Commission for
Communications Regulation

Assessment of Mobile Network Operators' Compliance with Licence Obligations (Coverage)

Summer 2015

Information Notice

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Additional Information

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1 Executive Summary

1. This document presents a summary of the results of the Commission for Communication Regulation's (ComReg) Drive Testing Programme (Drive Test) carried out between 20 June 2015 and 27 July 2015, by its contractor Advanced Wireless Technologies Group Limited AWTG)[1].

2. The Drive Tests are carried out across all of the relevant frequency bands and licence types simultaneously in order to assess the Mobile Network Operators' (MNO) compliance with the obligations of their respective licences.

3. The MNOs that currently hold licences in Ireland are:

    - Three Ireland Hutchison Limited (3IHL);
    - Meteor Mobile Communications Limited (Meteor);
    - Three Ireland Services (Hutchison) Limited (3ISHL) formerly Telefónica (O2) Ireland Limited ; and
    - Vodafone Ireland Limited (Vodafone).

4. The Drive Test represents a snapshot of how the MNOs networks performed in relation to their Licence Obligations at the point in time which the test was conducted.

5. Licence Coverage, as measured in the Drive Test, represents the ability to place a call at a specific location at a specific time using a standard handset; all measurements are performed from a vehicle containing a computer controlled measuring system [2] , which acts as a 'handset', matching an European Telecommunications Standards Institute (ETSI) standard handset[3]. It should be kept in mind that in reality the radio performance of many handsets differs due to a number of factors.

1 AWTG, were selected following an Invitation To Tender process detailed in ComReg Document No. 14/86a which was published on both e-tenders and in the Official Journal of the European Union.

2 This consists of the Anite Nemo Invex II measurement server, connected to both Samsung Note 4 handsets and the Nemo FSR 1 Multiband Scanner. Measurements are terminated at servers located in Ireland.

3 3GPP TS 36.101

6. Given the differing performance of handsets[4] and other variables that can affect end-user experience the coverage that is measured during these Drive Tests cannot always be equated to end-user experience. The figure below outlines some of the factors that currently affect end-user experience of their mobile phones.

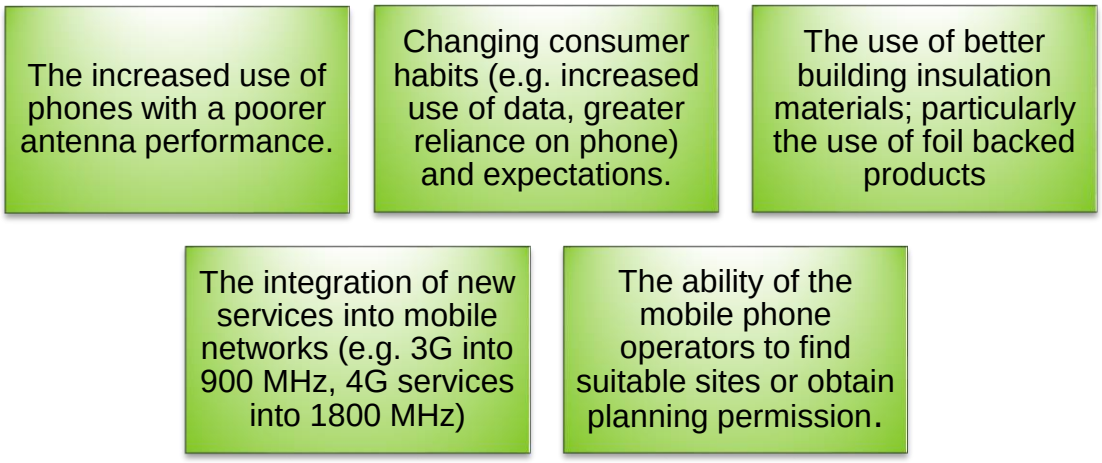

Figure 1 - Factors affecting end-user experience of mobile networks

7. It is not possible to effectively account for the wide range of variables that can affect end-user experience; as such in its licence conditions ComReg sets minimum requirements, based on European and International bodies' research, for mobile phone coverage assuming a certain level of handset performance and outdoor use.

8. Another factor which can affect the end user experience is the type of service being used, i.e. GSM, 3G, LTE, etc. Services, such as LTE, which provide the user with higher data speeds require higher signal levels to operate than traditional voice services. All digital modulation schemes are reliant on a minimum Signal to Noise Ratio (SNR) and the higher the data throughput the greater the SNR required.

9. The current Drive Test is designed to give an indication of the MNOs performance in relation to licence conditions during the period that the route is driven but it should be noted that not all of the coverage obligations have come into force[5], nor were all

4 https://erhvervsstyrelsen.dk/sites/default/files/media/mobile_phone_antenna_performance_2013_0.pdf
5 There is a rollout period allowed in the licence, full coverage obligations are not required to be met until Q1 2016. At this juncture ComReg will undertake further analysis to ensure all licence conditions are being adhered to.

of the new services possible under the Liberalised Use Licences commercially available to all customers[6].

10. All networks measured were found to be compliant with the licence conditions in force.

[6] For this first Drive Test period, LTE services were not enabled on the 3ISHL SIMS.

2 Licence Types

11. Licences are issued pursuant to Regulations made under Section 6 of the Wireless Telegraphy Act, 1926 (No. 45 of 1926) (the "Act of 1926") as amended. As such, MNOs are authorised to provide Electronic Communications Services ("ECS") and Electronic Communications Networks ("ECN") under Regulation 4 of the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations, 2011 (S.I. No. 335 of 2011), (the "Authorisation Regulations") using the spectrum assigned to them in their respective Licences.

12. Licences for GSM and Third Generation (3G) have now ceased or expired and have been superseded by the Liberal Use Licences[7] outlined below.

- The "800 MHz band" means the 791 to 821 MHz band paired with the 832 to 862 MHz band as set out in Annex 3 to ComReg Document 12/25;
- The "900 MHz band" means the 880 to 915 MHz band paired with the 925 to 960 MHz band as set out in Annex 3 to ComReg Document 12/25;
- The "1800 MHz band" means the 1710 to 1785 MHz band paired with the 1805 to 1880 MHz band as set out in Annex 3 to ComReg Document 12/25; and
- The "2100 MHz band" means the 1920 to 1980 MHz band paired with the 2110 to 2170 MHz band.

13. The following technologies are used in the bands outlined above:

- "GSM" means Global System for Mobile Communications from European Telecommunications Standards Institute ("ETSI");
- "Third Generation" means a mobile and wireless communications system based on a standard within the IMT-2000 system capable of supporting innovative multimedia services beyond the capability of second generation systems such as GSM, and capable of supporting the characteristics referred to in Annex 1 of the UMTS Decision;
- "LTE" means the Long Term Evolution family of standards from European Telecommunications Standards Institute ("ETSI") and Third Generation Partnership Project ("3GPP"); and

[7] Liberalised Use Licences issued pursuant to the Wireless Telegraphy (Liberalised Use and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz Bands) Regulations 2012, S.I. 251 of 2012.

- “UMTS” means the Universal Mobile Telecommunications System family of standards from European Telecommunications Standards Institute (“ETSI”) and Third Generation Partnership Project (“3GPP”).

3 Drive Test Route

14. The route is based on the most recent coverage maps which have been submitted to the office by the MNOs and a total of 5500km[8] is driven during the survey.

The route includes;

- Dublin City, including:
    1) *M50 Ring Road*
    2) *North Circular Road*
    3) *South Circular Road*
    4) *R114 from Portobello Bridge to Dame St.*
    5) *O'Connell Street from Eden Quay to Parnell Square East along North Frederick St. to Dorset Street.*
- Waterford City
- Cork City
- Limerick City
- Galway City
- All Primary and Secondary National Routes in full[9], including all towns and Motorway sections, along these routes.

9 For the avoidance of doubt, this means the complete length of each route within the jurisdiction of Ireland.

4 Presentation of Results

15. The *on route* coverage is measured to assess the usable coverage, as defined in the licence conditions, while the route is driven in terms of the received field strength.

16. ComReg takes a holistic view on the issue of mobile network coverage, as such the coverage requirements set down in licence conditions can be met through the use of different bands available to the MNO[10]. It is also noteworthy that the full coverage conditions specified in the licence do not apply for the first three years of the licence to allow for network rollout. This period comes to an end in Q1 2016.

17. Licence Coverage, as defined in paragraph 5 above, is determined by the percentage of the population covered; the data available through the Central Statistics Office 2011 Census is used to give an approximation of the population in the areas covered by the Drive Test[11].

18. The following maps provide a graphical representation of the field strengths measured during the Drive Test.

10 See Schedule 1, Part 4, paragraph 3(2)c to the Wireless Telegraphy (Liberalised Use and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz Bands) Regulations 2012, S.I. 251 of 2012.

