



Title: **Multiplex in Northern Ireland – Interim Report**

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Note: This is an Ofcom summary of a report prepared by Arqiva. Ofcom will publish the full report in due course.

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Northern Ireland

Introduction

Ofcom has asked Arqiva Spectrum Planning Department to investigate options for a potential further multiplex in Northern Ireland. This interim report provides an initial analysis of channel and coverage availability for the three main Northern Ireland transmitters – Divis, Limavady and Brougher Mountain.

Channel Availability for a Further Multiplex at Northern Irish Stations

The UK DSO frequency plan is well developed for much of the country. Planning was done to provide 3PSB multiplexes and 3 COM multiplexes at all existing DTT stations (Divis, Limavady and Brougher Mountain in Northern Ireland), 3PSB multiplexes at all other existing analogue transmitter stations, and to release 14 frequencies for the Digital Dividend. In early versions of the frequency plan, an additional 120 stations were assigned to the 3 COM multiplexes (of which 10 were in Northern Ireland), if the COM operators were interested. The COM operators turned down the opportunity to use these additional sites.

As the UK plan is an MFN plan and existing receive aerials are banded into 3 different sections of the UHF band (Band IV, Lower Band V and Upper Band V), generally main stations are in one section, with the relays of that main station occupying the other two sections. As main stations also cause interference significantly beyond their service boundaries, this presents planners with challenges to find available frequencies for a further multiplex without causing disruption to the DSO frequency plan.

Divis Channel Availability

At Divis both PSB and COM services have been planned in Band IV. This leaves only four channels in retained spectrum in Band IV that are not currently used for Divis (channels 22, 25, 28 and 30). However, channels 22, 25 and 28 are used for PSB services from Brougher Mountain and are ruled out. Arqiva have carried out further analysis of the use of Channel 30.

Divis Channel 30 Comments

Channel 30 is used by Caldbeck PSB service. The population loss based on varying power reductions at Divis is shown below. The coverage impact on Caldbeck PSB Ch 30 gross coverage is shown in Figure Seven.

Divis ERP	Caldbeck Gross Households Lost	%age of Gross Households Served	Caldbeck PSA Households Lost	% of PSA Households Served
50 kW	17,083	9.3%	6,657	5.7%
25 kW	12,905	7.0%	4,582	3.9%
12.5 kW	9,344	5.1%	3,363	2.9%
5 kW	5,488	3.0%	1,994	1.7%

Total Gross Households Served = 183,110 HH; Households served in PSA = 117,703 HH

In addition to the impact on coverage of Caldbeck Ch 30, there may also be an impact on the RBLs from Caldbeck. As the Regional System Design for Border region has been carried out, use of channel 30 at Divis might result in a requirement to change RBL receive antennas, use of re-transmitters instead of transposers, or, in extreme cases, require the use of line feeding sites.

An alternative approach may be to swap the channel allocated to the Caldbeck Scottish PSB1 service (Ch 22) for Channel 30. Further work would be required to see if this is a workable solution.

Channel 30 is in the GE-06 plan for Holywell Hill, Three Rock, Mount Leinster and Churchfield. Divis and Holywell Hill are planned to be co-channel with Brougher Mountain on channel 25. Therefore, it is believed that it would be possible to come to an agreement with Ireland on the same basis. Divis and Three Rock are also co-channel on channels 23 and 26, so it is expected that an agreement can be also reached for channel 30.

Divis Channel 48 Comments

When a channel search is carried out in Band V, a number of Northern Ireland relay stations are planned to use most Band V frequencies. Additionally, a number of stations in the Border TV region would also be affected on most Band V frequencies. As the Northern Ireland relay plan has not been completed and “locked down”, it might be easier to change the DSO plan at a limited number of sites, but changes to the Border region plan would be much harder to implement. Additionally, the Republic of Ireland make significant use of Band V frequencies, and Clermont Carn (52, 56, 66, 68, 53, 57, 60, 63) in particular would have to be avoided.

If use of Channel 30 at Divis is not possible, Arqiva believe that only channel 48 in retained spectrum is likely to be available for a further multiplex at Divis at any significant ERP. This channel is used at three Divis relays (Whitehead, Rostrevor and Bellair), which would need re-channelling.

There is no significant use of 48 in the Border TV region, but 48 is used for COM services at Moel-y-Parc. The population loss based on varying power reductions at Divis is shown in the table below. The coverage loss based on 50kW ERP at Divis is shown in Figure Eight. Ofcom is asked to advise on the level of protection required for Moel-y-Parc COM services, as it can be seen that even with a 10dB ERP reduction, there is still significant coverage loss.

Divis ERP	Moel-y-Parc Gross Households Lost	%age of Gross Households Served	Moel-y-Parc Gross Households Lost in Wales	% of Gross Households Served in Wales	Moel-y-Parc PSA Households Lost	%age of PSA Households Served
50	135,347	13.8%	9,623	10.7%	6,821	7.6%

kW						
25 kW	100,050	10.2%	5,744	6.4%	3,829	4.2%
12.5 kW	73,279	7.5%	4,118	4.6%	2,435	2.7%
5 kW	44,354	4.5%	2,944	3.3%	1,460	1.6%

Total Gross Households served = 979,754 HH; Total Gross Households served in Wales = 89,608 HH; Households served in PSA (includes some households in England) = 90,280 HH

Channel 48 is also in the UK GE-06 plan for use by COM services at Londonderry and Stranraer. If COM operators decide to go to these sites, an alternative frequency may be required. Channel 48 is an existing DTT frequency at Divis.

Channel 48 is not used by Ireland in the GE-06 plan except at Maghera which should have no issues with Divis, but in the last Bi-Lateral meeting with Ireland, the use of channel 48 at Clermont Carn was being considered to comply with the EC position on releasing channels 62 and above.

