

Lofty 88.9
Radio with altitude

Technical (Part B)

B32 Appendix 16
November 2019

Technology Blue Papers (TBP)
Series 1
Overview



TECHNOLOGY BLUE PAPER 1.0.1

Description	Introduction to Lofty's Technology Blue Papers (TBP)
Type	Overview
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

Lofty depends on three key technologies, being Radio Frequency (RF) technology, Audio/Visual technology (AV) and Information Technology (IT) to function.

To deliver a broadcast, these technologies need to be linked in a logical and effective manner. Lofty refers to technologies used to build these links as *Bridging* technologies, as they act as a bridge between the broadcast content's source and Lofty's transmitter (TX).

All of the above needs to be placed into context. Said context is established via legislative instruments, along with Lofty's interpretation of the same – effectively an *Overview* of the framework within which Lofty applies the technologies it uses.

In order to provide a clear understanding of Lofty's technologies and how we operate said technologies in a compliant manner, each technology is documented in a Technology Blue Paper (TBP).

APPLICATION

Each TBP aims to provide a clear and concise explanation of the technology used, with sources of further information given should the requirements of the reader fall outside of said TBP's scope.

FEATURES

TBPs are divided into five families, viz:

<i>1 – Overview</i>	Defines how Lofty operates its technology within the legislative framework, as well as providing brief descriptions of various interdependencies.
<i>2 – Bridging</i>	In IT terminology, bridging refers to the joining of two networks. For TBP purposes, bridging refers to the technology used to join Lofty's RF, IT and AV technologies viz. audio conversion from analogue to digital and vice versa, internet protocol (IP) networking hardware etc.
<i>3 – Transmission (TX)</i>	Includes Radio Frequency (RF) technologies, meaning the apparatus used by Lofty to emit a radiated signal for broadcast in terms of Lofty's Broadcast Service Licence (B32) and Lofty's Apparatus Licence (B12).
<i>4 – Information Technology (IT)</i>	Computer systems used as tools to facilitate the delivery of Lofty's services, including those to be delivered via RF technology.
<i>5 – Audio/Visual Technology (AV)</i>	Technologies whose sole purpose is to convert, process, amplify or otherwise manipulate audio or video.

OPERATIONS

TBPs are used by Lofty's Technology & Facilities Sub-committee to document each specific technology, system or apparatus in use.

Where technology interdependencies exist, each dependent technology's TBP is to be referenced.

Some technologies may only be operated within set legislative and/or compliance parameters. Where applicable, Lofty's TBPs address these parameters and how Lofty upholds its technical compliance obligations.

MAINTENANCE

A brief summary of how the technology is maintained. Details of maintenance processes are documented as procedures.

Specific technologies, either individual components or systems comprising of a number of bridged components, are subject to regular maintenance plans. This ensures maximum reliability by allowing Lofty to proactively identify potential failure points and undertaken rectification works before said potential failure points become actual failure points.

Maintenance logs are kept for both internal (viz. Lofty policy) and external (viz. obligations as legislated) compliance purposes.

Where available, manuals are kept for each component. Said manuals include but are not limited to:

- full operating (end user) manuals
- technical manuals including schematics where applicable
- data sheets, including white papers and/or blue papers issued by the component's vendor

References to "manual" (in the context of operating instructions pertaining to a specific component within any of Lofty's technology systems) are deemed to include any or all of the above documents.

A hard copy of each component's manual shall be kept where said component is in situ, with an additional copy kept in a central technical library located at Lofty's studio.

Where available, a PDF soft copy of each manual shall also be stored on Lofty's shared Google Drive, thus enabling access to any member of Lofty's Technology & Facilities team or their authorised delegate to access every available manual relating to each component within Lofty's technology systems via smartphone, tablet or computer from anywhere with internet connectivity.

SPECIFICATIONS

Depending on the technology, operating specifications may be provided by the technology's supplier. Where the supplier provides an official data sheet, said sheet is to be included in the TBP as an appendix, e.g. "Refer specification sheet (Appendix B)".



TECHNOLOGY BLUE PAPER 1.0.2

Description	Broadcast Services (Technical Planning) Guidelines 2017
Type	Overview
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

As the holder of broadcasting licences issued by the Australian Communications and Media Authority (ACMA), Lofty is obligated to operate its broadcasting service pursuant to the Broadcasting Services Act (Cth.) 1992 (the Act).

Section 33 of the Act gives ACMA the power to develop technical planning guidelines for the use of broadcasting services bands as a means of delivery.

The Broadcast Services (Technical Planning) Guidelines 2017 (the Guidelines) is the instrument to which Section 33 refers.

APPLICATION

The Guidelines set specifications pertaining to the delivery of broadcasting services in Australia.

This TBP describes how the Guidelines are applied in terms of Lofty's broadcasting service and/or apparatus licence, as well as identifying key considerations for Lofty in maintaining ongoing compliance relating to several key sections of the Guidelines.

FEATURES

The pertinent sections of the Guidelines referred to in this TBP are:

11	Minimum coverage criterion
16	Interference to other services – broadcasting services and datacasting services
21.(2)	Maximum field strength within the licence area (FM radio band, digital radio, television and data casting services)
22.(6)-22.(10)	Radiated signal characteristics (FM radio band)

OPERATIONS

Lofty operates its transmission (TX) equipment in the terms set out in its apparatus licence, with transmissions radiating from ACMA Site ID 305178.

Where an interference event is alleged, Lofty shall conduct a full investigation into its occurrence and install appropriate mitigation systems (including but not limited to devices and/or procedures) to ensure said interference issue shall not recur.

Reporting as a result of investigation into an interference event is to be lodged with ACMA as soon as practicable.

MAINTENANCE

Lofty undertakes regular field strength testing activities under the guidance of the South Australian Community Broadcasting Association (SACBA).

TX apparatus settings are checked and tested on a monthly basis, with said settings recorded in the maintenance log located at the TX site.

Real time spectrum analysis is undertaken to ensure compliance with frequency deviation, with specific apparatus installed and operated in-situ at Lofty's studio, located circa 2km from Lofty's TX, for this purpose.

SPECIFICATIONS *Minimum coverage criterion*

Appendix A shows a map of Mount Barker RA1 with an overlay of Lofty's coverage contained therein. This modelling suggests that Lofty's transmission meets the specifications contained within Section 11.

Interference to other services

As a responsible licensee of broadcasting spectrum, Lofty has zero tolerance for interference to other services. As such, we endeavour to resolve such claims as swiftly as possible.

Any report of Lofty's alleged interference with other services is to be treated as a Category 4 fault as defined in TBP 1.0.3 Fault Recording and Categorisation.

Maximum field strength

Lofty notes that its current apparatus, as licenced, operates outside of Section 21.(2), viz. > 1% of population receives Lofty's transmissions on 88.9 MHz with field strength exceeding 110 dB μ V/m as per coverage plot Appendix A. On this basis, Lofty has taken this as tacit approval by ACMA to exceed Section 21.(2) as licenced.

It should be noted that as at the time of writing, the other TCBL holder operating on 88.9MHz also operates outside of Section 21.(2), and does so in excess of Lofty based on both actual population and by percentage of population.

<i>Field strength modelling</i>	<i>Total population coverage ≥ 54 dBμV/m</i>	<i>Total population coverage > 110 dBμV/m</i>	<i>Percentage population coverage > 110 dBμV/m</i>
Based on Longley Rice modelling techniques.			
ACMA Site ID 305178 (Lofty 88.9)	30,404	2,495	8.21%
ACMA Site ID 23171 (Hills Radio)	71,685	8,941	12.47%

Field strength models for ACMA Site IDs 305178 and 23171 are attached as Appendices B and C respectively.

Radiated signal characteristics

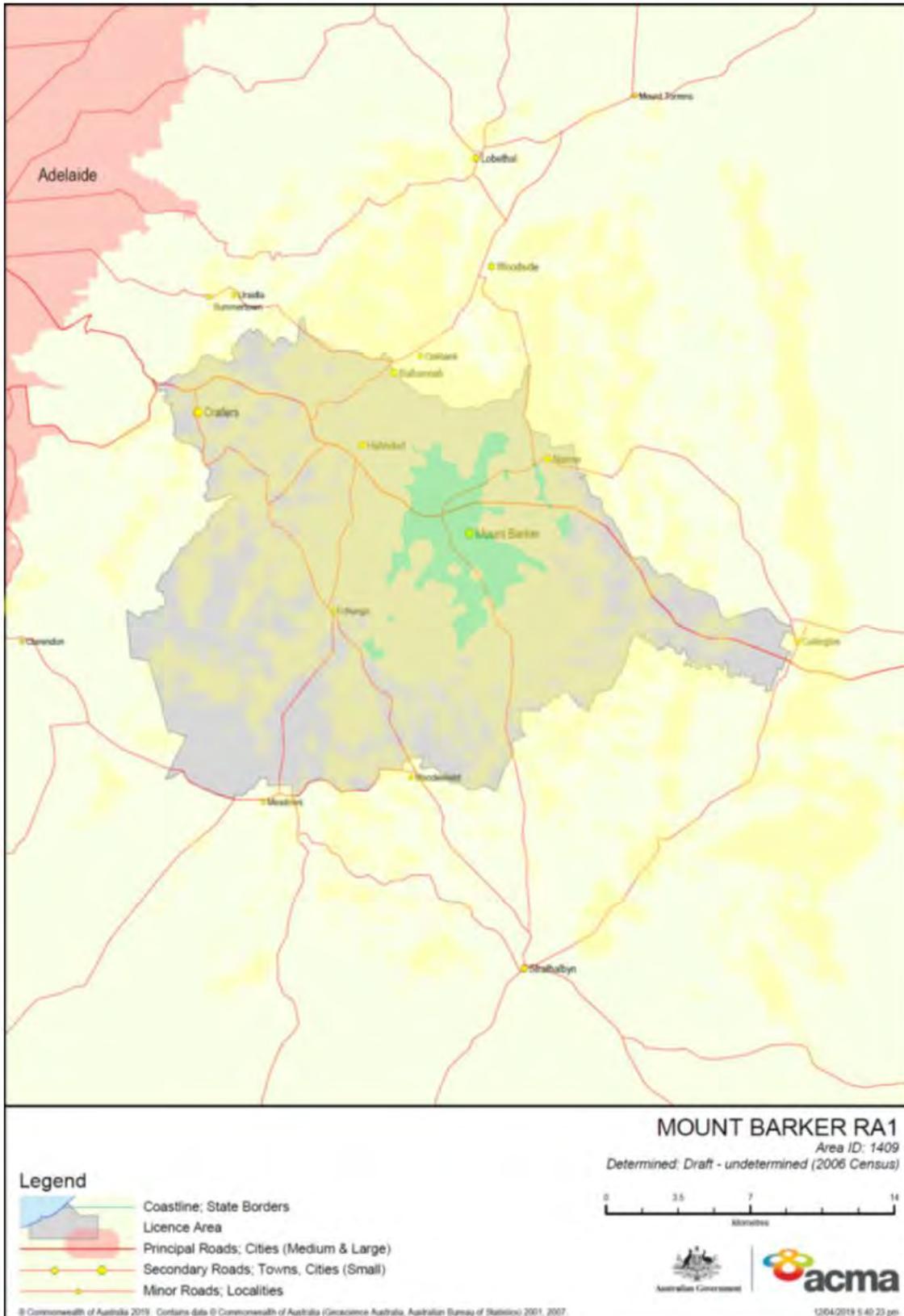
Radiated signal characteristics, specifically frequency deviation, is measured and logged via built-in telemetry contained within our TX hardware.

Secondary measurements are taken via a spectrum analysis unit installed at Lofty's studio. This unit consists of dedicated personal computer (PC) repurposed as an in-situ field strength testing and spectrum analyser, fitted with a software-defined radio (SDR) for this purpose.

In addition, Lofty undertakes spot checks with the assistance of field strength measuring equipment supplied by the South Australian Community Broadcasting Association (SACBA) on a semi-annual basis. Said equipment is also used to recalibrate the SDR contained in Lofty's in-situ spectrum analyser.

Where a significant deviation from the Guidelines has been found, Lofty shall engage an external consultant to undertake additional testing and provide advice on remedial action.

APPENDIX A – 5LCM (Lofty 88.9) field signal strength on 88.9Mhz within Mount Barker RA1

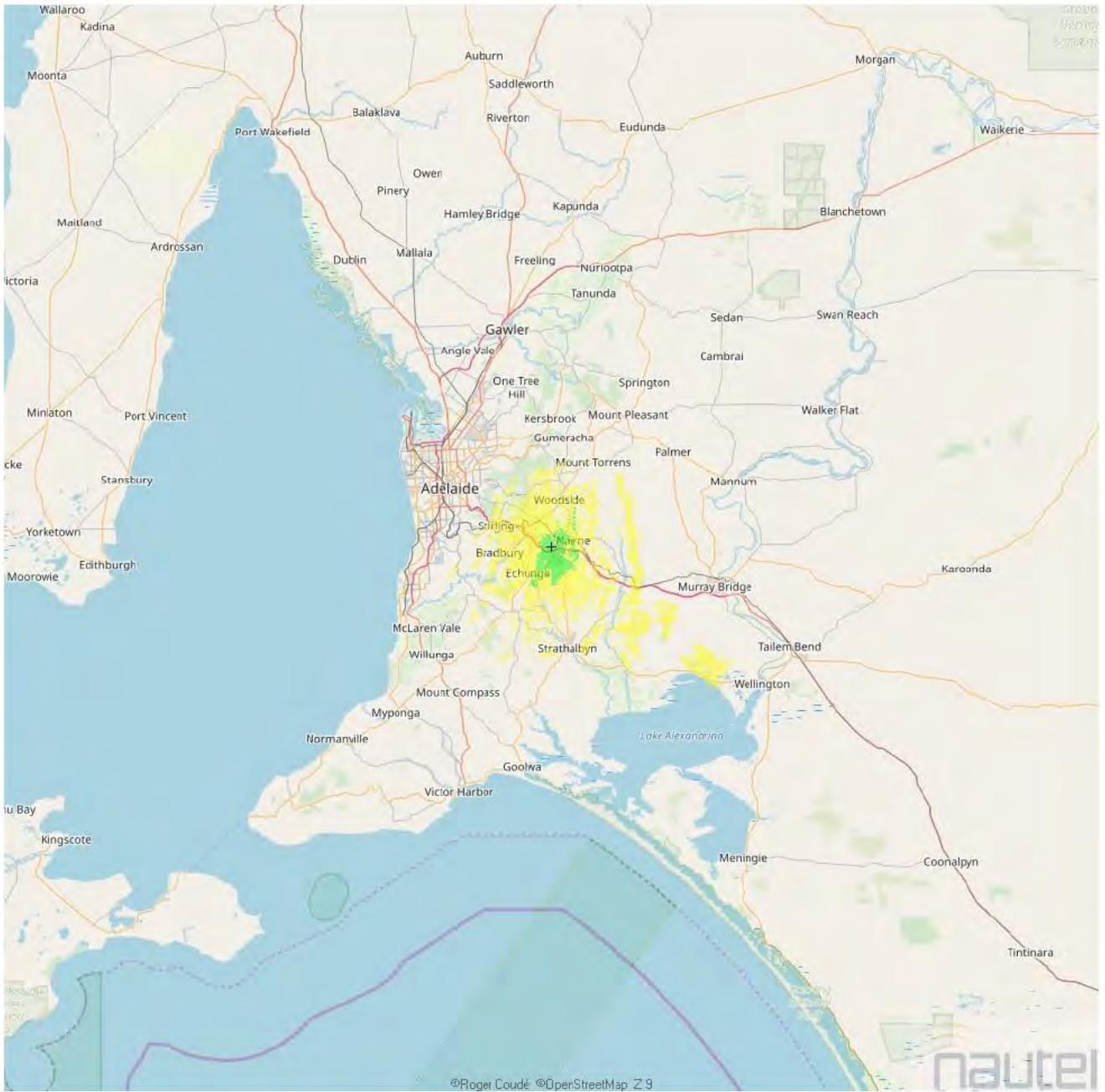


	Field strength > 110 dB μ V/m
	Field strength \geq 54 dB μ V/m

APPENDIX B – 5LCM (Lofty 88.9) radiated field strength on 88.9 MHz [ACMA Site ID 305178]



Description	Cleggett's Farm 500W 54/110 Single Sidemount Dipole
TX	0.5 KW
RX	Custom
Frequency	88.9 MHz
Base Name	Cleggett's Farm
Latitude	-35.04960600 °
Longitude	138.85328000 °
Latitude	35° 02' 58.58"S
Longitude	138° 51' 11.81"E
UTM (WGS84)	54H E304211 S6119349
Elevation	425.7 m
Base Ant. Height	15 m
Base Ant. Gain	0.0 dBi
Mobile Ant. Height	10.0 m
Tx Power	500.00000 W
Tx Line Loss	0.3 dB
Weak signal field	54.0 dBµV/m
Strong signal field	110.0 dBµV/m
Weak signal covered area	836 km ²
Strong signal covered area	71 km ²
Weak signal population reached	30404 pop
Strong signal population reached	2495 pop
Landcover used	Yes
Two rays method used	No
User ID	lofty
Radio coverage ID	NAUTEL836A4E019F0_1
Generated on	10/29/2019 9:09:39 PM

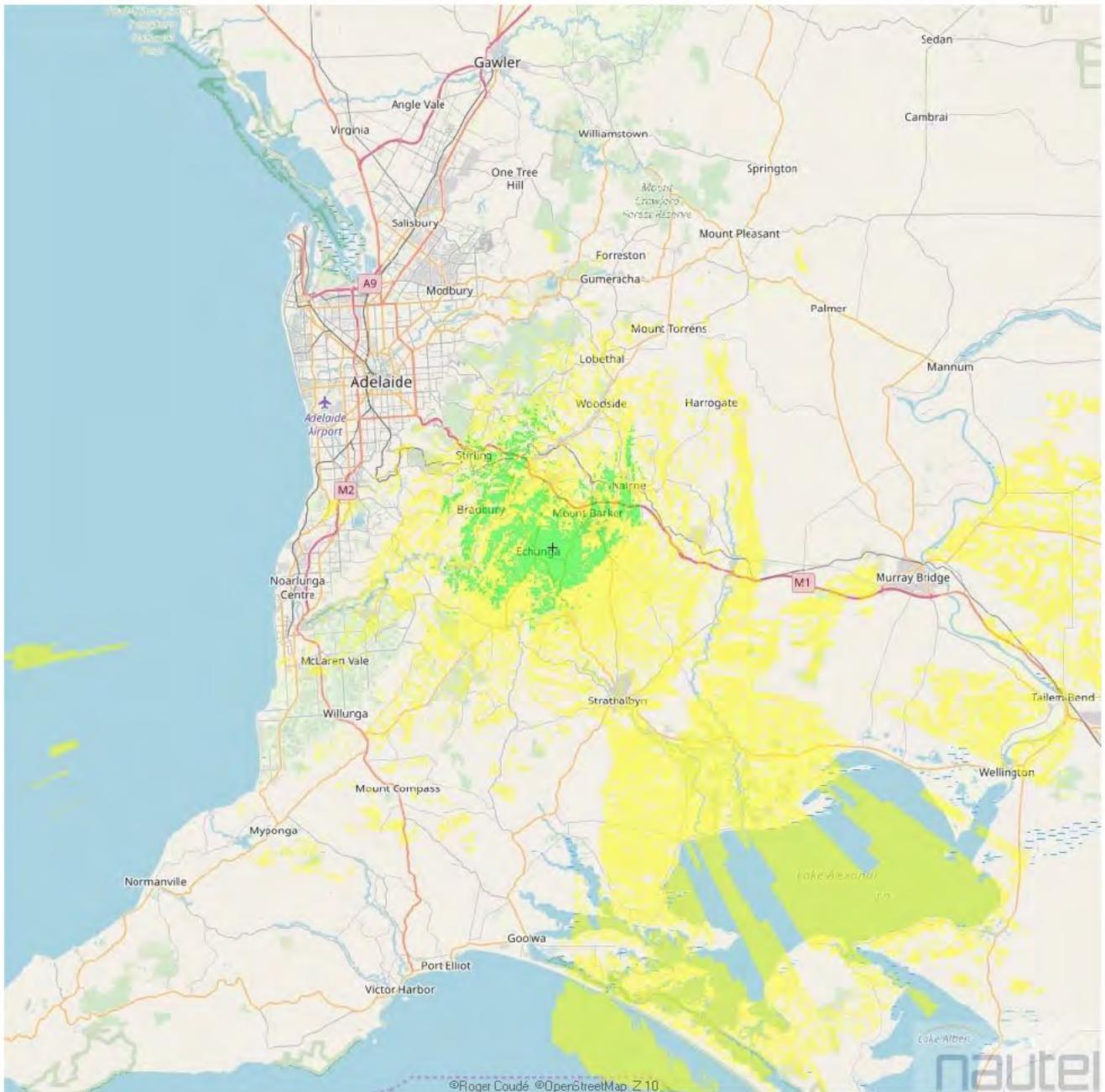


	Field strength > 110 dBμV/m
	Field strength ≥ 54 dBμV/m

APPENDIX C – Hills Radio’s radiated field strength on 88.9 MHz [ACMA Site ID 23171]



