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To : RSPG
Date : March 25th 2021
Subj. : 3 consultations March '21 on RSPP, spectrum sharing and spectrum needs

LS,

the below is a submission to RSPG on the current 3 consultations on spectrum plans and spectrum requirements. It particularly articulates the rapidly rising demand for private wireless networks in critical business environments and the associated spectrum demand. It reflects the profound opinions of a consultancy firm active in private wireless networks for years and also relates to a mail exchange we've had with Frank Kruger and Bo Andersson after the October '20 workshop on spectrum requirements.

0. Summary

This input aims at articulating the demand of private sectors and verticals for spectrum and highlights a couple of recent developments in representation of these users that require attention. This input also explains why the demand from verticals hasn't been very visible yet to RSPG but will soon be and how the RSPG can liaise to the industry verticals and their spectrum demand with the aim of strengthening the development of viable future proof industries in Europe. There are some reasons for the demand from verticals not having been manifest yet that we would like the RSPG to be aware of and receptive to; one thereof definitely being the dominance of MNO's in the portfolio of every vendor, provider or association. In response to the consultation, we also articulate some obvious, overriding requirements on spectrum for critical private and local networks that will apply whatever bands are made available. We also point at an emerging new role in the value chain, that again has everything to do with spectrum availability.

1. Preamble and Credentials

ULWIMO has been consultant for private wireless networks for a decade; notably for in building wireless networks and private wireless networks for verticals. In that capacity, Ulwimo already presented once for the RSPG on spectrum and verticals, in 2018; when the TCCA published a white paper[1] on operator roles for critical wireless services that we were one of the authors of.
Ulwimo was instrumental in the establishing of KMBG; the Dutch association of business critical users of wireless networks and spectrum. Recently Ulwimo is involved in the aggregation of user associations in Netherlands (KMBG), Germany (5GACIA), France (Agurre) and cooperates with the American OnGo alliance.

[1] TCCA white paper:
https://tcca.info/documents/2018-may_critical_communications_mobile_network_operators.pdf

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In 2020 Ulwimo published an article[2] on private wireless developments in the EU and Benelux and held a presentation on the subject at the Cambridge Wireless International Conference.
Over 2019 and 2020 Ulwimo provided interim portfolio development and marketing for pan European neutral host company Cellnex.

Due to its specialisation on the niche as illustrated, Ulwimo considers itself a credible spokes channel for the sector.

2. Links of consultations to private wireless domain and representation of 'verticals'

2.1. Representation of verticals and private wireless

Although we work with many reputed players and associations – some mentioned above – we deliberately chose to submit this response on our own behalf. The reason is for us to be able to speak/write openly without hesitations or restrictions due to large vested commercial interests. It is our opinion that not all relevant input reaches the RSPG due to 'conflicts of interests' amongst large suppliers and associations alike. In our neutral and independent role we'd like to provide that comprehensive view

2.2. Links and referrals consultations to private wireless spectrum

When reading all three consultations from RSPG, we see adequate reference to the issues concerning private wireless networks and (shared) spectrum for private wireless.

<u>The consultation on the RSPP</u> mentions a lot of things that are tightly related – but not identical - to private networks and verticals. Even though the language is at a higher abstraction level still there is mention of

- "multi-tiered spectrum access approaches" which is clearly what for instance CBRS already does for verticals,
- "third party operators" which is Neutral Hosting and (the likes of) Cellnex in the EU or the Neutral Hosts under CBRS.
- "light licencing based on automated platforms", which sounds like the SAS mechanism under CBRS, again for verticals

So we do see room to tie in to the document and ask for/promote/position private networks and spectrum for verticals and we see references to 'CBRS-like' mechanisms that have proven successful in the USA for private wireless markets .

