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BAE SYSTEMS

Spectrum planning for the London 2012 Olympic Games and Paralympic Games

BAE Systems Advanced Technology Centre provides research and development, consultancy, specialist manufacturing and technology brokering services into defence, aerospace and commercial markets. BAE Systems ATC Is delighted to respond to the Ofcom consultation on London 2012 Olympic Spectrum Planning

With 400 scientists and engineers, the Advanced Technology Centre works in collaboration and partnership with academia and innovative organisations identifying, pulling through and integrating technologies and capabilities to deliver discriminating solutions to its customers.

For several years BAESYSTEMS ATC had been developing technologies in the 60GHz band for several projects and applications including Wireless Broadcasting and Intelligent Transport Systems.

Of particular relevance to this consultation is our rf-on-fibre technology that has been proven to directly bear multiple 60GHz wireless links over an optical fibre network for HDTV cameras in the ROFMOD project – a project supported by the DTI (now BERR); and licensed by and previously presented to Ofcom

BAE Systems is also delighted to be working with UK Sport in supporting British athletes in preparing for sporting success at the Olympics, Paralympics, World and European Championships. We will be working with UK Sport from 2007 until 2012 in a joint partnership.

We would be pleased to provide any additional information on request or participate in any future discussions, both with Ofcom or any other stakeholder who has an interest in this topic.

Further reading:

ROFMOD - Radio on Fibre MObile data network Demonstrator

Developed under the DTI LINK OSDA Project

http://www.baesystems.com/Businesses/SharedServices/Divisions/AdvancedTechnologyCentre/FeatureArchive/bae_feat_atc_rofmod.html
- or in brief: http://tinyurl.com/26skxf

http://secure.theengineer.co.uk/Articles/294614/Signalling+a+new+TV+era+.htm

BAE SYSTEMS / UK Sport Partnership:

http://www.uksport.gov.uk/pages/uk_sport_bae_partnership/
http://www.baesystems.com/Newsroom/NewsReleases/autoGen_108023113837.html

Question 1. *Do you have any comments on our approach?*
Question 2. *Do you have any comments on our assumptions?*

Whilst the Ofcom approach is commendable, we are concerned with some serious shortcomings in accompanying third-party research on the potential use of EHF spectrum to support Wireless Camera PMSE applications.

Question 14a. *What is your assessment of the requirements for wireless cameras?*
Question 14b. *How can they be met most efficiently?*
Question 15. *How do you think the use of HD will affect spectrum requirements?*

Although a matter for broadcasters, there can be little doubt that the 2012 Olympics would have a high proportion of HD cameras and broadcasting. Trends in production standards suggest that 1080p could well be the dominant camera and studio standard, prior to final playout through the broadcast transmitter/satellite network. In contrast to the compressed nature of the latter transmissions, upstream camera data rate requirements are considerable.

Live events require low latency video data with minimal compression to facilitate multiple stages of studio processing and mixing. Standard video uses the SDI standard up to 270Mbps, whilst the HD-SDI equivalent uses HD-SDI at 1.4Gbps. Our own experience is that low-loss compression can bring HD-SDI down to the 270Mbps data rate without undue artefacts. However that is still an order beyond what lower frequency wireless channels have capacity for, particularly at venues where multiple cameras will be deployed.

Even with modest compression we therefore do not believe that the standard 20MHz wide spectrum channels in lower frequency bands are compatible with high quality HDTV production requirements that are likely to be in demand for such a premium event.

Question 17. *How do you think spectrum could be used more efficiently?*
We agree with Ofcom, and believe this is an opportunity to showcase more innovative and spectrally efficient approaches that also offer greater bandwidths to broadcasters

Question 18a. *Do you think that wireless-camera technology operating between 3 and 7.5GHz will be more widely available by the time of the London Games?*

We have reservations as to whether the data capacity on a typical 20MHz bandwidth channel could be compatible with quality HDTV data rates. In addition, for high density use there are also likely to be capacity limits in the absolute amount of overall spectrum to support multiple channels in the lower microwave bands where frequency reuse opportunities are more limited.

Question 18b*. Do you think that wireless-camera technology operating at up to 60 GHz will be available by the time of the London Games?*

Yes. BAE SYSTEMS ATC is confident that this is feasible. Our practical experience with working 60GHz systems indicates that there are also serious shortfalls with the third party research that Ofcom commissioned for this consultation which cast doubt on this.

Question 18c. *Could existing wireless cameras be adapted to work at higher frequencies?*
Question 18d. *Are there any other considerations that will affect the feasibility of using higher-frequency spectrum for wireless cameras?*

Modems and packaged microwave transmit/receive modules have been developed for 60GHz use. ROFMOD results also show that line of sight is not strictly necessary.

The 60GHz band is also the subject of a wide range of other industry developments for data links, domestic Wireless-HD and Intelligent Transport. Notable amongst the latter is the UK MILTRANS project developed and demonstrated within the Foresight Vehicle programme. This has demonstrated high speed robust links which are multipath and Doppler resistant.

MILTRANS: http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1113

Question 19. *Do you think that using optical-fibre cameras will reduce spectrum requirements?*
Question 20. *Do you think that using short, wireless video links to fixed, cabled access points will reduce spectrum requirements?*
Question 21. *Do you think that using optical fibre within and between competition venues will reduce the requirement for fixed point-to-point links?*

Yes, such an optical fibre approach is eminently sensible. Optical fibre is an economic means of providing reliable high bandwidth backbone to support the Games. It enables shorter range communications technologies to be deployed with greater frequency re-use and the fibre networks would also serve to enhance the post-games regeneration legacy.

