

# **INDEPENDENT QUALITY OF SERVICE SURVEY IN PAKISTAN – CITIES**

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THIRD QUARTER 2023

ENFORCEMENT WIRELESS – II DIRECTORATE  
PTA | F-5/1, ISLAMABAD

# INDEPENDENT QUALITY OF SERVICE SURVEY REPORT

## INTRODUCTION

1.1. In order to measure the performance and service quality of Cellular Mobile Operators (CMOs), an independent Quality of Service (QoS) Survey has been carried out in Seventeen (17) x Cities of Khyber Pakhtunkhwa, Punjab and Sindh during 3<sup>rd</sup> Quarter i.e. July~ Sep 2023. The names of cities along with survey dates are mentioned in **Table 1.1: QoS Survey Cities & Dates:**

S. #.	City	Province	Days	Survey Dates
1	SWABI	KHYBER PAKHTUNKHWA	3	15 <sup>th</sup> ~17 <sup>th</sup> August 2023
2	UPPER DIR		3	21 <sup>st</sup> ~23 <sup>rd</sup> August 2023
3	ABBOTTABAD		4	5 <sup>th</sup> ~8 <sup>th</sup> September 2023
4	BUNER		3	11 <sup>th</sup> ~13 <sup>th</sup> September 2023
5	SHAHKOT		4	15 <sup>th</sup> ~18 <sup>th</sup> August 2023
6	WAH/ TAXILA		4	16 <sup>th</sup> ~18 <sup>th</sup> &21 <sup>st</sup> August 2023
7	LAHORE		4	21 <sup>st</sup> ~24 <sup>th</sup> August 2023
8	KAHROR PACCA		3	22 <sup>nd</sup> ~24 <sup>th</sup> August 2023
9	GUJAR KHAN		4	22 <sup>nd</sup> ~25 <sup>th</sup> August 2023
10	SHUJABAD		4	28 <sup>th</sup> ~31 <sup>st</sup> August 2023
11	RAWALPINDI	PUNJAB	4	29 <sup>th</sup> August~1 <sup>st</sup> September 2023
12	MURIDKE		4	12 <sup>th</sup> ~15 <sup>th</sup> September 2023
13	LARKANA		3	22 <sup>nd</sup> ~24 <sup>th</sup> August 2023
14	KHAIRPUR		3	29 <sup>th</sup> ~31 <sup>st</sup> August 2023
15	JACOBABAD		3	4 <sup>th</sup> ~6 <sup>th</sup> September 2023
16	SUJAWAL		3	13 <sup>th</sup> ~15 <sup>th</sup> September 2023
17	MITHI		3	19 <sup>th</sup> ~21 <sup>st</sup> September 2023
SINDH				

Table 1.1: QoS Survey Dates and Samples

## DRIVE TEST DETAILS

2.1. The QoS survey was carried out using Automated QoS Monitoring & Benchmarking Tool i.e. "**SMARTBENCHMARKER**". Drive test teams selected survey routes in such a manner to cover main roads, service roads and majority of sectors/colonies. During the survey, mobile handsets for Voice Calls, SMS and Mobile Broadband/Data Sessions were kept in technology auto detect mode.

## MOBILE NETWORK COVERAGE

3.1. **4G / LTE SIGNAL STRENGTH**. During the survey, while conducting data test in technology auto detect mode, 4G/LTE signal strength samples were recorded on survey routes. As per Next Generation Mobile Service (NGMS) licenses, licensees are required to meet the threshold of -100 dBm or above of Reference Signal Receive Power (RSRP) with 90% confidence level. City wise compliance of 90% Confidence Level of signal strength is shown in **Table 3.1: 4G Signal Strength Technology Auto Detect Mode -100 dBm with 90% Confidence Level**.

City	4G Signal Strength -100dBm with 90% Confidence Level – Technology Auto Detect Mode							
	Confidence Level (%)				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	83.87%	89.27%	95.20%	95.70%	No	No	Yes	Yes
LARKANA	99.10%	87.30%	99.27%	99.90%	Yes	No	Yes	Yes
LAHORE	99.72%	92.65%	98.51%	99.82%	Yes	Yes	Yes	Yes
KHAIRPUR	98.20%	78.58%	94.67%	96.84%	Yes	No	Yes	Yes

4G Signal Strength -100dBm with 90% Confidence Level – Technology Auto Detect Mode								
City	Confidence Level (%)				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
KAHROR PACCA	97.51%	62.73%	77.12%	97.86%	Yes	No	No	Yes
SHAHKOT	96.90%	94.23%	96.48%	97.46%	Yes	Yes	Yes	Yes
GUJAR KHAN	98.91%	96.07%	99.28%	98.26%	Yes	Yes	Yes	Yes
WAH/ TAXILA	94.11%	94.19%	99.21%	94.53%	Yes	Yes	Yes	Yes
RAWALPINDI	94.46%	95.21%	99.71%	99.01%	Yes	Yes	Yes	Yes
BUNER	89.79%	86.59%	91.94%	78.32%	No	No	Yes	No
JACOBABAD	95.54%	91.06%	99.83%	99.28%	Yes	Yes	Yes	Yes
SUJAWAL	96.27%	98.59%	95.72%	98.13%	Yes	Yes	Yes	Yes
MITHI	96.53%	93.51%	97.78%	73.51%	Yes	Yes	Yes	No
ABBOTTABAD	96.05%	97.51%	99.27%	96.58%	Yes	Yes	Yes	Yes
SHUJABAD	94.98%	83.44%	81.25%	97.92%	Yes	No	No	Yes
SWABI	84.01%	90.01%	97.73%	98.88%	No	Yes	Yes	Yes
MURIDKE	99.14%	81.35%	88.68%	95.39%	Yes	No	No	Yes

Table 3.1: 4G Signal Strength Technology Auto Detect Mode -100 dBm with 90 Confidence Level

3.2. **3G SIGNAL STRENGTH IN TECNHOLGY AUTO DETECT MODE.** During the survey, 3G signal strength samples were also recorded on survey routes, wherever network switched to 3G while keeping the mobile handset in technology auto detect mode. As per Next Generation Mobile Service (NGMS) licenses, licensees are required to meet the threshold of -100 dBm or above of Received Signal Code Power (RSCP) with 90% confidence level. City wise compliance of 90% Confidence Level of signal strength is shown in **Table 3.2: 3G Signal Strength Technology Auto Detect Mode -100 dBm with 90% Confidence Level**

3G Signal Strength -100dBm with 90% Confidence Level – Technology Auto Detect Mode								
City	Confidence Level (%)				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	71.0%	84.85%	88.91%	90.45%	No	No	No	Yes
LARKANA	N/A	100.0%	100.0%	N/A	N/A	Yes	Yes	N/A
LAHORE	N/A	99.51%	100.0%	N/A	N/A	Yes	Yes	N/A
KHAIRPUR	N/A	100.0%	83.55%	100.0%	N/A	Yes	No	Yes
KAHROR PACCA	N/A	74.55%	N/A	N/A	N/A	No	N/A	N/A
SHAHKOT	N/A	N/A	100.0%	N/A	N/A	N/A	Yes	N/A
GUJAR KHAN	N/A	N/A	100.0%	N/A	N/A	N/A	Yes	N/A
WAH/ TAXILA	N/A	100.0%	100.0%	N/A	N/A	Yes	Yes	N/A
RAWALPINDI	N/A	100.0%	N/A	100.0%	N/A	Yes	N/A	Yes
BUNER	85.10%	100.0%	100.0%	44.68%	No	Yes	Yes	No
JACOBABAD	N/A	N/A	100.0%	N/A	N/A	N/A	Yes	N/A
SUJAWAL	N/A	N/A	100.0%	100.0%	N/A	N/A	Yes	Yes
MITHI	N/A	38.59%	93.57%	77.73%	N/A	No	Yes	No
ABBOTTABAD	100.0%	100.0%	99.79%	N/A	Yes	Yes	Yes	N/A
SHUJABAD	N/A	100.0%	N/A	N/A	N/A	Yes	N/A	N/A
SWABI	N/A	91.67%	100.0%	N/A	N/A	Yes	Yes	N/A
MURIDKE	N/A	N/A	100.0%	N/A	N/A	N/A	Yes	N/A

Note: N/A means No Fallback to 3G Network

Table 3.2: 3G Signal Strength Technology Auto Detect Mode -100 dBm with 90% Confidence Level

## **MOBILE BROADBAND SERVICE**

4.1. **DATA SESSIONS IN TECHNOLOGY AUTO DETECT MODE.** A series of data tests including Capacity Tests, Data Transfer Tests, Web Browsing and Ping were carried out wherein Key Performance Indicators (KPIs) of Upload and Download User Data Throughput (i.e. Speed), Webpage Loading Time and Latency have been measured. In Fixed Duration Testing, a File of 10GB was downloaded and Uploaded for 3 minutes duration whereas in Fixed Size Testing, a File of 5MB and 2MB was completely downloaded and uploaded respectively. In order to measure Webpage Loading Time, different webpages were checked and in case of Latency, different website(s) were pinged to measure Round Trip Time (RTT)/Latency. The 4G/LTE and 3G signal strengths, Number of Tests, Upload and Download User Data Throughput, Webpage Loading Time and Latency detail is mentioned in **Table4.1: Data Tests Statistics.**

DESCRIPTION			JAZZ	TELENOR	UFONE	ZONG
AUTO DETECT MODE	CAPACITY TEST	DOWNLOAD	ATTEMPTS	6409	6368	6393
			SPEED (Mbps)	22.727	6.379	10.695
	DATA TRANSFER TEST	UPLOAD	ATTEMPTS	6420	6382	6404
			SPEED (Mbps)	22.341	6.1	17.565
	BROWSING TEST	DOWNLOAD	ATTEMPTS	6271	6388	6160
			SPEED (Mbps)	9.995	5.62	7.41
	PING TEST	UPLOAD	ATTEMPTS	6452	6422	6434
			SPEED (Mbps)	5.802	3.865	5.578
	BROWSING TEST		ATTEMPTS	25687	25578	25597
			LOADING TIME (Seconds)	3.35	3.52	3.67
		ATTEMPTS	6469	6458	6458	
		LATENCY (msec)	106.36	64.99	62.45	
	AVERAGE 4G SIGNAL STRENGTH (RSRP) dBm			-81.2	-85.2	-80.4
	AVERAGE 3G SIGNAL STRENGTH (RSCP) dBm			-83.26	-78.09	-75.22
						-82.55

Table 4.1: Data Tests Statistics

4.2. **DOWNLOAD USER DATA THROUGHPUT.** As per Next Generation Mobile Service (NGMS) licenses, licensees are required to meet the threshold of minimum of 3Mbps of 4G/LTE & 512Kbps of 3G Download User Data Throughput. The results of Data Service QoS KPI i.e. Download User Data Throughput are shown in (i). **Table 4.2: Download User Data Throughput Technology Auto Detect Mode [Fixed Duration] ≥ 3Mbps**, (ii). **Table 4.3: Download User Data Throughput Technology Auto Detect Mode [Fixed Size] ≥ 3Mbps**,

DOWNLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED DURATION)								
City	Download User Data Throughput [Mbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	13.11	<b>2.33</b>	21.04	14.27	Third	<b>Fourth</b>	First	Second
LARKANA	19.08	5.57	7.38	23.37	Second	Fourth	Third	First
LAHORE	17.37	9.76	13.62	33.34	Second	Fourth	Third	First
KHAIRPUR	16.75	12.34	6.81	22.88	Second	Third	Fourth	First
KAHROR PACCA	17.62	13.51	5.35	21.17	Second	Third	Fourth	First
SHAHKOT	22.06	6.67	16.20	18.08	First	Fourth	Third	Second
GUJAR KHAN	28.30	<b>2.20</b>	11.12	28.56	Second	<b>Fourth</b>	Third	First
WAH/ TAXILA	22.35	<b>2.23</b>	13.55	20.85	First	<b>Fourth</b>	Third	Second
RAWALPINDI	30.89	4.33	8.96	21.62	First	Fourth	Third	Second
BUNER	30.44	<b>2.29</b>	3.45	16.87	First	<b>Fourth</b>	Third	Second
JACOBABAD	23.70	10.99	10.03	23.66	First	Third	Fourth	Second

DOWNLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED DURATION)								
City	Download User Data Throughput [Mbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
SUJAWAL	35.88	3.75	27.37	29.90	First	Fourth	Third	Second
MITHI	30.56	4.11	11.33	36.56	Second	Fourth	Third	First
ABBOTTABAD	21.49	4.03	7.54	20.56	First	Fourth	Third	Second
SHUJABAD	18.03	8.66	2.02	30.38	Second	Third	Fourth	First
SWABI	23.63	2.02	5.39	14.21	First	Fourth	Third	Second
MURIDKE	20.61	10.40	13.45	24.98	Second	Fourth	Third	First

Table4.2: Download User Data Throughput Technology Auto Detect Mode [Fixed Duration]  $\geq$  3Mbps

DOWNLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED SIZE)								
City	Download User Data Throughput [Mbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	7.00	4.50	10.29	9.07	Third	Fourth	First	Second
LARKANA	11.83	5.52	6.05	11.28	First	Fourth	Third	Second
LAHORE	10.40	7.47	10.28	14.39	Second	Fourth	Third	First
KHAIRPUR	9.14	8.73	6.62	11.90	Second	Third	Fourth	First
KAHROR PACCA	10.70	9.19	5.73	13.00	Second	Third	Fourth	First
SHAHKOT	12.78	6.46	11.27	10.13	First	Fourth	Second	Third
GUJAR KHAN	13.40	3.83	7.58	12.08	First	Fourth	Third	Second
WAH/ TAXILA	11.13	3.51	8.73	10.76	First	Fourth	Third	Second
RAWALPINDI	13.17	4.89	7.60	11.45	First	Fourth	Third	Second
BUNER	11.67	3.25	4.70	8.43	First	Fourth	Third	Second
JACOBABAD	13.22	7.57	7.64	11.59	First	Fourth	Third	Second
SUJAWAL	15.45	3.45	14.53	13.85	First	Fourth	Second	Third
MITHI	13.57	5.30	8.31	10.95	First	Fourth	Third	Second
ABBOTTABAD	10.9	4.9	6.7	10.5	First	Fourth	Third	Second
SHUJABAD	10.8	7.0	3.4	14.9	Second	Third	Fourth	First
SWABI	11.6	3.6	5.4	8.5	First	Fourth	Third	Second
MURIDKE	10.5	7.3	8.9	12.4	Second	Fourth	Third	First

Table4.3: Download User Data Throughput Technology Auto Detect Mode [Fixed Size]  $\geq$  3Mbps

4.3. **UPLOAD USER DATA THROUGHPUT.** As per Cellular Mobile Network Quality of Service (QoS) Regulations 2021, licensees are required to meet the threshold of minimum of 786Kbps of 4G/LTE & 128Kbps of 3G of Upload User Data Throughput. The results of Data Service QoS KPI i.e. Upload User Data Throughput is shown in (i). **Table 4.4: Upload User Data Throughput Technology Auto Detect Mode [Fixed Duration]  $\geq$  768Kbps**, (ii). **Table 4.5: Upload User Data Throughput Technology Auto Detect Mode [Fixed Size]  $\geq$  768Kbps**,

UPLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED DURATION)								
City	Upload User Data Throughput [Kbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	9507.45	3170.27	17244.33	13612.93	Third	Fourth	First	Second
LARKANA	24512.48	4702.53	20062.1	23229.12	First	Fourth	Third	Second
LAHORE	23461.84	8847.7	20101.42	22446.8	First	Fourth	Third	Second
KHAIRPUR	24993.93	6974.67	17714.76	23106.16	First	Fourth	Third	Second
KAHROR PACCA	30147.08	5254.37	12927.14	19185.98	First	Fourth	Third	Second
SHAHKOT	28517.78	4735.65	19663.35	24699.69	First	Fourth	Third	Second
GUJAR KHAN	29127.13	6331.51	20642.18	18486.91	First	Fourth	Second	Third
WAH/ TAXILA	20938.3	6911.5	21533.72	18357.29	Second	Fourth	First	Third
RAWALPINDI	23112.06	6676.87	18659.59	19165.98	First	Fourth	Third	Second

UPLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED DURATION)								
City	Upload User Data Throughput [Kbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
BUNER	12076.96	6402.05	11474.17	14910.37	Second	Fourth	Third	First
JACOBABAD	21392.15	5395.46	20752.6	24100.5	Second	Fourth	Third	First
SUJAWAL	30264.2	8667.95	24412.42	26721.56	First	Fourth	Third	Second
MITHI	27408.96	5363.88	21042.25	14055.58	First	Fourth	Second	Third
ABBOTTABAD	24644.38	5952.18	16826.93	16966.41	First	Fourth	Third	Second
SHUJABAD	18676.77	4130.71	10026.45	20404.5	Second	Fourth	Third	First
SWABI	16598.01	4779.99	15172.14	17896.14	Second	Fourth	Third	First
MURIDKE	27363.76	8960.83	19725.39	23908.06	First	Fourth	Third	Second

Table 4.4: Upload User Data Throughput Technology Auto Detect Mode [Fixed Duration]  $\geq 768$ Kbps

UPLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED SIZE)								
City	Upload User Data Throughput [Kbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	4927.35	3068.89	5575.65	5381.32	Third	Fourth	First	Second
LARKANA	6606.51	4256.48	7313.52	6148.18	Second	Fourth	First	Third
LAHORE	7698.76	5448.96	7130.36	6750.15	First	Fourth	Second	Third
KHAIRPUR	6051.87	5106.27	6749.1	6724.66	Third	Fourth	First	Second
KAHROR PACCA	7344.14	3887.46	5608.74	5704.35	First	Fourth	Third	Second
SHAHKOT	8255.79	3669.27	7264.38	7217.23	First	Fourth	Second	Third
GUJAR KHAN	8416.55	4617.48	7797.97	6288.04	First	Fourth	Second	Third
WAH/TAXILA	6595.94	4806.2	6713.08	7549.82	Third	Fourth	Second	First
RAWALPINDI	7460.44	4827.62	7021.3	8039.07	Second	Fourth	Third	First
BUNER	6027.38	4254.6	5553.95	5629.37	First	Fourth	Third	Second
JACOBABAD	6513.63	3991.51	6460.68	6941.84	Second	Fourth	Third	First
SUJAWAL	8739.95	5786.09	7771.44	7785.5	First	Fourth	Third	Second
MITHI	7910.93	3836.52	7066.35	5297.96	First	Fourth	Second	Third
ABBOTTABAD	6948.94	4392.97	6117.5	7318.75	Second	Fourth	Third	First
SHUJABAD	6214.58	3394.36	5405.01	5699.26	First	Fourth	Third	Second
SWABI	5912.57	3846.93	5942.12	6338.53	Third	Fourth	Second	First
MURIDKE	6260.61	5286.31	6539.18	6778.73	Third	Fourth	Second	First

Table 4.5: Upload User Data Throughput Technology Auto Detect Mode [Fixed Size]  $\geq 768$ Kbps

4.4. **WEBPAGE LOADING TIME.** As per Cellular Mobile Network Quality of Service (QoS) Regulations 2021, licensees are required to meet Webpage Loading Time threshold of 5 Seconds. The results of Webpage Loading Time are shown in **Table 4.6: Webpage Loading Time < 5 Seconds.**

WEBPAGE LOADING TIME IN TECHNOLOGY AUTO DETECT MODE								
City	Webpage Loading Time [seconds]				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	3.60	3.59	3.78	3.05	Yes	Yes	Yes	Yes
LARKANA	2.42	2.98	3.37	2.82	Yes	Yes	Yes	Yes
LAHORE	2.84	2.72	3.02	2.41	Yes	Yes	Yes	Yes
KHAIRPUR	2.50	2.70	3.20	2.70	Yes	Yes	Yes	Yes
KAHROR PACCA	2.57	3.58	3.73	2.61	Yes	Yes	Yes	Yes
SHAHKOT	2.41	3.01	2.31	2.17	Yes	Yes	Yes	Yes
GUJAR KHAN	3.12	3.03	3.28	2.92	Yes	Yes	Yes	Yes

WEBPAGE LOADING TIME IN TECHNOLOGY AUTO DETECT MODE								
City	Webpage Loading Time [seconds]				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
WAH/ TAXILA	3.05	3.34	2.72	3.05	Yes	Yes	Yes	Yes
RAWALPINDI	2.87	2.90	2.89	2.91	Yes	Yes	Yes	Yes
BUNER	2.78	3.02	2.73	2.69	Yes	Yes	Yes	Yes
JACOBABAD	2.40	2.80	3.40	2.40	Yes	Yes	Yes	Yes
SUJAWAL	2.07	2.65	3.02	2.29	Yes	Yes	Yes	Yes
MITHI	2.01	2.90	3.05	2.61	Yes	Yes	Yes	Yes
ABBOTTABAD	2.79	2.71	2.56	3.01	Yes	Yes	Yes	Yes
SHUJABAD	2.95	2.98	3.04	2.90	Yes	Yes	Yes	Yes
SWABI	2.87	2.68	3.31	3.18	Yes	Yes	Yes	Yes
MURIDKE	3.09	2.60	2.65	2.15	Yes	Yes	Yes	Yes

Table 4.6: Webpage Loading Time < 5 Seconds

4.5. **LATENCY.** As per Cellular Mobile Network Quality of Service (QoS) Regulations 2021, licensees are required to meet threshold of 75 milliseconds of 4G/LTE Technology & 150 milliseconds of 3G Technology of Latency. The results of QoS KPI Latency are shown in. **Table 4.7: Latency in Technology Auto Detect Mode < 75 milliseconds.**

LATENCY IN TECHNOLOGY AUTO DETECT MODE								
City	Latency [milliseconds]				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	182	96	90	127	No	No	No	No
LARKANA	68	70	43	57	Yes	Yes	Yes	Yes
LAHORE	63	52	55	47	Yes	Yes	Yes	Yes
KHAIRPUR	72	54	64	55	Yes	Yes	Yes	Yes
KAHROR PACCA	66	79	45	62	Yes	No	Yes	Yes
SHAHKOT	65	60	56	55	Yes	Yes	Yes	Yes
GUJAR KHAN	163	61	52	131	No	Yes	Yes	No
WAH/ TAXILA	101	68	52	88	No	Yes	Yes	No
RAWALPINDI	81	71	58	116	No	Yes	Yes	No
BUNER	219	69	116	108	No	Yes	No	No
JACOBABAD	96	51	56	50	No	Yes	Yes	Yes
SUJAWAL	44	38	31	47	Yes	Yes	Yes	Yes
MITHI	45	69	51	60	Yes	Yes	Yes	Yes
ABBOTTABAD	100	55	67	111	No	Yes	Yes	No
SHUJABAD	97	188	54	58	No	No	Yes	Yes
SWABI	154	66	91	104	No	Yes	No	No
MURIDKE	135	52	55	46	No	Yes	Yes	Yes

Table 4.7: Latency in Technology Auto Detect Mode < 75 milliseconds

4.6. **OOKLA SPEED TEST.** In addition, Ookla Speed Test was also carried out to measure Download and Upload User Data Throughput and Round-Trip Time/Latency. The Number of Tests, Upload and Download User Data Throughput and Latency detail is mentioned in **Table 4.8: Ookla Tests Statistics**. Whereas the City wise results of Ookla Download Throughout, Upload Throughput and Latency are shown in (i). **Table 4.9: Ookla Download Throughput in Technology Auto Detect Mode**, (ii). **Table 4.10: Ookla Upload Throughput in Technology Auto Detect Mode**, (iii) **Table 4.11 Ookla Latency in Technology Auto Detect Mode < 75 Milliseconds.**

DESCRIPTION			JAZZ	TELENOR	UFONE	ZONG	
Ookla Tests	THROUGHPUT TEST	DOWNLOAD	ATTEMPTS	8309	8284	8308	8295
			SPEED (Mbps)	28.361	4.916	11.909	23.291
	PING TEST	UPLOAD	ATTEMPTS	8309	8284	8308	8295
			SPEED (Mbps)	21.793	5.827	20.066	20.24
		ATTEMPTS	8309	8284	8308	8295	
		LATENCY (msec)	34.3	43.3	42	52.5	

Table 4.8: Ookla Tests Statistics

OOKLA DOWNLOAD THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE								
Cities	Download Throughput (Mbps)				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	10.86	3.16	11.36	17.84	Third	Fourth	Second	First
LARKANA	30.20	7.20	8.90	20.00	First	Fourth	Third	Second
LAHORE	23.15	10.88	16.15	32.24	Second	Fourth	Third	First
KHAIRPUR	24.49	15.50	8.86	32.00	Second	Third	Fourth	First
SHAHKOT	30.09	10.52	21.96	23.18	First	Fourth	Third	Second
GUJAR KHAN	32.95	<b>2.13</b>	9.83	17.98	First	<b>Fourth</b>	Third	Second
WAH/ TAXILA	29.45	<b>2.21</b>	17.33	21.65	First	<b>Fourth</b>	Third	Second
RAWALPINDI	33.39	3.96	9.43	17.54	First	Fourth	Third	Second
BUNER	40.78	<b>2.42</b>	5.47	22.75	First	<b>Fourth</b>	Third	Second
JACOBABAD	33.4	12.3	11.06	33.1	First	Third	Fourth	Second
SUJAWAL	48.46	4.29	19.02	40.88	First	Fourth	Third	Second
MITHI	46.04	3.72	13.64	18.93	First	Fourth	Third	Second
ABBOTTABAD	14.56	3.39	6.59	16.77	Second	Fourth	Third	First
SWABI	31.27	<b>1.89</b>	7.18	19.92	First	<b>Fourth</b>	Third	Second
MURIDKE	11.11	22.31	14.93	31.33	Fourth	Second	Third	First

Table 4.9: Ookla Download Throughput in Technology Auto Detect Mode

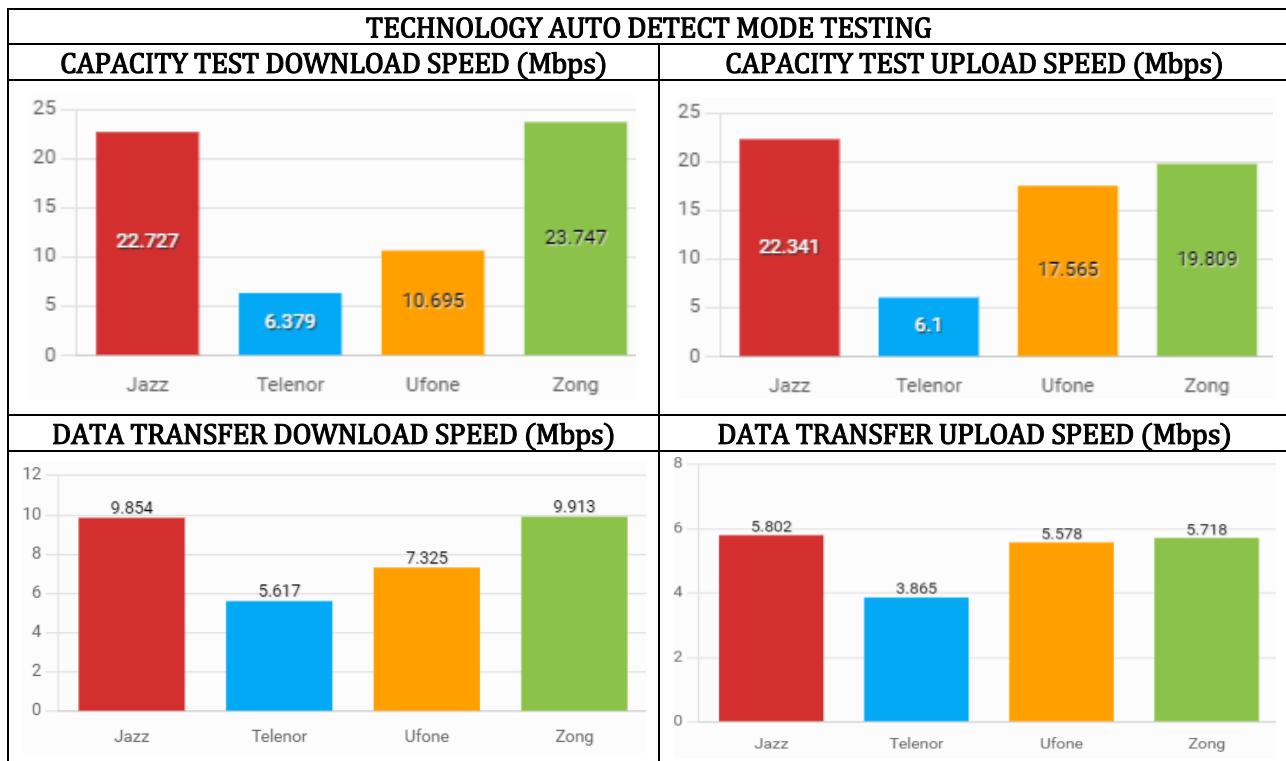
OOKLA UPLOAD THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE								
Cities	Upload Throughput (Kbps)				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	11065	3282	19139	14674	Third	Fourth	First	Second
LARKANA	3925	<b>600</b>	2875	2688	First	<b>Fourth</b>	Second	Third
LAHORE	25093	9296	24083	22899	First	Fourth	Second	Third
KHAIRPUR	3300	<b>713</b>	2325	3675	Second	<b>Fourth</b>	Third	First
SHAHKOT	33617	5476	24671	30238	First	Fourth	Third	Second
GUJAR KHAN	30928	5316	22251	13600	First	Fourth	Second	Third
WAH/ TAXILA	22982	6303	23838	18667	Second	Fourth	First	Third
RAWALPINDI	21782	5885	17791	13816	First	Fourth	Second	Third
BUNER	13262	7324	16522	13043	Second	Fourth	First	Third
JACOBABAD	2725	<b>600</b>	2738	4475	Third	<b>Fourth</b>	Second	First
SUJAWAL	25136	8283	14910	32259	Second	Fourth	Third	First
MITHI	15552	5947	25324	9073	Second	Fourth	First	Third
ABBOTTABAD	15691	4040	11510	15064	First	Fourth	Third	Second
SWABI	21012	4590	18413	23622	Second	Fourth	Third	First
MURIDKE	9286	31008	24276	30220	Fourth	First	Third	Second

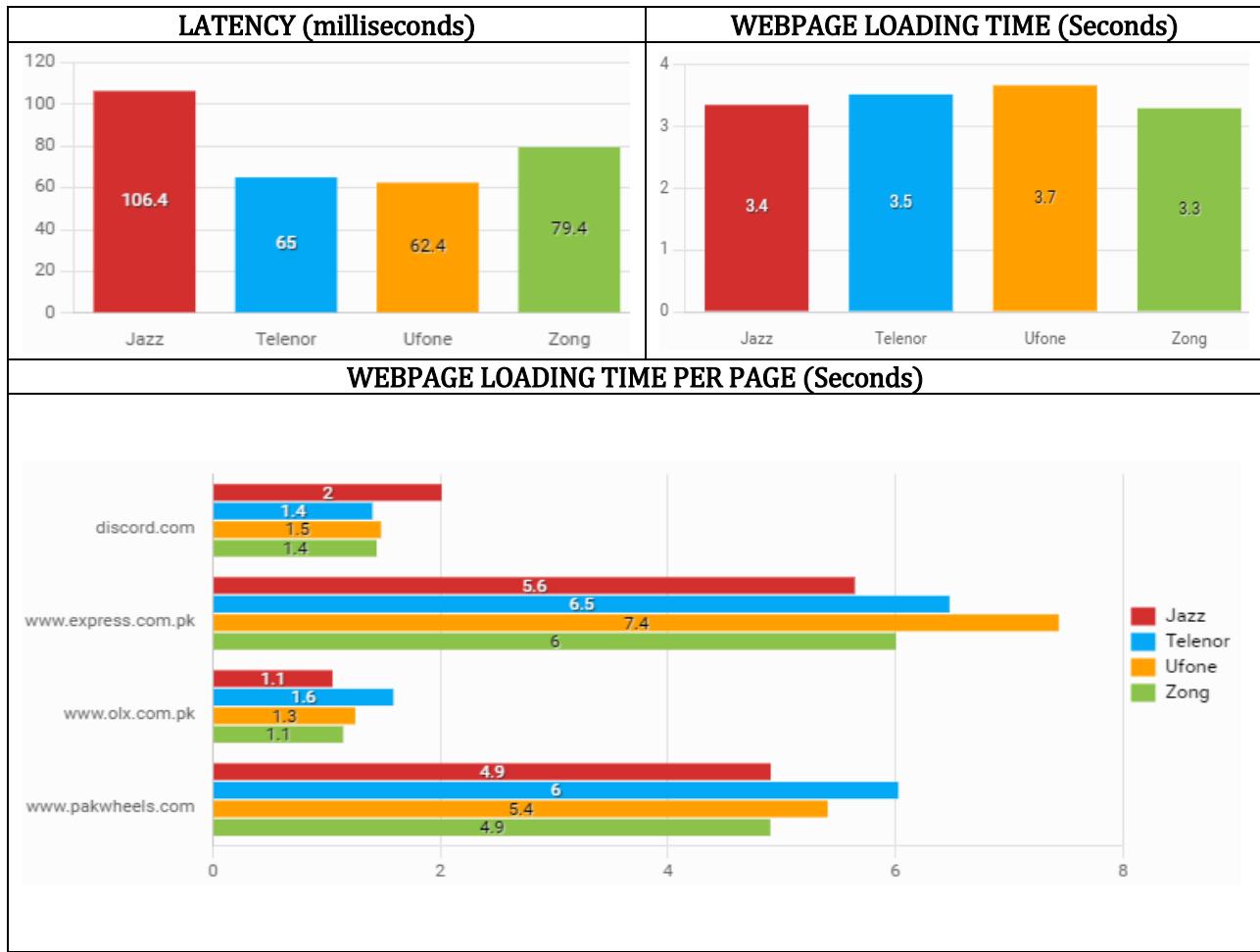
Table 4.10: Ookla Upload Throughput in Technology Auto Detect Mode

OOKLA LATENCY IN TECHNOLOGY AUTO DETECT MODE								
City	Latency [milliseconds]				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
UPPER DIR	42	55	74	90	Yes	Yes	Yes	No
LARKANA	26	51	34	32	Yes	Yes	Yes	Yes
LAHORE	33	20	36	18	Yes	Yes	Yes	Yes
KHAIRPUR	25	57	33	30	Yes	Yes	Yes	Yes
SHAHKOT	20	25	39	33	Yes	Yes	Yes	Yes
GUJAR KHAN	20	44	23	71	Yes	Yes	Yes	Yes
WAH/TAXILA	21	33	22	32	Yes	Yes	Yes	Yes
RAWALPINDI	21	30	27	46	Yes	Yes	Yes	Yes
BUNER	67	43	41	81	Yes	Yes	Yes	No
JACOBABAD	35	39	41	34	Yes	Yes	Yes	Yes
SUJAWAL	24	26	25	24	Yes	Yes	Yes	Yes
MITHI	26	36	29	34	Yes	Yes	Yes	Yes
ABBOTTABAD	37	74	54	84	Yes	Yes	Yes	No
SWABI	32	56	48	39	Yes	Yes	Yes	Yes
MURIDKE	21	56	40	19	Yes	Yes	Yes	Yes

Table 4.11: Ookla Latency in Technology Auto Detect Mode < 75 Milliseconds

4.6. Overall results of Download and Upload Throughputs in Capacity Tests, Data Transfer Tests, Latency (overall) and Latency (Per Web Page), can be seen in attached graphs.





## VOICE SERVICE

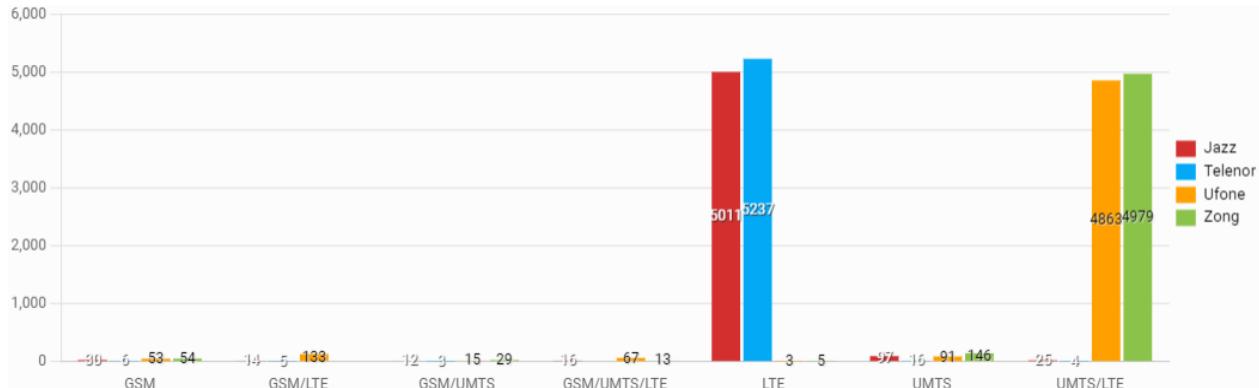
5.1. A total of **20,929** Call attempts were made and out of which **485** were failed attempts. In **20,444** successful call attempts, **184** calls dropped prior to completion of two minutes duration, whereas, **20,260** calls remained connected for the complete duration of two minutes. The company wise call statistics is shown in **Table 5.1: Call Statistics**.

DESCRIPTION	JAZZ	TELENOR	UFONE	ZONG
TOTAL CALLS ATTEMPTS	5205	5273	5225	5226
FAILED CALLS ATTEMPTS	85	170	78	152
ESTABLISHED CALLS ATTEMPTS	5120	5103	5147	5074
DROPPED CALLS ATTEMPTS	45	37	66	36
COMPLETED CALLS ATTEMPTS	5075	5066	5081	5038
CALL SETUP SUCCESS RATE (%)	98.37	96.78	98.51	97.09
CALL SETUP TIME (Sec)	5.59 s	8.85 s	6.54 s	6.76 s
CALL COMPLETION RATE (%)	99.34	91.3	98.09	97.77
ISHO SUCCESS RATE (%)	100	-	100	-
RAB SETUP SUCCESS RATE (%)	100	100	99.96	100
MEAN OPINION SCORE	3.77	3.82	3.46	3.52
MEAN OPINION SCORE EXCESS RATIO - MOS <1.6 (%)	4	2.55	2.04	2.47
TOTAL SPEECH TEST	51382	51253	51706	51181

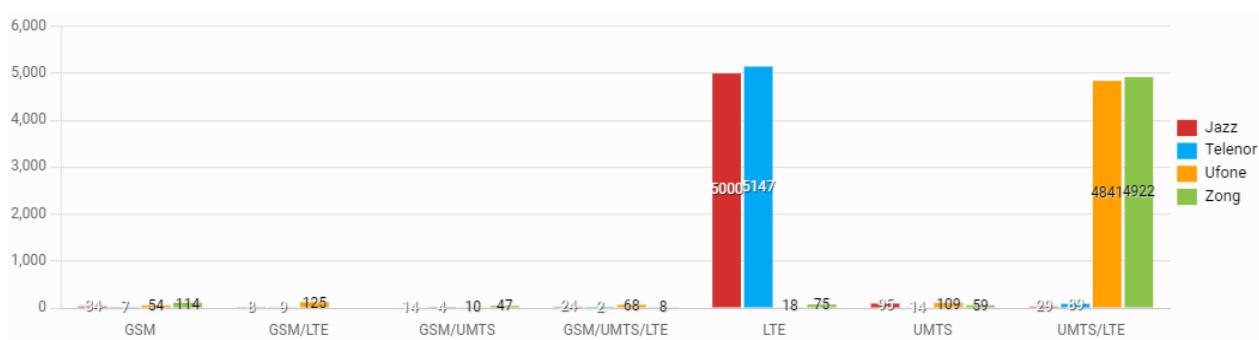
Table 5.1: Call Statistics

5.2. The overall Call Setup Success Rate and Call retainability along with Mean Opinion Score (MOS), the percentage of mute calls and MOS with respect to Voice CODEC is shown as under:

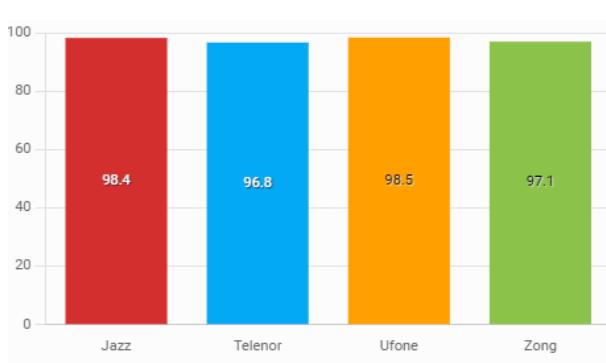
### TECHNOLOGY WISE DISTRIBUTION OF CALLS – A PARTY



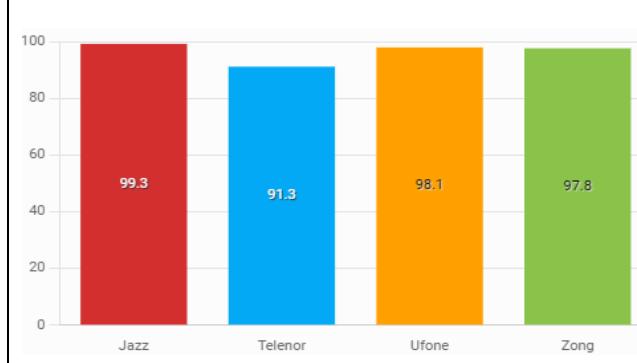
### TECHNOLOGY WISE DISTRIBUTION OF CALLS – B PARTY



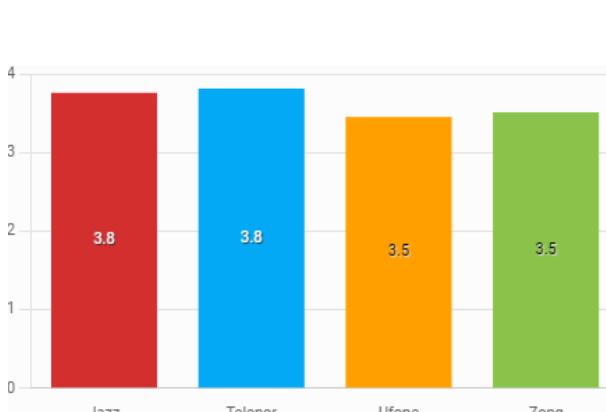
### CALL SETUP SUCCESS RATE



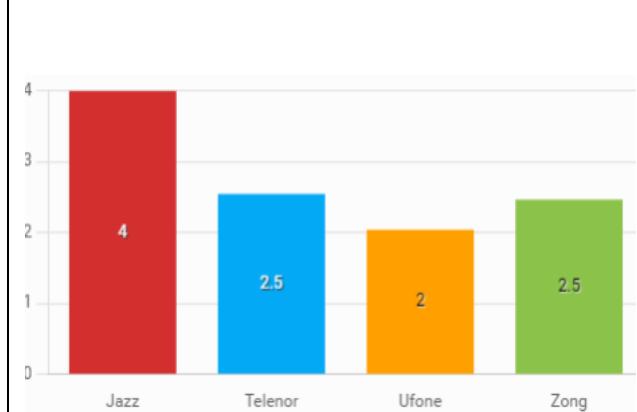
### CALL RETAINABILITY

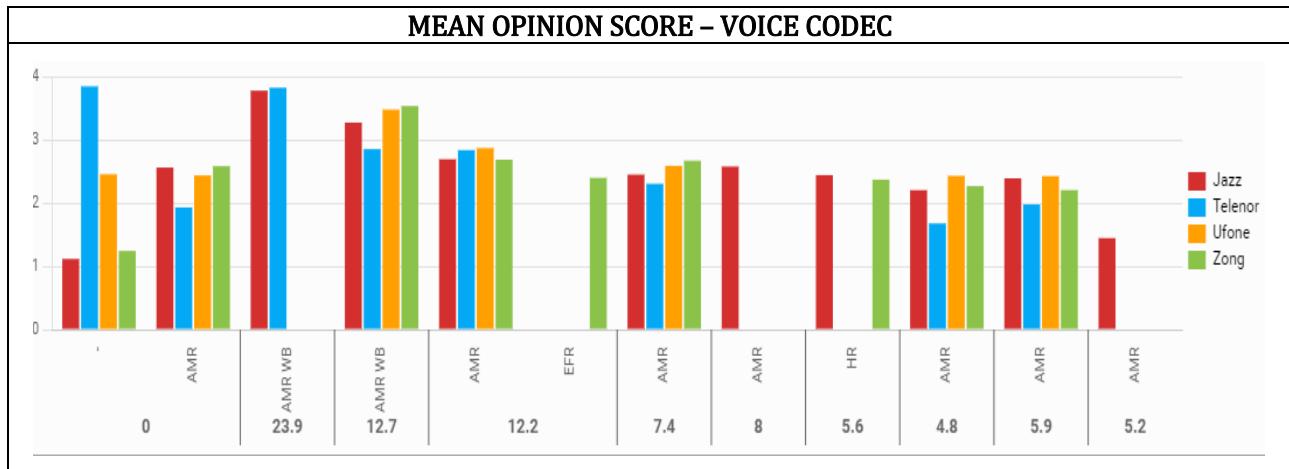


### MEAN OPINION SCORE - AVERAGE



### MEAN OPINION SCORE < 1.6 (PERCENTAGE)





5.3. The 7 x QoS KPIs (*i.e.* Network Accessibility, Call Setup Success Rate, Call Setup Time, Call Completion Rate, Mean Opinion Score, Inter System Handover Success Rate & RAB Setup Success Rate) have been measured while testing voice services in **17 x surveyed cities** of Pakistan. The compliance level of threshold values of voice QoS KPIs is shown in each **Table 5.2: Voice QoS KPIs Compliance Level**, **Table 5.3: Voice QoS KPIs Compliance Level** and **Table 5.4: Voice QoS KPIs Compliance Level**.

CMO	KPIs	Threshold	Upper Dir	Larkana	Lahore	Khairpur	Kahror Pacca	Shahkot
Jazz	NA	≥ 99%	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	≥ 98%	No	Yes	Yes	Yes	No	Yes
	CCT	≤ 7.5 sec	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	> 98%	No	Yes	Yes	Yes	Yes	Yes
	MOS	≥ 3	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	≥ 98%	Yes	Yes	Yes	Yes	Yes	Yes
	RSSR	> 98%	Yes	Yes	Yes	Yes	Yes	Yes
Telenor	NA	≥ 99%	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	≥ 98%	Yes	No	Yes	Yes	No	Yes
	CCT	≤ 7.5 sec	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	> 98%	Yes	Yes	Yes	Yes	No	Yes
	MOS	≥ 3	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	≥ 98%	Yes	Yes	Yes	Yes	Yes	Yes
	RSSR	> 98%	Yes	Yes	Yes	Yes	Yes	Yes
Ufone	NA	≥ 99%	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	≥ 98%	No	Yes	Yes	Yes	Yes	Yes
	CCT	≤ 7.5 sec	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	> 98%	Yes	Yes	Yes	No	Yes	No
	MOS	≥ 3	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	≥ 98%	Yes	Yes	Yes	Yes	Yes	Yes
	RSSR	> 98%	Yes	Yes	Yes	Yes	Yes	Yes
ZonG	NA	≥ 99%	No	Yes	Yes	Yes	Yes	Yes
	CSSR	≥ 98%	No	Yes	N/A	Yes	Yes	N/A
	CCT	≤ 7.5 sec	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	> 98%	No	Yes	N/A	Yes	Yes	N/A
	MOS	≥ 3	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	≥ 98%	Yes	Yes	Yes	Yes	Yes	Yes
	RSSR	> 98%	Yes	Yes	Yes	Yes	Yes	Yes

\*Note Voice QoS KPIs: Network Accessibility (NA) > 99%, Service Accessibility (SA)> 98%, Call Connection Time (CCT) ≤ 7.5 Seconds, Call Completion Ratio (CCR) ≥ 98%, Mean Opinion Score (MOS) > 3, Inter System Hand Over (ISHO) > 98% & RAB Setup Success Rate (RSSR) > 98%

Table 5.2: Voice QoS KPIs Compliance Level

<b>CMO</b>	<b>KPIs</b>	<b>THRESHOLD</b>	<b>GUJAR KHAN</b>	<b>WAH/TAXILA</b>	<b>RAWALPINDI</b>	<b>BUNER</b>	<b>JACOBABAD</b>	<b>SUJAWAL</b>
<b>Jazz</b>	NA	$\geq 99\%$	Yes	Yes	Yes	Yes	No	Yes
	CSSR	$\geq 98\%$	Yes	Yes	Yes	No	No	Yes
	CCT	$\leq 7.5 \text{ sec}$	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	$> 98\%$	Yes	Yes	Yes	No	Yes	Yes
	MOS	$\geq 3$	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	$\geq 98\%$	Yes	Yes	Yes	No	Yes	Yes
	RSSR	$> 98\%$	Yes	Yes	Yes	Yes	Yes	Yes
<b>Telenor</b>	NA	$\geq 99\%$	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes	Yes
	CCT	$\leq 7.5 \text{ sec}$	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	$> 98\%$	Yes	Yes	No	Yes	Yes	Yes
	MOS	$\geq 3$	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes	Yes
	RSSR	$> 98\%$	Yes	Yes	Yes	Yes	Yes	Yes
<b>Ufone</b>	NA	$\geq 99\%$	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	$\geq 98\%$	Yes	Yes	No	Yes	Yes	Yes
	CCT	$\leq 7.5 \text{ sec}$	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	$> 98\%$	Yes	No	Yes	Yes	Yes	Yes
	MOS	$\geq 3$	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes	Yes
	RSSR	$> 98\%$	Yes	Yes	Yes	Yes	Yes	Yes
<b>ZonG</b>	NA	$\geq 99\%$	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes	No
	CCT	$\leq 7.5 \text{ sec}$	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	$> 98\%$	Yes	Yes	Yes	Yes	Yes	Yes
	MOS	$\geq 3$	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes	Yes
	RSSR	$> 98\%$	Yes	Yes	Yes	Yes	Yes	Yes

Table 5.3: Voice QoS KPIs Compliance Level

<b>CMO</b>	<b>KPIs</b>	<b>THRESHOLD</b>	<b>ABBOTTABAD</b>	<b>SHUJABAD</b>	<b>SWABI</b>	<b>MURIDKE</b>	<b>MITHI</b>
<b>Jazz</b>	NA	$\geq 99\%$	Yes	Yes	Yes	Yes	Yes
	CSSR	$\geq 98\%$	Yes	<b>No</b>	Yes	Yes	Yes
	CCT	$\leq 7.5 \text{ sec}$	Yes	Yes	Yes	Yes	Yes
	CCR	$> 98\%$	Yes	Yes	Yes	Yes	Yes
	MOS	$\geq 3$	Yes	Yes	Yes	Yes	Yes
	ISHO	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes
	RSSR	$> 98\%$	Yes	Yes	Yes	Yes	Yes
<b>Telenor</b>	NA	$\geq 99\%$	Yes	Yes	Yes	Yes	Yes
	CSSR	$\geq 98\%$	<b>No</b>	<b>No</b>	Yes	Yes	Yes
	CCT	$\leq 7.5 \text{ sec}$	Yes	Yes	Yes	Yes	Yes
	CCR	$> 98\%$	Yes	Yes	Yes	Yes	Yes
	MOS	$\geq 3$	Yes	Yes	Yes	Yes	Yes
	ISHO	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes
	RSSR	$> 98\%$	Yes	Yes	Yes	Yes	Yes
<b>Ufone</b>	NA	$\geq 99\%$	Yes	Yes	Yes	Yes	Yes
	CSSR	$\geq 98\%$	Yes	<b>No</b>	Yes	Yes	Yes
	CCT	$\leq 7.5 \text{ sec}$	Yes	<b>No</b>	Yes	Yes	Yes
	CCR	$> 98\%$	<b>No</b>	Yes	Yes	Yes	Yes
	MOS	$\geq 3$	Yes	Yes	Yes	Yes	Yes
	ISHO	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes
	RSSR	$> 98\%$	Yes	Yes	Yes	Yes	Yes
<b>ZonG</b>	NA	$\geq 99\%$	Yes	Yes	Yes	Yes	Yes
	CSSR	$\geq 98\%$	Yes	Yes	Yes	<b>No</b>	Yes
	CCT	$\leq 7.5 \text{ sec}$	Yes	Yes	Yes	Yes	Yes
	CCR	$> 98\%$	Yes	Yes	Yes	Yes	Yes
	MOS	$\geq 3$	Yes	Yes	Yes	Yes	Yes
	ISHO	$\geq 98\%$	Yes	Yes	Yes	Yes	Yes
	RSSR	$> 98\%$	Yes	Yes	Yes	Yes	Yes

Table 5.4: Voice QoS KPIs Compliance Level

## SMS SERVICE

6.1. A total of **20878** SMS sending attempts were conducted, out of which **20751** SMS were **successfully transmitted** by A-Party while **20609** SMS were **successfully received** at B-Party. The company wise SMS Statistics are shown in **Table 6.1: SMS Statistics** while City wise compliance is shown in **Table 6.2: SMS QoS KPIs Compliance Level**

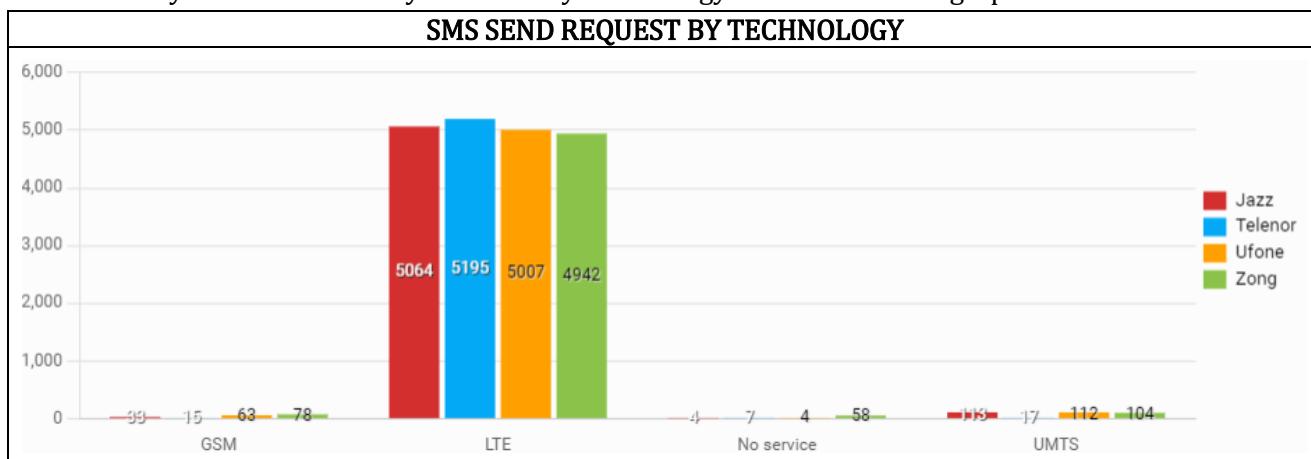
DESCRIPTION	JAZZ	TELENOR	UFONE	ZONG
SMS SEND REQUEST	5276	5234	5186	5182
SMS SUCCESSFULLY TRANSMITTED	5265	5215	5171	5100
SMS SUCCESSFULLY RECEIVED	5239	5168	5141	5061
SMS RECEIVE SUCCESS RATE (%)	99.3 %	98.74 %	99.13 %	97.66 %
END-TO-END DELIVERY TIME (Sec)	3.17	3.43	2.57	2.63

Table 6.1: SMS Statistics

Surveyed Cities	Operator	Jazz		Telenor		Ufone		ZonG	
	SMS KPI	Success Rate	Delivery Time						
UPPER DIR	No	Yes	No	Yes	No	Yes	No	Yes	Yes
LARKANA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAHORE	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
KHAIRPUR	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
KAHROR PACCA	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
SHAHKOT	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes
GUJAR KHAN	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
WAH/TAXILA	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
RAWALPINDI	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
BUNER	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
JACOBABAD	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SUJAWAL	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
MITHI	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes
ABBOTTABAD	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
SHUJABAD	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes
SWABI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MURIDKE	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes

Table 6.2: SMS QoS KPIs Compliance Level

6.2. The SMS Send Request & Successful Reception by Technology, Average Success Rate & End to End Delivery Time and Delivery Duration by Technology are shown in the graphs.





## SURVEY MAPS & GRAPHICAL RESULTS

7.1 The 4G/LTE (RSRP) and 3G (RSCP) Signal Strength samples recorded during drive test on survey routes, were plotted on maps. The Signal Strength maps along-with Voice, SMS and Data QoS KPIs survey results in graphical form are shown at **Annex-A (Coverage Maps)**, **Annex-B (Data QoS Results)** and **Annex-C (Voice & SMS Results)**.

