5G And The IOT: Scientific Overview Of Human Health Risks

(Source: https://ehtrust.org/key-issues/cell-phoneswireless/5g-networks-iot-scientific-overview-human-health-risks/)

5G is the term used to describe the next-generation of mobile networks beyond the 4G LTE mobile networks commonly used today. 5G is intended to be the technology that allows the Internet of Things (IOT) to exist and tie all internet connected devices together.
Click here to see the latest science on 5G millimeter waves.

Currently there is no standard for 5G networks in place and it will be a combination of a variety of frequencies and modulations. Industry is developing exactly what 5G will be as the standard has not been set yet. It is assumed that 5G networks will not become commercially available until 2020 but several cities are rolling out 5G as test areas *now.* Verizon and Sprint have announced "test cities" for 5G which include Sacramento, Washington DC, Atlanta, Dallas, Miami and New York.

A first glance at US government websites such as the CDC and EPA could lead you to believe that this radiation is safe. Yet over 240 scientists and doctors from 41 nations who have published research in the field have appealed to the United Nations calling for urgent action to reduce these ever growing wireless exposures and they wrote the FCC for a moratorium on the roll-out of 5G citing the serious risks that to human health and the environment.

Published peer reviewed science already indicates that the current wireless technologies of 2G, 3G and 4G – in use today with our cell phones, computers and wearable tech – creates radiofrequency exposures which poses a serious health risk to humans, animals and the environment. Scientists are cautioning that before rolling out 5G, research on human health effects urgently needs to be done first to ensure the public and environment are protected.

However, instead of prudent public health measures to ensure the public's safety, governments such as the United States are quickly rolling out 5G networks in neighborhoods and are enacting various state and federal regulations to "streamline" and fasttrack the rollout. These regulations will end the ability of communities to halt and be a part of the decision making process in this massive 5G infrastructure buildout.

Wireless company documents clearly state that 5G will increase the levels of RF radiation in the vicinity of the antennas. Many countries such as China, India, Poland, Russia, Italy and Switzerland have far more protective and stricter radiation limits which will not allow the deployment of 5G as the increased 5G radiation would exceed their limits. These countries are creating roadblocks to the 5G rollout and industry has launched large scale efforts to loosen limits.

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Click here to see the latest science on 5G millimeter waves.

THOUSANDS OF MINI CELL TOWERS TO BE BUILT IN FRONT OF HOMES

5G will require the buildout of literally hundreds of thousands of new wireless antennas in neighborhoods, cities and towns. A cellular small cell or other transmitter will be placed every two to ten homes according to estimates. The purpose of this massive infrastructure build out of small cells, distributed antennae systems and microcells is to increase range and capacity in populated urban areas and *prepare for the future 5G rollout*. 5G frequencies will utilize higher frequencies that do not travel as far as the lower frequencies.

US state and federal governments are moving forth regulations which would make the right of way in front of homes as available sites for 5G transmitters – without consent of the property owners. In response, communities are protesting en mass as they do not want these transmitters built in front of their homes and communities want to be able to regulate the placement on right of ways. Some municipalities are taking the case to the courts with litigation.

5G WILL USE HIGHER ELECTROMAGNETIC FREQUENCIES

5G will utilize multiple frequencies from those currently in use for cell phones and wireless to higher millimeter frequencies.

Today's cellular and Wi-Fi networks rely on microwaves – a type of electromagnetic radiation utilizing frequencies up to 6 gigahertz (GHz) in order to wirelessly transmit voice or data. However, 5G applications will require unlocking of new spectrum bands in higher frequency ranges above 6 GHz to 100 GHz and beyond, utilizing submillimeter and millimeter waves – to allow ultra-high rates of data to be transmitted in the same amount of time as compared with previous deployments of microwave radiation.

Click here to read about the difference between 1G, 2G, 3G and 4G

MILLIMETER AND SUBMILLIMETER WAVES ARE BIOLOGICALLY ACTIVE

Current investigations of wireless frequencies in the millimeter and submillimeter range confirm that these waves interact directly with human skin, specifically the sweat glands. Dr. Ben-Ishai of the Department of Physics, Hebrew University, Israel recently detailed how human sweat ducts act like an array of helical antennas when exposed to these wavelengths.

