



Another EMC resource
from EMC Standards

EMI Stories 476 to 570

Helping you solve your EMC problems

EMI Stories 476 to 570

476) Another lightning story

The Broward County (Florida) Civil Defense office had a 180 foot radio tower that was several years old before it was finally hit by lightning (this was many years ago). It turns out the tower was not grounded.

The lightning came down the heliax coaxial cables, about 2 inches in diameter (no cm back then), into the building. One of the (vacuum tube, remember those?) VHF radios looked like the speaker grille was hit by a fist from behind. The CD director's telephone was melted on the desk. All the electrical outlets were burned and the air-raid siren relay was welded 'on'. The siren activated and would not turn off.

The only person in the office was a secretary who knew nothing about electricity. I think she must have aged 10 years in 2 seconds that day. I was in high school at the time and came to realize at a tender age that there is no such thing as a 'lightning protector'.

(Copied from: "Another lightning story" in the thread "Danger and Power of Lightning", posted on emc-pstc@ieee.org by Douglas C. Smith, 2nd April 2002.)

477) Black Hawk helicopter crashes

In the mid 1980s, the US Army experienced 29 crashes of its UH-60 Black Hawk helicopters, at least five of which were believed to be due to RFI. The helicopter exhibited flashing indicator lights, unintended movement of the stabilator and other responses when it was near radar transmitters and microwave towers.

The US Navy also flies UH-60s under the name of Sea Hawks, but experienced no RFI incidents. The Navy had the chopper's manufacturer use additional shielding to meet greater electromagnetic ambient requirements. Eventually, the Army retrofitted its helicopters with additional shielding.

(Taken from Don White's 1998 EMC Encyclopaedia CD-ROM, 'Case Histories, EMI-related (a tutorial)', published by EMF-EMI Control, Inc.)

478) Electric guitar in studio is jammed by taxicab CB transmitter

A broadcast studio, located in downtown Manhattan, was experiencing a periodic interference to its electric guitars. Subsequently it was discovered that nearby taxicabs, equipped with illegal 1,000 watt CB transmitter amplifiers, were the culprit.

Shielding the street side of the studio would have removed the RFI demodulation problem, but the manufacturer had used unshielded and unprotected guitar cables. Adding clamp-on ferrites at the guitar input leads was the more economical fix. Shielded cable replacement or filter pin connectors would also have worked.

(Taken from Don White's 1998 EMC Encyclopaedia CD-ROM, 'Case Histories, EMI-related (a tutorial)', published by EMF-EMI Control, Inc.)

479) Taxicabs' transmitters interfere with computer room during rainy weather

Off the entrance foyer inside from the marquee is located a computer accounting room. The customer complained of computer crashes during rainy weather.

After letting off a customer, a taxicab calls the base station dispatcher for his next customer pick up. This is done while the cab is under the marquee, about 12 meters from the computer room.

Since the victims are so expansive, with multiple wiring distributed under the raised flooring, a simple protection scheme was not economical. Instead, the fix involved shielding the marquee side of the computer room.

(Taken from Don White's 1998 EMC Encyclopaedia CD-ROM, 'Case Histories, EMI-related (a tutorial)', published by EMF-EMI Control, Inc.)

480) Truck's brakes lock up due to interference, 13 teenagers killed

In the late 1980s, a truck, skidding out of control, crashed into an ice cream parlor in Munich, killing 13 teenagers and injuring others. Subsequent examination indicated that the truck's anti-skid breaks locked up when near certain type transmitters.

(Note: This kind of an EMI problem became well known in the late 1980s. It would not likely happen today, since automobile manufacturers now design to harden their vehicle wiring and modules to cope, and test whole vehicles to 200 V/m).

(Taken from Don White's 1998 EMC Encyclopaedia CD-ROM, 'Case Histories, EMI-related (a tutorial)', published by EMF-EMI Control, Inc.)

481) FDA Cautions User of Implantable Devices About RFIDs

The U.S. Food and Drug Administration (FDA) is cautioning consumers with pacemakers and other implantable medical devices about the potential for interference from radio frequency identification (RFID) tags.

RFID tags are gaining widespread use in inventory control, employee identification programs and transportation fare collection systems. But, implantable medical devices can be susceptible to interference from radio frequency sources, including RFID tags, resulting in malfunctions and even device failures.

The FDA cautions consumers with such devices to be vigilant about potential interactions between their device and RFID tags, and to leave any area immediately when experiencing physical symptoms that indicate that their device is not working properly.

View the complete text of the FDA's notice about RFID at www.fda.gov/cdrh/rfid.

(Copied from 'FDA Cautions User of Implantable Devices About RFIDs', *Conformity magazine's on-line newsletter*, Jun 28th, 2007 - 10:57:43, www.conformity.com)

482) Nissan warns U.S. cellphones can disable car keys

Some owners of 2007 Nissan Altima and Infiniti G35 sedans have found that if their cellphones and 'intelligent' car keys (known as I-Key) are touching, incoming or outgoing calls can alter the electronic code in the I-Key with the result that the car will not start. The I-Key cannot subsequently be reprogrammed.

So Nissan is asking customers of these models to keep their car keys and cellphones at least an inch apart to avoid disabling the I-Keys. For more on this, visit: <http://uk.reuters.com/article/technologyNews/idUKN2424455020070524>.

(Sent in by Graham Barber, Principal Policy Advisor, *The Institution of Engineering and Technology*, www.thiet.org. Also see *Banana Skin* No. 335, which suggest that the problem is not limited to these two Nissan models.)

483) Variable speed motor drive interferes with plastics moulding machine

The moulding machines concerned use high pressures and high temperatures to mould the plastic parts, and are about the size (and general shape) of the boiler of an old-fashioned steam railway locomotive. They use powerful AC motors to drive their pressure systems, but the pressure demand is not constant, so much of the motor power is wasted in recirculation.

To reduce electricity consumption, save money and help save the planet, the owner tried fitting a 100kW variable-speed AC motor drive to one of the machines, but whenever the drive was operated the moulding machine suffered interference to its temperature control systems. The result was that the plastic parts were deformed because either they were moulded at temperatures that were too high or too low.

The problem was solved by fitting a suitable mains filter to the drive, with the filter's case bolted directly to the chassis (several types of mains filters were tried, but most proved useless) and also by installing a shielded flexible conduit over the motor cable, bonded directly using EMC shielding glands to both the motor frame (at the terminal box) and to the drive unit's chassis. Neither of these techniques had any effect on their own, they both needed to be applied

together, which is typical of suppressing EMI from variable-speed drives. (Submitted by an EMC Consultant who wishes to remain anonymous.)

484) CD players interfere with VHF wireless microphones

The typical hi-fi style CD player produces interference on 175.000 MHz radio microphones. Basically, if you are using a radio microphone on this frequency, which is very common on the older VHF equipment, you need about a metre separation from any CD player. This is both inconvenient in a typical installation and CD players get moved around by users. Thankfully, UHF radio mics don't suffer from this problem.

(Sent in by Robert Higginson, 11th August 2007)

485) Many CE-marked products don't comply – EU market surveillance to increase

A recent study published in Science reveals that societal models for cooperation are doomed to vanish if the number of level-playing incidents (for example, those manufacturers that do not comply to CE rules, or “free riders” becomes too high. In that situation the model becomes untenable.

From a study performed by ANEC (the European Association for the coordination of Consumer Representation in Standardization) in 2005, we note following alarming issues:

- Manufacturers do not mark their equipment with the CE mark (a criminal offense: refer to the New Approach guidance document referenced above);
- Manufacturers do put the CE mark on their equipment, but required technical documentation and/or the DoC are completely or partially missing (also a criminal offense).

Data on market surveillance actions performed by authorities in Sweden, Germany, Finland and the UK show that percentages of non-conforming products are higher than 15% (the reference number which was used in the societal study referred to above). Rates of non-conforming products in these countries were 28.5%, 50%, 37.5% and 33% respectively.

In summary, the above suggests that the very reputation of the CE marking scheme is at stake.

This and other reasons prompted the European Commission to review the workings of the New Approach Directives, and consultations with stakeholders were held from 1998-2002. In 2005, a proposal was published on the EC web site, referred to as “Elements for a horizontal legislative approach to technical harmonization” (CERTIF 2005/16 rev 2).

The solution, according to this proposal? A horizontal legislation directive for all New Approach Directives.

In brief, the proposal suggests changes to:

- Basic notions and definitions (e.g. placing on the market);
- Conformity assessment bodies and facilities (‘essential requirements’ for them);
- A reinforced implementation and role for accreditation;
- Conformity assessment procedures (the ‘modules’ are changed);
- Market surveillance reinforcement.

The proposed timing to implement this horizontal legislation directive is as follows:

- Initiated by the European Council on 10 November 2003;
- The EC prepared CERTIF5 documents;
- Public consultation ended on 26 July 2006;
- EC is now preparing a legal proposal (6377/07, published 15th February 2007, see below – Editor);
- New horizontal framework directive to be published in 2007 or 2008.

(From “The Future of Market Surveillance for Technical Products in Europe”, by Ivan Hendrikx, Conformity, www.conformity.com, Apr 1, 2007 (but not an April Fool's joke!), http://www.conformity.com/artman/publish/article_158.shtml.)

(The Council of the European Union Interinstitutional File 2007/0029 (COD), 6377/07, 15 February 2007, "Proposal for a Regulation of the European Parliament and of the Council setting out the requirements for accreditation and market surveillance relating to the marketing of products", is at <http://register.consilium.europa.eu/pdf/en/07/st06/st06377.en07.pdf>.)

(The editor notes that the fact that many CE marked products don't actually comply with the EMC Directive, and (as other studies have shown) about the same proportion have questionable compliance, is one reason why the simplistic CE + CE = CE approach cannot ensure compliance of the finished equipment, system or installation.)

486) Underground transportation system malfunctions and damage

A public underground railway line suffered from regular interruptions in service during rush hour periods, and there were some cases of damage to its DC rectifiers. The mains was supplied at 120kV, with a switched capacitor bank to correct power factor as the load varied. The 120kV was stepped down via a number of 12kV transformers, each of which could supply up to 5 DC converter stations spread up to 19km along the railway line.

Special protection relays were installed in the DC converter substations to quickly detect flat tyres on the trains and protect the DC converters from the resulting short-circuits. Switching the 120kV switched capacitor bank regularly occurred during rush hours, and caused high-frequency oscillations to be superimposed on the normal supply waveform. The special protection relays were found to be very sensitive to these high frequency oscillations, and this was the cause of the regular interruptions in service.

It was also found that some of the breakers associated with the 120kV switched capacitor bank were faulty and prone to restriking the arc. Under some circumstances this restriking caused overvoltage surge of over 250kV – enough to damage the insulation of the cables. This was the cause of the damage to the DC converter rectifiers.

(Derived from subclause 9.2 of IEC/TR 61000-2-14:2006, "Environment – Overvoltages on public electricity distribution networks", Clause 9: "Case Studies", www.iec.ch)

487) Palmtop computer interferes with aircraft collision avoidance system

Synopsis: DC-9 flight crew received a false TCAS RA during departure climb and increased their rate of climb to avoid a false target apparently generated by a passenger's palmtop computer.

TCAS = Traffic Collision Avoidance System, RA = Resolution Advisory (a recommended avoidance measure)

Narrative: During climb while talking to SDF departures, we got a TCAS RA showing a target at 12:00 o'clock, level and showing a climb. TCASII commanded a full-scale (6000 feet per minute) climb and I as PF increased climb rate to 3000 feet per minute (the maximum we could safely do). We called SDF departures to repeat the RA and ask about the target. He said he had no target within 5 miles of us, so I hit the TCAS 'press to test' button. TCAS reported 'Test OK'. I then asked the lead flight attendant to do a PED walk and he reported back that a computer was in use in violation of the sterile environment condition. The computer, a 'Dell Inspiration 8000', with reportedly no transmission capability and no external power pack, was shutdown for the remainder of the flight and TCAS functioned normally with no further false RA's or TA's.

The reported believes that the issue of reliability of the TCAS system during a scenario such as this is a key safety issue.

(The above report is extracted from the 23rd January 2007 ASRS Report, No. 579608, http://asrs.arc.nasa.gov/report_sets/ped.pdf. See Banana Skin number 467 for more information on NASA's ASRS reports.

http://en.wikipedia.org/wiki/Traffic_Collision_Avoidance_System says (on 10th August 2007): The Traffic alert and Collision Avoidance System (or TCAS) is a computerised avionics device which is designed to reduce the danger of mid-air collisions between aircraft. It monitors the

airspace around an aircraft, independent of air traffic control, and warns pilots of the presence of other aircraft which may present a threat of mid-air collision (MAC).)

488) Aircraft navigation upset by passenger electronic devices

Synopsis: B727 flight crew experienced erratic VOR navigation course indicator possibly due to passengers' use of an electronic device.

Narrative: Shortly after our departure and giving the flight attendants the signal that it was OK for passengers to use personal electronic devices (PEDs), the #1 VOR OFF flag came in view and the course deviation indicator drove to full-scale deflection. The bearing pointer also began a slow drift away from the correct bearing.

This only lasted a few minutes while we were checking reception from other nav aids, and then the VOR began working properly again. Then, shortly before beginning descent to our destination, the #1 VOR again began reacting in the same abnormal manner. I made an announcement to the passengers to discontinue use of PEDs and the VOR returned to normal almost immediately. VOR operation remained normal from the rest of the flight. Our flight attendants did confirm that PEDs were in use at the time of the second incident but due to our proximity to landing, we did not have time to do more investigation to see which specific device was at fault.

(The above report is extracted from the 23rd January 2007 ASRS Report, No. 533768, http://asrs.arc.nasa.gov/report_sets/ped.pdf. See Banana Skin number 467 for more information on NASA's ASRS reports.)

489) Giant World-cup display screens cause interference

During the 2002 World-cup and 2003 Universiade sporting events in Seoul, South Korea, numerous giant display screens were installed at sports stadiums, subway and railway stations, highway toll-booths, etc. These screens used LED technology and could be more than 10 metres wide. Because they are each assembled on-site, and because of their large size, they cannot be tested in normal EMC test laboratories.

The operation of these giant LED screens caused complaints of interference from users of cell phones and radios, which were verified by the national authority. But because of the lack of detailed test methods and procedures for such large items, problems were encountered in enforcing the national EMI/EMS rules and regulations.

(A summary of part of CISPR/H/81/NP, a new work item proposal for the development of in-situ emissions measurement techniques for large items of equipment, November 2003.)

490) Interfering with multi-million dollar semiconductor machines

Remember that power-supply return, chassis common, and shielding ground have different requirements. You should avoid using the system's frame to return (power supply - Editor) current, as you would in the design of an automobile. (This auto-industry-standard approach also causes many EMC problems for motor cars, and is universally deprecated by all EMC engineers, for all types of applications – Editor).

Using the machine frame as a power-supply return is one reason that maintenance people cannot use FM radios in a semiconductor fab: doing so may cause the machinery to reboot or act unpredictably.

The problem is one of a classic ground loop, in which the shield in a coaxial cable carries the power-supply current and interferes with the signal by inducing a series voltage drop in the outer conductor (which makes it appear in series with the wanted signal – Editor). This approach can cause million-dollar semiconductor machines to crash when you stand next to them and key in a radio.

(Extracted from: "Circulating Currents: the Warnings are Out", Paul Rako, EDN Europe November 2006, pp 47-62, www.edn-europe.com.)

491) Airborne interference with GPS

A program that measured the in-flight RF spectrum on 37 revenue flights of commercial aircraft is described. The spectrum monitoring was performed from gate-to-gate in selected aviation-critical and personal electronics frequency bands over the period from September 23 to November 19, 2003. The commercial aircraft in-flight RF environment for two critical navigation frequency bands, VOR and Global Positioning System (GPS) and four consumer electronics frequency ranges are reported. A brief analysis of the GPS band data is presented.

While the avionics community specifically attempts to avoid emissions in the GPS band, this study revealed onboard signal activity. There were signals observed on 58 of 196 traces and creates the potential for interference. As future dependence on GPS grows, i.e. precision approaches, the threat posed by such interference will become more serious. Thus any observed signals should raise concern.

GPs will play a much greater role in future systems for navigation and precision approach. The FAA is 'aggressively implementing' GPS into critical aviation functions [32]. This includes navigation in the en route, terminal area, approach/landing, and surface operating regimes. The potential for GPS interference takes on new criticality in the context of precision approach. The needed exposure times on approach are relatively short (~ 150 seconds), but system continuity and integrity requirements are stringent [28]. The observed signal with a negative safety margin, the potential of undervalued signals and the high rate of observed signals all suggest that this is an issue that warrants careful future attention.

[32] Geyr, M. and Frazier, R. "FAA GPS RFI Mitigation Program." ION GPS-99, 12th International Technical Meeting of the Satellite Division of the Institute of Navigation, September 14-17, 1999, page 107, <http://www.ion.org/publications/toc/99gpstoc.html>.

[28] Erlandson, R.J. "Susceptibility of GNSS Sensors to RFI." 15th Digital Avionics Systems Conference, October 1996, pp 273-278. (Summary: A derivation from basic principles is presented of GLONASS receiver in-band susceptibility levels suitable for Category I approach use. The derived limits are -113.5 dBm for interference bandwidths less than 500 kHz and -110.5 dBm/MHz for greater than 500 kHz. The limits are more stringent at the wide and narrow bandwidth extremes than the existing ARINC standard. Also derived are wide and narrow bandwidth GPS limits which are consistent with RTCA/DO-229 except for a 2 dB lower CW level.)

(Extracted from "The Onboard Commercial Aircraft In-Flight RF Environment", Bill Strauss, IEEE 2006 International Symposium on Electromagnetic Compatibility, Portland, OR, Aug 14-18 2006.

The Editor is continually surprised at the evident eagerness to use the unreliable GPS system for safety-critical applications, such as landing aircraft (see above). Are the manufacturers and organisations concerned taking the serious issues mentioned in Banana Skins 29, 98, 119, 134, 207, 222-224, 227-232, 238, 278, 291, 357, 363, 371, 388, 415, 420 fully into account to achieve the level of safety that people generally have the right to expect? Or are they just focussing on the low cost?

For more information on the use of GPS in transportation infrastructure, visit: <http://www.volpe.dot.gov/gps/index.html>. A list of documents on GPS and transportation is available at: <http://www.volpe.dot.gov/gps/pubs2.html>. Another useful site is <http://www.ion.org/meetings/past/gps2001/a1.html>.)

492) Hazards of interference with prosthetics

Christine Evans-Pughe's article on smart prosthetics on the June 2006 issue of Engineering & Technology made interesting reading, all the more so when I read that a "fully integrated 433MHz transmitter" was being used.

These frequencies are in widespread use by car locking fobs and radio amateurs as well as the UK Ministry of Defence. Some interference is already observed between these users, I am getting visions of a soldier operating a radio, or a driver entering a car, only to cut short their endeavours as a result of strangling themselves with their prosthetic hands.



(From "Prosthetic Interference Hazards", *Feedback, IET Engineering & Technology*, July 2006, page 6, www.theiet.org/engtechmag.)

493) Immunity problems with consumer appliances

Instances of Electromagnetic Interference. In the 1950s and 1960s, the design of transformer-less AC/DC type broadcast receivers caused considerable grief to transmitter owners. Eliminating the power transformer solved one problem but created another for those close to a transmitter. Called "swamping" then, it is now called overload. Then, in the mid-1970s, there were about 30,000 reported cases of radio interference in Canada involving consumer electronic products (it has been estimated that these cases represented 7-10% of total cases in the U.S.).

Other reports over the years involve intercom systems installed in a new residential development north of Toronto, which picked up FM signals from the CN Tower—about 26 miles away! Most wired intercoms don't operate with FM. but here it was difficult to remove.

