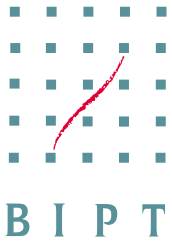

BELGIAN INSTITUTE FOR POSTAL SERVICES AND TELECOMMUNICATIONS

COMMUNICATION BY THE BIPT COUNCIL OF 10 SEPTEMBER 2018 REGARDING

THE INTRODUCTION OF 5G IN BELGIUM

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1. Introduction

Following the steady roll-out of public mobile networks and the technological evolution of 3G towards LTE[1], LTE advanced and 4.5G, 5G sets in as a true trend break. It is no longer just a question of providing the general public with powerful broadband voice and data connections, but also to digitise and interconnect the very diverse economic and social sectors. In the context of 5G, these sectors are referred to as "verticals". This applies to the automotive industry, security services, the energy sector, healthcare, the media, etc. Each sector will be characterised by specific communications needs. 5G is a technology developed especially for this, as of its conception, and that will be able to be deployed in all of these different domains.

5G's specific technical characteristics distinguish from 4G at three levels:

1. superfast mobile connections with a maximum speed (up until 20 GBits as a peak capacity and 100 MBits for each user);

2. strongly improved latency[2] *or a shorter response time (*1 ms);

3. the number of objects connected (up until 1,000,000 objects per square kilometre).

This will result in strongly improved mobile communication, ultrareliable networks for the Internet of Things (see below, point 4) and applications requiring a very low latency such as a self-driving cars.

5G will be standardised on an international level by the ITU[3] and 3GPP[4] (see below, point 6). In principle, the 3GPPP develops the technical standards which meet the objectives established by the ITU. In Europe, CEPT[5] should be mentioned, since it has also established a roadmap[6] for 5G. The European Commission is also very involved and has developed a 5G Action Plan[7].

In an opinion[8] adopted on 9 November 2016, the RSGP[9] considers that the 700 MHz, the 3400-3800 MHz and the 26 GHz bands are essential bands to introduce 5G in Europe, even before 2020. The RSPG believes that the 3400-3800 MHz band has the potential to give Europe a vanguard role in the roll-out of 5G.

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[1] *Long Term Evolution*.

[2] Delay.

[3] International Telecommunication Union.

[4] *3rd Generation Partnership Project.*

[5] *European Conference of Postal and Telecommunications Administrations*.

[6] http://www.cept.org/Documents/ecc/33340/finalsession1_workshop-conclusions

[7] https://ec.europa.eu/digital-single-market/en/5g-europe-action-plan

[8] *RSPG (Radio Spectrum Policy Group) Opinion on spectrum related aspects for next-generation wireless systems (5G).*

[9] Advisory group on radio spectrum policy set up by the Commission Decision 2002/622/EC of 26 July 2002 establishing a Radio Spectrum Policy Group.

That RSPG opinion does of course have a significant impact on the market's interest in future spectrum for public mobile networks. The conclusions[10] drawn following the BIPT consultation of 7 November 2014 consequently have to be put into perspective with a view to this later opinion.

At a national level BIPT is responsible for the efficient management and co-ordination of the radio frequencies (Art. 13 of the Act of 13 June 2005 on electronic communications (ECA)). In this context BIPT will promote the introduction of 5G in Belgium. For the consumer's interests and the functioning of the internal electronic communications market are at stake here.

BIPT believes that Belgium should be a front runner in Europe, giving operators the opportunity to implement 5G early. The policy regarding the availability of these bands (especially the 700 MHz and 3400-3800 MHz bands) should be adapted to the rapid evolution at an international level. In order to prepare Belgium for a digitised and interconnected world Belgian companies need to be able to implement 5G timely.

With a view to the strategic value of the 3400-3800 MHz band for the implementation of 5G, emphasis will be put on the making available of that band. The 700 MHz, 1.5 GHz and 26 GHz bands are of strategic importance to 5G as well.

On 26 July 2018 the federal Government adopted a number of draft Royal Decrees, among which drafts regarding the 700 MHz, 1500 MHz and 3600 MHz bands. The exact terms for the allocation of these bands are subject to the further evolution at an international level, the Belgian institutional obligations and the usual procedures leading up to the adoption of the necessary Royal Decrees.