## STANDING IN SURVEY

8.1. CMOs have been prioritized/ placed at 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> & 4<sup>th</sup> position in each category i.e. Mobile Network Coverage, Mobile Broadband Service and Voice Service based upon the compliance level against each QoS KPI in each category in 17 x surveyed cities of Punjab, KPK and Sindh.

- a. **MOBILE NETWORK COVERAGE.** The categorization of CMOs as per QoS KPI i.e. Signal Strength of 4G/LTE and 3G Networks measured in Technology Auto Detect Mode is shown in **Table 8.1: CMOs Standing in Mobile Network Coverage – Technology Auto Detect.**

S. #.	Operator	Compliance Level – Number of Cities Technology Auto Detect Mode						Standing	
		Compliant			Non-Compliant				
		4G	3G	Total	4G	3G	Total		
1.	Ufone	14	12	26	3	2	5	1 <sup>st</sup>	
2.	ZonG	15	4	19	2	2	4	2 <sup>nd</sup>	
4.	Jazz	14	1	15	3	2	5	3 <sup>rd</sup>	
3.	Telenor	10	9	19	7	3	10	4 <sup>th</sup>	

**Table 8.1: CMOs Standing in Mobile Network Coverage – Technology Auto Detect Mode**

**MOBILE BROADBAND SERVICE.** The categorization of each CMOs in Mobile Broadband Service is as under:

- i. User Download Data Throughput. The User Download Data Throughput in Fixed Duration and Fixed Size Testing, as per the highest to lowest obtained results, is shown in **Table 8.2: CMOs Standing in User Download Data Throughput – Technology Auto Detect Mode.**

S. #.	Operator	Highest Download Throughput – Number of Cities								Standing	
		Technology Auto Detect Mode									
		Fixed Duration				Fixed Size					
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>		
1.	ZonG	8	9	-	-	5	10	2	-	1 <sup>st</sup> 2 <sup>nd</sup>	
2.	Jazz	8	8	1	-	11	5	1	-	2 <sup>nd</sup> 1 <sup>st</sup>	
3.	Ufone	1	-	12	4	1	2	11	3	3 <sup>rd</sup> 3 <sup>rd</sup>	
4.	Telenor	-	-	4	13	-	-	3	14	4 <sup>th</sup> 4 <sup>th</sup>	

**Table 8.2: CMOs Standing in User Download Data Throughput- Technology Auto Detect Mode**

- ii. User Upload Data Throughput. The User Upload Data Throughput in Fixed Duration and Fixed Size Testing, as per the highest to lowest obtained results, is shown in **Table 8.3: CMOs Standing in User Upload Data Throughput – Technology Auto Detect Mode**

S. #.	Operator	Highest Upload Throughput – Number of Cities								Standing	
		Technology Auto Detect Mode									
		Fixed Duration				Fixed Size					
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>		
1.	Jazz	11	5	1	-	8	4	5	-	1 <sup>st</sup> 1 <sup>st</sup>	
2.	ZonG	4	10	3	-	6	6	5	-	2 <sup>nd</sup> 2 <sup>nd</sup>	
3.	Ufone	2	2	13	-	3	7	7	-	3 <sup>rd</sup> 3 <sup>rd</sup>	
4.	Telenor	-	-	-	17	-	-	-	17	4 <sup>th</sup> 4 <sup>th</sup>	

**Table 8.3: CMOs Standing in User Upload Data Throughput – Technology Auto Detect Mode**

- iii. **Webpage Loading Time**. The categorization of each CMOs, as per the maximum compliant of Webpage Loading Time QoS KPIs is shown, is shown in **Table 8.4: CMOs Standing in Webpage Loading Time**.

S. #.	Operator	Webpage Loading Time - Number of Cities		Standing
		Compliant	Non-Compliant	
1.	Jazz	17	-	1 <sup>st</sup>
2.	ZonG	17	-	1 <sup>st</sup>
3.	Ufone	17	-	1 <sup>st</sup>
4.	Telenor	17	-	1 <sup>st</sup>

**Table 8.4: CMOs Standing in Webpage Loading Time**

- iv. **Latency**. The categorization of each CMOs, as per the maximum compliant of Webpage Loading Time QoS KPIs is shown in **Table 8.5: CMOs Standing in Latency**.

S. #.	Operator	Latency - Number of Cities		Standing
		Compliant	Non-Compliant	
1.	Telenor	14	3	1 <sup>st</sup>
2.	Ufone	14	3	1 <sup>st</sup>
3.	ZonG	10	7	2 <sup>nd</sup>
4.	Jazz	7	10	3 <sup>rd</sup>

**Table 8.5: CMOs Standing in Latency**

- v. **Ookla**. The Ookla Throughput Testing Results for Download and Upload, as per the highest to lowest obtained results, are shown in (i) **Table 8.6: CMOs Standing in Ookla Download Throughput**. (ii) **Table 8.7: CMOs Standing in Ookla Upload Throughput**. (iii) **Table 8.8: CMOs Standing in Ookla Latency**.

S. #.	Operator	Ookla Download Throughput – Number of Cities				Standing
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
1.	Jazz	10	3	1	1	1 <sup>st</sup>
2.	ZonG	5	12	-	-	2 <sup>nd</sup>
3.	Ufone	-	1	12	2	3 <sup>rd</sup>
4.	Telenor	-	1	2	12	4 <sup>th</sup>

**Table 8.6: CMOs Standing in User Download Data Throughput– Technology Auto Detect Mode**

S. #.	Operator	Ookla Upload Throughput – Number of Cities				Standing
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
1.	Jazz	6	6	2	1	1 <sup>st</sup>
2.	Ufone	4	5	6	-	2 <sup>nd</sup>
3.	ZonG	4	4	7	-	3 <sup>rd</sup>
4.	Telenor	1	-	-	14	4 <sup>th</sup>

**Table 8.7: CMOs Standing in User Download Data Throughput– Technology Auto Detect Mode**

S. #.	Operator	Ookla Latency - Number of Cities		Standing
		Compliant	Non-Compliant	
1.	Telenor	15	0	1 <sup>st</sup>
2.	Ufone	15	0	1 <sup>st</sup>
3.	Jazz	15	0	1 <sup>st</sup>
4.	ZonG	12	3	2 <sup>nd</sup>

Table 8.8: CMOs Standing in Ookla Latency

- b. **VOICE SERVICE.** The categorization of each CMOs, as per the maximum compliant of Voice QoS KPIs is shown in **Table 8.9: CMOs Standing in Voice Service.**

S. #.	Operator	Voice QoS KPIs		Standing
		Compliant	Non-Compliant	
1.	ZonG	110	5	1 <sup>st</sup>
2.	Telenor	113	6	2 <sup>nd</sup>
3.	Ufone	111	8	3 <sup>rd</sup>
4.	Jazz	110	9	4 <sup>th</sup>

Table 8.9: CMOs Standing in Voice Service

- c. **OVERALL STANDING.** The overall standing of each CMOs in different category of services is mentioned in **Table 8.10: CMOs Overall Standing in QoS Survey.**

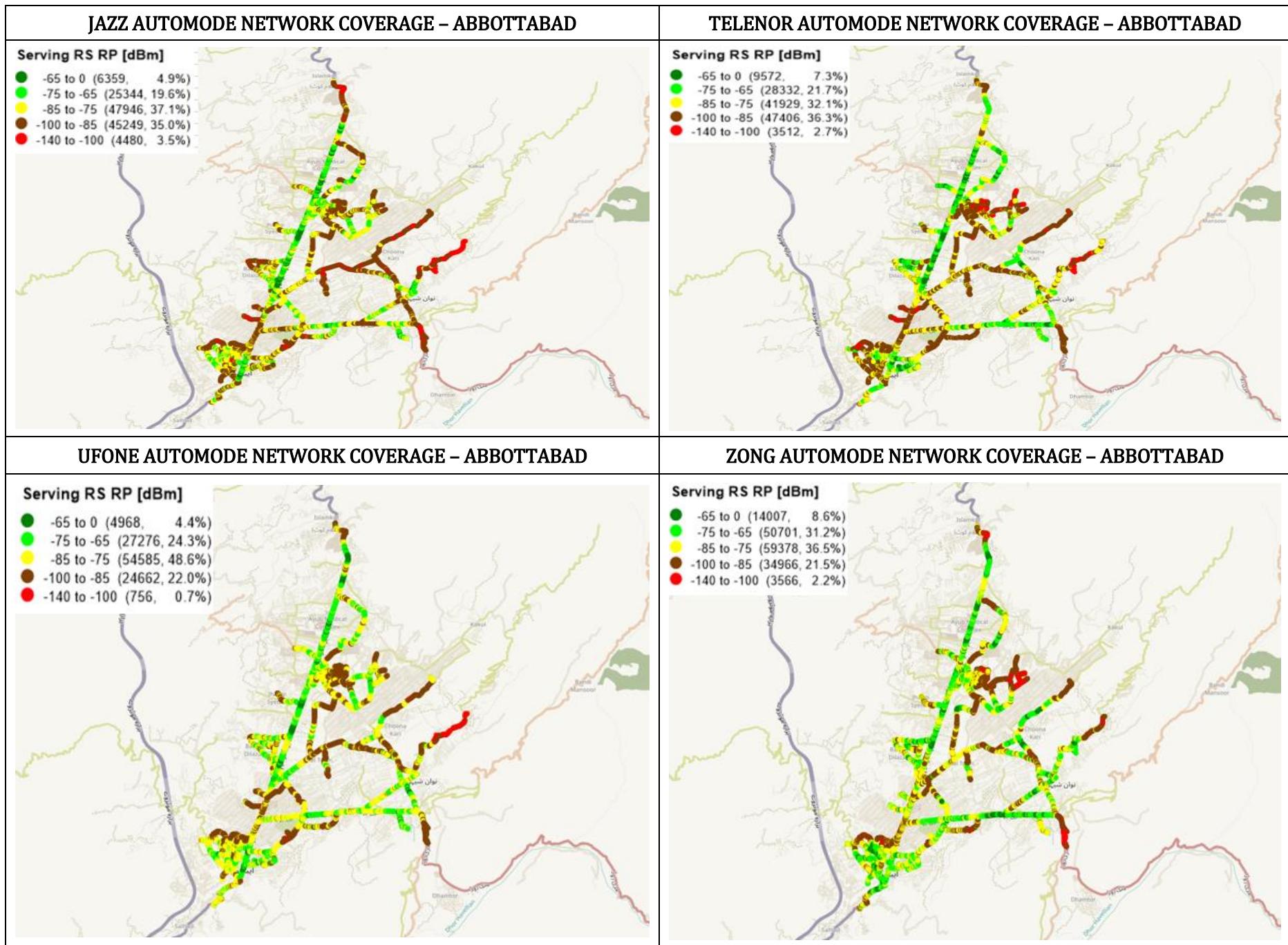
S. #.	Service	STANDING			
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
1.	Mobile Network Coverage	Ufone	ZonG	Jazz	Telenor
2.	Mobile Broadband	Fixed Duration	Download	ZonG	Jazz
			Upload	Jazz	ZonG
		Fixed Size	Download	Jazz	ZonG
			Upload	Jazz	ZonG
		Ookla	Download	Jazz	ZonG
			Upload	Jazz	Ufone
				Jazz	ZonG
				ZonG	Telenor
				Ufone	-
				Telenor	-
3.	Voice	ZonG	Telenor	Ufone	Jazz

Table 8.10: CMOs Overall Standing in QoS Survey

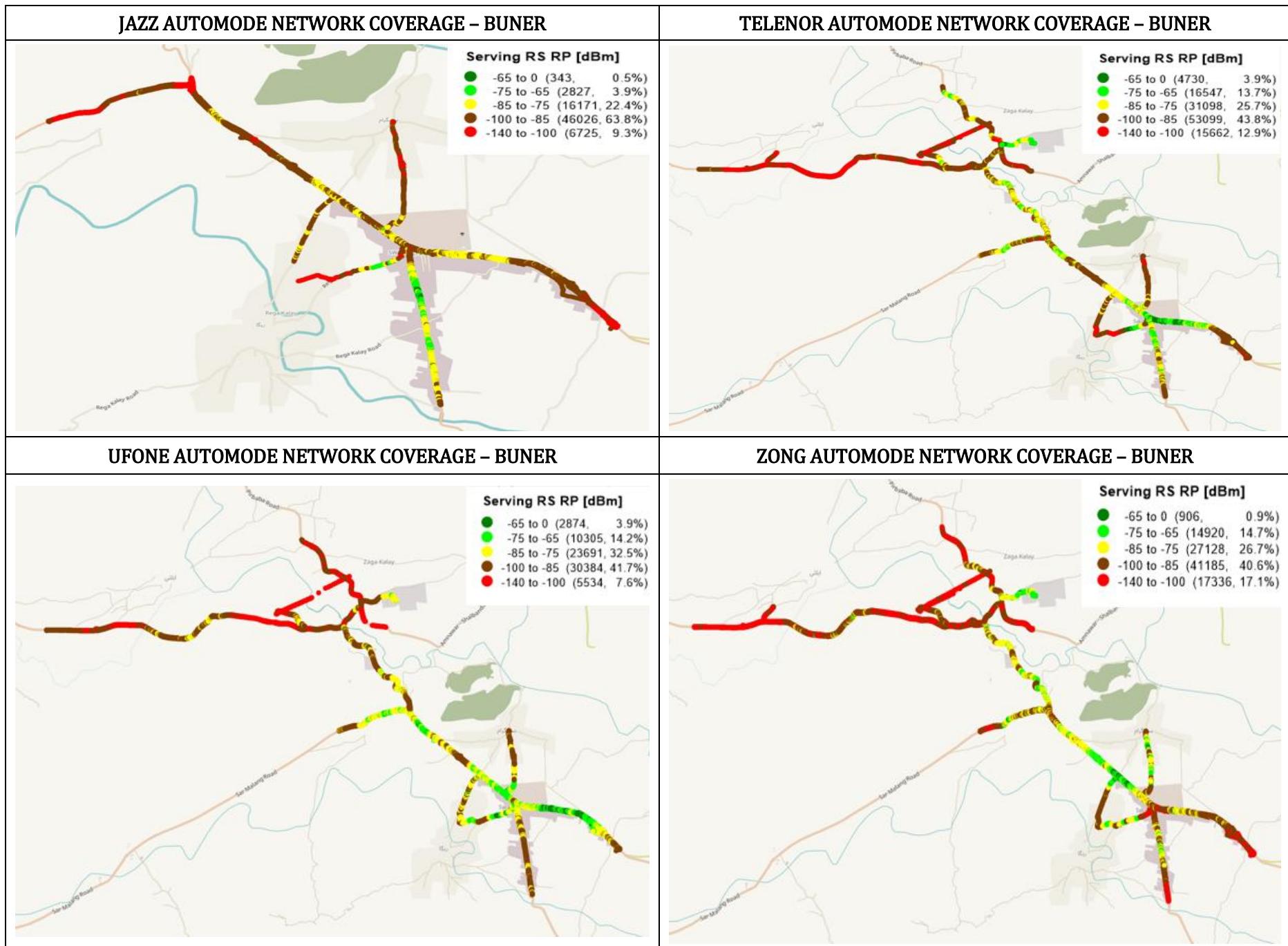
# Annex -A(Coverage Maps)

AUTOMODE

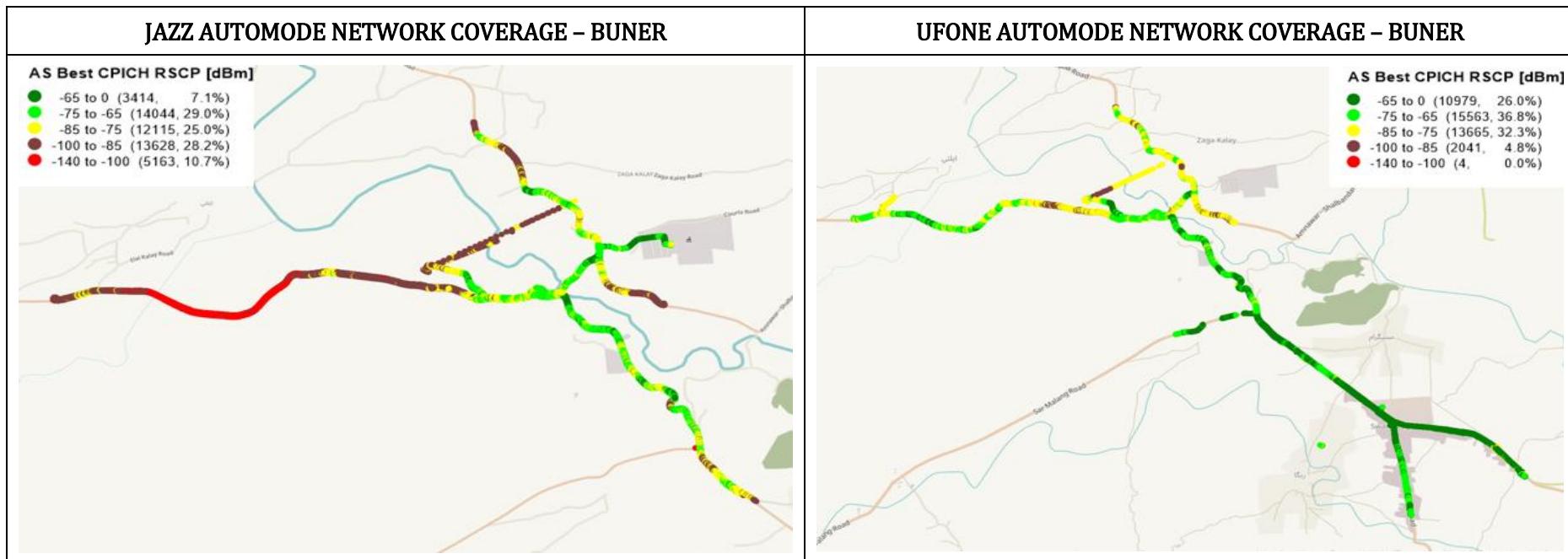
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



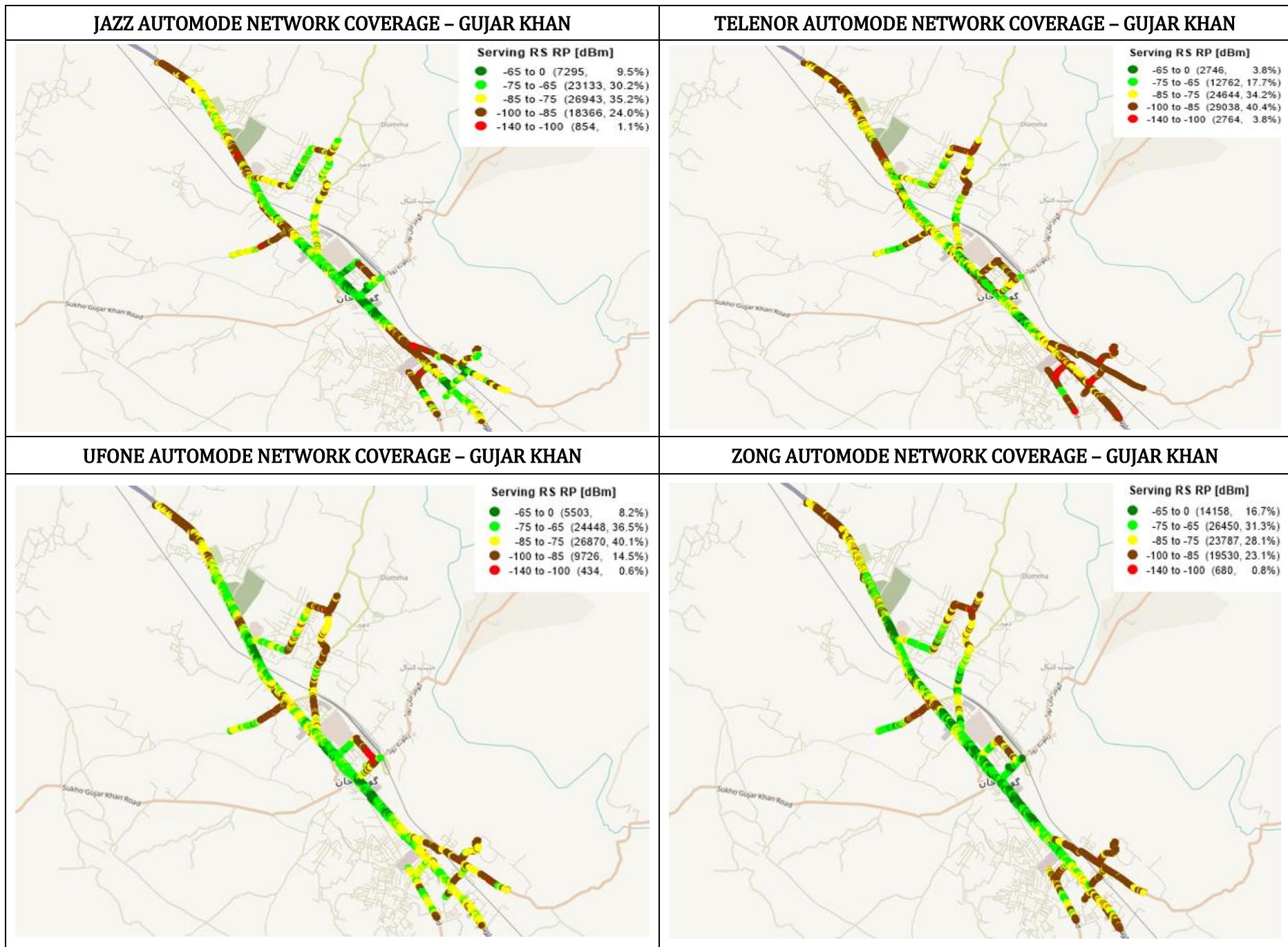
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



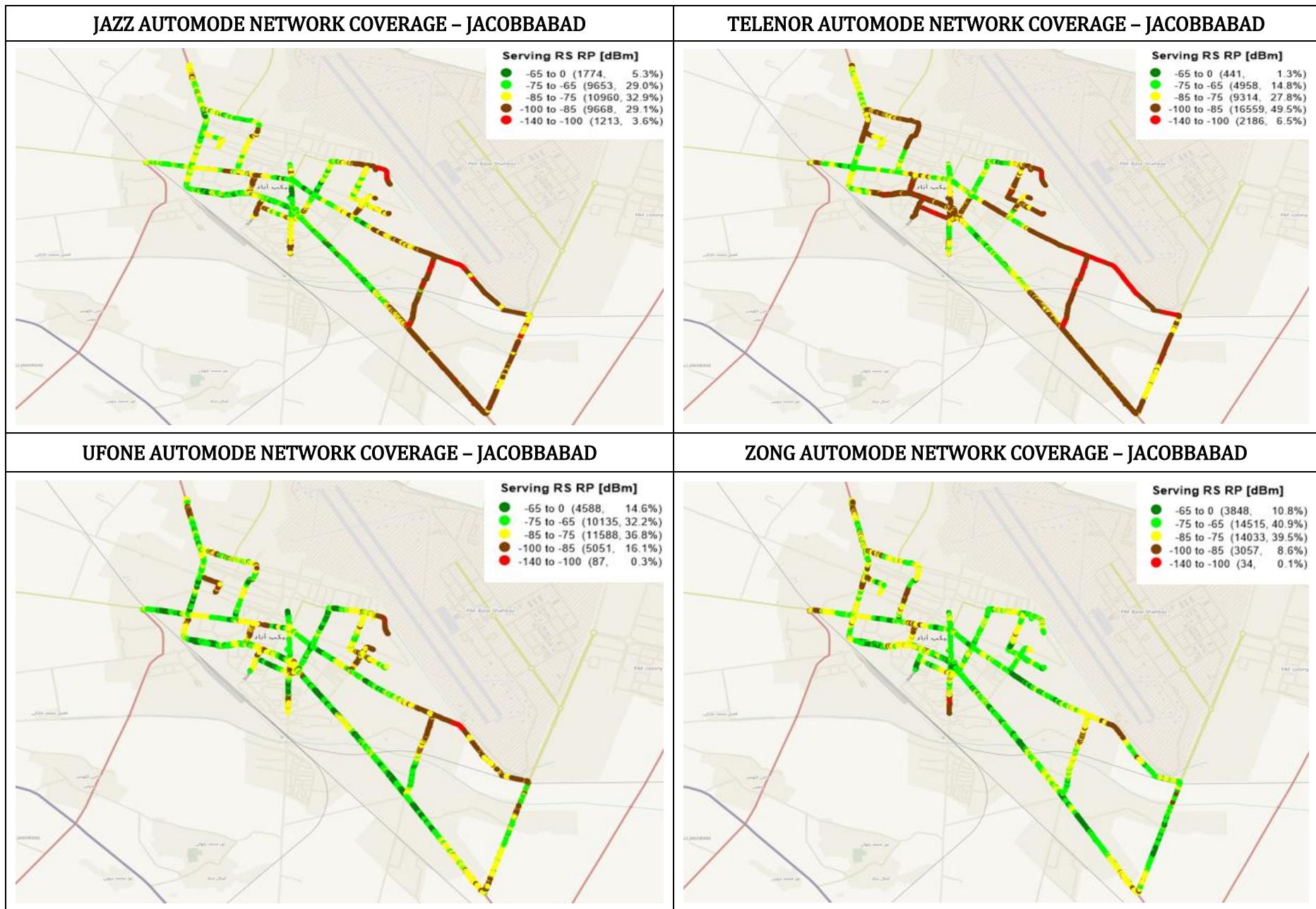
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)



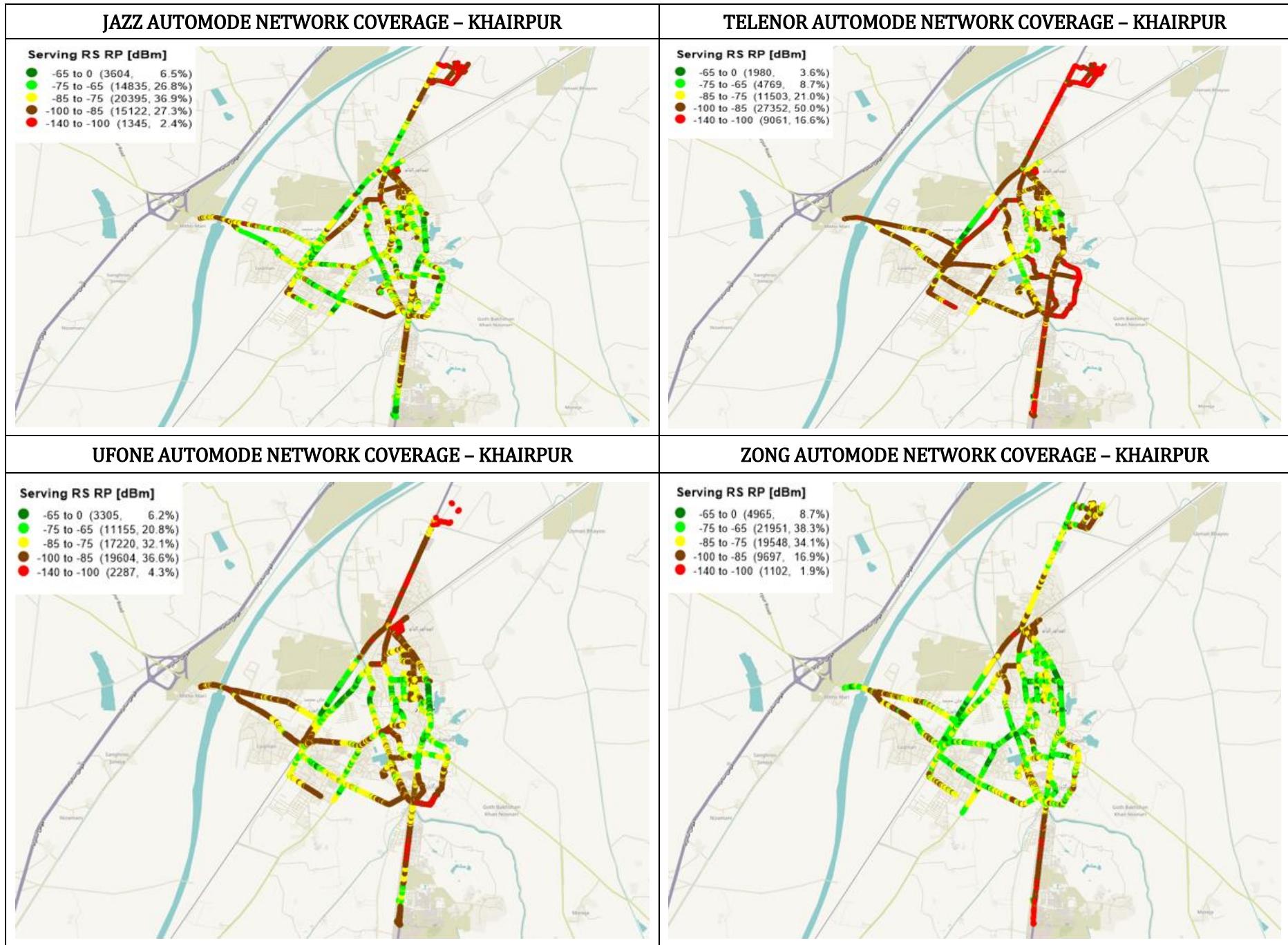
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



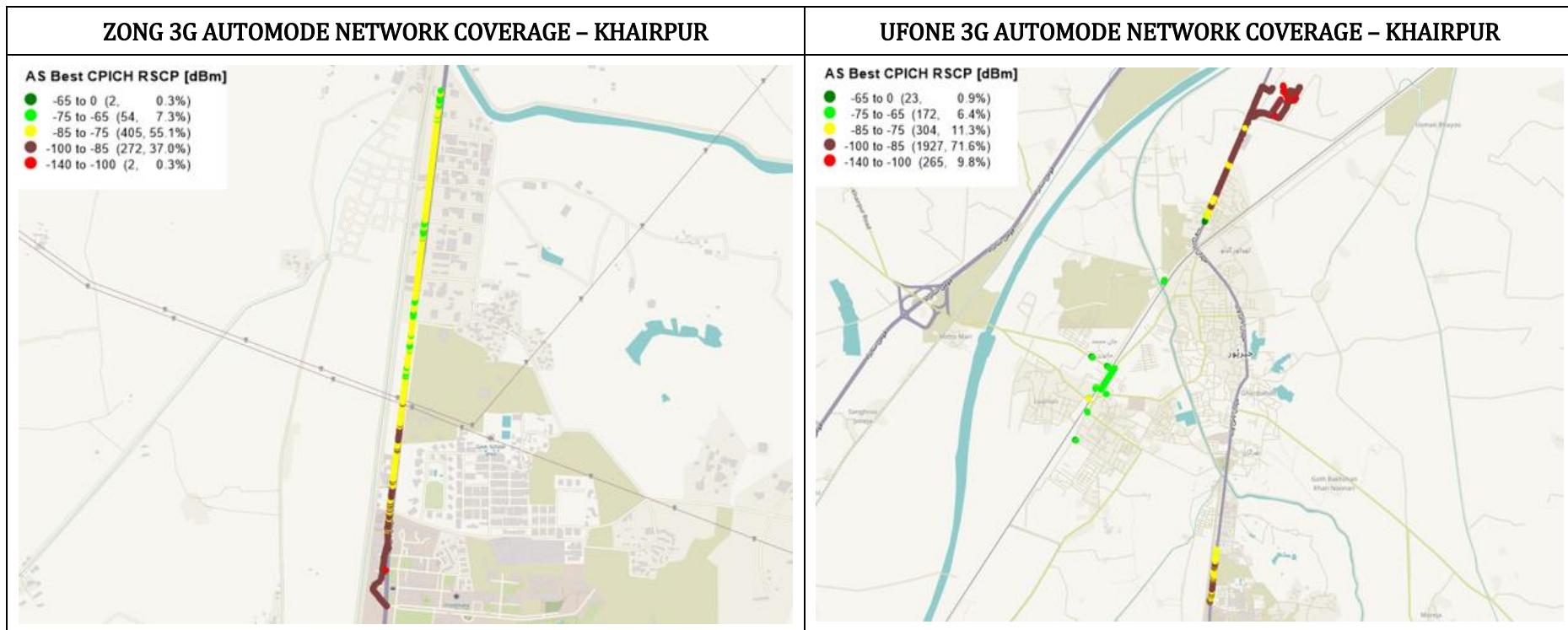
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



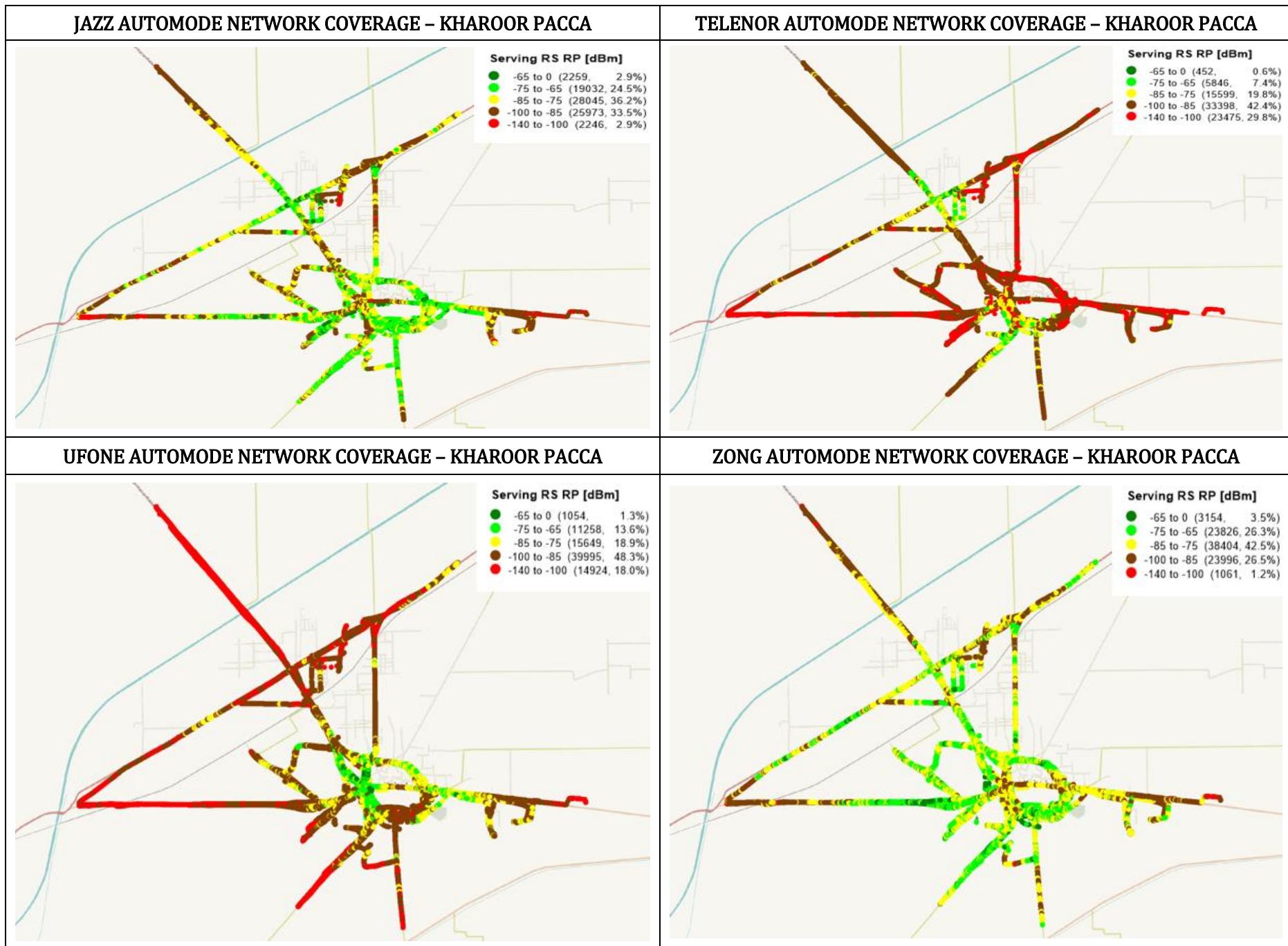
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



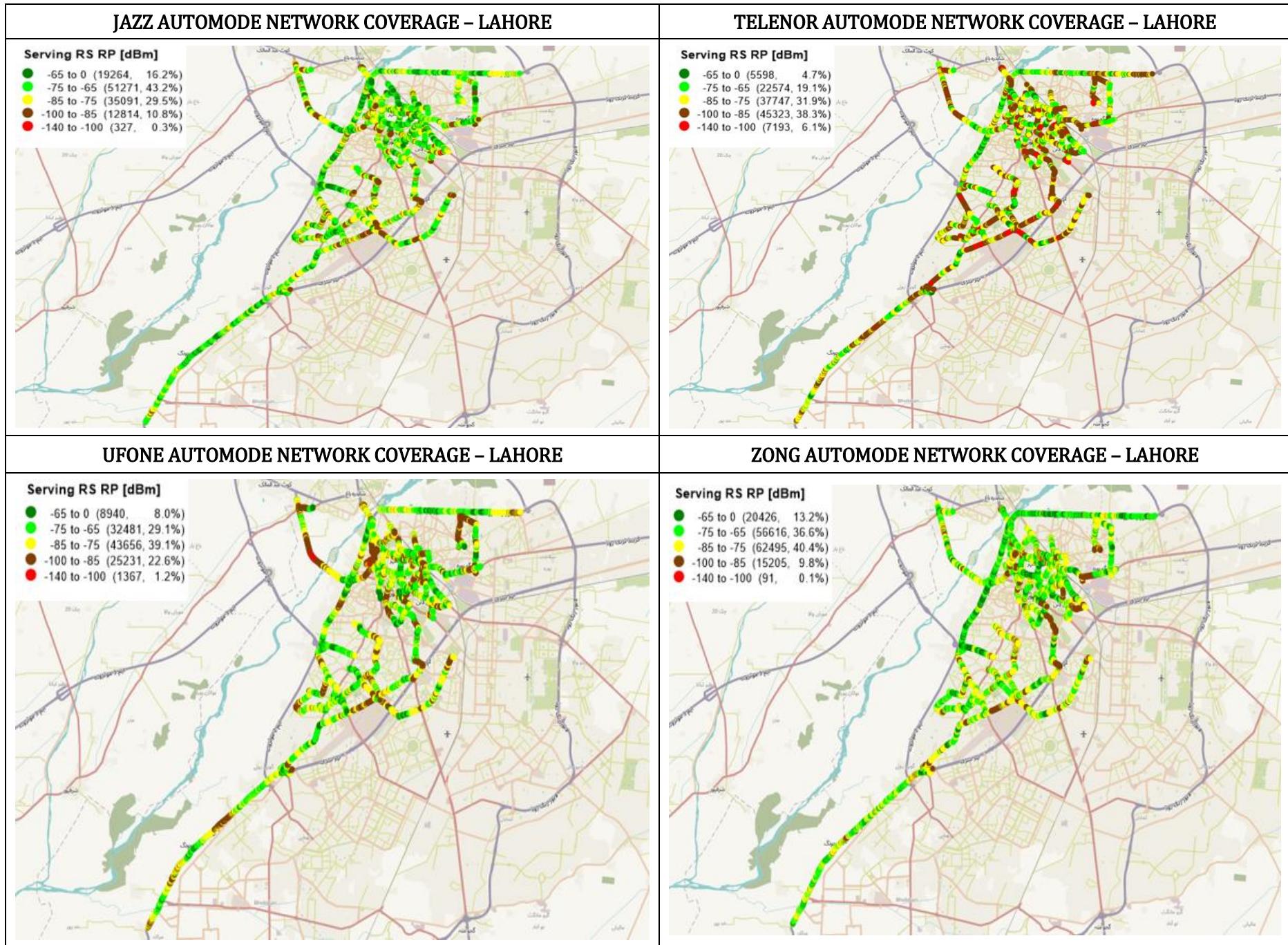
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)



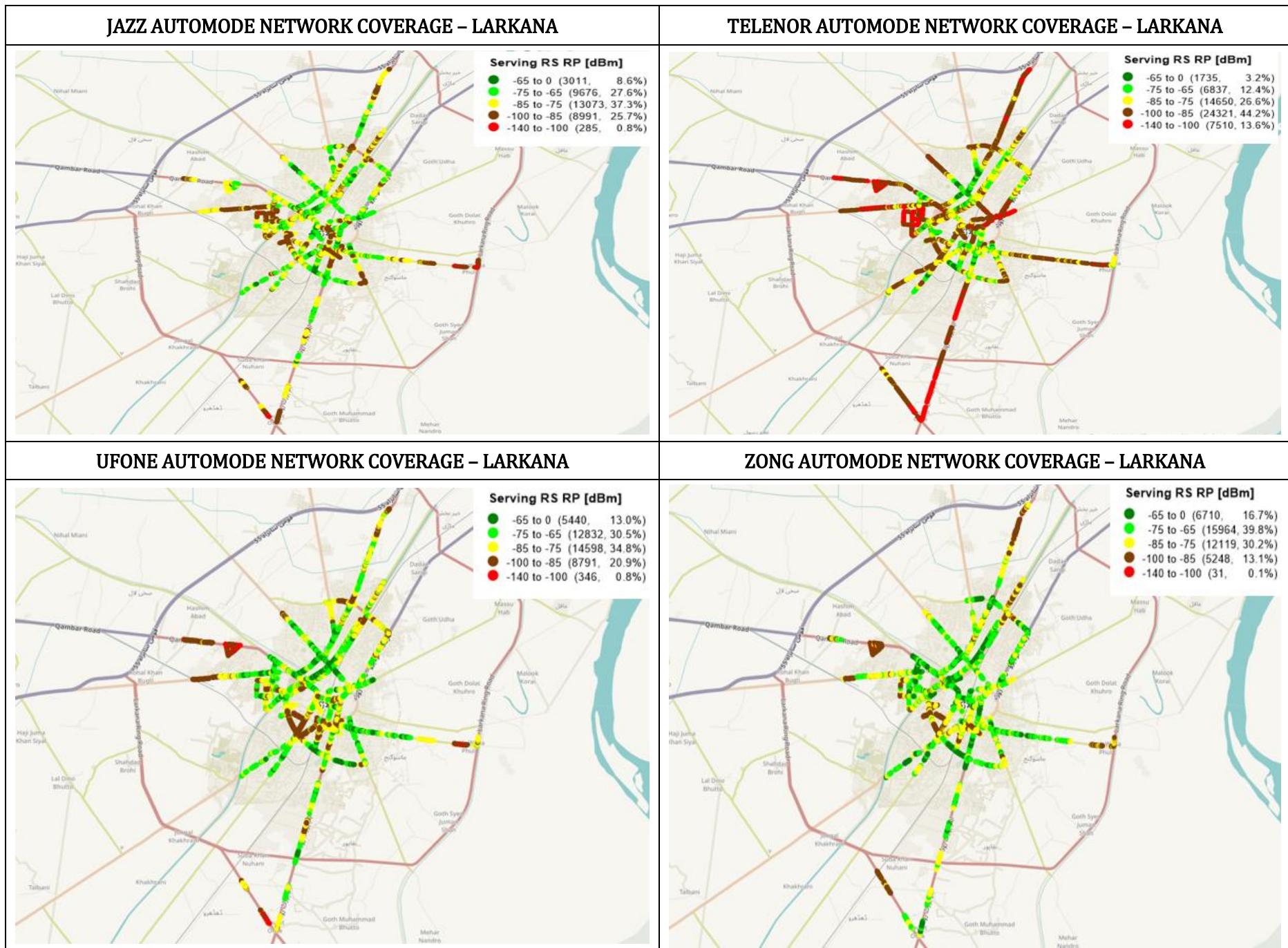
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



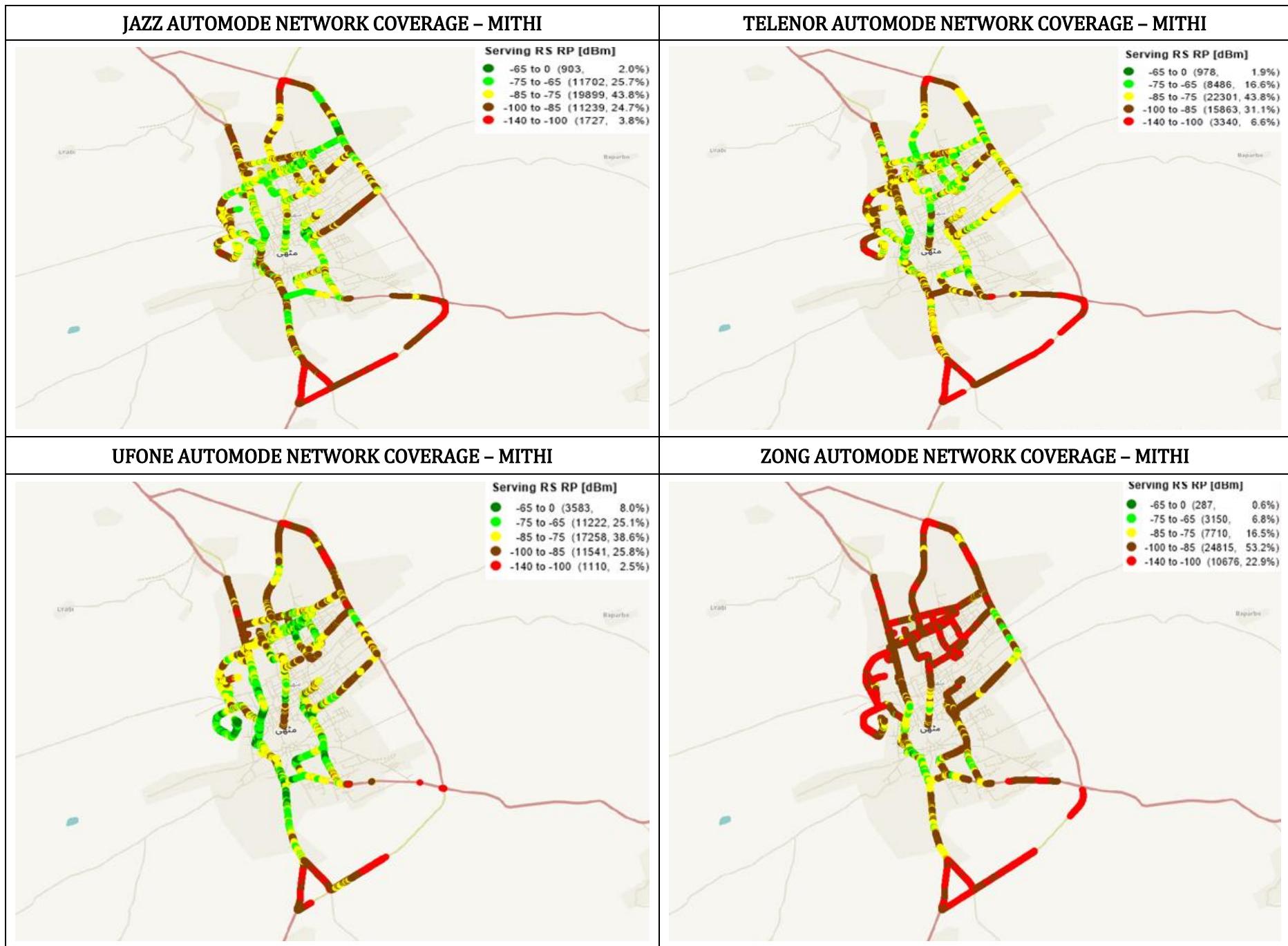
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



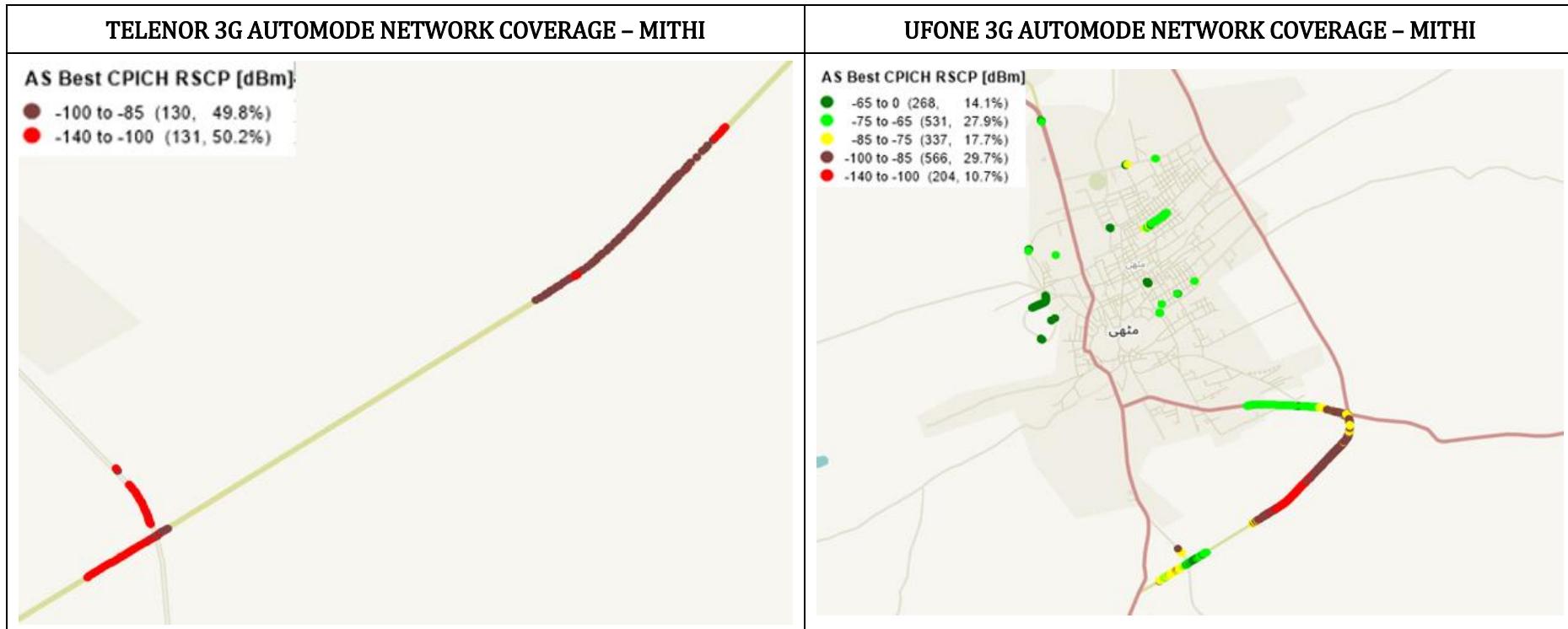
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



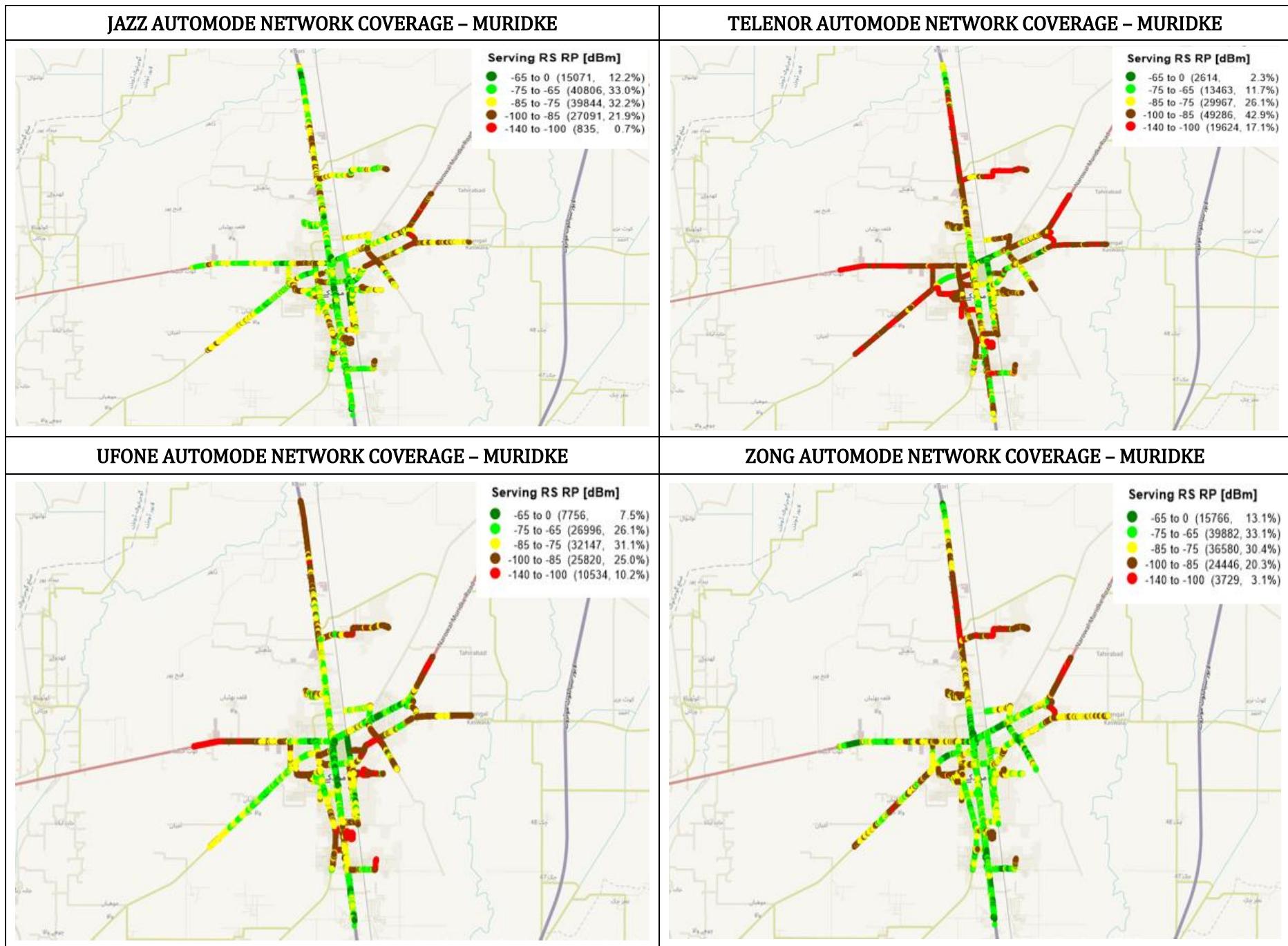
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



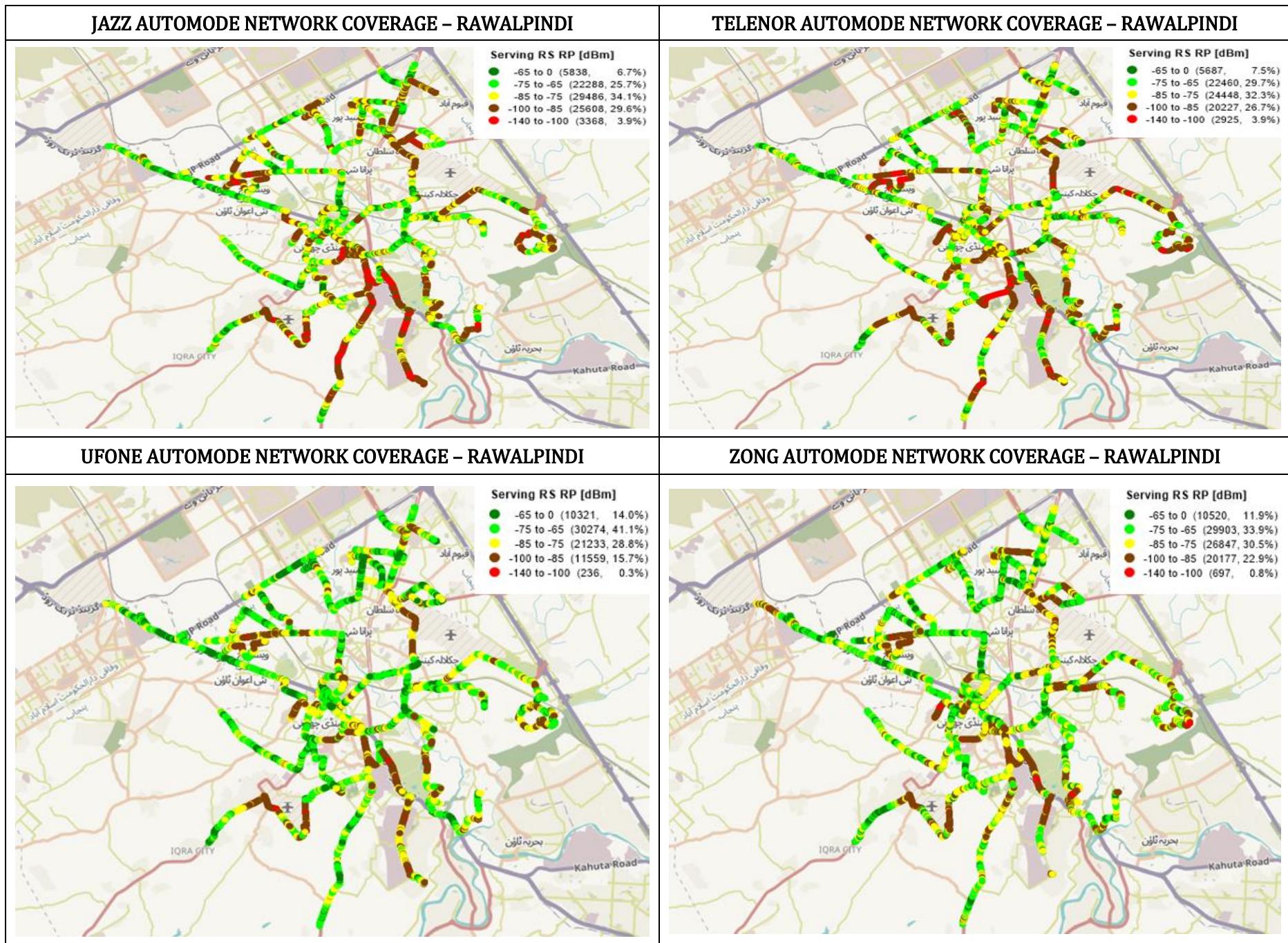
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)



