

## **Réponse à la consultation publique “Preparing the future of mobile networks”**

Dense Air would like to thank Arcep for the opportunity to provide its views on the public consultation on Preparing the future of mobile networks. We are one of the first entities that acquired site licences under Ofcom Shared Access Licence at the 3800-4200 MHz band in the UK. We are deploying both indoor and outdoor small cells. Our current deployments are on a vehicle test area in Bedfordshire, and we are in the process of setting up a network with a local authority in the north of England.

Our experience on the assignment of Shared Access Licences may hopefully give some useful aspects to consider also in France. In the UK, the assignment of Shared Access Licences is manually administered by Ofcom. An applicant identifies the specific location where it wants to set up an access point, after which Ofcom evaluates the interference to existing usage (such as fixed links) and any other Shared Access Licences already set up in the area. We find a number of problems with the current process here in the UK:

- 1) An applicant cannot define an area that it wants to cover, all the sites are licensed individually
- 2) The frequency for each site can be anywhere within 3800-4200 MHz so planning even a reasonable size private network needs a lot of back-and-forth between the applicant and Ofcom

We do not answer to all of the questions since some of them are of not relevant to Dense Air, or we do not have a specific view to state. The responses we did reply on are in numerical order below. Incidentally, we noticed that there is one question missing in the English translation (Question 38 in the French language original) because of which there is a difference of one from that question onwards. The references below are to the English translation.

### **Responses to the consultation:**

**Question 4: As an operator or business, to what extent do you plan on integrating these open architectures in your network deployment strategy? More specifically, in what context and to satisfy what requirements do you consider it advisable to introduce edge computing in mobile networks? What issues, in particular pertaining to access, deployment characteristics and usage, have you identified? How do they need to be handled?**

**Answer:** We intend to deploy small cells connected to 5G SA core network. The DU and CU can be from different vendors due to the open architecture standardized between them either at Small Cell Forum or Open RAN Alliance. These two organisations have adopted a different split point between CU and DU amongst the options shown in Figure 1. It is important to understand that networks that are vendor-agnostic are also deployer-agnostic. That is, in part, because interoperability opens the door to the hosting of network components. Cloudification, meanwhile, enables MNO network functions to be hosted as tenant applications.

