NATIONAL COMMUNICATIONS AUTHORITY

Quality of Service (QoS) Monitoring of Cellular Mobile   Voice Services-Upper West REGION

[July 2015]

[Communications for Development]

QUALITY OF SERVICE (QoS) MONITORING OF CELLULAR MOBILE VOICE SERVICES IN UPPER WEST REGION, JULY 2015

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Background

In pursuance of Annexure D1 and D2 of the Cellular Mobile Licence of Telecommunication Operators, the consumer 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 Upper West region in July 2015 for all Operators except for Expresso and Glo due to their technical challenges.

What we measure

The Quality of Service monitoring system measures many parameters including coverage signal strength and voice quality. These parameters are in the 3G licence, a complementary licence to the Cellular Mobile Licence. The Voice Quality is measured by an ITU standard P.863 fondly called (POLQA) Perceptual Objective Listening Quality Assessment.

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

- **Stand-alone Dedicated Control Channel (SDCCH) Congestion Rate**
- **Call Setup Time (CST)**
- **Call Congestion Rate**
- **Call Drop Rate (CDR)**
- **Voice Call Audio Quality**
- **Coverage Signal Strength**

Findings

The results for the cities and towns tested during the period are as below:

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

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

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,

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

Table 1. Signalling Congestion Rate Cellular Mobile Voice Service, July 2015

Month	City/Town	MTN	Vodafone	Tigo	Airtel
JULY	Jirapa	0	0	0	**7.3**
JULY	Lawra	0	0	0	0
JULY	Nandom	0	0	0	0
JULY	Tumu	0	0	0	0
JULY	Wa	0	0	0	0

REMARKS:

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

❖ Airtel had signalling congestion of 7.3% in Jirapa.

b) 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 to the receiving terminal;

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

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

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

Table 2. Call Setup Time of Cellular Mobile Voice Service, July 2015

Month	City/Town	MTN	Vodafone	Tigo	Airtel
JULY	Jirapa	3.89	4.33	7.64	**17.91**
JULY	Lawra	4.63	4.17	5.32	**11.19**
JULY	Nandom	4.71	**14.02**	5.74	7.03
JULY	Tumu	4.71	4.10	7.34	5.87
JULY	Wa	8.60	4.46	5.93	**18.95**

REMARKS:

❖ MTN and Tigo passed the Call setup Time obligation in all locations.

❖ Vodafone had call setup delays in Nandom.

❖ Airtel had call setup delays at Jirapa, Lawra and Wa.

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;

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

Table 3. Call Congestion Rate Cellular Mobile Voice Service, July 2015

Month	City/Town	MTN	Vodafone	Tigo	Airtel
JULY	Jirapa	0	0	0	0
JULY	Lawra	0	0	0	0
JULY	Nandom	0	0	0	0
JULY	Tumu	0	0	0	0
JULY	Wa	0	0	0	0

REMARKS:

❖ All operators were in compliance with the licence threshold of less than one percent (1%) in all the tested locations.

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;

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

Table 4. Call Drop Rate Cellular Mobile Voice Service, July 2015

Month	City/Town	MTN	Vodafone	Tigo	Airtel
JULY	Jirapa	0	0	0	0
JULY	Lawra	0	0	0	0
JULY	Nandom	0	0	0	0
JULY	Tumu	0	0	0	0
JULY	Wa	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.

Voice Call Audio Quality   - perceptibility of the conversation during a call. Voice Call Audio Quality is measured using a parameter called the Mean Opinion Score (MOS) which categorizes speech samples in ranges from 1 to 5. See legend below. This parameter is machine measured.

Range		Rating
(Min,1)		Very bad
(1,2)		Bad
(2, 3.2)		Poor
(3.2, 3.5)		Fair
(3.5, 3.9)		Good
(3.9, 5.01)		Very good
(5.01, Max)		Excellent

Table 5. Speech Quality Mean Opinion Score Central Region, July 2015

Central Region	MTN	Vodafone	Tigo	Airtel
MOS	3.8	3.69	3.65	3.61

REMARK:

❖ All operators were assessed to give 'GOOD' speech quality except Glo and Expresso who were not available to be assessed at the time of the exercise due technical challenges.

REMEDIES

❖ The NCA has notified Operators of publication of these findings and has directed all Operators in improve their coverage in some localities by December 2015.

❖ Vodafone has been directed to cure the Call Setup Time delays in Nandom.

❖ The Authority has sanctioned Airtel Ghana an amount of **Fifty Thousand Ghana Cedis (GH¢50,000.00) and also** directed Airtel Ghana to resolve **SDCCH Congestion** in **Jirapa** and improve **3G network coverage** in **Wa, Lawra, Tumu and Jirapa** by December 2015.

COVERAGE SIGNAL STRENGTH

COVERAGE AND SPEECH MAPS

The Maps below show the coverage level and speech quality in 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 attain by operators during measurement.

Coverage levels in green falls in the rage of -85dBm and above are considered good. Those between -85 and -95dBm are considered fair and are indicated in yellow. The red samples represent poor 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.

Coverage Legend

Colour	Area Coverage Rating
	Good Coverage Areas
	Fair Coverage Areas
	Poor Coverage Areas
	None Existent Coverage Areas

APPENDIX I

AIRTEL

Figure 1. Wa Coverage Map
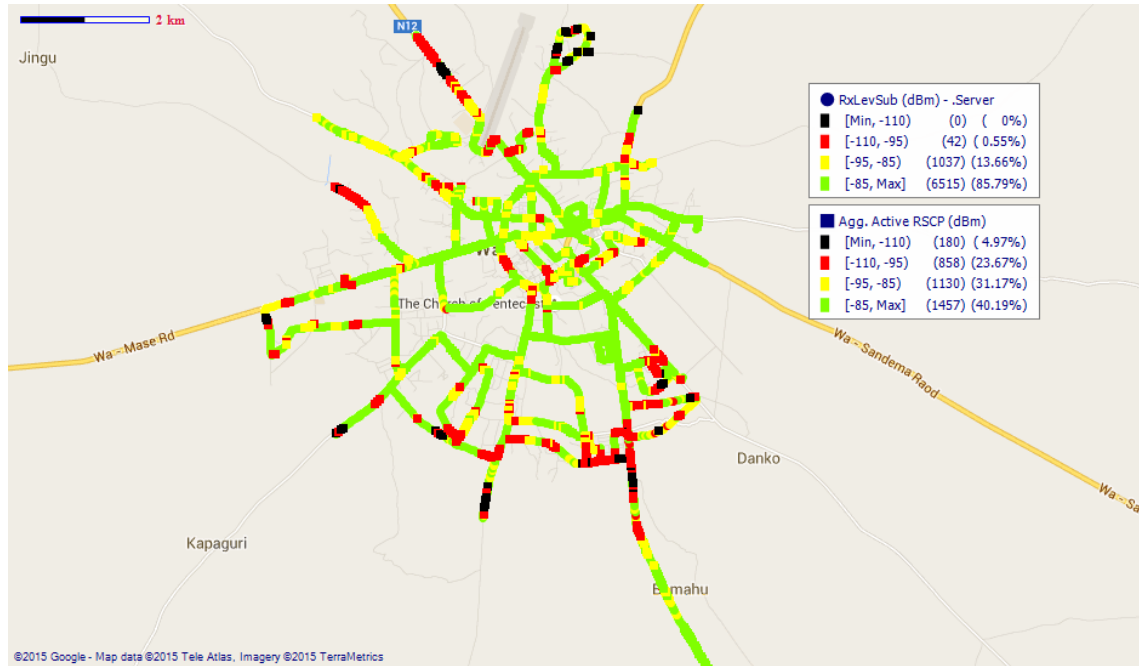
Remarks: Good 2G network coverage in central parts of Wa. Areas around SSNIT Estates and the Airstrip need major 2G and 3G coverage improvement.

