# A Rational and Lawful Spectrum Screen

**(WT Docket No. 12-269)**

March 26, 2014

## Overview

- The Commission should update the spectrum screen to include all spectrum that is suitable and available for mobile wireless services – including AWS-4, H Block and the entire 194 MHZ of BRS/EBS.
- The Commission's original rationale for a screen, to act as a safe harbor for aggregations that required no in-depth case by case review– remains sound and should be reaffirmed.
- The Commission should NOT adopt more radical proposals, such as a "weighted" screen that would count some mobile wireless spectrum (below 1 GHz) more than other mobile wireless spectrum.
- Proposals to count low band spectrum differently or separately are contrary to economics, engineering and the facts, harmful to consumers, and would be unlawful.


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## The Commission Should Update The Screen To Include *All* Spectrum That Is "Suitable" And "Available" For Mobile Wireless Services

- There is no dispute that AWS-4 and PCS H-Block should be immediately added to the screen.
- Once service rules are finalized and auctions complete, the screen should be updated to include AWS-3 (1695-1710 and 1755-1780/2155-2180 MHz) and 600 MHz.
- There is no basis for continuing to discount the BRS/EBS band.


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## There Is No Merit To Sprint's Proposal To Continue To Exclude Or Substantially Discount EBS From The Screen

- Sprint is *currently using* its EBS spectrum to provide its highly touted "Sprint Spark" mobile broadband service.
- Sprint's Chairman Masayoshi Son recently told the Chamber of Commerce that Sprint has got the technology to provide 200 Mbps over its 2.5 GHz spectrum, and using 8x8 MIMO antennas can propagate for longer distances.
- Spectrum that is actually being used for mobile broadband services is obviously "suitable" and "available" and thus should be included in the screen.
- Sprint's argument that its EBS spectrum is impaired is a non-starter. Virtually all spectrum is impaired in some way, yet it is fully included in the screen. There is no non-arbitrary basis for giving special treatment to Sprint's spectrum.


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## The Commission Should Reaffirm Its Original Safe Harbor Approach

- The Commission should reaffirm that the screen functions as a safe harbor – *i.e.*, the Commission should make clear that it will not entertain spectrum aggregation-related challenges to a proposed spectrum acquisition that does not exceed the screen.
- Such an approach appropriately balances regulatory certainty -- by assuring licensees that spectrum accumulations within a safe harbor will be approved, and regulatory flexibility -- by ensuring that aggregations above the screen, that may raise a question of potential market harm, are subject to case by case review.
- The current, approximately one-third safe harbor screen may be overly conservative as there is far more spectrum available today than when the screen was first established and technology allows for more efficient use of spectrum.


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## All Proposals For A Frequency-biased Screen Or Screens Ignore Basic Principles Of Economics

- All of the proposals to count “low band” spectrum separately, or more heavily, are based on the theory that differences in propagation characteristics make lower frequency spectrum cheaper to deploy because the minimum number of cell sites required to cover a given area would be fewer.
- The competitively relevant metric, however, is the total cost of deploying spectrum, which includes both cell site costs + spectrum license costs.
- If higher frequency spectrum costs more to deploy, market forces would reduce the cost of the higher frequency spectrum licenses, until total costs of deployment are roughly equivalent.
- It would be arbitrary to base a weighting scheme (or a separate screen for low band spectrum) on purported differences in deployment costs while ignoring the offsetting impact any such differences would have on spectrum acquisition costs.


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## Frequency-biased Schemes Ignore Important Frequency-specific Characteristics That Affect Spectrum "Value"

- **Contiguous blocks**: high-frequency spectrum is typically available in larger contiguous blocks that support faster, more spectrally efficient services.
- **Compatibility With Existing Network**: a provider typically prefers spectrum compatible with existing deployments that can be integrated into the network at lower cost and that can be used by its base of devices.
- **Antenna Capabilities:** higher frequency spectrum employs smaller antenna elements that can provide significantly higher antenna gain and take better advantage of performance-enhancing technologies such as MIMO, beam forming, and spatial multiplexing.
- **Interference In Dense Cell Areas:** higher frequency spectrum is often preferred in areas with dense cell grids because it is subject to less inter-cell interference.
- **Regulatory Requirements:** high frequency spectrum is often subject to less stringent build-out and other regulatory requirements.
- **International Harmonization:** high frequency spectrum is in use throughout the world, which fosters faster development of devices and equipment, with lower costs from greater economies of scale and international standardization.


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## The Frequency-biased Screen Proposals Ignore That Spectrum Deployments Are Typically Driven By Capacity, Not Coverage Needs

- With soaring wireless demand, network investment is now typically driven by capacity, not coverage.
- All operators are rapidly "densifying" their networks to meet capacity needs. AT&T is adding 10,000 macrocells, 40,000 small cells and a thousand distributed antenna systems ("DAS") as part of its Project VIP expansion.
- Thus, operators today rarely size their cells to reflect the maximum achievable size of a theoretical coverage-driven deployment.
- In this environment, the propagation "advantage" of low-frequency spectrum can actually be a disadvantage, because it causes more interference between base stations.


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## There Is No "In-building" Coverage Justification For A Frequency-biased Screen In Urban Areas

- Proponents' own studies refute the notion that low-frequency is always better at building penetration.
- High-frequency spectrum also has increased antenna gain and decreased inter-cell interference that can compensate for any propagation-related differences in building penetration.
- Urban buildings are generally close to cell sites and thus any "problem" buildings are likely to be a relatively small subset of buildings nearer to the cell edge or obstructed.
- In that small subset of affected buildings, network operators use efficient in-building solutions, such as the deployment of femtocells, DAS and small cells, not a costly doubling or tripling of macro cell sites.


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## Empirical Evidence Refutes The Cell-site Premise Of The Frequency-biased Screen Proposals

- If it were really the case that a provider using high-frequency spectrum would need to deploy many times more base stations than a provider using low-frequency spectrum, one would expect to see evidence of that in the real world.
- Empirical data confirm that AT&T (the operator with the highest average low-frequency holdings) and Sprint and T-Mobile (the operators with the heaviest concentration in high-frequency spectrum) have cell densities that are roughly *equal.* Not just in urban areas, but throughout entire CMAs of greatly varying population density.
- AT&T has *more* cell sites than Sprint in almost all of the top 100 CMAs (nearly two-thirds of the U.S. population), and more than T-Mobile in about half of them.
- Where Sprint and T-Mobile do have more cell sites, they typically have 20 to 30 percent more, not many times more, as the frequency-based screen proposals would predict.


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## A Frequency-biased Screen Would Harm Consumers and Undermine The 600 MHz Auction

- **Consumer Harm:** The proposed weighting schemes would harm consumers and undermine the competition-related purposes of the screen.
- A weighted screen would inefficiently increase providers' costs of expansion, distort network investment, and weaken competition, all of which would lead to higher quality-adjusted prices.
- **Undermine 600 MHz Auction:** A frequency-based screen would jeopardize the success of the 600 MHz auction by limiting bidding competition and by using regulation to diminish the value of low-frequency spectrum.
- Any such screen would yield a triple blow to the 600 MHz auction: reduced competition as a result of fewer bidders and fewer licenses pursued by each bidder; reduced willingness to pay among the bidders that do compete; and an increased supply of low-frequency spectrum on secondary markets, further reducing willingness to pay at auction.


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## Frequency-biased Screen Proposals Ignore That Most Deployments Are Not Green-field

- Spectrum transactions today are typically made by providers seeking to add capacity to existing deployments, not seeking to expand in green-field areas.
- These providers can use existing cell sites to deploy newly acquired spectrum.
- Cell site costs will thus not be a significant driver of the value of spectrum for these providers.
- Thus, any screen proposal based on values driven by cell site costs ignores how spectrum is actually valued by purchasers in the real world.


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## There Is No Merit To Sprint's Proposal To Continue To Exclude Or Discount EBS Spectrum

- Sprint argues that portions of EBS should excluded from the screen to the extent it: (1) is subject to a 5% educational use reservation, (2) is subject to coverage gaps, or (3) cannot be assembled into 20 MHz blocks.
- Almost every spectrum band is subject to similar "impairments," and it would be arbitrary to discount Sprint's EBS spectrum without adopting discounts for all other bands based on similar factors.
  - ✓ 850 MHz has coverage gaps (white spaces), but is fully counted in the screen.
  - ✓ Lower 700 MHz A-Block is subject to interference and exclusion zones because it is adjacent to Channel 51, but Lower 700 MHz A-Block is fully counted in the screen.
  - ✓ Lower 700 MHz D/E Block can be used only for supplemental downlink, and only in conjunction with high-band spectrum.
  - ✓ The recently auctioned PCS H Block is only 10 MHz, and many carriers hold less than 20 MHz in a given spectrum band.


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## If The Commission Adopts A Weighted Screen, It Must Treat Lower 700 MHz D And E Blocks As High Frequency Spectrum

- Unpaired Lower 700 MHz D and E Block will be used *only* for supplemental downlink bonded to high frequency spectrum.
- The D and E Blocks will be therefore deployed as if they were high-frequency spectrum – the deployment will necessarily mirror the deployment of the high-frequency spectrum to which it is bonded.
- Accordingly, under the theory of the weighting proposals, Lower 700 MHz D and E Block must be weighted as if it were high frequency spectrum, and any other result would be arbitrary.


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# APPENDIX


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## Empirical Evidence And Peer-Reviewed Academic Literature Refute Assumption That Higher Frequencies Always Experience Greater Penetration Loss

"[T]he dominant penetration mode [for urban buildings] is through slots such as windows and other frame openings, or even through grid openings in steel-reinforced concrete slabs. Losses associated with propagation through slots tend to be strongly frequency-selective, and overall decrease with increasing frequency." Comparison of Radio Propagation Characteristics at 700 and 2,500 MHz Pertaining to Macrocellular Coverage at 4, Communications Research Centre Canada, Ottawa (April 2011) (cited by KL Paper).

"For most floors of high-rise buildings . . . the 1920-MHz signal encountered less penetration loss than the 912-MHz signal." U.S. Department of Commerce, NTIA Report 95-32.5, Building penetration measurements from low-height base stations at 912, 1920, and 5990 MHz, at 44 (September 1995) (cited by KL Paper, n.26).

"The data measured in this paper [testing 900 and 1500 MHz] was found to follow the trend of decreasing building penetration loss as the frequency increases for the medium class of buildings." A. Davidson and C. Hill, Measurement of building penetration into medium buildings at 900 and 1500 MHz, IEEE Transactions on Vehicular Technology, vol. 46, no. 1, at 167 (February 1997) (cited by KL Paper).

"Notice that 1922 MHz encountered 3.5 dB less penetration loss than 880 MHz. Such a reduction in penetration loss at higher frequencies has also been documented by other authors. It appears that typical building walls are somewhat frequency selective, and tend to favor frequencies in the area of 1922 MHz over 880 MHz frequencies." William J. Tanis II and Glenn J. Pilato, "Building Penetration Characteristics of 880 MHz And 1922 MHz Radio Waves," IEEE 43rd Vehicular Technology Conference, pp. 207-208 (May 1993).

"The average penetration loss at ground floor level was found to be 14.2 dB at 900 MHz, 13.4 dB at 1800 MHz and 12.8 dB at 2300 MHz." A. F. de Toledo and A. M. D. Turkmani, "Propagation Into And Within Buildings At 900, 1800, And 2300 MHz," IEEE 42nd Vehicular Technology Conference, at 636 (May 1992).

"The results show that the penetration loss decreases as the frequency of transmission increases [from 441 MHz up to 1400 MHz]. These results (the decrease in penetration loss at higher frequency) are consistent with the conclusions drawn by [other researchers]." A. M. D. Turkmani, J. D. Parson, and D. G. Lewis, "Radio Propagation Into Buildings at 441, 900, and 1400 MHz," Proceedings of 4th International Conference on Land Mobile Radio, at S172 (December 1987).


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