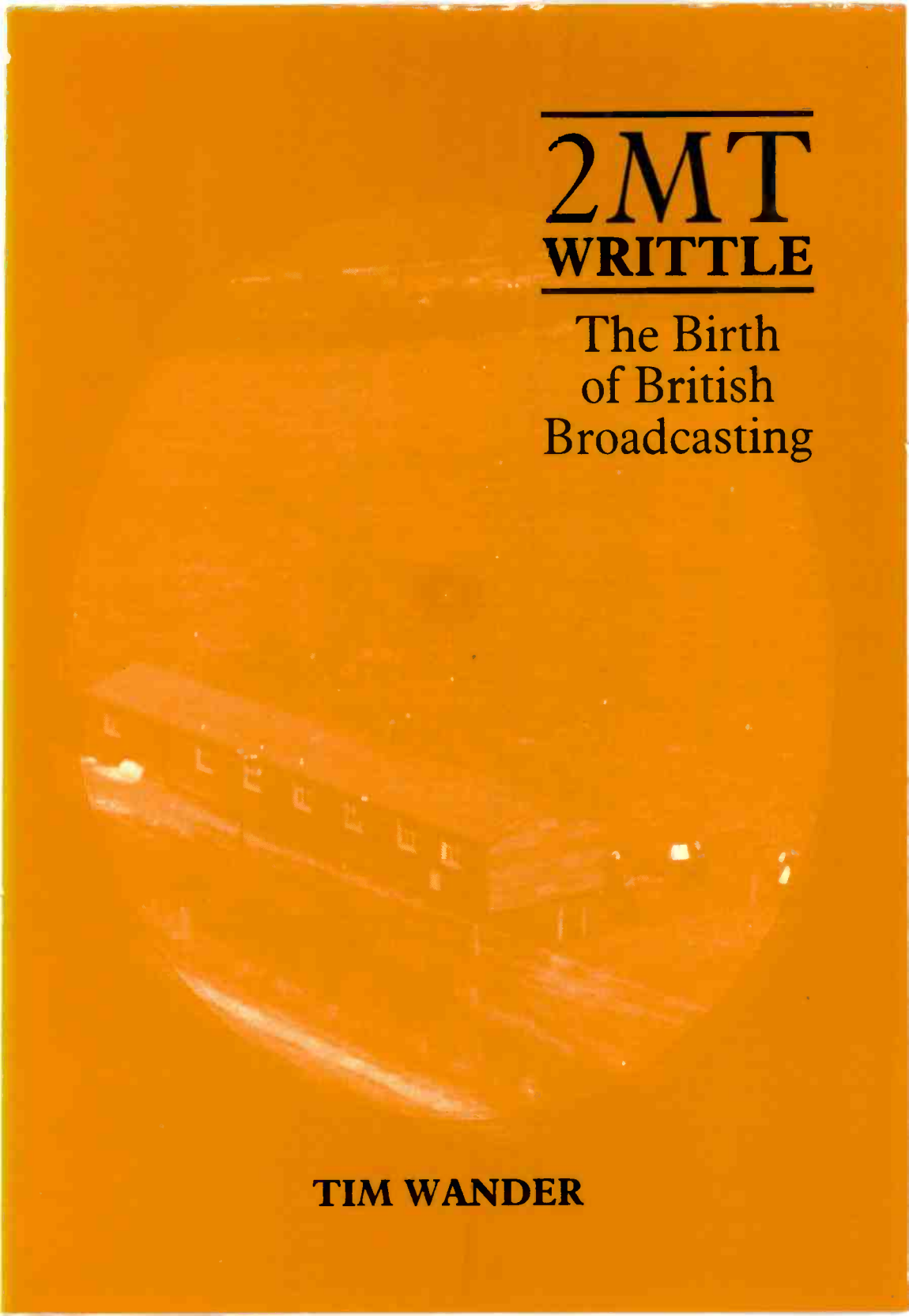
2MT
WRITTLE

The Birth of British Broadcasting



TIM WANDER

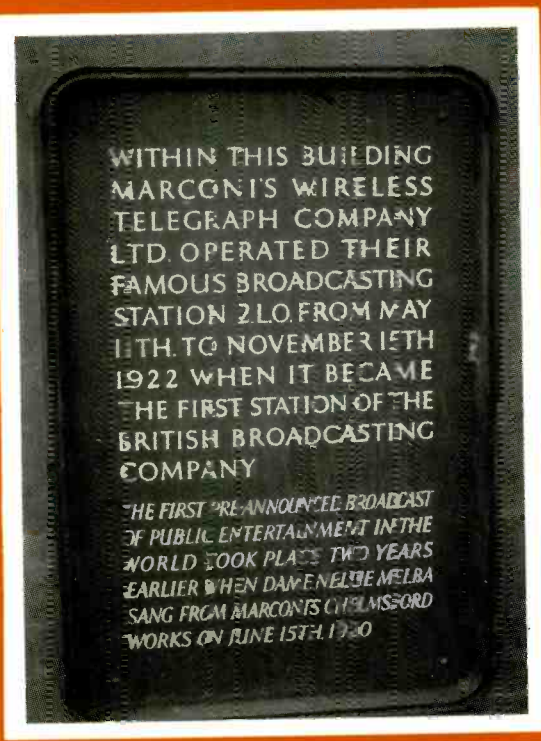
"Stay for one fleeting moment,
tuned to the last degree,
CQ! The concert's ending,
ending for 2MT!"

Often a one-man show, radio station 2MT at Writtle established an individuality all its own which will ever remain a pleasant memory to its broadcast audience. Its burlesque entertainments, its parodies of grand opera, its peculiar announcements, the light-hearted spirit which pervaded the whole proceedings and the sheer joie de vivre that bubbled across the aether were not only a first but truly unique in the history of broadcasting.

This book charts the struggle to achieve a broadcasting service in this country – from the famous broadcast of Dame Nellie Melba in Chelmsford, through Writtle's sparkling success to the birth of the BBC. It is aimed at a wide readership and can be easily understood by any reader. The book also includes separate technical/historical appendices on the Chelmsford and 2LO transmitters, the Dutch station PCGG, and early pioneers such as Grindell Matthews, Reginald Fessenden and David Hughes, and draws on much previously unpublished archive material and photographs.

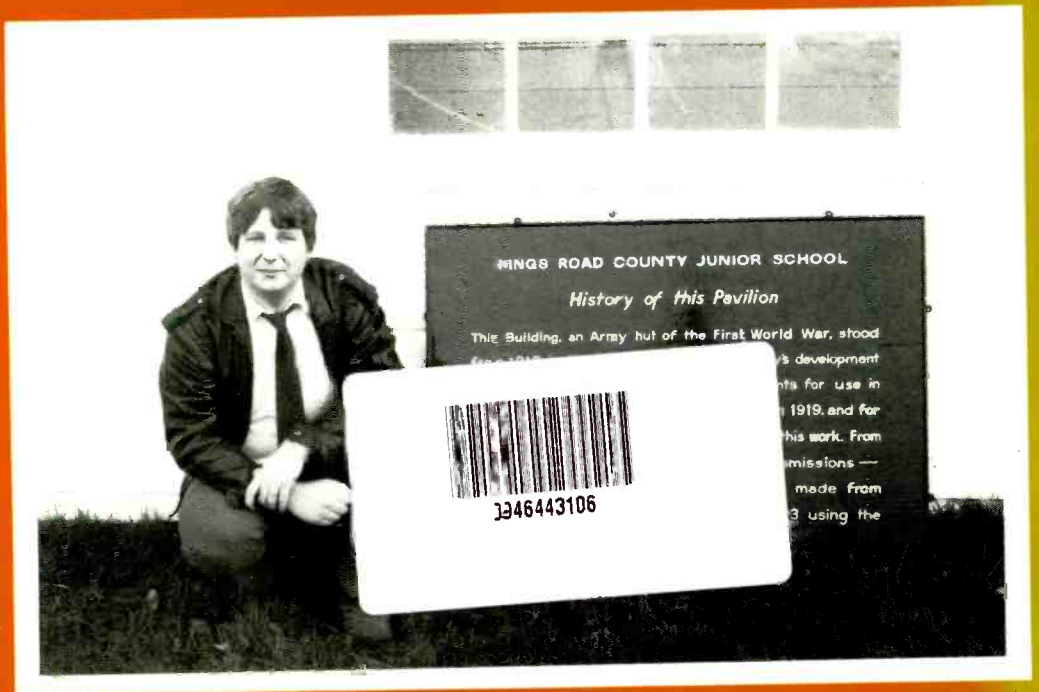
Front Cover –
The Writtle Hut –
Home of 2MT

The photographs on the back cover are the plaques commemorating 2LO on the wall of Marconi House in The Strand and 2MT on the wall of the orginal Writtle hut. The author is also there, at the insistence of the publisher!



About the Author

Tim Wander was born 'several' years after radio station 2MT at Writtle left the airwaves, his home town being Melton Mowbray, in the heart of rural Leicestershire. A degree in Computer Science from Aston University in Birmingham brought him by coincidence to work at the site of Writtle's somewhat forgotten wireless station. A long held passion for vintage radios and broadcasting history set him on a four year trail to record all there was to find out about 2MT, Writtle and the birth of British telephony broadcasting. This book, his first, is the product of that search.



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2MT WRITTLE.

The Birth of British Broadcasting

Born in laughter.
Nurtured in laughter.
Died in laughter.

This book is about a small group
of young engineers who made history.

It is written in recognition of their
pioneering efforts by another young
engineer, who owes much to the efforts
of his wife and parents.

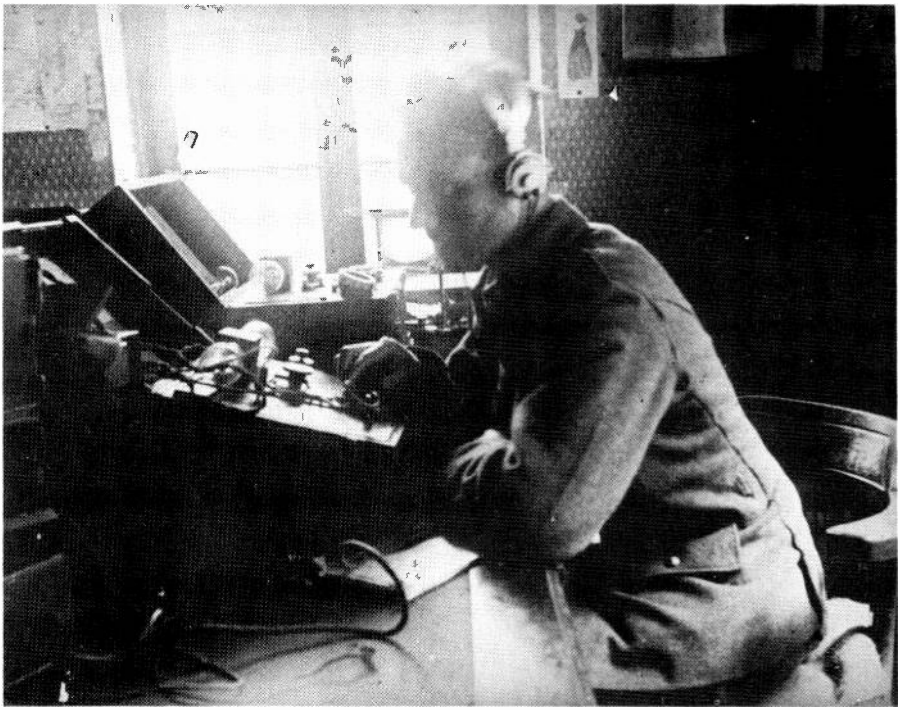
FOREWORD

To today's generation the radio is often the means of waking them in the morning and of lulling them to sleep at night. It provides news of the day's events, entertainment to keep them amused and information to assist them in the daily routine. To the politician in all countries of the world it is the prime means by which he can put over his ideas to the people whom he wishes to convince. Its effect on society is so widespread and penetrating that it is difficult to envisage the time, within the lifespan of the 'senior citizens' of our society, when broadcasting did not exist.

It is interesting that a member of the younger generation, whose day-to-day task involves the latest electronic technologies, has chosen to recall how it all began and in particular the events which happened on the site when he is currently working. He has felt, as have generations of 'Marconi men' before him, the spirit of adventure, excitement and (to use their own word) fun which was characteristic of the pioneers in broadcasting.

Few people can now claim to have played an active part in the Writtle 2MT broadcasts, or even in the design or manufacture of the equipment used, but many will recall having worked in the Writtle huts on more recent generations of equipment. Perhaps the sense of great things accomplished in the past helped them in achieving their own successes. It is certain that most of them with colleagues in other parts of the companies bearing Marconi's name, were conscious of following in the footsteps of outstanding pioneers, and others before Tim Wander have felt some of the excitement and romance of the past in delving through the company's very extensive archives. The reader will find references to some of them in his text and, in pursuing them, may also be caught up in the atmosphere of exploration. It is something which most of us who have worked under Marconi banner, attached to different flagships as the Company's history developed, have felt and which we would not have missed.

David Speake
Director of Research,
The Marconi Company, 1965-1982



Unknown radio operator with 'Trench set'. During the First World War

CONTENTS

APPENDICES

There was once a young Italian who claimed to be able to send messages hundreds of miles, but as everybody knows, nobody can shout further than a hundred yards. The Italian's name . . . . Guglielmo Marconi.

PHOTOGRAPH LIST

ACKNOWLEDGEMENTS

All photographs by kind permission of GEC-Marconi Ltd., except Nos. 2, 11, 12, 27, 30, 32-37, 39, 41-43, 47-51, 54 and 56-58, which are from the author's collection.

The text of letters and documents are faithfully reproduced from The Marconi Company archives, and this book would not have been possible without the co-operation of The Marconi Company.

My thanks to Tony Hopwood for his helpful comments and suggestions during my research and preparation of early drafts. I would also like to thank Tony for his introduction to the work of Grindell Matthews, also to Pat Hawker for his help with station PCGG. And I must extend my appreciation to the small band of co-opted proof readers who have helped the text through its different versions.

I must thank all those who have cast their minds back three generations to tell me their stories, all those who have searched for documents, newspaper cuttings and photographs to help paint the picture of 2MT. That picture due to its subject must be in part technical, describing the hardware that lay behind the transmitted words. 2MT Writtle is however far more than a discussion of valves and aerials, it is the people behind the microphone that give the real magic to the story. My thanks must also go to Roy Rodwell and the Marconi archives for the use of company photographs and extensive historical documentation. A mention must go to the fellow members of the 'Arc' team who work at Writtle's Wireless Station and who now know the story.

I would like to express my appreciation to Mike Skliros at Capella Typesetting for his help and technical expertise in turning my BBC disks into what you now see.

Part of the technical description of the 2MT transmitter in Chapter 8 appeared in the January 1963 edition of *Wireless World*, the original letter being lodged in The Marconi Company Archives.

The technical description and accompanying circuit diagram of the Chelmsford broadcast transmitter in Appendix D is taken from *Wireless World and Radio Review*, 1st May 1920, by Frank P. Swann. The original report is also lodged in the Marconi Company Archives.

The story of 2MT at Writtle was first conceived as a magazine article written in 1984 and published in the March/April 1986 editions of *Practical Wireless*.

The story of Reginald Fessenden's ill-fated Machrihanish wireless station in Appendix B formed part of a magazine article for *Ham Radio Today* magazine in June 1987.

I must thank my wife Judith for all her hard work in preparing the manuscript, throughout its many revisions and sometimes very dubious handwriting.

Last, but by no means least, my thanks to the following for their help and support:

Dick Wander, Michael Paskins, Mr. E. Bishop, Steve Valentine, Lachlan Mackinnon and Nick Keighley.

This book was written on a BBC 128K Master series microcomputer, using VIEW software. It was pre-formatted on a DEC VAX 8600 minicomputer and loaded onto an IBM PS/2 50 microcomputer, then sent to Capella House, Stowmarket, where it was edited under WordStar 2000 and transmitted into a Linotype CRTronic 150 phototypesetter.

Throughout this book I have tried to avoid getting wrapped up in dates, places and technical arguments, although at times this is of course unavoidable. The story of 2MT at Writtle, due to the nature of the times and of the engineers who worked there, is essentially a story about the people involved. With this view in mind I have as far as possible tried to avoid over technical discussions in the main text. Consequently descriptions of the Chelmsford transmitter and the 2LO transmitter are included as separate appendices.

To fully tell the story of 2MT it is also necessary to look at some of the early work that led up to the formation of the station, and something of what happened when it eventually closed down. Consequently the technical appendices are also joined by a number of short 'essays' that either expand or complement topics mentioned in the main text.

The Glossary contains explanations of technical or historical terms that may be unfamiliar.

PREFACE

"Stay for one fleeting moment,
Tuned to the last degree,
CQ! the concerts ending,
Ending for 2MT."

This book is the story of a radio station called 2MT, and how that and the events of 1922 fit into the history of broadcasting and radio. Let me state from the outset that I don't remember the heyday of Writtle and 2MT. I was born into a world when the transistor had just displaced the valve, and now work in a business dominated by the microprocessor and the computer revolution. Indeed, at Writtle the pioneering work of the very first wireless engineers on that site has been all but forgotten by their computing counterparts.

Just over 60 years ago, some ten yards from where I sit typing these words, a small piece of history was in the making. At eight o'clock on the evening of a cold and frosty St. Valentine's day in 1922, nervous engineers once watched the clock waiting for the first night of a new radio station they called 'Two-Emma-Toc'.

In that one night regular broadcasting came to the British Isles, but Writtle's station has always received little credit, even though they did it first and did it well. As always their work built upon foundations firmly laid by previous men of science, but 2MT at Writtle was to break new frontiers in radio. The technical excellence of the Writtle Wireless Station, combined with the humour, innovation and sheer fun of '2MT', not only gave birth to broadcasting in this country but led directly to the formation of the BBC. The British Broadcasting Corporation is now respected throughout the world as the premier broadcasting service, but Writtle was the first ever 'broadcasting service'.

Two generations on, radio has become so commonplace that it merges unnoticed into the background. This is itself a testament to the usually unrecognised work of all the engineers who made it so.

This book is respectfully dedicated to the engineers who not only made a radio station called 2MT, but also made British broadcasting. This is their story, a unique story of genius, laughter, innovation, invention and social change.

Tim Wander
Writtle
February 1987

1

OVERVIEW; ENGLAND'S FIRST VOICES

"If I see further than others,
(including yourself and Descartes)
it is because I stand on the shoulders of giants."
Isaac Newton (in a letter to Robert Hooke).

Sixty years ago a weak and static laden radio signal crackled out from an old army hut in a small Essex village. Few heard it and even less recognised it for what it was. The new art of broadcasting had come to Essex, and Britain had gained her first official voice. Rarely in the development of a technology can any single step truly be called a 'first' unless some explanation is added. The early days of radio are littered with claims and arguments as to who was the first to 'broadcast' using the new invention called Wireless.

The birth of wireless, later to be known simply as radio, has its origins in the scientific Renaissance of the late 1800's. (*See Appendix A.*) The birth of broadcasting, where words not morse code are transmitted via radio, all started with a lone eccentric inventor demonstrating a strange phenomenon in 1892. A mysterious figure called Nathan B. Stubblefield gave a public demonstration of the wireless transmission of speech in the small town square of Murray, Kentucky in the USA. He later repeated his 'atmospheric effects' in Philadelphia, and near Washington in early 1902. Unfortunately history was to bypass Mr Stubblefield, for he died of starvation, completely destitute in a Kentucky shack on the 28th March 1928. His gravestone in Murray records him as the 'Father of Broadcasting', and certainly his 1908 US patent number 887,357 for his system won him several court victories, but unfortunately no financial income. It would be 14 years before speech transmission was attempted again.

In 1906, just five years after Marconi had forced his famous morse code signal across the Atlantic from Poldhu point in Cornwall to the new world, Professor Reginald Aubrey Fessenden (1868-1932), launched his words into the ether. (*See Appendix B.*) The Canadian inventor is reputed to have actually achieved broadcast speech, albeit highly distorted, as early as the November of 1900, but by Christmas Eve of 1906 Fessenden had mastered the technique of speech transmission. To bolster his sagging spirits after the collapse of his Scottish radio station in Machrihanish, and consequently the end of his transatlantic speech experiments, he decided to organise a festive wireless concert. His initial speech

tests went out on the 11th December, modulating the spark transmitter by connecting the water cooled microphone directly into the aerial circuit. For the technically minded, the transmitter contained no valves and used a high frequency AC Alternator to finally radiate a signal of around 1Kw at 80Kc/s. Fessenden then set about presenting the world's first advertised broadcast of speech and music using the 420ft (128m) high radio mast of the National Electric Signalling Company at Brant Rock in Massachusetts. In the transmitter shack for the momentous Christmas Eve broadcast, Reggie Fessenden gathered two friends and his wife Helen around the asbestos covered microphone.

At exactly nine o'clock, a general CQ call to all stations was sent out in morse code, whereupon Fessenden stepped to the microphone and gave a short speech about the programme to follow. The Edison phonograph then squeaked out a solo voice singing Handel's Largo. One of the group of helpers, Mr Stein, stepped forward to say his piece, but froze at the microphone being unable to utter a single word. His fate was to be followed by thousands of others over the next 60 years of broadcasting, when they confronted that most sinister of devices, the microphone. To cover the sudden silence, Fessenden stepped in and quickly fiddled through his own version of Gounod's "O, Holy Night", even managing to sing the last verse as he played. The site secretary, a certain Miss Bent, and Helen Fessenden had then promised to read a piece of text from the Bible including "Glory to God in the highest and on earth peace to men of goodwill". Unfortunately, these two broadcasting pioneers also suffered from the same chronic microphone shyness and Fessenden again stepped to the microphone and spoke the parts. To close the festive broadcast a breathless Fessenden wished his listeners a Merry Christmas and advised that the programme would be repeated on New Year's Eve.

The words and music from the dynamic Mr Fessenden were picked up by a number of ships' radio operators from the US Navy, on some banana boats from the United Fruit Company and by a few amateurs within a five mile radius of the radio station. Fessenden kept his promise and produced a similar broadcast after the Christmas festivities had passed. On New Year's Eve 1906 he gave the world a brief glimpse of the future, for with much more favourable atmospheric conditions, reception was reported from as far away as the West Indies. Fessenden always regarded this and earlier experiments as a great success, so much so that he had already demanded, and got, an immediate salary rise from 300 dollars to 600 dollars a month. His financial backers T.H. Given and Hay Walker Jr. were to pour some two million dollars into Fessenden's National Electrical Signalling Company over the next four years. The NESCO was launched solely as an inventor's laboratory, and neither manufacturing nor commercial communications were ever really contemplated, only research into this thing called wireless. Fessenden's backers were men of considerable means, who believed that wireless was on the verge of a great development, and that investment in such a laboratory and experimental station should prove highly profitable.

The Christmas Broadcast was not Fessenden's only success. In the Spring of 1906 he had established reliable two-way telegraphy communication across the Atlantic, between Brant Rock in Massachusettes and the Machrihanish wireless station on the West coast of Scotland. In the July of 1907 the embryonic company then managed to transmit speech between Brant Rock and Jamaica Long Island at a distance of 180 miles with extremely good reception in both directions.

However it was not to last, for even though Fessenden and his company had made a historic contribution to the history of radio, he seemed unable to turn his ideas into hard cash. It was not all Fessenden's fault. His financial backers behaved very strangely, refusing point blank to make and market Fessenden's inventions themselves, but at the same time refusing to sell the rights of his inventions to others. Frustrated by the negative attitude, and the fact that a condition of their financial support was ownership of all Fessenden's patents, the inventors already abrupt manner became worse. The company also refused to help Fessenden fight the court battles over infringements of his own personal patents. The United States Navy and other companies world wide were already making millions of dollars from his inventions. His liquid barretter was blatantly copied by many people, but Fessenden was forced to spend his own time and money fighting these infringements in court. Fessenden already had well over 300 patents, and the whole business was now so complex and technical that Given the banker and Walker the soap-maker had no hope of understanding it. Fessenden's stubborn and irascible manner had always made customer relations very difficult. He could never quite understand why others would not work as hard as he did, or were not as bright as him. His individuality practically forced an early customer, the United Fruit Company, to start producing their own sets, again infringing Fessenden's hard fought patents.

The Company collapsed into dispute and acrimony, and the Pittsburgh capitalists soon came to feel that Fessenden was no longer working in their favour. In January 1911 they notified him of his dismissal. When Given and Walker acted they were swift and ruthless. Fessenden was first forced to attend a phoney meeting at his backer's office in Pittsburgh. While he was absent, private detectives moved in and seized the Brant Rock transmitter site, together with all its records and logbooks. Helen Fessenden and the site secretary Miss Bent were literally thrown out, and the gates were locked behind them. Despite his staff staying loyal and actually retaking the site armed with shotguns, Fessenden was finished at Brant Rock. The NESCO had all his inventions and he had no money to continue. To survive he took to inventing gimmicks, his resourceful mind designed everything from violins with amplifiers to aluminium bags to hold tea. Meanwhile his lawyers fought and argued and counter-sued. Fessenden was not a man to be easily rid of, especially as he always considered the company to be his alone. He promptly brought a large lawsuit against the Company for 400,000 dollars, claiming severe breach of contract. Given and Walker's actions were soon to backfire on them, for the loss of Fessenden's own particular brand of genius

soon forced the NESCO into bankruptcy, and it disappeared almost without trace from the history of radio.

The whole affair was a great loss to science, for at that time Reginald Fessenden probably knew as much about electricity as any man alive. His radio system was performing ever more reliably with very good signal reports from Puerto Rico and on one occasion, Alexandria in Egypt. Given and Walker eventually sold Fessenden's ideas, inventions and patents to a trust fund in an attempt to recoup some of their investment. Fessenden, the lone inventor, was to bitterly fight the trust and its lawyers in court for the next 16 years. On the 31st March 1928, aged 62, the court decided in his favour, and he finally received the hundreds of thousands of dollars he deserved.

The first telephony broadcast in Britain was made in 1907, just months after Fessenden fiddled his way through the famous Christmas concert. It is unclear exactly who was first but most documents refer to Lt. Quentin Crauford RN, who obtained Admiralty permission to air a concert from the radio-room of HMS Andromeda for the benefit of other ships moored at Chatham dockyard. Crauford had himself adapted the Andromeda's radio telegraphy system to allow the transmission of speech and music. He played several songs emphasising the patriotism of the moment, 'God Save the King', 'Rule Britannia' and 'Trafalgar Day'. As a little light relief he also included 'Three Blind Mice' into the Naval occasion, but the Navy insisted that results of the experiment should be kept secret.

The 11th May 1932 edition of Wireless World carried a letter from a British amateur, H. Anthony Hankey who had apparently also broadcast wireless telephony during the summer of 1907. He used a 250 watt portable Poulsen Arc transmitter mounted in a small travelling trunk and powered by a four cylinder petrol motor coupled with a dynamo. The demonstration was organised for the War Office with the transmitter located in Aldershot and General French and his staff listening in on a crystal set in the neighbourhood of Midhurst. Hankey's programme consisted of a number of songs and monologues which he personally conducted and this may well have been the first occasion that wireless telephony was broadcast in Britain.

Fessenden, Crauford and Hankey were rare exceptions bringing words and music to a handful of radio operators who had never heard anything like it before. In America the experiments with the 'spoken word' would continue, but few voices would be heard over the British Isles during the next ten years.

In March 1909 another Poulsen Arc transmitter from Lyngby put out an experimental wireless telephony transmission of phonograph records and speech in English, Dutch, French and German using a wavelength of 1,000 metres and later in June the Culler Coates station in Newcastle conducted several wireless telephony tests with Lyngby, although according to Hankey who listened in with a crystal set, a bad cough appeared to be troubling the operator.

There was one other brief, but memorable rippling of the British ether when on the 31st January 1912 the Daily Mirror reported "The Voice of the North Sea

Ghost". By 1912 speech had only replaced morse code on the airwaves in this country a handful of times, and very few people had actually heard it. It now appeared that someone, somewhere, was counting over the airwaves. Startled radio operators sailing from Hamburg to Avonmouth also heard music, whistling, singing and even a banjo. The newspaper delighted in suggesting explanations including voices from another planet, disembodied spirits or a ghostly voice haunting the North Sea. The wireless spirit had been heard within a radius of 600 miles, with reception reports coming in from London, Somerset, North Foreland and Scheveningen.

The disembodied voice was no ghost, just a scientist called Grindell Matthews, talking to the world from his experimental radio station in Gloucestershire. To silence the storm of press interest, Matthews demonstrated to an assembled audience that speech transmission was possible and could provide exciting opportunities for the future. (*See Appendix C.*)

The exciting future was a long way off, for the world was soon to face far more earth shattering news. The storm clouds of war were gathering over a Europe that was only months away from the bloodiest conflict in the history of mankind. For a brief time, just before war came, one more European station made its small voice heard. In Belgium, a little known radio station with the callsign OTL, set up its transmitter in the grounds of the Royal Castle at Laeken. Its aim was to transmit a programme of music for public reception every Saturday evening at 5 pm. The first broadcast went out on the 23rd March 1914, and was commented on by the Brussels daily newspaper 'Le Soir' on the 30th March. The paper reported good reception throughout Belgium and Northern France by several hundred listeners, and does show that this station was in fact run to provide pure entertainment for its listeners. In the argument as to which radio station in the world actually constitutes the earliest broadcast station, OTL must be considered, even though little is known of its operation. The Belgian concerts continued until German troops entered Brussels in the first days of World War One, when the transmitter had to be destroyed.

On the eve of war the American ether crackled with countless signals, the inevitable clatter of morse code, but also speech, phonograph records, poems, lectures, sermons, news, singing, time signals and weather predictions. On the other side of the Atlantic, the Continent was about to be torn apart by war, and in Britain the Marconi Company was still convinced that morse code was the most reliable and efficient form of communication between ship and shore. Because of this, it was a widely held belief that telephony had no real place in the evermore crowded ether.

This attitude did not last for long even though it may well have been justified as telephony transmission was still very crude and often 'splattered' across large sections of the radio spectrum causing severe interference. However the Great War of 1914-18 saw an enormous increase in the use of wireless by early experimenters and inventors now in uniform. Compounds and barracks were

often rigged to receive 'broadcast messages', while a civilian eccentric was known to have rigged up an induction system to talk from his house to the stables.

The requirement for reliable communications and reporting, especially upon the fall of artillery shells, meant that radio and thermeonic valve design moved at an unprecedented rate. The development of the valve provided the first satisfactory device for producing continuous oscillation that could have speech imposed upon it and broadcasting came another step nearer. In the November of 1915 human speech reliably crossed the Atlantic, transmitted from the US Navy Station at Arlington in Virginia by the American Telephone and Telegraph Company working with the Western Electric Company. The few faint words were heard 3,500 miles away by US radio telephone engineers on the Eiffel Tower in Paris, although Fessenden's Brant Rock Station had undoubtedly achieved this feat by accident some nine years before. (*See Appendix B.*)

The 'War to End All Wars' brought a tremendous cost in suffering, death and waste, but as usual war spurred the advance of technology and radio was no exception. This rapid technical development in hardware was met by an equal number of young men both fascinated by, and now well trained in the new art of wireless communication. By the armistice of 1918, radio had been transformed from an inventors plaything, into a faithful 'workhorse'.

It was in a Britain struggling to return to normality after the horrors of the war, that the first British broadcasts made their lonely voices heard. The radio amateur community, many of them fresh from the trenches of Europe, began earnestly experimenting with transmitted speech instead of morse code. The old pre-war arc 'n' spark transmitters had been discarded, for the new valve oscillators could be modulated far more easily. A few of these radio 'Hams' quickly became local celebrities in their own right, their spirit of adventure meant that their fellow amateur audience could listen to anything from gramophone records to humorous articles and local news items. The licence laws technically stated that music could be broadcast solely for testing purposes, but many amateurs found that little could surpass the excitement that the successful transmission of a piano, flute or cornet could bring. To call them the 1920's equivalent of today's 'Disc Jockey' is wrong, for they were far more. They were experimenters, inventors and innovators, but most of all they were pioneers. People still vividly remember these early days, Leslie McMichael's voice on the crystal set:-

"This is 2FG McMichael West Hampstead transmitting."

One radio enthusiast, Harold Walker, even had his own theme song for his amateur station 2OM. His test record was to become his signature tune, 'Three O'Clock in the morning' crackling into headphones soon became a firm favourite. People like McMichael and Walker, John Scott Taggart (G2LR) and Gerald Marcuse (G2NM) were in their own area, at their own particular moment to become household names. By 1920 there was a gradual increase in the amount of telephony available to the interested radio enthusiasts. On wavelengths between

180 and 1,000 metres gramophone records and even live piano solos could often be heard. However the main drawback was that no specific timetable was available and amateurs frequently tuned in just as the music died away. Popular Wireless assured readers that these impromptu amateur concerts could be caught between eight and twelve but a bigger name then entered the arena. Without a doubt broadcasting in this country was born due to the intervention of the company that bore the name of the father of wireless; Marconi.

The first ever British broadcasts were in the great tradition of radio, complete accidents. Two Marconi engineers, H.J. Round and W.T. Ditcham, who ran the high power experimental station at the Marconi Works in Chelmsford first brought entertainment to the airwaves. Their transmitter tests soon became far more than telephony experiments, their occasional evenings of music and news becoming true firsts in the history of radio. However it is interesting to note that great steps in science have often occurred simultaneously in two locations with no cooperation or contact between the two events. It is simply that the time has been right. In England, Chelmsford was always primarily an experimental station and as such it never appeared with any regularity. In the New World, broadcasting was also taking its first tentative steps into the airwaves. Station KDKA in Pittsburgh USA took to the airwaves some nine months after Chelmsford started its brief and spasmodic career. Claims to their positions in the history of radio depend on many factors, Chelmsford's lack of regularity, KDKA's commercial aspirations and the fact that in America several experimental broadcast stations had already come and gone. KDKA and Chelmsford may vie for position with dates and purpose, but one fact must lie beyond contention.

It is a small village in Essex that beyond all others can claim to be the birthplace of British broadcasting, due to its innovations and regularity of service. It faithfully appeared on the air every Tuesday evening for half an hour, at eight o'clock in the evening for almost a year. The village is called Writtle, the radio station that ran there was known as 2MT, and it made history.

2

AMERICAN PERSPECTIVE

"Air concert picked up by radio here"

Department Store Advertisement, 29th September 1920.

"Do you mean to tell me that people can hear me over this damned dingus ?"

