Global TD-LTE Initiative

Feb. 16th, 2014

Response to the public consultation on the strategic review of spectrum for high speed broadband in France

COMMENTS OF GTI

The Global TD-LTE Initiative (GTI) is pleased to be able to respond to French consultation on “Revue stratégique du spectre pour le très haut débit mobile”. This response has been prepared by the Spectrum Working Group of GTI.

GTI (Global TD-LTE Initiative) is an open platform in 2011, advocating cooperation among global operators and vendors to energize the creation of a world-class and a growth-focused business environment. GTI aims to build a robust ecosystem of converged TD-LTE/LTE FDD, and speed up its commercialization. With 4 years’ development, GTI has become one of the most important cooperation platforms with 116 operator members and 97 vendors.

Accordingly we welcome the initiative by the France to review the Spectrum Usage Strategy - 2.3 GHz, 2.6GHz and 3.5GHz bands, which would maximize future flexibility for a review of planning issues. GTI hereby submits its comments in response to the French consultation on the Spectrum Usage Strategy and the general views on future opportunities on some certain bands in your consultation paper.

1. General view and comments

1.1. General views on TDD and SDL modes

Question n° 5. Partagez-vous l'analyse présentée concernant le besoin d'accès à de nouvelles fréquences mobiles ? Quels sont selon vous les intérêts ou les limites des modes TDD et SDL parrapport au mode FDD ?

The explosive increase of mobile traffic foreseen over the next year places strong demand for the capacity of the future mobile networks, and enabling access to more spectrum for mobile service is one important aspect to meet this challenging requirement. Therefore, we welcome and appreciate all initiatives aiming to open more spectrum for mobile service. We also believe the unpaired spectrum planning will provide great values in terms of efficiency and flexibility of the spectrum utilization.

TDD and SDL, though both can be employed to utilize the unpaired spectrum, have remarkable different impacts on the ecosystem and market competition. We would like to take this opportunity to summarize our views.

1.1.1. Implications in case of SDL introduction in TDD bands

1) **If both regular TDD and SDL are allowed in the same band, it may cause coexistence issues and lead to less efficient use of the spectrum.**

Operators are well aware of the interference issues in case of unsynchronized TDD networks in the same band; inter-operator coordination, such as choosing a common UL/DL ratio, is recognized as the way forward in order to avoid loss of spectrum in guard bands or operator-specific filters (that may not be easily added to already deployed equipment).

SDL/TDD coexistence is a special case of unsynchronized TDD with the additional constraint for which DL-to-UL interference is not mutual (assuming that eNB-eNB is dominant and UE-UE interference is negligible). Considering that not all operators have the spectrum assets to allow carrier aggregation with other bands, and considering that some TDD networks have already been rolled out in some markets, the introduction of SDL would lead to the need of inter-operator guard bands in some markets.

2) **SDL introduction would split the global LTE UEs eco-system and UEs roaming**

SDL introduction would trigger different UE designs in the TDD bands, two different types of UEs in the same band which would weaken the ecosystem and determine negative impacts in terms of roaming. Different CA band combinations for different operators using SDL will further fragment the UE ecosystem.

The introduction of the SDL at this time would not allow industry to take benefits of the established ecosystem of LTE TDD for the TDD bands.

Introducing a non-standalone SDL carrier in TDD would suffer from:

- Throughput loss in case of legacy (i.e. non CA capable) UEs
- Limitation in the applicable deployment scenarios
- PUCCH congestion on the Macro cell
- Limitations to the end user devices roaming ability.

On the other hand, TDD standalone operation ensures:

- The backward compatibility for legacy UEs
- Avoiding incentive for UE vendors to design RX-only UEs for cost saving, this would fragment the UE ecosystem.

That the band can be used either as Primary Cell or Secondary Cell thanks to the UL channel availability, the UE has the flexibility to access any band with better coverage also ensuring energy saving on the UE side.

As a consequence, encouraging or allowing SDL could fragment the UE ecosystem and impact roaming capabilities or usability of current TDD UEs that can be used standalone today.

3) SDL may create negative consequences on market competition

On one hand it may be desirable to avoid TDD/SDL coexistence issues (just as it may be desirable to synchronize neighbor TDD networks), but on the other hand designing the whole band as SDL would impact competition as smaller operators with less spectrum assets would be excluded.

Synchronization is a key issue for TDD spectrum. It encompasses both a technical topic (i.e. how to transmit a proper common clock to all equipments) and a topic related to the business-case (how to agree on a common UL/DL ratio, and other technical parameters). Significant progress has been made in the recent years regarding the first issue, and there are now several alternatives beyond GPS that start to mature both technically and within the standards. Some of them are described in ECC report 216.

On the other hand, reaching agreement on a common UL/DL ratio may not be straightforward when operators have different business-cases and result is not guaranteed if this is left to an optional inter-operator negotiation, despite the lack of synchronization is often more harmful for the operators than setting a suboptimal UL/DL ratio. The consequence is not limited to the risk of guard bands, but more generally it means that

- no operator can start to deploy using the relaxed Block Edge Masks profile (i.e. without custom operator-specific filters on all equipments) until there is certainty that unanimity will be reached on inter-operator synchronization
- if new operators are introduced at a later point in time, and those refuse to

synchronize, then it brings new challenges since equipments already deployed won't be easily upgraded to meet the more restrictive block edge mask.

- UE-UE interference may happen since those don't integrate custom filters

Therefore, synchronization is very beneficial not only to avoid guard bands, but also to avoid custom operator-specific filters.

