



# MOBILE NETWORKS BENCHMARK REPORT OF PAKISTAN 2021

NETWORK PERFORMANCE SCORE

ENFORCEMENT WIRELESS – II DIRECTORATE  
PAKISTAN TELECOMMUNICATION AUTHORITY

# EXECUTIVE SUMMARY

## 1. NETWORK PERFORMANCE SCORE

1.1. Pakistan Telecommunication Authority (PTA) has carried out Cellular Mobile Operators (CMOs) Quality of Service (QoS) Benchmarking Campaign from 1<sup>st</sup> February to 25<sup>th</sup> March 2021 and collected data in accordance with the methodology of ETSI TR 103 559 in different cities, towns and Roads throughout Pakistan. During this campaign, a total of 10 x Cities, 4 x Towns and 18 x Motorways/Highways/Roads surveyed and 3,570 KM of distance traversed.

## 2. DATA VALIDATION

2.1. The data collected in 10 x Cities, 4 x Towns and 18 x Motorways/Highways/Roads has been validated by Rohde & Schwarz and a Network Performance Score (NPS) report has been generated as per method described in ETSI TR 103 559.

## 3. CAMPAIGN HIGHLIGHTS

3.1. The Key Performance Indicators (KPIs) of Voice and Data Services, collected during the campaign have been analyzed as per the above referred NPS standard and the outcome of the same is summarized as under:

### 3.1.1. VOICE SERVICE

All CMOs have shown overall good results for Voice Services with ZonG in the leading position.

- Currently, 4G/LTE networks deployed by CMOs are not supporting Voice over LTE (VoLTE).
- CMOs needs to improve Call Setup Success Rate (CSSR).
- The Call Drop Rate (CDR) level is not good. Telenor has the biggest opportunity for further improvements in CDR.
- The End-to-End Speech Quality/Mean Opinion Score (MOS) level of non-VoLTE networks is good.
- ZonG has a very high utilization of the Wide Band (WB) Adaptive Multi Rate (AMR) audio codec and is far ahead in comparison to other CMOs.

### 3.1.2. DATA SERVICE

All CMOs have shown poor performance in Data Services, as the companies not achieving more than 30 - 45% NPS points for Data Services.

- The HTTP data transfer performance of all CMOs remained at minimum level. In addition, the scoring points in Uplink (UL) are more than Downlink (DL).
- HTTP success ratio differs a lot between CMOs. ZonG result is at acceptable good level, whereas Jazz is at the lower edge, showing poor results.
- ZonG achieved the highest DL throughput, whereas Jazz has the highest UL throughput.
- Ufone is utilizing a single LTE carrier of only 5 MHz bandwidth, therefore, Ufone is at clear disadvantage compared to other CMOs.

- ZonG showing good LTE carrier aggregation distribution with more than 60% of the measured test samples.
- All CMOs are supporting 256QAM modulation in the DL with Ufone in the leading position.
- Low Resource Block (RB) usage indicates high network load for all CMOs.
- All CMOS have a good video success ratio.
- Web browsing is the biggest challenge for all CMOs with respect to success ratio and browsing duration.
- Social media access is good for all CMOs.

#### 4. HIGHEST SCORER

4.1. ZonG secured highest score in the overall benchmarking campaign in Pakistan, Ufone on the second place followed by Jazz and Telenor. ZonG, Ufone, Jazz and Telenor secured 605, 520, 472 & 459 points respectively.

##### 4.2.1. OVERALL RESULTS

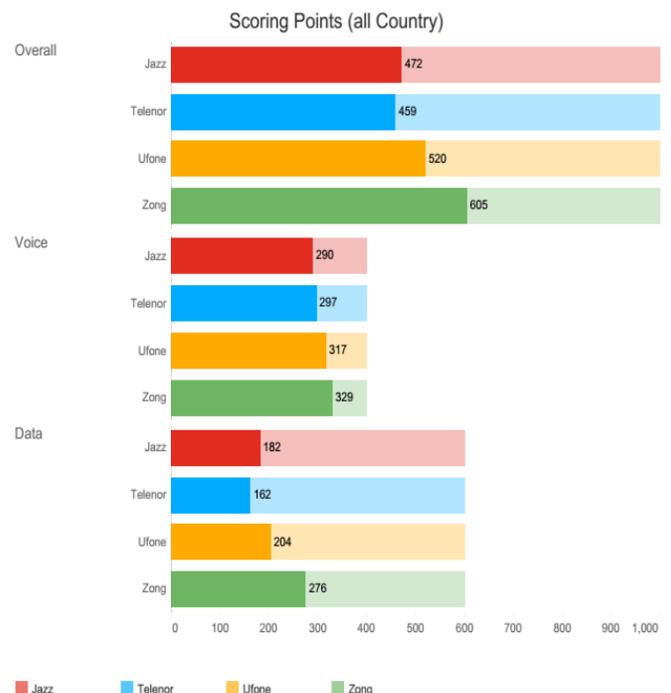
ZonG has the best overall Network Performance Score exceeding 600 points in total and having a comfortable advantage of 85 points to Ufone positioned at the second place. Jazz and Telenor are statistically on par with the lowest scores.

##### 4.2.2. VOICE SERVICE

Best Voice Service is offered by ZonG, followed by Ufone, Telenor and Jazz. The overall voice performance is on a good level for the two leading operators achieving 310+ points out of 400 maximum points.

##### 4.2.3. DATA SERVICE

ZonG also offers the best Data Service in this benchmarking campaign with a significant margin to other CMOs. However, the overall data performance is fair for ZonG and quite poor for the others.



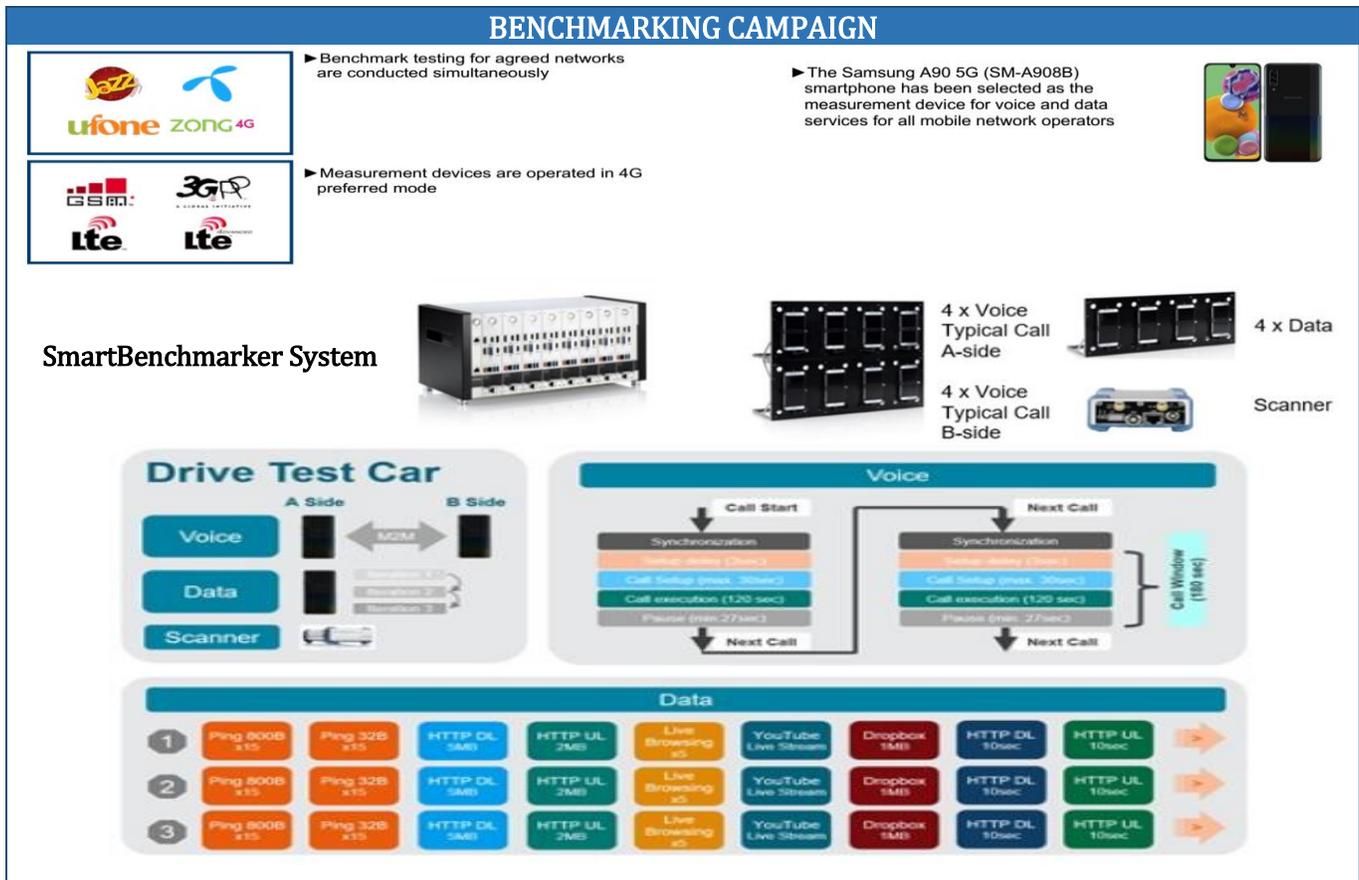
# CAMPAIGN OVERVIEW

## 1. INTRODUCTION

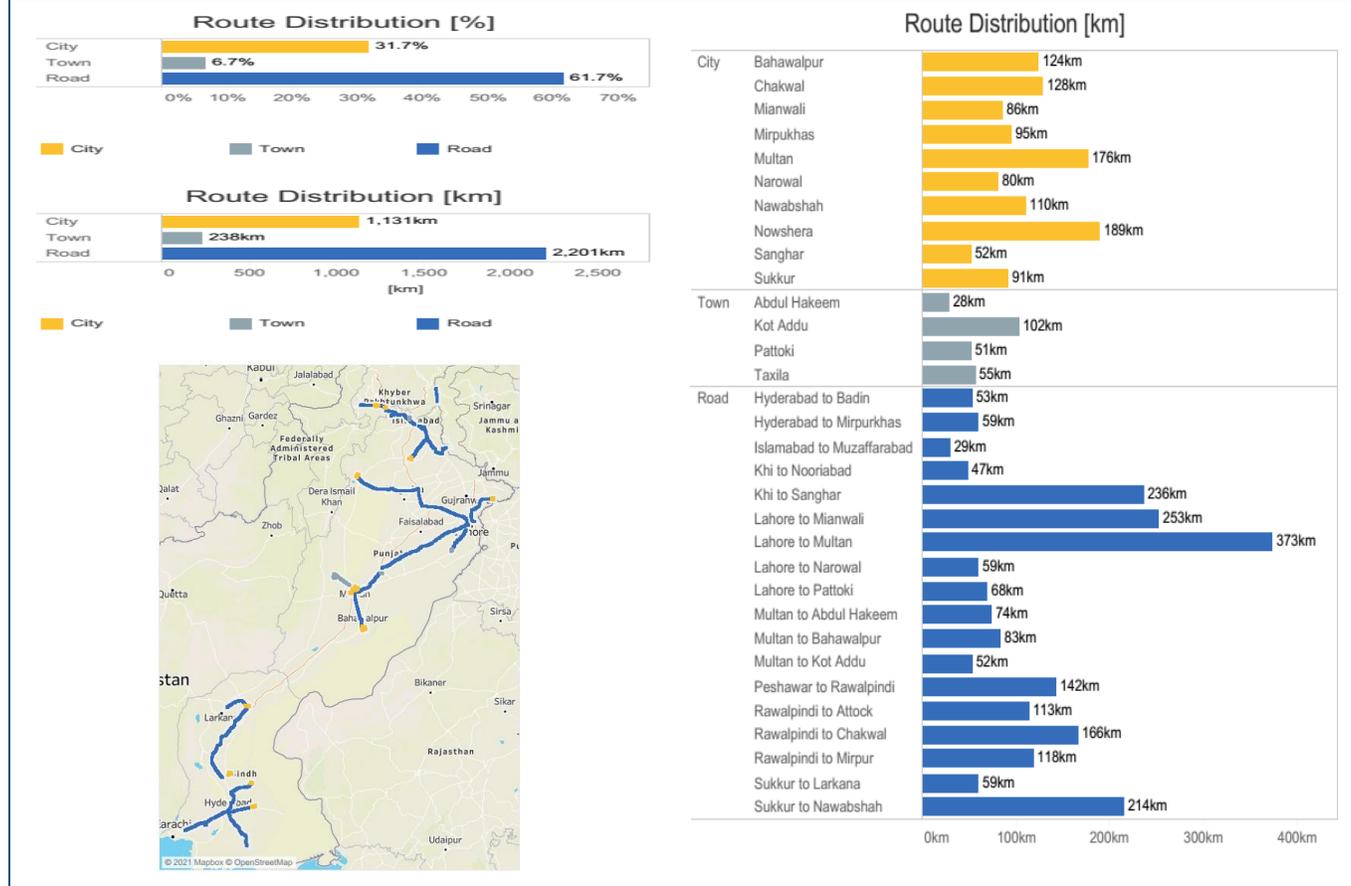
1.1. European Telecommunications Standards Institute (ETSI) has published a technical report i.e. ETSI TR 103 559 ***"SPEECH AND MULTIMEDIA TRANSMISSION QUALITY (STQ); BEST PRACTICES FOR ROBUST NETWORK QOS BENCHMARK TESTING AND SCORING"***, in August 2019, commonly known as Network Performance Score (NPS). This report provides a method to collect and aggregate the test results and the weighting of the various aspects tested for each application like telephony, video and data services. The application fields are then in turn weighted and aggregated over the different areas where the data is collected i.e. City, Town and Road etc. Finally, calculation of an overall score or a joint score is performed.

## 2. BENCHMARKING CAMPAIGN

2.1. Pakistan Telecommunication Authority (PTA) has carried out Cellular Mobile Operators (CMOs) Quality of Service (QoS) Benchmarking Campaign from 1<sup>st</sup> February to 25<sup>th</sup> March 2021 and collected drive test data of Voice and Data Services in different cities, towns and Roads throughout Pakistan. During this campaign, a total 10 x Cities, 4 x Towns and 18 x Motorways/Highways/Roads have been surveyed wherein a total of 3,570 KM distance traversed alongwith **2,600 Voice Calls** and **26,000 Data Tests**. The Benchmarking Campaign details are described in **Figure1.1: Network Performance Score Benchmarking Campaign**.



