Public Sector Spectrum Release (PSSR).

Technical coexistence issues for the release of the 2.3 and 3.4GHz award.

EE's response to Ofcom's consultation

15th May 2014.

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1. Introduction

EE is pleased to respond to the Ofcom document 'Public Sector Spectrum Release (PSSR). Technical coexistence issues for the 2.3 and 3.4 GHz award'.

We are generally in agreement with the Ofcom analysis but suggest that further work is desirable in a number of areas to fully address the coexistence issues surrounding release of the bands.

We believe that the analysis somewhat underestimates the likely number of Wi-Fi systems that may be affected on release of the 2.3GHz and 3.4GHz bands, but that the underestimation is probably not significant in terms of ability of Wi-Fi users to mitigate the additional impact. For those cases where user mitigation is not possible, such as where Wi-Fi devices are connected to public networks, we suggest that Ofcom works in relevant international fora to amend Wi-Fi blocking performance standards to lessen Wi-Fi susceptibility to interference from LTE systems.

To facilitate the widest possible 2.3GHz and 3.4GHz equipment economies of scale we urge Ofcom to adopt least restrictive equipment harmonised standards. In this context we note that the country specific CEPT Report 49 requirements for protection of military radar below 3400MHz of -59dBm/MHz EIRP are excessively challenging for a system deployed at 3410MHz and would prevent operator purchase of standard supplier equipment. We suggest that discussion between Ofcom and the MOD takes place with a view to relaxing the requirements of CEPT Report 49 options A and B to an EIRP of -59dBm/MHz at 3350MHz.

In the area of technical licence conditions we believe that additional work is required in determining appropriate license conditions for fixed user devices. We believe that use of fixed user devices at current maximum permitted in block power limits may cause interference to adjacent block users.

We note the omission of a formal statement of coordination requirements with respect to 2.3GHz systems and maritime and air traffic control radars. We suggest Ofcom clarifies the position in its statement of response to this consultation.

We note that the technical coexistence analysis considers the impact of possible deployment on adjacent spectrum users but offers little analysis on impact of adjacent spectrum users on future incumbents of the 2.3GHz and 3.4GHz bands. Ofcom should undertake due diligence with respect to interference into the 2.3GHz and 3.5GHz bands and publish full details not later than the consultation on draft Information Memorandum. We note in particular that the allowed out of band emission levels of Wi-Fi devices are insufficient to protect LTE systems. We encourage Ofcom to work at international level to update the relevant Wi-Fi standard ETSI EN300 328.

2. Consultation questions

EE's responses to the consultation questions are as follows:-

Question 4.1: Do you agree with our proposal to conduct a market led award through an auction process for licensed use of the 2.3 and 3.4 GHz bands? If not, please provide evidence to counter this proposal.

EE supports the award of the 2.3GHz and 3.4GHz bands through an appropriate market based mechanism. We agree that market based mechanisms offer the most efficient and effective method for ensuring optimal spectrum use.

We note that if Ofcom proceeds on the basis of a Combinatorial Clock Auction (CCA), it will be important to analyse how various policy measures interact with the CCA. For example, asymmetric spectrum caps could have an impact on pricing in a CCA but are less likely to in a Simultaneous Multiple Round Ascending auction. Equally, the 'spectrum floors' included in the Combined Award of 800 MHz and 2.6 GHz affected bidders' incentives and the primary rounds were not as informative as they could have been with respect to understanding the final outcome. It would be important for Ofcom to ensure that a multiple round auction actually facilitates price discovery.

Question 4.2: Do you agree that we should not offer arrangements for aggregate bidding for low power use for these release bands? If you believe we should make such arrangements, please provide supporting evidence.

EE does not support preferential treatment of aggregate bidding for low power use. EE agrees with Ofcom's position that there was limited revealed demand for low power shared access in the recent combined award of 800MHz and 2.6GHz and therefore the overhead of incorporating the option into this forthcoming award is not justified. Only three bidders placed bids on low-power lots in the combined award and two of these sets of bids appeared to be entirely for strategic reasons to the detriment of the efficiency of the auction. Based on evidence from the Combined Award, we do not believe there is any chance that low-power bidders could in aggregate win against high-power bidders and any design to allow aggregation of low-power bidders would compromise the efficiency of the auction.

Question 6.1: Do you have evidence to challenge our methodology and assumptions, which show the number of Wi-Fi routers likely to be affected by LTE interference is low?

EE notes that the analysis is largely based on the assumption of macro layer deployment. In reality a hierarchy of deployment of macro layer, small cell and femto cells is likely. The aggregate effects of such a deployment may mean that the number of Wi-Fi routers affected is somewhat under estimated. EE however believes that within the context of available mitigation options such underestimation is not likely to prove significantly problematic.

