BASIC DETAILS

Consultation title: Application for a variation to 3G licences (and consequent proposal to vary draft 2GHz MSS/CGC Base station licences)

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Name Mark Waddell Signed (if hard copy)

BBC Response to Ofcom Consultation:

Application for a variation to 3G licences (and consequent proposal to vary draft 2GHz MSS/CGC Base station licences)

The BBC welcomes Ofcom's consultation on proposals for variations to 3G and CGC base station licences. Our prime concern remains the protection of the increasingly scarce 2GHz spectrum required for the operation of our wireless cameras. The 3G (2110 – 2170MHz) and CGC (2170 – 2200 MHz) allocations are adjacent to the 2GHz PMSE bands (2025-2110MHz and 2200-2300MHz) with no guard band to protect the low power wireless camera signals (20dBm typ.) from the high power base station signals (68dBm proposed). This inevitably results in significant interference at the PMSE band edges which effectively sterilises between 1 and 2 wireless camera channels for each adjacency.

The 2GHz PMSE channels are essential to programme making and ENG operations for all UK broadcasters. This spectrum has become increasingly congested given the anticipated losses from 2500-2690MHz resulting from the 2.6GHz award proposals. The licence conditions discussed in this latest consultation document pose a further threat to our PMSE operations. We have discussed these issues with Ofcom on a number of occasions and in an earlier response[1] we requested a tightening of the permitted out of band energy into the PMSE bands to improve the utility of the PMSE spectrum. We have also requested clarification of the actual performance of typical 3G base stations so we can better understand the interference scenarios. Unfortunately the calculations in this latest consultation are presented without any supporting measurements and provide only limited insight into the interference expected in real-world deployments.

In Ofcom's preparation for its 2.6GHz award, it analysed the compatibility requirements for different services that might be awarded the 2.6GHz spectrum. The technical licence conditions resulting from this analysis were documented in an Ofcom statement[2] which recommended an EIRP limit of 61dBm and an out of band limit of -38dBm/MHz to protect PMSE. In addition, an EIRP limit of 25dBm was proposed on certain so called restricted channels where the adjacent licensee might use a different radio technology. It is of considerable concern, given this previous work, that Ofcom now proposes an increased base station power of 68dBm for 3G licensees with no improvement to the out of band performance specification of -15dBm/MHz currently licensed. The justification for this seems to be that the interference from 3G base stations into PMSE is already so acute that a further increase will not affect us too much.

Ofcom's analysis in this consultation concludes that the ACLR contribution to PMSE interference often dominates based on the existing limit of -15dBm/MHz specified in 3GPP TS 25.104. Unfortunately it is proposed to retain this unsatisfactory limit in the revised licences. Our concern is that the 3GPP level of -15dBm is a relaxed specification which can be easily met. A 6dB increase in on-channel EIRP will inevitably result in an increased level of actual OOB emissions from the 3G base, due to reduced PA headroom, and a further reduction in PMSE spectrum quality.

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[1] BBC response to Ofcom 2GHz CGC consultation:
http://www.ofcom.org.uk/consult/condocs/cgcs2/responses/BBC.pdf

[2] Ofcom statement on 2.6GHz TLCs:
http://www.ofcom.org.uk/consult/condocs/2ghzrules/statementim/statement/statement.pdf

Q1 Are there any reasonable grounds why Ofcom should not grant the request to vary the five Wireless Telegraphy Third Generation Mobile Licences by increasing the permitted maximum in-band EIRP to 68dBm as soon as practicable? If so, please explain your reasoning for this.

Our primary concern is that this proposal ignores the recommendations resulting from Ofcom's own 2.6GHz award compatibility studies. This work recommended an out of band limit of -38dBm/MHz and an in band EIRP of 61dBm.

Background

The existing 3G masks were designed without consideration of the PMSE adjacency and there is considerable interference in areas where H3G coverage has been implemented. This is a particular concern at 2105MHz but also at 2095MHz. Current operational practice is to avoid these channels whenever possible. We feel future variation to the UK 3G licences should respect the PMSE requirements. Our analysis, presented in this section suggests that modest improvements in base station out of band performance would dramatically reduce the interference to PMSE and this would improve the utility of the PMSE spectrum. We feel such proposals would be in line with Ofcom's duty to ensure "the efficient management and use of the spectrum for wireless telegraphy".

Analysis

The total interference experienced by a PMSE receiver is a function of the ACS characteristic of the receiver and the ACLR of the interfering base station.

