# Selective Measurements in 5G NR frequency range 2 at 24 - 29 GHz with directive and omni-directional antenna design

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## Introduction

In the last 30 years, the world of isotropic EMF measurement was still in harmony. In the norms, standards and measurement regulations it was said that for good reasons one should measure isotropically, i.e. independent of direction. And the manufacturers of the corresponding measuring devices also supplied such standard-compliant measuring probes and antennas. Even when EMF measurement technology became selective, it was possible to develop appropriate antennas and make them ready for series production.
Now, however, 5G NR is coming with FR2, which means frequencies > 20 GHz and bandwidths up to 1000 MHz. This is not a major hurdle for broadband measurement technology; isotropic measurement are also possible up to 100 GHz. But what about frequency selective measurements?

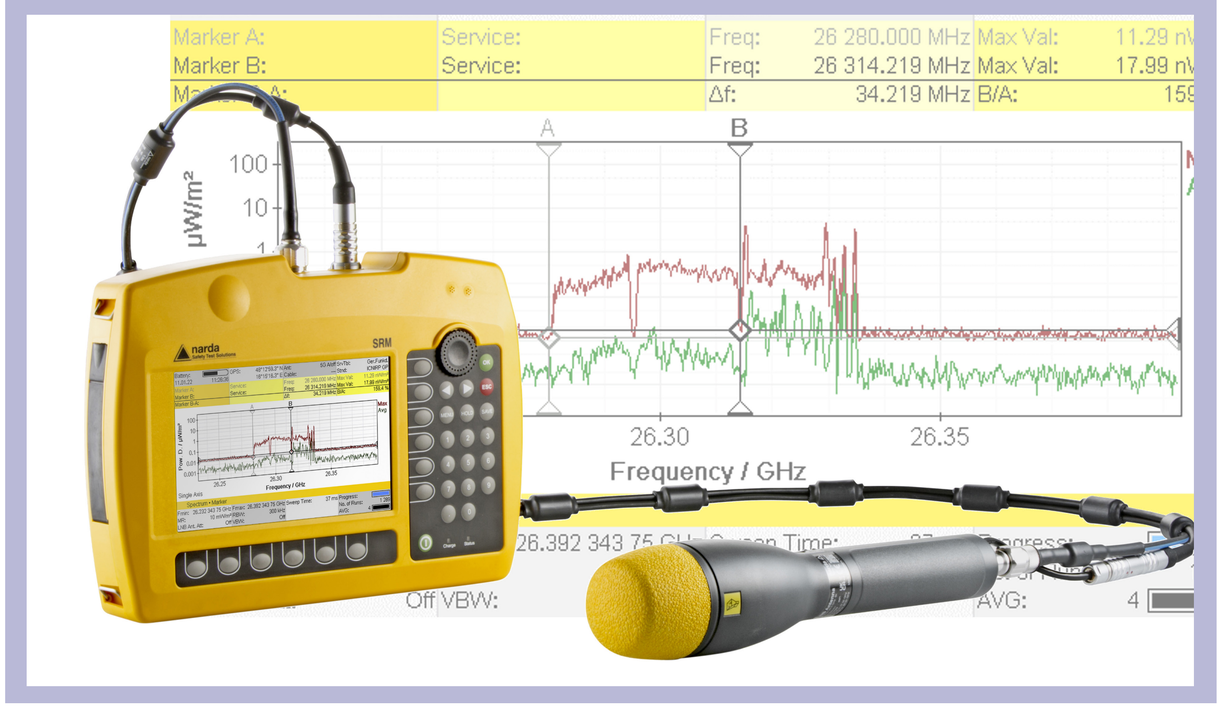
## Methods

A first antenna for the FR2 specifically for EMF measurement technology is on the market. It is available in two different designs, one as a directional antenna with horn characteristic and one as an omni-directional antenna. In parallel, operators set up first test sites for FR2. At these sites, the new antennas are being tested to answer the questions:

- What is the difference between a measurement with a horn antenna and an omni-directional antenna?
- Is it possible to make an isotropic measurement with these antennas?
- Is an isotropic measurement mandatory in this frequency range?

