LES ACTES DE L'ARCEP

RÉPUBLIQUE FRANÇAISE

Janvier 2010

Utilisation des bandes hautes pour des liens fixes à haut débit

Consultation publique portant sur l'ouverture des bandes de fréquences 57-66 GHz, 71-76 GHz et 81-86 GHz

(25 janvier au 28 février 2010)

ARCEP Autorité de régulation des communications électroniques et des postes
www.arcep.fr

MODALITES PRATIQUES DE LA CONSULTATION PUBLIQUE

La présente consultation porte sur l'ouverture future des bandes de fréquences 57-66 GHz, 71-76 GHz et 81-86 GHz au profit des liaisons point-à-point du service fixe.

L'Autorité, soucieuse de prendre en compte l'intérêt du marché pour ce sujet, souhaite recueillir, au travers de cette consultation, les avis de tous les acteurs concernés, en particulier, les opérateurs, ou futurs utilisateurs, mais aussi les industriels, sur les perspectives de développement d'applications et d'équipements dans chacune de ces bandes de fréquences.

L'objet de cette consultation vise donc à :

- rappeler le **cadre réglementaire** en vigueur ;
- évaluer les **besoins en ressources spectrales** des applications point-à-point du service fixe pour chacune de ces bandes de fréquences ;
- proposer les **modalités d'attribution** de ces nouvelles bandes de fréquences ou parties d'entre elles aux liaisons point-à-point du service fixe.

Modalités pratiques

Les réponses à la présente consultation devront être transmises avant le 28 février 2010 par voie postale ou via courrier électronique au choix des contributeurs :

- par voie postale :

A l'attention de Jérôme Rousseau

Directeur du spectre et des relations avec les équipementiers

Autorité de régulation des communications électroniques et des postes

7, square Max Hymans

75750 Paris Cedex 15

- via le courrier électronique :

En précisant l'objet « Réponse à la consultation publique sur les bandes 60, 70 et 80 GHz » et en l'adressant à : consult.bandeshautes@arcep.fr

Renseignements

Des renseignements complémentaires peuvent être obtenus auprès de :

Ludivine Dépit Tél : 01 40 47 71 09 ludivine.depit@arcep.fr

Jacques Meyer Tél : 01 40 47 70 85 jacques.meyer@arcep.fr

Ce document est disponible en téléchargement sur le site : www.arcep.fr

L'utilisation des bandes de fréquences au profit des liaisons point-à-point du service fixe est actuellement limitée aux fréquences inférieures à 39,5 GHz.

L'intérêt annoncé pour le déploiement de réseaux fixes point-à-point à très haut débit bénéficiant d'une rapidité d'installation de matériel et d'un encombrement minimal conduit l'Autorité à consulter le marché sur l'usage de bandes de fréquences « plus hautes » en vue d'une future ouverture.

A. Cadre réglementaire actuel et conditions techniques

Les bandes de fréquences sont attribuées à différents services de radiocommunication dans le tableau national de répartition des bandes de fréquences (TNRBF).

Dans les bandes 57-66 GHz, 71-76 GHz et 81-86 GHz, plusieurs services coexistent. La répartition de ces différents services peut occasionner des difficultés de partage et conduire à une concurrence pour l'utilisation de la ressource.

La réglementation en vigueur[1] est la suivante

- Bande 57-66 GHz

Cette bande est attribuée au service fixe pour l'Autorité en partage avec d'autres services (exploration de la terre par satellite, inter-satellites, recherche spatiale, mobile terrestre) pour plusieurs affectataires (Espace (CNES), ministère de la défense).

- Bande 71-74 GHz

Cette bande est attribuée au service fixe pour l'Autorité en partage avec d'autres services (fixe par satellite et mobile par satellite espace vers terre) pour l'affectataire ministère de la défense (bande OTAN).

- Bande 74-76 GHz

Cette bande est attribuée au service fixe pour l'Autorité en partage avec d'autres services (radiodiffusion et radiodiffusion par satellite) pour l'affectataire CSA.

