# The roll-out of DTT in France

## — not just SD ... but HD and mobile TV services as well

**Aurélien Louis and Matthieu Roger**
*Conseil supérieur de l'audiovisuel (CSA)*

**Despite the rather late launch of DTT services in France compared to some neighbouring countries, they are already being adopted widely by the viewers, thanks to a long tradition of terrestrial television reception. By increasing the number of services and the transmission quality, the digital television landscape is maintaining its rapid evolutionary pace.**

**This article gives a brief description of the current DTT situation in France and of its soon-to-come evolution: HDTV and mobile TV launches. In the longer term, terrestrial broadcasting networks will develop further, as a result of a national scheme to re-allocate the frequencies freed up by the digital switchover process.**

## Digital Terrestrial Television in France

Digital terrestrial television in France will soon be three years old, as the first services started broadcasting in 2005. Its roll-out brought immediate value for the French consumer: more channels with better quality pictures, at an affordable price (only the cost of an MPEG-2 set-top box) and trouble-free everyday use.

This technological breakthrough had however been in preparation for many years. The first call for tender organized by the *Conseil supérieur de l'audiovisuel* (CSA), the French independent broadcasting regulator, indeed took place in 2001. This followed many years of international discussions at the technical level, and intense regulatory and legal thinking.

### *An unusual regulatory framework for the main television broadcasting platform*

The French regulatory framework for DTT is quite specific among the European member states and pertains to the French "*exception culturelle*".

On the one hand, the selection procedure applies to each TV channel editor, to whom the resource is allocated, and not to the platform, multiplex or technical operators. The goal behind this direct selection of each DTT broadcaster is to preserve the political, social and cultural pluralism of the French audiovisual landscape.

On the other hand, the selection is achieved through a "beauty contest" and leads to no financial charge for spectrum usage. This aims at maintaining high standards of content quality for the

selected channels. Indeed, the selection of the broadcasters and the free allocation of spectrum enable the regulator to be more demanding regarding the applicants' broadcasting obligation and contribution to the production of European or French programmes.

On the technical side, the broadcasting and compression standards are defined through government decisions. Spectrum planning is under the responsibility of the CSA, in partnership with the *Agence Nationale des Fréquences* (ANFr), the French spectrum management agency that is responsible for coordination with neighbouring countries.

In 2007, terrestrial TV accounted for 57% of French television viewing and 18% of that was digital viewing. These figures show that terrestrial is the main television platform, which explains why such attention is being provided by the regulator to the diversity and quality of the terrestrial programming.

## *Planning and organization of a DTT multiplex*

In France, as in the majority of the European countries, six digital multiplexes have been planned and coordinated, according to the Chester 97 agreement.

Selecting a broadcasting modulation scheme implies, on the one hand, a trade-off between the robustness of the transmissions and the cost of the infrastructure and, on the other hand, the data rate to be used. The decision taken in France was to maximize the number of channels while keeping a fair image quality. Those considerations led to the choice of 64-QAM modulation [1].

Taking into account this modulation, it was foreseen that the 113 main TV transmitters would provide DTT coverage to 85% of the population.

As far as the channel line-up is concerned, *Fig. 1* shows the present distribution of services across the multiplexes.

Multiplex R1 was specifically designed to enable the public broadcaster France 3, which operates local and regional programmes, to broadcast regional variations.

