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Summary of comments received in the public consultation on awarding the spectrum usage rights in the frequency bands 694-790 MHz, 791-796 MHz/832-837 MHz, 1452-1492 MHz, 2530-2570 MHz/2650-2690 MHz, 3410-3420 MHz/3510-3520 MHz, 3450-3465 MHz/3550-3565 MHz

From 26 June to 11 August 2017, The National Authority for Management and Regulation in Communications (hereinafter referred to as *ANCOM* or *the Authority*) organised a public consultation on awarding the rights of radio spectrum use in the new frequency bands harmonised on a European level for broadband mobile communications systems, i.e. 694-790 MHz (the 700 MHz band) and 1452-1492 MHz (the 1500 MHz band), as well as in the frequency sub-bands not awarded during the selection procedures held in 2012 and 2015 in the 800 MHz, 2600 MHz and 3400-3600 MHz bands - respectively in the 791-796 MHz/832-837 MHz, 2530-2570 MHz/2650-2690 MHz, 3410-3420 MHz/3510-3520 MHz and 3450-3465 MHz/3550-3565 MHz bands.

The public consultation was aimed at collecting the opinions of the interested parties on the need and opportunity of organising a competitive selection procedure for awarding new rights in the above-mentioned bands and on the existing market players' or of potential new entrants' intentions on their participation in a competitive selection procedure that could be organised in the next period.

The bands submitted to public consultation will contribute to ensuring spectrum resources needed for the efficient development of broadband communications services, in the context of the rapid growing mobile internet demand, using the existing tehnologies, as well as to the future implementation of new generation technologies, also known as 5G or IMT-2020. Taking into account the importance of the limited spectrum resource available, the impact of the decision to be taken on the future use of these frequency bands, as well as its effect on the Romanian electronic communications market, ANCOM deemed it necessary to consult all the interested parties, in order to ensure a transparent and fair decisional process, and the predictability of the adopted measures.

To this end, ANCOM elaborated a consultation document, including a questionnaire for the potentially interested parties, a document aimed at obtaining the market players' views and comments on the opportunity of organizing a competitive selection procedure for awarding the usage rights in the said bands in the 2017-2018 time period, their interest in acquiring rights of use in these bands and in participating in such a selection procedure. Moreover, the Authority aimed to clarify a series of technical and economic aspects regarding the access in these frequency bands and the awarding conditions, as

well as some elements that could influence results, such as the selection procedure design, minimum spectrum requirements, the maximum spectrum amounts available to be acquired by one operator in various frequency bands (below 1 GHz and above 1 GHz), the validity period of the awarded rights of use or certain obligations included in licences.

During the public consultation, ANCOM received answers from 9 respondents (4 mobile communications operators in the Romanian communications market, one global satellite communications operator , two radio communications equipment suppliers an interested entity and a state institution.

ANCOM is analysing the responses received, presented below, and will take into account the views, intentions and recommendations expressed during the consultation in substantiating the decision on awarding rights of frequency use in the 694-790 MHz, 1452-1492 MHz, 791-796 MHz/832-837 MHz, 2530-2570 MHz/2650-2690 MHz, 3410-3420 MHz/3510-3520 MHz and 3450-3465 MHz/3550-3565 MHz and in establishing a future action plan for awarding these rights.

The answers to the questionnaire submitted by the Authority are presented below.

1. Necessity and opportunity of organising a competitive selection procedure

Question no. 1
In the context of the technological developments and of the relevant international regulations, in order to be up to the increasing and ever more diversifying demand for mobile broadband services and applications and to the 5G challenges, and given the structure of the mobile broadband market in Romania, as well as the current situation of spectrum allotments in the frequency bands for the provision of public mobile/fixed broadband communications networks, *do you consider the organisation of a competitive selection procedure for granting spectrum usage rights in the frequency bands 694-790 MHz, 791-796 MHz/832-837 MHz, 1452-1492 MHz, 2530-2570 MHz/2650-2690 MHz, 3410-3420Mz/3510-3520 MHz and 3450-3465 MHz/3550-3565 MHz to be necessary and timely?* *Please provide a rationale for your answer.*

Two respondents find it premature to organize the competitive selection procedure for awarding rights of radio spectrum use in the bands submitted to consultation earlier than 2019, before the 5G technology is fully standardized and before customer equipment starts being commercially available.

It is deemed that only starting from that moment on will the premises of a predictable environment for investment depreciation be set. In the absence of a clear view of the 5G standard and of the technical ecosystem, it is extremely difficult for operators to prepare a long-term strategy on additional spectrum needs and to define their specific requirements in each of the frequency bands.

Another argument brought by one of the respondents is that ANCOM has not completed the co-ordination process with the neighbouring countries, especially with non-EU countries, with a view to the clearance of the 700 MHz band from the use of digital terrestrial television (DTT) in these countries. The use of DTT in neighbouring countries results in excluding the implementation of IMT technology over large areas of the Romanian territory. The respondent highlights that operators cannot develop deployment scenarios and therefore cannot perform spectrum assessment as long as ANCOM has not set a timetable for completing co-ordination with the neighbouring countries for their release of the 700 MHz band.

The same respondent is of the opinion that ANCOM should strive to make available the entire L band (1427-1518 MHz) for SDL mode from 2020, so as to allow the ecosystem development in this band, since the 1427-1452 MHz and the 1492-1518 MHz sub-bands were identified at WRC-15 for IMT

systems, and the technical conditions for the use of the entire L band are currently being defined at CEPT level, and are expected to be completed by the beginning of 2019. In this context, the awarding of only part of the L band, specifically of the 1452-1492 MHz sub-band, could be regarded as inefficient spectrum management.

One of the respondents considers that the organization of the auction procedure in 2019 is an appropriate time horizon for ANCOM, as well, since the process of preparing the selection procedure should be a lengthy one in order to allow for a detailed analysis of the existing synergies in the sector level. Otherwise, the results of the selection procedure could be negatively influenced, as it is to be a complex procedure, at least in view of the numerous frequency bands involved and of the multiple assignment rounds required.

A third respondent considers that, for a sustainable planning of the mobile communications networks development, it is essential to ensure the predictability of radio spectrum resources by awarding the rights for the use of the necessary spectrum well in advance.
With a view to the awarding of the 5G spectrum, the respondent deems that there are two major issues that should be considered:

- *The current conditions in the Romanian communications market*: the respondent states that there is currently no growth in the mobile communications market and the possible revenue or recovery of 5G technology investments are uncertain;
- The 5G standard is not complete yet.

Therefore, in the respondent's opinion, the licensing regime should take into account the current situation of the operators and encourage investment, which would involve:

- Granting the licenses for longer periods, of at least 25 years;
- Reducing the annual spectrum usage tariff, correlated with the revenues from spectrum use.

The respondent deems that otherwise, it may be premature to license the 5G spectrum, since the business plan will be launched in 5 years' time, at the soonest.

A fourth respondent considers it timely to organize a competitive selection procedure for awarding the spectrum resources under the consultation, in the near future.

A fifth respondent considers that, given the current market environment, the position of mobile operators in Romania and their more concentrated business strategy, there is a high risk that a spectrum auction for the proposed radio spectrum should not produce the results expected by ANCOM (the least possible spectrum left unlicensed, respectively the highest possible revenues for the budget).

A reason therefor would be the sales volume of radio access network (RAN) equipment manufacturers, in the respondent's opinion the situation in Romania being consistent with the external estimates of the declining percentage of investments in mobile networks worldwide, not just in Europe. The respondent also asserts that radio access equipment manufacturers already estimate a negative adjustment of certain large operators' investments, such estimate being based on internal, therefore reliable, information. Consequently, in view of these indicators, the respondent appreciates that interest in acquiring radio spectrum will be low, regardless of bandwidth.

A sixth respondent submits to ANCOM's attention the possibility of reserving, for BB-PPDR (broadband communications for public protection and disaster relief) communications, in the 700 MHz band, 2 paired frequency bands of 2x10 MHz bandwidth, divided into 2 duplex blocks of 2x5 MHz each, until the allotment – and, possibly, standardization - of a common EU-wide frequency range for BB-PPDR, which should ensure the right to the free movement

of devices (if these are to be specifically dedicated) and the implementation of specific electronic services in line with the availability of radio spectrum.

The respondent's rationale in support of the proposal to award additional frequency bands for BB-PPDR in the 694-790 MHz band is presented below:

1) At present, the institutions of the national defence, public order and security system, as well as the institutions responsible for public protection and disaster relief (PPDR) use, for digital mobile radiocommunications services, the Common Platform TETRA (PCT) infrastructure, operating in the 380-385 MHz/390-395 MHz frequency band. The available services are mainly voice and narrowband secured data services, the network infrastructure being dedicated exclusively to use by PPDR institutions. However, during 2020-2030, most EU and worldwide countries are planning to migrate mobile networks dedicated to PPDR (TETRA, TETRAPOL, conventional ones) towards PPDR broadband solutions (BB-PPDR) implemented based on 3GPP standards.
2) Institutions using PCT have growing operational needs, requiring mobile broadband data services. Moreover, over the recent years, more than 40 studies and projects funded by the European Commission have been developed at European level, aiming to identify the requirements for BB-PPDR networks, applications/services and terminals, as well as ensuring cross-border interoperability and the European harmonization of the radio spectrum required for BB-PPDR communications.
3) In 2016, the BroadMap project, financed under the Horizon 2020 programme, centralized the operational requirements for BB-PPDR communications (115 Romanian institutions responded to the questionnaire). The requirements of the Romanian institutions are aligned with the similar requirements of the PPDR institutions in Europe and were also analysed by the Technical Commission of the PCT (CT-PCT), in accordance with a mandate received from the Interdepartmental Commission in charge of coordinating the field of information and communication technologies associated to the CSAT (ICT Commission).
4) The conclusions of this analysis resulted in a study and a 10-year measure plan for the development and modernization of PCT at national level, these documents being endorsed by the ICT Commission through a memorandum. One of the measures concerns the creation of a dedicated/hybrid radio access network with national coverage, along with the migration of all critical mobile voice and broadband data services for public protection and disaster relief - PPDR on the infrastructure of this network. In pursuit of this measure, it will also be necessary to designate, at national level, a spectrum segment for broadband voice and data communications to be used both by the PPDR institutions and by the institutions in charge of national security.
5) The need to designate a frequency band for BB-PPDR communications is obvious, in the respondent's view, considering at least the following:
   a) the Mission-Critical (MCxxx) features in the 3GPP specifications are available only for the 3GPP versions that are superior to Rel. 13, while the implementation of these versions on commercial networks is not mandatory, and public operators are going to implement it based on strictly commercial criteria (the existence of a "business case"), which may cover both radio-electric coverage and the technology in which this coverage is achieved; specifically, in Romania's case, the entire territory should be geographically covered by networks with at least Rel. 13 3GPP versions to ensure at least part of the Mission-Critical features for BB-PPDR;
   b) the specific security requirements for PPDR communications cannot be sufficiently implemented through the exclusive use of commercial networks;
   c) the risk of unavailability of communications services in major emergency/crisis situations caused by the technical impossibility to ensure priority and pre-emptive treatment in case of extreme traffic congestion;
   d) even when the networks of commercial operators are used, an infrastructure dedicated to PPDR communications needs to be available, since there are situations where commercial networks do

not have coverage and/or locations or moments where massive security or public order related events occur.