During the installation phase of an FM transmitter in Brockville Ontario (Canada), over 500 complaints were filed relating to interference with the operation of domestic products. A survey taken in the Barrhaven area of Ottawa Ontario in 1986 confirmed 600 complaints from an AM station located within 1000 feet of a residential area. Many of these results were to be expected, but the media focused primarily on the amusing side effects of the interference, such as the "talking card table " and the "talking water bed."

Over the years, I have found that manufacturers' efforts to ensure EMC in consumer electronics and appliances are largely voluntary, and complicated by the challenge of determining what standards, if any, apply. In fact, because Industry Canada no longer investigates or records consumer complaints of radio interference, there appears to be little incentive for manufacturers to ensure EMC immunity in their products.

How does interference manifest itself? What are some of today's most radiosensitive consumer products? The list includes televisions, stereo systems, telephones, intercoms, touch lamps, baby monitors, VCRs, electronic organs, furnace controls, alarm systems, active TV antennas, cordless phones, CD players and computer modems. Personal experience also supports the addition to this list of domestic gas range controllers, and it is incidences of gas range controller malfunctions associated with EMI and the potential safety hazards that those malfunctions pose that have prompted the writing of this article.

How do the effects of EMI on consumer electronics and appliances manifest themselves? In TV sets, for example, the effects include total blanking of the video, the loss of horizontal and vertical synch, and light cross-hatching or modulation bars. The extent of these unwanted effects depends on the frequency of the undesired signal mixing with the desired signal, but such effects are always visible. Undesired signals may also impair the audio quality, from total suppression of the audio feed to mixing with the desired program audio content. In many instances, both audio and video are affected.

In Canada, the landmark Houghby-Ravenscoft case involved a radio amateur and began with a radiosensitive electric furnace controller. Every time that the operators transmitted Morse code, the furnace control relay keyed a 10kW load on and off with an alarming sound. At the same time, a black and white television lost synch with a mere 5 watts into the amateur operator's antenna. Measured field strength within the home was 0.7V/m (with 1kW input to the amateur's transmitter). That case took five years and over \$80,000 in legal fees to wind its way through the court system. It seems that Mr. Linden's "Law of Torts" didn't take into account the laws of Physics and electromagnetic coupling.

The veritable rat's nest of wires behind the average stereo system has a large capture area to local radio fields, and may couple these directly to the solid state amplifiers connected to the speakers, resulting in audio rectification in the output transistor junctions. Speaker wires make excellent antennas and shielded leads are not always a solution to preventing such effects. It is not uncommon to hear these audible effects, even with the equipment turned off. I have heard

AC/DC kitchen radios respond to 450 MHz when they shouldn't, even when achieving power line isolation is relatively easy to do.

Security control systems, such as intrusion alarms, motion sensors and, on occasion, outdoor klaxons, can react in a manner for which they have not been designed, including sporadic and unpredictable operation. I recall the indignation of neighbors when an outdoor klaxon (horn) blasted forth at 5 a.m., until it was finally manually silenced by the homeowner. Motion sensors are essentially diodes, and can rectify broadband RF and create false "intrusions" when so excited. Some electronic outdoor timers respond in similar fashion. Observing residential outside lights that turn on during daylight hours is a dead giveaway.

Finally, many of us remember how Air Force One would activate garage door openers in California, whenever U.S. President Nixon traveled there, providing his neighbors with advanced notice of his visit.

All of the examples I've cited above represent classic cases of lack of immunity or poor selectivity. However, in my experience of resolving over 300 consumer complaints due to amateur radio operation and or commercial broadcast facilities or embassies, 95% of such cases are easily resolvable.

(Extracted from "Interference Immunity in Consumer Products" by Ralph Cameron, Conformity, March 2006, pp 12-17. The article includes many other case histories, and can be found at: www.conformity.com/artman/publish/printer_20.shtml or by searching the Conformity website www.conformity.com.)

494) Audio induction loop monitors suffer digital interference

The Audio Frequency Induction Loop is a means of magnetic coupling of a clean audio signal into a hearing aid. This bypasses the hearing aid's own microphone, and so removes unwanted sounds such as a conversation behind the hearing aid user. A coil of wire around the required listening area is driven with a current as if it were a loudspeaker. The resulting magnetic field is picked up by a coil in the hearing aid, known as a 'T-coil'. For testing, and for use by those without hearing aids, a 'loop monitor' may be used. They have T-coils and headphone amplifiers, and either ordinary headphones, or the in-ear phones common with MP3 players can be plugged into them.

In a recent induction loop installation in a Quaker Meeting House, several loop monitors were provided for use by people who did not have hearing aids. The loop monitors were an industry standard product made by a reputable manufacturer, but suffered from considerable levels of audible 'digital' interference wherever they were used in the meeting room.

The audible noise was not turned down by the volume control, so was not caused by the audio induction loop signal. Suspicion fell on mobile phone aerials on top of a building well under a quarter of a mile away. Moving the headphones to orient their wires with respect to the mobile phone antennas, effectively using them as radio antennas (as they are used by the FM receivers that are a common feature of many MP3 players) could vary the interference from negligible to intrusive.

So it seems that the headphone wires were picking up the RF transmissions from the nearby mobile phone aerials, injecting the RF signals into the outputs of the headphone amplifiers, which then demodulated the RF signals and outputted the resulting 'digital' modulation envelope – which of course was in the audio frequency range and the cause of the annoying noise – to the headphones.

I wonder if the loop monitors had ever been tested to the radiated RF immunity tests under the EMC Directive? The field strength from the mobile phone antennas was almost certainly less than 3V/m, the test level used in such tests.

(By Keith Armstrong of Cherry Clough Consultants, www.cherryclough.com, summarising an August 2007 discussion with Robert Higginson of AREAC Midlands Ltd., www.areac.co.uk.)

495) Electromagnetic Interference...an Achilles Heel for the U.S. Department of Defense

As an organization, we in the Department of Defense (DoD) fall short in our ability to detect, characterize, report and resolve electromagnetic interference or EMI. EMI is a combination of terms that broadly refers to any type of interference that can potentially disrupt, degrade or otherwise interfere with authorized electronic emissions over approved portions of the electromagnetic spectrum. Some are probably more familiar with the term "radio-frequency interference (RFI)," which is actually a specific type of EMI.

We don't have an effective means to swiftly combat and overcome EMI—detection and characterization of offending signals. Reporting and tracking of incidents, geographical location and identification of sources, and resolution are all essential phases in working an EMI event. Mitigation is also a very important part of the process. Furthermore, growing competition for portions of the frequency spectrum and equipment limitations make our ability to operate through EMI increasingly problematic.

By increasing widespread awareness and garnering upper-level support, our collective attitude toward EMI will improve giving rise to a much more effective EMI mechanism within the DoD. Our capacity for EMI mitigation and resolution is a very critical issue, basic to the successful accomplishment of the DoD mission. Whether this serves as an epiphany, confirmation of something you already know, or a point of contention, we simply cannot ignore how EMI regularly affects our operations with potentially crippling possibilities.

(Extracted from "Electromagnetic Interference...an Achilles Heel", by CWO4 Todd D. Conley, U.S. Navy, 2001, http://www.chips.navy.mil/archives/01_fall/electromagnetic_interference.htm.)

496) Fish fryer in Feltham

A frying machine at a fish restaurant in Feltham, which is near the flight path for Heathrow Airport's Runway 1, emitted RF interference. When they were testing the instrument landing systems on Trident aircraft, they tended to land earlier than they should have when the fryer was operating.

(Sent in by Dave Imeson of Compliance Europe Ltd. Dave is also the Secretary of the EMC Test Labs Association, www.emctla.co.uk, whose website includes a large number of Technical Guidance Notes and other documents useful for test laboratories. Landing earlier can be a big safety problem, if the start of the runway has not yet been reached!)

497) Monitor image jitter caused by faulty building wiring

At a local council office providing office accommodation for around 700 staff, the image on computer monitor screens used throughout the building by office staff had been progressively deteriorating. The image presented on the screen 'jittered' with words and pictures moving rapidly up and down the screen with no operator intervention and caused dizziness and nausea to operators. The level of jitter on each screen varied from irritating in some offices, to total illegibility in others.

A survey using an ELF meter (20-400Hz bandwidth) made evident that there was a 50Hz problem with field levels of 40-200mG measured throughout the building. Further investigation revealed that the source of the problem was located at a small power distribution board in the basement of the building. A current clamp placed around the cables showed that the neutral and earth were carrying currents significantly larger than the live (30A in one neutral with only 2A in its associated live). It was apparent that there was a significant number of wiring faults and this was causing the large magnetic fields.

Electrical engineers were then instructed and over the next few days the various wiring faults were systematically identified and corrected, and with a corresponding reduction in the level of magnetic fields and associated interference the jitter problem was resolved.

(Extracted from "A Guide to Performing EMC Site Surveys, with Case Studies", by Rob St-John James of Hursley EMC UK, <http://www.hursley-emc.co.uk>, EMC-UK 2004, Newbury, U.K., October 18-19 2004, www.emcuk.co.uk/conference.)

498) Interference with gas cooker control creates safety risks

In one particular Canadian community, many residents had complained over a number of years about interference with gas cooking ranges and other appliances located in their homes. In March 2004, for instance, one resident found that her range was intermittently being programmed, followed by the oven operating at random temperatures. It usually remained in this mode until manually turned off.

Similarly, in March 2005, another resident found that she had no control over the functions of her gas range, other than the ability to turn the range on or off. A third complaint was registered in October 2005, involving a range of the same model, type and manufacturer. This particular range had been operating reliably for the prior four years in another a residential community west of Toronto. By coincidence, the homeowner in this instance was located next door to the resident involved in the second incident noted above.

The residents had no prior knowledge of what might have caused the effects that they experienced (the developer who built the community had told them that they were located too close to the airport!). Imagine their surprise upon learning that the actual source of their problems was that AM transmitter located half a kilometer away. Their surprise was even greater when they found out that the transmitter causing the interference was actually legally operating within the terms of its license.

Fortunately, all three of these potential fire hazards were resolved satisfactorily (I describe the solution later in this article). But how many more ranges of the same type and model are out there, waiting for the "right" interference signal to cause a malfunction, perhaps even a disastrous one?

(Extracted from "Interference Immunity in Consumer Products" by Ralph Cameron, Conformity, March 2006, pp 12-17. The article includes many other case histories, and can be found at: www.conformity.com/artman/publish/printer_20.shtml or by searching the Conformity website www.conformity.com.)

499) RF welder stops factory

A supplier of specialist RF welding equipment for plastics had installed a new machine at a processing factory; the 3kW welding machine used RF in the 27MHz ISM band. The welding machine....was installed in a highly automated manufacturing line as part of a pilot scheme for a new manufacturing process.

When the welder was powered up and began to operate, not only did the pilot scheme not function but the other established manufacturing processes within the factory ceased to operate properly. The RF welder was identified as the culprit and the supplier came under considerable pressure to resolve the problem.

Using a spectrum analyser the RF survey confirmed that the RF welder was producing RF fields in the order of 3-6V/m. Closer inspection showed that the RF welder had a short low-impedance path from the RF generator but the return path was through wires to the chassis of the assembly line and conveyor belt system.

The long length (5-15m) of the return path through wires and the conveyor system was creating an antenna at the wavelength of around 27MHz. By isolating the RF welder return path from the chassis of the assembly line and providing an intentionally short low-impedance return path (using copper straps) the field level dropped to below 1V/m. In combination with a few ferrites placed on sensitive analogue transducer cables, a solution was achieved.

(Extracted from "A Guide to Performing EMC Site Surveys, with Case Studies", by Rob St-John James of Hursley EMC UK, <http://www.hursley-emc.co.uk>, EMC-UK 2004, Newbury, U.K., October 18-19 2004, www.emcuk.co.uk/conference. Contact Pam at pam@nutwood.eu.com for a copy of the Proceedings.)

500) Love, Energy Medicine, Frequencies and Flowers

How does energy medicine work? Isn't it the same as thought medicine? What energies comprise body and mind? We know the body is made of particles, in some views, or waves of energy from other viewpoints.

Is there a scientific instrument (other than the human mind) precise enough to measure the smallest particle—the one that underlies measurable wave forms of energy? Not so far. Therefore physicists sometimes describe the fundamental units of physical energy so far discovered as being dual in nature: particles and/or waves, depending upon the viewing instrument. Ultimately, will scientists view an ultimate particle, an adamantite particle that is alive, yet not a wave form? We'll see, but what about the mind?

The human mind has been described as two-fold, consisting of

1. The brain, a DNA constructed, thought receiving and transmitting instrument
2. An electromagnetic field.

Being partially an electromagnetic field, within the Einsteinian Unified and infinite Field, gives the human mind a unique property: Infinite expandability — and the ability to access the Infinite storehouse of all that is imagined to be in universal, or unified consciousness.

(We always try to use an amusing or off-beat item for every 100th Banana Skin. The above is extracted from "Love, Energy Medicine, Frequencies and Flowers" by Scott E. Miners, http://www.wellbeingjournal.com/index.php?option=com_content&task=view&id=49&Itemid=1for , or else: <http://www.lightparty.com/Health/LoveEnergyFlowerMedicine.html>)

501) RFID 'radio tags' can interfere with hospital equipment

Lifesaving equipment in hospitals may be switched off by radio-frequency devices used to track people and machines, Dutch scientists claim.

Radio frequency identification devices (RFIDs) are on the rise in healthcare, helping identify patients, and reveal the location of equipment. The Journal of the American Medical Association study found they could interfere with machines. But NHS computer specialists said RFIDs could eventually make patients safer.

There are two types of RFID, one which transmits information, and another, "passive", device which can be "read" by a powered machine when it is held nearby. They are small and cheap enough to be in everyday use in society, in everything from security and travel cards – such as London Transport's Oystercard, to anti-theft devices on goods in shops, and hospitals are starting to become aware of their potential.

At Heartlands Hospital in Birmingham, patients heading for the operating theatre wear an RFID wristband, so that even when anaesthetised, their full identity, including a picture, can be downloaded into a PDA held nearby.

The latest research, conducted at Vrije University in Amsterdam, tested the effect of holding both "passive" and powered RFIDs close to 41 medical devices, including ventilators, syringe pumps, dialysis machines and pacemakers. A total of 123 tests, three on each machine, were carried out, and 34 produced an "incident" in which the RFID appeared to have an effect – 24 of which were deemed either "significant" or "hazardous".

In some tests, RFIDs either switched off or changed the settings on mechanical ventilators, completely stopped the working of syringe pumps, caused external pacemakers to malfunction, and halted dialysis machines. The device did not have to be held right up to the machine to make this happen – some "hazardous" incidents happened when the RFID was more than 10 inches away.

Dr Donald Berwick, from the Institute of Healthcare Improvement in Cambridge, Massachusetts, said: "Design in isolation is risky – even the most seductive technology will interact in the tightly-coupled healthcare world in ways physicians and other members of the healthcare team had better understand, or they and their patients may pay a dear price."

A spokesman for NHS Connecting for Health, which manages various IT projects across the health service, said that RFIDs had the potential to deliver big improvements in patient safety,

reducing mistakes caused by the wrong identification of patients. She said: "Any product such as this which is for use in a healthcare setting has to meet a standard which means it is very unlikely to interfere with medical equipment. "This risk is more likely to come from RFID tags from other sources - such as a travel card, a tag on clothing, or on another retail item."

A spokesman for the Medicines and Healthcare Products Regulatory Agency said that, as for mobile phone use, individual Trusts needed to make risk assessments about the use of RFIDs.

He said: "Despite much debate in the literature on the subject of electromagnetic interference (EMI) of medical devices by mobile telephones and other sources of radiofrequency transmission, the MHRA has received very few reports of adverse events caused by this problem over the last seven years or so. "Of those incidents reported, only a very small number have been proven to be as a direct result of EMI."

(The above is the BBC News report "Hospital risk from radio tags" at <http://news.bbc.co.uk/go/pr/fr/-/1/hi/health/7471008.stm>. Download the free abstract for the JAMA article, and/or purchase the whole thing for US\$15, from: http://jama.ama-assn.org/cgi/search?fulltext=Lieshout&quicksearch_submit.x=4&quicksearch_submit.y=7. The JAMA article was picked up by many other news media, including: <http://uk.reuters.com/article/technologyNews/idUKL245111220080625>, www.spectrum.ieee.org/jun08/6405, www.newscientist.com/channel/health/dn14198-radio-id-tags-can-play-havoc-with-hospital-devices.html?feedId=online-news_rss20, www.eetimes.com/showArticle.jhtml?articleID=208800768, and www.ashe.org/ashe/codes/advisories. Thanks for all these links go to: Graham Barber, Principal Policy Advisor for the IET; Antony Anderson, independent forensic engineer and expert witness; Richard Hoad, Technical Leader EMES, QinetiQ, Chris Zombolas of EMC Technologies, Australia, and a senior healthcare professional in the UK who wishes to remain anonymous.)

The Editor adds the following notes to the BBC News report above:

a) It seems possible that the problem is one of 'reactive near-field' interference. It is impossible to predict near-field emissions or immunity from far-field tests such as those used by the medical EMC standard IEC/EN 60601-1-2. Also see Banana Skin No. 423 "*Interference causes poisoning of patient*".

b) The quote from the spokesman for NHS Connecting for Health intrigued our anonymous respondent, who emailed for clarification and got the following response (their spelling): "*It's the electro magnetic compatability (EMC) standard - which means the RFID is safe to be used in medical environment and carries no risk of affecting medical equipment. The Medicinces and Health Regulatory Agency (MHRA) insists on this standard.*"

The standard they are referring to is IEC/EN 60601-1-2 – but it is not true to say that it removes all risks from EMI. On 23rd September 2005 the IEC's medical standards committee TC 62 published 62A/509/DC: '*Deficiencies in the current edition of IEC 60601-1-2*' that included the following statement about IEC 60601-1-2: "*...safety with regard to electromagnetic influences is not adequately addressed.*" (my underlining).

Work on the 4th Edition of IEC 60601-1-2 is under way with the intention of creating a 'proper' EMC safety standard, but it will not be published until at least 2009, so would not become mandatory under the EU Medical Devices Directive until at least 2011. It will probably be long after 2020 before at least half of the RFID and medical devices in use meet this 4th Edition.

c) The quotation from a spokesman for the Medicines and Healthcare Products Regulatory Agency that ends the BBC News report is a classic example of the fallacious argument beloved by politicians, known as the 'absence of proof = proof of absence' argument. Representatives of the US Food and Drug Administration have admitted publicly that if EMI was a problem in US hospitals, they would not know about it because they do not collect the necessary data, and the UK's NHS is no different.

So we should not mistake the spokesman's careful words above as meaning that we do not have a problem. It simply means that we don't know if we have a problem or not.

The annual IEEE International EMC Symposium is always a good place to pick up Banana Skins, and this year's, held in Detroit, was no exception. It was nice to discover that many of the 'movers and shakers' in the EMC world read the EMC Journal, and that they especially appreciated this column! Numbers 502 to 507 are some of the anecdotes heard there (that are suitable for printing)...

502) Airport Instrument Landing System affected by bad batch of garage door openers

San Francisco Airport's ILS (Instrument Landing System) glide slope control was affected by a bad batch of wireless-controlled garage door openers sold to a new housing estate nearby. The super-regenerative oscillators in the receivers were unstable, and emitted radiation in the frequency band used by the ILS. The result was that planes coming in to land thought the runway was several feet lower than it really was, resulting in some very hard landings, potentially a serious safety risk.

(Kindly submitted by Harry H Hodes, of Acme Testing).

503) The EM environment in a lawyers' office

The average field strength in a law firm's office on 55th floor of a building just within Chicago's 'Loop' was between 3 and 5V/m.