[11] ComReg notes that the populations in many areas may differ slightly since 2011.

4.1 Liberalised Use Licence; 900 & 1800 MHz (GSM)

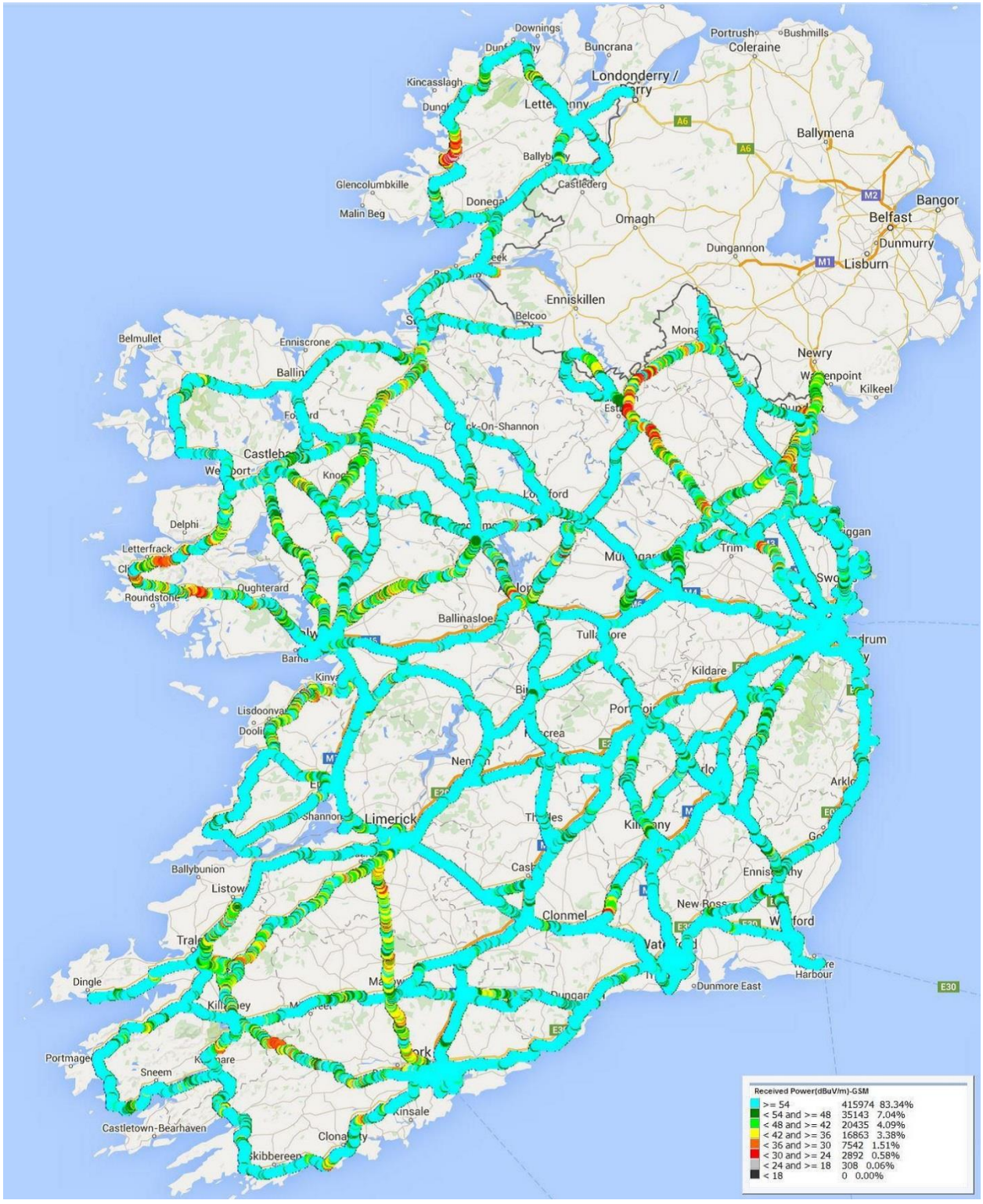

Figure 2: Meteor GSM 900 & 1800 MHz On Route Coverage Map

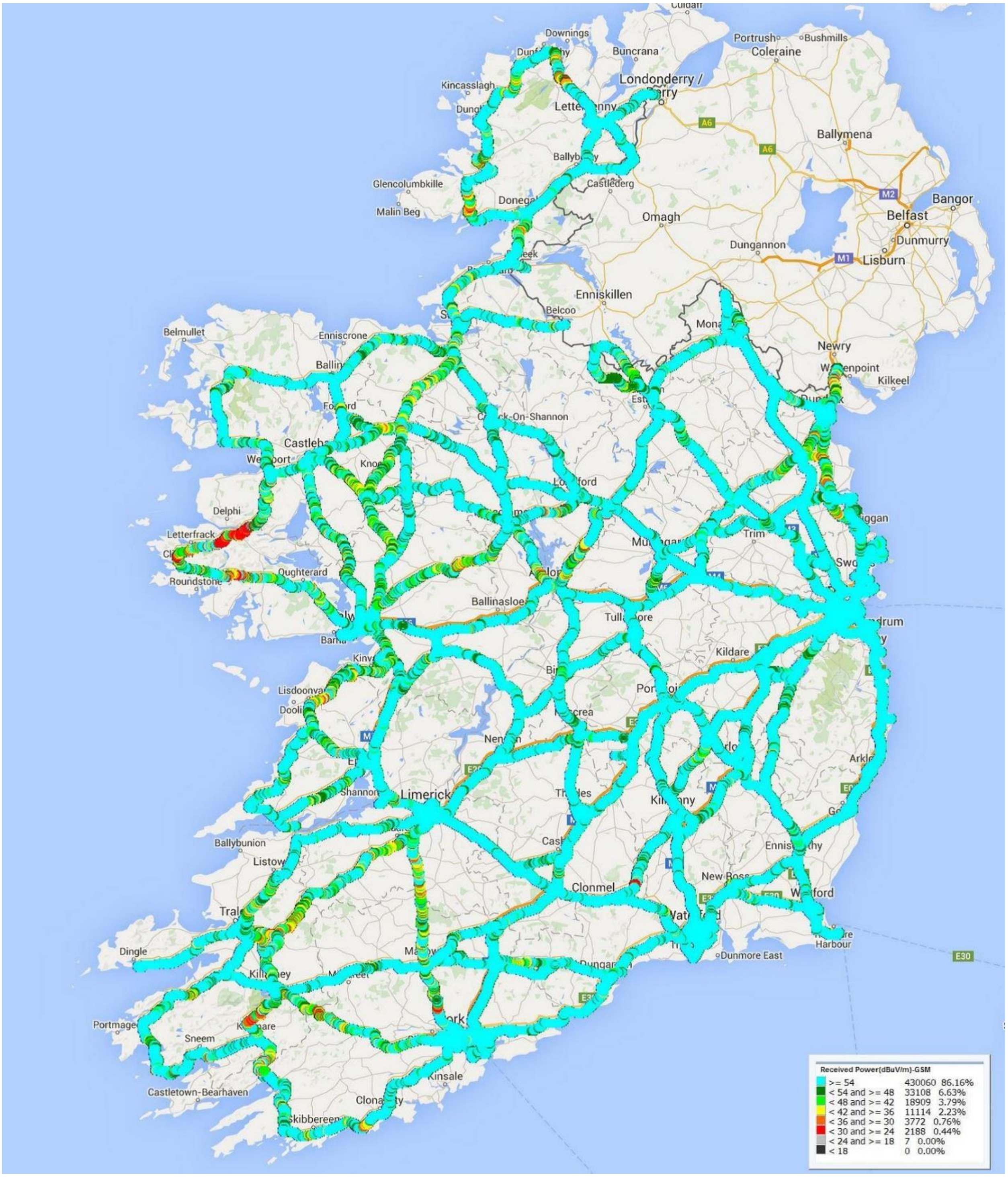