[10] Point 2.8 of the BIPT Council Communication of 7 April 2015 regarding a pluriannual plan for the spectrum for public mobile services, see www.bipt.be.

2. Making available of the 5G frequency bands

All user rights allocated by BIPT are technologically neutral. This means that in principle the operator is free to choose the technology. In practice however, an ecosystem is brought about and certain frequency bands are mainly used for a specific technology: 800 MHz is for example exclusively used for LTE (4G), the 2100 MHz band traditionally serves as a UMTS band (3G), …

For 5G the RSPG, as mentioned in point 1, has designated the 700 MHz, the 3400-3800 MHz and the 26 GHz bands as essential bands in Europe. The 1.5 GHz band presents itself as a future band for 5G as well.

On 7 December 2016 the European Commission gave CEPT a mandate to examine the technical harmonisation terms for 5G[11].

As for Belgium BIPT confirms that, as already stated in the Communication of 7 April 2015[12], an open and transparent allocation procedure will have to be organised in the fall of 2019 in order to reallocate the 2G and 3G user rights for a period starting as of 15 March 2021. Provided that a Royal Decree laying down the allocation in the sense of Art. 18 of the ECA is published in due time, the 700 MHz band shall be opened up for the market in that same period.

The goal is to have the user rights for the 700 MHz band enter into force late 2020.

At the moment two operators have user rights in the 3400-3600 MHz band (Gridmax BVBA and Citymesh NV).

For the existing two players 20 MHz of TDD[13] spectrum is reserved on a national level. Both the other candidates and the operators who are already licensed get the opportunity to acquire spectrum in this band until 2040. BIPT finds it essential that the same terms apply to all licence holders, both as regards the annual rights and the unique fee. For that reason it is recommended that no licence holder should pay a unique fee for the period until 2025. An appropriate spectrum cap should ensure sufficient space for 4 operators. BIPT also feels that it should be ensured that each operator can dispose of a contiguous frequency block.

As for the 26 GHz band, it is still too early to say when it will be available approximately. Presumably this will be after 2021.

[11] *Mandate to CEPT to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union.*
[12] Point 2.1 of the BIPT Council Communication of 7 April 2015 regarding a pluriannual plan for the spectrum for public mobile services, see www.bipt.be.
[13] *Time Division Duplex.*

A table summarising the indicative time schedule for the 5G roadmap looks as follows:

Band	Period for the allocation procedure	Bandwidth
700 MHz	Fall 2019 Test goals 2018 – Q4 2020	60 MHz
3400-3800 MHz	Fall 2019 Test goals 2018 – Q1 2020	400 MHz
1.5 GHz (SDL)	Fall 2019 Test goals 2018 – Q1 2020	90 MHz
26 GHz	From 2021 Test goals 2018-2021	1 GHz
28 GHz	Test goals 2018-2021	
31.8-33.4 GHz and 40.5-43.5 GHz	2022-2027	

1550 MHz

3. The different frequency bands

3.1. 700 MHz band (making available 60 MHz)

A decision of the European Parliament and of the Council[14] on the use of the 470-790 MHz frequency band in the Union obliges the Member States to open up the 694-790 MHz band for mobile broadband systems by 30 June 2020.

The industrial shift towards 5G requires an effective and efficient management of the spectrum. The 700 MHz band will play an important role in this, namely for the coverage of rural areas and "deep indoor".

Against the background of a slow roll-out of 4G and the ancillary services in Europe, the successful launch of 5G in the Union will be of the utmost importance for the economic development, the competitiveness and the economy's productivity. This requires a ubiquitous network coverage in order to develop and offer services relating to the Internet of Things, e-commerce and the European cloud services. The 700 MHz band will have a great deal to contribute in this matter. BIPT will publish a roadmap for the 700 MHz band.

3.2. L band (making available 90 MHz)

The European Commission issued a mandate to CEPT[15] on 19 March 2014 to examine the harmonised technical conditions for wireless electronic communications broadband services in the 1.5 GHz band.

