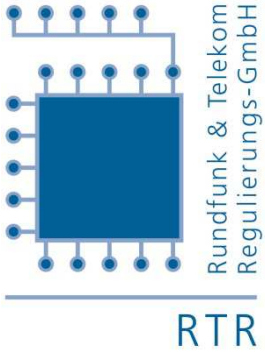


Consultation

on Future Frequency Awards

NON-BINDING TRANSLATION

Vienna, March 2016

1 Introduction

In the summer of 2015 the Austrian federal government decided to make the 700 MHz band available for mobile telecommunications from the beginning of 2020.[1] On this basis the regulatory authority assumes that the 700 MHz band will be able to be used for mobile telecommunications from 1 January 2020. The usage rights for the 2100 Mhz band expire at the end of 2020, and for the 3400-3600 MHz band at the end of 2019. Moreover, the bands 3600-3800 MHz, 1500 MHz and 2300 MHz have been identified at European level as harmonised ECS bands. Consequently we can expect award procedures in the short and medium term for the following frequency ranges:

- 700 MHz
- 1500 MHz
- 2100 MHz[2]
- 2300 MHz[3]
- 3400-3600 MHz
- 3600-3800 MHz

The regulations regarding responsibility in the field of frequency administration are derived from Art. 54 Par. 3 of the 2003 Telecommunications Act (TKG 2003). Accordingly, the regulatory authority (Telekom-Control–Kommission, TKK) is responsible for awarding the spectra for which a provision as specified in Art. 52 Par. 3 TKG 2003 has been made in the frequency usage plan (limited number). It was determined by the Federal Minister of Transport, Innovation and Technology that the number of the frequencies in question shall be limited, or it is anticipated that such a decision will be made. It follows from this that the TKK is responsible for awarding frequencies.

The regulatory authority expects that the 700 MHz, 1500 MHz, 2100 MHz and presumably also the 2300 MHz band will be used for mobile telecommunications due to their (almost) global use as IMT bands and their propagation characteristics. Utilisation both by mobile network operators and by regional wireless broadband providers is conceivable for the 3400-3600 MHz and 3600-3800 MHz bands. In any case, ensuring a fair and objective award of frequencies for all interested parties by means of an appropriate invitation to tender is considered by the regulatory authority to be a key task.

The BMVIT and the regulatory authority (RTR) wish to collect important ideas and suggestions on the upcoming awards and discuss possible approaches during this consultation. With it, the BMVIT and the regulatory authority are addressing in particular current mobile network operators, regional wireless broadband providers, possible new entrants, manufacturers and the interested public.

From the regulatory authority's perspective, focus should be placed on the following regulatory objectives when planning further action:

- Ensuring efficient use of the frequencies as a limited resource
- Ensuring sustainable competition
- Legal certainty
- Improving the public supply of broadband services

---

[1] Refer to the press release of the Federal Ministry of Transport, Innovation and Technology (BMVIT; available on the BMVIT website).

[2] In future only the FDD spectrum within the 2100 MHz band will be considered. The 2100 MHz TDD spectrum will be deemed obsolete for mobile telecommunications purposes.

[3] Depending on any specifications in the Frequency Utilisation Ordinance (FNV), needs of the entities at national level requiring frequencies and developments at European level. See below for further details.

- Investment security

To ensure planning security for market participants, the TKK together with the BMVIT intends to publish a general roadmap for the future frequency awards (Spectrum Release Plan) after the internal discussions are completed. This legally non-binding plan will be designed to reflect the authorities' current assessment of future frequency awards.

The content addressed below is also non-binding and is therefore without prejudice to any future decisions of the Telekom-Control-Kommission.

2 Market development

2.1 Mobile services

2.1.1 Mobile network operators

There are currently three mobile network operators in Austria (A1 Telekom, T-Mobile Austria and Hutchison Drei Austria). The following chart shows the market shares of the mobile network operators in Austria, calculated based on their subscriber numbers (number of SIM cards in use). According to the chart, A1 Telekom (A1 TA) had a market share in June 2015 of 40.2%, T-Mobile (TMA) held 29.2% and Hutchison Drei Austria (H3A) controlled 28.2%. Alongside the mobile network operators, Austria also has mobile virtual network operators (MVNOs) and resellers active on the mobile telecommunications market. These providers collectively have a market share of 2.4%.

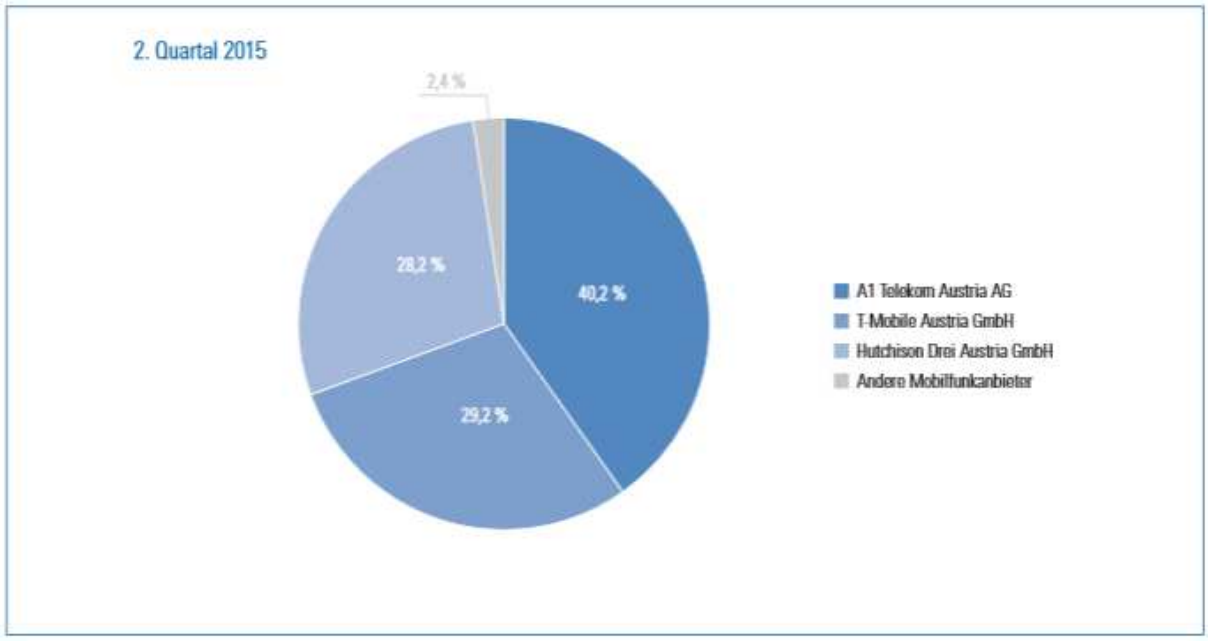


Figure 1: Market shares of mobile network operators (as of June 2015)
Source: RTR Telekom Monitor

2.1.2 Frequency assignments

Mobile telecommunications currently use the following frequency bands for direct end-user connections[4]:

- 800 MHz band (2x30 MHz)
- 900 MHz band (2x35 MHz)
- 1800 MHz band (2x70 MHz)
- 2100 MHz band (2x60 MHz)[5]
- 2600 MHz band (2x70 MHz and also 1x50 MHz unpaired spectrum)

[4] Other higher frequency bands are also used to connect base stations via microwave radio. This spectrum is not relevant for the consultation.

[5] The 2100 MHz TDD spectrum is no longer considered here.

The following table shows the distribution of frequencies until the end of 2020 based on current decisions.

Table 1: Frequency spectra of Austrian mobile network operators [in MHz]

Network operator	Band	2016	2017	2018	2019	2020
A1 TA	800 MHz	2x20	2x20	2x20	2x20	2x20
	900 MHz	2x18.3	2x18.3	2x15	2x15	2x15
	1800 MHz	2x15.5	2x15.5	2x26.4	2x26.4	2x35
	2100 MHz	2x20	2x20	2x20	2x20	2x20
	2600 MHz	2x25	2x25	2x25	2x25	2x25
	FDD total	2x98.8	2x98.8	2x106.4	2x106.4	2x115
	FDD share	36.6%	36.6%	39.4%	39.4%	42.6%
	2600 MHz TDD	25	25	25	25	25
	Total	222.6	222.6	237.8	237.8	255
	Total share	37.7%	37.7%	40.3%	40.3%	43.2%
TMA	800 MHz	2x10	2x10	2x10	2x10	2x10
	900 MHz	2x11.7	2x11.7	2x15	2x15	2x15
	1800 MHz	2x24	2x24	2x28.7	2x28.7	2x20
	2100 MHz	2x15	2x15	2x15	2x15	2x15
	2600 MHz	2x20	2x20	2x20	2x20	2x20
	FDD total	2x80.7	2x80.7	2x88.7	2x88.7	2x80
	FDD share	29.9%	29.9%	32.9%	32.9%	29.6%
	2600 MHz TDD	-	-	-	-	-
	Total	161.4	161.4	177.4	177.4	160
	Total share	27.4%	27.4%	30.1%	30.1%	27.1%
H3A	800 MHz	-	-	-	-	-
	900 MHz	2x5	2x5	2x5	2x5	2x5
	1800 MHz	2x35.5	2x35.5	2x19.9	2x19.9	2x20
	2100 MHz	2x25	2x25	2x25	2x25	2x25
	2600 MHz	2x25	2x25	2x25	2x25	2x25
	FDD total	2x90.5	2x90.5	2x74.9	2x84.9	2x75
	FDD share	33.5%	33.5%	27.7%	27.7%	27.8%
	2600 MHz TDD	25	25	25	25	25
	Total	206	206	174.8	174.8	175
	Total share	34.9%	34.9%	29.6%	29.6%	29.7%

Source: RTR, see https://www.rtr.at/en/tk/FRQshare
Note: Some figures are rounded (e.g. for the 2100 MHz band).

Detailed information on the assignments can be found on the regulatory authority's website at http://www.rtr.at/en/tk/Frequenzen.

2.1.3 Market development

Mobile telecommunications are characterised by fast growth. Some 93% of Austrian households now have (at least) one mobile phone connection, while the penetration rate relative to the population is 150%.[6] Despite moderate declines in call minutes and other options being used for text messaging, overall traffic reveals exponential growth, with annual rates reaching around 50%.[7] This means that the volume of traffic is currently more than doubling every second year (refer to the following figure).