- Bande 81-84 GHz

Cette bande est attribuée au service fixe pour l'Autorité en partage avec d'autres services (fixe par satellite et mobile par satellite terre vers espace, radioastronomie) pour plusieurs affectataires (ministère de la défense (bande OTAN), radioastronomie).

[1] Arrêté du 25 juin 2009 portant modification du TNRBF Edition 2008 (Journal Officiel du 27 juin 2009)

- Bande 84-86 GHz

Cette bande est attribuée au service fixe pour l'Autorité en partage avec un autre service (radioastronomie).

Par consultation préliminaire dans le cadre de la demande d'attribution des bandes 70/80 GHz au profit de l'affectataire ARCEP pour le service fixe, les affectataires ministère de la défense, CSA et radioastronomie n'ont exprimé aucune objection de principe à de futures demandes de coordination dans les sous-bandes en partage les concernant.

Aux niveaux international et européen, plusieurs textes ont été élaborés, dont certains récemment, afin de proposer des spécifications techniques d'équipements et leur mise en œuvre dans ces bandes de fréquences :

- des recommandations de 2005 et 2009 de la conférence européenne des postes et des télécommunications (CEPT) proposant un plan de canalisation : ECC/REC/(05)07 pour les bandes 71-76 & 81-86 GHz et ECC/REC/(09)01 pour les bandes 57-64 GHz ;
- le rapport F.2107 de 2007 de l'Union internationale des télécommunications (UIT) pour les fréquences supérieures à 57 GHz ;
- le rapport 132 de 2009 du comité des communications électroniques (ECC) sur la description des régimes de licences ;
- la spécification technique TS 102 524 de l'Institut européen des standards de télécommunications (ETSI) pour les bandes 71-76 & 81-86 GHz.

L'Autorité estime qu'il est préférable que soit appliqué le cadre réglementaire inscrit dans les recommandations européennes susvisées.

Q1. Donner un caractère obligatoire à ces recommandations européennes vous paraît-il contraignant ou au contraire utile au développement des applications sur ces bandes de fréquences ?

Q1.

We strongly suggest following the European recommendations and standards adopting them as mandatory requirements. As the vast majority of the equipment vendors manufacture equipment that conforms to the European recommendations, this will lead to a greater variety of equipment to be offered to potential customers. In addition, conforming to the European recommendations will ease the selection process of the equipment made by relevant customers.

In addition to the above mentioned recommendations, it is important to follow the following ETSI recommendations as well:

1. ETSI EN 302 217-3 V1.3.1 (2009-07)
2. ETSI EN 302 217-4-2 V1.4.1 (2009-03)
3. ETSI EN 302 217-4-1 V1.3.1 (2009-03)

B. Evaluation des besoins

L'Autorité est affectataire de ressources en fréquences dans les bandes 57-66 GHz, 71-76 GHz et 81-86 GHz au profit des liaisons point-à-point du service fixe.

Quelques acteurs ont manifesté auprès de l'Autorité leur souhait de disposer de canaux de fréquences dans les bandes supérieures à 57 GHz.

Les réponses aux questions suivantes permettront à l'Autorité d'évaluer au mieux l'intérêt réel des acteurs du marché dans ces bandes.

Q2. Votre société a-t-elle des projets concernant la fourniture ou l'utilisation de matériel point-à-point du service fixe dans des bandes supérieures à 39,5 GHz, et plus particulièrement dans des sous-bandes de la présente consultation ?

Q2.

There are numerous applications that can leverage the advantages of the 71-76 GHz, 81-86 GHz and 57-66 GHz bands. Following are the main applications:

1. Core network connectivity
2. Access network connectivity and fiber extension
3. Enterprise connectivity
4. National security

Each of the above mentioned applications has different requirements from the wireless backhaul solutions. In the answer to Q5 we provide a short description of the application and the main requirements.

