

Question 1: Do you consider the measures in the proposed guidance relating to the resilience of the physical infrastructure domains to be appropriate and proportionate?

Three in the main agrees that the measures in the proposed guidance relating to the resilience of the physical infrastructure domains are appropriate and proportionate. However, we want to highlight the following where we suggest some variance or clarification.

In section 4.1, we would suggest to clarify that referenced document from EC-RRG is to be used as guidelines and not as technical specifications that CPs will be audited against.

In section 4.2.1, with reference to "Access network equipment or locations such as mobile base stations and street cabinets are often connected to a single 'parent' site without resilient connectivity. In cases where greater resilience is appropriate, communications providers should equip mobile base-stations or cabinets with resilient connectivity to an additional 'parent' site.". We would suggest that OFCOM clarifies the scenarios where greater resilience is to be considered appropriate. We would like to point out that having dual links from a mobile base stations to two parent sites is cost prohibitive.

In section 4.2.1, with reference to "On sites and equipment where a number of customers' last-mile connections are aggregated, resilience of the equipment and all key dependencies should be considered in the site and equipment design. Where possible, communications providers should seek to eliminate loss of key dependencies, including mains power and network timing/synchronisation, for a significant period of time bearing in mind that citizens depend on the access network for access to emergency services.", we would suggest to clarify the meaning of "where possible". With regards to emergency calls there is already resilience in the UK mobile networks through "limited service state" be it through the combined coverage footprint of MNOs and/or mobile device manufacturers (e.g. Apple) providing Emergency SOS capabilities via satellite.

In section 4.2.1, with reference to "In the case of mobile cell sites, in order to meet their duties, MNOs should take at least some measures to mitigate against the risks of power outages

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and support continued communications services during short term power outages and surges which might reasonably be expected to occur." We believe that it is reasonable to expect UK power networks (DNOs) to minimise short term power outages and surges. For longer term power outages, the focus ought to be with DNOs working effectively with other critical network infrastructure parties to quickly restore power and services after major power incidents.

In section 4.2.3, with reference to "fail over from one core site to another automatically". We would suggest to add "where technically feasible". Automatic fail-over may not always be possible as it depends on the ability of the peering node to detect failure. Manual intervention may be required in some cases.

In section 4.2.3, with reference to "This requires all network functions in core sites to be configured and scaled to cater for the loss of a core site including instantaneous load that may result." We would suggest to change "scaled" with "designed". Core elements may not always be scaled to cope with the instantaneous load generated in a fail-over scenario but they may implement overload control/throttling measures to "smooth out" the peak load and protect the network from cascading effect.

In section 4.2.3, the referenced section 4.5.1.3 does not exist in the document.

Question

Your response

Question 2: Do you consider the measures in the proposed guidance relating to the resilience at the Control Plane to be appropriate and proportionate?

Three broadly agrees with the proposed guidance. However, we would suggest some clarifications. In section 4.3.1, with reference to "eliminate any service impacts if one or more of the instances of these special control plane functions was to fail". We would suggest to remove "or more" as it is not proportionate or possible in some cases to design networks for multiple failures. Mobile networks are not typically designed to ensure there is no service impact in multiple failure scenarios.

Throughout section 4.3, there are several references to "support fully automatic switchover". We would suggest to qualify this statement with "where technically feasible" as automatic fail-over may not always be possible as it depends on the ability of the peering node to detect failure (e.g. unexpected errors may not always trigger automatic failover). Manual intervention may be required in some cases.

In section 4.3.1, with reference to "Ensuring all aspects of the instances and their feature set are hardened to be robust against a broad range of abnormal messages and unexpected conditions". We would suggest to remove this statement. Communications providers are reliant on suppliers to provide equipment that is robust against abnormal messages and unexpected conditions. It is not possible for operators to simulate these events in a test bed and operators typically do not have access to the code of the products they use to verify its robustness.

In section 4.3.1, we would suggest to clarify that the referenced GSMA and NICC documents are to be used as guidelines and not as technical specifications that CPs will be audited against.

Question 3: Do you consider the measures in the proposed guidance relating to the resilience of the Management Plane to be appropriate and proportionate?

Three broadly agrees with the proposed guidance.

Question

Your response

Question 4: Do you consider the measures in the proposed guidance relating to communications providers' own managed services to be appropriate and proportionate?

Three broadly agrees with the proposed guidance. However, we suggest some clarifications. In section 4.5.3, with reference to "the failover mechanisms of the platforms, solutions, and designs should be tested in a representative test environment and optimised under load". We would suggest to clarify that "optimised under load" applies to the production environment as in general test environments do not have the capability to generate significant load.

