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| NCA Tower, Airport City P.O Box CT1568 Cantonments-Accra | April 2021 |

NATIONAL COMMUNICATIONS AUTHORITY

**QUALITY OF DATA SERVICE REPORT- MTN**

**GREATER ACCRA REGION**



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# EXECUTIVE SUMMARY

From 18th March to 5th April 2021, the National Communications Authority (NCA) carried out an assessment of mobile data services provided by MTN in selected District Capitals in the Greater Accra Region by analysing technical parameters that translate into the perception of quality from the user’s standpoint.

The methodology that was used in this study relies on field tests performed from the user’s standpoint, by using NEMO INVEX II for data collection and NEMO WINDCATCHER for analysis and reporting. The automatic measurement system measures several parameters that reflect the quality of data services (end-to-end measurements). Measurements were carried out on equal terms regarding the four operators at the same time, the same locations and with the same parameters, thus making it possible to perform comparative analysis of the observed performances. Test was carried out every day for four (4) days in each of the selected District Capital.

The main quality indicators analysed, considering the user’s perspective and the service under study is as below:

**Data Throughput** - the speed at which information is accessed.

The technical and methodological options of this study directly influenced its results and must be taken into account when analysing the results, namely the following ones:

* Tests were exclusively based on a technical solution (equipment + software) and performed in a totally automatic way, thereby setting homogenous conditions for the monitoring of the four operators and eliminating the subjectivity inherent to the human operator of the system.
* It used *Samsung Galaxy Note 5 terminal* equipment.
* Tests were carried out in stationary vehicles.
* Data tests were made with the handset locked to 3G.
* The results of the study only reflect the behaviour of the networks on the locations and moments of the measurements.

# INTRODUCTION

This report evaluates the quality of data services as perceived by consumers and applications offered by service providers on the 3G network delivered to the selected District Capitals.

Measurement procedures relies on conditions that must be verified in order to correctly assess the quality of data and to guarantee the reliability of the tests. They also include standardization and the definition of testing and measurement parameters, thus making it possible to perform analyses and compare results.

# TEST/MEASUREMENT AND POST-PROCESSING SYSTEMS

The *NEMO INVEX II* system was used for measurements on the field and *NEMO WINDCATCHER* was used for the post-processing.

This system which is specifically designed for the analysis and benchmarking of cellular mobile communications systems is made up of the following modules:

1. Mobile User Equipment (NEMO INVEX II) equipped with 3G-capable ***Samsung Galaxy Note 5*** for GSM & WCDMA and external GPS
2. QoS analysis and reporting (NEMO WINDCATCHER) equipped with software licences for Table and mapping analysis and also for reporting in excel.
3. Test is conducted with the device locked to 3G.

# MEASUREMENT SEQUENCE

The measurement sequence of this test is controlled by a script. The sequence of activities starts with the configuration activities. This includes a network connect activity where the particular network’s details such as the APN and IP Address etc. are set and the setting of the Radio Access Technology ‘Locked’ to 3G. A five second wait period ends the configuration activities and allows the system to fully apply the selected settings.

The next set of activities referred to as the measurement sequence activities is where the actual testing takes place. Several FTP download tests will be conducted with the tests separated by five (5) seconds wait time. Each test ends with the network disconnect activity and is iterated continuously throughout the test duration. Details of the various tests are listed below:

Table 1. FTP Get Test Profile

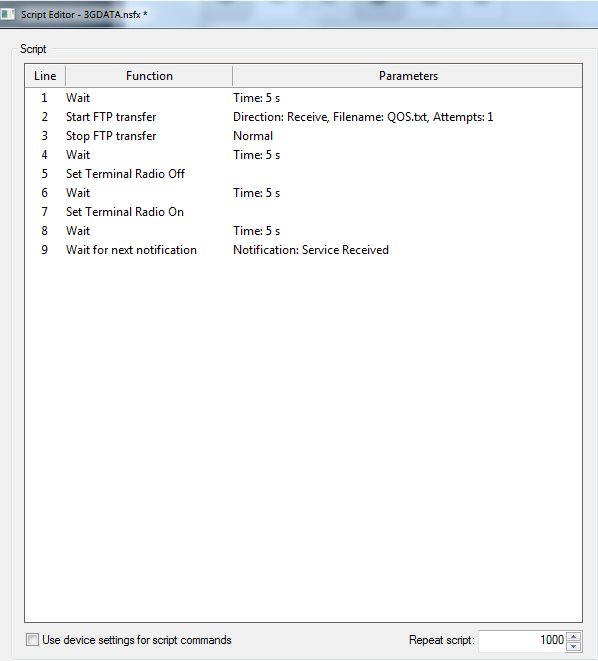
|  |  |
| --- | --- |
| **FTP TEST** | |
| Direction | Download |
| Server Address | ftp://52.178.136.189 |
| Username | qosftpsite@nca.org.gh |
| No Activity Timeout | 60 |
| Server Port | 21 |
| Local file | QoS.txt |
| Remote file | QoS.txt |
| End Session After Time | No |

Table 2. Network Connect Profile

|  |  |
| --- | --- |
| **NETWORK CONNECT TEST** | |
| APN | Internet |
| IP Address | Null |
| Username | Null |
| Succeed if already connected | True |

Below is a sample of the test script:

Figure 1. Sample Test Script for Data Test



# PARAMETERS, DEFINITIONS AND FORMULAE

This report is on the assessment of quality of cellular mobile data services provided by MTN in the Greater Accra Region. As per the 3G Cellular Mobile Licence obligations, the QoS indicators and their respective threshold for compliance under assessment considering the user’s perspective are;

Fig. 1a: Session Setup (UE side)

**MS RAN SGSN GGSN**

**A**. Activate PDP Context Request

**B.** Create PDP Context Request

**C**. Create PDP Context Response

**D**. Radio Access Bearer Setup

**E**. Activate PDP Context Accept

Fig. 1b: Session Setup (Network side)

**MS SGSN HLR GGSN**

1.PDP PDU PDU

2. Send Routing Info. For GPRS

3. Send Routing Info. For GPRS ACK

3b. Failure

4. PDU NGreater Accrafication Request

5. PDU NGreater Accrafication Response

5b. Failure

6. Request PDP Context Activation Activation

Fig. 2a: Session in Progress (UE Side)

**MS RAN SGSN GGSN**

1. Modify PDP Context Request

2 Update PDP Context Request

3. Update PDP Context Response

3b. Update PDP Context Reject

Modify PDP Context Reject

Deactivate PDP Context Reject

Modify PDP Context Accept

Fig. 2b: Session in Progress (Network Side)

**MS RAN SGSN GGSN**

1. Update PDP Context Request

2. Update PDP Context Response

3. Modify PDP Context Request

4. Modify PDP Context Accept

Fig. 3a: Session Termination (UE Side)

**MS RAN SGSN GGSN**

1. Deactivate PDP Context Request

2 Delete PDP Context Request

3. Delete PDP Context Response

4. Deactivate PDP Context Accept

5. Radio Access Bearer Release

Fig. 3b: Session Termination (Network Side)

**MS RAN SGSN GGSN**

1. Delete PDP Context Request

2. Delete PDP Context Response

3. Deactivate PDP Context Request

4. Deactivate PDP Context Accept

1. **Data Throughput**

Throughput is the rate of data transfer.

As per the 3G licence obligations, 90% of data connections should be ***256kbps or better***

Mathematically, using the NEMO Excel report:

Throughput [%]: = {Countif [array (Mean DL Throughput), 256] / Countif [array (Mean DL Throughput)]}

# FINDINGS AND ANALYSIS

## 6.1 TEST LOCATIONS AND TIMES

The Quality of Cellular Data Service monitoring was conducted in the Greater Accra Region from 18th March to 5th April 2021. The tests were carried out at locations chosen to give an accurate representation of network performance at economic, educational and residential hotspots during peak times. Test was carried out every day for four (4) days per location. Table 3 below indicates the locations and times of the testing.