Siklu develops and manufactures millimeter wave wireless backhaul solutions operating at the 71-76 GHz and 57-66 GHz frequency bands. Siklu's products are designed for access network connectivity, fiber extension and national security applications amongst other relevant applications. Siklu's solutions are optimized for these applications providing the necessary performance while dramatically reducing costs by 80%. In addition, Siklu's small, environmentally friendly design results in easier and quicker deployment and adoption.

Q2bis. Si oui, précisez votre projet :

- **la ou les sous-bandes ciblées**
- **le besoin en fréquences (quantité, largeur de bande,…)**
- **le marché visé (cible commerciale, privée, expérimentations en laboratoire,…)**
- **le débit**
- **la longueur du bond et la disponibilité associée**
- **la zone géographique (rurale, grandes villes, zones industrielles,…)**
- **le calendrier dans lequel s'inscrit votre projet**

Q2bis.

Siklu is in contact with numerous leading mobile operators, business service providers, wireless ISPs and other telecom related providers in France. Our understand from these on-going relationships is that there is great interest in these bands particularly the 71-76 GHz and 81-86 GHz band for all of the above mentioned applications with an emphasis on the access network connectivity and fiber extension applications. We expect that as soon as the regulation of these bands will be finalized numerous projects will be initiated and implemented.

Q3. La largeur minimale d'un canal proposée dans le plan CEPT est de 250 MHz. Quelle quantité spectrale minimale recommanderiez-vous d'attribuer à chaque utilisateur ?

Q3.

We suggest that the minimum bandwidth assigned to be 250 MHz. This will enable affordable access to multiple users and prevent spectrum inefficiency and misuse which might lead to blocking of other users. With spectral efficient system design utilizing a 250 MHz channel allows to provide multi-Mbps capacities.

Q4. Quels sont vos besoins à long terme dans l'utilisation de ces bandes ?

Q4.

The introduction of mobile broadband is changing consumer habits with mobile web surfing, emailing and other advanced data services becoming routine. But this Mobile broadband is leading to a dramatic exponential increase in the capacity transported over the cellular network affecting the cellular network planning and particularly the backhaul network. While the 3G/ 4G air-interface and the core network support this capacity explosion it is necessary that the backhaul network will be designed to cope with this new phenomenon as well.

With the dramatic capacity increase and the increase of the density of the cell-sites deployed in 3G

and 4G networks, the backhaul network needs to be carefully planned taking into account the advantages and limitations of the various backhaul alternatives. The increasing number of wireless backhaul links in the 6-38 GHz bands together with the scarcity of available spectrum is eventually leading to a congestion of this spectrum even to a point where it will no longer be available for new allocations.

Understanding this, mobile operators worldwide are turning to the E-band spectrum especially the 71-76 GHz, 81-86 GHz bands to enhance and streamline their backhaul networks. Utilizing the E-band spectrum, mobile operators can better design their backhaul allowing a more efficient frequency plan. Mobile operators are building a layered backhaul network where the 6-38 GHz spectrum will be used for relatively long-haul transmission and the E-band spectrum for high-capacity, short-haul links particularly in urban and sub urban deployments. Doing so, mobile operators are able to increase their backhaul capacity according to their increasing needs without causing frequency congestion. This allows the mobile operators to introduce new and advanced mobile broadband services to the consumers. The consumers on the other hand are enjoying the true experience of mobile broadband at their fingertips.

C. Equipements

Afin de définir au mieux les éventuelles contraintes techniques de l'utilisation de ces bandes de fréquences, l'Autorité souhaite connaître le plus précisément possible les caractéristiques des équipements dédiés à l'utilisation de liaisons point-à-point de service fixe dans ces bandes de fréquences.

Q5. Précisez pour chaque bande :

- **les applications possibles**
- **les types d'équipements et antennes et leurs principales caractéristiques**
- **techniques (gain, puissance à l'antenne, débit, type de modulation,…) envisagés**
- **les fournisseurs**

Q5.

