Your response

Question	Your response
Question 1: Hybrid sharing could mean that the upper 6 GHz band will be used for mobile outdoors and Wi-Fi indoors. What are your views on the priorities for each of these two services, assuming that suitable coexistence mechanisms are developed?	*No answer*
Question 2(a): Hybrid sharing could mean that the upper 6 GHz ban will be used for mobile in some locations, and Wi-Fi in others. We would like feedback on the priorities for each of these two services, assuming that suitable coexistence mechanisms are developed. From the point of view of mobile, is the upper 6 GHz band most useful to provide outdoor coverage, or indoor coverage? Is it most useful in urban areas, or in those base stations that are currently carrying more traffic, or some other split?	*No answer*
Question 2(b): Similarly, what are the priorities from the point of view of Wi-Fi deployments?	*No answer*
Question 3: What are your views on a modified AFC or SAS-type approach to enable hybrid sharing? What additional work do you think would be required?	*Is this response confidential? – N* WInnForum has produced several outputs that can help inform Ofcom's question as to whether or not a modified AFC or SAS-type approach can enable hybrid sharing: - In a joint effort to promote spectrum sharing approaches for specific use cases, ETSI and the WInnForum have developed a joint whitepaper: Spectrum Sharing Frameworks for Temporary, Dynamic, and Flexible Spectrum Access for Local Private Networks.. Based on the recently released ETSI Technical Report ETSI TR 103 885 and WinnForum Technical Report WINNF-TR-2011 V1.0.0, this international collaboration provides a status analysis of dynamic spectrum sharing use cases and frameworks, including the

	associated evaluation elements and opportunities to adopt these frameworks, to regulators such as the CEPT worldwide. Use cases addressed in this whitepaper include audio Programme Making and Special Events (audio PMSE), wireless industrial automation, Public Protection & Disaster Relief (PPDR), and drone control and payload. All presented use cases demand high level of Quality of Service (QoS) and are limited in time and space. The document also introduces various standardized spectrum sharing frameworks that are based on data base architectures, such as Licensed Shared Access (LSA), evolved Licensed Shared Access (eLSA), Automated Frequency Coordination (AFC), and Citizens Broadband Radio Service (CBRS). Per the paper, designing and implementing appropriate dynamic spectrum sharing frameworks would provide a solution to the current issues of scarcity and usability of spectrum in different regions of the world. Based on the most challenging characteristics extracted from all use cases, a desirable parameter set for an envisaged sharing framework is presented that suggests further evolution of the frameworks discussed. Taking into account the benefits and disadvantages of the various sharing procedures with respect to the use cases described authors conclude that AFC and eLSA could be possible candidates for a sharing framework that ensures incumbent protection and CBRS a starting point for a sharing solution that natively supports inter-system coordination between secondary users. Adjustments of all procedures are envisaged to make the frameworks useable for various applications. This will accommodate for specific QoS levels and the common need for automation of local ad-hoc deployment of private networks.

	- The WInnForum's 6 GHz Committee (6GHzC) serves as the leading industry body to study and specify sharing arrangements in spectrum designated for unlicensed operation within all or part of the 6 GHz band (5925-7125 MHz). The Committee provides technical input and standards to inform the FCC's 6 GHz rulemaking and facilitates the interpretation and implementation of the rulemaking to allow industry and regulators to collaborate on implementation of a common, efficient and well-functioning 6 GHz ecosystem. For documents produced to date, see our Standards page. - WInnForum has completed the standards comprising the baseline specifications for commercial operations within the 3.5 GHz Citizens Broadband Radio Service (CBRS) band. WInnForum continues to develop additional follow-up standards. Click below for the specifications, policies and reports documents. • Baseline Standard Specifications (Release 1) • Enhancements to the Baseline Specifications (Release 2) • Policies and Procedures • Reports and Recommendations • WInnForum Information Documents
Question 4: How could existing access protocols and sensing mechanisms be leveraged (i.e., those in Wi-Fi or 5G NR-U) to enable hybrid sharing?	*Is this response confidential? – N* WInnForum recommends that advances in spectrum sensing technologies not be discounted in future regulatory and system planning. A Spectrum Sensing Device intelligently detects whether a band of electromagnetic spectrum within radio frequencies is currently in use. Technologies for Spectrum Sensing include both non-Cooperative (e.g. matched filters, energy

	detection, cyclostationary analysis, wavelet analysis, and covariance detection) and Cooperative sensing. Cooperative sensing helps to improve detection by providing readings from multiple users who collaborate with each other to refine non-cooperative spectrum sensing devices. Cooperative sensing provides both users and network administrators an appropriate spectrum context for implementation and optimization of policy based spectrum management. Multiple independent observations may be useful in identifying hidden nodes, minimizing false alarms, and may provide more accurate signal detection.[1] However, care should be used when considering spectrum sensing technologies regarding the need to minimise interference susceptibility so as not to limit deployment of desired systems.[2]
Question 5: What mechanisms could potentially enable device-to-device connectivity?	*No answer*
Question 6: If hybrid sharing is eventually adopted, and requires licensed mobile to operate at medium power, in what way would mobile networks use the upper 6 GHz band?	*Is this response confidential? – N* WinnForum advocates the use of spectrum sharing and small cell technologies. WinnForum recommends the use of new technologies, and paradigms such as spectrum sharing and small cells that address the emerging spectrum crisis.
Question 7: How would you suggest that the mechanisms presented here can be used, enhanced, or combined to enable hybrid sharing or are there any other mechanisms that would be suitable that we have not addressed?	*Is this response confidential? – N* WinnForum strongly supports the use of networked and synchronized databases accessed with device location information. These databases have emerged as a critical technology for enabling and managing spectrum access (e.g., [Television White Space (TVWS), Citizen's Broadband Radio Service (CBRS)] and 6 GHz Automated Frequency Coordination [AFC] system). Basing

