INDEPENDENT QUALITY OF SERVICE SURVEY - CITIES

THIRD QUARTER 2022

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 Nine (09) x cities of Punjab and Sindh during 3rd Quarter i.e. July ~ September 2022. The name of cities along with survey dates are mentioned in **Table 1.1: QoS Survey Cities & Dates**:

S. #.	Province	City	Days	Survey Dates
1.	Punjab	Lodhran	4	18~21 July, 2022
2.		Rawalpindi	4	19~22 July, 2022
3.		Hafizabad	3	25~27 July, 2022
4.		Khanpur	4	25~28 July, 2022
5.		Attock	4	25~28 July, 2022
6.		Wazirabad	3	01~03 August, 2022
7.		Pakpattan	5	15~19 August, 2022
8.	Sindh	Hyderabad	5	18~22 July, 2022
9.		Karachi East	4	20~23 September, 2022

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 were kept in auto detect mode whereas in case of Data Sessions, the mobile handsets were kept both in auto detect and as well as locked mode.

MOBILE NETWORK COVERAGE

3.1. **4G / LTE SIGNAL STRENGTH**. During the survey, while conducting data test in technology auto detect mode as well as locked 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 (i). **Table 3.1: 4G Signal Strength Technology Auto Detect Mode -100 dBm with 90% Confidence Level** & (ii). **Table 3.2: 4G Signal Strength Technology Locked Mode -100 dBm with 90% Confidence Level.**

4G Signal Strength -100dBm with 90% Confidence Level – Technology Auto Detect Mode								
City	Operators				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	96.55%	93.32%	93.93%	97.84%	Yes	Yes	Yes	Yes
Hafizabad	97.18%	98.49%	90.75%	96.82%	Yes	Yes	Yes	Yes
Rawalpindi	97.96%	96.12%	99.44%	99.40%	Yes	Yes	Yes	Yes
Hyderabad	97.46%	**88.56%**	91.71%	98.17%	Yes	**No**	Yes	Yes
Karachi East	98.98%	97.22%	99.22%	99.67%	Yes	Yes	Yes	Yes
Pakpattan	96.58%	**85.39%**	**89.43%**	98.64%	Yes	**No**	**No**	Yes
Khanpur	95.64%	**88.61%**	95.61%	98.37%	Yes	**No**	Yes	Yes
Lodhran	97.17%	**60.62%**	**N/A**	98.72%	Yes	**No**	**N/A**	Yes
Wazirabad	99.28%	97.54%	98.44%	96.19%	Yes	Yes	Yes	Yes

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

4G Signal Strength -100dBm with 90% Confidence Level – Technology Locked Mode								
City	Operators				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	95.45%	92.65%	91.08%	96.58%	Yes	Yes	Yes	Yes
Hafizabad	98.82%	98.70%	**88.86%**	97.96%	Yes	Yes	**No**	Yes
Rawalpindi	97.45%	95.50%	99.55%	99.43%	Yes	Yes	Yes	Yes
Hyderabad	97.46%	**88.65%**	92.05%	98.16%	Yes	**No**	Yes	Yes
Karachi East	99.74%	98.55%	99.02%	99.55%	Yes	Yes	Yes	Yes
Pakpattan	98.69%	91.56%	**85.88%**	99.01%	Yes	Yes	**No**	Yes
Khanpur	92.58%	95.04%	93.75%	99.18%	Yes	Yes	Yes	Yes
Lodhran	99.26%	**76.85%**	**62.37%**	99.67%	Yes	**No**	**No**	Yes
Wazirabad	98.42%	95.13%	99.16%	97.27%	Yes	Yes	Yes	Yes

Table 3.2: 4G Signal Strength Technology Locked Mode -100 dBm with 90% Confidence Level

3.2. 3G SIGNAL STRENGTH IN TECNHOLOGY AUTO DETECT MODE. During the survey, the signal strength samples were recorded on survey routes, wherever network switched to 3G while keeping the mobile handset in technology auto detect mode and also in technology locked 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 (i). **Table 3.3: 3G Signal Strength Technology Auto Detect Mode -100 dBm with 90% Confidence Level** (ii). **Table 3.4: 3G Signal Strength Technology Locked Mode -100 dBm with 90% Confidence Level.**

3G Signal Strength -100dBm with 90% Confidence Level – Technology Auto Detect Mode								
City	Operators				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	**100%**	**N/A**	100%	**N/A**	Yes	**N/A**	Yes	**N/A**
Hafizabad	97%	98%	91%	97%	Yes	Yes	Yes	Yes
Rawalpindi	**N/A**	100%	100%	**N/A**	**N/A**	Yes	Yes	**N/A**
Hyderabad	**N/A**							
Karachi East	**100%**	**100%**	100%	**100%**	Yes	Yes	Yes	Yes
Pakpattan	N/A	**N/A**	100%	**N/A**	**N/A**	**N/A**	Yes	**N/A**
Khanpur	99%	**N/A**	**N/A**	**N/A**	Yes	**N/A**	**N/A**	**N/A**
Lodhran	100%	94%	100%	**N/A**	Yes	Yes	Yes	**N/A**
Wazirabad	**N/A**							
Note: N/A means No Fallback to 3G Network								

Table 3.3: 3G Signal Strength Technology Auto Detect Mode -100 dBm with 90% Confidence Level

3G Signal Strength -100dBm with 90% Confidence Level – Technology Locked Mode								
City	Operators				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	100.00%	99.88%	99.21%	99.99%	Yes	Yes	Yes	Yes
Hafizabad	99.97%	100.00%	98.64%	100.00%	Yes	Yes	Yes	Yes
Rawalpindi	100.00%	100.00%	100.00%	100.00%	Yes	Yes	Yes	Yes
Hyderabad	100.00%	99.48%	99.89%	100.00%	Yes	Yes	Yes	Yes
Karachi East	99.83%	99.94%	100.00%	100.00%	Yes	Yes	Yes	Yes
Pakpattan	100.00%	99.27%	98.40%	100.00%	Yes	Yes	Yes	Yes
Khanpur	100.00%	99.93%	99.96%	100.00%	Yes	Yes	Yes	Yes
Lodhran	99.60%	98.22%	98.58%	100.00%	Yes	Yes	Yes	Yes
Wazirabad	100.00%	100.00%	100.00%	100.00%	Yes	Yes	Yes	Yes

Table 3.4: 3G Signal Strength Technology Locked Mode -100 dBm with 90% Confidence Level

MOBILE BROADBAND SERVICE

4.1. DATA SESSIONS IN TECHNOLOGY AUTO DETECT MODE & LOCKED 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 national webpages were checked and in case of Latency international and national host were pinged to measure Round Trip Time (RTT)/Latency. The 4G/LTE, 3G and 2G signal strength, 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*	2763	2758	2752	2771
				SPEED (Mbps)	13.04	6.68	14.26	14.33
			UPLOAD	*ATTEMPTS*	2768	2765	2753	2774
				SPEED (Mbps)	19.24	6.16	19.64	20.47
		DATA TRANSFER TEST	*DOWNLOAD*	*ATTEMPTS*	2797	2793	2781	2795
				SPEED (Mbps)	7.12	5.09	7.43	7.79
			UPLOAD	*ATTEMPTS*	2793	2790	2777	2794
				SPEED (Mbps)	6.918	5.462	7.693	7.554
		BROWSING TEST	*ATTEMPTS*		13900	13891	13828	13924
			LOADING TIME (Seconds)		**6.93**	**6.9**	**6.07**	**6.12**
		PING TEST	*ATTEMPTS*		5610	5607	5580	5610
			LATENCY (msec)		**238.22**	**228.75**	**215.36**	**228.21**
		AVERAGE 4G SIGNAL STRENGTH (RSRP) dBm			-78.5	-82.9	-79	-78.8
		AVERAGE 3G SIGNAL STRENGTH (RSCP) dBm			-69.89	-75.94	-71.11	**N/A**
LOCKED MODE	*4G*	*DATA TRANSFER TEST*	*DOWNLOAD*	*ATTEMPTS*	1890	1659	1862	1879
				SPEED (Mbps)	10.39	7.59	22.58	15.73
			UPLOAD	*ATTEMPTS*	1634	1402	1605	1633
				SPEED (Mbps)	17.901	4.928	20.726	19.037
		PING TEST	*ATTEMPTS*		1663	1429	1633	1662
			LATENCY (msec)		**79.69**	**85.76**	71.48	**101.81**
		AVERAGE 4G SIGNAL STRENGTH (RSRP) dBm			-78.9	-83.9	-80.9	-80.7
	3G	*DATA TRANSFER TEST*	*DOWNLOAD*	*ATTEMPTS*	1162	1806	1825	1856
				SPEED (Mbps)	1.828	2.915	4.327	1.789
			UPLOAD	*ATTEMPTS*	792	1542	1567	1605
				SPEED (Mbps)	0.71	1.49	2.49	1.42
		PING TEST	*ATTEMPTS*		1628	1809	1639	1629
			LATENCY (msec)		**467.26**	**488.22**	**476.08**	**155.07**
		AVERAGE 3G SIGNAL STRENGTH (RSCP) dBm			-66.47	-70.38	-67.17	-65.06

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 2Mbps of 4G/LTE & 256Kbps of 3G Download User Data Throughput. The results of Data Service QoS KPI i.e. Download User Data Throughput is shown in (i). **Table 4.2: Download User Data Throughput Technology Auto Detect Mode [Fixed Duration] ≥ 2Mbps,** (ii). **Table 4.3: Download User Data Throughput Technology Auto Detect Mode [Fixed Size] ≥ 2Mbps**, (iii). **Table 4.4: Download User Data Throughput IN 4G/LTE Technology Locked Mode [Fixed Duration] ≥ 2Mbps &** (iv). **Table 4.5: Download User Data Throughput IN 3G Technology Locked Mode [Fixed Duration] ≥ 256Kbps.**

DOWNLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED DURATION)								
City	User Data Throughput [Mbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	9.34	4.49	9.93	8.89	Second	Fourth	First	Third
Hafizabad	7.11	2.68	16.10	11.98	Third	Fourth	First	Second
Rawalpindi	13.16	5.74	7.22	15.98	Second	Fourth	Third	First
Hyderabad	13.42	7.38	11.22	14.28	Second	Fourth	Third	First
Karachi East	22.36	13.61	13.43	21.60	First	Third	Fourth	Second
Pakpattan	10.64	10.33	29.76	10.40	Second	Fourth	First	Third

Khanpur	4.28	4.59	9.49	6.19	Fourth	Third	First	Second
Lodhran	3.45	3.26	2.74	4.65	Second	Third	Fourth	First
Wazirabad	26.51	7.31	25.28	27.43	Second	Fourth	Third	First

Table4.2: Download User Data Throughput Technology Auto Detect Mode [Fixed Duration] ≥ 2Mbps

DOWNLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED SIZE)								
City	User Data Throughput [Mbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	4.24	2.93	3.91	4.38	Second	Fourth	Third	First
Hafizabad	4.20	3.43	6.88	6.37	Third	Fourth	First	Second
Rawalpindi	7.16	4.31	5.29	8.53	Second	Fourth	Third	First
Hyderabad	7.62	4.57	6.47	8.69	Second	Fourth	Third	First
Karachi East	11.40	9.29	9.67	12.29	Second	Fourth	Third	First
Pakpattan	6.65	7.82	14.18	7.98	Fourth	Third	First	Second
Khanpur	3.46	2.38	3.37	2.95	First	Fourth	Second	Third
Lodhran	**1.79**	**1.81**	**1.93**	**1.63**	**Third**	**Second**	**First**	**Fourth**
Wazirabad	12.74	6.29	12.55	12.94	Second	Fourth	Third	First

Table4.3: Download User Data Throughput Technology Auto Detect Mode [Fixed Size] ≥ 2Mbps

DOWNLOAD USER DATA THROUGHPUT IN 4G/LTE TECHNOLOGY LOCKED MODE (FIXED DURATION)								
City	User Data Throughput [Mbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	11.30	2.42	**0.61**	4.19	First	Third	**Fourth**	Second
Hafizabad	6.10	2.25	23.67	18.49	Third	Fourth	First	Second
Rawalpindi	13.28	3.42	7.69	15.72	Second	Fourth	Third	First
Hyderabad	17.71	8.80	14.16	18.39	Second	Fourth	Third	First
Karachi East	12.12	12.24	13.34	20.64	Fourth	Third	Second	First
Pakpattan	5.10	10.16	28.36	8.98	Fourth	Second	First	Third
Khanpur	4.93	9.26	16.85	7.63	Fourth	Second	First	Third
Lodhran	9.31	6.41	**1.86**	9.04	First	Third	**Fourth**	Second
Wazirabad	17.34	4.54	22.69	23.07	Third	Fourth	Second	First

Table 4.4: Download User Data Throughput 4G/LTE Technology Locked Mode [Fixed Duration] ≥ 2Mbps

DOWNLOAD USER DATA THROUGHPUT IN 3G TECHNOLOGY LOCKED MODE (FIXED DURATION)								
City	User Data Throughput [Kbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	1834.6	3412.95	1923.16	1098.75	Third	First	Second	Fourth
Hafizabad	2280.07	1293.84	4783.55	1999.91	Second	Fourth	First	Third
Rawalpindi	4501.05	2439.69	3350.17	1871.2	First	Third	Second	Fourth
Hyderabad	2133.61	3387.4	3468.7	1391.58	Third	Second	First	Fourth
Karachi East	2233.88	4018.89	4373.47	2526.04	Fourth	Second	First	Third
Pakpattan	3594.84	3923.9	8898.88	1938.59	Third	Second	First	Fourth
Khanpur	1851.68	2796.31	3331.04	1292.49	Third	Second	First	Fourth
Lodhran	2278.56	2781.33	2854.97	1742.59	Third	Second	First	Fourth
Wazirabad	1708.86	2906.23	5171.48	2067.32	Fourth	Second	First	Third

Table 4.5: Download User Data Throughput IN 3G Technology Locked Mode [Fixed Duration] ≥ 256Kbps

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 512Kbps of 4G/LTE & 64Kbps 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 4.6: Upload User Data Throughput Technology Auto Detect Mode [Fixed Duration] ≥ 512Kbps,** (ii). **Table 4.7: Upload User Data Throughput Technology Auto Detect Mode [Fixed Size] ≥ 512Kbps,** (iii). **Table 4.8: Upload User Data Throughput in 4G/LTE Technology Locked Mode [Fixed Duration] ≥ 512Kbps** & (iv). **Table 4.9: Upload User Data Throughput in 3G Technology Locked Mode [Fixed Duration] ≥ 64Kbps.**

UPLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED DURATION)								
City	Automode Throughput [Kbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	18681.4	6550.38	21332.57	17390.48	Second	Fourth	First	Third
Hafizabad	15931.56	4114.74	17867.28	21280.89	Third	Fourth	Second	First
Rawalpindi	18242.43	7080.04	17693.23	19484.96	Second	Fourth	Third	First
Hyderabad	19770.05	6705.88	19144.34	22657.11	Second	Fourth	Third	First
Karachi East	24533.27	7413.88	23835.34	23545.16	First	Fourth	Second	Third
Pakpattan	20157.72	6022.37	20918.29	21940.6	Third	Fourth	Second	First
Khanpur	16010.83	3910.02	21426.82	19114.83	Third	Fourth	First	Second
Lodhran	15828.19	3164.41	2642.72	16035.03	Second	Third	Fourth	First
Wazirabad	23128.26	7243.53	26927.81	24956.32	Third	Fourth	First	Second

Table 4.6: Upload User Data Throughput Technology Auto Detect Mode [Fixed Duration] ≥ 512Kbps

UPLOAD USER DATA THROUGHPUT IN TECHNOLOGY AUTO DETECT MODE (FIXED SIZE)								
City	Auto mode Throughput [Kbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	13157.41	11358.81	16858.45	15273.11	Third	Fourth	First	Second
Hafizabad	12864.18	9134.07	13447.81	12204.07	Second	Fourth	First	Third
Rawalpindi	14348.58	11036.09	13954.39	16244.83	Second	Fourth	Third	First
Hyderabad	10297.19	11918.57	15964.71	14653	Fourth	Third	First	Second
Karachi East	9850.67	5939.53	9768.73	8845.32	First	Fourth	Second	Third
Pakpattan	13249.11	10563.21	17890.04	16822.68	Third	Fourth	First	Second
Khanpur	13179.07	9004.47	17306.99	14748.16	Third	Fourth	First	Second
Lodhran	12458.87	8555.51	4766.04	10756.71	First	Third	Fourth	Second
Wazirabad	15044.95	11215.83	14808.64	14349.81	First	Fourth	Second	Third

Table 4.7: Upload User Data Throughput Technology Auto Detect Mode [Fixed Size] ≥ 512Kbps

UPLOAD USER DATA THROUGHPUT IN 4G TECHNOLOGY LOCKED MODE (FIXED DURATION)								
City	Auto mode Throughput [Kbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	19522.9	4990.77	20817.14	17494.09	Second	Fourth	First	Third
Hafizabad	17176.81	3765.95	20466.42	22540.34	Third	Fourth	Second	First
Rawalpindi	17097.68	6274.1	18186.68	18546.47	Third	Fourth	Second	First
Hyderabad	20377.2	6776.42	19671.8	22597.74	Second	Fourth	Third	First
Karachi East	**N/A**				**N/A**			
Pakpattan	18769.39	5528.99	19285.91	18925.83	Third	Fourth	First	Second
Khanpur	15418.48	3551.11	19207.88	16992.99	Third	Fourth	First	Second
Lodhran	20057.11	3392.23	**11.43**	16073.45	First	**Third**	Fourth	Second
Wazirabad	17110.54	5861.4	24210.63	20364.96	Third	Fourth	First	Second

Table 4.8: Upload User Data Throughput Technology Locked Mode [Fixed Duration] ≥ 512Kbps

UPLOAD USER DATA THROUGHPUT IN 3G TECHNOLOGY LOCKED MODE (FIXED DURATION)								
City	Auto mode Throughput [Kbps]				Operator Position			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	1273.94	1520.25	1735.54	600.11	Third	Second	First	Fourth
Hafizabad	375.65	1150.07	2886.45	1572.91	Fourth	Third	First	Second
Rawalpindi	1365.88	1256.67	1914.83	863.49	Second	Third	First	Fourth
Hyderabad	654.74	**N/A**	1668.77	**N/A**	Second	**N/A**	First	**N/A**
Karachi East	**N/A**				**N/A**			
Pakpattan	1332.88	1522.54	4363.72	1592.64	Fourth	Third	First	Second
Khanpur	1225.32	1448.2	2479.74	1307.45	Fourth	Second	First	Third
Lodhran	1418.56	2195.33	2455.8	1495.07	Fourth	Second	First	Third
Wazirabad	314.45	1452.9	3025.82	1886.9	Fourth	Third	First	Second

Table 4.9: Upload User Data Throughput in 3G Technology Locked Mode [Fixed Duration] ≥ 64Kbps

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 is shown in **Table 4.10: Webpage Loading Time < 5 Seconds.**

WEBPAGE LOADING TIME IN TECHNOLOGY AUTO DETECT MODE IN CITIES								
City	Webpage Loading Time [Seconds]				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	6.3	6.6	6.5	5.1	No	No	No	No
Hafizabad	6.7	7.6	5.0	6.2	No	No	No	No
Rawalpindi	6.2	6.2	5.7	4.9	No	No	No	Yes
Hyderabad	5.2	5.4	4.9	4.6	No	No	Yes	Yes
Karachi East	6.3	6.1	5.5	5.4	No	No	No	No
Pakpattan	5.8	6.0	4.2	5.5	No	No	Yes	No
Khanpur	7.6	7.4	5.2	6.3	No	No	No	No
Lodhran	7.5	6.9	8.1	6.5	No	No	No	No
Wazirabad	4.8	5.8	4.8	4.8	Yes	No	Yes	Yes

Table 4.10: 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 is shown in (i). **Table 4.11: Latency in Technology Auto Detect Mode < 75 milliseconds**, (ii). **Table 4.12: Latency in 4G/LTE Technology Locked Mode < 75 milliseconds** & (iii) **Table 4.13: Latency in 3G Technology Locked Mode < 150 milliseconds.**

LATENCY IN TECHNOLOGY AUTO DETECT MODE								
City	Latency (milliseconds)				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	241	219	205	208	No	No	No	No
Hafizabad	256	231	226	238	No	No	No	No
Rawalpindi	224	230	212	226	No	No	No	No
Hyderabad	281	215	223	249	No	No	No	No
Karachi East	205	209	195	213	No	No	No	No
Pakpattan	250	245	216	229	No	No	No	No
Khanpur	248	253	201	223	No	No	No	No
Lodhran	216	266	246	275	No	No	No	No
Wazirabad	219	216	225	222	No	No	No	No

Table 4.11: Latency in Technology Auto Detect Mode < 75 milliseconds

LATENCY IN 4G/LTE TECHNOLOGY LOCKED MODE								
City	Latency [milliseconds]				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	87	74	67	169	No	Yes	Yes	No
Hafizabad	84	77	78	154	No	No	No	No
Rawalpindi	67	77	71	118	Yes	No	Yes	No
Hyderabad	276	211	223	248	No	No	No	No
Karachi East	N/A				N/A			
Pakpattan	88	84	60	69	No	No	Yes	Yes
Khanpur	78	109	62	84	No	No	Yes	No
Lodhran	68	105	84	77	Yes	No	No	No
Wazirabad	80	74	87	74	No	Yes	No	Yes

Table 4.12: Latency in 4G/LTE Technology Locked Mode < 75 milliseconds

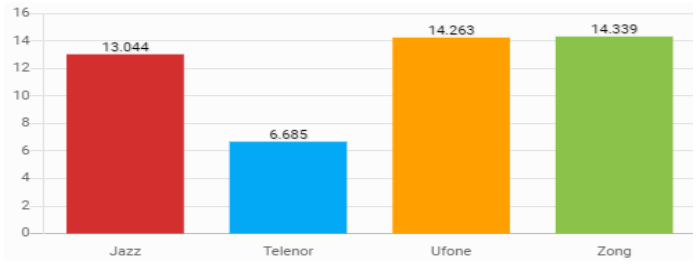
LATENCY IN 3G TECHNOLOGY LOCKED MODE								
City	Latency [milliseconds]				Compliant (Yes/No)			
	Jazz	Telenor	Ufone	ZonG	Jazz	Telenor	Ufone	ZonG
Attock	521	504	523	270	No	No	No	No
Hafizabad	537	338	525	172	No	No	No	No
Rawalpindi	504	340	466	206	No	No	No	No
Hyderabad	463	N/A	231	N/A	No	No	No	No
Karachi East	N/A	N/A	N/A	N/A	No	No	No	No
Pakpattan	560	694	388	110	No	No	No	Yes
Khanpur	248	783	505	159	No	No	No	No
Lodhran	243	1021	480	114	No	No	No	Yes
Wazirabad	557	457	499	127	No	No	No	Yes

Table 4.13: Latency in 3G Technology Locked Mode < 150 milliseconds

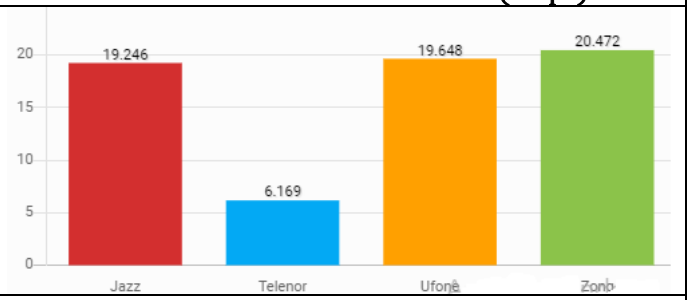
4.6. During the survey, the deployed technologies by Cellular Mobile Operators (CMOs), Success Rate of http Transfer Download Tests and Resource Block Utilization have been recorded. The details can be seen in attached graphs.

TECHNOLOGY AUTO DETECT MODE TESTING

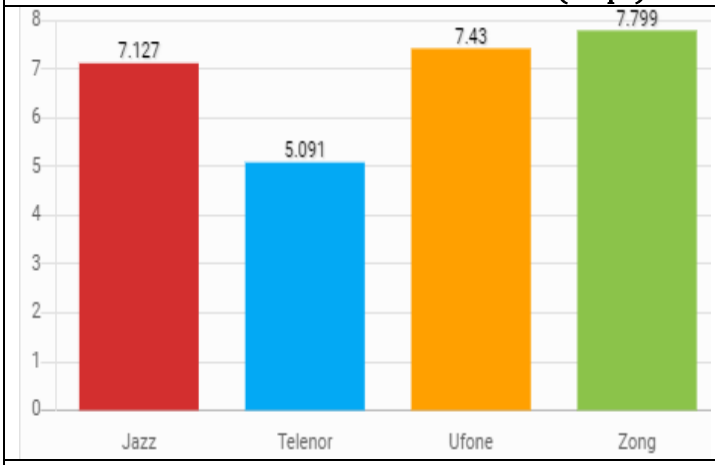
CAPACITY TEST DOWNLOAD SPEED (Mbps)



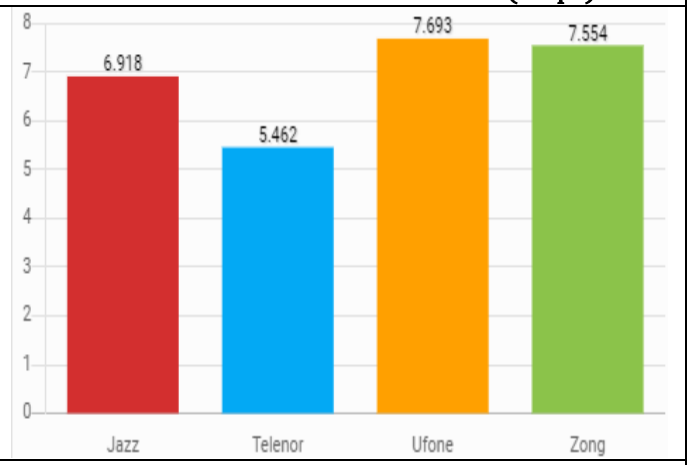
CAPACITY TEST UPLOAD SPEED (Mbps)



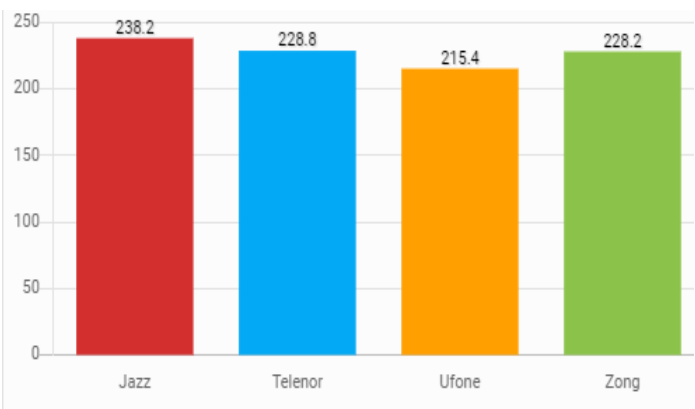
DATA TRANSFER DOWNLOAD SPEED (Mbps)



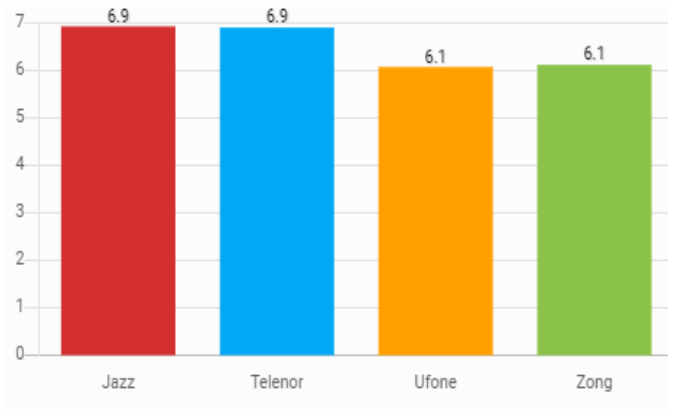
DATA TRANSFER UPLOAD SPEED (Mbps)



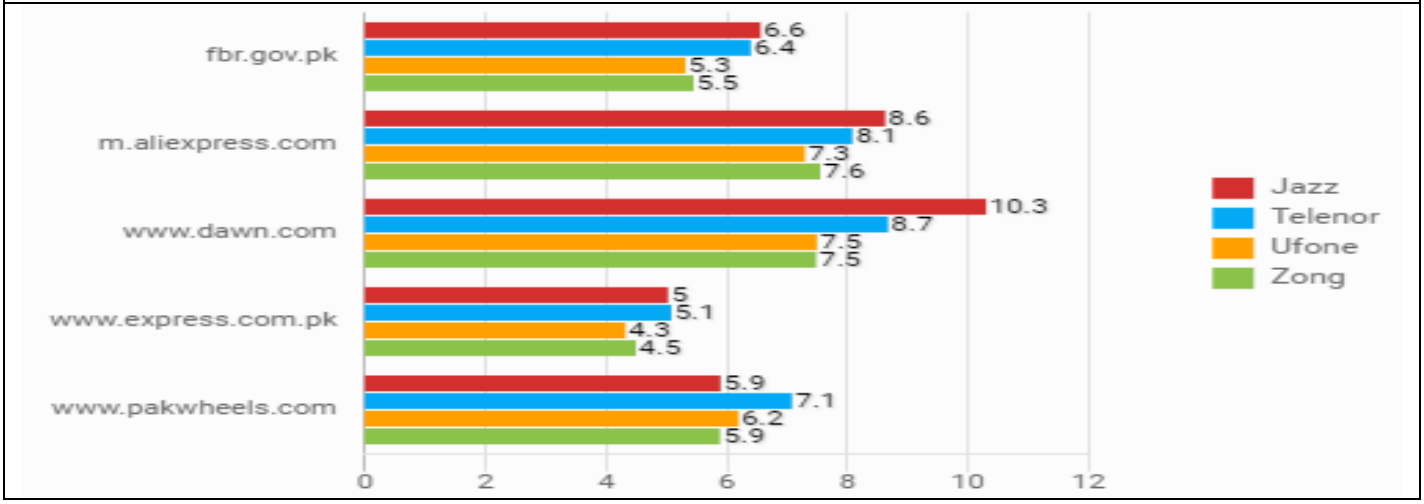
LATENCY (milliseconds)



WEBPAGE LOADING TIME (Seconds)

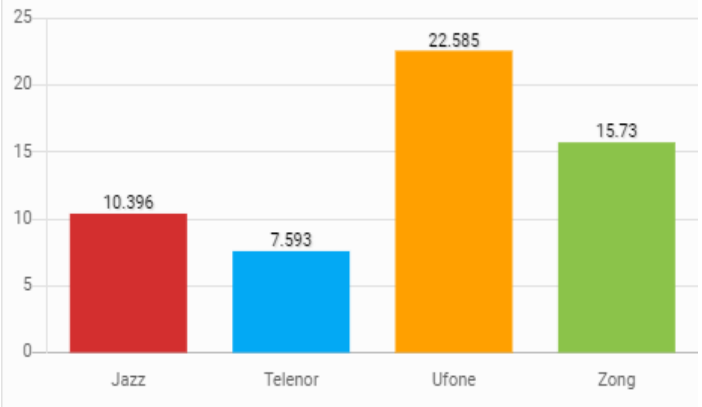


WEBPAGE LOADING TIME PER PAGE (Seconds)

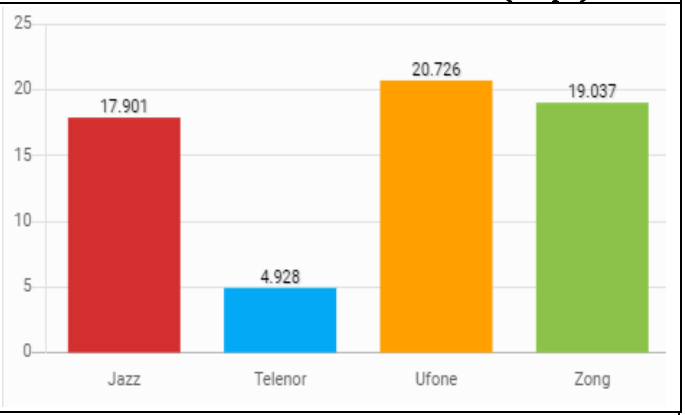


4G/LTE TECHNOLOGY LOCKED MODE

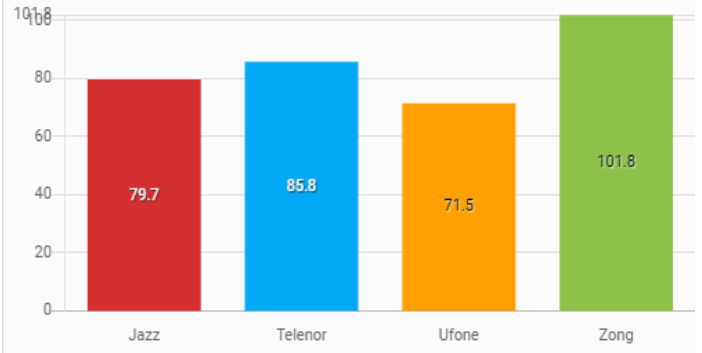
DATA TRANSFER DOWNLOAD SPEED (Mbps)



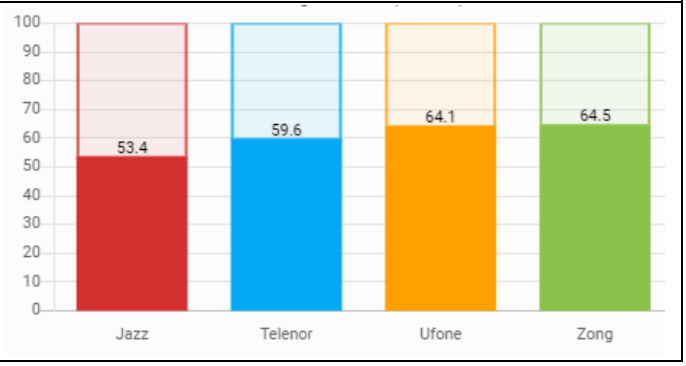
DATA TRANSFER UPLOAD SPEED (Mbps)



LATENCY (milliseconds)

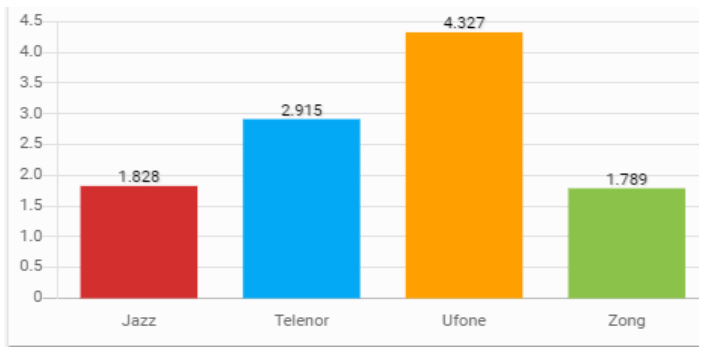


RESOURCE BLOCK USAGE DOWNLOAD

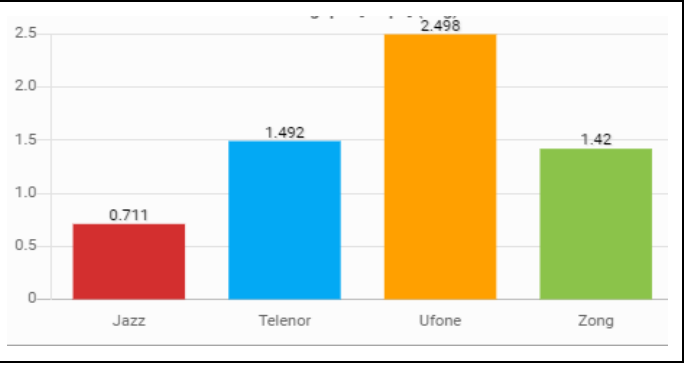


3G TECHNOLOGY LOCKED MODE

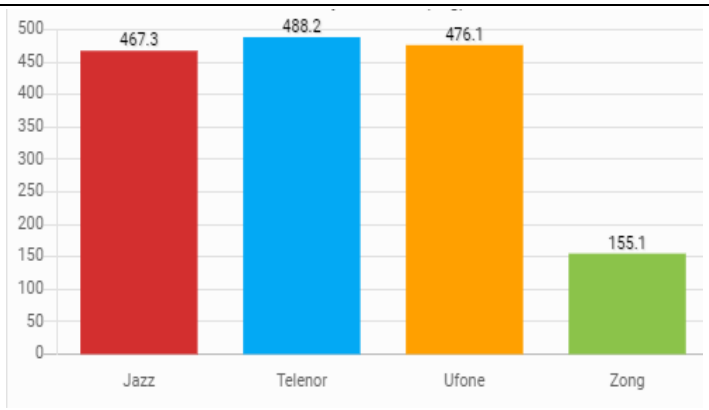
DATA TRANSFER DOWNLOAD SPEED (Mbps)



DATA TRANSFER UPLOAD SPEED (Mbps)



LATENCY (milliseconds)



VOICE SERVICE

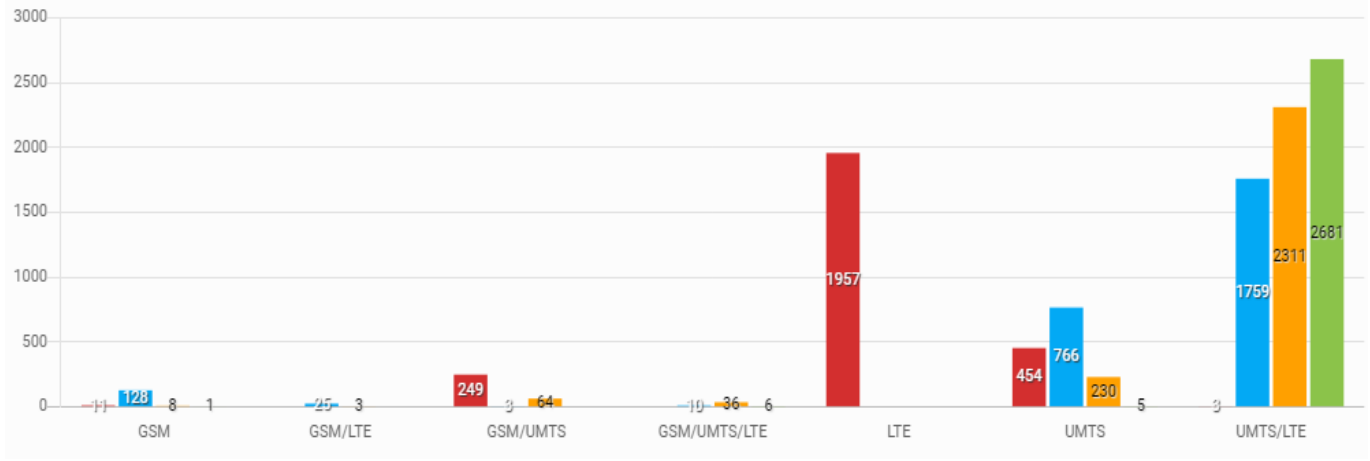
5.1. A total of **10,711 Call attempts** were made and out of which **160 were failed attempts**. In **10,551 successful call attempts**, **83 calls dropped** prior to completion of two minutes duration, whereas, **10,468 calls remained connected** for the complete duration of two minutes. The company wise call statistics is shown in **Table 5.1: Call Statistics.**

DESCRIPTION	JAZZ	TELENOR	UFONE	ZONG
TOTAL CALLS ATTEMPTS	2674	2692	2652	2693
FAILED CALLS ATTEMPTS	28	65	43	24
ESTABLISHED CALLS ATTEMPTS	2646	2627	2609	2669
DROPPED CALLS ATTEMPTS	24	32	20	7
COMPLETED CALLS ATTEMPTS	2622	2595	2589	2662
CALL SETUP SUCCESS RATE	98.95 %	**97.59 %**	98.38 %	99.11 %
CALL SETUP TIME	6.24	**8.53**	6.27	7.03
CALL COMPLETION RATE	99.15 %	**97.59 %**	98.64 %	**97.95 %**
ISHO SUCCESS RATE	98.68 %	100 %	98.78 %	-
RAB SETUP SUCCESS RATE	99.88 %	100 %	99.86 %	100 %
MEAN OPINION SCORE	3.7	3.21	3.36	3.59
MEAN OPINION SCORE EXCESS RATIO – MOS <1.6	4.03 %	1.17 %	1.28 %	0.56 %
TOTAL SPEECH TEST	26352	26171	26072	26768

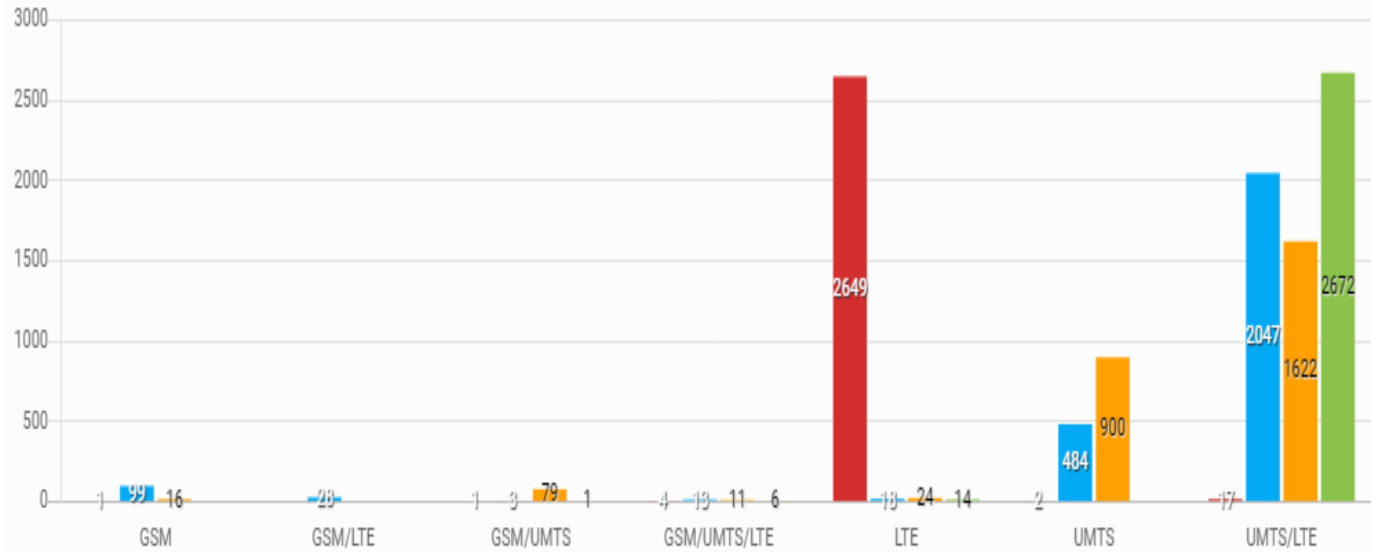
Table5.1: Call Statistics

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:

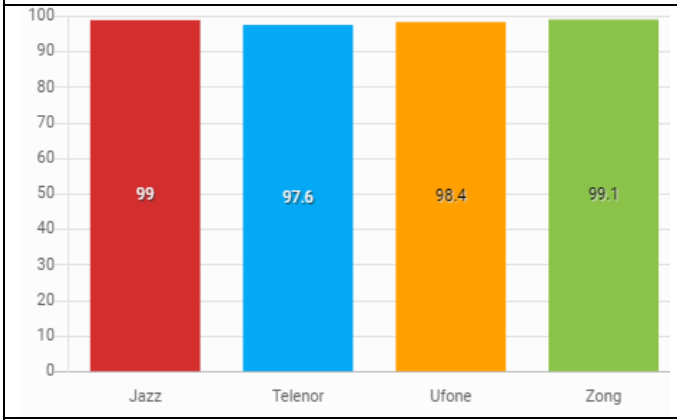
TECHNOLOGY WISE DISTRIBUTION OF CALLS – A PARTY



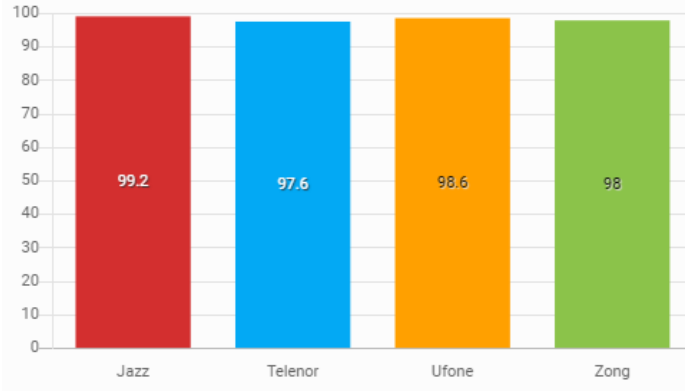
TECHNOLOGY WISE DISTRIBUTION OF CALLS – B PARTY



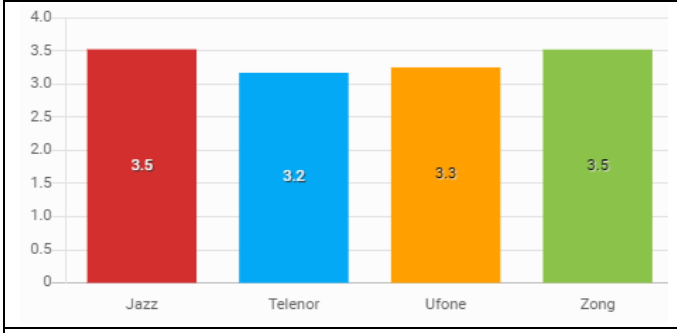
CALL SETUP SUCCESS RATE



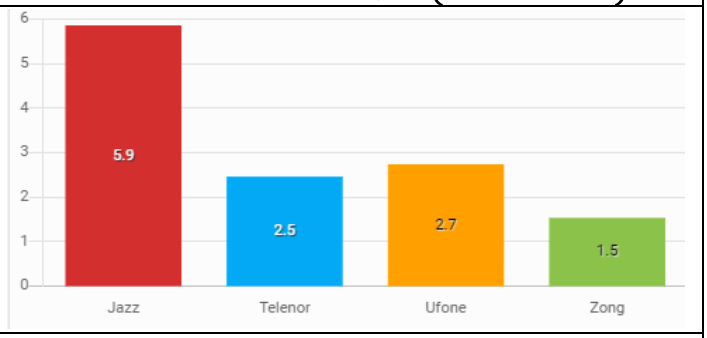
CALL RETAINABILITY



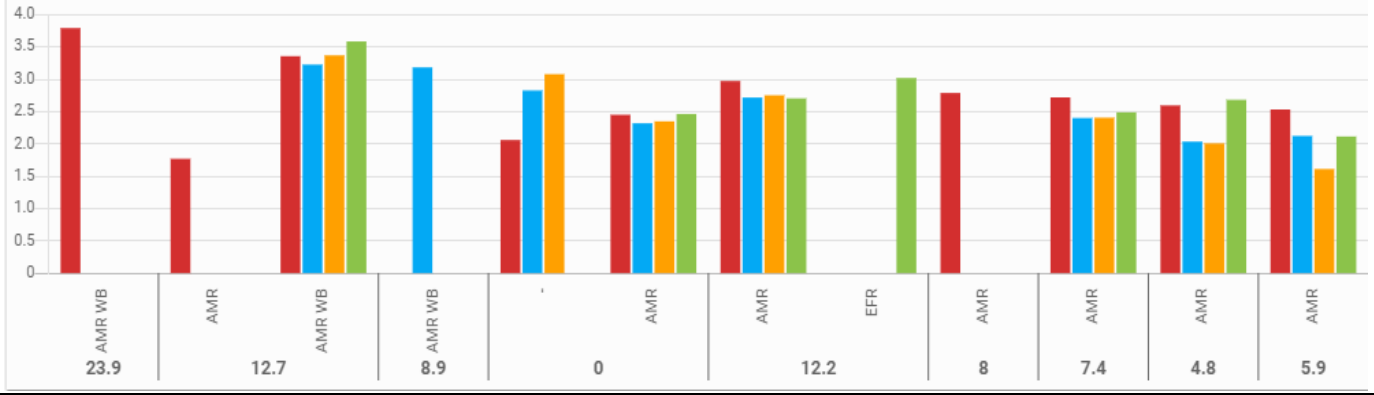
MEAN OPINION SCORE - AVERAGE



MEAN OPINION SCORE < 1.6 (PERCENTAGE)



MEAN OPINION SCORE – VOICE CODEC



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 **9 x surveyed cities** of Pakistan. The compliance level of threshold values of voice QoS KPIs is shown in each **Table 5.1: Voice QoS KPIs Compliance Level.**

CMO	KPIs	Attock	Hafizabad	Rawalpindi	Hyderabad	Karachi East	Pakpattan	Khanpur	Lodhran	Wazirabad
Jazz	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	**No**	Yes	Yes	Yes	Yes	**No**	**No**	**No**	**No**
	CCT	Yes	**N/A**	Yes	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	Yes
	CCR	**No**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	MOS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	Yes	**N/A**	**No**	Yes	Yes	**N/A**	**N/A**	**N/A**	Yes
	RSSR	Yes	Yes	Yes	Yes	Yes	Yes	**N/A**	**N/A**	**No**
Telenor	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	**No**	Yes	**No**	**No**	**No**	**No**	**No**	**No**	**No**
	CCT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	Yes	**No**	Yes	**No**	**No**	Yes	Yes	Yes	Yes
	MOS	Yes	**No**	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	**N/A**	**N/A**	**Yes**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	RSSR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ufone	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	**No**	Yes	Yes	**No**	Yes	Yes	**No**	Yes	**No**
	CCT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	Yes	Yes	**No**	Yes	Yes	Yes	Yes	Yes	Yes
	MOS	**No**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	Yes	Yes	**No**	Yes	**N/A**	Yes	Yes	**No**	Yes
	RSSR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ZonG	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CSSR	**No**	Yes	**No**	**No**	Yes	Yes	Yes	Yes	Yes
	CCT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CCR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	MOS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	ISHO	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	RSSR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5.1: Voice QoS KPIs Compliance Level

SMS SERVICE

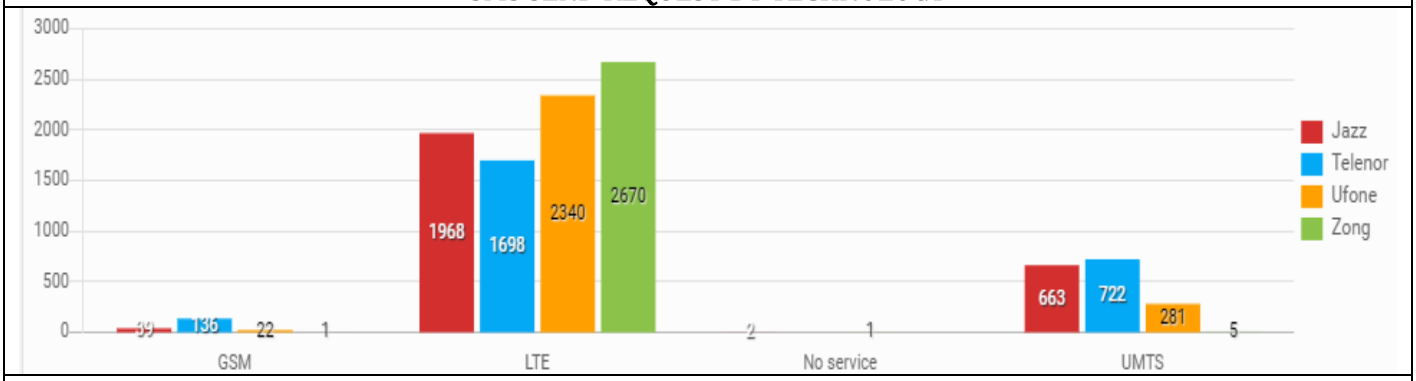
6.1. A total of **10,548 SMS sending attempts** were conducted, out of which **10,495 SMS** were **successfully transmitted** by A-Party while **10,310 SMS** were **successfully received** at B-Party. The company wise SMS Statistics are shown in **Table 6.1: SMS Statistics**

DESCRIPTION	JAZZ	TELENOR	UFONE	ZONG
SMS SEND REQUEST	2672	2556	2644	2676
SMS SUCCESSFULLY TRANSMITTED	2665	2523	2633	2674
SMS SUCCESSFULLY RECEIVED	2648	2380	2620	2662
SMS RECEIVE SUCCESS RATE	99.1 %	**93.11 %**	99.09 %	99.48 %
END-TO-END DELIVERY TIME	4.06	**17.77**	4.44	2.57

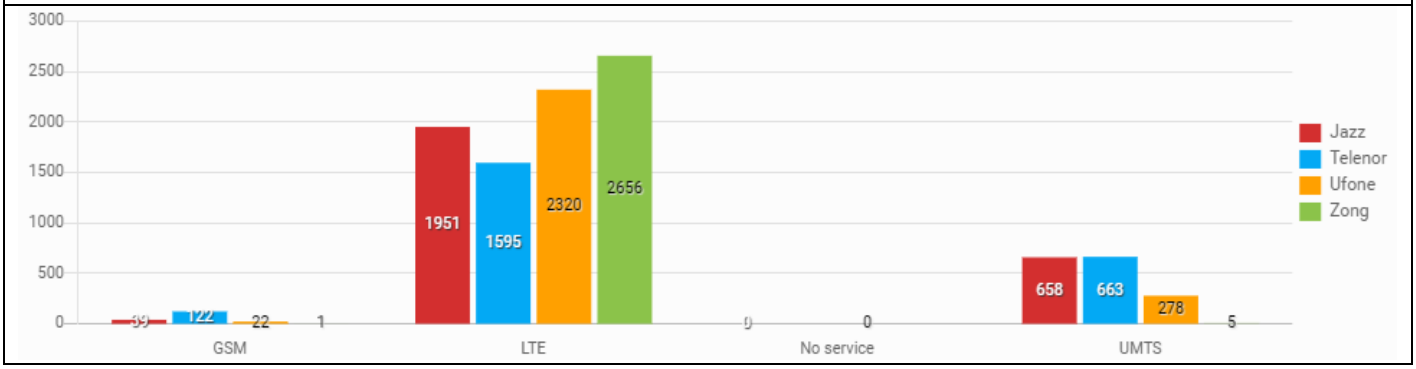
Table 6.1: SMS Statistics

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.

