WIRELESS TELEGRAPHY ACT, 1926

WIRELESS TELEGRAPHY (3.6 GHz BAND LICENCES) REGULATIONS 2016

3.6 GHz Band Liberalised Use Licence for terrestrial systems capable of providing Electronic Communications Services

Licence under section 5 of the Wireless Telegraphy Act 1926 (No. 45 of 1926) as amended, to keep and have possession of apparatus for wireless telegraphyfor terrestrial systems capable of providing Electronic Communications Services.

The Commission for Communications Regulation, in exercise of the powers conferred on it by section 5 of the Wireless Telegraphy Act 1926 (No. 45 of 1926) as amended, hereby grants the following licence to **Dense Air Limited** of **Unit 405, Q House, 176 Furze Rd, Sandyford Industrial Estate, Dublin 18, D18 CD51** ("the Licensee").

The Licensee is hereby authorised to keep and have possession of apparatus for wireless telegraphy for terrestrial systems capable of providing Electronic Communications Services as specified in Part 2 to this Licence, subject to such apparatus being installed, maintained, worked and used in accordance with the terms and conditions and restrictions set out in the Wireless Telegraphy (3.6 GHz Band Licences) Regulations 2016 (S.I. No. 532 of 2016) ("the Regulations"), including, but not limited to, the following:

(1) The Licensee shall ensure that it complies with all of the conditions contained within the Regulations, under which this Licence is issued, and within Parts 1 to 4 of this Licence; and

(2) The Licensee shall ensure that it makes payment of all fees as detailed in the Regulations under which this Licence is issued.

This Licence shall come into effect on 01/08/2017 (the "Licence Commencement Date") and, subject to revocation, suspension or withdrawal, expires on 31/07/2032.

Signed: Brendan O'Brien

For and on behalf of the Commission for Communications Regulation

Date of Issue: 21/04/2023

Part 1

Commencement and Expiry dates per Type A and Type B Spectrum Block per Region

Region	Spectrum Block	Frequency Assigned	Commencement Date	Expiry Date
Borders Midlands & West, South West, East, South East, CSO Boundary for Dublin City & Suburbs, CSO Boundary for Limerick City & Suburbs, CSO Boundary for Galway City & Suburbs, CSO Boundary for Waterford City & Suburbs.	A1	3410 – 3435 MHz	25 March 2019	31 July 2032
CSO Boundary for Cork City & Suburbs	A1	3410 – 3435 MHz	1 April 2023	31 July 2032
CSO Boundary for Dublin City & Suburbs.	B22	3580 – 3585 MHz	1 January 2019	31 July 2032
CSO Boundary for Cork City & Suburbs, CSO Boundary for Limerick City & Suburbs.	B22	3580 – 3585 MHz	18 November 2019	31 July 2032
CSO Boundary for Galway City & Suburbs.	B22	3580 – 3585 MHz	1 July 2022	31 July 2032
CSO Boundary for Waterford City & Suburbs.	B22	3580 – 3585 MHz	TBD	31 July 2032
CSO Boundary for Dublin City & Suburbs.	B23	3585 – 3590 MHz	1 January 2019	31 July 2032
CSO Boundary for Cork City & Suburbs, CSO Boundary for Limerick City & Suburbs.	B23	3585 – 3590 MHz	18 November 2019	31 July 2032
CSO Boundary for Galway City & Suburbs.	B23	3585 – 3590 MHz	1 July 2022	31 July 2032
CSO Boundary for Waterford City & Suburbs.	B23	3585 – 3590 MHz	TBD	31 July 2032
CSO Boundary for Dublin City & Suburbs.	B24	3590 – 3595 MHz	1 January 2019	31 July 2032
CSO Boundary for Cork City & Suburbs, CSO Boundary for Limerick City & Suburbs	B24	3590 – 3595 MHz	18 November 2019	31 July 2032

