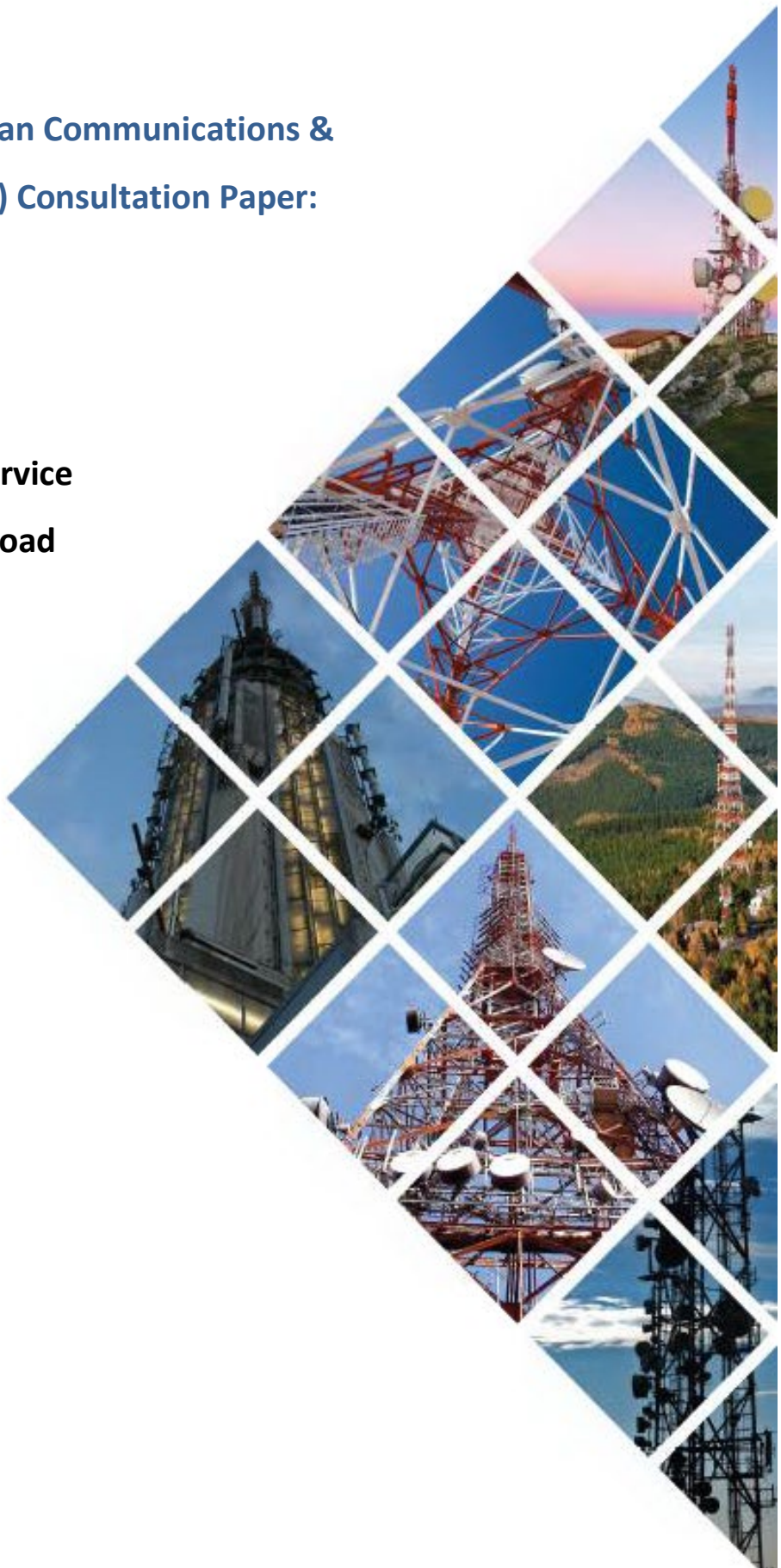
RFI
TECHNOLOGY SOLUTIONS

Submission to the Australian Communications & Media Authority ("ACMA") Consultation Paper:

"Facilitating trials of radionavigation- satellite service (RNSS) repeater devices in road tunnel networks"



In collaboration with partner

SYNTONY GNSS

TABLE OF CONTENTS

1 Letter of Introduction & Statement of Capability and Interest

To: The Manager
Spectrum Licensing Policy Section
Australian Communications and Media Authority ("ACMA")
PO Box 13112 Law Courts
Melbourne Vic 8010

13 July 2020

Subject: Introduction of RFI Submission to the ACMA Industry Consultation,

"Facilitating trials of radionavigation- satellite service (RNSS) repeater devices in road tunnel networks".