MECHANISM OF ACTION IS PROVEN

Research already indicates serious adverse effects from the wireless modalities in use today. Research studies from the Dielectric Spectroscopy Laboratory of the Department of Applied Physics, Hebrew University of Jerusalem, headed by Dr. Yuri Feldman, indicate that 5Gs millimeter and submillimeter waves will uniquely interact with human skin and lead to preferential layer absorption. The number of sweat ducts within human skin varies from two million to four million. Replicated peer research of these biological effects in laboratory research has been conducted internationally and scientists consider this mechanism of action well proven (See documentation further down on this webpage).

5G FREQUENCIES ARE USED IN WEAPONS

For years, the U.S., Russian and Chinese defense agencies have been developing weapons that rely on the capability of this electromagnetic frequency range to induce unpleasant burning sensations on the skin as a form of crowd control. Millimeter waves are utilized by the U.S. Army in crowd dispersal guns called Active Denial Systems. Dr. Paul Ben-Ishai pointed to research that was commissioned by the U.S. Army to find out why people ran away when the beam touched them. “If you are unlucky enough to be standing there when it hits you, you will feel like your body is on fire.” The U.S. Department of Defense explains how “The sensation dissipates when the target moves out of the beam. The sensation is intense enough to cause a nearly instantaneous reflex action of the target to flee the beam.”

HUMAN SKIN WILL BE CLASSIFIED AS AN EXTREMITY ALLOWING HIGHER EXPOSURES

Our skin is our largest organ. Dariusz Leszczynski, PhD, Chief Editor of Radiation and Health has stated that the *International Commission on Non-Ionizing Radiation Protection usually referred to as I*CNIRP – is developing recommendations for public exposure limits of these higher frequencies is

planning to classify all the skin in the human body as belonging to the limbs rather than to the head or torso. Leszczynski cautioned that, “If you classify skin as limbs – no matter where the skin is – you are permitted to expose it more than otherwise.”

We assume that in terms of US exposure limits this means that the skin will be classified as “an extremity”. Extremities are allowed to be exposed to much higher radiation levels than the brain, torso, legs and arms. In the USA extremities -in regards to wireless radiation- are specifically wrists and hands, ankles and feet and the ear.

5G DEPLOYMENT WITHOUT HEALTH EFFECT EVALUATION

5G is being developed and implemented without adequate evaluation of the effect of this technology on human health after long term exposure to these frequencies. Peer reviewed research studies have found adverse effects from the electromagnetic frequencies currently in use and that will be in use for this new technology.

“There is an urgent need to evaluate 5G health effects now before millions are exposed. We need to know if 5G increases the risk of skin diseases such as melanoma or other skin cancers,” stated Ron Melnick, the National Institutes of Health scientist, now retired, who led the design of the National Toxicology Program study on cell phone radiofrequency radiation.

In Dr. Cindy Russell’s A 5G Wireless Future: Will it give us a smart nation or contribute to an unhealthy one (Text PDF), published in the the Santa Clara Medical Association, Russell states that “3G, 4G, 5G or a combination of zapping frequencies giving us immersive connection and entertainment but at a potentially steep price.” Russell details the scientific documentation on 5G’s

frequencies which include arrhythmias, heart rate variability, bacterial affects, antibiotic resistance, immune system affects, chromatin affects, teratogenic effects, altered gene expression and cataracts.

Dr. Cindy Russell lists specific recommendations shared by Environmental Health Trust and scientists worldwide.

RECOMMENDATIONS TO PROTECT PUBLIC HEALTH

1. Do not proceed to roll out 5G technologies pending pre-market studies on health effects.
2. Reevaluate safety standards based on long term as well as short term studies on biological effects.
3. Rescind a portion of Section 704 of the Telecommunications Act of 1996 which preempts state and local government regulation for the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects so that health and environmental issues can be addressed.
4. Rescind portions of The Spectrum Act which was passed in 2012 as part of the Middle Class Tax Relief and Job Creation Act, which strips the ability city officials and local governments to regulate cellular communications equipment, provides no public notification or opportunity for public input and may potentially result in environmental impacts.
5. Create an independent multidisciplinary scientific agency tasked with developing appropriate safety regulations, premarket testing and research needs in a transparent environment with public input.
6. Label pertinent EMF information on devices along with appropriate precautionary warnings.