CSO Boundary for Galway City & Suburbs.	B24	3590 – 3595 MHz	1 July 2022	31 July 2032
CSO Boundary for Waterford City & Suburbs.	B24	3590 – 3595 MHz	TBD	31 July 2032
CSO Boundary for Dublin City & Suburbs.	B25	3595 – 3600 MHz	1 January 2019	31 July 2032
CSO Boundary for Cork City & Suburbs, CSO Boundary for Limerick City & Suburbs.	B25	3595 – 3600 MHz	18 November 2019	31 July 2032
CSO Boundary for Galway City & Suburbs.	B25	3595 – 3600 MHz	1 July 2022	31 July 2032
CSO Boundary for Waterford City & Suburbs.	B25	3595 – 3600 MHz	TBD	31 July 2032
CSO Boundary for Dublin City & Suburbs, CSO Boundary for Cork City & Suburbs, CSO Boundary for Limerick City & Suburbs, CSO Boundary for Galway City & Suburbs, CSO Boundary for Waterford City & Suburbs.	B26	3600 – 3605 MHz	1 January 2019	31 July 2032
CSO Boundary for Dublin City & Suburbs, CSO Boundary for Cork City & Suburbs, CSO Boundary for Limerick City & Suburbs, CSO Boundary for Galway City & Suburbs, CSO Boundary for Waterford City & Suburbs.	B27	3605 – 3610 MHz	1 January 2019	31 July 2032
CSO Boundary for Dublin City & Suburbs, CSO Boundary for Cork City & Suburbs, CSO Boundary for Limerick City & Suburbs, CSO Boundary for Galway City & Suburbs, CSO Boundary for Waterford City & Suburbs.	B28	3610-3615 MHz	1 January 2019	31 July 2032

Part 2

The Apparatus to which this Licence applies

This information is updated annually and a non-confidential version is available separately on the ComReg webpage for “Mobile & WBB-Licensed Apparatus & Sites”.

Part 3

Apparatus Location and Details

This information is updated annually and a non-confidential version is available separately on the ComReg webpage for “Mobile & WBB-Licensed Apparatus & Sites”.

Part 4

Licence Conditions

Section 1: General

1. Definitions

The following additional definitions shall apply to this Licence:

"Equivalent Isotropically Radiated Power" (EIRP) means the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna;

"Licensed Spectrum Blocks" means the Spectrum Blocks set out in Part 1 of the Licence;

"Terrestrial Systems" means terrestrial systems capable of providing Electronic Communications Services that are in compliance with the technical implementing measures adopted pursuant to EC Decision No 2008/411/EC (as amended) and in conformity with the standards referred to in Parts 4; and

"Licensed Regions" means the Regions specified in Part 1 of the Licence.

2. Provision of Maps and Data

For the purposes of complying with rollout obligations (see Section 4) and quality of service obligations (see Section 5) compliance assessments, the Licensee shall, on request, provide to the Commission the following:

(1) Maps showing rollout as required under Section 4;

(2) An up-to-date list of the locations of Base Stations including the Rollout Base Stations covered by the Licence; and

(3) An adequate number of Terminal Stations, Subscriber Identity Modules (SIM) cards or equivalents for testing as applicable.

Section 2: Technical Conditions

1. Definitions

The following additional definitions shall apply to this Licence:

"Active antenna systems" ("AAS") means a base station and an antenna system where the amplitude and/or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This excludes long-term beam shaping such as fixed electrical down tilt. In AAS base stations the antenna system is integrated as part of the base station system or product;

"Base Station" means Apparatus connected to a backhaul network, which provides a Radiocommunication Service to Terminal Stations using the 3.6 GHz Band;

"dBm" means decibels of power referenced to one milliwatt;

"Downlink" means transmissions from a Base Station to a Terminal Station;

"Equivalent Isotropically Radiated Power" (EIRP) means the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna;

"Indoor Small Cell" means a Base Station with an EIRP of less than or equal to 24 dBm per 20 MHz carrier that is located indoors either within a residential or non-residential property;

"Inter-Licensee Co-ordination Agreement" means bi-lateral or multi-lateral agreements between Licensees on field strength co-ordination threshold levels at the boundaries of Regions;

"Inter-Licensee Synchronisation Procedure" means the synchronisation procedure set out in Section 3;

"Permissive Block Edge Mask" means the Base Station technical conditions defined in Table 1 below;

"Restrictive Block Edge Mask" means the Base Station technical conditions defined in Table 2 below;

"Semi-synchronised operation" means operation of two or more different TDD networks, where part of the frame is consistent with synchronised operation, while the remaining portion of the frame is consistent with unsynchronised operation. This requires the adoption of a frame structure for all TDD networks involved, including slots where the UL/DL direction is not specified, as well as synchronising the beginning of the frame across all networks.