(Mentioned by a participant in the session on The EM Environment, Friday afternoon 22nd August.)

504) Military planes exposed to Wi-Fi from LA

The communications dishes of military aircraft flying out of Edwards Air Force Base, are now picking up Wi-Fi from new suburbs of Los Angeles.

(Mentioned by a participant in the session on The EM Environment, Friday afternoon 22nd August.)

505) Lack of compatibility between medical EMC standards

The medical safety standard for HF surgery equipment (electro-surgery) sets no limits for the emissions from the equipment when it is operating. So there is no compatibility with the immunity of equipment covered by other medical standards, such as IEC 60601-1-2, even though all these standards come under one IEC committee, TC62.

The standard has an informative annexe that suggests checking the immunity of other equipment by wrapping the ES leads a few times around them, and operating it. But this would not have found the problem with the blood pump in Banana Skin 506 below, because the coupling was via the patient's bloodstream.

(Comment by Jeff Silberberg of the FDA, at the Friday afternoon session on The EM Environment, 22 August.)

506) FDA recall of blood pumps due to interference from electro-surgery

Please see the following link regarding a recall of a blood pump for susceptibility to HF surgery emissions: <http://www.fda.gov/cdrh/recalls/recall-031708.html>.

This device meets 60601-1-2, which of course does not assure immunity to HF surgery emissions.

The device was tested for immunity to HF surgery emissions, but not under the following conditions, which were confirmed to result in the pump stopping and alarming:

- with a Valleylab Force FX-C or Valleylab SSE2L in the coagulate mode with monopolar electrodes;
- with blood as a coupling path; and
- with the patient ungrounded.

The recall ordered by the FDA for the blood pumps was because, when electrosurgery was used and the patient was not grounded, RF energy coupled from the ES into the blood pump via the patient's blood.

The blood pump manufacturer thought it was acceptable to have a label that instructed the operator to reset the pump in such circumstances, but the FDA disagreed.

(Kindly supplied by Jeff Silberberg of the FDA, to the team working on IEC 60601-1-2, and as comments made at the Friday afternoon session on The EM Environment, 22 August.)

507) The US Navy bans the use of RFID in ordnance or pyrotechnic areas

(Mentioned during the presentation by Mike Slocum and Greg Tait on “Random Walk Technique: Measuring EME in Below-Deck Complex Cavities”, at the Friday afternoon session on The EM Environment, 22nd August. Also see Banana Skin No. 501)

508) Federal Commission Completes Report on Consequences of an EMP Attack

The Commission to Assess the Threat to the United States from Electromagnetic Pulse has issued a 208-page report detailing a grim scenario of cascading disasters as critical infrastructures fail. If terrorists were to obtain a nuclear weapon and to detonate it over the continental United States, every facet of modern life that depends on electricity would be impacted.

The authors point out a successful attack would affect the electrical grid, transportation, telecommunications, banking and finance, and access to petroleum and natural gas. The collapse of systems for delivering food and purified water to the populace would eventually undermine the social fabric.

The report calls for a concerted effort to plan ahead for such a disaster including a plan for the prolonged rebuilding process. Interestingly, one of its most emphatic recommendations is to work on a plan for communications and for keeping citizens informed. Stockpiles of food, water, and medical supplies are of little value unless people know of and report to facilities offering aid. The entire report can be viewed online at the Commission’s website.

(From Interference Technology, 7th August 2008, http://www.interferencetechnology.com/lead-news/article/federal-commission-completes-report-on-consequences-of-an-emp-attack.html?tx_ttnews%5BbackPid%5D=1&cHash=7bad1cace5. Also see Banana Skin No. 448.)

509) Cool facts on Lightning

Lightning is essentially a gigantic electrical spark that results from billions of volts of natural static electricity. Lightning is usually associated with thunderstorms and rain. Most meteorologists will agree that ice formation in clouds is a key factor for starting the “electric generator” that produces lightning. There are several theories as to how lightning is produced.

It seems the best one so far [called the “Charge Reversal Concept”] requires that falling graupel (small ice pellets) become negatively charged while small supercooled cloud droplets that strike then bounce off the graupel become positively charged. Cloud temperature can affect the “charge sign” of the graupel. If the temperature is below -10C then the graupel takes a negative charge and the supercooled cloud droplets take a positive charge. The supercooled cloud droplets rise on updrafts to the top of the storm while the graupel pellets fall and melt in the lower regions of the storm.

Lightning Safety Facts from NOAA: Each second there are 50 to 100 Cloud-to-Ground Lightning Strikes to the Earth world-wide. Most lightning strikes average 2 to 3 miles long and carry a current of 10,000 Amps at 100 million Volts.

A “Positive Giant” is a lightning strike that hits the ground up to 20 miles away from the storm. Because it seems to strike from a clear sky it is known as “A Bolt From The Blue”. These “Positive Giant” flashes strike between the storm’s top “anvil” and the Earth and carry several times the destructive energy of a “regular” lightning strike.

Thunder can only be heard about 12 miles away under good quiet outdoor conditions. Daytime lightning is difficult or impossible to see under local sun and/or hazy conditions. Night-time “heat lightning” can be seen up to 100 miles away (depending on “seeing” conditions).

“Lightning Crawlers” or “Spider Lightning” can travel over 35 miles as it “crawls” across the bottoms or through squall line “frontal” clouds. This rare type of lightning is very beautiful as it

zaps from “horizon-to-horizon”. However it can turn deadly if it happens to strike the ground at the end of its super long path! {Lightning Crawlers from The Blue!}

Radar has detected Lightning “Crawlers” traveling at high altitudes (15,000 ft to 20,000 ft) as they zap from cloud-to-cloud. Lightning “Crawlers” over seventy five (75) miles long have been observed by Radar!

The temperature of a typical lightning bolt is 5x hotter than the surface of the Sun! How big around is a typical lightning bolt? Answer: About the size of a Quarter to Half-Dollar! Lightning looks so much wider than it really is just because its light is so bright!

Lightning Strikes create powerful radio waves in the frequency range of 3 kHz (audio, VLF) through 10 MHz (shortwave radio). The VLF (3000 Hz to 30,000 Hz) “lightning signatures” can travel around the world, allowing monitoring of world-wide lightning. The shortwave “lightning signatures” can travel half-way around the Earth (the night-time side of the Earth). The best region to listen for distant shortwave lightning signatures is from 2 MHz through 7 MHz. After 3 AM local time you can listen to 3 MHz and hear the beautiful dispersion-ringing of the static as it bounces back-and-forth between the earth and ionosphere. It can at times sound like hundreds of tiny bells ringing at once!

Red Sprite lightning is a newly-discovered type of lightning that zaps between the 40 mile span between the tops of severe storm clouds to the lower ionosphere “D” layer. Red Sprite Lightning looks like a giant “blood-red”-colored jellyfish having light-blue tentacles. Red Sprite Lightning creates extremely powerful radio emissions from 1000 Hz through VHF. Red Sprite Lightning has been associated with very powerful “Atmospheric Gamma Ray Bursts”. Nuclear Radiation from Lightning Strikes!

(From “Extreme Currents” Volume 408, Military Edition, A newsletter dedicated to lightning and other extreme energy, <http://www.nexteklightning.com/enews/408/coolfacts.htm> 23rd May 2008)

510) EMI Causes Washington, DC Metro Trains to Switch to Manual Operation of Doors

The Washington Metropolitan Area Transit Authority has announced that for the immediate future the opening of all doors on its trains will be controlled by train operators.

On rare occasions, doors have opened on the wrong side of the car as the train comes to a stop at a station. This problem has occurred as Metro officials have been working to upgrade power substations and related infrastructure to produce enough electricity so that additional eight-car trains can be run to accommodate growing ridership demands.

Apparently, the upgrades are causing electromagnetic interference with the system that automatically opens the doors. The temporary fix is to have train operators open the doors manually overriding the automatic system. In the long term an electronic component will need to be installed in all of Metro’s 1066 rail cars.

According to Metro Rail Chief Dave Kubicek, “While this problem happens only rarely, it is a safety concern. This has only happened four times in the last 22 million times that train doors have opened, but even one time is too many.”

(From Interference Technology, <http://www.interferencetechnology.com/emcnews/id1503>, 25th April 2008. See the original announcement on the Metro website at: http://www.wmata.com/about/met_news/PressReleaseDetail.cfm?ReleaseID=2059.)

511) Audio amplifier goes ‘clunk’

In a lab where a special-purpose computer was being tested, there was also a large audio amplifier with a toroidal mains transformer under test. The amplifier produced an audible ‘clunk’ at random intervals while the computer was running.

It turned out that when lightly-loaded at a mains voltage above 227 V, the SMPS went into a half-wave mode, clearly drawing current from the mains only on alternate half-cycles, of the same polarity. This means that even harmonics of the supply frequency are ‘emitted’ (or ‘drawn’, with opposite polarity), together with a DC component.

Very little DC is needed to magnetize a toroidal core, and the 'clunk' was caused by the core being magnetized by the DC component of the SMPS current.

There isn't, at present, any standard that has requirements to prevent this happening. But the solution to this problem doesn't fall neatly into IEC/EN 61000-3-2 or any other existing standard.

(Kindly sent in by John Woodgate, 17th October 2007, jmw@jmwa.demon.co.uk.)

512) Arc-welder emissions damage inverter drives

Like many large scientific and industrial sites, we can have people doing arc-welding on steelwork at various locations at any given time. They usually plug their welder into the building's normal mains supply, and do their welding outside.

I never used to think anything about this, until one day some arc-welding put so much noise onto the mains supply of the building I was working in, that it took out two variable-speed motor drive inverters. They had to be sent back to their manufacturer for repair.

(Comment by a delegate during a course on "Good Engineering Practices for the EMC Compliance of Fixed Installations with the New EMC Directive", The Chequers Hotel, Newbury, 26th February 2008, run by Alan Warner aws-emc@talktalk.net.)

513) Neighbours find ABC has turned the radio up too far

Residents living near the ABC's main radio transmitter at Liverpool have complained repeatedly of interference from the powerful signals it emits, amid concerns that planners have overlooked the impact of electromagnetic radiation on the area.

Residents in a new housing estate at Prestons, which is across the road from the tower, have had the signal from the ABC radio station 702 interrupting phone calls, throwing lines across television screens and turning electronic equipment on and off without warning.

"There would be music at the back of our phone calls," one resident, Arvin Prasad, said.

"Telstra kept saying it was not their problem but finally they fixed it. They put some kind of filter on the lines."

Another resident, Marina Baldin, said: "I had one of those touch lamps. It used to go off and one by itself. I got rid of it."

The Herald reported last week that the five AM radio transmitters at Homebush Bay will have to be moved because Planning NSW has given approval for a multistorey building 200 metres from the 2UE-2SM transmitter.

Scientists are divided about the long-term health risks of exposure to non-ionising electromagnetic radiation. No one is yet living at Homebush Bay, and the issue is who will pay the \$40 million cost of moving the transmitters.

But at Prestons people have been living for more than a year in two-storey houses within 350 metres of the ABC tower. The ABC broadcasts at 50 kilowatts - ten times the power of the AM stations at Homebush.

(From an article by Anne Davies, Urban Affairs Editor, Sydney Morning Herald, www.smh.com.au, February 24 2003, sent in by Chris Zombolas of EMC Technologies Pty Ltd, www.emctech.com.au. Liverpool is in New South Wales, Australia, ABC is the Australian Broadcasting Company, and Telstra is the national telecommunications organisation.)

514) Church sound system creates a buzz

One church sound system installation included a DVD player for the video projector, with the audio linked into out mixer. I could hear a buzz which was clearly the picture signal breaking through into the audio. Usually this implies multiple earths creating some sort of a loop. However in this case the problem was cured when I added an earth from the mixer to the metal chassis of the DVD player. So we replaced the phono-to-phono leads with a different make. This got the buzz down to satisfactory levels (inaudible at normal settings).

Investigation after the fact showed that the original leads, which probably came as part of a CD or DVD player package, had insufficient copper in the "screen" to make a good earth. Indeed,

some leads we have cut up to solder to equipment have not had a true screen at all. What we found was a few strands (about the same as in the core) of fine wire twisted to make a single core where the screen should have been. So some cables on the market are not what they seem and not fit for purpose as screened audio leads.

(Sent in by Robert Higginson on 16th August 2007. Robert has put his finger on an important issue that most EMC testers discover eventually – one cannot rely on the shielding effectiveness (SE) of most purchased cable assemblies. The issue is so pervasive and problematic, that advanced drafts of the second edition of the European Union's EMC Directive – 2004/108/EC – included requirements for compliance of 'ready-made connecting devices'. For example, COM(2002) 759 final, 2002/0306 (COD), dated 23.12.2002 said: "Ready-made connecting devices intended for the transmission of signals are, under certain conditions, deemed to be apparatus and subject to the essential requirements, the conformity assessment regime and the CE marking provisions of the Directive.")

515) Products interfering with broadband internet services are costly to discover

BT has investigated hundreds of cases where a product is causing significant interference to broadband services (and to radio services) but still functions to the user as intended. The cost for dealing with each case can be up to £15,000.

The reason for the degradation has been shown in some cases to be due component ageing due to poor design (almost always the X and Y capacitors in the mains filters).

If we believe the CE marking of the products was done correctly, then their emissions have increased by more than 60 dB during their normal lifetime.

(From the presentation by Martin Wright of BT, at the EMCIA/EMCTLA meeting: "Interpretation of the EMC Directive 2004/108/EC", held at Newbury, UK, on the 29th November 2007.)

516) TV emits 3V noise onto mains, stops ADSL over a large area

A test lab received a call from BT, concerning a problem that was blanking out their ADSL broadband internet services over an area of about a mile diameter. It had been discovered that a six year old television was the cause – when tested in the lab it was found to be putting about 3V of noise onto its mains cable, roughly 60dB more than the limits in EN 55013. Its high levels of emissions were spread from about 150kHz to 5MHz.

Often, when you find this problem with an older item of equipment, it is because the X and Y capacitors in its mains filter have finally succumbed to high levels of surges. These types of capacitors are designed to fail open-circuit, so as not to cause electric shock or fire hazards, and normal mains voltages are routinely exposed to surge voltages of 6kV (or higher, according to EN 50160), whilst the surge levels tested by immunity test standards listed under the EMC Directive are no more than 2kV, so failure of X and Y capacitors, resulting in increased levels of emissions, is not unusual. However, the X capacitors in this TV were checked and found they were fully functional.

The TV was a reputable make and it seems fairly certain that that model complied with the emissions limits in EN 55013 when tested. Having emissions that worsened by 60dB over 6 years of operation sounds as if it should be unusual, but BT have recently been saying that they are having significant numbers of similar problems with domestic appliances interfering with their broadband systems (see No. 515 above).

(Summary of a discussion with an EMC lab manager in the UK, who wishes to remain anonymous, 13th December 2007.)

517) Vacuum cleaner interferes with burglar alarm system

I have just disposed of an Oreck upright vacuum cleaner which we were given, as every time I used it, it set off the internal alarm on our burglar alarm system which could only be turned off by a full power down reset by the engineer. Normal keyboard reset codes had no effect. The burglar alarm system is pre-EMC Directive, being around 15 years old. It was cheaper to buy a new vacuum cleaner than replace the alarm system. I certainly wasn't going to pull up all the floorboards to harden the system.

It is worth pointing out that the burglar alarm system in question works quite happily with all my other appliances including heavy duty power tools, washing machines, washing up machines, Wi-Fi, Bluetooth, wireless phones and multiple mobile phones but then I assume the Oreck was CE marked in the US?

(Kindly sent in by Dr Nigel Carter, until recently Technical Manager E and EMC, QinetiQ, Farnborough.)

518) Justification for FAA rulemaking on High Intensity Radiated Fields (HIRF)

The electromagnetic HIRF environment exists because of the transmission of electromagnetic energy from radar, radio, and television transmitters, and other ground-based, shipborne, or airborne radio frequency (RF) transmitters. In the late 1970s, designs for civil aircraft were first proposed that included flight-critical electronic controls, electronic displays, and electronic engine controls, such as those used in military aircraft since the mid-1970s. Accidents and incidents on civil aircraft with flight-critical electrical and electronic systems have brought attention to the need to provide HIRF protection for these critical systems.

On April 15, 1990, an Airship Industries Airship-600 traversed the beam of a highly directional RF broadcast from a Voice of America antenna and suffered a complete loss of power in both engines that resulted in a collision with trees and the terrain during a forced landing in North Carolina. The National Transportation Safety Board stated in its investigation of the accident that the lack of HIRF certification standards for airships at the time of the airship's certification was a factor in the accident.

More recently, on March 2, 1999, a Robinson R-44 helicopter passed within 1,000 meters of the main beam of a high frequency (HF), high energy broadcast transmission antenna in Portugal. The pilot reported strong interference in the intercommunication and communication systems and navigation radios, followed by illumination of the low rotor revolutions per minute (RPM) and clutch lights. He further noted the engine noise dropped to idle level and the engine and rotor RPM indicators dropped. The pilot entered autorotation and landed the helicopter successfully with only damage to the main rotors. Following landing, the pilot reported all cockpit indications were normal. The accident investigation division of Portugal's Instituto Nacional da Aviação Civil stated in its investigation of the incident that the probable cause was severe electromagnetic and RF interference.

The FAA has issued three airworthiness directives (ADs) in response to HIRF effects between 1991 and 1998. In AD 91-03-05, Airship Industries Skyship Model 600 Airships, the FAA required the installation of a modified ignition control unit because of the previously described dual-engine failure that occurred when the ignition control units were exposed to HIRF.

In AD 96-21-13, LITEF GmbH Attitude and Heading System Reference (AHRS) Unit Model LCR-92, LCR-92S, and LCR-92H, the FAA stated there are indications of an unusual AHRS reaction to certain RF signals that could cause the AHRS to give misleading roll and pitch information. As a result, the FAA required either (1) the installation of a placard adjacent to each primary attitude indicator stating that flight is limited to day visual flight rules (VFR) operations only, or, if the primary attitude instruments have been deactivated, stating flight is limited to VFR operations only, or (2) a modification and inspection of the AHRS wiring cables, a repetitive inspection of the cable shielding, and an insertion of a statement in the aircraft flight manual regarding unannounced heading errors that could occur after switching from DC to MAG or operation of the \pm switch in flight with any bank angle.

In AD 98-24-05, HOAC-Austria Model DV-20 Katana Airplanes, the FAA required the replacement of engine electronic modules to prevent electromagnetic interference in the engine electronic module. The FAA required the replacement of the modules because electromagnetic interference could cause the airplane's engine to stop due to an interruption in the ignition system resulting in loss of control.

Concern for the protection of electrical and electronic systems in aircraft has increased substantially in recent years because of—

- (1) A greater dependence on electrical and electronic systems performing functions required for the continued safe flight and landing of the aircraft;
- (2) The reduced electromagnetic shielding afforded by some composite materials used in aircraft designs;
- (3) The increase in susceptibility of electrical and electronic systems to HIRF because of increased data bus or processor operating speeds, higher density integrated circuits and cards, and greater sensitivities of electronic equipment;
- (4) Expanded frequency usage, especially above 1 gigahertz (GHz);
- (5) The increased severity of the HIRF environment because of an increase in the number and power of RF transmitters; and
- (6) The adverse effects experienced by some aircraft when exposed to HIRF.

(This is the justification given for the FAA's 2006 HIRF rule for civil aerospace: "FAA Action: High-Intensity Radiated Fields (HIRF) Protection for Aircraft Electrical and Electronic Systems – Docket No. FAA-2006-23658: Proposed rulemaking (NPRM), Advisory Circular 20-158, and Final rule.". Note that for the previous 20 years there were special conditions in force to ensure aircraft were designed to resist the HIRF environment.)

