*Introduction*

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Landcare Research

Wireless Research Centre

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# Low Power Wireless monitoring of pest control systems to improve the efficiency of field workers.

***Sponsored by Landcare Research.***
***Part of the "Strategic Technologies for Pest Control" project funded by MBIE.***

This project consisted of two parts:

1. Remote monitoring of pest control devices.
2. Remote data collection of images from camera traps.

Two masters in engineering students were commissioned to carry out the work.

# *What is the problem?*

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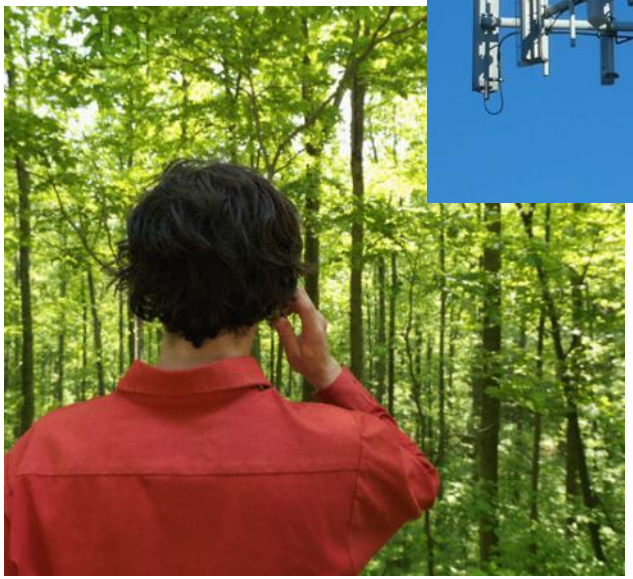
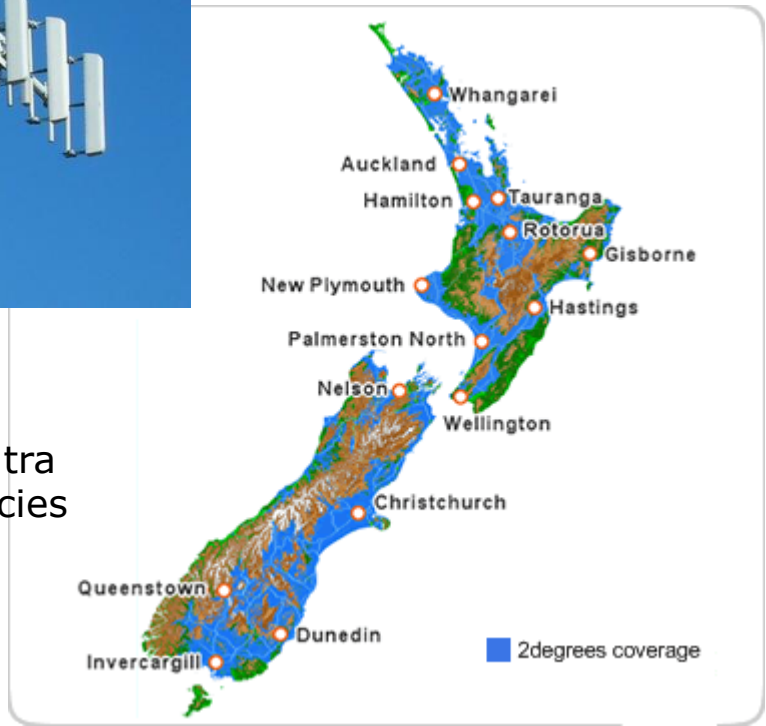
High frequency radio signals travel poorly through forest



Popular technology focuses on ultra high frequencies to carry high speed data

This application requires low power, low speed data



# *Radio propagation in foliage and forest*

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- The project required radio propagation in forest to be characterised.
- Trials setup in various forest environments over a 500m range.
- Various frequencies were tested.
- Tests were carried out over various distances to create a propagation model.

