



Commission for
Communications Regulation

Results of the 3.6 GHz Band Spectrum Award

Information Notice

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**An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation**

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1 Results of the 3.6 GHz Band Spectrum Award

1.1 Introduction

1.1 Following its Decision (Document 16/57 and D04/16), ComReg initiated the Award Process with the publication of its Information Memorandum (IM) (Document 16/71). The IM sets out the processes and procedures ComReg employed in conducting this Award Process. In accordance with its Decision, and as demand for the 350 MHz of Award Spectrum exceeded supply, ComReg proceeded to award the spectrum rights of use via an Auction.

1.2 Results of the 3.6 GHz Band Spectrum Auction

1.2 The Auction resulted in the successful assignment of all 350 MHz of TDD¹ spectrum². The Auction offered this spectrum in 594 lots spread over nine geographic regions (four rural and five urban) and is assigned on a contiguous basis³.

1.3 The Auction resulted in five Winning Bidders⁴:

- **Imagine Communications Ireland Ltd (Imagine)**, currently the largest Wireless Internet Service Provider (WISP) obtained spectrum rights of use for **60 MHz in each of the rural regions**;
- **Airspan Spectrum Holdings Ltd (Airspan)**, a new entrant and the UK arm of a US global provider of 4G broadband wireless systems and solutions. Airspan's products serve operators and markets such as smart utilities, transportation and public safety in both licensed and licence exempt frequency bands. Airspan obtained spectrum rights of use for **25 MHz in the rural regions and 60 MHz in the cities**;
- **Vodafone Ireland Ltd**, a mobile network operator with circa 2.3 million mobile subscribers (38.5% market share) and circa 268,00 fixed broadband

¹ Time Division Duplex

² Please note that the results presented here are preliminary, in that the frequency plan as presented in Annex 7 is subject to any changes arising from the Negotiation Phase. ComReg will later publish the final results.

³ The Award Spectrum and the Regions are as set out in Annexes 4 and 5 respectively.

⁴ Annex 1 provides a table with the results set out in more detail.

subscribers (19.7% market share) obtained **85 MHz in rural regions and 105 MHz in the cities;**

- **Three Ireland Hutchison Ltd**, a mobile network operator with circa 2.08 million mobile subscribers (35% market share) obtained **100 MHz nationally;** and
- **Meteor Mobile Communications Ltd**, a mobile network operator and a wholly owned subsidiary of Eircom Group which has circa 1.08 million mobile subscribers (18 % market share). Eircom Group has circa 444,000 fixed broadband subscribers (32.6% market share). Meteor obtained **80 MHz in the rural regions and 85 MHz in the cities.**

- 1.4 All spectrum rights of use obtained under the Auction will expire on 31 July 2032 (fifteen years). **Winning bidders will pay in excess of €78m for spectrum rights of use**, comprising €60.5m in upfront fees and €17.7m⁵ in spectrum usage fees which will be paid over the 15 year duration of the licences. Full details are set out at Annex 1.
- 1.5 The availability of the Lots in the band is subject to the completion of Transition Activities to be set out in the Transition Plan and agreed between existing and new licensees in keeping with the steps outlined at Section 3.8 of the Information Memorandum.
- 1.6 ComReg was advised on the design and implementation of its award by DotEcon, a global supplier of design and build services for high value auctions. The results of the award have been independently verified.
- 1.7 Following this award, ComReg is at the vanguard in Europe, having awarded 350 MHz on a TDD basis and in full accordance with the harmonisation Decision, **fully ready for any future 5G deployment.**

1.3 Key Award Features

- 1.8 The award contains a number of key features:
- the 350 MHz of spectrum was made available in nine separate geographic regions covering the entire country⁶. The Award design considered a number of factors, including; (1) the potential for different types of bidders (urban and rural); (2) the scale of potential bidders including incumbent operators and potential

⁵ Spectrum Usage Fees will be indexed to CPI and paid annually over the duration of the Award. Figures presented do not assume any adjustment and are presented as indicative.