RFI is pleased to respond with this submission to the ACMA industry consultation on this subject. We appreciate that ACMA recognises the rapid technological changes in radiocommunication solutions and devices and evolving user demand for such technologies especially location services. We fully support the ACMA review and endeavours to align the Radiocommunication Regulations to allow the importation, deployment and usage of RNSS repeater devices for legitimate purposes including road tunnels.

RFI also commends ACMA for its enngagement with industry stakeholders as part of its "Five-year spectrum outlook 2019-2023". We welcome the ACMA review and consultation on 'Prohibition declarations and exemption determinations" that have direct bearing on the ability to facilitate the planned trials of radionavigation satellite service (RNSS) repeater devices in road tunnel networks.

RFI/Syntony fully support the proposed RNSS repeater road tunnel trials that will enable technology familiarization by Australian stakeholders, confirm solutions meet the spectrum of user expectations, and the beneficial use cases and compliance to acceptable radiocommunication emission standards. Demonstration and trialling will improve tunnel operator investment confidence, confirm location performance with end users and provide ACMA evidence to undertake appropriate amendments to radiocommunications licencing.

RFI has over 40-years history as an Australian company manufacturing and suppling wireless solutions to the Australian and global radiocommunications market. This has included the design and supply of rebroadcast products and services into the majority of road tunnels in Australia and New Zealand and professional wireless solutions used locally and globally by emergency services, government agencies, industrial and commercial enterprises.

In addition, RFI has established a formal partnership with Syntony-GNSS, the global leader in RNSS/GNSS solutions that have been both extensively trialled in Europe and North America and deployed operationally in many road tunnels and transport subways. These deployments have required intimate involvement with all project stakeholders including regulatory authority peers in these countries.

We believe the RFI/Syntony partnership is therefore well equipped to offer expert input into this ACMA consultation and the proposed road tunnel trials.

Many other industries (e.g. rail/mass transit, mining, etc.) have similar operational requirements for accurate and seamless location information in underground and confined space environments to that readily available outside. RNSS/GNSS location information will most likely also play a role in future C-ITS and Connected & Autonomous Vehicles to augment navigation capability.

Our submission substantiates the following key recommendations to the industry consultation based on real life experiences from multiple deployments and trials globally:

a) **RNSS Repeater devices be exempted under the prohibitions and exemptions framework under the Act**
b) **Scientific Licencing be utilized as the most expeditious approach to facilitating proposed in-tunnel trials while a permanent licencing framework is enacted. That Scientific Licencing also be available as interim option for other industry applications (e.g. rail/metro, subways, mining etc.) At all times boundary condition specifications under ETSI Harmonised Standard EN 302645 must be complied.**
c) **Longer term RNSS Repeater licencing be expedited under Class Licencing (preferred option) or Apparatus Licencing such that it is not limited to national security, law enforcement and emergency services/governments, but also available to other entities operating in underground/confines spaces (where licencing, performance and boundary condition specifications can be mandated) including Road Tunnel operators and other legitimate use cases. At all times boundary condition specifications under ETSI Harmonised Standard EN 302645 must be complied.**
d) **Licence conditions based on ETSI Harmonized Standard EN 302 645 boundary condition specifications, with in-tunnel EIRP not prescribed or limited, total system gain not prescribed or otherwise limited other than for out-of-band spurious emission performance. This will in some circumstances allow retrofitting of RNSS Repeater capabilities into existing confined space locations where existing RF signal distribution equipment (i.e. radiating**

cable) may require higher gains and RF transmitter powers to achieve useable radiated signal levels required by standard RNSS receiving devices . At all times boundary condition specifications under ETSI Harmonised Standard EN 302645 must be complied.

e) **In-tunnel trials are conducted with RNSS Repeater equipment that can provide seamless location information and accuracy levels consistent with requirements/expectations of the broad spectrum of beneficial users with standard RNSS receivers.**

RFI and Syntony would be pleased to share further our extensive experience in design and deployment of RNSS Repeater solutions in road tunnels and subways and would welcome the opportunity to collaborate with ACMA and road tunnel operators in the proposed trials.