6) According to Decision 2016/687/ EU, part of the 700 MHz band (694-790 MHz) can be used for public protection and disaster relief (PPDR) radiocommunications systems. According to the decision, the allotment options for BB-PPDR are:
   a) 2x5 MHz (698-703 MHz paired with 753-758 MHz);
   b) 2x3 MHz (733-736 MHz paired with 788-791 MHz);
   c) part of the 2x30 MHz band (703-733 MHz paired with 758-788 MHz).
7) Out of the three options above, there are already commercially available equipment only in the 2x30 MHz band corresponding to the option "c", respectively band 28 defined by the 3GPP ETSI TS 136 101 standard “LTE; E-UTRA; User Equipment (UE) radio transmission and reception". The commercial availability of the equipment has the advantage of reduced terminal equipment and infrastructure costs.
8) Given that - based on the answers to the questionnaire sent within the BroadMap project - 150,000 users are estimated for BB-PPDR communications, and given the nature of the requested services, a minimum of 2x10 MHz is deemed necessary to be reserved for broadband communications services for PPDR. These will be requested and allotted afterwards, upon the completion of regulations at European and national level.

A seventh respondent states that it does not intend to take a firm position on the opportunity of organising a competitive selection procedure for awarding the rights of spectrum use in the frequency bands under consultation, in the coming period.
This respondent deems that the views of the market players/potential investors, i.e. existing and potential new operators with regards to applying a competitive selection procedure for the aforementioned spectrum portions and its respective timing, should be one of the decisive factors for the final decision by ANCOM.

However, it would like to contribute to the discussion by sharing its own market and industry knowledge in terms of both technology, but also of what is the common practice in other countries/markets, taking advantage of its global experience.
With regards to the specific frequency bands that are being examined for licensing, the respondent’s general view is presented below:

- The 791-796 MHz/832-837 MHz and 2530-2570 MHz/2650-2690 MHz bands are considered to be mature bands already for LTE and should in general be given the highest priority to be licensed in support of the evolution to Gigabit LTE, provided there is relevant market interest from operators. Whatever the licensing process that will be followed, it will be important for the regulator to ensure that each licensee has contiguous spectrum allotments to improve spectrum efficiency and access to a large device ecosystem.

- Band 694-790 MHz is expected to further improve the capacity in rural areas and in-door network performance. The ecosystem for the 3GPP Band 28 (700 MHz band) is well developed. Based on the above, licensing of this band could follow soon after, provided the issues with the neighbouring countries are resolved in order to allow for full utilization of the band across the country. If not possible, then it is key to reach bilateral agreements with neighbouring countries sooner than later and provide a clear plan to the market for when this band will be made fully available. Any selection procedure should follow.
  It is noted that at the moment, only Germany, France and Finland have auctioned this band (June 2015, November 2015, and November 2016 respectively). Finland in particular, is the first European country where operators can use the band nationwide, since January 1, 2017.
  In addition, the respondent suggests that the 700MHz centre gap (20MHz of SDL) should be awarded at the same time as the 700MHz FDD sub-bands (2x30MHz).

- Band 1452-1492 MHz can wait a little longer and will probably be enlarged to 1427-1517 MHz for SDL use.
  The reasoning therefor is presented below:
  At WRC-15 it was decided to widen the band to 1427-1518 MHz (minus some guard bands currently being studied). This has led to a situation that operators hesitate to ask smartphone vendors to support the L-band, and also additional countries to license the band, until the study of the extended L-band has been finalized and the duplex method been finally decided. Everything points to the fact that the whole band will be an SDL-band as it is today, but final decisions are expected to be taken at WRC-19.
  At the moment, the L-Band, 1452-1492/1496 MHz (3GPP Band 32) has been licensed in UK, Germany and Italy but it is not yet commercialized.
  Finally, one should also consider the opportunity associated with aggregation in the low bands, since bands both above and below 1GHz can be aggregated with the 1.4 GHz band as defined by 3GPP (such as e.g. aggregation with the 800 MHz band to improve network capacity and speed, or with the 1800 MHz band).
  Based on the above, it could be expected that many countries will wait with the licensing until WRC-19 decisions and also that the ecosystem will accelerate with a new wider band plan agreed.
- Bands 3410-3420 MHz/3510-3520 MHz & 3450-3465 MHz/3550-3565 MHz should be re-farmed together with as much as possible of the whole 3400-3600 & 3600-3800 MHz spectrum for the introduction of LTE Advanced or LTE Advanced Pro technologies on the way to 5G as well as used for early pre-commercial 5G trials during 2017/2108. Bands 42 and 43 will offer the best compromise between coverage and capacity also for the new 5G - NR (New Radio) technology expected to be fully standardized in 2020 (the respondent deems that for efficient deployment of NR each operator should have at least 80 to 100 MHz of contiguous spectrum for 5G/TDD use). It is also important that each licensee gets contiguous spectrum allotments to improve spectrum efficiency and access to a large device ecosystem.

An eighth respondent states that it does normally not comment on the national methodology to grant spectrum access. However, it expresses its view on the use of certain bands under consultation and recommends to keep at least 2x10 MHz of the 2x30 MHz total amount of spectrum in the 700 MHz band designated for FDD use, for future BB-PPDR systems.

The respondent's rationale is presented below:

The respondent draws attention to the fact that, in the case of the band 694–790 MHz, a special attention is directed by the ITU-R and the WRC-15 Resolution 646 to address evolving broadband PPDR needs. Resolution 646 (WRC-15) resolves that administrations when planning their spectrum should consider PPDR spectrum needs, in particular for broadband, within a global frequency range 694-894 MHz for establishment of Mobile Broadband aimed at PPDR.

Within the EU/CEPT area, the Commission implementing decision (EU) 2016/687 of 28 April 2016 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 is attracting special interest, as it sets the stage for a technical harmonisation across the EU for Broadband Public Protection and Disaster Relief (BB-PPDR) communications networks, and the ECC/DEC(16)02 of June 2016 on Harmonised technical conditions and frequency bands for the implementation of BB-PPDR systems.

In consideration of an eventual award of the 2x30 MHz MFCN blocks of the 700 MHz band, MSI advise to keep national control of at least 2x 10 MHz for future BB-PPDR and hold this spectrum resource back

from an eventual commercial auction and reserve it for a future emergency communication use or operation (PPDR) that may be appointed through the usual EU tendering process. Scenarios where spectrum remains at all times the property of the state, but can be rented/on loan or allotted etc. to the emergency communications operator for as long as the license lasts, are recommended.

If the rights of spectrum use for the emergency communications are sold on commercial terms, the EU rules of spectrum trading may result in an ownership of the spectrum for emergency communications, which may be not in the national interest or even hostile to Romania, and national control is lost.

Such considerations have already taken place in Sweden, as an example.

Question no. 2
If your answer to the previous question is affirmative, which of the following time options for the organization of the competitive selection procedure is considered to be appropriate: *a) during 2017;* *b) during 2018.* *Please provide rationale for your answer.*

Two respondents consider that the selection procedure should be organized neither in 2017, nor in 2018, deeming that it is to the benefit of the market as a whole to be organized in 2019.

The main argument resides in the fact that in 2019 – at the soonest - would the basic conditions for the pre-existence of a predictable environment, from the perspective of investment amortization, be fulfilled, through the full standardization of 5G technology and the emergence of terminal equipment on the market. See also the respondents' arguments in the answers to question no. 1.

A third respondent considers that, during 2018, there might be a good timing to organize the selection procedure, if the issues raised in the answer to question no. 1 are settled.

A fourth respondent finds it highly opportune to organize the selection and licensing procedure in 2018, without presenting its rationale in this regard.

Another respondent makes reference to its answer to Question no. 1.

Question no. 3
If your answer to question no. 1 is affirmative, would you participate in a competitive selection procedure organized in 2017, for the purpose of granting spectrum usage rights in the frequency bands mentioned under Question no. 1? What about in a competitive selection procedure organized in 2018?

One respondent states that an internal assessment revealed that it would be prepared to take part in a selection procedure to be held, at the earliest, in 2019.

Another respondent states that his participation in the selection procedure will be determined by the reasonable level of starting prices, given the uncertainties surrounding

the limited potential of revenue that can be obtained from the 5G technology and by the reasonable conditions for the licensing period, by coverage obligations, etc.

A third respondent considers it appropriate to organize the selection procedure as well as to grant licenses in the coming period and it would participate in the selection procedure both in 2017 and in 2018, but notes that the organization of the auction in 2017 would be premature, for at least the following reasons:

- operators need to budget the financial resources involved with sufficient time in advance, given the corresponding funding required. Lack of budgeting can have effects in the long-term auction results, with direct impact on the market, with the incoming payments following the auction being potentially diminished;
- 5G standardization is still ongoing and there will be more clarified elements under the conditions for auctioning in 2018, including in the frequency bands concerned, the equipment available in various bands. These issues have a direct impact on the operators' business plans, manner of defining future services, depreciation, expenses, and future revenues.

Question no. 4
If your answer to question no. 3 is affirmative, which bands would you potentially be interested in? *Please provide rationale for your answer.*

Despite a negative answer to question no. 3, one respondent nevertheless provided an answer to this question.
In its view, in principle, all the bands that are subject to this consultation may be of interest and may be relevant to any mobile operator at the appropriate time. It, for one, is currently interested in taking part in the selection procedure organized for granting rights of use in the 700 MHz band. Moreover, it examines the possibility of acquiring usage rights in the 800 MHz, 2600 MHz or 3400-3800 MHz bands, but the final decision to invest will depend decisively on the establishment of some administrative measures to rearrange the radio spectrum in the said bands. The respondent considers that spectrum rearrangement is an essential condition for maximizing the degree of use of those bands by providing adjacent spectrum resources to all interested operators so as to ensure an adequate competitive environment for the benefit of end-users.

A second respondent makes reference to its own answer to question no. 3.

A third respondent shows high or medium interest in the 700 MHz, 800 MHz, 1500 MHz and 2600 MHz bands.

Interest for the 3500 MHz and 3700 MHz bands is reportedly lower, as there are not enough terminals available yet, so as to provide for the launch of commercial services in the medium term; the frequencies have been in the operators' portfolio for a few years already and yet there is no significant adoption of the services launched.

Question no. 5
If your answer to question no. 1 is negative, when do you consider that the selection procedure for granting the spectrum usage rights in the frequency bands nominated under question no. 1 should be organised? *Please provide rationale for your answer.*

In the opinion of a respondent, organizing the selection procedure in the second half of 2019 would best serve harmonizing the interests of all the interested parties, given that the operational requirements for implementing 5G technology in the new frequency bands still need to be clarified, while for the already available bands operators still have to fully use the spectrum they hold.
Other reasons provided by the respondent that could highlight the opportunity to organize a tender procedure at the earliest in 2019 are presented below:

- the award of frequency bands could be achieved in line with the commercial demand;
- the 700 MHz band will become operational not earlier than the second half of 2020 (most likely much later, considering that 70% of Romania's border is with non-EU states, that are not required to make this spectrum available for the provision of mobile communications services);
- the 1500 MHz band has been awarded in only a few countries so far, and is not yet available in the commercial consumer equipment portfolio, so that an early assignment in Romania does not seem to be necessary;
- the debates on 5G parameters and standards are ongoing, so that organizing the selection procedure in 2019 would give the industry the chance to have a clear and precise perspective of specific implementation requirements;
- a short-term assignment of the spectrum available in the 3400-3800 MHz bands is not necessary/useful for the market;
  Nevertheless, if an operator wishes to acquire short-term use rights in these bands, the respondent considers that the usage rights should be awarded by 2025, as an auction/refarming is required in all available spectrum (400 MHz), and the creation of a framework for the actual spectrum allotment with a view to the provision of real broadband services (e.g. 100 MHz of contiguous spectrum) for sustainable and competitive 5G development.
- the rest of the spectrum, in the respondent's opinion, is not operationally useful in the near future and may be included in a possible selection procedure in 2019; the operator also considers that the spectrum in the 2.1 GHz band, for which user rights will expire, may be included in that procedure.

