NATIONAL COMMUNICATIONS AUTHORITY

Quality of Service (QoS) Monitoring of Cellular Mobile Voice Services-Greater Accra Region

[February 2016]

[Communications for Development]

QUALITY OF SERVICE (QoS) MONITORING OF CELLULAR MOBILE VOICE SERVICES IN GREATER ACCRA REGION, FEBRUARY 2016

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Background

In pursuance of Annexure D1 and D2 of the Cellular Mobile Licence of Telecommunication Operators, the user perspective of the quality of voice services are tested to ensure the compliance of Operators to the obligations on service quality to the user.

The report is based on findings on quality of service in Greater Accra Region from 26th January to 29th February 2016 for all Operators except for Expresso due to technical challenges.

What we measure

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

- **Stand-alone Dedicated Control Channel (SDCCH) Congestion Rate**

- **Call Setup Time (CST)**

- **Call Congestion Rate**

- **Call Drop Rate (CDR)**

- **Call Completion Rate (CCR)**

- **Voice Call Audio Quality**

- **Coverage**

Findings

The results for the district capitals within Greater Accra Region tested during the period are as below:

a) Stand-alone Dedicated Control Channel (SDCCH) Congestion Rate

SDCCH Congestion is defined as the probability of failure of accessing a stand-alone dedicated control channel during call set up.

For analysis and calculations,

$$\text{SDCCH Congestion}[\%] = \frac{\text{Number of connect fails due to Immediate Assignment Failures}}{\text{MOC call attempts}} \times 100\%$$

SDCCH Congestion Rate should be equal or less than one per cent (1%).

The results for the cities and towns tested in February are as below:

Table 1 Signalling Congestion Rate Cellular Mobile Voice Service, February 2016

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
February	Abokobi	0%	0%	0%	0%	0%
February	Accra	0%	0%	0%	0%	0%
February	Ashaiman	0%	0%	0%	0%	0%
February	Adenta	0%	0%	0%	0%	0%
February	Dodowa	0%	0%	0%	0%	0%
February	Gbawe	0%	0%	0%	0%	0%
February	Kpone	0%	0%	0%	0%	0%
February	La	0%	0%	0%	0%	0%
February	Madina	0%	0%	0%	0%	0%
February	Prampram	0%	0%	0%	0%	0%
February	Sege	0%	0%	0%	0%	0%
February	Sowutuom	0%	0%	0%	0%	0%
February	Tema	0%	0%	0%	0%	0%
February	Teshie-Nungua	0%	0%	0%	0%	0%

REMARK:

❖ All Operators were in compliance in tested cities and towns with the signalling congestion threshold of less than 1 percent (1%).

b) 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 to the receiving terminal;

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

$t_{alerting\ signal}$ – Moment when an alerting signal is sent to the called terminal

$t_{address\ sending}$ – Moment user presses the SEND button on the calling terminal

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

Table 2 Call Setup Time of Cellular Mobile Voice Service, February 2016

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
February	Abokobi	9.87sec	2.92sec	5.23sec	4.99sec	16.4sec
February	Accra	8.88sec	3.38sec	12.15sec	7.54sec	9.31sec
February	Ashaiman	8.02sec	3.79sec	6.33sec	7.66sec	7.57sec
February	Adenta	9.96sec	3.03sec	6.18sec	12.62sec	14.87sec
February	Dodowa	12.78sec	2.13sec	6.40sec	10.00sec	28.97sec
February	Gbawe	9.49sec	2.08sec	13.55sec	12.94sec	10.00sec
February	Kpone	9.32sec	2.80sec	5.91sec	7.78sec	9.77sec
February	La	7.79 sec	3.00sec	5.66sec	11.39sec	16.45sec
February	Madina	8.91sec	4.1sec	6.11sec	8.24sec	7.20sec
February	Prampram	9.54sec	2.38sec	5.77sec	12.89sec	13.31sec
February	Sege	4.97sec	3.61sec	6.60sec	11.94sec	21.22sec
February	Sowutuom	9.78sec	3.17sec	6.44sec	11.89sec	6.41sec
February	Tema	10.00sec	3.26sec	6.00sec	11.89sec	8.86sec
February	Teshie-Nungua	7.26sec	2.12 sec	2.16sec	11.23sec	19.15sec

REMARKS:

❖ All Operators except Vodafone failed to meet the parameter threshold for Call Setup Time in certain localities.

❖ Airtel and Glo had high Call Setup Time of 12.46sec and 11.74sec respectively in for the Greater Accra region.

❖ MTN had Call Setup Time delays at Dodowa.

❖ Tigo had Call Setup Time delays in Accra and Gbawe.

❖ Airtel had Call Setup Time delays at Adenta, Gbawe, La, Prampram, Sege, Sowutuom, Tema and Teshie-Nungua.

❖ Glo had Call Setup Time delays at Abokobi, Adenta, Dodowa, La, Prampram, Sege and Teshie-Nungua.

c) Call Congestion Rate

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

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

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

Table 3 Call Congestion Rate Cellular Mobile Voice Service, February 2016

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
February	Abokobi	0%	0%	0%	0%	0%
February	Accra	0%	0%	0%	0%	0%
February	Ashaiman	0%	0%	0.77%	0%	0%
February	Adenta	0%	0%	0%	0%	0%
February	Dodowa	0%	0%	0%	0%	0%
February	Gbawe	0%	0%	0%	0%	1.46%
February	Kpone	0%	0%	0%	0%	0%
February	La	0%	0%	0%	0%	0%
February	Madina	0%	0%	0%	0%	0%
February	Prampram	0%	0%	0%	0%	0%
February	Sege	0%	0%	0%	0%	0%
February	Sowutuom	0%	0%	0%	0%	0%
February	Tema	0%	0%	0.15%	0%	0.62%
February	Teshie-Nungua	0%	0%	0%	0%	0%

REMARKS:

❖ All Operators except Glo remained compliant with the licence threshold of less than one percent (1%) in all the tested locations.

❖ Glo recorded high traffic congestion at Gbawe.

d) Call Drop Rate (CDR)

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

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

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

Table 3 Call Drop Rate Cellular Mobile Voice Service, February 2016

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
February	Abokobi	0%	0%	0%	0%	0%
February	Accra	0%	0%	0%	0%	0%
February	Ashaiman	0%	0%	0%	0%	0%
February	Adenta	0%	0%	0%	0%	0.59%
February	Dodowa	0%	0%	0%	0%	0%
February	Gbawe	0%	0%	0%	0%	0%
February	Kpone	0%	0%	0%	0%	0%
February	La	0%	0%	0%	0%	0%
February	Madina	0%	0%	0%	0%	0%
February	Prampram	0%	0%	0%	0%	0%
February	Sege	0%	0%	0%	0%	0%
February	Sowutuom	0%	0%	0%	0%	0%
February	Tema	0%	0%	0%	0%	0%
February	Teshie-Nungua	0%	0%	0%	0%	0%

REMARK:

❖ All Operators were in compliance with the Call Drop Rate licence threshold of less than three percent (3%) in all localities tested.

e) Call Completion Rate (CCR)

Call Completion Rate is defined as the probability that a call has, after being successfully set up, be maintained during a period of time and ending normally.

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

Call Completion Rate should be equal or better than seventy percent (70%).

Table 4 Call Completion Rate Cellular Mobile Voice Service, February 2016

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
February	Abokobi	100.0%	100.0%	98.2%	92.7%	94.5%
February	Accra	100.0%	100.0%	100.0%	100.0%	99.4%
February	Ashaiman	100.0%	100.0%	93.8%	96.7%	96.5%
February	Adenta	97.9%	100.0%	98.8%	67.7%	85.3%
February	Dodowa	90.3%	100.0%	100.0%	100.0%	100.0%
February	Gbawe	95.3%	80.0%	100.0%	78.2%	90.5%
February	Kpone	99.2%	100.0%	86.6%	94.7%	87.5%
February	La	100.0%	100.0%	100.0%	97.8%	77.8%
February	Madina	100.0%	96.9%	98.3%	92.1%	78.8%
February	Prampram	100.0%	100.0%	98.5%	89.1%	95.6%
February	Sege	100.0%	100.0%	100.0%	100.0%	83.3%
February	Sowutuom	96.1%	100.0%	98.8%	100.0%	89.6%
February	Tema	97.2%	99.3%	99.0%	98.0%	91.3%
February	Teshie-Nungua	100.0%	100.0%	99.0%	100.0%	84.7%

REMARKS:

❖ All Operators except Airtel were in compliance with the Call Completion Rate licence threshold of less than seventy percent (70%) in all localities tested.

❖ Airtel recorded a low Call Completion Rate at Adenta.

f) Voice Call Audio Quality

Voice Call Audio Quality is the perceptibility of the conversation during a call. Voice Call Audio Quality is measured by a parameter called the Mean Opinion Score (MOS) which categorizes speech samples in ranges from 0 to 5.

Range	Colour Code	Rating
[0 – 2.5)		Poor
[2.5 – 3.5)		Fair
[3.5 – 4)		Good
[4.1 – 5)		Excellent

Table 5 Speech Quality Mean Opinion Score Greater Accra Region, February 2016

Greater Accra	MTN	Vodafone	Tigo	Airtel	Glo
MOS	3.54	3.57	3.44	3.27	3.57

REMARKS:

❖ MTN, Vodafone and Glo were assessed to give GOOD speech quality.

❖ Airtel and Tigo were assessed to give FAIR speech quality.

REMEDIES

❖ The NCA has notified Operators of these findings and has directed all Operators to improve their coverage in some localities by June 2016.
❖ Airtel has been granted moratorium till May 2016 to resolve the persistent Call Setup Time delays which been acute since 2015.
❖ Glo has also been sanctioned for the failure in Call Setup Time obligation in Greater Accra region.

APPENDICES

COVERAGE AND SPEECH MAPS

The Maps below show the coverage level and speech quality in the various towns where monitoring was performed. The coverage map is a combination of both 2G and 3G network signal strength. In each plot is a legend to indicate definitions of signal strength and quality range attained by operators during measurement. Coverage levels in green falls in the rage of -85dBm and above, and are considered good. Those between -85 and -95dBm are considered average and are indicated in yellow. The red samples represent worse coverage in the range of -95 to -110dBm. The black samples represent areas with no coverage. The speech quality was assessed with Mean Opinion Score (MOS) which ranges from 5 to 1.