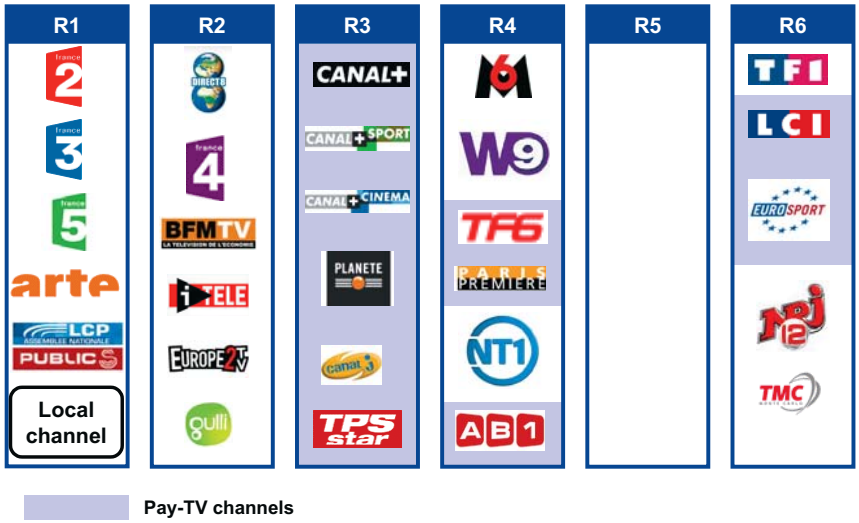


**Figure 1**
**The six current DTT multiplexes in France**

Although this situation implies additional constraints and, hence, a more extensive use of spectrum, those regional variations are quite popular and are important in regard to the role of digital television as a community link.

From the beginning, multiplex R5 has not carried any services, being dedicated to future or innovative uses. But as detailed below, it is now being allocated to the first free-to-air HD services on the terrestrial platform.

## *The debate on compression standards: MPEG-2 or MPEG-4*

The French situation is also specific in the way that multiplexes use both MPEG-2 and MPEG-4 compression standards. Once again, the reasons for this technological choice is to be found in social and political orientations.

1. To be precise and complete, usually with FEC 2/3, guard interval 1/32 and carrier type 8k.

In 2004, a public debate was opened regarding the opportunity to launch DTT in MPEG-4 rather than in MPEG-2, taking into account the recent developments in MPEG-4.

MPEG-4 was an opportunity to derive benefits from compression gains in the future and was considered as a first step towards HD. However, it was still a very expensive technology at the time, with no significant efficiency gains over MPEG-2 in the next two years to come. Above all, the availability of multi-standard terminals (MPEG-4 SD and HD) was not secured at that time, which made the possibility of a seamless switch to HD unrealistic.

On the other hand, MPEG-2 was largely acknowledged as an affordable and available technology. It had been selected for the majority of DTT platforms around the world, leading to large economies of scale, particularly thanks to an earlier launch of the technology in neighbouring countries, such as the United Kingdom, seven years before. The downside of MPEG-2 was its maturity: no additional compression gains were to be expected, while MPEG-4 technology claimed to be able to produce a 50% improvement. Moreover, it implied a replacement of the set-top boxes deployed if switching to HD.

After a fierce debate, a hybrid choice was made by the government: MPEG-2 to be used for free-to-air services and MPEG-4 for pay-TV and HD services.

This unprecedented decision had a strong rationale behind it. By choosing MPEG-2 for the FTA services, a wide public accessibility to those services, at limited costs, was achievable and the launch of the free DTT services was expected to be on time. And indeed it was: on 31 March 2005, when set-top boxes retailed at around 100€, the 18 free DTT services were ready to broadcast, as scheduled.

The choice of MPEG-4 for pay-TV services was meant to facilitate the introduction of new services at a later date, thanks to future compression gains which would free up some spectrum used by the first pay-TV services. In that regard, this decision has also been a success. Since the 2005 MPEG-4 pay-TV launch, compression gains of 30% have been achieved, thus enabling the development of an HDTV terrestrial offer in France.

The second reason for this choice was the question of the MPEG-4 HD terminals: there was some hope that the pay-TV market could create a customer base ready to receive HD services, and also that this would help to decrease the costs of the MPEG-4 technology. However, the slow take-off of the DTT pay-TV market in France (a few hundreds of thousands of subscribers) has limited the size of the MPEG-4 user base. Nevertheless, the simultaneous deployment of HD-capable, DTT-compatible ADSL set-top boxes (combined DTT and IPTV) has significantly increased this installed base.

## *The success of DTT: coverage and take-up*

At the end of 2007, DTT was available to 85% of the population of France, from the 113 main transmitting sites.

