

## **Dealing with alarm EMC problems - Advice for RSGB members (Leaflet EMC 03)**

*This leaflet, EMC03, "Dealing with alarm EMC problems" is intended for members' own use, not for neighbours or alarm installers.*

The accompanying RSGB information sheet "Radio Transmitters and Home Security Systems" (EMC 02) is intended to be given to neighbours or alarm installers. You may wish to keep your copy as a master and make good quality photocopies to give out.

If you need further advice on alarm EMC or any other EMC problem, please contact your nearest RSGB EMC Co-ordinator (see list in current RSGB Call Book). If necessary, the EMC co-ordinator can refer the case to the EMC Committee.

### **1. If your transmissions set off an intruder alarm.**

This can be rather worrying but on the technical side, you are in a strong position. The EMC Committee has never known a case of alarm RF triggering which could not be cured by fitting RF immune PIRs or occasionally a more immune control panel. If your transmissions set off the neighbours' alarm system, it is advisable to tell them as soon as possible otherwise they may be charged for a visit by the installer or maintenance engineer who may find no fault. If the system is centrally monitored, the monitoring service could be withdrawn if there are too many false alarms.

Some installers have come across RF triggering before (not necessarily from amateur transmissions) and may realise the cause if they see your aerials. Others claim that it has never happened to one of their installations before and assume that it must be the radio amateur's fault, which is isn't. If the installer does not have sufficient technical knowledge to deal with the problem, you will need to give some technical advice otherwise they may waste time trying things which are unlikely to work.

### **2. Questions to ask.**

It is worth finding out as much information as possible. Some of it may be useful later:

- \* The most important information is the make and model of the PIR sensors, how many there are and whether or not they are CE marked. (The CE mark may be on the instructions, the packaging or the sensor itself)
- \* What is the make and model of the alarm control panel?
- \* The name, address, phone number and any fax number of the installer.
- \* The name of the Managing Director or Technical Director.
- \* Is the installer approved by NACOSS or a member of SSAIB or BSIA?
- \* Approximately how long ago was the system installed?
- \* When it was installed, were any aerials clearly visible at your QTH?
- \* Is it a "bell only" system or is it linked by phone line to a central monitoring service?
- \* Does the installation claim to meet BS4737? (Insurance companies normally require this)
- \* Is it covered by a maintenance contract? (Insurance companies normally require this)
- \* What is the distance from your aerial to the nearest PIR sensor and to the nearest point of the wiring of the alarm system?

### **3. Standards for alarm installations**

If an alarm installation is claimed to meet BS 4737, then installers should note part 1 of the 1986 edition of BS4737 which covers installation requirements for intruder alarm systems. Section 3.2.3 makes the following reference to "environmental" conditions,

*"The system shall comply with this part of BS4737 in the environmental conditions to which it is likely to be exposed at the protected premises, including mechanical damage, weather, dampness, corrosion, heat, oil, electrical interference and adverse industrial atmospheres."*

BS4737 Part 3 : 1988 applies to components used in alarm systems and defines various environmental conditions. Section 3.6 states, "No alarm conditions shall occur during exposure to the specified environmental conditions". Section 3.6(g) specifies electromagnetic fields of 10 V/m from 0.1 MHz - 150 MHz and 5 V/m from 150 MHz - 1000 MHz.

It is important to note that if alarm components such as PIR sensors are 'CE' marked and manufactured before 1st January 2001, they may have been tested to RF immunity standards that are lower than the levels specified in BS4737 Part 3 : 1988.

The environmental conditions of BS 4737 put you in a strong position because your signals are part of the "environmental conditions" so up to a point, the system should be immune to them (see also section 6 below). If your amateur aerials were visible when the alarm was installed and they were obviously not TV or FM broadcast aerials, this puts you in a stronger position as it could be argued that the alarm installer should have realised that there was a radio transmitter nearby.

