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The US AWS-3 Auction: Back to Basics in Auction Design

By **Richard Marsden** and **Jonathan Pike**

The award of the AWS-3 band will be the first major release of spectrum suitable for mobile broadband deployment in the United States since the 700 MHz auction in 2008. A total of 65 MHz of spectrum, of which 25+25 MHz is paired, will be available in an auction scheduled for November 2014. As with the FCC's 600 MHz Incentive Auction, the spectrum is expected to be used for deployment of 4G mobile broadband.

In recent years, the FCC has embraced new auction formats for spectrum awards: for the 700 MHz auction, it allowed limited package bidding on one of the main blocks; and for the 600 MHz Incentive Auction, it has proposed an innovative two-sided clock auction design.[1] For AWS-3, the FCC is going 'back to basics' and will use its tried and tested simultaneous multiple round (SMR) auction format.[2] The FCC continues to innovate regarding the detailed rules, for example to help bidders manage aggregation risks and discourage gaming. While minor changes are proposed, the basic structure remains the same and participants would be advised to anticipate another US spectrum auction featuring significant strategic behavior by rival bidders.

The AWS-3 band

The US AWS-3 band will consist of 65 MHz of spectrum, split into two sub-bands:

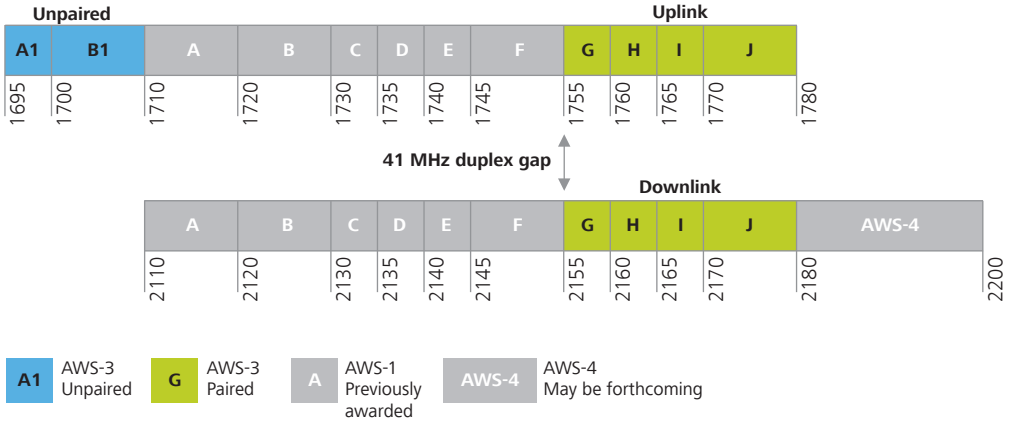
- 15 MHz of unpaired spectrum from 1695-1710 MHz, available as one 5 MHz block and one 10 MHz block; and
- 2x25 MHz of paired spectrum from 1755-1780 MHz (uplink) and 2155-2180 MHz (downlink), available as three 2x5 MHz blocks and one 2x10 MHz block.

The paired spectrum is likely to be particularly valuable to operators that already operate networks using the adjoining AWS-1 band.

This release is effectively an extension of the existing AWS-1 band, as illustrated in Figure 1. This should make the spectrum particularly attractive to cellular operators, as it can be readily integrated with existing networks and there should be no substantial barriers to production of compatible handsets. Furthermore, this spectrum lies in the 1 GHz and 2.5 GHz range, which is considered ideal for urban capacity to serve fast growing data traffic. The paired spectrum may be particularly coveted, because there may be few if any further opportunities for release of paired spectrum at these frequencies in the next decade.

All frequencies being released are adjacent to the existing AWS-1 band, awarded in 2006 in the United States and 2008 in Canada. Some 40 MHz of the available spectrum is currently occupied by Federal incumbent operators. Revenues from the auction will be used to fund the relocation of these users and/or facilitate shared use of the bands. Going forward, most Federal users in paired 1755-1780 MHz band will relocate, whereas Federal meteorological-satellite data users in the unpaired 1695-1710 MHz band will remain.

Figure 1. **US Band Plan for AWS-3**



Even though the license structure is more uniform than the 700 MHz and AWS-1 auctions, bidders seeking large regional or national footprints or contiguous spectrum will still face significant aggregation risks.