Furthermore, rf-on-optical fibre technologies which directly bear the rf frequency on an optical carrier permit a seamless marriage of EHF links with optical fibre infrastructure. They also offer the scope for excellent spectrum efficiency and quality HDTV data rates and have already been demonstrated at 60GHz by the ROFMOD project

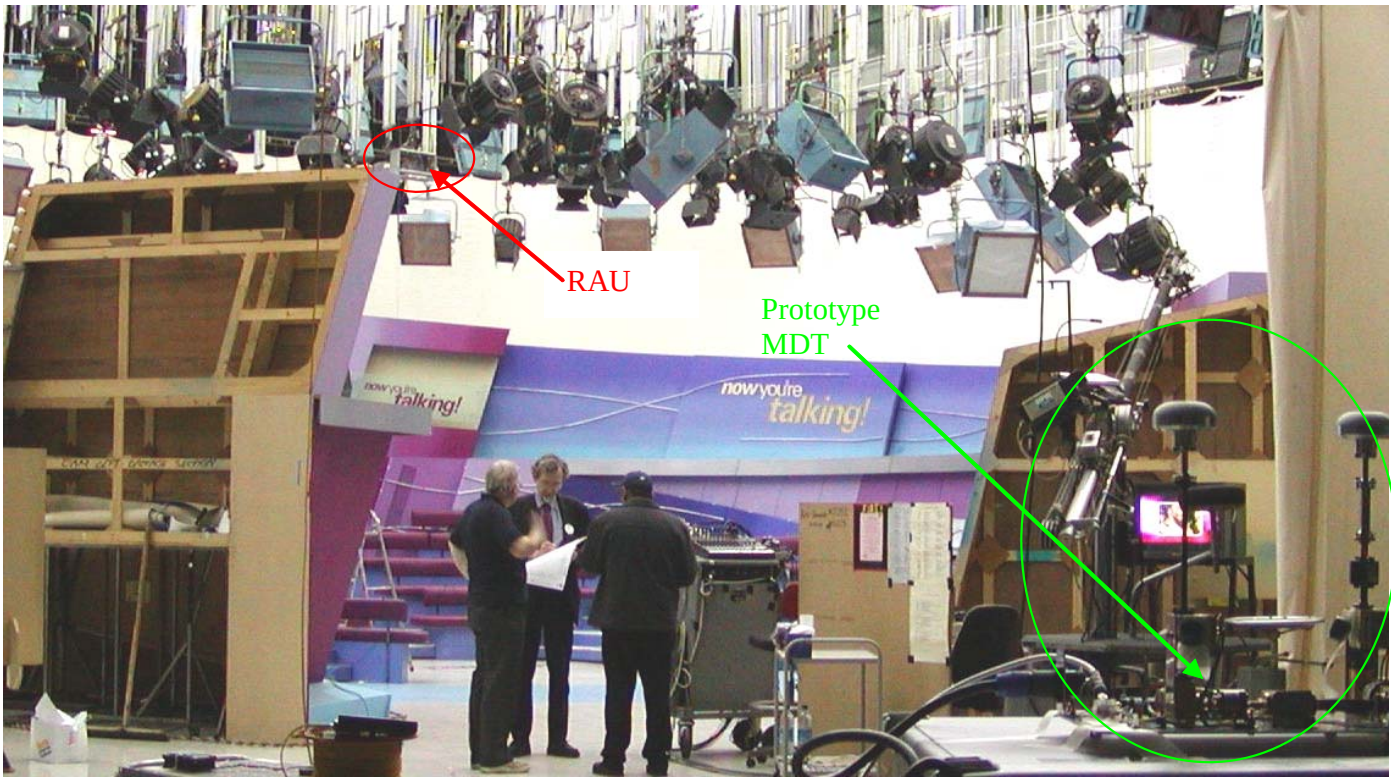
Question 26. *Do you have any views on enforcement?*

We fully support any measures Ofcom feels necessary. In addition it is an important aspect that all spectrum users are made aware that their use of such spectrum is for a defined period. We would be concerned if loaned spectrum in lower microwave bands, some of which would no doubt normally be for Defence and Security applications suffer from interference issues from continued use beyond the games period.

Annexe-1: ROFMOD

The ROFMOD fibre radio system provides a number of bi-directional high data rate (≤270Mbit/s) communication channels (limited by the available spectrum) between a fixed base station and a number of mobile data terminals (MDT) distributed over an area. Multiple Remote Antenna Units (RAU) are used to provide areas of overlapping coverage between the base station and the MDTs, where the number of RAUs is determined by the required area coverage and the individual cell sizes.

The Ofcom Test and Development Licence issued for use on the ROFMOD project at the BAE SYSTEMS site at Great Baddow, provides a downlink (direction between the base station and the mobile data terminal (MDT)) frequency range of 57 to 59GHz and an uplink (between the MDT and the base station) frequency range of 62 to 64GHz. Hence after allowing for guard bands five of the 356MHz (270Mbps) COFDM channels can be supported in the downlink and uplink frequency ranges



ROFMOD System Tests at Teddington TV Studios