If channel 48 is ruled out because of interference to Moel-y-Parc, it is not believed that there is an alternative Band V frequency that would be acceptable.

Limavady Channel Availability

Limavady is planned to use channels 55, 59 and 62 for PSB services and 54, 58 and 61 for COM services. The Clermont Carn channels are avoided due to interference in areas to the east of Limavady, and channel 48 has been identified for use at Divis. Therefore, channel 51 has been identified as in-band frequency at Limavady with good coverage.

Channel 51 is only used on a limited basis within the UK, and it is not expected that Limavady would cause significant interference to the UK DSO plan. However, the impact on the coverage of Moel-y-Parc COM and Emley Moor COM would need to be checked.

Channel 51 is in the Irish GE-06 plan at Achil, Aranmore, Cahirciveen, Cairn Hill, Casla, Knockanore, Mitchelstown, Mount Gabriel and Woodcock Hill. It is not expected that Limavady would cause significant interference to any of these sites.

This channel has been identified and co-ordinated for use at Londonderry and Cambret Hill as a COM channel. Therefore, if the COM operators were to renew interest in going to Londonderry and Cambret Hill, an alternative frequency may need to be found for either site.

Brougher Mountain Channel Availability

Brougher Mountain is planned to use channels 22, 25 and 28 for PSBs and 21, 24 and 27 for COMs. Channels 21, 24 and 27 are co-channel with Divis PSB services, and are limited in ERP to 2kW.

Although Brougher Mountain COM is co-channel with Divis PSBs, it is not recommended that channels 23, 26 and 29 (Divis COM channels) are used. This is because an ERP of 10kW is required to provide service to Omagh.

Therefore, channel 30 has been identified as in-band frequency for use at Brougher Mountain, if it is not used by Divis. This channel is not expected to cause significant interference to UK stations, although Caldbeck PSB coverage would need to be checked. Channel 30 is an existing DTT frequency at Brougher Mountain.

Channel 30 is in the GE-06 plan for Holywell Hill, Three Rock, Mount Leinster and Churchfield. Holywell Hill is planned to be co-channel with Brougher Mountain on channel 25. Coverage of Brougher Mountain would also increase if the 6dB restriction on Holywell Hill for channel 25 can also be agreed for channel 30.

It is also expected that Brougher Mountain and Three Rock can co-exist on the same frequency.

If channel 30 is used at Divis, then either Brougher Mountain would need to operate as an SFN, or an alternative channel would be required. Channel 48 could be used at Brougher Mountain with little impact on Moel-y-Parc, so this is proposed.

Coverage Analysis

Coverage has been predicted for Divis, Limavady and Brougher Mountain on the basis of the following characteristics, utilising interference lists developed from the V5.6 Frequency Plan:

Station	Channel	ERP	Antenna Height	Antenna File
Divis	48	50 kW	186 m	107002900
Divis	30	50 kW	186 m	107002900
Limavady	51	10 kW	37 m	130005800
Brougher Mountain	30	10 kW	61 m	Analogue Helicopter measured pattern
Brougher Mountain	48	10 kW	61 m	Analogue Helicopter measured pattern

The analogue helicopter measured pattern of Brougher Mountain was used as the PLT files are pure omni-directional files. Coverage has assumed use of the main antenna system at all sites, but this would need to be verified by the site landlord (NGW in all three cases). It is known that at Divis, the DSO antenna system is close to safety rating, and it is very likely that an individual antenna system would be required, especially if restrictions are required towards Moel-y-Parc.

Station	Gross Coverage, 70% Locations, In Northern Ireland (Households)	PSA Coverage, 70% Locations, In Northern Ireland (Households)	Figure of Merit
Divis Channel 48 Figure One	498,856	426,457	0.97
Divis Channel 30 Figure Two	431,146	389,194	0.89
Limavady Channel 51 Figure Three	76,257	45,077	0.97
Brougher Mountain Channel 30 Figure Four	29,660	28,221	0.73
Brougher Mountain Channel 48 Figure Five	42,529	32,694	0.85

	Coverage in Northern Ireland, 70% Locations (Households)	Percentage of Total Northern Ireland Households Covered
Northern Ireland Main Stations Combined Coverage*	580,831	84.9%

* Northern Ireland Main Station combined coverage assume use of Channel 48 at 50kW at Divis, Channel 51 at 10kW at Limavady and Channel 30 at 10kW at Brougher Mountain

Total Northern Ireland Households = 684,444

Figure Six shows the combined coverage of Northern Ireland Main Stations.

Coverage of Different Transmission Modes

The coverage predictions in the previous section assume use of 64 QAM 2/3 transmission mode, to match the mode of the UK post DSO multiplexes. However, if it is acceptable to reduce capacity, the transmission mode can be changed such that the ERP (and thus outgoing interference) can be reduced, without reducing coverage.

The post DSO UK multiplexes will use 64 QAM 2/3 transmission mode, and the capacity is 24 Mbit/s, which allows for approximately 8 standard definition services, plus data services. If QPSK 2/3 is used, the capacity drops to 8 Mbit/s, but the ERP can be reduced by 10dB with respect to 64 QAM 2/3 services and coverage is maintained. This would give space for 2 to 3 SD services.

16 QAM 2/3 has a capacity of 16 Mbit/s, allowing for approximately 6 SD services, and the ERP can be reduced by about 6dB with respect to 64 QAM 2/3. The tables below show the coverage of both modes.

