August 2010

ACCRA & TEMA METROPOLIS

QUALITY OF SERVICE REPORT

Test conducted | June-July 2010

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EXECUTIVE SUMMARY

From 24th June to 28th July 2010, the National Communications Authority carried out an assessment of the quality of Cellular mobile voice services provided by the operators MTN, Vodafone, Tigo, Zain and Kasapa in the Accra Metropolis, Tema Metropolis, Dawhenya and Prampram.

By analyzing technical parameters that translate the quality perception from the mobile phone user's standpoint, benchmarking against compliance requirements as per the Cellular Mobile licence, our findings are as follows:

a) Call Setup Time (CST)

Call Setup Time is the period of time elapsing from the sending of a complete destination address (target telephone number) to the setting up of a call. CST should be less than ten seconds (<10secs) in 95% of cases.

The performance of the operators in respect of call set up time is as shown in Table1 below:

Table 1 Call Setup time of Cellular Operators in Accra-Tema Metropolis, June-July 2010

	MTN	Vodafone	Tigo	Zain	Kasapa
Accra	12.09secs	15.21secs	11.67secs	13.86secs	15.28secs
Tema	11.97secs	13.44secs	11.39secs	14.32secs	16.26secs
Prampram & Dawhenya	10.63secs	11.41secs	10.76secs	12.20secs	13.38secs

REMARKS:

- There were call setup delays on all networks in Accra Metropolis irrespective of the suburb.
- There were call setup delays on all the networks in Tema Metropolis, Prampram and Dawhenya townships.

b) Call Congestion Rate

Call Congestion Rate is the probability of failure of accessing a traffic channel during call setup. Traffic Channel Congestion rate should be equal or less than one per cent (1%).

The performance of the operators in respect of call congestion is as shown in Table 2 below:

Table 2 Call Congestion Rate of Cellular Operators in Accra-Tema Metropolis, June-July 2010

	MTN	Vodafone	Tigo	Zain	Kasapa
Accra	3%	17%	27%	12%	10%
Tema	7%	4%	3%	4%	10%
Prampram & Dawhenya	3%	2%	1%	4%	6%

REMARKS:

- Users in Accra experience high call congestion in most localities irrespective of the network. The most severe call congestion is at Achimota, Dome, and Kwabenya on all the networks.
- Users in Tema experience call congestion irrespective of the network at Communities 1, 2, 3, 5, 21, 22, Michel Camp, Afienya and Kakasunaka.
- Users in Prampram and Dawhenya experience excessive call congestion on MTN, Vodafone, Zain and Kasapa. Only Tigo operate under the licence call congestion threshold of 1%.

c) Call Drop Rate (CDR)

Voice Call Drop Rate is the probability of a call terminating without any of the users' will. Call drop rate should be equal or less than three per cent (3%).

The performance of the operators in respect of call drops is as shown in Table 3 below:

Table3 Call Drop Rate of Cellular Operators in Accra Metropolis, June-July 2010

	MTN	Vodafone	Tigo	Zain	Kasapa
Accra	1%	3%	32%	8%	2%
Tema	3%	0%	3%	2%	1%
Prampram & Dawhenya	6%	2%	6%	10%	0%

REMARKS

- Users of Zain and Tigo experience high call drops in Accra; with the most severe on Tigo at all the suburbs.
- In spite of Operator compliance of their call drop obligation over the entire Tema Metropolis, users of MTN, Tigo and Zain experience intolerable call drops at Communities 1, 2, 3, 5, 18, 19, 20 and Sakumono.
- There are severe call drops on MTN, Tigo and Zain in Prampram and Dawhenya.

INTRODUCTION

From 24th June to 28th July, 2010, the National Communications Authority (NCA) carried out an assessment to verify the quality of mobile services – voice and network coverage signal strength – provided by operators MTN, Vodafone, Tigo, Zain and Kasapa in the Accra Metropolis by analyzing technical parameters that translate the quality perception from the mobile phone user's standpoint.

As per the Cellular Mobile licence obligations, the QoS indicators and their respective threshold for compliance under assessment considering the user's perspective are;

a) Call Setup Time (CST)

CST should be less than ten seconds (<10secs) in 95% of cases.

Call Setup Time is the period of time elapsing from the sending of a complete destination address (target telephone number) to the setting up of a call;

$$\text{Call set-up time } [\text{s}] = t_{address\text{-}sending} - t_{calling\text{-}signal}$$

$t_{calling\,signal}$ – Moment when the user presses the send button

$t_{address\ sending}$ – Moment one hears the call signal on the caller terminal

b) Call Completion Rate (CCR)

CCR should be equal or better than seventy per cent (70%).

Call Completion Rate is the probability that a call has, after being successfully set up, to be maintained during a period of time, ending normally, i.e., according to the user's will;

$$\text{Call Completion}[\%] = \frac{\text{Number of normally ended calls}}{\text{Total number of call attempts}} \times 100\%$$

c) Call Congestion Rate

Traffic Channel Congestion should be equal or less than one per cent (1%).

Call Congestion Rate is the probability of failure of accessing a traffic channel during call setup;

$$\text{Call Congestion}[\%] = \frac{\text{Number of Connect failed calls}}{\text{Total number of call attempts}} \times 100\%$$

d) Call Drop Rate (CDR)

Call drop rate should be equal or less than three per cent (3%).

Voice Call Drop Rate is the probability of a call terminating without any of the users' will;

$$\text{Drop Rate}[\%] = \frac{\text{Number of calls terminated unwillingly}}{\text{Total number of call attempts}} \times 100\%$$

Voice Call Audio Quality

Voice Call Audio Quality is the perceptibility of the conversation during a call.

Speech quality of Operators is evaluated using ITU-T Recommendation P.862.1 with the ranges as in Table 1.1 below:

Table 1.1 Mapping of ITU-T Rec. P862.1

Speech Quality	Mean Opinion Score(MOS)
Excellent	> 3.5
Good	2.7 to 3.5
Fair	2.1 to 2.7
Poor	1.5 to 2.1
Bad	< 1.5

METHODOLOGY

The methodology is based on three basic characteristics:

a) End-to-end measurements - measurements reflect all aspects that impact the quality of a service;

b) Impartiality - Measurements are carried out under equal terms for the five operators (MTN, Vodafone, Tigo, Zain and Kasapa); Simultaneous measurements of different networks are done on the QVoice Symphony giving an accurate picture of how the networks perform under the same conditions; same time, at the same locations and with the same parameters, thus making it possible to perform comparative analysis of the observed performances.

c) Objectivity - Tests are carried out in a totally automatic way, thus eliminating the subjectivity inherent to human intervention or decision.