RESOURCES

Click Here For EHT's Scientific FactSheets On 5G

Click here to see the latest science on 5G millimeter waves.

Please take the time to scroll down to read research recent research studies, watch videos and see expert testimony. EHT also has a youtube playlist dedicated to 5G science and to citizen testimony on 5G.

This webpage contains lists including recent bioeffects research, videos of expert lectures, and a list of submissions to the FCC on Spectrum Frontiers. Please scroll down for this information.

Potential Risks to Human Health Originating from Future Sub-MM Communication Systems

Expert Forum Lecture at the Israel Institute for Advanced Study at Hebrew University Medical School, January 24, 2017

Watch a lecture on submillimeter and millimeter frequencies by Paul Ben-Ishai, PhD of the Department of Physics, Ariel University, Israel, Full Bio and Yuri Feldman, PhD, Head of the Dielectric Spectroscopy Laboratory, Department of Applied Physics, Hebrew University of Jerusalem, Full Bio. Click here for a PDF of Abstract for this Presentation

NEWS

Is 5G technology dangerous? Early data shows a slight increase of tumors in male rats exposed to cellphone radiation, Jim Puzzanghera, Los Angeles Times, Aug 8, 2016

A 5G Wireless Future: Will it give us a smart nation or contribute to an unhealthy one, Dr. Cindy Russell, Santa Clara Medical Association Bulletin Jan/Feb 2017 (Page 20 to 23) (Text only PDF)

The Internet of Things Poses Human Health Risks: Scientists Question the Safety of Untested 5G Technology at International Conference, Environmental Health Trust Press Release 3/9/2017

Everything You Need to Know About 5G IEEE article

RESOURCES FOR THE COMMUNITY

Click Here For EHT's Scientific FactSheets On 5G

Why We Should Oppose 5G on Health Grounds, by Dr. Ronald Powell

WHAT ARE 5G AND THE INTERNET OF THINGS? Website: http://whatis5g.info/ This website considers all the issues surrounding 5G and the man ways 5G and the IoT will harm humans, the environment, and our Earth from cybersecurity to conflict minerals to health.

Citizens' Cell Tower 5G Information Packet of Montgomery County: This slide presentation contains key details for communities addressing small cells in their neighborhood.

RECENT 5G and MILLIMETER WAVE BIOEFFECT STUDIES

Click here to see the latest science on 5G millimeter waves.

This compilation has included several papers compiled from Dr. Joel Moskowitz on his blog SaferEMR, from work presented at the Israel Institute for Advanced Studies at Hebrew University and from the Environmental Health Research Team.

Russell CL. 5G wireless telecommunications expansion: Public health and environmental implications. Environmental Research. Available online 11 April 2018. in press.

- "On the horizon, a new generation of even shorter high frequency 5G wavelengths is being proposed to power the Internet of Things (IoT)."
- "It is argued that the addition of this added high frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome both from both physical and mental health perspectives."
- "Like other common toxic exposures, the effects of radiofrequency electromagnetic radiation (RF EMR) will be problematic if not impossible to sort out epidemiologically as there no longer remains an unexposed control group. This is especially important considering these effects are likely magnified by synergistic toxic exposures and other common health risk behaviors. Effects can also be non-linear. Because this is the first generation to have cradle-to-grave lifespan exposure to this level of man-made microwave (RF EMR) radiofrequencies, it will be years or decades before the true health consequences are known. Precaution in the roll out of this new technology is strongly indicated."
- "Current radiofrequency radiation wavelengths we are exposed to appear to act as a toxin to biological systems. A moratorium on the deployment of 5G is warranted, along with development of independent health and environmental advisory boards that include independent scientists who research biological effects and exposure levels of radiofrequency radiation. Sound regulatory policy regarding current and future telecommunications initiative will require more careful assessment of risks to human health, environmental health, public safety, privacy, security and social consequences. Public health regulations need to be updated to match appropriate independent science with the adoption of biologically based exposure standards prior to further deployment of 4G or 5G technology."