Description	RAA District Council Site ECHUNGA SA 5153 (500W)
TX	0.5 KW
RX	Custom
Frequency	88.9 MHz
Base Name	ACMA Site ID 23171
Latitude	-35.10115158 °
Longitude	138.81337698 °
Latitude	35° 06' 04.15"S
Longitude	138° 48' 48.16"E
UTM (WGS84)	54H E300696 S6113552
Elevation	462.5 m
Base Ant. Height	30 m
Base Ant. Gain	3.2 dBi
Mobile Ant. Height	1.0 m
Tx Power	500.00000 W
Tx Line Loss	0.3 dB
Weak signal field	54.0 dB μ V/m
Strong signal field	110.0 dB μ V/m
Weak signal covered area	2568 km ²
Strong signal covered area	152 km ²
Weak signal population reached	71685 pop
Strong signal population reached	8941 pop
Landcover used	Yes
Two rays method used	No
User ID	lofty
Radio coverage ID	NAUTELA1DFD335D150_0
Generated on	10/29/2019 9:10:18 PM





TECHNOLOGY BLUE PAPER 1.0.3

Description	Fault recording and categorisation
Type	Overview
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION Despite Lofty's best endeavours to minimise potential faults, technology failures will occur with from time to time.

This TBP outlines how and why Lofty logs and categorises faults.

APPLICATION This TBP applies to any fault found within any of Lofty's technology categories viz. transmission (TX), information technology (IT), audio/visual (AV) or any combination of same (Bridging).

FEATURES Faults are logged by date and severity; the latter as defined in Specifications. The central fault log is the one "source of truth" for all faults logged with Lofty. Designed to capture every fault that develops with Lofty's technology, irrespective of whether or not on-air broadcasting service is affected. The central fault log is a valuable tool that enables Lofty's Technology & Facilities Sub-committee to make effective maintenance plans, as well as providing visibility of potential points of failure to be addressed via proactive maintenance

OPERATIONS Faults are logged in Lofty's central fault log, an electronic-based log located in a shared folder within Lofty's IT network, accessible to all Lofty members/volunteers.

Supplementary fault logs, in paper form, are kept in each studio and at the TX site. Each of these paper-based supplementary fault logs relate to faults occurring at each site.

Each fault is assigned a category based on severity of its impact on Lofty's ability to deliver a reliable and compliant broadcasting service.

MAINTENANCE All supplementary fault logs are transcribed into the central fault log.

Fault logs are to be kept for a minimum of seven (7) years.

Copies of Lofty's fault log shall be provided to the regulator, being ACMA and/or their successor(s) where applicable, upon request.

SPECIFICATIONS *Fault Categories*

1 – Minor	<ul style="list-style-type: none"> • A fault with low or very low impact on Lofty’s ability to provide an effective broadcasting service. • These faults may even be fixed almost immediately after first being discovered. • Listener is unaware that fault has occurred. • Refers only to internal IT or AV technology failures that pose minor inconvenience to users. • Resolution of fault usually rolled into Lofty’s standard maintenance schedule.
2 – Moderate	<ul style="list-style-type: none"> • A fault with low-moderate impact on Lofty’s ability to provide an effective broadcasting service, or has a moderate-high impact on non-broadcast related technology. • Some listeners may be aware of said fault. • Resolution of fault takes priority over standard scheduled maintenance. • Any fault deemed to be a minor fault but has an impact on TX and/or Bridging technology is considered a Level 2 Moderate fault by default.
3 – Major	<ul style="list-style-type: none"> • A fault with moderate-high impact on Lofty’s ability to provide an effective broadcasting service. • Whilst a major fault may not prevent Lofty’s ability to broadcast, said fault has an adverse effect on the quality of the broadcast e.g. degraded signal quality. • Fault is noticeable to most listeners. • May impede a presenter/producer’s ability to effectively broadcast their program. • Lofty to dedicate all available resources to rectifying fault as soon as possible.
4 - Critical	<ul style="list-style-type: none"> • A fault that either prevents Lofty from providing an effective broadcasting service or places Lofty in imminent danger of breaching one or more of its broadcasting licence conditions. • Listeners are to be informed of said faults via service advisories posted on Lofty’s social media and/or website. • Lofty to dedicate all available resources to rectifying fault as soon as possible. • Once resolved, Lofty shall undertake a formal investigation into how the fault occurred, as well as formulating mitigation strategies to avoid a repeat. • Lofty to report all Level 4 Critical faults to the regulator for compliance purposes.



TECHNOLOGY BLUE PAPER 1.0.4

Description	Redundancy (Fallback)
Type	Overview
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

In order to provide a service with high levels of reliability and technical quality, a competent broadcast licence holder needs to have a Plan B for every component that makes up the broadcast chain.

Lofty's Plan B is to ensure that every component in this chain has *redundancy*.

TechTerms defines redundancy as "... duplicate devices that are used for backup purposes. The goal of redundancy is to prevent or recover from the failure of a specific component or system"¹.

Synonyms include *fallback* and *failover*. Lofty uses the term *fallback* to describe the components that make up its redundancy.

A desirable outcome is to minimise (if not eliminate) the use of fallback systems and/or components. Lofty is proactive in this regard by using its fault logs to identify proactive maintenance opportunities when a potential primary system and/or component is identified.

Fallback reliance is also minimised via Lofty's infrastructure, consisting of quality components underpinned by sound engineering principles.

APPLICATION

This TBP specifies Lofty's minimum fallback requirements at a systemic level. Fallback requirements for individual components are documented in their own respective TBPs.

FEATURES

Fallback may either be automated, semi-automated or manual.

Some systems and/or components have more than one fallback.

Use of fallback systems and/or components are documented in Lofty's fault log.

OPERATIONS

When fallback is triggered, the Technology & Facilities Sub-committee may receive notification via e-mail or SMS, depending on which primary system and/or component has failed.

Where possible, failover is triggered automatically. Where full automation is not possible, semi-automatic fallback may be engaged.

In some instances, such as physical hardware failure, manual fallback is the only available option. In terms of TBP 1.0.3 (Fault recording and categorisation), manual fallback is deemed to be a Level 4 (Critical) fault.

¹ <https://techterms.com/definition/redundancy>

MAINTENANCE

All fallback events are recorded in Lofty’s fault log, with the following default fault categories to be applied:

<i>Fallback type</i>	<i>Fault category</i>
Automatic	Level 2 (Moderate)
Semi-Automatic	Level 3 (Major)
Manual	Level 4 (Critical)

The root cause of each fallback event is to be investigated, with proactive maintenance to be scheduled as soon as practicable.

Where fallback has been triggered by primary hardware failure, use of its fallback equivalent is to be kept to a minimum.

Replacement primary hardware is to be sourced in terms of Lofty’s relevant procurement policies.

Fault logs are to be kept for a minimum of seven (7) years.

Copies of Lofty’s fault log shall be provided to the regulator upon request.

SPECIFICATIONS *Fallback systems and components*

Tech. Cat	Component or system	Location	Fallback type
IT	PC hardware	All sites	Manual
IT/Bridging	PC software	All sites	Automatic, semi-auto or manual depending on fault
IT/Bridging	Network hardware	All sites	Manual
IT/Bridging	Network routing (LAN, WAN, STL)	All sites	Automatic
Bridging	AoIP encoder	Studio	Manual
Bridging	AoIP decoder	TX	Automatic
TX	Program Fail detector	TX	Automatic (re: AoIP failover); Manual (re: hardware failure)
TX	DSP/MPX	TX	Manual
TX	Exciter	TX	Manual
TX	Power Amp	TX	Manual
TX	Antenna	TX	Manual
All	230V 10A AC	All sites	Automatic
All	Physical damage or obstruction to Lofty’s facilities	All sites	Broadcast Continuity Plan (BCP) refer TBP 1.0.6



TECHNOLOGY BLUE PAPER 1.0.5

Description	Maintenance overview and categorisation
Type	Overview
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION To ensure maximum reliability of its facilities and systems, Lofty undertakes regular maintenance activities. Said activities can be divided into three categories: proactive, reactive and ad-hoc.

APPLICATION Applies to all of Lofty's technology systems and/or components.

FEATURES Proactive maintenance is carried out before a fault occurs. This is designed to minimise downtime across Lofty's systems and/or components, thus allowing Lofty to deliver a reliable broadcasting service of high technical quality.

Reactive maintenance is carried out in response to a fault raised in Lofty's fault log, and is prioritised based on its severity as categorised (TBP 1.0.3).

Ad-hoc maintenance occurs when prompted, as is generally minor or below minor in terms of overall impact to Lofty's systems.

OPERATIONS Proactive maintenance is carried out based on a set time interval depending on the technology in use and how it is applied. Such proactive maintenance activities are usually documented as procedures.

Reactive maintenance activities are scheduled based on the severity of its' underlying fault. Generally speaking, Level 1 (Minor) or Level 2 (Moderate) faults will be addressed during its' system/component next scheduled maintenance window.

Ad-hoc maintenance is usually triggered by a prompt issued by the component seeking to be maintained e.g. software updates. There is usually no set interval for these prompts. Ad-hoc maintenance may be delayed until the next proactive maintenance window at the discretion of the Technology & Facilities Sub-committee and/or its delegate(s).

Level 3 (Major) faults are addressed as soon as practicable.

A Level 4 (Critical) fault is not considered to be maintenance. A fault of this nature is a significant event that requires immediate attention.

Where a Level 3 or Level 4 fault develops during a proactive maintenance window, fault rectification is given maximum priority. In this circumstance, the interrupted proactive maintenance window may either be postponed or cancelled, depending on the nature of the proactive maintenance in question along with when its next maintenance window is scheduled.

MAINTENANCE A maintenance log is kept for each component and/or system subject to proactive maintenance. Said maintenance log may be in paper or electronic format.

Reactive maintenance triggered by a fault is to be recorded in Lofty's central fault log, with reference to its assigned fault number.

Other ad-hoc maintenance activities are usually omitted from Lofty's central fault log, as (a) it's not a fault per se and (b) in the case of system software and/or firmware updates, said system usually retains its own event log.

A hard copy of each component's respective manual shall be stored with or adjacent to said component. Where said component is located at a site other than Lofty's main studio, a second hard copy is kept in Lofty's central technical library.

Where available, a soft copy of each component's respective manual is to be stored in PDF format on Lofty's shared Google Drive.

SPECIFICATIONS Refer to procedures for proactive maintenance schedules.

Component-based maintenance specifications may also be found in said component's TBP.

Technology Blue Papers (TBP)
Series 2
Bridging Technologies

Including studio-to-transmitter link (STL)



TECHNOLOGY BLUE PAPER 2.0.1

Description	Lofty's Studio to Transmitter Link (STL)
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

Lofty's Studio to Transmitter Link (STL) is a crucial component in Lofty's overall transmission (TX) chain.

To provide maximum flexibility and cost effectiveness, Lofty has adopted a pure Audio over Internet Protocol (AoIP) STL. Cost-effectiveness as the technology used in Lofty's primary STL does not require licencing (viz. 5GHz AC band wireless networking) and flexibility in that AoIP allows Lofty to use a combination of National Broadband Network (NBN) and 4G mobile IP connectivity for STL purposes should the primary STL fail.

APPLICATION

Facilitates the transportation of content from Lofty's studio to its TX via either a wireless extension of Lofty's Local Area Network (LAN) or via the internet should the primary STL be unavailable.

FEATURES

Primary STL is not subject to licencing costs, as it operates in the 5GHz spectrum in use by domestic wifi equipment.

Clear line of sight (LOS) from Lofty's studio to TX site, resulting in primary STL uptime > 99.99% since primary STL commissioned in November 2018.

Use of AoIP for content delivery allows for live programming to be rerouted to the TX via the internet in the event of primary STL failure, maximising overall STL uptime.

AoIP allows for easy switching between content sources viz. multiple studios, outside broadcast (OB), Community Radio Network (CRN) feed etc.

Discrete AoIP encoding and decoding devices minimise potential RF interference to analogue signal during TX process.

Every component in the STL chain has at least one fallback, maximising Lofty's ability to provide a continuous broadcast.

OPERATIONS

Please refer to TX chain diagram (Appendix A) and STL & TX Site diagram legend (Appendix B).

MAINTENANCE

AoIP device vital signs are monitored via remote network management console (PRTG).

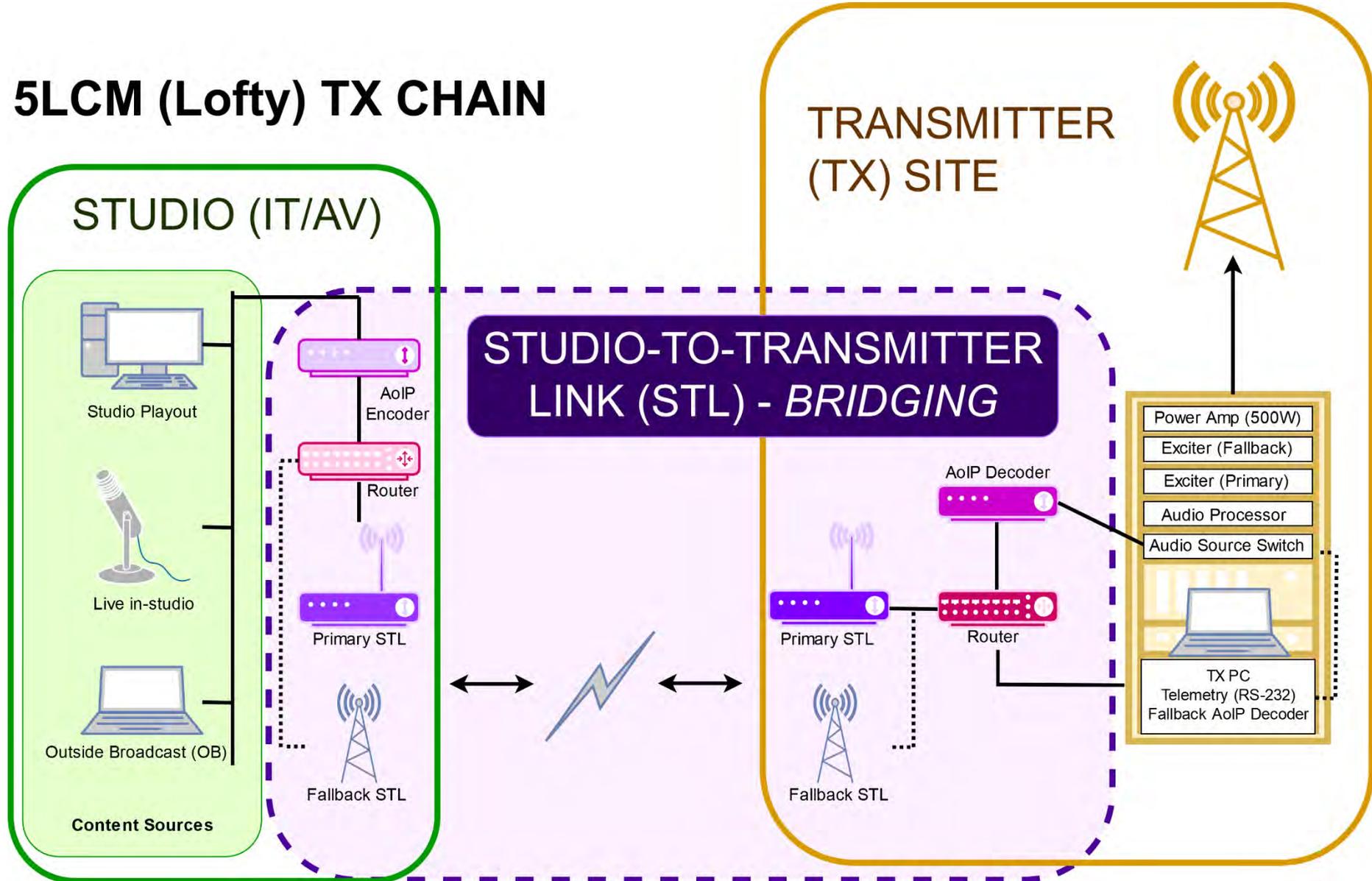
All devices on AoIP/TX chain can be accessed via web interface, accessible only via Lofty's LAN. Remote desktop connection to Lofty's LAN is available via virtual private network (VPN).

SPECIFICATIONS

Please refer to each component's respective TBP, as listed in Appendix B.

Internal survey information showing direct LOS between Lofty's studio and the TX site can be found in TBP 2.1.3.