Mayor Lew Shank, Indianapolis, 1921.
(In front of a live microphone)

To say that broadcasting started at Writtle would be untrue. It is fairer to simply state that the first regular British broadcasting station operated from that small Essex village. However the birth of broadcasting worldwide has its origins in the country on the opposite side of the ocean Marconi had only 20 years before spanned with such difficulty. It was America that jumped into the radio explosion with both feet as the post war decade started, and established a precedent for chaos that was to hamper the development of broadcasting in Britain up until the formation of the BBC.

The early attempts at broadcasting in the United States of America were purely experimental, but historic in their own right. The first experimental broadcasts were transmitted from the top floor of the Parker Building on Fourth Avenue at 19th Street, New York in February 1907 by the DeForest Radio Telephone Company. The broadcast was heard by groups of people specially assembled in New York by the Company, and by ships operators and local amateur radio enthusiasts. It was widely regarded as being a success, although at times it was the victim of quite severe interference from other stations morse code transmissions, and even amateur radio enthusiasts experimenting with speech. Their often ribald comments, and some marked signal fading due to atmospheric conditions led the New York Times to report that "The homeless songwaves had lost their way".

To start with, the programmes consisted solely of Columbia gramophone records, but DeForest soon came up with the idea of having a live performer on the wireless. In September of 1907 the Swedish soprano Eugenia Farrar sang 'I Love You Truly' and 'Just a wearyin' for You' in a broadcast from the USS Connecticut in the Brooklyn Navy Yard. In 1909 DeForest also brought his well-known mother-in-law, Harriet Stanton Black, to the studio to give the world's first

broadcast talk. The subject she expounded at length was currently topical. Women had been demanding the vote for several years and the new technology of radio provided a superb platform for the women's suffrage movement. The station created two other notable 'firsts' by presenting the world's first 'outside broadcast'. On 13th January 1910, listeners were able to hear the great Enrico Caruso sing live from the Metropolitan Opera House. It was a double bill of Cavalleria Rusticana and Pagliacci, for which DeForest used two microphones, one on stage and the other in the wings. A 500 watt transmitter was installed in an attic room of the opera house, just off the ballet rehearsal room, and the antenna was suspended between two bamboo fishing poles on the roof. DeForest then made history again by managing to persuade an artiste of international repute to actually perform in a studio. Less than a month after Caruso's broadcast, Prima Donna Mme. Mariette Mazarin sang for the wireless.

These experiments soon spread. Thomas E. Clark had started with an electrical appliance store in 1899 but soon formed the Clark Wireless Telegraph and Telephone Company, Detroit. He installed wireless on several of the Great Lakes' steamers, including the 'Garland', the 'Sappho' and the 'Promise' and began transmitting record programmes in 1907 for the benefit of the passengers. Clark had built transmitters in a number of the city ports served by the steamers, the whole system allowing five people on board the ships to listen in at any one time.

Two years later Charles 'Doc' Herrold, widely quoted as being a 'genius lacking formal qualifications', began broadcasting from his 'School of Radio' at the Garden City Bank Building at San Jose, California in January 1909. This station began by transmitting gramophone records, but soon added live vocalists and, according to one claim, news on a once-weekly basis. Herold had a great enthusiasm for radio, and when his first child was born in 1914 his wife held the newborn infant up to the microphone so that friends could hear its cries. Charles's station went from strength to strength, being assigned the call letters SJN in 1912. Within two years it had become the first broadcasting station in the world to establish a daily scheduled service. The success was shortlived, for the outbreak of war stopped the station's activities. Herrold did try to revive it after the armistice, but was unable to raise suitable finance. He was forced to sell out to the local Avenue Baptist Church, who then ran the station under the callsign KQW. Several subsequent owners finally led to the station being purchased by Columbia Broadcasting Systems to become KBCS San Francisco in 1949. The new station installed a 50,000 watt transmitter instead of Herrolds 15 watt school system, but KBCS is now generally acknowledged to be the oldest broadcasting station in the world.

Rival claimants to this honour are many, although they are all American. Lee DeForest's station had been 'regular' in the sense that it continued broadcasting for four years without any long intervals off the air. The station started up again in 1916 when he installed a rebuilt transmitter on the roof of his laboratories at High Beach in the Bronx, New York. He immediately began to broadcast record concerts five times a week until, as with Station SJN, America's entry into the war

put a stop to all non-essential use of radio telephony. Three years later DeForest's Station reopened as Station 2XG in 1919, and took several important steps towards the realisation of radio as a real entertainment medium. It appointed the first paid announcers (Bill Gowen and Bill Garity), as well as the first programme director in history, Richard Klein. Throughout the history of radio one problem has been in how to actually define the word 'Broadcasting'. The following sets out a possible criteria against which broadcasting stations can be measured.

(1) That it is a radio telephonic information and entertainment service.

(2) It is sent to the general public, not just technical personnel or radio amateurs.

(3) That it is sent on a regular schedule.

(4) This schedule is then advertised, in advance, to the public.

So much of the early American work cannot be counted as true broadcasting because it failed to meet one, or all of these criteria. Even Lee DeForest's early work must be excluded, for although his Company actually manufactured wireless sets, he never thought to simplify them so that they could be used by the general public. Station 2XG did represent the halfway stage between purely experimental radio transmissions and a fully fledged entertainment broadcasting service. But early in 1920, 2XG came to a premature end when DeForest decided to move the station from High Beach to the world's tallest building on 46th Street and Broadway. In doing so, however, he unwittingly broke the law by transferring his transmitter from the Bronx, where it was licensed, to Manhattan, where it was not. The New York Federal Radio Inspector not only notified DeForest that he must cease broadcasting forthwith, but at the same time ruled that 'there is no room on the ether for entertainment'. This statement was later to be repeated by the Inspector's English counterpart, the Postmaster General, when he closed down the Chelmsford experimental station.

The American interest in radio telephony transmission began when the science of radio was in its infancy. This enthusiasm culminated in an epidemic of transmitters established during the summer of 1920. March saw 77, in April 76, in May 97, in June 72 and in July 76. The problem was to get worse, within three years more than 500 stations had come on 'the air' in the United States alone. Clumsy, grotesque towers and aerial masts grew across the nation, with dozens of stations, both amateur and professional all using the same or nearby wavelengths. Vast as America is, serious problems arose because the radio stations all craved an audience and consequently they all tended to cram into densely populated areas. By January 1923, 72 universities, colleges and schools had broadcasting licences, together with 69 newspapers, 29 department stores, 12 religious organisations,

several city governments and even automobile dealers, theatres and banks. Radio in America had simply exploded, by 1922 sales of radio sets and parts reached over 60 million dollars, rising to 136 million dollars in 1923 and 358 million dollars in 1924. An official BBC historian captured the situation when he wrote:–

> "It would be true to say that at times in England we could not hear anything for the silence whereas in America they could not hear anything for the noise."

The problem was in part the fault of the United States Department of Commerce who had insisted on issuing all licences on one spot frequency of 360 metres (833.3KHz), for news, lectures and entertainment. The only other permitted frequency was 485 metres (618.6KHz) for Government functions such as crop and weather reports. It was obvious that some form of control was urgently needed and the Federal Radio Commission (now the Federal Communications Commission) was set up to administer broadcasting in the United States.

Despite the ensuing chaos, two of these new stations are considered to have initiated the modern era of American broadcasting. One began its career as the amateur station 8MK Detroit, and began transmitting experimentally from the offices of the Detroit News newspaper early in 1920. The station presented regular scheduled broadcasts, consisting mainly of record concerts. These were advertised from 20th August 1920, the first time that daily programme announcements had appeared in any newspaper.

The other station developed from Dr Frank Conrad's amateur station 8XK, which had been built to carry out telephony transmission range tests, and actually operated from the back of Conrad's garage. During these tests Conrad often left the transmitter to adjust other equipment or monitor his own signals using gramophone records to supply the signal. To his surprise he received a large number of letters asking for more music, especially from ex-service personnel who having met radio during the war had home built crystal sets to receive commercial transmissions. In sheer self defence Conrad found himself putting on two recitals a week on Wednesday and Saturday nights. Entertainment broadcasting had come to America and Pittsburgh by accident.

On the 29th September 1920 Joseph Hornes' department stores ran an advertisement for their new range of $10 (and upwards) radios currently on sale in the store's west basement. The promotion was inserted into the Pittsburgh Sun and (retaining the original grammar and spelling) read:–

> 'Air concert picked up by radio here'
>
> Victrola music, played into the air over a wireless telephone, was 'picked up' by listeners on the wireless receiving station which was recently installed here for patrons interested in wireless experiments. The concert was heard Thursday night about 10 o'clock and continued 20 minutes. Two orchestra numbers, a soprano solo – which rang

particularly high and clear through the air – and a juvenile 'talking piece' constituted the programme.

The music from a victrola pulled up close to the transmitter of a wireless telephone in the home of Frank Conrad, Penn and Peebles Avenues, Wilkinsburg. Mr Conrad is a wireless enthusiast and puts on wireless concerts periodically for the entertainment of the many people in this district who have wireless sets.

Amateur Wireless Sets, made by the maker of the Set which is in operation in our store, are on sale here 10 dollars up.

'West Basement

The sets were all sold within two weeks. The response to this advertisement, and the involvement of Dr Conrad quickly came to the attention of the Westinghouse Company. Speculating on a totally unknown market the Vice President of the Westinghouse Company, Harry P. Davies, authorised Conrad (who was actually an engineer with Westinghouse) to build a larger transmitter. It is this action that has always promoted KDKA's claim as the earliest non-experimental broadcasting station in the world. On the roof of one of the taller buildings in the Pittsburgh Westinghouse Works a small shack was built and a 100 Watt transmitter assembled and installed. The whole station was put together with amazing speed by Conrad's team. The antenna ran from a steel pole on the roof to one of the power house smoke stacks. On 16th October Westinghouse applied to the Department of Commerce for a special licence and were temporarily allocated the amateur callsign 8ZZ. On 27th October the Department issued the callsign KDKA, normally the call-letters of a commercial shore station, and authorised transmission on 360 metres, but a channel away from the normal amateur and broadcast bands.

The first broadcast of the new station was timed to coincide with the American Presidential election. The Pittsburgh Post agreed to telephone results to the hastily prepared station as they came over the national wire service. To fill in the gaps a hand cranked phonograph provided some musical interludes, together with some background comments and information on the ensuing contest. The news and concert started at 8 pm on the 2nd November 1920 and ran until well after midnight, reporting on the returns of the battle between Warren G. Harding, US Senator for Ohio, and James M. Cox, Governor of Ohio. The station closed down when it became clear that the nation had decided to return the former as its President for the next five years. The success of this live event was followed by a series of one hour concerts each evening between 8.30 and 9.30 pm. These gave all manner of local acts a chance to air their talents, although the Westinghouse Band found that bad reverberation in the studio meant that their broadcasts had to come live from a large tent on the roof of the building. KDKA's audience still only

numbered several hundred interested people, but the stations object was solely to provide a programme service entertaining and informative enough to persuade listeners to buy Westinghouse domestic radio sets and components. These had been hurriedly designed and constructed for the inaugural broadcast, at great financial risk, but had been made simple enough for any ordinary non-technical person to use. It was to be an inspired business gamble, for Westinghouse, Conrad and radio in general, immediately gained a great deal of publicity. The new project had succeeded beyond anyone's wildest dreams. Westinghouse's speculation had paid off. It is interesting that even after this success the Americans never used the term broadcasting. Typical was Station WJZ that operated from Newark, New Jersey which called their programmes simply a 'Radio Phone Service'. Whatever the name, American broadcasting had found its feet, with a regular station not aimed at an experimenting amateur audience. America had broadcasting, but eight months earlier England had shown the world how.

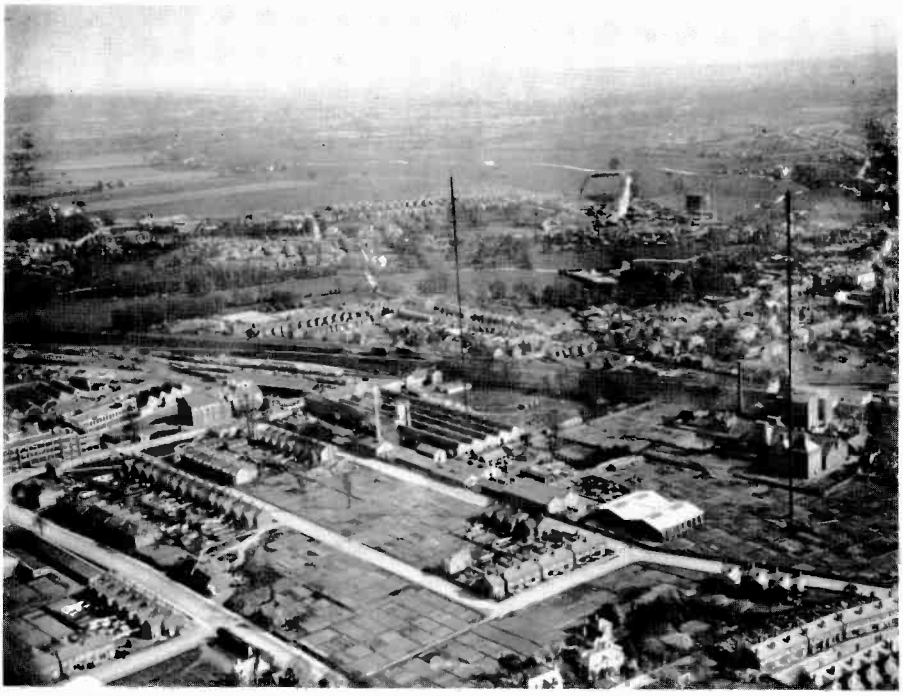
3

THE CHELMSFORD BROADCASTS

"Bradshaws train time table ?
Well, it was somewhat tedious . . "

The armistice, signed on the eleventh hour of the eleventh day of the eleventh month of 1918 brought peace to Europe. As the Marconi Company returned to peace time activities it commenced production of a range of high power wireless telephony transmitters (¼Kw, 1½Kw, 3Kw, 6Kw 'panel sets') and started design work on a range of high power valves. In March 1919, just four months after the end of the First World War, one of these new 3Kw wireless telephony transmitters was installed at Ballybunion in Ireland under the direction of Captain Henry Joseph Round. Round had joined the Marconi company in 1902 and was undoubtedly a brilliant engineer, far ahead of the times in terms of his ideas. His approach to technical problems was renowned, he examined it from every conceivable angle, turned it inside out and upside down, and then instantly come up with the solution for the most obscure faults. He also had a great aversion to red tape, protocol and technical mystique, preferring things to be as simple and as practical as possible. It was these skills that had made him a close personal assistant and friend of Marconi, whose own great talent was to surround himself with the right men for the job. Round's lone wolf inventive fervour had won him the Military Cross in 1918 for his services in developing radio direction finding, and the design of airborne telephony equipment during the First World War. The actual award had to be sent to him in the post, as he refused it on the grounds that designing a direction finding system was not an individual act of gallantry. He was a bluff, forthright and extrovert man, who became Chief of Research at the Marconi Company, filing some 117 patents during his lifetime. The last one was in 1962 when aged 82, just four years before his death on the 17th August 1966. These included the screen grid valve, the RF pentode, aircraft wireless and of course, sound broadcasting.

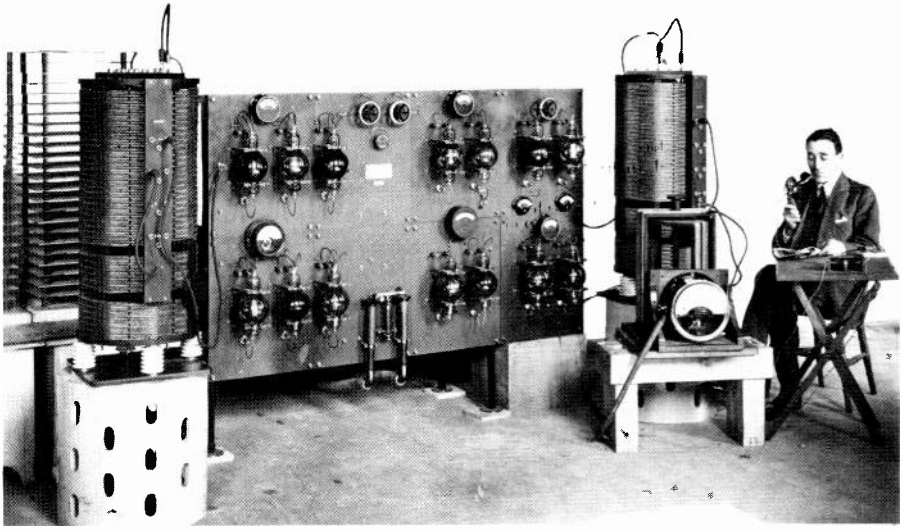
It was Captain Round's research into the high power transmission of speech and the development of the new MT1 and MT2 transmitter valves that led him to be in charge of the Irish station. The transmitter operated on a relatively long wavelength of 3,800 metres and generated around 2.5 Kilowatts using just three main valves. This was sufficient to allow a Marconi engineer, W.T Ditcham, to become the first European voice to cross the Atlantic to a receiving station located



3. Chelmsford from the air. The New Street works in 1920.

at Louisbourg in Nova Scotia. The success of this initial experiment was to lead to far greater things. In late December 1919 the Marconi Company then installed and began testing a 6Kw input telephony transmitter under an experimental Post Office licence, using the callsign MZX. Its purpose was primarily to investigate the properties of long distance speech transmission. The new Chelmsford transmitter fed a huge 'T' aerial suspended between two 450ft towering 'drainpipes' which dominated the company's New Street works and the town. Normally this would not have raised much comment as the company was always testing new transmitters at its Chelmsford sites, but this time something extraordinary occurred. The Company had developed a standard testing format for new transmitting equipment, and in this case Marconi land stations throughout the country were told to listen for anything heard on 2,750 metres during specified periods. The times allocated for the early 1920 tests were between 11.00 and 11.30, or 20.00 and 20.30 GMT, for two weeks from 23rd February except on Saturday nights and Sundays. The broadcasts were otherwise unannounced, so the Marconi engineers in charge, fresh from the success of the Irish station, W.T. Ditcham and Captain H.J Round, considered that they had a free rein. In 1920 the airwaves were still relatively empty with just 32 high-power

radio stations using between 100 and 300Kw listed worldwide, from Bordeaux (callsign LY) on 23,450 metres to Nantes (callsign UA) on 9,000 metres using an arc or alternator to transmit only morse code.



4. W.T. Ditcham at the Chelmsford transmitter.

Ditcham and Round were becoming bored with the standard speech tests for telephony transmissions used by the Marconi Company at that time. Weeks of continually repeating railway station names or reading Bradshaw's train timetable broken only by the occasional time check could drive even the most dedicated of company men to distraction. They decided to do something totally different. On the 15th January 1920 they started the first ever true telephony 'broadcasts' in Britain by transmitting a programme of speech and gramophone music from the Chelmsford works. This historic accident could well have gone unnoticed, but 214 appreciative reports soon arrived from amateurs and ships' operators alike. The radio amateurs were enraptured to hear words and music on their radio sets at last, and they reported this in glowing terms to the Marconi Company. The Chelmsford station had been heard from Norway to Portugal, the greatest reported distance being 1,450 miles. The telegram from Madrid reported exceptional signal strength and quality and the engineers realised that they had struck 'gold'.

The young engineers became more ambitious. The 6Kw set was dismantled and replaced with one rated at 15Kw input that was made available to Ditcham and Round. (*See Appendix D.*) They then set about their task with great enthusiasm

and for a brief period from 23rd February until the 6th March 1920 their tests became a regular series of 30 minute programmes. These were aired twice daily primarily as a wireless telephony news service on a wavelength of 2,750 metres. This was the same frequency used by the historic Marconi site down on Poldhu Point in Cornwall from where the first morse letter 'S' had been transmitted across the Atlantic some 19 years earlier. Despite the enthusiasm generated by the Chelmsford radio events, the Marconi Company still believed that the future of wireless telephony lay solely with commercial speech transmission, not entertainment. However it is to the Company's credit that it was always willing to allow individual engineers to experiment and suggest without complaining too much about money. It was to do that just now, Ditcham and Round were given the free hand that their work deserved. Additional entertainment was soon arranged and W.T. Ditcham soon became 'head cook and bottle washer', organising programmes, announcing news and music items ably supported by A.R. Burrows and W. Petterigill. The final programmes that Chelmsford gave to the nation consisted of readings from newspapers, gramophone records, and for the first time, live musical performances.

The instrumentalists who provided these first live radio interludes were drawn from the Marconi engineering staff. Mr G.W. White, an excellent musician organised the short musical passages and whenever possible played the piano, Mr A.V.W. Beeton featured on oboe and Mr W. Higby on cornet. Vocal numbers were rendered by Mr Edward Cooper, a tenor with Freddie Munnions concert band the 'Funnions', otherwise employed in the Marconi mounting shop. Despite the experimental nature of these telephony tests the unofficial musical interludes soon gained a large following. The spirit of adventure was maintained when the first paid artiste, Miss Winifred Sayer (later Mrs Collins) was invited to sing. Miss Sayer worked for the Hoffman Manufacturing Company in Chelmsford but sang as an amateur soprano with the 'Funnions' in the evenings. She was paid the handsome fee of ten shillings nightly for three half hour concerts from the new studio, a disused packing shed. She was later informed by the Managing Director of the Marconi Company, Godfrey Isaacs that she had helped to make history, but at the time she remembers that she was unimpressed by the new entertainment medium. She called the whole affair a 'Punch and Judy show' and it was a very primitive beginning to radio broadcasting. The studio had terrible acoustics, it was untidy, dark, cold and there was no music for the lady's recital. Miss Sayer had to take her key from a tuning fork, which meant that all the songs had to be short and simple using an upturned telephone mouthpiece as a crude microphone.

Despite these shortcomings the Chelmsford programmes soon captured a wide amateur audience. The radio 'hams' were all accustomed to listening to two noted European stations that transmitted regular time signals. These were the Eiffel Tower station (callsign FL) in Paris, France on 115kHz (2,600m) and the German station POZ at Nauen, operating on 77kHz (3,900m). Both of these stations could be tuned in on a standard Post Office antenna, and could be separated by a crystal set. The stations became immediately recognisable by their sound, and provided

important landmarks for wireless calibration. The French station emitted a deep low note, while the German sent a high note that was usually a little weaker. The phrase the amateurs remembered was that 'Nauen squeaked and the Tower squawked'. The time signals were accurate to a fraction of a second and were transmitted at regular 12-hour intervals.

The routine transmission of daily time signals from the Eiffel Tower Observatory had begun in 1910 and had continued without a break making Paris the wireless time centre of the world. The principle morning signals were transmitted from 9.26 to 9.30am and from 10.44 to 10.49am GMT with seven groups of time signals transmitted during the day, the last group ending at 10.49pm. Tuning to the Chelmsford station on its slightly longer wavelength created little problem, and further interest was generated when the Eiffel tower also started to broadcast music, stock market and weather reports for two hours a week using about 400 watts at the aerial.

On 20th February 1922 the Van Diaz wireless press service was opened for the purpose of transmitting press and market reports from the Amsterdam stock exchange on 2075m, eight times per day between 7.55am and 4.10pm GMT to 42 non-technical subscribers who each rented a four valve receiver. In Germany the Konigwusterhausen station (callsign LP), which was some 575 miles from London also broadcast for half an hour each day on 4,000 metres, later moving to 2,500 metres. (1,250m by 1928.)

The new concept of speech and music crackling over the airwaves into the front rooms of ordinary people was poised to revolutionize entertainment, and was enthusiastically greeted by radio amateurs and newspapers throughout Europe. The amateur enthusiast was always willing to try anything, and with large numbers of people experimenting chance discoveries were bound to occur. It even appeared that the popularity of the experimental wireless stations, especially Chelmsford, Paris and the Dutch station PCGG (*See Appendix F.*) had modified the somewhat reticent attitude of the Marconi Company toward using wireless telephony for entertainment purposes.

Remembering for a moment the experimental nature of these tests it is interesting to record that on the 6th March 1920, a telegram (that still survives in the Marconi archives) arrived at Chelmsford. Mr B.T. Fisk, Managing Director of the Australian Marconi Company, reported that weak but steady signals were heard in Melbourne on two of the Chelmsford broadcast schedules. Even though speech could not be clearly discerned, it appeared to all that the future of broadcasting looked very bright.

4

DAME NELLIE SINGS

"There must be a great future
for wireless concerts."

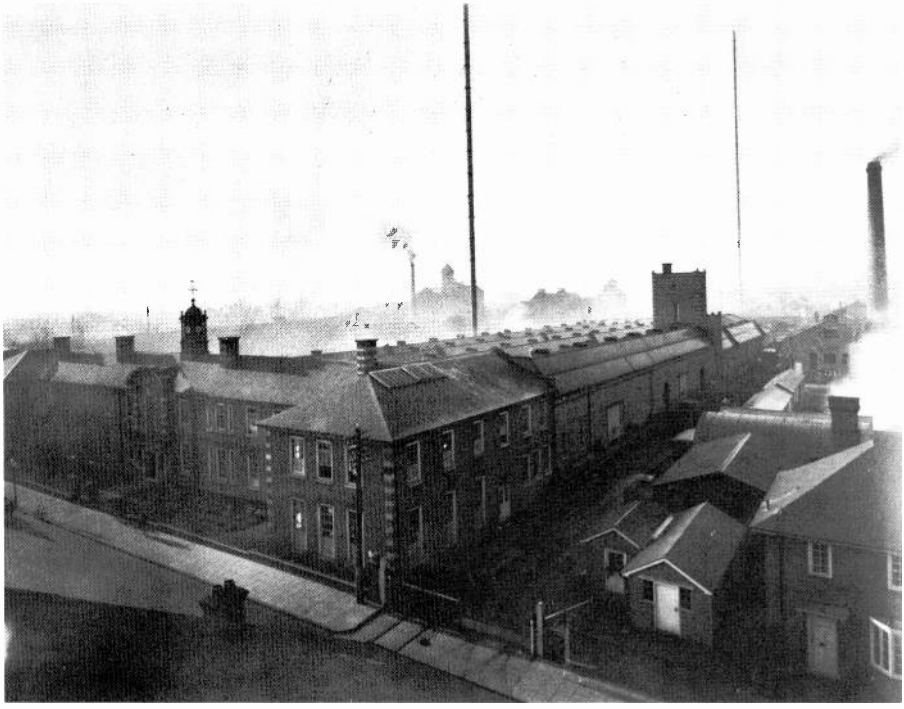
Dame Nellie Melba's Secretary.

A turning point in this history of British broadcasting and radio was the first broadcast by a recognised professional artiste. The famous Australian Prima Donna Dame Nellie Melba gave her historic 30 minute concert from the Chelmsford works on 15th June 1920. The event was commissioned by Lord Northcliffe the proprietor of the Daily Mail newspaper, but getting the great lady to agree was difficult. When first approached the singer remained adamant that her voice was not a matter for experimentation by young wireless amateurs and their 'magic playboxes'.

It is reputed to have taken all the persuasive talents that Lord Northcliffe could muster to change her mind. The great lady was pacified when the planned concert, its possible rewards and publicity were explained in detail, and she decided to sing. There was just one problem, there was nowhere for her to do it. In the weeks preceding the concert everything humanly possible had been done to improve the 'studio' acoustics, appearance and general quality of the microphone and transmitter circuits. It had been originally intended to put in a long land line right across the Marconi New Street works so that the famous singer could perform in more pleasant surroundings. This was duly laid in, but at the last moment it completely burnt out due to the high currents induced by initial test transmissions. These tests also destroyed the modulating valves causing great consternation among the already panic stricken engineering staff.

When the great day arrived, despite the valiant efforts of all concerned, the ex-packing shed was still a gloomy place, its floors and walls bare of any decoration. The building was full of innumerable wires and pieces of equipment, although a thick pile carpet and several mats had been placed on the floor almost at the last moment. Dame Nellie Melba was shown the transmitting equipment, and the antenna masts by the head of the Marconi Company Publicity Department Arthur Burrows. Burrows remarked that from the wires at the top her voice would be carried far and wide. Her comment has become a piece of radio folklore:–

"Young man" she exclaimed,
"If you think I am going to climb up there you are greatly mistaken."



5. Marconi New Street works.

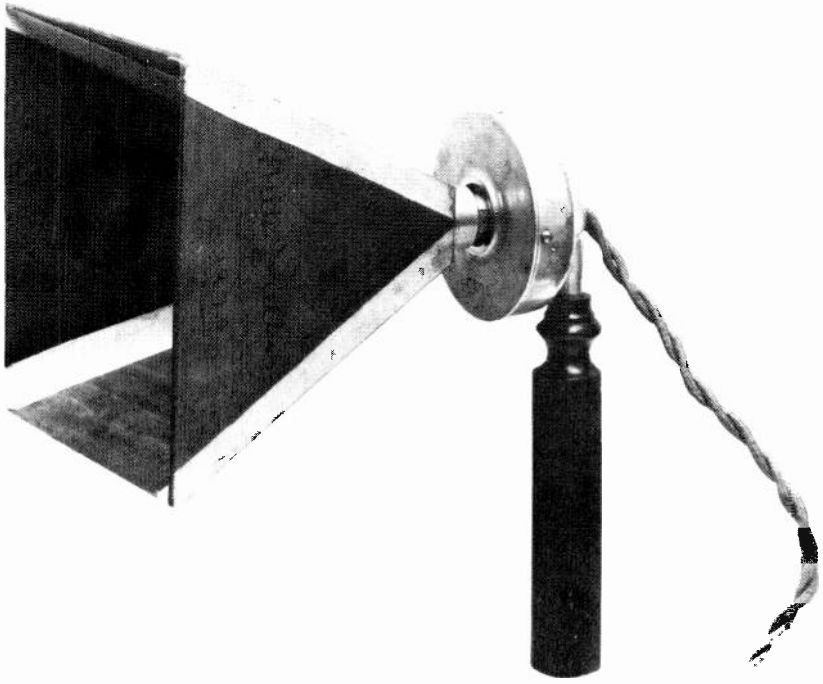
It seemed that all was set for the great event, but Dame Nellie insisted that before she began she must have her favourite dinner of chicken, champagne and special unleaven white bread. This clause, or menu, was specially written into her contract, and had to be imported for it far outstripped the resources of the normal company canteen. After her hearty meal, Dame Nellie was escorted to the studio. She passed no immediate comment on the room (to the relief of the engineers who had even hurridley whitewashed parts of the walls) and seemed unworried by the spartan surroundings. Her first glance at the studio floor brought the initial reaction, a firm kick at the new carpet. Dame Nellie announced to the assembled personages of the Marconi Company :–

"First of all we'll get rid of this thing!"

Dame Nellie was not a lady to be ignored, the new carpet was hastily rolled to one side revealing the bare stone warehouse floor, but despite this attempt to improve the rooms acoustics the engineers were still worried as concert time approached. To fail now, with the whole world listening, might well endanger the cause of radio broadcasting for years to come. The Daily Mail reported that:–

> At a quarter past seven this evening a great singer will hail the world by a long trill into space. Thousands of people on land and at sea are eagerly looking forward to hearing the glorious voice of the Australian nightingale Dame Nellie Melba swelling through space into their instruments.

After an interval for photographs and other formalities the programme was arranged to start. The transmitters were run-up but just as Dame Nellie was about to sing the last photographer in the transmitter room let off a flash bulb. The engineer on the switch panel saw the reflected flash, panicked and instantly pulled out all the switches so that the painful process of transmitter run-up had to be gone through again.



6. Dame Nellie Melba's microphone. The telephone handset and its cigar box wood shield used for the historic broadcast has been preserved as a prized exhibit of the Marconi Company archives. After the event Dame Nellie autographed the wood cone, and her signature was also engraved on the handset. Both are still perfectly legible to this day.

It was only a minor technical hitch. On a perfect summer evening it seemed that anybody who could pick up wireless waves throughout the country held their breath as Dame Nellie Melba stood in front of the microphone. Even this was something of a compromise, consisting of a telephone mouthpiece with a 'home-made' horn of cigar-box wood fastened to it during the final afternoons testing. The whole contraption was suspended from a modified hatrack by a length of elastic, but it has survived intact to this day. A hushed silence fell over the first-ever broadcast studio, and one of the Marconi engineers announced:

> "Hallo, Hallo, Hallo!" "Dame Nellie Melba, the Prima Donna, is going to sing for you, first in English, then Italian, then in French."

The Marconi Company then apologised for not having control over the 'atmospherics'. A chord was struck and at 7.10 pm precisely listeners heard their first fleeting notes as Dame Nellie ran up and down the scale. This preliminary sound check brought a flurry of adjustments in the studio, the engineers swinging condensers and tapping meters. (Condensers became known as capacitors to later generations). The distances between microphones, singer, accompanists and the small grand piano were all critical in maintaining as high a quality as possible.

Mr. Frank St Leger played the first two songs in the programme and M. Bemberg, the French Composer, played the third. It was, as the Daily Mail reported, a remarkable scene. Outside the 'studio' a large crowd had gathered but the police requisitioned to keep order were not required.

