

# JOINT OPERATORS TECHNICAL SPECIFICATION OF THE NEUTRAL HOST IN-BUILDING SMALL CELL SOLUTION

## ANNEX 5 FULFILMENT

### SCOPE

This Annex defines the Fulfilment specification for the JOTS Neutral Host In-Building (NHIB) solution, capable of supporting cellular services for multiple Mobile Network Operators.

### PURPOSE

This specification will be used by *Operators*, *Neutral Hosts* and *Retailers* to implement instances of the Neutral Host In-Building solution. To assist in that task the overall specification is divided into a set of annexes, each covering a key aspect of the implementation:

- Annex 1 – Architecture
- Annex 2 – Radio Requirements
- Annex 3 – Testing and Acceptance
- Annex 4 – Operational Processes
- Annex 5 – Fulfilment (**This document**)

Each annex is separately version controlled. Collectively the latest versions of all the annexes define the JOTS Neutral Host In-Building specification.



JOTS   
**(NEUTRAL HOST IN-BUILDING)**

**ANNEX 5  
FULFILMENT**

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## PARAGRAPH MARKINGS

Throughout this specification, the following paragraph markings are used:

- M** A mandatory and critical requirement that must be met by the solution. Details shall be provided stating how mandatory requirements have been met within any proposed solution.
- R** A requirement of the specification. These are to be considered mandatory to the extent that non-compliance will require the *Neutral Host* to provide to the *Operator* (or visa-versa) specific justification as to why they are not compliant to the requirement.
- I** Informative statement, providing either points of clarification or a statement relating to implementation good practice.

## GLOSSARY AND ABBREVIATIONS

AMF	Access and Mobility Management Function (5G)
<b>b</b> -interface	Interface between the <b>Neutral Host Domain</b> and the <b>Operator Domain</b>
BTS	Base Station (e.g. picocell, eRAN cell, femtocell)
CM	Configuration Management
Controller	Aggregation unit (services node) for controlling and aggregating multiple BTS
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Server
<b>f</b> -interface	Interface between the <b>Retailer Domain</b> and the <b>Neutral Host Domain</b>
FM	Fault Management
HOT	Heads of Terms (outline of legal agreement)
ICNIRP	International Commission on Non-Ionizing Radiation Protection
HeNB GW	Home eNode Gateway
JOTS	Joint Operator Technical Specification (technical forum attended by UK MNOs)
LAN	Local Area Network
LOI	Location of Interest
LTE	Long Term Evolution (4G radio interface)
MME	Mobility Management Entity (4G)
MTPAS	Mobile Telecommunications Privileged Access Scheme
NG	5G interface between gNodeB and AMF/UPF
NHIB	Neutral Host In-Building
NHP	Neutral Host Provider (installer of radio kit at the venue)
NMC	Network Management Centre
NR	New Radio (5G radio interface)
NTE	Network Termination Equipment (backhaul provider)
PM	Performance Management
S1	4G interface between eNodeB and MME/SGW
SAT	System Acceptance Test
SecGW	Security Gateway (terminates IPSec tunnel end points)
SGW	Serving Gateway (4G)
Tier 1b SecGW	<b>b</b> -interface security gateway (within <b>Neutral Host Domain</b> )
Tier 1f SecGW	<b>f</b> -interface security gateway (within <b>Neutral Host Domain</b> )
Tier 2 SecGW	<b>b</b> -interface security gateway (within <b>Operator Domain</b> )
TSCoP	Draft Telecommunications Security Code of Practice
UPF	User Plane Function (5G)

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## 1 INTRODUCTION

The JOTS Neutral Host In-Building (NHIB) specification sets out the central principles of the NHIB concept.

The JOTS NHIB architecture is split into the **Retailer Domain**, **Neutral Host Domain** and **Operator Domain**. Fulfilment responsibilities within each domain are defined in this Annex.

The aim of this Annex is to set out high level principles and processes that the *Retailer*, *Neutral Host* and *Operator* should follow when adding radio nodes that make up a Neutral Host In-Building solution.

The JOTS NHIB specification is expected to be an evolving specification which will be updated as and when required (by the JOTS forum) to maintain alignment and relevance with new technologies and developing vendor capabilities.

## 2 DOMAINS

1. I The Neutral Host In-Building (NHIB) deployment is separated into three domains: the **Retailer Domain**<sup>1</sup>, the **Neutral Host Domain** and the **Operator Domain**, with the key areas of responsibility as shown in *Figure 2-1*:

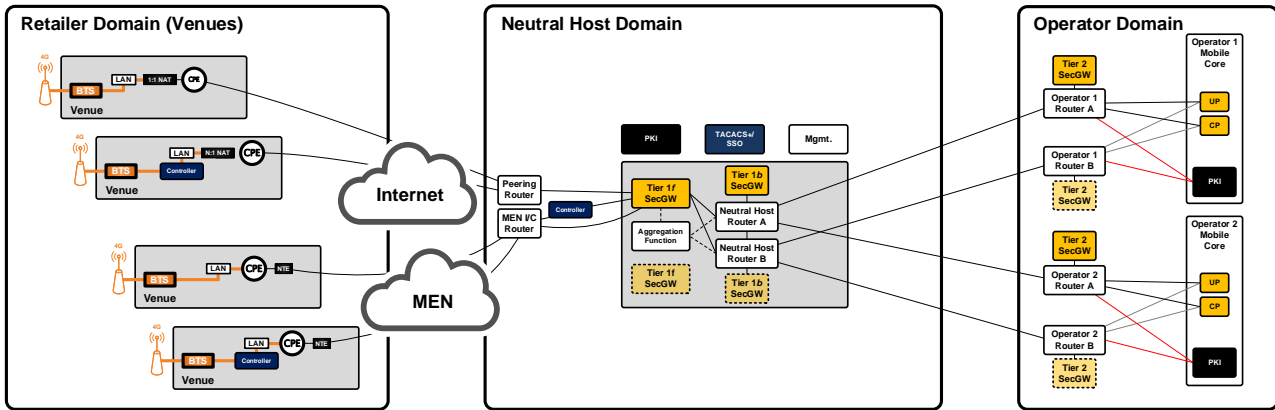


Figure 2-1 - Domain Overview

2. I The following high-level statements can be made to describe the fulfilment responsibilities of the *Retailer* within the **Retailer Domain**:
- The *Retailer* is responsible for planning, acquiring, deploying and commissioning BTS equipment within the **Retailer Domain** (i.e. venues);
  - The *Retailer* is responsible for acquiring and commissioning *f*-interface connectivity from the venue to the *Neutral Host* in their datacentre environment;
  - The *Retailer* is responsible for the site equipment (including associated customer site related security measures);
  - The *Retailer* has responsibility for testing the BTS equipment at the venues;
  - The *Retailer* is responsible for the relationship with the end customer (i.e. venues).
3. I The following high-level statements can be made to describe the fulfilment responsibilities of the *Neutral Host* within the **Neutral Host Domain**:
- The *Neutral Host* is responsible for planning, acquiring, deploying and commissioning sufficient equipment and resources to be able to operate a ‘live’ (customer supporting) platform at their datacentre;
  - The *Neutral Host* is responsible for acquiring and commissioning *b*-interface connectivity, including in-band and out-of-band management connectivity, to the point-of-interconnect which provides onward connectivity to the core networks of each hosted *Operator*;
  - The *Neutral Host* has responsibility for carrying out end-to-end testing of the NHIB platform and associated Controllers, BTS equipment and their associated management platforms;

<sup>1</sup> For the avoidance of doubt, a *Retailer* within the **Retailer Domain**, in this context, is not a ‘shop’, but an entity whose commercial model is built around providing in-building coverage solutions to venues.



- The *Neutral Host* is responsible for compiling a test exit report which shall, if necessary, highlight to the *Operator* any issues or concerns relating to the system's performance or functioning;
- That appropriate ISO27001 and TSCoP<sup>2</sup> governance measures are followed and shown to not compromise those requirements within the overall deployment of each *Operator*;
- The *Neutral Host* is responsible for maintaining documentation relating to any *Operator* specific test and acceptance requirements in respect of design decisions or architectural principles which must be adhered to.

4.1 The following high-level statements can be made to describe the fulfilment responsibilities of the *Operator* within the **Operator Domain**:

- The *Operator* is responsible for accepting connections from NHIB live platforms and routing those connections to their relevant live core components.

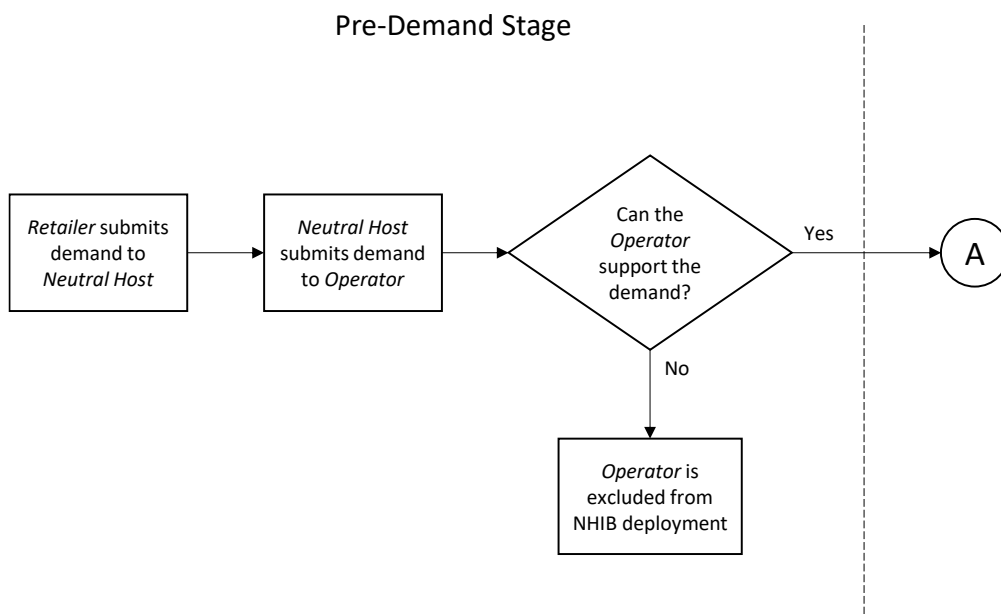
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<sup>2</sup> Draft Telecommunications Security Code of Practice and Telecommunications (Security) Act 2021 ([legislation.gov.uk](https://legislation.gov.uk)).