## BENCHMARKING CAMPAIGN



**Figure 1.1: Network Performance Score Benchmarking Campaign**

### 3. KEY PERFORMANCE INDICATORS

3.1. During the said campaign, Key Performance Indicators (KPIs) for Voice and Data Services (i.e. Data Transfer, Video Streaming and Web Browsing & Social Media) have been measured. The same are mentioned in **Table 1.1: Voice and Data Service Key Performance Indicators**

S. #.	SERVICE	KEY PERFORMANCE INDICATORS	
1.	Voice	Call Setup Success Ratio	Call Drop Ratio
		Call Setup Time Average	Call Setup Time > 15 seconds Ratio
		Call Setup time 10 <sup>th</sup> Percentile	Voice MOS Average
		Voice MOS < 1.6	Voice MOS 90 <sup>th</sup> Percentile
2.	Data Transfer	Http DL Success Ratio	Http UL Success Ratio
		Http DL Throughput Average	Http UL Throughput Average
		Http DL Throughput 10 <sup>th</sup> Percentile	Http DL Throughput 90 <sup>th</sup> Percentile
		Http UL Throughput 10 <sup>th</sup> Percentile	Http UL Throughput 90 <sup>th</sup> Percentile
3.	Video Streaming	Video Success Ratio	Video MOS Average
		Video MOS 10 <sup>th</sup> Percentile	Video Setup Average
		Video Setup Time > 10 seconds Ratio	
4.	Browsing	Browsing Success Ratio	Browsing Duration Average
		Browsing Duration < 6 Seconds Ratio	
5.	Social Media	Social Media Success Ratio	Social Media Duration Average
		Social Media Duration > 15 Seconds Ratio	

**Table 1.1: Voice and Data Service Key Performance Indicators**

## 4. NPS KPIS THRESHOLD VALUES

4.1. ETSI TR 103 559 defined the NPS KPIs High and Low Thresholds Values for Voice and Data Services (i.e. Data Transfer, Video Streaming, Web Browsing & Social Media). The Network Score rates the overall Quality of Experience (QoE) of a network by combining the fulfillment of main KPIs from different services. It takes into account the technical performance of the services only. Billing, tariffs or support quality are not considered. Each NPS QoS KPI High and Low Threshold values are listed in **Table 1.2: Network Performance Score Key Performance Indicators High & Low Threshold Values**

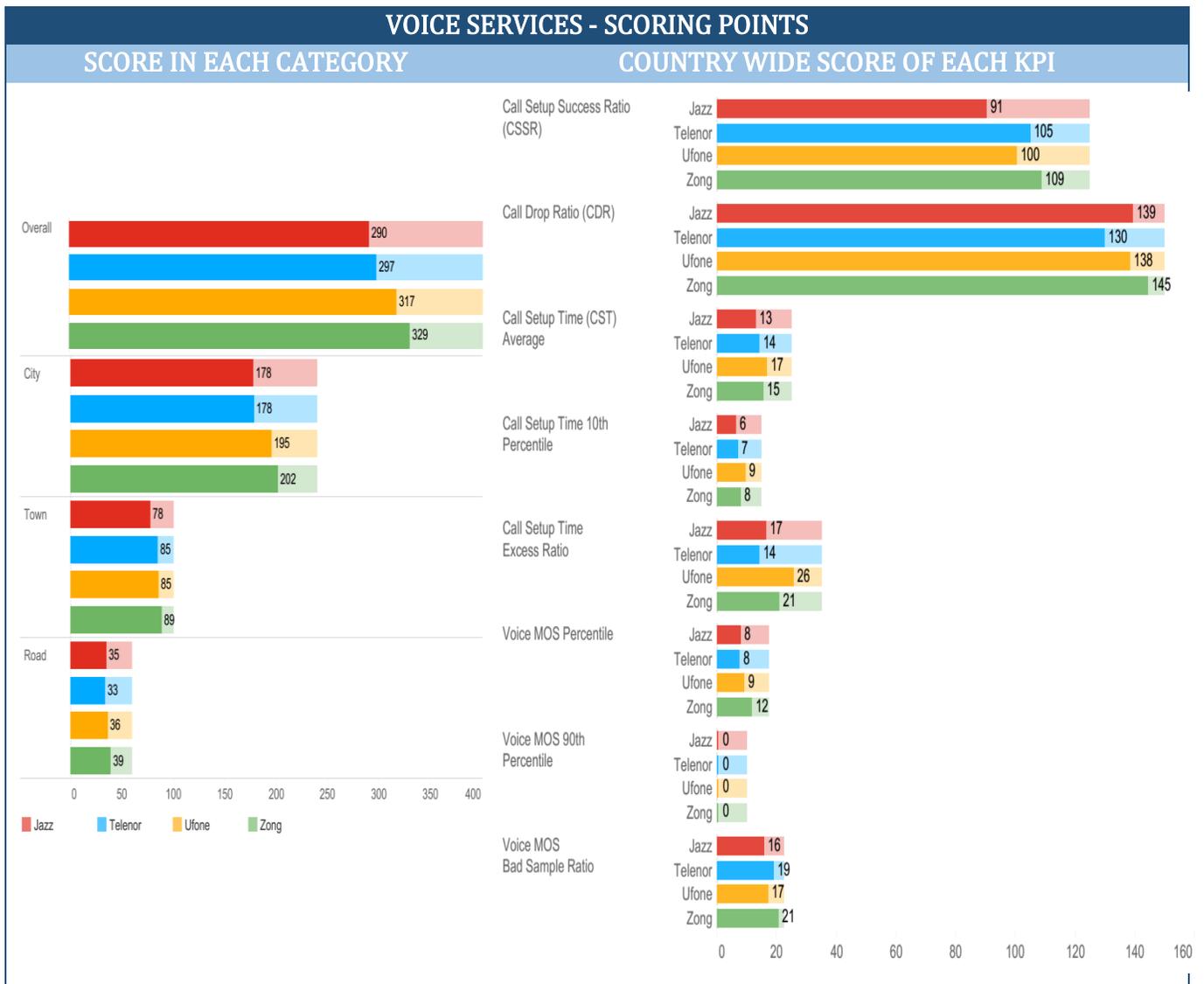
VOICE SERVICE	
CSSR High Threshold	100%
CSSR Low Threshold	85%
CDR High Threshold	0%
CDR Low Threshold	10%
CST High Threshold	4.5s
CST Low Threshold	12.0s
CST 10 High Threshold	4.0s
CST 10 Low Threshold	8.0s
CST Excess Rate High Threshold	0%
CST Excess Rate Low Threshold	3%
POLQA MOS High Threshold	4 MOS
POLQA MOS Low Threshold	2 MOS
POLQA MOS 90 High Threshold	5 MOS
POLQA MOS 90 Low Threshold	4 MOS
POLQA MOS Bad Rate High Threshold	0%
POLQA MOS Bad Rate Low Threshold	10%
DATA SERVICE	
HTTP SR High Threshold	100%
HTTP SR Low Threshold	80%
HTTP DL TP High Threshold	100.0 Mbps
HTTP DL TP Low Threshold	1.0 Mbps
HTTP DL TP 10 High Threshold	40.0 Mbps
HTTP DL TP 10 Low Threshold	1.0 Mbps
HTTP DL TP 90 High Threshold	240.0 Mbps
HTTP DL TP 90 Low Threshold	10.0 Mbps
HTTP UL TP High Threshold	50.0 Mbps
HTTP UL TP Low Threshold	0.5 Mbps
HTTP UL TP 10 High Threshold	30.0 Mbps
HTTP UL TP 10 Low Threshold	0.5 Mbps
HTTP UL TP 90 High Threshold	100.0 Mbps
HTTP UL TP 90 Low Threshold	5.0 Mbps
Browsing SR High Threshold	100%
Browsing SR Low Threshold	80%
Browsing Duration High Threshold	1.0s
Browsing Duration Low Threshold	6.0s
Browsing Duration Excess Rate High Threshold	0%
Browsing Duration Excess Rate Low Threshold	15%
App Test SR High Threshold	100%
App Test SR Low Threshold	80%
App Test Duration High Threshold	3.0s
App Test Duration Low Threshold	15.0s
App Test Duration Excess Rate High Threshold	0%
App Test Duration Excess Rate Low Threshold	5%
Video SR High Threshold	100%
Video SR Low Threshold	80%
Video MOS High Threshold	5 VMOS
Video MOS Low Threshold	3 VMOS
Video MOS 10 High Threshold	4 VMOS
Video MOS 10 Low Threshold	2 VMOS
Video TTFP High Threshold	2s
Video TTFP Low Threshold	7s
Video TTFP Excess Rate High Threshold	0%
Video TTFP Excess Rate Low Threshold	5%

**Table 1.2: Network Performance Score Key Performance Indicators High & Low Threshold Values**

# NETWORK PERFORMANCE RESULTS – VOICE

## 1. OVERALL SCORE

1.1. In case of Voice Service, ZonG, Ufone, Telenor and Jazz obtained an overall score of 329, 317, 297 and 290 respectively. Voice Services in the categories city and town are better compared to roads. Jazz has problem in the Call Setup and Telenor has the highest Call Drop Rate (CDR). The scoring points of CMOs are mentioned in **Figure 2.1: Voice Service Scoring Points**



**Figure 2.1: Voice Service Scoring Points**

## 2. CALL SETUP SUCCESS RATIO & CALL DROP RATIO

2.1. The survey results revealed that ZonG has the best Call Setup Success Ratio (CSSR) as well as the lowest Call Drop Ratio (CDR) in all categories (i.e. City, Town & Road). Furthermore, currently, none of the 4G/LTE Networks of CMOs support Voice over LTE (VoLTE). The details of CSSR and CDRs of each CMO are stated in **Figure 2.2: CSSR, CDR & Call Status per RAT/Technology**.



Figure 2.2: CSSR, CDR & Call Status per RAT/Technology

### 3. CALL SETUP TIME

3.1. The average Call Setup Times (CST) are on a very good level for Circuit Switched Fall Back (CSFB) calls and can only be improved for pure VoLTE calls. Best results were achieved in the

category town by all CMOs. The detail of different aspects of Call Setup Time can be seen in **Figure 2.3: Call Setup Time of CMOs.**



**Figure 2.3: Call Setup Time of CMOs.**

#### 4. CALL SETUP TIME PER CALL MODE

4.1. Ufone has a significant amount of Circuit Switched (CS) calls, pointing to a weaker LTE coverage. On the other hand Ufone has the best CST in both call modes. The **Figure 2.4: Call Setup Time per Call Mode** shows the company wise details of Calls both in CSFB and CS modes.

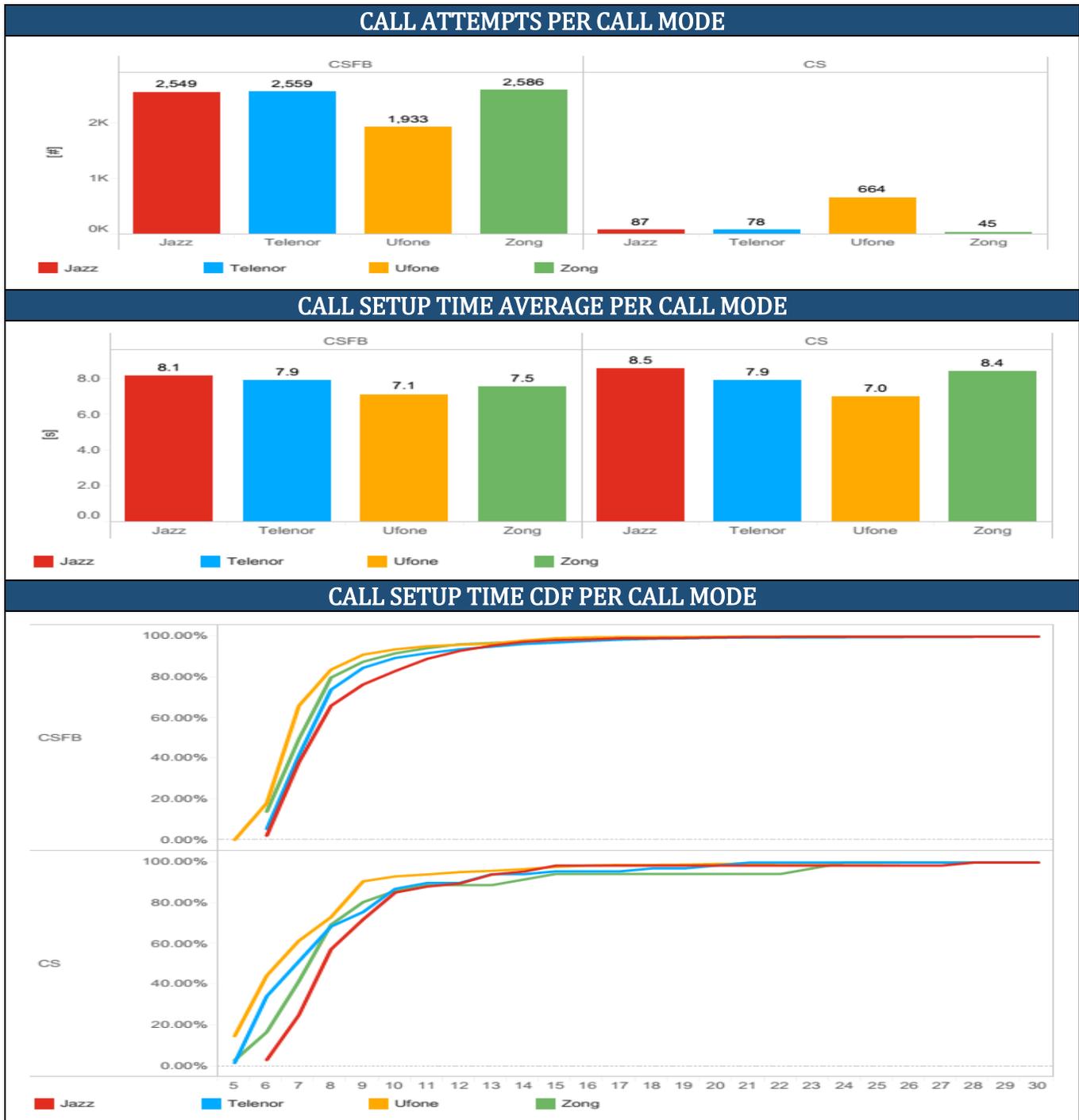


Figure 2.4: Call Setup Time per Call Mode

## 5. SPEECH QUALITY / MEAN OPINION SCORE

5.1. ZonG offers the best speech quality to its customers in all the measured categories (i.e. City, Town & Road). Different aspects of Mean Opinion Score i.e. average value, 90<sup>th</sup> percentile, Cumulative Distribution Function (CDF) and bad sample ratio obtained by CMOs is shown in **Figure 2.5: Voice Mean Opinion Score**.

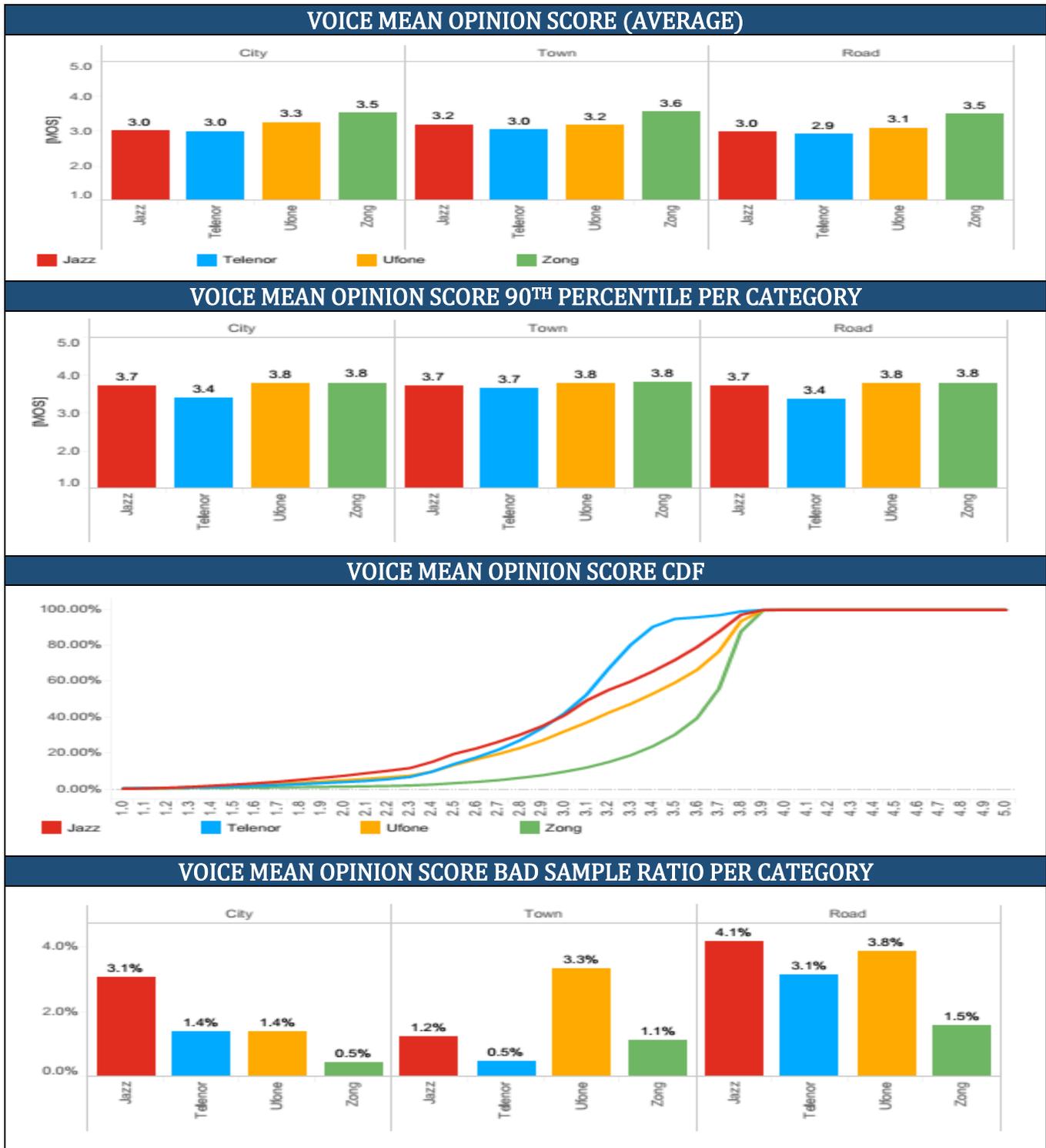


Figure 2.5: Voice Mean Opinion Score.

