



RADIO SPECTRUM

(Radio Spectrum Management,
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A brief history of regulation of radiocommunications

Note: This is the print view with all the Document page

A report detailing the history of radiocommunications in New Zealand between 1900 and 2000.

A brief history of regulation of radiocommunications in New Zealand

Introduction

This document has been compiled from many sources, both public and private. We make no claim to originality, accuracy or completeness of the subject matter.

1921

The first radio broadcast

Early history of radio

In 1865 a Scottish physicist, Maxwell, demonstrated mathematically the theory of electromagnetic energy. This was confirmed in 1888 when Heinrich Hertz, a German, caused an electrical discharge between two metal balls placed very close together. Hertz's achievement was to project the charge from the space between the balls across a distance of some feet to detection apparatus consisting of a wire loop with a similar gap. Hertz had demonstrated the ability to convert electricity into another form, electromagnetic energy, which could be conducted over distance without wires. This energy came to be known as radio waves, Hertzian waves or simply wireless¹. Many others contributed to the improvement of transmission and reception devices², including New Zealander Ernest Rutherford who, in 1894, developed a more sensitive receiver known as a magnetic detector for radio waves.

It was left to a 21 year old Italian - Irishman Guglielmo Marconi to realise the communication possibilities of artificially generated radio wave energy³. In 1895 he experimented on the family farm near Bologna with a home-made transmitter and receiver and, most importantly, added a telegraph morse key. With this primitive equipment he managed to send the letter 'S' in morse over a distance of 3 kilometres. The Italian Minister for Post and Telegraph declared that the new technology had no potential for communication purposes so Marconi took his ideas and equipment to England where the British Government backed his work. In 1899 he sent a message across the English Channel, and by 1901 he had spanned the Atlantic. The technology was primitive and the concept of frequency management as a means of enabling simultaneous radiocommunications was still largely unrealised.

Footnotes

¹ Radio waves were also known as airwaves because it was originally thought that air molecules conducted radio energy, or in other words radio waves could not propagate in a vacuum. Although this was proved incorrect, and satellite and spacecraft radiocommunication today confirms it, the term remains in common use.

² Righi (Italian), Lodge (English), Branly (French) and Popov (Russian)

³ Naturally occurring radio wave energy, such as that emitted by stars and other objects in the universe, has no known utility for communication purposes.

Government monopoly

The first official mention of radio in New Zealand is a 17 October 1902 notification to mariners of a list of stations established by the Marconi Wireless Telegraph Company, albeit there were none in the southern hemisphere, let alone New Zealand. Nevertheless the New Zealand Government was reputedly first in the world to take control of the use of the new technology by way of the New Zealand Wireless Telegraphy Act 1903⁴. In essence only the Government was permitted to receive and transmit wireless communications and anyone else who did so without permission was liable to a £500 fine and confiscation of equipment. As Albert Pitt, the Attorney-General, stated to Parliament at the time "the whole principle of the Bill is that the Government intend to acquire a monopoly of this system in the colony". One of the main concerns, as outlined by the Postmaster - General of the day, was that the new wireless telegraphy technology might render the wired telegraphy network obsolete and thereby deprive the Government of revenue.

The first public demonstration of radio in New Zealand was given by the Marconi Company at the 1906 Christchurch International Exhibition. The military and maritime potential of radio was spurred by the Radio-

telegraph Convention signed at Berlin on 3 November 1906, which the New Zealand Government ratified the following year. The first message by wireless from New Zealand to another country was sent on 3 February 1908 from Sir Joseph Ward on board the HMS Pioneer berthed at Wellington. The message was relayed by the HMS Powerful in the Tasman Sea to the HMS Psyche berthed at Sydney.

In 1909 an Australasian Telegraph Conference was held in Melbourne and this led to a New Zealand Government decision to establish a number of marine radio coast stations at Auckland (ZLD), Wellington (ZLW) and the Chatham Islands (ZLC)⁵. The first station, a 2.5 kilowatt 'spark' transmitter, opened on 26 July 1911 and operated from a tower at the General Post Office in Wellington⁶. In October of that year⁷ the station was transferred to Mount Etako (also known as Mt Wakefield and latterly as Tinakori Hill) where it provided a wireless telegraph service to ships within a 600 mile radius. Two high-power stations with a range of 1250 miles were also planned, one at Awanui (ZLA) in the north and the other at Awarua (ZLB) near Bluff⁸.

The frequency of early radio transmitters and receivers was not able to be controlled to any significant degree, thus only one wireless communication at a time could take place in any given geographical area. With the tragic circumstances surrounding the loss of the Titanic in 1912⁹, it was realised that a management framework for radio transmission and reception was necessary to ensure the potential of the technology could be realised. Although the upper range of frequencies suitable for wireless communication was unknown, the concept gradually emerged of the radio spectrum¹⁰ as a public and economic resource, and licensing (the generation of radio waves) as a management tool for the prevention of radio interference.

