

Interpreting India 5G Auctions

Renju John

Department of EEE

Birla Institute of technology and Science.

2001B5A3602

Pilani Rajasthan 333031

ABSTRACT

India Spectrum Auctions need analysis from various angles to interpret the success of the Auctions. The 3 players of the Auction are DOT, TRAI and TSPs. DOT evaluates the technical angle of the auction, TRAI evaluates the economic angle and the TSPs try to acquire the maximum cellular spectrum at minimum cost. Several Iterative computations need to be done to arrive at efficiency of an Auction. The main questions that need to be asked are how much does the government earn? What was the percentage bidding? Was the reserve price feasible? Which were the technologies and bands on offer? These are some of the questions that this paper is set out to answer.

KEYWORDS: Auction, ARPU, Reserve Price

Date of Submission: 07-10-2023

Date of acceptance: 22-10-2023

I. INTRODUCTION

The auction for India's 5G spectrum began July 26, 2022^[7] and closed August 1 after 40 rounds of bidding spread over seven days. Reliance Jio was the top bidder, putting up over INR 880.78 billion for 24.740GHz worth of airwaves across the 700MHz, 800MHz, 1800MHz, 3300MHz, and 26GHz bands. Bharti Airtel was the next top bidder, and put up INR 430.84 billion for 19.867GHz worth of airwaves across the 900MHz, 1800MHz, 2100MHz, 3300MHz, and 26GHz bands. Vodafone Idea bid INR 187.99 billion for the 800MHz, 2100MHz, 2500MHz, 3300MHz and 26GHz bands, totaling 6.228GHz worth of airwaves. Finally, the Adani Group bid on the 26GHz band to set up a private telecom network for their organization.

Telecom operators like Airtel and Jio had initially been concerned about private captive networks belonging to big tech firms accessing 5G spectrum during the auctions, which is why the government released fresh guidelines on the eligibility and scope of the private captive networks license. The rationalization was that it would enable enterprise 5G innovation and power Industry 4.0 applications, such as machine to machine communications (M2M), IoT, AI, etc.

II. Computational matrices

Bands	Offer	Bid	PC
700	660	0	0%
800	232.5	150	65%
900	98.8	38.4	39%
2100	175	15	9%
2300	560	500	89%
2500	230	0	0%
Total	2308.8	855.6	37%
Player	Mhz	Rs(Cr)	PPH(Rs)
Rjio	488.35	57122.65	1170
Airtel	355.45	18698.75	526
VI	11.8	1993.4	1689
Total	855.6	77814.8	909
MarketRPM			91

Table 1: 2021 Auctions^[5]

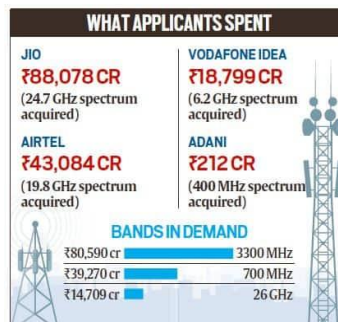
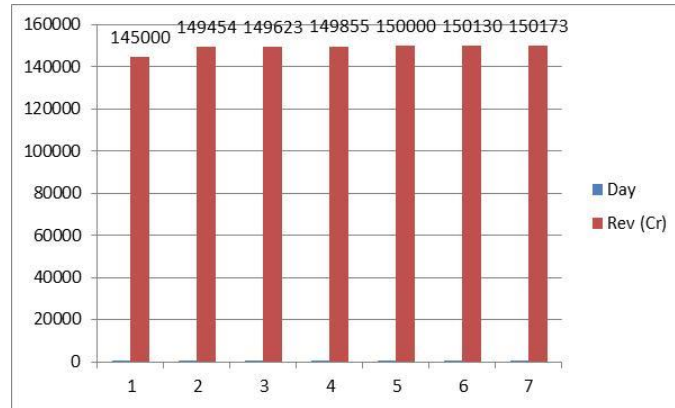


Figure 1: The 7 Day 40 round bid 2022 Auctions and Applicant spent^[6]

Indian telecom market is a consolidated 4 player market. They are reliance Jio, Bharti Airtel, Vodafone Idea and Government owned BSNL. First one needs to understand which the bands in India available are for TSPs.