Yours Sincerely

Kevin Graham
Advisor, Strategic Technologies, and Innovation
RFI Technology Solutions

2 RFI & Syntony Statements of Capability

About RFI: A global technology solutions company, specialising in wireless coverage and solar power. RFI has one of the largest, most innovative and experienced wireless and solar solutions teams with dedicated engineers, product managers, deployment engineers, logistics, distribution and R&D staff. For over 40 years, as an Australian founded and headquartered company, RFI has developed, manufactured (in Australia) and distributed world-class, high performance wireless products including: antenna systems, rebroadcast & monitoring equipment, power systems and cabling and connectors. In Australia and New Zealand RFI has provided the majority of radio rebroadcast systems for road tunnel projects. RFI is recognised as a market leader in wireless products and offers the best products backed with outstanding technical support. We are proud to be an Australian success story with manufacturing, distribution and warehousing across Australia, New Zealand, the USA and the UK.

RFI have supplied rebroadcast products and/or services in the majority of road tunnels in Australia and New Zealand including; Sydney/NSW (M2, M4E, M5, NM5, M4M5-LINK, Rozelle Interchange, Sydney Harbour Tunnel, Lane Cove, T2E Byron Bay, Cross City and Eastern Distributor Tunnels), Perth (Polly Farmer Tunnel), Adelaide ('Bahn and Heysen Tunnels), Melbourne (Citylink and Mullum Mullum Tunnels), Brisbane (Airport Link, Legacy Way, and Clem 7 tunnels) and New Zealand (Waterview, Wellington Terrace, Arras, Lyttleton, Mt Victoria and Victoria Park Tunnels).

www.rfi.com.au

About SYNTONY: Acknowledged as one of the global leaders in the GNSS simulation, receivers and underground GPS location markets. With a heritage based on 15 years research and design and collaborations with industry leaders. Syntony was formed to create a portfolio of products and integrated solutions that are recognized and recommended for their uniqueness, high performance and competitiveness. Syntony continues to expand its global presence to address many critical sectors that increasingly rely on location and navigation services in their operations and who now demand indoor location/navigation where the GPS/GNSS satellites signals cannot be received by the user devices.

SYNTONY have proof of concept, demonstration and active systems deployed and operating in Europe (Sweden, France, Germany, Finland) and in USA (New York) with more planned.

www.syntony-gnss.com

3 Qualification of Use Cases for RNSS Repeater Devices.

The proliferation of a broad range of mobile communication technologies, Geographical Information System (GIS) and Global Positioning System (GPS) technologies have become ubiquitous in our modern society. When combined, GIS and GPS systems provide a broad range of Location-Based Services (LBS) to an extensive range of mobile users. These users include wide range of consumer, public safety, commercial and public-purpose applications.

In terms of incident response, establishing an accurate location is a critical step for ensuring that response resources can quickly locate both an incident and deploy response assets to that incident. Whilst GPS technologies have greatly enhanced the establishment of an accurate location and way finding to that location, the modern urban environment creates several difficulties for establishing location accuracy. These difficulties exist for both the indoor and underground environment.

Major fires within road (and rail) tunnels are relatively rare; however, when they do occur, they can be catastrophic. For example, McDaniel (4:2017)[1] has identified 21 incidents where fatalities have occurred due to vehicle fires within tunnels. In addition to vehicle fires, road collision (ranging in severity from minor injuries to fatalities) and vehicle breakdowns are common incidents that occur within the underground road network. When these incidents occur, quickly establishing an accurate location and developing both response and traffic management plans ensures that road management authorities can simultaneously aid the affected parties and minimise the adverse impact on the road network.

