COMMUNICATIONS AUTHORITY OF KENYA

NETWORK REDUNDANCY, RESILIENCE AND DIVERSITY (NRRD) COMPLIANCE RETURN FORM

PURSUANT TO THE PROVISIONS OF KICA 1998 AS AMENDED, THE KENYA INFORMATION AND COMMUNICATIONS REGULATIONS AND THE LICENSE CONDITIONS

Please note that the latest version of this form is the one on the Authority's website

1. GENERAL INFORMATION

1.1   Licensee Details

Name of Licensee _____

License No _____

Other Licenses held _____

1.2   Period under review (Tick against appropriate quarter)

FINANCIAL YEAR _____ (based on Government of Kenya Financial year)

Quarter 1 (1st Jul-30th Sep)	Quarter 2 (1st Oct -31stDec)	Quarter 3 (1st Jan -31st Mar)	Quarter 2 (1st Apr-30th Jun)
☐	☐	☐	☐

1.3   Contact details

Name of Head of Organization _____

Title of Head of Organization _____

Name of contact person _____

Title _____

Telephone _____

Email _____

Signature _____

1.4 Instructions

1. Please provide information in the space provided, you may insert additional rows and pages as required.
2. Please refer to Appendix A for calculations of the required metrics. Appendix B provides worked examples on how to calculate a metric. Please note that:

   (a) where the reporting network does not have specific element/link types, please mark the corresponding Availability metric as "not applicable;"

   (b) the network/link descriptions given are intended to be generic. If a particular network uses different naming conventions and/or network architectural components other than those specified, please report Availability for a given network element based on the appropriate functionally analogous category. Please annotate your answer if you believe additional information concerning the equipment/configuration reported on is required.

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REPORTING SECTION
[please complete the appropriate section/s in relation to your license category/ies]

(Information should be submitted within 15 days after the end of each Quarter)

2.0 NRRD Metrics for Mobile Network Operators (MNO)

2.1 Service Availability
  Target: **99.900% availability**

	Service Availability	Availability (%)

2.2 Network Element Availability -

a) **Availability of Critical Network Elements**
  Target: **99.999% availability**

	Network Element	Availability (%)
i).	Signal Transfer Point /IP Transfer Point (STP / ITP)	
ii).	Mobile Switching Centre (MSC)	
iii).	MSC-Servers	
iv).	Circuit Switched Media Gateway (CS MGW)	
v).	Serving GPRS Support Node (SGSN)	
vi).	Gateway GPRS Support Node (GGSN)	
vii).	Mobile Management Entity (MME)	
viii).	Serving Gateway (S-GW)	
ix).	Packet Data Network Gateway (PDN-GW)	
x).	Home Location Register –Authentication Centre (HLR-AuC)	
xi).	Home Subscriber Server (HSS)	
xii).	Core Network Power Supply	
xiii).	Gateway Mobile Services Switching Centre (GMSC)	
xiv).	GMSC-Server	
xv).	Policy and Charging Rules Function (PCRF)	
xvi).	Online Charging System (OCS)	
xvii).	Link between Core Network and first Aggregation Layer	

b) **Availability of Major Network Elements**
  Target: **99.990% availability**

	Network Element	Availability (%)
i).	Radio Network Controller (RNC)	
ii).	Link between first Aggregation Layer and the second Aggregation Layer.	

c) Availability of Minor Network Elements
Target: **99.9% availability**

	Network Element	Availability (%)
i).	Base Transceiver Station (BTS) or its functional equivalent (NodeB or eNodeB)	
ii).	Links to BTS' and functional equivalents	

2.3 Link Availability
Target: **99.990% availability**

	Links	Availability (%)
i).	Links between the MNO and other MNOs	
ii).	Links between the MNO and other Public switched telephone network (PSTN) Operators;	
iii).	Links between the MNO and Internet Service Providers (ISP)/Internet Exchange Point (IXP);	
iv).	Links between the MNO and International Gateway (IGW) Operators	
v).	Links between the MNO and Roaming Links.	