Figure 3: 3ISHL GSM 900 & 1800 MHz On Route Coverage Map

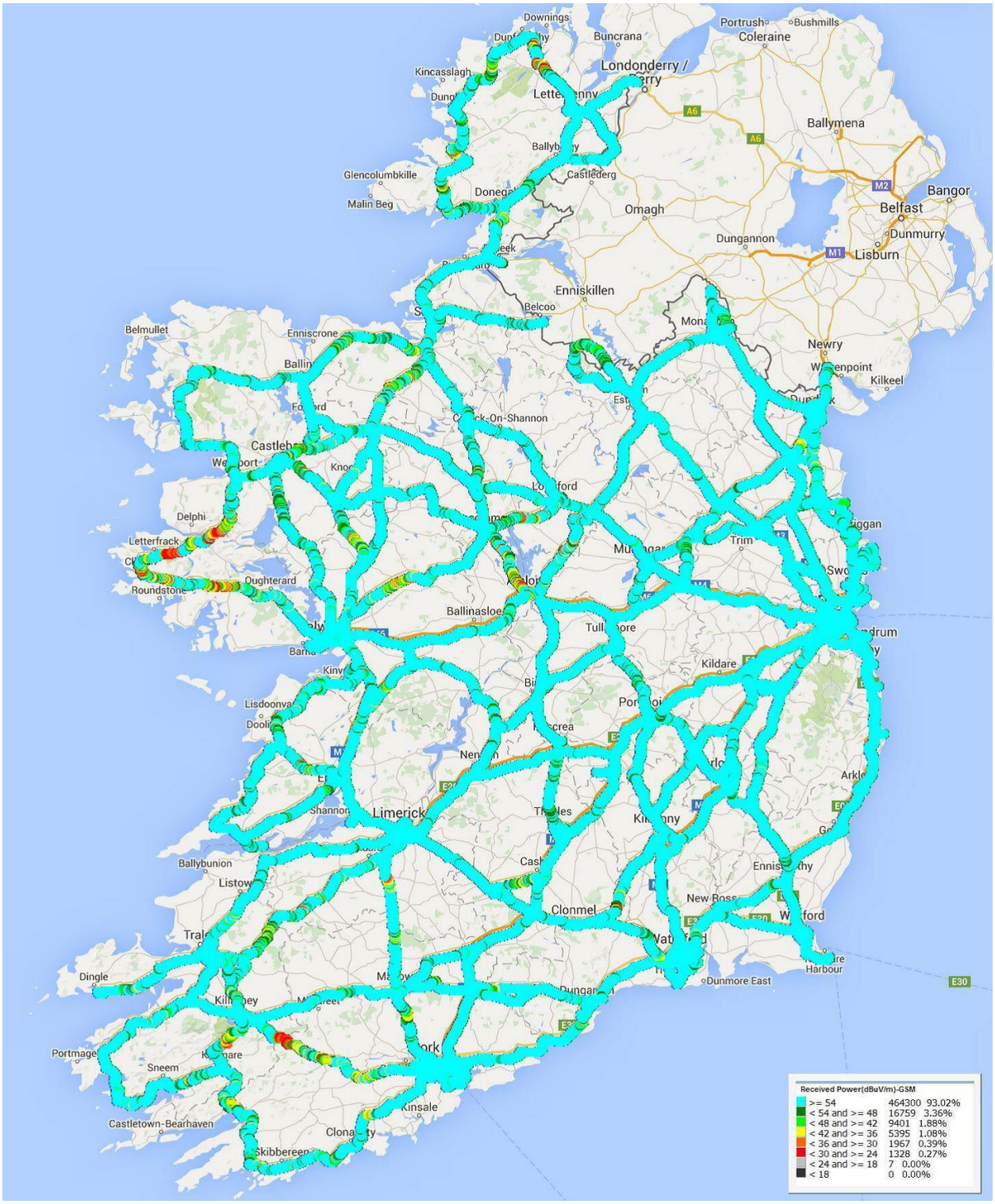

Figure 4: Vodafone GSM 900 & 1800 MHz On Route Coverage Map

4.2 Third Generation Licence; UMTS (2100 MHz)

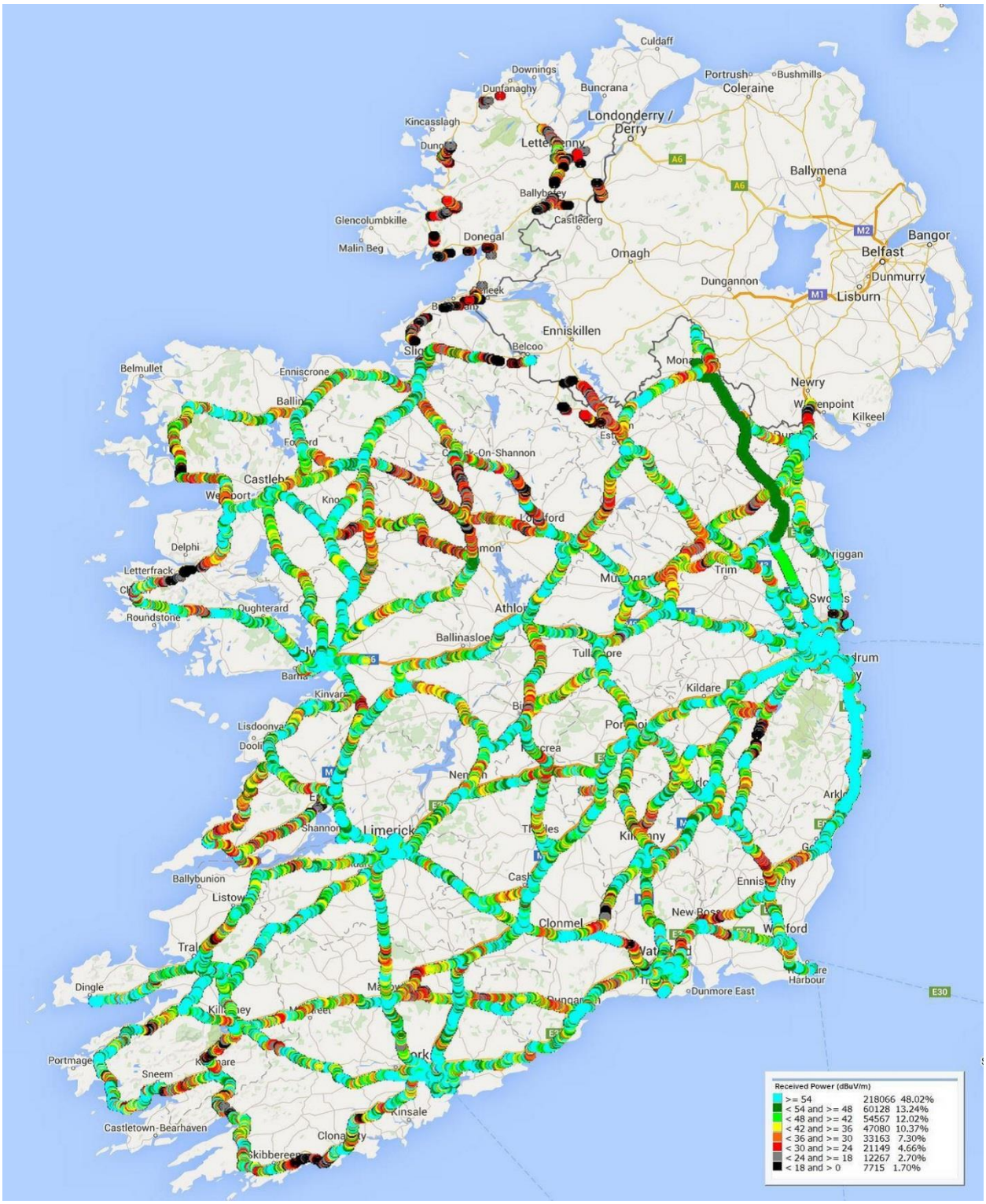

Figure 5: Meteor Third Generation Licence 2100 MHz (UMTS)