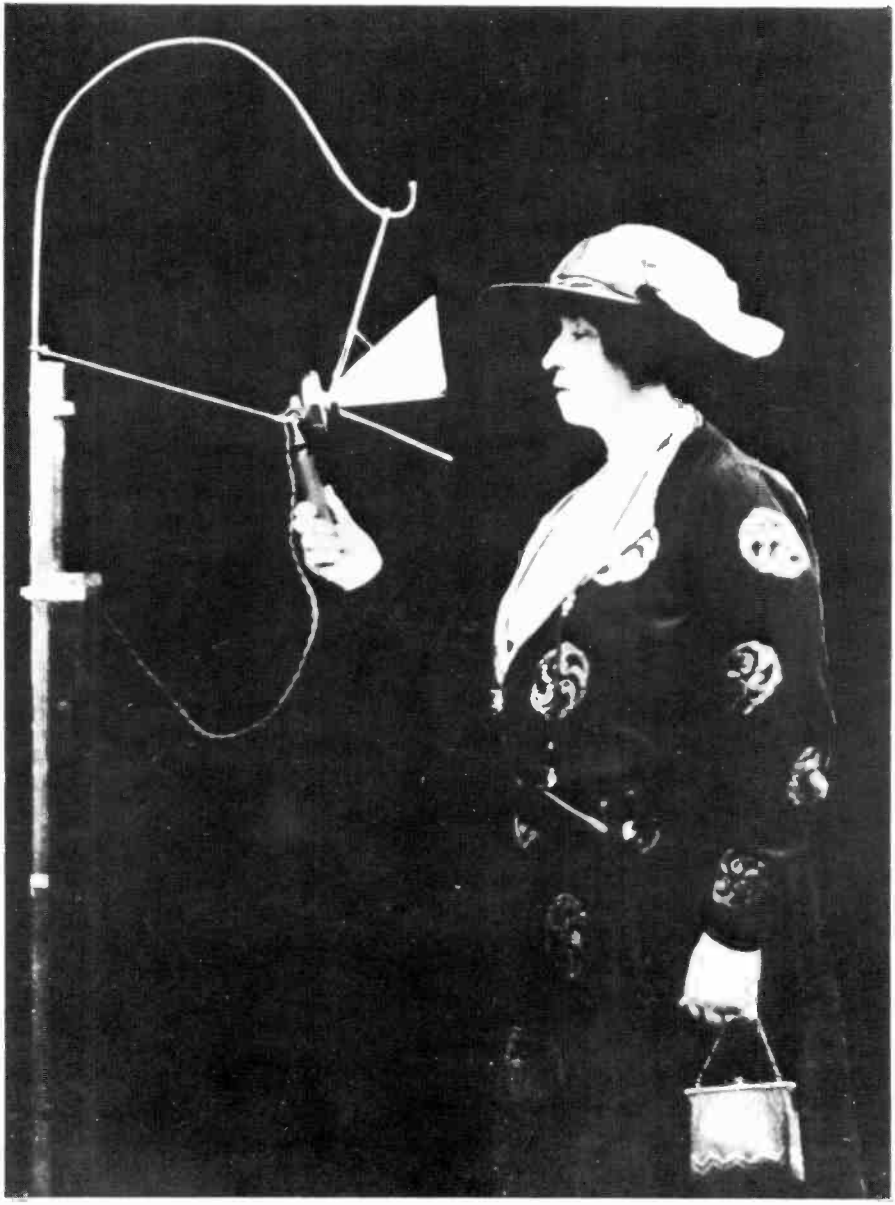
Inside the room another group had assembled that included Mr and Mrs Godfrey Isaacs, Mr and Mrs George Armstrong, Lord Northcliffe, Dame Nellie's son and daughter-in-law and Sir Campbell Stuart. The first lady to broadcast from the Chelmsford site, Miss Winifred Sayer had also come along and remembers peeping around the door to watch the scene.

Dame Nellie called her long silvery trill her "Hallo to the world", and the world seemed to be listening. All over the country wireless enthusiasts frantically tickled their cat's-whisker crystal sets, desperately seeking a stronger signal. Headphones were clamped tighter, whole households lapsed into total silence. Dame Nellie took a deep breath, and began to sing.

> "Punctually at a quarter past seven" said a newspaper the next morning, "The words of 'Home Sweet Home' swam into the receivers. Those who heard might have been members of the audience at the Albert hall."

This rendition was followed by Bemberg's 'Nymphes et Sylvains' (in French), and Puccini's 'Addio' from 'La Boheme' (in Italian). That was the end of the scheduled concert. A man's voice announced:–

> "Hallo, Hallo, We hope you have enjoyed hearing Melba sing, Good Night!"



7. Dame Nellie Melba sings at Chelmsford. 15th June 1920. Contrary to many published captions for this photograph, Dame Nellie Melba never sang for 2MT at Writtle.

However, as Captain Round recalled, the transmitter had initially behaved very well during the concert, but had started to play up at the start of Melba's third song. Listening in anxiously on a wavemeter in the equipment room Round watched in horror as mid way through the rendition one of the transmitter valves failed. He immediately rushed from the transmitter room to the shed where Melba was singing and waited for her to finish the last song.

Captain Round:–

"Madame Melba, the world is calling for more"

Dame Nellie Melba:- "Are they? Shall I go on singing?"

This was exactly what Round had hoped for, but whereas he had expected just one more song to make up for the partially lost one, in fact the good lady sang four. While Round was 'pleading' for another song Ditcham had corrected the fault and a minute or two later the notes of a piano floated into listeners front rooms and Dame Nellie Melba then sang Bemberg's 'Chant Venitien'.

After a brief pause for further adjustments to the transmitter, Dame Nellie gave a further encore, repeated 'Nymphes et Sylvains', and then sang the first stanza of 'God save the King'.

The wireless sets of the nation, indeed the world then lapsed into silence. The concert was over, the great lady had sung her considerable heart out and the assembled audience both inside and outside the studio spontaneously applauded. It was now up to the engineers to have relayed this to the audience with the clarity it deserved and hope that the partial failure had been compensated for by the extra songs. They knew that the audience was potentially huge and liable to be very critical, indeed nearly 600 new licences had been issued in the two months up until the broadcast.

Within days the Marconi Company received its answer, enthusiastic letters from the four corners of the world poured into the Chelmsford office, as amateurs and ships' operators reported how they had sung along. Every commercial station in the world had tuned in, and amateurs amused themselves by listening to the wireless stations at Lymphe and Croydon discussing the performance between songs.

The Marconi Company had supplied to the Daily mail a complete list of all stations and ships that were within range of Chelmsford. They received telegrams or letters from most.

LISTENING-IN AT SEA

OPPORTUNITIES FOR PASSENGERS IN MANY LINERS

The Marconi Company supply the following list of ships which should be in position this evening to hear the concert:–

Bantry (Liverpool for W. Africa)
Bardie (London for USA)
Bosworth (London for Canada)

Bosworth (London for Canada)
Kanawha (London for Canada)
Olympic (Belfast for Southampton)
Megantic (Liverpool for Canada)
Caronia (Liverpool for New York)
Zeppelin (Gibraltar for Hull)
La Lorraine (New York for Havre)
Scotian (London for Canada)
Manaar (Manchester for India)
Mandala (Gibraltar for London)
Chakrata (Genoa for London)
Chyebassa (Port Said for Antwerp)
Kursk (Malta for Southampton)
Macharda (Liverpool for Gibraltar)
Walmer Castle (Cape for Southampton)

The Olympic has been specially advised of the concert.

The concert was a resounding success, Dame Nellie's voice had spanned the world and produced excellent signal reports from Sultanabad in Northern Persia, from Madrid, the Hague, Sweden, Norway and Berlin. Dame Melba described the event as being the 'most wonderful experience of my career' and took a great personal pride in being the first singer to broadcast all over the world. Dame Nellie continued to be intensely interested in broadcasting and contributed regular articles to the Daily Mail newspaper over the next few years.

Dame Nellie Melba's "Hallo to the World" had been heard with surprising clarity on every kind of wireless set imaginable. A large proportion of the 400 or so immediate replys that the Marconi Company received were from listeners using nothing more than a simple crystal set. These included several excellent reports from several Welsh listeners, but the record went to Mr P.S Smith on board the SS. Baltic at a distance of 1,506 miles using nothing more than a 'cats whisker' crystal wireless set.

In Paris the French Radio Electric Company of 79 Boulevard Haussmann attached an aluminium trumpet as a resonant amplifier to one of their receivers and relayed the concert to crowds that gathered in the street. Representatives of the Pathe Film Company made a film record of the scene and the Radio Electric Engineers also switched the sound through another line into the receiver of a gramophone which recorded the concert on a wax disc. It has since been reported that reception at the Eiffel Tower was so strong that gramophone records were also cut of the concert, although in 1970 the French broadcasting service, RTF could not find any evidence that this had occurred.

Dame Melba's secretary was bold enough to prophesy "There must be a great future for wireless concerts" although Dame Nellie Melba's ten thousand pound fee for the performance (paid by the Daily Mail) may have added a little to his enthusiasm. H.M. Dowsett wrote in Wireless Telephony and Broadcasting (1922-1923):-

> "The renown of the singer, the worldwide attention that was given to her performance and the great distance at which reception was made, all combined to give the Melba concert the atmosphere of a great initiation ceremony. The era of public entertainment may be said to have completed its preliminary trials and to have definitely launched its meteoric career from this date."

Dame Nellie Melba came to Chelmsford for one historic June evening in 1920. It is hard today to imagine the excitement that the broadcast caused. The Daily Mail on Wednesday 16th June 1920 reported

> "It was a wonderful half hour."

> "Art and science joined hands and the world listening in must have counted every minute of it precious."

and the paper ran the story as headline news for the entire week.

Wireless entertainment, indeed wireless telephony had passed its first test but the experiments continued. The second chance for the 'new system' to prove itself came in the shape of a delegation sailing from Liverpool to an Imperial Press Union Conference in Ottawa on 20th July 1920, aboard the Liner Victorian.

With the co-operation of the Canadian Pacific Ocean Service a 3Kw telephone/ telegraphy set was installed abroad the Victorian by the Marconi International Marine Communication Company. The same Company also placed a 1.5Kw cabinet telephone set aboard another liner, the Olympic. A 6Kw telephone transmitter was installed at Signal Hill in Newfoundland, where 19 years earlier Marconi had strained to hear the first signals to cross the Atlantic. As the Victorian steamed towards Canada the Press delegates were provided with morning and evening issues of the 'North Atlantic Times'. This was edited by Arthur Burrows, the Marconi Publicity Manager, from material received via the Poldhu 6Kw transmitter (callsign MPD), the Cornish end of Marconi's famous transatlantic success.

The delegates and passengers were also entertained by musical programmes from the 15Kw 'Melba' transmitter from Chelmsford broadcasting on the Poldhu wavelength of 2,750 metres and reproduced by in the first class passenger lounge by Brown loud speaker units. By 26th July the concerts were still being received when the Victorian was over 2,100 miles from Chelmsford, a world record for shore to ship telephony. The Victorian also transmitted gramophone records, these shipboard concerts being overheard by operators on many other shipping lines, and by the Olympic's newly installed telephony set. Two way communication between the liners Victorian and Olympic took place up to 570 miles, while two way speech was exchanged between the Victorian and the Signal Hill station at a range of 650 miles. This success was achieved on 25th July when greetings were exchanged between the Premier of Newfoundland and Lord

8. Wireless Reception on board the Liner Victorian. July 1920.

Burnham, leader of the Press delegation and President of the Empire Press Union aboard the Victorian.

The whole experiment had been a tremendous success, especially in the eyes of the very people able to provide as much publicity as possible for the new art of wireless broadcasting. At one stage the ship and shore station were exchanging passenger requests for specific records. Poldhu's rich musical note echoing around the Victorian's decks made the liner the stage for the first ever 'DJ' session, somewhat different to the next ocean bourne radio stations, when in the 1960's radio pirates were to rule the waves.

During the July and August of 1920 news items were regularly broadcast from the Chelmsford station to offices in Sheffield, Preston, Newcastle and Belfast and also to Norwegian, Danish and Swedish journals. In all cases reception was effected by use of six-valve receivers used in conjunction with frame antennas.

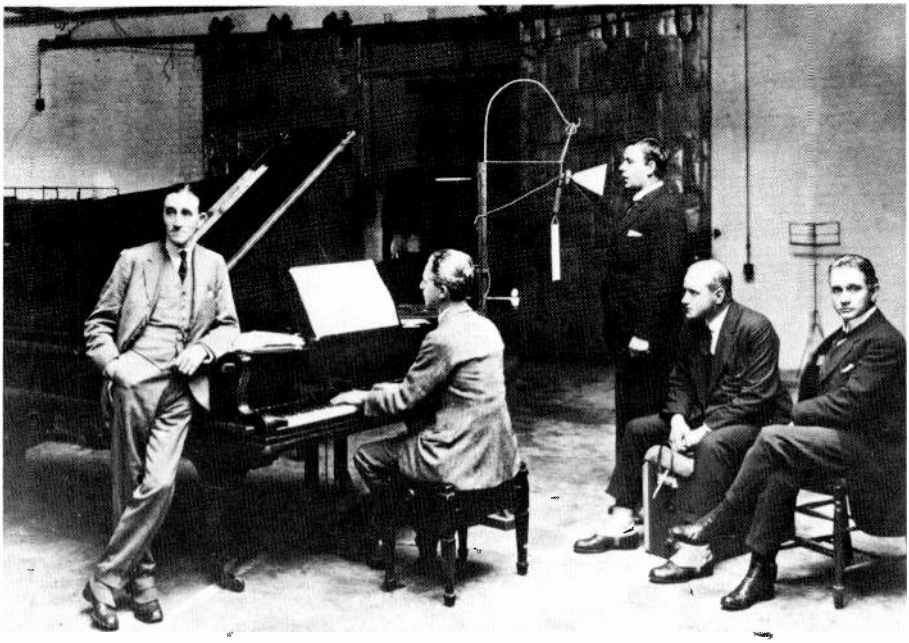
The experiments continued, and on 23rd July a Daily Mail reporter carrying a portable telephone receiving set, successfully intercepted a message from the news editor of his paper transmitted on the Chelmsford 15Kw set. His receiver consisted of a 6-valve amplifier with tuning condenser and accumulators all mounted in a dispatch case 17.5in. by 7in by 13.5in. The aerial was a small loop of fifty turns of No. 20 wire, 16.4in by 13.5in, carried on the reporter's back underneath his coat.

In July 1920 the King of Spain was given a full demonstration of the Chelmsford station, reception being staged by use of a three valve set and frame aerial in another room at the New Street works. Presumably there was no problem with lack of signal strength! Further distances were spanned later in the month when on the 30th July a journalistic broadcast to the newspaper offices in Scandinavia was followed by a live link up with Scandinavian telephone subscribers. They were able to enjoy a unique and historic event when Lauritz Melchior, the famous Danish tenor, broadcast from the Chelmsford station. The telephone exchanges in the Scandinavian capitals were connected to the receiving station which enabled all subscribers to listen to the 'overseas' broadcast, another first for the Chelmsford station. Lauritz Melchior sang several numbers for his home audience, including the national anthems of Denmark, Norway, Sweden and Great Britain. The concert was a great success, both technically and artistically although Melchior initially caused the engineers severe problems on account of his powerful voice blasting the microphone. In the end they placed him some 16 feet from the microphone before obtaining satisfactory results. At one point strong atmospheric interference was encountered, but it did not spoil the event. The concert was immediately followed by several messages of greeting. One was given by Queen Alexandra.

> "Upon this, the first occasion of a wireless telephone communication being sent from this country to Scandinavia, I am very glad to take the opportunity of sending my warmest greetings to the peoples of the Scandinavian countries."

The next message was from a man who was no stranger to wireless transmission. His famous four sevens patent, (Number 7777, 26th April 1900) for 'Improvements in Apparatus for Wireless Telegraphy' simply stated him to be 'an Electrician'. His name . . . . Senatore, Marchese Guglielmo Marconi, Knight of the Order of St. Anne, Honorary Knight Grand Cross of the Royal Victorian Order, Citizen of Rome, Holder of the Kelvin Medal, the Albert Medal of the Royal Society of Arts, and the Nobel Prize for Physics. The young Italian who believed that he could send messages far further than people could shout had come a long way.

Dame Nellie Melba's concert was undoubtedly the high point of the short, sporadic, yet quite spectacular career of the Chelmsford experimental station MZX. It was not to last. Through all the publicity, acclaim and enthusiasm that the concert generated at least one person distinctly disapproved of the whole event. The Postmaster General, The Rt Hon Albert Illingsworth was definitely not amused. He promptly sent a strongly worded protest deploring the fact that a national service such as wireless telegraphy should be put to such frivolous uses. It was the end of the beginning.



9. Lauritz Melchior at Chelmsford. 30th July 1920.
(Extreme left: W.T. Ditcham. Seated at piano: G.W. White.)

5

CHELMSFORD CLOSES DOWN

"Severe interference with
legitimate sources."

Postmaster General – 23rd November 1920.

Despite the fact that entertainment broadcasting was rapidly gaining favour with the general public, on 23rd November 1920 the Postmaster General spoke to the House of Commons. He announced that the experimental broadcasts from Chelmsford were to be suspended on the grounds of 'interference with legitimate services' and for the time being no more trials would be permitted. Each experimental music programme from the Chelmsford works had to operate under a special Post Office permit, and there were to be no more permits. One of the legitimate services badly affected was the new Croydon air traffic control system; typical was an article in the Financier newspaper on the 25th August 1920. It reported that a few days previously the pilot of a Vickers Vimy aeroplane was crossing the English Channel in thick fog and was desperately trying to obtain weather and landing reports from Lympne, but all he could hear was a Chelmsford musical evening. It also stated that:–

> "The opinion among airmen is practically united against a continuation of the 'concerts' given to the world at large by the Chelmsford wireless station."

This view seemed to be echoed by the Navy and the Army, who stoutly maintained that any civilian broadcasting would hamper 'genuine experiments' and would not be 'in the best interests of imperial defence'. The critics of wireless broadcasting saw that the device was ideally equipped to be a servant of mankind, but were determined that it should never be considered as a toy to amuse children.

The Chelmsford broadcasts had also interfered with the Post Offices newly opened arc transmitting station at Leafield near Oxford carrying press and Foreign Office morse transmissions on 12,200m to Cairo, India and America. Faced with these problems the Post Master General felt that he had no option but to close the Chelmsford station down. For the moment, as MZX lapsed into silence the airwaves returned to their normal monotonous clatter of morse code, but the seeds for the future of broadcasting had been sown. The Chelmsford engineers had focussed the attention of both the press and the public on the

possibilites of using wireless telephony as a means of bringing entertainment into the home. It must be admitted that the Marconi licence was solely experimental, with no mention of broadcast entertainment programmes; but its cancellation denied British industry the chance to make strong bids for world markets in receivers and broadcast transmitters, a chance the Americans were not slow to seize.

However this seemingly obstructive attitude did have an explanation. In the early 1920's the Post Office could never have foreseen that radio broadcasting would become such a powerful medium in so short a time. Indeed it was felt by some observers that the amateur radio community actively urged telephony experimentation simply because morse code was limited to those who could get their 'speed' high enough. To hear voices and even music in the headphones was on the other hand very exciting. Regardless of methods or motives, under the strict control of the Post Office, the development of broadcasting in the United Kingdom was to follow an ordered and logical course, avoiding the total chaos of jammed American airwaves.

The sequence of events then turned full circle. The future of broadcasting in this country was returned to the small, but growing band of amateur radio enthusiasts who had first appreciated the fascination of the transmitted spoken word. They were furious at the closedown of the Chelmsford station as it had been a vital reference signal operating on a precisely known wavelength and a declared power. Despite this setback more and more amateur telephony began to appear on 1,000 metres and 180 metres despite severe restrictions being placed upon their operation, including a maximum output power of only ten watts. By March 1921 there were 150 transmitting licences and 4,000 receiving licences issued in this country, but some 1,700 requests or enquires for experimental licences remained unprocessed.

It also appeared that the British public preferred the singing of Dame Nellie Melba to the silence imposed by the Post Office. In response to this demand from a number of amateurs for a short, regular transmission of telephony for calibration and other purposes, the Marconi Company put forward a proposal to the Post Master General in December 1920.

The suggestion was for a very limited service of about half an hour's duration per week on wave-lengths and power to be determined. Two wave-lengths would be used for calibration purposes, the constants of the transmitting circuits would be broadcast for the benefit of listeners-in and half the programme would use telegraphy and half telephony. This suggestion was turned down on the grounds that to grant one request would make it impossible to reject requests from all other manufacturers.

However it was hinted that a request from the amateur community would be looked upon with more favour. In fact Commander Loring, Inspector of Wireless Telegraphy at the Post Office, stated that an application for a regular telephone transmission sent to the Postmaster-General by the Wireless Society of London on behalf of any firm would be favourably considered. This could be dealt with easier

than a similar application from any firm direct, as in the event of a permit being granted in the latter case other firms would have the right to ask for the same treatment.

To this end the Wireless Society of London held a conference in March 1921 with the 63 Provincial and Suburban Amateur Wireless Societies (some 3,000 members later to become amalgamated as the Radio Society of Great Britain). Under the presidency of Dr. J. Erskine Murray, the following item on the agenda was discussed, which had been suggested by several wireless societies.

"The possibility of regular telephone transmission from a high-power station to include all matters of interest to amateurs and to be on different definite wavelengths for calibration purposes."

The conference contained much discussion, comment and argument, although little direct action was immediately forthcoming. The general mood of the amateur radio community was rebellious. Leslie McMichael (founder of the McMichael Company) G2FG and Gerald Marcuse G2NM among others decided that the best course was to exert continuous pressure upon the Post Office to reestablish telephony transmissions.

On the 15th August 1921 letters in the press and regular concerts from the Hague wireless station PCGG achieved a small success. It was announced that the Postmaster General had authorised transmission by the Marconi Company of calibration signals, consisting of the name of the station and its current frequency continuously repeated in morse code. The Post Office sent the following letter laying out the strict conditions of the new licence.

GENERAL POST OFFICE,
LONDON, E.C.1.
15th August 1921.

Gentlemen,

With reference to your letter of the 12th April last and the subsequent oral correspondence with Mr Blake, concerning the proposal to transmit signals for a period of half an hour per week from Chelmsford for the benefit of Wireless Societies and amateurs, I am directed by the Postmaster General to say that the other authorities concerned see no objection to the proposals so far as wireless telegraphy is concerned but they are unable to agree to the inclusion of wireless telephony in the arrangement.

The Postmaster General accordingly authorises you to transmit signals by Wireless Telegraphy only from a station at your Chelmsford works, for the benefit of Wireless Societies and amateurs, subject to the conditions shown below:—

(1) Transmission shall take place for a period of half an hour only (7 pm. to 7.30 pm.) each week on any day except Saturday and Sunday. You will no doubt say which day is selected.

(2) The maximum power used shall be 1Kw, and fixed waves of 180 metres and 450 metres shall be used for spark and C.W. and a further fixed wave of 1,000 metres for C.W. only. It is understood that part of the transmission will be on powers of ½Kw ¼Kw only.

(3) The general conditions applicable to the working of your experimental stations in the Chelmsford area shall apply in this case so far as they are appropriate. In particular the station shall be equipped for reception as well as transmission, and a qualified operator shall 'listen-in' frequently, on the wave being used for transmission, to ascertain if interference is being caused to Government or Commercial stations. Transmission shall at once be discontinued at the request of any such station.

(4) The Call signal 2 MT (two m t) shall be sent three times, at a speed not greater than 20 words per minute, at the beginning and at the end of each short series of transmissions and on every occasion when the wave is changed.

(5) The station shall be open to inspection at all reasonable times by properly authorised officers of the Post Office.

(6) This permit is subject to withdrawal or modification at any time at the Postmaster General's discretion should occasion arise. In particular it will be necessary to review the permit if interference is caused to Government or Commercial Wireless stations.

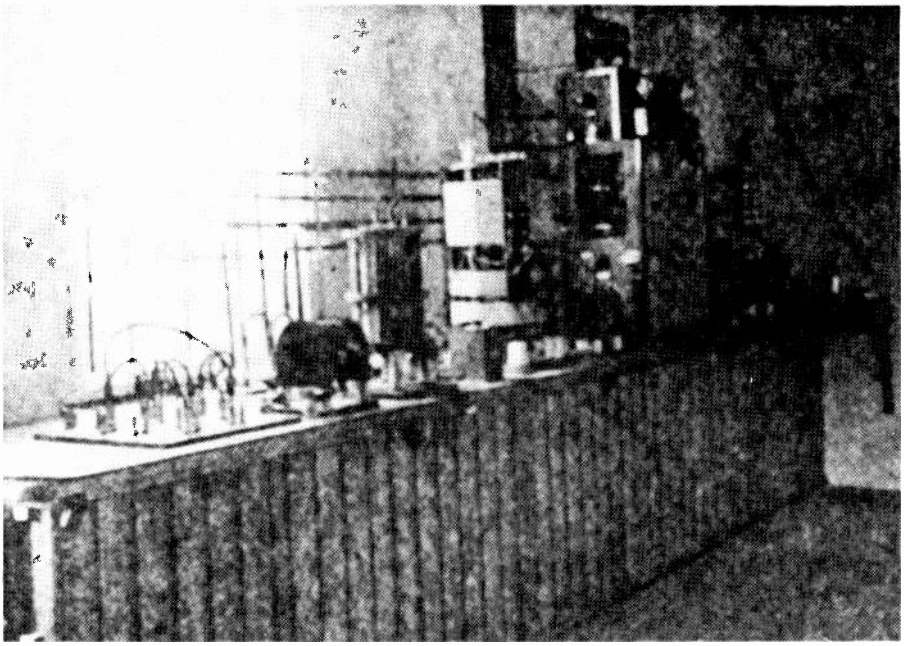
I am, Gentlemen,
Your obedient Servant,
sgd. F.J. Brown.

It was a start, a small hole in the enormous blanket of silence imposed by the Post Office, but the amateurs were not satisfied, they wanted to hear speech. On 29th December 1921 the radio societies presented a further petition to the Post Office, which had been signed by officers of the 63 affiliated radio societies, representing upwards of 3,300 radio telegraphists. (*See Appendix E.*) The amateur community en masse was complaining about the slow progress made in negotiations, and demanded the reinstatement of telephony transmissions.

Suddenly the battle was over and it had been won. Less than a month after the petition had been presented, at the third annual conference of affiliated radio societies, a letter dated 13th January 1922 was read out. The Right Hon F.G Kellaway MP (Postmaster General) had authorised the transmission of a 15 minute programme of speech and music, to be included within the weekly half hour calibration transmission. The Home Office had smiled favourably on the amateurs, and at the request of the London Wireless Society the Marconi

Company undertook to provide the first ever officially approved broadcast service in this country. To house the new station the company chose one of its experimental sites, formed after the First World War in Writtle, a small village some two miles from Chelmsford. The Writtle site had been established in anticipation of a new market in airborne telephony when civil aviation got underway after the. It had already achieved some measure of success having provided much of the work on a 1.5Kw transmitter at the Croydon Aerodrome wireless station that had become Britains main civil airport, although broadcasts from the Chelmsford station MZX had often caused interference. The Croydon air traffic control system operated on two wavelengths, 900 metres and 1,400 metres, used a double cage transmit aerial 270ft long, and could be easily identified by its callsign GED as amateurs listened in to aircraft on route to Paris. Apart from providing one of the first ever air control systems, Writtle also designed and tested the Marconi 'AD' series of airborne radio equipment.

10. Croydon Aerodrome. The Writtle team designed the air traffic control system for the World's first civil airport.



11. Croydon Aerodrome radio room.

So it was that an ex-army wooden hut, parked unceremoniously on the edge of a large Essex field was to become the next chapter in the history of radio. The small Writtle station by accident was to be the true birth place of broadcasting in Britain. Its callsign . . . . 2MT.

6

THE VILLAGE

"It is a royal village . . ."

Writtle is an old village and a peaceful place, hidden in rural Essex some two miles from the outskirts of the City of Chelmsford. In 1086 the Domesday Book gave Writtle its place in English history, recorded there as Wiritelamten by William the Conqueror, after he took the village, the manor and the country from King Harold himself. In Old English the village was known as Writtlelaburns, literally translated as the 'bubbling purling stream'. This is a reference to the river Wid that rises south of Ingatestone, flows alongside the Marconi site, under Writtle bridge, and then joins the river Can before it reaches Chelmsford. Writtle is also a royal village. A long succession of monarchs have used the village ford on a diversion from the main Colchester to London road when the rivers Can and Wid flooded at Chelmsford in Winter.

Writtle was by far the most important village in the whole area during these times, having a population of over 700 souls (167 households) as opposed to the mere hamlet of Chelmsford with just 20 people in four households. Indeed King John, the monarch who carelessly left his crown jewels somewhere in the Wash, had his hunting lodge and royal hunting woods there. The surrounding countryside was predominantly oak woodland and wild boars were plentiful. The lodge was built in 1211 for John and his court as a retreat from the pollution of London, and was later granted out to the Bruce's in the late 13th Century. It is very likely that on 11th July 1274, King John's hunting lodge was the birth place of Robert the Bruce, the famous spider watcher who subsequently inherited the manor and the title 'Lord Writtle' in 1304.

During this period the manor was extremely popular and both Henry III and Edward I were regular visitors. However when Robert Bruce became King of Scotland in 1306 the manor was snatched back by Edward I, but rapidly fell into disrepair and was completely ruined by 1566. Its foundations still remain in the grounds of the Agricultural College, which is now a dominant feature of the village.

The public house is a focal point for life in every village and Writtle is no exception. The central Cock and Bell pub is reputed to be the site of the village's medieval cock fighting pit in the days when this now outlawed sport was all the rage. The pub takes its name from the custom that the winning cock gave the owner the privilege of wearing a bell in his cap. The pub was run by Mr Beeson

who held the Cock and Bell licence for 40 years from 1892. It was his daughter Elizabeth Munsey Beeson who took her London secretary training, her Pitman shorthand and typing to the new Marconi site. The pub's backyard was for generations the site of horse stabling and watering, being right next to the willow tree shaded village duck pond. This quiet scene of village life is overlooked by Writtle church set in a quiet almost sombre avenue of poplar trees. Its Norman nave and chancel date back to 1250 with the North and South aisles added 100 years later. It has remained unchanged, almost timeless throughout the ages, although the tower did unfortunately collapse on Friday 4th April 1802, bringing the church bells down with a 'clamour and a clangour'.

During the First World War the inn saw a complement of the Ox and Bucks Royal Field Artillery billeted there and throughout the village. The pub is also reputed to be haunted by a Victorian maiden who hanged herself from a hook in the bedroom ceiling, but this has not stopped generations of Marconi Engineers drinking there. It was the Cock and Bell that legend has it provided the piano for the Writtle Broadcasts, although Herbert Edwards remembers that it was he and Fred Wilkinson who once loaded the village hall piano on a barrow and lumbered down the lane. The Cock and Bell sits directly opposite St. John's Green, which is unusually the village's second village green. One lays beside the pond while St John's is only a stone's throw from the Marconi site. This may be explained by the fact that this area was the site of the village's medieval market. The Green and the village's main road, Lordship Lane, take their names from King John who used them as a short cut from his lodge to the village church. Legend has it that King John took this back route because he refused to use the main entrance, always entering the church via the vestry door.

Writtle in the early 1920's was a village of characters and faces. There was Holy Joe, the chimney sweep and pall-bearer, renowned for his mighty swings with a cricket bat on the village green, as the bakers window, and the baker Mr Hanser could attest. There was Ernie Perry who sang and played his tin penny whistle on the steps of the Cock and Bell, and Jack the pea picker who never did very much but drink and watch the world go by. Memories have faded but there was Farmer 'Bodger' Garwood and Old Maid Barlow the local doctor. Ping Pong Summerfield and Smutty Wilkinson the odd job men and general labourers, Chalky Wallace who ran the Chequers Pub, and Chuffy Dennison who sang with gusto in the village choir. Like the pioneers from the radio station they have all left us, even the shops have changed. Mr Wallace the wheelwright, and Mr Pamplin the blacksmith could not find much business now.

Inhabitants of the village still remember the strange men from down the lane. Although village life was obviously old fashioned and set in its ways, they did not mind the comings and goings from the inhabitants of the long field at the bottom of 'Lowford' Lane. Locals will recognise a spelling mistake as the current Marconi site sits on Lawford Lane, but all prewar maps record it as Low-Ford. The villagers worried more about the fact that the five acre field often flooded, but the engineers assured them that they did not mind the occasional deluge for the flood

plain was ideal for their aerial experiments. The 1958 flood caused considerably more chaos, filling the site waist deep in cold, muddy river water by 6th September, although a dam upstream is now supposed to have abated such problems. The villagers had for years known the field as hopgardens, hops for the local Writtle Brewery (called the Maltings) and owned by Russells Ales had long been grown there. The canal beside the church provided the soft water for beer making, which did mean that long streches of the canal had to be cleaned out regularly, and its bottom restoned every year. But at least the ducks had a clean pond as it was often refilled from the canal's overflow.

12. Writtle village plaque – 1987. This was designed by Colin Berrett and unveiled on the Village green on 20th April 1980. It depicts in its quarters the three Saxon swords of Essex, the Church Tower, a sheaf of corn for the agricultural college and an aerial mast for the Marconi site.

It seems that nobody in the village seemed to be sure exactly what the Marconi men did at Writtle, most simply found it all a bit confusing. They were content to let them play with their gadgets and wires, for radio was still brand new, little more than a scientist's experiment or an eccentric's toy. When the 'radio men' came to Writtle the general consensus is that they were a jolly bunch who were pleased to join in the life of the village. They played football on St. John's Green and an occasional cricket match beside the village pond. They always drank in the Cock and Bell, laughed with the locals, and even joined the village pageant held every year for 700 years on Whit Monday. However it seems that they tactfully avoided the tradition of the pageant to settle old scores on this day.

It seems that few people in the village listened to the ripples in the ether that the Marconi men were about to make, for things change very slowly in small villages. Commercial sets had yet to be produced, so only the home constructor and enthusiast could listen in. Mrs Gladys Scales remembers passing round an earphone in the garden shed from her brother's crystal set, not daring to breath for fear of disturbing the cat's-whisker. Her main concern seems to have been the aerial wire tied to her linen pole. Few had heard Fessenden's Christmas words in 1906, but by the early 1920's people from all walks of life were becoming listeners. It was relatively simple and cheap. A long piece of wire from chimney stack to washing pole, insulated at either end with empty cotton reels formed an adequate aerial. A metal bicycle pump could act as a reasonable condenser. Two melted lead soldiers mixed with a handful of flowers of sulphur would make lead sulphide, an artificial galena crystal. Alternatively a walking holiday in Derbyshire or Cornwall would provide the real thing. One early experimentor remembers distracting the Ironmonger so that he could chip off small pieces of the carborundum grinding wheel used for sharpening knives to use as crystals for his cat's-whisker wireless. Headphones had to be purchased and 25 shillings was a large expense, but placing them in a pudding basin allowed the faint sounds to resonate around the room.

It was worth all the time and effort, when 'tickling the whisker' brought words out of thin air. The voice of a man called Peter Eckersley, speaking faintly against the background static forced headphones to be clamped tighter to the ears, and the gentlest of adjustments made. To the listeners each Tuesday night was to become radio night, a memorable moment in their lives.

7

THE EARLIEST DAYS OF WRITTLE

"A good North-East wind,
and a completely earthed goat"

Writtle has always been a very picturesque village, but in 1922 the Marconi site hardly appeared to be the place for history in the making.

The Marconi Aircraft Department was formed after the First World War, but did not arrive in the quiet village immediately. Originally it consisted of Colonel H.B.T Childs, Major C.E Prince, Captain J.M Furnival, Captain Peter Eckersley and Messrs. Van de Velde, Whistlecroft, Price-Smith and E.H.Trump. They were mostly ex Royal Flying Corps (RFC) or more correctly ex Royal Air Force Wireless Officers, who had started in the very early days of wireless telephony communication. The early war years relied on communications using the crudest of equipment. There were no valves at all, in fact aircraft wireless consisted of a spark set in the plane and a massive crystal receiver on the ground. It was quickly found that in an open cockpit, against the roar of engine, wind and gunfire, that it was almost impossible to understand morse code sent using this equipment or any other. Consequently the first RFC units that arrived in France were equipped with only one airborne spark transmitter and one ground based receiver between them. Speech on the other hand seemed to provide the solution to this barrage of noise, so a team of engineers was soon assembled to make it all happen. This airborne telephony research department never really formed, Major C.E. Prince, then serving with the Westmorland-Cumberland Yeomanary was simply sent down to Brooklands to 'cooperate' with the Flying Corps. The Brooklands site in Surrey had originally been a Marconi experimental establishment, but it was hurriedly taken over by the RFC in 1914.