519) Another example showing that EMI is not a new concern

In the early 1960s NATO decided to start a missile test range in the Aegean sea. Genistron, a Southern Californian EMC testing and filter manufacturing company, was contracted to perform an RF survey of the area. The NATO folks were rightfully concerned about supersonic missiles heading in the wrong direction due to RF interference.

(Extracted from "Chapter Chatter" by Todd Robinson, a column in the IEEE EMC Society's quarterly newsletter, <http://www.ewh.ieee.org/soc/emcs/acstrial/newsletters.htm>, Issue 219, Fall 2008, page 12.)

520) Headphone magnets interfere with heart implants

Heart patients who have been fitted with pacemakers or defibrillators have been warned against placing the headphones of the MP3 players in their top pockets or draping them over their hearts. According to research presented at the American Heart Association's Scientific Sessions 2008, many headphones contain the magnetic substance neodymium, which could adversely affect the operation of cardiac implants.

Doctors use magnets in a clinical setting to test pacemakers, which treat slow heart rhythms. When exposed to magnets, these devices automatically pace, sending low energy signals to the heart to make it beat. Defibrillators, which treat slow and dangerously fast heart rhythms, send either low or high-energy signals to the heart, but when near magnets may stop looking for abnormal heart rhythms.

Implanted cardiac devices that react in these ways to magnets outside the clinical setting can be potentially dangerous for patients who rely on their lifesaving technologies. Field strength (sic) of 10 gauss at the site of the pacemaker or defibrillator has the potential to interact with the device. The researchers found that some of the headphones had field strengths as high as 200 gauss or more. "Even at those high levels, we did not observe any interactions when the headphones were at least 3cm from the skin's surface."

(Extracted from "Headphones interfere with heart implants", by Kris Sangani, Engineering & Technology, www.theiet.org/engtechmag, 22 Nov – 5 Dec 2008, page 6. This research, combined with the current fashionability of MP3 players, created numerous news items to be published in various media, including: http://www.interferencetechnology.com/lead-news/article/headphones-mayinterfere-with-implantable-defibrillatorspaceakers.html?tx_ttnews%5BbackPid%5D=1&cHash=59fcd739b9, www.telegraph.co.uk/health/article3411300.ec. Many people brought it to our attention – thanks to you all! It is a useful reminder that EMC is not simply a radio-frequency issue, it is required down to DC.)

521) Digital TV interference from motorcycles

When I watch digital TV channels from a terrestrial transmitter, I have to endure periodic interruptions during which the audio and video start stuttering. I recently realised that the disturbances occur every time motorbikes – particularly scooters – pass my house. This doesn't happen with cars. How do scooters disrupt my TV?

(This question was posed by a reader in "The last word" column in the New Scientist, www.newscientist.com/lastword, 25 Oct 2008, page 85. Rather than copy the three replies in full, the below is a brief summary of them.)

a) Modern cars use electronic ignition with lossy carbon cables, whereas two-stroke motorcycles and scooters use magneto-ignition with metal cables and so emit much higher levels of EMI.

b) Digital TV uses a very high level of coding, making the results of EMI worse than with analogue TV. Sometimes using double or triple-screened aerial cables can help.

c) Until analogue TV transmissions are switched off in the UK in 2012, digital TV is transmitted at low power. After 2012 the situation should improve.

(The third respondent mentioned that watching digital satellite TV he still suffered interference from one particular motorcycle, even though these TV signals are in the GHz range. This item also reminded the editor of staying in a UK hotel in 2008, watching digital TV while a farmer applied a petrol-powered hedge trimmer to his border about 30m away. When the trimmer was revved up to perform a cut, the TV picture would freeze until the farmer let the revs drop to an idle again.)

522) New York Blackout caused by harmonics

The last major blackout in New York (NY, USA) was caused by harmonics and resulted in the creation of a series of standards and guidelines designed to guarantee network quality, even in the star-shaped mains distribution networks commonly used in the US (due to the large distances to be bridged.)

(Extracted from: "Beat the harmonics and clean up your power", Panel and System Building, www.psbonthenet.net/enquiries, October 2008, pages 14-17. And to think that President Bill Clinton once wrote to the EU asking them not to list EN 61000-3-2 in the Official Journal under the EMC Directive!)

523) Qantas QF72 plunge

The Singapore to Perth Qantas Airbus A330-300, which had 303 passengers, went into an uncontrolled climb and sharp descent on Tuesday as it neared the West Australia Coast. The scare resulted in injuries to 74 people, with 51 being treated by three Perth hospitals for fractures, lacerations and suspected spinal injuries after being thrown against the roof, walls and cabin furniture.

The crew called a mayday and landed at Learmouth airport, where the plane remains.

Chris Zombolas, the Technical Director of EMC Technologies, which tests electromagnetic fields made by electronic equipment, said the risks of passengers using laptops and other devices in planes was a serious issue. "It is well known in the electrical engineering community that the operation of electronics systems, including air navigation systems, may be adversely affected by electromagnetic interference," he said. "Could a laptop or mobile phone have caused Qantas QF72 to plunge? The answer is yes," he said.

(Extracted from: "Laptop plane plunge query in Qantas case", Herald Sun, www.news.com.au/heraldsun/story/0,21985,24473201-661,00.html, 10th October 2008. This is another story on which a lot has been published in the media, and many people have sent it in to the Banana Skins column. Possible causes such as laptops and mobile phones have been investigated (although, of course, no-one with any assets to lose would admit to have been using such devices, when asked after the event), as well as the plane's proximity to a 1MW VLF (19.8kHz) submarine communications transmitter at Exmouth, Western Australia – which has been implicated by some in a similar malfunction in a Boeing 777-200 on 1ST August

2005. The latest news at the time of writing is that air transport investigators are saying that the incident was caused by a faulty computer component that sent “erratic and erroneous information” to the plane’s flight control system. But I don’t know at this time if they have actually found a faulty component, or whether they are simply assuming it must be faulty because erratic and erroneous data was received from it, which could of course be due to EMI (see the article: “Absence of proof is not proof of absence” in the EMC Journal, www.theemcjournal.com, September 2008, Page 16.)

524) Cell phone EMI warning

RF signals may affect improperly installed or inadequately shielded electronic systems in motor vehicles such as electronic fuel injection systems, electronic anti-skid (antilock) braking systems, electronic speed control systems, and air bag systems. For more information, check with the manufacturer, or its representative, of your vehicle or any equipment that has been added.

(Taken from the Nokia 6300 Cell Phone User’s Guide 2008, kindly sent in by independent forensic engineer Dr Antony Anderson, antony.anderson@onyxnet.co.uk. It is important to understand that similar warnings are, or should be, provided by all cellphone manufacturers for all their models – the RF transmissions from the Nokia 6300 featured above are no worse than other cellphones in their ability to cause interference.)

525) Cellphone causes bus to change gear

NHTSA Identification Number: 06E-100

Date of Notification: 12-29-06

Model or Size Designation: Gear Shift

Identification of Component: Arens AS Tronic

Number of Components Recalled: 2,197

Brief Description of Defect: Mfg.Campaign No. N/A - Electronic Gear Shift.

DOM: N/A.

Electronic gear shifters, p/nos. 0501 214 599 and 0501 212 979 installed on transit buses. Cell phone placed in proximity of shifter touch pad could cause display to change from “R” (reverse) to “D” (drive) should phone receive call. Radio interference can also cause unintended shift. This will allow vehicle to move in unintended direction, resulting in crash. Correct by providing warning sticker and modifying software to prevent shift.

(Taken from a recall notice issued by the USA’s National Highway Traffic Administration Authority (NHTSA), kindly supplied by Clarence Ditlow, Executive Director, Center for Auto Safety, 1825 Connecticut Ave NW, Washington DC 20009, www.autosafety.org, in December 2008.)

526) 12 metres of coal is not a good shield against EMI

SAFETY ALERT NO. 124, Issued 22/02/2005 by Mines Inspectorate, Safety and Health, Brisbane – Head Office, PO Box 2454 Brisbane QLD 4001, Australia, Phone +61 07 3237 1105 Fax: +61 07 3224 7768 Vision: ‘Our Industries Free of Safety and Health Incidents’

Incident With 2 Remote Control Transmitters

MINE TYPE: All Underground Mines

INCIDENT: A twin heading underground roadway was being developed using two mining machines, (continuous miners), both controlled by their operators using hand held remote control transmitters. Each

continuous miner remote control operated on a different frequency to prevent interference between the 2 units.

A 10 to 12 metre coal barrier remained between the two development headings, (A&B), when the B heading miner was pulled back to the intersection on dayshift in readiness to recommence driving on afternoon shift.

At the start of afternoon shift the A heading remote control transmitter was mistakenly taken to B heading miner. When the operator tried to start B heading miner, the machine did not commence the pre-start cycle, however the A heading operator witnessed the A heading continuous miner commence its pre-start cycle. The operator alerted the panel deputy, who carried out additional testing and found he could start the miner in A heading from B heading.

EQUIPMENT: Equipment involved consisted of the two continuous miners and their respective hand-held remote control transmitters. The remote control transmitters were painted differently to match their respective continuous miners.

HAZARD: Uncontrolled operation of equipment

CAUSE: There were insufficient controls in place to prevent a remote control transmitter being mistakenly taken to the wrong mining machine, and then used to inadvertently commence the pre-start cycle on another machine in a separate development heading.

COMMENTS: Although the incident could not be repeated consistently, investigation established radio waves could travel through a coal barrier up to 12 metres thick.

Therefore the distance separating remote control systems underground cannot be relied upon as the only control measure to prevent interference between units. Beside the signal being able to penetrate the ground for some distance, there is always the possibility of the signal being coupled through cabling, pipework or metal roof supporting structures.

RECOMMENDATIONS: This hazard must be recognised, and the possibility of unintended remote control operation of machinery through use of the wrong transmitter, through the ground or over what at first appears to be long distances, must be considered in the development of a coal mine's safety and health management system, and in the risk management practices and procedures used by metalliferous mines.

Peter Garland, Regional Inspector of Mines – Southern.

Contact: John Kabel, Senior Electrical Inspector of Mines, +61 (07) 3237 1105

(Kindly sent in by Chris Zombolas of EMC Technologies Pty Ltd, www.emctech.com.au, 8th January 2009, http://www.nrm.qld.gov.au/mines/inspectorate/safety_alerts.html. The Banana Skins issue is that the mining industry – at least in Queensland – relies upon shielding by the earth to prevent radio controllers from operating the wrong machinery – yet in this case even 12 metres of (conductive!) coal did not provide sufficient attenuation. Who would have expected that?)

527) German Tornado crashes

Holzkirchen was the location of one of the main transmitting stations for Radio Free Europe. Transmissions started in 1951 and provided the people of Eastern Europe with news from Western Europe. The transmitters had a strength of up to 250 kiloWatts, and in the 1980s caused a Tornado aircraft to crash near Oberlaidern. Transmissions were reduced after the fall of the Communist block and the transmitters were dismantled in 2004.

UK Tornados never suffered from such interference, despite being exactly the same design and build, because pilots were issued with maps showing areas of high field strength from such transmitters, to be avoided during flight.

(From a presentation by Professor Nigel Carter, at the EMCIA meeting, held at the EEF in London on the 17 December 2008. Some of the information above is taken from <http://en.wikipedia.org/wiki/Holzkirchen>)

528) Microwave cooker interferes with TV

A neighbour told me he had recently purchased an 'own brand' LCD television from a well-known UK-wide chain of supermarkets, and installed it the kitchen of his house. It worked fine, except when the microwave cooker was operating, when its picture went totally crazy. A replacement from the same supermarket did exactly the same. After getting a full refund, he bought a well-known brand of LCD television instead, and this worked just fine in the same location.

(Mike Ashton, proprietor of Brocton Post Office, Brocton, Stafford, UK, in conversation with Keith Armstrong on 21 February 2009.)

(Editor's note: microwave cookers operate around 2.45GHz, and since this is not a frequency reserved for communications, the only limits at that frequency are based on human health hazards. But the immunity standard for televisions, EN 55020, does not test at frequencies above 0.15GHz. This is an example of how products that fully comply with EMC standards listed under the EMC Directive, can nevertheless interfere with each other in normal use and therefore fail to comply with the Essential Requirements of the EMC Directive – its basic legal requirements. Article 10 of 2004/108/EC exists for just such situations, but seems to be rarely invoked.)

529) DECT phone interferes with TV

I bought a well-known brand of LCD television, and placed it on a shelf in my living room. It would not work unless I pulled it about 6 inches forward, away from the wall. There was nothing I could imagine in the wall that might cause a proximity problem, yet the effect was repeatable. In case it was some kind of fault in the television, I swapped it for another one of the same type, which behaved just the same!

So next I suspected my rooftop antenna and its cable, and had them replaced. This new TV was becoming quite costly! But the new one had exactly the same problem!

Then, while trying to peer into the gap between the television and the wall to see if there was something odd going on in there (without much hope of success, but you have to try everything when the usual things fail), I pushed my wireless (DECT) telephone charger out of the way to get a better view. Suddenly, the television worked!

My telephone charger was also the basestation for the DECT system, and is apparently always transmitting. All that I had to do was move the 'phone 3 inches to one side, further from the television, and I had no more problems.

(From Phil Cross, of Sellafield Ltd (used to be BNFL), in conversation with Keith Armstrong on 23 February 2009.)

(Editor's note: DECT wireless telephones transmit about 0.25W at around 1.9GHz, and are licensed to do this. But just as for No. 528 above, the immunity standard for televisions only tests up to 0.15GHz, so once again products can fully comply with EMC Directive standards yet interfere in normal use. It is quite obvious that, these days, a domestic TV could be used near to a DECT phone basestation, or microwave cooker, yet the EMC standards do not cover such obvious situations.)

530) Weight-saving on military aircraft causes costly EMC problems

The Airbus A380 saves a lot of weight by using large areas of glass-fibre with a thin aluminium layer in its construction. However, the A400 military transport plane currently in development uses carbon-fibre panels instead, which are stronger and lighter, and also conductive. They do not have an aluminium layer.

Unfortunately, the carbon-fibre is not conductive enough to provide sufficient EMI shielding – so the project is suffering huge delays as filtering and shielding is added for the benefit of the on-board electronics. One wonders if the added weight of these EMI measures might offset the benefit of using costly carbon-fibre.

I would have imagined that, on a large project like this, using a new material that is well-known to have much lower conductivity than the traditional aluminium, and with the military's long history of costly EMC problems and resulting in-house expertise – that simple, quick, low-cost experiments would have been done to discover what EMI shielding would be achieved by using carbon fibre, and that they would have predicted this problem before the aircraft design even started.

(From Keith Armstrong, following discussions with attendees at an EMC training course in March 2009.)

531) Cost-saving on military aircraft causes costly EMC problems for suppliers

There appears to be a tendency to attempt to reduce the cost of new aircraft, which in some cases is creating great difficulties for suppliers of flight instruments. For example, some new helicopters have removed the EMI shielding layers from their glass cockpits, making the EM environment of the flight instruments almost the same as equipment mounted outside the vehicle, requiring them to function correctly (many of them flight-critical, some safety-critical) in radiated fields of kV/m at frequencies to 10s of GHz, to cover the situation where the helicopter is operating close to an airfield or carrier radar.

Since modern aircraft use one or more large LCD flat-panel visual displays, instead of large numbers of small 'dials', shielding these displays against kV/m fields requires a lot of metal in front of the screen, reducing its readability and dimming its brightness. Since the displays also have to be readable in bright sunlight, the power required by their backlights has to increase considerably, increasing the problems of dissipating heat in the flight deck.

(From Keith Armstrong, following discussions with attendees at an EMC training course in March 2009.)

532) A "Bermuda Triangle" in New York

Since Bermuda is too far away and the affected area is actually circular, we will name this phenomenon the "Manhattan Circle". Thus anointed, the psychic reach of the Manhattan Circle is centred on the Empire State Building and extends for about five city blocks. Airplanes and ships are not dealt with here for they are virtually nonexistent, save for a few exceptions like those of 9/11 and the aircraft that attacked King Kong.

Yet, within this circle some automobiles are doomed. Their remote keyless entry systems will not always work. Even if the mysterious force fails to deny an owner entry to his vehicle, it may disable his vehicle's ignition system, and assistance must be summoned. If towed five city blocks away, all systems are again GO!

As in the real Bermuda Triangle, only a few vehicles succumb. I. Leview, manager of Citywide Towing, asserts that 10 to 15 cars a day require his assistance.

At least no lives are lost and the force destroys no human hardware.

The phantom culprit apparently resides in the Empire State Building. Its grasping tentacles are only electromagnetic. Somehow, it seems, the many new antennas installed high atop this edifice after the demise of the twin towers of the World Trade Center have created a circular focus of electronic frustration.

(Richard Weir, "What's Making Cars near Landmark Go Kaput?" New York Daily News, January 27, 2008. Cr. M. Piechota, from William Corliss' book, "Scientific Anomalies", see http://en.wikipedia.org/wiki/William_R._Corliss, kindly sent in By Anne Silk.)

533) Cellphone turns on CD player

Garage door-openers often fall victim to electronic gremlins sent by nearby transmitter towers. When our granddaughter Stefi visits us, her cellphone repeatedly turns on our CD Player.

Repent, there's no escape from the coming Electronic Armageddon.

(A comment appended to the publication of No. 532, kindly sent in by Anne Silk.)

534) A poetic EMI experience

As Anne sat in her Volvo 'tank'
At Berko, somewhere near the bank
The traffic lights, they were so slow
To change to green they would not go.
But what was this? A 'clunk', a 'hiss',
Poor Anne's locked in, something's remiss!
Fear not, the Police are just right by
Their great antenna. Showing on high
Atop their Station, slowly swaying



Sent message down to Anne's car, saying
"Ho! Lock her in that Volvo there,
and watch her have a damn great swear"
Driving along towards Drumnessie,
Poor Anne was worried, what a messie!
The doors did open, all was well,
That RFI can go to hell!

(Personal communication from Anne Silk, to whom this happened on 15 February 2001. 'Berko' is local slang for Berkhamstead in the UK.)

535) EMC War Stories from Milton Kant

I'll go back pretty much to the beginning of my career in EMC which was at the Sperry Gyroscope Company. In those years, Sperry was an equipment manufacturer that made all types of equipment from complete airborne systems to airborne systems including control systems for drones. They made navigation systems for aircrafts; they made ground equipment; they made high powered radar for ground systems and ship-boards; and they made submarine equipment. They were the subcontractor for the Polaris submarine navigation system so our RFI lab started out as a measurement facility.

Once you start making EMC/RFI measurements, you end up also helping to fix any problems that you uncover for the equipment that is out of specification. You end up learning how to filter EMI, suppress emissions, and shield equipment. This lab/troubleshooting experience led in turn to trying to educate the design engineers that they should design the EMI suppression and shielding requirements into their equipment as part of the equipment design.

We used to hold classes for design engineers to try to teach them the basics of EMI design. Not only was it important to do the design correctly but it was also economical. To try to fix a piece of equipment after it's been designed and in pre-production equipment, built and gone through tests - to try to change the design after that effort is much more expensive than the effort that is taken during the design to make sure that you analyze the equipment and put the fixes in at the beginning. Most of the design and circuit engineers at Sperry would only be interested in getting the equipment to work in terms of performance characteristics. The requirements for interference, reliability and all the other environmental regulations were usually just an afterthought. That attitude was prevalent throughout the industry.

The Aegis system had a computer, which at that time was still a tube-computer because it used electronic tubes. They were using a clock bus in the megahertz range, two to four megahertz, around it. That bus was running around all the equipment. Naturally, when they tried to meet the EMC spec, the signal was radiating all over the place. A good effort was made to try to contain clock frequencies within the computers and not let them radiate. Once again, the designers weren't interested in that. They just knew they needed the clock frequencies to be sent all around their system and how to use them in operation of the computer.