3.0 NRRD Metrics for Internet Service Providers (ISP)

3.1 Service Availability
Target: **99.900% availability**

	Service Availability	Availability (%)

3.2 Network Element Availability

a) Availability of Critical Network Elements
Target: **99.99% availability**

	Network Element	Availability (%)
i).	Provider (P)/Provider Edge (PE)/Aggregation/Access Routers	
ii).	Switches	
iii).	AAA	
iv).	DHCP servers	
v).	Link between Core Network and first Aggregation Layer	

b) Availability of Major Network Elements
Target: **99.9% availability**

	Network Element	Availability (%)
i).	World Wide Web (www) server	

	Network Element	Availability (%)
ii).	Policy server	
iii).	Links between Aggregation Point and Provider Edge (PE)	
iv).	Links within the P core network	
v).	Links between Provider (P) and Provider Edge (PE) routers	
vi).	Links between P/PE routers and Aggregation Layer	

c) Availability of Minor Network Elements
Target: **99.9% availability**

	Network Element	Availability (%)
i).	Access Node and its functional equivalents	
ii).	Links between Aggregation Layer and Access Nodes and their functional equivalent	

3.3 Link Availability
Target: **99.900% availability**

	Links	Availability (%)
i).	Links between ISP and ISP networks	
ii).	Links between the ISP network and the Internet Exchange Point (IXP)	
iii).	Links between the ISP network and the Fixed Network (FN)	

4.0 NRRD Metrics for Fixed Wireless Access Network

4.1 Service Availability
Target: **99.0% availability**

	Service Availability	Availability (%)

4.2 Network Element Availability

a) Availability of Critical Network Elements
Target: **99.99% availability**

	Network Element	Availability (%)
i).	Voice Gateways	
ii).	AAA Servers	
iii).	Link between Connectivity Service Network (CSN) and Access Service Network Gateway (ASN)	

b) Availability of Major Network Elements
Target: **99.900% availability**

	Network Element	Availability (%)
i).	Domain Name System (DNS) Servers	

ii).	Dynamic Host Configuration Protocol (DHCP) Servers	
iii).	Access Service Network *(*ASN)-Gateway	
iv).	Link between Access Service Network Gateway (ASN) and Access Network	

c) Availability of Minor Network Elements
Target: **99.0 % availability**

	Network Element	Availability (%)
i).	Radio Access Nodes	
ii).	Links between Access Network and Radio Access Nodes	

4.3 Link Availability
Target: **99.9% availability**

	Links	Availability (%)
i).	Links between the Fixed Wireless Network and Other Fixed Wireless Networks	
ii).	Links between the Fixed Wireless Network and other public switched telephone network (PSTN) Operators	
iii).	Links between the Fixed Wireless Network and Mobile Network Operators (MNO's)	
iv).	Links between the Fixed Wireless Network and Internet Service Provider (ISP)/Internet Exchange Point (IXP)	
v).	Links between the Fixed Wireless Network and International Gateway (IGW) Operators	
vi).	Links between Internet Service Provider (ISP) and Submarine Cable Networks (SCN) operators	

5.0 NRRD Metrics for Internet Gateway Network (IGW) Operators

5.1 Service Availability
Target:
i). Voice calls to specific, major traffic destinations (referring here to the top 10 jurisdictions for the reporting period) shall be reachable 99.990% of time and
ii). Voice calls to all other international destinations shall be reachable 99.9% of time.

	Service Availability	Availability (%)
i).	major traffic destinations	
ii).	other international destinations	

5.2 Network Element Availability-Availability of Critical Network Elements
Target: **99.9% availability**

	Network Element	Availability (%)
i).	Time Division Multiplexing (TDM) Switches (Exchange);	
ii).	Signal Transfer point (STP)-Internet Transfer point (ITP)	

	mated pairs	
iii).	Session Border Controller (SBC);	
iv).	Gateway power supply	
v).	Firewalls	
vi).	Session Initiation Protocol (SIP) servers	

5.3 Link Availability
Target: **99.999% availability**

	Links	Availability (%)
i).	Links between the International Gateway Network (IGW) and Interconnect points of Submarine Cable Network (SCN) Interconnect Points	
ii).	Links between the International Gateway Network (IGW) and international destinations through fibre leased circuits	
iii).	Links between the International Gateway Network (IGW) and International destinations through satellite	

6.0 NRRD Metrics for Submarine Cable Network (SCN) Operators

6.1 Service Availability
Target: **99.99% availability**

	Service Availability	Availability (%)

6.2 Network Element Availability

a) Availability of Critical Network Elements-Dry Section
Target: **99.999% availability**

	Network Element	Availability (%)
i).	Network Protection Equipment (NPE)	
ii).	Submarine Line Terminating Equipment (SLTE)	
iii).	Power Feed Equipment (PFE)	
iv).	SCLS Power Supply Unit (PSU)	
v).	Link to the Interconnect PoP	
vi).	Link between dry and wet section	

b) Availability of Critical Network Elements-Wet Section
Target: **99.999% availability**