Core Network Connectivity:

In the core network connectivity applications wireless backhaul solutions operating in the 71-76 GHz and 81-86 GHz frequency bands are used to complete segments and expand the core network which is mostly fiber based. Following are the main requirements for this application:

1. Very high capacity: In this application very high capacities of 1 Gbps and possible even multi-Gbps are required. In order to provide these high capacities FDD within the 71-76 GHz and 81-86 GHz or paired FDD between the 71-76 GHz and 81-86 GHz is required.
2. Longer distances: The typical distances between Points of Presence (PoPs) in the core network are relatively long. As such the wireless backhaul solutions are required to achieve

longer distances of 3-8 km. In order to achieve these distances a larger antenna of 2 feet is required. In addition, the systems are required to be high performance systems to reach these distances as well. These requirements have a substantial influence on the cost of the systems.

3. Large form factor: In order to reach the longer distances required for this application a 2 feet antenna is used. As such, the form factor of the equipment used for this application is relatively large.
4. Power consumption: The wireless backhaul solutions for this application are installed in core network PoPs. In these PoPs there are numerous equipments of the core network that consume a substantial amount of power. As such, there isn't a strong requirement that the wireless backhaul equipment will have low power consumption.
5. High cost: Since the total number of wireless links that will be used in this application is relatively small, together with the requirement for capacity and distance the cost of the wireless backhaul solutions will be high.

Access Network Connectivity and Fiber Extension:

In the access network connectivity and fiber extension applications wireless backhaul solutions operating in the 71-76 GHz and 81-86 GHz frequency bands are used to provide connectivity between base stations and/or businesses to an aggregation point or PoP that has fiber connectivity. With the introduction of 3G and 4G mobile networks there is a growing demand to increase the backhaul to each cell site together with an ever growing number of cell sites deployed. These applications are predominantly in urban and dense urban scenarios. Following are the main requirements for these applications:

1. High capacity: In these applications high capacities of up to 1 Gbps are required. The asymmetric nature of the traffic together with the need for better spectral efficiency gives TDD systems an advantage for these applications.
2. Short distances: The distances between cell sites continues to decrease as the need to provide higher capacities to the user increases. This trend will become even more dominant with the introduction of 4G networks. As such, the required distances in these applications are a maximum distance of 2-3 km. The shorter required distances allow simplifying the system design and utilizing a small antenna of up to 1 foot in size.
3. Small form factor: As these applications are predominantly intended for urban scenarios it is very important that the wireless backhaul systems that are used will have an extremely small form factor that will allow to easily blending into the environment. In addition, an all-outdoor form factor provides yet another advantage as it eliminates the need for an indoor space which could be obstructive in the urban environment.
1. Low power consumption: As the deployment of wireless backhaul solutions in these applications are in the urban environment, low power consumption is important to further minimize the footprint of the installation and reduce the cost of the ownership. The systems should have low power consumption, preferably under 26W. This power consumption allows the use of standard "Power over Ethernet" feeding (IEEE 802.3af or

IEEE 802.3at) eliminating the need for an additional power cable.

2. Low cost: Since the total number of wireless links that will be used in these applications is large it is important that the wireless backhaul solutions will be low cost. The smaller antenna, the shorter distance requirements and utilizing TDD duplexing, allow reaching this requirement.

In the deployment of 4G networks topologies it is expected that an underlay layer of picocells will be deployed to provide the required coverage and capacity. This later will require a very low cost, very small, very low power wireless backhaul solutions. Due to the natural propagation characteristics, in particularly the atmospheric attenuation, wireless systems operating is the 57-66 GHz band can deliver high capacities to short distances of up to 1 km. As such this band can be ideal for this application.

In order to allow a very small and low cost solution it is important to ease the requirements of the antenna gain for these frequency bands. This will allow the design of equipment with very small antennas (typical size of 10-15 cm). This will allow these systems to have a small form factor will allow integration of the backhaul equipment with the network equipment into a single solution. This will contribute to the blending of the equipment into the urban environment.