A second respondent also considers that the selection procedure should be organized during the 2019 and by that time the 700 MHz band should be released in the neighbouring countries and available for use throughout Romania.

In addition to the bands under discussion, the respondent also has two proposals on spectrum usage rights in the 2100 MHz and 3600-3800 MHz bands.
Thus, according to the licence in force, spectrum usage rights in the 2100 MHz band expire in March 2020. Therefore, the respondent is interested in knowing whether the Authority intends to extend the validity of these licenses in accordance with the provisions of Article 31(3) of the Government Emergency Ordinance no. 111/2011 on electronic communications, approved, with amendments and completions, by Law no. 140/2012, with the subsequent amendments and completions, since it is important to have predictability with regard to spectrum usage rights for which operators develop long-term strategies.

In Romania, the 3400-3600 MHz band is currently organized for predominantly FDD use, with blocks allotted in duplex mode to all operators. This mode of use involves reserving guard bands between the uplink and the downlink and also at the limit to the 3600-3800 MHz band. As the 5G technology will initially develop in this frequency band, as well, the respondent considers that it is in everyone's interest to maximize the bandwidth available for this service. Therefore, it recommends that a refarming of the 3400-3600 MHz spectrum, i.e. providing for the use of TDD, so that networks in 5G technology could be deployed and the bands 3490-3510 MHz and 3590-3600 MHz – now used for the guard band imposed by the FDD organization – could be released for an auction. Such a refarming also involves the prior grouping in one block of the duplex blocks allotted to each operator at the moment. The respondent expects to be able to switch from FDD to TDD use in the 3400-3600 MHz band, from 2020.

In view of the above, the respondent proposes that – in the auction – the sub-bands in the 3400-3600 MHz band should be used exclusively for TDD use. Furthermore, the operators holding rights of use in band need to start, together with ANCOM, refarming the spectrum they have acquired, so that it could be used only in the TDD mode, starting from 2020.

Another respondent considers that - for the frequencies mentioned in question no. 1 - 2019 would be better suited for organising an auction. The only exception is the interest utterly manifested by an operator for a particular frequency band, by submitting an application according to Article 26 of Government Emergency Ordinance no. 111/2011.

Question no. 6
Following the expiry of Telemobil's licence to provide a cellular mobile broadband communications network in CDMA 450 technology, in 2013, the 453-457.5 MHz/463-467.5 MHz paired bands (450 MHz band) have become available. In accordance with Art. 5 of the ITU Radio Regulations - 2016 edition, the 450-470 MHz band is allocated to the mobile service, on a primary basis, in all three regions of the globe, being identified by No. 5.286AA of ITU-RR for IMT systems, in accordance with Resolution 224 revised at WRC-15. This identification does not preclude the use of the band by any application of the service to which the band is allocated and does not establish priority for IMT in Radio Regulations. The 453-457.5 MHz/463-467.5 MHz bands are, however, not harmonized at European level for use by IMT systems, being designated for other types of applications, including for broadband PPDR applications (public protection and disaster relief). *In the case of organizing the competitive selection procedure for granting spectrum usage rights in the bands under question no. 1, do you think that the 453-457.5 MHz/463-467.5 MHz bands should also be included in the selection procedure?* *Please provide rationale for your answer.*

One respondent considers that the bands under question no. 6 should not be included in the selection procedure, as the amount of spectrum available is not sufficient to allow the transfer data rates required for current applications. Moreover, as the band is available for mobile communications in a limited number of states, the development of client equipment will not be regarded as a priority for equipment suppliers. An additional argument for not including the 450 MHz band in a multi-band assignment procedure is that it is a band with very specific usage options.

A second respondent has a neutral approach on the inclusion of the 453-457.5 MHz/463-467.5 MHz bands in a selection procedure alongside the bands nominated under question no. 1.

A third respondent considers that the 450 MHz band is not within the scope of a 5G auction and should therefore be treated separately, in order to avoid potential confusion in the auction and to ensure that only harmonized bands are included in the auction.

A fourth respondent does not consider it necessary to include the 450 MHz band, because it is not harmonized at European level and is therefore not supported by terminals or network equipment or clear standardization therefor is not yet expected in the medium term. In its view, the use of this band is practically unfeasible in the short or medium term.

A fifth respondent states that, in January 2017, on grounds of Article 26 of Government Emergency Ordinance no. 111/2011, it submitted a request for the organization of the procedure for awarding the exclusive right to use, on a national level, of radio frequencies in the band 452.5-457.5 MHz/462.5-467.5 MHz, subject to the amendment of the NTFA (National Table of Frequency Allocations) so that the respective band should become fully non-governmental (NG).

The respondent further states that the Authority's reply was that the 452.5-453 MHz/462.5-463 MHz bands were exclusively government-restricted bands and that the change in the use status of these bands had not been endorsed by the Interdepartmental Radiocommunications Commission.

However, the respondent is still interested in the 450 MHz band (even the band 453-457.5 MHz/463-467.5 MHz), but only if a comparative selection procedure one is organized, not a competitive one. Obviously, the conditions in the terms of reference for such a comparative procedure should be subject to public consultation.
The respondent's reason in favour of its position is that - if, since February 2013 (when Telemobil's license expired) until August 2017, i.e. during four and a half years, no other operator has shown its firm interest in this band, organizing a competitive selection would be doomed to failure. In its opinion, if an operator shows his firm and precise interest in a particular band, ANCOM not only can, but is even bound to grant the right to use it by competitive or comparative selection, within eight months from the moment of receiving an application therefor, according to Article 26 of GEO no. 111/2011.

A sixth respondent submits to ANCOM's attention the likelihood that the 453-457.5 MHz/463-467.5 MHz bands could be required for use by the institutions responsible for ensuring PPDR, after the completion of the European and national regulations, taking into account that the bands in question are not harmonized at European level for use by IMT systems, being designated for other types of applications, including PPDR ones.

A seventh respondent sees no reasons for including the bands 453-457.5 MHz/463-467.5 MHz in the selection procedure, unless there is an expressed strong market interest.
The 400 MHz band is currently of limited interest globally, as there is no global agreement or view with regards to its use, hence the ecosystem is not expected to be mature any time soon. It is also noted that there is a draft ECC Report on LTE in 400 MHz, studying NB-IoT and eMTC implementation. The draft ECC Report on “LTE 400” does not currently include NB-IoT. Consequently, there is a risk that this

will delay the deadline of the report. In addition, the offered amount of spectrum in this band is particularly small.

An eighth respondent deems that, in the short term, the 450 MHz band should not be included in a selection procedure for awarding usage rights along with the bands mentioned in question no. 1.
The CEPT is currently developing studies in WG SE, which on the longer term may provide the means for developing a harmonized PMR/PAMR market in the entire 450 – 470 MHz for narrowband as well as for broadband. This study is under development by SE7, and deals with the elaboration of a new ECC Report focusing (in 450 – 470 MHz) on the coexistence between legacy NarrowBand PMR/PAMR systems and BroadBand systems that are operating spectrally adjacent and un-coordinated within the band. In particular, the interference from Intermodulation components (IM) excited by Broadband Carriers overlapping Narrow Band Carriers is studied and assessed. This study is planned for adoption early 2018, and the respondent therefore suggests not introducing regulatory changes until administrations can take guidance from this advisory ECC Report.

Question no. 7
Leaving aside your particular interest in one particular frequency band or another, how do you assess the (commercial, technical, etc.) attractiveness of each of the bands mentioned in this document? *Please provide rationale for your answer.*

A first respondent considers that the most attractive bands are those below 1 GHz, given that they offer the possibility of obtaining a higher degree of indoor coverage, but all the bands should be made available to the mobile industry in an optimal and timely manner.
The 700 MHz and 3.5 GHz bands have been designated by the RSPG as "pioneer bands" for the implementation of 5G technology, so they will have a very important role in the mobile operators' planning. The 1500 MHz and 2600 MHz bands will serve as additional capacity bands and will also become particularly important after 2020. The 800 MHz band may also be attractive, but only if the terms of reference provided the necessary steps for conducting a process of refarming the radio spectrum.

Concerning the 3.7 GHz band, in particular the 3645-3685 MHz sub-band, a second respondent deems it surprising that such a significant part of a spectrum resource dedicated to commercial use was allotted for governmental use, contrary to the provisions of the NTFA (approved by MCSI Order No. 789/2009, with the subsequent amendments) and without prior consultation with the industry. The respondent considers this process to have breached the current legal provisions, and therefore the 3645-3685 MHz band should be refarmed, released for non-governmental use and included in the auction process.
At the same time, given that the 3.7 GHz spectrum rights will be awarded for the deployment of 5G technology, the use of the 3645-3685 MHz sub-band for government purposes hinders the development of future generation networks by 2025.

A third respondent considers that spectrum quality is an essential criterion for the spectrum evaluation and that it is absolutely necessary to assess potential harmful interferences, which should be reflected in the commercial value of spectrum blocks. Such an example of spectrum potentially affected

by harmful interferences would be the 700 MHz band – due to the lack of harmonized use in Ukraine, Moldova, and Serbia.
The attractiveness for a particular frequency band depends, in addition to the propagation characteristics of the band, on the architecture of the operator's network, as well as on the frequency bands already alloted to an operator. From this perspective, any evaluation is subjective, being specifically designed to meet the requirements of each operator.

A fourth respondent estimates the technical and commercial attractiveness of frequency bands as follows:
700 MHz – commercially low (not enough terminals yet), technically high
800 MHz – commercially high, technically high
1500 MHz – commercially low, technically average
2600 MHz – commercially high, technically high
3500 MHz – commercially low (not enough terminals yet), technically average
3700 MHz – commercially low (not enough terminals yet), technically average

A fifth respondent considers that each band of those subject to public consultation has a specific attractiveness, which inevitably depends on each operator's marketing strategy and policy. So, if an operator wants to launch a marketing campaign invoking "national coverage" - without thinking about network capacity or service quality - it is obvious that it needs a low frequency band, such as 694 -790 MHz. If, on the other hand, an operator is interested in the network capacity or wants to offer high download speeds, a low frequency band rather complicates the achievement of this goal from a technical point of view, so the logical choice will be the 1452-1492 MHz band.
The respondent considers that Question no. 7 in the questionnaire is erroneously formulated, as one's interest in participating in a - competitive or comparative - selection procedure cannot be dissociated from a certain frequency band.

