



White Paper

Informing a Concerned Public about RF Exposure Levels of 5G

As 5G technology is rolled out worldwide, making a success of the transition to a connected world, the public remains concerned:

“How can we know if we are being overexposed?”

This whitepaper is about public health concerns, the standards evolving to ensure best practices, and the tools available to help city councils monitor RF levels and inform their communities.

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▮ The rise of public concern



The introduction of 5G as mainstream technology has been welcomed the world over with enthusiasm. It will boost economies, grow industries and improve living standards for much of the global population.

With every macro evolution though, comes controversy. The roll out of 5G has been met with trepidation by many public and community groups. Concerns over the potential health risks caused by radio frequency (RF) energy transmitted by 5G base stations are undoubtedly on the up, with some people backing the claims that increased, involuntary RF exposure can lead to thermal damage of the skin or cornea.

Involuntary exposure of the public to RF energy will continue to evolve, and be regulated, in accordance with our global transition towards a connected world. In fact, standardisation is already being tightened to ensure our safety, with the IEC/IEEE standardisation bodies working to ensure that current and future 5G devices all conform to exposure levels as defined by ICNIRP and WHO.

This is no simple task, with the methodology for evaluating exposure to RF from future 5G devices being considerably different from previous technologies to accommodate the complexity of 5G systems. It is important to remember that whilst the industry is moving apace to roll out 5G and make a success of the transition to a connected world, the public remain concerned. A major part of this transition therefore, will be bringing to market tools which evaluate exposure and deliver tangible data that can be easily understood by concerned communities.

Exploring the key concerns

One of the most fundamental benefits of 5G technology is the fast rate of data transfer. In fact, this new generation of connectivity promises to speed up transfer rates by up to 100 times or more, by greatly reducing latency (time between a phone sending a signal and receiving a response). This evolutionary necessity comes in direct response to the increasing amount of data traffic generated across all major networks and will require significant infrastructure changes in order to accommodate performance.

Public worry, at present, is centred around two key concerns:

1/ The use of millimeter frequencies

At present, 5G will operate in several frequency bands, including one that is slightly below the millimeter-wave part of the RF spectrum. When fully rolled out, it will extend further into the millimeter wave frequency band (30-300 GHz).

It is fair to say that so far millimeter waves have not been used for cellular communication, but have been used extensively for other applications such as anti-collision radars on cars, airport security scanners and to link cellular base stations that are already in use.

The fact of the matter is that whilst some 5G functionality may use millimeter band widths to handle high-traffic applications, the majority of 5G will operate at frequencies close to those used by present cellular networks.

2/ 5G's reliance on 'small cells' and smart transmitters

In a process known as 'densification', the evolution of 5G will rely on a vast network of 'small cells' which need to be mounted close to cellular device users. Most commonly, they will feature on utility poles within public streets and incorporate 'smart' antennas, capable of transmitting multiple beams of which there are currently 64 designs¹, with many more under development. These can be independently steered to individual subscribers, giving the faster, more accurate connection and transfer speed which is synonymous with 5G.

In time, these street-mounted small cells will be replaced with pico cells located within buildings, operating at low power levels.

The suspected risk to human health



Those campaigning for the protection of human health against increased involuntary RF exposure claim that humans are at risk of a variety of ailments. That said, many campaigns of this nature ignore scientific evidence, such as that provided by WHO, which disproves such claims.

FACT: If RF energy is absorbed in large amounts by materials containing water such as food, fluids and body tissues, it can increase the temperature of the material.

FACT: RF energy at lower frequencies can penetrate deeper into human tissue, compared to the 0.5 mm skin surface absorption depth of millimeter waves, but even those levels of exposure are still far too low to increase body temperature, let alone cause other health complications.

It may be said that the general public are confusing the cancer-causing effects of ionizing radiation, and the lesser dangers of RF – a non-ionizing form of radio frequency radiation. Despite a damning lack of scientific evidence to support claims of adverse health risks, a number of scientists continue to make bold claims about the technology.



A recent survey² of 2,450 residents of six European countries revealed that 40% of respondents had some concerns over electromagnetic field (EMF)

exposure, with 12% describing themselves as “enduringly concerned” – that is, frequently thinking and talking about the issue.

¹ Kenneth R. Foster to Scientific American. 5G Is Coming: How Worried Should We Be about the Health Risks?, 16. Sep. 2019, <https://blogs.scientificamerican.com/observations/5g-is-coming-how-worried-should-we-be-about-the-health-risks/>

² Peter Wiedemann, University of Wollongong University, Australia, 2017, Does precautionary information about electromagnetic fields trigger placebo responses? An experimental risk communication study.