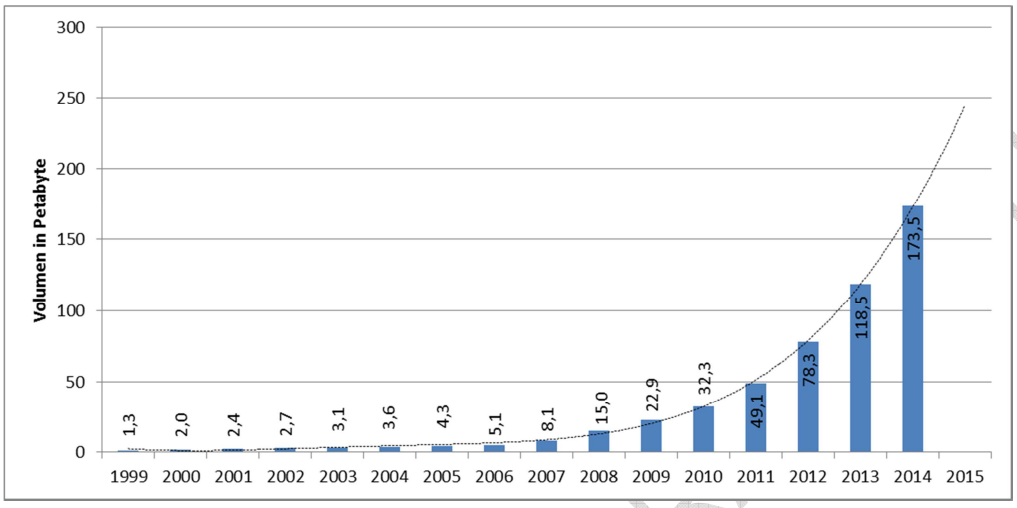
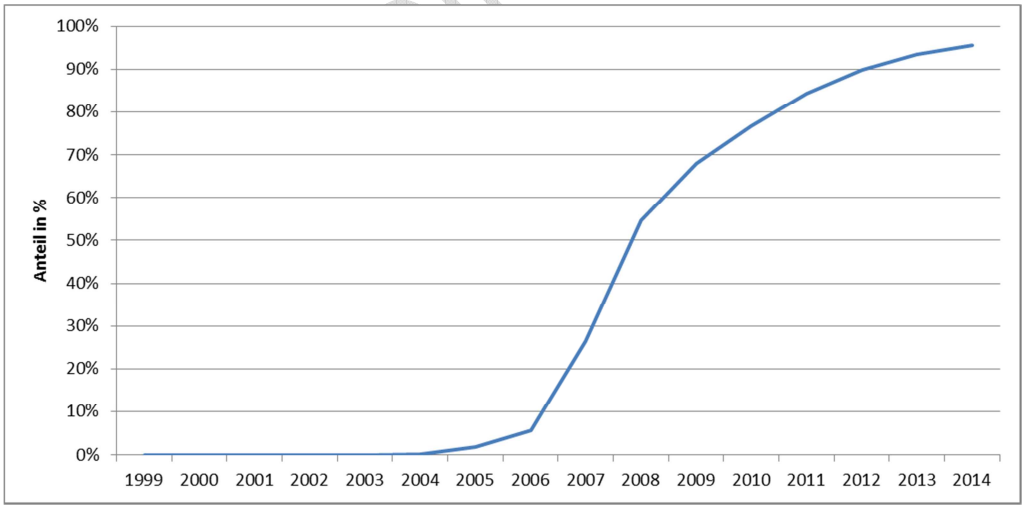


Figure 2: Growth of total traffic
Source: RTR

Data traffic now accounts for the majority of total traffic. While the share of call minutes in total traffic totalled almost 100% in 1999, it has now fallen to around 4%, which means data traffic accounts for 96% of total traffic (see Figure 3).



6 Source RTR-GmbH (NASE and RTR Telekom Monitor).

7 To depict the growth of total traffic, text messages and call services are converted into data volumes, thereby taking terminating traffic into account as well. Conversion of call and text message services into data services: no overheads (neither for calls nor data), voice transmission at AMR-WB 12.65 kbps; depiction of ratio of data to the sum of data + calls (converted) + text messages (converted); for text messages a maximum length of 140 bytes (i.e. 160 characters, 7 bit coding) is assumed.

Figure 3: Share of data traffic in total traffic
Source: RTR

The spectrum range for mobile telecommunications has failed to keep pace with the strong increase in traffic in recent years. This is clearly visible by comparing the volume of traffic with the mobile telecommunication spectrum (see Figure 4). In 1999 traffic totalled only about 6 terabytes per MHz, rising to 89 terabytes per MHz in 2010 and finally 321 terabytes per MHz in 2014.

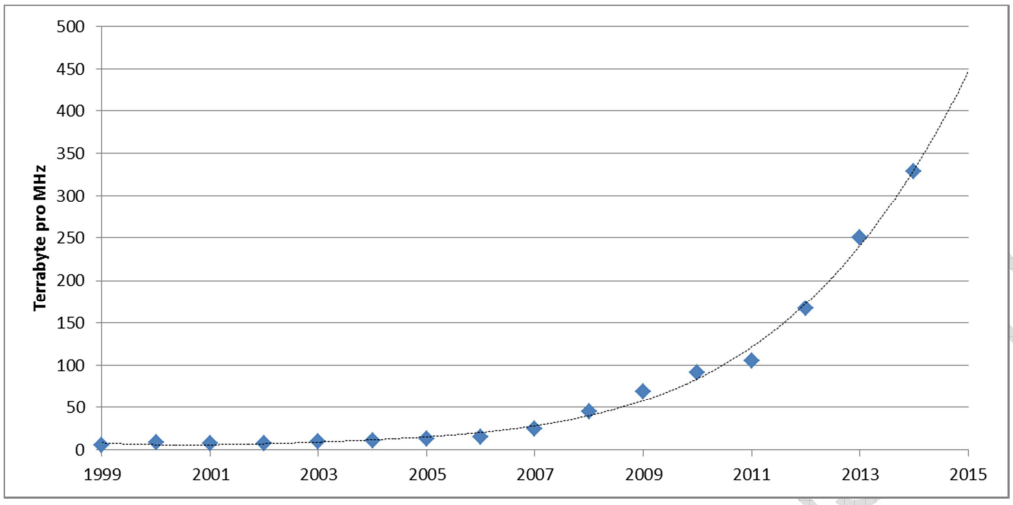


Figure 4: Total traffic per MHz
Source: RTR

Many experts assume the relatively high growth rates will also continue in the foreseeable future.[8]

2.1.4 Mobile network coverage

One objective of the forthcoming frequency awards is to improve broadband coverage. The following coverage requirements from the 2013 multiband auction will gradually take effect until 1 July 2019.[9]

Table 2: Narrowband coverage

Network operator	Share of population	End-user bandwidth
A1 Telekom	98% of Austrian population, outdoors	12.2 kbps
T-Mobile	98% of Austrian population, outdoors	12.2 kbps
Hutchison	98% of Austrian population, outdoors	12.2 kbps

Table 3: Broadband coverage

Network operator	Share of population	End-user bandwidth
A1 Telekom	95% of Austrian population, outdoors	Downlink: 1 Mbps Uplink: 0.25 Mbps
T-Mobile	95% of Austrian population, outdoors	Downlink: 1 Mbps Uplink: 0.25 Mbps
Hutchison	90% of Austrian population, outdoors	Downlink: 1 Mbps

[8] Refer to the VNI Mobile Forecast (2014 – 2019) by Cisco for example (see http://www.cisco.com/assets/sol/sp/vni/forecast_highlights_mobile/index.html) or the Mobility Report by Ericsson (see http://www.ericsson.com/mobility-report).

[9] Refer to https://www.rtr.at/de/tk/Versorgungsauflagen (in German).

	Uplink: 0.25 Mbps

Table 4: Broadband coverage for selected municipalities (conditions for 800 MHz)

Network operator	Share of population	Bandwidth
A1 Telekom	240 of the 297 municipalities listed in Appendix H of the multiband auction 120 of the 244 municipalities listed in Appendix I of the multiband auction 50% of municipal population, indoors 90% of municipal population, outdoors	Downlink: 2 Mbps Uplink: 0.5 Mbps
T-Mobile	60 of the 297 municipalities listed in Appendix H of the multiband auction 120 of the 244 municipalities listed in Appendix I of the multiband auction 50% of municipal population, indoors 90% of municipal population, outdoors	Downlink: 1 Mbps Uplink: 0.25 Mbps

There are other coverage requirements for certain frequency bands: 25% of the resident population (pop coverage) in each of the bands 800 MHz, 900 MHz, 1800 MHz and 2600 MHz; and 50% pop coverage in the 2100 MHz band.

The regulatory authority assumes that the actual coverage provided by individual network operators in individual bands already exceeds the coverage requirements.

2.2 Regional wireless broadband

2.2.1 Providers

Radio-based regional broadband providers currently use frequencies in the 3.5 GHz band. This band has ten regional spectrum holders at present[10]:

- EVN Netz GmbH
- LinzNet Internet Service Provider GmbH
- B.net Burgenland Telekom GmbH
- Peter Rauter GmbH
- NETcompany - WLAN Internet Provider GmbH
- Salzburg AG
- Otto M. Steinmann e.U.
- Westnet Telekommunikations- und Informationsdienstleistungs GmbH
- Camyno GmbH
- Russmedia IT GmbH

2.2.2 Frequency assignments

The coverage areas of the spectrum assigned in the 3.5 GHz band are currently divided into 18 regions (see Figure 5). The division into regions is derived from various regional divisions in earlier

[10] For details see https://www.rtr.at/en/tk/Spektrum3600MHz_Verf.

awards. The initial division was based on six economic regions. Other coverage areas were chosen in subsequent award procedures due to increased regional demand.

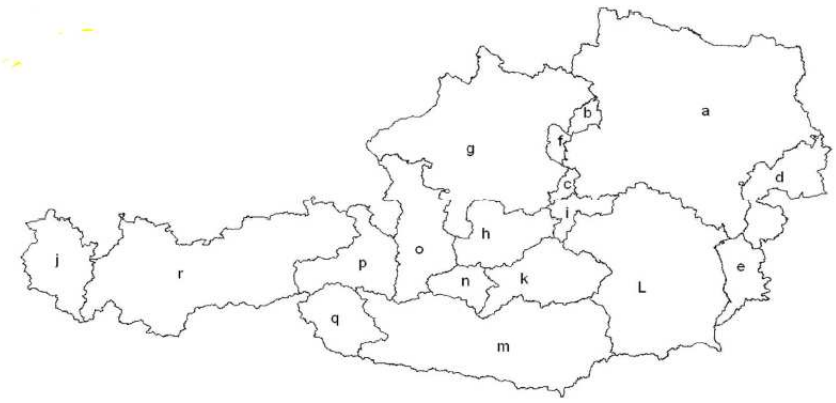


Figure 5: Current coverage areas in 3400-3600 MHz band
Source: RTR (for details see https://www.rtr.at/en/tk/Spektrum3600MHz_Reg).

Table 5 shows the current spectrum assigned in the individual coverage areas. At present there are two active providers in ten coverage areas, and one active provider in eight coverage areas. None of the coverage areas have more than two active providers. That some coverage areas have two active providers does not necessarily mean that their actual areas of use overlap.

Table 5: Frequency assignments in 3400-3600 MHz band

Frq/Reg		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
3410-3431 3510-3531	2x21 MHz	EVN	*LinzNet*	*LinzNet*	B.Net	*B.Net*	Peter Rauter GmbH	Peter Rauter GmbH	Peter Rauter GmbH					netcom-pany	*Sbg AG*	Peter Rauter GmbH	*Sbg AG*		
3438-3466 3538-3566	2x28 MHz	Otto M. Stein-mann	Otto M. Stein-mann	Otto M. Stein-mann	Otto M. Stein-mann	B.Net	*EVN*	*LinzNet*		Otto M. Stein-mann				netcom-pany	Sbg AG	*Sbg AG*	Sbg AG		
3473-3494 3573-3594	2x21 MHz	*EVN*	*LinzNet*	*LinzNet*	*B.Net*	Westnet	EVN	*LinzNet*				netcom-pany	Westnet	netcom-pany	netcom-pany	Sbg AG	Camyno GmbH	netcom-pany	Camyno GmbH
3410-3445 3510-3545	2x35 MHz										Russ-media								
3452-3494 3552-3594	2x42 MHz										Russ-media								

Source: RTR (for details see https://www.rtr.at/en/tk/Spektrum3600MHz_Reg).

Questions

Question 2.1.: How do you see market and traffic developments in the field of mobile broadband services in the next 5 to 7 years? What services and data transmission rates can be expected?

Question22.: How do you see market and traffic developments in the field of regional fixed wireless broadband services in the next 5 to 7 years? What services and data transmission rates can be expected?

Question 2.3.: What level of coverage with mobile telecommunications services do you expect in the next 5 years?

Type of coverage	Level of coverage and share of municipalities in % for various downlink/uplink data transmission rates			
	12.2 kbps, 12.2 kbps	2 Mbps, 500 kbps	20 Mbps, 5 Mbps	200 Mbps, 50 Mbps
Pop coverage outdoors				
Area coverage outdoors				
Pop coverage indoors*				
Area coverage indoors*				
Share of municipalities** with outdoor pop coverage ≥ 90%				
Share of municipalities** with indoor* pop coverage ≥ 90%				
Share of municipalities** with indoor* pop coverage ≥ 50%				

* Indoor coverage with building attenuation of 20 dB

** Based on municipality list as of 1 January 2016, see http://www.statistik.at/blickgem/gemList.do?bdl=3

Question 2.4.: What level of coverage will you yourself target in the next 5 years?