Two important decisions by the European Commission apply to this band:

- thehttps://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015D0750&from=EN for the 1452-1492 MHz band and Decision (EU)2015/750 of 8 May 2015

- the Decision (EU) 2018/661 of 26 April 2018 including an extension with the 1427-1517 MHz band. This decision was adopted following the mandate issued by the European Commission to CEPT[16] in this regard on 19 March 2014 in order to study the 1427 MHz-1517 MHz band for "downlink only". Before only the 1452-1492 MHz band was indicated as an SDL[17] band. To that effect CEPT delivered the report 65.

The (EU) Decision 2018/661 comprises the harmonised technical conditions for the contiguous spectrum of the 1427-1517 MHz frequency band including a revision of the terms and conditions for the 1452-1492 MHz band supporting the future 5G systems.

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[14] Decision (EU) 2017/899 of the European Parliament and of the Council of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union (*OJ L.* 138 of 25 May 2017).

[15] CEPT ("*European Conference of Postal and Telecommunications Administrations")*. CEPT studies and elaborates the policy regarding the compatibility terms for electronic communications activities in European context taking into account the European and international legislations and stipulations.

[16] *Mandate to CEPT to develop harmonised technical conditions in additional frequency bands in the 1,5 GHz range for their use for terrestrial wireless broadband electronic communication services in support of 5G.*

[17] *Supplemental Downlink*.

It will be preferable to make available the entire 1.5 GHz band at the same time as the auction of the other 5G bands takes place. In the Communication by the BIPT Council of 7 April 2015 regarding a pluriannual plan for the spectrum for public mobile services (see www.bipt.be) it was stated that the actual allocation procedure would only be organised if there was an actual need for it and provided the equipment is available. Such an approach will stimulate investments, reduce equipment costs and create economies of scale for investments. The situation has evolved since 2015 and BIPT is now looking into the opportunity to combine the auction of this band with the other bands in the multiband auction.

BIPT is authorised to lay down the technical parameters for the entire 1427-1517 MHz band[18] and will do so before the auction of this band, in accordance with the Decision (EU) 2018/661.

3.3. 3400-3800 MHz band (making available 400 MHz)

The RSPG has given a clear signal to the industry by designating 400 MHz of contiguous spectrum[19] as the essential band for 5G in Europe.

BIPT shall organise an open, transparent and non-discriminatory allocation procedure in order to allocate user rights for the entire 3400-3800 MHz band for the period as of 2020 (see point 2). User rights shall be allocated for a total of 400 MHz.

As mentioned in point 2, a draft of a new Royal Decree has been adopted, which is better adapted for the allocation of the 3400-3800 MHz band for 5G. That draft Royal Decree provides for an auction procedure for the entire 3400-3800 MHz band. These new user rights will be valid between 2020 and 2040, and include a mechanism for renewal. The auction procedure for the entire 3400-3800 MHz band, namely 400 MHz, is planned for the fall of 2019 at this moment. Two types of lots will be auctioned:

- spectrum for which no user rights exist (in total 360 MHz);
- spectrum for which Gridmax BVBA and Citymesh NV hold regional user rights at the moment (40 MHz in total).

Citymesh and Gridmax will also be allowed to participate in this auction procedure to keep user rights for the period as of 7 May 2025 and/or to obtain extra spectrum. In order to ensure that at least one other operator in addition to the three main public mobile operators can obtain 5G user rights, it will be possible to set a spectrum cap (of 100 MHz). Both the existing licence holders and the incumbent operators, as well as a possible newcomer, shall be given the opportunity to acquire sufficient spectrum in that band for 5G.

A distinction is made between two separate periods:

1) Until 7 May 2025

- The existing user rights of Citymesh and Gridmax will remain valid in the municipalities falling under these user rights, apart from the case in which these rights would be withdrawn.

[18] See Art. 18 § 1, subsection two, 1° and Art. 40, ECA.
[19] See footnote 8.

- The 5G user rights for which no user rights exists will be available on the entire Belgian territory. It concerns a band of 360 MHz.