Station and Channel	Mode	ERP	Gross Coverage, 70% Locations, In Northern Ireland (Households)	PSA Coverage, 70% Locations, In Northern Ireland (Households)	Figure of Merit
Divis Ch 48	QPSK 2/3	5 kW	504,933	429,527	0.98
Divis Ch 48	16 QAM 2/3	12.5 kW	497,806	426,144	0.97
Divis Ch 30	QPSK 2/3	5 kW	445,436	397,463	0.91
Divis Ch 30	16 QAM 2/3	12.5 kW	427,695	387,340	0.88
Limavady Ch 51	QPSK 2/3	1 kW	76,321	45,375	0.97
Limavady Ch 51	16 QAM 2/3	2.5 kW	75,210	45,075	0.97
Brougher Mountain Ch 30	QPSK 2/3	1 kW	32,249	30,036	0.78
Brougher Mountain Ch 30	16 QAM 2/3	2.5 kW	28,761	27,511	0.71
Brougher Mountain Ch 48	QPSK 2/3	1 kW	49,502	33,684	0.87
Brougher Mountain Ch 48	16 QAM 2/3	2.5 kW	41,736	32,535	0.84

Summary and Further Work

The interim phase of this study has shown that it is possible to find a channel for an additional DTT multiplex at the main stations in Northern Ireland which is expected to have minimal impact on the coverage of both UK and Ireland coverage. This is especially true if a lower capacity transmission mode is used.

At Limavady and Brougher Mountain, an in-band frequency has been found, but for Divis an out of band frequency would have to be used. Coverage has been shown to be good on first analysis, assuming use of the top mounted antenna system.

Further work that should be carried out in order to fully assess the possibilities for a further multiplex in Northern Ireland is as follows. Ofcom is asked to advise on what should be included in any final report.

- Ofcom to advise on the level of protection required to Caldbeck PSB from Divis Ch 30 or Moel-y-Parc COM from Divis Ch 48
- Ofcom to comment on whether investigation on changing the channel allocations for Caldbeck PSB Ch 30 for Caldbeck Scottish PSB Ch 22 is worthwhile to reduce impact from Ch 30 at Divis
- Assess the impact on other UK stations from these proposals to determine if other restrictions are required (if JPP proposed restriction requirements for interleaved spectrum are required, these restrictions

could significantly reduce coverage and require use of specific antenna systems)

- Find alternative channels for Whitehead, Rostrevor and Bellair DSO plan due to use of channel 48 at Divis
- Discuss channels for Divis, Limavady and Brougher Mountain with Ireland, especially channel 48 which has been informally discussed with the UK for use at Clermont Carn
- Discuss antenna and aperture availability with site landlords