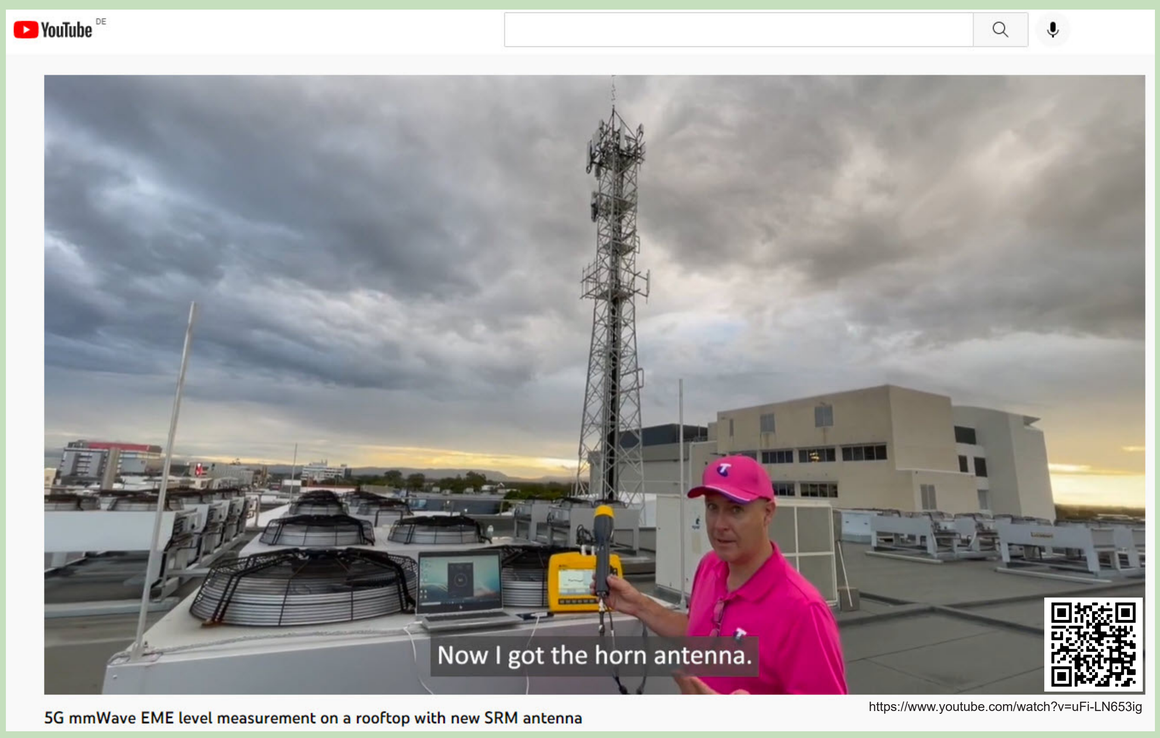
## Available today

Two LNB-antennas for SRM-3006, from outside completely the same, but with different receiving characteristics
Receiving band: 24.25 - 29.5 GHz

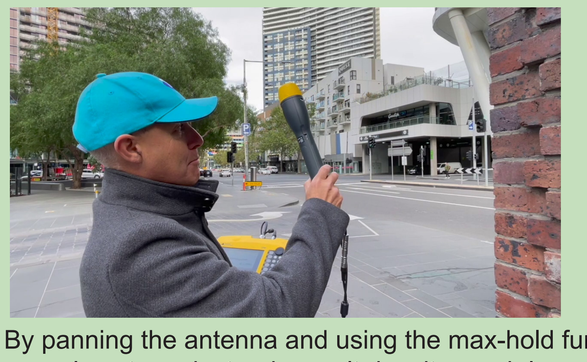



## Practical measurements

In Australia, the roll-out of the FR2 network is already well on its way. Mike Wood from Telstra and his team have been able to perform many practical measurements there. They have recorded their reports and experiences on YouTube.



