Intelligens Consulting

Intelligens Consulting Report To

Colchester City Council

5G Deployment Concerns

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Contents

1 Executive summary

This report, commissioned by Colchester City Council, provides an independent assessment of the safety and deployment of the Council's 5G private network. The network forms a key part of the Council's Connected Tourism Project, designed to enhance the visitor experience through augmented and virtual reality applications, while supporting Colchester's ambition to be a leading digitally connected city.

This report reviews the network's technical configuration, radiation emission levels, compliance with national and international safety standards and responds to public concerns and Freedom of Information (FoI) requests.

Key Findings

- **Purpose of the Network**. The Council's 5G network is designed to deliver high-quality digital experiences across heritage locations. It is a medium-power private network, operated under an Ofcom Shared Access Licence (SAL) using proven Nokia small cell technology.
- **Safety and Compliance**. Independent verification of modelling confirms that radio frequency (RF) emission levels are well within UK and international safety guidelines, including those set by the International Commission on Non-Ionising Radiation Protection (ICNIRP). Exclusion zones for public and occupational safety are clearly defined.
- **Comparison with Other RF Sources**. The network's RF emissions are significantly lower than those from other common sources such as television broadcasts, microwave ovens, and mobile handsets. The Council's 5G infrastructure does not emit harmful ionising radiation.
- **Public Concerns and Misinformation**. This report addresses a range of questions frequently raised by the public, including potential health risks, legal considerations, and claims of misinformation. Independent sources from UK5G, the UK Health Security Agency (UKHSA) and international health bodies are referenced to debunk myths and reinforce the safety of 5G.
- **Transparency and Planning**. The Council has followed appropriate planning procedures and has obtained all relevant ICNIRP compliance undertakings. Concerns over signatories and application details do not compromise the validity of the safety assessments.

Recommendations

- **Communications**. Use the included Q&A sections to support FoI responses and public engagement. These are designed for clarity and accessibility, citing credible sources throughout.
- **Legal Advice**. For legal or enforcement-related queries, further input from specialist legal advisors may be considered.
- **Ongoing Monitoring**. Continue to monitor public feedback. Consider publishing a simplified public-facing version of this report to increase trust and transparency.

This report provides assurance that Colchester's 5G network is safe, well-managed, and aligned with best practice deployment standards.

2 Introduction

Background

In 2021, Colchester City Council outlined a bold ambition to become the best digitally connected place in the Eastern region of the UK. As part of this ambition, the Council has launched their Connected Tourism Project, which leverages 5G and immersive technologies to enhance the visitor experience at key cultural and heritage sites.

The project responds to two key strategic drivers:

- **Post-COVID Economic Recovery**: The local visitor economy was severely impacted by the pandemic. The project aims to attract new visitors and support local businesses through technology-driven tourism.
- **Digital Infrastructure Investment:** By deploying a private 5G network, the Council is aiming to unlock future private sector investment in Colchester's digital infrastructure and build capability for emerging use cases.

The 5G network has been deployed by FreshWave, using Nokia small cell technology and operating under an Ofcom SAL. It provides medium-power, high-capacity, low-latency connectivity across Colchester, including heritage landmarks such as the Roman Wall and Colchester Castle.

The network enables location-based augmented reality and virtual reality experiences, accessed via a dedicated mobile app or rented headsets. Visitors can interact with immersive content, such as historical reconstructions and actor-led storytelling, as they explore Colchester's Roman heritage sites.

The project has attracted significant public interest, including from groups raising concerns about the safety, legality, and environmental impact of 5G. In response, the Council has commissioned an independent, evidence-based assessment to clarify:

- The technical parameters of the Council's network deployment.
- How the Council's network's compliance with safety guidelines.
- How the Council's network compares to other sources of RF exposure.
- The veracity of activist claims and concerns.
- The Council's legal responsibilities and planning obligations.

This report represents Intelligens Consulting's response to that commission.

Purpose and Scope of the Report

Colchester City Council has commissioned this independent report from Intelligens Consulting to assess the safety, technical configuration, and regulatory compliance of its recently deployed 5G network. The network forms part of the Council's Connected Tourism Project, which aims to revitalise the local visitor economy through the use of immersive technologies powered by private digital infrastructure.

This report addresses public concerns, technical queries, and legal questions surrounding the 5G deployment. It has been developed with three core objectives:

- **To assess the network's safety and regulatory compliance.** This includes verifying whether radiation levels from the network meet national and international guidelines, such as those set by the ICNIRP.
- **To respond to public questions and concerns.** A structured Q&A section is included to support the Council in managing FoI requests and correspondence from members of the public, particularly around health and safety, legal obligations, and misinformation.

- **To support transparent communication and future readiness.** The findings are presented in an accessible format to help the Council maintain transparency and credibility. Recommendations are included for how to respond to ongoing public engagement, manage reputational risks, and ensure continuous compliance.

This report draws on a combination of technical assessments, industry literature, regulatory frameworks, and engagement with Council officers. Where legal interpretation is required, the report identifies areas where additional specialist advice might be sought.

3 5G Network Deployment

Overview

Colchester City Council has deployed a 5G mobile private network to support their Connected Tourism Project. The network enhances digital experiences at historic landmarks using augmented and virtual reality, helping to attract visitors and stimulate the local economy.

The deployment has been delivered by Freshwave, a specialist provider of network infrastructure. The network uses Nokia small cell equipment and operates in the N77 band (3.8–4.2 GHz) under a medium-power Ofcom SAL.

The network consists of ten outdoor radio units strategically installed at key heritage sites, connected via fibre to a centralised network core located in Colchester Town Hall.

Network Architecture

The system follows a typical small cell architecture:

- **Core and Baseband Units**. Centralised at Colchester Town Hall.
- **Remote Radio Units (RRUs).** Nokia AirScale Micro (AWHQM), delivering medium-power signals (36 dBm per site).
- **Antennas.** Alpha Wireless AW3941-T0-F omnidirectional antennas with 8.5 dBi gain.
- **Backhaul**. Fibre connections to all sites.
- **Power**. Mains-supplied with local grounding; each site includes a power converter for the RRU.

This configuration ensures secure, high-capacity, low-latency connectivity suitable for streaming immersive digital content.

Site Locations

The ten small cell locations align with Colchester's Roman heritage sites. The sites are shown in Figure 1.

Figure 1 – Small Cell Sites. Source: Colchester_5G-SA Private Network HLD, 2025.

All equipment locations have been verified through design documentation and FreshWave field surveys.

Compliance and Modelling

The network's coverage and RF power levels have been modelled using RANPLAN, a recognised industry tool. These models demonstrate anticipated signal strengths and highlight exclusion zones in line with ICNIRP safety guidelines.

Freshwave's technical submission includes:

- Effective Isotropic Radiated Power (EIRP) calculations (based on equipment specifications and antenna gains).
- Received Signal Level (RSL) and Reference Signal Received Power (RSRP) predictions.
- Joint Operators Technical Specification (JOTS) signal quality classification.
- Site-specific exclusion zones for occupational and public safety.

4 Radiation Power Levels and Safety Analysis

This section sets out the technical basis for understanding the radiation power levels associated with Colchester City Council's 5G deployment. It explains key concepts such as EIRP, signal attenuation, and safe exposure thresholds, and it presents modelled outputs used to demonstrate compliance with ICNIRP safety guidelines.

