powertec
TELECOMMUNICATIONS pty ltd

EOI - DESIGN OF ALTERNATIVE VOICE SERVICE TRIALS

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1 OVERVIEW

Department of Communication and the Arts are seeking expressions of interest from Australian technology providers in development of alternative ways to deliver voice telephone services in rural and remote areas. Subsequent trials will seek to replace services delivered over the aging High Capacity Radio Concentrator (HCRC) network. There are approximately 6,400 premises being serviced by the HCRC network.

In analysis of the USG Summary Report [2], Powertec recognises replacing the HCRC network will require a mix of technologies, with a combination of Mobile, Fixed Wireless, and Satellite services being required.

Powertec proposes two of its systems as candidates for replacement of HCRC sites.

The first system, Cel-Fi RMOE, is a mobile smart repeater system that reuses the HCRC tower and solar infrastructure already deployed at customer premises. This system has already been trialled and undergoing active deployment by Telstra in remote areas. This system uses a high gain donor antenna to detect and boost weak mobile signal, providing local mobile coverage to the surrounding area.

A second system, known as the Powertec LTE-M Voice Gateway, is a long-range CPE providing Fixed Wireless services over the Telstra LTE-M network. Still in early development, the device uses a high gain external antenna to provide VoLTE voice calling over CPE similar to an ordinary house phone.

Powertec's Queensland-designed and built systems are backed by its local support team and national network of field technicians.

1.1 RELATED DOCUMENTS

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

[1] Design of Alternative Voice Service Trials – request for comments and expressions of interest
[2] Development of the Universal Service Guarantee—summary report

1.2 DEFINITIONS, SYMBOLS, AND ABBREVIATIONS

1.2.1 Definitions

Section not in use.

1.2.2 Symbols

For the purposes of the present document, the following symbols apply.

dBi	decibels relative to an isotropic radiator
dBm	decibels relative to milli-Watt
dB	decibel
Gb/s	Gigabits per second
GHz	GigaHertz
Mb/s	Megabits per second
MHz	MegaHertz

1.2.3 Acronyms and abbreviations

For the purposes of the present document, the following acronyms and abbreviations apply.

ACMA	Australian Communications and Media Authority
CPE	Customer Premises Equipment
DCA	Department of Communications and the Arts
FWA	Fixed Wireless Access
HCRC	High Capacity Radio Concentrator
LTE	Long Term Evolution (4G)
MCL	Maximum Coupling Loss
NBN	National Broadband Network
NGWL	Next-G Wireless Local Loop
RMOE	Remotely Managed Outdoor Equipment
USG	Universal Service Guarantee

2 RESPONDENT DETAILS

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Title:	
Email:	

3 ORGANISATION CAPABILITY AND CAPACITY

Powertec is a Queensland-based telecommunications company established in 1995. The company comprises a team of over 40 permanent staff, 65 national field contractors, and supported by a network of several hundred local distributors and dealers spanning Australia and New Zealand.

Historically a provider of commercial telecommunications systems, Powertec was first launched into the national spotlight following the launch of its mobile phone signal booster systems in 2014. Called the Cel-Fi, Powertec's boosters began a revolution in regional connectivity.

The company broke ground again 2018, this time making international headlines with the wholly Queensland designed and manufactured IoT system - myinsight.io. Development of such a unique device began in 2016, with the Powertec electronics team recognising the ongoing war between IoT standards waging across the globe. The team embarked on the design of a truly innovative device capable of operating on all IoT standards.

Powertec's ground-breaking electronics development continues, with projects in remote asset monitoring, long range voice communications, among many others.

Powertec's extensive capabilities encompass everything a wireless project requires, including communications towers, solar systems, microwave links, long range antennas, sensors, and modems. Strategic partnerships with mobile network operators and IoT providers coupled with its national network of field technicians allows Powertec to deliver truly turn-key remote communication systems.

With a company history spanning the decades, Powertec's engineering success is built on a solid administrative foundation. The company operates an industry-leading Enterprise Resource Planning suite, along with CRM and technical support ticketing systems. Powertec is ISO 9001, ISO 14001, and AS/NZS 4801 certified.

