NSW Telco Authority

In-Building Coverage Guidelines: For the Public Safety Network

Full name	NSW Telco Authority In-building coverage guidelines: For the Public Safety Network	Working title	In-building coverage guidelines
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Approved by	Kylie De Courteney, Managing Director, NSW Telco Authority	Date	3 September 2020
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1. Introduction

1.1 Purpose

These guidelines have been developed by the NSW Government Telecommunications Authority (NSWTA) to guide interested parties regarding the requirements for in-building (indoor) coverage that will operate as part of the NSW Public Safety Network (PSN[1]).

1.2 Government telecommunications network

One of the main responsibilities of the NSWTA under the *NSW Government Telecommunications Act 2018* (the Act) is the establishment, control, management, maintenance and operation of a secure telecommunications network to be used for operational communications.

The Act refers to the Government telecommunications network, which is intended as an umbrella term to incorporate the PSN and future developments of the network, such as Public Safety Mobile Broadband (PSMB).

Operational communications, in simple terms, refers to communication services to support emergency management operations, primarily used by Emergency Services Organisations (ESO), namely: NSW Rural Fire Service; Fire and Rescue NSW; NSW Ambulance, NSW Police Force and NSW State Emergency Service.

In the Act, operational communications is defined as communications to facilitate the exercise of functions by a government sector agency:

(a) in connection with preventing, preparing for, responding to or recovering from, an emergency, public safety incident or other incident posing a risk of harm to any person or property (including training activities in relation to the exercise of those functions), and

(b) in relation to the NSW Police Force—in connection with law enforcement and compliance

These guidelines extend the scope to include private entities that provide in-building coverage (IBC) to support such operational communications. This is because the sites where IBC systems operate, like large buildings, are often privately owned.

1.3 Critical Communications Enhancement Program

The CCEP is a major project with the primary purpose of delivering a network that operates effectively supporting operational communications across NSW. This involves identifying appropriate sites, including new sites and sites where there is existing infrastructure, building or improving sites and decommissioning sites that are not suited to the PSN.

The CCEP will increase the level of shared coverage available to NSW Government agencies and essential services from less than 40 per cent in 2018 to over 80 per cent of the state by 2023/24. Coverage in urban areas will also improve from 96 per cent to close to 100 per cent. Emergency and day-to-day operational communications will also benefit

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[1] Also known as Government Radio Network (GRN)

from network capacity, availability and resilience designed to meet Public Safety Network standards.

In-building coverage is an important part of the expanding network. When an Ambulance medic, for example, is in a building attending to a call out, good network coverage to receive or report information about the patient or the location can be lifesaving.

All NSW ESOs have provided feedback to the NSWTA emphatically in support of improved indoor coverage, particularly in large shopping centres, apartment buildings, tunnels and stadiums. Currently, it is difficult to determine if IBC systems are required in areas where work under the CCEP is in early stages. Macro radio sites (such as large towers) can penetrate some buildings better than others.

Over fifty per cent of New South Wales Police Force's (NSWPF) operational work, and the majority of NSW Ambulance's (NSWA) operational work, occurs inside or near buildings and structures, from residential dwellings to large commercial centres. Both NSWPF and NSWA have stated that their mode of greatest interest in using the PSN is portable, indoor use. Around 25 per cent of fires attended by Fire and Rescue NSW (FRNSW) are building and structural fires.

1.4   Governance

In NSW and across Australia, there is no building code, regulation or legislation that mandates IBC to support operational communications.

With the responsibility of the PSN allocated to the NSWTA under the Act (s15), the owners of all IBC systems using the network in NSW are required to enter into a 'GRN In-building Coverage Licence Agreement' (Agreement) with the Authority for the use of the network. See 3.5 'Licencing and agreements' for more information.

2. How IBC works

2.1 Coverage and attenuation

Attenuation is defined as a lessening in amount, force, or magnitude. When applied to a radio network, attenuation means reduction in the strength of a signal.

Some building materials such as masonry, concrete, metal alloy cladding and low emissivity glass can cause attenuation of signals sent from external macro radio network towers, which is exacerbated if a building is located further away from radio base stations, or if the building is surrounded by other buildings.

To ensure that ESOs have access to a reliable radio network indoors, IBC systems are placed within a building or tunnel where signals from external towers are weak or non-existent. IBC systems generally extend coverage of existing signals and must be fed by either a base station or a repeater.