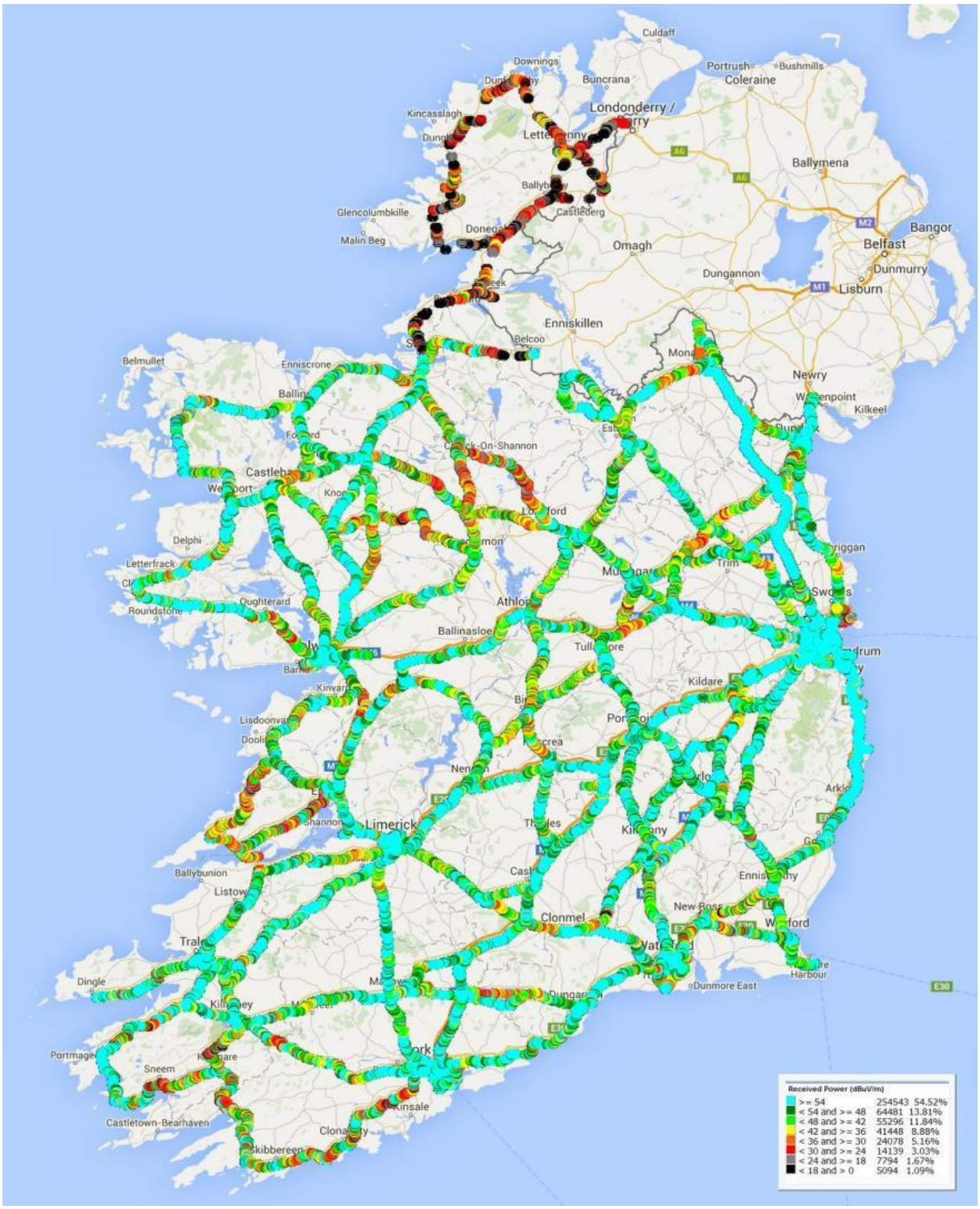

Figure 6: 3IHL Third Generation Licence 2100 MHz (UMTS)

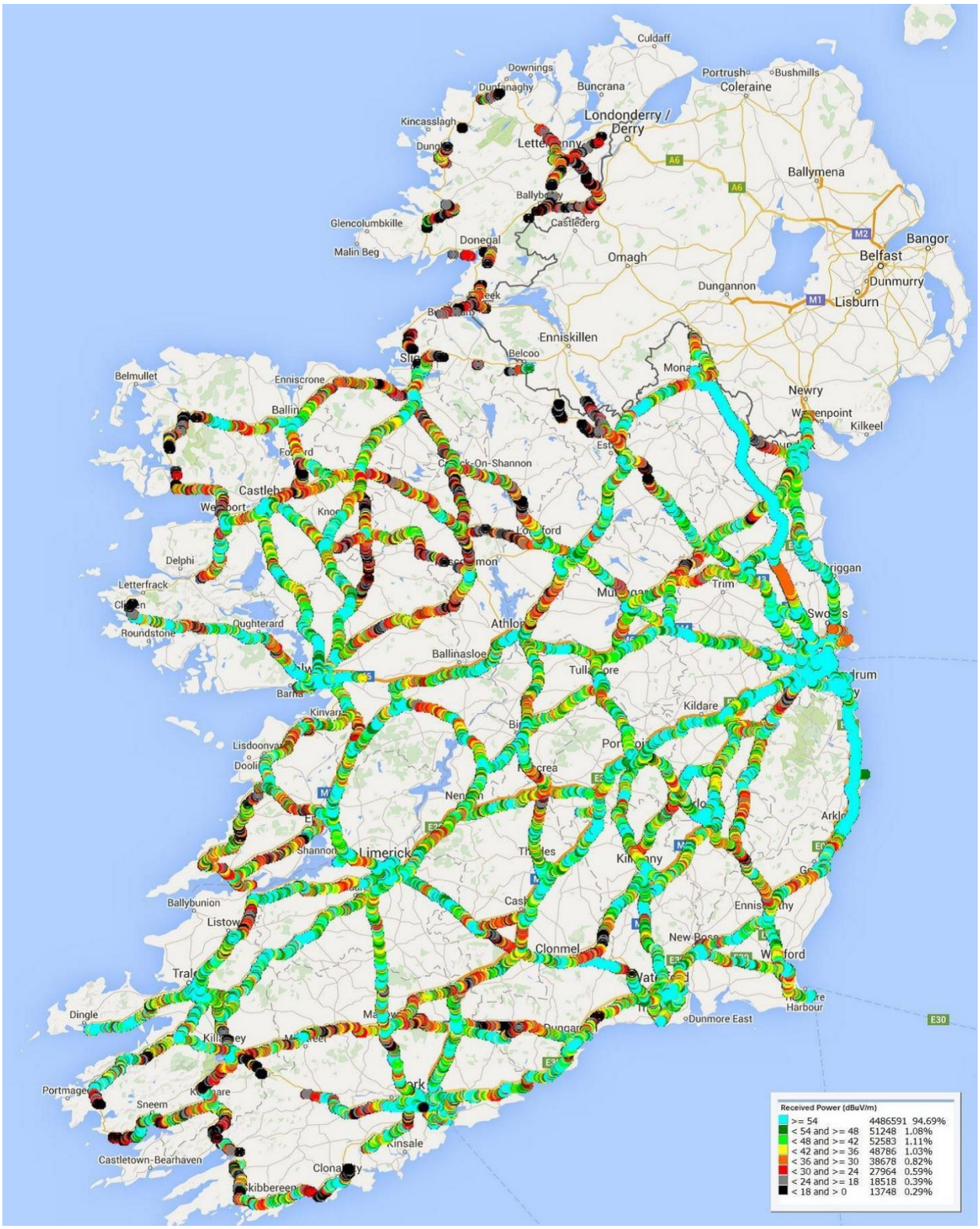

Figure 7: 3ISHL Third Generation Licence 2100 MHz (UMTS)