	Network Element	Availability (%)
i).	Repeaters	
ii).	Branching Units	

6.3 Link Availability
Target: **99.999% availability**

	Links	Availability (%)
	Link between the interconnect point where all other service providers connect to the SCN	

7.0 NRRD Metrics for Internet Exchange Point (IXP) Operator

7.1 Service Availability
Target: **99.99% availability**

	Service Availability	Availability (%)

7.2 Network Element Availability
a) Availability of Critical Network Elements
Target: **99.999% availability**

	Network Element	Availability (%)
i).	High speed Switching Fabric	
ii).	Authentication, authorization, and accounting (AAA)	
iii).	Firewall	
iv).	IX Route server	
v).	Multiplexer/ De-multiplexer (MUX/DMUX);	
vi).	Dynamic Name Server (DNS)	
vii).	Exchange Power Supply	
viii).	Switching Fabrics	
ix).	Caching servers	
x).	Routers	

b) Availability of Major Network Elements
Target: **99.990% availability**

	Network Element	Availability (%)
i).	World Wide Web Server	
ii).	Network Time Protocol (NTP)	
iii).	Link between ISP/CSP/HSP and Switching Fabric	
iv).	Link between Aggregation Point and MUX/DMUX	

7.3 Link Availability
Target: **99.999% availability**

	Links	Availability (%)
	Link between Internet Exchange Point (IXP) and Submarine Cable Network (SCN) operators	

8.0 NRRD Metrics for Fixed Network Operator

8.1 Service Availability
Target: **99.9% availability**

	Service Availability	Availability (%)

8.2 Network Element Availability

a) Availability of Critical Network Elements
Target: **99.99% availability**

	Network Element	Availability (%)
i).	Local Exchange	
ii).	Tandem or Trunk Exchange	
iii).	Toll Exchange	
iv).	STP	
v).	Link between Toll Exchange and Local Exchange	
vi).	Link between Toll Exchange and Tandem Exchange	

b) Availability of Major Network Elements
Target: **99.9% availability**

	Network Element	Availability (%)
i).	Remote Concentrator	
ii).	Links between Local Exchange and Remote Concentrators	

c) Availability of Minor Network Elements
Target: **99.0% availability**

	Network Element	Availability (%)
i).	Cabinets	
ii).	Links between Remote Concentrators and Cabinets	

8.3 Link Availability
Target: **99.900% availability**

	Links	Availability (%)
i).	Links between Fixed Network Operator (FNO) and other FNOs	
ii).	Links between Fixed Network Operator (FNO)	
iii).	Links between Fixed Network Operator (FNO) and IGW	
iv).	Links between Fixed Network Operator (FNO) and SCN	

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9.0 INCIDENT REPORTING

This section should be completed only where a licensee has reported Service and/or Network Element/Link Availability below the Targets set by the Authority for the current reporting period. If this is the case, please complete the below tables, adding rows as necessary.

9.1 Service Unavailability Incidents for Reporting Period

Please complete the below table, adding lines as necessary if your Service Availability for the current reporting period is below the appropriate Target set by the Authority. Please list each separate Service unavailability incident in a separate row.

ID	Service Unavailability Incident Reporting					
	FROM Date/Time	**TO Date/Time**	**Service(s) Affected**	**Failure Description**	**Maximum Geographic Area Impacted**	**Estimated No. of customers impacted**
	00/00/2010/00:00	00/00/2010/00:00	e.g. voice, data, SMS etc.	Causation, equipment/ links affected, sequence of events, restoration efforts required etc.	Counties or Sub counties	Class of customers (e.g. consumer, enterprise, carrier – if so, identify) and numbers)
S.1.						
S.2.						
S.3.						
S.4.						
S.5.						

9.2. Network Element Unavailability Incidents for Reporting Period

Please complete the below table, adding lines as necessary for any category of Network Element and Link for which availability in the current reporting period is below the applicable Target(s) set by the Authority. Please list each separate unavailability incident in a separate row.

ID	Network Element Unavailability Incident Reporting					
	FROM Date/Time	**TO Date/Time**	**Network Elements(s) Affected**	**Failure Description**	**Maximum Geographic Area Impacted**	**Estimated No. of customers impacted**
	00/00/2010/00:00	00/00/2010/00:00	Network element/internal link description	Causation, equipment/ links affected, sequence of events, restoration efforts required etc.	Counties or Sub counties	Class of customers (e.g. consumer, enterprise, carrier – if so, identify) and numbers)
NE.1.						
NE.2.						
NE.3.						
NE.4.						
NE.5.						

