SR Telecom

Inquiry into Wireless Broadband Technologies

To the Minister for Communications, Information Technology and the Arts

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SR Telecom

Wireless Technologies to Provide Broadband Communication Services in Australia

Abstract

For the last ten years several new wired and wireless technologies have emerged. For the reason that many factors related either to the geography, the existing infrastructure or the local regulation, the objective of this paper, when comparing the various technologies, is not to try to classify them according either to their technical merits, nor to their commercial success, but to point out their respective merits and limitations with regard to the local environment and the application.

Keeping in mind that what we call the "Local Loop" or "Fixed Wireless Access" includes a transmission and a distribution sub-network, various wired and wireless technologies can be used and combined together to cope with the local constraints and the services to be provided.

Among the different existing wireless technologies, PMP (point-to-multipoint) and cordless are SR Telecom preferences for fixed access when compared with cellular systems, which were designed and optimized for mobility purposes.

With regard to "broadband" communications (128 kbps and over), our view is that, for better spectrum efficiency, packet transmission is the most appropriate to transmit data. However, for marketing and economic reasons, specific systems for different voice and data applications may not be viable. Thus, for suburban and rural areas the best solution, in many cases, is to use wireless technology(ies) able to support voice and data and having the flexibility to adapt automatically the bit rate to the demand. These will provide the highest spectrum efficiency.

The SR Telecom PMP and DECT cordless systems fulfil these requirements.

DECT is a proven viable technology but it's use is inhibited by regulation. The use of 1.9GHz for DECT in Urban areas would greatly extend the use of this technology.

Wireless Technologies to Provide Broadband Communication Services in Australia.

1. Wireless and Information Technology

From more than ten years now, new telecommunications tools have considerably changed our daily life. We have entered what we call the information society. Looking back, we can state that two major technical inventions have greatly contributed to this cultural revolution.

The mobile cellular networks, which at first not only added the « space » and of course the « mobility » dimension to our voice communication, but also introduced something like the « time and space continuity » to what we are still used to call telephony.

The second major invention and revolution is, without contest, Internet which not only extends the space notion from our home and professional environment to the whole world, but also introduces the new concept of access to « multiple services and media ». Thanks to Internet, we not only access many services in the world, but also all types of information i.e. speech, sound and video.

So far, following the market demand, Australia, as many developed countries around the world, has deployed and now operates various wired and wireless telecommunication networks providing voice and/or data communications to residential and business users.

However the wide variety of geographical and demographic situations makes the Australian case a particularly difficult and challenging exercise for all interested bodies i.e. regulatory bodies, operators, service providers and manufacturers.

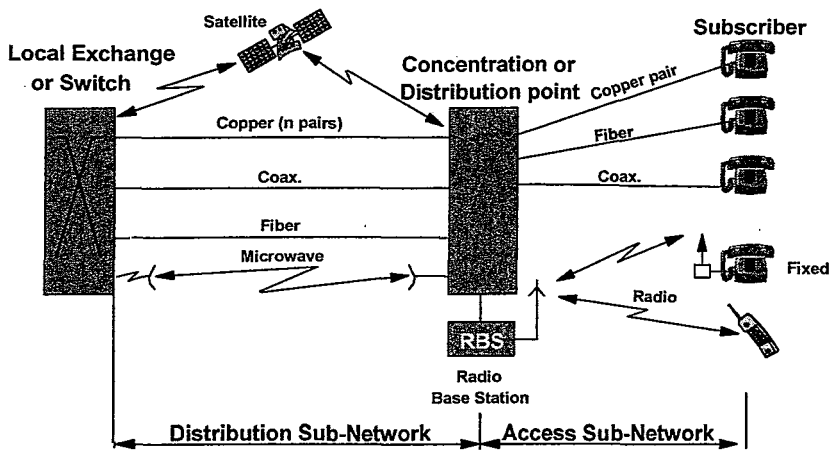
SR Telecom, as a leading manufacturer of fixed wireless access systems in Australia is strongly committed to contribute and cooperate with the Australian Broadband Advisory Group on this important issue.

