

Observations of health regarding EMF exposures

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CONTEXT

This paper has been written to present a record of health related observational data from a perspective of electromagnetic field exposures in domestic settings in New Zealand. This data has been gathered by the author who has at the time of writing conducted many hundreds of EMF surveys of homes all over the country commencing in 2014. This data is based on information freely offered by individuals and recognises their privacy. This paper also makes no reference or correlation to geography, meteorological or solar activity, geomagnetic activity or other natural phenomena. This paper also does not make any reference to medication, medical treatments or past health history of any individuals. From time to time as more information arises, this paper may be updated.

OPENING STATEMENT

In terms of official national standards and monitoring of ELF (extremely low frequency) AC electromagnetic, radio frequency and microwave radiation exposures, there is a clear omission in data provided from government and other accredited bodies. Part of this missing data relates to domestic observational data and the associated footprint of EMF exposure on individuals and families from inside the home and outside influences from other infrastructure.

After a number of years working in the EMF survey field, it became apparent that health conditions being shared with the author where noticeably reoccurring across similar EMF environments and exposure levels. From all the homes surveyed and the countless conversations with people across many areas of the country, a pattern of similarities is evident. In many cases, the correlation is that in the majority of cases the removal of the measured EMF influence has reduced or moderated individuals conditions.

Many of these observations are noticeable across exposures from different sources of EMF, some cases there is recorded single type of EMF and in others there are combined sources of EMF.

The EMF or electromagnetic influences referred to in this paper are:

- ELF AC electric fields
- ELF AC magnetic fields
- Radio frequency
- Microwave radiation
- Dirty electricity also known as unwanted electrical disturbances

This paper is not intended as medical advice or statements against particular health conditions, symptoms or treatments. This paper merely documents the authors personal observations made across patterns of EMF recordings and should not be construed as medical information or advice.

SUMMARY

It is clear as demonstrated in the environmental changes in this paper that over the last decade or so the electromagnetic influences in our environments have increased significantly both inside and outside the home. The main factors highlighting this are:

- The number of sources emitting EMF into our environment have increased
- The length of time we are exposed to EMFs has grown

- We now spend increasing time closer to sources of EMF
- Being closer to sources of EMF equates to elevated exposure as electromagnetic radiation scatters with distance

The most notable indicators are sleep disorders¹ and brain fog which occur across all EMF contributors. Magnetic field influences from AC electrical systems seem to particularly affect sleep², chest and ears. AC electric fields appear to have cross over indicators but also include sensations on the skin, whereas radio frequency and wireless exposures are noted as contributing to all manner of head related feelings including brain fog and confusion, anxiety, tinnitus and other skin sensations including heat and sleep disturbances. Dirty electricity or unwanted electrical disturbances have a combination of all other related EMF indicators.

It is also clear from my perspective that repetitively similar symptoms are present where there are EMF anomalies outside the typical range of what is measurable inside a home. Where low EMF influences are present, there are fewer health related indicators, where elevated EMF influences exist, health indicators have been present.

In many instances individuals have other conditions under which they are receiving treatment and it has not been uncommon to hear similar themes. Common themes that appear to link together have been auto immune conditions, gut sensitivities and electrical sensitivity.

From a broad viewpoint, our homes are essentially an isolation chamber from nature. The constant influence and multitude of EMF sources and exposures create unnatural living, travel and working environments. Which, as we know is expanding very quickly. The bias across governments, corporations, institutions and medical establishments have set standards around thermal conditions while ignoring the wider understanding of how electromagnetic energy and physics is fundamental to all life. Thus, the wilful discouraging and distraction away from non thermal effects is clearly evident and has been for many decades.

Perhaps the bigger question around EMF influences is not what disease is caused by what EMF source, but rather, do unnatural non native electromagnetic influences affect our connection to nature and what is the consequence of that?

OBSERVATIONS

In this section we breakdown different sources of electromagnetic influences we are exposed to with reference to health observations. These have been gathered across New Zealand resident environments where many different scenarios both inside and outside homes have been measured. There is no one typical type of home as our EMF findings have spanned across just about every type of dwelling available such as:

- Single bedsits
- Apartments - different floor levels, including penthouses
- Typical homes with 2+ bedrooms - detached, semi detached and town houses
- Old and new homes including show homes
- Rural and remote properties
- Off grid homes
- Large mansions
- Tiny homes and caravans
- Boats and large watercraft

¹ <https://www.emfdata.org/en/studien/detail&id=933>

² <https://www.emfdata.org/en/studies/detail?id=935>

All health related information recorded has been offered openly by home owners and other individuals.