APPENDIX I

COVERAGE AT ACCRA

Fig. 1 - MTN Coverage Map, Accra Metropolitan- February 2016
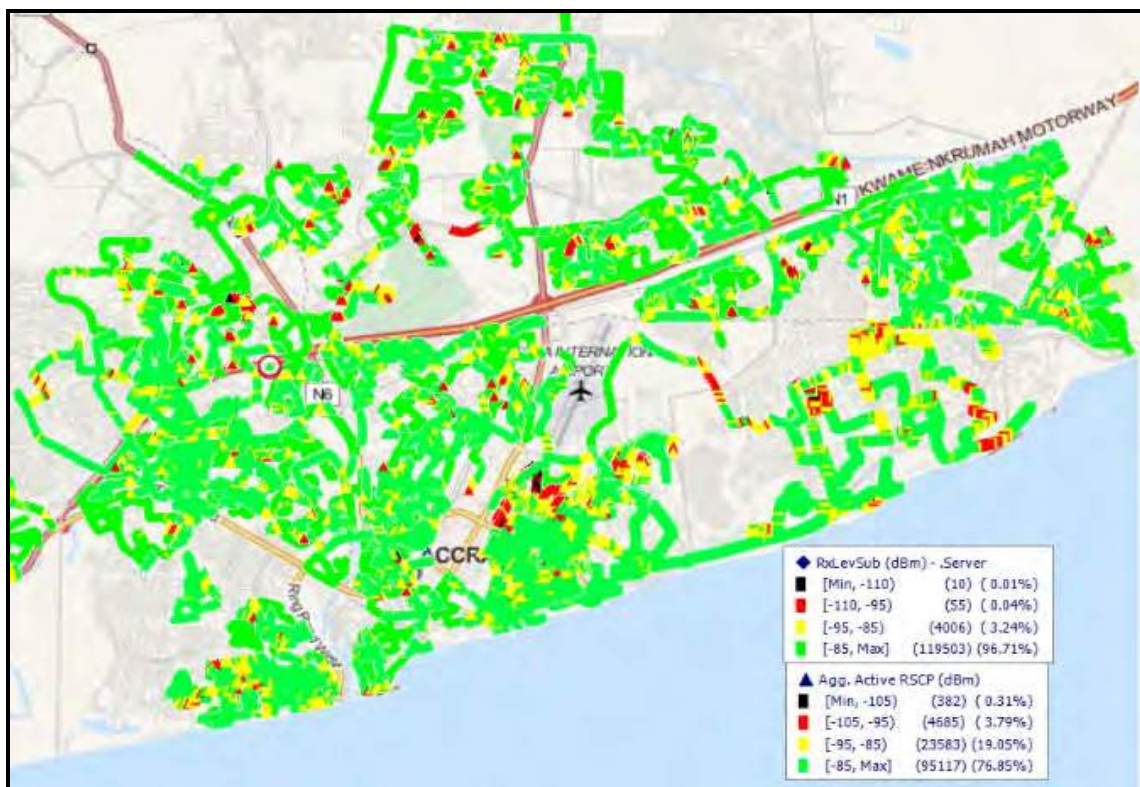
Remarks: Good 2G & 3G network coverage with few scattered spots of poor coverage

Fig. 2 - Vodafone Coverage Map, Accra Metropolitan - February 2016
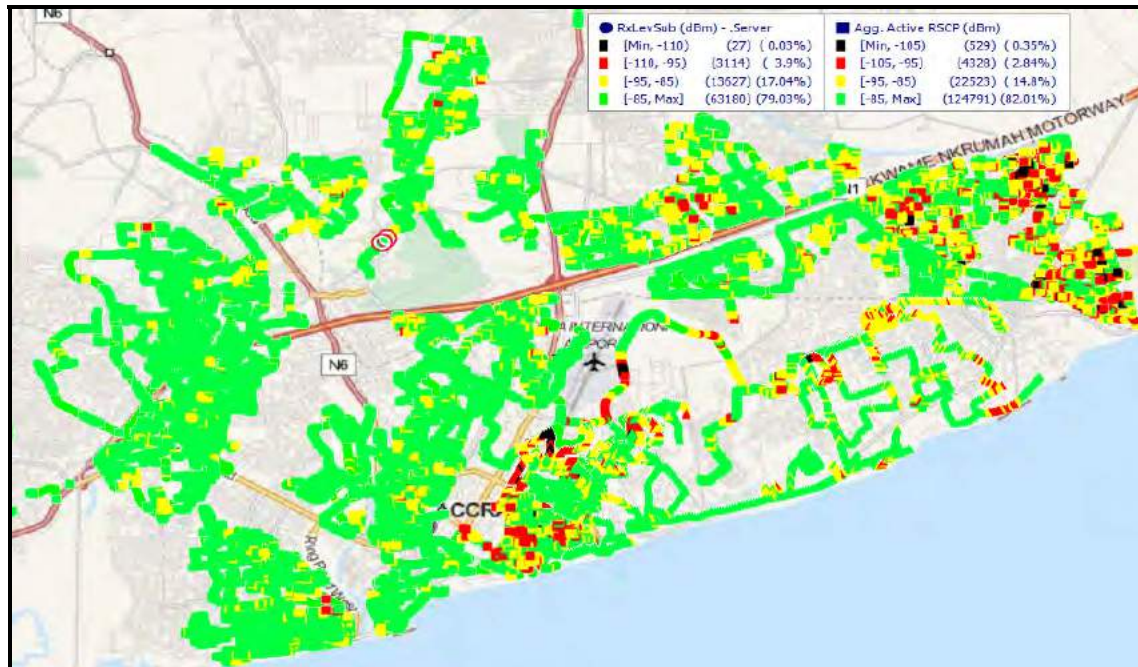
Remarks: Good network coverage however 3G coverage improvement is needed at Cantonments, Sakumono and Lashibi.

Fig. 3 - Tigo Coverage Map, Accra Metropolitan - February 2016
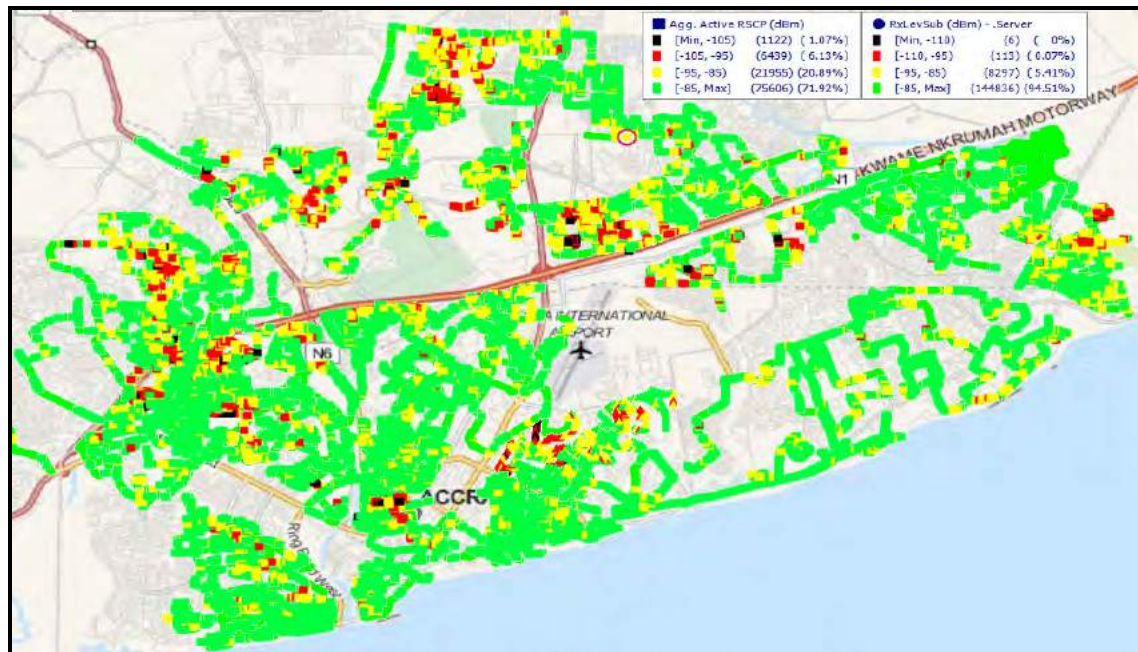
Remarks: Good 2G & 3G network coverage across Accra Metropolis, except for some spots up Accra North

Fig. 4 - Airtel Coverage Map, Accra Metropolitan - February 2016
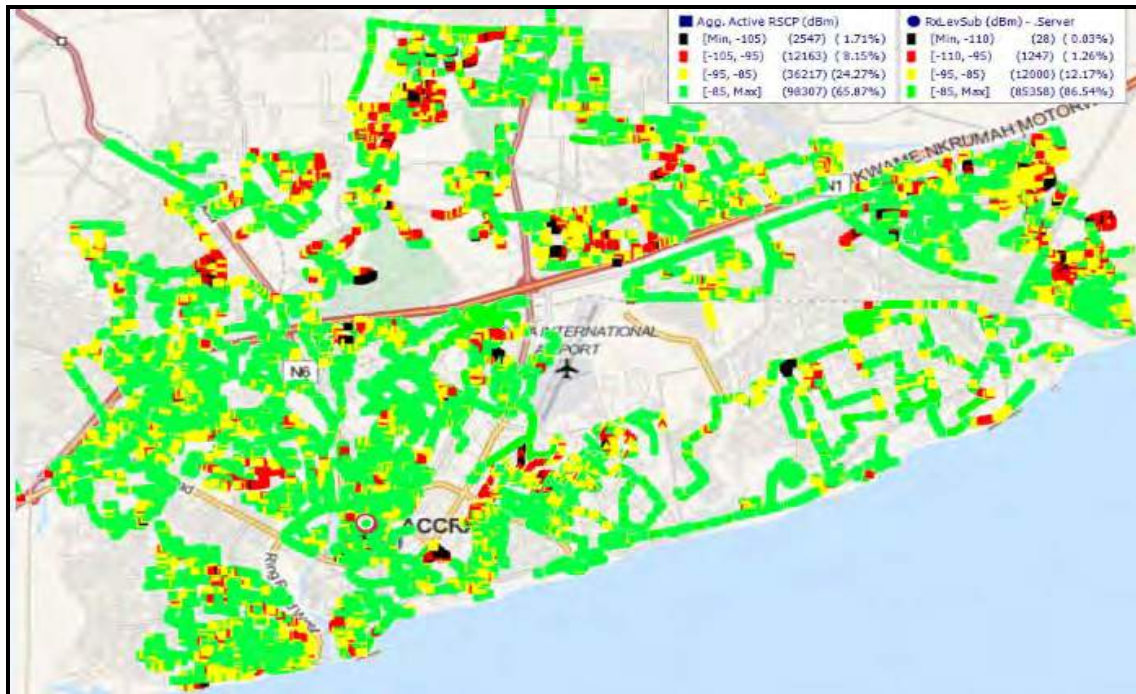
Remarks: Airtel has good 2G & 3G network coverage across Accra Metropolis.

