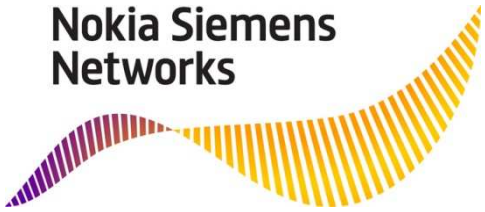

NOKIA SIEMENS NETWORKS'S RESPONSE TO

CONSULTATION PAPER ISSUED BY THE INFO-COMMUNICATIONS DEVELOPMENT AUTHORITY OF SINGAPORE PROPOSED FRAMEWORK FOR THE REALLOCATION OF SPECTRUM FOR FOURTH GENERATION ("4G") TELECOMMUNICATION SYSTEMS AND SERVICES
Issued 10 April 2012

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PART II: AVAILABLE SPECTRUM

Question 1

IDA seeks views on the proposed allocation of the 1800 MHz, 2.3 GHz and 2.5 GHz spectrum bands.

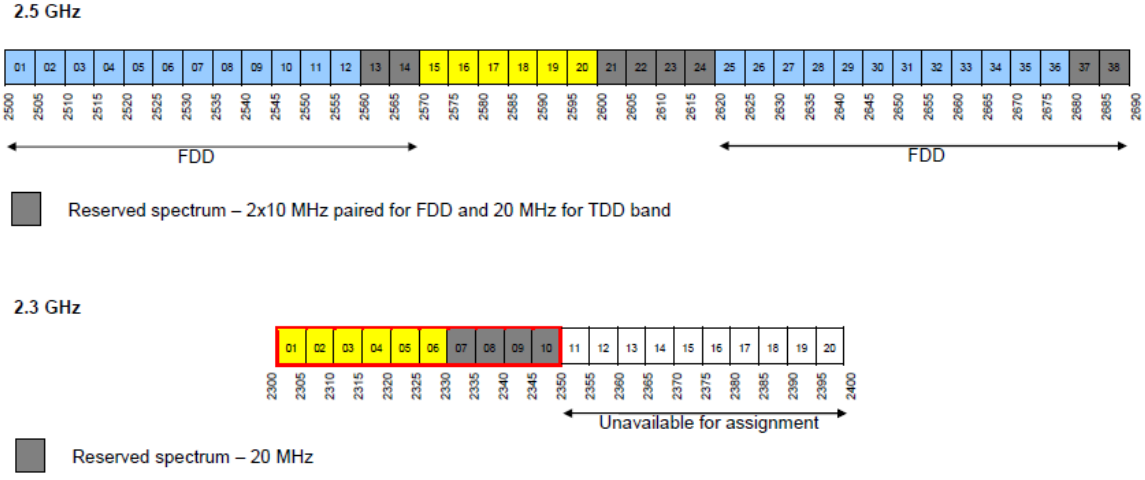
<Nokia Siemens Networks>:
Nokia Siemens Networks supports IDA's proposed allocation of the 1800 MHz, 2.3 GHz and 2.5 GHz spectrum bands.

Question 2

IDA seeks views on the amount of spectrum to be made available for allocation in the 1800 MHz, 2.3 GHz and 2.5 GHz bands

ANNEX A

POSSIBLE ALLOCATION OF SPECTRUM IN THE 2.3 AND 2.5 GHz BANDS IN 2015 AND THE 1800 MHz BAND IN 2017



<Nokia Siemens Networks>:
Nokia Siemens Networks supports IDA's proposal. NSN further recommends IDA to allocate the entire available spectrum on 1800 MHz band and not to reserve 2x5MHz. NSN's view is that trial and temporary use can be facilitated on the reserved spectrum on 2.3 GHz and 2.5 GHz bands while GSM specific testing can be done in 900 band, LTE testing can be done in 2600 or 700 MHz when the latter is available. NSN's view is that use cases like high definition video uploading would be most efficiently supported on unpaired spectrum on 2.3 GHz and 2.5 GHz bands. In the event when the winner is the current license holder for the 1800 MHz band, the allocation of the specific blocks should follow today's assignment. That would allow the seamless re-use of installed equipment such as combiners, DAS, etc. without the need for modifications.

Question 3

IDA seeks views on the benefits of an earlier start date for the full-band sharing arrangement, and what an appropriate start date might be

<Nokia Siemens Networks>:
Nokia Siemens Networks believes that it is beneficial for the quality of experience and affordability of the mobile broadband services in Singapore that the full band sharing can commence before 1 July 2015. However, NSN is not in a position to comment on what an

appropriate start date might be.

Question 4
IDA seeks views on the proposed block size per spectrum lot, the number of spectrum lots, and the arrangement of the spectrum lots to be made available for reallocation

<Nokia Siemens Networks>:
Nokia Siemens Networks recommends IDA to allocate the entire available spectrum on 1800 MHz band and not to reserve 2x5MHz. Further, NSN recommends a block size of 5 MHz in 1800 but 10/20 MHz in 2600 & 2300 MHz. For better spectral efficiency continuous band should be allocated in any case.

Question 5
IDA seeks views on its proposal for operators to co-ordinate the use of different services and not to set aside guard bands at the frequency boundaries between FDD and TDD technologies in the 2.5 GHz band.

