FEDERATION OF COMMUNICATION SERVICES

BUSINESS RADIO

The FCS Contribution to the Ofcom Call for Input on 5G Spectrum Access at 26GHz

FCS September 2017

A Federation of Communication Services (FCS) Response

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Foreword

The Federation of Communication Services (FCS) represents companies who provide professional communications solutions to professional users. Our members deliver telecommunications services via mobile and fixed line telephony networks, broadband, satellite, wi-fi and business radio. Our members' customers range from SMEs, home-workers and micro-businesses up to the very largest national and international private enterprises and public-sector users. FCS is the largest UK trade organisation in the professional communications arena, representing the interests of nearly 400 businesses with a combined annual turnover in excess of £45 billion.

This focus on professional radiocommunications solutions to professional users results in a perspective that is far removed from the more familiar public cellular communications service delivery to consumers. Most of the factors that are (quite rightly) high priority for providers of large-scale consumer services don't even exist in the FCS world. A good example is that in the FCS concept of Business Radio, the delivery of entertainment is not normally even a consideration[1].

Many of the solutions are intended to provide resilient communications in extreme circumstances. Human nature dictates that in such circumstances, a voice service is (and probably always will be) of the highest level of essentiality. However, in recent times, the FCS has noted that even in these situations, there may be a growing need to also support high-resilience[2] data communications capability to meet all the needs of the professionals handling the situation and the wider organization affected.

The exact situation is still evolving and very difficult to quantify. However, the FCS has previously provided Ofcom with a report on this matter that contains analyses of various aspects of this new demand.

We are therefore grateful for the opportunity to make a contribution to the Call for Input on 5G Spectrum Access at 26GHz.

Principal Contribution:

The Federation of Communication Services believes that there is a case for some or all of the 26GHz band, to be dynamically assigned to users on an 'as and where needed' basis, coordinated by Ofcom using a Geo-Location Database tool.

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[1] The FCS notes that some FCS members are now looking at providing a complete portfolio of consumer services, especially in areas where it has previously proved very difficult for residents to obtain these services. However, the commercial arrangements may be that they supply a solution a local provider company rather than direct to the end consumer.

[2] The FCS takes a "comprehensive" view on what "Resilience" really means. Having a system that includes signalling protocols that support features that are often also seen in professional systems doesn't make that system "Mission-Critical" (say). Equally, the virtual slicing of the network to provide different user facility packages, doesn't make it work more reliably. Much much more is needed. See the Annex to this Contribution.

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Brief Introduction to the UK Business Radiocommunications Sector

An increasing number of UK professional organisations rely on high-resilience radiocommunications for their day-to-day operations. Whilst the extent of this reliance varies from end user to end user, there is a common underlying theme that they all share. This is that the radiocommunications must work when they need it to work.

This rather unsurprising point has consequences. These consequences impact requirements definition, service levels, technical design, implementation, incorporated features and a host of other parameters that all combine to achieve a resilience service that meets the needs of the operation.

Whilst Ofcom staff have a very good appreciation of the Business Radio environment in the UK, the FCS feels it may be helpful to other readers to make a few introductory points here. To that end, we offer some highly simplified and informal definitions of the three classes of "Criticality" that are in common use in the sector. Whilst clearly there are some instances of overlap between these definitions, they are in no way interchangeable.

Business-Critical Facilities and services are Business-Critical if their use is needed to achieve overall operational efficiency improvements. Typically, these types of services may positively impact the operational cost lines to improve the performance of the entity in a highly competitive sector of enterprise. In the general case, the facilities that are classed as Business-Critical may be only a sub-set of the facilities the user has at their disposal. Others may be "Best-Efforts" grade etc.

Mission-Critical Facilities and services are Mission-Critical if their use is essential in the achievement of an operation. That is, if the radiocommunications fail, so does the operation. Obviously, if the operation has a big impact on the overall success of the entity, the radiocommunications are very important to that entity. If the operation is less important, any failure in the radiocommunications is correspondingly reduced in impact. In common with Business-Critical usage, the professionals may have other facilities also available to them that are not so critical.

