

Introduction



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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?

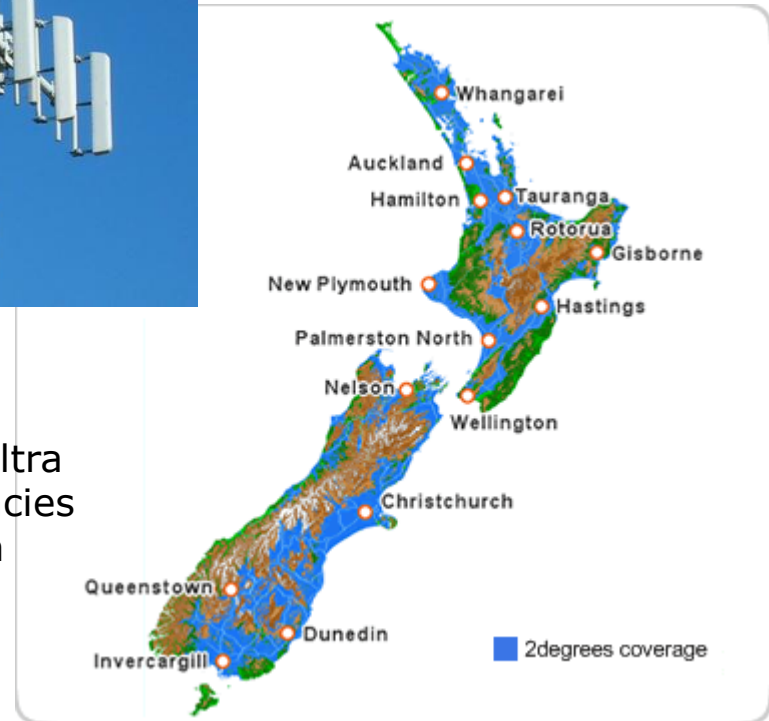


High frequency radio signals travel poorly through forest



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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- Both parts of 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.