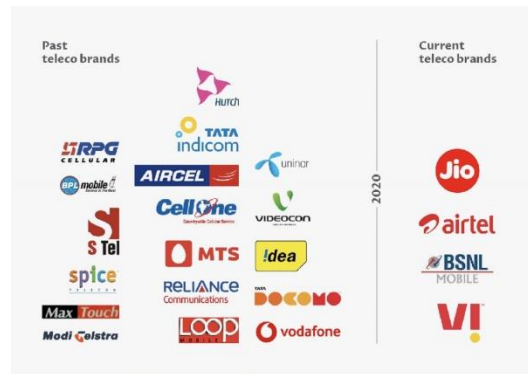


Figure 2: Market Consolidation

Band number	Type	Multiplex	Freq	Uplink(L)	Uplink(U)	Downlink(L)	Downlink(U)	Uplink (BW)	Downlink(BW)	Total(BW)	Block
1	Paired	FDD	2100	1939	1979	2129	2169	40	40	80	5
3	Paired	FDD	1800	1710	1765	1805	1860	55	55	110	0.2
5	Paired	FDD	800	824	844	869	889	20	20	40	1.25
7	Paired	FDD	2600	2500	2570	2620	2690	70	70	140	10
8	Paired	FDD	900	890	915	935	960	25	25	50	0.2
28	Paired	FDD	700	713	748	768	803	35	35	70	5
40	Unpaired	TDD	2300	2300	2400						10
41	Unpaired	TDD	2600	2535	2555						10
				2635	2655						
4G LTE band	5G NR band	Multiplex	freq	Uplink(L)	Uplink(U)	Downlink(L)	Downlink(U)	Uplink (BW)	Downlink(BW)	Total(BW)	Block
B1	n1	FDD	2100	1939	1979	2121	2169	40	40	80	5
B3	n3	FDD	1800	1710	1765	1805	1860	55	55	110	0.2
B5	n5	FDD	800	824	844	869	889	20	20	40	1.25
B8	n8	FDD	900	890	915	935	960	25	25	50	0.2
B28	n28	FDD	700	723	748	778	803	25	25	50	5
-	n105	FDD	600	663	703	612	652	40	40	80	5
B40		TDD	2300	2300	2400						10

Table 2: Bands and Technologies/Bandwidth

We also need to understand the possession of the various bands by these 4 players.

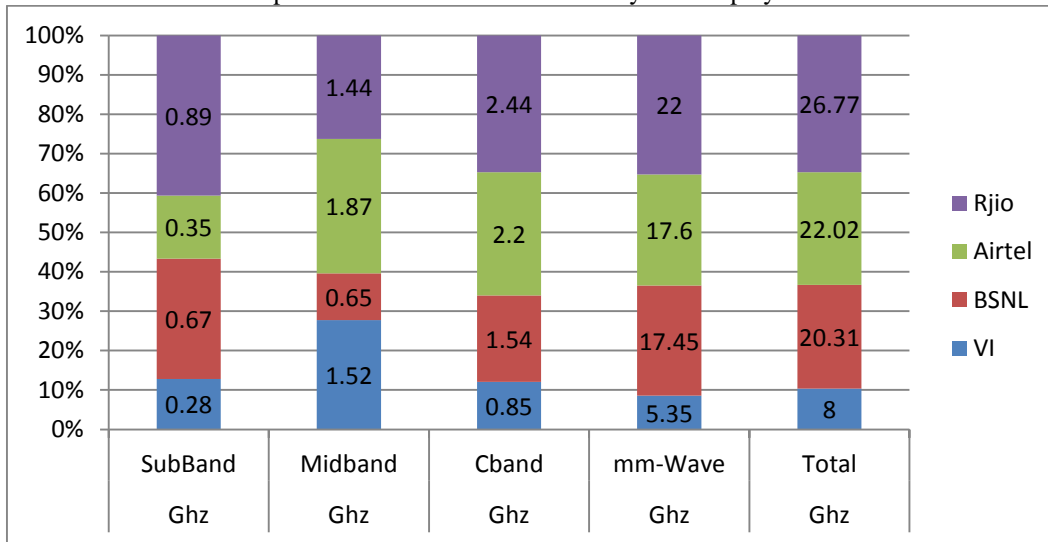


Figure 3: Reliance Jio and Airtel the market leaders 70% by market possess 55% of the spectrum currently.^[6]

	SubBand Ghz	Midband Ghz	Cband Ghz	mm-Wave Ghz	Total Ghz
VI	0.28	1.52	0.85	5.35	8
BSNL	0.67	0.65	1.54	17.45	20.31
Airtel	0.35	1.87	2.2	17.6	22.02
Rjio	0.89	1.44	2.44	22	26.77
Total	2.19	5.48	7.03	62.4	77.1

Of these C-Bands and mm waves are exclusively allocated for 5G.