The RFC had begun to wonder why the wireless telephone could not be made to work in the air, Major Prince was told to do it, but no one was quite sure how. Many Marconi staff were seconded to the service, but to speed the development process all qualified wireless engineers were given commissions as officers. The experimental station was turned into a school for pilots run by Major Prince assisted by Captain Whiddington and Captain Furnival, all ex Marconi engineers.

The spur to their research was the development of the thermeonic valve, although it was still a very crude device, each filament being hand made, and each glass envelope individually blown. Early examples even had to be coaxed into

operation by holding a lighted match under the top pip of the valve to assist the valves little electric heater. Indeed, surviving examples still show these burn marks. The long top pip of the valve actually contained a small piece of asbestos, which when warmed released a gas that made the valve work much better. Signal strengths could be greatly improved by stroking the valve with a match flame, but conscientious operators apparently lost all sense of pain in fingers that soon resembled well done sausages. The technology was still in its earliest stages, but the work of the airborne research department was considered top secret. Everyone who entered Prince's workshop had to sign the Official Secrets Act, and swear the following oath.

> "I . . . . do hereby swear I will not divulge now or at any time hereafter, by word or mouth, writing, photography or any other means, any information regarding 'Wireless Telephony' that I have acquired or may acquire at any time during my employment by the Government, except to persons authorised by my commanding officer. So help me God."

This hung in Prince's office in a plain wooden frame, with the signatures preserved under glass. The first name on the list, dated 22/09/15 was that of a young engineer destined to play his part in the birth of broadcasting. His signature read P.P. Eckersley.

The problems with any airborne wireless are two fold, namely size and weight. The canvas covered 'stringbags' had extremely cramped cockpits, and early aero-engines were notoriously inadequate and unreliable. Despite the already extremely poor power to weight ratio a practical aircraft telephone was produced towards the close of 1915, being known not unreasonably as the Mark 1. It was Captain H.J Round who used his pre-war work to produce the valves for the receiver and the transmitter. The 'Q' valve was developed in 1916 and attacked the problem of how to get reasonable amounts of RF amplification from a triode valve. The solution was to enclose the electrode in a glass tube closely fitting around the anode, and to bring the grid and anode connections out on opposite sides of the tube.

In February 1916 Major Prince crossed the English Channel and demonstrated the Mark 1 in France to a party of senior officers, including Lord Kitchener himself. Later, Prince was attached to the Royal Signals Experimental Establishment at Woolwich where he designed the Wireless Telephone Mark II which was the set eventually adopted for war use. For the development of the wireless telephone Prince's work was to be honoured with the presentation of the O.B.E, a grant of one thousand pounds, and the thanks of the Air Ministry.

The development of airborne wireless telephony was really a matter of taking one step at a time. The first and easiest task was to communicate from the air to the ground. The next experiment was communicating upwards, and finally, from machine to machine. It has been widely thought that the first upward message was

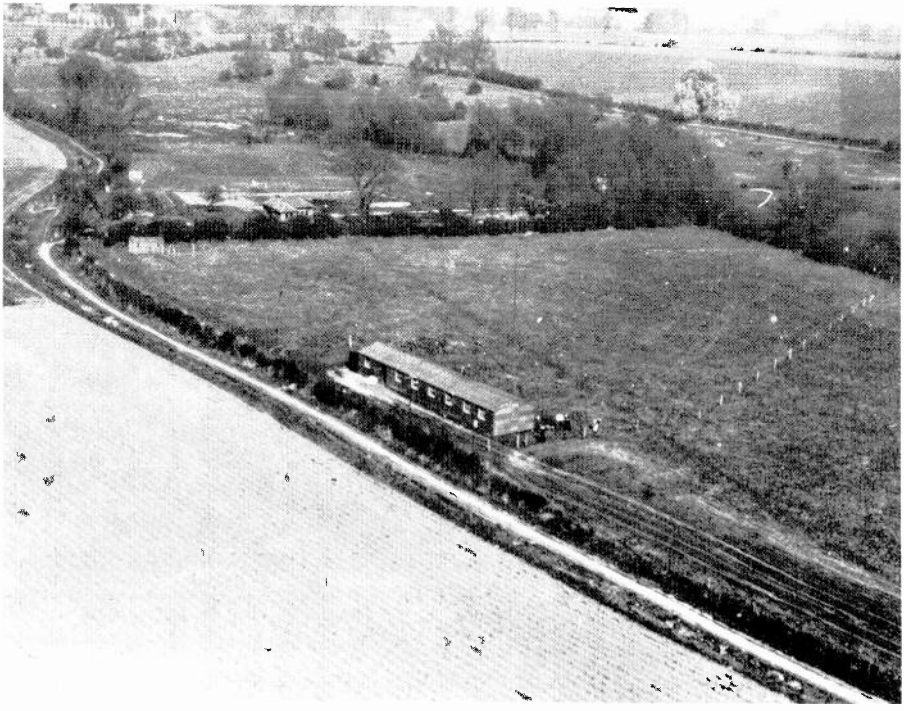
sent by Major Prince, calling Captain J.M. Furnival as he circled the field in his aircraft during the long summer of 1915.

> "Hello Furnie. If you can hear me now it will be the first time speech has ever been communicated to an aeroplane in flight."

The message concluded with a request that the pilot should dip his aircraft to signal if the message was received. The aeroplane, travelling at its top speed of 50 miles an hour, gave 'an obedient lurch.' However the west country inventor, Grindell Matthews had spoken to an airborne C.B Hucks four years earlier as he circled overhead. That early experiment used a large double telephone receiver, and was never developed into any form of practical system. The range now achieved during these wartime tests was almost 20 miles on a wavelength of 300 metres. To do this the aircraft had to tow some 250 feet of aerial wire reeled by hand out of the observers cockpit. This in itself created several serious problems. In the event of attack it was impossible to reel the aerial wire in, so it had to be cut away. The increased drag made the aeroplane very difficult to fly at the best of times, in combat it could become a deathtrap. The wire also had a tendency to wrap itself around the aeroplanes control surfaces if its end weight twisted loose. To cut down on engine interference the ignition cables were screened with metal piping and sheeting, which not only added unwelcome weight, but also tended to make the aeroplanes power unit even more unreliable.

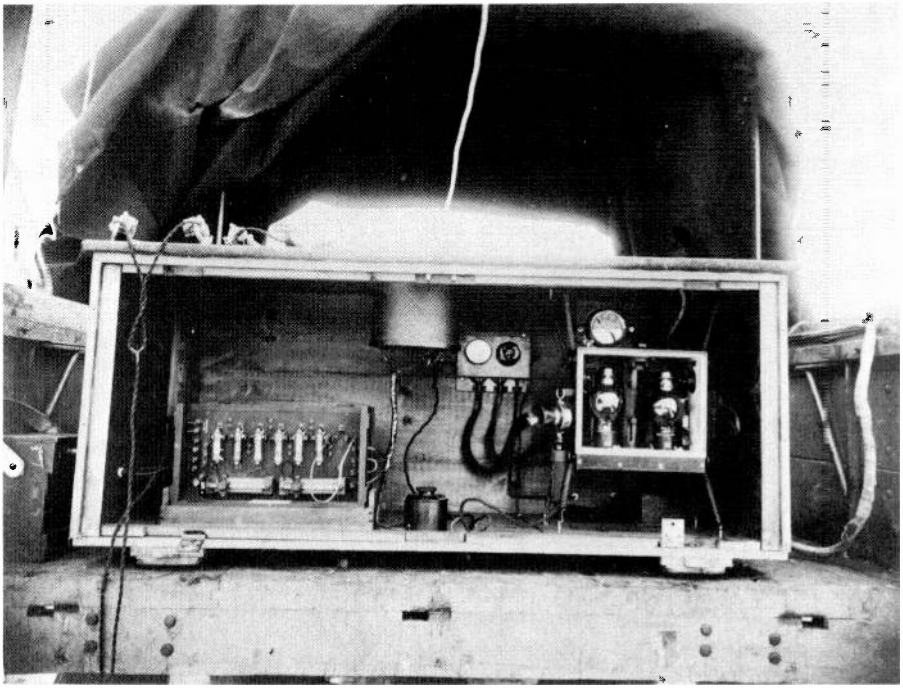
Airborne telephony still had its problems, but the reliable long distance communication of speech from ground to air was nevertheless a remarkable step forward. As Eckersley noted, they "must have been using the right sort of matches that day". Prince was to give many brilliant lectures on the intricate workings of the valve while at Brooklands. He could make the device seem a friendly thing, that functioned solely for the engineer's special pleasure. Typical of the men who joined Prince was Edward Herbert Trump. He was born in Battersea in 1894, and drifted into the Royal Flying Corps straight from University. He began fitting the new wireless into aeroplanes as the pilots learnt to fly around him. He remembered the training of pilots as they played at war, throwing flour bombs as they tried to make their cumbersome Henry Farman Trainers fly. They had only a few hours struggling to keep airborne before the bombs became real and their flying kept them out of the trenches. The skies over France were also a deadly place, only one in 15 was expected to survive for a month, firing their service revolvers at the enemy. By late 1917 the Brooklands school under Captain Furnival had an output of 36 fighter pilots per week, fully trained in the use of wireless telephony equipment. They were also taught the essential art of clear articulation under the extremely noisy conditions of an aircraft in flight. It is tragic to remember that there was an average of 400 casualties per year among RFC wireless operators, rising to nearly 500 lives lost during the months of May to November 1918. Despite their losses, by the end of the war, the Royal Air Force had 600 aeroplanes fitted with wireless equipment, 1,000 ground stations, and over 18,000 trained wireless operators.

The formation of the Royal Air Force in 1918, and of an experimental establishment at Biggin Hill, Kent brought about Prince's immediate transfer. At Biggin, soon to be centre stage in another airborne war, he was rejoined by most of his old team when the Brooklands experimental station (now led by Captain Furnival) was also transferred there. The new Biggin Hill team quickly set up a station to further develop ground to air communication, using Prince's pioneering work in choke control for modulation of telephony transmitters as suggested by Captain H.J Round in 1914. The transmitter was really an extended Mark II, but its design was good enough to take with them six months later, when upon demobilization, Prince, Eckersley and the rest of the team joined the Marconi Company. They formed the new Marconi Aircraft section which first operated from Marconi House which was then in the Strand. The new section occupied a couple of small offices for design work, and a corner of Mr Round's workshop to build their prototypes. It was however found to be difficult to develop airborne wireless in the heart of the capital and so a move was made to a temporary site in a field at Writtle, and it has been there ever since. The only building was a long ex-army hut, with an office at one end, a drawing office and laboratory in the middle



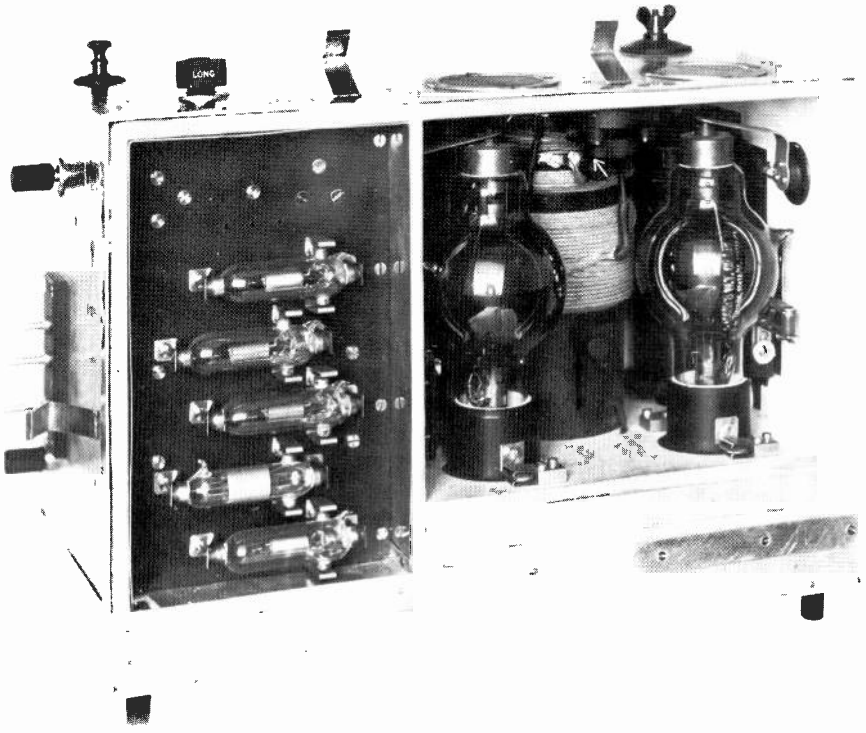
13. The old army hut from the air – 1922.

and a workshop at the far end. Writtle had already been exposed to aircraft during the First World War when a temporary airfield was set up in Front field on the outskirts of the village. The reason it was called Front field the locals explained was simply because it was in front of the farm. It was lit by flares at night and allowed Lieutenant Robinson to shoot down two Zeppelins, their burning wrecks falling at Billericay and Potters Bar. A school now stands on Front field which had returned to grass before the Marconi Company brought its staff to Writtle.



14. AD1 – mounted for testing on an open lorry.

The new site at Writtle was considered a very pleasant change from London and much approved by all, except Major Prince who apparently disliked it immediately. Chelmsford simply did not agree with him. There was no escaping the fact that a good North East wind reminded them all of a very active sewage farm in the next field, known locally as the sill beds. The fact that they were washed out every week may have had nothing to do with his decision, even though on one famous occasion he executed a perfect three point landing in the biggest pool. In fact until very recently the sewage works were, on a warm summer day, a pungent addition to the countryside air.

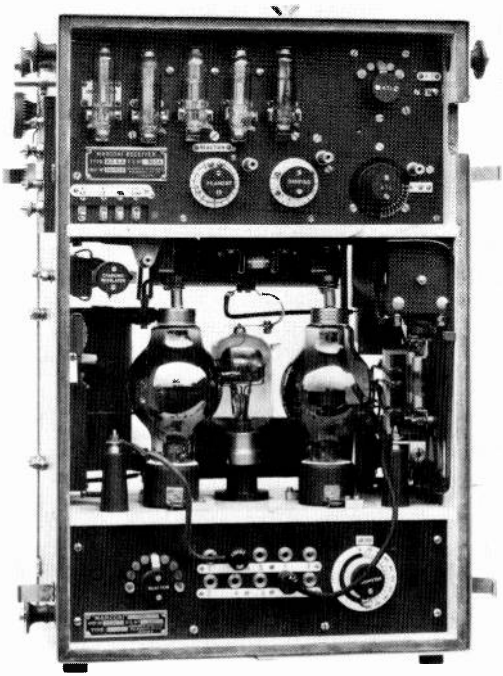


15. AD2 – Airborne wireless equipment designed by the Writtle team.

The Writtle site in 1919 was very primitive. There was no electricity supply, (the only power being provided by a 100 volt D.C generator), little sanitation and for a while no direct water supply. It is noted in the more 'private' areas of Writtle past, that for some time the only 'small room' at the radio station was a large horn speaker half buried in the hedgerow. The lack of civilized amenities also applied to the hut's heating which was supplied by a ancient coke stove that dictated that it was always too hot or too cold. The hut is unanimously remembered as being dark and spartan with little or no comforts, only long trestle workbenches covered with wires and components. It was not all gloom and despondency. At least the atmosphere is remembered as being friendly and constructive, "we all taught one another, cursed head office and screamed good natured abuse at the works for not following our specifications". The team was extremely loyal to their own section and found a lot of time to laugh despite the fact that conditions were far from ideal.

Apparatus in those days was made at the New Street Works, but the design, installation, testing, demonstrating and all the business side was attended to by the Writtle staff. Typical was the AD series of airborne wireless equipment, designed, prototyped and part tested at the Writtle site.

The AD equipment was pilot operated and developed for use with aircraft of the Handley Page Transport Company and of Air Transport and Travel, and provided reliable ranges of over 100 miles. In 1920 the Marconi Company acquired a DH6 aircraft for experimental work and this machine was the first private plane to receive a wireless licence from the Post Master General. The DH6 often operated from the Writtle field and was the first to be fitted with a completely screened ignition system developed under the supervision of H.C Van de Velde.



16. AD6 – 'Aircraft Wireless Telephone Combined Transmitter and Receiver'.

The Writtle team were lucky in having 'hard' valves, because these had been in existence for only three or four years. Before these hard valves, no two thermeonic valves were alike, and the Writtle engineers had had their share of burnt sausage fingers during the war, warming valve top pips with a lighted match. In 1917 valves were hand made, fragile, unpredictable and often provided very indifferent performance. The requirements of war brought about the evolution of efficient and robust cathodes together with the technology to 'pull' very 'hard' vacuums. The valves the Writtle engineers designed for, and built with, were altogether more stable and predictable. These new devices were also reasonably reliable, performing for the first time within definable tolerances, and providing a useful amplification at audio levels. However the engineers found that it was still experience alone that could tell just how much blue glow these new hard valves

17. The Marconi Company Aircraft – licensed for airborne wireless.

could stand without flashing over. The devices had to be treated with great respect due to their rarity and great cost, to burn out a valve due to clumsy adjustment was considered a terrible crime. However one member of the Writtle staff caused great consternation by filling up a 55 receiver with its seven valves (six V24's as RF amplifiers and a Q valve as a detector), switching on, and promptly burning the lot out. He did not leave it at that however, he left the HT battery connected to the L.T. terminals, switched on again and brought the total up to 14, and probably still holds the record for the site.

Transmitter design at the time of the AD1 was comparatively easy, one could at least measure the DC input and the HF output, but receivers were not so easy because there was no means of measuring either signal input or output. The first variable signal generator used was a buzzer wavemeter mounted on a little trolley, running along a plank some ten yards long and four feet high, set up in the open air with one end up against a window. The trolley could be pulled to and fro from inside the hut by an endless string, and the measurement of output from the receiver was simply the distance of the 'meat-waver' when you could just hear the signal. Apparently it worked quite well, provided the buzzer kept going and it did not rain too hard.

Another Writtle worthy for a time was Mr Ellingford. He was a keen naturalist and often pointed out a goldfinch or a green woodpecker. All the hut windows looked out on hedges and fields and the Essex countryside has always been alive with wildlife. Everything from birds to grass snakes visited the Writtle site

including hundreds of rabbits providing great sport for the local village lads. For a long time it was a custom for villagers and even members of staff to keep billy-goats tethered in the field, but it was soon found necessary to keep them towards the North East for the breeze from that direction was already very peculiar. The site does hold another record, possibly unique in the history of radio. Writtle lay claim to the world's only truly earthed goat, firmly tethered to the site's earth spike.

It was also one of the Writtle staff, whose name was unfortunately not recorded, who was perhaps unique in another quite different way. Being a good tenor it seems that not unreasonably he sang regularly in a church choir, but he also (hopefully from love of music) sang just as regularly in a Synagogue choir. The difference in Sabbath days made this easy and detection was most improbable, but trouble did arise when choir practice days clashed.

The Writtle team were constantly experimenting with the latest 'state of the art' technology but on one memorable occasion when hurriedly demonstrating a Newton generator things started to go wrong. Everything was a complete lash-up, the drive being taken direct from the pedal driven lathe. The generator was screwed to the floor and having no proper power plug each lead was jammed in with a match. Factory inspectors were unheard of at the time and allowances must be made, for they were all pioneers after all. The demonstration went from bad to worse, continual difficulties with irregular speed plagued the engineers, the drive belt broke, and then the leads started falling out. Things were patched up, but one lead kept coming loose. In the end the distinguished visitor got up off his knees and held up his hand for silence. He spoke:–

> "This will not do – we must make a proper job of it – give me another match!"

Such was the talent of the Marconi management.

In those days the only vehicle for goods transport was a motorcycle and sidecar, which for the most of the time had very poor brakes, especially in wet weather. One day Mr Trump was on his way to New Street on the vehicle when just in front, a traffic policeman held up his arm. On a dry day he might have made it, but as it was, there was only one thing to do, he held his head down to miss the elevated arm and shot past and round the corner. It seems that the policeman was so surprised that he did not even get the registration number, or if he did he could not find the Writtle site, a problem many visitors still have today. Indeed the 1921 OS Map of Writtle failed to record the presence of the temporary hut, however this was rectified with later revisions.

The motorcycle had to make many trips, usually to Head Office at New Street in Chelmsford, or to the other Marconi site in Waterhouse Lane, but it often made slight diversions on the journey. A friendly farmer and his cart were regularly called upon to extract the outfit from the ditch, but the engineers were used to such minor events. It is also recorded that Peter Eckersley perfected another technique

with Writtle's highly suspect motor transportation. He is vividly remembered riding the motorcycle and sidecar up London road in Chelmsford, with the sidecar wheel kept well off the ground, rather than get the puncture repaired.

The hut itself also seemed to be a constant source of chaos. The lathe was situated some three feet from the stove. Mr Bubb was doing a little turning job and was heard to complain about excessive heat on his back. Then there was silence, but not for long. All of a sudden there was a loud explosion and Bubb flew through the door and demanded what had hit him. The pieces of asbestos-cement board sprinkled all round the stove and the lathe soon told the tale. The stove created many stories at Writtle, it either ran too hot, or not at all. One of Marconi's respected and venerated chiefs was warming himself by the stove when he remarked:–

"I believe there's something burning somewhere . . . . "

One minute later, "I'm sure there's something burning . . . . "
Still no action taken.

"Why don't you fellows do something – I'm sure there's . . . "

"Oh my – . . . "

Writtle being the place it was, everybody had been searching high and low, sniffing equipment and feeling components. Unfortunately it was his trousers, and the smell reached the owner first.

Writtle seems to have been populated with brilliant eccentrics, one engineer made a little flower bed by the hedge but found that his plants were being eaten by slugs. He told the labourer to take a torch out in the late afternoon to see if he could catch them. It is a well known fact that most site labourers do not believe in rushing things. There were however men at Writtle who swear that he only managed to catch one, because all the others ran away. The stories from the early days of Writtle are endless. On one occasion a ten inch coil became available and the Writtle engineers obtained an X-ray tube, sewing machine cover and a cat. It need only be said that the cover was intended to keep the cat in check, and the sight of a skeleton cat walking to and fro across the screen caused great hilarity throughout the closeknit department. A game that had quite a long run in the early days, was 'odds or evens', a quiet little diversion that attracted a few small wagers until someone evolved an all too effective 'system'. The whole idea depended on P.P. Eckersley's socks. Captain Peter Pendleton Eckersley was the most amazing character Writtle ever saw, being widely known as 'Captain' or simply 'PP'. He was a total extrovert and practically every word he spoke or wrote carried his eccentric enthusiasm for all things radio. Typical was his custom that, when dragged away from the friendly environment of Writtle on an outside job he often forgot everything. His saviour came in the form of a toothbrush. In the morning

he used it first to clean his teeth, then to brush his hair, then his clothes and then his shoes. Finally he threw it away and went down to breakfast. Eckersley remembered that the Writtle team were not sorry when Round and Ditcham's Chelmsford Station finally closed down. The broadcasts were so powerful that they badly interfered with Writtle's experimental work and continually plagued the engineers. On a clear day the Writtle team could see the huge masts towering above Chelmsford, and they could easily light receiver valves with the aerial current alone when Chelmsford was 'on air'.

18. The Writtle Team in 1922. Back, l. to r.: B.N. Maclarty; H.L. Kirke, The Hon. R.T.B. Wynn; H.J. Russell. Front, l. to r.: F. Bubb; Noel Ashbridge; Capt. P.P. Eckersley; E.H. Trump; Miss E.M. Beeson. Trump always denied taking this picture using a wire attached to his left foot.

All the stories of Writtle in the early days paint a mixed picture of schoolboy pranks and undisciplined behaviour but they were exceptions, brilliant men letting off intellectual steam. By 1921 the site had gradually built up a wealth of experience, becoming a central Company think tank for airborne wireless and telephony transmission. The Writtle staff had been augmented and the functions

of the section expanded. The Design department had been formed which brought the Aircraft department and the Field station department under one head, R.D Bangay. Peter Eckersley became head of the experimental section of the design department in the Writtle hut. His small team of engineers was soon to form the nucleus of the technical side of British broadcasting. Their names, Noel Ashbridge, Harry L. Kirke, Rolls T.B Wynn, Basil N. Maclarty and Edward Trump (although Trump was often called away for long periods of time). It was then almost inevitable that the newly licensed radio station should come to Writtle as the main Chelmsford Works had finished their testing and moved the equipment to the historic Marconi transmitting sites at Poldhu Point in Cornwall and Clifden in Ireland.

The new Writtle station quickly realised that they could not hope to match the power output of the earlier Chelmsford concerts especially as they were instructed that they must not interrupt their normal routine while putting the station on the air. The Home Office regulations imposed on the station were also very strict, with specified output powers, modes, frequencies and transmission time not to exceed one half hour each week. The station also had to close down for three minutes in every ten while the engineers maintained a listening watch on their transmit frequency for instructions to close down completely should the broadcast be causing interference with any 'legitimate' service. The Writtle engineers were quite pleased to think that this made the 2MT station despite its licence, an illegitimate service. Several authors, including W.J. Baker in his history of the Marconi Company described the formation of 2MT as being the electronics equivalent of a man with a red flag forced to walk in front of the horseless carriage. When Writtle hit the airwaves I think that man with the flag probably had to join 2MT's motorcycle in the ditch. While taking a long lunch at the Cock and Bell the engineers had decided to broadcast a single programme between 7.00 and 7.30 on a Tuesday evening, hoping to catch their amateur audience home from work after their supper. The Marconi Company had agreed to supply all the necessary components and a little extra pay for transmitter construction but most design and planning was done in their own spare time. Almost immediately they began rather lightheartedly to throw together some valves, condensers and chokes on a board to produce the low power transmitter.

Captain Eckersley remembered the story.

"If you had a wireless as an amateur that had never done anything but, parp, parp, par, par, par, parp, suddenly you heard a voice or even music, well it was fascinating. The Post Master General, on whom be ever lasting peace, realised that we couldn't have such things as this without committee judgement and consideration. The idea amongst the wireless amateurs – they are called hams by the way – the people who wound coils and drilled ebonite and did all the happy things which you do do with wireless sets and valves. They are growing band of people who have no professional interest in wireless, but take their hobby very seriously. You can always recognise their short wave transmissions because out of

courtesy they always refer to each other as 'old man', but they are in fact usually very young men indeed. They petitioned the Post Master General for a station, so that they could have a constant source against which they could calibrate their receivers. The result of this petition was very naturally that it was turned down, but under the influence of shock tactics, the preparation of another petition etc, it was decided that there should be a station at Writtle. The engineers at Writtle were simply told to do this thing called broadcasting. It was very formally licensed and all that – power had to be limited to 1Kw which included the power necessary for illuminating or heating the filaments of the valves, but as that took 2Kw already we probably still owe the Post Master General a number of Kilowatts."

Captain Eckersley remembered with pride:–

> "We were the first regular station and gee boy golly were we regular, half an hour, once a week, every Tuesday, and we never missed once."

It was Writtle's regularity of service that gives it its firm postion as the true birthplace of British broadcasting. The extrovert group of lively, intelligent and extremely versatile young engineers set out on this new enterprise with a mixture of curiosity and lighthearted inventive fervour. They initially regarded their task as just another job. It would however certainly cut into their spare time and the departments already allocated funds. They also had a feeling that it was going to be one of those projects for which they would get all the blame if things went wrong, but would be hardly noticed if things went right. The Writtle team were forced to start completely from scratch. Nobody at the site had any previous broadcasting experience, the project was allocated no funds and all equipment had to be designed and built from first principles. It did not matter, the Writtle pioneers were about to write their own small piece of history. On 14th February 1922 for eleven months, until 17th January 1923 the young engineers, in their spare time launched and sustained the first regular scheduled broadcasting service that Britain had ever seen.

8

THE TRANSMITTER

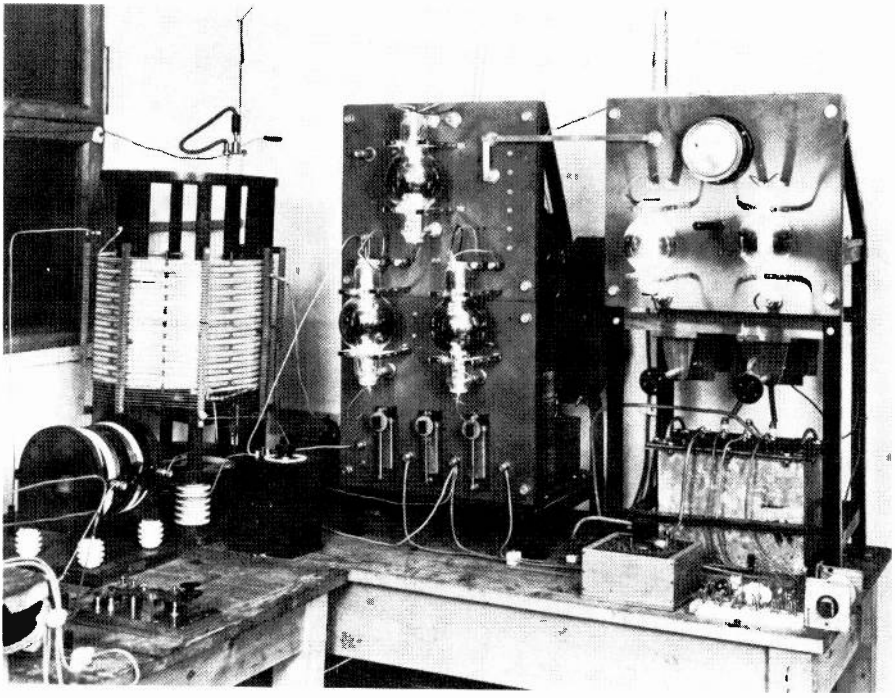
" The power behind the microphone."

The transmitter that was to give the new radio station its voice was designed by Maclarty and Kirke. Basil Maclarty was born in 1899 and always considered himself to be the junior member of the 2MT team. In December 1919, he became the assistant to the communications engineer in the Aircraft Transport and Travel Company, the first civilian aviation company in Great Britain fitting wireless into aircraft. The sets they installed were the AD1 and AD2 types, designed, tested and part built at the Writtle site. Having extensively used the product in the field, it was almost inevitable that Maclarty should take his ideas for improvements to the hut in 1921.

As a construction guide for the 2MT transmitter the young engineers used a similar circuit to the transmitter designed by P.P. Eckersley for the ground station at Croydon Aerodrome in 1920. It was built by Freddy Bubb and H.J. Russell from any available components found around the hut. The final assembly was mounted on two panels obtained from a disused C.W transmitter and was very simple compared to other equipment under development at that time in Writtle. It is reputed to have taken under an hour to get it going but during the rest of the week various parts had to be removed as they belonged to other experimental work in progress, yet every Tuesday it was reassembled to put Writtle back on the air. However any impression that the station was short of components is incorrect as the Marconi laboratories in Chelmsford could supply their needs within the hour especially replacement valves, which were still regarded as altogether vicious and troublesome beasts.

The transmitter can be best described by one of the people who designed it, B.N Maclarty, Engineer in Chief at the Marconi Wireless Telegraphy Co. Ltd. The following extract is a letter written for the Marconi Archives, later sent to Wireless World in January 1963. It relies on a fairly comprehensive understanding of transmitter techniques, and perhaps it should be browsed over by the non-technical reader.

"It can be seen from the circuit diagram that the radio frequency circuit was of the self oscillatory variety using a reaction coil (tuned to 0.7 of the operating wavelength) coupled to the main tank circuit. The aerial tuning coil consisted of an ebonite slat transformer which was magnetically coupled to the primary tuning circuit while the closed circuit condenser consisted of a stack of zinc plates



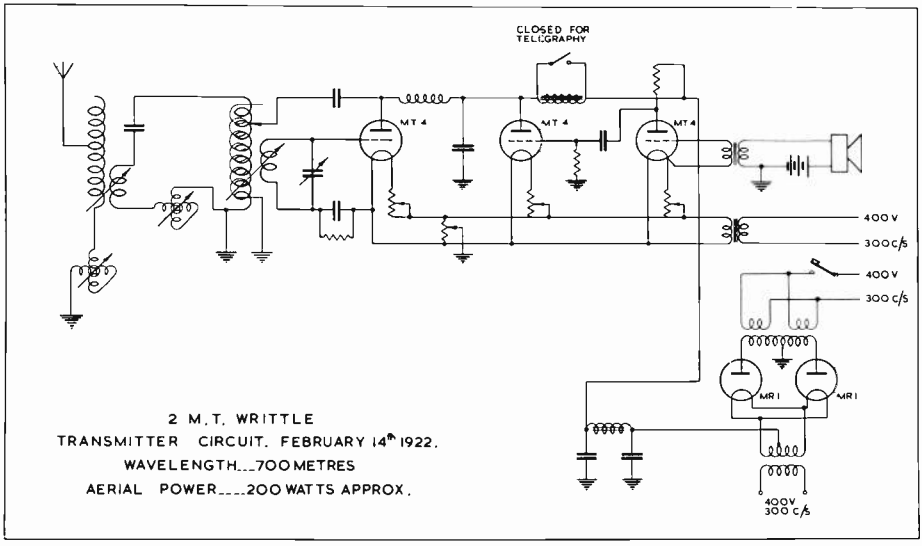
19. The 2MT transmitter in action.

The radiated power of the 2MT transmitter has often been debated, but the design is usually quoted at 250 watts. It is possible that the transmitter could have produced up to 1KW using morse code but the Writtle concerts were usually transmitted using 250 watts which struck a happy medium between reception range and valve life.

separated by ebonite insulators which was kept under the bench. In order to obtain the correct anode impedance a tightly coupled secondary winding (consisting of a coil of 20 gauge wire) was wound over the primary tuning inductance. This coupled circuit was later dismantled and a plain aerial circuit was adopted, using an aerial tuning coil tightly coupled to a secondary winding. This was known as the 'ratio winding' and was patented by Eckersley in 1919.

It should be noted that all the wire used in the aerial coils and elsewhere was all made on site in 1919 by P.P Eckersley an his team, the aerial tuning coil being 243/36 stranded wire and the primary tuning coil being 729/44 stranded wire.