The roll-out of DTT has been progressive and organized in six phases. For the regulator, dealing with the huge spectrum re-engineering and refarming that such a development implied – and protecting the analogue terrestrial broadcasting networks from interference caused by the digital transmissions – has been a huge challenge. Indeed, the goal has been to deploy the six new national digital networks in addition to the existing national [2] analogue ones. To cope with the workload, the technical and planning capacity of the CSA has been strongly increased.

2. Three analogue terrestrial networks (TF1, France 2 and France 3) cover around 99% of the population in the UHF bands, and two other networks (France 5/Arte and M6) serve around 85% of the population, also in the UHF bands.

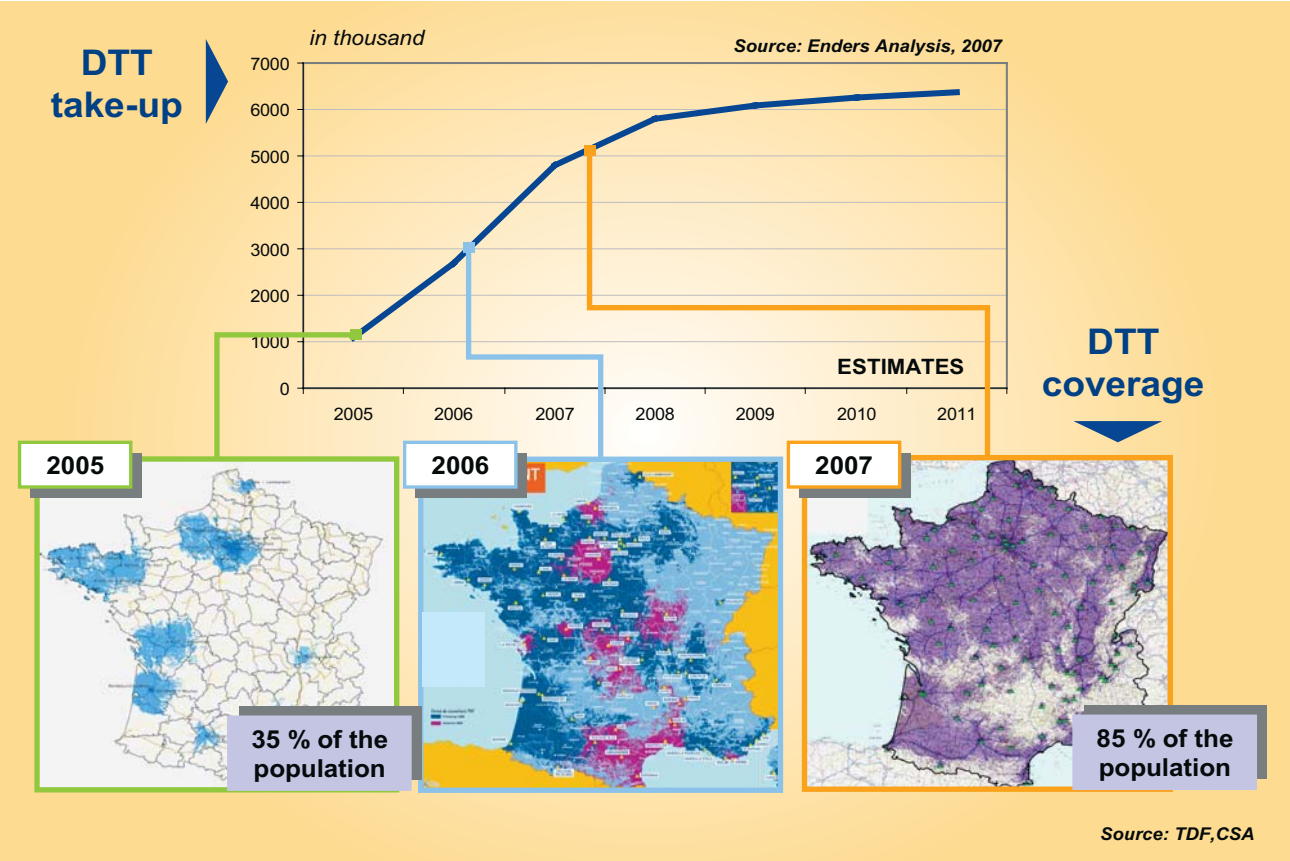


**Figure 2**
**DTT take-up in France: 2005 to 2007**

However, the latest audiovisual bill, voted on the 5th March 2007, now implies that the broadcasters should further extend the DTT coverage to at least 95% of the population for every "analogue incumbent channel".

In order to comply with this obligation, the CSA has paved the way for this extension by detailed obligations for the broadcasters, in order to prevent any digital divide. These complementary obligations aim at levelling the coverage of each *département* (French administrative sub-region), so that DTT coverage in geographically difficult regions with a low density of population keep in line with those benefiting from an easy coverage over large urban areas.

Those two obligations, national and "departmental" coverage, will represent an important workload in terms of the transmitters to switch on. It is generally agreed that more than 1500 new transmitters will be needed to match that coverage.

Finally, for the last 5% share of the population, satellite coverage is recommended. French law requires that a satellite bouquet, accessible without paying subscription fees or having to rent a terminal, should be put into operation. Today, such an offer has been provided by CanalSatellite with the service called TNTSat, which delivers the 18 free DTT services.

These three coverage extensions, although financially demanding for the broadcasters and implying an important planning workload, are conditional to the success of the DTT platform in the future. It will surely drive the DTT take-up and also increase the popular demand for new services, such as HDTV.