Table 3. Details of Test Locations in Greater Accra Region

| DATE | TIME | LOCATION | DISTRICT CAPITAL |
| --- | --- | --- | --- |
| 18/03/2021 | 11:49 AM – 12:50 PM | Junction Mall | Nungua |
| 18/03/2021 | 02:11 PM – 03:12 PM | Nungua Lorry Station | Nungua |
| 18/03/2021 | 12:56 PM - 02:00 PM | Regional Maritime University | Nungua |
| 18/03/2021 | 06:56 PM – 07:58 PM | Darkuman Police Station | Darkuman |
| 18/03/2021 | 08:05 PM – 09:06 PM | Darkuman Trotro Station | Darkuman |
| 18/03/2021 | 09:12 PM – 10:25 PM | Darkuman Circle Station | Darkuman |
| 19/03/2021 | 10:59 AM – 12:01 PM | Darkuman Circle Station | Darkuman |
| 19/03/2021 | 11:05 AM – 12:05 PM | Junction Mall | Nungua |
| 19/03/2021 | 12:12 PM – 01:12 PM | Regional Maritime University | Nungua |
| 19/03/2021 | 12:17 PM – 01:19 PM | Darkuman Trotro Station | Darkuman |
| 19/03/2021 | 01:25 PM – 02:31 PM | Nungua Lorry Station | Nungua |
| 19/03/2021 | 01:26 PM – 02:29 PM | Darkuman Police Station | Darkuman |
| 20/03/2021 | 11:43 AM – 12:40 PM | Darkuman Circle Station | Darkuman |
| 20/03/2021 | 11:44 AM – 12:56 PM | Junction Mall | Nungua |
| 20/03/2021 | 12:43 PM – 01:45 PM | Darkuman Trotro Station | Darkuman |
| 20/03/2021 | 01:07 PM – 02:08 PM | Regional Maritime University | Nungua |
| 20/03/2021 | 01:53 PM – 02:57 PM | Darkuman Police Station | Darkuman |
| 20/03/2021 | 02:22 PM – 03:24 PM | Nungua Lorry Station | Nungua |
| 21/03/2021 | 10:36 AM – 11:36 AM | Darkuman Circle Station | Darkuman |
| 21/03/2021 | 11:40 AM – 12:42 PM | Darkuman Trotro Station | Darkuman |
| 21/03/2021 | 12:49 PM - 01:50 PM | Darkuman Police Station | Darkuman |
| 21/03/2021 | 12:55 PM – 01:57 PM | Junction Mall | Nungua |
| 21/03/2021 | 02:08 PM – 03:08 PM | Regional Maritime University | Nungua |
| 21/03/2021 | 03:20 PM – 04:21 PM | Nungua Lorry Station | Nungua |
| 22/03/2021 | 10:26 AM – 11:27 AM | TDC | Tema |
| 22/03/2021 | 11:33 AM – 12:34 PM | TMA | Tema |
| 22/03/2021 | 01:18 PM – 02:20 PM | GBC | Tema |
| 23/03/2021 | 12:10 PM – 01:11 PM | TDC | Tema |
| 23/03/2021 | 01:18 PM – 02:09 PM | TMA | Tema |
| 23/03/2021 | 02:11 PM – 02:28 PM | TMA | Tema |
| 23/03/2021 | 02:57 PM – 03:59 PM | GBC | Tema |
| 24/03/2021 | 09:49 AM – 10:56 AM | Adenta Municipal Assembly | Adenta |
| 24/03/2021 | 10:52 AM – 11:52 AM | TDC | Tema |
| 24/03/2021 | 11:01 AM – 12:02 PM | Adenta SSNIT Flats | Adenta |
| 24/03/2021 | 12:08 PM – 01:10 PM | Adenta Lorry Station | Adenta |
| 24/03/2021 | 12:20 PM – 01:16 PM | TMA | Tema |
| 24/03/2021 | 01:57 PM – 03:04 PM | GBC | Tema |
| 25/03/2021 | 09:35 AM – 10:37 AM | Adenta Municipal Assembly | Adenta |
| 25/03/2021 | 10:21 AM – 11:22 AM | TDC | Tema |
| 25/03/2021 | 10:40 AM – 11:43 AM | Adenta Lorry Station | Adenta |
| 25/03/2021 | 11:28 AM – 12:34 PM | TMA | Tema |
| 25/03/2021 | 11:47 AM – 12:50 AM | Adenta SSNIT Flats | Adenta |
| 25/03/2021 | 01:09 PM – 02:09 PM | GBC | Tema |
| 26/03/2021 | 07:30 AM – 08:34 AM | Ashaiman SHS | Ashaiman |
| 26/03/2021 | 08:42 AM – 09:53 AM | Ashaiman MA | Ashaiman |
| 26/03/2021 | 09:56 AM – 10 :59 AM | Adenta Municipal Assembly | Adenta |
| 26/03/2021 | 11:03 AM – 12:03 PM | Adenta Lorry Station | Adenta |