A sixth respondent expressed the following views:
In general, bands below 1GHz are needed for providing better coverage in rural areas and deep indoor penetration in urban areas, while bands above 1GHz are used for providing both better urban coverage as well as improved capacity. Especially the bands above 6 GHz, are intended to be used for high capacity and extremely low latency with 5G, through small cell deployments.

To be able to invest properly and be successful in their mobile broadband and 5G deployments in the future, operators need to be able to ensure a good mix and a fair amount of spectrum across all three bands: low (<1 GHz) – medium (between 1 and 6 GHz) – high (>6 GHz).

Another aspect that needs to be taken into account is to provide the possibility to operators to acquire contiguous lots of spectrum as much as possible in as many frequency bands as possible.

700 MHz band:

700 MHz is a key coverage band which needs to be coordinated with Romania's neighbours.
In addition to its possible use with LTE, the 700 MHz band is seen to be a pioneer 5G band, and is in discussion in many countries as being the "Mission Critical Coverage" (Ultra Reliable Low Latency Communications – URLLC) applications.
European states are currently preparing the award of the 700 MHz band for wireless broadband, as the second digital dividend after the award of the 800 MHz band some years ago. This is in accordance with the decision taken at WRC-12 and the European Commission's implementing

decision 2016/687 (adopted on April 28, 2016) on the harmonization of the 694–790 MHz band. According to this, member states shall allow the use of the band for wireless broadband by June 30, 2020.
The decision provides the allocation of 2x30 MHz (703–733 and 758–788 MHz) for wireless broadband electronic communications services.

Some member states are pushing ahead early: Germany and France already auctioned the band in June 2015 and November 2015. Finland auctioned the band in November 2016 and is the first European country where operators can use the band nationwide, since January 1, 2017.

1500 MHz band:

Following the European Commission implementing decision 2015/750/EC (May 8, 2015) to harmonize the 1452–1492 MHz band for terrestrial systems capable of providing electronic communications services, this band will be used for supplemental downlink (SDL) in blocks of 5 MHz or multiples of 5 MHz with power limits defined as block edge masks (BEMs) in the annex of the decision.

1452-1492 MHz band has already been awarded in Germany, Italy and the UK, and deployments have begun.

The characteristics of this spectrum allow it to be combined with the 800MHz band, thus benefitting from a significant increase in capacity whilst retaining the coverage of the 800MHz band, a fact that makes this an attractive band for most operators.

The device eco-system for this band, whilst not mature, is expected to increase significantly as more countries consult on awarding this frequency band.

It is also noted that this is an SDL band and therefore need to be combined with an existing deployments. To our view, no coverage obligations should be specified for this band.

3400-3600 MHz band:

The 3.4-3.8 GHz band has been identified by the EU as the 5G Pioneer band in Europe. As a consequence, administrations across the EU are currently looking at how to make part (or all) of this frequency available for 5G (either re-awarded, or on a trial basis) already by end 2018.

The amount of spectrum available, combined with the RF properties of the band (this is considered a “low” 5G band, as compared to the mmWave frequencies often discussed with 5G) make this a very attractive band for 5G launches.

The respondent considers that this spectrum should be awarded in a TDD arrangement only, in order to have a harmonized approach across Europe.

A bandwidth of at least 100 MHz of contiguous spectrum per network operator in this band will be required to fully utilize and exploit the capabilities of 5G in this band.

Furthermore, in the respondent’s view, the 3.4-3.8 GHz band should be licensed on a national non-exclusive basis, allowing the license holders to sublease to interested industries subject to commercial arrangements. In addition, local allocations (e.g. for industrial applications) would be useful additions to enable 5G industry-specific applications and use cases in very small areas (e.g. industrial plants, enterprise solutions, sports arenas, etc.). The respondent favours the

development of mobile services in the range of 3-6 GHz in order to cover large geographic areas and a large proportion of population in mobility.

If only awarding part of this spectrum band at this time, ANCOM may wish to consider regulations around spectrum trading which could allow license holders to swap holdings at a future date (if they so desire), so as to combine holdings in the 3.4-3.6 GHz with those in the 3.6-3.8 GHz into one contiguous award.

This frequency is expected to be used for 5G-NR with carrier sizes greater than 20MHz, and utilizing antenna techniques such as Massive MIMO beamforming active antenna systems. It should be noted that there is ongoing work in CEPT/3GPP around the proposed regulations for such a technology operation. It is highly recommended that ANCOM aligns with the eventual outcome of this study and the resulting EU conclusions. If considering an award of this band before the conclusion of this study, it is recommended that ANCOM includes a mechanism to adopt any potential new regulations at the earliest possible date.

At the same time, the respondent asks ANCOM not to lose sight of the 3.8-4.2 GHz range. Its customer experience shows that the use of this band for directional radio applications has been steadily declining over the years in favour of the 6 - 8 GHz bands. From this point of view, and taking into account the global interest in Japan and the US, the 3.8 - 4.2 GHz range seems to be a future candidate for 5G applications.

In addition, simulation results show that the frequencies of 3.4-4.2 GHz are very suitable for a macro-network rollout using existing mobile radio sites, especially in the urban area. This results in a faster, simpler and more cost-efficient design of 5G services and applications.

A seventh respondent is of the view that the 3400-3800 MHz band, a pioneer band for 5G, as mentioned in the 5G Mandate to CEPT (RSCOM16-40rev3) seems the most attractive and realistic band to this new category of devices/systems.

Question no. 8
Do you consider that frequencies in different bands could be substitutable and/or complementary? If so, which? *Please provide rationale for your answer, considering the bands mentioned in this document and, if applicable, those you already have in your spectrum portfolio.*

A respondent considers that some bands may be interchangeable, but the higher the frequency bands, the higher the level of investment required to ensure similar coverage. On the other hand, one must take into account the fact that low, medium and high bands are extremely difficult to substitute for each other, regardless of the technology used (2G, 3G, 4G or 5G).

In another respondent's opinion, the 700 MHz and 800 MHz bands may be substitutable due to similar propagation characteristics. Therefore, the terms and conditions, including the reserve price for these bands, should be similar to those applicable in the 2012 auction. Applying different rules for frequencies in the same band or similar spectrum bands would lead to discriminatory regulatory treatment, unjustified for the interested entities in the market, having a negative impact on the competition environment.

Regarding the SDL mode, due to the UL/DL propagation characteristics, the operator considers it should be associated with the low frequency DL band.

A third respondent is of the opinion that each operator analyses the need for spectrum resources in the context of the exponential growth of the data services use in Romania, and it is imperative to make available additional spectrum resources to meet this demand. It also deems that the bands are not potentially substitutable, considering there is no absolute substitutability.

Regarding the complementarity of the bands, it considers that such complementarity depends essentially on each operator's network architecture and on the specificity of the geographic area envisaged for the provision of 5G services.

A fourth respondent considers that radio spectrum in the bands below 1 GHz cannot be substituted by higher bands without involving absolutely significant investments, which would offset competition between operators. May significant investment be achieved, differences would remain in the services provided to end-users with and without the use of a low frequency band, due to different indoor penetration of low frequency bands, compared to that of high frequencies. Especially in densely populated urban areas, varying coverage in low bands versus in high ones can practically lead to significant differences in data transfer rates under certain radio conditions.

The respondent deems that some frequencies may be substitutable, but due account should be taken of the fact that there is currently a discrepancy in the number of terminals that support certain bands over others. Thus, from a technical point of view, the frequencies in the 700 MHz band could be substituted for those of in the 800 MHz or 900 MHz bands, respectively those in 3500 MHz for those in the 3700 MHz band and vice-versa. Nevertheless, commercially, for example, in the 700 MHz frequency band, there are fewer terminals than in the 800 MHz frequency band; terminals currently operating in the 900 MHz band are generally not compatible with 4G, but only with 2G or 3G. Similarly, in the 3500 MHz, 3700 MHz bands, there are extremely few terminals compared to the 2600 MHz band.

A fifth respondent considers that the frequency bands mentioned in the questionnaire are neither potentially substitutable nor complementary.

The views expressed by another respondent on the substitutability/complementarity of frequency bands are presented below.

For 4G, the 700 and 800 MHz bands have similar coverage characteristics, although the 800 MHz band has a much more developed ecosystem of devices and it is nationally available and usable in Romania already now.

The 1800, 2100 and 2600 MHz bands have similar capacity characteristics and similar maturity in terms of LTE ecosystem.

The 3400-3800 MHz will be a very significant band for 5G, since indoor coverage can be achieved based on an 1800 MHz macro site grid.

In general, the 700/800/900 MHz band forms one group of bands very suitable for network coverage and deep indoor penetrations.

The 1800/2100/2600 are also well established bands, suitable for incremental network capacity. The 1500 MHz band is a future capacity band.
The capacity bands are also excellent for carrier aggregation to increase network speed. The 3.5 and 3.7 GHz bands are very suitable for the introduction of 5G since they can be used for reaching indoor coverage using the existing macro base station site grid.

Mobile Network Operators (MNOs) need a well balanced mix and a timely availability of both coverage and capacity bands to be able to offer superior user experience for everyone in Romania (and in any country). It is expected that MNOs will need at least 80-100 MHz spectrum each in the 3.4-3.8 GHz band in order to be able to introduce 5G in a meaningful way.

In addition, low and mid frequency bands <3GHz, currently occupied by narrowband technologies, will eventually become a target for spectrum migration towards broadband technologies. For example, it is envisioned that 900 MHz and 1800 MHz will be used more and more for LTE Advanced Pro technologies first and for 5G NR beyond 2025.

In addition, SDL (supplementary downlink) is a very efficient spectrum mechanism offering operators the capability to augment the existing spectrum properties in a very efficient way improving the mobile broadband services in Romania.

L-Band can complement bandwidth-limited low frequency bands, such as 700 and 800 MHz, to improve the user average and peak throughput for both rural and urban areas without compromising service coverage. This is achieved by using the Carrier Aggregation function combining the two different spectrum bands resulting in a wider spectrum band equal to the sum of the primary combined carriers.

In addition, according to ECC Report 54, L-band deployment can operate on a high EIRP limit ranging up to 68 dBm/5 MHz, while higher levels may also be considered in specific circumstances such as when aggregated with FDD coverage bands in lower frequencies, to ensure the SDL capacity all over the base station cell. This makes the L-band even more attractive as it is possible to match lower frequencies coverage area.

Question no. 9
Considering in particular the SDL mode, with what frequency bands could these be best associated? *Please provide rationale for your answer.*

One respondent considers that SDL bands are extremely important for ensuring additional download capacity for symmetrical debit paired bands, where demand for download capacity is much higher than for upload capacity. Thus, the SDL mode will mainly be associated with the LTE 800 and LTE 1800 systems, but it may also be associated with LTE 900 or LTE 700 MHz systems.

A second respondent considers SDL mode to be associated with low frequency bands (below 1 GHz).

A third respondent states that theoretically, according to the 3GPP standard, the 1500 MHz SDL band can be aggregated with the 800 MHz, 1800 MHz and 2600 MHz bands, but in practice, aggregation depends on each operator's network architecture.

According to a fourth respondent, SDL in any frequency band can be associated with any other 4G-enabled frequency band where both network equipment and terminals are available.

Another respondent's answer on the SDL bands is presented below:

1452-1492 MHz and after WRC-19, 1427-1517 MHz can be aggregated e.g. with the 800 MHz band, to boost capacity and data speed in rural areas where higher towers and higher output power can be used.