5LCM (Lofty) TX CHAIN



APPENDIX B – STL & TX SITE DIAGRAM LEGEND

TBP Ref	Category	Description	Location	Status
2.1.2	AoIP Encoder	Deva TX-91 AoIP encoder	Studio	Primary
2.2.1	<i>AoIP Encoder</i>	<i>Software</i>	<i>Studio</i>	<i>Fallback</i>
2.1.2	Router	Technicolor TG789vac v2 router	Studio	Primary
2.2.2	<i>Router</i>	<i>Technicolor TG789vac v2 router (spare)</i>	<i>Studio</i>	<i>Fallback</i>
2.1.3	Primary STL	Ubiquiti Nanobeam AC16	Studio	Primary
2.2.3(a)	<i>Fallback STL</i>	<i>Internode 50/20 NBN connection</i>	<i>Studio</i>	<i>Fallback</i>
2.1.3	Primary STL	Ubiquiti Nanobeam AC16	TX Site	Primary
2.2.3(b)	<i>Fallback STL</i>	<i>Telstra/Vodafone 4G</i>	<i>Studio/TX</i>	<i>Fallback</i>
2.1.4	Router	Dovado Pro AC router	TX Site	Primary
2.2.4	<i>Router</i>	<i>TP-Link TP-ML3420 router</i>	<i>TX Site</i>	<i>Fallback</i>
2.1.5	AoIP Decoder	Deva RX-91 AoIP encoder	TX Site	Primary
2.2.5	<i>AoIP Decoder</i>	<i>Software</i>	<i>TX Site</i>	<i>Fallback</i>
3.1.1	Source Switch	Elan Audio RPF-02 Fail Detector	TX Site	Primary
3.2.1	<i>Source Switch</i>	<i>Elan Audio RPF-02 Fail Detector(spare)</i>	<i>TX Site</i>	<i>Fallback</i>
3.1.2	DSP/MPX	BW Broadcast DSPX-FM processor	TX Site	Primary
3.1.2	<i>DSP/MPX</i>	<i>NO FALLBACK PRESENT</i>	<i>TX Site</i>	<i>Fallback</i>
3.1.3	Exciter	SRK FMX101+ 100W TX/exciter	TX Site	Primary
3.2.3	<i>Exciter</i>	<i>RVR TEX100/S 100W TX/exciter</i>	<i>TX Site</i>	<i>Fallback</i>
3.1.4	Power Amp	SRK FMA501 500W power amplifier	TX Site	Primary
3.1.4	<i>Power Amp</i>	<i>Exciter only operation (100W)</i>	<i>TX Site</i>	<i>Fallback</i>
3.1.5	Antenna	Primary (ZCG folded dipole)	TX Site	Primary
3.1.5	<i>Antenna</i>	<i>Fallback (portable 100W groundplane)</i>	<i>TX Site</i>	<i>Fallback</i>



TECHNOLOGY BLUE PAPER 2.1.1

Description	Audio over IP (AoIP) encoder - Deva TX-91
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

Content to be transported along Lofty's TX chain via internet protocol (IP). This is in the form of audio that has been converted to a digital stream and then transported via Audio over Internet Protocol (AoIP).

Devices to encode audio from analogue signals into an AoIP stream and decode audio from an AoIP stream and into analogue signals for feeding into the TX chain facilitate this process.

APPLICATION

The Deva TX-91 AoIP encoder receives analogue input from the studio's panel, which is then encoded using one of several codecs.

The resultant AoIP stream is fed into the studio router for transport across Lofty's studio to transmitter link (STL).

FEATURES

Encodes up to four (4) AoIP streams simultaneously for transport via Lofty's IP network (viz. STL and/or Icecast online streaming radio servers).

Supports the following codecs:

- PCM: 16-bit at up to 48kHz (1,411kbps)
- AAC+ (HE-AAC v2) at up to 48kHz (320kbps)¹
- MP3 at up to 48kHz (320kbps)

OPERATIONS

Please refer to transmission (TX) chain diagram extract (Appendix A).

FALLBACK

Software-based AoIP encoding (TBP 2.2.1).

MAINTENANCE

Vital signs viz. ping monitored via remote network management console (PRTG).

Web interface restricted to inside Lofty's LAN, however Lofty's LAN is available via remote desktop over VPN.

A hard copy of the Deva TX-91 AoIP encoder manual is kept at the TX site, with an additional copy kept at Lofty's studio. A PDF soft copy version is stored on Lofty's shared Google Drive.

SPECIFICATIONS

Primary AoIP link transport stream is encoded with PCM codec. Bitrate 1,411kbps.

First backup AoIP link is Lofty's High Quality Icecast stream; encoded with AAC+ codec. Bitrate 128kbps.

¹ This codec forms part of the Digital Audio Broadcasting (DAB+) standard.

Second backup AoIP link is Lofty's Medium Quality Icecast stream; encoded with AAC+ codec. Bitrate 48kbps.

Third backup AoIP link is Lofty's Medium Quality Icecast stream; encoded with AAC+ codec. Bitrate 24kbps.

Source audio sample rate 16 bits at 44.1kHz. Stream encoded in stereo.

APPENDIX A *TX chain extract*

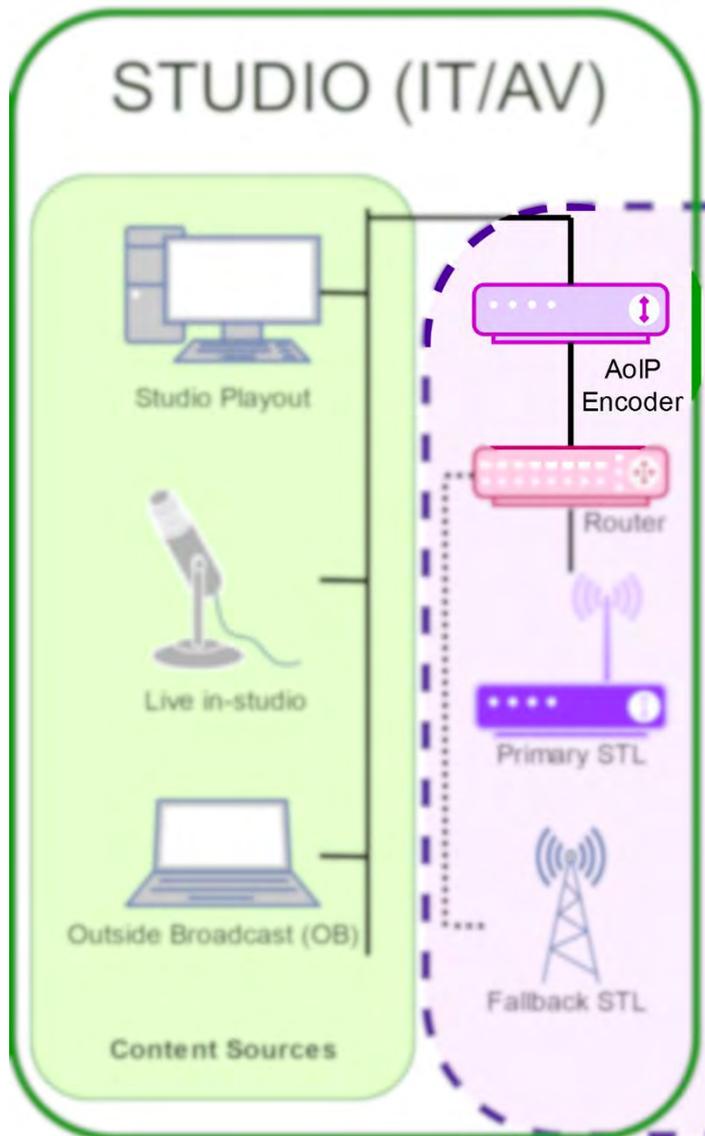


Figure 2.1.1(a) – AoIP encoder position in TX chain (studio end)



TECHNOLOGY BLUE PAPER 2.1.2

Description	Router (Studio): Technicolor TG789VACv2
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

A key component of Lofty's network infrastructure is its routers. There are two routers within Lofty's network; one located at the studio, the other located at the TX site.

Lofty uses a Technicolor TG789VACv2 router. This is a domestic grade router as issued by Lofty's preferred NBN ISP, Internode (TBP 2.2.3[a]).

In production use, the TG789v2 has been extremely reliable. However, a second TG789VACv2 is kept in stock by Lofty, and is configured as a clone of the production router (TBP 2.2.2).

APPLICATION

The TG789VACv2 is installed above Lofty's server rack.

In its role as the primary network gateway, all of Lofty's internet protocol (IP) network traffic is processed and directed via this router, viz:

- Local Area Network (LAN)
- Wide Area Network (WAN)
- Studio to Transmitter Link (STL)

FEATURES

Compatible with NBN fixed line technologies viz. FTTN, FTTP.

4G mobile broadband fallback.

Configured as one of several firewalls located within Lofty's network.

Fully supported by Internode.

Port forwarding, enabling Lofty to operate its own streaming radio servers and other supporting servers in-house.

OPERATIONS

Please refer to TX chain diagram (TBP 2.0.1 Appendix A) and STL & TX Site diagram legend (TBP 2.0.1 Appendix B).

FALLBACK TYPE Hardware

Manual. Cloned unit kept in stock, to be swapped out in case of production unit failure.

WAN (Internet)

Automatic. Fallback to 4G connectivity should NBN fail.

MAINTENANCE

Key functionality viz. admin control panel checked and tested to ensure reliable connectivity.

Firmware update checks undertaken from time to time; said firmware update is tested with the clone router prior to being rolled out to production router.

ISP (Internode) standard issue router simplifies potential support calls should Lofty's NBN connection experience failure.

Cloned TG789VACv2 held in stock should production unit fail. In the event of a failure, the production router is to be swapped out with the cloned router, with the clone becoming the new production router (refer TBP 2.2.2).

Spare Cat5e ethernet cables held at studio in the event of failure.

A hard copy of the TG789VACv2 router manual is kept at Lofty's studio, and PDF soft copy version is stored on Lofty's shared Google Drive.

SPECIFICATIONS Refer Appendix A.

APPENDIX A – SPECIFICATIONS

Source: whirlpool.net.au (https://bc.whirlpool.net.au/bc/hardware/?action=h_view&model_id=1739), as retrieved 2 November 2019 14:44.

» Broadband Choice » Hardware » Alcatel / Thomson / Technicolor » TG789vac v2

Essential		
(?)	Model name	TG789vac v2
(?)	Also known as	Specs here for the iiNet model
(?)	Current model	
DSL modem		
(?)	ADSL 1	
(?)	ADSL 2	
(?)	ADSL 2+	
(?)	ADSL 2+ Annex M	
(?)	VDSL2	
(?)	NBN VDSL2 FTTB/FTTN Compliant	
(?)	ADSL line condition viewer	
(?)	PPPoA client	
LAN connectivity		
(?)	10/100/1000 Mbps LAN ports	4
(?)	Auto crossover detection	
(?)	Power over Ethernet	
Router		
(?)	WAN ethernet port maximum speed (Mbps)	1000
(?)	BigPond Cable login client	
(?)	DHCP relay	
(?)	DMZ	
(?)	DNS forwarding	
(?)	IPv6 Support	
(?)	NAT routing	
(?)	Port forwarding	

(?)	Port forwarding of ranges	 Format port1:port2
(?)	Port triggering	
(?)	PPP auto-reconnect	
(?)	UPnP support	
(?)	DHCP server	
(?)	PPPoE client	
(?)	QoS prioritisation	
(?)	QoS for VoIP	
iFi		
(?)	Default SSID	See router base label
(?)	Multiple SSID	 2.4GHz + Guest 5GHz + Guest
(?)	WPA	
(?)	WPA-PSK	

(?)	WPA2	
(?)	WPA2-PSK	
(?)	WPS support	
(?)	802.11a (54 Mbps)	
(?)	802.11b (11 Mbps)	
(?)	802.11b+ (22 Mbps)	
(?)	802.11g (54 Mbps)	
(?)	802.11g "Super-G" (108Mbps)	
(?)	Draft 802.11n (Pre-N)	
(?)	802.11n (2.4GHz)	
(?)	802.11n (5GHz)	
(?)	Draft 802.11ac	
(?)	802.11ac	
(?)	Fastest 802.11ac supported	1300 Mbps
(?)	Internal antenna(s)	2 2.4 GHz - 2x2 MIMO 5 GHz - 3x3 MIMO
(?)	External antenna(s)	0

(?)	External Antenna Removable?	N/A
Fir wall		
(?)	DoS protection	<input checked="" type="checkbox"/>
(?)	SPI firewall	<input checked="" type="checkbox"/>
(?)	URL filtering	<input checked="" type="checkbox"/>
(?)	Firewall can be updated	<input checked="" type="checkbox"/>
V oIP		
(?)	FXS (ATA) ports	2
(?)	PSTN fallback	<input type="checkbox"/>
(?)	VoIP Dial Plans	<input type="checkbox"/>
(?)	PSTN Dial Plans	<input type="checkbox"/>
(?)	Supports Telephony features (caller ID, call forward, etc)	<input checked="" type="checkbox"/>
(?)	VoIP provider config presets	<input checked="" type="checkbox"/>
(?)	Number of VOIP providers supported	1
(?)	T.38 (Fax over IP)	<input type="checkbox"/>
Print Server		
(?)	Parallel ports	0
(?)	USB ports	1
Storage		
(?)	SMB server	<input checked="" type="checkbox"/>
(?)	USB2 ports	1
(?)	USB3 Ports	0
(?)	microSD slot	<input type="checkbox"/>
(?)	DLNA Server	<input checked="" type="checkbox"/>
Misc har lware info		
(?)	Warranty period (months)	24 Or as long as you rent from iiNet
(?)	Built-In RAM (MBytes)	256 DDR3
(?)	Firmware upgradable	<input checked="" type="checkbox"/> 128 MB flash memory
(?)	xDSL Chipset	Broadcom BCM63168

(?)	Wireless Chipset	Broadcom BCM4360
(?)	Wall mountable	✓
(?)	NTP client	✓
(?)	DDNS client	✓
		Extensive number of services
(?)	Event/Syslog logging	✓
(?)	Wake on LAN/WOL	✓
Configuration		
(?)	Backup/Restore functionality	✓
(?)	Centralised management	✓
(?)	Quick configuration wizard	✓
(?)	Remote configuration	✓
(?)	SSL secure web configuration	✓
		Remote access only
(?)	Web based configuration	✓
(?)	Default IP address	10.1.1.1
(?)	Default admin username	admin
(?)	Default admin password	See router base label for password
Support		
(?)	Official model website	http://www.technicolor.com
(?)	User Guide/Manual	https://iihelp.iinet.net.au/support/iattachl...
(?)	Firmware updates	ftp://ftp.iinet.net.au/pub/iinet/firmware/TG7...
(?)	Australian distributor website	https://www.iinet.net.au/
<input type="button" value="Show change history"/>		



TECHNOLOGY BLUE PAPER 2.1.3

Description	Primary Studio to Transmitter Link (STL) hardware
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

The Ubiquiti Nanobeam NBE-5AC-16 airMax® ac Bridge (Nanobeam) is the backbone of Lofty's primary studio to transmitter link (STL).

The Nanobeam transmits and receives via 5GHz spectrum using the IEEE 802.11ac networking standard.

APPLICATION

A Nanobeam unit is installed on the roof of Lofty's studio, with another installed at Lofty's TX site. The unit installed at the TX site has direct line of sight to Lofty's studio, with said LOS visible to the naked eye.

The link distance is approximately 2.4km.

Appendix A contains a satellite map showing line of sight between the Nanobeam units located at Lofty's studio and TX site.

FEATURES

Bidirectional connectivity at over 450 megabits per second (Mbps).

Comprehensive on-board management and diagnostic tools via web interface.

Built-in ESD (surge) protection.

Proven reliability in demanding outdoor environments.

Technical support is readily available either online or by contacting other community radio stations that have deployed Nanobeams in either their primary or secondary STLs.

Recommended by the South Australian Community Broadcasting Association (SACBA) for STL over AoIP applications.

Theoretical maximum range of over 15km.

OPERATIONS

Please refer to TX chain diagram (TBP 2.0.1 Appendix A) and STL & TX Site diagram legend (TBP 2.0.1 Appendix B).

MAINTENANCE

Nanobeam vital signs viz. ping monitored via remote network management console (PRTG).

Devices are periodically checked and tested to ensure reliable connectivity.

Lofty holds two spare pre-configured Nanobeam units on hand for rapid deployment in the event of one of the installed Nanobeam units failing.

Spare RF shielded heavy-duty Cat5e ethernet cables are also on hand for rapid deployment in the event of failure.

A hard copy of the Ubiquiti Nanobeam NBE-5AC-16 airMax® ac Bridge manual is kept at the TX site, with an additional copy kept at Lofty's studio. A PDF soft copy version is stored on Lofty's shared Google Drive.

SPECIFICATIONS Refer Appendices B and C.

APPENDIX A – Nanobeam (primary STL) line of sight

Studio: 20 Stephen Street MOUNT BARKER SA 5251

TX site: Cleggett Road LITTLEHAMPTON SA 5250

Land Services Group

The Property Location Browser is available on the Land Services Group Website: www.s.a.gov.au/land-services

Lofty to Cleggett's

Lofty STL @ Nitschke's, Cleggett's STL on pole

Date created:

October 26, 2018



Government of South Australia
Department of Planning,
Transport and Infrastructure



Disclaimer: The information provided above, is not represented to be accurate, current or complete at the time of printing this report. The Government of South Australia accepts no liability for the use of this data, or any reliance placed on it.

Lofty STL @ Nitschke's, Cleggett's STL on pole

Figure 2.1.3[a].i Line of sight (LOS) between Lofty studio and TX site

TBP 2.1.3 - Primary Studio to Transmitter Link (STL) hardware

Correct as at 3/11/2019 5:58 PM. Printed version of this document is uncontrolled.

Land Services Group

The Property Location Browser is available on the Land Services Group Website: www.sa.gov.au/landservices

Date created:
October 26, 2018

Lofty to Cleggett's

Zoom at Lofty End



Disclaimer: The information provided above, is not represented to be accurate, current or complete at the time of printing this report. The Government of South Australia accepts no liability for the use of this data, or any reliance placed on it.

Figure 2.1.3[a].ii Nanobeam mounted on roof of Lofty's studio in Mount Barker CBD

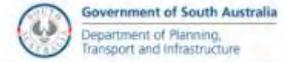
Land Services Group

The Property Location Browser is available on the Land Services Group Website: www.sa.gov.au/landservices

Date created:
October 26, 2018

Lofty to Cleggett's

Zoom at Cleggett's End

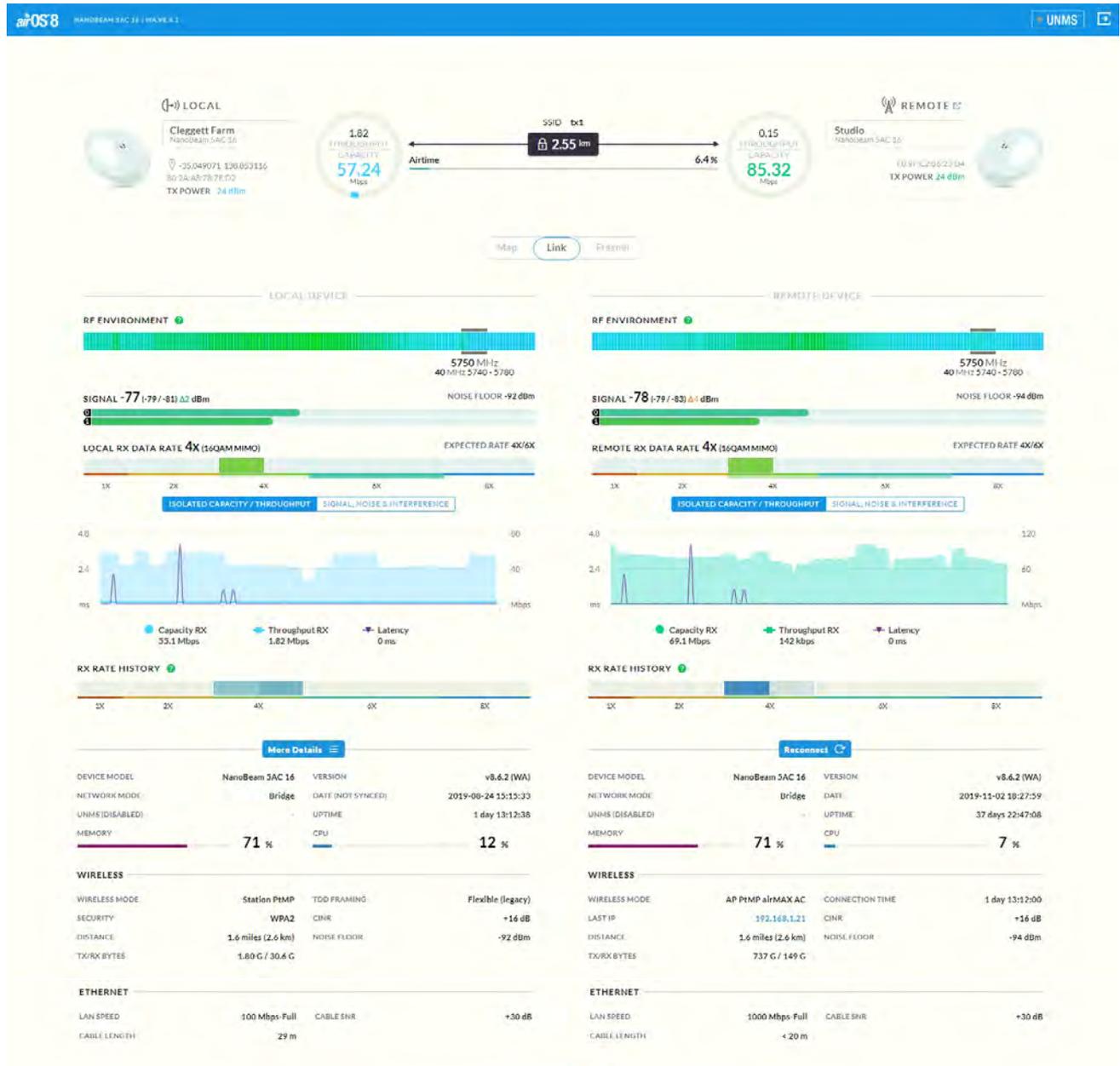


Disclaimer: The information provided above, is not represented to be accurate, current or complete at the time of printing this report. The Government of South Australia accepts no liability for the use of this data, or any reliance placed on it.