2. Inter-relationship Between the Various Broadband Wireless Technologies

During the last ten years several new wired and wireless technologies have emerged. For the reason that many factors related either to the geography, the existing infrastructure or the local regulation, the objective of this paper, when comparing the various technologies, is not to try to classify them according either to their technical merits, nor to their commercial success, but to point out their respective merits and limitations with regard to the local environment and the application.

As a first point of clarification, it is important to understand that, when discussing "Local Loop" or "Fixed Wireless Access", various definitions may be used and different wired and/or wireless technologies may apply.
Then, the term « Local Loop » is generally used to mean all, or the final part of the access network, depending on the structure of the network and on the cultural origin (e.g. a PSTN or a new wireless operator). To avoid any ambiguity, we will use the term « Local Loop » to designate the access network and the distribution network together.
The term «access sub-network» is used to describe that part of the network between the subscriber premises and the first point of geographical distribution or circuit concentration.
The term «distribution sub-network» is used to describe that part of the network between the first point of geographical distribution or circuit concentration and the local exchange.
The distribution or concentration point may not exist if the access sub-network is directly connected to the local exchange.
So far, the reference point between the access sub-network and the distribution sub-network is not fixed and varies according to the network architecture and the local loop technology.
This also means that different technologies may be used for each of the two sub-networks. Hence, hybrid wired/wireless or wireless/wired combinations may be used. A lot of configurations are possible. These will depend on topography, performance, services, costs, regulatory and environmental constraints, operator strategy, etc.

Definition of the Local Loop



The most suitable solution will mostly depend on three factors:

- the subscriber's location (including the density and the concentration factors)
- the topography and the distance from the nearest switch
- the type of services to be delivered,

keeping in mind that coherence between the distribution and the access sub-networks has to be insured. Like for plumbing, the dimensioning of the different "pipes" must be technically and economically adjusted to the needs (present and future).

The same way we defined the term "Local Loop", the term "Broadband" needs to be defined.
Misunderstandings may result when talking about the application without mentioning the bit rate that specifies the amount of data and the time required to transmit it.
In our view we qualify as a "broadband transmission", data transmitted at bit rates of 128 kbps and over.

3.1 Microwave Point-to-Multipoint (PMP) Systems.

Such digital systems are available today from a number of manufacturers, and are mainly used to provide telecommunications services to isolated subscribers or small communities in rural areas.
There is no common air interface standard for such systems, but only « coexistence » standards defining the access method and the spectrum mask. They also comply with ITU- R Recommendation 756.
The physical layer is normally based on 2 Mbps transmissions, with a total capacity equivalent to a multiple of 2 Mbps PCM systems (30 traffic channels, each of 64 kbps bandwidth). Some systems are also available using 4 Mbps transmissions and provide 60 traffic channels at 64, 32 or 16 kbps.
Access is by TDM (downlink) and TDMA (uplink) with assignment of the channel on demand and using a frequency duplex arrangement (FDD).
PMP systems operate typically at 500 MHz and between 1 and 3,5 Ghz in normal « fixed service » allocations (see ITU-R recommendation 701).
PMP systems offer full 64 Kbps transparent channels and the ability to provide the user with several channels (High performamce data rates).
PMP systems perfectly fulfill the requirements of WLL applications as they have been specifically designed for the replacement of the copper backbone mainly in suburban and rural areas. They can operate over a very long range, up to 1000 km from the local exchange with typical hops of 50 to 80 km. Furthermore, they can also be extended in a « tree » configuration using repeaters to perfectly cope with the terrain constraints and the subscriber locations.

Traffic is carried in 64, 32 or 16 kbps timeslots, and the system is therefore fully transparent to normal voiceband services, and some systems are capable of supporting ISDN like services.

In addition it should be noted that, in the near future, there are plans to interconnect PMP with ATM broadband networks and thus to provide direct ADSL services at 128 kbps and over to the subscriber. This gives the possibility to deliver Broadband Services to Rural areas on existing technology.

Moreover, circuit-switched and packet-switched transmissions will coexist on the same systems and will interconnect directly with the respective PSTN and ATM broadband networks thereby ensuring the highest spectrum efficiency and offering maximum flexibility to the operator (i.e. bandwidth on demand).