⁶ The Regions are as set out in Annex 5

new entrants; and, (3) compatibility with the lots on offer in the National Broadband Plan;

- the Award design allowed for both regional and national operators to acquire spectrum rights of use for large contiguous blocks of TDD spectrum in multiples of 5 MHz⁷;
- consortia bidding was facilitated prior to application to allow operators to come together to create larger economies of scale, and
- the potential for operators to (1) roll-out services quickly, (2) maximise the use of the spectrum assigned to them, and (3) ultimately provide better quality services to customers was facilitated by;
 - setting out an Inter-Licensee Synchronisation Procedure that all Licensees are bound by;
 - establishing a procedure for Winning Bidders to enter into Alliances in advance of the Assignment Round and jointly bid for their preferred spectrum assignment⁸; and,
 - generating Assignment Options for Bidders so that they obtain the same spectrum in each region to the maximum extent.

1.9 The above taken together, contributed to a flexibly designed award, which facilitated divergent bidders to obtain spectrum rights of use while also ensuring a very efficient outcome.

1.4 Potential Uses

1.10 The 3.6 GHz band is fully harmonised at a European level for the terrestrial provision of electronic communications services (ECS), mainly targeting the provision of wireless broadband (WBB) services. The completion of this award, and the assignment of new spectrum rights of use on a service and technology neutral basis, will ensure that Ireland is now in full accordance with the 3.6 GHz EC Decision⁹ which is mandatory for all EU Member States.

1.11 The 3.6 GHz band is currently used for the provision of fixed wireless access services to about twenty five thousand customers, predominantly in rural areas.

⁷ Bidders could select the number of B lots they required in multiples of 5 MHz (up to the competition Cap) and be assured of their contiguity.

⁸ Airspan and Imagine availed of this provision and bid jointly in the Assignment Round.

⁹ The 2014 3.6 GHz EC Decision of 2 May 2014 (2014/276/EC) on amending the 2008 3.6 GHz EC Decision 2008/411/EC on the harmonisation of the 3 400 – 3 800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community <http://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:32014D0276&from=EN>

Imagine Communications Ireland Limited, by far the largest provider of fixed wireless access services in the 3.6 GHz band, holding 80% of the existing licences in the band, has secured sufficient spectrum so as to be in a position to maintain and enhance services.

- 1.12 The 3.6 GHz band has also been identified by the Radio Spectrum Policy Group (“RSPG”)¹⁰ as a suitable band for the delivery of wireless broadband applications¹¹. This is recognised in the 3.6 GHz EC Decision. Further, the RSPG opinion on spectrum related aspects for next-generation wireless systems (5G) identified the 3.6 GHz band as the primary band suitable for the introduction of 5G in Europe, even before 2020¹².
- 1.13 Given the quantum of spectrum in the 3.6 GHz band, the preferred TDD channelling arrangement¹³ and developments at European level, the 3.6 GHz Band could be suitable for addressing mobile capacity constraints, for introducing new 5G services, and as a core band for providing fixed WBB services particularly in rural areas¹⁴.
- 1.14 The release of new spectrum rights of use in the 3.6 GHz band will increase the amount of harmonised spectrum for mobile, nomadic and fixed wireless broadband services by 86 %:

¹⁰ RSPG Website - <http://rspg-spectrum.eu>

¹¹ RSPG Opinion on Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband - 13 June 2013 [Document RSPG13-521 rev1](#)

¹² RSPG STRATEGIC ROADMAP TOWARDS 5G FOR EUROPE - Opinion on spectrum related aspects for next-generation wireless systems (5G) <http://rspg-spectrum.eu/>. 9 November 2016 (RSPG16-032).

¹³ The 2014 3.6 GHz EC Decision states that Time Division Duplex (TDD) shall be the preferred duplex mode of operation in the 3 400 - 3 600 MHz sub-band and the duplex mode of operation in the 3 600 – 3 800 MHz sub-band.

¹⁴ Fixed WBB services are also provided in Ireland via the licensed 10.5 GHz and 26 GHz bands and the licence-exempt 2.4 GHz and 5.8 GHz bands.