Type of coverage	Level of coverage/share of municipalities in % for various downlink/uplink data transmission rates			
	12.2 kbps, 12.2 kbps	2 Mbps, 500 kbps	20 Mbps, 5 Mbps	200 Mbps, 50 Mbps
Pop coverage outdoors				
Pop coverage indoors*				
Area coverage				
Number of municipalities** with outdoor pop coverage ≥ 90%				
Number of municipalities** with indoor* pop coverage ≥ 90%				
Number of municipalities** with indoor* pop coverage ≥ 50%				

* Indoor coverage with building attenuation of 20 dB

** Based on municipality list as of 1 January 2016, see http://www.statistik.at/blickgem/gemList.do?bdl=3

Question 2.5.: Do you expect any new companies to join the mobile telecommunications market in the next 5 to 7 years?

Question 2.6.: This question is directed exclusively at current operators providing regional wireless broadband services in the 3400-3800 MHz frequency range: How have traffic volumes and subscriber numbers changed in the last 5 years?

Question 2.7.: How do you see the market in the field of regional wireless broadband services in the frequency range of 3400-3800 MHz developing in the next 5 to 7 years? What business models can be expected? What services will be offered? What bandwidths can be expected?

Question 2.8.: Do you expect to see other regional wireless broadband providers enter the market in the next 5 to 7 years?

Question 2.9.: How big will the coverage areas of regional wireless broadband providers tend to be in the coming years?

Question 2.10.: What level of coverage are you targeting as a regional wireless broadband provider (number of municipalities and number of households or companies)? What coverage plan will you implement in these regions (i.e. non line of sight as in mobile telecommunications or line of sight with subscribers' roof antennae as in wireless local loop systems)?

Question 2.11.: In connection with the use of the frequencies mentioned above, do you see any stronger or weaker demand for joint use of frequencies and infrastructure? Which

network elements and coverage areas would be affected? What impacts would you expect from changed sharing patterns?

3 Spectra

3.1 700 MHz band

The Austrian federal government has decided to take national measures to allow the 694-790 MHz frequency range to be used for mobile telecommunications services in Austria, starting from 2020. The 700 MHz band consists of a paired frequency range of 2 x 30 MHz. The band is divided into six 5 MHz channels in accordance with harmonisation requirements at EU level; refer to the figure and table below:[11]

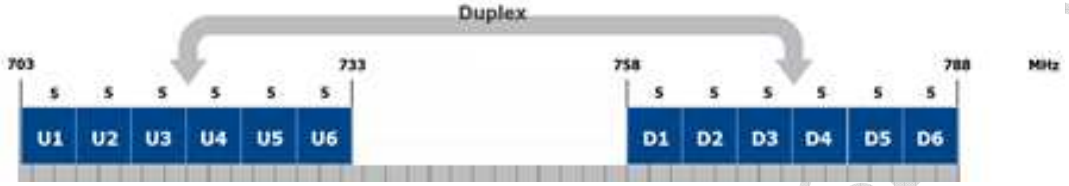


Figure 6: 700 MHz band (LTE band 28)

Table 6: List of frequency blocks in 700 MHz band

Frequency blocks in 700 MHz band	Uplink/MHz	Downlink/MHz
1	703-708	758-763
2	708-713	763-768
3	713-718	768-773
4	718-723	773-778
5	723-728	778-783
6	728-733	783-788

This frequency band is currently used for terrestrial television, and comprises DVB-T(2) channels 49 to 60.

The frequency band is part of LTE band 28. The APT 700 MHz band is already supported by a range of terminal equipment, for example by the current generation of Apple iPhones (iPhone 6s/iPhone 6s Plus[12]) or the latest Google devices Nexus 5P[13] and Nexus 6X[14], which are manufactured by LG and Huawei.

[11] Refer to ECC/DEC/(15)01 available at www.cept.org/ecc.

[12] Source: http://www.apple.com/iphone/LTE/, all country variants, especially models A1687 and A1688 designated for the European market; accessed on 15 September 2015.

[13] see https://store.google.com/product/nexus_5x (accessed on 3 October 2015); the Nexus 5P supports LTE (FDD) on bands B1/2/3/4/5/7/8/9/17/18/19/20/26/**28** and LTE (TDD) on bands B38/40/41; it also supports carrier aggregation (LTE CA) for DL with the following band combinations: B1-B3, B1-B5, B1-B7, B1-B8, B1-B18, B1-B19, B1-B26, B3-B3, B3-B5, B3-B7, B3-B8, B3-B19, B3-B20, **B3-B28**, B5-B7, B7-B7, B7-B20, **B7-B28**, B40-B40, B41-B41.

Questions
Question 3.1.: When should this band be assigned in your opinion?
Question 3.2.: Combined with frequencies of which other bands might a new entrant wish to acquire frequencies in this band?
Question 3.3.: What minimum number of frequencies would a network operator need to obtain in order to use the frequencies in this band efficiently?
Question 3.4.: What is the maximum number of frequencies a network operator should be allowed to acquire in this band, and above which number of frequencies would frequency use no longer be efficient? Please give reasons for your answer.
Question 3.5.: Are you interested in acquiring frequencies in this band? If yes, how many frequencies (minimum/maximum) do you plan to acquire?

3.2 1500 MHz band

The 1500 MHz band (formerly also referred to as the L band, LTE band 32) was previously designated for T-DAB. It currently offers a bandwidth of 40 MHz within a relatively low frequency range and therefore provides good coverage both outdoors and indoors. The 2013 Frequency Utilisation Ordinance has classified the band under Art. 52 par. 3 TKG 2003 (limiting the number of frequencies) and it can therefore be awarded by the regulatory authority.

Based on a mandate from the European Commission (RSCOM13-67rev3) the CEPT has defined a channelling arrangement (table of channels) and technical conditions of use (Block Edge Masks or BEMs) for this band (CEPT Report 54[15]).

Commission Implementing Decision (EU) 2015/750 of 8 May 2015[16] was published in the Official Gazette of the European Commission. This created the EU legal requirements for the harmonised assignment of the band.

[At the WRC-15,[17] the band was expanded[18].] The 1427-1452 MHz and 1492-1518 MHz bands were identified worldwide for IMT at the WRC-15. The “core” band of 1452-1492 MHz was identified for IMT in ITU regions 2 and 3. In ITU region 1[19] – which Europe belongs to as well – identification as IMT was limited to certain countries of Africa and the Middle East. The “core” band was not identified for IMT in CEPT countries as it is used for other purposes in some countries of Eastern Europe. That said, the basis for the IMT use of the 1452-1492 MHz band continues to be provided by the primary mobile allocation and ECC Decision (13)03 as well as Commission Implementing Decision of 8 May 2015[20]

[14] see https://store.google.com/product/nexus_6p (accessed on 3 October 2015); the Nexus 5P supports LTE (FDD) on bands B1/2/3/4/5/7/8/9/17/19/20/**28** and LTE (TDD) on bands B38/B39/40/41. The device also supports carrier aggregation (LTE CA) for DL with the following band combinations: B1-B5, B1-B8, B1-B19, B3-B3, B3-B5, B3-B7, B3-B8, B3-B19, B3-B20, **B3-B28**, B5-B7, B7-B7, B7-B20, **B7-B28**, B39-B39, B40-B40, B41-B41.

[15] Refer to https://www.rtr.at/de/tk/Spectrum1500MHz/CEPTREP054.PDF.

[16] Refer tohttp://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32015D0750.

[17] The provisional final acts of the World Radiocommunication Conference (WRC15) were published by the ITU in https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.11-2015-PDF-E.pdf. (accessed on 24 January 2016).

[18] In http://www.cept.org/files/4200/_WRC-15%20weekly%20reports/Report%20of%20CEPT%20at%20WRC-15-final.docx the CEPT published a concise report on the extensive results of the conference.

[19] A list of the ITU member countries by ITU region can be found at http://life.itu.int/radioclub/rr/itureg.htm.

[20] Commission Implementing Decision of 8 May 2015 on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union (2015/750/EU).

on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union (2015/750/EU).

The “core” band has a bandwidth of 40 MHz and is available as LTE band 32; see following table on the frequency blocks of the “core” band:

Table 7: List of 5 MHz frequency blocks of the 1500 MHz band (LTE band 32)

Frequency blocks in 1500 MHz “core” band	Frequency range/MHz
1	1452-1457
2	1457-1462
3	1462-1467
4	1467-1472
5	1472-1477
6	1477-1482
7	1482-1487
8	1487-1492

LTE band 32 is a “downlink-only” band, i.e. transmission is one way in the downlink direction. This means it can only be used with carrier aggregation. At present, aggregation is only possible with the 800 MHz band (Band 20).

The further development of the 1500 MHz extension bands is difficult for the regulatory authority to assess. It is conceivable that the 1500 MHz expansion bands could extend the existing LTE band 32, whereas a completely different band structure (e.g. frequency duplex) could also be established for the broadened 1500 MHz band. For this reason it is questionable whether an immediate award of the “core” band would result in efficient frequency use.

The adjacent expansion bands are currently dedicated for other wireless services and used as specified in the Frequency Utilisation Ordinance (FNV). No specification has been included up to now in the FNV that would in accordance with Art. 52 par. 3 TKG 2003 limit the number of partial frequency bands that could be assigned. Until any assignment, these frequency ranges may not be completely available for use due to existing usage arrangements, and specifically certain use limitations are expected.

Questions

Question 3.6.: What impacts do you expect the decisions at the WRC15 to have on the usability of the “core” band?

Question 3.7.: In your view, would it make sense to assign the “core” band as quickly as possible, or should this wait until clarification about the 1500 MHz extension bands is obtained? Please give reasons for your answer.

Question 3.a: Would an assignment of the frequencies even involving use restrictions be attractive to you? What kind of use limitations would you find acceptable?

Question 3.8.: What future uses of the core band do you expect to see? Will this still be the current LTE band 32 (downlink only)? What timeline do you expect?

Question 3.9.: What future uses (band plans, duplex or downlink-only) of the 1500 MHz extension bands do you expect? What timeline do you expect?

Question 3.10.: What future carrier aggregation opportunities do you expect for the core band?

Question 3.11.: Which business models and technologies will these frequencies likely be used for?

Question 3.12.: When should this band be assigned in your opinion? When do you expect terminal equipment and technologies to be available?

Question 3.13.: How should the band be divided up for the auction?

Question 3.14.: What minimum number of frequencies would a network operator need to obtain in order to use the frequencies in this band efficiently?

Question 3.15.: What is the maximum number of frequencies a network operator should be allowed to acquire in this band, and above which number of frequencies would frequency use no longer be efficient?

Question 3.16.: Are you interested in acquiring frequencies in this band? If yes, how many frequencies (minimum/maximum) do you plan to acquire?

3.3 2100 MHz band

The 2100 MHz band is used today for UMTS. Use for LTE is also expected in the future. The current rights of use from the assignment in 2000 expire on 31 December 2020. Given the intensive use of the band, by organising a timely award of frequency packages with use starting on 1 January 2021 the regulatory authority would like to ensure continuous use of the band and a prompt re-planning of the channels adjusted from 1 January 2021 based on the auction results.