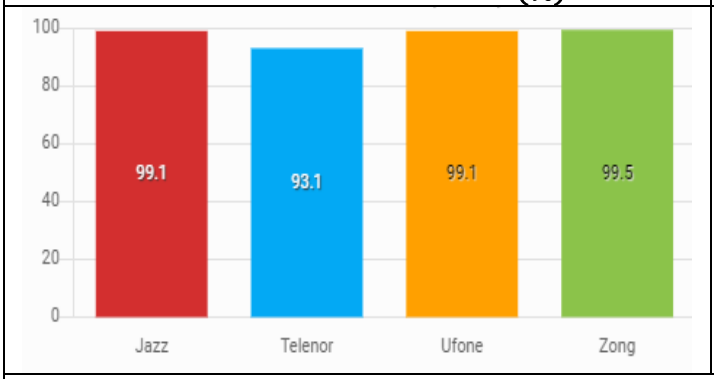
SMS SEND REQUEST BY TECHNOLOGY



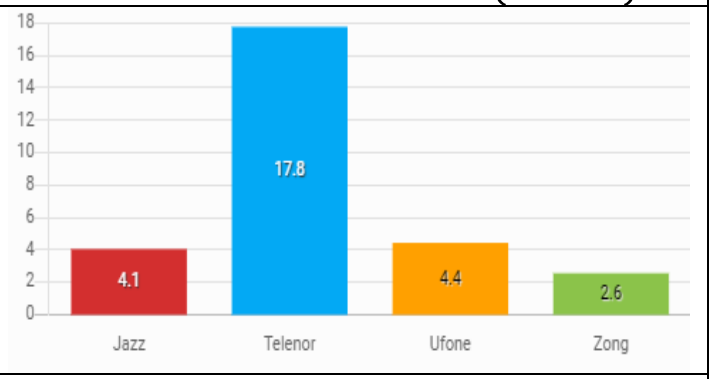
SMS SUCCESSFUL RECEPTION BY TECHNOLOGY



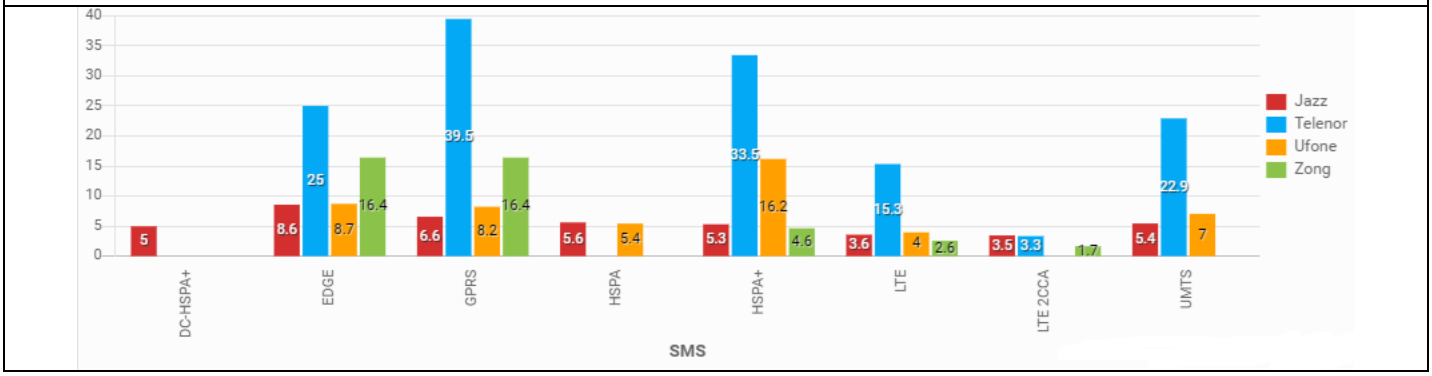
SMS RECEIVE SUCCESS RATE (%)



SMS END TO END DELIVERY TIME (SECONDS)



SMS DELIVERY DURATION BY TECHNOLOGY



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 1st, 2nd, 3rd & 4th 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 9 x surveyed cities of Punjab 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 and Locked Mode is shown in **Table 8.1: CMOs Standing in Mobile Network Coverage – Technology Auto Detect Mode** & **Table 8.2: CMOs Standing in Mobile Network Coverage – Technology Locked Mode**

S. #.	Operator	Compliance Level – Number of Cities Technology Auto Detect Mode						Standing
		Compliant			Non-Compliant			
		4G	3G	Total	4G	3G	Total	
1.	Jazz	9	5	14	-	-	-	1st
2.	ZonG	9	2	11	-	-	-	1st
3.	Ufone	7	6	13	1	-	1	2nd
4.	Telenor	5	4	9	4	-	4	3rd

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

S. #.	Operator	Compliance Level – Number of Cities Technology Locked Mode						Standing
		Compliant			Non-Compliant			
		4G	3G	Total	4G	3G	Total	
1.	Jazz	9	9	18	-	-	-	1st
2.	ZonG	9	9	18	-	-	-	1st
3.	Ufone	7	9	16	2	-	2	2nd
4.	Telenor	6	9	15	3	-	3	3rd

Table 8.2: CMOs Standing in Mobile Network Coverage – Technology Locked Mode

b. **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 8.3: CMOs Standing in User Download Data Throughput – Technology Auto Detect Mode** & Table **8.4: CMOs Standing in User Download Data Throughput – Technology Locked Mode.**

S. #.	Operator	Highest Download Throughput – Number of Cities Technology Auto Detect Mode								Standing	
		Fixed Duration				Fixed Size				Fixed Duration	Fixed Size
		1st	2nd	3rd	4th	1st	2nd	3rd	4th		
1.	ZonG	4	3	2	-	5	2	1	1	1st	1st
2.	Ufone	4	-	3	2	3	1	5	-	2nd	2nd
3.	Jazz	1	6	1	1	1	5	2	1	3rd	3rd
4.	Telenor	-	-	3	6	-	1	1	7	4th	4th

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

S. #.	Operator	Highest Download Throughput – Number of Cities								Standing	
		4G Locked Mode				3G Locked Mode					
		Fixed Duration				Fixed Duration				4G Fixed Duration	3G Fixed Duration
		1st	2nd	3rd	4th	1st	2nd	3rd	4th		
1.	ZonG	4	3	2	-	-	-	3	6	1st	4th
2.	Ufone	3	2	2	2	7	2	-	-	2nd	1st
3.	Jazz	2	2	2	3	1	1	5	2	3rd	3rd
4.	Telenor	-	2	3	4	1	6	1	1	4th	2nd

Table 8.4: CMOs Standing in User Download Data Throughput – Technology Locked 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 8.5: CMOs Standing in User Upload Data Throughput – Technology Auto Detect Mode** & Table **8.6: CMOs Standing in User Upload Data Throughput – Technology Locked Mode.**

S. #.	Operator	Highest Upload Throughput – Number of Cities								Standing	
		Technology Auto Detect Mode									
		Fixed Duration				Fixed Size				Fixed Duration	Fixed Size
		1st	2nd	3rd	4th	1st	2nd	3rd	4th		
1.	ZonG	5	2	2	-	1	5	3	-	1st	3rd
2.	Ufone	3	3	2	1	5	2	1	1	2nd	1st
3.	Jazz	1	4	4	-	3	2	3	1	3rd	2nd
4.	Telenor	-	-	1	8	-	-	2	7	4th	4th

Table 8.5: CMOs Standing in User Upload Data Throughput – Technology Auto Detect Mode

S. #.	Operator	Highest Upload Throughput – Number of Cities								Standing	
		4G Locked Mode				3G Locked Mode					
		Fixed Duration				Fixed Duration				4G Fixed Duration	3G Fixed Duration
		1st	2nd	3rd	4th	1st	2nd	3rd	4th		
1.	Ufone	4	2	1	1	8	-	-	-	1st	1st
2.	ZonG	3	4	1	-	-	3	2	2	2nd	3rd
3.	Jazz	1	2	5	-	-	2	1	5	3rd	4th
4.	Telenor	-	-	1	7	-	3	4	-	4th	2nd

Table 8.6: CMOs Standing in User Upload Data Throughput – Technology Locked 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 8.7: CMOs Standing in Webpage Loading Time.**

S. #.	Operator	Webpage Loading Time - Number of Cities		Standing
		Compliant	Non-Compliant	
1.	Jazz	1	8	2nd
2.	Telenor	-	9	-
3.	Ufone	3	6	1st
4.	ZonG	3	6	1st

Table 8.7: 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 8.8: CMOs Standing in Latency.**

S. #.	Operator	Latency - Number of Cities								Standing
		Compliant				Non-Compliant				
		Auto	4G	3G	Total	Auto	4G	3G	Total	
1.	ZonG	-	2	3	5	9	6	6	21	1st
2.	Ufone	-	4	-	4	9	4	9	22	2nd
3.	Jazz	-	2	-	2	9	6	9	25	3rd
4.	Telenor	-	2	-	2	9	6	9	25	3rd

Table 8.8: CMOs Standing in Latency

c. **VOICE SERVICE.** The categorization of each CMOs, as per the maximum compliant of Voice QoS KPIs is shown in **Table 8.8: CMOs Standing in Voice Service.**

S. #.	Operator	Voice QoS KPIs		Standing
		Compliant	Non-Compliant	
1.	ZonG	51	3	1st
2.	Ufone	54	8	2nd
3.	Jazz	40	8	3rd
4.	Telenor	43	12	4th

Table 8.8: CMOs Standing in Voice Service

d. **OVERALL STANDING.** The overall standing of each CMOs in different category of services is mentioned in **Table 8.9: CMOs Overall Standing in QoS Survey.**

S. #.	Service				STANDING			
					1st	2nd	3rd	4th
1.	Mobile Network Coverage			Auto Mode	Jazz & ZonG	Ufone	Telenor	-
				Locked Mode	Jazz & ZonG	Ufone	Telenor	-
2.	Mobile Broadband	Fixed Duration	Download	Auto Mode	ZonG	Ufone	Jazz	Telenor
				4G	ZonG	Ufone	Jazz	Telenor
				3G	Ufone	Telenor	Jazz	ZonG
			Upload	Auto Mode	ZonG	Ufone	Jazz	Telenor
				4G	Ufone	ZonG	Jazz	Telenor
				3G	Ufone	Telenor	ZonG	Jazz
		Fixed Size	Download	Auto Mode	ZonG	Ufone	Jazz	Telenor
			Upload	Auto Mode	Ufone	Jazz	ZonG	Telenor
		Webpage Loading Time			Ufone & ZonG	Jazz	-	-
		Latency			ZonG	Ufone	Jazz & Telenor	-
3.	Voice				ZonG	Ufone	Jazz	Telenor

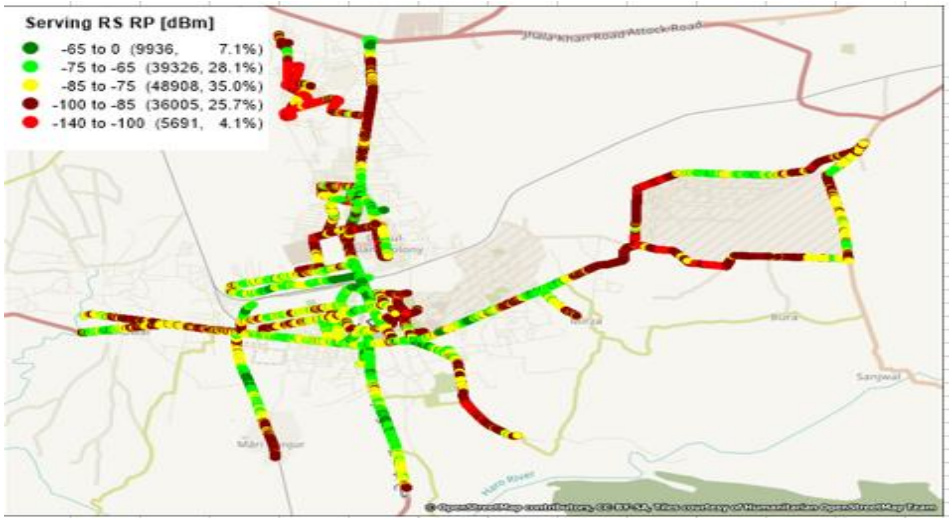
Table 8.9: CMOs Overall Standing in QoS Survey

Annex-A (Coverage Maps)

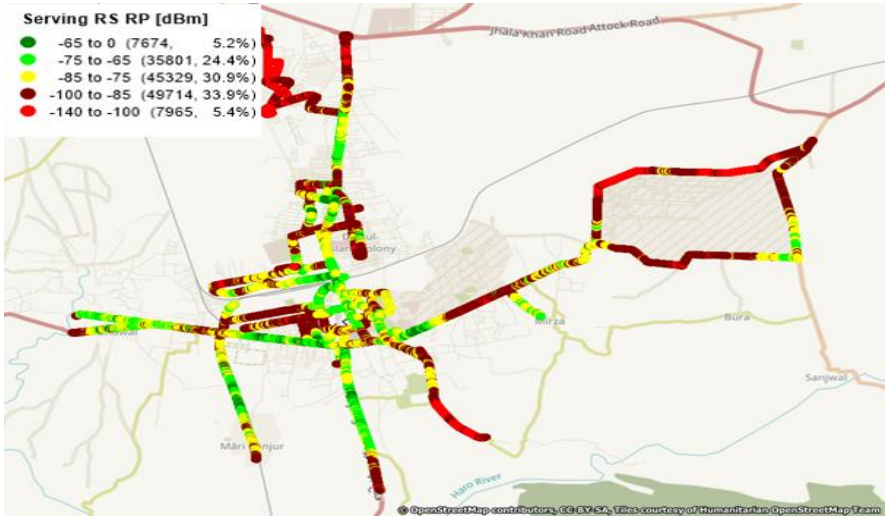
COVERAGE MAPS (AUTOMODE)

AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

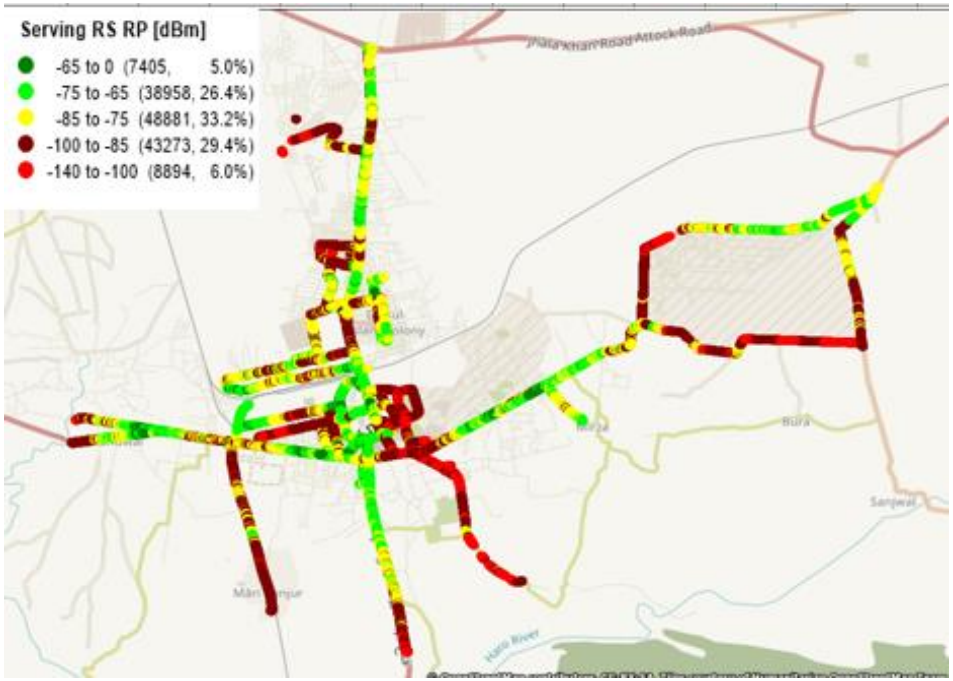
JAZZ AUTOMODE 4G NETWORK COVERAGE – ATTOCK



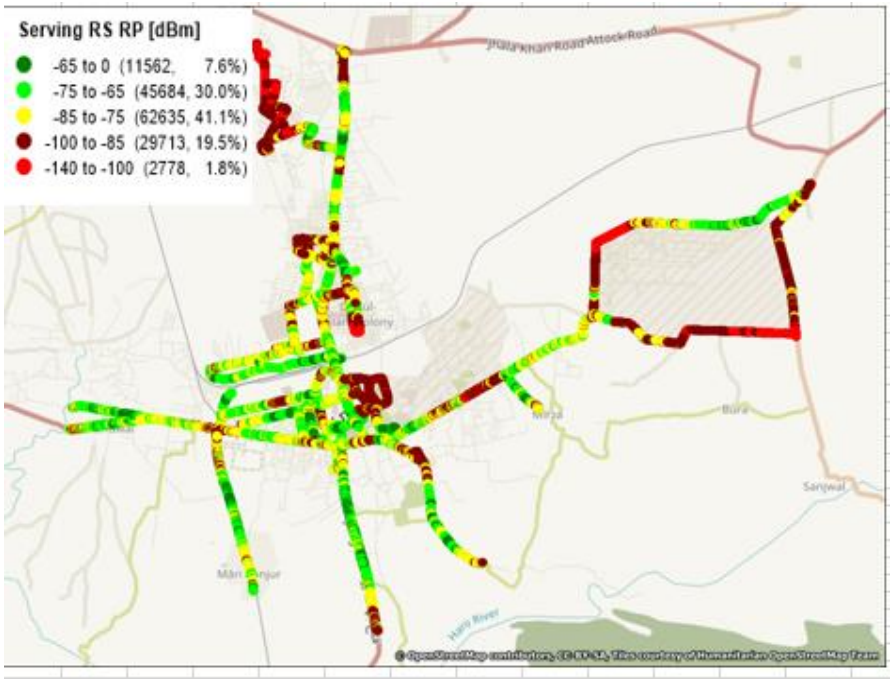
TELENOR AUTOMODE 4G NETWORK COVERAGE – ATTOCK



UFONE AUTOMODE 4G NETWORK COVERAGE – ATTOCK

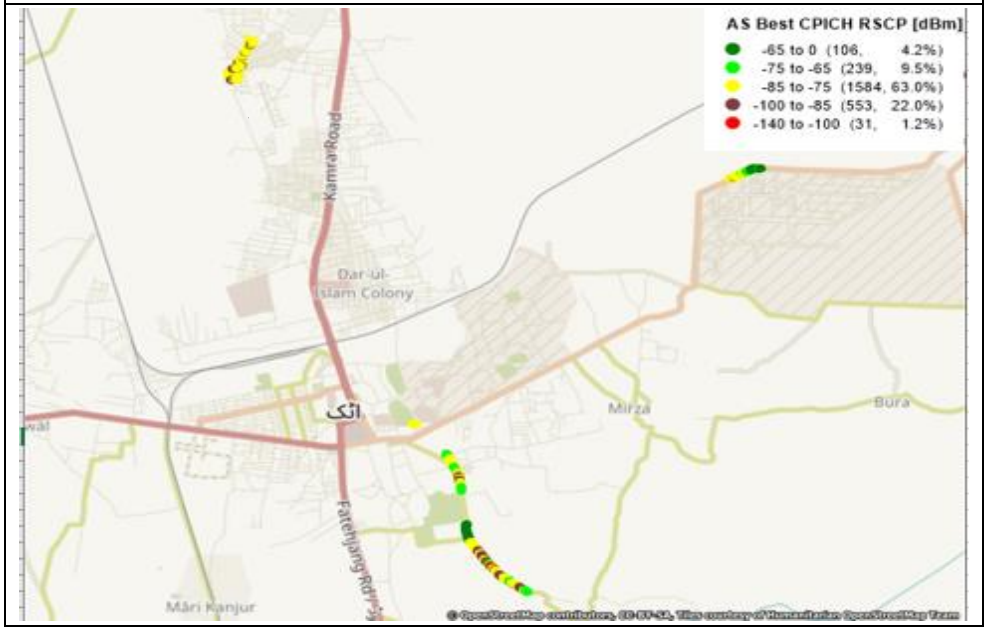


ZONG AUTOMODE 4G NETWORK COVERAGE – ATTOCK



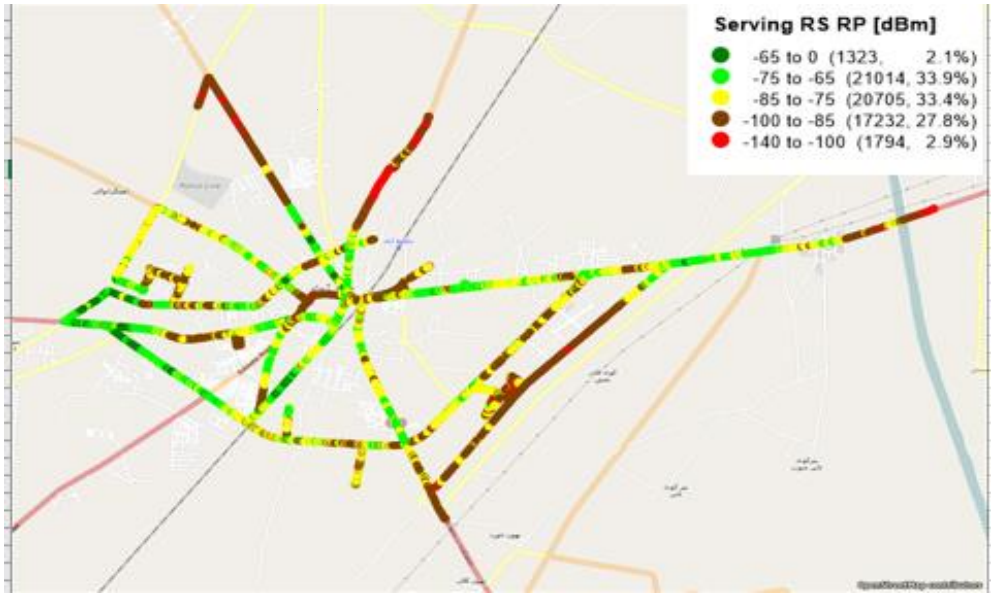
AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

UFONE AUTOMODE 3G NETWORK COVERAGE – ATTOCK

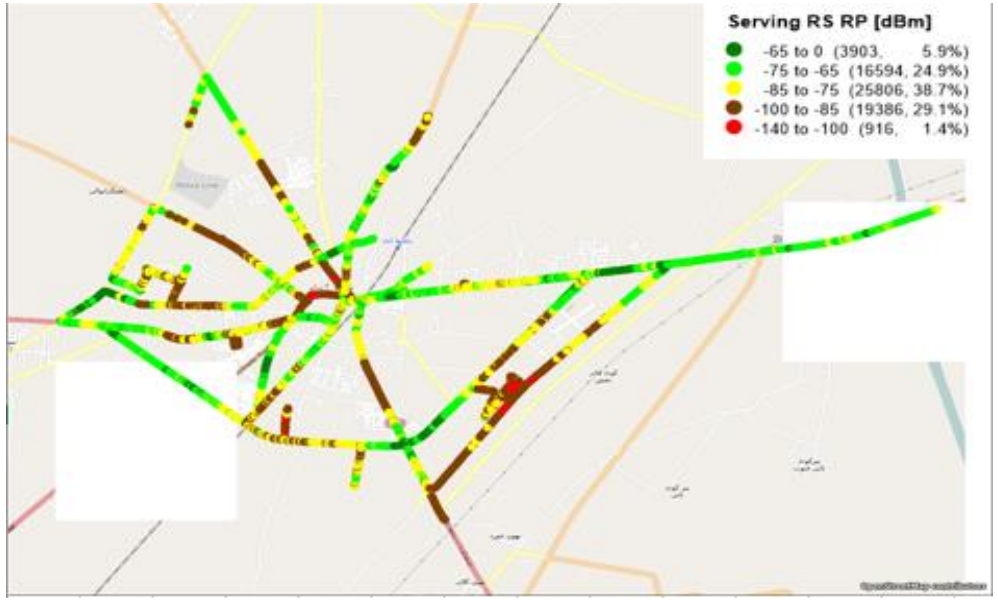


AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

JAZZ AUTOMODE 4G NETWORK COVERAGE – HAFIZABAD



TELENOR AUTOMODE 4G NETWORK COVERAGE – HAFIZABAD

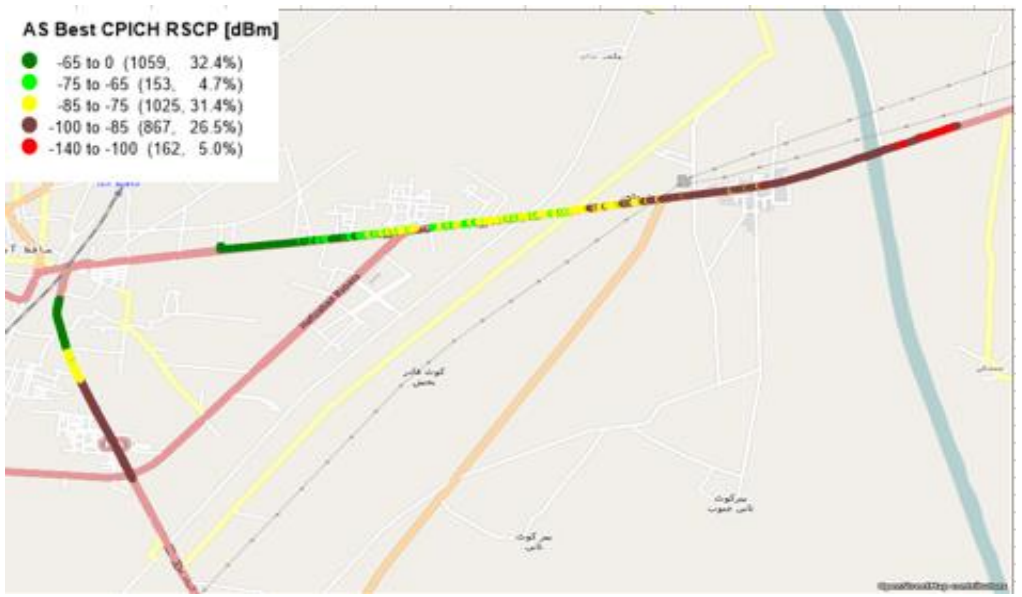


UFONE AUTOMODE 4G NETWORK COVERAGE – HAFIZABAD

ZONG AUTOMODE 4G NETWORK COVERAGE – HAFIZABAD

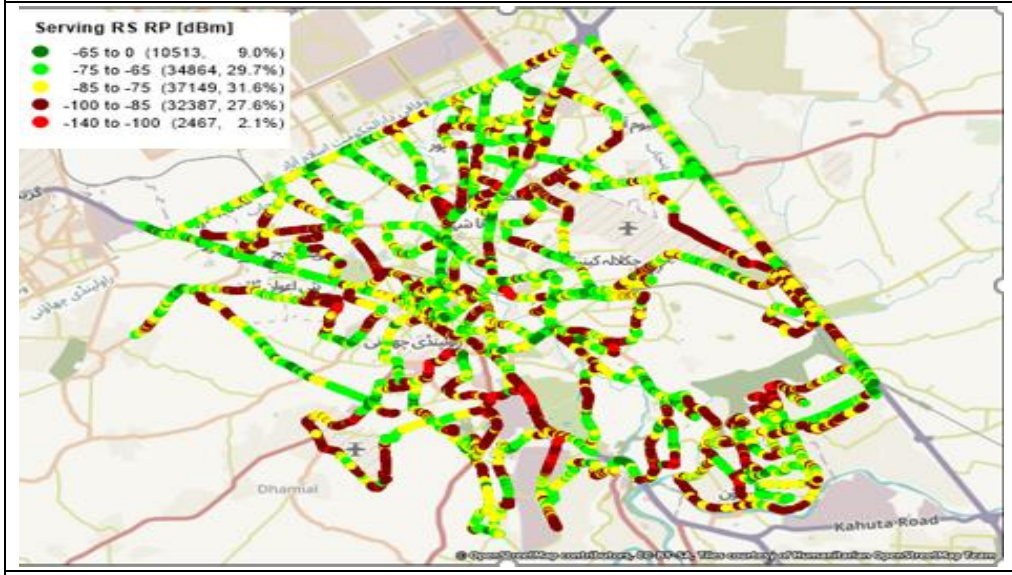
AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

UFONE AUTOMODE 3G NETWORK COVERAGE – HAFIZABAD

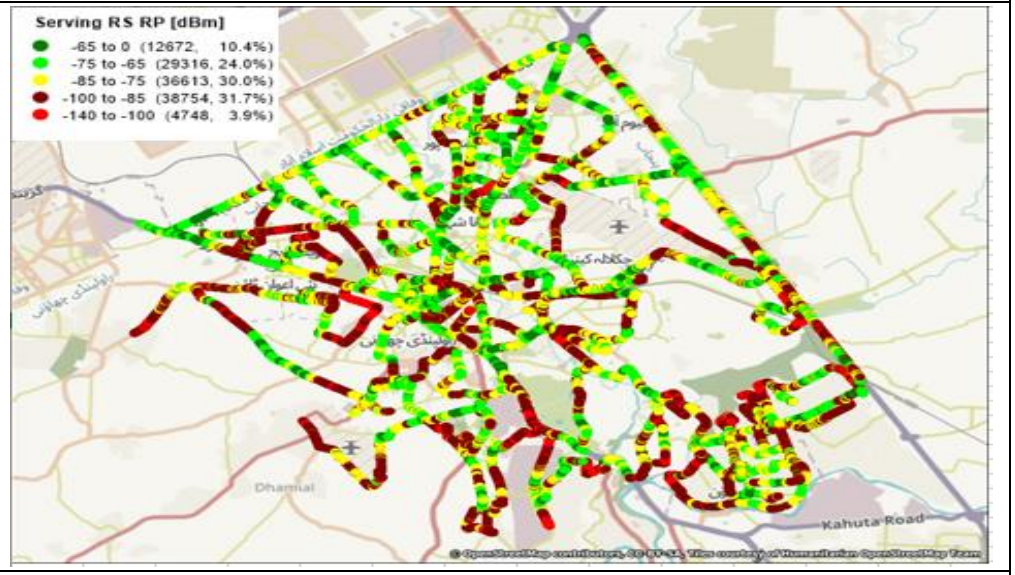


AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

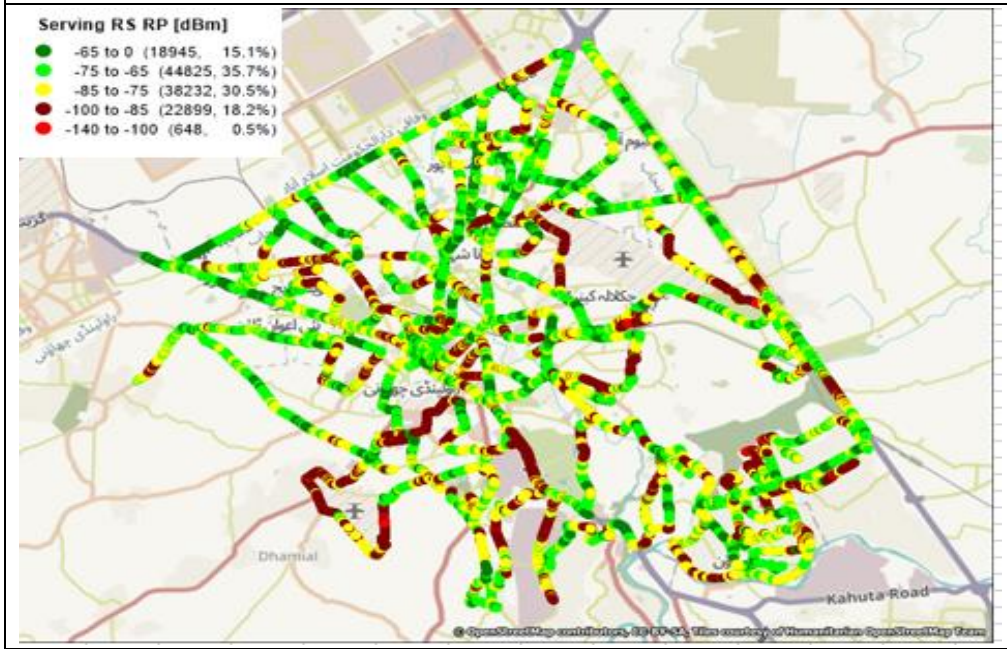
JAZZ AUTOMODE 4G NETWORK COVERAGE – RAWALPINDI



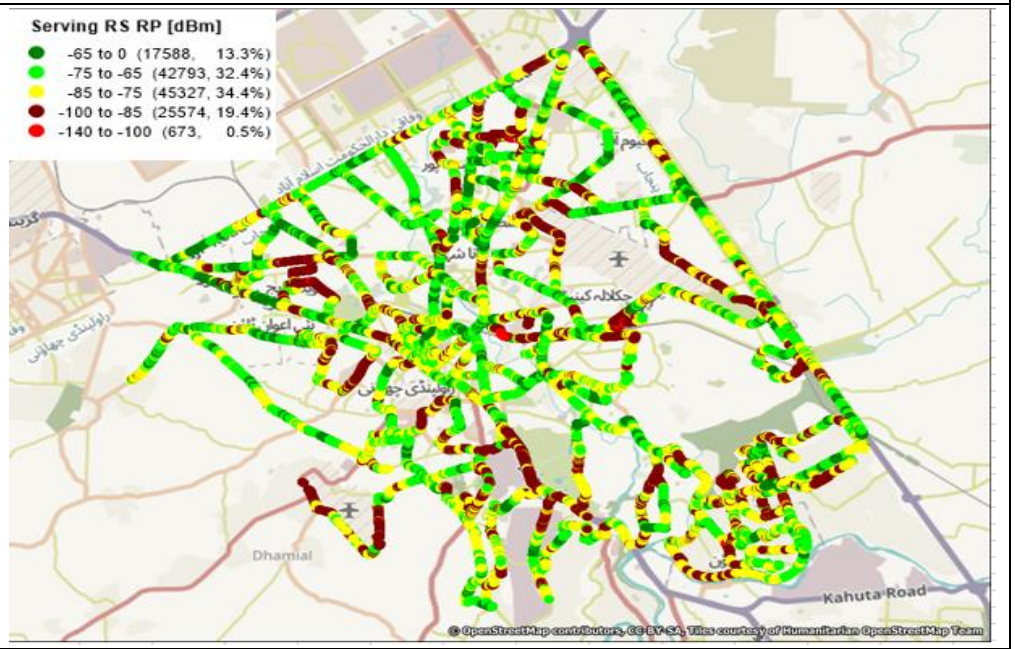
TELENOR AUTOMODE 4G NETWORK COVERAGE – RAWALPINDI



UFONE AUTOMODE 4G NETWORK COVERAGE – RAWALPINDI

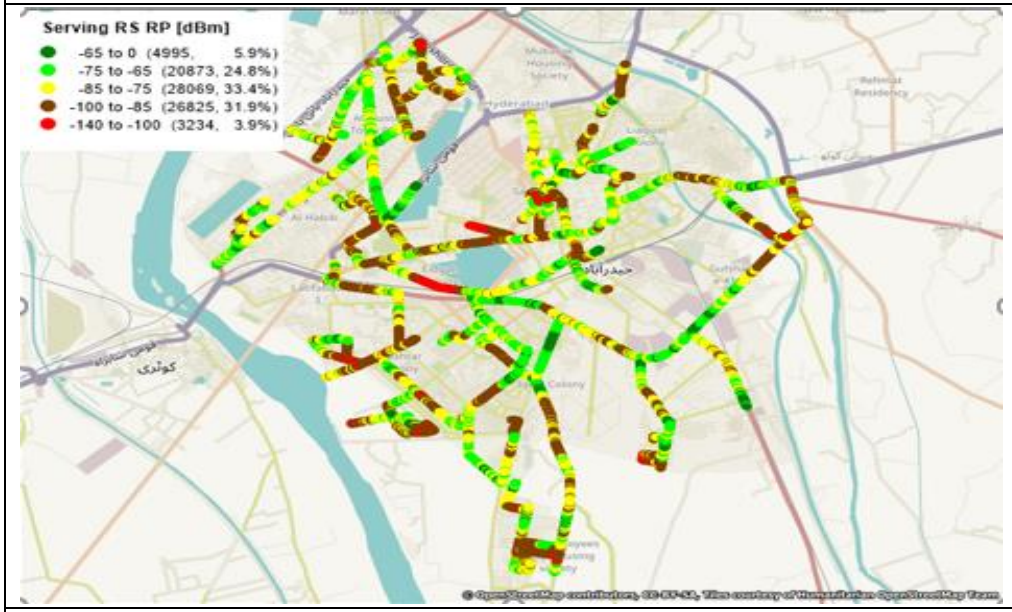


ZONG AUTOMODE 4G NETWORK COVERAGE – RAWALPINDI

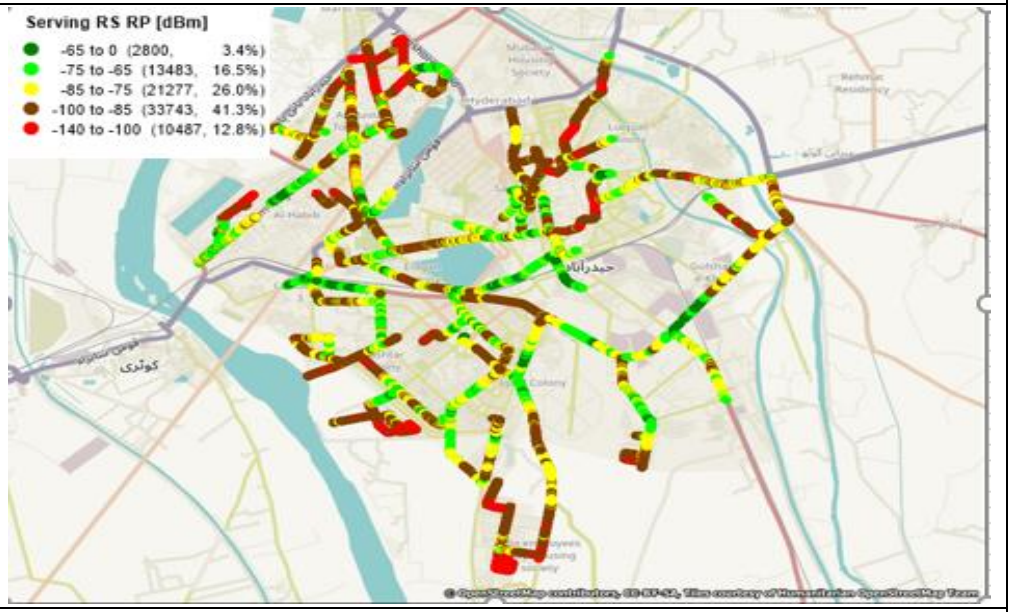


AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

JAZZ AUTOMODE 4G NETWORK COVERAGE – HYDERABAD



TELENOR AUTOMODE 4G NETWORK COVERAGE – HYDERABAD



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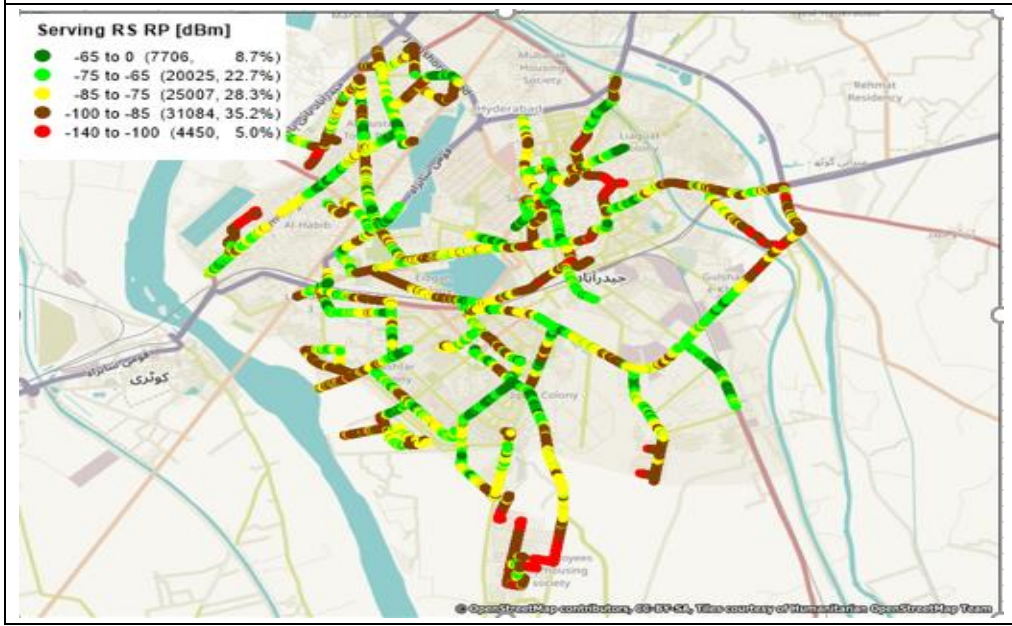

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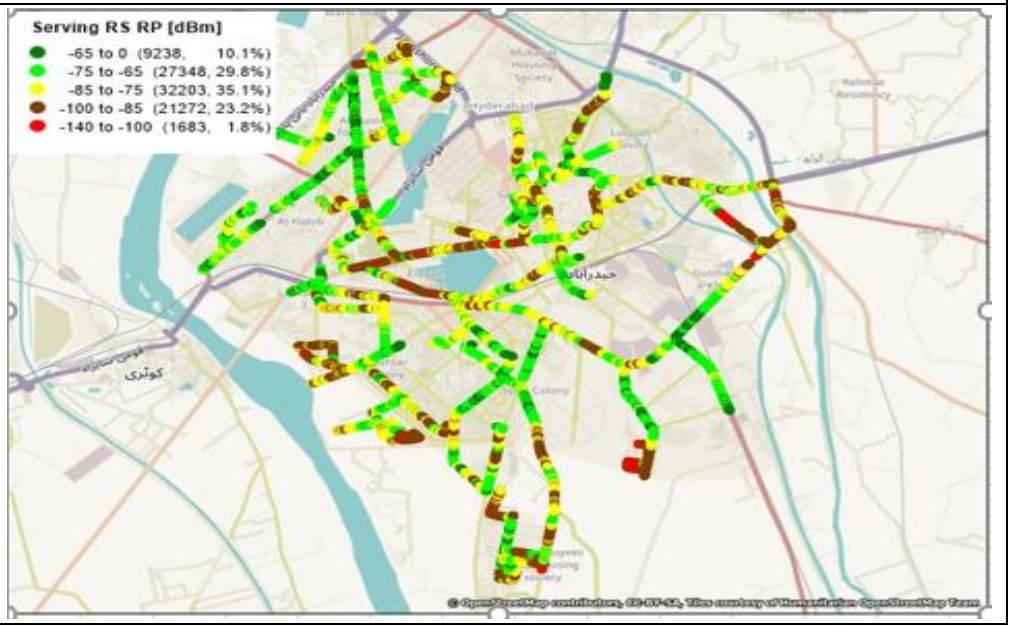
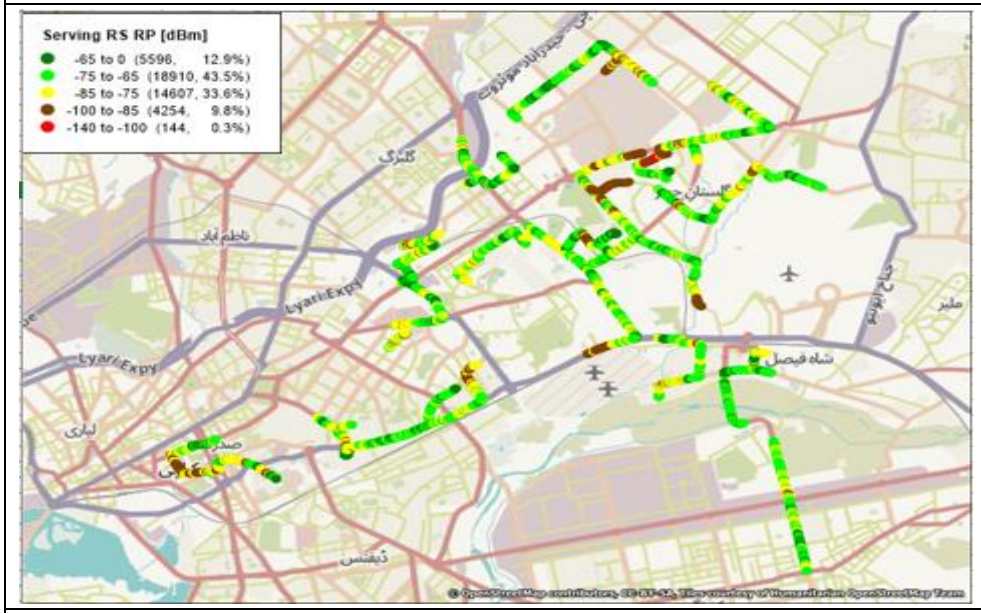


AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

JAZZ AUTOMODE 4G NETWORK COVERAGE – KARACHI EAST



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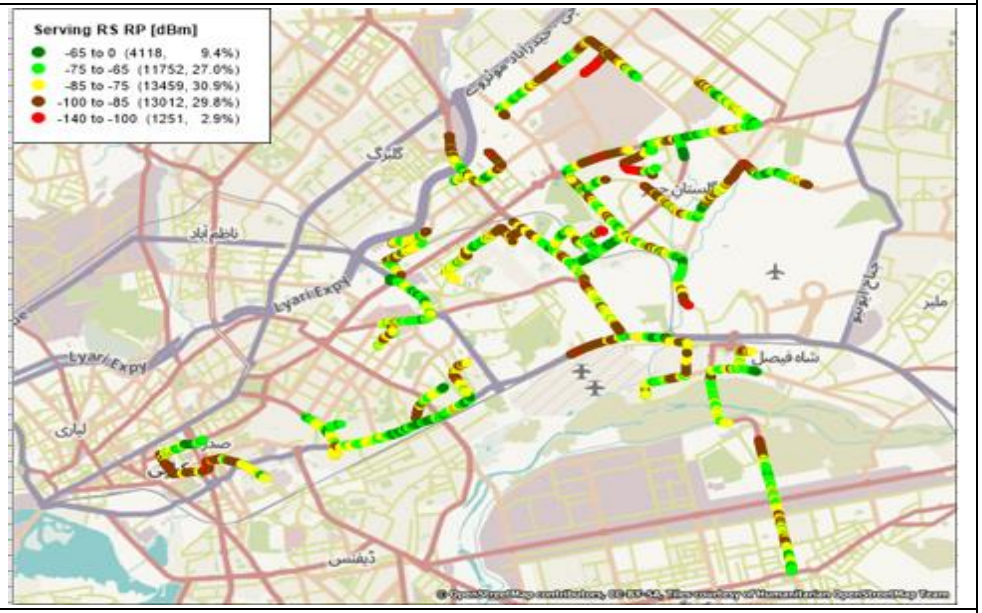

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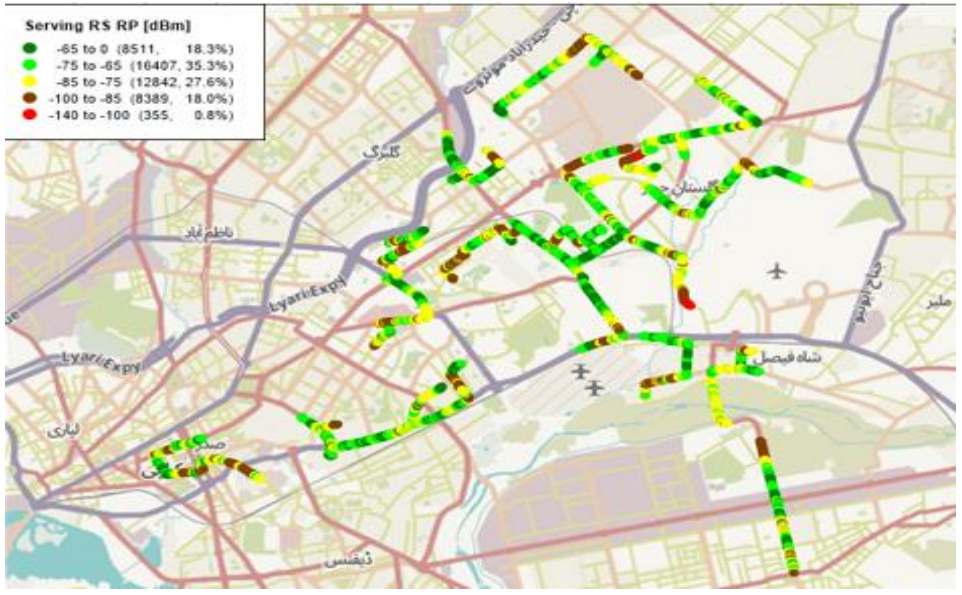

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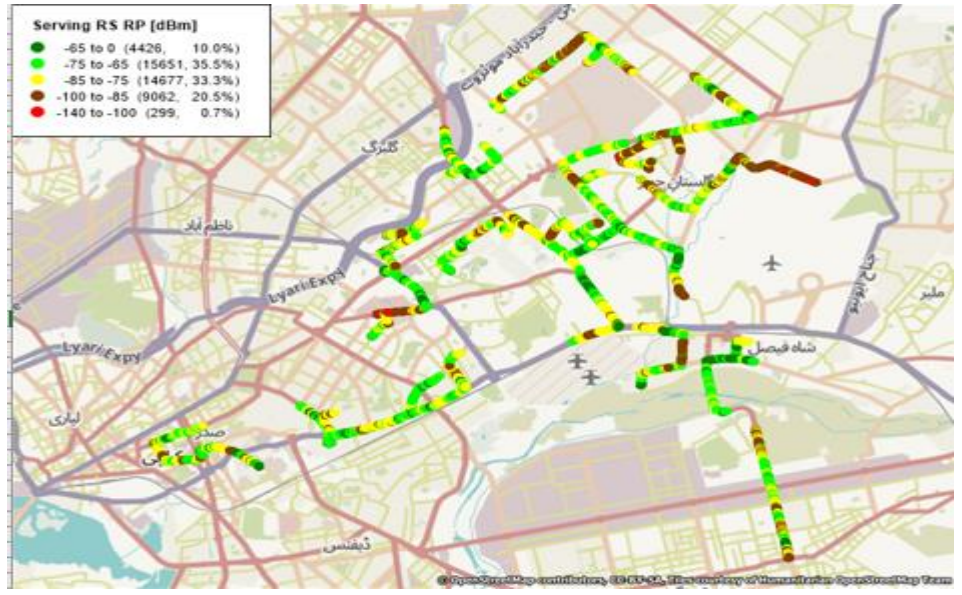
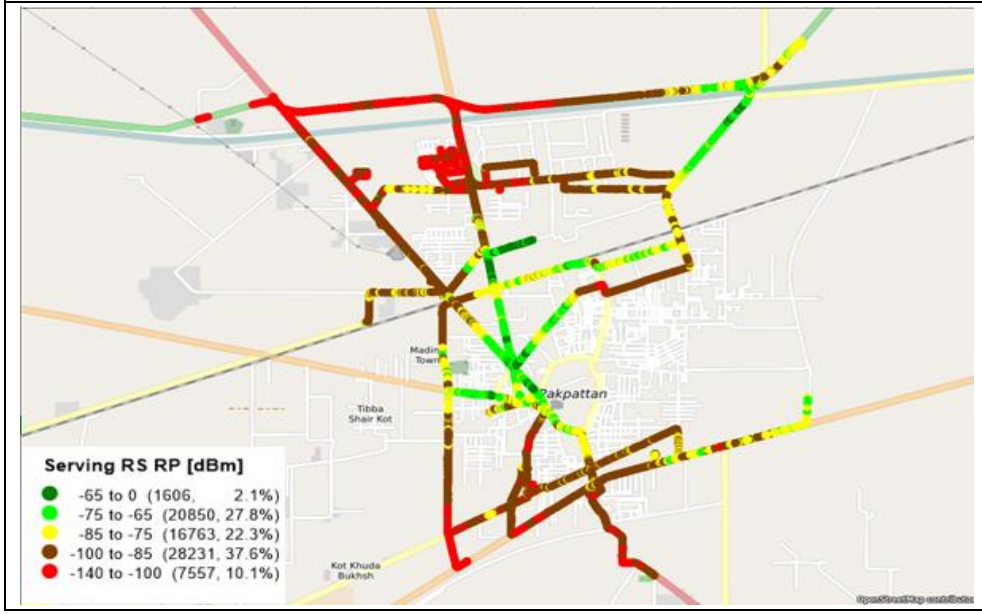


AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

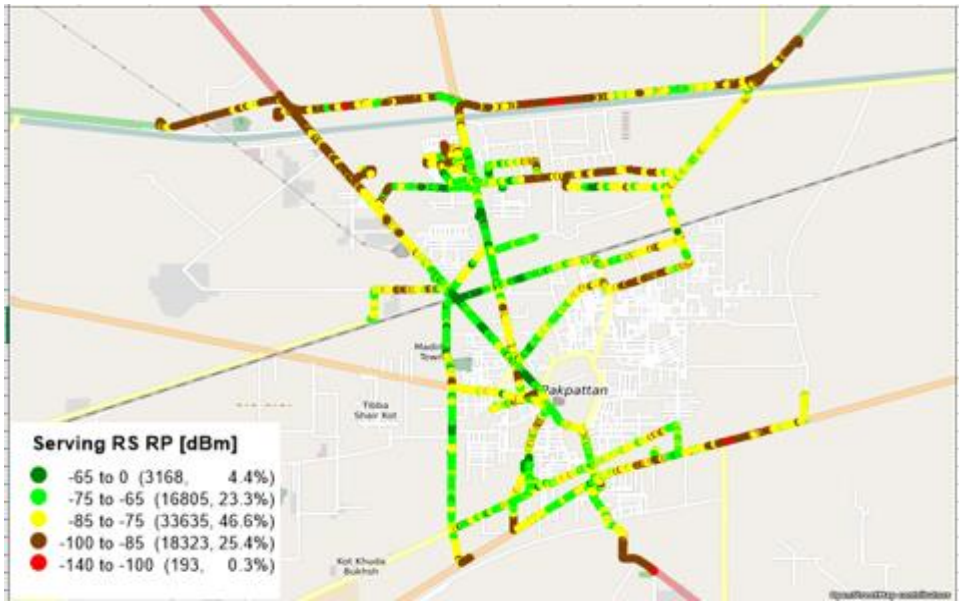
JAZZ AUTOMODE 4G NETWORK COVERAGE – PAKPATTAN

TELENOR AUTOMODE 4G NETWORK COVERAGE – PAKPATTAN

UFONE AUTOMODE 4G NETWORK COVERAGE – PAKPATTAN



ZONG AUTOMODE 4G NETWORK COVERAGE – PAKPATTAN

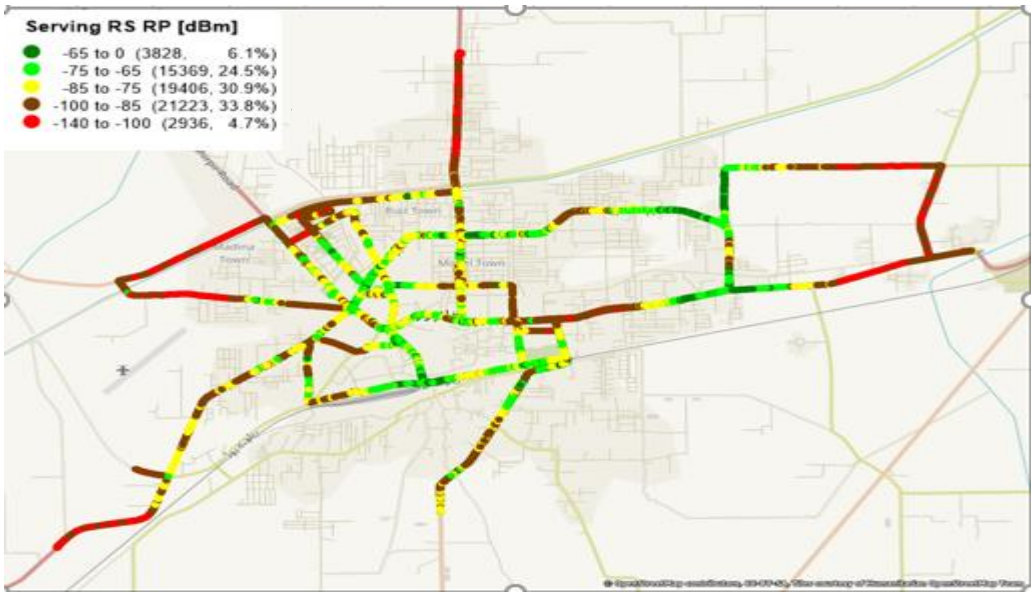


AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

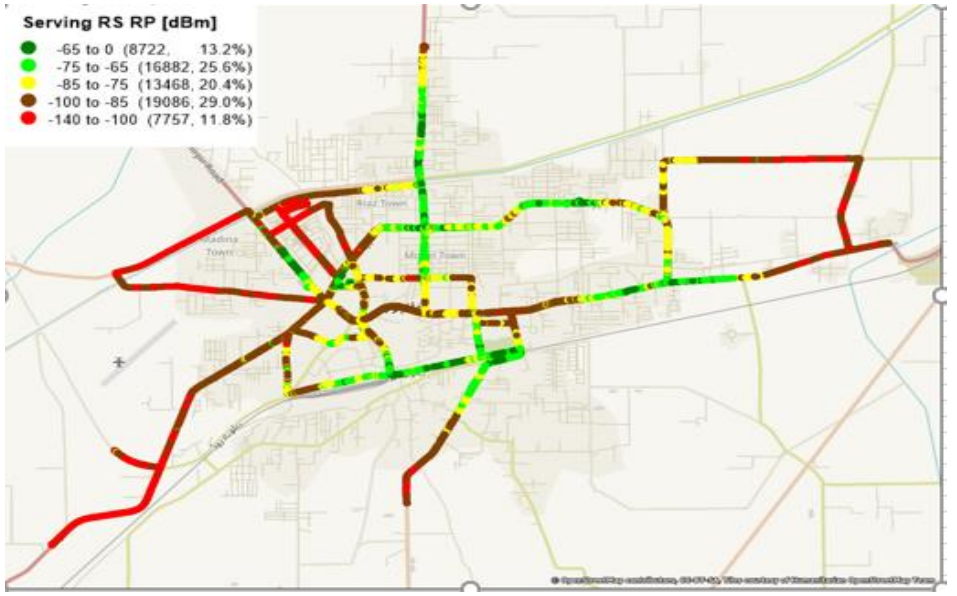
UFONE AUTOMODE 3G NETWORK COVERAGE – PAKPATTAN

AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

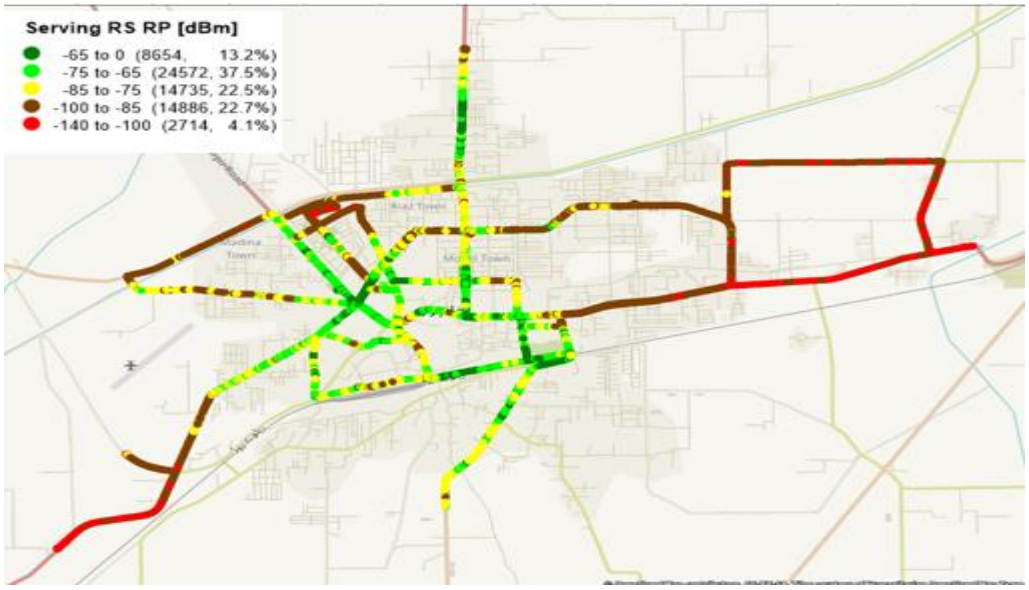
JAZZ AUTOMODE 4G NETWORK COVERAGE – KHANPUR



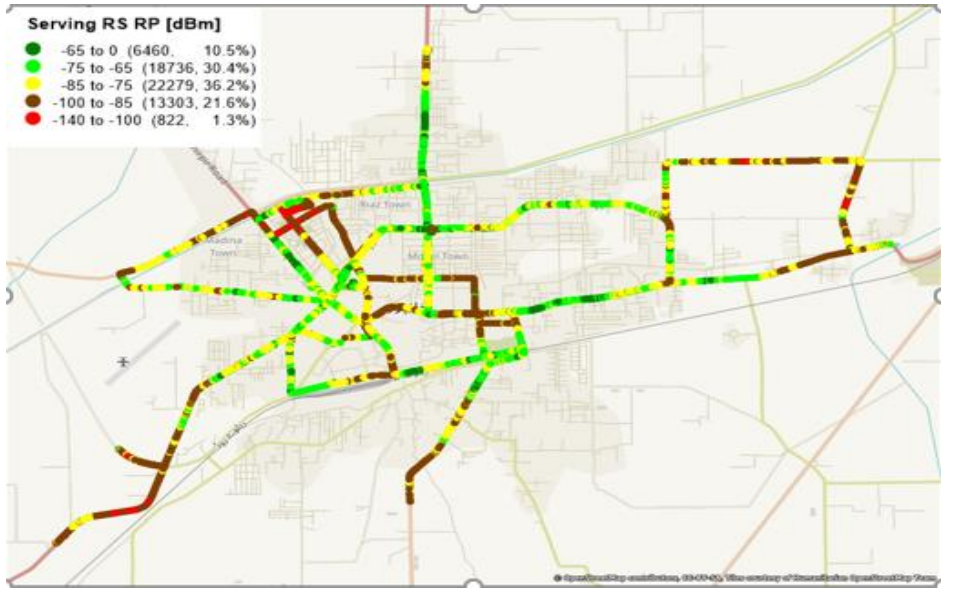
TELENOR AUTOMODE 4G NETWORK COVERAGE – KHANPUR



UFONE AUTOMODE 4G NETWORK COVERAGE – KHANPUR

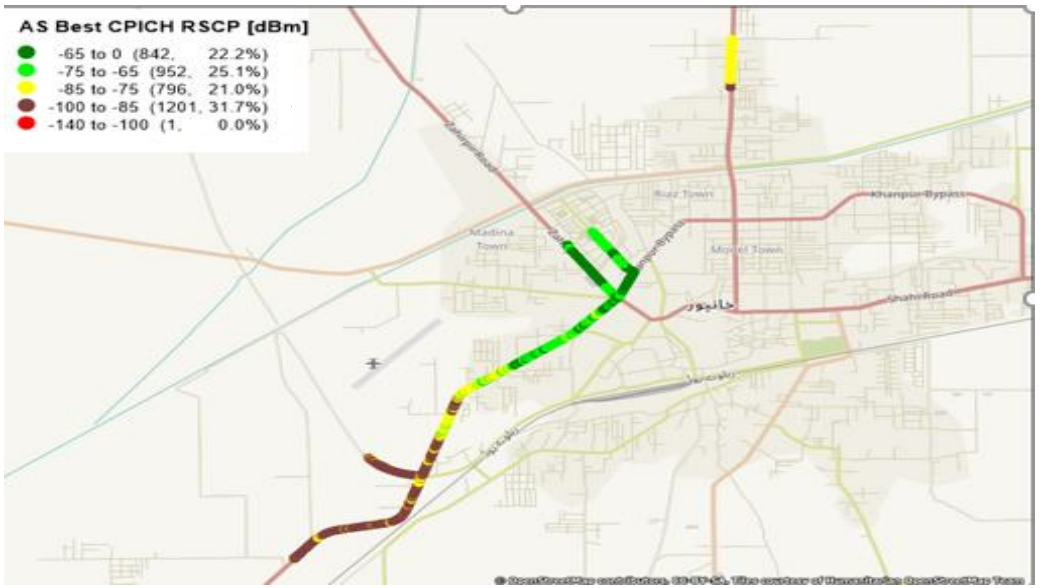


ZONG AUTOMODE 4G NETWORK COVERAGE – KHANPUR



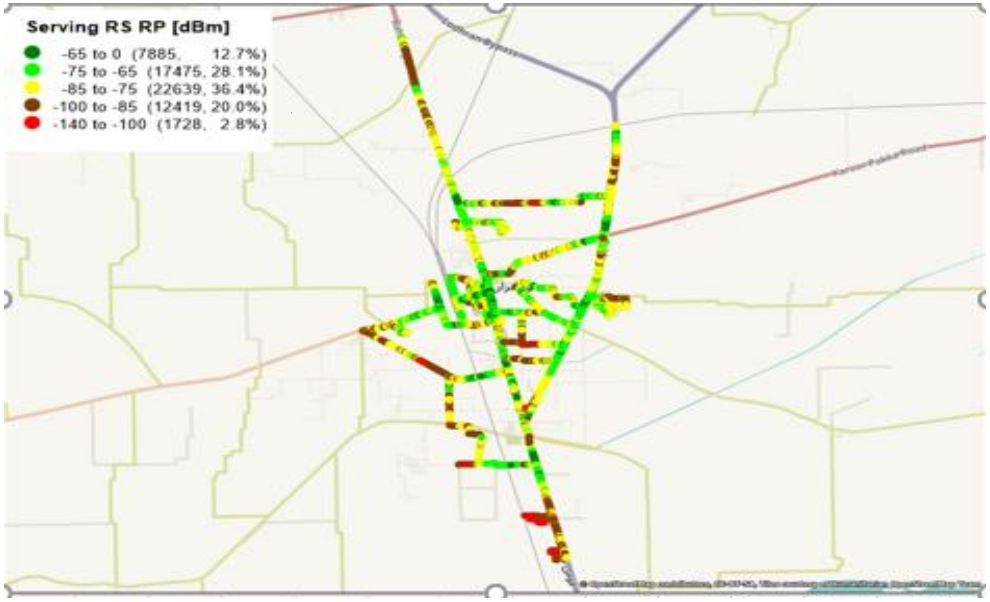
AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

TELENOR AUTOMODE 4G NETWORK COVERAGE – KHANPUR

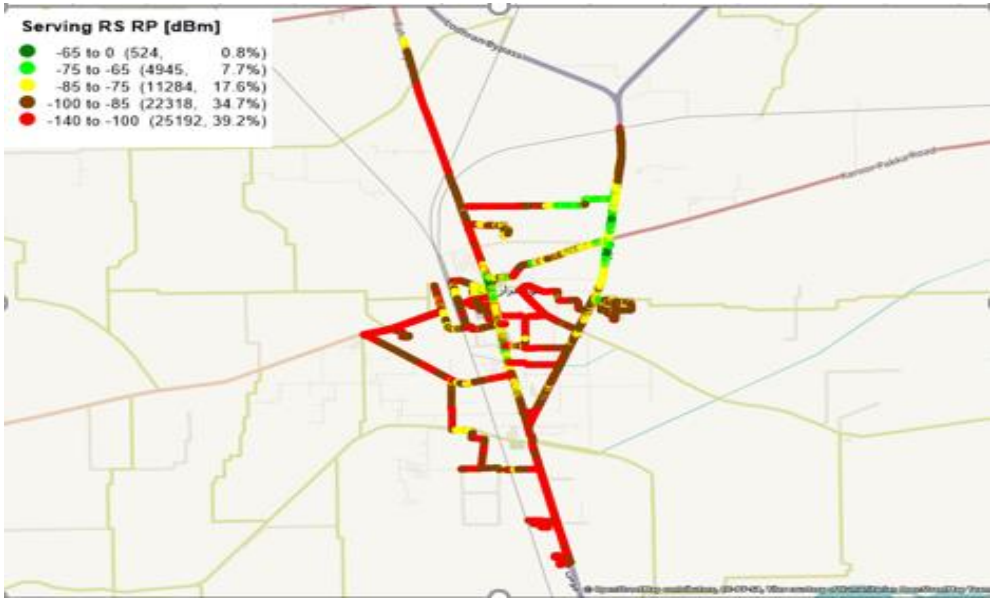


AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

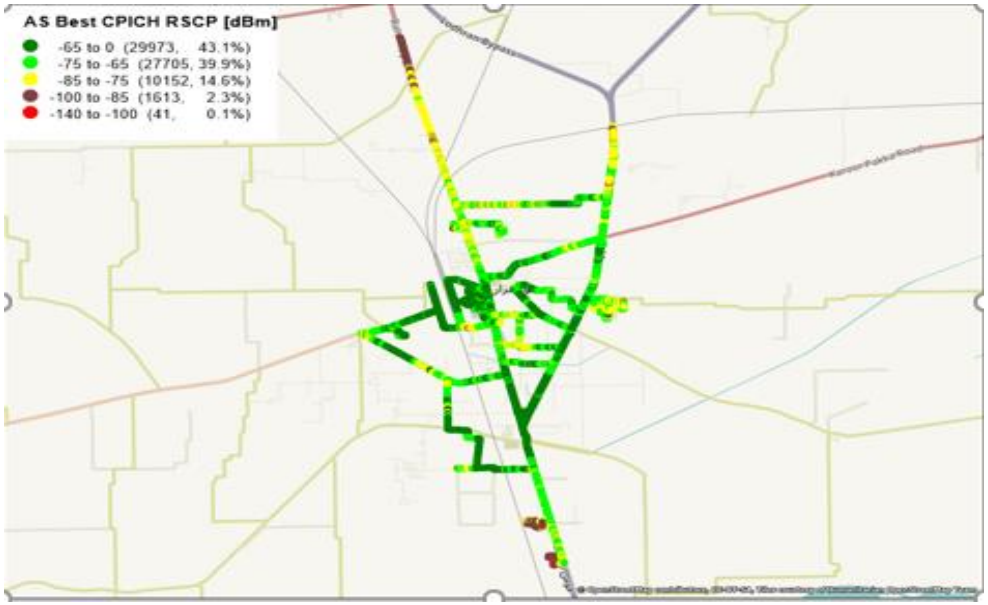
JAZZ AUTOMODE 4G NETWORK COVERAGE – LODHRAN



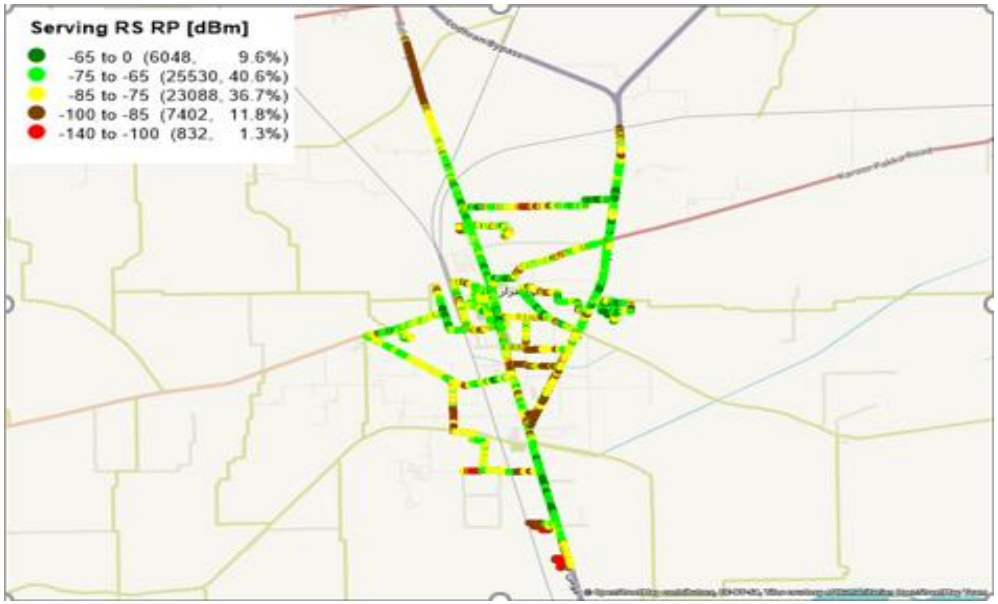
TELENOR AUTOMODE 4G NETWORK COVERAGE – LODHRAN



UFONE AUTOMODE 3G NETWORK COVERAGE – LODHRAN

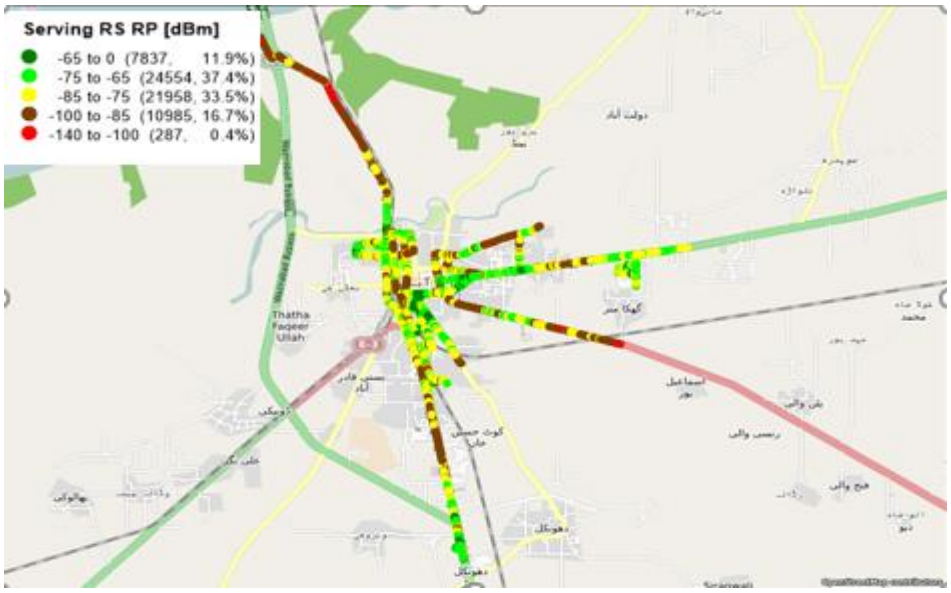


ZONG AUTOMODE 4G NETWORK COVERAGE – LODHRAN

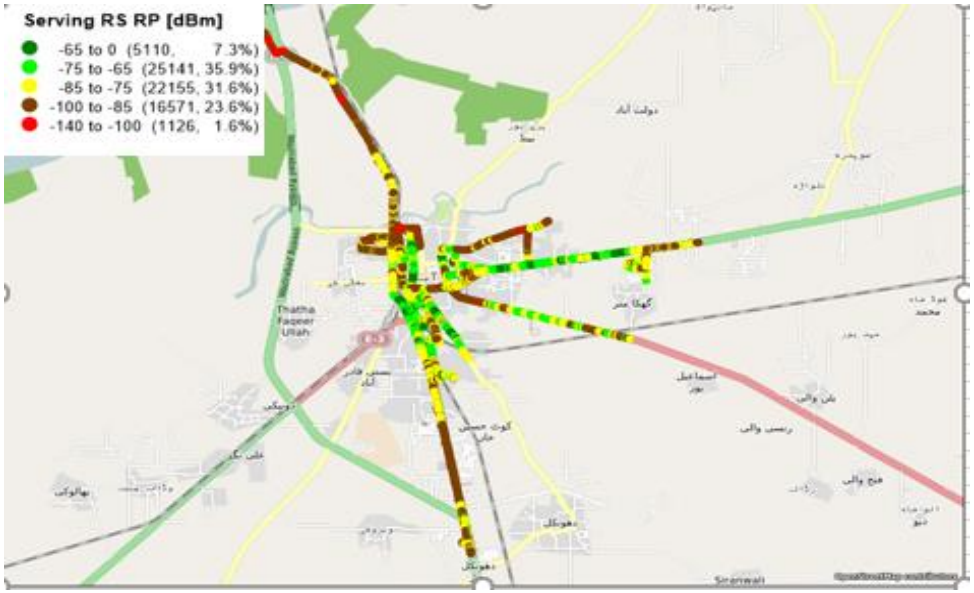


AUTOMODE MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

JAZZ AUTOMODE 4G NETWORK COVERAGE – WAZIRABAD



TELENOR AUTOMODE 4G NETWORK COVERAGE – WAZIRABAD



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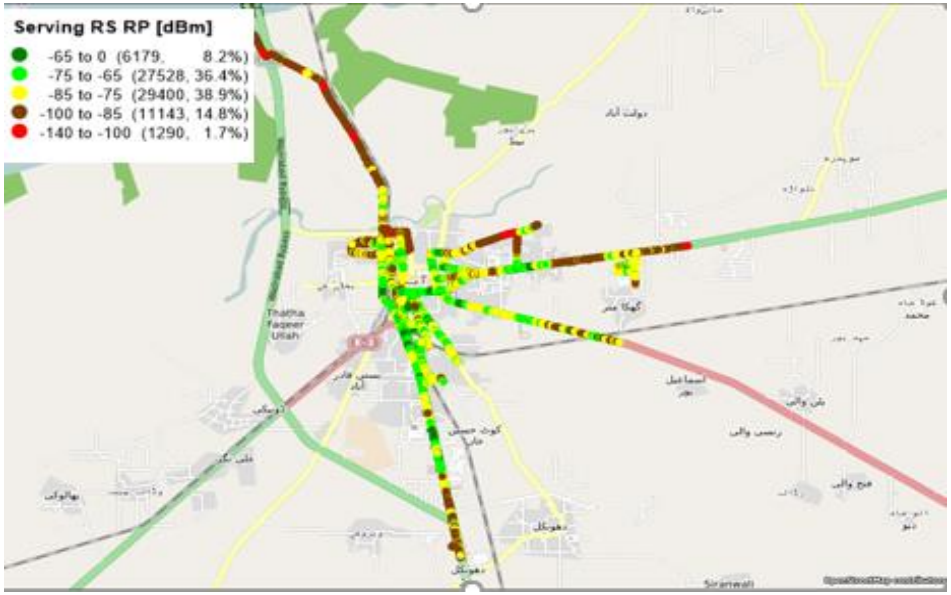
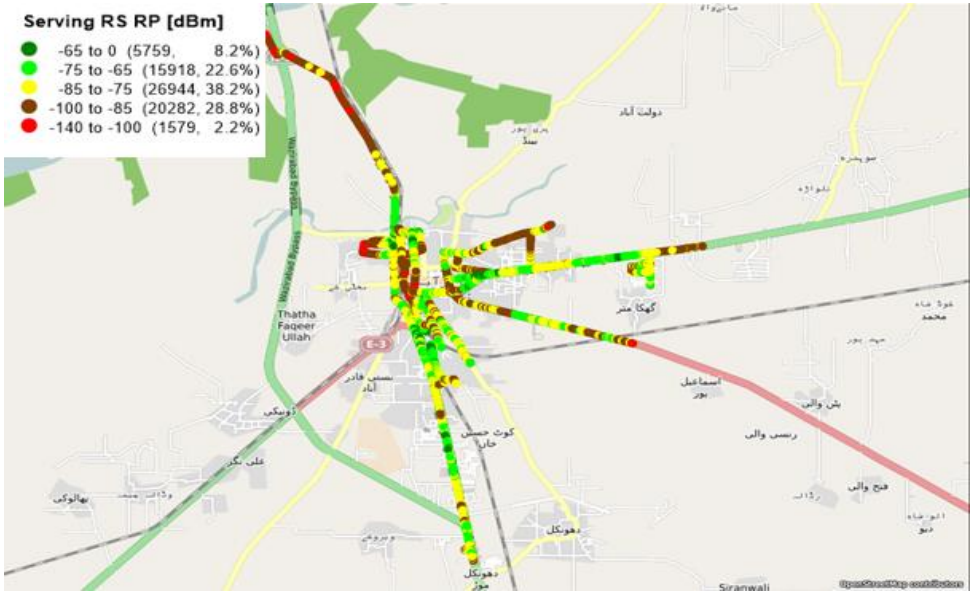
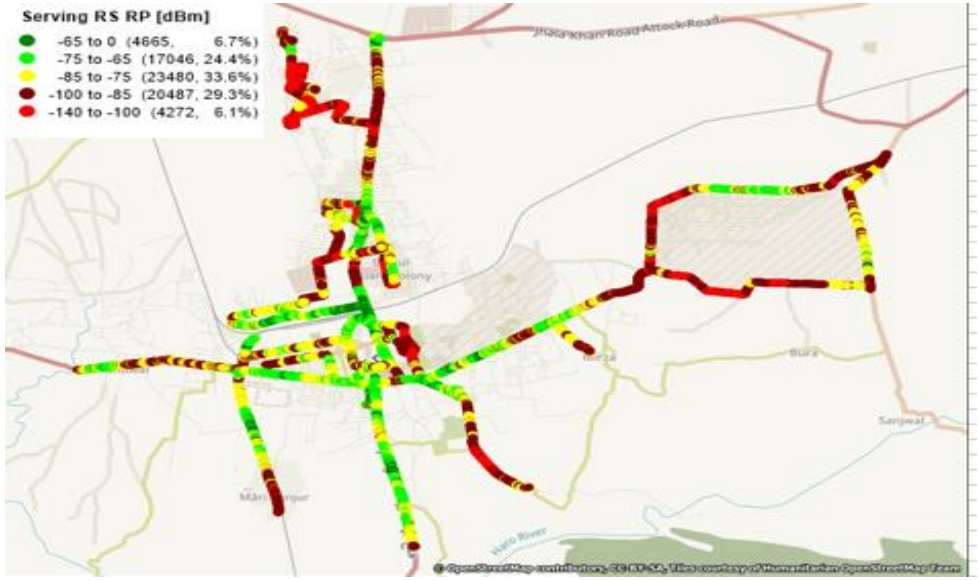
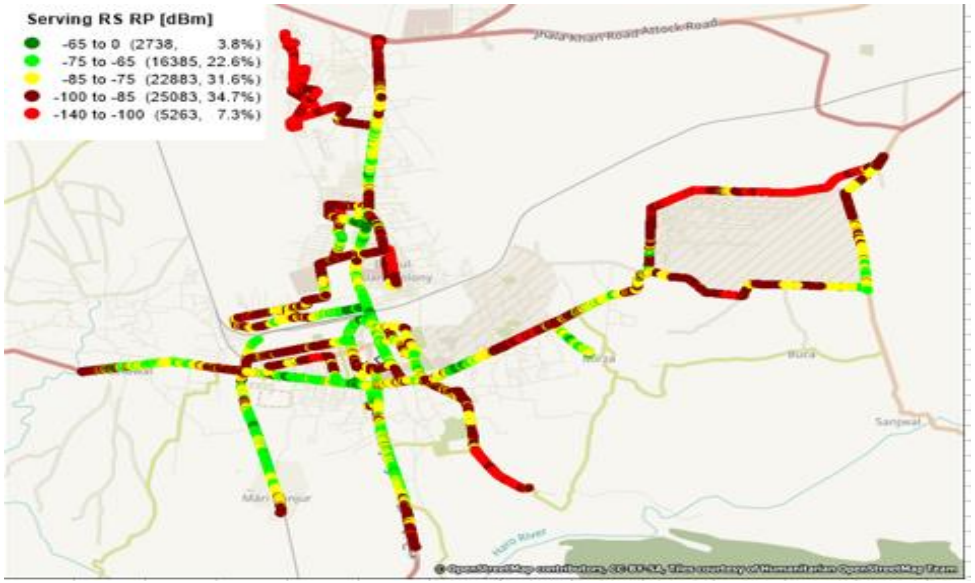
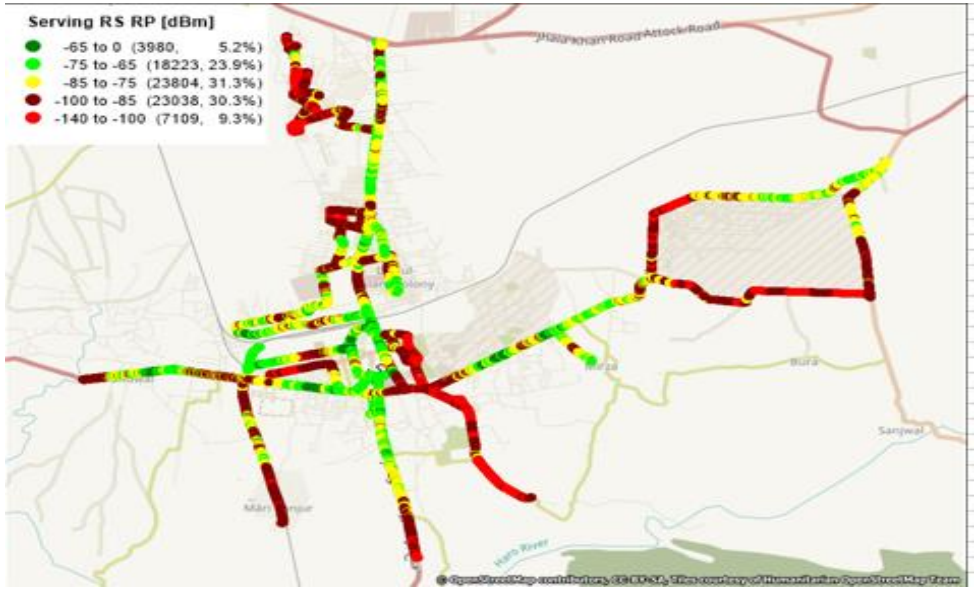
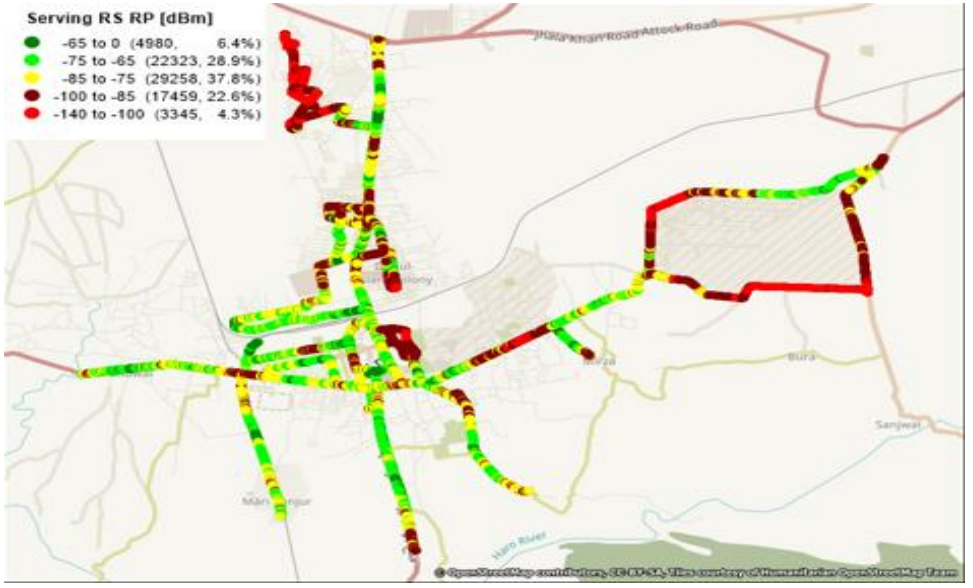


ZONG AUTOMODE 4G NETWORK COVERAGE – WAZIRABAD



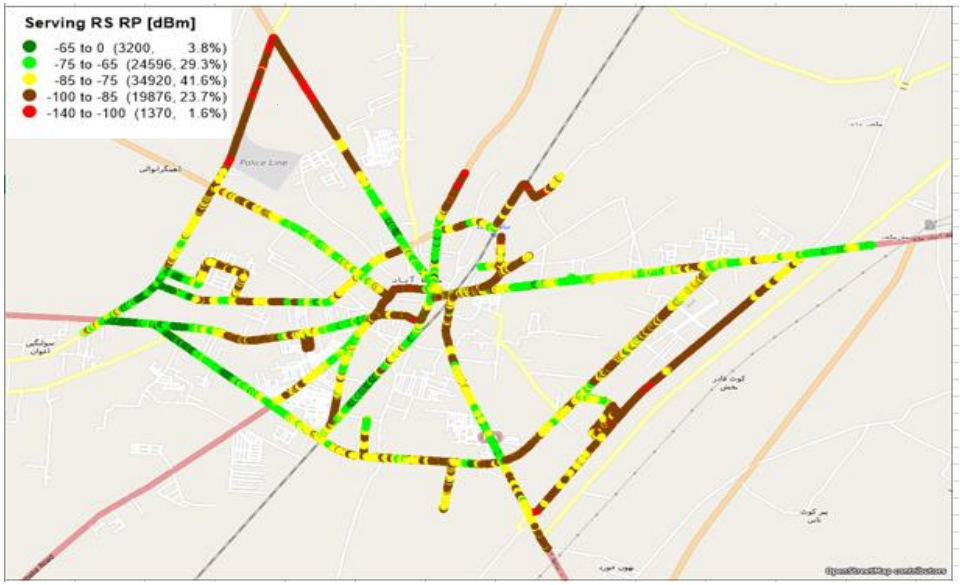
COVERAGE MAPS (4G)

4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

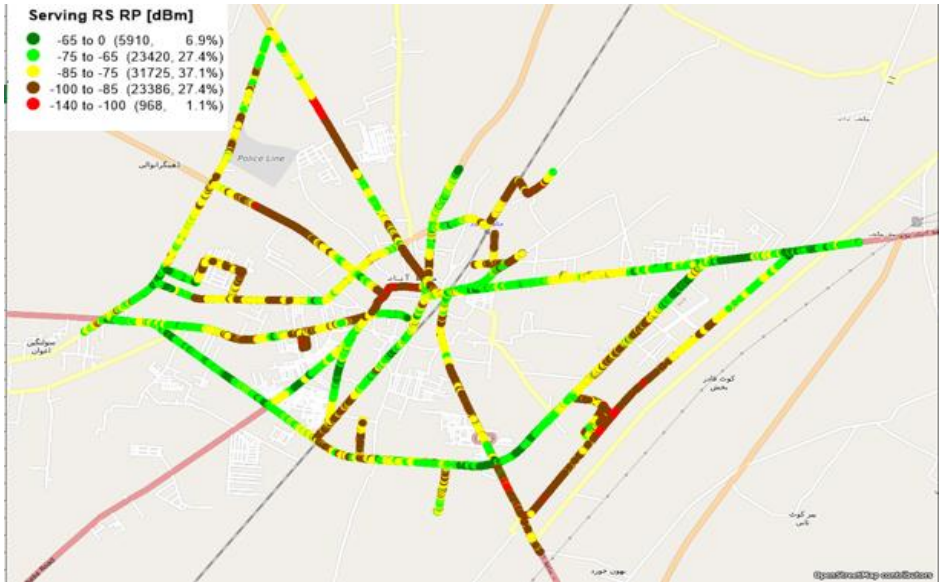
JAZZ 4G NETWORK COVERAGE – ATTOCK	TELENOR 4G NETWORK COVERAGE – ATTOCK
	
UFONE 4G NETWORK COVERAGE – ATTOCK	**ZONG 4G NETWORK COVERAGE – ATTOCK**
	

4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

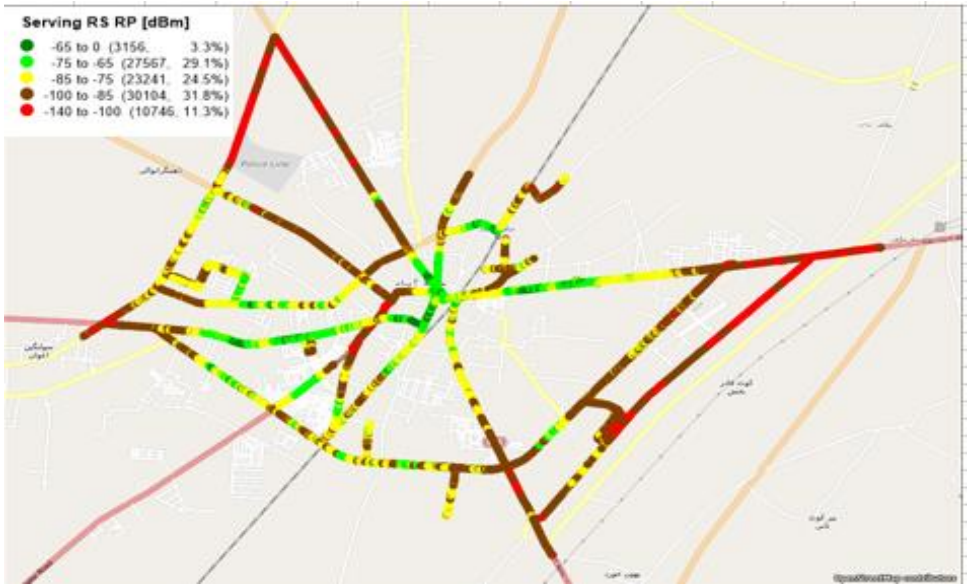
JAZZ 4G NETWORK COVERAGE – HAFIZABAD



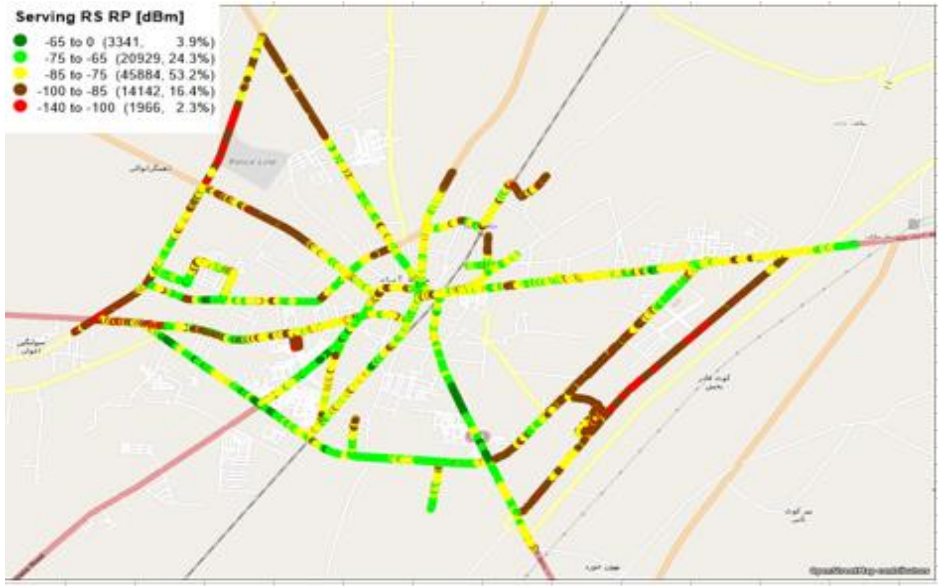
TELENOR 4G NETWORK COVERAGE – HAFIZABAD



UFONE 4G NETWORK COVERAGE – HAFIZABAD

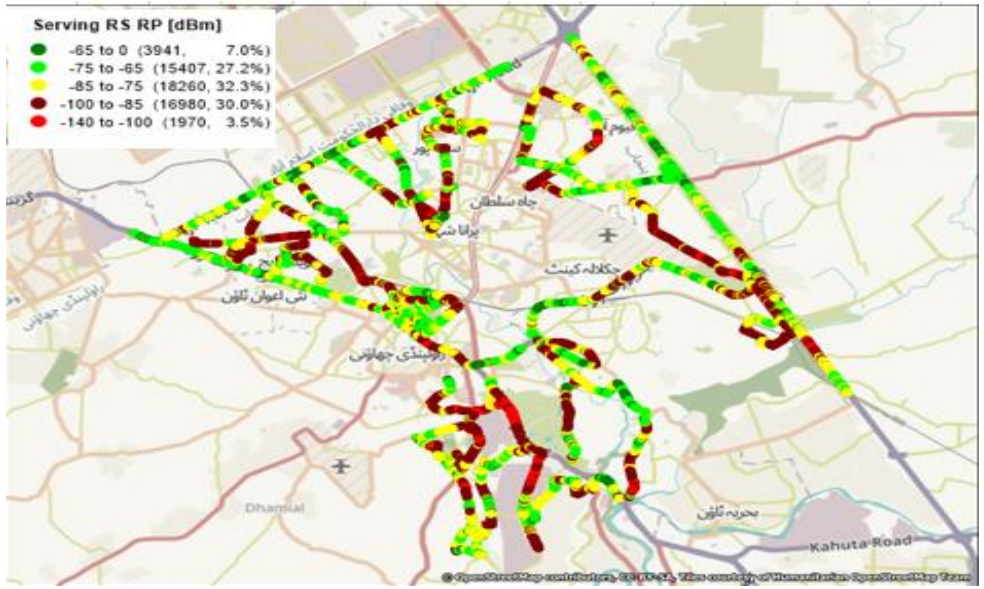


ZONG 4G NETWORK COVERAGE – HAFIZABAD

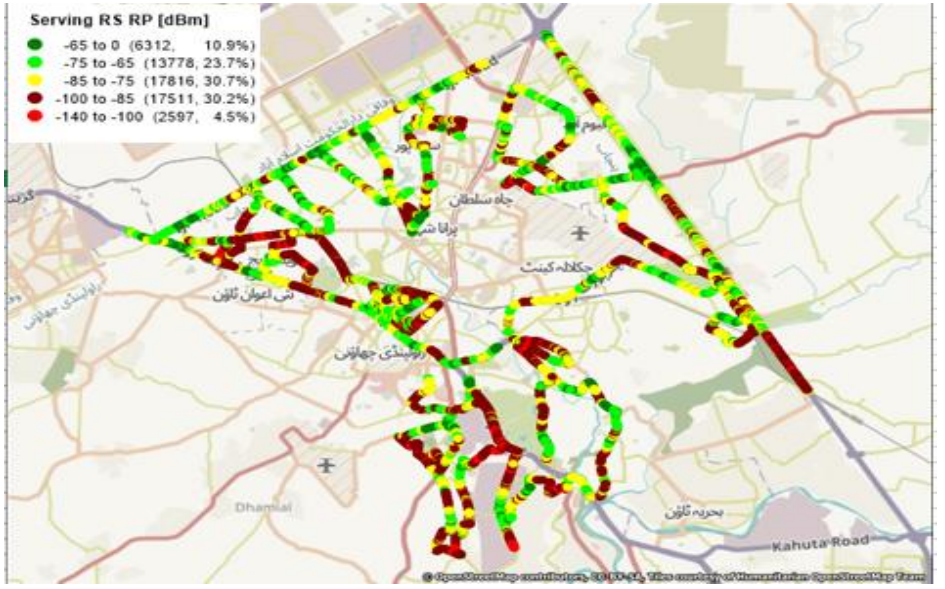


4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

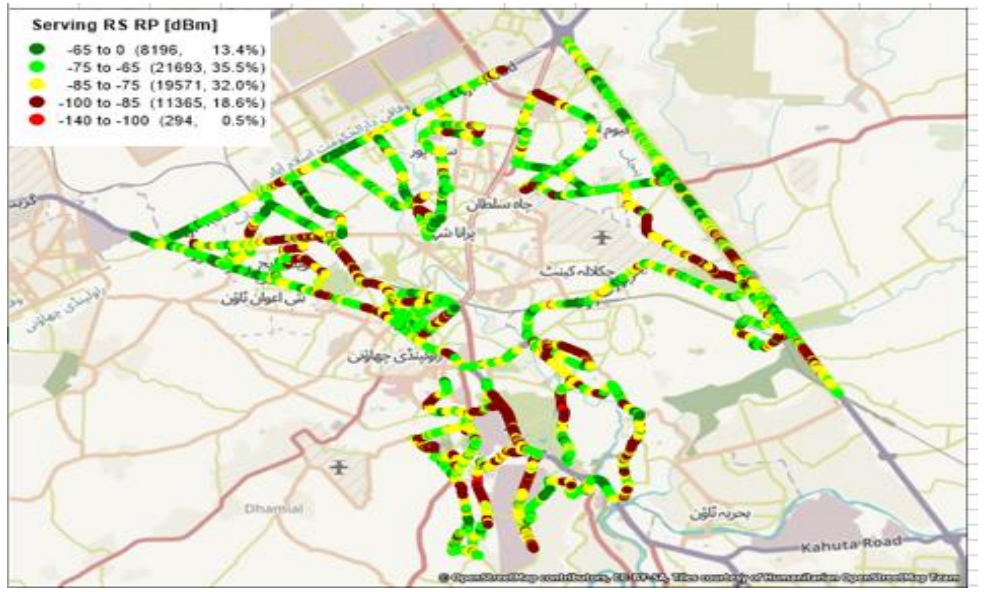
JAZZ 4G NETWORK COVERAGE – RAWALPINDI



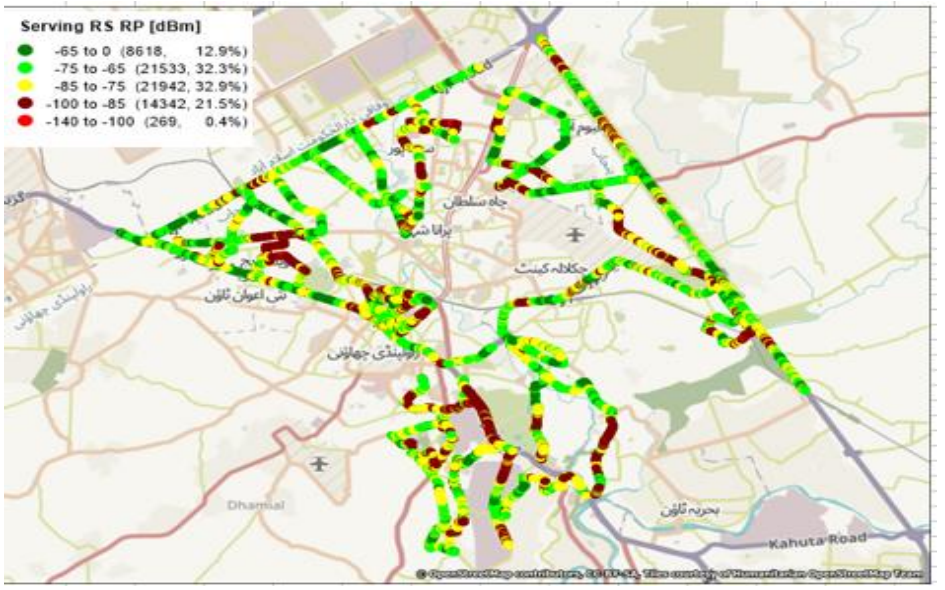
TELENOR 4G NETWORK COVERAGE – RAWALPINDI