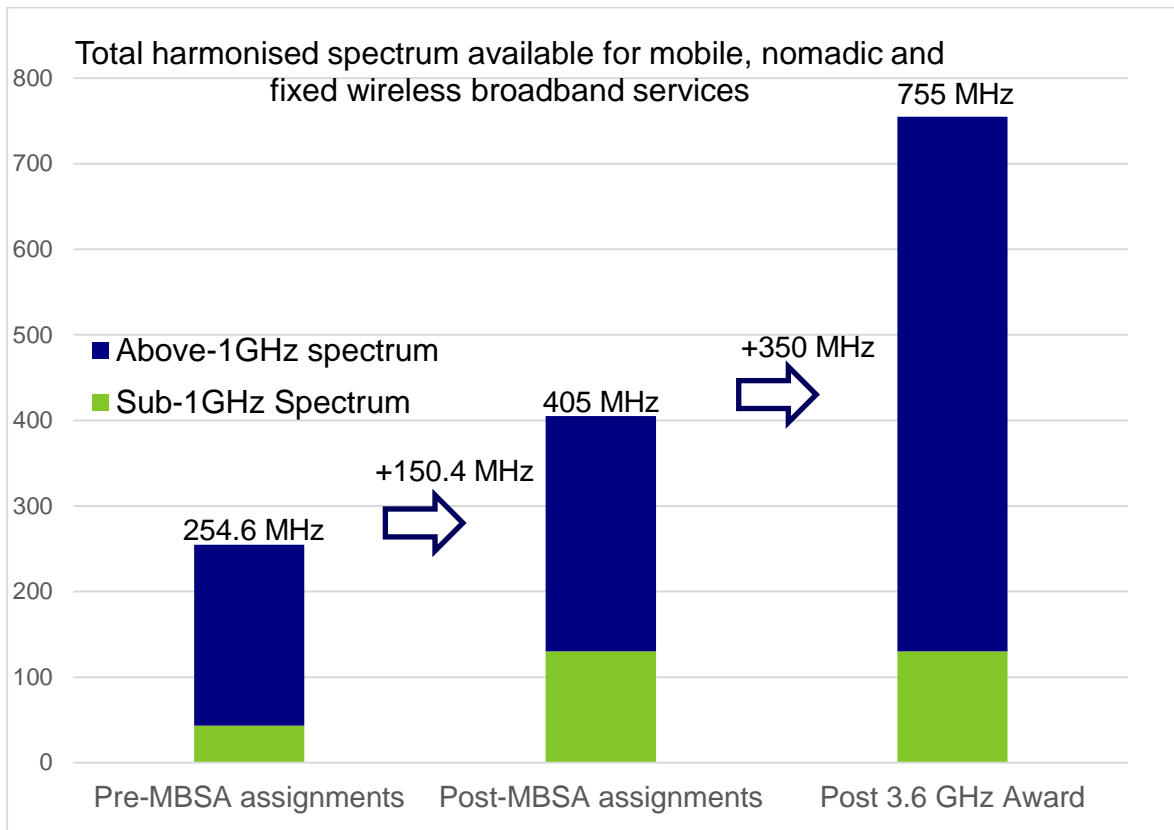


Figure 1: Total amount of harmonised spectrum for mobile, nomadic and fixed wireless broadband services¹⁵

¹⁵ MBSA - ComReg's 2012 Multi Band Spectrum Award

Annex 1: Results of 3.6 GHz Band Spectrum Award

Region	Airspan Spectrum Holdings Ltd	Imagine Communications Ireland Ltd	Meteor Communications Ltd	Mobile Three (Hutchison) Ltd	Ireland Vodafone Ltd	Ireland
Borders Midlands and West	25 MHz	60 MHz	80 MHz	100 MHz	85 MHz	
South West	25 MHz	60 MHz	80 MHz	100 MHz	85 MHz	
East	25 MHz	60 MHz	80 MHz	100 MHz	85 MHz	
South East	25 MHz	60 MHz	80 MHz	100 MHz	85 MHz	
Dublin City and Suburbs	60 MHz	-	85 MHz	100 MHz	105 MHz	
Cork City and Suburbs	60 MHz	-	85 MHz	100 MHz	105 MHz	
Limerick City and Suburbs	60 MHz	-	85 MHz	100 MHz	105 MHz	
Galway City and Suburbs	60 MHz	-	85 MHz	100 MHz	105 MHz	
Waterford City and Suburbs	60 MHz	-	85 MHz	100 MHz	105 MHz	
Final Upfront Fees¹⁶	€ 7,556,700	€ 8,128,800	€ 11,498,400	€ 15,313,700	€ 17,968,712	
Total Spectrum Usage Fees¹⁷	€ 2,078,550	€ 1,640,520	€ 4,163,610	€ 5,059,200	€ 4,765,320	
TOTAL			€ 78,173,512			

