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| Plenary | | | Doc. ECC(14)019 |
| 36th Meeting | |  | |
| Cluj-Napoca, 11th – 14th March 2014 | |  | |
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| Date issued: | 5th March 2014 | | |
| Source: | ECC PT1 chairman | | |
| Subject: | Follow-up on questionnaire on coverage obligations | | |
| N  Group membership required to read? (Y/N) | | | |
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| Summary: | | | |
| ECC PT1 has received replies to the questionnaire on enforcement of coverage obligations, which was issued in January 2014. The answers contain a lot of information and ECC PT1 proposes that this information is used as basis for a new ECC Report on “coverage obligations” criteria. | | | |
| Proposal: | | | |
| ECC PT1 invites ECC to consider and agree on   * A new work item for ECC PT1 to develop an ECC Report on “coverage obligations”.   Based on analysis of the answers to the questionnaire on enforcement of coverage obligations issued by ECC PT1 at its meeting in January 2014, the project team should discuss the options towards reaching a possible best practices for setting criteria to be used for defining coverage obligations for mobile voice as well as mobile data services and how these obligations can be enforced.  The answers to the questionnaire provide detailed information on coverage obligations imposed and relevant criteria used throughout the CEPT.  The task for the project team should be   * To review the practices in the different CEPT countries and identify commonalities in the approaches as currently implemented. * To develop a set of possible measurable criteria which can be used, under a voluntary approach, by the national authorities in their enforcement of coverage obligations for future licences to use spectrum, bearing in mind that the definitions and enforcement of coverage obligations are to be considered a national matter. * To define guidelines which could be used by administrations while planning their enforcement activities of relevant coverage obligations.   ECC PT1 notes, that ECC at its last meeting identified the need to develop a similar report on LTE measurements as the ECC report already available to UMTS. It is noted that WG FM/FM22 will take on board this task. ECC PT1 can liaise with FM/FM22 as appropriate. | | | |
| Background: | | | |
| Previously the ECC has noted the need to assess the various coverage obligations in force and how they are measured and enforced. The collected information could help to reach a best practice or a common understanding of the criteria to establish whether a certain area is considered to be covered by mobile services. If feasible this could translate into a common set of technical parameters to be used to determine radio coverage using both measurement and/or simulation tools.  In consequence, ECC at its 35th meeting invited ECC PT1 to develop a questionnaire on coverage obligations and how they are controlled (measurement and/or simulation) and to report at the ECC meeting in March 2014.  This questionnaire was developed through ECO Forum during December 2013, approved by the 45th meeting of PT1 in January 2014 and issued on 21 January by ECO. The replies to the questionnaire are collected in the annex to this document.  29 administrations have replied to the questionnaire and detailed information is available from the answers to the questions. The answers from the administrations indicate a significant interest in the subject and provide a good base for developing a report.  The answers to the questions indicate many different approaches to coverage obligations, criteria for coverage as well as enforcement of coverage obligations. In some cases clear measurable criteria are not available, and this is likely to affect the possibility to monitor and enforce compliance to the obligations. In many cases enforcement is limited to the operators stating that they have coverage and in some cases this is supplemented by the administration performing simulations/predictions and/or performing spot-/drive-tests.  ECC had previously agreed the need to reuse as appropriate the information available in particular from the previous results of a questionnaire from BEREC/RSPG on coverage obligations. Some of the replies to the new questionnaire refer to the BEREC/RSPG questionnaire and the relevant parts of that questionnaire should also be checked for relevant information in the further work on the subject. An extract of the BEREC/RSPG questionnaire is available in the annex to the summary of replies which is in the annex to this document. | | | |

Annex 01: Summary of the responses received

Annex 02 : Responses to questionnaire received by country

**ANNEX 01**

**Questionnaire on enforcement of coverage obligations to be sent to CEPT administrations**

|  |  |
| --- | --- |
| **Responding organisation** |  |
| **Country** |  |
| **Address / e-mail address** |  |
| **Contact name** |  |

**CEPT Administrations are kindly requested to return the completed questionnaire to the European Communications Office (ECO) by 17 February 2014**

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| Recipient of replies | Susanne Have, [susanne.have@eco.cept.org](mailto:susanne.have@eco.cept.org) |
| ECO contact (enquiries) | Alexander Gulyaev  [alexander.gulyaev@eco.cept.org](mailto:alexander.gulyaev@eco.cept.org) |

**Introduction**

The purpose of this questionnaire is to collect information about the current coverage obligations and how these obligations are enforced in public cellular networks (800 MHz, 900 MHz, 1800 MHz, 2 GHz, 2.6 GHz) throughout the CEPT countries. It is not the intention to set common coverage obligations or assumptions such as area to be covered by a certain service, to define bitrates or to establish deadlines.

ECC had noted the need to assess the various coverage obligations in force and how they are measured and enforced. In the end the collected information could help to reach a best practice or a common understanding of the criteria to establish whether a certain area is considered to be covered. If feasible this could translate into a common set of technical parameters to be used to determine radio coverage using both measurement and/or simulation tools.

In consequence, ECC invited ECC PT1 to develop this questionnaire on coverage obligations and how they are controlled (measurement and/or simulation) and to report at next ECC meeting in March 2014.

ECC agreed the need to reuse as appropriate the information available in particular from the previous results of a questionnaire from BEREC/RSPG on coverage obligations.

**Results of BEREC/RSPG-questionnaire**

In 2011 BEREC/RSPG issued a questionnaire on ‘Economic and social value of spectrum’. The purpose of that survey was to collect information on the assignment process in a number of WAPECS frequency bands. The answers to the questionnaire did not contain any information on the actual field strength or signal level necessary to achieve the required coverage in mobile telephony/data networks.

The answers related to aspects on coverage obligations in the BEREC/RSPG-questionnaire are collected in the Annex to this document.

From the answers to the BEREC/RSPG questionnaire it can be concluded that there is a large variation in the coverage and service obligations from one country to another and, even from one frequency band to another.

* In some countries the operators must provide a specific minimum service level to a certain minimum percentage of the area of the country, to a certain number of citizens or even to specific locations within the county.
* In other countries there are no coverage obligations at all or the coverage obligations has been removed from the licence once they were reached a number of years after launch of the service.
* The coverage obligation may differ also from one frequency band to another in a given country.

The answers also indicate a large variation in the choice of monitoring/enforcement.

* Some administrations are satisfied with a periodic (annual, bi-annual etc) statement from the operator proclaiming that the obligations are fulfilled.
* Other administrations conduct their own measurements and compare the result to coverage maps supplied by the operators.

Though some administrations have provided the information that the operators must provide a certain level of coverage for voice/telephony or a certain minimum bit rate, there is no information about what field strength is necessary to provide coverage or how to verify a bit rate.

**New questionnaire**

As already stated, it is not the intention to set common coverage obligations or assumptions such as area to be covered by a certain service, to define bitrates or to establish deadlines.

ECC will further discuss the issue at the next meeting based on the summary of responses received.

**ECO has received replies from the following 29 countries: Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark\*, Estonia, Finland, France, Germany, Hungary\*\*, Iceland, Ireland, Italy, Latvia, Liechtenstein\*\*\*, Lithuania, Luxembourg, Montenegro, The Netherlands, Norway, Portugal, Serbia, Slovak Republic, Slovenia, Spain, Sweden , Switzerland and the United Kingdom.**

**GENERAL COMMENTS**

**Denmark:**

Requirements for the Collection and Processing of Data for Mapping of Mobile Coverage for Voice Communication in Denmark

**General**

Each operator has to report their field strength calculations for outdoor coverage with a resolution of (pixels) of 100 meters x 100 meters.

**Calculations: Technologies and Frequencies**

The data must be calculated for all relevant technologies in all relevant frequency band, i.e. separate data for GSM900, GSM1800, UMTS2100 and UMTS900.

The reported field strength is defined as the calculated field strength with 95 % probability when log-normal fading is taken into account.

**Calculations: Power and Field Strength**

**For GSM,** the field strength for a single carrier is defined as equal to the field strength which is available for a voice call. For a given GSM terminal sensitivity this is the field strength there determines the communication range.

**For UMTS**, the field strength is defined as the maximum power (of the available total carrier power) for each base station for all parameter settings, which can be used for each voice call. The calculation of the field strength in each pixel must be based on the maximum power the operator has set in each cell on each DPDCH to the individual user. Speech coding of 12.2 kbps AMR is used for the calculations.

**Hungary:**

Referring to the Questionnaire on coverage obligations please be informed that the Hungarian Administration cannot answer this questionnaire at the present time as the tender documentation concerning the use of broadband services in the frequency bands indicated in the questionnaire is under consideration in Hungary. The first draft of the documentation was published at the end of November 2013 and was followed by a public consultation in December 2013. According to the comments received during the consultation the specification concerning coverage obligations and their enforcement is subject to reconsideration. We will be in the position to answer this questionnaire only when the tendering documentation is finalised.

**Liechtenstein:**

For your information, we are currently considering the allocation of the 800 and 2600 MHz to our main operators based on technology neutrality approach.

As for the GSM and UMTS existing licenses in the 900/1800 and 2100 MHz bands, we foresee a possible re-farming of the bands in the future upon request.

**Question 1 Coverage obligations – definitions and criteria to fulfil the obligations**

In case coverage obligations are defined for operators of public mobile telephony/data networks in your country:

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| **Question 1:**  **In case coverage obligations are defined for operators of public mobile telephony/data networks in your country:\*** | |
| 1. **What are the coverage obligations in force in various mobile bands (if response has not been already provided in RSPG BEREC questionnaire attached)? Please specify.** | |
| **Cyprus** | See table below |
| **Czech Republic** | Please see table below |
| **Denmark** | See table |
| **Finland** | Only for 800 MHz we have coverage obligations, see table below. |
| **France** | Response already provided in RSPG BEREC questionnaire |
| **Ireland** | Please refer to Table 1, below. |
| **Latvia** | E.g. obligation to provide coverage, temporal obligation of population coverage (%), obligation to obtain a certain number of radio frequency assignment use permits, obligation to install a certain number of base stations per square kilometres. |
| **Norway** | See table below. |
| **Portugal** | Portugal answered the RSPG BEREC questionnaire. Some updated information is now provided.  800 MHz:  For each lot of 2 x 5 MHz the operator is obliged to cover a maximum of 80 parish areas where the broadband mobile coverage is either inexistent or at least not adequate. The list of parishes to be covered was fulfilled by ANACOM in august 2013, and each mobile operator has now the obligation to cover 160 parishes geographically (as there are three mobile operators in Portugal, each of them with 2 x 10 MHz of spectrum allocated, they will have to cover 480 parishes - in a total of 4260).  Geographically, the obligation for each of these local areas imposes the coverage of at least the headquarters of the parish. The objective of this coverage obligation is to guarantee that even in the remote areas people will have access to mobile broadband provided by at least one operator. At the same time, the intention has also been not to impose unnecessary burden to operators as the remote areas are usually not commercially attractive.  The mobile broadband service to be made available must enable data transmission speeds which are equal to the highest speed provided by the commercial offers subscribed to, at any given time, by customers in the lowest quartile of such offers when ranked according to maximum transmission speed of the offer subscribed to. These obligations must be fulfilled in at least 50% and 100% of the parishes within maximum periods of 6 months and 1 year respectively following ANACOM’s notification as to the end of the existing restrictions on the operation of the 800 MHz band (due to DTT emissions in Spain). The notification is foreseen to be done during 2014. The definition of the methodology to calculate the data transmission speeds was in public consultation and, currently, ANACOM is finalising the analysis to the responses received.  These coverage obligations only can be meet with the use of frequencies in the 800 MHz and 900 MHz bands (the operator should communicate if they intend to use the 900 MHz band).  VOICE AND DATA RATE UP TO 9600 bps:  In the beginning (90’s) coverage obligations were established for the voice service to be provided either by GSM 900 or DCS 1800.  In the licenses renewal made (2000’s …), operators were obliged to maintain at least the levels of coverage they ensured at the time the licenses were renewed [reference date] for voice and data rates up to 9600 bps. The mobile operators sent the required information by the Regulator, having as the basis the reference date, and since that reference date the coverage obligations, for voice and data rates up to 9600 bps, are defined is terms of:  • Total population covered on [reference date];  • Total population covered by borough council on [reference date];  • Total population covered by locality with more than 10000 inhabitants on [reference date].  These obligations can be fulfilled using all the frequencies/technologies that are allocated/authorised for the mobile operators, namely, 800 MHz, 900 MHz, 1800 MHz, 2 GHz and 2,6 GHz.  DATA RATE OF 144 kbps AND OF 384 kbps:  These obligations were originally associated with the UMTS license (2 GHz) and are the following:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **OPERATOR NAME** | **POPULATION COVERAGE (%)** | | **AREA COVERAGE (%)** | | | **DATA RATE** | | **DATA RATE** | | | **144 kbps** | **384 kbps** | **144 kbps** | **384 kbps** | | OPTIMUS | 60.8% | 29.7% | 23.8% | 7.8% | | TMN | 77.3% | 7.7% | 38.3% | 0.07% | | VODAFONE | 99.3% | 78.9% | 83.5% | 49.9% |   These obligations can be fulfilled using all the frequencies/technologies that are allocated/authorised for the mobile operators, namely, 800 MHz, 900 MHz, 1800 MHz, 2 GHz and 2,6 GHz. |
| **Serbia** | The quality parameters for electronic communication networks under public bidding regime are set in Rulebook on quality parameters for publicly available electronic communication services and monitoring of electronic communication activity (Official Gazette of RoS Nos. 73/11 and 3/14) (Rolebook)  [http://www.ratel.rs/upload/documents/Regulativa/Pravilnici/Telekomunikacije/Rulebook%20on%20-](http://www.ratel.rs/upload/documents/Regulativa/Pravilnici/Telekomunikacije/Rulebook%20on%20-quality%20parameters%20for%20publicly%20available%20electronic%20communication%-20services%20and%20monitoring%20of%20electronic%20communication%20activi.pdf)  [quality%20parameters%20for%20publicly%20available%20electronic%20communication%-](http://www.ratel.rs/upload/documents/Regulativa/Pravilnici/Telekomunikacije/Rulebook%20on%20-quality%20parameters%20for%20publicly%20available%20electronic%20communication%-20services%20and%20monitoring%20of%20electronic%20communication%20activi.pdf)  [20services%20and%20monitoring%20of%20electronic%20communication%20activi.pdf](http://www.ratel.rs/upload/documents/Regulativa/Pravilnici/Telekomunikacije/Rulebook%20on%20-quality%20parameters%20for%20publicly%20available%20electronic%20communication%-20services%20and%20monitoring%20of%20electronic%20communication%20activi.pdf) |
| **Slovak Republic** | - We have no universal coverage obligations for various mobile bands. Into next table providing with you information about all new coverage obligations after Electronic Auction in Slovak Republic of the end 2013. |
| **Slovenia** | 1. territory coverage obligations in force:   GSM (900 MHz + 1800 MHz) more than 96%  UMTS more than 67% (except one operator with 20 %)  see table for TRA-ECS |
| **Switzerland** | See comments in Table 1 |
| **United Kingdom** | Please replace the previous RSPG BEREC information with the table below (ECO: presumably UK asks to replace its national info in the BEREC questionnaire with the new information provided in Table 1 below) |
| 1. **Do you define the assumptions (e.g. outdoor/indoor coverage, height, service, map scale) the right use/authorisation?** | |
| **Cyprus** | N/A |
| **Czech Republic** | Please see table below |
| **Denmark** | See table |
| **Finland** | For 800 MHz, reasonable indoor coverage is obligation. |
| **France** | Outdoor coverage |
| **Ireland** | Please refer to Table 1, below. |
| **Latvia** | No |
| **Norway** | The coverage obligations are specified as outdoor coverage. |
| **Portugal** | No |
| **Serbia** | No |
| **Slovak Republic** | No |
| **Slovenia** | No |
| **Switzerland** | See comments in Table 1 |
| **United Kingdom** | Yes. Please see table below for details. |
| 1. **How do you define whether or not coverage is achieved, per coverage obligation?** | |
| **Cyprus** | Authorised Entities inform us on a regular basis about their coverage percentage. |
| **Czech Republic** | * + Data provided by operators;   + Administration calculations with the following criteria:     - Map resolution 100×100m;     - Statistical model of signal propagation (ITU 1546-2CA).     - Calculated over maps with detailed population distribution (building / block of buildings level).     - For details, please see <http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013_appendix_3.pdf> |
| **Finland** | This is under consideration. |
| **France** | - Drive tests to check the reliability of the coverage map  - Computation of the percentage of population covered, based on the map, using a population database which geographically distributes the French population over the territory |
| **Ireland** | Please refer to Table 1, below. |
| **Latvia** | Operators usually provide annual information on their networks coverage. Information on issued radio frequency assignment use permits can be taken into account. |
| **Norway** | Licensees have to report to NPT each year. NPT will both use data simulations and spot test measurements. NPT is considering to develop a mobile app for users to measure and report data throughput to NPT. The report will indicate a GPS position (or cell ID - depending on the privacy level agreed) of the mobile and average data speed. |
| **Portugal** | We perform theoretical studies per coverage obligation, and if the results of the studies are higher than the coverage obligation it means that it is achieved. |
| **Serbia** | Per coverage obligations. The operators are required to submit the results of the measurement of the basic set of parameters pertaining to network quality monitoring, at least once a year, using the forms which are specified in the Rulebook. |
| **Slovak Republic** | - This is defined through the minimum guaranteed transmission speed for the end-user (without aggregation), crucial for meeting the transmission criteria is the outdoor transmission speed. |
| **Slovenia** | From tender documentation:  **A. MONITORING THE FULFILLMENT OF COVERAGE OBLIGATIONS**  The Agency shall monitor the fulfillment of population coverage obligations in two ways, namely:  - based on the calculation of coverage using the information about base stations submitted to the Agency by the holder of the DARF; and  - based on random measurements of service quality at user locations, which the Agency conducts at its own discretion to verify the accuracy of information submitted by the holder of the DARF.  The holder of a DARF must within a month of expiry of a deadline for meeting coverage obligations as set in the DARF and at the Agency’s request submit relevant documentation on network operation related to the fulfillment of coverage obligations comprising selected technical parameters and simulation of service levels provided by the network. The submitted information must comprise:  - the locations of the base stations in accordance with a specified geographical projection;  - heights above ground level in meters;  - For each sector:  - azimuth – direction (degrees);  - horizontal 3 dB beamwidth (degrees);  - combined mechanical and electrical downtilt (degrees);  - vertical 3 dB beamwidth (degrees);  - the effective isotropic radiated power EIRP;  - an indication of the frequency blocks used in each cell (sector);  - a map of Slovenia with base station locations and covered areas (GIS format, vector graphics, defined by the Agency in cooperation with each operator);  - a list of raster cells covered and the coverage level calculated on that basis; and  - in the event of special coverage obligations for the 800 MHz band:  - a list of covered populated addresses[1] in certain settlements from the list as determined by this tender documentation in Chapter A.7.3.4.3 Special Coverage Obligations in the 800 MHz Band and its subsections;  - the population coverage in percent for each selected settlement in accordance with the data base on populated addresses (available on the Agency’s website);  - and a list of addresses (HS\_MID ) and the number of FWBA connections at these addresses.  Based on the information about base stations submitted by the holders of DARFs and the tests made in the field based on the list of active base stations, the calculations shall be made to assess the fulfillment of the coverage obligations. The analysis shall be made based on technical parameters of base stations and by using the Agency’s software tool for planning and analyzing telecommunication and broadcasting networks and radio frequency spectrum planning. The analysis shall be made on a model selected in accordance with the ITU-R P.1812 recommendation, with raster cells in the 100 x 100 m grid as population units (e.g. Geostatistical database of the Statistical Office of the Republic of Slovenia. Detailed information about the calculation procedure shall be made available when the decisions on the assignment of radio frequencies are issued in collaboration with each holder of a decision on the assignment of radio frequencies.  **A.1 CALCULATING THE COVERAGE WHEN VERIFYING THE FULFILLMENT OF SPECIAL COVERAGE OBLIGATIONS IN THE 800 MHZ BAND**  Based on the information about base stations submitted by the holder of a Decision on the Assignment of Radio Frequencies, the calculations shall be made to assess the fulfillment of the coverage obligations. The calculation of coverage is based on the service provided by technologies in accordance with 3GPP TS 36.201 V11.1.0 (2012-12) and other 3GPPP technical specification – versions 8 and 9 for the E-UTRA air interface, or ETSI EN 301 908-13 V6.2.1 (2013-10), ETSI EN 301 908-14 V6.2.1 (2013-10) standards in the 800 MHz frequency band. A holder of a DARF with imposed special coverage obligations must fulfill these obligations with technologies in accordance with 3GPP TS 36.201 V11.1.0 (2012-12) and other 3GPPP technical specification – versions 8 and 9 for the E-UTRA air interface, or ETSI EN 301 908-13 V6.2.1 (2013-10), ETSI EN 301 908-14 V6.2.1 (2013-10), whereby it can also fulfill the obligations using other frequencies at its disposal.  Based on this data, the Agency shall calculate the locations and the number of population points, where services are provided, in accordance with the following assumptions:  - median propagation loss based on the ITU-R P.1812 recommendation with specified clutter parameters and a time percentage of 50%;  - lognormal location variation with a specified standard deviation;  - a specified terrain database (DTM);  - a specified clutter database;  - specified population locations and settlement identifiers ;  - specified use equipment noise figure and antenna gain;  - theoretical base station antenna azimuth and elevation radiation patterns taken from 3GPP TR36.814;  - network load of 15%;  Each population location shall be considered as covered with a bitrate of 10 Mbps downlink if the resulting predicted signal to interference plus noise ratio is greater than or equal to a specified value.  The coverage obligation shall be considered as fulfilled if, based on the data supplied:  - the total covered population is at least 95% of the total population of Slovenia, and  - at least 75% of the population within every settlement or group of settlements shall have access to services  - in accordance with the requirements from Chapter A.7.3.4.3 Special Coverage Obligations in the 800 MHz Band and its subsections; and in accordance with the schedule and requirements from these sections.  **A.2 VERIFICATION MEASUREMENTS**  The Agency shall at its own discretion, conduct tests on the license holder’s network and measure the quality of service at times and places of its choice in order to verify that the submitted information regarding base stations and coverage is an accurate representation of the actual state of the license holder’s network. These tests shall be intended to verify the base station parameters, level of field strength and quality of service at some end users locations to directly verify network coverage determined by the above calculation. For the purposes of verifying the provision of FWBA service, the Agency may verify capacity and network coverage |
| **Switzerland** | See comments in Table 1 |
| **United Kingdom** | Coverage obligation assessment is carried out as per the methodologies. The relevant links are provided in table below. |
| 1. **If you defined/identified measurable threshold levels such as field strength or minimum bit rates – please specify relevant values.** | |
| **Cyprus** | See table below |
| **Czech Republic** | * + LTE 800 MHz - limit values RSRP (Reference signal received power) -109 dBm (outdoor), SINR (Signal-to-interference-plus-noise ratio) 5 dB;   + LTE 2600 MHz - limit values RSRP -105 dBm (outdoor), SINR 5 dB.   + All bands: Downlink speed min. 2 Mbit/s (first 7 years) and min. 5 Mbit/s (afterwards).   + For details, please see <http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013_appendix_3.pdf> |
| **Denmark** | See table |
| **Ireland** | Please refer to Table 1, below. |
| **Norway** | For the coverage obligations in the 800 MHz band, a bit rate of 2 Mbps applies. Further details are in the table below. No field strength level is defined. |
| **Portugal** | That information is provided by each of the operators. |
| **Serbia** | Specified in the table below. |
| **Slovak Republic** | - In the 800 MHz band: 2 Mbit/s for downlink and 256 kbit/s for uplink;  - In the 1800 MHz band: 12.2 kbit/s for the GSM technology for voice phone services; 2 Mbit/s for downlink and 256 kbit/s for uplink in the case of other technologies;  - In the 2600 MHz band: 2 Mbit/s for downlink and 256 kbit/s for uplink; |
| **Switzerland** | See comments in Table 1 |
| **United Kingdom** | As explained in table below. |