In section 4.5.3, with reference to "users may be aware of an impact to service for up to a second or two, but do not need to take any action". We would suggest to change this to 1-2 minutes as, depending on the protocol, it may take more than 1-2 seconds to detect failure and execute switch-over, e.g. due to heartbeat timer settings.

Question 5: Do you consider the measures in the proposed guidance relating to communications providers' arrangements for preparing for adequate process, skills and training to be appropriate and proportionate?

Three broadly agrees with the proposed guidance. However, we suggest some clarifications. In section 5.1.1.2, with reference to "capacity planning and failover mechanisms should allow for the loss of a core site or peering/interconnect site during the busy hour without resulting in network congestion or overload". We would suggest to remove "without resulting in network congestion or overload ", as typically the loss of a core site would trigger mass re-registration of devices, which may lead to overload in the remaining core sites. Networks are typically designed to "smooth out" the peak load with overload protection / throttling mechanisms to allow full service to resume rapidly.

In section 5.1.1.5, with reference to "Selection of supplier hardware, software, or solutions should include assessment based on a suite of testing of reliability and resilience". We would suggest to clarify that such assessment can be based on evidence of testing provided by the Supplier. It is generally not practically possible for CPs to perform equipment testing in the supplier selection phase.

In section 5.2.1.3, with reference to "A broad suite of testing should be performed including: functional testing, component resilience testing under load". We would suggest to remove "under load". Test beds typically do not have the ability to generate significant load for every service being tested. CPs would be reliant on assessment of evidence provided by suppliers of load testing in their test environments.

Throughout section 5.3, we would suggest to qualify "monitoring" as the process of collecting/processing alarms (Fault Monitoring) and counters (Performance Monitoring) as in the FCAPS framework.

In section 5.3.1.1, with reference to "MNOs are expected to log, monitor, and correlate signalling between the radio access network and mobile core network (S1-C for example) in addition to all Diameter, 5G SBA (HTTP2), SIGTRAN/SS7, GTP-C, and SIP signalling messages and associated errors". We would suggest to add "where technically feasible and economically viable", as collecting and analysing all control plane signal-

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Your response

ling may not always be possible (e.g. due to encrypted interfaces) or may result in prohibitive cost due to the vast amount of data to be collected, processed and stored.

Call for Input

Question

Your response

CFI question 1: Does this framework accurately capture the factors relevant to assessing what is an appropriate and proportionate measure for MNOs to take with regards to power resilience for RAN cell sites?

Three broadly agrees that the framework captures the key factors relevant to assessing what is an appropriate and proportionate measure with regards to power resilience for RAN Cell Sites.

However, consideration for potential costs of improving current levels of power resilience should include the cost of:

- 1) a battery refresh programme. The batteries have a limited life cycle¹ and will degrade over time.
- 2) replacing stolen batteries and any associated equipment damage
- 3) any related security measures to protect the energy asset.

¹ Battery life cycle could range from 10 to 15 years.

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CFI question 2: Do you agree that at a minimum MNO's networks should be able to operationally withstand short term power-related incidents?

Your response

At the RAN Cell Site level, MNOs should not be required to utilise battery backup solutions to mitigate against short term power-related incidents because (i) Distribution Network Operators (DNOs) are already providing high levels of availability², (ii) the cost to deliver and maintain battery backup at RAN Cell Sites is prohibitive, (iii) short-term power outages are de-minimis in comparison to the overall network availability and any other outages due to planned activity. We note the confidential data previously provided to Ofcom as part of the S135 on power related outages.

In areas of high customer density, where the impact of short term power loss is most felt, there is overlapping coverage from adjacent sites³. Thus a loss of power at one cell site does not necessarily imply a total loss of service.

In order to ensure continuity of service, MNOs should consider appropriate resilience at:

- (i) the Aggregation domain
 - a. for critical "Hub Sites" – effectively providing continuity of service for child sites as well as
 - b. at pre-Aggregation nodes (Exchanges)
- (ii) the Core Edge Data Centres – effectively providing un-interrupted Power Supply (UPS) to mitigate the nature and scale of harm to the end user resulting from power outages at locations where these domain elements are hosted.

² Mobile UK, in response to Huw Saunders on "mobile network resilience" (letter date 2nd August 2023) stated that the best performing DNOs experience an average of around 13 'customer minutes lost' per annum and the worst performing 56 customer minutes lost per annum. The DNOs in conjunction with OFGEM have a 5-year network improvement plan in place, funded through regulated prices. This investment package is to facilitate DNOs in delivering "cheaper, cleaner, more reliable local grids", thus improving their KPIs further, making power networks even more reliable.

³ Cross Sector Forum for Resilient Communications | 21st June 2023

Question

Your response

CFI question 3: What mobile services should consumers be able to expect during a power outage, what consumer harms should power backup up focus on mitigating and does this vary depending on the type or duration of the outage?