We were building high powered radars which were being sited across the country as part of the early warning system. There was a site out at Mantioch, Long Island. They were getting complaints that they were picking up the radar on the radio and hi-fi systems out there. A second site in Michigan was interfering with a control tower at an airport nearby. We would go out and check the radiated characteristics of the signal to make sure that it met the requirements or that the harmonic levels were low. We made field measurements to validate that they were within the allowable limits. Then, we had to convince people that it's not the problem of the transmitter, rather, the design of the audio equipment was such that it was susceptible to these high-powered radars which supposedly indicated that no equipment was tested for susceptibility characteristics, especially commercial equipment. This is being remedied these days; I think there is much more awareness of the fact that all of the new electronic equipment is susceptible to high-powered radiation.

The Aegis Destroyer not only had EMC requirements, it had very high-powered radar. It was a challenge to make sure all of the other systems on the ship could operate when the radar was operating.

(Extracts from "EMC War Stories, by Milton Kant, EMC Society Founder, IEEE EMC Society Newsletter, Fall 2008, pp32-33, www.ieee.org/organizations/pubs/newsletters/emcs/fall08/history.pdf.)

536) Coronal Mass Ejection – inevitable Armageddon for the developed world

It is midnight on 22 September 2012 and the skies above Manhattan are filled with a flickering curtain of colourful light. Few New Yorkers have seen the aurora this far south but their fascination is short-lived. Within a few seconds, electric bulbs dim and flicker, then become unusually bright for a fleeting moment. Then all the lights in the state go out. Within 90 seconds, the entire eastern half of the US is without power.

A year later and millions of Americans are dead and the nation's infrastructure lies in tatters. The World Bank declares America a developing nation. Europe, Scandinavia, China and Japan are also struggling to recover from the same fateful event - a violent storm, 150 million kilometres away on the surface of the sun.

Surely the sun couldn't create so profound a disaster on Earth. Yet an extraordinary report funded by NASA and issued by the US National Academy of Sciences (NAS) in January this year claims it could do just that.

Our modern way of life, with its reliance on technology, has unwittingly exposed us to an extraordinary danger: plasma balls spewed from the surface of the sun could wipe out our power grids, with catastrophic consequences.

The projections of just how catastrophic make chilling reading. "We're moving closer and closer to the edge of a possible disaster," says Daniel Baker, a space weather expert based at the University of Colorado in Boulder, and chair of the NAS committee responsible for the report.

The surface of the sun is a roiling mass of plasma - charged high-energy particles - some of which escape the surface and travel through space as the solar wind. From time to time, that wind carries a billion-tonne glob of plasma, a fireball known as a coronal mass ejection (see "When hell comes to Earth" below). If one should hit the Earth's magnetic shield, the result could be truly devastating.

The incursion of the plasma into our atmosphere causes rapid changes in the configuration of Earth's magnetic field which, in turn, induce currents in the long wires of the power grids. The grids were not built to handle direct current. The greatest danger is at the step-up and step-down transformers used to convert power from its transport voltage to domestically useful voltage. The increased DC current creates strong magnetic fields that saturate a transformer's magnetic core. The result is runaway current in the transformer's copper wiring, which rapidly heats up and melts. This is exactly what happened in the Canadian province of Quebec in March 1989, and six million people spent 9 hours without electricity. But things could get much, much worse than that.

.....the grid's interdependence with the systems that support our lives: water and sewage treatment, supermarket delivery infrastructures, power station controls, financial markets and many others all rely on electricity.

.....it is clear that a repeat of the Carrington event (*1859, stunning auroras even at equatorial latitudes*) could produce a catastrophe the likes of which the world has never seen.

According to the NAS report, the impact of what it terms a "severe geomagnetic storm scenario" could be as high as \$2 trillion. And that's just the first year after the storm. The NAS puts the recovery time at four to 10 years. It is questionable whether the US would ever bounce back.

"I don't think the NAS report is scaremongering," says Mike Hapgood, who chairs the European Space Agency's space weather team. Green agrees. "Scientists are conservative by nature and this group is really thoughtful," he says. "This is a fair and balanced report." Neither is Europe

sufficiently prepared. Responsibility for dealing with space weather issues is "very fragmented" in Europe, says Hapgood. Europe's electricity grids are highly interconnected and extremely vulnerable to cascading failures.

When Hell comes to Earth

Severe space weather events often coincide with the appearance of sunspots, which are indicators of particularly intense magnetic fields at the sun's surface.

The chaotic motion of charged particles in the upper atmosphere of the sun creates magnetic fields that writhe, twist and turn, and occasionally snap and reconfigure themselves in what is known as a "reconnection". These reconnection events are violent, and can fling out billions of tonnes of plasma in a "coronal mass ejection" (CME).

If flung towards the Earth, the plasma ball will accelerate as it travels through space and its intense magnetic field will soon interact with the planet's magnetic field, the magnetosphere. Several things can then happen. If the fields are oriented in the same direction, they slip round one another. In the worst case scenario, though, when the field of a particularly energetic CME opposes the Earth's field, things get much more dramatic. "The Earth can't cope with the plasma," says James Green, head of NASA's planetary division. "The CME just opens up the magnetosphere like a can-opener, and matter squirts in."

The sun's activity waxes and wanes every 11 years or so, with the appearance of sunspots following the same cycle. At the moment the sun appears calm. "We're in the equivalent of an idyllic summer's day. The sun is quiet and benign, the quietest it has been for 100 years," says Mike Hapgood, who chairs the European Space Agency's space weather team, "but it could turn the other way." The next solar maximum is expected in 2012.

(Extracted from "Gone in 90 Seconds" by Michael Brooks, New Scientist, 21 March 2009, pp 31-35, www.newscientist.com. The report mentioned is: "Severe Space Weather Events-- Understanding Societal and Economic Impacts: A workshop report", http://www.nap.edu/catalog.php?record_id=12507.)

(Other recent articles on this subject include "The 2012 Apocalypse — And How to Stop It" by Brandon Keim, Wired Science, 17 April 2009, <http://www.wired.com/wiredscience/2009/04/2012storms/>, and "2012: The Year Of Looming Solar Disaster, When Civilization Devolves?" by Brian Dipert, EDN, 5 May 2009, <http://www.edn.com/blog/40000040/post/1810044181.html?nid=3351&rid=9249788>.)

(The Editor writes: Banana Skin No. 448 discussed a US Congressional report, available from: http://www.empcommission.org/docs/A2473-EMP_Commission-7MB.pdf, that described how a single airburst nuclear bomb would knock the USA – or any developed nation – back into the iron age, with huge numbers of deaths and complete breakdown of civil society, simply because of the damage it would do to the HV distribution transformers on which – it turns out – almost every aspect of our lives relies if we live in a developed country.)

(Nobody keeps spare HV transformers, and they take at least a year to manufacture if all the necessary services are readily available – which they won't be if the HV grid is down. And how do you start up a power plant with no grid power available? Where are you going to find the 100MW you need to jump-start your 400MW generator?)

(We could at least believe that we could prevent an airburst nuclear explosion over our country, whether this belief was justified or not, But there is no way to stop a coronal mass ejection like the 1859 Carrington Event, which would destroy most HV grids around the world, could happen tomorrow, and is certain to occur one day.)

537) EMC Trends and Needs

The main building blocks of an electronic system are the integrated circuits (ICs). According to the International Technology Roadmap for Semiconductors, the communication speed between the chips is increasing and is projected to be 10 GHz with an on-chip clock of 15 GHz in the year 2010.

Given this projection, logic thresholds will be lower, the noise margin will decrease, and ICs will become more vulnerable to interference. Radiated emissions will increase because of faster switching edges and the concomitant increase in energy in a harmonic spectrum that extends to higher frequencies.

Over the coming decade, the number and variety of potential disturbance sources and victims is set to increase exponentially—leading to an astronomical increase in the risk of interference. Consequently, controlling this interference is becoming a key issue in system design.

The market needs safe, secure, highly reliable, low-cost products that are interference-free and EMC-compliant. To achieve this goal, new methods and tools must be developed to reduce emissions and to boost the immunity of components, interconnects, and subsystems. The future electromagnetic environment must be controlled by legislation and standardization with new test methods, frequency bands, and limits.

EMC Design

A high-speed digital lifestyle (including digital radio/TV, Internet, and new applications and services) is fast emerging. By 2010 all products will incorporate digital technology. Multimedia products combine radio, TV, PC, and wireless functions. Such device integration only increases the risk of self-pollution. The explosive growth in the popularity of wireless devices will lead to greater interference challenges. In-home digital wired and wireless networks will cause non-traditional EMI scenarios.

Time-to-market and product life cycles are becoming increasingly shorter. For consumer electronics, the first six months on the market are the most profitable. If the product launch is delayed, a significant share of the life-cycle profits may be lost. EMI problems can thwart speedy movement along the critical path of product creation. The risk of re-design must be reduced, and design efficiency must be improved. Better design methodologies are needed to reduce emissions and to increase immunity. Possibilities include simulation/diagnostic tools, new design rules, and expert systems in CAD tools.

An integral EMC design approach is needed to achieve an optimum cost-effective integration of technologies at the chip, package, board, cable, module, enclosure, and system level. Signal integrity (SI) thermal, software, and cost must be factored into any effective approach.

EMC Standardization

Crucial areas for improvement include:

More and stricter EMC regulations must be developed for products with high clock frequencies, for digital modulation techniques, and for wired and wireless communication devices. An increase in the number of microprocessors in homes, businesses, factories, and vehicles will lead to a rise in interference problems. New emission and immunity test methods must be developed for higher frequencies (mode-stirred chambers, fully anechoic rooms, etc.)

Reassessment of present EMI limits is warranted given the changes taking place in the electrical environment. EMC practitioners must develop a database of defined protection levels for radio services that can be used as a basis for deriving future EMC limits.

Digital radio services have tolerances to broadband and narrowband interference that differ from those of analog services. There is an urgent need to investigate the impact of these differences when determining interference limits and test methods for digital radio/TV products. Resolving the digital EMC problem will be a major challenge in the coming decade.

The EMC of networks and installations constitute the “missing link” in the current mass of EMC standards. Many wired home networks use existing power or telephone wiring and—without coordination—such an arrangement will lead to EMC problems.

EM Safety

Product safety issues must be addressed. All electronic devices are subject to errors or malfunctions caused by electromagnetic interference. A functional safety perspective on EMC is needed in those cases in which errors could result in injury or harm to the health of users.

Failure to do so puts consumers in jeopardy and leaves manufacturers exposed to financial risks including liability lawsuits, product recalls, negative publicity, and loss of consumer confidence. In fact, the risks caused by EMI-related functional safety lapses are increasing because of:

- Rapidly increasing use of electronics in safety-related applications,
- Worsening electromagnetic environment,
- Increasing use of electronic devices.

At the present time no published safety or EMC standards adequately control EMI-related functional safety issues.

(Extracts from: "Towards an EMC Technology Roadmap", by Marcel Van Doorn, Technology & Strategy Manager of the Philips Electromagnetics & Cooling Competence Center, <http://www.interferencetechnology.com/articles/articles/article/towards-an-emc-technology-roadmap.html>. The brochure: "Vision 2020: The EMC Technology Roadmap" may be downloaded from www.emc-esd.nl, link:ETN-SEE.)

538) Interference: Reports from the Field

This Banana Skin Item is a compendium very kindly sent in by Pete Alsop, a Senior Field Engineer working for Ofcom (www.ofcom.org.uk). Ofcom has the responsibility for radio, TV, radiocommunications and telecommunications (including the Internet) in the UK, and part of that is ensuring that these services do not suffer from interference, so they employ 35 field engineers whose job it is to investigate complaints and deal with them. Causing the interference to cease is a matter of pride to them, and they deal with most complaints successfully.

If you think you might have an interference problem with your telephone (landline or cell), your radio or TV reception, or your internet service, click on "How to complain" on the above website, or go direct to <http://www.ofcom.org.uk/complain/>.

I had asked Pete what technologies gave him and his fellow field engineers most interference complaints over the years. I was not concerned with co-channel or adjacent-channel interference, or illegal transmitters, all of which Ofcom's field engineers also have to deal with, and his reply (on 30 June 2009) is below.

Here is a general breakdown of types of proven causes of interference for the period January 2007 to May 2009:

<i>Lighting Systems</i>	252
<i>Thermostats</i>	223
<i>Aerial Amplifiers</i>	197
<i>Power supplies (switch-mode)</i>	82
<i>Digital Receivers</i>	49
<i>IT equipment</i>	33
<i>Motor Systems</i>	29
<i>Ignition Systems</i>	24
<i>ISM Equipment</i>	5
<i>Welding Equipment</i>	1

You can see from above, that the two major causes of interference, and several others, are wide band interferers, where obviously some kind of arcing is taking place. The cause of the arcing is obvious enough in a thermostat, and explains why we find that complaints of interference increase during the winter months – more people are using their central heating, and so are passing currents through the contacts of the thermostats on their boilers and in their rooms!

PLT is a new technology that Ofcom are also receiving complaints about, and solving, but it is felt that it is too early to include it on the above list of interference from established technologies. The latest Ofcom update on PLT is at: www.ofcom.org.uk/radiocomms/ifi/enforcement/plt.

I once had to deal with a complaint of radio interference that turned out to be caused by a low-power nightlight that used a low-energy fluorescent tube. At certain times, it would apparently start to arc inside, causing the problem. Filament lightbulbs will also often maintain a small arc inside (usually before they fail) that can generate a surprising amount of radio noise.

Aerial amplifiers have become less of a problem more recently, as Digital Terrestrial Television broadcasts using OFDM techniques can cope well with a single carrier interferer. Cheap unfiltered aerial amplifiers are also prone to creating intermodulation products (overloaded by strong RF signals nearby) which go on to interfere with the required TV channel, and that's why they are high on the list.

Generally speaking, our work results from devices that have been incorrectly installed and/or have developed a fault of some description, not as a result of being poorly designed with regards to EMC.

Occasionally we do have issues with equipment radiating energy on or very close to the emissions limit in an EN standard. For example, recently I received a complaint from an airport that used 125MHz for AM voice communications, complaining of a permanent interfering signal at a particular location. The source was traced to a nearby building which had recently installed a new CAT 5 cabled IP CCTV security system, where its external video cameras were radiating 125MHz from clock circuits within the control switch, which was located deep in the centre of the building. The cameras were changed for others, and this stopped the interference. But it was not really the cameras' fault – they weren't generating the interference themselves, simply allowing it to pass through.

Here are some examples and experiences that my colleagues and I have had over the years.

- Light sensors found radiating in the TV band causing patterning to one UHF channel. The light sensors were submitted for testing under the relevant EMC Directive-listed standards, which showed that they failed to satisfy both the radiated emission *and* interference power limits.

The devices contained an emission source having a 10 MHz bandwidth with the maximum emission occurring at the top of the band at 157 MHz. The disturbance power emission (EN 55014) limit was exceeded at 157 MHz by 37.8 dB. Radiated emissions exceeded the limit (EN 55022 Class B) at 157 MHz by 31.4 dB and exceeded the limit at 314 MHz and 471 MHz by 23.8 dB and 8.7 dB respectively.

The manufacturer claimed compliance with EN 55014, but this standard applies specifically to household appliances, electric tools and similar apparatus. This standard only tests up to 300 MHz, so does not encompass the TV band in which its 471 MHz (the third harmonic of 157MHz) emissions spectrum lies. Tests were made using EN 55022 (information technology equipment) which is the basic measurement standard applicable to residential, domestic and light industrial applications, which covers up to 1000 MHz and so covers all of the UHF television bands. This standard was considered to be more applicable to light sensor devices.

- Complaints were received from numerous residents unable to start their vehicles due to spurious carrier blocking the RF receivers on the key fob car alarm/management systems.

The signal was traced to a child's life size motorbike with a built in video game operating on the 433 MHz licensed exempt band. The residents couldn't believe it until we deactivated the gaming unit on the bike adjacent to the affected vehicles and the problem cleared. The RF unit had developed a fault and was returned to the manufacturer by its owner.

- In the 1970s I was still dismantling old sewing machines and vacuum cleaners to fit suppression capacitors. Central heating interference was solved by trying suppressors first and only condemning the worn-out thermostat if all else failed to stop the interference. There was still VHF monochrome television susceptible to all forms of electrical interference and herringbone patterning from transmitter harmonics and local oscillators in

- other receivers. Valve oscillators ran at higher power levels than today's semiconductors and shielding had to be restricted to allow for their cooling.
- 4 watt AM CB Radio appeared in the late 1970s and early 1980s, revealing terrible EMC design weakness in every type of electronic appliance, including telephones. In the worst cases, the breakthrough would continue with the affected TV set or HiFi amplifier switched off and unplugged. The audio output transistors or ICs would act as 'crystal set detectors' and produce sufficient energy to drive the loudspeaker audibly *without any additional power*.
 - Microwave ovens appeared in the 1980s, revealing EMC weakness in nearby TV tuners, which accepted the low levels of 2.4GHz from the ovens. On certain channels, a harmonic of the TV local oscillator would fall at the I.F. frequency away from the microwave oscillation, resulting in a distinctive pattern on the TV screen whenever the cooker was in use.
 - Vehicle ignition suppression has improved but some misguided car enthusiasts still compromise the vehicle's EMC performance by replacing carbon plug leads with copper, resulting in TV interference where reception is weak. A few white analogue dots can be ignored but DTTV is far less forgiving with pixilation and sound loss causing greater annoyance.
 - Manufacturers of electric motors and thermostats gradually incorporated RF components into the design, but occasionally the suppression fails, or a fault generates excessive interference.
 - TV aerial amplifier design used to be straightforward and cheap – high gain, no shielding, no filtering and wide bandwidth. Amplifier specifications are now far more important – with cellphones below 1GHz, Airwave communications (e.g. TETRA), Amateur, CB and PMR on many other frequencies. Dynamic range is also more critical with five analogue channels and six weaker DTTV multiplexes having to be amplified without excessive intermodulation. Also, when a mast head amplifier develops a fault, it easily becomes an oscillator and causes nearby interference.
 - Rear-of-set TV amplifiers continue to create problems. A favourite is the unused amplifier which remains powered. The owner, not fully understanding it finds a loose coax flex and plugs it neatly into a spare socket. It looks tidy but an oscillator has now been created causing interference to nearby TV or radio.
 - Low-power radio devices operating in the license-exempt 433MHz band are used for a wide variety of purposes, but inevitably a small number develop a fault and transmit constantly causing interference.
 - For example, cordless doorbells operate around 433 MHz, as do car remote door locks. A manufacturer designed a doorbell push with a grey rubber button surrounded by a white plastic housing, but if its button is pressed slightly off-centre it gets trapped under the plastic surround – causing the doorbell to transmit permanently. A nearby car's door lock receiver cannot receive the brief signal from the key fob (being swamped by the continuous noise from the door bell) so the car stays locked.
 - Although ADSL broadband causes little radio interference, plug-top switch-mode power supply units that power their wireless routers only have a manufacturer's expected MTBF of 3 to 4 years when run 24/7 as many people do. One PSU fault which occurs generates high levels of wideband buzzing across MF and HF radio frequencies. Ironically the noise is easily induced into unshielded telephone wiring, considerably slowing ADSL speed for the owner of the faulty unit and also neighbours nearby.
 - I guess interference affecting TV reception has changed with the uptake of DTV. What used to be a tolerable interference problem, e.g. an occasional one second burst from an arcing boiler thermostat affecting analogue TV has now become more of a problem. The

one second burst now appears as a total loss of reception for a longer period of time, due to the processing time of the digital receiver.

