CEPT regulation for the 3.8-4.2 GHz band

- Progress status and debated topics -

Theo Spathopoulos
Senior Specialist Spectrum Standardisation

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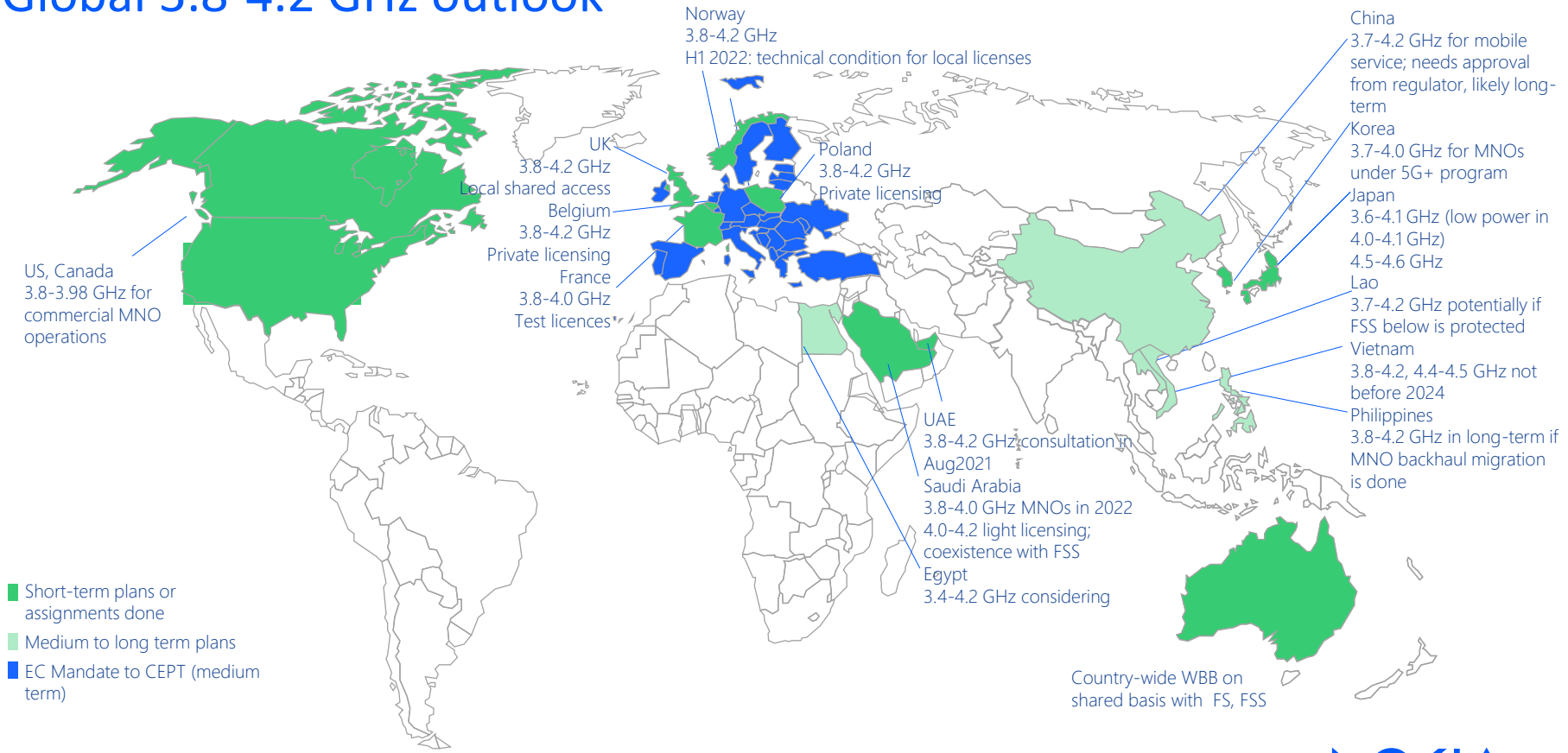
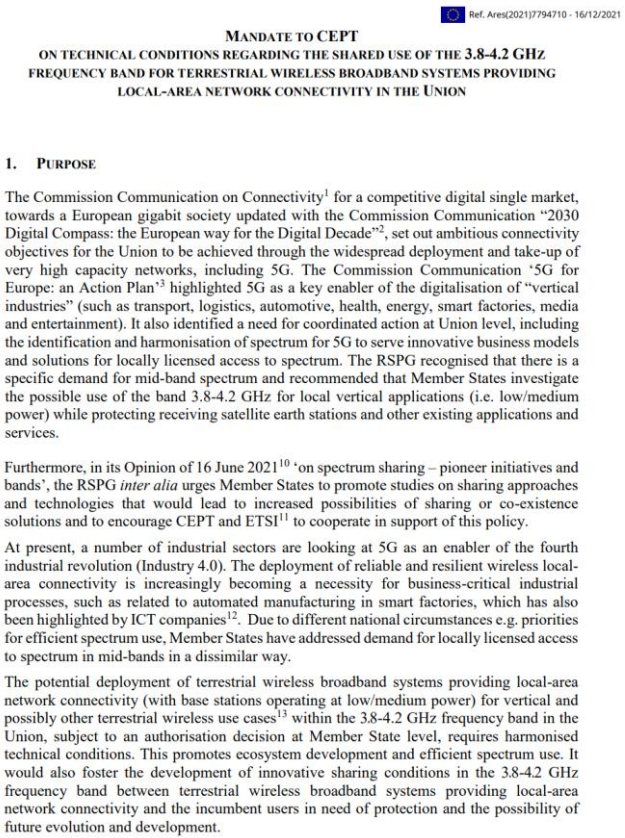
Global 3.8-4.2 GHz outlook