Unwanted Electrical Disturbances (UED) also referred to as Dirty Electricity

In our estimation, it is likely that 95% of homes have elevated electrical disturbances present on the electrical circuits. Modern technology adds to UED and levels in a home increase and decrease depending on what networks, electrical systems, appliances, devices or lighting are in operation. Electrical disturbances in one home will affect the next home as the grid moves into one house from another. Solar power and electric car charges add high levels of UED.

Most of the unwanted disturbances originate as flowing electricity is modified through inline technology effectively creating waste. As electricity flows, the incumbent proportionality of electric and magnetic energy is purposefully altered in relation to the needs of the technology it is passing through. This mismatch in correlating field characteristics is the main contributing cause to electrical disturbances. These disturbances are made up of a wide scope of frequencies in KHz, MHz and GHz ranges and travel on electrical wiring and are also inherent in the broadcast electric field present around all energised conductors.

Other types of electrical disturbances come from broadcasting antennas such as AM radio as described below.

Full explanations of UED are covered in other papers and blogs by the author.

Homes with solar power (includes battery storage)

Domestic solar power inverters add high amounts of electrical disturbances to all the circuits of a home. This is referred to in the solar industry as Total Harmonic Distortion. All solar systems contribute to THD to differing degrees dependent on types of inverters, the level of use based on electricity needs and battery storage. Systems without batteries only add UED to a home during the day while systems with battery storage introduce UED into both day and night time exposure. The main contributor here to exposure is the influence this has on the areas where home owners sleep as electric fields broadcast over beds. Homes with solar power tied to the grid can often add UED to the line which is measurable and will influence neighbouring homes. This subject is covered extensively in this factsheet <https://www.emfshop.co.nz/product-page/dirty-electricity-emf-guide>.

These are the most common effects noted in these situations:

- High degree of difficulty sleeping
- Disturbed sleep (ranging from often disturbances to consistently disturbed)
- Feelings of being energised while in bed described as electrical sensations over the skin
- As solar power increases with sun movements during the day, increased disorientation, dizziness, heaviness, headaches and brain fog inside the home
- Turning on solar power which activates the inverter and so adds UED to each circuit in a home has shown immediate effect in many individuals where they feel sudden pressure in the head, brain fog, headaches, sharp pain above the ears and forehead, difficulty expressing thoughts, disorientation. Turning off solar power in these instances, symptoms cleared almost immediately.
- Low energy inside the house
- Agitation and irritability
- Cold and flu like symptoms (running nose, coughing, sneezing, itchy eyes)
- Ringing in the ears (high rates of incidences)
- Lethargy
- Loss of balance

Homes with elevated UED from other non solar power sources

Homes without solar power generally have lower levels of UED but in many circumstances this can be still high. The sources of this disturbance are usually from appliances, devices and lighting inside the home and what enters from the outside grid.

- Family of four all becoming sick with flu like symptoms immediately moving to a new house (continuous coughing and lethargy)
- High pitched noises
- Electrical sensations on the skin
- Difficulty sleeping/sleep disturbances
- Strange and repetitive dreams
- Waking at similar times in the middle of the night
- Ringing in the ears
- High blood sugar
- Brain fog
- Difficulty thinking
- Irritability
- Static electric shocks
- Thirsty/Dehydrated
- Lethargy

After filtering and removing UED from homes, we have recorded these observations

Reduction and removal of UED through measuring, filtering and elimination focusing on the main areas of bedrooms and lounge and other areas where most time is spent produces these results:

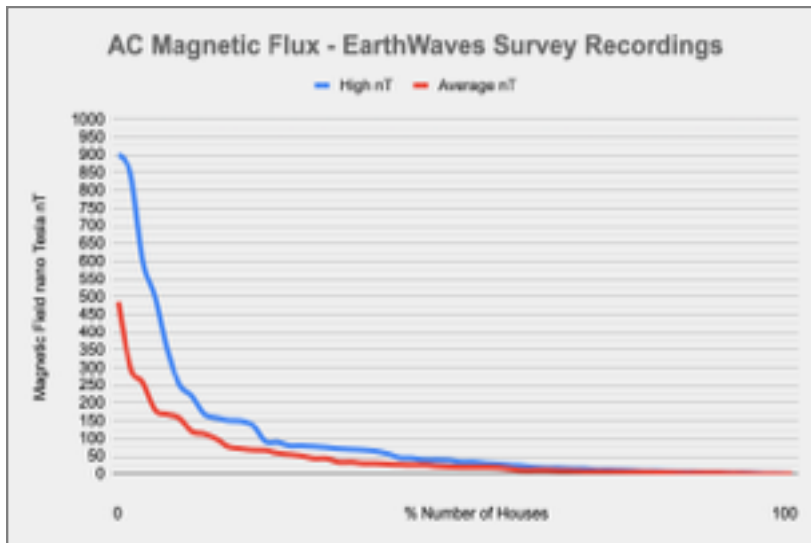
- Immediate feeling of calmness with the energy in the house - multiple mentions
- Feelings of breathing easier
- Electrical sensations over skin stopped
- High frequency noises ceased
- Ringing in the ears reduced/stopped
- Flu like symptoms from the family of four all simultaneously clearing within days
- Less disturbed sleep
- Deeper sleep
- Brain fog lifted, thinking more clearly
- Fewer static electric shocks
- More energy, feelings of more vitality

AC Magnetic Fields 50Hz

There are many sources of AC magnetic fields which influence a home. Typically these are outside residential power lines, high voltage transmission lines, buried power lines, transformers, smart meters, electrical lines connecting the meter to mains switchboards, wiring errors, mismatched current, aged wiring and grounding issues. In some cases appliances add to magnetic field exposure like washing machines/dryers, electrical underfloor heating, domestic lighting transformers and many others. The electrical layout of a home is also very important in magnetic field exposure where positioning of smart meter, switchboard, kitchen and bedrooms against the orientation of street services all contribute to exposure.

For context, in a typical home over a bed and lounge seating magnetic fields tend to measure from 10nT to 20nT (nanoTesla). In our estimation, 90% of homes are in this category where good electrical wiring, layout and lack of exposure to outside magnetic influences add to the lower ranges recorded.

This graph shows the distribution of recorded AC magnetic fields across 100 homes. Some exceptional data ranging in to the 1000's nT has been removed to keep a readable scale.



Sleeping in magnetic fields 400nT to 3000nT

These sleeping environments have been exposed to magnetic fields from single smart meters, multiple smart meters, unmatched current and grounding issues from the building. The influences from outside have in most cases come from residential above ground power lines (note, this refers to street power lines and not high voltage transmission lines - see below). These lines are usually located outside, on pavements or edges of property up to 10m distance from the house. In many cases, the bedrooms are at the front of the house exposed to these powerlines. In cases where a home is located on a corner of a street with residential power lines on two sides, magnetic fields broadcast across different orientations and readings show these to be more pervasive across the footprint of the house and measure in a higher range. In these situations, there are usually multiple magnetic field line sources across the distribution range of voltages from 230, 400 to 11,000 volts.

Where transformers are located outside homes, depending on the distance from the house, magnetic fields may also have an influence.

Buried powerlines do not affect the magnetic fields and these can be measured above ground at various heights. These too can influence the magnetic fields inside a home.

In these situations we have recorded these indicators:

- Vivid strong dreams
- Shouting in the sleep
- Jolting/jerking during sleep
- Pressure sensations in the head
- Highly energised in bed (Quote, "It felt like all my cells where vibrating out of control.")
- Vomiting (the morning after being highly energised)
- Consistent headaches
- Brain fog
- Disturbed restless sleep
- Dark circles under eyes (multiple mentions in children)
- Night Sweating
- Tinnitus
- Pressure in the chest (heart area)
- Consistently thirsty