- The 5G user rights for which user rights exist, may not be used in the municipalities to which those user rights apply. This regards a band of 40 MHz. BIPT will have to lay down the necessary technical and operational conditions to avoid harmful interference between the existing user rights and the 5G user rights. If the operator who holds the existing user rights also holds the 5G user rights, the latter are de facto available across the existing Belgian territory.

2) <u>As of 7 May 2025</u>

- Citymesh and Gridmax can make a bid on a band of 20 MHz reserved for the licence holders in the multiband auction (planned for the fall of 2019 at this moment). This auction's results will be valid for a period of 20 years.

- The entire 3400-3800 MHz band, i.e. 400 MHz, will be available across the entire Belgian territory (national blocks).

The draft Royal Decree approved by the Government on 26 July 2018, states that a number of stipulations from the Royal Decree of 24 March 2009 remain in force until 7 May 2025. The draft also provides that BIPT may change the distribution of the existing licence holders: the blocks that are allocated to Citymesh and Gridmax will be regrouped in the lower part of the band.

Each allocation procedure is subject to Article 30 of the Act of 13 June 2005 *on electronic communications.* Article 30 of the Act of 13 June 2005 shall be modified to provide for a unique fee for the 3400-3800 MHz frequency band. According to the draft approved by the Government, that unique fee will however not be due for the period up until 7 May 2025. For the current operators (Citymesh and Gridmax) do not pay unique fees for their user rights up until 7 May 2025 in this band by virtue of Article 30 of the Act of 13 June 2005 and the current RD of 24 March 2009. As the demand for this band shall increase its scarcity and value in the future, BIPT finds it justified to provide for a unique fee for the period after 2025 however.

For the 3400-3800 MHz frequency band exclusive user rights for 5G shall be granted. For bands higher than 30 GHz it shall be decided later which licensing system to apply. CEPT elaborated the harmonised technical conditions in report 67 . The European Commission (EC) will probably adopt an implementation decision on this matter before the end of the year.

3.4. 26 GHz band (24.25-27.5 GHz) and 28 GHz

26 GHz band

Today the lower part of the 26 GHz band (below 26.5 GHz) is partially used by the mobile operators for fixed backhaul connections.

The upper part (26.5-27.5 GHz) was an exclusive military band that was not used up until today.

BIPT now designates that band (26.5-27.5 GHz) as the pioneer band for 5G at 26 GHz. During a first period BIPT will make these bands available for 5G testing purposes[20]. Interested parties may submit their request with BIPT. At the moment no draft Royal Decree has been drawn up for this band. To this effect BIPT is considering 5 blocks of 200 MHz eligible for future allocation.

At this moment it is not yet clear how much spectrum there will be needed at 26 GHz. For operators with radio-relay links in this band it is therefore recommended to be very careful with additional investments in 26 GHz at the moment. For there is a possibility that this band will be subject to a reorganisation. See in this regard the Decision of the BIPT Council on the allocation of exclusive frequency bands for the use of radio-relay links, and radio interface E18 (26 GHz band), published for public consultation on BIPT's website (www.bipt.be).

In July 2008 CEPT approved the Report 68. This report will serve as a basis for an EC decision.

28 GHz band

Although the 28 GHz band is not meant for 5G use in Europe in the long run, test licences for 28 GHz are possible however. The 28 GHz band is a band that was designated for 5G in other parts of the world. The 28 GHz band is especially important as it has been designated for use in the United States and Korea[21]. The 26 GHz band and 28 GHz can easily be incorporated in one and the same device. We may therefore expect equipment to be commercialised in this band, serving to perform tests. The results of the tests at 28 GHz will be representative for the actual operation of the 26 GHz band.

[20] See Article 4, 6° and 6, § 3, of the Royal Decree on private radio communications and user rights for fixed networks and trunked networks.

[21] http://www.gsma.com/spectrum/wp-content/uploads/2016/06/GSMA-5G-Spectrum-PPP.pdf, pagina4.