## 6. SPEECH QUALITY BREAKDOWN

6.1. The breakdown of the speech quality into the used speech codecs (i.e. HR, EFR, AMR & AMR-WB) and bitrates (i.e. 4.75, 5.60, 5.90, 6.60, 7.40, 8.85, 12.20 & 12.65) revealed that the best Voice Mean Opinion Score of Zong is driven by the very high utilization of AMR WB with 12.65 Kbps bitrate. The company wise speech codecs and bitrates utilization is shown in **Figure 2.6: Breakdown of Mean Opinion Score in Used Speech Codecs & Bitrates**.

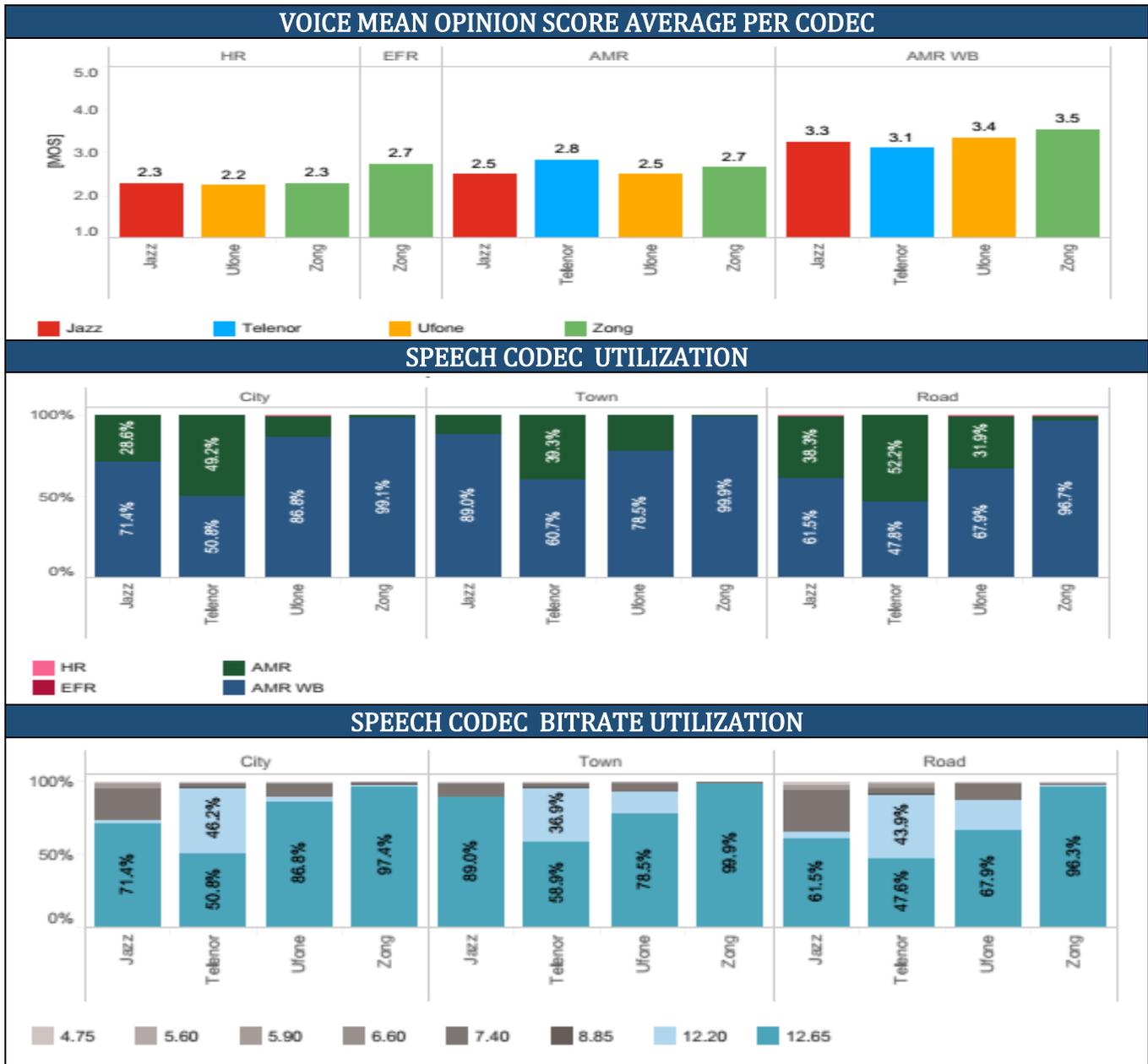
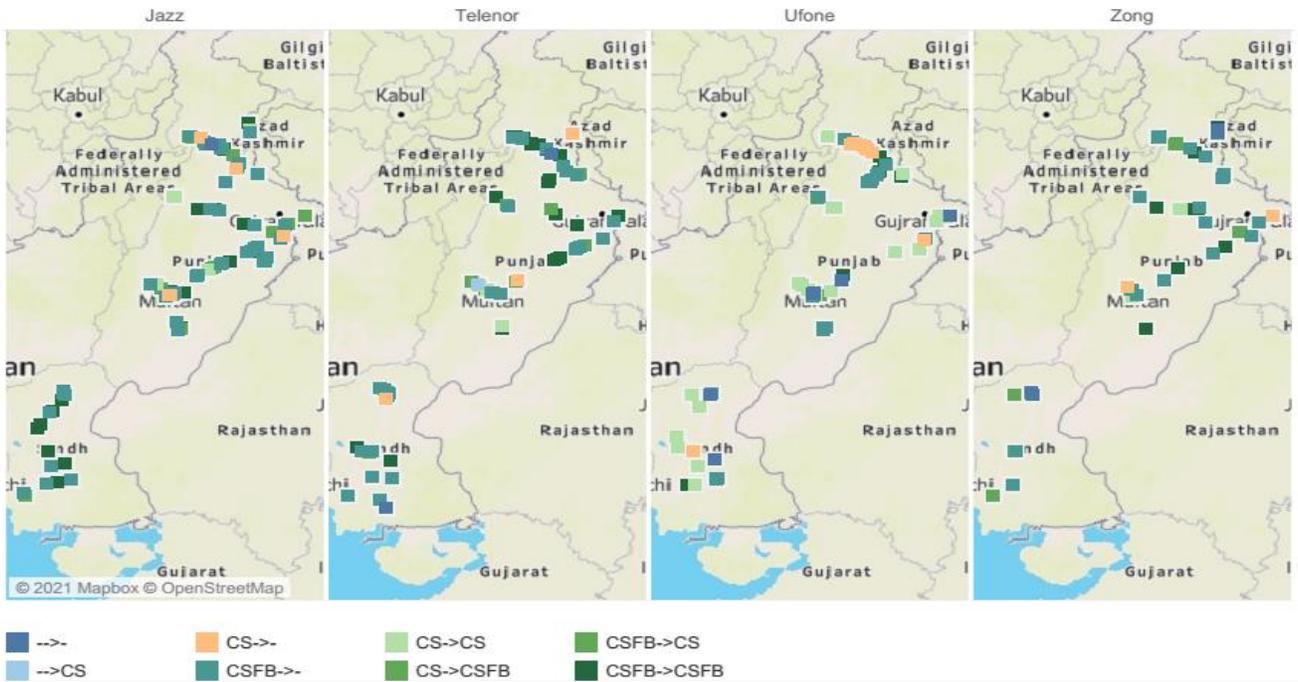


Figure 2.6: Breakdown of Mean Opinion Score in Used Speech Codecs & Bitrates

## 7. CALL SETUP FAILURE LOCATIONS

7.1. Call setup failure locations with the related call modes A -> B are shown both statistically and on map in **Figure 2.7: Call Setup Failure Locations**. Call mode indicated by "-" refers to LTE call modes, where the failure occurred before the CSFB was successful established.

## CALL SETUP FAILURE PER CALL MODE A/B



## CALL SETUP FAILURE PER CALL MODE – EACH CATEGORY

		City B side											
		Jazz			Telenor			Ufone			Zong		
		-	CS	CSFB	-	CS	CSFB	-	CS	CSFB	-	CS	CSFB
A side	CSFB	17	10	10	13	2	10	21	2	7	11	3	4
	CS	3	5	2		1		1	4	1	1	1	2
	-							4					

		Town B side									
		Jazz			Telenor		Ufone			Zong	
		-	CS	CSFB	-	CS	-	CS	CSFB	-	CS
A side	CSFB	2	2	7	1	3			1	4	1
	CS		1	1		1		2			
	-						1				

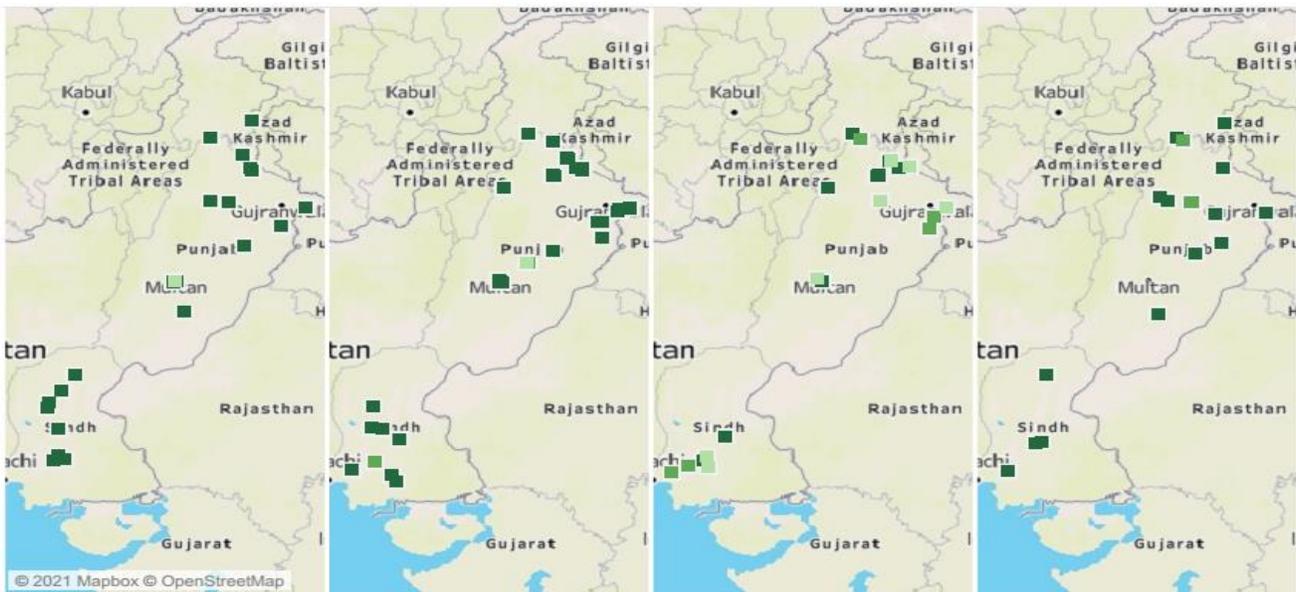
		Road B side											
		Jazz			Telenor			Ufone			Zong		
		-	CS	CSFB	-	CS	CSFB	-	CS	CSFB	-	CS	CSFB
A side	CSFB	38	4	15	19	7	17	6	3	7	12	7	9
	CS	2	2	3	3	2	1	13	23	1	1	4	
	-	1			2	1		1			4		

**Figure 2.7: Call Setup Failure Locations**

## 8. DROPPED CALLS LOCATIONS

8.1. Dropped Calls Locations with the related call modes A -> B are shown on the map and statistically in the **Figure 2.8: Dropped Calls Locations**. The lowest number of dropped calls in the category “town”, with Jazz and Zong without dropped calls in that category.

## DROPPED CALLS PER CALL MODE AND CALL TECHNOLOGY



- CS->CS
- CSFB->CS
- CS->CSFB
- CSFB->CSFB

## DROPPED CALLS PER CALL MODE AND CALL TECHNOLOGY – EACH CATEGORY

		City											
		Jazz			Telenor			Ufone			Zong		
		B side			B side			B side			B side		
		GSM/LTE	GSM/UMTS/..	UMTS/LTE	GSM/UMT..	UMTS/LTE	GSM/UMT..	UMTS/LTE	GSM/UMT..	UMTS/LTE	GSM/UMT..	UMTS/LTE	UMTS/LTE
A side	GSM/UMTS/LTE		2	2	1	6	3	2					
	UMTS	1											
	UMTS/LTE			5	4	10	3					2	

		Town					
		Telenor			Ufone		
		B side			B side		
		UMTS/LTE			GSM		
A side	GSM						1
	UMTS/LTE	1					

		Road														
		Jazz			Telenor			Ufone			Zong					
		B side			B side			B side			B side					
		GSM/LTE	GSM/UMTS/..	UMTS/LTE	GSM/LTE	GSM/UMTS/..	UMTS	UMTS/LTE	GSM	GSM/UMTS	GSM/UMTS/..	UMTS	UMTS/LTE	GSM/UMTS	GSM/UMTS/..	UMTS/LTE
A side	GSM							1		1						
	GSM/LTE	1														
	GSM/UMTS								3	1	1					
	GSM/UMTS/LTE		5	1		1		3							1	1
	UMTS						1	1	1	1			1			2
	UMTS/LTE		1	7		1	1	1	12	1	1			6	1	1

Figure 2.8: Dropped Calls Locations

# NETWORK PERFORMACEN RESULTS – DATA

## 1. DATA TRANSFER- OVERALL SCORE

1.1. In case of Data Service (i.e. Data Transfer, Video Streaming and Web Browsing & Social Media), ZonG, Ufone, Jazz and Telenor have obtained score of 276, 204, 182 and 162 respectively. The **Figure 3.1: Data Transfer- Overall Score**, shows the details of Data NPS Breakdown into individual KPIs (pale colors showing maximum achievable points) scoring card offers opportunities of biggest improvement potentials.