### 3 FULFILMENT PROCESS

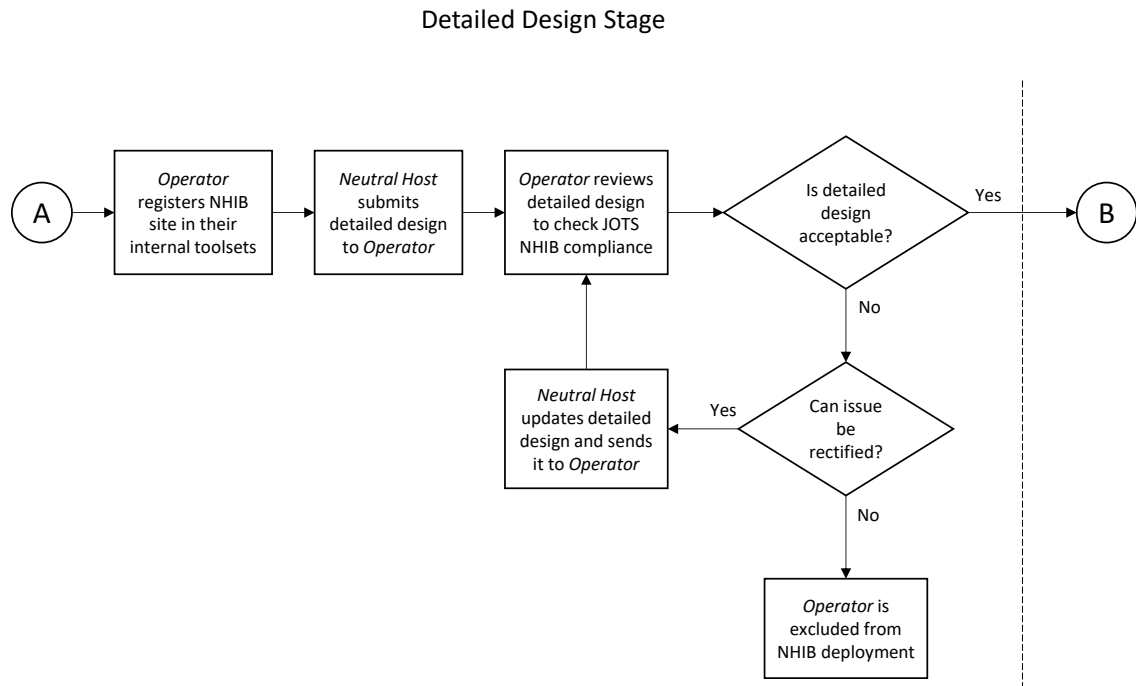
#### 3.1 Adding NHIB Sites

- 5. I A high-level overview of the NHIB fulfilment process is illustrated in *Figure 3-1, Figure 3-2, Figure 3-3, Figure 3-4 and Figure 3-5*. The fulfilment process is divided into five stages: **Pre-Demand, Detailed Design, Declaration/Nomination, Build Complete and Quality Assurance** and **Handover/Ready For Service**. The high-level overview is provided as guidance and for information only. It is not mandated but recommended. Adherence to the principles of this fulfilment process is expected to simplify the rollout of NHIB sites through commonality of approach across the **Retailer Domain, Neutral Host Domain** and **Operator Domain**.
  
- 6. R The **Pre-Demand** stage exists to check that the proposed NHIB site is, in principle, acceptable to the *Operator*. In most cases the NHIB site would be supported by the *Operator*, but occasionally it might not. Reasons for not supporting the site could include, for example, that the *Operator* already has a site at that location, or a new site might be planned nearby, or engineering work or network outages are ongoing, or perhaps the *Operator's* deployment teams decide that the proposed location is not appropriate for an in-building solution.



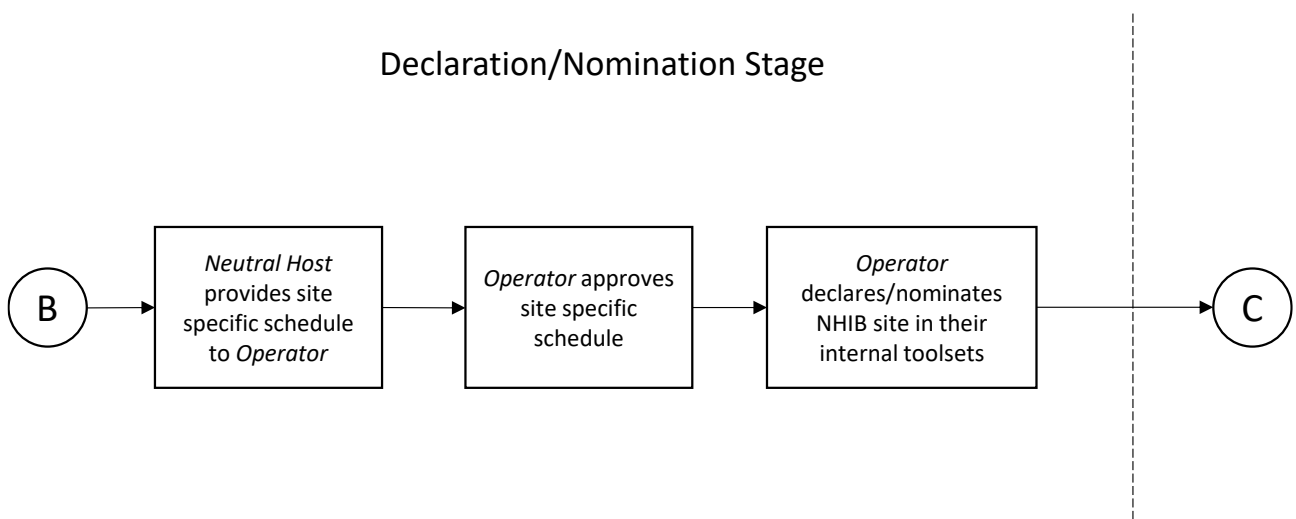
**Figure 3-1. Fulfilment process - Pre-Demand stage.**