3.5. Bands without licence

A number of EU harmonised frequency bands can be considered for 5G terrestrial wireless systems for certain 5G applications:

- 5150-5350 MHz and 5470-5725 MHz (5 GHz band), destined for RLAN[22]/WAS[23];
- 5875-5905 MHz (5,9 GHz) for safety-related applications of intelligent transport systems (ITS);
- specific frequency bands for short range devices (SRD);
- A frequency range at 60 GHz (e.g. for WiGig[24]) as well as the frequency range 63-64 GHz for ITS.

[22] *Radio Local Area Networks.*
[23] *Wireless Access Systems.*
[24] *Wireless Gigabit*: new Wi-Fi norm enabling higher speed.

4. Internet of Things (IoT)

The introduction of 5G pushes us to define a policy for the so-called "Internet of Things". While operators wanting to offer connections with a high capacity, concentrate on higher frequency bands, operators of networks for the "Internet of Things" applications such as Sigfox and LoRa[25] will mainly target low frequencies.

The Internet of Things is heterogenous. There are many applications, each with its specific requirements. Let it be clear that there is no single solution for the access to the spectrum applicable to all of these possible cases. The steady and expected growth of applications for the Internet of Things results in an increasing demand for spectrum access, especially in the bands below 1 GHz (the 800-900 MHz band). These allocations will have to take into account the needs and the protection of other spectrum users (e.g. railways). The industry especially presses for frequencies for licence-free applications (especially for smart meters, smart home applications, etc.).

A complementary mix of individual licences and licence-free bands will be required for spectrum access. New applications will be made possible thanks to the use of 5G. This is taken into account as of the design phase of 5G in terms of network slicing[26], a low energy consumption and scalability[27]. These operators can use both licensed frequencies and bands exempt from licence:

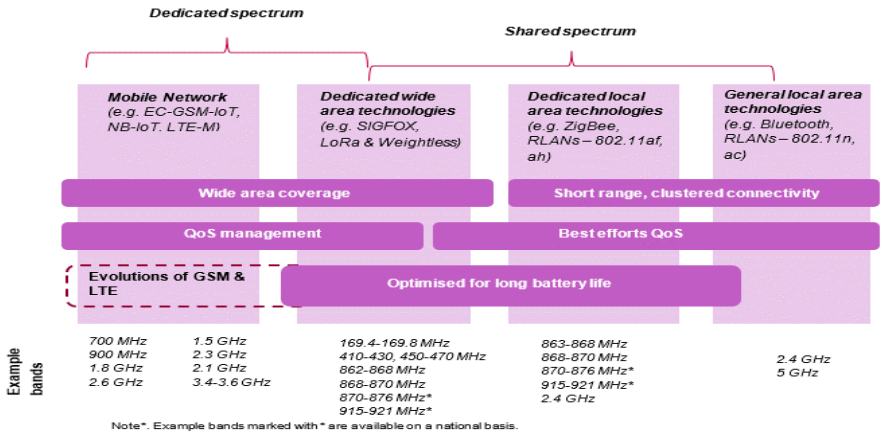

Figure 1: RSPG *roadmap* for IoT[28]

The bands exempt from licence are harmonised at a European level by means of EC decisions, such as Decision 2006/771/EC of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices.

The bands used by the public mobile operators offer the possibility to use 4 different technologies for the *Internet of Things (IoT)*:

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[25] *Long Range Low Power*.

[26] *"Network slicing"* entails the division of a physical network into different virtual networks, each with specific goals.

[27] Degree to which the system can be easily expanded upon increase of the use.

[28] *Opinion on the Spectrum Aspects of the Internet-of-things (IoT) including M2M*, 7 February 2017.

- NB-IoT[29];
- LTE-MTC[30];
- LTE-eMTC[31];
- EC-GSM-IoT[32].

CEPT approved the report 66 in which the technical conditions for 900 MHz and 1800 MHz for IoT have been examined. This resulted in Decision (EU) 2018/637 of the European Commission obliging the Member States to allow the introduction of the above-mentioned four technologies in the 900 MHz and 1800 MHz frequency bands. BIPT will publish a decision on this matter later.