In some situations such as rural areas, isolated cells, low-power small cells, etc., inter-operator synchronization may remain optional as the interference to other cells in adjacent channels is limited. However in the case of urban deployments with macro/microcells, it may be beneficial to design a proper regulation that will ensure that inter-operator synchronization will be guaranteed if the majority (as opposed to unanimity) of operators estimate the benefits overcome the drawbacks (e.g. in China and Japan, inter-operator synchronization was mandatory to avoid those uncertainties).

1.1.2. Overall Remarks and Recommendation

With increased recognition of its value, LTE TDD has gained wide ecosystem acceptance and backing from leading operators, infrastructure and device vendors. The consistent global TDD assignment in TDD bands will enlarge the global market scale for standardized products and facilitate global roaming.

With reference to the downlink-only SDL, the unquestioned benefits deriving from the availability of extra downlink resources could be very well achieved with other UL:DL TDD frame ratios, as already supported in the 3GPP standard. What’s more, converged FDD + TDD network can also achieve above mentioned benefit. Up to date there are already 18 converged FDD+TDD network commercially launched. Additionally, some FDD operators e.g. in Japan, Singapore and South Korea are deploying or planning converged FDD+TDD networks.

Industry greatly benefits from stable regulations for harmonized bands, this is especially applies at this time to the 3GPP Band 38, Band 40, Band 42 and 43, whose LTE-TDD ecosystem has already reached a remarkable degree of consistency.

GTI therefore strongly recommends France regulators to take into account the points highlighted in this report and to enable TDD utilization for the spectrum bands with well established global TDD ecosystem or with high potential of becoming main-stream TDD bands in future.

1.2. IMT2300-2400 unpaired spectrum TDD

Question n° 26. A quelle date des équipements de réseaux et des terminaux mobiles en

bande 2,3 GHz seront-ils disponibles à grande échelle et compatibles avec un déploiement commercial en Europe ? Avez-vous des remarques à apporter sur les conditions techniques d'utilisation de la bande telles que décrites ici ? Préconisez-vous la mise en oeuvre de réseaux TDD synchronisés ou nonsynchronisés? Dans le cas de réseaux TDD non-synchronisés, sur quelle largueur de bande serait-il nécessaire de mettre en place une bande de garde ou des blocs restreints ? Quelle est votre analyse quant à l'intérêt présenté par la bande 2,3 GHz pour le développement du très haut débit mobile ? Le partage, dans sa version statique ou dynamique, des fréquences avec le ministère de la Défense vous parait-il réalisable ? A quelle échéance faut-il le cas échéant attribuer ces fréquences ? Quelle quantité de fréquences faut-il prévoir par opérateur ?

1.2.1. General view on IMT 2300-2400

The standardization organizations, operators and manufacturers have promoted TDD network developed quickly in some countries, especially in the 2.3GHz band. Due to large bandwidths available with medium propagation loss and penetration loss, this band has been highly appreciated by industry. 13 countries have deployed 20 commercial LTE TDD networks in 2.3GHz band, such as China, Russia, India, South Africa, etc. In addition, others 17 TDD commercial networks are in deployment or firmly planned in band 40.

Commercially launched LTE TDD networks in 2.3GHz band

Country	Operator	TDD frequency	TDD band(s)
Australia	NBN Co.	2.3GHz	40
Australia	Optus	2.3GHz	40
Canada	Telus	2.3GHz	40
China	China Mobile	2.3GHz	40
China	China Unicom	2.3GHz	40
Côte d'Ivoire	YooMee	2.3GHz	40
Hong Kong	China Mobile Hong Kong	2.3GHz	40
India	Aircel	2.3GHz	40
India	Bharti Airtel	2.3GHz	40
Indonesia	PT Internux	2.3GHz	40
Nigeria	Spectranet	2.3GHz	40
Nigeria	Swift Networks	2.3GHz	40

Oman	Omantel	2.3GHz	40
Oman	Ooredoo	2.3GHz	40
Russia	Vainakh Telecom	2.3GHz	40
Saudi Arabia	STC	2.3GHz	40
South Africa	Telkom Mobile(8ta)	2.3GHz	40
Sri Lanka	Dialog Axiata	2.3GHz	40
Sri Lanka	Lanka Bell	2.3GHz	40
Vanuatu	WanTok	2.3GHz	40

Until October 14, 2014, 2,218 LTE user devices (including operator & frequency variants) are announced by 183 suppliers. 644 of LTE devices (29%), which is 370 more than a year ago, can operate in LTE TDD mode (TD-LTE), supporting the growing number of LTE operators using unpaired spectrum. Bands 40 (2.3 GHz) has the largest choice of terminals: 427 devices (66.3%), and among which are 171 smartphones. Regional progress and standardization progress are introduced as follow.

1) Region 1

As we know, there has been several 2.3GHz TDD networks developed or in deployment in region 1.Such as, Vainakh Telecom has launched the 2.3GHz TDD network in Russia. Besides Europe the 2.3GHz TDD networks are progressing well in Middle East. The 2.3GHz TDD network has been deployed by STC to ensure users experience of the smartphone and data card in Saudi Arabia.

In Europe the band 2300 – 2400 MHz (2.3 GHz) is allocated to the Fixed and Mobile services on a co-primary basis, and to the Radiolocation and Amateur services on a secondary basis.