Official guidance – what the regulatory bodies say

With very little tangible scientific evidence on the bioeffects of millimeter waves and no concrete understanding of our future reliance on this part of the spectrum, the resounding opinion of health agencies worldwide is that there remains no cause for concern. And this is, of course, reflected in their official regulations and guidance at this stage. The IEEE and IEC now have specific Joint Working Groups dedicated to harmonising Electromagnetic Field (EMF) safety compliance assessment standards for 5G devices, and the IEC has completed a new Technical Report with case studies for base stations and EMF assessments which, for the first time, includes methods for 5G³.

That said, we are stampeding towards never-before-seen territory and the public is understandably nervous. It would be fair to ask “have the thresholds recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) concerning health risks been exceeded?” The answer in short is most probably no and, of course, further guidance on thresholds will be anticipated as 5G continues to become the mainstream cellular range.

THE GLOBAL BENCHMARK

Ajit Pai, Chairman of the FCC, announced in August 2019 that the commission proposes to maintain its current RF exposure safety standards (from 1996). Upon doing so he quoted the Director of the U.S. Food and Drug Administration Centre for Devices and Radiological Health, who said: “*The available scientific evidence to date does not support adverse health effects in humans due to exposures at or under the current limits.*”

Unsurprisingly, most countries have used ICNIRP RF exposure limits as a benchmark for their own. A number of countries such as India, Belgium and Italy, and even individual cities like Paris, have opted for a more cautious lower limit which will work in their favour should limits be lowered in the future.

Russia, and a number of former Soviet states, have not changed the far lower exposure limits inherited from the Soviet Union, which again will make things easier should official limits be lowered further down the line.

Do not confuse these variations as a direct impact of the 5G rollout though; these have been present for many years and have not changed as a result of the recent 5G launch.

Despite the FCC and its counterparts around the world holding their positions on RF exposure levels, there is a definite undertone of acceptance that more research will be needed as 5G is further used for telecommunications. This is a reassuring notion for the industry, but not so much, it seems, for the concerned public.

Reassuring the public is a more imminent concern, and one which is to be taken seriously should the use of street-level small cells continue.

The answer lies in science



It is vital that manufacturers like MVG innovate effective products which will enable the telecommunications industry, local government and regulatory bodies to reassure concerned communities.

“The answer to this lies in science. By openly measuring RF in their local area, in both open spaces and within public or private buildings, we can make those results readily available alongside ICNIRP recommendations and FCC guidance (or a regional equivalent), so that communities can see for themselves that levels of RF are not exceeding recommendations.

“This is one of many challenges MVG has tackled head on, with the innovation of a dosimeter which delivers easy to understand, real-time results.”

Shoaib Anwar,
RF/Antenna Engineer

// The City of Bourges – a research case study



With the erection of new base station antennas arousing concern from residents in the French city of Bourges, officials turned to science in a bid to reassure the local population.

Quickly establishing an Electromagnetic Waves Observatory, the city council invested in two of MVG's EME SPY Dosimeters. Readings were taken around the city, and residents were able to request measurements to be taken within their homes for free, which would accurately analyse their exposure to radio frequency signals coming from almost all the wireless signals present in the environment (broadcast TV & radio, mobile phones, mobile network, security networks, Wi-Fi, house-hold wireless phones, etc.).

TEST RESULTS

Throughout the course of the study, 120 measurements were taken in public places such as schools, cultural centres, administrative buildings and sports facilities, as well as homes, with 95% of these measurements delivering readings of less than 1 V/m⁴. Whereas, the maximum limit for general public is 61V/m between 2 - 6 GHz according to the ICNIRP guidelines which is about 98.3% lower than the maximum limit defined by the guidelines. Using accurate analysis of frequency bands, EME SPY shows that in the case of Bourges, the main contributors of electromagnetic field measurements in a household are not the external antennas, but the domestic appliances.

A REASSURED POPULATION

The information gathered throughout the study in Bourges was made readily available to members of the public. The frequency of requests for measurements declined rapidly, proving that the population felt reassured of their safety.

// Introducing the EME SPY – a dosimeter to inform the public

Designed specifically to measure human exposure to electromagnetic fields, MVG's light and portable personal monitoring device performs continuous measurements from a list of 84 standard frequency bands (see figure 1), between 88 MHz and 6 GHz, which includes the majority of future 5G frequencies.

Conducting real-time monitoring of EMF levels on your smart device (see figure 2), the EME SPY dosimeter can be mounted on a tripod to conduct measurements within a variety of environments, as showcased in the city of Bourges. From airports and stadiums, to dense urban terrains, the EME SPY offers ultra-reliable low latency and indoor penetration, reporting exposure levels in an easy to read and understandable manner.

