Coordination procedures for deployment in the 2.6 GHz band

Stakeholder event
17 May 2012

Agenda

15.00	Welcome and introduction (Ofcom)
15.20	The protection thresholds (Ofcom)
15.55	Impact on deployment in 2.6 GHz band (Ofcom)
16.10	Roll-out of modifications to civil radars (DfT)
16.30	Roll-out of modifications to military radars (MOD)
16.40	Questions
17.00	Close

The HMG radar remediation programme

- Radars operating in the 2.7 GHz band need to be modified in order to safeguard them from future 4G signals in the neighbouring 2.6 GHz band
- A Government programme comprising DCMS, DfT and the MOD supported by Ofcom and the CAA, has been established to assist radar operators in modifying their radars to prepare for the introduction of 4G services
- Ofcom's role includes setting technical licence conditions for the 2.6 GHz band and coordination procedures to protect radars, before and after they are modified

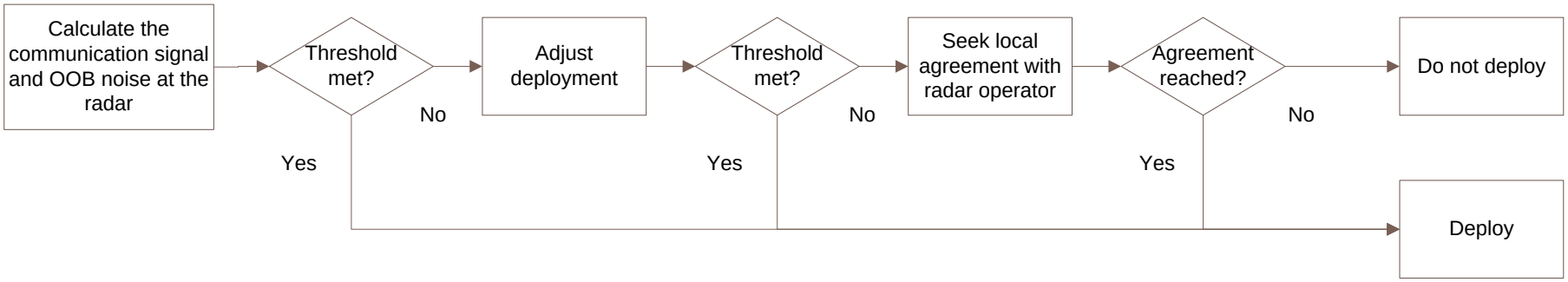
Today's presentation

- Today's presentation provides further information relevant to the coordination procedures
- Attendees should note that no final decision has been reached on these procedures and that the information set out in this presentation only represents our current thinking
- We intend to publish the draft licence, along with the draft coordination procedures, at the same time as the Information Memorandum and other documents relating to the combined award of the 800 MHz and 2.6 GHz bands
- As a result, the information set out in this presentation is for information purposes only and should not be used as a basis for deciding whether to proceed with a further investigation of possible participation in the award process

Current position on coordination procedures

- This presentation follows on from our stakeholder event on 20 January 2012 which briefed stakeholders on the technical work undertaken and our then current thinking on coordination procedures
- Ofcom will notify 2.6 GHz licensees of the coordination procedures they must comply with when deploying in the 2.6 GHz band
- It will be a condition of the 2.6 GHz licence to comply with the coordination procedures notified by Ofcom

Process overview



Protection thresholds

Protection thresholds

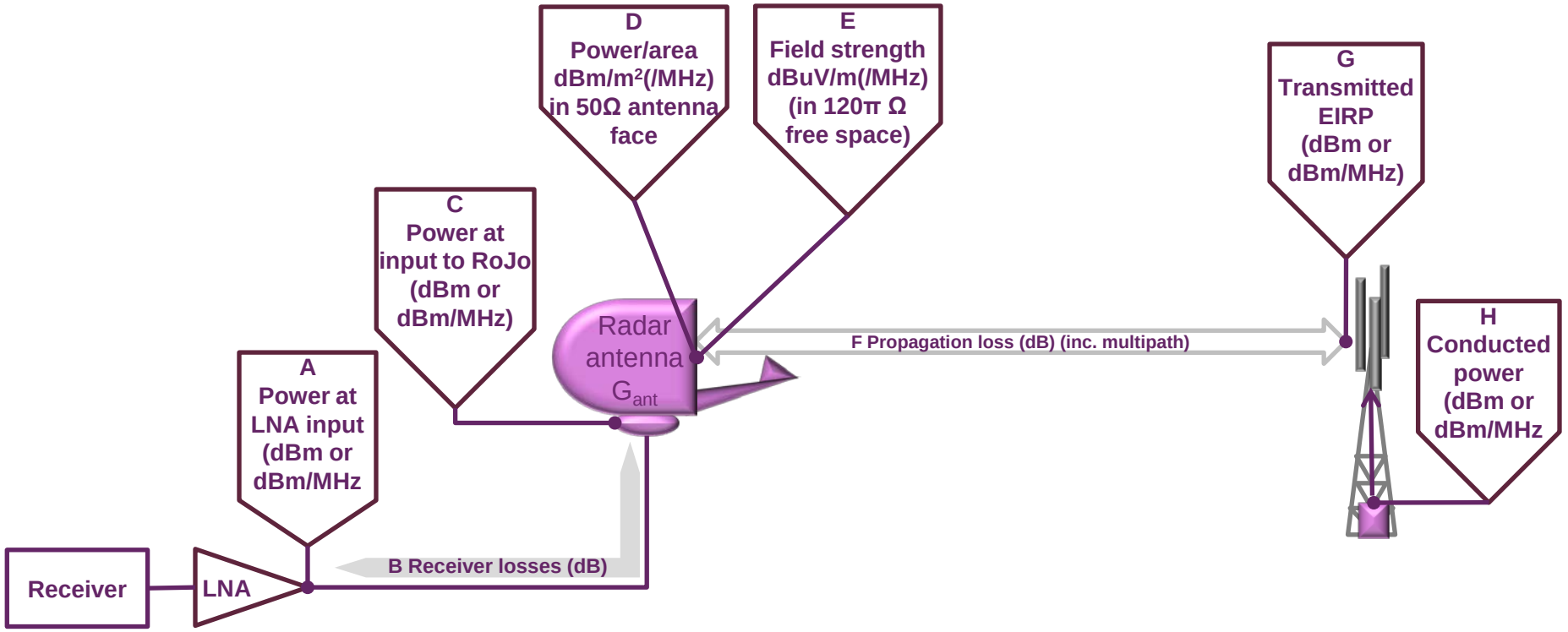
- We know new communication services in the proximity to some current radars presents two problems
  - Communications signals causing compression effects in the radar
  - Communications OOB emissions raising the radar noise level

- Ofcom has initiated work in radar companies to ensure the compression effects in the radar are substantially reduced
  - Before modification the susceptibility is high
  - After modification the susceptibility is low