In some countries in Europe the band is extensively used for defense or security purposes including aeronautical telemetry in accordance with ERC Recommendation 62-02 and Closed-Circuit Television (CCTV). The band is still a core band for wireless cameras as part of SAP or SAB applications. SAP/SAB operates on a non-interference, non-protected basis and assignments of these services tend to be temporary in nature.

In CEPT ECC, The Frequency Management Working Group, via project team FM 52, has been tasked with developing a draft ECC Decision, aimed at harmonizing implementation measures for MFCN (including broadband wireless access systems) in the frequency band 2300-2400 MHz including:

- least restrictive technical conditions (LRTC), taking into account the existing standardization framework and activities at the worldwide level, and an appropriate frequency arrangement;
- Regulatory provisions based on Licensed Shared Access (LSA) to facilitate the long

term incumbent use of the band in the territory of those administrations that wish to maintain such use.

FM52 is also developing a recommendation on cross-border coordination between MFCN, and, between MFCN network & other systems in the 2300-2400 MHz band.

In UK, In September 2013, the Ministry of Defence (MoD) announced that Ofcom would be made responsible for the award of 40MHz of spectrum across the 2.3GHz bands. The Ofcom plan to award licenses for use of the released 2.3GHz frequencies as soon as is practical. They plan to do this during the 2015-16 financial years. Given that the 3GPP standard only contains an unpaired band plan and CEPT are only considering an unpaired band plan, the Ofcom are proposing to be consistent with these.

As for the standardization, the band has already been standardized in 3GPP (Band 40).

2) Region 3

In region 3, a good number of countries have utilized TDD network in 2.3GHz. For examples, CMHK has achieved 2.3GHz TDD first-stage project with 1500 base stations in December 2012. Bharti Airtel has built a 2.3GHz TDD network with 6000 base stations in India. Malaysia, Sri Lanka, Indonesia are also in deployment or firmly planned in 2.3GHz. Furthermore, lots of operators have voiced intention on TDD network in 2.3GHz.

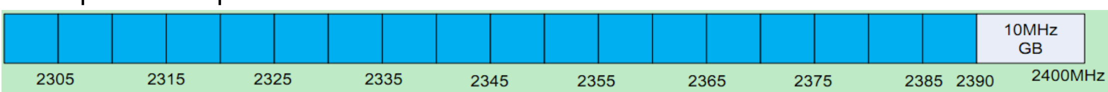
Considering the responses of 2300-2400 MHz Questionnaire from APT member countries, following frequency arrangement are recognized in the band 2300-2400MHz in APT region:

- ➢ Full TDD arrangement is preferred. However, flexible FDD/TDD arrangement is also considered for administrations that are required to meet local conditions.
- ➢ Channel raster of 5MHz and 9 MHz are used.
- ➢ 10MHz or wider/narrower guard band to 2.4GHz ISM band is considered.

Illustrations for band plan options based on the views are as follows:

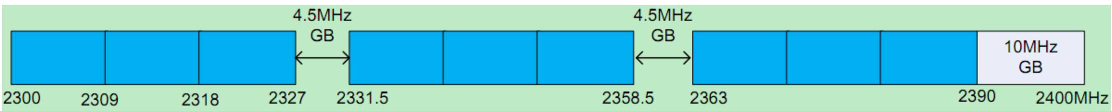
- ● Option 1: Full TDD without specific arrangement

- ● Option 2 : implementation of 5MHz channel raster



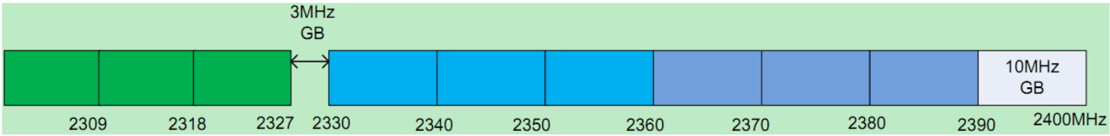
- ● Option 3: implementation of 9 MHz channel raster

- Case A: 9 MHz only

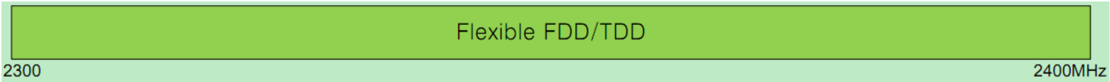


- Case B: 9 MHz and 10MHz

· Technical condition for coexistence between 9 MHz and 10MHz is being considered.



Option 4: Flexible FDD/TDD



1.2.2. 2300-2400MHz---Now and for the Future

It is of utmost importance to serve the growth in mobile broadband services in the 2300 – 2400 MHz frequency band, which is allocated to the Mobile Service and identified for IMT globally in the ITU Radio Regulations. The band is targeted for utilizing TDD technology by 3GPP as LTE Band 40. Driven by the growing developments in the Asia Pacific region, multi band devices are already available supporting this band.

1.2.3. Comments on the consultant

GTI think that with the adoption of more mobile devices under exclusive licensed (top priority), 2300 – 2400 MHz is a global harmonized TDD frequency band. Considering the TDD block bandwidth, larger bandwidth such as 40MHz or more is suggested, which are all supported by LTE-A technology and can satisfy the needs of traffic boost. Considering the high spectrum usage, synchronization is also recommended. LSA would also be considered to enable the sharing between IMT and incumbent services.