## A strong expectation for HD content

Aside from the receiver costs and the rapidly expanding geographical coverage, the two main key drivers for the adoption of DTT by the public were certainly the improved image quality and the

greater number of services. Eighteen free-to-air digital services against five analogue ones, as well as eleven pay services against one, contributed to a momentum that was supported by the crisp and sharp images provided by the digital transmissions. No more "snow" on the screen, and no more crackling sounds.

In parallel, the success of the DVD and CD against VHS and audio magnetic tapes has led to a growing expectation of quality. Home theatres, multichannel sound, audio effects, improving video games, and higher resolutions on personal computers have all contributed in the meantime to create a need for more quality.

HDTV therefore comes as the next step and is often considered as the future of television, in the same way that colour replaced black and white, several decades ago.

## *Existing HDTV offer over other bearers*

French-speaking HDTV services are already proposed over satellite, cable and ADSL TV (IPTV). Some are free-to-air, but most are pay services, often billed as "options" in the bouquets, even when the corresponding SD services are free-to-air. In particular, the first free-to-air private French channels, such as M6 or TF1 which get most of their audiences from terrestrial broadcasting (whether analogue or digital), are never available for free when they are simulcast in HD.

Some new services, such as NRJ12 HD, are provided as part of the basic bouquet of some triple play offers. Looking a bit more like a free-to-air service, since no additional fee is needed, it nevertheless requires a subscription to an internet access provider.

Moreover, ADSL – unlike traditional broadcast networks – quickly bumps into bandwidth limitations and therefore HD accessibility over 5 Mbit/s, if proposed, is limited to just a few customers.

## *HDTV needs to be terrestrial*

Taking into account the broad take-up of terrestrial reception for TV services in France, the introduction of HDTV over DTT is a must. Otherwise, this would limit the ability of most people to gain access to such services. Moreover, since the terrestrial platform is still leading the audience-driven market for advertisements, this is probably the only place where free-to-air HDTV can be first implemented and then developed: if HDTV is to be provided to every French citizen, then it must be terrestrial.