UFONE 4G NETWORK COVERAGE – RAWALPINDI



ZONG 4G NETWORK COVERAGE – RAWALPINDI



4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

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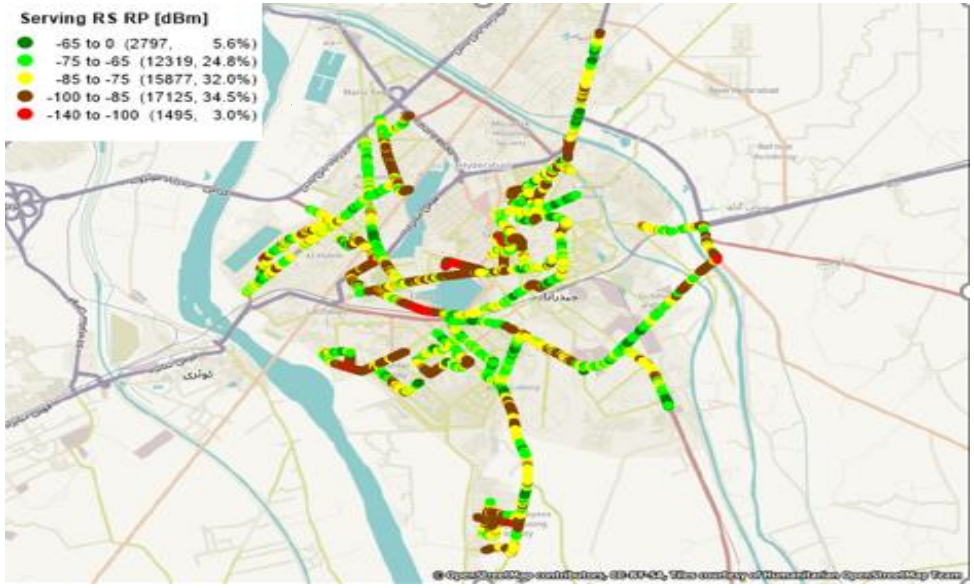
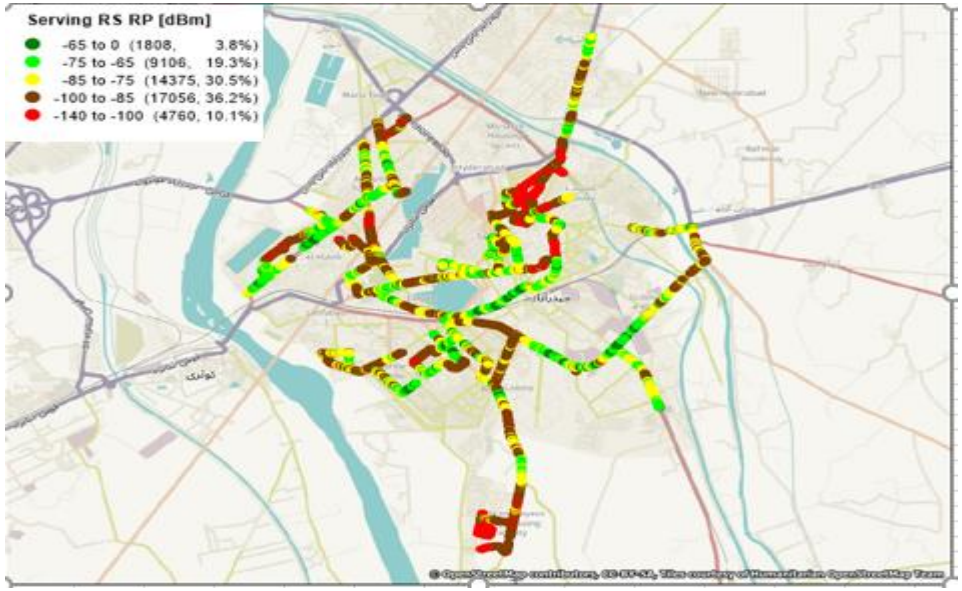
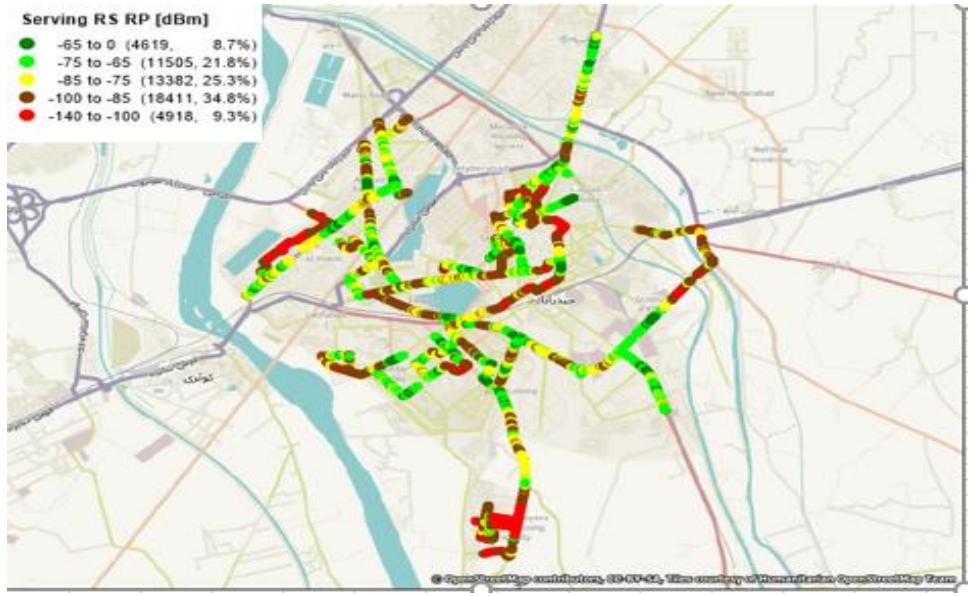
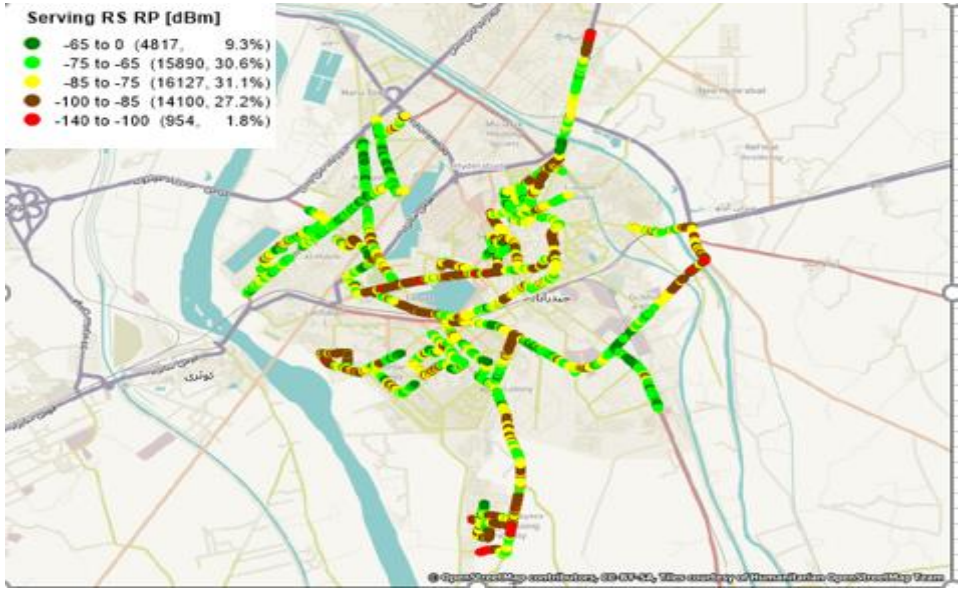
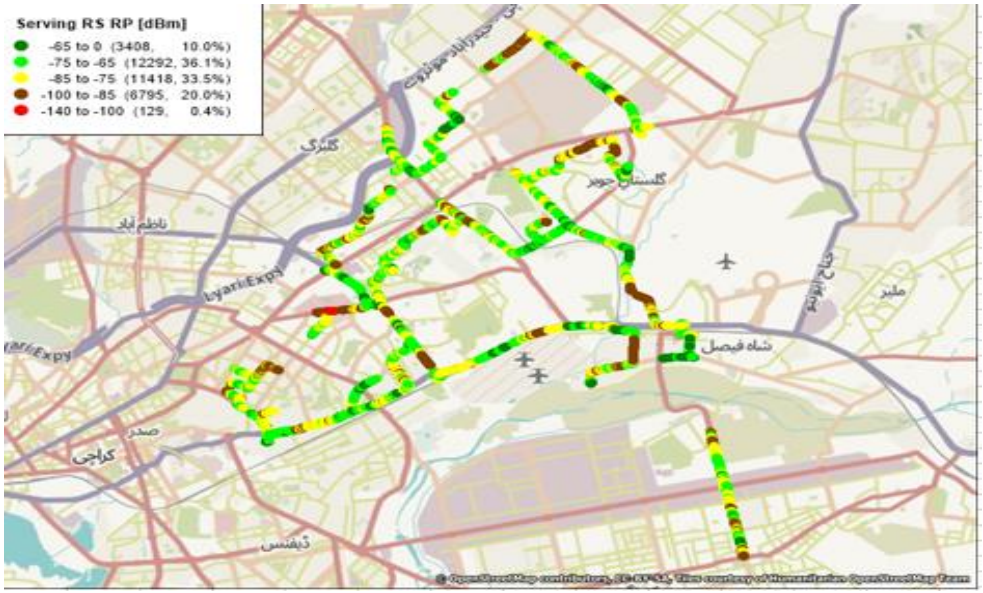
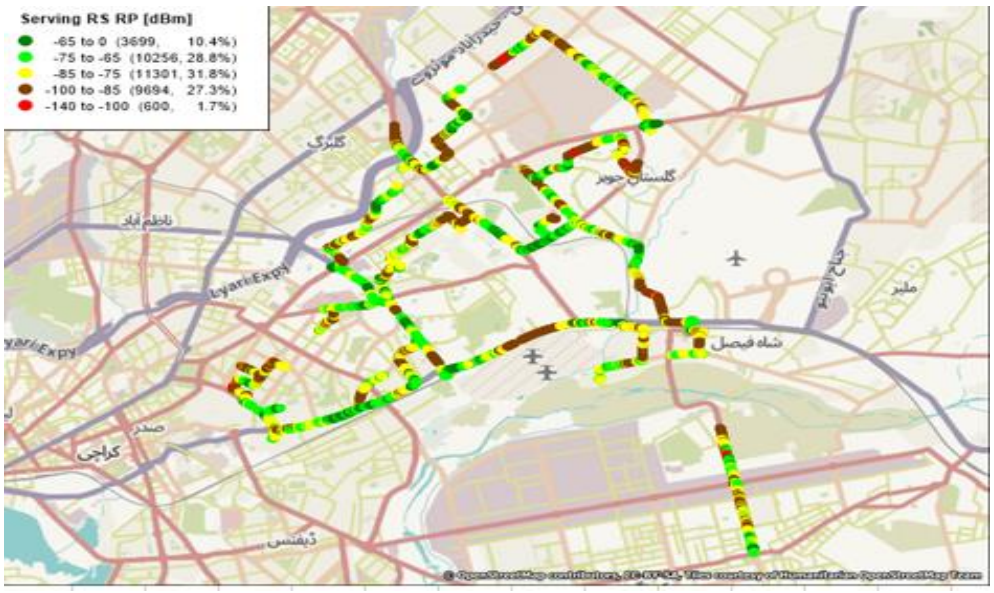
	
UFONE 4G NETWORK COVERAGE – HYDERABAD	**ZONG 4G NETWORK COVERAGE – HYDERABAD**
	

4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

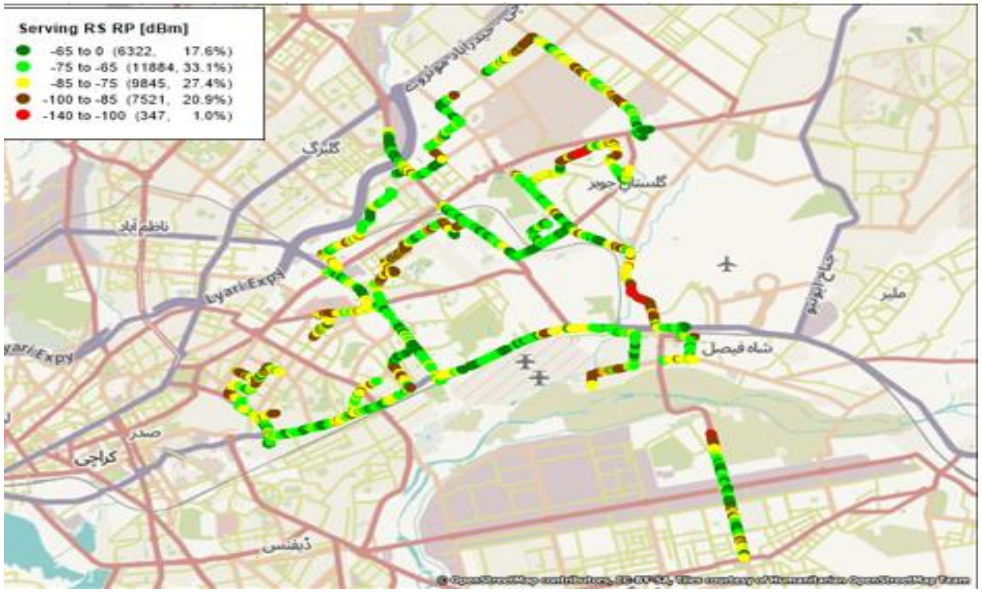
JAZZ 4G NETWORK COVERAGE – KARACHI EAST



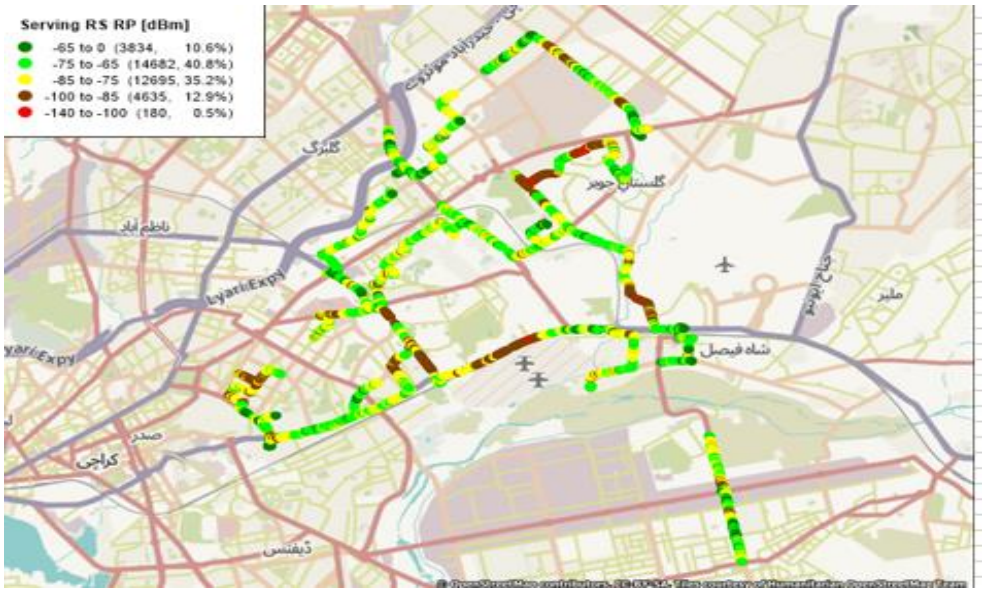
TELENOR 4G NETWORK COVERAGE – KARACHI EAST



UFONE 4G NETWORK COVERAGE – KARACHI EAST



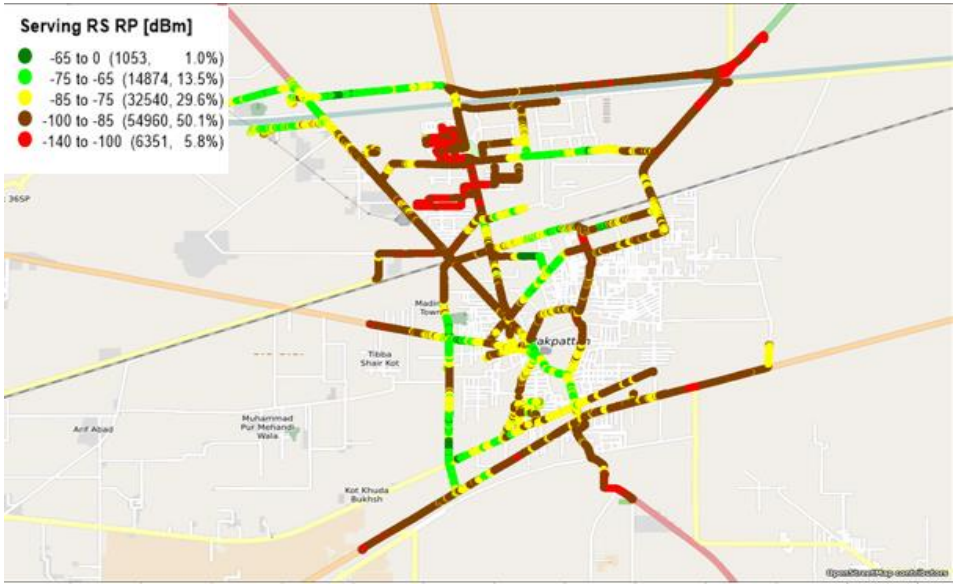
ZONG 4G NETWORK COVERAGE – KARACHI EAST



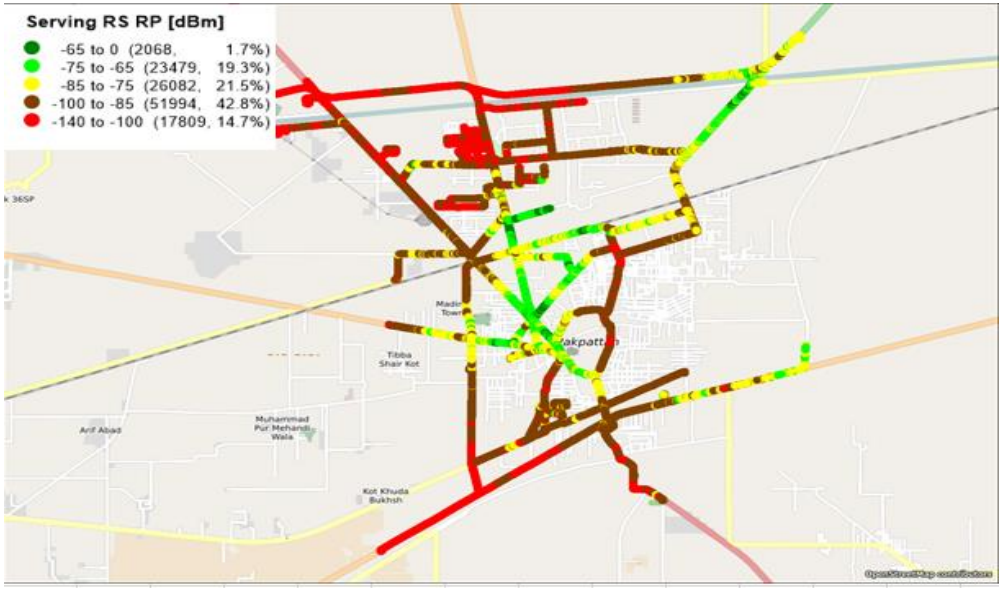
4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

JAZZ 4G NETWORK COVERAGE – PAKPATTAN

TELENOR 4G NETWORK COVERAGE – PAKPATTAN



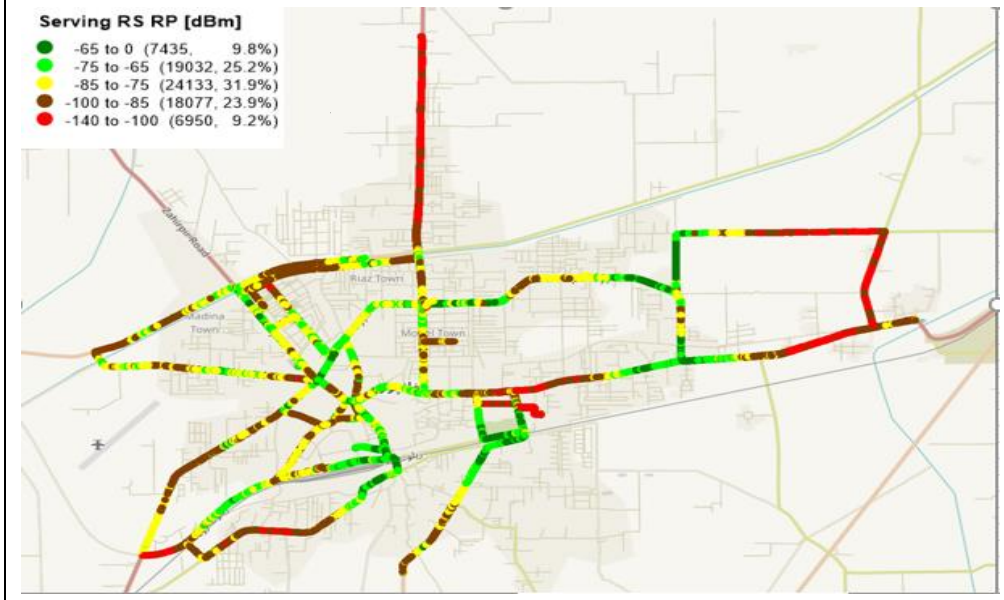
UFONE 4G NETWORK COVERAGE – PAKPATTAN



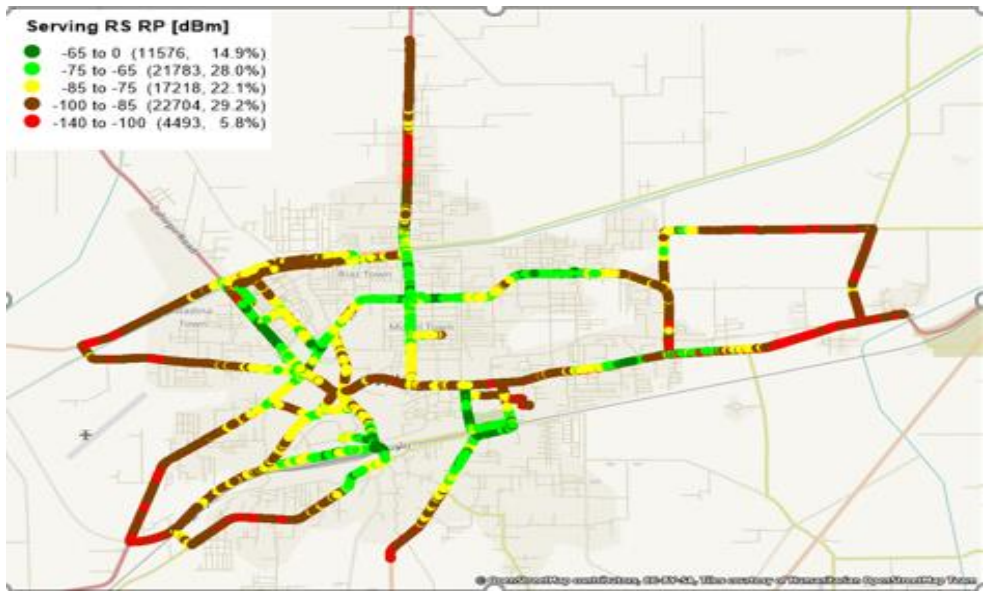
ZONG 4G NETWORK COVERAGE – PAKPATTAN

4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

JAZZ 4G NETWORK COVERAGE – KHANPUR



TELENOR 4G NETWORK COVERAGE – KHANPUR



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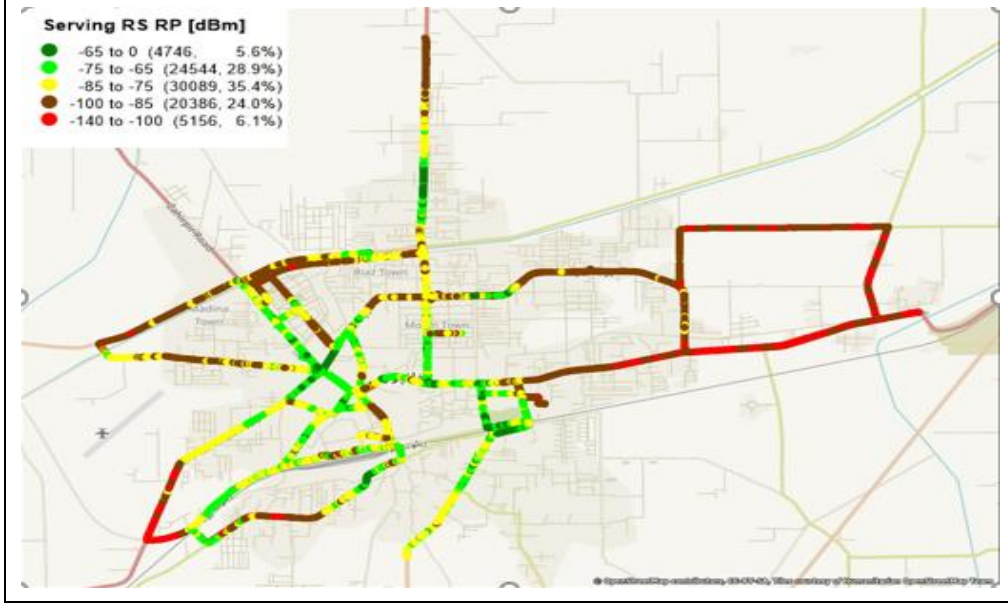
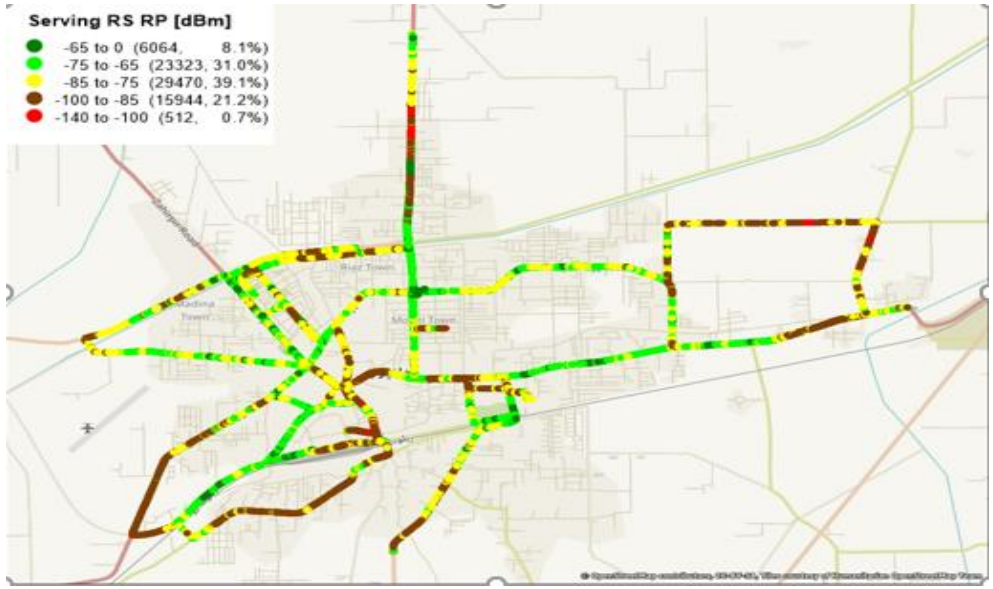
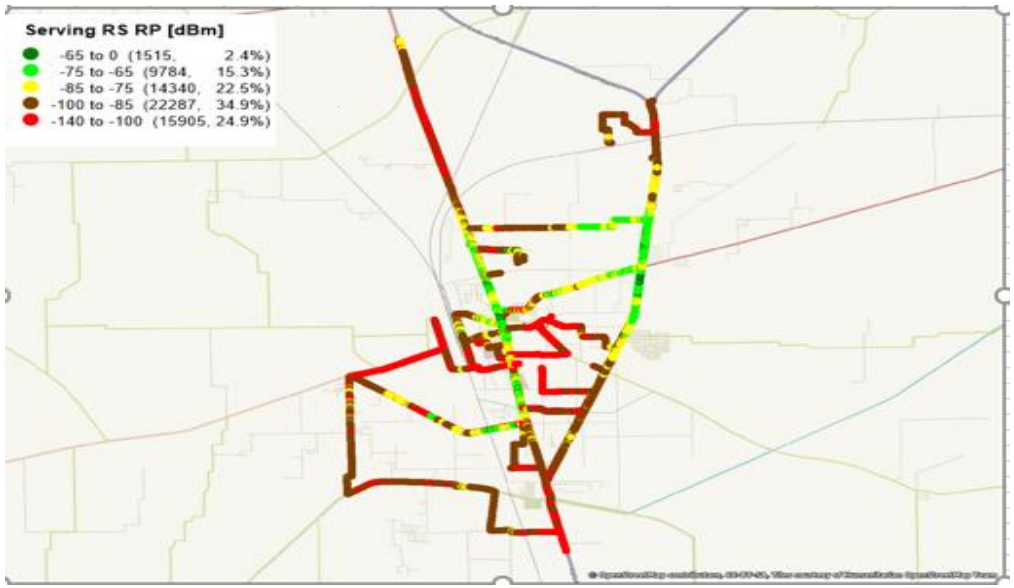
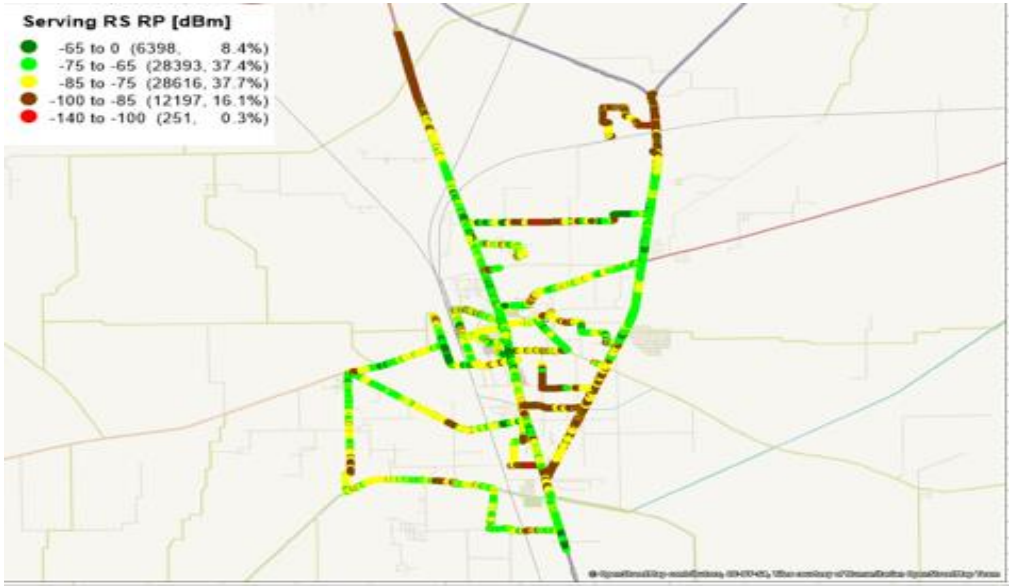


ZONG 4G NETWORK COVERAGE – KHANPUR

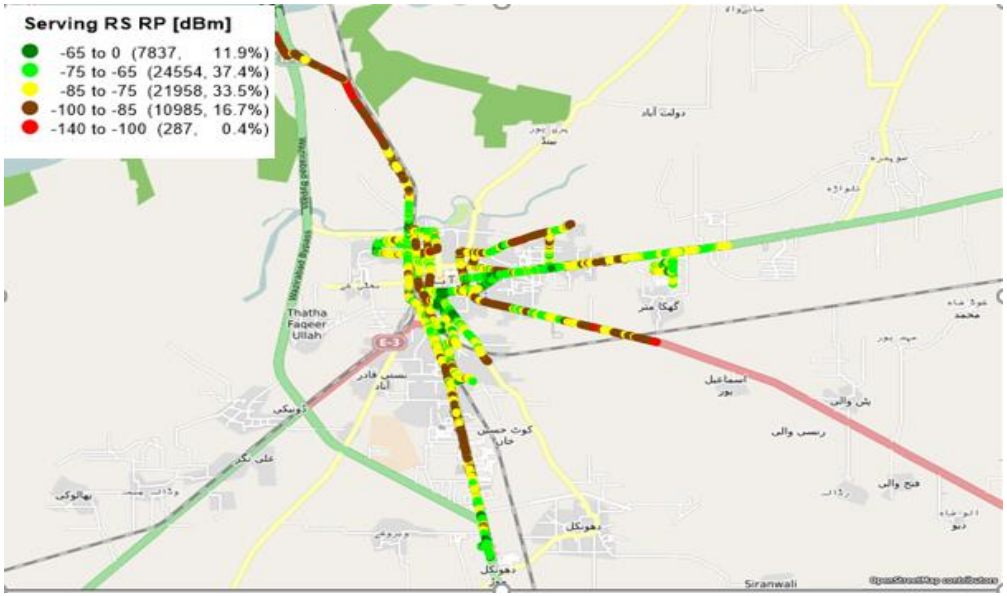


4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

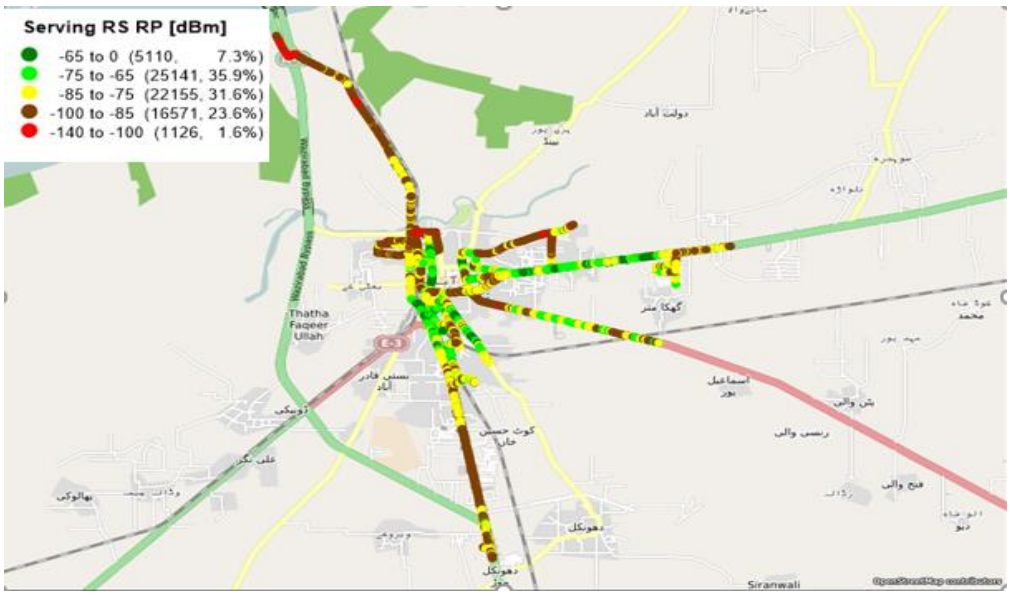
TELENOR 4G NETWORK COVERAGE – LODHRAN	ZONG 4G NETWORK COVERAGE – LODHRAN
	

4G MOBILE COVERAGE – SIGNAL STRENGTH (RSRP)

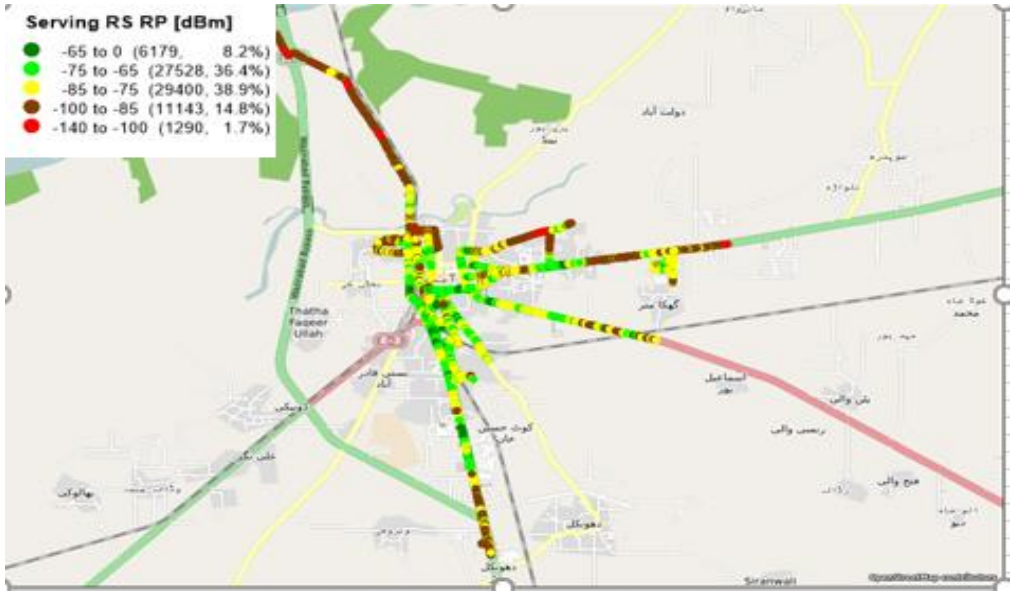
JAZZ 4G NETWORK COVERAGE – WAZIRABAD



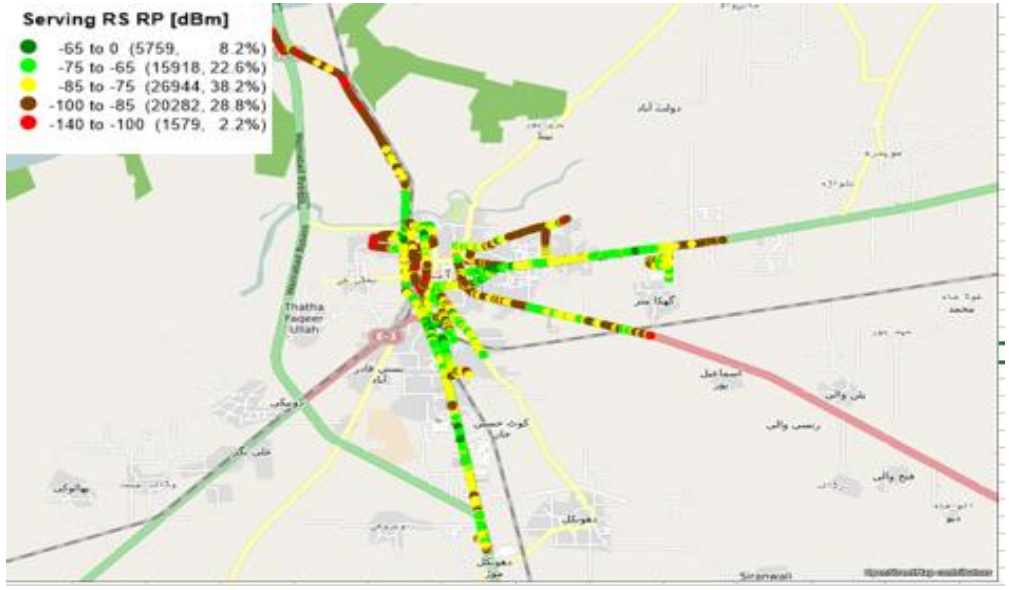
TELENOR 4G NETWORK COVERAGE – WAZIRABAD



UFONE 4G NETWORK COVERAGE – WAZIRABAD

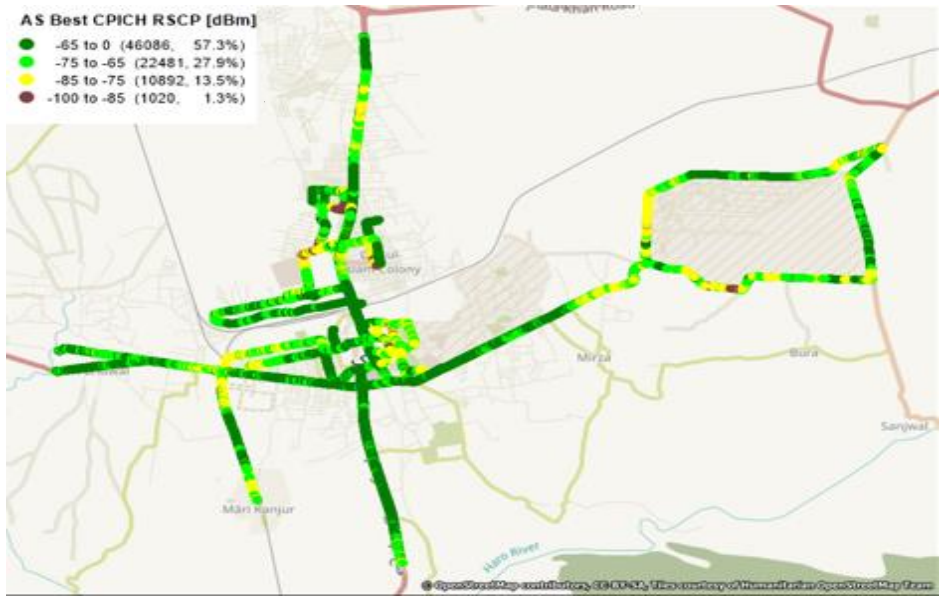
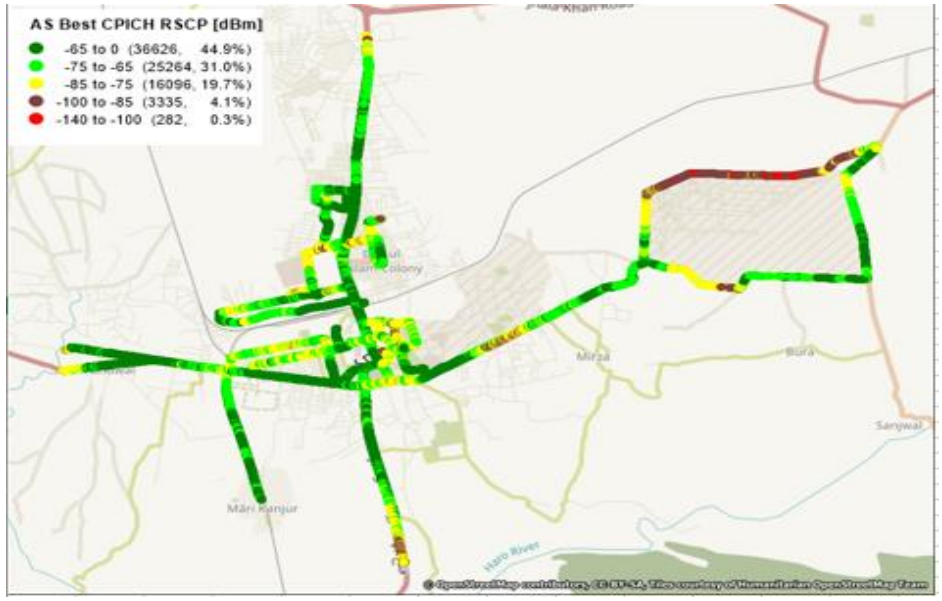
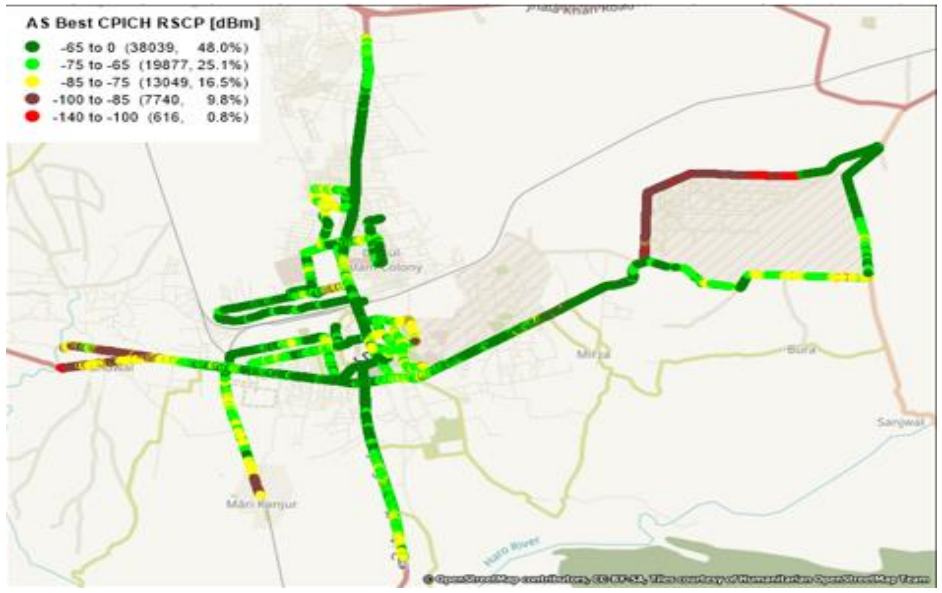
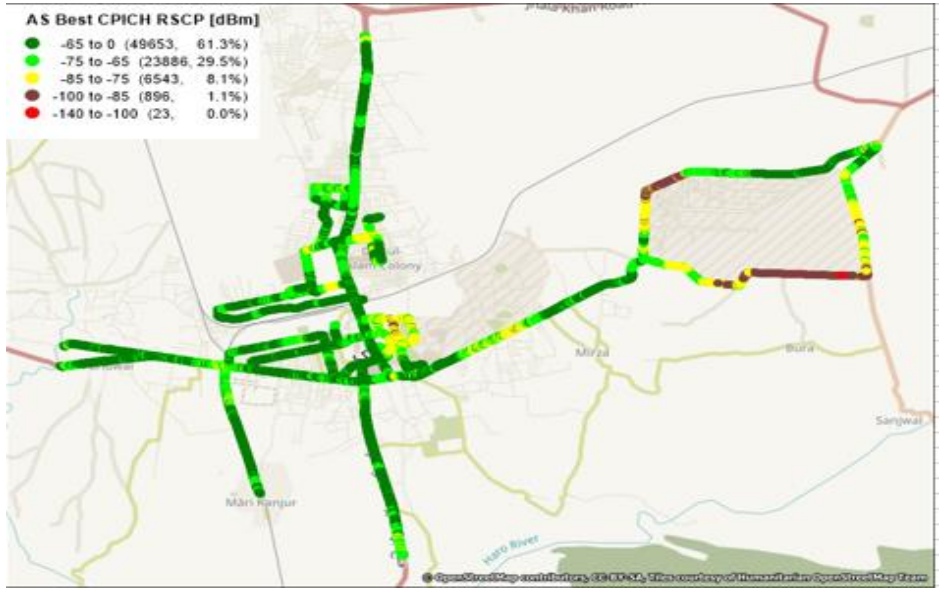


ZONG 4G NETWORK COVERAGE – WAZIRABAD



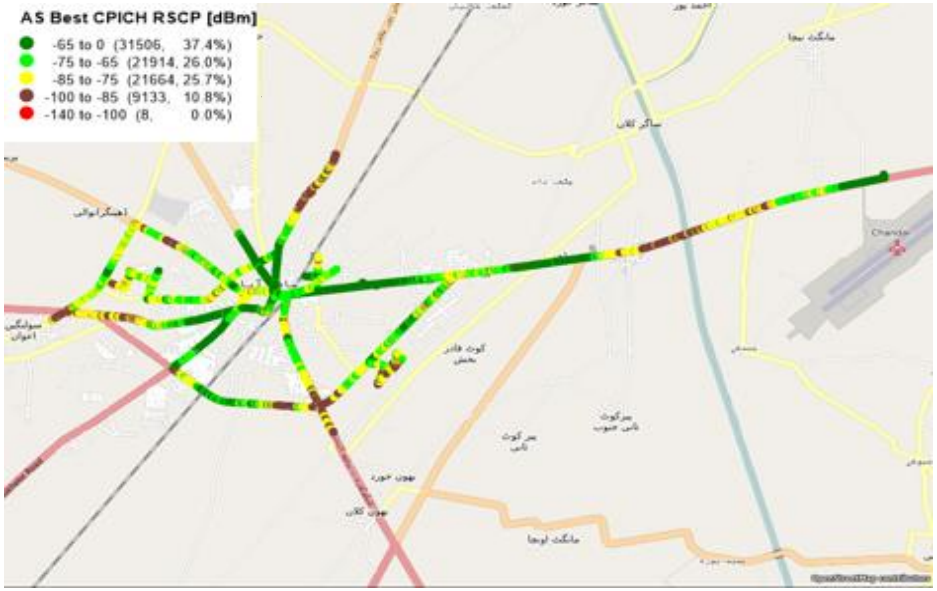
COVERAGE MAPS (3G)

3G MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

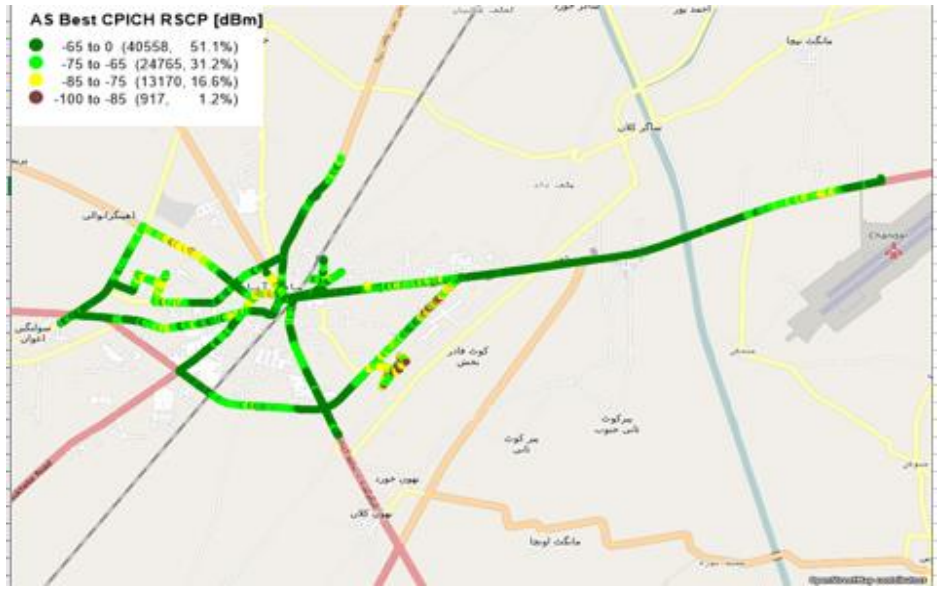
JAZZ 3G NETWORK COVERAGE – ATTOCK	TELENOR 3G NETWORK COVERAGE –ATTOCK
	
UFONE 3G NETWORK COVERAGE – ATTOCK	**ZONG 3G NETWORK COVERAGE – ATTOCK**
	

3G MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

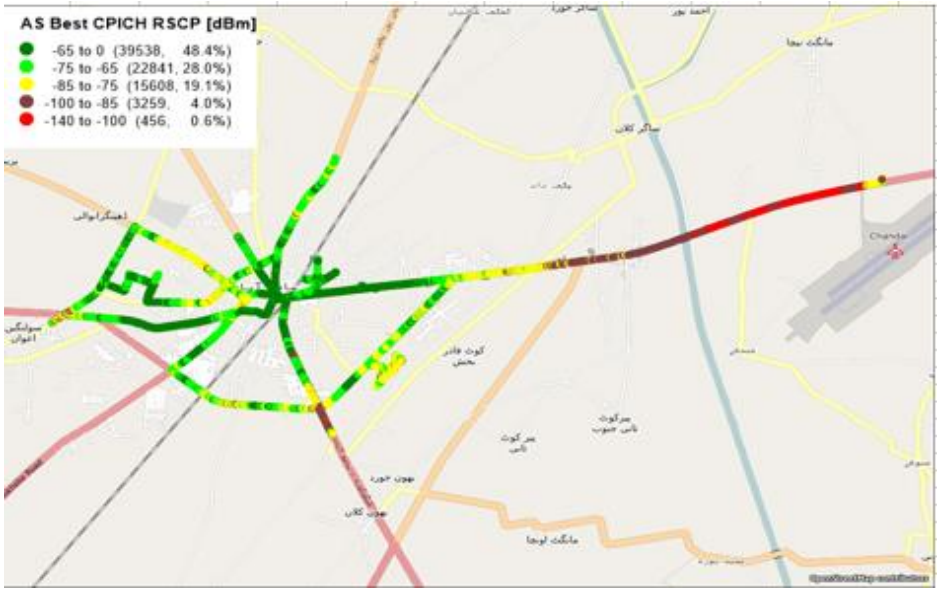
JAZZ 3G NETWORK COVERAGE – HAFIZABAD



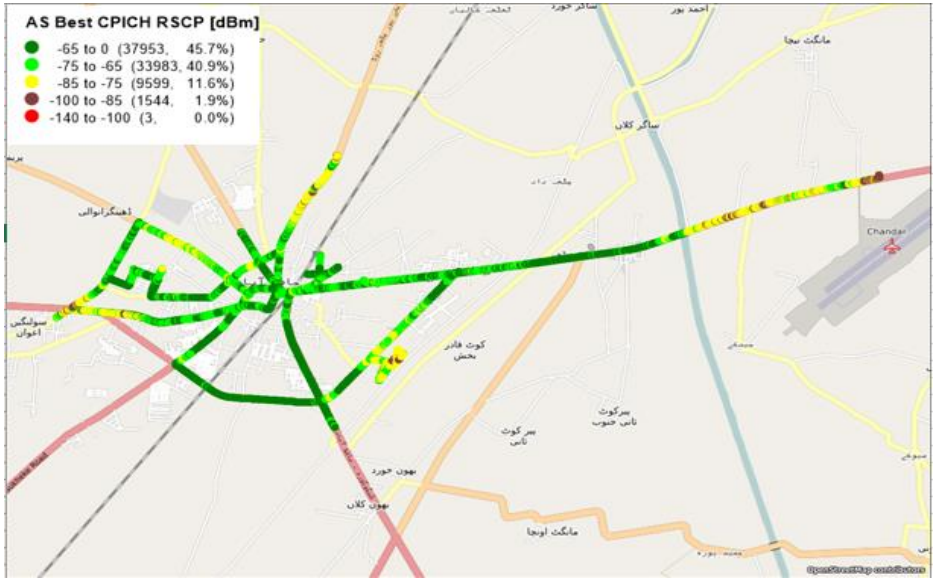
TELENOR 3G NETWORK COVERAGE – HAFIZABAD



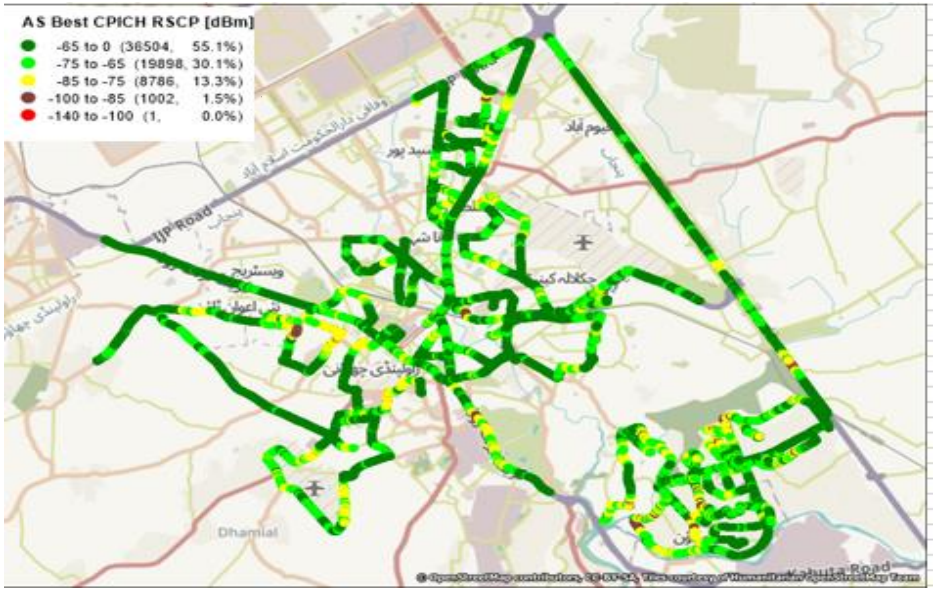
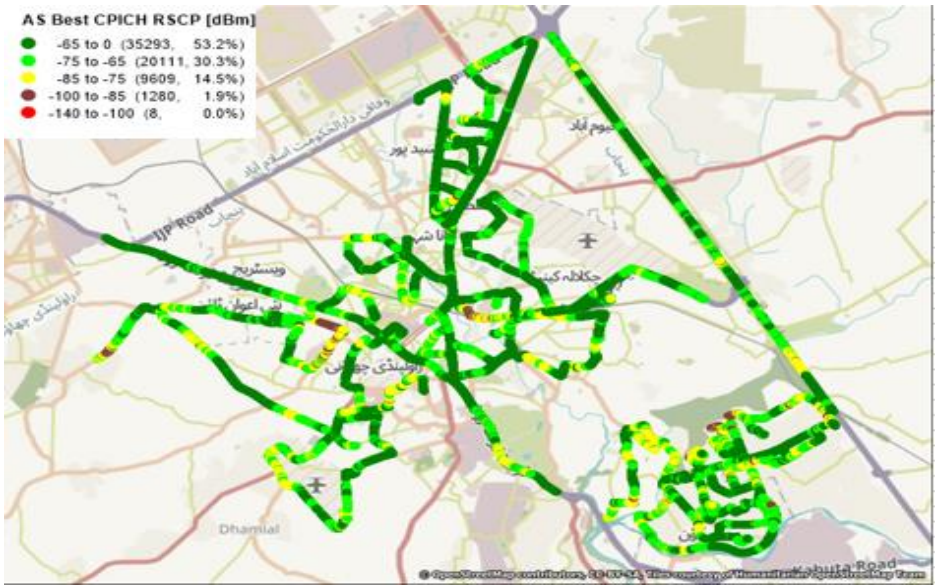
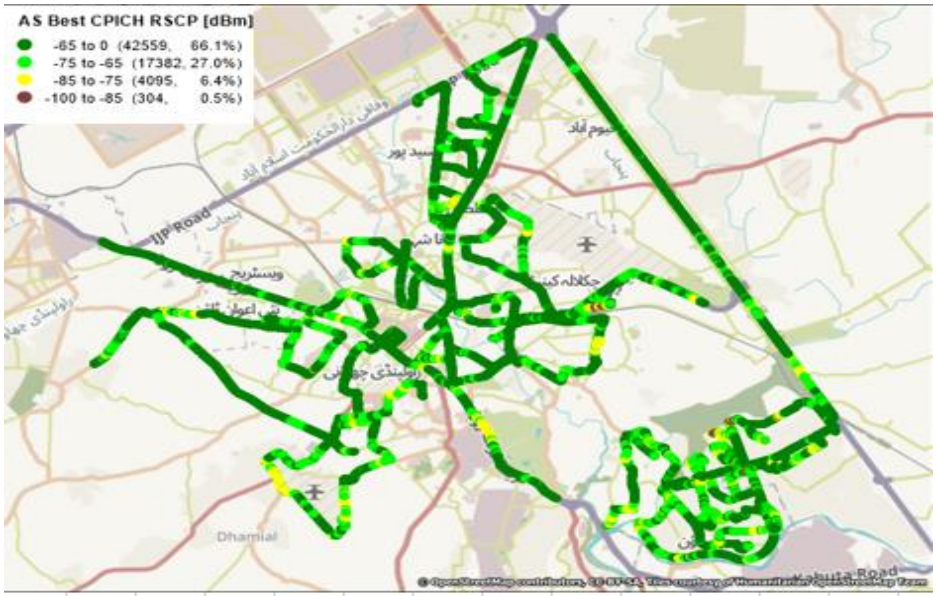
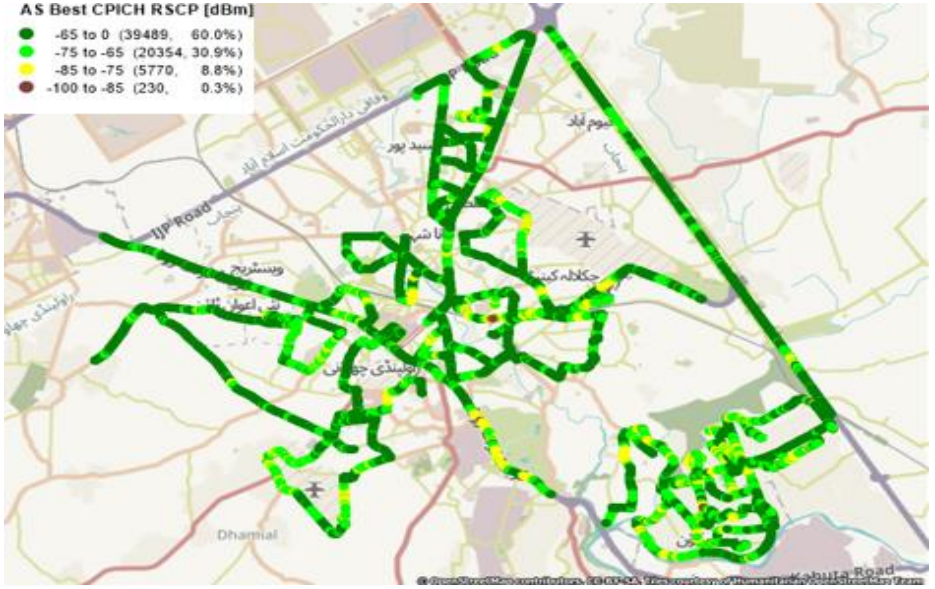
UFONE 3G NETWORK COVERAGE – HAFIZABAD



