How Green are today's Digital Wireless Cameras?

With demand for digital wireless cameras increasing and the available pool of spectrum decreasing, congested frequency space is inevitable. JFMG has been investigating some aspects of digital wireless camera performance not normally found in the brochures. Paul Gill reports:

If programme makers are to successfully work alongside each other, and also in harmony with other radio users, then it is vital that their digital wireless is fully fit-for-purpose.

Publicity and features in the industry press make seductive claims about simple long-range operation even in difficult urban areas. But for some time, JFMG has received reports from the ground that indicate the expected operational performance is not always a reality. Further, with an auction looming for spectrum neighbouring wireless camera bands, there is potential for escalating problems from new users moving in 'next door'.

JFMG decided that it was time to investigate and use the findings to inform Ofcom's auction advisors of the potential pitfalls for programme makers.

Wireless Camera tests in progress:
L-R: John Levett, JFMG; Richard Penman, BBC; Stewart Kelly, BBC; Mark Waddell, BBC

Laboratory facilities and expertise from BBC Training and Development at Wood Norton near Evesham, were hired-in. The industry rallied to support the work with loans of their operational wireless camera systems and specialised test equipment. During the 3 days of testing, a wide range of the popular systems deployed in the UK including new High Definition designs were put through their paces.

The test programme was designed to explore how wireless cameras perform in the real world. The aim was to determine how good the receivers are at keeping-out unwanted signals from other services including 3G cellular mobile. It was also an excellent opportunity to study how two or more cameras work alongside each other. Finally the investigation set-out to look at how 'clean' typical wireless camera transmitters are or in other words, to what extent a signal spills out of its allocated channel.

Wireless Camera receivers and 3G cellular phones

3G mobile phone towers already operate in the band immediately above 2110 MHz and have caused severe problems for wireless cameras operating in the 2025 to 2110 MHz band.

Roof-top wireless camera receivers are often situated close to roof-top mobile phone transmitters which operate at high power. The result is that the operating range for the wireless camera can be severely reduced. The worst affected channels are likely to be 2105 MHz and to a lesser extent, 2095 MHz. In extreme cases, operation on any channels in the band may be impaired if the 3G signals are strong enough to overload the wireless camera receiver.

The imminent auction will see new users in the band below 2025 MHz and also above 2290 MHz. This could cause further problems for programme makers.

For wireless camera **receivers** it was found that:

- Some don't have adequate protection against another wireless camera in the next channel.
- Some are very vulnerable to interference from 3G masts.
- Some downconverters are susceptible to overload by strong signals which impairs their performance.
- Some HD systems are more vulnerable to interference from a user in the next channel than for a similar SD system
- Some are overly vulnerable to signals from other services in unrelated and widely spaced frequency bands

For wireless camera **transmitters** it was found that:

- Many higher-power systems spill-over into neighbouring channels more than is permitted and risk causing interference to other users

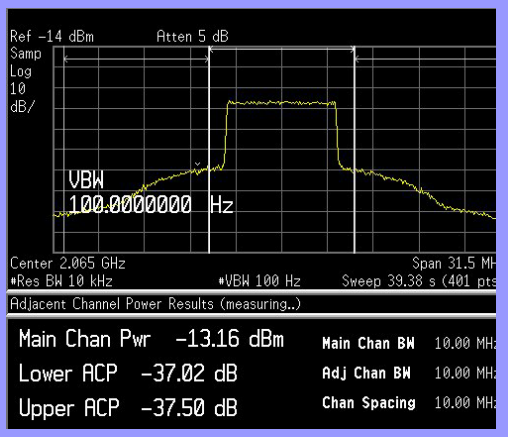
JFMG will provide detailed feedback to manufacturers on these findings, particularly for transmitters that appear not to meet the required performance standard. But it should be noted that there is no minimum performance requirement that wireless camera receivers must meet. Users must ensure that the performance is suitable for the type of deployment that is envisaged■

Wireless Camera spectrum

For successful sharing of congested spectrum, the signal from a digital wireless camera transmitter must be contained within its allocated channel. In practice, some signal is inevitably spilled and so it is important that this is controlled and kept within critical limits.

In the spectrum plot (right) the allocated bandwidth is indicated by the white 'goalpost'. Most of the signal is contained within the allocated bandwidth but the signal also clearly has rounded shoulders which spill into both of the next-door channels.

The reference standard that applies is EN 302 064 (ETSI). This defines a limit to the total power that a transmitter can spill into spectrum outside the working channel. For low power operation (less than 300mW) the permitted overspill is dependent on the actual transmitter power.



For higher-power transmitters the spill-over into either next-door channel must never exceed 0.075mW. This requirement is increasingly demanding as the transmitter power increases.