9.2. Link Unavailability Incidents for Reporting Period

Please complete the below table, adding lines as necessary for any category of Network Element and Link for which availability in the current reporting period is below the applicable Target(s) set by the Authority. Please list each separate unavailability incident in a separate row.

ID	Network Element Unavailability Incident Reporting					
	FROM Date/Time	**TO Date/Time**	**Link(s) Affected**	**Failure Description**	**Maximum Geographic Area Impacted**	**Estimated No. of customers impacted**
	00/00/2010/00:00	00/00/2010/00:00	Link to other operator (specify)	Causation, equipment/ links affected, sequence of events, restoration efforts required etc.	Counties or Sub counties	Class of customers (e.g. consumer, enterprise, carrier – if so, identify) and numbers)
L.1.						
L.2.						
L.3.						
L.4.						
L.5.						

APPENDIX A: AVAILABILITY MEASURES	

Metric Name	Description and Objective
(a) Service Availability	This metric represents the availability measure in a prescribed monitoring period and its cumulative representation over consecutive monitoring periods. This metric is measured independently of the number of users impacted. **Calculation Method:** $$Service\ availability\ (Monitoring\ Period\ (M))\ \% = \left[1 - \frac{\sum_i^N service\ downtime(i)}{Monitoring\ Period\ (M)}\right] * 100$$ Where**:** M = The monitoring period. N = number of times the service is down. Note: 1) Downtime and Monitoring period in seconds 2) Monitoring period should exclude downtime due to planned maintenance 3) Monitoring period should exclude downtime due to natural causes, acts of terrorism, and malicious damage $$Cumulative\ Service\ availability\ (for\ K\ number\ of\ Monitoring\ Periods)\ (\%)$$ $$= \left[1 - \frac{\sum_1^K \sum_i^N service\ downtime(i)}{\sum_1^K Monitoring\ period\ (M)}\right] * 100$$ Where: K = the number of monitoring periods.
(b) Network Element Availability	This metric represents Network Element availability measured in a prescribed monitoring period and its cumulative representations over consecutive monitoring periods. Here, Network Elements refer to the elements in the core network, access and internal links (links between network elements entirely within an operator's network). **Calculation Method: Shall be calculated separately for each network element type** $$Network\ Element\ X\ availability\ (Monitoiring\ Period\ (M))\%$$ $$= \left[1 - \frac{\sum_i^N Network\ Element\ (X)downtime(i)}{Monitoring\ Period\ (M)}\right] * 100$$ Where**:**

N = number of times a network element type is down resulting in loss or impairment of its functionality as a result of the loss of that network element.

X = Represents a specific network element type. In a network, where there is a population of a network element type, the downtime of each element shall contribute to the overall downtime (e.g. failure of any transport links between core network and various elements up to the access nodes shall contribute to the overall downtime, where appropriate)

M = The monitoring period.

Note:

1) Downtime and Monitoring period in seconds

2) Monitoring period should exclude downtime due to planned maintenance

3) Monitoring period should exclude downtime due to natural causes, acts of terrorism, and malicious damage

4) If there are redundant elements/nodes deployed in active-standby mode, then availability should be considered for the combined system as one unit.

5) If the redundant nodes are deployed in load-sharing mode and dimensioning is applied in such a way that where there is failure of one node, all the traffic is automatically moved to the second available node, then availability should be considered for the combined system as one unit.

6) If the redundancy nodes require manual switchover and there is a potential loss of service during the switching period, then availability should be considered separately for these individual nodes.

$$\textbf{\textit{Cumulative Network Element X availability (for K number of Monitoring Periods)}} \text{ (\%)}$$
$$= \left[1 - \frac{\sum_1^K \sum_i^N \textbf{\textit{Network Element (X) downtime}}(i)}{\sum_1^K \textbf{\textit{Monitoring period (M)}}} \right] * 100$$

Where:

K = the number of monitoring periods.