The ACS performance of PMSE receivers is discussed in Annex A and the following values are appropriate for interference calculations when considering the PMSE channels at 2095MHz and 2105MHz:

PMSE Channel Centre Frequency	2095MHz	2105MHz
Typical receiver ACS (dB)	67	55
Enhanced receiver ACS using filters (dB)	107	85

Table 1: PMSE Receiver ACS performance

The ACLR values proposed in this consultation are shown in Table 2 below.

PMSE Channel Centre Frequency	2095MHz	2105MHz
Proposed ACLR for 68dBm EIRP (dB)	71	54

Table 2: Proposed base station ACLR specifications

For the interference performance to be determined by the receiver selectivity characteristic, the ACLR values should exceed the ACS values.

Comparing the values in table 1 and table 2 for the PMSE channel at 2095MHz it can be seen that the ACS contribution dominates for receivers without additional filtering. The ACS can be improved to 107dB with a filter, and in this case the ACLR contribution (71dB) limits the performance. This partly explains the reduced performance currently experienced when licensing 2095MHz.

For the PMSE channel at 2105MHz, the ACS and ACLR contributions are similar for receivers without additional channel filtering. However, by fitting a channel filter with 30dB suppression (as discussed in Annex A), the ACS is improved to 85dB, which is some 31dB above the ACLR. Improving the out of band performance by 23dB to the figure of -38dBm/MHz previously proposed by Ofcom would improve the ACLR to 94dB, thus making the PMSE channel at 2105MHz far more usable. For ACS=ACLR, an improvement in OOB to -46dBm/MHz would be desirable.

A further important consideration is the receiver sensitivity degradation for a given level of OOB emission. This is a function of the isolation between the 3G base station and the victim PMSE antenna. This is considered in Table 3 below where line of sight propagation from 3G base station to PMSE antenna is used to calculate the worst case coupling. The table shows that a 1dB degradation in PMSE receiver sensitivity is experienced by a receiver operating at 140m from a 3G base station with an OOB specification of -38dBm/MHz. This is just about acceptable to us, and would improve with clutter between the 3G base and the victim PMSE antenna.

Receiver parameters:			
Frequency	2105 MHz		
Noise figure	3 dB		
Antenna gain	3 dBi		
OOB level	-38 dBm/MHz		
Receiver noise floor	-111 dBm/MHz		
Performance Degradation (dB)	OOB level (dBm/MHz)	Required FSL (dB)	Distance (m)
0.1	-127	92	469
1	-117	82	141
3	-111	76	72

Table 3: PMSE receiver performance degradation from 3G OOB emissions

Conclusion

Base station ACLR dominates the interference contributions at 2105MHz and 2095MHz for the proposed licence variation and the channel at 2105MHz is effectively sterilized in areas where H3G bases are deployed at 2112.5MHz. Although the PMSE channel at 2105MHz is subject to degradation due to finite ACS performance, this can be overcome by using additional filtering. An improvement in base station OOB level is thus required to address the interference problem and we support Ofcom's earlier work recommending

a base station out of band level of -38dBm/MHz. Ideally, an improvement to -46dBm/MHz would be appropriate and highly desirable.

Increasing the EIRP limits for 3G licences without addressing OOB limits would be a worst case scenario for wireless camera users. The channel at 2095MHz would suffer a degradation if additional filtering were not used, due to finite receiver ACS, and we would expect actual base station OOB levels to rise as a result of the variation due to reduced PA back offs and decreased compliance margins.

Q2 Are there any reasonable grounds why Ofcom should not also apply the increased permitted maximum in-band EIRP to future 2 GHz MSS/CGC licences? If so, please explain your reasoning for this.

The technical licence conditions for 2GHz MSS/CGC licences were published in a previous Ofcom consultation statement. The CGC assignments will potentially degrade up to 2 PMSE channels in the 2200-2300 MHz band. We do not feel it is appropriate to relax the CGC licence conditions and degrade a further 2 PMSE channels at a time when 2GHz spectrum for PMSE is becoming increasingly scarce.

