Message from the NSTF Executive Director

To 5G or not to 5G?

The coronavirus lacks 5G connectivity

No, the virus is not spread by 5G. The virus is live material that is spread among people by people. 5G is a standard of wireless communication, and will provide superfast connections for phones and computers. As with 1G, 2G, 3G and 4G, it requires infrastructure consisting of towers and antennas. It is the next generation of standards for wireless communication, but it is basically the same thing as the previous four generations. It is just one thousand times faster. 4G can transmit data at a speed of one megabyte per second. 5G can transmit data at a speed of one gigabyte per second. (Megabyte = 1 million bytes. Gigabyte = 1 billion bytes.) Fortunately, the coronavirus cannot be spread 1000 time faster with the help of 5G!

Myths and conspiracy theories have been flying thick and fast across 4G connections (mainly) and some over 3G, as people have taken to social media to air their fears about this new and seemingly unknown thing called 5G. Retweeted, forwarded or shared social media posts have a life of their own. No-one knows where they come from, who originally sent them, what proof the original sender might have, what his/her motives are, and what the full story really is. All we know for sure, is that the more a message is repeated, the more credible it seems to become. After all, one might think – how can a few million people be wrong? But they can.

The problem with entertaining myths and conspiracy theories is distraction from what needs to be done. Fast connectivity is necessary to do business and take advantage of global business opportunities, to extend educational opportunities to all children and everyone else, to improve service delivery, to implement 4IR technologies in government and industry, among others. The question becomes: can we as South Africa afford not to roll out 5G networks?

How far is the roll out of 5G networks across the world?

In an article in Lifewire, 5G: The Latest News & Updates (February 2021) (lifewire.com) on 1 Feb 2021, Tim Fisher says:

"New 5G information is released daily from around the world. Some companies are starting 5G trials in new cities, others are announcing when customers can order their new service, and some businesses are releasing new ideas for how 5G will change the way we live."

"5G availability is extremely limited right now, with only a few locations having a live, non-demo, subscriber-based network up and running. However, many companies are just a few months away from launching a full-blown 5G network for customers to use."

However, he gives an impressive list of places all over the globe that already have access to 5G or have launched 5G initiatives, since March 2020. Service providers in the USA, Canada, UK, Japan, the Netherlands, Norway, Denmark and Sweden, Austria and China seem to be particularly active in

establishing 5G networks. In the USA, Verizon boasts that more than 230 million people in over 2,700 cities can access their 5G network.

Others like Australia, Israel, Germany and France, e.g. are also on track to provide 5G coverage to their citizens. In short, it is again highly developed countries that are first to provide 5G connectivity, all through private companies.

What about the rest of the world?

Here are two interesting developments:

- **November 18**: Nokia and Claro will showcase the power of 5G in Colombia's largest trial. It will cover mobile and FWA and use cases like enterprise private wireless solutions and remote and immersive education.

- **January 5**: Singtel transforms payphone booths into 5G-powered multimedia kiosks in Singapore.

What about Africa?

- **May 4**: Vodacom turns on 5G in Africa, in Johannesburg, Pretoria, and Cape Town.

- **November 30**: Nokia and Airtel Kenya come to a three-year deal to bring 5G to Nairobi.

- **November 30**: Togocom and Nokia begin deploying 5G in West Africa with the introduction of the network in Togo's capital Lomé.

South Africa is once again in the middle, on track to follow the developed world, amidst the challenges of having our other leg in the underdeveloped world. It is clear that SA will be left behind if we do not move fast with the rollout of 5G networks. It is also obvious that SA will lead the rollout of 5G in Africa, with opportunities to do business across Africa and improve people's lives at the same time.

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The NSTF provides a platform to be informed

The representatives of professional bodies belonging to the NSTF decided that we should shed light on the dark myths and scientific and technical realities surrounding the rollout of 5G infrastructure and devices. On 23 November 2020 we held a webinar on **Internet of Things Technologies and 5G rollout**, where Dr Fisseha Mekuria (Chief Researcher at the CSIR: Networked Systems and applications, Next Generation Enterprises and Institutions, and Head of the CSIR Smart Spectrum team that won the NSTF Award for Innovation in a Corporate Organisation recently) and Mr Sean Laval of Sqidnet, gave very detailed and informative presentations. The online event was hosted by the NSTF's Professional Bodies and Learned Societies sector called pro*SET*. The media release which explains in a thorough but accessible way, what was presented, can be found here: 20IoT5GmediaRelease.pdf (nstf.org.za) and Dr Mekuria's talk can be watched here: Dr Fisseha Mekuria 5 G+ Tech Standards & IoT - YouTube.

All of the webinar was interesting, but reflecting on it afterwards, we thought the public needs more straightforward answers to their questions about 5G. What is it? Why is it necessary? Is it harmful to human health? What is the situation with property rights and the erection of towers? Etc.

