

Comments and answers to RA consultation regarding 'Provision of Public Telecommunication Services in Licence-Exempt Spectrum'

1. Introduction

Comments and answers to the RA consultation regarding provision of Public Telecommunication Services in Licence-Exempt spectrum are given in this document. We describe economical and technological perspectives on providing services to third parties by means of wireless access in unlicensed and licence exempt bands. The bands 2400-2483.5 MHz (ISM), 5150-5350 MHz and 5470-5725 MHz are put under special attention due the efforts in implementing Wireless Local Area Networks (WLAN) systems complementing the emerging 3G services. The terminology Radio Local Area Network (RLAN) is used in ITU-R and CEPT for mobile and nomadic LANs based on radio technology. In this document RLAN is corresponding to WLAN, which today is a more popular and widely used acronym.

End-user requirements on access independent services and concepts like nomadic working emphasize the trend towards multi access networks utilizing both fixed lines, as well as a variety of radio access in licensed, license exempt and unlicensed spectrum. Telia, Sonera and small start up service providers like default-city, are today providing public services both for mobile and nomadic users in unlicensed band. Obviously, access networks in the unlicensed ISM band at 2.45 GHz exist both for public and private users in some European countries, e.g. Sweden Norway and Finland, as well as in the US.

The emerging WLAN products operating in the 5 GHz band will be used in a similar way as ISM band devices of today. Thus we can expect end-users having multi-mode terminals giving Internet and Intranet access both in public, corporate and private environments. Interworking between WLAN and 2G/3G cellular systems is being standardised both on a European level within ETSI (i.e. EP BRAN) and on a global level within 3GPP. HiperLAN2 Global Forum (H2GF) promotes the Interworking, and H2GF also supports the mix of private and public services using the same HiperLAN2 equipment in the 5 GHz licence exempt bands. The Eurescom project P1046- LUPA has also come to the conclusion that: "The public UMTS network will not have sufficient bandwidth to support all Next Generation (NG) services. Interworking with other radio systems is required" [1]. It was also found that: "The most potential systems for interworking are Wireless LAN and UMTS/GSM".

Several presentations from the telecom manufacturers (e.g. Nokia, Siemens) have announced that future terminals will combine WLAN support with 3G and GPRS (General Packet Radio Service). In a white paper by Siemens [2] it "3G mobile radio will unleash a wave of new devices with varying shapes and functions. In conjunction with short-range radio technologies (such as DECT, Bluetooth, Wireless Local Area Network (WLAN)), several units in close proximity can be interconnected very quickly and simply as required without the use of cables." The growth of WLAN devices is already remarkable and it is necessary for UK and Europe to allow the multifaceted use of the new technology to keep pace with the US. Public services based on WLAN in unlicensed bands are well

established in US. In Japan NTT, KDDI, Toshiba and Matsushita have been running trials, which provide a user-friendly, high-quality broadband environment using high-speed wireless technology demo based on the Japanese version of HiperLAN2 [4]. Toshiba also provided multimode terminal for combined public access using hybrid Personal Handyphone System (PHS) and 5 GHz WLAN. This trial aimed at providing compact terminals for use by the general public. The European and global deregulation requirements alongside with technological progress in wireless systems inevitably open the door for a mix of public and private services for mobile and nomadic users irrespective of operational frequency. European research projects within the IST framework, see e.g. the TONIC presentation [3], give technical and economical reasons for UMTS and WLAN integration.

The member companies in H2GF support the provision of public services in license exempt band. This is in agreement with the H2GF mission statement: "Drive the adoption of HiperLAN2 as the globally accepted, broadband wireless technology in the 5GHz band, providing connectivity for mobile devices in corporate, public and home environments." Obviously, the public services are necessary components for the future of WLAN in Europe.

2. Deregulation and Harmonisation

The use of radio spectrum is subject to licensing for public services using systems like GSM/GPRS and UMTS. However, successful implementation of low powered short-range devices and mobile terminals increase the number of devices, which can be used both within public and private networks. New as well as incumbent operators can complement the public services offered by systems in licensed bands by means of access in licence exempt bands.

