Executive Summary

September 2008

Wireless local loop: current status and future outlook

Summary of the results of the audit, completed on 30 June 2008

ARCEP
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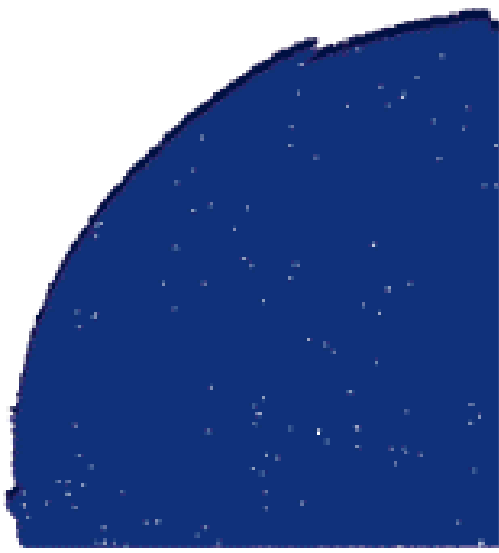
AUTORITÉ DE RÉGULATION des Communications électroniques et des Postes



Introduction

Licences for the deployment of public wireless local loop (WLL) networks in the 3.4-3.6 GHz frequency band were awarded by ARCEP on 25 July 2006, following a call for candidates launched in August 2005.

These licences include deployment obligations, whose first inspection deadline was 30 June 2008.

Over the course of summer 2008, ARCEP performed an audit on these deployment obligations. It also held hearings to achieve its analysis of the current status and future outlook for wireless local loop projects in the 3.4-3.6 GHz frequency band.

The goal of this document is to render an account of this audit and to provide a summary analysis of the situation, based on the elements supplied by the players.

This report is composed of three parts:

- a precise inventory of rollouts as of 30 June 2008;
- an analysis of the technological and economic factors that have affected rollouts;
- an updated view of the wireless local loop's development prospects.

1. Status as of 30 June 2008

1.1. Background

Between 2004 and July 2006, the Authority held a call for candidates for regional wireless local loop licences in the 3.4-3.6 GHz frequency band in Metropolitan France and in the overseas regions of Guyana, Saint-Pierre and Miquelon and Mayotte.

Following the public consultation conducted by the Authority in 2004, whose purpose was to identify the market's interest in the wireless local loop in the 3.4-3.8 GHz frequency band, the call for candidates for wireless frequency licences in the 3.4-3.6 GHz frequency band was launched in 6 August 2005 after publication by the Ministry of Economy, Finance and Industry of the order concerning the procedures and terms for awarding frequency licences defined in ARCEP Decisions nos. 05-0646 and 05-0647 of 7 July 2005.

The Authority began the selection procedure with a preparatory phase which included the submission of 175 letters of intent from the candidates on 14 October 2005. This stage was to allow those players interested in being awarded a licence to access the wireless local loop to explore the different possibilities for sharing the use of the frequencies.

Once this stage was completed, in early January the Authority established an inventory of the submissions to be able to assess the possible scarcity of frequencies on a region-by-region basis. The 45 submissions received led to a determination of scarcity on 10 January 2006 in 22 regions in Metropolitan France, in Guyana and Mayotte, where selection procedures had been officially launched. No scarcity of spectrum resources was determined for Saint-Pierre and Miquelon. There were ultimately 35 players selected as candidates.

Among these 35 candidates, 15 players were selected, including six *conseils régionaux* (regional councils), each with a 15MHz duplex. The selection procedure was based in equal part on the following selection criteria:

- contribution to the national broadband development plan;
- the project's capacity to stimulate broadband market competition;
- the sum of the fee that the candidate was willing to pay.

The selected candidates agreed to large-scale rollout commitments which were included as obligations in the terms of their licences.

The goal of the audit performed on 30 June 2008 was to assess the degree to which the licence-holders were meeting their commitments, particularly in terms of deployment objectives.

This audit also provided an opportunity to take an inventory of wireless local loop deployments and to get an updated view of the players' plans with respect to ADSL dead zone coverage and the development of roaming services.

1.2. Licence holders as of 30 June 2008

The licences awarded by the Authority concern frequencies that can be traded in the secondary market. This system has been widely used by the original licence-holders. The transfers include not only a transfer of rights but also of the original licence-holder's obligations. The following paragraph lists the licence-holders as of 30 June 2008 which were the subject of the audit.

In Metropolitan France

As of 30 June 2008, the number of licence-holders in Metropolitan France had practically doubled (19 licence-holders of which 14 local authorities and 5 operators) compared to the 10 original licence-holders (6 regional councils and 4 private operators).

The mechanisms of the secondary market have been employed chiefly by the regional councils to cede their rights to the *conseils généraux* (departmental councils). As a result, the number of local authorities involved has increased considerably following the transfers of frequency usage licences. 14 local authorities currently hold a frequency licence.