1.3. IMT2570-2620 spectrum

Question n° 27. A quelle date des équipements de réseaux et des terminaux mobiles en bande 2.6 GHz TDD seront-ils disponibles à grande échelle et compatibles avec un déploiement commercial eu Europe ? Avez-vous des remarques à apporter sur les conditions techniques d'utilisation de la bande telles que décrites ici ? Si plusieurs opérateurs sont autorisés dans la bande, préconisez-vous la mise en oeuvre de réseaux TDD synchronisés ou non-synchronisés ? Dans le cas de réseaux TDD nonsynchronisés, sur quelle largueur de bande serait-il nécessaire de mettre en place une bande de garde ou des blocs restreints ? Quelle est votre analyse quant à l'intérêt présenté par la bande 2,6 GHz TDD pour le développement du très haut débit mobile ? A quelle échéance faut-il le cas échéant attribuer ces fréquences ? Quelle quantité de fréquences faut-il prévoir par opérateur ?

1.3.1. General view on IMT 2600

It is very wise to consider the 2.6GHz band for mobile and fixed wireless access system as it has become one of the key bands for LTE deployment globally. As the latest advanced mobile network technology, Long-Term Evolution (LTE) will contribute to maximize the social and economic value of 2.6GHz spectrum.

1) 2.6GHz spectrum status

The following 3 frequency arrangements were recommended and captured in ITU Recommendation M.1036 [1] in the year around 2004. And in the following years, the band plan and frequency arrangement have been determined by the administrations in different countries/regions.

Frequency arrangements	Paired arrangements					Unpaired arrangements (e.g. for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	Centre gap usage	
C1	2 500-2 570	50	2 620-2 690	120	TDD	2 570-2 620 TDD
C2	2 500-2 570	50	2 620-2 690	120	FDD	2 570-2 620 FDD DL external
C3	Flexible FDD/TDD					

Figure 1.1 ITU Frequency arrangement in 2500-2690MHz

Follow-up to the ECC Decision of 18 March 2005 (ECC/DEC/(05)05) [2], most of the EU countries which released 2.6GHz band, such as France, Germany, Sweden, Finland, Holland and etc., have allocated this band according to the following arrangement.

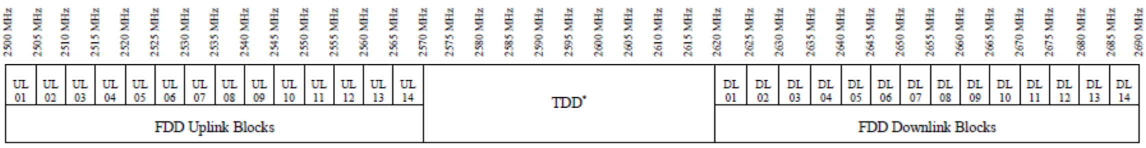


Figure 1.2 EU Frequency arrangement in 2500-2690MHz

Besides Europe, countries in other parts of the world, representatively US, China and Japan, have planned this band for IMT system with TDD mode which aligns with ITU frequency arrangement C3.

In the United States the 2.6GHz band is designated by Part 27 of the FCC rules and regulations, as specified in Title 47 of the Code of Federal Regulations [3]. The arrangement of the 2496 – 2690MHz band is shown below in Figure 1.3.

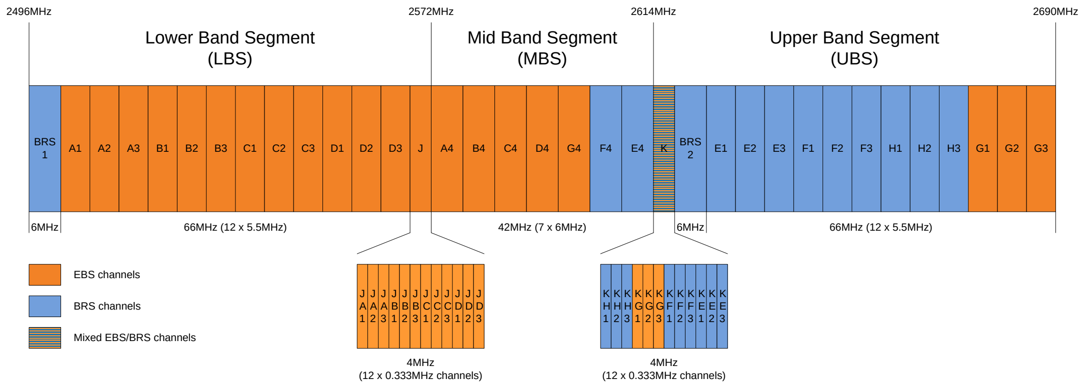


Figure 1.3 BRS/EBS channel plan and LBS/MBS/UBS band segmentation

Commercial operators can own the BRS blocks or lease EBS blocks (commercial operators cannot own EBS blocks, only non-commercial operators such as churches or educational institutions can) across various markets in order to make up their spectrum holding. Due to the fragmented nature of ownership, each block can potentially have a different owner within a specific geographic area and, in certain areas, the availability of EBS blocks (mainly in the LBS) is limited. The consequence of this ownership structure is that operators in the US preferring to operate TDD based systems in order to make best use of the spectrum available. Then the 2.6GHz spectrum is standardized as TDD band 41 (shown in figure 1.4) in 3GPP [4, 5] in 2010.

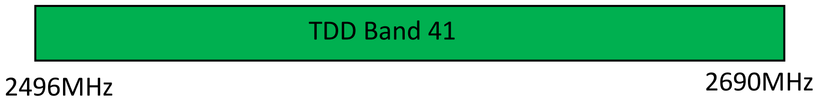


Figure 1.4 TDD Band 41

In China, the whole frequency band 2500-2690MHz has been planned for IMT system with TDD mode in Oct 2012 and manually required synchronization in 2013. Three Chinese operators China Mobile, China Telecom and China Unicom have got spectrum in this band and all of them have provided services in Band 41 based on LTE TDD technology.