Measurement Profile

The measurement profile includes process standardization to guarantee the reliability of the test and the definition of testing parameters, thus making it possible to perform analyses and compare results.

Voice calls are performed in series of 2 attempts within 5 seconds for a delay of 15 seconds between series. A successful call is to last a maximum of 60 seconds and has to be completed in a window of 90 seconds. The minimum time required for a call set up before the end of a call window is 30 seconds. The maximum call set up time is 30 seconds. The relationship between Mobile Originating Calls (MOC) and Mobile Terminating Calls (MTC) is 1:1.

FINDINGS AND ANALYSIS

The findings of the study only reflect the behaviour of the networks at the locations and on the period of the measurements.

Accra Metropolis

Quality of Service field monitoring was conducted in Accra Metropolitan Areas from 24th June to 12th July, 2010. Field data collection were done from 9am to 4pm; and 5pm to11 pm to assess voice call service experience and network coverage provided by respective Cellular Operators.

Call Set Up Time

For the Call Setup Time obligation of 95% calls in less than 10 seconds, the networks performed in Accra as follows:

- MTN sets up 95% of its calls in 12.09 seconds.
- Vodafone sets up 95% of its calls in 15.21 seconds.
- Tigo sets up 95% of its calls in 11.67 seconds.
- Zain sets up 95% of its calls in 13.86 seconds.
- Kasapa sets up 95% of its calls in 15.28 seconds.

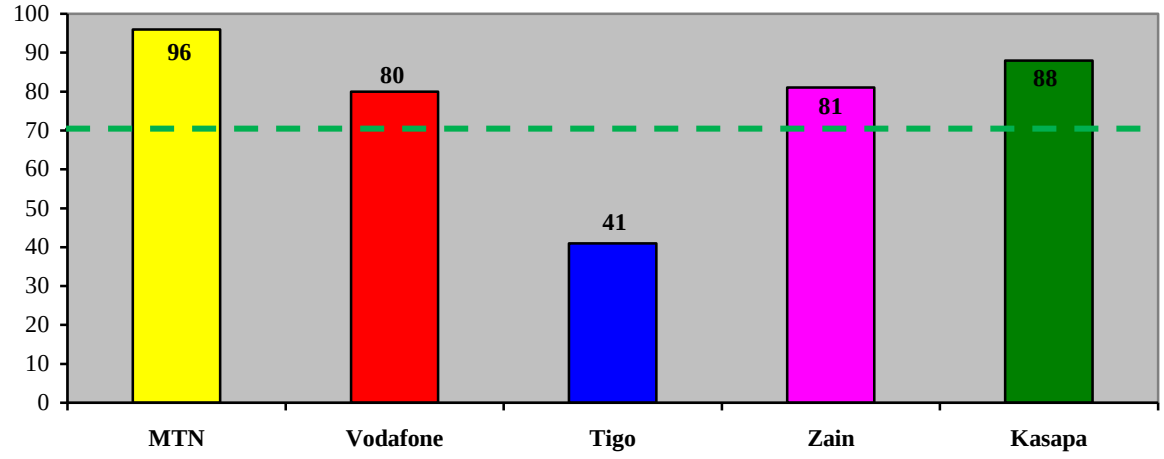
Remarks:

There were call set up delays on all networks.

Call Completion

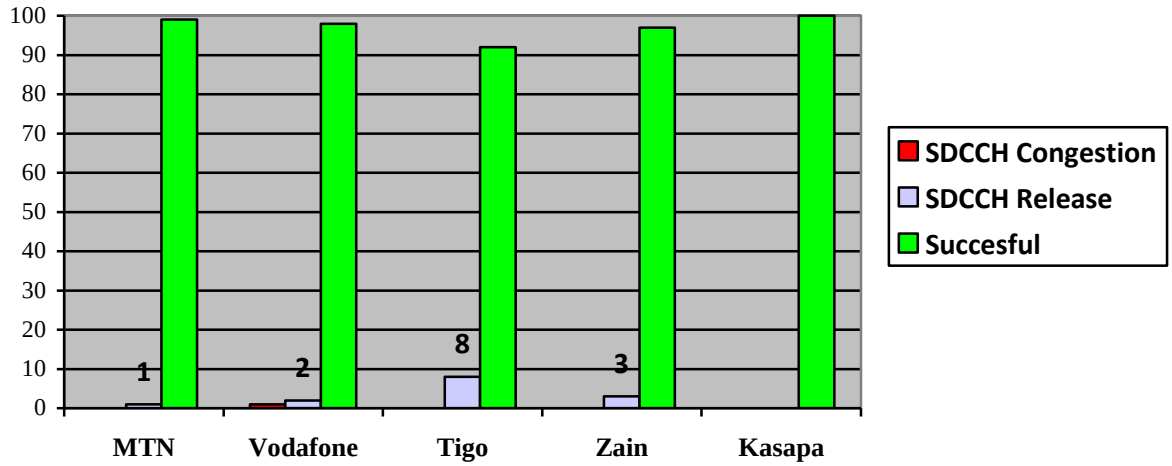
All Operators except Tigo complied with the Call Completion Rate obligation of 70% as shown in Figure 1 below:

Figure 1 Call Completion Rate of Operators at Accra in June-July 2010



Tigo had Signalling Channel Release rate of 8% as shown in Figure 2 which adversely affected its Call Set up.

Figure 2 SDCCH Congestion and SDCCH Released of Operators at Accra in June-July 2010



Groups of Suburbs in Accra to be represented by alphabets in Figures 4 and 6 below are detailed as in Table 2.1 below:

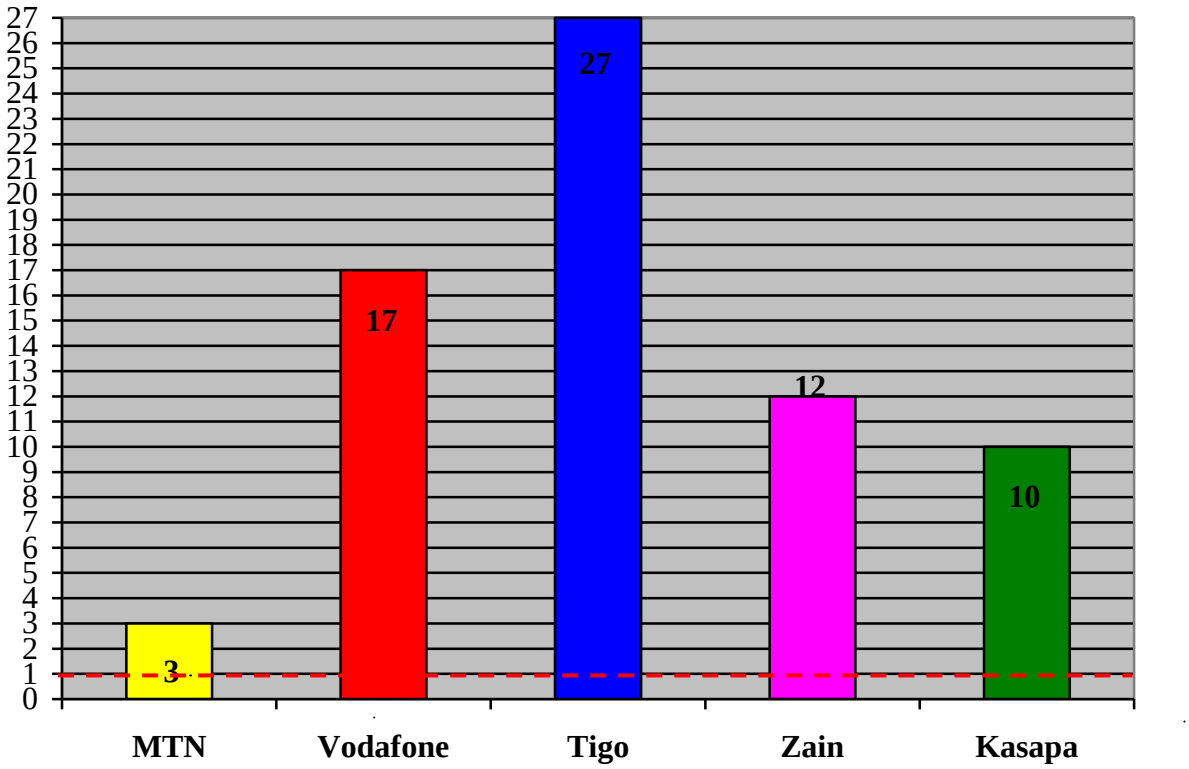
Table 2.1 Clusters and detailed suburbs in Accra

Cluster	Detailed suburbs
A	Larterbiokorshe,Agege,Chorkor,KorleGonno,Korle Bu,Mamprobi
B	Agbobloshie,High Street, Makola,James Town,Adabraka,Asylum Down
C	Dansoman,Russia, Abossey Okai Kaneshie,Mateheko
D	Official Town,Kokompe,Darkoman,Nyamekye
E	Shiashi,Legon Campus,East/West Legon,Ashaley Botwe,Adjingano, Trassaco
F	Oxford Str,Stadium,Independence Avenue,Cantonments,Ridge,Burma Camp
G	Labone, La Teshie
H	Nima, New town, Dworwulu, Mamobi, Abavana, Kotobabi
I	Bubuashie, North Kaneshie, North & South Industrial Area, Kokomlemle
J	Odorkor,Sakama,Mallam Junction, Weija, Kokrobite, Mandella
K	37,Airport, Cantonment, Roman Ridge
L	Abeka Lapaz, Nii Boi Town, Kwashiman, Santa Maria, Ofankor
M	Achimota, Dome, Kwabenya, Saint Johns, Parakuo Estates
N	Mallam, Gbawe, Awoshie, Sowutuom, Oduman, Kwashieman
O	Chantan, Taifa, Burkina, Tesano, Akweteman, Abofo
P	Fadama, Nyamekye
Q	Madina, Adenta, Abokobi, Oyarifa, Frafraha, Agbogba

Call Congestion

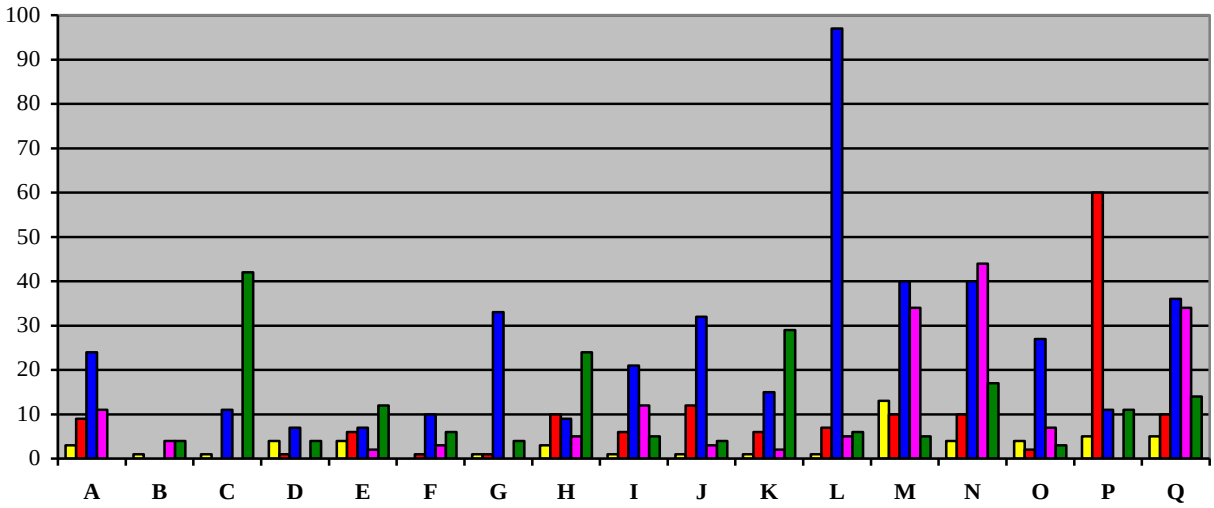
All Operators failed on their Traffic Channel congestion obligation of less or equal to 1% as shown in Figure 3 below:

Figure 3 Call Congestion Rate of Operators at Accra in June-July 2010



Call Congestion as spread by respective Operators in Accra Metropolis is as shown in Figure 4 below:

Figure 4 Call Congestion Rate at Accra suburbs in June-July 2010



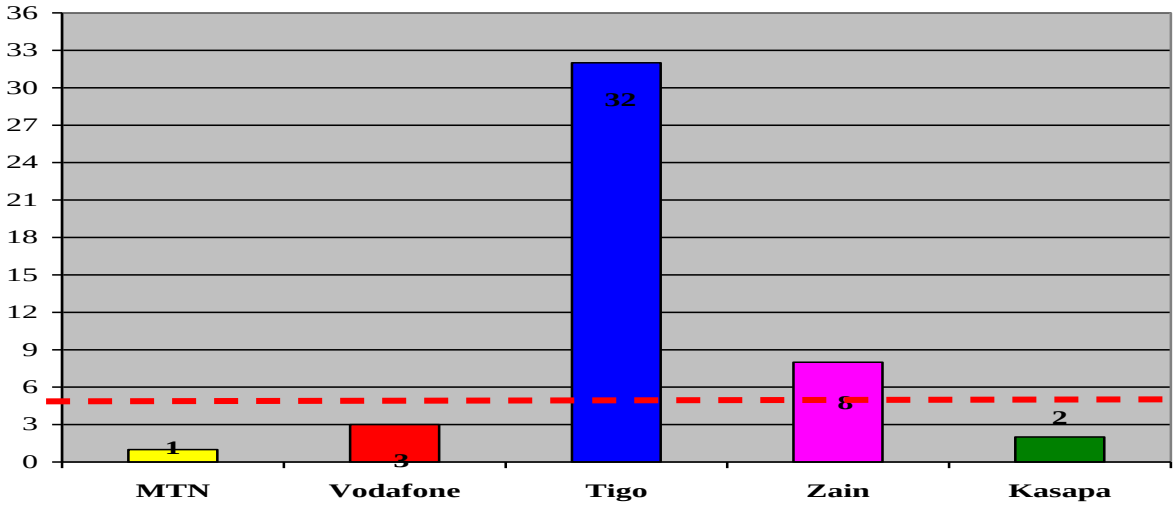
Remarks:

- Users of all networks experience call congestion in Accra; with the most severe on Kasapa and Tigo in almost all areas tested. Zain was severely congested at Achimota, Mallam and Madina clusters.
- Vodafone had severe congestion at Fadama cluster and MTN had its worst congestion at Achimota cluster.

Call Drop

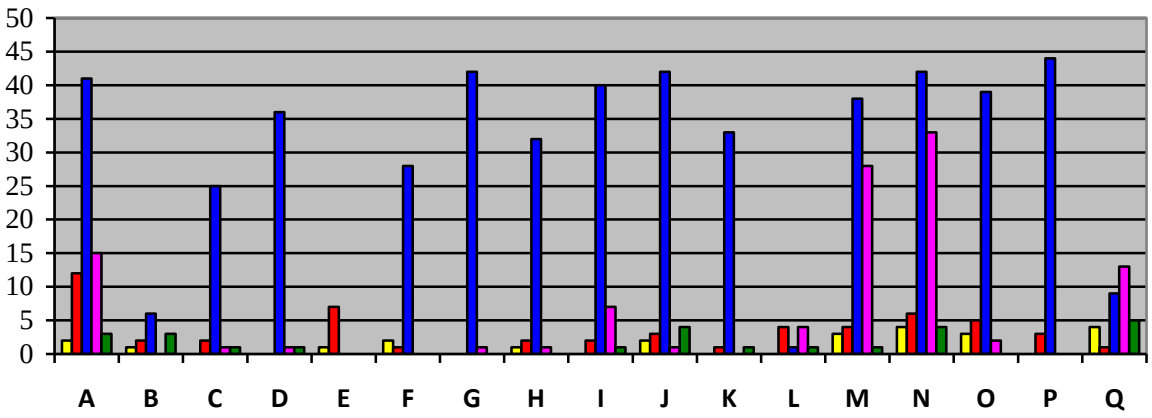
All Operators except Tigo and Zain complied with their Drop Call Obligation of less than or equal to 3% as shown in Figure 5 below:

Figure 5 Call Drop Rate of Operators at Accra in June-July 2010



Call Drop as spread by respective Operators in Accra Metropolis is as shown in Figure 6 below:

Figure 6 Call Drop at Accra suburbs in June-July 2010



Groups of Suburbs in Accra as represented by alphabets in Figure 5 above are detailed as Table 2.1 above.

Remarks:

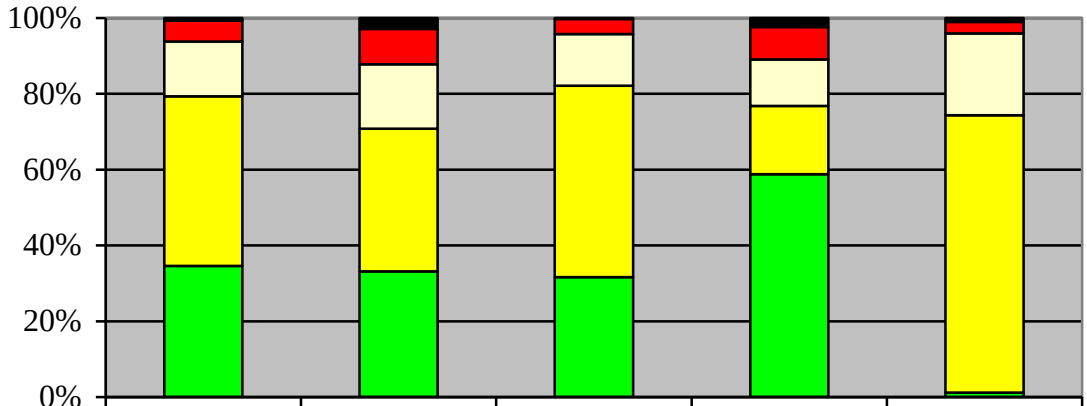
There were severe call drops on Tigo network in almost all areas tested whereas for Zain, the drop calls were severe at Larterbiokorshie, Bubuashie, Achimota, Mallam and Madina clusters.

The high drop calls experienced on Vodafone were at Larterbiokorshie, Legon, Chantan and Mallam clusters.

Call Audio Quality

The summary of speech quality spread over Accra is as presented in Figure 7.

Figure 7 Speech Quality at Accra in June-July 2010



	MTN	Vodafone	Tigo	Zain	Kasapa
Bad	0.70%	2.89%	0.29%	2.35%	0.98%
Poor	5.50%	9.25%	3.92%	8.57%	3.05%
Fair	14.43%	17.02%	13.65%	12.30%	21.60%
Good	44.80%	37.70%	50.53%	18.01%	73.19%
Excellent	34.57%	33.13%	31.62%	58.76%	1.18%

Remarks:

There were mainly excellent and good speech quality experienced on all networks. Some bad speech quality was experienced on Vodafone and Zain networks.

Tema Metropolis

Quality of Service field monitoring was conducted in Tema Metropolitan Areas from 20th to 27th July, 2010. Field data collection was done from 9am to 3pm; and 5pm to10 pm to assess voice call service experience provided by respective Cellular Operators.