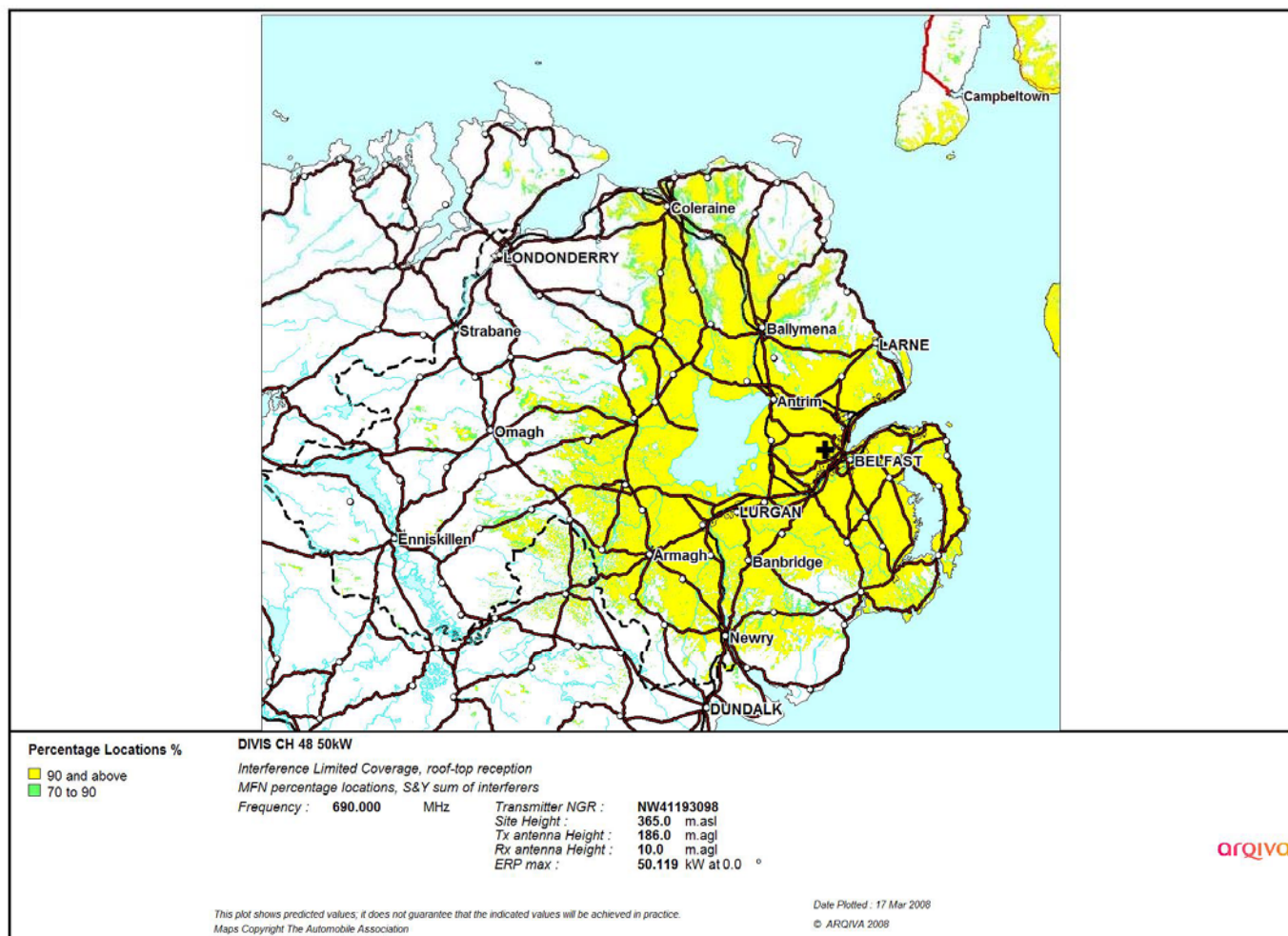


Figure One – Divis Ch 48 50kW Coverage

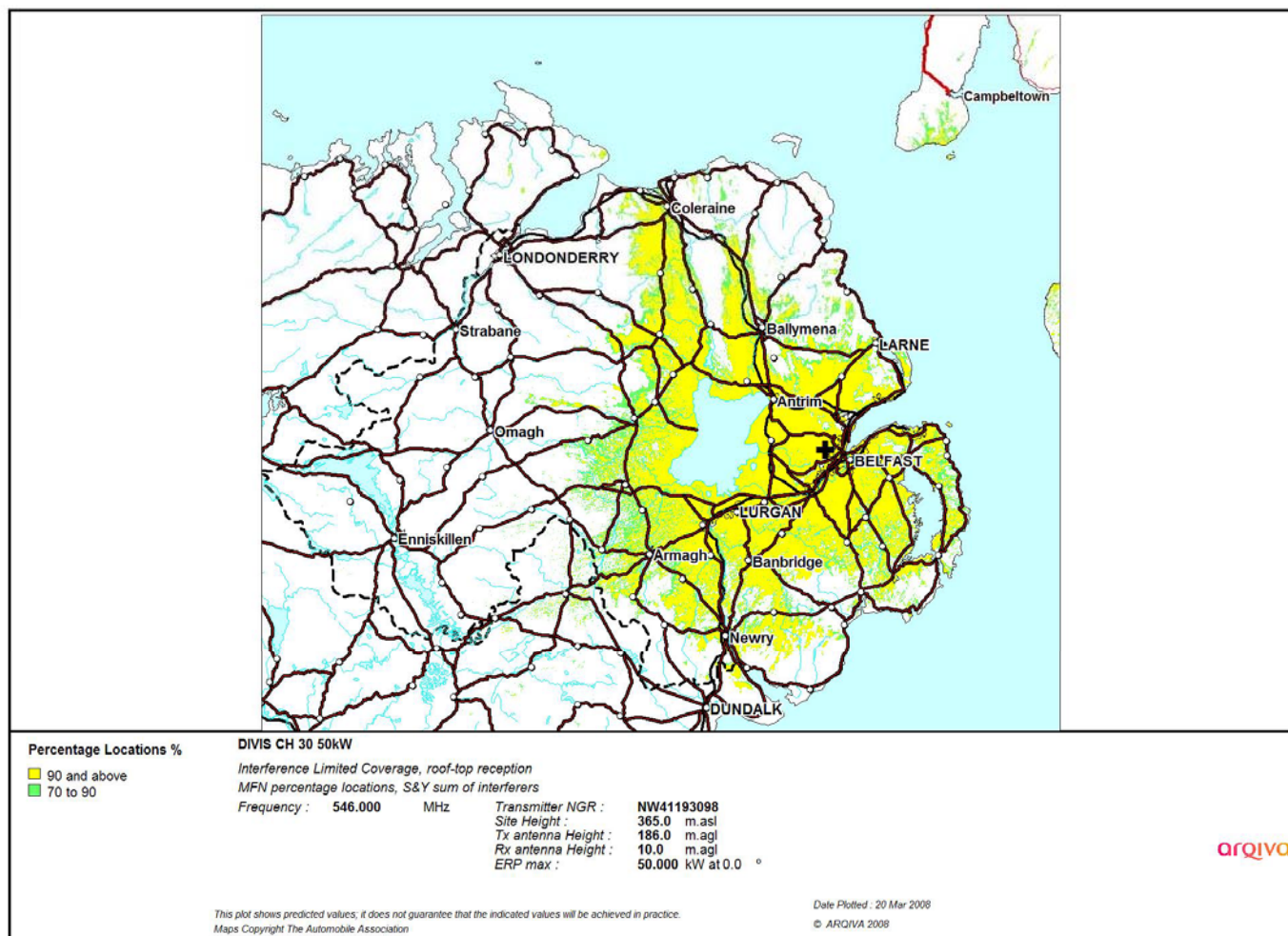


Figure Two – Divis Ch 30 50kW Coverage

