CommVerge Solutions Incorporated

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Triton Network Systems ™

Response to IDA Consultation Document

Proposed Approach To Fixed-Wireless Broadband Network Deployment And Service Provisioning in Singapore
(16 February 2000)

March 31, 2000

Ng Cher Keng
Policy Director
Infocomm Development Authority of Singapore
35 Robinson Road
Singapore 068876

Dear Ms Ng Cher Keng,

CommVerge Solutions Incorporated and Triton Network Systems™ are pleased to have this opportunity to provide its comments and views to the Info-communications Development Authority of Singapore regarding the allocation of frequency spectrum for the deployment of broadband wireless telecommunications services. The following comments are presented from the perspective of the telco systems integrator and the product supplier/vendor. Our objective is to provide the IDA with technical considerations which have bearing upon Singapore's spectrum allocation policy and hence the successful deployment of broadband wireless access networks in the Singapore market.

Comments and Responses

(a) the potential of and benefits arising from the deployment of fixed-wireless broadband network, the likely services/applications to be deployed and the potential demand from business and consumers.

CommVerge Solutions and Triton Network Systems are both experiencing tremendous demand for broadband wireless access solutions at 100 Mbps and greater in the U.S., Asia, and other international markets. Deregulation of the telecommunications industry and the explosion of bandwidth demand from the Internet are the main drivers behind this demand. Services/applications to be deployed include the full spectrum of telecommunications services/applications: traditional voice, data, frame relay, VPNs, IP, broadband Internet access, video conferencing, video streaming, etc. It is expected that the demand in Singapore for such services will match or even exceed the take-up rates seen in other industrialized nations, given the commitment on the part of the Singaporean government and local industry to enhance the nation's info-structure and computer literacy.

(b) the possible uses for the fixed-wireless broadband technology,and how the competing demands for the spectrum should be managed, including the allocation process, the timing of the process and criteria to be used.

Operators are in the best position to address this issue.

IDA also seeks comments on whether there are interconnection and access issues that may pose problems to achieving IDA's objective of transparent and seamless interconnection and open access; and how these may be practically and realistically addressed.

We recommend that industry standards that have already been established for SONET, Fast Ethernet, etc. be followed.

IDA further seeks comments on the type and level of QOS standards, including both network and customer QOS standards, that would be appropriate to benchmark the quality of the network and services deployed.

This is a cost benefit trade-off. Industry trends indicate the market is moving towards networks with greater bandwidth and less sophisticated quality of service (QOS) including simple retransmission to address errors.

(c) the amount of spectrum that should be made available for terrestrial fixed-wireless broadband and satellite services, including the timing for review of spectrum reservation and allocation, where appropriate.

Operators are in the best position to address this issue.

(d) the optimal amount of spectrum to be allocated to each operator, including the detailed assumptions/basis/calculations used to derive the proposed spectrum bandwidth, and the timing of allocation where appropriate. IDA also seeks comments on the optimal number of operators that can be licensed, bearing in mind the growth of the broadband market in Singapore.

Given the intense market demand and number of operators interested in applying for frequency spectrum, it will undoubtedly be a difficult task to balance the operators demands for large blocks of spectrum with the scarcity of spectrum. Hence it is imperative that any deployed solution be both spectrally efficient and, at the same time, radiate a minimal amount of interference outside of the allocated spectrum. To this end, and in order for multiple operators to co-exist in harmony, the following recommendations are made:

- **A minimum of 100 MHz of spectrum should be allocated to each carrier**

  This figure is derived using the product specifications of Triton Network Systems Invisible Fiber ™ unit (IFU) as a baseline. The IFU is a FDD (Frequency Division Duplex) system which currently utilizes 50MHz of spectrum in each of the transmit and receive directions, for a total spectrum occupancy of 100MHz. A full duplex 155Mbps SONET/SDH fiber-quality signal is carried. For details of the Triton Network System's product and unique Consecutive Point network architecture, please refer to the attached product data sheets and the whitepaper titled "Consecutive Point Architecture For Broadband Wireless Access Networks".

  A frequency reuse factor of n=1 is achievable with Triton Network Systems revolutionary Consecutive Point architecture. This is due to the sophisticated Adaptive Transmit Power Control (AdTPC) algorithm, which serves to minimize co-channel and adjacent-channel interference. This low interference level and subsequently high frequency reuse factor is detailed in the attached whitepaper titled "Techniques to Achieve Dense Deployment in Broadband Wireless Network".

For an operator utilizing Triton Network Systems IFU, a minimum spectrum allocation of 100MHz is sufficient to deploy a STM-1/OC-3 broadband wireless network around Singapore. But owing to the continual technological breakthroughs being achieved by Triton, a STM-4/OC-12 version of the IFU is planned for release in 2001. This new IFU will have a spectral occupancy of 150MHz on each of the transmit and receive frequencies, for a total of 300MHz.

- **Allocations of split frequency bands are more spectrally efficient overall than those of contiguous frequency bands**

  All currently available solutions in the market require a guard band or separation between the transmit and receive frequencies (with the exception of Time Division Duplex systems, which are still in the preliminary stages of technological feasibility and market acceptance). An operator awarded a contiguous block of spectrum will have to provision for a guard band within its allocation and thus waste this portion of its spectrum. However, if the frequency licenses are awarded in a split band fashion, no guard band is required for each operator – the transmit/receive frequency separation is already present, and each operator can then maximize the utilization of its awarded spectrum without wasting any on guard bands. Triton Network Systems IFU have a tunable range in both the transmit and receive frequencies, and the minimum required separation is 200MHz.

(e) the most appropriate licensing and spectrum allocation approach to adopt. Views are also sought on whether spectrum should be assigned in a phased manner or allocated fully to the operator at the grant of license. Should there be a separate component for license fees payable in addition to spectrum fees payable?

Operators are in the best position to address this issue.

(f) whether the proposed spectrum band in para 2.4.1 should be reserved primarily for IBBMM services or whether they should be assigned for broadcasters' usage.

Operators are in the best position to address this issue.

(g) the appropriate license duration for the provision of fixed-wireless broadband services.

Operators are in the best position to address this issue.

(h) the timeframe for award of license as well as the time needed by the operators to roll-out their networks and offer commercial services to the public.

Operators are in the best position to address this issue.

(i) how the issues of rain attenuation and compliance with QOS standards would be addressed.

CommVerge Solutions and Triton Network Systems recommends the use of Adaptive Transmit Power Control (AdTPC) instead of constant power output. The benefits of AdTPC are twofold: during raining conditions, it increases the transmit power to compensate for rain attenuation; during clear weather conditions, it reduces the transmit power to a minimum in order to reduce interference. This permits very dense deployments in metropolitan areas such as Singapore because it always utilizes the lowest power necessary to transmit and receive, with power only increasing in 0.50 dB steps up to 50 dB when interference is detected (i.e. heavy rainfall). It is also recommended that at least linear two (2) watts of power be permitted allowing for flawless transmission in adverse weather conditions.

(j) how operators plan to install there own internal wiring, the potential difficulties faced and the cost of doing so. IDA also seeks comments on how these difficulties can be practically and realistically addressed by potential operators and how IDA can facilitate the installation.

Operators are in the best position to address this issue.