Let us first have a look at how different auctions have fared over the years

YEAR	Revenue (Rs Bn)	Offer(Mhz)	Bid (Mhz)	RPM (Cr/Mhz)	PPM(Cr/Mhz)	Offer/Bid)%	Operators	Bands	Days	Rounds	Auction Model	Technology	Generation
2010	1062	1785	1785	59.50	59.50	100%	9	2	34	183	SMRA	GSM	3G
2012	94.7	271.25	89.5125	34.91	105.80	33%	5	2	2	14	SMRA	GSM/CDMA	3G
2013	64	124.25	18.6375	51.51	343.39	15%	1	3	1	1	SMRA	GSM/CDMA	3G
2014	611.62	353.2	289.624	173.17	211.18	82%	8	3	10	68	SMRA	GSM	4G
2015	1098.75	418.25	372.2425	262.70	295.17	89%	7	4	19	115	SMRA	GSM	4G
2016	657.89	2354.55	965	27.94	68.18	41%	7	7	5	31	SMRA	GSM	4G
2021	778.15	2308.8	855.6	33.70	90.95	37%	3	5	2	14	SMRA	GSM	5G
2022	1501.73	72000	51240	2.09	2.93	71%	4	9	7	40	SMRA	GSM	5G

Table 3: 2010 and 2022 is the best 2 Auctions as there is heavy parity between

- RPM(Revenue Per Mhz) and
 - PPM (Price Per Mhz)
- Now we will Study the 2022 5G Auction at a Micro level w.r.t the Bands

III.Methodology

Now we will Study the 2022 5G Auction at a Micro level w.r.t the Bands. All data has been mined and VLookuped from TRAI Statistical tables and computed iteratively to arrive at the required matrices. I try to answer the quintessential question .Were the reserve prices set reasonable? Let us see the progress from 2021 to 2022 Auctions and see how the reserve prices were set in each band. The Sub bands except the 700 Mhz band are seeing very poor bid % due to its very high pan india Reserve Price.

Intepreting India 5G Auctions

YEAR	BAND	TECH	CAT	Offer(Ghz)	Bid(Ghz)	PER		Ghz	Ghz	Ghz	Ghz	Ghz
2022	600	FDD	SUB	0.7	0.0	0%		SubBand	Midband	Cband	mm-Wave	Total
2022	700	FDD	SUB	0.6	0.2	40%	VI	0.28	1.52	0.85	5.35	8
2022	800	FDD	SUB	0.1	0.0	15%	BSNL	0.67	0.65	1.54	17.45	20.31
2022	900	FDD	SUB	0.1	0.0	16%	Airtel	0.35	1.87	2.2	17.6	22.02
2022	1800	FDD	MID	0.3	0.1	33%	Rjio	0.89	1.44	2.44	22	26.77
2022	2100	FDD	MID	0.2	0.0	19%	Total(After 5G Auction)	2.19	5.48	7.03	62.4	77.1
2022	2300	FDD	MID	0.1	0.0	0%						
2022	2500	FDD	MID	0.2	0.0	9%	5G Auctions 2022	0.2	0.1	5.5	45	50.8
2022	3500	TDD	C	7.3	5.5	76%	Prior	1.99	5.38	0	0	7.37
2022	26000	TDD	mm Wave	62.7	45.0	72%	Govt Allocation	0	0	1.54	17.45	18.99
							Total(After 5G Auction)	2.19	5.48	7.04	62.45	77.16
	Total			72.1	50.8	71%						