Table 1: Results of the 3.6 GHz Band Spectrum Award

¹⁶ Final Upfront Fees is contingent on any licence fee refunds in respect of delayed commencement arising from Transition Activities as detailed in the Information Memorandum.

¹⁷ Spectrum Usage Fees will be indexed to CPI and paid annually over the duration of the Award. Figures presented do not assume any adjustment and are presented as indicative.

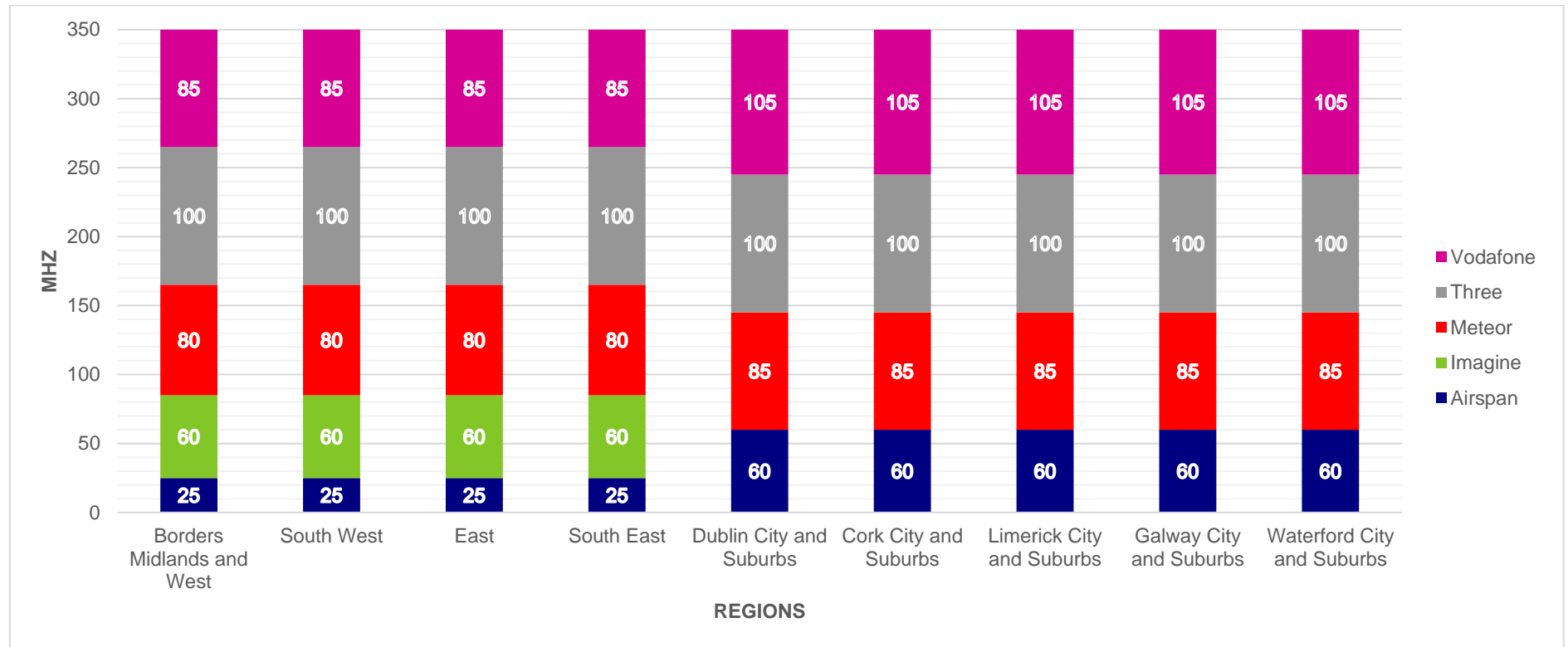


Figure 2: Spectrum holding per Region in the 3.6 GHz Band

Annex 2: **Background and consultation process**

A 2.1 The 3.6 GHz band is currently licensed in Ireland¹⁸. The frequency range from 3 410 – 3 435 MHz and 3 435 – 3 800 MHz is currently licensed under the Fixed Wireless Access Local Area (“FWALA”) licensing framework, for the provision of fixed wireless services on a local area basis and the remaining 40 MHz in the frequency range from 3 435 – 3 475 MHz is licensed for the provision of State Services.¹⁹