ZONG 3G NETWORK COVERAGE – HAFIZABAD

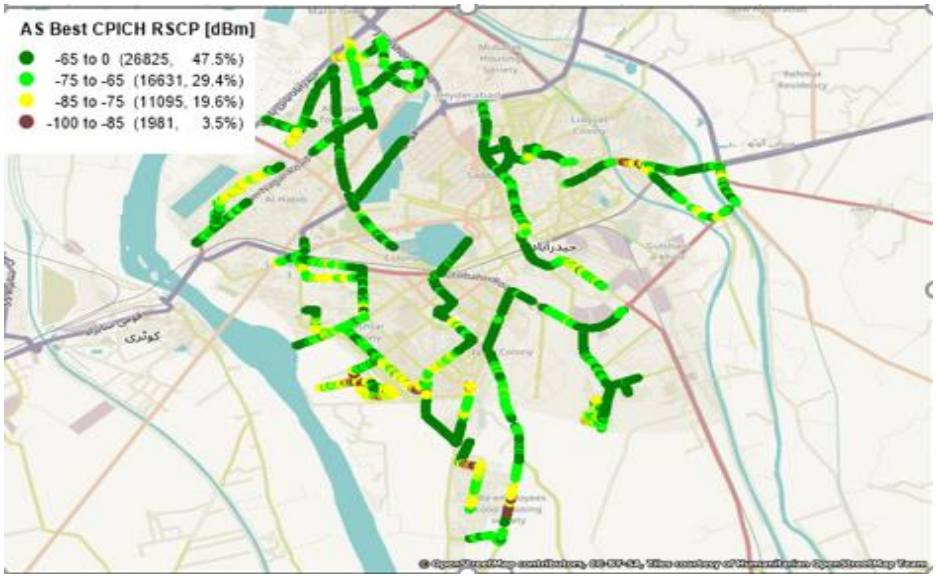


3G MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

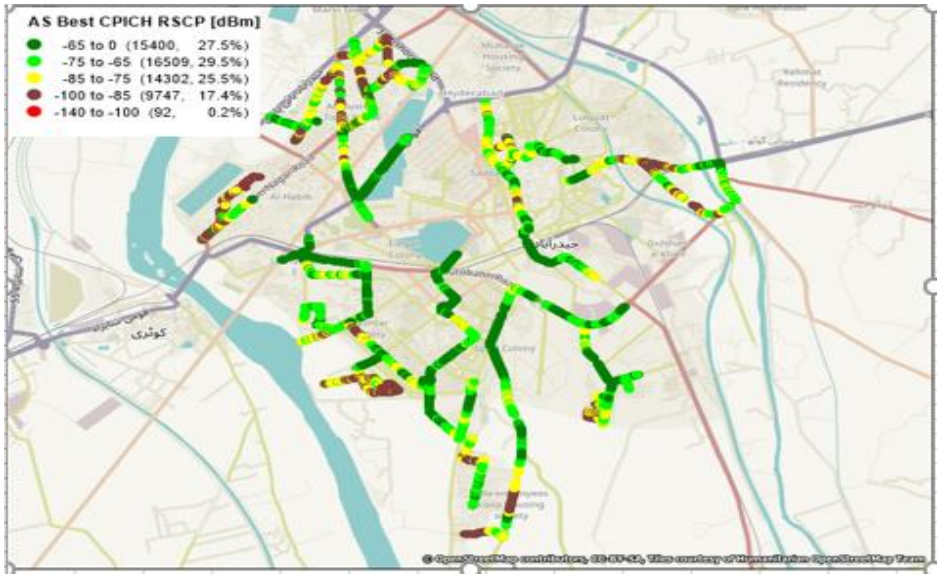
JAZZ 3G NETWORK COVERAGE – RAWALPINDI	TELENOR 3G NETWORK COVERAGE – RAWALPINDI
	
UFONE 3G NETWORK COVERAGE – RAWALPINDI	**ZONG 3G NETWORK COVERAGE – RAWALPINDI**
	

3G MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

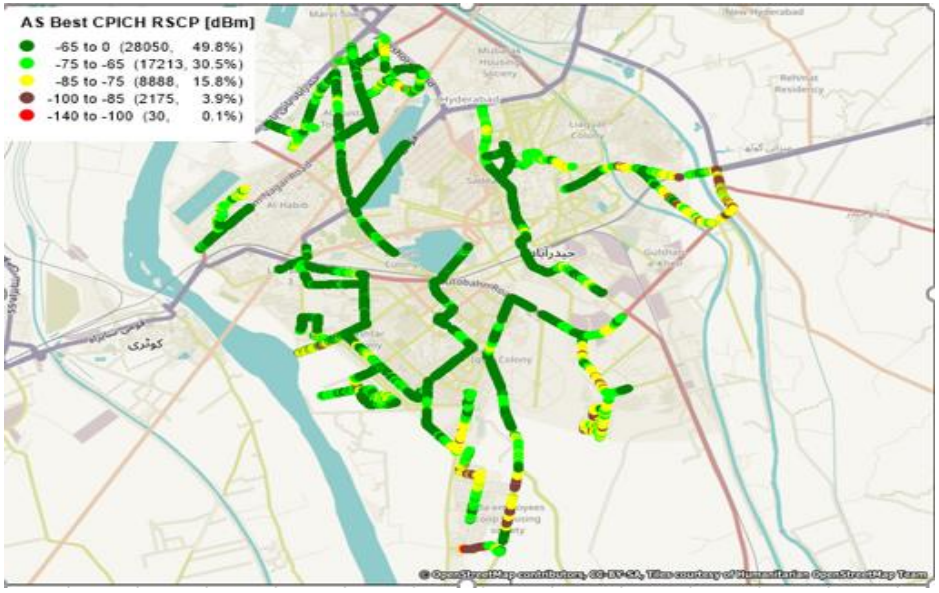
JAZZ 3G NETWORK COVERAGE – HYDERABAD



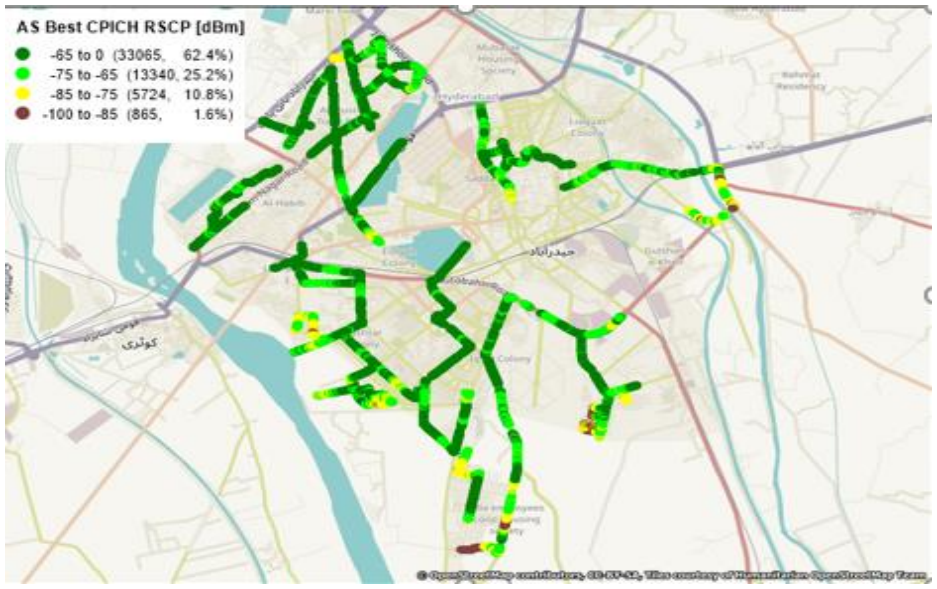
TELENOR 3G NETWORK COVERAGE – HYDERABAD



UFONE 3G NETWORK COVERAGE – HYDERABAD



ZONG 3G NETWORK COVERAGE – HYDERABAD



3G MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

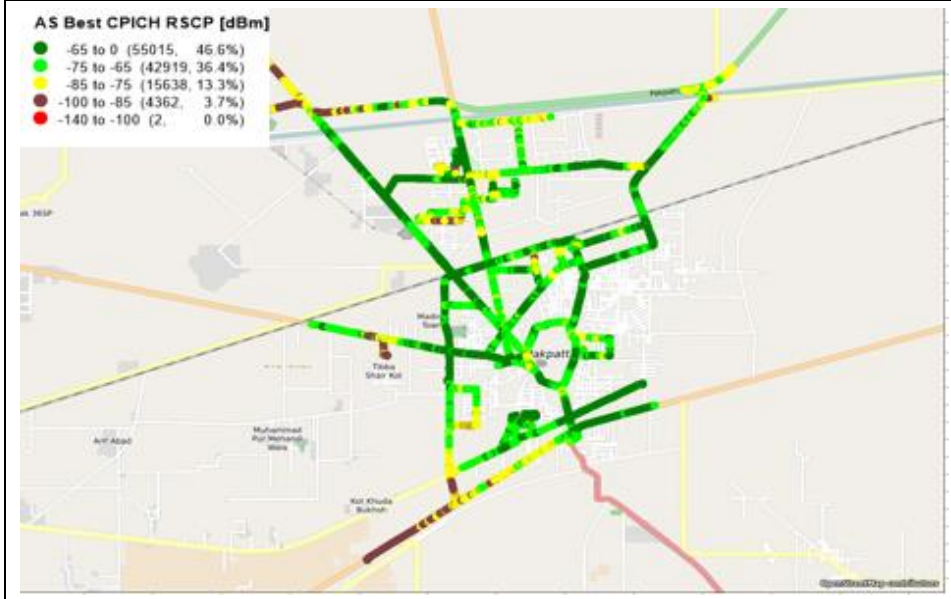
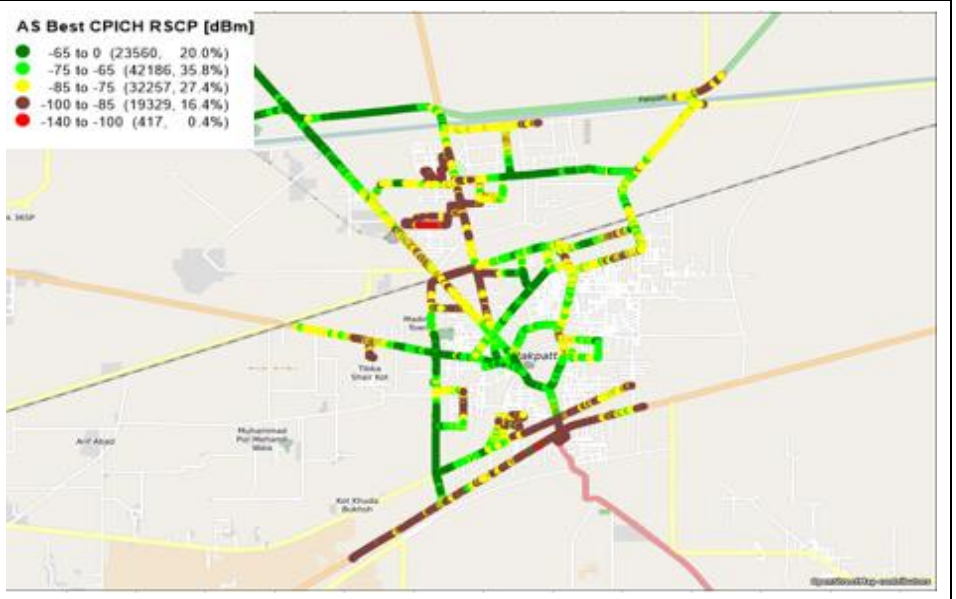
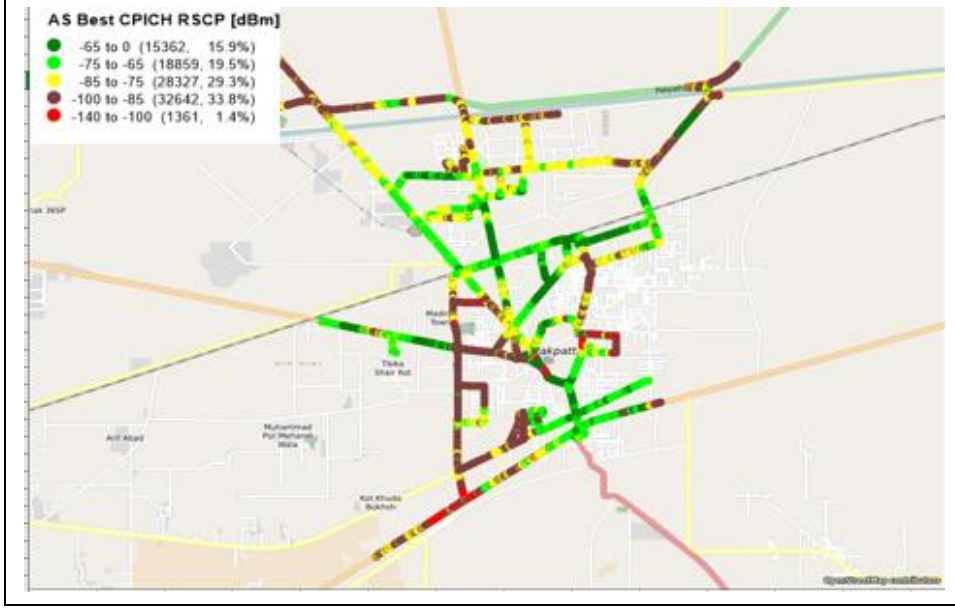
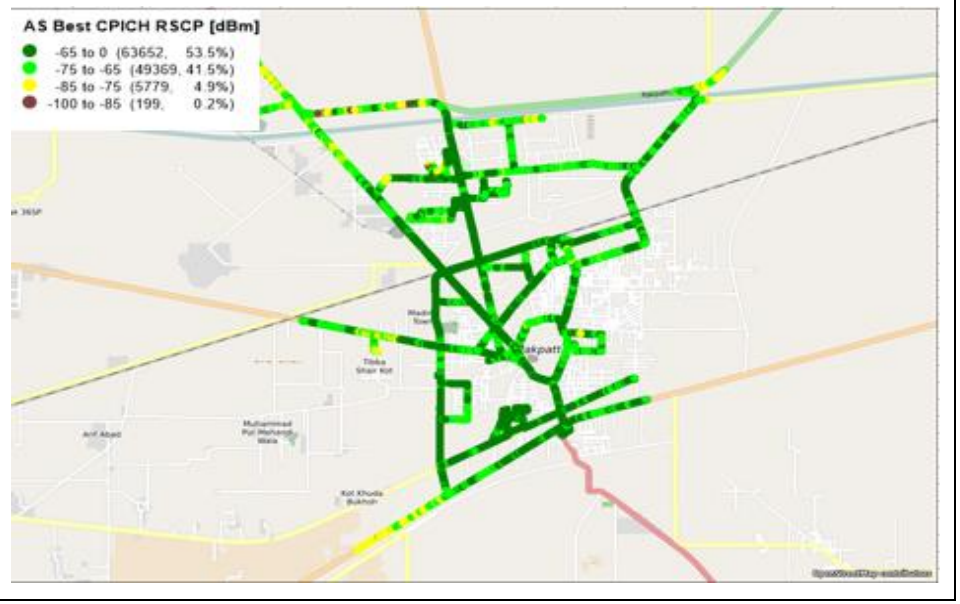
JAZZ 3G NETWORK COVERAGE – KARACHI EAST

TELENOR 3G NETWORK COVERAGE – KARACHI EAST

UFONE 3G NETWORK COVERAGE – KARACHI EAST

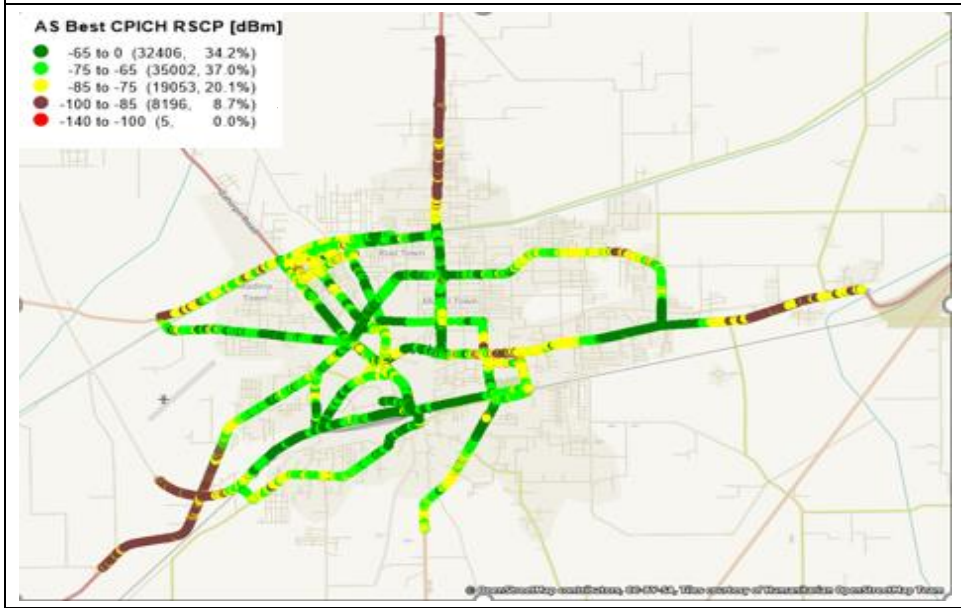
ZONG 3G NETWORK COVERAGE – KARACHI EAST

3G MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

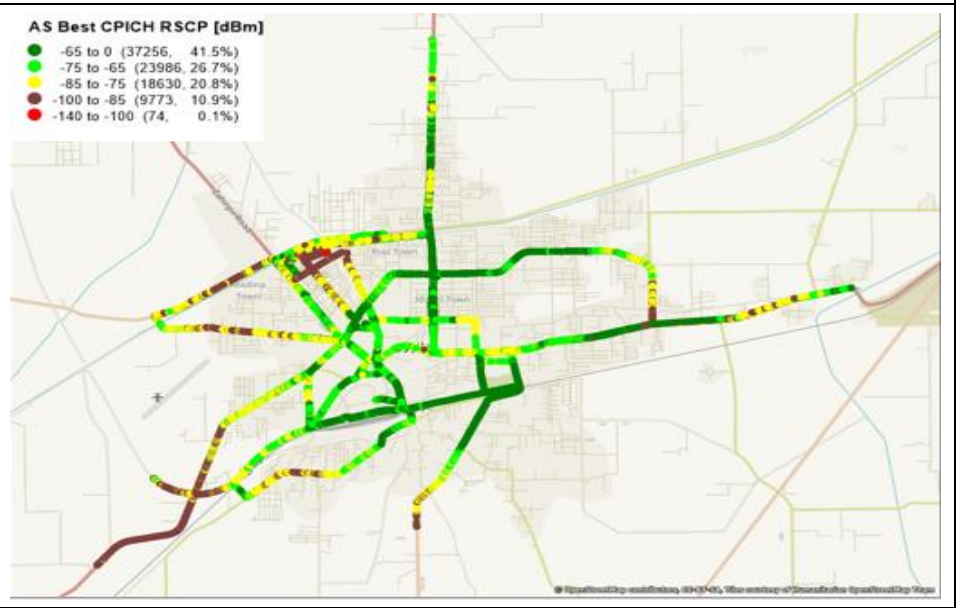
JAZZ 3G NETWORK COVERAGE – PAKPATTAN	TELENOR 3G NETWORK COVERAGE – PAKPATTAN
	
UFONE 3G NETWORK COVERAGE – PAKPATTAN	**ZONG 3G NETWORK COVERAGE – PAKPATTAN**
	

3G MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

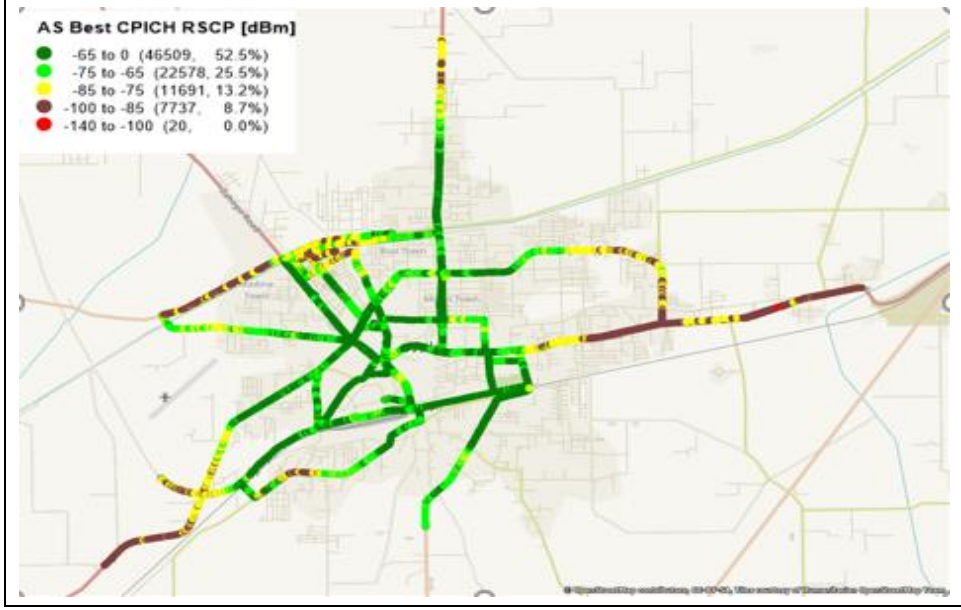
JAZZ 3G NETWORK COVERAGE – KHANPUR



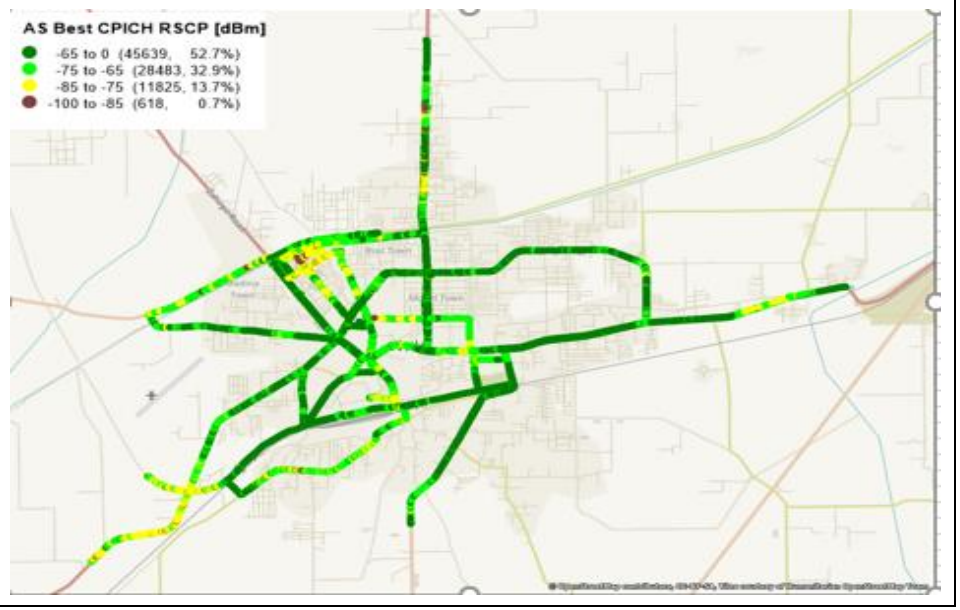
TELENOR 3G NETWORK COVERAGE – KHANPUR



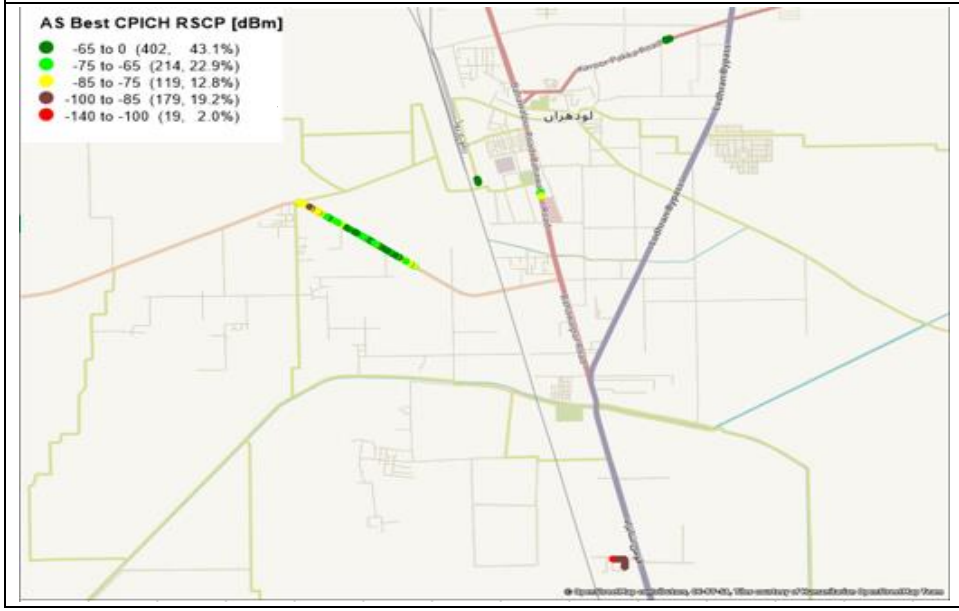
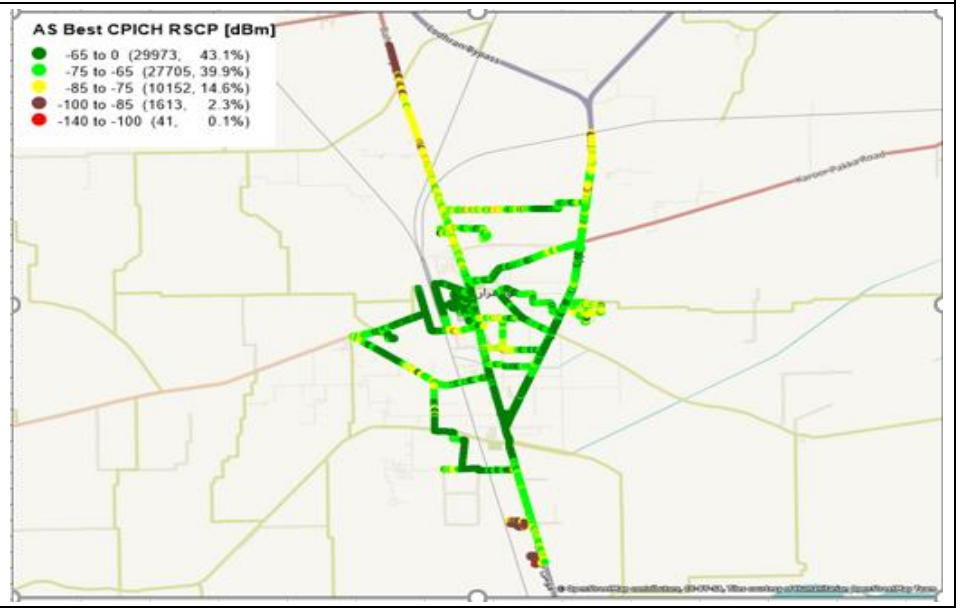
UFONE 3G NETWORK COVERAGE – KHANPUR



ZONG 3G NETWORK COVERAGE – KHANPUR



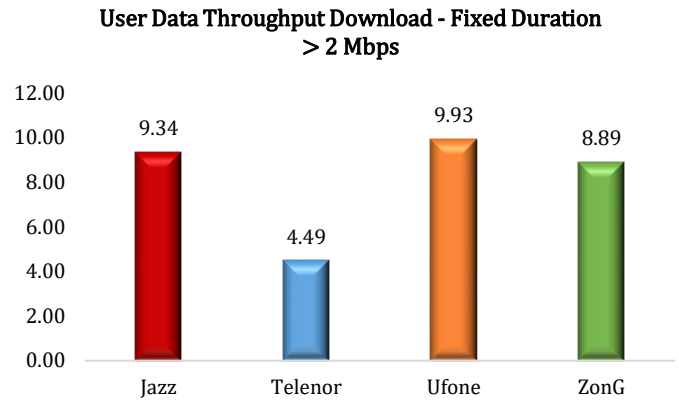
3G MOBILE COVERAGE – SIGNAL STRENGTH (RSCP)

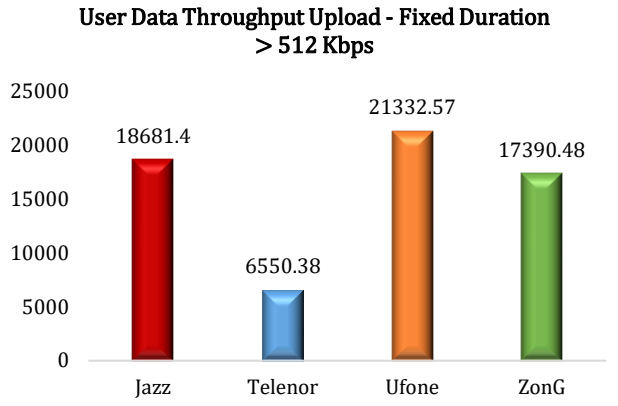
JAZZ 3G NETWORK COVERAGE – LODHRAN	UFONE 3G NETWORK COVERAGE – LODHRAN
	

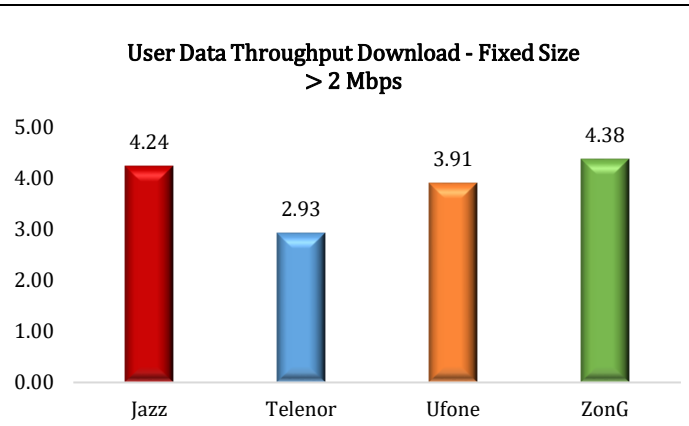
Annex-B (Data QoS Results)

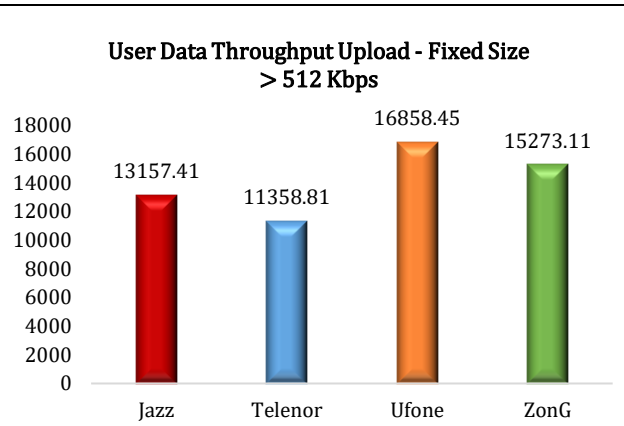
QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE)

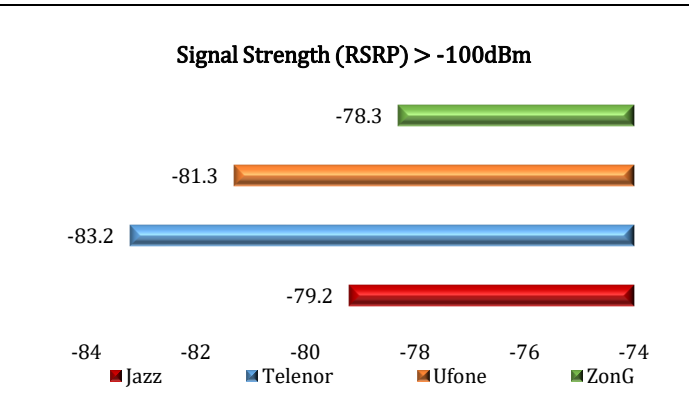
QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – ATTOCK

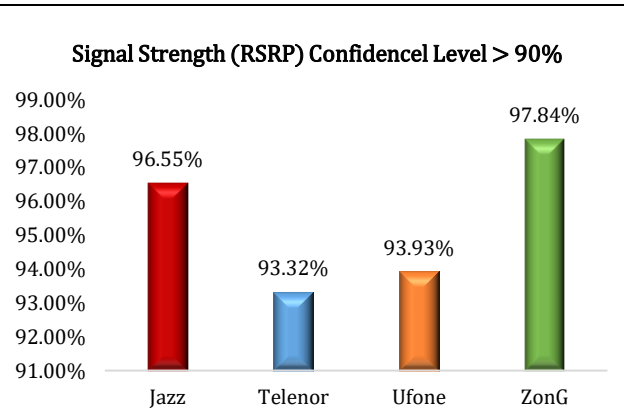


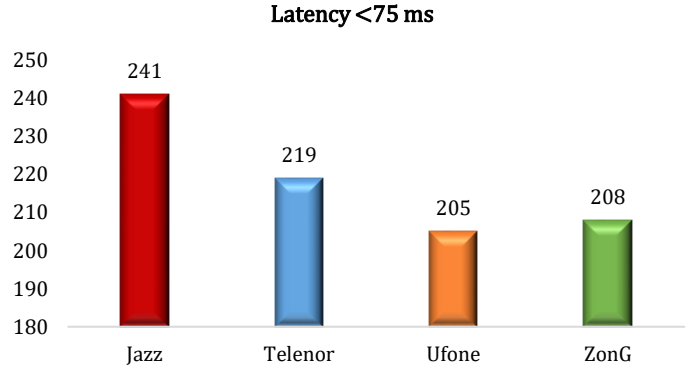


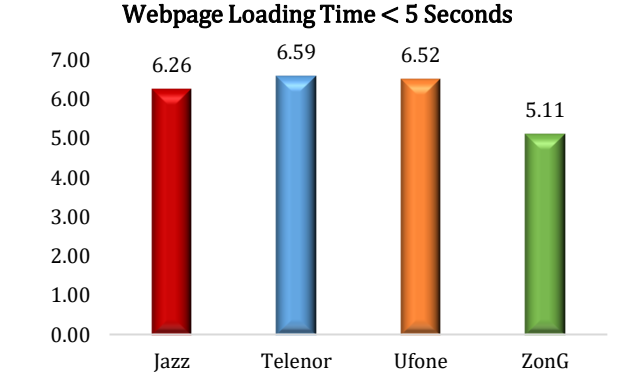






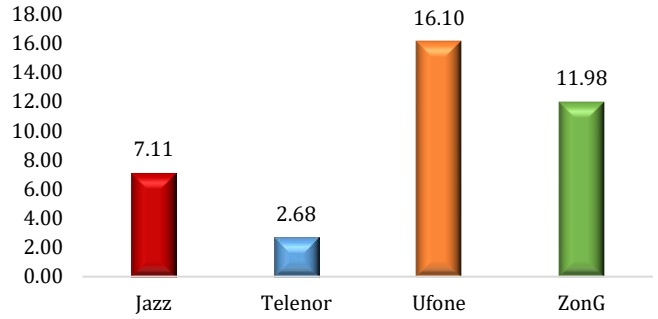




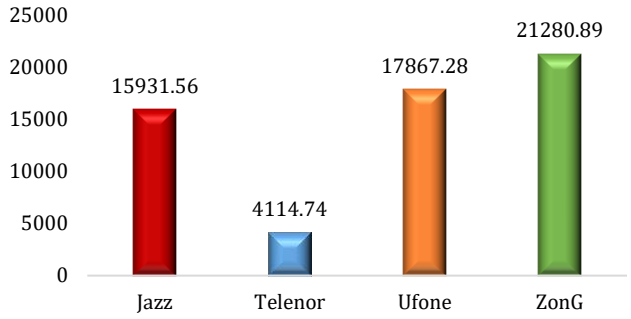


QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – HAFIZABAD

User Data Throughput Download - Fixed Duration
> 2 Mbps



User Data Throughput Upload - Fixed Duration
> 512 Kbps



User Data Throughput Download - Fixed Size
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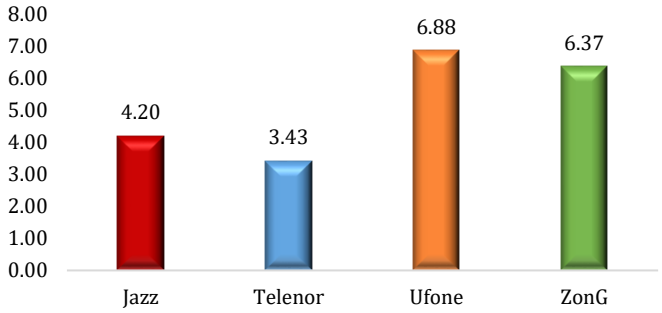

User Data Throughput Upload - Fixed Size
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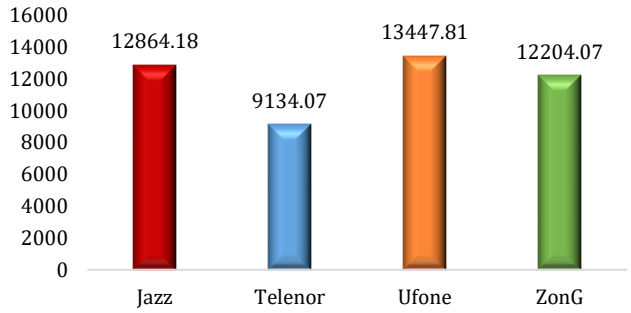
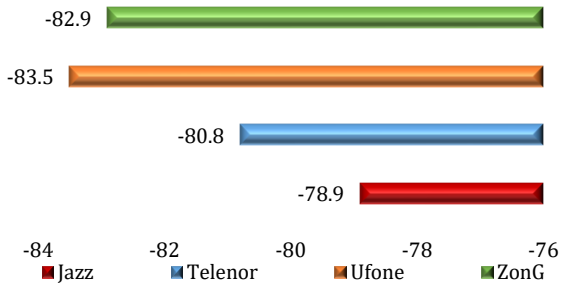
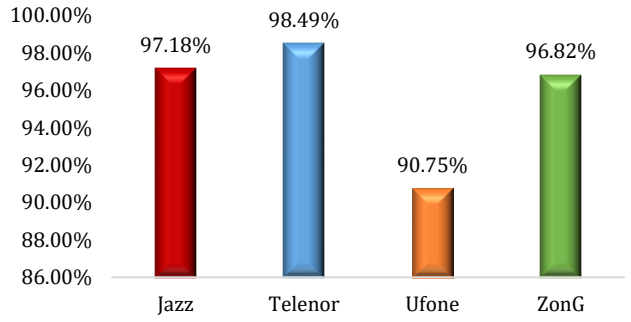


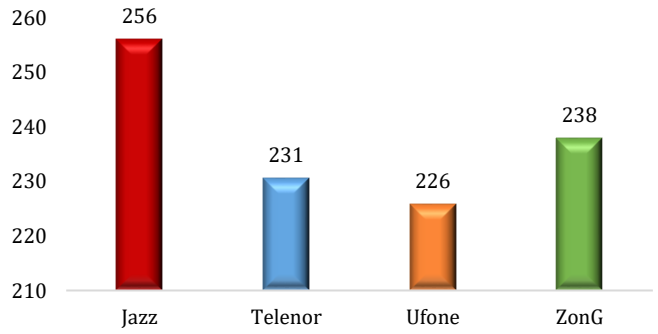
Signal Strength (RSRP) > -100dBm



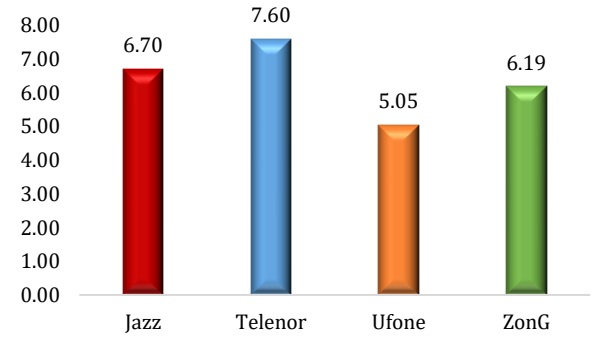
Signal Strength (RSRP) Confidencel Level > 90%



Latency <75 ms

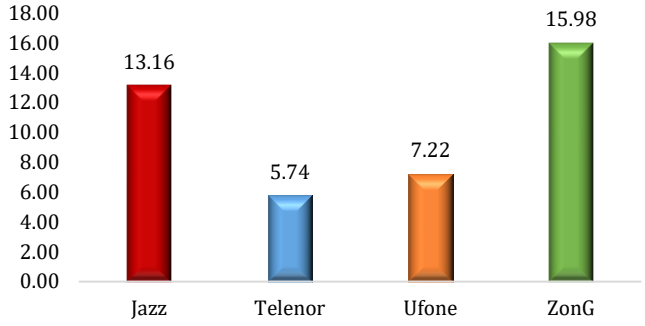


Webpage Loading Time < 5 Seconds



QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – RAWALPINDI

User Data Throughput Download - Fixed Duration
> 2 Mbps



User Data Throughput Upload - Fixed Duration
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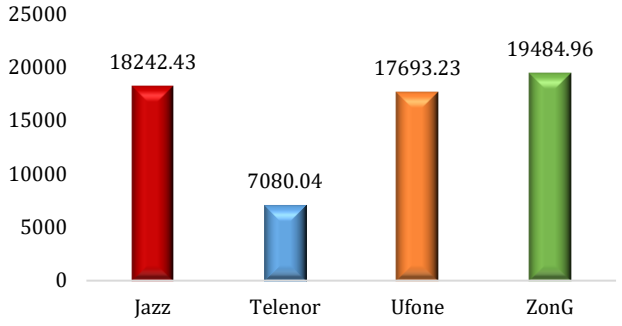

User Data Throughput Download - Fixed Size
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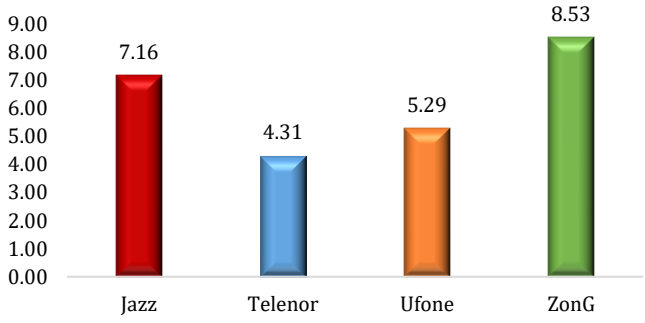

User Data Throughput Upload - Fixed Size
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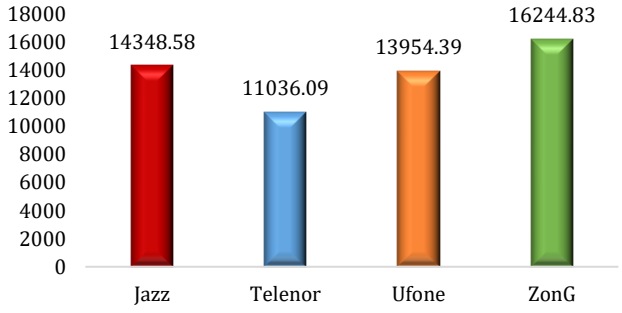
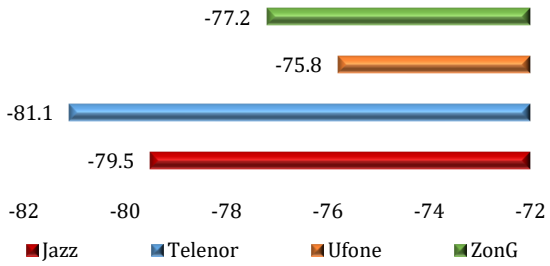
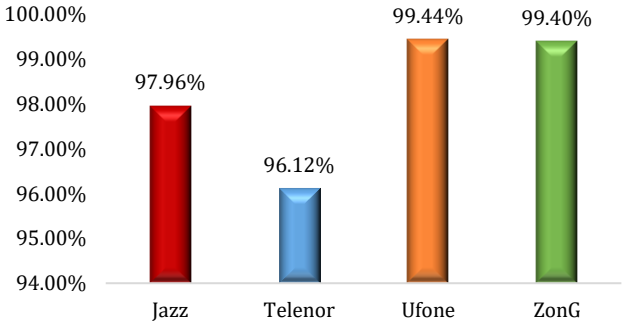


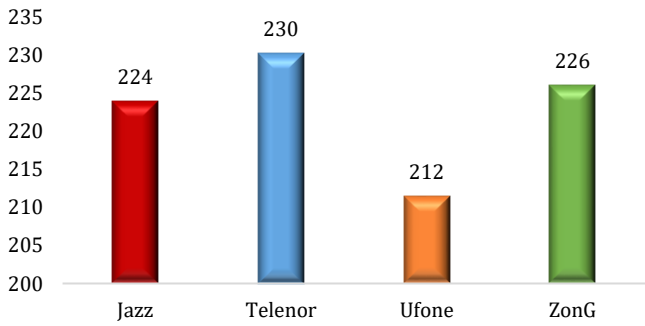
Signal Strength (RSRP) > -100dBm



Signal Strength (RSRP) Confidencel Level > 90%



Latency <75 ms



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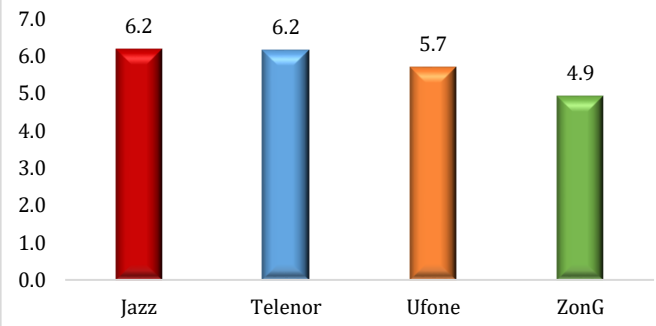
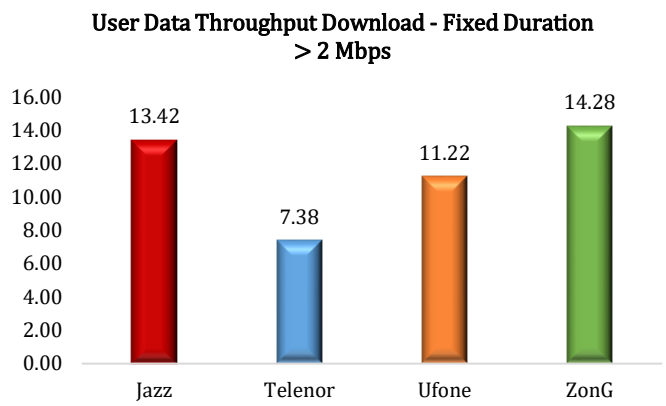
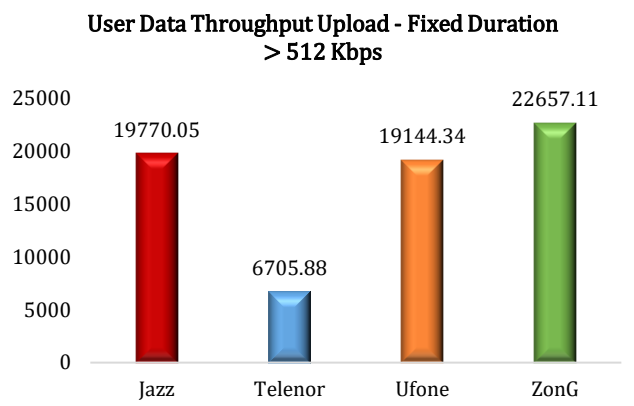
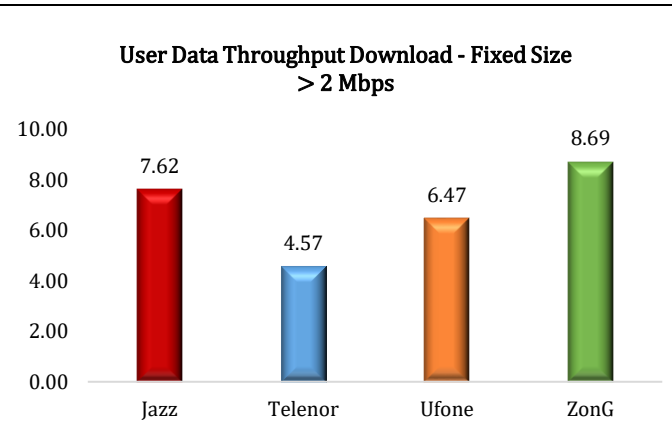
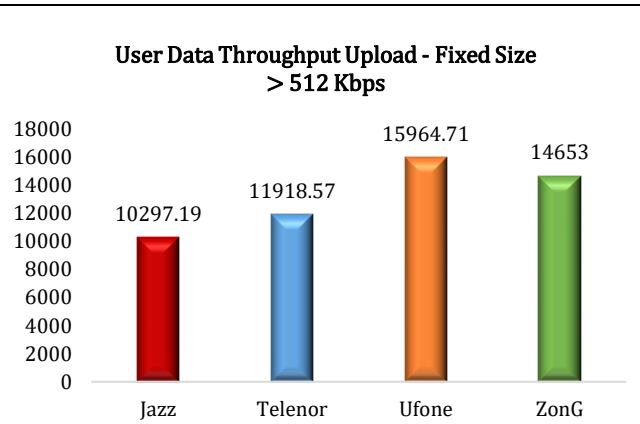