- One that I have quoted as an example of the 'never discount anything' principle, involved domestic TV interference that went in bursts. Each burst lasted 2 - 3 minutes at a time and the first one would be around 7.30pm. This was followed by another at around 8.00pm with a third shortly afterwards. It would then be quiet all evening until around 11.00pm where there would be two further bursts.
- The source was traced to a house on the opposite side of the road occupied by a family with three youngish children. The source was found to be a battery operated toothbrush and the bursts coincided with bedtime for the children followed by bedtime for the parents!
- You wouldn't think that something running off a single 1.5V battery could have caused interference that was strong enough to affect a television the best part of 100m away – but these toothbrushes did!
- Electric fences have caused a few problems particularly if they are poorly maintained. DIY repairs to the long wire result in arching and play havoc with DTTV reception, whereas previously – with analogue TVs – only a faint horizontal line may have been seen.

539) Cellphone turns on gas oven (with link to YouTube video)

Ever have that sinking feeling that you left a major appliance running when you left the house? Well you might not be paranoid: It may actually be on... though not of your own doing.

Andrei Melnikov found that out the hard way: Something activated his oven, causing it to turn itself on and melt a plastic meat thermometer which had been left inside.

How did this happen? Melnikov and his Brooklyn apartment building's skeptical super eventually figured it out through trial and error: The tenant's ringing cell phone somehow turned on his nearby Maytag oven when it rang. If you're skeptical, check out the video of this in action at the New York Times website and see for yourself.

Calling the situation "highly unusual," Maytag (and other experts) blame the problem on electromagnetic interference -- basically the same thing that happens when your cell phone gets too close to your speakers and it starts making that beep-beep-beeping noise. In this case, the interference didn't make a sound but rather caused the oven to turn on.



And this may not be an isolated incident: The Times suggests that preliminary experiments have confirmed that

different brands of cell phones can activate multiple models of Maytag ovens. And, as the story notes, the oven "prefers high" and activates the broiler when it turns on -- which means anything inside the thing is going to get totally fried. On the other hand, tests with a General Electric oven failed to generate the same response.

Takeaways? It's hard to be a Luddite these days, but mysterious situations like this are likely to become more and more common as advanced electronics find their way into an increasing number of products. There's no special reason why an oven or a toaster needs to have a computer brain so advanced, but microprocessors have become so cheap it's probably easier to include one in an oven than it is to include an old-fashioned, analog temperature control system... and it's probably more accurate, too.

The bottom line: Always keep an eye out for oddball effects like this. If you see something strange happening with the electronics in your kitchen -- or any other room in the house -- consider how close your cell phone is when the antics occur, and try a little home-grown experimentation for yourself. Hey, maybe you'll make the news.

*(Copied from: "It ain't poltergeists: Cell phone activates oven", Mon Aug 24, 2009 12:25AM EDT, visit: <http://tech.yahoo.com/blogs/null/147548>. **For the YouTube video**, visit: "Hello, Oven? It's Phone. Now Let's Get Cooking!" by Jim Dwyer, The New York Times, August 23, 2009, http://www.nytimes.com/2009/08/23/nyregion/23about.html?_r=2.*

It also appeared on Fox News as "Cell Phone Call Lights Man's Gas Oven", Monday, 17 Aug 2009, 10:02 AM EDT, http://www.myfoxdc.com/dpp/news/offbeat/Cell_Phone_Call_Lights_Mans_Gas_Oven_dpgo_20090817_jst_2992357; and by Sonia Rincon as "A Brooklyn Man's Kitchen Surprise", 1010 WINS, Monday, 17 August 2009 7:12PM, <http://www.1010wins.com/A-B-klyn-Man-s-Kitchen-Surprise/5016882>.

Kindly sent in by Dennis Swanson, Electromagnetic Effects Staff Engineer - Specialty Engineering Group, Lockheed Martin MS2 Tactical Systems, Eagan, Minnesota; Dr William Radasky, President, Metatech Corporation, Goleta, California; and Paul Bertalan of Sensis Corporation, Dewitt, New York State. Banana Skins certainly gets around! The photograph above is of the cooker model concerned, the Maytag Magic Chef, model CGR1425 ADW.)

*(On 8th October 2009, just after the publication of this Issue in September 2009, Richard Babyak, the Editor of Appliance Design magazine sent me a link to a CBS News item on this story, which has **a much better video** than the one mentioned above! Visit: <http://www.cbsnews.com/stories/2009/08/18/national/main5248949.shtml>)*

540) Mysterious Signal in Cumbrian Village

Ofcom, the UK agency charged with achieving the most efficient use of the spectrum, commissioned a study which mapped the use of spectrum throughout the UK. Several anomalies turned up in it.

Just north of Cambridge, high powered transmissions can be detected in the 863- to 870-MHz band that is ostensibly for the use of short-range devices such as remote light switches and car key fobs.

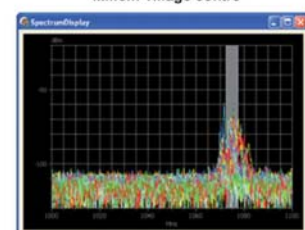


Another surprise was a mysterious signal at 1.075-GHz coming from the Cumbrian village of Millom.

The mystery was soon solved without any need for the investigative wiles of a Sherlock Holmes.

The signal was tracked to a small shopkeeper operating an illegally imported closed circuit TV setup.

Figure 57 Spectral data plot for 1.075 GHz, Millom village centre



The entire report on spectrum mapping can be viewed at:
http://www.ofcom.org.uk/research/technology/research/state_use/vehicles/vehicles.pdf

(Copied from <http://www.interferencetechnology.com/lead-news/article/mysterious-signal-in-cumbrian-village.html>, 05/13/09 02:50 PM, kindly sent in by Ged Dean, of Nottingham University Hospitals NHS Trust.)

541) Interference causes recall of defibrillators

Medical device manufacturer Welch Allyn is recalling approximately 14,000 external defibrillators after 39 reported incidents, including two deaths. The recall involves 14,054 AED 10 and MRL "JumpStart" external defibrillators manufactured between October 3, 2002 and January 25, 2007. According to Welch Allyn there is the possibility that these prescription devices are susceptible to electromagnetic interference, may deliver low energy shock, or may shutdown unexpectedly. If these issues prevent defibrillation in a patient in cardiac arrest, the outcome would be fatal. For additional details, visit the Welch Allyn website www.welchallyn.com/support/customer/AED_lookup.jsp



(Copied from "Interference vs. Defibrillators", <http://www.interferencetechnology.com/lead-news/article/interference-vs-defibrillators.html>, 03/18/09 10:49 AM.)

542) People trapped in elevators

I did a survey on a lift installation last year, high rise building, processors playing up, people being trapped in elevators for long periods as the systems were crashing.

The problem was traced to the elevator mains riser earth being bonded onto the roof lightning conductor, but elevator's earth return was severed in the building, meaning that the elevator's earth return was the lightning conductor. Now consider 20 floors worth of landing push button stations being connected only to a lightning conductor!

This was not the only problem, and it took me a week to correct all the installation faults and get the elevators working reliably

(Kindly sent in by Gary Morgan, email, 5th March 2009)

543) EMI Cited as One Possible Factor in Deadly DC Metrorail Crash

The National Transportation Safety Board continues to make progress in its investigation of the June 22, 2009, collision of two Washington Metropolitan Area Transit Authority (WMATA) trains on the Red Line in Washington, D.C. The Board has developed the following factual information:

Two signal companies, Ansaldo STS USA (US&S) and Alstom Signaling Inc. (GRS), that designed and manufactured the automatic train control components for the WMATA system, are providing technical assistance to the NTSB investigation.



As previously reported, an impedance bond (#15) for the track circuit where the accident occurred was replaced on June 17th, 2009, five days before the accident. Continued review of the maintenance logs has identified that the impedance bond (#14), located on the other end of the same circuit, was replaced in December 2007. WMATA records reveal that this track circuit's train occupancy signal has been intermittently fluctuating since the replacement was installed in December 2007.

The NTSB has requested trouble tickets for the last 18 months to see if these problems had been reported, and seeking records to see if any operators reported problems on this circuit.

The investigation is identifying possible sources of interference affecting the automatic train control (ATC) operation. These potential sources include Electromagnetic Interference (EMI), traction power harmonics and signal crosstalk, communication lines, and system upgrades and changes.

Following the accident, WMATA began to review operations data and identified some problems at other circuits. These anomalies are being examined by NTSB and WMATA to determine if they are the same kinds of problems as were found in the location of the accident site.

Testing has identified that the circuit problems are occurring more frequently during the rush hour time period. As a result, the NTSB and WMATA testing at the accident location on the Red Line is continuing. These tests may result in occasional delays on the Red Line in the Fort Totten area. All testing in the Fort Totten area is closely coordinated with WMATA and is scheduled to minimize delays on that area of track during rush hour.

On Saturday, July 18, the NTSB conducted a sight distance test at the accident location. Information collected from the test will be correlated with rail markings documented after the accident, the braking characteristics of the striking train, and the speed information gleaned from the WMATA Operations Control Center records.

(NTSB Advisory, National Transportation Safety Board, Washington, DC 20594, July 23, 2009, THIRD UPDATE ON NTSB INVESTIGATION INTO COLLISION OF TWO METRORAIL TRAINS IN WASHINGTON, D.C., <http://www.nts.gov/Pressrel/2009/090723.html>. I was put onto this by Interference Technology, <http://www.interferencetechnology.com/lead-news/article/emi-cited-as-one-possible-factor-in-deadly-dc-metrorail-crash.html>)

544) CMOS latch-up causes aircraft safety problem

I am reminded of a verified war story about one of the first "Glass Cockpits" introduced in the Biz-Av world. An engineering safety analysis had determined that the likelihood of simultaneous failures of both the pilot's and co-pilot's primary attitude reference was less than one chance in a billion flight hours.

On the first take-off of the first test flight of the certification program, as the pilot rotated the aircraft off the runway both displays went to big red x's...both displays were inop. This problem was resolved to a hardware failure of a CMOS MUX chip that suffered from a condition known as latch-up.

(Kindly sent in by "John", who wishes to remain anonymous, by email on 17th July 2009. For more on the latch-up phenomenon, which afflicts most common types of ICs but has been especially problematic for CMOS types, visit: <http://en.wikipedia.org/wiki/Latchup>.)

545) From the archives — Mains spikes crash payroll computer on Fridays

This was told to me so long ago that I'm surprised it hasn't already appeared in Banana Skins!

Many years ago, when computers were just entering large corporations and were viewed suspiciously by people who didn't see what was wrong with the 'old ways', a company installed one of these new-fangled machines to handle the payroll.

Programs were written, test data run through the system and all went well until the system crashed whilst running the 'live' payroll data on a Friday morning.

More tests were run, and everything worked fine until the next Friday morning when another crash occurred.

After a couple more weeks of this, it was found that the 'old guard' had a room full of clerks double-checking the figures on their trusty electric adding machines every Friday morning. The resulting mass of mains spikes was too much for the computer power supply to handle...

One thing this taught me was to check for less obvious causes of problems – the "what else was happening when the unit failed?" type of question. Shredders on the same mains outlet seem to be a particular favourite!

(Kindly sent in by Andy Gulliver, email, 8th July 2009)

546) Singapore Grand Prix gearbox failure

And after their one-two in Monza a fortnight ago, this was a sobering session for Button and his Brawn team mate Rubens Barichello.

The Brazilian, who lies 14 points behind Button with four Grands Prix to go this year, had a golden opportunity to close the gap but a gearbox failure in practice, caused by electromagnetic signals from the subway system beneath the Marina Bay Circuit, meant he entered qualifying knowing he would have a five-place grid penalty no matter what.

(Extracted from an article by Tom Cary in the Telegraph, 27 September 09, which was kindly sent in by Dave Imeson, Secretary of the EMC Test Labs Association, www.emctla.co.uk.)

547) “Smart” life raft beacons too dumb

Considerable progress has been made regarding the re-introduction of personal locator beacons (PLBs). Below is a summary of where we currently are in the process.

Background: Personal beacons, which were being carried by some passengers on offshore helicopter flights to oil and gas installations, were withdrawn from service in March, following the ditching of an offshore helicopter in the UK sector in February. It was found that interference from the personal beacon had caused the 'smart' long-range beacons on the life rafts to shut down.

The smart technology fitted to the life raft beacons is designed to shut the beacon down if it detects another beacon signal within a certain radius. This is to ensure that only one high-powered aircraft beacon is transmitting at a time, which helps search and rescue operations to home in more effectively and protects battery life. However, in the February ditching, the lower powered (non-smart) passenger PLBs were detected by the smart beacons, which caused life raft beacons to shut down. This could have had implications for search and rescue operations *(because the high-powered beacons shut down in favour of the lower-powered personal beacons, which would not be as easy to locate – Editor).*

(From an email entitled: “Helicopter Task Group update – Re-introduction of Personal Locator Beacons – 04 November 2009”, by the United Kingdom Offshore Oil and Gas Industry Association Limited, trading as Oil & Gas UK, kindly sent in by Simon Brown, Principal Specialist Inspector, HSE Hazardous Installations Directorate – Offshore Division. To find out more about the work of the helicopter task group and other important areas of work, please go to: www.oilandgasuk.co.uk/issues/helitaskgroup.cfm.)

(This item is not, strictly speaking, an EMI incident like those we normally report here. It is more of an operational incompatibility, but nevertheless it is important because we are making equipment ‘smarter’ all the time by using digital processing to run more software – but of course it is still very dumb indeed when compared with a person, not clever enough to deal with unforeseen problems like this example of ‘interference’.)

548) Bad connection in 50kV line interferes with TV, cellphones, even cable TV

A bad connection in an overhead HV cable was producing S9+10dB on my receiver. On a quiet afternoon you could hear the acoustic noise from the arc 100 feet away! The power utility was initially uninterested until I threatened to complain to the FCC that their AC mains line fault was producing enough RF interference to make HF communication impossible. The work crew asked me to show them the location, and they sort of freaked out at the intensity. It was a 50KV line and at twilight the arc was clearly visible. As they were working, people who lived nearby stopped by to see what was happening. After the mechanical fault was repaired, the locals were very happy because they could watch TV and use their cell phones. The RF noise was intense enough to penetrate the cable TV system.

Given your professional interest in EMC and RF noise sources, I thought you might find the handbook "The Mitigation of Radio Noise from External Sources at Radio Receiving Sites, 6th Edition", published by the US Naval Post Graduate School, interesting and useful. It has been a great help in locating "local" power line noise sources. In a personal Email with George Munsch, he told me the companion "internal noise" handbook is about 90% complete, but the School lacks the funds for completion. www.arrl.org/tis/info/HTML/power_line_handbook/ExternalNoiseHandbook.pdf.

(Kindly sent in by Terrence Fugate, WN4ISX, 13 October 2009.)

549) Access BPL can seriously interfere with safety of flight

Before the Federal Communications Commission, Washington, DC 20554, In the Matter of Carrier Current Systems, including Broadband over Power Line Systems, ET Docket No. 03-104

Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems, ET Docket No. 04-37

Reply Comments of Aeronautical Radio, Inc.

Aeronautical Radio, Inc. ("ARINC") hereby submits its Reply Comments in these proceedings. The record makes clear that access broadband over power line service ("Access BPL") can seriously interfere with the nation's high frequency communications system that guards the safety of flight and thus should be authorized only under conditions that protect the HF Aeronautical Mobile (R) Service.

(From:

http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6516214698.

Also

see:

http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6516214700,

http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6516214699,

and

http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6516214701.

Kindly sent in by Peter Kerry, EMC Consultant, 19 October 2009, who saw them on the UKQRM website www.ukqrm.org)

550) Boy's TV interfered with aircraft

A signal booster on the television set of a Bedfordshire boy has been found to be interfering with aircraft. The aerial on 12-year-old Nicky Chamberlain's bedroom TV was disrupting communications between pilots and air traffic control at Luton airport.

Communications regulator Ofcom traced the problem to the home in Knaves Hill, Linslade, 18 miles from the airport.

Nicky's dad, Dave Chamberlain said: "I came home to find an Ofcom engineer parked outside the house. It was bizarre. I had never heard of anything like this before. Nicky had the booster for a couple of years and there had been no problem. Recently they changed the flight-path and that must have caused the problem with pilots talking to the airport."

He added: "We are decorating Nicky's bedroom now and when that's finished we will get him a new aerial that does not interfere with passing planes."

A spokesperson for communications regulator Ofcom said: "It is not common for something like this to happen. We have field engineers who go around the country investigating for radio interference. In this case the faulty aerial booster was found to be interfering with the pilot's radio."

(Taken from BBC News: <http://news.bbc.co.uk/go/pr/fr/-/1/hi/england/beds/bucks/herts/8327549.stm>, 2009/10/27, kindly sent in by Peter Day, System/Development Engineer, Hitech Instruments Ltd, and by John Davies, Managing Director, Blackwood Compliance Laboratories, on 30 October 2009. Visit <http://news.bbc.co.uk/1/hi/england/beds/bucks/herts/8327549.stm>, which has a video.)

551) Detecting PC keyboard strokes by sniffing the ground

My mate John sent me this BBC news link just now, it's fun in case you hadn't seen it: <http://news.bbc.co.uk/1/hi/technology/8147534.stm>

A couple of lads have discovered they can pick up keystroke signals from PS/2 connections on the mains earth at a distance. The presentation to which it refers is here: http://dev.inversepath.com/download/tempest/tempest_2009.pdf

I'd thought the BBC report was a bit flaky on the description of the connection, and assumed it was a typical journalistic misquote, but actually the report quotes the presentation quite

accurately. The authors themselves aren't really clued-up on EMC. It turns out that they are monitoring the noise voltage between the ring main earth and building metalwork, which has enough of the coupled PS/2 signal to give useable data when filtered.

Of course, TEMPEST as a subject has been around for years, but it's fun to see a couple of hackers (for this is what they are) getting into the public domain with it. I particularly like one of the points in the "Why bother?" slide of the presentation: "As always....more important: girls will melt when you show this..." And the Tempest acronym is decoded as "The Emissions Might Produce Extremely Sweet Talks"

(Kindly sent in by Tim Williams, EMC Consultant, Elmac Services Ltd, www.elmac.co.uk, in July 2009.)

552) Wireless headphones tune-in to Elvis

I bought a pair of wireless headphones a few years ago, I put them on in the shop and was surprised to find music come out of them. Not knowing what frequency they worked on, didn't think to much of it. Anyway it turns out that they run in the 863 to 870 MHz area and they are the auto tuning type so they regularly tune in to probably this broad cast. Someone who is probably at home all day, has it connected to their home stereo, and has a particular liking for amongst others Seasick Steve, Thin Lizzy and Elvis. Currently broadcasting Elvis.

(Kindly sent in 20th October 2009, the author wishes to remain anonymous.)

553) Tyre pressure warning triggered by Fort Meade

Click and Clack (Tom and Ray on NPR's [National Public Radio] Car Talk) had a caller this morning saying that her Vesta tire-pressure warning system goes off whenever she drove on a particular stretch of highway. After a little grilling, it turns out she was passing the NSA complex at Fort Meade. C&C concluded it had to be Radio Frequency Interference, and wondered whether it affects only Vestas, or perhaps other late-model cars with the newly mandated wireless sensors that might operate on the same frequency.

(Kindly sent in on 24th April 2009 by Matthew Wilson, Product Design & Production Manager, GB Electronics (UK) Ltd, who saw the above extract (Sun, 19 Apr 2009 11:06:45 PDT, From: "Peter G. Neumann" neumann@csl.sri.com, Subject: Vesta tire-pressure warnings) on the 'comp.risk' newsletter moderated by the 'ACM Committee on Computers and Public Policy', <http://catless.ncl.ac.uk/Risks>, and thought of the Banana Skin column.)