| 26/03/2021 | 12:08 PM – 01 :09 PM | Adenta SSNIT Flats | Adenta |
| 26/03/2021 | 01:35 PM – 02:36 PM | Ashaiman Lorry Station | Ashaiman |
| 26/03/2021 | 05:47 PM – 06:27 PM | Nima GCB | Nima |
| 26/03/2021 | 06:47 PM - 07:52 PM | Nima Police Station | Nima |
| 26/03/2021 | 07:56 PM - 08:57 PM | Nima Polyclinic | Nima |
| 27/03/2021 | 09:46 AM – 10:48 AM | Adenta Municipal Assembly | Adenta |
| 27/03/2021 | 10:05 AM – 11:54 AM | Adenta Lorry Station | Adenta |
| 27/03/2021 | 10:19 AM – 11:20 AM | Ashaiman Lorry Station | Ashaiman |
| 27/03/2021 | 11:29 AM - 12 :29 PM | Ashaiman MA | Ashaiman |
| 27/03/2021 | 11:57 AM – 01:03 PM | Adenta SSNIT Flats | Adenta |
| 27/03/2021 | 12:33 PM – 01:34 PM | Ashaiman SHS | Ashaiman |
| 27/03/2021 | 04:36 PM - 05:36 PM | Nima GBC | Nima |
| 27/03/2021 | 05:57 PM - 06:22 PM | Nima Polyclinic | Nima |
| 27/03/2021 | 07:09 PM - 08:09 PM | Nima Police Station | Nima |
| 28/03/2021 | 10:06 AM – 11:09 AM | Ashaiman MA | Ashaiman |
| 28/03/2021 | 11:23 AM – 12:24 PM | Ashaiman Lorry Station | Ashaiman |
| 28/03/2021 | 12:29 PM – 01:29 PM | Ashaiman SHS | Ashaiman |
| 28/03/2021 | 03:31 PM - 04:35 PM | Nima GBC | Nima |
| 28/03/2021 | 04:46 PM - 05:47 PM | Nima Polyclinic | Nima |
| 28/03/2021 | 05:49 PM - 06:49 PM | Nima Police Station | Nima |
| 29/03/2021 | 04:58 PM - 05:58 PM | Nima Polyclinic | Nima |
| 29/03/2021 | 06:17 PM - 07:17 PM | Nima GBC | Nima |
| 29/03/2021 | 07:27 PM - 08:28 PM | Nima Police Station | Nima |
| 29/03/2021 | 11:48 AM - 12:49 PM | Abokobi Lorry Station | Abokobi |
| 29/03/2021 | 11:52 AM – 12:09 PM | Ashaiman Lorry Station | Ashaiman |
| 29/03/2021 | 12:17 PM – 12:40 PM | Ashaiman Lorry Station | Ashaiman |
| 29/03/2021 | 12:41 PM – 12:54 PM | Ashaiman Lorry Station | Ashaiman |
| 29/03/2021 | 12:57 PM - 01:57 PM | Abokobi GEMA | Abokobi |
| 29/03/2021 | 01:04 PM – 02:04 PM | Ashaiman MA | Ashaiman |
| 29/03/2021 | 02:07 PM – 03:07 PM | Ashaiman SHS | Ashaiman |
| 29/03/2021 | 02:17 PM - 03:19 PM | Abokobi Hill View Guest Center | Abokobi |
| 30/03/2021 | 10:57 AM - 11:58 AM | Abokobi Hill View Guest Center | Abokobi |
| 30/03/2021 | 12:13 PM - 01:14 PM | Abokobi GEMA | Abokobi |
| 30/03/2021 | 01:32 PM - 02:21 PM | Abokobi Lorry Station | Abokobi |
| 30/03/2021 | 02:48 PM - 03:49 PM | Atomic Roundabout | Madina |
| 30/03/2021 | 04:28 PM - 05:29 PM | Post Office | Madina |
| 30/03/2021 | 05:43 PM - 06:44 PM | UPSA | Madina |
| 31/03/2021 | 10:00 AM - 11:03 AM | Abokobi Lorry Station | Abokobi |
| 31/03/2021 | 11:11 AM - 12:12 PM | Abokobi GEMA | Abokobi |
| 31/03/2021 | 12:28 PM - 01:28 PM | Abokobi Hill View Guest Center | Abokobi |
| 31/03/2021 | 01:58 PM - 02:59 PM | Atomic Roundabout | Madina |
| 31/03/2021 | 03:14 PM - 04:15 PM | Post Office | Madina |
| 31/03/2021 | 04:48 PM - 05:48 PM | UPSA | Madina |
| 01/04/2021 | 03:11 PM - 04:12 PM | Post Office | Madina |
| 01/04/2021 | 04:30 PM - 05:30 PM | Atomic Roundabout | Madina |
| 01/04/2021 | 05:49 PM - 06:50 PM | UPSA | Madina |
| 02/04/2021 | 06:17 PM - 07:18 PM | Post Office | Madina |
| 02/04/2021 | 07:36 PM - 08:37 PM | Atomic Roundabout | Madina |
| 02/04/2021 | 08:45 PM - 09:46 PM | UPSA | Madina |