[2] Article in Radio Resource International:
[Draft article RCRwireless private networks Benelux (cellnextelecom.nl)](cellnextelecom.nl)

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The consultation on spectrum sharing mentions many of the terms related to private spectrum and networks; though most indications are indirect and again point at CBRS-like mechanisms:

- "LSA using databases", "geolocation databases", "spectrum authorisation automated from a database"…. Which all points at mechanisms like SAS under CBRS
- "multi tier sharing" which equals CBRS
- "new entrants" in addition to incumbents which is Neutral Hosts.
- the most obvious anchor: 1.1-8: "MS should consider sharing solutions that may help *vertical industries* and other spectrum users to access spectrum on a mutually beneficial basis"

So again plenty of anchor points to tie the below visions on private spectrum and -networks to…

The consultation on additional spectrum and future wireless contains one dramatic conclusion from the questionnaire held:
"low interest in dedicated spectrum expressed by verticals"

This is dramatic in itself and unfortunately true till now and when observed shallowly. We will though use this consultation to positively express that interest and indicate remedies for that (lack of) articulation.

3. Emerging market for private wireless

It is only very recently that the market has seen a rapid increase in the deployment of private wireless networks and geographically confined shared access networks. Apart form exceptions like the Netherlands where 5 MHz of 1800 MHz 'guard band' spectrum has been available for long and lead to over 500 (!) systems[3] already, most countries have only liberated spectrum for private networks recently. Such spectrum availability immediately leads to a rapid development of demand, supply, eco system, players and market dynamics. The best European example is 5GACIA and its number of impressive industrial members and many deliverables; all of which has seen the light only since 2018 when 5GACIA was formed. The best known overseas example is of course CBRS, where shared spectrum availability has led to a nationwide auctioning mechanisms, various access levels and wide deployment of spectrum for industry, FWA and local operators. The fact that the CBRS – now OnGo – alliance is expanding internationally as the spokes channel for shared spectrum and private wireless networks says a lot about the success of it.

Availability of shared spectrum for such private networks is key to the development of industry 4.0, robotics, IoT and may more innovative applications for European industries. Europe cannot afford to fall behind; already the list of top 20 IT industries is dominated by Chinese and American companies rather that European ones…

[3] Number by the ministry

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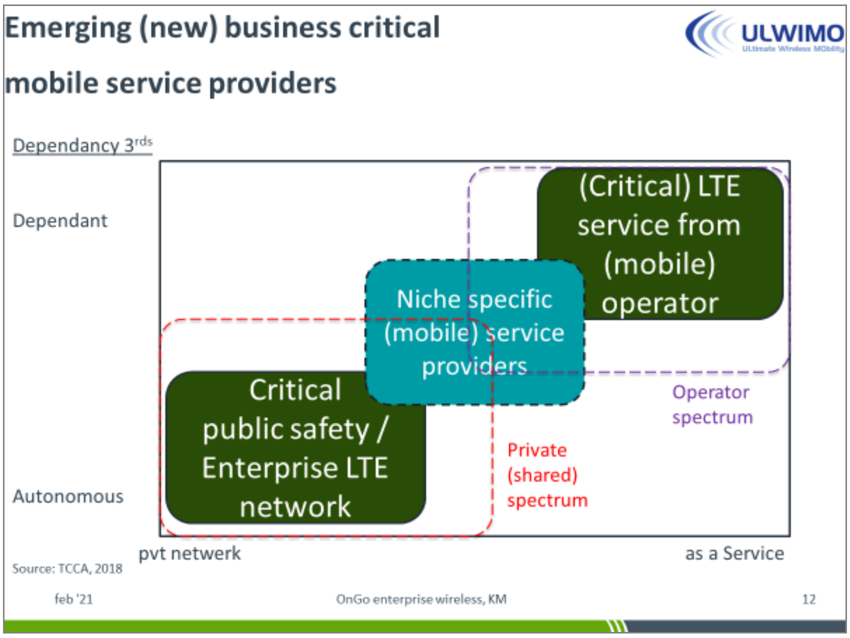
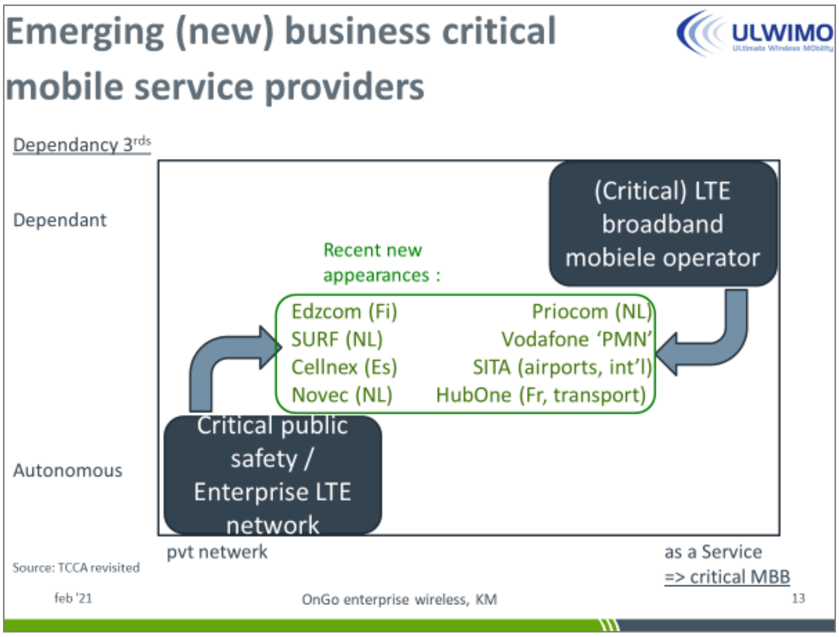
In the TCCA 2018 white paper that we already mentioned and that Ulwimo was co-author of; we already identified the caveat between two basic options for a private wireless network or service: either a classical physical network purchased from a vendor or a wireless service obtained from an MNO. The 'niche specific mobile service provider' is that envisaged new entrant! :