I cannot provide answers to all your questions and concerns. We hope to have an event to follow up on the one in November where the online audience can learn more. However, here I relate what was explained about 5G specifically during the webinar and point to online resources that might be useful to put people's minds at ease.

The radio wave spectrum

5G, like the previous generations, is about radio waves – they are used for all cell phone communications, radar, navigation, and to broadcast television and radio. The radio spectrum can be divided into licensed and unlicensed bands. Licensed bands can only be used by the company that licenced and paid for it. Unlicensed bands are not exclusive but are regulated.

Radio waves can travel through air, water, and solid material. That is how we can communicate on our cell phones even when we are inside a building, and how we can listen to a radio or watch television while inside a building or car. Radio waves also can travel through space. Radioastronomy works on the principle that radio waves from far and deep in space can be picked up with instruments like the SKA – the Square Kilometre Array radio telescope in the Northern Cape.

A particularly clear explanation of the electromagnetic spectrum is provided by the educational site 'Science ABC': [What If We Run Out Of Space On The Radio Frequency Spectrum(s)? (scienceabc.com)](). The following graphic is from this page and gives a clear overview:
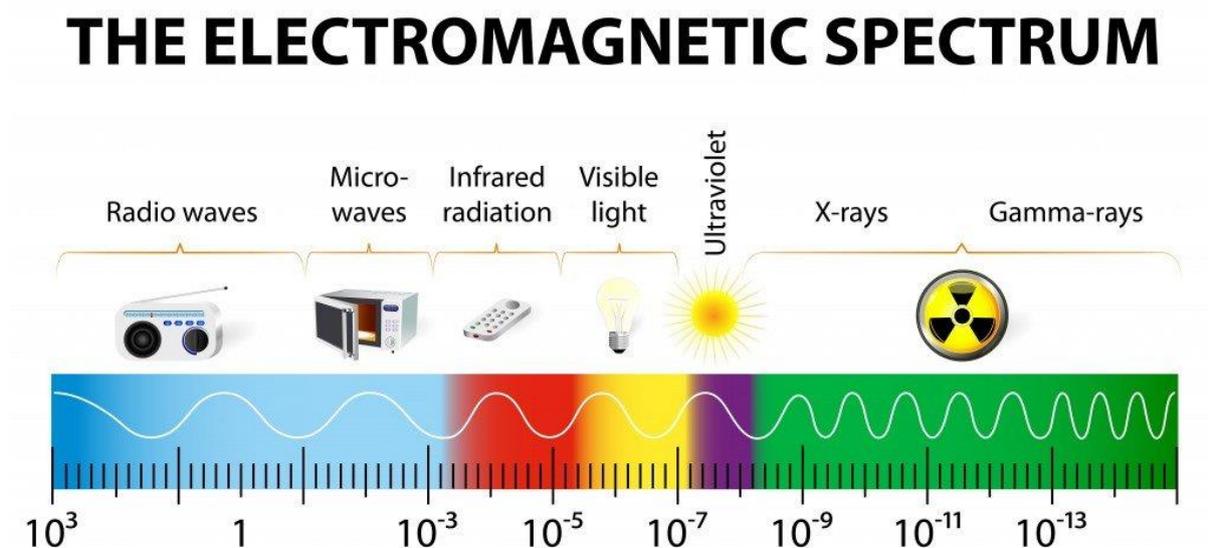
It is clear from this picture that the radio waves are on the low frequency side of the electromagnetic spectrum. So even if we refer to the high frequency spectrum used for 5G transmission, these are still low, compared to infrared radiation, visible light and harmful rays from radioactivity. There is no danger of the cancer and other health conditions and illnesses that radioactive substances can cause.

This article says that researchers all over the world are investigating ways to use the 'white space' between the allocated parts of the spectrum and "super-fast 5G devices that use signals of extremely high gigahertz frequencies may soon become a reality". ('Extremely high' being a relative term!) This will help to use the limited spectrum that is available more efficiently.

The path to the networked society

Dr Fisseha Mekuria presented on **'5G+ Tech Standards & IoT: The path to autonomic networks and the networked society'**. He gave clear explanations about the 'standards' and 'generations of standards'. The following paragraphs are quoted from our media release.

The different generations

The first-generation wireless network (1G) was developed in the 1980s. It supplied basic voice services using analog devices. From mid 80s through to the 90s, came the next generations of wireless networks – 2G and 3G. There was improved coverage and capacity. With 2G, the world saw the first digital standards. Mekuria explains that standards are verified by the ITU, a body that oversees networks globally. The standards ensure infrastructure compatibility with all the technologies involved 'talking' to the same network core. (The International Telecommunication Union – ITU – is a specialised agency of the United Nations that is responsible for Information and Communication Technology (ICT) matters.) The 3G wireless networks brought voice and other data activities: multimedia communications, texts and the internet. This standard needed to account for the great increase in people becoming connected, as well as new data activities. The 3G wireless networks also brought about the flexibility of working from anywhere.