A 2.2 The 3.6 GHz band is one of four bands used for the provision of FWA services along with the licence exempt 5.8 GHz band, 10.5 GHz band and 26 GHz band. There are currently circa forty six thousand FWA subscribers in total (see ComReg’s Q4 2016 Quarterly Report, Document 17/15), circa twenty five thousand of whom are in the 3.6 GHz band.

A 2.3 The FWALA licensing framework, has provided consumers with access to broadband services, particularly in rural areas. More recently, however, the FWALA framework has been contracting with fewer subscribers than before.

A 2.4 In April 2010 and taking account of a number of developments both nationally and at an EU level, ComReg gave notice (Document 10/29) that existing 3.6 GHz FWALA licences in the band would not be renewed or extended beyond 31 July 2017²⁰.

The Consultation Process

A 2.5 In September 2014, with the publication of Document 14/101, ComReg commenced the process of determining how spectrum rights of use would be awarded in a number of spectrum bands i.e. 700 MHz, 1.4 GHz, 2.3 GHz, 2.6 GHz and 3.6 GHz bands ComReg proposed the release of all of the above bands in the same award process.

A 2.6 ComReg observed that while there were potential benefits to the inclusion of the 3.6 GHz band in the planned award, the band also had certain characteristics (e.g. likely interest from different types of users) which could differentiate it from, and might justify its separate treatment to, the other bands.

A 2.7 A number of respondents highlighted differences between the 3.6 GHz Band and the other bands with some favouring the release of the 3.6 GHz band in a separate award process.

¹⁸ Excluding the guard band 3 400 – 3 410MHz.

¹⁹ State Services relate to airborne communication systems consisting of microwave links from aircraft to fixed and mobile receiving stations located around Ireland.

²⁰ See also Section 5.2 of ComReg Document 11/03 for further consideration of this issue.

A 2.8 Further, to assist with the Government's National Broadband Plan (NBP), ComReg in its role as National Regulatory Authority (NRA) under the EC's State Aid Guideline (SAG)²¹, issued a call for input, (Document 14/126²²), with regard to the regulatory implications of the NBP. A number of respondents to that call for input made submissions concerning radio spectrum, including in respect of the 3.6 GHz band.

A 2.9 In light of the submissions to Documents 14/101 and 14/126, on 16 February 2015 ComReg published an Information Notice, (Document 15/14), indicating that it intended to consider the possible release of rights of use in the 3.6 GHz Band in a separate competitive award process and further consult on this matter in the summer of 2015. This in turn led to the publication of a number of further documents and supporting material:

- **Document 15/70**²³ - which presented ComReg's first consultation dealing with the proposed award of the 3.6 GHz band in a separate award process;
- **Document 15/140**²⁴ ("the Draft Decision") - which presented ComReg's comprehensive proposals for the award of the 3.6 GHz band, including a draft decision and supported by a draft regulatory impact assessment.
- **Document 16/22**²⁵ ("the Draft Information Memorandum") – which detailed the processes and procedures ComReg envisaged it would employ in the implementation of its substantive proposals as detailed in its Draft Decision
- **Response to consultation, Document 16/57 and Decision 04/16** – which presented ComReg's Response to Consultation and substantive Decision to hold a competitive award process for individual rights of use in the 3.6 GHz band.;
- **Response to consultation 16/70** – which set out ComReg's response to its consultation on the Draft Information Memorandum; and
- **The Information Memorandum, Document 16/71** – which detailed the final processes that ComReg would employ in its 3.6 GHz band Spectrum Award Process to implement its substantive decisions as set out in Response to Consultation 16/57 and Decision 04/16.