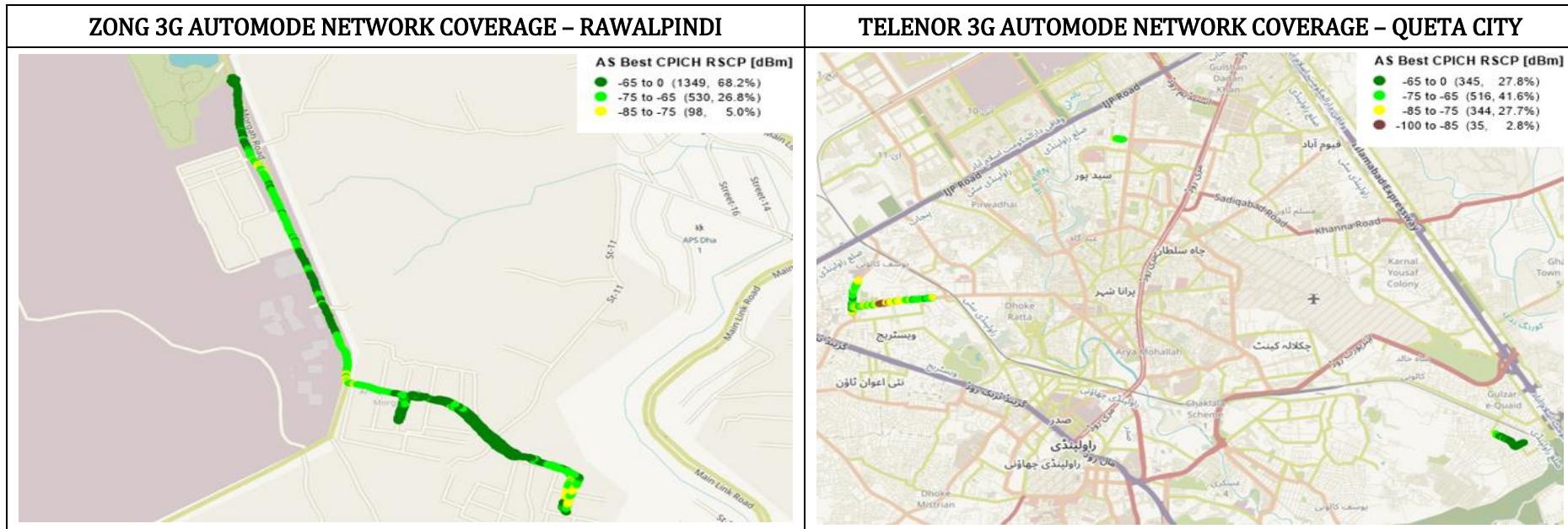
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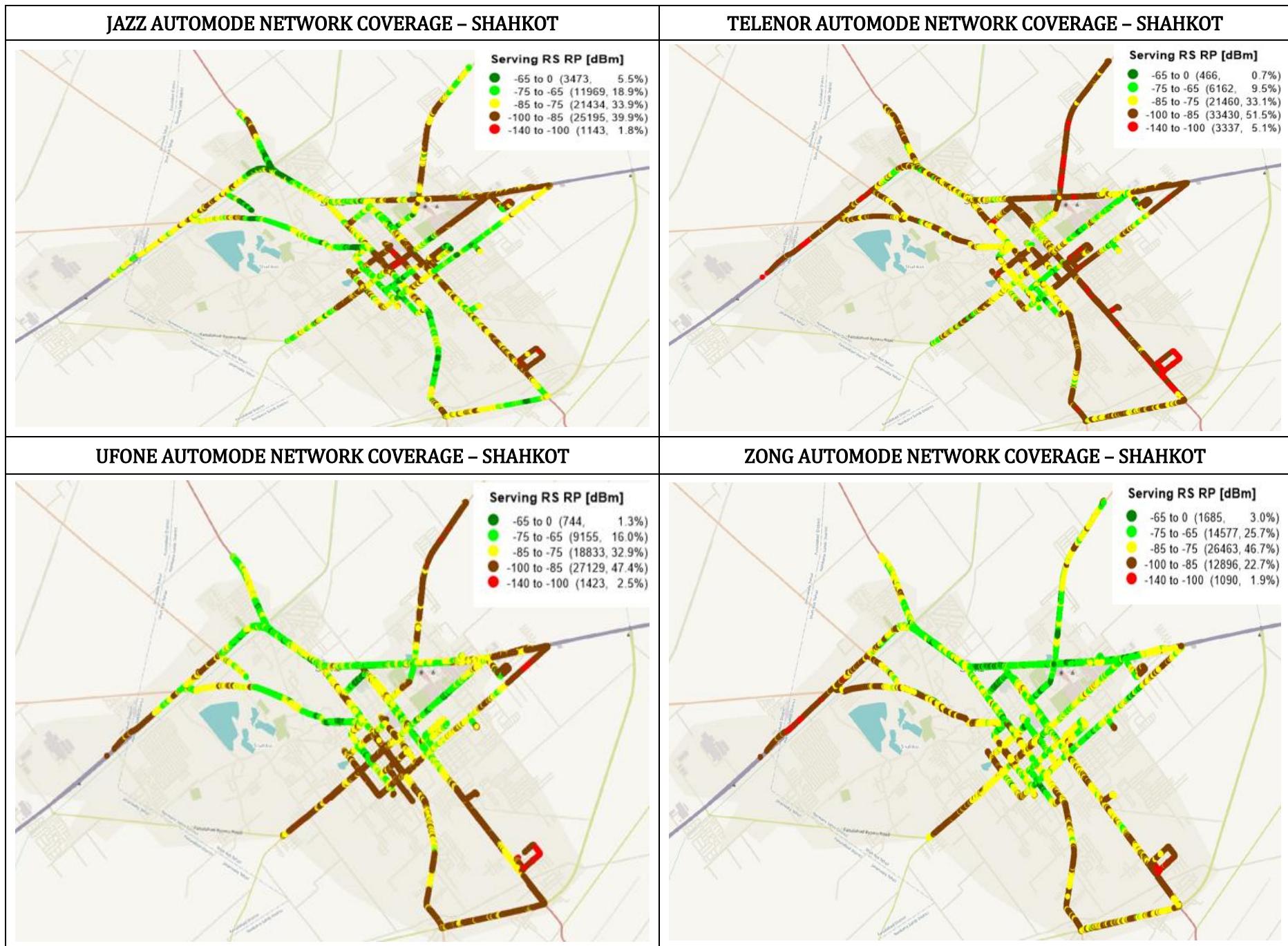
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



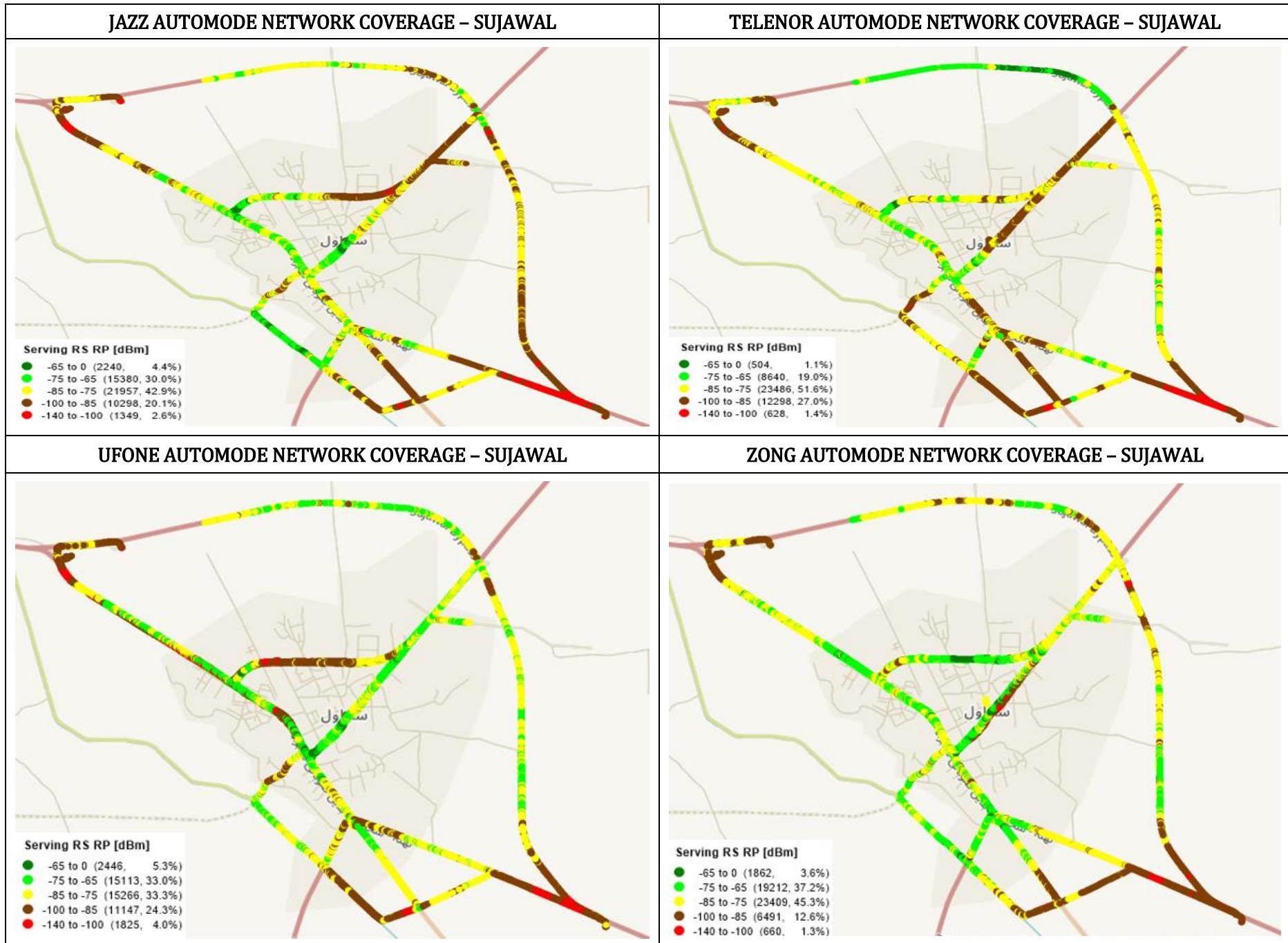
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)



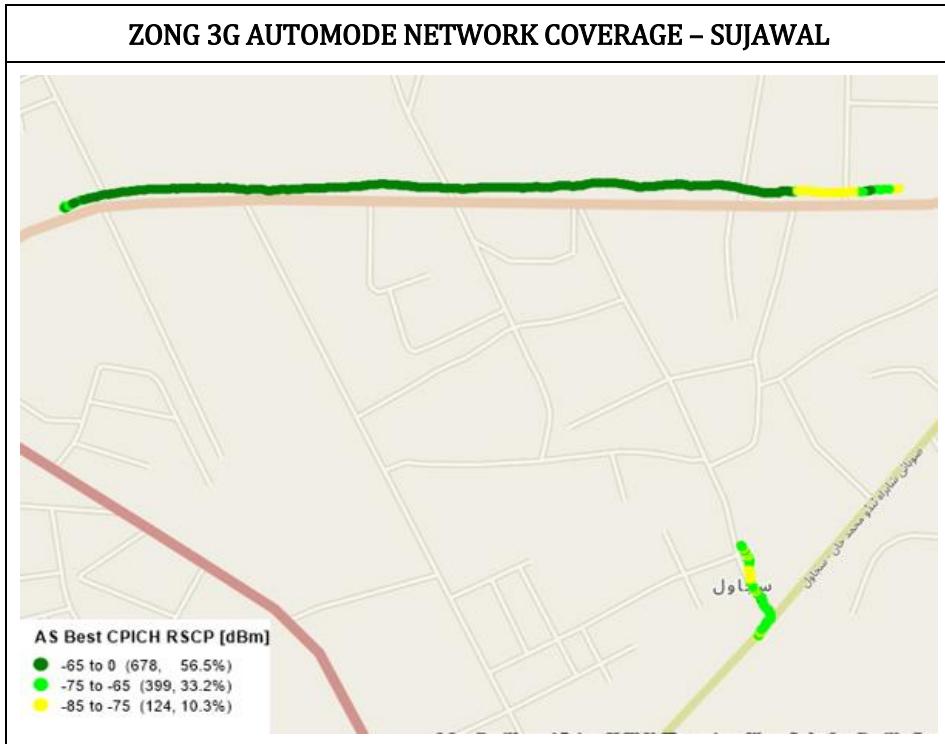
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



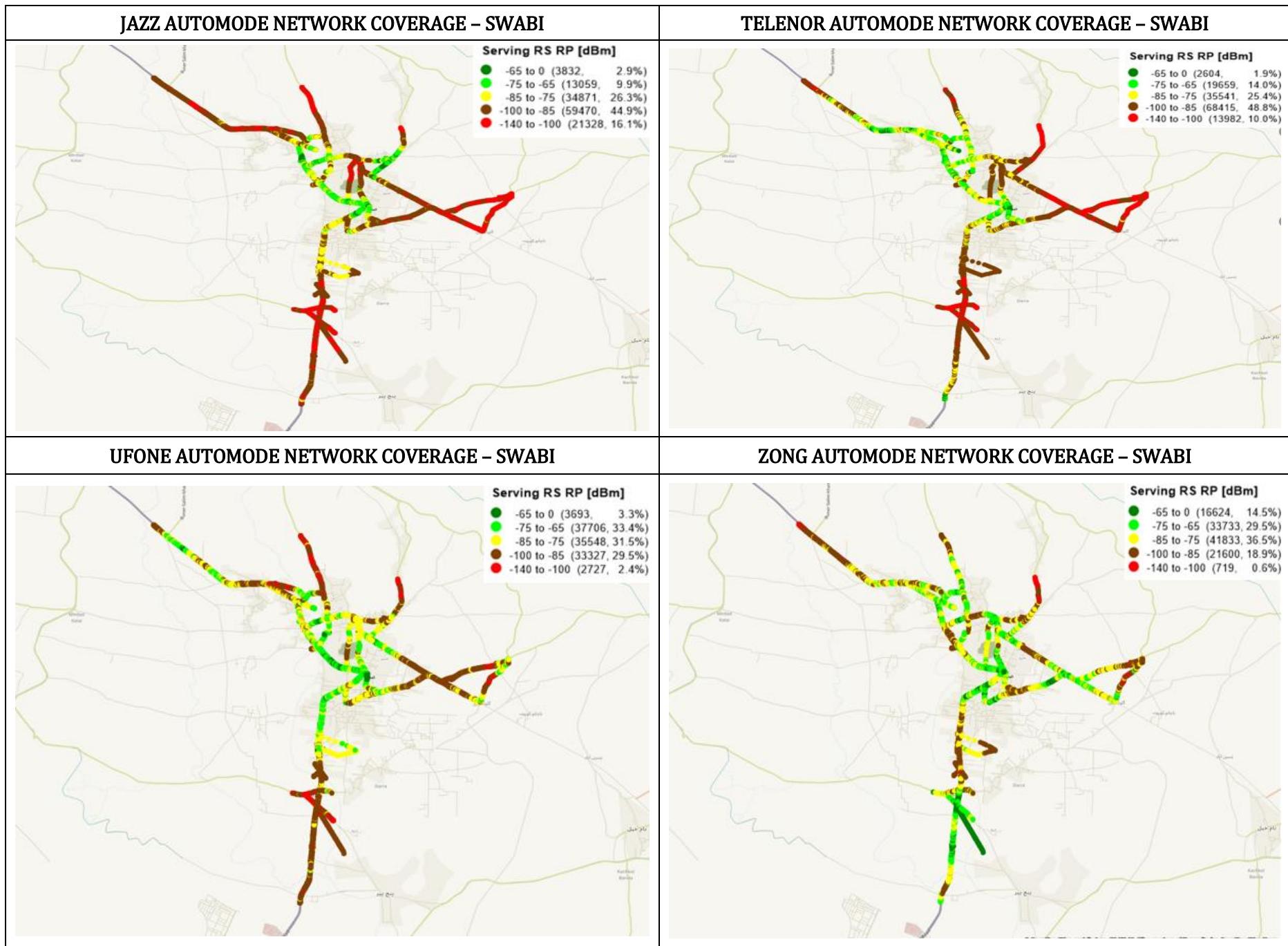
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



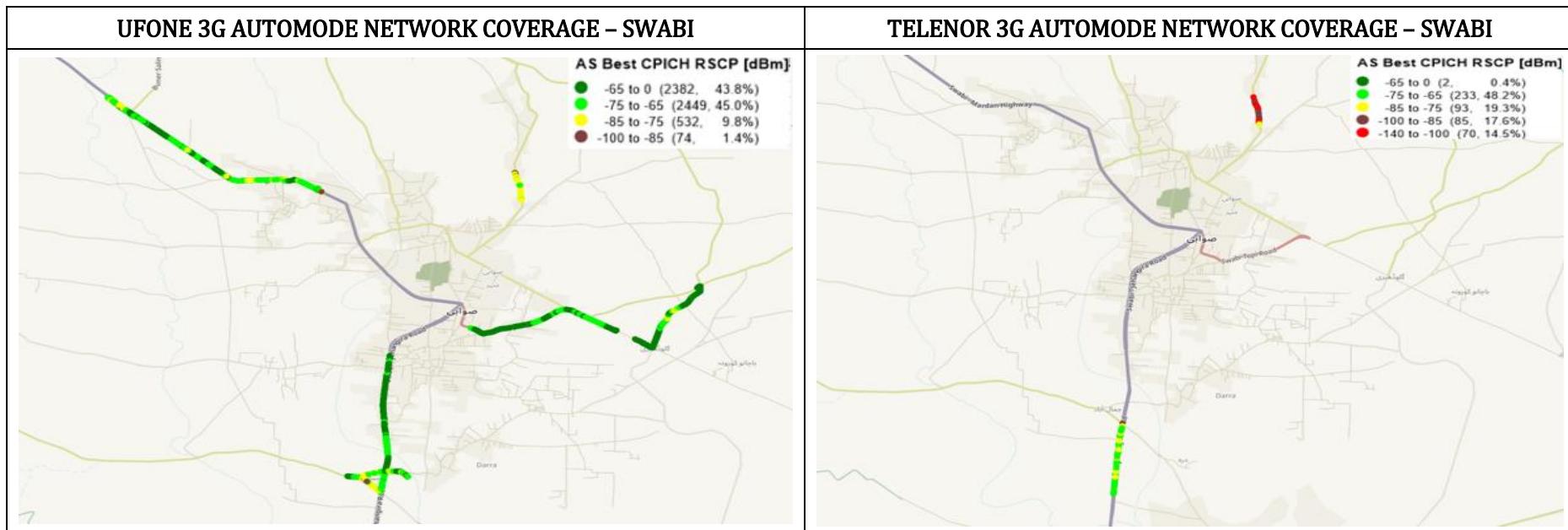
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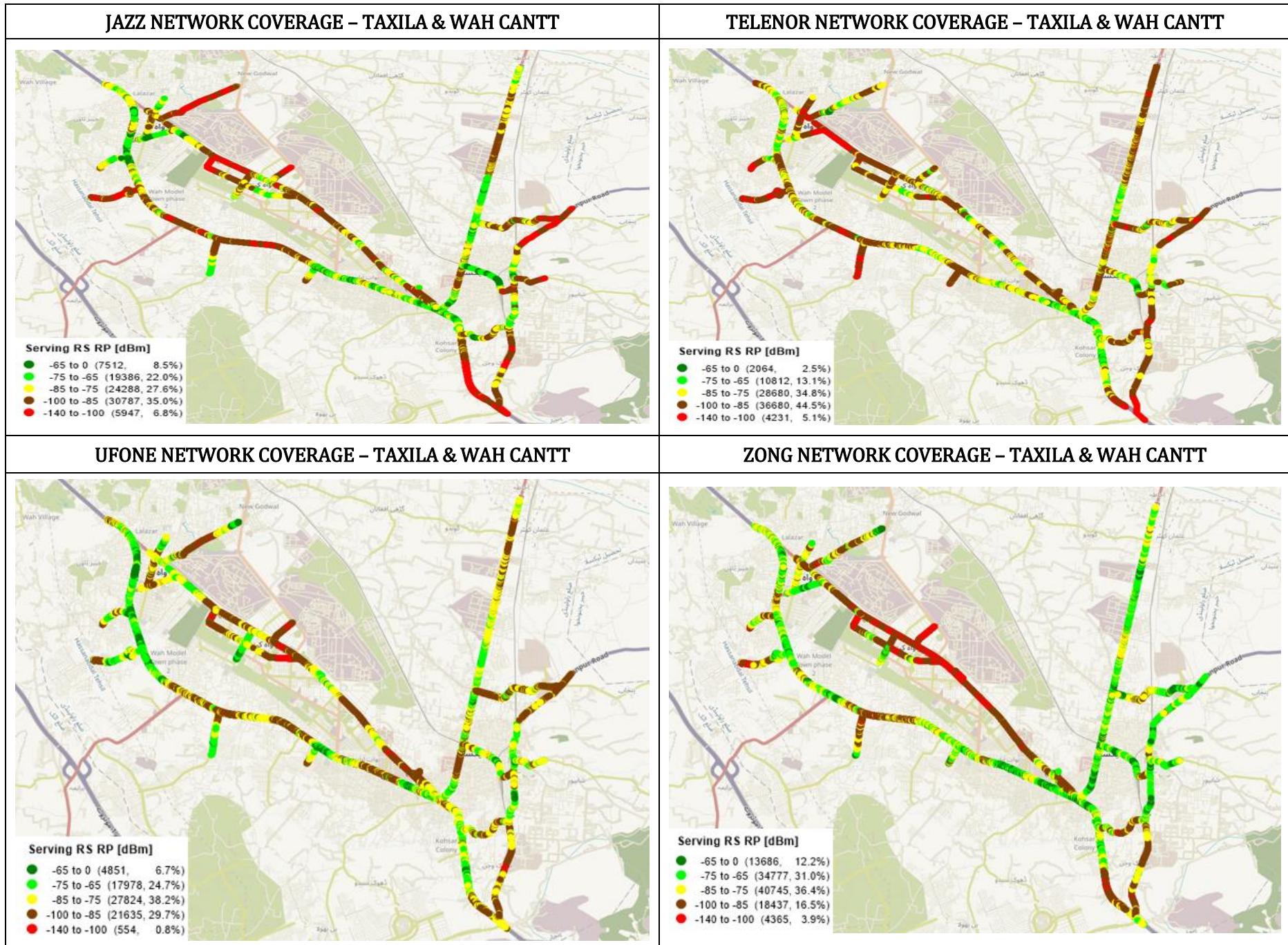
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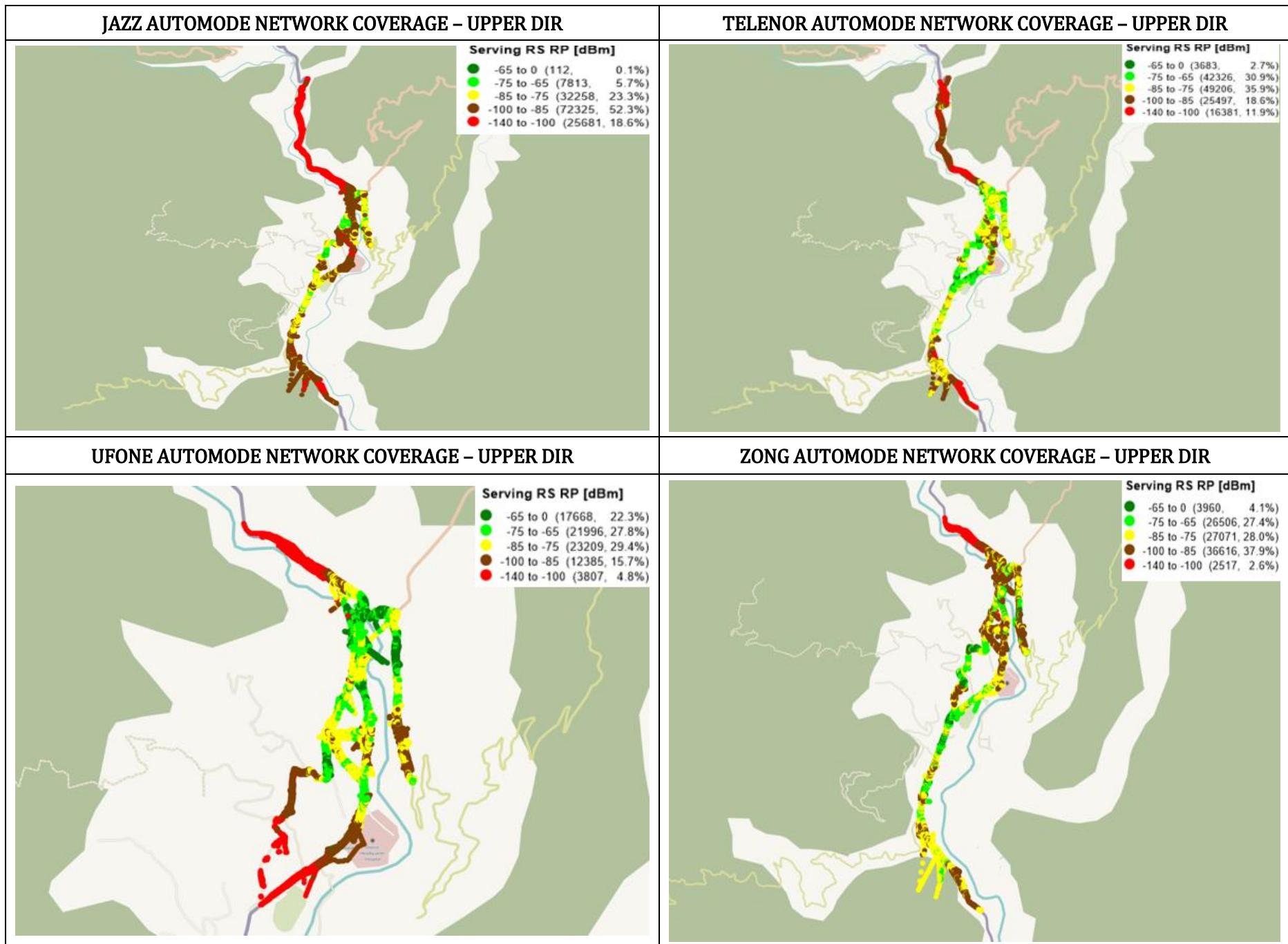
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)



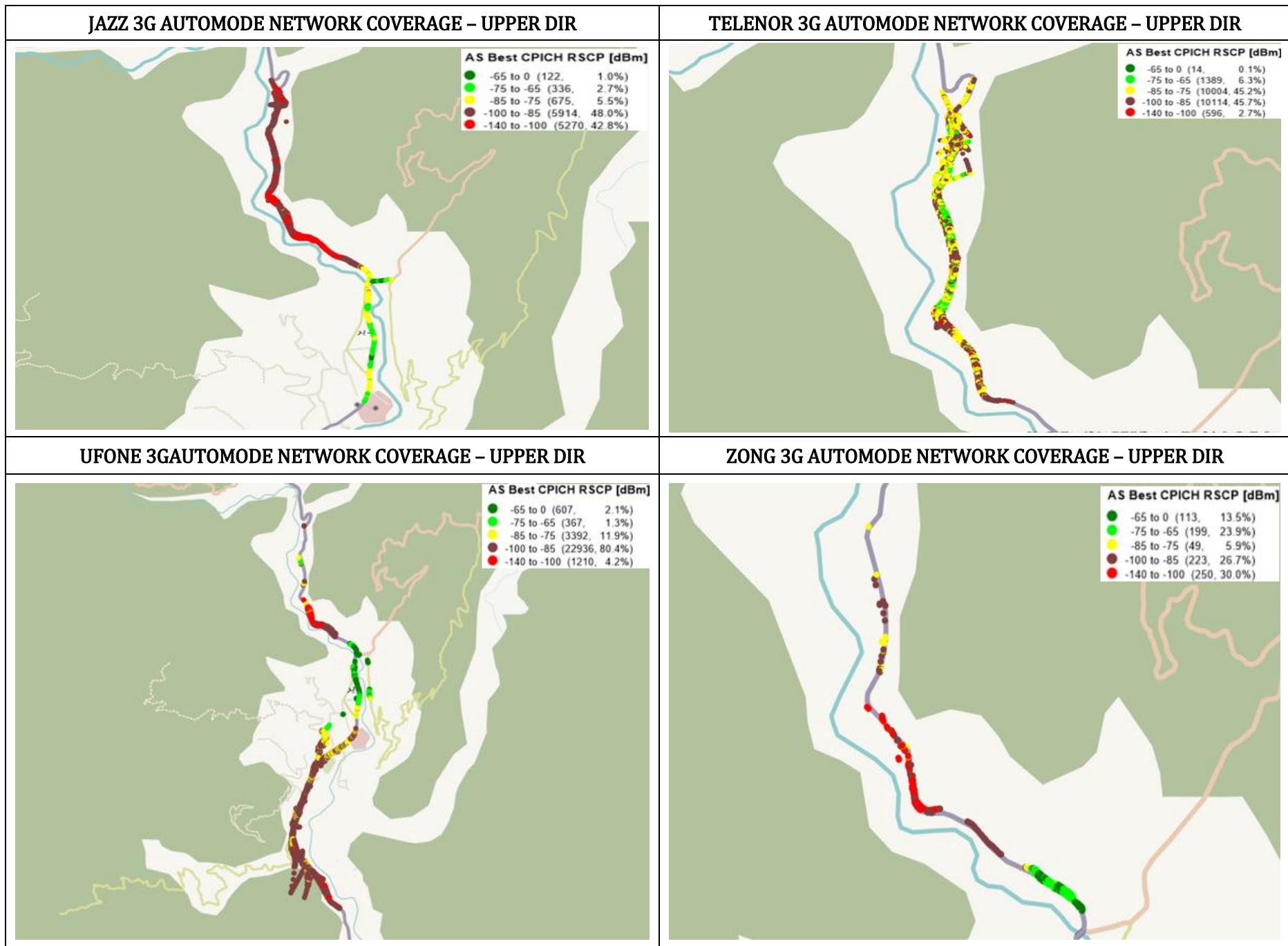
## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)



## AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

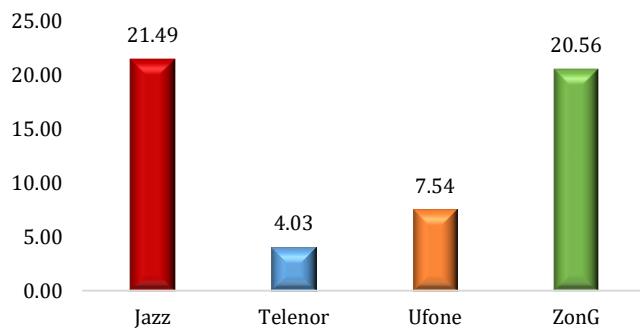


## Annex -A1(Data QoS Results)

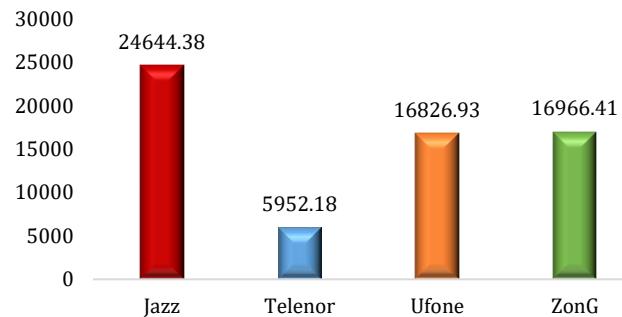
AUTOMODE

## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – ABBOTTABAD

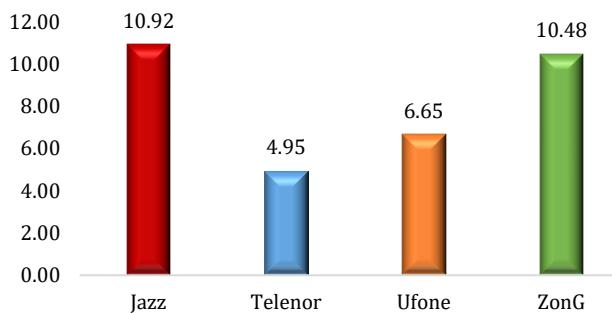
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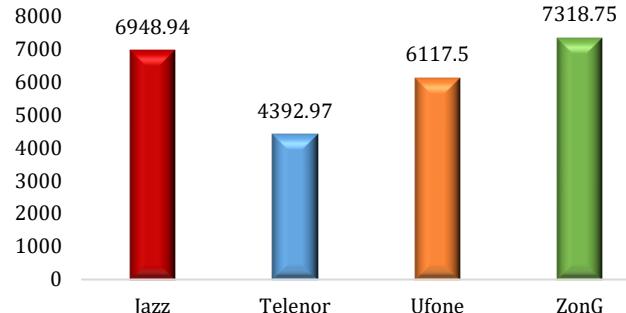
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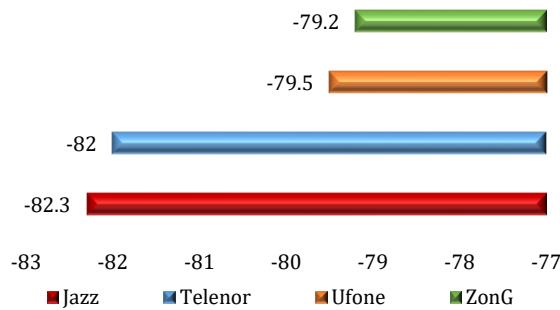
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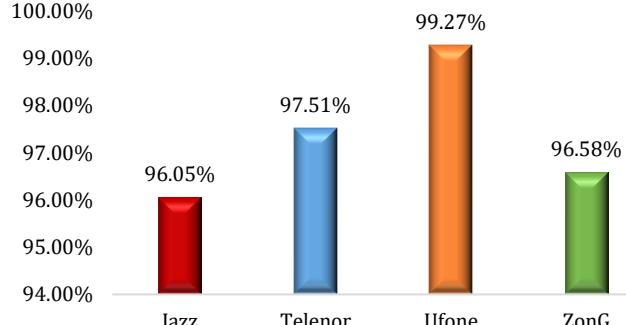
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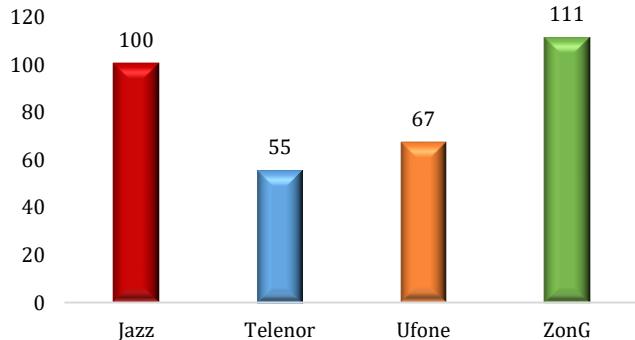
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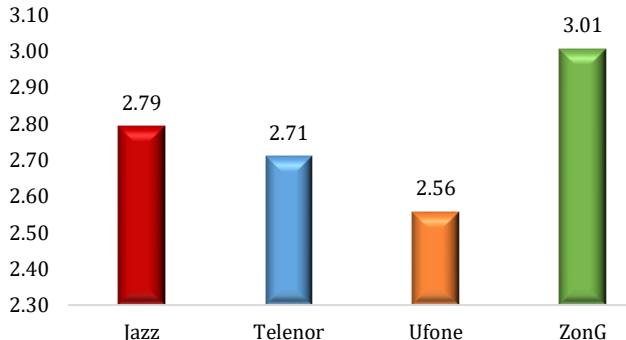
Signal Strength (RSRP) Confidence Level > 90%



Latency <75 ms

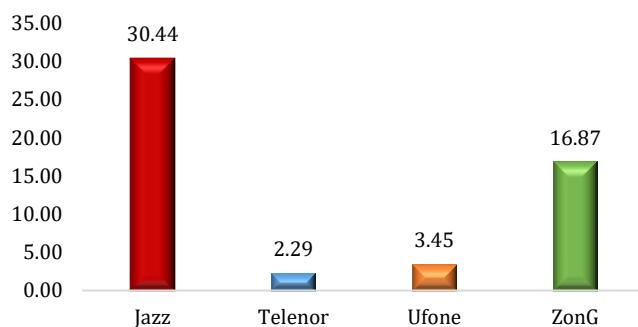


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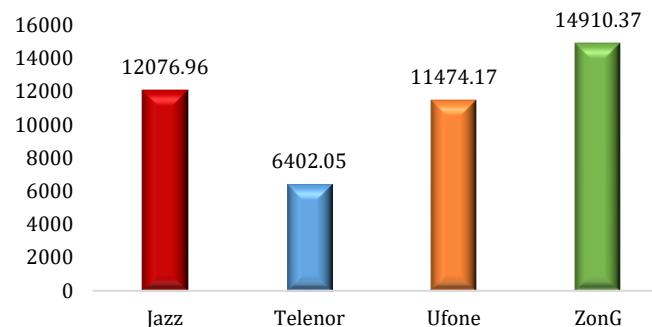


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – BUNER

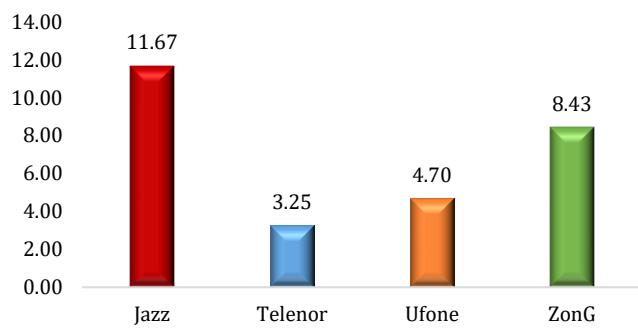
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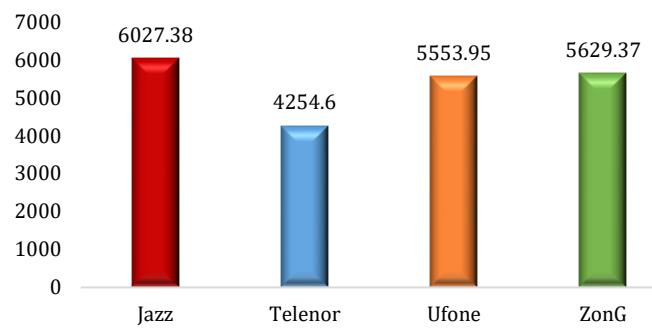
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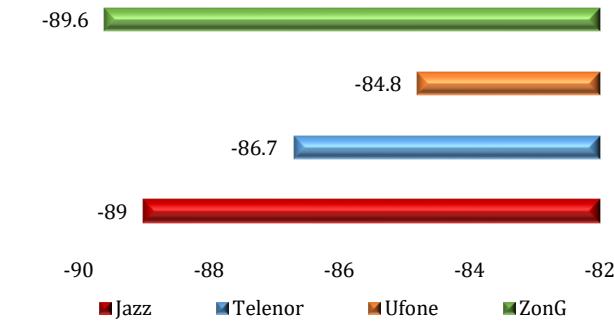
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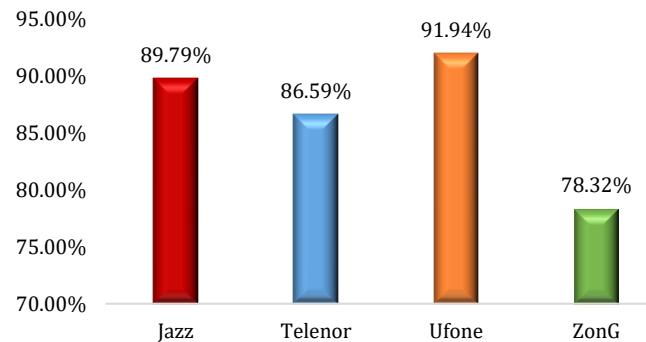
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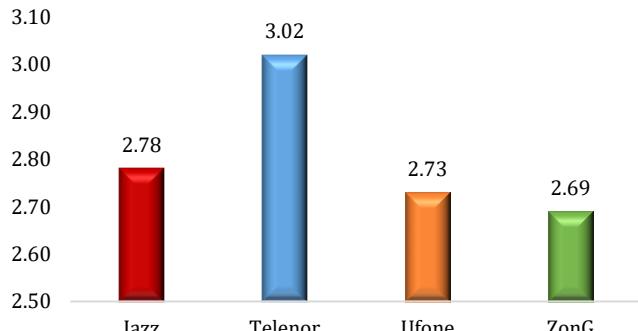
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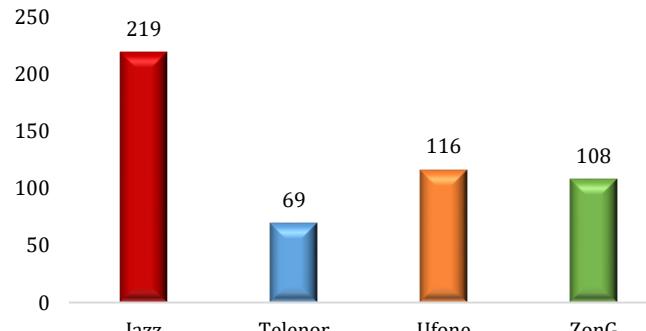
Signal Strength (RSRP) Confidence Level > 90%



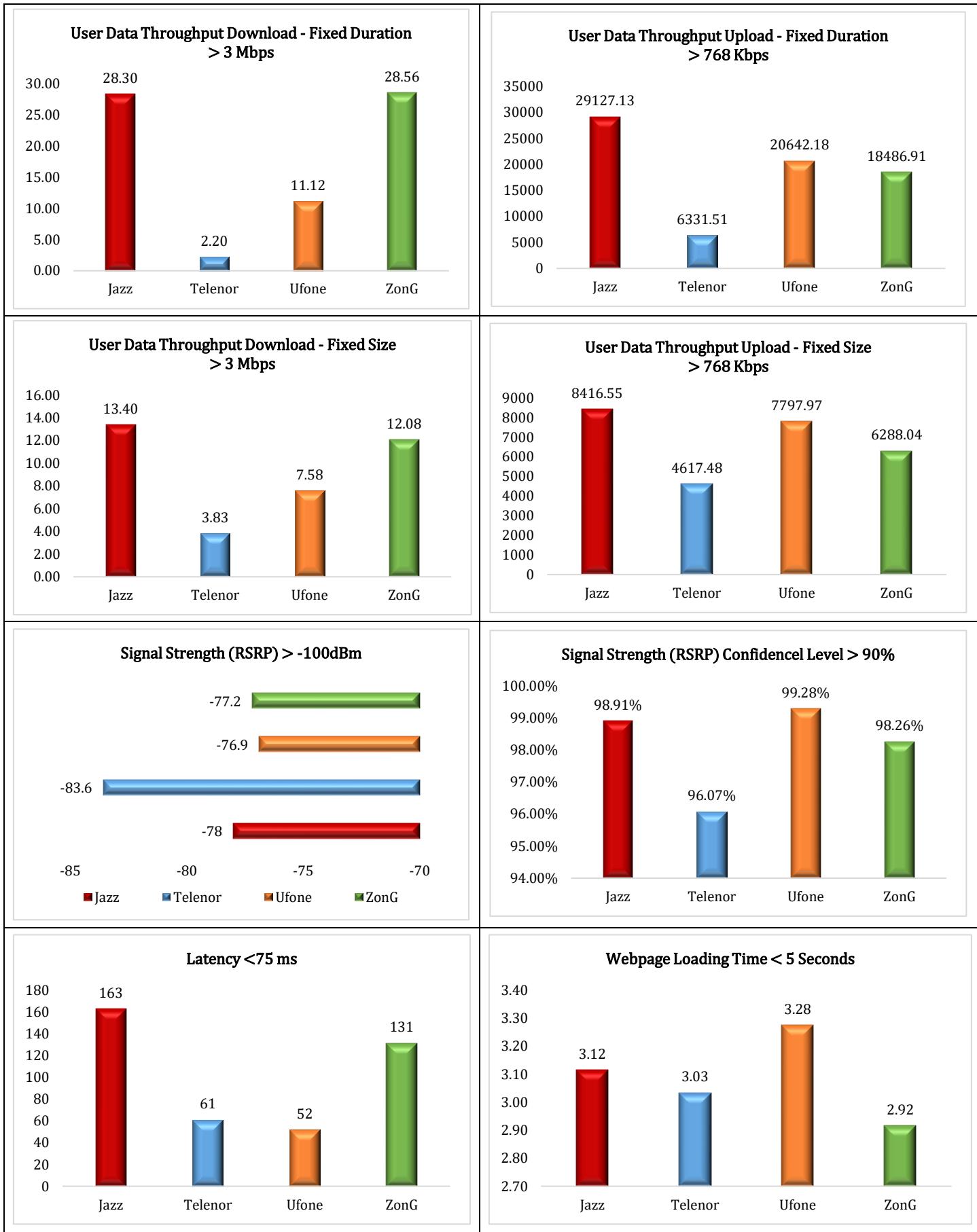
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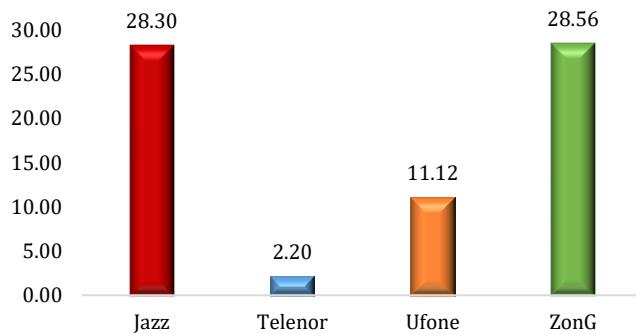


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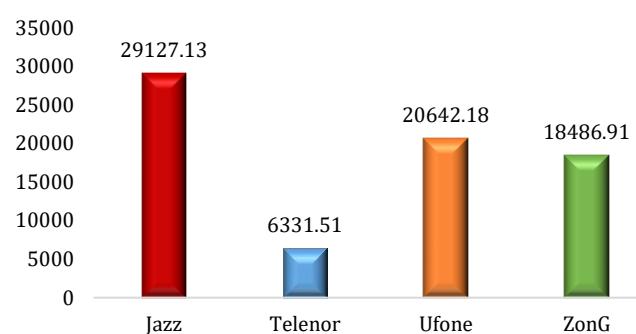


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – JACOBBABAD

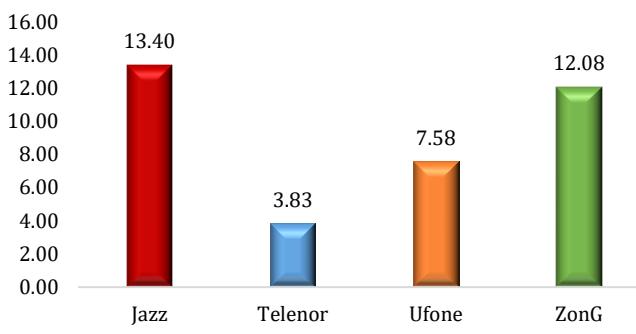
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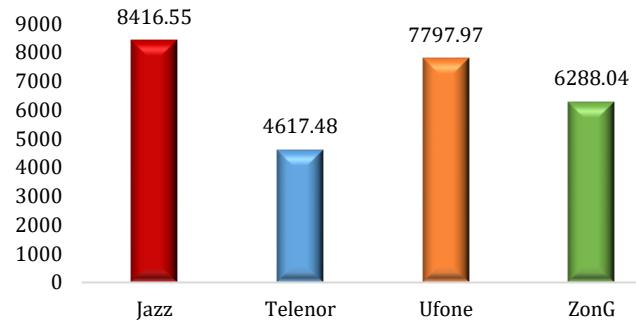
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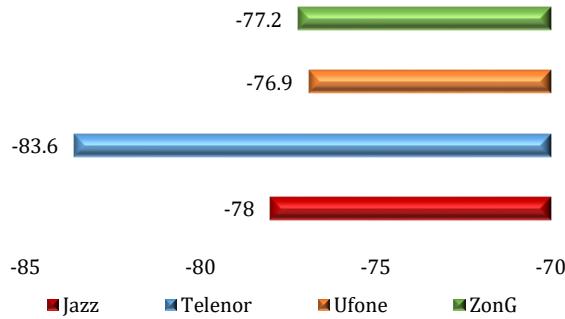
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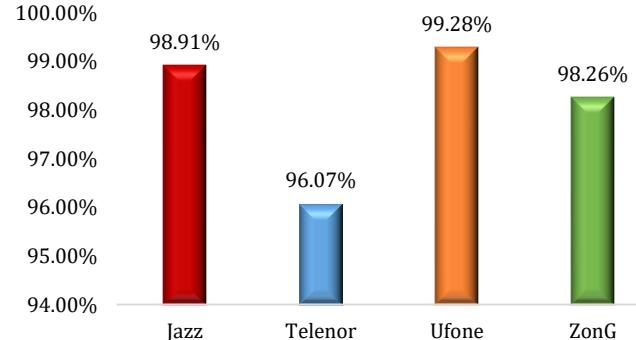
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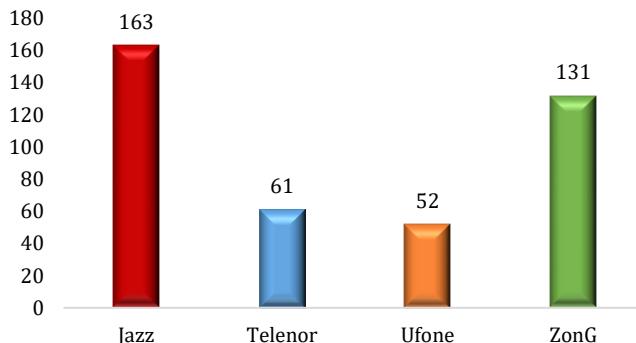
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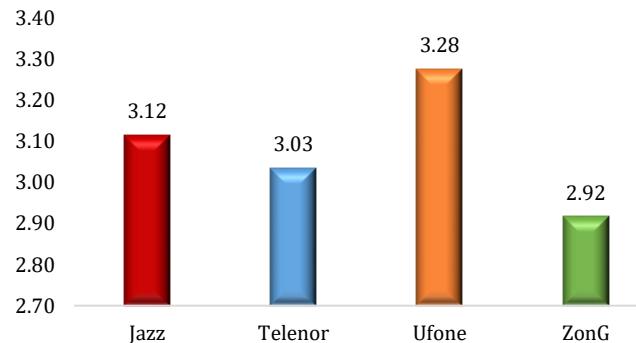
Signal Strength (RSRP) Confidence Level > 90%



Latency <75 ms

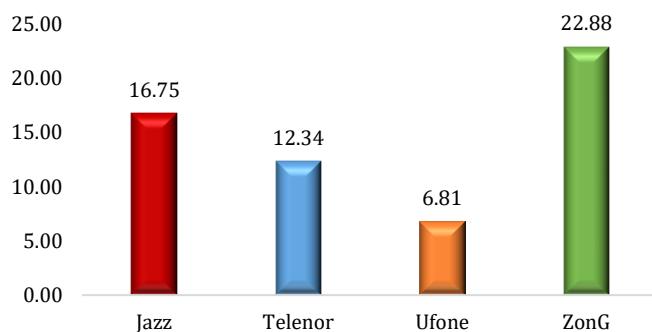


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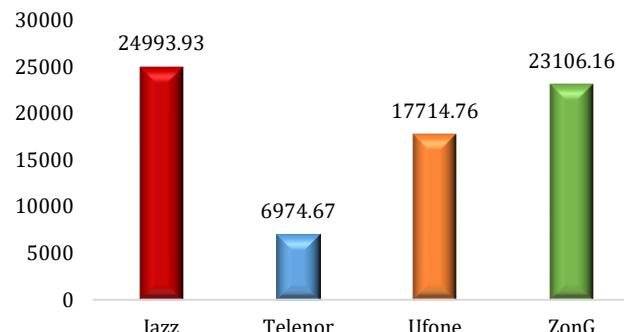


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – KHAIRPUR

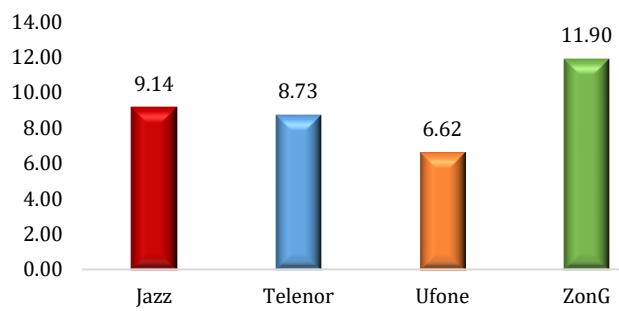
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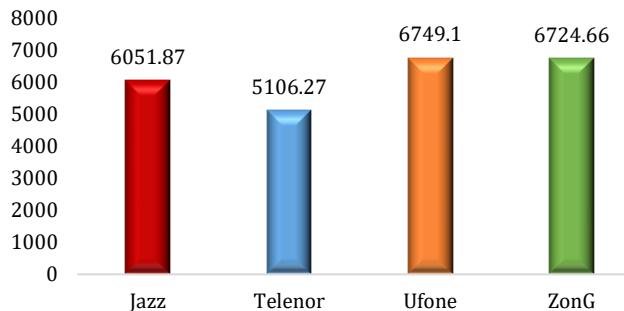
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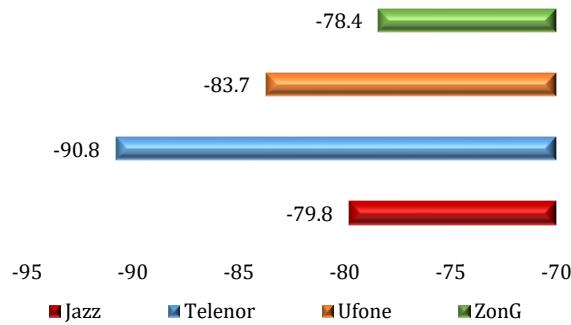
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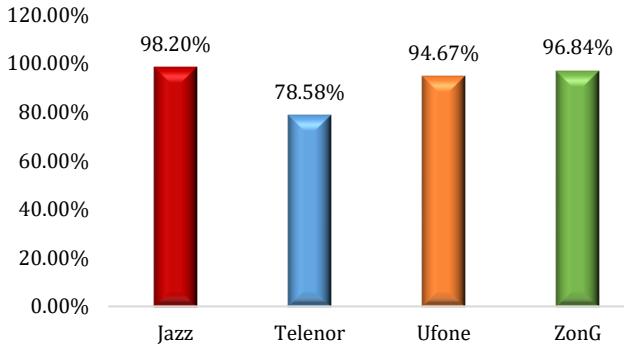
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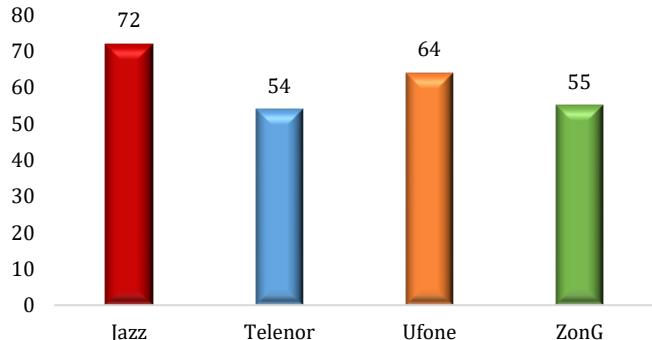
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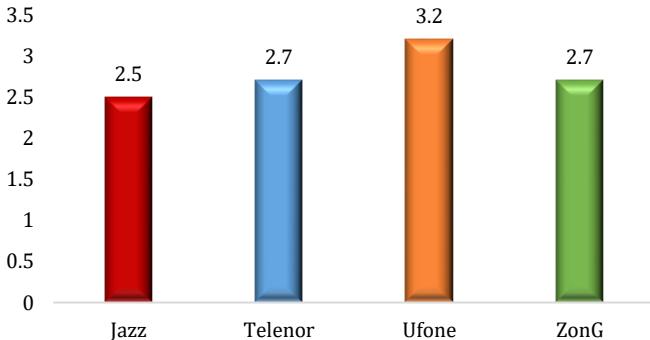
**Signal Strength (RSRP) Confidence Level > 90%**