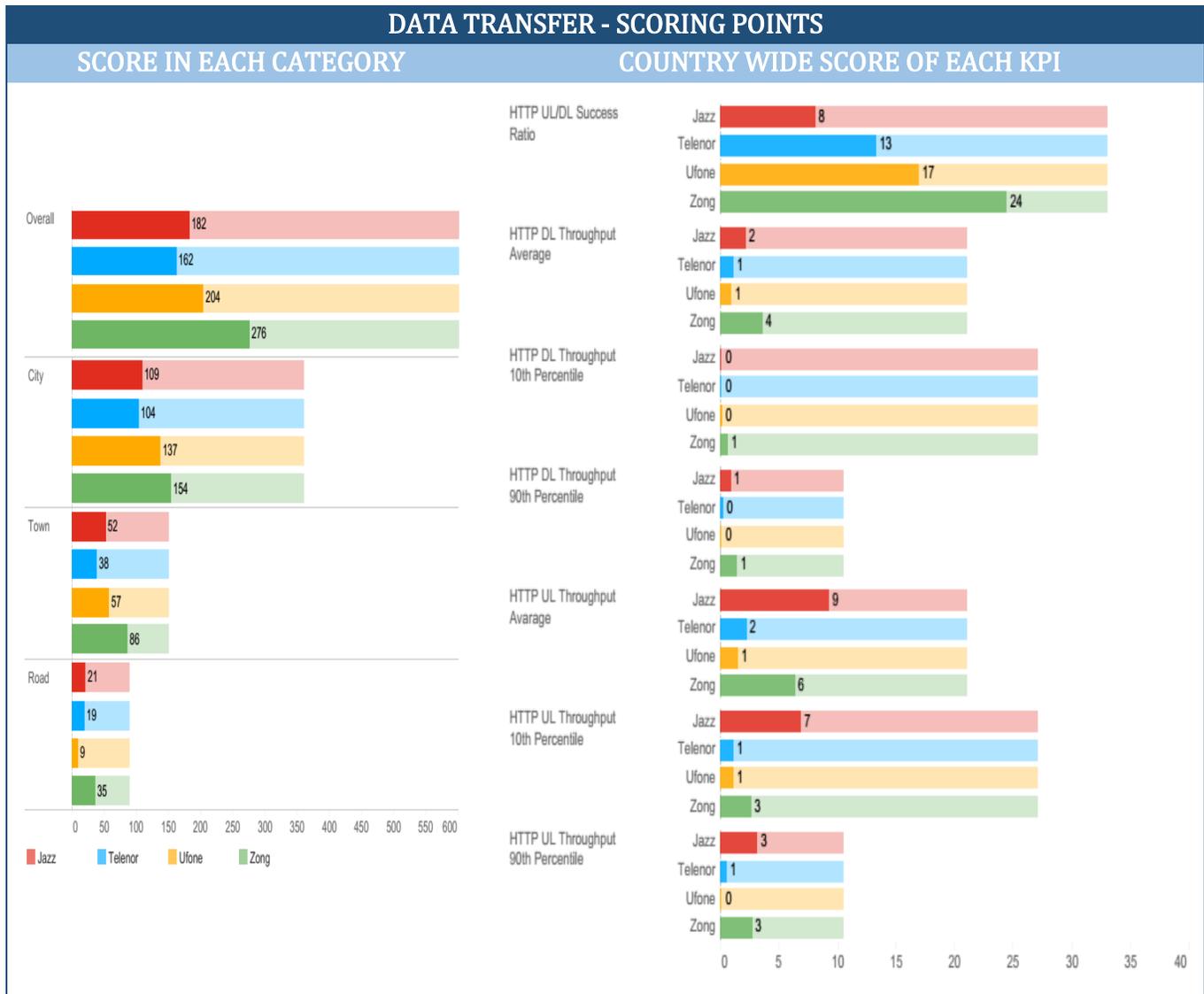


Figure 3.1: Data Transfer- Overall Score

## 2. HTTP SINGLE FILE TRANSFER (DOWNLINK)

2.1. In case of HTTP File Transfer of a fixed size (DL: 5MB), only ZonG and Jazz have achieved few points in success ratio in some categories. The **Figure 3.2: Http Success Ratio & UL/DL Duration Ratio**

shows details of both success ratio and the DL/UL file transfer duration, where ZonG shows the best performance.

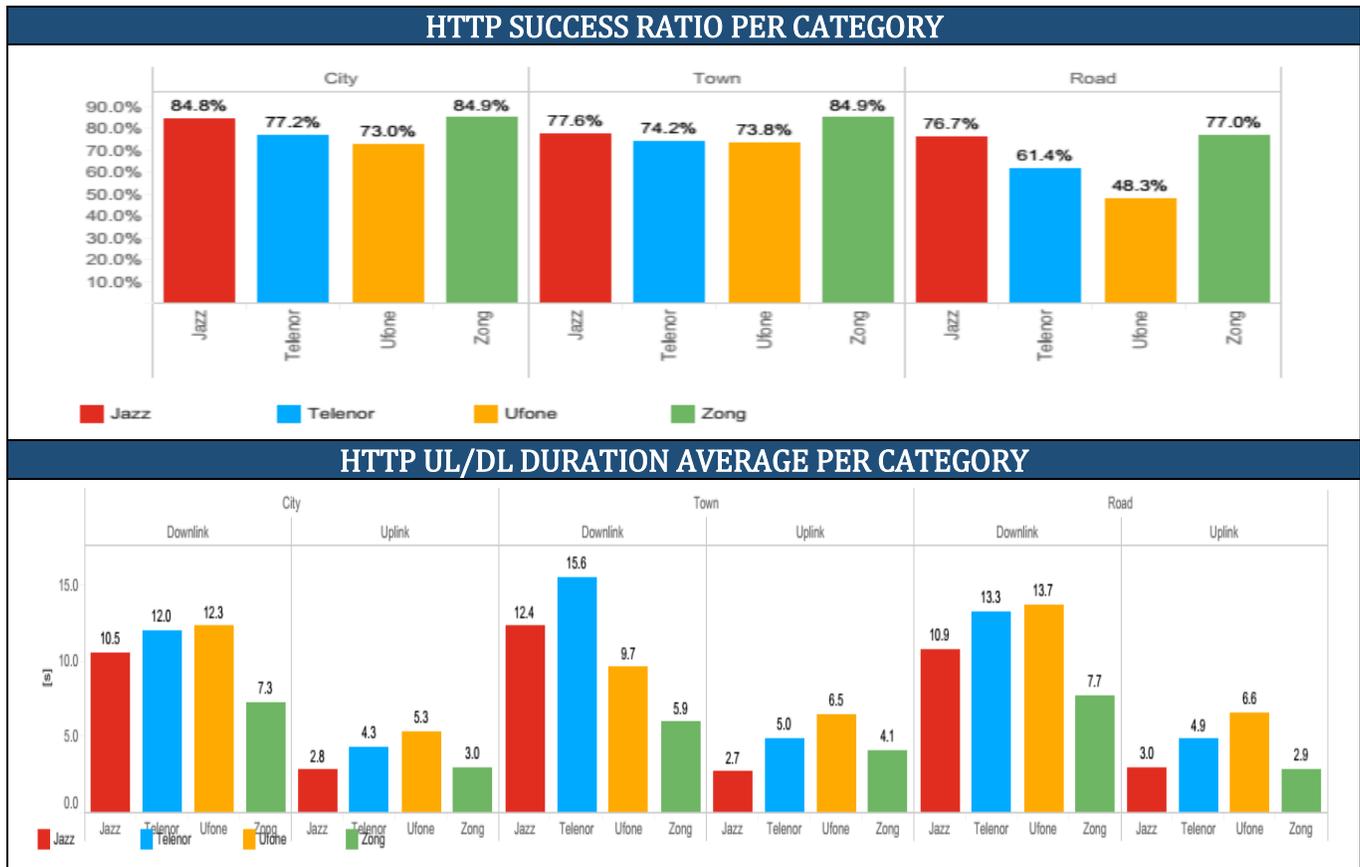
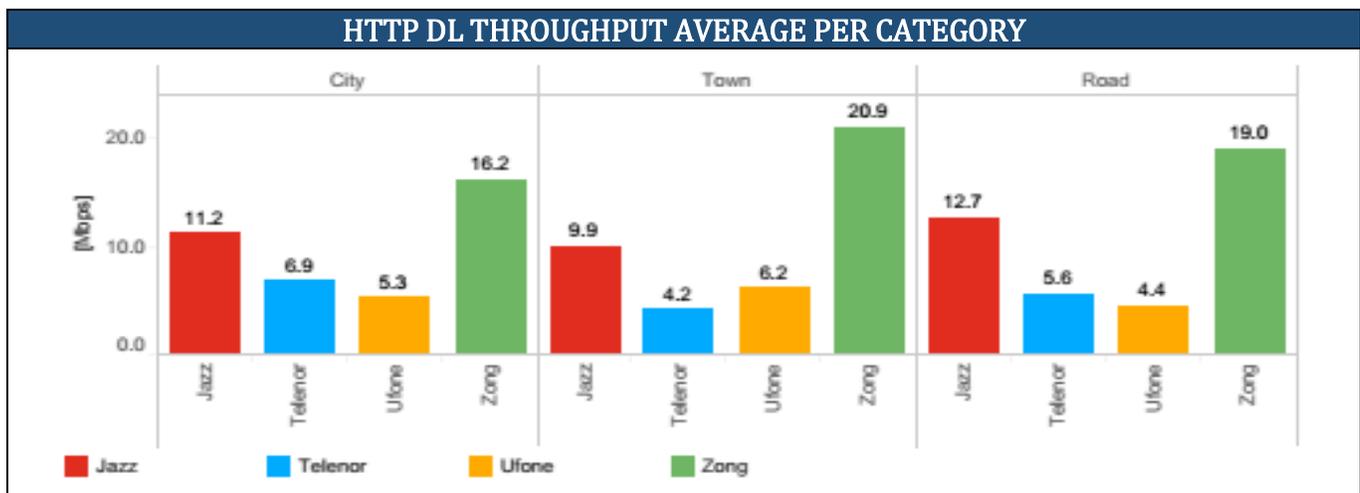


Figure 3.2: Http Success Ratio & UL/DL Duration Ratio

2.2. In order to investigate highest possible application throughput, HTTP file of fixed duration downloaded multiple times, which shows that ZonG achieved the highest DL throughput in all categories and for the average and 10<sup>th</sup> and 90<sup>th</sup> percentile. Telenor and Ufone performance remained the worst. However, none of the CMOs is significantly exceeding the minimal requirements of 1/1/10 Mbps for the average/10<sup>th</sup>/90<sup>th</sup> thresholds with respect to the maximum thresholds of 100/40/240 Mbps. The details is listed in **Figure 3.3: Http DL Throughput**.



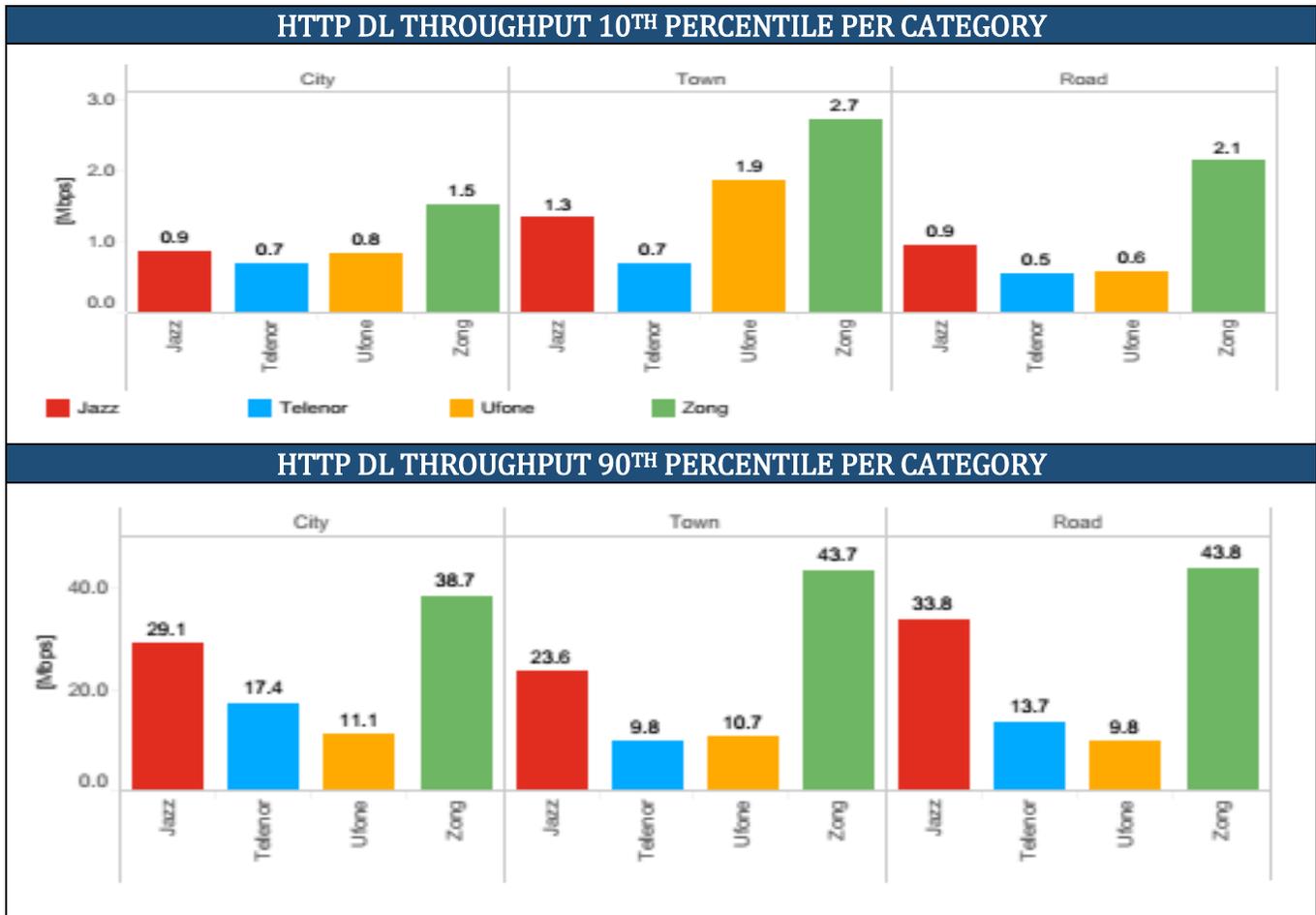
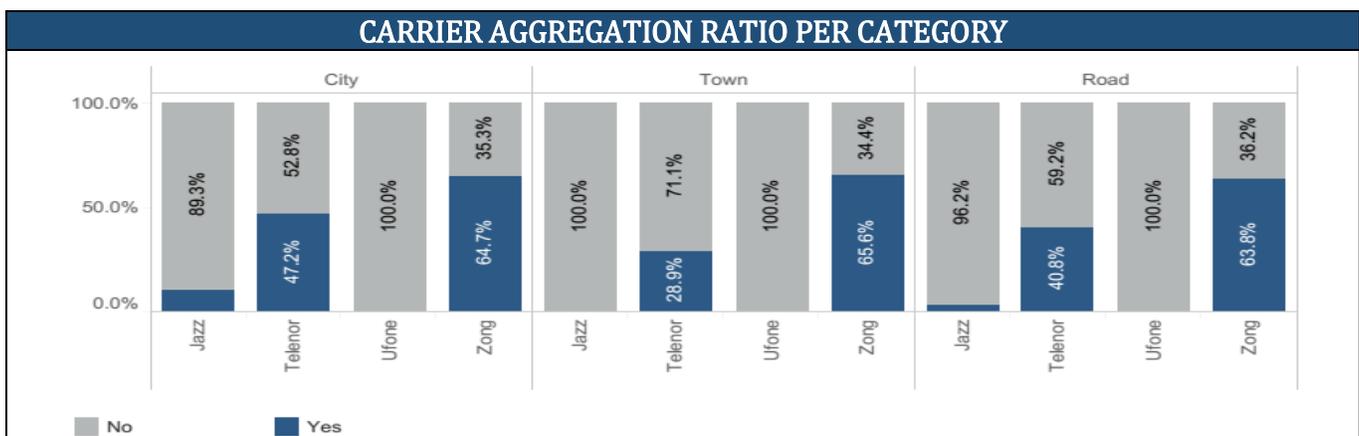


Figure 3.3: Http DL Throughput.