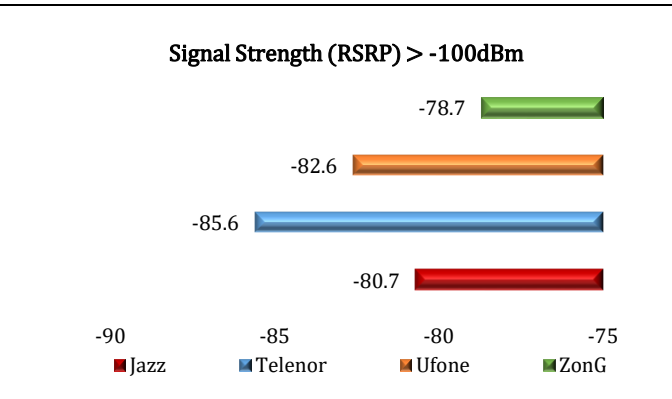
QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – HYDERABAD

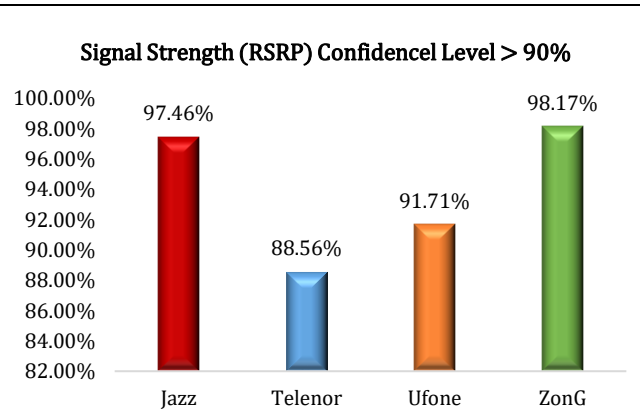


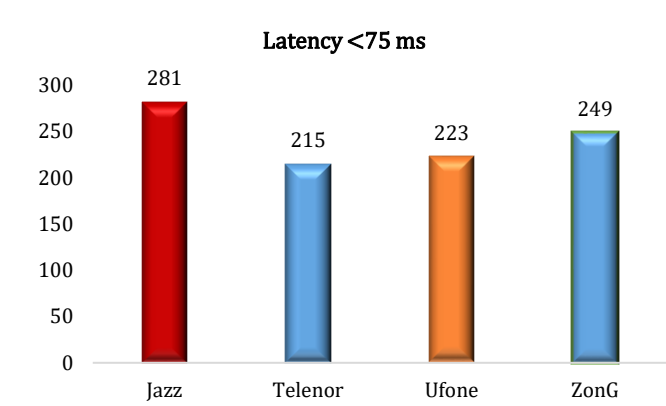


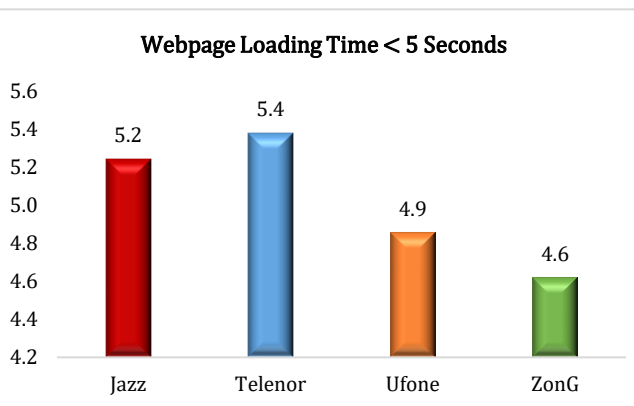












QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – KARACHI EAST

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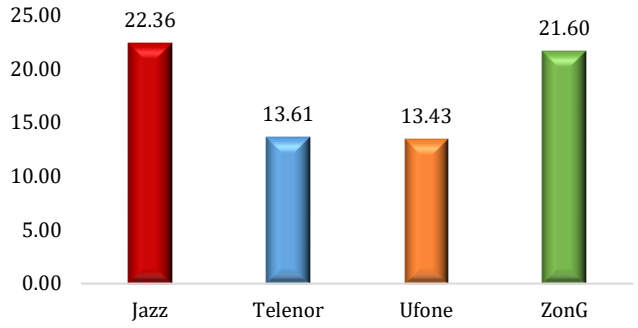
> 2 Mbps



User Data Throughput Upload - Fixed Duration
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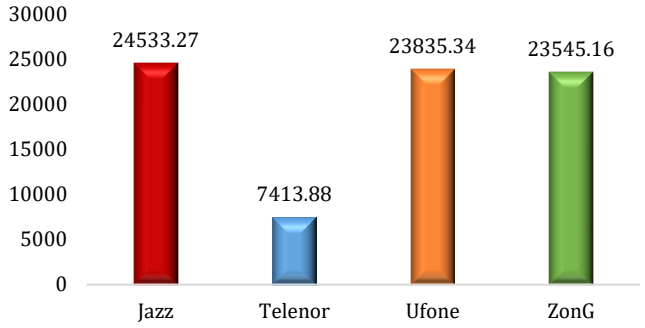

User Data Throughput Download - Fixed Size
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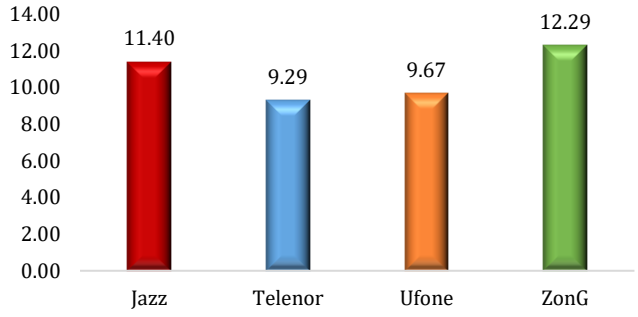

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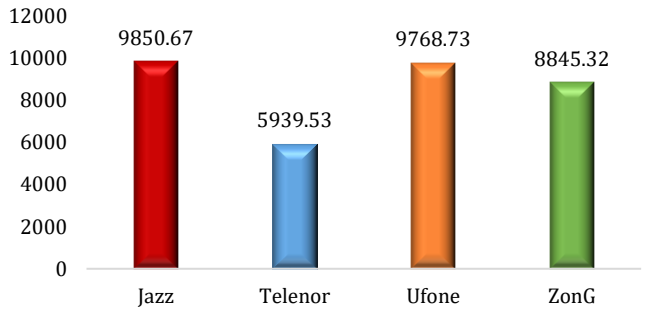
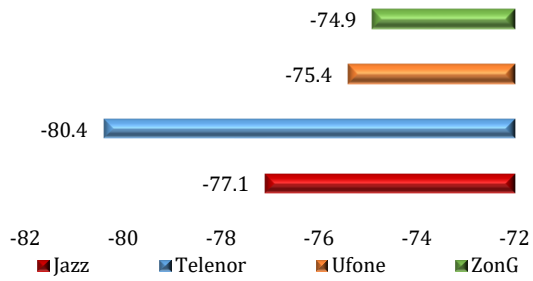
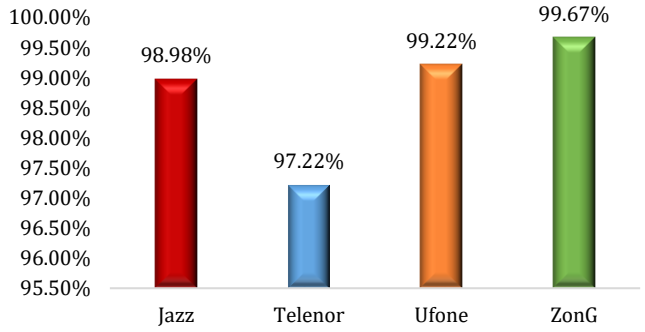


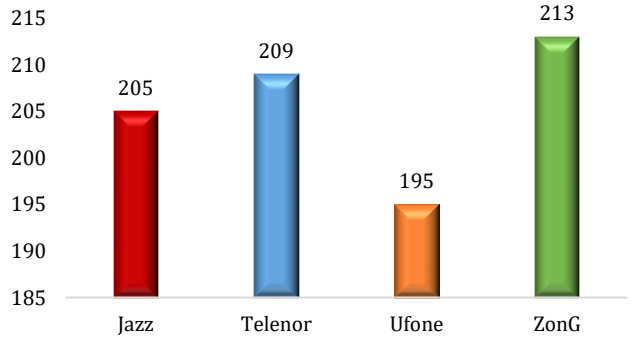
Signal Strength (RSRP) > -100dBm



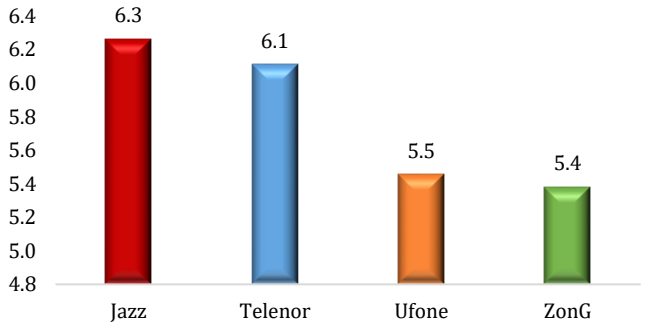
Signal Strength (RSRP) Confidencel Level > 90%



Latency <75 ms

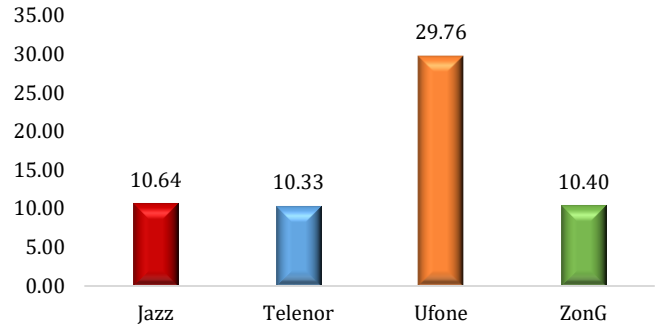


Webpage Loading Time < 5 Seconds



QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – PAKPATTAN

User Data Throughput Download - Fixed Duration
> 2 Mbps



User Data Throughput Upload - Fixed Duration
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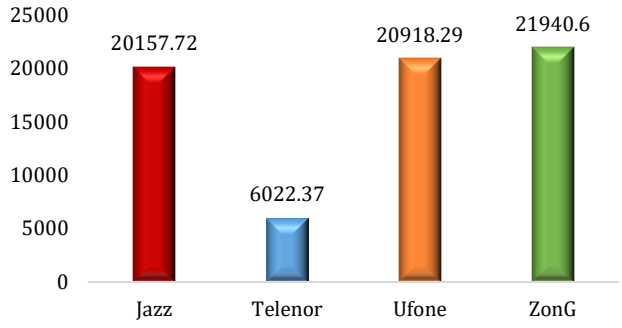

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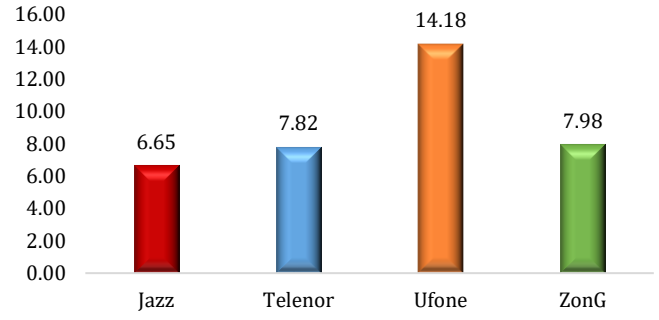

User Data Throughput Upload - Fixed Size
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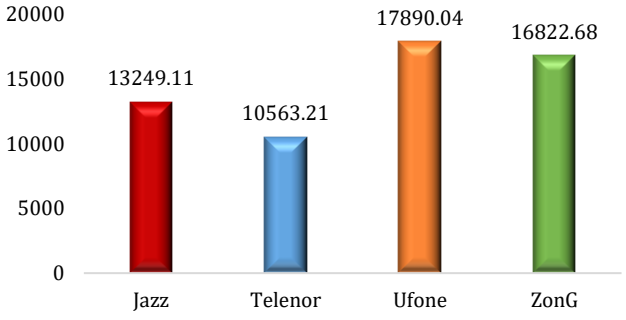
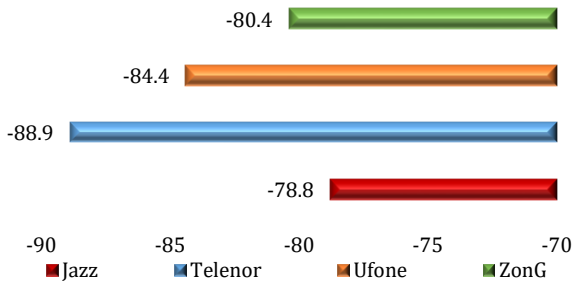
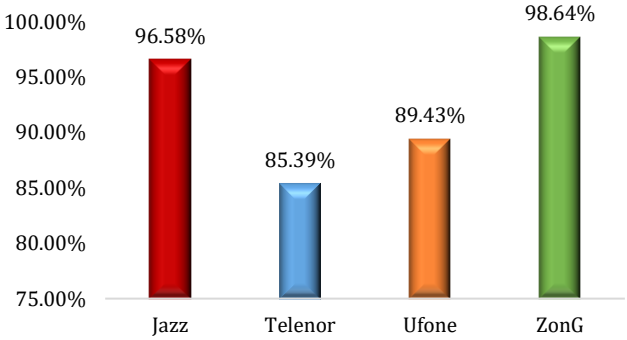


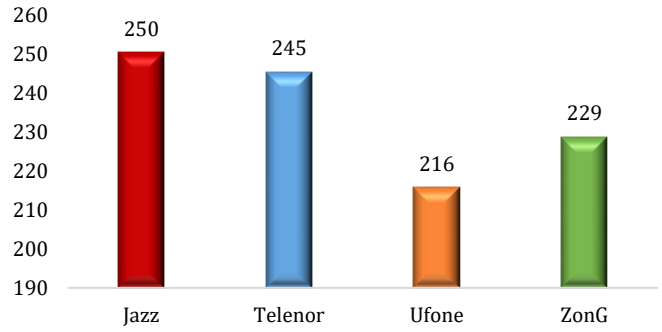
Signal Strength (RSRP) > -100dBm



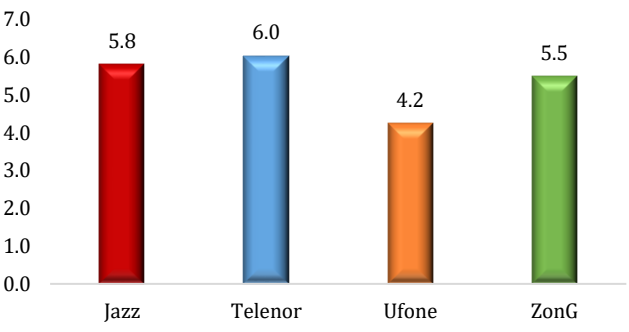
Signal Strength (RSRP) Confidencel Level > 90%



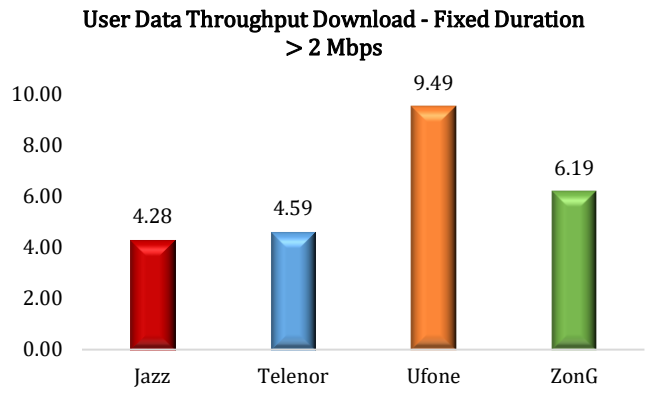
Latency <75 ms

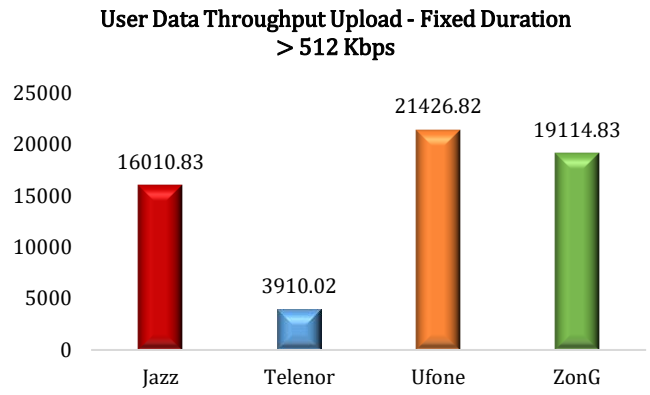


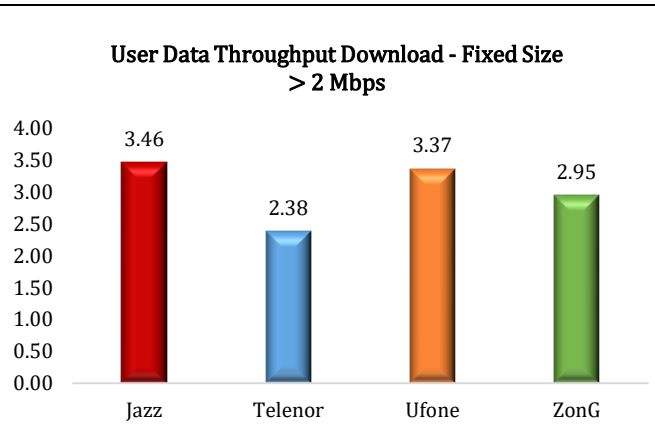
Webpage Loading Time < 5 Seconds

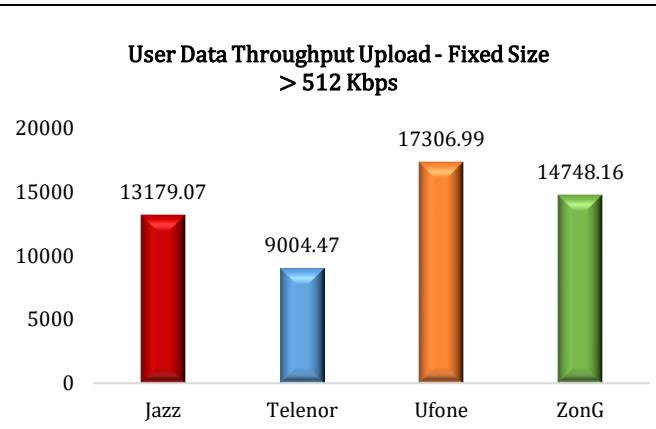


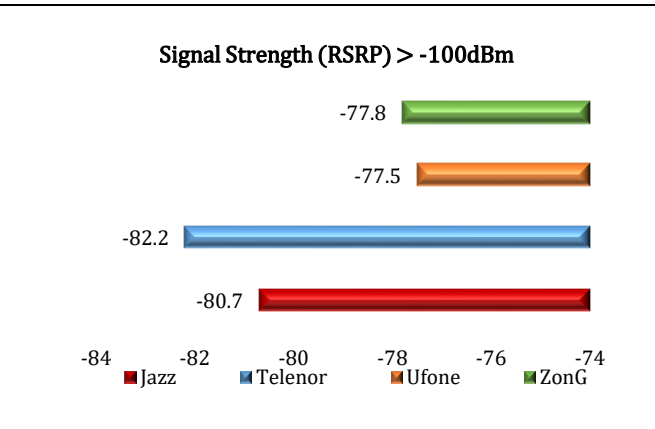
QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – KHANPUR

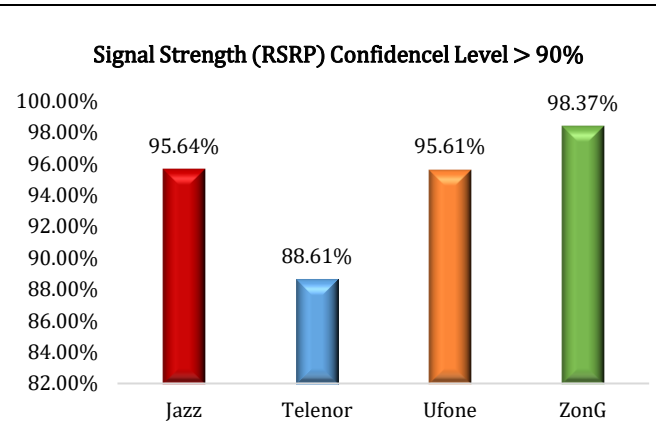


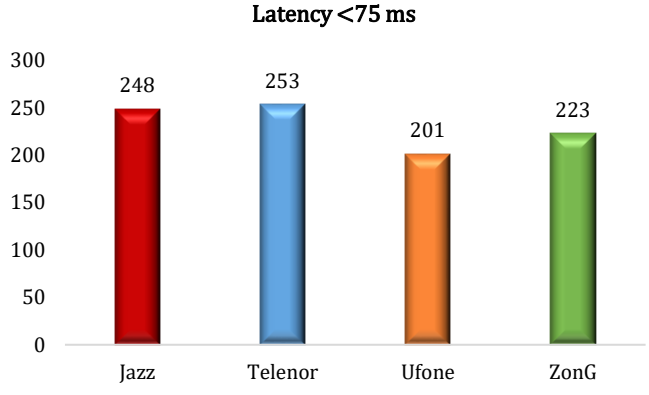


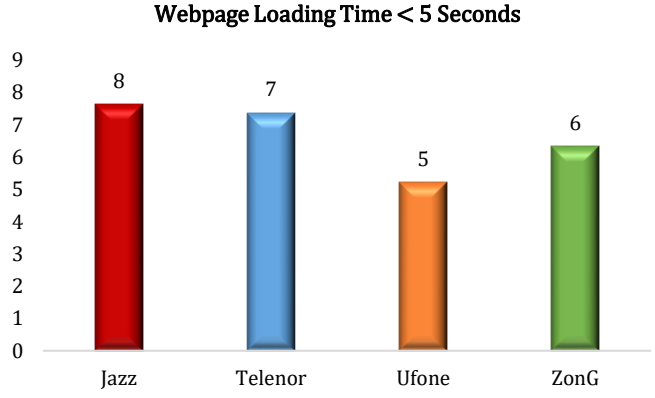




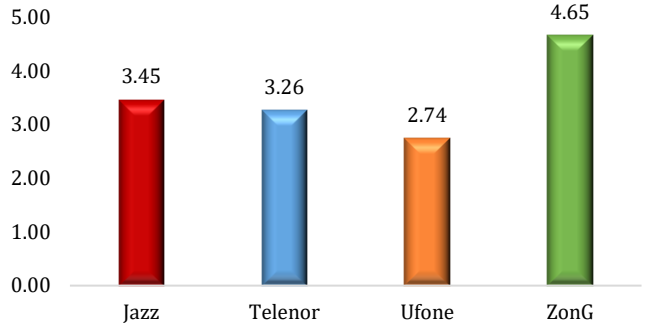


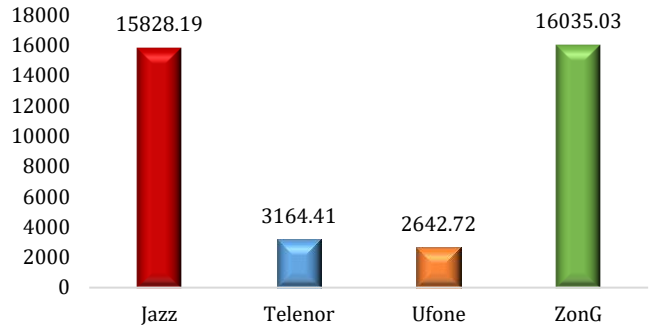


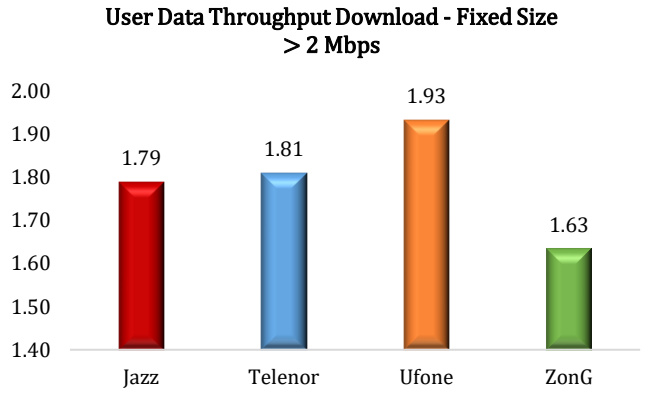


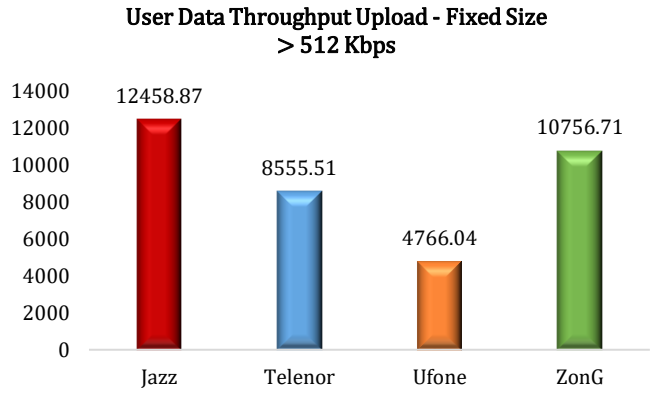


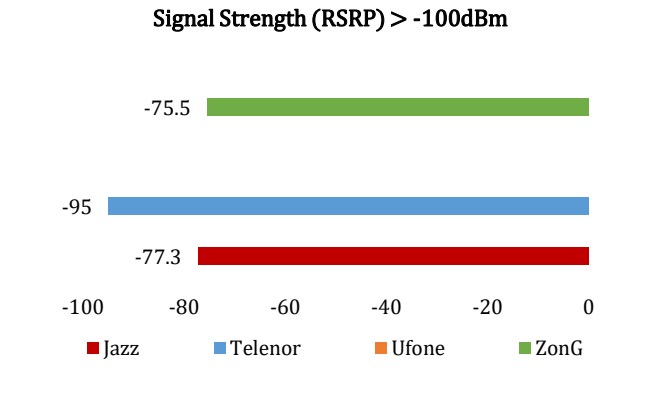
QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – LODHRAN

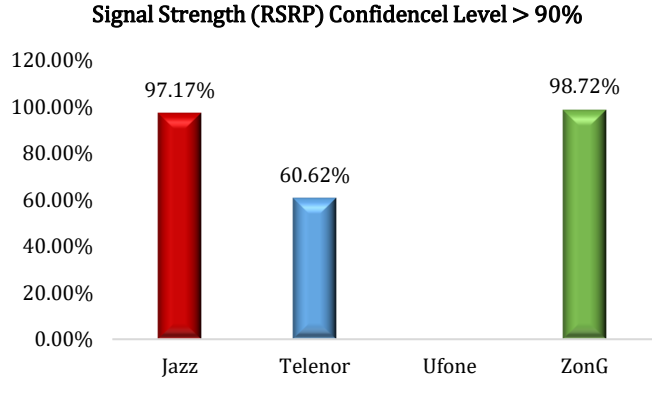


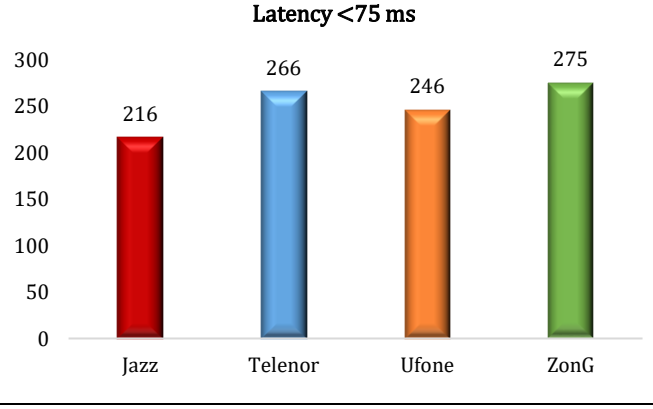


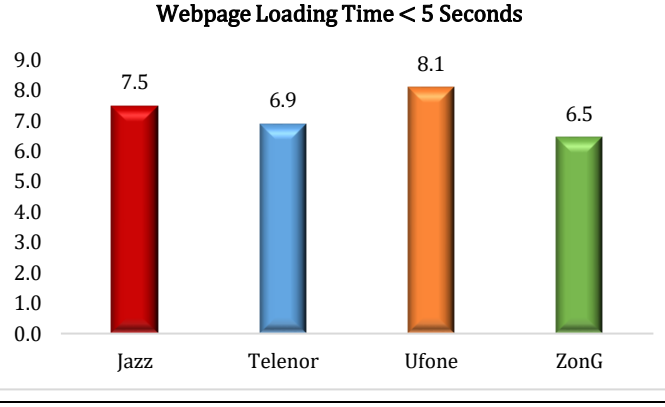




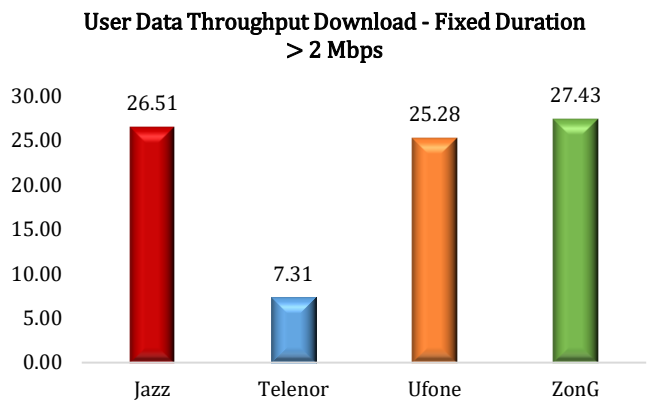


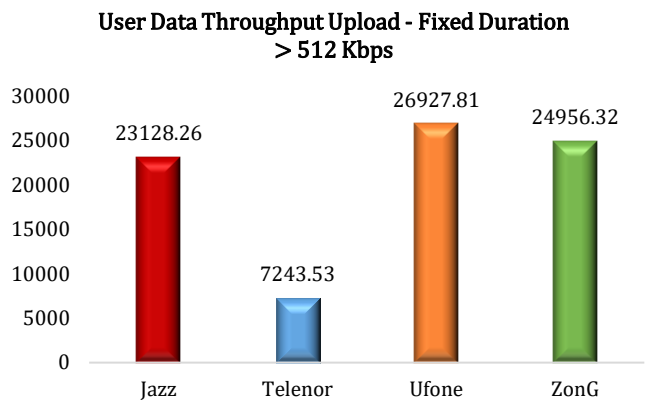


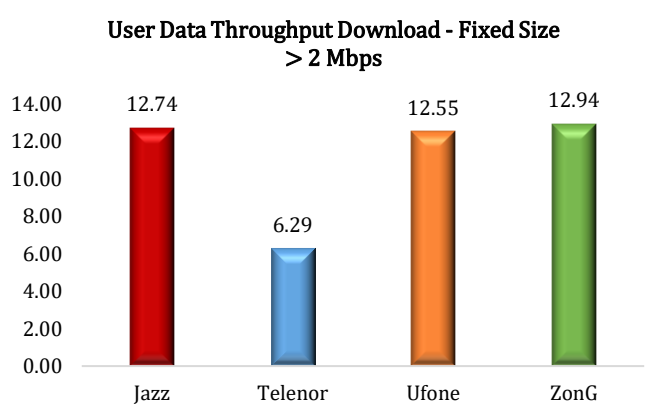


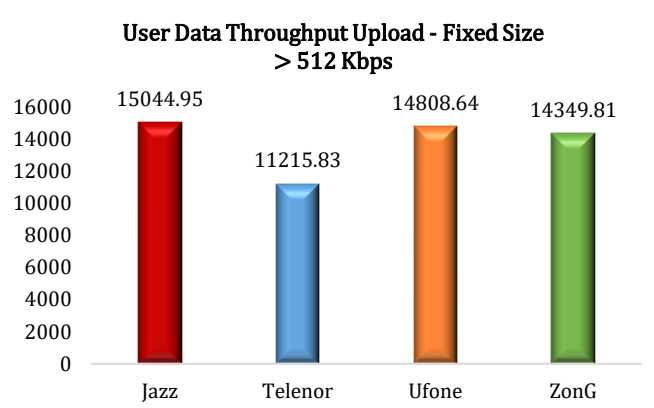


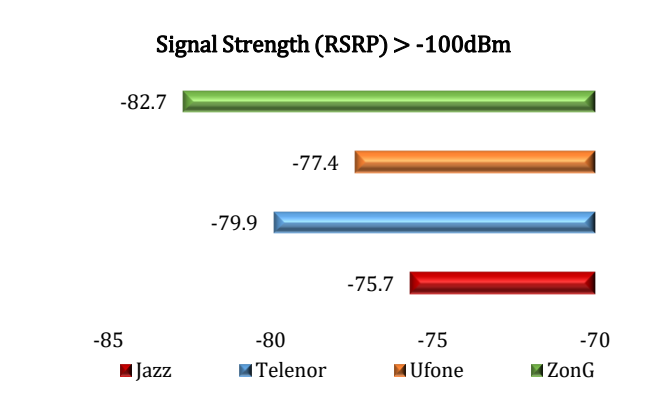
QUALITY OF SERVICE SURVEY RESULTS (AUTOMODE) – WAZIRABAD

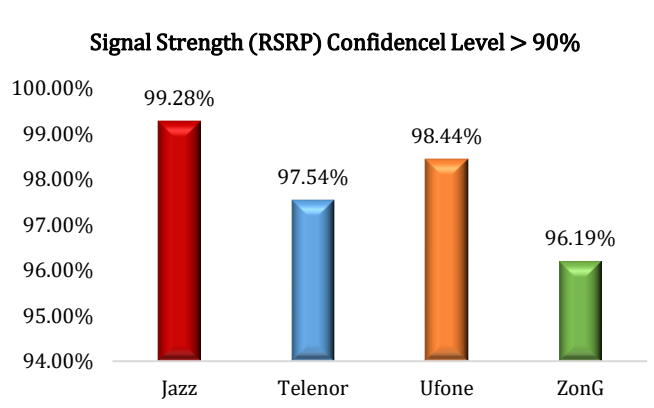


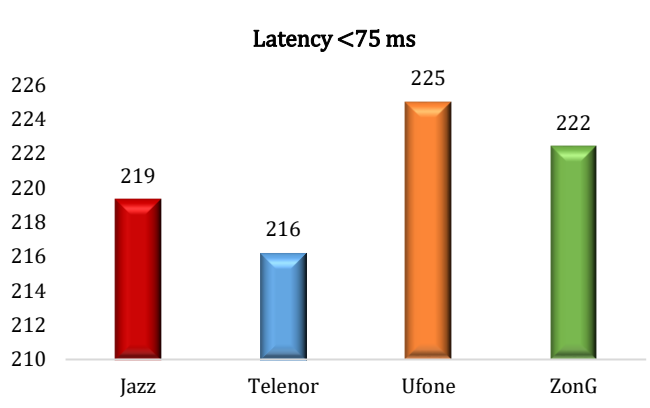


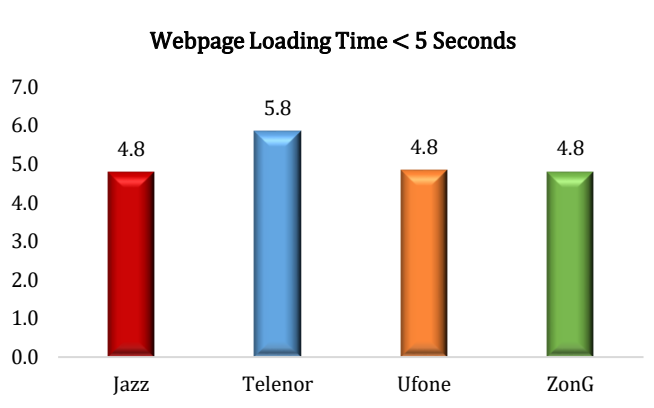








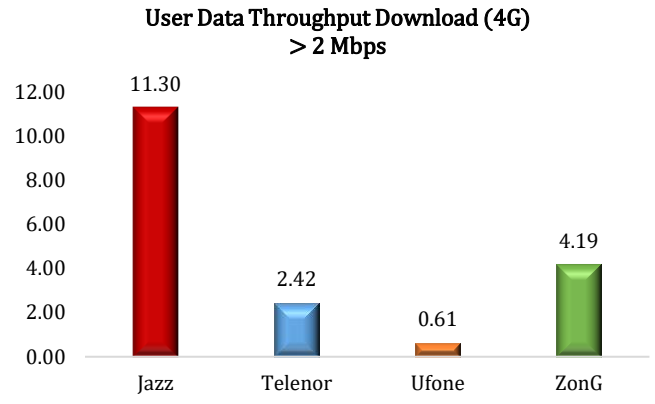


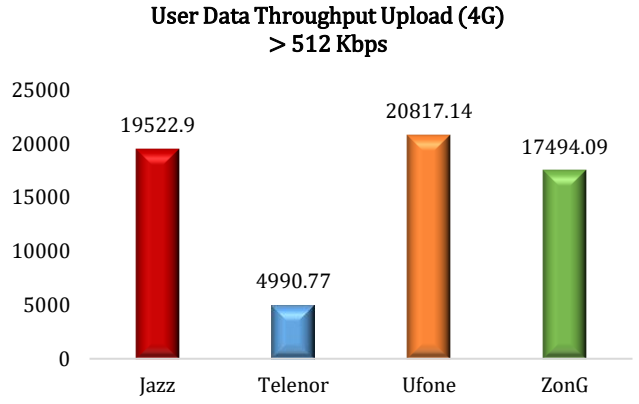


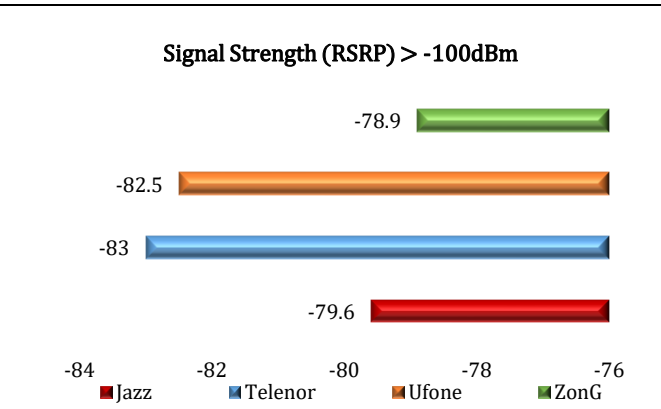
QUALITY OF SERVICE SURVEY RESULTS

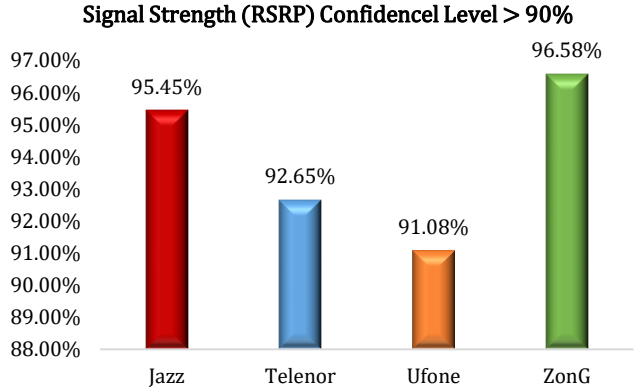
(4G)

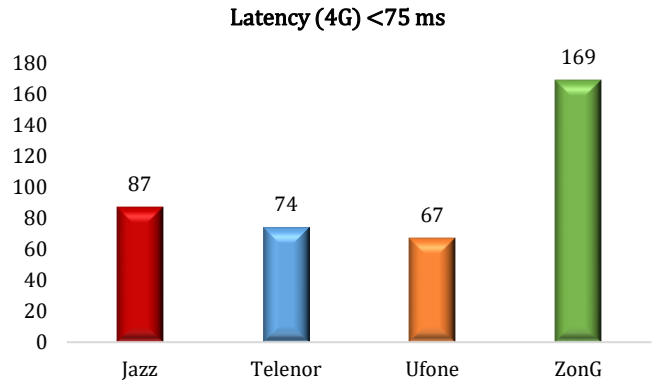
QUALITY OF SERVICE SURVEY RESULTS (4G) – ATTOCK



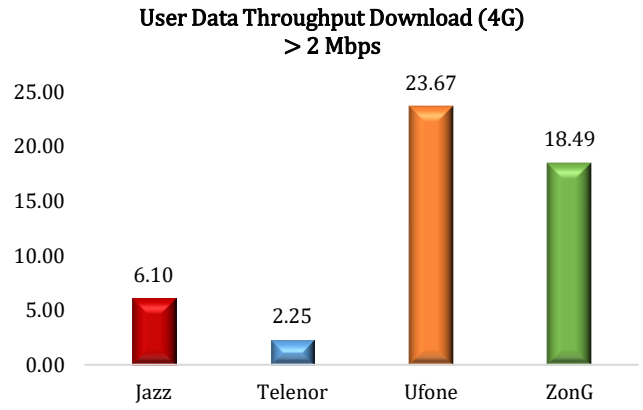


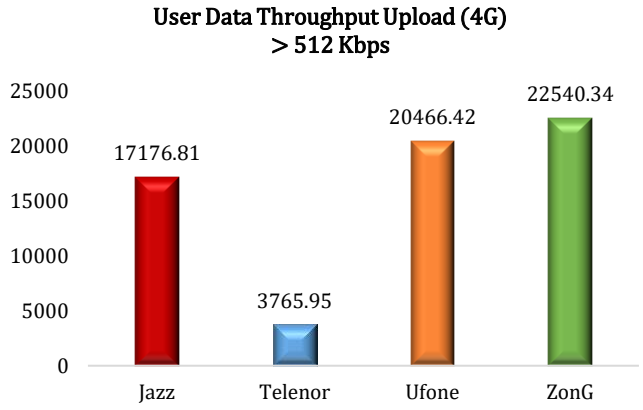


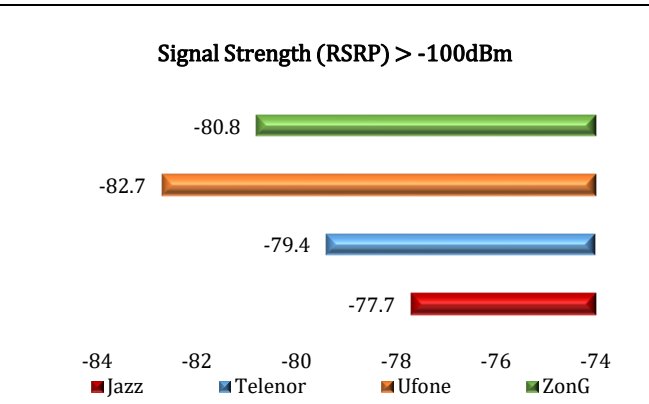


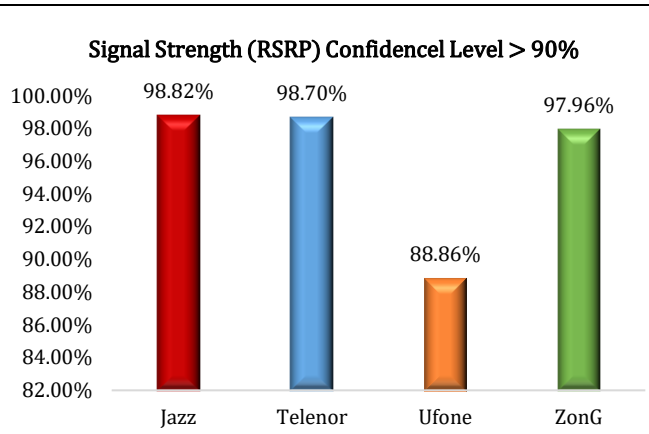


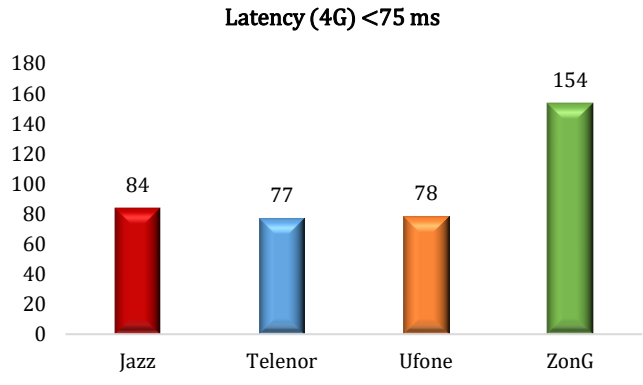
QUALITY OF SERVICE SURVEY RESULTS (4G) – HAFIZABAD



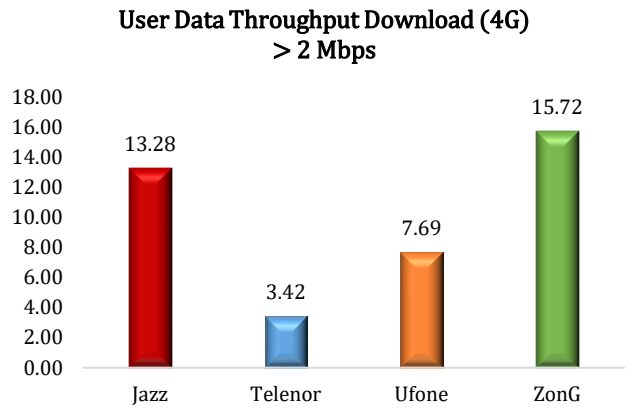


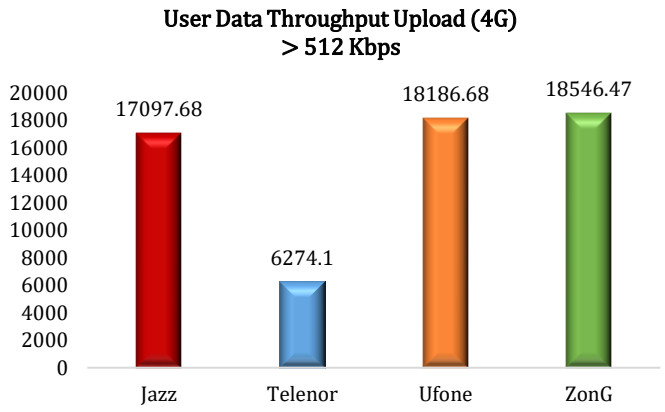


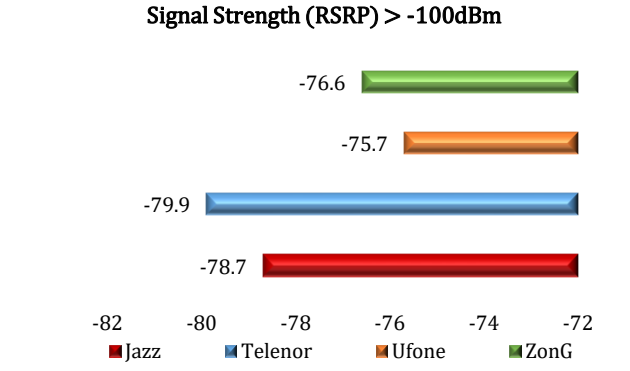


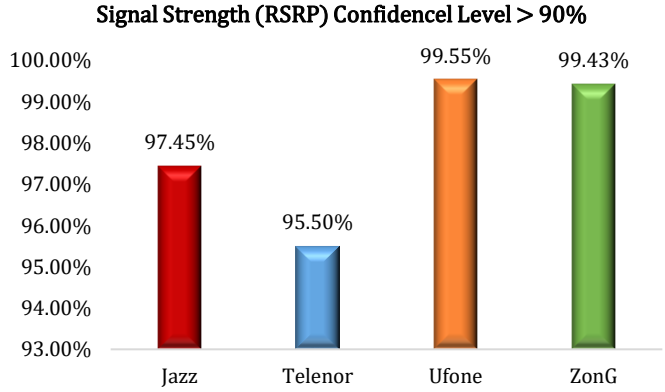


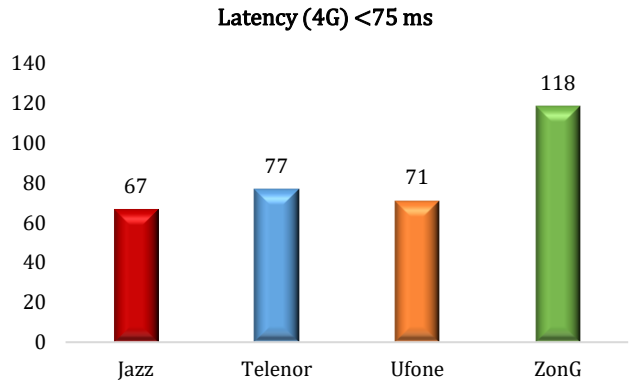
QUALITY OF SERVICE SURVEY RESULTS (4G) – RAWALPINDI



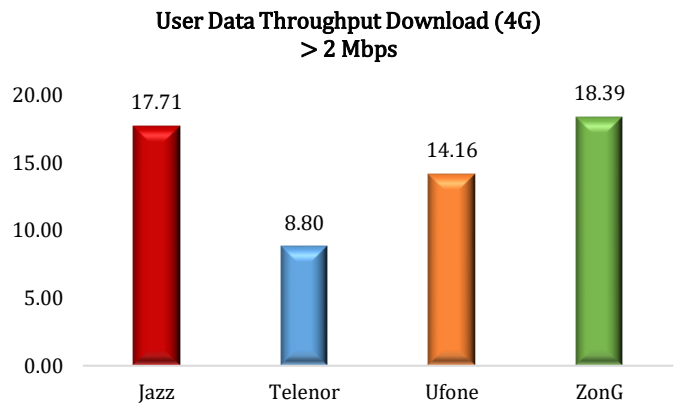


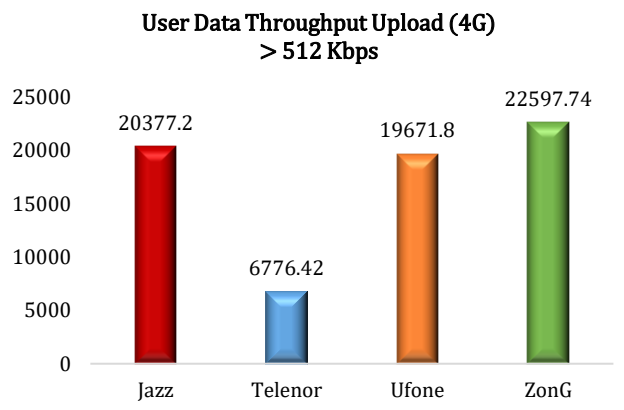


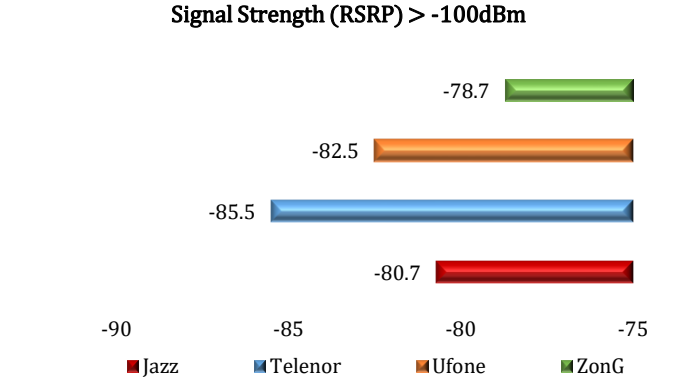


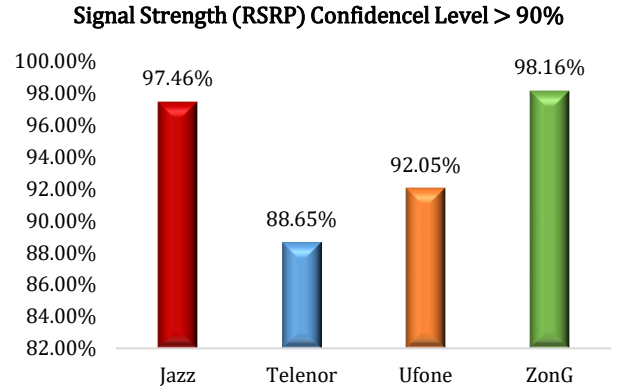


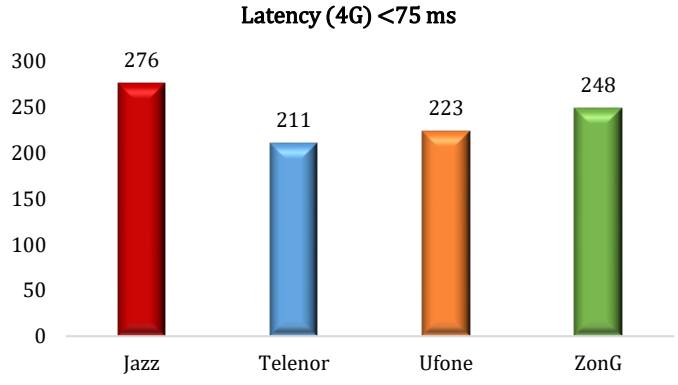
QUALITY OF SERVICE SURVEY RESULTS (4G) – HYDERABAD