Fig. 5 - Glo Coverage Map, Accra Metropolitan - February 2016
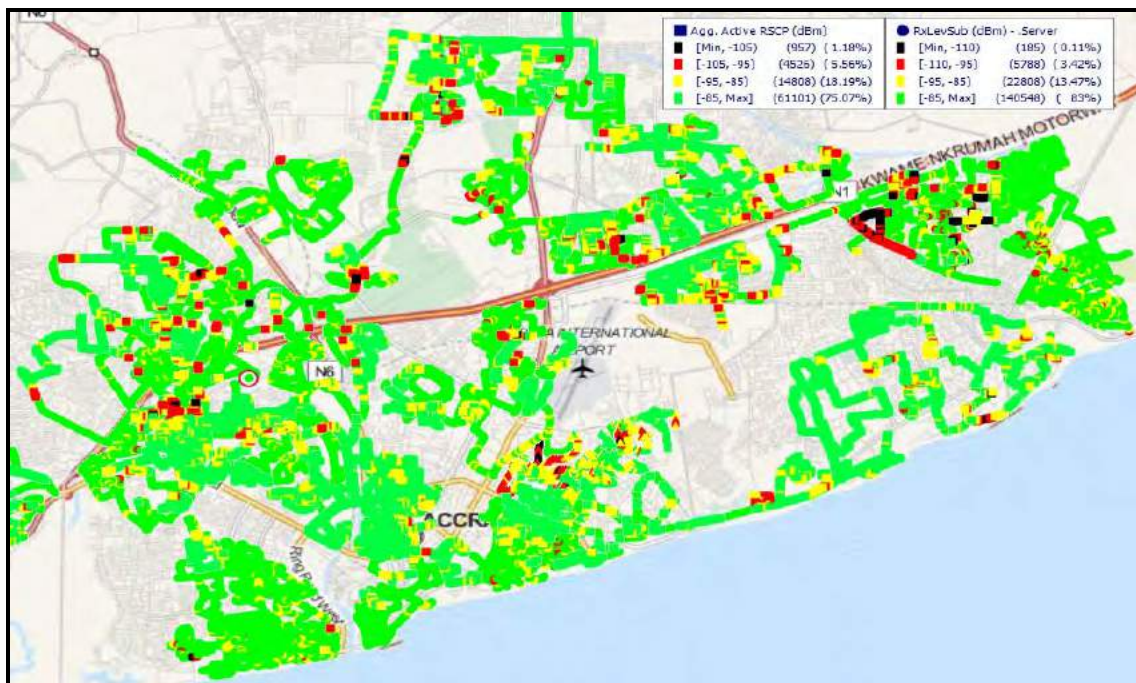
Remarks: Glo has good 2G network coverage across Accra Metropolis with scattered spots of poor 3G coverage at Spintex

COVERAGE AT TEMA-KPONE

Fig. 6 - MTN Coverage Map, Tema-Kpone - February 2016
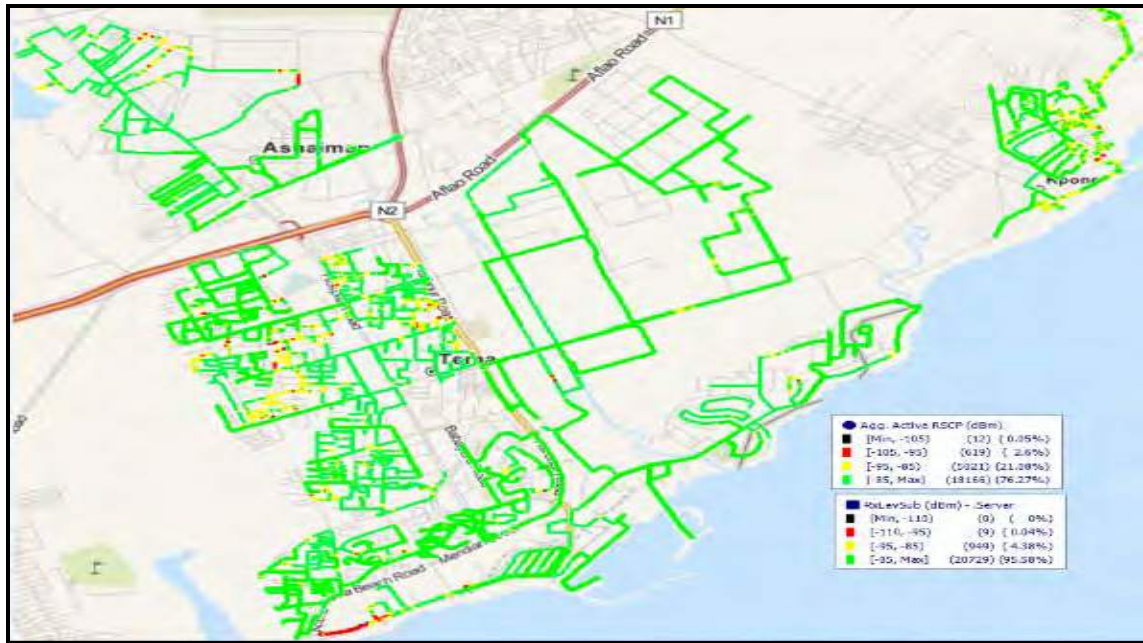
Remarks: Good 2G& 3G network coverage across Tema Municipal and Kpone District

Fig. 7 - Vodafone Coverage Map, Tema-Kpone - February 2016
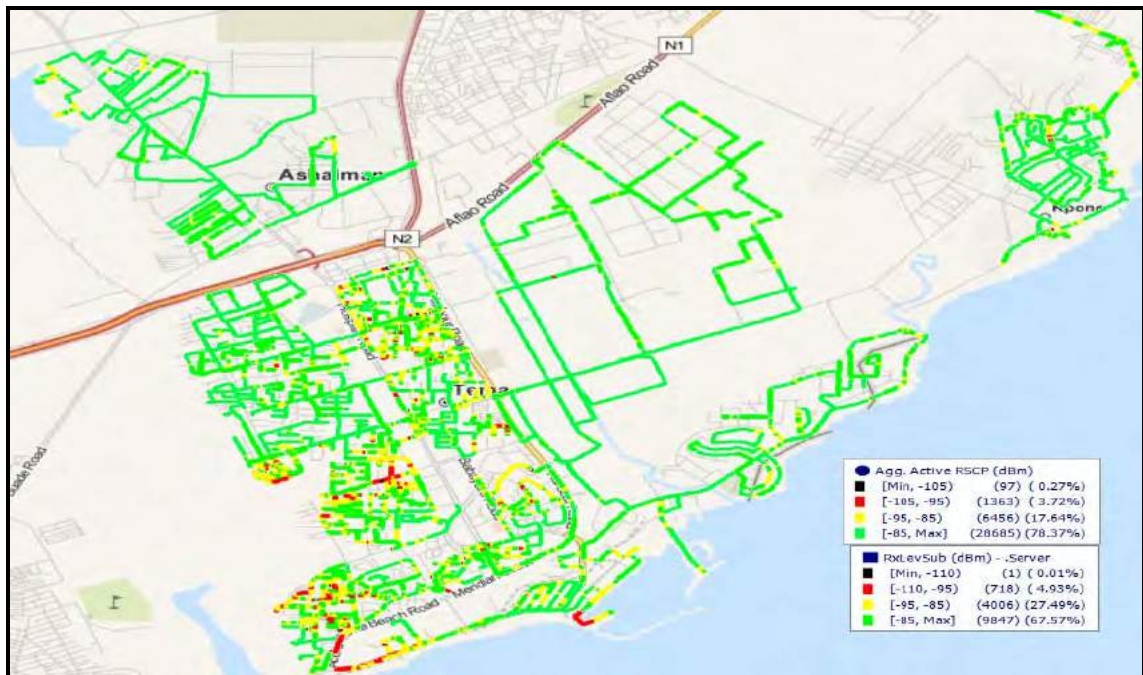
Remarks: Good network coverage yet some improvement is needed at Tema Community 3

Fig. 8 - Tigo Coverage Map, Tema-Kpone - February 2016
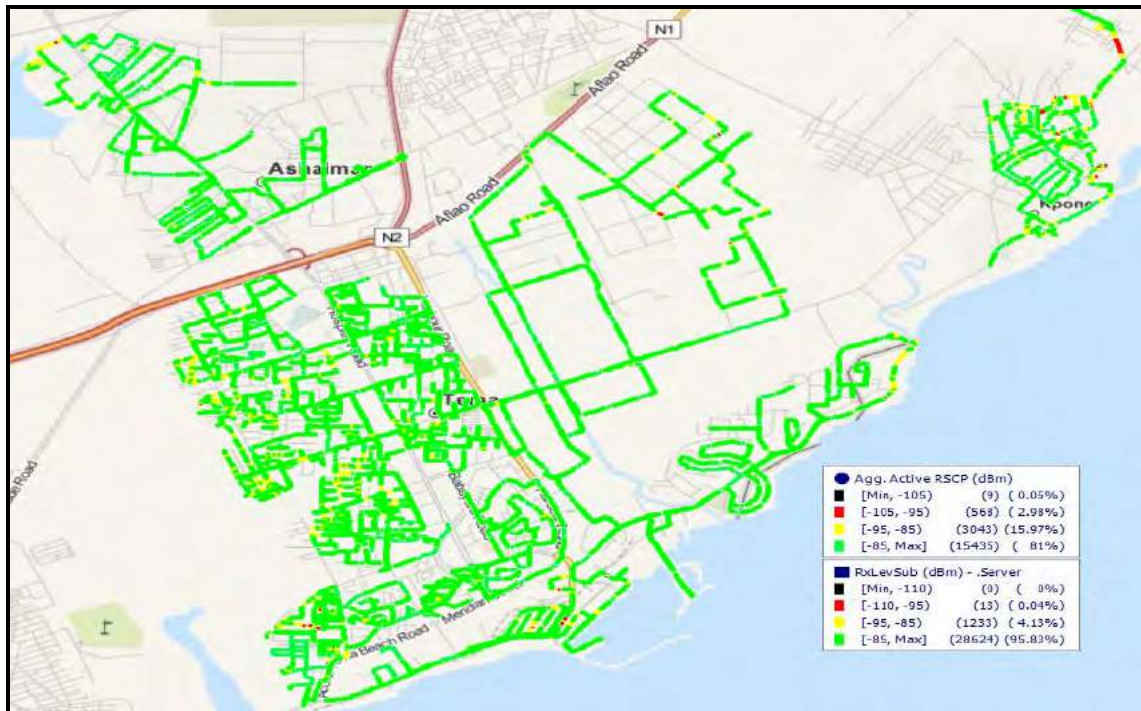
Remarks: Good 2G& 3G network coverage across Tema Municipal and Kpone district

Fig. 9 - Airtel Coverage Map, Tema-Kpone - February 2016
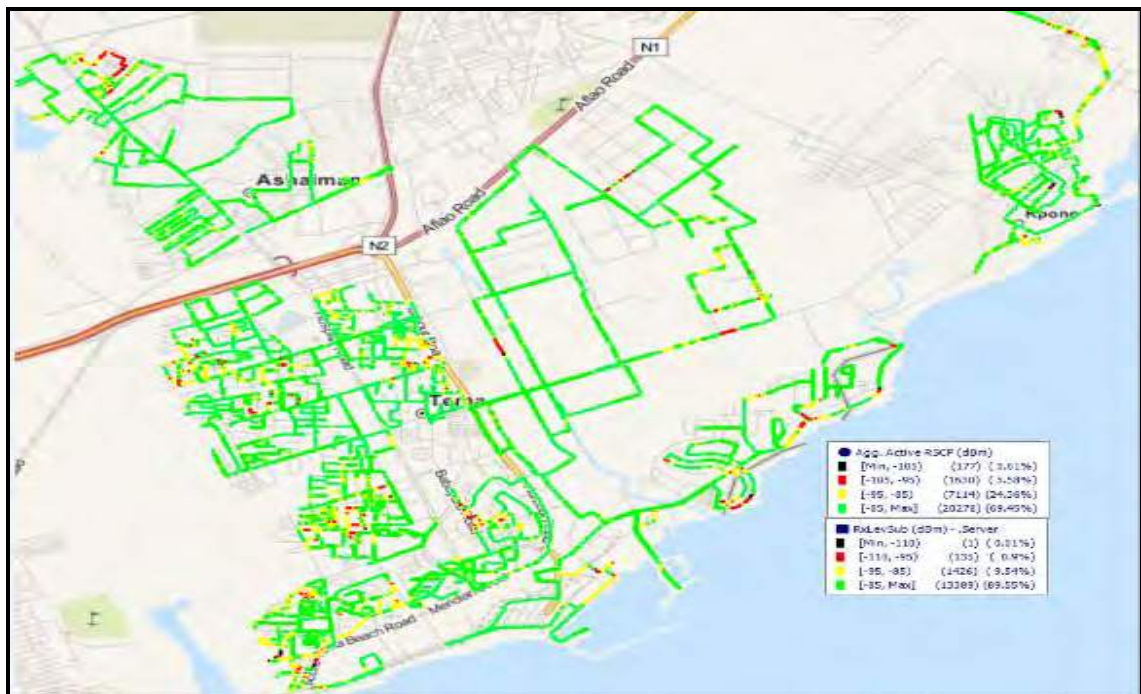
Remarks: Airtel needs coverage improvement in Tema Communities 3,5,6 & 22.

