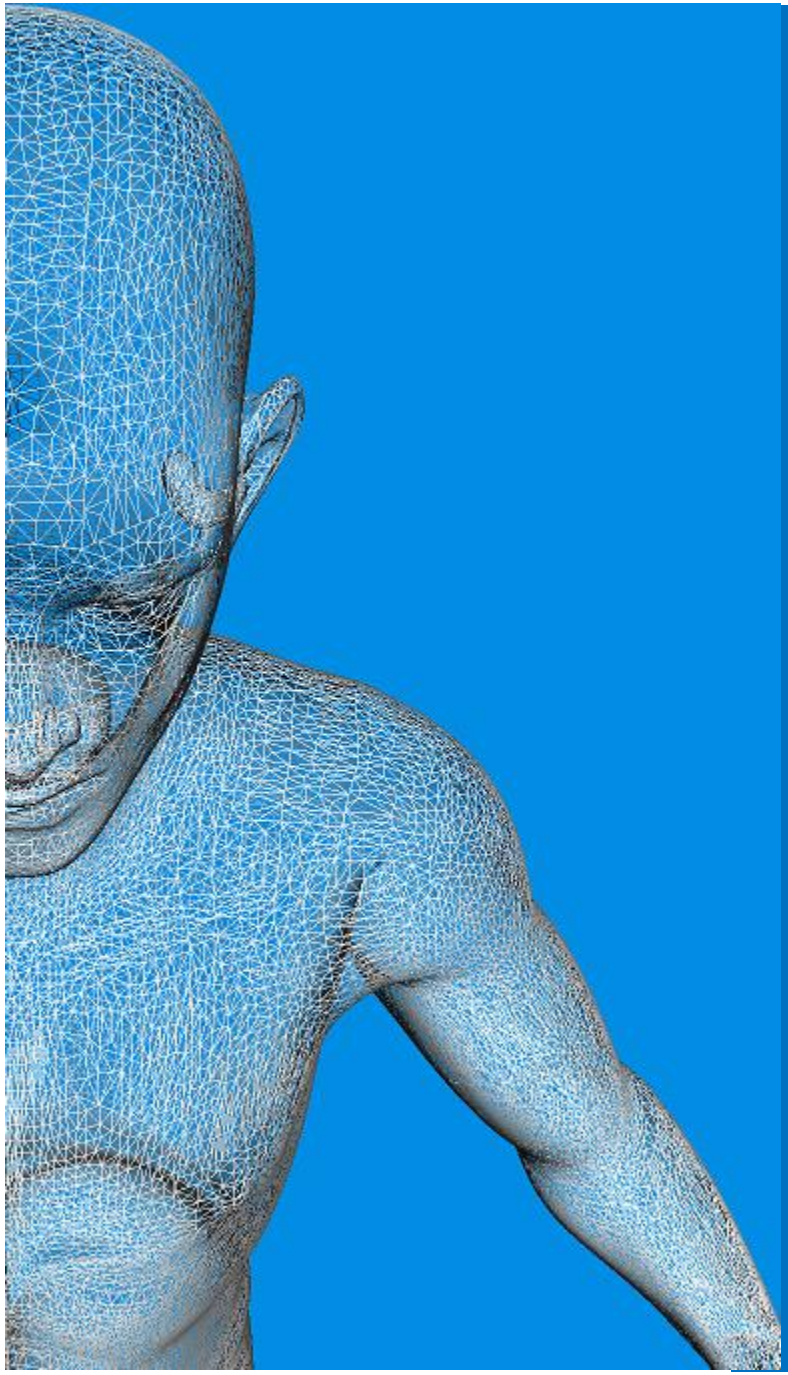

EMFcomp®

Safety Specialists For Electromagnetic Fields

EMF Safety & 5G

EMFcomp Limited
www.emfcomp.com

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Introduction & My Experience

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- PhD in electromagnetics, Chair of the UK's EMF Safety Committee for the Society for SRP. Published over 20 papers in the peer-reviewed scientific literature on EMF safety.

- Almost 20 years' experience in EMF safety, previously worked for the UK's NRPB and HPA. Now manager of my own EMF safety company.

- Specialise in measurement (e.g. completed over 30 rooftop antenna surveys), modelling (e.g. carried out all modelling for the EC's EMF Directive practical guide) and advice (e.g. international expert committees).