Figure 2. Lawra Coverage Map
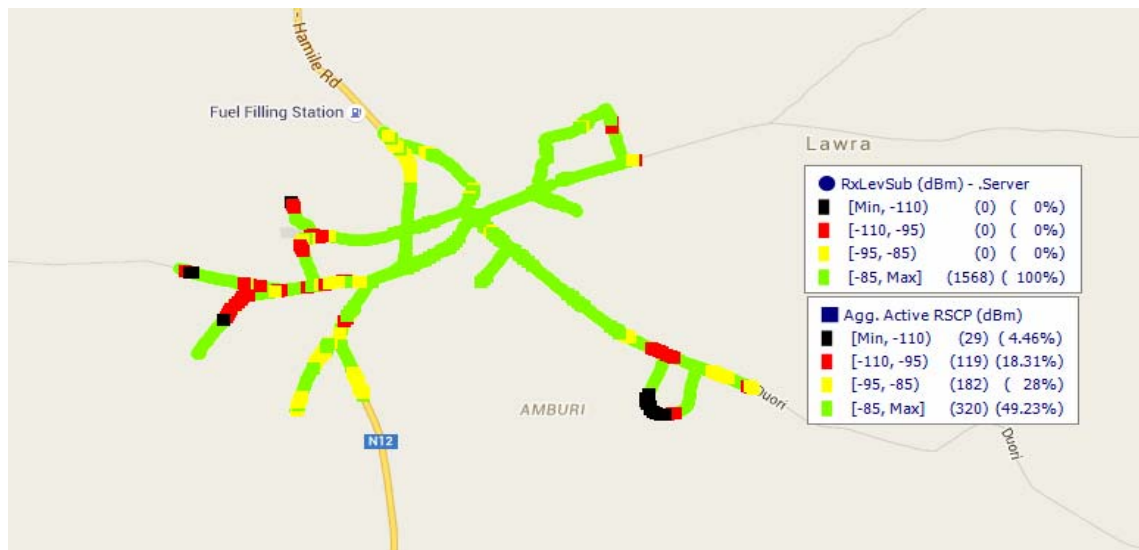
Remarks: Good 2G network in Lawra with poor 3G coverage at outlying areas. Major 3G coverage improvements are required.

Figure 3. Tumu Coverage Map
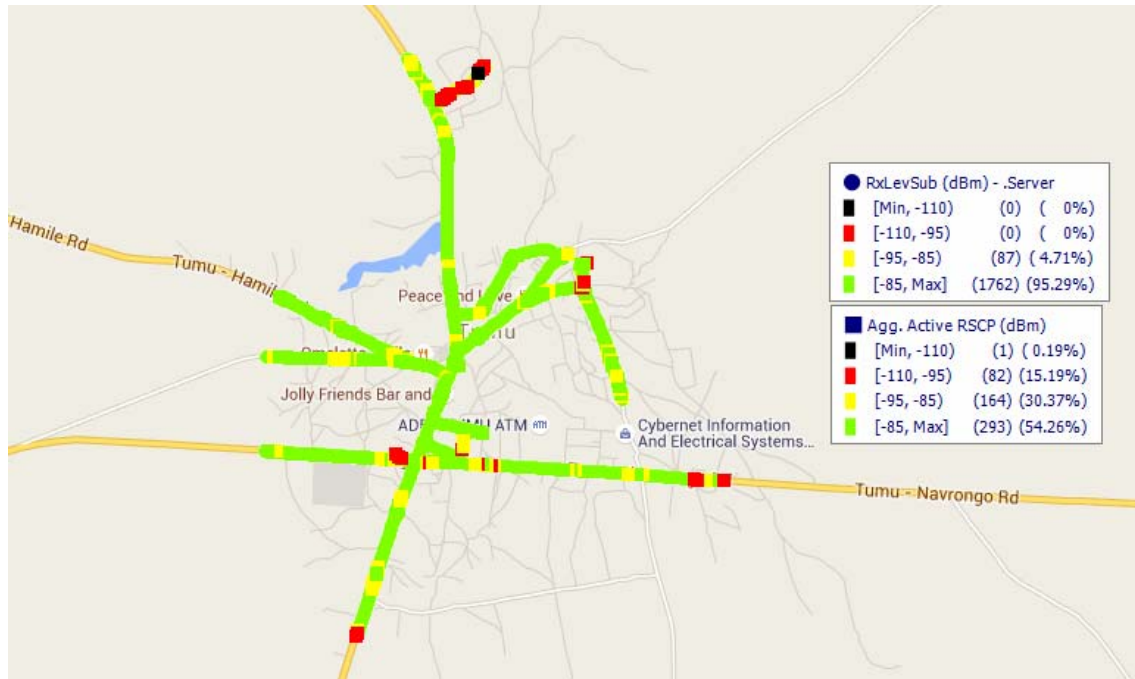
Remarks: Good 2G network across Tumu, however 3G network coverage needs improvement.

Figure 4. Jirapa Coverage Map
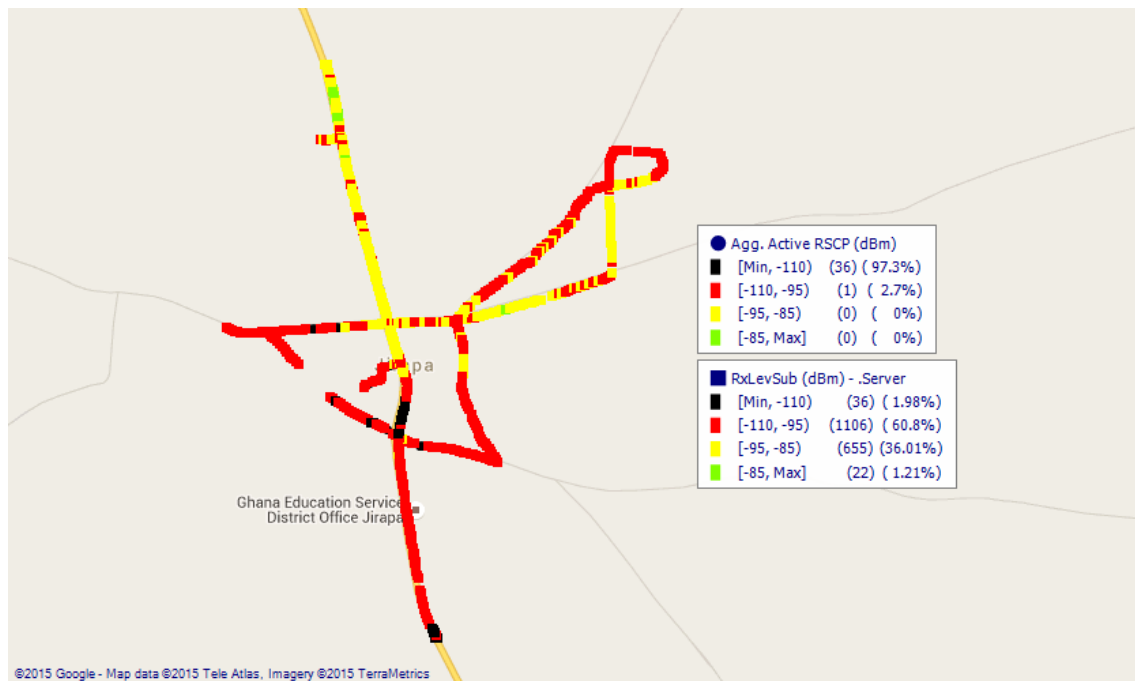
Remarks: Very poor 2G and 3G network coverage across Jirapa. Major coverage improvements are required.