Figure 2.1.3[a].iii Clear studio-TX site LOS achieved by mounting Nanobeam c. 30m E of TX hut

APPENDIX B – Ubiquiti Nanobeam NBE-5AC-16 airMax® ac Bridge Site Survey

Real time primary STL status as recorded at TX site, 2 November 2019 18:27.



APPENDIX C – Ubiquiti Nanobeam NBE-5AC-16 airMax® ac Bridge Specifications

Extract from Ubiquiti Nanobeam NBE-5AC-16 airMax® ac Bridge data sheet retrieved via internet 2 November 2019 18:39 (https://dl.ubnt.com/datasheets/NanoBeam_ac/NanoBeam_ac_DS.pdf)

Datasheet

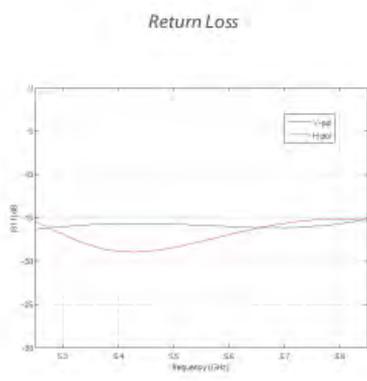
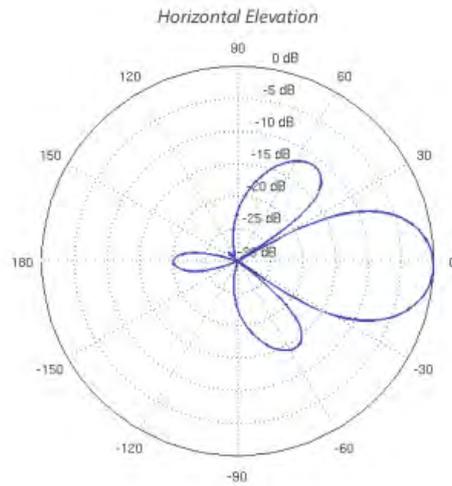
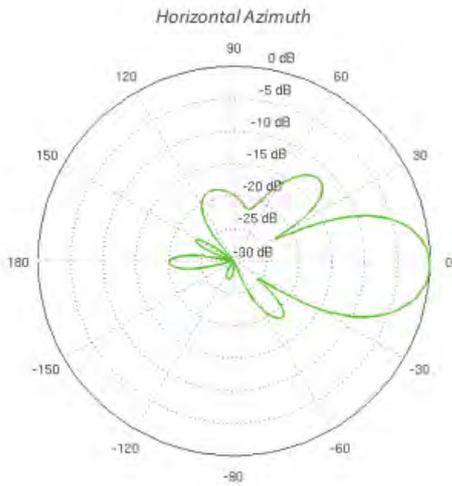
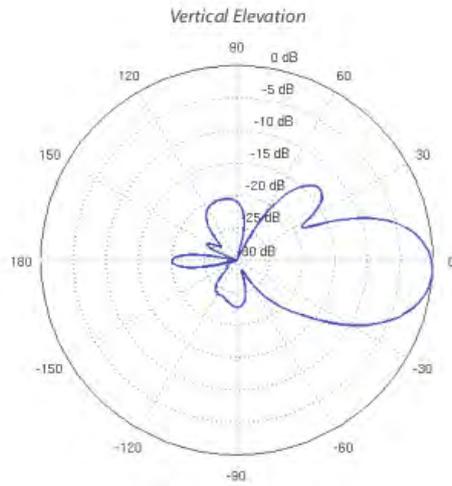
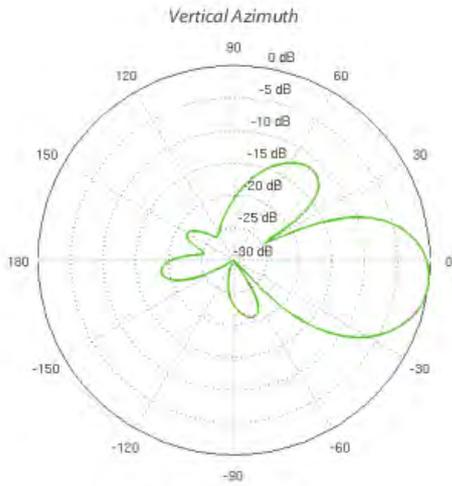
NanoBeam ac

Specifications

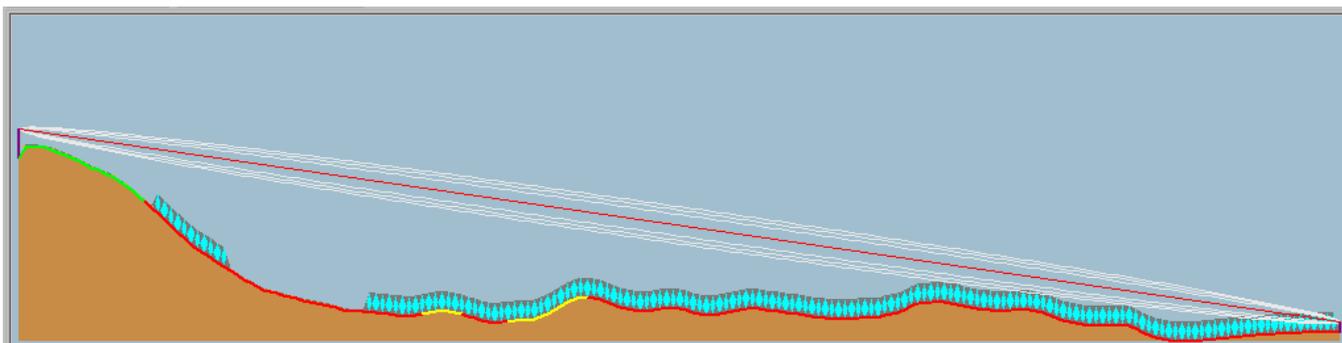
NBE-5AC-16					
Dimensions	140 x 140 x 54 mm (5.51 x 5.51 x 2.13")				
Weight	0.320 kg (0.71 lb)				
Power Supply	24V, 0.5A Gigabit PoE				
Max. Power Consumption	6W				
Operating Frequency	Worldwide	USA: U-NII-1	USA: U-NII-2A	USA: U-NII-2C	USA: U-NII-3
	5150 - 5875 MHz	5150 - 5250 MHz*	5250 - 5350 MHz*	5470 - 5725 MHz*	5725 - 5850 MHz*
Gain	16 dBi				
Networking Interface	(1) 10/100/1000 Ethernet Port				
Processor Specs	Atheros MIPS 74Kc, 533 MHz				
Memory	64 MB DDR2, 8 MB Flash				
LEDs	(1) Power, (1) LAN, (4) WLAN				
Signal Strength LEDs	Software-Adjustable to Correspond to Custom RSSI Levels				
Max. VSWR	1.5:1				
Channel Sizes	PTP Mode		PtMP Mode		
	10/20/30/40/50/60/80 MHz		10/20/30/40 MHz		
Polarization	Dual Linear				
Enclosure	Outdoor UV Stabilized Plastic				
Mounting	Pole-Mount (Kit Included), Wall-Mount				
Wind Loading	21.4 N @ 200 km/h (4.8 lbf @ 125 mph)				
Wind Survivability	200 km/h (125 mph)				
ESD/EMP Protection	Air: ± 24 kV, Contact: ± 24 kV				
Operating Temperature	-40 to 70° C (-40 to 158° F)				
Operating Humidity	5 to 95% Noncondensing				
Wireless Approvals	FCC, IC, CE				
RoHS Compliance	Yes				
Salt Fog Test	IEC 68-2-11 (ASTM B 117), Equivalent; MIL-STD-810 G Method 509.5				
Vibration Test	IEC 68-2-6				
Temperature Shock Test	IEC 68-2-14				
UV Test	IEC 68-2-5 at 40° C (104° F), Equivalent; ETS 300 019-1-4				
Wind-Driven Rain Test	ETS 300 019-1-4, Equivalent; MIL-STD-810 G Method 506.5				

NBE-5AC-16 Output Power: 24 dBm							
TX Power Specifications				RX Power Specifications			
Modulation	Data Rate	Avg. TX	Tolerance	Modulation	Data Rate	Sensitivity	Tolerance
airMAX ac	1x BPSK (1/2)	24 dBm	± 2 dB	airMAX ac	1x BPSK (1/2)	-96 dBm	± 2 dB
	2x QPSK (1/2)	24 dBm	± 2 dB		2x QPSK (1/2)	-95 dBm	± 2 dB
	2x QPSK (1/4)	24 dBm	± 2 dB		2x QPSK (1/4)	-92 dBm	± 2 dB
	4x 16QAM (1/2)	24 dBm	± 2 dB		4x 16QAM (1/2)	-90 dBm	± 2 dB
	4x 16QAM (1/4)	24 dBm	± 2 dB		4x 16QAM (1/4)	-86 dBm	± 2 dB
	6x 64QAM (1/2)	23 dBm	± 2 dB		6x 64QAM (1/2)	-83 dBm	± 2 dB
	6x 64QAM (1/4)	22 dBm	± 2 dB		6x 64QAM (1/4)	-77 dBm	± 2 dB
	6x 64QAM (1/8)	21 dBm	± 2 dB		6x 64QAM (1/8)	-74 dBm	± 2 dB
8x 256QAM (1/4)	20 dBm	± 2 dB	8x 256QAM (1/4)	-69 dBm	± 2 dB		
8x 256QAM (1/8)	19 dBm	± 2 dB	8x 256QAM (1/8)	-65 dBm	± 2 dB		

*Some frequencies may require activation; visit: <https://www.ubnt.com/fcc/labelrequest>



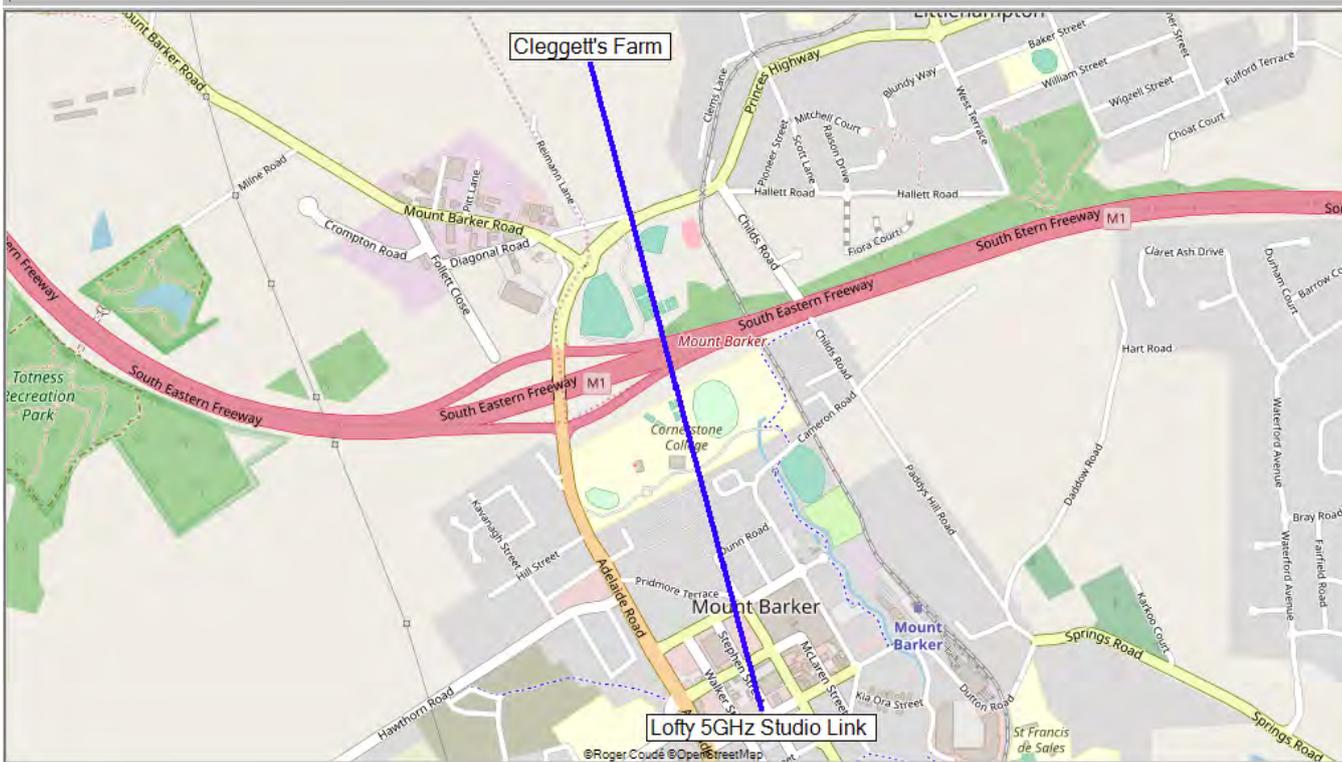
STL via 5GHz AoIP – Lofty Studio to Cleggett Farm (ACMA Site ID 305178)



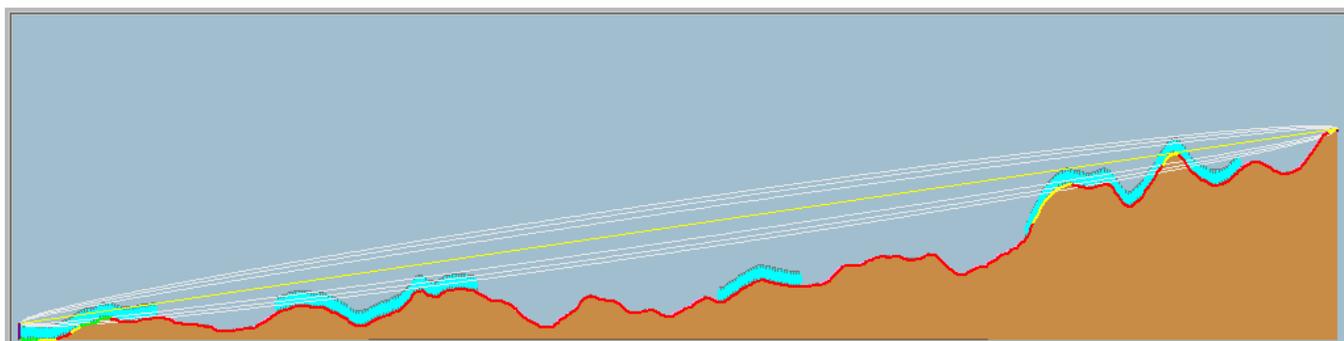
Lofty-Cleggetts AoIP 5GHz****

Cleggett's Farm (1)		(2) Lofty 5GHz Studio Link	
Latitude	-35.049606 °	Latitude	-35.066951 °
Longitude	138.853280 °	Longitude	138.858854 °
Ground elevation	420.0 m	Ground elevation	331.9 m
Antenna height	15.0 m	Antenna height	5.0 m
Azimuth	165.26 TN 157.08 MG °	Azimuth	345.26 TN 337.07 MG °
Tilt	-2.82 °	Tilt	2.81 °
Radio system		Propagation	
TX power	37.78 dBm	Free space loss	112.39 dB
TX line loss	0.00 dB	Obstruction loss	0.00 dB
TX antenna gain	16.00 dBi	Forest loss	0.00 dB
RX antenna gain	16.00 dBi	Urban loss	4.77 dB
RX line loss	0.00 dB	Statistical loss	31.20 dB
RX sensitivity	-67.00 dBm	Total path loss	148.36 dB

Performance	
Distance	1.994 km
Precision	10.0 m
Frequency	5000.000 MHz
Equivalent Isotropically Radiated Power	238.864 W
System gain	136.78 dB
Required reliability	99.000 %
Received Signal	-78.57 dBm
Received Signal	26.38 μV
Fade Margin	-11.57 dB