- The noise effects can only be dealt with by managing Communication OOB noise emissions arriving at the radar face

- Both effects are considered in following examples and in the roll out slides

Setting the thresholds



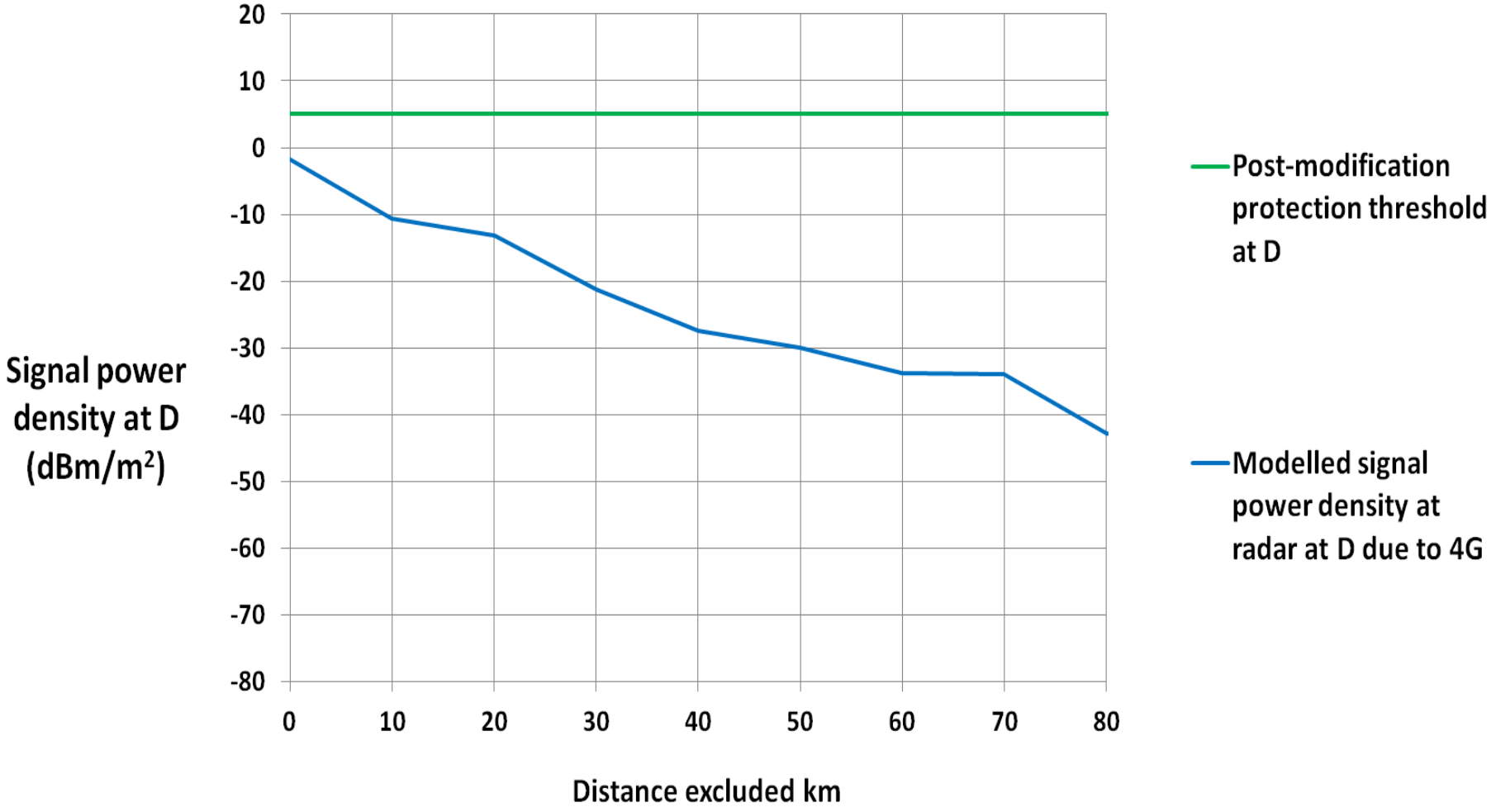
Thresholds

- Significant changes since the last stakeholder presentation (20th January 2012)
- Noise spectral power flux density threshold is now defined from 2720 MHz to 3100 MHz not at the local radar frequency
- This allows changes to radar frequencies and enables radar operators to replace current radars without any need to modify the noise characteristics of the base stations
- The pre-modification in communications band signal threshold (communication signal power per unit area in the antenna face (D)) has changed to -74 dBm/m^2 to account for other additional measurements by the radar companies
- The post modification in communications band signal threshold (communication signal power per unit area in the antenna face (D)) which was 8 dBm/m^2 has changed to 5 dBm/m^2 to account for other services close to the radar band

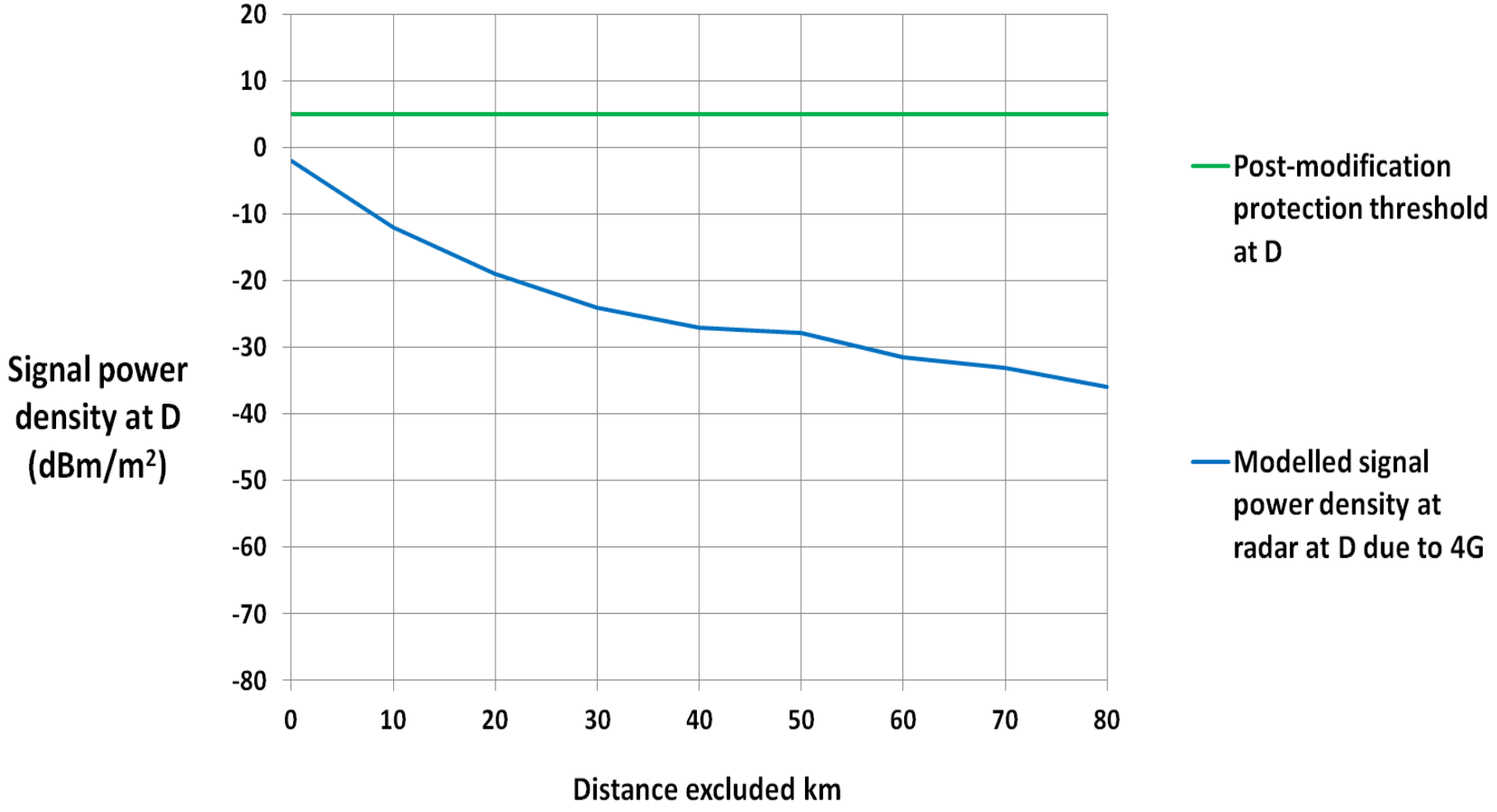
The possible effect on a ‘realistic network deployment’