2.2 Devices and capacity to transceive

Transceiving is the ability to both transmit and receive radio signals. Different radio devices can have different capacity to transceive. Mobile, vehicle-based radios have higher power output (25 watts), making it more likely for those radios to transmit and receive signals, even within buildings. Portable, handheld radios, on the other hand, have a maximum power output of 5 watts, which is often too low to effectively transceive radio signals within buildings with limited PSN coverage.

Additionally, portable radios are prone to 'body loss', which is signal attenuation as a result of the radio user's body blocking the antenna. In most cases, ESO first responders use portable radios for operations.

2.3 Spectrum

The PSN uses spectrum in the 400 MHz band (403-430 MHz and 450-470 MHz) for voice communications. Dedicated spectrum, called Harmonised Government Spectrum, in the 400 MHz band has been set aside by the Australian Communications and Media Authority (ACMA) as part of a national reform project designed to enhance the ability of government agencies across all states to effectively communicate in emergencies.

In NSW, the specific spectrum allocated to any IBC system using the PSN will be managed by the NSWTA's Spectrum Management Office in liaison with the ACMA.

For further information, please contact telco.spectrum@customerservice.nsw.gov.au

2.4 IBC Systems

There is a range of different IBC systems in the form of combinations of Distributed Antenna Systems (DAS) and PSN head-end radio equipment. IBC equipment and infrastructure are categorised as either active or passive. Active generally refers to infrastructure or equipment that produces a signal, while passive equipment carries an existing signal. The 'DAS' is usually the passive part of the IBC system, while 'PSN head-end equipment' refers to active components.

PSN head-end equipment consists of a DC power sub-system, site routers, radio signal filters and, depending on the design, either a repeater unit or radio base stations.

This section provides an overview of DAS. For more detailed information, please refer to the 'Indoor Radio Services Design Specifications' or contact TelcoClientServices@customerservice.nsw.gov.au.

DAS distribute existing signals and don't generate signals, so a signal source is required to supply the DAS. An off-air repeater is the most common signal source for a DAS. They receive signals from the original source, amplify it and redistribute the signal through the DAS antennae. The off-air repeater is a low-cost option and is well-suited to IBC. DAS can also be fed by a new base station, which is usually used when there are specific capacity requirements or when there isn't an appropriate radio donor source in the vicinity.

Which DAS should building-owners use?

A disadvantage of passive DAS is that the signal becomes weaker further from the amplifiers. However, passive DAS can operate reliably, are relatively inexpensive and can be upgraded more easily than active systems.

Using fibre optic cable, active DAS can continue signal strength, amplified by remote radio units (RRUs), for long distances. However, active DAS are more expensive and require a dedicated power source to operate the RRUs. A hybrid DAS can be a cost-effective solution, using fewer RRUs than an active DAS.

The NSWTA prefers passive DAS infrastructure for the following reasons:
- Passive systems tend to be easier to upgrade should new requirements emerge in the future
- Passive systems do not require the provision of power supplies throughout the DAS infrastructure
- Passive systems tend to be more reliable and require less maintenance and reduced spares holdings over active systems
- Passive systems are generally easier to design and have fewer constraints with respect to uplink path loss, intermodulation and noise

The NSWTA recognises that passive infrastructure is not always suitable.

Suppliers will determine which is the most appropriate IBC system for the location and will clearly articulate why a particular solution has been chosen. Some key aspects to be considered when selecting an IBC system are: cost; feasibility; future expansion; maintenance; and radio frequency performance.

For more detailed information, please refer to the 'Indoor Radio Services Design Specifications'.

3. Investing in IBC Systems

This section provides an overview of the governance requirements for investing in IBC systems that will broadcast or rebroadcast NSW Public Safety Network Signals.

3.1 Investment for NSW Government

The NSWTA has the responsibility to ensure that NSW Government agency investment activities align with a sector-wide policy framework for operational radio and related communications.

The NSW Government has approved a series of measures that will guide agencies planning their investment activities so that they are in accordance with the overall direction of the sector unless exempted.

The circular, *DFSI-2019-01-NSW Government Operational Communications Strategy*, sets out the approval process for agencies who wish to invest in:
- any expenditure on new radio communications assets and commercial services, and/or
- for new sites, new towers on a site or upgrades to a site

Any investment in IBC systems by any NSW Government agency must be considered in accordance with the circular. Notably, the state of NSW is moving away from investment by individual agencies as the CCEP works towards developing a consolidated network. When this work is complete, it will be unusual for any government agency to invest in any network for the purpose of operational communications, other than the NSW Telco Authority, who owns, operates and maintains the network in accordance with the Act.