Fig. 10 - Glo Coverage Map, Tema-Kpone - February 2016
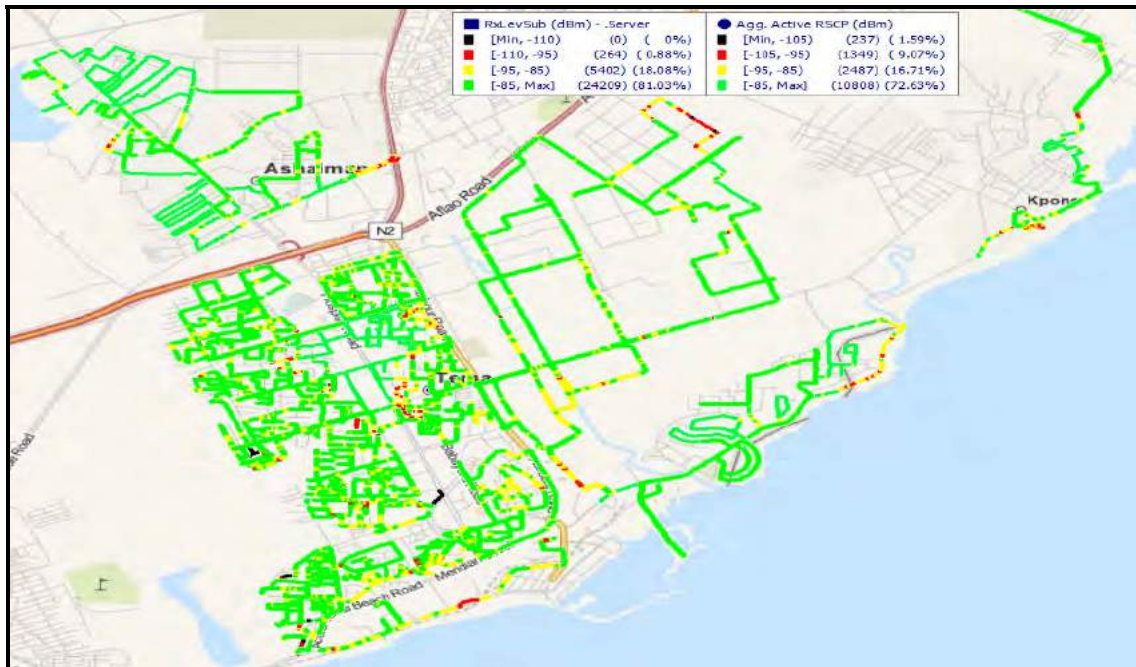
Remarks: Glo has poor coverage on the Beach road, Harbour road and parts of Kpone

COVERAGE AT DODOWA

Fig. 11 - MTN Coverage Map, Dodowa - February 2016
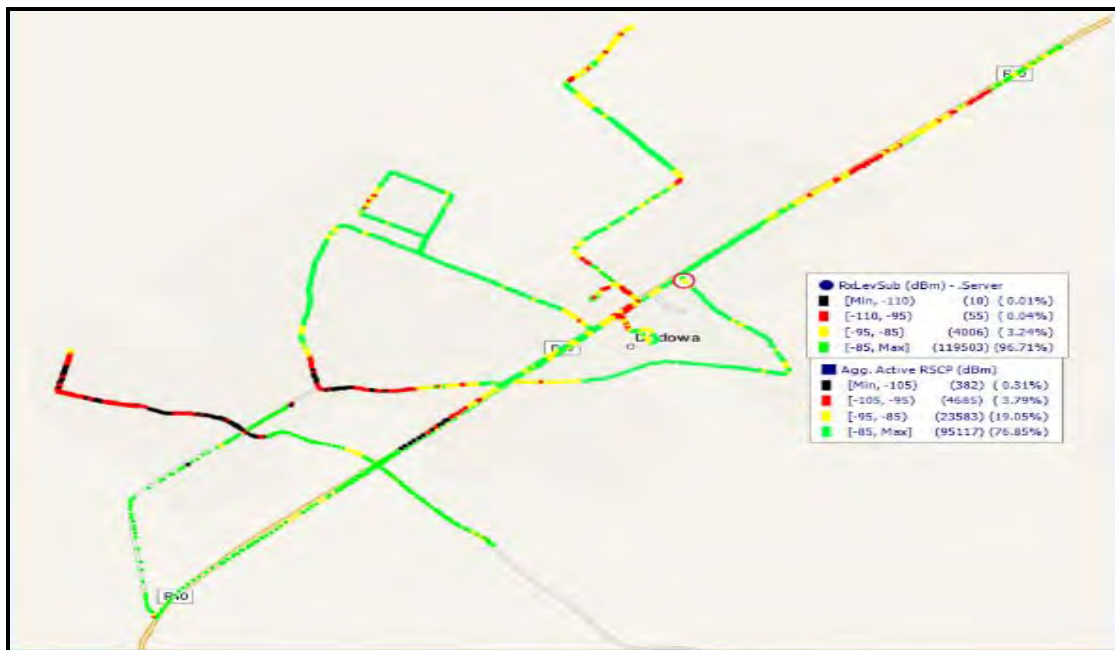
Remarks: Overall good coverage except for some black spots for 3G.

Fig. 12 - Vodafone Coverage Map, Dodowa - February 2016
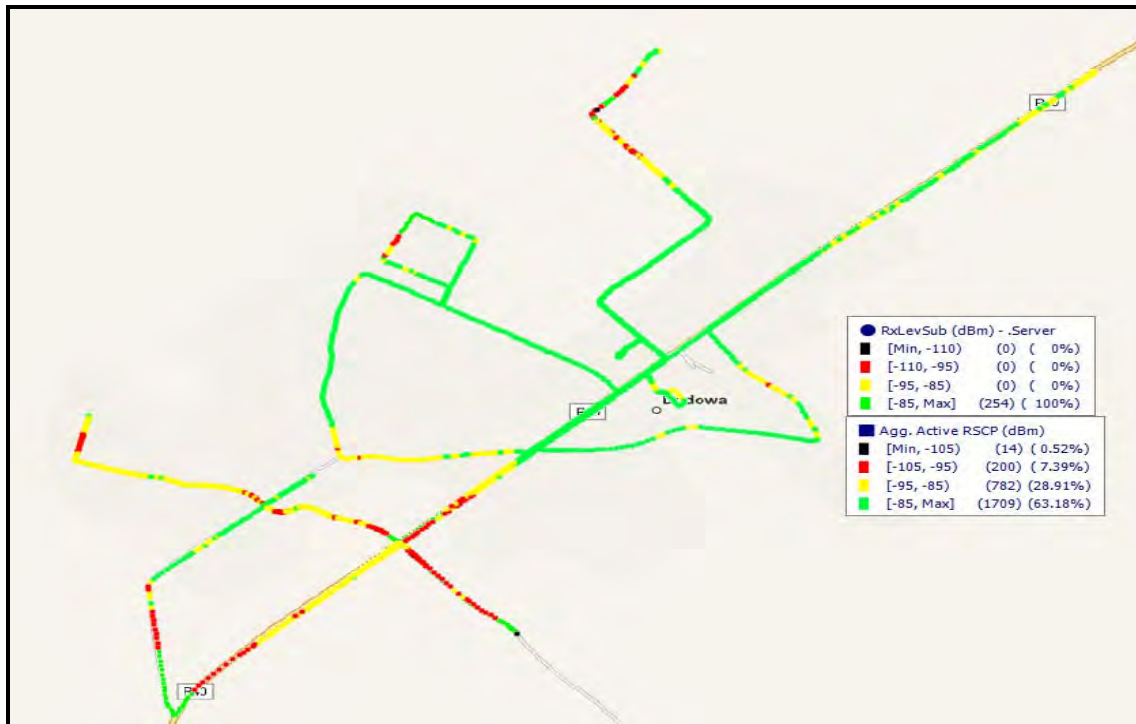
Remarks: Good 2G network however 3G coverage needs improvement.

Fig. 13 - Tigo Coverage Map, Dodowa - February 2016
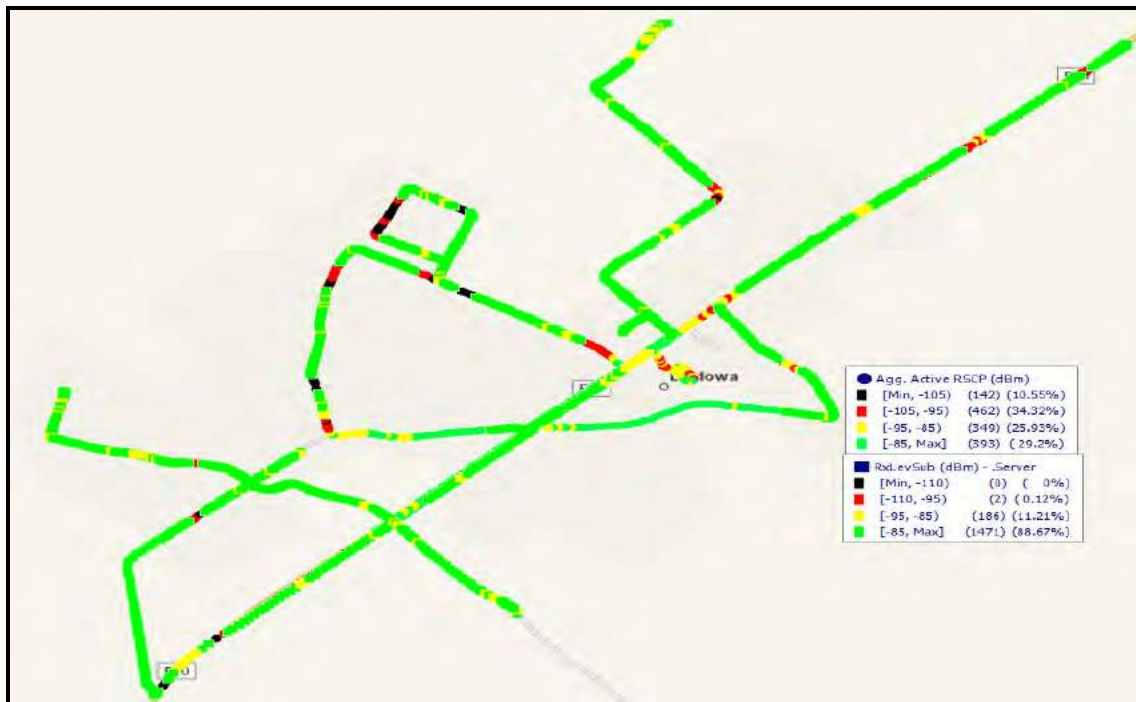
Remarks: Tigo has very poor 3G coverage in Dodowa