Homes under high voltage transmission lines

- Feeling pressure in chest and fainting

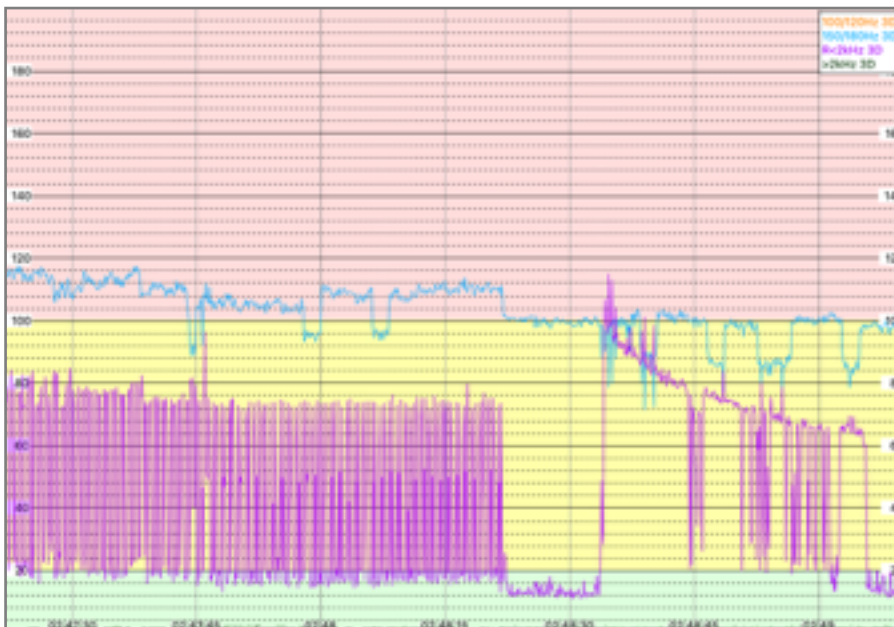
- Feelings of regular agitation
- Sleep disturbances
- Heart palpitations
- Heaviness in the chest
- Headaches
- Fainting
- Static electric shocks

In many of these instances, people report feelings of constant uneasiness in their bedroom and a feeling that something isn't right. Many home owners will move bedrooms to seek a better nights sleep knowing that their bedroom is contributing to their disturbed sleep. It is not uncommon for homeowners to naturally gravitate towards the lowest EMF spot in a house. These are often found in bedrooms without immediate influence from an EMF source or by moving beds or sleeping mats into the middle of a room. A small number of homeowners find they sleep much better in a tent in the garden. It is not uncommon for some highly sensitive people to build and sleep in a shielded bunker or use ship containers as faraday cages.

AC Magnetic Fields 50Hz to over 2000Hz

In these situations, there are often other dominant frequencies within the AC magnetic field outside of the 50Hz carrier. These are affectively dirty magnetic fields or unwanted magnetic disturbances. A sample of this data is shown here recorded at a customers home with outside residential powerlines in a large city. This data shows a range of other pulsing frequencies present in the magnetic fields in the house. These were recorded over the occupants bed.

Above ground power lines tend to have more of an influence in this regard than buried power lines. Although this is not common everywhere. The proximity of the house, constructions materials and the current load on the lines dictate how far the magnetic field will be drawn through the footprint of the home.



In these situations we have recorded:

- Very sensitive hearing
- Hear high pitched sounds

- Tinnitus
- Disturbed sleep
- Strong and vivid dreams
- Daytime tiredness
- Pressure in the chest

High AC Electric Fields 50Hz

AC electric fields are measurable in most areas of a home. When surveying a home, we pay close attention to EMF in areas where we sit, sleep and stand. Most electric field issues in a home are in the bedrooms from the electrical wiring in the walls and from cables, appliances and devices that are plugged in. In the vast majority of homes, areas where we sleep are exposed to multiple sources and orientations of AC electric fields. Electric blankets, earthing sheets, metal bed frames and other conducting materials add to the broadcast electric field effects. Where we sit in homes in lounges and dining rooms, we can also be exposed to electric field sources. Certain areas in a home may also have underfloor electric field sources which are present in the areas where we stand for instance in a kitchen. Typical symptoms in high electric field environments are:

- Burning sensation moving across the skin when getting into bed and lying down (vaccine injured)
- Feeling energised while trying to sleep
- Restless legs
- Tingling skin
- Disturbed sleep
- Easily build up static electricity in the body
- Feelings of frenetic energy and electricity
- Paranoia and anxiety
- Shaking hands and fingers
- Head pressure

Radio Frequency from Cell Phone Towers

With the constant installation and upgrading of 1000's of cell phone towers, we have many more people feeling the effects as reported through our EMF surveys and phone calls. Some feel these effects instantaneously, some people will feel no effects until they are in pain, others develop soft symptoms over time and then may identify the source of the issue, some do not and experience severe illness.

