



STOCKMAN
TELEMETRY SYSTEMS

**The practical & physical
limitations of wireless
sensing technologies to
monitor livestock.**

Tim Stockman – System Designer

- Quick background
 - Son of a merino sheep breeder.
 - 15 years industry experience developing and commissioning telemetry systems across outback Australia.
 - Developers of one of the first commercial telemetry systems for use on large scale pastoral properties

- There are a number of practical & physical issues to be resolved when developing the use of wireless technologies for use in livestock production enterprises.
- Many of the issues revolve around mutually exclusive factors *i.e. when improving one operational characteristic something else directly related suffers an equal or greater level of degradation.*

- Physical size of equipment
 - Limits to what/how payload can be “attached”
 - Choking/snagging hazard with collars
 - Size limits dictate battery size
- Power requirements
 - Consumption
 - Battery size
 - Battery life
 - Rechargeable vs non-rechargeable
 - RFID “powered” devices

- Antenna size
 - Size directly related to frequency
 - Lower frequency equals larger antenna
 - Larger antennas are more efficient
 - Larger antennas are less practical use in this application
- Signal coverage
 - Low frequencies offer better propagation characteristics
 - Low frequencies limit possible data rates

- Data Transmission

- Quantity of data vs time to transmit (TX)

- Data rates

- Higher rates limit TX time but also transmission distance & reliability.

- Lower rates improve distance but use more TX time and hence battery capacity suffers.

- Does data need to be “real-time” or can it be logged & retrieved at a “water point” ?
 - RFID type technologies may be able to be used to retrieve logged data.
 - Logger still requires power source
 - Effectiveness of “water point” data retrieval is affected by availability of other water after rain events.

- Example of typical “production” environment
 - Typical cattle station in north-east SA.
 - Undulating sand dune country with light patchy scrub.
 - Animals will regularly roam over 100km²
 - Maybe 2 musters times a year to physically replace batteries in devices

**Quick comparison of
possible RF choices**

UHF “CB” Handheld

- 5w RF power
 - Good transmission distance
 - Reasonable antenna size
- 30mA standby current
 - battery would need a capacity in excess of 130Ah to run for 6 months (40kg lead-acid battery!)

Low power 434Mhz LIPD UHF data module

- 25mW RF power
 - Poor transmission distance
 - 17cm antenna
- 1uA standby draw
 - Negligible current drain
 - Most power used by rest of the electronics

LIPD VHF Radio Module

- 100mW RF Power
 - Better coverage and propagation characteristics
 - Antenna is impractical at 47cm
- Micro-amp standby current suitable for compact battery operation

27Mhz.....

- 1W of power
- Antenna is HUGE @ 2.65m!
- High power consumption is not suitable for long term battery operation.
- High interference potential

Zigbee™

- 2mW of power.
- Power consumption high due to communications protocol used.
- Tiny antenna (3cm) but NO useable range in a “point to point” system.
- Ideally suited for “mesh” type networks but need to overcome power consumption issues.

(Bluetooth™ has similar limitations.)

More issues....

- Packaging/reliability in extreme environments
- Water/dust/shock proofing
- Antenna design & orientation issues
- Maintenance/battery replacement
- And of course when you think you have everything covered sorted out there is always Murphy's Law!