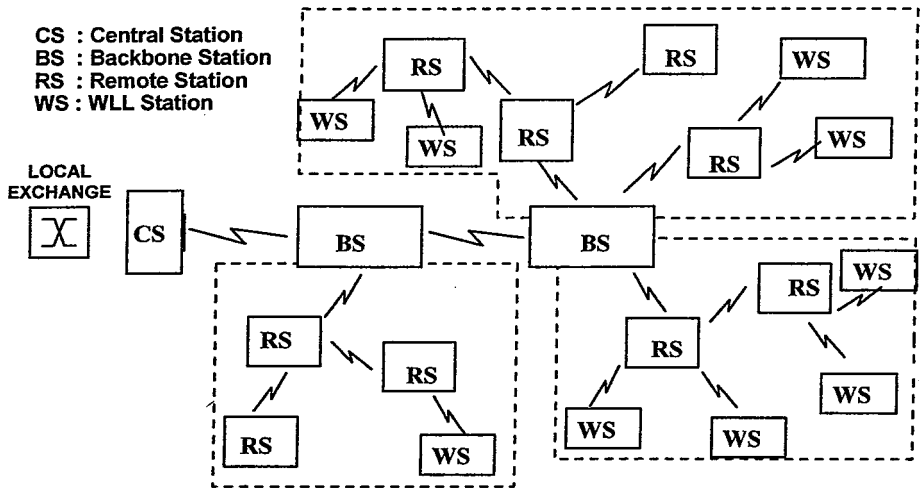
In conclusion, the PMP solution is a cost-effective way to extend existing wired digital networks (PSTN and ATM) or modernize old analogue networks, providing the customer with the same quality and grade of service as on the wired network. It also provides the user with all advanced services, from POTS to broadband ATM.
Finally, the economics of existing applications of PMP systems show that they are ideal for use in sparsely populated areas (rural and suburban).

Considering the local loop definition given earlier, the use of PMP systems with wireless local loop tails such as DECT offers numerous advantages. Also, the substitution of copper cable with wireless systems in the local loop reduces the maintenance costs associated with physical plant in rural areas.

- Strengths
- Very wide and flexible coverage (up to 1000 km) to cope with geographical conditions and subscriber locations
- Very low power consumption (e.g. easily powered by solar panels) and specifically designed for difficult weather conditions (high humidity, desert, intense cold, restricted maintenance etc.)
- Superior modularity to closely follow subscriber demand (e.g. for the addition of new subscribers and/or new services)
- Full transparency to PSTN and IP functionality.
- Complete integration with existing fixed networks including end to end test proceedures
- Standardized connection to all existing switches (e.g. ITU-T V5.2).
- Equivalent or superior quality and grade of service as on the fixed wired networks
- High spectrum efficiency (i.e. circuit and packet-switched transmissions on the same system)
- Bandwidth on demand

- Weaknesses
- Limited capacity, but several PMP systems can be co-located
- No common air interface
- No full mobility, no roaming

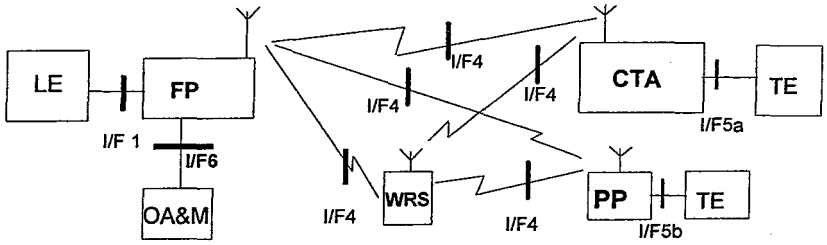
PMP TDMA System Architecture



3.2 Cordless

Current cordless technologies have been designed to provide low complexity and high traffic capacity solutions for micro-cellular arrangements. Such systems can be successfully applied to WLL applications. Among existing cordless technologies, DECT is one of the most advanced technologies. DECT fulfills all of the WLL requirements with respect to services aspects, s DECT also has the ability to interconnect with either fixed or mobile networks and make provision for a future evolution towards the 3rd generation mobile standards.
In terms of architecture, a DECT fixed wireless access network provides access to the local network by connecting to the local exchange. Contrary to a cellular network, a DECT network does not include the switching function, which is carried out in the existing local exchange.