Effective Isotropic Radiated Power (EIRP)

The small cell sites deployed in Colchester use Nokia AWHQM radios, each delivering a total radiated power of **36dBm EIRP (approximately 4 watts, 4W)**. This value is derived as follows:

- RRU output power 29dBm.
- Cable loss: 1dB.
- Antenna gain 8.5dBi.
- EIRP = 29dBm – 1dB + 8.5dBi = 36.5dBm.

These levels are well within the thresholds permitted under the Ofcom medium-power SAL in the N77 band.

To contextualise this power level, all ten cells combined radiate less power than a 50W light bulb.

Signal Attenuation and Free Space Path Loss (FSPL)

As RF energy propagates away from the antenna, it weakens, this is known as attenuation. The Free Space Path Loss (FSPL) equation quantifies this reduction in power over distance:

$$FSPL(dB) = 20\log_{10}(d) + 20\log_{10}(f) + 92.45$$

Where:

- d = distance in kilometres.
- f = frequency in GHz (here, 3.8GHz).

The figure below shows how signal strength drops over distance.

Figure 2 – Signal Attenuation and Free Space Path Loss. Source: Intelligens Consulting 2025.

Distance	FSPL (dB)	Resulting RSL (dBm)	Power (mW)
1m	44.05	-8.05	0.16mW
10m	64.05	-28.05	0.0016mW
100m	84.05	-48.05	~0.00001mW

This exponential decay explains why, even at short distances, power levels drop well below public safety thresholds.

Received Signal Strength and Coverage (RSRP)

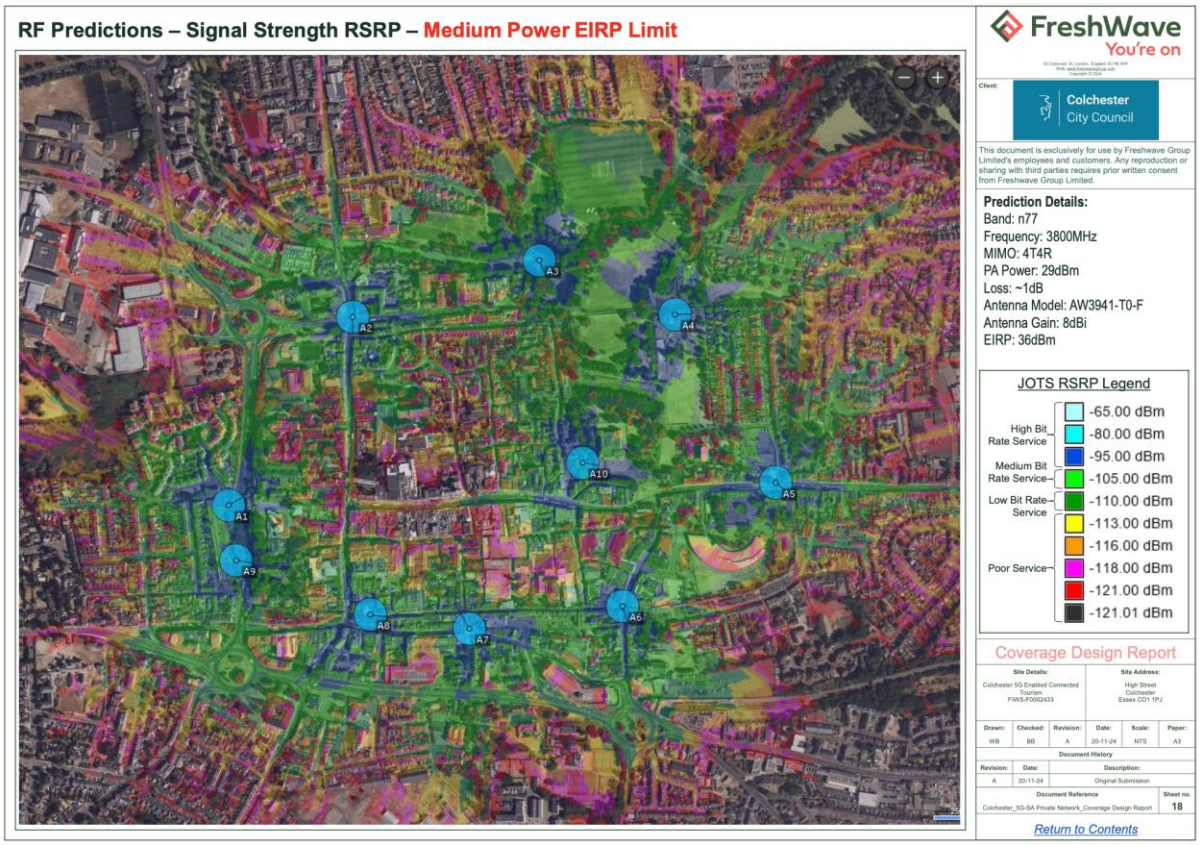
The network model uses RSRP to assess user experience and network design adequacy. On a 100MHz channel:

- -78 dBm RSL equates to -113dBm RSRP.
- JOTS coverage classification rates -65dBm to -95dBm as good, and -95dBm to -113dBm as adequate.

FreshWave had presented a RANPLAN model used to calculate coverage and received signal levels across the deployment area. The figure below shows that RF power beyond 10m from the small cell antenna is at the sub-microwatt (µW) level.

In summary, the levels of RF power radiated by the Council's network are very low.

Figure 3 - Location and RSRP map. Source: FreshWave FIWS2433



ICNIRP Compliance and Exclusion Zones

ICNIRP guidelines define power density limits for occupational and general public exposure. Freshwave has produced site-specific ICNIRP exclusion zone drawings showing safe operating boundaries for each antenna location.

These are calculated based on:

- Frequency and EIRP.
- Antenna gain and beam direction.
- Physical installation context (e.g. height, orientation).

Each site's exclusion zone typically falls within a 1m to 2m radius and is elevated well above public access points, further ensuring no practical exposure risk.

Figure 4 - Comparison with other RF sources. Source: Intelligens Consulting 2025

Technology	EIRP (dBm)	Power (watts)
Colchester 5G cell	36	4
Microwave oven leakage	-13.7/cm^2	~5μW/cm²
Mobile phone	Up to 34	2W – 3W
TV/radio broadcast	Up to 87	500,000W

A typical handheld mobile phone emits nearly as much RF energy than the Council's small cells and at much closer proximity to the user's head.

Conclusion

The Council's 5G network:

- Emits RF energy at very low levels, well within ICNIRP limits.
- Shows rapid signal attenuation with distance.
- Has robust ICNIRP exclusion zones in place.
- Is safer in power terms than many everyday technologies (e.g. phones, radios, microwaves).

These findings confirm the network is safe for public and occupational exposure and compliant with UK regulation and international best practice.

5 ICNIRP Safety Declarations

All licenced RF emitting equipment in the UK must comply with exposure limits set by the ICNIRP. These guidelines form the internationally recognised standard for limiting RF exposure and are endorsed by the World Health Organisation (WHO), the UKHSA and Ofcom.

Colchester's 5G deployment has been assessed against these guidelines. A detailed ICNIRP Compliance and Exclusion Zone Report was produced by Freshwave to validate safe installation and operation of all ten 5G sites.

What is ICNIRP?

ICNIRP is an independent, non-governmental organisation composed of expert scientists who develop exposure limits based on peer-reviewed, scientific evidence.