Unit	Mhz	Mhz	Mhz	Mhz	Mhz	Mhz	Mhz	Mhz	Mhz	Mhz	Mhz
Available 2021	0	600	232.5	98.8	0	175	560	500	0	0	
Bid-2021	0	0	150	38.4	0	15	230	0	0	0	
Remaining	0	600	82.5	60.4	0	160	330	500	0	0	
Available-2022	700	600	100	100	300	200	100	200	7300	62700	
Additional	700	0	17.5	39.6	300	40			7300	62700	
Bid-2022	0	200	0	0	100	0	0	0	5500	45000	
GENERATION	5G	4G/5G	4G	3G/4G	4G	4G	4G	4G	5G	5G	
MULTIPLEX	FDD	FDD	FDD	FDD	FDD	FDD	TDD	TDD	TDD	TDD	
BAND	600	700	800	900	1800	2100	2300	2500	3500	26000	
BANDWIDTH	80	50	40	50	110	190	40	40	370	3270	
Block	5	5	1.25	0.2	0.2	5	10	10	10	10	
RP Cr/Mhz	3927	3927	3620	3650	2115	1485	1485	480	317	5.9	

Table 4 and 5: 2021 to 2022 transition ^[5]

IV.Results

YEAR	Band	FDD/TDD	Category	Offered(Mhz)	Subscribed(Mhz)	Percent	
2022	600	FDD	SUB	660	0	0%	
2022	700	FDD	SUB	550	220	40%	
2022	800	FDD	SUB	136.25	20	15%	
2022	900	FDD	SUB	74.4	11.8	16%	
2022	1800	FDD	MID	267.2	88.4	33%	
2022	2100	FDD	MID	155	30	19%	
2022	2300	FDD	MID	60	0	0%	
2022	2500	FDD	MID	230	20	9%	16%
2022	3500	TDD	C	7260	5490	76%	4G
2022	26000	TDD	mm Wave	62700	44950	72%	
2022	2600+3500	TDD	C+mm	69960	50440	72%	72%
	Total			72092.85	50830.2	71%	5G

Table 6:4G to 5G Split

VI		Crores	PPM	RJO		Crores	PPM	AI		Crores	PPM	AD		Crores	PPM	Overall
600	0	0		600	0	0		600	0	0		600	0	0		
700	0	0		700	220	39270	178.50	700	0	0		700	0	0		178.50
800	0	0		800	20	1050	52.50	800	0	0		800	0	0		52.50
900	0	0		900	0	0		900	11.8	349		900	0	0		29.58
1800	3.4	585	172.06	1800	60	7028	117.13	1800	25	2764	110.56	1800	0	0		133.25
2100	5	500	100.00	2100	30.8	0		2100	30.8	2680	87.01	2100	0	0		93.51
2300	0	0		2300	0	0		2300	0	0		2300	0	0		
2500	20	650	32.50	2500	0	0		2500	0	0		2500	0	0		32.50
3500	850	15150	17.82	3500	2440	33740	13.83	3500	2200	31700		3500	0	0		15.83
26000	5350	1915	0.36	26000	22000	6990	0.32	26000	17600	5592	0.32	26000	400	212	0.53	0.38
Total	6228.4	18800	3.02	Total	24770.8	88078	3.56	Total	19867.6	43085	2.17	Total	400	212	0.53	2.32

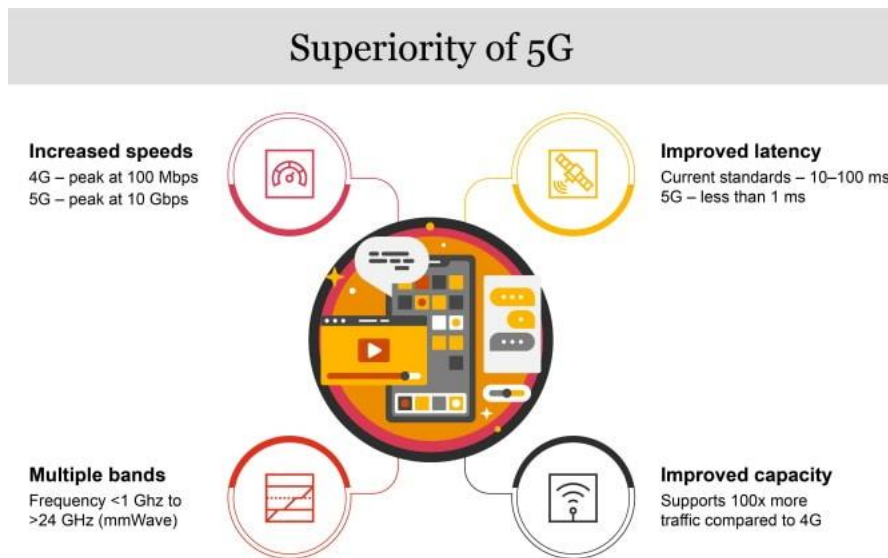
Table 7: The market expectation of the Spectrum price Blended value of 2.32 Cr/Mhz.

