

TerreStar 1400 MHz Spectrum

Securing the Value and Negotiability of the TerreStar 1400 Asset

Transforming TSTR 1400 Into a High Value Asset

TerreStar's 1400 MHz spectrum displays physical characteristics that are uniquely well suited to bit-intensive and latency intolerant wireless applications. The band's low noise floor and advantageous urban propagation characteristics suggest that proposed 4G applications will benefit from extremely high spectral efficiencies, which meaningfully exceed those in other parts of the commercial wireless spectrum.

Implicit in the positive engineering attributes of TSTR 1400 is a very high potential for long-term value. However, a series of significant regulatory and technological obstacles stand between the minimal baseline valuations set in FCC Auction 69 and much higher general market values, such as those presently associated with 700 MHz or AWS-1. Bridging the gap between the low \$0.01 - \$0.05 per MHz-POP values currently associated with this spectrum and the baseline \$0.22 - > \$1.00 per MHz-POP valuations associated with conventional CMRS spectrum will require a series of rapid rulemaking and engineering actions.

The following slides represent a basic overview of the technical attributes and applications strategies associated with this spectrum. For expansion, please contact:

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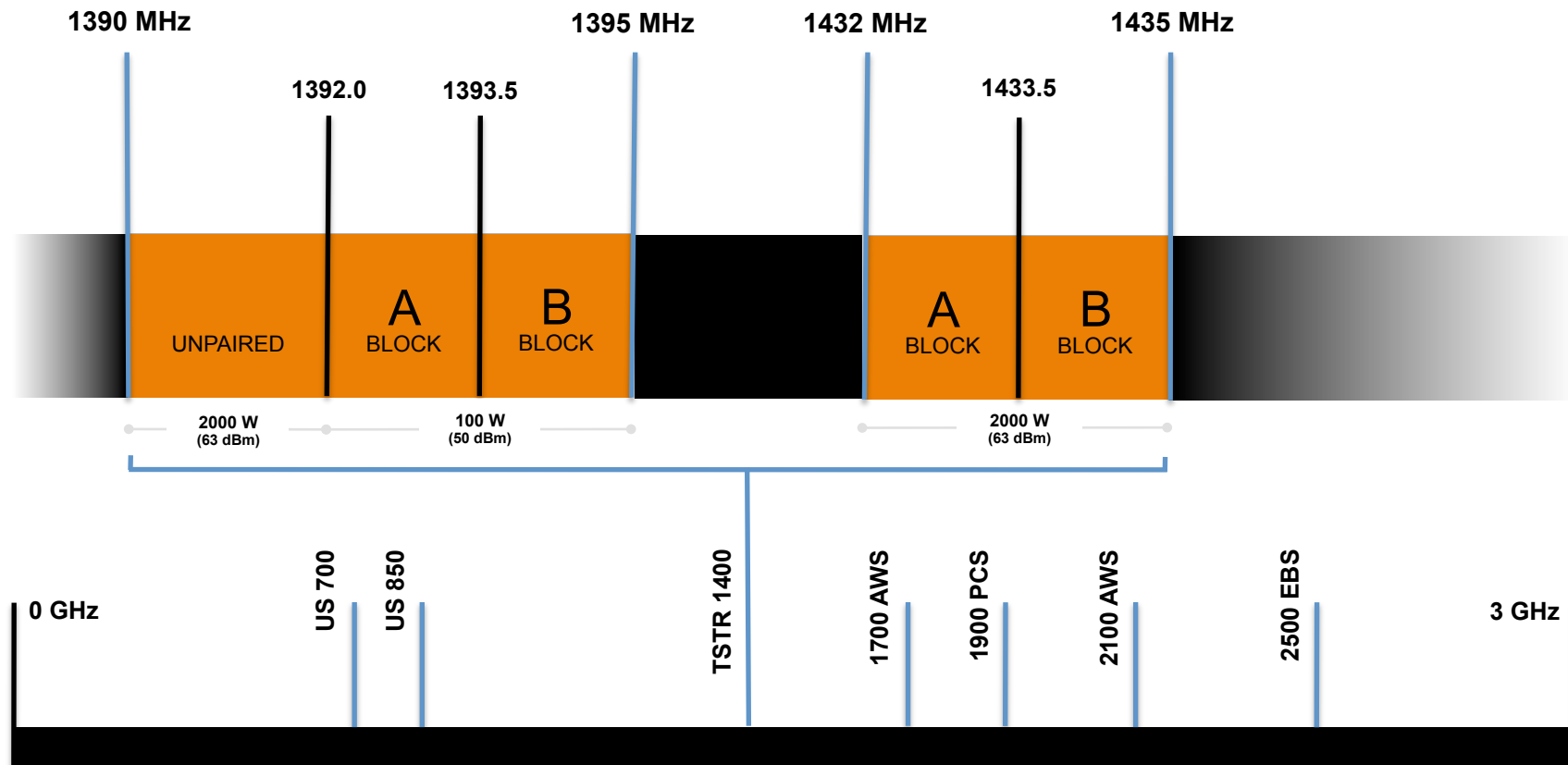
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Section I

**Beneficial Regulatory and Technical Attributes of the
TerreStar 1400 MHz Band**

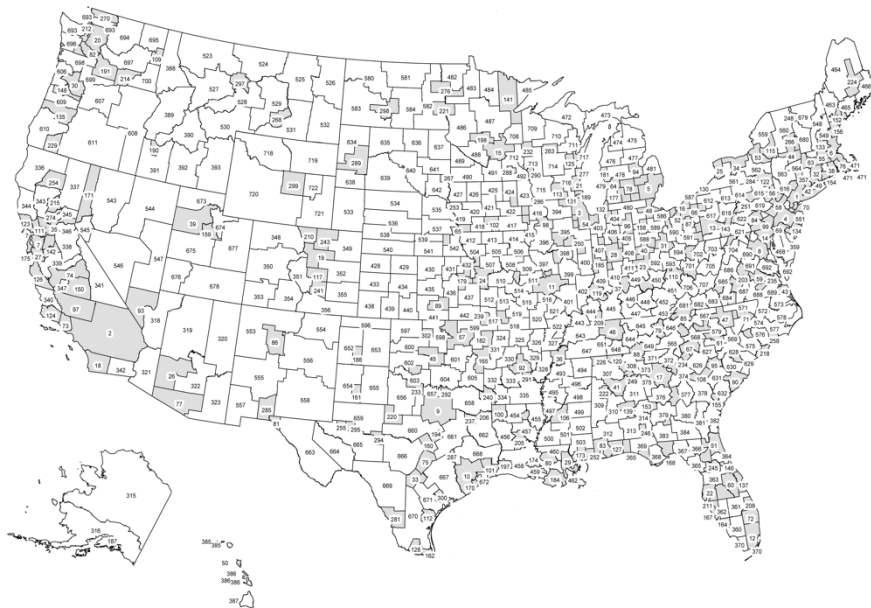
TerreStar 1400 MHz Spectrum Assets Overview

The TerreStar 1400 MHz allocation sits in a highly advantageous place within the usable RF spectrum. Low noise and desirable propagation characteristics make this band uniquely well suited to demanding 4G commercial applications. However, numerous market and regulatory obstacles stand between the band's current configuration and one that can achieve high \$ per-MHz-POP valuations.

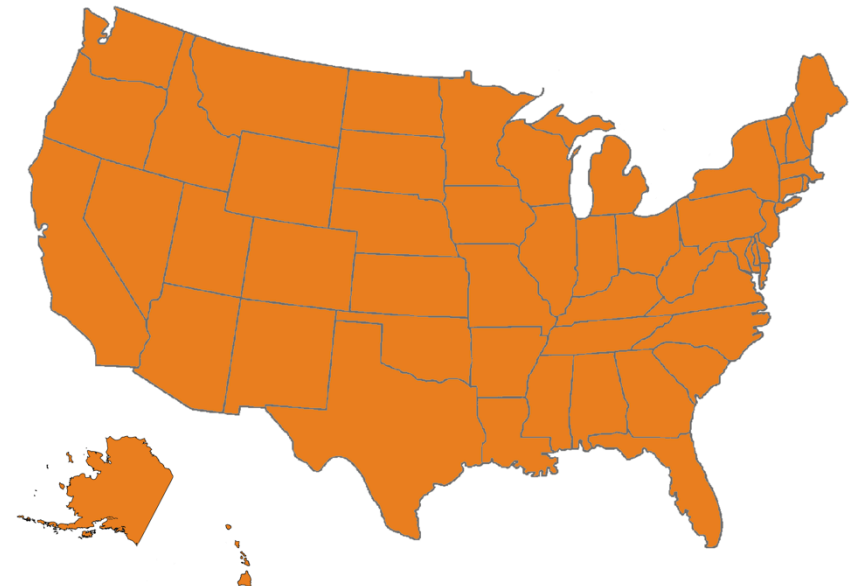


Benefit of Effective TSTR 1400 U.S. Market Continuity

Previously offered terrestrial wireless bands have suffered from considerable and highly disadvantageous geographic fragmentation in their license holdings. In contrast, TerreStar spectrum in the 1400 MHz band may be utilized with a single wide area authority. This distinction will likely have long-term inflative effects on value for network operators, while opening the market for non-carrier entities that cannot acquire geographically contiguous spectrum in the conventional auction process.



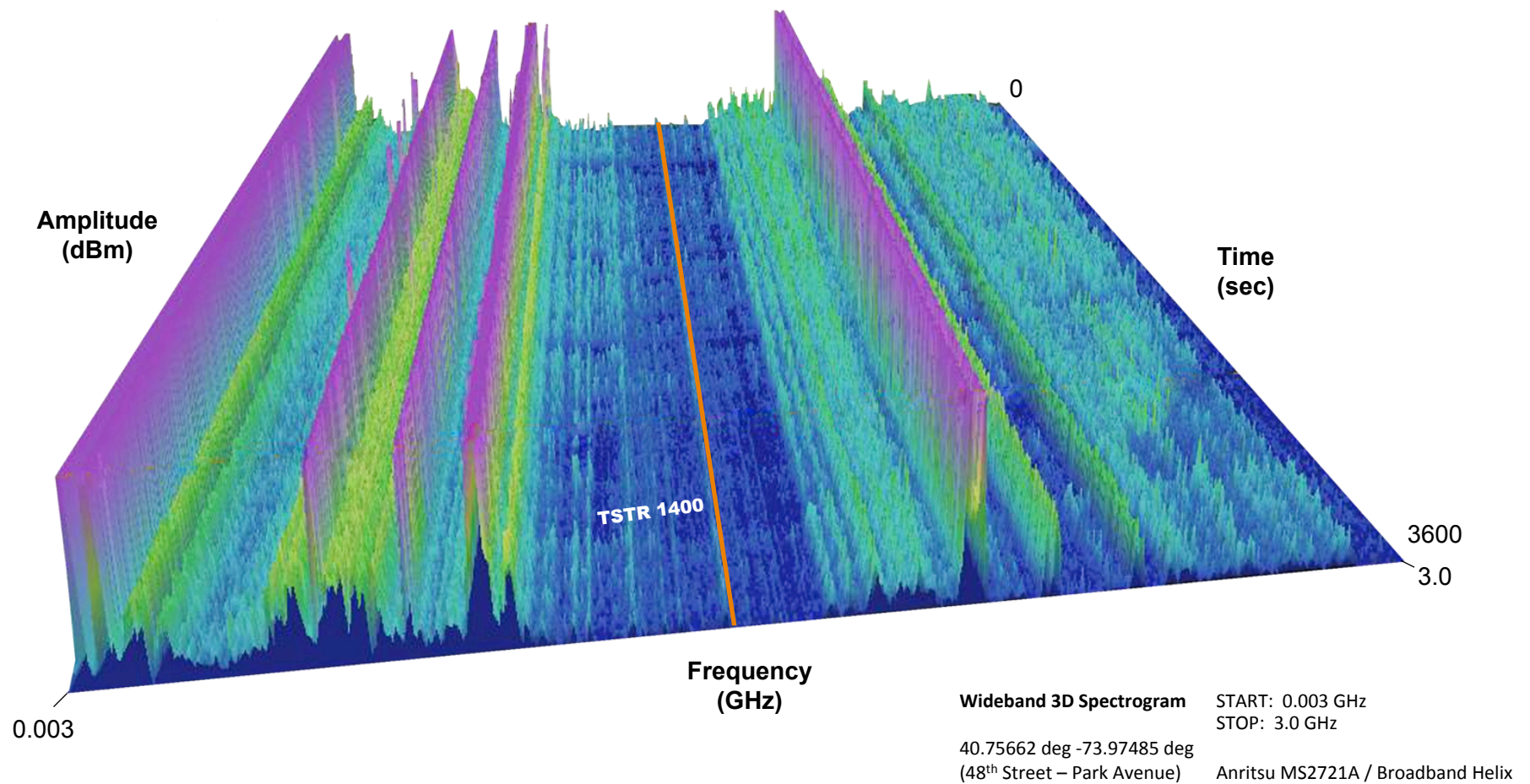
12 Regional Economic Areas
176 Basic Economic Areas
734 Cellular Market Areas



1 Nationwide License Authority

The 1400 MHz Band is a Unique Low Noise Refuge

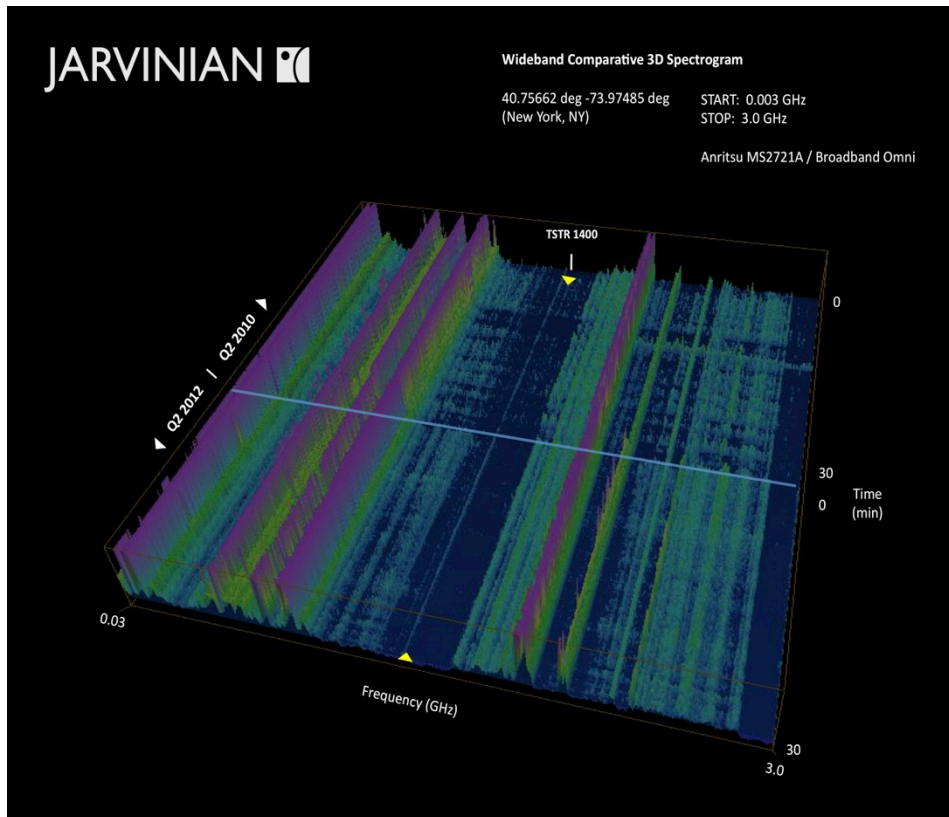
The usable wireless spectrum spans less than 3 GHz. Of the few remaining spectrum allocations, none exhibit the extreme low noise and interference characteristics of central L-Band. Free from the GPS considerations of other L-Band license holders, the TerreStar 1400 MHz band represents a unique spectrum resource for high density urban 4G data applications.



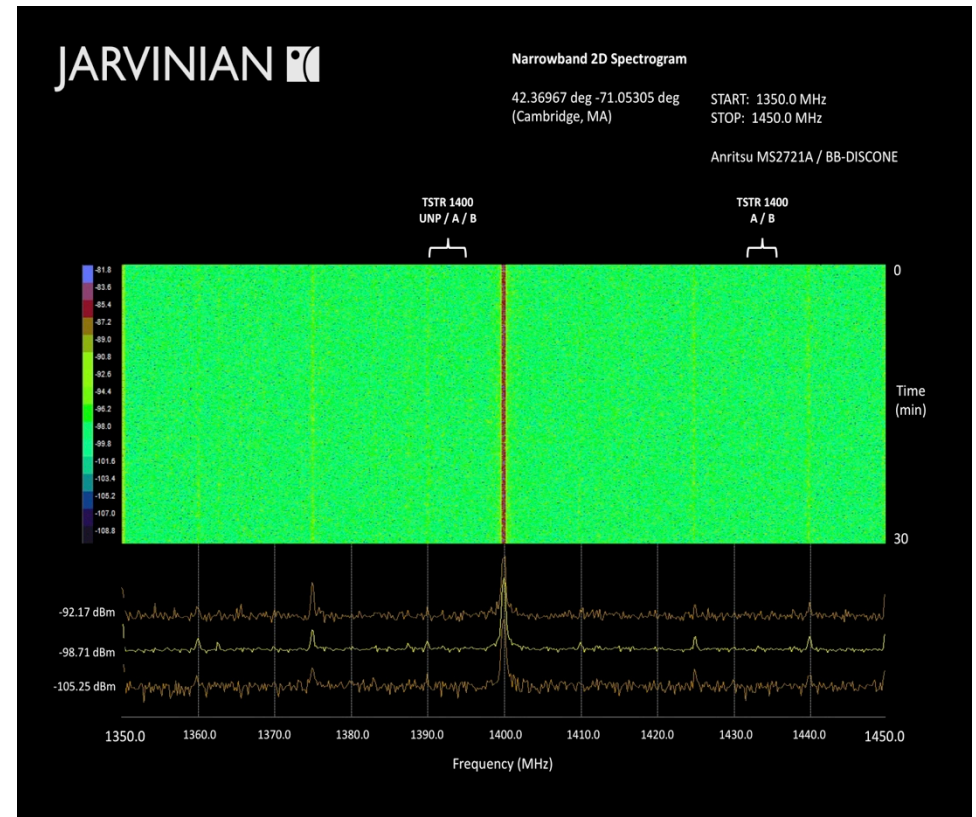
Detailed Spectrographic View of the TSTR 1400 Band

Wireless spectrum represents a finite and degrading resource as rapidly increasing utilization adds paralyzing noise and interference to commercial wireless allocations. TSTR 1400 is a notable exception, existing in a uniquely well preserved portion of the usable RF spectrum. Spectrographic analysis indicates a potential for extremely high relative per-Hz bandwidth capacity.

TSTR 1400 Relative to Degrading Wireless Spectrum

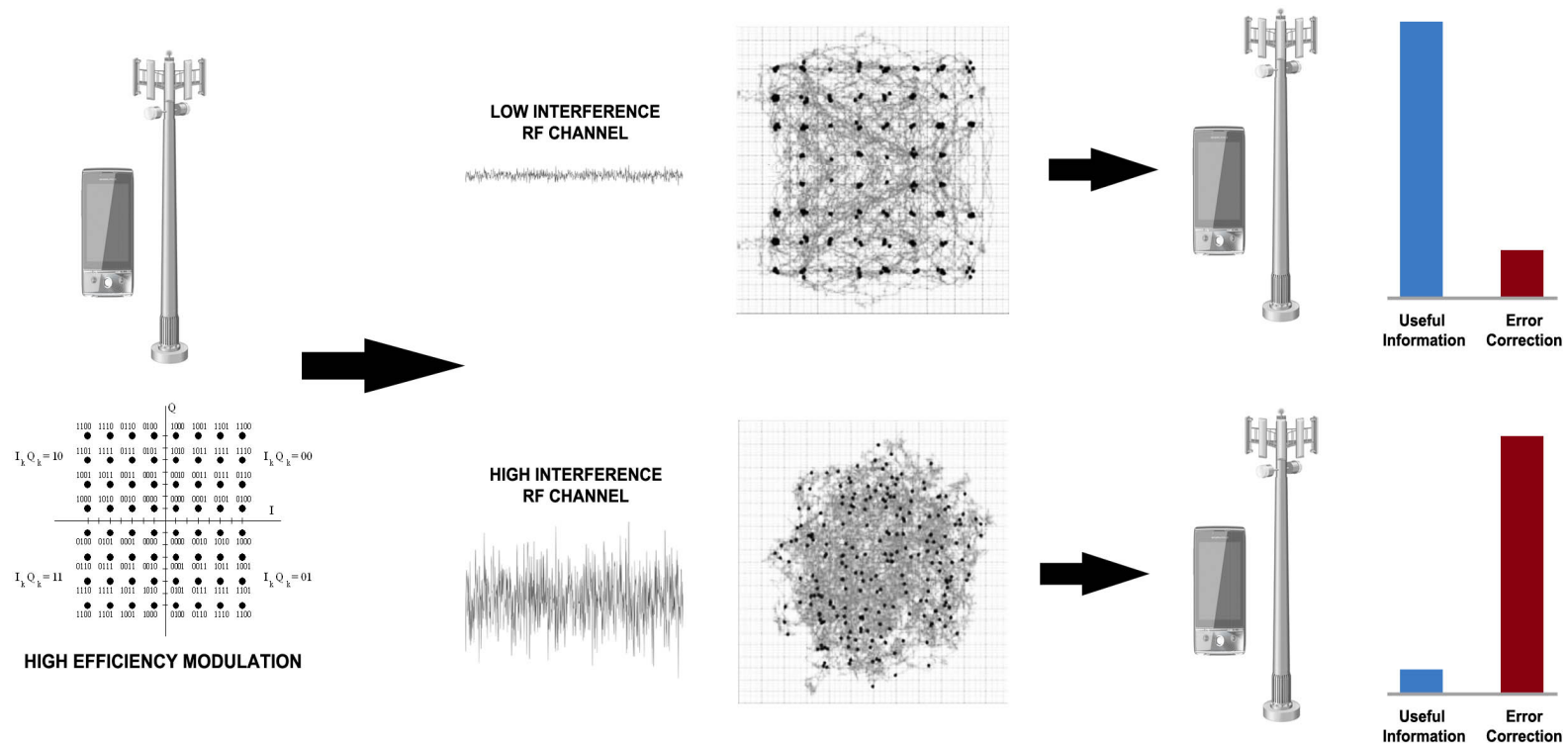


High Resolution Study of TSTR 1400 Characteristics



Low TSTR 1400 Noise Means Higher Speed and Capacity

4G network protocols exploit aggressive modulation techniques to provide high data speeds. However, as signal modulation becomes more efficient, it also becomes more susceptible to the deleterious impact of RF noise and interference. This is why a small amount of low noise and interference spectrum can carry significantly more data than a much larger parcel of noise and interference limited spectrum. The TerreStar 1400 MHz allocation is a prime example of this.

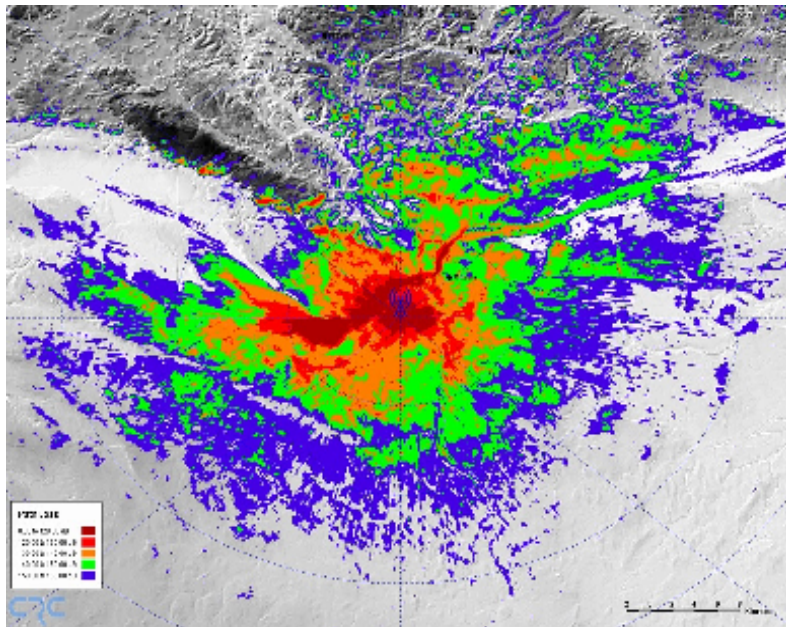
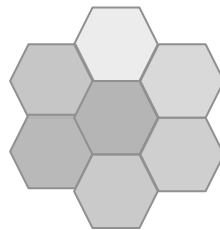


Coverage and Capacity Attributes of TSTR 1400

The RF propagation characteristics of a given band determine not only the ease by which signals will propagate through structures, but also the degree to which scarce spectrum can be recycled via cellular re-use. The TerreStar 1400 MHz band combines the penetrating power of low frequency bands (700 MHz) with the cellular reuse potential of high frequency bands (2500 MHz).

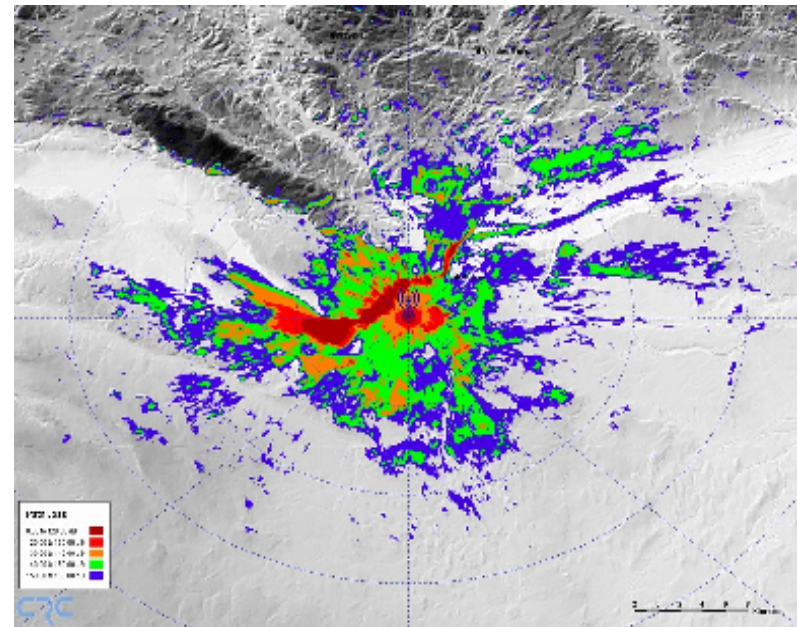
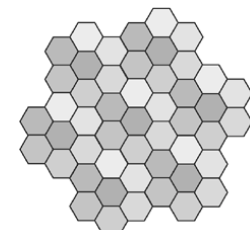
700 MHz Equivalent Power Urban Coverage

High Penetration / Low Reuse



2500 MHz Equivalent Power Urban Coverage

Low Penetration / High Reuse



Section II

**Re-banding Strategies and Potential Valuations for the
TerreStar 1400 MHz Band**

Value, Complexity, and Uncertainty for TSTR 1400

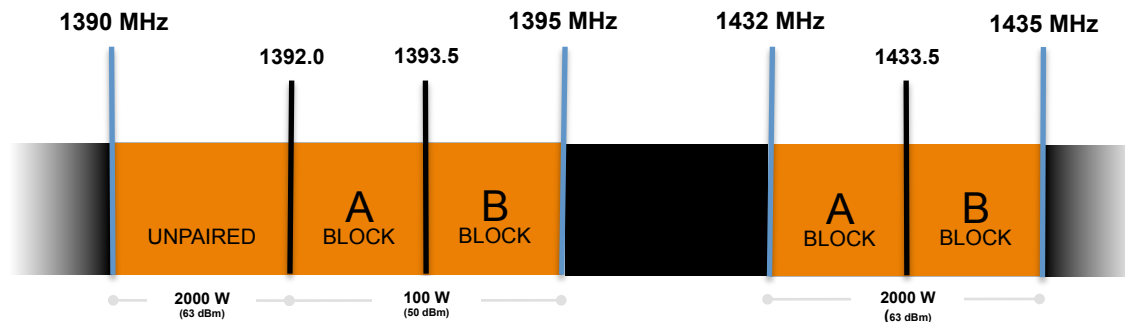
Four basic options delineate the likely range of sale / lease opportunities for TSTR 1400. Whereas M2M and related Smart Grid applications have traditionally been a focus for this band, it is clear that they are unlikely to represent recovery value for stakeholders. Repurposing TSTR 1400 for conventional commercial wireless service is the only viable means of increasing value. It is our opinion that at least three different types of application are possible here, each with varying degrees of regulatory and technological requirement.

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
	M2M / Smart Grid	Pairing with Orphaned Band	Creation of Carrier Aggregation Band	Creation of Conventional 5 x 5 FD-LTE Band
ANTICIPATED VALUE	VERY LOW	MODERATE - HIGH	MODERATE - HIGH	VERY HIGH
REGULATORY COMPLEXITY	LOW	MODERATE	MODERATE - HIGH	HIGH
TECHNOLOGICAL UNCERTAINTY	MODERATE - HIGH	MODERATE	MODERATE	LOW

OPTION 1: Smart Grid and General M2M Applications

While Part 25 regulatory treatment of TSTR is relatively liberal, the configuration of the band discourages high value carrier LTE applications. This is the reason why Smart Grid and other M2M applications have been a primary focus. However, the low applied values and long-term uncertainties associated with these applications make them highly undesirable.

ORIGINAL BAND PLAN



Configuration:

- (1) 2 MHz Unpaired Block
- (2) 1.5 x 1.5 MHz Paired Blocks

Engineering Potential:

- Band configuration not advantageous for consumer LTE applications.
- Purpose built M2M application best suited to band plan.

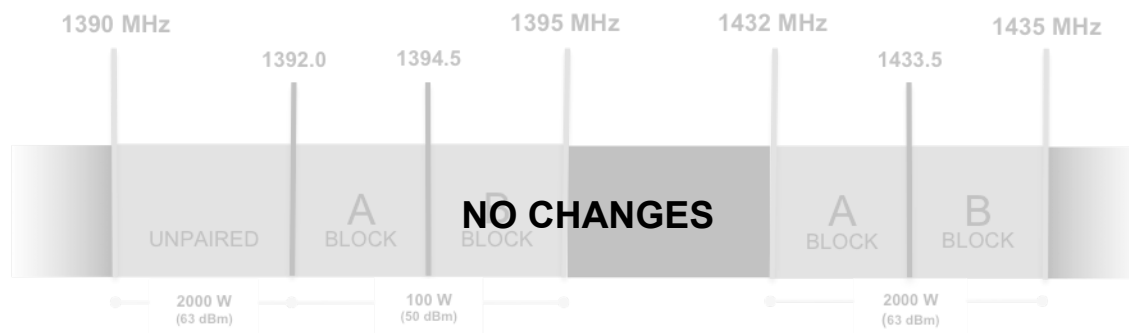
Market Factors:

- Auction 69 authorization removes regulatory uncertainty.
- 10 year build-out deadline adds pressure for new network applications.
- Public domain discussion of exclusion zones complicates negotiation.

Anticipated Value Range:

At or Below Auction 69 Pricing

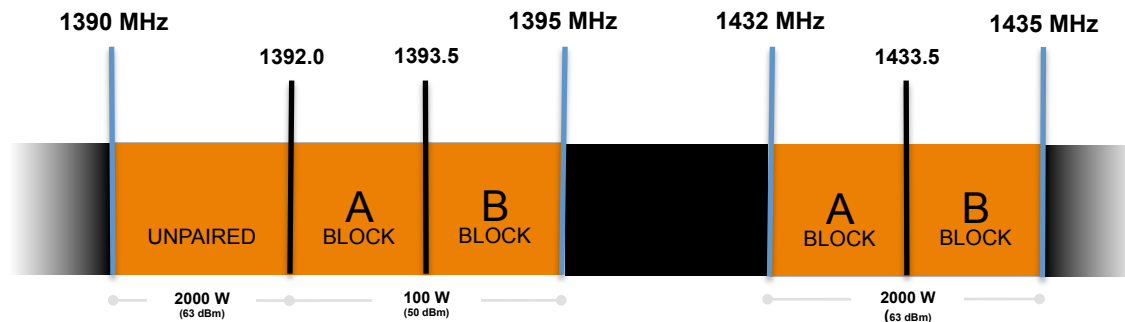
M2M / SMART GRID BAND PLAN



OPTION 2: Orphaned Spectrum Pairing Applications

Detailed survey work will demonstrate the superior data carrying (high bits / Hz) and propagation (high cellular reuse) characteristics of TSTR 1400. These attributes may permit the band to service as a “cross-band” pair to otherwise unpaired allocations in another part of the spectrum. Current possibilities include 700 MHz E-Block, as well as proposed 5 MHz LSQ “remedy” allocations.

ORIGINAL BAND PLAN



Configuration:

- (1) 5 MHz Unpaired Block
- (2) 1.5 MHz Unpaired Blocks

Engineering Potential:

- Lower band configuration matches at least two critical market opportunities for “cross-band” pairing.
- Upper band utility still problematic in the context of 4G CMRS applications.

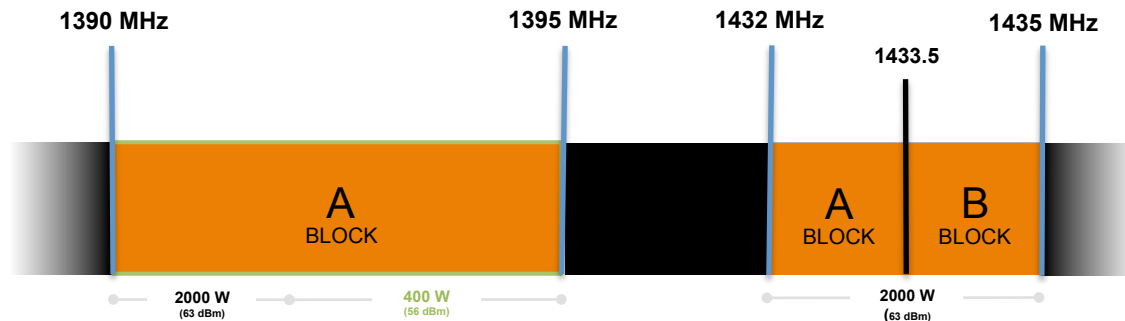
Market Factors:

- Auction 69 rule modification (waiver) will delay market acceptance.
- Public domain discussion of exclusion zones complicates negotiation.
- 3GPP and related standards process will pace roll-out.

Anticipated Value Range:

AWS-4 Level Pricing (Depending on Pair)

OPRHANED SPECTRUM PAIRING BAND PLAN

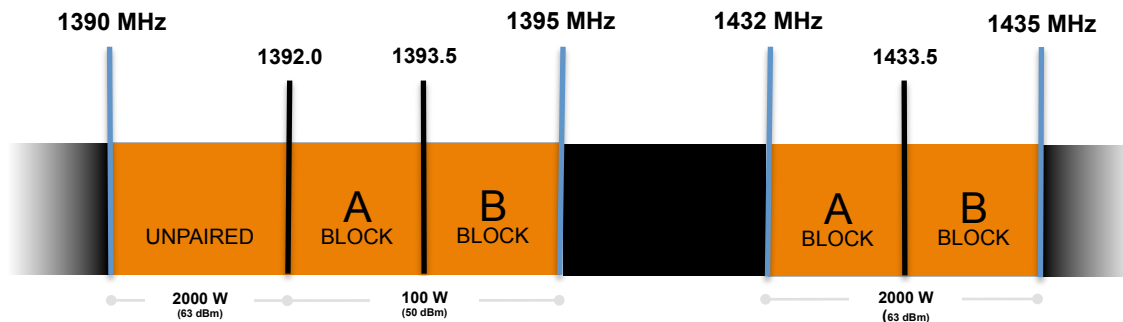


 REGULATORY MODIFICATION

OPTION 3: Carrier Aggregation / Supplemental Downlink Applications

One of the most important features of LTE Advanced is the ability to either aggregate disparate bands into a single wideband carrier or use unpaired spectrum to supplement the downlink capacity of a primary band allocation. We believe that TSTR is very well suited to such applications, which could be serviced via relatively modest regulatory waivers.

ORIGINAL BAND PLAN



Configuration:

- (1) 5 MHz Unpaired Block
- (1) 3 MHz Unpaired Block

Engineering Potential:

- Band configuration ideally suited to future LTE carrier aggregation and supplemental downlink applications.
- Maturity of advanced LTE base station will pace growth of market need.
- Lack of interim device ecosystem will pace growth of market need.

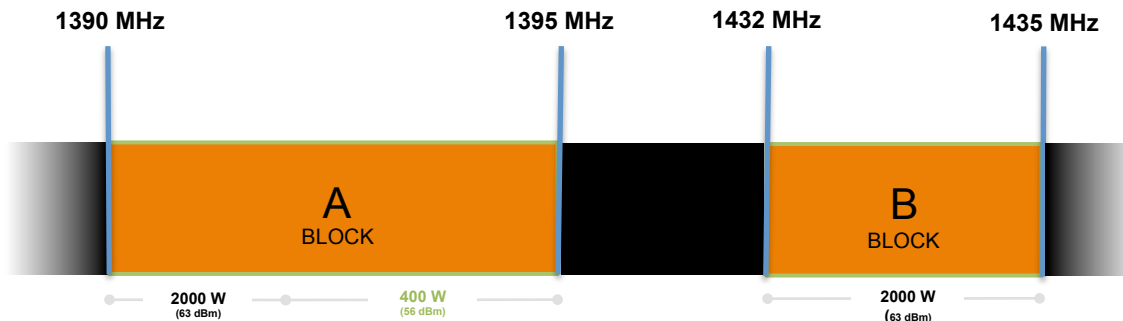
Market Factors:

- Aggregation critical to future LTE capacity needs.
- Public domain discussion of exclusion zones complicates negotiation.

Anticipated Value Range:

AWS-4 Level Pricing (Depending on LTE)

CARRIER AGGREGATION / SUPPLEMENTAL DL BAND PLAN

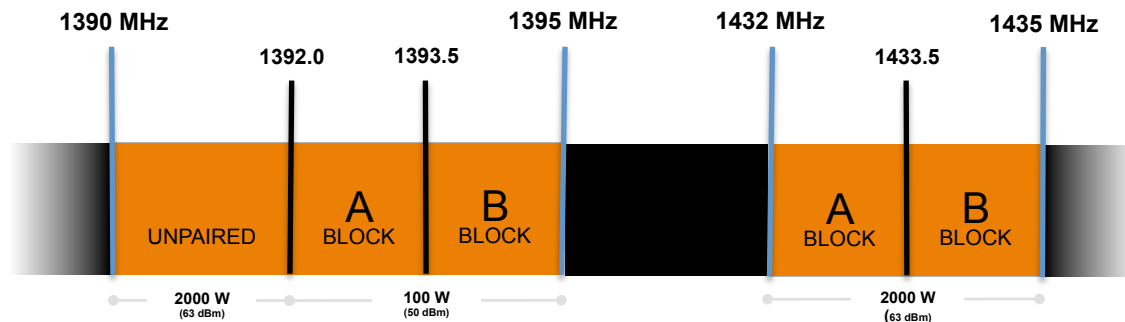


 REGULATORY MODIFICATION

OPTION 4: New 5 x 5 MHz Paired FDD LTE Band

Despite the mobile industry's continued evolution away from a technical need for symmetrically paired FDD spectrum, the market still places a meaningfully large premium on such allocations. Its advantageous physical properties notwithstanding, TSTR 1400's odd channel arrangement is a significant handicap. Reforming this band into a 5 x 5 FDD band will likely boost values to AWS-2 levels.

ORIGINAL BAND PLAN



Configuration:

(1) 5 x 5 MHz Paired Block

Engineering Potential:

- Classic FDD band configuration removes engineering uncertainties.
- 5 MHz channels allow providers to reach perceived "critical mass" in sector capacity.

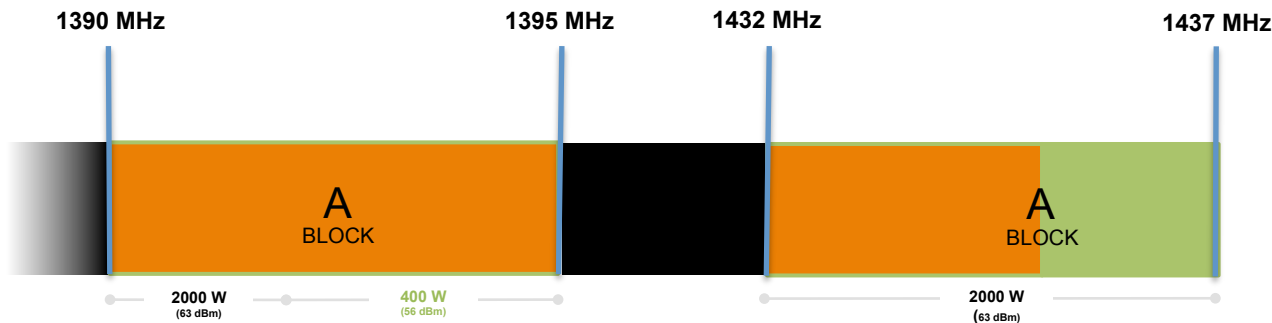
Market Factors:

- Paired 5 x 5 MHz FDD band significantly multiplies perceived value.
- Build-out horizon must be extended to something equivalent to AWS-4.
- Public domain discussion of exclusion zones complicates negotiation.

Anticipated Value Range:

AWS-1 / AWS-2 H-Block (Projected) Pricing

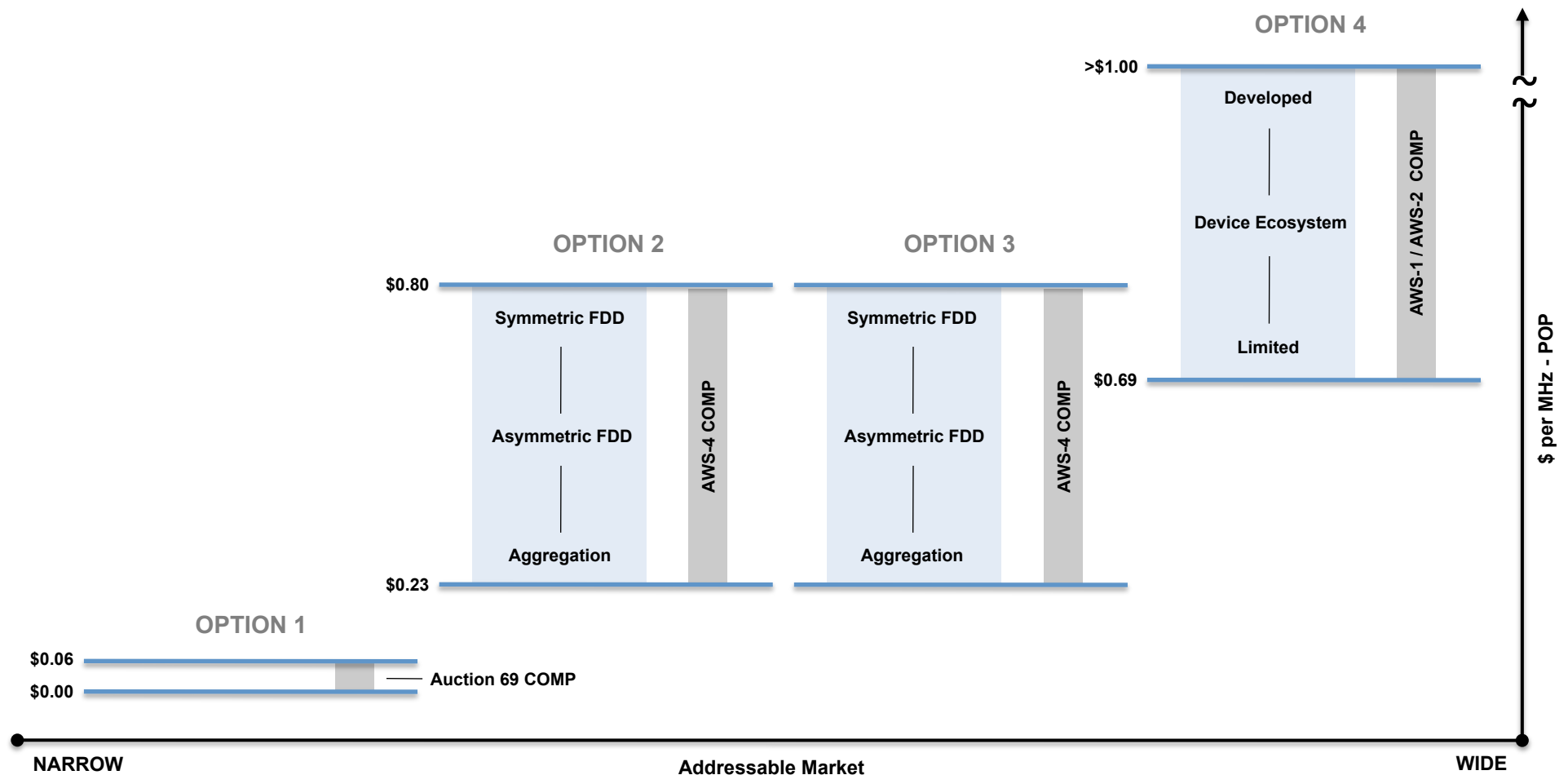
5 x 5 MHz PAIRED FD-LTE BAND PLAN



 REGULATORY MODIFICATION

Value Ranges Across Band Configuration Options

The current TSTR 1400 band configuration is likely incompatible with values exceeding those of Auction 69. However, modifications to the original band plan may achieve significantly higher valuations, especially as they more closely mirror conventional CMRS band configurations. These values exist as discrete plateaus with configuration dependent CMRS comparables.



Section III

**Scope of Regulatory, Market, and Technical Work for
the
TerreStar 1400 MHz Band**

Regulatory and Supporting Technical Work by Band Configuration

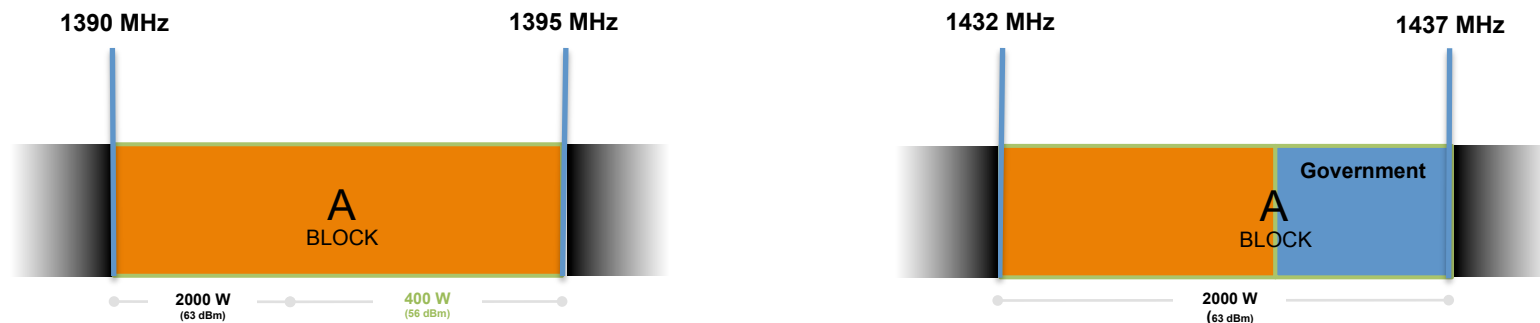
No band configuration option is without some need for regulatory relief, and modest re-banding in support of LTE-A carrier aggregation may likely be achieved via a waiver process. However, the highest value configuration (symmetric 5x5 FDD band) will almost certainly require a complex rule-making process that accommodates the interests of adjacent band license holders.

	OPTION 1 (Auction 69 Configuration)	OPTION 2 (Partial Aggregation)	OPTION 3 (Full Aggregation)	OPTION 4 (Conventional 5x5)
REGULATORY	Amendment <ul style="list-style-type: none"> • Extension of build-out deadline / clarification of substantive service. 	Waiver <ul style="list-style-type: none"> • Combine unpaired 2 MHz with lower A + B Blocks to form 5 MHz channel • Increase EIRP of lower A + B Block segment from 100 W (50 dBm) to 400 W (56 dBm) 	Waiver <ul style="list-style-type: none"> • Regulatory treatment of Option 2 • Combine upper A + B Blocks to form 3 MHz channel. 	Rule-Making / Re-Farming <ul style="list-style-type: none"> • Regulatory treatment of Options 1 + 2 • Add 2 MHz to upper Block • Combine Block segments into paired 5x5 MHz band • Retain license geography
TECHNICAL	<ul style="list-style-type: none"> • Technical defense of build-out constraints associated with M2M market fragmentation 	<ul style="list-style-type: none"> • OOB / Exclusion Zone co-existence analysis in support of increased lower A + B Block EIRP • 5 MHz LTE-A Aggregation Band impact study • Aggregation device / infrastructure filtration study 	<ul style="list-style-type: none"> • OOB / Exclusion Zone co-existence analysis in support of increased lower A + B Block EIRP • 5 MHz / 3 MHz LTE-A Aggregation Band impact study • 5x3 MHz band pair device duplexer study 	<ul style="list-style-type: none"> • 5x5 MHz paired FD-LTE Band “National Broadband” impact study • Migration plan for existing federal / commercial operators in adjacent re-farmed 2 MHz parcel.

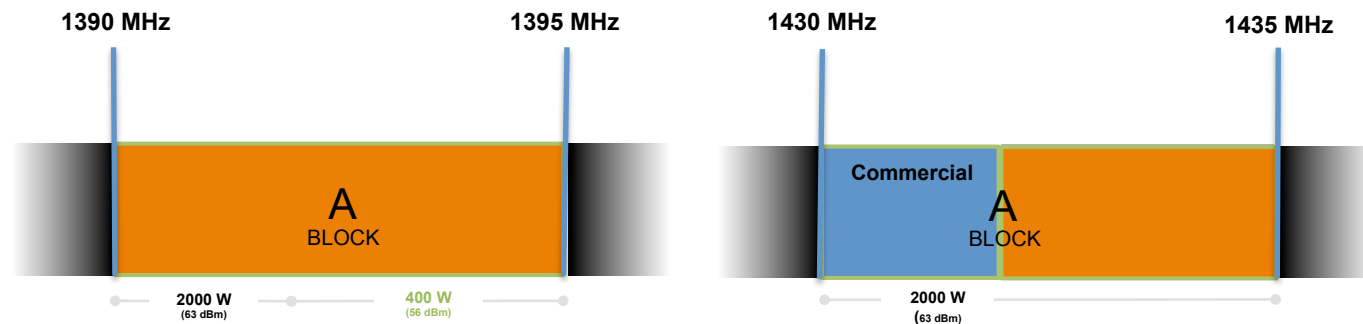
Potential Re-Farming Options for 5 x 5 MHz Band Configuration

Even with significant band pairing and effective radiated power level waivers, TSTR 1400 will remain an unconventional band with asymmetrical uplink / downlink blocks. However, the addition of 2 MHz may transform the band into one with value and utility comparable to the highly impactful PCS G-Block. Engineering must make the delicate case for adjacent spectrum re-farming.

Reallocation of Federal Service (1435 – 1437 MHz)



Reallocation of Private Licensee (1428 – 1430 MHz)



 REGULATORY MODIFICATION  RE-FARMED SPECTRUM

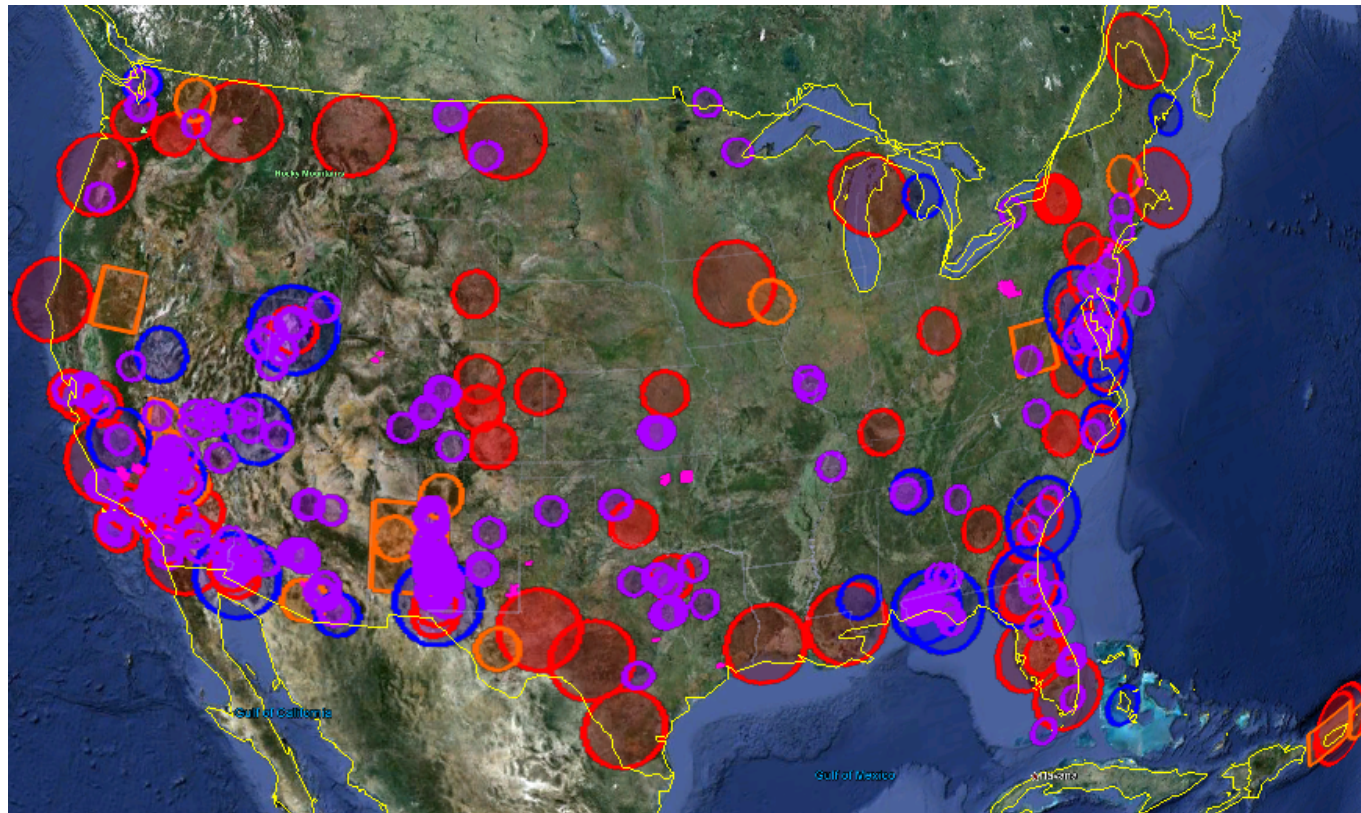
Marketing and Supporting Technical Work by Band Configuration

The M2M applications envisioned in Auction 69 are unlikely to achieve desirable valuations. Thus, commercial carrier friendly band configurations are likely to be the only viable exit pathway. Beyond critical regulatory re-banding efforts, engineering work must successfully remove existing exclusion zone and limited ecosystem concerns for network providers.

		OPTION 1 (Auction 69 Configuration)	OPTION 2 (Partial Aggregation)	OPTION 3 (Full Aggregation)	OPTION 4 (Conventional 5x5)
MARKET		M2M / Speculator <ul style="list-style-type: none"> • Exhaust perceived low value M2M opportunities • Introduce to strategic speculator (paired asset) • Introduce to financial speculators 	Carrier / Speculator <ul style="list-style-type: none"> • Integrate into LTE-A carrier aggregation strategy • Explore special purpose (e.g. mobile broadcast) applications 	Carrier / Speculator <ul style="list-style-type: none"> • Integrate into LTE-A carrier aggregation strategy • Create asymmetrically paired FD-LTE band plan 	Carrier <ul style="list-style-type: none"> • Create 3GPP standardized symmetrical 5x5 MHz FD-LTE band plan • Create competitive bid process across CMRS carriers
		TECHNICAL <ul style="list-style-type: none"> • Comprehensive study of superior RF spectral efficiency characteristics (noise level / propagation) • Detailed defense of exclusion zone / OOB threat (limit impact of RKF report) 	<ul style="list-style-type: none"> • Comprehensive study of LTE-A aggregation across heterogeneous bands • Rollout plan for carrier aggregation strategy (infrastructure and device ecosystems) 	<ul style="list-style-type: none"> • Comprehensive study of irregular 5x3 MHz FD-LTE band pairing • Rollout plan for carrier aggregation strategy (infrastructure and device ecosystems) 	<ul style="list-style-type: none"> • Accelerated 3GPP band classification process • Independent device ecosystem development in cooperation with chipset interests

Disruptive Potential of Perceived TSTR 1400 Exclusion Zones

Successful completion of either substantive waiver or rule making processes will unquestionably raise the value of TSTR 1400, perhaps to levels approaching that of conventional CMRS spectrum. However, no regulatory action will remove the deflative impact of perceived exclusion zones. TerreStar's own commissioned study may introduce considerable downward price pressure.



RKF Engineering Solutions
1.4 GHz Exclusion Zone Analysis

- RADAR
- RADIO ASTRONOMY
- GOVERNMENT SERVICE
- AERONAUTICAL TELEMETRY
- FIXED TELEMETRY

Simplified Phases of Regulatory, Technical, and Market Work

Before its market potential may be realized, TSTR must be transformed via a series of aggressive technical and regulatory actions. In the simplest sense, these may be placed into three major phases of activity. The goal of this work is to move swiftly towards a liberal regulatory treatment that achieves the highest possible valuation, while still preserving interim value levels and potential exits.