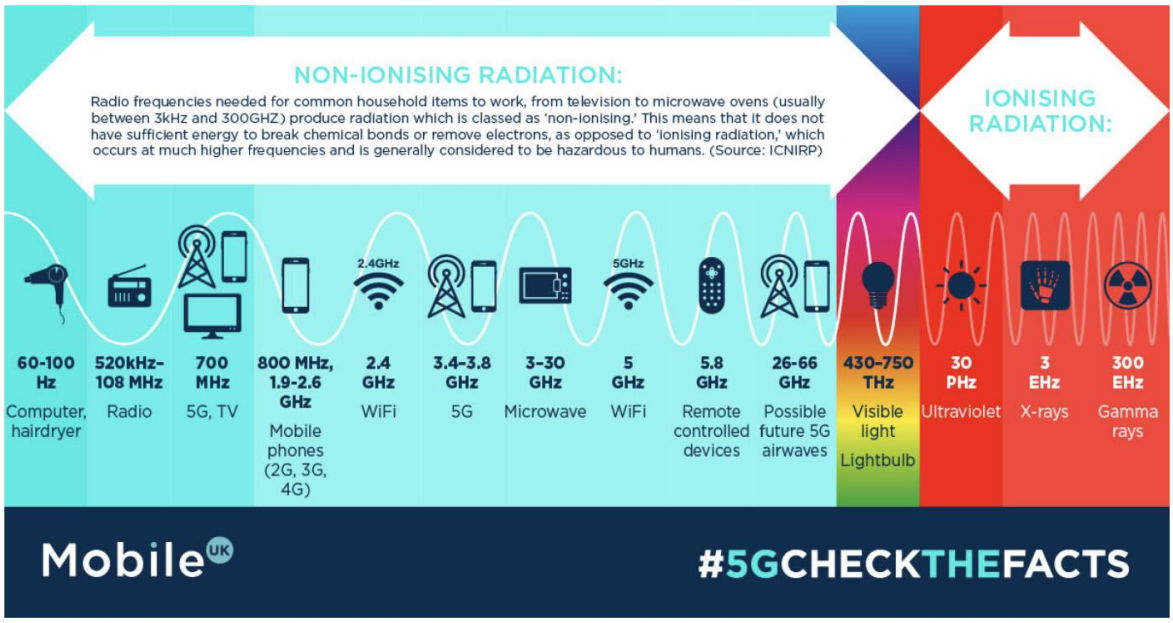
Their purpose is to protect human health from non-ionising radiation (NIR), which includes the radio waves used in telecommunications, by defining safe exposure thresholds for both the general public and occupational workers.

According to ICNIRP:

> *"Adverse health effects are only associated with exposure above certain thresholds… These limits ensure protection against established health effects such as tissue heating and nerve stimulation."*

Further information is available from ICNIRP's official guidance on 5G technologies.[1]

Figure 5 - Mobile UK NIR Guide. Source: Mobile UK, 2025



[1] Source: ICNIRP on 5G Exposure

Why Declaration Matters

Under UK planning regulations and Ofcom's spectrum licensing conditions, any organisation operating radio access network infrastructure must demonstrate that equipment operates within ICNIRP's guidelines.

Specifically:

- Planning applications must include an ICNIRP declaration (sometimes referred to as the ICNIRP "certificate").
- Ofcom licences for medium power, such as Colchester's SAL, include an explicit requirement for electromagnetic field (EMF) compliance.

This was confirmed by Ofcom in its 2024 FoI response:

> *"Ofcom carries out unannounced EMF tests and can take enforcement action where licensees breach ICNIRP limits. All measurements to date have been well within safe thresholds."*

Colchester's ICNIRP Compliance

Freshwave has provided formal evidence that Colchester's 5G network complies with ICNIRP guidelines, including:

- Calculated power levels at varying distances.
- Exclusion zone diagrams for each site.
- Confirmation of medium power EIRP limits (maximum 36dBm).
- Antenna orientation and mounting height specifications.

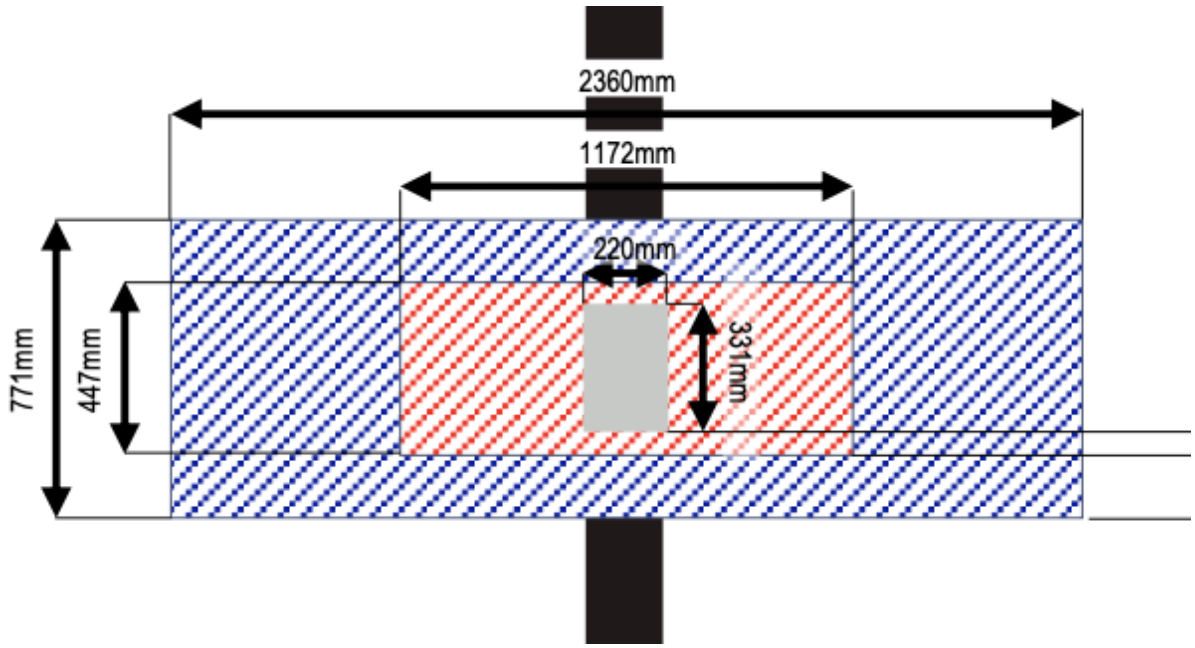
Each of the ten small cell locations has specific exclusion zones defining safe distances for public and occupational exposure

Freshwave's ICNIRP Report for detailed exclusion zone layouts per site shows, for example, for the St Mary's Steps site:

- Public exclusion zone, Clear horizontal clearance beyond 2.3m.
- Occupational exclusion zone, Limited to within ~0.7m of the antenna face.
- All zones positioned well above street level, ensuring the public cannot enter them.

As part of their network design FreshWave have set out exclusion zones around antennas which comply with ICNIRP guidelines, an example of which is included in Figure 6.

Figure 6 - ICNIRP exclusion zone. Source: FreshWave FIWS2433, 2025.



Public Concerns About Certification Validity

Some activist correspondence has questioned the validity of ICNIRP certificates, particularly in relation to:

- Incorrect company names or outdated operator details on planning applications.
- Perceived conflicts of interest among ICNIRP members.
- Assumptions that ICNIRP certificates equal blanket safety assurances.