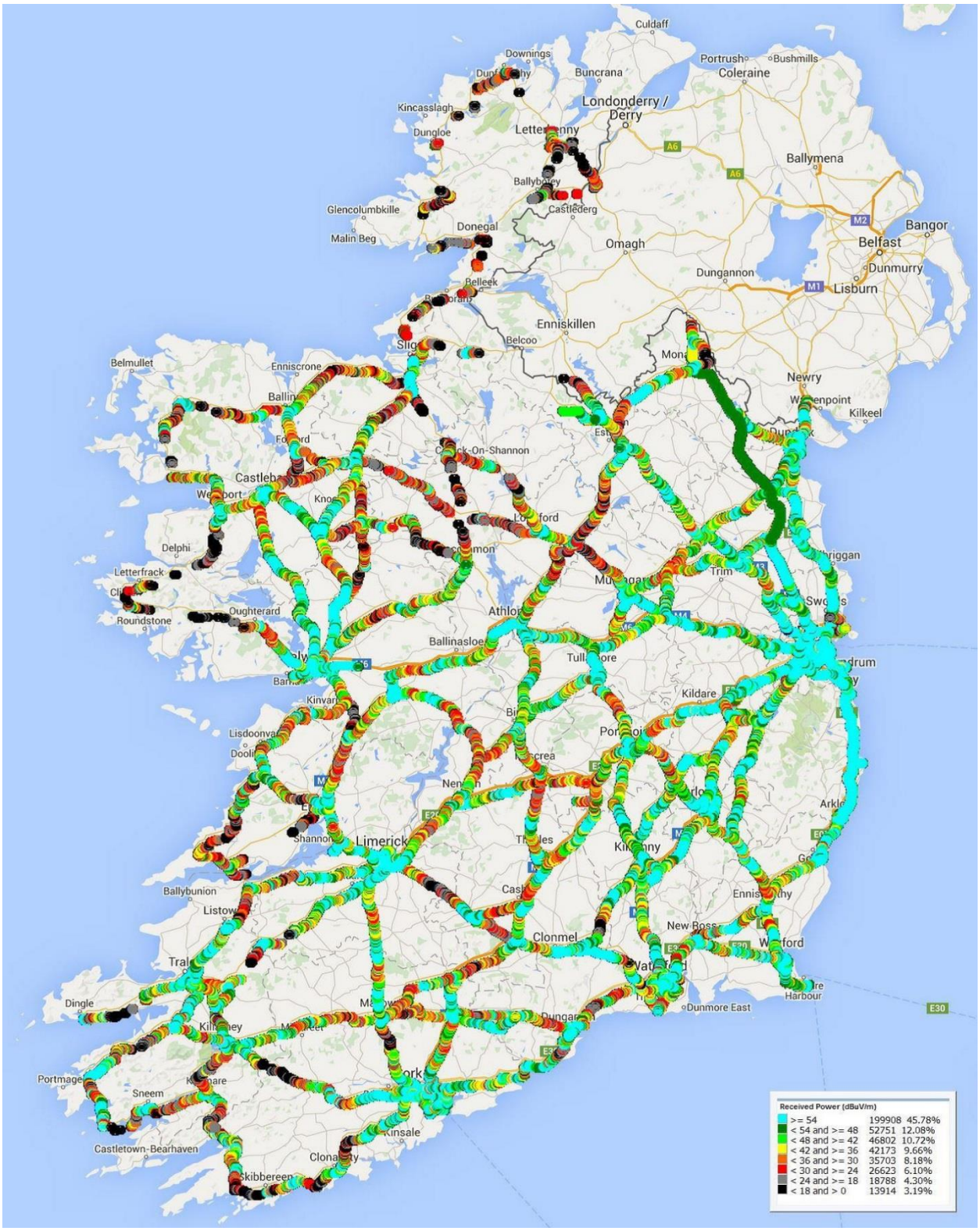

Figure 8: Vodafone Third Generation UMTS 2100 MHz (UMTS)

4.3 Liberalised Use Licence 900 MHz (HSDPA/UMTS)

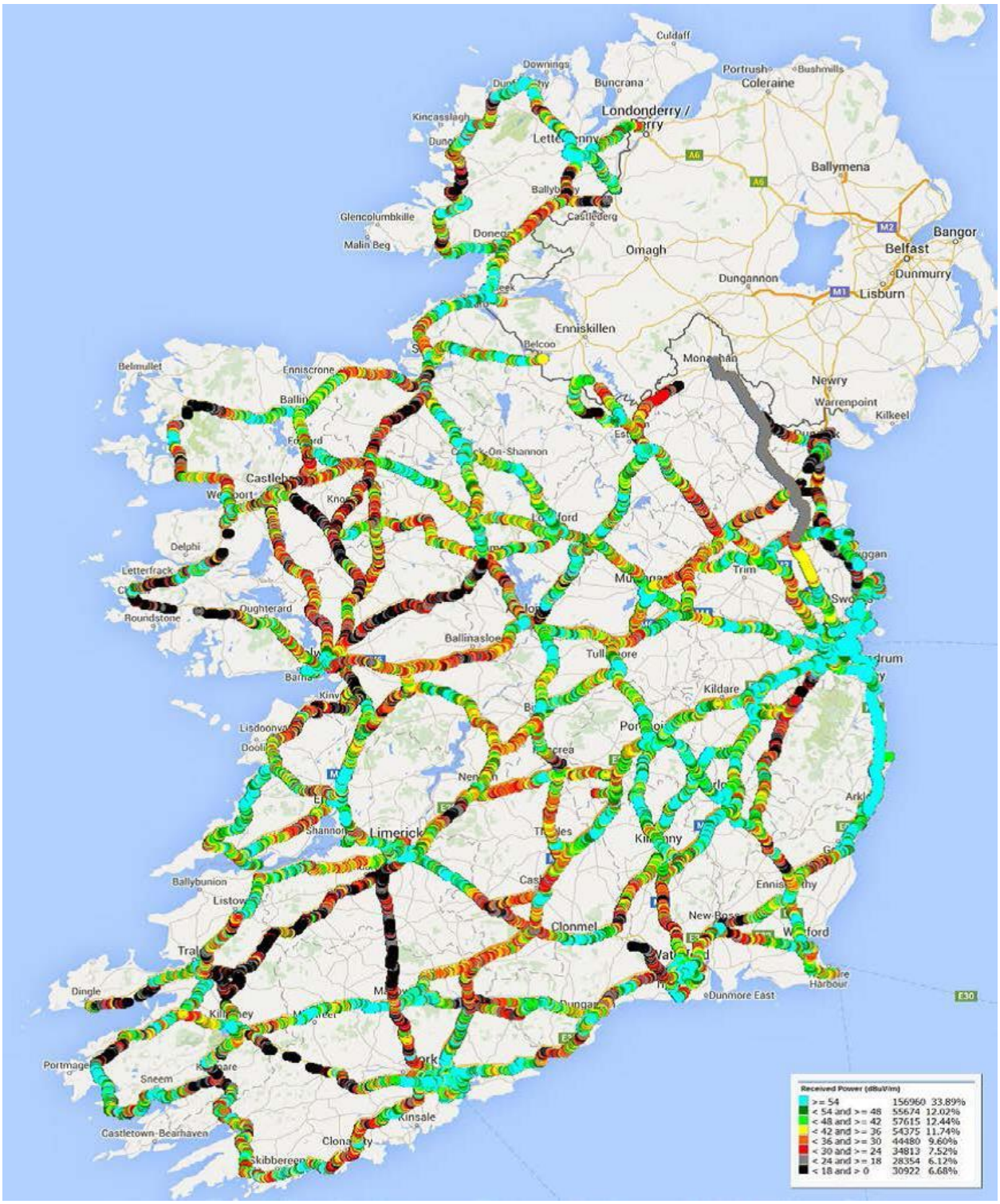

Figure 9: Meteor Liberalised Use Licence; 900 MHz (HSDPA/UMTS)

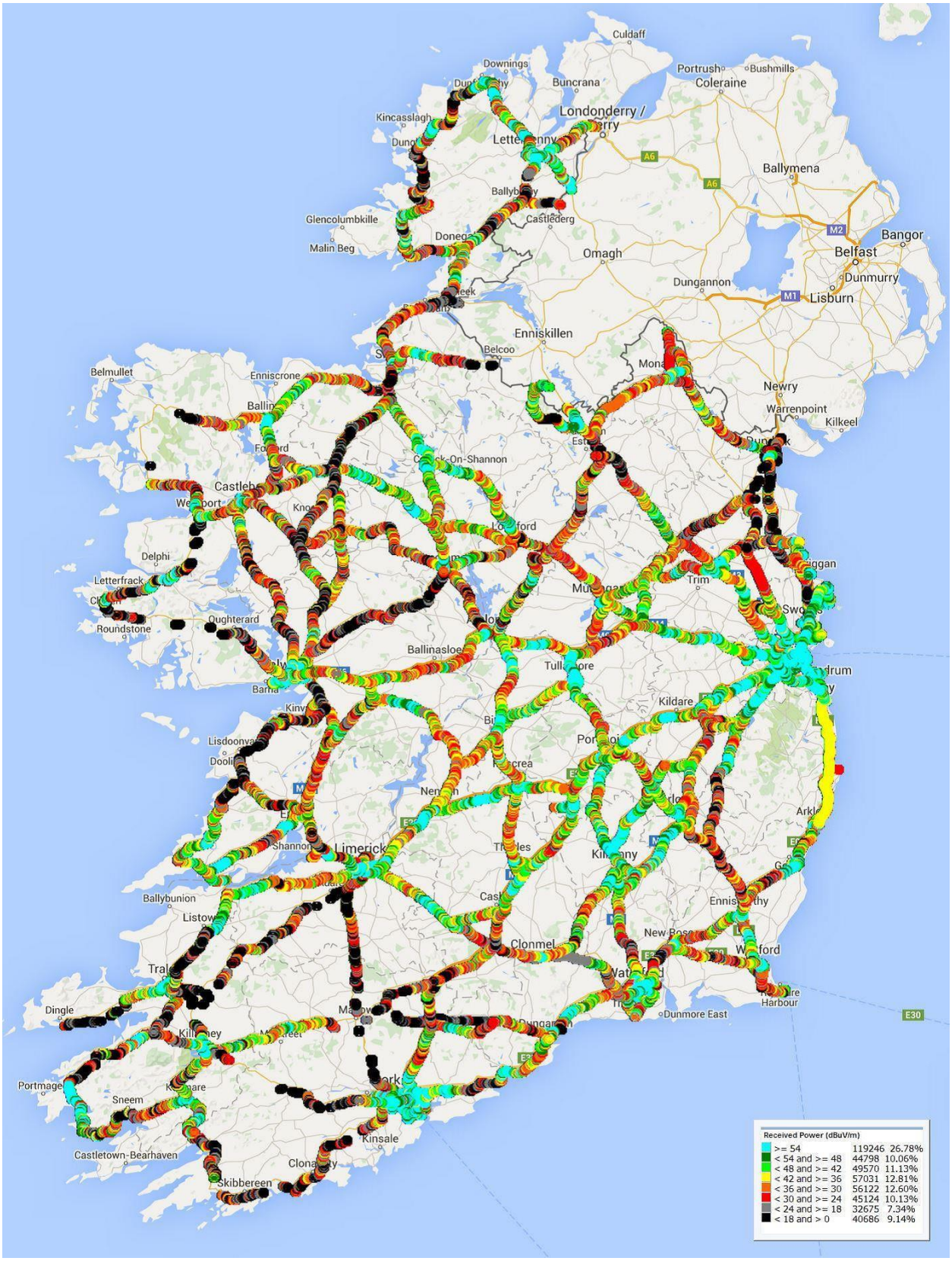

Figure 10: 3IHL Liberalised Use Licence; 900 MHz (HSDPA/UMTS)