(c) Link Availability	This metric represents Link availability measured in a prescribed monitoring period and its cumulative representations over consecutive monitoring periods. Here, Link refers to connectivity between one ICT network and another ICT network.
	Calculation Method: Shall be calculated separately for each external network it is connected to
	$$External\ Transport\ Link\ availability\ to\ Network\ Z\ (Monitoring\ Period\ M)\%$$ $$= \left[1 - \frac{\sum_i^N External\ Transport\ Link\ Availability\ to\ Network\ Z\ downtime(i)}{Monitoring\ Period}\right] * 100$$
	Where**:**
	N = number of times a link is down.
	M = The monitoring period.
	$$Cumulative\ External\ Transport\ Link\ availability\ to\ Network\ (Z)\ (for\ K\ number\ of\ Monitoring$$ $$= \left[1 - \frac{\sum_1^K \sum_i^N External\ Transport\ Link\ Availability\ to\ Network\ Z\ downtime(i)}{\sum_1^K Monitoring\ period\ (M)}\right] * 100$$
	Where:
	M = The monitoring period.
	K = the number of monitoring periods.
	Note:
	1) Downtime and Monitoring period in seconds.
	2) Monitoring period should exclude downtime due to planned maintenance.
	3) Monitoring period should exclude downtime due to natural causes, acts of terrorism, and malicious damage
	4) If there are redundant links deployed in active-standby mode, then availability should be considered for the combined link as one unit.
	5) If the redundant links are deployed in load-sharing mode and dimensioning is applied in such a way that where there is failure of one link, all the traffic is automatically moved to the second available link, then availability should be considered for the combined system as one unit.
	6) If the redundant links require manual switchover and there is a potential loss of service during the switching period, then availability should be considered separately for these individual links.

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APPENDIX B: EXAMPLES OF HOW TO CALCULATE THE METRICS

These calculation examples apply to service availability, network availability and link availability
Notes:
1. Monitoring periods will vary due to different days in a month over a calendar year.
2. Cumulative availability is an integration of the current and previous downtimes for each reporting period.
3. In the examples below, example 1 is the start of monitoring NRRD metrics.
4. Two calculations shall be carried out for each monitoring period: one specific to the monitoring period and one considering the previous monitoring availability (cumulative)

Examples
Monitoring period (MP) = 3 Months
MP =3*31*24*60*60 = 8035230 Seconds

Example 1: Two downtimes during the monitoring period -> MP1-DT1 and MP1-DT2
MP1-DT1 = 30 minutes = 1800 seconds
MP1-DT2 = 15 minutes = 900 seconds
MP1 Availability = {1- [(1800+900)/8035230)} * 100
MP1 Availability = 99.966%

Example 2: One downtime during the monitoring period -> MP2-DT1
MP2-DT1 = 60 minutes = 3600 seconds
MP2 Availability = {1- [(3600)/8035230)} * 100

MP2 Availability = 99.955%

Cumulative availability (over 2 the monitoring periods) -> Integrate over MP1 and MP2
Cumulative availability (6 months) = {1- [(1800+900+3600)/(8035230+8035230)} * 100

Cumulative availability (6 months) =99.960%

Example 3: No downtime during the monitoring period
MP3-DT = 0 seconds
MP3–Availability = {1- [(0)/8035230)} * 100

MP3-Availability = 100%

Cumulative availability (over the 3 monitoring periods) -> Integrate over MP1, MP2 and MP3
Cumulative availability (9 months) = {1- [(1800+900+3600+0)/(8035230+8035230+80335230)} * 100
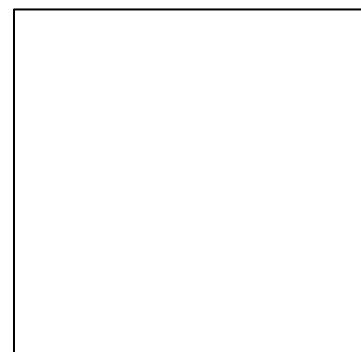
Cumulative availability (9 months) =99.974%

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10.0 COMMENTS/ SUGGESTIONS

Please share any challenges faced and/or make suggestions to improve the regulatory environment.

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Signed……………………………………………………………….
Name………………………………………………………………..
Title…………………………………………………………………
Date …………………………………………………………………

Company Stamp above

*(NB: Where nil returns are submitted, an explanation **MUST** be provided under the Comments/Suggestions section of this form)*

THANK YOU FOR COMPLETING THIS FORM

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FOR OFFICIAL USE ONLY – DO NOT FILL BELOW THIS LINE

These returns have been:

	Checked By:	**Verified by:**	**Approved/Rejected (Tick as appropriate)**
Name			
Title			
Signature			
Date			

ISSUANCE OF COMPLIANCE CERTIFICATE MAY BE WITHHELD IF A LICENSEE HAS NOT COMPLETED AND SUBMITTED THIS RETURNS FORM TO THE SATISFACTION OF THE AUTHORITY