"Synchronised operation" means operation of two or more different time division duplex (TDD) networks, where simultaneous uplink (UL) and downlink (DL) transmissions do not occur, that is at any given moment in time either all networks transmit in downlink or all networks transmit in uplink. This requires the alignment of all DL and UL transmissions for all TDD networks involved as well as synchronising the beginning of the frame across all networks;

"TDD" means time-division duplex;

"TD-LTE" means the TDD variant of LTE (Long Term Evolution) technology;

"Terminal Station" means mobile user equipment and fixed customer premise equipment which communicate with a Base Station using the 3.6 GHz Band;

"Total radiated power" ("TRP") is a measure of how much power a composite antenna radiates. It equals the total conducted power input into the antenna array system less any losses in the antenna array system. TRP means the integral of the power transmitted in different directions over the entire radiation sphere as shown in the formula:

$$TRP \stackrel{\text{def}}{=} \frac{1}{4\pi} \int_0^{2\pi} \int_0^{\pi} P(\theta, \varphi) \sin(\theta) d\theta d\varphi$$

where $P(\theta,\varphi)$ is the power radiated by an antenna array system in direction (θ,φ) given by the formula:

$$P(\theta,\varphi) = PTx g(\theta,\varphi)$$

where PTx denotes the conducted power (measured in Watts), which is input to the array system, and $g(\theta,\varphi)$ denotes the array systems directional gain along the (θ, φ) direction.

"Unsynchronised operation" means operation of two or more different TDD networks, where at

any given moment in time at least one network transmits in DL while at least one network transmits in UL. This might happen if the TDD networks either do not align all DL and UL transmissions or do not synchronise at the beginning of the frame;

"Uplink" means transmissions from a Terminal Station to a Base Station.

2. Technical Conditions

(1) Only Terrestrial Systems compatible with Decision 2008/411/EC (as amended) can be worked and used in the 3.6 GHz Band.

(2) In the 3400 – 3800 MHz frequency range of the 3.6 GHz Band, the duplex mode of operation is TDD.

Base Stations

(3) Where the Inter-Licensee Synchronisation Procedure specified in Section 3 determines that the Permissive Block Edge Mask applies for synchronised blocks, the technical conditions defined in Table 1 below shall apply to Base Stations.

(4) In Tables 1 and 3, the power level *PMax* is the maximum carrier power in dBm for the base station in question. *PMax* is defined and measured as the equivalent isotropically radiated power (e.i.r.p.) per antenna for base stations with non- active antenna systems (non-AAS). For AAS, base stations *PMax* is defined as the maximum mean carrier power in dBm for the base station and measured as TRP per carrier in a given cell.

(5) In Tables 1 and 3, the power limits are determined relative to a fixed upper limit by means of the formula Min(*PMax* — *A*, B), which sets the lower (or stricter) of two values: (1) (*PMax* A) expressing the maximum carrier power *PMax* minus a relative offset A, and (2) the fixed upper limit B.

Table 1: Permissive Block Edge Mask

BEM Element	Frequency Range	Non-AAS EIRP Power Limit	AAS TRP Power Limit
In-block	Block assigned to the Licensee	68 dBm/5 MHz per antenna	47 dBm/5 MHz per cell
Transitional Region	-5 to 0 MHz offset from lower block edge or 0 to 5 MHz offset from upper block edge	Min(PMax -40, 21) dBm/5 MHz per antenna (*)	Min(PMax -40, 16) dBm/5 MHz per cell (**)(***)
Transitional Region	-10 to -5 MHz offset from lower block edge or 5 to 10 MHz offset from upper block edge	Min(PMax -43, 15) dBm/5 MHz per antenna	Min(PMax -43, 12) dBm/5 MHz per cell (**)(***)

Baseline	Below – 10 MHz offset from lower block edge Above 10 MHz offset from upper block edge Within 3400—3800 MHz (except for in-block and transitional regions)	Min(PMax -43, 13) dBm/5 MHz per antenna (*)	Min(PMax -43, 1) dBm/5 MHz per cell (**)(***)

(*) PMax is the maximum mean carrier power in dBm for the base station measured as EIRP per carrier per antenna
(**) PMax′ is the maximum mean carrier power in dBm for the base station measured as TRP per carrier in a given cell
(***) In a multi-sector base station, the radiated power limit applies to each one of the individual sectors.