This is an SDL band and therefore needs to be combined with an existing deployment. The respondent recommends that no coverage obligations should be specified for this band and also makes reference to their answer 8 above.

In addition, the 700 MHz centre gap (20 MHz of SDL) should be awarded at the same time as the 700MHz 2*30 MHz FDD spectrum and can be aggregated with the 800 MHz band.

Question no. 10
With which of the following options for organizing the competitive selection procedure do you agree: *a) the organization of a competitive selection procedure should be initiated only after the prior expression of interest and firm commitment to participate in a possible selection procedure by submitting applications with a view to being granted spectrum usage rights in the concerned bands. The selection will only be organized if the aggregate spectrum demand exceeds the amount of spectrum available in at least one spectrum category in the bands under the selection procedure (e.g. FDD below 1 GHz, FDD above 1 GHz, SDL below 1 GHz, SDL above 1 GHz);* *b) the organization of the competitive selection procedure should be initiated without prior expression of interest and firm commitment to participate in the selection procedure by submitting applications with a view to being granted spectrum usage rights in the concerned bands?*

A first respondent prefers option a) as it considers it logical to first identify whether there is excessive demand and then determine the need to organize a selection procedure.
Therefore, it is of the opinion that the procedure for expressing interest in participating in a possible selection procedure should not be initiated before the end of this year.

A second respondent considers that the auction should be started only if the aggregated spectrum demand exceeds the amount of spectrum available in at least one spectrum category in the bands under the selection procedure, otherwise the organization of the procedure is not justified.

A third respondent agrees with option a) i.e. it is for organising a competitive selection procedure to be initiated only after firm commitment has been expressed through a formal request for frequency blocks and bands and for the awarding of the spectrum usage rights in the bands and blocks for which interest was firmly expressed by submitting the application, if the conditions for an auction are not met.

It also recommends that guarantees should be established at a level sufficient to reduce the risk of speculative or disruptive bidding.

A fourth respondent agrees with option b).

A fifth respondent considers that the organization of the competitive selection procedure (i.e. the 450 MHz band) should be initiated only after prior expression of interest and firm commitment to participate in a possible selection procedure have been stated by submitting applications according to Article 26 of Government Emergency Ordinance no. 111/2011.

A sixth respondent deems that option a) above appears to be most reasonable as it is based on identifying market demand first and then aligning the award process with it. In any case, the respondent strongly recommends to take a decision on the above based on the market interest and preference by the operators.

2. Applicable type of competitive selection procedure

Question no. 11
For awarding spectrum usage rights in the 800 MHz, 900 MHz, 1800 MHz and 2600 MHz bands, in 2012, ANCOM applied a competitive selection procedure consisting of a stage of clock auction primary rounds, followed by one or two additional sealed bidding rounds for the blocks still not awarded in the primary rounds and one sealed bidding round for awarding concrete blocks within each block category for the previous stages' winners of generic blocks. Clock auction: - iterative bidding procedure, in multiple rounds, where multiple abstract (generic) spectrum blocks are auctioned out simultaneously, by various categories, at pre-set prices announced by the organizer at the beginning of each round; - within each round, participants submit bids indicating the amount of generic blocks they want to acquire in each category, at the price set for that category in that round; - the price is gradually rising from one round to another, for the block categories where demand exceeds the offer; - the process is repeated until the demand no longer exceeds the offer for any block categories; - allows package bidding for spectrum licences; - ensures the flexibility of participants to submit bids for different spectrum combinations, across multiple bands; - participants can change the distribution of bids for the various blocks, each round, in compliance with an activity rule designed to stimulate participation during the auction and discourage strategic bidding behaviour; - leads to the participants' jointly discovery the price that reflects the market value; - determines the number of generic blocks obtained by winners in each category; - may be followed by a sealed bid auction stage whereby the concrete spectrum blocks are established for each of the winners of the clock auction stage.

The actual auction was preceded by a qualification stage, during which - upon assessment of the initial demand for frequency blocks within each category - the following decisions could have been taken:

a) to organize the auction stage starting with the primary rounds, if the aggregate demand had exceeded the number of frequency blocks available under the selection procedure in at least one category;
b) to organize the auction stage starting with the additional round/rounds, if the aggregate demand had not exceeded the number of blocks available under the 33/37 selection procedure in any category and there were blocks for which there was no demand ;
c) to organize only the assignment round of the auction stage, if the aggregate demand had not exceeded the number of frequency blocks available under the selection procedure in any category and there were no blocks for which there was no demand.

In the primary rounds of the auction stage (main stage), the bidders competed to obtain abstract frequency blocks within one or more spectrum block categories (spectrum packages), specifying the number of generic blocks they wanted to acquire in each of the available block categories.

All bids in the main stage were submitted for frequency block packages, valid only in its entirety. Generic blocks in all categories were auctioned out simultaneously, which allowed spectrum package bidding, blocks within a category being rated with the same number of eligibility points and being substitutable during the auction.

The maximum amount of spectrum that a bidder could acquire was limited by the total number of eligibility points available to each bidder (determined by the bidder's initial eligibility and its activity in each subsequent primary round) and by the restrictions and conditions applicable in the selection procedure.

The primary rounds were intended to determine the winning bids, respectively the winning bidders and the spectrum package acquired by each of them, as well as the reserve prices the winners had to pay for the respective package.

In the event that – following the submission of initial bids or following the primary rounds - abstract frequency blocks remained not acquired, ANCOM could decide to hold an additional bidding round, and if and after it some blocks still remained not acquired, it could decide to organize a second additional round.

After the additional round/rounds, the winning bids for the blocks not acquired in the primary rounds, respectively the winning bidders, as well as the reserve prices of the winning bids - which the bidders had to pay - were determined.

Primary and additional round/rounds were aimed at determining the winning bidders and the number of generic blocks they acquired in each block category.

After the primary and additional rounds/rounds stage, an assignment round was carried out to determine the individual position of the abstract blocks obtained by each winner in the previous stage, within each frequency band, i.e. the assignment of the concrete frequency blocks.

Taking into account the experience gained by ANCOM and by the providers of public electronic communications networks and services following the 2012 spectrum auction,

do you consider it appropriate that, if aggregate spectrum demand exceeds the amount of spectrum available in at least one of the spectrum categories in the auctioned bands, the spectrum usage rights in these bands should be granted through a competitive selection procedure similar to the one organized in 2012?

If you do not, please give rationale for your answer and propose a viable alternative solution

One respondent considers that the rights of use for the radio frequencies in the aforementioned bands should be awarded through a competitive selection procedure similar to that organized in 2012.

A second respondent considers that, given the success of the format used in organizing and conducting the 2012 procedure, it should also be applied to this auction.

A third respondent considers that, given the experience of the 2012 tender, it would be necessary to improve the selection procedure in order better to meet the needs of transparency and to ensure efficient and effective spectrum use in the future. Specifically, the respondent draws attention to the successful spectrum auction model used in Germany, which ensures full transparency during the auction and a subsequent negotiation phase for the assignment of concrete frequency bands. This has been proved to be beneficial both for the regulator and for the participating communications operators. For the assignment stage, if a negotiated solution has not been reached, the respondent suggests using a second price sealed-bid mechanism, which should be a more efficient alternative to the 2012 auction model, corroborated with the "minimum displacement" rule as regards the position in the frequency band of the spectrum resource currently used by each bidder (a rule successfully used in the latest 3.5-3.8 GHz auction in Romania). Such a mechanism is recognized because it encourages sound/efficient assignment rounds and avoids the inefficient method of over- or sub-bidding through the non-transparent and ineffective mechanism of "guessing" the other players' position.

A fourth respondent considers it appropriate that the Authority should award the rights to use frequencies in the bands under consultation through a competitive selection procedure similar to that organized in 2012.

A fifth respondent considers that whether aggregate spectrum demand exceeds or does not exceed the amount of spectrum available for a particular band cannot set a legal basis for organizing a competitive selection procedure because ANCOM is legally bound to award rights of use by competitive or comparative selection within 8 months from the receipt of a request therefor, according to Article 26 of Government Emergency Ordinance no. 111/2011, the law providing no "pre-auction" procedure for expression of interest. Moreover, the respondent states that it will not be possible to invoke a possible "auction fraud" even if ANCOM decides to hold an auction exclusively based on firm commitment, may it be written or not.

3. Conditions for acquiring spectrum usage rights

3.1. Minimum spectrum requirements

Question no. 12
In the case of a new entrant participating in the competitive selection procedure, do you consider that obtaining spectrum blocks in the bands below 1 GHz should be bound by obtaining a certain amount of spectrum in the bands above 1 GHz, in order to ensure a minimum spectrum portfolio for efficient implementation of a public mobile broadband network at a national level?

A respondent does not consider such a condition to be necessary, but deems that there should be no reserved blocks for potential new entrants. The manner of conducting the auction should allow the market to determine the winners of the competitive selection procedure.

However, the respondent considers that a pre-qualification stage should be established, in which potential applicants are required to prove they have the technical and the financial capacity required to meet the obligations incurred along with the awarded usage rights.

A second respondent states that the same rules should be applied objectively to all bidders, whether they are existing or new entrants. Given the existence of a highly competitive environment on the Romanian mobile communications market – which makes it difficult to invoke the need of encouraging market entry for new players – the setup of favourable conditions for potential new entrants would have a distorting effect on competition. The respondent considers that it is very important for existing operators to be incentivized to continue investments in coverage, new technologies and new services, which will ultimately have beneficial effects on end-users and on the digital economy. An incentive in this direction would be the reduction in annual spectrum usage tariffs.

A third respondent deems necessary to bind acquiring radio spectrum in the frequency bands below 1 GHz to acquiring radio spectrum resources in the bands above 1 GHz.

The respondent's arguments are presented below.

Where a new entrant gets a very small amount of spectrum and relies on access to existing operators' networks under national roaming contracts, this should be allowed only to the extent that the new entrant can prove a sustainable network development plan and the capacity to build a nationwide network within a reasonable timeframe.

Bandwidth in the bands below 1 GHz is limited and cannot ensure the capacity required to provide 4G/5G services in urban areas with high traffic concentration. The efficient implementation of a broadband mobile public network at national level therefore requires acquiring a certain amount of spectrum in the bands above 1 GHz.

Furthermore, the respondent deems it necessary to bind also acquiring radio spectrum in the band above 1 GHz to acquiring frequencies below 1 GHz, in order to ensure efficient spectrum investments and service provision at national level and to avoid high frequency spectrum hoarding.

A fourth respondent considers that it is unnecessary to bind acquiring spectrum in the band below 1 GHz to acquiring frequencies above 1 GHz, and that it depends on the new operator's commercial and technical strategy whether it has a business plan that enables building a national network, but that any spectrum resource should have similar coverage obligations to the other operators' obligations for the same frequency bands, resulting from the 2012 auction or from previous ones, in order to ensure a non-discriminatory competition environment.

The respondent also considers that, in the case of a new entrant (interested in frequency bands below 1 GHz), no condition on bidding or spectrum holding in the bands above 1 GHz should be introduced in the competitive selection procedure, because such a conditioning would mean an unacceptable interference in the business plan of a private economic operator.

