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Report: Electromagnet Interference

In this report I will look into the basis of electromagnet interferences! What is it may you think? Well never the matter because further on in this report, there would be more in-depth explanation on this topic! There will be annotated pictures which illustrate what is happening in some parts of this report so you the reader can understand it much better!

What is Electromagnetic Interference (EMI)?

First of all what is electromagnet might you ask? Well to put it in simple terms it is basically a live current going through an electrical wire that produces what we call a magnetic field! The term "electromagnetic" comes from the relationship between electricity and magnetism. The two forces always accompany each another. Where you have magnetism you have electricity and vice versa. Either cannot work nor exist without the other!

Another occasion is when you are next to your television set and you mobile phone goes off! You should notice a noise that interferes with the sound which is what we call electromagnet interference.

What Causes EMI?

There are three types of causes EMI. They are inherent, natural and man made! I will now talk through how each one of these work!

- Inherit: This produces noise but with any electronic equipment! A good example would be your television set making funny sounds when say a mobile phone is ring! The technical explanation for this is the thermal agitations of electrons that are flowing through the circuit resistance!
- Man Made: A number of different classes of electronic and electrical equipment produce man-made EMI! They include power generators transmitters, power lines, motors, lighting, engines and electrical controllers. People might think these equipment help us live better in life but they do have downsides! These devices can cause severe EMI, which can damage operation to land and sea data processing equipment.
- Natural EMI: This is caused by natural events such as rain, snow electrical and solar radiation! Usually the interference comes in the form of static or noise. Older communications and data links between e.g. land, sea and air would be affected by this the most but as technology is more advanced, most modern day digital equipment is not affected but this type of EMI. Talking from experience, the new digital TV service I have doesn't get affected by the weather much and the picture quality is clearer whereas before when I had the satellite TV, every time when the weather is bad I wouldn't be able to watch it because the signals are getting disruptive easier than digital TV.

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What Are The Effects of EMI?

Electromagnetic interference could affect anything that uses electricity. Anything from pacemakers to computer monitors can be affected! The difference is that they can be affected in different ways!

For example a pacemaker can malfunction because the EM signals disrupt the circuit boards inside of it. It is such a problem that even airport and hospitals have banned the use of them! Many hospitals have use wireless for equipment networking. For instance looking at the picture of the heart monitor, the black aerial/antenna sticking out of the top of the monitor connects to the back to the doctors screen station via a wireless network. If a mobile phone was used then it would create an interference which can disrupt the transmissions between the two pieces of equipment. Even by turning on the mobile it can cause interference because the signal comes in a burst of emissions going off.

Avoiding EMI?

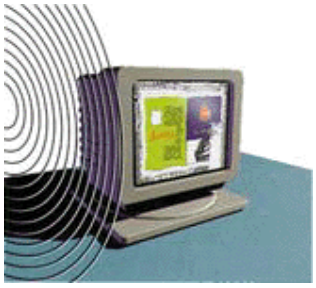
There have been anti EMI devices and equipment which have been design to stop EMI from happening! There are cheap and expensive options but for now I will go into detail about the cheap one first!

A good idea which not many people think of first is space planning in the room which has a lot of electronic equipment. In my scenario, I will use a 'typical' office layout. When laying out new space or rearranging current space, you try and identify all the major sources of AC and DC current, including electric panels, plugs, transformers major conduit paths etc. The space closest to these areas can be known as the "low technology" areas. This means that space with magnetic fields can be turned into corridors, storerooms, or lounge areas so there is a minimum chance EMI can take place! Obviously doing this sort of planning takes a lot of time and expertise; you can't just move things around and think you have done it all! In some cases, individual devices can emit fields and can interfere with other equipment so asking students/colleagues to take care when using such devices.

FMS Jitter Box

Another way in stopping EMI is by using the device which is called FMS Jitter Box. This box goes around the monitor of a PC and protects the monitor by attracting and absorbing the external ELF magnetic fields! The interference is prevented and the image remains stable like normal.

I will give another scenario so that it is easier for you to understand! There are common (elevated magnetic fields include printers, monitors, scanners, copiers and power lines) and hidden sources (magnetic fields include electrical cables, power transformers or electric doors) can cause the computer screen monitor to jump and pictures colours going in waves and jitter! As you can see from the diagram on the left, the magnetic emissions are



going through the monitor which would cause the problems I've mentioned previously!

