

CLEO Broadband Project

Microwave Safety Issues

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INTRODUCTION

The CLEO backbone network consists of 28 radio links of 155Mbps capacity with ranges of 2.5Km up to 40Km forming a figure of eight around Cumbria and Lancashire. The ends of the links are hosted on a mix of existing radio towers and school buildings. The final connections from the backbone nodes to the schools are done by a mixture of technologies including radio.

There has been a lot of debate recently about the safety of Cellular Radio, particularly siting base stations with school grounds. Naturally this concern has spilled over into worries that the microwave equipment we are using for CLEO may also be a potential hazard. This document looks at the issues involved and hopefully will reassure parents, governors and school staff.

CELLULAR RADIO TECHNOLOGIES

Cellular radio, both analogue and the newer GSM digital phones operate in two frequency bands, 900MHz and 1800MHz. The third generation G3 (UMTS) digital phones use slightly higher frequencies at 1900MHz and 2200MHz.

To provide coverage the cellular operators have to install base stations at quite small distances from each other as the ranges available in these frequency bands is limited. The area covered by a base station is called a cell and a big cell with a range of up to about 30Km is termed a macrocell. These macrocells are the ones that have to transmit the maximum power. The maximum power permitted under ETSI rules is 30Watts per channel radiated power with a maximum of 16 channels per base station. In reality, none of the operators runs stations at these extreme limits. The emitted radio energy is contained in a beam up to 120 degrees wide and around 6 degrees tall using directional sector aerials. Although the power sounds very high, its intensity falls away rapidly with the square of the distance from the transmitter. Some time ago the Government set up an independent expert group¹ to look into the safety of cellular radio. It published its report² on the 9th May 2000 and in its summary conclusions did not find anything to worry about as far as radiation from base stations was concerned. The report can be found online on the web³.

The actual cellular phone itself radiates power at a much lower level. Typically a peak power of 1 Watt for 1800MHz and 2 Watts for 900MHz handsets. As these handsets share the channel with other handsets they actually only get to transmit for one eighth of time so the average power transmitted is actually either 0.25 Watts or 0.125 Watts. However, the phone is held close to the body and therefore the amount of radiated energy hitting the body is in fact much higher than that from the base stations. The report adopts a more cautious approach here and whilst stating that there is no evidence that this is in any way harmful recommends 'a precautionary approach to their use'. This comes down to discouraging their use by children who are the most vulnerable.

POINT TO POINT MICROWAVE LINKS

For CLEO we are using a number of these operating in the 4GHz, 7.5GHz, 13GHz and 23GHz bands. They are the ones with the parabolic dishes that can be seen on many radio towers and have been used for many years to carry long-haul telephone and data services round the country. The use of this equipment is tightly regulated by the RadioCommunications Agency, a division of the DTI and licences to operate each link are granted by them on an annual basis in return for a fee. The type of equipment used and its power levels are very tightly controlled and have to be stated on the licence application.

¹ Independent Expert Group on Mobile Phones (IEGMP)

² IEGMP Report 'Mobile Phones and Health' Chairman Sir William Stewart

³ <http://www.iegmp.org.uk/>

Power levels are typically of the order of tens of milliwatts or between a hundredth and a tenth of the level of the typical cellular handset. The radio energy is also very focused by the parabolic aerials into a beam of between 0.8 degrees with a 2.4 metre dish, and 2 degrees with a 30 cm dish. The frequencies used make the link very much a point to point line of sight one. The radio waves cannot penetrate anything at all; even a few leaves on a tree will block the signal. Because of the tight beam it is unlikely that it will reach ground level at all but if it did then it would be at a range of many kilometres. The power levels are so low that even standing directly in front of one of the dishes the energy levels would be substantially below those from a mobile phone handset.

The 'Mobile Phones and Health' Working Party dismissed these links as being of too low a power level to warrant their consideration in the report.

POINT TO POINT MULTIPPOINT MICROWAVE LINKS

As well as the backbone links using the licensed band equipment, CLEO is using a range of equipment using the unlicensed 2.4GHz band. Although equipment operating in this band does not need a licence it does need to be type approved to ETS 300 328 standard. Amongst other things such as interference levels it stipulates that the maximum EIRP (effective isotropically radiated power) must be no more than 100 milliwatts. This is a peak directional power level and means that in general the power up the aerial will be between 30 and 60 milliwatts. This then gets focused by the aerial to give the 100Mw EIRP figure.

These links are the ones used for the 10Mbs link from the backbone to the schools. With flatplate aerials they can achieve ranges of up to about 15Km. The aerials are about 39cm x 45cm x 2cm thick and always located well above head height on roofs or walls. The reason for them being well above head height is nothing to do with safety, you could stand with your head against the aerial forever without any risk, but because the signal would be blocked. The 2.4GHz band has virtually no penetration power; even a few leaves on a tree would block the signal.

SUMMARY

Cellular base stations operate with power levels of tens of watts. When this is focused with directional aerials they can emit, under ETSI regulations, up to 1500 Watts EIRP. However, by the time the signal hits ground level the microvolts per square metre signal density is well inside permitted safety levels. There may be arguments about whether these levels are correctly set or not but as things stand there is no evidence of any health risk. The Stewart Report confirms this.

Cellular handsets operate with power levels of 1 to 2 Watts peak. This is much lower than the base stations but because they are held directly against the head, the microvolts per square metre radiation is much higher than that from base stations. Again the levels are well below the safety levels recommended by both the National Radiological Protection Board and the EU Safety Committee. However, the Stewart Report does recommend being cautious over the use of handsets particularly in the case of younger children. Arguing that they are still developing and therefore more at risk and also due to the amount of radiation they are likely to get over a long life.

Point to Point Microwave Links operate with power levels of the order of tens of milliwatts. Like cellular base stations they are located well above ground level. However, they are many orders of magnitude less powerful than the cellular transmitters. The Stewart Report dismissed these as of no interest to them as the levels were so low.

Point to Multipoint Microwave Links operate with similar power levels to the point to point links. Typically maximum power up the aerial is of the order of 35 to 65 milliwatts. Again they are located well above head height and the signal levels directly in front of the aerials are much below those of the ordinary cellular handset.