### Abbreviations

| | |
|---|---|
| **64-QAM** | 64-state Quadrature Amplitude Modulation |
| **AAC** | Advanced Audio Coding |
| **ADSL** | Asymmetric Digital Subscriber Line |
| **AVC** | (MPEG-4) Advanced Video Coding |
| **CAS** | Conditional Access System |
| **CSA** | *Conseil supérieur de l'audiovisuel* (French broadcasting regulator) |
| **CGTI** | *Conseil général des technologies de l'information* (French Council for Information Technology) |
| **DTT** | Digital Terrestrial Television |
| **DVB** | Digital Video Broadcasting http://www.dvb.org/ |
| **DVB-H** | DVB - Handheld |
| **ESG** | Electronic Service Guide |
| **ETSI** | European Telecommunication Standards Institute http://pda.etsi.org/pda/queryform.asp |
| **FTA** | Free-To-Air |
| **HD** | High-Definition |
| **HE-AAC** | High Efficiency AAC |
| **IPDC** | IP DataCasting |
| **IPTV** | Internet Protocol Televison |
| **MPEG** | Moving Picture Experts Group http://www.chiariglione.org/mpeg/ |
| **OMA** | Open Mobile Alliance http://www.openmobilealliance.org/ |
| **SD** | Standard-Definition |
| **TNT** | *Télévision Numérique Terrestre* (Digital Terrestrial Television, DTT) |

But terrestrial broadcasting implies having to deal with some constraints. The spectrum scarcity is non-negotiable, particularly if the bands allocated to television services today are partly reduced in the future.

There is therefore a strong need to get more into less space. The MPEG-4 part 10 codec (also named H.264) matches this target well. Further work in the DVB Forum, such as on scalable video codec support or the DVB-T2 modulation system, could also help to squeeze in more. Unfortunately, this would probably delay the wide deployment of HDTV in France by some years.

Once the codec and the modulation scheme have been agreed, the next problem to be solved concerns the number of services per multiplex or the service bandwidths to be used.

Thanks to a report from the *Conseil général des technologies de l'information* (CGTI) – a department of the Ministry of Finance in charge of information technology – and also as a result of a consultation launched by the CSA in December 2006, it is considered feasible to broadcast three HDTV services in a multiplex, with a combined bitrate of 24 Mbit/s, with the help of statistical multiplexing (statmux).

Some HDTV experiments in Paris, Lyon and Marseille, which allowed the testing of different bitrates, were extended to more cities. These new trials were subject to a very stringent obligation – only native HD content could be broadcast (i.e. no upconverted HD programmes). As expected, the feedback from the people able to watch these events in HD (Rugby World Cup, *Tour de France*, Concerts, Series, etc.) was excellent. At the time, three services could be broadcast in a single multiplex.

## *HDTV but where and when?*

One national multiplex, called R5, was identified to carry the HD services. In June 2007, a beauty contest was organized by the CSA to allocate this multiplex to two HD services, the third one being already reserved by the government for a public television service. Among the four candidates, M6 HD and TF1 HD – which are simply HD simulcasts of their SD channels – were selected. There are now ongoing negotiations to finalise their obligations before the actual launch can occur between now and the end of the year. The roll-out rate for extending coverage of this network, aiming finally to become national, will be set soon. The CSA is very keen to extend coverage quickly to 85% of the population as a minimum target.