European Mandate



Ref. Ares(2021)7794710 - 16/12/2021

MANDATE TO CEPT
ON TECHNICAL CONDITIONS REGARDING THE SHARED USE OF THE 3.8-4.2 GHZ FREQUENCY BAND FOR TERRESTRIAL WIRELESS BROADBAND SYSTEMS PROVIDING LOCAL-AREA NETWORK CONNECTIVITY IN THE UNION

1. PURPOSE

The Commission Communication on Connectivity[1] for a competitive digital single market, towards a European gigabit society updated with the Commission Communication "2030 Digital Compass: the European way for the Digital Decade"[2], set out ambitious connectivity objectives for the Union to be achieved through the widespread deployment and take-up of very high capacity networks, including 5G. The Commission Communication '5G for Europe: an Action Plan'[3] highlighted 5G as a key enabler of the digitalisation of "vertical industries" (such as transport, logistics, automotive, health, energy, smart factories, media and entertainment). It also identified a need for coordinated action at Union level, including the identification and harmonisation of spectrum for 5G to serve innovative business models and solutions for locally licensed access to spectrum. The RSPG recognised that there is a specific demand for mid-band spectrum and recommended that Member States investigate the possible use of the band 3.8-4.2 GHz for local vertical applications (i.e. low/medium power) while protecting receiving satellite earth stations and other existing applications and services.

Furthermore, in its Opinion of 16 June 2021[10] 'on spectrum sharing – pioneer initiatives and bands', the RSPG *inter alia* urges Member States to promote studies on sharing approaches and technologies that would lead to increased possibilities of sharing or co-existence solutions and to encourage CEPT and ETSI[11] to cooperate in support of this policy.

At present, a number of industrial sectors are looking at 5G as an enabler of the fourth industrial revolution (Industry 4.0). The deployment of reliable and resilient wireless local-area connectivity is increasingly becoming a necessity for business-critical industrial processes, such as related to automated manufacturing in smart factories, which has also been highlighted by ICT companies[12]. Due to different national circumstances e.g. priorities for efficient spectrum use, Member States have addressed demand for locally licensed access to spectrum in mid-bands in a dissimilar way.