(6) Where the Inter-Licensee Synchronisation Procedure specified in Section 3 determines that the Restrictive Block Edge Mask applies for semi-synchronised blocks, the technical conditions defined in Table 2 below shall apply. In order to meet the Restrictive Block Edge Mask, a Licensee may be required to adopt guard bands within its Licensed Spectrum Block(s).

Table 2: Restrictive Block Edge Mask

BEM Element	Frequency Range	Non-AAS EIRP Power Limit	AAS TRP Power Limit
In-block	Block assigned to the Licensee	68 dBm/5 MHz per antenna	47 dBm/5 MHz per cell
Baseline	3400–3800 MHz (except for in-block frequencies)	-34 dBm/5 MHz per cell (*)	-43 dBm/5 MHz per cell (*)

(*) In a multi-sector base station, the radiated power limit applies to each one of the individual sectors

(7) The additional baseline power limits in Table 3 below apply at the 3800 MHz band edge for coexistence with fixed satellite services (FSS) and fixed services (FS) above 3800 MHz.

Table 3: Additional baseline power limits above 3 800 MHz for base stations for coexistence with fixed satellite services (FSS) and fixed services (FS)

BEM Element	Frequency Range	Non-AAS EIRP Power Limit	AAS TRP Power Limit
Additional baseline	3 800-3 805 MHz	Min(PMax – 40, 21) dBm/(5 MHz) per antenna (*)	Min(PMax′ – 40, 16) dBm/(5 MHz) per cell(**)(***)
	3 805-3 810 MHz	Min(PMax – 43, 15) dBm/(5 MHz) per antenna (*)	Min(PMax′ – 43, 12) dBm/(5 MHz) per cell(**)(***)
	3 810-3 840 MHz	Min(PMax – 43, 13) dBm/(5 MHz) per antenna (*)	Min(PMax′ – 43, 1) dBm/(5 MHz) per cell(**)(***)
	Above 3 840 MHz	– 2 dBm/(5 MHz) per antenna (*)	– 14 dBm/(5 MHz) per cell(***)

(*) PMax is the maximum mean carrier power in dBm for the base station measured as e.i.r.p. per carrier per antenna

(**) PMax′ is the maximum mean carrier power in dBm for the base station measured as TRP per carrier in a given cell
(***) In a multi-sector base station, the radiated power limit refers to the level corresponding to each one of the individual sectors

(8) The Licensee shall comply with all memoranda of understanding agreed from time to time between the Commission and the national regulatory authority responsible for communications matters in the UK, Ofcom, or its successor, in relation to the 3.6 GHz Band.[1]

(9) A co-ordination threshold limit of 32 dBμV/m/5MHz for 90 per cent of the time and 90 per cent of the locations at a height of 10 metres at the borders of each Region shall apply.[2]

(10) The co-ordination threshold limit specified at paragraph 8 may be relaxed when an Inter-Licensee Co-ordination Agreement is in place between all potentially affected Licensees. Inter-Licensee Co-ordination Agreements may be guided by ECC Recommendation (15)01[3] or subsequent relevant guidance documents.

(11) In the event of Harmful Interference, the affected Licensees shall exchange information with a view to resolving the Harmful Interference by mutual consent. Where resolution cannot be agreed between the affected Licensees, ComReg may mediate in accordance with its statutory functions, objectives and duties.

Terminal Stations

(12) With the exception of fixed outdoor Terminal Stations with a directional antenna the maximum in-block power for a Terminal Station shall not exceed 28 dBm/5 MHz TRP.

(13) The maximum in-block power limit for fixed outdoor Terminal Stations with a directional antenna shall not exceed 37 dBm/5 MHz EIRP.

(14) Fixed outdoor Terminal Stations with a directional antenna shall:

(a) be installed, controlled by and remain the responsibility of the Licensee; and

(b) not cause Harmful Interference to any other users, be that Base Stations, other Terminal Stations, or other apparatus for wireless telegraphy in other radio frequency spectrum bands.