²¹ "EU Guidelines for the application of State Aid rules in relation to the rapid development of broadband networks" (2013/C 25/01).

²² Document 14/126 - "National Broadband Plan Call for Input on Regulatory Implications".

²³ Document 15/70 – "Consultation on Proposed 3.6 GHz Band Spectrum Award".

²⁴ Document 15/140 - "Response to Consultation and draft Decision - on Proposed 3.6 GHz Band Spectrum Award"

²⁵ Document 16/22 – "Draft Information Memorandum - Proposed 3.6 GHz Band Spectrum Award".

Annex 3: The Award Process

A 3.1 ComReg held an open competitive selection process for the award of spectrum rights of use on a regional basis in the 3.6 GHz band, having concluded that this approach was preferable to other award options

A 3.2 Given the many complexities for ComReg in running an award with nine Regions, and the statutory objectives and duties relating to such a spectrum award, much work was required to devise the optimal award format and conditions and to ensure that all bidders were sufficiently familiar with the process. Some of the key features of the 3.6 GHz Award Process adopted by ComReg included:

- a) A number of separate stages, including: an Application Stage, a Qualification Stage, a Main stage, an Assignment stage and, finally, a Notification and Grant Stage²⁶;
- b) In submitting a binding application to ComReg to participate in the 3.6 GHz Band Spectrum Award Process, bidders agreed that any bid submitted was a binding commitment to obtain the spectrum rights of use at the prevailing prices and pay the associated Spectrum Usage Fees (SUFs)²⁷;
- c) As demand was greater than supply a main stage, comprised of a Combinatorial Clock Auction (CCA), was held. A CCA is used to sell multiple items in a single process. It provides bidders with the flexibility to bid on different combinations of spectrum rights across the different regions in response to changes in prices.
- d) A CCA also creates good incentives for bidders to bid their full value for the spectrum and to compete over the amount of spectrum they acquire, leading to an efficient outcome.
- e) The main stage of the auction determines who won (1) the A-Lot (frequency specific) in each region and (2) the number of B-Lots (frequency generic) in each region.
- f) The assignment stage determines the specific frequency assignments of the B Lots in each of the nine regions awarded during the Main Stage; and
- g) To safeguard competition in the Award no bidder could bid for more than 150 MHz in any region.

A 3.3 To promote efficient spectrum use, fees were applied to Lots in the Award Process, based on a conservative estimate of the market value of liberalised spectrum in the 3.6 GHz band, as derived from an international benchmarking analysis.

²⁶ Noting that the Notification and Grant stage has yet to be initiated.

²⁷ In the event that demand did not exceed supply at Application, an Applicants Initial Bid was a binding bid to obtain spectrum rights of use at the corresponding minimum prices.

A 3.4 The fees consist of an Upfront Fee which is paid at the end of the Award Process and Spectrum Usage Fees (“SUFs”) which are paid prior to the first grant of a 3.6 GHz band Liberalised Use Licence and then annually²⁸ over its duration.

A 3.5 The Reserve Prices and the SUF’s per Lot per Region are set out in Tables 3 and 4 below respectively.

Region	Reserve Price per A-Lot, €	Reserve Price per B-Lot €
Border, Midlands & West	114,000	22,800
South-West	72,000	14,400
East	64,000	12,800
South-East	44,000	8,800
Dublin City & Suburbs	178,000	35,600
Cork City & Suburbs	34,000	6,800
Limerick City & Suburbs	16,000	3,200
Galway City & Suburbs	14,000	2,800
Waterford City and Suburbs	8,000	1,600

Table 2: Reserve Prices per Lot per Region

Region	Annual SUF before CPI Adjustment per A-Lot (€)	Annual SUF before CPI Adjustment per B-Lot (€)
Border, Midlands & West	17,670	3,534
South-West	14,400	2,232
East	12,800	1,984
South-East	8,800	1,364
Dublin City & Suburbs	35,600	5,518
Cork City & Suburbs	6,800	1,054
Limerick City & Suburbs	3,200	496
Galway City & Suburbs	2,800	434
Waterford City and Suburbs	1,600	248

Table 3: Annual SUF before CPI adjustment per Lot per Region

A 3.6 The results obtained reflect a sound competitive dynamic within a robust auction process.