However with the FMS Jitter Box these problems can be tackled. The box goes around the monitor and acts as a barrier between it and the emissions! This would then stop the problems like jitter-ness and waves than might appear on the screen. To purchase one, you can go to **www.fms-corp.com/resources.htm**

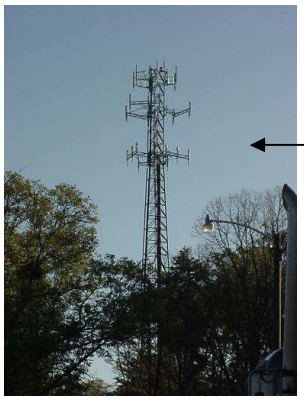
The emissions are being stopped from entering the monitor! You can compare this with the diagram above that **hasn't** got the FMS Jitter Box with it.

The Jitter Box is:

- Adjustable: comes in three sizes and can be reduced in size for each one to fit by custom.
- Affordable: it is made from alloy processed for high magnetic permeability! This means the Jitter Box provides effective ELF magnetic field shielding so if material costs are low then RRP prices are going to be low too.
- Attractive: The final product comes in a platinum coloured smooth surface so it looks good as well as doing the job it was brought to do!

The Mobile Phone

Almost everywhere you turn in the street you would find a person using a mobile phone, but some don't even know how mobile and radio wave technology is used! Mobile communications equipment uses radio waves that use frequencies from tens of megahertz (MHz) to several gigahertzes (GHz) which can cause EMI. Since technology is moving at a very fast rate, so have the demand/requirements of the ever increasing mobile number users and the bandwidth requirements. Operating frequencies have increased dramatically over the years. Digital encoding is now being extensively used so that bandwidth can be divided and improve the quality of communications as time goes by!



This is what you call a mobile phone tower which transmits mobile phone calls from one handset to another! Some residents who live near these have complained at them being there because it is a health risk because of the radio wave signals they are giving off! Some areas have even seen a high increase of cancer cases!

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The average level of radio wave signals of mobile communications equipment is low, it doesn't give off as much as say a microwave oven but the power radiated can cause a lot of problems when radio signals are induced into other electronic equipment! Many sensitive electronic circuits, although not damaged by the induced voltages and currents, can for a short period of time give extraneous output signals. These signals can cause damage in control centres or hospitals.

Another Way of Communicating?

There could be possible alternatives in how we communicate without using radio waves. An option is using infrared which offers **short range** (about 250 feet on average) communications without any of the emission or susceptibility problems that radio transmission gives us! Infra red is part of the electromagnetic spectrum between visible light and radio-waves. It is invisible to the human eye!

When infrared is used with digital encoding techniques and incorporated with a distributed mobile approach, areas of thousands of square metres can be covered with multi-channel full duplex mobile communications. This technique is very common with devices such as two way radios.

Due to the fact that digitally encoded infrared communications use of low level invisible light, do not radiate radio waves, have no health hazard, and are totally unaffected by high levels of electromagnetic radiation from electronic/electrical equipment! This was a major problem for radio wave signals! The quality of the transmitted signals that are in close proximity to equipment which is radiating high levels of electromagnetic noise is great. Infra red systems can be safely used at the same time with the most sensitive electronic equipment without any adverse effect!

Advantages of using Infrared

I have shortened out some advantages for using infrared as a way of communicating:

- No potential health risks.
- Short range predictable area of coverage, allows total security and the segregation of systems by distance.
- It is unaffected by other electromagnet radiation in the spectrum up to and including several GHz.
- Has little or no electromagnetic radiation below several GHz.
- Requires no licence requirements.
- Very clear communications.

Disadvantages of using Infra-Red

- Not being able to cover far distances as radio waves does
- The signals cannot pass through walls or ceilings

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Conclusion

After reading this report, you may have come to the conclusion that EMI affects us in everyday life whether you're at an airport, petrol station forecourt or even at home! Some may even not know it is happening but we know it is happening all day and everyday somewhere on Earth. As technology advances, we may have more EMI to deal with, but what goes with bad has to come good! Maybe a new theory or invention could come out within the distance future which could put an end to EMI?