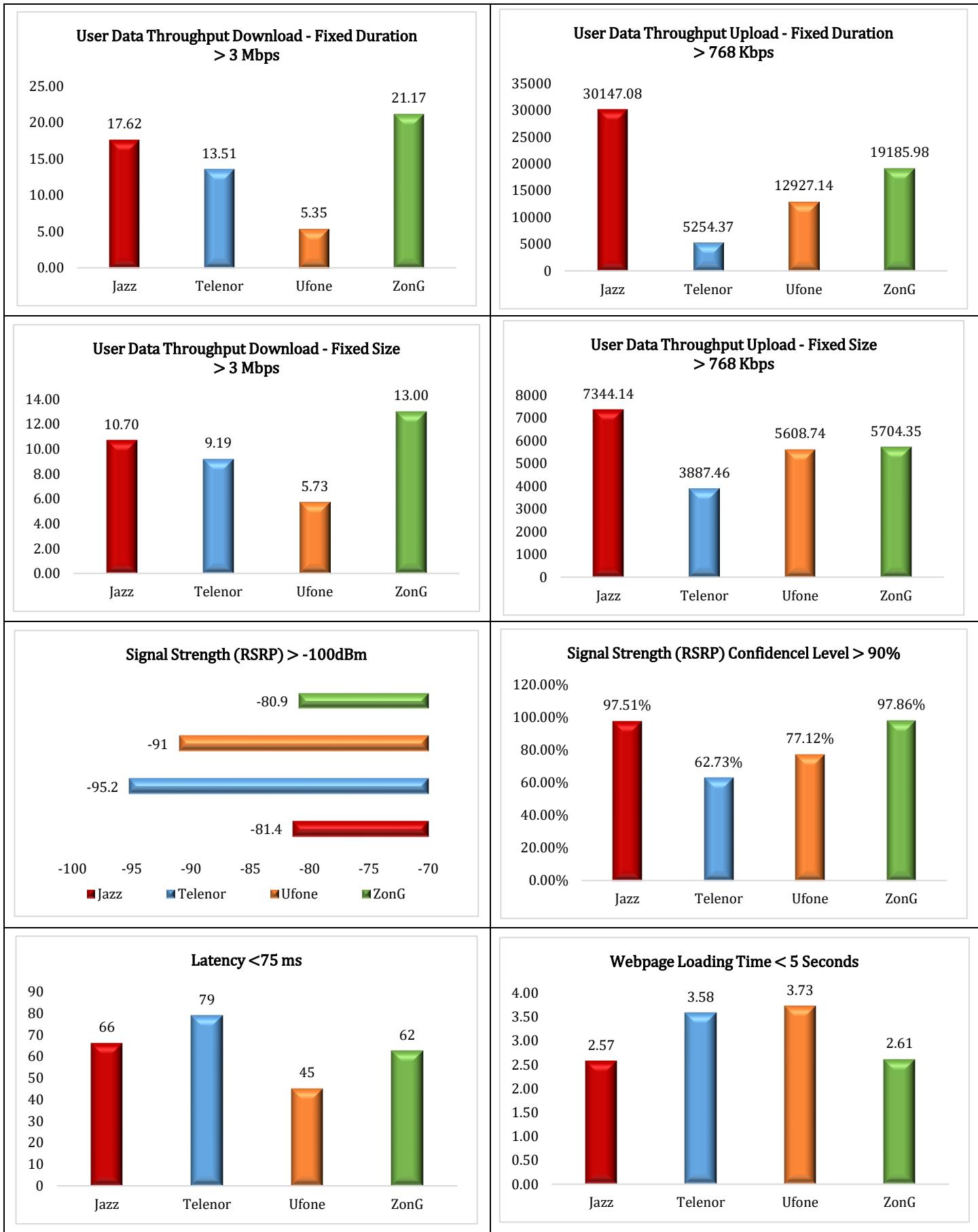
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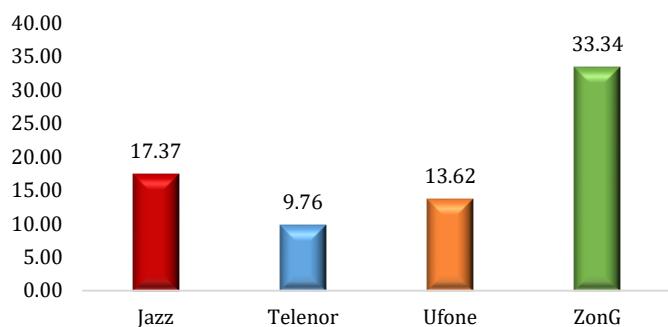


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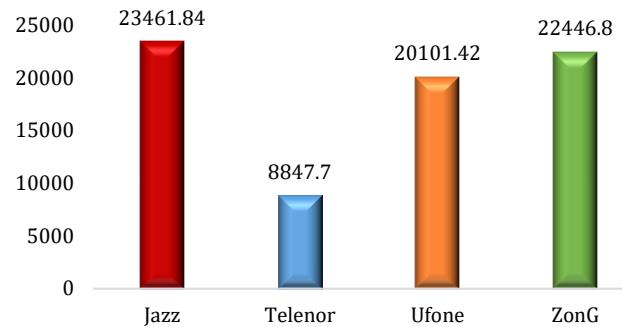


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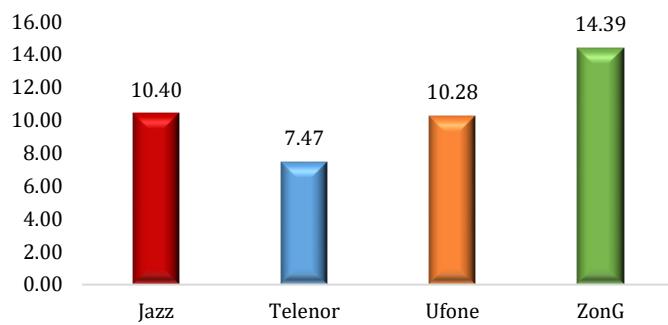
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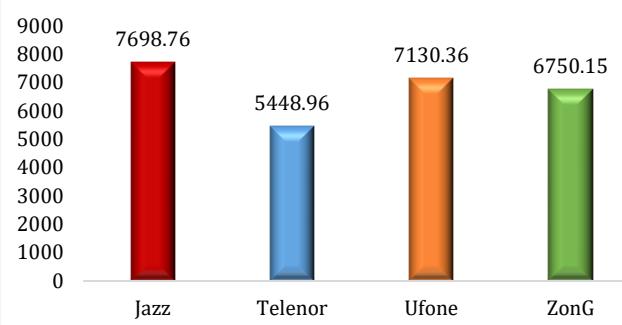
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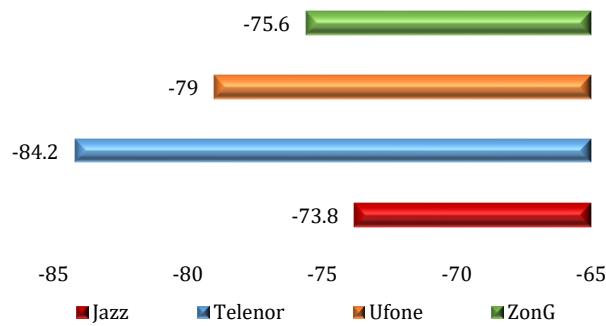
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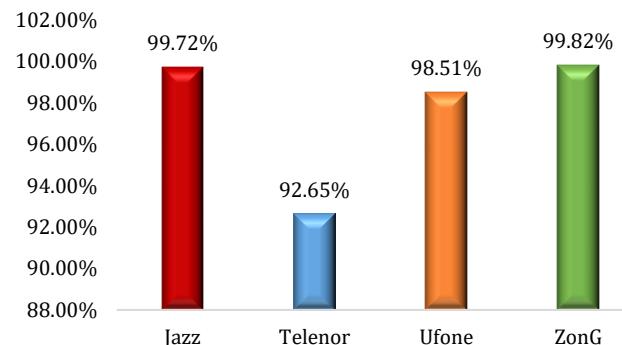
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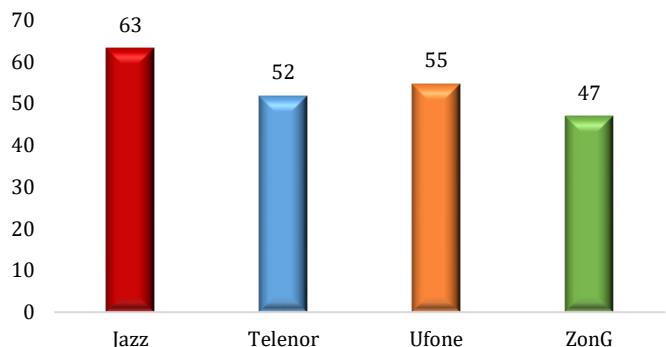
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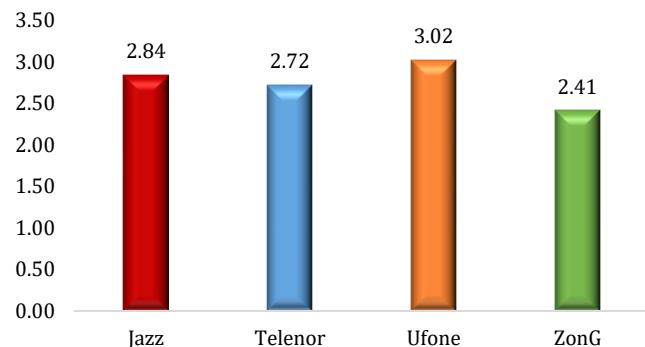
**Signal Strength (RSRP) Confidence Level > 90%**



**Latency < 75 ms**

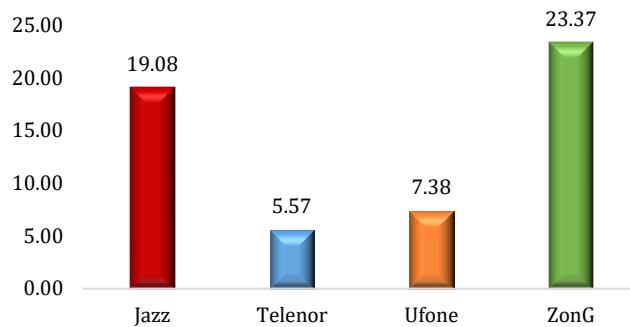


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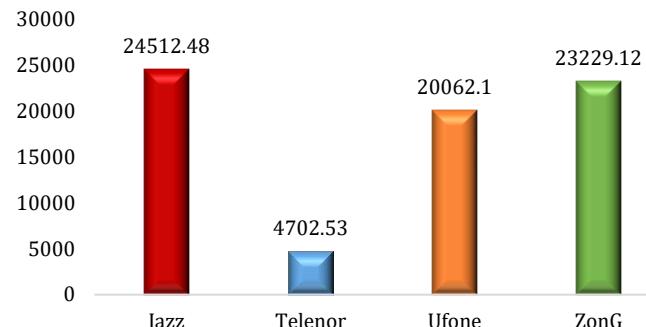


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – LARKANA

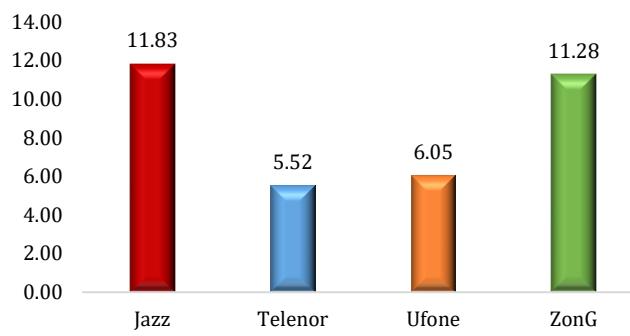
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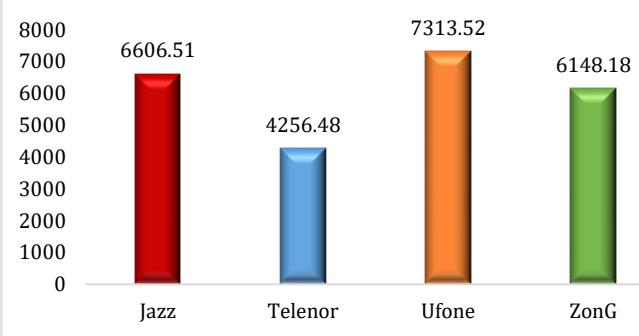
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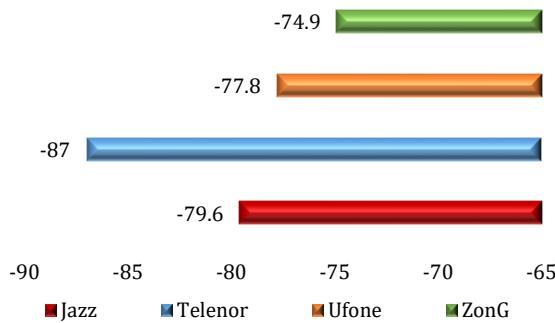
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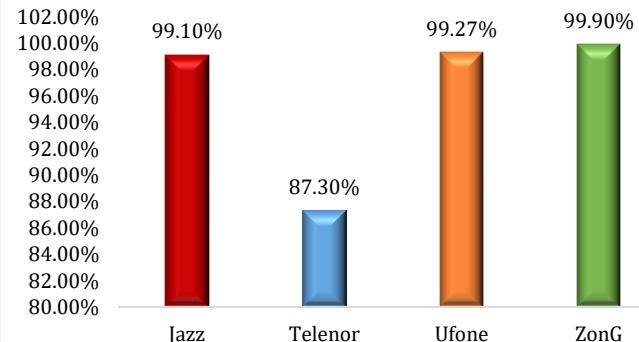
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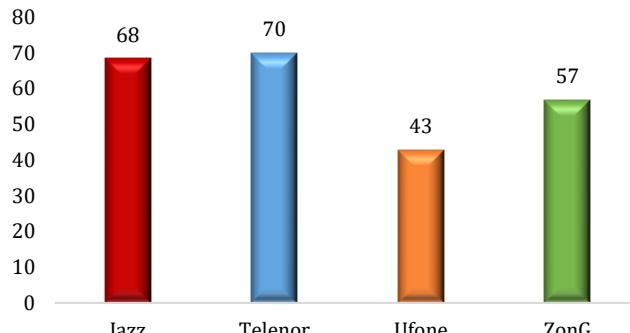
**Signal Strength (RSRP) > -100dBm**



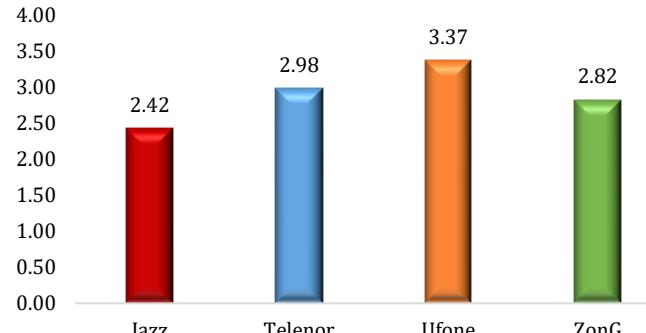
**Signal Strength (RSRP) Confidence Level > 90%**



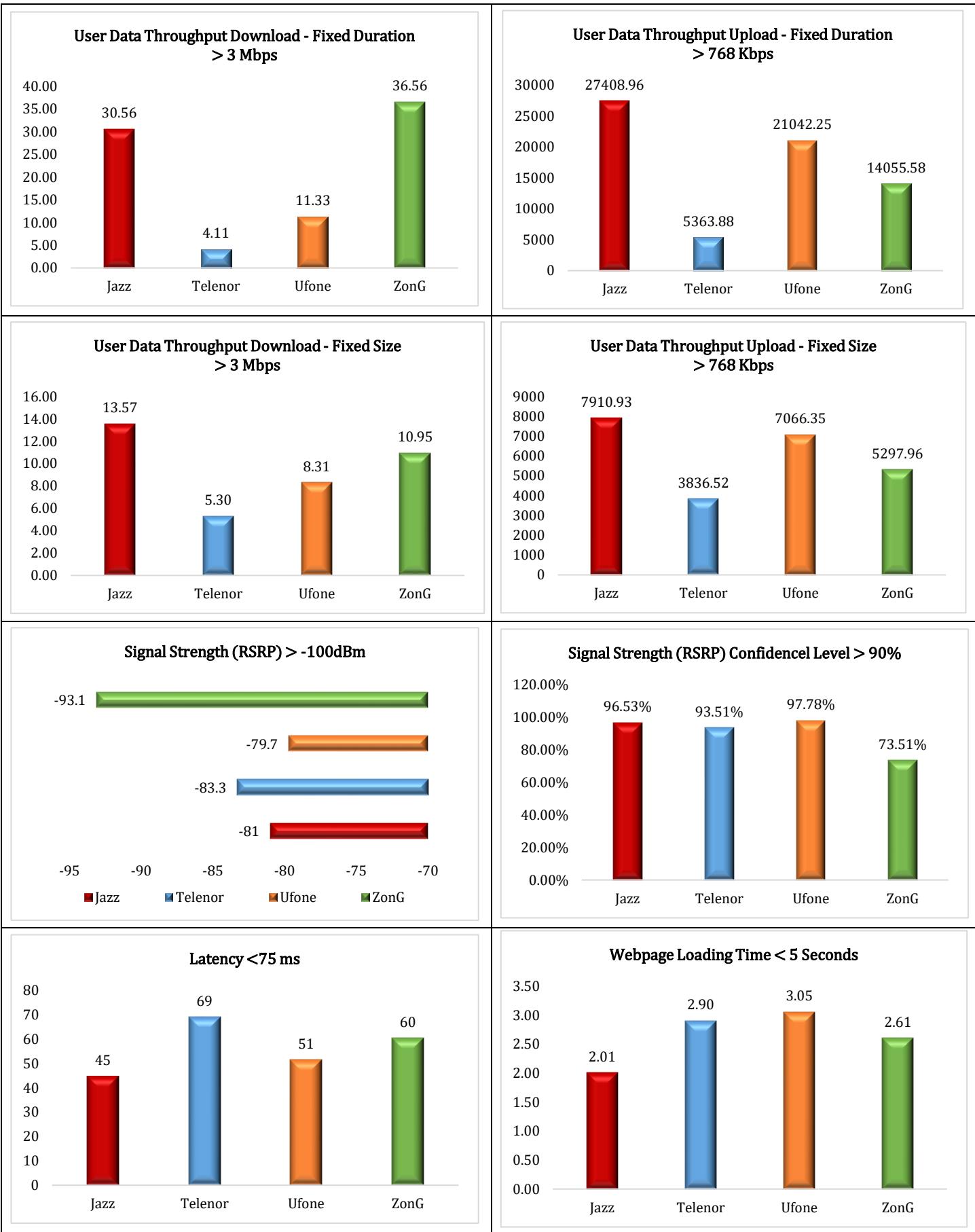
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**Webpage Loading Time < 5 Seconds**

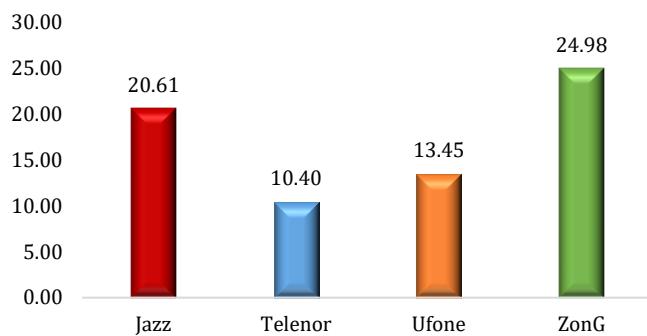


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – MITHI

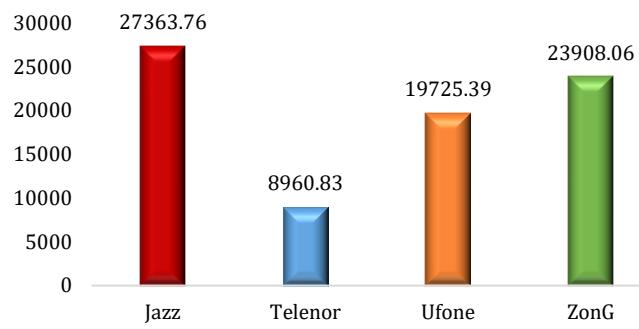


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – MURIDKE

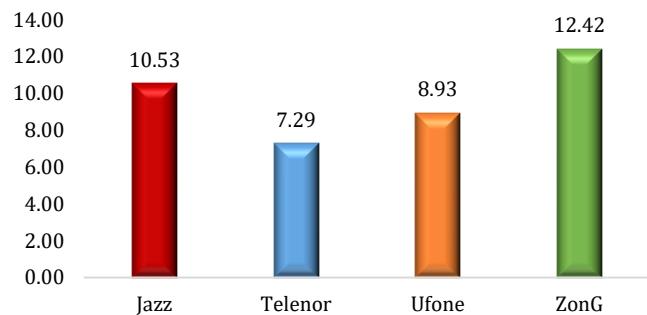
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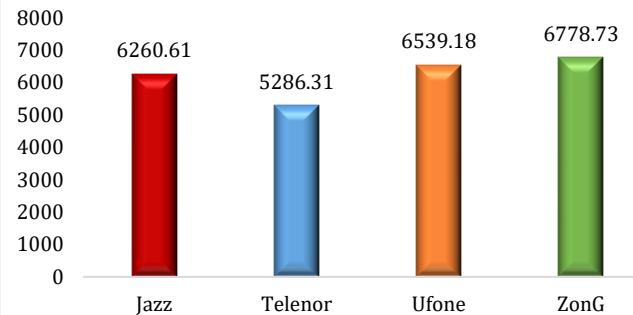
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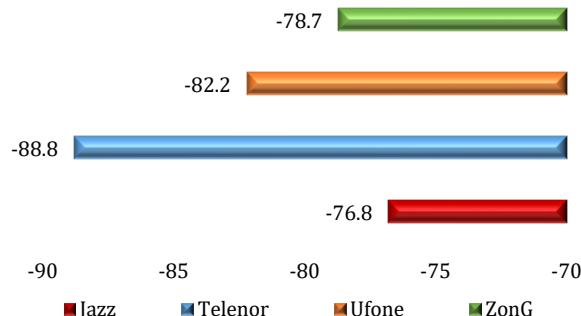
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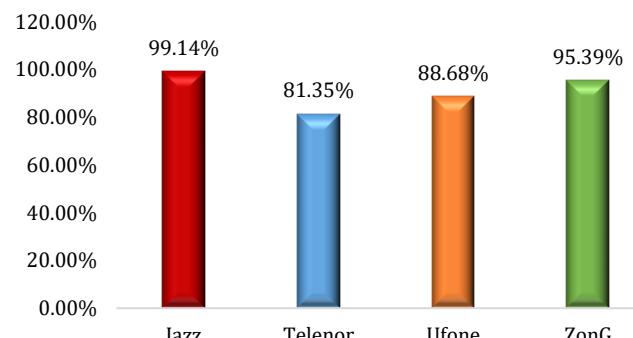
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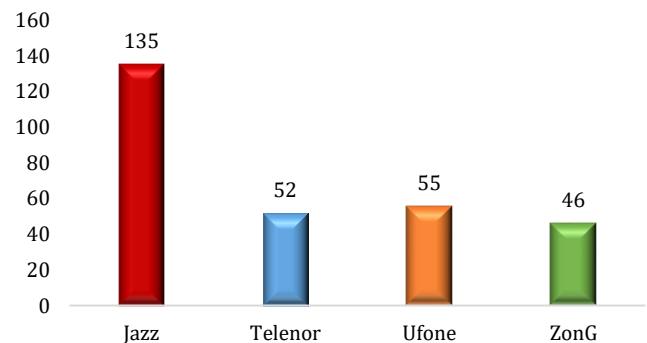
**Signal Strength (RSRP) > -100dBm**



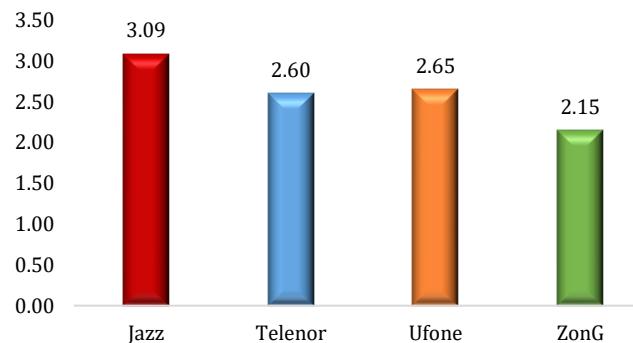
**Signal Strength (RSRP) Confidence Level > 90%**



**Latency <75 ms**

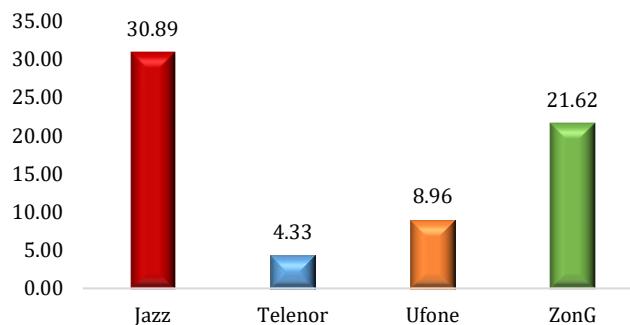


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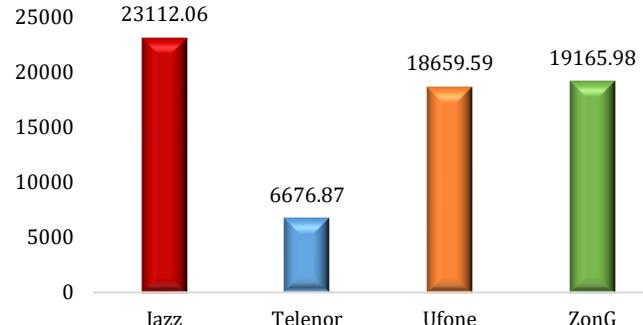


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – RAWALPINDI

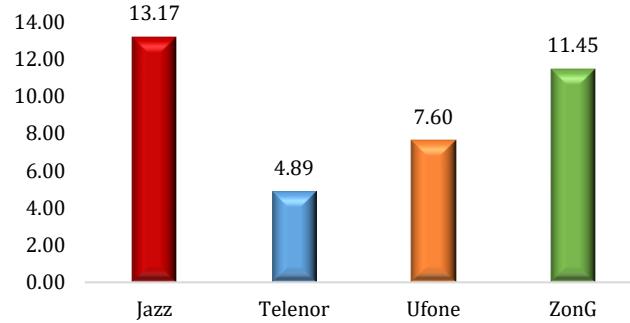
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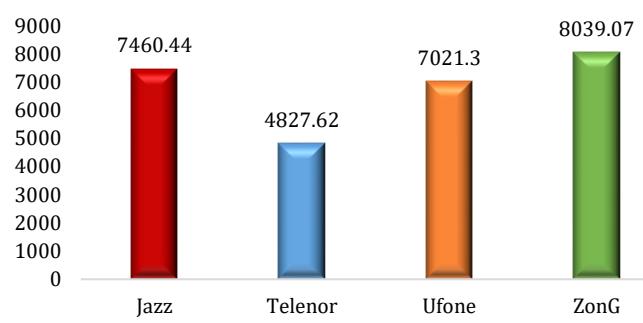
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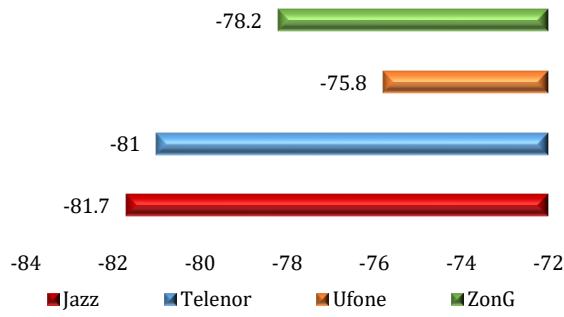
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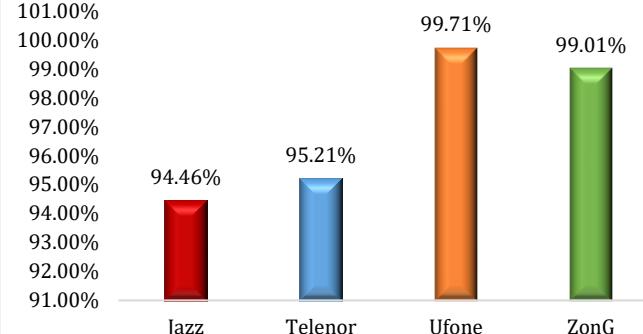
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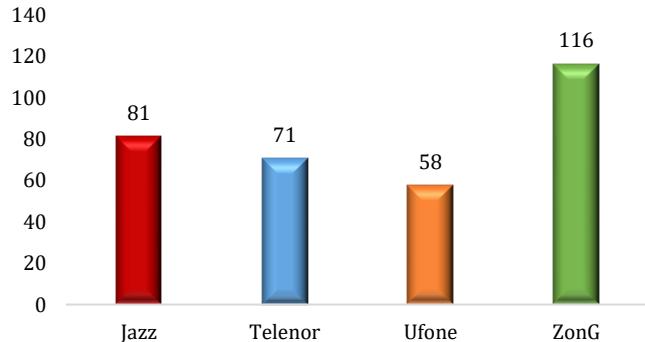
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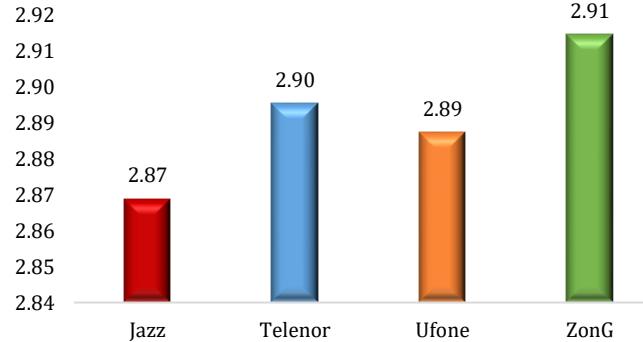
Signal Strength (RSRP) Confidence Level > 90%



Latency <75 ms

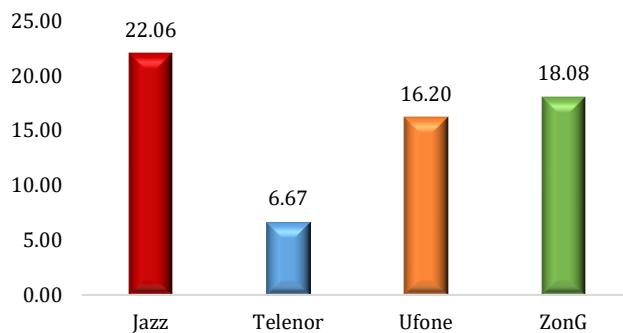


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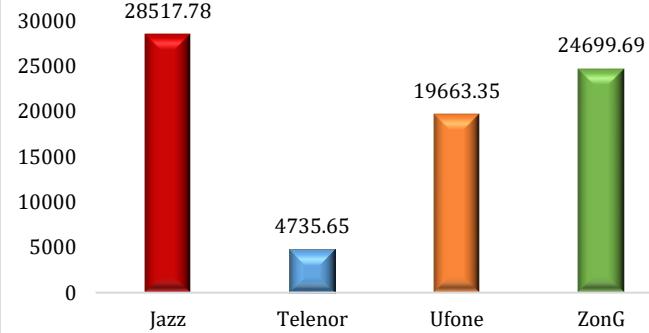


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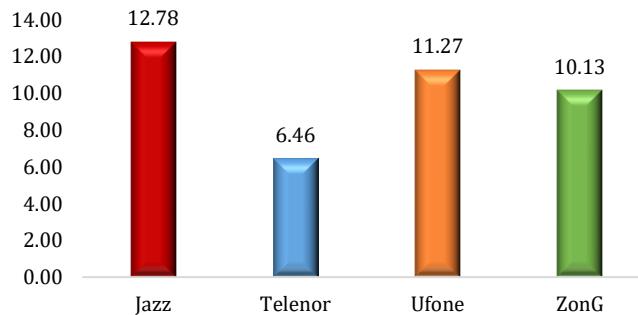
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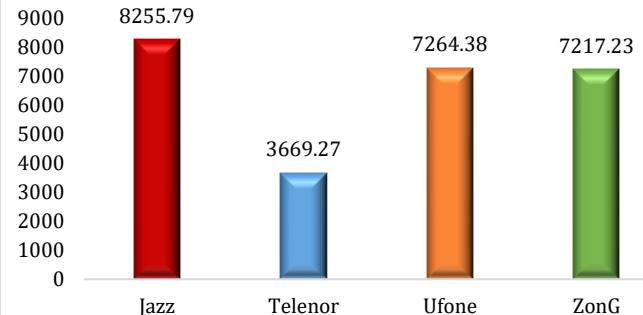
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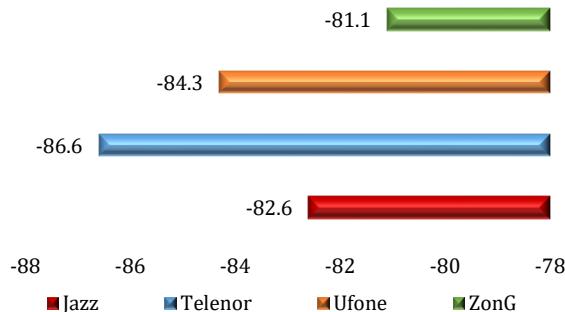
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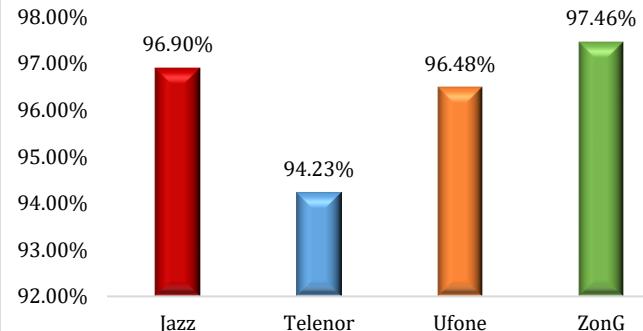
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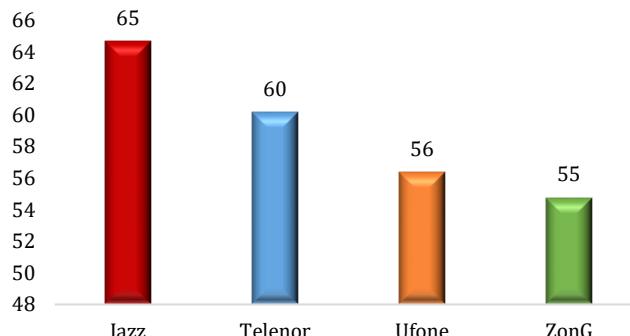
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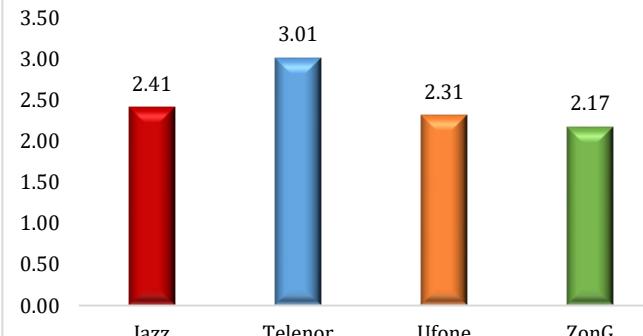
Signal Strength (RSRP) Confidence Level > 90%



Latency <75 ms

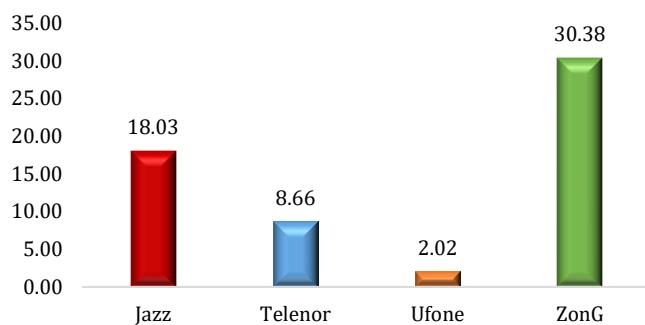


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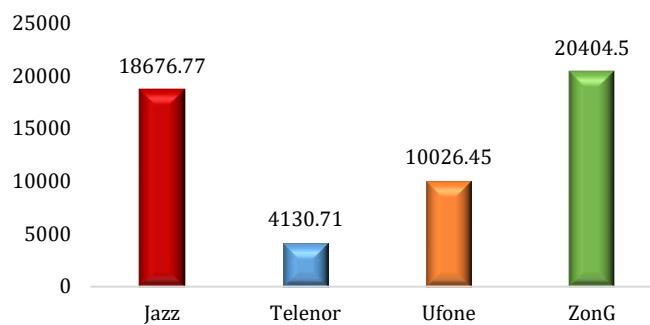


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – SHUJABAD

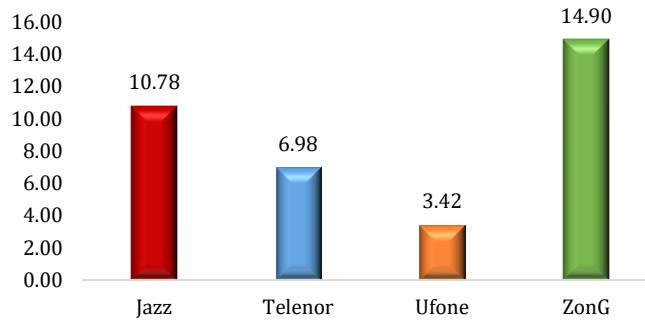
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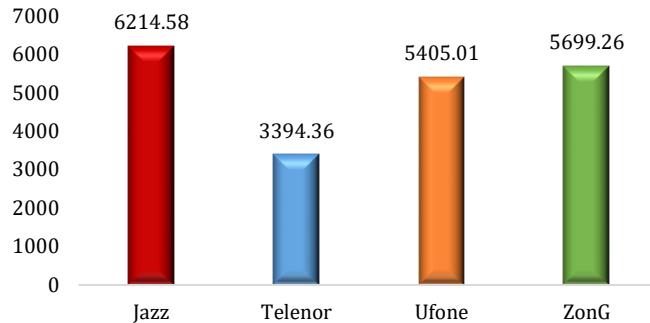
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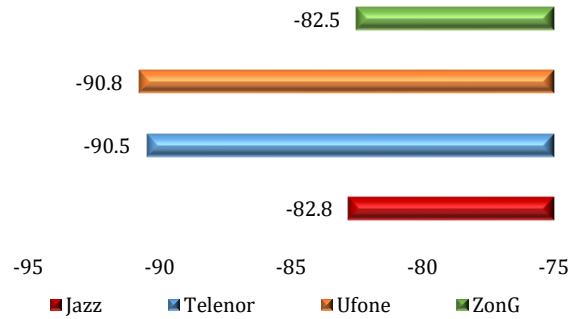
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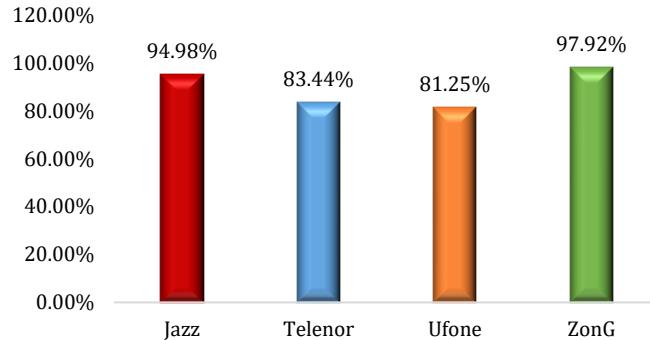
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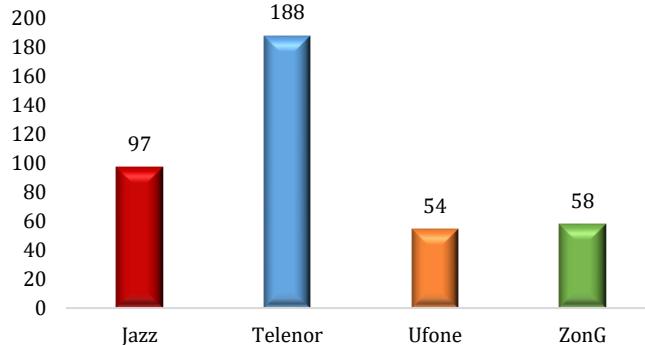
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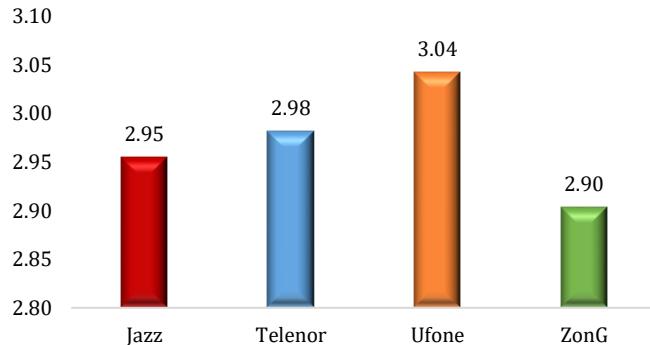
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Latency <75 ms

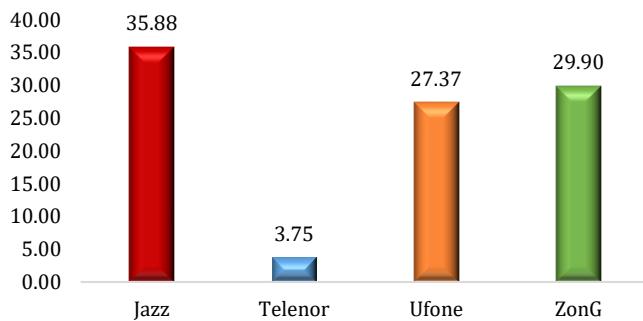


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## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – SUJAWAL

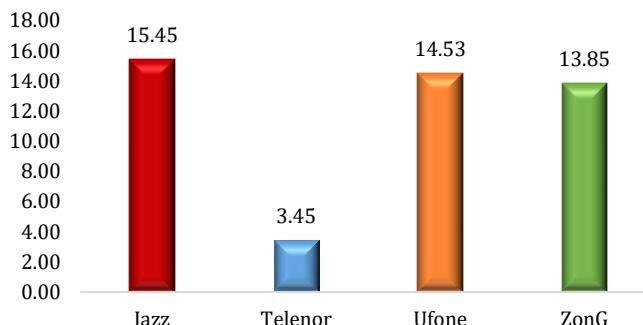
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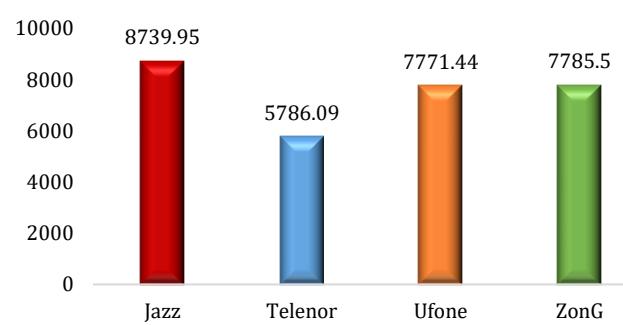
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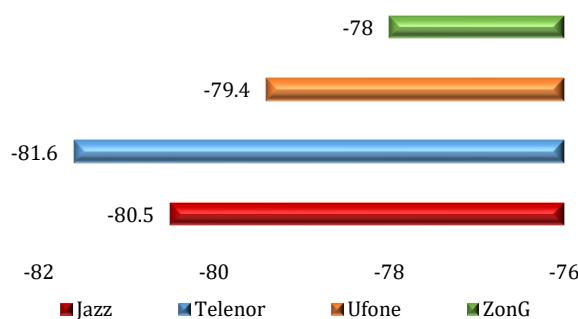
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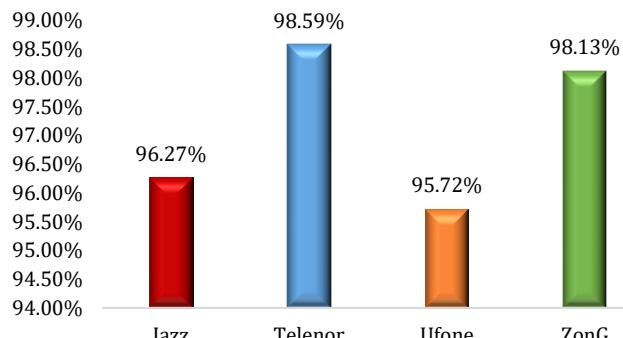
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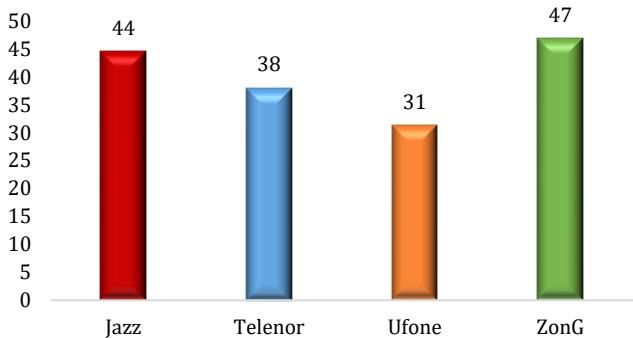
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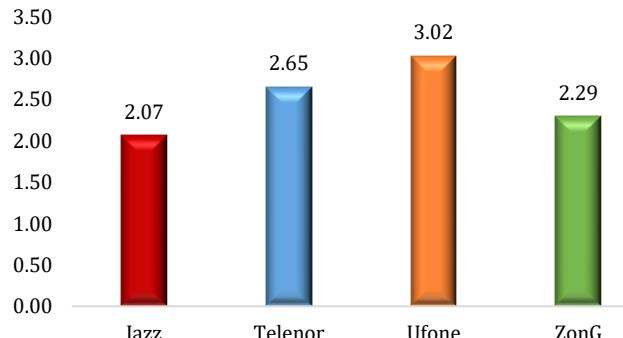
Signal Strength (RSRP) Confidence Level > 90%



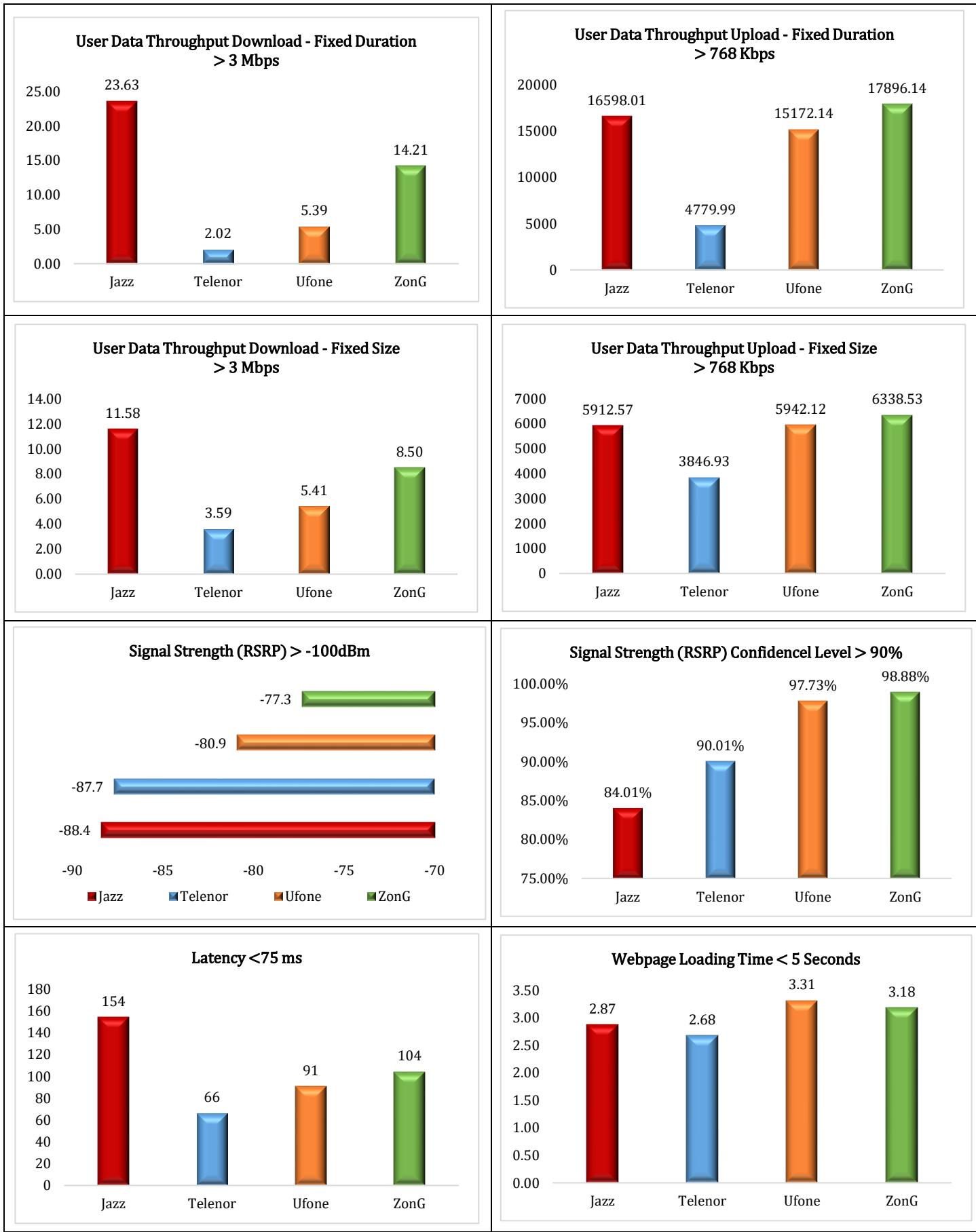
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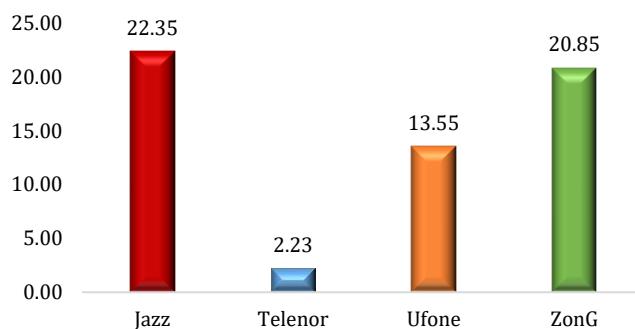


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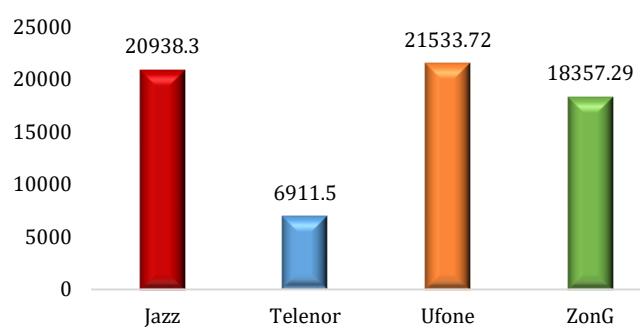


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – TAXILA & WAH CANTT

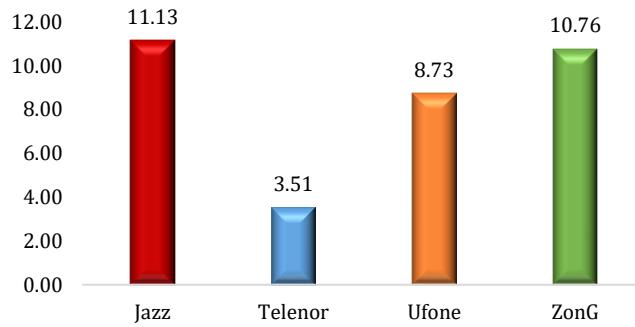
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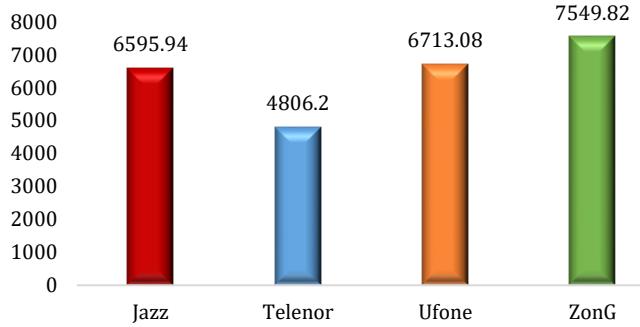
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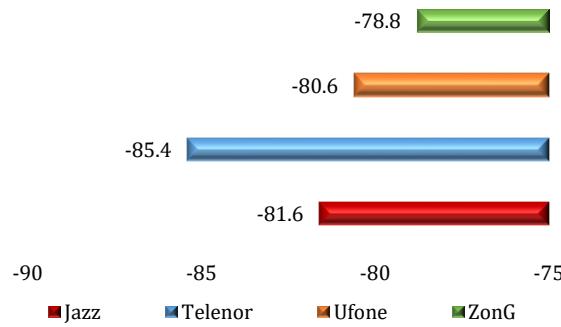
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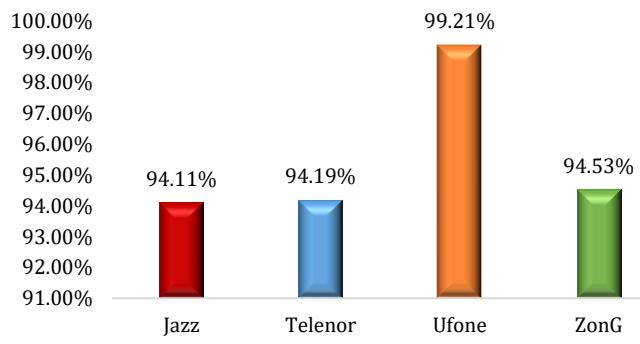
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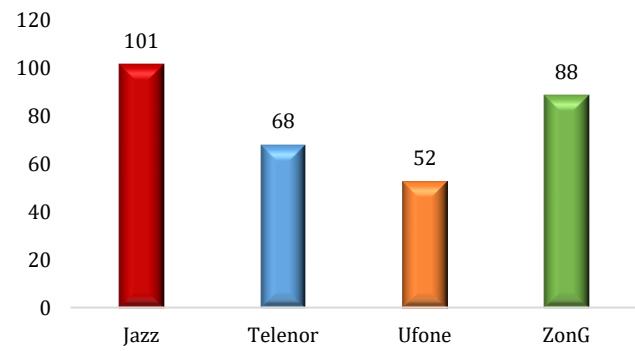
Signal Strength (RSRP) > -100dBm