The most likely cause of RF triggering of an alarm is poor RF immunity of the PIR sensors. This seems to be more common on the HF bands than on VHF and can nearly always be cured by changing all the PIR sensors to a sufficiently immune type. There have been a few cases of RF triggering of alarm control panels but these have only involved radio amateurs' own alarm systems being triggered by 3.5 MHz transmissions.

#### **4. Conducting tests.**

If the owner of the alarm is co-operative, it is possible to do tests without setting off the alarm and without the need for the installer to be present. The red "walk test" LED normally flashes if the PIR is triggered by movement or RF, whether or not the alarm system is "armed". If the LED is not working, it has probably been switched off by a link inside the PIR. With some alarm systems, the PIR walk test can be switched on or off from the control panel. It is recommended that you do not touch, adjust or modify any part of your neighbour's alarm system.

If the "walk test" LED is working, find out how much power is needed on each band to make the LED flash. Nearly all PIRs use pulse counting so for an adequate test the RF carrier must be *pulsed on and off*, for example by transmitting a few seconds of Morse or SSB voice. With an FM only transmitter, key up and down at least 4 times within a few seconds. It is a good idea to get someone to help you so that they watch the LED while you operate the transmitter. A better idea is to get another radio amateur to operate your transmitter while you watch the LED.

If you prove that the PIRs are RF triggered, the next step is to ask the neighbour to contact the installer stating that the system does not meet BS 4737 and asking for this problem to be rectified free of charge. It is worth pointing out to the owner of the alarm that if the PIRs have poor RF immunity, there is a possibility of RF triggering by transmitters in passing vehicles and that when the problem is solved, they should have a better and more reliable system. It is best if you can deal directly with the installer on technical matters but

the installer may not be prepared to deal with you or to discuss details of the alarm system without written permission from the owner of the alarm system.

It is recommended that you phone the installer first to find out who deals with technical matters. That person may not be available and may not call you back so it is worth confirming the details by fax or letter, enclosing a copy of the RSGB "Radio Transmitters and Home Security Systems" information sheet (EMC 02). A polite but firm approach is recommended.

The installer may blame the PIR supplier or manufacturer and suggest fitting screened cable, filters, ferrite rings or adjusting the pulse count. *None of these measures is likely to produce any significant improvement.* The most effective solution is for the installer to replace all the PIRs with a more immune model, including any which are not RF triggered. Some could be just on the point of RF triggering so if not replaced, problems could reappear in future if you change your aerial system or start operating on different bands or at higher power. If you discuss frequencies with the owner or the installer, it is best to use Megahertz, *not* metres, as "80 metres" is often misunderstood as 80 MHz!

#### **5. Getting new PIRs installed**

The question of who pays for new PIRs is likely to arise. The owner of the alarm system could insist that the installer supplies and fits them free of charge on the grounds the system does not comply with BS 4737. If the system does not claim to meet BS 4737, it could still be argued that it is not fit for the purpose for which it is sold. Nevertheless, the installer may be unwilling to rectify the problem free of charge and the owner may not be prepared to exert pressure on the installer. A possible solution is to contact the PIR manufacturer or importer but first, you need to find out the make and model of PIR. The owner may not know and the installer may refuse to tell you without the owner's written permission! If the PIR manufacturer supplies industrial as well as domestic PIRs, they will probably have a more immune model and may be prepared to supply some of these free of charge in exchange for the old ones. Even if you have spoken to the PIR manufacturer by telephone and they have agreed to send some new PIRs, it is worth confirming the details by letter or fax to show that this is a genuine case of RF triggering.

You are under no obligation to pay anything towards the cost of solving an alarm RF immunity problem. In certain circumstances however, you may consider that it is worth paying some or all of the cost of new PIRs in the interest of maintaining good relations. If you do this, you are advised to make it clear that it is *purely a gesture of good will and not an admission of liability*. As paying the installer to supply and fit new PIRs can prove expensive, a less expensive solution is for you to buy suitable PIRs and get the installer to fit them. This also has the advantage that you can get some PIRs which are known to have good RF immunity in practice whereas the installer may buy some which do not live up to expectations.