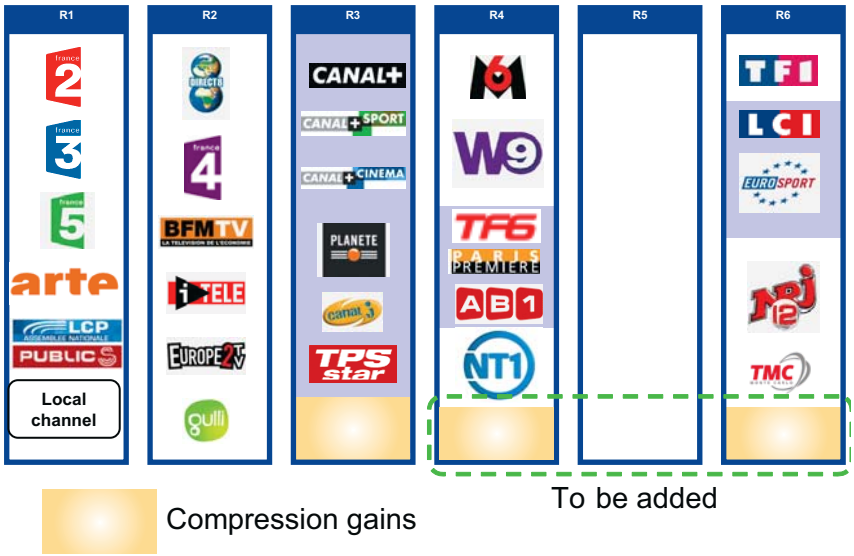


**Figure 3**
**Making space in the multiplexes for new HD services**

In parallel with this process, with thanks to the aforementioned report from CGTI, it was recently concluded that a further compression gain on SD MPEG-4 pay services was achievable. This led to a recent decision of the *Conseil* to provide sufficient resources for two new HD services: a pay-service converted from SD to HD and a brand new service. The latter will become available when the new freed-up space has been consolidated onto a single multiplex, i.e. by transferring some existing services to other multiplexes. A new beauty contest is being issued for the conversion of the pay service.

### *The other side of HD broadcasting: reception*

Last but not least, some work was undertaken by various French groups (HD Forum, Simavelec and other partners) to widen the reception means for HDTV by updating the IEC EN-62216-1 standard and by preparing a test bed. Among other topics, this involved the audio components and the signalling for simulcast SD/HD services.

Closely working with them, as the owner of the signalling profile, the CSA will take care of signals compliance so that future, as well as the already-installed, HDTV-compatible equipment performs well.

Indeed, more than a million receivers of different kinds are already able to handle HDTV services. Most of the latest triple-play boxes embed a digital tuner and are MPEG-4 HD compatible. Various types of set-top boxes have been sold over the last two years, and the first integrated television sets were proposed to the customers last summer. In addition, the majority of DTT pay-TV set-top boxes distributed across the French territory are also HDTV compatible.

If some difficulties can be foreseen, they should easily be overcome thanks to the high level of involvement of the industry, broadcasters and network operators. Despite there being no French DTG or Freeview organization, as in the UK, to check the conformity of receivers and richness of signalling (EPG, etc.), this looks like a very important and shared step, targeting a high level of services for the delivery of HDTV programmes to everyone.

And even the law, as voted on 5th March 2007, will contribute to a skyrocketing deployment of HDTV receivers, since it is mandated that all the “HD Ready” television sets will actually embed the parts needed to natively support HDTV reception from 1st December 2008.

But if HDTV is a major project for DTT, other projects are also being implemented in order to continue improving the public offer.

## The new frontiers of digital broadcasting

If digitalization has brought more quality to the public, especially with the introduction of HDTV, digital broadcasting frequencies are able to deliver much more for the benefit of the whole population: among others, an increase in the proximity of television with the development of local television on a much larger scale than is possible in analogue and, of course, consumption of audiovisual content in mobile situations on handheld terminals.

The bill of 5th March 2007 tackles these new challenges and urges the CSA to move forward in these fields.

### *The development of local digital television*

In comparison with its closest neighbours, France does not have a developed local broadcasting sector over its terrestrial networks. For instance, Spain has more than one thousand local television stations, where France currently has only twenty-six of them. Adding such new services is therefore at the heart of the CSA policy, in order to keep building a high level of media pluralism and cultural diversity by allowing easier access to these services.

Digitalization is therefore a real opportunity to improve the situation. Indeed, by dividing transmission costs, it opens new economic spaces for local television to develop within.

As far as spectrum is concerned, a reorganization of the multiplexes took place on 13th September 2007 and freed up a slot on the public DTT multiplex (identified as “R1” on the illustrations). Thanks to its unique engineering and frequency structure which enables local programme variations, this multiplex is particularly suited to local television. Where appropriate, this resource will be comple-

mented – in some specific areas where priority has been given to an increased availability of local variations of France 3 or other public services – by frequencies which will constitute an 8th DTT multiplex.