\*Note: The purpose of this question is to collect information on for example actual field strengths considered to be sufficient to provide coverage in mobile phone networks. It is also the intention to collect information on the required bit rate within the coverage area. Please continue the list of technologies/bands, if necessary.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Table 1** | | | | | | |
| **Country** | **Frequency band** | **Technology** | **Coverage obligation in force**  **(e.g. voice service, data service, geographic, demographic, roads, towns etc.)** | **Coverage criteria – Voice service**  **(e.g. RSSI, field strength, probability, height above ground etc.)** | | **Coverage criteria – Data service**  **(e.g. bit rate, peak hour/day average etc.)** |
| **Austria** | 800 MHz | neutral | \* 25% of population  \* additional 95% obligation taking into account coverage by other bands;  \* additional coverage obligation for specific municipalities, see <https://www.rtr.at/en/tk/multibandauktion_AU>  for details | indoor for specific municipalities, else outdoor; indoor is defined as outdoor 1,5 m above ground - 20dB additional atteniuation | | \* 2 Mbit/s downlink und 0,5 Mbit/s uplink for specific municipalities;  \* 1 Mbit/s downlink und 0,25 Mbit/s uplink for 25%//95% |
| 900 MHz | neutral  (expiring GSM usage) | \* up to 98% narrow band (voice)  \* additional 95% broadband taking into account coverage by other bands for some blocks (from 2016 onwards)  See <https://www.rtr.at/en/tk/multibandauktion_AU>  for details | outdoor | | \* broadband:  1 Mbit/s downlink und 0,25 Mbit/s uplink  \* narrowband: 12,2/12,2 kbit/s |
| 1800 MHz | neutral (expiring GSM usage) | \* up to 98% narrow band (voice)  \* additional 95% broadband taking into account coverage by other bands for some blocks (from 2016 onwards)  See <https://www.rtr.at/en/tk/multibandauktion_AU>  for details | outdoor | | \* broadband:  1 Mbit/s downlink und 0,25 Mbit/s uplink  \* narrowband: 12,2/12,2 kbit/s |
| 2100 MHz | UMTS | 50% of population  See <https://www.rtr.at/en/tk/FRQ_2100MHz_2000_AU>  for details | outdoor | | 144 kbit/s |
| 2600 MHz | neutral | 25% of population  See <https://www.rtr.at/en/tk/FRQ_2600MHz_2010_AU>  for details | outdoor | | 1 Mbit/s downlink,  256 kbit/s uplink |
|  |  |  |  |  | |  |
| **Belgium** | 800 MHz | Technology neutral | - 30% of population 2 years after obtaining licence.  - 70% of population 4 years after obtaining licence.  - 98% of population 6 years after obtaining licence  - supplementary obligation (for one of the 3 licences only) for 60 specific towns 3 years after obtaining licence  These obligations can be reached using other bands (900 MHz, 1800 MHz, 2100 MHz and 2600 MHz) | No obligation for voice service | | 3 Mbit/s available 24 hours a day, 7 days a week |
| 900 MHz | GSM | Combined obligation for 900 MHz and 1800 MHz  Coverage commitment (not publicly available) was a selection criteria in the beauty contest procedure. | RXQUAL ≤ 4 | | No obligation for data service |
| 1800 MHz | GSM | Combined obligation for 900 MHz and 1800 MHz  Coverage commitment (not publicly available) was a selection criteria in the beauty contest procedure. | RXQUAL ≤ 4 | | No obligation for data service |
| 2100 MHz | IMT | - 30% of population 3 years after obtaining licence.  - 40% of population 4 years after obtaining licence.  - 50% of population 5 years after obtaining licence  - 85% of population 8 years after obtaining licence (this last obligation can be reached using the 900 and 1800 MHz bands) | No specific criteria | | No specific criteria |
| 2600 MHz | Technology neutral | No coverage obligation |  | |  |
|  |  |  |  |  | |  |
| **Croatia** | 800 MHz | LTE | 50% of the country 3 years after HAKOM declares that there is acceptable level of interference from neighbouring countries. Refers to the outdoor coverage. | Not defined. | | Not defined. |
| 900 MHz | GSM  UMTS  LTE | 95% of population and 75% of the country for T-Mobile and VIPnet regardless of technology in use. For Tele2 who is 3rd operator in the market 93% of population and 82% of the country for GSM and 65% of population and 35% of the country for UMTS. Refers to the outdoor coverage. | Not defined. | | Not defined. |
| 1800 MHz | GSM  UMTS  LTE | 95% of population and 75% of the country for T-Mobile and VIPnet regardless of technology in use. For Tele2 who is 3rd operator in the market 93% of population and 82% of the country for GSM and 65% of population and 35% of the country for UMTS. Refers to the outdoor coverage. | Not defined. | | Not defined. |
| 2100 MHz | UMTS | 50% of population for T-Mobile and VIPnet. For Tele2 who is 3rd operator in the market 93% of population and 82% of the country and it refers to 900, 1800 and 2100 MHz together regardless of technology in use. Refers to the outdoor coverage. | Not defined. | | Not defined. |
| 2600 MHz | The licenses have not been issued. |  |  | |  |
| 3500 MHz | WiMAX | Operator has obligation to install a certain number of base stations in defined time periods. | Not defined. | | Not defined. |
| **Cyprus** | 800 MHz | No licenses granted in this band. |  |  | |  |
| 900/1800/-2100 MHz  The licenses granted in these bands include bandwidth from all three bands. Coverage obligations are linked with technology and not with the band itself. | GSM | Incumbent – 90% geographical coverage from the date of issue of the licence  2nd Operator – 50% geographical coverage within 2 years from the date of issue of the licence and 75% geographical coverage within 4 years from the date of issue of the licence | Minimum signal level (BCCH) in all covered area  -102 dBm | |  |
| UMTS | For the 2 existing operators 60% geographical coverage within 10 years from the date of issue of the licence.  For the 2 existing operators there was an adjustment in 2013 when their licenses were amended and became technology neutral (ie. GSM/UMTS/LTE allowed in all three band), that is 70% geographical coverage within 2 years from the date of amendment of their licence. | Minimum signal level (P-CPICH) in all covered area -106 dBm | |  |
| 4G (LTE, WiMAX) | For the 2 existing operators, 40% geographical coverage within 5 years from the date of amendment of their licence (their license was amended in 2013 and became technology neutral)  Newcomer (license was issued on 7 February 2014), 40% geographical coverage within 3 years from the date of issue of licence and 65% geographical coverage within 5 years from the date of issue of the licence | Minimum signal level (pilot) in all covered area -106 dBm | | Access the Internet with at least 30Mbps, in all covered area |
| 1800 MHz | See answer for 900MHz |  |  | |  |
| 2100 MHz | See answer for 900MHz |  |  | |  |
| 2600 MHz | No licenses granted in this band. |  |  | |  |
| 3400-3800MHz | No licenses granted in this band. |  |  | |  |
| **Czech Republic** | 800 MHz | Technology neutral (Commission Decision 2010/267/EU) | CZE districts divided into groups A (low density of population) and B (other districts).  **Within 30 months:** at least 30 of 32 districts from Group A.  **Within 5 years:** 100% of the districts of Group A, at least 22 districts of Group B, at least 50% of transit railway corridors, motorways and express roads.  **Within 7 years:** 100% of Group A and Group B districts, transit railway corridors I to IV, motorways and express roads.  **Required coverage:** 95% of each district’s population with a 75% probability of indoor coverage without use of an external antenna. | n/a (data only) | | Downlink 2 Mbit/s (first 7 years), 5 Mbit/s (afterwards). |
| 900 MHz | Technology neutral (Commission Decision 2011/251/EU) | Not relevant, all the obligations within the 900 MHz spectrum awards had already been reached. |  | |  |
| 1800 MHz | Technology neutral (Commission Decision 2011/251/EU) | Not relevant, all the obligations within the 1800 MHz spectrum awards had already been reached. |  | |  |
| 2100 MHz | Technology neutral | Not relevant, all the obligations within the 2100 MHz spectrum awards had already been reached. |  | |  |
| 2600 MHz | Technology neutral (Commission Decision 2008/477/ES) | **Within 7 years:** 10% of the population of the Czech Republic. | n/a (data only) | | Downlink 2 Mbit/s (first 7 years), 5 Mbit/s (afterwards). |
| **Denmark** | 800 MHz | Neutral | 2 licenses in total.  One license without coverage obligation, one license with the following obligation:  98 % geographical coverage and 99.8 % population coverage, in approx 1/3 of the post districts in DK, 3 years after obtaining the licence, covered with 10 Mbps downlink outdoor |  | | *Down link user experience: 10 Mbps outdoor, qualified by simulations and/or measurements by the licensee* |
| 900 MHz | GSM | 5 licenses in total.  1991 (2 licenses): 95 % geographical coverage for all licenses  2000/2001 (2 licenses): The tender had a two step minimum requirement: 40 % geographical coverage after 3 years and 90 % geographical coverage after 5 years.  2010 (1 license): No coverage obligation. | 46 dBµV/m, 1.5 m above ground outdoor, 75 % location probability on cell edge. | | - |
| 1800 MHz | GSM | 7 licenses in total.  1997 (4 licenses): The minimum requirement in the tender for three of the licensees was 50 % geographical coverage within 5 years. The fourth license (won by Telenor) had no coverage obligation.  2000/2001 (2 licenses): The operators have to fulfil the minimum requirements from the tender: 25 % geographical coverage within 3 years and 45 % geographical coverage within 5 years.  2010 (1 license): No coverage obligation. | 54 dBµV/m, 1.5 m above ground, 75 % location probability on cell edge, for outdoor coverage. | | - |
| 2100 MHz | UMTS | The coverage obligation in connection with the auction in 2001 had to be fulfilled in two steps.  2004: 30 % demographic coverage  2008: 80 % demographic coverage  The same coverage obligations applied in the 2005 auction, but the deadline for implementation was 2009 and 2013 respectively. | 38 dBµV/m, 1.5 m above ground, 50 % location probability on cell edge, for outdoor coverage, corresponding to a data speed at 12,2 kbit/s. | | - |
| 2600 MHz | Neutral | 4 licenses.  No coverage obligation. | - | | - |
|  |  |  |  |  | |  |
| **Estonia** | 800 MHz | Technologically neutral  (LTE) | Only networks with nation-wide coverage allocated.  In frequency range 801-811/842-852 MHz operator has obligation to erect at least 199 base stations (outdoor), service coverage 95 % of territory (except cities) | 58 dBµV/m/5MHz, 1.7 m above ground | | 5 Mbps downlink |
| 900 MHz | Technologically neutral  (LTE/UMTS/GSM) | Only networks with nation-wide coverage allocated. |  | |  |
| 1800 MHz | Technologically neutral  (LTE/UMTS/GSM) | Only networks with nation-wide coverage allocated. |  | |  |
| 2100 MHz | Technologically neutral  (UMTS/LTE) | Only networks with nation-wide coverage allocated.  One licence has obligation: 80% of population 7 years after obtaining licence |  | | One licence has obligation:  Minimum data speed rate 144 kbit/s (in towns), 64 kbit/s (outside towns) |
| 2600 MHz | Technologically neutral  (LTE) | Only networks with nation-wide coverage allocated.  Operators are obliged to install in the territory of the country the number of base station declared in their bid during the period declared in their bid. | 58 dBµV/m/5MHz, 1.7 m above ground, | | 2 Mbps Downlink |
|  |  |  |  |  | |  |
| **Finland** | 800 MHz | technology neutral (assumption: LTE) | Three licences (from 1.1.2014) with outdoor and reasonable indoor coverage.  Operator 1:  97 % of population 5 years after obtaining licence  Operator 2:  95 % of population 3 years after obtaining licence  99 % of population 5 years after obtaining licence  Operator 3:  97 % of population 5 years after obtaining licence |  | | basic coverage |
| 900 MHz |  | None | None | | None |
| 1800 MHz |  | None | None | | None |
| 2100 MHz |  | None | None | | None |
| 2600 MHz |  | None | None | | None |
| **France** | 800 MHz | LTE | See RSPG BEREC questionnaire |  | | Maximum theoretical data rate has to be at least 60 Mbit/s on the downlink (assessment of obligations under development) |
| 900 MHz | GSM/UMTS | See RSPG BEREC questionnaire | ability to make a one-minute phone call | |  |
| 1800 MHz | GSM (and LTE for Bouygues Telecom) | See RSPG BEREC questionnaire | ability to make a one-minute phone call | | LTE: Maximum theoretical data rate has to be at least 60 Mbit/s on the downlink (assessment of obligations under development) |
| 2100 MHz | UMTS | See RSPG BEREC questionnaire | ability to make a one-minute phone call | |  |
| 2600 MHz | LTE | See RSPG BEREC questionnaire |  | | Maximum theoretical data rate has to be at least 60 Mbit/s on the downlink (assessment of obligations under development) |
|  |  |  |  |  | |  |
| **Germany** | 800 MHz |  | For this the federal states of Germany provided lists of areas that were not yet sufficiently provided with broadband services, divided into stages of priority. Only when 90 % of the population in one priority stage has been covered can the frequencies be used for coverage of the areas in the next priority stage. This obligation was set in response, particularly, to the political objective of nationwide broadband rollout. | No general specifications. Ex post parameters according to test and measurement services of the authority | | No general specifications. Ex post parameters according to test and measurement services of the authority |
| 900 MHz |  | Commitment up to 98% of the population in GSM license |  | |  |
| 1800 MHz |  | Commitment up to 98% of the population in GSM license.  for frequencies assigned technology and service neutral in 2010:  25 % of population as from  1 January 2014.  50 % of population as from  1 January 2016. | No general specifications. Ex post parameters according to test and measurement services of the authority | | No general specifications. Ex post parameters according to test and measurement services of the authority |
| 2100 MHz |  | 25 % of population as from  1 January 2014.  50 % of population as from  1 January 2016. | No general specifications. Ex post parameters according to test and measurement services of the authority | | No general specifications. Ex post parameters according to test and measurement services of the authority |
| 2600 MHz |  | 25 % of population as from  1 January 2014.  50 % of population as from  1 January 2016. | No general specifications. Ex post parameters according to test and measurement services of the authority | | No general specifications. Ex post parameters according to test and measurement services of the authority |
|  |  |  |  |  | |  |
| **Iceland** | 800 MHz | LTE | Licence A: 99.5% of homes and businesses 4 years after obtaining licence – 10 Mbps. 30 Mbps 8 years after obtaining licence to the same coverage area.  Licence B: 93.5% of homes and businesses within 4 years after obtaining licence – 10 Mbps. 30 Mbps 8 years after obtaining licence to the same coverage area. | -85 dBm in densed areas and -100 dBm in rural areas, 1.7 m abobe ground | | Down link user experience: 10 Mbps (sometime during 24 hours), 3.85 Mbps (24 hour average) and 2.5 Mbps (average 3 hours peak time) within 4 years after obtaining licence.  Down link user experience: 30 Mbps (sometime during 24 hours), 11.3 Mbps (24 hour average) and 7.5 Mbps (average 3 hours peak time) within 8 years after obtaining licence.  Additional guidelines regarding network neutrality |
| 900 MHz | GSM/UMTS | Original GSM900 – incumbent:  98% of the population after obtaining license  Original GSM900 – second operator:  80% of the population after obtaining license | GSM (1.7 m above ground)  -75 dBm in 95% cases in urban areas  -95 dBm in 95% cases in rural areas  UMTS (1.7 m above ground)  -85 dBm in urban areas  -100 dBm in rural areas  Less than 2% rejection of calls | | - |