OBSEQUENTIA
QUALITY CERTIFIED
ISO 9001:2015

OBSEQUENTIA
ENVIRONMENT CERTIFIED
ISO 14001:2015

OBSEQUENTIA
SAFETY CERTIFIED
AS/NZS 4801:2001

4 PROPOSAL DETAILS

4.1 INDUSTRY ANALYSIS

In determining suitability of its proposed solutions, Powertec bases much of its reasoning on the analysis contained within the USG Summary Report [2].

The USG Summary Report identifies VoIP as the recommended delivery technology, suggesting that VoIP when deployed correctly provides a quality of service exceeding that of conventional landline phone services.

Powertec believes that a nationally available voice carriage service, such as an NBN Sky Muster TC1 VoIP service, appears to be the most practical candidate for HCRC network replacement. The Report however suggests given the service's susceptibility to rain-fade (99.712% average annual uptime), this option is to be discounted.

Consequently, Powertec's suggestion is to attempt to service most HCRC customers using the availability of existing Telstra mobile services. The Report identifies that 88% of premises outside the NBN Fixed Line footprint and currently serviced by a Telstra fixed line are estimated to have access to a Telstra mobile service.

This figure does not account for the premises that can be serviced through the provision of high gain external antenna, which provide a significant improvement to the useable range of a mobile service. The map below provides a general indication of the HCRC sites potentially serviceable by a mobile-based solution.