Figure 5. Nandom Coverage Map
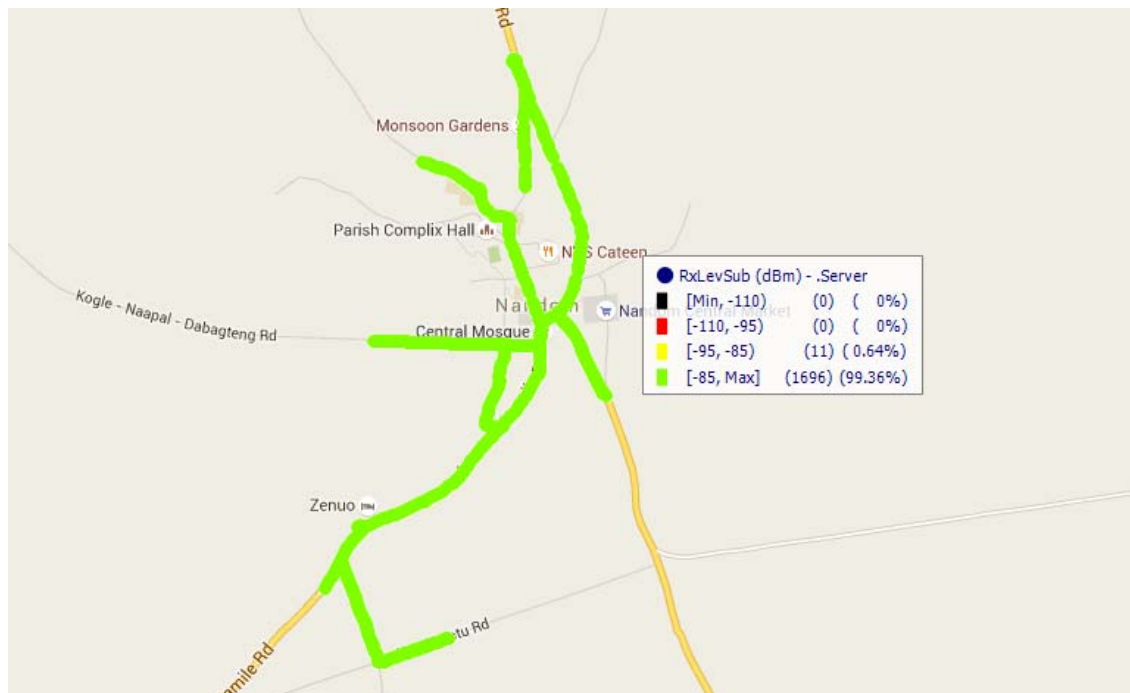
Remarks: Good 2G network coverage in Nandom

APPENDIX II

VODAFONE

Figure 6. Wa Coverage Map
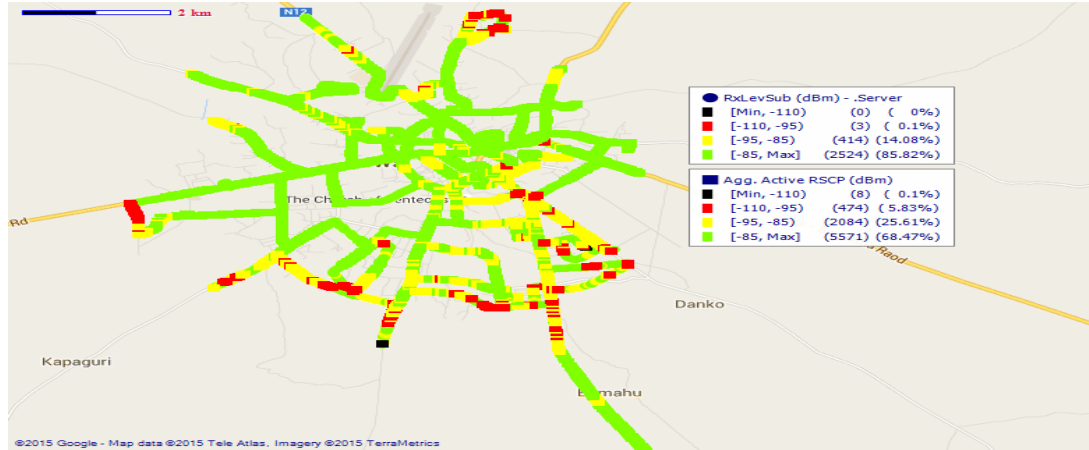
Remarks: Good coverage at the central areas of Wa with poor coverage at the southern part and around the Airstrip which require improvements.

Figure 7.Lawra Coverage Map
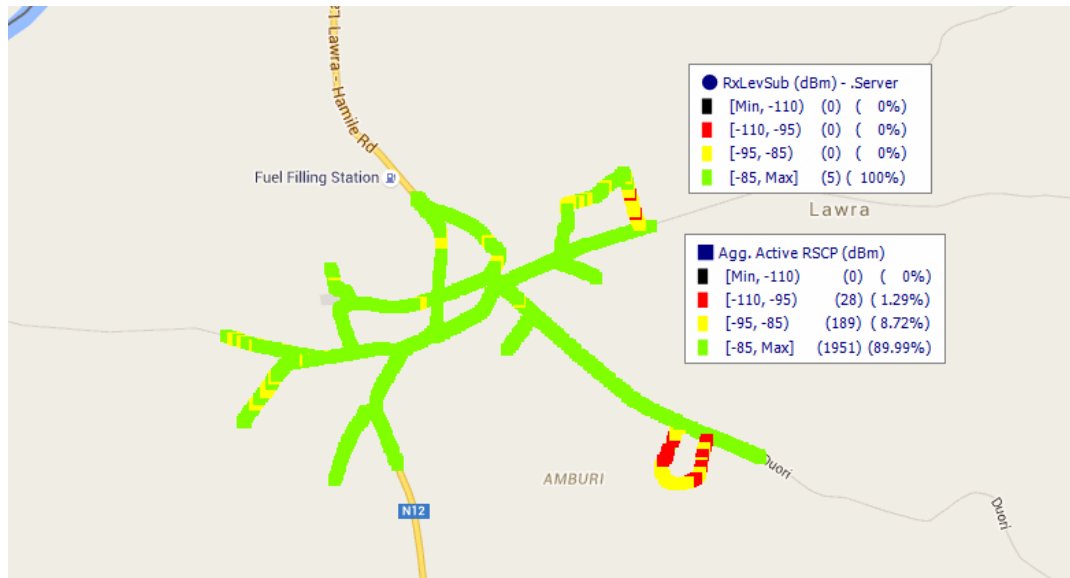
Remarks: Good coverage across Lawra.