²⁸ SUFs are index-linked to the overall Consumer Price Index (“CPI”) as published by the Central Statistics Office of Ireland (or its successor)

Annex 4: The Award Spectrum

A 4.1 The spectrum was divided into two Lot types, A-Lots and B-Lots. The A-Lot consists of 25 MHz of spectrum and is positioned below State Services from 3 410 MHz to 3 435 MHz. The B-Lots consist of sixty-five 5 MHz Lots positioned above State Services from 3 475 – 3 800 MHz.

Frequency Band	Frequency range (MHz)	Spectrum rights available
3.6 GHz	3 410 – 3 435	25 MHz
	3 475 – 3 800	325 MHz

Table 4: The spectrum rights available in the Award Process

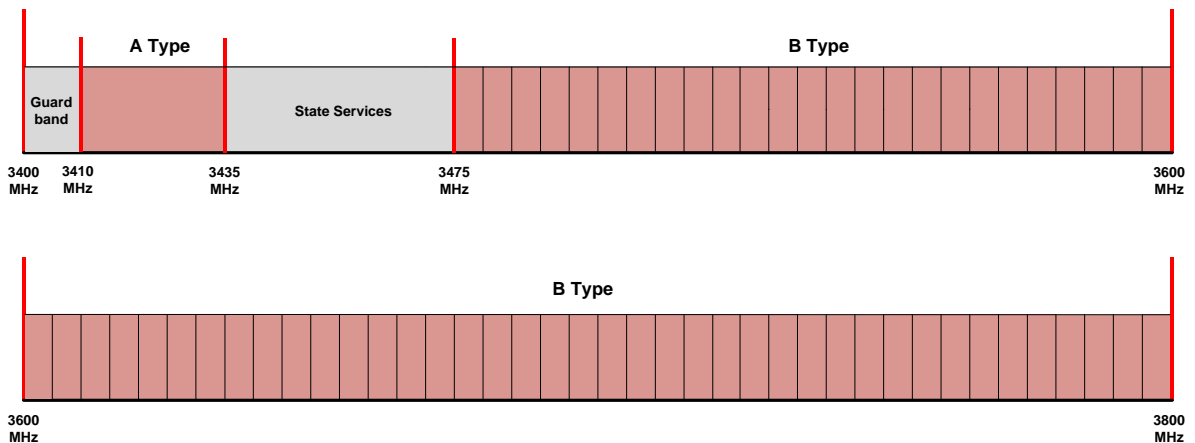


Figure 2: The band plan for the 3.6 GHz Band

Annex 5: The Regions

The Regions in the Award Process

A 5.1 By means of the Award Process, spectrum rights of use has been made available on a service and technology neutral basis, in distinct non-overlapping Regions of the State. There are nine such Regions, being:

- **Borders, Midlands and West:** That area of the State comprising counties Donegal, Leitrim, Sligo, Mayo, Roscommon, Cavan, Monaghan, Louth, Longford, Westmeath, Offaly, Laois and Galway, but excluding the respective parts of these counties contained in the CSO Boundary for Galway City and Suburbs Region.
- **South West:** That area of the State comprising counties Clare, Limerick, Kerry, Cork and the former local authority area of North Tipperary but excluding the respective parts of these counties contained in the CSO Boundary for Cork City and Suburbs region and the CSO Boundary for Limerick City and Suburbs Region.
- **East:** That area of the State comprising counties Meath, Kildare, Wicklow and Dublin, but excluding the respective parts of these counties contained in the CSO Boundary for Dublin City and Suburbs Region.
- **South East:** That area of the State comprising counties Carlow, Wexford, the former local authority area of South Tipperary, Kilkenny and Waterford, but excluding the respective parts of these counties contained in the CSO Boundary of Waterford City and Suburbs Region.
- **CSO Boundary for Dublin City and Suburbs:** That area of the State as defined by the CSO in the Census 2011 Boundary Files for Dublin City and Suburbs.
- **CSO Boundary for Cork City and Suburbs:** That area of the State as defined by the CSO in the Census 2011 Boundary Files for Cork City and Suburbs.
- **CSO Boundary for Limerick City and Suburbs:** That area of the State as defined by the CSO in the Census 2011 Boundary Files for Limerick City and Suburbs.
- **CSO Boundary for Galway City and Suburbs:** That area of the State as defined by the CSO in the Census 2011 Boundary Files for Galway City and Suburbs.
- **CSO Boundary for Waterford City and Suburbs:** That area of the State as defined by the CSO in the Census 2011 Boundary Files for Waterford City and Suburbs.