The DECT Reference Model



TE - Terminal Equipment
FP - Fixed Part
WRS - Wireless Relay Station
CTA - Cordless Terminal Adapter
PP - Portable Part

I/F1 - Local Exchange to FP Interface
I/F4 - DECT Air Interface
I/F5a - CTA to Terminal Interface
I/F5b - PP to Terminal Interface
I/F6 - Operation, Administration & Maintenance Interface

With regard to operational characteristics, DECT makes use of specific technical features, which ensure a high grade of service (GoS), high performance and very efficient use of the spectrum. Among others, these features are:

- A multi-carrier TDMA air interface and decentralized radio resource management which is the basis of the very efficient and rapid dynamic channel selection (DCS) made at the terminal level.
- DCS greatly improves the performances and the capacity of the access system in short-range cluttered environments where fixed channel planning becomes very difficult to achieve.
  In such very short coverage and high traffic density spots, and thanks to DCS, DECT WLL networks do not require extensive frequency planning studies. Moreover, continuous DCS during the call, e.g. for hand-over, ensures that the channel allocation is continually optimized to the instantaneous local conditions.
- A high-speed and robust signaling channel provides DECT with a very efficient, secure and reliable signaling transmission.
- The use of repeaters to extend the WLL coverage.
  Regarding the applications, DECT supports the following services:
- Voice telephony is provided using a 32 kbp/s ADPCM codec fully compliant with ITU-T Recommendation G.726. In addition, the ADPCM codec or the signaling channel can transparently carry DTMF tones.
- Voiceband data and fax

The complete operation of all voiceband modem equipment can be assured by providing a 64 kbps DECT channel Or by the use of appropriate terminal adaptors.
- Analogue leased lines provided as permanent connections by the PSTN and supported by DECT.
- IP performance. Planned data rates of 384kbit will be available by mid-2003. DECT technology has the capability to go beyond 384K in future.

Like for other technologies the strength and weakness analysis applies:
- Strengths:
  - Dedicated frequency bands: 1880-1900 MHz
  - High capacity for "hot spots"
  - Transparency to voiceband data
  - Capability up to ISDN 2B+D available today
  - Secure authentication and encryption
- Weaknesses:
  - Range limited by RF power
  - Sensitivity to delay dispersion

4. The Spectrum Aspects

When discussing wireless, the key question always comes to the spectrum aspects. Indeed, spectrum is a very scarce resource and great attention must be given to the spectrum efficiency of the radio systems to be implemented with regard to its socio-economic benefit.
In order to harmonize the frequency bands for fixed applications throughout the world and thus to manage the spectrum in the most efficient way, the ITU has produced recommendations for fixed services in the frequency bands 500 MHz, 1.5 GHz, 2.5 GHz, 3.5 GHz and 10.5 GHz.
SR Telecom fully supports the ITU recommendations and warns against any attempt to mix fixed and mobile services on the same system using common spectrum to the detriment of overall spectrum efficiency.

Regulation restriction of 1.9GHz DECT

In addition to the existing allocation of spectrum in the 500 MHz and 1.5 GHz frequency bands for PMP in rural areas, as well as 1.9 GHz for DECT wireless loop tails in rural areas, SR Telecom recommends that the 1.9 GHz allocation for DECT be extended to the urban and sub-urban areas in Australia.
This is supported by the fact that, thanks to its DCS (Dynamic Channel Selection) functionality, DECT fixed wireless access systems can efficiently coexist both with DECT private indoor systems sharing the band, as well as with mobile systems operating in adjacent bands. This has been carefully studied and demonstrated by experiments in Asia and in Europe (CEPT ERC).

5. The Regulatory Aspects

When planning the deployment of fixed wireless access either in urban or rural areas, the following additional questions relating to the radio spectrum must be considered.