Safety-Related Facilities and services are Safety-Related if they affect the likelihood of an injury or even death of a person taking place and/or subsequently affect the ability to perform the necessary actions after such an accident. This is a notoriously difficult area under law due to the inclusion of the concept that the incident that resulted in injury/death could reasonably be predicted. The current trend towards lower staff levels (even the introduction of lone-working in places where it has not been so before) has clearly increased the importance of being able to summon help when incapacitated, lying on the floor. This directly affects the correct choice of equipment where such accidents may occur (the number of which is also increasing).

This principle is well established within Health and Safety Legislation. For example, The Provision and Use of Work Equipment Regulations 1998 (amended).[3] Of course, EU Legislation exists to the same purpose[4]. One must make sure that the right equipment is provided to workers. This legislation has been in place for many years.

In the UK, the situation is clear. It is a fundamental obligation on the employer that the work equipment is suitable for the purpose and includes consideration of the risks to Health and Safety. One of the relevant paragraphs is quoted here as an illustration of the clarity of the UK legislation regarding providing the right equipment.

The Provision and Use of Work Equipment Regulations 1998

Suitability of work equipment

4.—(1) Every employer shall ensure that work equipment is so constructed or adapted as to be suitable for the purpose for which it is used or provided.

(2) In selecting work equipment, every employer shall have regard to the working conditions and to the risks to the health and safety of persons which exist in the premises or undertaking in which that work equipment is to be used and any additional risk posed by the use of that work equipment.

(3) Every employer shall ensure that work equipment is used only for operations for which, and under conditions for which, it is suitable.

(4) In this regulation "suitable" means suitable in any respect which it is reasonably foreseeable will affect the health or safety of any person.

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[3] 1998 No. 2306 et-al.

[4] Directive 89-381 as an example

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It is difficult to imagine how the law could be more clear in this regard. Providing the workforce with radiocommunications that might not work when they need it, that is it isn't sufficiently resilient, is clearly not compliant to the law if more suitable equipment was easily available, (one asks why anyone would bother buying the less capable equipment at all).

The FCS membership have for some years addressed the users' requirements with a combination of the appropriate level of resilient voice communications hosted on a private system with any data needs hosted on public communications. However, users are starting to demand more reliable data systems. This presents the UK Business Radio sector with a serious problem. Not least, what radio spectrum could be utilized to carry the new air-traffic.

Historically, Business Radio solution providers met the extremely high levels of voice-communications resilience required by many users with a KISS[5] strategy. This has enabled voice solutions to achieve end-to-end availabilities into regions well above 95% time after time. In recent years, the industry has developed, and now deployed, digital solutions which support modest amounts of resilient signaling in addition to the resilient voice service.

The data services that are the subject of this FCS contribution are not these data services. What we are now seeing more of are genuine expansions of Mission-Critical (etc.) capability to solutions requiring the interchange of significant amounts of data, perhaps for video applications.

In consequence, this contribution discusses the mechanisms for the introduction of operational data communications, sufficient to the needs of users operating to the three critical levels.

In answering, the FCS offers three actual case studies and a proposal for a Spectrum Management Strategy that we believe would meet the needs of all users.

Responses to Questions Posed by the Call for Information

The FCS is clearly not itself a provider of communications. Therefore, these contributions are limited to questions 4 & 5.

Questions 4

Question 4.1: What service would be delivered and to which consumers and/or organisations?

Question 4.2: Where in the UK would the 26 GHz spectrum be used to deliver services? For example, will deployments be focused on:

Areas of existing high mobile broadband demand?

Rural areas?

Rail and road corridors?

Specific types of enterprise or industrial sites?

Indoors or outdoors?

Specific nations or regions of the UK?

Question 4.3: Where 5G cells are deployed, are they expected to be individual cells or as clusters of cells required to give wider areas of contiguous coverage? What would be the area of a typical contiguous coverage cell cluster?

Question 4.4: What capacity and bandwidth (i.e Channel Bandwidth in MHz) would be required at each cell to meet initial capacity requirements? How will this change over time?

Question 4.5: What quality of service is required? How sensitive is the service being offered to variations in radio interference from other operator's 5G cells and other spectrum users?

Question 4.6: Will end users be fixed or mobile?

Question 4.7: What are the characteristics of 5G at 26 GHz which make this band particularly suited to the service you plan to deploy? What other spectrum bands could be used as an alternative, or in preference to, the 26 GHz band? To what extent could carrier aggregation and other techniques reduce your reliance on 26 GHz?

