

SAP REG RESPONSE TO OFCOM CONSULTATION

“UK BROADBAND APPLICATION FOR LICENCE VARIATION”

23 August 2007

1 Introduction

The Satellite Action Plan Regulatory Group (SAP REG), whose members include most major satellite operators and manufacturers serving Europe, is pleased to comment on Ofcom’s consultation titled “UK Broadband application for licence variation”.

In the consultation document, Ofcom proposes some changes to the licence conditions on UK Broadband, the sole UK licensee in the 3.5 GHz band. UK Broadband is licensed to operate in the bands 3480-3500 MHz and 3580-3600 MHz. These two bands are part of the band 3400-4200 MHz which is allocated internationally to the fixed satellite service (FSS). The band 3400-3600 MHz is not allocated in the UK to the fixed satellite service, but the band 3600-4200 MHz is allocated to the fixed satellite service and is extensively used by receiving earth stations in the UK. Some of the earth stations which operate in this band are receive-only earth stations, and therefore may not be licensed.

While recognizing that the bands licensed to UK Broadband are not shared with fixed satellite earth stations in the UK, SAP REG has some concerns with Ofcom’s proposals, as described below.

2 Comparison of the proposed limits with those used in sharing studies

The issue of sharing between BWA systems and fixed satellite earth stations is a hot topic in international regulatory fora. The CEPT has recently completed a new report, ECC Report 100, on sharing between BWA and other systems, including FSS systems¹. Furthermore, in the ITU-R, Study Group 8 has recently adopted new ITU-R Report M.[8/185] on sharing between IMT systems and FSS systems in the range 3400-4200 MHz². Both these reports address co-frequency operations between FSS earth stations and BWA systems, and also adjacent frequency operations. The latter report is pertinent as the technology proposed to be used by UK Broadband in the 3.5 GHz band – WiMAX – is also in the process of being adopted as one of the family of IMT technologies.

The former document has formed a basis on which CEPT has decided to designate the bands 3400-3600 MHz and 3600-3800 MHz to BWA. The European Commission is considering an EC Decision along the same lines, also partly based on the sharing studies contained in ECC Report 100. The latter document forms the major technical analysis on which administrations

¹ ECC Report 100, “Compatibility Studies in the Band 3400-3800 MHz between Broadband Wireless Access (BWA) systems and other services”, Bern, February 2007.

² ITU-R Document 8/185, “Draft New Report on Sharing Studies between IMT-Advanced Systems and Geostationary Satellite Networks in the Fixed Satellite Service in the 3 400-4 200 and 4 500-4 800 MHz frequency bands”, 5 June 2007.

will consider whether all or part of the band 3400-4200 MHz should be identified for terrestrial IMT systems at WRC-07.

Given the current relevance and importance of these two reports, it is important to be sure that the technical characteristics and assumptions for BWA and IMT systems accurately reflect the expected use. The table below compares the e.i.r.p. limits proposed by Ofcom for the 3.5 GHz licence with those used in the two reports.

	Central Station	Fixed Terminal Station	Mobile terminals
Ofcom proposals			
maximum e.i.r.p. (dBW/MHz)	29	29	-5
ECC Report 100 (see table 5.4.1)	“critical case”	“critical case”	"omni"
Tx peak output power (dBm)	43	30	20
channel bandwidth (MHz)	7	7	7
feeder loss (dB)	1	1	1
power control (dB)	0	0	0
peak antenna gain (dBi)	17	20	0
maximum e.i.r.p. (dBW/MHz)	20.5	10.5	-19.5
<i>Difference with respect to Ofcom proposals (dB)</i>	-8.5	-18.5	-14.5
ITU-R Report M.[8/185] (see tables 3 and 4 of document 8/185)	“base station”	not applicable	“mobile station”
e.i.r.p. density (dBm/MHz)	46		7.5
e.i.r.p. density (dBW/MHz)	16		-22.5
<i>Difference with respect to Ofcom proposals (dB)</i>	-13		-17.5

Table 1 Comparison of e.i.r.p. limits proposed by Ofcom with those used in sharing studies

The table shows that there are major differences in the limits proposed by Ofcom compared with the maximum e.i.r.p. values assumed in these sharing studies. The values proposed by Ofcom are between 8.5 dB and 18.5 dB higher than those used in the sharing studies.