Fig. 14 - Airtel Coverage Map, Dodowa - February 2016
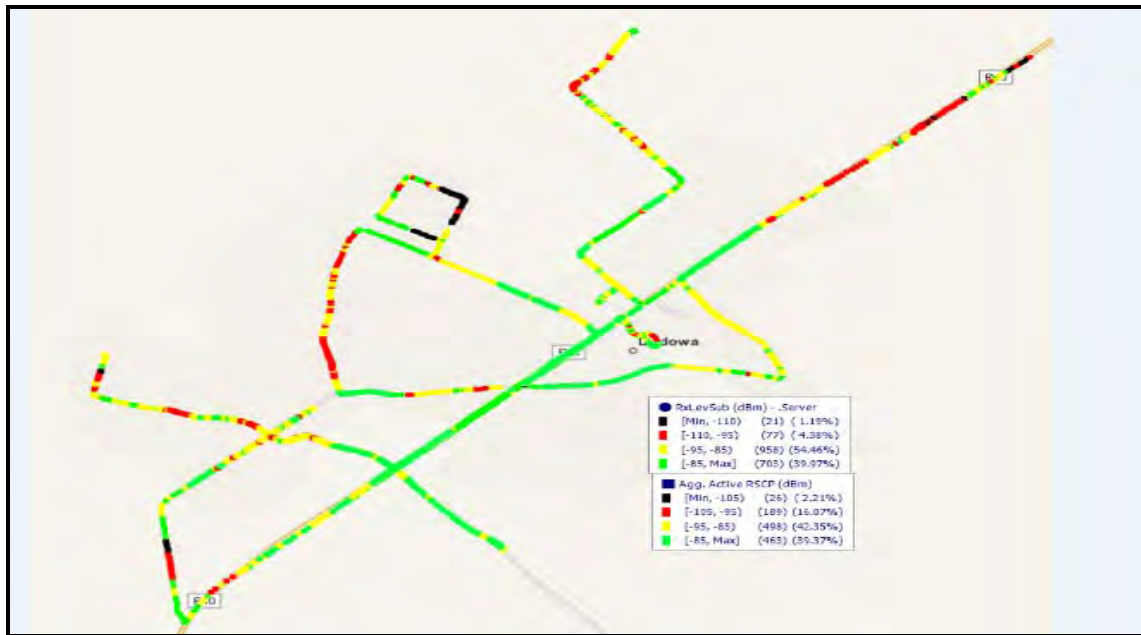
Remarks: Airtel does not have the best of coverage in Dodowa

Fig. 15 - Glo Coverage Map, Dodowa - February 2016
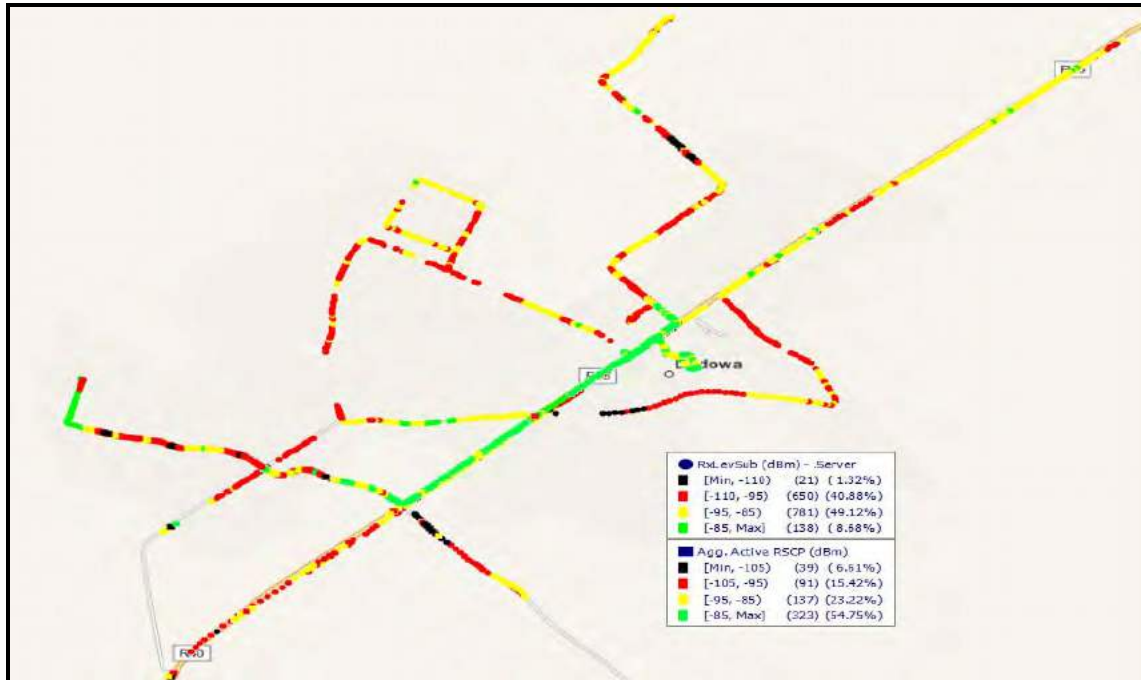
Remarks: Glo's 2G &3G network coverage is poor and needs serious improvement in and around Dodowa

COVERAGE AT PRAMPRAM

Fig. 16 - MTN Coverage Map, Prampram - February 2016
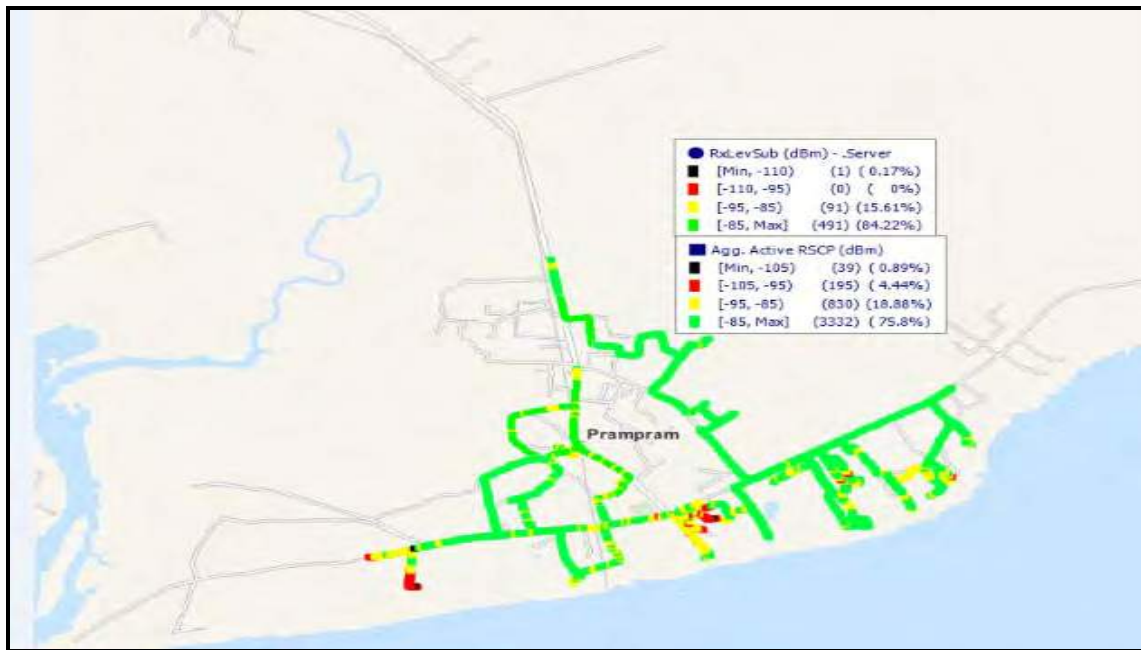
Remarks: Good network coverage however improvement is required at the beach area

Fig. 17 - Vodafone Coverage Map, Prampram - February 2016
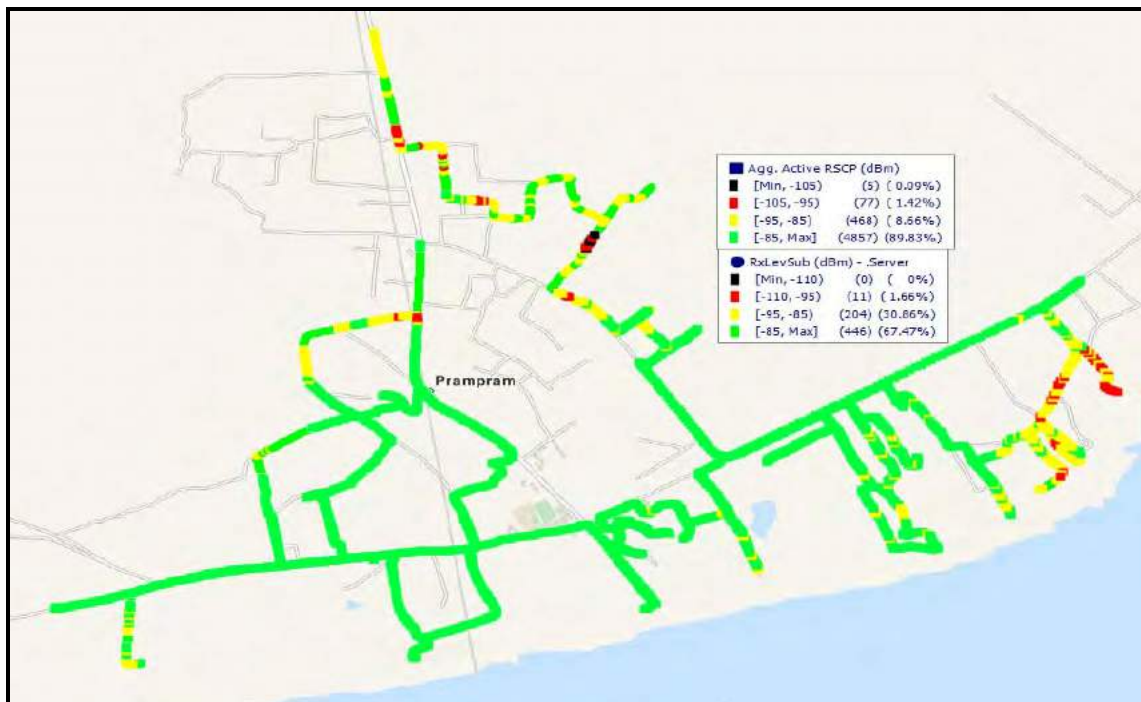
Remarks: Good network coverage in Prampram