### 3. CARRIER AGGREGATION & USED BANDWIDTH

3.1. Carrier Aggregation utilization and used bandwidth (Downlink) shows that ZonG has the highest utilization (about 65%) of LTE carrier aggregation with a maximum of 2 component carriers in all three categories. The maximum bandwidth is up to 30 MHz. Telenor utilized 2CCA in cities and roads and also in towns with maximum 15 MHz aggregated bandwidth. Jazz uses 20 MHz bandwidth for the primary carrier and expands it to 25 MHz by only 10% of the measured samples in cities. Ufone is in a clear disadvantage with utilization of a single 5 MHz carrier only. The details are mentioned in **Figure 3.4: Carrier Aggregation Utilization & Used Bandwidth (DL)**



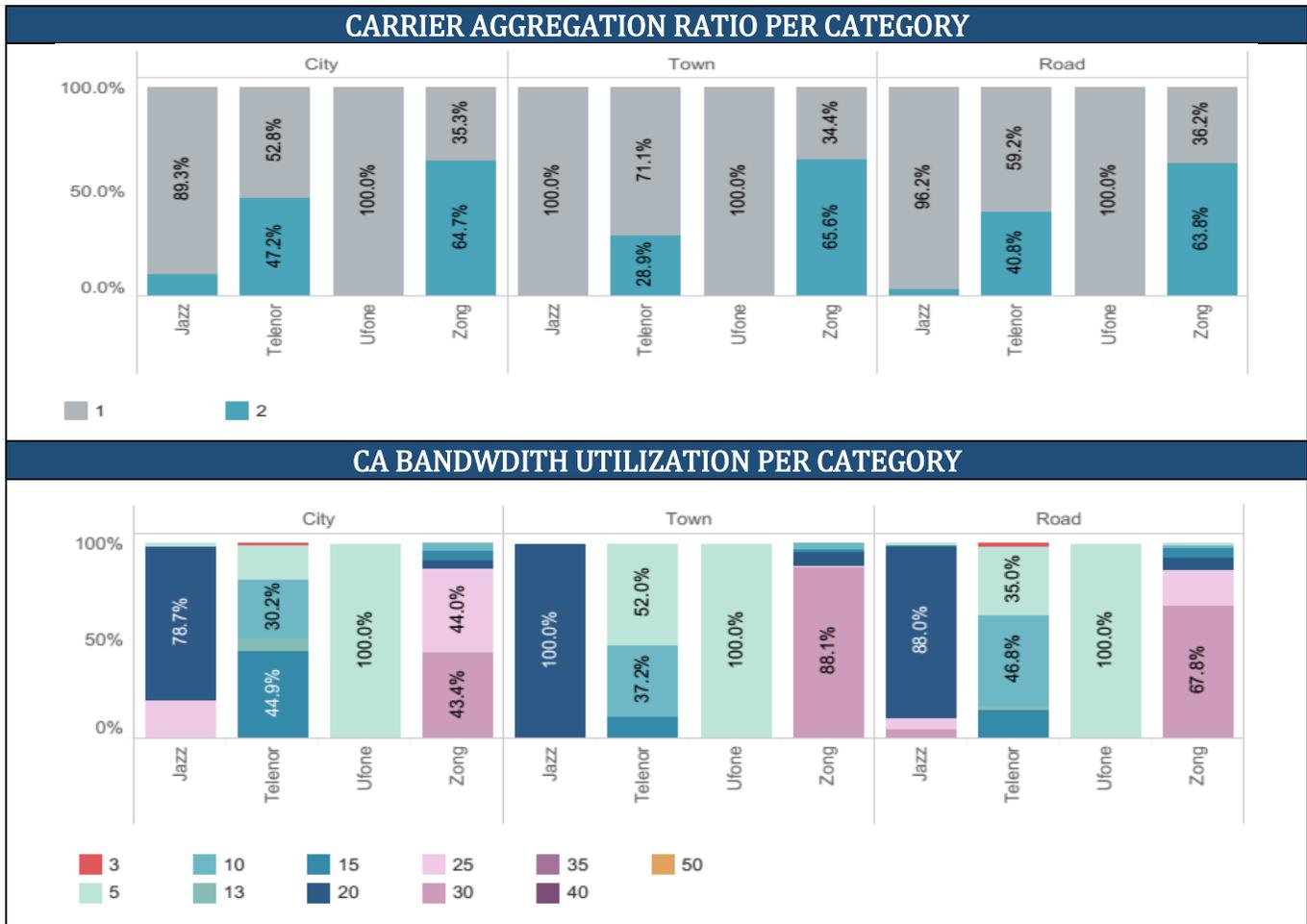
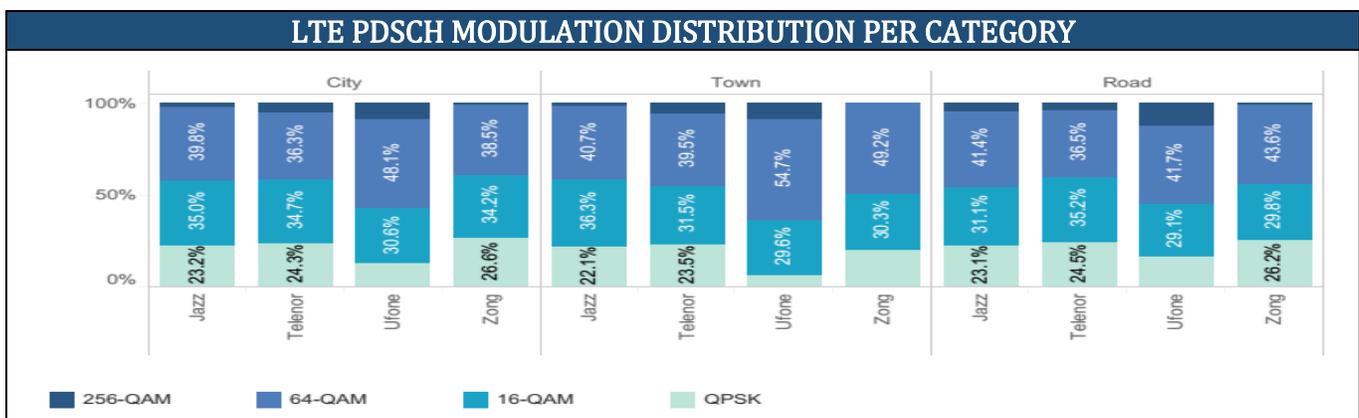


Figure 3.4: Carrier Aggregation Utilization & Used Bandwidth (DL)

#### 4. MODULATION DISTRIBUTION & RESOURCE BLOCK UTILIZATION

4.1. LTE Physical Downlink Shared Channel (PDSCH) modulation distribution and DL Resource Block (RB) utilization shows that Ufone has the best LTE PDSCH modulation distribution with highest contribution of 256QAM and 64QAM. Other CMOs show a very similar distribution. Zong is the only operator without the highest modulation of 256QAM. The RB usage is an indicator for the network load. All CMOs are showing a low usage of about 50%, pointing to shared resources which reduced the data throughput. Ufone is slightly better positioned with 60% RB usage. The company wise details are shown in **Figure 3.5: Modulation Distribution & Resource Block Utilization**.



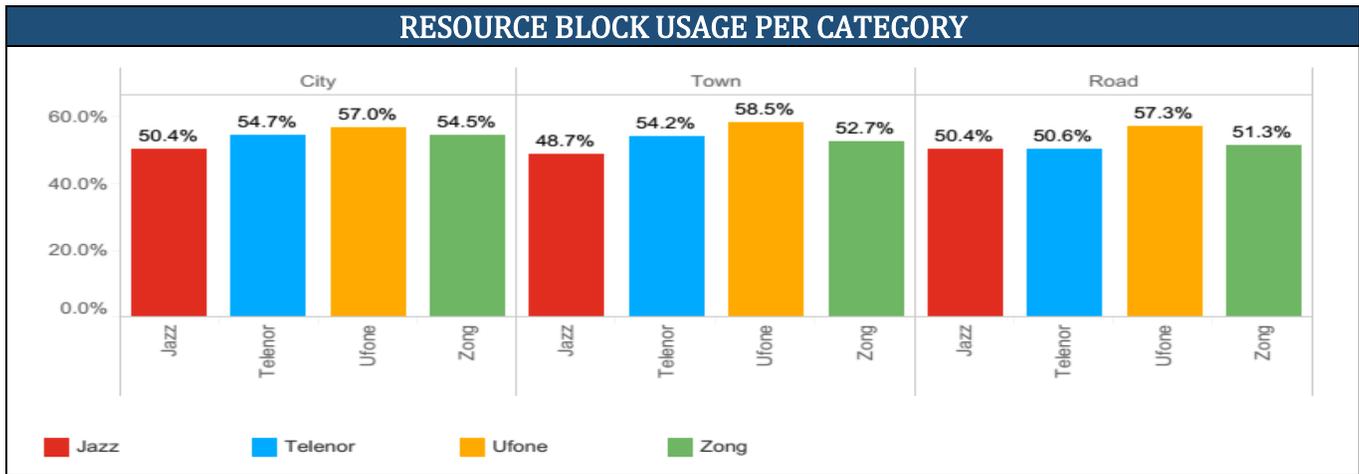
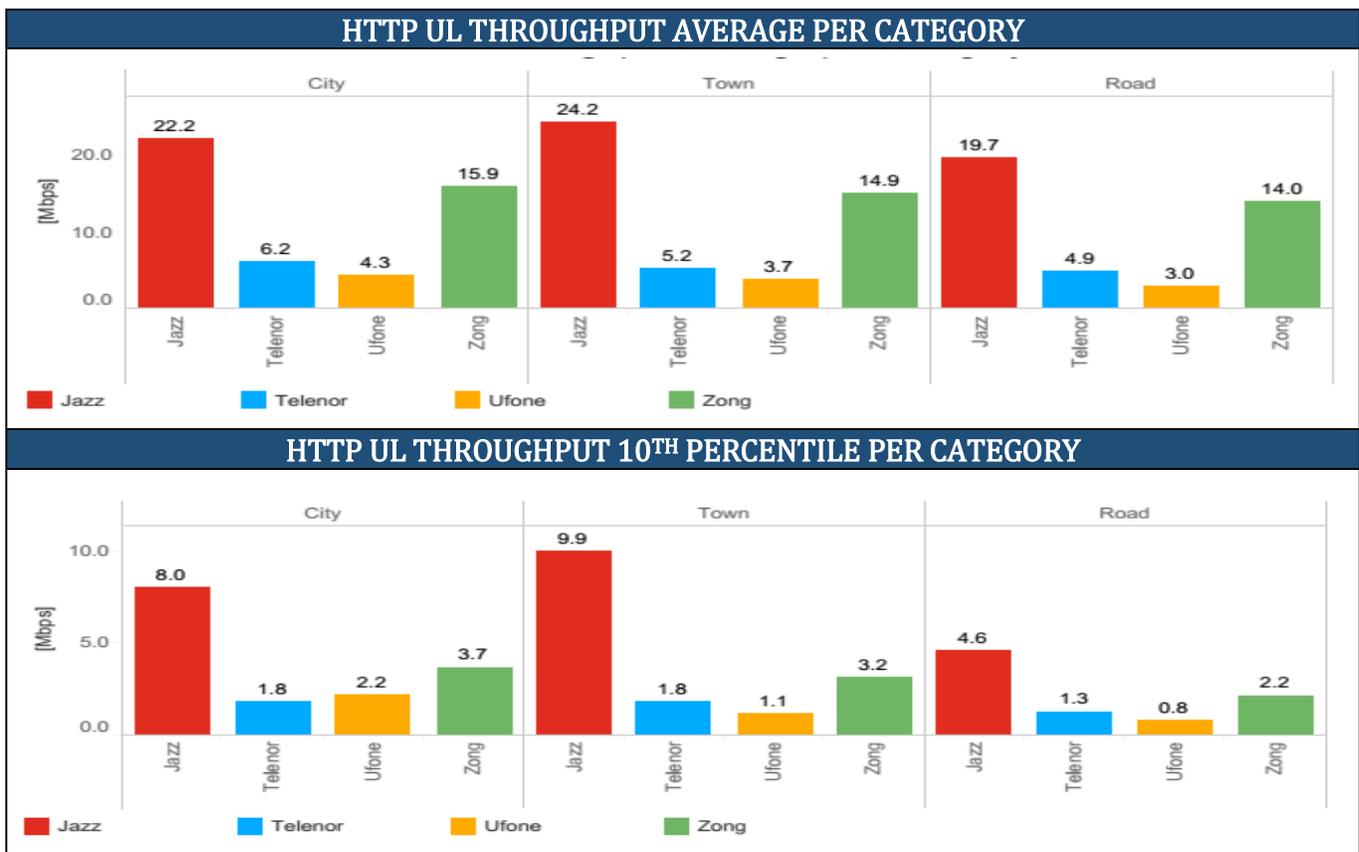


Figure 3.5: Modulation Distribution & Resource Block Utilization

## 5. HTTP SINGLE FILE TRANSFER (UPLINK)

5.1. In case of HTTP File Transfer of a fixed size (UL: 2MB), the Success Ratios below 80% are scoring with zero points. Further to investigate highest possible application throughput, HTTP file of fixed duration uploaded multiple times, which shows that Jazz achieves the highest UL throughput in all categories and for the average and 10<sup>th</sup> and 90<sup>th</sup> percentile. Telenor and Ufone with the worst performance as for the DL before. However, the UL performance is better than the DL performance with respect to the defined KPI target thresholds of minimum 0.5/0.5/5Mbps and maximum 30/50/100 Mbps for the average/10<sup>th</sup>/90<sup>th</sup> results. The company wise details is shown in **Figure 3.6: Http Uplink Throughput**.



## HTTP UL THROUGHPUT 90<sup>TH</sup> PERCENTILE PER CATEGORY

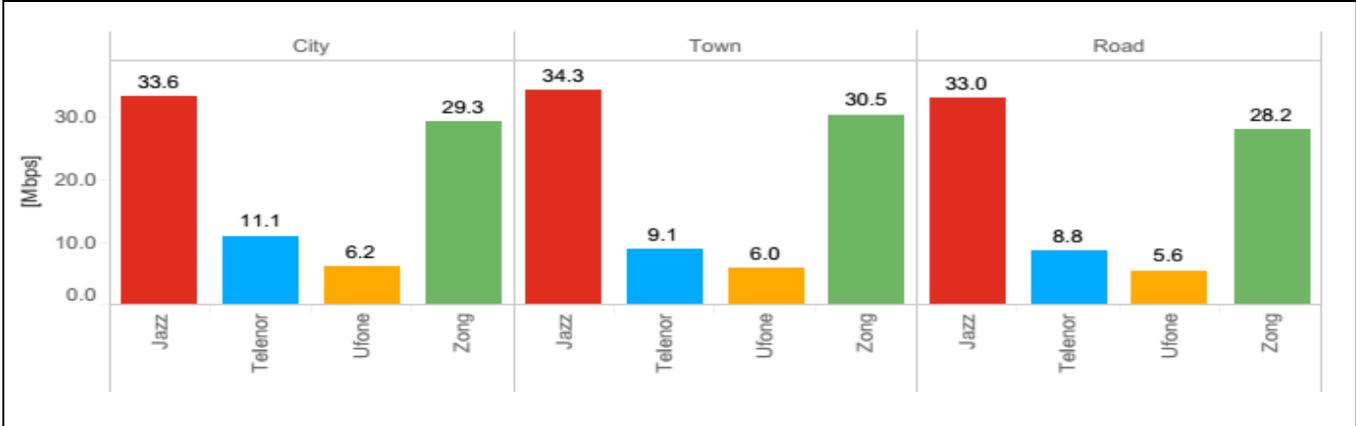


Figure 3.6: Http Uplink Throughput

## 6. VIDEO STREAMING - OVERALL SCORE

6.1. The **Figure 3.7: Video Streaming- Overall Score**, shows the details of Data NPS Breakdown into individual KPIs (pale colors showing maximum achievable points) scoring card offers opportunities of biggest improvement potentials.