<Nokia Siemens Networks>:
3GPP (see 36.104) has stated the following parameters should be considered for the coexistence/collocation of an e-UTRA BTS with systems operating in other frequency bands:-

- TX spurious:
  - Co-existence:
    - -52dBm/MHz with 10MHz guard band (i.e. **the in-band is defined to extend 10MHz wider than the actual band, and the co-existing limit starts after that guard band**)
  - Co-location:
    - -86dBm/MHz with 10MHz guard band (see above)

- RX blocking :
  - Co-existence:
    - -15dBm with **20MHz** guard band
  - Co-location:
    - +16dBm with **10MHz** guard band
  - Note that 3GPP 36.104 also defines "*Some combinations of bands may not be possible to co-site based on the requirements above. The current state-of-the-art technology does not allow a single generic solution for co-location of UTRA TDD or E-UTRA TDD with E-UTRA FDD on adjacent frequencies for 30dB BS-BS minimum coupling loss. However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [8]".*

Hence, guard bands are highly recommended to be set aside between TDD and FDD technologies on 2.5GHz.

In the absence of guard bands or <10MHz/20MHz, it is important that necessary measures (e.g. antenna isolation and placement, site co-existence or co-location), are taken to ensure the TDD/FDD interference do not cause degradation in performance.

In case there is no guard band used, the TDD networks among different operators need to be time synchronized with an identical DL/UL configuration to be used.

PART III: ALLOWABLE USES FOR THE SPECTRUM

Question 6
IDA seeks views on its proposed definition of 4G technologies and the proposal to assess on

a case-by-case basis alternative technologies to be deployed in the 4G spectrum bands.

<Nokia Siemens Networks>:
As technologies and the amount of non-interfered spectrum available are continually evolving, the proposal put forth by IDA to assess on a case-by-case basis, but being able to meet as a minimum, the standards and specifications of either LTE (i.e. 3GPP Release 8), or WiMax (i.e. IEEE 802.16-2009), is a flexible and practical approach to the definition of 4G.

Question 7
IDA seeks views on its proposal that successful bidders of 4G spectrum should meet nationwide 4G systems and service coverage requirements by the dates specified.

<Nokia Siemens Networks>:
NSN view is that service coverage requirements should be driven by market demand primarily. In particular IDA has issued QoS requirements for current 3G networks to ensure good service coverage and to improve the overall user experience in Singapore. While the LTE outdoor service coverage requirement may be demanded by the market in 2016, the indoor requirements may be sufficiently covered through existing HSPA+ networks.

PART V: PROPOSED AUCTION FORMATS

Question 8
IDA would like to seek the industry's views on the proposed auction parameters for the 4G spectrum rights.

<Nokia Siemens Networks>:
NSN is not in a position to comment on proposed auction parameters.

PART VI: NEW ENTRANTS IN THE WIRELESS BROADBAND SERVICES MARKET

Question 9
IDA would like to solicit interest from potential new entrants in the market. In addition, IDA seeks views on the proposed spectrum set-aside and nationwide 4G systems and service coverage obligations for the new entrant.
Interested parties may submit their comments on the "new entrant" rules in a confidential annex if required.
IDA would also like to seek the industry's views on whether the reserve price for the spectrum set aside for a new entrant should differ from the spectrum to be auctioned to non-new entrants.

<Nokia Siemens Networks>:
NSN is not in a position to comment on the rules for potential new entrants in the market.

PART VII: PROPOSED PRICING

No Question

PART VIII: CROSS BORDER CO-ORDINATION

Question 10
IDA invites views and comments on the adoption of the ECC/REC/(11)05 Recommendation

for cross border coordination in the 2.5 GHz band in Singapore.

<Nokia Siemens Networks>:
NSN recommends to adapt ECC/REC/(11)05 Recommendation for cross border coordination in the 2.5 GHz band in Singapore.

Question 11
IDA invites views and comments on the practical measures for the deployment of 4G base stations at the border areas for the harmonised co-existence with the BSS in Indonesia.

<Nokia Siemens Networks>:
NSN view is in line with ECC/REC/(11)05 Recommendation that list a couple of practical measures for the deployment of 4G base stations at border areas such as

- Field strength level agreement
- Physical Cell Identifier (PCI) co-ordination
- Demodulation Reference Signal (DM RS) coordination
- Physical Random Access Channel (PRACH) coordination

Question 12
IDA invites views and comments on the possible practical measures that the operators would implement to allow coexistence of mobile services and radar services in the adjacent band. IDA also invites views and comments on the required mitigation parameters indicated in the ECC Report 174 and the regulatory limit proposed by IDA for the co-existence between mobile services in 2.5 GHz with S-band radars.

<Nokia Siemens Networks>:
NSN recommends adapting ECC Report 174 Recommendation to allow the coexistence of mobile services and radar services in the adjacent band

The report list possible mitigation techniques to avoid blocking and unwanted emissions which are in line with NSN's view:

- improvement of the receiver selectivity
- reduce unwanted emissions of transmitters
- reduced Power from the mobile service Base Station
- site specific deployment
- physical separation between radar and mobile service stations
- frequency separation

PART IX: USE OF 900 MHZ AND 1800 MHZ SPECTRUM BANDS FOR SECOND GENERATION ("2G") SYSTEMS AND SERVICES

Question 13
IDA would like to seek the industry's views on whether IDA should: (1) allow the 2G service providers to individually decide on when to shut down their 2G networks; or (2) intervene or assist to facilitate in any aspect of a possible winding down of 2G services in Singapore in order to manage the efficient use of spectrum. Such intervention could include the possibility of IDA centrally managing the 2G spectrum made available, e.g., by specifying spectrum, to be used by the 2G service providers on a shared basis for a shared 2G network.

<Nokia Siemens Networks>:
NSN's view is that 2G networks may still be required beyond 2020 if there is still a demand for 2G coverage from either inbound roamers or other business reasons. Although IDA is correct

in the view of 3G 900MHz and LTE 1800 refarming are already taking place in the industry, the exercise should be primarily driven by market demand.

NSN supports technology-neutral allocation of spectrum and the potential phase-out of technologies along market demand (as established by mobile operators' business plans), Further, NSN supports regulatory option to allow spectrum pooling, which could facilitate shared networks.