Figure 8.Tumu Coverage Map
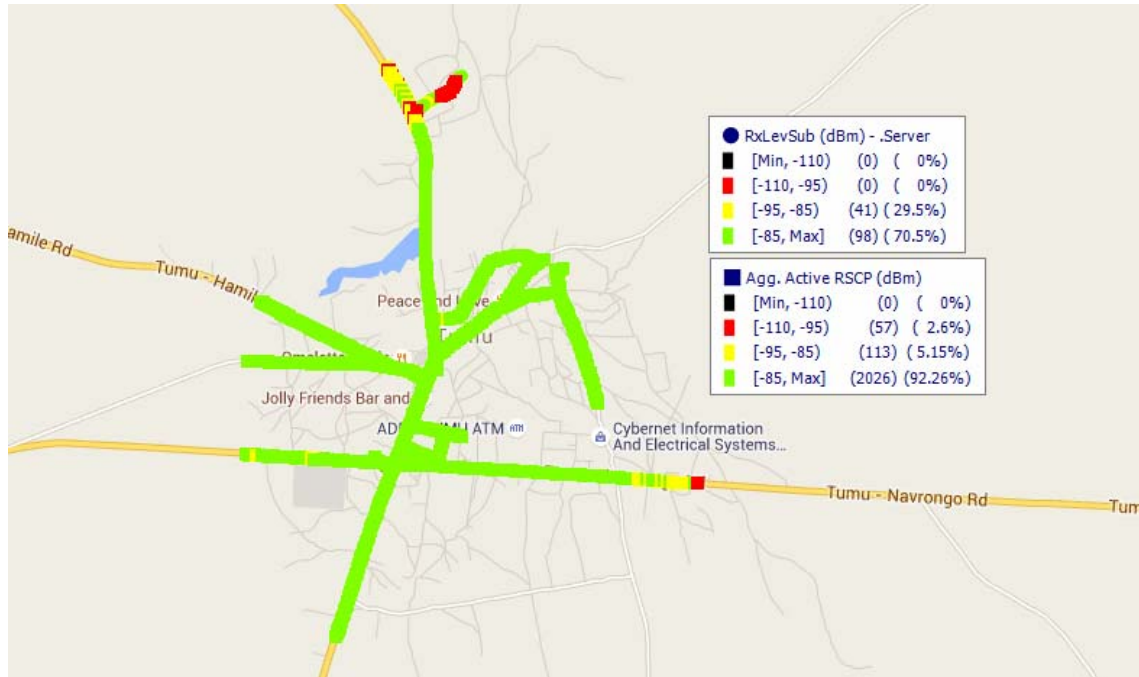
Remarks: Good network coverage across Tumu

Figure 9. Jirapa Coverage Map
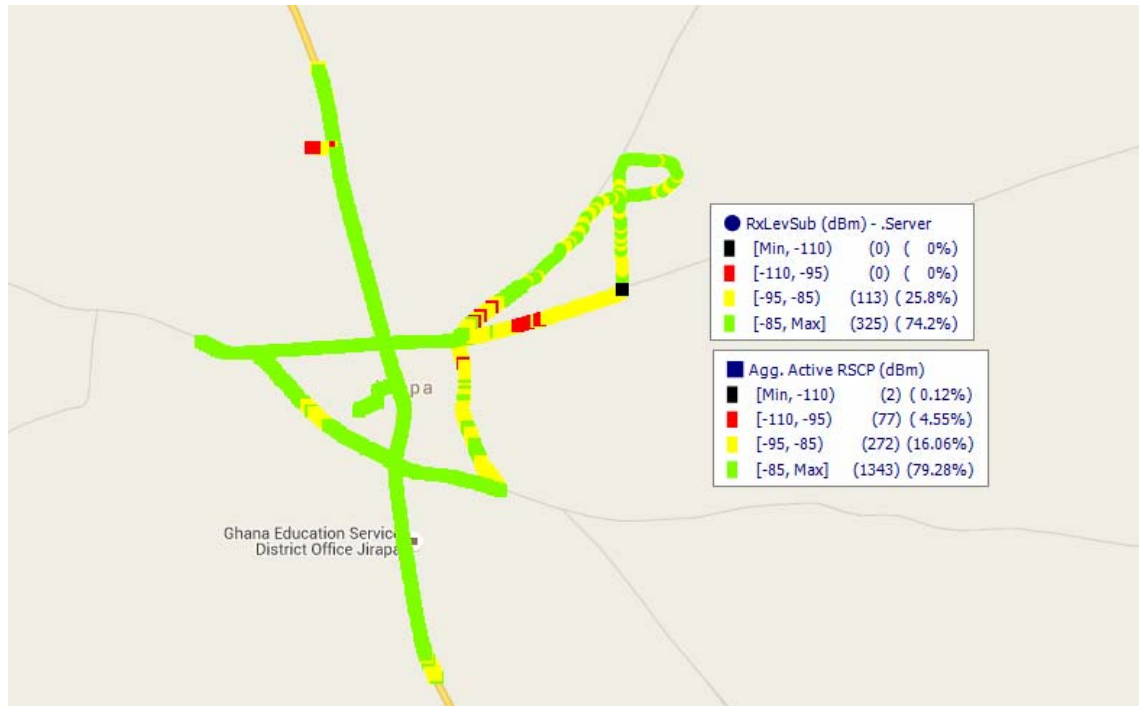
Remarks: Good coverage at Jirapa which requires improvement at the eastern side of the township.

Figure 10. Nandom Network Coverage
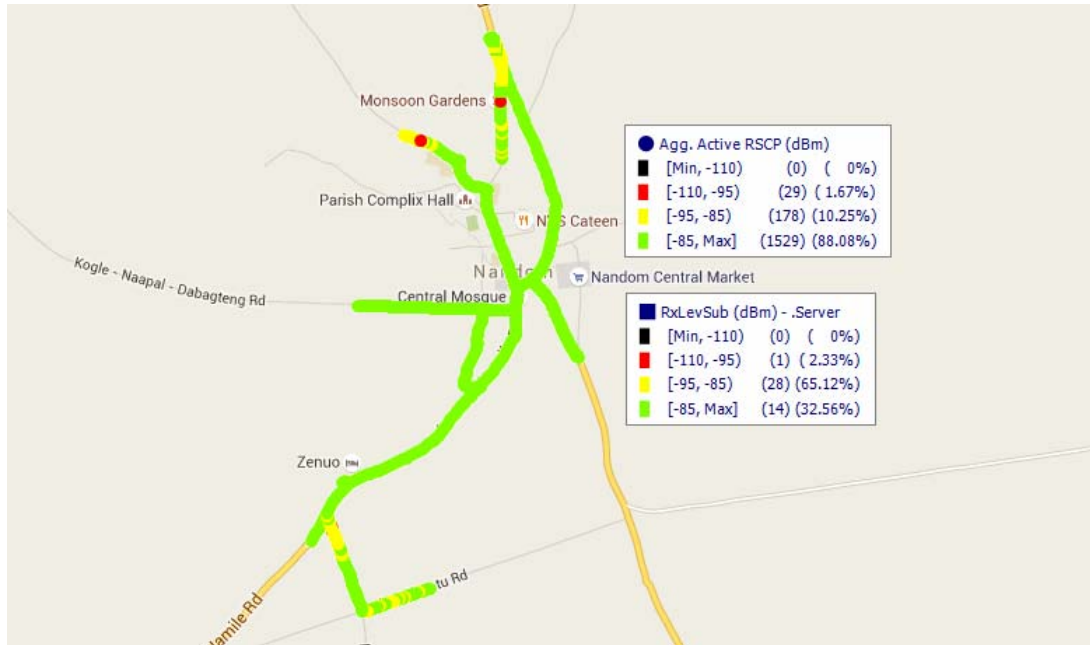
Remarks: Good coverage across Nandom.

