Here are some thoughts on the Tesla (or any) electric car. I talk about testing and selecting typical gas combustion vehicles in items 6 & 7 below.

**1 –** One of the first issues to deal with is the numerous RF sources within the car. I have not measured the inside of a Tesla yet, but it surely has Bluetooth, possibly WiFi and most likely a 4G connection for regular software updates. Being in a car that has just Bluetooth radiating can be troublesome. I get nauseous after just 20 minutes of such an exposure (the antenna is right in the dash).

Here is a video demonstrating Bluetooth in a Toyota Camry:

https://www.youtube.com/watch?v=kL5EBHN_PfU

You will need a decent RF meter to test these things. I recommend the Safe and Sound Pro seen on this page:

https://www.emfanalysis.com/recommended-emf-meters/

If RF sources are radiating within the car, that can lead to electrical sensitivity and/or exacerbate symptoms. You will have to work with Tesla to figure out how to turn these RF sources off. Most likely, they don't want you to do this (because of the software updates) and they may even state that doing so voids the warranty. In most cars, however, simply deleting any phone numbers from the directory disables the Bluetooth antenna:

https://www.youtube.com/watch?v=MYXMx0-hvcU

**2 –** The Tesla has much more electronics in the dash (basically a super-computer and monitor) than most cars. This is highly problematic for ES people (and may cause normal people to become ES). An AM radio test (get the Radio Shack AM Radio model 12-467 on ebay for $20 to $30) will help you hear these radiated mid-range frequencies (500 KHz to 2 MHz).

**3 –** A typical low-frequency AC Gauss meter is not the instrument to test a Tesla with. The battery/motor run on DC and the frequencies created are often above the range of typical gauss meters. Here is how I test a conventional car:

How to Measure a Car for EMFs: https://www.youtube.com/watch?v=T1YCApcm3gM

Also see: https://www.youtube.com/watch?v=pHfJdsiM4aU

Here is the magnetic field in a Toyota Yaris for instance: https://youtu.be/PR6Uh-Ni214

The AM radio test mentioned above is a more accurate representation of the radiated EMI (electromagnetic interference) from the motor. You will likely get more static as you increase speeds in

the car (and the engine is running more power/current). Here are examples of how I use an AM radio to detect radiated EMI in a home:

EMI from Specialty Lighting: https://www.youtube.com/watch?v=k6fZP-J2brk

TV EMI: https://youtu.be/316F-KiC2rk

**4 –** An overlooked part of the Tesla/electric car EMF equation is the charger. This is an inverter, often in your garage, that is converting the AC grid power to a DC power supply to charge your Tesla battery. I have measured homes that have a similar inverter to charge electric motorbikes. I was surprised to find that the inverter was lighting up the AM radio throughout the entire home (not just next to the home electrical wiring). This EMI exposure may be the worst EMF aspect of owning a Tesla. It will also vary from owner to owner based on the particular electrical wiring issues in each home (all homes are different and nearly every home has 1-2 wiring errors/problems that can and should be fixed).

The process of converting AC to DC pollutes your home wiring with EMI (as does the opposite process of converting DC solar panel to AC). The issue for Tesla owners (as opposed to solar) is that this process is taking place all night, when you are sleeping, detoxing, recharging yourself. We know EMF disrupts our biological processes (melatonin production for example, which is critical for nighttime detoxification). At night is when you need your home (and home wiring) to be as low-EMF as possible. Most likely, this isn't happening if you are charging a Tesla in the garage.

**5 –** For a more technical explanation regarding the EMF aspects of a Tesla, the following was my electrical engineering mentor's response to a PhD student who contacted me hoping to bring this question up to his university's engineering department:

"Engineers and academic types are humans too, and electrical engineers will not often understand something outside their own personal experience. They have a vested interest in thinking that all electronics and power are harmless to humans. To think otherwise would have them ridiculed, ostracized and jobless. It's like religion - no true facts, no real data or science, but very strong feelings based on community and indoctrination. Strong feelings that can provoke anger. Humans can be very angry and irrational when confronted with conflicting hard science and facts.

If I was seriously investigating this, I would look at the magnetic fields from 60 to 100 KHz and up, and electric fields from 10K to at least 100Mhz. The 2 electric motors (induction motors up to 15k rpm) in the Tesla are being controlled by variable frequency and voltage inverters. In order to be efficient and minimize heat sinking, they will be hard and fast switching substantial currents. This generates a lot of emissions. Electric motors generate substantial magnetic fields which thin steel is not highly effective for shielding. The electric fields are relatively easy to shield.