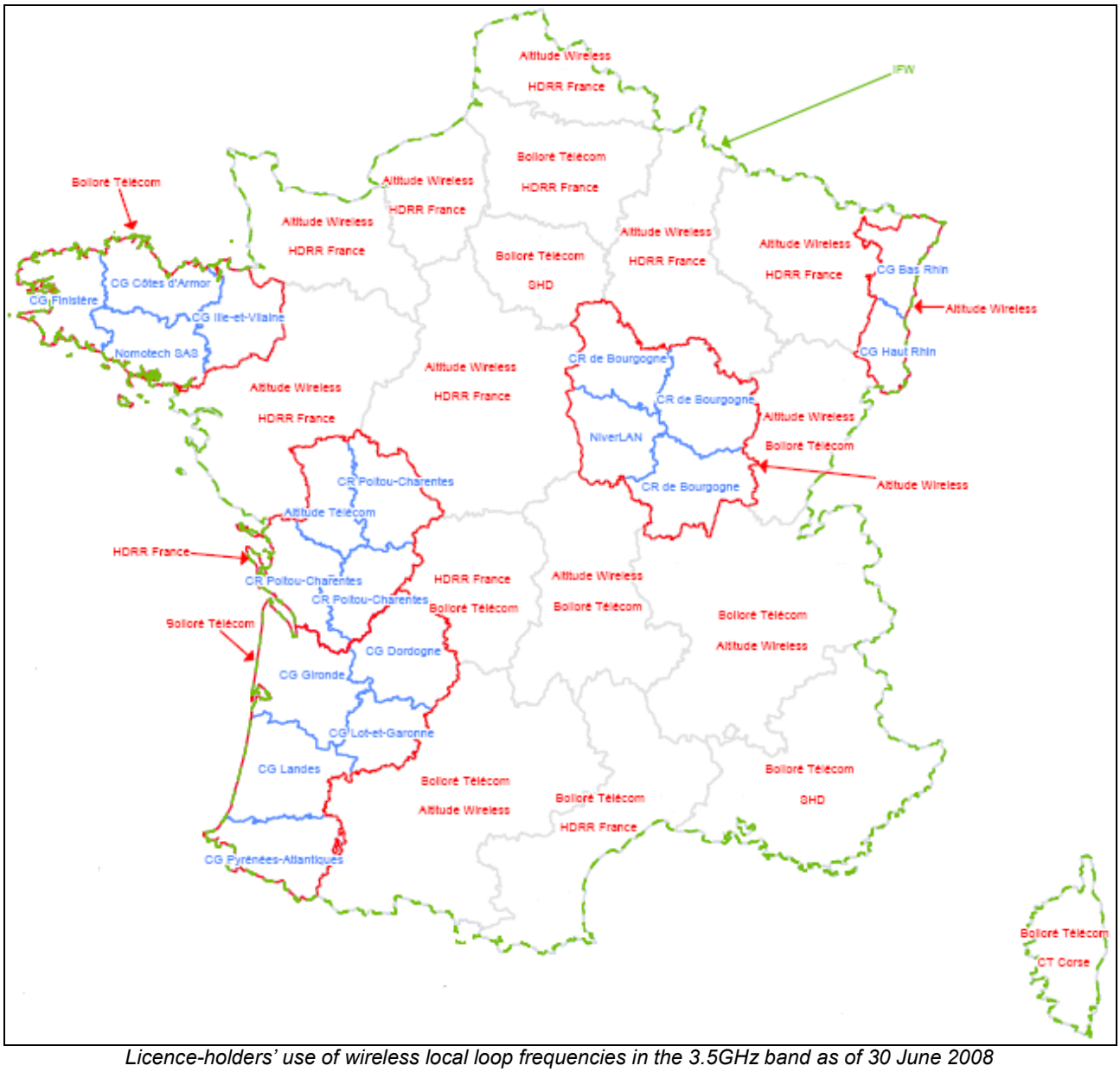
In Alsace, the *Conseil régional* transferred its licence to the *Conseils généraux* of the Haut-Rhin and the Bas-Rhin in their respective *départements*. In the same vein, in Aquitaine, the *Conseil régional* ceded its licence to the five *Conseils généraux* (*Conseils généraux* of the Gironde, the Dordogne, the Landes, the Lot-et-Garonne and the Pyrénées-Atlantiques). Le *Conseil régional* of Poitou-Charentes, which was initially a licence-holder for the entire region, transferred a portion of its licence in the Deux-Sèvres *département* to the firm, Altitude, and kept its licence to the Charente region's three other *département*s. In Brittany, the *Conseil régional* ceded its licence to the *Conseils généraux* of the Côtes d'Armor, the Finistère and Ille-et-Vilaine in their respective *départements,* and to operator Nomotech in the Morbihan *département*.
The *Conseil régional* of Burgundy transferred a portion of its licence to the NiverLAN joint union in the Nièvre *département,* keeping its licence to the rest of the region. And, finally, Corsica kept its original licence.

The private operators that are licence-holders are HDRR France, Altitude Wireless, Bolloré Télécom, SHD and Nomotech SHD.
HDRR France (formerly HDRR multi-regions and HDDR Centre Est) has licences in 11 regions (Lower Normandy, Centre, Champagne-Ardenne, Upper Normandy, Languedoc-Roussillon, Limousin, Lorraine, Nord-Pas-de-Calais, Pays de la Loire, Picardie, Poitou-Charentes). The company acquired all of the wireless local loop frequency licences from its wholly-owned subsidiaries, HDRR Multi Regions and HDRR Centre-Est, on 30 November 2006.
Altitude Wireless has a licence in 13 regions (Alsace, Auvergne, Lower Normandy, Burgundy, Centre, Champagne-Ardenne, Franche-Comté, Upper Normandy, Lorraine, Midi-Pyrénées, Nord-Pas-de-Calais, Pays de la Loire, Rhône-Alpes) and Altitude Télécom has a licence in the Deux Sèvres *département*. The company, Altistream (renamed Altitude Wireless), a wholly-owned Altitude subsidiary, acquired all of its wireless local loop frequency licences from the firm Maxtel, of which Altitude controls 50%, on 7 June 2007 for 11 regions, and on 16 October 2007 for the two remaining regions: Franche-Comté and Rhône-Alpes.
Bolloré Télécom holds licences in 12 regions (Aquitaine, Auvergne, Brittany, Corse, Franche-Comté, Ile-de-France, Upper Normandy, Limousin, Midi-Pyrénées, Picardie, Provence-Alpes-Côte d'Azur, Rhône-Alpes) and SHD (Neuf and SFR subsidiary) in 2 regions (Ile-de-France, Provence-Alpes-Côte d'Azur). And, finally, the firm Nomotech SAS has acquired a licence for the Morbihan *département*.