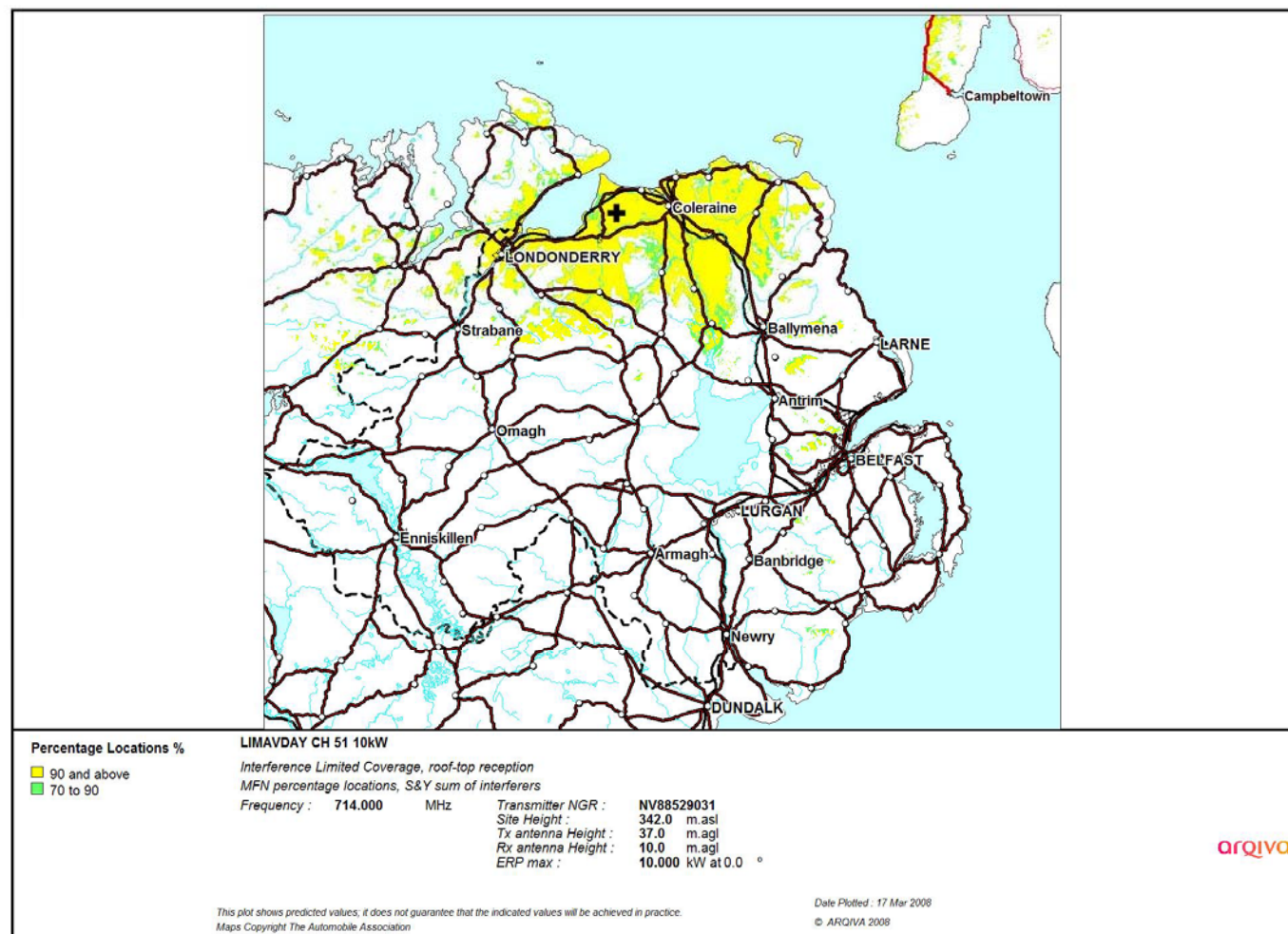


Figure Three – Limavady Ch 51 10kW Coverage

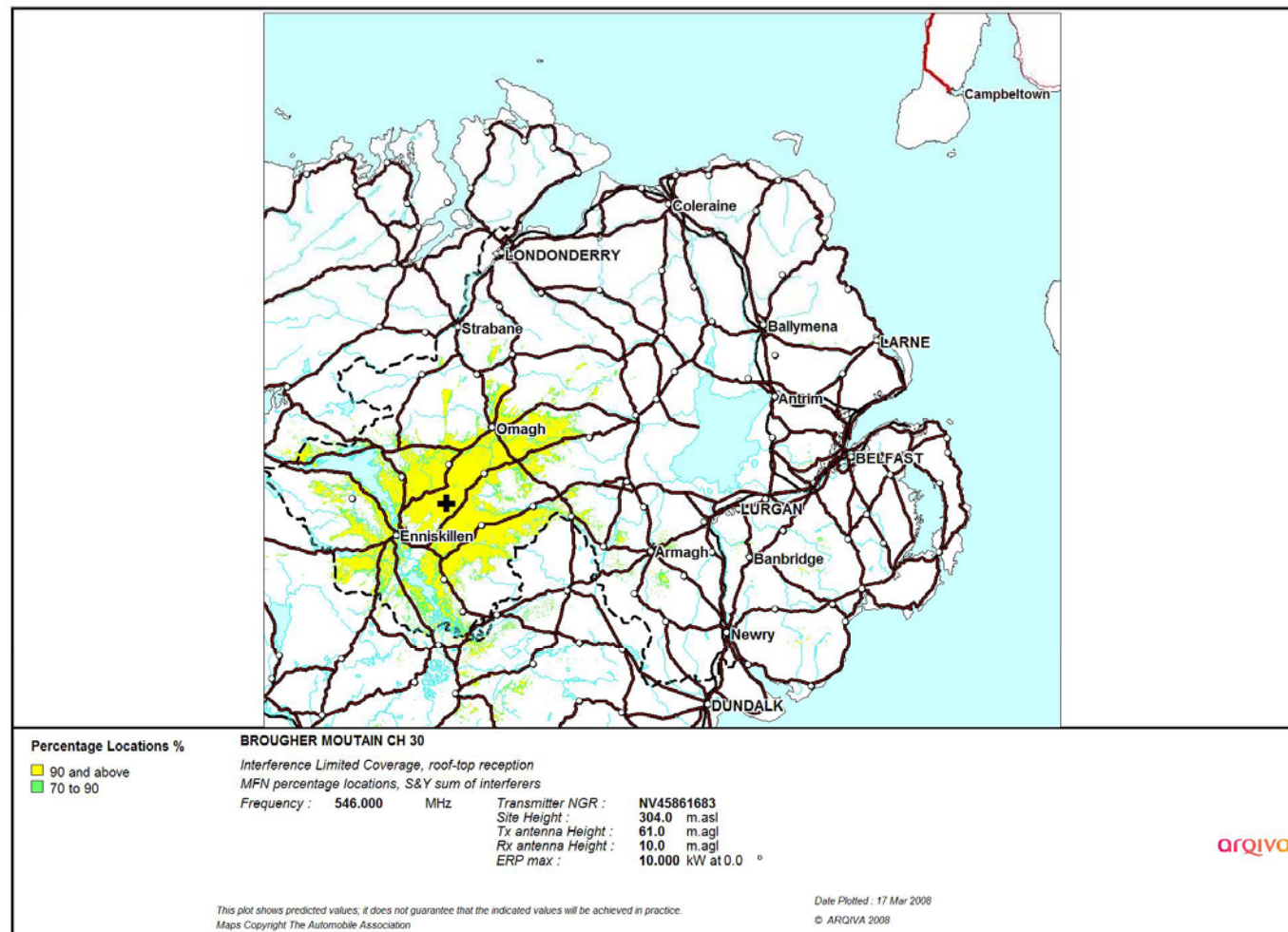


Figure Four – Brougher