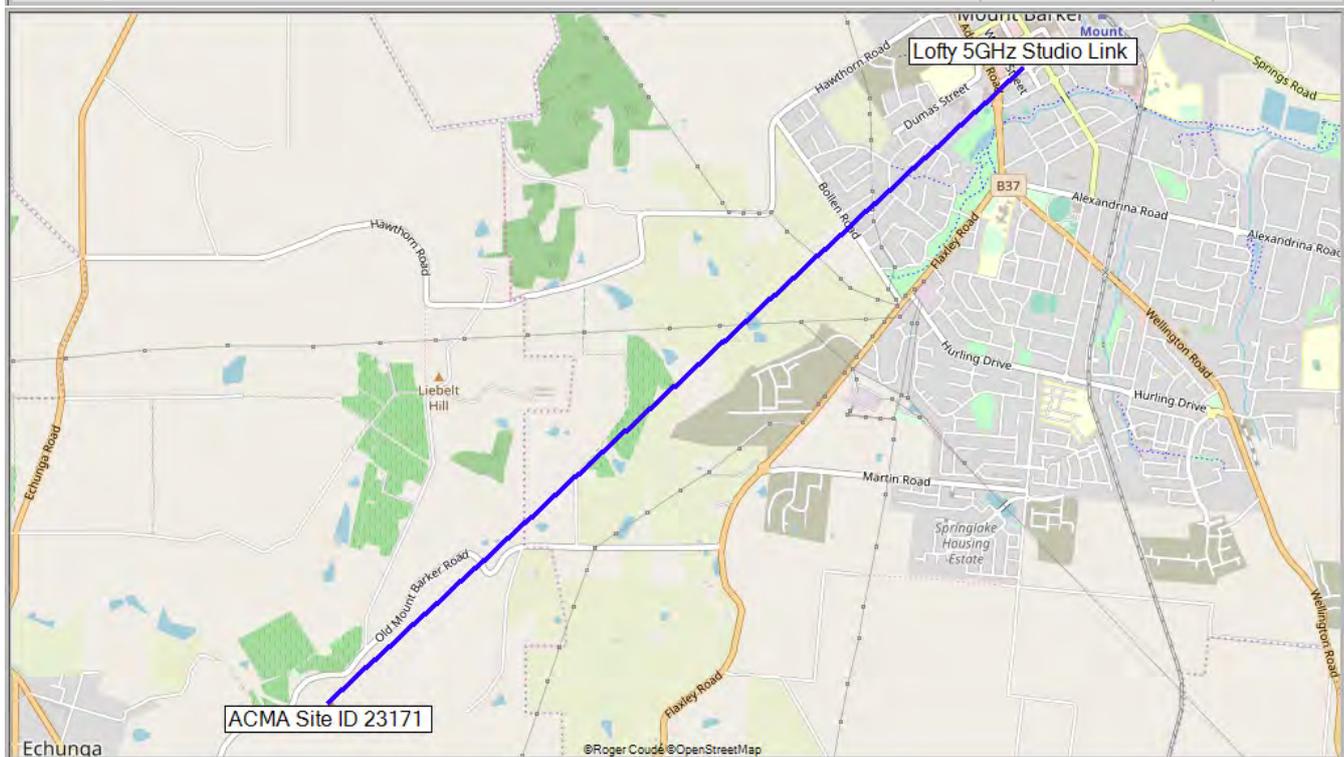
STL via 5GHz AoIP – Lofty Studio to ACMA Site ID 23171



Lofty-23171 (direct)

Lofty 5GHz Studio Link (1)		(2) ACMA Site ID 23171	
Latitude	-35.066951 °	Latitude	-35.101152 °
Longitude	138.858854 °	Longitude	138.813377 °
Ground elevation	331.9 m	Ground elevation	462.5 m
Antenna height	10.0 m	Antenna height	1.0 m
Azimuth	227.40 TN 219.21 MG °	Azimuth	47.43 TN 39.25 MG °
Tilt	1.21 °	Tilt	-1.26 °
Radio system		Propagation	
TX power	37.78 dBm	Free space loss	121.38 dB
TX line loss	0.00 dB	Obstruction loss	0.00 dB
TX antenna gain	16.00 dBi	Forest loss	0.00 dB
RX antenna gain	16.00 dBi	Urban loss	5.16 dB
RX line loss	0.00 dB	Statistical loss	30.91 dB
RX sensitivity	-87.00 dBm	Total path loss	157.45 dB

Performance	
Distance	5.620 km
Precision	10.0 m
Frequency	5000.000 MHz
Equivalent Isotropically Radiated Power	238.864 W
System gain	156.78 dB
Required reliability	99.000 %
Received Signal	-87.67 dBm
Received Signal	9.26 μV
Fade Margin	-0.67 dB





TECHNOLOGY BLUE PAPER 2.1.4

Description	Router (TX): Dovado Pro AC
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

In order to coordinate a number of networked devices at Lofty's transmission (TX) site, a router has been deployed rather than a simple switch.

The Dovado Pro AC router (Dovado) was selected to replace Lofty's previous TX site router, the TP-Link TL-MR3420 (TBP 2.2.4), as the former contains additional functionality that is desirable for TX site management viz. Z-Wave home automation controller, router access via SMS.

The TP-Link has been retained at the TX site as a backup should the Dovado fail.

APPLICATION

The Dovado is installed at the TX site.

IP connectivity is fed into the Dovado either via Nanobeam or 4G fallback, which is then distributed to IP-based hardware within the TX site viz:

- BW Broadcast DSPX-FM audio processor
- Deva RX-91 Audio over IP (AoIP) decoder
- PC configured for multiple support roles including but not limited to TX telemetry logging, TX site climate control and backup off-air logging

FEATURES

High reliability (Linux-based) prosumer hardware router for LAN and WAN traffic.

Internet connectivity via ethernet or 4G; currently configured to use STL as primary internet connection with 4G fallback.

Z-Wave home automation controller, accessible via web interface, app and/or SMS.

OPERATIONS

Please refer to TX chain diagram (TBP 2.0.1 Appendix A) and STL & TX Site diagram legend (TBP 2.0.1 Appendix B).

FALLBACK TYPE Hardware

Manual. Spare router as per TBP 2.2.4.

STL

As per TBP 2.2.3[b].

MAINTENANCE

Key functionality viz. 4G fallback, Z-Wave control, SMS interface periodically checked and tested to ensure reliable connectivity.

Spare router (TP-Link TL-MR3240, refer TBP 2.2.4) held as backup should Dovado fail.

In the event of failure, the Dovado will be subject to a factory reset and/or firmware update, with extensive testing to follow in a non-production environment. Once Dovado has passed testing, it shall be reinstated.

Where factory reset and firmware update has not resolved the issue, Lofty shall refer back to Dovado for further assistance. This may result in Lofty requesting a return merchandise authorisation (RMA) from Dovado.

Windows-based TX PC is equipped with Z-Wave controller and may act as a fallback should the Dovado fail.

Spare Cat5e ethernet cables held at TX hut in the event of failure.

A hard copy of the Dovado Pro AC router manual is kept at the TX site, with an additional copy kept at Lofty's studio. A PDF soft copy version is stored on Lofty's shared Google Drive.

SPECIFICATIONS Refer Appendix B

APPENDIX A – Specifications

TECHNICAL SPECIFICATIONS

PHYSICAL

ANTENNA TYPE
2x3dBi detachable dipole antenna.

WEIGHT
287g

POWER REQUIREMENTS
12 VDC, 1.5A (MAX) (incl. AC/DC adaptor)

DIMENSIONS
180 x 130 x 35 mm

LEDs
LAN 1-4 (with Gigabit Indication), WAN (with with Gigabit Indication), WLAN, USB 1-2, PWR, SMS

OVERVIEW

HARDWARE

1 x USB 3.0 High Speed Port
1 x USB 2.0 Port
4 x 10/100/1000Mbit/s Ethernet LAN Port
1 x 10/100/1000Mbit/s Ethernet WAN Port
100-240VAC, 50/60Hz, power switching adaptor
WiFi Antennas: 2x detachable 3dBi dual band (2.4GHz + 5GHz)
WiFi: AC1200 (300Mbps 802.11bgn + 900Mbps 802.11ac)

ROUTER FEATURES

NAT router with DHCP server
Operates in Routed/Bridged Mode (Mobile Broadband)
Supports a growing range of USB modems: SmartUSB™, to re-power USB modem in event of failure
Mobile Internet Auto-Configuration Solution (MIAS)
4G/LTE-Advanced routing in excess of 300 Mbps
4G/LTE Manual Frequency Selection
SpotBoost® WiFi-Tethering connects router to a different WiFi source
Multilingual Quick Setup Wizard
Connection Tracker™ (maintains uptime)
Ethernet WAN port or USB modem as primary Internet access.
Automatic fail-over between Internet connections
High speed NAS/FTP server, via USB external storage
Manual Selection of 4G/LTE Frequency Band
Positioning/Tracking via external USB GPS
GPS logging towards FTP server
Dynamic DNS services
Remote Access/Upgrade
NTP clock client
Bimonthly USB Modem Data traffic Counter

Port-Forwarding
SPI-Firewall
UPnP
VPN Pass-Through
VPN Client (PPTP) with Phonebook, Port-Forwarding, Host Exemptions and Dynamic DNS
USB Modem Redundancy
PPPoE (Authentication Protocol)

WiFi SECURITY

MAC Address Filtering for WiFi
WEP 64/128 bit encryption
WPA/WPA2 (TKIP/AES/Mixed)-PSK
WPA2 Enterprise (requires a RADIUS Server)
WPS Softbutton (via Graphical User Interface)

SMS FUNCTIONALITY

SMS Mailbox for sending and receiving messages
Status Check via SMS command
Remote Control via SMS command
Event & Connection Notifications via SMS
Periodic notification of data consumption via SMS
Home Automation
API for 3rd party apps
SMS forwarding to a different number/E-mail

HOME AUTOMATION

Home Automation via USB, controlled by Web/App/SMS
Event Scheduling for power switching of lights/appliances
API for 3rd party apps

ENVIRONMENT

Operating Temperature: 0-40° Celsius
Operating Humidity: 10% to 90% (non-condensing)

FIRMWARE UPDATES

Frequent firmware updates
Dovado Firmware Desktop Utility: with Rescue functionality
Live Firmware Upgrade from Dovado servers, with SMS and/or E-mail notifications

CERTIFICATIONS

Type: CE

* See www.dovado.com/modems for SMS & Bridge Mode compatibility
For more information, visit www.dovado.com

Dovado Europe AB
Kvarnåsgatan 9
164 40 Kista
Sweden
T: +46 8 522 91885 | F: +46 8 522 91886
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TECHNOLOGY BLUE PAPER 2.1.5

Description	Deva RX-91 Audio over IP (AoIP) decoder
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

Content to be transported along Lofty's TX chain via internet protocol (IP). This is in the form of audio that has been converted to a digital stream and then transported via Audio over Internet Protocol (AoIP).

Devices to encode audio from analogue signals into an AoIP stream and decode audio from an AoIP stream and into analogue signals for feeding into the TX chain facilitate this process.

APPLICATION

The Deva RX-91 AoIP decoder receives an AoIP stream as routed via the Dovado Pro AC router and decodes said stream into an analogue signal.

The analogue signal is fed into the next device in the TX chain, being the sound processor (TBP 4.x.0)

AoIP origin may be either of Lofty's studios, or directly via Lofty's outside broadcasting (OB) facilities.

FEATURES

Decodes up to three AoIP sources.

Supports locally stored backup of up to 8GB via microSD card.

Silence detection, which may be used to trigger a backup AoIP source or local backup.

AoIP stream sources can be automatically switched by timer i.e. where programming is broadcast from an alternate studio on a regular basis every week.

Secure remote access allows for stream source to be changed on the fly e.g. to switching to and from an OB directly rather than being dependent by a studio-based panel operator.

OPERATIONS

Please refer to TX chain diagram (TBP 2.0.1 Appendix A) and STL & TX Site diagram legend (TBP 2.0.1 Appendix B).

MAINTENANCE

Vital signs viz. ping monitored via remote network management console (PRTG).

Web interface restricted to inside Lofty's LAN, however Lofty's LAN is available via remote desktop over VPN.

A hard copy of the Deva RX-91 AoIP decoder manual is kept at the TX site, with an additional copy kept at Lofty's studio. A PDF soft copy version is stored on Lofty's shared Google Drive.

SPECIFICATIONS Primary AoIP link is encoded via PCM codec. Bitrate 1,411kbps.
First backup AoIP link is encoded via AAC+ codec. Bitrate 320kbps.
Second backup AoIP link is encoded via AAC+ codec. Bitrate 32kbps.
Third backup consists of pre-recorded programming stored on 8GB microSD card, encoded as MP3 320kbps.
Source audio sample rate 16 bits at 44.1kHz.



TECHNOLOGY BLUE PAPER 2.2.1

Description	Fallback Audio over IP (AoIP) encoder - software
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION	<p>Content to transported along Lofty's TX chain via internet protocol (IP). This is in the form of audio that has been converted to a digital stream and then transported via Audio over Internet Protocol (AoIP).</p> <p>Should the primary AoIP encoder fail, the STL will automatically switch to a fallback AoIP stream.</p>
APPLICATION	<p>All in-studio desktop PCs and outside broadcast (OB) laptops used to create Lofty's broadcast are configured to automatically launch fallback AoIP encoding at start-up.</p> <p>Fallback AoIP encoding consists of two components: the stream encoder and the streaming server.</p>
FEATURES	<p>A self-contained software AoIP encoding solution consisting of two components:</p> <ul style="list-style-type: none">• Stream encoder (BUTT)• Streaming server (Iccast) <p>Based on open source software (BUTT and Iccast).</p> <p>Negligible (viz. < 2%) additional CPU load on playout PCs.</p> <p>Unobtrusive operation, effectively invisible to in-studio presenter(s).</p>
OPERATIONS	<p>AoIP decoding at TX site configured to switch from hardware-generated AoIP stream to software-generated AoIP stream in < 5 seconds.</p> <p>AoIP decoder will automatically revert to primary AoIP source within 5 seconds of said hardware-generated AoIP stream source coming back online.</p> <p>Software AoIP encoder operates on all studio PCs at all times.</p> <p>Listener impact is restricted to the aforementioned interruption when hardware-generated AoIP is lost (viz. < 5 seconds).</p>
FALLBACK TYPE	<p><i>Automatic; switched either via primary AoIP decoder (TBP 2.1.5) or fallback software decoding (TBP 2.2.5).</i></p>
MAINTENANCE	<p>Should software-generated AoIP stream be requested by AoIP decoder, a Level 2 (Moderate) fault shall be raised in Lofty's fault log, with investigation into root cause of fallback to be undertaken as soon as practicable.</p>

SPECIFICATIONS As per Lofty's High Quality Icecast stream; encoded with AAC+ codec.
Bitrate 128kbps.

Source audio sample rate 16 bits at 44.1kHz. Stream encoded in stereo.



TECHNOLOGY BLUE PAPER 2.2.2

Description	Router (Studio): Technicolor TG789VACv2 [Clone]
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

A key component of Lofty's network infrastructure is its routers. There are two routers within Lofty's network; one located at the studio, the other located at the TX site.

Lofty uses a Technicolor TG789VACv2 router as per TBP 2.1.2. This is a domestic grade router as issued by Lofty's preferred NBN ISP, Internode (TBP 2.2.3[a]).

In production use, the TG789VACv2 has been extremely reliable. However, a second TG789VACv2 is kept in stock by Lofty, and is configured as a clone of the production router ("clone router").

APPLICATION

The clone router is stored adjacent Lofty's server rack.

When deployed, the clone should operate in an identical manner to the failed production unit.

FEATURES

As per TBP 2.1.2.

OPERATIONS

As per TBP 2.1.2.

FALLBACK TYPE

Hardware

Manual. Cloned unit kept in stock, to be swapped out in case of production unit failure. In this instance, the clone router shall become the new production router.

WAN (Internet)

As per TBP 2.1.2.

MAINTENANCE

The clone router is to be left in situ, as it now taken the role of production router.

The erstwhile production router shall be tested, and may also be subject to a factory reset and/or a firmware update.

Once said router has been satisfactorily tested in a non-production environment, it shall become the new clone router.

Should said router fail non-production testing, it shall be recycled via standard e-waste protocols, with the disposal of said router being recorded in Lofty's Asset Register.

Where the erstwhile production router has been disposed of, a replacement TG789VACv2 shall be procured as soon as practicable. Said replacement

may either be sourced new from Internode (preferred source), or via the secondary market viz. eBay.

In the event that said replacement TG789VACv2 is sourced via the secondary market, care is to be taken to ensure that said replacement can be successfully cloned to Lofty's production unit i.e. secondary market unit shall be either:

- Internode-branded; or
- unbranded

TG789VACv2 routers carrying other ISP branding may be locked to a specific ISP. Whilst it is possible to unlock the TG789VACv2, this is undesirable due to additional cost and work as a result of the unlocking process.

All other maintenance as per TBP 2.1.2.

SPECIFICATIONS As per TBP 2.1.2.



TECHNOLOGY BLUE PAPER 2.2.3[a]

Description	Fallback STL [Studio] – National Broadband Network (NBN) Fixed Line
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

Easy and reliable fallback was a key consideration in the design of Lofty's studio to transmitter link (STL). On this basis, the decision was made for STL content transport to be made exclusively via Audio over Internet Protocol (AoIP), as documented in TBP 2.0.1.

Using AoIP for content transport allows Lofty's STL to easily divert to a fallback STL path should any part of the primary STL fail. This diversion is automatic, and is put into place in a matter of seconds, thus minimising the impact of a primary STL failure on Lofty's delivery of the broadcasting service for which it is licenced.

STL fallback connectivity consists of NBN fixed line and 4G mobile broadband components.

APPLICATION

For STL purposes, Lofty's NBN link is the first fallback method engaged at *the studio end* in the event of primary STL failure.

Lofty's current preferred NBN provider is Internode.

FEATURES

Based on Internode NBN Gold (nbn50) Unlimited GB with Business Pack.

Static IP (IPv4) simplifies connectivity to Lofty's Audio over IP (AoIP) content transport stream and the wider internet, thus permitting Lofty to redirect said AoIP via a reliable fallback path (a virtual STL) in the event of primary STL failure.

OPERATIONS

Connectivity is managed by the studio router (TBP 2.1.2).

Lofty's studio is within a coverage area where NBN fixed line services are delivered via Fibre to the Node (FTTN) technology. As this technology is significantly inferior to the originally proposed Fibre to the Premises (FTTP) technology, Lofty's connectivity speed is essentially capped to 50Mbps download and 20Mbps upload.

From Lofty's perspective, upload speeds are of greater relevance due to streaming audio performance (AoIP) being contingent on fast upload speeds, with download speeds being of little consequence.

FALLBACK TYPE

Automatic. Where content transport is not possible via primary STL, routers at the studio (TBP 2.1.2) and the TX (TBP 2.1.4) will enter fallback until such time as the primary STL is restored.

MAINTENANCE

Fallback routing is tested periodically, usually outside of peak listening times (viz. 00:00-05:59).

Where connectivity issues are reported by Lofty’s users, speed testing is conducted to confirm that Lofty’s NBN connectivity is within specifications.

Lofty’s plan with Internode includes a Service Level Agreement (SLA) as specified in this TBP. This sets a minimum uptime expectation in excess of comparable consumer-grade NBN services and permits Lofty to seek compensation should Internode fail to deliver NBN connectivity that meets or exceeds said uptime expectation.

All other maintenance and fault logging as per respective Bridging and IT TBPs.

SPECIFICATIONS

Internode NBN Gold (nbn50) Unlimited GB with Business Pack	
Maximum upload/download (Mbps)	50 / 20
Real world upload/download (Mbps) ¹	47.46 / 18.11 (Appendix A)
Data limit	Unlimited
Service Level Agreement (SLA)	Yes (see below)
Static IP address	Yes
Priority support	Yes
Audio over IP (AoIP) in relation to available upload bandwidth (%) ²	
Primary (PCM @ 1,411Kbps)	9.35%
Backup 1 (AAC+ @ 128Kbps)	0.84%
Backup 2 (AAC+ @ 48Kbps)	0.32%
Backup 3 (AAC+ @ 24Kbps)	0.16%

Our NBN SLA is based on Internode’s Business Pack Service Description, which forms part of our Customer Relationship Agreement with Internode.

Key points:

- Minimum NBN connectivity availability (uptime) 99.2% per calendar month viz. no more than approximately six (6) hours’ downtime per calendar month.
- A service restoration target of ten (10) hours in the event of NBN connectivity failure.
- Where Internode is unable to meet its SLA, Lofty may be eligible for a credit on its account.

The current version of said Agreement is attached as Appendix B.

¹ As measured via speedtest.net using Internode’s Adelaide server 2 November 2019 13:37.

