
Measurement of radio
wave exposure from
5G base stations in
Sweden

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INTRODUCTION

The rollout of 5G networks is ongoing in Sweden like in many other countries. Existing base stations and frequency bands that are used for 4G can often be used also for 5G, but new equipment is also introduced that operates in other frequency bands and that can steer the radio signals in those directions where they are needed and reduce them in other directions (so called beamforming).

This fact sheet provides information about the radio wave exposure levels from these new 5G base stations and compares these with the total exposure from all mobile technologies (2G, 3G, 4G and 5G). The results were obtained by measurements near 5G base stations in the centre of Stockholm, which were conducted by Ericsson Research on behalf of TechSverige.

MEASUREMENTS AND RESULTS

Measurements of exposure to radiofrequency electromagnetic fields (EMF) were conducted in June 2021 in the vicinity of 10 radio base stations of one of the commercial 5G networks in downtown Stockholm. The base stations (manufactured by Ericsson) operate in the 3500 MHz frequency range and were chosen among those with the highest traffic load. Measurements were conducted outdoor at street level and in line-of-sight with the 5G antennas, which are installed on roof-tops near antennas of other existing mobile technologies (2G, 3G, 4G) operating within different frequency bands between 700 and 2600 MHz. All measurements were conducted with calibrated equipment (Narda SRM 3006 and MVG EME Spy Evolution) in accordance with the standard SS-EN 62232 and taken during daytime when the traffic in the network is expected to be highest.

The total radio wave exposure levels (expressed as power density with the unit W/m^2) measured at the 10 sites are presented in Figure 1 as percentage of the international limits (reference levels) for the general public recommended by ICNIRP (International Commission on Non-Ionizing Radiation Protection). These limits are applied in Sweden in the general guidelines from the Swedish Radiation Safety Authority (SSMFS 2008:18). For each site, the result shows the total radio wave exposure of all mobile technologies, frequency bands, and mobile network operators. The measured power density was time-averaged over 6 minutes as specified in the ICNIRP and Swedish guidelines. The total exposure was found to be less than 0.5% of the limits.

Figure 2 shows the measured exposure levels for each frequency band and averaged over the 10 sites. The maximum EMF level (power density) was found to be less than 0.1% of the limits. The contribution to the exposure from the different frequency bands is quite similar except from the 3500 MHz band where the level is lower since this frequency band is entirely allocated to the recently deployed 5G services that still have fewer users and less traffic compared to for example 4G.

With increasing 5G traffic the EMF exposure will remain well below the limits. This is shown in Figure 3, where the exposure from 5G at 3500 MHz was measured at one of the sites with the base station being forced to transmit at the highest possible power, corresponding to maximum traffic. The selected 5G base station was the one with the highest exposure level under current traffic conditions. While base stations under real conditions do not operate at maximum power for a longer period, the results in Figure 3 show that even if such extreme and unlikely traffic conditions would occur, the EMF exposure from 5G is still below 0.2% of the general public limit at 3500 MHz.

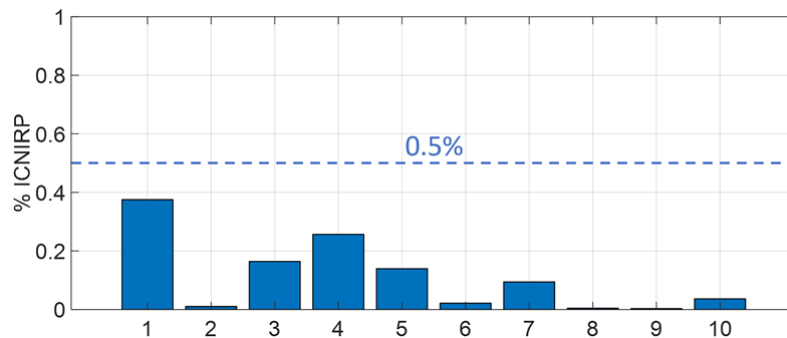


Figure 1. Total radio wave exposure, including all frequency bands used by 2G, 3G, 4G and 5G, expressed as percentage of the ICNIRP and SSM limits for the 10 sites where measurements were conducted. The maximum measured value was below 0.5% of the limits for the general public. Note that the vertical axis extends to 1%, i.e., one hundredth of the limit.