With each new generation of wireless network, speed has increased dramatically. Consider that 3G was 2000 kbps to 4G at 100 000 kbps. The 4G networks are designed primarily for sending data using internet protocols (IP). The term 'LTE' is the standard associated with 4G. (The full name is 'Long Term Evolution'.) This wireless network gave us true mobile broadband and marked the time of the smart phone, says Mekuria.

The fifth-generation wireless network (5G) is already here, with even faster speeds (1-2 Gbps). Mekuria says that it's ready to support smart cities, industrial automation, IoT, and more. But don't get too comfortable, because 6G is being developed. This generation includes new ways of optimising networks (for more bandwidth, coverage, and to connect everywhere) and green networks (for reducing energy use and using green sources of energy).

5G standards for different use cases

Mekuria notes that 5G is a group of technology standards that supports different use cases (or scenarios). Examples of standards that fall under this are: Enhanced mobile broadband (allowing 4G radio systems to be used with a 5G core network) and Massive Machine Type Communications (MTC) using low power so that smart sensor networks can communicate. Work is also being done on technologies and standards for affordable broadband to cater to rural and underserved areas. The 5G use case scenarios needed to support industry, but there also needs to be social value, says Mekuria. This includes medical care, transportation, the energy sector, and intelligent transport sectors. "It requires that we work together i.e. we need public-private partnerships. This includes regulators, industry, the CSIR and government. We can then develop the social value working together for safer cities and public services, to improve the quality of people's lives, and to build industry's ecosystem and thus develop SA's economy," says Mekuria.

He further notes that ethics are key in the move to a networked digital society. An example is digital inclusion rather than only rich areas acquiring more bandwidth with rural areas being left behind.

Developing innovative applications for 5G

Mekuria says it's important to have a 5G testbed for developing innovative applications and that testbeds accelerate use case scenarios. Launched in Kenya in 2007, M-Pesa is a world renowned mobile phone-based money transfer service and a payments and micro-financing service. It's an

example of an application that started through experimentation in a testbed. (The mobile operator had provided a testbed for developers to experiment with 3G technologies.) The CSIR, with international collaborators, is building a 5G technology testbed. Although still under development, Mekuria says it's being used to test some use cases, such as self-driving vehicles. The aim is to encourage innovators (such as university students) to come and develop 5G use cases, apps and services.

Spectrum sharing

The CSIR would like to see spectrum sharing and Mekuria is the leader of the team that developed the Smart Spectrum Toolbox. It was a 2020 NSTF-South32 winner for Innovation by a Corporate Organisation. It's an innovative spectrum sharing and management system with a suite of technology products known as the CSIR Geo-Location Spectrum Database (GLSD). It provides a cloud interface service, designed to provide spectrum availability information to new entrant network operators.

It detects unused radio frequency spectrum areas in the Ultra High Frequency (UHF) bands. These identified spectrum white spaces are made available for broadband internet services, thus improving affordable digital connectivity. This process helps to accelerate the deployment of wireless ICT services, as well as providing impetus for the creation of SMMEs that deploy network infrastructure and provide affordable broadband internet.

The business model involves digital SMMEs, based in rural areas. These businesses would provide broadband internet services to rural and underserved communities using the CSIR Smart Spectrum Toolbox. Mekuria sees it as part of the solution to bridging the urban and rural divide with affordable and sustainable rural connectivity.

Mekuria does offer a warning regarding technology – we need to consider its relevance and ethical use. Technology can also be used for harm, such as illegal surveillance and other privacy issues.

Mekuria says that 5G is now being commercially rolled out in SA and globally. While it's a global standard, technical regulations, business models, policy, and ethics of use are still in their infancy. He sees *5G* and IoT and the associated technologies and skill sets as part of realising the Fourth Industrial Revolution (4IR) vision. You can find out more about 5G technology and use cases for Africa in the CSIR and Ericsson White paper, 'Making 5G a reality for Africa'.

> **Safety issues**
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> Noting the health claims that had been made around *5G*, Mekuria says that this is a highly regulated space internationally and that *5G* does not have detrimental health effects. The CSIR has a report, 'An assessment of claims regarding health effects of 5G mobile telephony networks', from May 2020 with further details.

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Conclusion

So, we see that 5G will only harm people (1) if used for illegal and unethical activities, and (2) if it is absent, thus making us miss the opportunities to improve our country and people's lives.

The opinions expressed above are those of the Executive Director, Ms Jansie Niehaus, and do not necessarily reflect the views of the Executive Committee or members of the NSTF.