Call Set Up Time

For the Call Setup Time obligation of 95% calls in less than 10 seconds, the networks performed in Tema as follows:

- MTN sets up 95% of its calls in 11.97 seconds.
- Vodafone sets up 95% of its calls in 13.44 seconds.
- Tigo sets up 95% of its calls in 11.39 seconds.
- Zain sets up 95% of its calls in 14.32 seconds.
- Kasapa sets up 95% of its calls in 16.26 seconds.

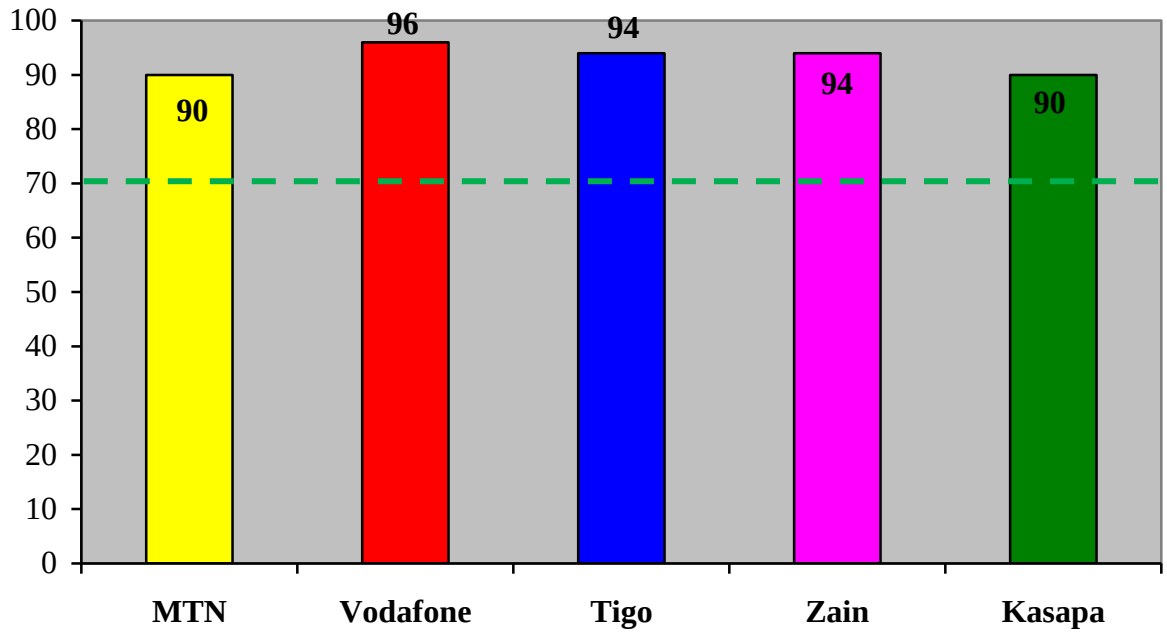
Remarks:

There were call set up delays all networks in Tema Metropolis.

Call Completion

All Operators complied with the Call Completion Rate obligation of 70% as shown in Figure 8 below:

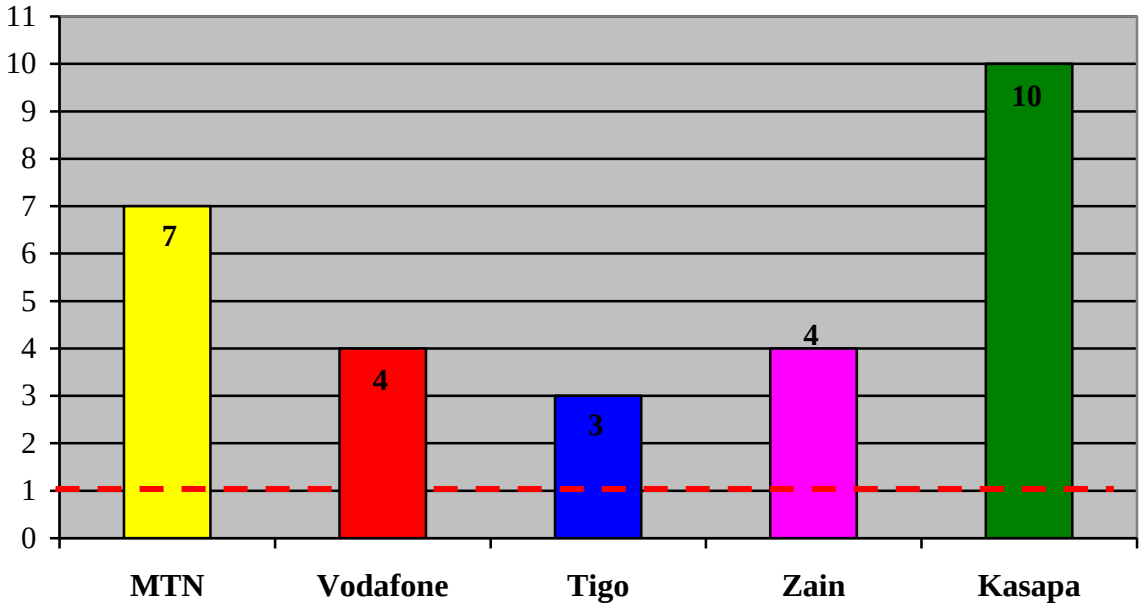
Figure 8 Call Completion Rate of Operators at Tema in July 2010



Call Congestion

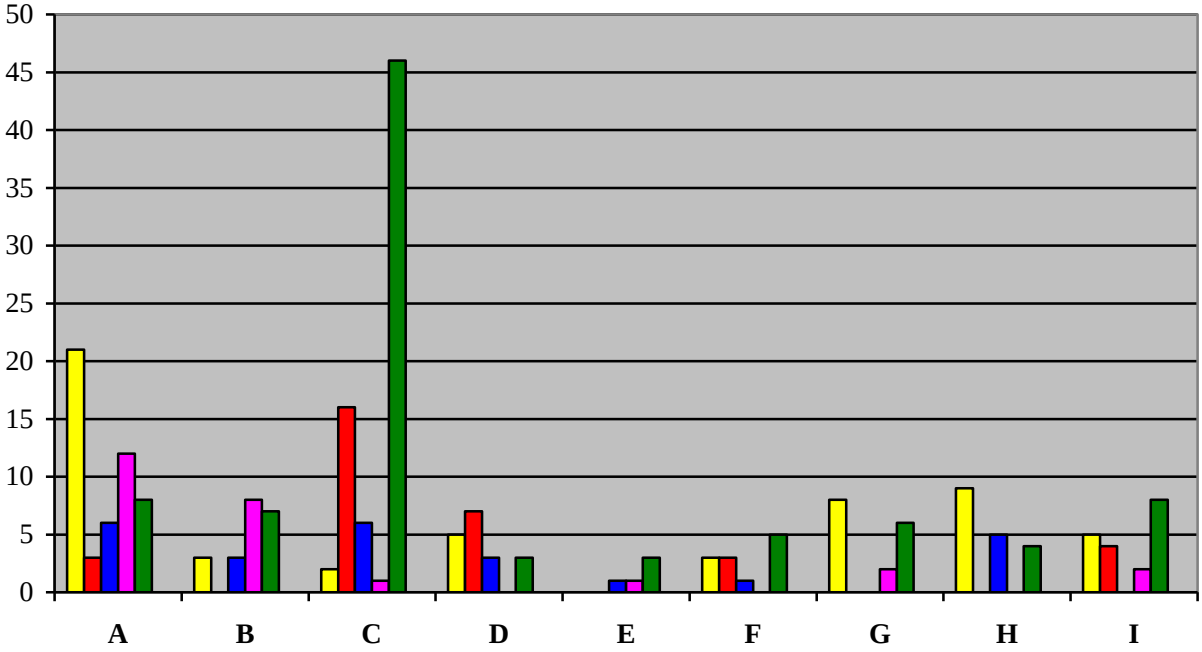
All Operators failed on their Traffic Channel congestion obligation of less or equal to 1% as shown in Figure 9 below:

Figure 9 Call Congestion Rate of Operators at Tema, July 2010



Call Congestion as spread by respective Operators in Tema Metropolis is as shown in Figure 10 below:

Figure 10 Call Congestion Rate at Tema suburbs in July 2010



Groups of Suburbs in Tema Metropolis as represented by alphabets in Figure 10 above are detailed as in Table 2.2 below:

Table 2.2 Clusters and detailed suburbs in Accra

Cluster	Detailed suburbs
A	Communities 1, 2, 3 and 5
B	Communities 4, 6, 7, 8, 10 and 12
C	Michel Camp, Kakasunaka, Afienya, Communities 21,22 and Afariwa
D	Communities 18, 19, 20 and Sakumono
E	Ashiaman
F	Baatsona, Lashibi
G	Light Industrial Area, TOR, Kpone
H	Spintex Road, Manet and Regimanuel Estates
I	Tema Harbour and New Town

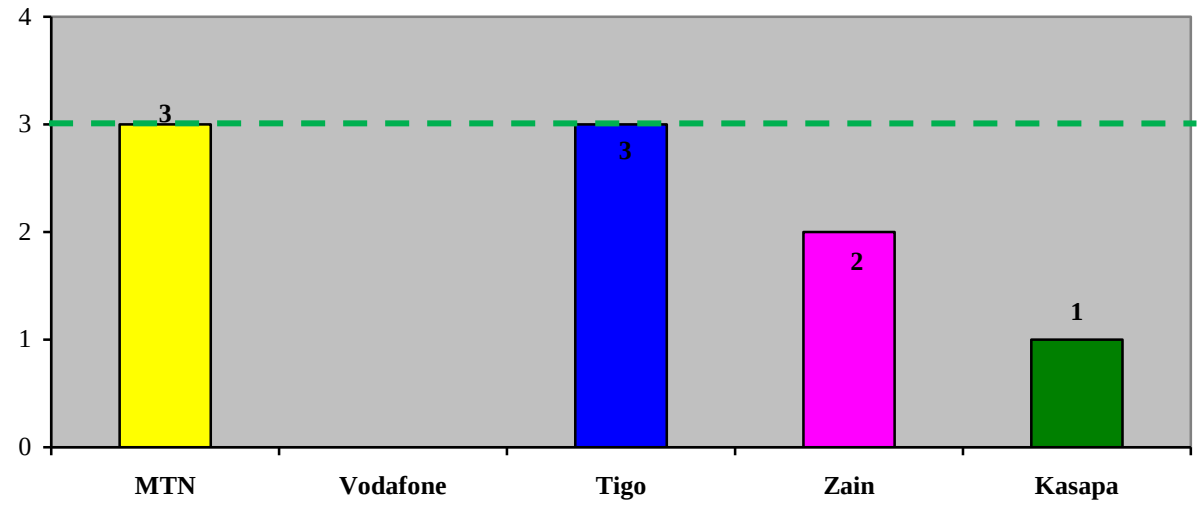
Remarks:

Users in Tema experience call congestion irrespective of the network at Communities 1, 2, 3, 5, 21, 22, Michel Camp, Afienya and Kakasunaka.

Call Drop

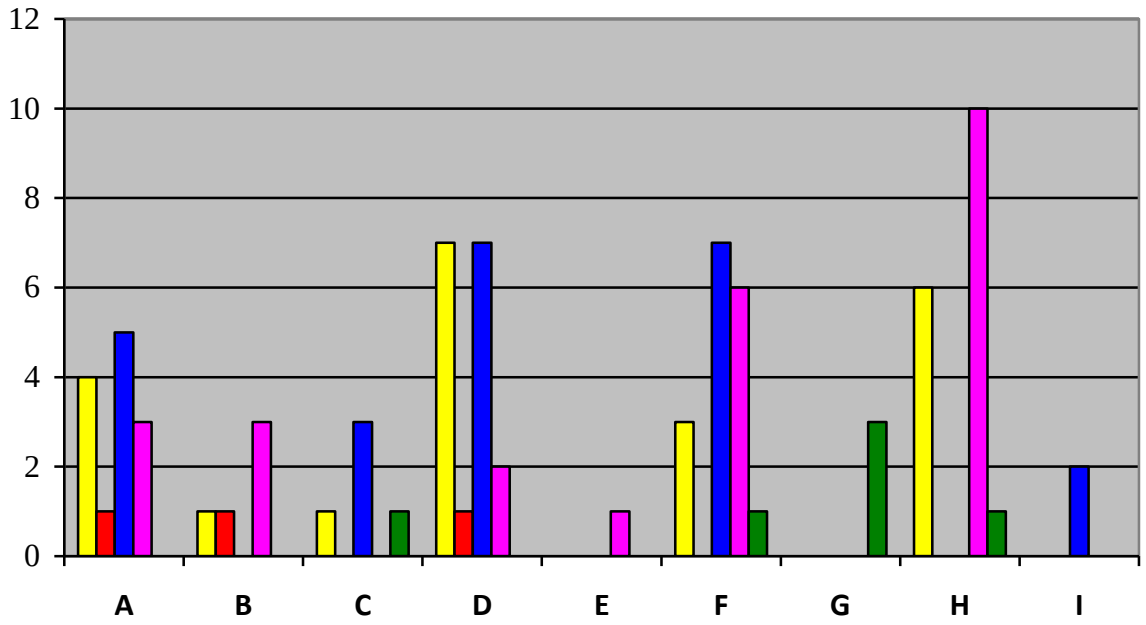
All Operators complied with their Drop Call Obligation of less than or equal to 3% as shown in Figure 11 below:

Figure 11 Call Drop Rate of Operators at Tema in July 2010



Call Drop as spread by respective Operators in Tema Metropolis is as shown in Figure 12 below:

Figure 12 Call Drop at Tema suburbs in July 2010



Groups of Suburbs in Tema as represented by alphabets in Figure 12 above are detailed as Table 2.2 above.

