

5g safety – separating fact and fiction
Additional questions

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| <p>An ISPreview article last August said that Fidelity are planning to use 60GHz and 70GHz in West Sussex. The 28GHz spectrum has been sold. I understand that 5G will go up to 300GHz.</p> | <p>That's this article I think. If so it's a misunderstanding. They've made the common error of confusing 5G with "mm wave" and "mm wave" with "60 GHz"</p> <p>https://www.ispreview.co.uk/index.php/2019/08/fidelity-to-rollout-first-uk-5g-fixed-wireless-broadband-in-west-sussex.html</p> <p>My prediction, as I mentioned, was that 5G will go to higher frequencies, certainly 30+ GHz. 60 is possible although it's of course very short-range because it doesn't propagate well.</p> <p>I doubt we'll get to 300 GHz with 5G. That's essentially infra-red and the technology is very different from radio, more like LiFi</p> |
| <p>Wavelength of 600-700MHz</p> | <p>Answered live – it's 50 to 43cm</p> |
| <p>Having had a stent fitted some of the aftercare advice is to beware of EM fields or radiation. What is your view on this and what advice/information can you provide please</p> | <p>There is some very specific advice on radio devices with regard to active implants such as pacemakers, insulin pumps etc. Stents are not considered in the same way because they are not electronic.</p> <p>Passive medical implants really only have the issue of potential self-heating in very strong fields, so someone with a rod in the leg might need to be cautious near an induction furnace, but for 5G the power at any realistic exposure location is low and the penetration depth of the RF will be quite small.</p> <p>Even for active implants it's considered (in general) that compliance with general public reference levels affords adequate protection. I wouldn't be at all concerned about a stent.</p> |

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| <p>How can higher frequency (24-28GHz) have lower penetration? In the spectrum the highest (e.g. gamma/x) freq, penetrates the most.</p> | <p>Different mechanisms. For ionising radiation it's kinetic absorption, where the particle or photon energy determines how far it gets before it is stopped, like firing bullets at a sandbag.</p> <p>For RF the absorption mechanism is power dissipation by (essentially) eddy current induction at very low levels. It's a "skin depth" effect, where the effective penetration depends on conductivity and frequency</p> <p>At 50 Hz magnetic fields pass right through. The absorption depth is bigger than the body's dimensions well up into the tens of MHz range. For a microwave oven at 2.45 GHz it's a couple of cm in your meat pie, which is why the middle of food can be cold when the outside is hot. It's why commercial ovens use 900 MHz – because the things they are cooking are bigger and they need deeper heating.</p> <p>Microwaves transition to infrared at 300 GHz, and of course for IR the heating is on the skin's surface.</p> <p>The general rule of thumb is that about about 10 GHz, RF is absorbed in the skin</p> |
| <p>[text missing]</p> | |
| <p>Some say 5G network architecture will be a (macro site) "top" layer with densification via a (small cell) "lower" layer. Is this a likely outcome in your view & what frequencies will be used for small cells?</p> | <p>I touched on this in the webinar. Yes, that's my view. I think the macrocells will be 600-700 MHz in rural areas, and about 3.5 GHz in more populated places, with as you say urban/high traffic densification which will be small, low power cells at 3.5 GHz for voice and mobile data.</p> <p>There will also be small cells using 24-28 GHz, at very low powers, for essentially point-to-point and point-to-multipoint data, but as I mentioned in the webinar these</p> |

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| | will not be very amenable to handheld and portable devices and are likely to be used for fixed, semi-fixed data such as home internet, and for things like autonomous cars where external antennas can communicate with transmitters on gantries over motorways in a reasonable controlled geometry with little clutter |
| It's my understanding that 5G has a larger ICNIRP envelope so antennas will need to be positioned higher and further from premises to protect the occupational and public exposures. How do we best protect ourselves with equipment positioning? | <p>It shouldn't do. It will depend on the installation. My prediction is that the 600-700 MHz macrocells will be high power than 3G, maybe like early 2G, but that most 5G cells will be much like 3G and small cells will look like 4G small cells.</p> <p>There's been a bit of fuss about beamsteering, beam shaping and massive MIMO, but this is more about optimising where the signal is going than using more of it. The devices won't need a stronger signal so there is no need for the power density in the beam to be bigger</p> <p>I am sure that there will be differences, but operators will have to ensure compliance with both public and occupational limits at all positions of exposure.</p> |
| Is the power output for a 5 g mast greater or less than a similar sized 3/4G mast. | See answers above |
| if we link all emergency services network to the public use system, how does this relate to resilience | Good question. But not one for me. |
| can you talk about masts in relation to gallileo and iridium satellite systems | <p>It's possible that satellites in low earth orbit with low latency could be used for backhaul from 5G base stations in remote areas, and that means maybe the new Starlink system, but it's unlikely to be used much in most of the UK outside really very remote places</p> <p>Gallileo is the GPS satellite network and Iridium is a commercial/military satellite phone system.</p> |