After the 30 June 2008, ARCEP approved the HDRR France plans to transfer licences to Bolloré Télécom in 8 regions. At the outcome of this transfer, HDRR France still held licences in three regions (Picardie, Languedoc-Roussillon and Limousin) and Bolloré Télécom became the licence-holder in 20 of the 22 regions in Metropolitan France (all except Alsace and Burgundy).

These transactions illustrate two trends: first, operators' restructuring which has enabled the emergence of a virtually nationwide operator and, second, a fragmentation at the departmental level created by local authorities.

Lastly, operator IFW, which holds a national licence whose deployment deadline is later than the rest (December 2008), will be audited at a later time.



Licence-holders' use of wireless local loop frequencies in the 3.5GHz band as of 30 June 2008

Outside Metropolitan France

In 2006, licences were also awarded in the geographical zones outside Metropolitan France. The following licence holders were thus also subject to the audit:

- France Telecom (Saint-Pierre and Miquelon, Guyana and Mayotte)
- Guetali (Mayotte)
- Guyacom (Guyana)
- Omtel SPM (Saint-Pierre and Miquelon)
- STOI (Mayotte)
- Mediaserv (Saint-Pierre and Miquelon)

1.3. Overall situation as of 30 June 2008

The audit of licence-holders' compliance with the terms of their wireless local loop frequency licences, which was performed two years after these licences were awarded, allows the Authority to obtain an inventory of the first rollouts in the 3.4-3.6 GHz frequency band. These rollouts involve a large number of sites (more than 500 operational sites). Commercial offers are also available and the first customers (around 4,000 residential

and business customers) have been connected, especially in the less densely populated areas. Deployments nevertheless remain small scale compared to what had been planned in 2006, and there are still sizeable disparities from region to region (some are equipped with a large number of sites while others have none) and from one licence-holder to the next. On the whole, the current state of WLL deployments is well below the licence-holders' initial commitments.

In Metropolitan France

A total 526 sites have been deployed, of which 512 are operational with a commercial offering either available or scheduled to launch in the last quarter of 2008. HDRR France and Altitude Wireless are reporting several thousand customers connected (business and residential).

Three licence-holders have met their obligations in terms of the number of sites to be deployed: the *Conseil général* of the Haut-Rhin, the NiverLAN joint union (Nièvre) and the firm Nomotech SAS (Morbihan).

Half of the local authorities that have WLL licences are involved in a large-scale WiMAX rollout for which they have appointed a technical partner and mobilised substantial financing, even if no site has yet to be deployed. In many cases, the objectives for these projects exceed those contained in their licence (in number of sites and breadth of coverage).

The first commercial offers are available. They are aimed at both residential users (including services running at 2 Mbps downstream, 512 kbps upstream or 1 Mbps downstream, 128 kbps upstream) and businesses (including services delivering 4 Mbps downstream, 1 Mbps downstream and 8 Mbps symmetrical), providing broadband internet access at the same price as ASDL services, along with unmetered voice services for residential users for an additional €10 euros a month. Several thousand customers, both residential and business, already subscribe to these offers.

A regional inventory of rollouts reveals that of the 22 regions in Metropolitan France, 16 are equipped with their first sites and commercial offerings – the first rollouts having been achieved by private sector licence-holders in 13 regions and by public authorities in the other three. Pioneer deployments have taken place in a large percentage of the country, albeit in a disparate fashion.

Figures on the rollouts are presented in the tables below, which reveal, among other things that:

- SHD has achieved significant deployments in its two regions. Commercial launch is scheduled for September 2008 (Numéo), and the wholesale offering has been available since March 2007;
- Altitude Wireless has installed 212 sites in 7 regions and markets a commercial offer in four of its 13 regions;
- HDRR France has transferred its licence in 8 regions. The company has met its obligations in terms of number of sites to be deployed in three of these regions (Upper Normandy, Pays de la Loire and Poitou-Charentes) and performed rollouts (63 sites) in the other regions, with the exception of Lower Normandy. In the three regions where HDRR France has kept its licence, significant rollouts have taken place in the Limousin where a commercial service is available (Numéo);
- Bolloré Télécom is testing its equipment and has deployed trial sites in one of its 12 regions;
- Nomotech SAS has deployed two sites in accordance with its obligations as of 30 June 2008, and the commercial launch of its services was scheduled for summer 2008.

The following tables provide a summary, by licence-holder and by region, of the extent to which licence-holders' obligations had been met as of 30 June 2008 in terms of:

- scale of deployment (number of sites);
- proper use of frequencies. This obligation translates into the presence of at least one operational site and the availability of a commercial offering in each *département*.