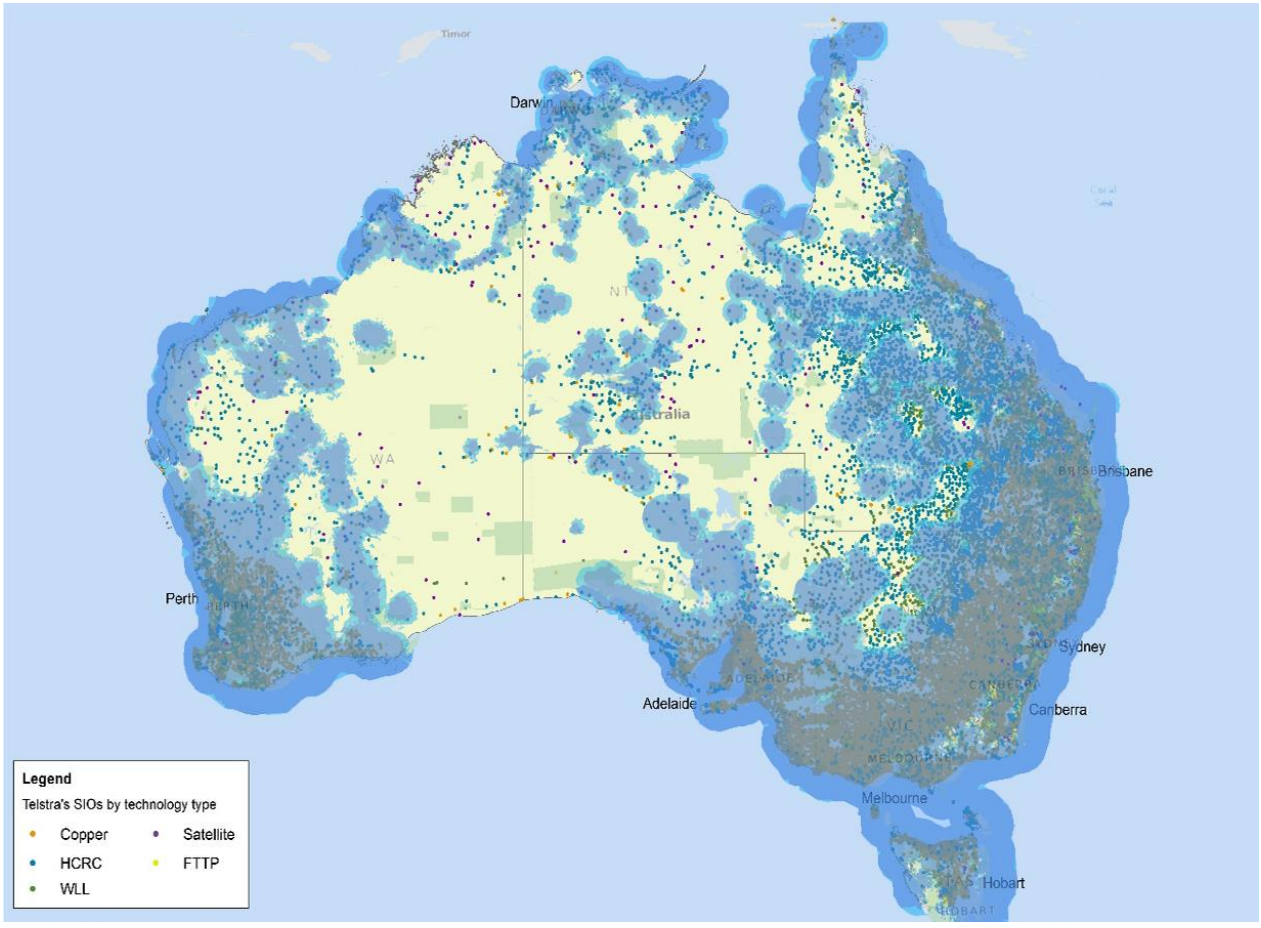

Figure 1 - Telstra LTE-M Overlayed on HCRC Sites

Sites falling outside the range of a mobile-based solution may be serviced by the existing Telstra USO geostationary satellite network, which according to the Report already provides voice connectivity for around 1,000 premises. An essential component of this approach would be the migration of numerous satellite services falling within mobile coverage areas to leave capacity available for ex-HCRC premises.

The suitability of Powertec's mobile-based solutions are discussed in brief below.

4.2 MOBILE-BASED SOLUTIONS

While it is noted that mobile networks face similar uptime constraints as an alternative service like NBN Sky Muster, the very notable advantage is its reduced latency – 50 to 60 ms compared to a typical 500 to 600 ms.

Telstra's confidence in its mobile-based solutions is such that it has already begun migrating customers from its HCRC network onto Next-G Wireless Local Loop (NGWL) services. Telstra's NGWL service has been in operation since 2008 and uses high gain external antenna connected to a 3G CPE which provides a landline phone connection. NGWL is similar in formfactor to an NBN Fixed Wireless connection.

4.2.1 Cel-Fi RMOE

In addition to NGWL, Telstra in partnership with Powertec have been implementing Cel-Fi RMOE as a means of providing mobile coverage to isolated locations.

Cel-Fi RMOE consists of a Cel-Fi Repeater connected to high gain donor and service antennas, along with solar power equipment, all mounted on a steel mast located on the customer premises. In most field deployments the system has reused existing HCRC masts.

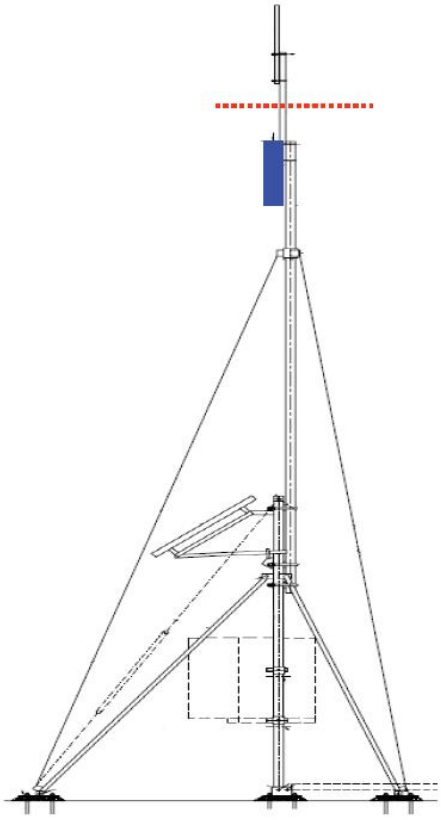

Figure 2 - RMOE Typical Layout

Figure 3 - RMOE Deployed by Telstra

RMOE deployments often reuse the HCRC mast to achieve a significant increase in receiver height which one of the most critical factors in migitating signal attenuated by terrain features, vegetation, precipitation, and thermal effects.