These concerns have been addressed by Ofcom and local authorities:

- The purpose of the ICNIRP certificate is to confirm that the equipment will operate within the guidelines. The declaration itself does not validate the science, nor does it replace regulatory enforcement.
- Ofcom confirmed that it does not hold or verify ICNIRP declarations, responsibility lies with operators and planning authorities.
- Enforcement is based on measured emissions and licence compliance, not on administrative formatting errors.

Conclusion

Colchester's 5G deployment is fully ICNIRP compliant based on:

- Freshwave's validated exclusion zone drawings.
- Calculated EIRP levels that remain well below risk thresholds.
- Adherence to planning and spectrum licensing expectations.
- Physical design elements that prevent public access to any high-exposure zones.

All available evidence, including third-party modelling and Ofcom guidance, supports the conclusion that the deployment is safe, compliant, and appropriately certified.

6 Comparison with Other Sources of NIR

To provide public reassurance and context, this section compares the RF power levels generated by Colchester's 5G small cell network with common sources of NIR. These include household appliances, broadcast infrastructure, and mobile phones. All comparisons highlight that Colchester's deployment operates at significantly lower power levels, with weaker fields, and in many cases further away from the human body.

Method of Comparison

All examples use the FSPL model and the RSL formula:

$FSPL(dB) = 20 \log_{10}(d) + 20 \log_{10}(f) + 92.45$

$RSL(dBm) = EIRP(dBm) - FSPL(dB)$

Where:

- d = distance in kilometres.
- f = frequency in GHz.

These equations allow like-for-like comparisons of signal levels at various distances, frequencies, and power outputs, all expressed in dBm (decibels relative to 1 milliwatt).

Comparative Examples

(a) The Sun

The sun emits both ionising and non-ionising radiation. Despite its distance, it delivers a power density of ~100 W/m² at Earth's surface including ionising radiation, which is known to cause cancer.

In contrast Colchester's 5G network emits NIR at a fraction of one watt, with power densities thousands of times lower.

(b) Microwave Ovens

Modern ovens operate at 800W – 1800W (62.5 dBm) at 2.45GHz. Leakage is limited by shielding, but proximity can still result in detectable power.

- EU safety limits define 5mW/cm² as the maximum permissible leakage.
- Freshwave modelling shows Colchester's small cells emit <1μW/cm² at accessible public distances.

(c) Broadcast TV and Radio (e.g. Droitwich Long Wave Radio Transmitter)

- Operates at 87dBm (500kW) at low frequencies (long wave is at 198kHz).
- Can deliver RSLs exceeding 82kW at 1m under near-field conditions.
- Measured RSLs in Colchester from Droitwich exceed those of the Council's own small cells outside a 1m radius.

Figure 7 - Droitwich RSL Over Distance. Source: Intelligens Consulting, 2025.

d (km)	EIRP (dBm)	$20Log_{10}(d)$	+ 18.45 (FSPL)	RSL(dBm)	RSL (mW)
100km	87	40	58.45	8.55	7.1614
10km	87	20	38.45	28.55	716.1434
1km	87	0	18.45	48.55	71,614.3410
100m	87	-20	-1.55	66.15	7,161,434.1021
10m	87	-40	-21.55	86.15	716,143,410.2129

(d) Mobile Phones

Mobile phones are limited to an EIRP of 3W (34dBm), the network adjusts the user equipment transmitter to the lowest power consistent with good signal quality, sometimes as low as 1mW (0dBm). The issue with a handset generating 3W is it's close to the user's head. Using Band 3 (1.8GHz).

$$\begin{aligned} \text{FSPL(dB)} &= 20Log_{10}(d) + 20Log_{10}(1.8) + 92.45 \\ &= 20Log_{10}(d) + 20(0.25) + 92.45 \\ &= 20Log_{10}(d) + 97.55 \end{aligned}$$

Figure 8 – Band 3 RSL Over Distance. Source: Intelligens Consulting, 2025.

d (km)	EIRP (dBm)	$20Log_{10}(d)$	+ 97.55 (FSPL)	RSL(dBm)	RSL (mW)
1m	34	-60	37.55	-6.55	0.221
10cm	34	-80	17.55	16.45	44.1570
1cm	34	-100	-2.45	36.45	4,415.7044

The RF generated by your phone has a greater effect than that generated by the Council's 5G network if it's within useable distance.

(e) Macro Cell Towers

Macro cells typically operate at **65dBm (3kW)**, with antenna heights of 15–30m. These form the backbone of national 4G/5G networks.

- Signal strength (RSL) at 100m from a macro cell: ~ -12dBm.
- Signal strength at 100m from Colchester's small cell: ~ -48dBm.

Colchester's private 5G network emits **over 1,000 times less power** than a typical macro cell.

(f) LEO Satellites

Current Starlink and similar low-earth orbit systems transmit at **45dBm – 52dBm**, but from 500km – 2,000km altitude. While the power is higher, the FSPL at these distances (~164dB) means signal levels are extremely low, often requiring highly sensitive equipment or directional antennas.

As satellite-to-handset services expand, RF exposure from above may exceed that from local ground-based 5G deployments.

7.4 Summary and Key Takeaways

The Council's network is the lowest powered RF source in this comparison. NIR emitted does not pose any known health risks at the exposure levels measured. ICNIRP exclusion zones are strictly enforced to keep exposure well below safe thresholds.

Figure 9 – Exposure Summary. Source: Intelligens Consulting, 2025.

Source	Typical Power Output	Close Proximity Risk	Public Exposure Comparison
Sun (UV radiation)	~100W/m²	High (ionising)	Much higher
Microwave Oven	800W – 1800W	Medium (if defective)	Much higher
Mobile Phone (1cm)	1mW – 3W (34dBm)	Yes	Higher
Macro Cell	3kW (65dBm)	No	Much higher
Colchester 5G Cell	4W (36dBm)	No	Lowest

7 Literature review

This section presents a review of the scientific, regulatory, and public-facing literature that addresses the health and safety of 5G. It is designed to help Colchester City Council respond to FoI requests and public concerns using credible, referenced material. It also examines claims made by campaigners opposed to 5G and provides evidence-based responses.

Scientific and Regulatory Evidence on 5G and Health

There is a strong and consistent international consensus that 5G, when deployed within regulated limits, does not pose a health risk to the public. This conclusion is supported by national and global health authorities, telecoms regulators, and engineering institutions.

The ICNIRP, which sets globally recognised safety guidelines for EMF exposure, updated its recommendations in 2020 following a comprehensive review of the available scientific literature. The guidelines define safe limits for both occupational and general public exposure and include conservative safety margins. ICNIRP confirms that exposure below these thresholds does not cause harm. These guidelines are widely adopted by national regulators, including Ofcom in the UK.