| 1800 MHz | GSM/UMTS | No coverage requirements | GSM (1.7 m above ground)  -75 dBm in 95% cases in urban areas  -95 dBm in 95% cases in rural areas  UMTS (1.7 m above ground)  -85 dBm in urban areas  -100 dBm in rural areas  Less than 2% rejection of calls | | - |
| 2100 MHz | UMTS | 75 – 100% of homes, depending on areas | 58 dBµV/m/5MHz, 1.7 m above ground | |  |
| 2600 MHz | MMDS - DTT |  |  | |  |
|  |  |  |  |  | |  |
| **Ireland** | 800 MHz | See Table\*\* (below) | Liberalised Use Licences in the 800MHz, 900MHz and 1800 MHz bands:  Within the Liberalised Use Licence framework, it is expected that a licensee will attain, at a minimum, a coverage level of 70%[[1]](#footnote-1) of the population within 3 years of licence commencement date. Please also refer to related footnote listed for 2100 MHz.  Voice and data services are not differentiated under this licensing framework.  Further Information on the Liberalised Use Licensing framework can be sourced at the following link:  [Liberalised Use Licences](http://www.comreg.ie/radio_spectrum/search.541.874.10031.0.rslicensing.html) | For Liberalised Use Licences, coverage (applicable to both Voice and Data Services (i.e. no differentiation)) is calculated as follows:  An average pilot signal will be measured outdoors at a height of 1.5 metres.  For propagation prediction systems, a pilot signal covering 95% of the area during 95% of the time is required.  Coverage level specification per frequency band, per bandwidth, and per terrestrial system is set out in Table 2. | | See coverage criteria for Voice service. |
| 900 MHz | See Table\*\* (below) | Liberalised Use Licences in the 800,900 &1800 MHz bands:  Same as that described for 800 MHz above | For Liberalised Use Licences, coverage is calculated as follows:  An average pilot signal will be measured outdoors at a height of 1.5 metres.  For propagation prediction systems, a pilot signal covering 95% of the area during 95% of the time is required.  Coverage level specification per frequency band, per bandwidth, and per terrestrial system is set out in Table 2. | | See coverage criteria for Voice service. |
| 1800 MHz | See Table\*\* (below) | For Liberalised Use Licences in the 800, 900 &1800 MHz bands:  Same as that described for 800 MHz above | For Liberalised Use Licences, coverage is calculated as follows:  An average pilot signal will be measured outdoors at a height of 1.5 metres.  For propagation prediction systems, a pilot signal covering 95% of the area during 95% of the time is required.  Coverage level specification per frequency band, per bandwidth, and per terrestrial system is set out in Table 2. | | See coverage criteria for Voice service. |
| 2100 MHz[[2]](#footnote-2) | UMTS | For 3rd Generation Mobile and wireless communications services, adequate coverage is achieved on the provision that Field strength, measured on the pilot signal (from the common pilot channel/downlink) from the outdoor base station, at a height of 1.7 metres, is maintained at a level greater than or equal to 58 dBµV/m over 95% of the area, during 95% of the time. | **Vodafone:**  The Licensee shall provide UDD full mobility (outdoor) 144kbps demographic Coverage of 85% by year end  2007.  **O2:**  UDD full mobility (outdoor) 144 kbps - demographic Coverage of 80% by year end 2007  demographic Coverage of the 3G network services shall not fall below 80% after 30 December 2007  **Hutchison:**  UDD full mobility outdoor at 144 kbps demographic coverage by year end 2007 – 85% Demographic Coverage.  **Meteor:**  The Licensee shall ensure that its 3G network services achieve demographic coverage of 83% (UDD full mobility @ 144 kbps) on and after 31 October 2012. | | See Coverage Criteria for Voice Service |
|  | 2600 MHz | N/A | N/A | N/A | | N/A |
|  |  |  |  |  | |  |
| **Italy** | 800 MHz |  | A list of several hundred small municipalities is associated to each frequency block (except one), where data service coverage must be provided following this calendar:  - before 31/12/2015 : 30% of the municipalities, on 800 MHz or on other frequencies - before 31/12/2017: 75% of the municipalities, on 800 MHz or on other frequencies  - before 31/12/2019 : 37,5% of the municipalities on 800 MHz frequency blocks - before 31/12/2022: 75 % of the municipalities, on 800 MHz frequency blocks |  | | Minimum single user data-rate: 2 Mbit/s |
| 900 MHz |  | Obligations regard voice service.  Coverage obligations are in terms of percentage of covered national population and differs among operators:  - First and second operator: 90% of national population  - Third operator: 96% of national population  - Fourth operator: the only obligation is launch of service | Specified values of minimum signal strength, location probability on cell edge, user antenna height and specified propagation model | |  |
| 1800 MHz  Assigned before the LTE auction in 2011 |  | Obligations regard voice service.  Coverage obligations are in terms of percentage of covered national population and differs among operators:  - First and second operator: 90% of national population  - Third operator: 96% of national population  - Fourth operator: the only obligation is launch of service | Specified values of minimum signal strength, location probability, user antenna height and specified propagation model | |  |
| 1800 MHz  Assigned with the LTE auction in 2011 |  | Launch of data service before 31/12/2013 |  | | Minimum single user data rate: 2 Mbit/s |
| 2100 MHz |  | Obligation are in terms of data service  All “province” (main towns) must be covered before 31/12/2006 |  | | Specified value of data-rate (144 kbit/s) and traffic distribution relation to population density |
| 2600 MHz |  | Data service coverage obligations follow this calendar :  - Before 31/12/2014 : at least 20% of national population and at least 5% of population of each administrative region ; 50% of such coverage can be carried out on different frequencies  - Before 31/12/2016: at least 40% of national population and at least 5% of population of each administrative region ; 50% of such coverage can be carried out on different frequencies  - Before 31/12/2023: at least 40% of national population and at least 5% of population of each administrative region on 2600 MHz band |  | | Minimum single user data rate: 2 Mbit/s |
| 3400-3600 MHz |  | Data service coverage obligations are set for each single region.  A score must be reached, based on the number and characteristics of covered municipalities from a provided list |  | | Minimum single user data rate: 2 Mbit/s |
|  |  |  |  |  | |  |
| **Latvia** | 800 MHz | Technology neutral | Obligation to install at least one base station per 200 km2 (excluding main cities) within 3 years from the date of assigning rights of use of frequencies. | No | | No |
| 900 MHz | Technology neutral | Rights/obligation to provide coverage.  E.g. obligation to obtain a certain number of radio frequency assignment use permits. | No | | No |
| 1800 MHz | Technology neutral | Rights to provide coverage. Coverage obligations were not specified. | No | | No |
| 2100 MHz | Technology neutral | Rights/obligation to provide coverage.  E.g. availability of UMTS services at least for 45% of population within 4 years from the date of assigning rights of use of frequencies (temporal obligation). | No | | No |
| 2600 MHz | Technology neutral | For FDD part of the band availability of electronic communications services at least for 55% of population within 4 years from the date of assigning rights of use of frequencies (temporal obligation).  Obligation to obtain a certain number of radio frequency assignment use permits for TDD part. | No | | No |
|  |  |  |  |  | |  |
| **Liechtenstein** | 800 MHz | Neutrality | no info  (allocation is in progress) | no info | | no info |
| 900 MHz | GSM  (refarming in progress) | 90% of population 2 year after obtaining licence.  95% of population 2 year after obtaining licence. | minimum field strength 45 dBμV/m; maximum loss rate busy hour 4%; handover success rate 96%; maximum dropped calls 5% | | not available |
| 1800 MHz | GSM  (refarming in progress) | 90% of population 2 year after obtaining licence.  95% of population 2 year after obtaining licence. | minimum field strength 51 dBμV/m; maximum loss rate busy hour 4%; handover success rate 96%; maximum dropped calls 5% | | not available |
| 2100 MHz | UMTS  (refarming in progress) | Orange: 90% of population 2 year after obtaining licence.  Mobilkom, Swisscom: no obligations | no criteria | | Orange: minimum data rate 144 kbit/s  Mobilkom, Swisscom: no criteria |
| 2600 MHz | Neutrality | no info  (allocation is in progress) | no info | | no info |
|  |  |  |  |  | |  |
| **Lithuania** | 800 MHz | Tech. neutral | 30% of sub-districts in 3 years after obtaining licence;  80% of sub-districts in 5 years after obtaining licence;  all territory (except some near border territory) till 2020. | No coverage criteria | | 2 Mb/s for 50% households in 3 years after obtaining licence;  2 Mb/s for 85% households in 5 years after obtaining licence;  4 Mb/s for 95% households till 2020. |
| 900 MHz | GSM, UMTS, LTE | 90% of the country | Received signal strength indication (RSSI):  For GSM:  -75 dBm for the urban territories;  -95 dBm for the rest territories.  For UMTS:  -95 dBm for the urban territories;  -114 dBm for the rest territories.  For LTE:  -72 dBm/5MHz for the urban territories;  -92 dBm/5MHz for the rest territories. | | The same as for voice service |
| 1800 MHz | GSM, UMTS, LTE | 5 biggest municipalities | RSSI at 3 m above ground:  For GSM:  -75 dBm for the urban territories;  -95 dBm for the rural territories.  For UMTS:  -95 dBm for the urban territories;  -114 dBm for the rest territories.  For LTE: -72 dBm/5MHz for the urban territories;  -92 dBm/5MHz for the rest territories. | | The same as for voice service |
| 2100 MHz | UMTS/IMT-2000 | 3 the biggest cities in 3 years after obtaining licence;  5 the biggest cities in 6 years after obtaining licence. | No coverage criteria | | No coverage criteria |
| 2600 MHz | LTE | 50% of population in 5 cities in 3 years after obtaining licence;  50% of population in 15 cities/towns in 5 years after obtaining licence. | No coverage criteria | | No coverage criteria |
|  |  |  |  |  | |  |
| **Luxembourg** | 800 MHz | No more coverage obligations | | | | |
| 900 | No more coverage obligations | | | | |
| 1800 | No more coverage obligations | | | | |
| 2100 | No more coverage obligations | | | | |
| 2600 | No more coverage obligations | | | | |
|  |  |  |  | |  |  |
| **Montenegro** | 800 MHz | Not assigned |  | |  |  |
| 900 MHz | GSM/UMTS | For GSM system in 900 MHz and 1800 MHz bands.  For two GSM operators obtaining licence without tender procedure in 2002 - 93% of population until the end of period of licence validity  Requested in tender procedure in 2007 for new comer - 50% of population 3 years after obtaining licence and 80% of population 7 years after obtaining licence.  Offered by the operator - 96% of population until the end of the first year after obtaining licence. | | Percentage of populated area in the country where signal strength is above -99 dBm.  (For UMTS in case of 30% cell load.) |  |
| 1800 MHz | GSM/LTE | For GSM system in 900 MHz and 1800 MHz bands.  For two GSM operators obtaining licence without tender procedure in 2002 - 93% of population until the end of period of licence validity  Requested in tender procedure in 2007 for new comer - 50% of population 3 years after obtaining licence and 80% of population 7 years after obtaining licence.  Offered by the operator - 96% of population until the end of the first year after obtaining licence.  For LTE system (by reframing in 2012):  Offered by the operators – Opeartor 1: 20% of population until the end of the first year after obtaining licence, 30% of population 2 years after obtaining licence and 40% of population 3 years after obtaining licence. Expected data rates up to 172 Mb/s in DL and 57 Mb/s in UL on each eNodeB.  Opeartor 2: 18% of population 2 years after obtaining licence and 35% of population 3 years after obtaining licence.  Expected data rates up to 100 Mb/s in DL and 50 Mb/s in UL on each eNodeB. | | Percentage of populated area in the country where signal strength is above -99 dBm | For LTE maximal expected data rates on each eNodeB. |
| 2100 MHz | UMTS | Requested in tender procedure in 2007 - 25% of population 3 years after obtaining licence and 50% of population 5 years after obtaining licence for existing GSM operators and 25% of population 3 years after obtaining licence and 50% of population 7 years after obtaining licence for new comer.  Offered by the operators - Existing GSM operator 1: 40% of population until the end of the first year after obtaining licence, 75% of population 3 years after obtaining licence and 97% of population 5 years after obtaining licence.  Min. data rate of 128 kb/s and max. data rate of 3.6Mb/s until the end of the first year after obtaining licence, 6 Mb/s 2 years after obtaining licence and 14.4 Mb/s 3 years after obtaining licence, on each NodeB.  Existing GSM operator 2: 11% of population until the end of the first year after obtaining licence, 28% of population 3 years after obtaining licence and 53% of population 5 years after obtaining licence.  Min. data rate of 64 kb/s and max. data rate of 384 kb/s until the end of the first year after obtaining licence, min. data rate of 384 kb/s and max data rate of 1.8 Mb/s 3 years after obtaining licence, on each NodeB.  New comer (2G/3G): 75% 3 years after obtaining licence, 90% of population 5 years after obtaining licence.  Min. data rate of 128 kb/s and max. data rate of 3.6Mb/s until the end of the first year after obtaining licence, on each NodeB.  After tender procedure in 2012 for additional frequencies for UMTS system in the bands 900 MHz and 2100 MHz:  Offered by the operators - Operator 1: 97% of population until the end of the first year after obtaining licence.  Operator 2: 57% of population until the end of the first year after obtaining licence. | | Percentage of populated area in the country where signal strength is above -99 dBm in case of 30% cell load. | Minimal and maximal data rates in case of 30% cell load. |
| 2600 MHz | Not assigned |  | |  |  |
|  |  |  |  | |  |  |
| **Netherlands** | 800 MHz | Neutral | Geographical coverage defined per 2 x 5 MHz licensed spectrum. After 2 years 308 km²; after 5 years 7471 km². The operator will need to offer a public electronic communications service in this area. | |  | None |
| 900 MHz | Neutral | Geographical coverage defined per 2 x 5 MHz licensed spectrum.. After 2 years 257 km²; after 5 years 2567 km². The operator will need to offer a public electronic communications service in this area. | |  | None |
| 1800 MHz | Neutral | Geographical coverage defined per 2 x 5 MHz licensed spectrum.. After 2 years 37 km²; after 5 years 367 km². The operator will need to offer a public electronic communications service in this area. | |  | None |
| 2100 MHz | UMTS, Upcoming licenses: Neutral | Existing licenses: Coverage of population (60% of population). Gradual coverage: big cities, all cities > 25.000 inhabitants, all main roads and waterways and airports.  Upcoming licenses: Geographical coverage.  27,5 km² / 5 MHz @ 2 years  275 km² / 5 MHz @ 5 years | |  | 144 Kbit/sec outdoor 95%/time. Upcoming licenses: None |
| 2600 MHz | Neutral | Geographical coverage defined per 2 x 5 MHz licensed spectrum.. After 2 years 20 km²; after 5 years 200 km². The operator will need to offer a public electronic communications service in this area. | |  | None |
|  |  |  |  | |  |  |
| **Norway** | 800 MHz | Technology neutral, mobile broadband | Access to mobile broadband for 40 % of the population within 4 years after obtaining the licence, applicable to all licensees in the 800 MHz band. | |  | Outdoor coverage, delivered service shall have an average net download speed of minimum 2 Mbps at any time.  Details will be discussed between NPT and the licensees during the first year of the licence period (2014). |
