

"Smartbridge® ", Helping the NSW Government (GRN) Radio Network to Reach Out Even Further...

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Introduction

For many years now the State of NSW has been operating its "GRN" Government Radio Network.

Based on the Motorola "SmartZone" system and operating in the UHF 403-420 MHz frequency band, the GRN network covers a substantial part of the State of New South Wales, from an ever expanding number of sites (currently well over 50), using many hundreds of channels, and servicing tens of thousands of field radio.

Given its massive size and coverage area, the GRN Network is one of the largest Radio Networks world wide. In spite of this, its coverage footprint still fits easily within the State's boundaries, and there are still large areas that are not within the system's radio reach.

Furthermore, "Wide Area" coverage is not always synonymous for "full" area coverage. Take Sydney for instance, the centre of the GRN system. From a radio point of view Sydney is a "hard to cover" area, due to its undulating geography, many tunnels, and large freeway sections carved out in rock. So, even if Metropolitan Sydney is a fully saturated area, there are still many "pockets" that have poor, or no radio coverage.

Technically, there are no reasons why full, true Area Wide coverage should not be achievable but obviously, the limitations are primarily economical, as new sites are very capital intensive.

"Smartbridge® " is a device that was specially designed to provide economical solutions to extend coverage of a main Trunking system into those areas which are "hard to cover" otherwise, be it for technical, or economical reasons.

This article focuses on some typical Smartbridge® applications in the NSW GRN Network.

Message Trunking or Transmission Trunking - Which Method is Better??

Before we get to these applications, a description of some specific technical and operational characteristics of the GRN Network will be helpful in developing an understanding of the Smartbridge® principles.

The GRN Network uses the principle of "Transmission Trunking", as against the "Message Trunking" principle that forms the basis of MPT1327 based Trunked Systems.

In Transmission Trunking systems each new transmission is (potentially) re-assigned to any of the channels from the pool of channels assigned to the System. In other words, during the one "message" transaction (or "call"), the RF channel may change from transmission to transmission. (In actual fact, the System will actually "reserve" the current channel for a short period (approximately 2 seconds) after each Over, to avoid constant re-allocation of the channel after each and every Over. This of course results in far better overall channel utilisation than possible otherwise, as each new channel assignment requires an exchange of signalling messages which takes up air time).

In Message Trunking an RF channel is assigned for the duration of the "message" (or "call"). In other words, once users have been directed to a "channel", that channel will be for their exclusive use for the duration of that "message".

Both systems have their own specific advantages. Message Trunking (the standard method used in MPT1327 based systems) economises on signalling overhead, as the channel is allocated once only; at the start of the call. However, if users only use that channel sparingly after it has been assigned, overall efficiency will be adversely affected. Transmission Trunking (as used in the GRN Network) has the advantage that precious system capacity is not unnecessarily wasted during longer pauses in a conversation, but if the traffic is of an intermittent nature, efficiency may reduce because of the signalling time required to set up a new resource.

There is a further fundamental difference between the GRN Network and common MPT1327 systems. The GRN system's usage platform is primarily that of an "Open Channel" (or "Group Call") nature - whilst the MPT1327 platform is primarily based on "person to person" call requirements. And perhaps, this is directly related to the trunking method used anyway, as transmission trunking appears the best option for an "open channel" platform, whilst message trunking appears to be the logical choice for "station to station" call requirements.

The GRN Network - A Transmission Trunking System.

It is not easy to analyse and draw firm conclusions on the relative advantages and disadvantages of the two principal trunking methods, and to provide answers to the directly related question as to which usage platform is a "better" basis for a Trunking system. Such an analysis is not only fraught with technical pitfalls, but also, tends to force the analyser, whether he wants it or not, into either a "Motorola camp", or into the more common "MPT1327 camp" (TAIT, NOKIA, and others).

And maybe, the bottom line of such an analysis will show that there are not too many "real" differences between the two systems after all anyway, as MPT1327 systems are perfectly capable of handling Group Calls, and SmartZone systems are equally capable of full "station to station" (Private Call) calling facilities.

In any event, the subject is well beyond the scope of this article. Suffice to say that the GRN Network (which is SmartZone based) uses the transmission trunking method.

"Smartbridge® " - Interconnecting Conventional and Trunked Radio Systems

"Smartbridge® " is an "intelligent" Crossband Repeater control system which provides a highly cost effective method to extend coverage of Main Trunking systems in areas where a new Site is not justified or practical. Essentially, it makes a Conventional Network completely transparent to the trunked network.

It will be clear that the Message Trunking based MPT1327 system requires a fundamentally different approach to Network Interconnection than that required for the SmartZone based GRN Network, and Smartbridge® is indeed available in two fundamentally different versions to cater for both requirements. The design of the Smartbridge® MPT1327 version (SB200 Series) is primarily based on "station to station" Call Set up requirements, and the GRN version (Smartbridge® SB100 series) is primarily addressed at application at "Talk Group" level.

So, not surprisingly, the differences between these two versions closely follow the fundamental differences between their Parent systems outlined above - the SB200 operates very much on a "Call by Call" basis (as each new Call requires a new Interconnect Call Set up), whilst the SB100 provides Network Interconnection on a (semi) permanent Talk Group set up basis. Essentially, the SB100 makes a fleet of Conventional radios an extension of the original GRN Talk Group, providing full two way communication between the users of a specific Talk Group and the Conventional fleet.