In the UK, the statutory body responsible for EMF and health is the UKHSA. UKHSA affirms that 5G exposure, including in public spaces, is well below ICNIRP limits. Their published position is clear: "*The overall exposure is expected to remain low relative to guidelines and, as such, there should be no consequences for public health*".[2]

The WHO has similarly reviewed global research on EMF exposure and concluded that there is no substantiated evidence of adverse health effects from wireless technologies. Although RF radiation is classified by the WHO's International Agency for Research on Cancer (IARC) as a Group 2B "*possible carcinogen*", this category also includes coffee and pickled vegetables, a designation that reflects theoretical or limited evidence, not a proven causal link.[3]

In terms of enforcement and licensing, Ofcom requires all spectrum licensees to comply with ICNIRP limits. Since 2021, Ofcom has included specific EMF conditions in spectrum licences. In a 2024 FoI response, Ofcom confirmed that it does not hold public health studies (which fall under UKHSA's remit) but stated that all 5G EMF measurements it has conducted show levels well within ICNIRP limits.[4]

Additional confirmations come from UK-based organisations. Cancer Research UK states that there is no good evidence linking mobile phone or 5G use to cancer.[5] Similarly, the Institution of Engineering and Technology supports the use of ICNIRP guidelines and confirms that current 5G deployment in the UK is technically safe.

[2] Source: UK Government, 2019

[3] Source: WHO factsheet

[4] Source: Ofcom EMF policy

[5] Source: CRUK Factsheet

Electromagnetic Hypersensitivity (EHS)

Concerns about EHS, where individuals report health effects they believe are caused by EMF, have featured in some FoI submissions. The WHO has investigated these claims and concludes that while symptoms such as headaches and sleep disruption are real, there is no scientific evidence that these effects are caused by EMF exposure. Controlled, double-blind studies show that individuals who report EHS cannot detect whether EMF is present, and that symptoms persist even in EMF-free environments. The WHO maintains that "*there is no scientific basis to link EHS symptoms to EMF exposure*".

Realising the Benefits of 5G

Activist campaigns often focus solely on the perceived risks of 5G while ignoring the positive public outcomes it can support. The UK5G and Department for Digital, Culture, Media and Sport (DCMS) report *Realising the Benefits of 5G* highlights substantial societal value. It projects up to £164bn in economic benefit to the UK by 2030, or £2,500 per capita, and outlines use cases in public health, education, transport, and environmental monitoring. These include faster diagnosis through remote medical imaging, improved logistics through connected infrastructure, and enhanced virtual education tools.

UK5G Resources: Answering the Public's Most Common Questions

UK5G, working with industry and local authorities, has created a series of communications guides and FAQs tailored for elected officials and planning officers. These materials are directly relevant to the questions Colchester City Council is currently receiving.

For example:

- **"Is 5G safe?"** UK5G and UKHSA confirm that 5G is safe when exposure levels remain within ICNIRP limits, which they do in all UK deployments.
- **"Is 5G banned in other countries?"** Contrary to online claims, Switzerland, Belgium, and Japan have not banned 5G. While some locations temporarily paused deployment pending compliance reviews, all have since resumed.
- **"What about children or vulnerable groups?"** ICNIRP exposure guidelines are set conservatively to protect all members of the public, including infants and pregnant individuals.
- **"Does 5G harm pollinators or birds?"** Research supported by DEFRA does not identify electromagnetic radiation as a factor in pollinator population decline[6]. Habitat loss, pesticide use, and climate change are the primary drivers.

These questions are addressed directly in the *UK5G Elected Officials FAQ* and *Planning Officers FAQ*.

Responding to Activist Campaigns and Misinformation

Some activist groups, such as Action Against 5G and the EM Radiation Research Trust, have influenced local discourse in Colchester. These groups raise concerns about certificate errors, cancer claims, or a lack of "independent" testing.

For example, Action Against 5G attempted a judicial review of the UK Government's 5G policy. The High Court dismissed the case in 2023, citing a lack of credible scientific evidence.

[6] Source: DEFRA Science Search

Concerns over ICNIRP declarations, particularly the naming of “Three UK Limited”, have also been raised. However, Ofcom clarified that it does not verify declarations’ content and does not require declarations to be issued under specific naming conventions, provided they meet guidelines.[7]

Conclusion

The available literature, from ICNIRP, WHO, UKHSA, Ofcom, Cancer Research UK, and others, overwhelmingly supports the conclusion that 5G does not pose a health risk when operated within recognised exposure limits. Scientific claims made by opponents of 5G have repeatedly failed legal and academic scrutiny. At the same time, the public value of 5G continues to grow, with applications in healthcare, education, tourism, and digital infrastructure.

Colchester City Council can rely on this evidence base to address concerns, inform public communications, and respond robustly to future FoI enquiries.

[7] Source: Ofcom guidance on maps and planning

8 Q&A General 5G Deployment

This section addresses commonly asked questions about 5G technology, its purpose in Colchester, and why existing networks are not sufficient. These responses are based on national policy, scientific guidance, technical assessments, and materials included in this report and its annexes.

What is 5G?

5G is the fifth generation of mobile telecommunications technology. It builds upon earlier generations (2G to 4G) by offering significantly faster data speeds, much lower latency (response time), and the ability to connect far more devices simultaneously. Unlike previous generations, 5G enables real-time data transmission and supports a wide range of use cases such as smart infrastructure, virtual tourism, and remote diagnostics.

According to the ICNIRP, 5G uses RF waves in the non-ionising part of the electromagnetic spectrum, meaning it cannot cause damage to DNA. ICNIRP provides international exposure limits for 5G frequencies, and compliance with these limits is required for all network deployments.[8]

UK5G, the national innovation network for 5G, explains that 5G enables new capabilities that were not possible under 4G, such as virtual and augmented reality, remote healthcare, and smart city systems.[9]

Why do we need 5G?

5G is a critical enabler for digital innovation across sectors. In Colchester, 5G has been introduced to power the Connected Tourism Project, which allows visitors to use smartphones or headsets to access augmented and virtual reality content at heritage sites like Colchester Castle and the Roman Wall. These experiences require ultra-low latency and high bandwidth, performance characteristics that 4G and Wi-Fi cannot reliably provide.

A UK Government report commissioned by the DCMS and authored by UK5G estimates that 5G could deliver £164bn in economic value to the UK by 2030. It cites benefits across healthcare, transport, education, agriculture, and tourism, including saving the NHS up to 1.1 million GP hours annually through connected diagnostics and remote care.[10]

The UKHSA and the WHO also support 5G rollout, provided exposure remains within ICNIRP guidelines. Both bodies have confirmed that exposure levels from 5G installations in the UK are well below these limits.[11,12]

Why can't we just use the networks we already have?

Existing 4G and Wi-Fi networks are not designed to handle the demands of modern digital services. 4G networks are already reaching their capacity limits in busy areas and have higher latency than is acceptable for real-time applications. Wi-Fi is typically constrained to indoor use, has limited range, and is more vulnerable to interference in outdoor or public spaces.

Colchester's Connected Tourism Project uses high-resolution, actor-led digital content streamed over the air. Delivering this content seamlessly requires consistently high signal quality and low latency, which only 5G's small cell network architecture can provide.

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[8] Source: ICNIRP 2020 Guidelines

[9] Source: UK5G 5G Safety Messaging and Communications Guide

[10] Source: DCMS Realising the Benefits of 5G

[11] Source: UKHSA EMF Collection

[12] Source: WHO Fact Sheet

According to the JOTS, 4G networks struggle to meet these thresholds reliably, particularly in historic or built-up areas with complex signal propagation.

Coverage modelling by Freshwave, using the RANPLAN tool, confirms that the Council's 5G deployment offers better performance and consistency than what could be achieved through 4G or Wi-Fi alone.

Why is 5G being rolled out in Colchester?