² Based on kilobits per second (Kbps) plus nominal 20% network protocol overhead.

APPENDIX A

Lofty's NBN fixed line connectivity as measured via speedtest.net, 2 November 2019 13:37.



APPENDIX B

Our Customer Relationship Agreement BUSINESS PACK SERVICE DESCRIPTION

Internode Pty Ltd ABN 82 052 008 581

Phone: 13 66 33

1/502 Hay Street, Subiaco WA 6008

9 November 2015

Rules of interpretation and capitalised terms used in this Service Description are defined in the General Terms of our CRA or our Master Services Agreement (as applicable), or in the body of this Service Description.

1. ABOUT THE BUSINESS PACK SERVICE DESCRIPTION

- 1.1 The terms and conditions contained in this Service Description are additional to, and should be read in conjunction with, our CRA or Master Services Agreement (as applicable).
- 1.2 Use of the Internode Business Pack Service ("**Service**") is subject to this Service Description and:
 - (a) the General Terms of our CRA, including the other documents listed in clause 1.2 of the General Terms; or
 - (b) our Master Services Agreement (as applicable).

2. BUSINESS PACK

- 2.1 The Service is a value adding feature pack that may be added to existing Internode services. Full details of the available features of the Service are accessible on our Website.
- 2.2 The Service may only be used in conjunction with one of our existing Services. Accordingly, this Service Description is additional to and should be read in conjunction with the corresponding product Service Description relevant to the Internode service to which the Service is applied.
- 2.3 Business Pack customers receive prioritised access to our help desk, which can be contacted by calling 13 66 33. This prioritised access is available through the initial support greeting menu by pressing 3 for technical support followed by pressing 2 for business support. Your priority access ensures your service issue is reported and resolved as quickly as possible.
- 2.4 If we do not achieve the specified service Availability Target of 99.2% within any calendar month, you may be eligible for a credit on your account in accordance with our CRA or Master Services Agreement (as applicable).

INET GROUP CRA – INTERNODE BUSINESS PACK SERVICE DESCRIPTION

- 2.5 If we do not achieve the specified Restore Target of 10 hours, you may be eligible for a credit on your account in accordance with our CRA or Master Services Agreement (as applicable).
- 2.6 The rebates discussed in clauses 2.4 and 2.5 above are only applicable if you:
- (a) use access equipment that is sold and supported by us;
 - (b) log the fault report with us; and
 - (c) submit an SLA Rebate Form in accordance with our instructions.
- Please refer to our Website for full details of the rebate process.
- 2.7 The Availability Guarantee (defined in the Business Further Terms and Conditions) and the corresponding rebates do not apply:
- (d) to faults that are not reported promptly and correctly to us; or
 - (e) if the online SLA Rebate form has not been correctly completed and submitted.

3. INTERNODE HELP DESK

Contact Number: 13-NODE (13 66 33)

(Press 1 for technical support, then 2 for priority Business support)

Hours of Coverage to Respond	07.00 to 24.00 7 Days (including Public Holidays)
Response Target:	2 hours
Hours of Coverage to Restore	08.00 to 18.00 7 Days (including Public Holidays)
Customer Update Period	Every 4 Hours
Restore Target	10 Hours
Availability Target	99.2%
Availability Guarantee	YES



TECHNOLOGY BLUE PAPER 2.2.3[b]

Description	Fallback STL [Studio & TX] – 4G Mobile Broadband (4G)
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

Easy and reliable fallback was a key consideration in the design of Lofty's studio to transmitter link (STL). On this basis, the decision was made for STL content transport to be made exclusively via Audio over Internet Protocol (AoIP), as documented in TBP 2.0.1.

Using AoIP for content transport allows Lofty's STL to easily divert to a fallback STL path should any part of the primary STL fail. This diversion is automatic, and is put into place in a matter of seconds, thus minimising the impact of a primary STL failure on Lofty's delivery of the broadcasting service for which it is licenced.

STL fallback connectivity consists of NBN fixed line and 4G mobile broadband components.

APPLICATION

For STL purposes, 4G wireless internet is the second fallback method engaged *at the studio end* and the first fallback method engaged *at the TX end* in the event of primary STL failure.

Due to occasional instances of widespread mobile network failure, Lofty maintains 4G connectivity with two providers viz. Telstra and Vodafone.

As a result of field testing by way of conducting two seasons' worth of outside broadcasts (OB) for the Hills Football League (HFL), Lofty has found Vodafone to provide superior connectivity quality (viz. coverage and speed). Telstra's 4G network is on par with Vodafone's for the most part.

On this basis, Lofty's studio and TX routers are equipped with Vodafone 4G by default. Telstra 4G hardware is kept as a backup at the studio and TX, and can replace in situ Vodafone hardware in the event of Vodafone suffering network difficulties.

FEATURES

Pre-paid internet connectivity as per Lofty's specifications.

OPERATIONS

Connectivity is managed by routers located at the studio (TBP 2.1.2) and the TX (TBP 2.1.4).

As 4G connectivity is subject to data transfer limits and variable speeds, the preferred AoIP transport stream is Backup 1 (viz. AAC+ @ 128Kbps). This provides a content stream of similar technical quality to high bitrate DAB+ digital radio stations.

FALLBACK TYPE

In most instances, automatic fallback is expected. By default, 4G wireless internet connectivity is provided by Vodafone. However, where the primary STL fails and there is an outage affecting Vodafone's 4G mobile network, manual intervention will be required at the TX router to physically swap out

the Vodafone 4G mobile network device for its Telstra equivalent, and may be required at the studio router should the studio's NBN fixed line fail.

MAINTENANCE Fallback routing is tested periodically, usually outside of peak listening times (viz. 00:00-05:59).

All other maintenance and fault logging as per respective Bridging and IT TBPs.

SPECIFICATIONS

Minimum specifications – Telstra and Vodafone 4G broadband	
Nominal max upload/download (Mbps)	30 / 10
Expiry (recharge frequency)	180 days
Data limit per recharge	20GB ¹
Estimated Audio over IP (AoIP) deliverable within data limit (time) ²	
Primary (PCM @ 1,411Kbps)	26h 52m
Backup 1 (AAC+ @ 128kps)	289h 21m (c. 1 week 5 days)
Backup 2 (AAC+ @ 48Kbps)	771h 36m (c. 4 weeks 4 days)
Backup 3 (AAC+ @ 24Kbps)	1,543h 12m (c. 9 weeks 3 days)
Audio over IP (AoIP) in relation to available upload bandwidth (%) ³	
Primary (PCM @ 1,411Kbps)	14.11%
Backup 1 (AAC+ @ 128Kbps)	1.28%
Backup 2 (AAC+ @ 48Kbps)	0.48%
Backup 3 (AAC+ @ 24Kbps)	0.24%

¹ Based on the assumption that each respective service provider measures data limits based on IEC Metric (Decimal) standards, where 20 Gigabytes (GB) is equal to 20,000 Megabytes (MB).

² Based on JEDEC (Binary) standards, where 1 Kilobit (Kb) is equal to 0.125 Kilobytes (KB), 1,024KB is equal to 1 Megabyte (MB) and 1,024MB is equal to 1 Gigabyte (GB); plus nominal 20% network protocol overhead.

³ Based on JEDEC (binary) Kilobits per second (Kbps) plus nominal 20% network protocol overhead.



TECHNOLOGY BLUE PAPER 2.2.4

Description	Router (TX): TP-Link TL-MR3420
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION In order to coordinate a number of networked devices at Lofty's transmission (TX) site, a router has been deployed rather than a simple switch.

Prior to the commissioning of its replacement (Dovado Pro AC, refer TBP 2.1.4), IP network routing at the TX was managed using the TP-Link TL-MR3420 (TP-Link).

The TP-Link has been retained for fallback purposes should the Dovado fail.

APPLICATION The TP-Link is held at the TX site.

IP connectivity is fed into the TP-Link either via Nanobeam or 4G fallback, which is then distributed to IP-based hardware within the TX site viz:

- BW Broadcast DSPX-FM audio processor
- Deva RX-91 Audio over IP (AoIP) decoder
- Windows-based PC, configured for multiple support roles including but not limited to TX telemetry logging, TX site climate control and backup off-air logging

FEATURES High reliability (Linux-based) consumer grade hardware router for LAN and WAN traffic.

Internet connectivity via ethernet or 4G; currently configured to use STL as primary internet connection with 4G fallback.

OPERATIONS Please refer to TX chain diagram (TBP 2.0.1 Appendix A) and STL & TX Site diagram legend (TBP 2.0.1 Appendix B).

FALLBACK TYPE Hardware

Manual. Used to swap out Dovado Pro AC (TBP 2.1.4) should this unit fail.

WAN (Internet)

As per TBP 2.2.3[b].

MAINTENANCE Key functionality viz. 4G fallback, routing checked and tested to ensure reliable connectivity.

Spare Cat5e ethernet cables held at TX hut in the event of failure.

A hard copy of the Ubiquiti Nanobeam NBE-5AC-16 airMax® ac Bridge manual is kept at the TX site, with an additional copy kept at Lofty's studio. A PDF soft copy version is stored on Lofty's shared Google Drive

APPENDIX A – Specifications

As retrieved from TP-Link website 2 November 2019 19:11. (<https://www.tp-link.com/lk/home-networking/lte-3g/tl-mr3420/#specifications>)

LTE/3G TL-MR3420 Overview Specifications Reviews & Awards Support

HARDWARE FEATURES

Interface	1 USB 2.0 Port for LTE/HSPA+/HSUPA/HSDPA/UMTS/EVDO USB Modem 1 10/100Mbps WAN Port, 4 10/100Mbps LAN Ports, support the auto-Negotiation and auto-MDI/MDIX
Button	WPS/Reset Button Wireless On/Off Switch Power On/Off Button
External Power Supply	12VDC/1A
Dimensions (W x D x H)	8*5.4*1.7 in. (204*138*44 mm)
Antenna Type	Omni directional, Detachable, Reverse SMA
Antenna Gain	2x5dBi

WIRELESS FEATURES

Wireless Standards	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n
Frequency	2.4-2.4835GHz
Transmit Power	<20dBm
Wireless Security	Support 64/128 bit WEP, WPA-PSK/WPA2-PSK Wireless MAC Filtering

SOFTWARE FEATURES

Security	NAT Firewall, SPI Firewall, MAC / IP / Packet / Application / URL Filtering Denial of Service(DoS), SYN Flooding, Ping of Death
Management	Web Based Configuration(HTTP), Web Based Firmware Upgrade

OTHERS

Certification	CE, FCC, RoHS
Package Contents	3G/4G Wireless N Router TL-MR3420 2 Antennas Power supply unit Ethernet Cable Resource CD Quick Installation Guide
System Requirements	Microsoft® Windows® 98SE, NT, 2000, XP, Vista™ Windows 7, 8, 10, MAC® OS, NetWare®, UNIX® or Linux.
Environment	Operating Temperature: 0°C~40°C (32°F~104°F) Storage Temperature: -40°C~70°C (-40°F~158°F) Operating Humidity: 10%~90% non-condensing Storage Humidity: 5%~90% non-condensing



TECHNOLOGY BLUE PAPER 2.2.5

Description	Fallback Audio over IP (AoIP) encoder - software
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION Content to transported along Lofty's TX chain via internet protocol (IP). This is in the form of audio that has been converted to a digital stream and then transported via Audio over Internet Protocol (AoIP).

Should the primary AoIP decoder fail, the STL will automatically switch to a fallback AoIP decoder.

APPLICATION Lofty's Windows-based TX PC is equipped with VideoLAN Player (VLC) software.

Upon startup, VLC automatically connects to Lofty's AAC+ 128kbps online streaming server. This creates what is essentially a virtual STL, operating irrespectively of which underlying hardware and/or network routing is used.

In the event that the hardware AoIP decoder fails (TBP 2.1.5), the program fail detector (TBP 3.1.1) will automatically switch its input feed to the software AoIP decoder.

Once the hardware AoIP decoder is reinstated, the program fail detector will automatically cut over from the fallback AoIP decoder feed.

FEATURES Based on open source software (VLC).

Negligible (viz. < 2%) additional CPU load on playout PCs.

Not reliant on any particular physical STL configuration.

Low bandwidth overhead minimises/eliminates buffering and its resultant delays, even when underlying physical STL has reverted to 4G at both studio and TX ends.

OPERATIONS AoIP decoding at TX site configured to switch from hardware-generated AoIP stream to software-generated AoIP stream in < 5 seconds.

AoIP decoder will automatically revert to primary AoIP source within 5 seconds of said hardware-generated AoIP stream source coming back online.

Software AoIP decoder operates on TX PC at all times.

Listener impact is restricted to the aforementioned interruption when hardware-generated AoIP decoding is first lost (viz. < 5 seconds).

FALLBACK TYPE *Automatic.*

MAINTENANCE Should software-generated AoIP stream be requested by AoIP decoder, a Level 2 (Moderate) fault shall be raised in Lofty's fault log, with investigation into root cause of fallback to be undertaken as soon as practicable.

SPECIFICATIONS As per Lofty's High Quality Icecast stream; encoded with AAC+ codec. Bitrate 128kbps.

Source audio sample rate 16 bits at 44.1kHz. Stream encoded in stereo.

Technology Blue Papers (TBP)
Series 3
Transmitter (TX)



TECHNOLOGY BLUE PAPER 3.1.1

Description	Program Fail Detector
Type	Transmission (TX)
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION The first entry point for program content transported via Lofty's IP-based studio to transmitter link (STL) into the analogue transmission (TX) chain is the Elan Audio RPF-02 Program Fail Detector (RPF-02).

APPLICATION Receives audio signals from the two AoIP decoders (Deva RX-91 and software) as described in TBP 2.1.5 and TBP 2.2.5 respectively.

When silence is detected on the primary audio inputs (hardware AoIP decoder), the RPF-02 waits for a set period of time before automatically switching over to the secondary audio input (software AoIP decoder).

FEATURES Adjustable silence detection sensitivity.

Program fail detection adjustable between 2 and 256 seconds.

Program recovery detection adjustable between 1 and 128 seconds.

OPERATIONS The primary source, being the Deva RX-91 AoIP decoder, is connected to inputs 1 and 2 on the RPF-02.

After approximately 10 seconds of silence on the primary source, the RPF-02 will automatically switch to the secondary source, being the TX PC with software AoIP decoder. This source is connected to inputs 3 and 4 on the RPF-02.

Once the primary source is back online, the RPF-02 will wait 10 seconds before switching back from the secondary source to the primary.

This process should be almost seamless to the listener.

FALLBACK TYPE *Manual. Whilst this device controls automatic fallback for AoIP decoding (TBP 2.1.5, TBP 2.2.5), should this device fail whilst in service, it will need to be manually replaced.*

MAINTENANCE Fallback routing is tested periodically, usually outside of peak listening times (viz. 00:00-05:59).

An identical RPF-02 unit is held at the TX site and can be swapped in should the production unit fail. In this instance, the fallback unit will then become the production unit.

A hard copy of the RPF-02 manual is kept at the TX site, with an additional copy kept at Lofty's studio. A PDF soft copy version is stored on Lofty's shared Google Drive.

SPECIFICATIONS As per Elan Audio RPF-02 Program Fail Detector Product Description, attached as Appendix A.



TECHNOLOGY BLUE PAPER 3.1.2

Description	BW Broadcast DSPX-FM Sound Processor (DSP)
Type	Bridging
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION Digital sound processor (DSP) designed to optimise quality of source content for FM broadcasting purposes, including but not limited to multiplex (MPX) signal generation.

APPLICATION Analogue audio signal is fed into the DSP from the Elan Audio RPF-02 Program Fail Detector (TBP 3.1.1).

Various parameters are applied to said audio signal, including compression and limiting, providing a consistent broadcast-quality signal that is able to compensate for source material of variable quality.

Stereo generation is produced via the DSP's onboard MPX encoder.

Provides 50µS de-emphasis, compatible with most FM stereo receivers currently in use in Australia.

FEATURES Pre-set scheduling allowing for multiple sound processing configurations, thus allowing Lofty's audio signal to be more closely matched to scheduled music content e.g. compression can be automatically turned off during regularly scheduled fine music programming, and then returned to its default setting upon said fine music program's conclusion.

DSP stereo encoder with composite clipping control, mitigating distortion where source material is subject to clipping.

ITU BS.412 power limiter.

Pilot protection filter.

Multiplex (MPX) generator.

Real-time clock.

Remote configuration and monitoring.

OPERATIONS Please refer to TX rack diagram (Appendix A).

FALLBACK TYPE *Manual. In the event of DSP failure, minor reconfiguration of other components within the TX chain may be required. Whilst sound quality may be slightly compromised, DSP failure would not cause Lofty to go off the air.*

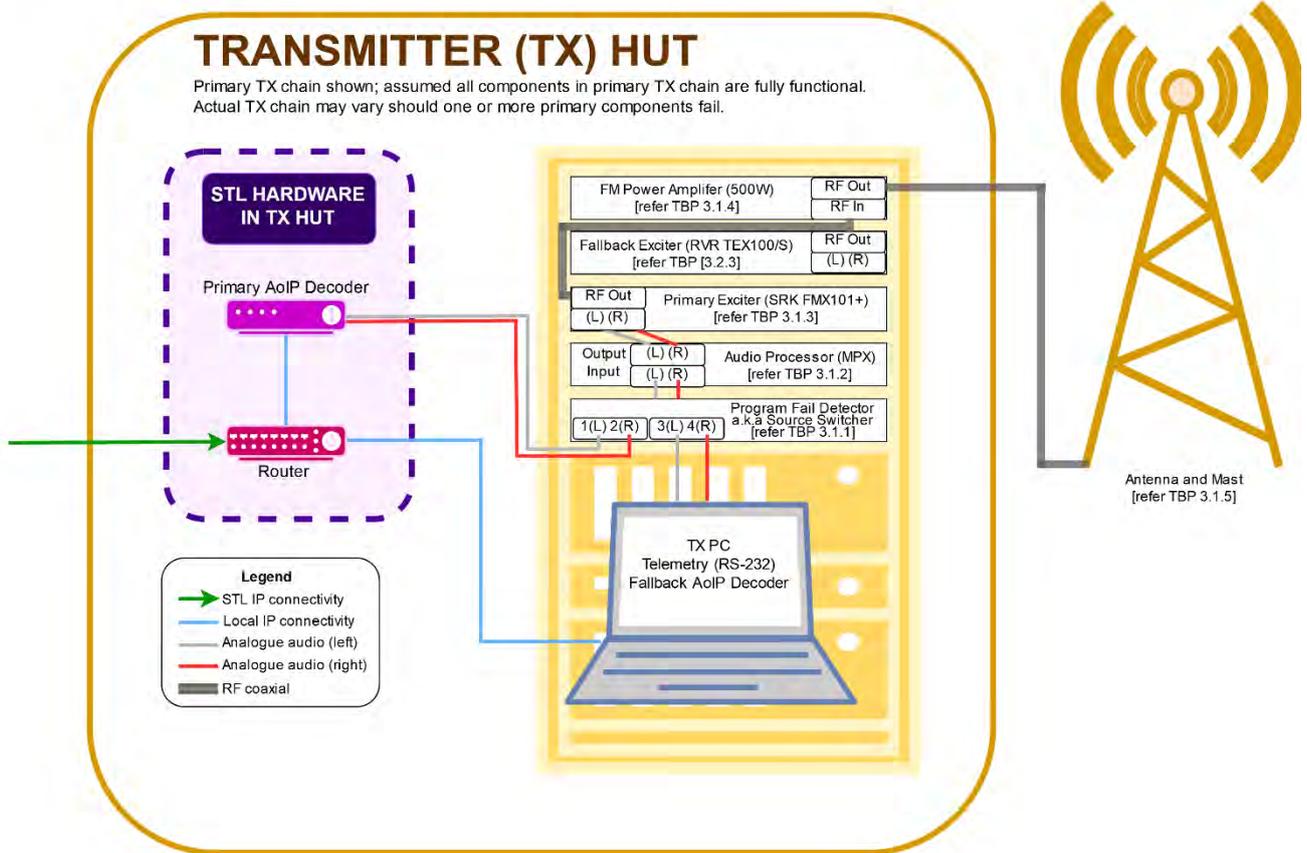
MAINTENANCE Configurable via specific software, accessible over Lofty's LAN.