# Antennas

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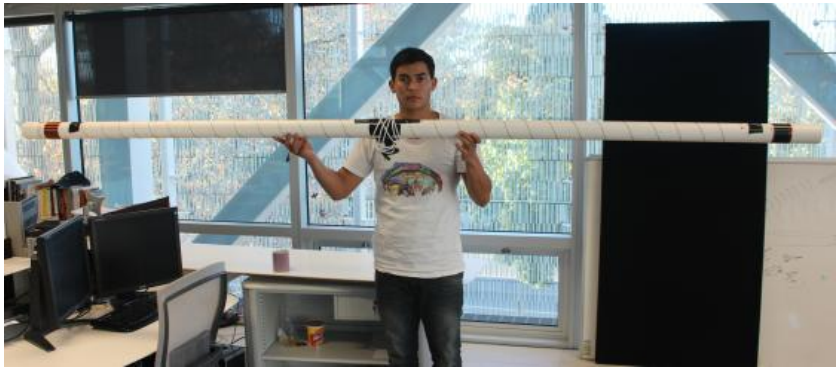
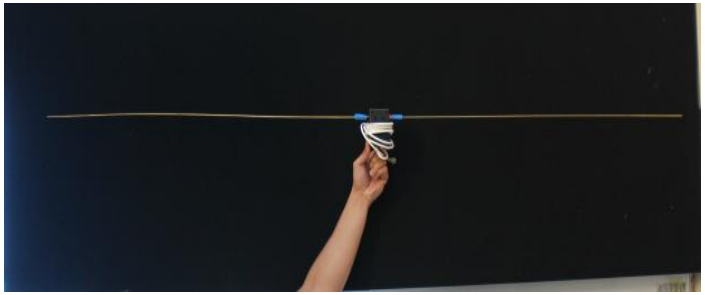
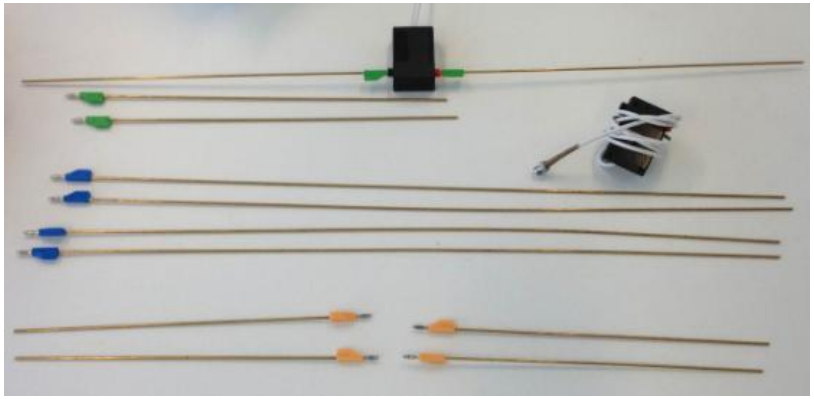


6.2MHz

50MHz



80MHz



170MHz 140MHz 80MHz

# *Radio propagation trials*

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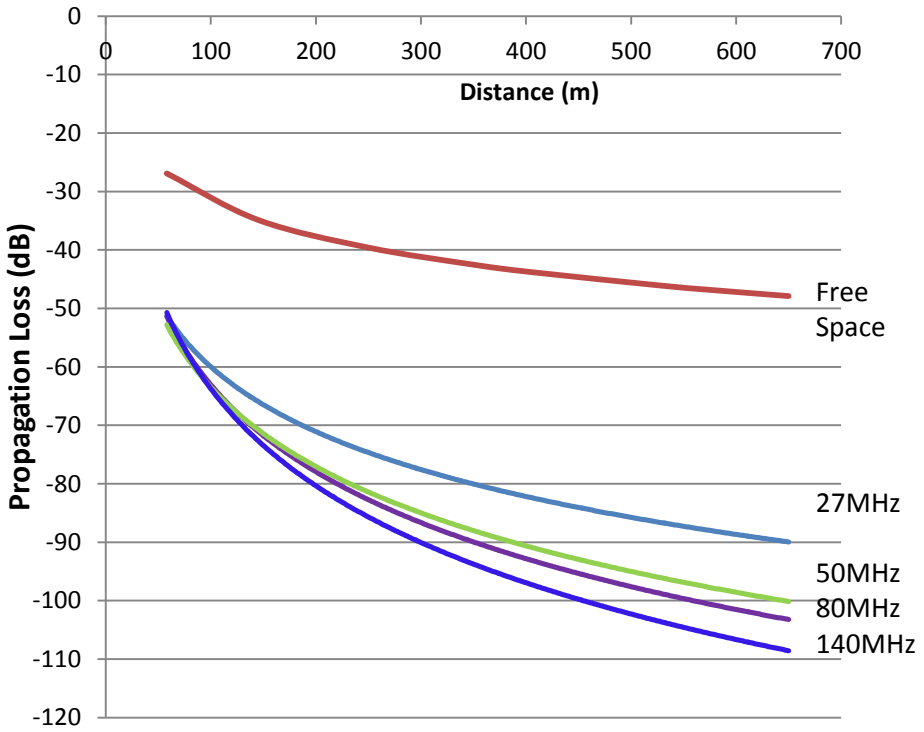
Trials were carried out to measure the attenuation of signals over various distances in forest