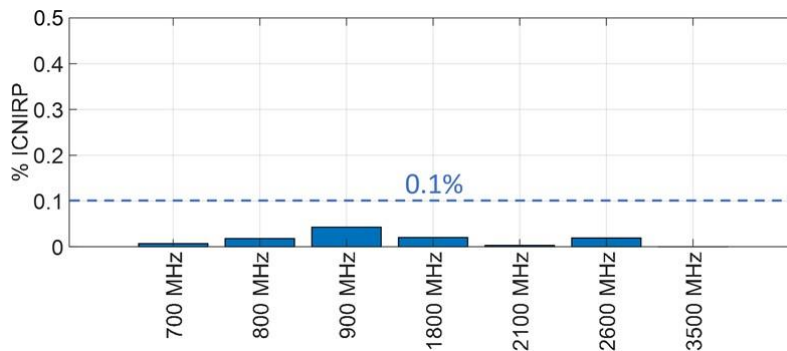


Figure 2. Total radio wave exposure for each of the measured frequency bands is expressed as a percentage of the ICNIRP and SSM limits and as an average value for the 10 measurement sites. The maximum measured exposure in all frequency bands was below 0.1% of the ICNIRP and SSM limits for the general public.

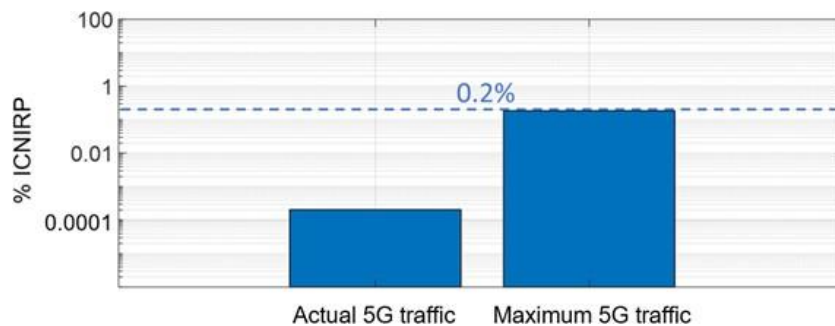


Figure 3. Radio wave exposure from 5G (3500 MHz) for one of the measurement sites. The left bar shows the actual level at the time of measurement and the right bar shows the level when the base station was forced to transmit at maximum power, corresponding to the maximum traffic load. The results are expressed as a percentage of the ICNIRP and SSM limits and given on a logarithmic scale (the distance between 0.0001% and 0.01%, 0.01% and 1%, 1% and 100% are the same). Even for the extreme situation, which does not represent normal conditions, the maximum measured exposure from 5G was less than 0.2% of the general public limit.

CONCLUSIONS

Radio wave exposure measurements have been conducted in central Stockholm in the vicinity of 10 5G base stations operating in the 3500 MHz band. The total exposure from all frequency bands and mobile networks (2G, 3G, 4G, 5G) was less than 0.5% of the international limits applied in Sweden. The contribution to the exposure from the 5G base stations is similar to that from other mobile technologies and much lower than the limit values also considering maximum traffic load.

The Nokia logo, consisting of the word "NOKIA" in a bold, blue, sans-serif font.The Telia logo, featuring a purple stylized globe icon to the left of the word "Telia" in a purple, sans-serif font.The Tele2 logo, featuring the word "TELE2" in a bold, black, sans-serif font with a row of five colored dots (yellow, green, blue, purple, red) underneath.The Huawei logo, consisting of a red stylized flower icon above the word "HUAWEI" in a black, sans-serif font.The Telenor logo, featuring a blue stylized flower icon to the left of the word "telenor" in a black, sans-serif font.The Ericsson logo, consisting of three horizontal black bars of varying lengths above the word "ERICSSON" in a black, sans-serif font.The TechSverige logo, featuring a vertical line to the left of the word "TechSverige" in a bold, black, sans-serif font.