5. ITU WP 5D/3GPP

ITU WP 5D

The entire telecommunications industry is focused on the future introduction of 5G. To that effect a norm should define what 5G actually is. And there the concept of IMT[33]-2020 appears. IMT-2020 is the name the ITU gives to 5G. Together IMT-2000 (3G), IMT-Advanced (4G) and IMT-2020 (5G) constitute the IMT family. The term IMT-2020 was conceived by the ITU in 2012 and means IMT before and after 2020. Within the ITU the WP 5D is the working group dealing with IMT-2000. The WP 5D's activities are followed by the major players in the sector, industry forums, national and regional standardisation institutes, ITU Member States, regulators, network operators, equipment manufacturers as well as representatives of universities and research facilities. In 2017 WP 5D completed a series of studies on the main requirements regarding the quality of the functioning of the 5G technologies for IMT-2020. The next step consists of assessing the eligible technologies by 2020, determining which of those will be entitled to the IMT-2020 label, and agreeing on the elaborate specifications for IMT-2020.

3GPP

3GPP is a collaboration between standardisation bodies regarding telecommunications, laying down the technical specifications for mobile standards of the GSM family, namely for:

• the 2G standards GSM[34], GPRS[35] and EDGE[36];

• the 3G standards UMTS[37], HSPA[38] and HSPA+;

• the 4G standards LTE, LTE-Advanced (4.5G) and

[29] *Narrowband IoT.*
[30] *LTE (Long Term Evolution) Machine Type Communications*.
[31] *LTE evolved Machine Type Communications*.
[32] *Extended Coverage GSM IoT*.
[33] *International Mobile Telecommunications*.
[34] *Global System for Mobile communications*.
[35] *General Packet Radio Service*.
[36] *Enhanced Data rates for GSM Evolution*.
[37] *Universal Mobile Telecommunications System*.
[38] *High-Speed Downlink Packet Access*.

• LTE-Advanced Pro (4.9G).

The 3GPP TSG Plenary Meeting approved Release 15 of the 5G stand-alone (SA) specifications approved in June 2018. Following the 5G NR specifications for non-stand-alone (NSA) operation in December 2017, this essential step regarding standardisation of 5G was successfully completed. The completion of the SA specifications that constitute an addition to the NSA specifications, allows an independent implementation of 5G NR and brings with it a brand-new end-to-end network architecture, making 5G a facilitator and an accelerator in the communications technology of business customers and vertical industries. New business models will be developed and the door to a new era will open in which everything shall be interconnected for both mobile operators and industrial partners.

The WRC-19 World Radiocommunications Conference.

The World Radiocommunications Conference (WRC-15) also approved, as usual, the agenda for the following WRC which will take place in 2019. An important item on the WRC-19 agenda is the identification of new frequency bands for 5G. It concerns bands higher than 6 GHz. Especially the millimetre wavelengths (above 30 GHz) shall be studied. BIPT will closely follow the discussions in preparation of the 2019 World Radiocommunications Conference.

CEPT already clearly stated that the harmonisation of the 26 GHz band in Europe should be completed before the WRC-19. Europe has harmonised the 27,5-29,5 GHz band for broadband satellite services. As a consequence this band is not available for 5G.

The studies will therefore focus on the 24.25-27.5 GHz, 31.8-33.4 GHz and the 40.5-43.5 GHz band. It should be possible to make these additional bands at 31 and 40 GHz available for 5G in the period 2020-2025.

6. Licensing system

For the bands below 3.8 GHz BIPT proposes exclusive licensed frequency assignments. The possibilities to share infrastructure and frequencies will be evaluated further depending on the European legislation and the Belgian directives. BIPT has published an external study (IDATE/MARPIJ) regarding the sharing of frequencies among operators. The drafts, approved by the Government on 26 July 2018, already include the possibility for 5G operators to share frequencies among themselves.

For the higher bands, other licensing systems can be considered. The higher the frequencies, the more the band is suitable for assigning frequencies without an individual licence ("general authorization regime").

The possibility to release the 57-66 GHz band under a less restrictive and flexible system for backhauling shall be looked into as well. "WiGig" can play a role in this context as well.