Radio frequency from cell phone towers is very invasive, contains literally 1000's of frequencies all of which have unnatural signal characteristics including pulse modulation and polarisation. Alongside these features, exposure to the radio frequency radiation from cell phone transmitters can be influenced by:

- Intensity of the combined range of emitted frequencies (peak signal strengths)
- Duration of exposure (ie sleeping in a bedroom with a cell phone tower outside the house)
- Proximity to transmitters
- Interference from signals (causes destructive interference and unwanted emissions)
- Number of transmitting sources
- Variations of frequency (2G, 3G, 4G and 5G all at the same time)
- Orientation of cell phone transmitters (RF radiation broadcast in certain patterns)
- Reflection from materials outside and inside a home
- Construction materials of a house and that of neighbours homes

Across the broad spectrum of homes assessed where radio frequency influences exist from cell phones towers, we have recorded these health related indicators:

- Instant feeling of unease and brain fog (when in the vicinity of a cell tower, or having a new installation activated outside a home)
- Instant headaches after installation
- Unable to think clearly
- Complaints of pressure waves
- Hearing a low pitch hum after a cell phone tower has been erected (five cases)
- Disturbed sleep
- Constant dehydration
- Lack of energy during the day
- Feel more calm when outside away from the tower (antenna grounding effect)
- Dogs become very placid and withdrawn - then when in a different location dogs are normal and playful (personally witnessed this)
- Paranoia
- Anxiety
- Nausea

Very high levels of RF exposure from cell phone transmitters

In one home a tenant was sleeping approximately 80m from ten cell phone transmitters located at the same height. The orientation of five of these transmitters where in the direction of the tenants sleeping area. The RF measured where they slept consistently peaked at over 2.5 million $\mu\text{W}/\text{m}^2$.

This is exceptionally high in comparison with other homes located near cell towers (at this time). In the timeframe of one year, this unfortunate person had multiple blood disorders, breast cancer, brain fog, chronic fatigue and a host of numerous other concerning health conditions. They constantly felt sick in the property. When away visiting relatives in the country, they observed feeling better, more clarity and less brain fog.

WiFi and in home wireless systems

With the expansion of wireless connectivity systems and devices that are available, there is a marked increase in radio frequency influences across the footprint of a home. Contributing factors include; types of routers, increasing power output from WiFi routers, addition of multiple WiFi signals, expansion of wireless products and changing software that limits control functionality (ie reducing power or disabling functions not available in many devices).

This ever expanding technology is increasing exposure to a vast range of radio frequency energy across our own environments.

We have noted these as key examples of symptoms in homes with WiFi from a typical power density range of 5000 to 150,000 $\mu\text{W}/\text{m}^2$ (micro watts per square meter):

- Brain fog (high level of incidence)
- Ringing and buzzing in the ears (high level of incidence)
- Hearing very high pitch sounds
- Overall feeling of uneasiness
- Gentleman with early Parkinson's disease could feel immediate pressure and pain when walking in the room where the home router was located
- Loss of balance after sitting within 3 feet of a router
- Burning and heating sensations on one side of the face after sitting within 3 feet of a router (over a long period of many years)
- Disturbed sleep

- Numerous mentions of people with auto immune conditions feeling nebulous uneasiness symptoms
- Heightened paranoia
- Confused thinking, imagining bizarre situations of being watched and targeted with microwave weapons (multiple accounts)
- High RF from multiple indoor sources reflected and concentrated in one bedroom caused vivid dreams and less quality sleep (less than 8 years of age)

AM Radio Masts

While there are only a small number of AM radio masts installed around the country, the EMF emissions can have a much greater influence on a home than a cell phone tower. Radio Frequency radiation from a cell phone tower can be reduced through the construction materials of the house and through appropriate shielding techniques. RF from AM radio signals pass through most materials and the energy jump conducts on to a homes electrical circuits and broadcast high frequency in every room as an electrical disturbance. This effectively creates a highly influenced unnatural energy space. Homes assessed close to AM radio masts have all had extremely high levels of dirty electricity.

In this environment it is common to hear from home owners about:

- Constant disturbed sleep, every night with some bedrooms worse than others
- Consistent and long lasting brain fog
- Slow slurred speech
- Constant headaches
- Severe chronic fatigue
- Paranoia
- High anxiety

It is not uncommon for home owners to report that they feel targeted by someone or some group.