Colchester City Council is deploying a private 5G network to support its Connected Tourism Project. The project was initiated to help revitalise the local visitor economy after the COVID-19 pandemic. Through augmented reality apps and headset rentals, visitors can engage with Roman history in immersive ways, for example, by experiencing life inside the Castle or along the Roman Wall.

The Outline Business Case for the project, published in December 2021, states that Colchester aims to become the most digitally connected place in the Eastern region. The 5G infrastructure is being delivered by Freshwave using Nokia small cell radios and operates in the N77 spectrum band under an Ofcom SAL. The deployment is compliant with all applicable EMF safety and planning regulations.

This use of 5G aligns with national digital strategy and leverages public sector infrastructure to attract private sector investment. [13,14]

Who approved the 5G deployment in Colchester?

The 5G network was commissioned by Colchester City Council and delivered by Freshwave through a standard procurement process. Each installation site followed UK planning policy and required the submission of ICNIRP compliance certificates, as stipulated by the National Planning Policy Framework (NPPF) and the Code of Best Practice on Mobile Network Development in England (2022 edition).

The installations were reviewed by Council officers and supported by Freshwave's ICNIRP exclusion zone drawings, power level calculations, and planning documentation. Ofcom's SAL provides spectrum authorisation for operation in the N77 band and Freshwave holds this licence for the project.

Ofcom does not pre-approve installations but can conduct audits and enforce compliance. All current measurements across UK mobile networks remain below ICNIRP limits, according to Ofcom's published EMF monitoring data.

Can the Council stop 5G from being deployed?

The Council cannot ban or prohibit 5G deployment where national planning and licensing requirements have been met. Telecommunications infrastructure is governed by the Electronic Communications Code and national planning regulations. These provide network operators with certain statutory rights to install infrastructure, subject to conditions such as ICNIRP compliance and planning validation.

In this case, Colchester City Council has chosen to use 5G proactively as part of a Council-led initiative. It retains full control over the infrastructure it commissions or hosts and has worked with expert partners to ensure legal, technical, and safety compliance. Any additional installations by third parties would also be subject to national law and planning procedures.

Public objections based on safety concerns are considered but cannot override national health and safety guidance. The Council has provided this report, along with public-facing

[13] Source: Colchester Council Outline Business Case Issued 23 Dec 21

[14] Source: Ofcom EMF Policy

Q&A material and technical documents, to ensure transparency and evidence-based engagement with the community.[15,16]

[15] Source: DCMS 5GElected Official FAQ

[16] Source: ICNIRP Planning Guidance

9 Q&A Health and Safety concerns

This section addresses the most frequently raised public concerns regarding the potential health effects of 5G. It includes questions about cancer, risk assessments, vulnerable populations, and scientific disagreement. Each response reflects the latest guidance from authoritative health and regulatory bodies, including the UKHSA, the ICNIRP, the WHO and Ofcom.

Who is responsible for public safety relating to 5G?

Responsibility for public safety in relation to 5G is shared across **public health authorities**, **spectrum regulators**, and **local planning authorities**.

The **UKHSA** provides scientific guidance on the health implications of RF exposure. It affirms that there are no established health risks from 5G exposure when emissions remain within ICNIRP limits. According to UKHSA, "*the overall exposure is expected to remain low relative to guidelines and, as such, there should be no consequences for public health*"[17].

ICNIRP, whose guidelines form the international standard for safe RF exposure, has set conservative limits based on decades of peer-reviewed scientific evidence. These limits apply to all mobile network technologies, including 5G, and include large safety margins to protect even the most vulnerable individuals.[18]

Ofcom enforces these guidelines via spectrum licences. Since 2021, it has required telecoms operators to comply with ICNIRP exposure limits as a condition of their licence. Ofcom also conducts field measurements and has reported that EMF levels from UK 5G sites remain well below safety thresholds.[19]

Local planning authorities, such as Colchester City Council, ensure that infrastructure developments are legally compliant with planning policy. As required under the NPPF, all planning applications for telecommunications masts must include a signed ICNIRP certificate stating that the equipment complies with public exposure guidelines. The local authority's role is to ensure this declaration is provided and aligns with planning and siting regulations.

Does 5G cause cancer?

There is no reliable scientific evidence that 5G causes cancer. 5G networks use non-ionising RF energy, which does not carry enough energy to damage DNA or cells in the human body.

The **WHO** states that "*to date, and after much research performed, no adverse health effect has been causally linked with exposure to wireless technologies*".[20]

Although the WHO's IARC classified RF radiation as a Group 2B "*possible carcinogen*", this designation also includes commonly consumed items like coffee and pickled vegetables. It indicates that the evidence is limited or inconsistent, not that a causal link has been established.

[17] Source: UKHSA guidance

[18] Source: ICNIRP Guidelines

[19] Source: Ofcom EMF Compliance

[20] Source: WHO Fact Sheet

Cancer Research UK also confirms that there is no good evidence linking mobile phone use or 5G to cancer and that people should not be concerned about routine exposure from wireless networks.[21]

In all UK deployments, 5G infrastructure must operate within ICNIRP exposure limits. Freshwave's modelling of Colchester's 5G network confirms that RF levels are far below these limits, even at short distances from the antennas.

Has Colchester Council conducted risk assessments on 5G?

Yes. Colchester City Council commissioned Freshwave to undertake a detailed technical assessment of its 5G deployment. This included:

- RF power level modelling using RANPLAN.
- ICNIRP-compliant exclusion zone calculations.
- Equipment specifications and antenna characteristics.
- Site-specific evaluations for each of the ten small cell locations.

These assessments confirm that RF exposure levels are significantly below ICNIRP limits at all publicly accessible locations.

Further public health guidance was reviewed as part of the preparation of this document, including materials from UKHSA, WHO, and UK5G, to ensure that the Council's deployment aligns with the most current safety standards.

Are different age groups at risk from 5G exposure?

No. ICNIRP exposure limits are set at levels intended to protect all members of the public, including children, pregnant people, the elderly, and individuals with pre-existing health conditions.

The **UKHSA** confirms that "*the guidelines are set to protect the whole population, including children and vulnerable groups*" and that exposure levels from 5G networks in the UK are far below these limits in real-world conditions.[22]

This has been validated by independent studies and Ofcom EMF audits, which measure real emissions from base stations and confirm they are within safe limits at all distances relevant to public access.

In the case of Colchester's network, Freshwave's exclusion zone analysis shows that even at 1m from an antenna, power levels are significantly below the public threshold. Beyond 10m, emissions drop to levels comparable to background RF from older technologies like television and radio.

Why do some scientists claim 5G is dangerous?

While the majority of scientific studies and regulatory reviews conclude that 5G is safe within established limits, a small number of researchers have raised concerns. These concerns are often based on laboratory studies that are either not reproducible or conducted under conditions (e.g. unrealistically high exposure levels) that do not reflect real-world network deployment.

[21] Source: Cancer Research UK

[22] Source: UKHSA EMF Policy

According to UK5G's *Safety Messaging and Communications Guide*, published in coordination with Public Health England and the Institution of Engineering and Technology, anti-5G arguments generally fall into three categories: health effects, environmental concerns, and broader distrust of institutions. The guide notes that many of these claims stem from misunderstanding, misapplied science, or non-peer-reviewed sources.[23]

The scientific consensus remains clear: there is no credible evidence that 5G, when used within ICNIRP limits, causes harm to human health.

Has any country banned 5G due to health concerns?