In 2008, the CSA will launch an unprecedented wave of calls for tender over the whole territory for the digitalization of local broadcasting, which will hopefully lead to a stronger local audiovisual sector.

## *The launch of DVB-H services*

The CSA has also launched, on 6th November 2007, a call for tender for mobile television services using DVB-H technology. With this initiative, France will join the group of European countries which are leaders in this area: Finland and Italy but also, very soon, Germany, Switzerland, Austria and Spain.

As detailed below, this call is the result of more than one year of intense work for the main supporters of mobile television in France and the Administration. These efforts have lead to a quick implementation of the regulatory process which progressively removed the main uncertainties for the roll-out of mobile TV: the availability of spectrum, the framework for the authorization procedure, the technical standards.

The first phase consisted of spectrum planning, overseen by the CSA. This work resulted in the identification of a set of frequencies covering around 80 of the main urban areas in France, allowing a coverage of more than 30% of the population. This new multiplex, nicknamed M7, will extend its coverage when the analogue switch-off has been completed.

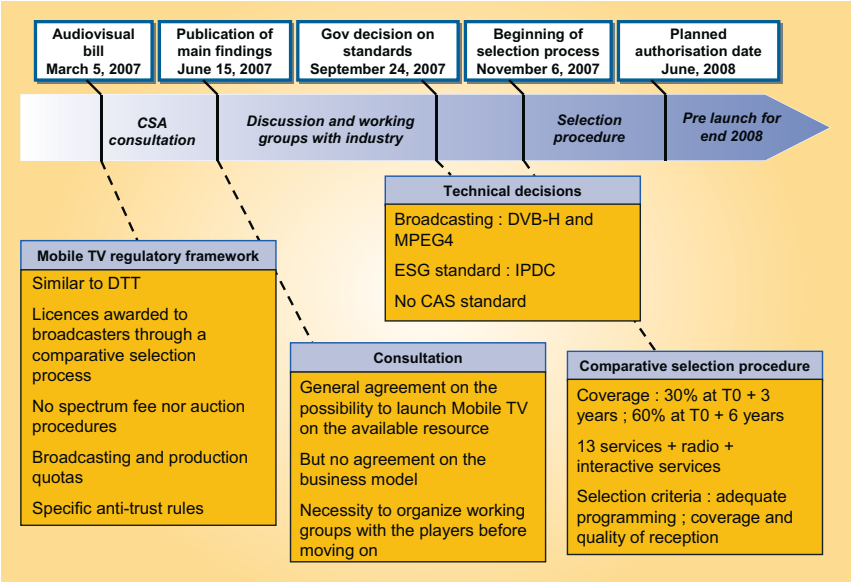


**Figure 4**
**Planning for mobile TV broadcast services in France**

With a guaranteed availability of spectrum for mobile television, the definition of the regulatory framework for mobile television was the next big challenge. The bill of 5th March 2007 was an opportunity to adapt the existing regulations on digital television in order to tackle the specific convergence issues that this new medium was creating.

Concerning the standards, the choice of MPEG-4 AVC, HE-AAC and DVB-H by the Ministry of Industry and the Ministry of Culture, after a wide consultation, was well received. Their "open approach" to conditional access, consisting of imposing one scrambling algorithm (Ismacryp) and pushing for a simulcrypt of the services was also well supported.

However, the early choice of DVB-IPDC as the ESG standard is now becoming problematic, considering the recent evolutions in the OMA-BCAST smartcard profile which is to become available at the end of 2008, and the strong support it is receiving from the mobile operators. An evolution of the technical framework might therefore be needed in order to launch mobile services in the best conditions.