Other Notes

Holding mobile phones and using laptop trackpads

A common theme we hear often is how achey and sore fingers and hands become after using mobile phones. This is also true of using trackpads on laptops. Symptoms reduce and disappear after the event. Any device like a mobile phone has both an electric and magnetic field present and other high frequencies. Touch screens on phones rely on the electrical charge from a finger to interact with the electrically conductive materials in the phone. Where trackpads are in use is often while a laptop is under AC power which has an increased electrical field load on the fingers. My own personal opinion on this is the EMF from these devices affects the electrical charge of red blood cells adding to the Rouleau effect³ where blood cells form stacks and basically stick together reducing blood flow.

Holding a mobile phone against your head

Typical conversations about effects from holding mobile phones to the ear cover heating of the skin on the side of the head, headaches, brain fog and aching fingers. Certainly heating of the skin is known as the thermal effect and is basically the RF radiation exciting cells in the skin and head converting energy to heat. Mobile phone RF emission standards use a SAR (specific absorption rate) scale referring to the amount of RF energy that is absorbed by the human body and the dissipation of that heat over a six minute period. Standards for mobile phone RF emissions cover only thermal effects and pay zero attention to non thermal effects.

³ <https://ehtrust.org/wp-content/uploads/Rouleaux-Fact-Sheet-2026.pdf>

iPhone 17 Pro Max, iPhone 11 and computer monitors

A gentleman bought an iPhone 17 and found that the RF emissions made it impossible to use. Feelings of chest pressure, headaches and nausea were noted when the phone was in use. With previous mobile phone upgrades, the gentleman noted that when he upgraded to an iPhone 11 he had similar symptoms but they settled down after a month. An upgrade with his computer to a Samsung smart computer monitor gave him headaches immediately and he is unable to use the monitor.

Electric Cars - 2019 Nissan Leaf

A company requested an EMF survey of a Nissan Leaf as they had recently updated their company car fleet. The request came after the driver noted feelings of nausea and headaches during each journey which abated after getting out of the car. As expected, the car had an elevated and fluctuating range of magnetic fields and RF.

High levels of combined EMF

In a home where the master bedroom was exposed to high magnetic and electric fields, high levels of dirty electricity and RF from a WiFi network, the occupant had developed a condition called mast cell activation. In this situation, the person 'felt' there was an issue in their bedroom which turned out to have high levels of all the EMF influences mentioned.

Smart Meters

It is difficult to adequately comment on health indicators around smart meters. Certainly in a number of cases people who have slept within three feet of them have reported many of the symptoms already mentioned. In these cases, the dominant EMF influence near smart meters is an AC magnetic field. This is due to the internal configuration of the meter and the magnetic field from the phase and neutral electrical cabling not cancelling out the opposing field. Concern and notable affects with RF pulsing appear less noticeable with current data.

However, it can not be discounted that the regular RF pulses from smart meters do not contribute to any recorded health indicator. These modulated RF pulses when emitted not only pass through many parts of a house, they also travel on electrical conductors as an electrical disturbance and so broadcast within the electric field.

ENVIRONMENTAL CHANGES

The first use of electromagnetic energy for communication and began around the mid 1800's which quickly lead to the rollout of the electric grid a few decades later. The growth, pace of adoption and technology advancement in this area has been colossal with a correlating variable of EMF exposure. These changes have been very well documented in the books 'Invisible Rainbow' by Arthur Firstenberg, 'Going Somewhere' by Dr Andrew Marino and Dr Sam Milham's book 'Dirty Electricity'.

For this paper however we are covering the period of 2014 to mid 2026. During this time, a large number of changes affecting the electromagnetic environment have taken place here in New Zealand. To add context to how the environment has changed, here are a few examples that have impacted the increasing domestic EMF footprint.