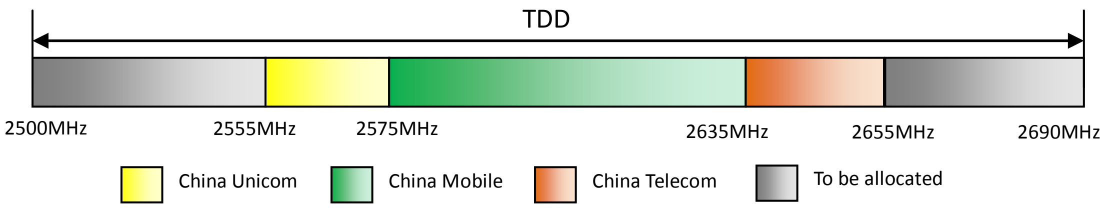


Figure 1.5 2500-2690MHz frequency arrangements in China

Japan also followed TDD band 41 subsequently and Soft Bank has launched LTE TDD commercial network in this band in 2012.

Many other countries in Asia and other regions, have allocated this band for WiMAX technology years ago and a lot of legacy spectrum in this band is owned by WiMAX operators. As for the re-farming, LTE TDD is an ideal choice for WiMAX operators in

2.6GHz spectrum growing their business. It is expected that LTE TDD will continue to exploit and expand global economies of scales in 2.6GHz band in these regions/countries.

2) LTE Industry and Ecosystem at 2.6GHz

LTE FDD Network Status at 2.6GHz

Band 7 is already widely deployed being used in 26% of LTE-FDD networks worldwide in 86 networks. And is the second most used band for LTE-FDD behind 1800MHz (Band 3).

LTE TDD Network Status at 2.6GHz

LTE TDD is one of the mainstream technology delivering capacity, data throughput enhancements and low latency to support existing and new services and features requiring high level of capability and performance. Interest in LTE TDD is global and strengthening. GSA confirms that around 1 in 8 commercial LTE networks incorporate the TDD mode. 48 LTE TDD systems are commercially launched in 30 countries, including 17 operators who have deployed both FDD and TDD modes in their mobile operations.

As mentioned above, 2.6GHz band is one of the key bands for LTE development. Up to now operators from China, the United States, Japan and so on, have launched commercial LTE TDD network in Band 41. Also some operators launched LTE TDD network in Band 38 which have overlapping frequency (2570-2620MHz) as Band 41. It means that LTE TDD has formed the basis of global roaming in 2.6GHz band.

The decision by operators in China to deploy LTE TDD ensures that a large-scale market and robust ecosystem will be established in 2.6GHz, benefitting all TDD markets. MIIT issued LTE TDD licenses to China Mobile, China Telecom and China Unicom on December, 2013.

- China Mobile commercially launched LTE TDD on December 18, 2013 in Band 39, 40 and 41. 320,000 base stations were activated by June 2014. The announced target in 2014 includes 500,000 base stations deployed across 340 major cities and 100 million LTE TDD user terminal sales.
- China Telecom commercially launched LTE TDD service in Band 41 on February 14, 2014, initially offering service in almost 100 cities.
- China Unicom commercially launched LTE TDD services in Band 40 and Band 41 on March 18, 2014 in 25 cities and plans to cover 100 cities in 2014.

According to MIIT, the number of LTE subscribers in China has reached 40 million at end September, 2014.

SoftBank commercially launched LTE TDD (AXGP) in Feb, 2012. The AXGP subscribers have approximated 4000,000 by the end of July, 2014.

Following its buyout of Clearwire who owns all 2.6GHz TDD spectrum in US, Sprint stopped selling WiMAX service after 2012 and commercially launched LTE TDD in Band 41.

The total number of LTE TDD subscribers is forecasted to increase to 100 million by the end of 2014, according to Digitimes Research.

Availability of devices [6]

FDD Band 7 is strongly supported in devices, again ranking 2nd in LTE-FDD network behind Band 3.

The ecosystems for TDD bands 38 and 41 (2.6GHz) dominate the LTE TDD devices and are almost identical, supported in almost half of TDD devices. Availability of devices that can support TD-LTE remains growing. According to GSA statistics, there are 683 devices in the market in mid-July 2014.

1.3.2. Comments on the consultation

As mentioned above, IMT 2600MHz band is one of the most important key bands for LTE global development. Hence we would recommend that the authority consider band7+band38 plans for IMT 2600 band. Considering the TDD block bandwidth, larger bandwidth such as 20MHz or more is suggested, which are all supported by LTE-A technology and can satisfy the needs of traffic boost. Considering the high spectrum usage, synchronization is also recommended among TDD operators, or if band 38 would be allocated to only one TDD operator, inter-operator interference can be avoided.

1.4. IMT3400-3800 unpaired TDD spectrum

Question n° 28. A quelle date des équipements de réseaux et des terminaux mobiles en bande
3,5 GHz seront-ils disponibles à grande échelle et compatibles avec un déploiement commercial eu
Europe ? Avez-vous des remarques à apporter sur les conditions techniques d'usage de la bande telles que décrites ici ? Préconisez-vous la mise en oeuvre d'un plan TDD ou FDD pour la sous-bande 3,4-3,6 GHz ? Pour un plan TDD, préconisez-vous la mise en oeuvre de réseaux TDD synchronisés ou non-synchronisés ? Dans le cas de réseaux TDD non-synchronisés, sur quelle largueur de bande seraitil nécessaire de mettre en place une bande de garde ou des blocs restreints ? Quelle est votre analyse quant à l'intérêt présenté par la bande 3,5 GHz pour le développement du très haut débit mobile ? A quelle échéance faut-il le cas échéant attribuer ces fréquences ? Quelle quantité de fréquences faut-il prévoir par opérateur ?