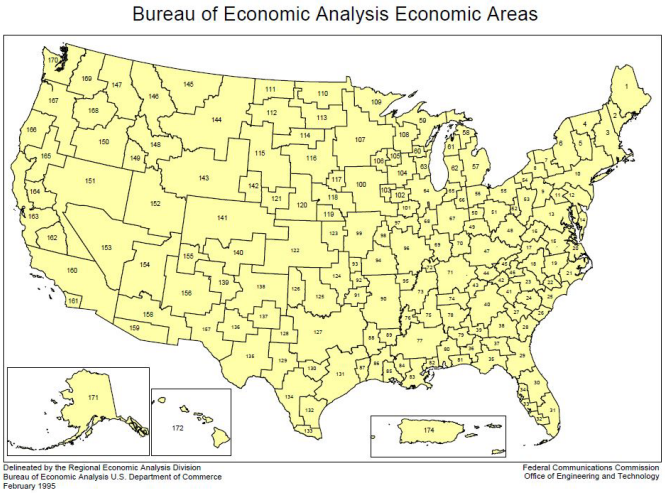
Lot structure

In past spectrum auctions, the FCC has often packaged licenses using a mix of frequency sizes and geographic tiers, so as to accommodate the demands of different bidder types. In contrast, in its deliberations over the 600 MHz band plan, the FCC advocated selling identical sized frequency lots and using the same geographic structure across the United States – so as to simplify auction design and reduce substitution risk for bidders. The AWS-3 plan may be portrayed as a compromise between these approaches. For each of the paired and unpaired spectrum, it will use two different frequency block sizes. However, five of the six blocks will be sold at the Economic Area (EA) level, which divides the country in 176 EAs nationwide. Just one 5+5 MHz block (lot G) will be available at the Cellular Market Area (CMA) level, which divides the country into 734 areas. The two tier structures are illustrated in Figure 2.

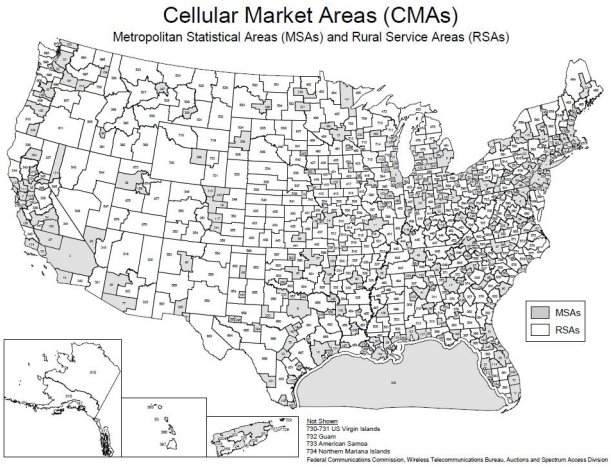
In total, there will still be 1,614 licenses in the auction: 880 EA licenses and 734 CMA licenses. This is a larger number than the US AWS-1 and 700 MHz auctions, which had 1,087 and 1,090 licenses respectively, but much less than the 600 MHz Forward Auction, which could have up to 4,992 licenses.

Figure 2. **Geographic licensing proposed for the US AWS-3 auction**

176 EAs – proposed for blocks A1, B1, H, I & J



734 CMAs – proposed for block G



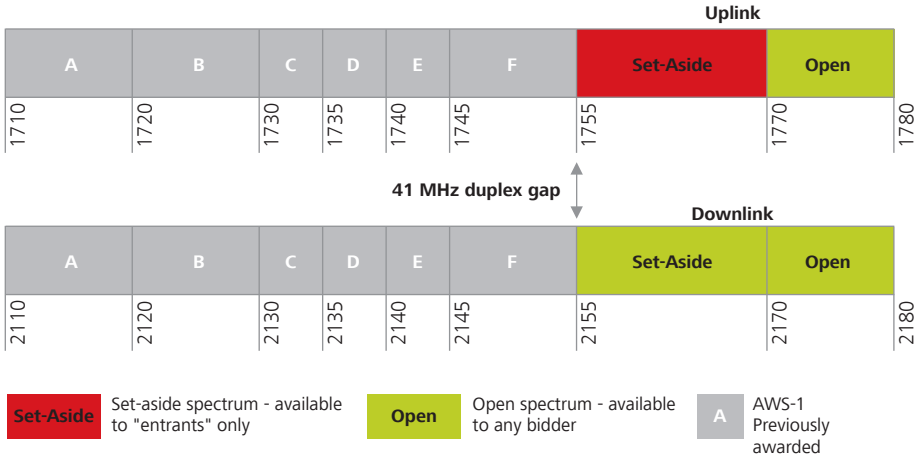
Source: FCC (www.fcc.gov)

Canada to follow close behind

The value of the bands in Canada is highly dependent on a successful sale in the USA, as Canadian operators rely on the economies of scale from sharing the US ecosystem for handsets.