Licence-holders	Geographical zones	Sites leased but not equipped	Number of *départements* equipped with at least 1 site/total number of *départements*	Number of sites installed/ obligations	Number of sites installed (% of obligations)			Commercial offering (no. of customers > 100)
					from 0 to 5%	from 5 to 40%	>40%	
Altitude Wireless	Alsace, Auvergne, Lower Normandy, Burgundy, Centre, Champagne-Ardenne, Franche-Comté, Upper Normandy, Lorraine, Midi-Pyrénées, Nord-Pas-de-Calais, Pays de la Loire, Rhône-Alpes, Deux-Sèvres *department*	Yes	14/57	**212/1796**		13.6%		yes
HDRR France	Lower Normandy, Centre, Champagne-Ardenne, Upper Normandy, Languedoc-Roussillon, Limousin, Lorraine, Nord-Pas-de-Calais, Pays de la Loire, Picardie, Poitou-Charentes	Yes	14/41	**170/312**			46%	yes
SHD	Ile-de-France, Provence-Alpes-Côte d'Azur	Yes	14/14	**86/177**			49%	yes
CG[1] Haut-Rhin	Haut-Rhin	Yes	1/1	**20/19**			100%	yes
NiverLAN	Nièvre	Yes	1/1	**20/14**			100%	yes
Nomotech SAS	Morbihan	Yes	1/1	**2/2**			100%	yes
CG Finistère	Finistère	Yes	1/1	**2/20**		10%		yes
CG Ille-et-Vilaine	Ille-et-Vilaine	Yes	1/1	**2/5**		40%		
Bolloré Télécom	Aquitaine, Auvergne, Brittany, Corse, Franche-Comté, Ile-de-France, Languedoc-Roussillon, Limousin, Midi-Pyrénées, Picardie, Provence-Alpes-Côte d'Azur, Rhône-Alpes	Yes	1/60	**11/968**	1%			
CG Bas-Rhin	Bas-Rhin	Yes	1/1	**1/28**	3.5%			
CG Lot-et-Garonne	Lot-et-Garonne	Yes	0	**0/8**				
CG Pyrénées-Atlantiques	Pyrénées-Atlantiques	Yes	0	**0/13**				
CG Côtes d'Armor	Côtes d'Armor	Yes	0	**0/30**				
CG Landes	Landes	Yes	0	**0/3**				
CR Burgundy	Burgundy except the Nièvre	No	0	**0/55**				
CG Gironde	Gironde	No	0	**0/9**				
CR Poitou-Charentes	Poitou-Charentes except Deux-Sèvres	No	0	**0/75**				
CG Dordogne	Dordogne	No	0	**0/8**				
OC Corsica	Corsica	No	0	**0/22**				
Total				**526/3564**				

Recap of licence-holder rollouts as of 30 June 2008

[1] CR: *Conseil régional (*Regional Council), CG: *Conseil général* (Departmental Council), OC: Overseas collectivity

Following the HDRR France transfer of 8 licences to Bolloré Télécom:

HDRR France	Languedoc-Roussillon, Limousin, Picardie			5/11	**41/146**		28%		yes
Bolloré Télécom	Aquitaine, Auvergne, Lower Normandy, Brittany, Centre, Champagne-Ardenne, Corse, Franche-Comté, Upper Normandy, Ile-de-France, Languedoc-Roussillon, Limousin, Lorraine, Midi-Pyrénées, Nord-Pas-de-Calais, Pays de la Loire, Picardie, Poitou-Charentes, Provence-Alpes-Côte d'Azur, Rhône-Alpes			10/90	**140/1134**		12.3%		yes

HDRR France and Bolloré Télécom rollouts following transfers

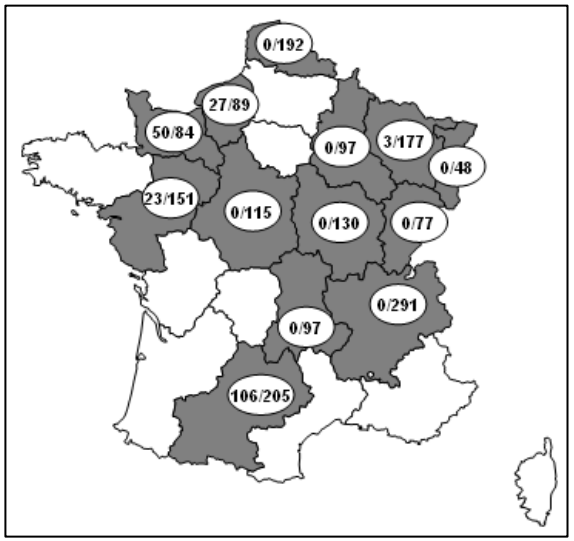
The information supplied by the licence-holders also made it possible to assess deployments in each region:

Regions	Number of sites installed	Number of *départements* in which a commercial offer is available
Alsace	**21/95**	1/2
Aquitaine	**0/95**	0/5
Auvergne	**0/154**	0/4
Lower Normandy	**50/100**	3/3
Burgundy	**20/199**	1/4
Brittany	**6/110**	1/4
Centre	**14/140**	1/6
Champagne-Ardenne	**3/124**	0/4
Corse	**0/44**	0/2
Franche-Comté	**0/126**	0/4
Upper Normandy	**62/99**	2/2
Ile-de-France	**59/245**	0/8
Languedoc-Roussillon	**3/133**	2/5
Limousin	**38/106**	3/3
Lorraine	**6/207**	1/4
Midi-Pyrénées	**106/353**	2/8
Nord-Pas-de-Calais	**2/207**	1/2
Pays de la Loire	**61/175**	4/5
Picardie	**0/71**	0/3
Poitou-Charentes	**34/139**	0/4
Provence-Alpes-Côte d'Azur	**39/188**	0/6
Rhône-Alpes	**0/446**	0/8