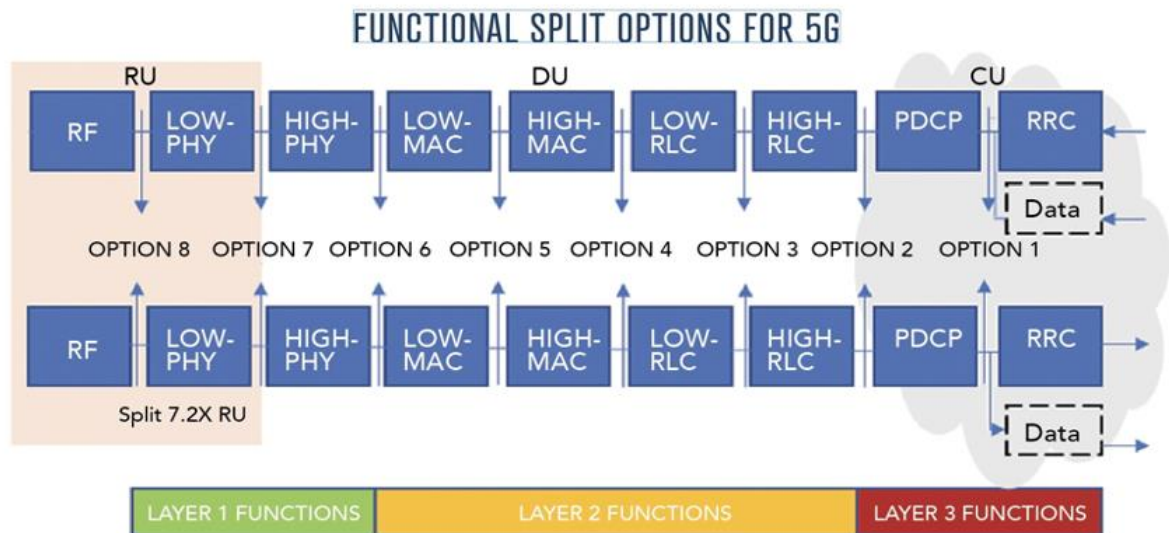


Figure 1: 3GPP functional split options

**Question 5: In what ways do these architectural changes require (if any) changes to how access to spectrum resources is managed (frequency licence holders' identity, quantities assigned, etc.)?**

**Answer:** In neutral host operation we consider the optimal approach in small cell shared architecture to be MOCN (Multi Operator Core Network). In this architecture, the MNOs accessing the neutral host RAN operate in a shared spectrum band that is managed by the neutral host provisioner, and all the MNOs' PLMNs are broadcast over that single swathe of spectrum.

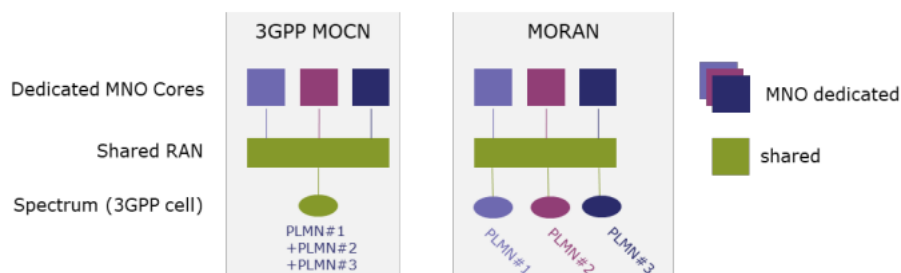


Figure 2: MOCN vs MORAN (source: Small Cell Forum SCF244)

Clearly, this could be the spectrum band of an MNO that acts as neutral host. On the other hand, an entity that only operates as neutral host providing access to shared RAN could be the spectrum rights holder. In the latter case the spectrum rights are not with the MNOs that have end user relationship to consumers but the neutral host provider.

**Question 6: In what ways could these architectural changes (notably decentralisation and edge computing, Open RAN, etc.) hamper or accelerate network sharing? What competition issues might arise as a result?**

**Answer** Small Cell Forum has worked on developing the framework for neutral hosting and private networks proposed in SCF244 "Neutral Hosting Architectures". Inspired by

the UK MNOs' Joint Operator Technical Specification for NH In Building (JOTS NHIB), it has expanded to incorporate other regional implementations – such as CBRS-based hosting in the US and private networks. Potential tenants in a global hosted RAN framework include:

- One or more MNOs in a neutral hosting arrangement
- A private network as an enterprise tenant
- Other service providers – MSPs, hyperscalers, IoT providers, broadband providers, municipalities
- Combinations of the above

The JOTS model is somewhat prescriptive. In other markets where Dense Air operates we are seeing MNOs recognising the opportunity for improving the cost to serve and the viability of new coverage or capacity, offloading customers in poor radio conditions from the macro network, etc. Through Small Cell Forum's ongoing neutral host programme we will see greater positioning of the neutral host value proposition to stimulate shared network development across many markets and, hopefully, alignment and consistency in the architecture deployed.

**Question 16: For each of the three types of network listed above, which seems the most able to support which applications and satisfy which needs? What are the requirements and prerequisites that would ensure that using these types of networks would satisfy these needs? Which frequency bands are best suited to satisfying these needs? Which players could provide these solutions?**

**Answer:** Private dedicated networks can support multiple private tenants via APN/DNN differentiation or by running a common operational framework over several small-scale private networks. Hybrid network can be advantageously supported by neutral host provisioning. Our experience from recent projects is that for verticals' needs the mid-band spectrum at C-band is best suited for purpose. This extends cost-effectively also to outdoor private networks.