Telecommunications

Many changes have taken place with telecommunications which have lead to the massive growth of radio frequency and microwave radiation in the environment. Not only has there been changes with adding 4G and 5G to the existing 2G and 3G networks, but a number of other important factors have added to the increased RF footprint. These include but are not limited to:

- 1000's more cell phone towers have been erected in New Zealand over the last 12 years

- More cell towers have been installed closer to homes than 1G, 2G and 3G thus increasing personal proximity to transmitters
- Cell phone tower transmitters EIRP (irradiating power) has increased
- Intensity of RF exposure inside many homes from outside sources has increased markedly
- Number of modulated radio frequencies people are exposed to has vastly increased
- Duration of exposure to RF from telecommunications transmitters has increased
- Exposure to radio frequency interference (destructive interference) has increased
- Inside the home many models of routers also emit 3G and 4G frequencies
- Rollout of fibre has installed ONT optical network terminals in homes which also emit 3G and 4G
- Increased rollout of smart meters emitting RF inside and outside the home (and upgrades to 4G)

Personal Mobile Phones

In the last 10 years or so, the uptake in the adoption and use of smart mobile (cell) phones has increased. These cell phones have multiple RF transmitters and as with the roll out of 4G and 5G, cell phones have adapted to use these newer frequencies. Changes to software with the use of transmitters using 'Airplane' mode also have increased exposure. Use of cell phones for calls, texts, connection to Bluetooth devices and connection for data has risen. This increased usage also equates to higher levels of personal exposure as power to antennas has increased. RF exposure guidelines documented in the terms and conditions from cell phone manufacturers state that devices must be used within 5 to 8mm from the body in order to avoid an increase in RF radiation exposure.⁴

As software changes are adopted, more apps require connection to either WiFi for cell phone networks equating to more RF radiation exposure.

Bluetooth transmitter classifications over the years has allowed for greater power adding to RF exposure.

Computers, laptops and tablets

As with other technology, home computing also adds to the growing EMF footprint and exposure. In the areas around any plug in computer, there are electric fields and electrical disturbances. The use of laptops increases exposure through the proximity to the circuit boards when using the keyboard and trackpad. Using touch screen tablets adds to the EMF load through the capacitive systems which put the user in an active interaction with the electrical charge of the device. Any device that is used while charging will also elevate EMF exposure.

Wireless Expansion

Over this period, the adoption of wireless technologies has increased dramatically which has markedly added to the RF exposure inside our homes. The introduction of digital assistants, smart watches, addition of 5GHz and 6GHz WiFi to routers, removal of router functionality to disable WiFi, advancements with Bluetooth devices, wireless gaming, IOT, smart TVs, security cameras, boosters, plus a whole host of other devices all have significantly expanded, intensified and elevated exposure to radio frequency in homes, work places, shopping malls, hospitals, cities, transport and other areas. In outside infrastructure wireless transmitters are being used across innumerable services and products.

Cars and other vehicles

Cars in particular have changed considerably. With internal and external radar and internal radio frequency systems for WiFi and Bluetooth, on board technology and surveillance which increase the EMF influence inside and outside a car.

⁴ Exact wording of RF exposure may differ slightly between manufacturers.

Electric Cars

The increasing adoption of electric and plug in hybrid cars changes a number of key EMF considerations using the car and when storing and charging the car at home.

- When charging a car, there is a high increase in unwanted electrical disturbances (dirty electricity) during the charging process which will influence all circuits in a home and immediate neighbours homes. This is noticeable as a measured regular pulse of high frequency on the electric circuits.
- Increased magnetic fields around charging leads, metering, switchboards and all live wiring while under load.
- Driving electric and hybrid cars there is a distinctive elevated magnetic field that is distributed over a larger area inside the vehicle when compared to a typical petrol car.
- EV's and PHEV's tend to have larger batteries and so have greater use of electric motors. This introduces a large fluctuating magnetic field for all occupants.
- Hybrid electric vehicles or HEV's have a slightly lower overall fluctuating magnetic field when compared to EV's and PHEV's. This scenario is a general observation as there are a wide variety of car manufacturers and models of car.
- With higher fluctuating magnetic fields, there is also the exposure to dirty or unwanted high frequency magnetic fields which are produced as a by product of the technology.

Satellites and satellite dishes (ie Starlink)

Over the last 12 years, the number of operational satellites has increased many fold from around two thousand too close to 18,000 at this time of writing with around 29,000 objects in orbit being tracked. Satellites numbers increase quickly on a weekly basis from many countries and companies. Satellites typically use a phase modulation of radio frequency which is a different modulation from cell phones, WiFi and Bluetooth. Satellite frequencies are now measurable in a home using RF spectrum analysis. The number of satellites will continue to increase dramatically into many hundreds of thousands. At the time of writing, Starlink is moving forward with arrangements to have approval for increased power output from satellites. Satellite orbits affects the range over the earths surface that the signals can reach, the higher the orbit the greater the broadcast range. We are actively monitoring the growing number of connectable satellites overtime to understand EMF related data.