Section 3: Inter-Licensee Synchronisation Procedure

1. Definitions

The following additional definitions shall apply to this Licence:

"Default Frame Structure" means the frame structure as detailed in 3(1) below; and

[1] See Annex 3 of ComReg Document 06/17R7 for a list of memoranda of understanding in place at the date of making of the Regulations.
[2]The field prediction method used shall be in accordance with Recommendation ITU-R P.452- 16, unless otherwise specified by the Commission.
[3] See ECC Recommendation (15)01 — Cross-border coordination for mobile/fixed communications networks (MFCN) in the frequency bands: 694-790 MHz, 1452-1492 MHz, 3400-3600 MHz and 3600-3800 MHz — http://www.erodocdb.dk/Docs/doc98/official/pdf/ REC1501.PDF

"Other Frame Structure" means a frame structure other than the Default Frame Structure.

2. Introduction

(1) Licensees shall co-operate in such a way that one network deployment does not cause Harmful Interference to that of another Licensee within the 3.6 GHz Band.

(2) Licensees shall be bound by the Inter-Licensee Synchronisation procedure.

(3) This procedure sets out the circumstances in which Licensees may use the Permissive Block Edge Mask and the Restrictive Block Edge Mask, so as to minimise the risk of Harmful Interference to other Licensees.

3. Conditions for Permissive Block Edge Masks

(1) Default Frame Structure in case of synchronised operation — The technical conditions for Permissive Block Edge Mask set out in Section 2 shall apply where a Licensee's Base Station complies with the Default Frame Structure outlined below:

(a) Transmissions from a Licensee's Base Station(*s*) shall have a frame structure as shown in Figure 1. Indicated timeslots (or subframes) must not be allocated to anything other than Downlink (D) and Uplink (U) transmissions. S denotes a special subframe. TD-LTE frame configuration 2 (Downlink: Uplink, 3:1) with special subframe configuration 6 or equivalent frame structures whose transmit and receive periods are aligned with this configuration are permitted;

(b) Timeslots shall have a duration of 1 millisecond; and

(c) Licensees shall ensure that frames start at a common reference time(+/- 1.5 μs) so that all Licensees' frames are aligned and transmissions synchronised.

(2)

Figure 1: Default Frame Structure

DL/UL ratio	Timeslot or Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

4. Conditions for using the Restrictive Block Edge Masks

(1) Other Frame Structure— the technical conditions for Restrictive Block Edge Mask set out in Section 2 shall apply where a Licensee's Base Station complies with the Other Frame Structure as outlined below:

(a) Transmissions from a Licensee's Base Station(s) shall have a frame structure with special subframe configuration 6 or equivalent frame structure whose transmit and receive periods are aligned with this configuration are permitted;

(b) Licensees shall co-operate to minimise Harmful Interference causedby sub-frame overlaps if different technologies are used; and

(c) Licensees using the Restrictive Block Edge Mask shall not cause Harmful Interference to those Licensees' networks that use the Default Frame Structure (or equivalent). Achieving this may include applying internal guard bands and/or reduced in block power levels in blocks adjacent to those Licensees' networks that use the Default Frame Structure (or equivalent).

5. Indoor Small Cells

(1) Indoor Small Cells are exempted from synchronisation. The Permissive Block Edge Mask set out in Section 2 applies to such Indoor Small Cells on the condition that they do not cause Harmful Interference to any other Licensees.

Section 4: Rollout Requirements

1. Definitions

The following additional definitions shall apply to this Licence:

"Network-Controlled Wireless Telegraphy Apparatus" means apparatus which has backhaul capability[4] over a network connection under the control of the Licensee. For the avoidance of doubt, "plug-and-play" type apparatus, such as femto cells, Terminal Stations and repeaters, are not Network-Controlled Wire- less Telegraphy Apparatus; and

"Rollout Base Station" means a Network Controlled Wireless Telegraphy Apparatus in the 3.6 GHz Band with a minimum spectrum efficiency capability of 4 bits/Hz.

2. Base Station Minimum Rollout Requirements

(1) For each Licensed Region, the Licensee shall achieve and maintain the Rollout Base Station obligation detailed in Table 4 below within 3 years of the Licence Commencement Date relevant to its Licensed Regions.

Table 4: Rollout Base station obligation by 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

[4] If the 3.6 GHz Band is used for the provision of backhaul connectivity, even if such Apparatus comprises of multiple hops to the network, this counts as a single Rollout Base station, provided such backhaul connectivity carries data originating from or destined for multiple customer premises. The connection to individual customer premises equipment is excluded.

