Nokia response to Discussion document

” Technical Arrangements of the 3.5 GHz Band”

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Nokia welcomes the opportunity to share its’ views with respect to this very important discussion document on 5G spectrum in 3.5GHz band and the technical arrangements around it.

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Question 1: Do you agree with the proposed rules of co-existence and the process of change?

For successful 5G roll-out, the MNOs should be able to introduce new 5G NR BTSs on 3.5GHz band anywhere without delay. Also, MNOs should be in control of changing the frame configuration anytime if they mutually agree to do so.

If there are other systems on the same band, they must be able to adopt the timing and frame structure as agreed and adapt to any changes to those in future or they will require guard band and specific filters.

Question 2: Do you have any additional comments about the process?

Common synchronization and frame structure in 5G TDD network are key for network performance. Common frame structure eliminates the need of guard band between operators and thus maximize the utilisation of spectrum. In Nokia's view, this is critical.

Question 3: Do you agree with the proposed frame structure?

DDDDDDDSUU (5ms) frame configuration is adopted by UK and Australia as they need to synchronise with Existing TD LTE networks. China adopted frame configuration DDDSUDDSUU (5ms) to support long PRACH formats and South Korea adopted DDDSU (2.5ms) frame configuration.

In South Korea DDDSU works well due to high site density and no requirement for large cell range. Downsides of DDDSU frame configuration are:

1. somewhat restricted UL capacity
2. a single UL slot duration is 0.5ms and only allows short random-access channel (RACH) formats. Theoretically some short RACH formats allow few kilometers cell range, but the practical cell radius can be less than 1km with moderate root sequences and cyclic shift re-use.

This range limitation can be a problem for rural broadband applications as well as for sites near the coast.

An alternative frame structure (DDDSUDDSUU), which was adopted by China, allows two consecutive UL slots every 5ms and hence can accommodate those long RACH formats that use 1ms duration. This allows easily about 15km cell range from RACH point of view. This also allows about 50% more capacity in uplink direction at a cost of about 12% loss in downlink capacity.

3GPP also defines flexible frame structure which may be configured dynamically. As the technology advances, the MNOs may want to explore this option.

Nokia considers that the best approach is to give the MNOs the opportunity to address this among themselves. MNOs should agree to use same/common synchronization and frame structure. This will maximize spectrum utilization, spectral efficiency and network performance.

Only in the case where this is not possible for operators to agree on, regulations should be set for a common synchronization and frame structure.

Question 4: Do you agree with the proposed arrangement for the special slot?
Yes. Having only 2 GP symbols may, however, limit the maximum 5G device to BTS range to approximately 7km, which is adequate for most applications, but may be too short in some locations e.g. rural or coastal environment.

To overcome this distance limitation alternative arrangements for the special slot can be utilized, for example, 8xDL + 4xGP + 2xUL can be used in select locations. This 4GP arrangement with 2 UL symbol alternative does not cause interference towards those using 10xDL + 2xGP + 2xUL switching slot and can be considered as a compatible alternative. The 4GP arrangement allows maximum BTS to UE range of approximately 17km.

As with the frame structure the special slot configuration should be left for agreement between MNOs.

Question 5: Do you agree with the process for defining the start of the TDD frame for the first time?
The reference timing should be the same for all and this should be agreed between operators.

If other than 3GPP 5G TDD based systems are introduced on the same band, it is necessary to verify the frame structure compatibility, TX to RX transition time and time alignment in a lab. The setup in the lab typically involves connecting both the reference 5G BTS and other system TX ports to oscilloscope by use of power probes. That way the frame structure compliancy can be verified and accurate timing adjustment between the systems could be made.

Question 6: Do you agree with the proposed solution for a synchronisation source and timing alignment?
See the last chapter of response to question 3.

Question 7: Do you agree with the calculation methodology for the unwanted emission mask, particularly the choice of the nominal antenna gain?
from emission mask point of view, if EIRP instead of TRP must be used, 28dBi nominal antenna gain seems as a realistic value today for worst-case scenario. However, as the technology advances, it may not be future proof.

Question 8: Do you agree with the choice of EIRP over the TRP?
In context of 5G active antenna systems (AAS), Nokia prefers the use of TRP over EIRP for emission mask.

Question 9: Do you have any other comments regarding the out-of-band emission mask?

Figure 2 states that the unwanted emission mask is as defined for band n78 in 3GPP, but as it is also written above the figure, it is modified from the 3GPP specification and hence is not exactly 3GPP emission mask for band n78.

Masks which are not 3GPP compliant may require specific filters. However, if modifications to the 3GPP emission mask are made based on how some other major markets, such as the CEPT emission mask variants in Europe, New Zealand specific radios and filtering would not be required.

Please note that "operator specific filters" as an alternative, is not a practical option – it would require unique implementation of New Zealand specific 5G AAS products and could incur additional cost to MNOs.

Question 11: Do you agree with the technical compatibility analysis between SRD operation in 2900-3400 MHz and 5G (or compatible technology) in the 3.5 GHz band?

Question 12: Do you agree with the arrangement for satellite services in the frequency range 3800-3840 MHz?

Question 13: Do you agree that operators should be permitted to choose to not follow these technical principles as long as no harmful interference is caused to their adjacent operators?

Yes. An isolated antenna, located for example indoors in a shopping mall, in a factory plant or in remote rural area could run with different settings without causing problems. However, there should be a mandatory process defined for the MNOs to notify each other for such cases.

Question 14: Do you agree that the same technical principles should be imposed throughout the 3.5 GHz band?

Yes.