The two sharing reports, even with the much lower e.i.r.p. values assumed for BWA/IMT systems, already present a bleak assessment of the feasibility of sharing with FSS earth stations. Taking real terrain profiles into account, required separation distances are at least tens of kilometres, and sometimes hundreds of kilometres. If the values proposed by Ofcom were to be considered as limits to be applied in bands shared with the FSS, it is obvious that the sharing situation would be much worse than the already very unfavourable results given in these two reports. The limits proposed by Ofcom could not be considered suitable for BWA systems in a band also allocated to the FSS.

Furthermore, the proposals by UK Broadband and Ofcom illustrate that both the technology and the will exist to deploy BWA systems with significantly higher power than those assumed in the ECC and ITU-R sharing studies. As a consequence, the validity of these two reports

must be brought into question. SAP REG has previously maintained, and continues to maintain, that sharing between BWA or IMT systems with FSS earth stations cannot be considered realistic. The proposal to deploy BWA/IMT systems with significantly higher powers further strengthens the already strong argument that sharing cannot be considered a realistic option.

3 Adjacent band sharing issues

While the above comments could be considered as indirect consequences to Ofcom’s proposals, if implemented the proposals would also have a direct impact on existing and future FSS operations in the UK. Both frequency blocks licensed to UK Broadband are close to the band 3600-4200 MHz, allocated to and used by the FSS in the UK. One of the two frequency blocks is immediately adjacent to the band – i.e. there is effectively no guard band with respect to the FSS. This situation raises the issue of adjacent band sharing conditions.

The CEPT and ITU-R studies discussed above also considered adjacent band sharing issues. There are two interference mechanisms to be considered: (1) unwanted emissions from BWA transmitters that are received by an earth station on frequencies above 3600 MHz, and (2) emissions from BWA transmitters which may cause the earth station LNA (Low Noise Amplifier) to become saturated, or cause non-linear operation.

In ECC Report 100 (taking into account the corrections agreed by WG SE at its June 2007 meeting³), the required separation distances due to unwanted emissions are as shown in Table 2.

Type of BWA Station	Required Separation Distance (km)	
	FSS ES antenna off-axis angle	
CS-1 and CS-2	5°	1.087-4.33
	15°	0.277-1.1
	30°	0.117-0.464
TS-1	5°	13.7
	15°	3.48
	30°	1.47
TS-2 (Indoor)	5°	0.77
	15°	0.196
	30°	0.083
TS-3 (Mobile)	5°	1.37
	15°	0.348
	30°	0.147

Table 2 Separation distances due to unwanted emissions

It should be noted that these distances are determined based on assumptions for the unwanted emission levels which are different to those proposed for the UK Broadband licence. In the case of the central stations (CS-1 and CS-2) and in the case of the mobile station (TS-3), the level of the unwanted emissions assumed in the report are significantly below the values proposed by Ofcom.

Also in ECC Report 100, the separation distances required to avoid receiver saturation are as shown in Table 3.

³ See document SE(07)100, annex 28.

	CS-1			CS-2		
Arrival angle of BWA signal at FSS E/S	5	15	30	5	15	30
FSS E/S antenna off-axis gain (dBi) ¹	14.5	2.6	-4.9	14.5	2.6	-4.9
BWA EIRP (dBm)	60			52		
LNB Saturation Level (dBm)	-50					
Excess over LNB Saturation Level (dB)	124.5	112.6	105.1	116.5	104.6	97.1
Frequency (MHz)	3700					
Required Separation Distance (km)	10.89	2.76	1.16	4.33	1.10	0.46

Table 3a Separation distances due to FSS receiver saturation by BWA central station emissions

	TS-1			TS-2 (Indoor) ²			TS-3 (Mobile)		
Arrival angle of BWA signal at FSS E/S	5	15	30	5	15	30	5	15	30
FSS E/S antenna off-axis gain (dBi) ¹	14.5	2.6	-4.9	14.5	2.6	-4.9	14.5	2.6	-4.9
BWA EIRP (dBm)	50			32			20		
LNB Saturation Level (dBm)	-50								
Excess over LNB Saturation Level (dB)	114.5	102.6	95.1	96.5	84.6	77.1	84.5	72.6	65.1
Frequency (MHz)	3700								
Required Separation Distance (km)	3.44	0.87	0.37	0.43	0.11	0.05	0.11	0.03	0.01

Table 3b Separation distances due to FSS receiver saturation by BWA mobile station emissions

Similar to the case of unwanted emissions, these results are based on assumed values of BWA e.i.r.p. lower than those proposed by Ofcom (see Table 1).

ITU-R Report M.[8/185] also includes results which show the separation distances required due to unwanted emissions are up to tens of kilometres and that the receiver saturation can occur if the separation distances are less than some kilometres or some hundreds of metres, depending on terrain.