The sad part is that comparisons are always being made to gas-ignition-alternator vehicles, which vary widely but are notoriously horrible. The modern car has a collection of digital electronics and embedded microprocessors, pulsed valve control of the transmission, and wireless transmitters in each wheel for air pressure indication. Video cameras and computer displays are common as well. This in addition to the current pulses for spark modules and electronic fuel injectors, and magnetic field and EMI from the alternator and its un-snubbed diodes. So the comparison standard is absurd, but certainly, you will have an even worse magnetic field situation in an electric car.

It is ludicrous to think that an electric car can EVER be "low EMF". It would be a project worthy of only of NASA to do it. It would require ingenious motor design, controller design, and power filtering before the batteries that will be an incredible challenge, since the occupants are all in close proximity to all these high current components. I would start with the motors, if I had the task and budget to attempt it, because I suspect that the project would stumble right there.

I have not seen a single serious emissions evaluation of any electric car. I've seen some idiotic reports claiming no readings on a broadband RF meter that started too high to be useful, and measurements with Trifield meters which fall off to nothing over 10KHz.

Most of the ELF meters don't go high enough to measure the magnetic fields, just as they don't show much of anything from typical switching power supplies. They have likely done a fair job of electric field shielding in order to have all the other electronics still operate without interference.

It may be 200 years before we start thinking seriously about having our conveniences, while respecting the limitations of our evolved (think buggy Microsoft software) biology."

Regarding hybrid vehicles, this was his response:

"It's hard to generalize, because hybrids may use a smaller motor, and gas-ignition motor and transmission electronics can vary so wildly based on where the high frequency current paths are. I haven't measured any newish vehicles yet.

I would suggest avoiding electric cars, even hybrids, entirely."

**6 –** If you start looking for a new car, here are some of my personal experiences that may prove helpful:

Cars I do really well with are older Honda Civics and Toyota Corollas (I still own a 1996 Honda Civic to have a low-EMF car). I do well in a 2014 Toyota Camry (with Bluetooth disabled - my mom's car). I also do well in 2015 Hyundai Elantra/Accents and Mazda 2's. I have recently tested a 2007 Pontiac Vibe, 2017 Hyundai Elantra and 2019 Hyundai Accent and did fine in them. They are all basic models with less electronics and smaller engines than other cars. That is typically the key.

Magnetic Field – Pontiac Vibe: https://youtu.be/YJTMUgsGXpY

Low-EMF 2019 Hyundai Accent: https://www.youtube.com/watch?v=pHfJdsiM4aU


The magnetic field shown above is from a 2017 Hyundai Elantra with the engine running. The field drops to about 0.3 mG at the driver and passenger seats, which is quite low.

You can see that the magnetic field for a typical Toyota is much less: https://youtu.be/PR6Uh-Ni214

For a comparison, here is the magnetic field from a 2018 Kia Forte. The field at the seats was over 1.0 mG, which is higher than I would want in my car.

BMW's, Volkswagen's, Acura's, Mercedes and other higher end cars all seem to give ES people problems. New SUV's are typically a no-go. Many have powerful 4G LTE WiFi (as well as Bluetooth) now. However, I borrow a friend's 2004 Toyota Landcruiser each summer and do great with it. No off-gassing, no-RF, low-EMF.

Satellite radio and GPS is nothing to worry about - they are just receivers of satellite RF and emit nothing.

**7 –** Here are some additional tips from a colleague who recently went car shopping. The meters he used are likely not as accurate as what is mentioned above.

"Just finished low-EMF car hunting. Ended up with a 2011 Toyota RAV4 Limited. Tips I'll pass along:

- Older doesn't mean less EMF. Case in point - the worst car I tested was the oldest (a 2007 Acura TL). A 2015 Honda Accord tested better than a 2011. A 2008 Honda CR-V was worse than a 2012.

- Some brands are better than others, e.g., Toyota and Hondas are better than say, BMW, but you have to test EVERY CAR.

- Every car is going to have some amount of magnetic field coming from the floorboard near the pedals and the dash as those moving parts have to generate a field.

- Tires on ANY CAR will generate a magnetic field. You can get them degaussed but the mitigation isn't permanent.

- Bluetooth, while bad, is actually one of the easiest things to fix. Most cars allow you to either disable it or turn it off once phones are unpaired.

- If you can find a car with pretty low magnetic field coming from the floor, you can mitigate that entirely (or most of the way) with either magnetic shielding foil (effective) or Giron (most effective): https://lessemf.com/mag-shld.html

- Big dashboards with screens and other elements are usually the second biggest magnetic field offender.

- Trucks and SUVs should have lower magnetic field readings by default due to the distance between the engine and driver."

I hope this helps.

Let me know what questions come from reading this.

Jeromy