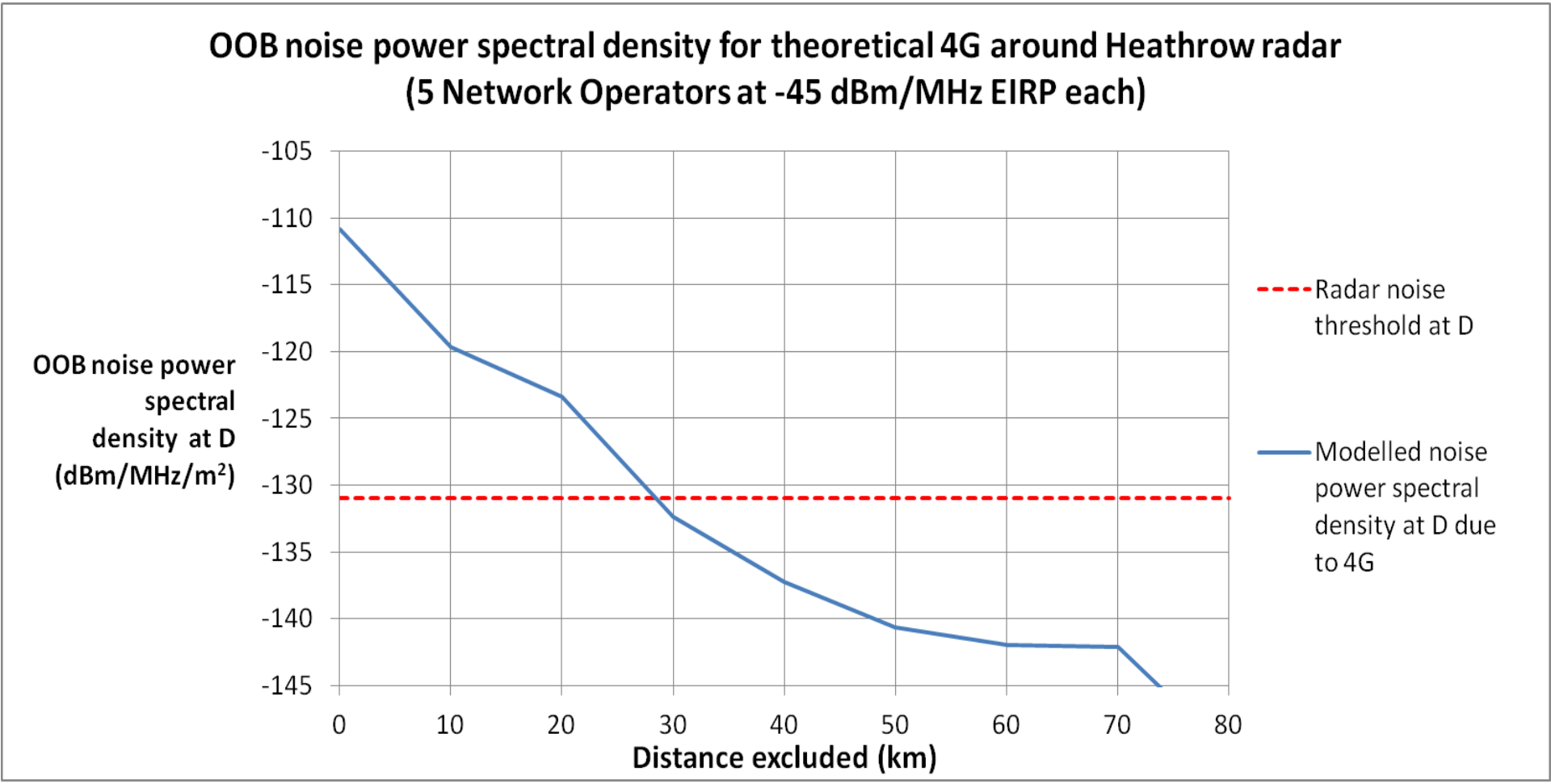
- We have modelled the effect on one theoretical but realistic 4G network using typical 3G locations, antenna height and EIRPs
- The following slides show modelled examples using Heathrow and Birmingham radars
  - We found that the radar modifications allow a high level of flexibility in base station deployment as the compression effects have been substantially reduced
  - The noise levels need to be managed by the 2.6 GHz licensee to ensure the level at the radar meets the required threshold
- This may require action at the base station
- The power density referred to is at the antenna face(D)

Communications signal power density at D for theoretical 4G around Heathrow radar