Annex 6: The 3.6 GHz Licence

A 6.1 The following are the main licence conditions included in the 3.6 GHz Liberalised Use Licences to be granted by ComReg on foot of the Award Process:

- a) all Licence holders must attain and maintain the rollout of a minimum number of base stations per Region (see Table 5 below) within 3 years of Licence issue. A higher rollout obligation is imposed on licensees holding more than 100 MHz of spectrum rights in a region compared to those holding up to 100 MHz. Base stations are required to be deployed in at least 4 counties in each non-urban region.

Reference Number of Region	Name of Region	Number of Rollout Base Stations to be worked and used	
		Licensee holding up to and including 100 MHz in the 3.6 GHz band in that Region	Licensee holding over 100 MHz in the 3.6 GHz band in that Region
1	Borders, Midlands and West	15	25
2	East	15	25
3	South East	15	25
4	South West	15	25
5	Dublin city and suburbs	10	15
6	Cork city and suburbs	2	4
7	Limerick city and suburbs	2	4
8	Galway city and suburbs	2	4
9	Waterford city and suburbs	2	4

Table 5: Rollout base station obligation by Region

- b) minimum Quality of Service conditions require that network unavailability will be less than 35 minutes per 6 month period and a minimum voice call quality standard requires quality levels are ensured against blocked and dropped calls as well as ensuring appropriate standards of speech transmission;
- c) compliance with the Inter Licensee Synchronisation procedure that builds on the technical conditions set out in the 3.6 GHz EC Decision to facilitate the co-existence of services in the 3.6 GHz band with services in the same band or in adjacent spectrum bands; and
- d) Technical conditions required to ensure co-channel co-existence across regional borders and
- e) compliance with International Memoranda of Understanding ('MoUs') applicable to the 3.6 GHz band.

A 6.2 Trading of spectrum rights attached to 3.6 GHz Band Licences will be permitted in accordance with ComReg document 14/10.

A 6.3 All public documents related to this process are also referenced on a dedicated webpage:

<https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/3-6ghz-spectrum-award/>

Annex 7: Provisional Frequency Plan

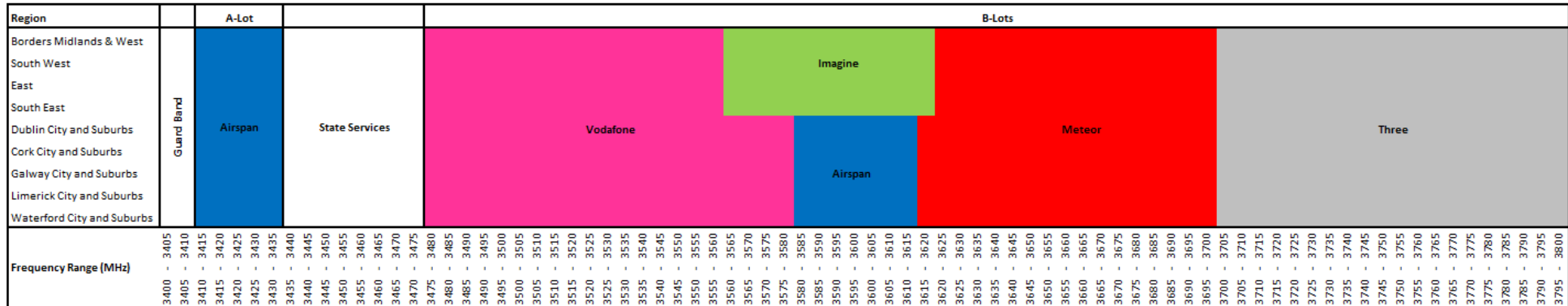


Figure 3: Provisional frequency plan