A hard copy of the DSPX-FM manual is kept at the TX site, with an additional copy kept at Lofty's studio. A PDF soft copy version is stored on Lofty's shared Google Drive.

SPECIFICATIONS Refer Appendix B

APPENDIX A

5LCM (Lofty) TX RACK IN DETAIL



APPENDIX B - SPECIFICATIONS

DSPX FM

FM Audio Processor



OVERVIEW

The four-band and wideband AGCs, both with intelligent gating, along with a four-band, program-dependent limiter, are enabled by a processing core employing 16 DSPs. Parametric and shelf bass enhancement, along with composite clipping with pilot protection, contribute to keeping your station's sound consistently loud and artefact free. The dual processing paths make the DSPX-FM effectively two processors in one, feeding both your analogue transmitter and a digital service, such as HD Radio, DAB, DRM or an Internet stream. The FM analogue path has a multi-band distortion-controlled clipper, while the second path, tapped via analogue and AES/EBU digital output connectors, incorporates a bit rate optimized, look-ahead limiter. Proven presets, as well as intuitive local and remote interfaces help you get your DSPX-FM on air fast.

FEATURES

- Dual processing path enabled for HD and digital radio
- 16 24-bit DSP's provide over 1 GIGA-MIPS of processing
- Comprehensive BLUE LED audio metering and screen
- Digital and Analogue IO
- Wide and Multi-Band AGCs with Intelligent Gating
- Multi-Band program dependent Limiting
- Multi-Band look ahead limiting and distortion cancelled clipping
- DSP stereo encoder with composite clipping control
- Back Panel and Rackroom (Front-Panel) RS232 Control
- Real time clock for preset scheduling
- Remote trigger port
- Full Range of User Presets with A/B Switching
- Software Upgradeable
- ITU BS.412 power limiter
- Pilot protection filter

SPECIFICATION

Analog input	
Nom. input level	-12 to +12dBu
Max input level	+24dBu
Connectors	XLR floating, EMI suppressed
A/D conversion	24 bit 48 KHz 128x oversampled
Analog output	
Analog output	-12 to +24dBu
Connectors	XLR floating, EMI suppressed
D/A conversion	24 bit 48 KHz 128x oversampled
Digital input (AES/EBU)	
Sampling rate	32-96 KHz
Connector	XLR floating, EMI suppressed
Digital output (AES/EBU)	
Sampling rate	32, 44.1, 48 KHz
Connector	XLR floating, EMI suppressed
Digital sync input (AES/EBU)	
Sampling rate	32-96 KHz
Connector	XLR floating, EMI suppressed
Stereo encoder	
Output level	0 to +12dBu
Connector	BNC, floating
D/A	24 bit 17.68 KHz
Stereo separation	>70dB (typ. > 75dB)
Src input	BNC floating
Pilot output	BNC, 5V
Remote interface	
RS232	2 x DB9
NET/LAN	RJ45 EMI shielded
Other	
Power	85-265 V AC 50-60Hz
Size	44mm x 482mm x 200mm
Weight	1.6 Kg

Amongst the world's
most popular audio
processor.

Great sound, easy configuration and dual-path operation that enable processing of a single program for both analogue and digital broadcast. The DSPX-FM gives you a competitive edge and builds listenership and revenue by enabling you to achieve the tailored sound and loudness needed to make your station distinctive.

 **bw broadcast**

www.bwbroadcast.com



TECHNOLOGY BLUE PAPER 3.1.3

Description	Primary TX/Exciter (SRK FMX101+)
Type	Transmission (TX)
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

In order to provide a technically compliant transmission, Lofty's transmitter (TX) is set up in two stages; an exciter and a power amplifier.

The exciter in use is an SRK FMX101+ 100W FM transmitter, which is connected to an SRK FMA501 500W FM amplifier (refer TBP 3.1.4).

For the purposes of this TBP, the SRK FMX101+ will be referred to as Lofty's primary TX/exciter.

APPLICATION

Converts audio signal provided by digital sound processor (DSP) into an FM signal to be radiated at 88.9MHz. Said FM signal is then passed to the power amplifier.

FEATURES

Radiates a frequency modulated (FM) signal at between 87.5MHz and 108.0MHz, adjustable in 0.1MHz increments.

Comprehensive self-test and auto diagnostic capabilities.

Robust design and construction.

Built-in stereo generator and audio limiter.

Comprehensive telemetry.

Australian made.

OPERATIONS

As at the time of writing the TX operates on a part-time basis, pursuant to conditions contained within the Temporary Community Broadcasting Licence (TCBL) currently held by Lofty.

Upon the commencement of 24/7 broadcasting, Lofty's switching technology shall be partially retained to allow the TX and power amplifier to be turned off or on from remote, as well as to provide additional vital signs of the TX and power amplifier's overall health viz. AC supply voltage, power consumption (W), current drawn (A).

FALLBACK TYPE *Manual.*

A fallback 100W FM TX/exciter (RVR TEX100/S) is held in secure storage. The fallback TX/exciter can be transported to the TX site and commissioned within 30 minutes of the primary TX/exciter suffering a failure. Details of the rationale behind holding said fallback TX/exciter off-site is contained in TBP 3.2.3.

For short term emergency use (i.e. from the time Lofty's primary TX/exciter fails until the fallback TX/exciter is commissioned), Lofty has a 1W TX/exciter located at the TX site. When used with the power amp (TBP 3.1.4), adequate coverage is achieved across much of Mount Barker RA1. When used

without the power amp, coverage is restricted to parts of Mount Barker and Littlehampton only.

MAINTENANCE Monthly maintenance includes:

- Confirmation of current TX/exciter parameters re: forward power, reflected power, frequency deviation
- Visual inspection of all cables and connections to and from the TX/exciter
- Air intakes checked for dust build-up and cleaned with compressed air where necessary
- Front-mounted air filters are checked and cleaned with compressed air where necessary

TX parameters are read via the TX/exciter's LCD display on a monthly basis, with said readings added to the TX maintenance log kept at the TX site.

Significant changes in one or more parameters may indicate a problem with the TX chain; not necessarily within the TX/exciter, as a fault occurring elsewhere in the TX chain between the TX/exciter and the antenna may adversely affect the TX/exciter's performance.

Should any of the following parameters be outside of Lofty's specification, a Level 3 Major fault shall be raised with fault investigation and rectification to be carried out as a matter of priority.

TX/exciter parameter	Lofty specification
Forward power ¹	< 7.0W
Reflected power ²	< 1.0W± ³
Gain/deviation	< ±60kHz @ 0dB ⁴

Hard copies of the FMX101+ TX/exciter manual are kept at the TX site and at Lofty's studio, while a PDF version is stored on Lofty's shared Google Drive.

Remote monitoring and telemetry via RS-232 serial connection available, with readings regularly taken and logged automatically by Lofty's TX PC.

SPECIFICATIONS As per Appendix A

¹ When TX/exciter is used in conjunction with SRK FMA501 power amplifier (TBP 3.1.4).

² The FMX101+ TX/exciter contains protective circuitry to automatically reduce forward power should reflected power exceed 10W.

³ Reflected power recorded at circa 0.1W at the time TX/exciter was commissioned in November 2018. Excessive reflected power reading may indicate a fault in the power amplifier or antenna. Reflected power of 1.0W represents a tenfold increase over Lofty's benchmark, and therefore considered to be a Level 3 Major fault.

⁴ Whilst Section 22(6)(b) of the Broadcasting Services (Technical Planning) Guidelines 2017 allows for a maximum frequency deviation of ±75kHz, Lofty sets its TX/exciter gain/deviation at 60kHz to reduce the risk of peaking in excess of the ±75kHz threshold should overmodulated source material be broadcast in error. It should be noted that the FMX101+ contains circuitry that sets a hard limit on frequency deviation of ±75kHz, therefore it is highly unlikely that Lofty would breach Section 22(6)(b) in practice.

APPENDIX A – Specifications

As per the SRK Electronics FMX101+ Manual



2 Specifications

Output power	0 to >100W continuous
Carrier frequency	87.5 to 108.0 MHz
Channel spacing	100 KHz
Carrier stability	<200Hz from nominal
Modulation	Stereo FM 75KHz peak deviation
Audio response	10Hz to 15KHz
Pre-emphasis	50µS
Distortion	<0.05%
Audio SNR	80dB typical
Stereo separation	>50dB
Line voltage	90-264VAC
Line power	<250VA
Audio input level	-10dBm to +10dBm
Input impedance	10K balanced
Protection	Over temperature Over line voltage Over SWR
Operating temperature	0 - 60 °C
Operating altitude	0 to 4000 m above sea level
Dimensions	Width 482mm Depth 270mm Height 88mm (2RU)
Weight (approx)	<8Kg
Cooling	Forced air
Audio connector	XLR female
Input line connector	IEC male
Output RF connector	N female
Telemetry connector	DB9 female



TECHNOLOGY BLUE PAPER 3.1.4

Description	FM Power Amplifier (SRK FMA501)
Type	Transmission (TX)
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

In order to provide a technically compliant transmission, Lofty's TX is set up in two stages; an exciter and a power amplifier.

The SRK FMA501 is an FM power amplifier that is capable of taking nominal radiated output from an FM exciter and amplify said output to around 500W.

When used with Lofty's primary TX/exciter (SRK FMX101+ refer TBP 3.1.3), the FMA501 is able to generate a nominal 500W of effective radiated power (ERP) from approximately 7W of ERP fed into it from the exciter.

APPLICATION

Amplifies radiated signal from FM exciter for radiation via antenna at Lofty's TX site.

FEATURES

Clear LCD display.

Comprehensive self-test and auto diagnostic capabilities.

Robust design and construction.

Built-in stereo generator and audio limiter.

Comprehensive telemetry.

Australian made.

OPERATIONS

As at the time of writing the TX operates on a part-time basis, pursuant to conditions contained within the Temporary Community Broadcasting Licence (TCBL) currently held by Lofty.

Upon the commencement of 24/7 broadcasting, Lofty's switching technology shall be partially retained to allow the TX and power amplifier to be turned off or on from remote, as well as to provide additional vital signs of the TX and power amplifier's overall health viz. AC supply voltage, power consumption (W), current drawn (A).

The FMA501 contains several protective features:

- Where reflected power exceeds 50W, output RF power is reduced to a level where reflected power does not exceed 50W.
- Forward power is hard limited to 550W.
- Maximum RF input power 10W (note that Lofty's TX/exciter feeds 7W into the FMA501 to generate a nominal 500W of forward power).
- Automatic thermal protection when internal power amplifier temperature exceeds 85 degrees C.
- Protection against voltage extremes viz. < 200V and > 275V.

FALLBACK TYPE *Manual. In the event of failure, the amplification stage of the TX chain will be bypassed and the power amplifier will be removed from service until it is repaired. This will result in the exciter acting alone in the TX chain, with Lofty's effective radiated power (ERP) being limited to 100W commensurate with the maximum power rating of each of Lofty's TX/exciter.*

Appendix A illustrates how much of an impact a reduction of ERP from 500W to 100W may have on Lofty's ability to service Mount Barker RA1.

MAINTENANCE Monthly maintenance includes:

- Confirmation of current power amplifier parameters re: forward power, reflected power, input power, operating temperature etc
- Visual inspection of all cables and connections to and from the TX/exciter
- Air intakes checked for dust build-up and cleaned with compressed air where necessary
- Front-mounted air filters are checked and cleaned with compressed air where necessary

Power amplifier parameters are read via the LCD display on a monthly basis, with said readings added to the TX maintenance log kept at the TX site.

Significant changes in one or more parameters may indicate a problem with the TX chain; not necessarily within the power amplifier, as a fault occurring elsewhere in the TX chain between the TX/exciter and the antenna may adversely affect the power amplifier's performance.

Should any of the following parameters be outside of Lofty's specification, a Level 3 Major fault shall be raised with fault investigation and rectification to be carried out as a matter of priority.

TX/exciter parameter	Lofty specification
Forward power ¹	> 450W and < 500W
Reflected power ²	< 1.0W \pm ³

Hard copies of the FMA501 FM power amplifier manual are kept at the TX site and at Lofty's studio, while a PDF version is stored on Lofty's shared Google Drive.

Remote monitoring and telemetry via RS-232 serial connection available, with readings regularly taken and logged automatically by Lofty's TX PC.

SPECIFICATIONS As per Appendix B.

¹ When TX/exciter is used in conjunction with SRK FMA501 power amplifier (TBP 3.1.3).

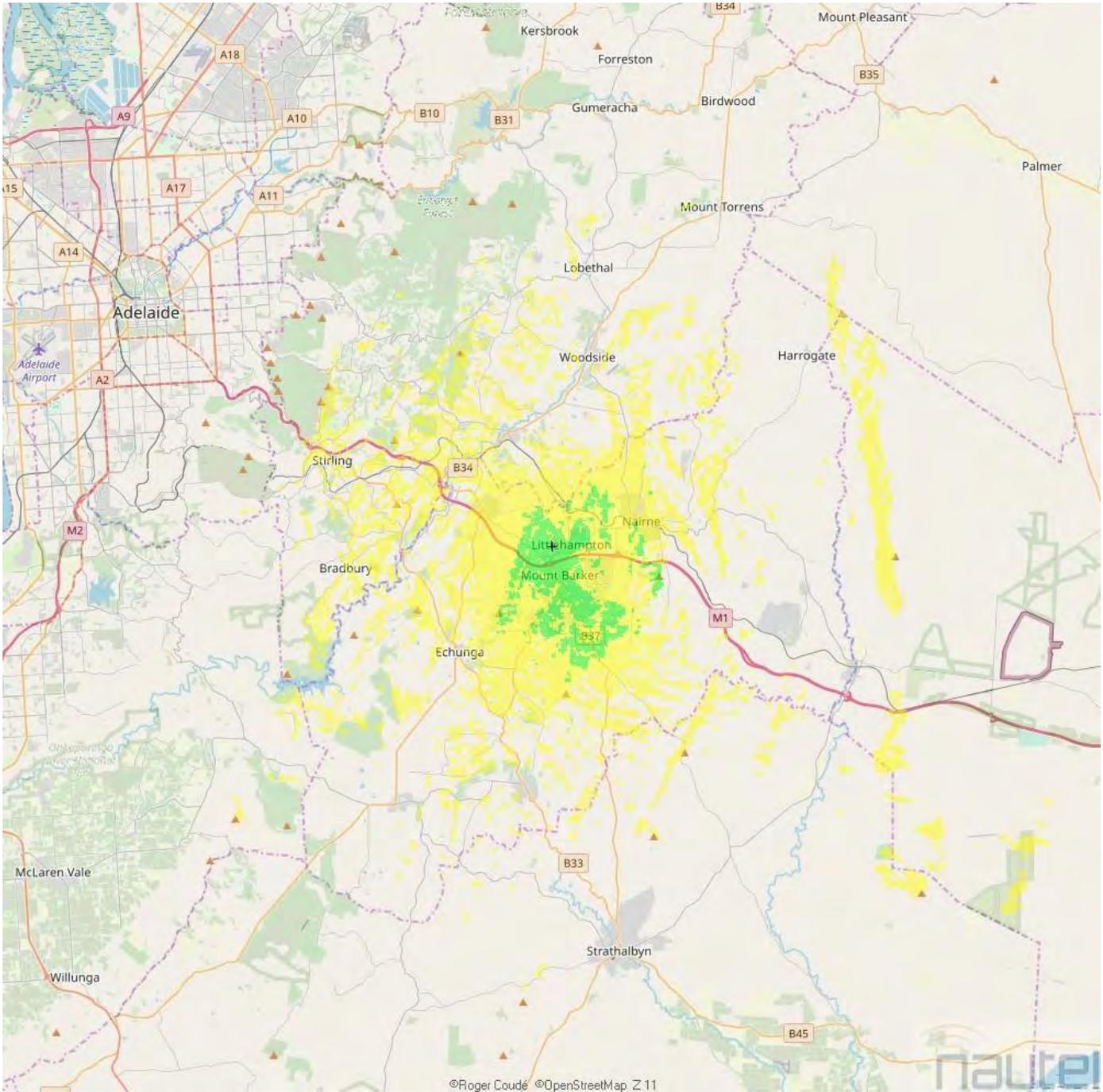
² The FMA501 FM power amplifier contains protective circuitry to automatically reduce forward power should reflected power exceed 50W.

³ Reflected power recorded at circa 0.1W at the time TX/exciter was commissioned in November 2018. Excessive reflected power reading may indicate a fault in the power amplifier or antenna. Reflected power of 1.0W represents a tenfold increase over Lofty's benchmark, and therefore considered to be a Level 3 Major fault.

APPENDIX A - 5LCM (Lofty 88.9) radiated field strength without FMA501 (viz. fallback)



Description	Cleggett's Farm 100W 54/110 Single Sidemount Dipole
TX	0.1 KW
RX	Custom
Frequency	88.9 MHz
Base Name	Cleggett's Farm
Latitude	-35.04960600 °
Longitude	138.85328000 °
Latitude	35° 02' 58.58"S
Longitude	138° 51' 11.81"E
UTM (WGS84)	54H E304211 S6119349
Elevation	425.7 m
Base Ant. Height	15 m
Base Ant. Gain	3.2 dBi
Mobile Ant. Height	1.0 m
Tx Power	100.00000 W
Tx Line Loss	0.3 dB
Weak signal field	54.0 dB μ V/m
Strong signal field	110.0 dB μ V/m
Weak signal covered area	318 km ²
Strong signal covered area	30 km ²
Weak signal population reached	13297 pop
Strong signal population reached	1035 pop
Landcover used	Yes
Two rays method used	No
User ID	lofty
Radio coverage ID	NAUTELCC6BB28D625C 0
Generated on	11/2/2019 11:59:46 AM



APPENDIX B – Specifications



FMA501 500W AMPLIFIER



The FMA501 is a self contained 500W amplifier intended for FM broadcast service. The rugged design and construction of the FMA501, coupled with the most extensive metering and telemetry available, make this unit a first choice for broadcasters.

The FMA501 Consists of two 300W rated MOSFET amplifiers, an efficient 1500W switch mode power supply, output filtering and metering circuitry. Solid copper heat spreaders are used to ensure an average transistor case temperature of only twelve degrees above ambient.

The following parameters are available for measurement via the front panel or RS232 telemetry:

- Output forward power
- Output reverse power
- Input power
- Amplifier A heatsink temperature
- Amplifier ADC current
- Amplifier B heatsink temperature
- Amplifier B DC current
- Amplifier DC voltage
- AC line voltage
- Elapsed time in days
- Time and date

The extensive protection features include: high SWR, high output power, high input power, high temperature and under/over line volts.