Mountain Ch 30 10kW Coverage

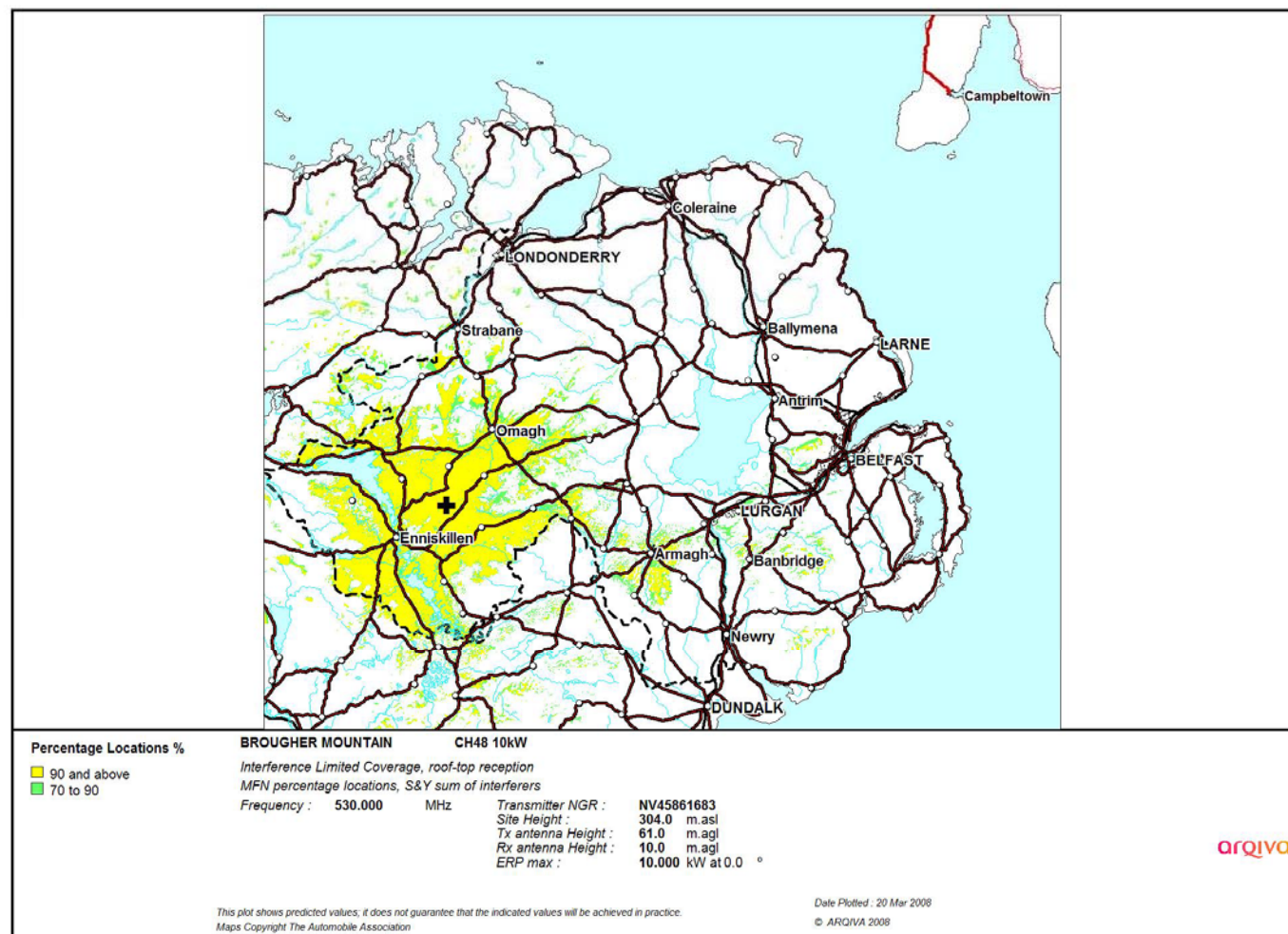


Figure Five – Brougher Mountain Ch 48 10kW Coverage

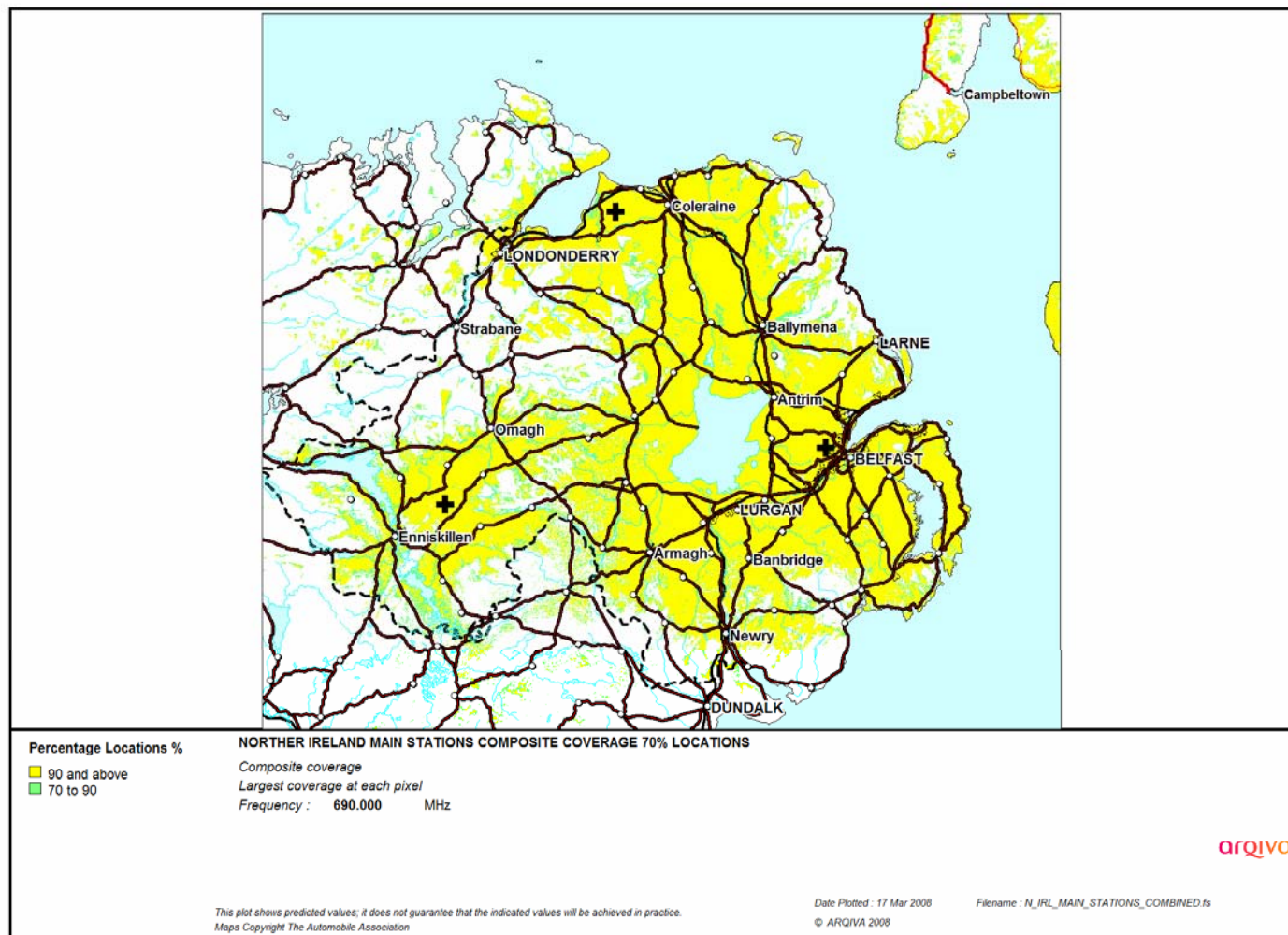