[1] (https://www.wirelessinnovation.org/assets/work_products/Recommendations/WINNF-RC-0007%20V1.2.0%20%20WINNF%20Advocacy%20Agenda.pdf

[2] https://winnf.memberclicks.net/assets/CBRS/WINNF-TR-5003.pdf
https://winnf.memberclicks.net/assets/work_products/Reports/WINNF-TR-1015-V1.0.0%20ESC%20Sensor%20Impact%20Technical%20Report.pdf

	management and policy decisions in networked and synchronized databases allow regulations and services to adapt over time and vary by band while protecting incumbent users. Networked databases provide access to information beyond what is immediately observable by a radio, thereby mitigating hidden node problems in spectrum sharing scenarios. They provide a simpler mechanism for managing upgrades to spectrum management and dynamic access schemes by updating rules in a small set of databases rather than in millions of individual radios. Furthermore, this approach has additional foreseeable benefits in that it starts the community down a path towards gathering real-time spectrum information and awareness from many distributed users, thereby helping to achieve the real-time spectrum dashboard vision endorsed by WinnForum. It also simplifies the integration and application of non-spectrum domain information into spectrum management decisions, and such a solution should scale well over time. Databases could be made an integral part of a coexistence architecture given their visibility into the locations and operational states of many different radios from disparate wireless networks. Such a solution would need relatively rapid database responsiveness to account for changing environmental conditions. This could be helped by adopting a hierarchical architecture of databases with local caching.
Question 8(a): Assuming the future of the band includes indoor use for Wi-Fi and outdoors use for mobile: How could this be achieved without creating or suffering interference?	*Is this response confidential? – N* WinnForum advocates the use of spectrum sharing and small cell technologies. WinnForum recommends the use of new technologies, and paradigms such as spectrum sharing and small cells that address the emerging spectrum crisis
Question 8(b): Could there be a combination of technical adjustments such as power limits and other mechanisms (including databases or sensing mechanisms)?	*Is this response confidential? – N* WinnForum notes that managing spectrum access in such a manner should account for the following considerations. • The possibility of a catastrophic single-point of failure implies that the system should have redundancies built in. • The possibility of disparate information leading to conflicting and potentially difficult to

	trace decisions means that these multiple redundant databases should be well-synchronized. • Spectrum sharing systems leveraging networked databases have a greater need for secure communications and authentication due to the potential for impacting a large number of systems. • Further, as with all databases, there exists the possibility of incomplete or erroneous information. Thus, there is value to incorporating fail-safe mechanisms, such as spectrum sensing, which could provide a mechanism for assessing the presence of protected users independently of databases.
Question 9(a): We are interested in input about the importance of the upper 6 GHz band for its incumbent users, and on the potential impact of hybrid sharing of the band. What evidence do you have on whether incumbents are likely to coexist with hybrid sharing of the band with mobile and Wi-Fi? Are there unique advantages of the upper 6 GHz band for these uses?	*No answer*
Question 9(b): What are your views on the initial analysis we have conducted around hybrid sharing and coexistence with incumbents?	*No answer*
Question 9(c): For any incumbent uses that you view as unlikely to be able to coexist, what alternatives are there? What are the barriers that might prevent those alternatives?	*Is this response confidential? – N* WinnForum advocates legacy users augmenting their existing systems, where possible to facilitate cooperative sharing of spectrum. There is an inherent inefficiency of spectrum etiquettes that do not account for the presence or behavior of other radio systems. To share spectrum, radio systems' operational parameters are implemented so both systems have access to the spectrum. While many parameters such as transmitted power (e.g., transmit power control), frequency (e.g., dynamic frequency selection) and time (e.g., predictive scheduling) directly impact coexistence metrics and are obvious candidates for cognitive radio control, many other parameters can be set to ensure and enhance coexistence such as route selection (choosing routes to minimize interference), network

	association (preferentially connecting to a network with greater protective measures), and application layer parameters (such as reducing video quality which reduces occupied bandwidth). Conceptually, virtually every parameter, setting, and/or process which influences the transceiver operations of a radio can be controlled to ensure or enhance the coexistence of cognitive radio systems with other users. Out of necessity, most proposed techniques for gaining information about legacy systems (e.g., TV or satellite) adopt a non-cooperative approach, where the cognitive radio system has to gain relevant information without help from the incumbent. Cooperative techniques such as has been proposed for systems utilizing a Radio Environment Map database are therefore generally limited to use for coexistence between cognitive radio systems accessing available "white space". However, this need not be the case as with the proper inducements, legacy users could augment their existing systems to aid cognitive radio systems' observation and orientation processes. This includes registering accurate transmitter and receiver characteristics for legacy radio systems with the radio environment map database. The members of WinnForum endorse this approach, which allow for the design, development and standardization of a "spectrum dashboard" providing a real time or near real time view of the radio environment map at a given location and at a given time. Such a dashboard will be a key tool in determining the etiquettes that the cognitive radio must consider when making its decisions.
Question 10: Do you have any other thoughts that you would like to share about hybrid sharing in the upper 6 GHz band, or about hybrid sharing more generally and its potential for applications in other bands?	*No answer*
Question 11: Do you have any other comments to make on these proposals or on the future use of the upper 6 GHz band?	WInnForum is dedicated to advancing technologies supporting the innovative utilization of spectrum and remains at Ofcom's disposal to provide any additional information as needed.

Please complete this form in full and return to Hybridupper6ghz@ofcom.org.uk.