Ofcom's proposal to exempt the use of automotive short-range radar equipment at 24GHz from Wireless Telegraphy licensing

Introduction

GH Engineering is a small privately owned company specialising in the design and development of Radio Frequency sub-systems, particularly medium-power amplifiers operating at frequencies above 1GHz. The customer base is wide and varied, including commercial equipment suppliers, broadcasters, government departments and amateur radio operators. New projects are always in development, and these include equipments such as up- and down-converters for a number of microwave bands, including the K band (18 – 26.5GHz), and in particular the 24GHz band, and it is for this reason that GH Engineering has an interest in this part of the radio spectrum.

GH Engineering welcomes the opportunity to reply to this important consultation.

Ofcom Proposal

GH Engineering believes that any use of new technology for the purposes of improving vehicle and/or pedestrian safety should be encouraged wherever possible. However, the introduction of any new safely-related devices must be done in such a way that the system can be relied on to perform it's function when required. Such systems introduced into vehicles include airbags and anti-lock braking systems, where instances of failure and unreliability are practically non-existent. Consequently the user has a very high degree of confidence in these systems.

The proposed introduction of vehicle-based Short-range radars operating in the 24GHz does not represent a system where the user will have a very high degree of confidence in the system, due to the possibility of interference from other, licensed users of the same part of the radio spectrum. Furthermore, there is clear evidence that SRR devices operating in the 24GHz band may cause interference to existing, primary users of this band.

Interference to SRR devices

There exists a real possibility that 24GHz SRR devices could suffer interference from existing users. It is anticipated that SRR devices will use technologies where the signal is spread over a range of frequencies, such systems being referred to as 'spread spectrum'. If the bandwidth of these systems is sufficiently wide, then they may also be referred to as 'UltraWideBand' (UWB). Many such systems are designed with interference-cancelling mechanisms built in from the outset, such that the bandwidth of the system (in this case SRR) is considerably wider than a likely interfering signal, thus allowing the system to function more or less normally in the presence of an unwanted signal. However, it must be noted that signals used for point-to-point communications in the 24GHz band are often generated from transmitters producing over 1W in power, which in turn are connected to antennas having in excess of 30dB gain. Therefore, the effective radiated power of such systems can be many kilowatts, or even 10s of kilowatts, albeit occupying a fairly narrow beam width of 1 degree or less. However, such point-to-point communications systems are designed for communications of 10s of km or more, and not for short-range use. Any SRR device that happens to be close to the beam of such a signal is likely to suffer interference from a mechanism known as 'blocking', whereby the shear strength of the signal simply swamps the receiver thus rendering it inoperable. This situation is obviously more likely the closer the receiver is to the strong signal. Note that this is not a 'damaging' condition; the receiver resumes normal operation as soon as it is far enough away from the beam of the strong signal.

The likelihood of this situation occurring whereby a SRR device is rendered temporarily inoperable due to interference from a fixed radio link is difficult to quantify. However, if such a situation did exist then it is highly unlikely that the user of the SRR device (i.e. car driver) would be aware of it, and even if he/she was aware of it then it is equally unlikely that appropriate action could be taken to mitigate the situation. The

consequences of such a situation arising could be very serious, and could lead to adverse publicity for the car manufacturer or the manufacturer of the SRR device, even though neither of these parties would be 'at fault'. The exact 'failure' mechanism in this instance would not be understood by a member of the general public, the failure mechanism being quite technical in nature, which could in turn lead to confusion and bad publicity for SRRs in general.

Interference from SRR devices

CEPT have acknowledged that SRR devices operating in the 24GHz band have the potential to cause interference to existing users of the band, including primary users. GH Engineering believes that this is not an acceptable situation, regardless of the likelihood of potential interference. It should also be noted that the calculations for estimating the interference levels are based on a single SRR device; if many SRR devices were used in close proximity (for example if multiple vehicles were located in closely together) then the chances of harmful interference increase, as would the level of any such interference.