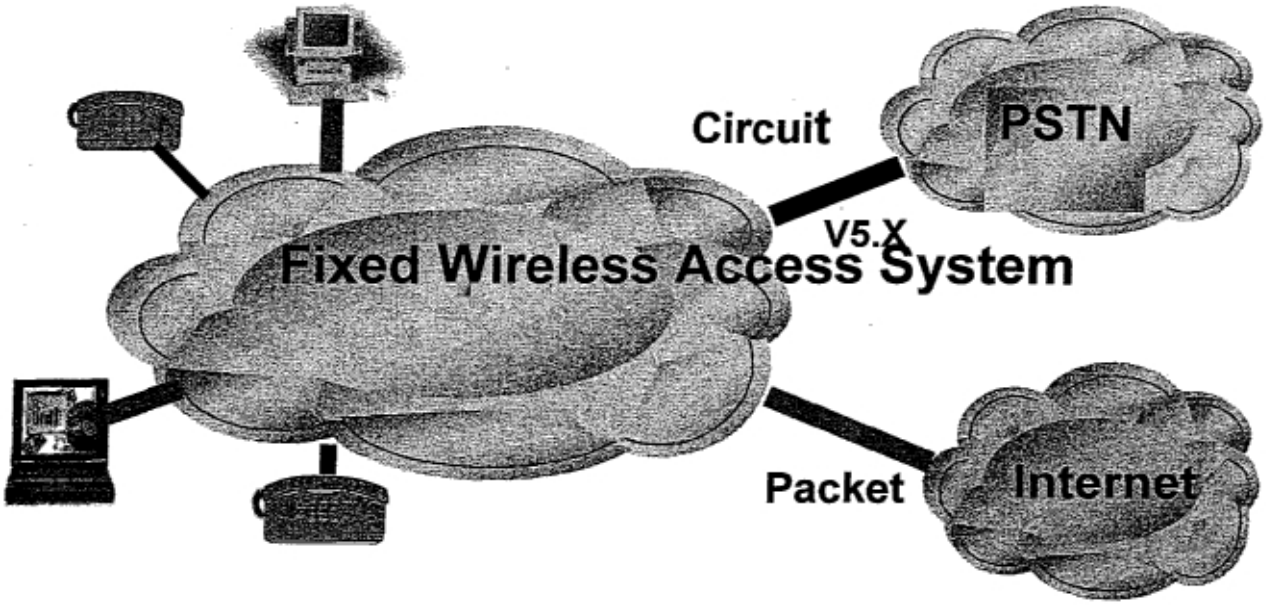
Voice and/or Data services? - Circuit or Packet-Switching?

With regard to spectrum efficiency, the use packet-switching for the transmission of data is definitely much more efficient when compared to circuit-switched modes of transmission, which normally applies to telephony services. Even though the transmission of voice and short video files are supported by packet technologies (e.g. voice and video over IP), attempts to provide acceptable telephony services over Internet, or simply over IP, is still not economically competitive. Thus, traditional circuit-switched transmission modes remain today the most reliable and efficient technique for the delivery of telephony services.

Then the next question is: Should telephony and high bitrate data services, or circuit and packet-switching be simultaneously supported by the same system or split over specialized, and of course, more spectrum efficient air interfaces? Their is no definitive answer to this question. However, like for wired technologies, where traditional copper, leased lines, coaxial cable and new optical fiber connections coexist in a complementary way, it seems clear that all types of wireless systems (i.e. cellular, PMP, cordless, LMDS, MMDS, Satellite, etc.) will continue to exist in the future. Furthermore, as already explained they can be complementary not only for services but for geographical reasons when combined together.

Splitting Circuit and Packet Transmissions

To closely follow the market needs and improve the overall network efficiency, there is no doubt that traditional POTS and broadband services will probably be separated for still some time. However, FWA systems like PMP TDMA and DECT offer the flexibility to make the split at the earliest stage, i.e. at the customer premises and thus ensuring the most efficient use of the radio spectrum.