The **Texecom "Reflex"** PIR (see Dec '94 RadCom, p75) is sold at about £13 + VAT by alarm trade suppliers such as Alarm Express and by CPC (Combined Precision Components) Ltd. It is also available from Maplin Electronics as "High Immunity Indoor Pulse-Count Detector" (Stock No. AG81C) but at a much higher price. This model claims RFI immunity to 30 V/m from 0.15-1000 MHz and in cases known to the EMC Committee where this model has been used to solve an RF triggering problem, it has always been successful.

Another PIR sensor that has been found to have good RF immunity in practice is the **Rokonet 'Cosmos PQ'**. The 'PQ' model has a 'Quad' type infra-red detector (unlike the 'Cosmos PR'). It is available from UK alarm trade suppliers and should not cost more than about £15 + VAT.

Another solution is to use a "dual technology" PIR such as the **Rokonet 'Cosmos DT'**. This has an infra-red and a microwave detector in the same unit. This type normally has very good immunity to RF triggering but dual technology detectors tend to be fairly expensive at around £30 + VAT each trade price. A suitable type of 'quad' PIR detector will generally solve the problem at much lower cost.

## **6. PIR RF immunity specifications**

Specifications for PIRs often quote field strengths in volts per metre (V/m), for example, "Complete RF immunity up to 1 GHz at 20 V/m". Unfortunately, the immunity may be considerably less in an actual installation because *the immunity is measured under special test conditions which may not represent the real-life situation*. Another factor is that *some models for domestic use are not tested below 20 or 27 MHz*.

To find the theoretical field strength at a certain distance from a transmitting aerial, first find the Effective Radiated Power (ERP not EIRP). Take the square root of the ERP in watts, multiply by 7 and divide by the distance in metres. This calculation gives 7 V/m at 10 metres distance from 100 W ERP. It assumes free-space 'far field' conditions although these are unlikely to be valid on the lower HF bands where a distance of 5-10 m is a small fraction of a wavelength. It also assumes 100% efficiency of the transmitting antenna whereas some antennas, such as the G4MH type 'mini beam' may fall well short of this on some bands.

There is an IEC document, IEC 1000-2-5, *Electromagnetic Compatibility (EMC) - Part 2: Environment - Section 5: Classification of Electromagnetic Environments*. This standard lists various sources of RF (and other types of electromagnetic disturbance) which may exist in various classes of location including residential (urban), residential (rural) commercial, etc. In most of these environment classes including residential (urban), the standard states that field strengths of up to 10 V/m may be expected in locations which are at least 20 m from the nearest amateur radio transmitter.

In the UK, the Loss Prevention Council has an approved list of PIR sensors which meet the LPS 1169 standard. This requires immunity to a field strength of at least 10 V/m over the frequency range 1-1000 MHz. The carrier is pulsed on and off during the test. There is a new European immunity standard for PIRs, EN 50130 Part 4 but PIRs made before 1st Jan 2001 do not have to meet this standard. Some "CE" marked PIRs for domestic use manufactured before 2001 may only have been tested to the Generic Immunity standard, EN 50082-1 : 1992. This only requires immunity to an unmodulated field strength of 3 V/m and this field strength could be produced by a 25 W ERP mobile transmitter in a passing vehicle at a distance of 10m.

In the past, some manufacturers quoted immunity to IEC 801-3 (BS 6667 Pt 3) but it is also necessary to know which test level was used. This standard has test levels of 1, 3 or 10 V/m of which 10 V/m is Level 3. In practice, it has been found that 10 V/m is only a basic standard of immunity for an alarm PIR so some manufacturers quote 20 or 30 V/m. IEC 801-3 only tests from 26-1000 MHz. Tests from 150 kHz - 26 MHz are specified in IEC 801-6 but some PIRs may not have been tested at all below about 20 - 26 MHz.