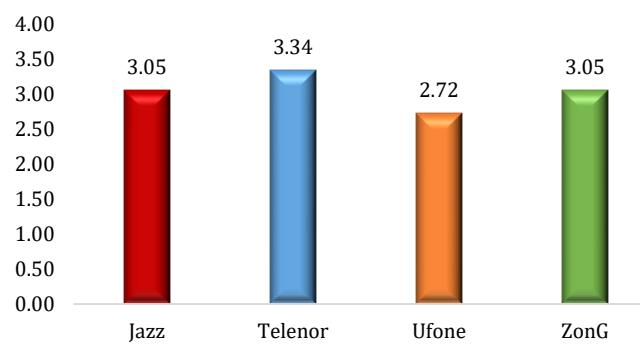
Signal Strength (RSRP) Confidence Level > 90%



Latency <75 ms

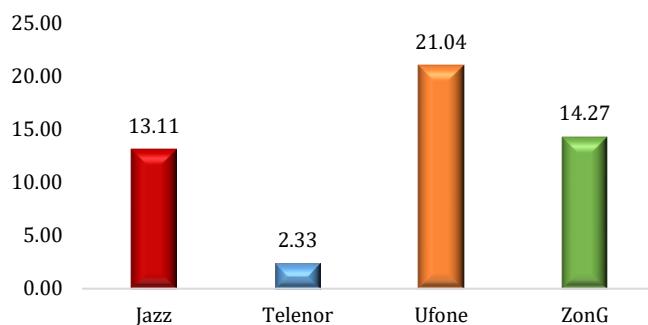


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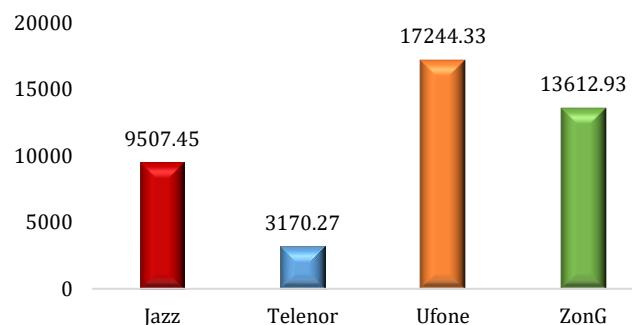


## QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – UPPER DIR

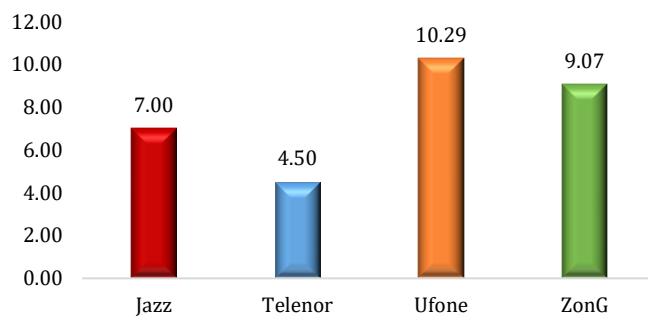
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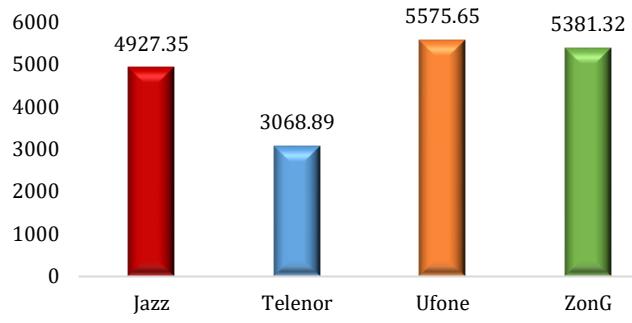
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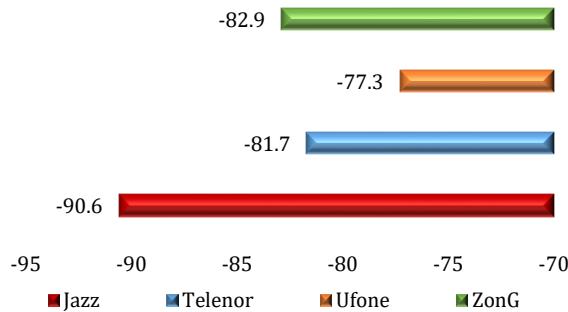
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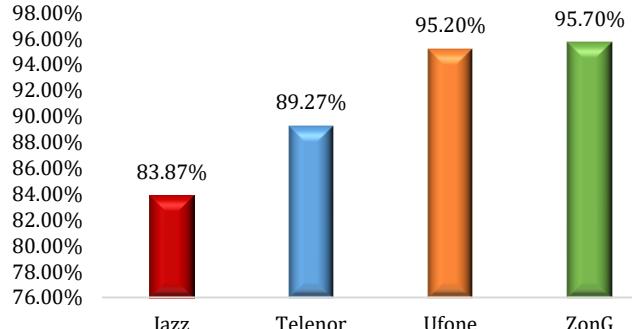
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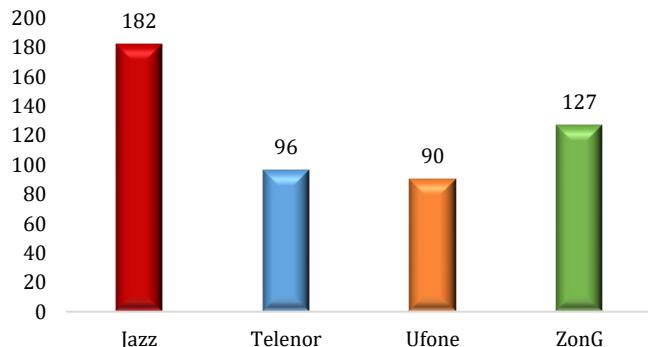
Signal Strength (RSRP) > -100dBm



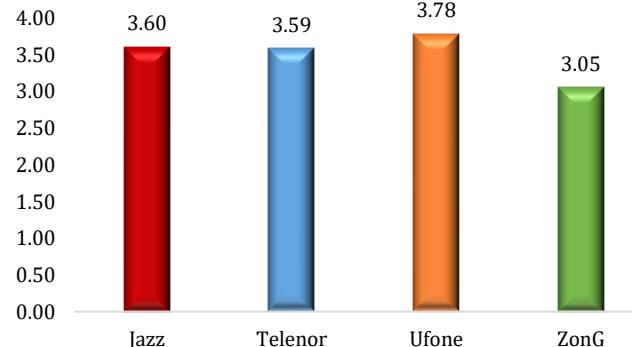
Signal Strength (RSRP) Confidence Level > 90%



Latency <75 ms



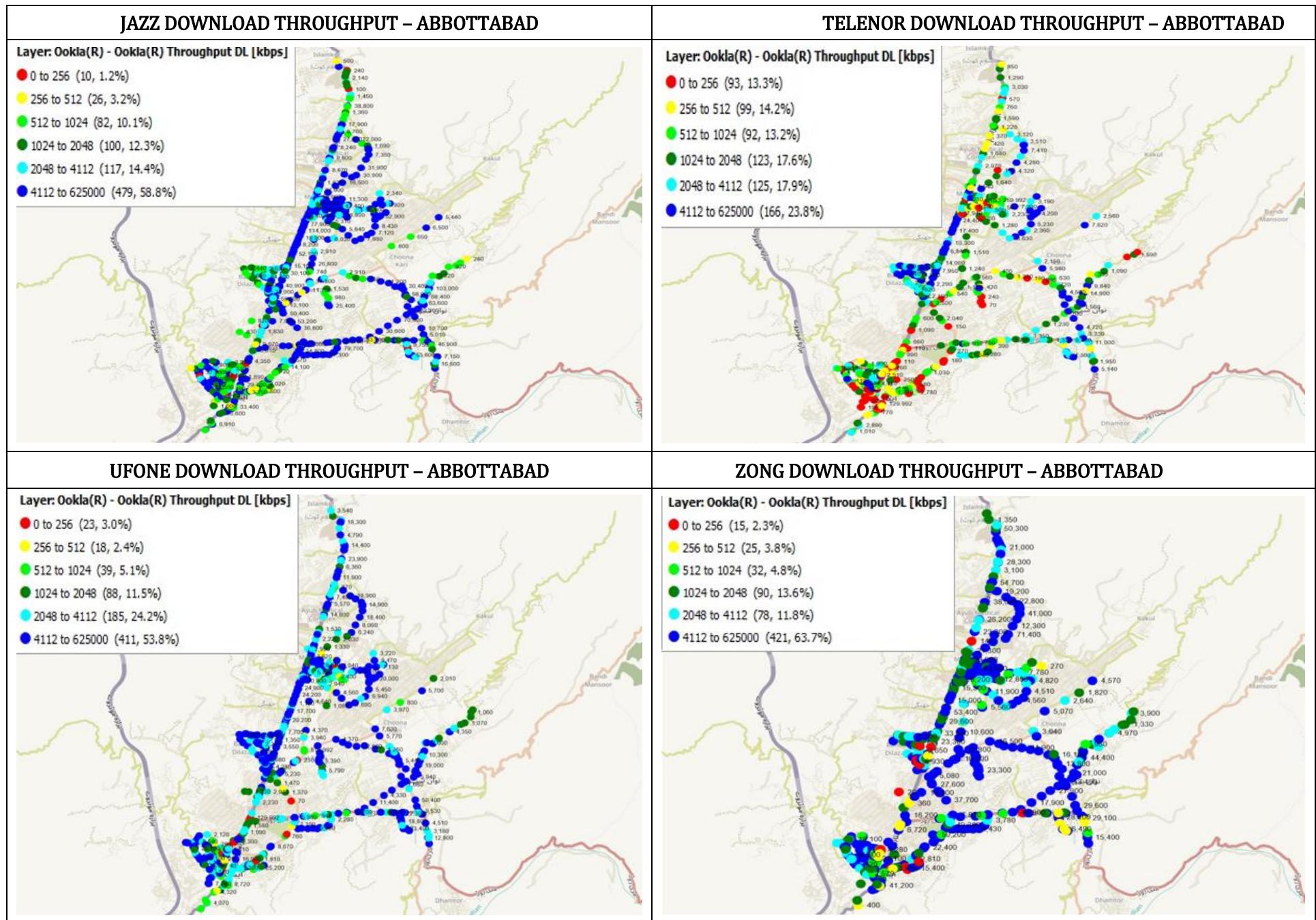
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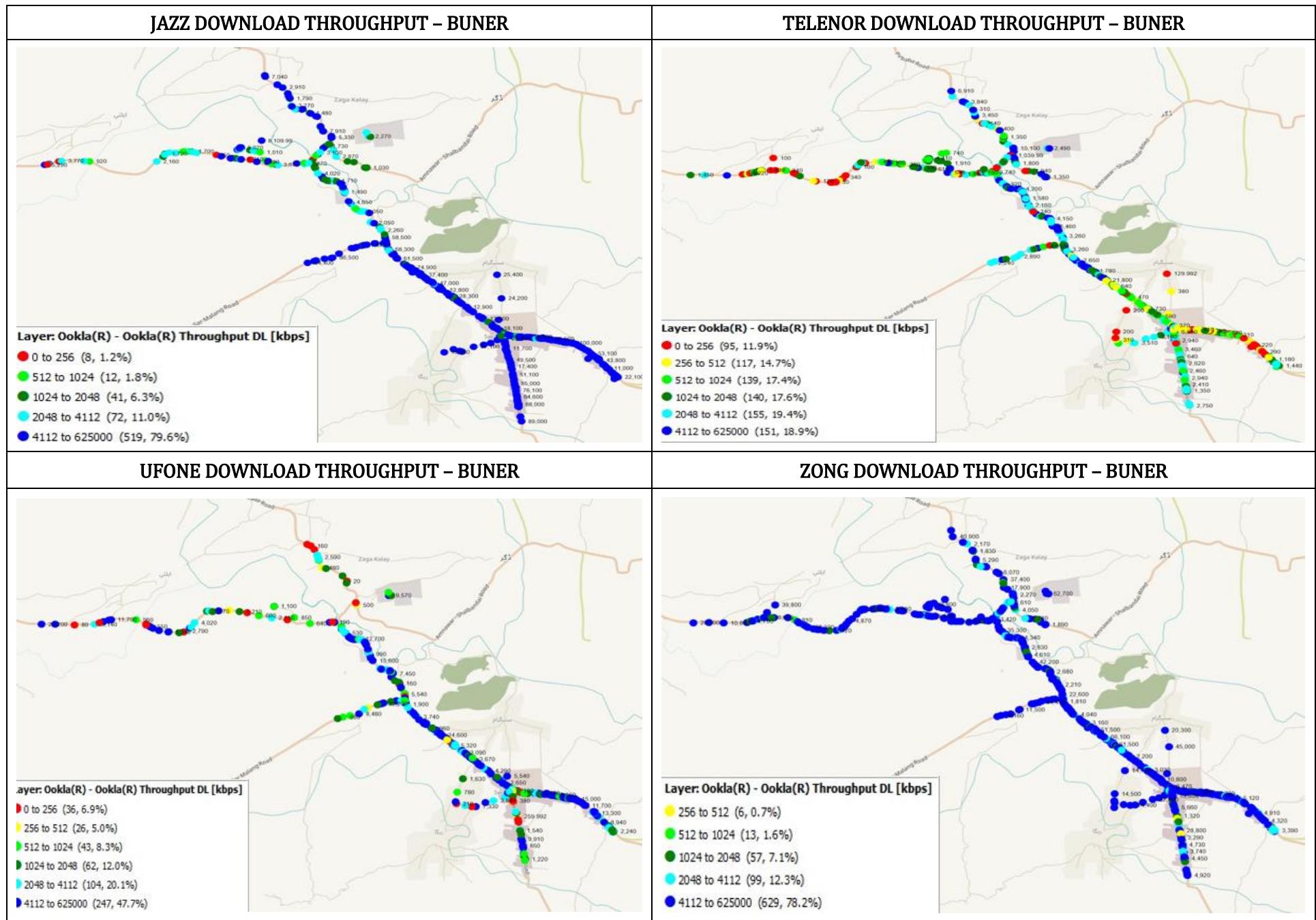
## Annex -B(Coverage Maps)

00KLA

## OOKLA SPEED TEST RESULTS

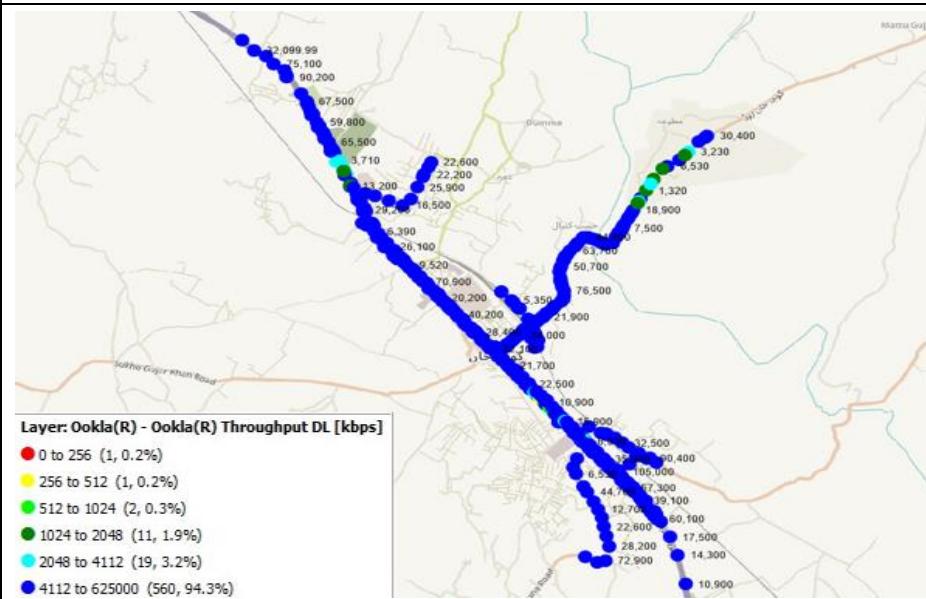


## OOKLA SPEED TEST RESULTS

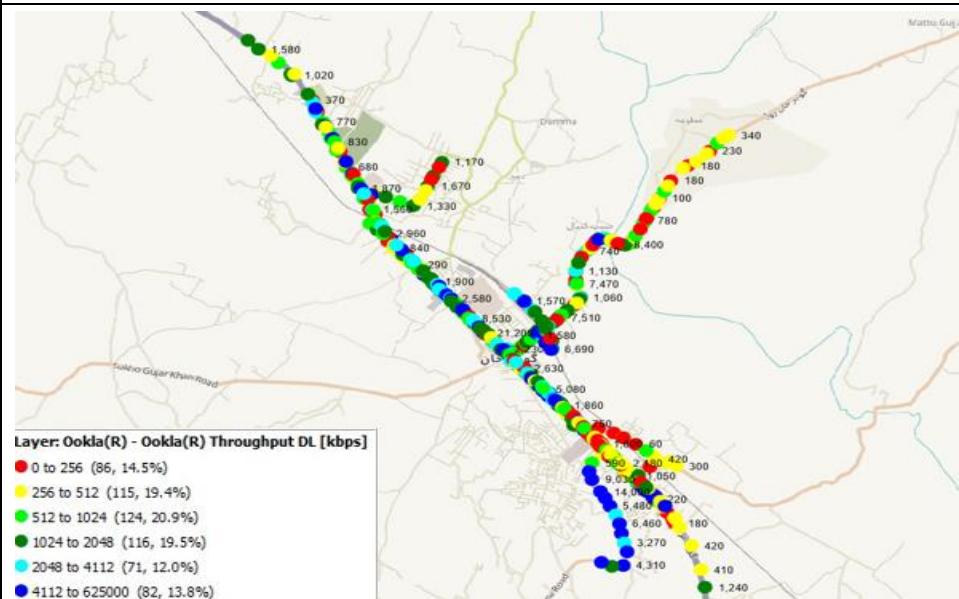


## OOKLA SPEED TEST RESULTS

JAZZ DOWNLOAD THROUGHPUT – GUJAR KHAN



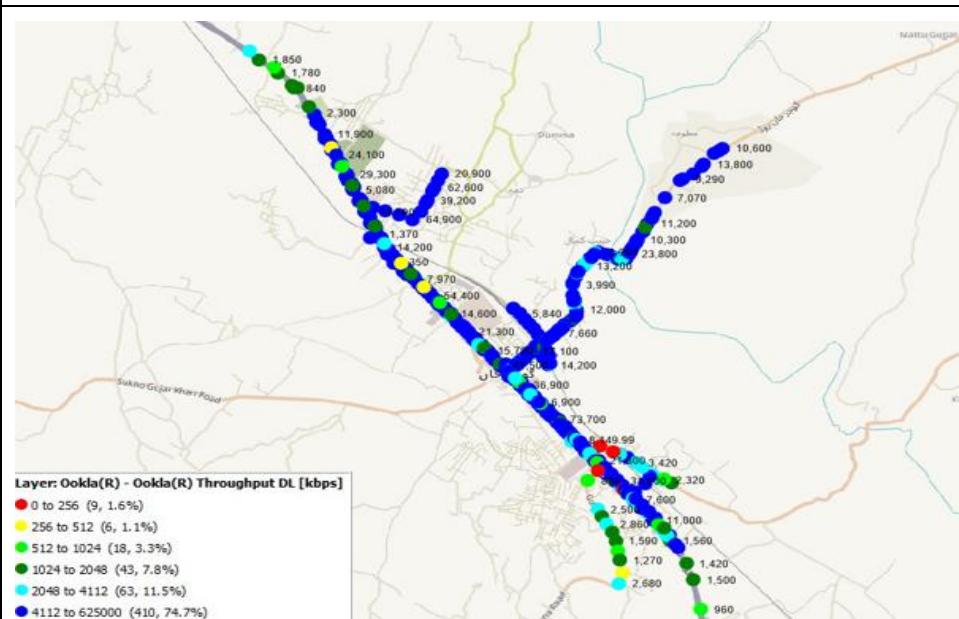
TELENOR DOWNLOAD THROUGHPUT – GUJAR KHAN



UFONE DOWNLOAD THROUGHPUT – GUJAR KHAN

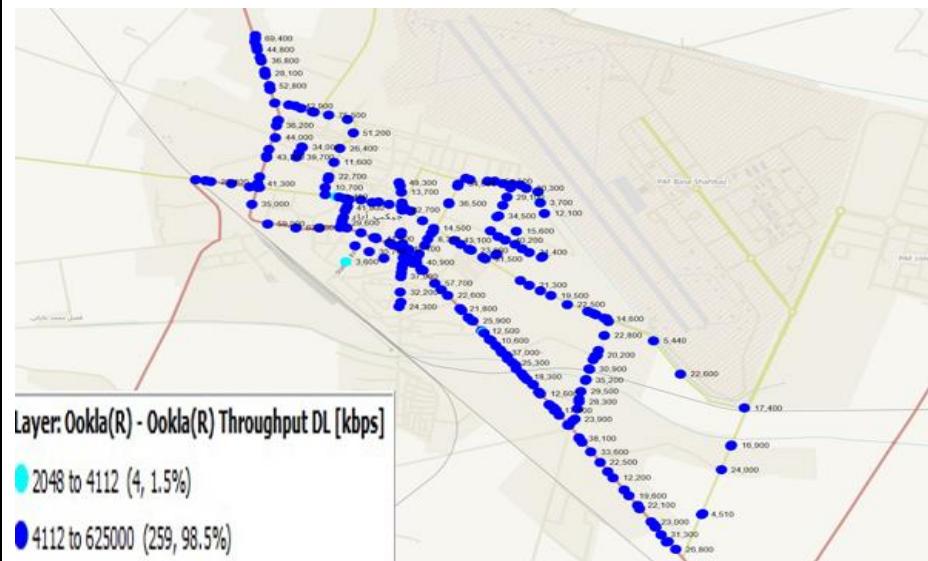


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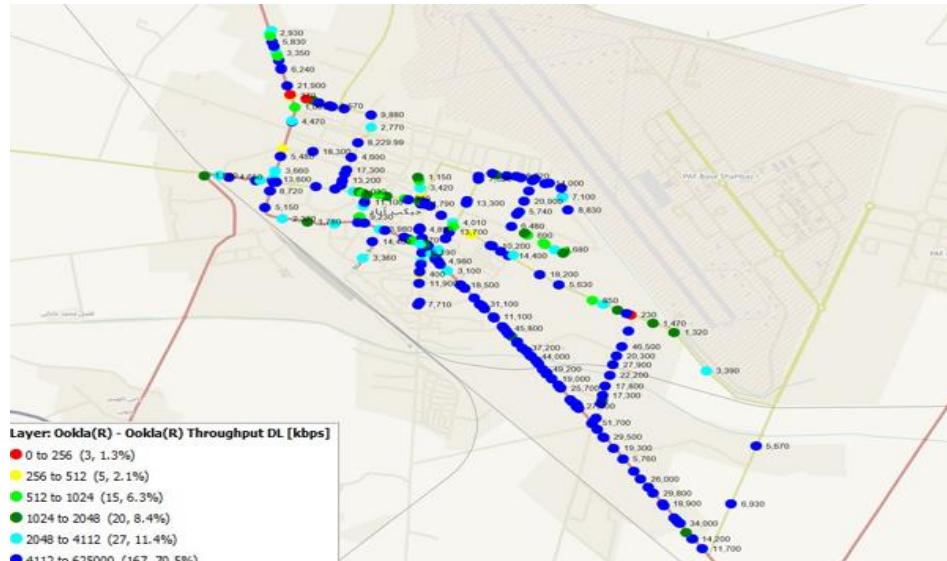


## OOKLA SPEED TEST RESULTS

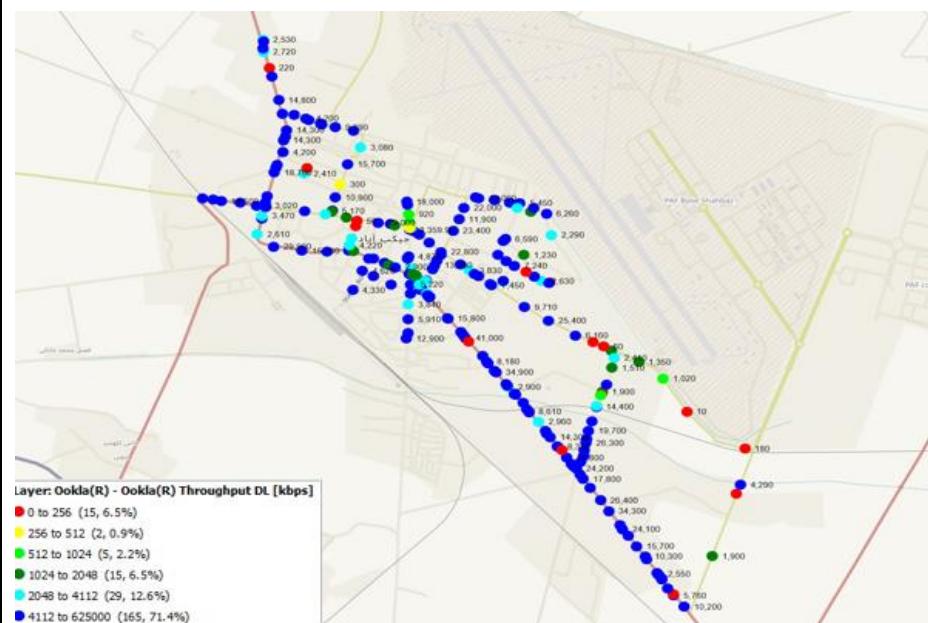
JAZZ DOWNLOAD THROUGHPUT – JACOBABAD



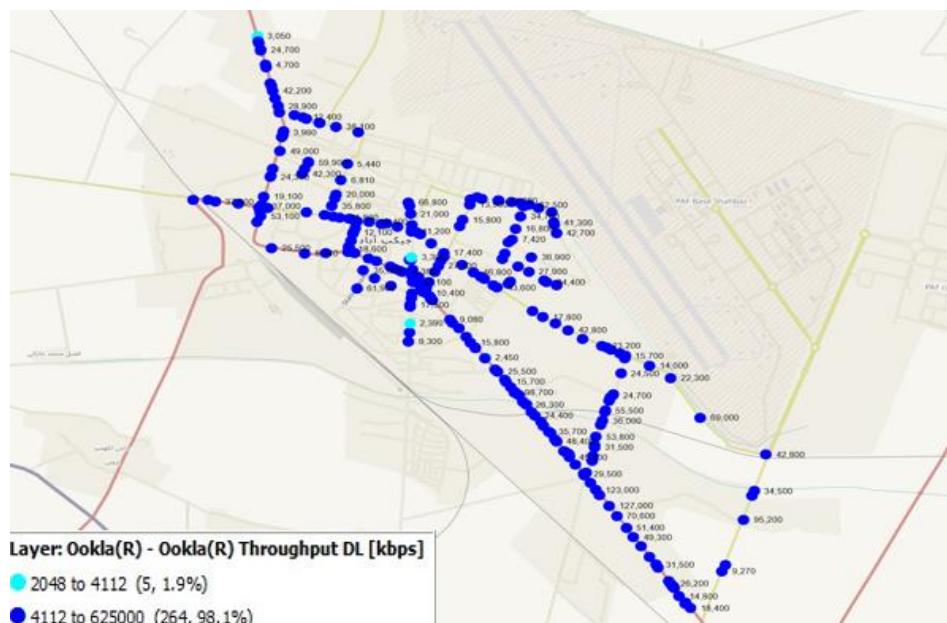
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UFONE DOWNLOAD THROUGHPUT – JACOBABAD

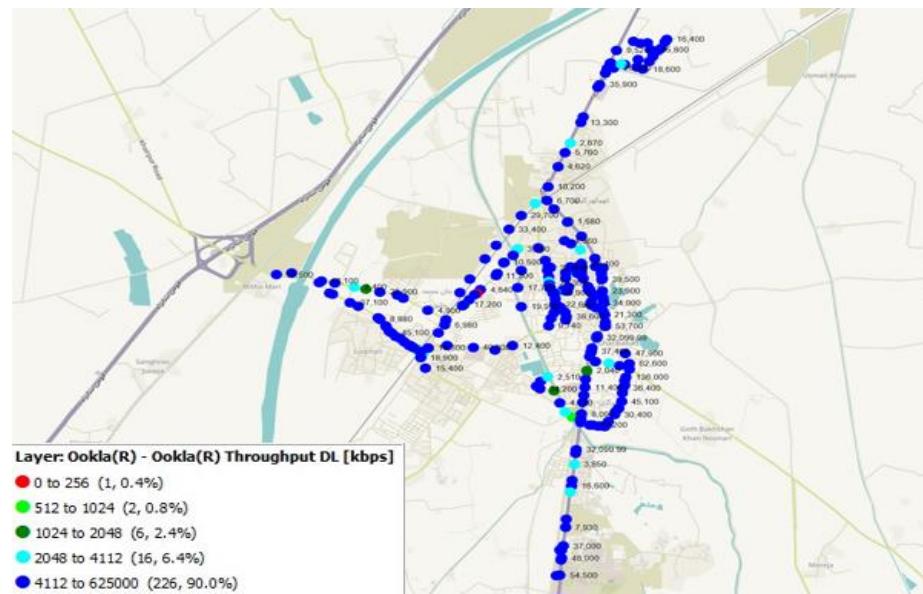


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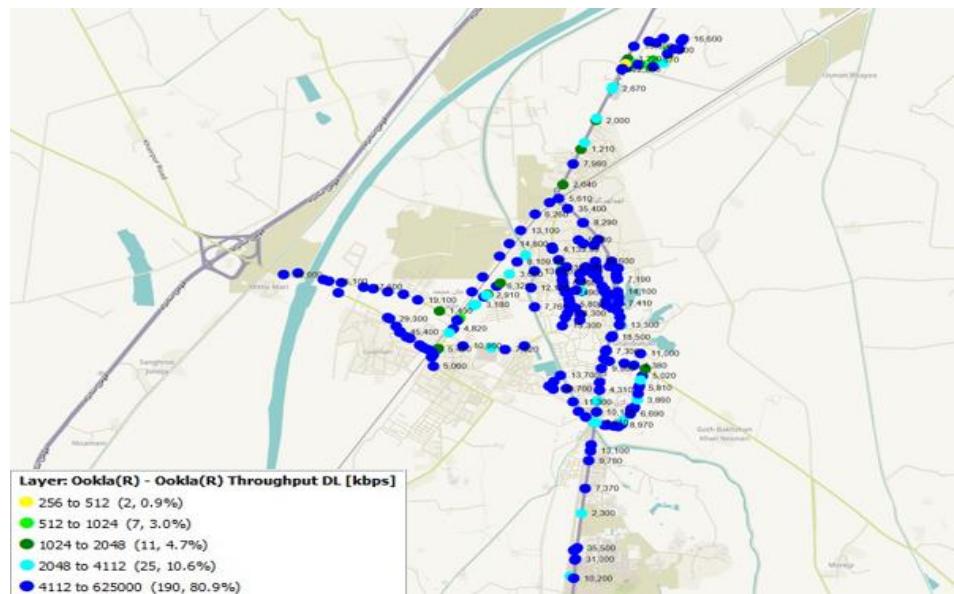


## OOKLA SPEED TEST RESULTS

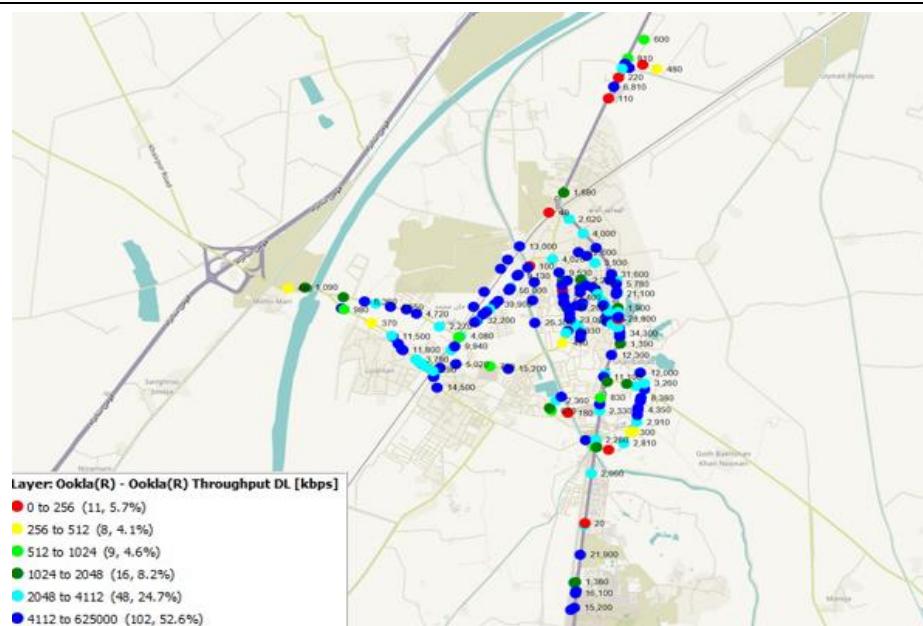
JAZZ DOWNLOAD THROUGHPUT – KHAIRPUR



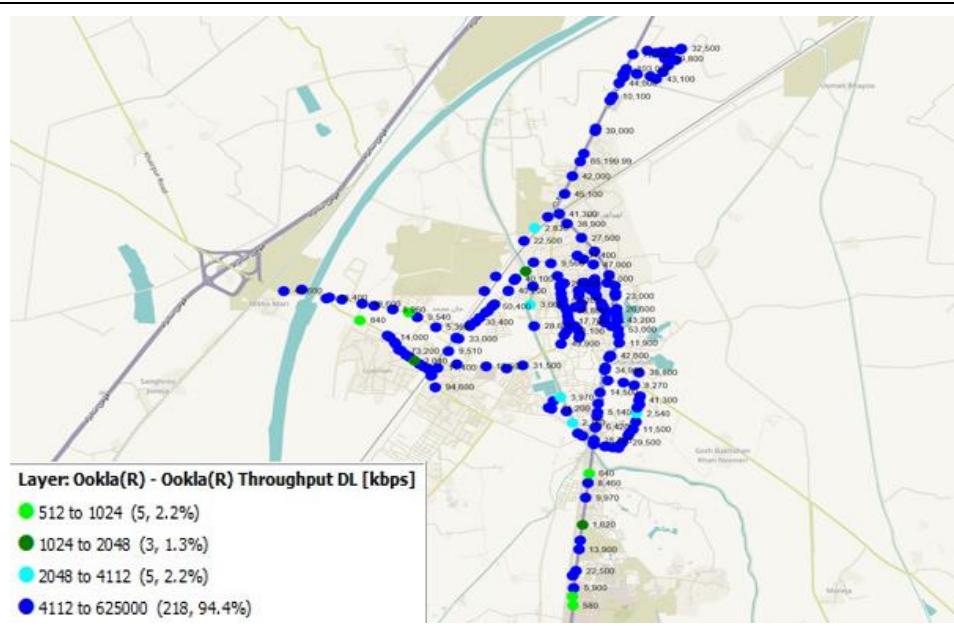
TELENOR DOWNLOAD THROUGHPUT – KHAIRPUR



UFONE DOWNLOAD THROUGHPUT – KHAIRPUR

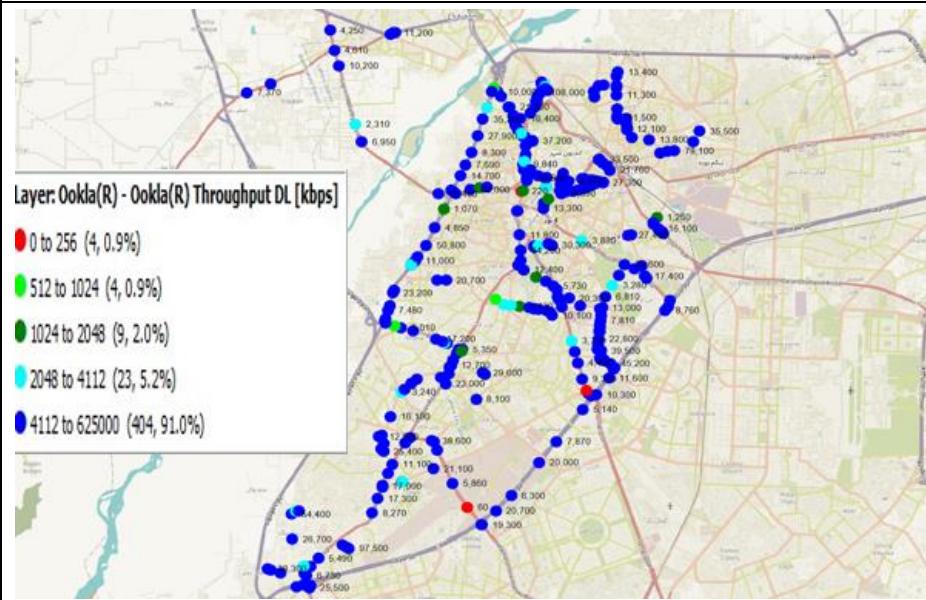


ZONG DOWNLOAD THROUGHPUT – KHAIRPUR

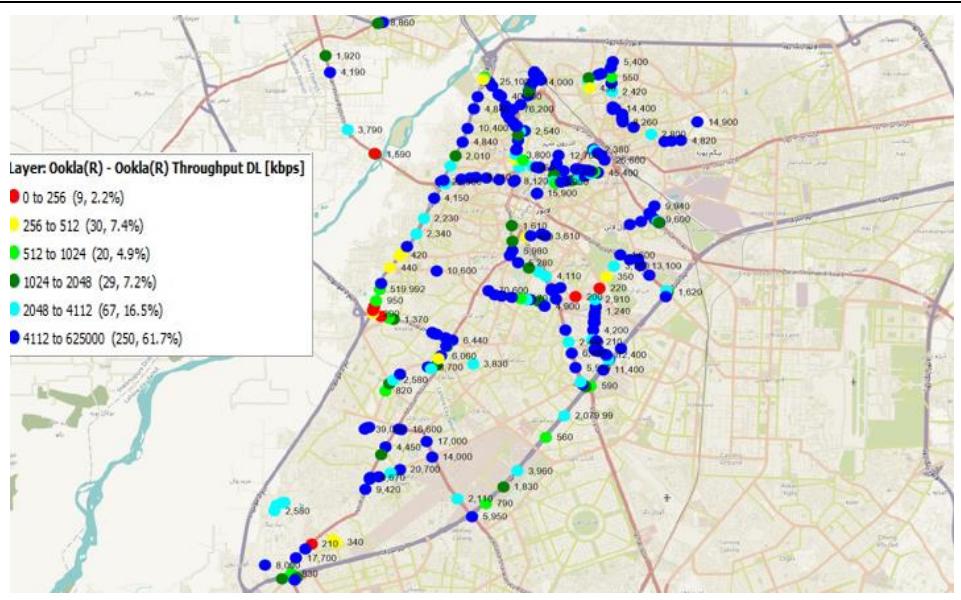


## OOKLA SPEED TEST RESULTS

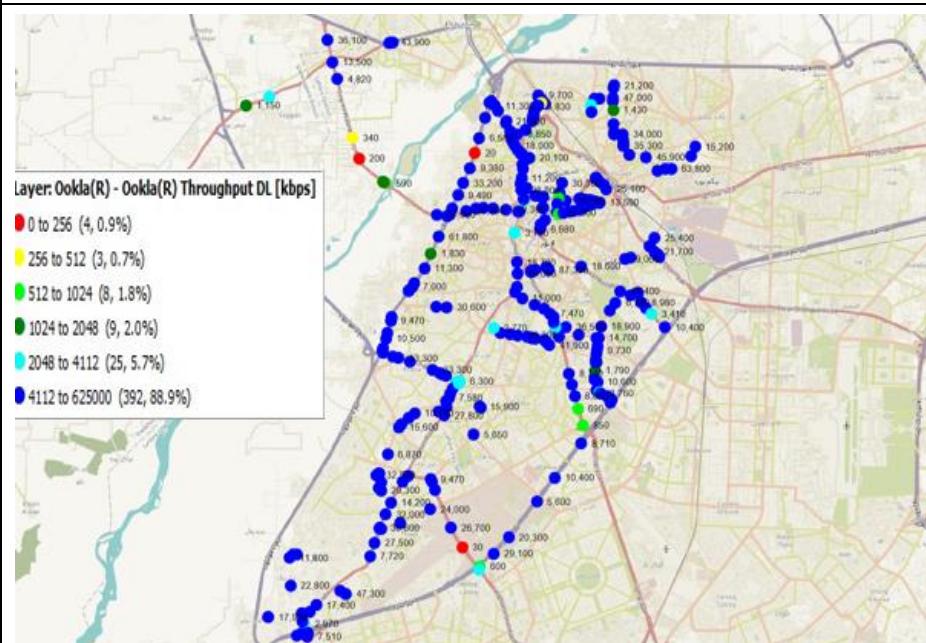
JAZZ DOWNLOAD THROUGHPUT – LAHORE



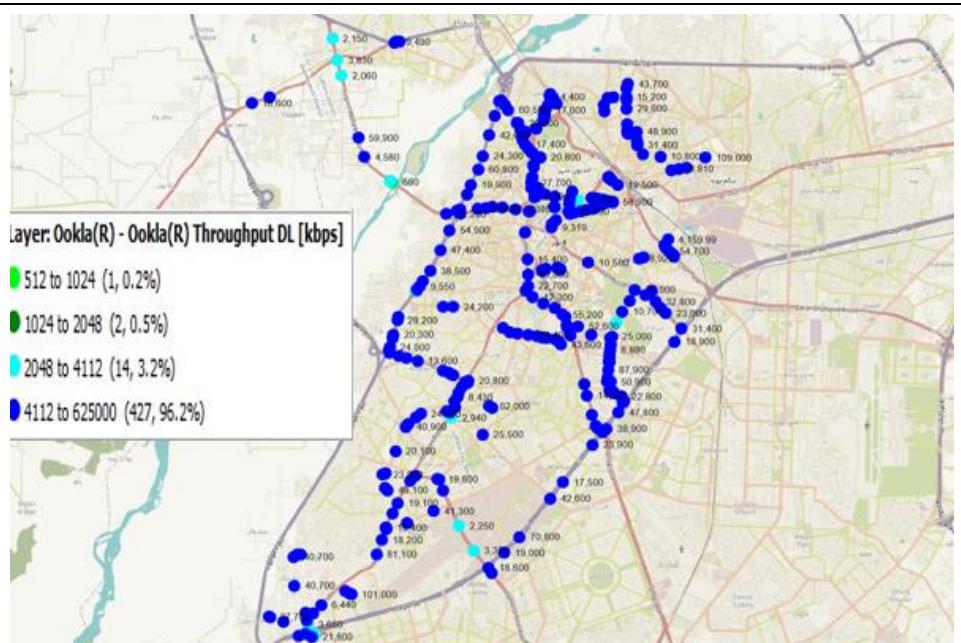
TELENOR DOWNLOAD THROUGHPUT – LAHORE



UFONE DOWNLOAD THROUGHPUT – LAHORE

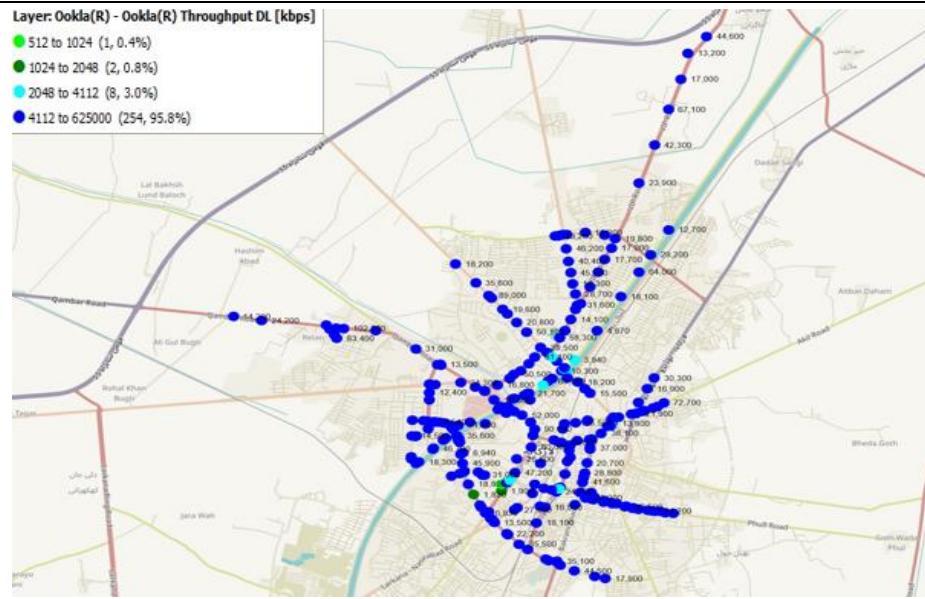


ZONG DOWNLOAD THROUGHPUT – LAHORE

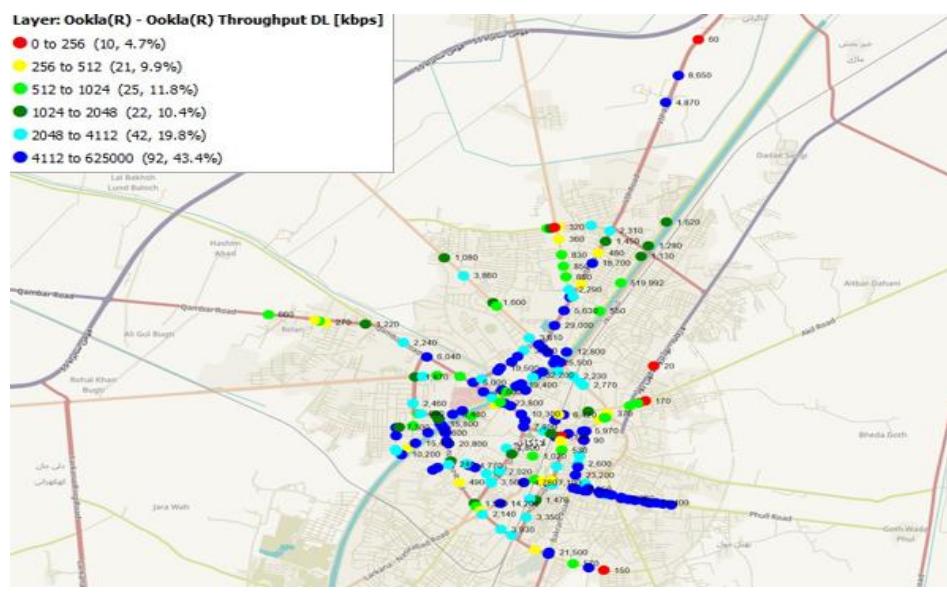


## **OOKLA SPEED TEST RESULTS**

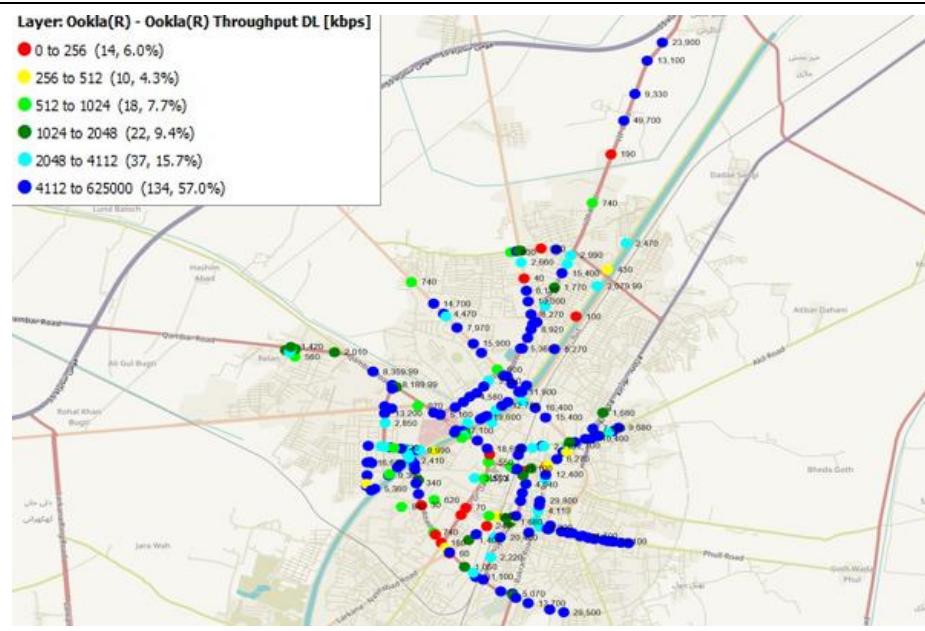
## JAZZ DOWNLOAD THROUGHPUT – LARKANA



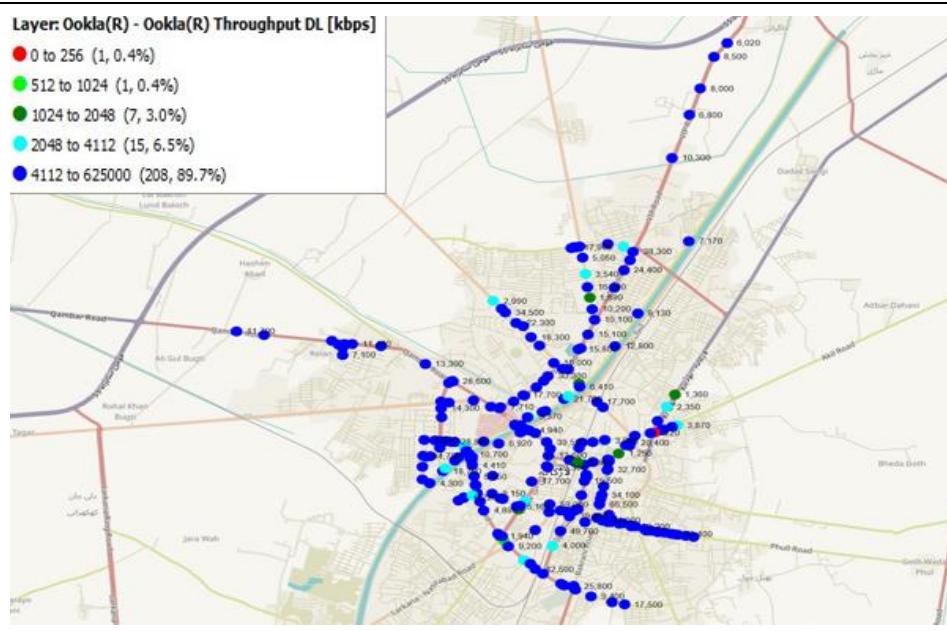
## **TELENOR DOWNLOAD THROUGHPUT- LARKANA**