APPENDIX III

TIGO

Figure 11. Wa Coverage Map
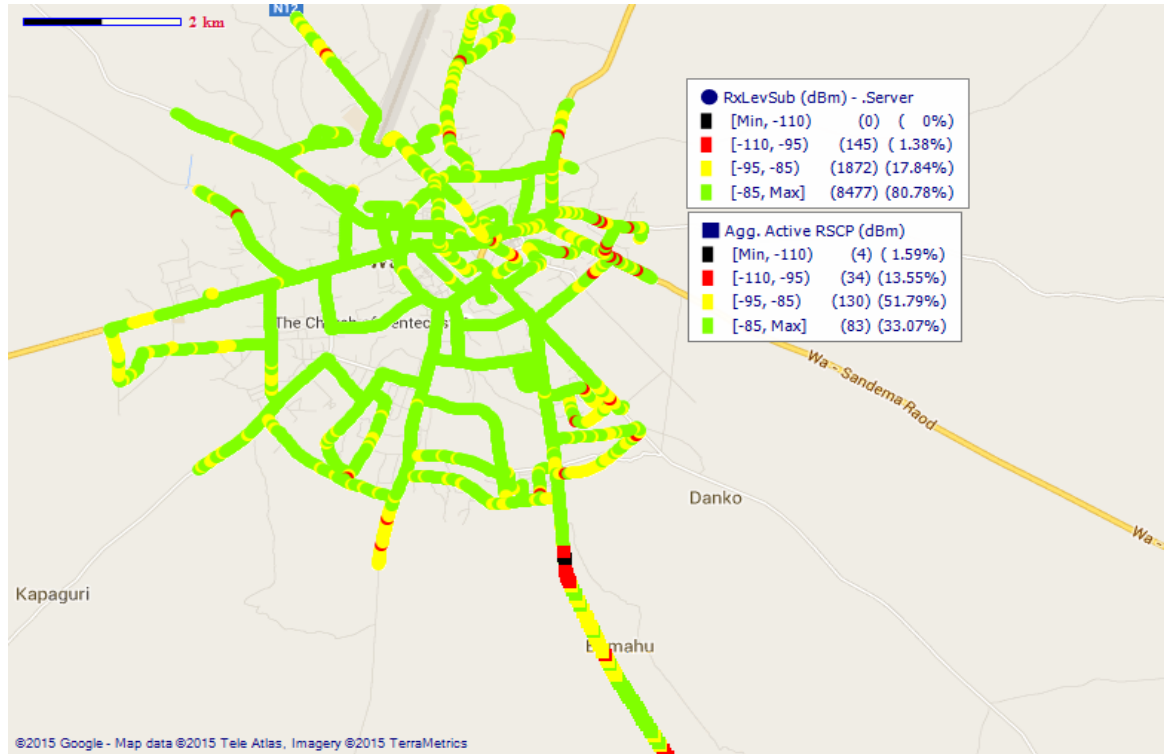
Remarks: Good 2G coverage across Wa, yet major 3G coverage improvements required especially at the University of Development Studies Campus.

Figure 12. Lawra Coverage Map
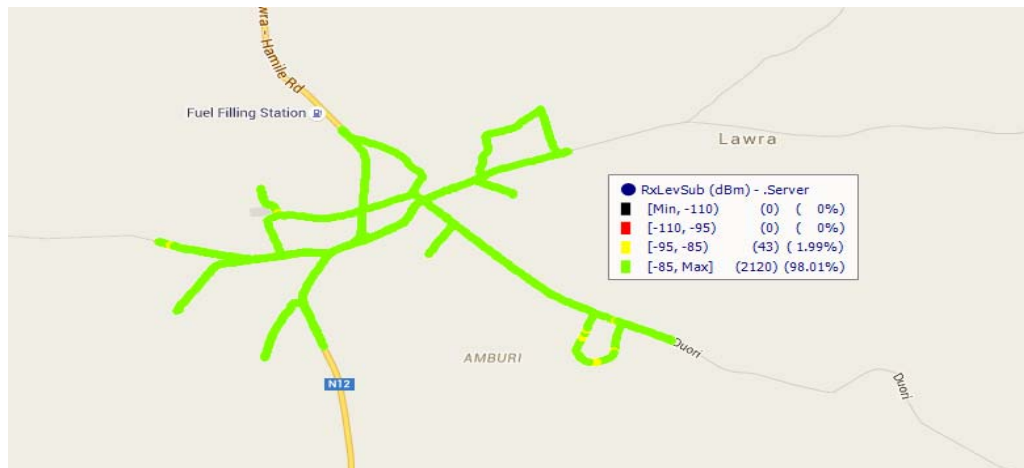
Remarks: Good 2G coverage across Lawra.

Figure 13. Tumu Coverage Map
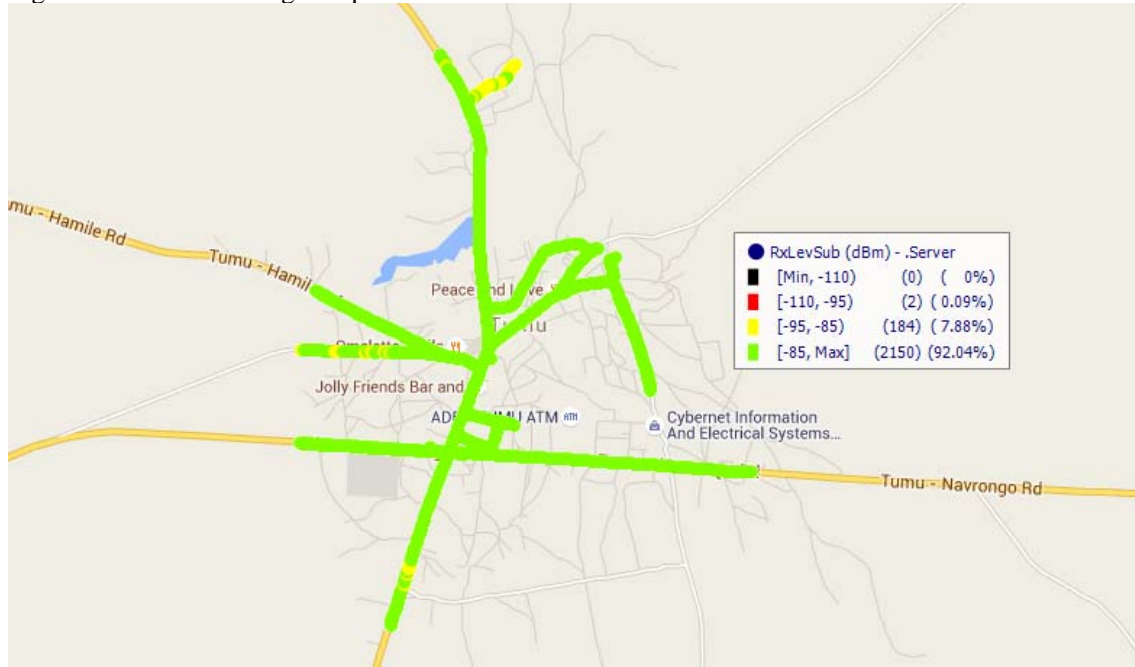
Remarks: Good 2G coverage across Tumu.