The system's high gain donor antenna provides a 6 to 14 dBm improvement to signal strength, which can translate to beyond a 200% increase in receivable range from the cellular base station.

The RMOE's service antenna rebroadcasts mobile phone service at up to a 100 dB gain, in an arc typically 100 to 500 metres in distance and potentially further depending on antenna configuration.

RMOE is designed for either a mains power supply or solar powering. The system has an integrated mobile broadband modem for external monitoring by the service provider.

4.2.1.1 RMOE advantages

The USG Summary Report identifies that the demand for landline services is dropping, and continues to drop, with the report stating that 9.5% of home phone owners were considering disconnecting their service within the next 12 months. The demand for mobile voice and data services however continues to accelerate.

In recognition of these trends, RMOE offers a distinct advantage being one of few solutions capable of delivering high quality mobile voice and data services at HCRC sites. Figure 1 shows a very large number of HCRC sites within range of Telstra mobile services, and hence considered good candidates for RMOE deployment.

In assessing economic viability, RMOE has so far been deployed by Telstra by reusing existing HCRC mast and solar equipment. This allows the solution to be implemented at a comparatively low cost, using known hardware that has already been field proven to stand the test of the harsh Australian environment. The equipment is, in effect, a drop-in upgrade.

The useable range of RMOE can be extended by the daisy-chaining of multiple repeaters. Many HCRC premises rely on the relaying of the radio connection through guyed towers as tall as 60 metres. It is conceivable that mobile connectivity could be relayed to RMOE site(s) by reusing the existing tower infrastructure.

RMOE is also network operator agnostic and can be implemented on all three mobile network operators.

4.2.1.2 RMOE limitations

While the Telstra network is estimated to cover some 3,500,000 square kilometres, and over 4,000,000 square kilometres with the use of high gain antenna, this falls short of covering all HCRC sites. It is recognised that RMOE can only form part of a multi-technology solution, which Powertec's recommendation is to deploy alongside the USO satellite network.

The uptime of an RMOE solution is dependent on the availability of the mobile network that it retrieves its connection from. While remote-area network uptime statistics are closely guarded, this factor however has not dissuaded Telstra from proceeding with its roll out.

4.2.2 LTE-M Voice Gateway

With Telstra announcing the switch-off of its 3G network by 2024, USO technologies like NGWL will require replacement. The implementation of LTE over the 700 MHz band has provided near-equivalent coverage of the ageing Next-G 850 MHz network. However, in practice 850 MHz tends to provide marginally better coverage than 700 MHz due to the narrower 3.84 MHz channel size, allowing a connection to be established at greater distances. As technology currently stands switching 3G off will represent a noticeable reduction in availability of regional mobile connectivity.

Telstra's 700 MHz LTE service uses a 20 MHz channel in most areas in order to provide very high data rates. The downside of this large channel size is the difficulty consumer devices have in detecting it under poor RF conditions. In January 2018 Telstra announced the activation of its LTE-M network.

LTE-M follows the same principle which allows the detection of 3G at greater distances, whereby narrowing the channel width a more sensitive receiver can be implemented and transmit power is used more effectively. LTE-M operates on a narrow 1.08 MHz channel, allowing an improvement in Maximum Coupling Loss (MCL) from 142 dB under legacy LTE networks to 156 dB with LTE-M Cat-M1. Theoretically, a 14 dB increase could represent an increase in receivable range from 20 kilometres to as far as 100 kilometres from a mobile base station.

When coupled with the use of a high gain directional antenna the potential range of an LTE-M connection is extraordinary. Under field conditions the use of a high gain antenna can double the effective range of a mobile connection. Their combination with the tall masts and guyed lattice towers used to deliver HCRC in extremely remote areas could potentially connect premises far outside the range of ordinary mobile networks.

Powertec's LTE-M Voice Gateway leverages the addition of VoLTE over LTE-M, which Telstra announced its support for in September 2017. While still under development, once released the device will operate with little useability difference to existing 3G voice gateways that technologies like NGWL are delivered over.