7. R The **Detailed Design** stage is the point at which the *Neutral Host* designs the radio solution at the venue. The output of this stage is a detailed design which is shared with and reviewed by the *Operator’s* deployment teams. If there are identified issues with the design, or simply that there is insufficient detail in the design, this can be rectified at this stage. Unresolvable issues between the *Neutral Host* and *Operator* would result in the *Operator* being excluded from the deployment.



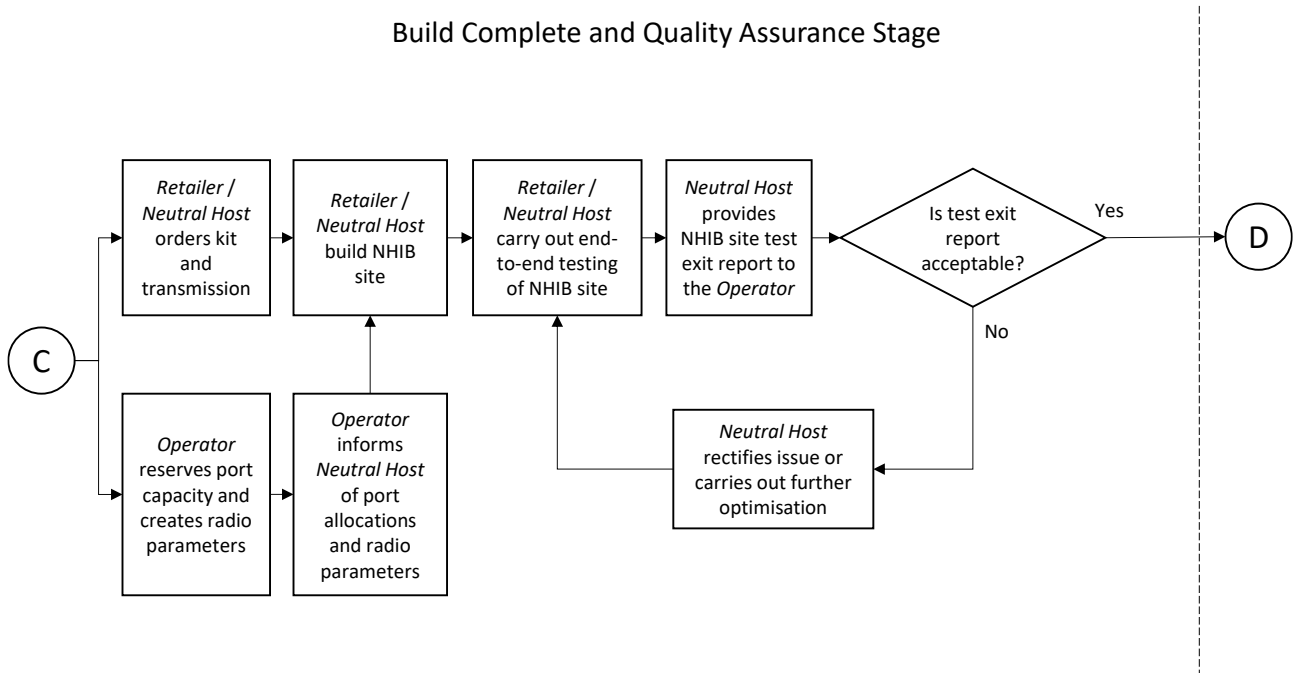
**Figure 3-2. Fulfilment process - Detailed Design stage.**

8. R The **Declaration/Nomination** stage is the point in the fulfilment process where the *Operator* formally logs the NHIB site in their internal toolsets. Note that at this point the site has not yet been built, but it is assumed that it will be, and so the ‘pending’ site details are added to the *Operator’s* network database.



**Figure 3-3. Fulfilment process – Declaration/Nomination stage.**

9. R The **Build Complete and Quality Assurance** stage sees the site installed and commissioned at the venue. The *Neutral Host* and *Retailer*<sup>3</sup> are jointly responsible for the kit and *f*-interface orders, the site build, including the resolution of any unforeseen installation issues, and end-to-end testing, including the resolution, through optimisation or otherwise, of any shortfalls in coverage or service targets. Whilst in parallel the *Operator* reserves port capacity (if required) and provides relevant location specific radio parameters to the *Neutral Host* for the BTSs deployed at the venue.



**Figure 3-4. Fulfilment process - Build Complete and Quality Assurance stage.**

10. I The **Handover/Ready For Service** stage enables the NHIB site to reach commercial launch. The *Neutral Host* provides to the *Operator* an agreed handover pack which includes all the relevant information required by the hosted *Operator*. The *Operator*, on receiving a satisfactory handover pack, confirms to the *Neutral Host* that the NHIB site can carry commercial traffic.

<sup>3</sup> In many cases the *Retailer* and *Neutral Host* roles would be carried out by the same commercial entity and thus the responsibilities would sit with that single entity. Here, however, the point is made that there exists a joint responsibility between the *Neutral Host* and *Retailer*, and by omission, the responsibility does not sit with the *Operator*.