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| | <p>I touched briefly in the webinar on a comparison between the top band of 5G and satellite comms, particularly that it's essentially the same stuff, and we have already Ka band satellites with a footprint covering most of Europe that provide satellite internet services. The ground level exposures are similar to what we might expect from 5G.</p> <p>If anyone is on LinkedIn, this is a really useful comparison of Starlink and 5G</p> <p>https://www.linkedin.com/pulse/quick-analysis-starlink-link-budget-potential-emf-david-witkowski</p> |
| <p>Is this frequency effects on crane lifting activities and other instruments of near by plants</p> | <p>Shouldn't be. Such critical systems should already be tested against RF interference, and 5G has its own specified EMC parameters.</p> <p>Sometimes of course they aren't. Handheld radios (particularly the old analogue ones, GSM and some TETRAS) have been known to interfere with cranes. But there's no reason to expect 5G to be any worse than 3G in this respect</p> |
| <p>I understand that device and network providers are only expected to self certify for conformance - there is no independent testing as such. There are a lot of studies showing health effects and I advise that you check the websites of the EHTrust, PHIREMedical, EM Radiation Research Trust.</p> | <p>The performance characteristics of a phone at the point it is put on the market are declared by the manufacturer, just as they are for any device. All base stations have to have an ICNIRP certificate in UK.</p> <p>There is post-market surveillance of both devices and networks. In any case, public exposures from networks are a tiny fraction of limits.</p> <p>The organisations you refer to are professional antiphone campaigns, with very little genuine expertise. I did touch in the webinar on the contrast between what these people claim and what the myriad independent multidisciplinary reviews of the science by disinterested qualified scientists conclude.</p> |

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| | <p>You can read the expert reviews here</p> <p>https://www.ices-emfsafety.org/expert-reviews/</p> |
| <p>Fantastic presentation folks. Can I ask if there are any good visuals available about safe and unsafe areas around the mast heads ??</p> | <p>I am not aware of any publicly-available visuals as such. IOSH B&T Group may be able to help.</p> |
| <p>Some operators measure 5G output by considering the whole time the cell is operating. Others recognise there is a pulsing so in micro-seconds it's off for as much as it's on. So they half the effect. Which is the correct approach</p> | <p>It's more to do with call traffic, and it depends what you are trying to do.</p> <p>If you are seeking a snapshot of actual exposure levels in a place from multiple networks you would measure what's there, and it will vary with traffic. If you are doing compliance then you assume worst-case, full power and wither measure under those conditions or scale the measurement accordingly.</p> <p>Where a system is regularly pulse-modulated, such as a radar, you would look at the mean exposure across the cycle (as well as enduring that the peak met peak exposure limits)</p> <p>ndependent multidisciplinary reviews of the science by disinterested qualified scientists conclude.</p> <p>You can read the expert reviews here</p> <p>https://www.ices-emfsafety.org/expert-reviews/</p> |
| <p>Are there other health effects from pulsed emitters to continuous wave emitters? Is 5G pulsed or CW?</p> | <p>There don't seem to be. This was a very big issue with 2G/GSM where the handset signal in particular was modulated in frames to accommodate multiple channels (TDMA). Many of us will remember the famous GSM buzz that resulted if you used your phone near a loudspeaker or a radio microphone</p> |

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| | <p>https://www.youtube.com/watch?v=fh4IR_gPuUE</p> <p>There are actually some very good biophysical reasons to not expect any biological effects from modulation at carrier frequencies above 10 MHz or so (to do with the electrical properties of cell membranes) and we also have a number of quite elegant experiments that show the absence of any such mechanism. My own personal experience is of contact current in my arm from touching fences at various radio sites. Below 1 MHz I can definitely feel the modulation and it's a bit like a mild electric shock. Above 10 MHz, that goes away and at much higher contact currents I have perceived heating in my wrist and elbow.</p> <p>Either way, 5G, like 3G, is not pulse-modulated like GSM was.</p> |
| <p>Check the paper 'Risks to Health and Well-being from radio frequency radiation emitted by cell phones and other wireless devices' by Miller et al, 2019, <i>Frontiers in Public Health</i></p> | <p>This is exactly the point I was making in the webinar about the 25,000 studies and the need for independent expert reviews.</p> <p>By cherry picking from the literature just the studies that show an effect and ignoring the majority that don't, it's possible to produce a "review" to claim anything one likes.</p> <p>The authors of that review are all professional antiphone campaigners, the journal it is edited by one and I have to say I have never heard of either of the reviewers chosen. I just looked them up, and neither has any expertise whatsoever in this field</p> <p>I absolutely doubt that that paper would have cleared peer review in a neutral journal like <i>Bioelectromagnetics</i> or <i>Trans IEEE</i>.</p> |