UFONE DOWNLOAD THROUGHPUT- LARKANA

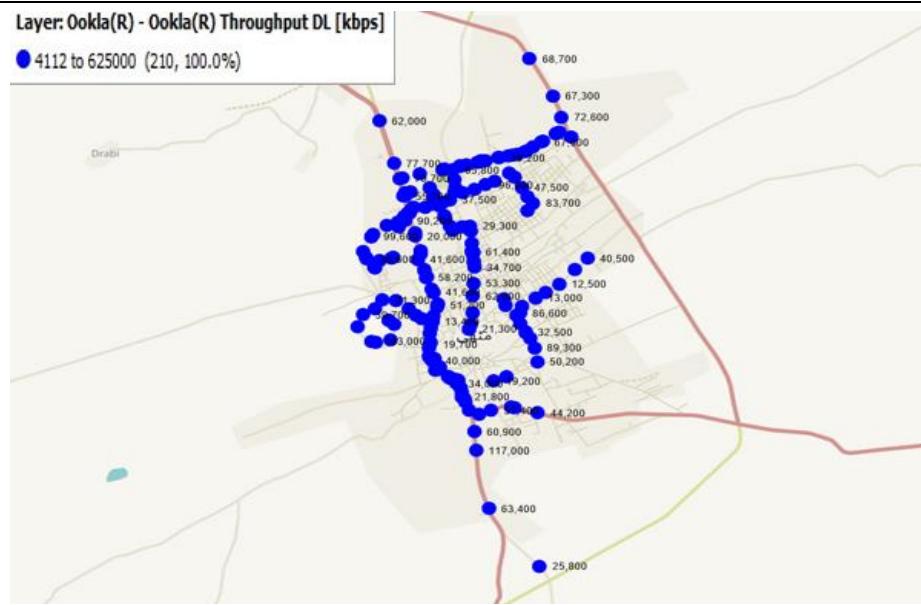


## ZONG DOWNLOAD THROUGHPUT – LARKANA

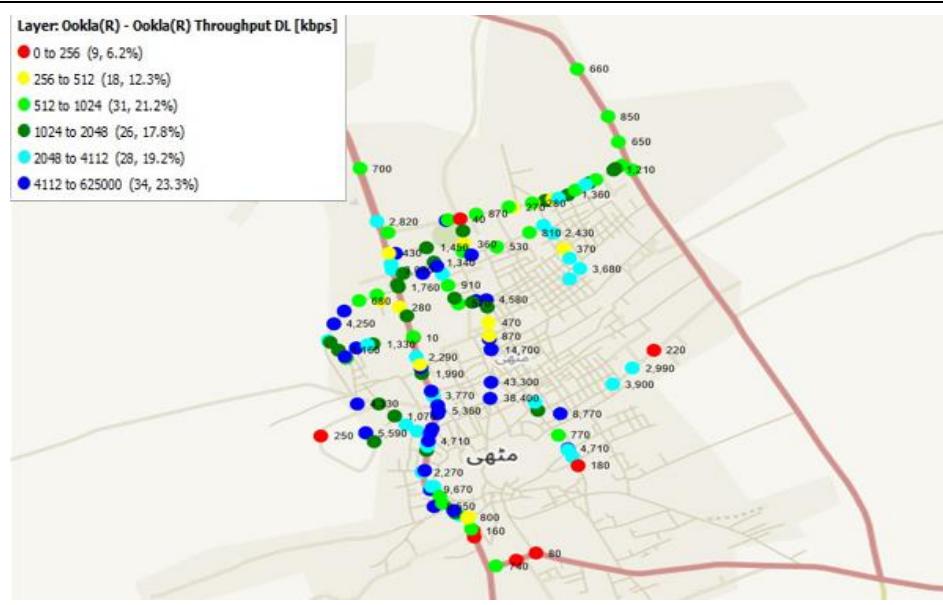


## OOKLA SPEED TEST RESULTS

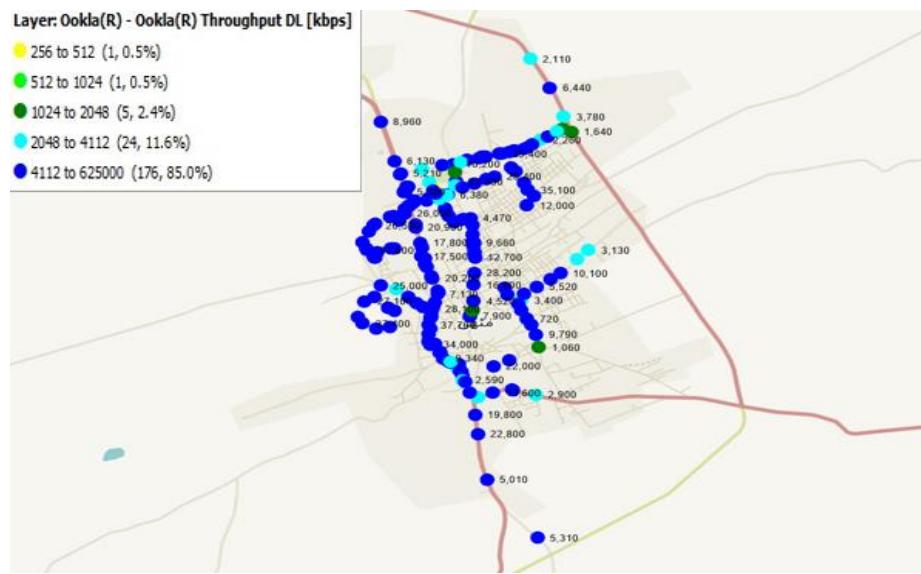
JAZZ DOWNLOAD THROUGHPUT – MITHI



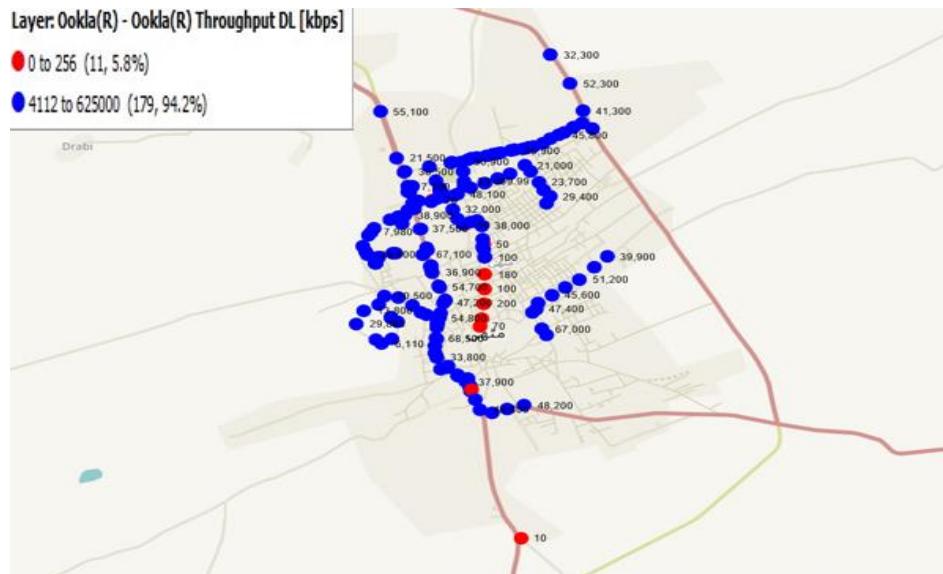
TELENOR DOWNLOAD THROUGHPUT – MITHI



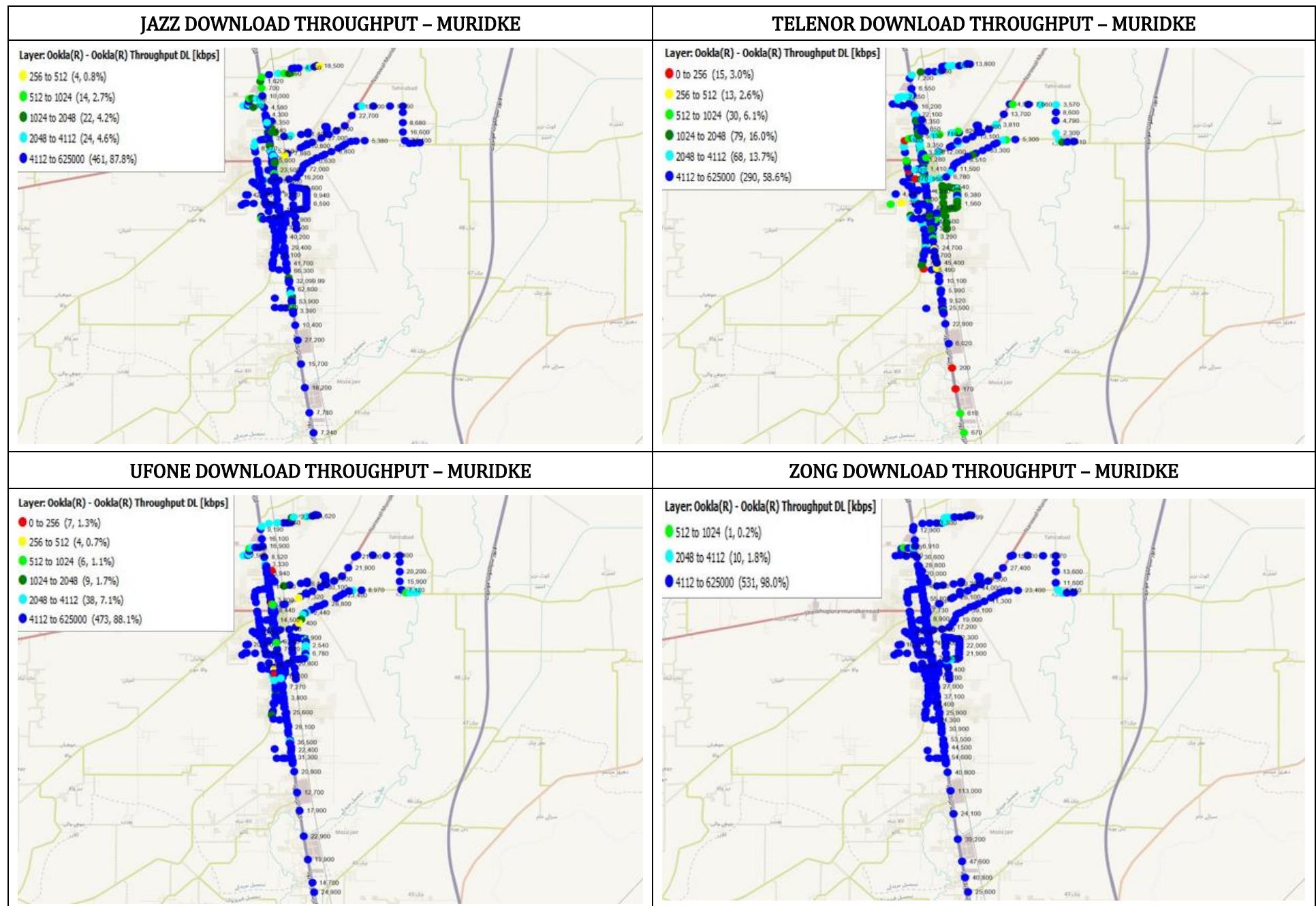
UFONE DOWNLOAD THROUGHPUT – MITHI



ZONG DOWNLOAD THROUGHPUT – MITHI



## OOKLA SPEED TEST RESULTS

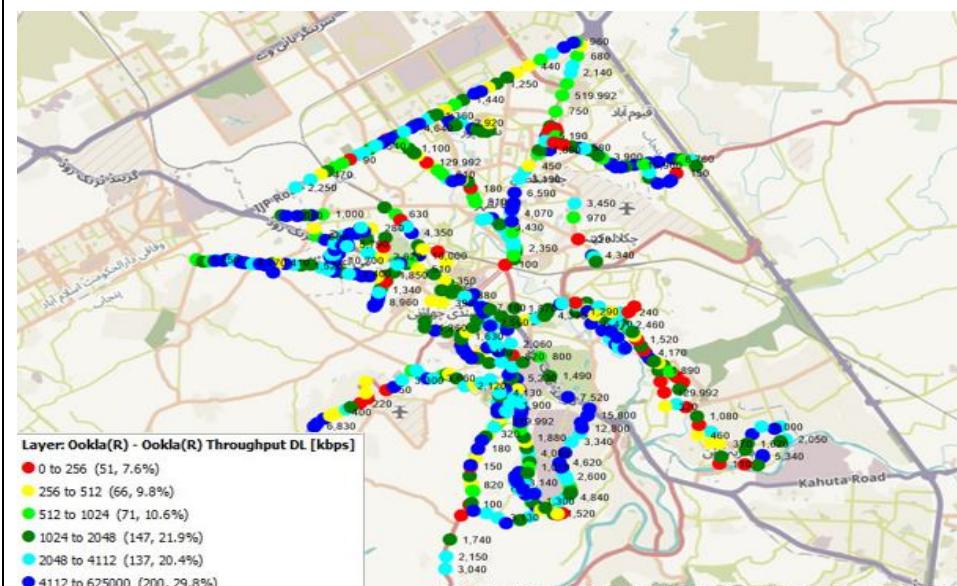


## OOKLA SPEED TEST RESULTS

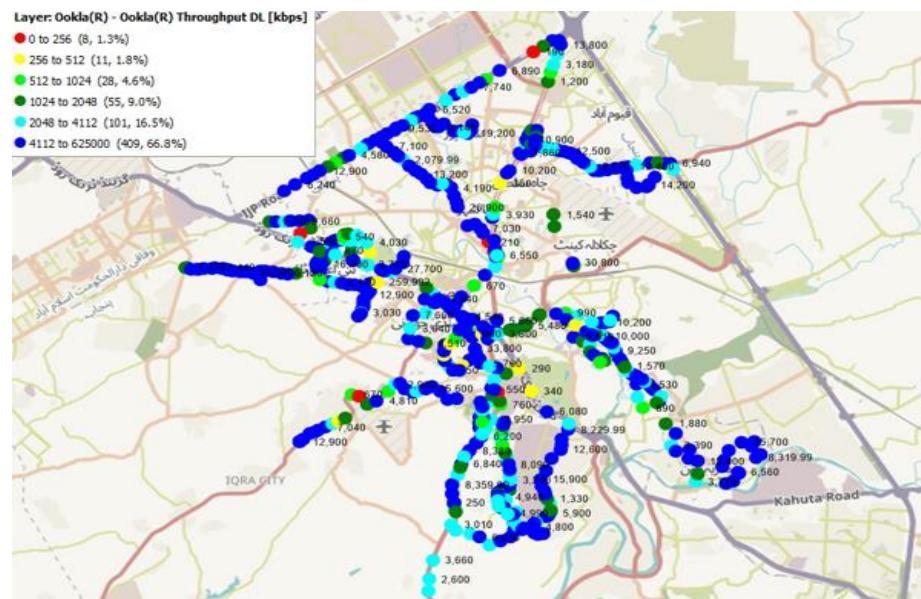
JAZZ DOWNLOAD THROUGHPUT – RAWALPINDI



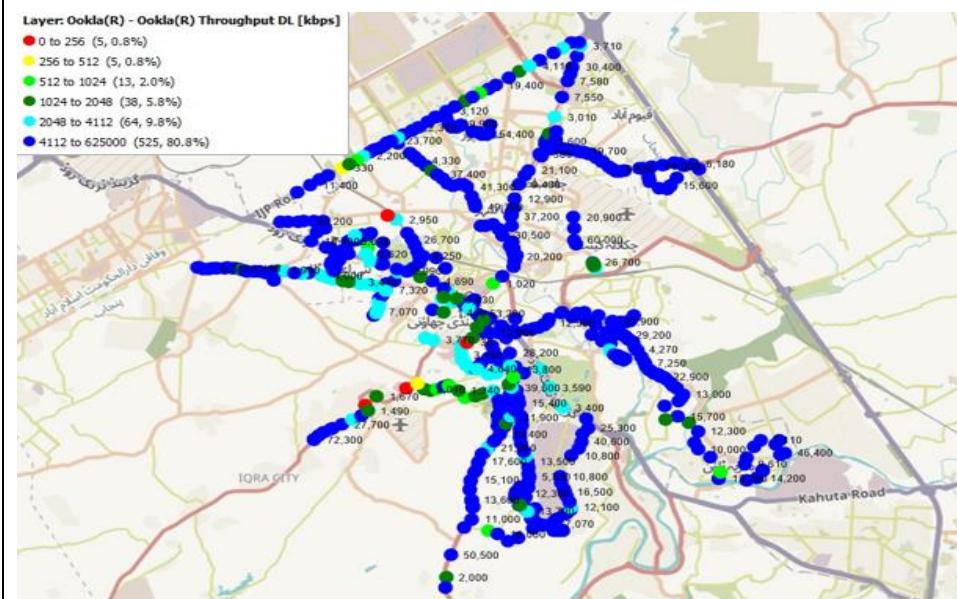
TELENOR DOWNLOAD THROUGHPUT – RAWALPINDI



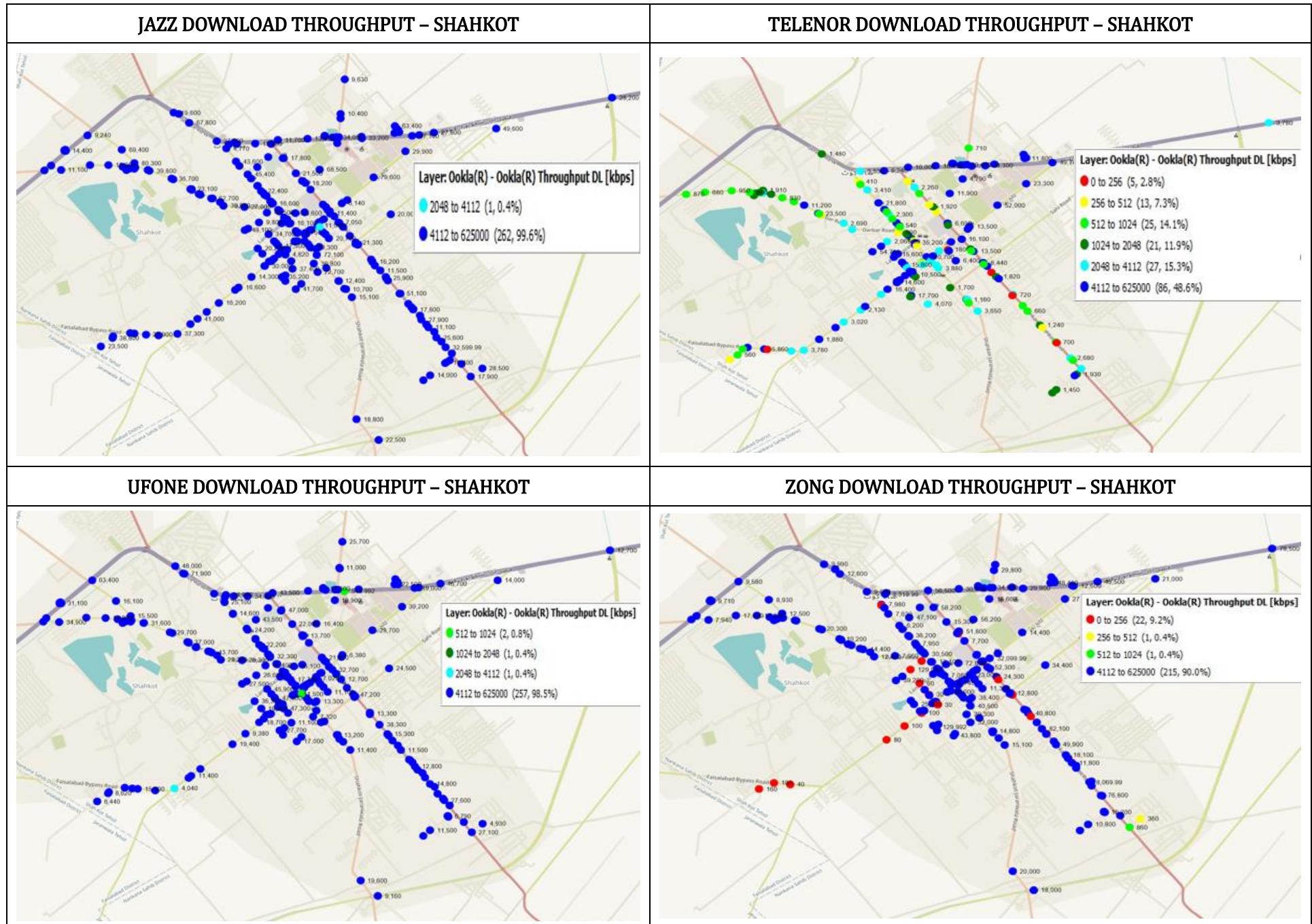
UFONE DOWNLOAD THROUGHPUT – RAWALPINDI



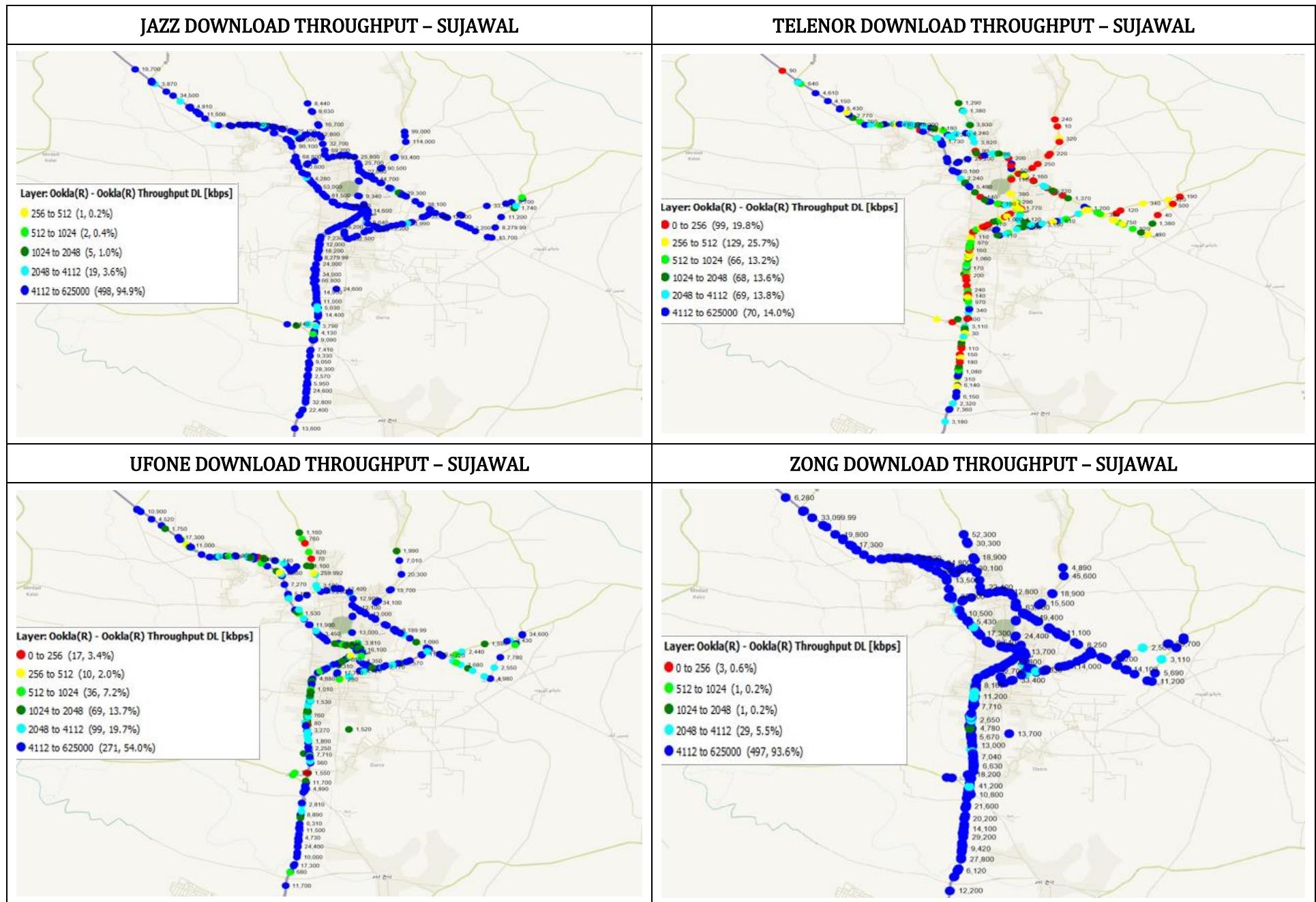
ZONG DOWNLOAD THROUGHPUT – RAWALPINDI



## OOKLA SPEED TEST RESULTS



## OOKLA SPEED TEST RESULTS

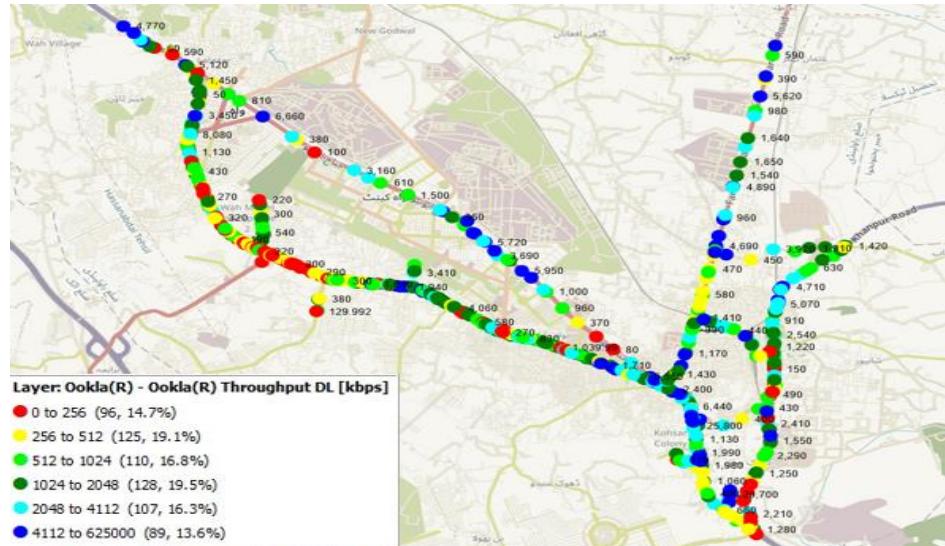


## OOKLA SPEED TEST RESULTS

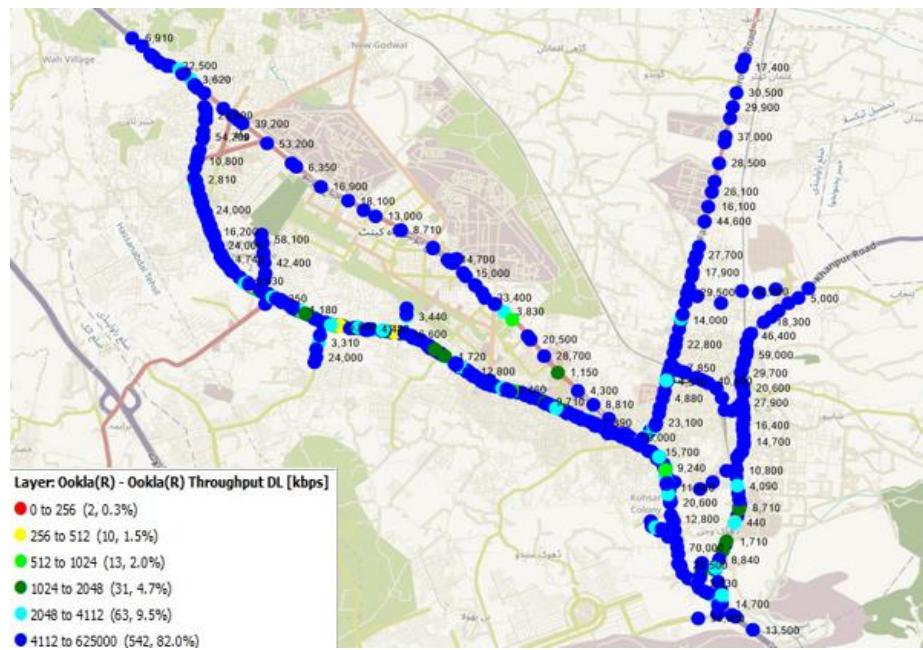
JAZZ DOWNLOAD THROUGHPUT – TAXILA & WAH CANTT



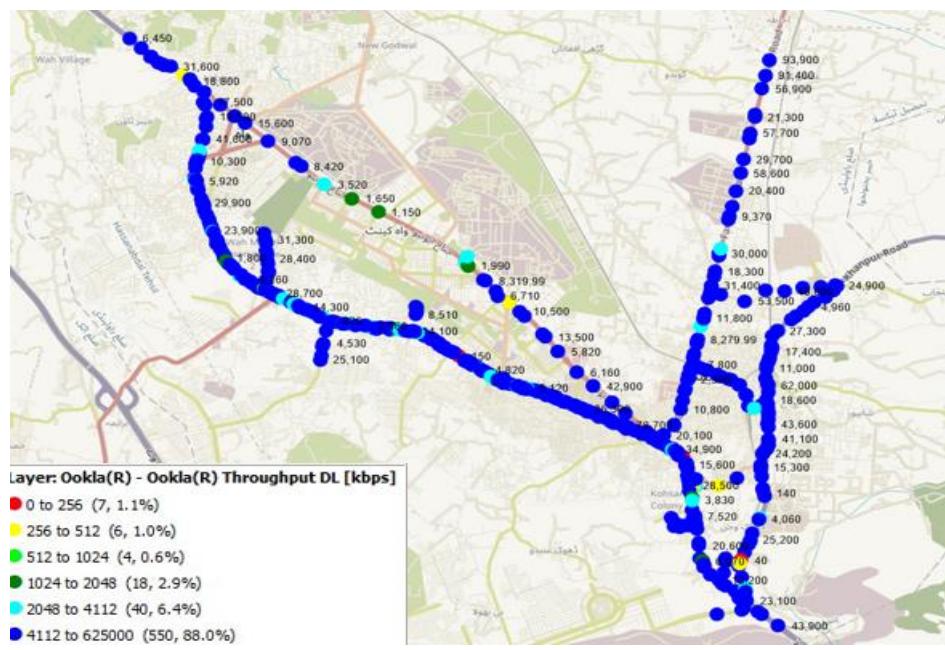
TELENOR DOWNLOAD THROUGHPUT – TAXILA & WAH CANTT



UFONE DOWNLOAD THROUGHPUT – TAXILA & WAH CANTT

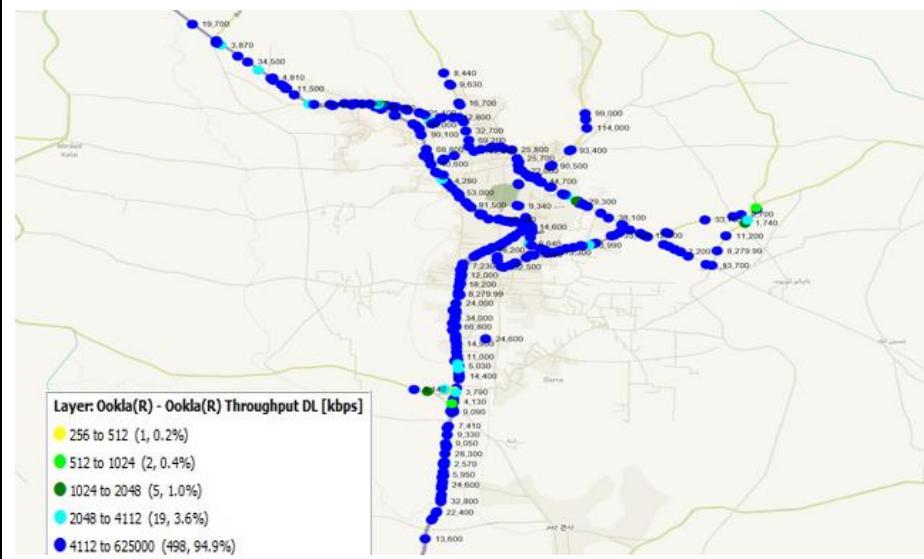


ZONG DOWNLOAD THROUGHPUT – TAXILA & WAH CANTT

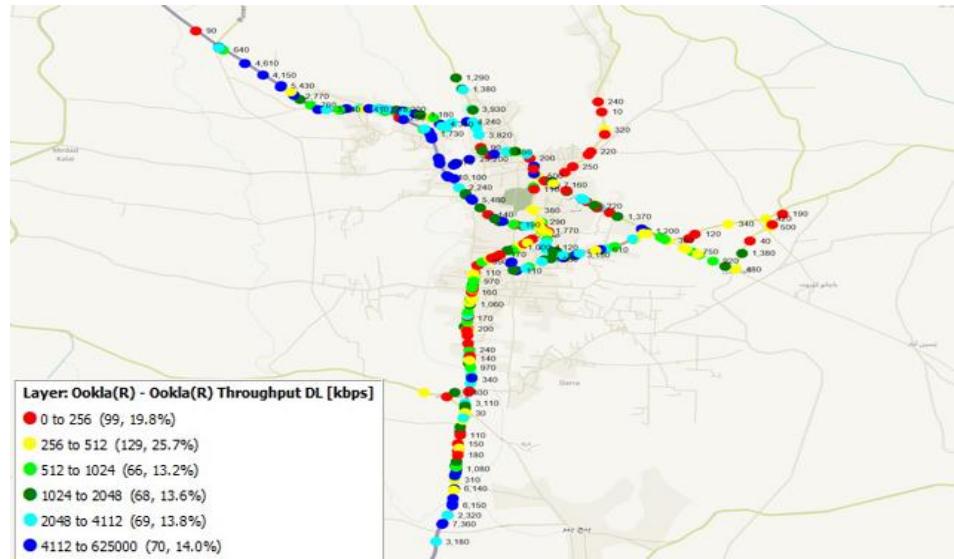


## OOKLA SPEED TEST RESULTS

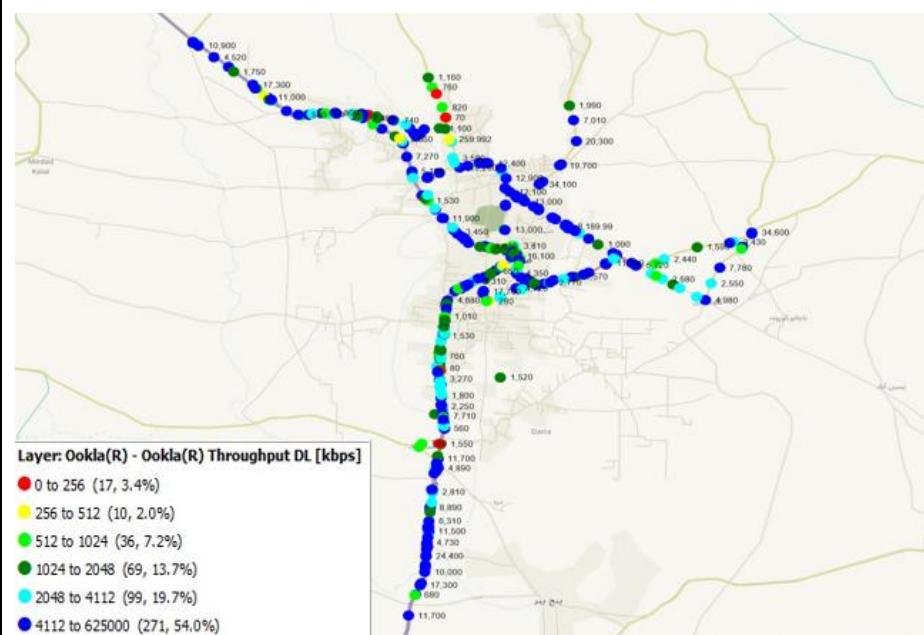
JAZZ DOWNLOAD THROUGHPUT – SWABI



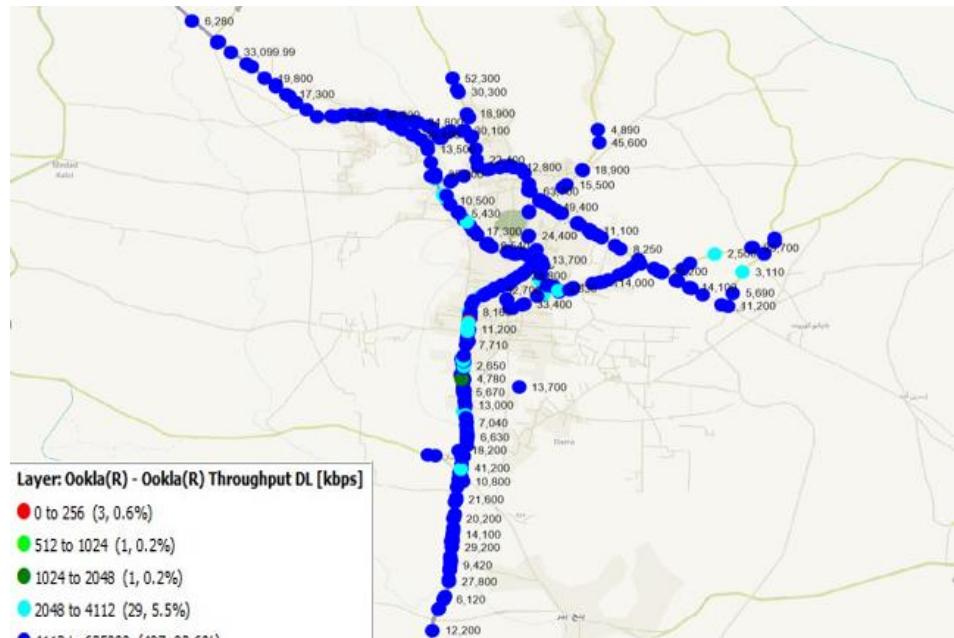
TELENOR DOWNLOAD THROUGHPUT – SWABI



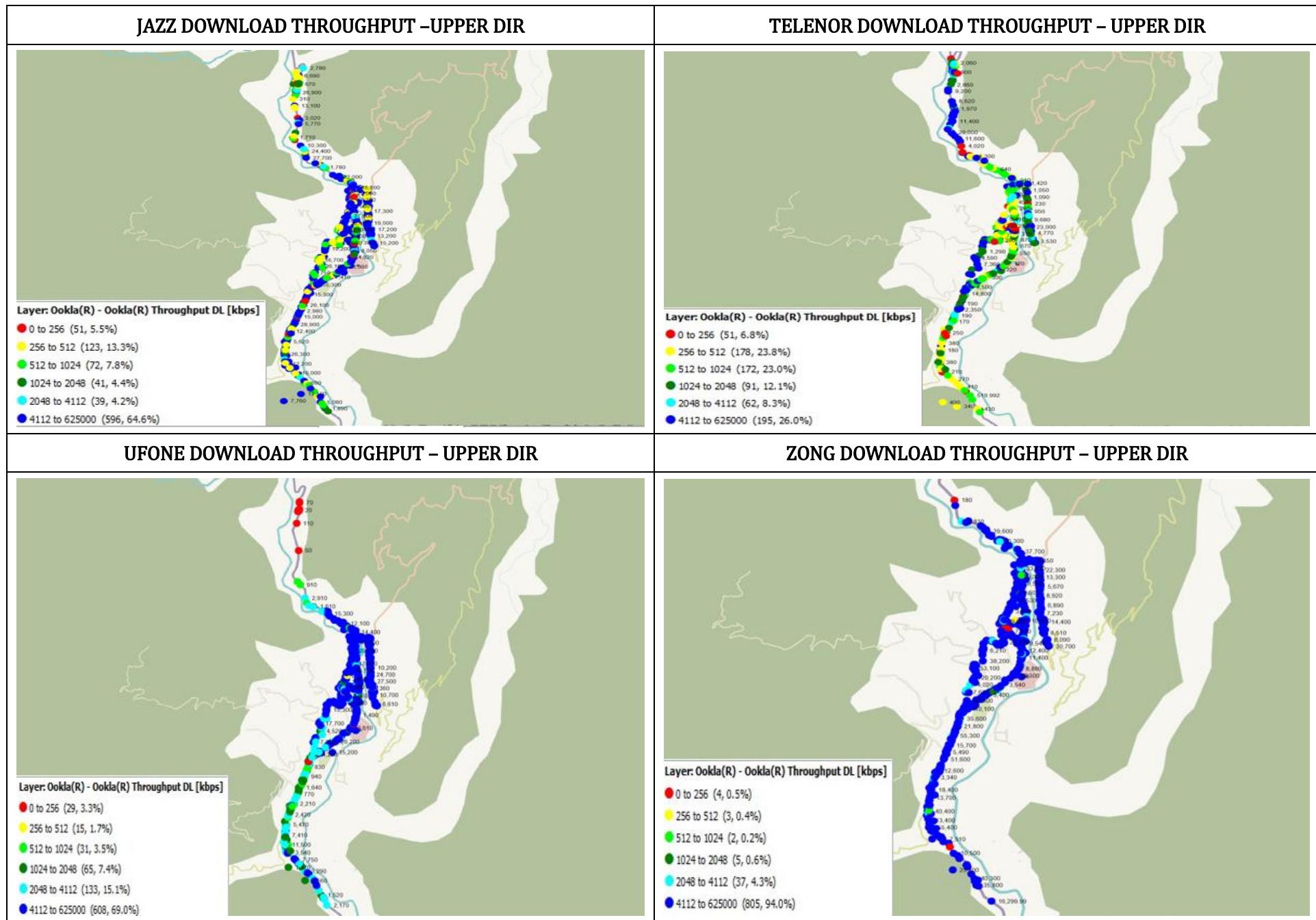
UFONE DOWNLOAD THROUGHPUT – SWABI



ZONG DOWNLOAD THROUGHPUT – SWABI



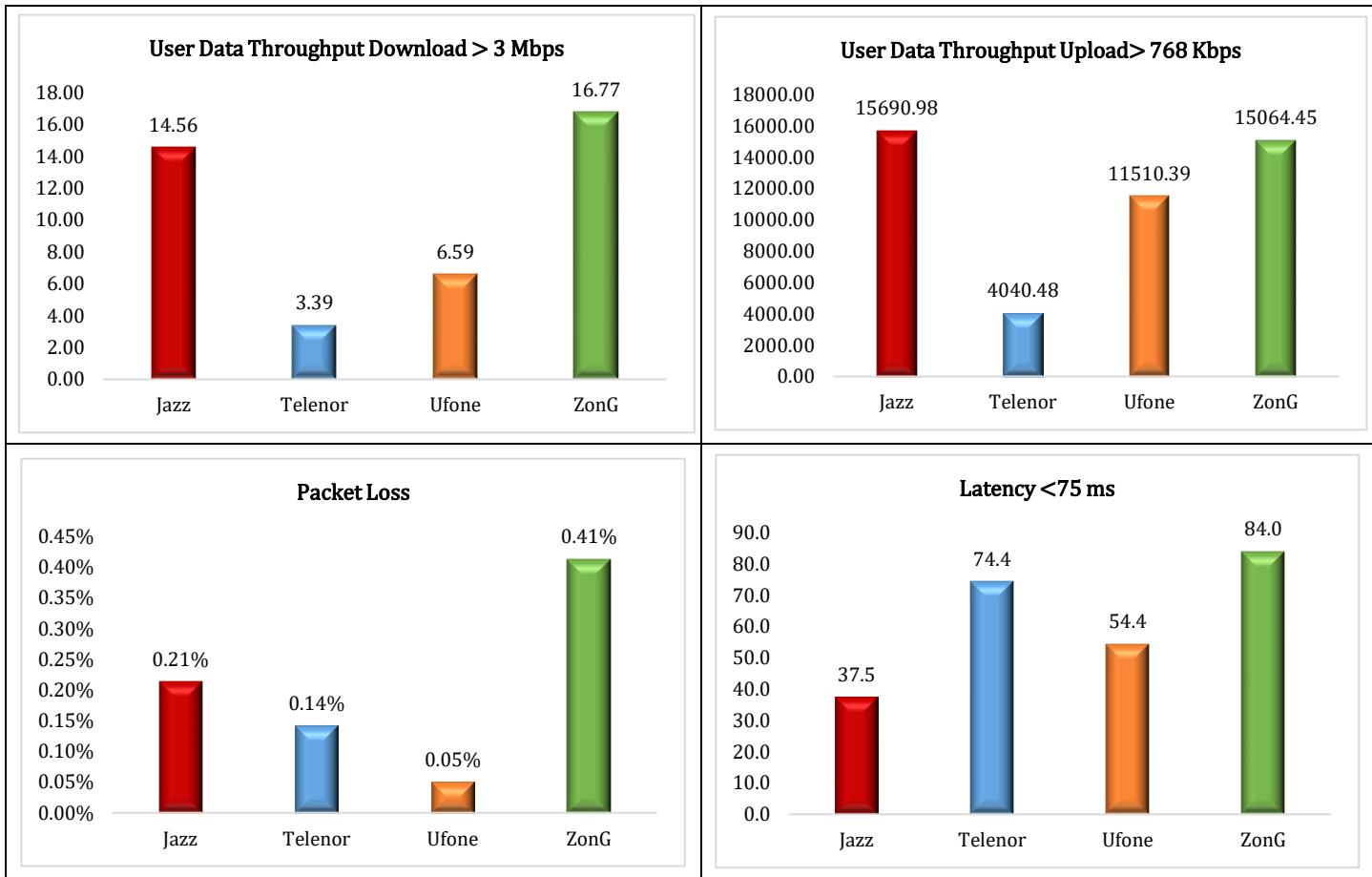
## OOKLA SPEED TEST RESULTS



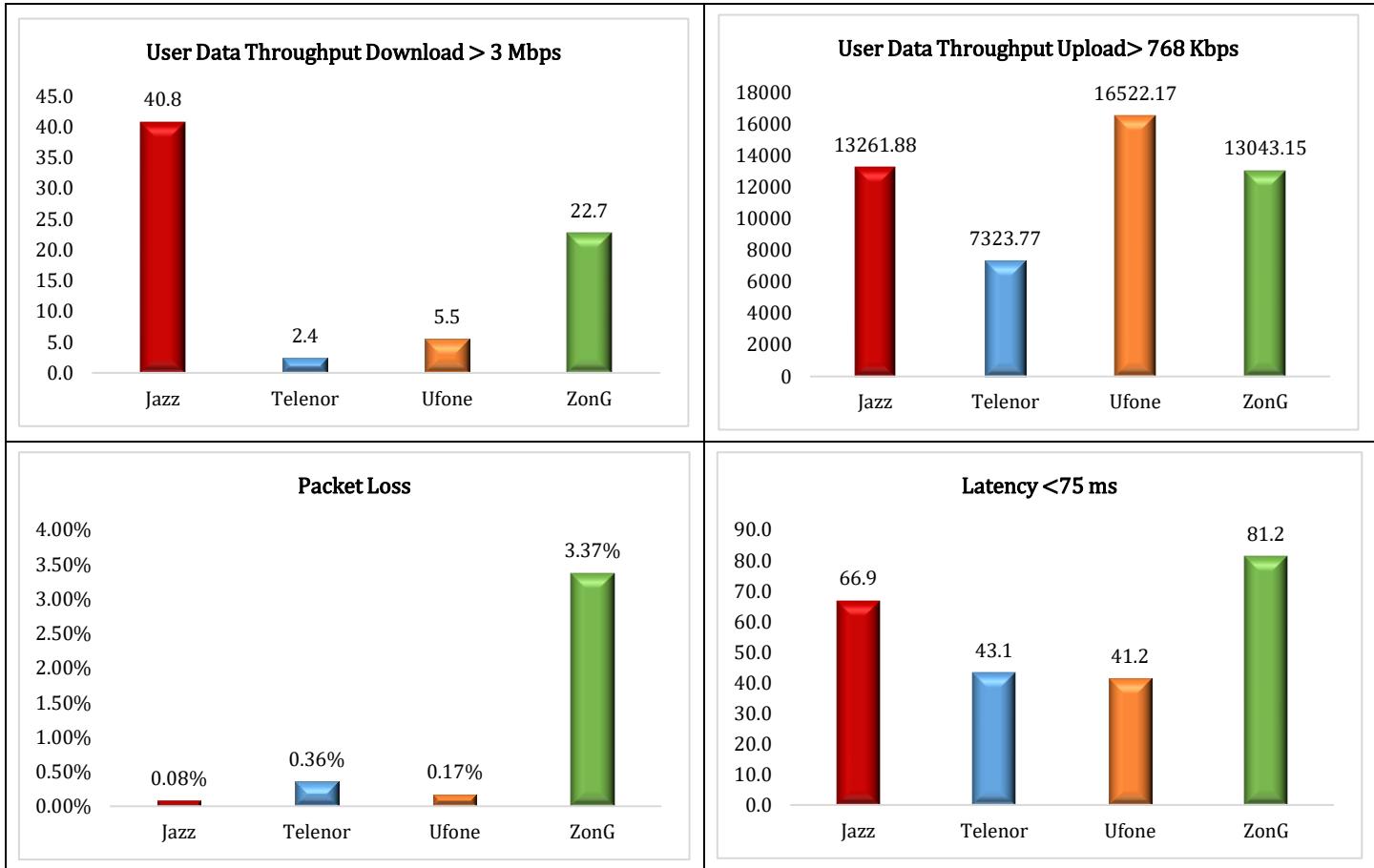
## Annex -B1(Data QoS Results)

OOKLA

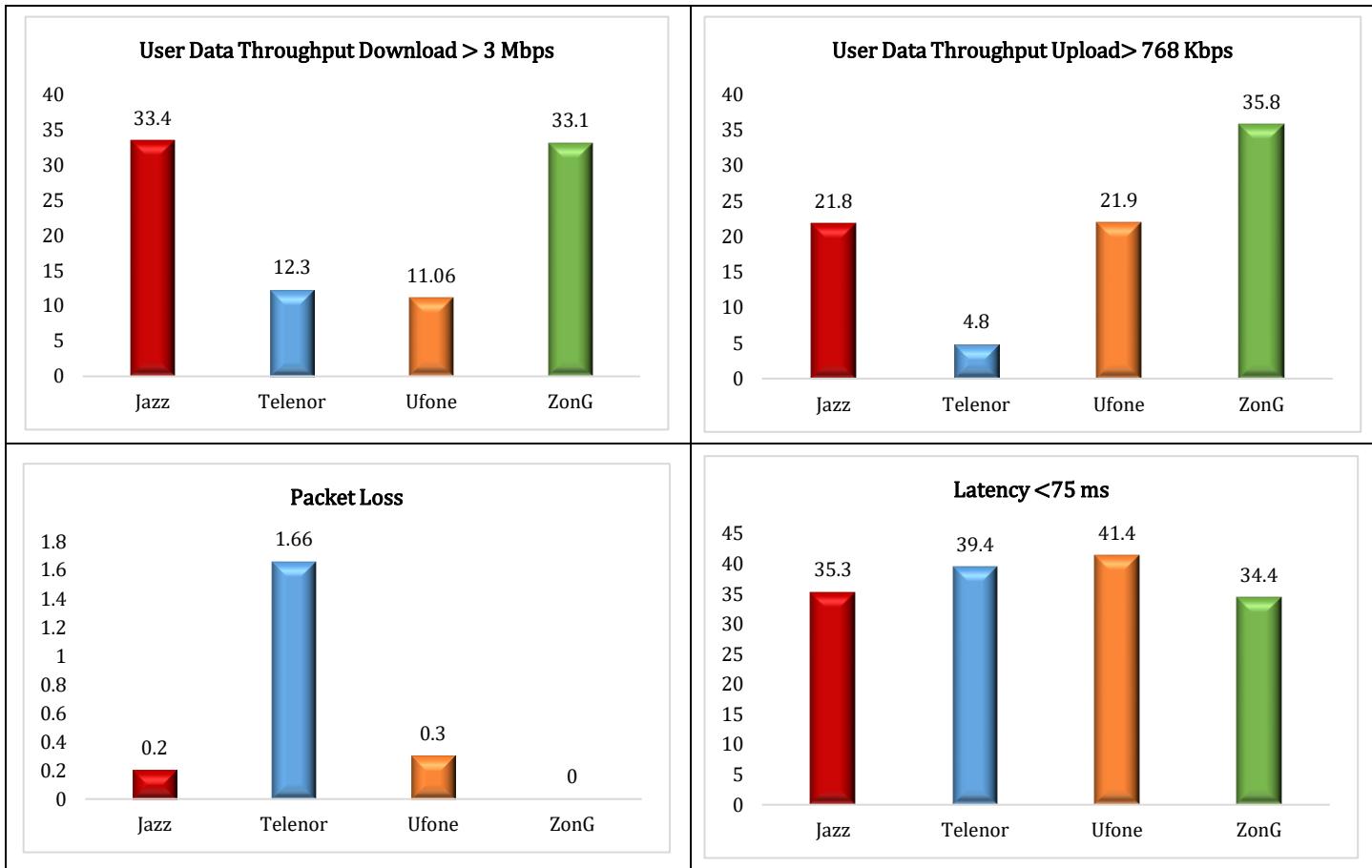
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) -ABBOTTABAD



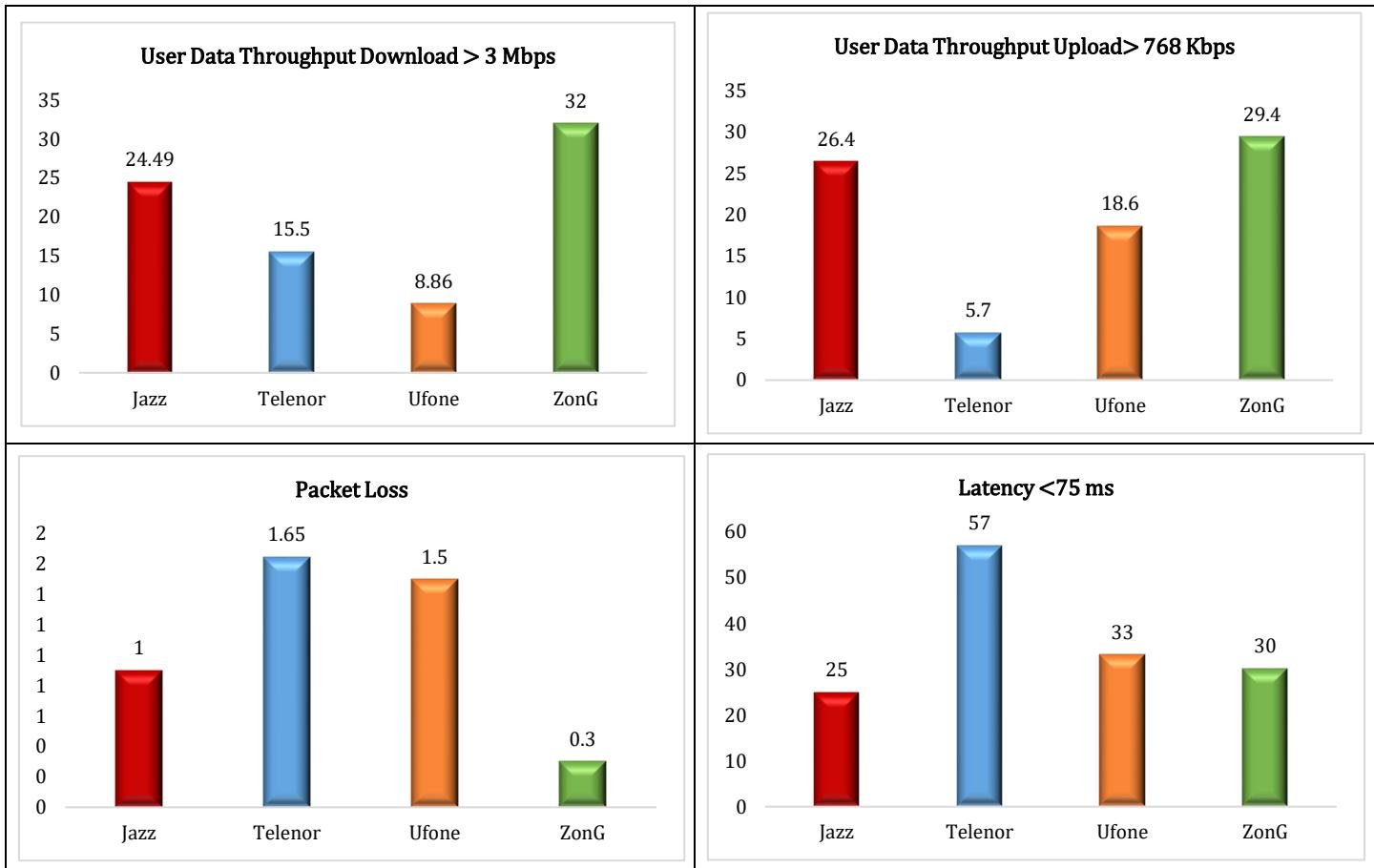
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) -BUNER



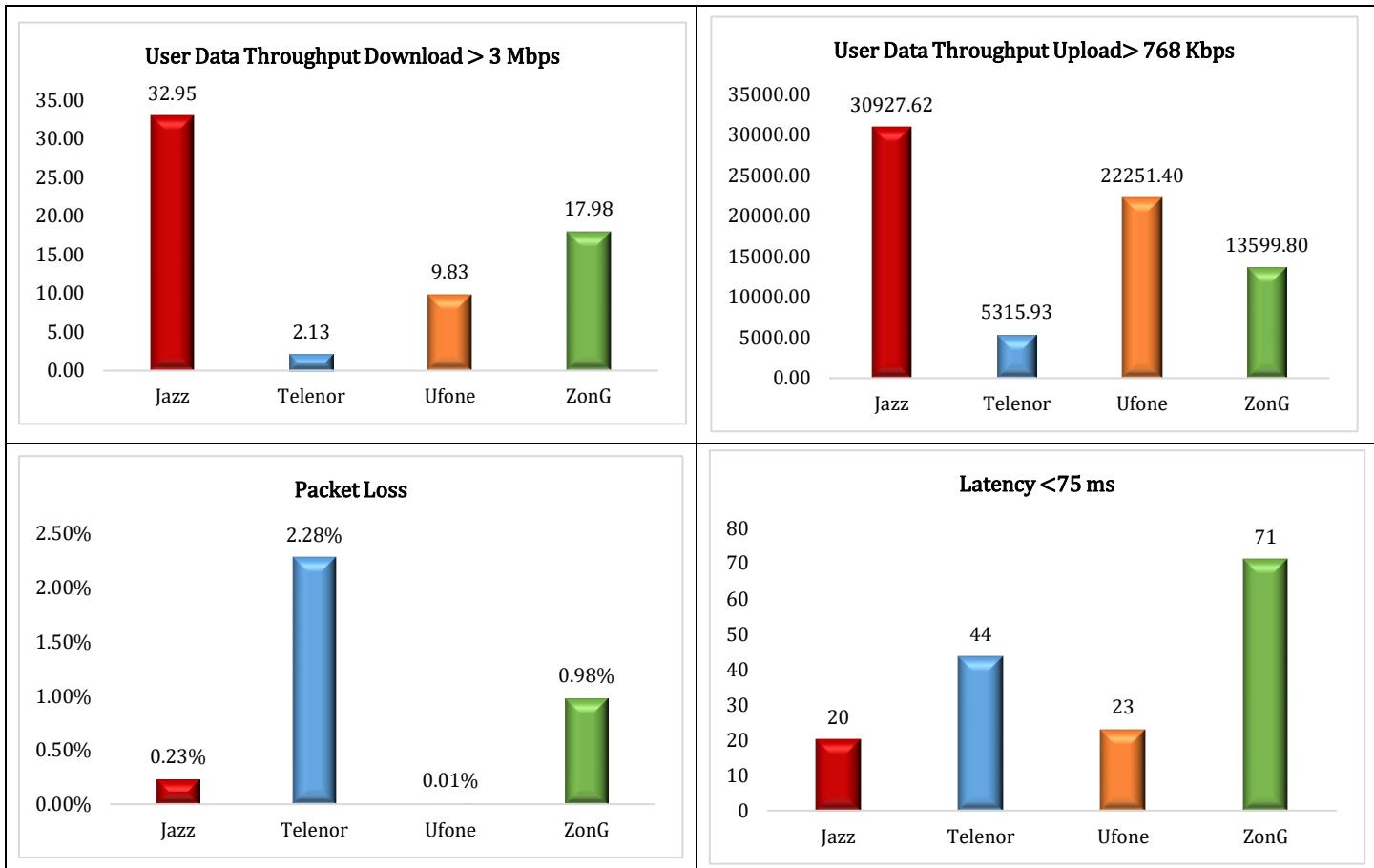
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) – JACOBABAD



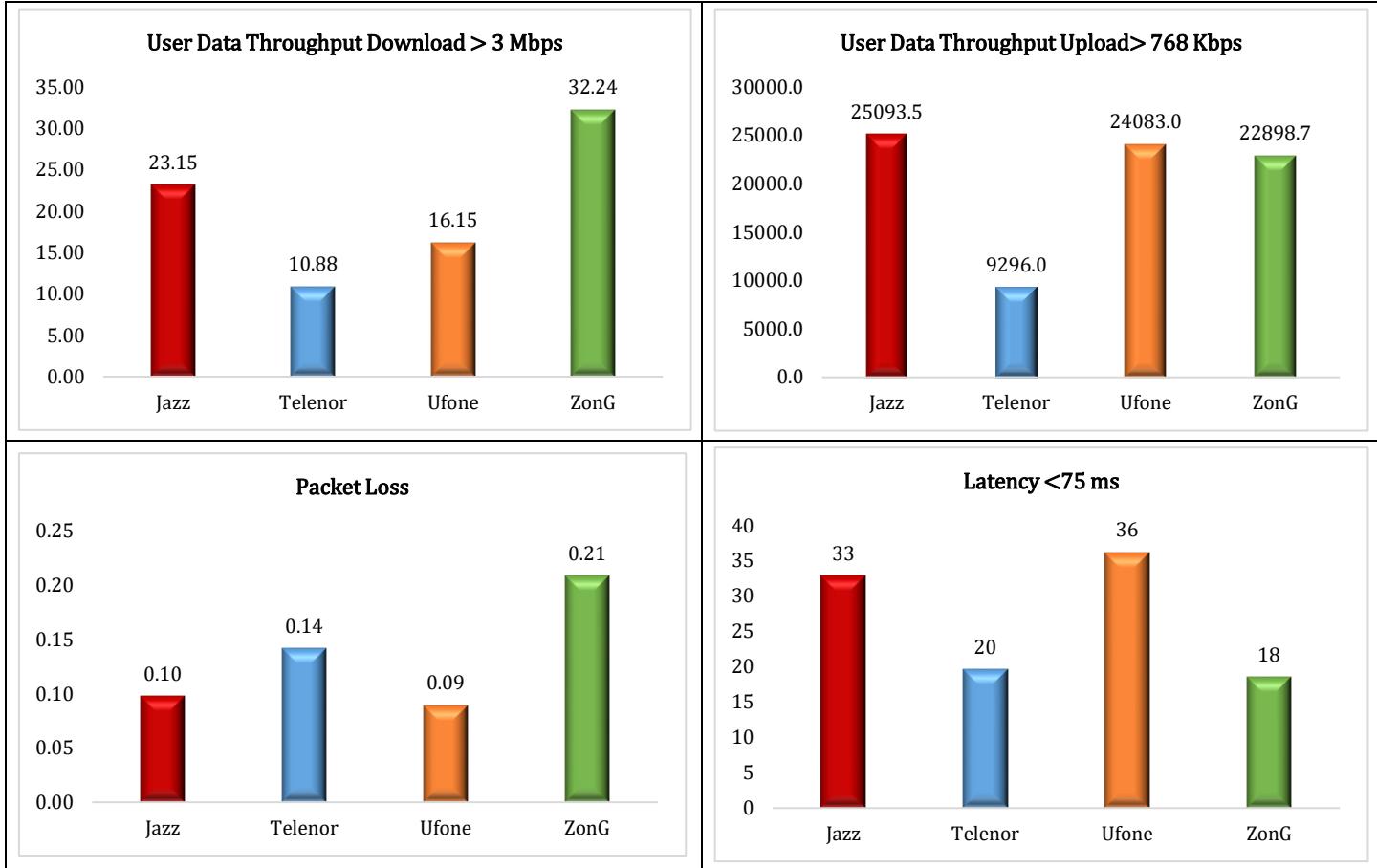
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) –KHAIRPUR