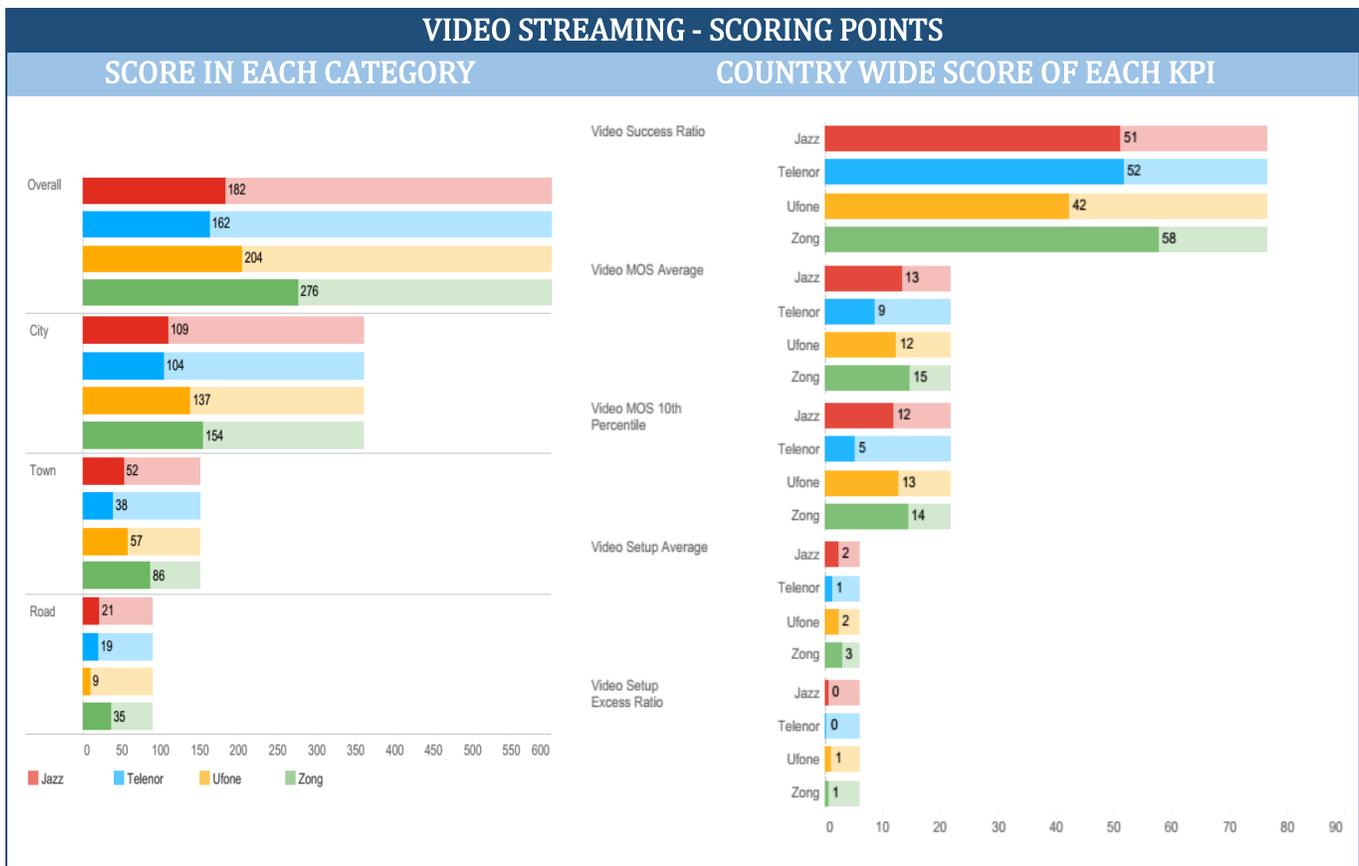
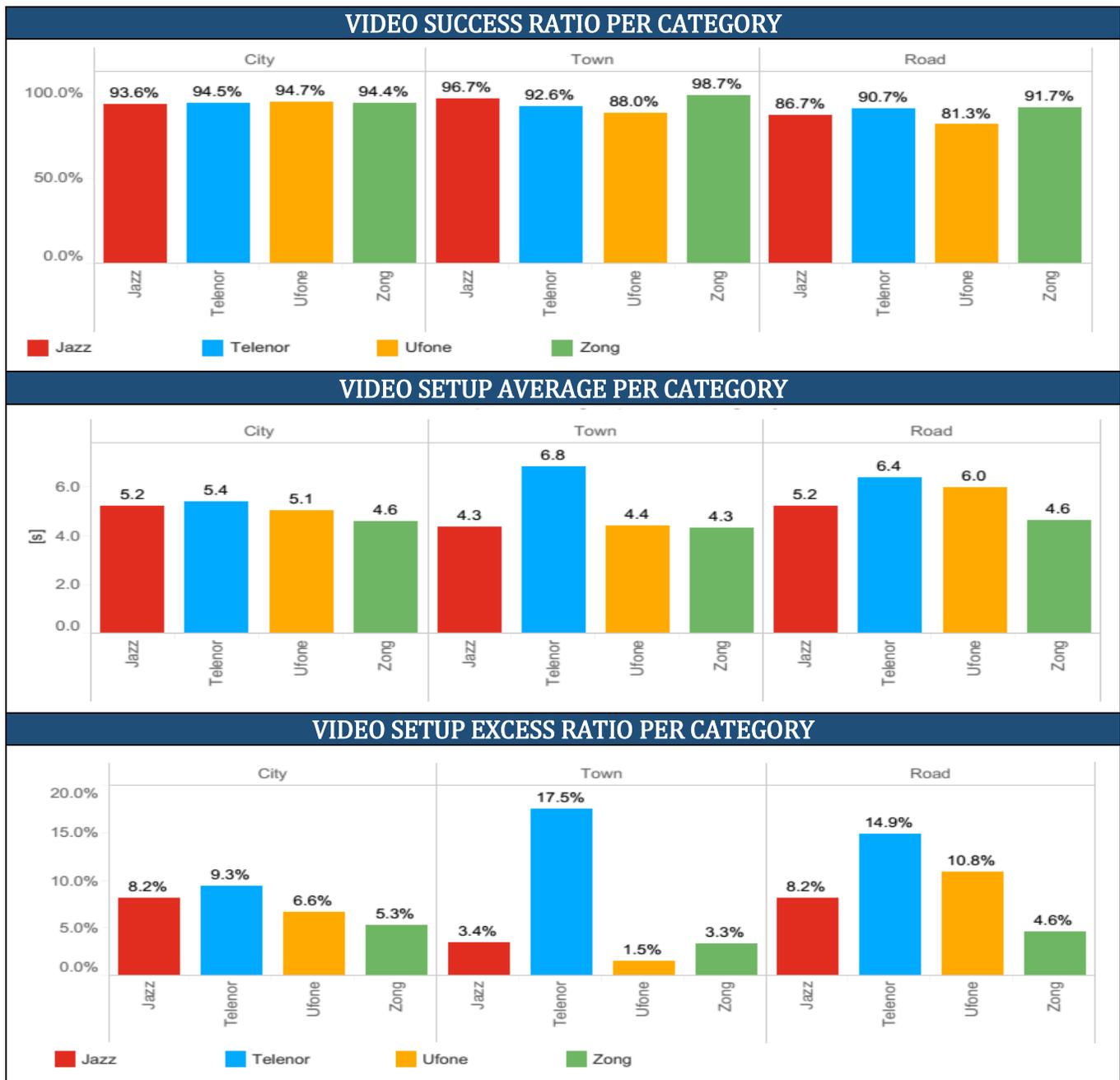


Figure 3.7: Video Streaming- Overall Score

## 7. VIDEO SUCCESS RATIO & SETUP TIME

7.1. The video success ratio is good for all CMOs in the category City. Jazz is losing ground in the category Road. Ufone shows weakness in the category town and has the worst result in the category

Road. Zong has the best video setup average time in all three categories. Telenor having higher video setup excess ratio in Town and Road. The company wise details is listed in **Figure 3.8: Video Success Ratio & Setup Time**.



**Figure 3.8: Video Success Ratio & Setup Time.**

## 8. VIDEO MEAN OPINION SCORE & RESOLUTION

8.1. The overall Video MOS average reflects a good result for all operators, where only Telenor is slightly behind the other operators. Telenor's worse results is based on the lowest full-HD and HD resolution. All operators offering full-HD resolution (1 080p). No 4k resolution for any operator observed. The company wise details is listed in **Figure 3.9: Video Mean Opinion Score & Resolution**.

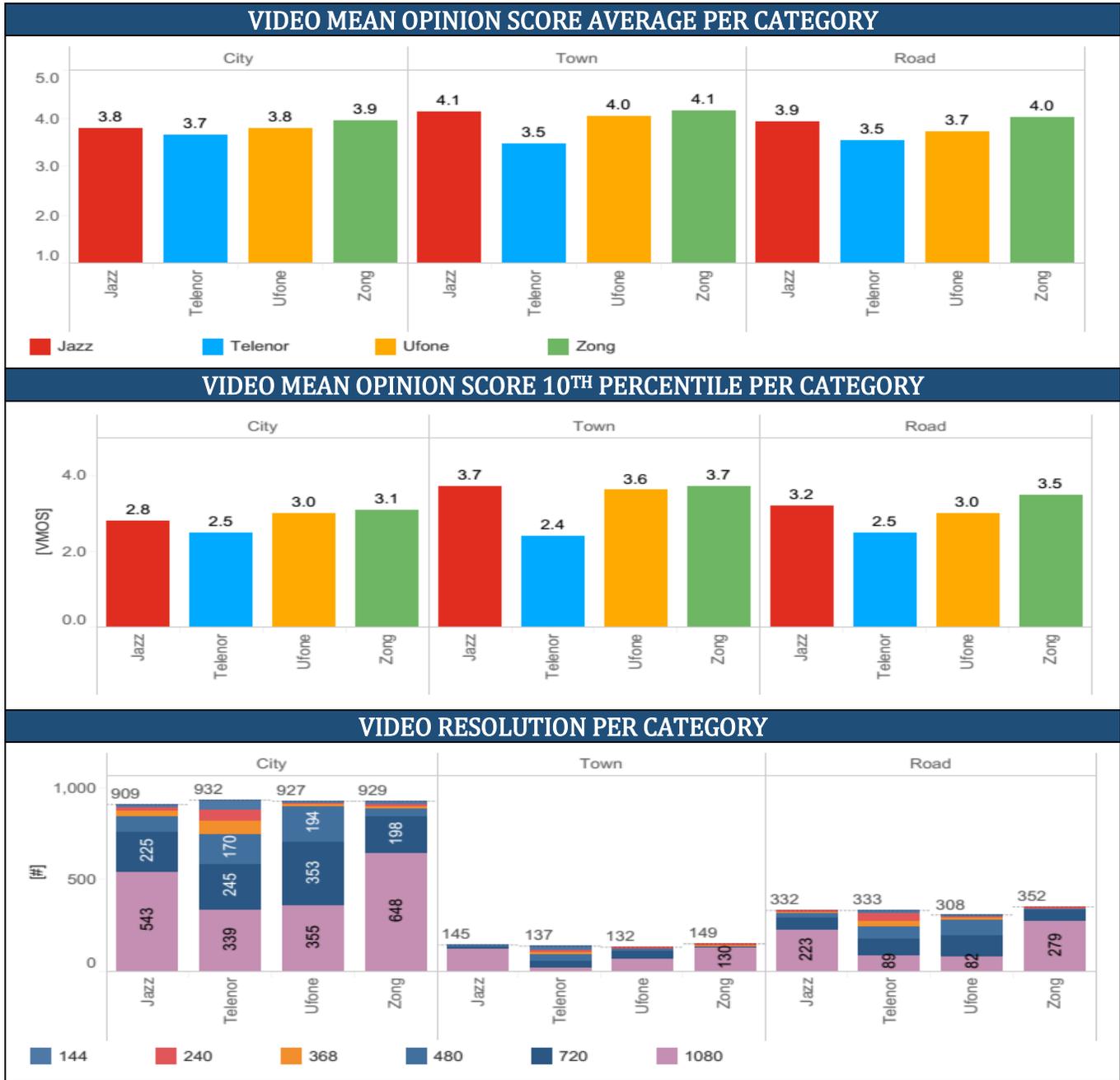


Figure 3.9: Video Mean Opinion Score & Resolution.

## 9. BROWSING & SOCIAL MEDIA – OVERALL SCORE

9.1. The **Figure 3.10: Browsing & Social Media - Overall Score**, shows the details of Data NPS Breakdown into individual KPIs (pale colors showing maximum achievable points) scoring card offers opportunities of biggest improvement potentials.