At a point where NSW agencies are ready to migrate fully to the consolidated network, Section 16 of the Act will be proclaimed, enforcing use of the Government telecommunications network by all NSW Government agencies. In cases where the PSN is not available or applicable, agencies will be able to apply for approval of the Minister, Customer Service for an alternative network.

IBC proposals, as with broader NSW Government information technology investments, will need to be consistent with the investment principles of the NSW Government ICT Investment Policy and Guidelines, particularly by:
- complying with whole-of-government procurement policies and directions
- considering a service orientation, including 'as a service' sourcing models
- demonstrating standardisation and interoperability of technologies and solutions
- demonstrating better value to government and citizens over the life of the investment

In order to ensure investments are consistent with Operational Communications Strategy objectives:
- agencies must procure goods and services from any product catalogue established by the Authority under Panel Contract ITS 2573 – Operational Telecommunications Services, Equipment and Infrastructure unless exempted[2]

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[2] This refers to exemptions granted by Telco Authority for agencies not to use Panel Contract ITS 2573, not exemption from using the network.

- agencies are required to comply with any technical standards, guidelines or policies issued by the Authority for the procurement and use of operational communications infrastructure, equipment, services and spectrum unless exempted[3]. The Authority will consult with agencies prior to the release of any such standard, guideline or policy.

In simple terms, any NSW Government agency seeking to invest in IBC systems that will use the PSN, must consult with and gain the approval of the NSWTA.

3.2   Investment for private businesses

For any other parties (including private entities), approval of the NSWTA must be sought when considering investment in IBC systems that will broadcast or rebroadcast PSN signals in NSW. This authority is provided in the Act (s15), which allocates responsibility of the network to the NSW Telco Authority.

Any party investing in IBC systems that broadcast or rebroadcast PSN signals in NSW are required to enter into an Agreement with the NSWTA for the use of the network. (see 3.5 'Licencing and agreements')

3.3   TA Issued Materials

The NSWTA prefers to issue the active PSN head-end equipment used for IBC systems to ensure that the infrastructure and equipment is supplied by authorised suppliers and meets PSN network standards. The IBC owner is expected to source and pay for the relevant passive equipment in addition to providing all the required supporting infrastructure for the new PSN head-end equipment such as AC mains power, rack space, cooling, lighting, security, etc. The NSWTA will provide the list of preferred providers of the government scheme, ITS2573, to assist with sourcing.

Passive and active parts of the system will be clearly identified in the demarcation diagram of the Statement of Work and/or Agreement.

When there is a signed Agreement between the parties to operate an IBC system using the PSN, the NSWTA will purchase required materials through approved suppliers and will invoice the signatory to the Agreement for the cost (without markup) of the materials.

The NSWTA will endeavour to develop the Conceptual Design for new PSN systems according to standard template designs. However, if there are site-specific requirements resulting in deviations from a standard PSN site design, there may be a requirement for the PSN system design to include a provision of spares for any equipment parts new to the network. The Customer shall pay for the required spares as part of the TA Issued Materials for the new PSN system/s.

3.4   Ownership

The NSWTA will take ownership of and will operate and maintain active PSN head-end equipment and the site owner will own, operate and maintain passive DAS infrastructure and any other supporting infrastructure. This arrangement will be clearly articulated in the

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[3] This refers to exemptions granted by Telco Authority from following standard procurement processes or guidelines, not exemption from using the network.

'GRN In-building Coverage Licence Agreement' signed by both the NSWTA and the IBC site owner.

The requirement for the NSWTA's ownership of any developer-led PSN IBC system is underpinned by the ability of the NSWTA to perform maintenance on the equipment, replace the system at end-of-life or upgrade the system for any significant technological changes.

3.5 Licencing and agreements

3.5.1 Statement of Work

Any party entering into an Agreement with the NSWTA for use of the PSN will be required to agree to the terms and conditions provided in a Statement of Work (SOW) prior to entering into the Agreement. The SOW will provide detail of the scope of works, including the equipment and infrastructure to be used for the IBC solution, agreement for the payment of required items, as well as the technical performance requirements and project deliverables.

3.5.2 Licencing to use the PSN

Any party using an IBC system to broadcast or rebroadcast PSN signals in NSW is required to enter into a 'GRN In-building Coverage Licence Agreement' with the NSWTA for the use of the network.