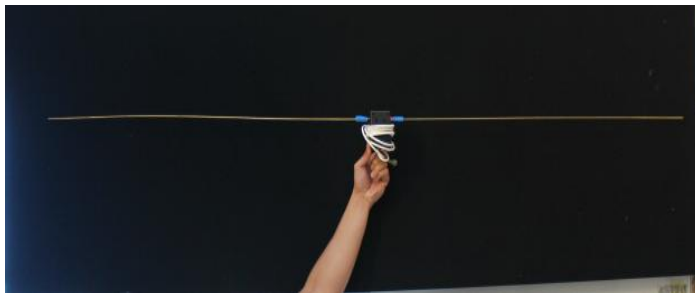
Antennas



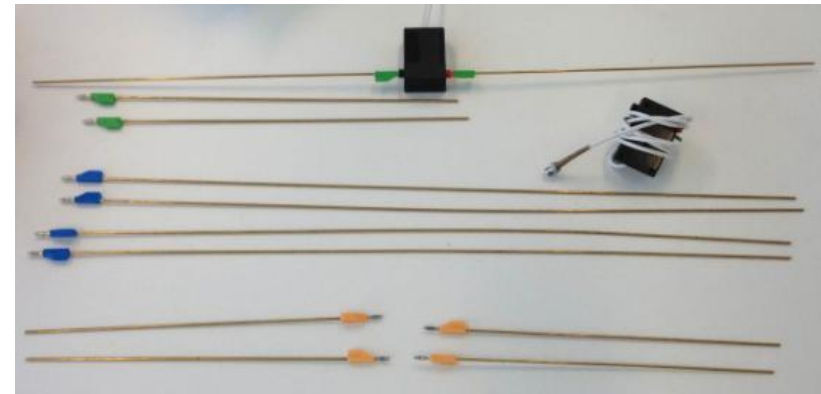
6.2MHz



50MHz



80MHz

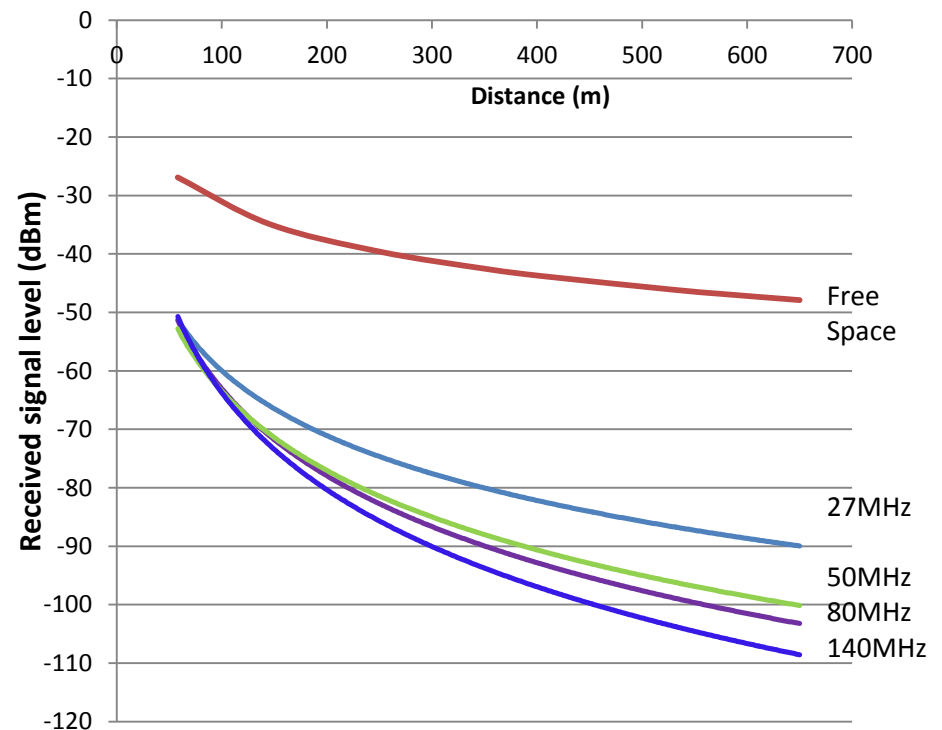


170MHz 140MHz 80MHz

Radio propagation trials



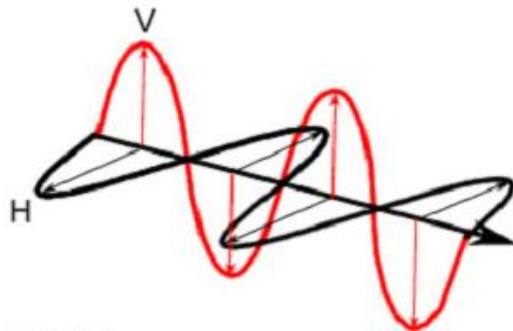
Trials were carried out to measure the attenuation of signals over various distances in forest



Frequency and Polarisation

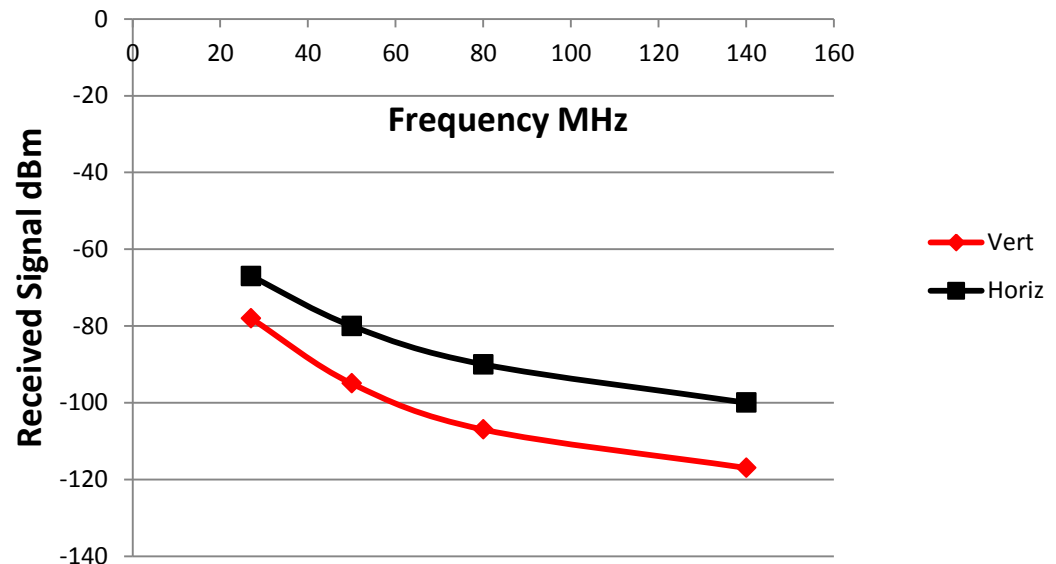


- Attenuation is dependant on frequency.
- Attenuation is dependant on signal polarisation.

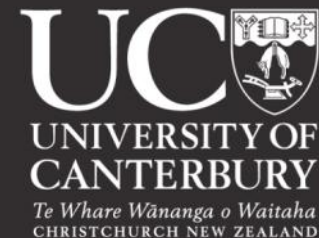


Radio Wave Polarisation

Receiver signal versus Frequency (500m)



The best frequency



Criteria

	Weighting	Frequency (MHz)					
		6.2**	27*	50	80	140	169
Radiation Performance	0.6	0.3	0.43	0.4	0.27	0.22	0.21
Portability	0.1	0.25	0.25	0.35	0.5	0.75	0.78
Manufacturability/ Expected Cost	0.05	0.1	0.5	0.5	0.6	0.6	0.6
Durability	0.2	0.4	0.65	0.4	0.5	0.6	0.7
Ease of Use***	0.05	0.2	0.45	0.48	0.5	0.5	0.5
Totals		0.3	0.4605	0.404	0.367	0.382	0.399
Ranking		6	1	2	5	3	4