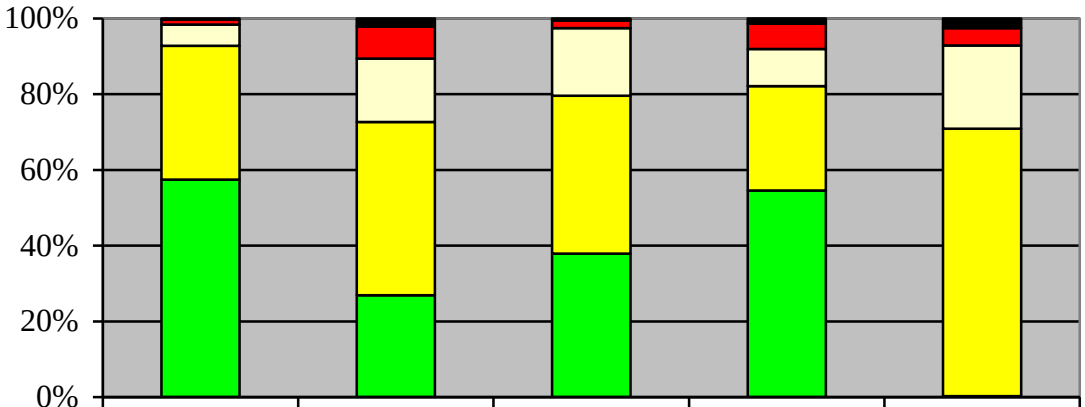
Remarks:

In spite of Operator compliance of their call drop obligation over the entire Tema Metropolis, users of MTN, Tigo and Zain experience intolerable call drops at Communities 1, 2, 3, 5, 18, 19, 20 and Sakumono.

Call Audio Quality

The summary of speech quality spread over Tema is as presented in Figure 13.

Figure 13 Speech Quality at Tema in July 2010



	MTN	Vodafone	Tigo	Zain	Kasapa
Bad	0.22%	2.10%	0.54%	1.36%	2.58%
Poor	1.42%	8.50%	2.02%	6.68%	4.53%
Fair	5.52%	16.69%	17.84%	9.83%	21.97%
Good	35.43%	45.77%	41.68%	27.58%	70.64%
Excellent	57.40%	26.94%	37.92%	54.55%	0.28%

Remarks:

Users in Tema experience excellent speech quality mostly on MTN and Zain whilst little bad speech quality is most likely to be experienced on Vodafone, Zain and Kasapa.

Prampram & Dawhenya Townships

Quality of Service field monitoring was conducted at Prampram and Dawhenya on 28th July, 2010 from 10:00 to 15:30 hours to assess voice call service quality provided by respective Cellular Operators.

Call Set Up Time

For the Call Setup Time obligation of 95% calls in less than 10 seconds, the networks performed in Prampram/Dawhenya as follows:

- ☒ MTN set up 95% of its calls in 10.63 seconds.
- ☒ Vodafone set up 95% of its calls in 11.41 seconds.
- ☒ Tigo set up 95% of its calls in 10.76 seconds.
- ☒ Zain set up 95% of its calls in 12.20 seconds.
- ☒ Kasapa set up 95% of its calls in 13.38 seconds.

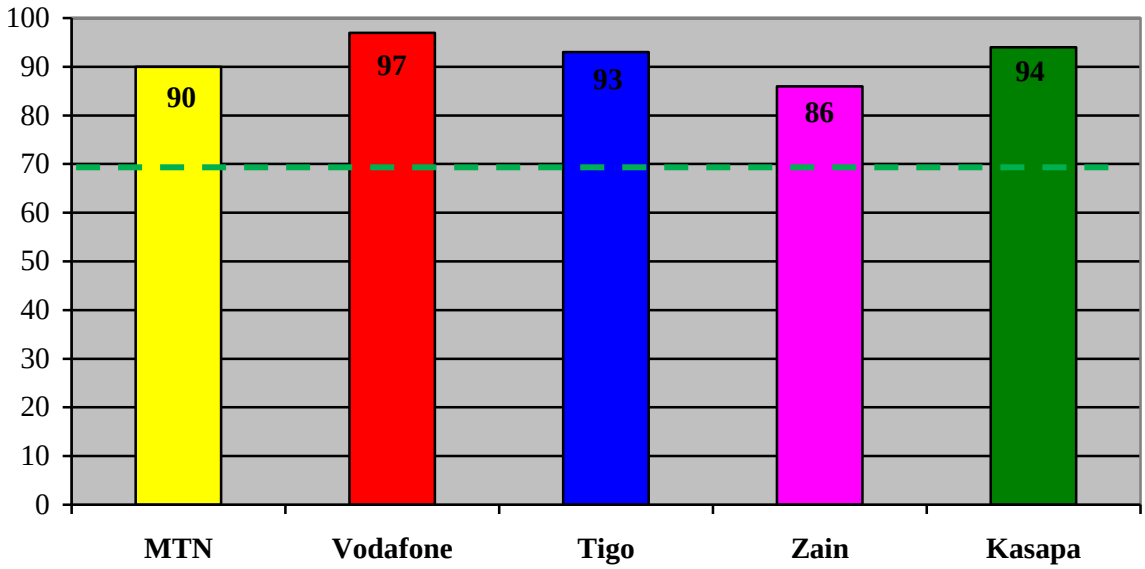
Remarks:

All the Operators experience Call Setup delays when making calls in the areas mentioned above.