Fig. 18 - Tigo Coverage Map, Prampram - February 2016
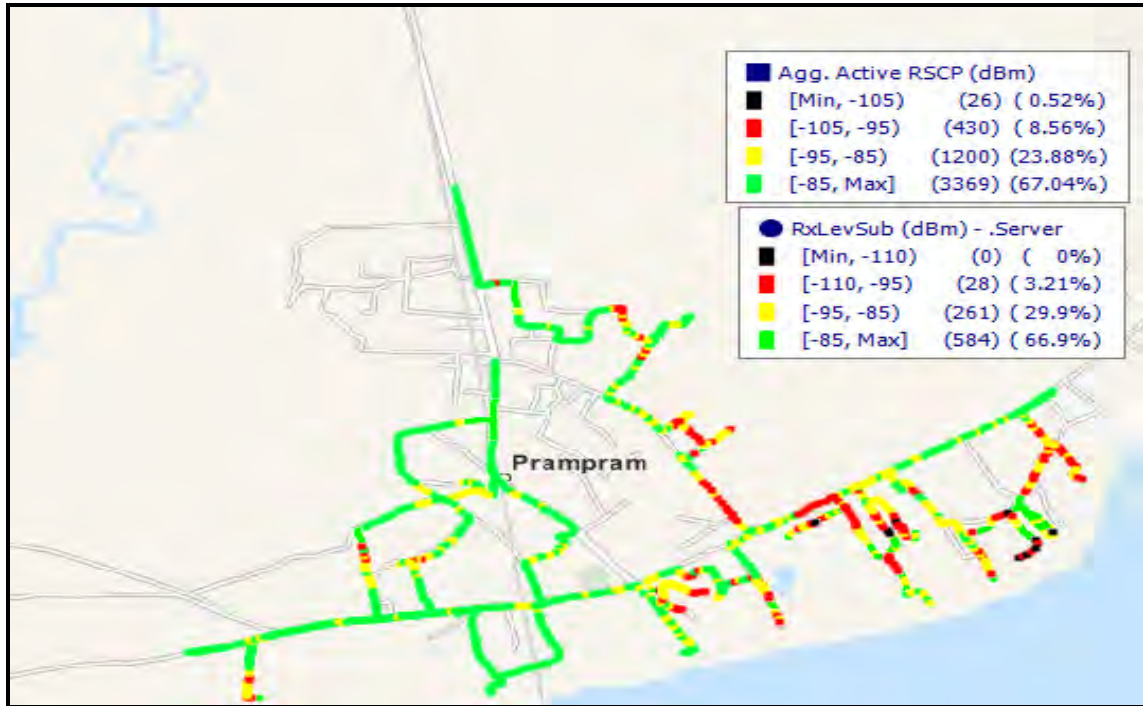
Remarks: Good network coverage in Prampram. However, coverage around road leading to Ningo requires improvement.

Fig. 19 - Airtel Coverage Map, Prampram - February 2016

Remarks: Airtel 3G network coverage in Prampram is poor even though it has good 2G network.

Fig. 20, Glo Coverage Map, Prampram - February 2016

Remarks: Very poor 3G coverage

COVERAGE AT ADA

Fig. 21 - MTN Coverage Map, Ada - February 2016

Good Coverge in Ada Foah. Some improvement will be needed around Big Ada

Fig. 22 - Vodafone Coverage Map, Ada - February 2016

Remarks: Good network coverage yet improvements are needed at the Fish Market area.

Fig. 23 - Tigo Coverage Map, Ada - February 2016
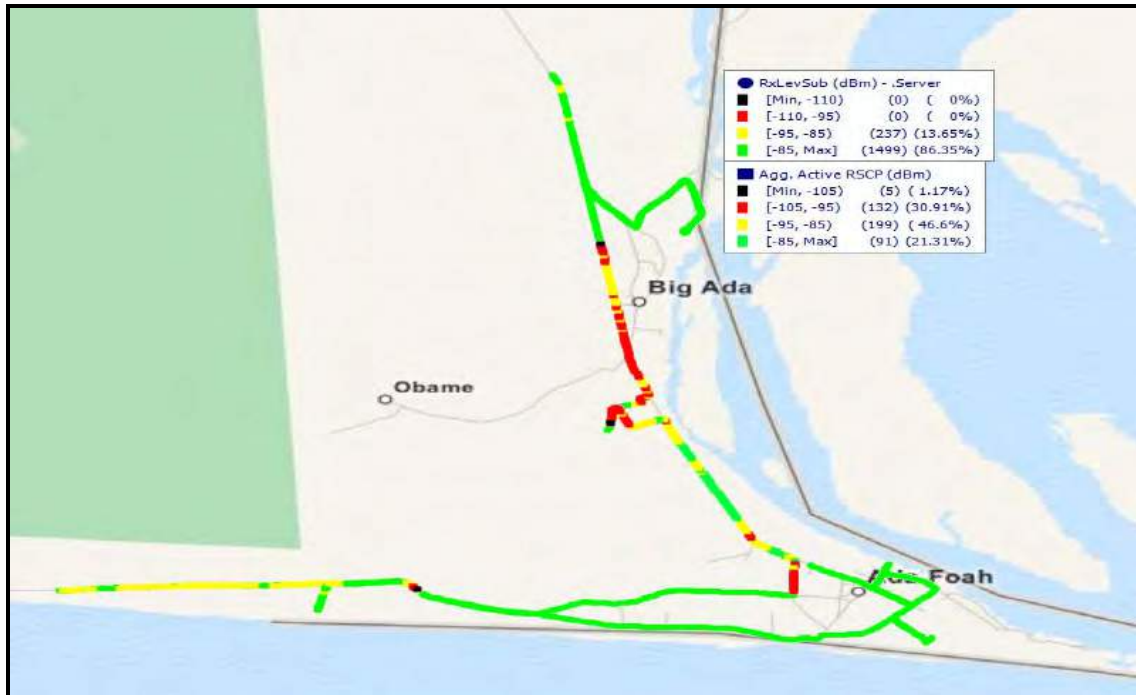
Remarks: Overall good 2G coverage within and around Ada Foah. However, there is poor 2G&3G network in Big Ada that requires major improvement.

Fig. 24 - Airtel Coverage Map, Ada - February 2016
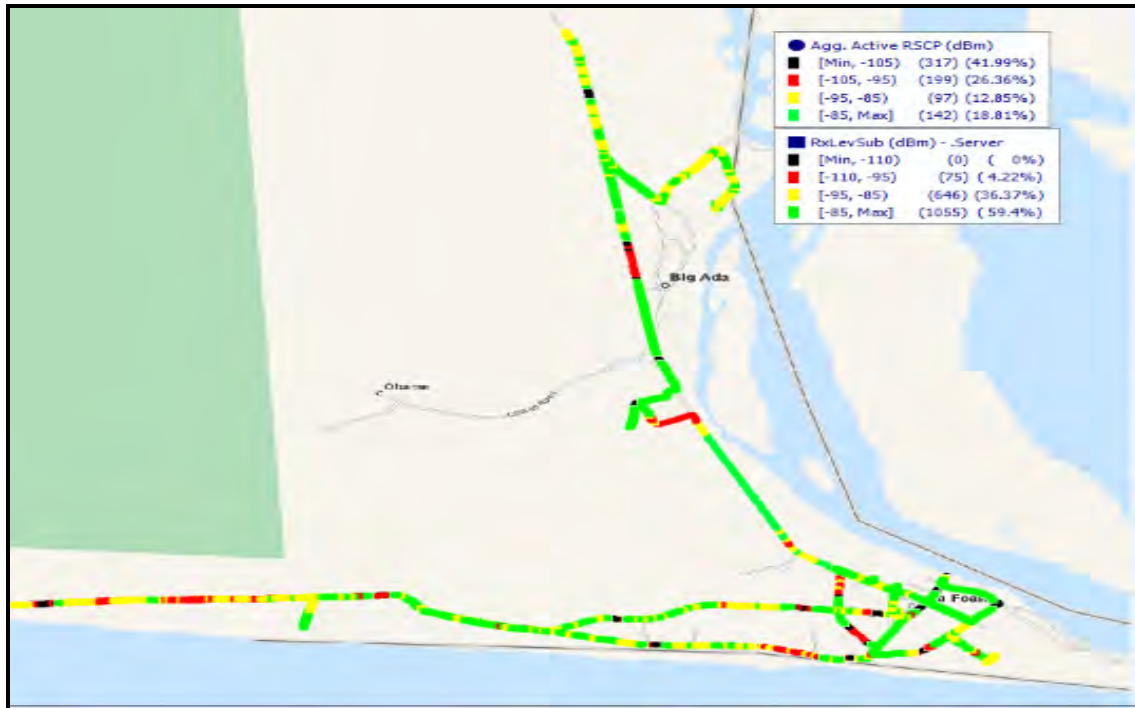
Remarks: Overall good 2G coverage within and around Ada Foah with 3G coverage gaps in some spots

Fig. 25 - Glo Coverage Map, Ada - February 2016

Remarks: Poor 2G & 3G coverage network in Ada

COVERAGE AT SEGE

Fig. 26 - MTN Coverage Map, Sege - February 2016
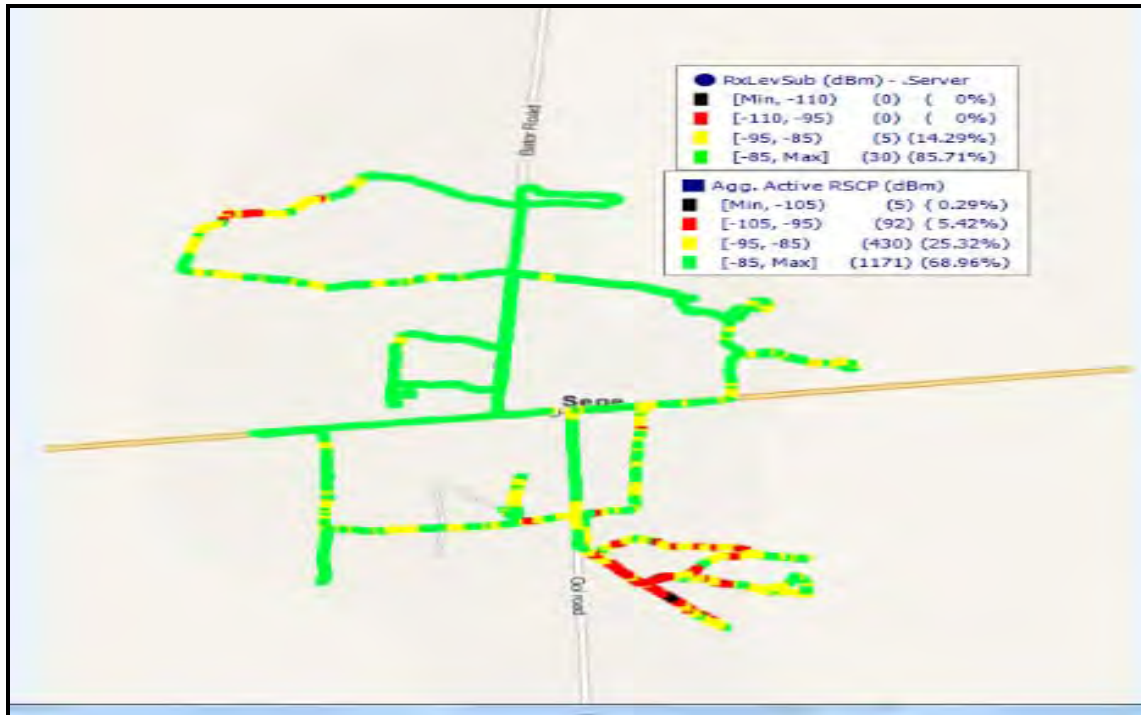
Remarks: Good 2G & 3G coverage in and around Sege. However, 3G coverage alongside Goi road is patchy