Betzalel N, Ben Ishai P, Feldman Y., The human skin as a sub-THz receiver – Does 5G pose a danger to it or not? Environ Res. 2018 May;163:208-216. doi: 10.1016/j.envres.2018.01.032. Epub 2018 Feb 22.

- Experimentally we showed that the reflectance of the human skin in the sub-THz region depends on the intensity of perspiration, i.e. sweat duct's conductivity, and correlates with levels of human stress (physical, mental and emotional). Later on, we detected circular dichroism in the reflectance from the skin, a signature of the axial mode of a helical antenna. The full ramifications of what these findings represent in the human condition are still unclear. We also revealed correlation of electrocardiography (ECG) parameters to the sub-THz reflection coefficient of human skin. In a recent work, we developed a unique simulation tool of human skin, taking into account the skin multi-layer structure together with the helical segment of the sweat duct embedded in it. The presence of the sweat duct led to a high specific absorption rate (SAR) of the skin in extremely high frequency band. In this paper, we summarize the physical evidence for this phenomenon and consider its implication for the future exploitation of the electromagnetic spectrum by wireless communication. Starting from July 2016 the US Federal Communications Commission (FCC) has adopted new rules for wireless broadband operations above 24 GHz (5 G). This trend of exploitation is predicted to expand to higher frequencies in the sub-THz region. One must consider the implications of human immersion in the electromagnetic noise, caused by devices working at the very same frequencies as those, to which the sweat duct (as a helical antenna) is most attuned. We are raising a warning flag against the unrestricted use of sub-THz technologies for communication, before the possible consequences for public health are explored.

Nasim I, Kim S. Human Exposure to RF Fields in 5G Downlink. Submitted on 10 Nov 2017 to IEEE International Communications Conference.

- Our results show that 5G downlink RF fields generate significantly higher power density (PD) and specific absorption rate (SAR) than a current cellular system. This paper also shows that SAR should also be taken into account for determining human RF exposure in the mmW downlink.

TRIPATHI et al., Frequency of the resonance of the human sweat duct in a normal mode of operation, BIOMEDICAL OPTICS EXPRESS 130, Vol. 9, No. 3 | 1 March 2018

- This result indicates that careful consideration should be given while designing electronic and photonic devices operating in the sub-terahertz frequency region in order to avoid various effects on human health due to these waves.

Betzalel, Y. Feldman, and P. Ben Ishai, "The Modeling of the Absorbance of Sub-THz Radiation by Human Skin," IEEE Trans. THz Sci. Tech. (Paris) 7(5), 521–528 (2017).

- In 2008, we demonstrated that the coiled portion of the sweat duct in upper skin layer could be regarded as a helical antenna in the sub-THz band. The full ramifications of what these findings represent in the human condition are still very unclear, but it is obvious that the absorption of electromagnetic energy is governed by the topology for the skin and its organelles, especially the sweat duct.

Di Ciaula, Towards 5G communication systems: Are there health implications?, Int J Hyg Environ Health. 2018 Feb 2.

- "Preliminary observations showed that MMW increase skin temperature, alter gene expression, promote cellular proliferation and synthesis of proteins linked with oxidative stress, inflammatory and metabolic processes, could generate ocular damages, affect neuro-muscular dynamics."
- "Further studies are needed to better and independently explore the health effects of RF-EMF in general and of MMW in particular. However, available findings seem sufficient to demonstrate the existence of biomedical effects, to invoke the precautionary principle, to define exposed subjects as potentially vulnerable and to revise existing limits.

Scientific Citations from the published study "Potential Risks to Human Health Originating from Future Sub-MM Communication Systems" by Paul Ben-Ishai, PhD and Yuri Feldman, PhD

Feldman, Yuri and Paul Ben-Ishai. "Potential Risks to Human Health Originating from Future Sub-MM Communication Systems." Abstract, 2017.

Feldman, Yuri, et al. "Human skin as arrays of helical antennas in the millimeter and submillimeter wave range." *Physical Review Letters*, vol. 100, no. 12, 2008.

Hayut, Itai, et al. "Circular polarization induced by the three-dimensional chiral structure of human sweat ducts." *Physical Review*, vol. 89, no. 4, 2014.

Hayut, Itai, et al. "The Helical Structure of Sweat Ducts: Their Influence on the Electromagnetic Reflection Spectrum of the Skin." *IEEE Transactions on Terahertz Science and Technology*, vol. 3, no. 2, 2013, pp. 207-15.