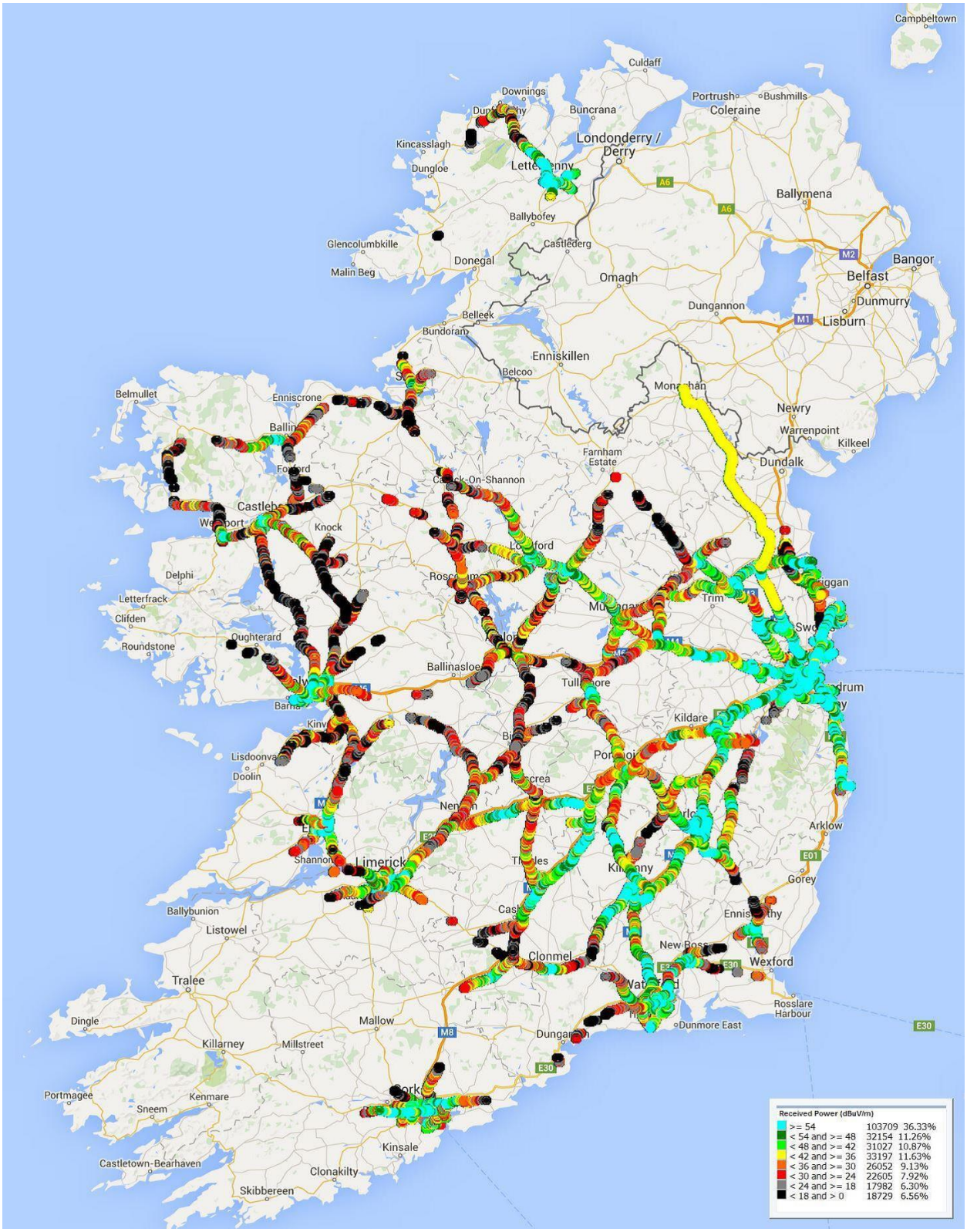

Figure 11: 3ISHL Liberalised Use Licence; 900 MHz (HSDPA/UMTS)

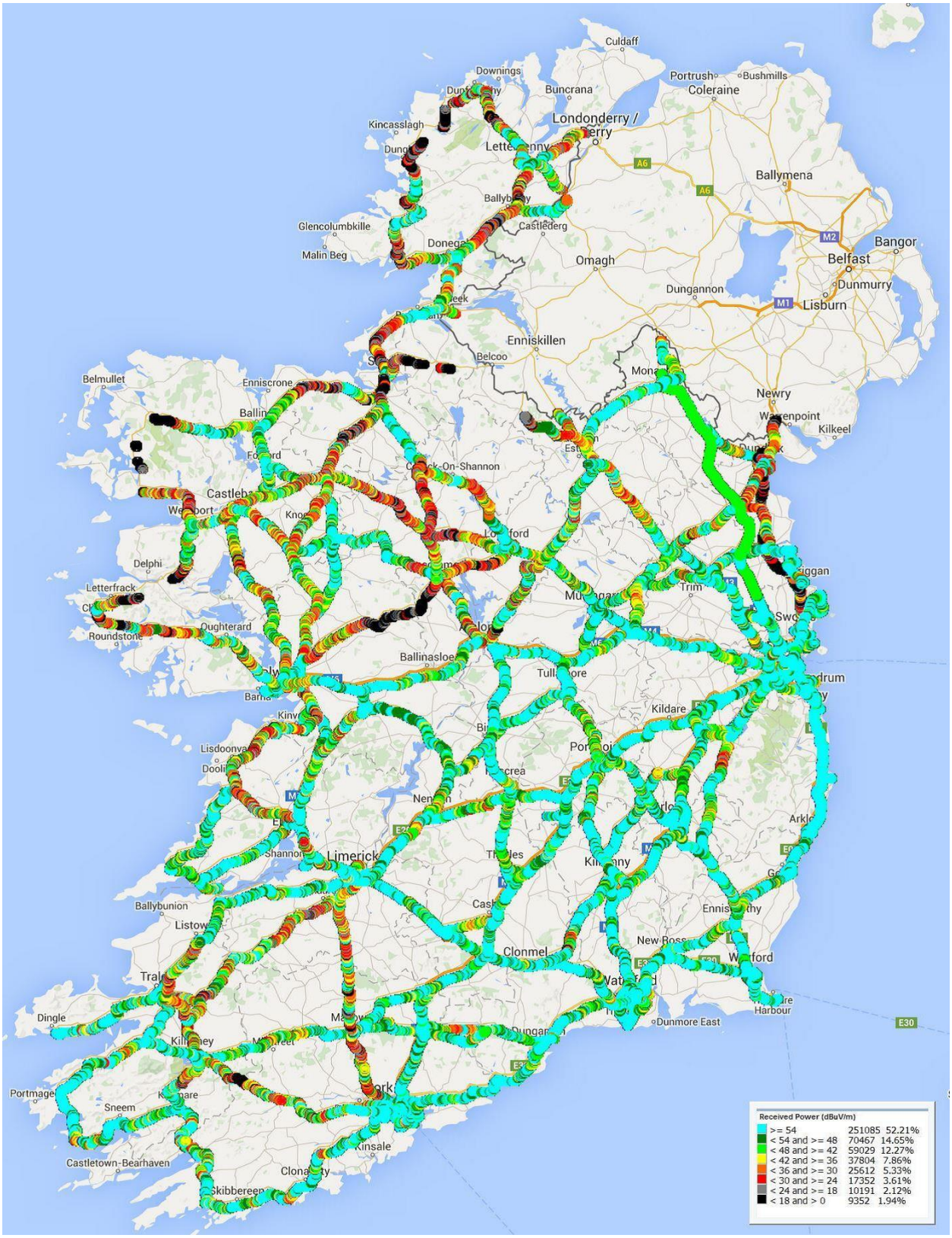

Figure 12: Vodafone Liberalised Use Licence; 900 MHz (HSDPA/UMTS)