The 2100 MHz band (LTE band 1) is presented in the following figure:

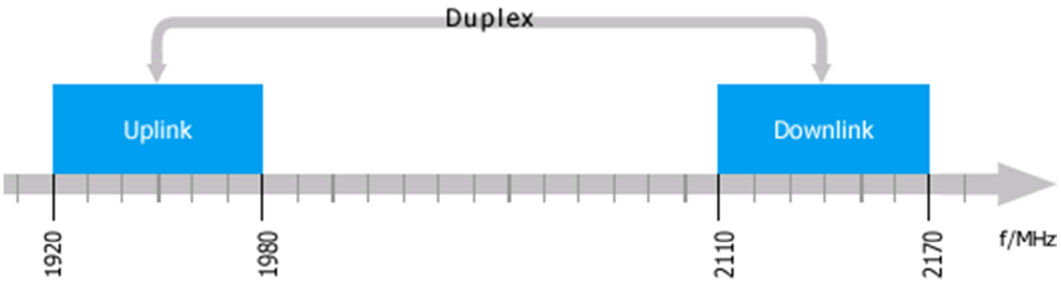


Figure 7: 2100 MHz band (LTE band 1)

The band comprises 2 x 60 MHz. Due to historical guard intervals to neighbouring bands, the current assignment is based on channels less than 5 MHz in some cases. With a future assignment of frequency packages the regulatory authority would like to ensure 5 MHz blocks (i.e. exactly 5.0 MHz), which results in the following list of blocks for a future assignment:

Table 8: List of frequency blocks in 2100 MHz band

Frequency blocks in 2100 MHz band	Uplink/MHz	Downlink/MHz
1	1920-1925	2110-2115
2	1925-1930	2115-2120
3	1930-1935	2120-2125
4	1935-1940	2125-2130
5	1940-1945	2130-2135
6	1945-1950	2135-2140
7	1950-1955	2140-2145
8	1955-1960	2145-2150
9	1950-1965	2150-2155
10	1965-1970	2155-2160
11	1970-1975	2160-2165
12	1975-1980	2165-2170

Questions

Question 3.17.: Do you consider the assignment of precisely 5 MHz blocks as per the table above to be appropriate?

Question 3.18.: Which business models and technologies will these frequencies likely be used for?

Question 3.19.: When should this band be assigned in your opinion?

Question 3.20.: How should the band be divided up for the auction?

Question 3.21.: What minimum number of frequencies would a network operator need to obtain in order to use the frequencies in this band efficiently?

Question 3.22.: What is the maximum number of frequencies a network operator should be allowed to acquire in this band, and above which number of frequencies would frequency use no longer be efficient?

Question 3.23.: Are you interested in acquiring frequencies in this band? If yes, how many frequencies (minimum/maximum) do you plan to acquire?

3.4 2300 MHz band

The 2300 MHz band is currently used for wireless cameras and for military telemetry. Internationally the band is earmarked as the global band for IMT (TDD LTE band 40). As with the 700 MHz band, terminal equipment is already available for this frequency band, not least because the band is already used today in key global markets (such as China and India).

From today's perspective it cannot be predicted when – and under what conditions – this band will be available in Austria. If future use becomes possible, this could be in the form of exclusive rights of use of the 2.3 GHz band (or a part of it) or licensed share access (LSA). LSA could facilitate coexistence of use for wireless cameras and use for mobile telecommunications (refer to Chapter 4.1.2).

Nevertheless, the regulatory authority would still like to gauge interest and possible implementation scenarios for this band.

The 5 MHz frequency blocks of the 2300 MHz band are presented in the following figure and table:

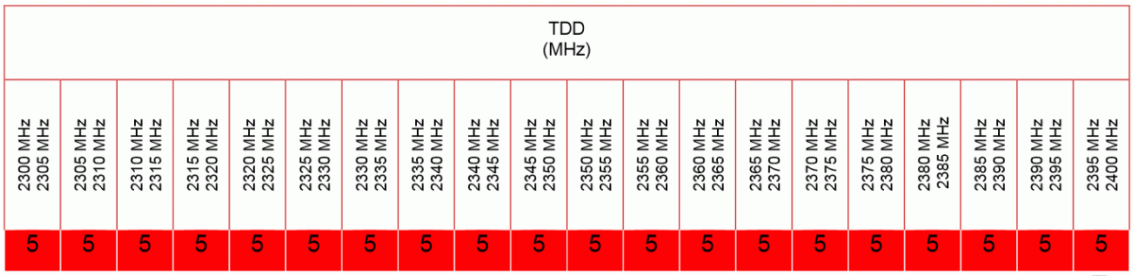


Figure 8: 2300 MHz band (LTE band 40)

Table 9: List of 5 MHz frequency blocks of the 2300 MHz band (abridged view)

Frequency blocks in 2300 MHz band	Frequency range/MHz
1	2300-2305
2	2305-2310
3	2310-2315
…	…
18	2385-2390
19	2390-2395
20	2395-2400

From the regulatory authority's perspective the 2300 MHz band is to be assigned nationwide (i.e. not in regions). The frequency band is expected to be used mainly for "hotspots" and indoors. For this reason the regulatory authority is considering allowing use for mobile services, specifically in regions where no incumbent use (i.e. existing use such as for wireless cameras and telemetry) is currently being made of the 2300 MHz band; in this case a (temporary/time-limited/restricted/permitted) use for mobile services could be allowed (refer to LSA in Section 4.1.2).

Investigations on behalf of Ofcom[21] have shown that some 2.4 GHz WLAN devices can be impaired by the adjacent use of LTE in frequency band 2300 MHz. Further studies currently being conducted should provide a clearer picture of the real interference potential[22] and of the need for restrictions.

Please refer to Chapter 34 for questions on the synchronisation of TDD use.

Questions

Question 3.24.: In which areas would you wish to use the 2300 MHz frequencies?

Question 3.25.: Would use of this band on an LSA basis be attractive for you in general? Why (not)?

[21] Refer tohttp://stakeholders.ofcom.org.uk/binaries/consultations/pssr-2014/annexes/The_Effect_of_TDD_LTE_Signals.pdf.

[22] It is essentially impossible to rule out interferences between different radio systems completely. This is why studies define the probability of interference in a pessimistic scenario. If the interferences in such conservative simulations are just minor, these are accepted.

Question 3.26.: In the case of LSA: what requirements would you have relating to temporary, local restrictions? How should such restrictions be specified and communicated as the occasion arises?

Question 3.27.: In the case of LSA: how quickly could a restriction of the area of use be implemented?

Question 3.28.: In the case of LSA: what overall conditions would be realistic for use under LSA?

Question 3.29.: If exclusive rights of use (i.e. not under LSA) are possible in a sub-band: Would a restriction be acceptable to you according to which temporary use for wireless cameras would still be permitted – and tolerated by spectrum holders – in areas where there are no 2300 MHz base stations? Would such a restriction lead to any disadvantages for mobile services use?

Question 3.30.: Which business models and technologies will these frequencies likely be used for?

Question 3.31.: When should this band be assigned in your opinion? When do you expect terminal equipment and technologies to be available?

Question 3.32.: How should the band be divided up for the auction?

Question 3.33.: What minimum number of frequencies would a network operator need to obtain in order to use the frequencies in this band efficiently?

Question 3.34.: What is the maximum number of frequencies a network operator should be allowed to acquire in this band, and above which number of frequencies would frequency use no longer be efficient?

Question 3.35.: Are you interested in acquiring frequencies in this band? If yes, how many frequencies (minimum/maximum) do you plan to acquire?

3.5 3400-3600 MHz band

The 3400-3600 MHz band (LTE band 42[23]) is also sometimes referred to as the (lower) “C band”. Apart from satellite use, it was previously used for microwave radio, and since 2004 for wireless regional broadband services and for wireless cameras for a limited term. The licences for regional broadband services expire on 31 December 2019.

The frequency band is depicted in the following chart:

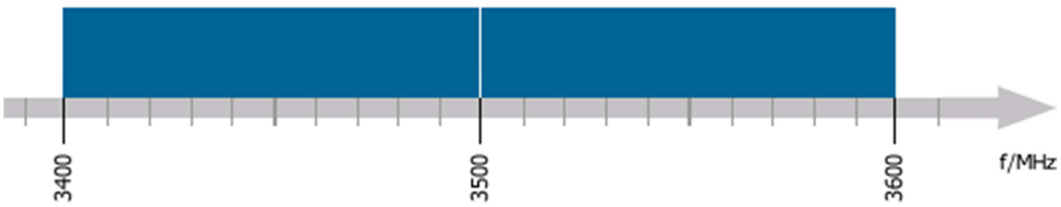


Figure 9: 3400-3600 MHz band (LTE band 42)

Use for mobile broadband is expected in the future. This band is suitable for high data transmission rates because of its large bandwidth. Given the relatively high frequency for mobile

[23] LTE band 42 facilitates the use of TDD. Additionally, the 3GPP has also earmarked LTE band 22 for possible FDD use.

telecommunications, its range is very low, which means it is likely to be used first and foremost for hotspots. The band is also well suited for the indoor coverage of buildings. The number of frequencies in this band is limited; the regulatory authority is planning to schedule an award that enables use from 1 January 2020.

At the WRC15 the mobile telecommunication identification for this band in Region 1 was converted into an entry in the frequency allocation table; the band was identified for IMT. This strengthened the position of the frequency band. The conditions[24] of a PFD limit and the application of footnotes 9.17, 9.18 and 9.21 are not expected to limit the use of the frequency band in Austria.

Previous assignments[25] related to a paired spectrum as a multiple of 7 MHz, i.e. frequency blocks with a duplex distance of 100 MHz were assigned. Consequently, FDD was the preferred use. TDD use was also an option here, with the proviso, however, that the use of FDD in neighbouring areas and on adjacent frequencies was not impaired.

After intensive discussions within the CEPT[26], TDD was specified as the preferred duplex mode of operation in the European Union through Commission Implementing Decision 2014/276/EU:[27]

The preferred duplex mode of operation in the 3400-3600 MHz sub-band shall be Time Division Duplex (TDD). Member States may alternatively implement Frequency Division Duplex (FDD) mode of operation in the 3400-3600 MHz sub-band for the purpose of:

a) ensuring greater efficiency of spectrum use, such as when sharing with existing rights of use during a co-existence period or implementing market-based spectrum management; or

b) protecting existing uses or avoiding interference; or

c) coordination with non-EU countries.

None of the reasons listed would speak for an alternative mode of operation (i.e. FDD), in the opinion of the regulatory authority. This is why an unpaired assignment of 5 MHz blocks (or multiples thereof) is planned. While a “subordinate” enabling of use would be feasible in principle, this would either make the assignment inefficient or significantly increase its complexity.

In the past, the 3400-3600 MHz frequency range was not fully available. This was partly because of a different use in the 3400-3410 MHz range, and partly because of the FDD band plan based on 7 MHz channels. Consequently, 3410-3494 MHz paired with 3510-3594 MHz was assigned, with 7 MHz guard channels between the awarded frequencies.

Current use in the frequency range 3400-3410 MHz limits the use to frequencies over 3410 MHz, which means the 3410-3600 MHz range can be assigned. This can be done in blocks of 5 MHz (or multiples thereof):

Table 10: List of 5 MHz frequency blocks in 3400-3600 MHz band (abridged view)

Frequency blocks in 3400-3600 MHz band	Frequency range/MHz
1	3410-3415
2	3415-3420
3	3425-3430
…	…

[24] Refer to Final Acts of WRC15.

[25] Details on previous assignments can be found at https://www.rtr.at/en/tk/Spectrum3400_3600MHz.

[26] The result of the discussion within the ECC can be found in document ECC/DEC(11)06, at http://www.erodocdb.dk/docs/doc98/official/pdf/Rec1106.pdf.

[27] Refer to https://www.rtr.at/en/tk/Spectrum3400_3600MHz/1999_2014_276_EU_en.pdf.

35	3585-3590
37	3590-3595
38	3595-3600

In principle, use for both mobile telecommunications (i.e. LTE) and for regional broadband providers (WiMax, wireless DOCSIS, LTE) would be conceivable. While mobile telecommunications use is generally nationwide, use for regional broadband providers means a regional assignment of the frequencies. This gives rise to the additional need to define regions as well as conditions of use at regional borders.

Use for regional broadband providers can potentially require higher maximum transmission power to terminal stations (i.e. mobile stations at the end users). In Appendix 1, Point C, Table 7 of Commission Implementing Decision 2014/276/EU, equivalent isotropic radiated power (EIRP) of 25 dBm is permitted. However, the Commission Implementing Decision does enable Member States to relax the limit under certain circumstances, provided that protection of other existing use in the 3400-3600 MHz frequency band is not compromised and cross-border obligations are fulfilled. It must therefore be clarified whether an EIRP of 25 dBm is enough for regional broadband providers[28].