Question no. 13
If your answer to question no. 12 is affirmative, what minimum spectrum amount would you consider that a new entrant should acquire in the bands below 1 GHz and, respectively, above 1 GHz, in order to be able to provide an efficient public mobile broadband network at national level, in pursuit of meeting the 5G requirements?

One respondent deems that the recommended minimum bandwidth for 5G services is 50 MHz. Therefore, for a new entrant, the minimum amount of spectrum to be acquired in the 5G auction should be:

- below 1 GHz: min 2x10 MHz

- above 1 GHz: min 2x40 MHz

In another respondent's opinion, question no. 13 in the Questionnaire would ignore an essential aspect, i.e. the fact that licenses for the use of radio frequencies are technologically neutral, drawing attention to the fact that ANCOM cannot condition awarding a spectrum license to holder's compliance with the "*5G requirements*". The respondent also states that, moreover, the 5G standard has not been finalized, therefore such requirements should not be specified in the terms of reference.

Also, as regards the objective of "*providing an efficient public broadband mobile network*", the respondent deems that the decision to be "efficient" or not belongs to the mobile operator and that, in particular, the fundamental right to freedom of economy must be respected.

On the other hand, the respondent draws attention to the fact that if a bidder is allowed to bid and acquire a spectrum amount corresponding to only 2x5 MHz bandwidth, obviously that operator will not be able to offer broadband services, given the constraint imposed by the Shannon Law applicable to radio channel capacity.

A third respondent recommends that no limit should be set that could stop a participant from acquiring at least 2x10 MHz of 700 MHz and at least 100 MHz of 3.4-3.8 GHz, in order to best support innovation and high speed data services.

The respondent also recommends ensuring that any participant has the option to acquire at least 20 MHz of the 1500 MHz band, if wanted.

3.2. Spectrum caps

Since the frequency spectrum below 1 GHz offers advantages in terms of coverage efficiency compared to the spectrum above 1 GHz and given the small amount of spectrum available in the frequency bands below 1 GHz, in order to prevent anticompetitive results, such as excessive concentration or excessive asymmetry of spectrum holdings below 1 GHz, in the 2012 selection procedure ANCOM imposed caps on the spectrum amount that an operator may hold in the frequency bands below 1 GHz.

By imposing such a cap, ANCOM aimed at ensuring the conditions for:

- equitable access to the spectrum resources below 1 GHz, which is more appropriate for providing indoor and rural coverage, involving lower costs for infrastructure rollout;

- encouraging efficient investments in infrastructure;
- promoting sustainable competition, based on equitable access to spectrum resources.

Thus, in the 2012 selection procedure for granting spectrum usage rights in the 800 MHz, 900 MHz, 1800 MHz and 2600 MHz bands, the following caps were imposed on the maximum spectrum amounts that a bidder could acquire in the bands below 1 GHz, following the selection procedure, during 06.04.2014-05.04.2029:

a) the total maximum amount of spectrum in the (cumulated) 800 MHz and 900 MHz bands, over which a bidder could hold usage rights, following the selection procedure, during 06.04.2014-05.04.2029, was 2 x 20 MHz;
b) the total maximum amount of spectrum in the 800 MHz band, over which a bidder could hold usage rights, following the selection procedure, during 06.04.2014- 05.04.2029, was 2 x 10 MHz;
c) the total maximum amount of spectrum in the 900 MHz band, over which a bidder could hold usage rights, following the selection procedure, during 06.04.2014- 05.04.2029, was 2 x 10 MHz.

Question no. 14
In your opinion, in order to set the premises for fair competition and equitable access to spectrum resources for the provision of broadband mobile networks and services, is it necessary to impose caps on the maximum amount of spectrum over which a bidder may hold usage rights in certain bands, following the selection procedure, also taking into account the spectrum for which bidders already have usage rights? *Please give rationale for your answer.*

One respondent answered affirmatively, considering that such caps would allow a better distribution of scarce spectrum resources, while fostering competition in the market.

Another respondent deems that it is necessary to set spectrum caps below 1 GHz. Such caps will contribute to enhancing competition, while allowing more flexibility as regards the spectrum options required for ensuring coverage.

The respondent does not consider it necessary to apply spectrum caps above 1 GHz, since, in his view, the amount of spectrum above 1 GHz is sufficient to allow all operators to develop and compete in a fair environment.

A third respondent considers that, within a tender procedure, it is not necessary to impose maximum spectrum caps, invoking the following reasons:

Fair access is actually ensured through the bidding procedure itself, operators being interested in buying the amount of spectrum that responds optimally to communications needs. Thus, there is no risk of hoarding valuable spectrum resources that could be used for offering 5G services to end-users in Romania.

The benefits, in the respondent's opinion, are:

- assigning the full spectrum and avoiding the situation in 2012, when there were some frequencies remained not acquired;

- optimization of the state frequency spectrum resources through the acquired financial resources.

A fourth respondent answered affirmatively.

A fifth respondent considers that the caps imposed in the 2012 auction should be valid in a future auction, as well, respectively maximum 2x10 MHz for each band below 1 GHz.

A sixth respondent has no comments on spectrum caps per participant. Concerning spectrum caps in a certain band, the respondent recommends that no limit is set which would stop a participant from securing at least 2x10 MHz of 700MHz and at least 100 MHz of 3.4-3.8GHz, in order to best support innovation and high speed data services.
The respondent also recommends ensuring that any participant has the option to acquire at least 20 MHz of the 1500 MHz band.

Question no. 15
If your answer to question no. 14 is affirmative, please specify what would be the maximum amount of spectrum an operator could hold in the bands below 1 GHz? What about the bands above 1 GHz - do you consider that limitations should be imposed on the maximum amount of spectrum that can be acquired in the selection procedure and, if so, what would those limitations be? *Please give rationale for your answer.*

In the opinion of a respondent, in order to ensure a fair competition environment, an operator should hold a maximum of 30 MHz in the bands below 1 GHz (700 MHz, 800 MHz and 900 MHz).

In the bands above 1 GHz, the respondent considers that at least for the 3.5-3.7 GHz bands, a maximum limit of 100 MHz per operator should be imposed.

Another respondent considers it necessary to impose the following limits in the spectrum below 1 GHz:

- maximum 2x10 MHz for the 694-790 MHz band - to discourage spectrum hoarding;
- maximum 2x30 MHz for the entire frequency spectrum below 1 GHz, excepting the frequency bands in SDL mode.

The respondent deems that it is not necessary to apply spectrum caps per operator in the spectrum above 1 GHz.

The answer of a third respondent is as follows:

Below 1 GHz: maximum 25 MHz (regarding FDD bands, i.e., in fact, 2x25 MHz - 25 MHz downlink and 25 MHz uplink) + maximum 5 MHz (TDD/SDL).

Above 1 GHz, no caps are indicated, given that there is still not acquired spectrum and the amount of spectrum above 1 GHz is significantly higher than below 1 GHz.

A fourth respondent expressed the following point of view:

The maximum spectrum resources that an operator may hold in the bands below 1 GHz should be 2x10 MHz for each band, a cap that should be maintained for the post-auction period, as well. Concerning the bands above 1 GHz, it considers that limiting the maximum amount of spectrum held by an operator is not recommended.

A fifth respondent makes reference to its answer to Question no. 14.

3.3. Other conditions associated with spectrum usage rights

Question no. 16
Do you consider it adequate to impose additional license conditions, in order to avoid spectrum hoarding? If so, what such conditions could the Authority impose?

A first respondent does not consider it appropriate to impose additional measures to avoid spectrum hoarding, since, in its opinion, the obligation to pay the annual tariff is sufficient to incentivize the holders to use the spectrum. On the other hand, the respondent considers that a pre-qualification stage must be established, in which potential applicants can prove they possess the technical capacity and financial resources necessary to fulfil the obligations that would result from the awarding of the usage rights.

A second respondent deems that, in order to avoid spectrum hoarding, ANCOM may impose obligations on operators that should lead to the efficient use of the spectrum acquired, within a specified period and, in the event of failure to fulfil the commitments, the regulator should have the authority to apply penalties and even withdraw the spectrum usage rights.

A third respondent considers it necessary and sufficient to impose an obligation to effectively use the spectrum acquired in the auction, within a reasonable time.

A fourth respondent does not consider it necessary to impose additional measures to avoid spectrum hoarding.

A fifth respondent deems that, in order to avoid spectrum hoarding, it is appropriate to impose, in a first instance, – in the very terms of reference – the prohibition to participate in an auction of those operators that have not launched commercial services in the bands already in their portfolio or that have not complied with their coverage obligations in the already owned bands. E.g., one of the existing operators has not launched commercial services in the 2600 MHz TDD band yet, although it holds usage rights in this band starting from April 2014 – which, in the respondent's opinion, equals to spectrum hoarding.

Later on, by licenses, the coverage obligation should be imposed for each band individually (for each licence holder), otherwise the use of a band only at regional or even local level (may the service coverage be ensured through other bands) would - in the respondent's view - equal to spectrum hoarding.

A sixth respondent expressed the following view:

In general, coverage obligations for licensing of (and limited to) sub-1 GHz spectrum, such as population and geographical coverage, could be considered in support of national broadband goals. However, any coverage obligations for licensing sub-1 GHz bands should be combined with a regulation allowing licensees to do passive and active network sharing, including spectrum pooling, based on market terms.

The respondent deems that, for higher spectrum bands and in order to support innovation and IoT, regulation could be considered that aims at letting anyone who is interested to have access to spectrum where the licensee does not intend to build out coverage. The regulator could, for example, open up for spectrum sharing if there is market interest to use unused spectrum in parts of the country where a license holder does not plan to use the spectrum, as may be the case e.g. in industrial/agricultural applications, etc.

Another respondent proposes that, when a licence is issued - and upon the adoption of an ANCOM decision -, the possibility of network function virtualization (NFV) should be considered, so as to ensure that applications used in emergency communications services, public protection and disaster relief are guaranteed network resources, i.e. their data traffic is separate from the general data stream on the mobile network.

3.4. Validity of spectrum usage rights

Question no. 17
In your opinion, what should the date of entry into force of the spectrum usage rights in the bands under consultation be? *Please give rationale for your answer.*

One respondent is of the opinion that the new usage rights should come into force immediately after the award procedure has been completed, as the rights holders should not have their financial resources blocked in assets that cannot produce value.

A second respondent considers that spectrum usage rights should be awarded immediately after the auction completion.

A third respondent deems that in 2019, at the latest in early 2020, the new frequency usage rights should come into force.

A fourth respondent provided the following answer:

for the 700 MHz band - as soon as the coordination agreements are signed, possibly 2020

for the 800 MHz band - immediately

for the 2600 MHz band - immediately

for the 1500 MHz band - immediately

for the 3500 MHz band - immediately

for the 3700 MHz band - immediately

A fifth respondent provided the following answer:

The date of entry into force of the frequency usage rights to be awarded in the bands subject to the consultation should be at least 6 months from the time of the auction completion. The exact date will depend on the year and period in which ANCOM considers it opportune to organize such an auction.

A sixth respondent gave the following answer:

As soon as the licensing process is completed and the related spectrum is available, in order to avoid unnecessarily early blocking of operators' investments in spectrum licenses.