Call Completion

All Operators complied with the Call Completion Rate obligation of 70% as shown in Figure 14 below:

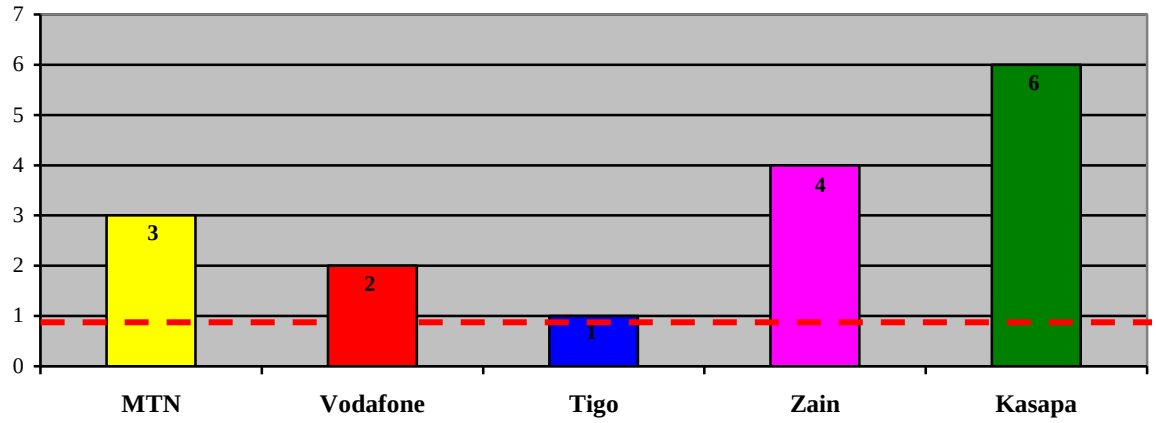
Figure 14 Call Completion Rate of Operators at Prampram &Dawhenya in July 2010



Call Congestion

MTN, Vodafone, Zain and Kasapa failed on their Traffic Channel congestion obligation of less or equal to 1% as shown in Figure 15 below:

Figure 15 Call Congestion of Operators at Prampram & Dawhenya in July 2010



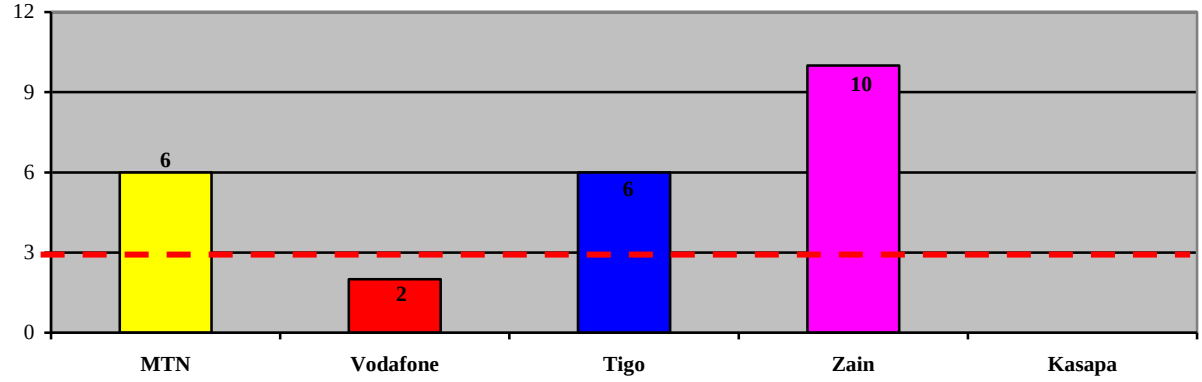
Remarks:

Users in Prampram experience some congestion on MTN, Zain and Kasapa.

Call Drop

MTN, Tigo and Zain failed to comply with their Drop Call Obligation of less than or equal to 3% as shown in Figure 16 below:

Figure 16 Call Drop Rate of Operators at Prampram & Dawhenya in July 2010



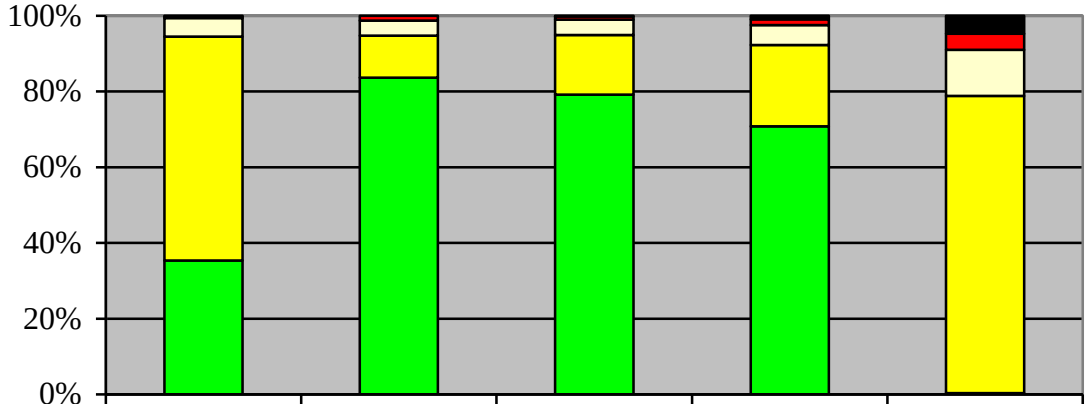
Remarks:

Users of MTN, Tigo and Zain are likely to experience high call drops in Prampram and Dawhenya township.

Call Audio Quality

The summary of speech quality spread over Prampram and Dawhenya is as presented in Figure 17

Figure 17 Speech Quality at Prampram & Dawhenya in July 2010



	MTN	Vodafone	Tigo	Zain	Kasapa
Bad	0.19%	0.00%	0.17%	0.97%	4.73%
Poor	0.38%	1.23%	0.85%	1.45%	4.22%
Fair	4.91%	4.04%	4.07%	5.31%	12.16%
Good	59.17%	11.07%	15.76%	21.50%	78.55%
Excellent	35.35%	83.66%	79.15%	70.77%	0.34%

Remarks:

Users in Prampram and Dawhenya experience excellent speech quality mostly on Vodafone, Tigo and Zain whilst MTN and Kasapa are mainly good. Also Kasapa had bad speech sample spread all over.

CONCLUSION

There are call set delays on all networks across the Accra, Tema Metropolis, Prampram and Dawhenya townships.

From the findings on both call congestion and call drops;

i. the suburbs in Accra Metropolis with the worst quality of experience are:

- ☒ Achimota, Dome, Kwabenya, Saint Johns, Parakuo Estates
- ☒ Mallam, Gbawe, Awoshie, Sowutuom, Oduman, Kwashieman
- ☒ Madina, Adenta, Abokobi, Oyarifa, Frafraha, Agbogba

ii. the suburbs in Tema Metropolis with the worst quality of experience are:

- ☒ Communities 1, 2, 3, 4, 5, 18,19, 20, 21, 22
- ☒ Michel Camp, Afienya and Kakasunaka and Sakumono.