Annex A– Receiver ACS performance with and without filters

PMSE receivers use DVB-T technology, with RF circuitry derived from DTT receiver designs. Typical designs use high-end TV CAN tuners operating at UHF with suitable down converters connected to the PMSE antennas. As such, the selectivity characteristics tend to be similar to the higher performance consumer DVB-T receivers. The ACS of a typical DTT receiver, used in SE42 and SE 43 compatibility studies, is shown in Figure A1 below[3]:

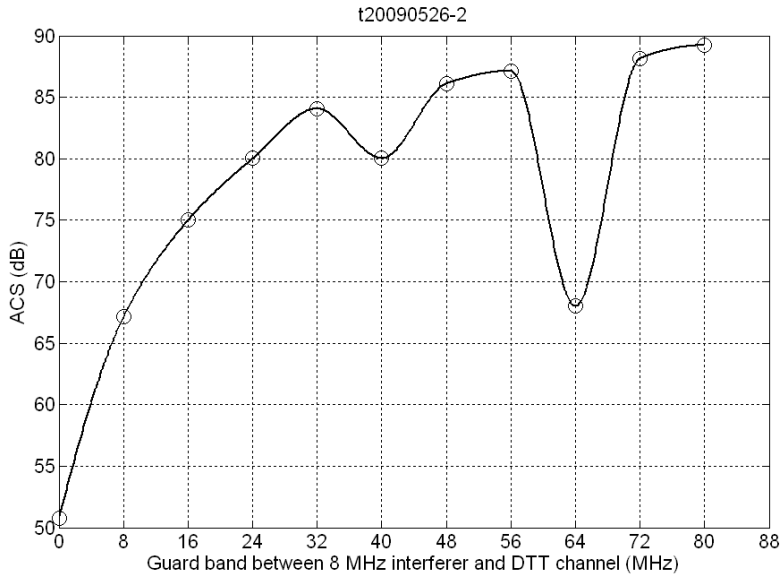

Figure A1: Variation of DTT receiver ACS with interferer guard band.

Fitting band stop filters to protect PMSE receive stations can greatly improve the ACS performance. Figure A2 below, shows the response of a band stop filter deployed at East Tower in London W12, which improves receiver ACS performance by over 40dB for the channel at 2095 MHz

[3] Note Figure A1 shows adjacent-channel selectivity as a function of the guard band between an 8 MHz interferer and a victim DTT channel. These are based on conductive measurements of protection ratios from a DVB-T interferer to a DVB-T receiver in an additive white Gaussian channel

Figure A2: Typical band stop filter for PMSE receiver sites

Previous research commissioned by Ofcom from ERA[4] demonstrated that band pass filters could also improve the ACS performance of PMSE receivers. The filter response shown in Figure A3 from ERA's report suggests that the ACS of a receiver could be improved by over 30dB, thus improving rejection of interference from adjacent base stations at 7.5MHz offset. Such a filter would be particularly useful in a PMSE application using the channel at 2105MHz.

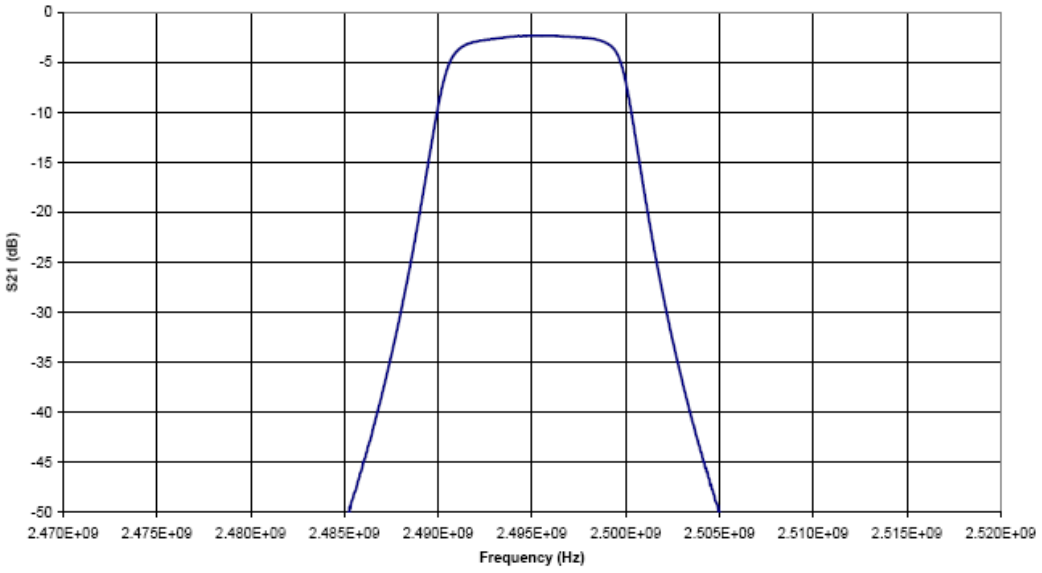

Figure A3: PMSE band pass filter response procured for ERA 2007-0447 report

[4] ERA Report 2007-0447: http://www.ofcom.org.uk/research/technology/ctc/era05-07/2007-0447.pdf