When providing information in relation to **question 4.1**, the FCS believes that actual examples would be the most helpful course. The FCS is careful to treat all the members' commercial activities as confidential. These case studies are as provided direct to the FCS by the end user seeking our assistance. Any future development of this activity with members is not provided here.

Case - July 2017 – Prestigious London Architect Company

In July this year, the IT Director of a prestigious Architect Consultancy based in London contacted the FCS with a request for the name and details of a member company that meet their new Disaster Control Policy[6].

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[5] Keep It Simple, Stupid

[6] The FCS treats all members equally at all times. Therefore, it is impossible for the FCS to provide a single recommendation. However, information on all members was sent. Progress from that point on is not noted here.

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In the light of the Grenfell Tower fire, the company had instigated a review of their existing policy and found it lacking. This (highly intelligent and competent) IT professional has performed some research and analysis and reached the conclusion that in their circumstances, a completely new approach was needed. The key features of the new requirement:

1. The over-arching aim is to have a system that will allow ALL staff in the affected location(s) to exit the building and reach safety in a timely fashion. The system must continue to work throughout the incident.
2. There can be no assumption of the existence of external dependencies such as the availability of mains power or land-line or mobile phone service etc. A self-sustaining private system is therefore required.
3. The Consultancy staff move around a lot and may be travelling internationally. Experience shows that it is virtually impossible to have a reliable record of exactly where all staff are at any one time. Therefore, the system must be so constructed that the warning will reach all persons in the affected building with an extremely high probability of success even though there is no way of knowing who the affected staff are.
4. The scheme should ensure that all facilities (including international premises such as the second Head Office in Shanghai) are similarly protected.
5. The system must be capable of expansion to any new office that is brought into existence, anywhere in the world if desired.
6. The disaster will be controlled by a senior manager who has been appointed to this role in addition to his regular duties.
7. The controller will have a "virtual control centre" available, irrespective of where he/she is in the world. From this control centre, it will be possible to ascertain that the warnings have gone out, that all the various stages of evacuation are completed in turn and exception warnings are provided. It is envisaged that all necessary facilities are provided within this virtual control-centre which would be hosted on the cloud[7].
8. In the event that the controller is not available, the entire package can be routed to a second-in-command etc.
9. Mobile radiocommunications via public networks appear to be unable to meet the high resilience requirements.

It is interesting to note that at this stage, the potential cost of such a system was less of a consideration.

The international communications through the system to and from the controller (who may not even be in any office, perhaps at an airport terminal) represent challenges to any system.

It is important to recall that this is definitely a Safety-Related service.

Case - August 2017 – Road Transport Logistics

The FCS was contacted in August this year to comment on an increasingly common application to have a fully integrated road transport logistics control suite. This would provide the necessary facilities to control not only the current progress of items identified by delivery information codes through the depots, but also on the road.

The enquiry was provoked by recent experience of holes in the coverage whereby location information was not transmitted and communications were lost even though the signal strength appeared adequate.

This concept arose with a need to improve cost lines and also differentiate the service above others. The Key features were described (in general terms) as follows:

1. A communications system that allows the tracking of the location of vehicles on every road everywhere in the UK and to permit communication with the driver.
2. Accompanying information on the items to include pictures of the article being delivered if required
3. Means to permit the customer to know where the vehicle was in relation to the delivery of their item. This feature was primarily targeted at B2B communications to other distributors rather than an end-consumer service.
4. On-board video surveillance to protect the vehicle and possibly even the driver.
5. The usual suite of other features for transport.

Clearly, the key question on this application was coverage in deep-rural locations. The service itself appeared to be Business-Critical and not more stringent. However, this is always a difficult assessment as there may well be situations where the use of the radiocommunications system is essential in a Safety-Related context (an accident perhaps or if the driver was attacked).

The enquiry in the context of 5G was in response to advice received from a different source that 5G coverage would be better than 4G. The FCS refrains from comment on that point.

Case – (Previously) - Security Guard Personal Safety

A security company wished to enhance the protection level given to their staff while on patrol in industrial premises. The key new requirement was a Safety-Related enhancement of their existing portfolio of services whereby a guard on patrol would be able to have the surveillance camera feed piped to their mobile terminal so that the guard would have a fully up-to-date view of what was happening and thus be able to make a much better-informed assessment whether to engage or hold-off.

Obviously, this enhancement is a major change and probably required a new system.

From a technology perspective, none of the above uses appeared to need extremely high data rates. LTE would appear to suffice.