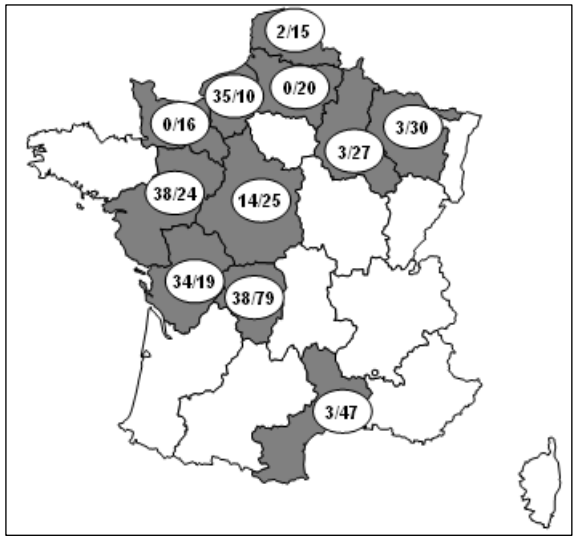
Total	524/3564	22/96

Recap of rollouts by region as of 30 June 2008

Deployment maps by licence-holder, as of 30 June 2008



Altitude Wireless



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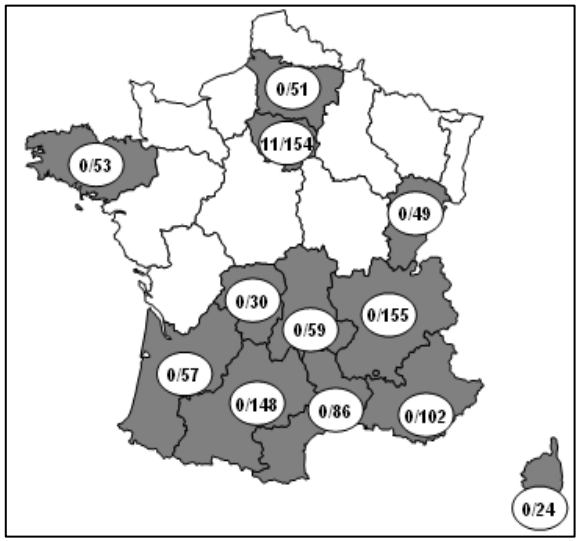
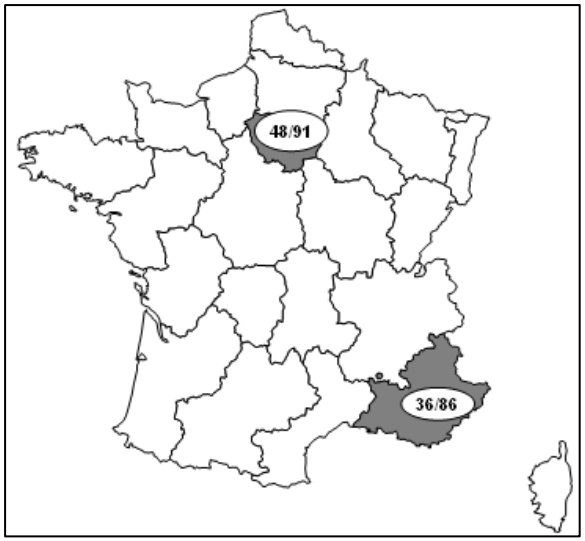
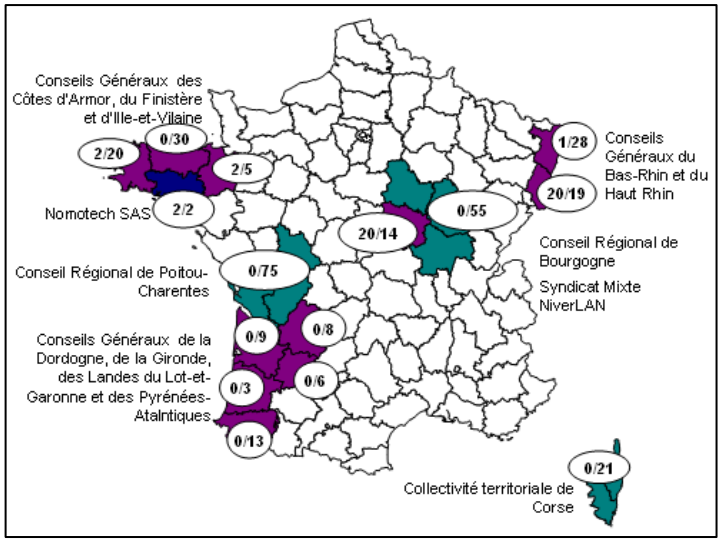


Bolloré Télécom





SHD **Local authorities and Nomotech SAS**

The situation from one operator to the next is very disparate, with some licence-holders having not yet begun their deployments while others are altering their strategies, such as HDRR France which, although it had deployed sites, transferred 8 of its 11 licences to Bolloré Télécom which is continuing its trials and waiting for terminal equipment to be available in large volumes before undertaking its rollouts. SHD has completed around half of its planned deployments, and has been marketing a wholesale offer since March 2007.

And, lastly, Altitude Wireless is continuing its rollouts but only as part of projects financed by local authorities (whose role in the development of the wireless local loop is addressed in section 2.3.5).

Some local authorities, notably the *Conseil général* of the Dordogne and the overseas collectivity of Corsica, have opted for another broadband access technology – namely dead zone subscriber connection points or NRA-ZO (*Nœuds de Raccordement Abonnés Zones d'Ombre*).

Outside Metropolitan France

Deployments in Guyana have been achieved chiefly by Guyacom (5 operational sites and some 15 businesses connected) and France Telecom (2 sites installed but not operational).
In Mayotte, Guetali has met its obligations and has a base of around 100 business customers. In Saint-Pierre and Miquelon, two France Telecom sites are operational.

2. Analysis of technological and economic factors

The results presented in the previous chapter provide a quantified illustration of wireless local loop deployments – clearly revealing the disparities amongst licence-holders. The goal of this chapter is to present the elements supplied by licence-holders in their responses which justify the differences in the status of their projects' timetables.

