

EMF measurement approaches for 5G – spot and long-term measurements

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Background

5G means that there are new sources of electromagnetic emissions to be considered. There is already some public concern and discussion about the new frequencies and technologies used by 5G. Narda and Telstra have performed instantaneous spot measurements for occupational health & safety, as well as long-term measurements as an approach for the purpose of environmental assessment. We have also assessed the procedures for working safely on 5G base stations.

Objectives

With 5G there are new sources of electromagnetic emissions to be considered. On the one hand the contribution of only 5G services to the total exposure to electromagnetic fields is of interest, and on the other hand the possible changes in the total electromagnetic emissions. There is already some public concern and discussion about new frequencies used by 5G and new technologies. Frequencies in the mmWave that formerly have been used for radar, point to point services and military applications will now also be used by 5G in cities and communities.



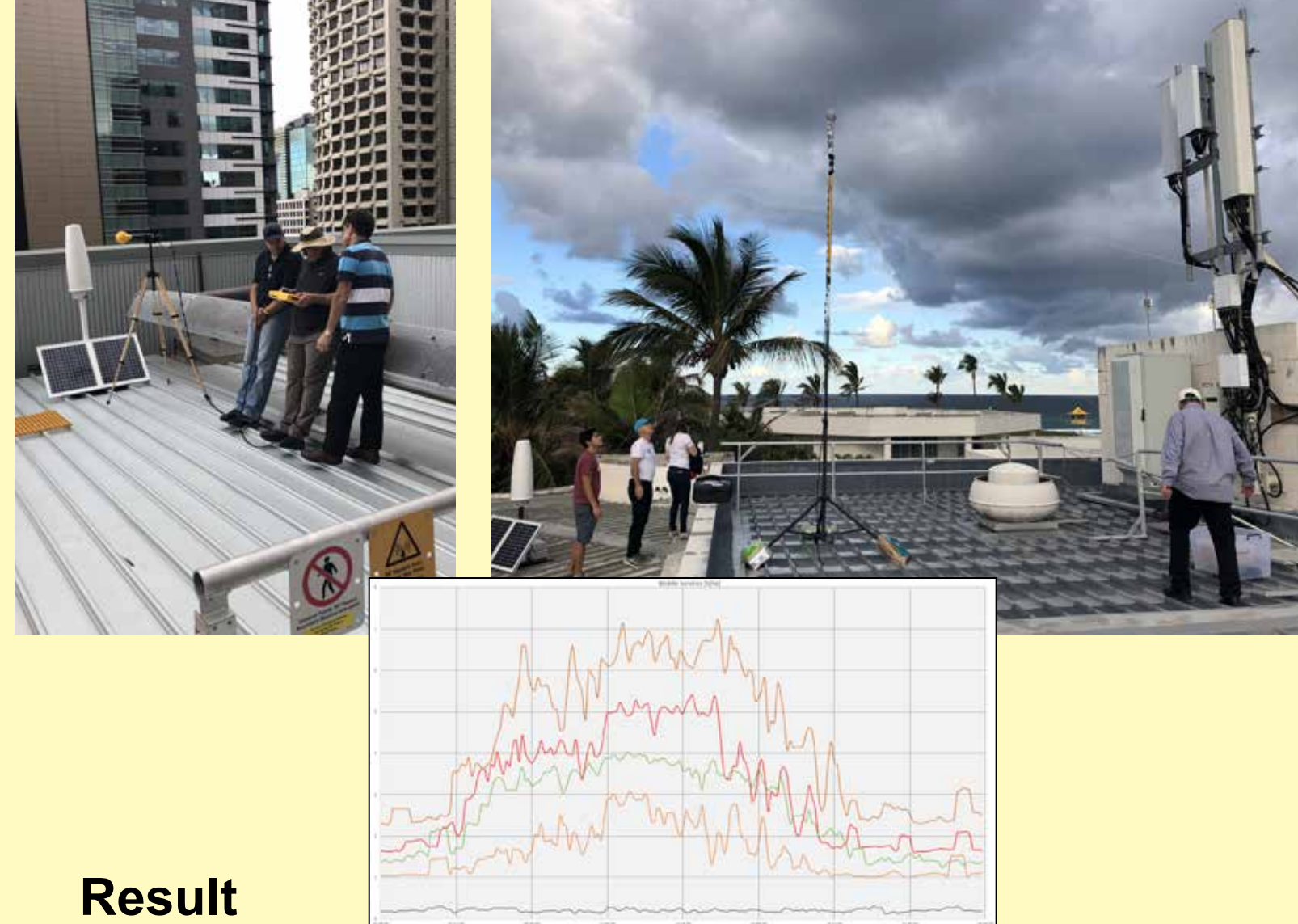

5G test networks are a crucial step towards the launch of the 5th generation of mobile communication services because operators must first determine which measurement technologies are suitable. The assessment of EMF levels and possible exclusion zones around base station antennas is also a key part of this initial testing phase. As well as functional testing for commissioning, ensuring health and safety in the workplace as well as for the public are vital considerations. A key aim for this project is to determine the actual EMF exposure from the new 5G technology and existing 3G and 4G wireless networks during normal operation.



Realistic exposure assessment is the key to this. Around the world there are different evaluation assessment methods in place, ranging from showing the actual exposure values to worst-case extrapolation.

Method

As an initial evaluation, measurements to assess the EMF levels have been undertaken on Telstra's 5G networks in Australia. Narda and Telstra have performed instantaneous spot measurements for occupational health & safety assessments, as well as long-term measurements as an approach for the purpose of environmental assessment. We have also assessed the procedures for working safely on 5G base stations.