This could have a detrimental impact on the quality of service for a number of users, including commercial point-to-point (fixed link) operators and users of the amateur and amateur satellite service. For commercial customers, the situation could result in new or existing services being moved to other bands, possibly at great expense. As mentioned previously, GH Engineering has a number of products for use in the 18-26GHz range which are at various stages of development. The re-location of any such services could have a detrimental impact on the business case for completing the development of these products, for which a considerable amount of research and development work has already been carried out.

GH Engineering also provides equipment for use by radio amateurs, and sees this market as being particularly useful as a means to produce quality products at affordable prices. The 24GHz band is the lowest frequency microwave band where primary status is granted to the amateur service and the amateur satellite service, and this primary status is of great importance as it allows greater degrees of freedom and protection than in bands with a secondary allocation, subject to the license conditions.

Radio amateurs have been particularly innovative in their use of the bands that have been allocated to them. The characteristics of the 24GHz band are that attenuation due to water absorption dominates long-range propagation. This means that long-distance communications (150km+) are particularly challenging, and the use of narrowband techniques is a major factor in achieving such long-distance communications. The amateur satellite service also makes use of the 24GHz band; a satellite carrying a 24GHz transponder for space-earth communications was launched over 4 years ago, and this experimental transponder was used successfully by many amateur radio operators around the world, including the in the UK. A new amateur radio satellite is due to be launched early in 2006, which will also carry a 24GHz transponder. Such projects represent true state-of-the-art techniques, and are at the cutting edge of RF & microwave technology. Radio amateurs are not limited by the self-imposed constraints of commercial satellite operators, and are therefore able to use new techniques in component selection, circuit design, construction and operating that are literally many years ahead of commercial operators. The nature of such activities is highly experimental, and the results of such experiments are of benefit to the whole satellite community – including commercial, military and broadcast operators.

Equipment used by radio amateurs in the microwave bands is often of an extremely high specification, in terms of receiver noise figure, selectivity etc. Much time and effort is spent in building and aligning such equipment in order to achieve best results. However, in order to use this equipment, a certain amount of radio frequency spectrum is required. Furthermore, in order to reap the most value from such work, the allocated spectrum needs to be free from external interference. The amateur service and amateur satellite services have a primary allocation between 24000 and 24050 MHz, with the condition that users must accept interference from Industrial, Scientific and Medical users. Such cases of interference are extremely rare, which is partly due to any use of this band by ISM users being restricted to fixed links. If interference occurred, means could be taken to reduce the effects of this interference by re-location.

Use of the 24GHz spectrum for SRR could change this situation considerably. The effect of an SRR device operating in the vicinity of a high-sensitivity narrow-band receiver would be to raise the level of the noise floor, thus degrading the signal-noise ratio of any received signals. The effects of multiple SRRs in close proximity would be even greater, which could have a seriously detrimental effect on the quality of any received signals. Received signal levels at 24GHz are almost invariably weak at best, often being just above the noise floor. Furthermore, due to the mobility of the SRR devices, the effects of SRR interference would be non-predictable, which means that it would be much more difficult to take mitigating steps.

Interference to users of the amateur and amateur satellite allocations could have a serious impact on the use of the 24GHz band, which in turn could restrict the development of innovative new circuit ideas and operating techniques in an important part of the radio spectrum.

GH Engineering believes that the 24GHz band in general, and the primary allocation in particular, should remain as interference-free as possible, thus allowing for maximum use of this spectrum by the current primary license holders.

Conlusion

GH Engineering is strongly opposed to the introduction of license-exempt Short-range radar devices in the 24GHz band. The logical frequency allocation for these devices is the EU harmonised band at 79GHz. Ofcom does not have a legal obligation to allow 24GHz SRR devices to be used in the UK, but should honour it's obligation to current primary users to keep the 24GHz band as free from interference as possible.

There has been a lot of investment in communications equipment for the 24GHz band, and the value of this investment could be considerably reduced by the introduction of SRR in the 24GHz band.

24GHz SRRs could suffer interference from current users and could generate interference to current users. Microwave technology for devices operting at around 76-77GHz is now sufficiently advanced such that manufacturers must be encouraged to use this band rather than the 24GHz band. This would encourage rapid take-up by SRR equipment manufacturers of the 79GHz band which is the correct place for these important devices.

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