The picture also illustrates where what spectrum fits in; entirely in line with your consultation. Now; the picture also allows us to position the recent emergence of novel players and niche specific service providers that fit 'in between' the identified two basic flavours of mobile networks & services:



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This image has no pretence to be complete; merely an illustration of how new actors emerge and fill the void.

Needless to say that most of this can only happen provided shared local spectrum is available! It isn't a coincidence that most of these recent emergences have occurred in countries with a spectrum allocation for verticals (: Netherlands, UK, Germany, France) though often different allocations. This proves that spectrum availability does indeed 'do its job': entice innovation and new services.

4. Visibility of the demand for spectrum amongst verticals

In your consultation there is the alarming notion that there is

"low interest in dedicated spectrum expressed by verticals"

This is a tragic conclusion; yet not entire untrue as we witnessed in the October workshop on the RSPP where no less than 12(incumbent) spectrum users took the stage but not industries:

This was the starting point of our mail exchanges with Kruger and Andersson. On the one hand, verticals should take the responsibility for this lack of visibility of their own spectrum requirements (that do exist as articulated under item 3). On the other had there are sound reasons why this articulation of their quest for spectrum is behind that of other sectors! Allow us to explain:

4.1. Double fragmentation

First of all; please do realise that the verticals are vastly dispersed and fragmented; as opposed to spectrum user such as MNO's of which there are 3 per country and typically well organised. Verticals are vastly different, fragmented, scattered and ill organised when it comes to spectrum.

Verticals suffer from 'double fragmentation':

- First there is fragmentation amongst verticals: petrochemical industry, ports and airports, manufacture, warehousing and logistics; they are all very distant sectors and not organised to collectively act on for instance spectrum matters

- Secondly, even within a vertical there is fragmentation. (hence 'double fragmentation'). A vertical like petrochemical has many constituents, like Shell, BASF, Dow and many others.

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They may be a bit better organised withing their sector but still not accustomed to jointly act on spectrum matters.

Hence, we defend the notion of double fragmentation. Nonetheless things are happening ! Associations of critical users of wireless and spectrum have emerged and are aggregating their demand and collectively representing industries:

Comparable associations of critical mobile broadband users !

country	association	focus
	KMBG: Kritisch Mobiel Breedband Gebruikers	Public Safety, infrastructure and large industry verticals
	5G ACIA: 5G Alliance for Connected Industry and Automation	Predominantly manufacture and plant automation
	AGURRE (Association des Grandes Utilisateurs de Radio Resources d'Entreprises)	Public Safety, airports and large nationwide verticals (EdF etc)
	Tech UK **SPF**, spectrum policy forum	*Any* vertical with a stake in spectrum issues
TCCA	**TCCA**; The Critical Communication Association	Mission and business critical worldwide
	CBRS/OnGo alliance	Complete eco system of users, operators and vendors under CBRS regime

OnGo enterprise wireless, KM 12

Then again they are often young and still 'finding their way' as opposed to for instance MNO's or defence who have been around for decades.