Fig. 27 - Vodafone Coverage Map, Sege - February 2016
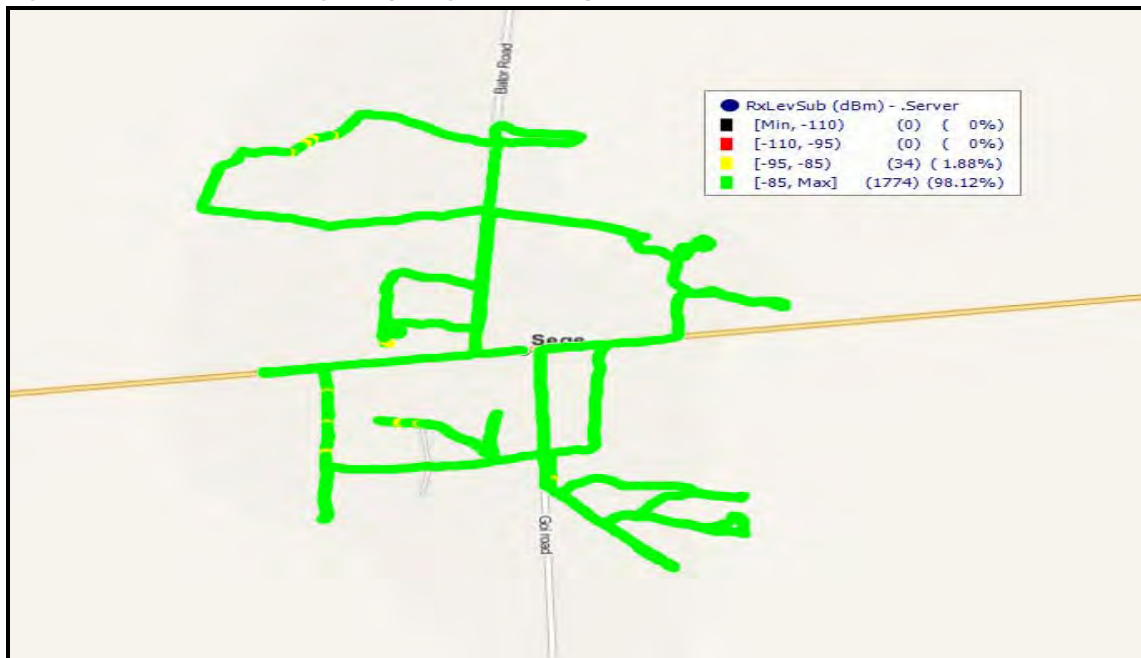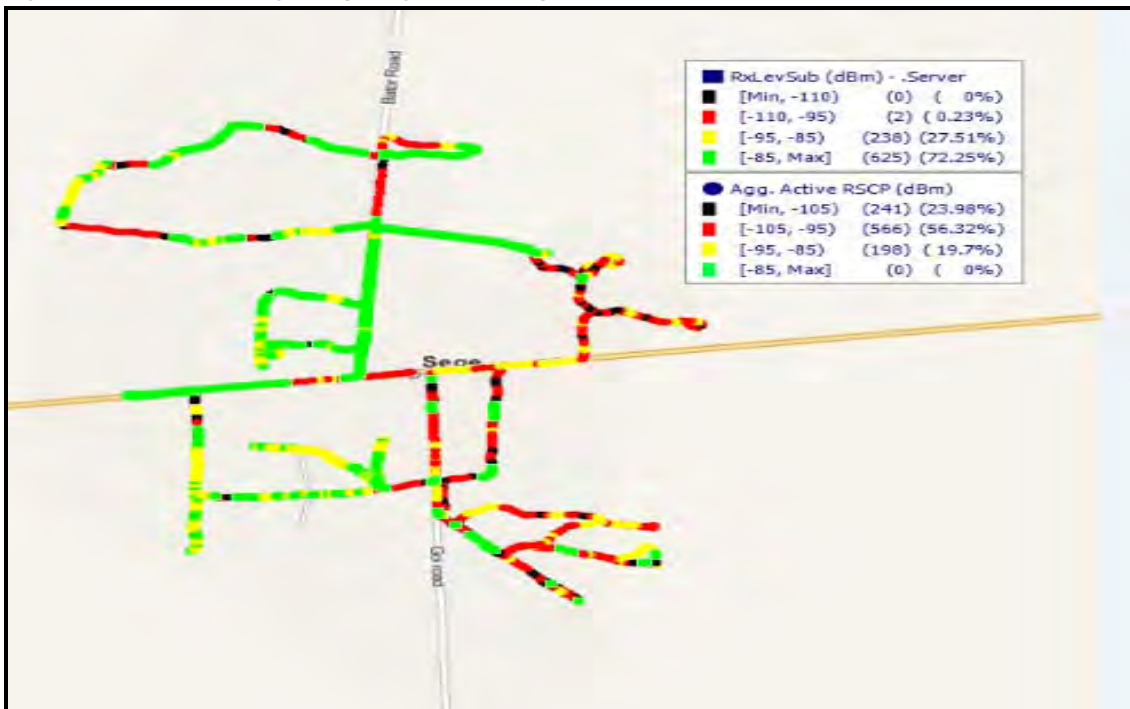

Remarks: Good 2G network coverage but no 3G coverage
Fig. 28 - Tigo Coverage Map, Sege - February 2016
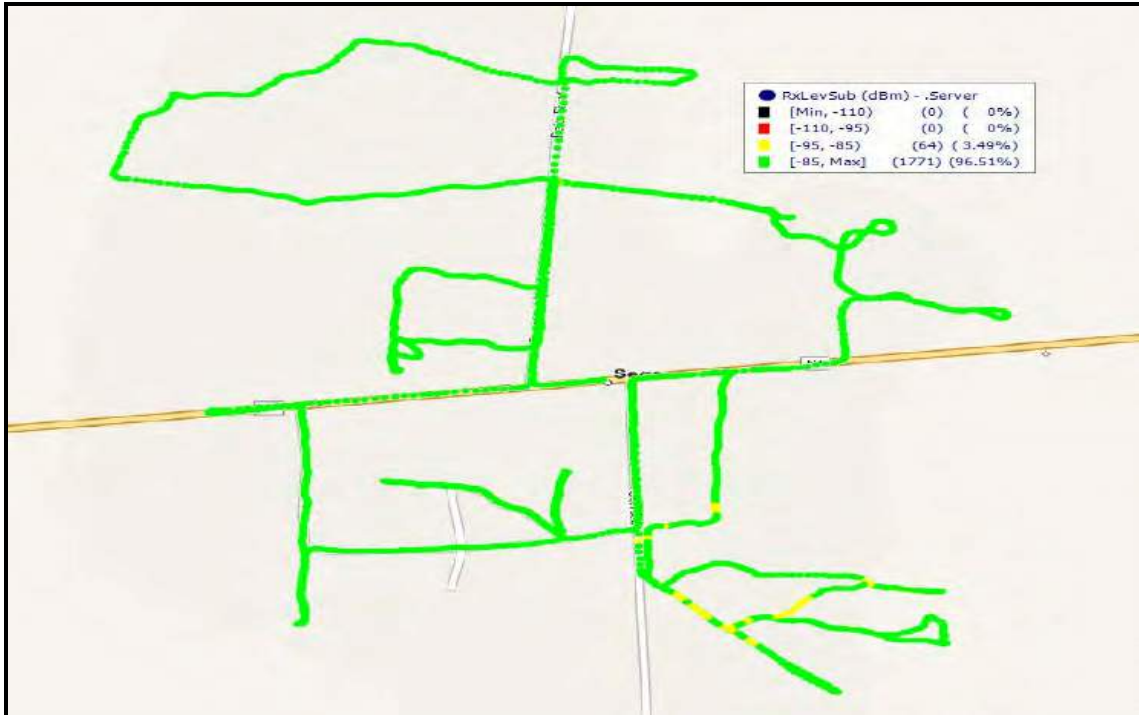
Remarks: Tigo has good 2G network coverage but no 3G coverage

Fig. 29 - Airtel Coverage Map, Sege - February 2016

Remarks: Good 2G coverage in and around Sege. The 3G is however poor and requires major improvement.