# *Frequency and Polarisation*

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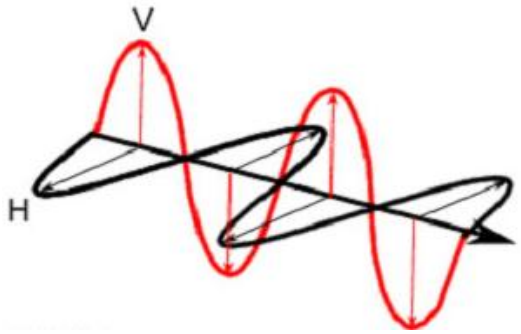
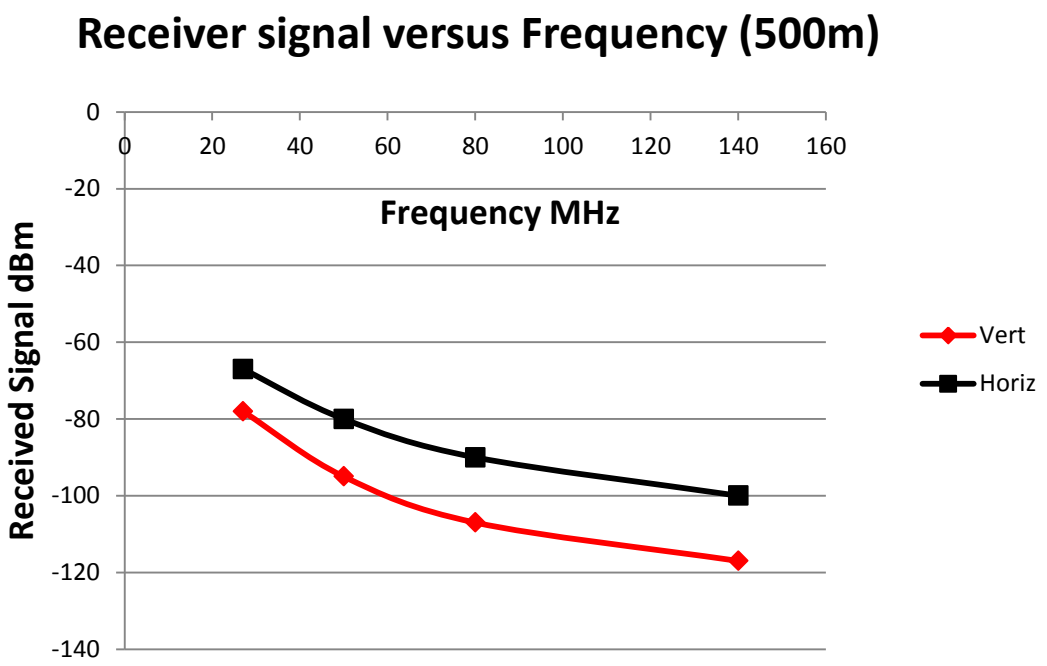
- Attenuation is dependant on frequency.
- Attenuation is dependant on signal polarisation.




Radio Wave Polarisation



# *Practical antenna*

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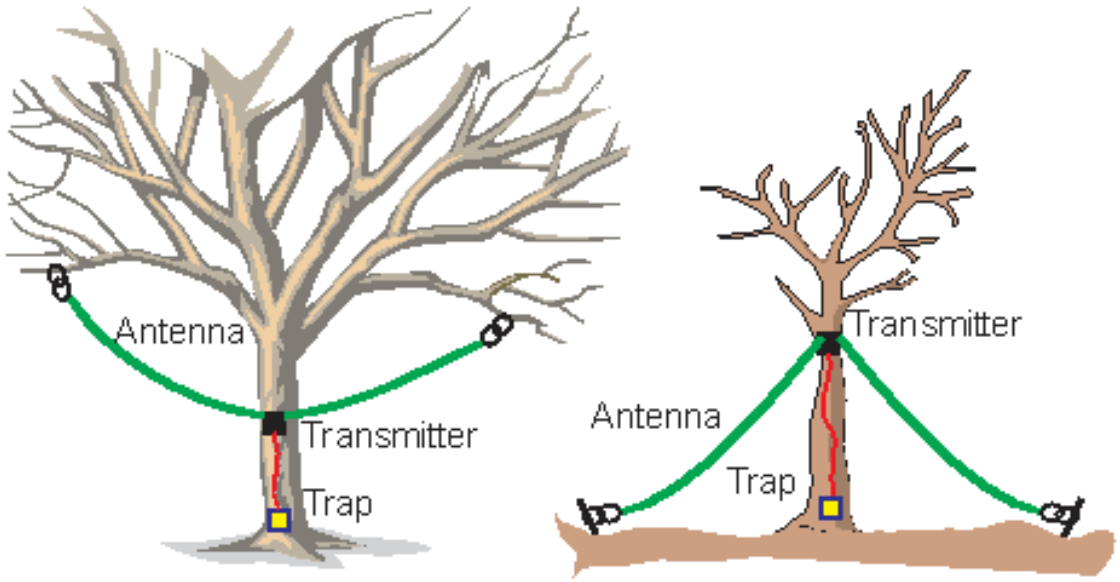
- Although the 27MHz antenna is 5m long, it can take the form of a roll up wire