Figure 14. Jirapa Coverage Map
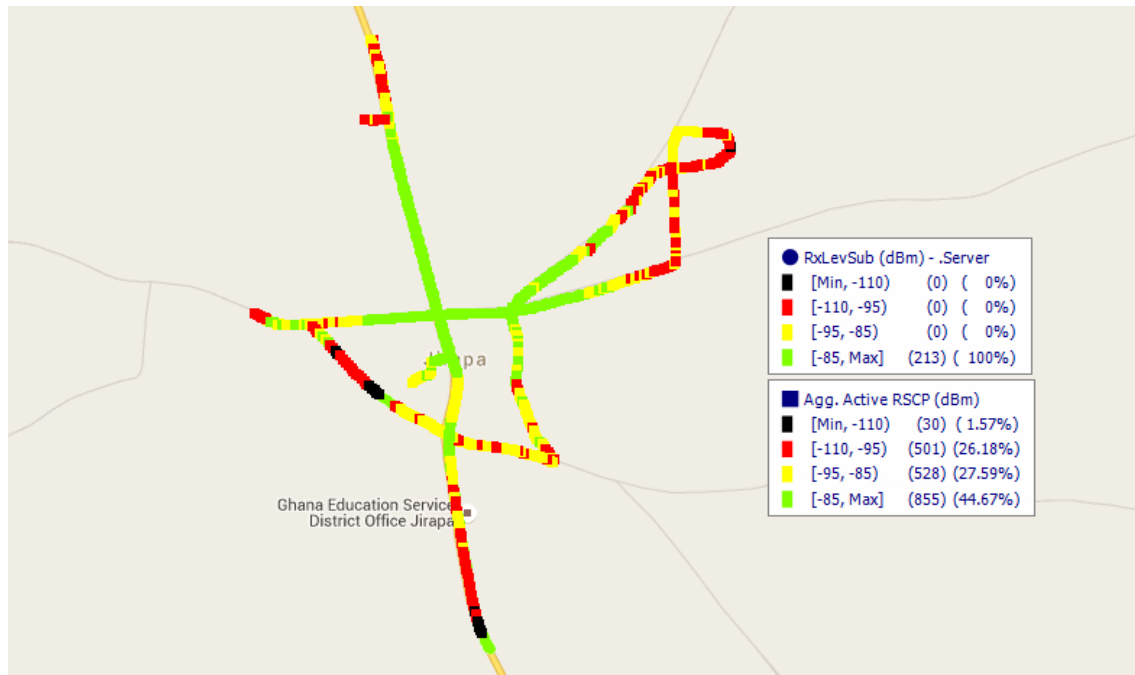
Remarks: Good Coverage in Jirapa town center but deteriorates at the outskirts. Coverage improvement is therefore needed at the outskirts.

Figure 15. Nandom Network Coverage

Remarks: Good 2G network across Nandom.

APPENDIX IV

 MTN

Figure 16. Wa Coverage Map
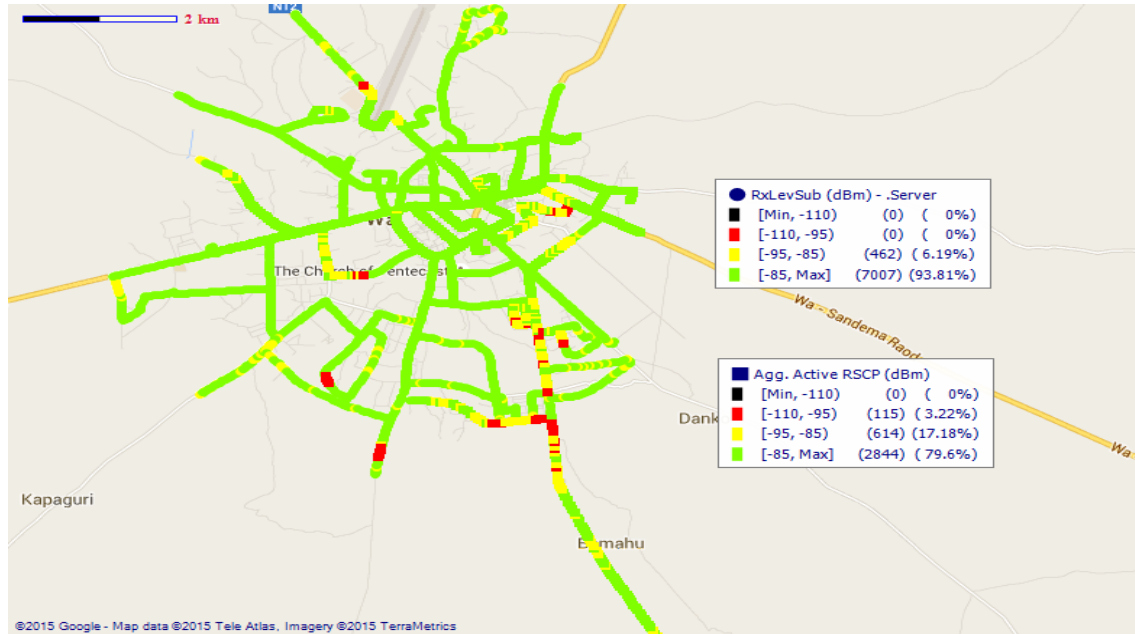
 Remarks: Good network coverage across Wa with few scattered spots of bad coverage around SSNIT Estates which require improvement.

Figure 17.Lawra Coverage Map
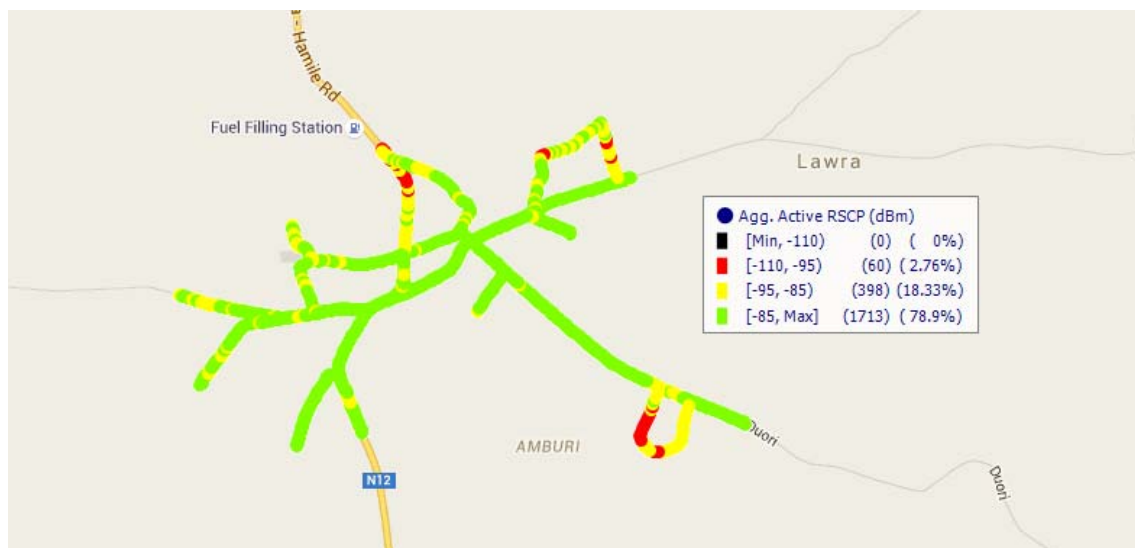
Remarks: Good 3G coverage across Lawra. However some improvement will be needed around Amburi