So, for the RSPG we'd like to point at enticing the verticals and their bodies and associations; soliciting their input and opinions maybe more proactively and allowing some leeway for the developing collective representation.

4.2. Hesitation to express themselves due to vested interests

The other reason why you may not have heard yet of the verticals' demand for spectrum or found them to be 'vocal' on spectrum needs is an understandable yet prohibitive vested interest with a large and dominant client group… the MNO's. I know from experience with suppliers, service providers and associations as mentioned that almost always there is the hesitation to explicitly articulate the demand for private spectrum; as their members or clients are often MNO's. MNO's typically find private spectrum and shared access counter to their interests and perceive private on premises networks as their market, which they can serve out of exclusive and actioned spectrum. If

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you are a vendor whose turnover depends on MNO's for a very large part; you are less likely to speak up in shared private spectrum matters. I know from experience and conversations this hesitation exists and I have literally heard this very hesitation from
- vendors that also sell to MNO's
- user associations that MNO's are also members of
- service providers who also rent infrastructure out to MNO's

which is very concerning because the necessary input does not reach you, RSPG ! This is the reason for us to submit to you on our own account: so we can bring this ambiguity to your attention!

4.3. Nascent expression of verticals' spectrum needs

The fact that spectrum demand hasn't been well expressed up till now should not be mistaken for a sign of such demand not existing.
Nonetheless, you will most probably receive input on the consultation this time from at least two of the associations we mentioned above and a large service provider, all on spectrum for verticals. This is due to intensive lobbying by amongst others us; in order for verticals' representatives to abandon their shyness.
Here too, RSPG may be more proactive in 'making' verticals express their demand; for instance through one on one encounters, presentations like the one we ourselves gave for RSPG in 2018, etc. Settings other than having to put their spectrum requirements on paper bluntly and openly may help verticals to articulate so and get more proficient in expressing their demand for private spectrum whilst still respecting the position of their large customers, MNO's.

5. Spectrum requirements of verticals

Now let's dwell on the concrete questions you pose notably in the 'spectrum needs and future wireless broadband' consultation. The needs of verticals are generally of a higher abstraction level than articulated spectrum bands and propagation properties of frequency bands. Verticals' requirements are centred around tangible performance aspects:

- **Throughput** and attainable DL and UL; which translates into bandwidth available

- **KPI's** such as latency, jitter, density of devices, again throughput, continuity of the service. All of these KPI's translate into bands and spectrum, however it will be up to the service provider, integrator or neutral host to make that translation. Verticals aren't likely to have the expertise to express spectrum needs as specific as designated bands .

- **Eco system** of equipment and devices. In the private wireless domain, there is an abundance of EPC and EnodeB suppliers; many more than the few global players that serve the MNO market. A recent study by RealWirless (UK) revealed the plethora of actors in the private wireless domain. These players though, often smaller and dedicated to niches, do not develop all the features that

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a macro network equipment is likely to have, notably SDR capabilities that allow a radio to work in a multitude of bands .