Question 6.2: Do you have evidence to challenge our methodology and assumptions, which show the number of Wi-Fi client devices affected by LTE interference is low?

Some interference mechanisms such as the simultaneous use of Wi-Fi client devices and LTE devices may have been overlooked. A user simultaneously using a Wi-Fi client for computer connection and making an LTE call is an example. EE however believes that within the context of available mitigation options such under estimation is unlikely to prove significantly problematic or at worst a transitory issue in the context of the Wi-Fi client device replacement cycle.

Question 6.3: Do you agree with our assessment of the available options for mitigation of interference to home networks?

EE supports Ofcom's view of the available mitigation options for Wi-Fi. Wi-Fi is heavily congested in some areas and EE notes that it may prove difficult for users to understand the sources of interference affecting Wi-Fi performance and whether the source of the interference is neighbour Wi-Fi routers or LTE. In such a scenario the solution of moving the device may not entirely resolve the issue from the user's perspective. The choice of a 50% throughput is somewhat arbitrary and it is not clear the extent to which it is reflective of an adequate user experience.

Question 6.4: Do you agree with our assessment of the available options for mitigation of interference to public networks (both indoor and outdoor)?

EE supports Ofcom's assessment. Public Networks (both indoor and outdoor) Wi-Fi stations (routers) are installed and managed by professionals therefore appropriate mitigation solutions such as proposed filters included in the Wi-Fi stations (routers) should be possible. The problem may however remain for Wi-Fi devices, such as Wi-Fi in computers. EE notes that 'hand down' may result in Wi-Fi devices being in place for longer than is assumed by the analysis.

Question 6.5: Do you agree with our assessment of the available options for mitigation of interference to Enterprise Networks?

Please refer to the answer to Question 6.4.

Question 6.6: Do you agree with our conclusion that the impact to Wi-Fi is not of a significant nature and therefore no regulatory intervention is necessary? If not, can you provide evidence?

EE supports the view that the impact to Wi-Fi is not of a significant nature, but we do not agree that no action is required.

- We agree that Wi-Fi stations/routers installed by professionals (ISP, Enterprise, public network operators) can be updated with a new product design with the inclusion of appropriate filters. We also note that some moderate cost chip-set filters are available.
- Wi-Fi in LTE terminals can also be designed with appropriate filter inside to prevent in-device interference.
- For consumer Wi-Fi devices, for example Wi-Fi in computers, Wi-Fi routers in scenarios where “moving the device” mitigation cannot be applied in practice, the only solution is to change the European harmonised standards with respect to minimum Wi-Fi receiver blocking level requirements. We suggest Ofcom presses for the revision of the ETSI EN 300 328 standard minimum blocking levels.

We also note that in the studies conducted by Ofcom, the interference from Wi-Fi (out of band emissions) to LTE base station/user equipment reception was not analysed. The Wi-Fi standard has defined Wi-Fi Out of band emissions (spurious) of -30 dBm/MHz which is not sufficient to protect the LTE bands. Even though some measured Wi-Fi Routers/devices perform much better than the minimum requirements defined in the standard, significant variance between devices exist. The solution to provide appropriate protection to LTE band reception below 2390 MHz is the update of the Wi-Fi harmonised standard EN 300 328.

Question 7.1: Do you agree that we do not need to perform technical analysis on the applications in the middle of the band as set out in paragraph 7.7?

We agree that such analysis is not necessary.

Question 7.2: Do you agree with our technical analysis in relation to Bluetooth devices operating in the 2.4 GHz band, and that no additional restrictions are required in order to protect these applications?

We agree with the technical analysis undertaken.

Question 7.3: Do you agree with our technical analysis in relation to ZigBee devices operating in the 2.4 GHz band and that no additional restrictions are required in order to protect these applications?

We agree that no additional restrictions are required in order to protect ZigBee applications.

Question 7.4: Do you agree with our technical analysis in relation to video sender devices operating in the 2.4 GHz band and that no additional restrictions are required in order to protect these applications?

We agree that no additional restrictions are required in order to protect video sender applications.

We note that video senders have in the past acted as a particular source of interference into 3G systems. We request that Ofcom, as part of pre-award preparation, carries out a study into interference from neighbouring 2.4GHz systems, including video senders, into the 2.3GHz band.

Question 7.5: Do you agree with our technical analysis in relation to radio microphones devices operating in the 2.4 GHz band and that no additional restrictions are required in order to protect these applications?

EE provisionally supports the analysis but questions the practicality of maintaining access for PMSE, on a geographic basis, unless such access is defined on the basis of limited coordination burden on mobile operators. Mobile network rollout will consist of macro, small cell and indoor system rollout and coordination of all these base station types would be significantly burdensome.