Adverse Health Effects from 5G

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- Direct Effects: Thermal stress, heating effects leading to heatstroke etc. Auditory effects such as perception of clicks or buzzing. RF burns.

- Indirect Effects: interference with implanted medical devices such as pacemakers, heating of passive devices such as metal implants (artificial joints, pins, wires or plates made of metal).

- No compelling evidence for: brain tumours, other cancers, Parkinson's disease, Alzheimer's disease etc.

5G Exposure Assessment Methods

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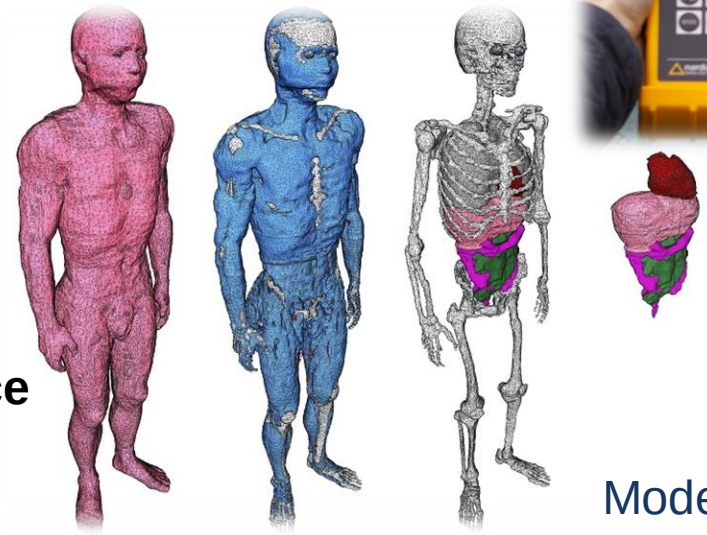
- Direct Effects: Compare the measured radiofrequency fields (V m^{-1} or W m^{-2}) from base station antenna arrays with the **Action Levels (ALs)** in the **EMF Directive 2013/35/EU**.

- Direct Effects: If ALs are exceeded, compare the modelled Specific Absorption Rate (SAR, W kg^{-1}) with the **Exposure Limit Values (ELVs)** in the EMF Directive 2013/35/EU.

- Indirect Effects: Compared measured/modelled fields with **EC Council Recommendation 1999/519/EC Reference Levels (RLs)** – these are the same as ICNIRP 1998 public reference levels.

Measurement



Modelling

Measurement Comparisons With Action Levels

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- Procedure is to measure the RF field with an RF probe and map out an exclusion zone – within which the field is not in compliance with the **EMF Directive Action Levels (ALs)**.

- You can time average the measured field (average over 6 minutes).

- You can spatially average the measured field (over the area of the human body – for localised EMF exposure).