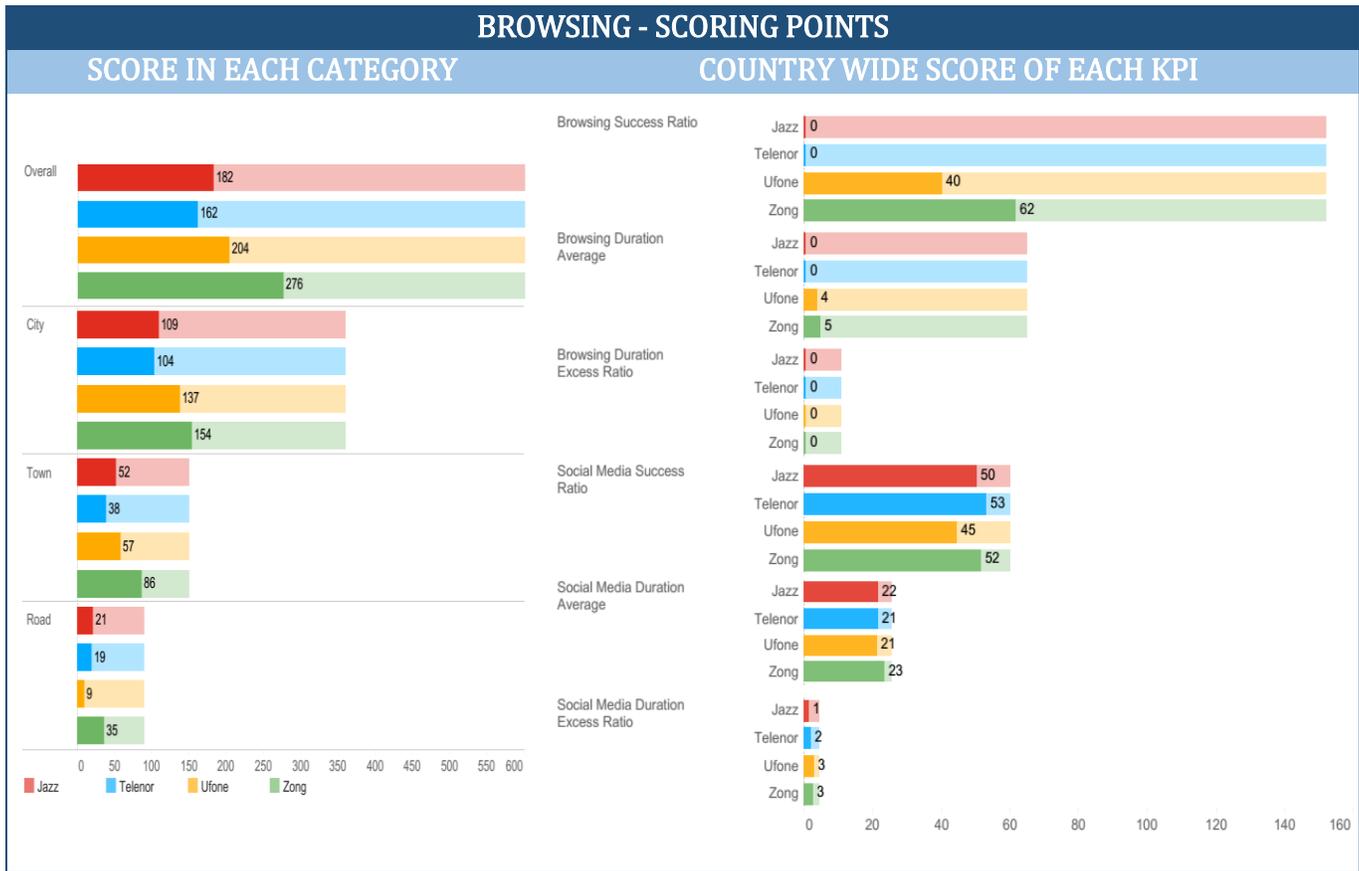
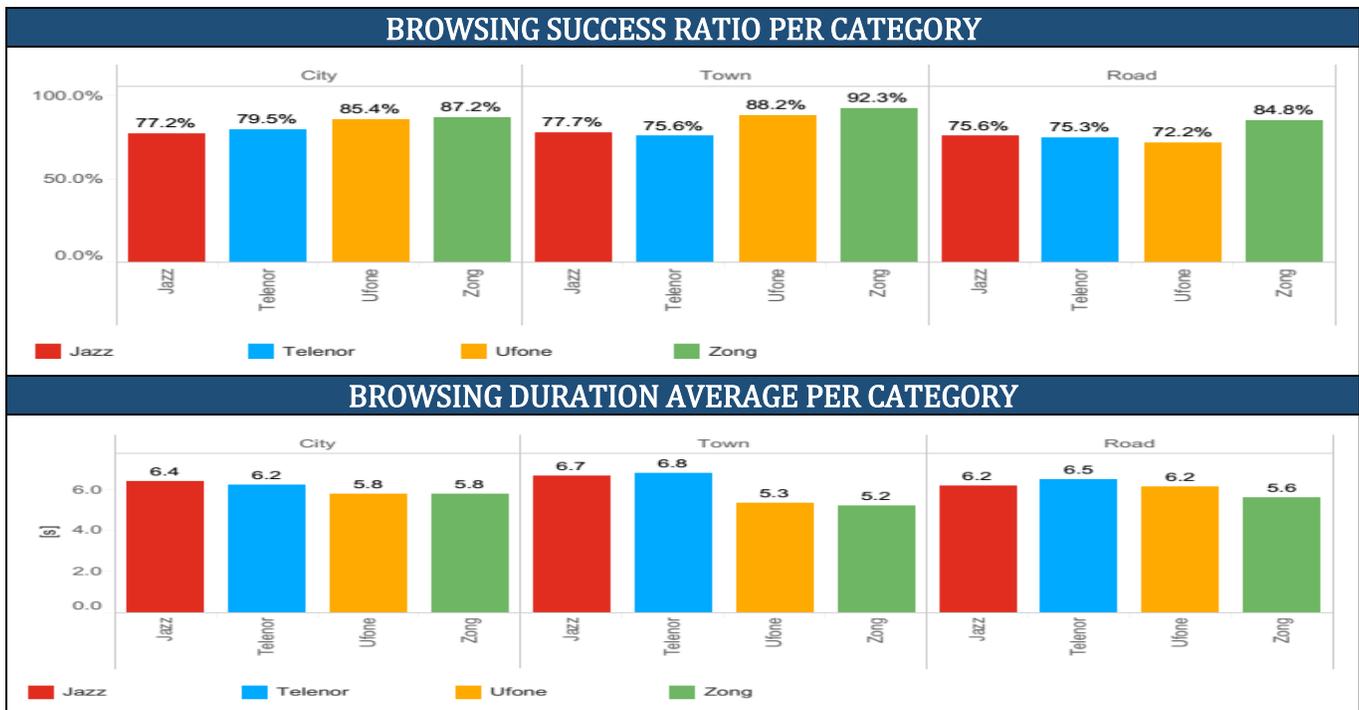


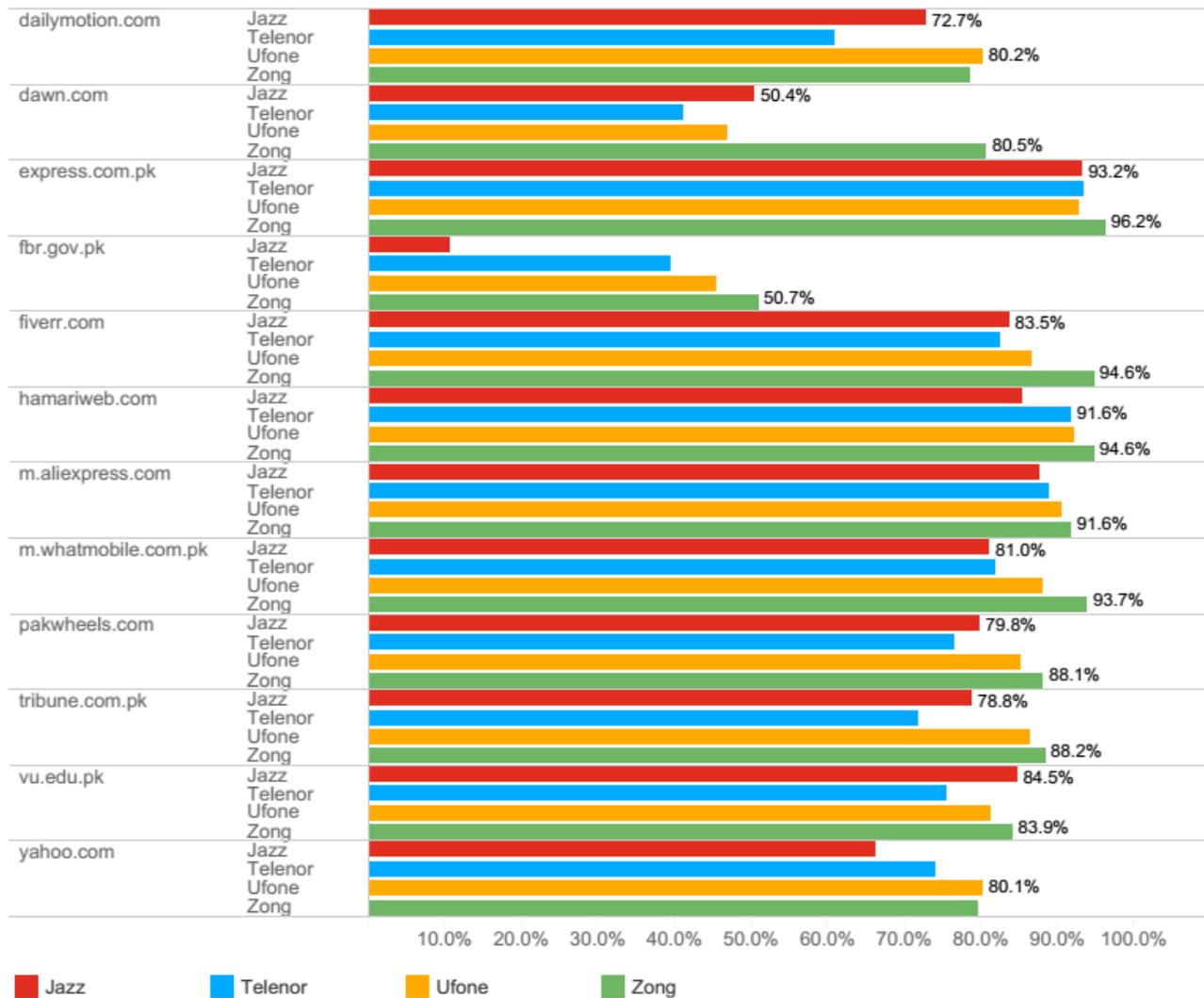
Figure 3.10: Browsing & Social Media - Overall Score

## 10. BROWSING KEY PERFORMANCE INDICATORS

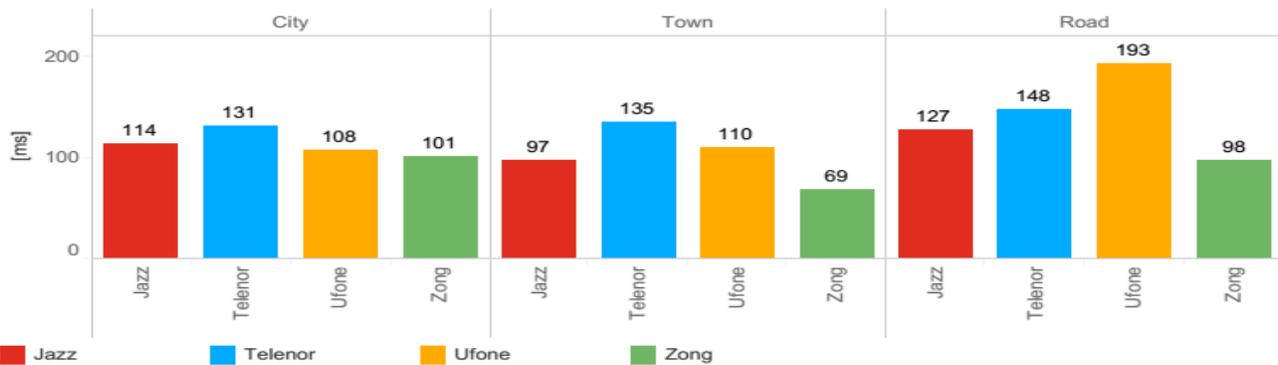
10.1. The details of Browsing Success Ratio and Duration etc., are shown in **Figure 3.11: Browsing Key Performance Indicators.**



## BROWSING SUCCESS RATIO PER URL



## DNS RESOLUTION TIME AVERAGE PER CATEGORY



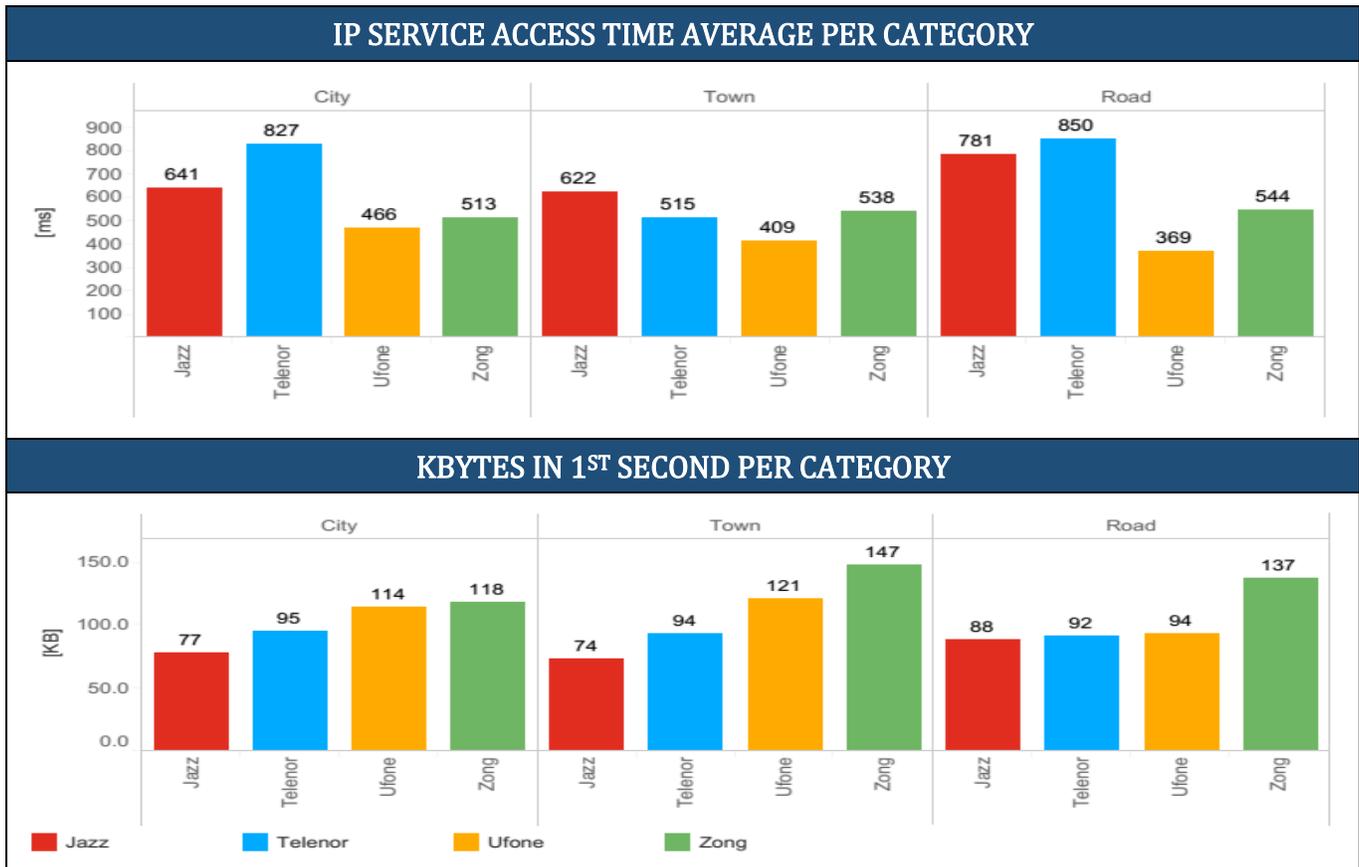
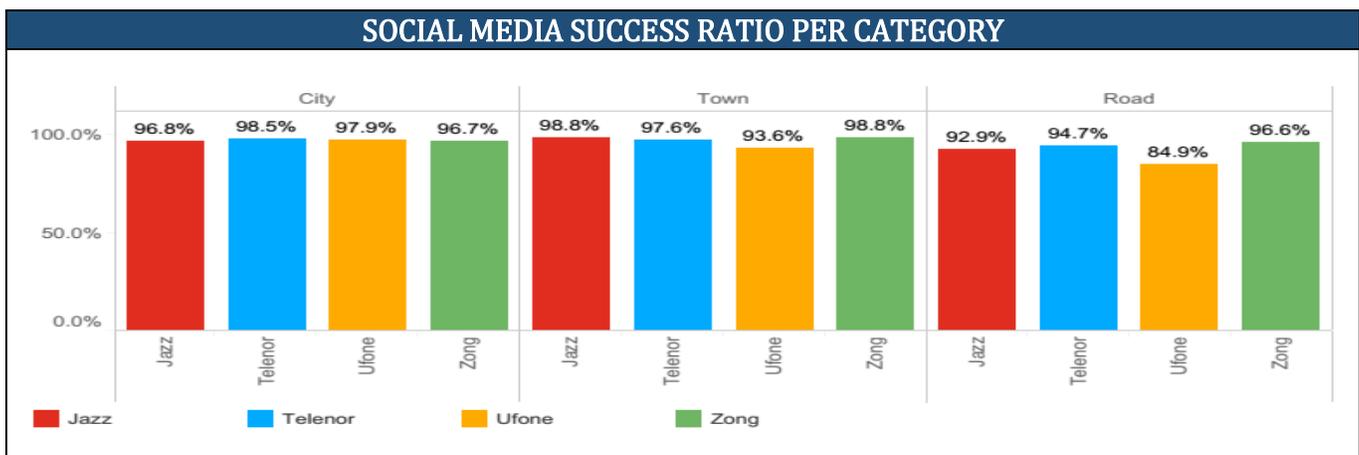


Figure 3.11: Browsing & Social Media Key Performance Indicators.

## 11. SOCIAL MEDIA (DROPBOX) EVALUATION

11.1. All CMOs shown good results for the success ratio in the main category city. Ufone shows some weaker results in categories town and road. Jazz faces some degradation in the category road.

11.2. All CMOs shown good results for the average duration in all categories to the threshold of 3 sec to achieve full scoring for this KPI, Ufone shows some weaker result in categories road. Zong has the shortest average duration in all categories with 4 - 4.1 sec. The company wise detail is shown in Figure 3.12: Social Media Key Performance Indicators.