Emergency services in Australia already use RNSS extensively to report the location of emergency service assets and personnel in the field and to assist in selection and navigation of these resources. to an incident via the most efficient and expedient route. Increasingly position and date/time information is being appended to operational reporting, evidential information collection (e.g. body worn cameras). RNSS services are also becoming increasingly important to support OHS procedures and tools in the provision of safe workplaces for participating personnel (i.e. location of personnel at an incident scene, emergency/man down alerts that include location information, geo-fencing, and incident area entry/exit tagging). It is inevitable that the mandating and use of GIS and RNSS applications will continue to increase.

International experience exists via trials and operational deployments already undertaken.

[1] https://mountainscholar.org/bitstream/handle/11124/170970/McDaniel_mines_0052E_11224.pdf?sequence=1

RFI would be pleased to share with ACMA and proposed trial stakeholders' details of how these trials progressed, the regulatory frameworks that applied, the test plans adopted and the outcomes of the trialling. We believe such insights could allow ACMA to form an early opinion and commence, with confidence, short-term and longer-term licencing option, in parallel with the contemplated road tunnel trials conducted under interim "Scientific Licencing" (Option 3).

RFI supports the use of Radio Navigation Satellite System (RNSS) in-tunnel navigation solutions that utilise RNSS repeaters as an effective and seamless means of providing accurate position information to motorists and emergency services in current and future road tunnels. Road tunnels (and Rail tunnels/subways) continue to proliferate in Australia and internationally as part of modernizing cities and improving travel times. On the east coast of Australian alone, the 3 State governments have project commitments when completed, that will add approximately 130 kilometres of underground carriageways to those that currently exist.

A key objective of the road operators is to provide motorist with seamless, efficient, and safe travelling that aims to reduce travel times and above-ground road network congestion, especially important for toll-based motorways. RNSS in-tunnel repeater navigation solutions can provide motorists and emergency services the benefit of uninterrupted navigation services, more accurate position fixes including wayfinding and direction information. This will greatly assist in lane selection and safer early guidance for exit points applicable for the motorists' destination. In addition, more accurate and seamless position information in tunnels will significantly reduce errors and latency currently experienced with mapping applications relying on position data and therefore improve user experience and safety.

Emergency services will also benefit from the implementation of RNSS in-tunnel navigation solutions. In the event of a road tunnel fire, which, can reduce visibility to less than one metre, access to accurate navigations information via handheld devices could save lives. RNSS in-tunnel navigation solutions using RNSS repeaters are superior to other solutions (i.e. Waze beacons, wi-fi location solutions, direct short-range communications) as they seamlessly work with any RNSS receiver without further integration via blue tooth communications or additional third-party applications.

There are future requirements emerging that will need provisioning of smart infrastructure to support connected and highly automated vehicles (CAV). The associated digital infrastructure will need to support the growing volume of data and communications flowing between these infrastructures and control centres and other connected vehicles. These applications will therefore also require RNSS location services in road tunnels to support CAV.

Transport user groups are already relying on location services for fleet management telematics for job dispatch, trip tracking and route management, asset management, fatigue management, Freight and asset tracking (e.g. dangerous goods, high value, biomedical or other sensitive goods).The associated on-board sensors and sensing data generated in modern vehicles and trucks is usually always referenced in time and in space to the specific location. When traversing road tunnels and when stationed in confined spaces RNSS location services are also required by RNSS receivers fitted to these vehicles or personnel carried devices.

In addition to the ESO, Road tunnel, transport uses cases above, we are aware of existing demands and emerging demands from other public and private industries for confined space location services using RNSS Repeating devices. These include, for example, RNSS Repeater vendors, military, transportation (rail, bus, airport, trucking, taxi, valuable and dangerous good racking), subways, carparks, vehicle installation and maintenance depots (where RNSS receiving devices must be tested before active service or return to service), mining, freight and logistic centres and manufacturing.

We highly recommend ACMA and trial stakeholders look at international evidence accumulated to date on existing trials and deployments to shape trial programs and advance local regulatory efforts on long term licencing options in parallel. We understand that road tunnel operators while amenable to trials using Scientific Licences, understandably, require the confidence and certainty of a permanent long-term licencing option, as soon as possible, to justify the significant investment that will be required to implement trials. With the rate of motorway expansions, new constructions committed and planned, motorway operators also require licencing certainty well ahead of their design and procurement planning.