Firstly, DNOs have an obligation to minimise power outages and improvement plans already in place in conjunction with Ofgem to provide even better resilience. Any intervention over and above this needs a funding discussion.

Emergency calls/text should be the consumer harm to protect.

With regards to this consumer harm there is resilience in the UK mobile network through "limited service status" be it through the combined coverage footprint of MNOs and/or mobile device manufacturers (e.g. Apple) providing Emergency SOS capabilities via satellite.

This combined MNO coverage footprint will be further enhanced with the conclusion of the Shared Rural Network deployment.

CFI question 4: What technical choices are available to MNOs to reduce power consumption, and should be considered as part of assessment of appropriate and proportionate measures?

Reducing power consumption in order to extend battery life (if any battery is deployed in the first place) will invariably have an impact on customer experience especially in busy sites in areas of high population density. Clarification will be required on what service levels are deemed appropriate?

Technical choices may include:

(i) Equipment vendor energy saving features (intelligent switch off of radio resources when not utilised)

(ii) Decommissioning of legacy technologies

(iii) Automation (Centralised - Self Optimising Network) to manage and optimise the Radio Access Network (RAN) performance in a challenging multivendor radio environment

Question

Your response

CFI question 5: How many sites would it be feasible to upgrade and maintain and why?

It is not possible to answer this question without Ofcom specifying the service levels to be met.

This will require a more detailed assessment as there are many factors to consider including technical and commercial. These include:

- (i) services to back up and resulting batteries required,
- (ii) feasibility of upgrading sites with additional cabinets for housing the batteries and ancillary equipment
- (iii) for these impacted sites, commercials for any associated additional demise will need to be agreed.

CFI question 6: Do you consider that providing a minimum of 1 hr backup to all RAN cell sites would be proportionate to meet the security duties under s.105A to D of the Communications Act 2003?

No, providing 1hr battery backup to all RAN cell sites is not proportionate to the scale of any one individual outage and is ultimately cost prohibitive.

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Question

Your response

CFI question 7: What cost effective solutions do you consider could meet consumers' needs during a power outage?

Ofcom noted, a cost effective solution may include a coordinated optimisation of power resilient UK emergency call and SMS coverage could be introduced, which would require battery backup across different MNO RANs⁴. While this appears logical, it is fraught with risks and further unclear costs – including competition compliance and capacity management that will need to be addressed.

Other solutions could include:

- (i) Mobile device manufacturers (e.g. Apple) providing Emergency SOS capabilities via satellite.
- (ii) HMG establishing relationships with operators providing satellite-direct-to-standard-phone system services – these service players are starting to develop and provide effective back up to mobile networks by roaming solution should consumers be willing to pay the roaming rates.

CFI question 8:

a) Is it more cost efficient to increase power backup up to any space, weight, or planning limitations, i.e., increasing power backup as much as is feasible provides the lowest £ per hour?

b) do the benefits of any power backup solution have diminishing returns, i.e., the benefit per hour decreases as you increase the amount of power backup?

This question starts from the premise that power back is cost efficient in the first place. As has already been mentioned, providing battery backup to all RAN cell sites is not proportionate to the scale of any one individual outage and is ultimately cost prohibitive.

⁴ Section 5.57, Resilience guidance consultation and Call for Input on mobile RAN power back up – 8 December 2023

Question

Your response

CFI question 9: Does the mobile market fail to capture the value or importance of power backup, and if so, why?

Power backup is not part of a consumer's criteria when selecting a network and they have not signalled their willingness to pay more in order to have power backup. Hence it is not an important factor in the mobile market.

CFI question 10: Should improvements in power backup be focused on solutions at sites which are identified as higher risk of outages?

In areas identified as higher risk of outages, focus should be on the DNO to improve their service and reduce the risk of outages.

CFI question 11: Why would any requirement lower than a minimum of 1 hour be sufficient in future? What duration do you consider would be sufficient and why?

Providing battery backup to all RAN cell sites is not proportionate to the scale of any one individual outage and is ultimately cost prohibitive. To answer this question constructively, further insights on consumer willingness to pay and/or a viable funding structure is integral.

CFI question 12: Over what time period could industry make upgrades to provide a minimum of 1 hour at every cell site or other cost-effective solutions to address potential consumer harm?

The answer to this questions is difficult to quantify. We do not consider providing 1 hour of power at every cell site to be cost effective in any circumstance as noted in a number of questions above e.g. 8, 11. In addition to being cost prohibitive there are many factors to consider here including battery availability, technical feasibility, physical constraints, and commercial negotiations with Site Providers. We would have to conduct a site by site survey to assess whether this was even possible. We would expect over multiple years.

Please complete this form in full and return to resilience.team@ofcom.org.uk.