1.4.1. General view on IMT 3600

We think it is very wise for France to consider the 3.6GHz band for mobile service. As the latest advanced mobile network technology, Long-Term Evolution (LTE) will contribute to maximize the social and economic value of spectrum, especially in the case of local area deployment.

3.6GHz is being increasingly recognized as the most promising global harmonized TDD band and will play a key role in meeting the explosive mobile data demands. Regional band planning or re-farming considerations for this band have made significant progress in the world in recent years. The progress of 3.6GHz band is introduced as below.

1) Progress in Region 1

In Europe, there has been a transition from a framework designed for BWA/rural access to a new framework designed for IMT-Advanced purposes. The initial BWA framework (reflected in EC decision 2008/411/EC) assumed paired spectrum allocations could be used either as TDD or FDD, together with a proper block-edge-mask. This was fine as rural deployment usually exhibit few inter-operator coexistence issues, and ensuring flexibility was more important in this context. However, for IMT-Advanced purposes, those assumptions were no longer true, i.e. sites are often shared among operators, and FDD/TDD or unsynchronized TDD/TDD coexistence issues were expected. Besides, the flexible arrangement did not provide enough guidance to the industry to know where to invest (which is illustrated by WiMAX failure to properly address the mobile market in this frequency band). Yet, most countries and operators recognized the 3.4-3.8 GHz bands as the main suitable contiguous block of spectrum to enable IMT-Advanced data rates, and it was desirable to get a new proper harmonized regulatory framework to help those deployments happen.

Despite this situation, some operators have already started to deploy fixed and mobile services in Europe, and most existing WiMAX operators are transitioning to LTE-TDD or planning to do so. Depending on the country and context, fixed and mobile markets can be considered. However the common denominator of all successful deployments within this band is that they all have access to a significant amount of spectrum to enable large datarates and compete fairly with lower bands. For example:

- UK Broadband has access to 130 MHz
- B-lite (Belgium) has access to 100 MHz
- Softbank (Japan) has access to 40 MHz
- e-plus (Germany) has access to 84 MHz
- ex-Clearwire Spain has access to 40 MHz

Since 2014, a new regulatory framework targeted for IMT-Advanced has been approved at ECC. Among other things, it recommends wide channels such as 40 MHz or greater to enable IMT-A datarates, and now mandates a homogeneous band plan to avoid TDD/FDD interferences within a country, and recommends TDD as the preferred arrangement for this band. All this work is reflected in CEPT report 49 (November 2013), in ECC decision (11)06 (march 2014), and in the new EC decision 2014/276/EU, as well as in ECC report 203 (Block Edge Masks) and ECC report 216 (synchronization).

The choice of the preferred TDD band plan has allowed the industry to have a clear view on a common profile worldwide

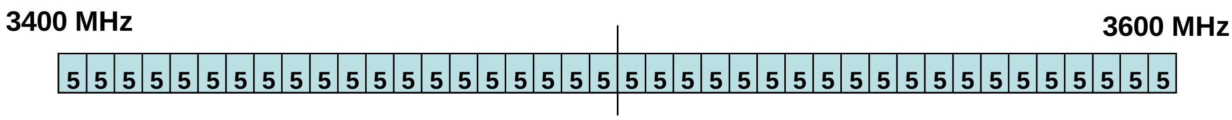


Figure 1.6 Preferred Frequency arrangement for the 3400-3600 MHz band based on TDD

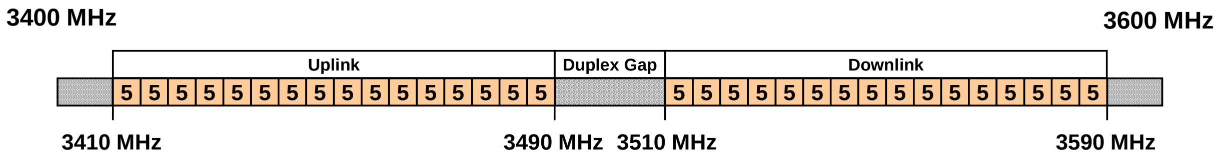


Figure 1.7 Alternative Frequency arrangement for the 3400-3600MHz band based on FDD

2) Progress in Region 3

Regulators in Region 3 have also speed up the planning of this band and it is expected to finish the planning soon in some representative countries, e.g. in Japan and China

In China, co-existence study and field tests have been carried out to evaluate the compatibility between TD-LTE and fixed satellite services. It is thought that current sharing study between TD-LTE and satellite is enough. It is feasible for TD-LTE to operate and coexist with satellite within band 42. Co-existence issue in very limited cases will be handled by the approach of geographic separation. It is anticipated that the planning for this band will be speed up in 2015.

In Japan, introduction of LTE-Advanced systems to 3400-3600MHz band was studied during 2012-2013. The technical requirements such as the coexistence with the incumbent systems (satellite, and microwave links) were concluded. And it is announced that Japan will launch LTE-A TDD in 3.6GHz commercial service around 2016.