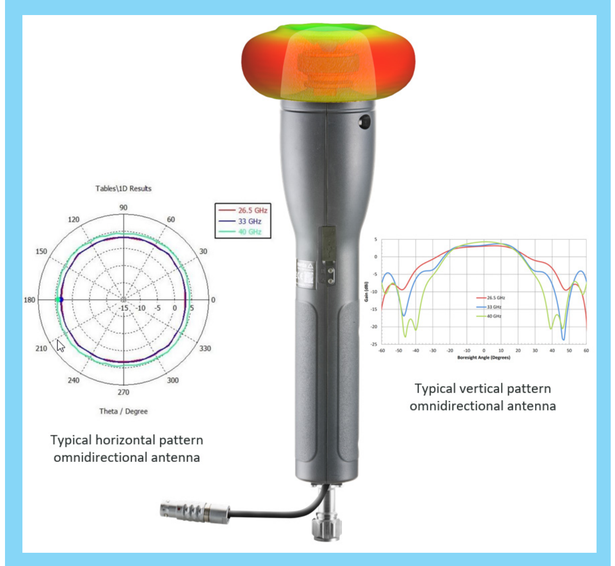

5G mmWave EME level measurement on a rooftop with new SRM antenna
https://www.youtube.com/watch?v=uFi-LN653ig



By panning the antenna and using the max-hold function, one can capture almost all emitters and is very close to an isotropic result despite much lower measurement effort.

## Omni-directional Antenna

For EMF measurements, national as well as international standards recommend an isotropic measurement. Such antennas are not available for the FR2 frequency range. The antenna 3591/02 offers an omni-directional reception characteristic that roughly corresponds to that of a donut. Ideal reception results are therefore obtained from an X-Y spatial plane.
An omni-directional antenna is the best compromise between a directional horn antenna and a non-existent isotropic antenna for the FR2 range.




## Antenna orientation

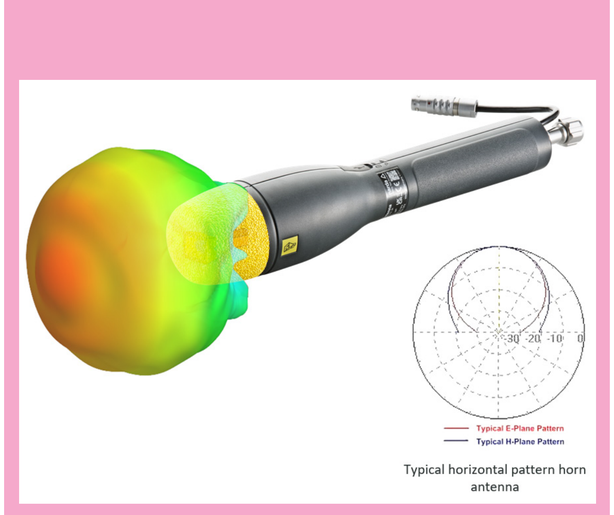
The omni-directional antenna is held vertically upwards. Thanks to its large opening angle in the Z-direction, it can also detect higher base stations.

## Conclusion omni-directional antenna

The omni-directional antenna is perfect for boundary compliance testing and to measure background levels.
Its omni-directional character is close to isotropic and with Max-Hold and a light panning all emitters should be captured.

## Directional (Horn) Antenna

Ideal for measurements of very low field strength. For example, behind a window. Or from a larger distance.
To be able to detect such a field strength, a high gain antenna is needed. However, such antennas have a high directivity due to their principle. The antenna model 3591/01 has such a characteristic. In addition, the directional characteristic can be used to detect the field strength of geographically separated base stations.




## Antenna orientation

The directional horn is directed directly with the tip of the antenna to the base station to be measured.

## Conclusion directional antenna

The directional antenna has an advantage in app. 6 dB more sensitivity. So specially for applications were levels are very low, this could be a deciding factor. Plus mm-Wave normally operate in TDD-mode so that up-links can disturb a measurement. Due to its directivity the directional antenna is much more immune against such pick-ups.

https://www.narda-sts.com/en/selective-emf/srm-3006-field-strength-analyzer/5g-fr2-antenne