YEAR	ARPU(IDEA)	ARPU(Airtel)	ARPU(Vodafone)	ARPU(Jio)	ARPU(BSNL)	ARPU(VI)
2010	167	220	177	0	99	0
2012	159	189	185	0	78	0
2013	169	196	194	0	81	0
2014	111	195	199	0	117	0
2015	179	187	175	0	123	0
2016	132	172	205	300	118	0
2021	0	163	0	178.8	86	135
2022	0	200	0	180.5	85	139

Table 8:ARPUs 2010 to 2022 <200 Below Market Expectations

V. Discussions

5G is expected to offer 10-times faster connectivity compared to 4G networks, but more importantly, 5G’s low latency network offers bigger potential for applications that work on latency-sensitive services, such as telemedicine, autonomous driving, online gaming, etc. This makes it highly attractive to big tech and private networks.



Telecom equipment makers, such as Nokia, Ericsson, and Samsung, who have already conducted 5G technology trials in the country view this announcement as a massive opportunity. Enterprise 5G will be less costly when compared with the mass consumer space, where Chinese players like Huawei have a dominant presence. The Indian Cellular Operators Association (COAI), which includes Bharti Airtel, Reliance Jio, and Vodafone Idea, as its members had expressed dissatisfaction with the government’s decision of allocating spectrum to enterprises for operating private captive networks and have demanded a level playing field. The COAI urged the government to ensure that these new private networks be made to conform to the same license fee and GST payment requirements as existing telecom providers.

Enterprises must be subjected to necessary technical and regulatory safeguards to ensure that such networks remain truly private and isolated so as to not cause interference with public networks. These include norms like storing call/data records for two years, command logs for three years, keeping records of software updates, and ensuring data localization with remote access only from in-country and no remote access from outside of India. The COAI had also demanded clarity in defining the scope of CNPNs, and suggested that it be restricted to machine-to-machine communication inside the CNPN’s premises only. Furthermore, citing national security concerns, the COAI said that these networks should be made to comply with the prescribed subscriber verification norms to ensure adequate verification and traceability of every user.

Unified License can only be awarded to an Indian Company. Foreign applicants will need to form or acquire an Indian company, to obtain a Unified License. More bands on Offer more revenue on offer and more spectrums at affordable cost leading to more bidding. The revenue of an operator has seen close co relations of up to 0.81 with the Reserve price in the past. Thus when future 5G auctions are conducted indexing to 2022

auctions the reserve prices have to be set correct. Else the already failing balance sheets of the operators will fail to invest in the next gen infrastructure thereby offsetting the advantages.

VI. Conclusions

- The market expectation of the Spectrum price is a blended value of **2.32 Cr/Mhz.**
- **600 Mhz** is seeing no bidding to the very high pan India spectrum reserve Price
- **700 Mhz** is seeing bidding due to its high penetration and range factor.
- **Only 16%** bidding in 4G bands compared to **72% in 5G** and this trend will continue.
- Indian operators have been long trying to keep an ARPU of **Rs 200 since 2010** and to touch **Rs 350 by the end of Rs 2025.** Operators see 5G as the biggest enabler to this goal.

References

- [1]. Spectrum Auction Report October 2016 by TRAI
- [2]. GSA Response to spectrum design to TRAI 10.10.2017
- [3]. Evaluating Spectrum Auction in India Rajat Kathuria
Indian Council for Research on International Economic Relations (ICRIER) April 2019
- [4]. Promotional Mix for Indian Telecom Industry
Journal of Modern Management & Entrepreneurship (JMME): Dr Ashok Kumar Varma Vol 10 April 2020
- [5]. Telecom India Statistics 2021, Statistics Division Economic Research unit. 07/04/2022
- [6]. 5G Spectrum Table :TelecomTalk 02 Aug 2022
- [7]. TRAI Press Release 77/2023 released 24 August 2023