The CSA took the initiative to organize technical working groups with the industry, to solve some issues over what was needed to launch a call for tender. The most important of these were:

- **Estimating the relevant bitrates for the different services.** It was a necessary step for the CSA to decide on the number of services to be broadcast in the multiplex. The CSA decided to open the DVB-H multiplex to 16 television services, 4 to 9 radio services and to reserve 120 kbit/s for interactive services;

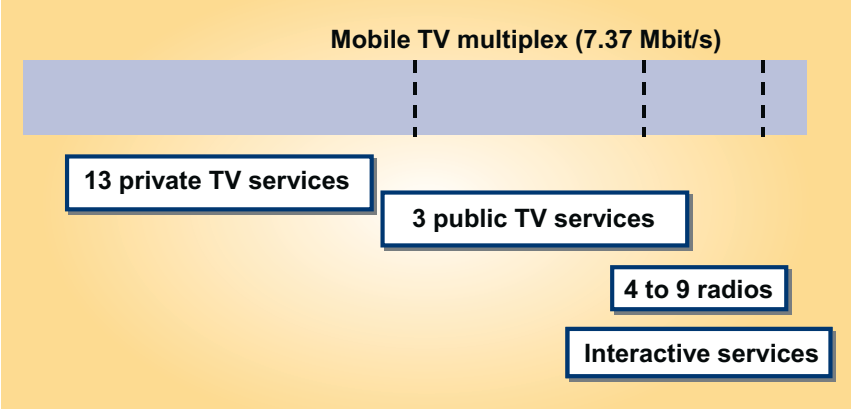


**Figure 5**
**Allocation of mobile services in a single multiplex**

- **Defining common terms of references for the quality of coverage and the minimal field strengths needed.** The estimation of the scale of the related network infrastructure has guided the CSA in the definition of minimal obligations in term of coverage (30% of the population to be offered outdoor coverage over the next three years and 60% after six years);

- **Assessing the risk of interference to existing services due to the introduction of DVB-H networks.** This point is still under study, with various field trials taking place in France.

36 projects have been registered with the CSA, less than half of which are pure simulcasts. The results reveal a strong involvement of newcomers in the audiovisual business, such as the mobile phone operators. Indeed, Orange for instance filed two projects.

As in 2007, 2008 will be full of challenges for the regulator in the field of mobile TV. Besides the necessary technical work (planning the protocols, signalling profile, etc.. . ), new issues will have to be addressed. Some examples are: interactive services, which will require specific regulations; the extension of the existing regulations concerning the protection of minors from harmful content ...

Before joining the technology division of the CSA, **Aurélien Louis** worked at Siemens medical solutions in the field of nuclear imaging, as a reseach scientist in applied mathematics and statistics.

At the CSA, he is project manager for mobile television and European spectrum policy in the “development & forecast” team.

He is a graduate of *Ecole Polytechnique* in Paris and holds a Masters degree in information and communication technology from *Telecom ParisTech*. He is a civil servant of the *corps des telecommunications*.

**Matthieu Roger** is head of the department “development & forecast” in the technologies directorate of the *Conseil supérieur de l'audiovisuel* (CSA). He holds a Masters degree in telecommunication from the *Ecole Nationale Supérieure des Télécommunications* in Paris (*Telecom ParisTech*).

He has been active in the fields of broadcasting and telecommunications over the last ten years and has been involved in various different projects : DTT promotion in its early stages; standardization follow-up; project management for private networks deployment; conditional access systems; DTT signalling; spectrum policy …

## Conclusions

After a late launch of DTT in 2005, France is now quickly developing a host of new digital television services. With up to eight HD DTT services using MPEG-4 compression planned for the end of 2008, to DVB-H mobile TV, plus digital radio in T-DMB ... the evolution of the whole French audio-visual landscape is strongly moving forwards, also supported by cable, satellite and a fast developing TV-over-ADSL (IPTV) platform.

Bringing this digital revolution to everyone will also be one of the main challenges in the future for the regulator and the government. The extension of DTT coverage to 95% of population is set to be completed before November 2011 and a CSA report is soon to delivered to the government on how to develop DTT in the French overseas territories.

At some point, all these developments will require more spectrum to be further deployed: switching off the analogue TV transmissions will therefore be part of the main priorities for the CSA in the coming years.