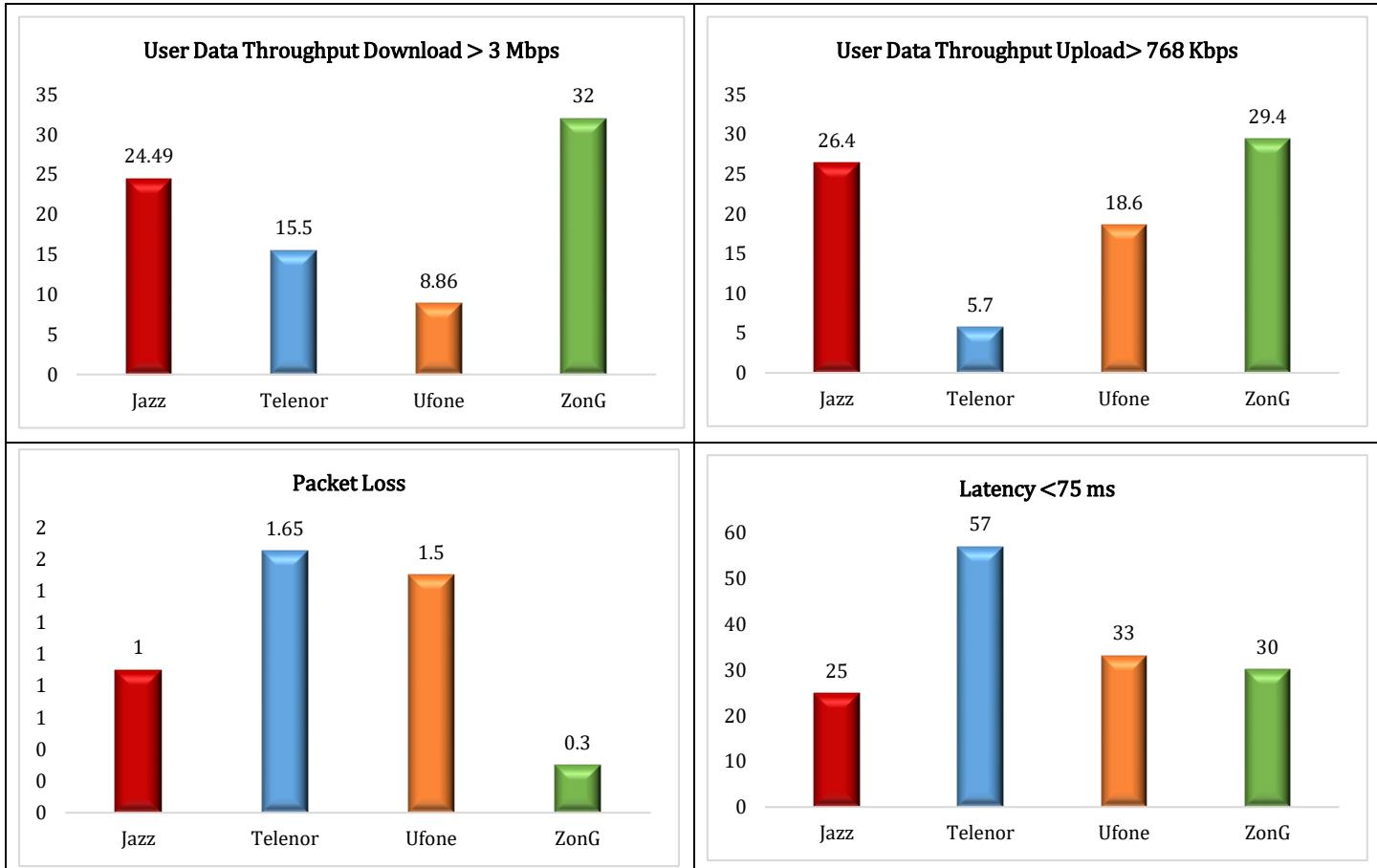
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) – GUJAR KHAN



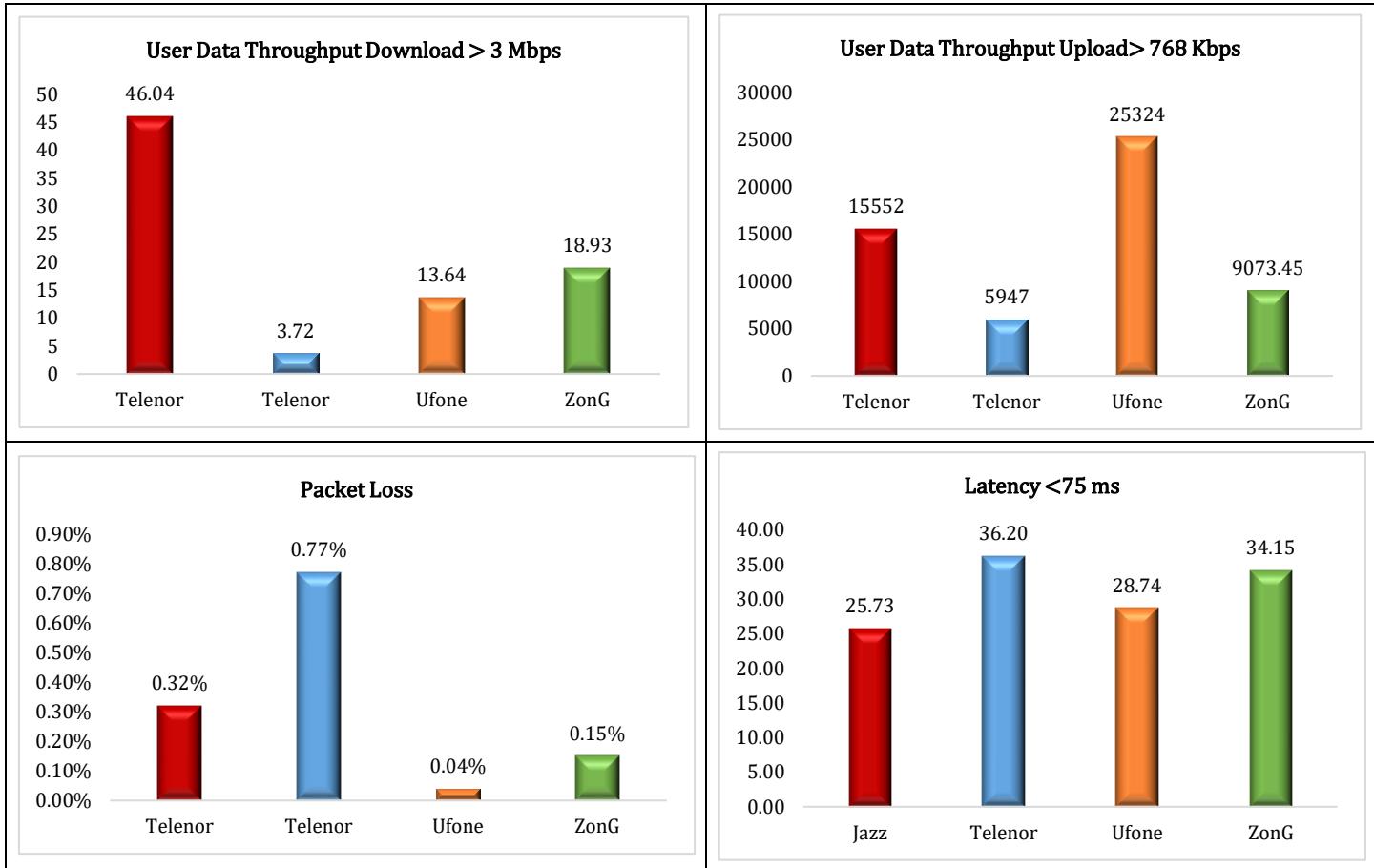
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) -LAHORE



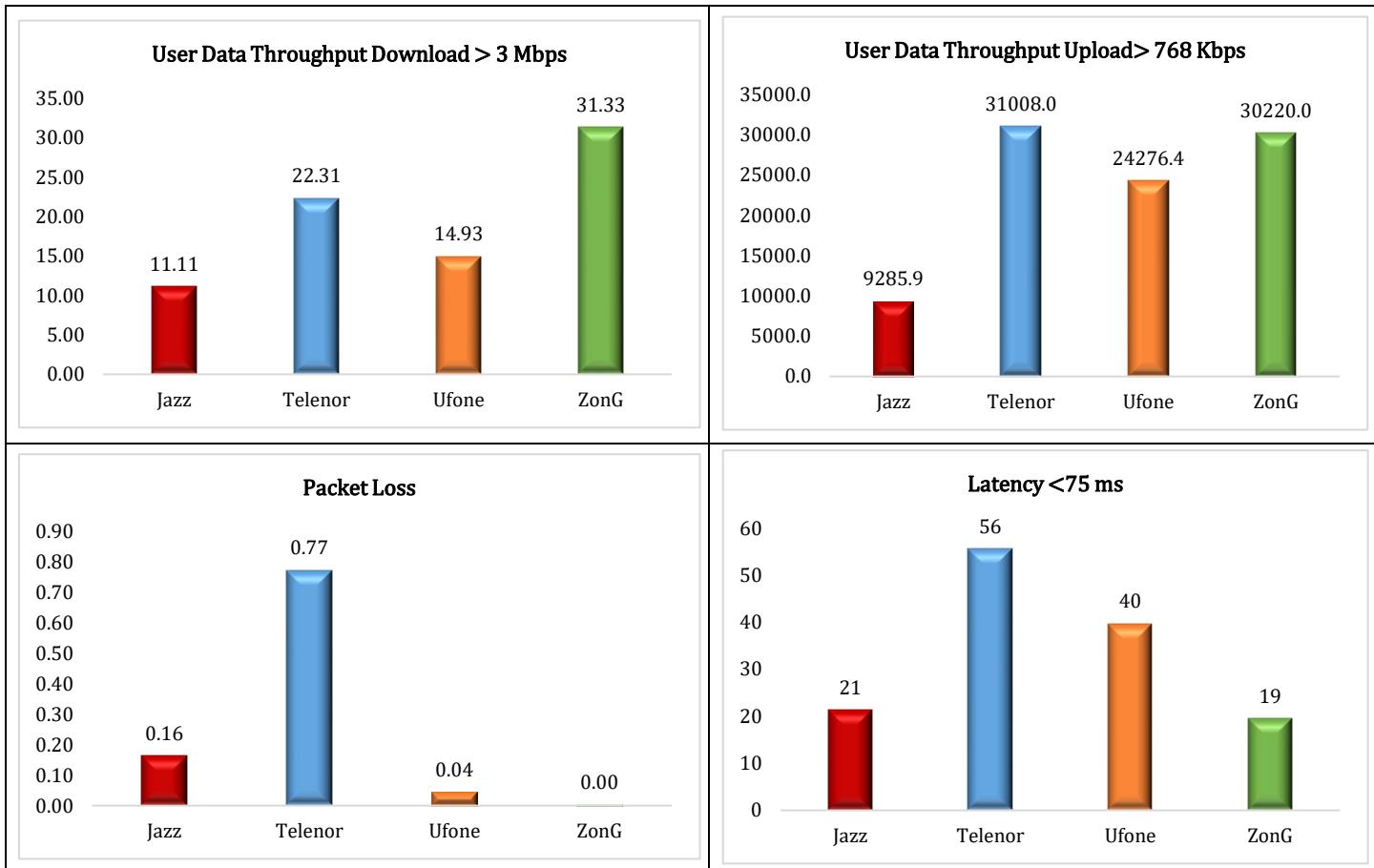
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) –LARKANA



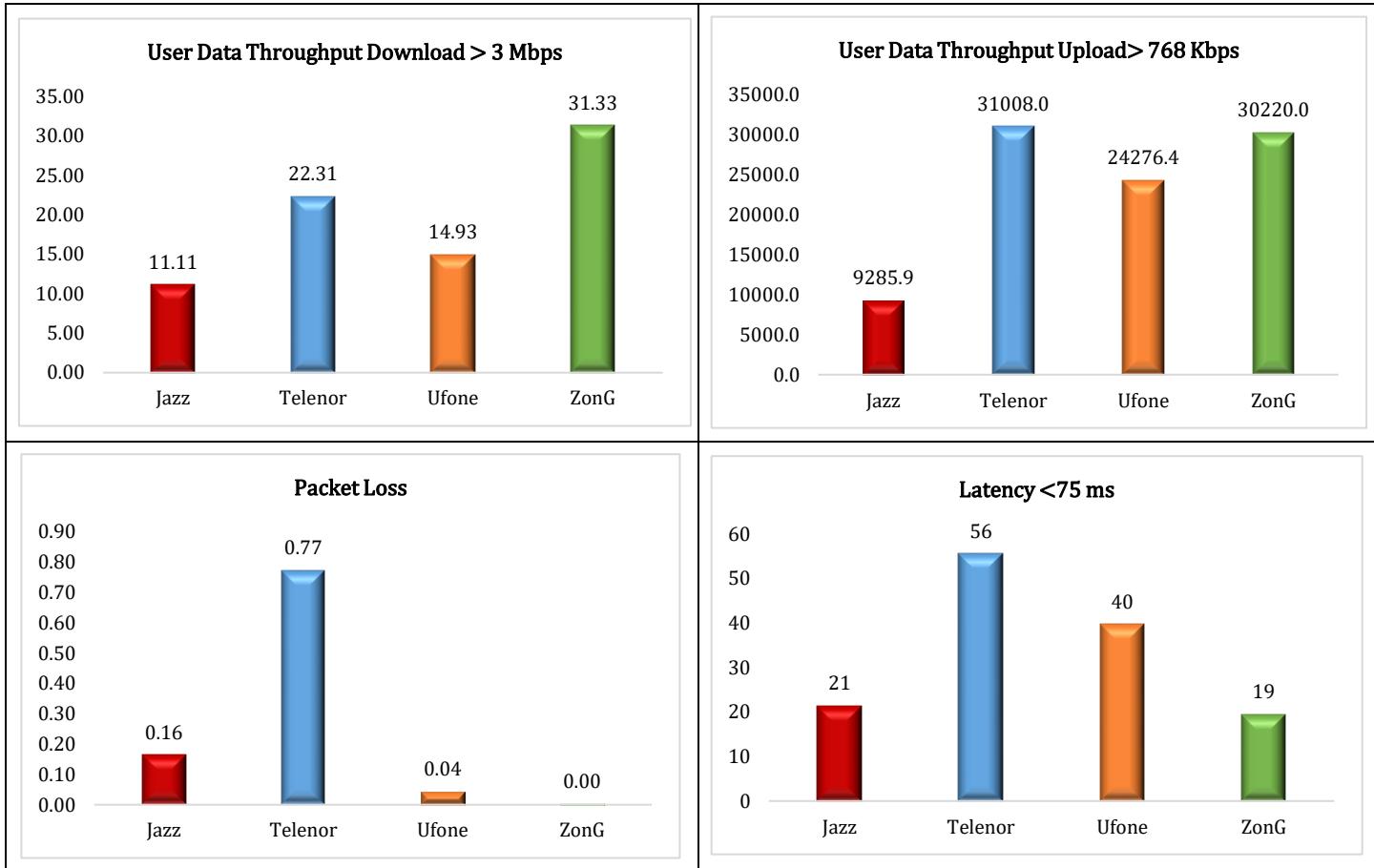
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) -MITHI



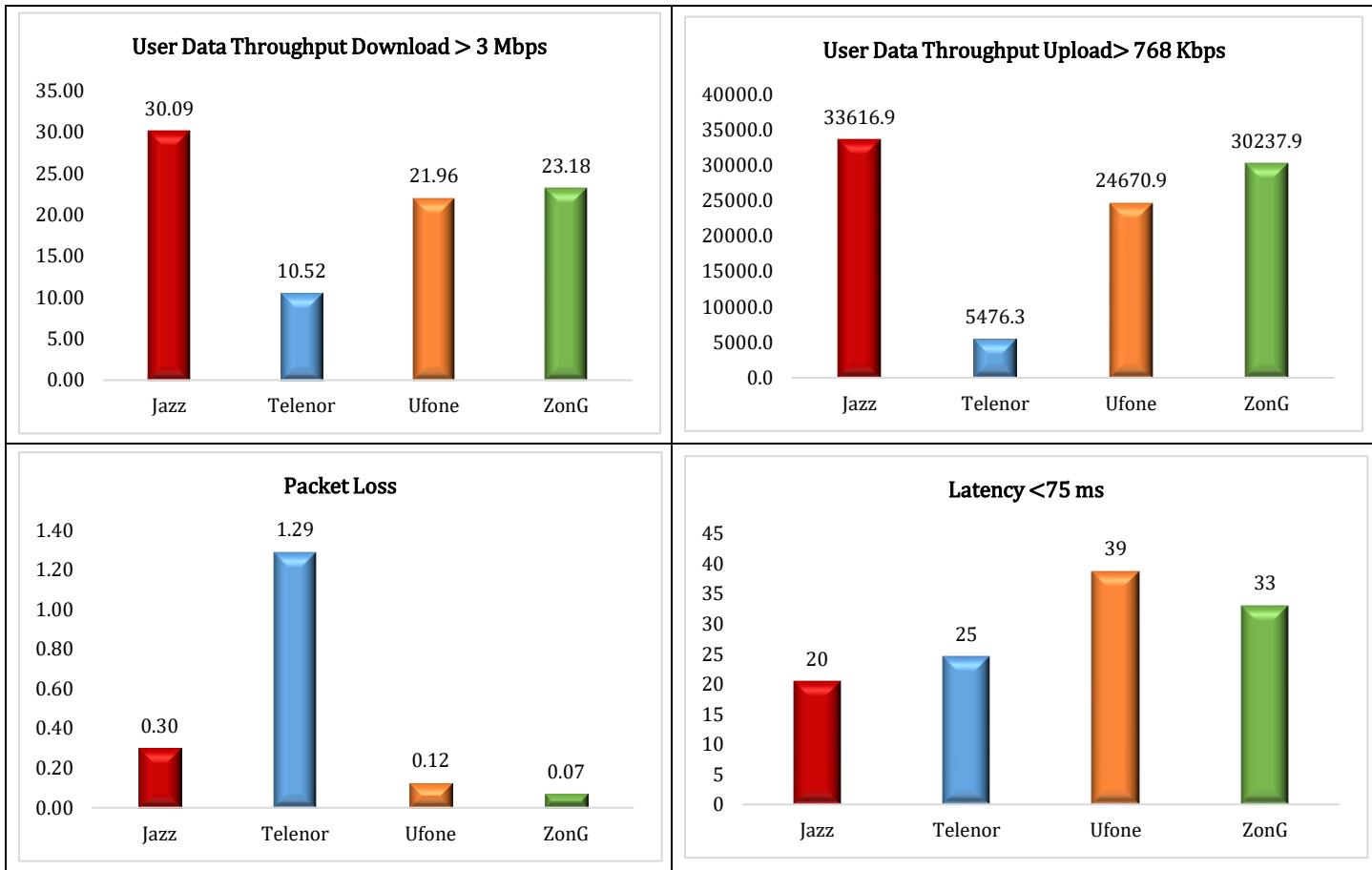
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) –MURIDKE



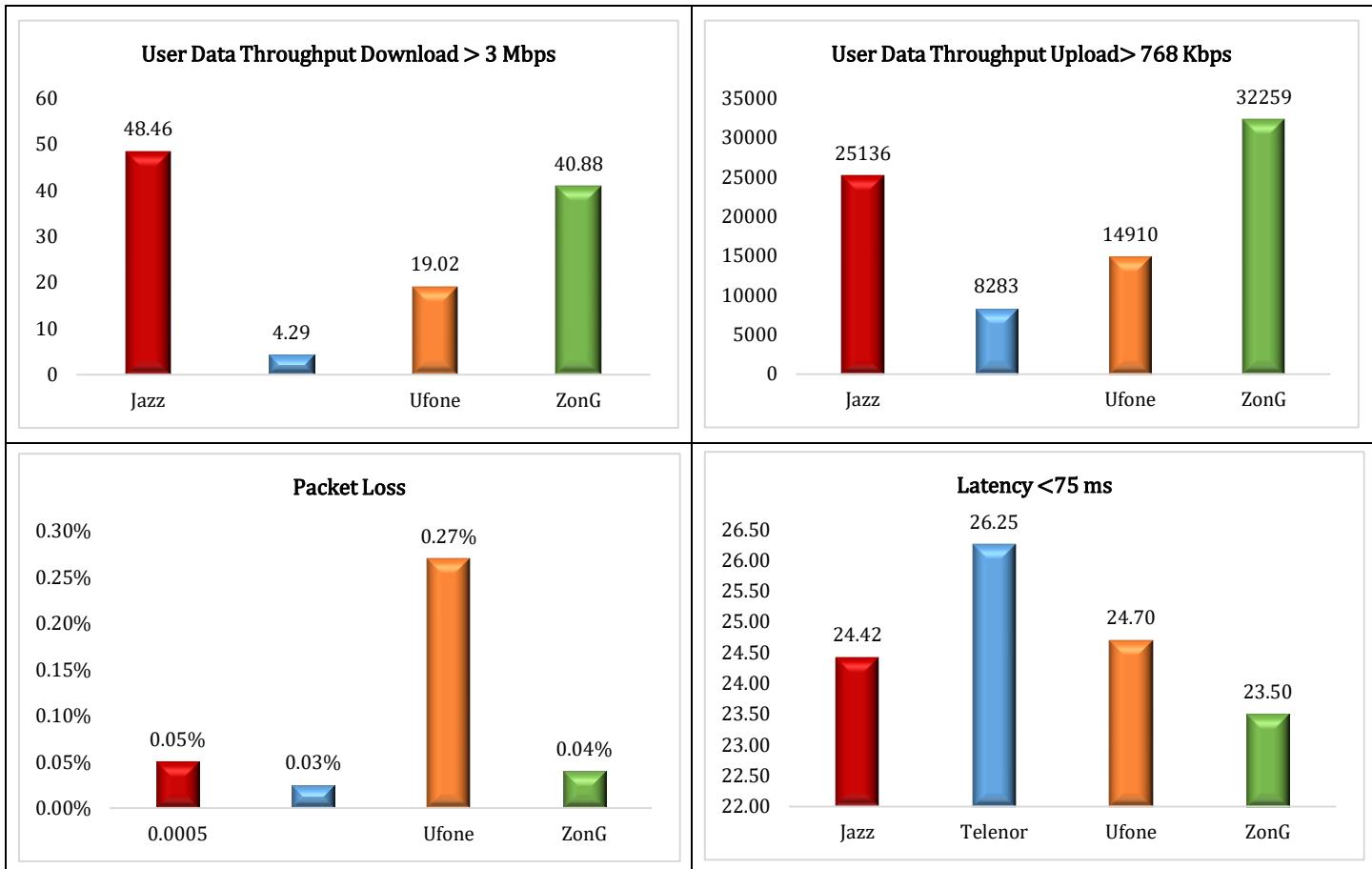
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) –RAWALPINDI



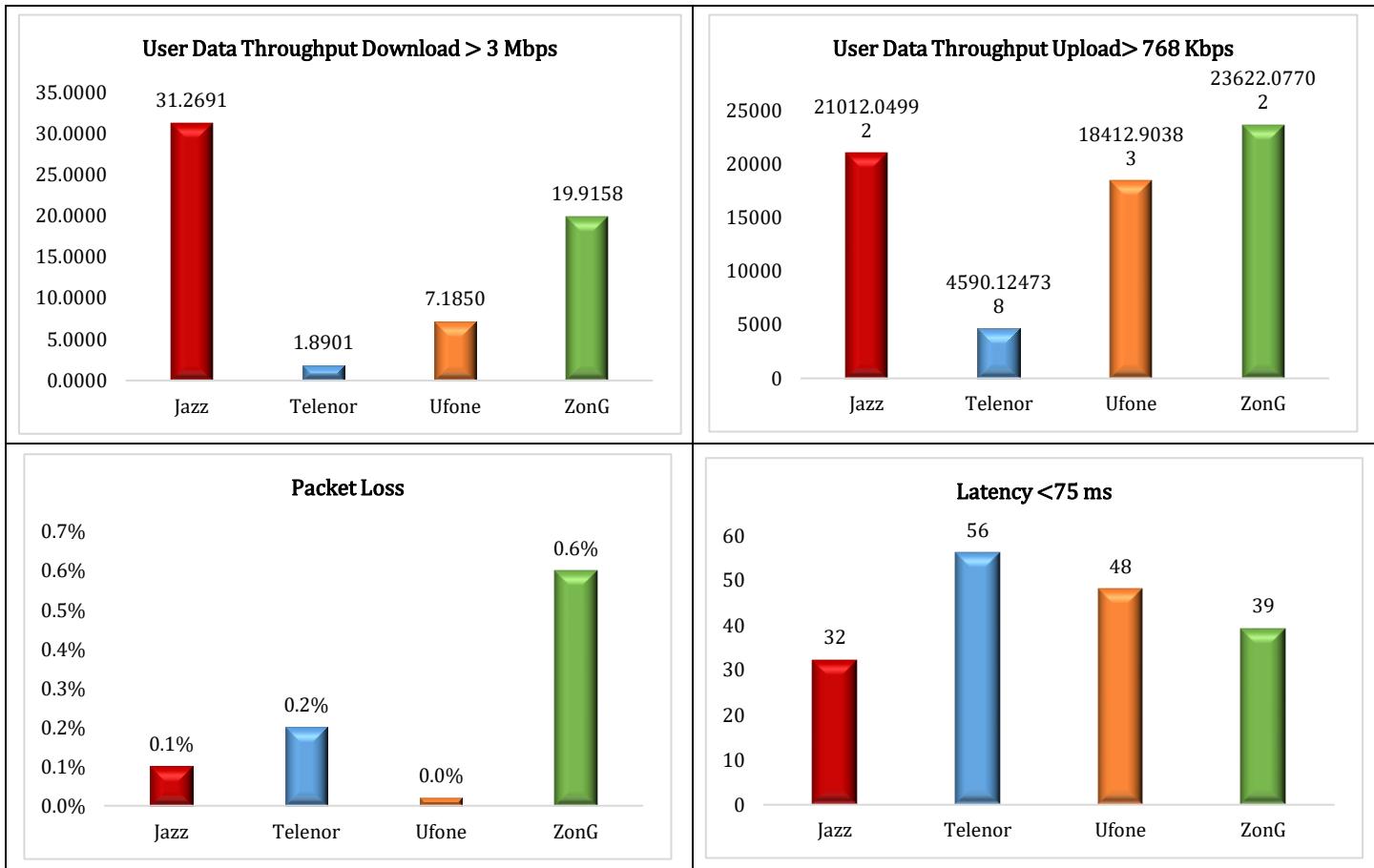
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) –SHAHKOT



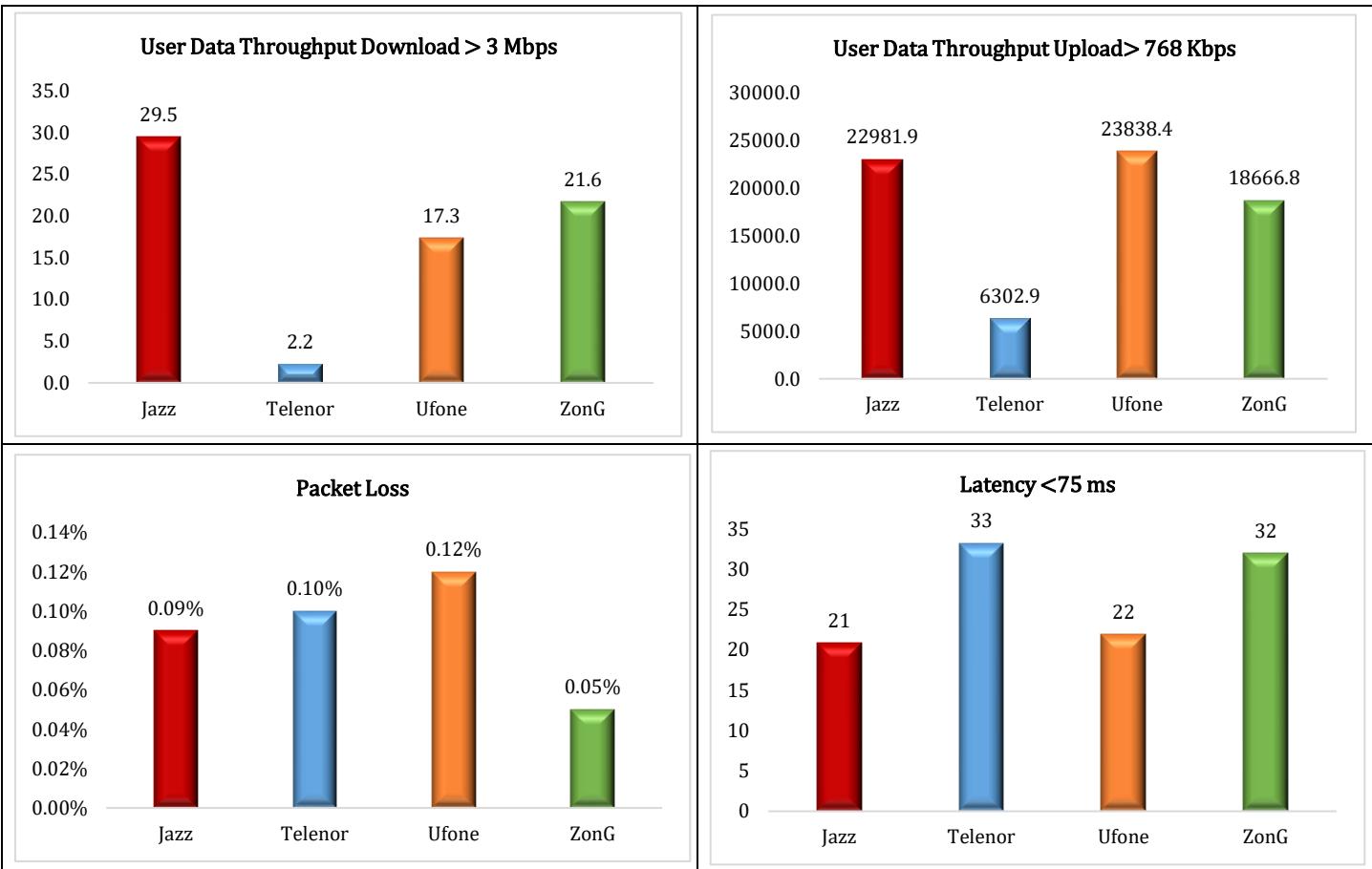
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) –SUJAWAL



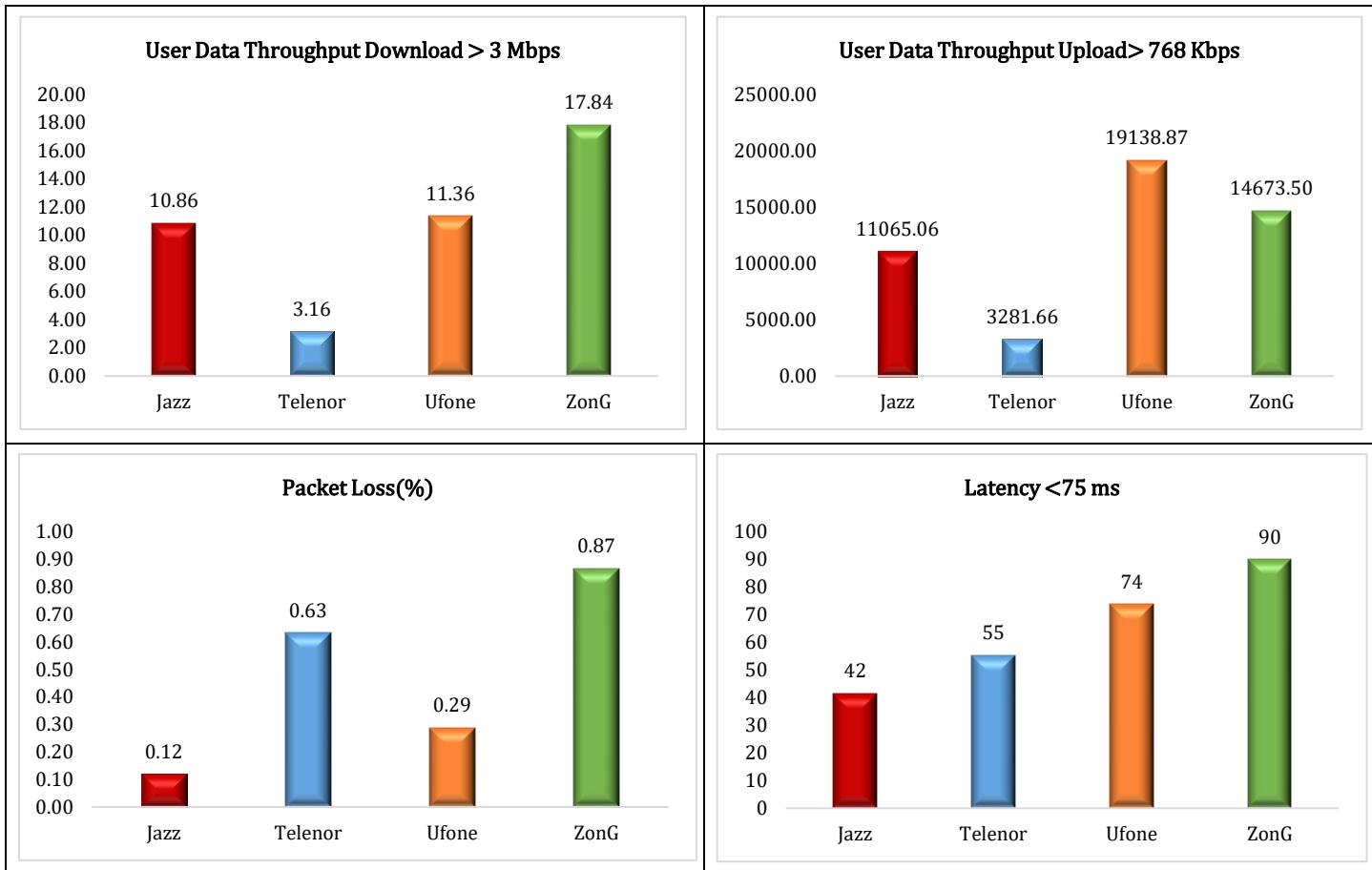
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) –SWABI



## QUALITY OF SERVICE SURVEY RESULTS (Ookla) – TAXILA & WAH CANTT



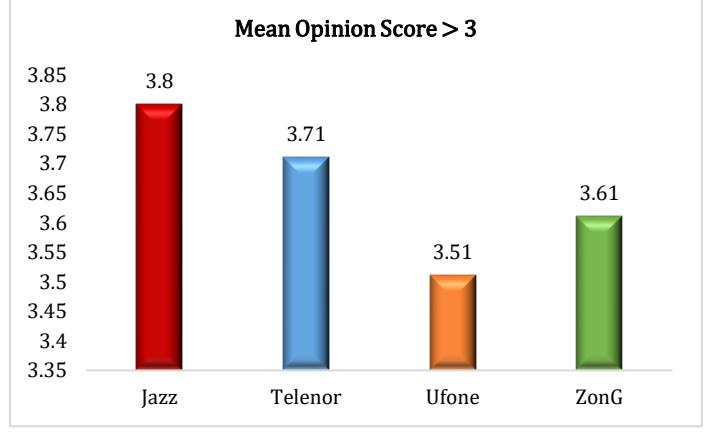
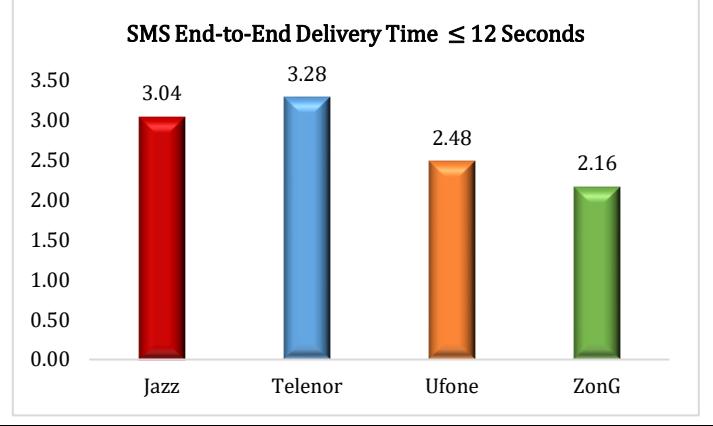
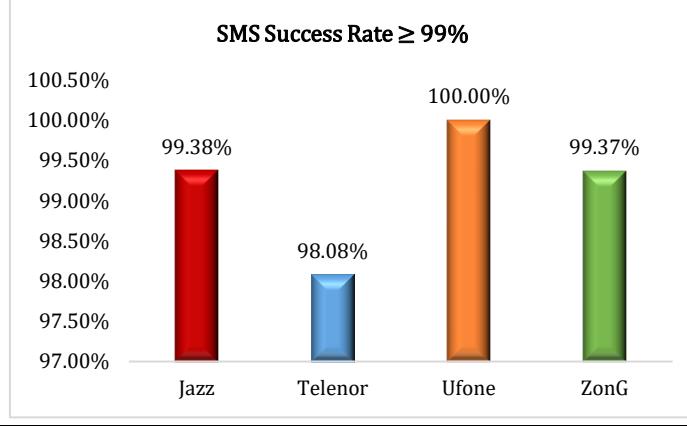
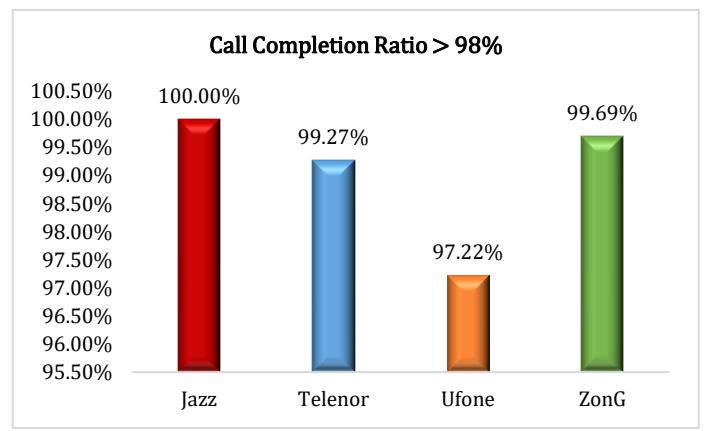
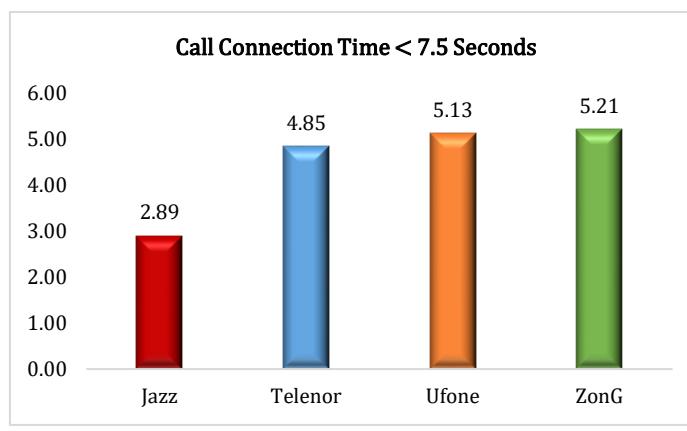
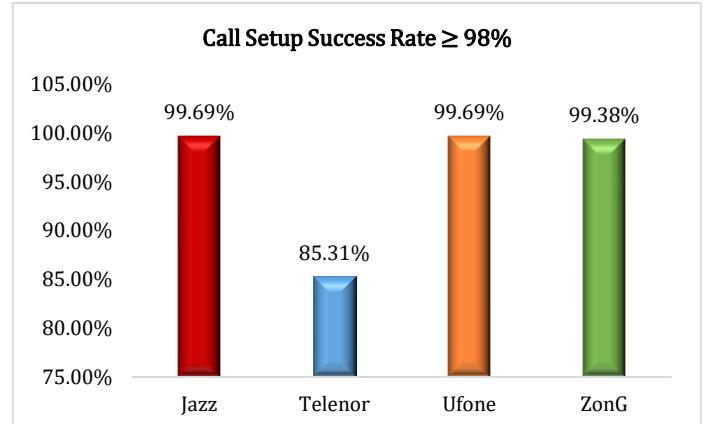
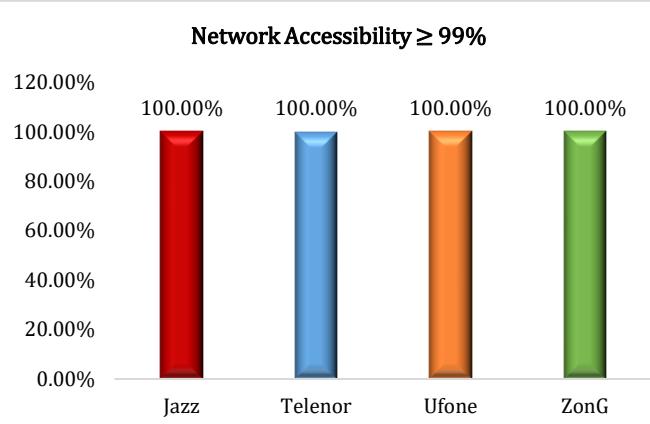
## QUALITY OF SERVICE SURVEY RESULTS (Ookla) –UPPER DIR



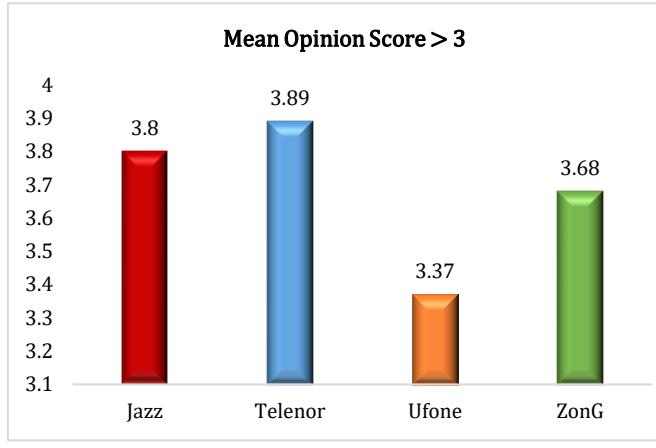
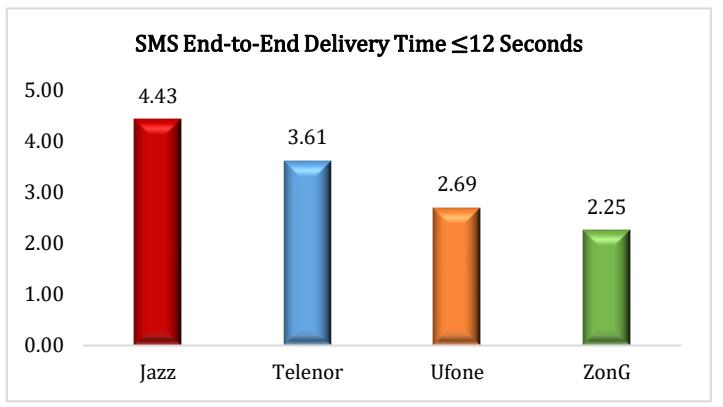
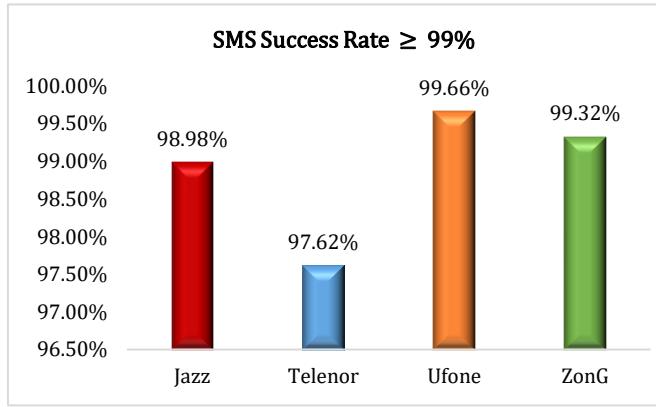
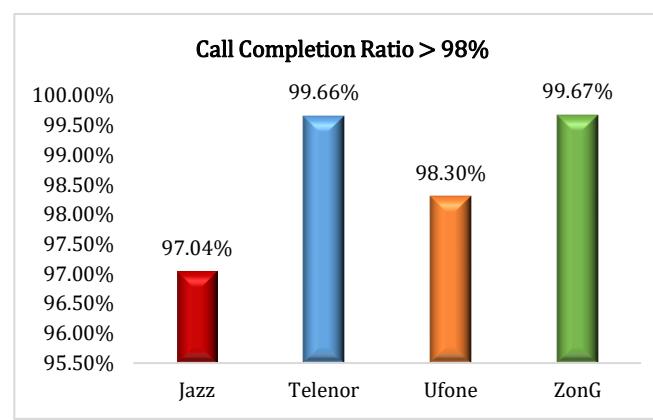
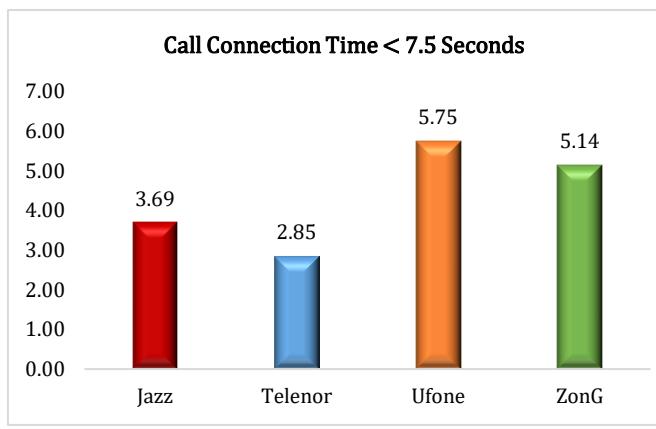
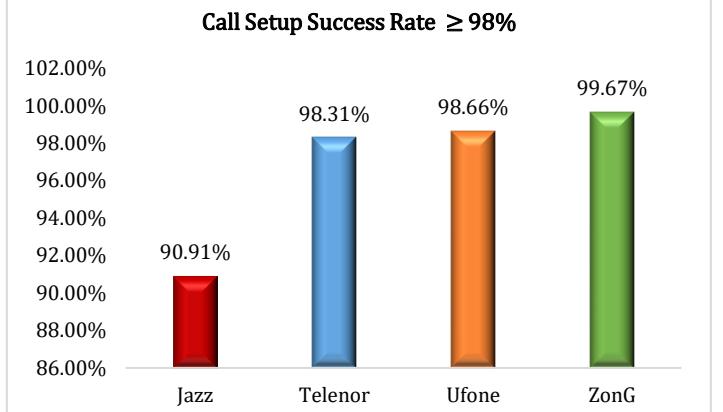
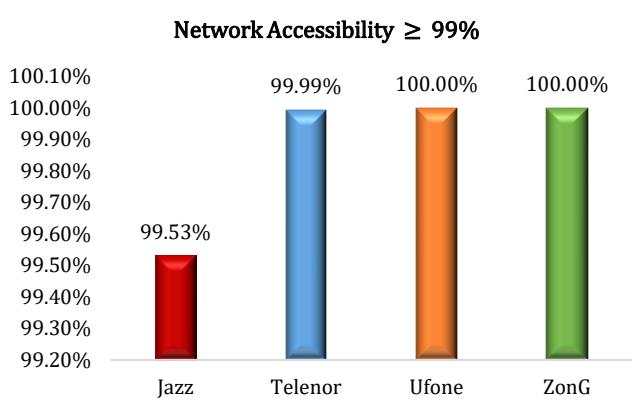
## Annex -C(Voice & SMS Results)

VOICE AUTOMODE

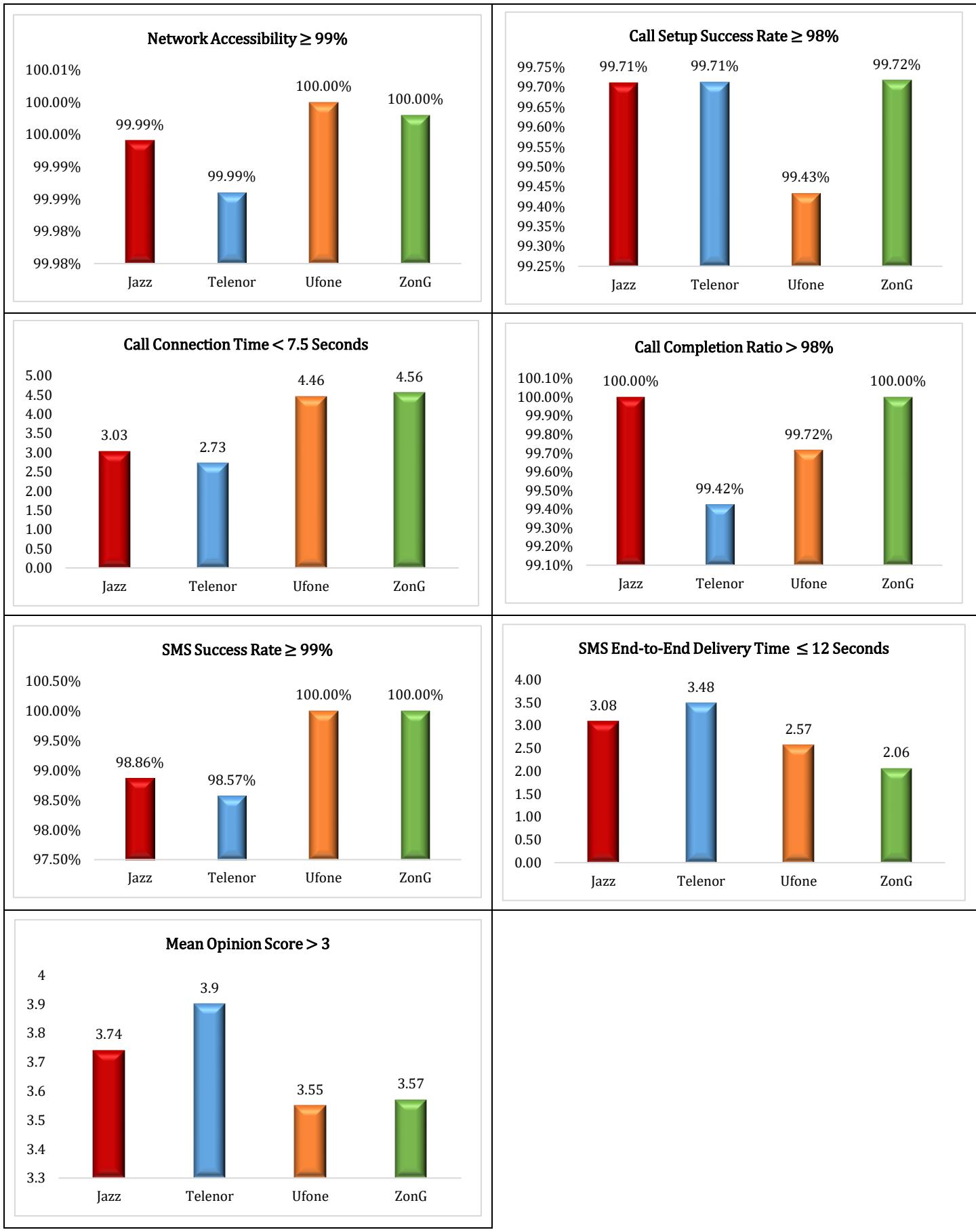
## QUALITY OF SERVICE SURVEY RESULTS – ABBOTTABAD



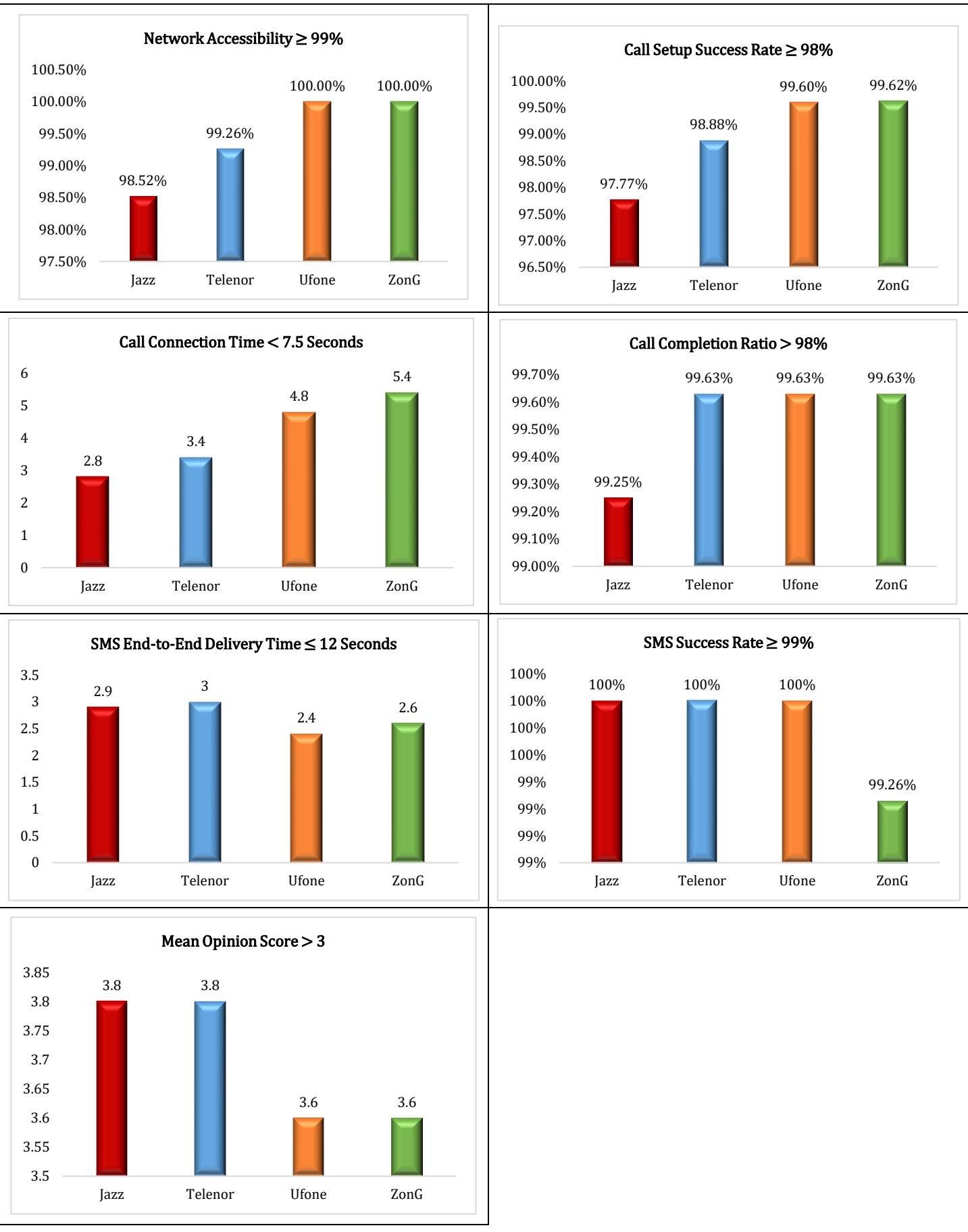
## QUALITY OF SERVICE SURVEY RESULTS – BUNER