The circuit was shunt connected to one MT4 triode while amplitude modulation was achieved by a Heising circuit with one MT4 being used as a modulator and another as an amplifier. In the first few transmissions the microphone was connected directly to the grid of this valve while the anode H.T. (8,000 volts) was supplied by two MR1 valves in bi-phase connection. The



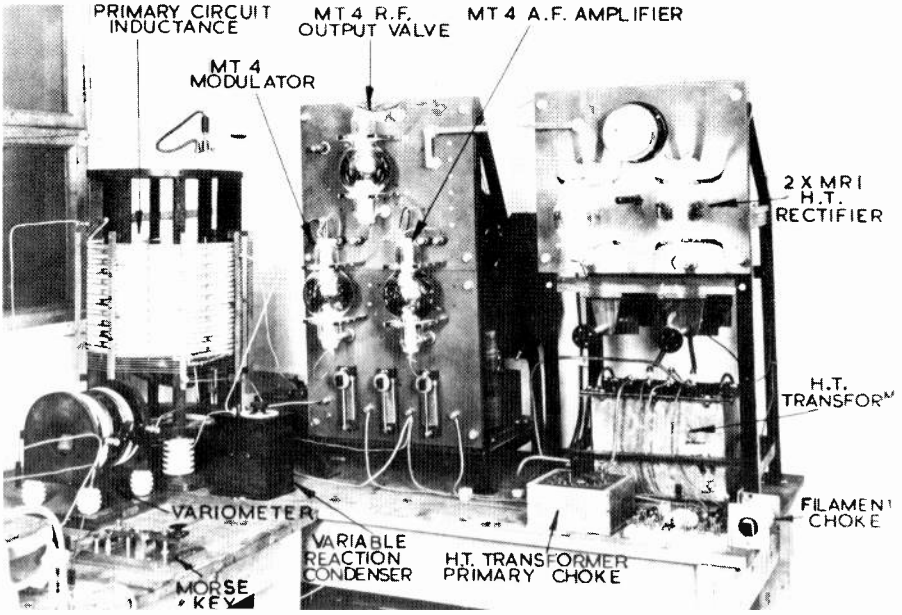
20. Circuit Diagram – The 2MT transmitter.

primary supply to the H.T. transformers was supplied by a 400 volt, 300 cycle single phase alternator, driven by a 110 volt D.C motor. This received its supply from two four cylinder, Austin 4.5Kw 110 volt petrol motor generators with smoothing being helped by a large condenser and an iron cored choke."

Writtle and 2MT was ready to go live but it was quickly realised that although the Heising modulation circuit was suitable for high quality reproduction, the MT4 valve was not. Consequently after one or two transmissions a microphone amplifier was used in place of the MT4 amplifier, and three MT4 valves with their grids biased positive were used in an effort to obtain linear working. It was not possible however to obtain sufficient dissipation at the anode of these valves to provide class AB working. Hence these were promptly replaced by types developed by Noel Ashbridge and H.L Kirke. These were quickly delivered by the M.O Valve Company and three were used in parallel operating in class A mode.

The Writtle team have sometimes been described as empiricists, relying solely on practical experience while disregarding scientific methods, observation and experiments. The station and events of 2MT have also been portrayed as being bathed in a 'celestial light' of inspiration, tomfoolery and eccentricity. Nothing could be further from the truth. The 2MT transmitter proved to be a valuable research and development tool, especially in terms of the regular signal reports the station received. The continual development of the transmitter circuits, all the fine tuning and experimenting also provided the station with several technical breakthroughs. H.L. Kirke discovered how to minimise the effects of grid current

upon distortion in the modulating valve, while dismissing the problem of independent drives. It seems that Ashbridge was always concerned whether the transmitter modulation was in fact pure amplitude as he hoped, or whether frequency shift also played its part in the final signal. He never managed to answer this question to his complete satisfaction.



21. Annotated 2MT transmitter.

The aerial in the small Essex field was nowhere near the mighty structures that towered over Round and Ditcham's transmitters. 2MT's modest effort was far less than half a wavelength, a fact which pressed the engineers to force the aerial ammeter to its highest deflection. They also employed an earth screen for the aerial in place of the ordinary earth, as this provided a low resistance aerial system which decreased the losses by a substantial amount. The aerial that the engineers decided to erect was an inverted 'L' construction, consisting of four parallel wires equally spaced on a 12 ft spreader slung between two portable Marconi masts. The masts were each 110 ft high, 200 ft apart at the base with the aerial feeder being run out of the window immediately behind the transmitter. Captain P.P Eckersley's article '2MT Writtle. A Description of the Transmitter Plant', carried in the 23rd September 1922 (Vol X No 26) edition of 'The Wireless World and Radio Review', contained the following calculation. The conclusion may well have been verified by experimentation, but it is probable that it would not stand up today in the light of modern aerial techniques as the calculation of aerial resistance can be very complex.

'The effective height of the aerial was about 20 metres, and this gave a radiation resistance, at a wavelength of 400 metres of:

$$\frac{1600(20)^2}{(400)^2} = 4 \text{ ohms.}$$

The power is ¼kW, and this gives about 4 amps in the aerial. Assuming a 60 per cent efficiency, this gives a total resistance of the aerial system as about 9 ohms, or 5 ohms for the aerial and aerial inductance, and 4 ohms for the radiation resistance. Overall this gave a radiation efficiency of nearly 50 per cent, which was an extremely good figure, thanks to the low resistance aerial and the short wavelength.'

The policy of 2MT was always to maintain technical excellence, which in some cases required a redesign of the transmitter circuit. Half way through the career of 2MT the design was changed to employ direct coupling as the method of producing oscillations, as before this a coupled circuit was employed to improve the quality of the morse calibration signals. As these were no longer required it was thought that the abolition of the coupled circuit would not result in any deterioration of speech quality, certainly none of the more critical amateur listeners ever reported it.

All valves, both control and oscillator, were lighted from accumulators which gave freedom from hum. The station did occasionally receive complaints from some amateurs that hum was present, but from their descriptions this was probably not due to the alternator, but possibly to some breathing noises in a temporarily packed microphone. The engineers thought that the use of alternating current for producing the H.T. supply did not give any hum in the carrier wave, as the Writtle team always maintained that they took suitable precautions. They did however consider it essential to use D.C. for lighting the valve filaments to obtain total silence. The then well-known method of choke (or 'Anode') control was used in the transmitter, and practically all the subsidiary control circuits used iron in the circuits. From the point of view of strict theory, distortion should have arisen from the use of 'iron circuits', but in practice it was found that the distortion was not that serious, and the simplicity and efficiency of the usual choke control circuit amply compensated for its theoretical disadvantages. Many argued that the necessary blocking condenser connected (as regards the speech circuits) across the choke, must have brought in a measure of resonance, producing 'wolf notes' in musical reproduction, but the heavy damping in the circuit made the effect very slight. Eckersley did concede however that the unpleasant ringing sounds in musical production by wireless telephony were due to the partial resonance in the control circuits. The Writtle engineers repeatedly proved that this ringing or hanging-in effect got worse the greater the control employed; in fact the less the control the better the quality, but unfortunately they could not please the single

valve listener at 100 miles if the control was cut down too much. The London amateur, was provided with a better signal with what in point of fact was merely a ripple on top of strong C.W. In the control system at Writtle, every care was taken to damp out tuned circuits and to prevent any reaction in the amplification chain from the microphone to the main control valves. Spurious low frequency reaction in control circuits could be a frequent cause of the 'hanging-in' effect, and the emission of wolf notes.

One of the major limitations of the entire transmitting setup, despite shielding, packing or part enclosing was the 6-volt Peel Connor microphone used for all the 2MT concerts. It was this large and unwieldy device that was probably at the root of most of Writtle's music distortion troubles, good as it was. Before touching the control circuits the microphone had to be checked for it had been solely designed for speech and was never intended for music. The diaphragm of the microphone had a natural period and consequently tended to give prominence to sounds of that period. This was Eckersley's excuse for the awful hoarse grunt that a low piano note gave, the excellence of a violin or soprano, and the poor quality of instrumental harmonised works. The musical quality of 2MT never managed to match the first BBC stations, but unfortunately no substitute for the microphone was available until mid 1923 when Round and Sykes developed their much improved microphone.

The whole transmitter was assembled using experience as the only guide, and most people quickly became experts at diagnosing which component was responsible for flash-overs or evil burning smells. The occasional covert puff of tobacco smoke into live equipment as a joke always fell flat, when without looking up the operator simply said "tobacco".

But joking was put aside as the Tuesday night of February the 14th 1922 approached.

9

FIRST NIGHT NERVES

"Five minutes before going live there was a horrible explosion."

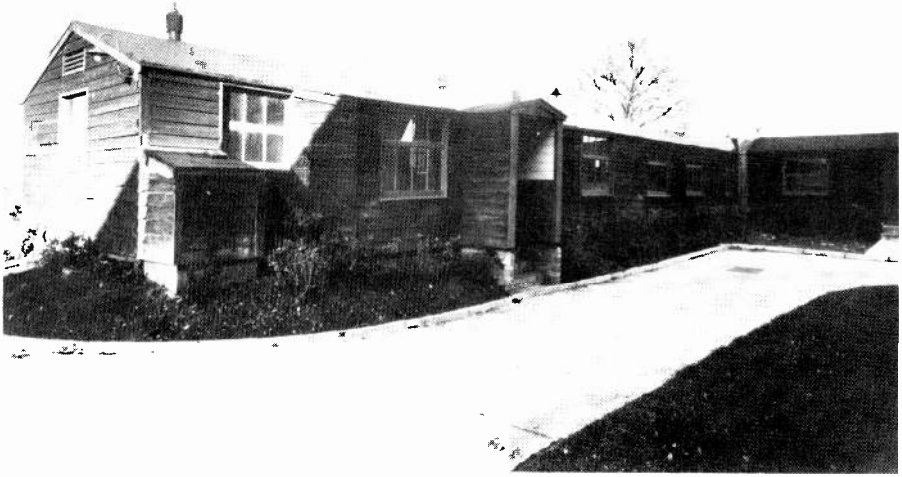
'Doing this thing called broadcasting' quickly turned out to be more complicated than it first seemed. P.P. Eckersley remembered the first live broadcast as almost being a disaster. Five minutes before going on the air a loud explosion completely shattered a tubular glass condenser, and a loud crackling sound signified a complete loss of signal. Despite hurried surgery, when speech came through the repaired circuit it was noticed that it had a very peculiar tone. It was also noted in the engineers logbook that the valve anodes were 'blushing' far more than usual, but it was written off as first night nerves and the broadcast continued. That first broadcast consisted of three five minute sections of morse code at three different powers (1KW, 500W, 250W) on 1,000m starting at 7.00pm, broken by brief pauses when the station closed down to listen for emergency messages. At about 7.35 pm one of the engineers stepped to the microphone and began the very formal format, commencing with an initial call and then, as Eckersley recalled it;

> "We will now play a gramophone record entitled (so and so), played by (such and such an artist) and recorded by (this or that company)."

On the opening night the new radio station presented a selection of songs by Robert Howe, broadcast on a wavelength of 700m using 250Watts. The records arrived in parcels from London, and those that were not rejected as being too highbrow were played on a mechanical gramophone with the microphone held into the opening of the horn. The day before the broadcast Writtle had perfected what Eckersley called the 'ultimate volume control'. The old windup gramophone (with the squeaking spring) had two small doors over its internal horn. The 'smoothest volume control in history' consisted of the engineer moving the microphone closer or further away from the opening. Apparently closing the doors also provided a rudimentary tone control. In Eckersley's words, "pioneers always know better".

The mechanical HMV gramophone was a definite favourite of the Writtle engineers, but the saga of the gramophones at Writtle was to run for the entire career of 2MT. Before the station began transmitting its scheduled programmes, A.R.Burrows over in the Marconi Publicity Department had made special

arrangements with the Chappell Piano Company Ltd., (Piano and Piano Player Manufacturers) located at 50 New Bond Street, London W1. They agreed to supply a brand new Cliftophone Model No.5 gramophone for the 2MT broadcasts, but in the true spirit of what was to follow at Writtle he arranged a generous discount, reducing the price from 27 pounds and 10 shillings to 13 pounds and 15 shillings. In exchange for this huge price reduction he agreed that the new broadcast station would use the name Cliftophone before each record was played. Presumably this made Writtle the first radio station ever to accept advertisements, albeit indirectly, however events were not to transpire as the Piano Company hoped. On 20th February they duly dispatched a brand new Cliftophone No.5 gramophone for appraisal to the Marconi New Street Works which was soon passed on to Writtle. The occupants of the hut, presumably in their enthusiasm for the new adventure, promptly broke the mechanism beyond repair. Well, they were wireless engineers after all. It was hastily returned to London for repair as the first transmission was fast approaching, but in the great tradition of Writtle the custom made packing case was 'lost' somewhere in the hut. A.R.Burrows was to send several terse memos to Writtle asking for its return, the first of many polite and not so polite notes he was to issue to the Writtle site over the following months. It was probably too late, the amazing, all consuming stove had claimed another victim.



22. Ground view of the Writtle hut – around 1955.

The Cliftophone suitably repaired, made its way back to Writtle along with a large parcel, which Eckersley always called his 'bunch' of records, supplied with the compliments of the Chappell Piano Company. The selection also included 'The Swan' (Flute Solo), 'The Angels Serenade' (Cello Solo), 'Il Bacio' (Cornet Solo), 'Simple Aveu' (Flute Solo) and 'Softly Wakes my Heart' (Cornet Solo). It is doubtful whether Writtle actually managed to play them as Eckersley's dislike and mistrust of anything too 'highbrow' was legendary. But this was the first night, so the concert continued in a formal vein. The station call '2MT' was repeated followed by:–

> "You have just heard a gramophone record entitled (x), played by (x), performed by (x), and now we are closing down for three minutes."

The rest of the evening's broadcast went smoothly enough, very formal, very repetitive, but also very proper. It was not the content or format of the programme that worried the engineers, simply the technical quality of the transmitted signal. The whole team simply were not satisfied with their first effort; the next morning Writtle was a gloomy place. The engineers all agreed that it "hadn't been quite so good", and that for some reason the signal was somewhat muffled and lacked top. Initial signal reports were fair, but far from enthusiastic, but it was to get worse. The morning after the first broadcast The Daily Mail reported:–

WIRELESS CONCERT
FIRST OF BRITISH WEEKLY SERIES

> Wireless 'amateurs' listened last night to the first of a series of regular wireless concerts which are to be sent on Tuesday evenings by the Marconi Wireless Scientific Instrument Company from Writtle, Essex.
>
> Last night's concert consisted of songs by Mr. Robert Howe and of gramophone records played by the 'Cliftophone'. The first three items of the concert were heard fairly clearly on The Daily Mail wireless receiving set, but after that the sounds seemed to be entirely wiped out.
>
> The same thing occurred at other stations, and Mr. Leslie McMichael, the secretary of the Wireless Society of London, who had been listening to the concert, expressed the opinion that the reason of the inaudibility of the last part of the concert was that it was wiped out by a 'harmonic', possibly coming from the Post Office transmitting station at Leafield.

After two or three more transmissions the station's critics, radio amateurs near and far, began to send numerous pungent complaints about Writtle's poor signal quality. These even led W.T. Ditcham, pioneer of the earlier Chelmsford broadcasts, and a senior member of the Marconi Research Department to come and see if he could help. He duly checked the transmitter circuit, and waved a neon tube under the aerial, while Eckersley said "Arhh" into the microphone. The tube obediently flickered, so at least the transmitter was modulating. It was to be several weeks before Kirke, to his credit, and the relief of the team, found the fault. He discovered that the hurriedly replaced condenser had a value 100 times greater than practice demanded, the mistake being due to very poor markings on the component concerned. The substitute condenser was shunting speech currents so that the frequency characteristics of the equipment fell by 6dbs per octave above about 500 cycles per second (CPS = Hertz). The fault was rectified, but to save embarrassment, and test the validity of the audience's signal reports the engineers said nothing about the repair and within two weeks the complaints died away.

Once these initial teething troubles were defeated the routine was quickly established. The occasional artiste was 'persuaded' to take the train from London in return for an occasional one pound fee, but most of the entertainment was improvised by members of the staff who shook the ether for the sheer love of the adventure. A piano could usually be found somewhere in the village, being trundled down Lawford Lane every radio night and back again in the morning. The 'studio' consisted of nothing but a cleared end of the workshop, bare boards and cracked window pane which the piano and microphone almost filled. Normally Eckersley left the others to get on with the transmissions and went home to Witham, some eight miles away to listen in, being the stations biggest fan and greatest critic. One evening late in March 1922 he decided to stay on and see the transmissions through. The pre-broadcast planning was accompanied by a large meal at the 'local' and went on rather longer than usual. The hurried dash down the lane to warm up the transmitter convinced Eckersley to do some operating. PP, obviously feeling at peace with the world immediately adopted a less formal attitude toward the microphone than was normal, which when coupled with the look of horror on Ashbridge's face, Kirke's broad grin and Wynn's infectious chuckling made the whole broadcast more exuberant than was ever intended. He failed to play all the records, forgot to shut down for the regulation three minutes and just kept on talking. The rest of the broadcast team stood and stared in amazement. Eckersley came alive in front of the microphone, conducted the whole show more or less single handed and told the silliest stories. Writtle 2MT usually closed promptly at 8.30 pm but at gone nine Eckersley started singing.

It had been obvious from the onset of the 2MT station that P.P.E was never going to suffer from the dreaded disease of microphone shyness. During the early days of transmitter testing at Writtle, Eckersley had to be repeatedly restrained from blasting a distorted signal over the Essex countryside.

"1,2,3,4,5,6,7,8,9,10 !"
"Mary had a little Lamb !"
"Sister Susie's sewing shirts for soldiers !"
"A,B,C,D,E,F,G . . . . !!"

But this time it was very different, the country had been forewarned of the broadcast and many people had been listening. The next morning the team awaited the outcome with a great deal of trepidation. Broadcasting was very new, its tenure on the airwaves very slender and the Writtle team in one night had broken every convention possible. It must be remembered that the world of 1922 was in fact very different to what we now take for granted. Most of the engineers at Writtle had been born with Queen Victoria on the throne, whose 'not amused' attitude has itself become something of a catchphrase. Society had strict and unbreakable rules of formal behaviour, indeed when a senior manager from the Company boarded the regular train for London, all the company men on board would stand to attention and remove their hats. This is perhaps where Writtle was different, the outrageous broadcast could only have happened in a place where everybody was of similar age and background. At New Street you could work for a man for 40 years and never know his first name, at Writtle 'PP' was quite capable of setting fire to your shirt tail. The staff held a post mortem on his unusual broadcast, sat in front of the now silent transmitter. For once Eckersley did not say much, he was convinced at the time that he was being funny, but it all seemed rather awful to hear it repeated in cold blood. His only comment was

"Did I really say that? Really? Good Lord!"

It might be expected that Writtle's night out should have brought a storm of complaints and demands for the station's closedown, indeed the engineers faced the resulting postbag, swollen to 'horrid proportions' with this view in mind. It was not to be. Only one complaint was received and that was from Arthur Burrows, the head of the Marconi Publicity Department. The relieved engineers comments to Mr Burrows were never recorded but Writtle tended to ignore Head Office at the best of times. Arthur Burrows was soon to move to the fledgeling BBC where as 'Uncle Arthur' he would find fame that the Marconi Publicity Department could never give him. Instead of the expected barrage of complaints, over 50 postcards were received congratulating the station on the amazing broadcast. One of the postcards came from the sister of Herbert Edwards, a local lad who retells his tale of piano moving with great pride. She reported to the Company, and her brother, marvellous reception from Edenbridge in Kent, some 40 miles as the crow or radio signal flew, but nearly 60 miles for Herbert on his bike via Tilbury. Visitors to the new station were royally received by 'Eck' and his companions, even 15 year old boys cycling across from the next village after the concert were welcomed, the transmitter was still warm and the 'spit was still wet' on the microphone. Writtle and 2MT was in business, and the business was broadcast entertainment, making people laugh as radio came into their lives.

10

TWO-EMMA-TOC WRITTLE CALLING

"It was all rather fun . . . "

Peter Eckersley.

In response to the fan mail, and the call "Do it again, we like it", so began the true Writtle programmes remarkable for their gaiety and irresponsibility and always containing a surprise. Literally anything could happen, sometimes a burlesque of something deadly serious, sometimes a totally unexpected remark slipped into an otherwise perfectly normal transmission. Peter Eckersley continually came up with more and more outrageous stories and stunts. It was all totally new, in a matter of weeks the signals that amateurs could receive changed from the continual clatter of morse, to outlandish telephony quickly making Eckersley and the station the talk of Britain. Eckersley's favourite was playing a gramophone record pivoted at some point other than its centre, but whatever the plan the emphasis was always on amusing the listener.

To this day people can still remember a night of grand opera from the small Essex village when the whole company of singers, instrumentalists, special effects, scene shifters and property men consisted of just three people. Eckersley compered the show, sang the arias and even provided most of the mock interruptions to the 'normal transmission'. Mr Mclachlan often came over from Marconi Research, played the piano with great enthusiasm, and was very informal, while Peter Eckersley continually impersonated everything from Italian tenors to wireless noises. At times listeners even congratulated him on his impersonations when a guest singer had in fact been brought all the way from London. Writtle always managed to keep the show going, gramophone records, pranks, stories, news and live performances, everything from the piano to the penny whistle graced the bare boards of the hut. Captain Peter Eckersley, broadcasting from Writtle, late summer, nineteen hundred and twenty two:

Hello CQ! Hello CQ!
This is Two Emma Toc Writtle testing,
This is Two-o-o Emma Toc W-W-Writtle testing.

Hello Ash, Hello Ash . . . Ash Hello?
Are the signals OK? No they're not
Wave your hands if it's all OK.
Oh it's not OK.

Oh dear, No waves, no waves at all
Curse, Kirke Kirke is it all right in there?
No? It's not all right
Sorry CQ we are closing down for a minute.

Hello CQ Hello CQ!
This is Two Emma Toc Writtle testing
This is Two Emma Toc Writtle testing

Well tonight we have a most marvellous thing that's going to happen
We are going to receive Rome.
That famous Italian tenor . . now what's his name?
That famous Italian tenor Gridleako is going to sing
Nonflutoroma Fortissimo which being translated means
well it is very difficult.

Now we are going to receive it.
There may be some atmospherics, *(hisssss)*
There may be some jamming, *(parp parp, parp parp)*
There may be some oscillation *(wow wow)*
Hang on CQ, Hang on CQ
Hang on a minute
Here it is . . . .

(Peter Eckersley runs across the room, his voice fading)

Suddenly the old piano burst into life and a strange strangled voice shouting mock Italian made its debut on 2MT.

These were happy days for the engineers and it is probable that Eckersley never enjoyed himself more then when he was compere, actor manager and soloist at 2MT. At least his spontaneous humour and bubbling enthusiasm always gave that impression to his listeners. He was the power behind the microphone of 2MT, a brilliant engineer and organiser (as he later showed as director of the largest department at the BBC) but still capable of the most incredible fun and he was undoubtedly the star of the show. Eckersley was able to go up to the microphone and apparently without effort, be spontaneously funny for ten minutes at a time. He talked to the listeners as if he had lived next door to them for years and they loved it. Even today many still remember his enthusiastic voice crackling over headphones and horn speakers.

Peter Pendleton Eckersley, M.I.E.E, F.I.R.E, was born in January 1892 in La Puebla Mexico, being the youngest of three brothers. His mother was one of Professor T.H. Huxley's daughters and his father was the Chief Engineer on the new Mexican Grand Southern Railway. He was educated at Bedales School with his older brother Tom who later became a fellow of the Royal Society for his

research work with the Marconi Company. Peter inherited his early passion for all things wireless from his brother and became Tom's 'lab' boy, 'glad and proud' to turn switches and tidy the apparatus around their West Runton house.

Peter Eckersley had a charming friendly personality, an active mind, great ebulliency, inexhaustible energy and few peers as a public speaker. Such talents do not necessarily make a natural broadcaster, but his flair for translating technicalities into lay terms, always spiced with wit and humour made Eckersley just that. He could also be a perfect buffoon at any time, and was always ready to argue for, or against any problem.

After Bedales school in Petersfield Eckersley was briefly apprenticed to Mather and Platts Electrical Engineering Manufacturers in 1911 before attending the Manchester Municipal School of Technology (1912-1915), later to become Manchester University. Eckersley had volunteered for active service in 1914, but a knee firmly 'crocked' in a teenage rugby game meant that he was simply sent away. The War Office at this time held the view that only the very fittest could, or should fight. In 1915 he applied to be a pilot in the new RFC, hoping that the new organisation would not be so choosy. He satisfied his examiner that his family connections were sound, that he could foxhunt well and played all the right games. Three months later as he left to become a pilot, it appears that in passing someone casually asked him if he knew anything about wireless. Luckily for the history of broadcasting, Eckersley's aeronautical adventures were immediately curtailed and he joined the RFC not as a pilot, but as a Wireless Equipment Officer. After basic training, for some reason known only to the War Office, he was promptly dispatched to the Far East ending up in 1916 in Salonika, where a severe bout of malaria invalided him home. After a brief period in France Eckersley received a fresh posting to Brooklands and began to do what he was good at, experiment with wireless.

He had learnt his wireless skills mainly from his elder brother, T.L. (Tom) Eckersley who was himself a brilliant mathematician and respected radio engineer. It seems that Eckersley's spell in uniform did not manage to blunt his enthusiasm for practically everything, except red tape and bureaucracy. He was an instinctive pricker of balloons, anything smattering of the pompous was an irresistible target for his stiletto thrusts. He always seemed to fly in the face of convention, but his warm outgoing personality usually carried the day. He even wore a velvet jacket to the very august Institution of Electrical Engineers (IEE) meetings!

Peter Eckersley, engineer, humorist, broadcaster.

Hello CQ, Hello CQ
This is Two Emma Toc, Two-ooo Emma Toc.
Hello CQ this is Two Emma Toc,
Two-oo Emma Toc Wr-r-rittle calling.

Is it all right Ash?
Kirke is it all right? You're sure?
What, what do you say?
Oh it's blasting, Hello CQ, CQ it's blasting, do you want a blast;
I blast the whole lot of it.

Well look how are you tonight?
I'm afraid we've had one or two terrible things happen tonight;
we did expect to get a serious singer for you.
Well she failed, yes well singers do you know.

But we've got tonight a number of gramophone records as usual . . .
What's happening?

Hello CQ, Hello ? what do you say Kirke ?
It's not going out at all . . .
Oh dear – well it's your fault. It's what ?
Well for heaven's sake connect it up –
Oh it is connected up!
This has all been going out!

Hello CQ, Hello everyone,
I'm sorry, there has been a little bit of misunderstanding,
a little 'technical hitch' yes, yes, you get them too?
I know, aren't they awful?

Well I think we're ready to begin now, and the first thing I've got to introduce is a record entitled –
Why are records always *entitled*,
why aren't they just *called* something? –
So here it is – a record entitled . . . ."

Then with a scratching and a whistling the record would make its debut on 2MT. In the history of broadcasting only Peter Eckersley could produce a complete evenings entertainment from a damaged gramophone record, two biscuit tins, a prehistoric piano and himself. Eckersley became a part of broadcasting history, his dreary weather forecasts, and perpetual deep depression over Iceland were constant favourites. His observations on the weather, as he stared out of the hut window into the pitch black night became an established ritual. "On Monday morning it is always raining" soon became 2MT's catchphrase.

It has sometimes been suggested that 2MT broadcast into thin air and that there were few people to hear all the fun. Nothing could be further from the truth for by mid 1922 there were some 8,000 licensed radio operators and their families in Britain, who also listened to the only two other European broadcasting stations at that time. The Paris Eiffel Tower station, callsign FL, transmitted a daily recital

on 2,600 metres, and the Nederlandische Radio-industrie service from the Hague, station PCGG broadcast a Monday and Thursday evening programme. This station also transmitted a weekly "Dutch Concert" from 3 pm to 5.40 pm on Sundays (originally 8 pm to 9pm before Sep 17th 1922) and was heard throughout the British Isles. (*See Appendix F.*)

Despite the competition Writtle remained everyone's firm favourite. Her most popular concert was presented by a lady named Nora Scott, who braved the train journey and the mud to be 'fetched' all the way from London.

ENGLISH WIRELESS CONCERT
TUESDAY'S PROGRAMME

Tomorrow, Tuesday, at 7 pm. the principal attraction of the English Wireless concert transmitted from Writtle on 700 metres will be the singing by Miss Nora Scott, the well-known contralto, of three Ascherberg songs:–

"When The Dream Is There"	by Guy D'Hardelot
"I Will Not Doubt"	by Sir Frederick Cowen
"I Found A Paradise"	by Dorothy Foster

It will interest amateurs to know that for their benefit a change in the time and wavelength of these weekly wireless concerts has been arranged. Starting next Tuesday the concert will take place at 8 o'clock British Summer Time and the wavelength will be 400 metres.

With the compliments of
Marconi's Wireless Telegraph Co., Ltd.,
Marconi House, Strand, W.C.2.
May 22nd, 1922.

The concert brought appreciative reports pouring in. It seemed as if all England had listened; Loughborough, Norwich, Dartford, Liverpool, Newport in Monmouth, from all these places came letters, postcards and telegrams. From Gosport in Hampshire, came a minor complaint that "this superb concert" had been part jammed by the Isle of Wight coastal station located on St Catherines Point at Niton. This station had a range of 150 nautical miles and used the callsign GNI, as originally all British shore stations used a three letter callsign beginning with the letter G. It was a minor complaint that improved receivers would soon remove, overall the concert had been a great success. From Scotland to the South of France 2MT made her voice heard and people wanted to listen.

2MT Writtle originally broadcast on 700 metres as the Post Office licence stated, but this was changed on 29th May 1922 to 400 metres to avoid clashing with one of the harmonics of the G.P.O. station at Leafield. The Leafield station, located near Oxford, was a high power (arc) CW station operating on 12,200

23. Nora Scott sings for 2MT Writtle – 1922.

metres under the callsign GBL. The Leafield station was thought to be the cause of severe 'jambling' noises that 2MT listeners experienced from time to time, but GBL and its frequency were considered a fixture on the radio spectrum that the new art of broadcasting could never hope to influence. It was time for the Marconi Company to issue another formal notice.

ENGLISH WIRELESS CONCERT
ALTERATIONS IN WAVELENGTH AND TIME

From today, Tuesday, the English wireless concert transmitted each Tuesday evening from Writtle, Essex, will take place at 8 pm. British Summer time, on a wavelength of 400 metres; not at 7 pm. on a wavelength of 700 metres, as hitherto. In view of these changes wireless amateurs throughout the country are invited to send reports on their reception, with criticism of the individual items, to the Writtle Wireless Station.

With the compliments of
Marconi's Wireless Telegraph Co. Ltd.,
Marconi House, Strand, W.C.2.
May 29th, 1922.

The notice also heralded the abandoning of the morse calibration signals that had always preceded the telephony transmissions. The morse keying had been effected by simply interrupting the H.T. transformer primary circuit (400 volts!) using a standard Marconi Morse key.

It seemed that people from all walks of life listened to the Writtle Station and Nora Scott on all manner of wireless sets. G.W. Benzie from Peterculter in Aberdeenshire reported very good reception using three valves and headphones, while J.A. Coombie from Guthrie in Forfarshire reported loudspeaker audible reception on a five valve set. In Liverpool a single valve and a 12ft aerial provided reception for Mr S. Lowley, while four valves and a 25ft indoor aerial provided strong signals for Mr C. Bain in Newcastle Upon Tyne. The stations status and the rapt attention of the listeners was maintained when the Writtle engineers came up with the idea of presenting the first-ever wireless play on 17th October 1922.

The 'production team' chose to act out the balcony scene from Cyrano de Bergerac as it seemed the most suitable to broadcast with the limited means at the disposal of the men in the hut. The scene is played on stage in semi darkness with virtually stationary players. A young actress, Miss Agnes 'Uggy' Travers and her brother came to help the engineers with their lines. The players all sat around a kitchen table in the middle of the hut, speaking their words into the lip of a single microphone passed from hand to hand as the lines demanded. The actor's 'scripts' lay beside them neatly typed by Miss Beeson, complete with instructions in brackets imploring the speaker to read with 'voice raised', 'voice discrete' or 'voice passionate'. R.T.B Wynn remembered the engineers sitting around a table in his small rented room, reading the script into the back of a large tablespoon doubling for the microphone. The team had to practice passing the 'spoon' from reader to reader without dropping it, or rustling the scripts. It was, Wynn remembered, a nerve wracking experience, even though all he had do was watch the transmitter and produce the sound of rustling leaves at strategic moments. Miss Beeson's photograph in the staff line up for Writtle in 1922 captures her as a slightly prim and proper young lady, but memories of her paint a far different picture. Elizabeth was a kind, considerate and thoughtful person who simply 'mothered' the men who made 2MT. She was well liked and well respected by all the engineers on site, and was in fact Edward Trump's sister-in-law.

The part play was a great success but Writtle scored many other radio firsts. 2MT's five minute children's spot was very popular even though the Writtle programme now went out later in the evening. It was copied by 2LO and the BBC, a subject well covered by Ian Hartley's book 'Goodnight Children Everywhere'. It leads one to suspect that the programme was not so much aimed at children but at the engineers and amateurs who truly appreciated nursery rhymes such as:–

Hey diddle dodrode,
Two grids in one quadrode,
The outer one forming the plate.
The electrons got muddled
With so many grids,
But the final m value was eight.

or:

Four and twenty B valves standing on a shelf,
Ash. couldn't find one so I had to go myself.
When the circuit opened the phones began to sing,
Don't you think I was right to smash the beastly thing ?

Writtle was so sure of its listeners that they even ran a competition in connection with the transmission on 15th August 1922. The exact nature of the quiz is unrecorded, but the station received over 160 replies. After 'mature consideration' (they were late) Eckersley awarded three prizes, (exactly what, is again unrecorded), but for those who missed the results the first time, they are reproduced here.

First Prize went to C.W Clarabutt of the Bedford Physical and Radio Society.
The winner's address was Beechcroft, Beverley Crescent Bedford.

Second Prize went to J.P Beeson, listening in from Southwell in Nottinghamshire.

Third Prize went to C.G Williams, 22 Scholar Street, Sefton Park, Liverpool.

If they did not receive their 'prizes', they are either still in the hut – or they went into the stove!