The FMA501 comes complete with extensive documentation and a three year warranty.

The FMA501 is designed and manufactured in Australia.

SPECIFICATIONS

Output power	>500W continuous
Input power	15W max
Frequency range	87.5-108MHz
Output spurious	>-75dBc
I/P RL	>-12dB
Cooling	Forced air
Ambient	0-50C
Temperature	
Input voltage	210-270VAC
Max mains power	1000W
Power factor	>0.95
Input connector	N female
Output connector	N female
Mains connector	IEC male
Telemetry connector	DB9 female
Weight	<15Kg
Dimensions	483x400x133mm



SRK Electronics Pty Ltd, 8 Victoria Grove, Hawthorn East, VIC 3123. Tel 03 9882 3130. Fax 03 9882 6149. www.srkelectronics.com.au. Email: sales@srkelectronics.com.au. © SRK Electronics Pty Ltd 2003. Specifications subject to change without notice.



TECHNOLOGY BLUE PAPER 3.1.5

Description	Antenna System
Type	Transmission (TX)
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

The antenna where Lofty's broadcast signal radiates from, thus completing the transmission (TX) chain.

To ensure that Lofty delivers a high-quality broadcasting service that is fully compliant with regulatory requirements, a suitable antenna shall be connected via high quality coaxial cable and fittings to the final RF output in the TX chain.

Lofty's antenna is situated at Cleggett Farm, Littlehampton (ACMA Site ID 305178), and is co-located with a low power open narrowcasting (LPON) TX. Said LPON TX licenced to Dalebank Pty Ltd, and radiates its FM transmissions at 87.6MHz.

Lofty has an excellent working relationship with the principal of Dalebank Pty Ltd.

APPLICATION

Lofty's primary antenna is a ZCG B46B ½ wave folded dipole antenna. This is a simple yet effective FM broadcast antenna that is suitable for Australian conditions. Said antenna has been tuned to radiate at 88.9MHz.

Appendix A shows a modelled radiation pattern based on the antenna's specifications.

FEATURES

The antenna can be used by itself or as part of an array, thus allowing Lofty to build a multi-antenna array to improve overall efficiency of its TX chain i.e. reduce forward power whilst maintaining similar effective isotropic radiated power (EIRP) as the current single-antenna setup.

Use of ½" coax has resulted in very low line loss from the FM power amplifier to the antenna (estimated attenuation 0.31dB).

OPERATIONS

RF output from the FM power amplifier is fed via Andrew LDF4-50A HELIAX ½" foam dielectric coaxial cable (1/2" coax). The overall cable run is approximately 20 metres in length, with the antenna being installed approximately 15 metres from ground level.

FALLBACK TYPE

Manual. In the event of total antenna failure, Lofty has a spare antenna stored off-site which can be connected to Lofty's TX chain.

There is a spare mast at the TX site (c. 6m tall) which, whilst significantly shorter than the primary mast, is of a tilting design. As such, installing the spare antenna on the spare mast would take two people approximately 15 minutes to complete.

The spare antenna is limited to 100W maximum effective radiated power, therefore forward power from the TX chain would be reduced.

On this basis, primary antenna failure shall be deemed a Level 3 Major fault.

MAINTENANCE Physical inspection of coaxial cable from FM power amplifier to antenna mast undertaken as part of regular TX chain maintenance.

Due to difficulty of accessing antenna for regular inspections in situ, parameter readings from other components in the TX chain viz. exciter and power amplifier are used as a proxy for establishing the overall condition of the antenna and cable run.

Should either the exciter or power amplifier indicate abnormal readings that do not appear to be the result of an issue with either of these components, a physical inspection of the antenna and cable run in situ will be required.

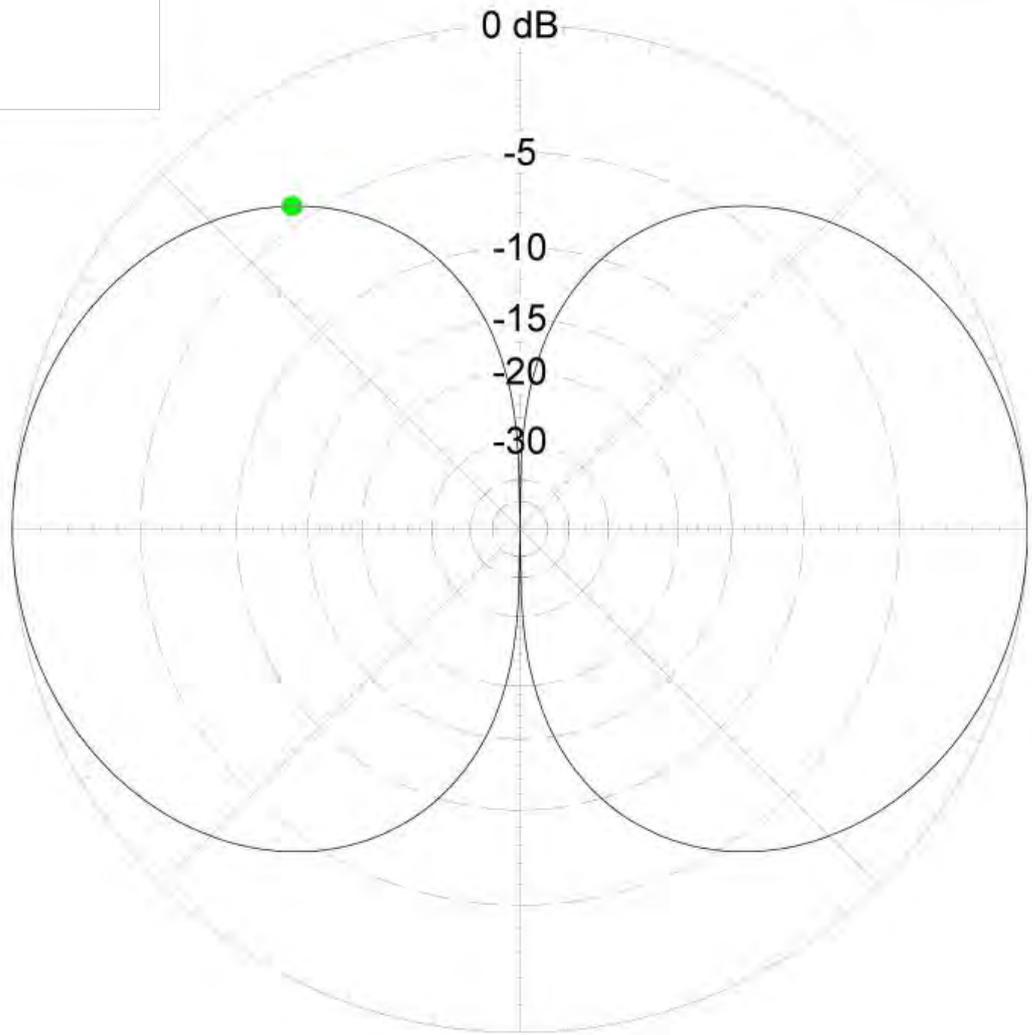
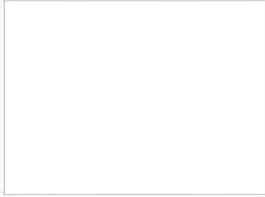
Where a physical inspection is called for, Lofty shall engage a suitably qualified rigger to conduct the physical inspection and make maintenance recommendations (if any) as a result of said inspection.

Regular inspections of the TX antenna mast (including guy wires) is also undertaken on a regular basis.

It should be noted that significant maintenance and upgrade works occurred at Lofty's TX site in October 2018, brought about as a result of Lofty's successful bid for a Temporary Community Broadcasting Licence (TCBL).

SPECIFICATIONS As per Appendices.

APPENDIX A – MODELLED RADIATION PATTERN OF 1/2 WAVE FOLDED DIPOLE ANTENNA



Cardioid

88.9 MHz

Azimuth Plot
 Elevation Angle 0.0 deg.
 Outer Ring 8.69 dBi

Cursor Az 125.0 deg.
 Gain 4.47 dBi
 -4.21 dBmax

Slice Max Gain 8.69 dBi @ Az Angle = 0.0 deg.
 Front/Side 99.99 dB
 Beamwidth 96.2 deg.; -3dB @ 31.1, 48.1 deg.
 Sidelobe Gain 8.69 dBi @ Az Angle = 180.0 deg.
 Front/Sidelobe 0.0 dB

APPENDIX B – ZCG B46B ½ WAVE FOLDED DIPOLE SPECIFICATIONS



Section 1
Broadcast

B46B Series Medium powered sidemount dipoles FM Radio 87.5-108MHz

Sidemount dipoles are an ideal choice for use as an FM radio broadcast antenna. They are of reliable construction, cover a broad bandwidth and permit single antenna sharing with multiple FM transmit frequencies.

Popular with community and commercial radio stations as a low powered arrays or as backup transmit antenna in case of faults.

Mounting hardware, coaxial feeder cable, connectors and other installation accessories are all available separately.



B46B - aluminium dipole



B46BSS - stainless steel dipole



B46BHPSS - stainless steel medium power dipole

Specifications	B46B	B46BSS	B46BHPSS
Construction	Aluminium	304 grade stainless steel	
Frequency range	FM Radio 87.5-108MHz		
Bandwidth	Full frequency range	Specify 10MHz	
Tuning	Factory		
VSWR	<1.3:1	<1.2:1 at specified 10MHz	
Gain	0 dBd for a single bay, stacking increases gain		
Polarisation	Vertical		
Impedance	50 Ohms		
Cable tail	1.5 metres RG213	1.5 metres ZCG1250	
Connector - fitted	N-type female	7/16" DIN female	
Maximum power	500 Watts per bay	2 Kilowatts per bay	
DC grounding	Yes		
Dipole height	1.4 metres		
Weight	3.5kg	5.0kg	5.0kg
Projected area	0.090m ²	0.090m ²	0.090m ²
Mount section	1.5m x 38mm	1.5m x 38mm	1.5m x 38mm
Wind load at 160kph	10.875kg, 0.107kN		
Mounting hardware (order separate)	1 x Y2300	1 x Y2300-SS	
Warranty	2 Years		



Single B46B sample radiation pattern

www.zcg.com.au



Updated 28th June 2019



TECHNOLOGY BLUE PAPER 3.2.1

Description	Fallback Program Fail Detector
Type	Transmission (TX)
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION The first entry point for program content transported via Lofty's IP-based studio to transmitter link (STL) into the analogue transmission (TX) chain is the Elan Audio RPF-02 Program Fail Detector (RPF-02).

APPLICATION Receives audio signals from the two AoIP decoders (Deva RX-91 and software) as described in TBP 2.1.5 and TBP 2.2.5 respectively.

When silence is detected on the primary audio inputs (hardware AoIP decoder), the RPF-02 waits for a set period of time before automatically switching over to the secondary audio input (software AoIP decoder).

FEATURES Adjustable silence detection sensitivity.

Program fail detection adjustable between 2 and 256 seconds.

Program recovery detection adjustable between 1 and 128 seconds.

OPERATIONS The primary source, being the Deva RX-91 AoIP decoder, is connected to inputs 1 and 2 on the RPF-02.

After approximately 10 seconds of silence on the primary source, the RPF-02 will automatically switch to the secondary source, being the TX PC with software AoIP decoder. This source is connected to inputs 3 and 4 on the RPF-02.

Once the primary source is back online, the RPF-02 will wait 10 seconds before switching back from the secondary source to the primary.

This process should be almost seamless to the listener.

FALLBACK TYPE *Manual. Whilst this device controls automatic fallback for AoIP decoding (TBP 2.1.5, TBP 2.2.5), should this device fail whilst in service, it will need to be manually replaced.*

MAINTENANCE Fallback routing is tested periodically, usually outside of peak listening times (viz. 00:00-05:59).

Should the fallback RPF-02 be placed into production, the production RPF-02 is to be physically inspected for any signs of component damage or other potential causes of failure.

Once said cause(s) of failure have been identified and repaired, the RPF-02 is to be tested in a non-production environment to ensure that the unit operates as it did prior to failure.

Once testing has been completed, the former production RPF-02 will be returned to the TX site and held as the new fallback RPF-02.

A hard copy of the RPF-02 manual is kept at the TX site, with an additional copy kept at Lofty's studio. A PDF soft copy version is stored on Lofty's shared Google Drive.

SPECIFICATIONS As per Elan Audio RPF-02 Program Fail Detector Product Description (refer TBP 3.1.1 Appendix A).



TECHNOLOGY BLUE PAPER 3.2.3

Description	Fallback TX/Exciter (RVR TEX100/S)
Type	Transmission (TX)
Version/Date	V1.0 1 October 2019
Maintained By	Technology & Facilities

INTRODUCTION

In order to provide a technically compliant transmission, Lofty's transmitter (TX) is set up in two stages; an exciter and a power amplifier.

Should our primary TX/exciter fail (SRK FMX101+ refer TBP 3.1.3), Lofty has an RVR TEX100/S 100W FM TX/exciter available for use as a fallback.

For the purposes of this TBP, the RVR TEX100/S will be referred to as Lofty's fallback TX/exciter.

APPLICATION

Converts audio signal into an FM signal to be radiated at 88.9MHz. Said FM signal is then either passed to the power amplifier or radiated directly into the antenna, depending on the circumstances in which the fallback TX/exciter has been deployed.

FEATURES

Radiates a frequency modulated (FM) signal at between 87.5MHz and 108.0MHz, adjustable in 0.1MHz increments.

Robust design and construction.

Built-in stereo generator and audio limiter.

Detailed user manual.

OPERATIONS

As fallback TX/exciter deployed to TX site

The fallback TX/exciter is used as a substitute for the primary TX/exciter in the event that said primary TX/exciter fails.

In order to mitigate against a black swan event (e.g. Lofty's TX site being cut off and/or destroyed by bushfire, Lofty's studio being damaged or destroyed either accidentally or maliciously etc.) Lofty has chosen to store its fallback TX/exciter at a secure location approximately 15km from both the studio and the TX site.

The fallback TX/exciter can be transported to Lofty's TX site and commissioned to replace the primary TX/exciter within 30 minutes of primary TX/exciter failure occurring.

During the commissioning process, calibration is to be checked and readings are to be taken to confirm the fallback TX/exciter's radiated power and frequency deviation. Said readings are to be recorded in the fallback TX/exciter's maintenance log.

As sole TX where nominated TX location is unavailable due to significant adverse event

As well as acting as Lofty's fallback TX/exciter in a relatively simple primary TX/exciter failure scenario, the fallback TX/exciter plays a vital role in Lofty's Broadcast Continuity Plan (BCP).

An omnidirectional antenna rated at 100W and tuned to 88.9MHz is also stored with the fallback TX/exciter, thus allowing Lofty to continue broadcasting at reduced ERP (viz. 100W) should Lofty's primary TX infrastructure be disabled as a result of a disaster (natural or otherwise).

Lofty shall not use its fallback TX/exciter and antenna at a location other than Lofty's nominal TX location unless authorised by ACMA to do so, on the proviso that transmissions shall recommence from Lofty's nominal TX location as soon as practicable.

FALLBACK TYPE *Manual.*

MAINTENANCE *In storage*

Semi-annual maintenance includes:

- Testing of fallback TX/exciter with a dummy load.
- Confirmation of TX/exciter parameters re: forward power, reflected power, frequency deviation.
- Recalibration of TX/exciter as per instruction manual (if required).
- Air intakes checked for dust build-up and cleaned with compressed air where necessary.
- Visual inspection of electronic components inside TX/exciter, with replacement of any worn or suspect components.
- Update maintenance records kept with TX/exciter.

In service

Whilst the fallback TX/exciter is a robust and compliant device, the lack of telemetry and overall lack of user-friendliness compared with the primary TX/exciter makes the fallback considerably less desirable for long term use.

Once the primary TX/exciter is ready to be placed back into service, the fallback TX/exciter will be swapped out as soon as practicable.

Prior to returning the fallback TX/exciter to storage:

- a visual inspection shall be undertaken inside the unit to ensure that all components are in good condition.
- Should any potentially worn or failing components be detected during inspection (e.g. bulging capacitors), said components are to be replaced.
- Prior to its return to storage, the fallback TX/exciter is to be tested using a dummy load, with calibration to be checked as per the instruction manual.

A record of maintenance undertaken (component replacement, recalibration) is to be kept with the fallback TX/exciter at all times.

A copy of the TEX100/S manual is kept with the fallback TX/exciter and at the Lofty studio. A soft copy is available on Lofty's shared Google Drive.

SPECIFICATIONS As per Appendix A.

APPENDIX A – Specifications

As per the RVR Elettronica TEX100/S Manual



TEX100

7. Technical Specifications

7.1 Mechanical Specifications

Panel size	483 mm (19") x 132.50 mm (5.20") (3 HE)
Depth	345 mm (13.7")
Weight	15 Kg
Temperature range	-10 °C \pm +50 °C

7.2 Electrical Specifications

General

A.C. Supply	117-230 V \pm 10%, 50-60 Hz single phase
Power consumption	approx. 230W
Cooling	Forced ventilation
Frequency range	from 87.5 to 108MHz in steps of 10KHz
Output power Adjustable	Adjustable from 5 to 100W
Automatic output level control	Stabilizes the set RF output level, separate with internal or external reference
S.W.R. protection	The maximum output power comes diminished in proportional way in case the reflected power increase; this control acts with internal or external reference
Output Impedance	50Ohm
Output connector	Standard "N"-type
Temperature control	Intervene in case of temperature excess of the final stage reducing the output power
Harmonic suppression	> -70dB
Spurious signal suppression	> -80dB
Intermodulation distortion	0.05% or less, measured at 1KHz and 1.3KHz, ratio 1:1 at 100% modulation
Frequency stability	\pm 500Hz (typically \pm 300Hz) from 0° to 50° C
Modulation type	Direct frequency modulation of the RF oscillator at fundamental frequency
Frequency deviation	\pm 75KHz nominal
Harmonic distortion	< 0.05% (typically 0.01%)
FM signal/noise ratio	> 75dB mono, > 70dB stereo measured with 75KHz deviation in the 30Hz to 15KHz band RMS.
Residual AM (asynchronous)	approx. 0.05% = 65dB RMS
Residual AM (synchronous)	0.1% = 60dB
Pre-emphasis	50 μ s \pm 2% or 75 μ s \pm 2% internally selectable
Audio input impedance	10KOhm balanced or 50KOhm unbalanced (600Ohm on request)
Audio input level	Selectable from -9 to +6dBm in 5 steps, continuously from -12 to +9 dBm
Audio frequency range	30-15000Hz, MONO input 30-10000Hz, MPX input
Audio input filter	> 45dB at 19KHz (mono) > 40dB from 20KHz to 100KHz
Mono frequency response	\pm 0.3dB from 30Hz to 15KHz
MPX frequency response	\pm 0.5dB from 30Hz to 75KHz
Stereo Separation	> 45dB (typically 50dB)
Pilot tone frequency	19KHz \pm 1Hz

TEX100



Pilot tone level	-20dBm adjustable
Number of SCA inputs	2
SCA input impedance	1KOhm unbalanced
SCA input level	0dBm per ± 7.5 KHz of deviation
SCA input response	± 0.5 dBm from 40KHz to 100KHz