The chief reason for being behind schedule cited across the board is terminal equipment delays in terms of both availability and technological maturity. This factor has a more or less significant impact on rollouts, depending on the service (fixed or roaming) and the planned business model.

The first section in this chapter examines the technological maturity and availability of the equipment. The second paragraph then assesses the impact on business models and explores the other factors that influence these models.

2.1. Technological maturity and high volume availability

The technologies currently employed to develop the wireless local loop in the 3.4-3.6 GHz frequency band belong to the 802.16 family of standards defined by the IEEE and referred to commonly as WiMAX (Worldwide Interoperability for Microwave Access). Only the two latest versions (d and e) are currently being used.

- ***802.16d version of WiMAX enabled connection of the first customers in rural areas***

Version 802.16d has proven itself as a technology that works for delivering a fixed WLL service. It had the advantage of being mature and available. This technology was used for pioneer fixed rollouts back in 2006 and later by local operators developing their own equipment based on this standard.

- ***…but the market worldwide shifted to the more promising 802.16e standard***

Market players around the globe, both equipment manufacturers and operators, have switched to the next version of WiMAX technology, namely 802.16e. Introduced later than anticipated, this technology – which enables roaming and announces better performance along with economies of scale at the global level – proved persuasive for most market players, including those wanting to provide a fixed service.

Mobile equipment manufacturers in particular began developing 802.16e-based products, and the entire market is now centred around the technology.

Meanwhile, version 802.16d is currently the focus of developments by only a handful of local players and by manufacturers offering hybrid 802.16d and 802.16e products that enable current installations to make the transition.

Operators in France thus elected to follow the same path as the global market.

- ***First 802.16e-based deployments are underway …***

With the exception of a few local operators, current deployments are all being performed using the 802.16e norm, including those by operators whose first rollouts were based on 802.16d.

As it stands, a great many manufacturers are able to supply a large volume of base stations and terminals for fixed usage (with rooftop antenna).

The terminal equipment needed to enable roaming usage (PCMCIA cards) are just now becoming available.

- ***… but 802.16e technology does not yet deliver the announced level of performance…***

According to operators, the performances by currently available equipment are below forecasts. In particular, coverage is 10% to 20% lower for an equivalent number of base stations, and indoor use is highly compromised by the equipment's lack of maturity. Rollout budget forecasts were thus revised as a higher

number of base stations is needed to achieve the same coverage as what was stated in the licence-holders' submissions.

In addition, according to one operator, the equipment's current state of maturity still makes it impossible to provide a high quality telephony service using 802.16e.

- ***…and the equipment is not interoperable***

One major obstacle cited by the WLL frequency licence-holders is the lack of interoperability between the terminals and the base stations employed for fixed usage, and no doubt for roaming as well. This lack of interoperability forces the players to perform more costly rollouts using a single supplier, added to which investments made to date may well be undermined if future equipment upgrades are needed.

WiMAX Forum certification of technical solutions has fallen behind schedule, with the timetable set in July 2006 indicating certification of the first equipment by the end of that year. This first wave of certification for equipment operating in the 2.6 GHz frequency band did not, in fact, occur until June 2008, and certification of 3.5 GHz- band equipment is now scheduled for late 2008 or early 2009.

This roadmap illustrates not only delays in manufacturing but also the fact that the development of equipment operating in the 3.4-3.6 GHz frequency band is closely bound up with the development of analoguous equipment operating in the 2.6 GHz band.

The future of this technology goes beyond just France, of course, and will be decided at the global level according to the leading manufacturers' and operators' commitments to large-scale projects in the 2.6 GHz and 3.5 GHz frequency bands.

2.2. Business models and windows of opportunity

When the WLL licences were delivered, two types of project had been identified for use of the 3.4-3.6 GHz band:

- contribution to developing broadband coverage nationwide, particularly in those zones not covered by ADSL;
- innovative endeavours in the area of roaming between fixed and mobile broadband, particularly in densely populated areas.

Both types of project are still on the table. Current wireless local loop deployments are focused on fixed usage, with pioneer rollouts and the launch of commercial services having been supported by public-initiative networks, for projects in sparsely populated areas, as a complement to zones covered by ADSL. WiMAX technology is, however, having to compete with new technological solutions such as the NRA-ZO (dead zone subscriber connection points) as well as proven technologies such as satellite and Wi-Fi.

In densely populated zones, as a solution for delivering broadband wireless roaming, WiMAX provides the market with innovative services between fixed and mobile broadband. But the below-par performances of the equipment thus far, the lack of suitable terminals and the lack of interoperability have all contributed to delaying rollouts.

These points are examined below.

2.2.1. WiMAX for regional digital development in dead zones

Licence-holders that have been working to equip dead zones underscore the fact that public-initiative networks have been a significant driving force in WLL rollouts in these areas. The majority of launches in Metropolitan France in fact occurred as part of a public-initiative network.

Economic fragility confirmed

Players with a WLL licence in the 3.5 GHz frequency band confirm the fragility of a business model for operations solely in dead zones and reveal that, without public financing, this model will not likely be viable. Furthermore, the economic area is stretched to the point that it cannot sustain two players in the same dead zone. As a result, regardless of the technology used, when a public-initiative network is underway, other players' rollouts are discouraged, and so preventing the introduction of a competing offer.

A national model aimed solely at covering ADSL dead zones does not seem viable

HDRR France's withdrawal demonstrates that it was unable to achieve economic viability with a multi-regional coverage model aimed only at those zones still not covered by ADSL. In addition to delays with the technology, the reasons cited by the operator are the introduction of the NRA-ZO solution and the fragmentation of the target market which resulted in the multiplication of public-initiative networks.