The receiving sets that the contestants and the rest of the Writtle's audience used were of many different types, but mostly all 'homebrewed'. Peter Eckersley in one of his many published articles on wireless topics, in Wireless World and Radio Review for 9th September 1922 described some equipment for listening to Writtle at various distances. Stations within ten miles of the village (assuming a full Post Master General approved aerial) only required a single valve or crystal set, although the crystal set would be rather weak at ten miles or more. The Post Office placed strict limitations on aerial size, to be known as an 'Approved Aerial'. This could consist of a single wire 'L', limited to 100 feet in length including the leadin, or a twin wire usually recommended because it could actually have 140 feet of wire. Writtle did receive reports from several crystal set listeners who received excellent signals of 30 miles distance, 42 miles being the record, but this was not really reliable. For a listener using a plain aerial for reception on 400 metres, Eckersley recommended a series condenser in order that the inductance may be

made as large as possible. If the series condenser is made too small it decreased sensitivity, albeit that the extra inductance enhanced it. Eckersley did warn about a 'disease' prevalent among amateurs at the time, he called it 'valveitis'. Writtle often received reception reports from stations using a full aerial and multiple valves located only a matter of miles from the transmitter site. These drove Eckersley to distraction, as the use of too many valves usually resulted in distortion due to saturation or heavy grid currents clipping the top. This led to very bad audio quality, and many such keen amateurs tended to give PP's beloved station a bad name which it did not deserve.

Between ten and 50 miles a single valve in a reaction circuit provided good reception, Writtle received many excellent reports of reception up to 100 miles with a single valve. Eckersley did however suggest that should finances allow, the addition of a second valve would reject jamming, increase volume, and prevent oscillation. In favourable atmospheric conditions the Writtle team received single valve reception reports from St Austell in Cornwall, and to a limited degree even mobile reception from on the Forth Bridge. (*See Appendix H.*)

The main complaint from receiving station between 50 and 100 miles was jamming. Many keen amateurs lived on the sea coast where interference from ship installations working in the narrow waters caused many headaches. For this problem Eckersley recommended a coupled circuit, although loose coupling was advised. To conclude 'PP' always refused to be drawn into a debate about how best to receive at distances of over 100 miles, preferring to leave it for the amateurs to experiment. Greater distances not unnaturally required ever more complex circuits, but from the reports that Writtle received, it seemed that in general amateurs tended to use little amplification at large ranges, and too much at short ranges. Writtle had her fair share of technical debate and argument, one of the trials of being the first is that others, possibly envious of that position should try and discredit your achievements. Despite what many have said and written in the past it was not all fun and competitions for Writtle. The station had its serious side as well.

On the 28th February 1922, the marriage ceremony of Princess Mary (only daughter of King George V) to Viscount Lascelles KG DSO eldest son of the Earl and Countess of Harewood was recorded by the Columbia gramophone record company. The Chappell Piano Company still anxious to sell their Cliftophone No5 gramophone, immediately sent Writtle a set of proof copies. Each record came complete with its ideal playing speed written on the sleeve. In exchange, the London company stated that they must actually dictate the script, so as to achieve maximum advertising effect. They wanted the Writtle Station to broadcast the following:–

> "We will now give you on the Cliftophone No.5 a selection of Princess Mary's wedding music played at Westminster Abbey today. The records have been specially prepared by the Columbia Gramophone Co. Ltd. The number of this record is (x) and its title is Handel's Water Music Suite (x)."

Because of the great occasion, for the first and probably the only time in its career, Writtle almost followed this. Their broadcast to the nation from Writtle causing, as one newspaper put it, "a great feeling of national pride and patriotism".

After the success of the Princess Mary record selection Columbia agreed to supply all the records for one week in every month for 2MT. They did just that, starting on the 4th April and continued until the 12th December 1922. The record selections always arrived promptly on the Monday morning before the Tuesday night broadcast and were then promptly sorted through with Eckersley's discerning eye.

There was one slight problem, Writtle with its unique flavour and gift for laughter and ad-libs usually forgot about the Cliftophone. In fact they seemed to forget a lot of things they did not like. M.E. Ricketts Esq, one of the directors of the Chappell Piano Company sent a strongly worded complaint to Arthur Burrows. To his credit Mr Burrows wrote back stating that the Cliftophone was at New Street, (he never gave a reason) and that Writtle was using its old HMV gramophone. He did mention that if they could have another Cliftophone at the same reduced price, then Writtle would use it. On the 18th June this duly arrived with several modifications to the horn as suggested by the Writtle engineers. The new horn was a great improvement, but the diaphragm would in fact stand still if too high a volume was demanded. To stop excess resonance the Writtle engineers also wound two yards of insulating tape around the new horn. Marconi's sent the old Cliftophone back to Chappells to be modified by return of post, but Writtle had put yet another black mark against her name. When the original Cliftophone returned with its modifications it was accompanied by a strong letter protesting at the worn and damaged state of the cabinet, although the piano company had patched it as best they could. It seems that life in the hut was very rough. Writtle even seemed to use an extraordinary number of gramophone needles, regularly requesting new supplies of 'The Arrow' for loud tone and 'The Duplex' for soft tone.

Writtle was willing to try anything new, and nurtured much homegrown talent. This was probably due to Writtle's remoteness from the artistic capital London, and the lack of funds with which to actually pay the performers. Guest singers that were persuaded to actually make the trip would be met at Chelmsford station, just outside the ticket barrier by a man 'wearing a black velour hat and a navy blue coat'. On arrival at Writtle, the performer was given a single run through their songs, performed live on air, and was then rushed back to the railway station to catch the return train. The one pound fee paid to such guest entertainers usually came from the engineers' own pockets, so most of the broadcast entertainment that graced the airwaves from the Writtle hut came from anyone who would play for free.

The diverse amateur and semi professional performances that the new station could provide were somewhat eclipsed on 2nd February 1923, when the famous Dutch tenor Mr Lauritz Melchior sang for 2MT. Melchior's concert for the Chelmsford station two years earlier had been a great success and received many

excellent reports from both sides of the North Sea. The muddy track at the bottom of Lowford Lane was however very different to the New Street complex that had once been graced by Dame Nellie Melba's performance. It also appears that Melchior had recently married, and had left his new wife comforted with a crystal set in Denmark ready to hear the concert. Unfortunately he worked on the principle that the louder he sang the more likely his wife was to hear him, and one thing Lauritz Melchior could do was sing loudly. The small army hut was no match for the largest opera houses of Europe and unlike the Chelmsford engineers the Writtle hut couldn't provide 16 feet between singer and microphone.

24. Lauritz Melchior – posing for photographs during his Chelmsford broadcast in 1920.

As Eckersley recounted the tale, Melchior first took an enormous breath that pulled the windows in the hut tightly shut. He then gave a huge bellow that overloaded the transmitter, pulled out the circuit breakers and shut the station down. For years afterwards the engineers always used to refer to any broken or faulty component as being part of the 'Melchior breakdown'.

The neatly typed programme of events told how it should have happened.

TUESDAY'S WIRELESS CONCERT
Famous Danish Tenor to Sing

During next Tuesday's English Wireless Concert radiated from the Marconi Station at Writtle, Essex (7 pm. summer time, 700 metres wavelength) Mr Lauritz Melchior, the world famous Dutch tenor will sing:–

(1) Ujarak's song from the opera Kaddara by Hakon Borrensen.
(2) The Blind Ploughman by R. Coningsby Clarke.
(3) "On with the motley" from 'Pagliacci'.
(4) "Sometimes in my dreams" by Guy d'Hardelot.

Miss Morwenna Felce (Melchiors Accompanist) will also play a piano solo.

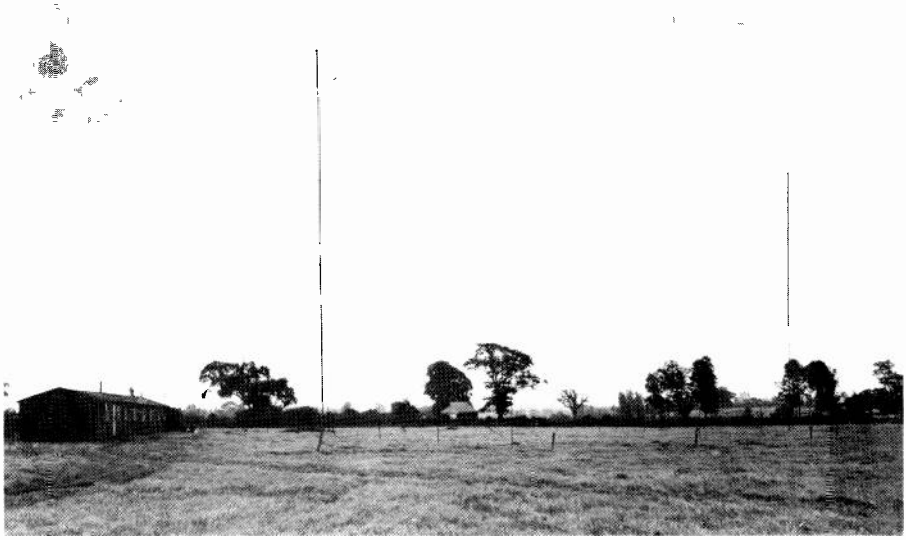
With the compliments
Marconi's Wireless Telegraph Co. Ltd.,
Marconi House, Strand, W.C.
April 28th 1922.

It seems that even the opening announcement was thought to be 'very nasal' and 'over resonant'. The engineers did appreciate that Melchior's accompanist was very proficient even if the battered piano was not up to her standard, it was regarded by all as a very 'tinny old instrument'. Its regular bouncing down the lane on a barrow, and the lack of a piano tuner did not help matters. Even if this particular broadcast 'was too slow to hold interest', that the 'top' was 'not sharp and bubbly' and Melchiors pauses seemed 'interminable' the live concerts usually went more smoothly. It seems that the hut was just not equipped to handle temperamental superstars.

Other problems also plagued the engineers when outside artists paid Writtle a visit. Duets were technically impossible using the existing microphone, also the hut was extremely cramped at the best of times. It seemed that particular instruments also defied all attempts to make them broadcast realistically. One of the worst culprits was the piano, even good ones in tune often sounded very tinny, deep tenors were often unrecognisable and "fiddles sounded like an oboe or concentina".

For no obvious reason some concerts just did not sound right. The Marconi archives contain handwritten notes scribbled on the back of a typed concert programme, that record some of the problems faced by the engineers during these first musical broadcasts. For no real reason concerts would "sound very metallic" with the "fiddle sounding like an oboe" and the "concertina having trouble stopping." The anonymous commentator also noted, possibly about the Melchior

broadcast, that there was "not a soft note in the whole show." "The whole transmission was almost too loud to be borne on the ears (we) tried to tune down without effect." "(When we) got the metallic tone away everything seemed a hundred miles off."



25. Writtle site and aerials – 1922.

Despite such technical hitches the musical output of 2MT was generally very good, which when coupled with Eckersley's talent at the microphone made Writtle the talking point of Britain. It seems that Peter Eckersley soon became something of a star himself, probably the first radio personality to make a real impact on the general populace. Writtle, and PP in particular began to receive what later generations would term 'fan mail', not just signal reports, technical comments and suggestions, but personal interest as well. One lonely lady corresponded regularly and at length, showing a great enthusiasm for the image of the man she pictured behind the voice. Eckersley and Wynn composed some touching replies to her letters, Writtle's lonely hearts club was a success, even if the performance of Mr Melchior left something to be desired.

The usual level of musical accomplishment can be gauged by the famous 2MT signature tune. This was sung in many versions to several different tunes. Memories differ as to the exact words but it seems a different version went out nearly every Tuesday night. The closing improvisations were performed by Eckersley in a high tenor voice with an accompliment vamped on the trusty old piano. Eckersley recalled in 1941 that the 'theme' was usually sung to the tune of Tosti's 'Goodbye', bidding the listeners a merry goodnight with the following verses:–

"So Goodnight CQ, Yes the usual song I know,

Dearest the concert's ended
Sad wails the heterodyne
You must soon switch off your valves
I must soon switch off mine
Write back and say you heard me
Your distance and where and how
Hark the engine's failing
Goodbye you old low-brow"

He then finished with:–

"So Goodnight CQ, God bless you, because I can't, Goodnight everybody!"

But R.T.B Wynn recalled a more rhythmical version sung to the tune of 'Parted'.

C.Q!! The concert's ending
Loud squeals the heterodyne
You must soon switch off your set
I must soon switch off mine.

Stay for one fleeting moment
Tuned to the last degree
C.Q!! The concert's ending –
Ending for 2MT.

(accel) How can we keep it going ?
Valves blue and engine hot

(cresc) CQ!! The concert's end - ed

(ff) I wish we could scrap the lot!
(rall pp) I wish we could scrap the lot.

It was all rather fun. Eckersley freely admitted that at times he was probably horribly facetious but he tried to be friendly and talk with, rather than to the listeners. Throughout the whole career of 2MT the success of the station lay in the fact that they always failed to take themselves seriously. The engineers at Writtle regarded the whole thing as nothing more or less than pure entertainment, as much for themselves as for the listeners. That was the secret of station 2MT Writtle's success.

11

2LO LONDON CALLING

"The beginning of the end for 2MT"

Shortly after 2MT began transmissions a rival to the Writtle broadcasts appeared on the air. The Post Office issued another permit direct to the Marconi Company authorising the establishment of another experimental station. This time radio broadcasting came to the heart of the city with the new station being established on the top floor of Marconi house in the Strand, London. From behind the heavy dust covered drapes installed in the old 20ft by 20ft cinema theatre to stifle echo came another voice:–

"Hello CQ 2LO Calling. Please stand by . . . ."

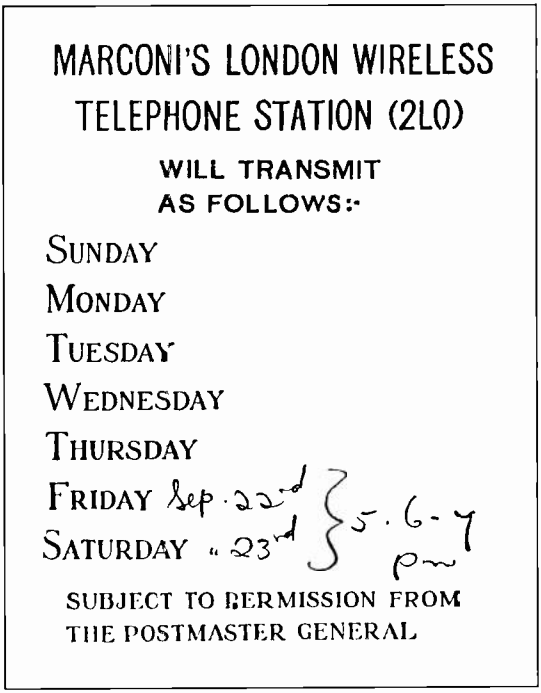
London's first voice was initially very modest. The new station was allowed to transmit only speech for a maximum period of just one hour daily, using a radiated power of not more than 100 watts. Although being in the heart of the capital removed the staff from the rigours of countryside life at Writtle the station was still very simple. The microphone was housed in a large box on castors commonly known as the 'meat safe' while the actual microphone was a moving coil 'Rounds-Sykes Magnetophone' suspended on an 'sorbo' rubber sling from a mahogany frame within a heavy mahogany case. The Magnetophone was an early moving coil microphone weighing some 30lbs, produced by Captain H.J Round in 1923 from an idea put forward by Mr A.J Sykes. Its huge electromagnet was energised from four heavy 12 Volt accumulators usually referred to as 'ships batteries.'

A large perforated metal cover was placed over the microphone to protect it, and this led to its resemblance to the perforated meat safes common before the widespread use of domestic refrigerators.

The new London wireless station also possessed two desks, three telephones, a piano, music stand and a signalling lamp to show that the station was 'on air'. The transmitter used two MR9 rectifiers and a MT2 self oscillator. It also used two MT4 valves in the main modulator with the HT being operated by a foot switch when all filaments and attenuators were ready. The roof of Marconi House provided the elevated platform for the new station's aerials which consisted of two cage or sausage shaped constructions, each of which had four wires. This was stretched between two masts nearly 50 feet above the roof and 100 feet apart at the base. The earth was provided by the building's lead roof, its steel framework and the substantial copper lightning conductor.

26. Marconi House, The Strand, London. Site of 2LO.

Although limited in power, the 2LO station did have an ideal location high above the city centre, full of potential listeners. However problems often arose because the young wireless engineers did not have sole use of the cinema, often having to work in the dark as training films flickered over their heads. Despite frequent arguments over allocated times, equipment storage and the fact that the cinema guests kept pulling the wires out, the station's first trial broadcast went out on the 11th May 1922. The small transmitter (that drifted off tune every time an engineer looked at it) only gave an area of coverage of some 40 miles if listeners were using valve sets or 15 miles at best for crystal set users. Each transmission was subject to a Post Office permit as all its programmes were officially only demonstrations, and as such were not publically advertised. Those listeners that were lucky enough to be on the company's mailing list were notified by post in advance of proposed schedules. These first 'Radio Times' were simple hand written postcards such as this despatched in September 1922.


MARCONI'S LONDON WIRELESS
TELEPHONE STATION (2LO)
WILL TRANSMIT
AS FOLLOWS:-
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY Sep. 22nd
SATURDAY " 23rd
5. 6. 7 pm
SUBJECT TO PERMISSION FROM
THE POSTMASTER GENERAL

27. 2LO – broadcast schedule by postcard.

The broadcasts were usually arranged for an audience at some institution, whereupon the company then installed and operated all wireless sets for the occasion. 2LO was to perform for many varied organisations and charities, including hospitals, private garden parties and even wireless societies. Writtle had shown that such special events were practical when the 2MT engineers organised a wireless demonstration station at the Writtle agricultural college in November 1922. The Post Office had on that occasion issued the Marconi Company with the following authorisation:–

Your reference X/B/H
P.O reference 177970/22

GENERAL POST OFFICE,
LONDON, E.C.1.

8th November 1922

Gentlemen,

Demonstration of Wireless Telephony

With reference to your letter of the 6th instant, I am directed by the Postmaster General to say that he hereby authorises you, on the usual conditions, to give a demonstration of wireless reception on the 9th November in connection with a meeting of the Chelmsford Engineering Society at the Agricultural College, Chelmsford. In this connection, he also authorises you to transmit speech etc., by wireless telephony during the period 7.30 pm. to 8.0 pm. on the date specified, from your station at Writtle, Chelmsford using power for transmission not exceeding 1 K.W. and a fixed wave length at 400 metres.

The apparatus and aerial at the temporary receiving station at the Agricultural College, Chelmsford, will no doubt be dismantled and removed as soon as possible after the demonstration.

I am, Gentlemen,
Your obedient Servant,

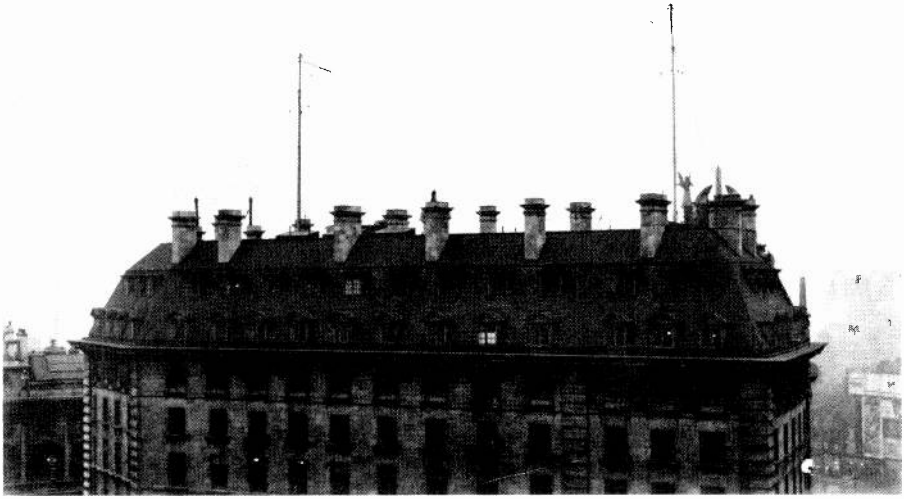
.....
for the Secretary.
Marconi's Wireless Telegraph Co, Ltd.,

The rules confining 2LO were later relaxed, and some evening programmes were even announced in the press beforehand, but no mention of Marconi House was ever allowed. Every broadcast also had to observe a three minute listening period (like 2MT did until they 'forgot' to do so) in every ten minutes of transmission, waiting for any official closedown message. The three minute break did give the Marconi engineers time to retune the transmitter, while the rest is reputed to have done the valves 'a power of good'. The new 2LO station did mirror 2MT in that all its members of staff quickly became adept at doing any of the jobs required to get the broadcast on air.

The requirement for engineering staff to turn their hand to any job persisted for many years. Roger Eckersley, who followed his younger brother Peter to the newly formed BBC in 1924, remembered reading the news, playing the piano, commentating on live events, including from the cab of a steam locomotive, even singing just to get the programme out. It was this flexibility that led to him later becoming the BBC's Director of Programmes.

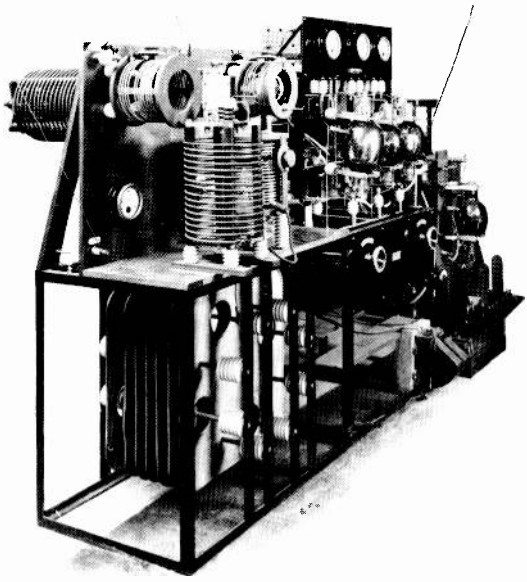
2LO was gaining a foothold in the ether, its amateur audience swelled by 'ordinary' entertainment seeking listeners. Over in the small village of Writtle the

spirit of farce and foolishness had always been based on a comradeship with their audience. This relationship was in sharp contrast to the careful and deliberate pomposity of the new London station who made it their policy to 'say nothing that might offend'. Station 2LO lived in constant fear of having its tenuous licence revoked. This fact was not lost on Eckersley and the rest of the team at 2MT who took every delight (and opportunity) in poking fun at 2LO's self conscious sobriety. 2LO's daily speech only broadcasts gave them plenty of time to listen for material for sketches, comments and skits. It must have been galling for Arthur Burrows (by then the joint 2LO Programme Director) to continually receive letters asking him not to transmit between 8.00 and 8.30 pm on a Tuesday evening, so that people could hear Writtle laughing at 2LO. The 1922 radio call book lists the London Station as broadcasting on 369 metres, (later 361.4m) which was close enough to Writtle's new wavelength of 400 metres to cause interference problems, especially for people listening in on 'cat's-whisker' crystal wireless sets.



28. The 2LO aerial array, high above the Strand.

Even when closing down 2LO's dignity was not safe. The London station devised a signing off chime, whereby a set of suspended tubular bells kept in the corner of the studio would be struck in sequence to announce going off air. To save costs the bells had actually been hired by the new London station, as the purchase price of twenty pounds had been considered exorbitant. 2MT Writtle soon found that their version was much more popular and considerably cheaper. Peter Eckersley sang his goodnight song and then closed the station down with a chorus of clashing metal saucepans and a cacophony of firmly struck milk and ginger beer bottles.

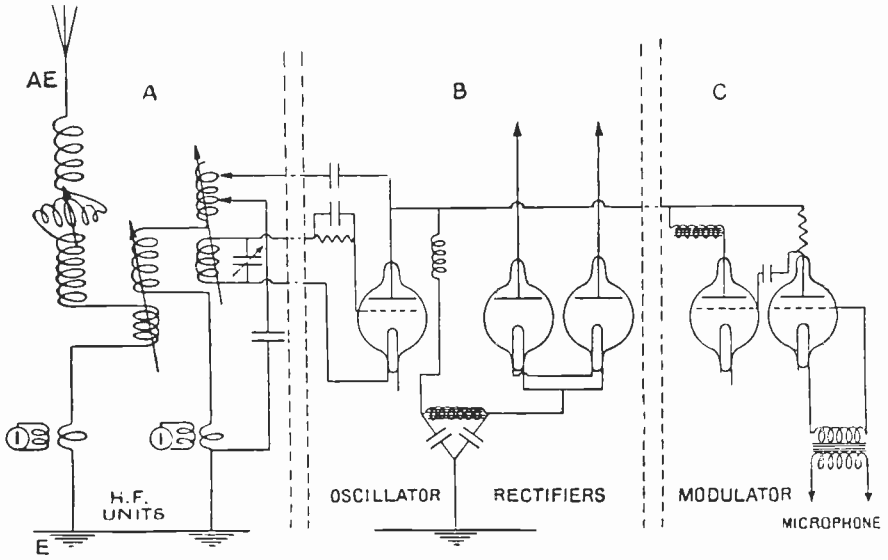


29. 2LO's first transmitter.

The original 2LO transmitter has sometimes been described as being built in a 'converted tea chest' possibly confused with the famous 'meat safe' microphone. This photograph is often mis-captioned, but is considered to have been 2LO's somewhat haphazardly constructed 'first voice'.

Arthur Burrows the ex-publicity chief of the Marconi Company, and formerly a journalist, was the man who had once had to contend with the antics of 2MT at Writtle. He had first become interested in radio through an article he wrote for in the 1918 year book of Wireless Telegraphy and Wireless Telephony entitled 'Wireless Possibilities'. Eckersley described him as 'the man with the golden voice', although he also had an amazing concern for detail and preciseness. Arthur Burrows was widely regarded as an amiable and even tempered man, if a little fussy; Eckersley well remembered his earnest concern over a letter from a parson in Norfolk who thought he heard someone say 'damn' into the microphone. Burrows has been described as lacking a sense of humour, but it is probable that his ordered mind was not well suited for the chaos of the new station. Typical of the situation was Peter Eckersley's London flat, where the carpet was invisible due to piles of unanswered technical correspondence. He even convinced his brother Roger to start writing replies, even though the poor man knew nothing at all about heterodynes and coils.

Burrows was determined that he would impose as much control over the activities of the new station as possible. He had already written a long letter to the Managing Director of the Marconi Company stating that the 2LO broadcasts should be conducted in a 'professional style' as distinct from the "engineers



30. Circuit diagram – 2LO's first transmitter.

31. 2LO Studio – 1923.

programme work with which the public had hitherto become accustomed". Just as 2MT before it, station 2LO had all the basic problems of a new science, coupled with a new art form while both were still in their infancy. Performing artists constantly over modulated while using microphones, Eckersley's blasting problem was to haunt radio engineers for many years. It was very hard to make people talk naturally when confronted with 'that device', while performers inevitably dropped things, made unfortunate noises or comments during, or immediately after the transmission of their piece. It also seemed that to anyone unuse to a broadcast studio it quickly became a minefield as they tripped over wires, headphone leads, transmitters, microphone stands or even themselves. At Writtle everybody was used to it, and it was accepted as part of the fun.

At 2LO, to comply with Arthur Burrows' edict, the general output was usually very mundane, although they did have their highlights. The stations debut came on 11th May 1922 at 9.25 pm when it ambitiously managed to broadcast a running commentary covering the Lewis/Carpentier boxing match at Olympia in West London. The words were relayed live from ringside via a telephone from the Daily Mail reporters through to Marconi House, however the technical feat was somewhat upstaged when Carpentier won by a knock out within the first minute. On 24th June 1922 2LO gave its first live broadcast, a musical number presented by Miss Beatrice Eveline on the cello, Miss Ethel Walker on piano and Mr Charles Knowles. The microphone was placed in the centre of the now carpeted studio and the instrumentalists and vocalists were grouped around it at distances where no one voice or instrument would predominate. The distances were all found by trial and error, causing much chair shifting on the part of the musicians involved.

This first live broadcast was a success to be quickly followed on 7th July 1922 by excerpts from a new musical known as 'Lumber Love' with Mr Emmett Adams the composer taking part. On 12th December a pioneer of a different field, Dr. Alexander Graham Bell, and Lord Burnham spoke from Marconi House to journalists assembled in Geneva recording the proceedings of the first assembly of the League of Nations. The September 7th and 8th broadcasts carried reports on the King's Cup Air Race, and in October the Prince of Wales broadcast to the Boy Scouts of Great Britain following the great scout rally at Alexander Palace. On the 21st June 1922 2LO stirred the consciousness of the country when they broadcast the haunting strains of the Last Post and Reveille. This introduced the Managing Director of the Marconi Company, Godfrey C. Issac's broadcast, as he unveiled a memorial to the 348 men of the Marconi Companies who lost their lives during the First World War. The majority of the Wireless operators who gave their lives in the service of their country belonged to the Marconi International Marine Company, and were mostly lost at sea. Their memorial plaque, now moved to the Chelmsford building, bears these few simple words:- "They Dying So Live".

Writtle, often described as being miles from anywhere, could never match broadcasts of such impact. The two horse race between 2MT and 2LO was rapidly drawing to a close. Within months of 2MT starting transmission, no less than twenty three other companies had applied for licences to establish broadcasting

stations. It was decided by the Post Office, who had by then developed a more lenient attitude to broadcasting, to vest the power of transmission in one authority. This was seen as the only way of preventing the chaos that had occurred in America. The success of Writtle and 2MT paved the way for 2LO to grow from its humble beginnings.

On 18th May 1922 a proposal was put forward to some 400 eligible manufacturers to form a consortium to bring broadcasting under a single controlling company. The six prominent radio manufacturers in this country, British Thomson Houston Company Ltd (BTH), The Marconi Wireless Telegraph Company Ltd, General Electric Company Ltd, Metropolitan Vickers, Radio Communication Company and the Western Electric Company formed a committee with the President of the Institution of Electrical Engineers as Chairman. Negotiations were started with Sir William Noble (a retired Chief Engineer with the Post Office) and the Post Office to inaugurate the proposed single broadcasting company.

On 18th October 1922 at a meeting held at the Institute of Electrical Engineers the scheme was explained to representatives of over 200 manufacturers to which membership would be open and the Director of a seventh firm, Burndept Ltd was coopted onto the board to represent the interests of the smaller concerns.

The British Broadcasting Company Ltd was instigated with an initial capital of 100,000 pounds in one pound shares put up by the big six and its licence was to initially run until 31st December 1926. Any bonafide manufacturer could then become a member by purchasing at least one share and depositing 50 pounds. The new 'BBC' was to be financed by a ten shilling annual licence fee from each listener and a tariff of approximately 10% paid by the member manufacturers on all receiving sets that they sold. To provide an initial protectionist buffer all foreign receivers were banned for two years, and all official British receivers and accessories had to be approved by and bear the circular '**BBC TYPE APPROVED BY POST MASTER GENERAL**' stamp. This scheme seems to have worked well, although the market was flooded by cheap German and French headphones during 1923.

This frantic activity led to station 2LO getting an immediate facelift as the 100 watt 'tea chest' transmitter was replaced with a 1.5Kw transmitter designed by Captain H.J. Round. (*See Appendix I.*) Round was fresh from redesigning the high power panel for the Marconi station at Caernarvon using 56 MT2 valves and 10Kw DC as it converted from spark to valve transmission. On 19th November 1921, using the new equipment, signals from the Welsh station were successfully received in Australia. The official registration of the BBC was still a month away when the British Broadcasting Company transmitted its first programme. On the 14th November 1922, the London station 2LO broadcast a news summary and a weather report, nothing more. The broadcast went out promptly at 6 pm, was repeated at 9 pm and the station then closed down. On 15th November The Daily Mail reported:–

BROADCASTING BEGUN
TWICE NIGHTLY
1,000 WORDS LATEST NEWS

The first British wireless telephone broadcasting service was inaugurated yesterday evening. Messages will be broadcast twice every night, at 6 and 9. The call signal is 2LO and the wavelength 360 metres.

Tonight election results will be transmitted. The 9 o'clock call will continue until 1am tomorrow.

At 6 and again at 9 o'clock last night news messages of about 1,000 words were broadcast from the London broadcasting station, Marconi House, Strand, WC, by the Broadcasting Committee. This body is acting for the British Broadcasting Company until its formation is completed. The company is formed of the various wireless instrument manufacturers.

The news summary was read by Mr. Arthur R. Burrows into an ordinary telephone receiver connected to a 1.5 kilowatt wireless telephony transmitter.

THE BEST SPEED

Before broadcasting the news Mr. Burrows explained that he was going to read over the messages twice -once quickly and once slowly. He said he would be glad to hear reports of the reception of the messages. He asked that he might be told whether it was considered best that the reports should be read (a) once slowly; (b) once fast and once slowly; or (c) fast twice.

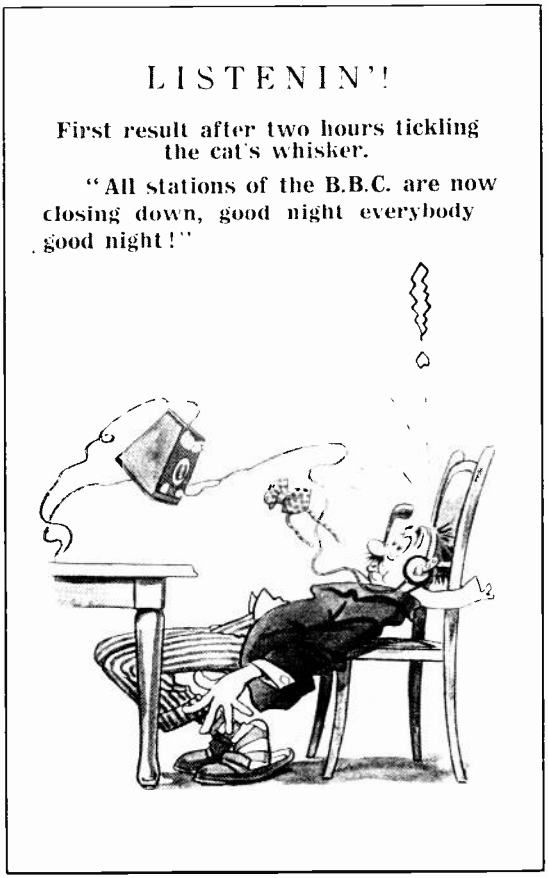
Last night Mr. Burrows said to a Daily Mail reporter: "If the messages are read too slowly the listeners may lose the thread of them. If they are read too fast the listeners may not have time to grasp their meaning. A new sense will have to be acquired by those listening to news by ear."

This microphone shyness was not to last, just two days later the BBC presented its first entertainment programme. It was broadcast from 2LO and lasted for over an hour starting at 7 pm. The BBC also now had its first performer, baritone Leonard Hawke sang the opening number 'Drake goes west' followed by a selection of vocal and instrumental items.