In relation to **question 4.2**, these professional services will be used anywhere and everywhere even in locations of extremely low population density. Unlike consumer use which may be heavily concentrated around population groupings, professional communications may be at industrial areas outside towns or even on remote hill tops etc. Thus, the financial justification for the creation of infrastructure may follow different logic.

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[7] The resilience limitations of cloud solutions were recognised. However, some degree of mitigation may be achievable.

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But, as in the case of the London Architect consultancy, the use of such critical mobile communications within the office or other indoor location is a major consideration. Current systems are addressed in a number of ways. Traditionally, the service is achieved to the desired resilience using a down-fire antenna on the roof. However, there are a number of disadvantages to such an approach in the broadband world. It may be preferable to use another current practice in use today of a distributed antenna arrangement at each floor. There are a number of ways this can be accomplished. Of course, the extremely low range necessary (a few metres) for these distributed systems fits nicely with the Broadband Access at 26GHz. Of course, the individual infrastructure elements must also be fitted to meet the requirements for resilience.

For **question 4.3** the FCS notes that the amount of infrastructure deployed may be a function of the resilience desired as well as the more normal traffic capacity considerations. The FCS makes further comments on opportunities for efficiency gains in relation to questions 5.

Question 4.4 seeks information on capacity. UK professional communications does not currently include entertainment in large amounts. The FCS does not expect this to change significantly for the foreseeable future. Therefore, the estimations for the growth of data traffic put forward by consumer-facing entities probably are not a good indication of future data growth in the professional sector.

However, the sector's current practice of placing data services on public networks is relevant. This practice is one of current necessity. Were a Mission-Critical data service to become available, it could be that today's services hosted on the public networks may seek the opportunity to migrate onto the more resilient services.

Even so, the FCS expects that to be an evolutionary shift rather than any form of revolution. One factor could change that. This is if a change in legislation occurs that places focus on the fact that compliance today to certain H&S legislation is achieved by current practice because there is no obvious alternative. However, were new schemes to become available that did offer an improved Safety-Related solution, some users may feel obliged to migrate. However, even then, the FCS expects that a transitional period of some years would be available.

Question 4.5 is a matter of genuine concern to the FCS. With the number of transmitters increasing in response to the reduced range, the control of interference becomes that much more acute.

The FCS notes that broadband systems working at high data rates may well emit high side-band noise levels. This could lead to serious inefficiencies that also deteriorate the overall benefits of the services.

This effect is also present with LTE which exhibits similar effects[8].

In relation to interference, the FCS urges Ofcom to prioritise management mechanisms that control the location of transmitters.

For **questions 4.6 & 4.7,** the FCS believes both fixed and mobile applications will have their place. However, the relatively short range achievable at 26GHz will certainly impact the suitable deployments. We would expect that indoor schemes would be favoured, at least initially, for the professional sector. This is because of coverage holes and the cost of infrastructure to fill them in wider area systems.

Questions 5

> Question 5.1: Should Ofcom consider licencing options other than the 3 examples set out above (licence exempt, shared coordinated and area defined) for the 26 GHz band? If so, what other options do you consider should be included?
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> Question 5.2: What methodologies could be used to pre-define 'high demand areas' for area defined licences?
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> Question 5.3: What mechanism could be used to coordinate cell deployments by different operators in shared spectrum?
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> Question 5.4: What methodologies could be used for determining the proportion of spectrum to allocate using area defined licences and coordinated deployment?
>
> Question 5.5: Do you agree that the 26 GHz band should be released progressively? What risks do you envisage with such an approach and how can these be best mitigated?

The FCS believes that the five questions on section five are, for the purposes of professional data communications, facets of the same issue. Accordingly, we would make our contribution in the form of a suggestion.

In consideration that:

1. The FCS believes that resilient data communications will increase in importance to customers who depend on their professional radiocommunications (BR) over the next few years.
2. There are at least some applications where 26GHz may be suitable for these uses
3. The FCS membership is not set on any particular technology at this time for the implementation of these new services. Indeed, in consideration of the resilience requirements, it may prove necessary for the Business Radio sector to invent its own (as recently happened for digital voice).