Government regulation of the transmission of radio waves thus had a two-fold purpose - to protect Government revenue (by ensuring there was a Government monopoly on telecommunications), and to organise and allocate frequencies to prevent interference. While the first objective disappeared with the progressive de-regulation of New Zealand telecommunications in the 1980's, spectrum management, albeit within a market allocation framework since 1990, has become increasingly important in maximising the societal benefits and commercial opportunities of radiocommunication technologies.

Footnotes

⁴ See Appendix A for an extract of Hansard relating to the passage of this Act.

⁵ Opened 18 September 1913.

⁶ The first Australian coast radio station opened in Melbourne on 8 February 1912.

⁷ The Auckland station at Musick Point opened at this time.

⁸ Both opened 18 December 1913. Awanui closed on 10 February 1930.

⁹ A wireless-equipped ship, the Californian, was only 10 miles away but the sole wireless operator had gone to bed and there was no international agreement for radio watch-keeping and frequencies of operation.

¹⁰ The range of frequencies of electromagnetic energy capable of sustaining radiocommunications.

Development of broadcasting

By 1907 the work of two men, John Fleming and Lee De Forest, had resulted in the development of a device to amplify and detect weak electrical signals - the vacuum tube (or valve as it was also known). This laid the foundation for radio-telephony and De Forest was quick to see the opportunities. His diary records the following comments "My present task is to distribute sweet melody broadcast over the city and sea someday the news and even advertising will be sent out over the wireless telephone"¹¹. Both radio telegraphy and radio telephony were used during World War I, but the military were slow to relinquish their hold on it for civilian applications. Even home construction of radio receivers was made difficult because valves were not freely available. It wasn't until the Post and Telegraph Amendment Act of 1920 that provision was made to licence receivers independent of transmitters, and this set the scene for broadcasting as we know it.

In 1921 a Wellington businessman, Charles Forrest, began transmitting gramophone recordings from a room in the Hope Gibbons building. Although he had no formal permit or licence he had a verbal understanding with the Chief Telegraph Engineer such that whenever his transmissions were causing reception problems at the nearby marine radio station, he would cease until the ship-to-shore communication was concluded. Professor Robert Jack of Otago University became the first licensed broadcaster when, on 17 November 1921, he transmitted the first of a series of concerts that included live music and gramophone recordings. His transmissions were heard as far afield as Auckland.

In July 1922 a radio station commenced in Wellington that was licensed to operate on a wavelength of 275 metres (~1000 kHz). The operators were even invited by the P & T to broadcast the 1922 election results. In

than 20 years. This largely consisted of NZPO telephone traffic, and news and event feeds for public broadcasters. In the words of an INTELSAT official it "was built around a fundamental concern of sovereign [nations] to control foreign communications in the interest of their national security". The policy of protecting INTELSAT is often defended by an appeal to global egalitarianism. Small, developing nations are supposed to gain from a single-system approach to international satellite communications. With the global telecommunication reforms of the last decade however the role of the organisation is being reviewed¹⁵.

Footnote

¹⁵ An 'Office Of Signatory Affairs' within TCNZ now facilitates access to INTELSAT services for a wide range of users and uses.

Spectrum management framework

Up to 1987 spectrum management in New Zealand evolved, as in many other economies, as a centralised, administered system. Under NZPO administration, frequency bands were allocated to services mainly in accordance with ITU recommendations¹⁶ and considering the frequency range of available transmitting and receiving equipment. Channelling plans and technical standards¹⁷ were determined, albeit with limited private sector input, and made publicly available. These spectrum planning decisions were largely based on technical efficiency and ITU provisions, rather than economic criteria.

Provided the NZPO monopoly on provision of telecommunication services was not compromised, radio licences¹⁸ were granted, essentially on a 'first-come-first-served basis'¹⁹. Annual licence fees were adjusted to recover licensing administration costs, including interference management and ITU membership. While a licence could, in theory, be revoked at any time or not offered for renewal by the NZPO, this was a rare occurrence. There was a general public acceptance however, although not explicitly documented, that services might need to be relocated from time to time to alternative frequencies to make way for new services or technology developments. While no direct compensation was provided, long transition periods and other technical arrangements were usually employed to maximise the economic life of existing equipment investment. The clearance of 94 - 100 MHz of land mobile services, beginning in the 1970's to provide for the introduction of FM broadcasting, was a notable example of this policy.

On 1 April 1987 the NZPO was split into three state-owned businesses (SOE's) and the regulatory functions, including radio spectrum management, were transferred to the Department of Trade and Industry (DTI)²⁰, and administered under the Telecommunications Act 1987. New regulations were passed in late 1987²¹ that, while continuing the Telecom monopoly²², for the first time prescribed criteria that the Secretary of Trade and Industry was required to have regard to when considering whether or not to grant radio licences²³. These were:

- "public interest in achieving the maximum benefit from the radio spectrum"
- Technical compatibility of equipment
- Government policies for broadcasting and telecommunications.