Handover/Ready For Service Stage

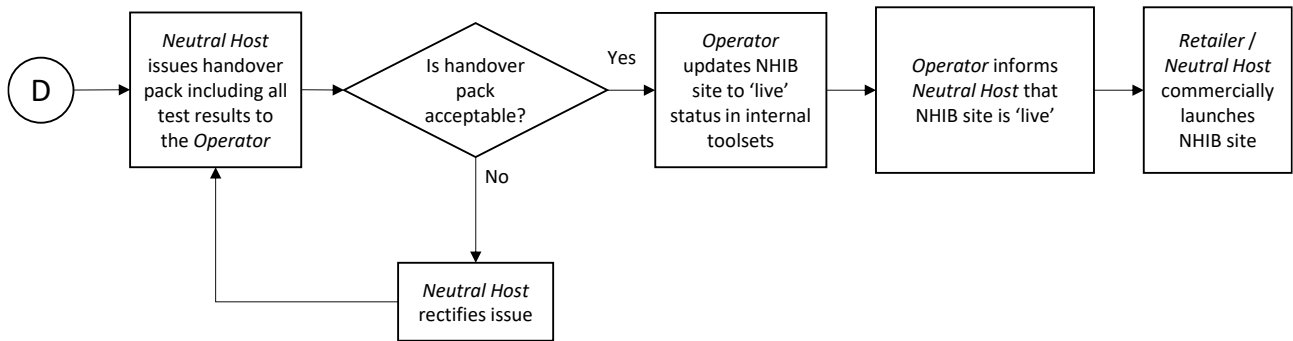


Figure 3-5. Fulfilment process – Handover/Ready For Service stage.

### 3.2 Roles and Responsibilities

- 11. M The *Retailer* and/or *Neutral Host* is responsible for designing the radio deployment at the venue and should, at the outset, define the number and approximate locations of the BTSs at the venue and the expected traffic volume for that venue.
- 12. M The *Retailer* and/or *Neutral Host* is responsible for acquiring, deploying, commissioning and testing the BTS equipment and *f*-interface connectivity at the venue.
- 13. M The *Retailer* and/or *Neutral Host* is responsible configuring on site equipment and associated site related security measures.
- 14. M The *Retailer* is responsible for the relationship with the end customer at the venue and should liaise with that end customer to resolve any deployment or operational issues at the venue.
- 15. M The *Neutral Host* is responsible for designing, acquiring and commissioning their datacentre facility.
- 16. M The *Neutral Host* is responsible for installing sufficient equipment and resources at their datacentre to support the expected traffic levels from the planned venues within the **Retailer Domain**.
- 17. M The *Neutral Host* is responsible for facilitating *b*-interface (resilient pair) towards the point-of-interconnect with the *Operator* with sufficient capacity to support expected traffic levels from the planned venues within the **Retailer Domain**.

18. M The *Neutral Host* is responsible for producing a test exit report for each hosted *Operator* at a venue. The test exit report should contain results from all tests carried out and must highlight any deployment issues or performance shortfalls detected.
19. M The *Operator* is responsible for facilitating connectivity from the point-of-interconnect to one or more instances of a live 4G (MME, SGW) or 5G (AMF, UPF) core network and for providing sufficient core capacity to support the expected traffic levels from the planned venues as forecast by the *Neutral Host*.

### 3.3 Regulatory Obligations

20. M The *Retailer*, or *Neutral Host* on behalf of the *Retailer*, must provide supporting evidence demonstrating that the BTS conforms to ICNIRP compliance (i.e. touch safe if relevant/safe by design), that the out-of-band emissions conform to licence requirements and, where appropriate, potential interference into nearby radar systems has been checked.
21. M The *Operator* is responsible for reviewing and validating that the NHIB deployments provided by the *Neutral Host* are TSCoP<sup>2</sup> compliant and support MTPAS, zone-code shutdown and provide the capability to complete Access Class Barring.

### 3.4 BTS Shutdown

22. M The *Neutral Host* will ensure that all newly introduced BTS can be locked down on command. The *Neutral Host* will demonstrate that either specific bands on the BTS can be locked or the entire BTS can be locked. The *Neutral Host* shall demonstrate per *Operator* band locking where *Operators* share BTS equipment.

### 3.5 Physical Security

23. M In instances where a BTS Controller is deployed at the venue, the *Retailer* is required to locate the BTS Controller in a secure (lockable) room or within a lockable cabinet.
24. M The *Retailer* is required physically attach the BTS equipment to a wall or ceiling (or fixture) within the venue, thereby making it less likely that the BTS is casually relocated within the venue without the *Retailer* or *Neutral Host* being informed.
25. M The *Operator* is required to accommodate live 4G/5G core elements and the Tier-2 SecGW components within a secure switch site.

26. M The *Neutral Host* must house their equipment inside lockable cabinets within their datacentre.
27. M The *Neutral Host* must accommodate the HeNB GW or S1/NG aggregation function, Tier-1**b** and Tier-1**f** SecGW components within a physically secure datacentre.