Workplace Personal Protection	Broadband Spot	Environmental Measurements	
		Selective Long-Term	Selective Spot
			
<p>Result Broadband</p> <p>Signal parameters such as modulation, crest factor and signal shape are not critical to broadband meters like the Narda NBM, RadMan 2 and Nardalert S3</p> <p>As 5G will also use frequencies > 24 GHz with output power that is relevant, equipment with an upper frequency limit of only 6 or 8 GHz is not recommended.</p>		<p>Result</p> <p>For 24/7 measurements, the area monitors AMB-8059 (broadband) and 8063 (selective) can measure the exposure and post the data on the Internet so that the public can see the current radiation level at any time.</p>	<p>Result</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>Selective Spot Measurement</p> </div>

Conclusion

Measurement equipment is available for every application in 5G with regard to safety in electromagnetic fields. Only the procedure proposed by Narda for the demodulation-based extrapolation to actual maximum exposure remains to be acknowledged by national and international bodies.

References

„On The Assessment of Human Exposure to Electromagnetic Fields Transmitted by 5G NR Base Stations“ (Health Physics: April 23, 2019 - Volume published ahead of print issue – p) Helmut Keller, Narda Safety Test Solutions GmbH https://journals.lww.com/health-physics/Abstract/publishahead/On_The_Assessment_of_Human_Exposure_to.99882.aspx



Acknowledgement

Special thanks to Telstra Australia and Total Radiation Solutions who helped perform the measurements at their 5G sites and in creating every possible measurement scenario.



Current Exposure

SRM-3006 can perform selective measurements up to 6 GHz, and is able to distinguish between different services. An extension of SRM-3006 to frequencies > 24 GHz is envisaged.

Time Domain Measurement

A similar method has already been proposed and used for LTE signals. This method requires the „Scope“ option for the Narda SRM-3006.

Code Selective Measurement

This method is similar to the UMTS and LTE options for the SRM-3006 but is not yet implemented, as approval for this method by national and international bodies is still pending.

Measurement of SS/PBCH block or SSS by SRM 3006

The transmitted power of a 5G NR base station strongly depends on the current traffic load and user behavior. Many regulators require extrapolation to the maximum load and comparison of this result with the local standard. This ensures that the exposure will not exceed the permitted limits.