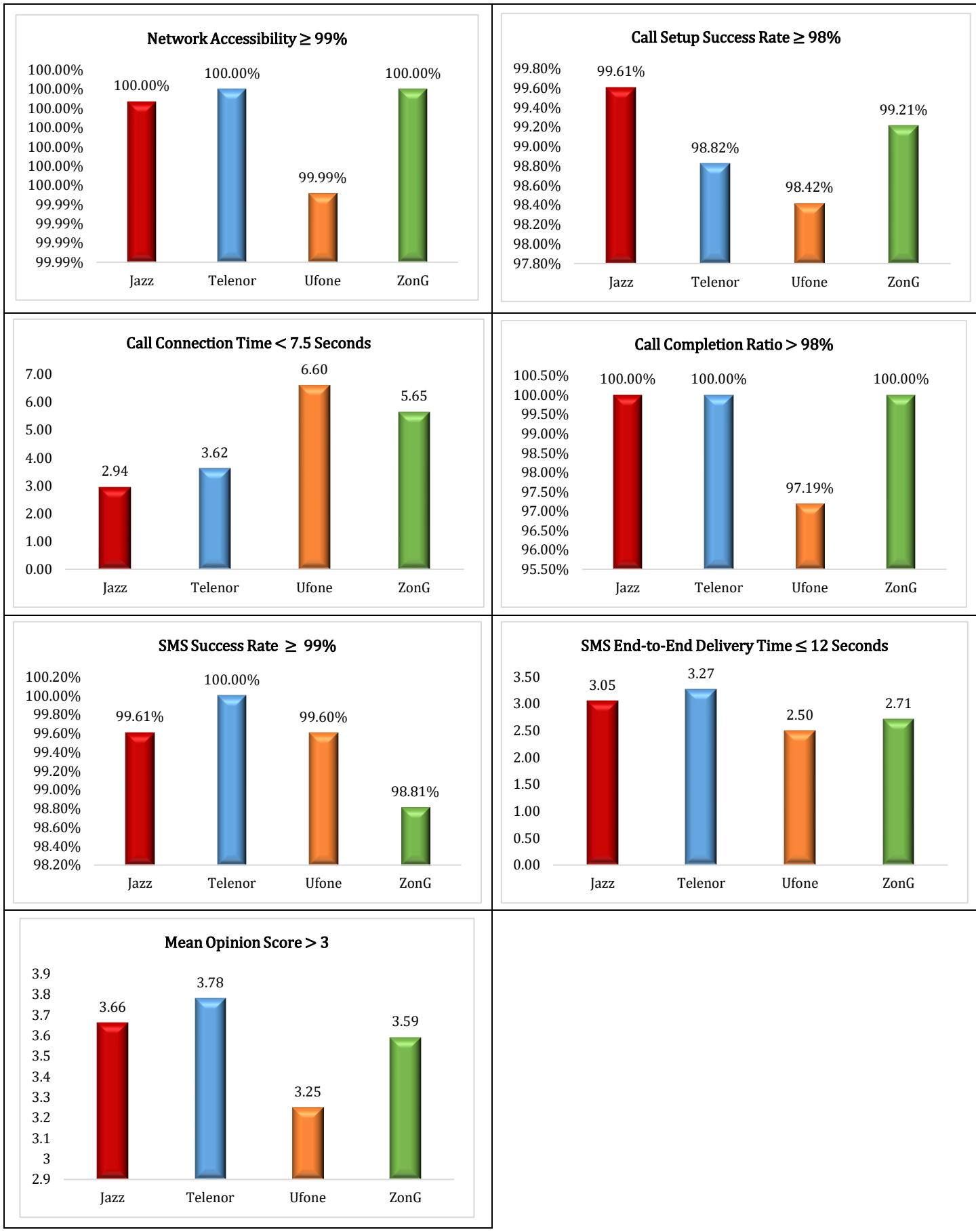
## QUALITY OF SERVICE SURVEY RESULTS – GUJAR KHAN



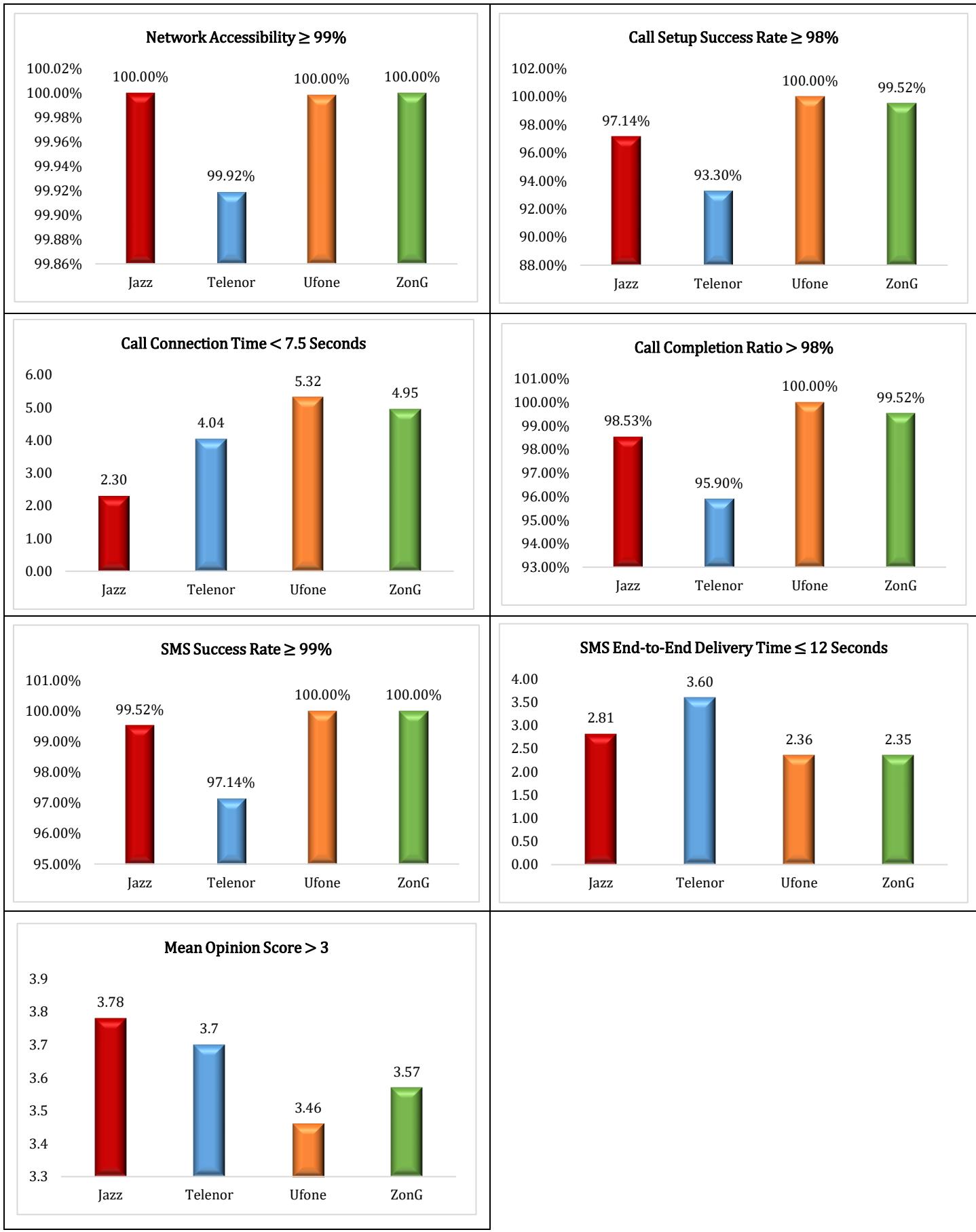
## QUALITY OF SERVICE SURVEY RESULTS – JACOBBABAD



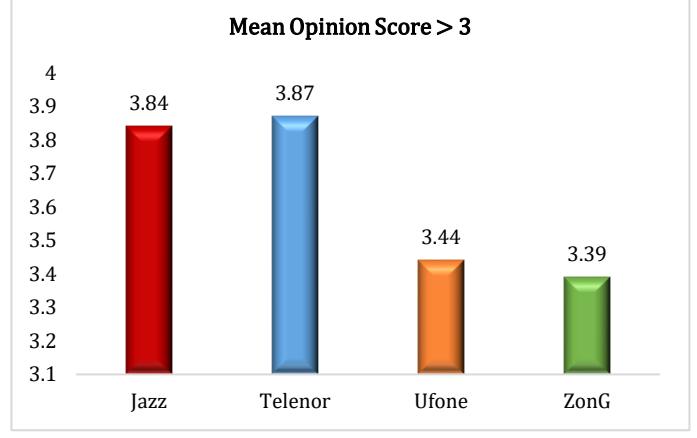
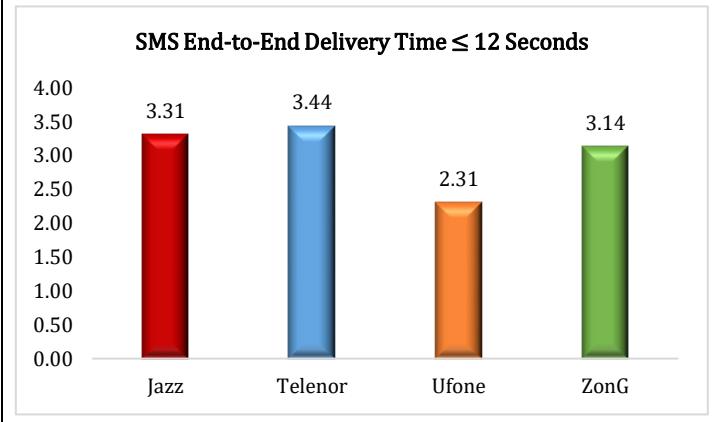
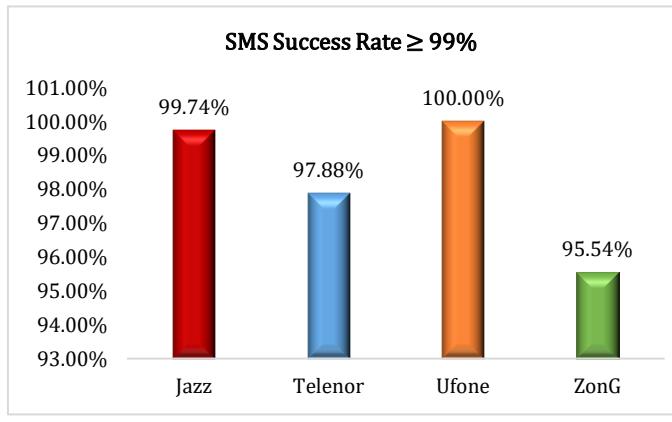
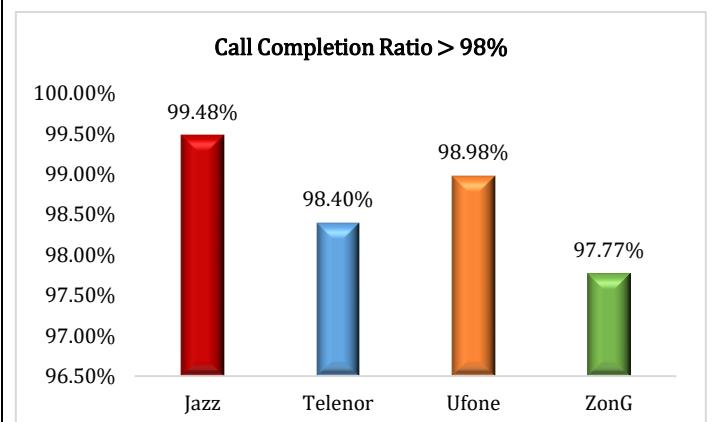
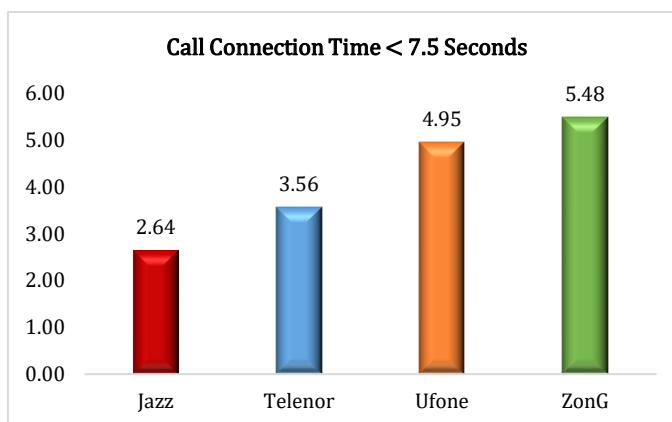
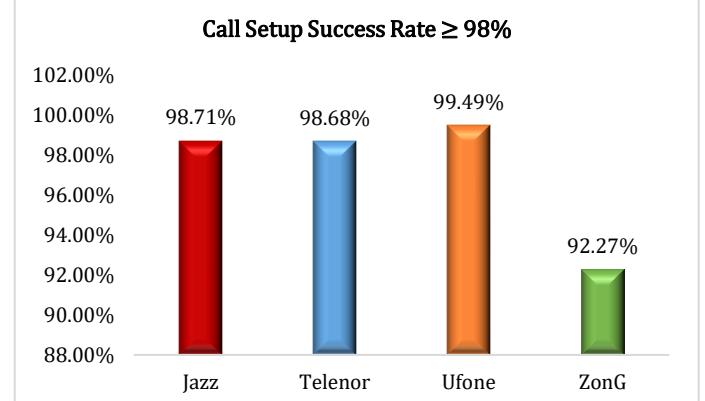
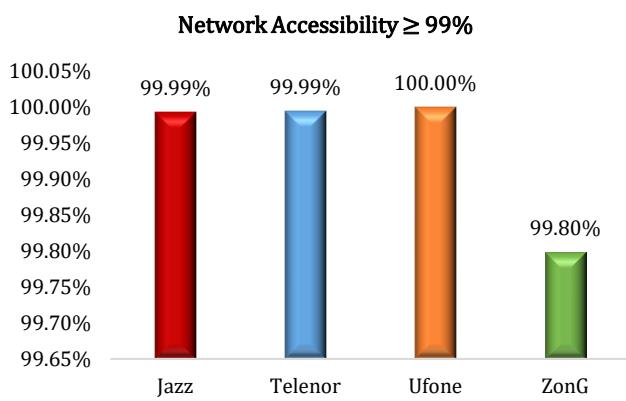
## QUALITY OF SERVICE SURVEY RESULTS – KHAIRPUR



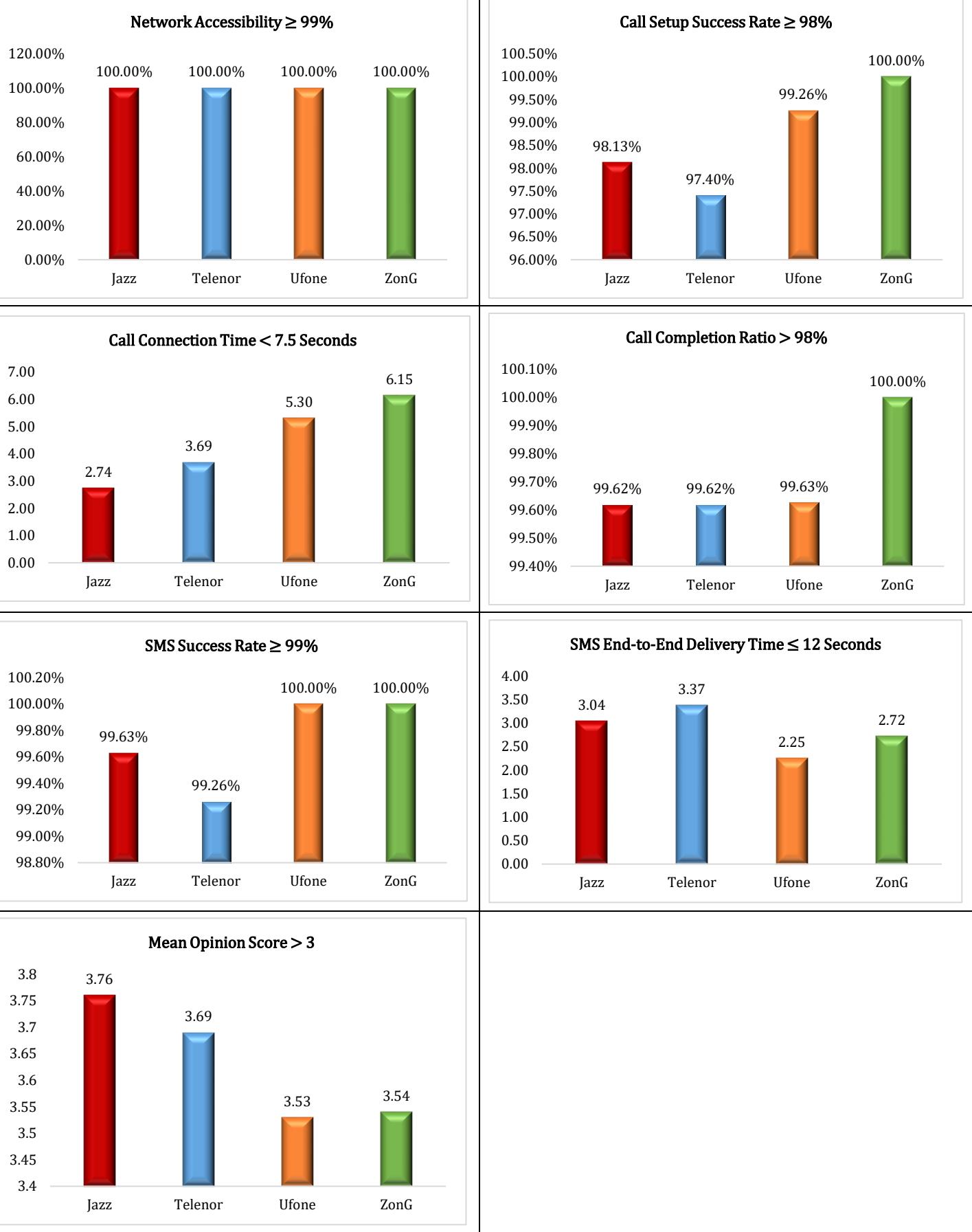
## QUALITY OF SERVICE SURVEY RESULTS – KHAROORPACCA



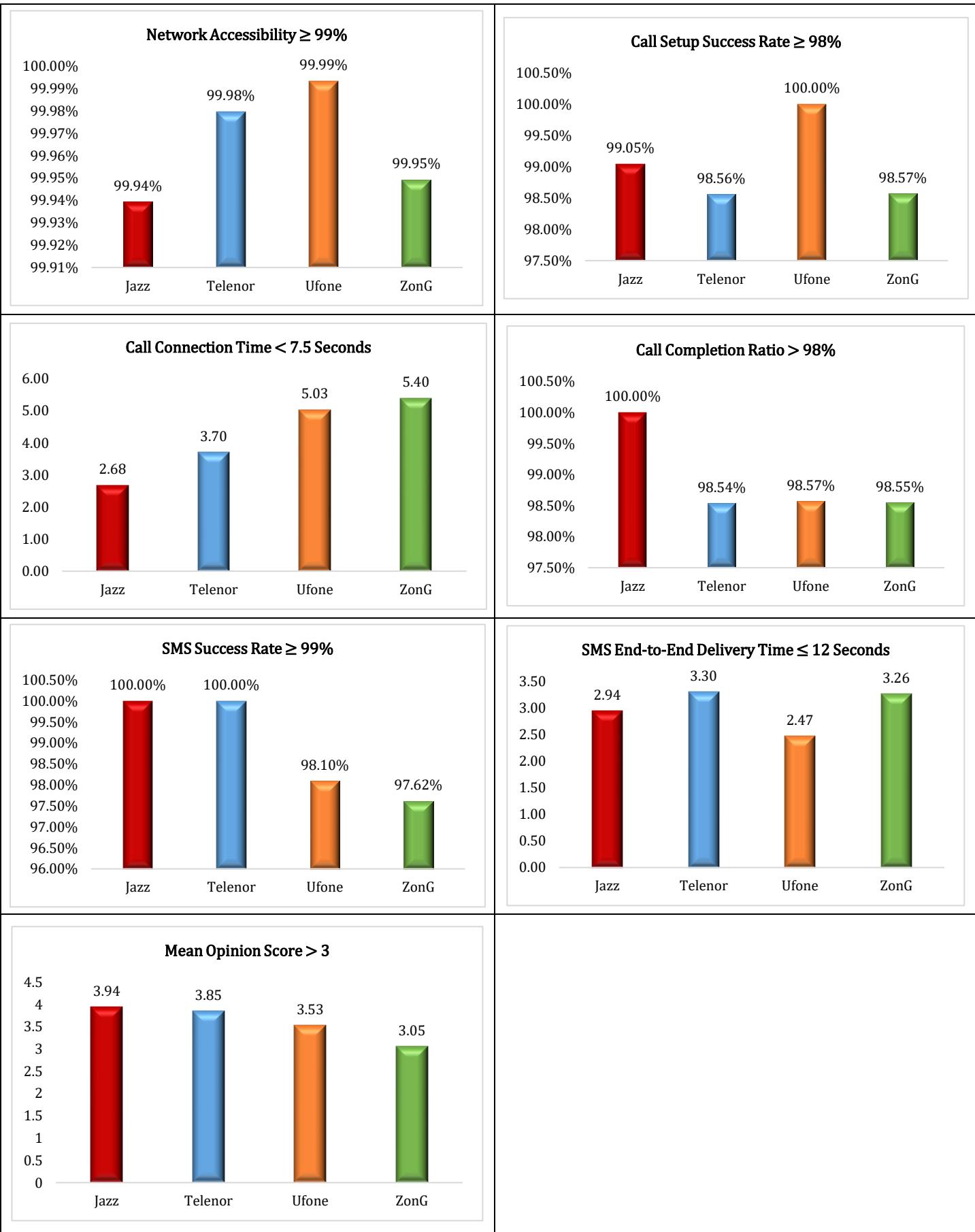
## QUALITY OF SERVICE SURVEY RESULTS – LAHORE



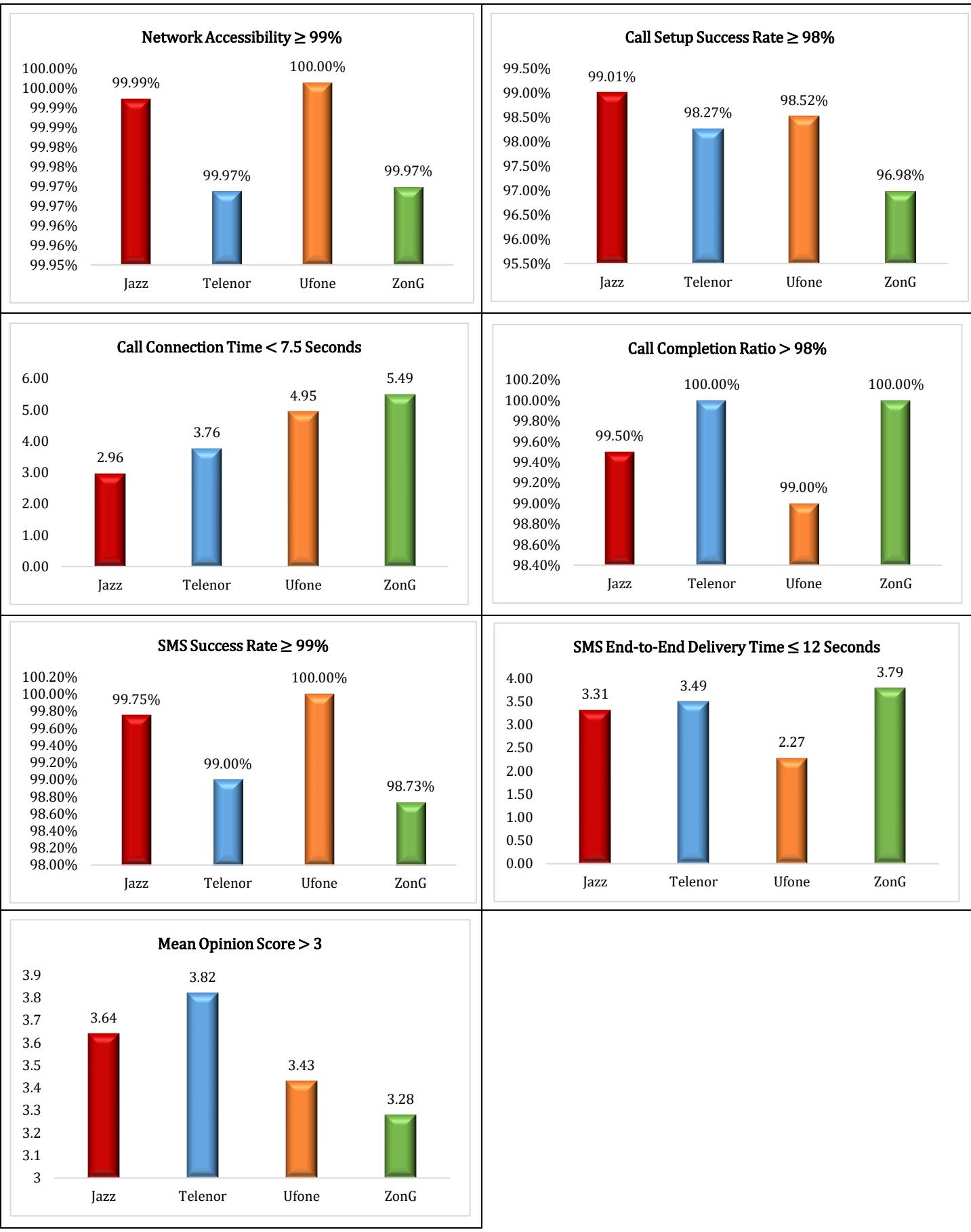
## QUALITY OF SERVICE SURVEY RESULTS – LARKANA



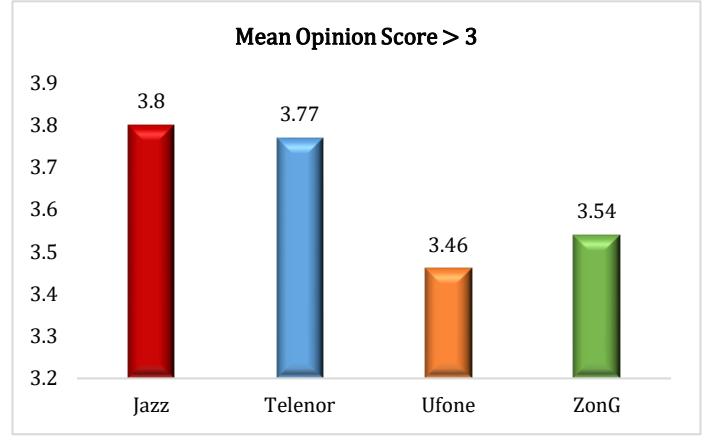
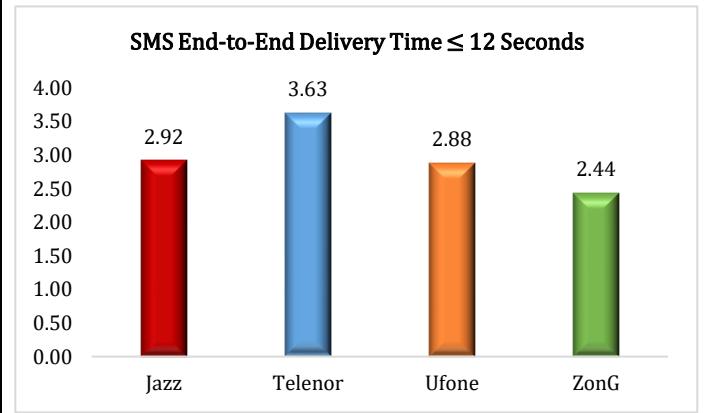
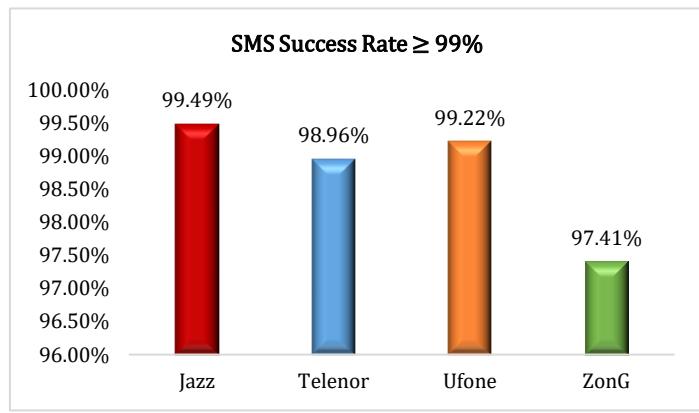
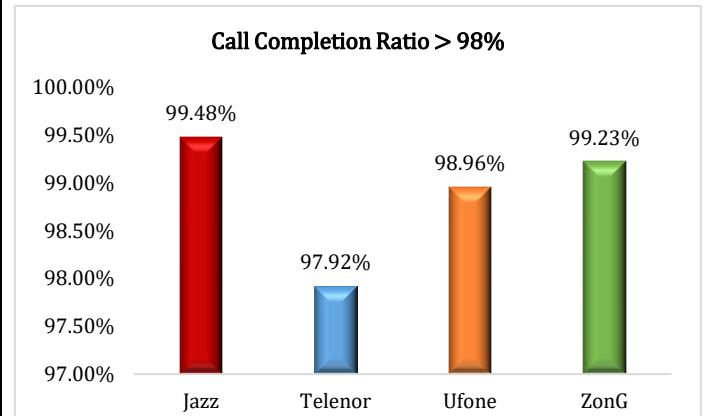
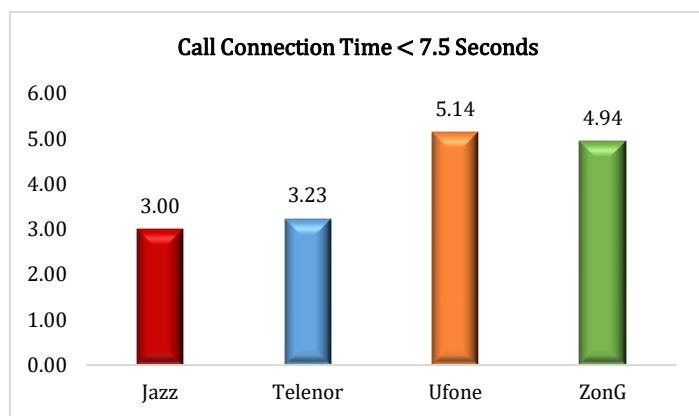
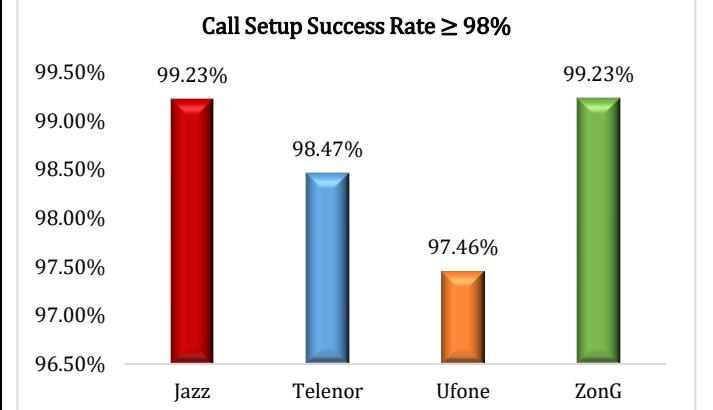
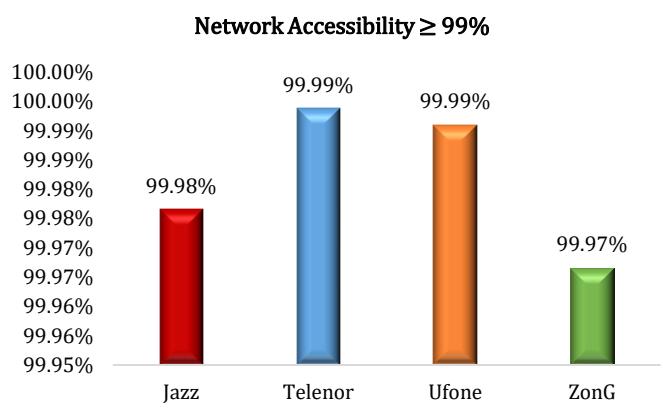
## QUALITY OF SERVICE SURVEY RESULTS – MITHI



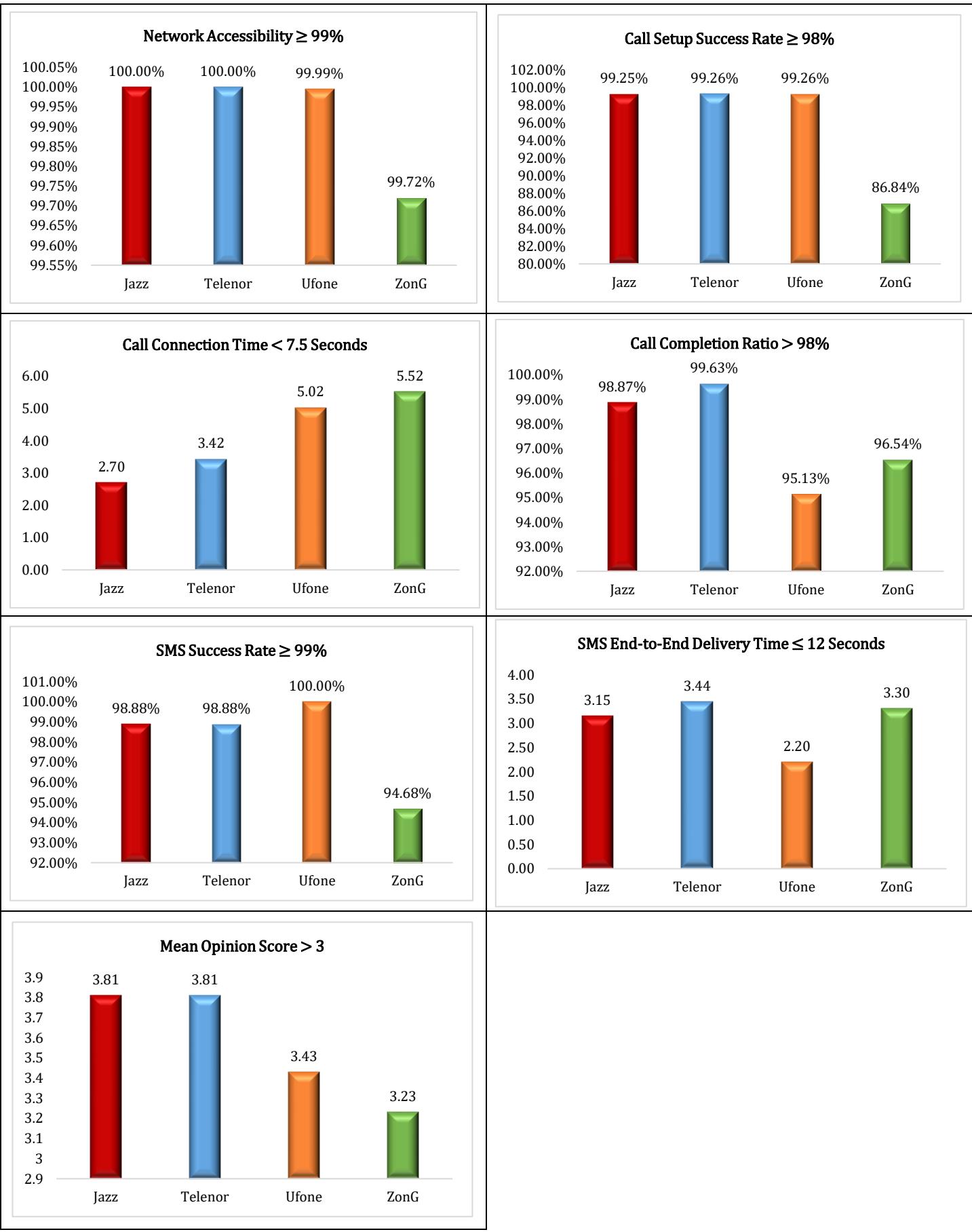
## QUALITY OF SERVICE SURVEY RESULTS – MURIDKE



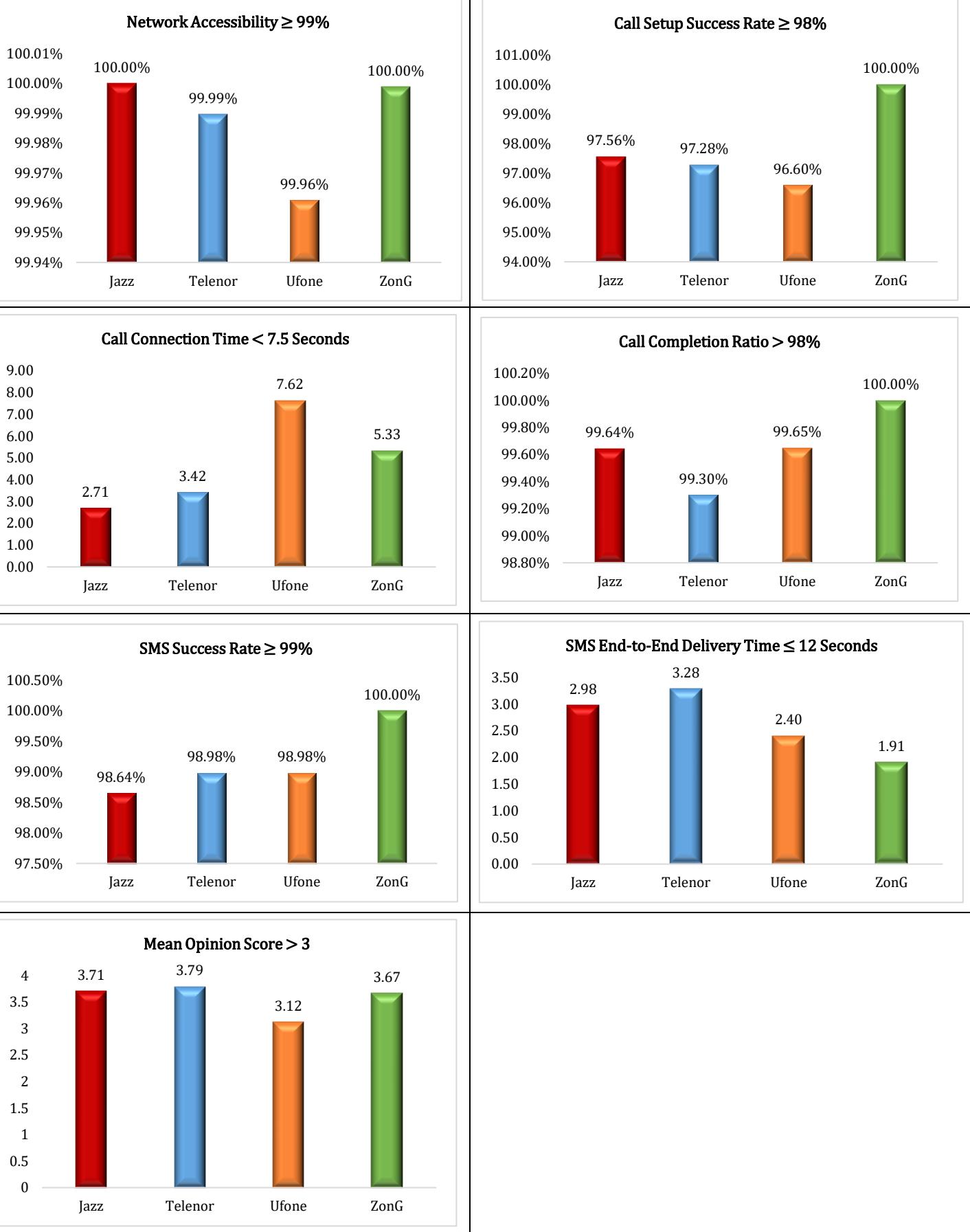
## QUALITY OF SERVICE SURVEY RESULTS – RAWALPINDI



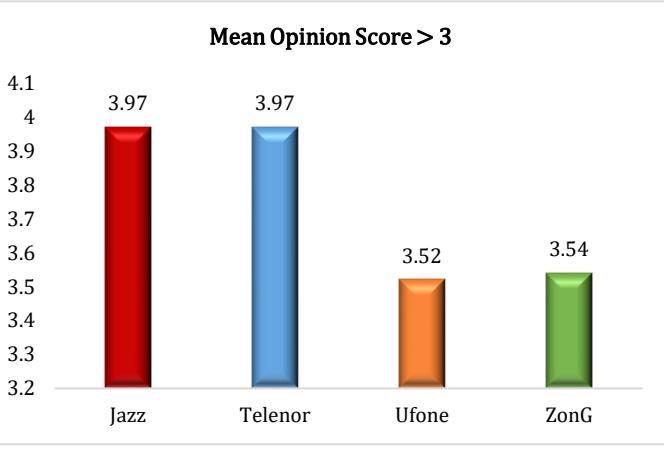
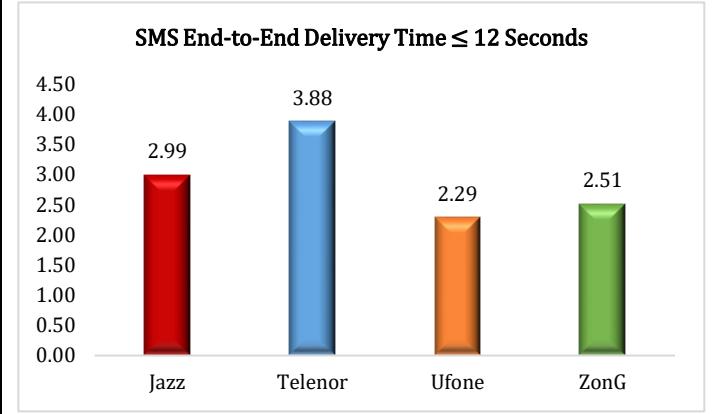
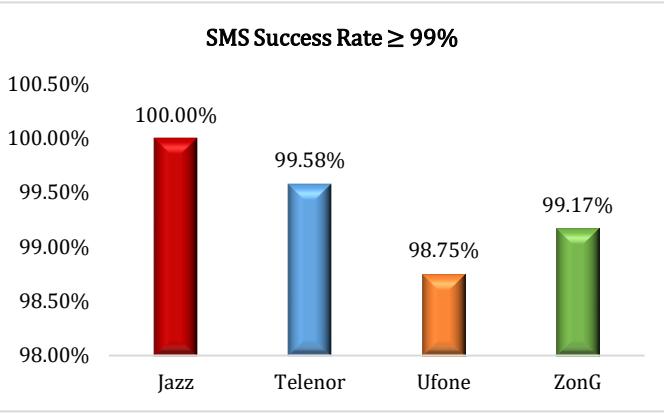
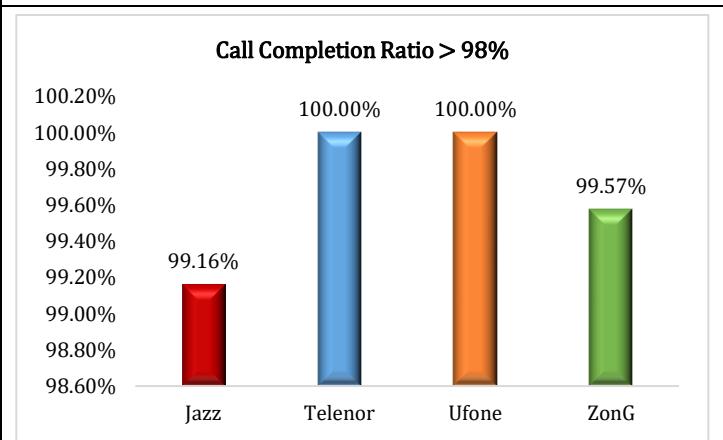
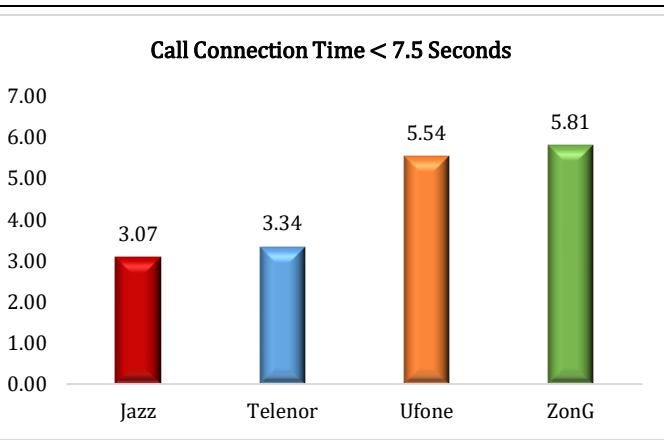
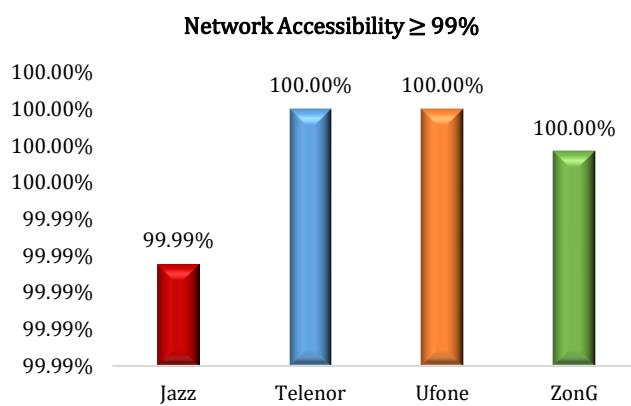
## QUALITY OF SERVICE SURVEY RESULTS – SHAHKOT



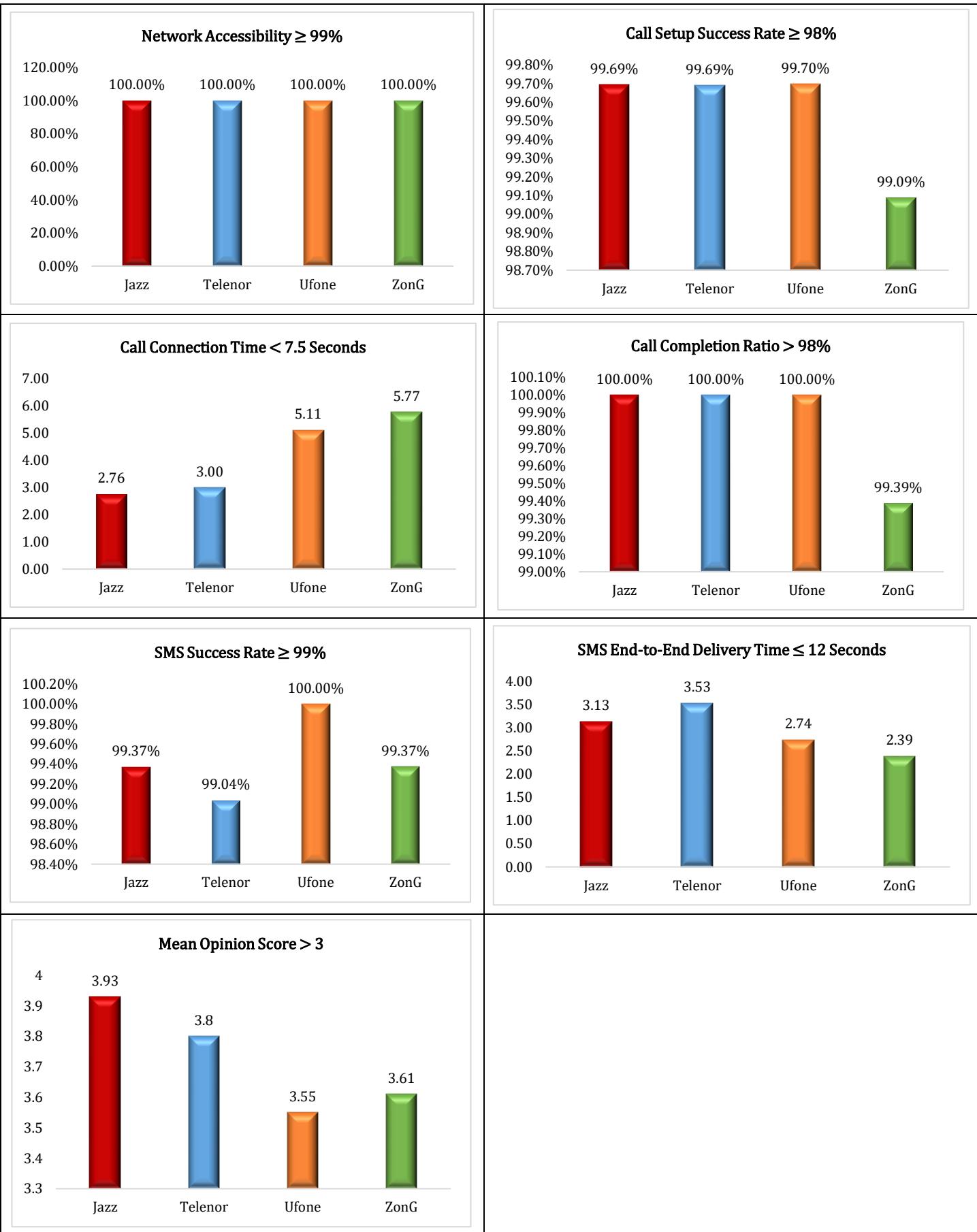
## QUALITY OF SERVICE SURVEY RESULTS – SHUJABAD



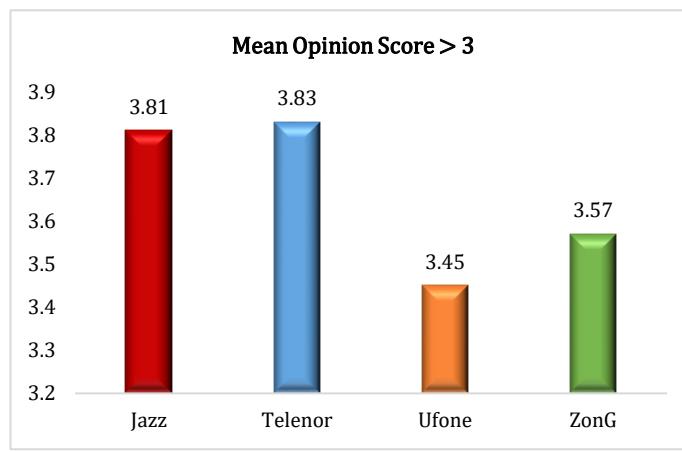
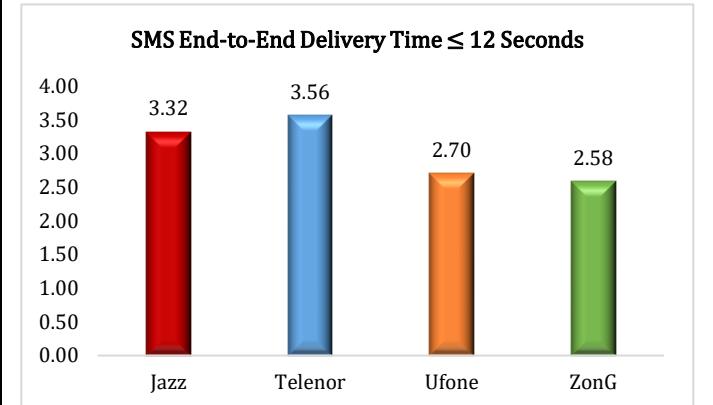
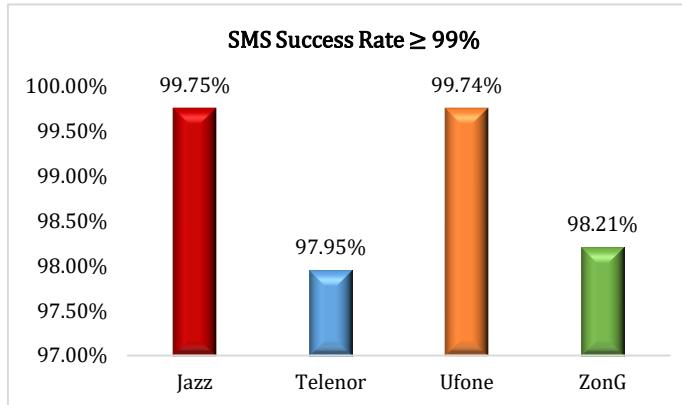
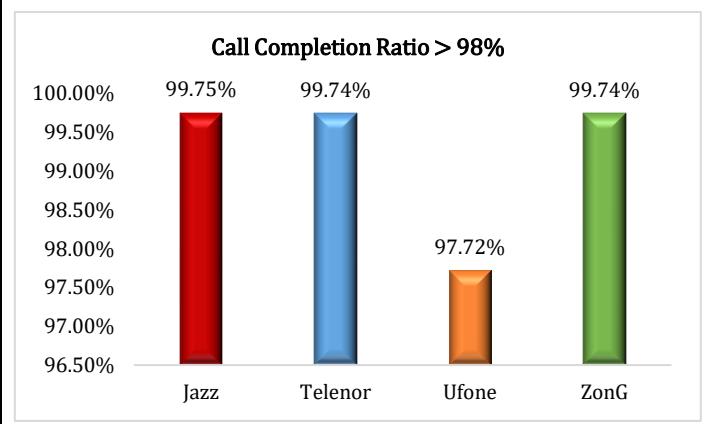
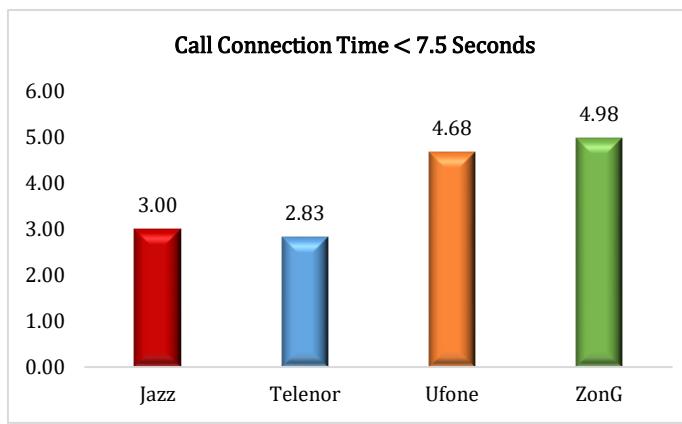
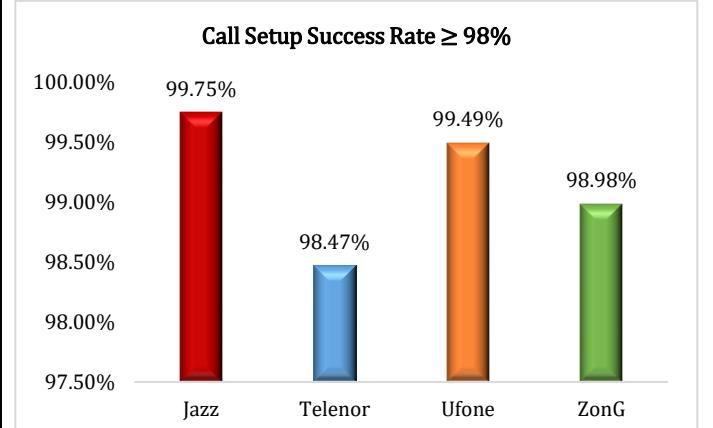
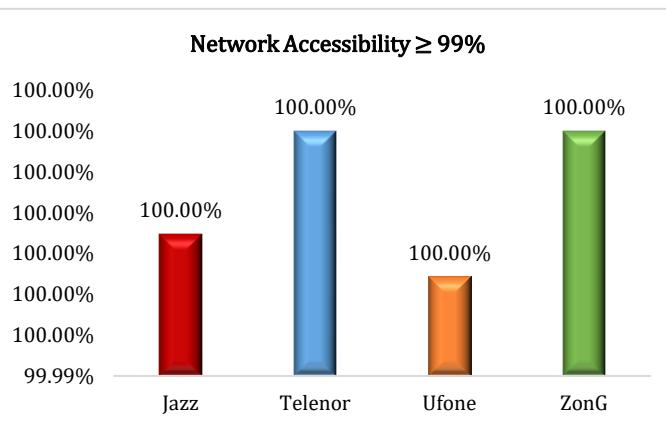
## QUALITY OF SERVICE SURVEY RESULTS – SUJAWAL



## QUALITY OF SERVICE SURVEY RESULTS – SWABI



## QUALITY OF SERVICE SURVEY RESULTS – TAXILA & WAH CANTT



## QUALITY OF SERVICE SURVEY RESULTS – UPPER DIR