The system comprises a high gain external antenna which is cabled to the LTE-M modem and provides a standard RJ11 phone connection output. Its operation is expected to be no different to the operation of an ordinary landline phone.

4.2.2.1 LTE-M Voice Gateway advantages

Replacing HCRC with an LTE-M Voice Gateway allows the technology to be implemented with no change to the end user experience. Recognising many regional customers may resist a change from a landline to mobile service, the voice gateway has the distinct advantage of allowing the customer to retain the use of their familiar home phone.

In comparison to the RMOE proposal, LTE-M offers a dramatic increase in receivable range, allowing a significantly greater number of HCRC premises to be migrated to an LTE-M solution. This would reduce the required number of premises to be shifted onto a satellite service.

Unlike HCRC or satellite solutions, LTE-M services would improve in quality and reliability as improvements are made to the Telstra mobile network. Additional premises would be covered with each new base station installed, with a single new Telstra base station adding theoretically as much as 30,000 square kilometres of additional LTE-M coverage.

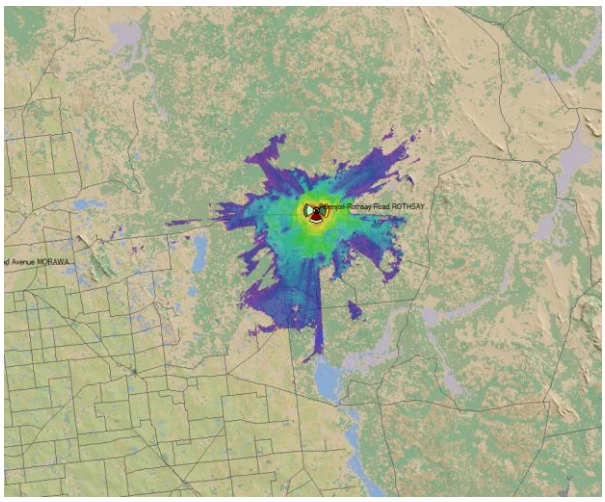

Figure 4 – Real world LTE coverage simulation (814 km^2)

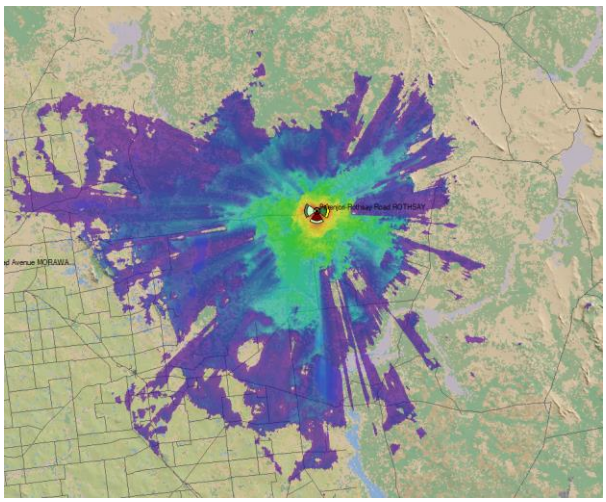

Figure 5 – Real world LTE-M coverage simulation (3,895 km^2)

Like NGWL, the formfactor of the LTE-M Voice Gateway most closely represents a Fixed Wireless Access (FWA) device, not dissimilar to an NBN Fixed Wireless implementation. The practical characteristics and challenges of FWA deployments are well understood. Likewise, the economics and administrative processes underpinning an FWA rollout are nowadays considered routine.

4.2.2.2 LTE-M Voice Gateway limitations

Like alternative mobile-based solutions, LTE-M Voice Gateways are limited by the availability and uptime of the Telstra mobile network. The recommendation remains to deploy alongside the USO satellite network.

A Voice Gateway service does not account for the growing trends of abandoning landline services as identified in the USG Summary Report. Currently there are no solutions available that provide Cat-M1 connectivity to ordinary mobile phones.

Most notably, at the present time the voice gateway device is still under development. The intention is that a small number of functional prototypes would be available for the trials.

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