The potential deployment of terrestrial wireless broadband systems providing local-area network connectivity (with base stations operating at low/medium power) for vertical and possibly other terrestrial wireless use cases[13] within the 3.8-4.2 GHz frequency band in the Union, subject to an authorisation decision at Member State level, requires harmonised technical conditions. This promotes ecosystem development and efficient spectrum use. It would also foster the development of innovative sharing conditions in the 3.8-4.2 GHz frequency band between terrestrial wireless broadband systems providing local-area network connectivity and the incumbent users in need of protection and the possibility of future evolution and development.

The European Commission's Mandate to evaluate the feasibility and the shared use of 3.8-4.2 GHz band by terrestrial wireless broadband systems providing local area network connectivity – issued in Dec2021

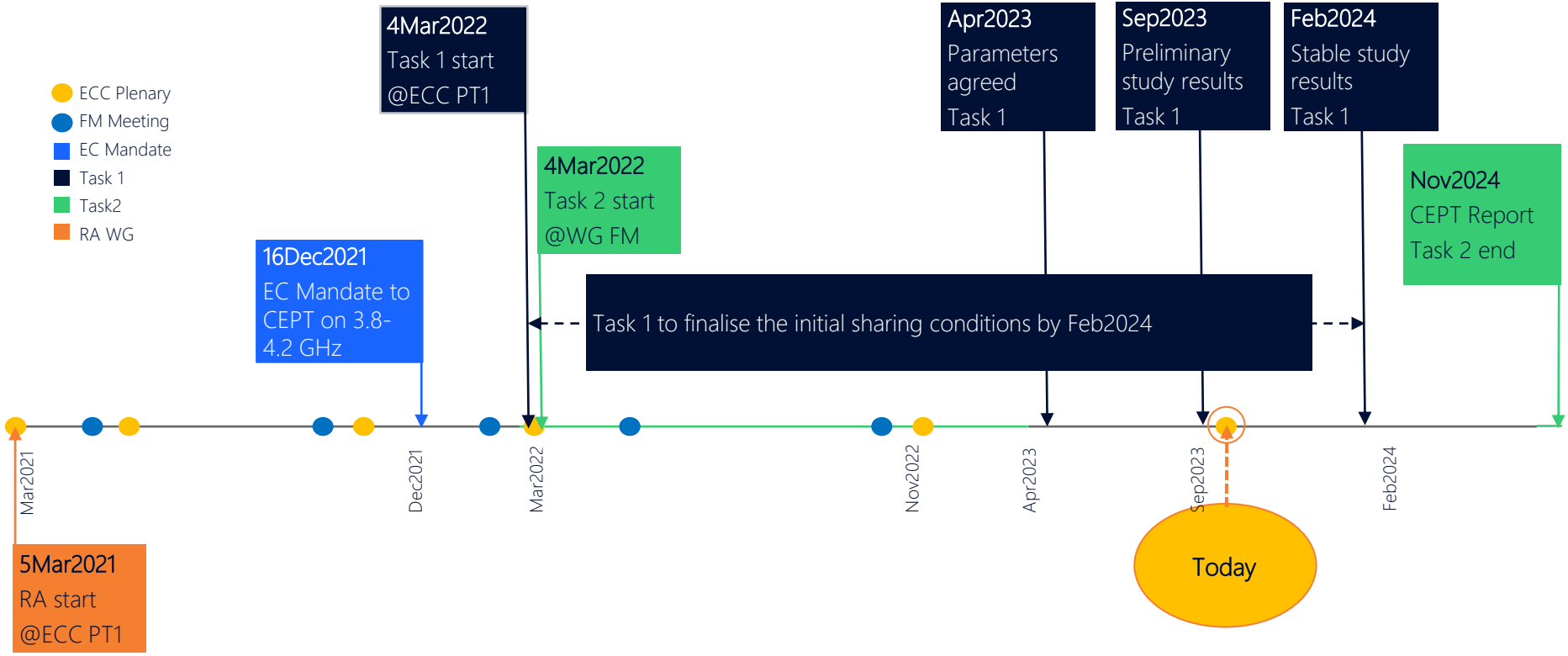
Two Tasks under the EC mandate:

- Task 1: Feasibility and sharing studies on the shared use of the band -> PT1
- Task 2: Harmonised technical conditions for the shared use of the band -> FM60

Technical conditions should consider sharing solutions, including innovative features for:

- Protection and future evolution of incumbents (FSS, FL)
- Coexistence with 5G in 3.4-3.8GHz and radio altimeters in 4.2-4.4 GHz

CEPT timeline



Latest status update in CEPT

Parameters for studies have been agreed and initial set of studies has been submitted and preliminary approved

Local Area Licences, referred to as WBB LMPs (Wireless BroadBand Low Medium Power services)

Parameters for studies of WBB LMPs primarily based on the UK SAL framework with an incremental approach being adopted which as a first step includes:

Incremental parameters for Medium Power consideration

- Deployment areas: Rural, Suburban, Urban
- Max EIRP: 51dBm/100MHz

Current plan to develop

- An ECC Report based on the submitted studies analysing coexistence feasibility
- An ECC Recommendation which will be used as a guidance for administrations regarding authorization and coordination among WBB LMPs and incumbent services

Some of the most debated topics in CEPT regulatory discussions

Issues with using max EIRP for AAS Medium Power BS

Currently discussed max EIRP power for Medium Power BS is 51dBm/100MHz.

While in theory AAS antennas are considered as part of the 3.8-4.2 GHz Medium Power licences, the current power levels, specified as EIRP, are still not suitable for AAS antennas, the regulation of which is based on TRP.

ETSI TS 138 104

The BS *rated carrier TRP output power* for *BS type 1-O* shall be within limits as specified in table 9.3.1-1.

Table 9.3.1-1: BS *rated carrier TRP output power* limits for *BS type 1-O*

BS class	$P_{rated,c,TRP}$
Wide Area BS	(note)
Medium Range BS	≤ + 47 dBm
Local Area BS	≤ + 33 dBm
NOTE: There is no upper limit for the $P_{rated,c,TRP}$ of the Wide Area Base Station.	

Max EIRP	*AAS configurations*	*Antenna gain*	*Approx. TRP*
51 dBm/100MHz	4x4 elements	18.5 dBi	32.5
	4x8 elements	21.5 dBi	29.5
	8x8 elements	24.5 dBi	26.5
Note: For the sake of simplicity, assuming an AAS Ohmic loss of 0 dB, provided the current EIRP limits, we get the above TRP and antenna gain values.			

Even with the updated EIRP of 51dBm/100MHz for Medium Power BS, the actual AAS TRP levels, based on AAS representative antenna gains, are of the Low Power range !

So, do the levels of the existing framework in the UK and framework under development in CEPT really allow Medium Power AAS operation?

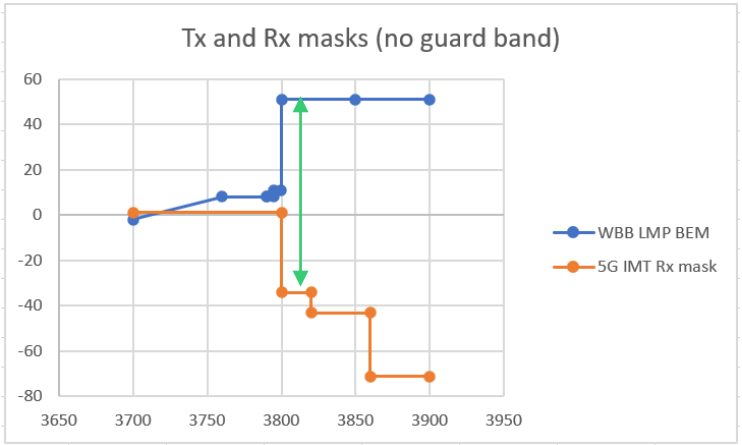
Issues with EIRP based AAS BEM for unwanted emissions