4.4 Liberalised Use Licence; 800 & 1800MHz (LTE)

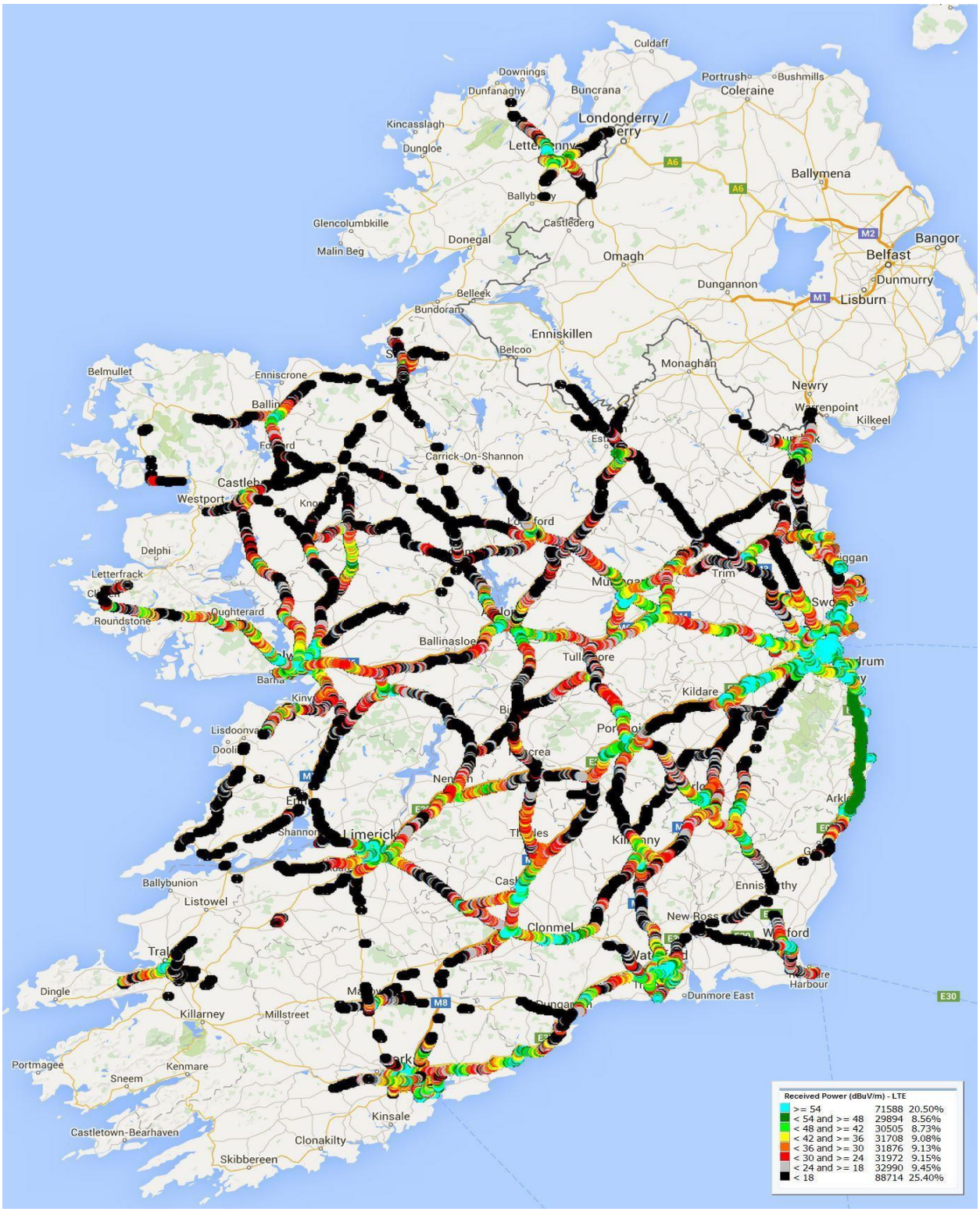

Figure 13: Meteor Liberalised Use Licence; 800 & 1800 MHz (LTE)

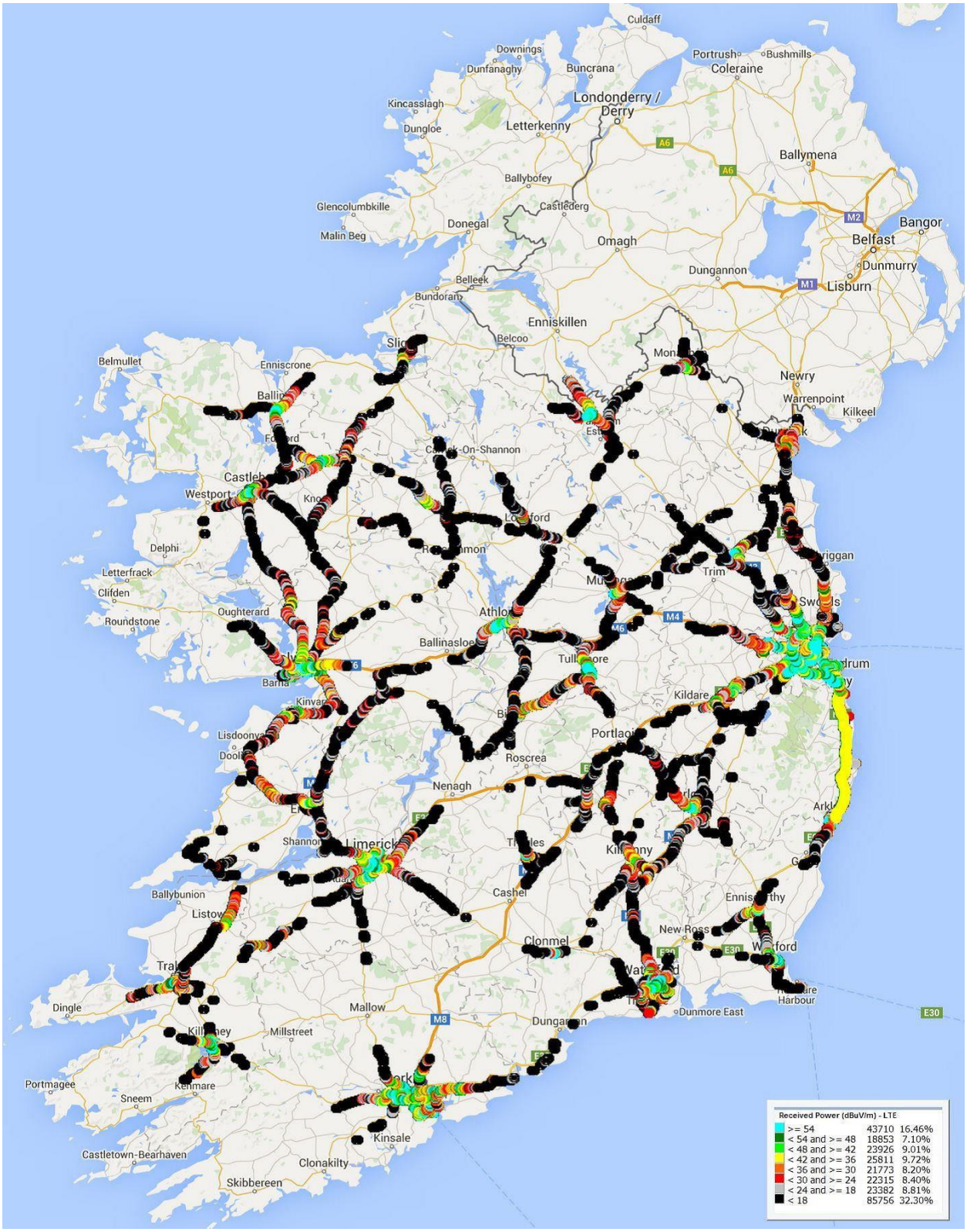

Figure 14: 3IHL Liberalised Use Licence; 1800 MHz (LTE)