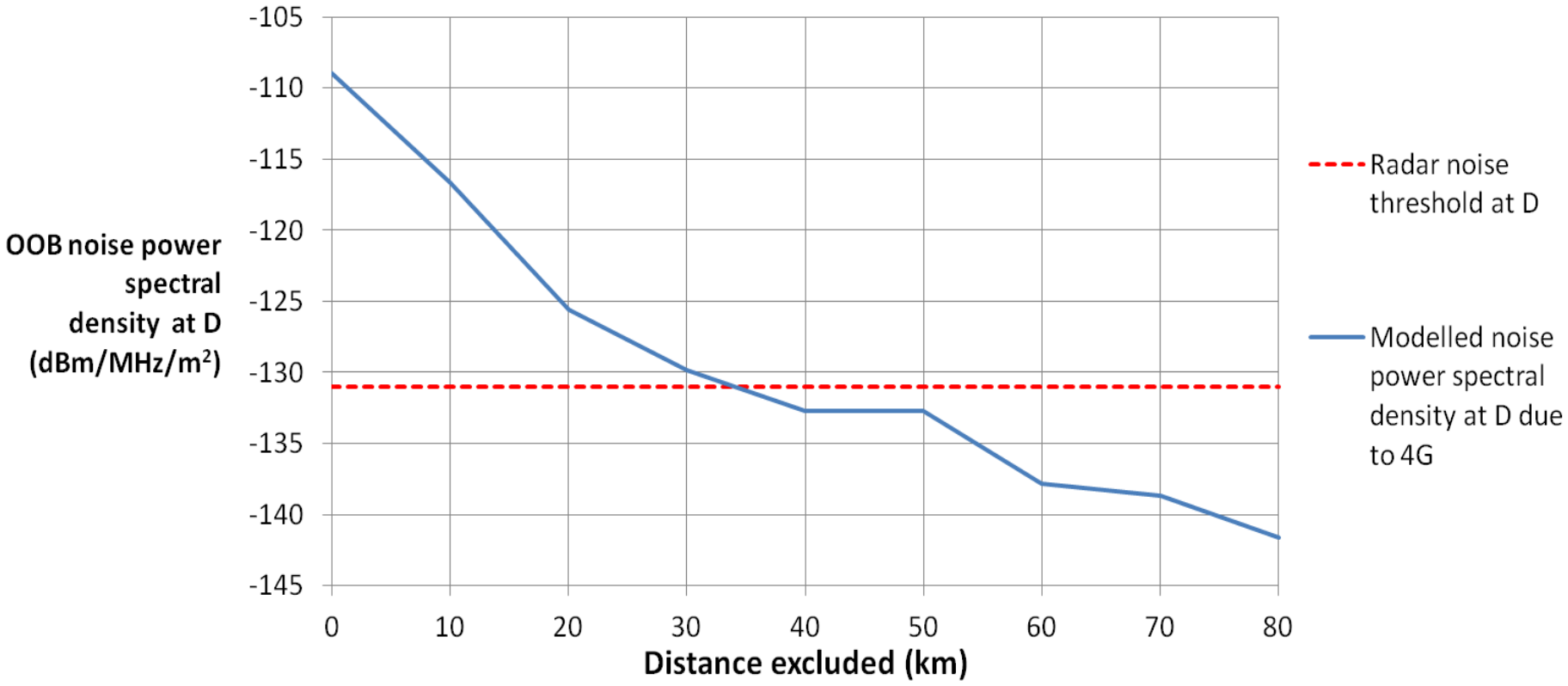


Communications signal power density at D for theoretical 4G around Birmingham radar




OOB noise power spectral density for theoretical 4G around Heathrow radar
(5 Network Operators at -45 dBm/MHz EIRP each)
OOB noise power spectral density at D (dBm/MHz/m²)
-105
-110
-115
-120
-125
-130
-135
-140
-145
0
10
20
30
40
50
60
70
80
Distance excluded (km)
Radar noise threshold at D
Modelled noise power spectral density at D due to 4G

OOB noise power spectral density for theoretical 4G around Birmingham radar (5 Network Operators at -45 dBm/MHz EIRP each)



Conclusions

- Our modelling of ‘realistic deployments’ around both Heathrow and Birmingham radars has shown that the power from the communications in-band signal would not exceed the post-modification radar protection threshold

- If the noise level of -45 dBm/MHz EIRP was emitted from each of 5 Network Operators some management of the noise level in the direction of the radars would be required. In the theoretical cases considered, this would be for base stations within approximately 30 km

- Measurements of base stations indicate that OOB emissions are generally lower than -45 dBm/MHz, in particular above 2.75 GHz

Impact on deployment in 2.6 GHz band

Analysis of in-communications-band impact

- The maps on the following slides consider a maximum range from the radar of 70 km, but it should be noted that base stations may still cause interference into the radar further away due to particular terrain and propagation effects

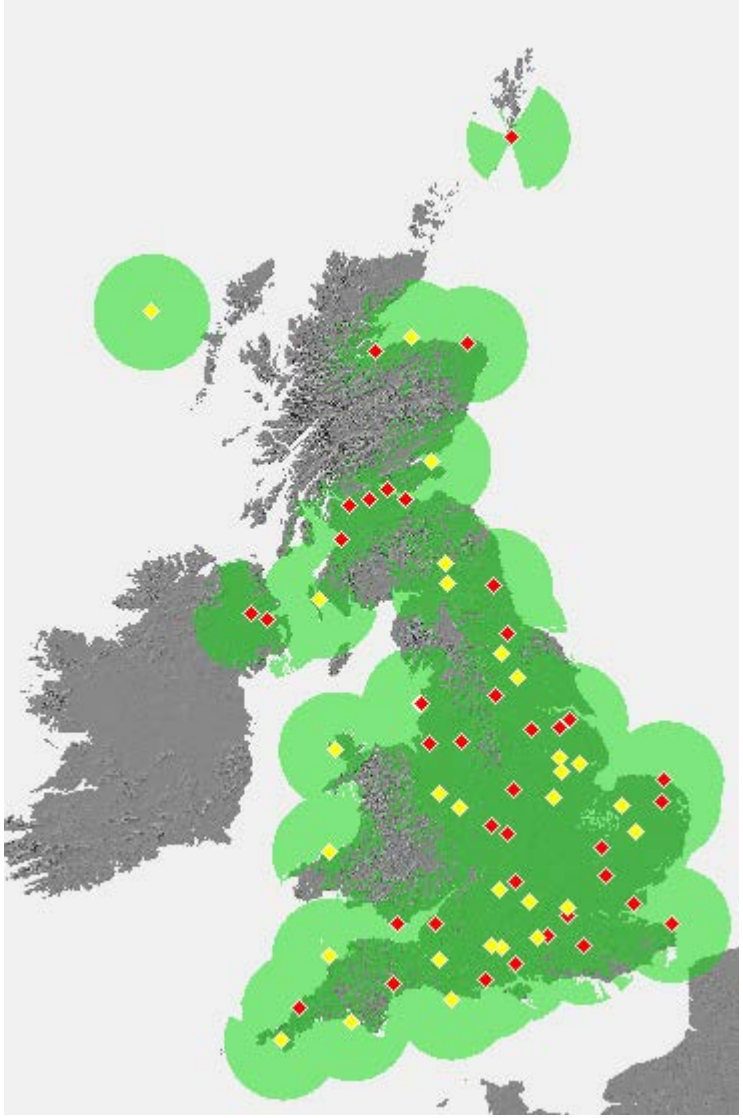
- Assumptions:
  - All base stations operate 4 channels (20MHz)
  - Maximum power 61dBm/5MHz
  - 20m above ground
  - Radar protection threshold -74dBm/m^2

- The radar protection threshold has been apportioned for a 20MHz transmission.