The initial specification of RF rebroadcasting system's need to consider all the services requiring rebroadcasting (including RNSS) as early in the design and procurement stages as possible. The earliest possible availability of a permanent long-term licencing regime is critical to effective specification and economical deployment of such rebroadcasting services.

The industry has demonstrated previously its ability to design and deploy in-tunnel RF rebroadcast solutions that do not interfere with the reception of radio signals operating outside the tunnel. AM and FM radio signals are one example of rebroadcasting that date back to the early 1990's in Australia. Such AM/FM rebroadcasting is allowed under existing class licensing.

RFI supports the three options outlined in the ACMA consultation paper as follows:

Option 3: Amend the Declaration, to exempt RNSS repeaters, and authorise trials through Scientific Licensing. We agree this provides a practical approach to allow vendors to import RNSS repeating solutions and the earliest commencement of trialling in road tunnels. This provides the most expeditious timescale for assembly of an evidence base to support better long-term policy and regulatory decisions. RFI would recommend the scientific licence approach be made available, beyond government/road tunnel operators, to include other potential professional applications in other industries. We also recommend that scientific licence terms have guaranteed automatic renewal until a permanent licencing regime can be enacted. This should include GNSS Repeater vendors to allow importation and use of RNSS repeater devices for internal engineering and demonstration purposes. This option should also be equally available to other legitimate end user industries to trial in other confined/underground applications.

Option 2: Amend the declaration, to exempt RNSS repeaters, and assess Class and or Apparatus Licencing arrangements for appropriateness. RFI supports both licence options and provides further recommendations later in this submission for each type, respectively.

Option 1: Amend the declaration to exempt RNSS repeaters, thereby allowing legitimate vendors to import and possess such devices in addition to the exemption determinations already available for national security, law enforcement and emergency services. RFI supports as a preference the approach via licencing arrangements under option 2 if these can be put in place within a reasonable timeframe. We recommend that scientific licencing, Option 3, allow automatic renewal, by ACMA, until such time longer-term licencing arrangements are fully enacted to give all users confidence and certainty on investments made for the purposes of the trials.

RFI agrees that the proposed road tunnel trials will provide ACMA sufficient evidence to allow location-based services to be equally permitted in other industries and within the urban environment more generally, where legitimate compliant and beneficial use cases are substantiated.

4 Response to Review of Radiocommunications Prohibitions and Exemptions Framework.

RFI recommends RNSS Repeater devices be exempted under the prohibitions and exemptions framework under the Act such that they can be deployed by industry, including, but not limited to, government and road tunnel operators, subject to the eventual radiocommunication licencing, Options 1-3.

5 Response to Options to Facilitate Use

5.1 Scientific Licencing Option 3.

RFI supports use of scientific licences for the interim trialling proposed for Road tunnels. We would seek that the same approach be extended to include trial uses in other industries beyond government and road tunnel operators where legitimate, compliant, and beneficial use cases can be substantiated. This should include legitimate RNSS repeater vendors who would require scientific licences as means for importation, internal engineering, demonstration and staging of equipment for trial users, including the initial road tunnel trials contemplated. We recommend that compliance by users to **boundary condition specifications under ETSI Harmonised Standard EN 302645 or similar be adopted.**

5.2 Class Licencing as a licencing arrangement Option 2

As cited above, the rebroadcasting of AM/FM/DAB+ and Two-Way Radio services has been approved in Australia under Class Licencing, with deployments going back to the early 1990's. This is one example where industry stakeholders have demonstrated deployments can operate successfully within prescribed interference limits and do not interfere with radio signals outside the confined spaces such as tunnels. Body Scanners used in airports etc. are another category of "restricted or special condition" class licenced devices {Radiocommunication (Body Scanning - Aviation Security) Class License 2018}. RFI would suggest that a RNSS repeaters class licence could be the preferable arrangement for long term licencing like that used for Body Scanners. Such class licence could define restriction to legitimate professional users who can substantiate beneficial uses cases and locations. The basis for this recommendation is:

a) in the case of road tunnel applications, the government or road tunnel operator cannot monetize the provision of RNSS repeaters as is the case with other rebroadcasting services already provided in tunnels generally (e.g. AM/FM/DAB+, cellular and ESO/Government Radio Network rebroadcast services)

b) present apparatus licencing fees would be prohibitive in terms of annual licence fees given fees are levied on channel bandwidth occupation.