3.5.1 Conditions of use at regional borders

ECC Recommendation (15)01 comprises recommendations for cross-border coordination in frequency ranges 3400-3600 and 3600-3800 MHz. Borders for domestic regions could also be regulated based on the recommendations drawn up for national borders. In a study for ComReg, Plum Consulting put forward a coordination threshold limit of 32 dBµV/m/5 MHz for 90% of the time and a 90% location probability. In principle, this seems reasonable to the regulatory authority. It also makes sense for network operators that are geographically adjacent to coordinate activities. This potentially allows the use of higher field strengths at the border. If on the other hand no agreement is reached between neighbouring operators, the coordination threshold value would be applied.

3.5.2 Synchronisation in 3400-3600 MHz band

Please refer mainly to Chapter 3.7 for questions on the synchronisation of TDD use. In terms of synchronisation, the 3400-3600 MHz band would be considered separately from the adjacent 3600-3800 MHz band, i.e. it would be assumed that both bands will not necessarily be operated synchronously. The resulting guard interval would be at the expense of use in the 3600-3800 MHz band, but in any case there would be no frequency restrictions for the 3400-3600 MHz band.

Questions

Question 3.36.: In the case of use for regional broadband providers: what output (EIRP) would be necessary for terminal stations? What would the restrictions be if limited to 25 dBm?

Question 3.37.: In the case of use for mobile telecommunications: would there be any impairment if terminal stations – considered neighbouring in terms of either location or frequency – to be used by regional broadband providers were to apply an EIRP higher than 25 dBm? What precautionary measures could be taken to prevent impairment?

[28] In its consultation on the 3.6 GHz band spectrum award dated 10 July 2015 (refer to http://www.comreg.ie/publications/consultation_on_proposed_3_6_ghz_band_spectrum_award.583.104900.p.html, page 164), Irish regulatory authority ComReg proposed a limit of 37 dBm/5 MHz, with the additional 12 dBi coming from CPE antenna gains; the electrical power at the antenna port would still be limited to 25 dBm, however.

Question 3.38.: In terms of synchronisation do you think it makes sense to consider the 3400-3600 MHz and 3600-3800 MHz bands separately from the proposed solution for the bordering channel between the bands? Please give reasons for your answer.

Question 3.39.: Would use by wireless cameras for a limited time be acceptable in areas where the frequencies are not actually used for communications services? Why (not)?

Question 3.40.: In the event of a regional award of frequency packages do you think it is appropriate to define coordination threshold limits at the regional borders and permit bilateral/multilateral coexistence agreements?

Question 3.41.: Which business models and technologies will these frequencies likely be used for?

Question 3.42.: When should this band be assigned in your opinion? When do you expect terminal equipment and technologies to be available?

Question 3.43.: How should the band be divided up for the auction?

Question 3.44.: What minimum number of frequencies would a network operator need to obtain in order to use the frequencies in this band efficiently?

Question 3.45.: What is the maximum number of frequencies a network operator should be allowed to acquire in this band, and above which number of frequencies would frequency use no longer be efficient?

Question 3.46.: Are you interested in acquiring frequencies in this band? If yes, how many frequencies (minimum/maximum) do you plan to acquire?

Question 3.47.: In which areas would you use the frequencies?

3.6 3600-3800 MHz band

The 3600-3800 MHz band (LTE band 43) is sometimes also referred to as the (upper) “C band”. It is a key component of fixed wireless service via satellite. Depending on the geographical location and the technical parameters, the corresponding earth stations require coordination zones with varying limits of expansion. For this reason, frequency use has to be coordinated in these geographical areas. In Austria there is currently one earth station in operation, located at Aflenz, that uses this frequency range. Due to the situation at Aflenz, a local coordination zone is required to protect the earth station there. In addition to use for fixed wireless service via satellite, the frequency band concerned is also being used for wireless camera applications for a limited term. The number of frequencies in this band has been limited and the band can therefore be awarded by the regulatory authority. EU Commission Implementing Decision 2014/276/EU defines TDD use for this band.

The following figure displays the frequency band:

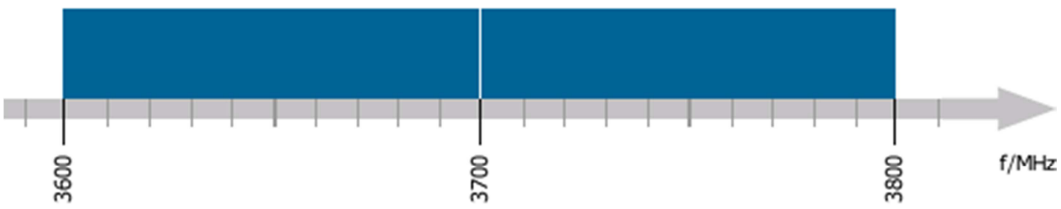


Figure 10: 3400-3600 MHz band (LTE band 43)

The entire frequency band is available, apart from the geographical coordination zone around Aflenz.[29] The assignment can ensue in blocks of 5 MHz (or multiples thereof):

Table 11: List of 5 MHz frequency blocks in 3600-3800 MHz band (abridged view)

Frequency blocks in 3600-3800 MHz band	Frequency range/MHz
1[30]	3600-3605
2	3605-3610
3	3610-3615
…	…
38	3785-3790
39	3790-3795
40	3795-3800

At WRC15 the 3600-3700 MHz sub-band was also identified for IMT in Canada and the United States among others, and allocated primarily for mobile use in these countries. This means we can expect both of the sub-bands 3600-3700 MHz and 3700-3800 MHz to develop at differing degrees and speeds towards use for mobile telecommunications. It would appear the 3700-3800 MHz sub-band is interesting first and foremost for regional broadband services. The 3600-3700 MHz band, by contrast, is likely to expand the 3400-3600 MHz band underneath in the medium term for mobile telecommunications.

The regulatory authority is therefore considering to award the two 100 MHz sub-bands separately if the award procedure takes place, or possibly in two separate award procedures; another option is a simplified auction procedure for part of the 3700-3800 MHz band (refer to Chapter 4.1).

3.6.1 Synchronisation in 3600-3800 MHz band

Please refer to Chapter 3.7 among others for questions on the synchronisation of TDD use. In terms of synchronisation, the 3600-3800 MHz band would be considered separately from the adjacent 3400-3600 MHz band, i.e. it would be assumed that both bands will generally not be operated synchronously. The guard interval necessary as a result would be at the expense of use in the 3600-3800 MHz band. The lowest frequency block (3600-3605 MHz) would thus only be usable if the user of the 3605-3610 MHz frequency block ensures synchronous operation with the user of the 3595-3600 MHz frequency block. If different technologies or uplink/downlink ratios hinder the synchronisation, this would be the responsibility of the holder of the 3605-3610 MHz block. The holder of this block may lay no claims of any kind against the holder of the 3595-3600 MHz block with regard to synchronisation, uplink/downlink ratios or technology.

As part of the award procedure it is conceivable for the 3600-3605 MHz frequency block to be awarded additionally to the successful bidder of the 3605-3610 MHz frequency block.

[29] When constructed, the earth station was positioned so that it is surrounded by mountains, thereby minimising possible interferences, for example caused by airport radar systems. This positioning now benefits terrestrial use of the 3600-3800 MHz band: the surrounding mountains provide a natural barrier and also constitute the border of the protection zone.

[30] The lowest frequency block is a guard channel for the case that use of the adjacent frequency blocks is not synchronised.

If the band is split into two sub-bands of 100 MHz each, having no synchronisation between the sub-bands and thus defining the 3700-3705 MHz frequency block as a guard channel should also be considered.

Questions

Question 3.48.: In the case of use for regional broadband providers: what output (EIRP) would be necessary for terminal stations? What would the restrictions be if limited to 25 dBm?

Question 3.49.: In the case of use for mobile telecommunications: would there be any impairment if terminal stations – considered neighbouring in terms of either location or frequency – to be used by regional broadband providers were to apply an EIRP higher than 25 dBm? What precautionary measures could be taken to prevent impairment?

Question 3.50.: Would use by wireless cameras for a limited time be acceptable in areas where the frequencies are not actually used for communications services? Why (not)?

Question 3.51.: For a regional award of frequency packages: Which criteria would you use to define the regions, what specific regions would this produce? What would be the pros and cons of such a definition of regions?

Question 3.52.: Do you think the 3600-3700 MHz and 3700-3800 MHz sub-bands should have different availabilities and usage scenarios? If yes, please provide details.

Question 3.53.: In the event of a regional award of frequency packages do you think it is appropriate to define coordination threshold limits at the regional borders and permit bilateral/multilateral coexistence agreements?

Question 3.54.: Which business models and technologies will these frequencies in the 3600-3700 MHz range likely be used for?

Question 3.55.: Which business models and technologies will these frequencies in the 3700-3800 MHz range likely be used for?

Question 3.56.: When should the 3600-3700 MHz band be awarded in your opinion? When do you expect terminal equipment and technologies to be available?

Question 3.57.: When should the 3700-3800 MHz band be awarded in your opinion? When do you expect terminal equipment and technologies to be available?

Question 3.58.: How should the 3600-3700 MHz band be divided up for the auction?

Question 3.59.: How should the 3700-3800 MHz band be divided up for the auction?

Question 3.60.: What minimum number of frequencies would a network operator need to obtain in order to use the frequencies in the 3600-3700 MHz band efficiently?

Question 3.61.: What minimum number of frequencies would a network operator need to obtain in order to use the frequencies in the 3700-3800 MHz band efficiently?

Question 3.62.: What is the maximum number of frequencies a network operator should be allowed to acquire in the 3600-3700 MHz band, and above which number of frequencies would frequency use no longer be efficient?

Question 3.63.: What is the maximum number of frequencies a network operator should be allowed to acquire in the 3700-3800 MHz band, and above which number of frequencies would frequency use no longer be efficient?

Question 3.64.: Are you interested in acquiring frequencies in the 3600-3700 MHz band? If yes, how many frequencies (minimum/maximum) do you plan to acquire?

Question 3.65.: Are you interested in acquiring frequencies in the 3700-3800 MHz band? If yes, how many frequencies (minimum/maximum) do you plan to acquire?

Question 3.66.: In which areas would you use the frequencies?

3.7 Synchronisation of TDD use

TDD enables base stations to transmit and receive on the same frequency. Synchronised networks align all transmission and receiving time slots over the network, overcoming the risk that a base station transmits while a neighbouring base station receives and there is therefore interference.

If TDD networks are operated in the same area on adjacent channels then guard channels are required to minimise the risk of mutual interference from base stations, provided that no synchronisation is used. If multi-operator synchronisation is applied, this removes the interference between the base stations and the networks can co-exist, without the need for guard channels.

Given the possibility for regional licences (especially in the 3400-3800 MHz bands), interference could be reduced significantly through co-channel synchronisation at regional borders and thus the frequencies can be used closer to the regional borders than is the case when networks on both sides of the regional border are operated without synchronisation.

ECC Report 216 gives practical guidance for TDD networks synchronisation[31]. Furthermore, the report compiled by Plum Consulting for the Irish regulatory authority (Report 1 on 3600 MHz[32]) includes ideas and recommendations for TDD synchronisation.

To achieve synchronisation – across technologies if required – network operators must

- have a common reference clock to align the start of a time slot, and
- use a compatible frame structure.

Alongside the advantages of synchronisation, especially with regard to spectrum efficiency, the block edge mask permits higher performance limits for synchronised TDD networks.

Given the benefits of synchronisation, the regulatory authority believes that the award procedure should promote synchronised operation.

This should be determined in the award procedure and it influences the definition of the frequencies to be awarded. It follows that no guard channels should generally be defined for the 2300 MHz, 3400-3600 MHz and 3600-3800 MHz bands. It is also possible to change the strategy at a later date – provided all spectrum holders agree – or even have different co-existing solutions.