Figure Six – Combined Coverage of Northern Ireland Main Stations

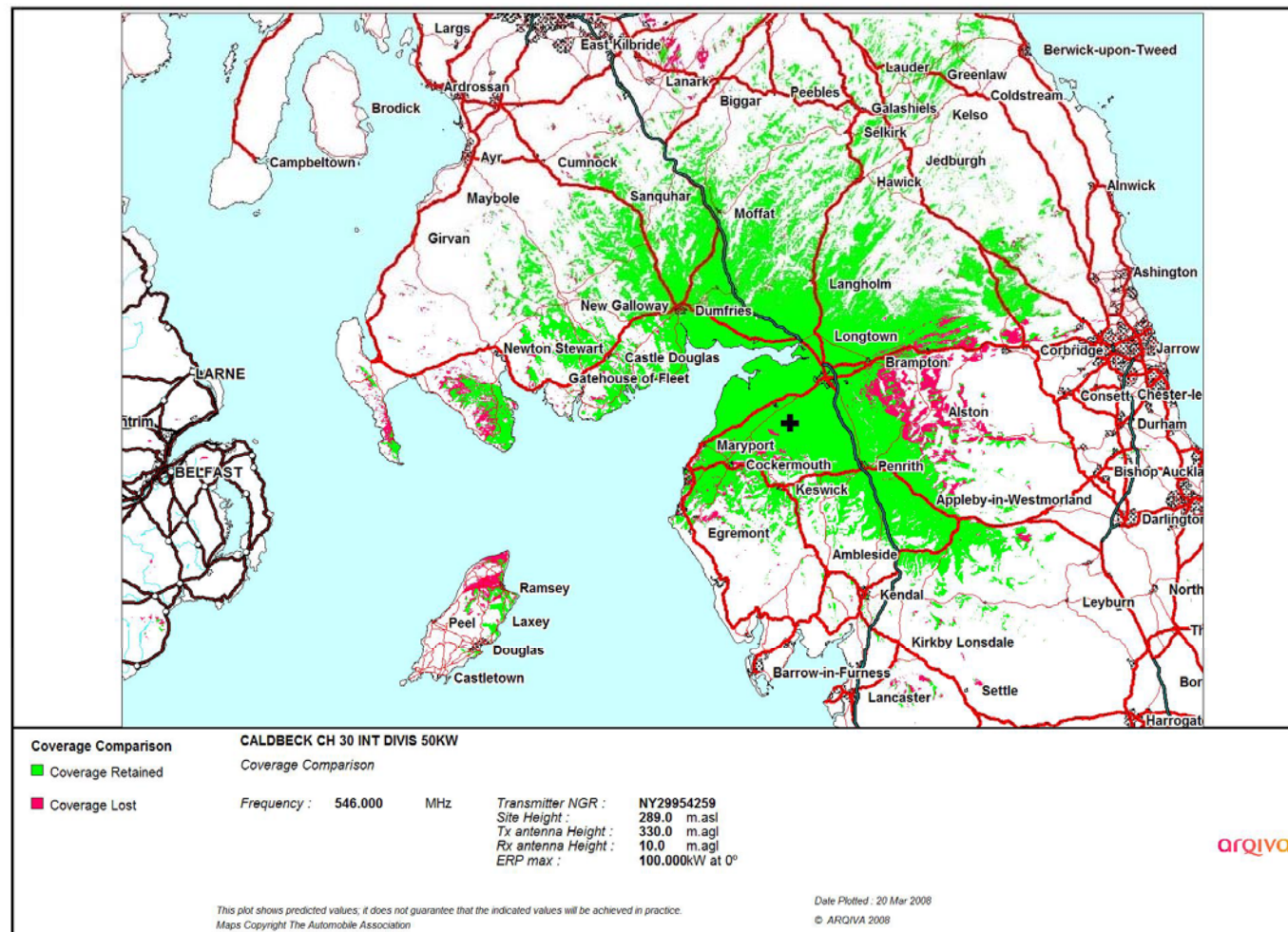


Figure Seven – Caldbeck PSB Ch 30 Coverage