Question no. 18
Taking into account the fact that the rights to use radio frequencies granted in the 800 MHz, 900 MHz, 1800 MHz and 2600 MHz bands, following the auction held in 2012, have a validity of 15 years, during 06.04.2014 - 05.04.2029, *do you consider it appropriate to align the expiry date of the spectrum usage rights in the frequency bands subject to consultation with the expiry date of the licenses already granted in the above mentioned bands, i.e. 05.04.2029?* *Please give rationale for your answer.*

In a respondent's opinion, aligning the expiry dates for the spectrum usage rights is a very important aspect and it considers it timely to align the expiry date of the usage rights acquired in the 800 MHz and 2600 MHz bands with the expiry date of the licenses already issued in these bands.

For the new bands (700 MHz and 1500 MHz), the respondent considers that ANCOM should take into account the European Commission's proposal for a minimum duration of 25 years of the usage rights, so that an investment-friendly environment can be created and the digitization process be stimulated. In the respondent's view, the minimum period of validity of the usage rights in order to substantiate from an economic perspective the decision to invest in the 700 MHz band would be until 31.12.2040. As it is well known, the full use of the band would be possible in the first half of 2020, due to the current use of television in neighbouring countries. As a result, an effective and complete validity period of at least 15 years should be guaranteed. In order not to create a different situation regarding the duration of the usage rights, the respondent considers that the 1500 MHz band should be assigned for the same period as the 700 MHz band.

For the 3.4-3.8 GHz band, the respondent considers that awarding short-term usage rights for the available spectrum is not necessary/useful for the market. In any event, if an operator wishes to obtain short-term usage rights in these bands, it considers that these should be granted by 2025 because, in the opinion of the respondent, an auction/refarming of the entire radio spectrum available (400 MHz) should be conducted, so as to create the framework for strong and competition-driven 5G development. The licenses already awarded render this band quite fragmented and it seems that the

need for a minimum of 100 MHz adjacent TDD spectrum for each operator cannot be ensured before the expiry of the current usage rights. In order to prevent further fragmentation, the respondent considers that all rights of use should be aligned to 2025 and the 400 MHz should be made available for mobile services, respecting the principle of technology and services neutrality and in line with the 3GPP planning that is currently underway and is expected not to be completed before next year. If ANCOM - contrary to the arguments presented - decides to organize the selection procedure for the 3.4-3.8 GHz bands, the respondent points out that it is essential from a competitive perspective to impose a limit of 100 MHz for each operator in these bands.

Moreover, the respondent deems that it is not desirable that all the validity periods of licenses in the different frequency bands expire on the same date. In such a situation, the entire activity of a mobile operator could be endangered in view of one auction. Therefore, the validity periods of licenses should be set in a manner ensuring at least two distinct expiry dates, ideally a combination of the available spectrum below 1 GHz and above 1 GHz respectively.

Another respondent considers that aligning the expiry dates of new licenses with those of existing licenses would lead to a very short duration for L-band usage rights (9 years). Developing a new network using new technology is based on a long-term strategy, and a 9-year period would not allow investment recovery.

Therefore, in the respondent's opinion, aligning the duration of the new licenses with the existing usage rights is not an efficient approach and would lead to a decrease in the participants' interest in the respective bands. The license should be granted for a minimum period of 15 years.

A third respondent finds it absolutely necessary that spectrum usage rights be granted for a minimum of 25 years, taking into account the following:

- There is no increase in revenue from current mobile communications services;
- There is no proven revenue growth due to 5G technology;
- Spectrum licenses will be granted 2-3 years before technology is available and a period of several years will be needed for network roll-out;
- Operators have not recovered their investments in 4G technology yet;
- Major investments are needed for the use of these new frequency bands.

In this respect, the respondent considers it appropriate to extend the validity period of the existing licenses, after 05.04.2029, in order to align the date of expiry of the spectrum usage rights already awarded with that of the usage rights of the new spectrum resources under consultation, thus ensuring predictability for the operators to make further investments by optimizing the use of the bands acquired in the two auctions.

A fourth respondent deems that it is not necessary to align the expiry dates, considering the experience so far, when previous licences have not been or are not necessarily aligned, and yet spectrum allotments and their market efficiency have worked.

A fifth respondent considers that licences should have a validity period of at least 15 years, and that the expiration date should not be synchronized with other auctions. As an example, in France, licenses for the 700 MHz band were granted over a period of 20 years (2019-2039), even if they were granted as early as 17 November 2015.

A sixth respondent expressed the following point of view:

The length of the spectrum license as well as its renewal terms can have a major impact on the quality, as well as on the reach of mobile networks. Regulators can encourage significant network investment, and therefore higher quality services, by providing a predictable environment and issuing licences that least for a minimum of 20 years. The European Union itself has recently proposed a license duration of 25 years in view of upcoming 5G investments as this would give operators adequate time to realise a reasonable financial return on their investments and reduces investment risk as well. If the regulator adopts short duration licences, operators are less likely to invest appropriately in their networks as their access to spectrum in the future is not guaranteed.

Also the more spectrum licences are due for renewal at a given time, the more uncertainty this means for operators. In turn, this increases the risk associated to network investments and could ultimately disrupt services. In order to avoid this outcome, regulators are advised to employ a transparent and predictable approach to renewal. Ideally, the process should begin three to four years before the license expiry, providing ample time for services to be resumed in other bands where necessary. In that respect, the respondent welcomes ANCOM's current initiative.

Based on the above rationale, the respondent considers that the spectrum usage rights duration should be of a minimum of 20 years with a presumption of renewal without cost, provided network deployment/service still exists in the spectrum. Also, caution should be taken so as not to have all spectrum rights expire concurrently and take into serious account the operators' views in this respect.

In the respondent's opinion, this will create an environment that favours long term investment and increases security of potential returns for the market.

4. Coverage obligations

Including obligations in licenses is a well-established practice in order to promote legitimate public interests. For example, in the selection procedures organized by ANCOM, requirements have been formulated, and minimum obligations have been included in licences regarding service coverage and network access.

In the terms of reference for the organization of the competitive selection procedure with a view to awarding the spectrum usage rights in the 800 MHz, 900 MHz, 1800 MHz and 2600 MHz bands, which took place in 2012, distinct coverage obligations were imposed in the licenses granted in the frequency bands below 1 GHz and – respectively – for those in bands above 1 GHz, with the validity period 06.04.2014 - 05.04.2029.

(*See Section 3.3.1 of the Terms of Reference, available here: http://www.ancom.org.ro/uploads/links_files/Caiet_de_sarcini_procedura_multibanda_800_900_1800_2600_02_07_2012_en.pdf*).

Question no. 19
a) What minimum coverage requirements would you see associated with spectrum usage rights, in the case of a new entrant acquiring spectrum in the bands below 1 GHz? *b) What about the minimum requirements in the case of a new entrant acquiring usage rights in the bands above 1 GHz?* *Please give rationale for your answer, correlating it with the answers to questions no. 12 and 13 on minimum spectrum requirements*

One respondent considers that for radio spectrum below 1 GHz, a new entrant should have similar coverage obligations as those imposed on existing operators by other issued licences.

It does not consider that coverage obligations for the spectrum above 1 GHz should be imposed on a new entrant.

Another respondent considers that coverage obligations for new operators should be the same as for existing operators and similar to those imposed for spectrum use in the 800 MHz, 1800 MHz and 2100 MHz bands. Imposing more relaxed obligations on new operators would lead to a slowdown in coverage, with a negative impact on consumers.

A third respondent considers that a new entrant should be committed to the achievement of the 5G Agenda objectives, in terms of service availability through both 5G network roll-out and services penetration.

In this respect, the respondent considers that appropriate coverage obligations should be imposed on new market entrants to ensure both commitment to the 5G Agenda objectives and the effective and efficient use of spectrum resources in Romania. These obligations should be aligned with those already assumed by existing operators on the market, with clear criteria regarding the coverage of population, territory and services.

A fourth respondent deems necessary:

a) the same obligations for coverage with mobile communications services as those of other operators that have acquired frequency spectrum in the bands below 1 GHz in the previous 2012 auction;

b) the same obligations for coverage with mobile communications services as those of other operators that have acquired spectrum resources in the bands above 1 GHz in the previous 2012 auction.

The respondent considers that, in order to ensure equal competition conditions for operators and not to distort the market, it is absolutely necessary for operators holding spectrum in the same frequency bands to meet the same coverage requirements.

A fifth respondent considers that minimum coverage obligations from the 2012 tender should be "copied", under the same rules (bands below 1 GHz/bands above 1 GHz).

A sixth respondent considers that any coverage obligations should only apply to sub 1 GHz spectrum. The respondent makes reference also to its answer to Question 20.

In general, the obligations that should be considered (if any) should not be generic, they should take into account the RF characteristics of the frequency band in question and the needs of Romania and its citizens.

Many countries consider coverage obligations (e.g. geographical, population, road/rail, indoor and outdoor) in their low (sub 1GHz) license awards, and they have been proven to have merit to overcome the lack of investment in uneconomical regions. Any coverage obligation should be factored into the spectrum valuations of forthcoming auctions, as it reduces the value to the operators due to increased cost obligations. It should also be aligned with respective obligations for existing operators.

Question no. 20
In the case of the granting spectrum usage rights in the frequency bands subject to this consultation to existing operators, what are the additional coverage obligations you think should be imposed, as to those set out in the already granted licenses, given the forthcoming provision of 5G services? *Please give rationale for your answer.*

In a respondent's opinion, coverage obligations should not be imposed on existing operators as they have already ensured national coverage and inherently will have to implement 5G technology by maximizing network coverage.

It is further stated that 5G will in fact constitute a "system of systems" covering a multitude of uses, will be an evolution of classical mobile services but at the same time will require interaction with them (and subsequently with the frequency bands) so it will be difficult to monitor coverage for "5G spectrum bands".

The respondent deems that, according to the existing obligations, Romanian operators must already ensure high quality coverage for their networks. In its view, the imposition of obligations on specific bands will only limit their operational flexibility and subsequently network performance, given that certain uses may be hindered by imposing strict coverage obligations.

A second respondent considers that only service coverage obligations should be imposed, obligations that are technologically neutral, similar to those in the current license. Strong competition in the market is a strong enough incentive for operators to invest in 5G coverage across nationally expanded areas.

A third respondent considers it appropriate to establish obligations to provide 5G services to a certain percentage of the population, up to a certain date, in terms of minimum data transfer rate.

In the case of imposing additional coverage obligations in the rural area for existing operators, unrelated to 5G services, they should also be valued and deducted from the price paid for the respective frequency spectrum.

The respondent is convinced that the commercial interest of the operators will be a powerful driver for 5G service coverage, and that the free market mechanism is more effective than imposing coverage obligations in specific areas.

A fourth respondent considers that no coverage obligations for existing operators should be imposed, as they meet the coverage requirements in the currently held frequency spectrum for both voice and data services. In particular, in new technologies, coverage obligations are still to be defined, especially when their standardization has not been completed, and future types of applications and uses are still at an early stage.

A fifth respondent deems that no additional coverage obligations should come with 5G since 3.5 GHz and mm-wave spectrum bands are not suitable for geographical coverage and the sub-1 GHz bands will be used with the same massive Machine Type Communications - MTC services as in LTE today.

5. Access obligations

Question no. 21
Do you consider that, for the holders of spectrum usage rights in the bands subject to consultation, access obligations should be set? Please give details and reasons supporting your view on what should be the access obligations for holders of spectrum usage in the frequency bands subject to this consultation.