### 3.6 Management Platform

28. M The *Neutral Host* must demonstrate that each new site added to their NHIB platform is visible within their management domain and that, where the *Neutral Host* has provided a portal (web interface) to their platform, the new site is visible to the hosted *Operator* via that portal interface.
29. M The *Neutral Host* must demonstrate that when an existing site is modified, that those modifications are made visible within their management domain and that, where the *Neutral Host* has provided a portal (web interface) to their platform, those modifications are visible to the hosted *Operator* via that portal interface.
30. M The *Neutral Host* must demonstrate that each site removed from their NHIB platform is no longer visible within their management domain and that, where the *Neutral Host* has provided a portal (web interface) to their platform, the removed site is no longer visible to the hosted *Operator* via that portal interface.
31. M The *Neutral Host* must implement a change process to support the addition, modification and removal of sites on the management platform. This process must allow for changes to be rolled back if required.

### 3.7 Configuration Management

32. R When a new component (which is agreed to be monitored within a Configuration Management system by the *Neutral Host* and *Operator*) is introduced to the overall NHIB solution, the *Operator* is required to add that component to the list of managed components within their Configuration Management platform.
33. M The *Operator* is required to configure transport parameters for Tier-2 terminated **b**-interface connections.
34. M The *Operator* is responsible for providing the NHIB RAN parameters to the *Neutral Host*.

- 
35. R Where the *Neutral Host* has agreed to provide a defined syslog feed to the *Operator*, the *Operator* is responsible for integrating that syslog feed from new platform components within the **Neutral Host Domain** into their existing Configuration Management platform.
36. M The *Operator* is responsible for defining configuration change filters and alarms to identify significant changes made within the **Neutral Host Domain**.
37. R The *Neutral Host* will host a Configuration Management platform to manage all components controlled by the *Neutral Host*.
38. M The *Neutral Host* is responsible for configuring their HeNB GW or S1/NG Aggregation function components.
39. M The *Neutral Host* is responsible for configuring the transport parameters on the Tier-1**b** SecGW.
40. M The *Neutral Host* is responsible for configuring their DNS server.
41. M The *Neutral Host* is responsible for configuring their BTS Controllers.
42. M The *Retailer* and/or the *Neutral Host* is responsible for configuring on-site routers, switches and local DNS servers (if required) at the venue.
43. M The *Retailer* and/or *Neutral Host* must confirm that on-site equipment can either be managed via a local comms port or via a remote access method.

### 3.8 Performance Management

44. M The *Operator* will specify and agree with the *Neutral Host* the formatting of performance engineering stats for import into the *Operator's* PM system.

### 3.9 Trouble Ticketing

45. M The *Operator* will provide an *Operator* NMC contact telephone number and email address for immediate trouble ticket registration/response/query.
46. M The *Operator* will define a process whereby the *Neutral Host* can register trouble tickets within the *Operator* domain for resolution.



47. M The *Neutral Host* will provide a *Neutral Host* NMC contact telephone number and email to receive expedited trouble tickets or to receive emergency or non-emergency BTS lock-down requests.
48. M The *Neutral Host* will define a process where both the *Operator* and *Retailer* can register trouble tickets within the *Neutral Host* domain for investigation and resolution.

### 3.10 Key Performance Indicators

49. R The *Operator* is responsible for defining any additional KPIs to be provided by the *Neutral Host*. The additional KPIs are to be jointly agreed by the *Operator* and *Neutral Host*.

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## 4 Radio Deployment

- 50.1 The term **Neutral Host Provider** (NHP) is assumed to be the commercial entity that performs the installation of the BTS equipment, and any associated Controllers and networking components including security appliances, at the venue.
- 51.1 The NHP could be the *Retailer* or the *Neutral Host* or an independent 3<sup>rd</sup> party employed by either the *Retailer* or *Neutral Host*. Where a 3<sup>rd</sup> party is employed to deploy the radio solution at the venue, it remains the case that the *Retailer* and *Neutral Host* are ultimately responsible for the deployment of the NHIB solution at the venue.

## 4.1 Site Naming Convention

52. I Each *Operator* today has its own internal (and probably unique) site naming convention. For the benefit of the *Neutral Host* and *Retailer* a common (across *Operators*) naming convention is defined for NHIB sites. The NHIB site name allows all parties to identify each site using a common identifier. It is expected that each *Operator* will map the common NHIB site name to their respective internal naming convention so that it can be accommodated within their current toolsets and processes.

53. M The NHIB site shall be identified using the following common naming convention:

**<Solution Type>|<RAT>|<Postcode>|<1<sup>st</sup> Line of Address>|<Floor>|<Instance>**

Where the fields within the naming convention are defined in *Table 1*.

**Table 1. NHIB site naming convention.**

Field	# of characters	Description
<Solution Type>	4 (max)	A shorthand for the type of solution deployed. This could be used to identify the providing <i>Neutral Host</i> , for example.
<RAT>	6 (max)	List of Radio Access Technologies supported at the site. Initially this would default to '4G' but later could be '4G5G'.
<Postcode>	8 (max)	This is a full postcode <sup>4</sup> for the address where the NHIB solution is deployed.
<1 <sup>st</sup> Line of Address>	20 (max)	This is taken to be the first line of the address that results from a query to the Royal Mail's Postcode Finder <sup>5</sup> (and must not include any commas).
<Floor>	6 (max)	A number to identify the floor on which the solution is deployed (where '0' indicates the ground floor). Numbers can be separated by a '-' to indicate a range of floors (e.g. 3-5)..
<Instance> (Optional)	2 (max)	The letter(s) (which are optional) can be used to tag a specific instance within the building

The fields must be separated by a '|' (vertical line) symbol.