Footnotes

¹⁶ The International Telecommunications Union (ITU) had its foundation in 1865 with the electric telegraph and later encompassed radio. New Zealand became a member of the ITU on 3 June 1878.

¹⁷ Based on considerations such as co-channel and adjacent channel interference probability, propagation, receiver characteristics etc.

¹⁸ Also known as apparatus licences or radio apparatus licences.

¹⁹ Where broadcasting was concerned a warrant from the Broadcasting Tribunal was necessary before the NZPO would grant a licence.

²⁰ Later to become the Ministry of Commerce.

²¹ The Radio Regulations 1987; 1987/412, 17 December 1987.

²² The prerequisite for a warrant, where broadcasting was concerned, was also retained.

²³ Regulation 13.

1923 the Government decided to promote private broadcasting and regulations were introduced which divided the country into regions, specified frequencies and transmitters powers, but banned advertising. The first station licensed under the new regulations was 1YA in Auckland. A licence, costing 5 shillings, was required to receive broadcast transmissions, and applicants had to supply a character reference and proof of British nationality.

Space does not permit a history of broadcasting in New Zealand, suffice to say that private broadcast stations (known as the 'B stations') flourished during the 1920's and 1930's. However the Broadcasting Act 1936 established state broadcasting under a new Government department, the National Broadcasting Service (NBS) and by the beginning of World War II all but two of the private stations had been purchased by the Government. Radio, and eventually television, broadcasting was largely to be the preserve of the Government for many years to come.

Footnotes

¹¹ The Radio Years - A History Of broadcasting In New Zealand, Patrick Day, Auckland University Press 1994, ISBN 1 86940 094 1.

Telecommunications

The early development of the use of radio grew out of the experimentation of radio amateurs (knowns as 'radio hams'). They pushed the boundaries of both the technology and its applications, especially in the use of the higher 'short wave' frequencies (3 - 30 MHz). In 1927 this lead was taken over by the Government when a short-wave radio-telegraph link was established with Apia by the Department of External affairs. The service was extended to Rarotonga in May 1930.

Also in 1930 voice telephony equipment was added to the short-wave transmitter installed at Wellington Radio. A public radio-telephone service was opened between New Zealand and Australia on 25 November 1930; and in July 1931 this service was linked with the Australia to UK service. A high - speed radiotelegraph service to San Francisco commenced in 1942.

World War II saw the development of new technologies such as radar which now have wide application in navigation and weather prediction. Interest in the short-range communication possibilities of Very High Frequencies (30 - 300 MHz) intensified. Traffic Officers had two-way VHF radios installed in their vehicles and the Police established a one-way broadcast system in Auckland and Wellington in 1946. This was expanded in 1949 to a 2-way VHF system operating at 40 MHz. Around the same time the Post and Telegraph Department¹² was establishing VHF radio toll circuits across Cook Strait. Commercial mobile radiotelephone services, aimed at taxis and delivery firms and the like, were also installed providing wide area coverage through VHF 'repeater' stations located on prominent hilltops. During the 1950's the first microwave bearer links were established in the North Island. In 1965 the first commercial HF radio circuits to Antarctica (Scott Base) were established at Wellington Radio¹³.

While the NZPO had a monopoly¹⁴ on the provision of commercial mobile services, some private services were licensed. These were often in rural areas where it was not considered viable for the NZPO to establish a service. One of the few significant departures to the NZPO monopoly was the establishment, in October 1969, of a microwave network operating in the 2GHz band for the purpose of reticulating state-owned television services.

Footnotes

¹² The Post and Telegraph Department became the New Zealand Post Office in 1959.

¹³ Later transferred to Himintangi (transmit) and Makara (receive).

¹⁴ Consolidated under the Post Office Act 1989. Regulation 31 of the Radio Regulations 1970 reads 'Except with the authority of the Minister a radio station shall not be used in any way to compete with Government communication services, and shall not transmit or receive any radiocommunications the transmission or reception of which is calculated in the judgement of the Minister to cause a loss of revenue to the Post Office'.

International communication links

Until the first telegraph cable was laid between Australia (Botany Bay) and New Zealand (Cable Bay near Nelson) in 1876, shipping provided the only means of international communication. The cable also provided an onward link to the UK - at a cost of 15 shillings a word! In 1965 the first global telecommunication satellite network, INTELSAT, came into being. It was essentially a geopolitical initiative of the USA that has since grown into a system of 14 satellites and over 100 member states, including New Zealand. Access to international communication services was managed by the NZPO through its INTELSAT earth station at Warkworth for more