c) RNSS repeater services benefit ESO's and all other commercial and public users entering the road tunnel. The same situation would apply for most other vertical market deployment applications beyond road tunnels.

d) Authorization for use could be, like that applied in the instance of Body Scanners and AM/FM/DAB+ and Two-Way Radio rebroadcasting with appropriate special conditions defined.

e) it would be beneficial to have deployment locations recorded on a register to ensure controlled deployment of such RNNS repeaters to minimum technical standards for interference protection.

f) We would highly recommend that compliance by users to boundary condition specifications under ETSI Harmonised Standard EN 302645 or similar be adopted in any case.

5.3 Apparatus Licencing as a Licencing Arrangement Option

RFI agrees that Apparatus licencing would provide the most controlled way of managing long term RNSS repeater licencing, however two concerns arise:

a) annual licence fees would require amendment to minimise recurring cost impacts on operators. RNSS repeating services requires significant additional capital expenditure and will add lifecycle operational and maintenance costs for operators. As mentioned previously the justification for such deployments would be based entirely for community benefit for ESO's and public. Therefore, any apparatus licence fee would need to be minimal, e.g. to cover only ACMA administrative fees; Therefore, it seems a new Apparatus fee category would be required and warranted.
b) the timescale for such amendments to be enacted under Apparatus Licencing in the Act.

Trial users desire certainty of a future licencing arrangement and guaranteed renewal of scientific licencing at fair and reasonable recurring licensing costs under Option 3 would be desirable until a new Apparatus Licence category was enacted. We would highly recommend that compliance by users to boundary condition specifications under ETSI Harmonised Standard EN 302645 or similar be adopted in any case.

6 Response to Licence Conditions & Managing the Risk of Interference

6.1 Overview & Considerations

We provide the following comments and responses to proposed Licence conditions to manage the risk of interference and ensure any RNSS Repeater solution deployment in Australia:

- meets user requirements and use cases and supports a broad spectrum of current and future standard RNSS receivers including smartphone, in-vehicle receivers, in-built car navigation, handheld navigation devices, handheld held two way and multimode devices used by emergency services, government, industry and enterprises.
- Leads to the most economic deployment, including where feasible retrofitting to existing underground/tunnel systems to minimize obsolescence/replacement of existing leaky feeder radiating cables, antennas, and rebroadcasting equipment. There are also significant costs of deploying within operational roadways where in-tunnel work hours are restricted and can usually only be performed during infrequent tunnel maintenance closures.

Underground/confined space geographies and environments vary significantly. For example, road tunnels can have complex geometries in terms of tunnel size, on-off ramps, interchanges and emergency escapes, provisioning of equipment spaces and access to services/interconnections. Existing tunnels and those in advanced stage of construction have significant communications infrastructure deployed or committed, including investment in rebroadcast systems incorporating bearers, leaky feeder radiating cabling, antennas and coupling systems. Our responses below have been made in consideration of both economic and technical factors that impact deployment of RNSS repeating in existing and new/future underground applications.

We agree that boundary conditions and specifications are essential but recommend that power levels should be based on the receive signal levels on the operating surfaces (e.g. road surface in road tunnel applications) while always meeting spurious emissions specifications both inside and outside the confined space.

6.2 Response to Licencing Conditions & Referenced Specifications

The following comments and suggestions are offered on License Conditions in the consultation paper.

a) We support:

- the frequency bands on which RNSS repeaters can be operated.
    - *1164-1215 MHz*
    - *1215-1300 MHz*
    - *1559-1610 MHz*
- ETSI Harmonised Specification EN 302 645 in respect the boundary conditions (this is consistent with the specifications imposed in existing deployments and trials outside Australia).

    Emissions radiated from any transmission point, on any permitted frequency will not exceed a level of -140 dBm/24 MHz measured by an isotropic antenna at a distance of 30 meters from the tunnel portal. This measurement is to be taken under clear sky conditions with no additional attenuation from the transmission point (i.e. based on

free space propagation with no allowance for additional attenuation such as building attenuation).

with exceptions noted in item b) below.