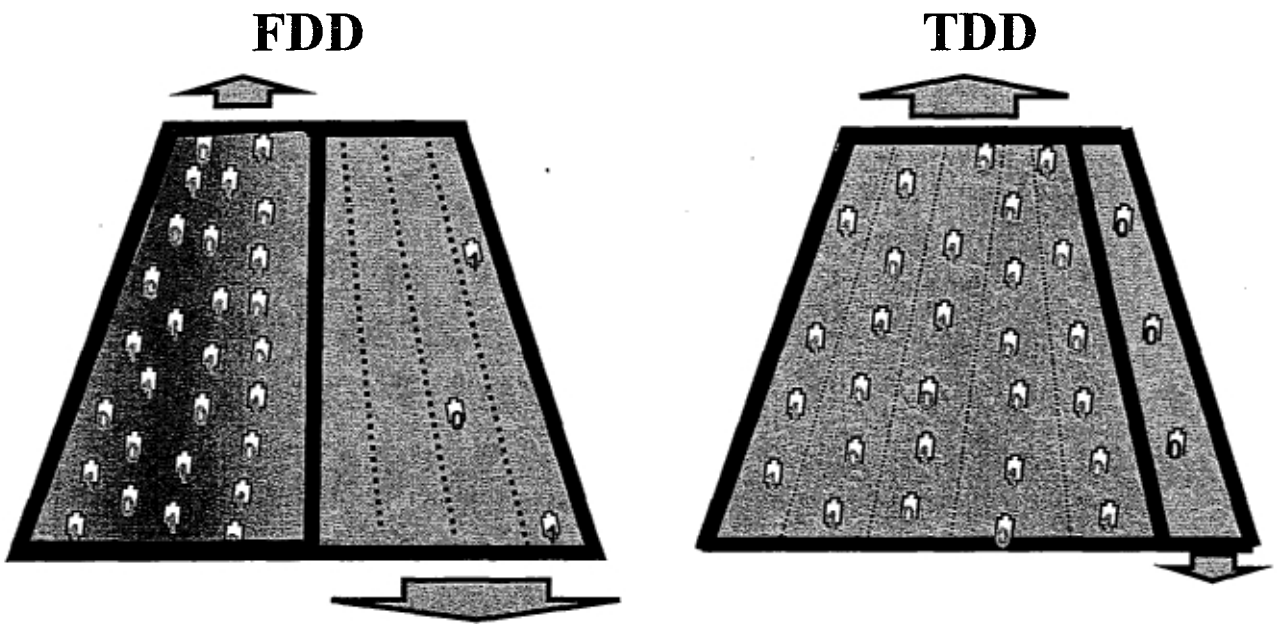


The Immediate Split of Packet and Circuit

FDD (Frequency Division Duplex) or TDD (Time Division Duplex) spectrum arrangements?

Historically, and for now more than 50 years, the radio spectrum has been managed using FDD arrangements where the radio channels for the uplinks and downlinks are separated by a frequency spacing. This was at the time perfectly adapted since the radio channels were calibrated on both links for voice transmission. Today, with digital transmission and the increasing use of Internet, this FDD spectrum arrangement is surely not the most efficient, especially when considering the asymmetrical nature of Internet traffic where the uplink direction usually supports only a very short request for a website consultation, while the downlink direction supports downloads of images, videos, audio files, etc.

The TDD arrangements where frequency channels are used indifferently in one way or the other is obviously very attractive. Experiments have demonstrated that, for Internet, TDD can increase the spectrum efficiency by 10 when compared with FDD.
DECT uses this TDD arrangement along with the DCS (Dynamic Channel Selection) innovation to automatically prevent interference from neighboring FDD systems using adjacent channels. When a potential interferer is detected by the DECT terminal, the system automatically switches to another channel without disruption or degradation of the ongoing communication.
Experiments in Europe and Asia have demonstrated the great advantage of DECT in this respect.



The Advantage of TDD for access to Internet

6 Trends

In recent years, wireless and information technologies have exploded. All existing radio technologies, e.g. cellular, PMP, cordless and satellite, have proven their ability to provide efficient, reliable and cost effective solutions in the local loop to various extents.
Looking at the possible local loop architectures, geographical constraints, regulatory conditions, services to be supported, etc., it is clear that there is not a single solution to cover absolutely all WLL requirements. However, in many cases, combined wired plus wireless (i.e. PMP) or wireless plus wireless (i.e. PMP +DECT) technologies have provided the optimized solution.