Modelling Comparisons With Exposure Limit Values

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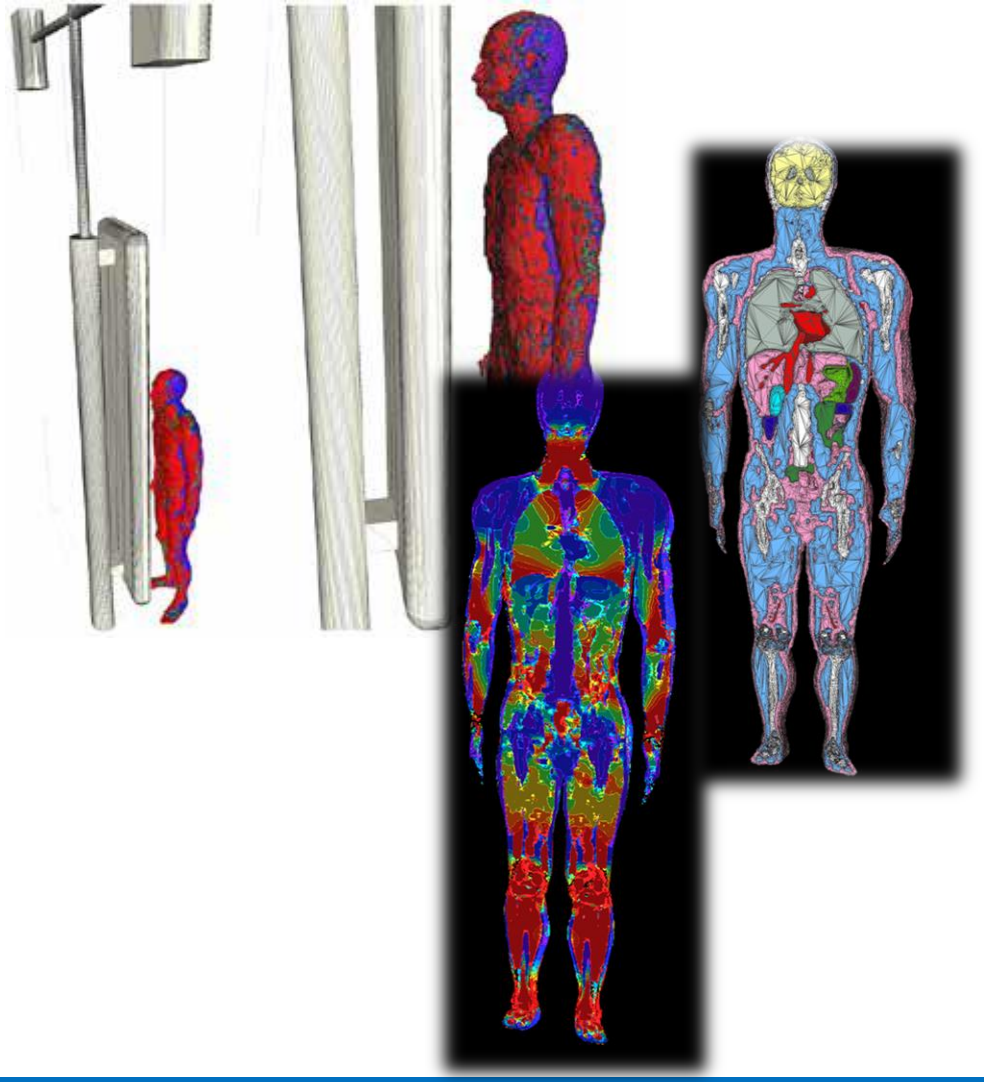
- Body temperature rise
  - 0 – 3 ºC : increasing discomfort
  - above 3 ºC : heat stroke, tissue damage

- Procedure is to model the SAR in the body using an appropriate numerical method and a realistic model of the human body. Then compare these with the **EMF Directive Exposure Limit Values (ELVs)**.

- Different SAR limits for the whole-body (0.4 W kg^{-1}), head and torso (10 W kg^{-1}) and limbs (20 W kg^{-1}).

- Again, you can time average the exposure.