<sup>4</sup> The postcode is assumed to conform to 'BS 7666 Address' format.

<sup>5</sup> <https://www.royalmail.com/find-a-postcode>

54. I *Table 2* provides some example NHIB site names for illustrative purposes only:

**Table 2. Example NHIB site names.**

Location of NHIB solution	NHIB Site Name
Lloyds of London Insurance Lloyds Building <sup>6</sup> 1 Lime Street LONDON EC3M 7HA  NHIB system deployed on 1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> floor. 'A' is used to tag a specific instance on those floors.	NH 4G EC3M 7HA Lloyds Building 1-3 A
Barclays Bank plc 1 Princes Street <sup>6</sup> IPSWICH IP1 1PN  NHIB system deployed on ground floor only.	NH 4G IP1 1PN 1 Princes Street 0

(Here 'NH' is used to identify a fictional Neutral Host).

## 4.2 NHP Responsibilities

- 55. M The NHP shall adopt quality processes starting from feasibility conception to the completion of the installation and integration of the NHIB solution.
- 56. M The NHP is responsible for the acquisition of the site and delivering the solution for the hosted *Operators*.
- 57. M The NHP is responsible for the design of both the NHIB site solution and the equipment room.
- 58. M The NHP shall submit the detailed design to the site owner for the design approval.
- 59. M The NHP shall produce detailed designs of the NHIB site solution for the hosted *Operators* to review.
- 60. M Where the NHP has not been able to meet the design requirements as set out in this annex, the design should be reviewed and amended, if necessary, in response to hosted *Operator's* feedback and comments.

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<sup>6</sup> This is the 1<sup>st</sup> line of the address.

- 
61. M The NHP shall procure and supply all equipment appropriate to the design meeting 3GPP Standards and Ofcom requirements.
62. M The NHIB solution must be appropriately designed to meet the environmental, health and safety and thermal management requirements. If required, it must be suitably air-conditioned to accommodate all the on-site equipment including all designed future expansion.
63. M The NHP shall provision the *f*-interface.
64. M If required, the NHP shall provide the detailed design of the equipment room, and an easily accessible space at the venue, for a third-party telecommunication installation.
65. M The NHP shall carry out the installation of all the equipment for the NHIB solution, including the equipment room.
66. M If required, the NHP shall provide and install the power supply equipment meeting the appropriate electrical regulations currently in force.
67. M The NHP shall advise the hosted *Operators* of technical difficulties in a timely fashion.
68. M The NHP shall carry out the commissioning tests of the NHIB solution, review and rectify non-conformance, if any, and highlight any non-conformance items.
69. R If requested by a hosted *Operator*, the NHP will arrange for that *Operator* to witness call testing at the venue.
70. M The NHP shall improve the NHIB solution where a performance shortfall has been identified. If improvement is not possible, a formal concession application shall be submitted for *Operator* approval. The fulfilment is not completed until the hosted *Operator* has signed off the system acceptance certificate, which will only be signed off if the system conforms to this specification or agreed concessions have been approved by the hosted *Operator*.
71. R Where necessary or requested by the hosted *Operator*, the NHP shall carry out individual project reviews with each hosted *Operator*.
72. M The NHP shall provide a project report and as-built handover document to the hosted *Operator* in an agreed format.

### 4.3 Hosted Operator Responsibilities

73. R The hosted *Operator* shall mutually agree with the NHP the project review processes and the project report format and frequency of both.
74. R The hosted *Operator* shall carry out design reviews and provide feedback comments to the NHP in a timely fashion.
75. R If necessary, the hosted *Operator* shall participate in technical review discussions with the NHP for complex projects.
76. R If necessary or requested by the hosted *Operator*, the hosted *Operator* shall participate in the commissioning test and verification test of the NHIB solution.
77. R The hosted *Operator* shall review the verification test results and approve proposed concessions are acceptable.

### 4.4 Documentation

78. R Over the course of the NHIB solution delivery, encompassing the installation of a NHIB system at a venue, the following documents will be provided by the NHP to each hosted *Operator*:
- Feasibility Report;
  - Design Document;
  - Concession Application;
  - Test Methodology Document;
  - System Commissioning and Acceptance Test Report;
  - As-Built Document;
  - Factory Acceptance Test Data on New Products.

#### 4.4.1 Feasibility Report

79. M The Feasibility Report shall contain the following information, as a minimum, to assist the *Operator* in making their decision to participate:
- (a) An executive summary page stating the number of small cell zones and the operating frequency bands being proposed, number of floors, expected number of small cell units.
  - (b) Location with the postcode and NGR.
  - (c) Local environment and a comment of the nearby commercial activities and development.
  - (d) A map showing the position of the location of interest (LOI).
  - (e) Photographs showing the LOI from different angles (if necessary).
  - (f) Size and footfall figures and the site owner.

- (g) Facilities and amenities, number of shops and the name of the major shops if the LOI is a shopping centre (to be shown on a floor plan).
- (h) An indication of the construction method of the LOI, such as roof and building type.
- (i) Current 2G, 3G, 4G and 5G network coverage (where appropriate).
- (j) A statement confirming landlord's consent.
- (k) Access arrangements to site and the main equipment locations plus any special site features.
- (l) Proposed small cell Zones (supported by polygon boundaries on site drawings).
- (m) An indication of the chance of acquisition success and build within a period of 6 months.