7. 5G backhauling

In addition to a limited latency 5G will mainly have to support higher speeds. In combination with a much more close-knit network and the use of millimetre bands (higher than 30 MHz), this will result in very high demands for the backhaul network.

The costs for the backhaul network will consequently take up quite a slice of the total network costs. As opposed to the current 2G/3G/4G generations it will be harder to set up the backhaul connections through radio-relay links due to the higher speeds. Operators who do possess a fibre network will be confronted with additional thresholds as compared to operators who do have fibre networks. BIPT will have to examine whether further measures have to be taken. In any case there is already a measure in the pipeline that provides for a considerable decrease of the annual fees for radio-relay links above 70 GHz.

8. Verticals.

In general the so-called "verticals" are expected to constitute a major growth pole for the evolution of 5G. This regards very diverse sectors such as healthcare, energy, PPDR[39], industrial automation, the automobile sector (connected cars), railways, etc. These ranges of application are illustrated below.

Figure 2: ranges of application for 5G[40]

Verticals can use the traditional mobile networks, share private networks or their own networks which may require a specific harmonisation of frequency bands.

For this opinion we focus on 3 verticals:

- PPDR;

-automotive industry and

- railways and public transport.

8.1. PPDR

The PPDR operator in Belgium is ASTRID[41]. BIPT assumes that ASTRID also looks at 4G and/or 5G systems that will in term replace or complement its current TETRA systems in the 380-400

[39] *Public Protection and Disaster Relief.*
[40] https://5g-ppp.eu/wp-content/uploads/2017/03/5GPPP-brochure-final-web-MWC.pdf
[41] According to Art. 3 of the Act of 8 June 1998 on radio communications of the emergency and safety services this public limited company's goal exists in the creation, the operation, the maintenance and the

MHz band. ASTRID has already shown its interest in access to the 700 MHz band. The 703-733/758-788 MHz band will be put up for public auction for the interested market parties.

On 28 April 2016 the EC adopted the 2016/687 Implementing Decision on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union.

This EC Decision allows Member States to allocate and make available the 698-703 MHz, 733-736 MHz, 753-758 MHz and 788-791 MHz frequency bands for PPDR provided that the FDD (Frequency Division Duplex) method is used and the duplex spacing is 55 MHz with a terminal transmission (PPDR uplink) in one or two of the 698-703 MHz and 733-736 MHz frequency bands and a base station transmission (PPDR downlink) in one or two of the 753-758 MHz and 788-791 MHz frequency bands respectively. BIPT agrees that it will be possible to reserve the 698-703/753-758 MHz band exclusively to this effect at a national level for ASTRID. This spectrum can then be used by ASTRID for a dedicated network.

ASTRID will also be able to use the mobile operators' public systems. In the draft Royal Decree on the 700 MHz band approved by the Government on 26 July 2018 a system of national roaming is provided for to this effect.

BIPT expects ASTRID to make complementary use of a combination of access to the existing mobile networks and access to one of its own networks (e.g. for rural areas, direct mode operation, ground-air communications, ...). Belgium therefore supported the allocation at a European level of a band for PPDR.

8.2. The automotive industry

The automotive industry set up a 5G association[42]. One of the main goals is to achieve V2X ("vehicle-to-x" or "vehicle to everything") for safety purposes and cooperative driving. This 5G association is founded on the basis that cellular technologies offer a superior performance compared to radio access based on the IEEE802.11p standard (see below).

Cellular V2X[43] comprises (see illustrations below):

- V2V (Vehicle-to-Vehicle), V2I (Vehicle-to-(Roadway) Infrastructure) and V2P (Vehicle-to-Pedestrian);
- Connections through the traditional mobile operators' networks (V2N);
- Communications through the traditional mobile operators' infrastructure (device to cell tower).

development adaptations and extensions of a radio communications network for voice and data traffic for the benefit of the Belgian emergency and safety services, State Security and institutional safety, public and private firms and associations, providing services in the field of emergency care or safety.

[42] http://5gaa.org/

[43] Cellular V2X (C-V2X) has been defined in the LTE V2X in 3GPP Release 14.