The Daily News newspaper provided readers with more detail on 2LO's first broadcast:–

"Two budgets of news were sent out by wireless telephony. The callsign was 2LO and the news came over in a clear voice which first announced the sending station. Mr Bonar Law was announced as having made his final election speech at Glasgow, his policy being quietness and stability. Mr Churchill was said to be none the worse for his rowdy meeting the previous night and there were to be no police court charges, the wireless said."

A brief story of a train robbery, the sale of a Shakespeare first folio and the fog in London were the other news items. The first news broadcast closed with a round up of the billiard scores for the day. The newsreader's name was never announced on air, (a policy that was followed for many years) but it was, as the Daily Mail reported Arthur Burrows the Director of Programmes at the BBC. It was the same Mr Burrows who had attempted to keep Writtle under control, now to find fame as one of the BBC's 'Wireless Uncles'. 'Uncle Arthur' had many thousands of children listening to him on 'Childrens Hour' every night at 6.00 pm starting from the 23rd December 1922. Uncle Arthur was ably assisted by C.A. Lewis (Uncle Caractacus), Stanton Jefferies (Uncle Jeff) and Rex Palmer (Uncle Rex). The instructions to the Childrens hour presenters were long and detailed, but they were allowed to tell stories about fairies, gnomes and the like, tales about school life, adventure, animals and classic legends. Informative items were also allowed, as long as they simple and interesting about books, music, animals, railways, ships and aeroplanes. The Childrens hours also had music, songs and part songs



32. The Cat's Whisker.

including nursery rhymes and folk songs. The term children's hour actually came from a poem by Henry Longfellow, and quickly became a new catchphrase in radio broadcasting.

The day after the BBC began transmission from 2LO in London, the former Western Electric station 5IT in Birmingham, and the Metropolitan-Vickers station 2ZY at Trafford Park in Manchester began transmission of BBC programmes. The programmes on their debut evening were devoted to broadcasting that day's election results although 2ZY, did manage to fit in a brief 'kiddies corner'. The idea of wireless entertainment for children was continued when the Engineer in Chief of station 5IT, A.E. Thompson became the first ever British wireless uncle, Uncle Tom on the 5th December 1922. His 'Children's Corner' told the story of two dwarfs, 'Spick and Span' and also included a gramophone record called 'Dance of the Goblins' especially for children. The idea of wireless uncles was taken from the American broadcast stations where mythical Uncle Bobs and Uncle Georges would read fairy stories and nursery rhymes for the children.

The Birmingham station 5IT should have been allocated the callsigns 2BH or 2BM, but these would have been confused with Bournemouth, so irrelevant letters were chosen for the callsign. Similarly the Manchester station 2ZY should have been allocated 2MC or even 2MT, but the Marconi Company already held these callsigns, so random letters were used again. The 500W 5IT transmitter had originally been based at the Western Electric Offices (callsign 2WP) in Norfolk Street, just off the Strand and practically around the corner from 2LO. It had a memorable trip by lorry up the country, arriving on a foggy night to be hurriedly installed at the BBC Works at Witton, Birmingham, where a few days later it went 'on air' as station 5IT. The studio and office were extremely small, especially as a player piano, gramophone and all the heavy drapes also had to be fitted in. The station was run by 5 harassed people who managed to transmit a programme of music provided by several intrepid artists who braved the thick fog that still hung 'like a pall' over the city on the opening night.

These pioneering stations were followed by the Newcastle station 5NO (NOrth) on Christmas Eve and the Cardiff station 5WA (WAles, 353m) on 13th February 1923. (*See Appendix J.*) The 1922 radio callbook list of concert broadcast stations records the following details for the new stations. Station 5IT operated on 425 metres (later 475m), broadcasting between 6.30 pm and 9.45 pm, station 5NO used 400 metres (later 312.5m) between 7 pm and 10 pm and station 2ZY in Manchester used 384.6metres (later 375) daily between 6 pm and 9 pm. Station 2ZY also installed a special listening station at Hale, seven miles away from the main transmitter site, so that the stations signal could be monitored and a regular report telephoned back. The new 2LO transmitter also provided the London station with a guaranteed reception range of over 75 miles on a two valve set, and often received favourable signal reports over an area of some 550 miles. A keen amateur, Mr Charles Coults, also reported regular reception on a single valve set

33. Listening in.

from Lerwick on the Shetland Islands while 5IT, from the heart of the West Midlands, even made its voice heard in Canada.

By February 1922 the BBC had five of its eight proposed main stations fully operational within the newly designated broadcast band between 300m and 530m and could boast over 40,000 listeners.

It was the beginning of the end for 2MT Writtle.

On the wall of Marconi House there is a plaque that reads:–

> "Within this building Marconi's Wireless Telegraph Company Ltd. operated their famous broadcasting station 2LO from May 11th to November 15th 1922 when it became the first station of the British Broadcasting Company.
>
> The first pre-announced broadcast of public entertainment in the world took place two years earlier when Dame Nellie Melba sang from Marconi's Chelmsford Works on 15th June 1920."

Although there are no words or plaque to record the historic and pioneering effort behind the fun of 2MT at Writtle, British broadcasting had come of age.

34. Marconi House, The Strand 1987.

12

WRITTLE LEAVES THE STAGE

"Not with a whimper, but the bang was only a popgun"

Writtle and station '2-Emma-Toc' (*See Appendix G.*) maintained their independence and continued to transmit regularly until its eventual close down on the 17th January 1923. In fact until the advent of Independent Local Radio in the late 1960's 2MT was the only licensed broadcast radio station to have legally shared the airwaves with the omnipresent BBC. I suppose it was really the formation of the BBC that knocked the wind out of 2MT's sails. The engineers soon realised that their beloved renegade station's days were numbered, especially as the majority of the new BBC stations transmitted with powers of 1.5Kw and Writtle's modest voice began to be lost in the noise.

In mid December 1922 Peter Eckersley had been asked to meet Mr Reith, the Chief Executive of the new BBC at Magnet House, Kingsway in London. PP arrived to find him installed in a small 'cupboard' off a small office, where his 15 staff members feverishly slaved away. Eckersley later recalled two things about the meeting, first that he left having promised to close 2MT Writtle down (something he had no real right to do), and secondly that he thought he would like to work for Mr Reith. Despite this conversation, it seems that Writtle was never really ordered to closedown, certainly the 2MT licence was not officially revoked. It was just that everybody involved knew it was time to step aside and move on, their pioneering work having been done.

Peter Eckersley later recalled that he realised that Writtle had run its course when one Tuesday evening he casually picked up his headphones to listen to the new BBC station. What he heard was a transmission of live opera and he remained spell bound for the entire hour, 'contemplating the potential of broadcasting.'

On a cold and frosty January evening 2MT sadly said goodbye to its listeners. The engineers drank their good health with a glass of water promoted to champagne by the sound of a pop gun, and then left the airwaves forever. No station could have given greater pleasure and as many thrills to the amateur radio fraternity, but it had served its purpose and it was time to leave the evermore crowded stage. In its short but hilarious career Two-Emma-Toc at Writtle firmly laid the foundations for the age of broadcasting and provided a vital reference station for all amateur experimentation at the time.

The final closedown seems to have been lost in the thunder created by 2LO and the new BBC. Even the most popular wireless magazine of the time, 'The Wireless World and Radio Review' (4d weekly) missed its going. The journal was still advertising the regular Writtle broadcasts right up to 3rd February edition in 1923. They then reported the passing with a brief note and a copy of the official Marconi Company communique. It was all a great change to the glowing technical reports and stories they had published during the previous year.

CESSATION OF WRITTLE WIRELESS CONCERTS

Wireless amateurs and the 'first 100,000' broadcast "Listeners-in" will learn with regret that they will not longer be entertained by those inimitable burlesques and parodies from the Writtle wireless station which have been enjoyed so much upon Tuesday evening during the last 12 months. The Writtle transmissions were inaugurated by the Marconi Scientific Instrument Company, Ltd., one of the Associated Marconi Companies, in February, 1922, to provide British amateurs with material for experimental purposes which had not previously been available in this country, and they proved to be of great value to the 12,000 amateurs who were interested in wireless before the broadcasting boom set in. The original programme consisted of telegraphic signals for calibration purposes followed by a musical programme. Listeners-in throughout Great Britain have looked forward with pleasurable anticipation to the Tuesday evening entertainment by Writtle, but now that there is an abundance of telephony available from the broadcast stations, the Marconi Scientific Instrument Company considers that its enterprise has served its purpose and that Writtle may rest upon its laurels.

With the compliments of
Marconi's Wireless Telegraph Co. Ltd.,
Marconi House, Strand, W.C.2.
February 2nd, 1923.

Today it seems that 2MT and all its success has been almost forgotten, but it created an enthusiasm for broadcasting that was destined to make radio into the greatest mass medium for communication and entertainment the world has ever seen. As Writtle returned to normality the staff that have given it its small claim to fame soon left, bitten by the broadcasting bug to become the nucleus of the new BBC. The engineers were sorry on personal grounds that their association had been broken, but the draughty hut would always be remembered with affection and pride. Their time at Writtle had been spent in the comradeship of a shared purpose, and looking back at it all, Peter Eckersley noted that the sense of history became part of the moment. For the men who made 2MT, it was now time to move onwards and upwards.

They would now help the BBC go from strength to strength, stretching her voice, and soon her face throughout the world. I think it is true to say that as Writtle prepared to leave the arena, a little of the life and vitality they gave to broadcasting left too. 2LO and the other famous stations that soon followed would like to have been light and amusing, continuing to entertain and make people smile, but it was not to be. The 2MT engineers had shown them how with their unique and idiosyncratic broadcasts from Writtle, but the advent of the puritanical John Charles Walsham Reith as General Manager would shape the face of BBC for the next twenty years. The 6ft 6in, tall gaunt Scotsman ran the fledgeling BBC with complete and unanswerable authority conducting its affairs with 'a will of iron and a heart of stone'. He may well have had his faults, his temper was always unpredictably volcanic and his conformist attitudes were perhaps out of place, but British Broadcasting owes a great debt to J.C.W Reith's administrative competence as he fought the petty rules and regulations imposed on his new company. John Reith's war service in Flanders had cost him the pain of a snipers bullet that had left his face badly scared, but it had also given him an insight into how to manage men. Some time in America had given him a familiarity with business techniques and despite his critics he was ideally suited to the awesome task of managing the development of broadcasting in this country.

The engineers that formed the new BBC were in the words of one of their number, Maurice Gorham, a 'very mixed lot'. The potential for chaos and confusion was enormous, but unlike the backwater of 2MT at Writtle the BBC had a far more visible face. It needed the discipline and determination of a man like Reith to hold it all together and make it work even if the result was not complete perfection. Newsreaders were expected to dress as if for dinner at an exclusive club, tails, bow tie and a fresh red carnation in their button hole, always standing while they read the news. The expression BBC English was a trade mark imparted to what hitherto would have been called Oxford English, and woe betide any unfortunate announcer who made a slip. Lists were compiled of proper pronunciations, especially place names, so the BBC's voice would be as correct as possible. To this end the BBC wrote to the Mayor and the Vicar of many towns asking them for the correct pronunciation of their town's name, unfortunately they often did not agree, but this was a minor problem compared to the sin of the announcer who actually said "broadcasted". The new BBC did manage to vary the musical content of the early programmes, ranging from chamber music combinations to solo artists and singers. These performances were not adversely affected by the very cramped surroundings of the small studio, but 2LO managed to fit in the massed Band of the Irish Guards. It may well have been the smallest military band concert ever.

Initially the balance between instruments was attained by varying the sensitivity of each groups individual microphone, but this method was replaced by actually altering the distance between each microphone and the instrument concerned. Writtle had taught them that much with their infinitely variable volume control. 2LO gave its first talk on 23rd December 1922, but the subject is

not recorded, however the second talk on January 27th was entitled 'How to Catch a Tiger', the forerunner of todays agricultural bulletins and household hints. Musical, dramatic, literary and film criticism began in February and was aired weekly. Although technical progress was at times rapid there were still quite severe limitations to the new service provided by the BBC. There was no news before 7 pm and then only bulletins provided by Post Office approved agencies. This arrangement held until the 31st December 1923. (*See Appendix J.*)

Reith considered that to exploit a great scientific invention for the sole purpose of entertainment would be an insult to the character and intelligence of the people who tuned in. So the new radio station that broke the clatter of Samuel Morse's code offered lots of plays, talks, news and features even opera and classical music. But fun was another matter. The wireless uncles, Uncle Arthur and Uncle Caractacus among them did liven the procedures a little, and of course Peter Eckersley could sometimes be found dictating a highly technical letter and an intensely humorous burlesque at the same time.

Captain Peter Pendleton Eckersley was to become Chief Engineer at the BBC even though at first both Eckersley and Ashbridge were disappointed to hear that the position had been filled from head office, but the prospective candidate turned it down. He joined the new team immediately after his Writtle experience, and many people felt that Eckersley was foolish to leave the safety of an established career for such an unpredictable adventure, even if the Marconi Company did have ten thousand pounds of its money invested in the broadcasting enterprise. When Eckersley joined the BBC in February 1923 he was obviously the Chief Engineer, because he was in fact the only engineer. His desk also had a small sign saying 'Chief Engineer', but it was also covered with piles of unopened and unanswered mail. He wondered at the time, if he ought to go straight back to Writtle. When he left, six and a half years later he was in charge of 304 engineers and technicians and had earned for himself the unofficial title of the 'Warwick' of broadcasting due to the number of changes he had brought about.

Eckersley's extrovert manner was the absolute antithesis of Reith's stolid demeanour, but it appears that Reith actually admired the Chief Engineer's infectious ingenuity and enthusiasm. Reith had by his own admission little grasp of technical matters having originally trained as a civil engineer, and seemed content to leave the engineering departments rule soley to Eckersley.

This may have been true when the young BBC was struggling to 'do this thing called broadcasting', and Eckersley's experience and expertise was invaluable. However as time went on, and the impact and power of the Corporation became huge, Reith and Eckersley were to have growing numbers of heated arguments and equally hostile silences. The end of the struggle, and the end of Peter Eckersley's career came when the exceptionally gifted engineer and publicist was forced to resign on 23rd September 1928. The reason for his leaving the BBC was well publicised at the time. In his own words he was about to be named as "the guilty party" in an action for divorce. The rumours in the BBC said that this was just an excuse, for it is certain that Eckersley had made many enemies within the

walls of the BBC. Peter Eckersley had joined an organisation dominated by the irrepressible Mr Reith. John Reith was in every sense a natural leader, despite his seemingly austere and lonely ego he had the ability to make decisions and the firmness to stand by them. He was able to control, channel and dominate people of widely diverse talents and inspired great loyalty to himself and the company. He was also undoubtedly feared.

When Peter Eckersley tarnished the good name of the Corporation, Reith's strong moral principles, strict code of behaviour (and certain members of the BBC board) gave him no option. The man who had pioneered, and now probably 'knew more about the art of broadcasting than any man in the country' had to go. Andrew Boyle, in his biography of Reith records that despite Eckersley's public acclaim and seniority, Reith was to waste few words on him.

> "My son, you have strayed from the paths of righteousness. Our ways must part forever. You are dismissed."

With that, Eckersley left the building and the BBC. He was never to return to broadcasting, and eventually found a new career with the HMV gramophone company. He also became consultant engineer to various companies and organisations (including Rediffusion Ltd and Standard Radio Relay Services Ltd), a journalist and a technical author. Peter Eckersley by his own admission was never subservient to higher authority in the Company, and had an alarming habit of always telling senior personnel exactly what he felt about the BBC's programmes and policy. Eckersley once described his life as being full of disastrous enthusiasm, indeed at times his criticisms were perhaps more forceful than coherent, but he did make it a point never to criticise individuals. Regardless of methods or motives, it is Eckersley's love of broadcasting and his enthusiasm for life that he will always be remembered for. He always said that it was coincidence that made him a wireless technician, and chance that made him Chief Engineer at the BBC. Eckersley always passionately believed that broadcasting would allow amusing and interesting people to get in touch with an amused and interested audience. He felt that music should be spread far and wide, and that the loudspeaker could become a philosopher and a friend. He saw his technical ideas and solutions widely used in broadcasting, but the aim of those ideas, to make broadcasting more interesting and entertaining was in his view never realised at the BBC.

Eckersley wrote that broadcasting "should let you join in events without having to drag your body all over the place". The radio on the sideboard, could teach, illuminate, perhaps even inspire, but if it was not used for those ends its was merely wires and glowing tubes in a box. He always felt that a great chance had been lost, and he left a sad and disappointed man because of it, but also intensely hurt and angry at the manner of his dismissal especially as it concerned what he considered to be his private life. His intense criticism of the BBC in the press reflected this, although he did admit in hindsight that he said and wrote things he later came to regret.

It is a matter of debate as to whether Eckersley's dream for radio came true, or if 'wire-less' broadcasting ever did become the device to encourage, educate and perhaps even stimulate those who listened in. In many ways radio has been overshadowed as a medium for entertainment by a new competitor in the ether. Television broadcasting has the ability to bring both pictures and words into the home, its immediacy and graphic story telling having now far outweighed the impact of the wireless. However radio is still the vital link for people outside the reach of the flickering image machine. It still provides an unsurpassed vehicle for the high speed communication of information, thoughts and ideas across any distance of earth, sea or even interplanetary vacuum.

Eckersley's place at the BBC was taken over by his assistant of three years, who had also followed him from the pioneering days at Writtle. Noel Ashbridge's quiet and academic approach to the new company fared much better. Roger Eckersley, Peters older brother who worked at the BBC in a non-technical capacity, described Ashbridge as a modest and dispassionate man with a full measure of good common sense and a balanced mind. He was also a very good judge of people, with of course an excellent technical background. These features were to serve him well. In 1935 he was knighted, and was soon after appointed to be the first technical director of the BBC. When he finally retired in July 1952 he became a director of the Marconi Company where it had all started nearly 30 years before.

B.N Maclarty also moved from Writtle to head the Design and Installation department of the new 'firm', while H.L Kirke CBE, MIEE, became head of the BBC Research Department. The Hon. Rolls T.B Wynn was also destined for the BBC, being promoted to Eckersley's old job as Chief Engineer between 1952 and 1960, leaving only Edward Trump as the last of the pioneers at Writtle. It is perhaps fitting that it was part of the 2MT team, Ashbridge, Kirke, Maclarty and Wynn who introduced VHF broadcasts into this country. In doing so they practically ended the elusive search for high quality broadcasting, a search they had started all those years ago in a small Essex field.

13

AFTERWORDS

"History in a sports hut"

The Writtle site continued to form the centre of the Marconi's Company airborne radio research effort. Not all of the 2MT team left for the new London Broadcasting Company, Edward Trump stayed on to lead the reformed department. Of all the team at Writtle it seems that Mr Trump was the least ambitious, preferring the relaxed countryside to the chaos surrounding the birth of the new broadcasting company. Shunning the bright lights of the city, Edward's first love was always thought to be archaeology, his house being full of flint arrowheads and fossils, where Eckersley and the rest had valves and wires.

Although 2MT lapsed into silence and her pioneering team went their separate ways, Writtle never truly left the airwaves. Unfortunately her voice now brought complaints rather than praise to the Company. As radio spread, crystal sets arrived even in a quiet hamlet like Writtle, after all they had a very large, and somewhat famous advertisement just down the lane. The problem was that these new listeners could not hear 2LO, or even the new high power station 5XX at Daventry, all they heard was Mr Trump testing, all day and every day. He had a nice patter in terms of where he was in the field or how far away the river was but it was not as good as the records from London. The new enforced listeners could not cut Writtle out for they were simply too close, but Mr Trump did moderate his language when things did not work quite right, after all he was a radio celebrity, one of the first.

It was the threat of war in 1939 that broke the experiments and tranquility of the research establishment. The Air Ministry with Sir Winston Churchill and Arthur Harris behind them forced a massive expansion of RAF Bomber Command. Since the First World War airborne radio development for the airforce had virtually stood still, a casualty of the huge postwar cutbacks in the RAF. Writtle had kept experimenting, and the Company turned to them now. The radio equipment made by the Marconi Company for Bomber Command constituted one of the largest contracts for a single piece of equipment in the whole War being well over one million pounds. The result of this contract was the famous 1154 transmitter and the 1155 receiver, which every British bomber and Coastal Command machine that flew during World War Two carried. Work upon the first of these Bomber Command sets was begun on the 22nd October 1939 and it was completed by the 2nd January 1940. Part of the operation involved bringing

35. From broadcast station to sports hut.

36. Writtle Hut interior 1987.

across the fields from the main road a complete Avro Lancaster bomber fuselage which sat on the Writtle field for many months. From the 'back of an envelope' stage, to flying and production in quantity, was achieved in five months, and it was done at Writtle. As always, Writtle had upheld the "highest possible standards of technical performance" a tribute often paid to the broadcasts from 2MT.

Since the end of the Second World War the Writtle site has continued to grow, becoming today an important part of Marconi Communication Systems Limited.

37. Writtle Hut interior 1987.

A large rebuilding scheme in the early 1950's meant that there was no longer a place at Writtle for the hut where it had all started. Like the personnel who made 2MT it left, never to return, on a cold March afternoon in 1960. No trace of the original 2MT site now remains at Writtle except for the outline of the hut's brick foundations bypassed by everybody without a second glance. It is unfortunate that no part of the historic transmitter has survived, as all its parts were returned to their normal experimental use when 2MT closed down. The motor generator was found in the field under an old tarpaulin during the mid 1950's by B.N Maclarty, but its whereabouts are now unclear. Eckersley is remembered in one other way, having a road on the new industrial estate just off Victoria road in Chelmsford named after him. However even his 'Who's Who' entry for 1933 does not mention 2MT as it is for his pioneering work as Chief Engineer at the BBC that Peter Eckersley is usually remembered.

One other thing, apart from the memories and photographs has survived. Eckersley's 'long low hut filled with long low people' was given to the Kings Road Junior School in Chelmsford. It stands there to this day on the edge of a different Essex field, only a mile or so from its first home.

It has not changed that much from the pictures of 2MT. The demonic stove has long since gone and the bare wooden boards are now covered with sports

equipment not valves and wires, but it has survived intact as a small monument to the memory of 2MT. A neat freshly painted plaque unveiled by B.N. Maclarty hangs on the front of the now whitewashed ex army hut. It tells a fragment of the story. It is perhaps sad that the children who play in the field beside it are a little young to understand.

Kings Road County Junior School
History of this Pavilion

> This Building, an Army hut of the First World War, stood from 1919 to 1960 on the Marconi Company's development site at Writtle. The first radio equipments for use in commercial aircraft were developed in it in 1919, and for the next forty years it was the centre of this work. From February 1922 wireless telephony test transmissions – Britain's first regular broadcasting – were made from this hut and continued until January 1923 using the callsign "2MT".

They also made history.

14

AUTHOR'S NOTES

"Sh-h-h 2LO is just coming through . . "
"I believe I've just got the Hague"
"It's Eck' . . . I can hear 2MT !"

The recent explosion in interest in Amateur Radio has caused a proliferation of new callsigns and prefixes, but they have been joined by an old friend. The amateur radio callsign G2MT was recently issued by the Home Office to a Marconi radio society in Stanmore, North London. Strange things happened in the history of 2MT, but perhaps none odder than the famous callsign being allocated to a town just over 30 miles from the small Essex village that gave British broadcasting its first home. At 12.00 on 2nd July G2MT graced the airwaves again, but it is a shame that it was not heard from Writtle. I hope that one day Writtle and its callsign might be united to pay tribute to the pioneers of 2MT. A station on the village green would allow "W-W-Writtle Two-Emma-Toc" to call again even if Captain Eckersley has long since left the helm. I'm sure his memory, if not his ghost would stand beside the operators.

It has often been asked why Writtle was given the callsign 2MT. The '2' part corresponds to most other amateur callsigns of this period although the actual issuing of the two letter prefix is shrouded in mystery. Certainly some amateur callsign prefixes of the time matched the owners or clubs initials, others seem to have been issued almost at random. At this time the callsign allocation to the Marconi Company was as follows:

2BN	General Testing.
2BO	Writtle.
2BP	Publicity.
2BQ	General Testing.
2BR	Beehive Lane site.
2BS	New Street Works, Chelmsford.
2BT	Marconi College, Arbour Lane.
2BU	Broomfield Road Site.
2BV	Hall Street Road works.
2BW	Rainsford Road Site.
2MF	Dean Street, Soho, London. (Also Willesden works)
2MT	Writtle, nr Chelmsford.
2SW	New Street Works, Chelmsford.
2YT	Poldhu Test.

and of course 2LO, usually taken as being 2 LOndon, although the late Gwilyn Dann, a former BBC engineer suggested an unknown Latin pun 'To Ello'!

It will be noted that Writtle's normal callsign was 2BO, not an auspicious start, but 2 experiMenTal, 2 Marconi Transmitter, 2 Marconi (wireless) Telegraph Company or even 2 Marconi Test was perhaps far more apt for Writtle's place in history.

It is interesting to note that on the 29th May 1977 the old army hut played host to another 'historic' event when the first annual general meeting of the newly formed British Vintage Wireless Society was held in it. The BVWS's aim is to preserve, document and restore as much of the early days of radio as possible, this the story of 2MT is part of that aim. The development of broadcasting as an art and as a science has always run hand in hand with the technical development of the 'hardware'. It is interesting to note that by 1970 there were an estimated 620 million radio sets in use in the world. The transmitter situation in America never abated from 1920, in 1972 the United States could boast some 6,372 authorised radio stations. The sound licences which had first financed the BBC were abolished on February 1st 1971 when the figure was 2,074,034 radio sets in Britain alone. It is a little humbling to think that it all began in a Writtle field because a young engineer called Peter Eckersley liked to call CQ.

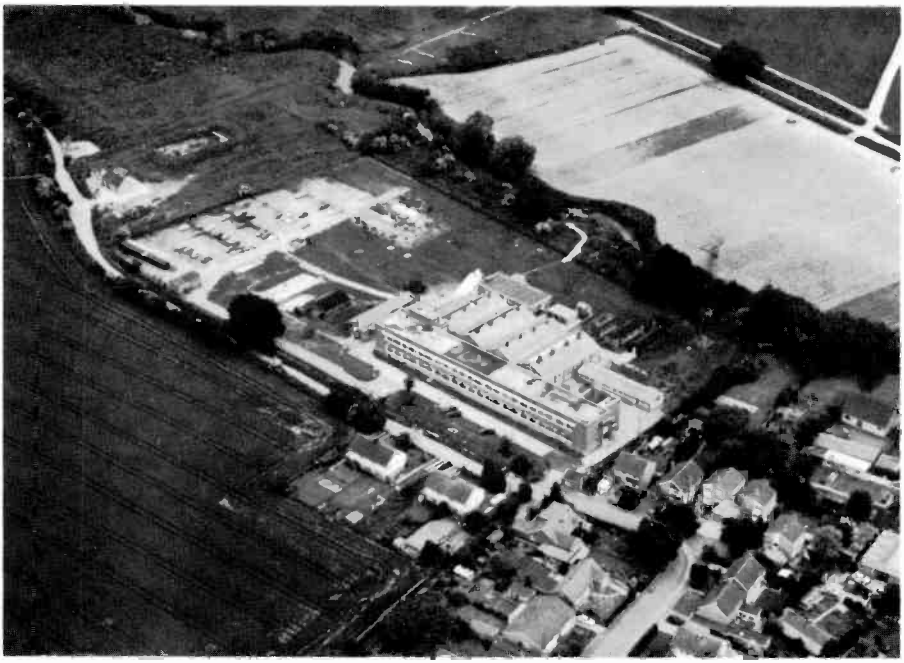
In 1972 the BBC hosted a reunion of the remaining members of the 2MT team. Amongst the guests were Basil Neil Maclarty OBE, R.T.B. Wynn, Sir Noel Ashbridge, Edward Trump, Freddy Bubb, and Elizabeth Beeson. Sadly Peter Eckersley and Harry Kirke had already left us, but it was pleasing to see the pioneering team recognised for their contribution to the birth of broadcasting in this country. Writtle broke the silence of the radio spectrum and gave birth to an explosion in broadcasting. Peter Eckersley, often in dispute with the methods and motives of the BBC made the following comment about part of this broadcasting expansion, the new art of television. It holds true today. To Eckersley the new of science of television was "like a little girl with a golden curl in the middle of her forehead. When she was good, she was very, very good, but when she was bad she was horrid."

Since that St Valentine's day evening in 1922 silence has only once returned to the ether. On 19th July 1937 at 5 O'clock in the morning, Guglielmo Marconi, the father of radio and the man who had banished silence and isolation from land, sea and air died in Rome aged 63. His body was laid to rest in the grounds of the Villa Griffone, where as a very young man he had first caused an electric impulse to spring through the air and ring a small bell. It was those same Hertzian waves that now carried news of his death to every corner of the globe by his invention wireless. On his funeral on 21st July 1937 the greatest tribute to him was the closing down of every Post Office wireless telegraph station and BBC broadcast station. Operators stood to attention beside their equipment throughout the British Isles for a two minute silence, a silence Marconi first broke, and which has remained chaotic ever since. What other men had been content to prove

impossible, Marconi accomplished, and that must surely be respected as greatness.

The atmosphere is now full of radio waves, thousands of broadcast stations transmit every hour of the day and night in every language, all over the radio spectrum, the 'ether' is never silent. It all seems a very long way from a small wooden hut in Writtle.

Amateur radio has also not stood still, the small band of dedicated enthusiasts whose experimentation gave birth to the modern age of broadcasting would wonder at radio amateurs in space shuttles and conversations via satellites. Radio signals now return to us from men and man made devices on other planets, and even beyond our solar system into deep space. Men even dare to listen for other worlds and other civilisations. Perhaps they listen with the same sense of expectancy that gripped early wireless enthusiasts searching for the faintest whispers of 2MT, or the uncertain voice of 2LO in their headphones, patiently tickling the cat's-whisker or cursing the tired old accumulator.



38. The Writtle Site from the air – 1983.

Perhaps one thing remains to be said about Writtle today. The Marconi site was full of informal pioneering spirit in 1922 but unfortunately those times have had to make way for progress. Today Writtle reflects its function as a research and development section of a modern high technology company, and as such is strictly

private property. It has already been pointed out that there is now nothing of historical interest at the site although Writtle as a village is well worth a visit. If you should pass through, walk around Writtle to soak up the atmosphere, buy a beer in the Cock and Bell and even hum a little tune as you stroll across the Green.

"Here rests the concerts ended
Loud wails the heterodyne
You must soon switch off your valves
I must soon switch off mine.
Write back and say you heard me
Your distance where and how
Goodbye the concerts ended
Wow, wow wow wow wow . . . .

Oh Dear I don't really like that you know, not at all.

But never mind,
Goodnight everybody

Goodnight from 2MT
Goodnight . . . . "

As Peter Eckersley once said.

"It was all rather fun."

Author's Note

On 11th November 1987, just as this book was going to press the Marconi Company announced that it was closing the Writtle site.

During its 68 year association with Marconi's generations of engineers have worked there and I count my self fortunate to be among those whose career started in Peter Eckersley's partly flooded field. However by the end of 1987 the site will stand empty, and at the time of writing its future is unclear.

Tim Wander.

Writtle.
November 1987.

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BIBLIOGRAPHY/FURTHER READING

In the many books about the history of radio and broadcasting you will often search in vain for any mention of 2MT and the village where it operated, Writtle. This is especially true of biographies of Marconi himself, but this is perhaps excusable in so much as Writtle was only one small episode in the life of his huge Company. It is left to Peter Eckersley's 'Power Behind the Microphone' to give more than a few lines to Writtle, and his amusing style is well worth the effort needed to find a copy of the book.

If the story of 2MT has wetted the appetite for the history of broadcasting, then W.J. Baker's book gives a good overall history of the Marconi Company from inception through to the mid 1960's. Erik Barnouw's 'A Tower in Babel' provides an excellent account of the history of broadcasting in the United States of America, while the equivalent English histories are provided by the comprehensive three volumes of Asa Brigg's 'History of Broadcasting' or W.M. Daltons slimmer three volumes, 'The Story of Radio'. If you enjoy a less technical approach to wireless history Ormond Raby's highly individual book tells the story of the little recognised pioneer of telephony, Reggie Fessenden. But for a stroke of destiny, or is it fate, he may have been as well known today as Marconi himself. E.H.G Barwell's book, 'The Death Ray Man' is also well worth the search necessary to find a copy. Barwell tells the full story of his friend, the amazing Grindell Matthews, inventor and pioneer. The 1946 biography is even more important because it appears to provide the only record of Matthews contribution to Wireless and broadcasting, and consequently forms the basis for Appendix C.

To my knowledge the story of 2MT at Writtle had never been told before, consequently most material in this book has been provided by the courtesy of the Marconi Company archives and the original documents, notes, cuttings, letters and assorted ephemera preserved there. It is quite possible for people who have first hand knowledge of the events recorded here in the Birth of Broadcasting to still be with us today. I have fought to keep the text impartial, factual and fair, but should it be found that a young researcher has got it wrong for whatever reason, I apologise in advance.

A full bibliography of sources would be difficult to compile. Such a list could never fully document all the archive material together with personal memories, interviews, handwritten notes, newspaper cuttings, magazine articles and commentaries during four years of research. I include here a number of publications grouped under the heading further reading, each like any book, with its own particular merits and no doubt accompanying faults.

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2MT Writtle
The Birth of British Broadcasting
Appendices A – J

APPENDIX A

THE FIRST GLIMMERS

"Gnomes to convey our thoughts through the earth"

The year is 1864. A man looks up from his scribbled notes in wonder for he has just produced, with elegant mathematical equations, a theory that says that electrical waves can travel through space. The man is a Scottish physicist called James Clerk Maxwell and his paper, 'The Dynamical Theory of the Electromagnetic Field' read before the Royal Society in December 1864 became a classic work in the history of science. A great mathematician and physicist, Maxwell became the first professor of experimental physics at Cambridge university, building on the earlier work of Faraday and Kelvin. Through mathematics Maxwell was able to not only predict the existence of electromagnetic waves, but also calculate their rate of travel, length, and the fact that they would travel more slowly in glass and water than in air. But despite his genius, Maxwell never knew how to generate or detect his etheric waves, nor did he realise that he had laid the foundations of a communications revolution.

The first suggestion that telegraphy might be possible without wires apparently came from a German Physicist, Professor C.A. Steinheil in 1838. In one of his earliest experiments Steinheil attempted to use railway tracks as conductors of telegraph messages between the stations of Nuremburg and Furth. Despite repeated attempts the experiment was doomed to failure, mainly due to bad insulation between the tracks and ground. However during the experiments Steinheil made an important discovery when he found that the earth itself would act as a return conductor. When applied to telegraphy systems this improvement saved both wire and labour, and he went on to suggest that one day it might be possible to dispense with even the single remaining wire. However he gave no hint as to how this might be achieved and continued to be frustrated in his efforts to build a long distance communication system.

