Response to Ofcom Consultation:
UK Broadband application for licence variation

Background

JFMG Ltd manages the spectrum allocated for use in programme making, entertainment, special events and related activities. JFMG coordinates the use of spectrum, issues licences and collects licence fees on behalf of Ofcom. JFMG has successfully managed spectrum for Ofcom (previously Radiocommunications Agency) since 1997.

In the UK, the professional use of radio for programme making and entertainment purposes is referred to as Programme Making and Special Events (PMSE). PMSE applications include:-

- Broadcast television studio production
- Broadcast television and radio coverage of news, sport or other public events including state occasions
- Theatre and touring shows
- Music and other entertainment productions
- Conferences, and corporate presentations and events
- Making advertisements and promotional material
- Production for multi-media and webcasting
- Movie film productions
- Public address systems at events and places of worship

Consultation Questions

Do you agree that the case for making changes requested by UK Broadband to its licence has been made? If not, why would it not be appropriate to vary UK Broadband's Wireless Telegraphy Public Fixed Wireless Access Operator Licence by (i) allowing application neutrality and (ii) increasing the permitted maximum in-band EIRP, and why would it not be appropriate to vary the licence as soon as practicable?

JFMG have serious concerns regarding the impact of the proposed changes to UK Broadband's licence could have on adjacent PMSE spectrum use, based on compatibility studies produced by Ofcom. We would therefore ask Ofcom to seriously consider these issues before making any final decisions regarding the licence variation.

The request from UK Broadband for changes to its licence could seriously impact Programme Makers using adjacent spectrum, reducing the availability of the whole band for routine television production. Currently UK Broadband operate a relatively low density, point-to-point network which has been shown to be compatible with Programme Making use in adjacent channels. The requested changes however are liable to result in new technologies radiated at much higher powers and deployed in more dense infrastructure networks. These services would not be compatible with Programme Makers' use of the band and severely restrict Programme Making activities at a time when alternative spectrum in the range 2500 – 2690MHz is also being lost to Programme Makers.

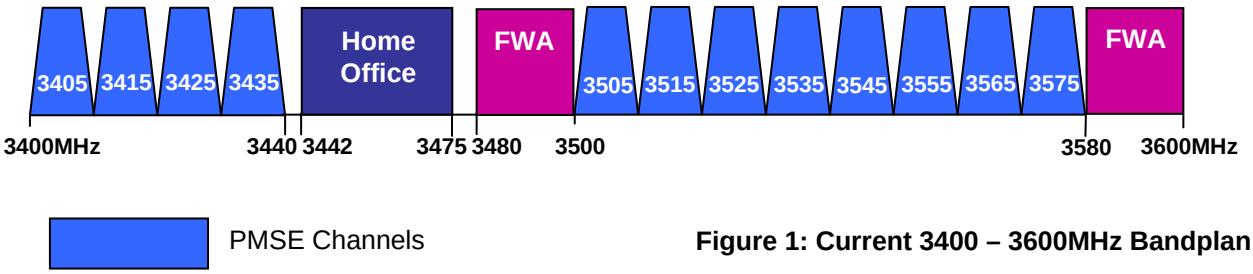

Figure 1: Current 3400 – 3600MHz Bandplan

Compatibility Issues

Before the original award of the bands 3480 – 3500MHz and 3580 – 3600MHz for FWA a number of compatibility studies were carried out to assess the adjacent channel interaction with PMSE. At that time in 2001 the predominant use of the band by Programme Makers was for short range analogue point-to-point vision links. The impact of FWA services on these links was found to be severe, though the impact on DVB-T based digital links was shown to be very much less for point-to-point applications. The risk of interference to Programme Makers was therefore assessed as manageable given a migration to digital links by Programme Makers which was already underway.

In the past five years there has been major growth in demand for spectrum suitable for low power digital Wireless Cameras, largely based on DVB-T technology. Already at major events it can be difficult to meet the spectrum demand for Wireless Cameras within the preferred PMSE frequency ranges, namely 2025 – 2110MHz, 2200 – 2290MHz and 2500 – 2690MHz. As a result the bands 3400 – 3440MHz and 3500 – 3580MHz are now used increasingly for low power Wireless Camera applications. 2500 – 2690MHz is about to be lost to Programme Making when it comes to auction and the only alternative spectrum suitable for the Wireless Cameras, for which equipment is readily available for purchase and hire, is in the range 3400 – 3600MHz. It is therefore important to consider the provision of spectrum for Wireless Cameras as a whole when determining the way forward with regard to the request from UK Broadband.