### SOCIAL MEDIA DURATION AVERAGE PER CATEGORY

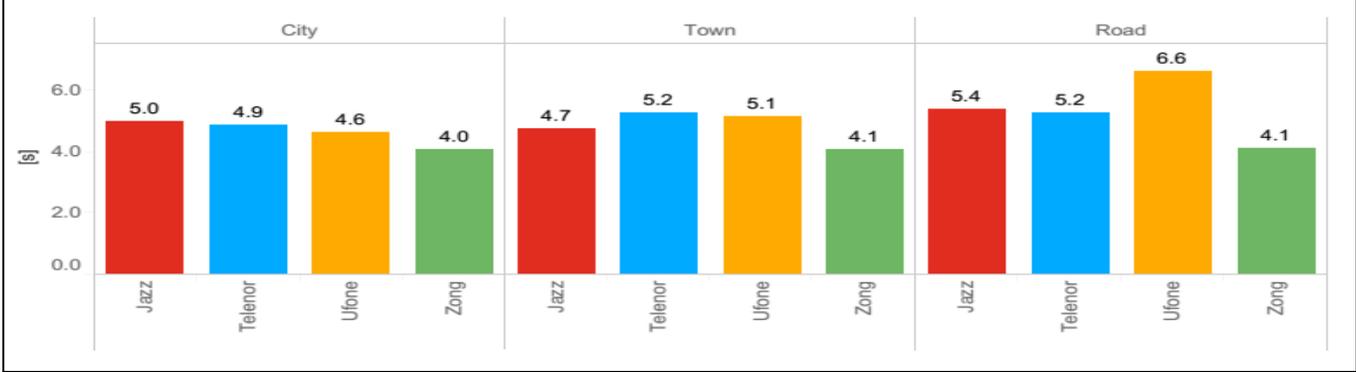
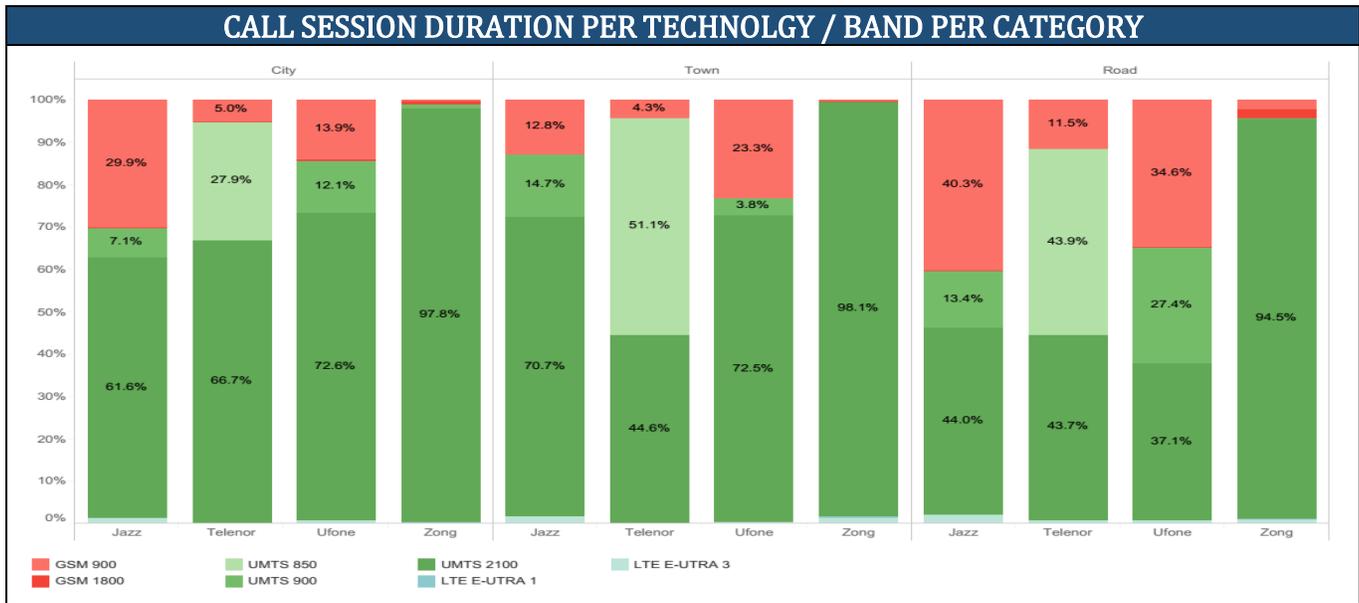


Figure 3.12: Social Media Key Performance Indicators.

# NETWORK PERFORMACEN RESULTS – SPECTRUM

## 1. VOICE SERVICE – TECHNOLOGY BREAKDOWN

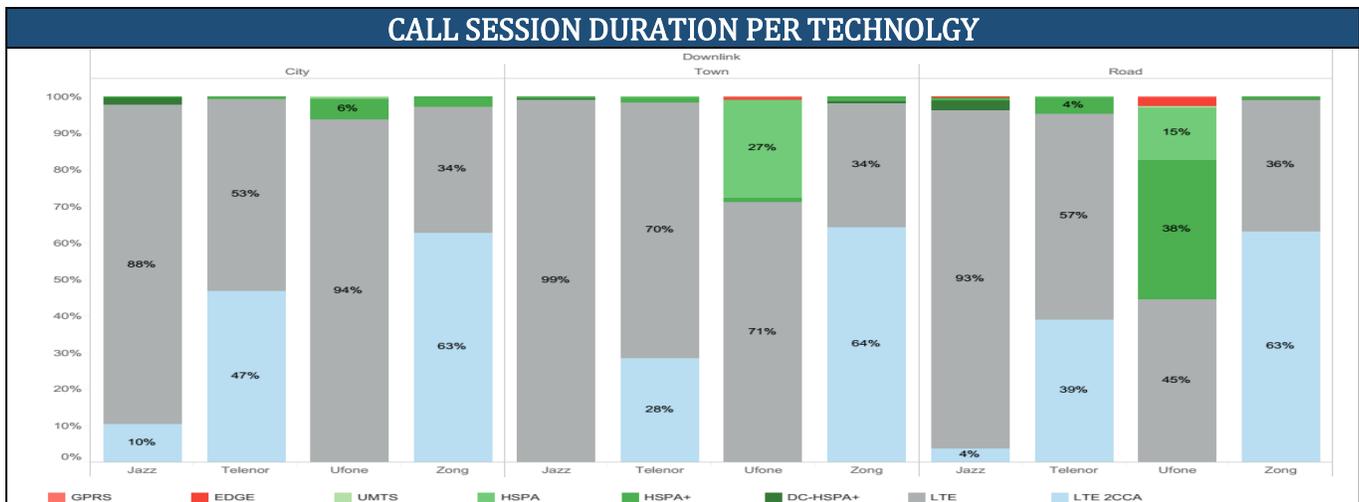
1.1. The analysis of Calls Sessions Duration per Technology / Band and Category shows that none of the CMOs offers VoLTE in the current test. Small LTE contribution linked to failed calls in the call setup phase. Zong with clearly the highest 3G (UMTS21 00) usage. Jazz with highest GSM usage. The details is shown in **Figure 4.1: Call Session Duration Per Technology / Band Per Category**.



**Figure 4.1: Call Session Duration Per Technology / Band Per Category**

## 2. DATA SERVICE – TECHNOLOGY BREAKDOWN

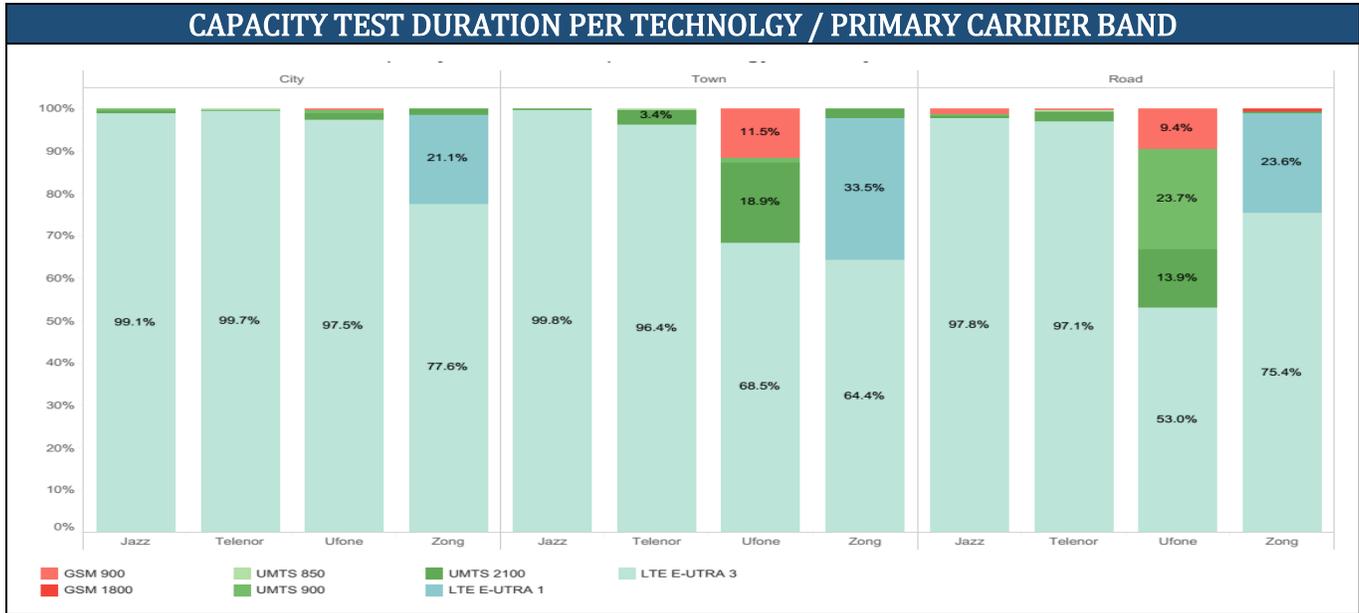
2.1. The analysis of Data Sessions Duration per Technology shows that ZonG with the best LTE utilization with more than 60% usage of 2CCA. Telenor utilizes also a wider range of 2CCA. Ufone the only operator not being able to offer 2CCA due to lack of spectrum holding. The details is shown in **Figure 4.2: Call Session Duration Per Technology**.



**Figure 4.2: Call Session Duration Per Technology**

### 3. DATA SERVICE – TECHNOLOGY BANDS BREAKDOWN

3.1. The analysis of Capacity Test Duration per Technology / Primary Carrier Band shows that LTE band 3 is the most common used band for data services. The graph shows the distribution of the used technology bands per operator. The details is shown in **Figure 4.3: Call Session Duration Per Technology / Primary Carrier Band**.



**Figure 4.3: Call Session Duration Per Technology / Primary Carrier Band**

# WAY FORWARD

## 1. OPPERTUNITY POINTS

1.1. The Opportunity View highlights KPIs to be addressed with the highest potential to gain points on the Score by each CMO. The charts present the missed points in NPS. Longer bars indicate higher improvement potential (e.g. more missing points to the maximum score). Overall a poor success ratio, especially in web browsing services is responsible for non-scoring in this KPI. Also the CSSR for voice and video have a high potential. The success ratios are making the key differences in the networks under tests. All other KPIs are on comparable levels, but most of the data KPIs are at a very low level and also have a big potential for improvements. The detail is listed in **Figure 5.1: Overall & KPIs Wise Scoring Point Opportunities**.

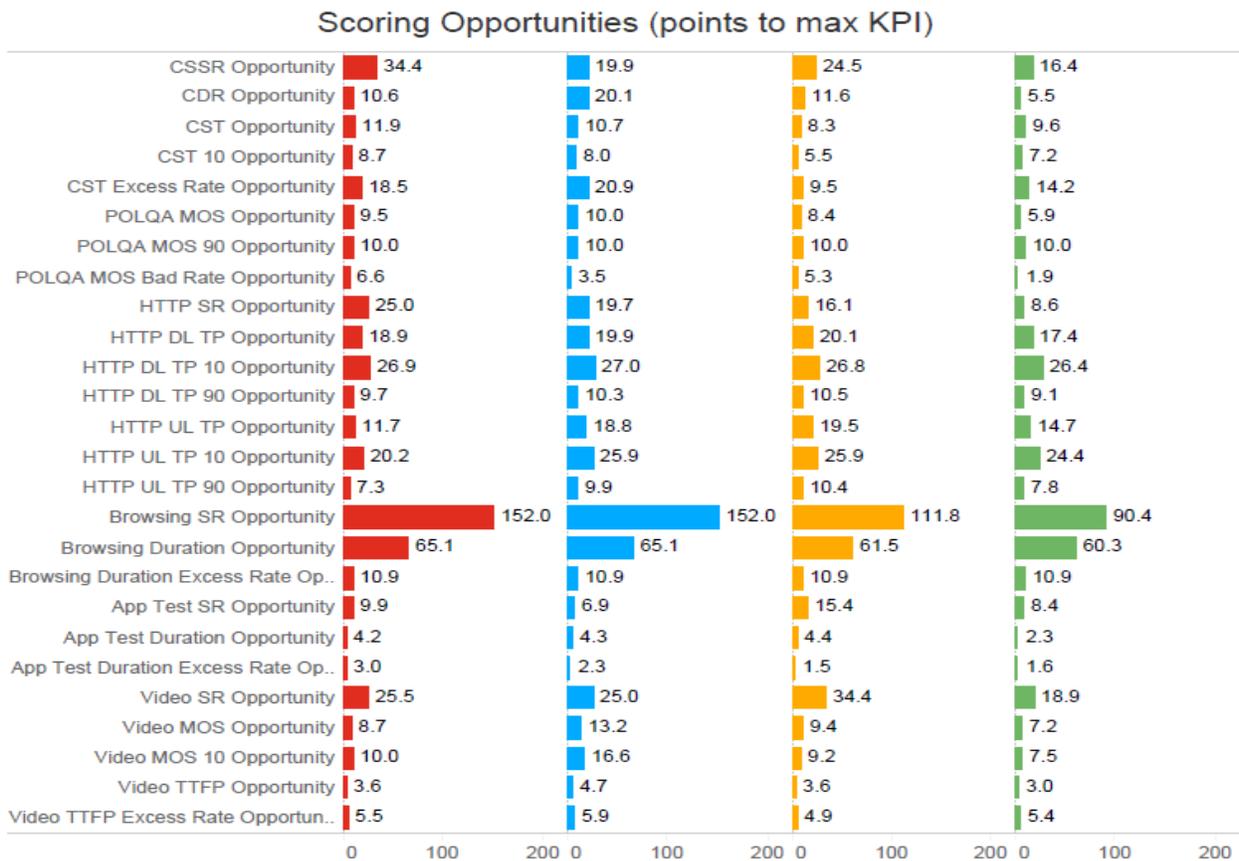
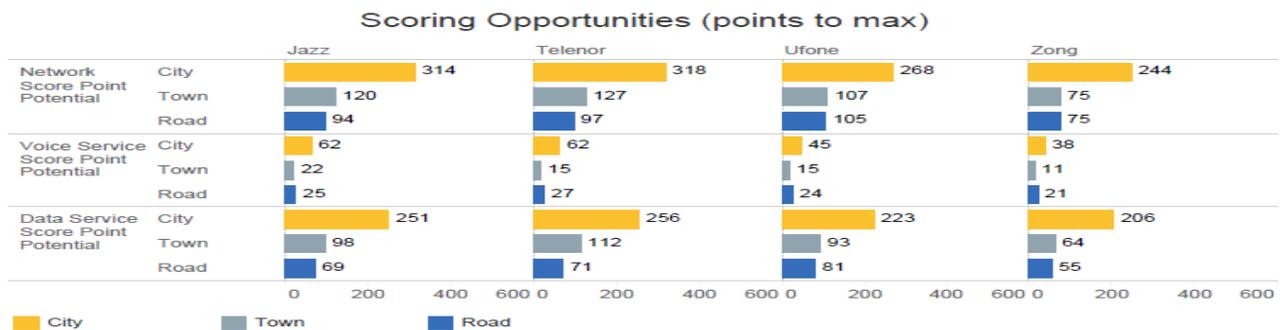


Figure 5.1: Overall & KPIs Wise Scoring Point Opportunities