# *Network design*

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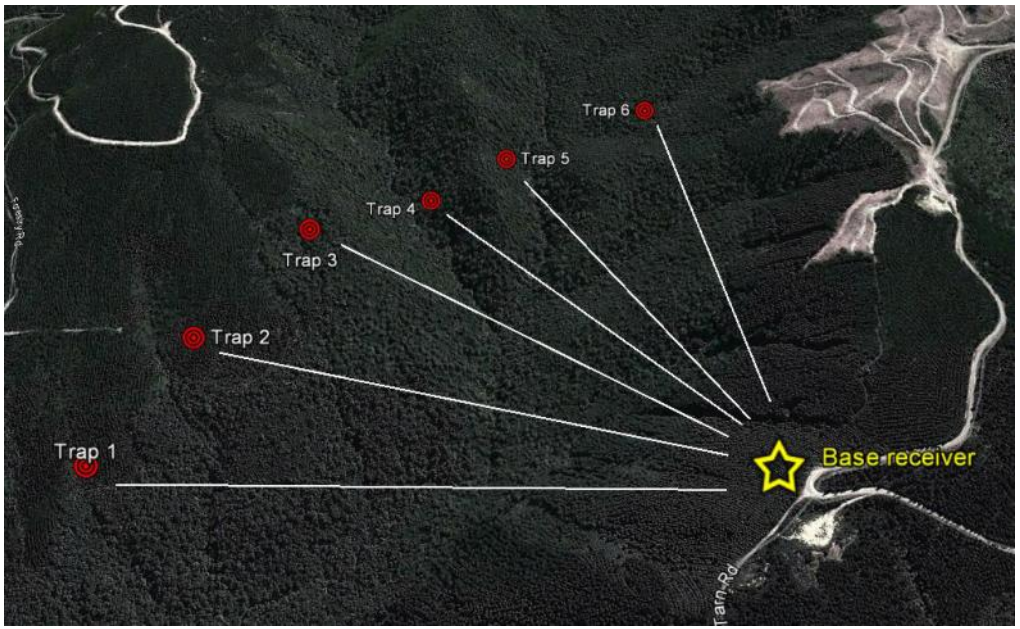
- Linear trap lines do not lend themselves to mesh networks.
- A star network was chosen as the most reliable and greatest tolerance to faults.
- The Base receiver would ideally be sited with a "reasonable view" of the trap line.
- If the base receiver was placed at a high point, it could have cell coverage, or access to an existing radio network.