At the same time, evolutionary data services such as Internet have open the new era of the global information society. This is not just a new technological invention, which can provide us with new facilities, it is a culture shift which will definitely change, not only our daily life, but also our general behavior.
So, at the same time we enter into both the wireless age and the global information society, it is a natural evolution that the two will merge in the near future.
The above described wireless technologies have the potential to support that evolution and to offer the user a « wireless as gateway to the global information society »

ABBREVIATIONS & ACRONYMS

ADPCM	:	Adaptive Differential Pulse Code Modulation
ATM	:	Asynchronous Transfer Mode
DECT	:	Digital Enhanced Cordless Telecommunication
FDD	:	Frequency Division Duplexing
FWA	:	Fixed Wireless Access
GPRS	:	General Packet Radio Service
GSM	:	Global System for Mobiles
ITU	:	International Telecommunications Union
MMDS	:	Multichannel Multipoint Distribution System
PMP	:	Point-to-Multipoint
POTS	:	Plain Old Telephone Service
PSTN	:	Public Switched Telephone Network
TDD	:	Time Division Duplexing
TDMA	:	Time Division Multiple Access
WLL	:	Wireless Local Loop

SR Telecom

COMPANY PROFILE

SR Telecom is a world leader in fixed wireless access solutions for Internet, voice and data applications. For more than 20 years, SR Telecom has been designing, building and implementing systems that are used by telecommunications providers in over 110 countries worldwide. As a pioneer and innovator, its extensive experience is unmatched by any other company in the fixed wireless access industry.

SR Telecom is renowned for the reliability of its network equipment and the exceptional quality of its turnkey services. From the design of fully expandable networks to installation, maintenance and project management, SR Telecom's tradition of attention to specific customer needs is extended continuously to new markets and new applications.

SR Telecom's products provide cost-efficient, reliable, fixed wireless telecommunication solutions to some of the most isolated regions and populated urban centres in the world. It has installed thousands of systems in 110 countries, serving requirements in telephony, business and data communications and industrial communications. Customers include the world's community of public and private telephone companies as well as private operators of telecommunications systems.

The main application of SR Telecom's systems is the provision of affordable carrier class telecommunication services in the networks operated by telephone companies. The company was a pioneer in the provision of such systems. The systems are traditionally used in lower density applications, where, because of distance and other terrain considerations, traditional wire and cable methods are not economical. In recent years, SR Telecom has established itself as a proven solution provider for simultaneous voice, data and Internet service to small and mid-sized enterprises (SMEs) in urban areas.

In addition the Corporation's systems are used in private voice and/or data networks owned and operated by specific users such as utilities, government departments, industrial concerns and specialized carriers. Such systems may be located in both urban and remote locations.

SR Telecom

SR Telecom was founded in 1981 and became a publicly traded company in 1986. Shares are traded on the Toronto Stock Exchange under the symbol SRX. Its corporate headquarters is located in Montreal, Canada. Project and regional sales offices are strategically located around the world.

SR Telecom established a project office in Brisbane, Australia in 2001. The prime purpose of the office is to roll out with Telstra and NDC the Untimed Local Call (ULC) project that provides communications in remote parts of Australia. SR Telecom attained the responsibility of providing the technology and support for this project after it bought out Lucents Wireless Access Division. This office also provides support facilities for the ULC and previous generations of Point-to-Multipoint rolled out over the last decade.

Sales offices are located in Sydney and Melbourne to meet the growing demand for SR Telecom solutions in this region. The future demand will be met by products supporting broadband and wireless applications.

Egan, Brendhan (REPS)

From: Robert Vanderslik [robert_vanderslik@srtelecom.com]
Sent: Thursday, 6 June 2002 11:42 PM
To: cita.Reps@aph.gov.au
Subject: Wireless Broadband Inquiry submission from SR Telecom

SR Telecom Wireless Broadband ...

To The Secretary, House of Representatives Standing Committee on Communications, IT and the Arts,

The attached document is SR Telecom's response to the inquiry on Wireless Broadband.

Regards,
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7/6/02