Headphones, AirPods and Bluetooth earpieces (including hearing aids)

These devices have also grown in popularity and use. Bluetooth ear pieces whether for personal media or as a hearing device, are known to use Bluetooth radio frequency which is in a similar range to WiFi. However, for each ear piece to connect to the other they use NFMI Near Field Magnetic Induction which resonates magnetic fields at 13.56MHz⁵. The change from over the ear headphones to ear pieces placed inside the ear has changed exposure levels and the introduction of NFMI has also introduced another component of EMF exposure. Apple airpods have five broadcasting antennas built into the device with the Bluetooth antenna located in the piece which fits in the ear.

Notes on radio frequency

1. It is also necessary to understand that where telecommunications and domestic wireless communications exist, that the radio frequency uses sophisticated modulation schemes with altered signal characteristics that are different from nature. These technologies use different frequency modulations, such as pulse modulation. Where transmitters broadcast radio frequency, there is also unwanted emissions created often called destructive interference. In the telecommunications world a controlled area of this is called UEL or unwanted emission limits which basically mean other incoherent frequencies are generated which may interfere with the broadcast system. What this signifies is that for any cell phone tower, WiFi router, Bluetooth speaker or other broadcasting device that is under power and transmitting, there are

⁵ This frequency is used for Apple AirPods.

other frequencies generated which could be classified as electro pollution. Starlink dishes for example by design create destructive interference as a waste product of the beam forming technology. It is fully expected that more beam forming technology is deployed as part of the new technology rollout currently underway.

2. The signal strength of radio frequency signals from telecommunications transmitters reduce over distance as the radio waves scatter. The signal strength is significantly greater closer to the transmitter. Many cell phone tower transmitters are much closer to bedrooms and other living spaces in a home than with previous generations of mobile phone technology.
3. In many urban and rural settings, radio frequency from cell phone towers can reflect off different surfaces including walls, fences, roofs, garages, buildings etc. The incoming incident wave can reflect the RF signal and depending on the surface material, some of the waves will be absorbed or pass through. In many cases, where surfaces are conductive like corrugated iron, RF may unintentionally concentrate into focussed areas increasing signal strength and destructive interference.

Electricity Supply and Infrastructure

Growth in population, housing, roading, commercial and business growth all adds to an increase in electrical infrastructure. Over the last 10 years the rollout of electricity smart meters has also continued. In recent times, many of these meters have also been upgraded to 4G. Smart meters introduced into a home will add electrical disturbances (dirty electricity) and pulsed radio frequency into the home.

The growth in housing numbers has also given rise to more homes being built near to or under high voltage transmission lines. Houses in these situations all have marked elevated AC magnetic fields up to 300 times higher than a typical home. There are also other effects. In these circumstances, where homes have conductive materials (roofing or cladding iron), the magnetic field induces currents and voltages in the conductive structure elevating EMF. Within the field from high voltage transmission lines, there can also be an electrostatic charge which ionises the air known as the corona effect. Ozone gas can also be produced in some circumstances. The standard NZECP 34:2001 covers the safe electrical distances from infrastructure.⁶

Lighting

The shift towards the use of LED lighting is also one of the contributors to altering and increasing electrical disturbances or dirty electricity. This includes street lighting, domestic lighting, commercial and industrial lighting. LED bulbs also emit other high frequencies in the electric field present around the bulb and produce high rates of flicker and spikes of blue light.

Population

Commensurate with the increasing footprint of infrastructure over time as population increases, It is also useful to note the population of New Zealand increased from 4,564,400 in December 2014 to 5,361,300 in March 2026. This makes an estimated increase of 796,900⁷.

ABOUT THE AUTHOR

Andy is the lead EMF specialist and founder of EMFShop and owner of the EarthWaves brand of products.

A full bio is linked here. <https://www.emfshop.co.nz/about-the-emfguy>

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⁶ <https://blob-static.vector.co.nz/blob/vector/media/vector-2024/nzecz-34-for-electrical-safe-distances.pdf>

⁷ <https://www.stats.govt.nz/topics/population/>