In South Korea although some of the capacity in the 3.6GHz range is used for fixed satellite services, the government plans to release at least 160MHz of capacity at 3.6GHz for mobile broadband services by 2018 as part of its Mobile Gwanggaeto Plan. Both TDD (200MHz) and FDD (2x80MHz) options in 3400-3600MHz are considered to meet the capacity target.

3) Progress in North America

North America envisions 3.6 GHz as an “innovation band,” Three-Tier Spectrum Access is proposed by FCC that the band be structured according to a three-tiered shared access system enforced by a Spectrum Access System (SAS) and the use of geo-location based technology.

The first tier, Incumbent Access, would include authorized federal users. These incumbents would be afforded protection from all other users in the 3.6 GHz Band.

The second tier, Priority Access (PA), would include critical use facilities, such as hospitals, utilities, government facilities, and public safety as well as non-critical entities such as operators that would be afforded a quality-assured access the 3.6 GHz Band. TD-LTE would be a good candidate for this tier.

The third tier, General Authorized Access (GAA), would be authorized to use the 3.6 GHz Band opportunistically. GAA users would be required to accept interference from Incumbent and Priority Access tier users but have to avoid causing any harmful interference to Priority Access Licensees and Incumbent Access tier users.

In addition to the US mentioned above, ABC Communications in Canada has already commercially launched LTE TDD in British Columbia using 3.6 GHz on April 23.

1.4.2. LTE Industry and Ecosystem at 3.6GHz

Ecosystem around TD-LTE at 3.6GHz band, including availability of chipsets and devices, availability of network equipment, and the future of 3.6GHz band are introduced as follow.

<u>Availability of chipsets and devices</u>

Chipsets that support TD-LTE at 3.6GHz are now available. Chipset vendors that are known to have 3.6GHz capability for their TD-LTE chipsets include Huawei/Hisilicon, Sequans and Altair Semiconductor. Other important chipset providers such as Qualcomm and Intel will have 3.6GHz TD-LTE chipsets ready in 2014/2015.

Availability of devices that can support TD-LTE remains growing. The earliest devices available to operators are indoor and outdoor CPE to support fixed wireless broadband applications. In late 2013, multimode MiFi (GSM/UMTS/TD-LTE) has come into market serving many significant markets. Furthermore, during MWC 2014, Huawei showcased the world's first 3.6GHz TD-LTE smart phone prototype. Improvements in PA and RFICs are still needed to be on par with lower bands in terms of cost, power efficiency and battery life, however the situation is quickly improving since PA and RFIC vendors are actively working on new chipsets targeted for mobile UEs, which are expected to be available in early 2016 (for the first commercial offers in Japan).

According to GSA statistics, there are 26 devices in the market in mid-October 2014. Details for some selected devices are presented in the following table.

Vendor	**Device type**	**Device name**	**Frequency bands supported**
FIC	Mobile tablet	Elija TF9300	TDD 3500 b42, 43
Greenpacket	Router	DA-235 TD-LTE and WiMAX CPE	TDD 2300 b40,TDD 2600 b38,TDD 2600 b41,TDD 3500 b42, 43
Huawei	Router	B2268A Cat 4 device	TDD 1900 b39,TDD 2300 b40,TDD 2600 b38,TDD 3500 b42, 43
Huawei	MiFi	E5776s-420 Cat 4 personal hotspot	TDD 3500 b42, 43, LTE FDD 2600MHz UMTS 850/900/2100MHz
Mitrastar Corporation	Router	Outdoor CPE band 42/43	TDD 3500 b42, 43
Netcomm	Router	WNTD-4243 Outdoor TD-LTE Router	TDD 2300 b40,TDD 2600 b38,TDD 2600 b41,TDD 3500 b42, 43

Availability of network equipment

The status of the network equipment market is similar to the status of the device market: improving. A number of vendors of radio network equipment are making available eNodeB base station equipments to support TD-LTE at 3.6GHz, including Huawei, ZTE, NSN, Datang Mobile, Airspan, Accelleran, etc. Existing products are currently mostly macro cells and microcells, but pico/femtocells are expected in a very short timeframe as chipset vendors such as Qualcomm/Broadcom also have small cells reference-designs that are nearly ready to work on 3.6GHz.

Operator commitments to invest in TD-LTE at 3.6GHz

Many global operators have signaled their clear desires to use in the 3.6GHz band.

Operator commitments to TD-LTE at 3.6GHz are growing steadily. At the end of January 2015, there were nine live commercial TD-LTE networks at 3.6GHz: UK Broadband in UK, PLDT in Philippines, b•lite in Belgium, Menatelecom in Bahrain, ABC Communications, Bell Mobility, Xplornet and Telus in Canada, and Neo-Sky in Spain. In addition to these live commercial networks, over 20 operators have announced plans to launch services using TD-LTE in bands 42 and 43. These include players from all parts of the world. Here show some typical operators as follows.

Operator	Country	Details
Azqtel	Azerbaijan	Targeting service launch 2015
VipNet	Côte d'Ivoire	Targeting commercial launch in 2015
ITC	Saudi Arabia	In deployment, in deployment
Dedicado	Uruguay	Combined WiMAX / LTE network in deployment
Imagine Group	Ireland	Currently conducting trials of LTE
Milmex	Poland	Plans to launch 3.5 GHz TD-LTE in 2015
DBD	Germany	Has a licence with 42 to 70 MHz of 3.5 GHz spectrum nationwide and plans to deploy TD-LTE.
Bolloré Telecom	France	Plans to introduce TD-LTE system in band 42 (3.5 GHz), and launch mobile services using MM-MB devices

Except for the operators mentioned above, we expect over 10 countries are planning to auction 3.6Hz spectrum in the coming two years, including Japan, United Kingdom, Czech, Bulgaria and so on. Specially, leading operators from Japan promise to make a great contribution to 3.6GHz TD-LTE. Japan government has allocated 3x40MHz in 3.6GHz band to Softbank, KDDI and NTT DoCoMo in late 2014, and will deploy TD-LTE-A commercial network soon. This will drive forward the ecosystem around 3.6GHz TD-LTE more quickly.