Canada, which also uses the AWS-1 band plan, intends to auction the same paired spectrum in 2015. However, it is not planning to sell the unpaired spectrum at this time. The proposed block structure in Canada, as illustrated in Figure 3, is rather different from the United States: it proposes to award just two blocks, one of 15+15 MHz, corresponding to blocks G, H & I in the US plan, and one of 10+10 MHz, corresponding to block J, as illustrated in Figure 3. Both these blocks will be sold at the Tier 2 level, which divides Canada into 14 regions, largely along provincial lines. As the Canadian blocks are supersets of the US ones, this approach is not expected to cause any cross-border interference concerns.

Figure 3. **Canadian band plan for AWS-3**



Reserve prices and opening bids

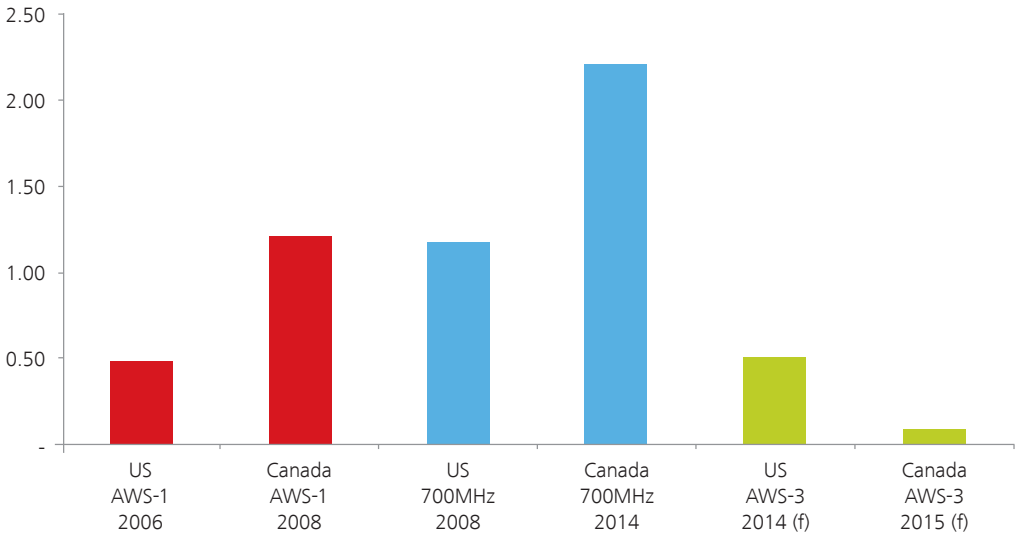
The US reserve price is unusually high (equivalent to the AWS-1 final prices). Comparison with past auctions suggests that this price is attainable but success cannot be taken for granted.

The AWS-3 auction must raise enough revenue to cover relocation and sharing costs for Federal incumbent users. The FCC has set the aggregate reserve price for licenses in the unpaired 1695-1710 MHz band at $580 million and the paired 1755-1780 MHz band at just over $5 billion. As the 1755-1780 MHz band covers only the uplink part of the paired licenses, only 50% of the revenue from winning bids for paired spectrum will be counted towards the aggregate reserve price. This has the effect of doubling the reserve price of the paired spectrum to over $10 billion. If aggregate revenues across the United States in either sub-band do not meet the reserve price, no licenses in that sub-band will be awarded.

The FCC will announce opening bid levels for each individual license based on the bandwidth and license area population: it has proposed $0.15 per MHz-pop for paired spectrum and $0.05 per MHz-pop for unpaired spectrum. Additionally, the FCC is considering adjusting opening bid amounts by "*incorporating pricing information from previous auctions based on an index of relative winning bid amounts for licenses in each CMA and EA*". This modification would result in opening bids ranging from $0.01 per MHz-pop to $0.53 per MHz-pop. The FCC has also proposed setting a minimum opening bid level of $2,500 for any license, and $2,000 per MHz for licenses covering the Gulf of Mexico.

Aggregate opening bids for each license will be less than the aggregate reserve price. This means that the US AWS-3 award can only succeed if there is competition. Figure 4 compares the AWS-3 reserve prices in the United States and Canada to final prices in previous AWS-1 and 700 MHz auctions. On this basis, the US reserve level looks unusually high. However, when compared to past sales prices, especially in Canada, the revenue target looks achievable.

Figure 4. **AWS-3 reserve prices compared to final prices for AWS-1 and 700 MHz auctions (price per MHz per pop is USD or CND as applicable)**



No spectrum caps

The US approach implies that any concerns about downstream competition related to spectrum are limited to sub-1 GHz frequencies.

In the US auction, there are no proposed spectrum caps and no restrictions on the lots that incumbents can bid for (although bidder credits are available for small businesses with turnover below $40 million). This is different from the 600 MHz Incentive Auction, where the FCC has proposed reservation rules that favor bidders other than AT&T and Verizon. It is also very different from Canada, where the majority of spectrum will be reserved on a regional basis for winning entrants from the previous AWS-1 and 700 MHz auctions.

Eligibility and bidder association rules

Eligibility-based activity rules give bidders great flexibility to switch between licenses but they can also create scope for gaming strategies, such as "parking" demand on non-target lots and attempting to manipulate the relative pace of price increases across license areas.

The rules governing bidder association and eligibility to bid for particular licenses during the auction are tied to the FCC's application process. Upon application, each bidder will be asked to:

- specify each license (EAs or CMAs) that they may want to bid on during the auction; and
- submit an upfront payment, which is used to determine their maximum eligibility (bidding units) during the auction.

The proposal to link bidder association rules to license selection at application is novel. It raises the possibility of bidding alliances between smaller bidders with non-overlapping geographic targets.

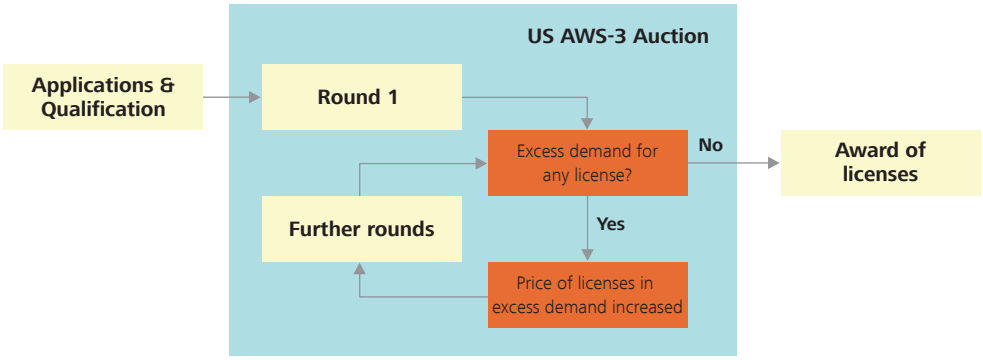
The upfront payment for each license will be roughly half of the opening bid. A bidders' initial eligibility will be equal to their upfront payment.

Our understanding is that a full list of US applicants will be published upon qualification of bidders. At this point, each applicant will also be notified of the identity of applicants with whom they are not allowed to communicate, which means any other applicant whose list of potential target regions overlaps with the applicant. To ensure this rule is not broken inadvertently, bidders will be restricted to bidding only on licenses that they specified in their lists at application.

US auction format and rules

For the AWS-3 award, the FCC has returned to the simultaneous multiple round (SMR) auction, the format used for many previous spectrum awards, including Auctions 66 (AWS-1), 73 (700 MHz), and 96 (H-block). In this format, bidders bid on individual licenses and a unique provisional winning bidder is identified for each license at the end of every round. The overall process is illustrated in Figure 5.

Figure 5. **Overview of the US AWS-3 Auction**



The FCC's Comment PN, published in June 2014, provides detailed information about the auction process and rules:

The rules are still subject to review following the conclusion of the consultation process.

- **First round**: Each bidder can submit bids for one or more licenses consistent with their eligibility and regional restrictions, as determined at application. The sum of the bidding units for all licenses that they bid on must be less than or equal to their initial eligibility. For each license, a bid can be made at the opening bid amount or one of eight other larger bid amounts (see explanation below).
- **Subsequent rounds**: Prices for licenses that received new bids in the previous round will be increased. In each round, bidders will be offered a choice of nine different prices levels for each license, each modestly higher than the previous one. A bidder with a provisional winning bid on a license may increase their bid, but is not obligated to do so. There is also a limited option to withdraw provisional winning bids.

- **Activity rules**: The scope for bidders to make new bids and switch between licenses will be constrained by activity rules, based on an eligibility point regime. Each bidder's eligibility will be based on their activity in the previous round, and their activity is equal to the sum of bidding units associated with the licenses that they were active on in the previous round (or their initial eligibility in round 1). As a general rule, bidders can only maintain or reduce their aggregate activity; they cannot increase it. Bidders may also use waivers to avoid dropping eligibility.

The proposal to allow the auction to end in a stage with a 95% activity requirement instead of 100% is novel. It will make it somewhat easier for larger bidders to avoid activity on small regions until late in the auction.

- There will be two activity rule stages during the auction:

  - In Stage One, a bidder is required to be active on bidding units covering 80% of their eligibility in order to maintain their eligibility. If a bidder's activity falls below this threshold, their eligibility for the next round will be reset to 125% of their activity.

  - In Stage Two, a bidder must be active on bidding units covering 95% of their current eligibility in order to maintain their eligibility. If a bidder's activity falls below this threshold, their eligibility for the next round will be reset to 20/19 (approx. 105%) of their activity.

  The auction will begin in Stage One and progress to Stage Two at the FCC's discretion. Bidders will receive a message through the auction system when the auction moves into Stage Two.

- **Provisional winning bids**: For each license, the highest bid received in a round will be the provisional winning bid. If two bidders place the exact same bid in the same round, a random tie-break rule is used to determine which bidder has the provisional winning bid.

- **Final Round**: Under the "simultaneous stopping rule", the auction will end when there is a round in which no new bids are placed, no proactive waivers are placed, and no provisional winning bids are withdrawn. The FCC also has discretion to close the auction early, subject to certain conditions. When the auction closes, all current provisional winning bids become winning bids, and must pay the sum of their winning bids (after allowing for any bidder credits).

The proposal includes a number of special rules, some of which are different from previous FCC auctions:

Bidders may be able to use larger increments as a device for signaling to rivals.

- **Bid amounts**: In each round, a **minimum acceptable bid** is specified for each license. From round 1 until such time that a bid is received, this is the opening bid. Thereafter, the minimum acceptable bid is set equal to the provisional winning bid amount plus a percentage increment.

Even though the increment formula may appear prescriptive, the FCC has sufficient discretion over input parameters to set bid increments how it wants (within broad bounds).

- A formula is used to set the increment, based on a minimum percentage amount (set by the FCC each round) multiplied by one plus an activity index. The activity index used to calculate prices for round n+1 is a weighted average of the number of unique bidders who placed a bid for that license in round n and the activity index for round n-1. Initially, the FCC will set the minimum percentage amount for each license at 10%, but it has discretion to vary this by license each round. The increment used to determine the minimum acceptable bid can never be greater than 30% of the provisional winning bid amount.

- Bidders can also place a bid at eight larger bid amounts. Each **additional bid amount** is equal to the minimum acceptable bid multiplied by one plus successively larger multiples of the bid increment percentage. The initial bid increment percentage will be set at 5%.

Restrictions on transparency make gaming behavior more difficult but will not eliminate opportunities for such behavior given that many bidders have predictable demands.

- **Limited transparency**. Although bidders will know the identity of other participants, the bidding process is otherwise anonymous. The FCC will not provide a list of upfront payments, initial eligibility, or target regions by bidder (although bidders may make inferences based on the full list of applicants and the list of applicants with whom they cannot communicate). During the auction, after each round, bidders will be told the number of bids and withdrawals at each price level on each license. However, the identities of the bidders and net bid amounts (reflecting bidder credits) will not be disclosed until the end of the auction. Bidders will receive information about their own bids.

Passive waivers protect a bidder with technical problems from losing eligibility but oddly they do not appear to protect them from the auction closing.

- **Waivers**: Each bidder starts the auction with three **activity rule waivers**. Deploying a waiver allows a bidder to maintain their current eligibility in a round where their bid would otherwise be insufficient to maintain eligibility. Waivers can be placed proactively or passively. If a bidder places a bid that will reduce their eligibility, the auction system will automatically apply a waiver unless explicitly instructed otherwise. Bidders can also proactively place a waiver to maintain their eligibility.

Withdraw rules are designed to give bidders some additional flexibility to manage aggregation risk, but exposure to penalties will increase markedly as the auction approaches conclusion.

- **Bid withdrawals**: Each bidder may withdraw provisional winning bids in at most two rounds. There is no limit to the number of provisional winning bids that can be withdrawn in a single round. However, each withdrawal is subject to a penalty unless another bidder acquires the lot at an equal or higher price. This penalty will be equal to the difference between the withdrawn bid and any smaller winning amount. Furthermore, if the license does not sell, the bidder will also have to pay a penalty equal to a proportion of their withdrawn bid (the FCC has proposed setting this proportion between 3% and 20%).

  No information is provided about what happens to bid amounts in case a provisional high bid is withdrawn and not replaced. The rules give the FCC great discretion over setting prices, and the penalty rule appears to imply that the FCC could reduce the minimum acceptable bid amount below the level of a withdrawn provisional winning bid.

The proposal to return to the traditional SMR auction format for the AWS-3 award was likely driven by a desire on the FCC's part to conclude the award process quickly. This approach appears broadly popular with operators, based on submission to the FCC published to date. This includes larger operators who face well documented aggregation and substitution risks when trying to put together large regional or national footprints.[3] Respondents also appear largely unperturbed by evidence of gaming behavior in past FCC auctions using the SMR auction format.[4]

The detailed rules include a number of innovations, such as a version of the staged activity rule that never reaches 100% and a bespoke pricing rule that gives bidders limited discretion over bid amounts. The FCC also reaffirmed its commitment to anonymous bidding, a rule change previously introduced to make gaming behavior more difficult. These rule changes may help bidders manage aggregation and substitution risk, and discourage some gaming, but they do not amount to a major overhaul. Given the combination of SMR format and complex, regional lot structure, participants would be advised to anticipate another US spectrum auction featuring significant strategic behavior by rival bidders.

Notes

1 For more information, see: Marsden, R and Pike, J, "US 600 MHz Incentive Auction Forward Auction Rules", 15 July 2014 & Marsden, R and Pike, J, "US 600 MHz Incentive Auction Reverse Auction Rules", 15 July 2014, both papers available at http://www.nera.com/67_8620.htm.

2 Our analysis is primarily based on a review of following award documents: FCC, Report & Order (Auction 97), GN Docket No. 13-185, 31 March 2014 & FCC, Public Notice, (Auction 97), DA 14-660, 19 May 2014.

3 See, for example: Peter Cramton, 2009, "Spectrum Auction Design" Working Paper, University of Maryland, available at: http://works.bepress.com/cramton/32.

4 See, for example, Jeremy Bulow, Jonathan Levin & Paul Milgrom, 2009, Winning Play in Spectrum Auctions, NBER Working Paper 14765, available at http://www.nber.org/papers/w14765.pdf.

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About the Authors

Richard Marsden, a Vice President based in New York City, leads NERA's spectrum policy and auction advisory work. Over the last 15 years, he has advised bidders or governments in more than 45 spectrum auctions in the Americas, Asia, Africa and Europe. He was a key member of the design team that pioneered the use of package auctions, including the CCA, for the UK, Dutch and Danish spectrum regulators. Recently, he has focused on developing and executing bid strategies for bidders in 4G spectrum auctions.

Jonathan Pike is an Analyst in NERA's Auctions Practice and is based in New York City. He has particular expertise in developing proprietary auction software to assist mobile operators during spectrum auctions. Jonathan's experience includes on-site support for bidders in 4G auctions in Australia, Canada, Czech Republic, Switzerland and the UK.

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Contact

For further information and questions, please contact the authors:

Richard Marsden
Vice President
+1 212 345 2981
Richard.Marsden@nera.com

Jonathan Pike
Analyst
+1 212 345 8301
Jonathan.Pike@nera.com

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