*27Mhz half wave dipole using flexible wire

**6.2MHz based on helical dipole

*** Set up difficulty, set up equipment, etc.

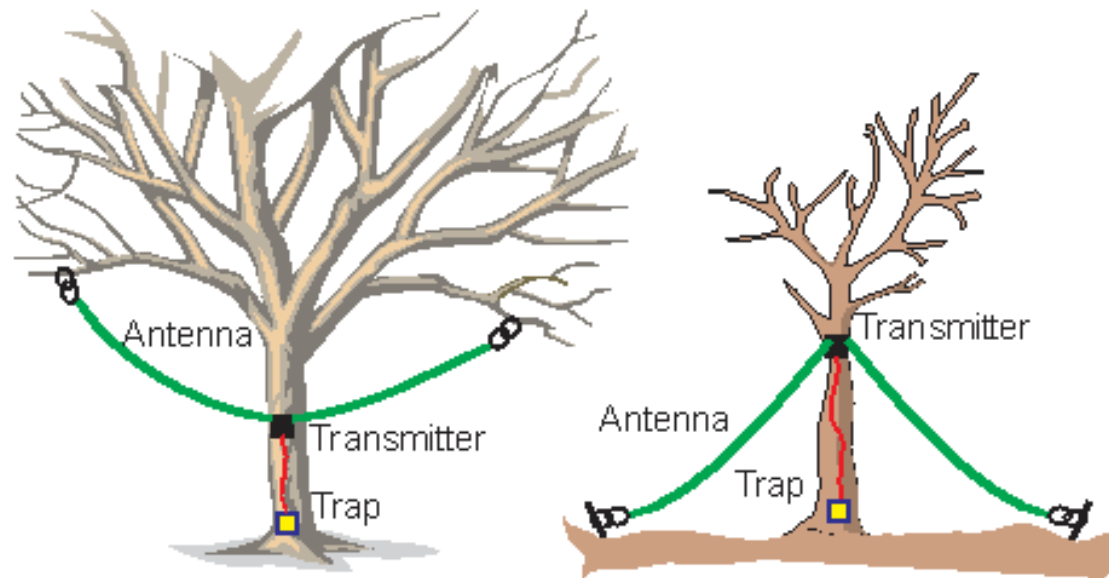
Practical antenna



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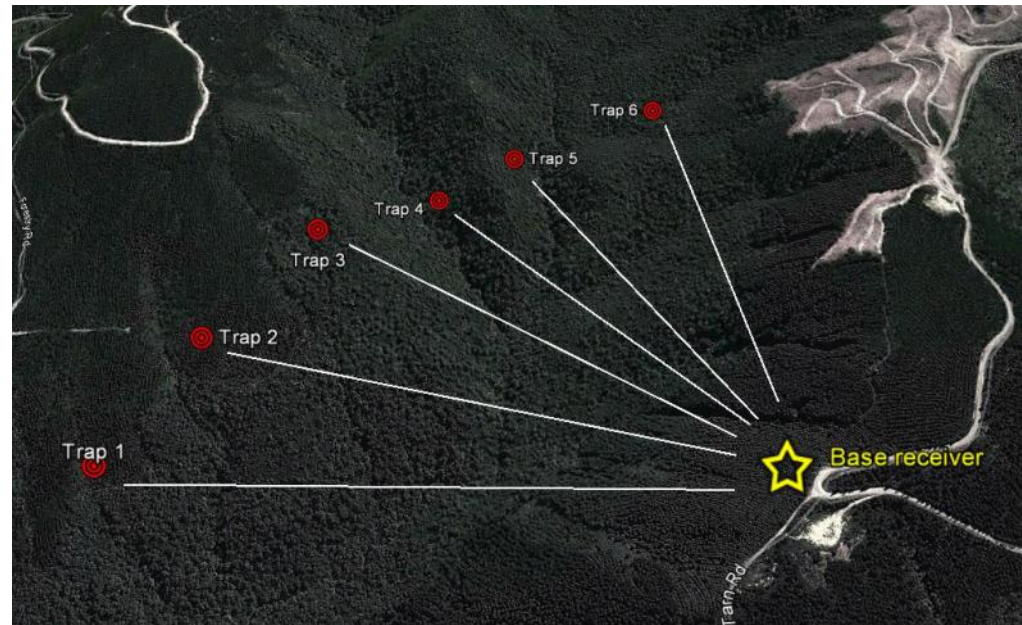
- Although the 27MHz antenna is 5m long, it can take the form of a roll up wire



Network design



- 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.
- There remains the possibility to use HF NVIS skywave propagation (like mountain radio) to get information back to headquarters.



Camera trap monitoring



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



SSTV camera module
and battery



SSTV transmission over 500m
distance in forested terrain

Conclusions



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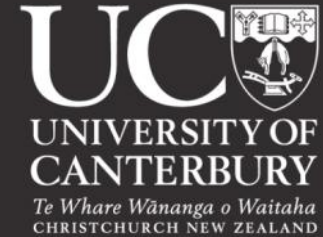
- A star pattern network was chosen for low cost, reliability and good flexibility.
- 27MHz was chosen based on a compromise of performance and antenna size. However a smaller antenna would result in just a small reduction in performance.
- A low cost, simple signaling system was proposed for monitoring 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.