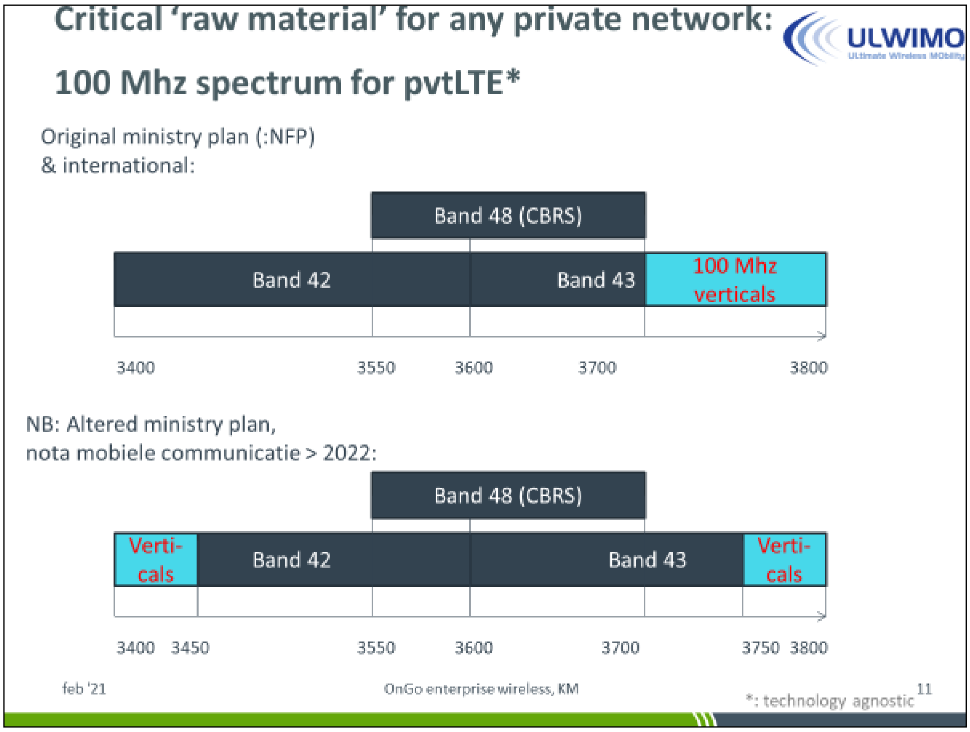
- Radio's for private networks inherently have to affordable; thus, typically, these radio's are developed for designated bands and aren't reconfigurable; which implies they have to be developed for assigned bands for private wireless.
- This in turn implies that there needs to be some harmonisation between bands and countries in order for the industry to develop equipment at all. CBRS in the USA has demonstrated what harmonisation can do for market acceleration

- **Service formats**; these range from establishing one's own network (Capex) to having a 3rd party manage a sourced network (managed service) to a full service model (Opex) with the investment being borne by the service provider or neutral host. This too translates into spectrum requirements such as longevity of a band or eco system of available equipment.

This being the case, there is an eminent role for the 'in between' players that were depicted in the graphic in par. 3: the service provider or neutral host will have to translate the required KPI's into spectrum and equipment. The radio knowledge is likely to be with that provider rather than the enterprise. As elaborated in par. 3 these knowledgeable novel players are now rapidly emerging.

The above overriding requirements also call for international harmonisation. There seems to be some consensus around 3.6 – 3.8 MHz and 3.8 – 4.2 MHz bands as deployed in Germany, Sweden, UK and partially Netherlands. These are also bands for which eco system exists or emerges due to large nationwide networks in those bands.

With this need for harmonisation in mind; the latest move from the Dutch policy makers looks contradictory… The Netherlands had 100 MHz private spectrum in band 43, yet will as off 2022 assign 2 portions of 50 MHz at the far ends of bands 42 and 43 instead:



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This in turn conflicts with the above bullets, notably with KPI's and with eco system. In the light of harmonisation, this is a move in the opposite direction and fiercely contested by the stakeholders in the Netherlands. Clearly, RSPG and coordination have a role to play here.

6. Conclusion on spectrum demand amongst verticals

To conclude, we express our conviction that the sought demand for shared spectrum for verticals is definitely there yet needs some time, leeway and proactively interrogating for it to become manifest at an early enough stage in the RSPP process. We know from our vast experience that the demand is there and we have demonstrated how availability of private shared spectrum has inherently enticed new offerings, innovations and markets and even new actors. We strongly defend that the fact that '*spectrum demand has not been visible to RSPG yet'* should not keep RSPG from proactively enticing such inputs, soliciting such inputs from novel bodies and associations and taking that demand into its considerations; together with that of other and more established sectors.

We off course, would be happy to interact with or present to RSPG on the requirements for verticals' spectrum at stake here and we can offer to do so either ourselves or with or on behalf of many of the mentioned associations that we work with. Logically, when talking/presenting with- or on behalf of any of the associations or companies mentioned in par.1; we have to adhere to their agenda and commercial interests and may speak less freely

We look forward to the next RSPP, confident it will contain more manifest spectrum for verticals.

Koen Mioulet
Director