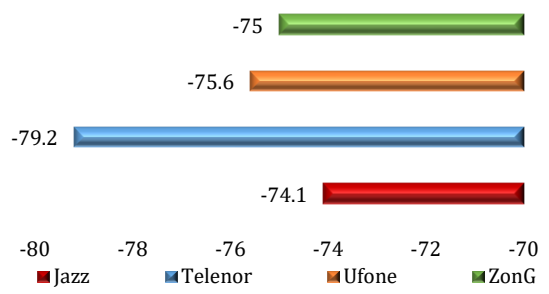




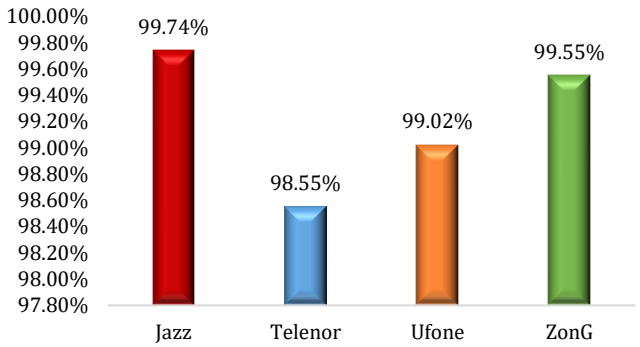


QUALITY OF SERVICE SURVEY RESULTS (4G) – KARACHI EAST

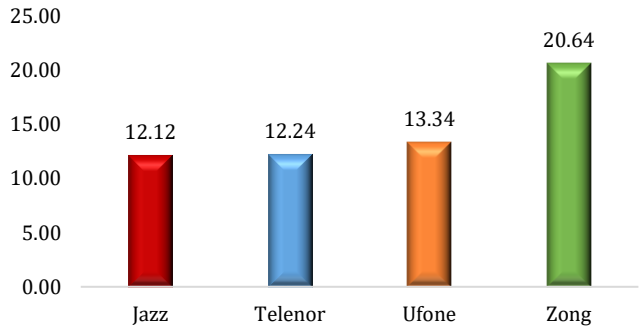
Signal Strength (RSRP) > -100dBm



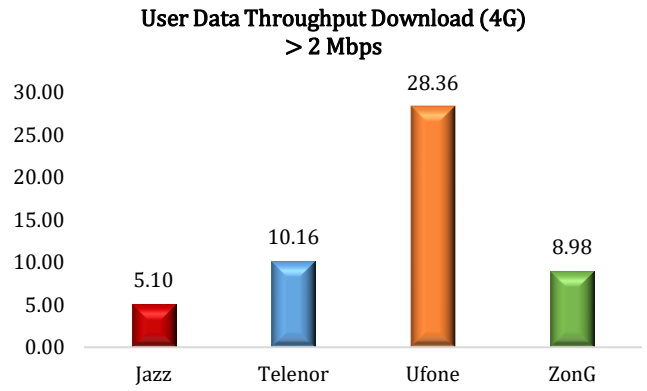
Signal Strength (RSRP) Confidencel Level > 90%

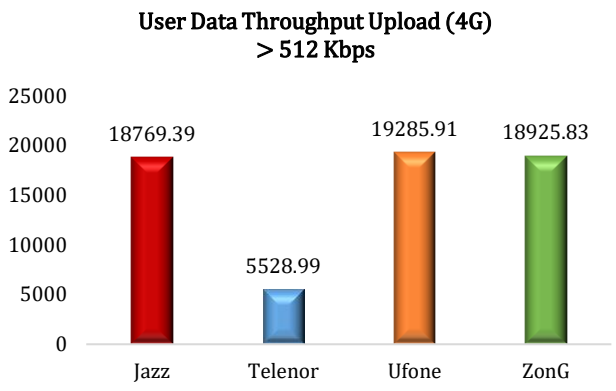


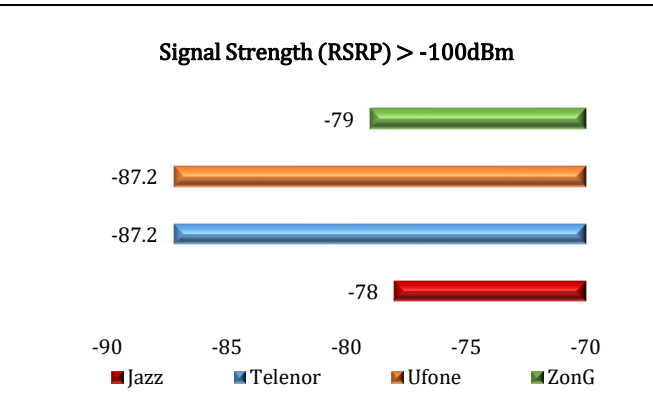
User Data Throughput Download (4G) > 2 Mbps

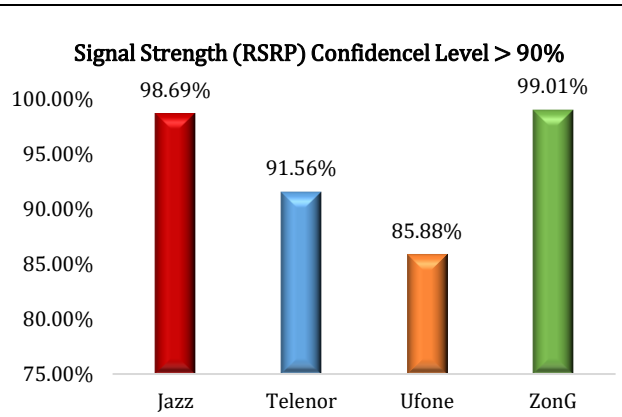


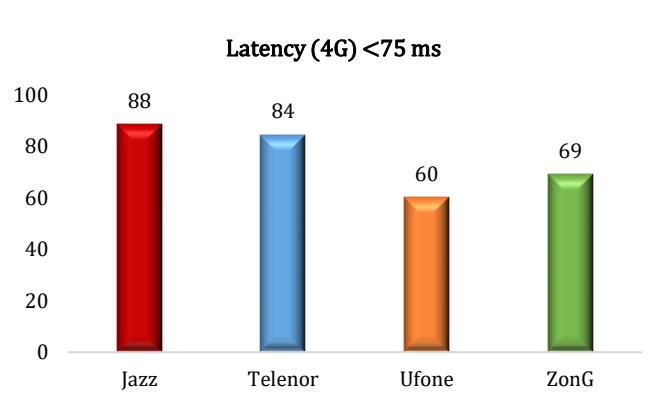
QUALITY OF SERVICE SURVEY RESULTS (4G) – PAKPATTAN



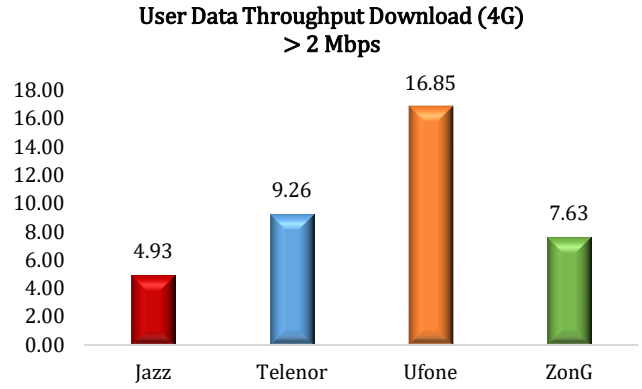


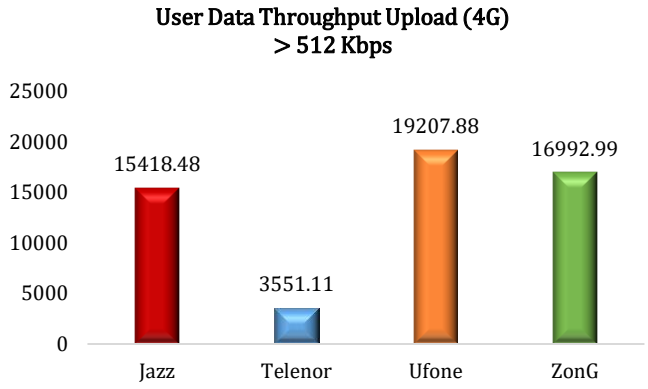


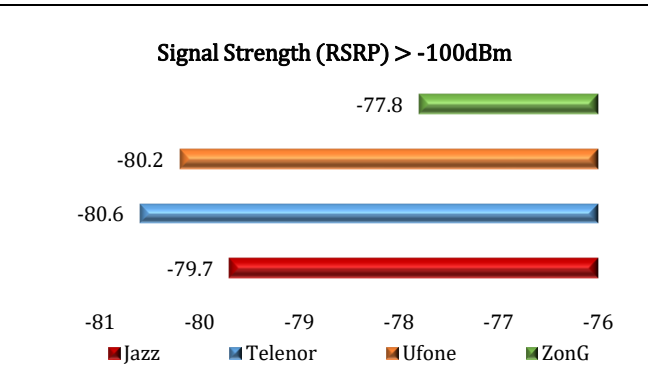


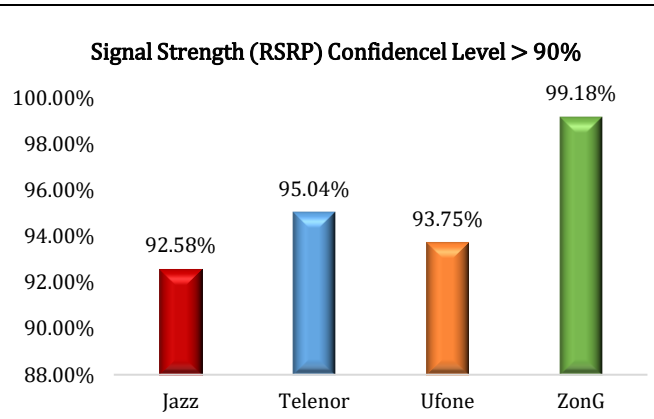


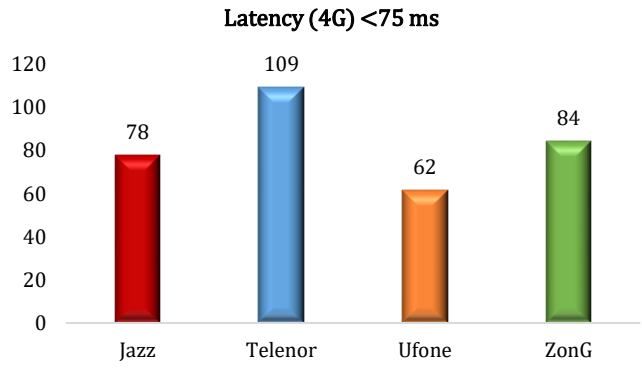
QUALITY OF SERVICE SURVEY RESULTS (4G) – KHANPUR



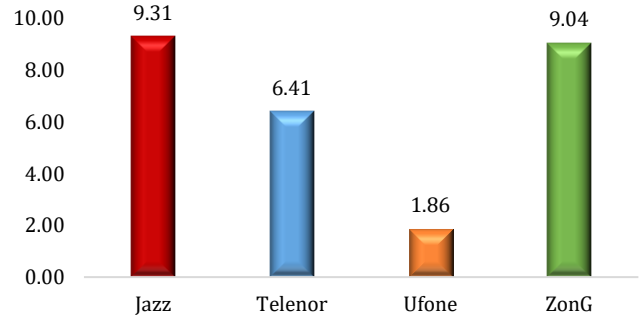


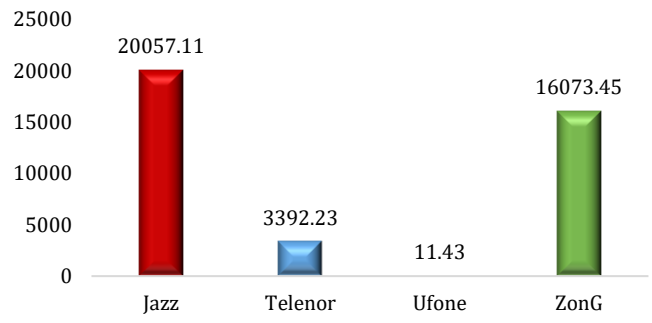


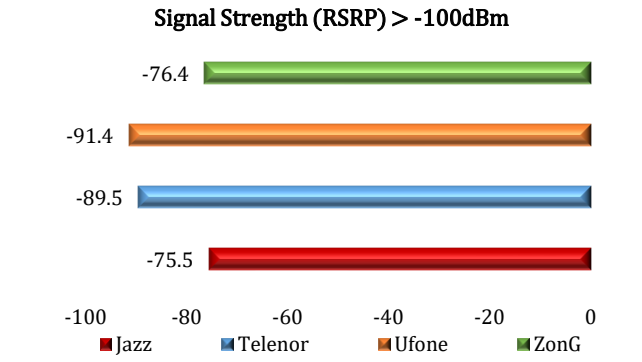


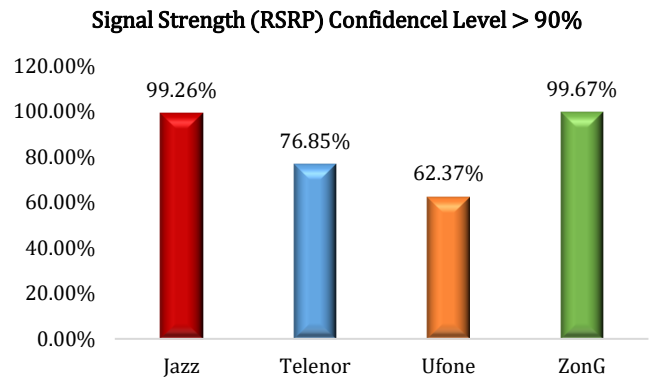


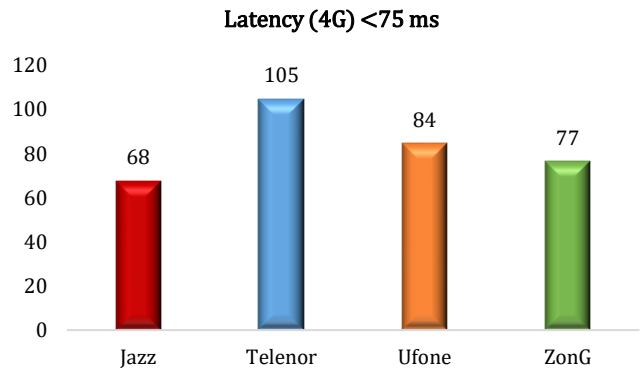
QUALITY OF SERVICE SURVEY RESULTS (4G) – LODHRAN





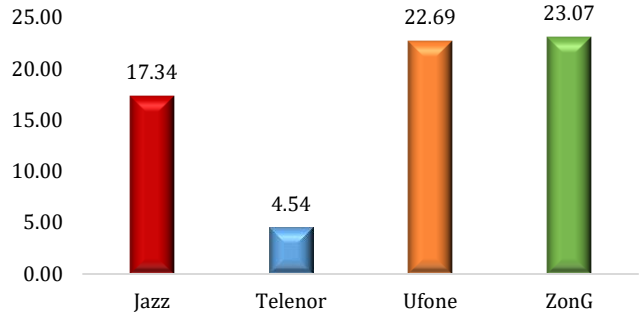




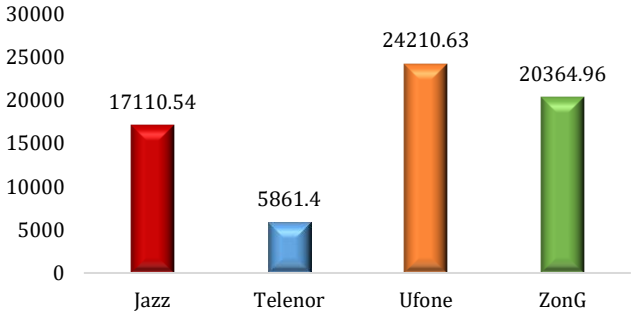


QUALITY OF SERVICE SURVEY RESULTS (4G) – WAZIRABAD

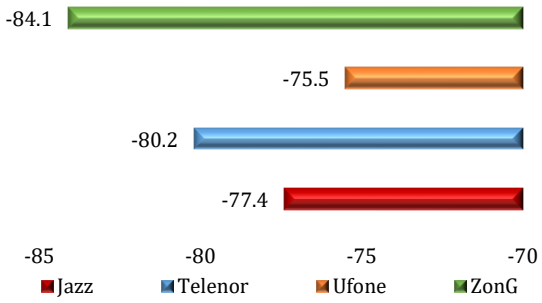
User Data Throughput Download (4G)
> 2 Mbps



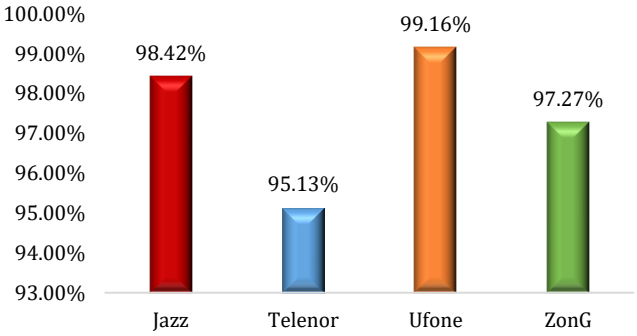
User Data Throughput Upload (4G)
> 512 Kbps



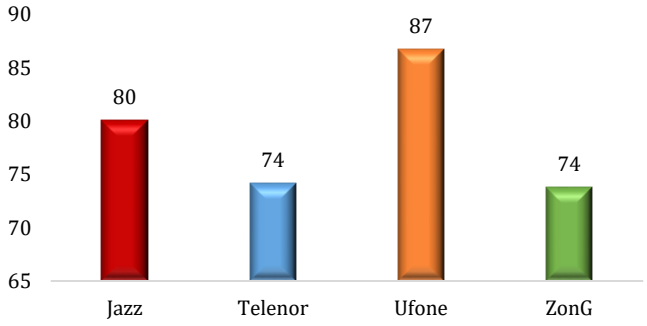
Signal Strength (RSRP) > -100dBm



Signal Strength (RSRP) Confidencel Level > 90%



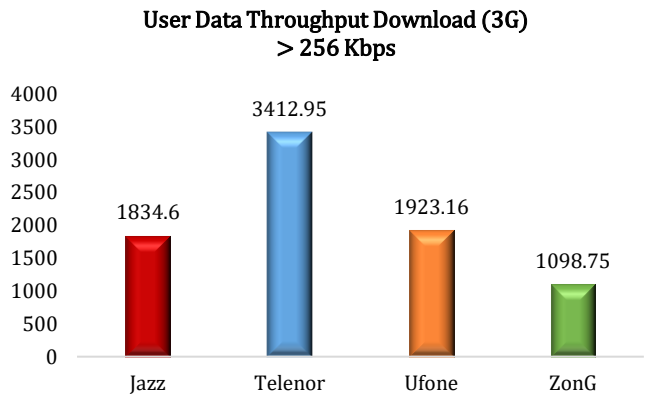
Latency (4G) <75 ms

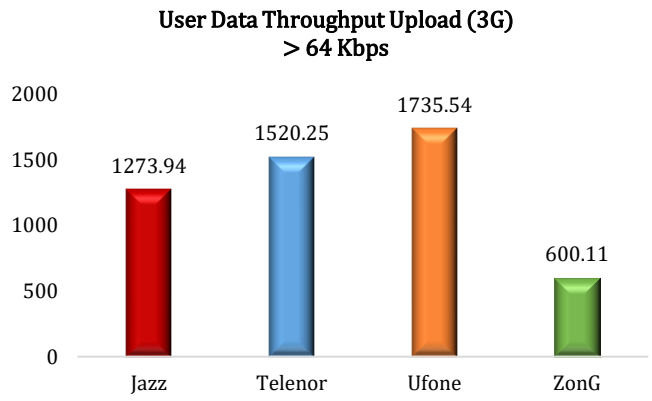


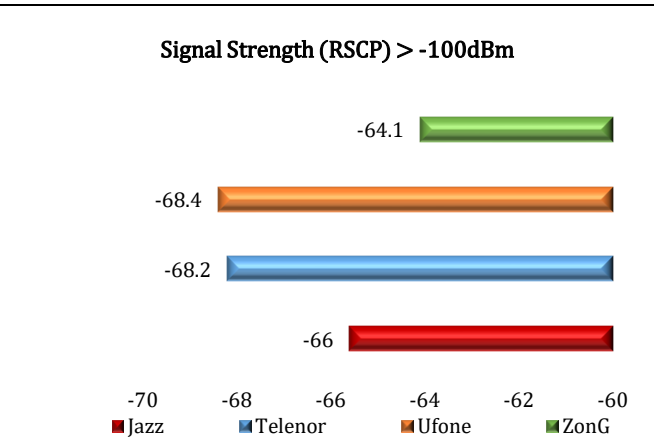
QUALITY OF SERVICE SURVEY RESULTS

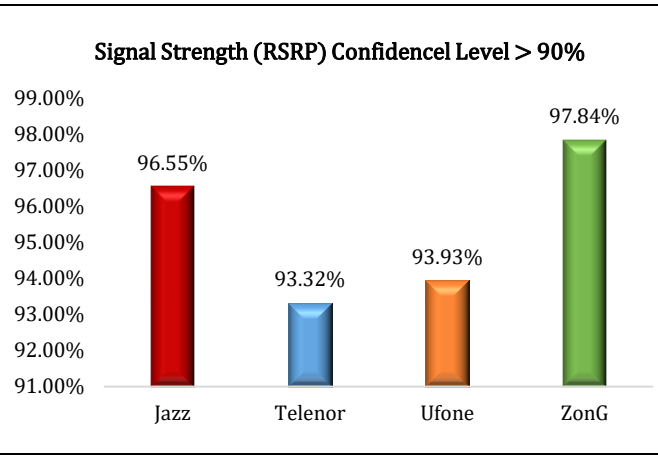
(3G)

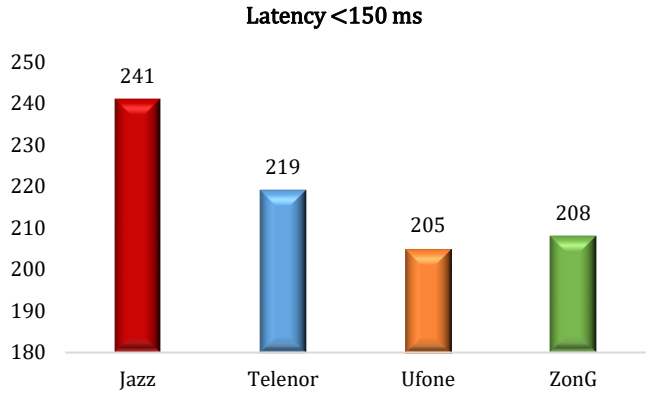
QUALITY OF SERVICE SURVEY RESULTS (3G) – ATTOCK



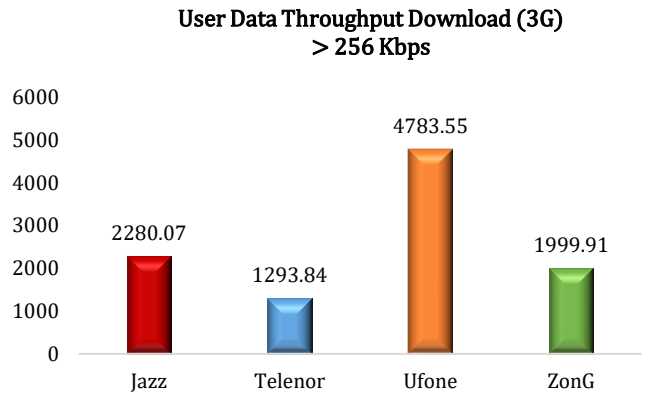


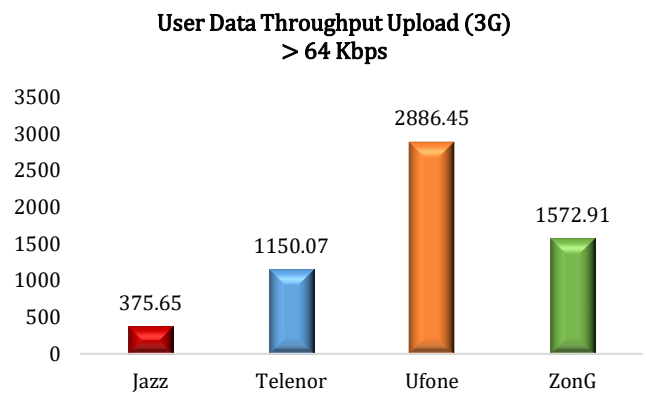


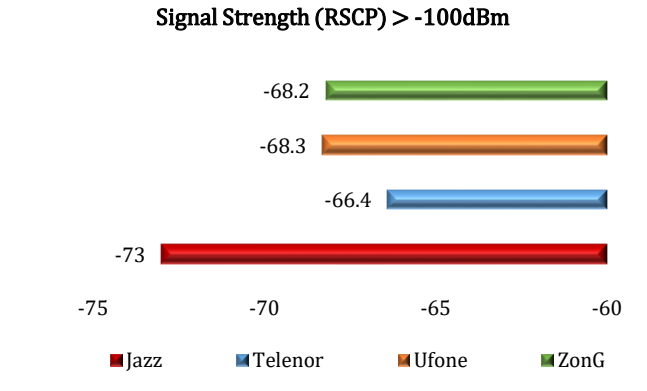


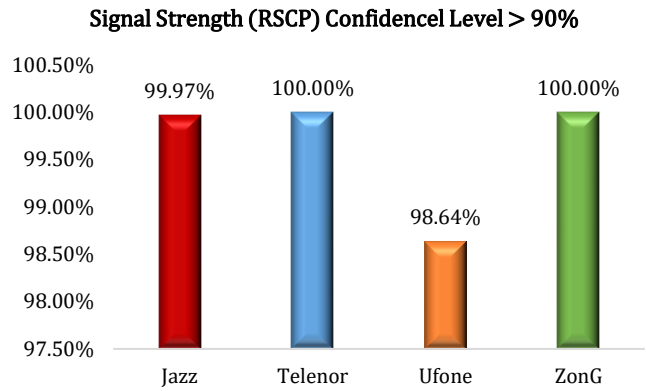


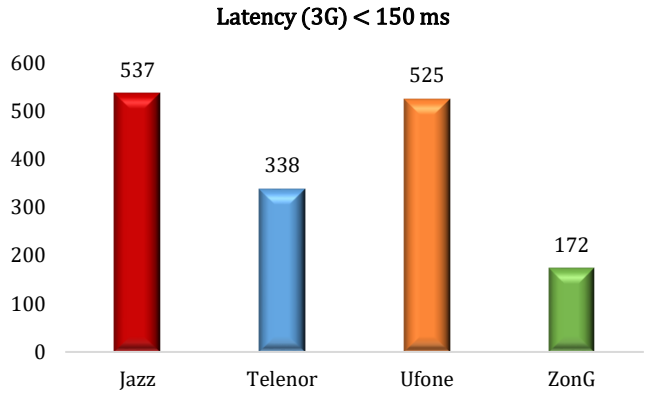
QUALITY OF SERVICE SURVEY RESULTS (3G) – HAFIZABAD



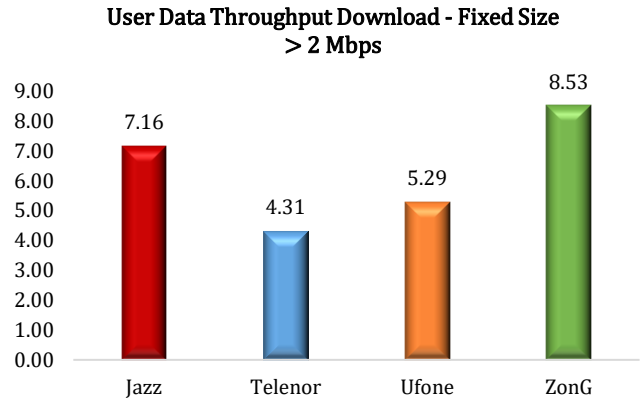


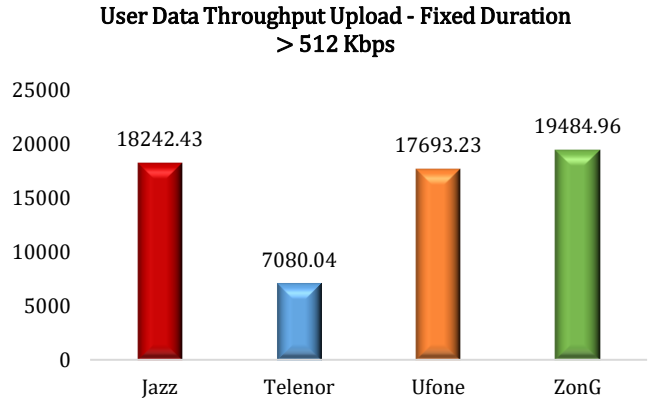


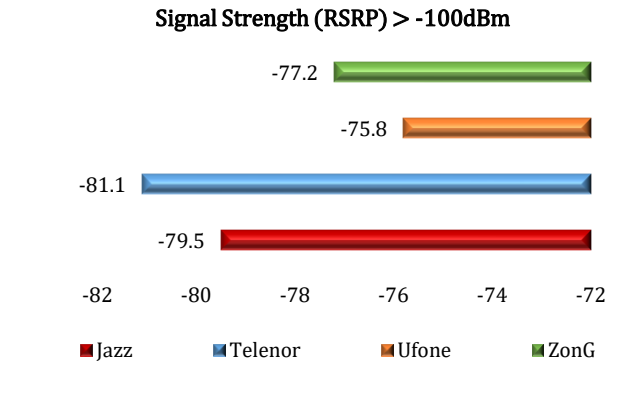


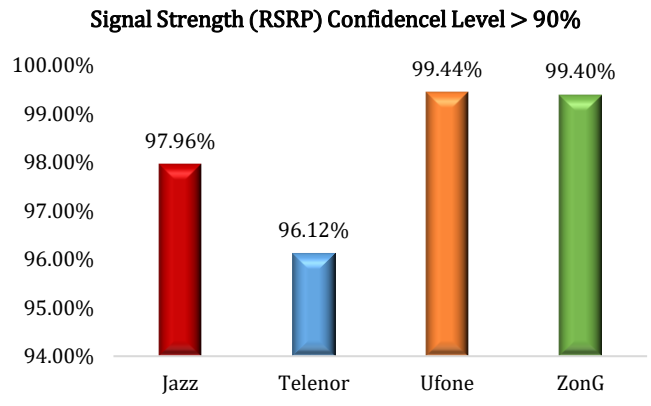


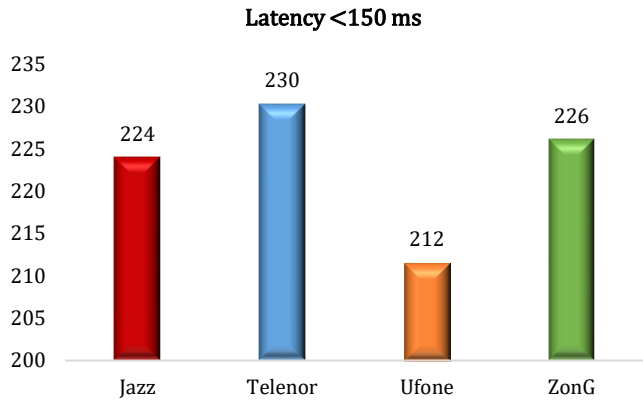
QUALITY OF SERVICE SURVEY RESULTS (3G) – RAWALPINDI



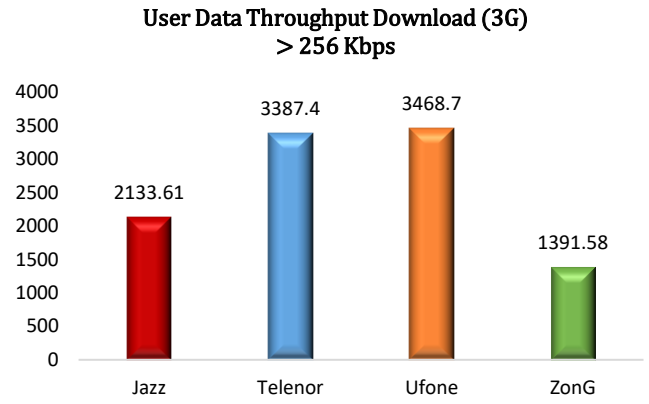


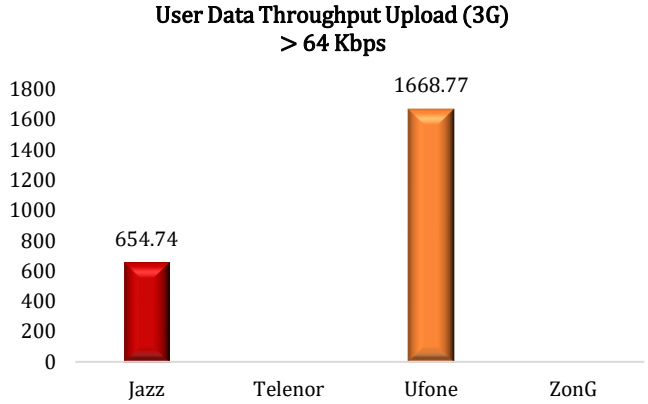


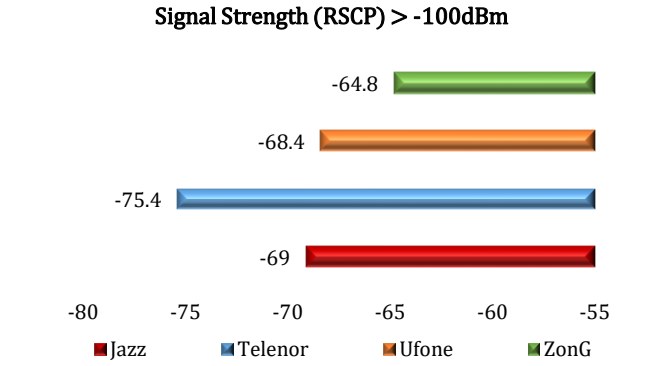


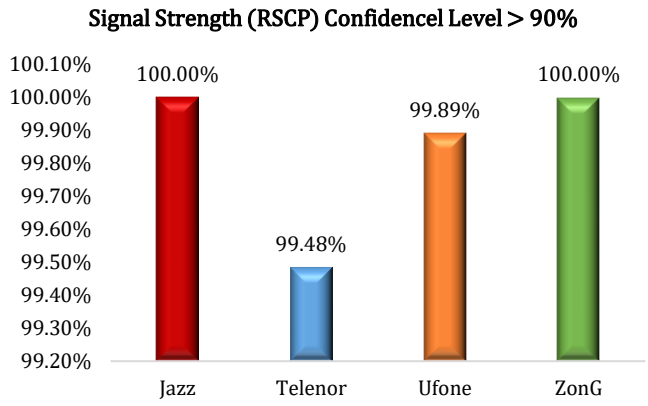


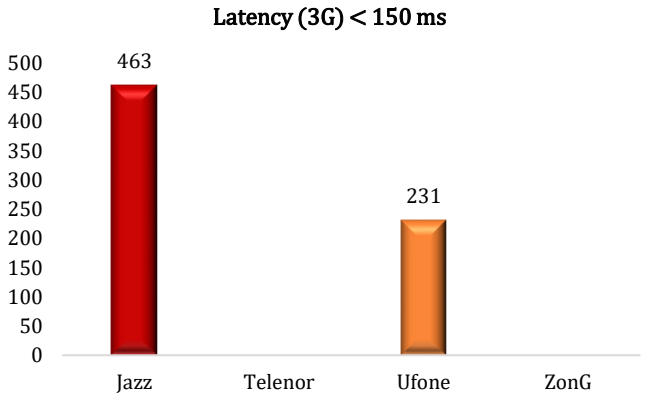
QUALITY OF SERVICE SURVEY RESULTS (3G) – HYDERABAD





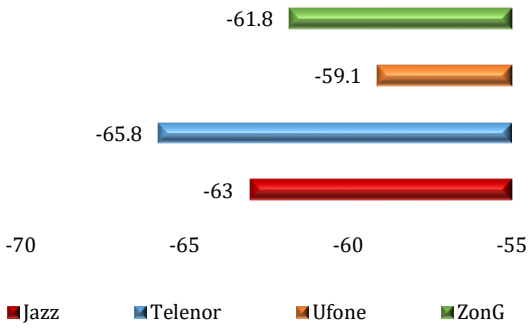




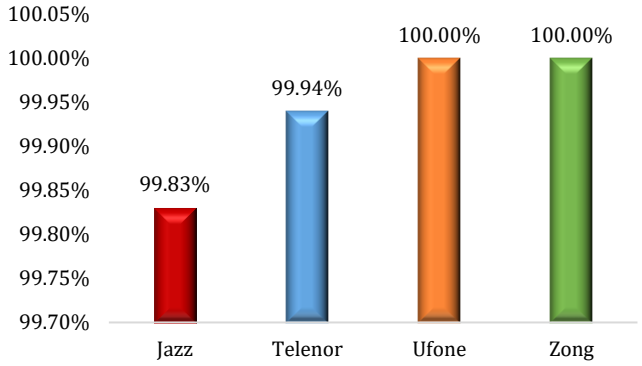


QUALITY OF SERVICE SURVEY RESULTS (3G) – KARACHI EAST

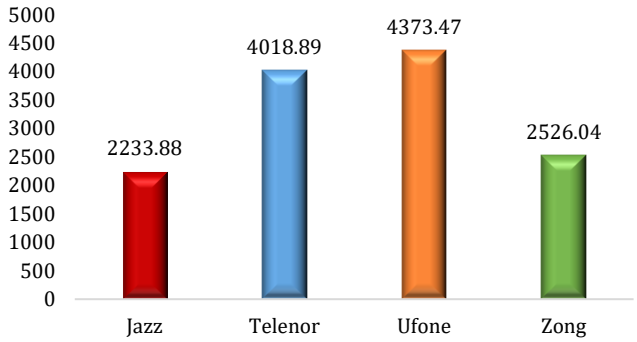
Signal Strength (RSCP) > -100dBm



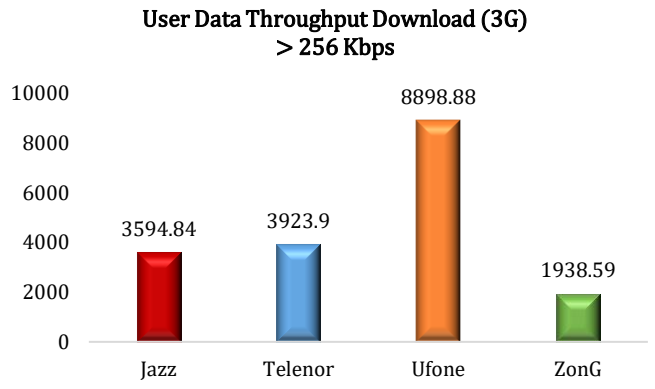
Signal Strength (RSCP) Confidencel Level > 90%

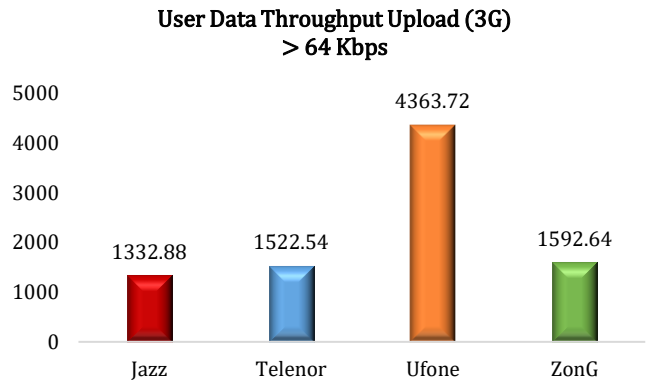


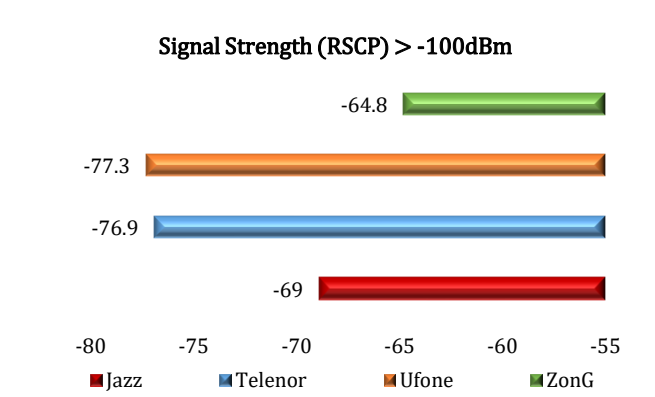
User Data Throughput Download (3G) > 256 Kbps

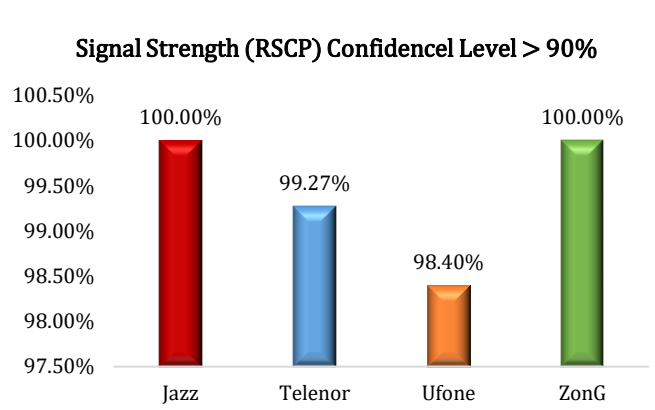


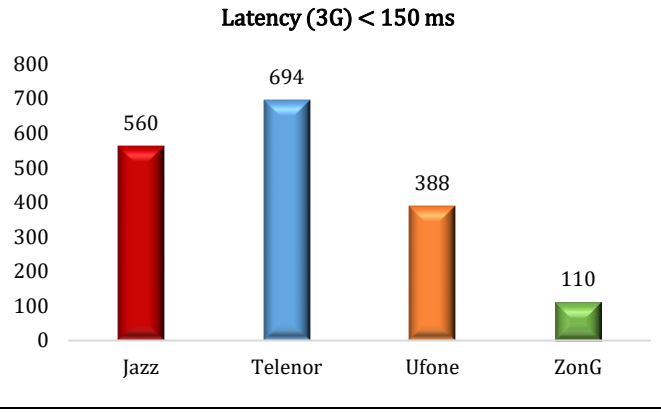
QUALITY OF SERVICE SURVEY RESULTS (3G) – PAKPATTAN



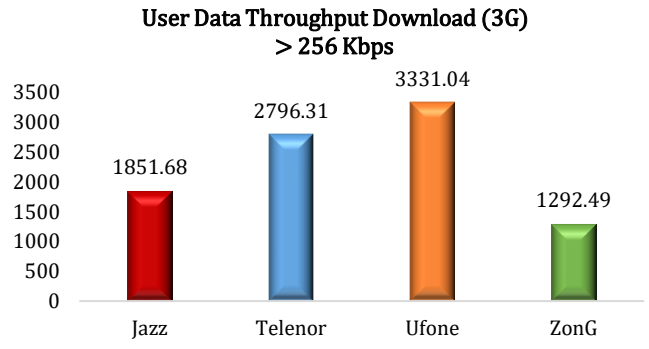


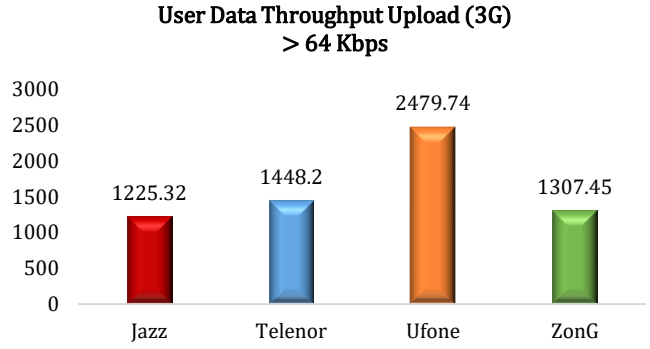


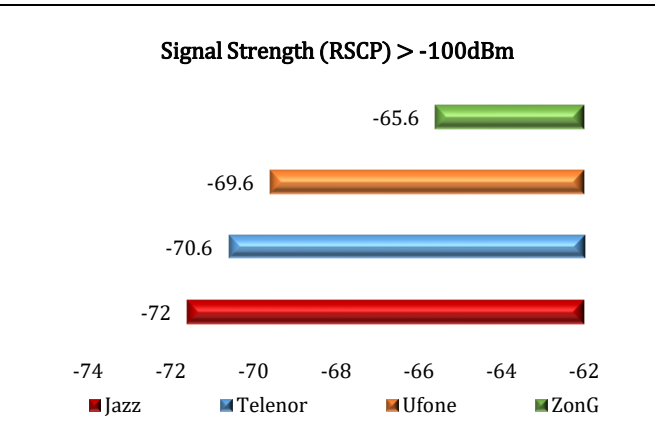


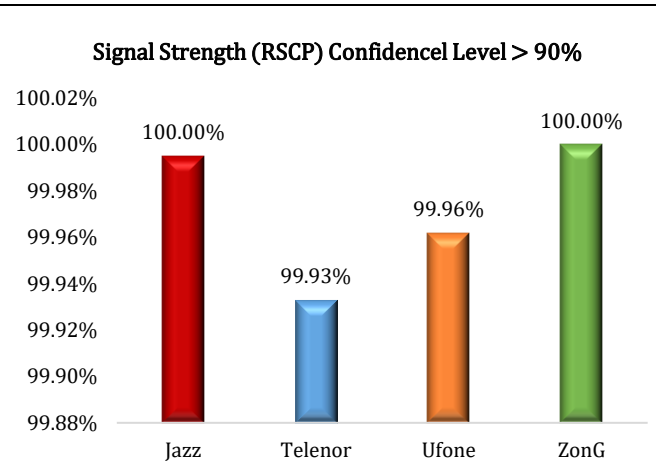


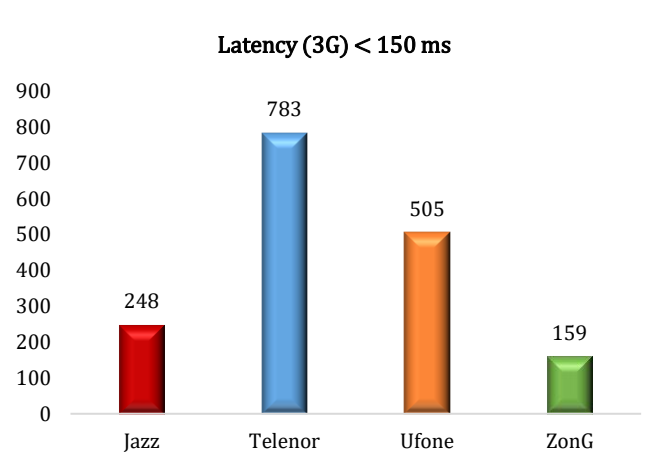
QUALITY OF SERVICE SURVEY RESULTS (3G) – KHANPUR



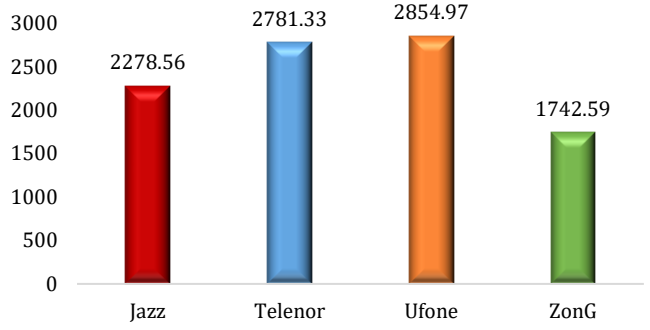


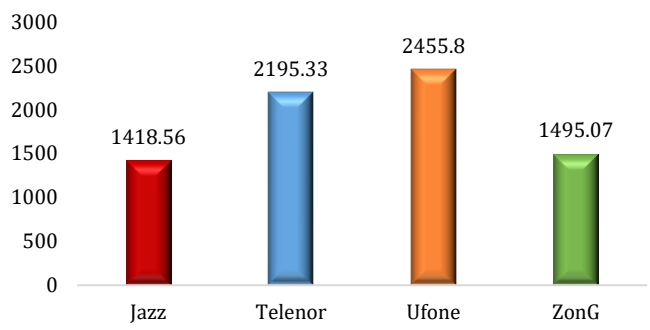


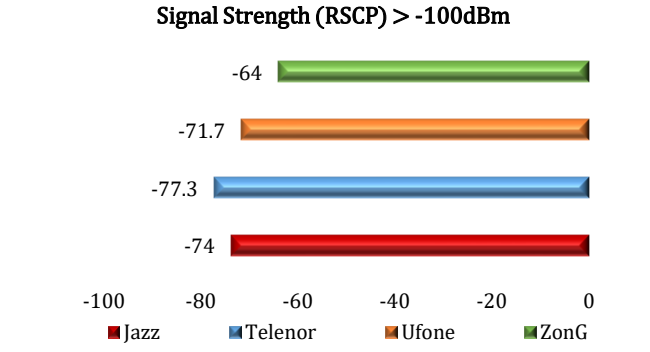


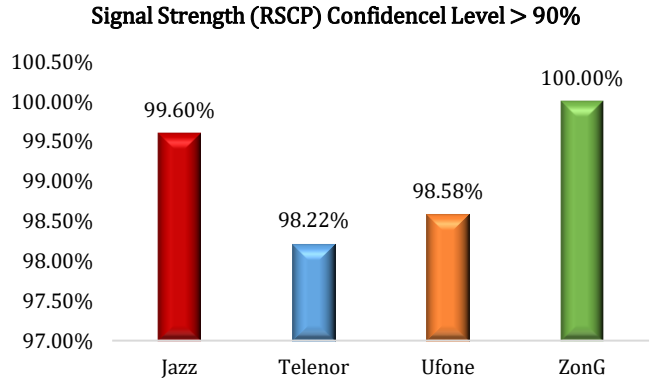


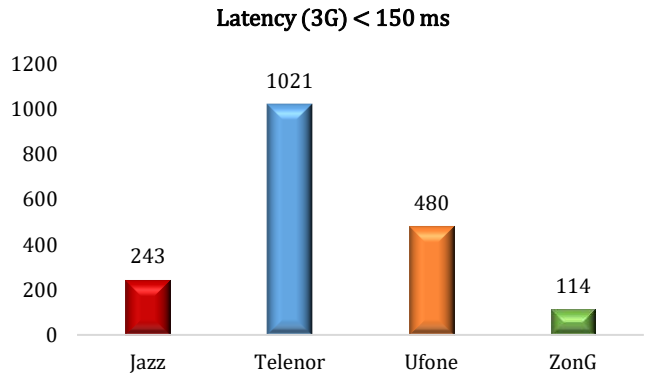
QUALITY OF SERVICE SURVEY RESULTS (3G) – LODHRAN



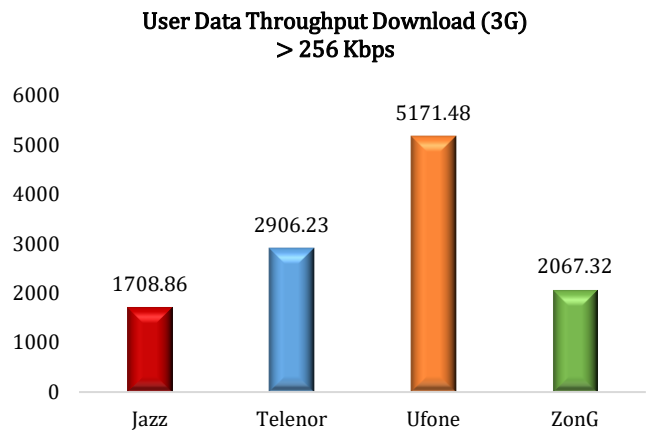


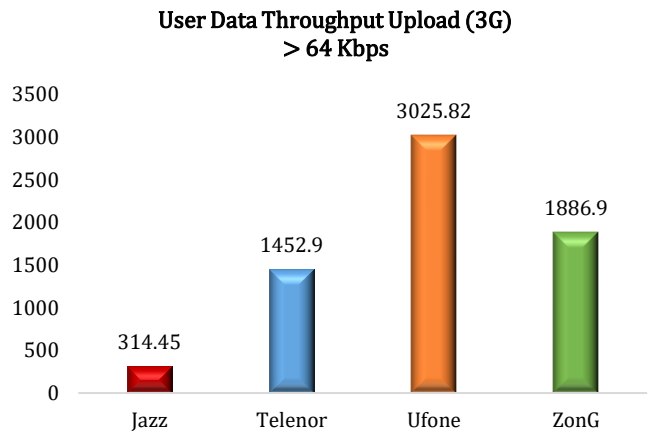


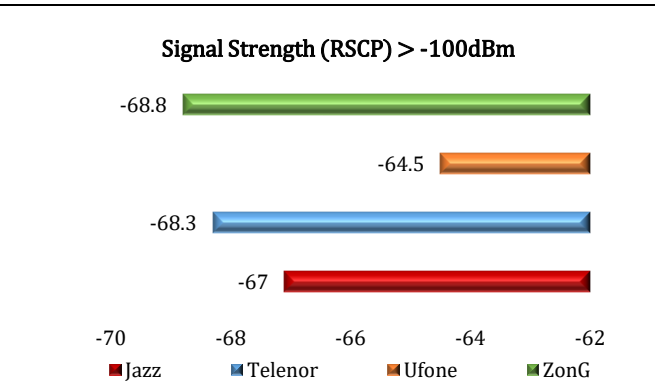


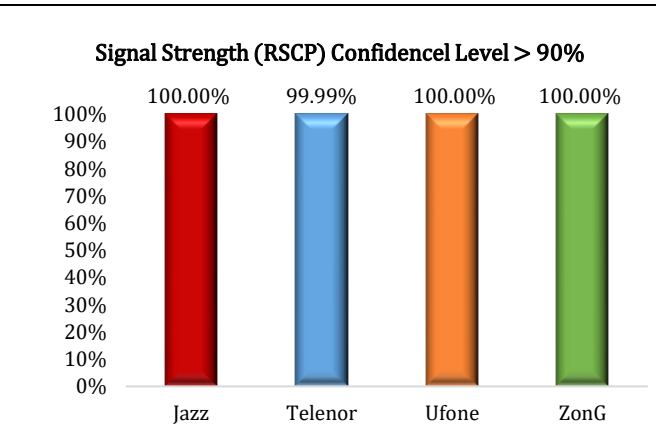


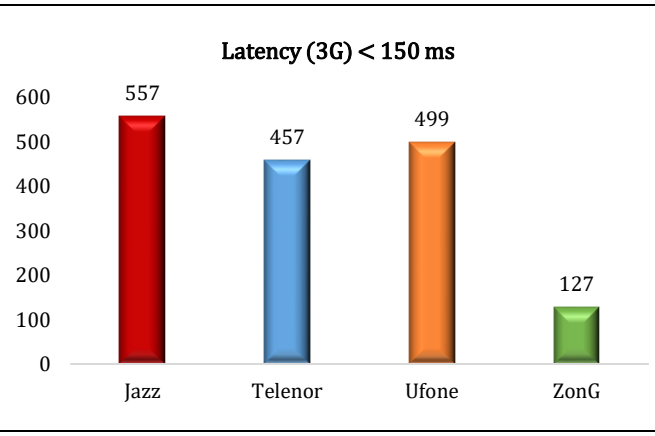
QUALITY OF SERVICE SURVEY RESULTS (3G) – WAZIRABAD