The WiMAX Forum⁴ has also considered the consequences of adjacent frequency operations between WiMAX and FSS earth stations in its report “Compatibility of Services Using WiMAX Technology with Satellite Services in the 2.3 - 2.7 GHz and 3.3 - 3.8 GHz Bands”⁵. With regard to the issue of unwanted emissions, the report breaks this down into its two components, out-of-band emissions and spurious emissions. For the more benign spurious emissions, the separation distance is about 5 km for the worst case azimuth. The report does not assess the effect of the higher out-of-band emissions, stating: “If there is insufficient guard band between the two services for the country concerned then this will need to be addressed in further detail”. In the case at hand, there is no guard band between the BWA frequencies and the frequencies allocated to FSS in the UK.

With regard to earth station receiver saturation, the WiMAX Forum report determines a separation distance of about 6 km on the worst case azimuth, based on a WiMAX transmitter e.i.r.p. of 0 dBW/MHz. For comparison, the e.i.r.p. proposed by Ofcom is 29 dBW/MHz.

⁴ The WiMAX Forum is an industry group “committed to promoting and certifying interoperable WiMAX products”, <http://www.wimaxforum.org>.

⁵ Report available at <http://www.wimaxforum.org/technology/downloads/>

The studies conducted by CEPT and the WiMAX Forum are included in a draft new ITU-R Report which is being developed by ITU-R WP 4A into compatibility between BWA systems and FSS systems⁶. This document also contains details of similar studies conducted by two regional regulatory groups: “APT Wireless Forum” and “CITEL PCCII”. In both of these additional studies, it is determined that separation is required between FSS earth stations and BWA stations operating in adjacent bands. Both of these additional studies have used assumed values for BWA in-band and out-of-band emissions which are much lower than those proposed by Ofcom.

Hence, there is ample evidence that adjacent frequency operations between BWA and FSS earth stations present a significant interference issue and this includes evidence published by the industry forum representing WiMAX interests.

The CEPT has agreed with us and has included in ECC Decision ECC/DEC/(07)02 the following decides 3:

“3. that for the deployment of BWA networks in the frequency bands identified in Decides 1, administrations shall take into account the in-band **and adjacent band compatibility** with other services/systems (e.g. FS, FSS, ENG/OB, etc) and as a result, coordination of the BWA CS with existing services/systems may be required in the concerned area;” [*emphasis added*].

The required separation distances determined in the adjacent band interference studies are generally a number of kilometres in the case of central stations and terminal stations, and are generally hundreds of metres in the case of mobile stations. Since Ofcom proposes e.i.r.p. limits much higher than those assumed in the sharing studies, the separation distances required to prevent receiver saturation are likely to be much higher than those suggested by the studies and reproduced above. Although Ofcom proposes to retain the current out of block emission limits for the time being, the fact that much higher power BWA stations will be permitted must increase the likelihood that stations will operate very close to those limits. In any case, the limits proposed by Ofcom are higher than those assumed in ECC Report 100 and hence the separation distances will be higher than suggested in that report.

Whatever values are chosen for the in-band e.i.r.p. limits and the out of block limits, some geographic separation is required and this needs to be ensured through appropriate regulation. The location of the terminal stations and mobile stations may not be known and this raises the question as to whether it would be feasible to coordinate such stations with FSS earth stations. Also, it would not be possible to coordinate with the majority of TVRO earth stations because their locations are not centrally recorded.

There have been reported several instances in other countries where BWA deployment on frequencies adjacent to FSS operations has caused harmful interference. For example the Malaysian government is reportedly considering withdrawal of its 3.5 GHz BWA licences due to interference with satellite earth stations operating on frequencies “very close” to the BWA systems⁷. The Office of the Telecommunication Authority in Hong Kong has recently decided not to proceed with authorisation of BWA systems in the 3.5 GHz band, after

⁶ See Annex 1 to ITU-R Document 4A/429 (28 June 2007).

⁷ As reported in the Magazine of Engineering & Technology, Institution of Engineering & Technology, May 2007 issue Vol 2, No 5.

carrying out technical studies, including test measurements, into co-frequency and adjacent frequency operations with FSS earth stations⁸.

Hence, SAP REG strongly urges Ofcom to give urgent consideration to how it will protect FSS earth stations operating in the band 3600-4200 MHz from interference from BWA systems operating below 3600 MHz. As this could require additional licence conditions on the BWA operator, SAP REG suggests that Ofcom should not proceed with the proposed licence amendments until this issue has been fully addressed.

⁸ <http://www.ofta.gov.hk/en/report-paper-guide/paper/consultation/20070511.pdf>