In the case of the 2.6 GHz auction a guard channel solution was defined for the TDD area. However, this solution appears to be less efficient for the much broader bands of 2300-2400 MHz, 3400-3600 MHz and 3600-3800 MHz. It is expected that network operators will want to acquire frequency blocks of 20 MHz (or multiples thereof) in these bands. If a network operator were to acquire 20 MHz, then under the “guard channel solution” they would be exposed to the risk of only being able to use 15 MHz of this spectrum. Were they to acquire 25 MHz, this would ensure the use of 20 MHz, but 5 MHz would in any case remain unused, since use of a single, unpaired 5 MHz block is inefficient at least in these frequency bands on account of the low bandwidth (and capacity).

3.7.1 Default frame structure

A compatible frame structure between network operators is required to achieve synchronisation. The frame structure defines the time slots for the uplinks and downlinks. These uplink and downlink time slots need to be aligned for the synchronisation to work. Technologies such as TDD-LTE or WiMax have technology-specific definitions of pre-defined frame structures that enable a range of downlink-uplink ratios. Selecting a suitable frame structure depends partly on the traffic profile (i.e. uplink and

[31] Refer to http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP216.PDF.

[32] Refer to http://www.plumconsulting.co.uk/pdfs/Plum_Jun_2015_ComReg_Technical_advice_3.6_GHz_band_Report_1_Coexistence_recommendations.pdf.

downlink traffic) to be transmitted over the network, and partly on whether the TDD frequency band is to be used independently or under a "carrier aggregation" arrangement.

Defining a default frame structure offers regulatory certainty for the first network operators that want to roll the network out in an area (i.e. there are no other networks with which to synchronise). It is therefore clear which BEM to apply. This would enable rapid use of the TDD bands and possibly avoid the need for time-consuming negotiations between operators about suitable frame structures.

There are currently seven TDD-LTE frame structures defined by the 3GPP:

Table 12: TDD-LTE frame structure options[33]

UL-DL Configuration	Subframe number										DL:UL Ratio
	0	1	2	3	4	5	6	7	8	9	
0	D	S	U	U	U	D	S	U	U	U	1:3
1	D	S	U	U	D	D	S	U	U	D	1:1
2	D	S	U	D	D	D	S	U	D	D	3:1
3	D	S	U	U	U	D	D	D	D	D	2:1
4	D	S	U	U	D	D	D	D	D	D	7:2
5	D	S	U	D	D	D	D	D	D	D	8:1
6	D	S	U	U	U	D	S	U	U	D	3:5

ECC Report 216 considered the compatibility between TDD-LTE frame structure options and existing WiMAX frame configurations. This evaluation revealed that the greatest probability of compatibility is with the use of TDD-LTE configuration 2 (i.e. a ratio of 3:1).

According to the aforementioned report by Plum Consulting, TDD-LTE configuration 2 is the most widely deployed configuration at present[34].

In its decision from 26 May 2015 on awarding the 2300 MHz and 3400-3600 MHz bands[35], UK regulatory authority Ofcom stated that configuration 2 would be the default frame structure. Those operators utilising configuration 2 would be required to operate under a permissive BEM and those choosing alternative frame structures would be required to operate under a restrictive BEM.

RTR believes that requiring a default frame structure promotes synchronisation between networks, facilitates a faster rollout of networks and ultimately results in more efficient use of frequencies. The market also seems to be moving towards configuration 2. This is why the regulatory authority recommends setting TDD-LTE configuration 2 (i.e. an uplink-downlink ratio of 3:1) or an equivalent frame structure of another technology as the default frame structure for TDD networks in the frequency bands 2300 MHz, 3400-3600 MHz and 3600-3800 MHz.

Operators using alternative frame structures (or those who do not synchronise transmissions with operators on neighbouring channels) would thus be limited to the restrictive BEM. Consequently, and to comply with these BEMs, such operators would need to have guard channels within their assigned spectrum. This would reduce the usable bandwidths available to these operators accordingly.

[33] Source: ComReg Consultation on 3600 MHz. "U" is for uplink transmission, "D" is for downlink transmission and "S" is a time slot used for a guard time.

[34] For example, this configuration is used in China and in Japan for TDD-LTE. The award of frequency packages will probably be based on this configuration in the United Kingdom and Ireland.

[35] Refer to http://stakeholders.ofcom.org.uk/binaries/consultations/2.3-3.4-ghz-auction-design/statement/statement.pdf.

In agreement with the planned specifications from Ofcom and ComReg, low-performance indoor cells (less than 24 dBm) would be exempted from the synchronisation obligation to avoid any interference.

Questions
Question 3.67.: Do you think synchronisation in the 2300 MHz band is appropriate? Why (not)?
Question 3.68.: Do you think synchronisation in the 3400-3600 MHz band is appropriate? Why (not)?
Question 3.69.: Do you think synchronisation in the 3600-3700 MHz sub-band is appropriate? Why (not)?
Question 3.70.: Do you think synchronisation in the 3700-3800 MHz sub-band is appropriate? Why (not)?
Question 3.71.: Is the planned specification of the TDD-LTE configuration 2 frame structure appropriate in your view? Why (not)? If not, which frame structure would you recommend and why?
Question 3.72.: Do you think that a synchronisation precision set at ±1.5 µs[36] is adequate? How should the clocking source be defined (e.g. first TDD network within a band or a definition relative to a reference time)? How should this clocking information be communicated between networks?
Question 3.73.: Do you think it is appropriate for a permissive BEM to be applied for synchronised and a restrictive BEM for unsynchronised networks? Why?
Question 3.74.: Do you think it is appropriate to exclude small cells from the synchronisation obligation? Why (not)?

[36] At a cell radius < 3 km (source: http://cpham.perso.univ-pau.fr/ENSEIGNEMENT/PAU-UPPA/RHD/PAPER/SyncLTESmallCell.pdf).

3.8 Frequency requirements across bands

Questions

Question 3.75.: Please enter your/the frequency requirement (minimum, maximum) for the following groups of bands. You can also expand the table with further band groups. Please give reasons for the required frequencies.

700 MHz (2x30 Mhz)	1500 MHz (40 MHz)[b]	2100 MHz (2x60 MHz)	2300 MHz (100 MHz)[b]	3400-3600 MHz (190 MHz)[b]	3600-3700 MHz (100 MHz)[b]	3700-3800 MHz (100 MHz)[b]	Frequency requirement Minimum - Maximum (in MHz[a])
X		X					
X		X		X			
X	X	X		X			
X	X	X	X	X			
				X	X	X	
					X	X	

[a] Please multiply paired spectrum by a factor of 2.
[b] For the number of frequencies available in the bands, please refer to Chapter 3.

4 Frequency awards

4.1 Award models

Frequencies must be awarded by the Telekom-Control-Kommission (TKK) based on an auction procedure in accordance with Art. 55 of the 2003 Telecommunications Act (TKG 2003). The TKK is responsible for designing the award procedure for frequency packages. The TKK has to formulate suitable rules for determining the standing high bid (auction design), but must also decide whether national or regional rights of use are to be awarded. A model, referred to as *licensed shared access*, is being discussed in Europe for the 2300 MHz band. The award of both nationwide and regional rights of use is conceivable for the 3400-3600 MHz and 3600-3800 MHz bands on account of the propagation characteristics and the forms of use expected.

4.1.1 Nationwide rights of use

In light of the specific propagation characteristics and forms of use (mobile telecommunications), the regulatory authority believes it would be useful to award nationwide rights of use for the 700 MHz, 1500 MHz and 2100 MHz bands. The regulatory authority does not expect there to be significantly varying regional demand for spectra in these bands. Mindful of the losses that a regional award could entail (protection zones), the specific propagation characteristics (especially 700 MHz) and the existing infrastructure (2100 MHz), the regulatory authority does not advocate the award of regional rights of use.

Questions
Question 4.1.: Do you share the view of the regulatory authority that the frequencies around 700 MHz, 2100 MHz and 1500 MHz should only be assigned based on nationwide rights of use?
Question 4.2.: If not, please explain why. Which model do you recommend?

4.1.2 Licensed shared access

Licensed shared access (LSA) is a specific model for joint use of frequencies by one (or more) incumbent(s) and one (or more) LSA licensee(s) (refer to Figure 11); in contrast to the LSA licensees, the incumbents are not telecommunications network operators.[37] The model is being discussed in Europe in connection with the 2300 MHz band, but could be used in other frequency ranges in future too. This model is designed to help improve the efficiency of frequency use and make more spectra available for broadband on a non-exclusive basis in the long run.

[37] Refer to *Licensed Shared Access (LSA),* ECC Report 205, June 2014, see http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP205.PDF .

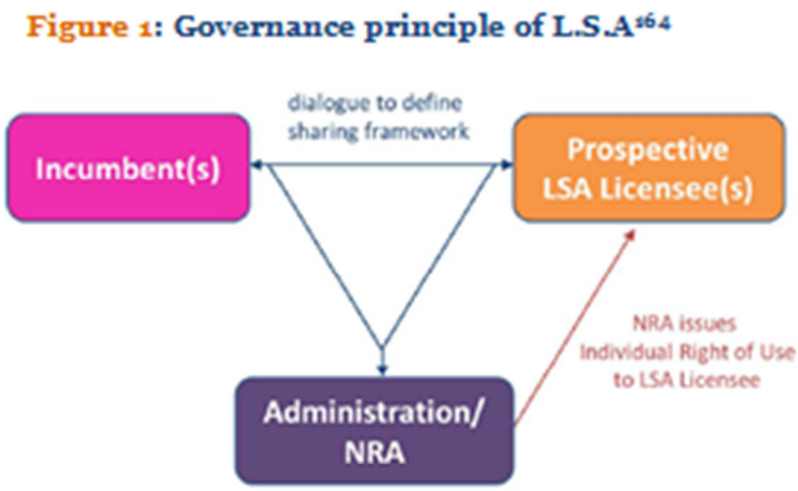


Figure 11: Licensed shared access
Source: ECC Report 205, refer to http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP205.PDF.
.

Joint use is based on a sharing framework to be negotiated by the frequency administration, the incumbents and the mobile network operators as future LSA licensees. The following forms of joint use are conceivable:

- Purely static use of mobile telecommunications in certain areas
- Semi-static use of mobile telecommunications at certain fixed, pre-determined times (in certain areas)
- Dynamic use through mobile telecommunications; here the time and location availability can change over time (coordination via a geo-location database)

In this context (especially with dynamic use), from a regulatory perspective the issue of accompanying economic conditions arises, including:

- How can an incentive system be designed to encourage incumbent users to make the frequencies available?
- How can sufficient investment security be ensured for the mobile telecommunications industry?

Significant importance is attached to these and other questions when designing the sharing framework. It is still unclear at present whether an LSA model will be applied in Austria and what the general conditions will be. However, the regulatory authority would already like to discuss a range of outstanding issues with potential users to help with the ongoing preparatory work.

Questions

Question 4.3.: How do you rate the potential of LSA with regard to the various sharing concepts? What are the pros and cons?

Question 4.4.: How should the general technical and economic conditions be designed so that LSA works?

Question 4.5.: Would you use LSA as a licensee? Which requirements need to be fulfilled for you to use LSA and invest in the corresponding technologies?

Question 4.6.: In this context the general issue arises as to the costs and benefits of LSA as compared with completely freeing the band. Assuming that replacement spectrum is

available, would you find it ultimately more expedient if future users of the band would bear the expense of relocating incumbent users to another frequency range in order to make the band available for exclusive use for mobile services?

4.1.3 Regional rights of use with set regional borders

The award of regional rights of use with set regional borders is conceivable both for the 3400-3600 MHz band as well as the 3600-3800 MHz band, and for sub-ranges within these bands. Such a model was used during the first auction of the 3400-3600 MHz band.

Here, Austria was divided into a certain number of non-overlapping regions, and one or more exclusive rights of use were auctioned off for each region. Figure 12 presents the six regions – defined mainly based on economic considerations – which were applied during the first award of the 3400-3600 MHz band. As a result of several frequency trading procedures there are now 18 coverage areas (see Chapter 2.2.2). It was thus subsequently recognised that the chosen regional model was compatible only to a limited extent with the business models of the providers. If the TKK were to opt for a model with set regional borders, it would have to decide which regional model to choose. In this context it should also be considered that losses due to guard intervals increase with smaller coverage areas.