Lost Due to Divis DTT Ch 30 50kW ERP

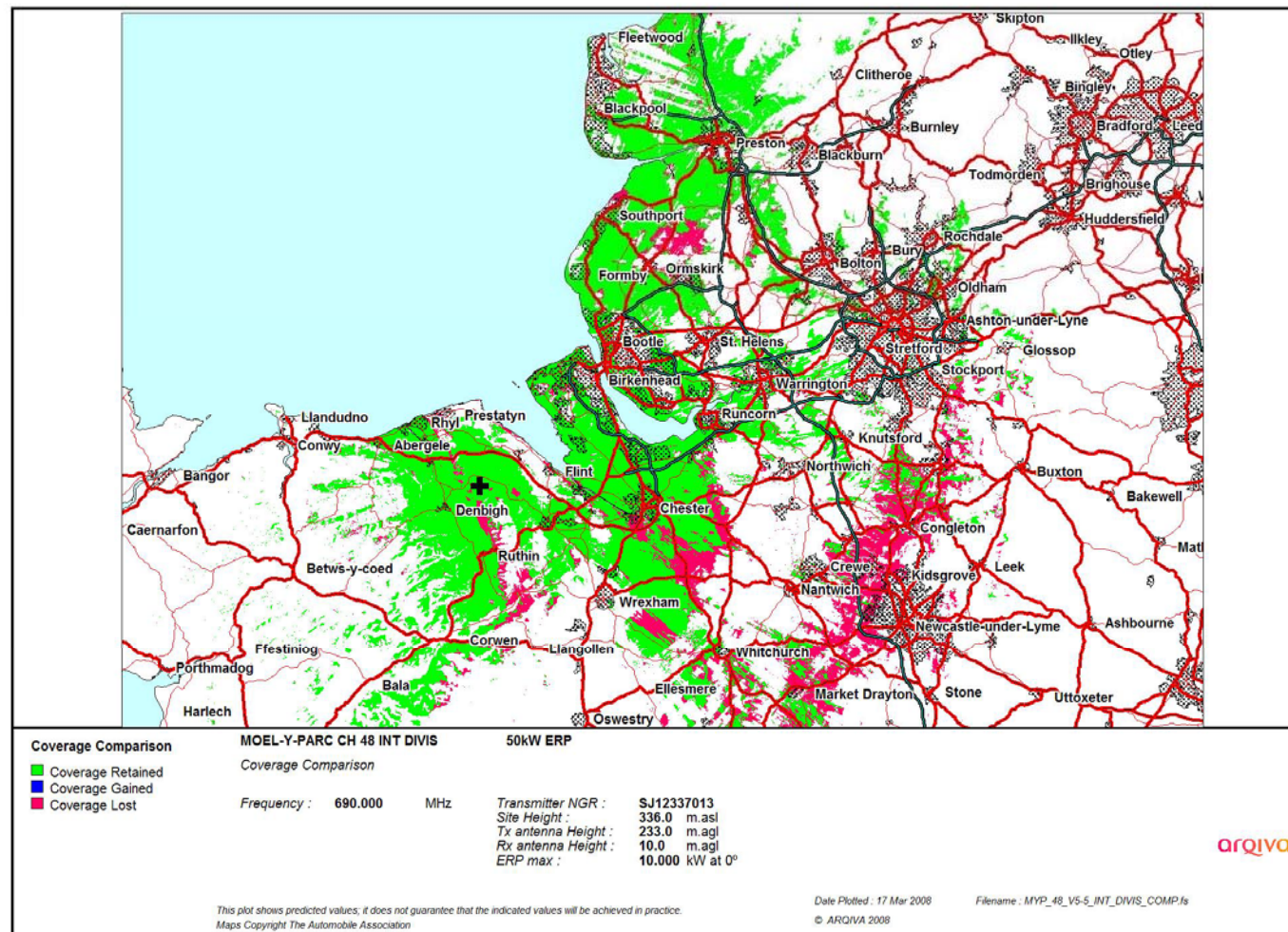


Figure Eight – Moel-y-Parc COM Ch 48 Coverage Lost Due to Divis DTT Ch 48 50kW ERP