Professor Yuri Feldman – Research Study Summaries, The Hebrew University of Jerusalem Department of Applied Physics, Dielectric Spectroscopy Laboratory

RESEARCH ON MILLIMETER WAVES

Haas AJ, et al. “Effect of acute millimeter wave exposure on dopamine metabolism of NGF-treated PC12 cells.” *Journal of Radiation Research*, 2017.

Gandhi OP, Riazi A. Absorption of millimeter waves by human beings and its biological implications. *IEEE Transactions on Microwave Theory and Techniques*, vol. 34, no. 2, 1986, pp. 228-235.

Haas AJ, et al. “Effects of 60-GHz millimeter waves on neurite outgrowth in PC12 cells using high-content screening.” *Neuroscience Letters*, vol. 618, 2016, pp. 58-65.

Le Dréan Y, et al. “State of knowledge on biological effects at 40–60 GHz.” *Comptes Rendus Physique*, vol. 14, no. 5, 2013, pp. 402-411.

Sivachenko IB, et al. “Effects of Millimeter-Wave Electromagnetic Radiation on the Experimental Model of Migraine.” *Bulletin of Experimental Biology and Medicine*, vol. 160, no. 4, 2016, pp. 425-8.

Soghomonyan D, K. Trchounian and A. Trchounian. “Millimeter waves or extremely high frequency electromagnetic fields in the environment: what are their effects on bacteria?” *Applied Microbiology and Biotechnology*, vol. 100, no. 11, 2016, pp. 4761-71.

Ramundo-Orlando A. Effects of millimeter waves radiation on cell membrane – A brief review. *Journal of Infrared Millimeter Terahertz Waves*, vol. 30, no. 12, 2010, pp. 1400-1411.

REFERENCES ON DEFENSE USE OF MILLIMETER WAVES

US Department of Defense Non-Lethal Weapons Program FAQS

A Narrative Summary and Independent Assessment of the Active Denial System The Human Effects Advisory Panel

SUBMISSIONS TO THE FCC ON SPECTRUM FRONTIERS

On July 14, 2016, the FCC voted to approve Spectrum Frontiers, making the U.S. the first country in the world to open up higher-frequency millimeter wave spectrum for the development of 5G fifth-generation wireless cellular technology. The FCC was flooded with comments in opposition to 5G. Read full details at the EHT website on Spectrum Frontiers

The Berkshire-Litchfield Environmental Council Comments to Thomas Wheeler, Chairman, Federal Communications Commission

“Federally-protected wildlife species are in danger”, Briefing Memorandum from Dr. Albert Manville

July 20, 2016 – Dr. Joel Moskowitz Comment to the FCC, “FCC Open Letter Calls for Moratorium on New Commercial Applications of Radiofrequency Radiation”

Dr. Yael Steins Comments to the FCC in Opposition to 5G Spectrum Frontiers Millimeter Wave Technology

Dr. Ronald M. Powell Ph.D. Comment to the FCC

Dr. Devra Davis to FCC, “Long Term Health and Safety Evaluation Needed Before Introduction of 5G”

Comments to FCC by Electrical Pollution, “Parents Write to the FCC: Be on the Right Side of History”

Submission to FCC by Susan Clark, “Stop 5G harm to all living beings: The Science is Conclusive”

Maryland Smartmeter Awareness Comment to the FCC, “FCC Proposed Move to 5G”

Comments by Dafna Tachover and “We are the Evidence” to FCC, “Those Injured by Wireless ask Congress: Please Protect us and help protect the public’s health. Say STOP to the FCC and wheeler in 5G vote”

Angela Tsiang to US Senate Committee on Commerce, Science, and Transportation

SPECTRUM FRONTIERS RESOURCES

July 14, 2016 FCC Meeting Video Spectrum Frontiers vote.

TV Technology: FCC Opens Higher Frequencies to Phone Companies

Public News Service: FCC Votes Today on Opening Additional Wireless Spectrum for 5G

Regulators Pave Way For Speedy Next-Generation 5G Networks

GSMA ANALYSIS Understanding 5G: Perspectives on future technological advancements in mobile