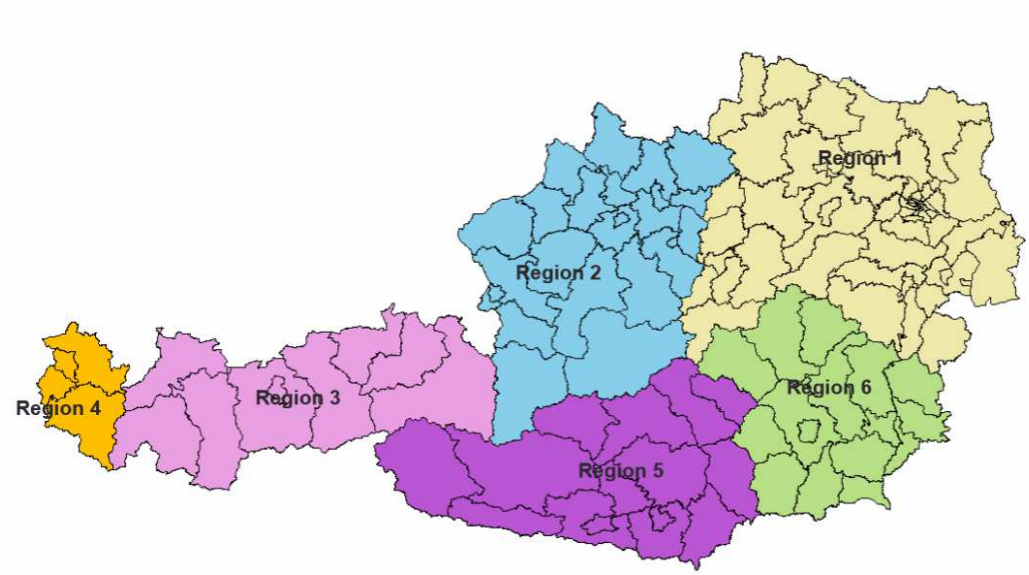


Figure 12: Economic regions at the 2004 award of frequency packages

The definition of the regions could be based on administrative boundaries (e.g. federal states), but also on economic zones; there could be a distinction made between rural and urban areas too. The latter could facilitate coexistence between urban mobile telecommunications and rural use for regional broadband services. That said, this approach has the disadvantage that suburban areas lie directly on regional borders, and these areas which are generally commercially important cannot be covered with the frequency band, or only to a limited extent. Furthermore, such a definition would be difficult because densely and sparsely populated areas are often closely adjacent.

The model with set regional borders has two disadvantages: firstly, as explained above, there is a risk of the division into regions not necessarily coinciding with the coverage areas of regional providers. Secondly, providers that want to cover several regions or even target nationwide use, such as mobile network operators, face a higher aggregation risk if they submit bids in the auction for individual frequencies in several regions.

The regulatory authority assumes that the medium to long-term demand of the mobile telecommunications industry for frequencies in the 3400-3600 MHz range will not be negligible, given

the traffic growth and the global IMT identification. Consequently, the regulatory authority will only award regional rights of use in this band (for part of the band) if there is clearly articulated demand from other network operators for these frequencies that cannot be satisfied by a corresponding supply in other frequency ranges, such as 3700-3800 MHz, which is more suited for regional wireless broadband services based on the global identification. If the regulatory authority awards regional rights of use for part of the 3400-3600 MHz band, when designing the auction it will seek to mitigate the aggregation risk, for example by adopting a combinatorial procedure.

Questions

Question 4.7.: Do you think assigning part of the 3400-3600 MHz band based on regional rights of use with set regional borders is the right approach, or would you prefer an award of nationwide rights of use for the entire frequency range? Please give reasons for your answer.

Question 4.8.: If yes, how would you recommend dividing the country into regions? Based on which criteria should the regions be defined? What would be the pros and cons of such a definition of regions?

Question 4.9.: If yes, would you submit bids in such a procedure? What coverage area would you aim at? How high would you estimate the aggregation risk is (per se) in an auction with a regional subdivision in this band?

Question 4.10.: Do you think assigning the 3600-3800 MHz frequency range based on regional rights of use with set regional borders is the right approach? Please give reasons for your answer.

Question 4.11.: If yes, how would you recommend dividing the country into regions? Based on which criteria should the regions be defined?

Question 4.12.: If yes, would you submit bids in such a procedure? What coverage area would you aim at? How high would you estimate the aggregation risk is (per se) in an auction with a regional subdivision in this band?

4.1.4 Regional rights of use with flexible coverage areas

There is currently no global IMT identification for the 3600-3800 MHz band, which is why the demand from mobile network operators for these frequencies – especially 3700-3800 MHz – is quite uncertain even in the long term. Against this background the regulatory authority would like to put a simplified auction procedure up for discussion for part of this band. Similar to the *light licensing* concept, the procedure would be better suited to the needs of regional providers (*light auctioning)*. To employ this procedure, however, the following premises must apply in the opinion of the regulatory authority:

- There is no – suitably large – interest in a nationwide use of individual frequencies or in larger, closed coverage areas that would preclude the procedure.
- The demand of individual interested parties varies strongly from region to region. The licensees tend to be interested in individual broadcasting locations (or very small coverage areas) and not in larger, closed coverage areas.
- At the same time, the award of exclusive rights of use should guarantee a minimum of interference protection.
- There is relatively little competition for use in individual coverage areas. The providers and interested parties are mostly active in different areas.
- In the event of competition for use in a certain area, the amount of the bid will be the key deciding factor. This ensures full compliance with the regulations of Art. 55 TKG 2003.

As part of such a light auction the regulatory authority would invite bids for a certain frequency range within the 3700-3800 MHz range without set regional borders. During the tender submission period, potential bidders would then have the opportunity to submit tenders for one or more broadcasting locations. The tenders would include the location, the financial bid and, where applicable, technical parameters such as the transmission power. The coverage area including the protection zone for interference protection would be determined on this basis. It is also conceivable for bidders to submit several alternative tenders with different parameters for one or more locations.

After all the tenders are received, they would be compared to determine whether any conflict of coverage areas exist. If there are no conflicts, the rights of use (for the minimum bid) would be awarded (see Figure 13).

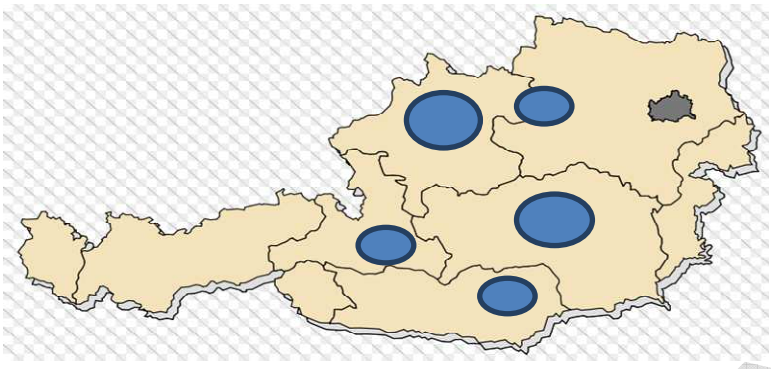


Figure 13: Light auctioning without competition for use

There is competition for use in individual regions where the protection zones overlap (Figure 14).

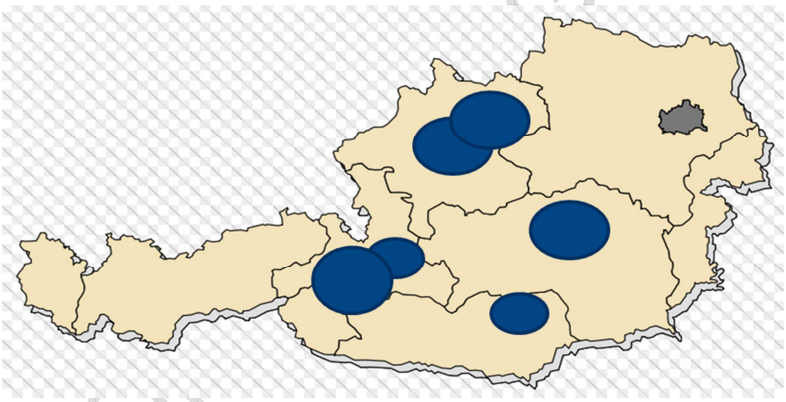


Figure 14: Light auctioning with competition for use

Only in this case are decision rules required to determine which bidder receives the contract award. According to Art. 55 TKG 2003, the decision is to be based on the amount of the bid (in financial terms). Suitable rules ensuring efficient frequency use must be established to determine the highest bidder and the payable price (first-price rule or second-price rule). What is more, for reasons of fair competition the maximum number of locations a bidder may apply for must be defined.

Questions

Question 4.13.: Do you think implementing such an award procedure (light auctioning) for the 3700-3800 MHz range is the right approach or would you prefer areas of use with set regional

borders or the award of nationwide rights of use? To what extent do the premises outlined above (not) apply? Please give reasons for your answer.

Question 4.14.: Would you submit a tender in such a procedure? If yes, please describe the business model in terms of its technical and economic criteria (e.g. point-to-point, point-to-multipoint, mobile indoor, number of users, etc.)? For how many locations would you submit tenders? Which coverage area would you target?

4.1.5 Preliminary position taken by the regulatory authority

The regulatory authority takes the following preliminary position with regard to the award model:

- Exclusive nationwide rights of use will be auctioned off in the 700 MHz, 1500 MHz and 2100 MHz bands.
- The actual availability and later the conditions of use are still to be determined for the 2300 MHz band. Depending on the conditions of use, a licensed shared access variant could be adopted.
- The preference for the 3400-3600 MHz band is to auction off nationwide rights of use. Only if there is clearly articulated demand for regional rights of use that cannot be satisfied by a corresponding supply in other frequency ranges could parts of the band be auctioned off on the basis of regional rights of use with set regional borders. In this case, however, when designing the auction the regulatory authority will make sure to mitigate the aggregation risk as much as possible, by using a combinatorial procedure for example.
- The regulatory authority is considering awarding regional rights of use for (at least) part of the 3700-3800 MHz range. Assuming there are no serious reservations are expressed regarding the premises listed above, the regulatory authority plans an assignment with flexible regional borders (light auctioning), otherwise the assignment will include set regional borders. The remainder of the 3600-3800 MHz band would be awarded in a subsequent award procedure.

Questions

Question 4.15.: What is your opinion of the preliminary position taken by the regulatory authority with regard to the award model? Please give reasons for any disagreement with it.

4.2 Competition

In the course of designing the auction, the TKK has to make a series of decisions that could impact the competition prevailing in markets downstream of the frequency markets. Examples include:

- A product designed in a certain way can improve or detract from the appeal of the offered frequencies for certain interested parties. For instance, new entrants can consider it important that both coverage and capacity spectra are offered in an auction. Mobile network operators are presumably interested mainly in nationwide rights of use, and regional wireless broadband providers in rights of use for smaller geographical coverage areas.
- Appropriate spectrum caps can prevent a network operator or a group of operators from acquiring too much spectra and therefore a dominant position. Spectrum caps can be determined for individual bands and for groups of bands (e.g. for bands under 1 GHz).
- Spectra can be implicitly reserved by means of competition constraints (spectrum floors), ensuring that a minimum number of network operators have a minimum number of frequencies to be able to function as effective competitors. This concept can only be

implemented as part of a Combinatorial Clock Auction (CCA) and requires the normative determination of minimum spectrum portfolios for each (type) of network operator.

- The TKK can also explicitly reserve spectra for a new entrant or very small network operators (set asides). The regulatory authority believes that reserving spectra for a new entrant first requires a market analysis to identify any challenges to competition.
- Reserving spectra can be supplemented by such further measures to support new entrants as to compensate for the disadvantages of entering the market at a later date (entry assistance). These include, for example, obliging existing network operators to provide new entrants with temporary access to their networks especially in rural areas (i.e. national roaming, site-sharing etc.).