The European harmonisation of radio standards and spectrum is promoted by the coordination in bodies like ETSI and CEPT. The solution using same systems all over Europe enhances the European wireless community and UK can be a leader in promoting new combinations of systems and services rather than hold back the possibilities using advanced technology in licence exempt bands. The deregulation in the telecom sector will benefit if the frequency band does not dictate the border between public and private use of existing and new systems and services.

The Finnish incumbent operator Sonera and Nokia has announced a deal which will enhance the existing WLAN-based public services. The Swedish operator Telia is providing public WLAN services in the ISM band both in Norway and Sweden. Some 300 sites are up and running in the end of 2001 and the so-called HomeRun service has been in operation since 1999. The system simplifies access to corporate networks via public Wireless LAN (WLAN) access points in places such as airports and hotels. There is a potential demand, particularly in areas of dense use, for short-range broadband wireless connection to public telecommunication networks to provide customers with, for example, improved Internet access. The end-users already take advantage of price pressure of the public Internet services within the ISM band and between ISM and licensed band. A press release in cellular news (27-Nov-2001) tells that at least 20 million wireless LAN users in Europe by 2006 will use public services, which are available at airports, railway stations and cafes. H2GF agrees on the expectation that countries such as Austria and Germany will be added to the Nordic countries Norway, Finland and Sweden, where public WLAN services exist. The revenues for public WLAN operators will certainly generate more than a billion euro in 2005.

3. Technological Progress

The progress in technology makes it possible to integrate multi-mode transceivers in mobile terminals operating in multi-bands. Low cost access points for WLANs in the 2.4 GHz ISM band and the 5 GHz bands are underway as a complement to cellular access in licensed bands where the peak rates for broadband communications are limited. Furthermore, Bluetooth operation in the unlicensed ISM band is also under discussion for access to public services. With integrated Bluetooth transceivers in more than 30% of all mobile terminals in the end of 2002, it is hardly possible to lock out services in UK as a specific restriction to the end user.

Several companies offer chip sets for and more have plans for integrated multi mode terminals. As an example, in November 2001, Spirea AB and embedded wireless devices Inc. (ewd) announced plans for a triple-band (5.8GHz, 5.2GHz and 2.4GHz) and multi-protocol wireless LAN chipset. The new wireless chipset would support 802.11a, 802.11b and HiperLAN2 wireless protocols with a single-radio solution. More companies offering chip-sets and products operating in licensed, license-exempt and unlicensed band will be on the market within a few years time.

The comments to the consultation are general and can be applied on all the existing licence-exempt frequency bands. The most appropriate licence exempt bands of interest for public services include:

- The DECT band at 1880 to 1900 MHz
- The 2400 to 2483.5 MHz band
- The bands 5.15 to 5.35 GHz; 5.47 to 5.725 GHz and the 5.725 to 5.875 GHz band.

These three bands should be open for the provision of public services. H2GF and the member companies are convinced that UK should take Scenario 3 where "the provision of public telecommunication services is permitted in licence-exempt spectrum without a WT Act licence, but with base station registration", as a starting point. However, a registration of access points (i.e. WLAN 'base stations') would not be helpful in bands where the public and private services can be provided by the same system.

4. Questions from RA and Answers from H2GF

Q1: What are the potential gains and benefits to the UK of allowing commercial services in licence-exempt bands, in terms of new innovative services (business models), promoting competition, and making Britain the best place to do e-business?

A1: The exploitation of new services based on short-range broadband public access telecommunication systems would benefit early adoption and competition. Britain would keep its position in the 'wireless community' and not fall back with respect to new business models. Keeping the existing regulation would delay, or even prevent, the introduction of new products and services.

New broadband radio technologies, which have the potential for efficient and effective shared use of the limited spectrum resource, are particularly suitable for deployment in uncoordinated licence-exempt bands. The current Exemption Regulations would mean that new and existing technologies, which operate efficiently in uncoordinated licence-exempt spectrum, cannot be utilised for public services. The problems of congestion in areas of high demand for high data rate public telecommunication services may be hard to solve if there is nothing to complement GPRS and UMTS capacity.