554) Scientists Map Earth's EM Emissions

An international team of scientists have issued a report on whistler-mode chorus waves, a type of electromagnetic emission generated by electrons in Earth's radiation belt, that have the potential to cause massive interference with satellite electronics as well as ground based communications.

The researchers used data from NASA's THEMIS (Time History of Events and Macroscale Interactions during Substorms) satellites to map the distribution of these waves.

They found that on Earth's nightside, chorus occurs only near the equator, but that daytime chorus extends to higher latitudes. Also, it appears that the amplitude of chorus waves depends strongly on geomagnetic activity.

At a distance greater than seven Earth radii (approximately 45,000 kilometres) moderate chorus is present more than 10 percent of the time and persists even during periods of low geomagnetic activity.

*(Extracted from a report in Interference Technology magazine:
<http://www.interferencetechnology.com/lead-news/article/scientists-map-earths-em-emissions.html>, 3rd June 2009. An abstract of the scientists' report is at:
www.agu.org/pubs/crossref/2009/2009GL037595.shtml.)*

555) Urban Wi-Fi Interference

British telecom regulator Ofcom has commissioned a report that concludes that Wi-Fi performance in central London can be up to four times slower than that found in less densely populated areas.

Although users of Wi-Fi have blamed nearby networks for much of the interference in the 2.4-GHz Wi-Fi band, the authors of the report pin the primary sources of interference on cautious parents using analog baby monitors, tired citizens watching retransmitted TV in their bedrooms, and microwave ovens.

The report notes that in central London, there are too many networks with resends, beacons, and housekeeping filling 90 percent of the data frames sent over Wi-Fi, thus leaving only 10 percent for users' data.

Another source of Wi-Fi trouble is caused by London's "Free Public Wi-Fi" points that are sending out beacon frames ten times more frequently than they should (every 0.01204 seconds) resulting in a significant amount of traffic on the Wi-Fi band.

Further complicating the situation is the fact that the makers of inexpensive unlicensed devices such as analog baby monitors or remote switches have no real incentive to develop more expensive digital models that cause less interference.

The entire 93-page report can be viewed online at:

www.ofcom.org.uk/research/technology/research/exempt/wifi/wfiutilisation.pdf, "Estimating the utilisation of key license-exempt bands spectrum bands", Final Report, Issue 3, April 2009, for Ofcom by Mass Consultants Ltd, Cambridge, UK, systems@mass.co.uk, MC/SC0710/REP003/3, 149 pages

*(Copied from a report by Interference Technology magazine, 05/13/09 02:57 PM:
www.interferencetechnology.com/lead-news/article/urban-Wi-Fi-interference.html,)*

(Interestingly, on 17th May 2009 the Sunday Times reported on a proposed car safety system that relies on Wi-Fi and GPS technology. See "Stop, Driver! The chip will take over now", by Emma Smith in the Ingear section. Also see "Technology could stop speeding and crashes" at http://technology.timesonline.co.uk/tol/news/tech_and_web/article6294866.ece. Are the proposers of these systems totally mad? We have known since 2001 that GPS is not recommended for safety-critical applications (see the very many items on EMI to GPS in "The First 500 Banana Skins" book, especially numbers 222, 223, 230, 231, 232, 238, 357, 363, 388 and 420 at www.theemcjournal.com or www.emcademy.org/books.asp) and now we learn that Wi-Fi is in big trouble too.)

556) RF Interference to Broadband Internet from Christmas Lights

UK ISP PlusNet said: "When putting up the tree this year, don't forget that some Christmas tree lights (especially some flashing ones) can cause intermittent connection faults. So, if you think you've got a broadband fault please remember to turn your lights off for a while and see if that cures the problem before calling."

"Some tree lights generate RF interference which can affect broadband ADSL. It's best to keep your Christmas tree lights and wiring well away from your telephone cables."

"Some people have suggested that one way of detecting interference is to tune an analogue radio to Medium Wave 612 through to 693, which should buzz when you wave the radio near problematical tree lights. We've not tried this though and you may have more than one source (RF band) of interference."

It should be noted that we haven't seen many problems like this in recent years, thanks in part to the growing take-up of lower power LED lights and fibre optic trees. The issue mostly affected older lights.

(Taken from: "Annual UK ADSL Broadband ISP and Christmas Tree Lights Warning", MarkJ - 5 December, 2009 (9:00 AM), <http://www.ispreview.co.uk/story/2009/12/05/annual-uk-adsl-broadband-isp-and-christmas-tree-lights-warning.html>, also reported by Interference



Technology magazine <http://www.interferencetechnology.com/lead-news/article/rf-interference-from-holiday-lights.html>, 12/09/09 05:18 PM.)

557) Reducing RF Interference to Broadband Internet

The iPlate is fitted to the home's master (NTE5) telephone socket simply by removing a couple of screws on the front plate, popping in the iPlate, then replacing the screws. This filters out the interference.

The Sunday Times has been testing two iPlates for several months. On one broadband line the speed has increased from just shy of 2Mbps to a far perkier 3.6Mbps – an improvement of 80%; on the other, speeds went from 3.5Mbps to 5.3Mbps, a 51% increase. Impressive stuff.

How does this miraculous little gadget work? Everything from microwave ovens to Christmas Tree Lights can affect home broadband and force the connection to drop out or run at a fraction of its potential. It's not only electrical equipment in your home that can affect your internet speed either: BT once bought a customer a spanking new television because his old set would bring down the entire street's broadband every time he switched on Top Gear.

All this interference is picked up by your home's bell wire, a copper cable that acts like an aerial. It is fitted to most homes, and originally was used to make old bakelight phones ring. Digital Phones have made this wire redundant but, like a human appendix, it still causes problems. The iPlate bypasses the bell wire, making broadband connections faster and more reliable.

Solwise says that the I-Plate, which BT claims can improve your broadband speed by up to 1.5Mbps when fitted to your home phone socket, isn't worth buying.

The I-Plate is a self-install filter which needs to be fitted in between the front and back plate of the BT NTE 5 master telephone socket. The I-Plate disables the bell wire that was used to make older telephones ring. Solwise, however, suggests a manual solution to disable the bell wire.

"The Solwise solution to this problem would be to detach the front section of your master socket and disconnect the bell-wire(s) (from pin 3) and re-fit the faceplate," the company said in an email.

A BT spokesman told Web User: "We couldn't comment on whether Solwise's instructions would be a successful alternative. The I-Plate has been fully tested and we know it gets results, and it's more convenient than fiddling about in the socket yourself." The spokesman also pointed out that the master socket belongs to BT and shouldn't be tampered with.

(Taken from: "The budget broadband booster" by Barry Collins, in the "ingear" section of the Sunday Times, 8 March 2009, and also from <http://www.webuser.co.uk/news/top-stories/397999/don-t-buy-bt-i-plate-says-stockist>, 1 Jan 2010. If you fancy trying Solwise's solution, visit <http://www.thinkbroadband.com/faq/sections/radsl.html#235>.)

558) High powered transmissions north of Cambridge

I have spotted a connection between Banana Skin No. 540 and the interference with my wireless headphones that was reported in No. 552.

No. 540 reported: "Just north of Cambridge, high powered transmissions can be detected in the 863- to 870-MHz band that is ostensibly for the use of short-range devices such as remote light switches and car key fobs". My headphones operate over 863.5 to 864.5MHz, so it seems likely that these "high powered transmissions just north of Cambridge" are from the same Elvis fan that interferes with them.

(Kindly sent in by David Cleare, 15 December 2009)

559) Some pre-compliance testing 'war stories' from Laplace Instruments

In a message dated 18/11/2009 14:30:22 GMT Standard Time, tech@laplace.co.uk writes:

A manufacturer was considering the purchase of some in-house test kit, so they wanted a demo of our stuff. After the usual pre-amble, we set up to measure conducted emissions on a bench top ultra-sonic cleaning tank. This (I was assured) was a compliant unit.

Measurement quickly showed that the unit was definitely non-compliant. Harmonics of 68kHz were over the QP and Ave limits by up to 6dB in the 150 - 600KHz region. Confusion and consternation!

So another example of the same type was brought in. This was definitely a modified unit so should be OK. Result... even worse! Panic.

Obviously it was our Laplace equipment that was wrong... after all, who would question a test lab report?

Then the Actual Unit (the one that had actually been to the test lab) was brought in. Result... OK, both QP and Ave below the limits by about 4dB (worst case). Hurray! But, all units were supposed to be the same?

On further investigation, both the non-compliant units had the transducer drive cable ty-wrapped to the incoming mains lead. Cutting the ty-wraps and making the two cables take different routes cleared the problem and reduced the emission levels to below the limits.

Conclusion...

1. If you have a sample tested as OK by a lab, you must ensure all other units of the same type are exactly the same.
2. The temptation to blame the test equipment for 'awkward' results should be resisted!

In a message dated 18/11/2009 17:50:02 GMT Standard Time, tech@laplace.co.uk writes:

We now have had a couple of instances of quite deliberate 'tweaking' of EMC results to obtain a 'pass', in both cases the guilty party was a 'foreign' test lab. In both cases Laplace equipment was used by the UK importer (Our customer) to check the compliance and in both cases we had a heluva job to convince our customer that 'we' were delivering the correct results. In both cases we chose (at our cost) to use the services of an independent accredited test lab in the UK to show that indeed our results were correct!

Our customers are inevitably impressed by official-looking certificates and accreditation marks, and will always assume such results are 'gold-plated'.

However, in each case, to the experienced EMC practitioner, they just looked wrong. They both were conducted emissions results, but they had a base line slope, conveniently angled such that relatively high peaks at one end or the other of the spectrum, were just below the limit. In one case the problem was at the low end, and the baseline sloped up with increasing frequency, and the other had a base line that sloped down, with 'problem' peaks at the high end. They both looked like they have been tweaked in Excel before plotting.

In a message dated 03/12/2009 17:38:43 GMT Standard Time, tech@laplace.co.uk writes:

Our Chinese distributor had a potential customer who was going to buy our kit. His product was a pulse mode PSU.

He had been to an accredited test lab and the PSU had failed – over the limit at around 24MHz. So he used that product as an evaluation test for our kit.

Our kit passed the product... no problem at 24MHz.

Naturally the customer was less than pleased, and our distributor was p....d off too!

We responded that our kit is always correct... so the test must have been done wrong. A certain amount of dialogue ensued after which they sent the PSU to me for further checking, expecting me to show that indeed it failed at 24MHz.

When we checked it in the office... no problem at 24MHz. We cycled this damn thing around 2 'proper' test labs, both gave results just like ours, no problems at 24MHz.

Looking at the Chinese results, they just looked like they had the 'poor LISN grounding' problem. We explained this phenomenon in great detail to them... but they were not interested and we never heard any more from them. I still have that PSU on my shelf!

(Extracts from three emails from David Mawdsley, MD of Laplace Instruments, to Keith Armstrong. David kindly agreed the above could be published as Banana Skins.)

560) RFeye helps in the fight against illegal use of the radio spectrum

Dr Alastair Massarella, CRFS Chief Executive, explained that the idea for RFeye originated from a previous point-to-multipoint radio telecommunication business, which was plagued by interference in licensed bands from sources such as air conditioning systems kicking in or less sophisticated telecoms equipment.

(Taken from "Frequency Finder" by Bernice Baker, The Engineer, 9-22 March 2009, page 11, www.theengineer.co.uk. RFeye is "A ruggedized box containing intelligent spectrum measuring equipment, small enough to fit into a backpack.")

561) "Digital Dividend" will interfere with millions of TVs, and broadband

Introduction: The "Digital Dividend" refers to the reallocation of 790-862MHz band previously used for analogue TV broadcasting, which has become available due to the switch-over to digital TV. However, televisions and other devices that still have analogue TV tuners are very likely to suffer interference from the new applications proposed for his band.

There is now a TC210 WG which will start work early next year on a new standard, but it will not help the millions of installed devices that have analogue TV tuners.

Background: Since the changes in spectrum allocation resulting from the WRC decision of 2007 were announced (*i.e. the "digital dividend, see Figure 1, which contains other surprises too – for example the spectrum allocated to PLT – Editor*), the European Commission (EC) and the Electronic Communications' Committee (ECC) have moved extremely quickly to consider: "The identification of common and minimal (least restrictive) Technical conditions for 790-862 MHz for the digital dividend in the European Union" (CEPT Report 30).

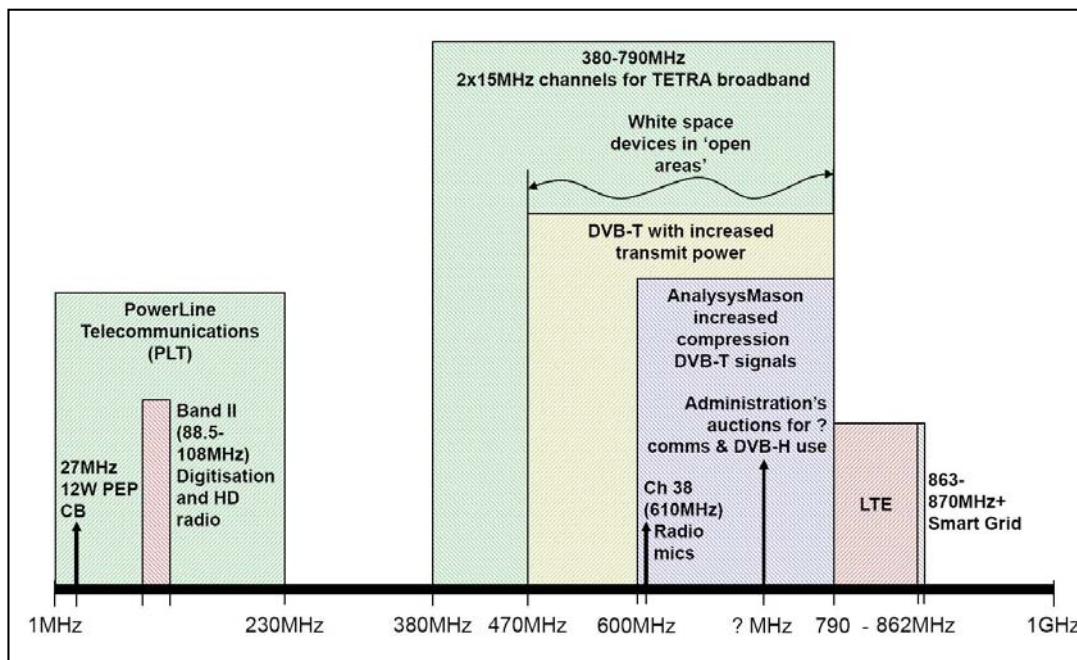


Figure 1: The Digital Dividend Spectrum (from Brian Copsy's TC210 report)

However, whilst the plight of domestic television reception has received some attention (ECC report 138), during the ECC work on the EC mandate a number of arrears affecting domestic reception of television and use of broadband have not been considered at all. These are:

1. The wide variety of domestic (and professional) broadcast reception equipment using a "tuner".
2. Immunity of equipment when a transmitter is used adjacent to it.
3. Citizens connected to communal aerial systems where a large complex of dwelling units is fed by a single aerial head end, these systems can also be found in University campus.

Many of these systems use broad band amplifiers with a very high gain both at the head end and also at floor or building level. Once a mobile signal, either base station or terminal unit operating within the frequency range of the amplifier is present interference or overloading of the communal system will take place giving interference or blocking TV reception by users of the system.

4. Cable TV networks which provide television, broadband and video on demand services to 74 million household, again the reception frequency of the set top box and the new mobile service (i.e. LTE) are the same and will cause interference or loss of service to the citizen.

The policy of "flexible use of spectrum" will also see further changes in the use of the 470-862MHz band at present under discussion (see Figure 1) by the EC and ECC will likely increase the interference potential to citizen's use of broadband and television services in coming years. For example:

- Analysys Mason have recently (9 September) given a presentation of their findings which includes a proposal that higher compression ratios should be used in TV broadcasts which will allow the band from 600 – 862 MHz to be released for communication use.
- A range of other groups including the PPDR are attempting to obtain spectrum (2 x 15 MHz) in the 470-862MHz band using TETRA.
- A number of administration wish to clear additional TV channels to either auction off or reallocate, probable for mobile use, including mobile TV.
- "White space" devices are being developed for this band.

The Interference potential of the above:

To date, television “tuners” have only had to operate in a relatively benign band occupied by broadcast transmissions and services ancillary to program making (SAP) consisting mainly of radio microphones in unused channels.

In future they will be operating in a harsh electromagnetic environment and need to consider the techniques used by transceivers to provide interference-free reception to viewers.

Already the European Commission statements of 28 October say that receiver design must be reviewed.

A first set of measurements by the Netherlands Administration on the effect of proposed LTE cellphones showed that interference with cable television varied between 39% and 91%, depending on the LTE frequency of operation, and distance from the TV set and its set-top box.

(The above is a combination of extracts from a paper presented by Brian Copsey, and another paper by Mr Robijns, both provided to both IEC TC210/WG1 and TC210 on 3 December 2009, plus emails from Dave Imeson, all kindly provided by Dave Imeson, Secretary of the EMC Test Labs Association (www.emctla.co.uk). Dave Imeson also raised this issue at the meeting of the EMCIA on 15th December 2009.)

(LTE (Long Term Evolution) is the project name of a new high performance air interface for cellular mobile communication systems. It is the last step toward the 4th generation (4G) of radio technologies designed to increase the capacity and speed of mobile telephone networks. Where the current generation of mobile telecommunication networks are collectively known as 3G (for "third generation"), LTE is marketed as 4G. However, it does not fully comply with the IMT Advanced 4G requirements. Most major mobile carriers in the United States and several worldwide carriers have announced plans to convert their networks to LTE beginning in 2009. See http://en.wikipedia.org/wiki/3GPP_Long_Term_Evolution for more detail.)

562) New Porsche Panamera: EMI locks people inside

Recalls and service campaigns are often triggered by issues experienced by owners. The Drive team learnt that first-hand after spending a few days with the new Porsche Panamera.

After days of fault-free motoring, the Panamera's electronics were tripped up when it was parked in a semi-industrial area in Sydney's north.

Its sensor key was not recognised and getting any response from the car was almost impossible, even though the battery was fully charged.

After five minutes of trying to lock and unlock doors (in an effort to reset the system or immobiliser) a phone call was made to Porsche Assistance. It was then that the locks thunked closed — and refused to open. Three people were trapped — wife and child included. Door handles did not work, buttons did not respond and with no ventilation the cabin heated up quickly.

After half an hour — including a phone call to the police — the decision was made to smash a window. (See photograph below, Editor)



It took another 90 minutes to drag the car on the tow truck, with its electronic handbrake refusing to release. (See photograph below, Editor)

Porsche has since tracked the problem to radio interference, presumably from TV and radio towers in the area. Similar

problems had apparently occurred in four other Panameras around the world, although this was the first time people were trapped in a car.

Porsche subsequently tried a software update but it failed. More recently the company ordered a radio suppressor unit designed by the factory in Germany to further shield the electronics from interference; it was trialled this week and worked.

Porsche now intends to fit the suppressor units to all Panameras as part of a mandatory service campaign.

While Porsche has stopped short of a recall, it has contacted Panamera customers (the car has only been on sale a few months so there are only about 50



on the road) and informed them of an imminent fix.

"It's a very serious matter given that we had people locked inside the car and we have reacted as quickly as possible and have found a solution which involves the fitment of a radio suppressor unit," says Porsche Australia public relations manager Paul Ellis.

Ellis says service campaigns are common among all brands and are often completed at regular services; the owner may not even be aware.

"This is obviously a phenomenon and is in no way a reflection on inferior build quality of the Panamera. External interference is not something that can be completely eliminated and you do get black holes where interference is possible. It's just unfortunate that this event transpired the way it did."