The extension of ADSL coverage enabled by the development of the NRA-ZO (dead zone coverage) solution reduces the size of the potential zone to be covered by WLL technologies. The NRA-ZO solution is positioned as a direct rival for WiMAX from an economic standpoint. The NRA-ZO connection points are being installed on the border of zones covered by ADSL. On the whole, a dead zone subscriber connection point installed in these zones captures around 25% of the lines in the target market, without reducing the quantity of WiMAX equipment (particularly base stations) that needs to be installed to ensure coverage in the remaining areas. As a result, the economic potential of WiMAX is seriously undermined while its required investments in infrastructure remain the same.

Furthermore, some licence-holders pointed out that the fragmentation caused by public-initiative networks reduces the size of the potential market for a national player, and so the potential economies of scale. This fragmentation also undermines the ability to achieve a homogenous and consistent marketing model. In particular, when marketing a wholesale offer, this fragmentation discourages ISPs from offering a service that would not be national or, at least, as widely available as possible. The customers for these wholesale offers are thus local ISPs (rarely operating beyond the departmental or multi-department level) which, for a national operator, generates additional costs for structuring and connecting to the information system.

Public authority financing for dead zone coverage projects helps rebalance this business model. Operators nevertheless indicate that the financing is sometimes accompanied by targets that well exceed the initial obligations contained in their WLL frequency licences. Moreover, financing that takes account only of the initial investment may not be enough to cover the cost of future technological developments.

And, finally, operators with a WLL licence underscore the fact that public-initiative network contract models are often complex and that the generally long timelines cannot be managed efficiently so as to keep up with technological developments.

This being the case, local authorities have a central role to play in the digital development of their region in general, and in WiMAX deployments in particular: this point is examined in more detail in section 3.3.2.

2.2.2. WiMAX for ISPs' national roaming projects

WiMAX technology, and the 802.16e standard in particular, was developed to enable roaming, and even mobile broadband access. By choosing this version of the norm, some operators' licence submissions included the fact that they wanted to help develop broadband market competition nationwide, and particularly in densely populated areas, with innovative roaming solutions.

Operators pointed out that the roaming equipment (PCMCIA cards, USB keys) required was in very short supply, and even non-existent when it came to 3.5 GHz chips embedded in PCs, added to which this equipment – whose production was already some 24 months behind schedule – is not interoperable.

The combination of these two factors is currently preventing operators from deploying networks that enable roaming services under viable economic conditions (the lack of interoperable equipment prevents the creation of a mass market and puts a halt to investments by operators which will undoubtedly have to upgrade their base stations once the terminal equipment has been certified).

Furthermore, projects in the 3.5 GHz band aimed at delivering roaming services are now having to contend with the development of 3G mobile broadband offerings and, in future, with new projects born of the upcoming availability of the 2.6 GHz and 800 MHz frequency bands.

The following chapter presents the players' updated perspective on the development outlook for the wireless local loop, and identifies a number of factors that will help stimulate its development.

3. Outlook for projects in the 3.5 GHz frequency band

This chapter is devoted to the outlook for wireless local loop projects in the 3.5 GHz frequency band, as presented by the players. The first part contains an analysis of the role that the WLL in the 3.5 GHz band will play in the broadband access market. The second part describes the factors that will be key to its development.

3.1. Role of the wireless local loop

Despite a rocky start, the audit performed with the players confirmed the existence of projects based on two very different models:

- nationwide projects for delivering roaming services in densely populated zones;
- regional digital development projects.

A national ISP model for a roaming broadband wireless internet access service

The recent consolidation of operator Bolloré Télécom illustrates a tendency to develop a national strategy aimed at delivering roaming broadband wireless internet access in densely populated areas, and confirms the market's interest in developing this type of project.

The Bolloré Télécom wireless local loop project underscores the operator's interest in WiMAX technology. The project involves sizeable investments and aims to build a strong nationwide brand with commercial offerings that benefit from economies of scale and consistent service thanks to the national dimension.

Providing a wireless local loop service nationwide would prove an appealing alternative or complementary solution to DSL technologies, particularly for roaming access to services.

To succeed, however, this type of business model would need to forge itself a place between fixed broadband access offers and mobile broadband access offers.

A digital regional development component in the projects

There does not appear to be a viable business model for using wireless local loop technology in the 3.5 GHz frequency band only for delivering fixed broadband access in zones not yet covered by ADSL or cable.

Given that the rollouts performed as part of a nationwide ISP model will initially target densely populated zones, covering dead zones with services in the 3.5 GHz band seems an unlikely prospect in the short to medium term, outside a local public-initiative network project.

Here, WLL technologies in the 3.5 GHz frequency band could contribute to achieving national coverage as part of projects that employ a combination of technologies. It does seem that no single technology – whether wireless local loop, wireline technologies or satellite systems – can single-handedly meet the goal of expanded coverage.

It is only by examining the local situation on a case-by-case basis that the optimal combination of technologies can be found to resolve a digital regional development problem.

Each alternative to the wireless local loop has its own set of advantages and disadvantages. The NRA-ZO solution, for instance, which targets dead zones, does not always meet the client enterprise's needs in terms of service as most businesses require guaranteed symmetrical bitrates. Satellite solutions have inherent technical limitations and remain costly for the speeds they deliver, although technological progress is expected in the coming years, as is a decrease in price. Wi-Fi is an easy, fast and inexpensive solution to install, but it is only temporary – one of its weaknesses being that it cannot guarantee quality of service. And, finally, optical fibre solutions which are competitive in densely populated zones, only serve as a collection network component in more sparsely populated areas and, using WiMAX as the access solution, constitute an intermediate stage in delivering fibre to the user.