Question 7.6: Do you agree with our technical analysis in relation to short range devices operating in the 2.4 GHz band and that no additional restrictions are required in order to protect these applications?

We agree with the technical analysis in relation to short range devices.

Question 7.7: Do you agree with our technical analysis in relation to medical devices operating in the 2.4 GHz band and that no additional restrictions are required in order to protect these applications?

We support the analysis and that no additional restrictions are required to protect medical devices. We do however suggest that hospital authority's procurement of medical devices should take into consideration the performance of band pass filtering of such devices to optimize robustness to any LTE interference.

Question 7.8: Do you agree with our technical analysis in relation to emergency services use in the 2.4 GHz band and that no additional restrictions are required in order to protect these applications?

We agree that no additional restrictions are required to protect emergency services applications.

Question 7.9: Do you agree with our technical analysis in relation to hearing aids and assisted listening devices operating in the 2.4 GHz band and that no additional restrictions are required in order to protect these applications?

We agree.

Question 8.1: Do you agree that the available mitigations address the potential shortfall of spectrum for PMSE at major events and that no additional regulatory intervention is necessary to protect PMSE in frequencies adjacent to the award bands?

We agree.

Question 8.2: Do you agree that PMSE should have some continuing access to spectrum in the 3.4 GHz band until new services are rolled out in an area?

EE agrees subject to a minimum overhead coordination procedure being developed.

Question 8.3: Which option for the provision of information about the roll-out of new services is most the appropriate? Should the requirement to supply information apply only in designated locations?

EE supports the option of a limited, nominated list of areas to which PMSE users would retain access until network rollout reached those areas. We do not support any arrangement that requires coordination of individual base stations as this would prove unduly burdensome.

Question 8.4: Do you agree that any continuing access should be limited to five years from the award of new 2.3 and 3.4 GHz licenses?

We believe PMSE should not have access to the 2.3 GHz band after the award of the new 2.3 GHz licenses.

We believe that any continuing access to 3.4 GHz spectrum should be limited to 5 years from the date of award of the 3.4 GHz licenses. We believe that this represents a reasonable period to allow PMSE user equipment migration to alternate bands.

Question 8.5: Do you agree with our assessment that there is little incremental benefit in on-going PMSE access to the 2.3 GHz award band?

We agree.

Question 10.1: Do you agree with our proposal that no coordination procedure is necessary in respect to maritime radar?

We agree that no coordination is required with maritime radar. We do however note that analysis was confined to assessment of the 3.4GHz band with no specific analysis or statement with respect to the 2.3GHz band.

Question 11.1: Do you agree with our proposal to require coordination procedures for the 3.4 GHz band - in order to protect of air traffic control radar - in line with those applied to the 2.6 GHz band?

EE supports the requirement to protect air traffic control radar. We suggest that the same PFD limit per MHz as for the 2.6GHz band is used for the 3.4GHz band. We note that Ofcom has not stated the required out of band noise limit to be applied to 3.4GHz system interference to radar. We also note that any statement with respect to 2.3GHz system interference to air traffic control radar is absent from the consultation. Ofcom needs to provide clarity with respect to any requirements in relation to the 2.3GHz band.

Question 12.1: Do you agree that for mobile satellite services operating in the band between 2170 and 2200 MHz, coexistence with LTE operating in the award bands above 2.35 GHz is unlikely to be an interference problem?

We agree.

Question 12.2: Do you agree that satellite services operating in the band 2483.5 MHz to 2500 MHz can co-exist with LTE operating in the award bands (i.e. 2350 to 2390 MHz and 3410 to 3590 MHz) and there is unlikely to be an interference problem?

We agree.

Question 12.3: Do you agree with that for satellite services operating between 2200 and 2290 MHz, coexistence with LTE operating in the release bands is unlikely to be an interference problem?

We agree that there is unlikely to be an interference problem.

Question 12.4: Do you agree that for amateur satellite services operating between 2400 and 2450 MHz, coexistence with unwanted/out of band emissions of LTE operating in the release bands (the nearest release band is 2350 to 2390 MHz) is unlikely to be a greater problem than the current in-band interference from licence exempt and ISM uses?

We agree.

Question 12.5: Do you agree with our preferred option to adopt our proposed mask with informal co-operation on a case-by-case basis if required?

EE supports the adoption of a harmonised mask aligned to CEPT Report 49, with informal co-operation on a case by case basis, as required.

Question 13.1: Do you agree with our preference not to have a transitional region between blocks for licenses in the 2.3 GHz band?