One respondent notes that, as it is unanimously acknowledged, Romania benefits from a highly performing and competitive mobile market. Therefore, that additional access obligations should not be established, in order not to jeopardize additional investment in mobile infrastructure in general, and in 5G infrastructure in particular.

A second respondent considers that no access obligations should be associated with the spectrum usage right. Most of the frequency bands included in the auction will be used to develop the 5G network and imposing an access obligation concerning the new technology would deter investments. The respondent also points out that even the licenses granted after the 2012 auction do not include access obligations for 4G networks. Another important aspect to be considered is the structure of competition in the Romanian market - four operators with relatively balanced positions, including as regards network coverage - which do not trigger the need for regulatory intervention. It is worth mentioning that the imposition of an access obligation may diminish the operators' interest in bidding.

A third respondent does not consider the imposition of obligations of access to these resources to be necessary, since the frequency bands are obtained following a very rigorous tender process. It considers that commercial interest will best adjust such requests for access.

A fourth respondent answered negatively.

In the opinion of a fifth respondent, there should be no access obligations for licensees in the frequency bands under this consultation. It argues that national roaming has created confusion among users, especially in terms of the use of subscription-included resources (due to national wholesale roaming charges) and the obligation to provide MVNO access was and is, in the opinion of the respondent, a failure (at least until now).

A sixth respondent proposes that, in the case of licensing, the possibility of network function virtualization (NFV) should be considered, so as to ensure that applications used in emergency communications services, public protection and disaster relief are guaranteed network resources, i.e. their data traffic should be separated from the general data stream on the mobile network.

6. Reserve prices (minimum license fee) / block of frequencies

Question no. 22
Do you agree that the operators' assessments on the fair values of their own licenses (intangible assets) can be helpful sources of information that need to be used for establishing reserve prices in competitive selection procedures?

A first respondent provided the following answer:

No, because the operators assessments are influenced by factors that are not strictly in keeping with radio spectrum (network development stage, customer base, etc.).
Operators' assessments do not provide any indication either of the new bands available, or of the ones already in use. The value of the rights of use the frequency bands must always be determined in an entirely individual process, based on factors such as:

- position in the frequency band;
- the degree of competition in the market;
- the options for using the new spectrum bands (for example, if the band is intended for a specific technology) and the estimated commercial exploitation possibilities.

The respondent considers that the best way of estimating reserve prices would be by reference to the average reserve prices in comparable selection procedures organized at the level of EU Member States.

A second respondent provided the following answer:

As a general rule, the purpose of the reserve price should be clear - it must establish that, if operators bid for this price or higher, the regulatory decision to move from the previous use of that spectrum to the mobile one is the right one. Therefore, the starting price should be set at the level of the opportunity cost for the previous or alternative use. Any price increase in the auction will be determined by the excess demand from mobile operators. Account should be taken of the fact that high reserve prices will substantially reduce the funds available to operators for further investment in the development of 5G networks in Romania.

The respondent appreciates that, in the case of Romania, reserve prices must take into account the specific characteristics of the market in which the participants operate:

- the lowest prices in the EU for mobile communications services;
- low economic power - GDP;
- strong competitiveness.

A third respondent provided the following answer:

Negative. For the previously auctioned bands, similar price conditions with previous auctions should be considered to ensure non-discriminatory conditions of competition between operators buying the same bands. At the same time, watching the market evolution, and taking into account that the development of the digital economy based on electronic communications services is the main driver for citizens' welfare and economic competitiveness, with cascading positive effects, ANCOM should see lowering the reserve prices and the annual spectrum use tariff as an

investment in accelerating Romania's development. Thus, the respondent considers that a downward revision of the previous auction prices would be required, as this decrease would speed up the development of networks, services, efficiency gains, service availability for more citizens and for more companies.

A fourth respondent states that although the Government, by issuing a decision, is the one setting the reserve price for spectrum auctions, the industry should indicate the approximate reserve price. A higher level of investment in expanding radio access networks will lower interest in new radio frequencies as it involves new investments in antennas and other radio equipment. It considers that current spectrum owners should come up with concrete proposals for the frequency bands under consultation.

A fifth respondent deems that, based on their experience, reserve prices should be reasonably low in order to allow for quick massive investments in network coverage and capacity as well as for the swift introduction of new technologies as e.g. 5G for the benefit of the country.

Question no. 23
Do you agree that 2 x 5 MHz blocks in harmonised frequency bands below 1 GHz (700 MHz, 800 MHz and 900 MHz) should have considerably close economic values in Romania? Please detail your answer.

One respondent answered negatively, as the economic value is influenced by the penetration rate of customer equipment and by the technologies used in each band. Furthermore, the availability and interference-free use of frequencies across the country (including the border area) influences the economic value of the frequency blocks.

In the opinion of a second respondent, the 700 MHz and 800 MHz bands can be substitutable due to similar propagation characteristics. Therefore, the terms and conditions, including the reserve price for these bands, should be similar to those applicable in the 2012 auction. Applying different rules for spectrum in the same frequency band or similar would create an unjustified, discriminatory regulatory regime for market players, having a negative impact on the competitive environment.

A third respondent considers that there are differences between the economic values of the frequency bands below 1 GHz.

In the respondent’s opinion, the assessment should take into account that, if spectrum usage tariff decreases to a reasonable percentage of revenue, the increase in the amount of the awarded spectrum should lead to lower prices per MHz (for all frequency bands). Otherwise, the operators will no longer be able to invest in the continuous upgrading of mobile networks - a situation already visible in India over the past 12 months.

Specifically for the 700 MHz band - there are risks related to spectrum release, plus the neighbourhood risk with non-EU countries that are not harmonized, still using these bands for television. The price should reflect the risk of harmful interference generated by uses in neighbouring non-EU countries.

The respondent also considers that the value of the 900 MHz band is clearly superior to that of other bands below 1 GHz and it should not be counted in a benchmarking aimed at establishing the prices for the 800 and 700 MHz bands.

A fourth respondent answered negatively, arguing that the spectrum in 900 MHz band is more valuable than that in the 800 MHz band, which in turn is more valuable than that in the 700 MHz band, from a commercial perspective: in 900 MHz - terminals for both voice and data have been available for a long time, in the 800 MHz band - the adoption of terminals is still at an early stage, whereas the 700 MHz spectrum - it is unclear whether it can be used in Romania within a reasonable time horizon, in the medium term.

In the opinion of a fifth respondent, the criterion by which the reserve price is set should be based on the utility and versatility of that band.

Thus, the 900 MHz band (which can be used for 2G, 3G and 4G) should be the most valuable (so, the most expensive). The 800 MHz and 700 MHz bands, since they can only be used for 4G, should have a lower reserve price.

The respondent deems that the 800 MHz band should have a reserve price identical to that of 2012 (EUR 35 million for a duplex 2x5 MHz block) and the 700 MHz band should have a reserve price of EUR 30 million for a duplex 2x5 MHz block (for 15 years validity).

Another respondent deems that since the ecosystem for the various technologies used in each band varies with the bands and also the level of interference from neighbouring countries is different for different frequency bands, the spectrum value is affected and may therefore differ between the aforementioned bands.

7. Indicative schedule of the selection procedure

Question no. 24
What do you think an indicative timetable for the preparation and organisation of the selection procedure should be, taking into account the activities listed below: *a)* Submission of applications for granting spectrum usage rights in the frequency sub-bands under consideration and expressing firm interest for participating in a possible selection procedure (in case it is decided to carry out this action before the start of the actual selection procedure); 37/37 *b)* Announcement of the need to organize a competitive selection procedure (if demand exceeds the offer) (in case it is decided to carry out this action before the of the actual selection procedure); *c)* Publication of the documentation required for the organization of the selection procedure (draft decision on organising the selection procedure, draft terms of reference - initial version, draft Government decision on the minimum amount of the licence fee); *d)* Public consultation on the documentation and submission of comments; *e)* Summary of comments and organization of the Consultative Council;

f) Adoption of the decision on the organization of the selection procedure and of the Government decision on the minimum amount of the license fee, along with the consolidation of the final version of the terms of reference;

g) Publication of the announcement;

h) Submission of requests for clarification;

i) Publication of answers to the requests for clarification received;

j) Receiving applications;

k) Announcement of qualified/unqualified applicants;

l) Submission of possible complaints;

m) Solving any disputes;

n) Announcement of the fact that the primary auction stage is organised and of its starting date or announcement of the fact that no primary auction stage is required as well as the announcement of the winning bidders of abstract blocks and the starting date of any additional rounds, or of the assignment round;

o) Information session on the auction rules;

p) Launch of the auction;

q) Completion of primary and/or additional rounds;

r) Assignment round;

s) Announcement of auction results;

t) Payment of the license fee resulting from the selection procedure;

u) Licence issuance.

One respondent considers that the entire process described above should take place over a period of one and a half to two years, starting from its initiation moment.

A second respondent states that, with regard to the auction calendar, it is surprising that ANCOM considers a scenario whereby operators are to express their firm commitment - including the amount of spectrum and the frequency bands required - before having the terms and conditions of the auction and without knowing the reserve price. Actually, expressing firm commitment is a promise of purchasing the spectrum amounts indicated in the application documents, at the reserve price and taking into account the obligations to be fulfilled associated with the required frequencies. It is obvious that, in the absence of such information, an operator cannot decide on the category and the volume of spectrum it intends to acquire. The respondent therefore considers it essential that ANCOM should amend the proposed timetable so that the publication and consultation of the terms of reference be carried out prior to the operators' submission of the applications and before expressing one's firm interest regarding participation in the selection procedure.

The calendar proposal is detailed below:

a) Publication of the documentation required for the organization of the selection procedure (draft decision on organising the selection procedure, draft terms of reference - initial version, draft Government decision on the minimum amount of the licence fee);

b) Public consultation on the documentation and submission of comments;

c) Summary of comments and organization of the Consultative Council;

d) Adoption of the decision on the organization of the selection procedure and of the Government decision on the minimum amount of the license fee, along with the consolidation of the final version of the terms of reference;

e) Publication of the announcement on the intention of awarding the frequencies and of the final terms of reference;

f) Purchase of the terms of reference;

g) Submission of requests for clarification;

h) Publication of answers to the requests for clarification received;

i) Receiving applications;

j) Announcement of qualified/unqualified applicants;

k) Submission of possible complaints;

l) Solving any disputes;

m) Announcement of the fact that the primary auction stage is organised and of its starting date or announcement of the fact that no primary auction stage is required as well as the announcement of the winning bidders of abstract blocks and the starting date of any additional rounds, or of the assignment round;

n) Information session on the auction rules;

o) Launch of the auction;

p) Completion of primary and/or additional rounds;

q) Assignment round;

r) Announcement of auction results;

s) Payment of the license fee resulting from the selection procedure;

t) Licence issuance.

A third respondent considers it appropriate that the details of the auction timetable should be the subject of separate discussions, after the issuance of the decision on organising an auction.

A fourth respondent proposes that the auction be completed by the end of 2018.

One respondent did not respond to the questionnaire, but expressed views on 5G mobile services and networks and made specific comments on the regulatory measures at international level on the use of the 28 GHz band (27.5-29.5 GHz), pointing out that this is an essential band for satellite services and its identification for terrestrial mobile services should not be considered.