It is important to mention that due to the atmospheric attenuation at this frequency band the risk of interference at the 57-66 GHz band is very low and even negligible.

Enterprise connectivity:

In the enterprise connectivity application wireless backhaul solutions operating in the 71-76 GHz and 81-86 GHz frequency bands are used to provide connectivity between enterprise buildings and campuses.

3. High capacity: In this application high capacities of up to 1 Gbps are required and possibly multi-Gbps capacities are required. In applications where the traffic is asymmetric the TDD will have an advantage while in the very high capacity the FDD will have an adavnatge.
4. Short distances: The distances between the enterprise buildings and campuses are usually relatively short. The shorter required distances allow simplifying the system design and utilizing a small antenna of up to 1 foot in size.
5. Small form factor: A small form factor is an advantage as will ease the installation and reduce the associated zoning fees. In addition, an all-outdoor form factor provides yet another advantage as it eliminates the need for an indoor space which could be obstructive in the urban environment.
6. Low power consumption: Low power consumption is important to further minimize the footprint of the installation and reduce the cost of the ownership. The systems should have low power consumption, preferably under 26W. This power consumption allows the use of standard “Power over Ethernet” feeding (IEEE 802.3af or IEEE 802.3at) eliminating the need for an additional power cable.
7. Low cost: As each customer in this application is expected to install a small number of link the cost of the systems is a secondary requirement.

National Security:

In the national security application wireless backhaul solutions operating in the 71-76 GHz and 81-86 GHz frequency bands are used to provide connectivity between security cameras and sensors that are deployed predominantly in urban scenarios. Following are the main requirements for these applications:

4. Medium-high capacity: In these applications medium to high capacities of hundreds of Mbps up to 1 Gbps are required. The asymmetric nature of the traffic together with the need for better spectral efficiency gives TDD systems an advantage for these applications.
5. Short distances: The distances between the security camera and sensor locations are typically short (for example on street lights at each intersection). As such, the required distances in these applications are a maximum distance of 2-3 km. The shorter required distances allow simplifying the system design and utilizing a small antenna of up to 1 foot in size.
6. Small form factor: As these applications are predominantly intended for urban scenarios it is very important that the wireless backhaul systems that are used will have an extremely small form factor that will allow to easily blending into the environment. In addition, an all-outdoor form factor provides yet another advantage as it eliminates the need for an indoor space which could be obstructive in the urban environment.
8. Low power consumption: As the deployment of wireless backhaul solutions in these applications are in the urban environment, low power consumption is important to further minimize the footprint of the installation and reduce the cost of the ownership. The systems should have low power consumption, preferably under 26W. This power consumption allows the use of standard “Power over Ethernet” feeding (IEEE 802.3af or IEEE 802.3at) eliminating the need for an additional power cable.
9. Low cost: Since the total number of wireless links that will be used in these applications is large it is important that the wireless backhaul solutions will be low cost. The smaller antenna, the shorter distance requirements and utilizing TDD duplexing, allow reaching this requirement.

Q6. Que pensez-vous de la maturité des équipements dans ces bandes de fréquences ?

Q6.

There are a number of vendors manufacturing wireless backhaul equipment operating in these bands. Some of these vendors have available equipment in the market for nearly 10 years. As such, systems operating in these bands are mature and ready to take an important in providing backhaul in the various applications mentioned in previous questions.

Q7. Quel mode de duplexage vous paraît-il le plus approprié (par exemple le modeFDD en duplex 70 / 80 GHz) ?

Q7.