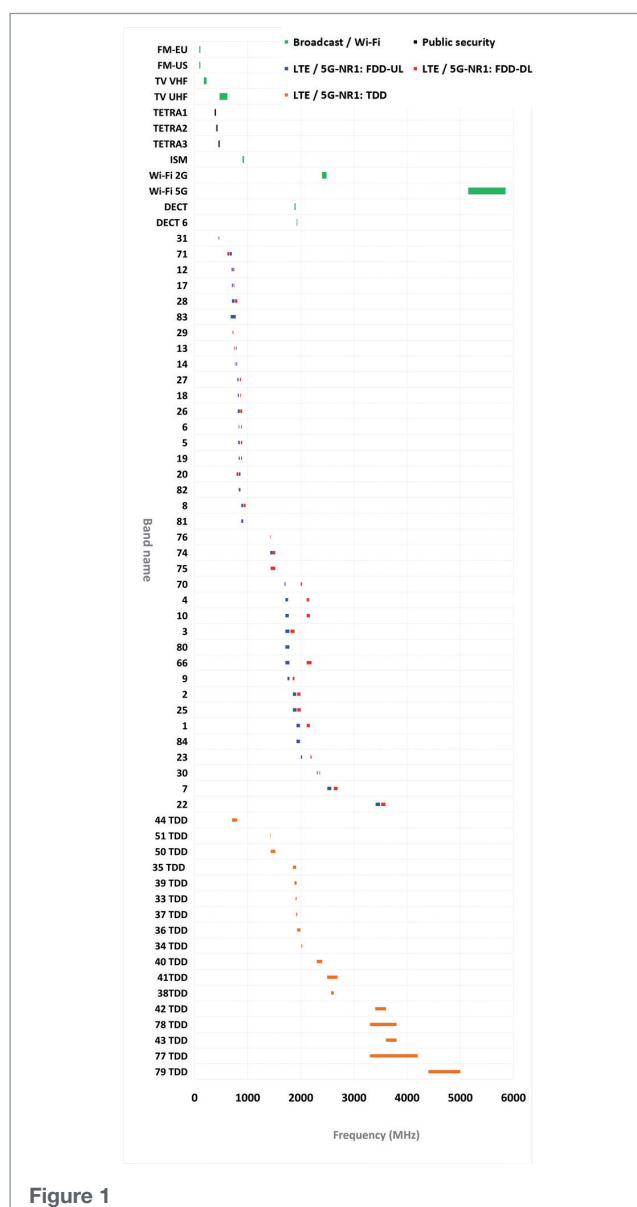


Figure 1

⁴ Case Study - EME SPY: a RF Dosimeter to Inform the Public: <https://www.mvg-world.com/resources/case-study/eme-spy-rf-dosimeter-inform-public>



Figure 2

It is important to acknowledge that standardization committees such as the IEC and the IEEE, are proactively and continually working to confirm best practice for measuring millimeter frequencies through a number of dedicated committees.

As a matter of fact, the ICNIRP has just recently published updated guidelines to cover radio-frequency EMFs in the 100 kHz to 300 GHz range in order to include the evolution of telecommunication standards and especially the arrival of 5G.

While those frequencies are believed to only be used for particular high-traffic hot spots and most 5G cellular connectivity will remain within the < 6 GHz range, these committees will continue to make sure standards regulate the use of technology and how it may affect public health. In the meantime, city and town councils, and company management teams can rely on EMF monitoring devices to help them inform their communities that old or new installations are meeting the required standards.

Discover more

For installation projects or council initiatives which require public consultation and the reassurance of concerns over involuntary RF exposure, the EME SPY from MVG is a valuable and worthwhile investment.

To find out more,
download the [datasheet](#)



Discuss your exacting
requirements with a
knowledgeable MVG
specialist in your area by
[contacting us](#)



MVG - Testing Connectivity for a Wireless World

The Microwave Vision Group offers cutting-edge technologies for the visualisation of electromagnetic waves. Enhancing the speed and accuracy of wireless connectivity testing, as well as the performance and reliability of anechoic and EMC technologies, our systems are integral to meeting the testing challenges of a fully connected world.

WORLDWIDE GROUP, LOCAL SUPPORT

Our teams, in offices around the world, guide and support you from purchase, through design, to delivery and installation. Because we are local, we can assure speed and attention in project follow through. This includes customer support and maintenance once the system is in place. For the exact addresses and up-to-date contact information: <https://www.mvg-world.com/contact>



For more information about EME Spy Evolution,
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