**Question 17: Regarding hybrid networks, why might the combination/complementary nature of the two types of network be needed (resilience, supplementary coverage, network access continuity, etc.)? What hybridisation schemes (distribution of the elements/features between private and operated network) would be best suited to meeting the needs and supporting the applications identified above (e.g. access on the public network, private core)? What role does access to frequencies play in these different schemes?**

**Answer:** Small Cell Forum has considered hosted RAN concept and this provides another way of looking at the hybrid network in the Arcep consultation.

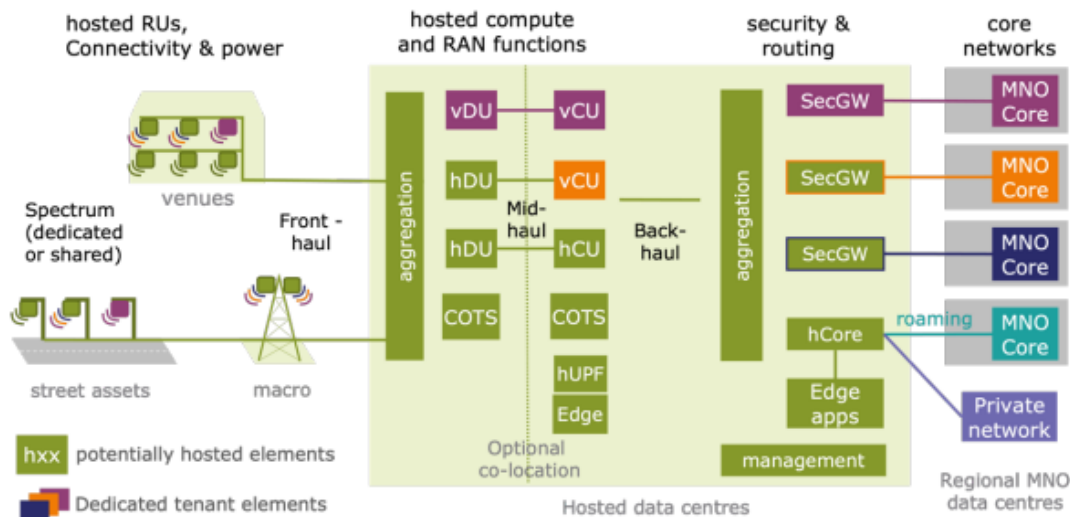


Figure 3: Hosted RAN framework (source: Small Cell Forum SCF245)

This kind of hosted network can support both the private network in the facility and also the connection to public networks (which may have their own core or use the hosted core). The access to frequencies can be based on MOCN or MORAN principles, but the private network would benefit from the host having dedicated spectrum to provide for the tenant.

**Question 18: Still on the matter of hybrid networks, what types of player could position themselves to contribute to the different hybridisation schemes? What business models could be created to provide this type of solution (e.g. neutral host model)?**

**Answer:** There are various types of entities that could provide the hybrid network. The hosted RAN network we describe above is optimal for a neutral host model.

**Question 20: Which of the ecosystem's players are in the strongest position to obtain frequency licences? For what reasons?**

**Answer:** In any kind of nationwide frequency auction process it is the MNOs that are in the strongest position to obtain frequency licences. In order to democratize the access to frequency resources, authorization on a local basis is beneficial.

**Question 24: What developments are expected in indoor use? What technical solutions and business models (e.g. neutral host) would be the most appropriate to meet requirements? What types of player would be most likely to deploy them? What competition, technical, regulatory or other type of issue would these solutions and business models create?**

**Answer:** Indoor use envisions tens of thousands of access points to provide coverage which necessitates asset sharing. Whilst operators can do sharing of small cell access points, a neutral host is an ideal approach to such deployments. In indoor deployments a neutral host provides service and equipment connectivity between retailers and operators. This includes the infrastructure to operate the radios (for example, the BTS,

switching, fibre aggregation and routers), multi-tenant management and reporting and appropriate security. It also ensures the provision of isolation between operators.