- The green area on the following maps shows a representation of the area in which base station deployment would be restricted (i.e. base stations may require adjustment in order not to exceed the radar protection threshold)

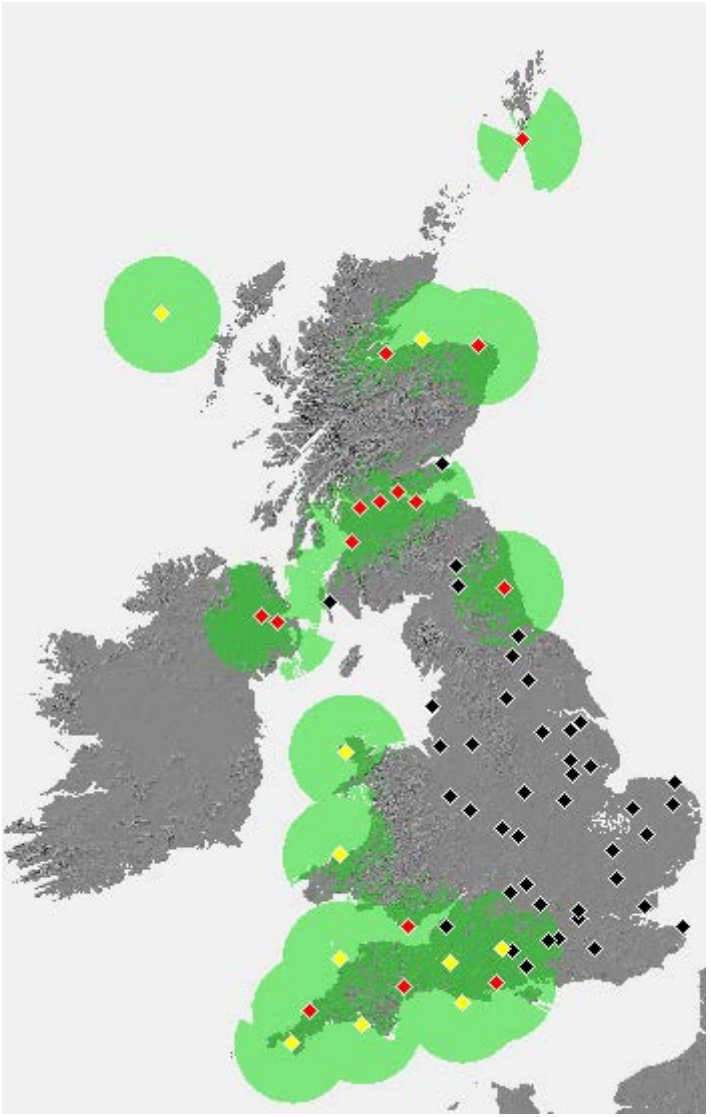
Prior to roll out of modifications

- The green area on this map shows the area where base station deployment would be restricted



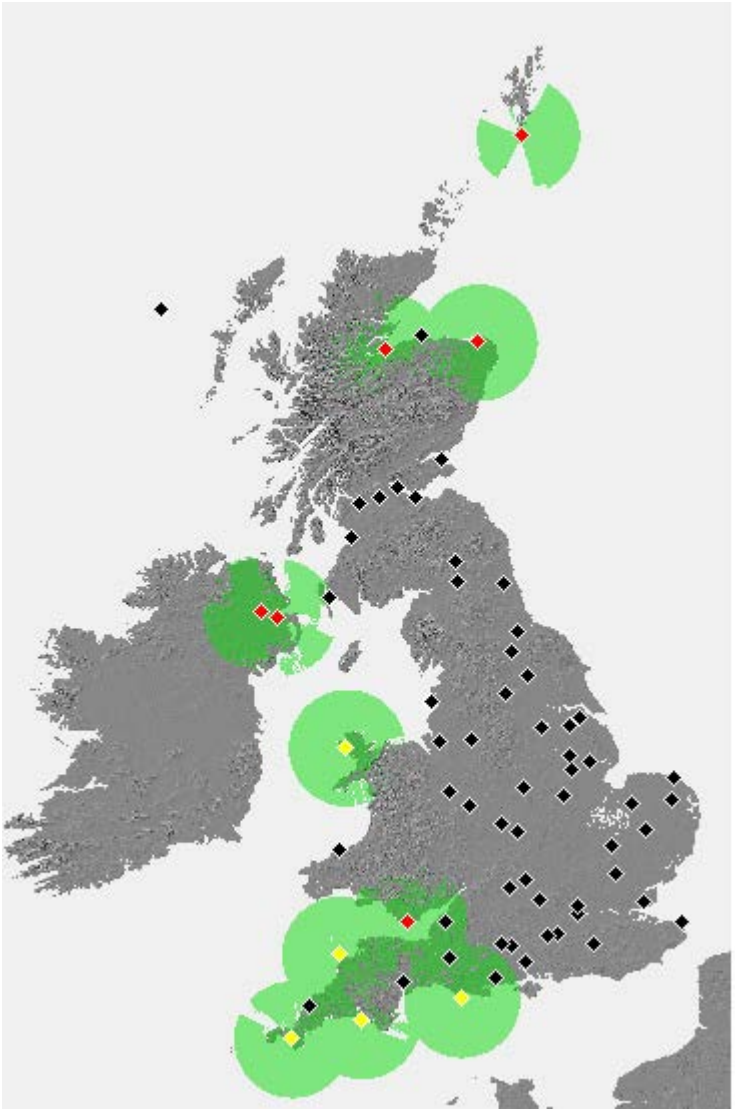
●	Civil (pre-mod) ATC radars
●	Military (pre-mod) ATC radars
●	Modified radars
●	Restricted area

End Q3 2013



●	Civil (pre-mod) ATC radars
●	Military (pre-mod) ATC radars
●	Modified radars
●	Restricted area