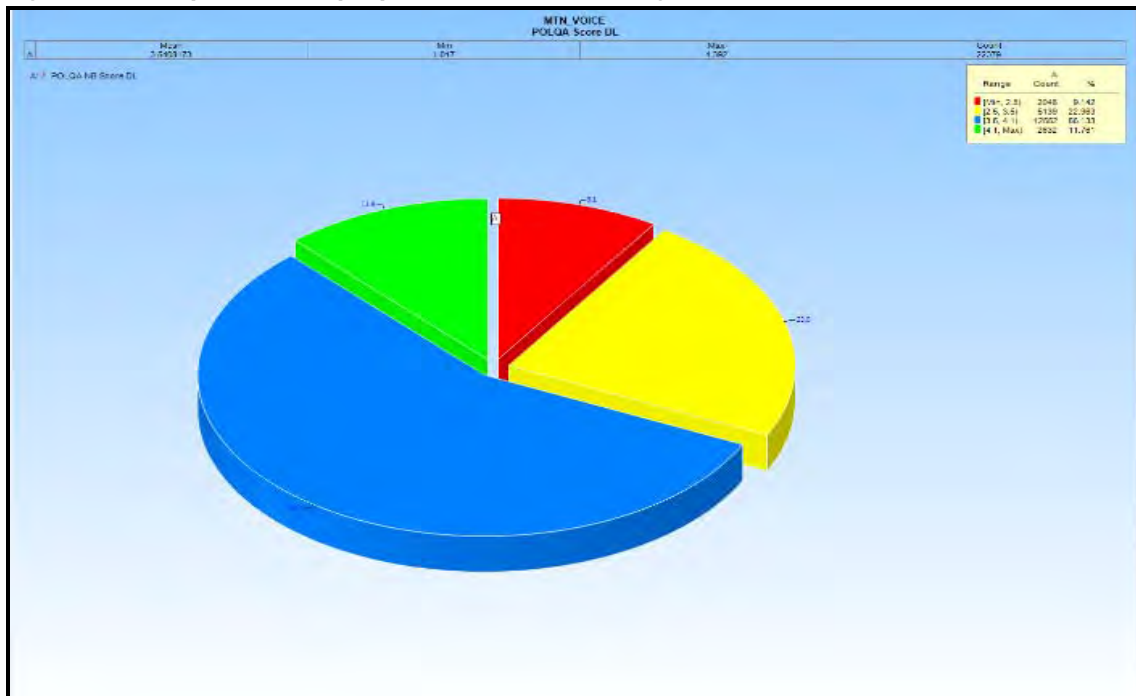**Fig. 30 - Glo Coverage Map, Sege - February 2016**
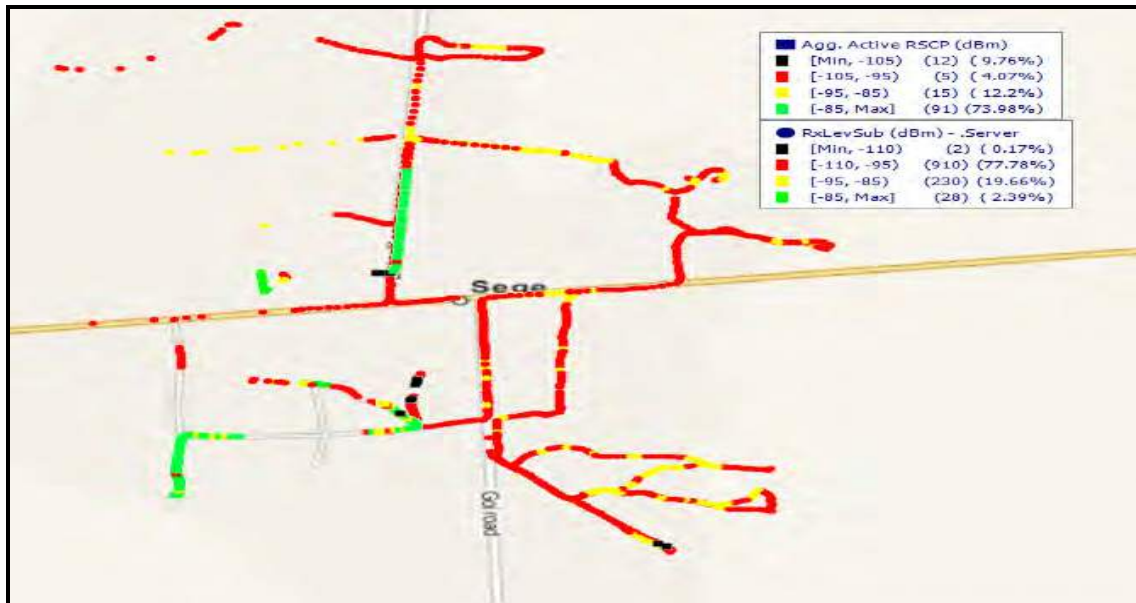
Remarks: Poor 2G&3G Network Coverage across Sege.

APPENDIX II

SPEECH QUALITY FOR OPERATORS

Fig. 31 - MTN Speech Quality report in Greater Accra Region

Fig. 32 - Vodafone Speech Quality report in Greater Accra Region
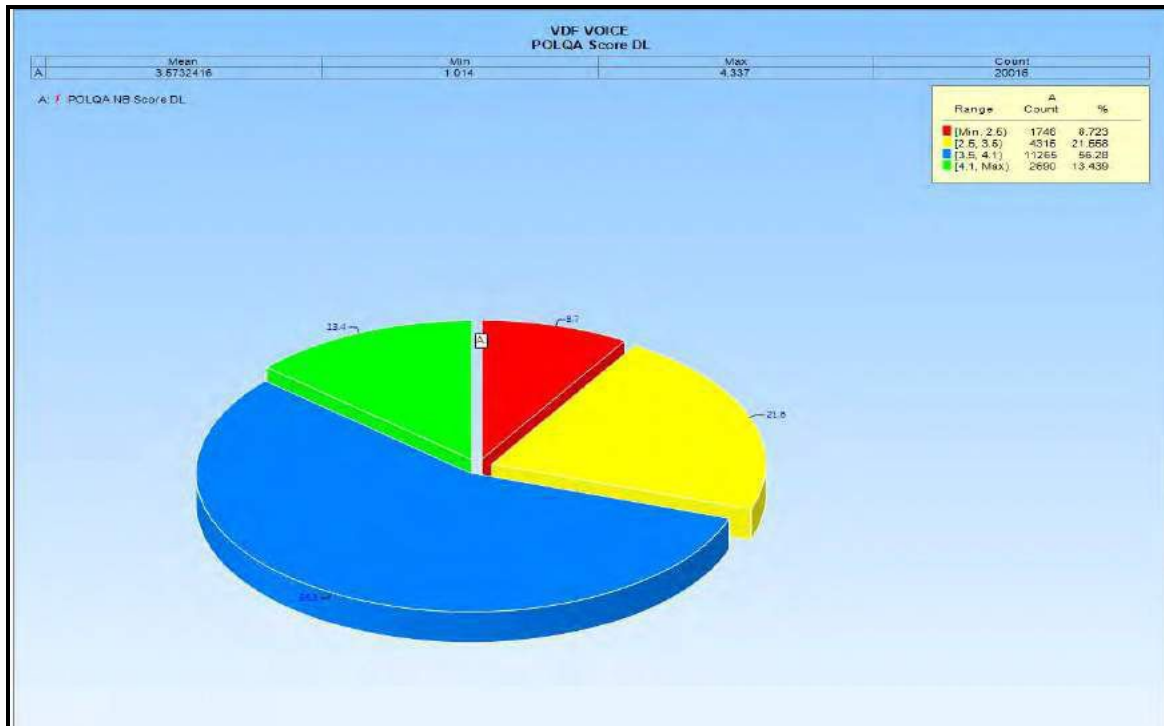
Fig. 33 - Tigo Speech Quality report in Greater Accra Region
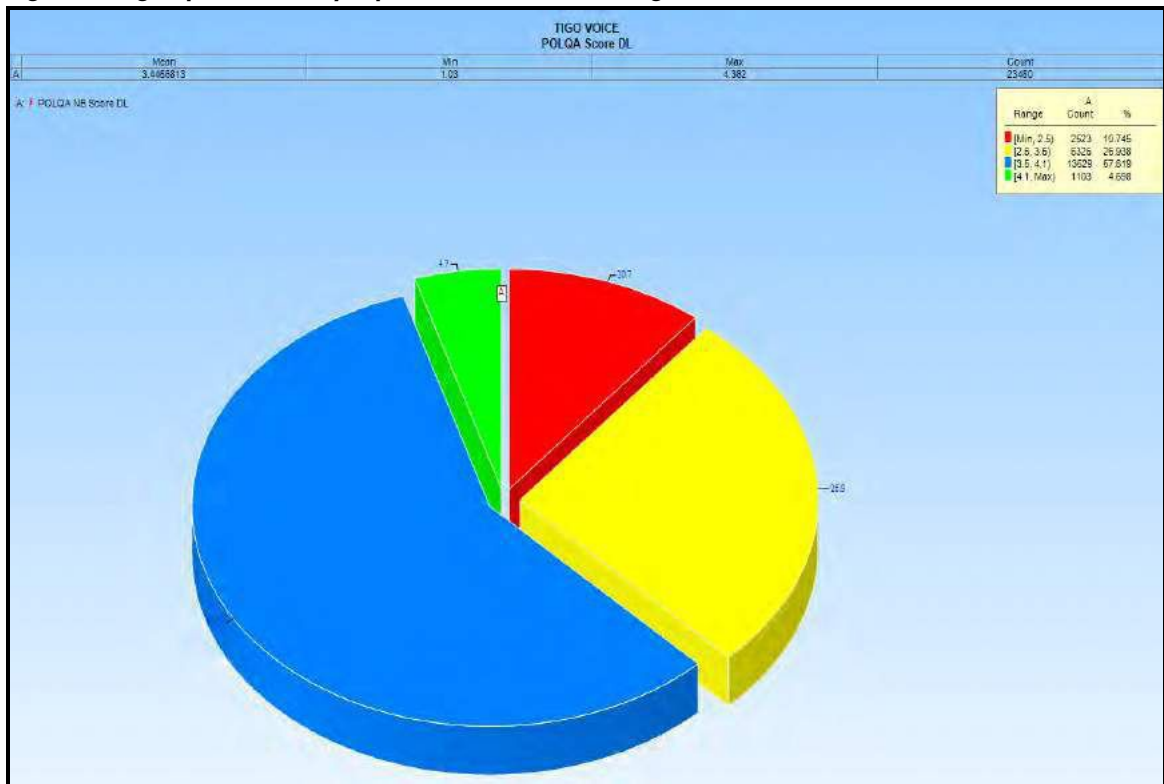
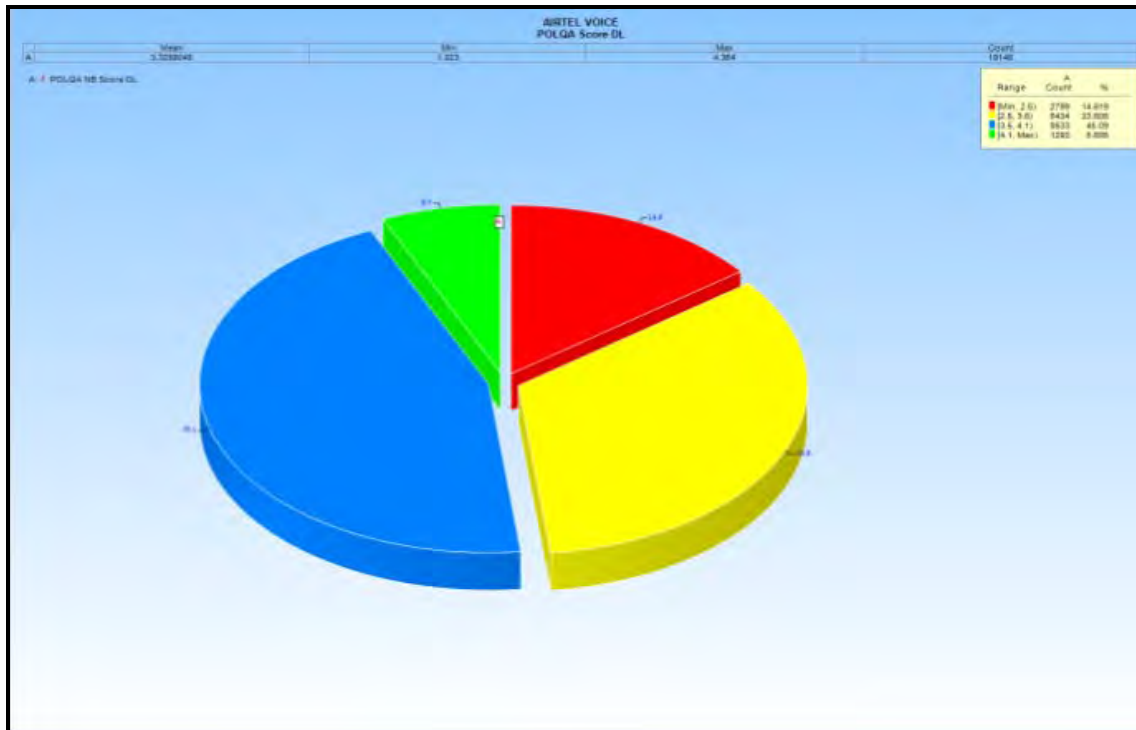**Fig. 34 - Airtel Speech Quality report in Greater Accra Region**

Fig. 35 - Glo Speech Quality report in Greater Accra Region