As we explain in answer to Question 71, indoor small cells can be envisioned to be used for self-installed public indoor coverage enhancement. This raises some challenges if it is not integrated with MNO spectrum and their processes. We are working on CBRS bands in the USA on such self-installed small cells, and the 3800-4200 MHz local networks can provide similar benefits in Europe.

**Question 33: In what environment (for instance: indoor/outdoor, densely/less densely populated, etc.) would small cell sharing be the most appropriate? For what gains? On the flipside, in which environment would it be the most problematic? What competition and/or strategic issues surrounding small cell sharing can you identify?**

**Answer:** Small cell sharing is feasible for both indoor and outdoor small cells. Due to the expected high density of small cells that need to be deployed, sharing is really the only appropriate way of operating them. Having only one installation of 5G small cells in a building or a well-coordinated set of 5G small street cells in a neighbourhood reduces clutter, energy consumption and enables access to also small tenants.

**Question 34: Of all the frequency bands listed above and detailed below, which rank highest for their ability to meet your needs?**

We are mostly interested in the 3800-4200 MHz band for neutral host provisioning. In addition, the 66 - 71 GHz band is very useful for fronthaul applications in distributed RAN installations.

**Question 71. What, in your opinion, are the expected use cases for this frequency band? Do you plan on taking advantage of the trial platform?**

**Answer:** We are using this band under the Ofcom Shared Access Licence in the UK where the deployments relate to indoor private enterprise networking and self-installed single small cells for public indoor coverage enhancement. Dense Air is also a member of a UK government supported project focusing on the densification of 5G NR outdoor small cell clusters - Comporan (<https://www.comporan.co.uk/about>). The use cases worked on under Comporan are

- 5G densification for MNOs
- Enabling 5G transportation corridors
- 5G FWA for suburban and rural

We do not currently have plans to take advantage of the trial platform in France, but we foresee the expected use cases to be fairly similar. It is good for local deployments of private networks, both indoors and outdoors (with small cells). The ease of acquiring spectrum only in areas needed also supports the use cases where a neutral host would provide shared RAN under the MOCN architecture (i.e. using a spectrum band that is commonly accessed by all the tenants).

**Question 72. Do you see any advantages in using this band for 5G or another mobile technology? Within what timeline? With what quantity of spectrum and over what geographical area? To provide which services?**

**Answer:** 3GPP already has band plans encompassing 3800-4200 MHz frequency (n77), and the proximity to 3400-3800 MHz ensures timely availability of equipment. This favours the use of 5G in this band. This frequency is typically suitable for small cell deployments both indoors and outdoors.

**Question 73. What would be the right conditions for cohabitating with other services already using this band?**

**Answer:** In the UK Ofcom evaluated the incumbent services in the 3800-4200 MHz band, and the proposal was to retain fixed links in rural areas and remove fixed links in higher population density urban areas. These decisions are naturally very country specific and depend on the circumstances around the services currently deployed on the band. Local licencing should in any case provide good opportunities to site networks whilst protecting the use that is eventually decided to remain in the band.

**Question 74. Once the band is standardised, would you like to see it assigned in France? If so, in what way?**

**Answer:** We would be very interested in seeing the band assigned in France now that the CEPT is also discussing local area network connectivity for 3800-4200 MHz.

**Question 75. Do you think it will be necessary to impose a synchronisation frame in this band? If not, what other coordination method would be advisable?**

**Answer:** Synchronised TDD frame structure helps avoiding the use of guard bands. Nevertheless, particularly in the context of multiple private networks active in the same area the coordination aspects need to be carefully planned. A common synchronisation reference and harmonised frame structure is one approach; for small cells with limited coverage area, strict sync requirements could be relaxed, however, as long as the frequency reuse distance is considered when assigning licences.