Figure 18.Tumu Coverage Map
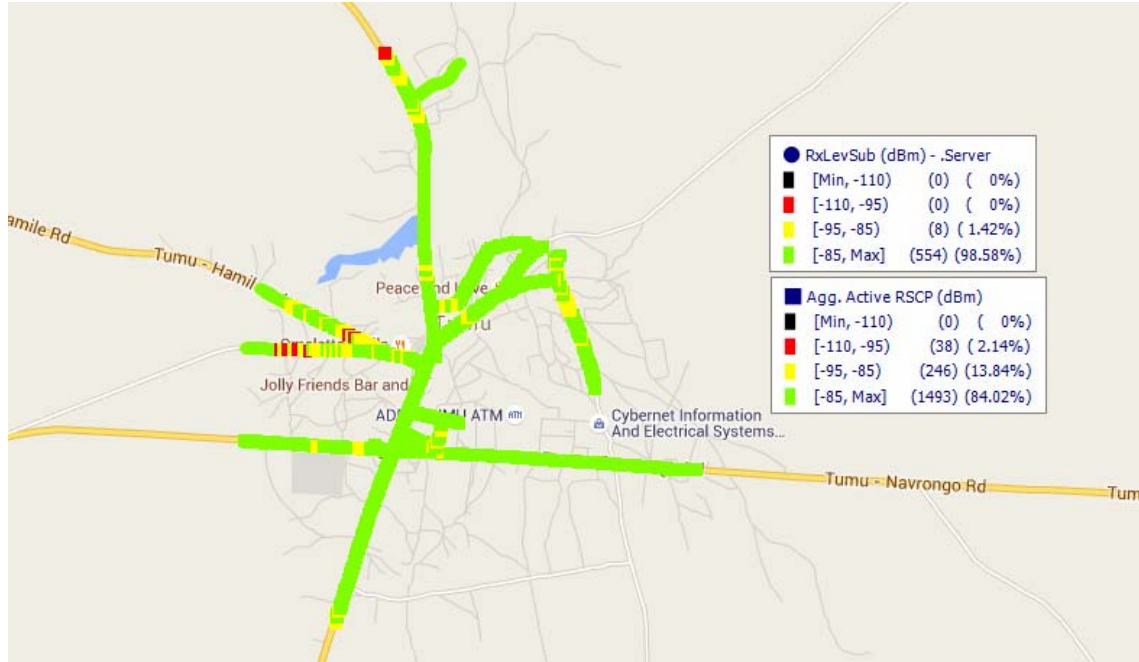
Remarks: Good network coverage in Tumu

Figure 19. Jirapa Coverage Map
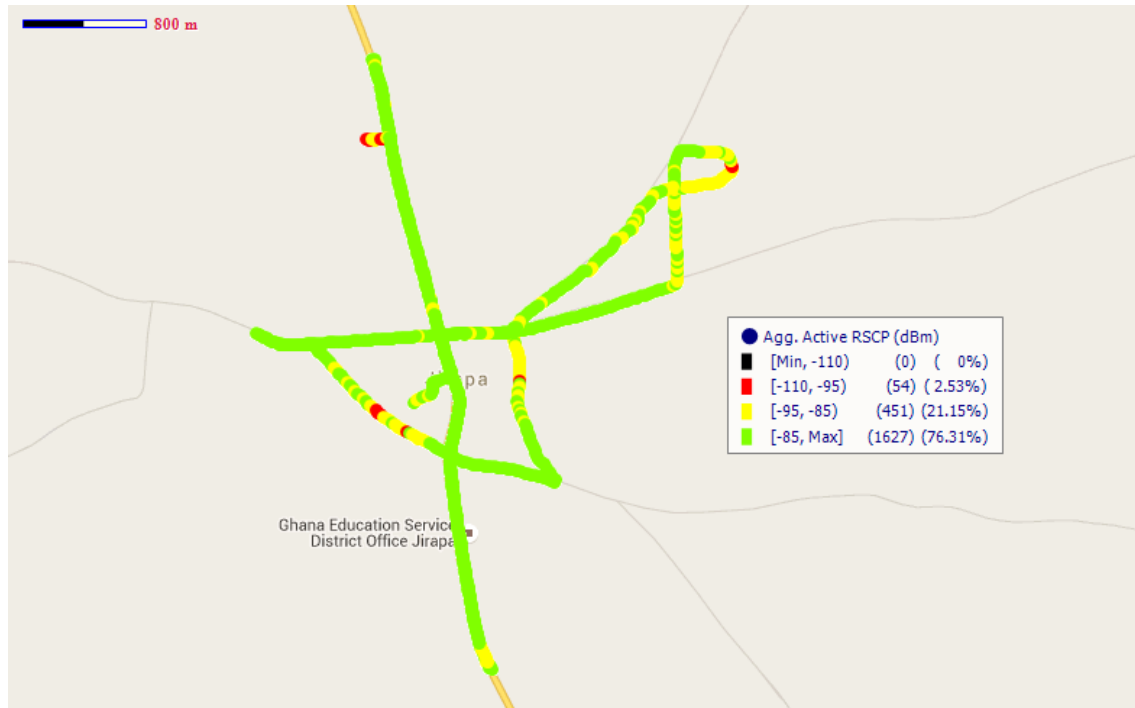
Remarks: Good network coverage across Jirapa.

Figure 20.Nandom Coverage Map
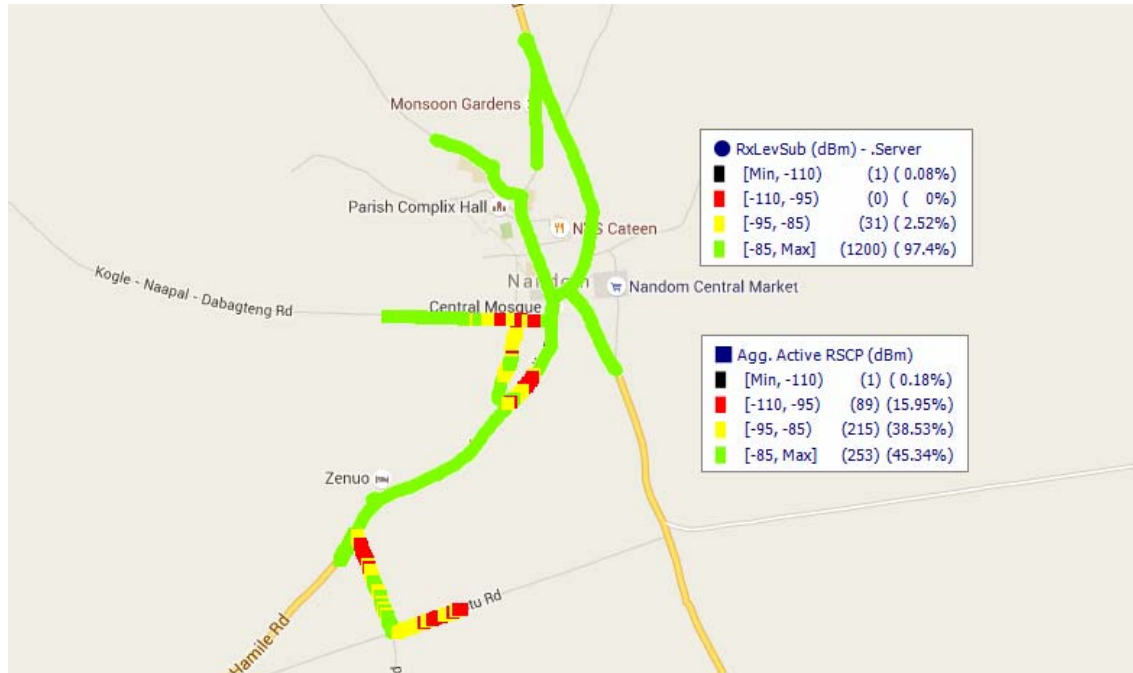
Remarks: Good 2G coverage across Nandom, however coverage around the Nandom Central Mosque and south of Zenuo need major improvements.