| 800 MHz | Technology neutral, mobile broadband | Access to mobile broadband for 98 % of the population within 5 years after obtaining the licence, applicable to one licensee in the 800 MHz band (2 x 10 MHz).  The licensee may use frequencies in other bands as well to fulfil the coverage obligations. | |  | Outdoor coverage, delivered service shall have an average net download speed of minimum 2 Mbps at any time.  Details will be discussed between NPT and the licensees during the first year of the licence period (2014). |
| 2100 MHz | 3G | Licensee shall offer 3G services that cover 40 % of the population within 6 years after obtaining the licence. | |  | Minimum data speed of 128 kbps in the area covered. |
|  |  |  |  | |  |  |
| Portugal | 800 MHz |  | Under evaluation | | | |
|  | 900 MHz |  | The relevant parameters are provided by the mobile operators, and used as appropriate in the coverage studies that we do to evaluate the results reported by the mobile operators. Please see our answer to question 2. | | | |
|  |  |  |  | |  |  |
| **Serbia** | 800 MHz | - | - | | - | - |
| 900 MHz | according to Licence  GSM (subject of ongoing discussion) | **Telenor, Telekom Serbia**: all the geographical obligations had been reached before the current licences are assigned to these two operators.  **VIP**:80% of population and 90% of the country 4 years after obtaining licence.  2 Mbps in 20 specific towns 3 years after obtaining licence. | | according to Licence  requirements  for RxLev > -95 dBm | according to Licence  requirements  Down link: 128 kbps  Up link: 64 kbps |
| 1800 MHz | according to Licence  GSM1800(subject of ongoing discussion) | **Telenor, Telekom Serbia**: all the geographical obligations had been reached before the current licences are assigned to these two operators.  **VIP**:80% of population and 90% of the country 4 years after obtaining licence.  2 Mbps in 20 specific towns 3 years after obtaining licence. | | according to Licence  requirements  for RxLev > -95 dBm | according to Licence  requirements  Down link: 128 kbps  Up link: 64 kbps |
| 2100 MHz | according to Licence  UMTS (subject of ongoing discussion) | 60% of population 3 years after obtaining licence | | according to Licence requirements  for CPICH RSCP > -105 dBm |  |
| 2600 MHz | - | - | | - | - |
|  |  |  |  | |  |  |
| **Slovak Republic** | 800 MHz |  | 25% of population - until 31.12.2015;  50% of population – until 31.12. 2017;  70% of population – until 31.12. 2018; | | No. | downlink 2 Mbit/s (uplink 256 kbit/s); |
| 900 MHz |  |  | |  |  |
| 1800 MHz |  | 25% of population - until 31.12.2015;  50% of population - until 31.12.2018; | | No. | downlink 2 Mbit/s (uplink 256 kbit/s),  (for GSM technology 12,2 kbit/s); |
| 2100 MHz |  |  | |  |  |
| 2600 MH |  | 10% of population - until 31.12.2015;  25% of population – until 31.12. 2018; | | No. | downlink 2 Mbit/s (uplink 256 kbit/s); |
|  |  |  |  | |  |  |
| **Slovenia** | 800 MHz | TRA-ECS | Special coverage obligation for one lot in 800 MHz band (2 x 10 MHz or 2 x 15 MHz):  95% of population of Slovenia (10 Mb/s DL outdoor) including  225 of 300 settlements (at least 75% population covered) after 3 years MS and FWBA (fixed wireless broadband access) with at least 10 Mbps DL or a minimum data transfer rate 2 Mbps. Operator may use any of the frequency bands assigned.  General coverage obligations:  Applicants must provide commercial wireless electronic communications services for:   * existing operators and new entrants which acquire reserved parts of the spectrum in the 800 MHz band (category A3) provide coverage in this band to:   -25% of the population of the Republic of Slovenia after 1 year,  -50% of the population of the Republic of Slovenia after 2 years,  -75% of the population of the Republic of Slovenia after 3 years.  - new entrants provide coverage to:  - 25% of the population of the Republic of Slovenia after 2 years,  - 50% of the population of the Republic of Slovenia after 3 years.  - 75% of the population of the Republic of Slovenia after 5 years,  where new entrants which at the same time acquire reserved parts of the spectrum in the 800 MHz band (category A3) are bound by the obligations from the first indent of this paragraph. | |  | Operator th whom 800 MHz lot with special coverage obligations is assigned must provide:   * Mobile broadband services at a bitrate of at least 10 Mbps downlink (outdoor) to at least 95% of the population of Slovenia and within this obligation * cover as well 225 of 300 settlements (with at least 75% population covered) after 3 years: (after the first year 75 selected settlements from the aforementioned list, another 75 after the second year (150 total), and another 75 after the third year (225 total), all selected at the operator’s discretion) The obligation of network deployment is tied to this list, as the network shall be providing these settlements or groups of settlements with mobile services as well as with a suitable service substituting for fixed broadband access. * The operator must provide the service substituting for fixed wireless broadband access (FWBA) by installing appropriate internal or external customer-premises equipment (CPE) with a suitable antenna, providing a transfer speed for a user experience of at least 10 Mbps downlink and with a minimum data transfer rate of at least 2 Mbps, and terminally assured uplink speeds of at least 1 Mbps. FWBA service is obligatory only for those addresses of permanent residences and businesses, as well as institutions registered with the AJPES, which do not have the option of receiving a suitable alternative broadband connection with a bitrate of at least 10 Mbps, and which are within the area of coverage for individual settled locations, even if they are not a part of a settlement or a contiguous group of settlements from the list below. In providing this bitrate with a user experience of at least 10 Mbps or a minimum data transfer rate of at least 2 Mbps, the operator must appropriately design its network, and in doing so may use any of the frequency bands it was assigned. The Agency has the right to verify the suitability of the network design. |
| 900 MHz | TRA-ECS | General coverage obligations:  Applicants must provide commercial wireless electronic communications services for:   * existing operators and new entrants which acquire reserved parts of the spectrum in the 800 MHz band (category A3) provide coverage in this band to:   - 25% of the population of the Republic of Slovenia after 1 year,  - 50% of the population of the Republic of Slovenia after 2 years,  - 75% of the population of the Republic of Slovenia after 3 years.  - new entrants provide coverage to:  - 25% of the population of the Republic of Slovenia after 2 years,  - 50% of the population of the Republic of Slovenia after 3 years.  - 75% of the population of the Republic of Slovenia after 5 years,  where new entrants which at the same time acquire reserved parts of the spectrum in the 800 MHz band (category A3) are bound by the obligations from the first indent of this paragraph. | |  |  |
| 1800 MHz | TRA-ECS | General coverage obligations:  Applicants which acquire parts of the spectrum in bands above 1 GHz must provide commercial wireless electronic communications services by using any of its assigned bands above 1 GHz in such a way that they provide coverage to:  -25% of the population of the Republic of Slovenia after 3 years,  -40% of the population of the Republic of Slovenia after 5 years,  All the above obligations take effect on the day the applicant has at its disposal an individual frequency band above 1 GHz. | |  |  |
| 2100 MHz | TRA-ECS | General coverage obligations:  Applicants which acquire parts of the spectrum in bands above 1 GHz must provide commercial wireless electronic communications services by using any of its assigned bands above 1 GHz in such a way that they provide coverage to:   * 25% of the population of the Republic of Slovenia after 3 years, * 40% of the population of the Republic of Slovenia after 5 years,   All the above obligations take effect on the day the applicant has at its disposal an individual frequency band above 1 GHz. | |  |  |
| 2600 MHz | TRA-ECS | General coverage obligations:  Applicants which acquire parts of the spectrum in bands above 1 GHz must provide commercial wireless electronic communications services by using any of its assigned bands above 1 GHz in such a way that they provide coverage to:   * 25% of the population of the Republic of Slovenia after 3 years, * 40% of the population of the Republic of Slovenia after 5 years,   All the above obligations take effect on the day the applicant has at its disposal an individual frequency band above 1 GHz. | |  |  |
|  |  |  |  | |  |  |
| **Spain** | 800 MHz |  | 30 Mbit/s available to 90 % of citizens living in population centres of less than 5.000 inhabitants  Obligation to operators holding 2x10 or more spectrum in 800 MHz band allocated in 2011  Focus on areas where coverage at 30 Mbit/s is not available through other technologies  The Ministry will approve an Extension Plan identifying the uncovered areas | | Not decided yet | Not decided yet |
| 900 MHz |  | According to a decision took in 2011, operators benefitting from refarming had to provide UMTS 900 in rural areas  Investments had to be addressed to population entities of less than 1.000 inhabitants  Deadline for investment was 31 December 2013  For the provision of UMTS900 operators could choose either to reach a volume of investment or to reach a number of population actually covered | | Population centre covered with a minimum level of signal of -90 dBm outdoor |  |
| 1800 MHz |  | Coverage obligation in cities higher than 500,000 inhabitants before 1999 | |  |  |
| 2100 MHz |  | Coverage obligation in cities higher than 250,000 inhabitants before 2003 | |  |  |
| 2600 MHz |  | No coverage obligations | |  |  |
|  |  |  |  | |  |  |
| **Sweden** | 450 MHz |  | Used for CDMA2000,  obligation to cover 80 percent of the land, at least with mobile telephony. | |  |  |
| 800 MHz | An appropriate and cost-effective rollout covers the following costs:  - Cost of infrastructure for the transmitter location  - Cost of infrastructure in radio equipment and other facilities required to provide coverage according to the requirement on coverage and rollout. This includes the cost of  - roads up to the site where the radio base station is to be installed if none exists and this is required,  - the radio base station,  - the building or the space where the radio base station is located; climate control required for the equipment to function as intended,  - the support systems required for the installation to function generally, e.g. power, masts for attaching radio antennae, foundations for the building and masts, radio antennae, cables, radio waveguides, etc. required to satisfy the technical specifications that apply to radio coverage within these areas,  - installation and commissioning, and  - work directly linked to the construction of infrastructure at the transmitter location, e.g. excavation. | Coverage obligation concerns FDD6.  The licence holder shall cover all permanent homes and fixed places of business that do not have data communications services with a particular bit rate identified by PTS, though no more than a rollout cost of 300 000 000 Swedish kronor (excluding value added tax) plus an annual adjustment for inflation.  The licence holder shall cover through rollout at least seventy-five (75) per cent of the permanent homes and fixed places of business on the list no later than 31 December 2013. PTS shall send this list to the licence holder no later than by January 2013, and;  from and including 2014 and beyond, the licence holder shall cover through rollout all of the permanent homes and fixed places of business on the list no later than by 31 December of each year.  Rollout shall continue until the rollout cost amounts to the amount stated above. | | Frequency Division Duplex, FDD. Effect-limits for different frequencies (block edge mask) | According to the decision coverage’ means:  - an appropriate and cost-effective rollout in accordance with the provisions of PTS’s guidelines for appropriate and cost-effective rollout, and  - that an end user gains access to data communications services in at least one room in the permanent home or at the fixed place of business so that the end user can receive services with a bit rate of 1 Mbps, or a higher applicable data rate for functional access to the Internet  where the home or place of business has been identified.    ‘A bit rate of 1 Mbps’ in item (ii) above means:  -that the bit rate amounts to at least 1 Mbps at some point in time in a day,  -that the average rate amounts to at least 750 kbps in a day, and  -that the average rate for four consecutive hours when the speed is at its lowest amounts to at least 500 kbps. |
| 900 MHz |  | The licence holder shall keep the percental coverage per county, for mobile telephony,  until 2015.  Coverage can be offered through own, or other licence holders, network in 900 MHz, 1800 MHz och 2,1 GHz-bands. | | Block egde mask |  |
| 1800 MHz |  | - | | - | - |
| 2100 MHz |  | - | | - | - |
| 2600 MHz |  | - | | - | - |
|  |  |  |  | |  |  |
| **Switzerland** | 800 MHz |  | Answer: General obligation regarding utilisation: the licensee is obliged to use the allocated frequencies as set out in Article 1 TCA and to provide commercial telecommunications services over its own transmission and reception units. In addition, the licensee must ensure the coverage of 50% of the population of Switzerland with mobile radio services via their own infrastructure by 31 December 2018 latest.  Remark: the above last obligation is already fulfilled by the licensees. There are no voice coverage or data service coverage criteria defined in the licenses. | |  |  |
| 900 MHz |
| 1800 MHz |
| 2100 MHz |
| 2600 MHz |
|  |  |  |  | |  |  |
| **United Kingdom** | 800 MHz | Technology Neutral | The Licensee shall by no later than 31 December 2017 provide, and thereafter maintain, an electronic communications network in an area within which at least 98% of the population of the United Kingdom lives and 95% of the population of each of England, Wales, Scotland and Northern Ireland lives.  An electronic communications network that is capable of providing, with 90% confidence, a mobile telecommunications service at indoor locations with a sustained downlink speed of not less than 2 Mbps when that network is lightly loaded. The service must be provided using radio equipment which is not situated inside the relevant residential premises.  For all assumptions and parameters, please refer to the verification methodology (<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/4GCov-verification.pdf>)  The coverage obligation is attached to one of the 800 MHz licences. The relevant licensee may use other cellular frequency bands or any technology to fulfil this obligation | | N/A | N/A |
| 2100 MHz | Technology Neutral | The Licensees must provide an electronic communications network  by 20 June 2013, that is capable of providing mobile telecommunications services to an area within which at least 90% of the population of the UK lives and with a 90% probability that users in outdoor locations within that area can receive the service with a sustained downlink speed of not less than 768 kbps in a lightly loaded cell.  For all assumptions and parameters, please refer to the verification methodology  (<http://stakeholders.ofcom.org.uk/binaries/consultations/2100-MHz-Third-Generation-Mobile/annexes/methodology.pdf>)  The licence conditions have since been varied and the licensees may use other cellular frequency bands or any technology to fulfil this obligation. | |  |  |