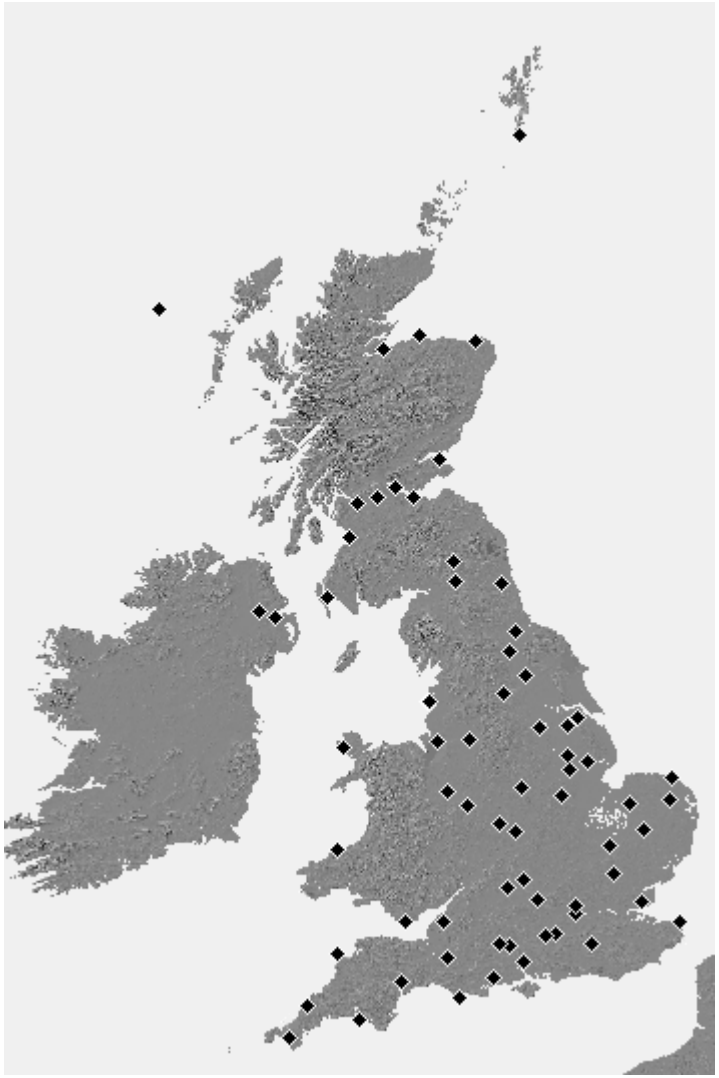
End Q4 2013



●	Civil (pre-mod) ATC radars
●	Military (pre-mod) ATC radars
●	Modified radars
●	Restricted area

End Q1 2014

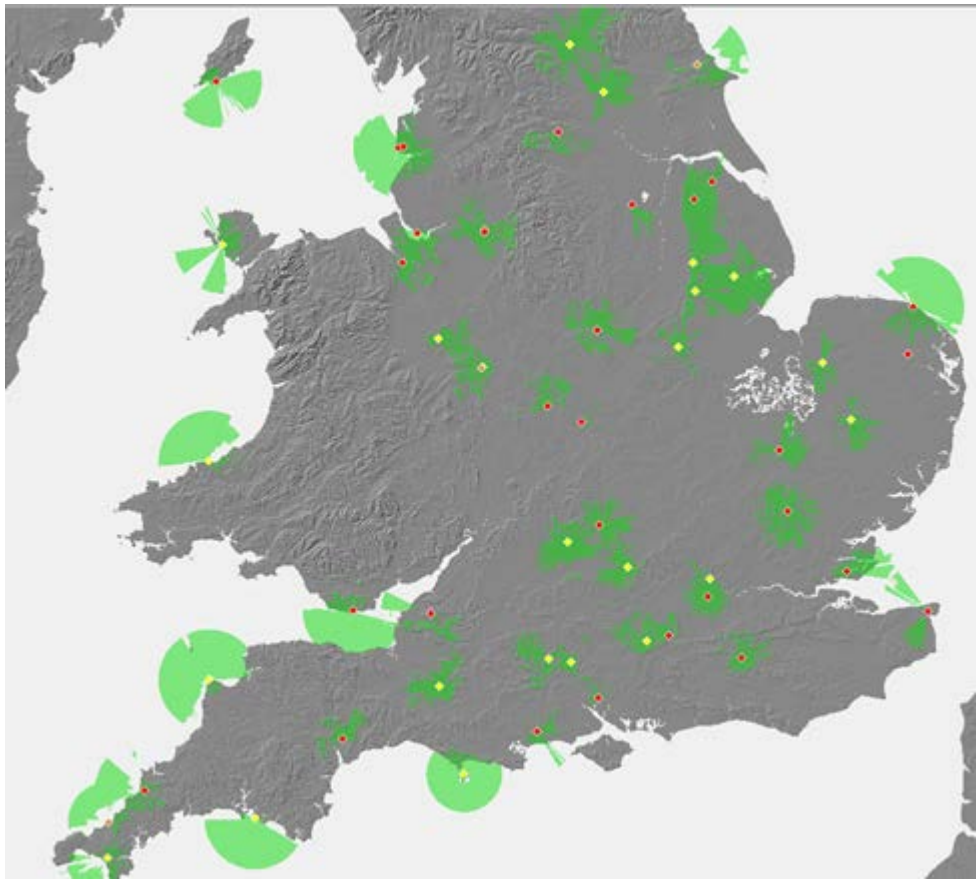
- Once all radars have been modified the green area will be very localised around radars and cannot be seen on this scale



	Civil (pre-mod) ATC radars
	Military (pre-mod) ATC radars
	Modified radars
	Restricted area

Base station out-of-band noise (-45dBm/MHz EIRP per operator)

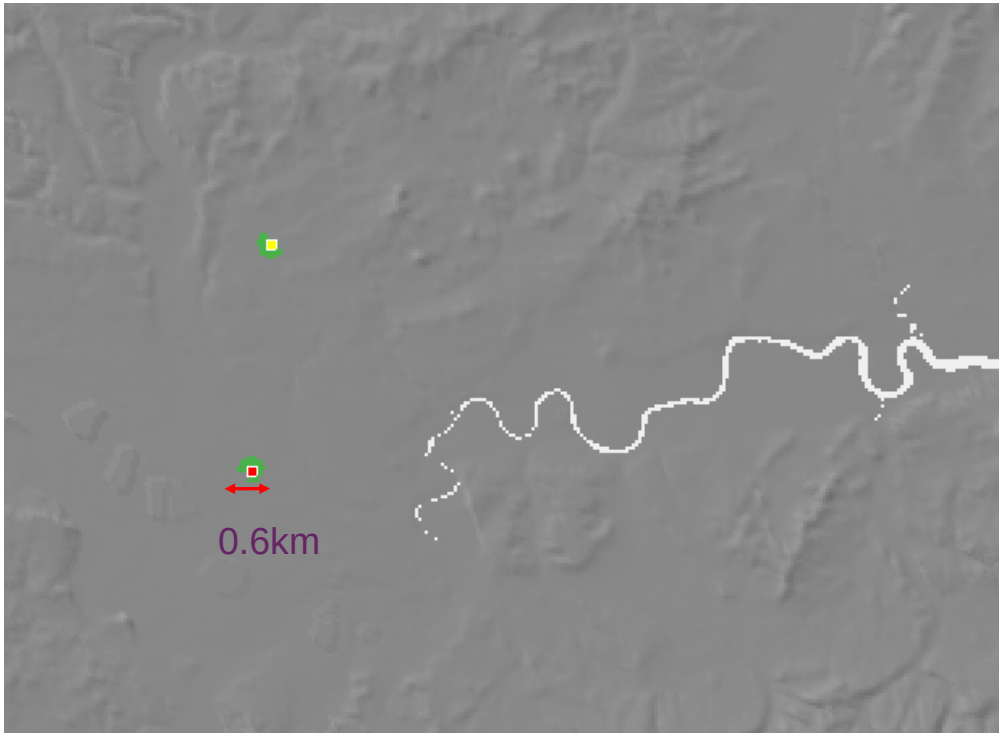
- The green area on this map shows the approximate area where base station deployment would be restricted due to the noise
- This is the same both pre- and post-modification of radars (5 operators assumed)