Typical Exclusion Zones - Measured

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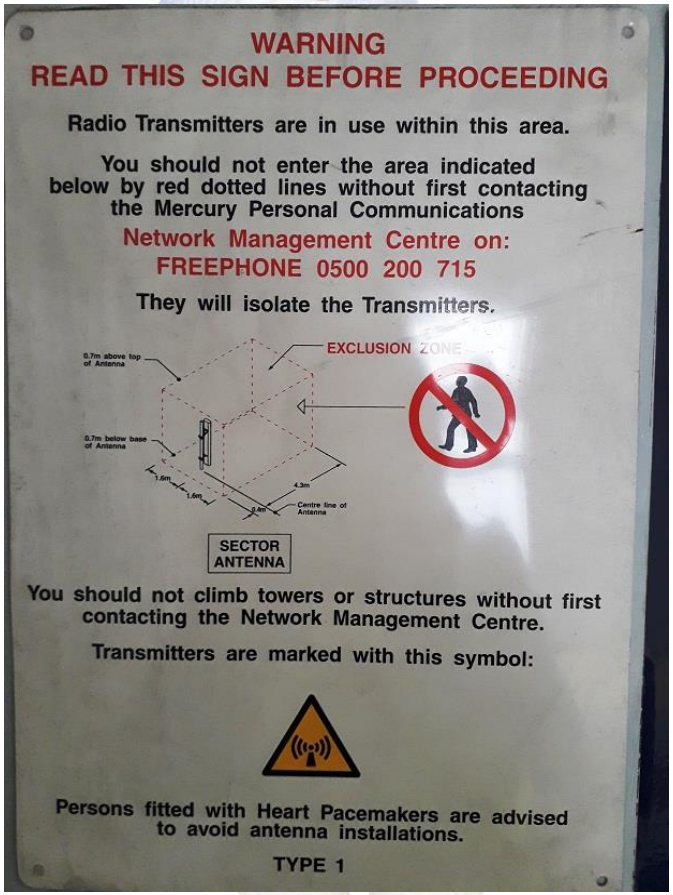
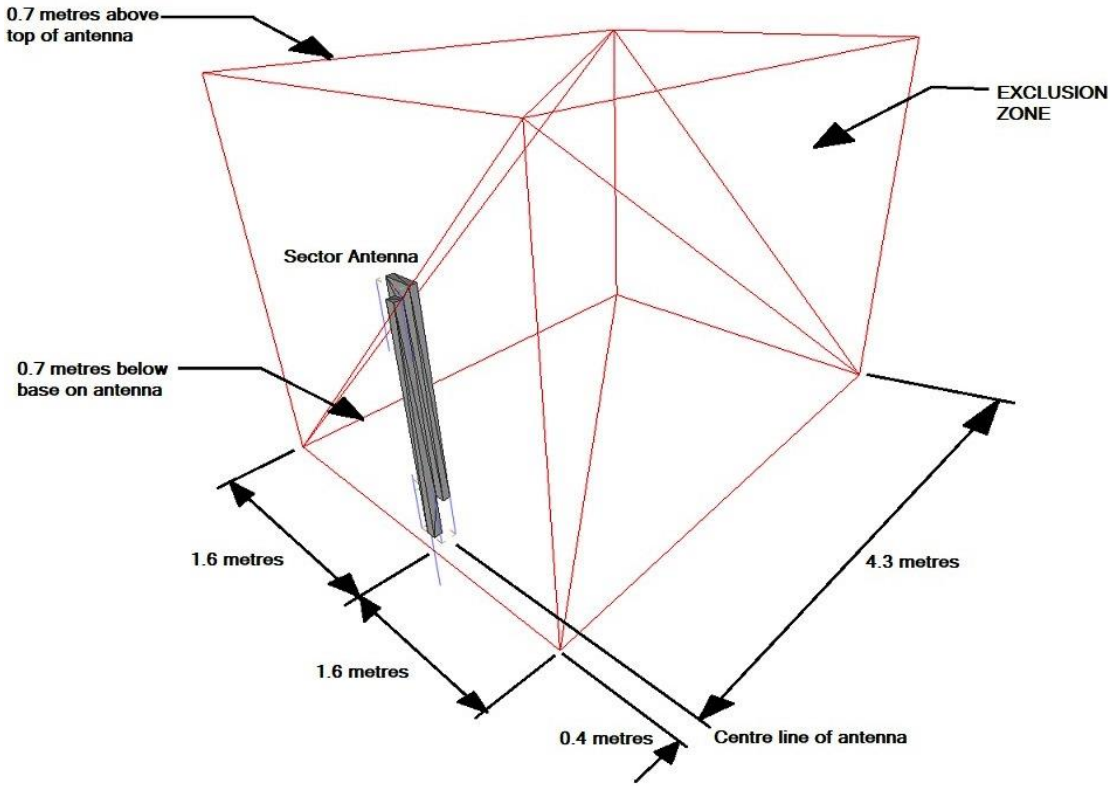
- Based on measurements of 2G/3G/4G/5G base station antenna arrays.





- Typically a 3 m by 3 m by 4 m exclusion zone.

Typical Exclusion Zones - Modelled

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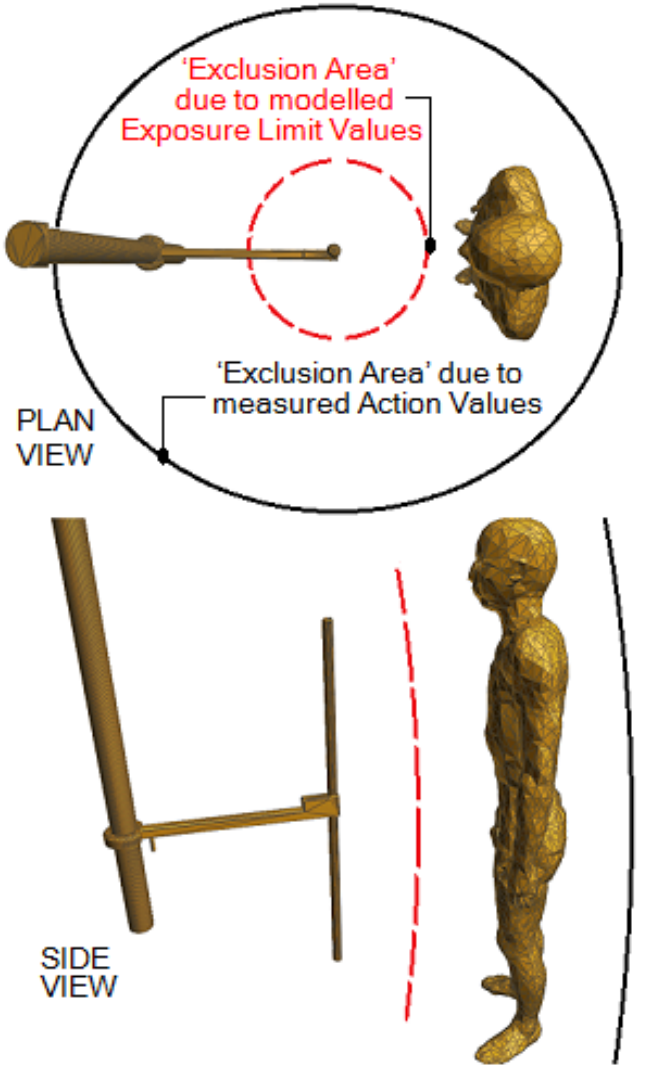
- Varies with antenna type, power, frequency and duty factors etc.