# *Network design NVIS*

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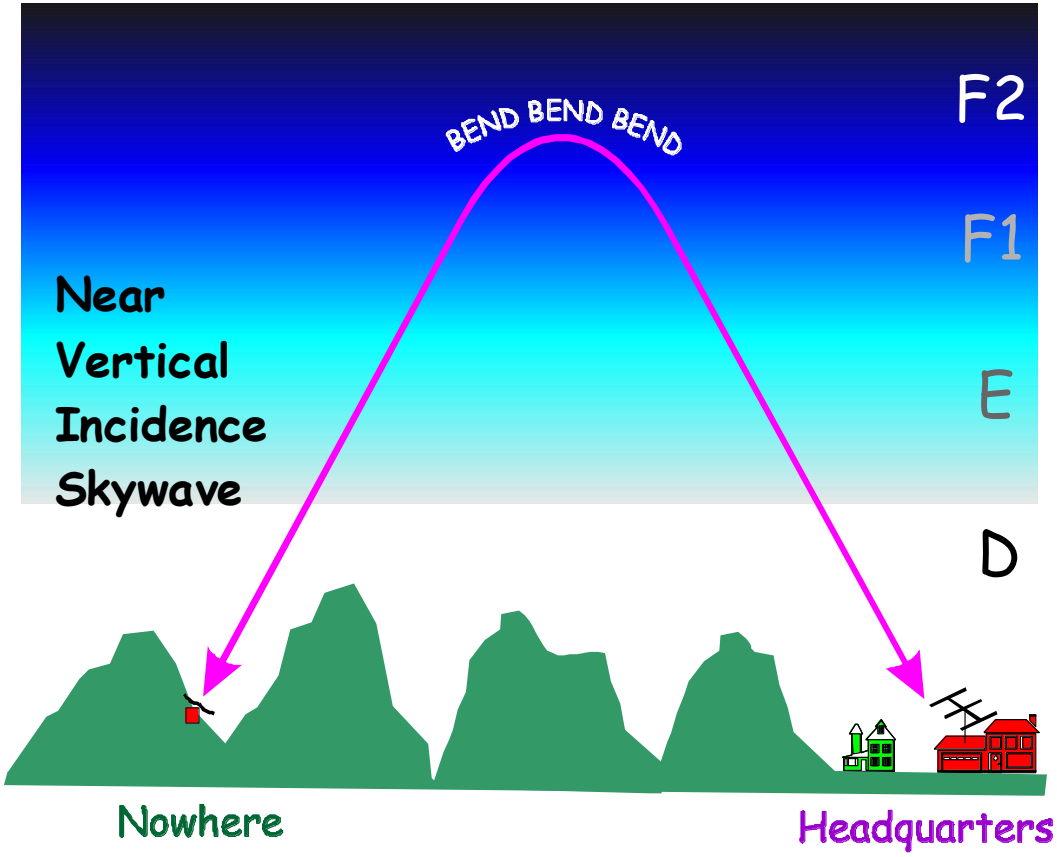
- Long range "Back Haul" communications.
- There remains the possibility to use HF NVIS skywave propagation (like mountain radio) to get information back to headquarters.
- There are many protocols in existence to transport low speed data over high frequency channels.
- DOC already owns frequencies that would be suitable



# *Pest control device monitoring*

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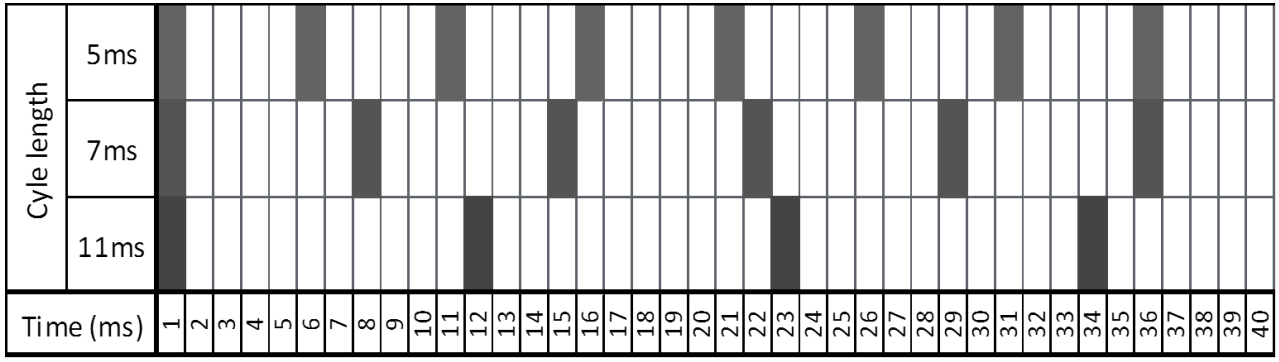
- Innovative method for multiple transmitters to be received at one receiver
- Very low cost, low complexity transmitter.
- Low power transmitter, an AA battery would last for over 800 days.



# *Camera trap monitoring*

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- Slow Scan TV mode chosen
- Low speed, high radio sensitivity mode

SSTV camera module and battery

SSTV transmission over 500m distance in forested terrain

# *Conclusions*

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- A star pattern network was chosen for low cost, reliability and good flexibility.
- 27MHz was chosen based on a compromise of performance and antenna size. However a smaller antenna would result in just a small reduction in performance.
- A low cost, simple signaling system was proposed for monitoring pest control devices. A prototype system was constructed
- An existing picture transmission system, using low power transmitters, was proposed for this application of camera traps.

# *Further work*

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*The following items were beyond the scope of this project, but if implemented would bring the systems to a stage that could be evaluated in a large scale test.*

1. The pest control device monitor system would need further development to improve performance.
2. Camera trap image transmitter requires the animal trigger system to be added, and a suitable transmitter/receiver module procured.
3. Antenna stowage for transporting.
4. Environmental protection.