	Civil (pre-mod) ATC radars
	Military (pre-mod) ATC radars
	Restricted area

Base station out-of-band noise (-70dBm/MHz EIRP per operator)

- The map has been zoomed in to show the green area, since it is very localised around radars (5 operators assumed)



●	Civil (pre-mod) ATC radars
●	Military (pre-mod) ATC radars
●	Restricted area

Roll-out of modifications to radars

Roll-out of Modifications for Civil Radars

Ian Wainwright
Rollout Manager

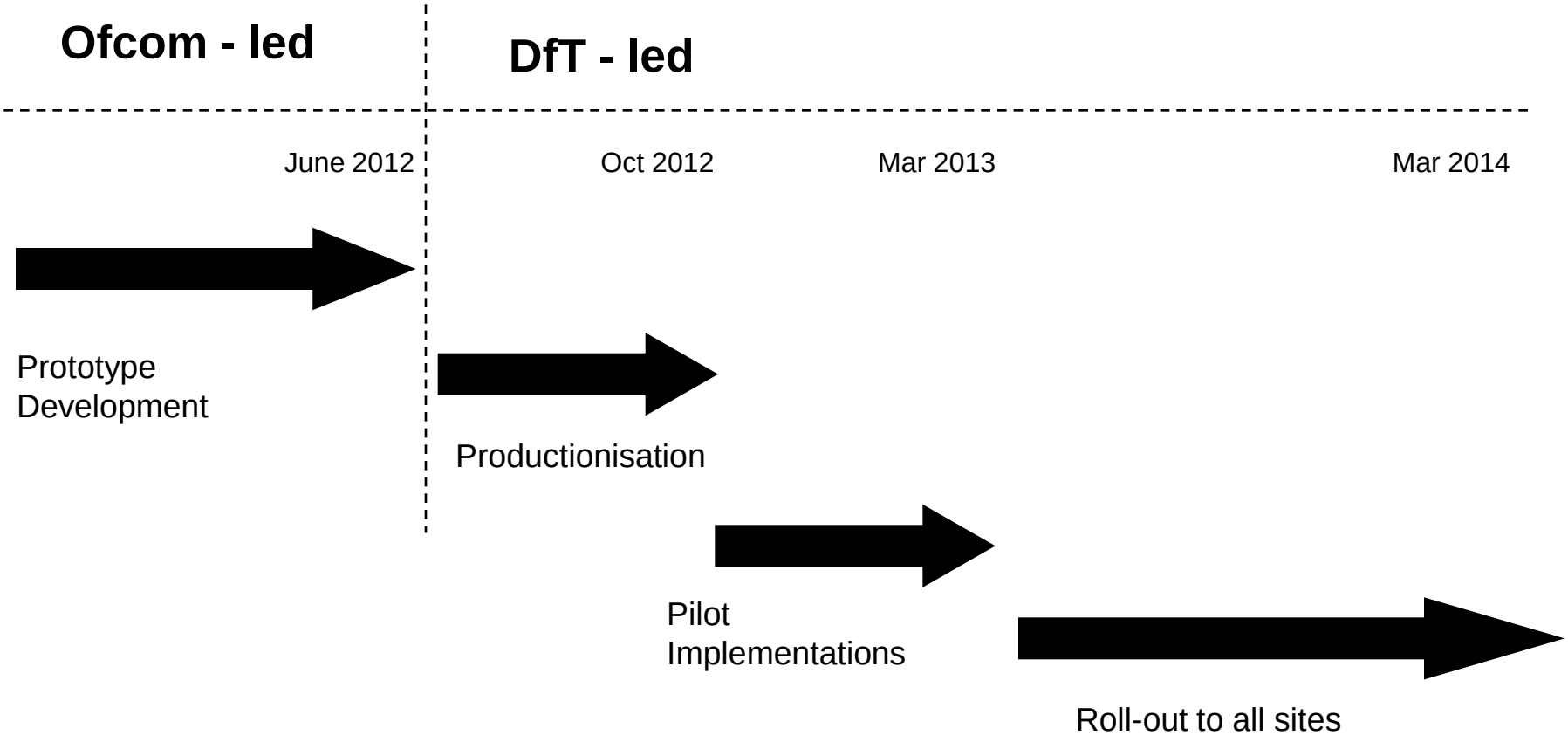
Roll-out sites

Department for Transport

Watchman	S511	ATCR-33S	ASR 10	Star 2000	NASR 10	AR15
Teesside Exeter Humberside Leeds/Bradford Sumburgh	East Midlands Newcastle Norwich Coventry	Newquay Bournemouth Belfast City Bristol Southend Isle of Man *(Not In funding programme)* Jersey (*Not in funding programme)*	Doncaster Farnborough Liverpool Allanshill Cromer Gatwick Stansted Heathrow South Manchester St Annes	Inverness Manston Cumbernauld Belfast (int'l) Cardiff Hibaldstow Oxford Birmingham Guernsey (*Not in funding programme)*	Edinburgh Glasgow Kincardine	Blackpool Cambridge

To Be Decided
Prestwick Southampton

Programme Phases



Purpose of Pilot Sites

Department for Transport

- Test how modification affects performance of an operational radar
- Prove modification remediates radar before rolling out to all radars of that type
- Gather data that will be used for safety case submission (Initially for pilot; Will be referred to in safety case submissions for other radars)

Pilot Sites

Department for Transport

Confirmed

S511	ASR 10	NASR 10
Norwich	Gatwick	Kincardine

To be confirmed

Watchman	ATCR-33S	Star 2000	AR15
Exeter or Humberside	Bristol	Hibaldstow or Birmingham	Blackpool or Cambridge