- However, it is always smaller than the exclusion zone defined by measurement (as measurements are more conservative) and can be as small as 1.0 m x 0.5 m x 0.5 m.



Perceived Problems With 5G

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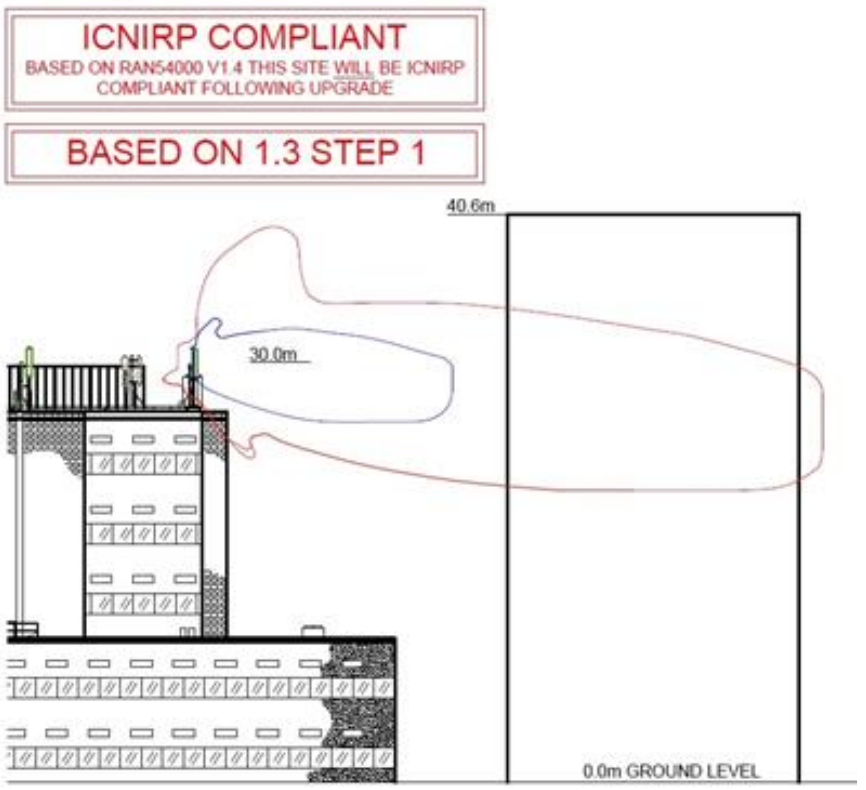
- The way in which 5G works is complicated (when compared to 2G/3G), therefore people do not understand how it works – hence people are concerned.

- Because it is complex, worst-case calculations for the exclusion zones (using software such as the ProX5) are unrealistic (sometimes up to 60 metres) as assumptions are made about 100% transmission, beam forming etc.

- Because exclusion zones are so much larger, they are being mounted at a higher level on rooftops. Workers/public see larger exclusion zones and antennas mounted higher, therefore assume 5G presents a greater risk to their health.



Excessive 5G exclusion zones (blue – workers, red – public) being given to building owners

5G Exposure Summary

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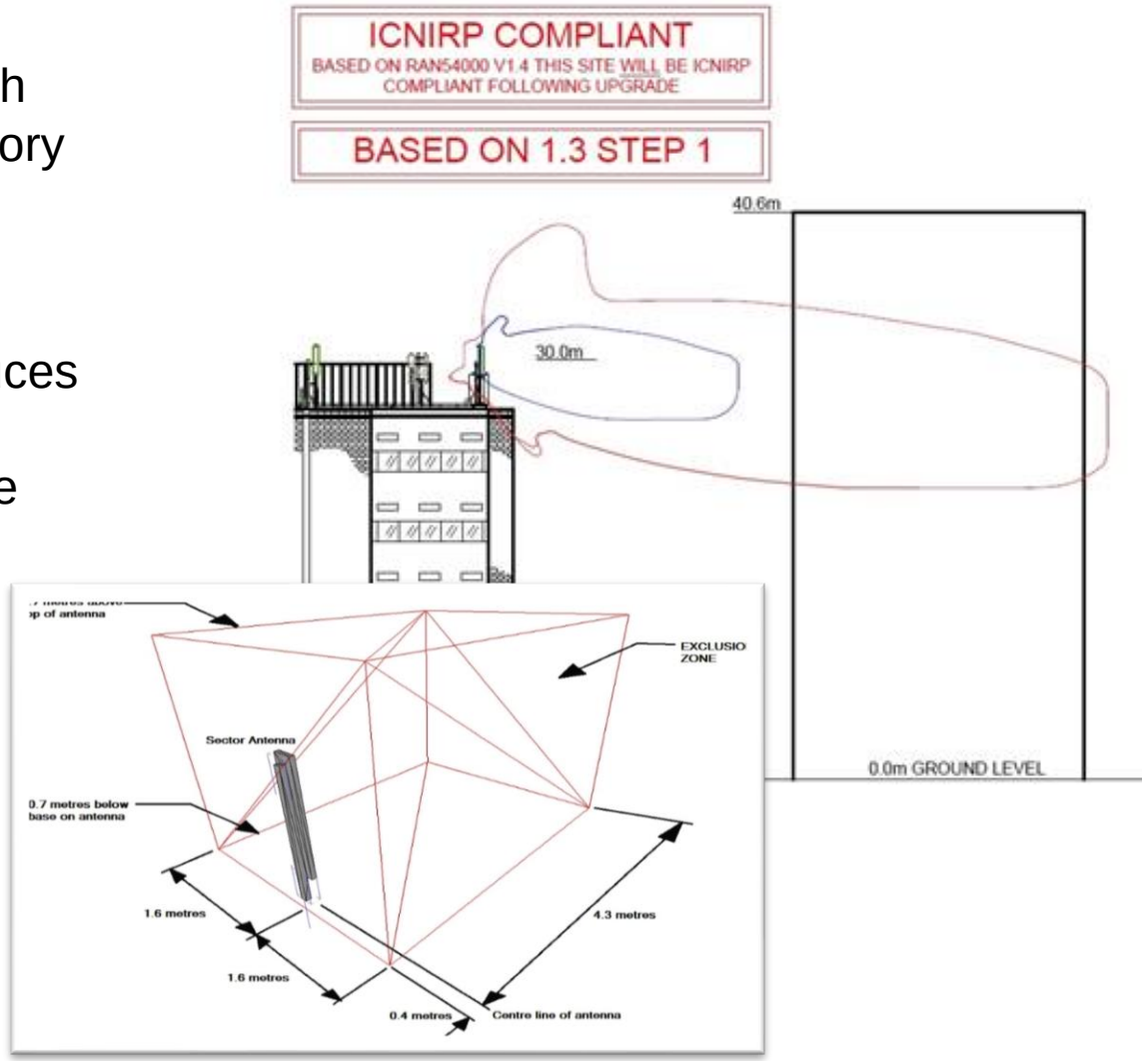
- The recognised adverse health effects are tissue heating, auditory effects and interference with medical devices.

- Measurement/modelling produces exclusion zones in front of 5G antenna arrays. Outside of these exclusion zones, there is no compelling evidence for any adverse health effects.

- Practical assessments so far suggest that exclusion zones should be similar to that for 2G/3G/4G.



Suggested Further Work on 5G

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- More assessments of 5G are required, because it is such a new technology and hence take up of 5G, traffic etc. has not peaked.

- A ‘realistic’ way of assessing human exposure, hence ‘realistic’ exclusion zones (not 60 metres in size) needs to be defined.

- Communication of the risks of 5G, conversations between the scientists/engineers and workers/members of pubic needs to improve.