Safeguarding competition is one of the regulatory authority's key goals in the award procedure. To ensure fair market entry conditions for any new entrants, the regulatory authority is planning at the very least to carry out a multiband auction of coverage and capacity spectra in the coming years.

With a view to taking any further measures, the regulatory authority would like to pose a series of questions to the sector. In particular, the regulatory authority wants to ascertain the minimum frequency spectrum that a network operator requires to be able to function as an effective player on the Austrian mobile telecommunications market, and the maximum amount of spectra that a network operator should be allowed to acquire.

Questions

Question 4.16.: Please enter for the following band groups the minimum bandwidth that a network operator (new or existing) needs to be able to operate as an effective competitor on the mobile telecommunications market. You may add to the table. Please give reasons for the requirements.

700 MHz (2 x 30 MHz)	800 MHz (2 x 30 MHz)	900 MHz (2 x 30 MHz)	1500 MHz (40 MHz)[b]	1800 MHz (2 x 75 MHz)	2100 MHz (2 x 60 MHz)	2300 MHz (100 MHz)[b]	2600 MHz (2 x 70 MHz + 50 MHz)	3400-3600 MHz (190 MHz)[b]	3600-3700 MHz (100 MHz)[b]	3700-3800 MHz (100 MHz)[b]	Minimum bandwidth for an effective competitor (in MHz[a] or as share of that band group in %)
X	X	X									
				X	X		X				
X	X	X		X	X		X				

[a] Please multiply paired spectrum by a factor of 2.
[b] For the number of frequencies available in the bands, please refer to Chapter 3.

Question 4.17.: Please indicate the maximum spectra a network operator should be allowed to acquire – taking into account current bandwidth in the 800 MHz, 900 MHz, 1800 MHz and 2600 MHz bands . You may add to the table. Please give reasons for the restrictions.

700 MHz (2 x 30 MHz)	800 MHz (2 x 30 MHz)	900 MHz (2 x 30 MHz)	1500 MHz (40 MHz)[b]	1800 MHz (2 x 75 MHz)	2100 MHz (2 x 60 MHz)	2300 MHz (100 MHz)[b]	2600 MHz (2 x 70 MHz + 50 MHz)	3400-3600 MHz (190 MHz)[b]	3600-3700 MHz (100 MHz)[b]	3700-3800 MHz (100 MHz)[b]	Maximum frequency spectra (in MHz[a] or as share of that band group in %)
X	X	X									
X	X	X		X	X						
X	X	X		X	X		X				
X	X	X		X	X		X	X			
X					X						
X					X			X			
								X	X	X	

[a] Please multiply paired spectrum by a factor of 2.
[b] For the number of frequencies available in the bands, please refer to Chapter 3.

Question 4.18.: Do you think measures are required to encourage new entrants into mobile telecommunications? If yes, what kind of measures?

Question 4.19.: Are you contemplating entering the Austrian mobile telecommunications market as a new entrant? If yes, what conditions have to exist?

Question 4.20.: In the event the TKK awards regional rights of use for frequencies in the 3700-3800 MHz range based on flexible regional borders (light auctioning), what is the maximum number of locations a network operator should be able to bid for?

4.3 Bundling of bands

The question in terms of the bands to be awarded is which frequencies, if any at all, should be jointly awarded in a so-called multiband auction. Alongside procedural efficiency there are principally two significant reasons why different frequency bands are auctioned off in one multiband auction:

- Where frequencies are (close) substitutes: where different frequencies (or portfolios of frequencies from different bands) are substitutes, auctioning them off in a simultaneous auction has advantages for bidders. In this case, bidders face the challenge of purchasing the frequencies that are least expensive in relative terms. This decision is made easier if the bidders can react to relative price changes by altering demand, and switch from one band to another for example. This is not possible in a sequential auction. In a sequential auction, bidders have to make their decisions based on expectations of future prices. Such decisions beset with uncertainties are naturally a risk, which is why we also talk about substitution risks. This risk can be significantly reduced with an appropriately designed simultaneous auction.
- Where there are complementary relationships between the frequencies: complementary interdependencies (or synergies) exist when the value of a number of frequencies is higher than the sum of the values of the individual frequencies. Complementary interdependencies regularly occur with frequencies for broadband technologies. For example, it is more efficient to roll out LTE with four blocks in one band than with one or two blocks. Another example is the joint evaluation of coverage and capacity spectra or the evaluation of frequencies from different bands for carrier aggregation. In this context we refer to aggregation risks that bidders are exposed to when they try to bring together individual blocks into a large whole, and thereby run the risk of buying a suboptimal quantity at possibly excessive prices. The aggregation risk can be mitigated or even eliminated through an appropriately designed auction. One requirement for such a design, however, is auctioning off the given frequencies simultaneously.

That said, the complexity and risks for bidders rise with the number of frequencies to be auctioned off in a joint auction (one shot game). Additionally, bidders with narrow budget constraints can be disadvantaged in large auctions. Thus, when deciding which bands to bundle together, the right balance must be struck between the advantages and disadvantages outlined above.

The regulatory authority believes that a balance is always given where the joint auction only bundles frequencies for which close economic relationships exist, thus avoiding aggregation and substitution risks. The following tables contain the bands and groups of bands which could be (close) substitutes or complements based on current technology and the expected use.

Table 13: Possible (narrower) substitutes

Band (group) 1	Band (group) 2	Note
700 MHz	2100 MHz	Both bands may be used by individual network operators as LTE spectra or coverage spectra
2100 MHz	3400-3600 MHz	Both bands may be used as capacity spectra in urban areas
700 MHz + 2100 MHz	700 MHz + 3400-3600 MHz	Both band groups may be used as a mix of coverage and capacity spectra

Table 14: Possible complements

Band (group) 1	Band (group) 2	Note
700 MHz	2100 MHz	Coverage and capacity spectra Carrier aggregation
700 MHz	3400-3600 MHz	Coverage and capacity spectra
2100 MHz	3400-3600 MHz	Carrier aggregation

Based on this provisional assessment, the regulatory authority wishes to propose the following draft Spectrum Release Plan for discussion (see following table).

Table 15: Proposal for bundling bands

Bands	Note
Sub-range 3700-3800 MHz	Single-band auction: Light auctioning or regional assignment with set regional borders
700 MHz, 2100 MHz, 3400-3600 MHz	Multiband auction, or regional rights of use with set regional borders for a sub-range from the 3400-3600 MHz band (possibly in a separate auction)
1500 MHz	Single-band auction
2300 MHz*	Single-band auction
Remaining band 3600-3800 MHz	Single-band auction

* The availability of the conditions of use is still unclear

This plan comprises the following main points:

- A separate auction for part of the 3700-3800 MHz frequency range, either in the form of an auction with flexible coverage areas (light auctioning) or in the form of an assignment with set regional borders.
- A multiband auction of the 700 MHz and 2100 MHz bands, and – depending on the consultation input – the entire band or parts of the 3400-3600 MHz band. Depending on the demand expressed during the consultation, part of the 3400-3600 MHz band could also be assigned in the form of regional rights of use with set regional borders, either in a multiband auction or in a single-band auction.
- The other bands would be auctioned off as part of single-band auctions.

This draft Spectrum Release Plan is subject to the consultation input, the specific award objectives of the TKK and the specific conditions of use in the individual bands. This applies for example to the 700 MHz band. It is currently unclear just how homogeneous the frequency blocks will be, and what priorities the TKK will assign to the individual award objectives (e.g. coverage obligations). To keep the complexity at a manageable level, the award of this band together with other bands in a multiband auction requires the frequency blocks to be largely homogeneous.

Questions

Question 4.21.: What is your opinion of the interdependencies between the individual frequencies? Which frequencies are (close) substitutes, and for which frequencies or bands are there complementary relationships? Please give reasons for your answer.

Question 4.22.: What is your opinion of the regulatory authority's draft Spectrum Release Plan? Please give reasons for any disagreement with it.

Question 4.23.: If part of the 3400-3600 MHz band is to be assinged in the form of regional rights of use with set regional borders, should these rights of use be awarded in a separate auction or auctioned off as part of the multiband auction?

4.4 Schedule

Provided there are no serious reasons to deviate from the Spectrum Release Plan outlined above, the regulatory authority would like to propose the schedule for the individual award procedures shown in the following table.

Table 16: Proposed Schedule for Spectrum Release Plan

Bands	Auction schedule	Note
Sub-range 3700-3800 MHz	2017 or 2018	Single-band auction: Light auctioning or regional assignment with set regional borders
700 MHz, 2100 MHz, 3400-3600 MHz	End of 2018 to mid-2019	Multiband auction, or regional rights of use with set regional borders for a sub-range from the 3400-3600 MHz band (possibly in a separate auction)
1500 MHz	Depends on network operator needs and input to consultation**	Single-band auction
2300 MHz*	Depends on availability and requirements of network operators (but probably only after 2020)*	Single-band auction
Remaining band 3400-3600 MHz	Depends on network operator needs and input to consultation	Single-band auction

* The availability of the conditions of use is still unclear

** It is still unclear whether only the core band (40 MHz) or the entire band (100 MHz) is to be assigned (refer to Chapter 3.2).

The regulatory authority believes the frequencies in the 3700-3800 MHz band should be assigned first, to offer the current licensees in the 3400-3600 MHz band a chance to switch to a band that has less competition for use with mobile telecommunications. The award date for the multiband auction is largely derived from the expiry date for the current rights of use in the 2100 MHz and 3400-3600 MHz bands as well as the Ministerial Council Decision on the second digital dividend (availability for mobile telecommunications as of 1 January 2020). The regulatory authority sees a corresponding window for the auction between the end of 2018 and the middle of 2019.

For the other auctions listed in the Spectrum Release Plan the regulatory authority would like to wait for the input of the consultation.

Questions

Question 4.24.: What is your opinion of the regulatory authority's schedule for the draft Spectrum Release Plan? Please give reasons for any disagreement with it.

Question 4.25.: In your opinion, when should the 3700-3800 MHz auction take place?

Question 4.26.: In your opinion, when should the multiband auction of the 700 MHz, 2100 MHz and possibly 3400-3600 MHz bands take place?

Question 4.27.: If the entire 3400-3600 MHz band or part of the 3400-3600 MHz band is to be assigned in a separate auction in the form of regional rights of use with set regional borders, when should these auctions take place?

Question 4.28.: In your opinion, when should the single-band 1500 MHz auction take place?

Question 4.29.: In your opinion, when should the single-band 2300 MHz auction take place?

Question 4.30.: In your opinion, when should the single-band auction for the remaining 3600-3800 MHz band take place?

Question 4.31.: If you would propose a different award plan, please provide the schedule.

---

5 Publication of consultation results

Statements (in German or English) must be emailed by **5 May 2016** to

tkfreq@rtr.at.

Please use the cover sheet below.

RTR will publish a summary (without naming organisations or individuals) of all the statements received. Additionally, a list of the organisations/individuals that submitted statements for the consultation and consented to disclosure of the organisation/individual will be published.

If requested, the complete, individual statements will be published as well.

Cover sheet – Statement on the Consultation on Future Frequency Awards

General information

Statement submitted by:

Represented by (if applicable):

Postal address:

E-mail address:

Confidentiality

Please indicate whether your statement is confidential and, if so, which parts, while providing reasons:

Non-confidential	☐	Name/Contact information/Profe	☐
Contents of the statement are confidential	☐	Organisation	☐
Passages of the statement are confidential	☐	In this case we request you	

to additionally submit an appropriately redacted version of the document that you consider suitable for publication.

RTR will publish a summary (without naming organisations or individuals) of all the statements received. Additionally, a list of the organisations/individuals that submitted statements for the consultation and consented to disclosure of the organisation/individual will be published.

Declaration

I hereby confirm that this communication is a formal statement within the framework of the current consultation and that the statement may be published by RTR subject to any confidentiality requests indicated above. When submitting the statement by e-mail, any standard e-mail texts concerning the confidentiality or disclosure of e-mail contents (including any attachments) will not be considered relevant by RTR for the case of publication.

Name: Signature: