Indian Spectrum Auctions

The Need for a New Model to Calculate Reserve Price

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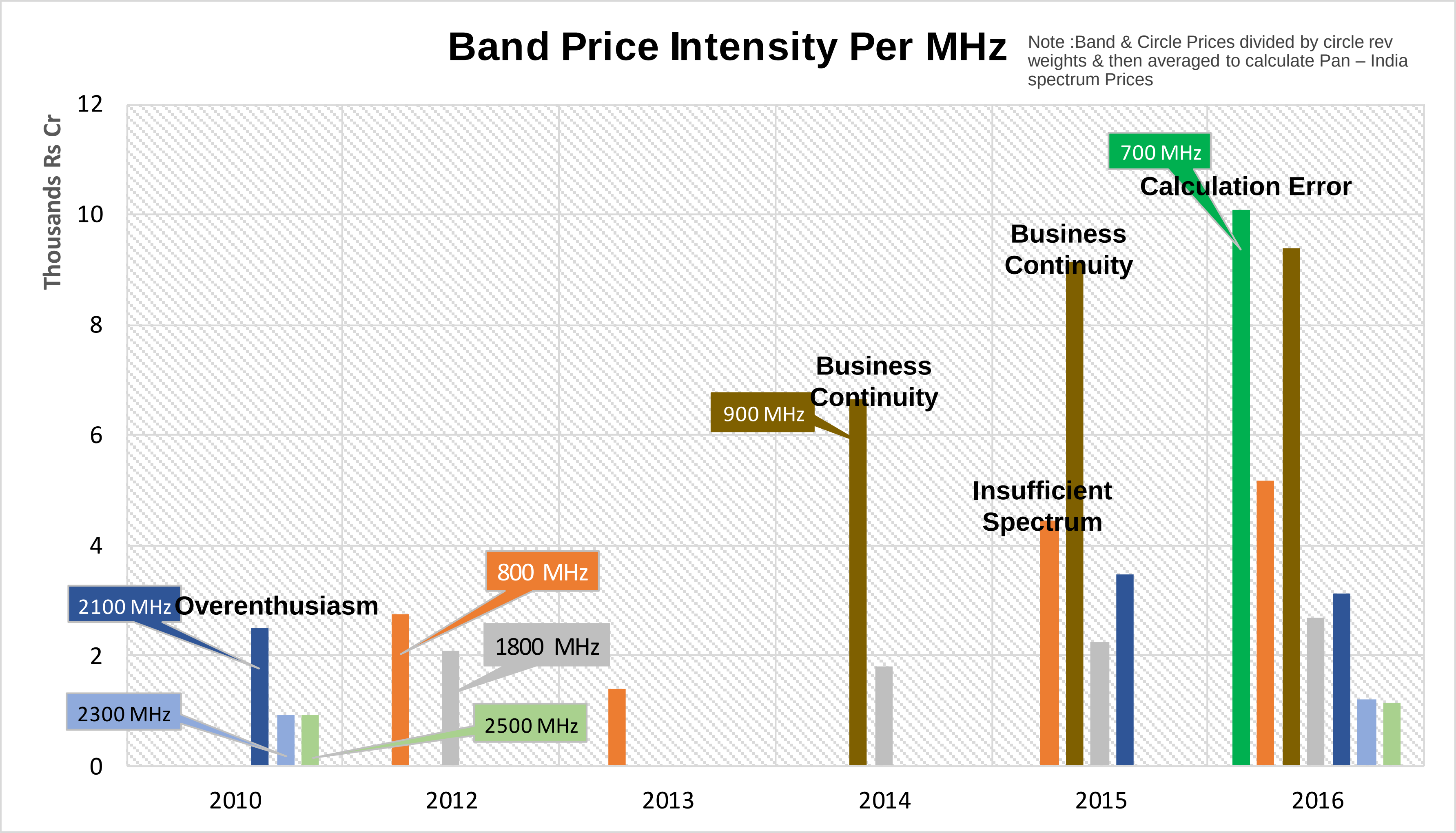
Outline

- **Auction : Past Experiences**
- **High Spectrum Price : Implications**
- **New Pricing Model : The Need**
- **The Pricing Model : Overview**
- **Conclusion**

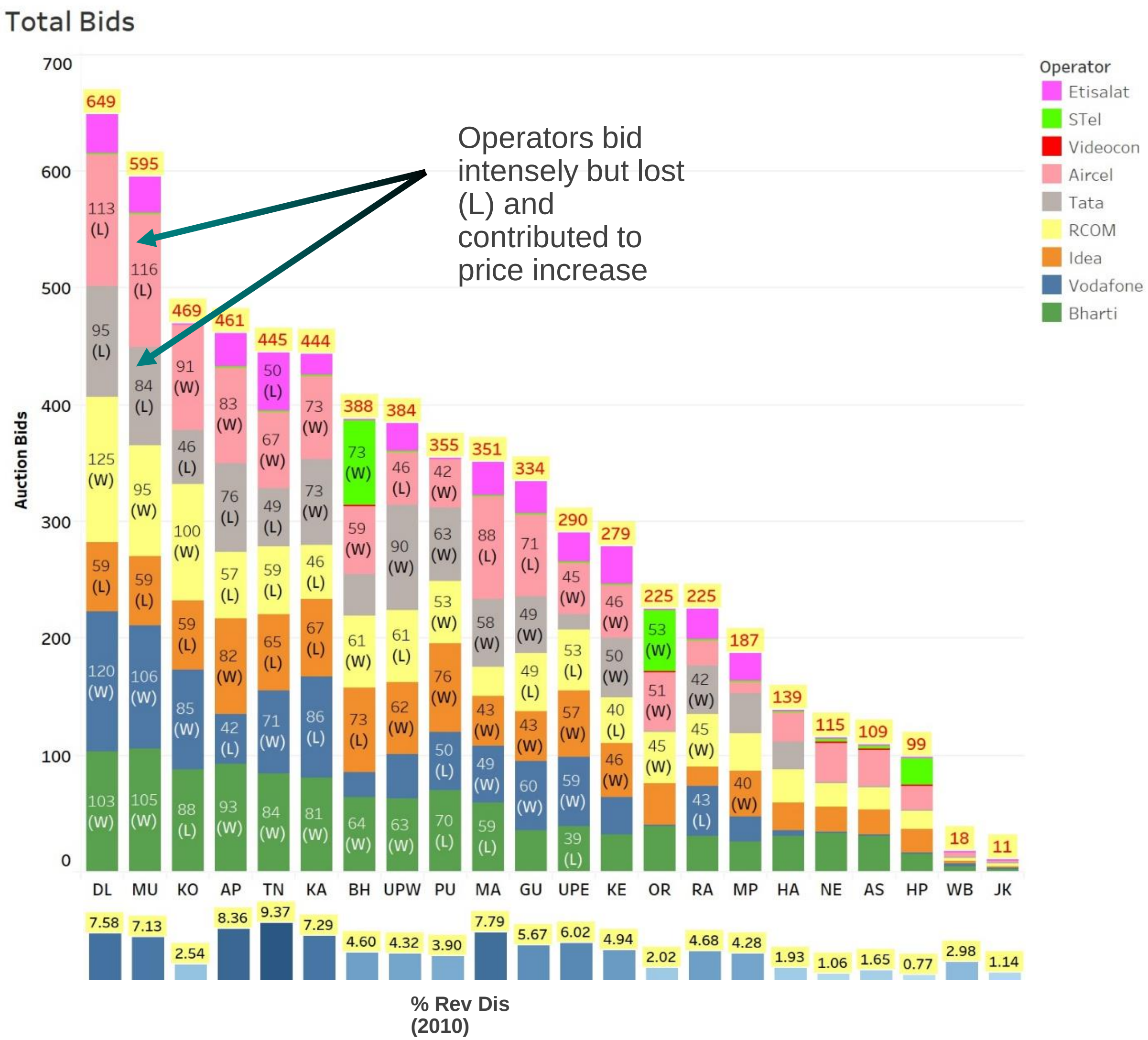
Auctions: Past Experiences

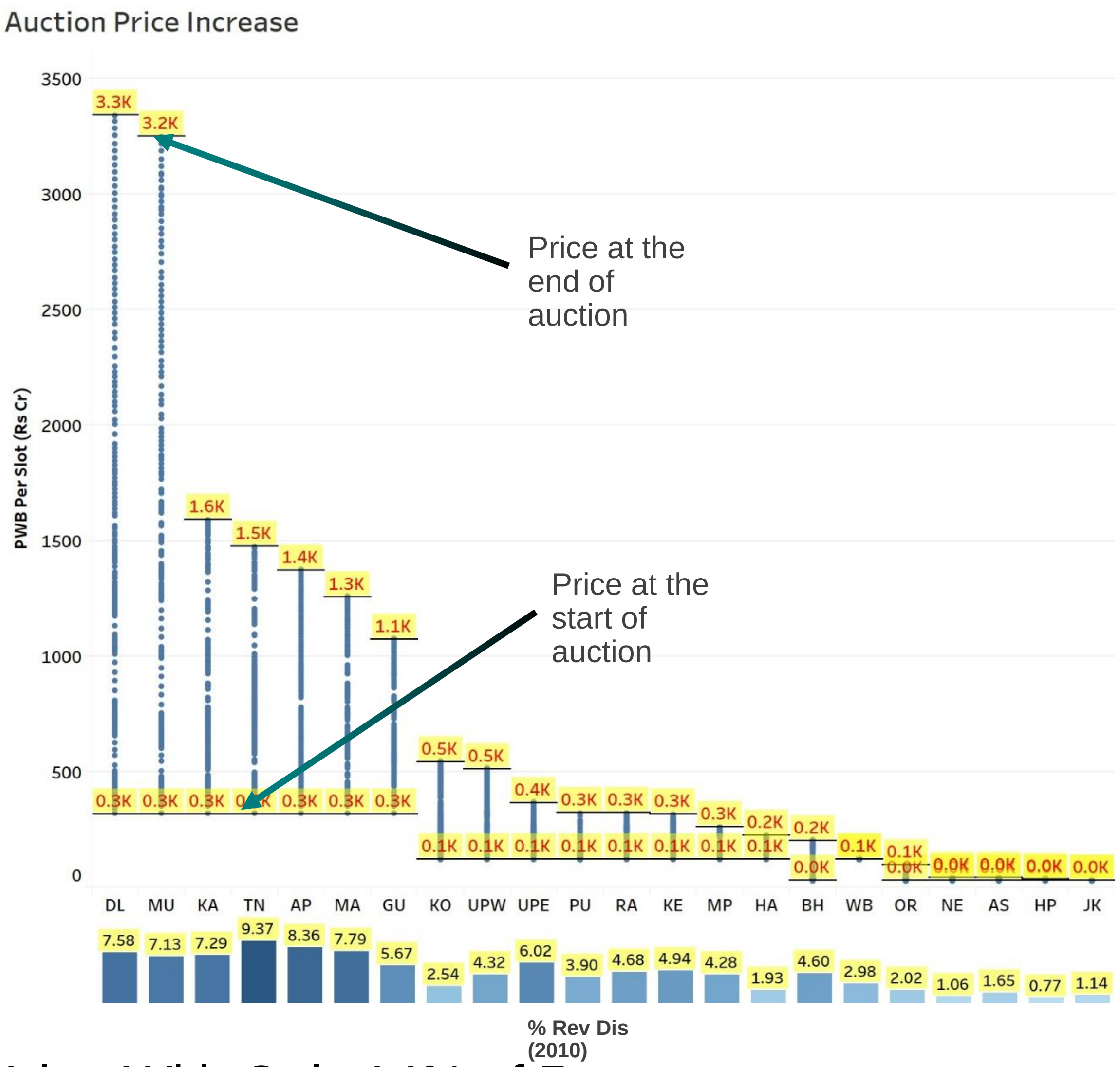
Spectrum Pricing: Trends



Spectrum Prices Have Increased At Different Rates

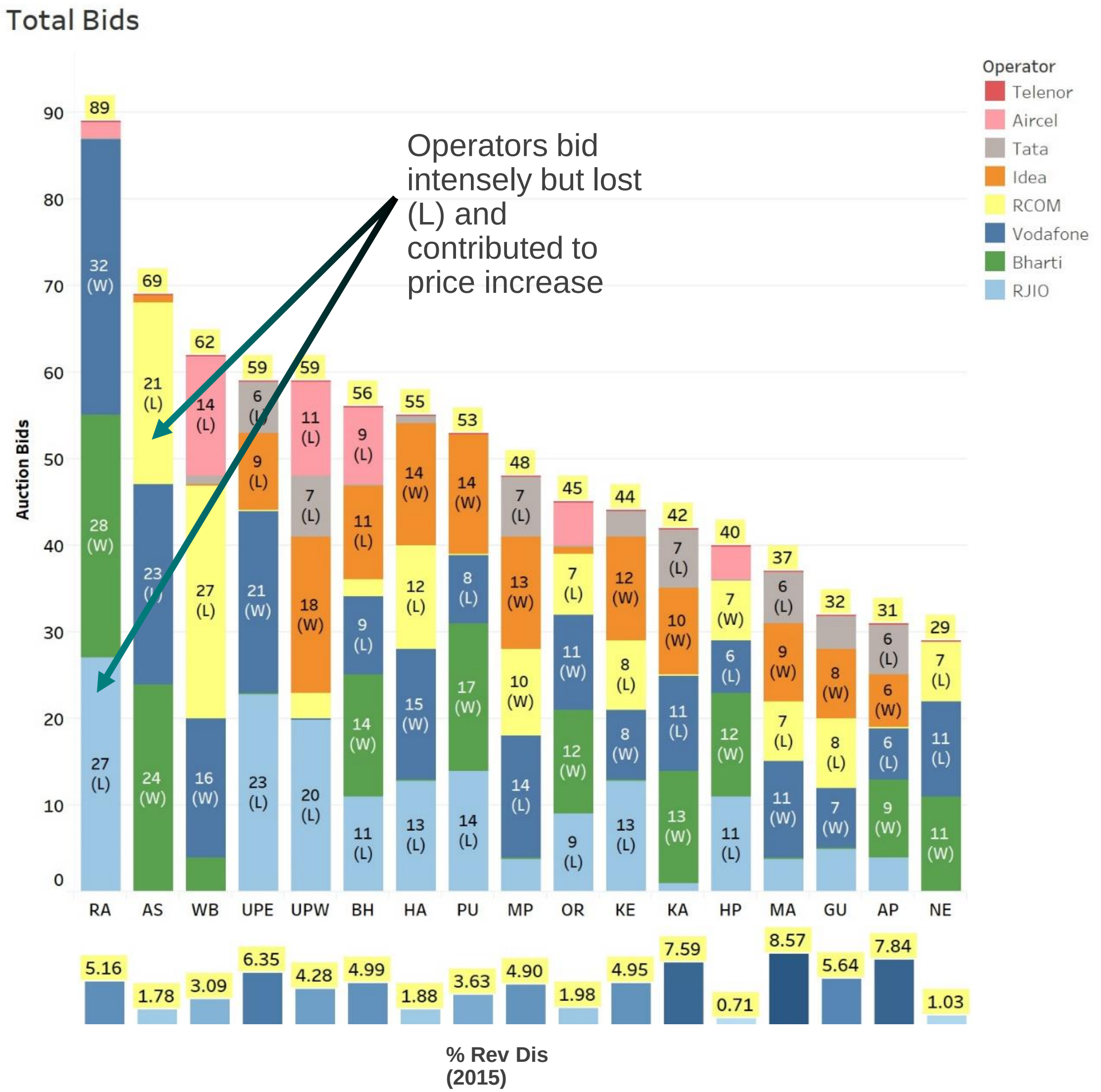
2100 Auction (2010) : Overenthusiasm

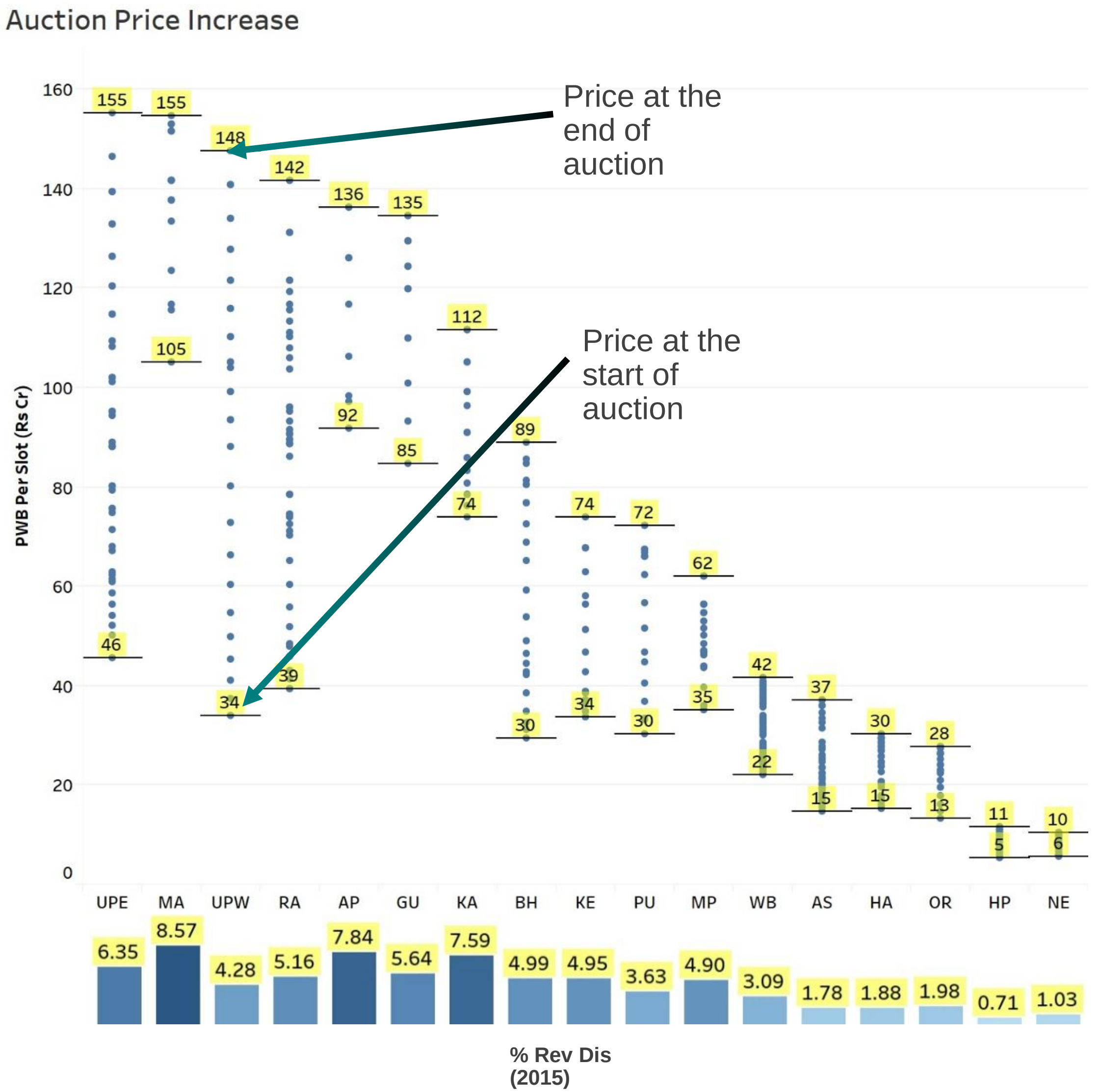




Delhi & Mumbai Was 40% of Auction Value With Only 14% of Revenue

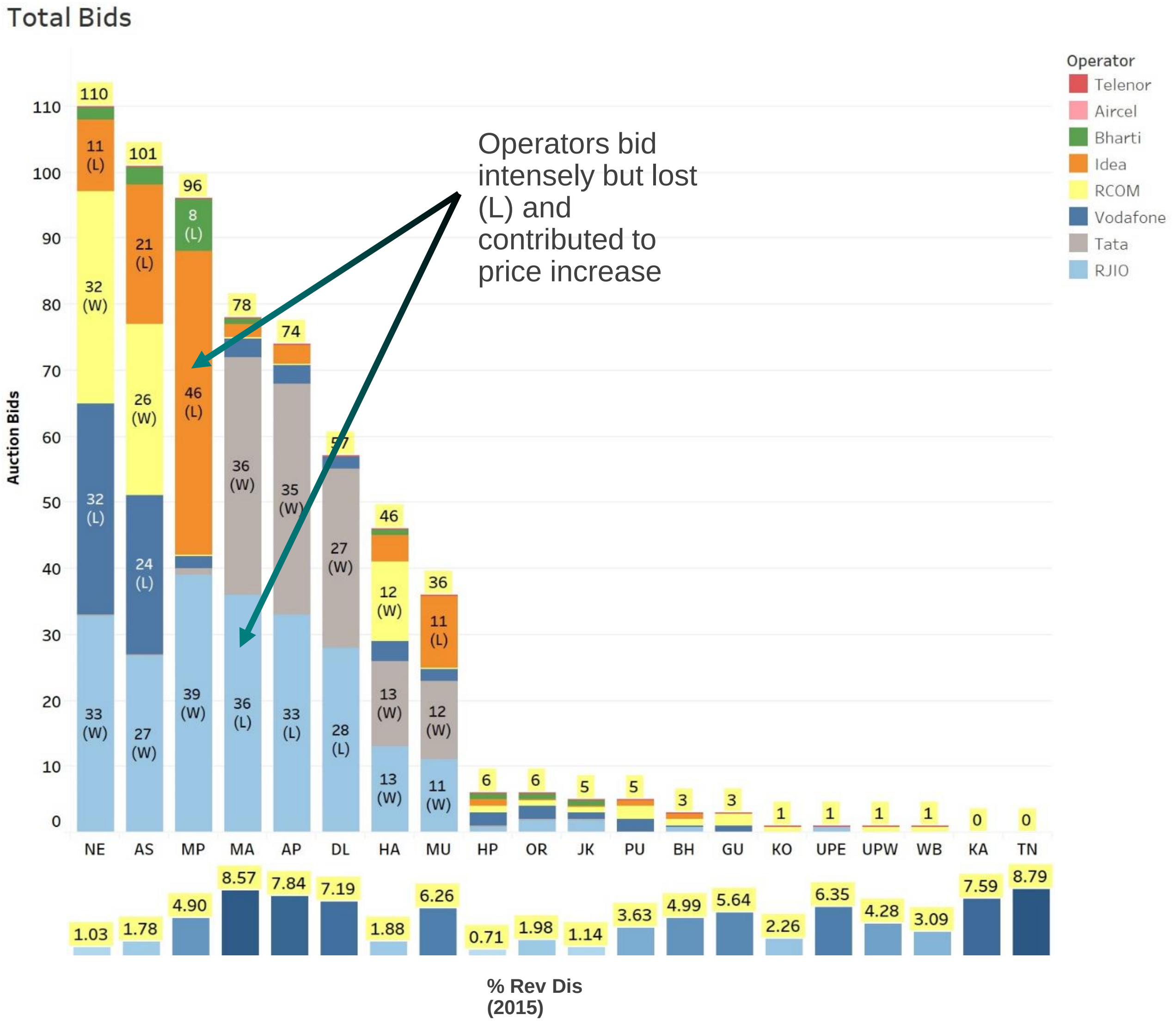
900 Auction (2015) : Business Continuity

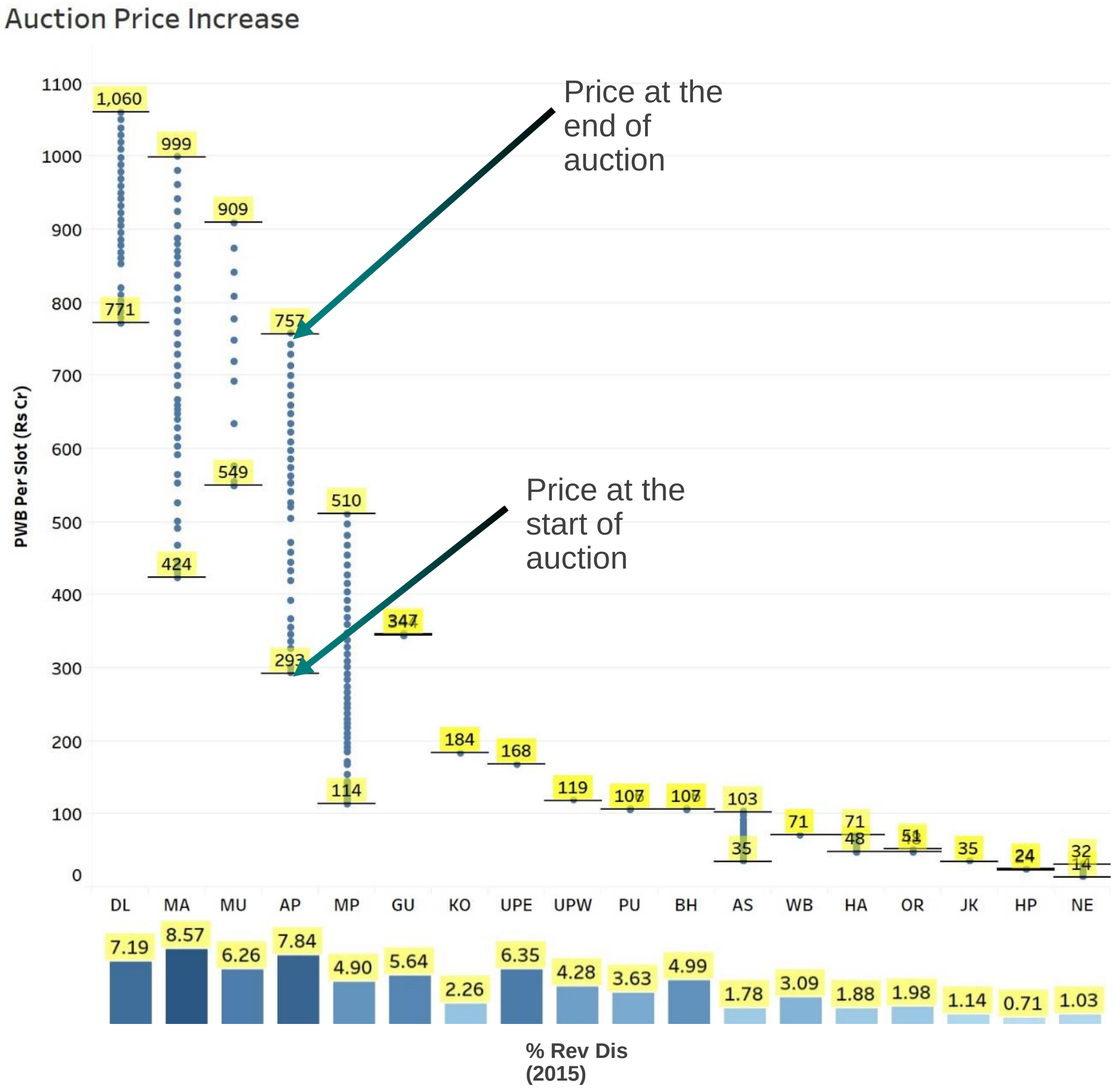




Final Price of Raj, UPE & UPW Increased 3.6, 4.2, 4.3 times Respectively

800 Auction (2015) : Insufficient Spectrum





Price of AP, DL, MA, MU Increased 2.5, 1.4, 2.3, 1.6 times Respectively

700 Auction (2016) : Inadvertent Error

Table Showing the Calculation Error

Page 104 of TRAI's Reco 23rd April 2012

Ratio : Unusually High

Table 3.5	Auction prices in European countries (Euro/MHz/pop)			
Euro/MHz/pop	**Date of auction**	**800 MHz** ★	**1800 MHz**	**Ratio (800/1800)**
France	Dec-11	0.5809		
Germany	May-10	0.6217	0.0218	28.52
Italy	Sep-11	0.6993	0.2252	3.11
Portugal	Dec-11	0.3616	0.2651	1.36
Spain	Jul-11	0.4043		
Sweden	2011	0.3174	0.1788	1.78
Simple Average		0.4809	0.1727	**2.78**

A / B = **C**

★ 800 MHz of Europe was linked with 700 MHz of India

Exact Calculation : **C** = 2.78

Removing Germany : **C** = 2.12

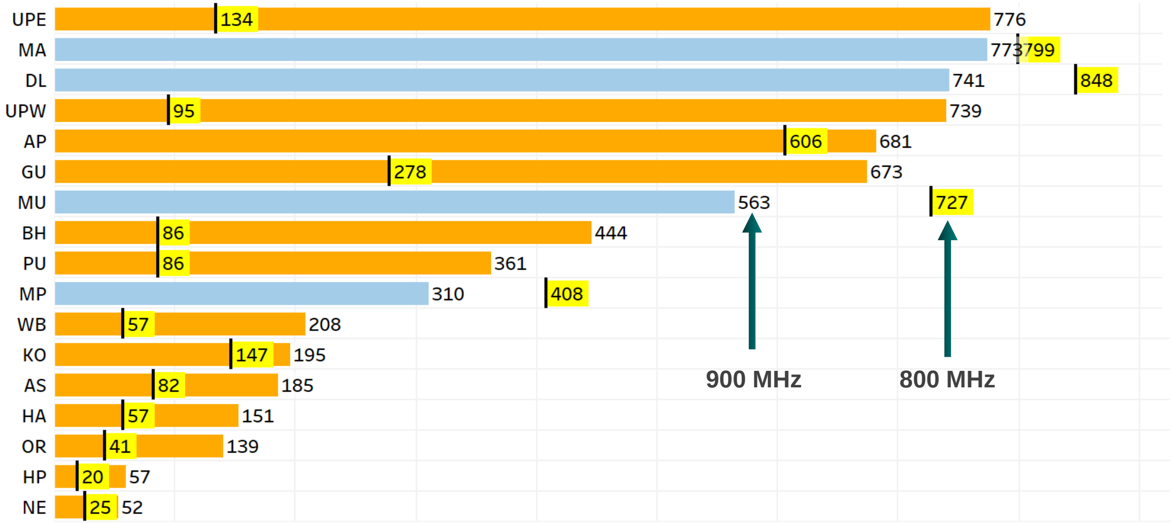
TRAI's Calculation : **C** = 4.00

TRAI Recommended 700 as **4 times** of 1800 **Instead** of **2 times**

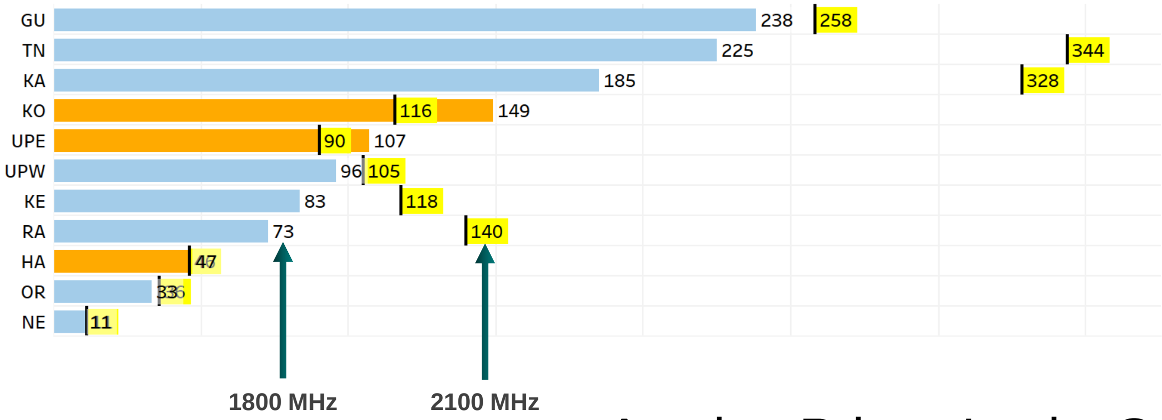
Implications : Distorted Prices

Price are in Rs Cr/MHz

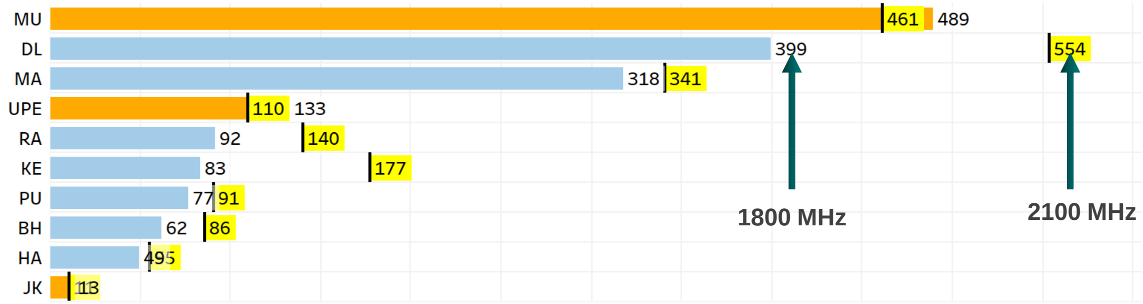
900 vs 800 (Auction Year - 2014 & 2015)



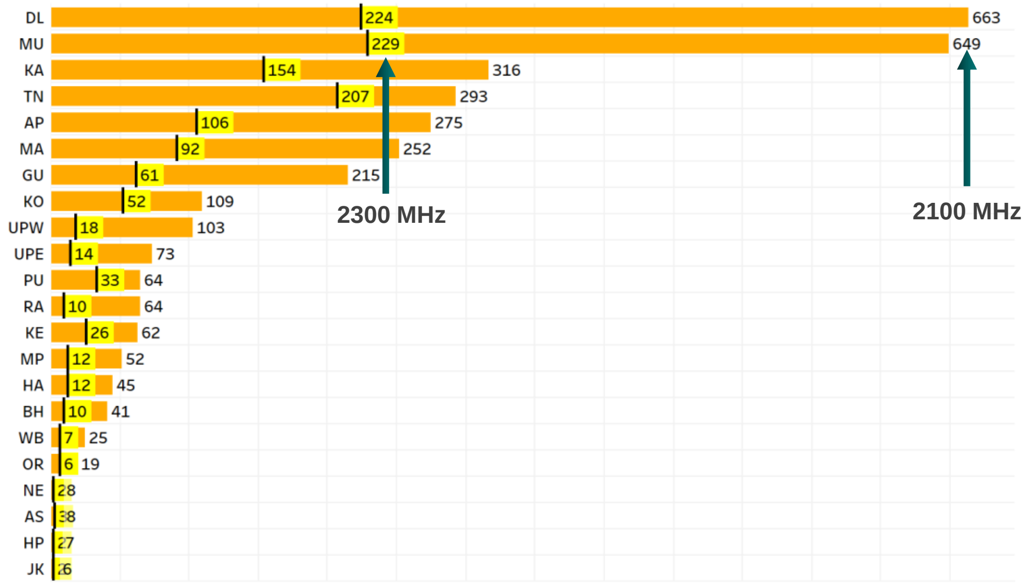
1800 vs 2100 (Auction Year - 2015)



1800 vs 2100 (Auction Year - 2016)



2100 vs 2300 (Auction Year - 2010)



Auction Prices Lacks Synergies Across Bands

Implications : Distorted Prices

Price are in Rs Cr/MHz

900 MHz (2015)

% Rev Dis Average	Circle	2014 TRAI	2014 DOT	2014 Auction	2015 TRAI	2015 DOT	2015 Auction	2016 TRAI	2016 DOT	2016 Auction
8.0%	**AP**				271	459	681			
1.7%	**AS**				58	74	185			
4.7%	**BH**				123	148	444	444	444	0
7.5%	**DL**	288	360	741						
5.8%	**GU**				339	424	673	673	673	0
2.0%	**HA**				64	76	151	151		
0.7%	**HP**				19	27	57			
7.4%	**KA**				286	370	558	558		
4.9%	**KE**				150	168	369			
2.5%	**KO**	100	125	195						
8.3%	**MA**				420	525	773			
4.5%	**MP**				138	175	310			
6.8%	**MU**	262	328	563						
1.0%	**NE**				21	29	52			
2.0%	**OR**				47	67	139			
3.8%	**PU**				141	151	361			
4.8%	**RA**				172	197	709			
9.2%	**TN**				338	0	0			
6.1%	**UPE**				195	228	776	776	776	0
4.3%	**UPW**				152	170	739	739	739	0
3.1%	**WB**				70	111	208			

Cat A circles Price < Cat B

Cat B circles with price > Cat A

Auction Prices Lacks Synergies Across Circles

Implications : Dissimilar Prices

Price are in Rs Cr/MHz TP : TRAI Price ; DP : DOT Price; FP : Final Price

800 MHz

Year	Type	AP	AS	BH	DL	GU	HA	HP	JK	KA	KE	KO	MA	MP	MU	NE	OR	PU	RA	TN	UPE	UPW	WB
2012	TP	594	18	88	1,435	465	96	16	13	683	135	235	544	112	1,404	18	42	139	139	634	158	222	53
	DP	298	9	44	721	234	48	8	7	343	68	118	273	56	706	9	21	70	70	318	79	112	27
	FP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	DP	149	5	22	360	117	24	4	3	172	34	59	137	28	353	5	11	35		159	40	56	13
	FP	0	0	0	360	117	0	0	0	172	34	59	0	0	0	0	0	0		159	0	56	13
2015	TP	192	27	61	450	212	30	13	8	199	69	101	282	64	352	8	25	63	59	247	84	93	46
	DP	234	28	85	617	275	38	19	28	303		147	339	91	439	11	38	85		360	134	95	57
	FP	606	82	86	848	278	57	20	28	303		147	799	408	727	25	41	86		360	134	95	57
2016	TP	606		136	848	285	57	24		303	243	160	799	408	727		57	119	204	360	219	182	82
	DP	606		136	848	285	57	24		303	243	160	799	408	727		57	119	204	360	219	182	82
	FP	0		0	0	335	0	0		0	0	0	0	0	0		0	137	232	0	219	0	0

900 MHz

Year	Type	AP	AS	BH	DL	GU	HA	HP	JK	KA	KE	KO	MA	MP	MU	NE	OR	PU	RA	TN	UPE	UPW	WB
2014	TP				288				0			100			262								
	DP				360							125			328								
	FP				741							195			563								
2015	TP	271	58	123		339	64	19		286	150		420	138		21	47	141	172	338	195	152	70
	DP	459	74	148		424	76	27		370	168		525	175		29	67	151	197	0	228	170	111
	FP	681	185	444		673	151	57		558	369		773	310		52	139	361	709	0	776	739	208
2016	TP			444		673	151			558											776	739	
	DP			444		673															776	739	
	FP			0		0															0	0	

Similar Band Different Prices

Similar Bands Priced Dissimilarly

Implications : Dissimilar Prices

Price are in Rs Cr/MHz TP : TRAI Price ; DP : DOT Price; FP : Final Price

1800 MHz

Year	Type	AP	AS	BH	DL	GU	HA	HP	JK	KA	KE	KO	MA	MP	MU	NE	OR	PU	RA	TN	UPE	UPW	WB
2012	TP	297	9	44	717	233	48	8	7	342	68	118	272	56	702	9	21	70	69	317	79	111	27
	DP	230	7	34	554	180	37	6	5	264	52	91	210	43	543	7	16	54	54	245	61	86	21
	FP	230	7	37	0	180	37	6	5	0	52	91	210	43	0	7	16	54	0	245	61	86	21
2014	TP	130	7	37	175	115	27	6	5	124	52	59	138	43	165	7	16	54	26	166	61	62	21
	DP	163	36	43	364	238	27	6	6	155	52	73	290	50	272	7	16	54	26	208	64	95	25
	FP	163	36	43	364	238	27	6	6	155	52	73	290	50	272	7	16	54	26	208	64	95	25
2015	TP	163	36	62	364	238	32	9	25	155	75	73		69	272	11	23	71	60	208	97	95	
	DP	169		62		238	32	9		185	75	73				11	23	71	60	225	97	95	
	FP	243		62		238	47	16		185	83	149				11	33	71	73	225	107	96	
2016	TP	243	40	62	399	238	47	16	13	185	83	149	318	83	298	11	38	77	91	225	115	96	46
	DP	243	40	62	399	238	47	16	13	185	83	149	318	83	298	11	38	77	91		115	96	46
	FP	243	40	62	399	238	49	16	13	0	83	151	318	83	489	11	0	77	92		133	100	46

2100 MHz

Year	Type	AP	AS	BH	DL	GU	HA	HP	JK	KA	KE	KO	MA	MP	MU	NE	OR	PU	RA	TN	UPE	UPW	WB
2010	TP	32	6	6	32	32	16	6	6	32	16	16	32	16	32	6	6	16	16	32	16	16	16
	DP	64	6	6	64	64	24	6	6	64	24	24	64	24	64	6	6	24	24	64	24	24	24
	FP	275	8	41	663	215	45	7	6	316	62	109	252	52	649	8	19	64	64	293	73	103	25
2015	TP	183	29	66	446	195	44	10	14	241	107	77	227	84	340	8	32	65	84	260	82	96	30
	DP	275	29		663	258	46			322	111	109	301	87	649	8	33		87	344	86	103	
	FP	275	39		663	258	46			328	118	116	301	91	649	11	36		140	344	90	105	
2016	TP	272	46	86	554	258	55	20	11	328	177	116	341	123	461	12	38	91	140	344	110	111	52
	DP	272	46	86	554	258	55	20	11	328	177	116	341	123	461	12	38	91	140	344	110	111	52
	FP	0	0	86	554	0	55	0	11	0	177	0	341	0	461	0	38	91	140	344	110	0	0

Similar Bands Priced Dissimilarly

Implications : Increasing Reserve Price

Note :Prices Adjusted by inflation index and band weights

Adjusted "Reserve Prices" @ Multiple of the "Minimum"

Year	Band	AP	AS	BH	DL	GU	HA	HP	JK	KA	KE	KO	MP	MA	MU	NE	OR	PU	RA	TN	UPE	UPW	WB
2010	2100	3.32	4.11	3.32	3.32	3.32	3.32	4.58	5.63	3.32	3.32	3.32	3.32	3.32	3.32	4.03	3.32	3.32	3.32	3.32	3.32	3.32	5.52
2010	2300	1.00	1.24	1.00	1.00	1.00	1.00	1.38	1.70	1.00	1.00	1.00	1.00	1.00	1.00	1.21	1.00	1.00	1.00	1.00	1.00	1.00	1.66
2010	2500	1.10	1.37	1.10	1.10	1.10	1.10	1.52	1.87	1.10	1.10	1.10	1.10	1.10	1.10	1.34	1.10	1.10	1.10	1.10	1.10	1.10	1.84
2012	800	5.61	2.24	8.87	13.56	4.40	2.43	2.24	2.24	6.46	3.41	5.93	2.82	5.14	13.27	2.24	4.23	3.51	3.50	5.99	3.97	5.60	2.24
2012	1800	8.90	3.56	14.07	21.50	6.98	3.85	3.55	3.56	10.24	5.40	9.41	4.47	8.15	21.05	3.55	6.71	5.57	5.55	9.50	6.30	8.89	3.55
2013	800	2.51	1.00	3.96	6.05	1.96	1.08	1.00	1.00	2.88	1.52	2.65	1.26	2.30	5.93	1.00	1.89	1.57	NA	2.67	1.77	2.50	1.00
2014	900	NA	NA	NA	6.00	NA	NA	NA	NA	NA	NA	5.56	NA	NA	5.47	NA	NA	NA	NA	NA	NA	NA	NA
2014	1800	5.26	2.99	12.74	7.07	4.61	2.32	2.85	2.92	5.00	4.47	6.28	3.70	5.58	6.68	2.92	5.51	4.65	2.24	6.71	5.25	5.34	3.00
2015	800	3.47	5.49	13.44	9.15	4.08	1.50	4.14	7.52	4.49	NA	5.81	3.60	5.03	6.51	2.11	6.01	3.36	NA	5.34	5.30	3.76	3.75
2015	900	7.25	15.44	24.92	NA	6.69	3.20	6.27	NA	5.84	7.07	NA	7.37	8.29	NA	5.93	11.28	6.36	8.29	NA	9.60	7.16	7.77
2015	1800	5.17	NA	20.22	NA	7.28	2.61	4.05	NA	5.66	6.11	5.95	NA	NA	NA	4.35	7.50	5.79	4.89	6.88	7.91	7.74	NA
2015	2100	9.38	13.08	NA	22.62	8.80	4.18	NA	NA	10.98	10.10	9.91	7.91	10.27	22.14	3.53	12.01	NA	7.91	11.73	7.82	9.37	NA
2016	700	11.84	25.47	32.26	19.45	11.61	6.05	11.48	11.48	9.02	10.86	19.38	10.76	15.51	14.54	6.95	19.77	10.02	11.84	10.98	14.93	12.49	9.89
2016	800	8.50	NA	20.34	11.89	4.00	2.13	4.95	NA	4.25	9.08	5.98	15.25	11.20	10.19	NA	8.52	4.45	7.63	5.05	8.19	6.80	5.10
2016	900	NA	NA	71.84	NA	10.21	6.11	NA	NA	8.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	31.39	29.89	NA
2016	1800	7.14	15.53	19.43	11.72	6.99	3.68	6.91	6.91	5.43	6.50	11.67	6.50	9.34	8.75	4.18	11.91	6.03	7.13	6.61	9.01	7.52	5.99
2016	2100	8.92	19.93	30.07	18.16	8.46	4.81	9.64	6.53	10.75	15.47	10.14	10.75	11.18	15.11	5.09	13.29	7.95	12.24	11.28	9.61	9.70	7.56
2016	2300	5.37	2.09	5.06	11.30	3.08	1.69	1.16	1.43	7.74	3.37	6.95	1.69	4.58	11.53	1.02	3.37	4.42	1.26	10.43	1.90	2.53	1.75
2016	2500	5.93	2.31	5.58	12.47	3.40	1.86	1.28	1.58	8.55	3.72	7.68	1.86	5.06	12.74	1.13	3.72	4.89	1.40	11.52	2.09	2.79	1.93

RP Increase

- ✓ Reserve prices have increased multiple time
- ✓ Not all circles & bands are equally impacted
- ✓ 700 & 900 have seen the highest increase
- ✓ 800, 1800 MHz is moderately impacted
- ✓ 2100 MHz slightly impacted
- ✓ 2300, 2500 MHz is least impacted

Auction Prices Needed to be Curated Across Bands & Circles

Implications: Unsold Spectrum

Unit Except % are in MHz

Year	Band	On Sale	Sold	% UnSold
2010	2100	355	355	0%
	2300	880	880	0%
	Total	1235	1235	0%
2012	800	95	0	100%
	1800	295	128	57%
	Total	390	128	67%
2013	800	95	30	68%
	1800	58	0	100%
	Total	153	30	80%
2014	900	46	46	0%
	1800	385	307	20%
	Total	431	353	18%
2015	800	108	86	20%
	900	178	168	6%
	1800	99	94	5%
	2100	85	70	18%
	Total	470	418	11%
2016	700	770	0	100%
	800	71	15	79%
	900	9	0	100%
	1800	220	174	21%
	2100	360	85	76%
	2300	320	320	0%
	2500	600	370	38%
	Total	2350	964	59%
Grand Total		5029	3128	38%

Most Spectrum Remained Unsold Due to High Reserve Price

Implications : Decreased Auction Intensity

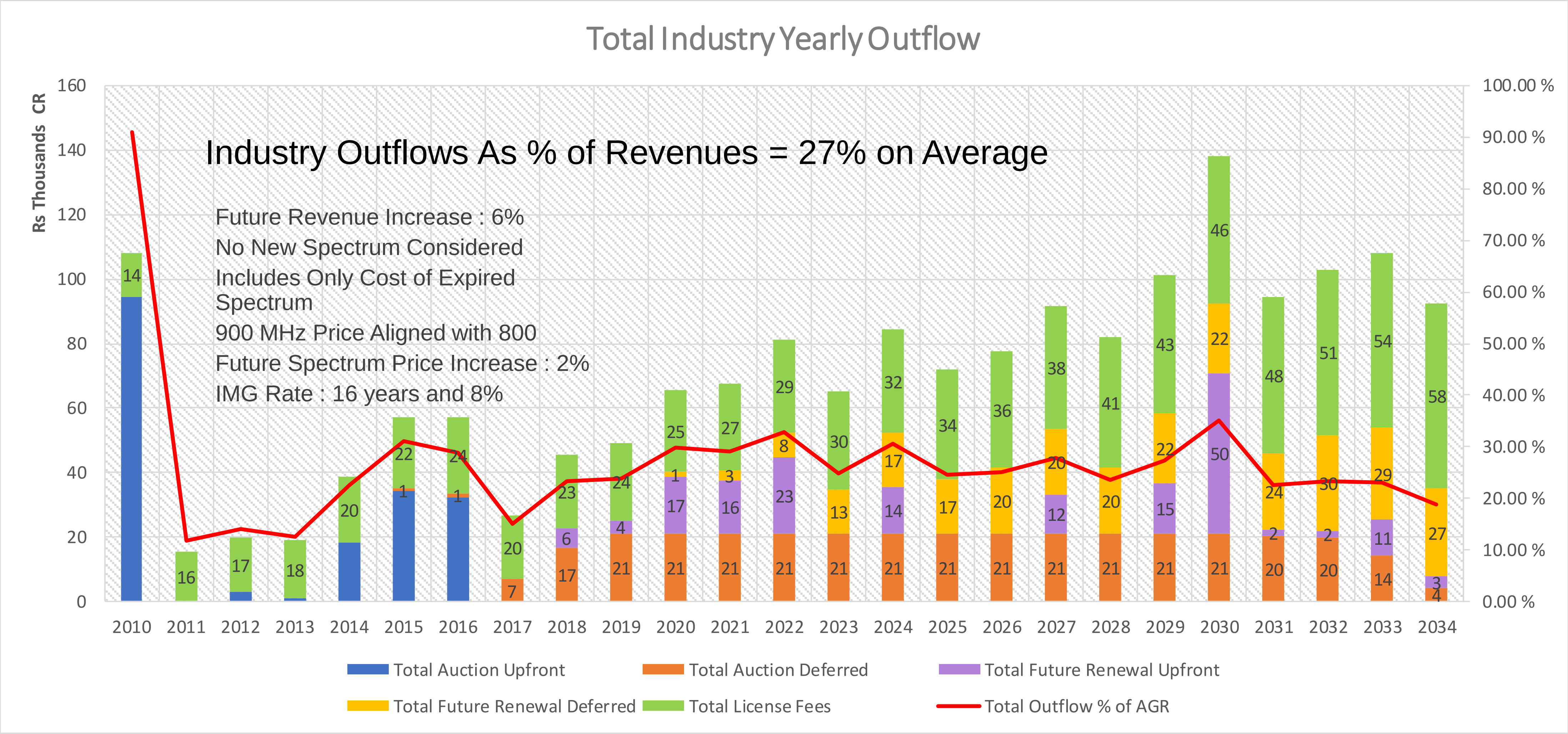
Auction Prices /Reserve Price

Year	Band	AP	AS	BH	DL	GU	HA	HP	JK	KA	KE	KO	MP	MA	MU	NE	OR	PU	RA	TN	UPE	UPW	WB
2010	2100	4.30	1.50	6.83	10.38	3.38	1.88	1.33	1.17	4.94	2.63	4.54	2.17	3.94	10.16	1.50	3.33	2.71	2.71	4.58	3.04	4.29	1.04
2010	2300	6.63	2.00	5.00	14.06	3.88	2.00	1.50	1.50	9.69	4.33	8.83	2.17	5.75	14.38	1.50	3.50	5.67	1.67	12.94	2.50	3.17	1.33
2010	2500	6.63	2.00	5.00	14.06	3.88	2.00	1.50	1.50	9.69	4.33	8.83	2.17	5.75	14.38	1.50	3.50	5.67	1.67	12.94	2.50	3.17	1.33
2012	800	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid
2012	1800	1.00	1.00	1.09	NoBid	1.00	1.00	1.00	1.00	NoBid	1.00	1.00	1.00	1.00	NoBid	1.00	1.00	1.00	NoBid	1.00	1.00	1.00	1.00
2013	800	NoBid	NoBid	NoBid	1.00	1.00	NoBid	NoBid	NoBid	1.00	1.00	1.00	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NA	1.00	NoBid	1.00	1.00
2014	900	NA	NA	NA	2.06	NA	NA	NA	NA	NA	NA	1.56	NA	NA	1.72	NA	NA	NA	NA	NA	NA	NA	NA
2014	1800	1.00	5.29	1.19	1.66	1.66	1.04	1.17	1.40	1.00	1.00	1.00	1.19	1.68	1.31	1.14	1.00	1.02	1.00	1.00	1.07	1.53	1.19
2015	800	2.55	2.86	0.99	1.35	0.99	1.46	1.00	1.00	NoBid	NA	0.98	4.40	2.32	1.63	2.17	1.08	0.99	NA	NoBid	0.98	0.98	0.98
2015	900	1.48	2.50	3.01	NA	1.59	2.00	2.15	NA	1.51	2.20	NA	1.77	1.47	NA	1.79	2.07	2.39	3.60	NA	3.40	4.35	1.87
2015	1800	1.44	NA	NoBid	NA	1.00	1.47	1.78	NA	1.00	1.12	2.05	NA	NA	NA	1.00	1.48	1.00	1.22	1.00	1.10	1.01	NA
2015	2100	NoBid	1.34	NA	NoBid	1.00	1.00	NA	NA	1.02	1.06	1.06	1.06	1.00	NoBid	1.50	1.12	NA	1.61	1.00	1.06	1.03	NA
2016	700	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid
2016	800	NoBid	NA	NoBid	NoBid	1.2	NoBid	NoBid	NA	NoBid	NoBid	NoBid	NoBid	NoBid	NoBid	NA	NoBid	1.2	1.1	NoBid	1.0	NoBid	NoBid
2016	900	NA	NA	NoBid	NA	NoBid	NoBid	NA	NA	NoBid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NoBid	NoBid	NA
2016	1800	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	NoBid	1.0	1.0	1.0	1.0	1.6	1.0	NoBid	1.0	1.0	NoBid	1.2	1.1	1.0
2016	2100	NoBid	NoBid	1.0	1.0	NoBid	1.0	NoBid	1.0	NoBid	1.0	NoBid	NoBid	1.0	1.0	NoBid	1.0	1.0	1.0	1.0	1.0	NoBid	NoBid
2016	2300	1.0	1.0	1.1	1.0	1.6	NoBid	1.0	NoBid	1.0	1.1	1.0	1.1	1.1	1.0	1.0	1.0	NoBid	NoBid	1.0	NoBid	NoBid	1.0
2016	2500	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	NoBid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	NoBid	1.0	1.0	1.0

Most Circles Not taken or Cleared at Reserve Price

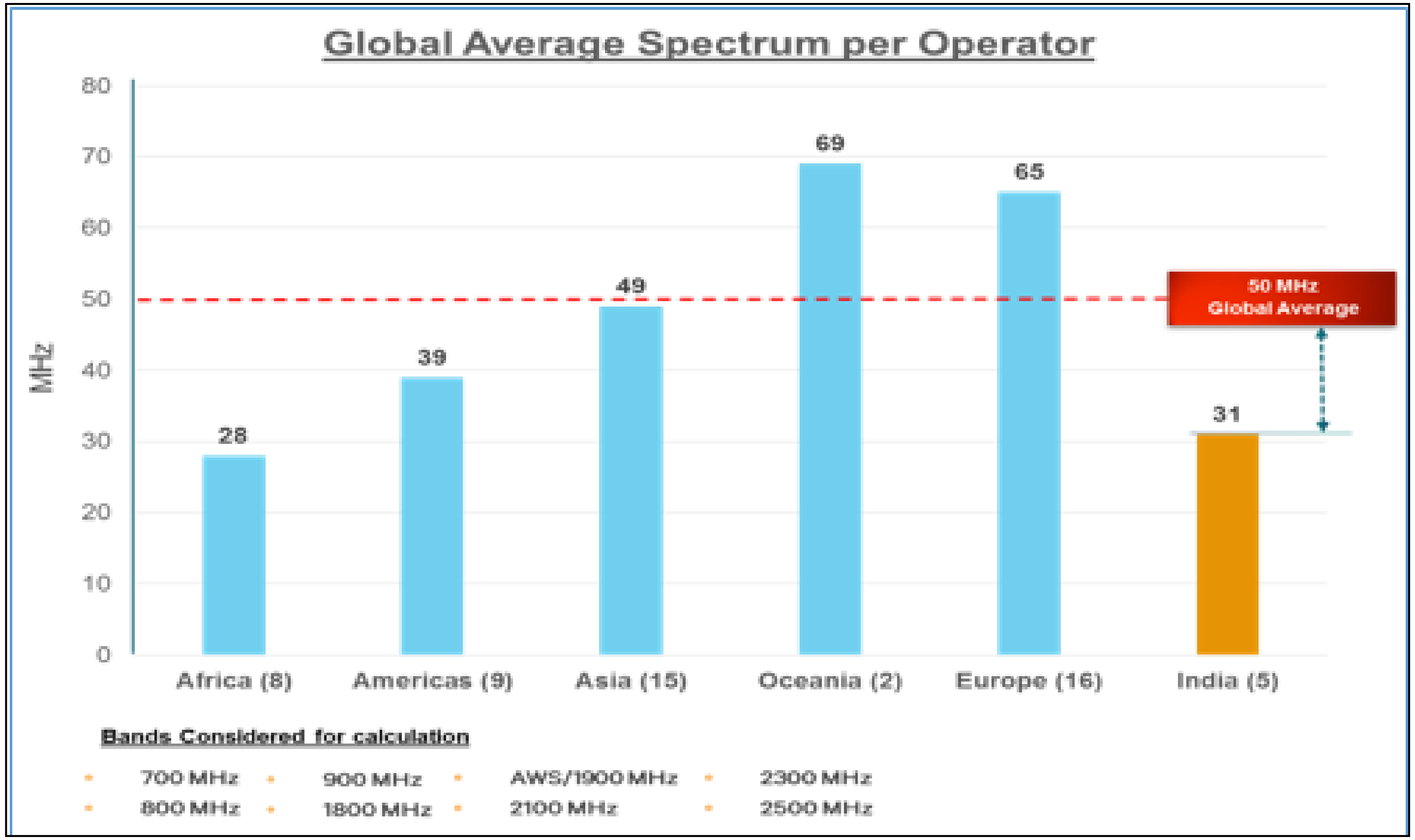
High Spectrum Price: Implications

Impact : Increased Industry Outflows



Industry Will Unable to Buy New Spectrum Even at Improved Assumptions

Impact : Reduce Service Flexibility

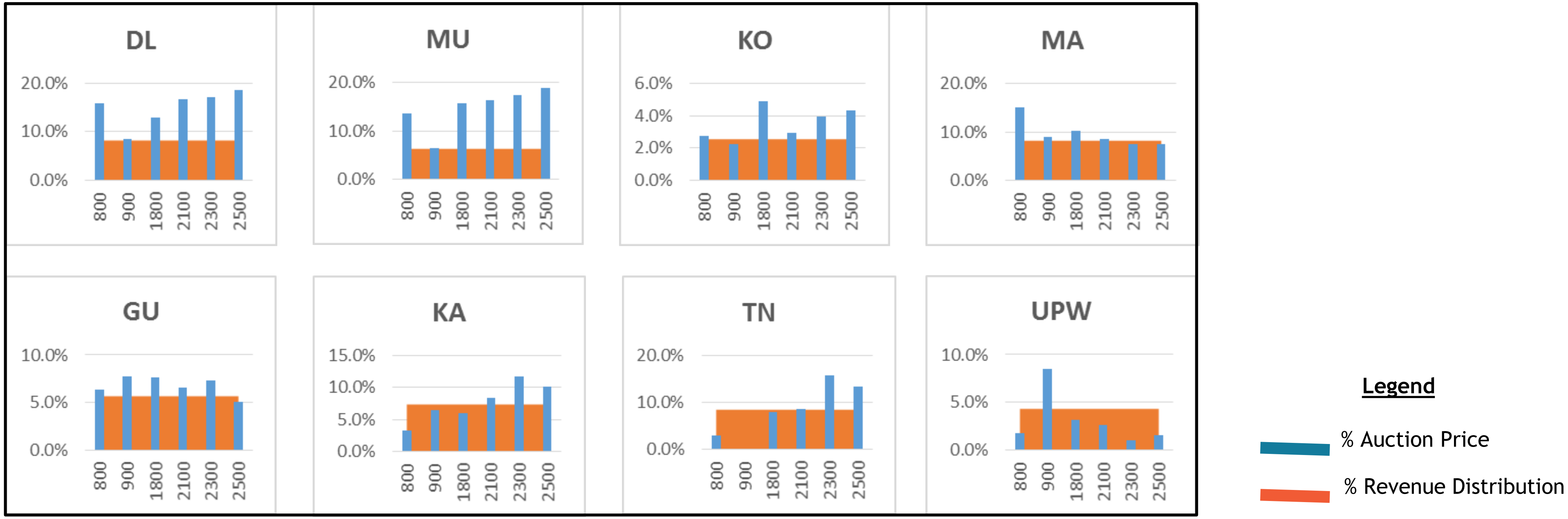


- Indian operators have 20 MHz spectrum less than global average
- India will need additional 100 MHz spectrum (assuming 5 players)
- Indian industry already spend total Rs. 3.5 lakh Cr (approx.) to acquire 31 MHz
- Indian industry have to spend additionally Rs. 13.6 Lakh Cr (at reserve price)

Consumers Will Experience Reduced Broadband Speeds

New Pricing Model: The Need

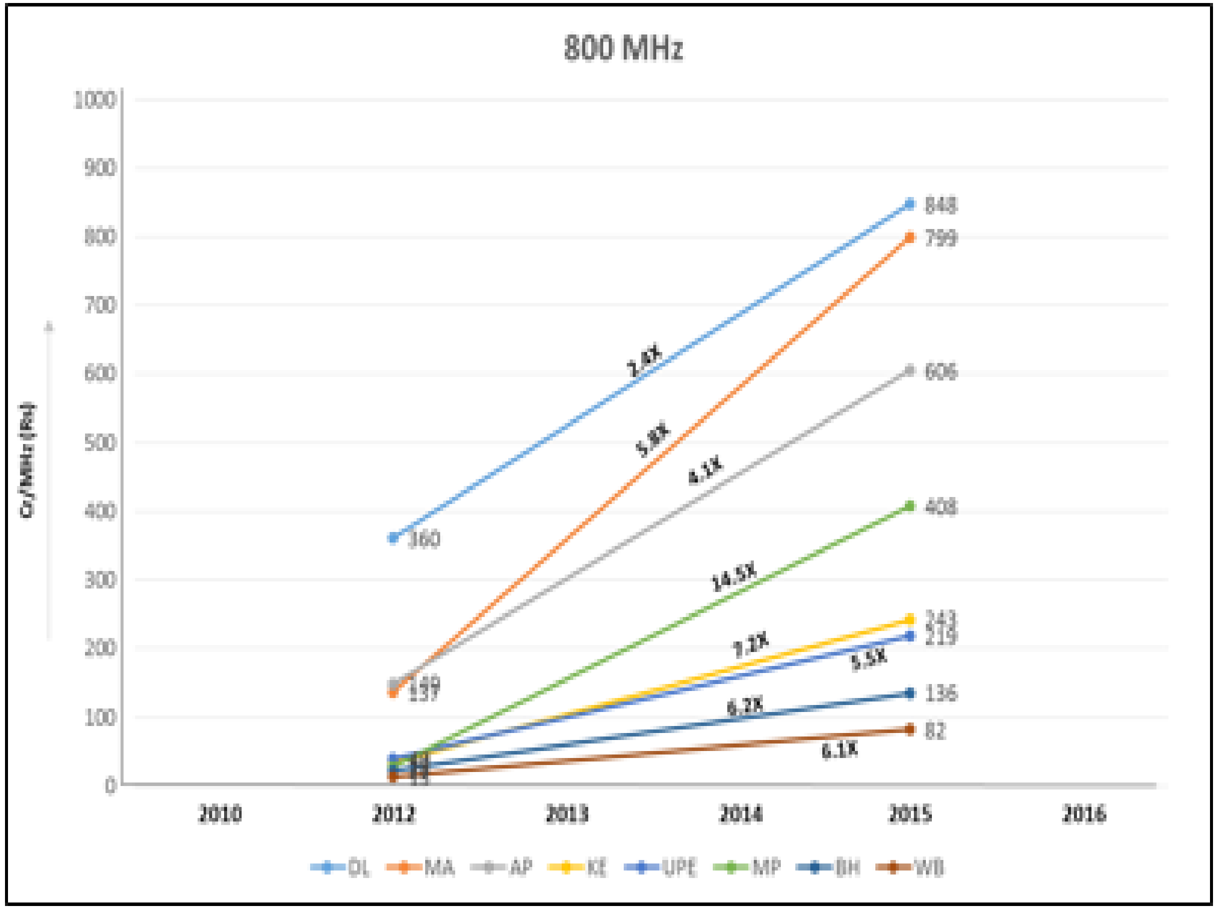
To Correct Pricing Distortions

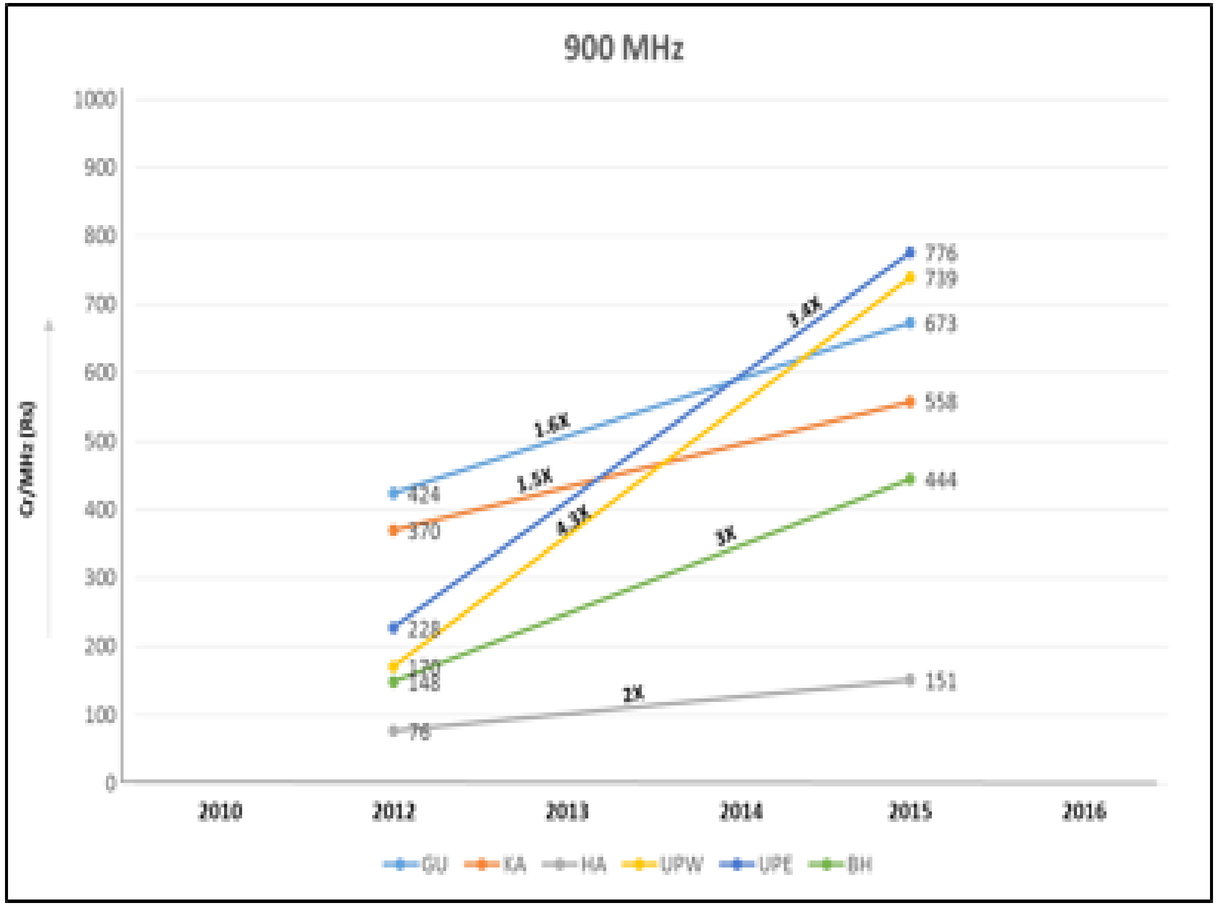


- Value of spectrum not proportional with market realties
- No correlation of value amongst different bands in same circle
- No band-wise correlation amongst various circles

No Correlation of Auction Prices with Circle Revenue Potential

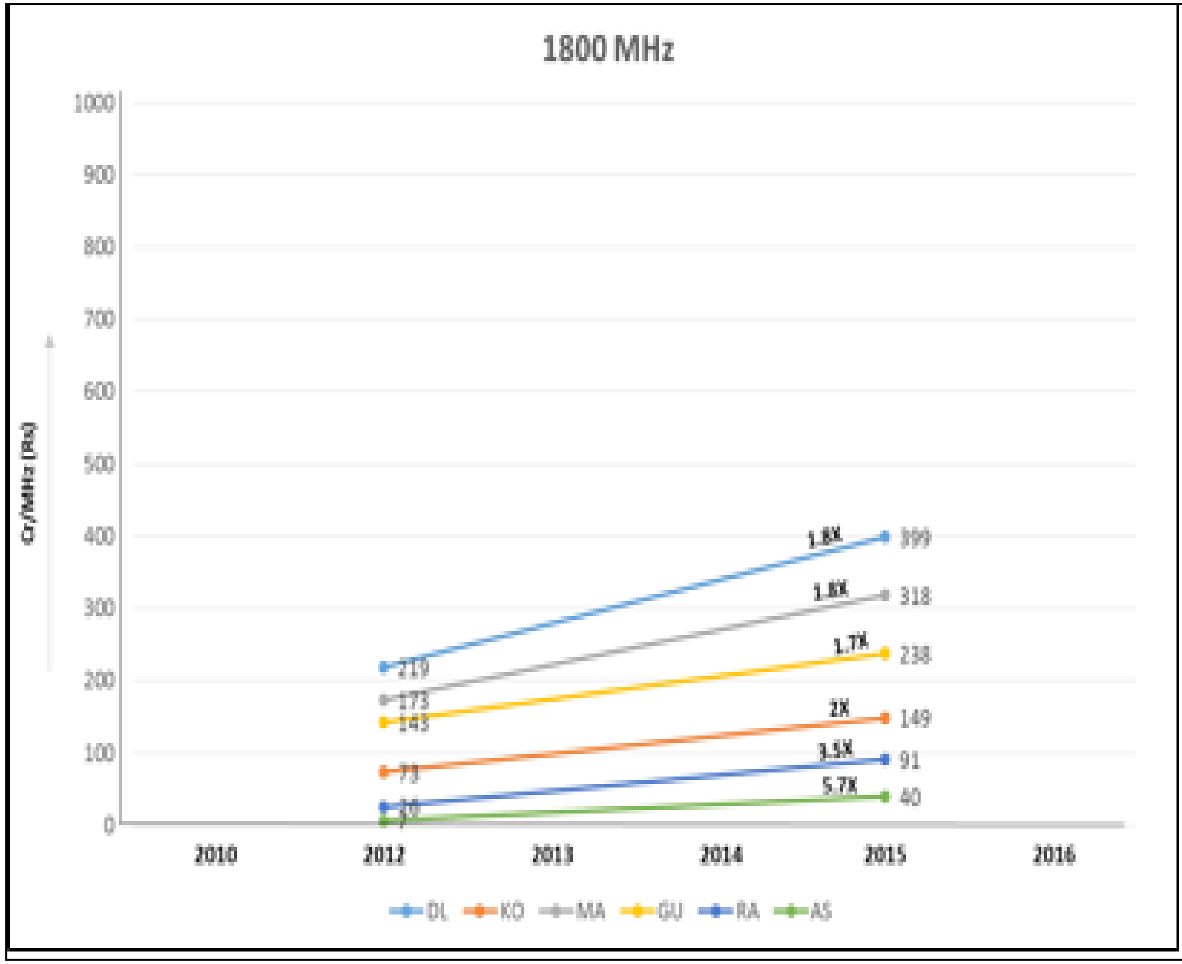
To Contain Unnatural Increase

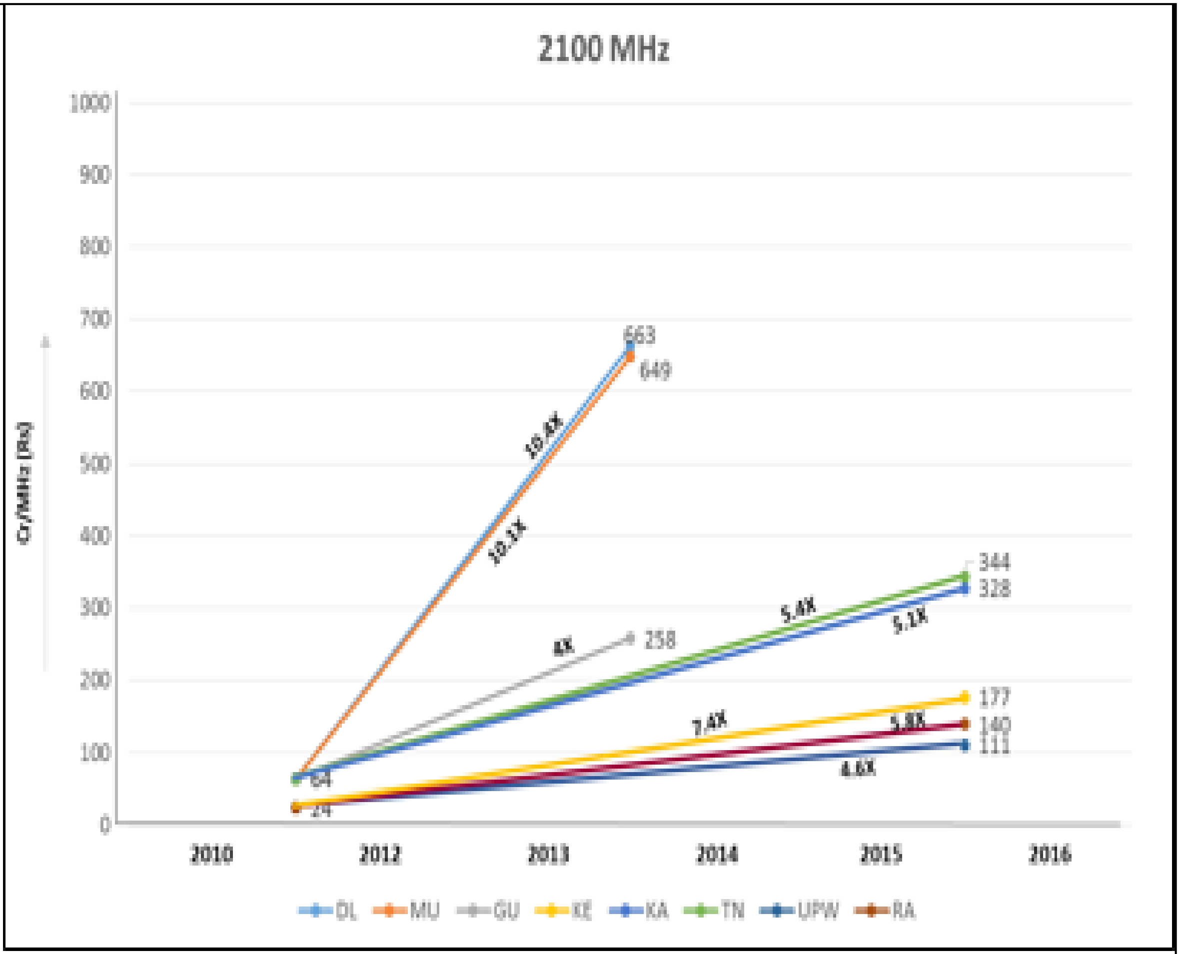




Reserve Price has increased significantly over the years

To Contain Unnatural Increase





Reserve Price has increased significantly over the years

To Align With International Prices

India vs USA – High Spectrum Price in India

Parameters	USA	India	
Band	600 MHz	800/1800/2100/2300/2500 MHz	700 MHz**
MHz	70	56	70
Bid (USD Bn)	19.77	10.17	61.84
Price/MHz (USD Bn)	0.28	0.18	0.88
ARPU Multiple (x)		15	15
Price Multiple (x)		0.6	3
Price Multiple adjusted for ARPU (x)		9	46

*Data as of 3Q16; ** Reserve Price has been taken for the calculation
Source: Global Wireless Matrix – Bank of America – Merill Lynch, 3Q16, FCC and DoT

Indicators	USA	India
Subscribers Million*	377	997
ARPU* USD/month	39.9	2.7

- 4 times more subscribers
- 14 times lower ARPU

- **Spectrum auctions held almost during the same period**
- **For 14 times lower ARPU (return) in India as compared to The USA:**
  - ***India paid 9 times the price for spectrum when compared to all spectrum sold in India.***
  - ***India paid 46 times the price for spectrum when compared to 700 MHz band.***

India auction price was effectively 9 times more than the US auction price

The Pricing Model : Overview

The Model : Basic Principle

- Input to the pricing model should be unambiguous
  - **Ambiguous** inputs is **hard to quantify** administratively
  - **Unambiguous** inputs will make the **process robust**
  - **Unambiguous** inputs will **remove** element of **discretion**
- Input to the pricing model should act as feedback
  - **Feedback** will prevent **distortions** percolating in **future auctions**
  - **Feedback** will promote **responsible bidding**
- Input to the pricing model should be integrative
  - **Integrative** model will **prevent distortion** across **bands**
  - **Integrative** model will **prevent distortion** across **circles**

In Nutshell, the model should promote **transparency**, **consistency** and **predictability**

The Model : Calculating Reserve Price

Input 4

Total Industry Revenue % Distribution											
LSA	AP	AS	BH	DL	GU	HA	HP	JK	KA	KE	KO
Rev %	8.0%	1.7%	4.7%	7.5%	5.8%	2.0%	0.7%	1.1%	7.4%	4.9%	2.5%
LSA	MA	MP	MU	NE	OR	PU	RA	TN	UPE	UPW	WB
Rev %	8.3%	4.5%	6.8%	1.0%	2.0%	3.8%	4.8%	9.2%	6.1%	4.3%	3.1%

Input 1

Price Index (2010 As Reference)	
Year	Factor
2010	1.00
2011	1.10
2012	1.20
2013	1.32
2014	1.44
2015	1.52
2016	1.58
2017	1.63

Input 2

Band Index (800 MHz As Reference)	
Band	Weights
700	1.15
800	1.00
900	0.92
1800	0.48
2100	0.43
2300	0.35
2500	0.32
3500	0.24

Input 3

Past Auction Prices for all Circles & Years

Calculation Model

Step 1 : **Readjust** Past **Auction Prices** with **Cost Inflation** Numbers

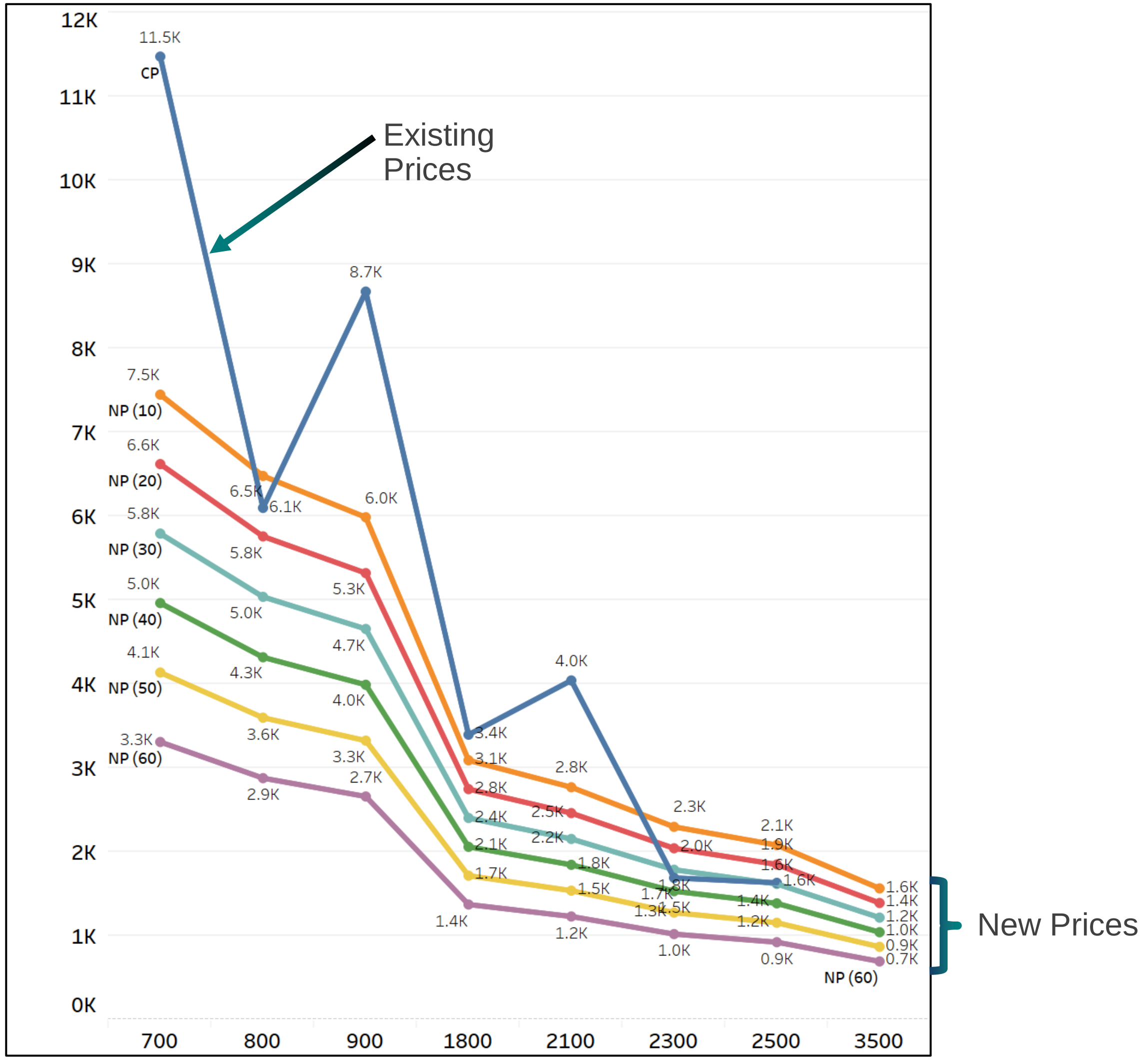
Step 2 : **Readjust** Past **Auction Prices** with **Band Index** Numbers

Step 3: **Calculate Average** Price Across Circles for all Auction & Years

Step 4: **Add** these **Averages** to Arrive at a **Single "Pan India"** Number

Prices will get automatically curated for distortions values

Reserve Prices : Calculated With New Model



New Reserve Price vs Old Price (50% Discount)				
Band	AP/RP (Rs Cr)	New RP (Rs Cr)	% Change	Type
700 MHz	11485	4141	-64%	Decrease
800 MHz	6104	3603	-41%	Decrease
900 MHz	8683	3329	-62%	Decrease
1800 MHz	3400	1719	-49%	Decrease
2100 MHz	4047	1541	-62%	Decrease
2300 MHz	1693	1279	-24%	Decrease
2500 MHz	1634	1158	-29%	Decrease
3500 MHz		871		

Make Reserve Prices Rationale

- ✓ Low for low revenue circles
- ✓ Low for higher spectrum bands

Motivate Responsible Bidding

- ✓ Prices will get automatically corrected
- ✓ Irrational bidders will be penalized

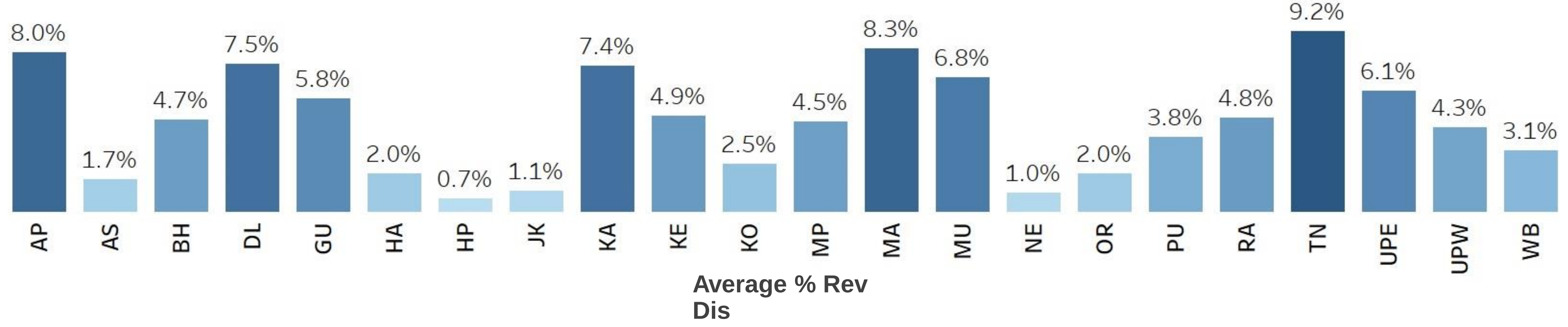
Improve Auction Design

- ✓ Penalize irresponsible behavior
- ✓ Reward responsible behavior

Prices will get automatically curated across bands

Reserve Prices : Calculated With New Model

Calculated "Reserve Price" (Rs Cr) (50% discount on Model Price)																							
Band	AP	AS	BH	DL	GU	HA	HP	JK	KA	KE	KO	MP	MA	MU	NE	OR	PU	RA	TN	UPE	UPW	WB	Total
700	333	70	194	309	239	81	30	44	308	203	102	188	342	281	42	81	156	199	380	253	178	128	4141
800	290	60	169	269	208	71	26	39	268	176	89	163	298	245	37	71	136	173	331	220	155	111	3603
900	268	56	156	249	192	65	24	36	248	163	82	151	275	226	34	65	126	160	306	203	143	103	3329
1800	138	29	81	128	99	34	13	18	128	84	42	78	142	117	17	34	65	83	158	105	74	53	1719
2100	124	26	72	115	89	30	11	17	115	75	38	70	127	105	16	30	58	74	141	94	66	47	1541
2300	103	21	60	96	74	25	9	14	95	63	32	58	106	87	13	25	48	61	117	78	55	39	1279
2500	93	19	54	87	67	23	8	12	86	57	29	53	96	79	12	23	44	56	106	71	50	36	1158
3500	70	15	41	65	50	17	6	9	65	43	22	40	72	59	9	17	33	42	80	53	37	27	871



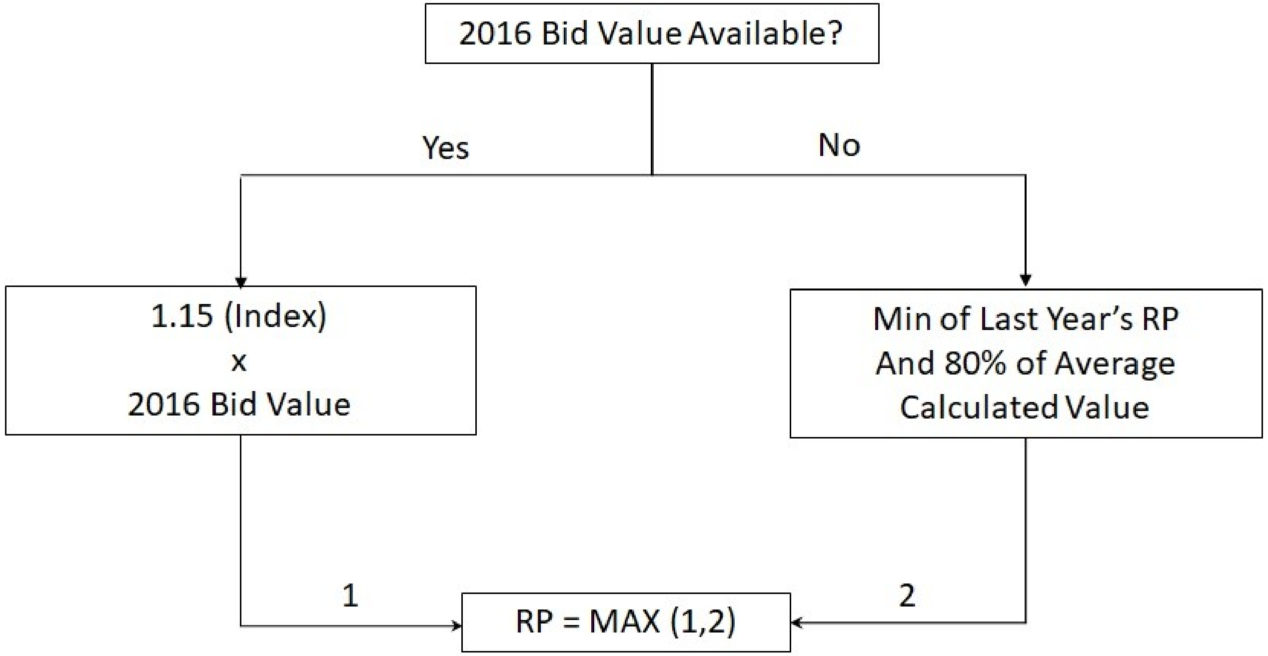
Prices will get automatically curated for distortions across circles

Conclusion

TRAI's Approach

Principle :

1. Estimate the price of 1800 MHz band using various valuation models.
2. Enhance the last bid value using SBI PLR index (i.e last bid value x 1.15).
3. Calculate the average of 1 & 2 for the individual circles.
4. New reserve price for each circle = Max of 2 & 3.



TRAI's Approach

Issues :

1. Using incorrect price escalation metric,
   - Telecom business does not correlate with banking business
   - SBI PLR is a reflection of banking business and not telecom
2. Using last auction price as a reference for market determine price
   - In many circles the bid value does not reflect market price
3. Using mean (instead of median) for aggregating the prices emanating out of various models
   - Median is the correct statistical tool for aggregation and NOT Mean
4. Unable to verify the pricing emanating out of the models
   - No supporting information like assumptions etc. is made available in the recommendation

Calculation using data emanating out of TRAI's Models

Level 1 describes the reserve price value emanating out of TRAI's approach

Level 2 describes the reserve price value when the last bid value is not indexed

Level 3 describes 80% of the average of all models (including indexed bid value)

Level 4 describes 80% of the average of all models (including non indexed bid value)

Level 5 describes 80% of the median of all models (including non indexed bid value)

The New Model Will

- Prevent **bidding distortion** percolating into future auctions
- Prevent **irresponsible bidding** by penalizing speculative actions
- Prevent **volatility** in auction prices and make it more predictable
- Prevent **moral hazard** resulting out of drastic corrections in prices
- Prevent **undue competitive advantage** to a few players
- Prevent **randomness** of auction prices across bands and circles
- Prevent **accusation** by audit agencies on bureaucratic actions

Thank You

Back Up

800 MHz Price Trends

% Rev Dis Average	Circle	2012			2013		2015			2016		
		TRAI	DOT	Auction	DOT	Auction	TRAI	DOT	Auction	TRAI	DOT	Auction
8.0%	**AP**	594	298	0	149	0	192	234	606	606	606	0
1.7%	**AS**	18	9	0	5	0	27	28	82			
4.7%	**BH**	88	44	0	22	0	61	85	86	136	136	0
7.5%	**DL**	1,435	721	0	360	360	450	617	848	848	848	0
5.8%	**GU**	465	234	0	117	117	212	275	278	285	285	335
2.0%	**HA**	96	48	0	24	0	30	38	57	57	57	0
0.7%	**HP**	16	8	0	4	0	13	19	20	24	24	0
1.1%	**JK**	13	7	0	3	0	8	28	28			
7.4%	**KA**	683	343	0	172	172	199	303	303	303	303	0
4.9%	**KE**	135	68	0	34	34	69			243	243	0
2.5%	**KO**	235	118	0	59	59	101	147	147	160	160	0
8.3%	**MA**	544	273	0	137	0	282	339	799	799	799	0
4.5%	**MP**	112	56	0	28	0	64	91	408	408	408	0
6.8%	**MU**	1,404	706	0	353	0	352	439	727	727	727	0
1.0%	**NE**	18	9	0	5	0	8	11	25			
2.0%	**OR**	42	21	0	11	0	25	38	41	57	57	0
3.8%	**PU**	139	70	0	35	0	63	85	86	119	119	137
4.8%	**RA**	139	70	0			59			204	204	232
9.2%	**TN**	634	318	0	159	159	247	360	360	360	360	0
6.1%	**UPE**	158	79	0	40	0	84	134	134	219	219	219
4.3%	**UPW**	222	112	0	56	56	93	95	95	182	182	0
3.1%	**WB**	53	27	0	13	13	46	57	57	82	82	0

900 MHz Price Trends

% Rev Dis Average	Circle	2014			2015			2016		
		TRAI	DOT	Auction	TRAI	DOT	Auction	TRAI	DOT	Auction
8.0%	**AP**				271	459	681			
1.7%	**AS**				58	74	185			
4.7%	**BH**				123	148	444	444	444	0
7.5%	**DL**	288	360	741						
5.8%	**GU**				339	424	673	673	673	0
2.0%	**HA**				64	76	151	151		
0.7%	**HP**				19	27	57			
7.4%	**KA**				286	370	558	558		
4.9%	**KE**				150	168	369			
2.5%	**KO**	100	125	195						
8.3%	**MA**				420	525	773			
4.5%	**MP**				138	175	310			
6.8%	**MU**	262	328	563						
1.0%	**NE**				21	29	52			
2.0%	**OR**				47	67	139			
3.8%	**PU**				141	151	361			
4.8%	**RA**				172	197	709			
9.2%	**TN**				338	0	0			
6.1%	**UPE**				195	228	776	776	776	0
4.3%	**UPW**				152	170	739	739	739	0
3.1%	**WB**				70	111	208			

1800 MHz Price Trends

% Rev Dis Average	Circle	2012			2014			2015			2016		
		TRAI	DOT	Auction	TRAI	DOT	Auction	TRAI	DOT	Auction	TRAI	DOT	Auction
8.0%	**AP**	297	230	230	130	163	163	163	169	243	243	243	243
1.7%	**AS**	9	7	7	7	36	36	36			40	40	40
4.7%	**BH**	44	34	37	37	43	43	62	62	62	62	62	62
7.5%	**DL**	717	554	0	175	364	364	364			399	399	399
5.8%	**GU**	233	180	180	115	238	238	238	238	238	238	238	238
2.0%	**HA**	48	37	37	27	27	27	32	32	47	47	47	49
0.7%	**HP**	8	6	6	6	6	6	9	9	16	16	16	16
1.1%	**JK**	7	5	5	5	6	6	25			13	13	13
7.4%	**KA**	342	264	0	124	155	155	155	185	185	185	185	0
4.9%	**KE**	68	52	52	52	52	52	75	75	83	83	83	83
2.5%	**KO**	118	91	91	59	73	73	73	73	149	149	149	151
8.3%	**MA**	272	210	210	138	290	290				318	318	318
4.5%	**MP**	56	43	43	43	50	50	69			83	83	83
6.8%	**MU**	702	543	0	165	272	272	272			298	298	489
1.0%	**NE**	9	7	7	7	7	7	11	11	11	11	11	11
2.0%	**OR**	21	16	16	16	16	16	23	23	33	38	38	0
3.8%	**PU**	70	54	54	54	54	54	71	71	71	77	77	77
4.8%	**RA**	69	54	0	26	26	26	60	60	73	91	91	92
9.2%	**TN**	317	245	245	166	208	208	208	225	225	225		
6.1%	**UPE**	79	61	61	61	64	64	97	97	107	115	115	133
4.3%	**UPW**	111	86	86	62	95	95	95	95	96	96	96	100
3.1%	**WB**	27	21	21	21	25	25				46	46	46

2100 MHz Price Trends

% Rev Dis Average	Circle	2010			2015			2016		
		TRAI	DOT	Auction	TRAI	DOT	Auction	TRAI	DOT	Auction
8.0%	AP	32	64	275	183	275	275	272	272	0
1.7%	AS	6	6	8	29	29	39	46	46	0
4.7%	BH	6	6	41	66			86	86	86
7.5%	DL	32	64	663	446	663	663	554	554	554
5.8%	GU	32	64	215	195	258	258	258	258	0
2.0%	HA	16	24	45	44	46	46	55	55	55
0.7%	HP	6	6	7	10			20	20	0
1.1%	JK	6	6	6	14			11	11	11
7.4%	KA	32	64	316	241	322	328	328	328	0
4.9%	KE	16	24	62	107	111	118	177	177	177
2.5%	KO	16	24	109	77	109	116	116	116	0
8.3%	MA	32	64	252	227	301	301	341	341	341
4.5%	MP	16	24	52	84	87	91	123	123	0
6.8%	MU	32	64	649	340	649	649	461	461	461
1.0%	NE	6	6	8	8	8	11	12	12	0
2.0%	OR	6	6	19	32	33	36	38	38	38
3.8%	PU	16	24	64	65			91	91	91
4.8%	RA	16	24	64	84	87	140	140	140	140
9.2%	TN	32	64	293	260	344	344	344	344	344
6.1%	UPE	16	24	73	82	86	90	110	110	110
4.3%	UPW	16	24	103	96	103	105	111	111	0
3.1%	WB	16	24	25	30			52	52	0

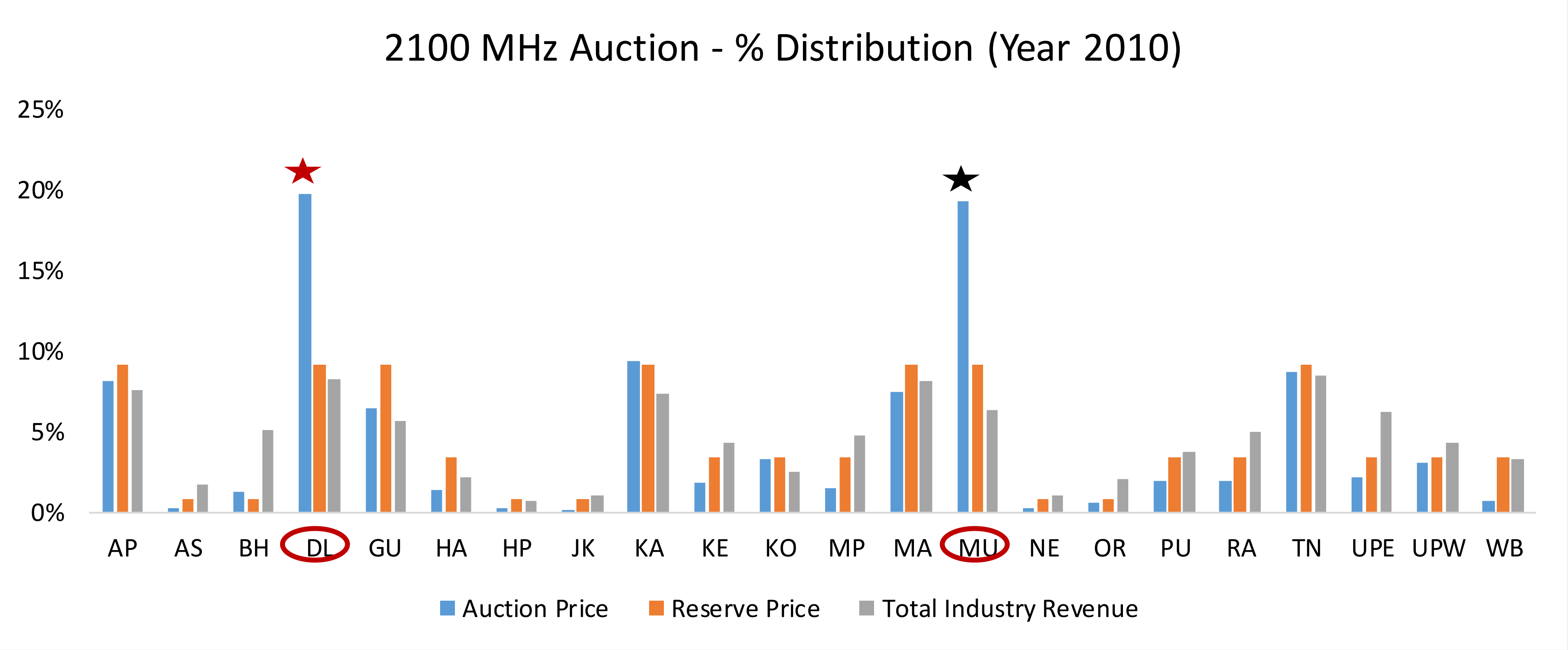
2300 MHz Price Trends

% Rev Dis Average	Circle	2010 TRAI	2010 DOT	2010 Auction	2016 TRAI	2016 DOT	2016 Auction
8.0%	**AP**	4	16	106	68	68	68
1.7%	**AS**	1	2	3	2	2	2
4.7%	**BH**	1	2	10	6	6	6
7.5%	**DL**	4	16	224	143	143	143
5.8%	**GU**	4	16	61	39	39	61
2.0%	**HA**	2	6	12	8		
0.7%	**HP**	1	2	2	1	1	1
1.1%	**JK**	1	2	2	1		
7.4%	**KA**	4	16	154	98	98	98
4.9%	**KE**	2	6	26	16	16	18
2.5%	**KO**	4	16	52	33	33	33
8.3%	**MA**	2	6	92	58	58	63
4.5%	**MP**	2	6	12	8	8	8
6.8%	**MU**	4	16	229	146	146	146
1.0%	**NE**	1	2	2	1	1	1
2.0%	**OR**	1	2	6	4	4	4
3.8%	**PU**	2	6	33	21		
4.8%	**RA**	2	6	10	6		
9.2%	**TN**	4	16	207	132	132	132
6.1%	**UPE**	2	6	14	9		
4.3%	**UPW**	2	6	18	12		
3.1%	**WB**	2	6	7	5	5	5

2100 Auction (2010) : Overenthusiasm

Tata (No 2G) Bid Till Last But Lost	RCOM & Aircel Bid Aggressively	3 Slots Chased by 6 Bidders

Bid Details	2010 : Last Bid (Round No)									2010: Bids (Total)									2010: Winner (MHz)								
Circles	BHA	VOD	IDE	RCO	TAT	AIR	VID	STE	ETI	BHA	VOD	IDE	RCO	TAT	AIR	VID	STE	ETI	BHA	VOD	IDE	RCO	TAT	AIR	VID	STE	ETI
DEL ★	182	181	109	182	181	153			96	103	120	59	125	95	113			34	5	5		5					
MUM ★	183	182	97	182	158	163			79	105	106	59	95	84	116			30	5	5		5					



Delhi & Mumbai Was 40% of Auction Value With Only 14% of Revenue

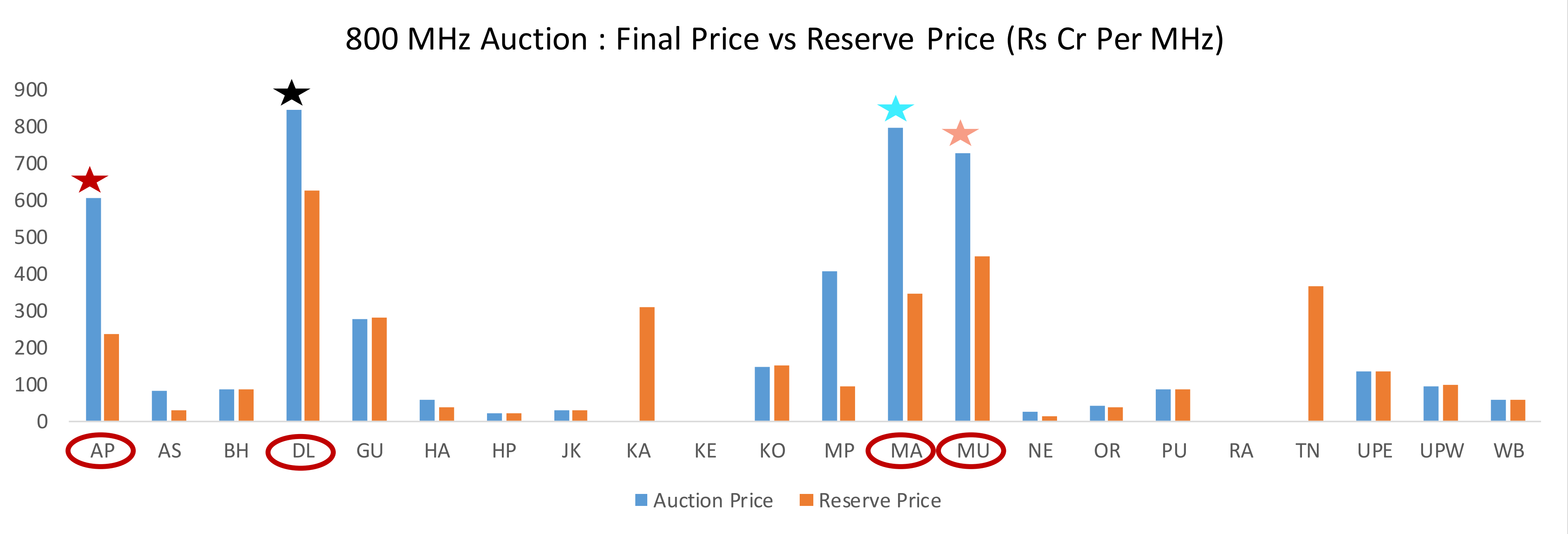
800 Auction (2015) : Insufficient Spectrum

RJIO Bid Till Last But Not Win 3 of 4 Below

TATA's & RJIO's Bidding Intensity Was High

Quantum of Spectrum Was Low

Bid Details	2015 : Last Bid (Round No)								2015 : Bids (Total)								2015 : Winners (MHz)							
Circles	BHA	VOD	IDE	RJIO	RCO	TAT	TEL	AIR	BHA	VOD	IDE	RJIO	RCO	TAT	TEL	AIR	BHA	VOD	IDE	RJIO	RCO	TAT	TEL	AIR
DEL		36		111		112				2		28		27								1.3		
MUM		23	45	47		48				2	11	11		12						5		2.5		
MAHA	1	38	34	111		112			1	3	2	36		36								2.5		
AP		21	48	113		114				3	3	33		35								3.8		



Price of AP, DL, MA, MU Increased 2.5, 1.4, 2.3, 1.6 times Respectively

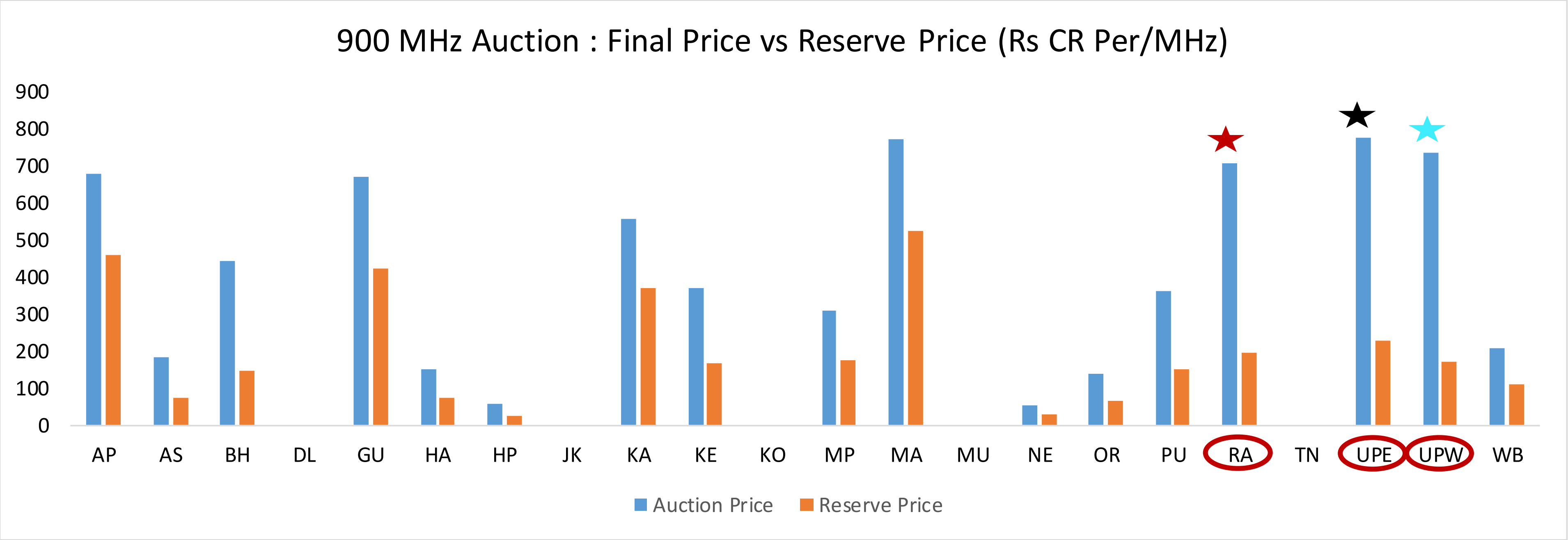
900 Auction (2015) : Business Continuity

RJIO Bid Till Last But Not Win

RJIO's Bidding Intensity Was High

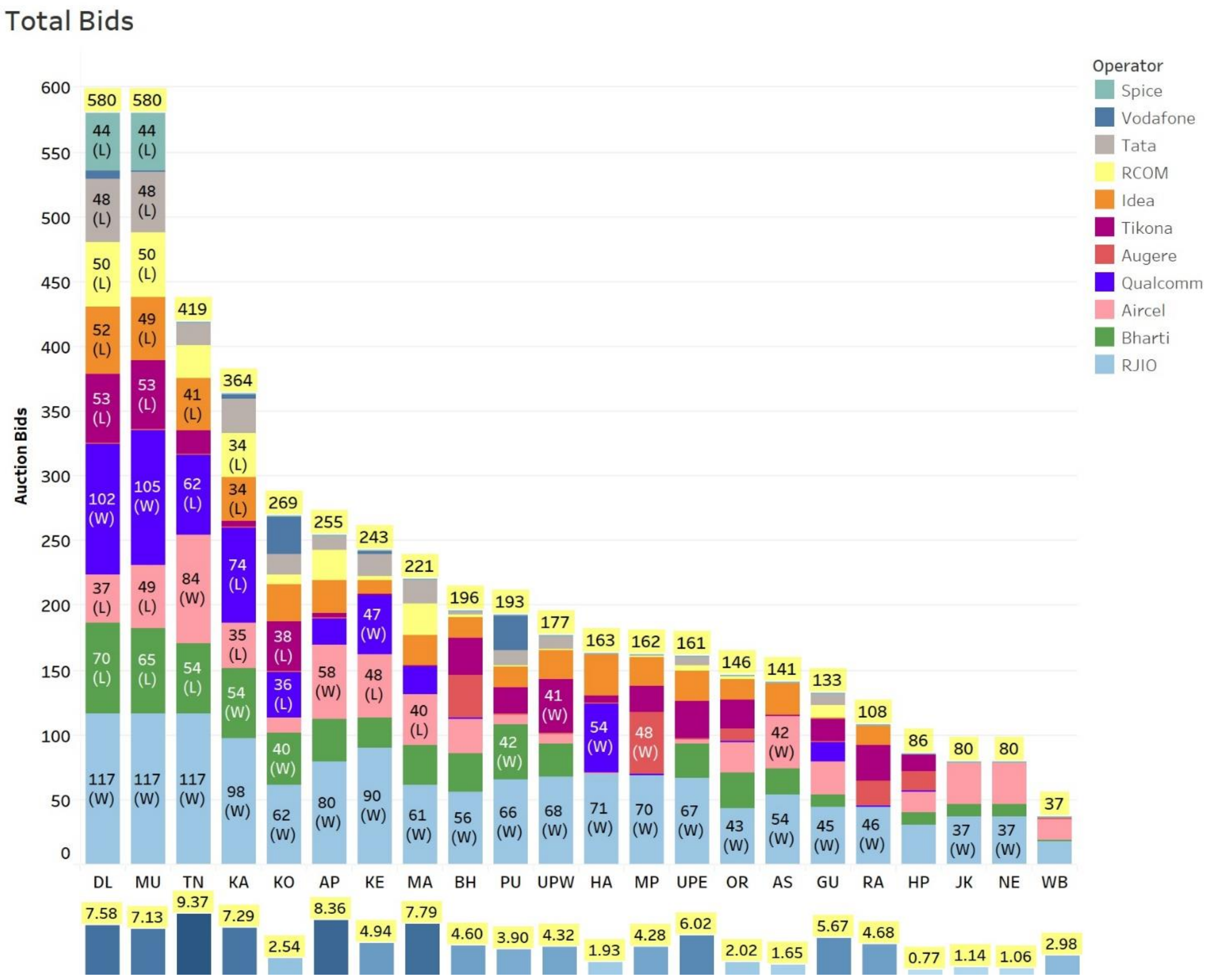
Quantum of Spectrum Was Low

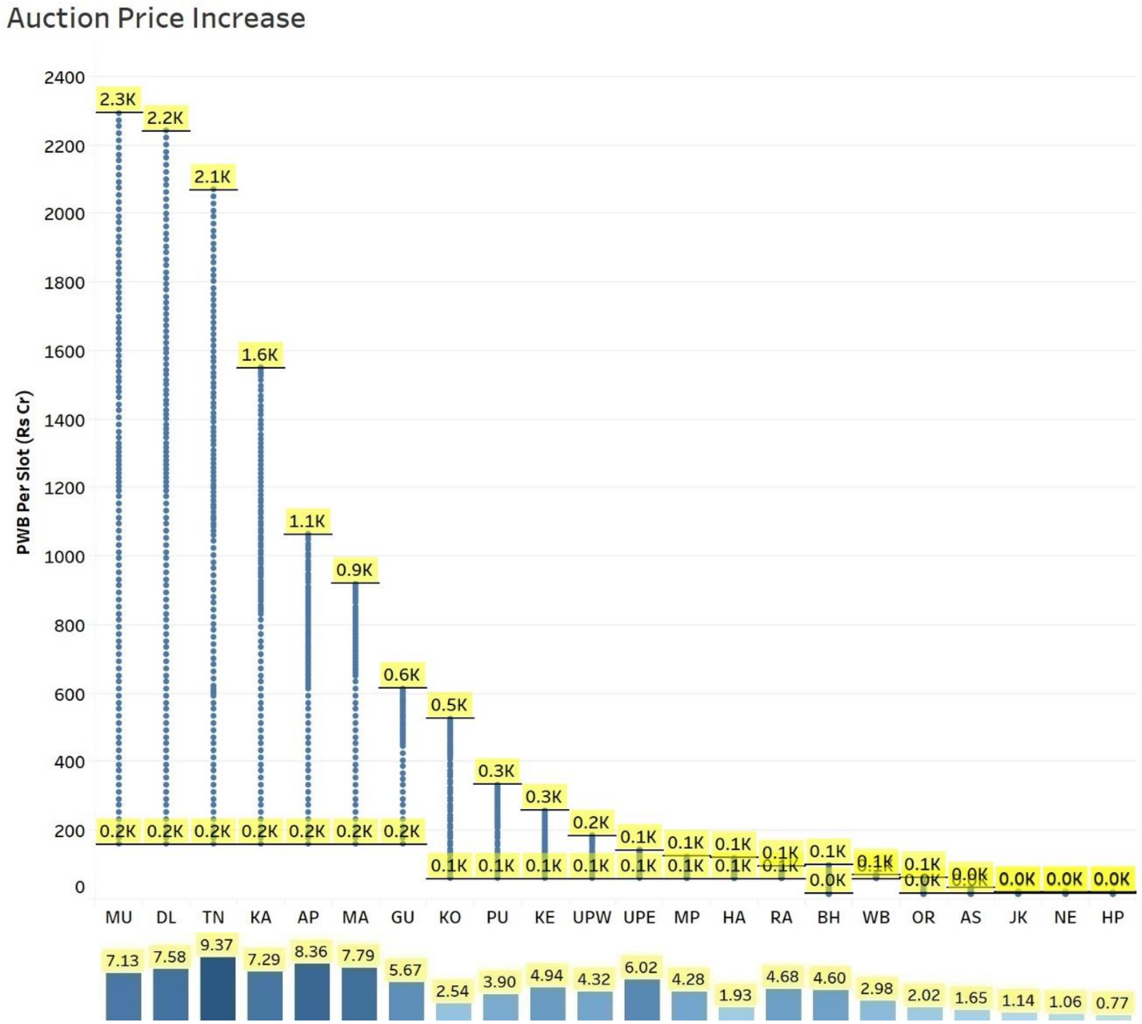
Bid Details	2015 : Last Bid (Round No)								2015 : Bids (Total)								2015 : Winners (MHz)							
Circles	BHA	VOD	IDE	RJIO	RCO	TAT	TEL	AIR	BHA	VOD	IDE	RJIO	RCO	TAT	TEL	AIR	BHA	VOD	IDE	RJIO	RCO	TAT	TEL	AIR
UPW ★			99	98	7	10		12			18	20	3	7		11			5					
UPE ★		110	22	109		6				21	9	23		6				5.6						
RAJA ★	106	107		104				16	28	32		27				2	6	6.4						



Final Price of Raj, UPE & UPW Increased 3.6, 4.2, 4.3 times Respectively

2300 Auction (2010) : Overenthusiasm





Delhi & Mumbai Was 40% of Auction Value With Only 14% of Revenue