7	Limerick city and suburbs	2	4
8	Galway city and suburbs	2	4
9	Waterford city and suburbs	2	4

(2) For Regions 1, 2, 3 and 4 in Table 4 above, the Licensee is required to workand use Rollout Base Stations in at least 4 counties for each Licensed Region[55].

(3) Where a Licensee has a Rollout Base Station in one county and this Rollout Base Station is worked and used to provide service to another county, the Rollout Base Station will be counted as being worked and used in the county it serves (and not the county in which it is located).

(4) Where a Licensee has a Rollout Base Station in one county and this Rollout Base Station is worked and used to provide services to more than one county (i.e. the county in which it is located in and also neighbouring counties), the Rollout Base Station will only be counted as a single Rollout Base Station for the purposes of meeting the Rollout Base Station obligation and the Licensee may chose the county in which such a Rollout Base Station is to be counted for this purpose.

(5) Rollout Base Stations worked and used pursuant to a spectrum leasing arrangement count towards the Rollout Base Station obligation of the Lessor's Licence.

(6) Where a Licensee has a spectrum leasing arrangement for a Rollout Base Station in a Region not contained in the Licensed Regions and this Rollout Base Station is being worked and used to serve a Region contained in the Licensed Regions, such a Rollout Base Station will be counted as being worked and used in the county and Region which it serves.

(7) Where a Licensee shares a Rollout Base Station with another Licensee, such Rollout Base Stations can count towards the Rollout Base Station obligation of each Licensee in their respective Licensed Regions, provided that at least one Licensed Spectrum Block of each Licensee is worked and used by the Rollout Base Station.

3. Reporting of Compliance

(1) The Licensee shall submit to the Commission an annual compliance report on rollout within 31 days of each anniversary of the commencement of the Licence.

(2) In the annual compliance report the Licensee shall notify the Commission whether or not it has met the relevant rollout obligation specified in Section 4 (2) above. Where the Licensee has failed to meet the relevant rollout obligation, the Licensee shall provide adequate reasons and supporting information for same.

(3) The information required for this annual compliance report shall be agreed with the Commission in advance and the compliance report shall have sufficient detail and granularity to allow the Commission to verify the con- tents of the Licensee's annual compliance report.

(4) Failure by the Licensee to submit the annual compliance report to the Commission within the specified time period shall be deemed to be non-compliance by the Licensee with both the reporting obligations and the relevant Base Station Rollout obligation.

[5] Each of the areas of South Tipperary and North Tipperary will be deemed to be a county for the purposes of determining compliance with the rollout obligation.

(5) The Commission reserves the right to inspect any Rollout Base Station installed by a Licensee at any time to ensure that the system is configured and operating in accordance with its Licence conditions and the Licensee shall facilitate any such inspections by the Commission within such time as may be specified by the Commission.

Section 5: Quality of Service (QoS) Obligations

1. Definitions

The following additional definitions shall apply to this Licence:

"Network" means any Terrestrial System which uses the Licensed Spectrum Blocks; and

"Network Unavailability" means the average number of minutes per six month period for which services on the network are not available due to a disturbance, failure or scheduled unavailability to a Network.

"Voice Call" means all relevant non-VOIP (Voice over Internet Protocol) and managed VOIP call services[66] which are considered by the Commission to be substitutable with traditional voice call services as may be updated and notified to Licensees from time to time.

2. The Minimum "Availability of the Network" Standard

(1) "Availability of the Network" shall be measured in terms of Network Unavailability and reported on an annual basis.

(2) The Licensee shall ensure that Network Unavailability is less than 35 minutes(based on the weighting factors set out in Table 5 below) per six month period.

Table 5: Weighting Factors for Network Unavailability tracking all periods of network unavailability.

Network Unavailability, Weighting Factors (divide duration of each network event by weighting factor)			
	Monday to Friday	Saturday	Sunday
For periods between 07:00 and 24:00 hours	1	2	4
For periods between 00:00 and 07:00 hours	4	8	16

(3) The "Availability of the Network" shall be calculated by combining the Network Unavailability measurements of the relevant services provided to the Licensee's customers and provided to third party customers by the Licensee via contractual or other arrangements with the Licensee.