## 6.2 SUMMARY RESULTS

### 6.2.0 KPIs

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

By analyzing the technical parameters that translate into the quality perception from the mobile phone user’s standpoint and benchmarking against compliance requirements as per the 3G licence, the summary of the results of the three QoS parameters under consideration are as in Table 4 below:

Table 4. MTN’s performance in selected Districts Capitals.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **District Capital** | **Average Data Throughput ≥ 256kbps (>90%)** | | | | **Compliance Status** |
| **Day 1** | **Day 2** | **Day 3** | **Day 4** |
| 1 | Abokobi | 98% | 99% | 100% | 97% | Pass |
| 2 | Adenta | 100% | 98% | 99% | 97% | Pass |
| 3 | Ashaiman | 100% | 98% | 100% | 96% | Pass |
| 4 | Darkuman | 92% | 100% | 100% | 100% | Pass |
| 5 | Madina | 100% | 98% | 91% | 94% | Pass |
| 6 | Nima | 99% | 100% | 99% | 100% | Pass |
| 7 | Nungua | 100% | 100% | 98% | 68% | Pass |
| 8 | Tema Community 1 | 100% | 100% | 100% | 94% | Pass |

### 6.2.1 GRAPHS

The graphical presentation of Data Throughput in the localities are as in the figures below:

Figure 2. Data Throughput Graph

**Remarks:** On the Fourth Day of tests in the selected district capitals, MTN met the Data Throughput Licence condition at a total of Twenty (20) out of Twenty-Four (24) locations tested.

# 7. CONCLUSION

* MTN met the Licence condition for Data Throughput in all the Eight (8) District Capitals tested.
* MTN needs to improve its Data Throughput at the following locations:

1. Ashaiman especially around the Ashaiman Lorry Station
2. In and around the UPSA Campus in Madina
3. Nungua especially around the Junction Mall
4. In and around the Tema Development Corporation (TDC).