**Table\*\* provided by Ireland:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Terrestrial Systems and bandwidth | 800MHz  FS (dB(μV/m)) | 800MHz  Ec/Io or BLER | 900MHz  FS (dB(μV/m)) | 900MHz  Ec/Io or BLER | 1800MHz  FS (dB(μV/m)) | 1800MHz  Ec/Io or BLER |
| GSM  (0.2MHz) | 45 | N/A | 46 | N/A | 54 | N/A |
| UMTS  (5MHz) | 49 | -8 | 50 | -8 | 57 | -8 |
| LTE  (5MHz) | 47 | 10² | 48 | 10² | 55 | 10² |
| LTE  (10MHz) | 44 | 10² | 45 | 10² | 52 | 10² |
| LTE  (15MHz) | 42.5 | 10² | 43.5 | 10² | 50.5 | 10² |
| LTE  (20MHz) | 41 | 10² | 42.5 | 10² | 49.5 | 10² |

Table\*\* - The coverage level specification per frequency band, per bandwidth, and per terrestrial system.[[3]](#footnote-3)[[4]](#footnote-4)

**Question 2 Enforcement**

|  |  |  |
| --- | --- | --- |
| **Question 2:**  **How do you supervise compliance to the coverage obligations?**  **Please specify relevant methods, values for each technology/frequency band/licence as relevant for your country.** | | |
| **Croatia** | Generally, operators are obligated to send all relevant technical data for particular base station and reports which include statement about population and territory coverage percentage. There is also a possibility to have coverage maps for each operator. Based on received data HAKOM is performing measurements/calculations on representative samples in order to verify the licence obligations. | |
| **Estonia** | At the moment the coverage obligation is applicable only in 800 MHz band and only for operator who has won the first license in “beauty contest”. Estimation was made after the start date of provision of services which was specified in the bid. | |
| **Ireland** | ComReg can perform it’s own drive tests, and conduct map comparison with Operator provided data.  There are also a number of Operator obligations with regard to the provision of relevant information to Comreg, outlined below:  **GSM 900/1800 Services.**  Measurements to determine coverage shall be carried out using;  i) in the case of the GSM 1800 mobile telephony service, a 1 Watt terminal operating outdoors, and;  ii) in the case of the GSM 900 mobile telephony service, a 2 Watt terminal operating outdoors.  Alternatively, signal strength measuring equipment may be used.  The licensee is also obliged to publish maps related to the above listed terminal powers.  The Licensee is obliged to keep a log ("the network log") and, approximately every 3 months, must provide a copy of the log relating to ComReg, reporting all events consisting of network disturbances, failures and periods of scheduled unavailability which occurred over that time period. Details provided in the network log should include the date, start time, duration of the event, and the estimated number of terminals affected.  The Licensee must also provide, on request, all measurement information considered necessary to adequately determine performance against mandatory service standards which have been specified to the Licensee.  Operators are also obliged to provide:   * An up to date list of the locations of the base transceiver stations; * A mechanism for identifying the base station that is handling a call at any given time; * An adequate number of test numbers (SIMS).   **3G Services.**  The Licensee shall keep a log (the “network log”) for the purposes of recording and tracking all periods of system unavailability. The Licensee shall maintain this network log in a manner that will demonstrate, to the satisfaction of the Commission, that such a network log is an adequate means of assessing whether the Licensee is complying with its system availability obligations under this licence. This Log will be made available to ComReg on request.  For the purposes of carrying out service quality surveys, the Licensee shall provide, on request, to the Commission the following:-   * Maps showing Coverage for 3G service. * An up to date list of the locations of the base transceiver stations; * A mechanism for identifying the base station that is handling a call at any given time; * An adequate number of test numbers (SIMS).   **Liberalised Use Licence Obligations:**  For the purposes of carrying out coverage and quality of service compliance checks, the Licensee shall, on request, provide to the Commission the following:   * Maps showing Coverage as defined in Section 3 of this Schedule; * An up-to-date list of the locations of the “Base Station”2 transmitters; * An adequate number of test numbers (SIMS).   **Further operator obligations:**   * Every twelve months, the Licensee shall submit an annual compliance report to ComReg on coverage. * The measurements required for this compliance report will be agreed with ComReg in advance and the compliance report shall have sufficient detail and granularity to allow the ComReg to verify the Licensee’s measurements. * Where the Licensee claims to have met minimum coverage and roll-out obligations for the first time, the compliance report is required to contain drive test measurements. Thereafter, upon request by ComReg, the Licensee must carry out drive test measurements and submit these results to ComReg. | |
| **Latvia** | Operators usually provide annual information on their networks coverage. Information on issued radio frequency assignment use permits can be used. | |
| **Montenegro** | Operators don’t provide any measurement results to the administration. | |
| **Norway** | Throughout Question 2 we have used the 800 MHz band as example as this is the band with most relevance. | |
| **Portugal** | To evaluate the theoretical coverage - excluding the 800 MHz obligations that are under evaluation - we do theoretical studies with a mobile planning tool called XG-PLANNER (please consult http://www.lstelcom.com/en/). First we ask mobile operators to give us details about the planning of their network, including elements like link budget, sensitivity, propagation model, digital maps, population maps, etc.. Than we analyse the information and if it is correct, in a theoretical basis, we use our mobile planning tool to replicate the studies done by the mobile operators, as far as we can, and check if the results (% of area and population covered) that we obtain are of the same magnitude.  In case that the results are completely different, a more detailed analysis is carried out, e.g by checking the results with a survey in sample areas (to be defined).  It should be noted that ANACOM register the location and some parameters like the e.i.r.p. of each base station of the mobile operators.  Before we set up this methodology we pondered to approve a common methodology to the three mobile operators, to calculate the coverage of their UMTS networks. However one of the disadvantages is that imposing one common methodology could give not “real” results (for instance the propagation model used for the operators could be different and imposing a kind of “universal” propagation model could change the “real” coverage results). | |
| **Sweden** | PTS work with this in the 800-band | |
| 1. **Is there a common set of technical parameters agreed between the administration and the operator to determine radio coverage using both measurement and/or simulation? If yes, which parameters are established (e.g. propagation models, map resolution, cell loading)?** | | |
| **Austria** | | Parameters and the way of measurement are specified in the license conditions (see URLs mentioned in the table above |
| **Belgium** | | No |
| **Croatia** | | No |
| **Cyprus** | | N/A |
| **Czech Republic** | | o Measurement:   LTE 800 MHz - limit values RSRP (Reference signal received power) -109 dBm (outdoor), SINR (Signal-to-interference-plus-noise ratio) 5 dB;   LTE 2600 MHz - limit values RSRP -105 dBm (outdoor), SINR 5 dB.   For details, please see http://www.ctu.cz/cs/download/vyberova\_rizeni/invitation\_to\_tender\_15\_08\_2013\_appendix\_3.pdf .  o Simulation:   Map resolution 100×100m;   Statistical model of signal propagation (ITU 1546-2CA) and diffractive model of signal propagation (ITU 1812).   Calculated over maps with detailed population distribution (building / block of buildings level).   For details, please see http://www.ctu.cz/cs/download/vyberova\_rizeni/invitation\_to\_tender\_15\_08\_2013\_appendix\_3.pdf . |
| **Denmark** | | No |
| **Estonia** | | There is an agreed value (58 dBµV/m/5MHz) for estimating coverage in the degree of Ministry of Economic Affairs and Communications. |
| **Finland** | | No, but we are working on it and hope that the ECC work will provide solutions. |
| **France** | | Operators have to provide reliable coverage maps (see question 1.c) ).  An ARCEP decision states the methodology used to verify coverage. |
| **Germany** | | No |
| **Iceland** | | No |
| **Ireland** | | Yes; map based, employing population polygons and field strengths determined using propagation models. |
| **Italy** | | See Table\*\*\*\* |
| **Latvia** | | No |
| **Liechtenstein** | | No |
| **Lithuania** | | There is a common set of parameters for measurement of radio coverage for GSM, UMTS and LTE networks which are performed by our administration (drive tests). These parameters, as well as methodology of how these measurements should be performed and how they should be compared to operators’ coverage simulation results are written in a legislatively approved methodology. |
| **Montenegro** | | There is set of measurement parameters to determine radio coverage agreed between the administration and the operators based on relevant ITU-R documents. |
| **Netherlands** | | For 2 GHz (UMTS) there is a common set of technical parameters agreed. This is the base for a protocol how to conduct measurements to verify the coverage and quality of service of the networks involved.  For the ‘new” licences in the 800 MHz, 900 MHz, 1800 MHz and 2,6 GHz band (and as well for the future 2 GHz band licences) the coverage-demands are strongly simplified. In this moment only for 2,6 GHz a coverage-obligation is mandatory. For this band a simple measurement-protocol is agreed with the operators. There is only a coverage-obligation, no quality of service-obligation. For the other bands the same protocol will be used as soon as the coverage obligation is mandatory. |
| **Norway** | | No, the process of establishing common set of technical parameters will start in 2014. However, there will be both simulations and measurements. Each licensee is obliged to report to NPT 31 January each year, starting 2015. |
| **Portugal** | | No. However a set of minimum technical parameters should be provided to the regulator, by each operator, justifying the coverage results achieved, per service, namely:  • Description of the exterior coverage in maps of adequate scale (minimum 1:1 500 000);  • The assumptions and methodology for the dimensioning of the coverage, and in minimum the following elements should be provided:  o Maps used in the calculations including the population maps;  o Propagation models;  o Indication of measurements done to calibrate the propagation models, if applicable;  o Sensitivity per service;  o Typical antennas used including radiation patterns;  o Link budgets. |
| **Serbia** | | The quality parameters for electronic communication networks under public bidding regime are set in Rulebook. |
| **Slovak Republic** | | Terms of coverage, percentage of the population and bit rate. |
| **Slovenia** | | see above text from tender documentation |
| **Spain** | | 800 MHz: not decided yet  900 MHz refarming: criteria set by the Administration |
| **Sweden** | | There are discussions about the parameters for defining coverage regarding different services (telephony, 3G/4G..) |
| **Switzerland** | | No |
| **United Kingdom** | | Yes. The parameters are given in the following links  (http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/4GCov-verification.pdf)  (<http://stakeholders.ofcom.org.uk/binaries/consultations/2100-MHz-Third-Generation-Mobile/annexes/methodology.pdf>) |
| 1. **Do you perform measurements and how are these measurements performed (e.g. spot-test/drive-test, measurement equipment, antenna type, antenna height, etc)?** | | |
| **Austria** | | Yes, implementation according to (a): spot-tests using consumer-terminals |
| **Belgium** | | Last measurements (3G) were made with commercial handsets for 1000 tests points. |
| **Croatia** | | Yes. Measurements are performed on Rohde & Schwarz ROMES platform. |
| **Cyprus** | | N/A |
| **Czech Republic** | | * + Measurements performed only in case of difference between operator calculated coverage and administration calculated coverage.   + Measurements performed during driving on all available public roads with 2 omni-directional antennas held at a height of 1.5m (MIMO).   All measurements are performed outside of buildings. Coefficients for each frequency band are used for assessing indoor coverage. |
| **Denmark** | | No |
| **Estonia** | | Before supervision of license conditions the operator provided all data needed (map where min 95% of coverage with at least 58 dBµV/m/5MHz and min download speed 5Mbit/s are guaranteed, locations of requested 199 base stations, all other technical information about network). Drive test was used to determine min field strength values to estimate service coverage. Spot-tests at random positions were used to determine required min download speed 5Mbit/s. To evaluate the LTE 800 MHz network coverage, ETSA used the RSSI (received signal strength indicator) signal strength values coming from the data USB modem during the measurement path. We used conversion factor from RSSI to field strength. ETSA averaged the signal strengths measured outside the cities after each travelled 100 m. |
| **Finland** | | Not until now, but in the future we will carry out coverage measurements to verify the coverage maps provided by the operators (e.g. drive test, R&S TSMU scanner, omnidirectional antenna, R&S ROMES measurement software) |
| **France** | | Reliability of coverage maps are checked with drive tests, using regular terminals. |
| **Germany** | | Spot-test / drive-test. |
| **Iceland** | | spot-test/drive-test, equipment TSMW Romes from ROS. |
| **Ireland** | | Drive tests utilising Swissqual type equipment. |
| **Italy** | | Spot and drive tests are occasionally but not regularly performed by local ministry headquarters with available instruments (spectrum/network analyzers) |
| **Liechtenstein** | | No |
| **Latvia** | | No |
| **Lithuania** | | Our administration performs measurements of the coverage of UMTS and GSM networks (drive test type) and spot test measurements for LTE, UMTS and GSM networks. For drive tests for now we use Agilent E6474A equipment with omnidirectional antennas and antenna height of 3 meters. In the near future our administration is going to change drive test antenna height to 1,5 and as well renew drive test equipment. |
| **Montenegro** | | We perform measurements on drive-test base by mobile monitoring station using R&S TSMQ scanner, proper GSM and UMTS antennas mounted on the top of monitoring vehicle. |
| **Netherlands** | | Yes, i.e. in the 2,6 GHz band we perform (drive) test with network analysis tools, 20 spot-test on 20 square kilometres per 5 MHz. (all new licences in the Netherlands have a frequency span of 5 MHz). The spot-tests are performed with a normal standard network-terminal outside the monitoring vehicle and are conducted per licence. On a spot we are downloading a file from our FTP server to determine if the service provided by the network is effective. The download speed is not part of the test, only the download itself. |
| **Norway** | | NPT will perform spot test measurements of the reported data. The test will be performed by using the three top selling mobile terminals from the previous year, which have support for the relevant frequency bands for mobile broadband. Average downlink data speed will be logged together with geographical position. All measurements will be done outdoor. |
| **Portugal** | | We did several surveys to assess the QoS of Voice and Video-telephony Services, of GSM and WCDMA Network Coverage, in the main Urban Agglomerations and on the Major Roads of Mainland Portugal and also in the main trains, available in the following link:  <http://www.anacom.pt/render.jsp?categoryId=293535&channel=graphic#horizontalMenuArea>  However this information is not used to evaluate the coverage obligations.  The level of coverage (« Boa » - good ; « Aceitável » - acceptable ; « Má »- bad ; « Inexistente » - nonexistent) for GSM and UMTS networks agreed by ANACOM and the mobile operators and are the following:  cid:image004.jpg@01CDC8A7.470165E0 |
| **Serbia** | | No |
| **Slovak Republic** | | It will be discussed in line with 4.2.5 Verifying the Conditions of Efficient Frequency Usage of the conditions of the tender by form Electronic Auction 2013. (http://www.teleoff.gov.sk/data/files/35571.pdf ); |
| **Spain** | | 800 MHz: not decided yet  900 MHz refarming: on the spot test for a given sample (size of sample set according to statistical approach) |