No country has banned 5G for health reasons. Some jurisdictions, such as Brussels, Geneva, and parts of Switzerland, temporarily paused deployments to assess whether national guidelines aligned with ICNIRP. In all cases, those pauses have been lifted, and 5G deployment has resumed.

For example, Brussels adjusted its local exposure limits in 2020 to allow for 5G rollout, while Geneva's moratorium was overturned by the Swiss Federal Government in 2021. Japan and Belgium, often cited in activist literature as having banned 5G, continue to operate and expand their 5G networks.

This has been confirmed by the UK Government and summarised in UK5G's *Planning Officers FAQ* also see 5G Observatory.[24]

[23] Source: UK5G 5G Safety Messaging and Communications Guide

[24] Source: 5G Observatory Report, June 2024

10 Q&A ICNIRP Declaration and Compliance

This section explains what an ICNIRP declaration is, why it is required, and how it fits into planning and regulatory processes. It also addresses public questions about the accuracy and legal status of these declarations, and clarifies the roles of local authorities, Ofcom, and ICNIRP itself.

What is an ICNIRP "certificate" and why is it required?

An ICNIRP "certificate", more accurately described as a declaration of compliance with ICNIRP guidelines, is a required document submitted as part of a planning application for new telecommunications infrastructure in the UK. It affirms that the equipment will operate within the exposure limits set by the ICNIRP.

ICNIRP exposure limits are used globally and endorsed by the WHO and the UKHSA. In England, the Code of Practice for Wireless Network Development (2022) requires that planning applications for masts, antennas, or small cells include a declaration to confirm public safety compliance.

This process helps local planning authorities, like Colchester City Council, ensure that safety considerations have been addressed before granting approval. The requirement is also embedded in the NPPF and applies to all prior approval and full planning applications involving telecoms infrastructure.

Is ICNIRP a neutral organisation? Can we trust their guidelines?

Yes. ICNIRP is an independent, not-for-profit scientific body composed of volunteer experts from multiple disciplines, including biology, epidemiology, physics, and medicine. Members do not represent their countries or institutions and must declare any conflicts of interest.

ICNIRP's work is solely focused on evaluating and issuing science-based exposure guidance for NIR. The guidelines are developed using peer-reviewed research and are widely recognised and adopted by governments and regulators worldwide, including WHO, UKHSA, Ofcom, and the European Union.

It is important to note that ICNIRP does not issue or endorse certificates itself. Instead, its role is to define the standards and exposure thresholds. The declarations made in the planning process are based on these standards but are completed by operators or their agents, not ICNIRP directly.

Who verifies that 5G masts comply with ICNIRP guidelines?

Responsibility for verifying compliance sits with Ofcom, the UK communications regulator. Since 2021, Ofcom has included specific EMF compliance conditions in spectrum licences. These conditions require licensees to ensure their equipment operates within ICNIRP limits and to maintain records showing how they meet those conditions.

Ofcom also conducts both routine and unannounced EMF inspections of 5G and other wireless installations. Its measurements consistently show that emissions across UK networks, including 5G masts, remain well within public exposure limits, typically less than 1% of the ICNIRP threshold.

If a member of the public believes a site may be non-compliant, they can report it to Ofcom, who will investigate under their regulatory powers.

Does an incorrect company name on an ICNIRP certificate make it invalid?

No, a clerical error on an ICNIRP declaration (such as naming “Three UK Limited” instead of “Hutchison 3G UK Limited”) does not automatically invalidate the safety assurance or the planning application. Ofcom has confirmed that these declarations are “self-certifications” made by operators or their authorised agents. The legal obligation rests on the operator to ensure compliance, regardless of which party signs the declaration information.

ICNIRP declarations are not “certificates” issued by a third party; they are statements of technical compliance submitted to demonstrate that exposure levels from the proposed installation will not exceed recognised safety limits. If a network operates outside of those limits, the operator is in breach of its Ofcom licence.

Colchester City Council, in line with national policy, does not verify the content of the certificate itself but ensures one is present as part of the planning submission.

Can the Council provide copies of ICNIRP certificates?

No. The Council is not legally required to retain copies of ICNIRP declarations once planning approval has been granted, and they are not published by ICNIRP or Ofcom.

ICNIRP itself has confirmed that it does not issue or verify any certificates and has clarified that questions about “ICNIRP certificates” should be directed to the relevant regulatory authority in each country. In the UK, this is Ofcom.

That said, Colchester City Council’s contractors, Freshwave, have provided a complete set of ICNIRP compliance documents, including exclusion zone drawings and equipment specifications, as part of the project governance process.

11 Q&A Transparency and FoI requests

This section deals with enquiries and FoI requests made to the Council. Activist sites have questioned the legality of the planning approval process for 5G masts.

Can the Council confirm if 5G masts in Colchester were approved legally?

The Council can confirm that it has followed relevant guidance in the assessment and approval of planning applications for new or upgraded installations including masts and antennas.

The Council follows UK government guidance: The Town and Country Planning Order 2015 (Section 16) and the NPPF on communications infrastructure. The Council has followed government guidance. [25,26]

Stroud set out their approach on their website.

> "*The Council's only responsibility for communication and emerging technology infrastructure is to assess prior approvals and planning applications for new or upgraded installations (e.g. masts or antennae).*
>
> *To assess these the Council follows the UK Government guidance: The Town and Country Planning Order 2015 (Section 16) and the NPPF on communications infrastructure.*
>
> *Officers dealing with such applications can only make recommendations based on agreed national and local policy.*" [27]

Has the Council independently verified the validity of ICNIRP certificates?

The Council can confirm that it has followed relevant guidance in the assessment and approval of planning applications for new or upgraded installations including masts and antennas.

The Council follows UK government guidance: The Town and Country Planning Order 2015 (Section 16) and the NPPF on communications infrastructure.

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>
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>
> *Officers dealing with such applications can only make recommendations based on agreed national and local policy."* [28]