1.4.3. TD-LTE at 3.6GHz: Now and for the Future

The aforementioned information means that the ecosystem around 3.6GHz TD-LTE is available and mature. As such, ever-increasing operators have a heightened interest in this large block of spectrum that has been available or may become available worldwide.

In contrast, the LTE FDD industry, has not yet announced any plans for the development of 3.6GHz networks or devices.

Global harmonization of the 3.6GHz spectrum band is critical to supporting a single ecosystem, particularly for chipsets and devices. Based on current situation, TD-LTE at 3.6GHz is the preferred choice for France, and it gives a bright future to address the rapid growing data needs. One thing to note is that inter-operator interference issues is suggested to be considered. China has avoided the inter-operator interference issue by making inter-operator mandatory (instead of optional, pending inter-operator agreements) in 2.6GHz. And TDD synchronization has been also mandated in 3.6GHz in Japan. This option may be better to explore to ensure TDD success in an urban environment with multiple operators.

1.4.4. Comments on the consultation

We think it is very wise for France to consider the 3.6GHz band for mobile service. Considering that 3.6GHz band is the most promising global harmonized TD-LTE band, your TDD decision will promote this 3.6GHz ecosystem.
Compared to some lower bands, the 3.4-3.6 GHz spectrum has drawbacks on coverage, diffraction properties, and indoor penetration, etc. however its main strength is the potential for worldwide harmonization with very high bandwidths for IMT-Advanced purposes.

From standards perspective, the 3.4-3.6 GHz band is supported both in TDD mode (Band 42) and paired FDD mode (Band 22). Yet, it has become clear in recent years that TD-LTE (i.e. band 42) at 3.5GHz has a far higher possibility to be the dominant IMT technology deployed around the world. As a comparison, 3.4-3.6 GHz FDD (band 22) has no device and no RF components available, and little or no roadmap from chipset vendors since market traction is much lower.

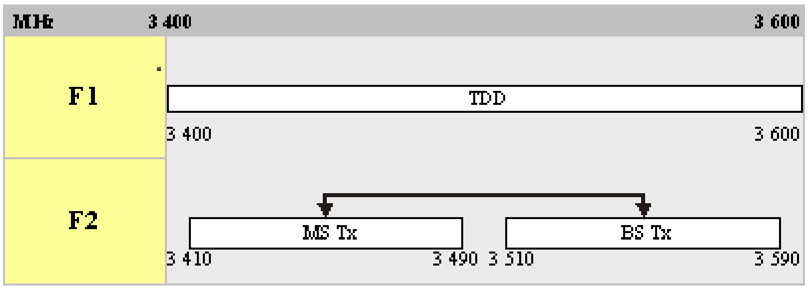


Figure 1.8 Two 3GPP specified arrangements on 3.5GHz

Besides, TDD is the only mode supported in the 3600-3800 MHz band (Band43). In the middle or short term, it is expected that C-Band (3800-4200 MHz) will be assigned for IMT use and the most likely technology is also expected to be TD-LTE.

Thus, TD-LTE at 3.6GHz is the widest 3GPP band, giving a total of 400MHz ultra wide bandwidth (further extended to 800MHz). This could enable operators to take the unique advantage of building super speed networks, which is highly desirable among global mobile operators when building a perfect heterogeneous MBB network.

As a consequence, GTI strongly supports the preferred TDD band plan in order to reach economies of scale with other regions of the world deploying 3.4-3.6 GHz TDD. GTI also notices that from ECC perspective, SDL is sometimes considered as a special case of TDD, yet we strongly discourage allowing SDL in this band (in all its potential forms, i.e. both subframe type 1 and type 2) since it raises significant risks of ecosystem fragmentation (RX-only UEs) and harmful interference (TDD/SDL, as exposed previously in section §1.1.2).

As mentioned in section §1.4.1, some other operators have already started to deploy in the 3.5 GHz band. However, successful operators nearly all have access to 40 MHz of spectrum or more. We understand that the situation is more complicated in France because the 3.4-3.6 GHz spectrum is fragmented, and existing licenses are very restrictive (small 15 MHz paired channels, restrictions on mobility or on usage as backhaul, etc.), which both impedes current incumbents and allocation of new blocks. Considering the new framework in EU, GTI encourages a global re-farming of the 3.4-3.6 GHz band in France that would be fair to existing incumbents and allow them to take advantage of the rising fixed and mobile IMT-A ecosystem in this band, while this defragmentation would also ease the allocation of new blocks for potential new operators and therefore be beneficial to everyone. Such a re-farming should target continuous blocks of 40 MHz as a minimum, and remove constraints or restrictions on mobility and coverage since 3.4-3.6 GHz is clearly a capacity band (whereas coverage of areas with low density of population is better handled with lower bands such as 700/800 MHz). Such a re-farming could also be the opportunity to design a more deterministic approach on inter-operator synchronization, as described in section §1.1.2 to ensure TDD success.

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