| **Sweden** | | PTS has made some spot-tests |
| **Switzerland** | | No |
| **United Kingdom** | | No. Measurements are not performed for the purposes of coverage obligation verification. However, improving mobile coverage for consumers is a priority area for Ofcom and we have published a five point plan to improving mobile coverage (<http://consumers.ofcom.org.uk/2013/11/five-point-plan-to-improving-mobile-coverage/>). Ofcom also has a duty to report on the national communications infrastructure every 3 years. As part of this program the mobile network operators provide their predicted network coverage annually to Ofcom. In the past Ofcom has undertaken measurement campaigns and compared results to operator predictions, on an ad-hoc basis (e.g. <http://www.ofcom.org.uk/static/research/CRFS_report.pdf> ) |
| 1. **Does the operator provide measurement results and how are these measurements performed?** | | |
| **Austria** | | No |
| **Belgium** | | No |
| **Croatia** | | No |
| **Cyprus** | | N/A |
| **Czech Republic** | | Operators provide only calculation results. |
| **Denmark** | | We know that the operators perform their own measurements, but not how they are performed |
| **Estonia** | | Sometimes operators provide measurements but these are not part of the process of supervision of license condition. |
| **Finland** | | To be decided. Concerning indoor coverage, the operators are obligated to provide measurement data on case by case, if necessary. |
| **France** | | Operators don’t provide measurements results to ARCEP. |
| **Germany** | | No |
| **Iceland** | | No |
| **Ireland** | | On achieving their licence obligations, the operator provides map-based data utilising the appropriate propagation model and population polygons, which have been verified by the operators own drive test. |
| **Italy** | | Generally, measurements are not required from operators |
| **Latvia** | | No |
| **Liechtenstein** | | Operator provides coverage plots if requested |
| **Lithuania** | | Operators do not provide measurement results, only simulation data. |
| **Montenegro** | | Operators don’t provide any measurement results to the administration. |
| **Netherlands** | | The operators provide coverage-information, generated by their planning tools. The spot-test are performed in the areas provided by the operators..  For 2,6 GHz the coverage-obligation is a minimum of 20 square kilometres per 5 MHz. 20 spots are randomly picked in the coverage-area(s) provided by the operators. At these spots an attempt is made to contact the network-service with the use of a standard network-terminal suited for the service provided (at this moment all the providers offer wireless internet access by dongle). If an attempt fails, two other attempts are made with a minimum interval of 1 minute. If these attempts also fail, one final measurement on this spot is conducted another day . When this attempt is successful the measurement on that particular spot is a Pass, otherwise the measurement on that particular spot is marked as Fail. On a total of 20 spots 18 measurements must be successful to provide a positive outcome, otherwise the network coverage is marked as unsatisfactory. |
| **Norway** | | No |
| **Portugal** | | No |
| **Serbia** | | The operators are on regular base required to submit the results of the measurement of the basic set of parameters pertaining to network quality monitoring, at least once a year, using the forms which are specified in the Rulebook. |
| **Slovak Republic** | | No, requiring records based on calculations model which will be verified by measurements ad hoc inspections. |
| **Slovenia** | | See above text from tender documentation |
| **Spain** | | 800 MHz: not decided yet  900 MHz refarming: operator does not provide measurement results, but only the list of population centres it presumes are covered |
| **Sweden** | | No there are not any measurement results from the operators |
| **Switzerland** | | Yes, the operators give percentage of the coverage of the population and the territory with the different technologies (LTE, UMTS, GSM). |
| **United Kingdom** | | No |
| 1. **Do you perform simulations/predictions/studies and how are these calculated (e.g. which software is used and which variables are set)?**   **Please specify.** | | |
| **Austria** | | No |
| **Belgium** | | No |
| **Croatia** | | Yes, with the following specifications/parameters:  - software used: LS telcom and Hnit-Baltic  - propagation model: Okumura-Hata and ray tracing models  - map resolution: 25m, 50m, 100m  - GSM: receiver signal level > -95 dBm  - UMTS: CPICH RSCP > -114 dBm  - LTE: RSRP > -115 dBm |
| **Cyprus** | | N/A |
| **Czech Republic** | | o RadioLab software by Czech company CRCData;  o ITU 1546-2CA and ITU 1812 propagation models;  o Coverage calculated on the basis of the network technical parameters submitted by the allocation holder. |
| **Denmark** | | No |
| **Estonia** | | No simulations/predictions/studies are performed. |
| **Finland** | | No planned |
| **France** | | No simulations or predictions. |
| **Germany** | | No |
| **Iceland** | | Yes with ICS Telecom SW |
| **Ireland** | | No, but it is possible to carry out such tasks using propagation software employing the appropriate propagation model. |
| **Italy** | | See table\*\*\*\* |
| **Latvia** | | Some experimental calculations were done using LS Telecom CHIRplus\_BC software for calculations of theoretical coverage of CDMA450 base stations network.  The following parameters were taken into account: coordinates of base station, antenna height, effective antenna heights, antenna azimuth, antenna tilt, e.r.p. A transmitting frequency and an antenna type were assumed. Finally, a theoretical coverage (%) of territory was calculated.  Used variables: radio wave propagation prediction model (Rec. ITU-R P.1546-1), a receiver antenna height (1.5m, 3m and 10m), time and location probability (50%T; 50%L), a received signal strength level (-75 dBm - indicating strong signal; -85 dBm; -95 dBm - indicating weak signal) for CDMA450 network, a topographical map with 100 m resolution was used. |
| **Liechtenstein** | | No |
| **Lithuania** | | We perform downlink coverage calculations using software ICS Telecom from company ATDI. Currently two types of clutters are used – rural area and forest.  For 900 MHz band we use Okumura-Hata-Davidson propagation model along with Deygout diffraction.  For 2100 MHz band we use Cost 231 propagation model along with Deygout diffraction. |
| **Montenegro** | | We perform coverage predictions by using ICS ATDI Telecom software. |
| **Netherlands** | | No, not at the moment, but we want to develop and use simulation tools in the near feature. Especially due to all the different TDD and FDD frequencies in the new licences simulations can be more effective. |
| **Norway** | | NPT will perform simulations by using the reported data from the licensees. NPT will use the system called ICS-Telecom, delivered by ATDI Ltd. Setting of the different variables will be done after discussing these issues with the relevant licensees. |
| **Portugal** | | Please see our answer to question 2. |
| **Serbia** | | No |
| **Slovak Republic** | | No, we do not plan perform special studies. |
| **Slovenia** | | See above text from tender documentation |
| **Spain** | | 800 MHz: not decided yet  900 MHz refarming: we only perform on the spot tests to verify that, for a given sample of population centres, signal is received with the required power level |
| **Switzerland** | | No |
| **United Kingdom** | | Yes. The assessment is undertaken using MATLAB software developed within Ofcom. The operator provides the specified base station parameters and these are assessed using the published methodologies. |
| 1. **Does the operator provide simulations/predictions and how are these calculated? How do you collect this information?** | | |
| **Austria** | | The operator provides simulations according to (a) and site positions in a GIS-format |
| **Belgium** | | Yes. Operators provide a text file with 0 (no coverage) and 1 (coverage) for squares of 200 m x 200 m. |
| **Croatia** | | Not on regular basis. This information can be obtained on HAKOM’s demand. |
| **Cyprus** | | N/A |
| **Czech Republic** | | o Operator only provides calculated coverage for each 100×100m square (covered / not covered);  o Format: csv in defined format. |
| **Denmark** | | No |
| **Estonia** | | No |
| **Finland** | | We are planning to do this. At first this is based on the operator's own calculations. Later the parameters will be agreed based on the results of the ECC work. |
| **France** | | Operators provide coverage maps, which are deemed to be reliable. No information on the methodology used is demanded.  Information is collected in a GIS format (shape). |
| **Germany** | | Simulations / predictions are provided by the operator. Calculations of this as subset of business policy will not be provided to the agency. Information will be given by the operators. |
| **Iceland** | | Yes, published on the operator web site. |
| **Ireland** | | Yes, Using band appropriate propagation models such as, for example, the COST-Hata model. |
| **Italy** | | Operators are required to regularly send data on their base stations and network coverage, in electronic and paper formats |
| **Latvia** | | Information on network coverage can be found in operators web pages. |
| **Liechtenstein** | | Operator provides coverage plots if requested |
| **Lithuania** | | Operators do not provide simulations/predictions results |
| **Montenegro** | | Operators provide to the administration simulation/prediction results on request. |
| **Netherlands** | | Yes, the operators provide us with their own simulations/predictions of their network coverage. Those simulations/predictions are generated by the operators own planning tools. As we have no detailed knowledge of the parameters used in their calculations we ask them for coverage information in a shape format, so we can copy the layer of information in our own geo tool to generate a coverage map. |
| **Norway** | | Not for the moment, but a conclusion on this will be taken after NPT have discussed the coverage obligations in detail with the licensees. |
| **Portugal** | | Yes they provide. Please see the answer to question 2, and 2.a).  Concerning the 800 MHz it is not yet defined how the coverage obligations will be evaluated but a similar process is foreseen. |
| **Serbia** | | No |
| **Slovak Republic** | | It will be discussed in line with 4.2.5 Verifying the Conditions of Efficient Frequency Usage of the “Conditions of the Tender” by form Electronic Auction 2013. |
| **Slovenia** | | See above text from tender documentation |
| **Spain** | | 800 MHz: not decided yet  900 MHz refarming: no |
| **Sweden** | | Yes the operator provide simulations, PTS collect them in charts |
| **Switzerland** | | No |
| **United Kingdom** | | No |
| 1. **Do you take into account multiple user scenarios – i.e. would the simulation include a number of users per cell/area other than one?** | | |
| **Austria** | | All simulations and measurements are done under real network conditions (actual load) |
| **Belgium** | | No |
| **Croatia** | | No |
| **Cyprus** | | N/A |
| **Czech Republic** | | No. Simulation is only performed for signal parameters, not speed parameters. |
| **Estonia** | | No |
| **Finland** | | We have not considered multiple user scenarios so far. We hope that the ECC work will provide solutions. |
| **France** | | Not applicable |
| **Germany** | | No |
| **Iceland** | | No, due to the scarce population of Iceland this is not the same problem as elsewhere. |
| **Italy** | | Only in the 2100 MHz coverage model multi-user traffic is considered. Traffic distribution is proportional to the population density |
| **Latvia** | | No |
| **Liechtenstein** | | No |
| **Lithuania** | | We do not take into account multiple user scenario. |
| **Montenegro** | | No |
| **Netherlands** | | No, we do not take into account the load of the network. |
| **Norway** | | Yes. Details will follow after discussions with the licensees. |
| **Portugal** | | Not for GSM.  For UMTS, and as far as the obligations are defined for data rates of 144 kbps and 384 kbps, our approach was to do the studies where we assumed that the cell is working with the maximum number of users (based in maximum cell loading) and using the same type of service, 144 kbps or 384 kbps. It is understood that this scenario is not realistic but served the objective. |
| **Slovak Republic** | | No |
| **Slovenia** | | No |
| **Spain** | | 800 MHz: not decided yet  900 MHz refarming: no |
| **Sweden** | | No |
| **Switzerland** | | No |
| **United Kingdom** | | A lightly loaded network is considered which is defined as having a single user demanding service within the serving cell, and the surrounding cells of the network are loaded to a light level (by which we mean the common channels only are transmitting at 22% of the maximum cell power). |
| 1. **Is there any tolerance (margin allowed for coverage obligations) compliance established in your administration? (e.g. if an obligation of the right of use/authorisation requires 90 % of population/area coverage, will an operator be in breach if the simulation studies performed by your administration come to the result of 88 % of population/area covered?)** | | |
| **Austria** | | No, but penalties are linked to degree of violation of obligation |
| **Belgium** | | No |
| **Croatia** | | No |
| **Cyprus** | | N/A |
| **Czech Republic** | | 5% of population in each district (required coverage is 95 % of population in each district, results >= 90% in administration coverage calculation are OK). |
| **Denmark** | | There is not tolerance in the coverage obligations, they are minimum requirements |
| **Estonia** | | There are no tolerances established. But if we make on sight field strength measurements with special equipment then uncertainty is taken into account. |
| **Finland** | | We have not considered any tolerances so far. We hope that the ECC work will provide solutions. |
| **France** | | The drive test results are compared to the coverage maps provided by operators: access has to be effective in any point within the coverage area (a local failure tolerance of 5% is accepted). If a discrepancy between the measures and a map is observed, the operator has to take measures either to correct its map or to modify the network coverage so that it matches the map. |
| **Germany** | | No |
| **Iceland** | | No |
| **Ireland** | | No margin allowed in most cases, but 3G is probabilistic coverage. |
| **Italy** | | A specific tolerance margin is defined only in the case of 800 MHz coverage obligations; since in this case the obligations concerns mainly small towns and sparse areas, a coverage obligation is fulfilled even if it misses the target by at most 10%, provided that the number of people to reach the target is lower than 30. |
| **Latvia** | | No |
| **Liechtenstein** | | The coverage obligations are predefined and has been fulfilled by all operators (Orange, Swisscom, Mobilkom) |
| **Lithuania** | | We do not use any margin for coverage obligations. |
| **Montenegro** | | Yes, there is a tolerance on which we discuss with operators and give additional reasonable period of time to comply with licence. |
| **Netherlands** | | N.A. (see at c.) |
| **Norway** | | No defined level of tolerance. If simulations show a lower level of coverage than obliged, NPT will investigate this further. NPT believes that 2 Mbps criterion is quite moderate and should be fulfilled without problems by all of the licensees. |
| **Portugal** | | A tolerance is not established.  As a first step we try to identify the assumptions of the studies, including the differences between our assumptions and the ones used by the mobile operators (for instance the propagation model could be different); this may provide a god basis to understand the reason of such a difference (e.g. the digital terrain model, the cell loading or other issue). If the difference is explained, a closer look to the issue is required in order to verify if the difference resulting from our internal calculation is negligible.    According to some internal analysis it is possible to say e.g. that a difference/error in threshold for coverage of 3 dB results in 2% of area coverage. |
| **Slovak Republic** | | Providers have an obligation to comply with the conditions of coverage specified in their licences. |
| **Slovenia** | | No |
| **Spain** | | 800 MHz: no tolerance  900 MHz refarming: no tolerance |
| **Switzerland** | | Not applicable in our case |
| **United Kingdom** | | No. An operator will be in breach even if the set coverage threshold is missed by a small margin. However, the size of breach and time an operator remains noncompliant is taken into account when considering whether enforcement action may be taken. |