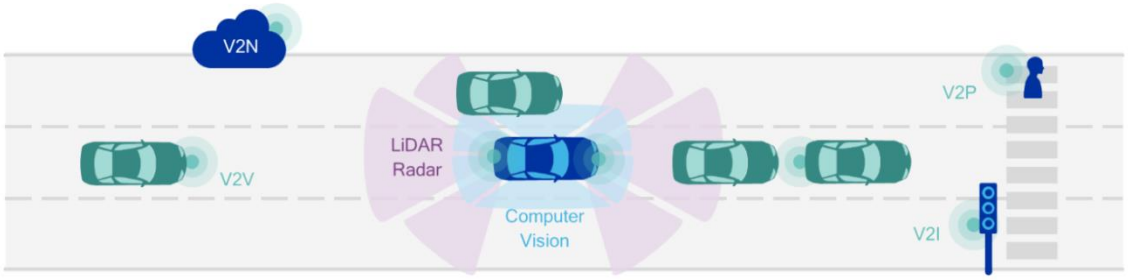

Figure 3: V2X[44]

IEEE 802.11p is related to the IEEE 802.11 standard for wireless access (Wi-Fi). The standard has been developed for a moving communications system and comprises modifications to 802.11 in order to support Intelligent Transport Systems (ITS) applications. This standard uses a bandwidth of 75 MHz in the 5.9 GHz band (5.850-5.925 MHz)[45]. As regards the latter, BIPT pointed out that a Belgian radio interface already exists for ITS[46].

BIPT recognises the connectivity challenges for the future cars. Sufficient attention has to be paid to the access to wireless and cellular networks, security, privacy, authentication, distributed cloud architectures and technology platforms. The upcoming 5G gives rise to new innovative applications.

BIPT does not believe however that there is a need today to designate specific frequencies in addition to the existing ITS frequencies and the possibilities of the cellular networks.

8.3. Railways and public transport

The railways do not currently use the GSM-R spectrum. On behalf of that system a 2x4 MHz (876-880/921-925 MHz) frequency band was harmonised in the past at European level. The RSPG opinion (Opinion on Spectrum Aspects of Intelligent Transport Systems) of 7 February 2017 states that Member States may allocate 3 MHz (873-876/918-921MHz) to GSM-R, up to two times[47].

Soon the EC will publish a decision harmonising the frequency bands and corresponding technical conditions for the availability and efficient use of the spectrum for short range equipment within the 874-876 MHz and 915-921 MHz frequency bands. For the same

[44] http://5gaa.org/pdfs/5GAA-whitepaper-23-Nov-2016.pdf

[45] *EN 302 663 Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band.*

[46] See radio interface I.1 (annex to the Council Decision of 18/11/2009 on the radio interfaces B3.1, B3.2, B3.3 and I.1 at www.bipt.be). A new version of the latter is being prepared (see consultation regarding the radio interfaces I01-01, I01-02 and I01-03, the modification of the radio interfaces D03-01 and D03-02 and the abolition of radio interface B01-24 at www.bipt.be)

[47] See *"Recommendations on spectrum for next-generation of railway communications systems",* point 1.

frequencies are also candidates for RFID[48] and IoT applications. All equipment within the data network will have to be controlled by network access points for the regulator to monitor the roll-out of this equipment by means of the licensing terms.

For the future generation (GSM-R successor) the sub bands 874.4-880 and 919.4-925 MHz are reserved.

5G will of course play an important part for other means of public transport as well. We shall confine ourselves to mentioning self-driving subway cars that are already operational in Paris and that will be introduced by the STIB-MIVB as well.

[48] *Radio frequency identification* (identification by means of radio waves).

9. Test licences in Belgium

Operators, providers, research facilities, etc. can request test licences[49] for 5G. These test licences may not be used for commercial purposes.

Further information on test licences can be obtained from RadioVergunningen@BIPT.be.

Axel Desmedt	Jack Hamande
Council Member	Council Member
Luc Vanfleteren	Michel Van Bellinghen
Council Member	Council Chairman

[49] See Article 4, 6° and 6, § 3, of the Royal Decree on private radio communications and user rights for fixed networks and trunked networks.