Instead of quoting field strength in V/m, some manufacturers quote the immunity as "100 watts at 5 feet" which is equivalent to 36 V/m with 100 W EIRP (100 watts into a theoretical isotropic radiator or 63 W into a dipole). One particular PIR which made this claim was found to fall well short of this immunity in an actual installation. There are several reasons why the immunity in an actual installation may be poorer than the claimed immunity:

(1) If a PIR is tested with a continuous unmodulated carrier, this is not a realistic test. A continuous carrier modulated with 1 kHz AM is not a realistic test either because PIRs do not respond to audio frequencies but to much lower frequencies such as 1 - 2 Hz. *For a realistic test, the carrier should be pulsed on and off at a slow rate such as 2 Hz to simulate the situation which occurs in practice with amateur SSB or CW signals.* It may be difficult to find out whether tests were performed with a modulated carrier and if so, what sort of modulation.

(2) Some PIRs are only tested from 10, 20 or 27 MHz up to 1000 MHz so their immunity at amateur frequencies such as 3.5 MHz or 7 MHz is unknown and claimed immunity levels may not be achieved at these frequencies.

(3) Radiated RF immunity tests are often performed in a TEM cell or GTEM cell where the PIR is connected to a fairly short wire. *Such a test on its own does not test for pickup in the cable* so the immunity may be substantially reduced when the PIR is connected to a long cable and mounted on a wall. To test for cable pickup, a conducted RF immunity test is required but may not have been performed.

## **7. Legal issues**

On one occasion, an RSGB member received a letter from the neighbour's solicitor threatening legal action for RF triggering of an alarm system. (See RadCom EMC Column, December 1994, Page 75). This may have been due to poor advice from an alarm installer or PIR manufacturer. Any such legal action is likely to be far more costly than replacing the PIRs. Provided a sound technical submission is made in defence of the radio amateur, the EMC Committee considers that such a case would be unlikely to succeed. Any RSGB member who receives a solicitor's letter about RF triggering of an alarm (or any other type of amateur radio EMC matter), is advised to write saying that they have received it but without commenting on the contents.

A copy of the solicitor's letter should then be sent to the EMC Committee Chairman immediately.

## **8. NACOSS or SSAIB Involvement**

The National Approval Council for Security Systems (NACOSS) is an approvals organisation for alarm installers (Tel. 01628 637512, <http://www.nacoss.org>). NACOSS can mediate in a dispute between a customer and an alarm installer who is a NACOSS member, but NACOSS will not normally become involved at the request of anyone other than the customer.

The Security Systems and Alarms Inspection Board (SSAIB) was set up by the security installation industry and maintains a list of registered installers. Tel 0191 296 3242/296 2667. <http://www.ssaib.co.uk>

## **9. Ofcom involvement.**

The owner of an RF triggered alarm system could send in form RA 179 to Ofcom. Form RA 179 can be used in two ways. The first is called the 'paid service' for which there is a fee.

When the fee is paid, Ofcom visit the complainant and investigate the problem but only if it involves UHF TV or FM broadcast reception. The paid service is not applicable to RF triggering of an alarm because alarm systems are not intended to receive radio signals at all.

Form RA 179 can also be used to submit an unpaid case, where the complainant nominates a suspected source of interference to Ofcom for possible investigation. If a radio amateur is nominated as a source of interference, Ofcom would normally visit the radio amateur and check that he or she is operating within the terms of his or her licence. Ofcom does not normally investigate the complainant's equipment in an unpaid case. If the complaint is only about RF triggering of an alarm system, Ofcom may not visit the amateur station.

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Ofcom form RA 179, 'Advice on Television and Radio Reception' can be obtained free of charge from Ofcom. It is also available online at: <http://www.ofcom.org.uk>