(Braham Bloom of EMI Solutions spotted an article on this, written by Toby Hagon, on page 7 of the "Weekend Drive" section of his local paper, the Sydney Morning Herald (Weekend Edition Feb 27-28 2010), and very kindly sent it to me. Chris Zombolas of EMC Technology Pty Ltd saw a shorter version of the same article, also by Toby Hagon, in his weekend paper, The Age, dated 27 February. <http://theage.drive.com.au/motor-news/road-test-throws-up-a-realworld-drama-20100226-p84l.html>, which referenced the Sydney Morning Herald as its source. The article copied above is the one from The Age, because I could not find a weblink to the original article and didn't want to have to type it all out by hand. Chris Z also wrote: "North Sydney is where the TV broadcast transmitters are located. (they have hundreds of other lower power transmitters as well). We have measured 3-6 V/m in the area surrounding the towers but that was a few years ago before digital transmissions commenced. Absolute and undeniable evidence of unforeseen problems caused by low level common interference sources.")

563) Mystery of the 'Windermere triangle' solved

A mystery phenomenon that has left motorists in a popular tourist town unable to unlock their cars has been solved.

For around 18 months, drivers parking up in one of the Lake District town's busiest shopping areas have found their electric key-fobs will not work.

Telecom watchdog OFCOM decided to investigate and sent field engineer Dave Thornber to Windermere with specialist scanning equipment.

He discovered that motorists' key fobs were being jammed because they were on the same wireless frequency as the till in the nearby Lazy Daisy Lakeland Kitchen cafe.

Mr Thornber said: "People thought it was a spook or some newly installed traffic lights but it is the till and the way waiting-on staff input meal orders."

He added: "We used what is called a spectrum analyser to make a sweep of the locality."

"The source of the interference was a wireless order taker in the cafe."

"The device used the same frequency as modern car key fobs which operate central locking."

"The key fobs use a very low power source to protect the life of the batteries inside and so their use was drowned out by the power of Lazy Daisy."

Some car owners complained that when they tried to open their cars they activated electric windows instead, others simply got no response at all. Motoring organisations were called in and batteries replaced but to no avail.

Cafe owner Tom Benton said: "Working with OFCOM we have adjusted the till frequency so it does not jam the locks anymore."

Mr Benton added: "I am just glad the whole mystery of the Windermere Triangle has been solved and there will not more people standing around their cars unable to drive off." "People have been talking about it for months."

(Sent in by Matthew Wilson, Product Design & Production Manager, GB Electronics (UK) Ltd., www.gbelectronics.com/ who saw this in his Daily Telegraph newspaper on Friday 26th February, see: www.telegraph.co.uk/news/uknews/7325141/Mystery-of-Windermere-triangle-

solved.html. Also sent in by Claire Ashman, Assessment Manager of UKAS (United Kingdom Accreditation Service), who found a similar article on the BBC News, 2nd March 2010 at: <http://news.bbc.co.uk/go/pr/fr/-/1/hi/england/cumbria/8545104.stm>. The Daily Telegraph had previously carried a story on this: "Drivers mystified by secret of "Windermere Triangle"" on 12th Feb 2010, see: <http://www.telegraph.co.uk/motoring/news/7215551/Drivers-mystified-by-secret-of-Windermere-Triangle.html>. This was of course before Ofcom's intrepid ghostbuster Dave Thornber had arrived on the scene, sirens wailing, fearlessly doing battle with weirdness armed only with what the BBC said was "a sophisticated gadget called a spectrum analyser" (much to Claire's amusement!.)

564) Some recent NASA Aviation Safety Reports

ACN: 754696 (5 of 50): Synopsis: In an apparent PED interference event, a PAX's portable Garmin GPS Model NUVI 660 allegedly interfered with a B7373 Classic's (no glass) DME Navigation update function.

(PED stands for passenger electronic device, a PAX is a passenger, PAX is multiple passengers, and DME stands for Distance Measuring Equipment, a type of radar fitted to aircraft – Editor)

ACN: 702630 (13 of 50) Synopsis: Captain of an A320 reports VHF interference on ZOB ARTCC frequency from a cellphone aboard his plane.

ACN: 681689 (15 of 50) Synopsis: A B757-200'S L fuel gauge blanked after takeoff and became operable prior to landing. Crew suspects possible PED interference.

ACN: 673795 (16 of 50) Synopsis: B737-800 flight crew experienced several TCAS RAs allegedly generated by a Wi-Fi enabled laptop computer.

(TCAS is the Traffic alert and Collision Avoidance System, designed to reduce the incidence of mid-air collisions between aircraft. An RA is a Resolution Advisory message generated by the TCAS when it detects a potential problem. See: http://en.wikipedia.org/wiki/Traffic_Collision_Avoidance_System)

ACN: 661013 (17 of 50) Synopsis: Flight crew of CRJ-700 reports that aural interference in VHF communications ceased when PAX were asked to ensure all forms of 2-way communications were turned off.

ACN: 609264 (26 of 50) Synopsis: B737-300 crew had erratic LOC signals on ILS runway 13 and runway 7 at JAX. A PAX was using a 'Palm Pilot' at the time.

(ILS is Instrument Landing System, see: http://en.wikipedia.org/wiki/Instrument_landing_system)

ACN: 600964 (29 of 50) Synopsis: Flight crew of MD80 experience misaligned heading info on FMS display. Suspect PAX operated electronic devices.

(FMS is the Flight Management System and controls navigation, see http://en.wikipedia.org/wiki/Flight_management_system)

ACN: 597486 (31 of 50) Synopsis: A false TCASII RA sends a DC9 flight into a climb to avoid a potential target 5 miles south-east of BUNTS International, NTXN, PA. A flight attendant had caught a lady trying to call her daughter on her cellphone at the time the flight "pulled up".

(TCASII is a version of TCAS, Traffic alert and Collision Avoidance System, see earlier)

ACN: 579608 (35 of 50) Synopsis: DC-9 Flight crew received a false TCAS RA during departure climb and increased their rate of climb to avoid a false target apparently generated by a PAX laptop computer.

ACN: 576709 (36 of 50) Synopsis: A B737-700 crew, on approach to BWI runway 10, attributes being off course to possible unauthorized use of cellphones prompted by a cabin announcement. The inability of the crew to both be on the ILS frequency because of the approach design, also may be a contributing factor.

ACN: 576147 (37 of 50) Synopsis: MD88 crew has static on the #1 VHF communications radio. The static stopped when the PAX were directed to turn off their electronic devices.

ACN: 535960 (47 of 50) Synopsis: CL65 crew had a possible PAX originated RF Interference with an autoflight system during vectors of the approach.

ACN: 533786 (50 of 50) Synopsis: B727 FLC experienced erratic VOR NAV course indicator possibly due to PAX use of an electronic device.

(VOR means VHF Omni-directional radio Range, a type of radio navigation system for aircraft, see http://en.wikipedia.org/wiki/VHF_omnidirectional_range.)

(The above are all synopses taken from the July 29, 2009 update to the NASA ASRS Report, <http://asrs.arc.nasa.gov/docs/rpsts/ped.pdf>, downloaded 17 February 2010. The full reports are available in the same download. I don't know where earlier "updates" are archived, or even if they are archived at all, but I have copies of all the ones that have been referenced in earlier Banana Skins if anyone needs them - Editor.)

565) Solar Storms Could Be Earth's Next Katrina

Photo by Bob Martinson/AP

The northern lights dance over the Knik River near Palmer, Alaska. Activity on the surface of the sun creates this natural light show, but severe solar storms could devastate Earth's power and water utilities, and knock out communications.

Government officials are concerned that a massive solar storm could leave millions of people around the world without electricity, running water, or phone service, according to a report by National Public Radio. The impact is likely to be far worse than in previous solar storms because of the growing dependence on satellites and other electronic devices that are vulnerable to electromagnetic radiation.



Solar Storms Could Be Earth's Next Katrina by Jon Hamilton, February 26, 2010

A massive solar storm could leave millions of people around the world without electricity, running water, or phone service, government officials say.

That was their conclusion after participating in a tabletop exercise that looked at what might happen today if the Earth were struck by a solar storm as intense as the huge storms that occurred in 1921 and 1859.

Solar storms happen when an eruption or explosion on the surface of the sun sends radiation or electrically charged particles toward Earth. Minor storms are common and can light up the Earth's Northern skies and interfere with radio signals.

Every few decades, though, the sun experiences a particularly large storm. These can release as much energy as 1 billion hydrogen bombs.

How Well Can We Weather The Solar Storm?

The exercise, held in Boulder, Colorado, was intended to investigate "what we think could be close to a worst-case scenario," says Tom Bogdan, who directs the Space Weather Prediction Center in Boulder. The Center is a part of the National Oceanic and Atmospheric Administration.



"It's important to understand that, along with other types of natural hazards, (solar) storms can cause impacts," says Craig Fugate, Administrator of the Federal Emergency Management Agency (FEMA), who also took part in the tabletop exercise.

Bogdan and Fugate say that eventually there will be another storm as big as the ones in 1921 and 1859 — a sort of solar Katrina.

But the impact is likely to be far worse than in previous solar storms because of our growing dependence on satellites and other electronic devices that are vulnerable to electromagnetic radiation.

In the tabletop exercise, the first sign of trouble came when radiation began disrupting radio signals and GPS devices, Bogdan says.

Ten or 20 minutes later electrically charged particles "basically took out" most of the commercial satellites that transmit telephone conversations, TV shows and huge amounts of data we depend on in our daily lives, Bogdan says.

"When you go into a gas station and put your credit card in and get some gas," he says, "that's a satellite transaction."

Disabled Satellites Are Just The Beginning

The worst damage came nearly a day later, when the solar storm began to induce electrical currents in high voltage power lines. The currents were strong enough to destroy transformers around the globe," Bogdan says, leaving millions of people in northern latitudes without power.

Without electricity, many people also lost running water, heat, air conditioning and phone service. And places like hospitals had to rely on emergency generators with fuel for only two or three days, Bogdan says.

In many ways, the impact of a major solar storm resembles that of a hurricane or an earthquake, says Fugate.

But a solar Katrina would cause damage in a much larger area than any natural disaster, Fugate says. For example, power could be knocked out almost simultaneously in countries from Sweden to Canada and the U.S., he says. So a lot more people in a lot more places would need help.

Individuals don't need to make any special preparation for a solar storm, Fugate says. The standard emergency kit of water and food and first aid supplies will work just fine.

"If you've got your family disaster plan together, you've taken the steps, whether it be a space storm, whether it be a system failure, whether it be another natural hazard that knocks the power out," Fugate says.

(Copied from www.interferencetechnology.com/lead-news/article/solar-storms-could-be-earths-next-katrina.html, 3rd March 2010, and www.npr.org/templates/story/story.php?storyId=124125001&ft=1&f=1001)

566) Severe lightning in Kentucky

Recently there were several severe storms in Kentucky. A real nasty one that produced an abnormal amount of intense lightning passed about 20 miles south of us.

www.wkyt.com/news/headlines/82320257.html is a link to TV news coverage, which is only about half accurate about the damage: "A single lightning strike from a thunderstorm damaged three homes in Boyle county Thursday night. The homes are located on Lebanon Road. The lightning bolt left a trench a foot wide and, in some places, a foot deep. After that, it traveled through a phone line and caused damage to three homes. The bolt busted up a concrete driveway outside one home. It also damaged phone and water lines. Another home also had a phone jack busted off and melted carpet. Fortunately, no one was hurt during the storm."

I know one of the residents whose home was hit. All of the electrical outlets, switches, breaker box and every electrical or electronic device was simply fried. They were home during the strike

and the static field was so strong that all of their hair stood straight out as though they were connected to a Van de Graaff generator.

I visited the home yesterday as inspectors were deciding if the home was salvageable.

They had removed large sections of the drywall and not only were the electrical fixtures fried, a 5' section of "Romex", three conductor power cable commonly used in the US that has hot, ground and neutral, has lost its ground wire! The remaining cable is full of burnt pinholes and there is copper bits buried in the 2x4 studs.

I watched as they pulled up the carpet and the concrete slab floor had the most interesting dendrite pattern. Large sections of the concrete will just lift out and much of the concrete is "pulverized". The foundation may have similar damage, or perhaps the lightning cut a underground trench which let water carry the dirt supporting the foundation away. One corner of the home sags over a foot.

What is interesting is the ground was saturated by the rain we have had in the last two weeks and the soil has not frozen. The earth path from the attachment point only approximates the buried telephone lines that it "followed". The actual attachment point was a small metal junction box that looks like a madman with an arc welder attacked it. The amazing thing is there are over 100 telephone lines in the box and the lightning path did not lead to the closest home. That home and most of the others only needed the exterior demarcation, or Network Interface Device, replaced.

Given the path length, and the massive damage, this strike has to be near the upper limits. I have some ~4" x 4" fused globs of sand and soil and a couple of globs of yellow clay that look as though they were fired in a kiln. My wife is an artist and this even impressed her.

The clay is very sponge like, very porous, were, I guess, the water boiled out. I expected to find only wet sand, clay and soil. A galvanized metal culvert had to be replaced as the lightning ran across the surface of the soil for maybe 25' and "exploded" the metal pipe.

There is a pronounced dip in the road where the pipe has failed. Looking in with a flashlight, hand torch, I could see thousands of dendritical burns, some of which had burned through the metal wall, exposing the dirt and gravel.

The state's chief fire marshal was there and he told me that in his 30 year career he had seen nothing close to this level of damage.

(Kindly sent in by Terrence Fugate, WN4ISX, on 26th January 2010. Terry's amateur radio gear was his only communication link with the outside world for three weeks after Hurricane Katrina.)

567) Overrun accident on Shonan Monorail officially caused by EMI

In 24 February 2008, there was an overrun accident on Shonan Monorail at Kanagawa, Japan. When the train started from a station on the scheduled time, it suffered unintended rapid acceleration. The train continue to accelerate even though the operator had not set the train's master controller to acceleration position.

When the train came near to the next station, it could not be decelerated enough even with its emergency brake activated, and caused an overrun. The train finally stopped, fortunately with no casualties, after collision with a rail point.

On 26 June 2009, an accident investigation report, RA2009-6, was issued from the Transportation Safety Board. The Board concluded that the accident was caused by roughly the following reasons:



1. Poorly grounded VVVF inverter (which drives the train) on the train caused excessive noise, which could be coupled to nearby wires;
2. A cable for an unused monitor board was still connected to the CPU, and the cable was not properly protected from possible incoming noise;
3. Noise on the cable could cause interrupt signal to the CPU;
4. The CPU didn't mask (disable) the unexpected interrupt, so the corresponding interrupt handler in the software could be activated due to the noise;
5. Somehow, once activated, the interrupt handler (not expected to be activated in normal situations) disabled all other interrupts after that, which made the acceleration/deceleration process no longer work at all;
6. The integrated watchdog timer couldn't recover the system due to a defect in the control software.

The moral of this story: especially for safety related systems, careful design and verification of the system, including its software, from an EMC point of view, is essential.

Reference for readers who can read Japanese: Accident investigation report RA2009-6, <http://araic.assistmicro.co.jp/railway/report/detail.asp?ID=1744>, or go direct to this PDF at: <http://araic.assistmicro.co.jp/railway/report/RA09-6-1.pdf>

(Kindly sent in by Tom Sato from Japan, on the 17 Jan 2010. The photograph below shows rescuers using an emergency chute to remove passengers from the crashed monorail train. I'd like to remind readers of the IET's very practical 2008 Guide to EMC for Functional Safety, www.theiet.org/factfiles/emc/emc-factfile.cfm, which can be purchased as a colour-printed book from www.emcacademy.org/books.asp -Editor)

568) Car door locks unstable when older car alongside

I would be very interested in seeing the risk analysis for any of the vehicles you mention in your article and more specifically for any system component that has changed from a hydraulic to electronic controlled. I can see issues with any system used for critical safety such as steering or braking. I am quite sure that a risk analysis for EMI has not been done to establish pass/fail criteria.

My own experience with a Ford car fitted with electronic door locking has convinced me that the EM environment is basically uncontrolled. Whenever an older car stopped beside me, the doors locked and unlocked until the vehicle passed by. Eventually after two sets of replacements the problem was fixed and I am sure was EMI related.

(Kindly sent in by Braham Bloom of EmiSolutions, Sydney, Australia, 21st February 2010.)

569) LED Reading light specified as interfering with DAB

Just found this on the web – a British made light that will interfere with DAB - who certified this one? Visit:

www.seriousreaders.com/mall/productpage.cfm/SeriousReaders/_780001/255469/Alex%20LED%20Table%20Light.

(Kindly sent in by Peter Kerry, an independent EMC consultant in the UK.)

New LED Technology
We are now offering our most popular Alex Light fitted with the latest LED technology. Only uses 5w of energy. **This LED model will interfere with DAB broadcasts.**

What difference will it make?
Available in high intensity Daylight White the LED version of our Alex light gives you light levels comparable to our high performing Halogen fittings.

See More Clearly

- Ultra White Light
- Six Times Brighter than a 60w Bulb
- Flexible Arm for Easy Positioning

Stress Free Reading

- Switch Located on the Light Head
- No Assembly Required
- 5 Year Guarantee
- 5w LED Bulb Lasts 25,000hrs
- Designed not to get hot

🇬🇧 Designed and hand-built in the UK.

Dimensions	
Height	152cm (60")
Weight	6kg (13lbs)
Cable	3m (10ft)

570) Rail industry doesn't understand EMI

During a coffee break at the IET Seminar: "EMC in Railways 2009", held at Savoy Place, London, on 12th Feb 2009, I met an old colleague who I knew was a proper EMC expert (as opposed to what the rail industry seems to think is an EMC expert), and asked them why it was that most of the rail industry believes that only in-band EM disturbances can cause EMI?

Given the safety-critical nature of railways, it seemed nothing short of astonishing to me that the whole industry should ignore (or deny) the many engineering issues that are responsible for most EMI incidents.

He said it was to do with the way dealing with EMC had evolved over many years on the railway and the historical focus on signalling equipment and a problem that he and his colleagues were trying to change, but were making slow progress. He then told me a story about a company that used very sophisticated coding to catch the incorrect data resulting from in-band interference and fail "right side" (railway-speak for fail safe).

Their calculations showed that this would occur so infrequently that it would not cause operational problems - the special coding was used "just in case", as a safety measure against what they thought of as the threats from EMI.

However, when their system was deployed in practice, the other kinds of EMI - the ones ignored or denied by most of the rail industry - caused their system to fail so often that it was never 'up' for long enough to be of any functional use. Needless to say an expensive investigation followed by remedial action was needed to render the system useable!

(Keith Armstrong, reporting a discussion during a coffee break at IET Seminar "EMC in Railways 2009", Savoy Place, London, 12th Feb 2009. There was such a strong reaction to this item from UK rail industry chiefs that an apology was necessary to avoid the threat of legal action, see below.)

Apology for Banana Skin No. 570, "Rail Industry Doesn't Understand EMI"

(The EMC Journal, May 2010, page 12)

I am very sorry that this Banana Skin has upset so many people. Although its complete title and most of its content faithfully reported the views of rail industry EMC experts present at that seminar, and the remainder of the material was my views, it was wrong of me to present the material in a way that tarred everyone with the same brush.

However, I am truly concerned that these

railway EMC experts could make such allegations about the general state of understanding of EMI and EMC in the rail industry, especially as I have previously heard many other similar claims from other well-respected EMC experts working in that industry.

Should it turn out that these concerns are justified, then given the safety implications

they are too serious to sweep under the carpet. Are there any responsible EMC engineers in the Railways industry who will remember the ethical obligations that came with their membership of the IET, and "blow the whistle"? The EMC Journal would print such articles anonymously and protect the sources.

Keith Armstrong