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[8] It is noted that it emerged in the recent work done in CEPT (FM54) that the deployment of CDMA at 450MHz is seriously problematic for reasons of sideband noise. The opportunity appeared to be limited to the establishment of a monopoly in the range 450-470MHz even if the entire band was otherwise cleared. See LTE 450, Ovum, LTE 450 Global Seminar, September 2014, Page 3.

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4. We would prefer an approach that allows the "pick-up" of as much existing technology as possible to take advantage of scale economies wherever possible
5. That for many professional users (especially those with formal obligations), having control of their communications is a prerequisite.
6. That high levels of resilience are already a necessity.
7. The FCS wonders if reliance on public communications as happens today may diminish as the perceived service deteriorates (or is thought to be deteriorating) as consumer demand further outstrip capacity
8. The short-term cost advantage of OPEX models for communications over CAPEX comes under greater scrutiny as pricing changes to recover margins as consumer data demand increasingly out-strips capacity, resulting in further infrastructure investments (that have to be recovered).

The FCS is lead to the conclusion that having controllable access to the 26GHz band for future data needs is highly desirable.

In addition, the FCS further notes the failure of radio spectrum assignment strategies that use market mechanisms to guarantee adequate geographical coverage for many users. Areas of the UK that are considered to not have sufficient business to justify the deployment of coverage under the existing business plan of the licence-holder, may forever remain excluded from the services. The number of such instances could well be even greater for 5G capability when supported by low range systems resulting from the millimetric frequencies that are contemplated for 5GHz in this Call for Input. In the case of important projects such as rural broadband coverage, the deployment of rural schemes based on radio spectrum made available through a Geo-Location database may provide an opportunity for success that might not otherwise exist and so be of benefit to the UK overall.

In conclusion, the FCS proposes that consideration is given to a spectrum management assignment scheme working dynamically through a Geo-Location Database. By this means, professional users could gain access to the necessary radio spectrum when and where they need it. Thus, part, or all of the band, could become a shared resource, each user being allocated an amount of radio spectrum for their exclusive use at the time and place they need to use it. This must surely be a more efficient way forward than any scheme whereby a licence is assigned to a successful bidder who may never deploy service in certain locations.

Furthermore, that the deployable technology should not be limited to a particular choice (as GSM was for example) but to any compatible technology.

Final Note

The FCS notes that broadband data systems have less stringent side-lobe specification limits than narrowband schemes. This may seriously impact the amount of service that can be carried in any radio spectrum band because users cannot be packed as densely into the radio spectrum and into the field.

This is an inevitable consequence unless regulations are in place that improve sidelobe performance (addition of filters on the transmitter and receiver etc.). These strategies could significantly affect the unit price to the end customer.

Taking into account that it isn't always easy for end users who deploy this apparatus to know where the near neighbours are and what channel they are using, there may be significant loss of efficiency due to Harmful Interference.

The FCS therefore suggests that even though Licence exemption has been proposed for some parts of the 5G bands, a strategy of Light Licensing may prove better for the UK in the long run.

Annex - Resilience

The FCS has become increasingly aware that the subject of resilience in radiocommunications is less-well understood than it previously was. We would say worryingly-so in some cases.

Furthermore, some users have become vulnerable to unsubstantiated claims made in relation to resilience. This is believed to be potentially dangerous in consideration of the nature of the operations these professional radiocommunications support and even enable.

To combat this, the FCS is creating a 5-Level Scheme to quantify resilience and which will facilitate useful discussions with end-users on each of the facets of Resilience and what the impacts of each could be.

The 5-Level Scheme establishes scores between 1 and 5 in each of the following categories:
- Infrastructure Location
- Physical Security
- Power Continuity
- Lightning / Power Surges
- Site Installation / Wiring
- Equipment Reliability
- OTA[9] Modulation / Protocol
- Points of Failure
- Control over System
- Cyber Security
- Radio Interference Hazard
- Maintenance / Repair Schedules
- Calculated Availability

and
- Over-Loading

Thus, end users have the opportunity to consider each of these facets and decide which ones are most appropriate to them.

For example, in the case of the Architect Company, they obviously want extremely high availability but, because they are primarily interested in occasional (Safety-Related) use, they may not need extraordinary efforts to have high scores on regular maintenance. A regular check of correct functioning may suffice.

By this means, users may tailor their requirements to their needs without incurring excess cost.

Readers are asked to particularly note that the Protocol is only one facet of achieving a resilient solution and not the most important one at that.

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[9] Over The Air

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