EE believes a transition block of 5 MHz is required in non-synchronized deployment. This should be a standard feature of licenses. This restricted block could be converted to a normal block dependent on synchronization being agreed by the operators concerned.

EE does not entirely support the Real Wireless[1] position that there is a simple linear decision tradeoff between loss of capacity due existence of guard/transition bands and greater uncontrolled allowed interference without guard band. This is because higher levels of interference are likely in those very areas where traffic demand is highest and the ability to serve that demand with a controlled quality of service has a value independent of absolute capacity.

Question 13.2: Do you agree with our preference not to have a transitional region between blocks for licenses in the 3.4 GHz band?

EE believes a transition block of 5 MHz is required in non-synchronised deployment.This restricted block would be converted to a normal block on synchronization being agreed by the operators concerned.

Question 13.3: Do you agree with our preference to not require synchronisation between different networks in the frequency band?

We agree that decision on synchronisation should be left to mutual agreement between adjacent network operators.

Question 13.4: Do you agree with our preference to include both the permissive (unsynchronized) and restrictive (synchronized) masks within the TLCs in the 2.3 GHz band?

Yes, we agree with this approach but it should be clearly stated that the permissive and restrictive masks can be relaxed based on mutual agreement between adjacent spectrum users.

[1] Executive Summary –MC192 Assessment of Capacity impacts with Various TD-LTE Block Configurations-V3.1, Real Wireless, December 2013.

Question 13.5: Do you agree with our preference to include both the permissive (unsynchronized) and restrictive (synchronized) masks within the TLCs in the 3.4 GHz band?

Yes, we agree with this approach but it should be clearly stated that the permissive and restrictive masks can be relaxed based on mutual agreement between adjacent spectrum users.

Question 13.6: Do you agree with our preference to not require synchronisation between different networks in the frequency band?

Yes, we agree that any decision on synchronisation should be left to mutual agreement between adjacent spectrum users.

Question 13.7: Do you agree with our proposed maximum in band power limit for base stations in the 2.3 GHz band?

Yes we agree.

Question 13.8: Do you agree with our proposed maximum in band power limit for user terminals in the 2.3 GHz band?

Yes, we agree.

We retain some concerns about the fixed or installed user equipment 25dBm EIRP in band power limit. When a device is transmitting at 25 dBm EIRP with a fixed antenna height of more than 1.5 m, it may cause interference to the adjacent spectrum user uplink due to the limitation of base station receiver selectivity/blocking. It should be noted that the base station ACS/blocking is specified by 3GPP for user equipment at 1.5m height above ground level not fixed equipment at greater height. We request that Ofcom consider this in final setting of detailed award license conditions.

Question 13.9: Do you agree with our proposed maximum in band power

limit for base stations in the 3.4 GHz band?

We agree with the proposed maximum in band power of 65dBm/5MHz.

We do not however agree with the proposed out of band power limits below 3400 MHz To facilitate the widest equipment economies of scale we urge Ofcom to adopt least restrictive equipment harmonized standards. In this context we note that the country specific CEPT Report 49 requirements for protection of military radar below 3400MHz of -59dBm/MHz EIRP are excessively challenging for a system deployed at 3410MHz and would prevent operator purchase of standard supplier equipment. We suggest that discussion occurs between Ofcom and the MOD with a view to relaxing the requirements of CEPT Report 49 options A and B to an EIRP of -59dBm/MHz EIRP at 3350 MHz.

Question 13.10: Do you agree with our proposed maximum in band power limit for user terminals in the 3.4 GHz band?

Yes, we agree on the mobile UE TRP of 25dBm.

We consider however that the 35 dBm/5 MHz EIRP for fixed or installed radio is too high. When a licensee is using 35 dBm/5 MHz EIRP for fixed or installed radio applications with UE antenna height more than 1.5 m, it may create interference to the adjacent licensee uplink due to the limitation of base station receiver selectivity/blocking. It should be noted that the base station adjacent channel selectivity/blocking is specified by 3GPP for mobile user equipment at 1.5m height at ground level. CEPT has not studied the impact on the adjacent block uplink due to fixed or installed radio application with UE antenna height at more than 1.5m. We request that Ofcom consider this in setting detailed license conditions.

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Question 14.1: Do you agree with our approach that it is not necessary to impose any guard bands or restricted blocks in order to manage the adjacencies between the incumbent UK Broadband and new users of spectrum to be awarded in the 3.4 GHz band?

We accept the proposed approach up to UK Broadband license expiry. Post license expiry, the same technical conditions as apply to other spectrum users should be mandated.

Question 14.2: Do you agree with our approach to require UK Broadband to

have the same coordination requirements as other users of the band?

Yes, we agree.