With the large number of installed Smartbridge® systems it is clear that strict control of the Interconnect points is essential.

For that reason, each new Smartbridge® installation requires prior approval from GRN's "NOCC" Operations Centre in Central Sydney, and is formally registered once commissioned

Furthermore, Smartbridge® systems can be remotely Enabled or Disabled, as and when required, using GRN Network based On/Off signalling control. This provides the "NOCC" Operations Centre in Sydney with full operational control over each and every Smartbridge® installed anywhere in the State.

"Smartbridge® " - Application Principles

There are several operational applications for Smartbridge® systems:

- As a migration tool, instantly linking an existing Conventional radio fleet to the GRN Network, not needing any changes to the Conventional radios.
- To provide temporary GRN coverage until a newly planned GRN Site has been installed and commissioned (Smartbridge® systems are of low cost and readily installed and commissioned). Furthermore, a Smartbridge® transportable system can provide temporary coverage in an area that normally does not require (e.g. an inaccessible bushfire area).
- To provide permanent GRN Coverage in areas where a "full" GRN site is not economically justified, for instance, in remotely located rural areas with a very low Mobile subscriber density.
- To provide Coverage Infill into areas where the Prime system does not cover (e.g. in tunnels or underground mining).

Two application examples will now be described, that of the Royal Agricultural Showgrounds (a "temporary coverage" application) and the Sydney Harbour Tunnel System (a permanent "infill" application).

The Royal Agricultural Showgrounds System

Currently, there is only limited GRN coverage of the Showgrounds area. A new GRN site is planned, but not yet installed. Grounds staff use a local Conventional radio system which provides adequate on-site communications, but safety considerations require a link to Fire Brigade Control from time to time, as and when operational circumstances require this.

A Smartbridge® system installed recently is now providing a "dial up" link between the on-site Conventional radio fleet and the Fire Brigade Control Talk Group. Whilst most Smartbridge® systems interconnect at Repeater (or Duplex) level, the Showgrounds radio system actually operates in Simplex mode, so in this case Smartbridge® is connected to a standard Simplex radio, necessitating an additional VOX switching option in the Smartbridge®, to only key up the Conventional radio when there is GRN speech activity. (When Smartbridge® is installed at Repeater (Duplex) level, there is no need for VOX switching, as the Repeater is able to receive and transmit at the same time).

The Sydney Harbour Tunnel System

The Sydney Harbour tunnel, which is located in close vicinity of the Bridge, is about 3 KM's long. The moment a vehicle enters the Tunnel, GRN radio contact is lost. A vehicle travelling at a speed of (say) 60 KM/hour, takes approximately 3 minutes to get through the tunnel, and a 3 minute loss of radio contact is not a problem for most operations.

However, this does not apply to the NSW Ambulance and NSW Fire Brigade communication systems. Accidents in the Tunnel can (and do) happen, and obviously, continuous coverage throughout the Tunnel is essential for any Emergency vehicles attending to the Emergency situation.

This tunnel coverage requirement is a prime example where a new GRN site, whilst technically entirely feasible, was not practical economically. A 3-channel Smartbridge® system however is providing a perfect and cost effective answer to the coverage requirements.

Two channels are allocated to the NSW Fire Brigade, the third channel links the NSW Ambulance Talk Group to any of its vehicles in the Tunnel. Physically, the system is distributed, that is, the GRN Radio/Smartbridge® combinations are installed in/on the North East Pylon of the Bridge to provide a link to the nearest GRN Site, connecting via 600 Ohm land line links to the 3 Conventional Repeaters located in the "Radio Re-Broadcast Room" inside the Tunnel. The Repeater RF signals are distributed throughout the Tunnel using "leaky feeder" radiating cable.

Emergency vehicles entering the Tunnel switch their radio from their GRN Talk Group to the Conventional radio channel of the required Smartbridge® system, and continuous coverage is guaranteed. The coverage is practically speaking "seamless" too, as GRN radios have the ability to switch instantly from a "Talk Group" to a "conventional" channel, by a simple "flick of the switch". (In contrast, many, if not most MPT1327 radios require a full re-initialisation cycle before they will switch to or from a Conventional channel.

This can take from several to many seconds, which in this particular case would be a very objectionable situation).

Summary and Conclusion

Smartbridge® based Radio Network Interconnection is a perfect tool to enhance and improve the operational features and functions of Trunked Main Systems. Currently, a large number of Smartbridge® systems installed throughout the State is providing continuous and reliable GRN Interconnect service and more systems are being added as the GRN Network itself is expanding across the State. Additionally, as Fleet Operators start to increasingly appreciate the powerful operational advantages that Smartbridge® has to offer, applications at Fleet level are growing as well.

The Smartbridge® /GRN concept was conceived some 3 years ago, through the combined efforts and long term vision of Karera Communications, a Hornsby, NSW based Radio Systems Design and Installation Company, Radio Systems Technologies, the Melbourne based specialist Radio Communications Engineering Company and of course, the GRN Network Management who were only too pleased to see their operational requirements translated into a practical, cost effective, and reliable tool to further improve the quality of their Network.

It is now possible to make truly "long distance" calls over the GRN Network, crossing distances of many hundreds of kilometers, involving 1, 2 or even more Smartbridge® links in the process. As such Smartbridge® has helped very much to break the long distance VHF/UHF radio communications barrier, opening the reach of the Network into the most remote corners of the State.

For further information: please [contact Radio Systems Technologies.](#)