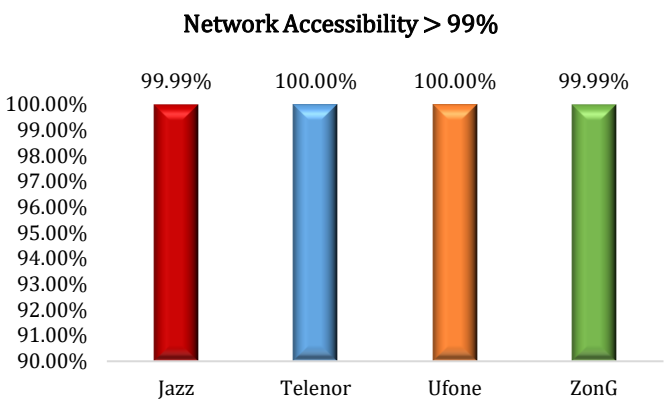


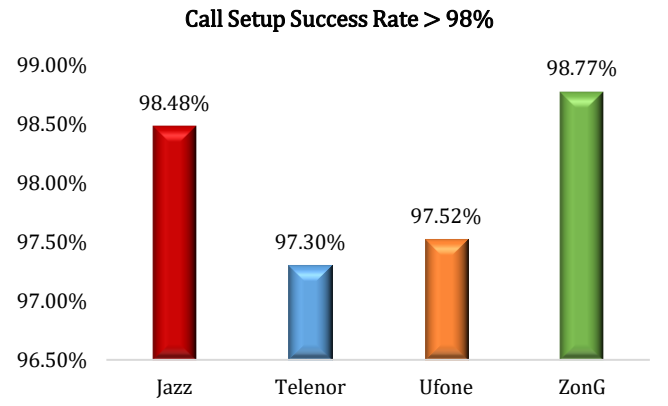


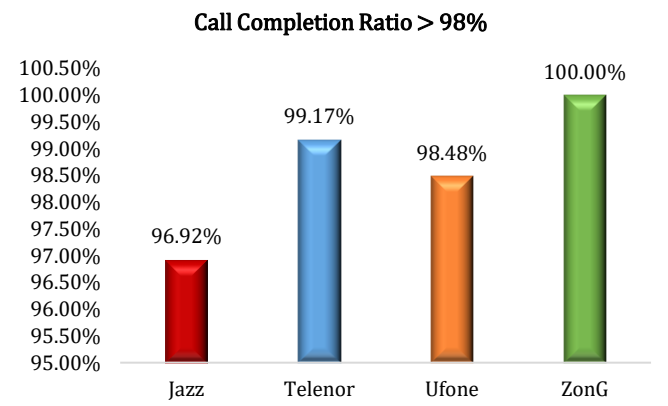


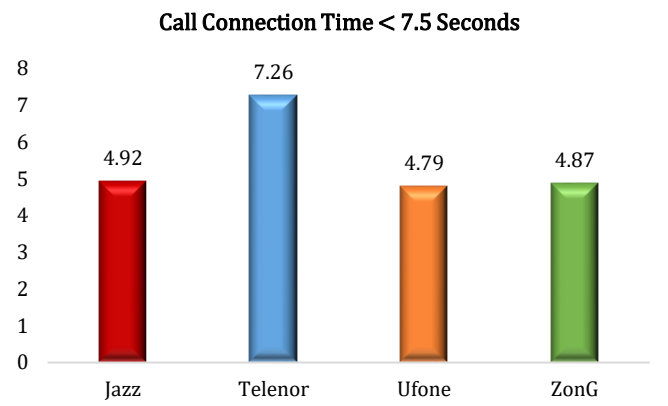
Annex-C (Voice & SMS Results)

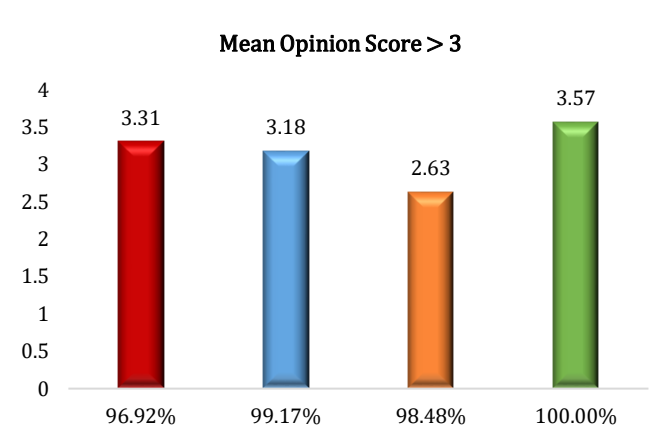
QUALITY OF SERVICE SURVEY RESULTS – ATTOCK

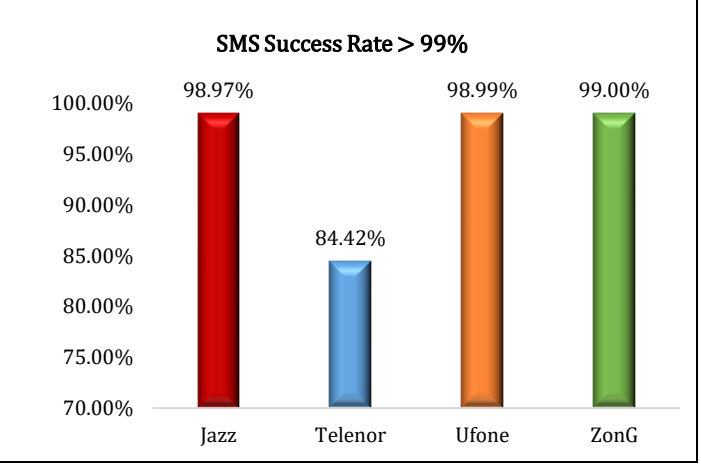


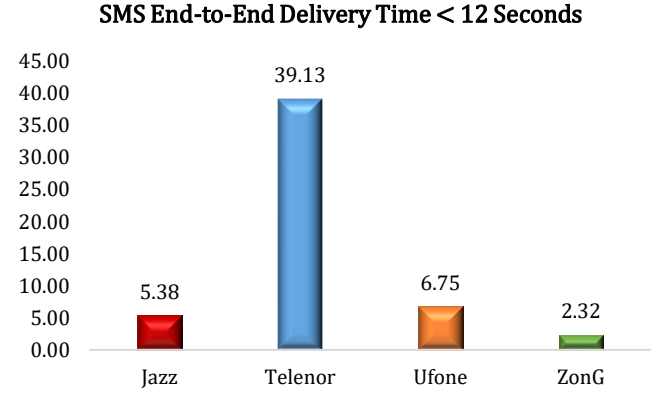




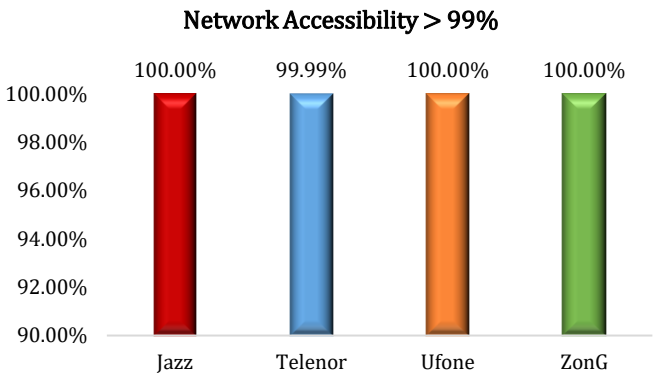


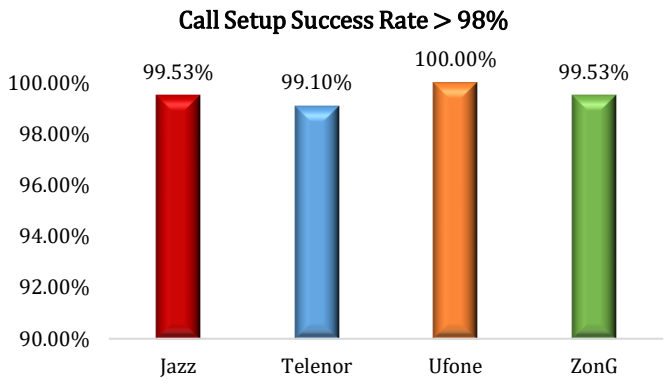


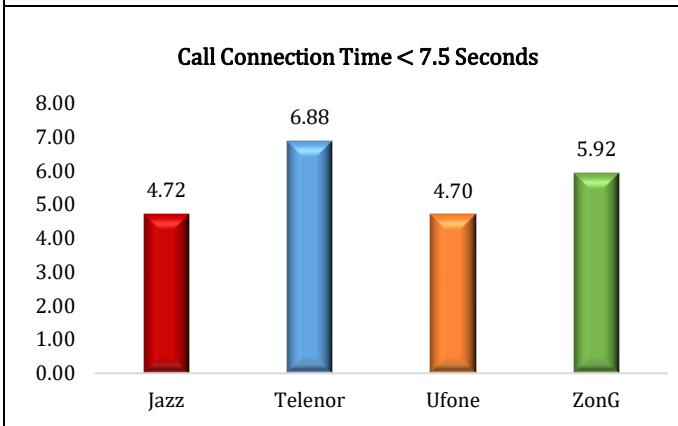


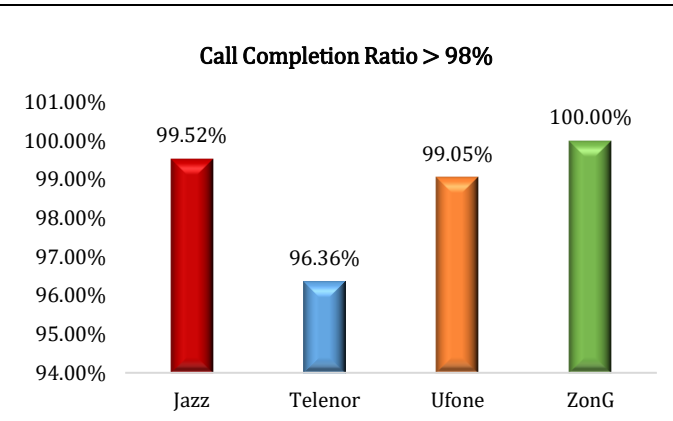


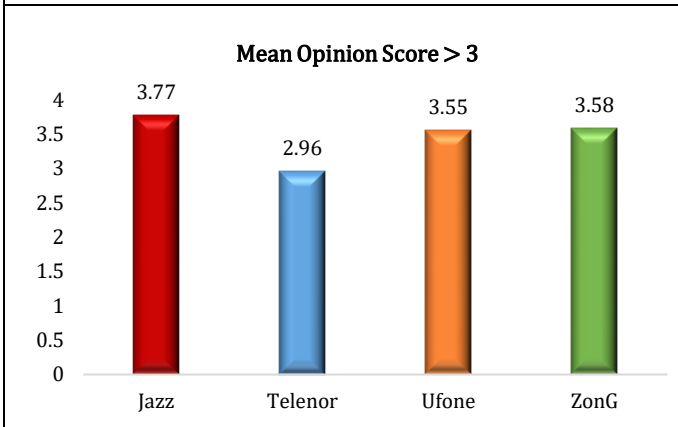
QUALITY OF SERVICE SURVEY RESULTS – HAFIZABAD

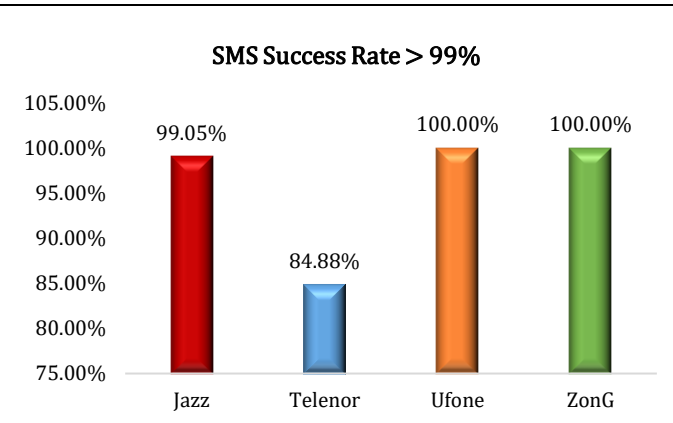


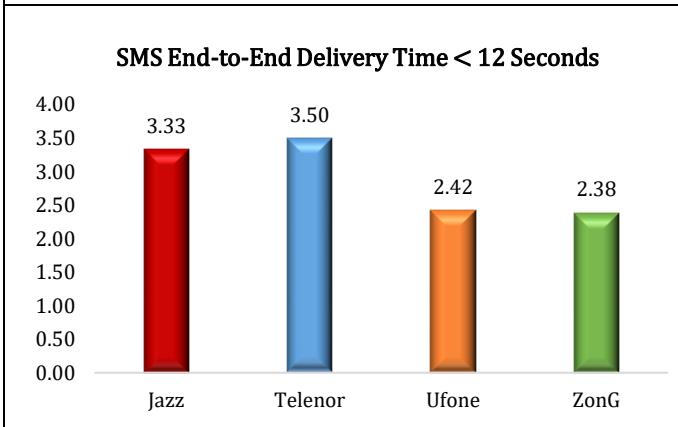




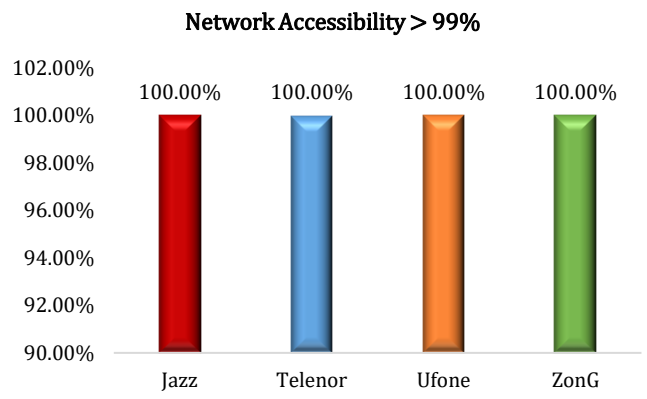


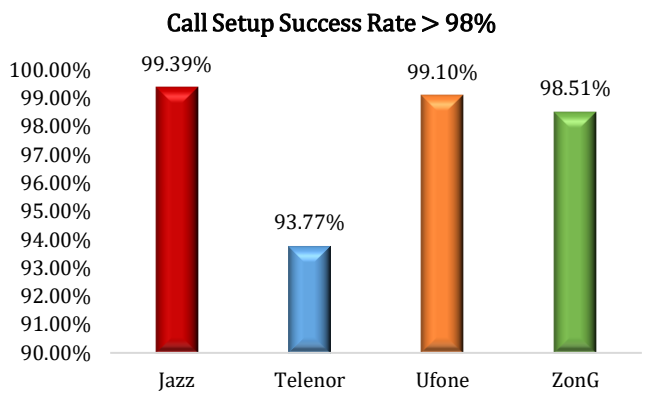


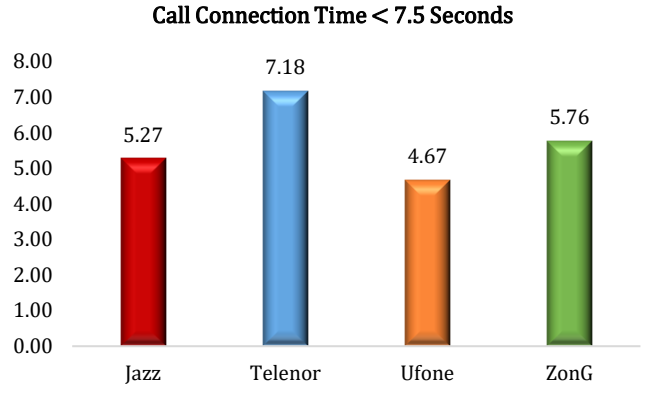


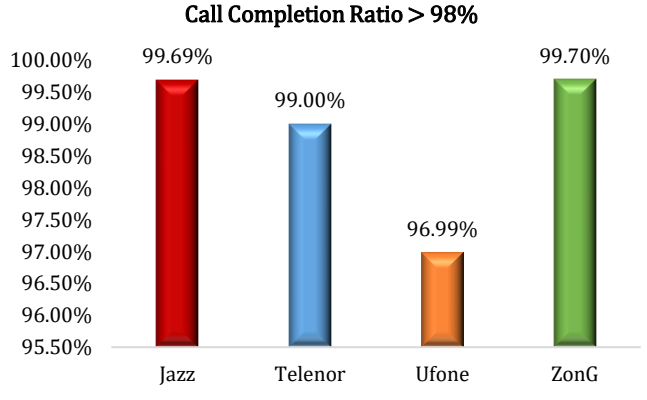


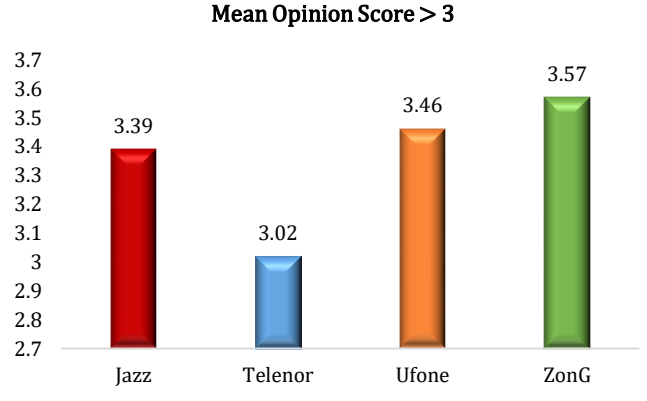
QUALITY OF SERVICE SURVEY RESULTS – RAWALPINDI

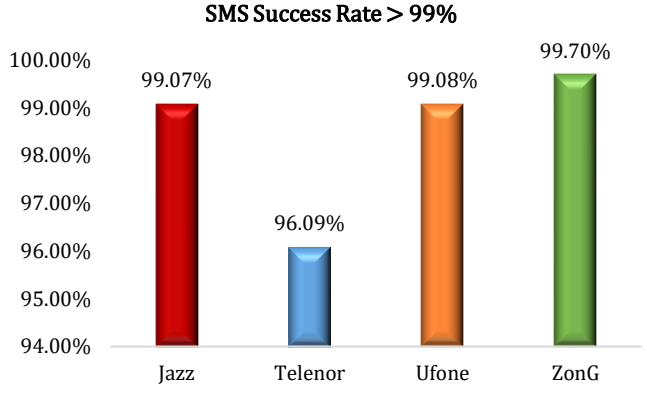


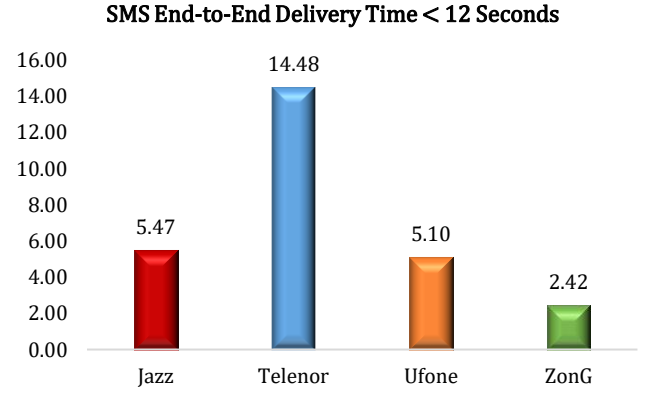






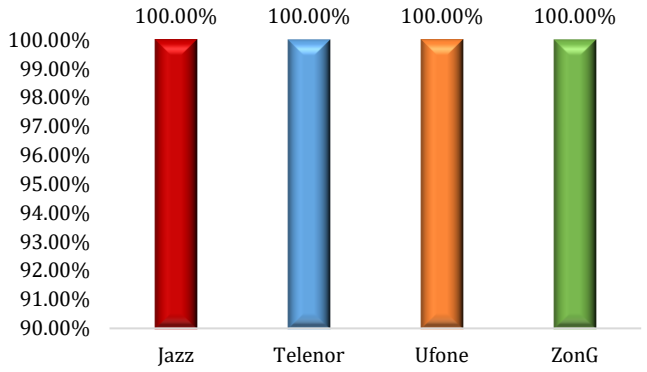




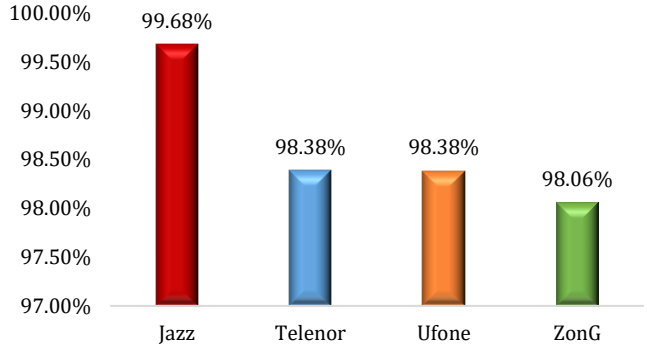


QUALITY OF SERVICE SURVEY RESULTS – HYDERABAD

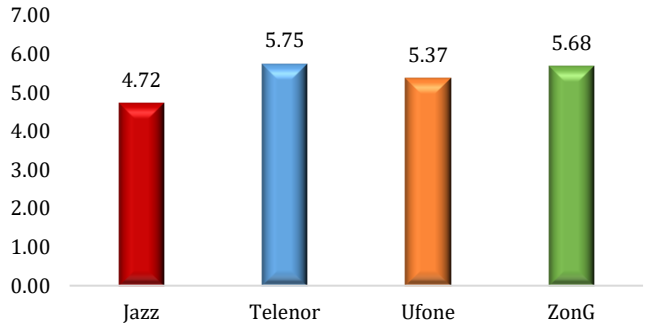
Network Accessibility > 99%



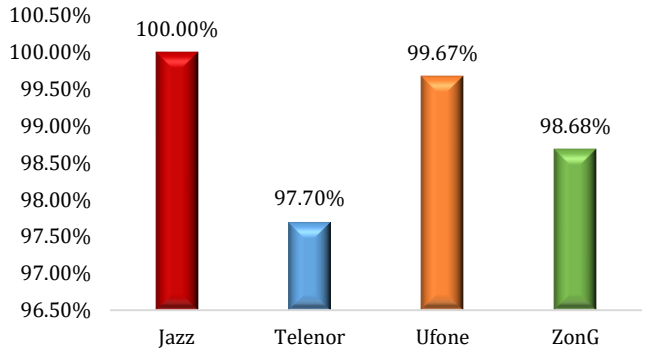
Call Setup Success Rate > 98%



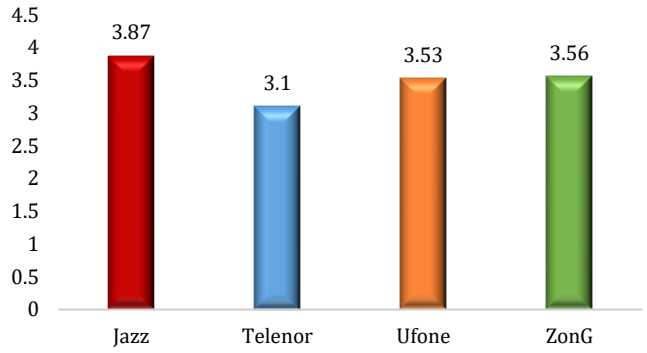
Call Connection Time < 7.5 Seconds



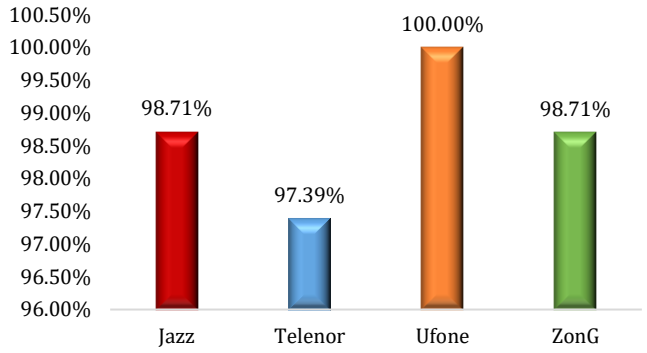
Call Completion Ratio > 98%



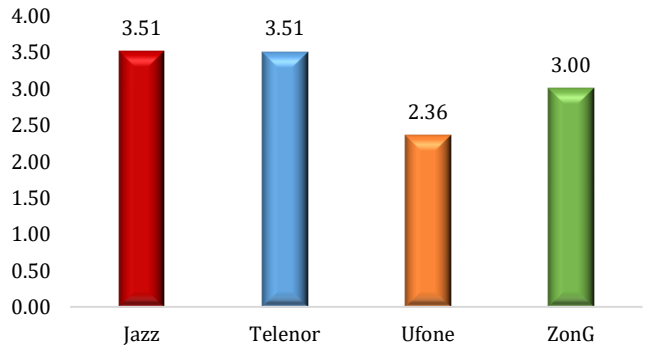
Mean Opinion Score > 3



SMS Success Rate > 99%

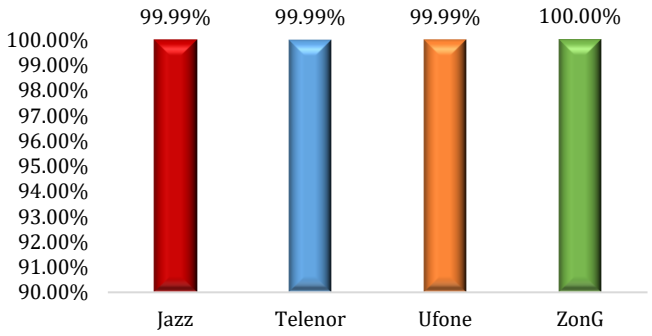


SMS End-to-End Delivery Time < 12 Seconds

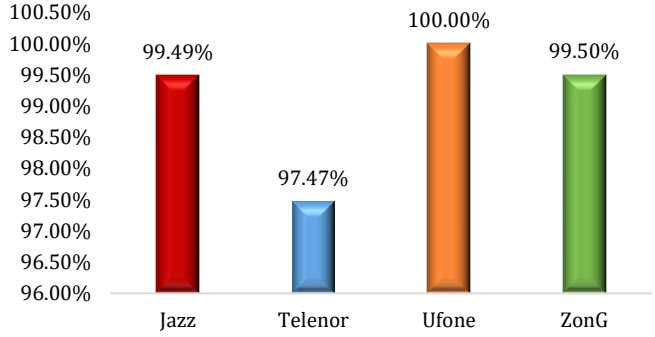


QUALITY OF SERVICE SURVEY RESULTS – KARACHI EAST

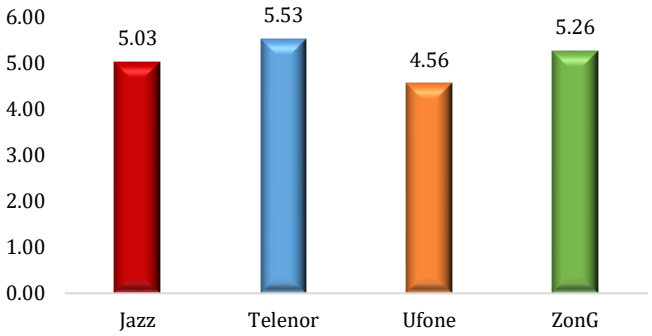
Network Accessibility > 99%



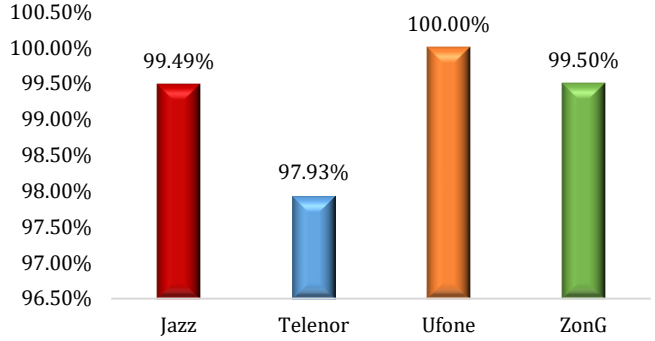
Call Setup Success Rate > 98%



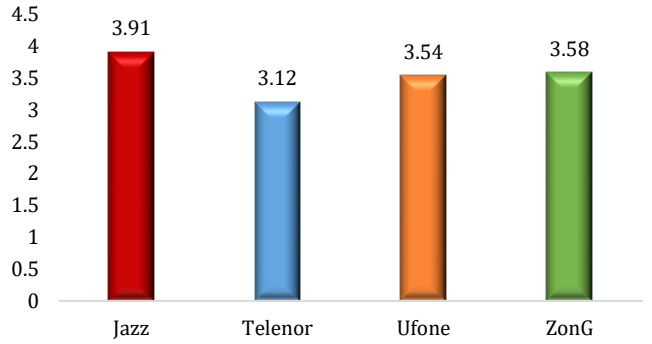
Call Connection Time < 7.5 Seconds



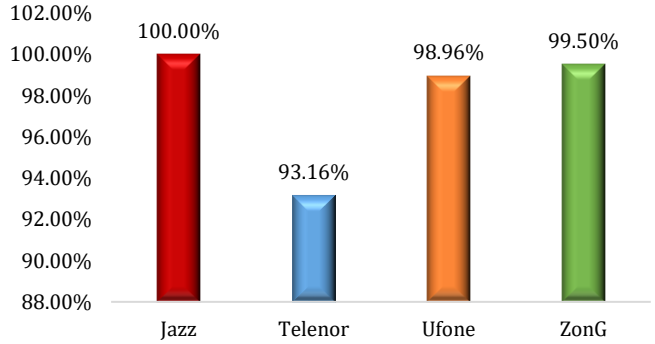
Call Completion Ratio > 98%



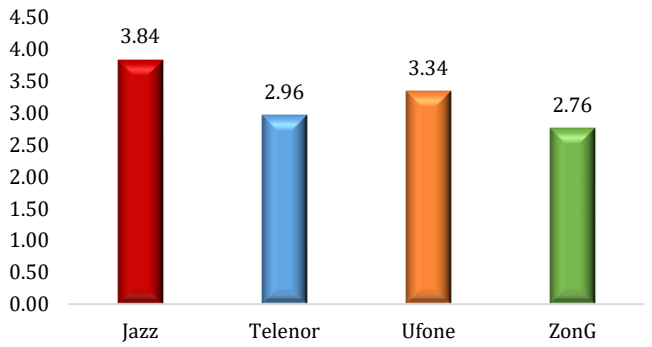
Mean Opinion Score > 3



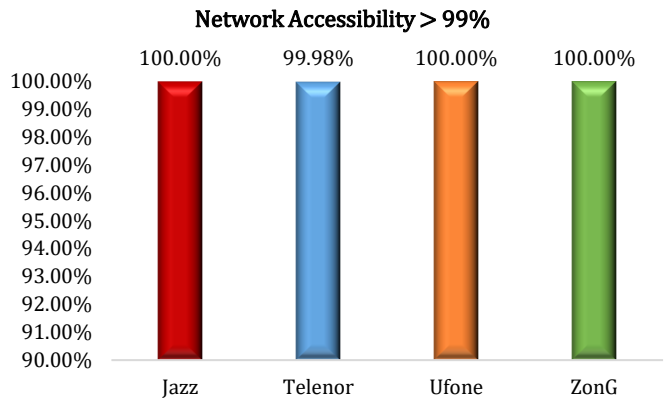
SMS Success Rate > 99%

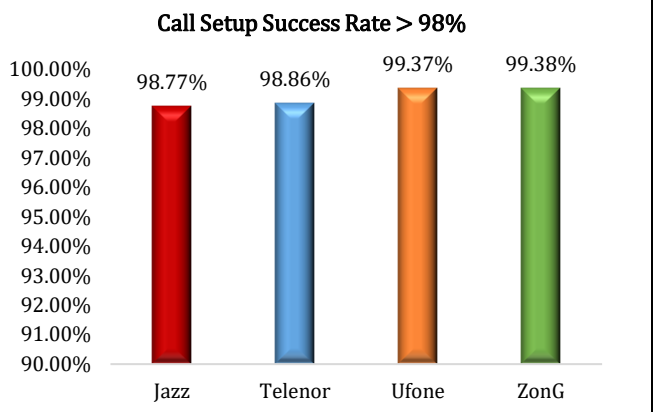


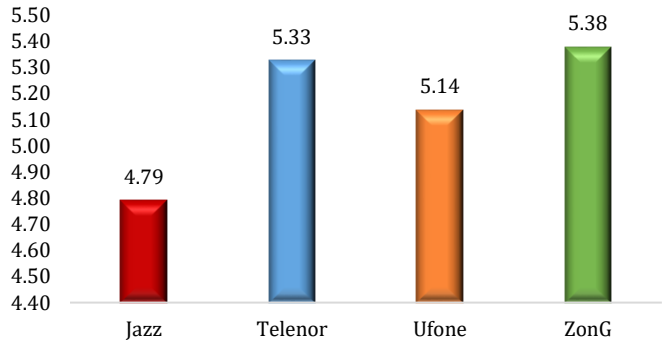
SMS End-to-End Delivery Time < 12 Seconds

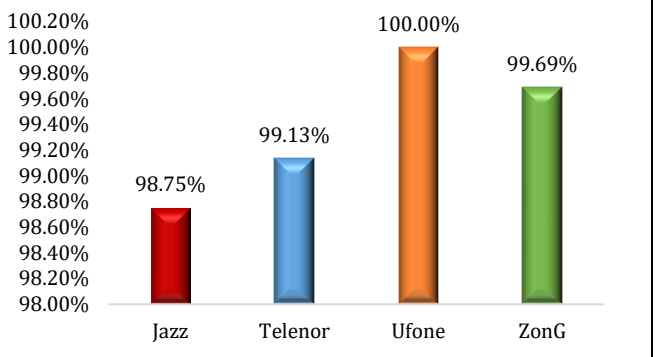


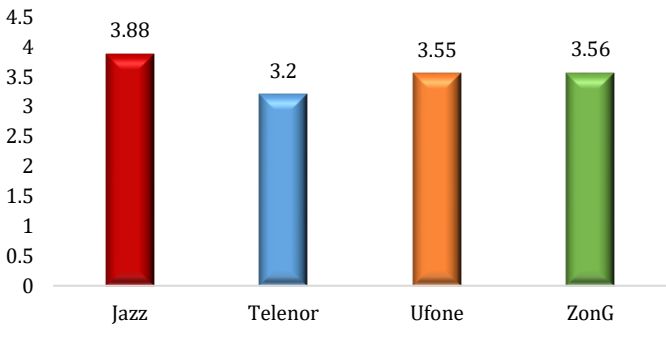
QUALITY OF SERVICE SURVEY RESULTS –PAKPATTAN

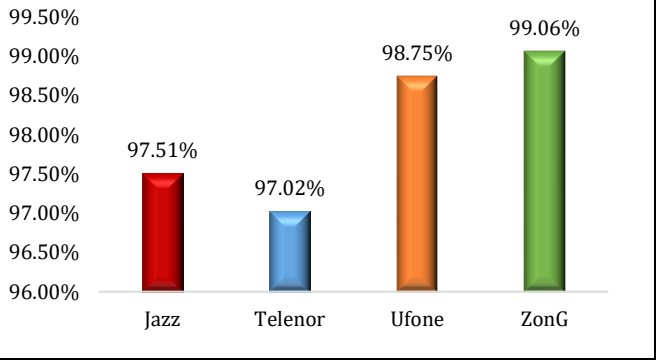


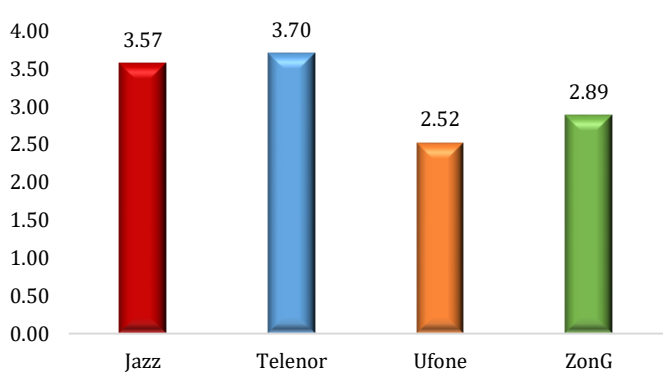




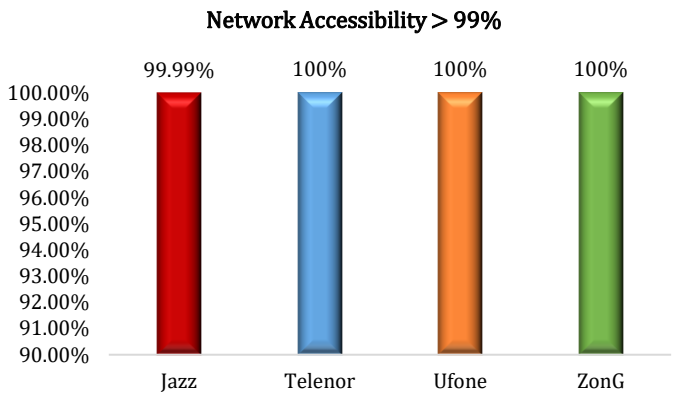


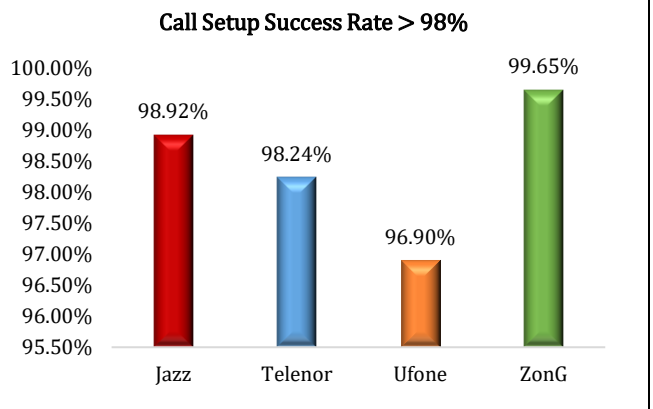


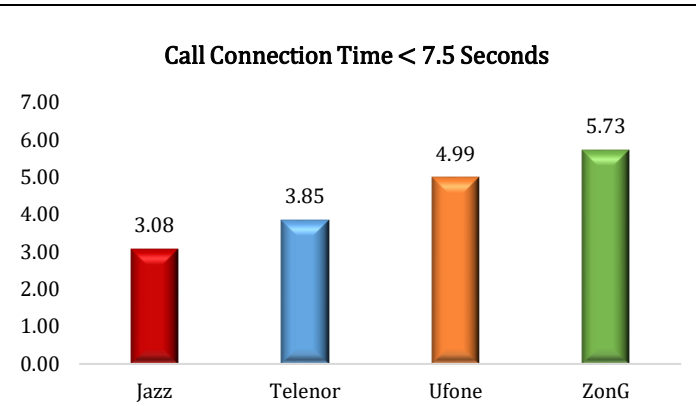


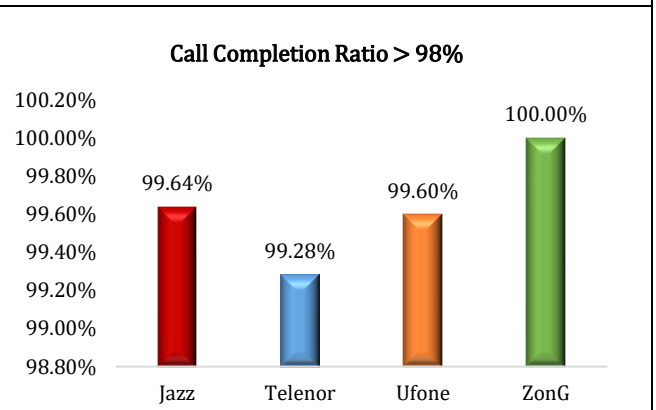


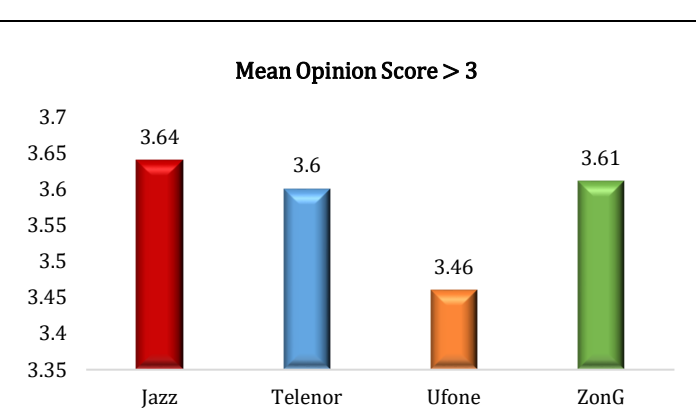
QUALITY OF SERVICE SURVEY RESULTS – KHANPUR

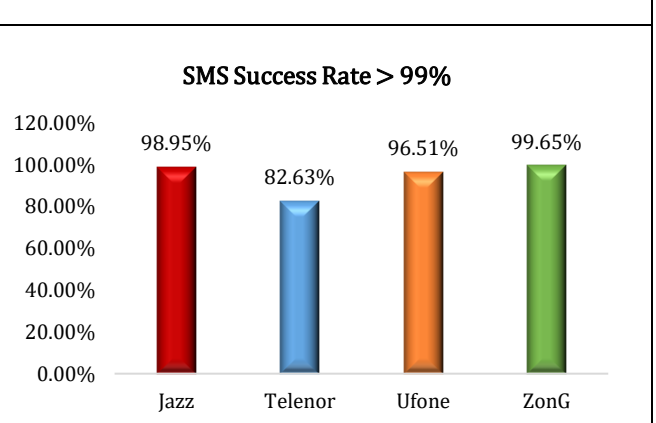


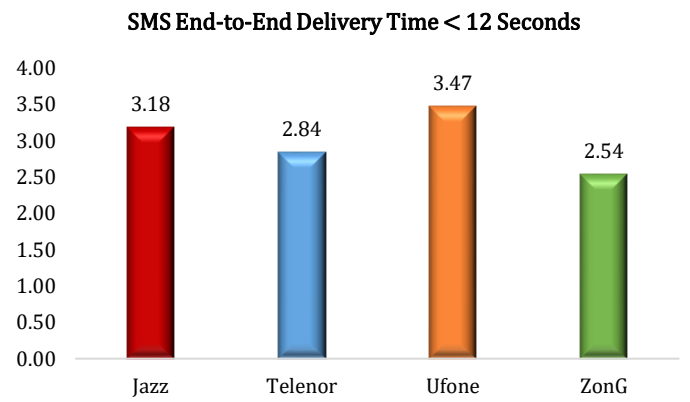




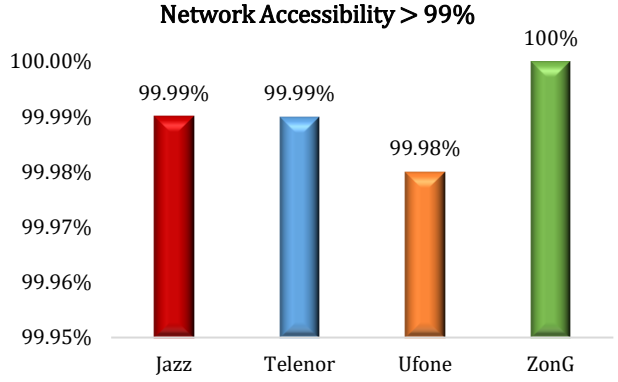


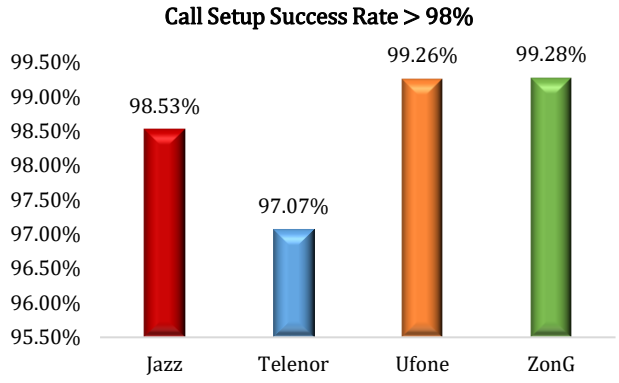


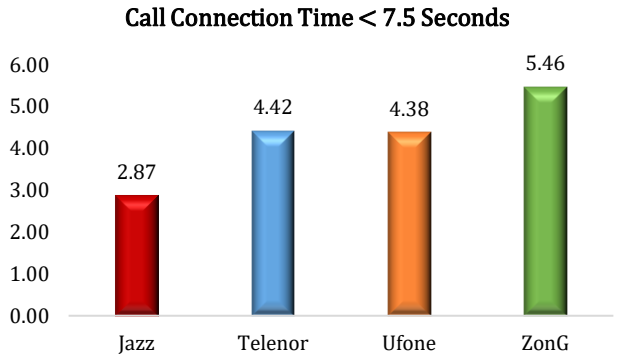


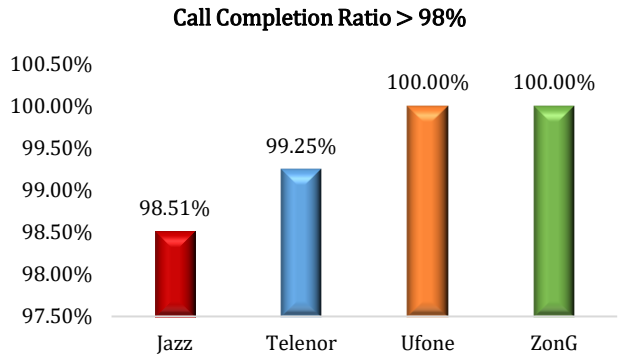


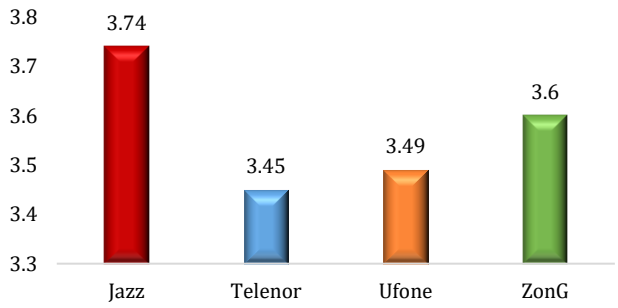
QUALITY OF SERVICE SURVEY RESULTS – LODHRAN

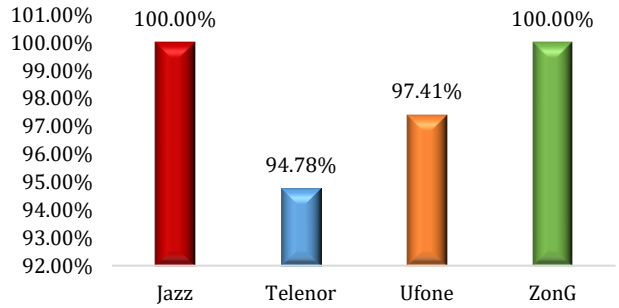


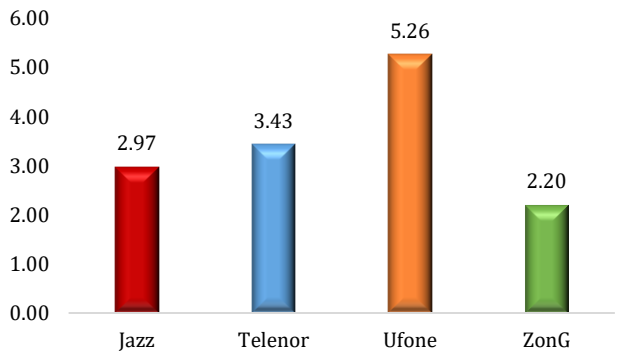
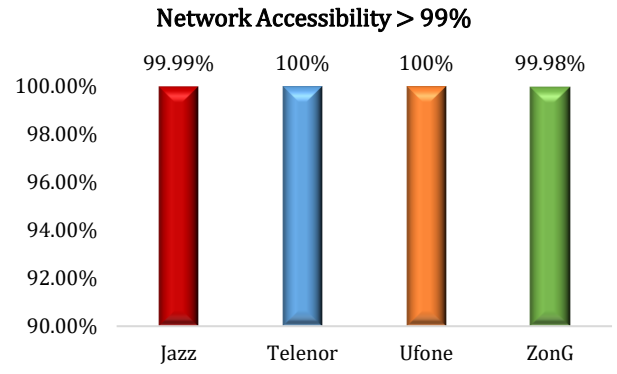
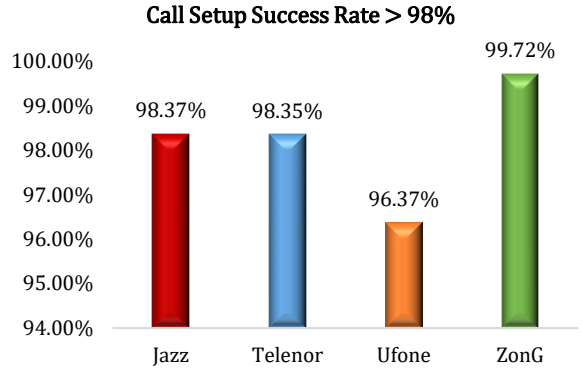
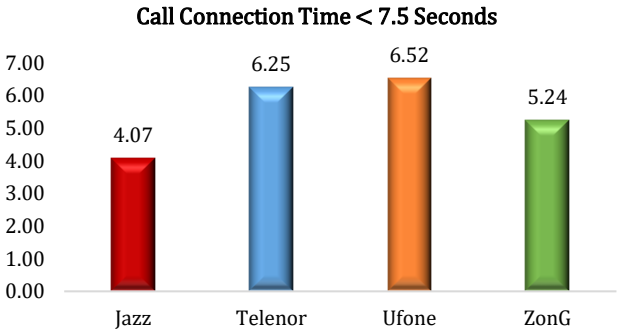
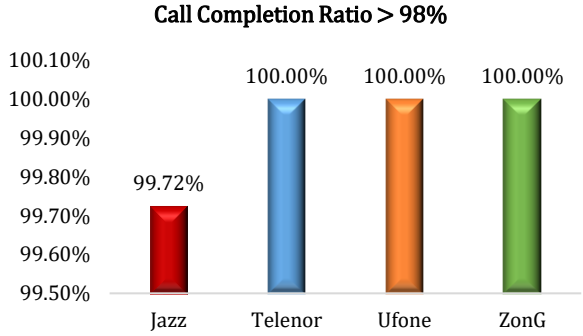
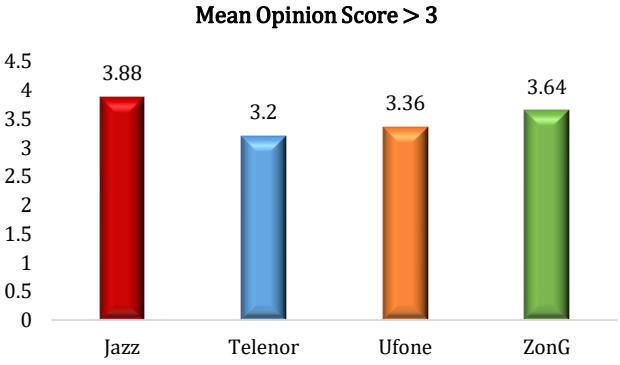
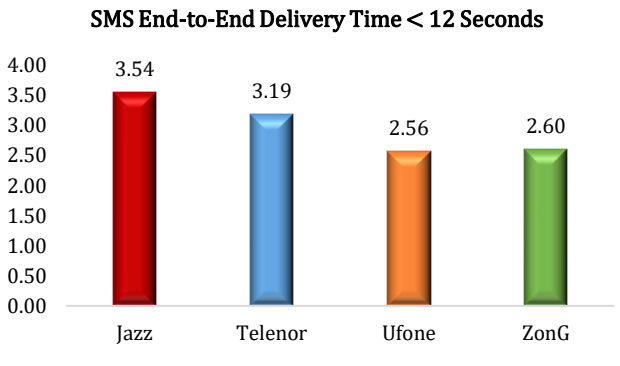












QUALITY OF SERVICE SURVEY RESULTS – WAZIRABAD