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10 November 2017

Innovation, Science and Economic Development Canada
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Dear Senior Director,

***re: Canada Gazette, Part I, June 17 2017, Notice Nº SLPB-001-17,* Consultation on Releasing Millimetre Wave Spectrum to Support 5G**

CBNL strongly supports initiatives to increase the use of millimetre-wave spectrum to provide advanced connectivity to Canadian citizens.

Worldwide, CBNL has deployed over 150,000 point-to-multipoint (PMP) systems in microwave and millimetre wave bands from 10 to 40GHz. The high end-user throughput, wide coverage area and excellent ROI offered by such networks has rightly led to their study as a foundational technology for 5G.

We make the following comments with reference to the particular questions 6-3 and 7-3.

Duplexing arrangements

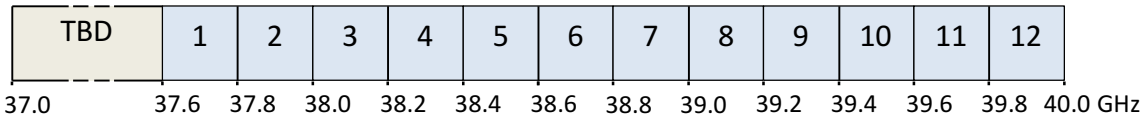
As CBNL has noted in comments to the Federal Communications Commission of the United States[1], for wide-area, licensed band operations, both fixed and mobile, frequency division duplexing (FDD) is the predominant mode of duplexing and interference avoidance. This is because of the simplicity of interference avoidance, even where systems adhering to differing technical standards are deployed at the same location in adjacent channels. In particular, the independence of the interference avoidance function from the detailed technical standard facilitates rapid innovation in the latter.

CBNL's product portfolio contains systems operating in both frequency division duplexing and time division duplexing (TDD) modes. However, in keeping with general custom and practice, the licensed band products use FDD and the unlicensed TDD.

We therefore urge that FDD operations not be prejudiced by the band plans adopted for mid-band spectrum. One way in which such prejudice can arise, for example, is where a band plan such as that proposed on pp. 16–17 of the Notice is used, and spectrum is

[1] CBNL, *CBNL comment on new 39GHz band plan*, September 2016; CBNL, CBNL comment on mid-band spectrum NOI 17-183, October 2017 and CBNL, Ex-parte Meeting Notice, October 2017.

auctioned in integral units. We reproduce the proposed plan here:



In such a scenario, the minimum number of blocks for which an operator must acquire a license in order to operate a TDD system is one. However, the minimum number of blocks required to operate an FDD system is two. Notwithstanding that such an FDD system will, all else being equal, have twice the capacity of the TDD system, this does represent a higher financial barrier to entry for FDD operations.

Mutual interference of TDD and FDD systems

Because of the limited performance of practical RF filters in particular, when a system transmits in a particular channel – say channel 1 in the above diagram – some amount of energy also leaks into the adjacent channels. The precise amount of leaked energy which is permissible is specified as part of the technical rules. If two transceivers, using channels 1 and 2 for instance, are co-located this creates the potential for mutual interference.

Interference arises when one of the transceivers is using its channel to receive and the other transceiver is using its channel to transmit. The spurious energy from the transmitter appears as interference at the receiver, degrading the signal it is attempting to decode.

When TDD systems are adjacent, they must be synchronized in order to avoid mutual interference. For TDD and FDD systems that are adjacent, this is not possible and depending on the precise configuration one or other system will suffer interference that cannot be mitigated. The accompanying presentation considers this problem in more detail.

One possible solution is to allocate TDD blocks starting at the bottom of a band, and FDD blocks starting at the top, with the combined size of an FDD paired block being equal to that of a TDD block. This approach is taken in recent ITU-R recommendations for millimetre wave bands, for example[2]. It should be noted that this does not constrain the transmit and receive FDD blocks to be of equal size. For instance, it may make sense for the example given here to pair 150MHz of spectrum for the downlink with 50MHz for the uplink, for obvious reasons concerning typical demand bias.

CBNL requests that these two matters be considered in choosing band plans for the various bands under consideration, and/or in the design of rules for the auctions thereof.

Pricing of radio license fees for point-to-multipoint systems

A point-to-multipoint topology is the dominant paradigm for wireless communications; consider, for example, that GSM, 3G, LTE and WiFi are all examples of PMP systems and together numerically dominate shipments of wireless systems by a large margin.

[2] RECOMMENDATION ITU-R F.2005 *Radio-frequency channel and block arrangements for fixed wireless systems operating in the 42 GHz (40.5 to 43.5 GHz) band,* March 2012.

It is usual for PMP systems (including Public Land Mobile systems) operating in licensed bands, in most administrations, to be licensed either nationally or regionally on a block assignment basis. Clearly as the number of terminals supported becomes very large, licensing on a link-by-link, or even base station-by-base station basis becomes cumbersome.

CBNL strongly advocate that this model of licensing—specifically regional block assignment—be adopted for PMP systems in used for fixed service type applications. Such applications may encompass Fixed Wireless Access (FWA), mobile backhaul, other applications; or indeed general purpose networks, supporting multiple such applications as virtual networks on one physical infrastructure.

It is the understanding of CBNL that, currently, such networks incur additional fees for each terminal station added to the network. We believe that this fails to incentivise the efficient reuse of spectrum both spatially and temporally, and is a barrier to the adoption of high capacity millimetre wave technologies in Canada.

CBNL would like warmly to thank ISED for the opportunity to contribute to this consultation.

Yours faithfully,

Dr John Naylon
CTO
Cambridge Broadband Networks Limited