[25] Source: The Town and Country Planning Order 2015 (Section 16

[26] Source: National Planning Policy Framework, UK Government, 2012

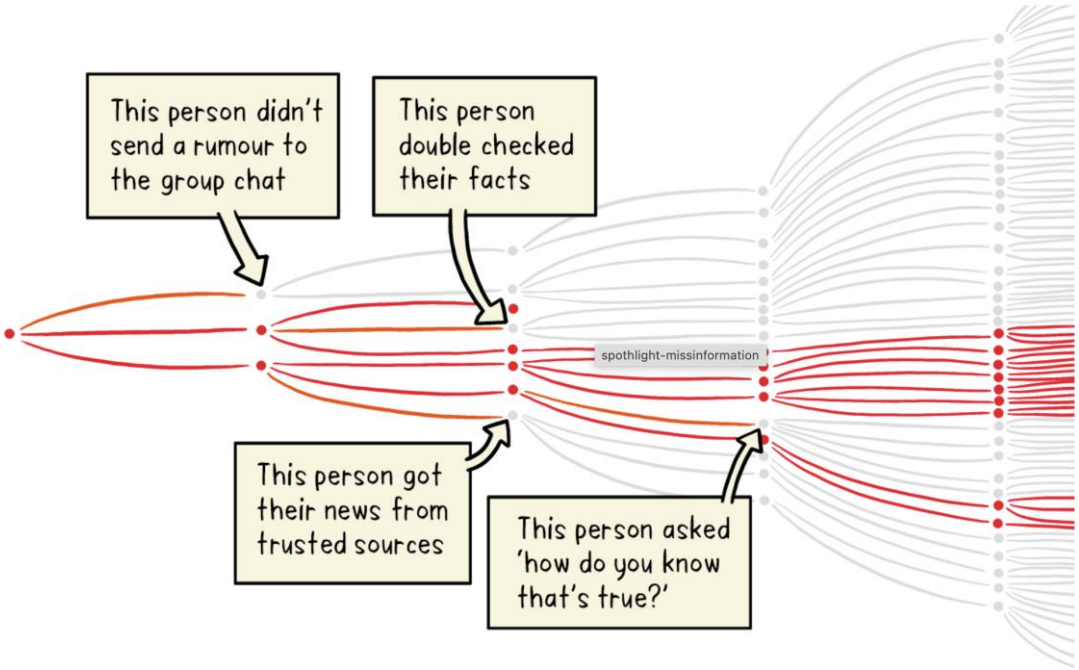
[27] Source: Slough Council Guidance

[28] Source: Slough Council Guidance

12 Q&A Misinformation and activist claims

This section deals with misinformation and activist claims originating from activist websites. The Internet is, by its very nature, unverified. Fake news and conspiracy theories abound. Belief becomes more important than fact. In many ways, this has been compounded by Artificial Intelligence which "hallucinates" (i.e. makes things up when it can't find an answer) and doesn't follow standard journalism practices such as fact checking or questioning the veracity of its multiple sources.

Figure 10 - Let's flatten the infodemic curve. Source: WHO



The WHO has produced an excellent piece on dealing with misinformation "Let's flatten the infodemic curve". [29]

Is 5G linked to COVID-19 or other diseases?

There is absolutely no evidence to suggest that Covid-19 (SARS-2) is linked to 5G.

> *"It has been claimed that exposure to the EMFs generated by 5G devices can both cause COVID-19 and increase its severity. These claims are not supported by any evidence (not even extremely weak evidence), and the large body of scientific knowledge regarding the EMFs relevant to 5G demonstrates that those claims are not feasible.*
>
> *EMF exposure from 5G devices does not cause COVID-19, nor does it have any effect on the disease process or health outcomes of those who are infected by the new corona virus (SARS-CoV-2) that causes COVID-19.*
>
> *As described by the WHO, you need to physically come into contact with the corona virus to become infected by it, and as the EMFs from 5G cannot carry viruses, they cannot bring you into contact with the virus."*

[29] Source: WHO let's flatten the infodemic curve

Do 5G towers allow the government to track people?

5G towers can't track people. 5G is very good at locating phones.

Location Based Services (LBS), a technology allowing mobile phones to be tracked, have been included in Mobile Network Operator (MNO) data since 3G. How this information is passed on to third parties, including government is covered in the subscriber's agreement with their MNO.

The BBC points out that 4G is better for tracking than 5G.

> *"European police forces may not be able to track criminals effectively over 5G mobile networks, Europol has warned. The pan-European agency's director said it currently lacked tools that on 4G networks gave police the ability to eavesdrop on criminals. Police forces joined discussions about 5G too late to ensure tracking abilities were preserved, it added. Mobile industry body the GSMA said the comments were "surprising" as criminals could still be lawfully tracked via 5G."* [30,31]

The implementation of LBS varies between equipment manufacturers. Apple, famously, won't divulge a user's location without their express permission. It's also possible to turn LBS off on an Apple handset.

Why is the Council ignoring concerns that 5G is dangerous?

The Council isn't ignoring concerns, it considers them. It responds to the questions and requests for information from concerned citizens and has appointed an external, disinterested party, Intelligens Consulting, to produce a report addressing concerns regarding the Council's rollout of a 5G network as part of their Connected Tourism Project.

The Council follows government guidance on public safety and monitors other councils' responses to citizens' concerns.

Does 5G cause brain tumours?

The case for RF causing any form of cancer is far from proven.

A 2021 report for the European Parliamentary Research Service suggested that RF may be related to certain types of brain cancers.

13 In 2020 the UK government issued guidance based on UKHSA and the Independent Expert Group on Mobile Phones recommended precautionary measures. [32]

"*The main advice is:*

- *excessive use of mobile phones by children should be discouraged.*
- *adults should be able to make their own choices about reducing their exposure should they so wish but be able to do this from an informed position.*

Measures that can be taken to reduce exposure include:

- *moving the phone away from the body, as when texting, results in very much lower exposures than if a phone is held to the head.*
- *using a hands-free kit, keeping calls short, making calls where the network signals are strong.*

---

[30] GSMA the GSM Association (the Global System for Mobile communications)

[31] Source: BBC News 5G in law enforcement

[32] Source: Independent Expert Group on Mobile Phones mobile use guidance

- *choosing a phone with a low specific energy absorption rate (SAR) value quoted by the manufacturer.*

Exposures from devices held further away from the body such as wireless-enabled laptop computers, and transmitter masts in the community are very much lower than those from mobile phones and UKHSA considers that community or individual measures to reduce such exposures are unnecessary." [33]

Does 5G kill birds, trees or pollinating insects?

There's absolutely no evidence to suggest that 5G kills birds, trees or any form of insect. There's nowhere near enough power, even very close to the antenna.

Birds are in decline but this is attributed to habitat climate and human action.[34]

5G technology does not directly kill trees. However, tree felling can occur in areas designated for 5G infrastructure due to the need for clear lines of sight for signal transmission. These felling practices are not specific to 5G but are part of broader land management practices.

There's no evidence to suggest that 5G is responsible for a reduction in the number of insects pollinating or non-pollinating. The number of insects decreased sixty percent over twenty years. Causes for this decline include habitat destruction the use of pesticides, introduced species and the effects of climate change. [35]

[33] Source: RADIO Waves reducing exposure

[34] Source: Birds are declining fastest where they were once common.

[35] Source: UK's flying insects have declined by 60% in 20 years

14 Q&A Legal and Planning questions

This section deals with legal and planning questions. If more detail is required Trenches Law can be engaged to provide legal direction on these questions. Here, Intelligens Consulting has reviewed other councils' responses to similar questions.

Can the Council confirm if 5G masts in Colchester were approved legally?

The Council can confirm that it has followed relevant guidance in the assessment and approval of planning applications for new or upgraded installations including masts and antennas.

Stroud set out their approach on their website

> "*The Council follows UK government guidance: The Town and Country Planning Order 2015 (Section 16) and the national planning policy framework on communications infrastructure.*
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> *To assess these the Council follows the UK Government guidance: The Town and Country Planning Order 2015 (Section 16) and the NPPF on communications infrastructure.*
>
> *Officers dealing with such applications can only make recommendations based on agreed national and local policy.* [36]

Can the Council take enforcement action against non-compliant 5G towers?

The Council can act against non-compliant 5G towers if this action is found to be in the public interest.

Ofcom can act against operators of 5G towers who are found to be non-compliant with Ofcom regulations, licencing conditions and ICNIRP guidelines.

Again, Stroud set out their approach on their website

> "*The Council follows UK government guidance: The Town and Country Planning Order 2015 (Section 16) and the national planning policy framework on communications infrastructure.*
>
> *The Council's only responsibility for communication and emerging technology infrastructure is to assess prior approvals and planning applications for new or upgraded installations (e.g. masts or antennae).*
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[36] Source: Stroud Council guidance

[37] Source: Stroud Council guidance