Q2: Will the introduction of public telecommunication services into existing licence-exempt frequency bands, within the conditions of use identified in Appendix B, result in unacceptable levels of interference to existing users, and if so, in what geographic locations might this be expected?

A2: Commercial and public services in the unlicensed 83.5 MHz in the 2.4 GHz ISM band meet the best effort requirements of Internet access. The frequency spectrum is shared between a variety of devices and it could result in high levels of interference in large indoor environments or outdoor if the penetration of devices is too high. Nevertheless, the typical data rates of today and a WLAN penetration of less than some 25% in the 2.4 GHz ISM band are possible to handle. The amount of spectrum in the licence exempt 5 GHz bands will allow new services operating above the peak rates of the systems within the licensed bands and the 2.4 GHz ISM band. Here the 19 RF channels designated for HiperLANs assure a high system capacity and would allow a combination of public and private services without congestion.

Q3: Would the introduction of public telecommunication services, into existing licence-exempt allocations and within the current conditions of use identified in Appendix B, result in congestion of the frequency bands?

A3: For voice services in the DECT band 1880-1900 MHz the capacity is sufficient for public traffic in addition to the existing private and corporate traffic. Public services in the DECT band would not result in congestion since the dynamic channel allocation strategy over the 20 MHz of bandwidth enables traffic capacities of hundreds of Erlangs in dense environments. Voice service in the DECT band has been offered in hot spots as a complement to licensed services in several countries.

It is possible to provide public and private Internet and Intranet services in the 2.4 GHz band. The existing WLAN standards operating in this band are mainly coverage rather than capacity limited.

The use of the 5 GHz bands designated for mobile applications according to the CEPT ERC(99)023 decision will not result in congestion within the time period until 2010. The regulatory requirements of Dynamic Frequency Selection and Transmitter Power Control are efficient mitigation both for Inter and Intra system interference. Estimations of total spectrum requirements based on HiperLAN2, or similar systems, show that approximately 500 MHz is necessary for the residential, corporate and public environments. Thus, the designated 455 MHz for mobile applications in the licence exempt band should be opened for public services as a complement to licensed bands. In fact this can allow a cost efficient service provisioning and deployment of the 3G systems. The licence exempt band at 5 GHz will allow new types of services not possible to manage and accommodate under the UMTS spectrum allocations.

Q4: In bands where channel access techniques have been identified for specific services, will these techniques be sufficient to avoid future congestion? If not, please give information about other techniques that might be applicable.

A4: DCA in the DECT system is specified to avoid interference and congestion for voice services. The direct sequence (DS) spread spectrum technique in the IEEE 802.11b standard in the ISM band is used to accommodate several users in an interference hostile environment. The MAC protocol CSMA in combination with the spread spectrum is sufficient for the penetration rate, number of users, and service data rates of today. However, the emerging number of Bluetooth devices in combination with microwave ovens and other ISM band products will certainly make the band congested. The introduction of new high data rate applications and quality of service (QoS) requirements need the capacity given by the 5 GHz system. The combination of capacity,

interference mitigation techniques and QoS support of HiperLAN2 makes it an excellent solution for public services in the 5 GHz licence exempt bands.

Q5: What type of public telecommunication services could be offered in licence-exempt spectrum and what is the anticipated market potential?

A5: The market potential for new services in licence exempt spectrum have been estimated to tens of millions of user within a few years time. The penetration rate of WLAN devices in the 2.45 GHz band will reach a significant part of the laptop market already in 2003. These devices will be used for Internet and Intranet access in private and public environments. Penetration for public services in the 5 GHz band will reach some 30% in 2010. Note that in the US a professor in communication research has stated in a network conference: "There will be more WLAN than 3G devices", which is an example of the demand of high data rate nomadic services. Nevertheless, H2GF is certain that the combined use of UMTS and WLAN in license exempt bands provide the basis for a variety of public IP services.