APPENDIX V

SPEECH QUALITY FOR OPERATORS

Figure 21 Airtel Speech Quality report in Upper West Region
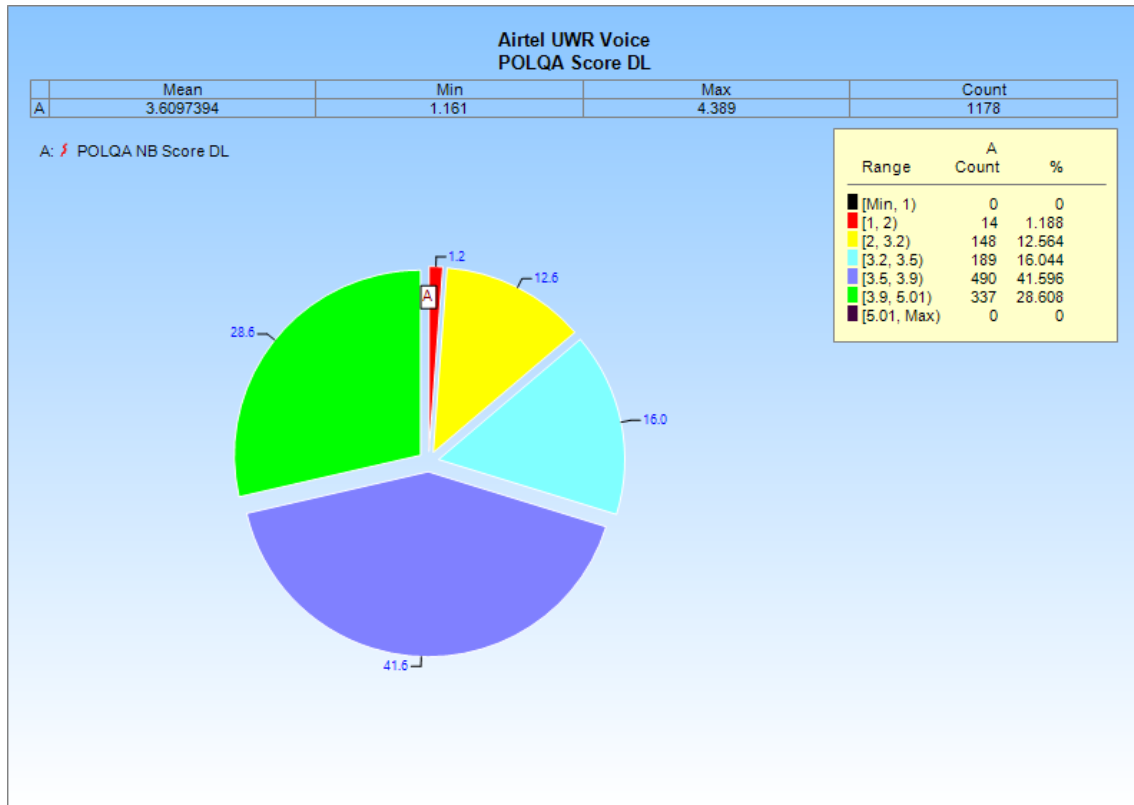
Figure 22 Vodafone Speech Quality report in Upper West Region
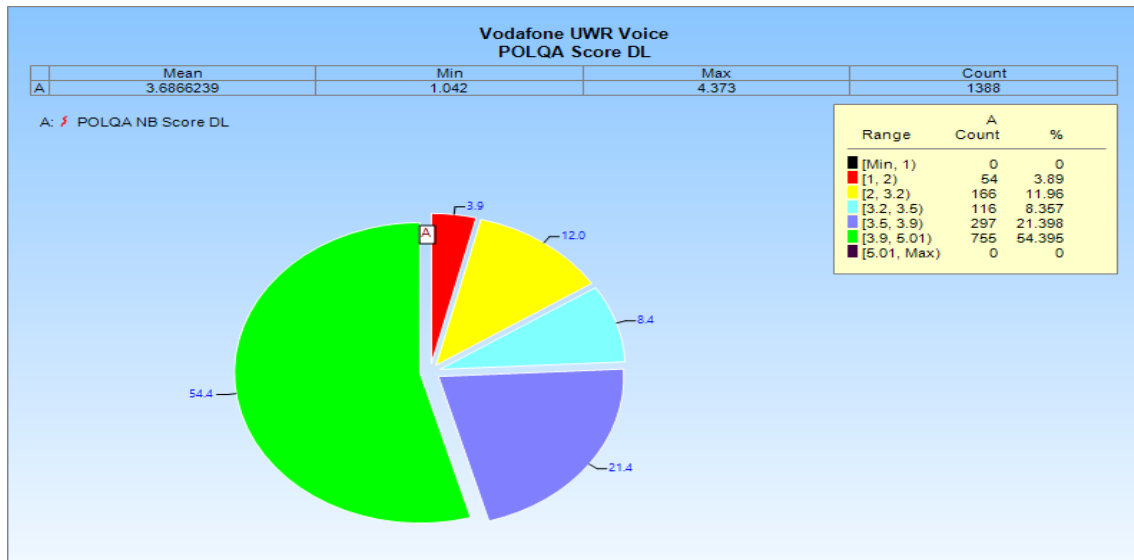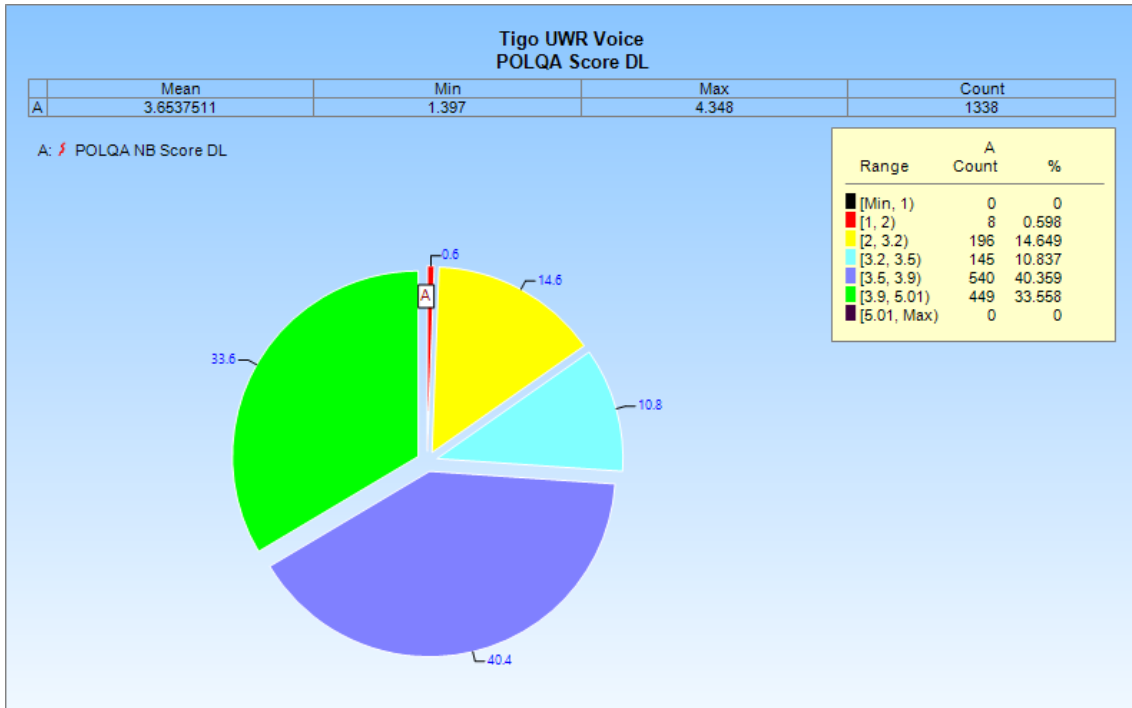
Figure 23 Tigo Speech Quality report in Upper West Region

Figure 24 MTN Speech Quality report in Central Region