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| | <p>One of the bugbears of this subject is poor quality “reviews” by vested interests getting waved though in friendly journals.</p> <p>I suggest that you look instead at the myriad independent multidisciplinary reviews of the science by disinterested qualified scientists:</p> <p>https://www.ices-emfsafety.org/expert-reviews/</p> |
| <p>My question is who is sponsoring this research? The phone companies etc? I.e the link with cancer and smoking was funded by the cigarette companies?</p> | <p>Answered live</p> |
| <p>what will be the public and occupational exposure limits</p> | <p>Referred to ICNIRP</p> <p>Currently general public is ICNIRP, and Occupational is the Control of Electromagnetic Fields at Work Regulations 2016.</p> <p>That’s no different for 5G than any other source of EMF.</p> |
| <p>Tests of mobile phones carried out in France found that 9 out of 10 mobile phones failed the ICNIRP SAR test.</p> | <p>No they didn’t. Firstly it’s not an “ICNIRP SAR test”. It’s from CENELEC, and specifically the committee I chaired for 15 years, TC106X</p> <p>Secondly all phones tested against the head met the limits</p> <p>Thirdly all phones tested in accordance with the current test requirements under the Radio Equipment Directive in the body test position passed. Only by setting the test distance from the specified < 5 mm to zero could they get failures, and even then it was only a handful of phones.</p> |

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| | <p>Zero distance requires you to have the phone with the screen pointing out pressed against</p> <p>your body and be wearing no clothes, whilst it operates on maximum power for 6 minutes. This is deemed a sufficiently unlikely set of circumstances that the policy makers chose < 5 mm as the test distance.</p> |
| <p>A 2020 study by Kostoff et al has identified adverse effects of non-ionising radiation on health. It emphasised that most lab experiments conducted to date are not designed to emulate real life conditions - they don't include the pulsing and modulation of the carrier signal. Nor do they cover other synergistic effects - chemical and biological - acting together with wireless radiation. The study presented evidence that 5G will not only affect the skin and eyes but have adverse systemic effects as well.</p> | <p>See answer 16.</p> |
| <p>Also if you have say 3 x 5G masts close by, can this double up like noise, in Decibels to increase dose to 15G, which can penetrate epidermis? Forgive my science on this</p> | <p>Answered live</p> |
| <p>I advise that you look up Barrie Trower on You Tube who worked with the military, 'Microwave Weapons, Cell Tower Radiation Experiments Barry Trower Part 6 of 11'</p> | <p>Barrie Trower is an entirely unqualified professional antiphone campaigner. I have spent some time trying to establish the bases of his claims to have been a "microwave weapons expert". I have so far not been successful.</p> |
| <p>A literature review by Alphonso Balmori in 2008 found that pulsed radio waves in the microwave spectrum caused impaired fertility in birds, with</p> | <p>See answer 16</p> |

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| <p>numbers of eggs and fewer chicks born, the nearer to the phone masts they were. California University also found that birds can be disoriented by phone masts, flying round and round them - there is a video on this.</p> | |
| <p>I watched a Dr Devra Davis YouTube lecture that included an experiment with worker bees not returning to hives with a powered-on mobile handset placed inside (compared to hives with no phone or switched-off phone). Also tests where sperm count was measurably lower in males with mobile kept in front jeans pockets. Is there an explanation for these?</p> | <p>Yes. Devra Davis is another professional antiphone campaigner with no relevant qualifications.</p> <p>See answer 16</p> |
| <p>What is the connection between 5G and autonomous vehicles and how will affect our society going forward?</p> | <p>That's outside my expertise I'm afraid</p> |
| <p>COVID had also been alleged to be caused by the introduction of the 5G technology. I could not wrap my head round it</p> | <p>Indeed. The FAQs at http://www.emfields.com/sub-pages/emf-faqs-including-5g addresses this in FAQ 25. It runs through the arguments for and against that claim.</p> |
| <p>Hi Phil. What is the risk of 5G exposure to telecommunication workers working live in close proximity to multiband antennas?</p> | <p>Answered live</p> |
| <p>What mechanisms exist to ensure comms installations are compliant in respect of power outputs, who polices it?</p> | <p>Each site will have its licensed power. OFCOM police it. I don't know the extent of of their checks, but they do happen</p> |

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| <p>Why have we not had a sensible education programme for the UK before the roll out? This probably would have avoided the present situation. The current shut down of a nation conversation is not helpful and increases more mistrust.</p> | <p>It may well have helped. The problem is that even when presented with the facts there is a degree of disbelief.</p> <p>One significant issue is that there is a very definite and quite well-funded campaign to discredit 5G. Some of it is doubtless people with political agendas: https://www.nytimes.com/2019/05/12/science/5g-phone-safety-health-russia.html</p> <p>but also, as some of the questions here allude to, there is a small number of professional anti 5G campaigners who are making a living out of generating fear, and a larger number of people who believe them. The claims are superficially quite plausible, and it requires a considerable effort to understand the science sufficiently well to see them as the disinformation that they are.</p> <p>Government agencies have always been reluctant to engage sufficiently strongly to quash the disinformation, so it has grown.</p> <p>For 3G, faced with similar issues, the Dept of Health set up the Stewart Group in 2000 and that process was quite successful in defusing the issue then. But of course then we didn't have the amplification factor of social media.</p> |