Q6: Assuming that there would be a lower quality of service available from public telecommunication services using licence-exempt spectrum, compared to those using licensed spectrum, how could potential end users be informed of this?

A6: The pricing of the services in each of the licensed, license exempt and unlicensed bands should reveal the trade-off between quality of service and capacity. Commercial and public systems in licence exempt bands will allow new services operating above the peak rates of the systems within the licensed bands. It is important to inform the potential users that 2G/3G public services in licensed bands are complemented by WLANs both in the 2.4 GHz and 5 GHz bands regarding the QoS, price and capacity.

Q7: Which, if any, frequency bands identified in Appendix B are not suitable for the introduction of public telecommunication services and why?

A7: The PMR 446 band at 446.00625 - 446.09375 MHz is probably not suitable for public access due to lack of capacity and interefernce mitigation possibilities. Unfortunately the Digital Cellular Telephone system in the UMTS Licence-Exempt 2010 – 2025 MHz could have capacity, co-channel and adjacent channel interference problems if run by independent operators in an uncoordinated fashion. The problems are, however, not significant until a significant market potential and usage of the services provided in this band have been reached.

Q8: Are there any potential problems associated with allowing commercial services in licence-exempt spectrum?

A8: There is a possible sharing problem in the 5 GHz licence exempt band if Fixed Wireless Access (FWA) is allowed in band designated for mobile applications. Not only the sharing between terrestrial mobile/nomadic and FWA systems would endanger the QoS, but also the interference levels to satellites, radars etc could be too high. The sharing between primary services, e.g. satellite feeder links, earth exploration satellites, radars etc and mobile terminals and access points in the bands 5150-5350 MHz and 5470-5725 MHz are based on interference mitigation principles. Introduction of FWA operating in parts of the band and without Dynamic Frequency selection would introduce unacceptable intra system interference levels.

Q9: Assuming that public telecommunication services are permitted in licence-exempt spectrum, what would be considered suitable time scales for making these changes in each of the bands identified in Appendix B?

A9: The timescale for public services in the licence exempt band should follow the emerging standards and products development in each of the bands. The DECT band could be considered immediately for public services since standards and products are mature. The 2.4 GHz is already used elsewhere in Europe and globally for public RLAN services and changing the regulations not later than end of 2002 are recommended. We recommend that the harmonization of public and private services in the 5 GHz licence exempt bands for RLAN and the implementation of the ERC decision are coordinated in UK. All CEPT by frequency authorities should have been made as stated in ERC (99)023 Decision 8: "that this Decision shall enter into force on 31 January 2000."

5. Options for future Exemption Regulations

There is only one way forward when harmonisation, deregulation and technological progress are considered for public services access to licence-exempt spectrum:

- **Option 3:** Remove the prohibition of public telecommunication services from existing Exemption Regulations and allow services to be established with the minimum possible regulatory constraints, relying on technological solutions to limit congestion.

6. Identifying the Benefits

The advantages for corporations, end users and public customers of allowing public services in licence-exempt spectrum include the provision of affordable broadband mobile and nomadic services. A significant product innovation, creation of european and global markets and an increase in the economic value of nomadic working are expected.

7. Conclusions

Existing and emerging radio access systems in the band suitable for RLANs have in built technologies to mitigate interference and congestion. The 5 GHz band is especially well suited for a mix of public and private services since the allocation of mobile services based on the HiperLAN2 standard is made with realistic service assumptions.

8. Summary and Recommendations

H2GF recommends the option 3 - "Full de-regulation – use of licence-exempt spectrum for public telecommunication" in the bands 2400-2483.5 MHz, 5150-5350 MHz and 5470-5725 MHz. The Radio Local Area Network access systems operating in unlicensed and licence exempt bands will complement the public services in the licensed band and allow innovative services and benefits for end users and public customers.

9. References

- [1] <http://www.eurescom.de/~ftproot/web-deliverables/public/P1000-series/P1046/>
- [2] http://www.siemens-mobile.de/mobile-business/CDA/external/press/en/WhitepaperUMTS_new_e.doc
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