Provisional Information Memorandum Delivery Dates

Department for Transport

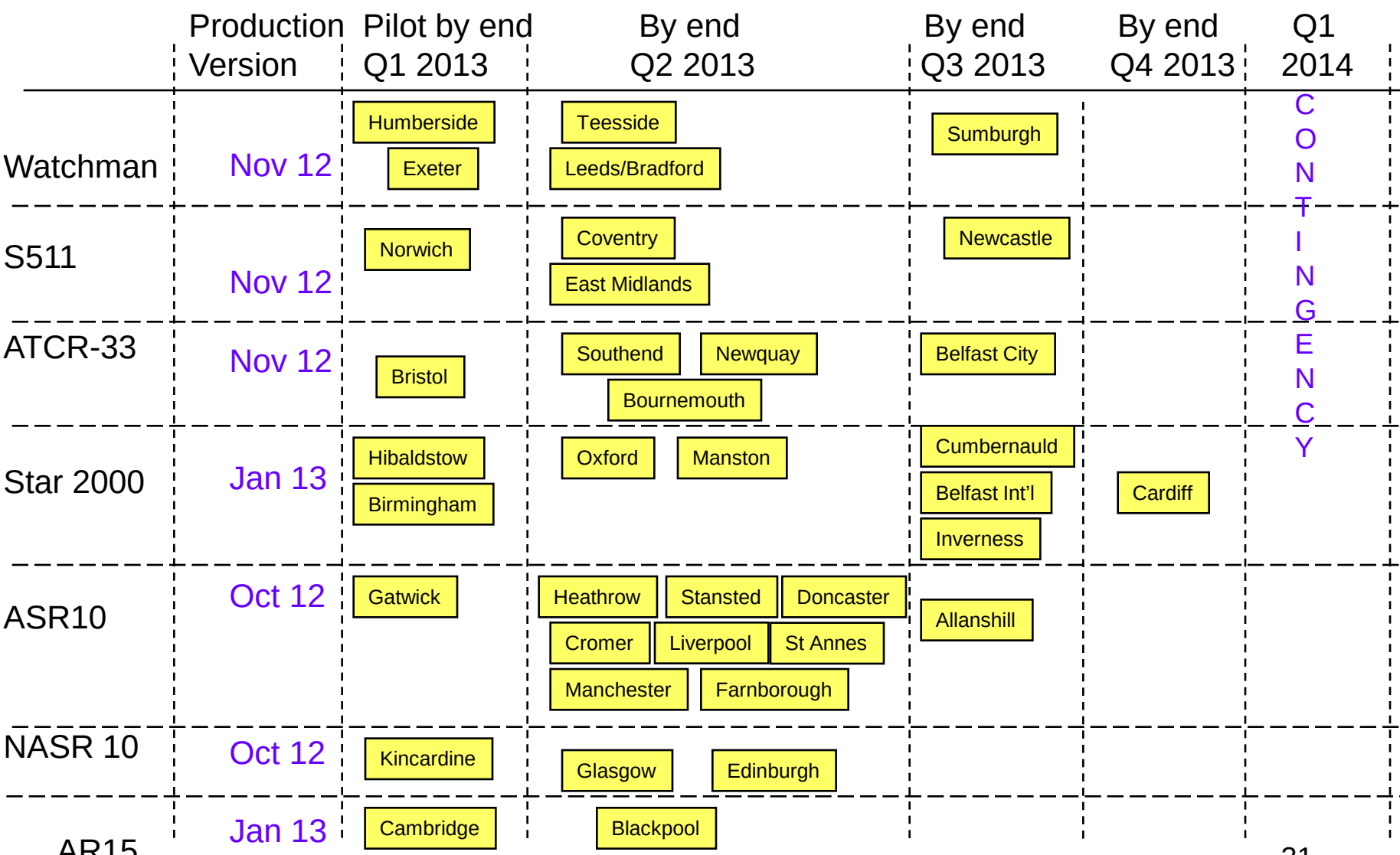
Radar	Modified by
Birmingham	Sep-13
Blackpool	
Bristol	
Cambridge	
Coventry	
Cromer	
Doncaster	
East Midlands	
Farnborough	
Gatwick	
Heathrow	
Hibaldstow	
Humberside	

Radar	Modified by
Leeds/ Bradford	Sep-13
Liverpool	
Manchester	
Manston	
Norwich	
Oxford	
Southampton	
Southend	
St Annes	
Stansted	
Teesside	
Bournemouth	Dec-13
Cumbernauld	

Radar	Modified by
Edinburgh	Dec-13
Exeter	
Glasgow	
Kincardine	
Newcastle	
Newquay	
Prestwick	
Allanshill	Mar-14
Belfast City	
Belfast International	
Cardiff	
Inverness	
Sumburgh	

Roll-out plan as at 16/5/12

Department for Transport



Air Defence and Air Traffic Systems DT

MOD 2.6 GHz Radar Remediation

Mark Ruston

Air Defence and Air Traffic Systems DT

Watchman ATC Project Timelines

- Provisional
  - Competition — July 12
  - Competition complete — Sep 12
  - Contract Award — Oct 12
  - Commercialise product — Nov/ Dec 12
  - Deliver first of type — Feb 13
  - Test first of type — Feb 13
  - Commence roll out — Mar 13

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Watchman - Provisional Roll Out Plan

Q2 2013		Q3 2013	
Culdrose	18 - 22 Mar	Middle Wallop	Jun
Cranwell	25 - 29 Mar	Linton on Ouse	Jul
Brize Norton	Apr	90SU Test System	Jul
Leuchars	Apr	Cosford	Jul
Coningsby	Apr	Cosford (Tac)	Aug
Benson	May	Dead Water Fell	Aug
Odiham	May	Berry Hill	Aug
Shawbury	May	Leeming	Sep
Waddington	Jun	Marham	Sep
Honington	Jun	West Freugh	Sep

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Watchman - Provisional Roll Out Plan

Q4 2013		Q1 2014	
St Kilda (Air)	Oct	MPA (Tac)	Jan
St Kilda (Sea)	Oct	Akrotiri	Jan
Gibraltar	Oct	Hartland Point	Feb
Boscombe Down	Nov	Wembury Pt	Feb
Aberporth	Nov	Portland	Feb
Bastion (Tac) 1	Nov	TAC 2	Mar
Lossiemouth	Dec	TAC 3	Mar
Yeovilton	Dec	Valley	Mar

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T101/T102 Air Defence Radar

- 2 x T101 & 2 x T102 - Cosford, Portreath, 2 mobile units
- Insufficient information at present
- 50% confidence modifications complete by Q3 2013

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Maritime Radars Affected

- SAMPSON – T45 destroyer
- 997 – replacement for 996 on Ocean, Albion, Bulwark plus all T23s
- 1008 navigation radar (all T23s)
- Pathfinder navigation radar (all T45s)
- 4G affects radars

Questions?

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MoD contact: Mark Ruston, Radar Project Coordinator (DESPTG-TD-Maritime-RM@mod.uk)