a recent paper published in *Health Physics* in December 2018 by Esra Neufeld and Niels Kuster. The paper suggests that permanent tissue damage from tissue heating may occur even after short exposures to 5G millimetre wave pulse trains (where repetitive pulses can cause rapid, localised heating). The authors stated that there is an urgent need for new thermal safety standards to address the kind of health risks possible with 5G technology. Although not mentioned in the paper, of particular concern for the creation of Brillouin precursors is the following excerpt:

The FIFTH generation of wireless communication technology (5G) promises to facilitate transmission at data rates up to a factor of 100 times higher than 4G. For that purpose, higher frequencies (including millimetre-wave bands), broadband modulation schemes, and thus faster signals with steeper rise and fall times will be employed, potentially in combination with pulsed operation for time domain multiple access...The thresholds for frequencies above 10 MHz set in current exposure guidelines (ICNIRP 1998, IEEE 2005, 2010) are intended to limit tissue heating. However, short pulses can lead to important temperature oscillations, which may be further exacerbated at high frequencies (>10 GHz, fundamental to 5G), where the shallow penetration depth leads to intense surface heating and a steep, rapid rise in temperature...”⁴⁵

Considering the uncertainties mentioned in the recent EC report on 5G, mentioned earlier, as well as the warnings by Neufeld and Kuster, there is an urgent need for further research on the possible adverse health effects from 5G technology before it is rolled out.

⁴⁴ email from Kurt Oughstun, May, 5, 2019.

⁴⁵ Neufeld E., Kuster N., “Systematic Derivation of Safety Limits For Time-Varying 5G Radiofrequency Exposure Based on Analytical Models and Thermal Dose”, December 2018, *Health Physics*, Volume 115, Number 6.

Concluding thoughts

What is apparent in this controversy is that the public's perception of risk and that of some experts defending the technology is at wide variance. The assurances of a complete absence of risk from 5G networks coming from these experts is not reflected in what is known about the many uncertainties which exist with 5G technology and speaks more about their own ignorance than that of concerned communities. A real danger of these 'expert' assurances of a lack of risk to health from 5G discourages the necessary research needed to determine the extent of any such risk.

What we are seeing here is an example of what has been defined as *technological fundamentalism*. To quote from Robert Jensen:

Technological fundamentalists believe that the increasing use of evermore sophisticated high-energy, advanced technology is always a good thing and that any problems caused by the unintended consequences of such technology eventually can be remedied by more technology. Those who question such declarations are often said to be "anti-technology," which is a meaningless insult. All human beings use technology of some kind, whether stone tools or computers. An anti-fundamentalist position is not that all technology is bad, but that the introduction of new technology should be evaluated carefully on the basis of its effects—predictable and unpredictable—on human communities and the non-human world, with an understanding of the limits of our knowledge.⁴⁶

⁴⁶ Jensen R., "Technological Fundamentalism", *Counterpunch*, January 28, 2011, <https://www.counterpunch.org/2011/01/28/technological-fundamentalism-2/>