(4) The Licensee shall maintain a network log on a per Base Station basis in a manner that can demonstrate to the satisfaction of the Commission that such a network log

[6] See for example, paragraph 2.6 of ComReg Document 14/89, Market Review: Retail Access to the Public Telephone Network at a Fixed Location for Residential and Non Residential Customers in relation to the fixed voice calls.

is an adequate means of assessing whether the Licensee is complying with its "Availability of the Network" licence obligations.

(5) The network log, or as may be appropriate part thereof, shall be made available to the Commission upon request by the Commission.

(6) The Licensee shall calculate the Network Unavailability for any period specified by the Commission from the information recorded in the network log, and shall, upon request and within such time as may be specified by the Commission, provide the Commission with the results of the calculation.

3. The Minimum Voice Call Standard

(1) Where the Licensee and/or any third party by means of a contractual or other arrangement with the Licensee provides a Voice Call service on a Terrestrial System using the Licensed Spectrum Blocks, the Licensee shall comply with the minimum Voice Call standard set out in Table 6 below.

Table 6: Minimum Voice Call Standards for each 6 month period for annual reporting

	Average	Worst Case
Maximum Permissible Blocking Rates (maximum percentage of total Voice Call attempts which are unsuccessful during the time consistent busy hour[7])	2%	4%
Maximum Permissible Dropped Call Rates (maximum percentage of total originating calls which are prematurely released by the Network within 3 minutes of the Voice Call being made.)	2%	4%
Transmission quality: The Licensee shall ensure that: • the speech transmission quality of Voice Calls is as good as or better than the speech quality associated with the relevant ETSI Standard and Technical Specifications; and • appropriate echo treatment equipment is used and that such equipment is properly configured.		

(2) Where a Voice Call service is provided by the Licensee and any third party via contractual or other arrangements with the Licensee, the minimum Voice Call standard shall be calculated by combining the Voice Call measurements of the Licensee with that of the third party.

4. Reporting on Compliance

(1) The Licensee shall maintain a log in respect of the performance of its Net- work against the Minimum Voice Call Standards in Table 6, according to measuring standards as agreed with the Commission and in such a manner that can demonstrate to the satisfaction of the Commission that its network

[7] "Time consistent busy hour" means the period of one-hour starting at the same time each day for which the average traffic of the network concerned is greatest over the days under consideration. The time consistent busy hour shall be determined from an analysis of traffic data obtained from the service and be subject to the Commission's approval.

The 'Time consistent busy hour' is determined from the Licensee's voice traffic. It is the one-hour period during which there is the highest level of traffic. The blocked call rates are measured for the same one-hour period during each review period (i.e. 6 months). The one- hour period is determined by the Licensee and is subject to the Commission's approval.

log is an adequate means of assessing whether the Licensee is complying with these standards.

(2) The Licensee shall measure and submit to the Commission, within 31 days of each anniversary of the commencement of the Licence, an annual compliance report on the performance of its Network against the Minimum Voice Call Standards in Table 6.

(3) In the annual compliance report the Licensee shall notify the Commission whether or not it has met the Minimum Voice Call Standards in Table 6. Where the Licensee has failed to meet any of these standards, the Licensee shall provide adequate reasons and supporting information for same.

(4) The annual compliance report shall have sufficient detail and granularity to allow the Commission to verify the Licensee's measurements.

(5) Failure by the Licensee to submit the annual compliance report to the Commission within the specified time period shall be deemed to be non-compliance by the Licensee with both these reporting obligations and the Voice Call standards.

(6) The Licensee shall, upon request by the Commission[8], carry out drive test measurements against the Maximum Permissible Blocking Rates and Maximum Permissible Dropped Call Rates standards and submit these results to the Commission. These drive test measurements are to be carried out at the Licensee's own expense and to a standard as agreed with the Commission.

(7) Failure by the Licensee to carry out and submit the drive tests measurements to the standard agreed with the Commission shall be deemed to be non- compliance by the Licensee with both these reporting obligations and the Maximum Permissible Blocking Rates and Maximum Permissible Dropped Call Rates standards.

[8] The Commission does not envisage drive test measurements being required on a frequent basis, but notes that such measurements may be appropriate in circumstances where:

- a Licensee is submitting a compliance report on QoS for the first time;
- the Commission's own verification checks, drive test measurements or other information suggests that there may be discrepancies in the compliance report on QoS or the Licensee may not be meeting its QoS obligations.