The issue of regional digital development is examined briefly in this document, but will be the subject of a detailed ARCEP report, in accordance with the law on modernising the economy (*Loi de Modernisation de l'Economie*).

3.2. Development factors

3.2.1 Global production situation

Widespread use of the wireless local loop in the 3.5 GHz frequency band depends to a considerable extent on the large-scale and global availability of WiMAX 802.16e standard-compliant equipment that is interoperable and that performs as expected.

This availability depends a great deal on the existence of a large enough worldwide market that projects in France alone cannot create.

Equipment availability

All of the WLL frequency licence-holders emphasised the impact of production delays in WiMAX equipment for the 3.5 GHz frequency band.

802.16e equipment for fixed usage is currently available, albeit carrying certain concerns over its interoperability with future hardware. Certification of the first roaming-compatible equipment in the 2.6 GHz band was the subject of a WiMAX Forum communiqué in June 2008, and equipment in the 3.5 GHz band is expected to be certified in late 2008-early 2009. The timetable is thus a positive sign of the development of WiMAX technology.

According to the manufacturers, equipment in the 3.5 GHz band will become available 6 to 12 months later than 2.6 GHz band equipment. This means that both public and private sector players will need to establish a technological plan that depends on developments around the globe, and so contains a portion of risk.

One key to successful projects will thus be the massive release of interoperable equipment, for both fixed and roaming usage. Its interoperability will lift the current restriction of having to rely on a single supplier.

In addition, operators need to continue to work to promote the development of the equipment, particularly by taking an active part in initiatives such as those being undertaken by the WiMAX Forum.

Technological evolution

As it stands, equipment performance levels vary from one manufacturer to the next. Of particular note is the fact that some manufacturers' products do not provide high enough quality to deliver a telephone service.
Manufacturers and operators are working together, notably within the WiMAX Forum, to improve the hardware's performance. The next generation of base stations and terminals is expected to deliver more robust wireless performance. Ongoing progress towards producing more robust and high performance equipment is thus another crucial factor for the future success of WiMAX in the 3.5 GHz band.

The situation worldwide

802.16e technology has the advantage of being the focus of production worldwide, which will only materialise from demand for large-scale projects. Uncertainties at the global level thus have a direct impact on equipment availability. In addition, the development of WiMAX-based equipment is focusing first on the 2.6 GHz band. WiMAX in this frequency band has a relative lead over 3.5 GHz-band equipment because of the geographical scope of the projects (in Asia and the United States). As a result, manufacturers naturally began by developing technical solutions in the 2.6 GHz band, which meant that 3.5 GHz band WiMAX developments were forced to take a backseat.

Mass production therefore depends, first, on manufacturers' commitment and, second, on the existence of operators' large-scale projects.

3.2.2. The role of local authorities in digital regional development projects

In the short and medium term, the use of WiMAX in the 3.5 GHz band for covering ADSL dead zones will be shaped largely by their inclusion in public-initiative networks.

The crucial factors that can help encourage the use of this type of technology are:

- the availability of a backbone network, e.g. optical fibre, which can be accessed under neutral and non-discriminatory conditions by all operators, allowing them to deploy their local loop quickly and at a lower cost. Investments induced by the construction of a backbone network have the added advantage of being lasting;
- the availability of high points.

Local authorities' commitments to making this type of lasting investment is one of the factors that will enable the deployment of wireless local loop technologies, while not being specific to WLL.

Furthermore, the role played by the wireless local loop in the 3.5 GHz band as part of a combination of technologies needed for digital regional development can be assessed at the local level, based on an inventory of the zones concerned and an technical-economic optimisation aimed at determining the solution that is best suited to each case.

If one of the solutions identified includes WiMAX, whether or not the local authority has a WLL licence, the deployment of a digital regional development project based on WiMAX could be facilitated if the local authority takes account of the operating costs and the costs generated by technological developments (evolving standards and equipment upgrades) during the financial planning stage.

Conclusion

Over the course of summer 2008, ARCEP performed an audit of the rollout obligations for public wireless local loop networks in the 3.4-3.6 GHz frequency band. The hearings that were held concurrently made it possible to assess the circumstances affecting the development of wireless local loop projects in the 3.4-3.6 GHz band and to obtain an updated view of the market.

The first point noted is the actual deployment of the wireless local loop in over 500 sites, along with the availability of commercial offers and several thousand residential and business customers. Rollouts remain still relatively small-scale, however, and currently fall well short of the licence-holders' original commitments. This situation can be explained in large part by the undeniable production delays worldwide of interoperable 802.16e standard equipment, whose outlook is more promising and towards which the market is currently oriented.

Widespread use of the wireless local loop in the 3.5 GHz frequency band depends to a considerable extent on the large-scale and global availability of WiMAX 802.16e standard-compliant equipment that is interoperable and that performs as expected. This availability depends a great deal on the existence of a large enough worldwide market that projects in France alone cannot create.

It emerged from the players' views on the outlook for their projects that the wireless ISP model devoted to providing nationwide roaming broadband services is still very much on the table. To succeed, this type of business model will need to forge itself a position between fixed broadband and mobile broadband access offers.

Among other things, wireless local loop technologies in the 3.5 GHz frequency band could contribute to regional digital development projects, as one component in a combination of technologies. It does seem that no single technology – whether wireless local loop, wireline technologies or satellite systems – can single-handedly meet the goal of covering all of the country's dead zones. The economic viability of a WiMAX project aimed specifically at dead zones does, however, appear unlikely outside their inclusion in public-initiative networks.