**\*\*\*\*Table provided by Italy**

|  |  |  |
| --- | --- | --- |
| Frequency band | a) | d) |
| 800 MHz | A coverage model for verifying the coverage obligations via simulations has been agreed.  It specifies link budget parameters, the propagation model, map resolution, clutter definition | The coverage data provided by the operators can be verified by simulations.  A software tool has been specifically developed to fully implement the agreed coverage model |
| 900 MHz | A coverage model has been agreed.  It specifies link budget parameters, the propagation model, map resolution, clutter definition |  |
| 1800 MHz  Assigned before the LTE auction in 2011 | Same model as for 900 MHz |  |
| 1800 MHz  Assigned with the LTE auction in 2011 | No, because there no specific obligations |  |
| 2100 MHz | A coverage model has been agreed.  It specifies link budget parameters, the propagation model, map resolution, clutter definition | The coverage data provided by the operators can be verified by simulations.  A software tool has been specifically developed to fully implement the agreed coverage model |
| 2600 MHz | A coverage model has been agreed.  It specifies the cell radius for each clutter category | The coverage data provided by the operators can be verified by simulations.  A software tool has been specifically developed to fully implement the agreed coverage model |
| 3400-3600 MHz | No | No |

**Question 3 Possible relationship with coverage obligations and enforcement**

|  |  |
| --- | --- |
| **Question 3;**  **Based on your national experience – do you have any thoughts on how limits in a coverage obligation could be defined and verified in the future? For different technologies (GSM, UMTS, LTE, WIMAX) same of them allowed to share the same frequency band (e.g. 900 MHz) what should be the approach? And if a coverage obligation is done with different technologies operating in different frequency bands what should be the approach?\*** | |
| **Country** | **Comments** |
| **Austria** | Based on your national experience – do you have any thoughts on how limits in a coverage obligation could be defined and verified in the future? For different technologies (GSM, UMTS, LTE, WIMAX) same of them allowed to share the same frequency band (e.g. 900 MHz) what should be the approach? And if a coverage obligation is done with different technologies operating in different frequency bands what should be the approach?  Yes, see coverage obligations in our recent tender:  <https://www.rtr.at/en/tk/multibandauktion_AU> |
| **Croatia** | Thoughts within HAKOM went in two directions. The need to ensure GSM coverage as the universal service and the need to have the adequate data service. At the time of licensing 800 MHz band, it was concluded that the market itself ensures mentioned before. Otherwise HAKOM was ready to react, and in the case of data traffic the idea was to define service of x Mbit/s in certain time intervals. In existing technology neutral licenses, coverage obligations can be met with different technologies. |
| **Cyprus** | We have no input for this matter |
| **Estonia** | National Spectrum Authorities should decide freely the limits in a coverage obligation. This gives an opportunity to be flexible to motivate operators to focus certain aspects (area coverage, % of population etc.) in roll out.  In order to avoid possible disputes later in enforcement process ETSA recommends defining the measurement methodology before issuing the licence with obligation. Especially in the case of beauty contest.  Also we would like to point out, that in modern communications networks the parameter “field strength” is not the best parameter for defining network or service coverage. We would recommend defining coverage by download or upload speed which is also much more practical to measure. Modern networks have different intelligent power control options and they may not radiate with full field strength all the time. Also modulations are very complicated which make the field strength measurements very challenging and can cause intolerable uncertainty. |
| **Finland** | For the voice service coverage obligation (geographic or population) a minimum signal strength requirement should be defined. For data services different bit rates and specified probability requirements should be defined. These values should be measurable and verified according to measurement methods specified by ECC. Operators are requested to deliver their coverage maps and on special request also measurement results on coverage and data service. |
| **France** | The framework is that operators have to publish reliable coverage maps, for each technology (and, if appropriate, for each band), and distinguishing voice and data services. The coverage verification method is defined once and for all for voice and data and can be used for any present or coming technology. |
| **Germany** | No general specifications. Ex post parameters according to test and measurement services of the authority. |
| **Iceland** | With the latest development in technology and regulation (GSM/UMTS/LTE in the same frequency band and shared spectrum for operators) it seems logical to require the same coverage obligation within certain time frame for at least GSM, UMTS and LTE.  Regulators also have better possibilities in making simulations/predictions than before so surveillance is easier than before. An example can be seen in shadow maps (GSM/UMTS) and coverage map (LTE) published on the Iceland PTA website (see links below). The maps represent all networks (outdoor coverage) but available are also maps for each operator separately. Further information is calculated/predicted (not yet published) regarding number of the population covered/not covered, number of homes covered/not covered (inside/outside), how far to a useful signal etc.  Links:  Shadow map (no coverage) GSM: <http://pfs.is/fjarskipti/kort-og-tidnitoflur/gsm-skuggakort/>  Shadow map (no coverage) UMTS: <http://pfs.is/fjarskipti/kort-og-tidnitoflur/3g-skuggakort/>  Coverage map LTE (800/1800): <http://pfs.is/fjarskipti/kort-og-tidnitoflur/4g-utbreidslukort/> |
| **Ireland** | Yes. Coverage obligations could potentially be based upon Field Strengths and Carrier to Noise Ratios, or Bit Error Rates for quasi error free signal. |
| **Italy** | Coverage obligations have the purpose to ensure that frequencies are used efficiently. Obligations should be formulated specifically for each frequency band and type of service, independently of technology. Requisites may vary, but as a general rule obligations are defined in terms of percentage of population reached by a good enough quality of service; in each case, required covered population may be set according to appropriate geographical sub-divisions of the national territory. |
| **Latvia** | There could be geographical/population coverage obligations or a requirement to obtain a certain number of radio frequency assignment use permits.  For verification of geographical coverage obligations an approach could be to perform calculations of theoretical coverage. Therefore the received signal strength threshold values for different technologies and calculation variables for each corresponding frequency band should be defined. |
| **Liechtenstein** | There are no thoughts as regards to the above mentioned relationship |
| **Netherlands** | In the Netherlands the coverage obligations are defined in a minimum square kilometre coverage of signal- and service per licence. Each individual licence covers 5 MHz. These obligations are individually measured (per licence), the technique used in a specific licence is not of great influence. So multiband coverage with different techniques is no problem in our present method of measurements. Parallel for the near future we would like to develop simulation tools to predict coverage based on information provided by the licensees and our own monitoring- and drive test information, as well as consumer information. If these simulations indicate that an obligation for a particular license is clearly undisputed, we can avoid time consuming test drives. Only in cases of doubt we will perform more extensive measurements. |
| **Norway** | In the 800 MHz licences, NPT has focused on the user experience. It is what the user experiences at a given geographical point that matters. This means that measurements by using commercial terminals will be important. One example on how measurements could be done is by using an app on the terminals that logs the data speed and location, and then registers this on a server. By focusing on the user experience you also address the fact that the quality of the terminals can vary. We think that it is difficult to set field strength limits to define coverage, but this might also be done in combination with user experience measurements. |
| **Portugal** | For the services voice and data rate up to 9600 bps, and data rates of 144 kbps and 384 kbps, in terms of coverage (excluding capacity) if we have one main technology providing the coverage and others technologies providing capacity in areas already covered by the main technology, the issue could be “easy” to solve and similar to what has been referred above, i.e. calculating the coverage only for the main technology. If this is not the case, the solution could be to calculate the coverage for different technologies/frequencies and in the end mix the different layers to obtain only one, that would be used to calculate the population and are covered.  The situation for the 800 MHz band is different because the coverage should be provided at least in specific points well known. So, after we define the data rates that the operators are obliged to deliver at least in those specific points, we could try three different exercises as appropriate, to evaluate the coverage obligations:  • Perform theoretical studies similar to the ones we do actually to evaluate the coverage obligations, and using the same approach (consult mobile operators, analyze the information provided, do calculations and check the results);  • Perform measurements in the field (field strength measurements and/or data rates measurements);  • Do both analyses above. |
| **Slovak Republic** | With regard to technological neutrality and service neutrality is not possible to predict the future and not unilaterally change the terms of coverage for frequencies whose license is still valid. |
| **Sweden** | PTS has not a clear picture, there are ongoing discussions continuously |
| **United Kingdom** | Coverage obligations as well as the assessment methodology (parameters, signal strength/interference thresholds and etc.) should be defined on a technology neutral basis. This means that coverage required under a licence condition (including a minimum level of capacity) may be delivered using any combination of that licensee’s spectrum holdings or other licences. The licensee can therefore decide which frequencies and technologies may be appropriate to optimise efficiency in any area to be served. Ofcom has had a long standing policy to avoid unnecessary technology restrictions in spectrum licences and to maximise the flexibility with which spectrum can be used, subject to the need to limit the risk of harmful interference. Within our liberalisation framework, we have varied the technical licence conditions to be technology neutral. |

\*Note: The purpose is to identify how limits in future coverage obligations can be established – not what the limits should be. For example: If an administration wants an operator to provide a service of x Mbit/s to y% of the population in a given geographical area z, the question concerns how to define the coverage criteria and how to establish that the obligation has been met. The ‘x’, ‘y’ and ‘z’ values are of no interest for the purpose of this questionnaire.



ANNEX 2



1. Where the Licensee has deployed more than one Terrestrial System in the 800 MHz, the 900 MHz and/or the 1800 MHz band, it is the combined coverage of these Terrestrial Systems that counts towards the minimum coverage and roll-out obligation set out in the Liberalised Use Licence. [↑](#footnote-ref-1)
2. With regard to Liberalised Use Licences in the 800, 900 and 1800 MHz bands, where the Licensee has deployed one or more than one terrestrial system in the 2100 MHz band, up to 35% of the population coverage (that is to say, one-half) of the 70% of the population coverage obligation, as listed for the 800, 900 and 1800 Mhz bands, may be met using coverage provided by the terrestrial systems in the 2100 MHz band. [↑](#footnote-ref-2)
3. Where:

   • FS = Field Strength;

   • BLER = Block Error Rate; and

   • Ec/Io = The ratio of the received energy per chip and the interference level.

   With regard to Table\*\*, above :

   • Where both a FS and an Ec/Io or BLER metric are specified in Table 5 for a particular Terrestrial System (i.e. UMTS7 and LTE8), an area will be deemed to have coverage where the Ec/Io or BELR exceeds the levels as set out in Table 1, even if the Field Strength is less than the value shown in the Table 1.

   • Where a FS metric is the only metric specified in Table 1 for a particular Terrestrial System (i.e. GSM), an area will be deemed to have coverage where the Field Strength in Table 1 above is met. [↑](#footnote-ref-3)
4. Should WiMAX, or any other terrestrial systems be deployed in one or more of the 800, 900, or 1800 MHz bands, measurement standards will be defined in accordance with, as appropriate, relevant international standards and recommendations, but for indicative purposes such standards are likely to be based on the following:

   • For measurement purposes – an average pilot signal field strength of “X” measured outdoors at a height of 1.5m, or a Carrier to Interference (C/I) ratio of –Y dB

   • For propagation prediction systems – a pilot signal field strength of “X” over 95% of the area during 95% of the time. [↑](#footnote-ref-4)