As we have detailed in the answer to Q5 there are applications that TDD duplexing has an advantage while there are other applications that FDD has an advantage. As such we suggest to fully implementing the CEPT and ETSI recommendations and allow the following duplexing schemes:

1. TDD within the 71-76 GHz band
2. FDD within the 71-76 GHz band
3. TDD within the 81-86 GHz band
4. FDD within the 81-86 GHz band
5. Paired FDD between the 71-76 GHz and 81-86 GHz bands

It is important to note that due to the narrow beam widths defined by the above mentioned ETSI standards and the propagation attenuation of these frequencies numerous TDD systems that are not synchronized between themselves can be installed at the same location without causing interference to each other.

D. Modalités d'attribution

Les différentes catégories d'utilisateurs potentiellement concernées par l'ouverture des bandes de fréquences supérieures à 57 GHz pour des liaisons point-à-point du service fixe sont les utilisateurs de réseaux ouverts au public, les utilisateurs de réseaux indépendants et les utilisateurs de réseaux de transport audiovisuel.

L'ensemble des bandes de fréquences de la présente consultation détaillées en partie A sont en partage avec d'autres services et/ou affectataires de fréquences. L'Autorité n'en a donc pas une utilisation exclusive, c'est pourquoi une utilisation de ces bandes en libre usage est exclue.

L'Autorité envisage ainsi un schéma d'autorisation dans lequel les utilisateurs procéderont à une demande d'autorisation d'utilisation de fréquences par assignation. On entend par assignation, toute autorisation accordée pour l'utilisation d'une fréquence sur un emplacement donné et dans des conditions identifiées.

Les titulaires d'autorisations d'utilisation de fréquences radioélectriques accordées par décision de l'Autorité de régulation des communications électroniques et des postes sont assujettis à une redevance annuelle de gestion et une redevance annuelle de mise à disposition.

Références réglementaires :

- le décret n°2007-1531 du 24 octobre 2007 instituant une redevance destinée à couvrir les coûts exposés par l'Etat pour la gestion de fréquences radioélectriques ;

- le décret n°2007-1532 du 24 octobre 2007 modifié relatif aux redevances d'utilisation des fréquences radioélectriques dues par les titulaires d'autorisations d'utilisation de fréquences ;
- l'arrêté du 24 octobre 2007 modifié portant application du décret n°2007-1532 susvisé.

Les dispositions conduisent au 1er janvier 2010 à un montant annuel des redevances de mise à disposition et de gestion d'environ 2 900 euros, équivalent à une liaison bidirectionnelle dans un canal de 1250 MHz.

Q8. Ces modalités d'attribution vous paraissent-elles adaptées aux besoins dumarché ?

Q8.

We suggest that the licensing fee model of these bands should be a "light licensing", self coordinating scheme as described in the CEPT ECC/REC/(05)07 recommendation.

The highly directional, "pencil beam" propagation characteristics of E-band wireless systems mean that operators can plan and deploy networks with an extremely high degree of frequency reuse, minimal frequency coordination and deploy links close to one another with minimal interference concerns. Identifying these advantages, national spectrum regulators worldwide have greatly simplified the licensing process, introducing a new and innovative "light licensing" processes. The "light licensing" process performs the interference analyses and link approval automatically using an on-line, internet-based system issuing the license within minutes. It is important to note that the "light license" awards the link owner the same "first come first served" rights and interference protection of traditional license.

In addition, the administration and analysis costs are vastly reduced. Hence, the cost of licenses under the "light licenses" process can be dramatically reduced. Countries that have implemented the "light licensing" scheme are charging nominal / minimal fees for the license.

Table 1 – Examples of countries adopting light licensing and the license fees

Country	Licensing scheme	Licensing fee
USA	Light licensing	$75 for a 10 year license
UK	Light licensing	£50 per year (~$100)
Australia	Light licensing	AU$187 per year (~$150)

It is important to acknowledge that the current frequency licensing fees formulas in the above mentioned countries are for the entire band of 5GHz (paired). There could be an apprehension that such a policy might lead to spectrum misuse (blocking of other users) and inefficiency. Therefore it is suggested that a light licensing scheme can be adopted with the above fee policy per 250MHz channel to enable affordable access to multiple users.