- ECC Recommendation 10(2) is like EN 302 645 and is acceptable with the exceptions noted in item b) below.
- That the specific technology used to provide RNSS rebroadcast (i.e. GPS simulation, off-air rebroadcasting, etc) should not be defined, so that different grades of RNSS rebroadcast solution can be made available to meet the various applications. In each case the RNSS repeater must meet the defined boundary conditions and spurious emissions specifications.

We believe underground environment limitations on the maximum radiated power from each RNSS repeater transmitter warrants further attention given our comments in section 6.1. It should also be noted that in a road tunnels, and other applications, vehicle types and other infrastructure, signage & other obstructions present additional attenuation barriers in respect received signal levels at RNSS receivers in the use cases.

b) We would therefore recommend that:

- Higher RNSS Repeating transmitting power be permitted to achieve an acceptable received signal level in these environments, providing such powers do not exceed the boundary condition and spurious emissions specifications under ETSI Harmonised Standard EN 302 645
- ETSI Harmonized Standard EN 302 645 section 1.3.1 does not prescribe a maximum EIRP from the GNSS repeater
- ETSI Harmonized Standard EN 302 645 defines a system gain limit of <45dbm. We recommend this limit is removed as this parameter does not intrinsically set or limit compliance with the boundary conditions and spurious emissions specifications
- All other specification in ETSI Harmonized Standard EN 302 645 be adopted
- Remove requirement in ECC 10(2) for limits to the maximum systems gain similarly to EN 302645 as this parameter does not intrinsically set or limit compliance with the boundary conditions and spurious emissions specifications

7 Trial Deployments of RNSS Repeater Technology

RFI recommends that ACMA and other stakeholders who will be involved in the proposed trials carefully assesses the available RNSS repeater technologies and solutions available for proposed trial deployments. Accuracy and seamless position fixes upon entry and exit to tunnels and while transiting the tunnel carriageways and any other internal locations of importance, that may include emergency exits and other internal confined space areas associated with the tunnels, will be essential to

demonstrate to trial users an acceptable experience. The RNSS repeater system design, architecture, support tools and applications, and previous experience with trialling and/or operational systems in similar environments will be important for economical deployment. This experience will also provide valuable insights for defining and execution of trial test plans consistent with the outcomes expected by those users, the tunnel operators and ACMA.

RFI and Syntony would be pleased to elaborate further outside this submission some of the key criteria we know from experience will be relevant to successfully trialling, successful user outcomes and appropriate test measurements and data capture.

8 Summary & Recommendations

In summary our submission outlines the following key recommendations based on real life experiences from multiple deployments and trials globally:

a) RNSS Repeater devices be exempted under the prohibitions and exemptions framework under the Act

b) Scientific Licencing be utilized as most expeditious approach to facilitating proposed in-tunnel trials while a permanent Licencing is determined. That scientific licencing also be available as interim option for other industry applications (e.g. rail/metro, subways, mining etc.) wishing to trial. We also recommend at all times boundary condition specifications under ETSI Harmonised Standard EN 302645 must be complied.

c) Longer term Licencing be expedited under Class Licencing (preferred option) or revised Apparatus Licencing and be available to all professional entities operating underground/confines spaces (where RNSS repeating boundary conditions, emission and interference specifications can be complied.) We also recommend at all times boundary condition specifications under ETSI Harmonised Standard EN 302645 must be complied.

d) Licence conditions based on ETSI Harmonized Standard EN 302 645 boundary condition specifications, with in-tunnel EIRP not prescribed or limited, total system gain not prescribed or limited other than for out-of-band spurious emissions. We agree fully that appropriate technical conditions are necessary to ensure professional deployment and the management of all potential interference risks, especially at network boundaries.

e) Road tunnel trials are conducted with equipment that provides seamless and accurate location information consistent with customer requirements/expectations across a broad spectrum of beneficial users and using a range of standard RNSS receivers.

RFI and partner Syntony-GNSS would appreciate the opportunity to discuss the content presented in this submission and provide any further information or clarifications that may assist the ACMA and other interested stakeholders.

For further information about this Submission or its content please contact:

Kevin Graham

M: +61 408 571 556

E: Kevin.Graham@rfi.com.au | www.rfi.com.au