BEM element	Frequency range	Max AAS TRP limit Medium Power BS as per current EIRP mask assuming EIRP=51dBm/100MHz and 21.5 dBi gain (4x8) assuming fully correlated elements	Max AAS TRP limit Low Power BS as per 3GPP UE
Transitional region	-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	-10.5 dBm/ 5 MHz	-7 dBm/5 MHz
Transitional region	-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	-13.5 dBm/ 5 MHz	-11 dBm/5 MHz
Baseline	Below -10 MHz offset from lower block edge. Above 10 MHz offset from upper block edge. Within operating band	-13.5 dBm/ 5 MHz	-11 dBm/5 MHz

- TRP unwanted emission levels of Medium Power BS, based on the proposed EIRP BEM, are lower than the TRP BEM for Low Power BS specified in ETSI.
- Vendors' proposed BEM for AAS medium Power (based on TRP<= 40dBm)
- Question remains, does the current UK framework and the framework under development in CEPT really allow Medium Power BS?
- Ofcom recognized that additional filtering may not be feasible for AAS and considered that "*further engagement with stakeholders is necessary before we consider any amendments to the technical conditions to further facilitate AAS in the 3.8-4.2 GHz band*"

Discussions on potential guard-band at 3.8 GHz for fully unsynchronised operation

Some studies indicate the potential need for guardband for unsynchronized WBB LMPs to ensure protection of 5G public services below 3.8 GHz. The justification of such need is based on the fact that blocking i.e., interference due to 5G IMT Rx mask is the limiting factor.



Ofcom’s unsynchronised operation

Ofcom in the UK SAL framework, hasn’t identified need for such high guardband in unsynchronized operation and considered a 100m separation being enough to mitigate potential interference due to unsynchronized operation since:

- Equipment performance can be 5-10 dB better than the standards
- Already accounted the effect of a 5MHz guardband at the top and the bottom of the 3.8-4.2 GHz band

Frame Structure A

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

Frame Structure B

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
Any	D	S	U							

Frame structure under UK’s SAL framework for unsynchronized operation is a form of the semi-synchronized frame structure (i.e., not fully unsynchronized).

Studies based on semi-synchronized operation submitted in PT1 suggest that separation distances to protect 5G public services can be significantly reduced when using a semi-synchronized frame structure compared to fully unsynchronized frame structure, with the condition that WBB LMP services should be open in the potential of experiencing some degree of potential interference from 5G public services if deployed close to a 5G BS.

Discussions on the semi-synchronized approach still ongoing to identify whether there is indeed a need for additional restrictions in unwanted emissions or the potential need for guardband.

Suggestions - Recommendations

- Studies has shown that coexistence is improved when using AAS antennas compared to non-AAS antennas, thus suitable technical conditions for the use of AAS should be developed.
- Consider, as an additional option, the potential of authorising higher power for a single Low Power BS as an alternative to multiple Low Power BS within 50m radius. (i.e., a single Low Power BS with 4x max EIRP rather than 4 Low Power BS with max EIRP)
- Possible consideration of a semi-synchronisation frame structure in addition to the existing synchronised and unsynchronised could provide additional benefits and flexibility. In the potential of interference, if the involved parties do not agree on interference mitigation, a synchronised frame structure should be imposed.
- New shared access licence coordination should be made considering as realistic parameters as possible.
- Need for opportunistic/temporary access to spectrum does not seem to reflect the needs of the majority of use-cases, thus instead of considering techniques for dynamic access to spectrum, maybe it would be more valuable to improve existing tools (i.e., Ofcom's spectrum portal) providing more information on spectrum/location availability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