#### 4.4.2 Design Document

80. M The Design Document will be issued after the *Operator* confirms their interest of participation. If necessary, further Design Documents will be issued confirming the final design.
81. M The Design Document shall contain the following information, as a minimum, and shall be provided to the participating *Operator* upon request:
- (a) Project plan identifying the forecast dates of main milestones such as design approval, acquisition HOT, site access, start of installation, installation completion, commissioning test, verification test and the project completion.
  - (b) System schematic diagram with the components appropriately labelled. Where necessary, the radiating power of each small cell per hosted *Operator* and per band shall be given. Appropriate colour codes/symbols shall be used for representing the small cell unit(s) exclusively assigned to an individual *Operator* or inclusively shared by multiple *Operators*.
  - (c) The design methodology should be supported as appropriate by prediction. Where the coverage prediction plots are provided, EIRP values such as the transmit pilot power of LTE/NR Reference Symbol used in the prediction should be clearly noted.
  - (d) Link budget calculations, which shall include the uplink and downlink coverage for the near mobile and the far mobile at the edge of the coverage.
  - (e) The area over which the NHIB solution will deliver the coverage as shown by a polygon(s) drawn over a floor plan, showing also the potential sectorisation and zone boundaries.
  - (f) An overall site plan showing the location of each individual small cell unit and its height information. If applicable, the antenna orientation shall be included.
  - (g) Photograph(s) showing the proposed location of each small cell unit and its surroundings.
  - (h) Current 2G, 3G, 4G and 5G network coverage (where appropriate).
  - (i) An appendix of the technical specification of the equipment in the NHIB solution (in particular if the equipment is being used for the first time).
  - (j) ICNIRP compliance calculations and conformance statement. A certificate confirming the compliance shall be included as part of the engrossment documentation.
  - (k) A declaration of compliance to this specification.
  - (l) Proposed survey routes for the System Acceptance Test (SAT).
  - (m) Part list summary table in Excel format.
  - (n) Transmission termination and location.
82. M The NHP shall provide a complete final Design Document detailing the changes from the initial design proposal. This document will be used as the reference for the system build and acceptance verification.

#### 4.4.3 Concession Application

83. M The NHP should advise all hosted *Operators* about concessions against this specification during any stage of the project.
84. R Where the NHP has not been able to deliver the proposed design, a concession application shall be submitted at the time of providing the system acceptance test report. It is noted here that concessions on matters relating to health and safety shall not be granted under any circumstance.
85. R The concession application shall provide the reason for the non-compliance, action plan and estimated time by which the non-compliance will be rectified, a drawing showing the area of non-compliance and the coverage/performance statistics, as appropriate.

#### 4.4.4 Test Methodology Document

86. M The Test Methodology Document shall include all the tests the *Neutral Host* is planning to carry out on the NHIB platform and connected BTS equipment. The Test Methodology Document shall be drafted by the *Neutral Host*.
87. M Each test should have an entry criteria, describing the set up of the test, and it should state what constitutes a successful outcome for the test.
88. I Tests which relate to the NHIB platform (aggregating components in the *Neutral Host's* datacentre) do not need to be repeated for each hosted venue deployed, since it is assumed that each venue is equivalent from the NHIB platform's perspective.
89. R Tests which relate to the venue may be generic in format, if the *Neutral Host* and hosted *Operator* jointly agree the testing required at each venue is the same. Otherwise the *Neutral Host* must provide a venue specific test plan for each venue deployment.
90. R The *Neutral Host* is required to produce a test exit report summarising the outcome of the tests and shall highlight any areas of concern or performance shortfalls impacting the hosted *Operator*.
91. R Where the testing identifies areas of concern of performance shortfalls, the *Neutral Host* shall propose corrective actions or mitigations to the affected hosted *Operator* and agreed a suitable resolution.



#### 4.4.5 System Commissioning and Acceptance Test Report

92. R The System Commissioning and Acceptance Test Report is part of the handover documentation providing details of the tests carried out on the NHIB solution by the NHP and records all the measurements results.

#### 4.4.6 As-Built Document

93. M The As-Built Document shall reflect the actual build of the system covering the following areas and shall be provided to the hosted *Operators* upon request:
- (a) Actual installation in the equipment room.
  - (b) Certification of the electrical installation.
  - (c) A statement of conformance to all the health and safety regulations.
  - (d) Confirmation of the ICNIRP compliance and verification work carried out.
  - (e) Drawing showing the routing of cables.
  - (f) Drawings showing the location of the small cell unit positions.
  - (g) As-built system diagram and set-up.
  - (h) A summary table to confirm the position, orientation, height and EIRP of each small cell unit, and justification for any change from the design document.
  - (i) As-built part list summary table.
  - (j) A photograph(s) showing the location of each small cell unit and its surroundings.
  - (k) A table summarising any deviations from the design.
  - (l) If the NHIB solution is only 4G/5G capable, a confirmation that landlord/tenant/visitors are informed that devices which are either not VoLTE capable or not VoLTE enabled will not be able to make CSFB emergency calls via the inbuilding system.

#### 4.4.7 Factory Acceptance Test Data on New Products

94. R Where a new product is deployed, the *Neutral Host* shall provide a complete set of factory acceptance test results with the design. The factory acceptance tests are the responsibility of the *Neutral Host* and are provided to support the acceptance of the design by *Operator* and confirm the design conforms to 3GPP specifications and Ofcom requirements.
95. R The test methodology for the factory acceptance test shall be provided in the same report.

--- End of Document ---