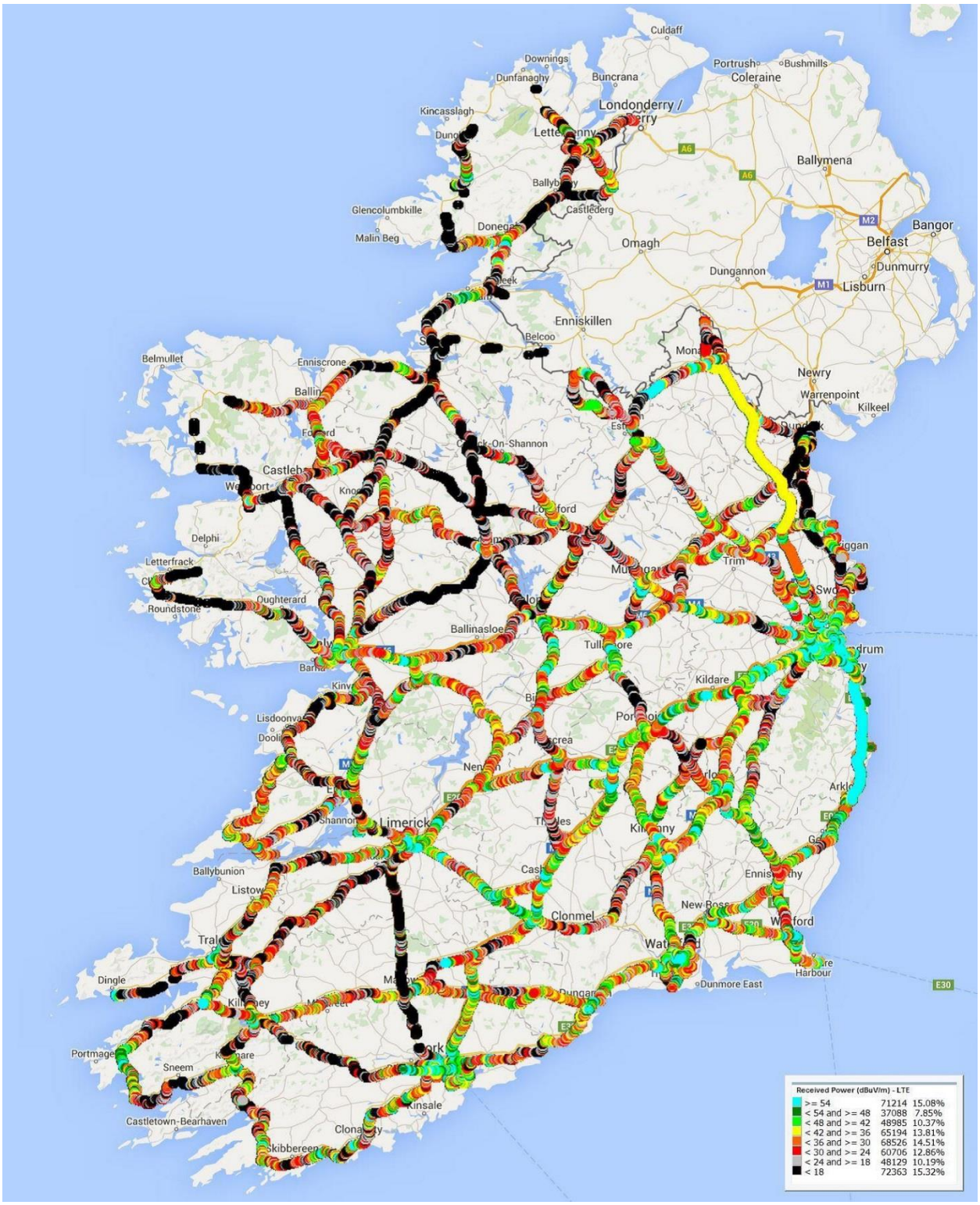

Figure 15: Vodafone Liberalised Use Licence; 800 & 1800MHz (LTE)

5 Conclusions

General Comments

20. ComReg notes the progress made so far in rolling out mobile electronic communications services under the Liberalised Use Licences and that in all cases the coverage criterion has already been met.

21. As mentioned previously the mobile networks are still in the rollout period[12] of their licence obligations and from the results of this Drive Test, it can be seen that these new networks are still in an evolutionary state. ComReg will continue to conduct Drive Tests for each of the Liberalised Use Licences to ensure compliance with licence obligations.

Coverage

22. All Licensees have exceeded their obligations under their respective Licences to date.

23. A simplified, collated version of the coverage results of this Drive Test is outlined in Table 1 below. These results represent the minimum coverage by population achieved during the Drive Test.

	GSM1800	UMTS2100	LUL/LTE(800/1800)	LUL/GSM(900/1800)	LUL/3G(900/2100)
Meteor	>53%	>90%	>53%	>90%	>53%
3IHL		>90%	>53%		>70%
3ISHL	>70%	>90%		>90%	>53%
Vodafone		>90%	>70%	>90%	>90%

Table 1 - Minimum coverage as indicated by the Drive Test

Average Download Speeds

24. While not a Licence Obligation, ComReg notes the average download speeds achieved during the Drive Test. The findings of the stationary portion of the drive test demonstrated that LTE speeds offered are on average 3.7 faster than those offered by 3G (“HSDPA”).

25. Table 2 below provides an overview of the average of the download speeds achieved throughout the Drive Test. It is acknowledged that speeds greater or less

[12] See Schedule 1, Part 4, paragraph 3(2)c to the Wireless Telegraphy (Liberalised Use and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz Bands) Regulations 2012, S.I. 251 of 2012

than these can be experienced based on, among other factors, geographic location and the load on the network.

Licensee	Technology	D/L Stationary (Mbps)	D/L Mobile[13] (Mbps)
Meteor	3G HSDPA	3.32	1.48
	LTE	10.66	2.03
3IHL	3G HSDPA	2.47	1.07
	LTE	7.62	1.64
3ISHL	3G HSDPA	2.91	1.00
	LTE[14]	N/A	N/A
Vodafone	3G HSDPA	3.51	1.72
	LTE	15.89	2.03

Table 2 - Average data speeds achieved during the Drive Test

26. It is normal that download speeds while moving are less than those achieved while stationary. It is an unavoidable physical phenomenon inherent in mobile communications.

27. It is also important to note, as discussed in section 1 above, that higher data services, such as 3G and LTE are more susceptible to interference and disruption. Consequently such services require higher signal levels to maintain speed and quality.

13 Average Vehicular Speed of 80kmph.

14 3ISHL did not offer LTE services at the time of this Drive Test.

Appendix 1: Glossary

A 1.1 Terms defined in this Information Notice, unless the context otherwise requires or admits, have the meaning set out below:

3G	Third Generation Mobile System (e.g. UMTS)
2G	Second generation mobile services (e.g. GSM)
3G Licence	A Licence issued under the Wireless Telegraphy (Third Generation and GSM Licence) Regulations, 2002 and 2003 (S.I. 345 of 2002 and S.I. No. 340 of 2003) for 3G services in the 2100 MHz band.
3GPP	Third Generation Partnership Project
3IHL	Three Ireland (Hutchison) Limited
3ISHL	Three Ireland Services (Hutchison) Limited
800MHz band	The frequency range 791 – 821 MHz paired with 832 – 862 MHz
900MHz band	The frequency range 880 – 915 MHz paired with 925 – 960 MHz
1800MHz band	The frequency range 1710 – 1785 MHz paired with 1805 – 1880 MHz
2100 MHz Band	1920 – 1980 MHz paired with 2110 – 2170 MHz, and 1900 – 1920 MHz
ComReg	Commission for Communications Regulation
DCENR	Department of Communications, Energy and Natural Resources
Down Link, D/L	The radio channel from the base station to the user's handset.

Drive Test	Measurements conducted from a vehicle containing a computer controlled measuring system which acts as a 'handset', matching an European Telecommunications Standards Institute ("ETSI") standard handset, which places the calls and transfers the files automatically to a fixed line and references the measurements to GPS ("Global Positioning System"), as the route is driven
EC	European Commission
ETSI	European Telecommunications Standards Institute
EU	European Union
General Authorisation	An authorisation for an undertaking to provide an electronic communications network or service under and in accordance with Regulation 4 of the Authorisation Regulations.
GPS	Global Positioning System
GSM	means Global System for Mobile Communications from the European Telecommunications Standards Institute ("ETSI")
HSDPA	High Speed Downlink Packet Access, 3G Mobile Broadband
Hz	Unit of Frequency
LTE	means the Long Term Evolution family of standards from European Telecommunications Standards Institute ("ETSI") and Third Generation Partnership Project ("3GPP");
Mbps	Mega (One Million) bits per second, a measure of data throughput.
Meteor	Meteor Mobile Communications Limited
MHz	Megahertz, One Million Hertz

MNO	Mobile Network Operator
Third Generation	means a mobile and wireless communications system based on a standard within the IMT-2000 system capable of supporting innovative multimedia services beyond the capability of second generation systems such as GSM, and capable of supporting the characteristics referred to in Annex 1 of the UMTS Decision
Up Link, U/L	The radio channel from the user's handset to the base station.
UMTS	Universal Mobile Telecommunications System.
Vodafone	Vodafone Ireland Limited

Appendix 2: Drive Test Equipment

A 2.1 The following equipment was used to conduct measurements during this Drive Test. All equipment was within calibration at the time the measurements were taken.

- Nemo Invex II with associated measurement servers
- Nemo FSR1 multi-band scanner
- 2 multi-band antennas
- Laptop with Nemo Outdoor application
- Samsung Note 4 test phone with Nemo Media Router application
- An FTP server based in Dublin
- Relevant SIM cards