Compatibility between Wireless Camera receivers and other radio services in adjacent bands is currently a major issue. Already there are difficulties between Wireless Cameras and UMTS base stations at 2110MHz and after the 2.6GHz spectrum auctions there is the likelihood of similar issues at a further three spectrum boundaries. To better understand the issues and evaluate possible mitigating solutions studies have been undertaken including a recent ERA report commissioned by Ofcom.

This report investigated the effectiveness of additional filtering on the Wireless Camera receiver to protect its operation from high power adjacent UMTS and WiMAX services. WiMAX is specifically mentioned in the consultation document as a likely candidate in the 3.5GHz band. An analysis has therefore been carried out by BBC Research on the impact to Wireless Camera receivers at 3500MHz resulting from WiMAX at the powers requested, based on results from the ERA report. The derivation of the results themselves can be found in Annex 1.

Compatibility Analysis

Taking the measured Adjacent Channel Selectivity (ACS) for Wireless Camera receivers from the ERA report an interference radius has been calculated for a typical WiMAX base station operating at the transmit power requested by UK Broadband. They show that for a Wireless Camera receiver there is the likelihood of receiver blocking in the adjacent channels at distances greater than 1km. This figure is derived from a propagation model which takes account of clutter and assumes that a sophisticated channel filter is employed. For a line of sight propagation model the interference distance increases to greater than

5km. The likelihood is that base stations will be located well within these interference distances making the channels 3505MHz and 3575MHz unusable.

For the next adjacent channels 3515MHz and 3565MHz interference distances of between 500m and 1km are predicted depending on the propagation model and no additional benefit is derived from the channel filter rejection. Again, dependent upon base station density, there is the likelihood that a further two channels will be severely impaired over wide areas.

Part 2 of the analysis shows that the remaining PMSE channels are unlikely to be immune to UK Broadband services either, based on the proposed levels of permissible out of band radiation. Current levels of out of band radiation are proposed to be maintained but given that the in-band power levels are proposed to be raised by 15dB there will be significant site engineering challenges to achieve these levels of radiation suppression out of band.

The ERA report goes a long way to characterising the performance of Wireless camera receivers in the presence of adjacent UMTS and WiMAX interferers. We feel it is optimistic however in a number of areas to the detriment of PMSE. One of them is in the spectrum mask of the interfering signals employed. Both the simulated UMTS and WiMAX signals used in the analysis are significantly better out of band than the standard masks, as would be expected from a bench test generator. The outputs of real base stations are unlikely to be so clean. The high power base stations proposed will struggle to meet the levels of out of band radiation in the masks. Additionally the receiver filters employed were prototypes and one of the manufacturers has confirmed that the level of rejection may not be achieved in an operational environment and that their effect will be diminished. Indeed, as noted in the report, the performance of one of the filters was worse than expected during the tests.

The consultation document in Section 5 defines the term ‘Receiver blocking’ which does not make a distinction between interference to a victim receiver in an immediately adjacent channel compared to ‘blocking’, generally accepted as interference to a victim receiver with a greater frequency separation. These are two distinct mechanisms which cannot be discounted together as they are in the consultation document. The requested increase of 15dB in maximum radiated power for base stations will without question further degrade the performance of a Wireless Camera receiver in adjacent channels. Separately the decision to retain the existing out of band limits may result in little change to the impact on a Wireless Camera receiver operating with greater frequency separation from the interferer. The assertion that increasing the in-band EIRP limits will not ‘create extra blocking effects’ is therefore misleading. It also asserts in paragraph 5.11 that increasing the power limit would reduce the number of base stations to serve a given number of customers. This is unlikely however as new services will be provided to mobile terminals which will instead require a greater density of base stations. These new mobile terminals also threaten to be a significant source of interference to PMSE.