This Agreement provides the terms and conditions to provide PSN IBC for any given site. It details the PSN licence area, the responsibilities of each party, related costs for licencing and use of the network and includes maintenance and any reporting requirements.

The Agreement also includes a clause which acknowledges the transfer of PSN infrastructure ownership to the NSWTA upon operational acceptance.

3.5.3 Licencing spectrum

Any party using an IBC system to broadcast or rebroadcast PSN signals in NSW is required to hold a licence for the spectrum or have an agreement with a licence holder.

Please contact the NSWTA's Spectrum Management Office at telco.spectrum@customerservice.nsw.gov.au to discuss spectrum allocation and licencing prior to installation of an IBC system.

3.5.4 Third party systems

If there is an existing IBC system at the designated site that will be used for the PSN and is owned by a third party, the IBC owner will need to enter into an Agreement to ensure the ongoing operation of PSN signals via the system. In such cases, there will need to be either multiple Agreements for a site or multiple signatories to a particular Agreement.

Where third parties own an IBC system and the building where it is housed, the expectation is that these third parties will supply the environment to enable the IBC to properly function. This can include power, space and cooling for example.

3.6   Pricing

Any proposed PSN IBC system must undergo design approval, site licencing and commissioning process in accordance with the IBC process map (see Appendix A). The design review, Agreement negotiation, backhaul procurement (for base station sites) and site integration is undertaken and managed by the NSWTA. The NSWTA seeks to support the deployment of PSN IBC systems led by agencies in the public sector and by developers in the private sector in a cost-neutral and financially sustainable manner.

The pricing model includes the following elements which account for the recovery of up-front costs for the project lifecycle:
- TA issued PSN head-end equipment
- Application fee for project resources from the NSWTA (design review, licence negotiation and project management)
- System integration costs charged to the NSWTA for onboarding new PSN site
- Application fee for licencing radio site frequencies
- Backhaul provisioning costs (for PSN sites using base station solution)

The pricing model also includes the following elements which account for the recovery of ongoing costs for the lifecycle of the PSN IBC system:
- Costs charged to the NSWTA by the NSWTA's partners for the ongoing maintenance and operation of the PSN IBC head-end system/s.
- Costs charged to the NSWTA for the provision of backhaul transmission links which connect the PSN IBC radio site to the rest of the network4.
- Annual fees for radio site frequency licences.
- Administrative fee for the NSWTA to manage commercial contracts and accounts payable associated with the PSN IBC system/service.

For the PSN fee structure, please contact the NSW Telco Authority at:
https://www.nsw.gov.au/telco-authority/contact-us

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[4] Backhaul costs will be either ongoing, paid annually, or one-off.

4. Future of PSN IBC

With the NSW Government telecommunications network under development through the CCEP, it is difficult to determine the level of need of in-building coverage across the state. The Telco Authority is currently investigating potential solutions to gain the best indoor coverage while considering options that are cost effective and considerate of current and future technologies. Naturally, as public safety network technology develops, such as the Public Safety Mobile Broadband (PSMB), IBC systems will have to be compatible.

Some of the options being considered by the NSWTA are:
- macro sites providing coverage into buildings
- land mobile radio (LMR) specific IBC's
- co-build IBC's with mobile carriers
- leveraging existing carrier DAS/Wi-Fi systems with alternative technologies
- handset capabilities in terms of leveraging the LTE/Wi-Fi capabilities of these terminals to deliver services
- PSN extension solutions such as 'Vehicle as a Node'

Some points to consider when planning future IBC solutions are:
- the densification of the PSN via CCEP will greatly improve in-building coverage throughout the state
- the future state the Government telecommunications network will be in the form of PSMB, which will be able to leverage the carrier-based IBCs (subject to final determination of the delivery model)
- many existing carrier DASs do not support PSN band of operation and cannot be plugged into without significant hardware changeout

5.   References

The NSWTA has prepared a range of reference and guiding documents to assist NSW Government and any external parties seeking information about in-building coverage.

Document	Purpose
In-building coverage guidelines: For the Public Safety network.	Provides an overview of IBC and the governance environment.
Indoor Radio Services Design Specifications	Provides detail of indoor radio design specifications.
IBC deployment guide	Provides an introductory overview of what is involved with deployment of an IBC system.

Appendix A

Figure 1 – IBC process map