Summary

- JFMG believes that the UK Broadband request to increase the maximum in-band power level to +29dB/MHz will have a significant impact on existing Programme Making spectrum between 3400 and 3600MHz for Wireless Cameras. The required separation distances between base stations and Wireless Camera receivers will significantly increase and seriously restrict programme making activities in four out of the existing twelve PMSE channels

- This conclusion is based on recent compatibility studies commissioned by Ofcom and counters assertions in the consultation document that no additional impact would be caused to adjacent services as a consequence of the proposed in-band power increase

- The rollout of high density networks is a likely consequence of increasing the maximum in-band power level, particularly in urban areas, to provide new services to mobile terminals. This will further limit Programme Makers use of channels in the range 3400-3600MHz

- At a time when Programme Makers are already losing spectrum for Wireless Cameras in the range 2500–2690MHz a further reduction of spectrum would be a serious loss. Currently the range 3400-3600MHz is the only alternative band for Programme Makers to migrate into for which Wireless Camera equipment is readily available

- JFMG would be happy to meet with Ofcom to discuss any of the issues raised

Annex 1

Interference zone for WiMAX Transmissions at 3.4GHz

Source: BBC Research

Part 1 : Calculation of the zone of interference based on a line of sight model (square law propagation) and a suburban propagation model that attempts to asses the effect of clutter (COST-231)
These calculations make use of the selectivity measurements in ERA report 2007-0447. The interference area is the region where blocking will occur at the QEF reception point.

Transmit Power	39	dBW	7.94	kW
Frequency	3500	MHz		
Tx ae ht	60	m	Assumed values for COST-231 model	
Rx ae ht	10	m	Assumed values for COST-231 model	
a(hm)	27.256			
Receiver Noise Figure	5	dB		
Demod Implementation	1	dB		

	ACS	DVB-T mode	C/N QEF	Prot. Ratio	QEF point	Reqd. FSL	Interference radius (km)		Cell area
Receiver Configuration	**(dB)**		**(dB)**	**(dB)**	**(dBm)**	**(dB)**	**Square Law**	**COST-231**	**(km^2)**
Rx A, No filter, N+1	48.6	QPSK, FEC 1/2	3.1	-45.5	-96.1	119.6	**6.51**	**1.41**	6.26
Rx A, Filter B, N+1	50	QPSK, FEC 1/2	3.1	-46.9	-96.1	118.2	**5.54**	**1.28**	5.15
Rx B, no filter, N+1	32.8	QPSK, FEC 1/2	3.1	-29.7	-96.1	135.4	**40.13**	**4.22**	55.80
Rx B, Filter B, N+1	48.8	QPSK, FEC 1/2	3.1	-45.7	-96.1	119.4	**6.36**	**1.39**	6.09
Rx A, No filter, N+2	60.2	QPSK, FEC 1/2	3.1	-57.1	-96.1	108.0	**1.71**	**0.63**	1.26
Rx A, Filter B, N+2	62	QPSK, FEC 1/2	3.1	-58.9	-96.1	106.2	**1.39**	**0.56**	0.98
Rx B, no filter, N+2	63.8	QPSK, FEC 1/2	3.1	-60.7	-96.1	104.4	**1.13**	**0.49**	0.76
Rx B, Filter B, N+2	63.4	QPSK, FEC 1/2	3.1	-60.3	-96.1	104.8	**1.18**	**0.51**	0.81

Part 2: Calculation of the zone of co-channel interference, based on the proposed out of band radiation. This potentially affects all of the 3.4GHz PMSE channels calculation based on 3dB degradation.

Co-channel Interference = receiver noise

Offset from Band Edge

From	To	Maximum Permitted radiation	
0	3.5	-43	dBW/MHz
3.5	beyond	-56	dBW/MHz

For 3dB degradation. Co-channel Interference = receiver noise

	Offset	PMSE BW	Cochannel Pwr	C/N QEF	QEF point	Reqd. FSL	Interference radius (km)
	(MHz)	(MHz)	(dBW)	(dB)	(dBm)	(dB)	Square Law
Adjacent channel	10	7.6	-38.91	3.1	-96.1	87.18	**0.16**
Other channels	20	7.6	-47.19	3.1	-96.1	78.90	**0.06**