Steinheil wrote: "It is impossible to conjure up gnomes at will to convey our thoughts through the earth. Nature has prevented this."

Over the next years many were to attempt message transmission without connecting wires. In December 1842 Professor Samuel Finley Breese Morse (1791-1872), the inventor of the morse code found that wires laid along the banks of a canal at Washington allowed water to be used as a conducting medium. Morse had developed his original code system in 1837 but it was found difficult to use due

to the use of different length dashes and letters with spaces in them. The system had to be revised in 1851, but since this time it has remained almost unchanged to become the morse code that is still used today. In Morse's experiments, probably the first use of his code system the ends of the wires on the canal banks were attached to copper plates sunk in the water. The experimental results showed that the quantity of electricity conducted was proportional to the size of these plates and the distance between the plates on each river bank. The canal was only some 50 feet in width, but in 1844 Samuel Morse and two assistants managed to successfully communicate over one mile across the Susquehanna River.

While Morse experimented in America, in Britain a linen weaver called James Bowman Lindsay combined the ideas of Steinheil and Morse. He conducted several successful experiments sending messages across the docks at Dundee and Portsmouth and across the river Tay, a distance of 2 miles. In 1854 he presented his system to the Electric Telegraph Company who unfortunately considered Lindsay's ideas to be too far outside their normal business interests to invest. However its representative, Mr W.H. Preece later described Lindsay's work as the first electrical experiments of any importance. Lindsay went on to suggest that telegraphing across the Atlantic was a possibility, and despite widespread ridicule he continued his experiments until his death in 1862.

There were many others who followed the same path. In 1845 J.W. Wilkins proposed to signal between England and France, using the English Channel as the conducting medium. In 1852 two brothers, Edward and Henry Highton conducted many experiments on the banks of the river Thames. The results from these tests led Henry to consider it feasible to telegraph across the Atlantic using the ocean as the conductor and a gold leaf electroscope as the detector. The equipment was not built and the experiment was never tried but many others still looked for a system to communicate without wires. Bonelli in Italy, Gintl in Austria, Bouchotte and Douat in France, but noone found anything that advanced the work of Lindsay and Morse.

The road to wireless communication was filled with numerous blind alleys and impractical ideas, but the most popular area of research between the years of 1838 and 1885 was a system to communicate with moving trains. In 1881 A.C. Brown, an official with the Eastern Telegraph Company attempted to use electromagnetic induction to communicate with moving trains by laying a single wire parallel to the rails and winding a coil of wire around the carriages. Two years later T.A. Edison and Gilliland took his ideas and used ordinary telegraph wires and morse keys to install a system on the Lehigh Valley railway at Staten Island USA in 1887. The system was an immediate success, with messages being sent and received easily even with the train travelling at 60 miles an hour. However despite this technical achievement the system rapidly fell into disuse when it was found that no-one actually wanted to send messages while on a train journey. The limited range and practical difficulties of using electromagnetic induction as the basis of a communication system were all to evident even though it was experimented with up until the turn of the century, but the future lay with electromagnetic radiation.

The first system to use 'wire-less' signalling was described only two years after Maxwell put his ideas onto paper. The first experimental pioneer of radio was Dr Mahlon Loomis of Washington D.C who recorded his results in a paper dated 21st July 1866. During the October of 1866 Loomis had succeeded in 'transmitting' messages over a distance of 14 miles between Catochin Ridge and Bears Den in Loudoun County Virginia USA, part of the famous Blue Ridge Mountains. He had developed his system at the expense of his family, friends and profitable dentist practice, but had made it work before Marconi had been born. The experiment was witnessed by US senator Samuel C. Pomeroy of Kansas and the US Representative John A. Binham of Ohio. From each of the 2,000 foot heights Loomis flew kites, each being held aloft by some six hundred feet of thin copper wire. Each kite also had beneath it a small piece of fine copper wire gauze some 15 inches square. At each site a galvonometer was well earthed by driving the binding posts into damp soil, and with each station having synchronised their watches, deliberate half minute connections were made and broken between the kite wire and the instrument at one site. This action deflected the needle at the 'receiving' site "with the same vigour and precision as if it had been attached to an ordinary battery". After a period of five minutes the procedure was reversed and it still continued to work, despite the risk of electric shock to the 'operators' from accumulated static, for a further three hours.

On 20th July 1872 Loomis was granted the worlds first wireless patent number 129971 for an 'improvement in telegraphing'. Like many of the early workers in radio, history was to be unkind to Doctor Loomis. In 1869 he succeeded in getting the backing of a group of Boston business men, but the great financial collapse of 'Black Friday' ruined his plans. In 1871 he started a new company in Chicago, but the great fire ruined his backers before he could begin work. As a last resort Loomis decided to apply to Congress for help and in January of 1877 congress passed a bill incorporating the Loomis Aerial Telegraph Company with the right to sell stock to a value of two million dollars. The Doctors luck was not to change for in the face of a severe depression little interest or capital was forthcoming, and Loomis struggled to keep his experiments going until his death in 1886. He died a sad and forgotten man, considered by all but a very few to be a crank, and having suffered much ridicule at the hands of the popular press. He could have at any stage discarded his system and made a success of his dental practice, but he was convinced that in the future his discoveries would be considered as important as those of Columbus. Loomis was moving in the right direction, but was groping in the dark in an age where charlatans and cynicism went hand in hand. 35 years later in 1901, another man, flying another kite on the coast of Newfoundland changed history.

On the 2nd April 1877 Dr. Alexander Graham Bell and Mr Thomas A.Watson held the first telephone communication over a considerable distance from New York to Boston. The invention of the telephone gave the scientific community a feel for long distance communication but it also gave them an excellent instrument to investigate the next step in the history of wireless.

In Britain the first system of radio signalling was devised by Professor David Edward Hughes between 1878 and 1880. Hughes, who was actually a professor of music, had made a chance discovery in 1879. He found that a microphone contact of carbon and steel, when connected to a telephone receiver would emit a sound whenever a circuit in his (faulty) home constructed induction balance was broken. The 'extra click or spark' could be heard despite the fact that there was no physical connection between balance and microphone, so simple conduction was no explanation. The balance was simply made by Hughes from deal, cardboard, brass wire, cork and a couple of matchsticks and the device still survives in the Science museum.

David Hughes was born in London on the 16th May 1830, although at the age of seven his family emigrated to Virginia. After a brief spell in Paris, Hughes returned to London and within a year he invented a revolutionary microphone that immediately took the place of the Bell transmitter, making a commercial success of the telephone. Further experimentation at his house at 40 Langham Street in London (about 300 yards from the present site of Broadcasting House) proved that a feeble electric spark in any circuit gave out such intense currents that they could be detected with a telephone earpiece in any part of the building up to 60 feet away.

To investigate further Hughes constructed what was effectively a crude spark transmitter, consisting of an induction coil driven by battery and a clockwork contact breaker to provide repeated automatic bursts of radio waves. With this apparatus left running, the worlds first radio transmitter allowed Hughes to take his experiments into the outdoors. To the amazement of the passing public the Professor could regularly be seen marching up and down Great Portland Street with an earpiece screwed firmly in his ear. The receiver consisted of a battery, a telephone earpiece and Hughes' own microphone, again homebuilt from a glass jar with a turned boxwood lid 4inches high by 2.5inches in diameter. The detector was provided by steel needle lightly touching a small piece of coke. Hughes also joined two short wires to his microphone contact as 'collectors' (or aerials) and used a fireguard as his radiator on the transmitter. He found that the received signals peaked at around 60 feet and then faded, although the greatest distance that they could be reliably detected was over 500 yards from the 'transmitter'.

On the 20th February 1880 Hughes demonstrated his experiment to Mr Spottiswoode the President, and several Fellows of the Royal Society. Hughes placed the receiver and the transmitter some 60 feet apart, in different rooms, and began to 'transmit'. Like his earlier demonstration in December 1879 to W.H Preece FRS and Sir William Crookes FRS it was a great success and Hughes was pressured by all present to put his work into print. However on reflection these eminent men, led by Professor Huxley FRS, eventually claimed that all the results could be completely explained by known electric and magnetic phenomena.

Hughes wrote the following in one of his notebooks:–

February 20th, 1880.

Mr. Spottiswoode, President of the Royal Society, Prof. Stokes and Prof. Huxley, visited me today at half-past 3pm and remained until quarter to 6.0 pm, in order to witness my experiments with the Extra Current Thermopile. The experiments were quite successful, and at first they were astonished at the results, but at 5.0pm Prof. Stokes commenced maintaining that the results were not due to conduction but to induction, and that results then were not so remarkable, as he could imagine rapid changes of electric tension by induction. Although I showed several experiments which pointed conclusively to its being conduction, he would not listen, but rather pooh-poohed all the results from that moment.

"This unpleasant discussion was then kept up by him, the others following his suit, until they hardly paid any attention to the experiments, even to the one working through gaspipe in Portland-street to Langham-place on roof. They did not sincerely compliment me at the end on results, seeming all to be very much displeased, because I would not give at once my Thermopile to the Royal Society so that others could make their results. I told them that when Prof. Hughes made an instrument of research, it was for Prof. Hughes's researches and no one else. They left very coldly and with none of the enthusiasm with which they commenced the experiments. I am sorry at these results of so much labour, but cannot help it.

(Signed) D.E. Hughes.

February 21st, 1880.

I wrote to Mr. Spottiswoode, that my opinion, firmly based on true experiments, that it was conduction and nothing else; so I have made matters worse, and may expect nothing more from them, except that they will probably copy my apparatus and make their own experiments. Adieu!"

No one associated Hughes's results with electromagnetic waves, and Maxwell's views partook of the nature of highly interesting speculations until 1888, when convincing evidence of their truth was provided by the brilliant research work of Heinrich Hertz.

Hughes, a somewhat embittered man was to write about one of the witnesses, Sir George Gabriel Stokes FRS.

"He stated that all the results could be explained by known electromagnetic induction effects, and therefore he could not accept my view of actual aerial electric waves unknown up to that time."

39. David Hughes (16th May 1830 – 22nd January 1900).

Hughes' protests were ignored; the eminent men had decided. In their view Hughes' observations did not constitute actual experimental evidence for James Clerk Maxwell's predicted 'electromagnetic radiation'. Hughes was devastated.

> "I was so discouraged at being unable to convince them of the truth of these aerial electric waves that I actually refused to write a paper on the subject until I was better prepared to demonstrate the existence of these waves.
>
> I continued my experiments for some years, in the hope of arriving at a perfect scientific demonstration of the existence of aerial electric waves, produced by a spark from the extra currents in coils, or from frictional electricity or from secondary coils."

Hughes, like many of his contemporary scientists, experimentors, investigators and even plain eccentrics was tantalisingly close to one of the great scientific breakthroughs of this century. He laboured on with his apparatus, but was unable to develop it any further. His attempts to detect the signals over a mile failed every time, possibly he said "due to the abundance of gas and water pipes absorbing the feeble spark".

Hughes' work continued unrecorded and unknown, but the curious properties of induction were also studied by Professor Sacher in Austria, Dufour in France, Edison in America, but the most persistent was Professor John Trowbridge of Harvard University. Between 1880 and 1891 Trowbridge searched for a method of communicating between ships so as to avoid collisions in fog, and he suspected that signalling through air without wires might be carried out by electromagnetic induction. However his numerous experiments were never conclusive, and his calculations led him to believe that such signalling over just half a mile would require coils composed of 10 turns of wire, but each with a radius of 800 feet.

In 1883 another American, Professor Amos Emerson Dolbear, actually succeeded in sending signals through space without wires, and may have come close to forestalling Marconi in the development of a viable system of wireless communication. Dolbear's equipment consisted of an induction coil with one terminal earthed and the other connected to a condenser. Reception was made via a telephone receiver, with one terminal earthed and the other joined to a condenser connected in series with a 100 volt battery. Transmission was made with a morse key and a kite carried a fine aerial line aloft attached to the secondary coil. He wrote.

> "The idea is to cause a series of electrical discharges into the earth at a given place without discharging onto the earth, the other terminal of the battery or induction coil . . . this feat that I have been told so many, many times was impossible, but which certainly can be done."

Dolbear managed to send signals over half a mile but later claimed to have received signals over a distance of 13 miles. He firmly believed that it was the air that assisted his signals to cross the gap between receiver and transmitter and this blind alley often misled his experiments. However had a man called Hertz completed his pioneering work by the time Dolbear took out his patent in 1883, the world might recognise a different name as the pioneer of wireless communication.

It was a German Physicist, Heinrich Rudolph Hertz (1857-1894), who somewhere between 1887 and 1889 demonstrated and identified the true nature of these aerial waves. His 'masterly researches' while working at the Karlsruhe Technical High School led him to discover that by using these waves he could 'transmit' energy across a room even though there was no physical connection between his equipment. Hertz called his apparatus an 'Oscillator', consisting of two parts, the 'Exciter' and the 'Resonator'. The Exciter was simply two metal rods, with one end of each rod terminated by a metal sphere and the other connected to the terminals of the secondary winding of a high voltage induction coil. Each side of the apparatus was connected to a large metal plate and with the spheres about half an inch apart the resulting spark gap provided Hertz with his electromagnetic wave generator. The Resonator consisted of an incomplete wire loop that had a small adjustable gap between the metal spheres that terminated each end of the wire. When the Exciter was set in action, smaller sparks jumped across the Resonator gap, despite the fact that the two were not connected by a wire. Hertz also found that the energy carrying waves travelled at the speed of light, and that they could be focussed using polished metal plates just like light, however, Hertzian waves as they soon became known were invisible.

The discovery of Hertzian waves had scarcely been announced when a German civil engineer in Munich called Huber suggested to Hertz that they might be used to communicate without wires. However Hertz failed to recognise the full significance of his discovery and even discouraged the idea of a wire-less communication system. Although Hertz missed the opportunity of adding to his fame, due to the loss of Hughes work there was no practical method of detecting electromagnetic waves of low intensity. Following his discoveries Hertz was appointed Professor of Physics at Bonn and it was a great loss to science when he died on the 1st January 1894 at the early age of 37. Although he did not live to see it, Hertz's vindication of the work of Maxwell, Hughes and even Amos Dolbear was to make his name an integral part of a new age in science, for the wireless age had just begun. The eminent British scientist Sir Oliver Lodge wrote of him.

> "He effected an achievement that will hand down his name to posterity as the founder of an epoch in experimental Physics"

David Hughes fully recognised that the German physicist's experimental results were far more conclusive than his own and in a letter to the 'Electrician' in 1899 he also discussed a young Italian who had lately come on the scene. "Marconi has

lately demonstrated that by use of the Hertzian waves and Branly's coherer he has been enabled to transmit and receive aerial electric waves to a greater distance than previously ever dreamed of by the numerous discoverers and inventors who have worked silently in this field." "The world will be right in placing his name on the highest pinnacle in relation to aerial electric telegraphy."

Despite Hughes's acceptance that the scientific world had passed him by, I feel that he must have been bitter that his pioneering work had gone unrecognised. He was forced to watch as others remade his previous discoveries as to the sensitiveness of the microphone contact, and its useful employment as a receiver for electric aerial waves. Thanks to the discouragement of Sir George Stokes, Hughes's great discovery was nearly lost to the world. Indeed, had not Sir William Crookes written his article on the subject, Hughes's pioneering experiments would have slipped into total obscurity. David Edward Hughes was a singular genius and a brilliant experimentor, but even in 1899 he was still unwilling to publish any details of his work. Sir Oliver Lodge, himself an early experimentor with Hertzian waves wrote of him in Wireless Weekly, on the 5th September 1923.

> "He was a man who 'thought with his fingers', and who worked with the simplest home-made apparatus – made of match-boxes and bits of wood and metal, stuck together with cobbler's-wax and sealing-wax. Such a man constantly working is sure to come upon phenomena inexplicable by orthodox science. And orthodox science is usually too ready to turn up its nose at phenomena which it does not understand, and so thinks it simplest not to believe in."

Happily David Hughes' story did not end like Dr Loomis. The music professor who so nearly made radio passed peacefully away in London on the 22nd January 1900. His legacy left the proceeds of his microphone and other inventions, some 400,000 pounds to London hospitals, and his work is now recognised for the pioneering effort it really was.

The first practical 'wire-less' system, that is one that was actually used for commercial purposes was actually another blind alley in the history of radio. In March 1882 the telegraph cable across the Solent between Southampton and Newport on the Isle of Wight broke down for some unknown reason. The Solent link provided most of the island communication with the mainland, and as a repair time could not be guaranteed the Chief Engineer to the Telegraph Department of the General Post Office, Sir (then Mr) William Henry Preece FRS, LLD installed an alternative system. Preece employed the conduction methods of Morse and Trowbridge (brought to his attention by Lindsay in 1854), to make a circuit from point to point through the intervening water. He deposited in the sea at the end of Ryde pier a copper plate six feet square, and connected it by an insulated wire to a second copper plate immersed off Sconce Point. On the opposite shore he placed a similar plate at Hurst Castle, connected by a wire to a plate at Southsea. The

distances involved in the system were: Southsea to Ryde – 6 miles, and from Sconce Point to Hurst Castle – 1.25 miles. A Morse key and 30 Leclanche cells were installed at Southampton, and despite the fact that conversation proved impossible, morse signals were successfully heard via conduction in the telephone at Newport.

Once the Solent cable had been repaired Preece started to study the possibility of improving the conduction system. This research was pushed ahead when in June 1892 a Royal Commission appointed Preece to investigate the possibility of communicating between lightships and the shore. One avenue of study was a phenomena that Preece had noted while tracing faults in the telephone system whereby the telephone lines seemed to pick up telegraphic signals. These observations were proved in 1884 along the Gray's Inn Road when it was discovered that telegraphic signals could be clearly heard in telephone circuits that ran parallel to the underground cables. The mystery was further heightened as the telephone wires were actually some 80 feet above the telegraph cables, which were themselves buried beneath the road.

In the course of his studies Preece established communication between squares of insulated wire laid out on Town moor near Newcastle and between the surface and an underground passage of the Broomhill colliery some 360feet below. Many other experiments were carried out by Preece on the banks of the Severn, across the Mersey and the Bristol channel but in 1895 the cable between the Isle of Mull and the mainland, about 2 miles away (near Oban) broke down. Preece hurried to the location, set up his system and the ordinary commercial service was restored until the cable was repaired with over 160 messages successfully exchanged, including a 120 word press telegram.

In March 1898 Preece's system was also permanently established between Lavernock Point and Flat Holm island in the Bristol channel, a distance of 3.3 miles, when it was then officially handed over to the war office.

In 1899 Preece experimented in the Menai Straits, telephoning without wires from Anglesey to the lighthouse on the Skerries rocks, nearly 3 miles distance. This was accomplished by erecting wire, 750 yards in length, across the Skerries, and erecting on the Anglesey shore a second wire, 3.5 miles in length. At each end of both wires copper plates were sunk in the sea. Telephonic and telegraphic communication was also established between the lighthouse on Rathlin Island (off the north coast of Ireland) and the mainland, 8 miles away.

Although Preece's system worked well, its limitations were soon realised. Preece like Morse nearly 60 years before, found that as the distance between the two wires increased, the length of the wires had to be increased also. In fact for the system to work at all it was necessary for the length of each wire to be roughly equal to the distance between the two. Preece recognised that the although quite successful for communication over short distances, this system was useless for long distances on account of the great lengths of wire necessary for its successful operation. Sir William Preece's real contribution to the development of viable

wireless communication was to lend his considerable influence and support to sponsor the work of a young man called Marconi.

Hertz's discoveries had sparked a rapid growth in laboratory experiments throughout the world, but his equipment was far too crude to form part of any practical system. The German physicist's experimental waves were usually many meters in length and it is certain that he never worked with any waves shorter than 30cms. The first improvements were made by Augusto Righi, Professor of Physics at Bologna University. Righi used exciters with very small spheres and generated waves of 2.5cm or less. He also replaced Hertz's hollow spheres with solid metal balls which doubled the ranges Hertz had ever obtained. Righi also encased the transmitting spark in a 'liquid cushion', where the metal spheres were enclosed in an ebonite frame that was filled with vaseline oil and thickened with ordinary vaseline. This improvement markedly decreased oxidation and made the transmitted waves far more regular.

It had also quickly become clear that a radically different and far more sensitive detector of Hertzian waves than Hertz's 'resonator' was needed. In 1850 Guitard had noticed that when dusty air was electrified from a point, the dust particles tended to join into strings or flakes. In 1866 Varley build this into a lightning protector for telegraph equipment using metallic dust enclosed between two corks in a glass tube. Through these corks were passed two wires that entered the dust but did not actually touch. He found that the resistance of the dust between the wires decreased markedly when high frequency currents (such as lightning) were introduced.

In 1885 Calzecchi Onesti, an Italian professor, substituted the iron filings with copper dust heaped between two brass plates. This device was normally non-conductive, but it became conductive when subjected to the discharge of an induction coil, the circuit resistance changing from millions to hundreds of ohms. Five years later in 1890 Edouard Branly in Paris invented his historic coherer detector, where he connected a battery across the metallic filings. However in reality he had actually rediscovered what David Hughes had worked with some eleven years earlier, even though Hughes had used a steel needle touching coke whereas Branly now used filings the principle was the same. The fall in resistance of the filings allowed current (ie radio waves) to pass, and this was recorded on a morse printer.

In June 1894 Sir Oliver Joseph Lodge the first Professor of Physics and Mathematics at Liverpool University first demonstrated the efficiency of Branly's coherer. On the 14th August 1894 at the British Association meeting in Oxford, Sir Oliver Lodge transmitted electromagnetic waves from one room to another. For his receiver he used a standard telegraphy instrument which caused a light spot to move as each 'wave' arrived. At about the same time as a young man of just 20, Guglielmo Marconi was working in the attic of his family home in Bologna, Italy. Marconi had read that Hertz had 'transmitted' energy from one circuit to another and immediately realised that might be the basis of a 'wire-less' signalling system. However Lodge, having demonstrated that wireless telegraphy was

40. Guglielmo Marconi (25th April 1874 – 20th July 1937).

possible promptly went off on a long walking holiday in the Tyrol before returning to University College Liverpool for another academic term.

Lodge often repeated all of Hertz' classic experiments for his students, but failed to recognise the equipment he had before him for what it really was. Lodge's apparatus easily crossed some 150 yards but he did not attempt to investigate how much further the waves could be detected. The world was now on the edge of the radio age. In 1895 Alexander Stapanowitch Popov (also spelt Popoff), a Russian Physicist used a near copy of Branly's coherer and a morse telegraph printer to record distant lightning flashes. He later went on to demonstrate a wireless telegraphy system capable of covering 1Km by April 1897 and is widely regarded in Russian circles as the 'inventor of radio'. In 1896 Rutherford in Cambridge designed a magnetic detector and signalled over half a mile while Captain Henry Jackson RN succeeded in communicating between ships moored in Davenport harbour using a coherer of his own design. In December 1895 Jackson had commenced a series of experiments in wireless telegraphy on board HMS Defiance the Naval Torpedo School at Davenport. In the spring of 1896 he successfully transmitted and received morse code messages which enforced his ideas first put forward in 1891 that electromagnetic waves could be used for Naval communication. In 1899 this became a reality and wireless telegraphy was introduced into the British Navy largely through Jacksons efforts, but the system used was built by Marconi.

The work of every inventor, investigator and experimentor in England, America, France, Italy and Germany was leading to a great climax. It needed one man to bring the labours of the earlier workers to fruition and provide a practical wireless communication system. The man who brought all the ideas together and added some genius of his own was born in Bologna, Italy on the 25 April 1874 just ten years after James Clerk Maxwell had put his theories onto paper. In the autumn of 1895 as a young man he gave his first wireless demonstration. In the top floor room of the Villa Griffone at Pontecchio near Bologna he showed his mother that his system could ring a buzzer across some 30 feet of empty room. His name was Guglielmo Marconi and he came to England in February 1896 at the age of 21.

APPENDIX B

R.A. FESSENDEN

"This afternoon, here at Cobb Island"

Reginald Aubrey Fessenden was born on 6th October 1866, (the year Loomis started his experiments) at Milton, in the province of Quebec, Canada. Fessenden was not born into a family as wealthy and understanding as Marconi, his father being the Rev. E.J. Fessenden, and 'Reggie's' early career was a continual struggle against lack of funds. Fessenden was educated at Bishop's College, Port of Quebec, and was principal of the Whitney Institute, Bermuda between 1885 and 1886. He was then made Inspecting Engineer for the Edison machine works in 1886, and in 1887 became Head Chemist for the Edison company at their Llewellyn Park Laboratories in New Jersey. His first task was to find a material that was completely fire resistant, but also totally flexible to be used as insulation for electric wiring. Working alongside Edison he came up with the idea of placing an electric motor in a gyroscope in such a way that it was able to turn in all directions. From this idea came a compass unaffected by magnetism, guiding ships, planes and even space rockets safely on their journey. To Fessenden's despair it also allowed arms manufacturers to sight their guns automatically, bringing widespread carnage to the battlefields of the First World War.

Three years later, as the Edison company went into a decline he was appointed Electrician to the Westinghouse Company, where he remained until he was elected Professor of Electrical Engineering at Purdue University, Indiana, in August 1892. The following year he became Professor of Engineering at the University of Pittsburgh, where he remained until appointed General Manager of the National Electric Signalling Company in 1902.

It was in 1892 that Reginald Fessenden first studied Hertzian waves at Purdue University. He set about attempting to transmit speech by the old spark-gap method, but soon found that the technical problems were insurmountable. In a moment of inspired insight he recognised that the modulation of a continuous wave was the answer to successful radio-telephony, but to attempt to overturn the Marconi system of interrupted waves was in many peoples eyes a complete act of heresy. In 1898 he set to work to produce this continuous wave, first by commutating a continuous current, then by a continuous arc, a high-frequency dynamo, and lastly by an unstable current.

On 23rd December 1900 after having moved his complete laboratory from Allegheny Pennsylvania to Brant Rock near Boston in Massachusetts, Fessenden

41. Reginald Fessenden (6th October 1866 – 22nd July 1932).

made his technical breakthrough. He recorded in his journal the birth of radio broadcasting.

> "This afternoon, here at Cobb Island intelligible speech by electromagnetic waves has for the first time in the world's history been transmitted."

The signal had crossed little more than a mile to Cobb Point, using a commutator or interrupter that gave 'somewhat less' than 10,000 breaks or sparks per second. The transmitted voice was highly distorted, overlayed with a very loud and disagreeable noise due to the irregularity of the spark, but it was speech on the wireless none the less. Spurred on by this partial success he continued his experiments and obtained much better results two years later, by using a continuous-arc (also called the Elihu Thomson 'singing' arc) from a newly installed dynamo. Using a frequency of 10,000 cycles per second and 1Kw output, he was able to transmit clearly articulated speech (albeit with a bad hiss) for distances up to 12 miles. By 1903 he had increased the range up to 25 miles, due to modification of the arc system, (US Patent 730753) and carried out public demonstrations at Washington to the delight of the assembled audience. A new machine giving 50,000 cycles per second was installed in the summer of 1906. Once working this was then somewhat modified by Fessenden's assistants Messrs Stein and Mansbendel. By late autumn Fessenden could count on a reliable 75,000 cycles per second and an output of at least ½Kw.

Having the tools for the transmit side meant that Fessenden also had to develop the receiver. The Branly type of coherer was crude and unreliable having to be tapped back 'into life' every time a signal was received. Fessenden invented several devices, the first of which was the ring receiver mounted on a sensitive microphonic contact, followed by the hot-wire barretter and the liquid barretter. Armed with his new equipment, Fessenden was ready to prove that reliable transmitted speech was possible. In 1906 he transmitted between Brant Rock and a tiny station at Plymouth about ten miles down the coast, relaying a conversation taken directly from the telephone system. In doing so he successfully demonstrated the possibility of connecting a land telephone line to a wireless telephony station. A report of these tests appeared in the American Telephone Journal of 26th January and 2nd February 1907.

It was a constant source of infuriation to Fessenden that despite his success he was never able to climb out of the shadow of the man he called his greatest rival, Marconi. Over the years he was to write many letters to the Canadian Government describing his wireless equipment, regularly stating that his apparatus could send dots and dashes with a faster and clearer signal than Marconi's. Further than this, Fessenden's system was also capable of transmitting real speech as well. It was all to no avail, for Canada was little more than a dominion of Britain at this time, and the British Government backed Marconi. Marconi had made history when he became the first to cross the Atlantic with a morse signal in 1901. Despite this

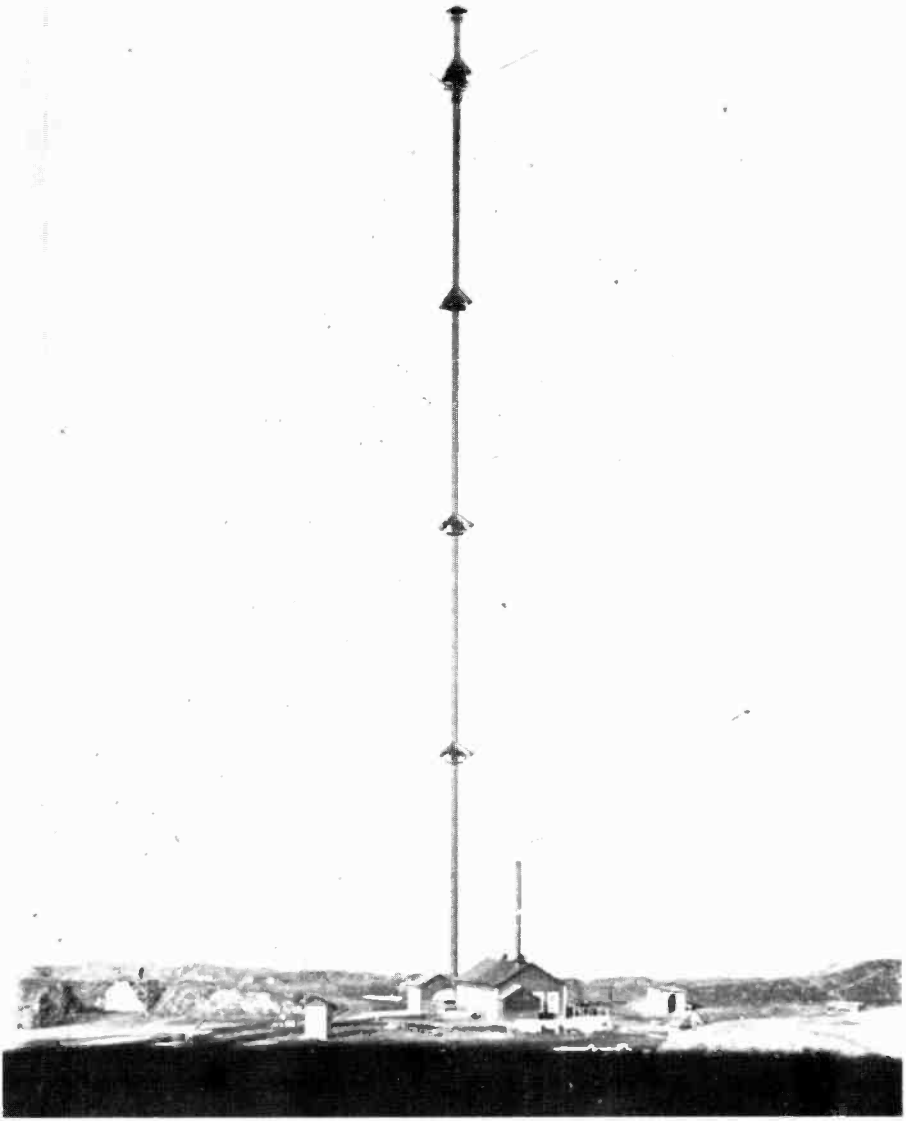
success, by the beginning of 1906 he had still failed to achieve reliable two way transatlantic communication. This was one race that Fessenden was determined to win. On 3rd January 1906 he gained his victors laurels when the morse letter D was repeatedly exchanged between Brant Rock station and the Machrihanish station on the West coast of Scotland.

Fessenden was ecstatic, although he had always disliked the morse code as a means of communication. His career was to be cursed by his obsession with the thought of sending voices through the air, a far higher goal than the young Marconi, who was content with mechanical signals. The opportunity to score another victory over his arch rival did not present itself until the middle of November 1906. It started with a letter, marked personal and private, from the operator at the Machrihanish wireless station, a certain Mr Armor. The letter contained the following paragraph.

> "At four o'clock in the morning I was listening for telegraph signals from Brant Rock when to my astonishment I heard instead of dots and dashes the voice of Mr Stein (the Brant Rock Operator) telling Plymouth how to run their dynamo."

It was usual for these two operators to use speech over this short distance. However for the Machrihanish operator to overhear the conversation was almost unbelievable, but the logbooks and operators accounts were all checked and they tallied completely. Without a doubt speech had crossed the Atlantic Ocean by accident; the implications for the world were devastating. Fessenden was overjoyed, his equipment had been working well recently, in the early hours of the morning the echo of morse signals from Scotland could clearly be heard one fifth of a second later, having travelled the long way around the earth. History had been made, but if your name is Fessenden you refuse to announce such success to the world until you are certain of reproducible results.

Fessenden's National Electric Signalling Company had leased the six acre site at Uisaed point in Machrihanish bay from the local landowner Captain Macneal. Construction of the wireless station started on the 1st of August 1905 by the Brown Hoisting Machinery Company of Cleveland Ohio. The tower was built in tubular sections some 5 feet in diameter, and when completed the mast was 420 feet high with an internal continuous ladder to the top. To support the mast it was guyed at 100 foot intervals using four platforms and its base was mounted on a large concrete block via a ball and joint arrangement. The radiating aerial was provided by a mushroom shaped arrangement of wires strung between three 50 foot cross spars at the top of the mast. To provide a ground plane for the aerial system the entire station perimeter was fenced off, and the whole area was covered with a grid of wires laid in shallow earth filled trenches. These were 'earthed' by joining all the ends of the wires and burying them in a deep trench that ran along the shoreline at sea level.



42 Machrihanish – Reginald Fessenden's transatlantic wireless station just before its collapse on 5th December 1906.

The planned public demonstration of speech crossing the Atlantic ocean was six days off when disaster struck. From early Wednesday morning on 5th December 1906, a storm had raged that pounded the transmitter building with squalls of exceptional velocity, until by mid-day when the gale was at its height the mast was visibly swaying backwards and forwards. Shortly before one o'clock in the afternoon, without warning one of the stays parted on the west side of the mast. People for miles around were startled by the loud double report as the tower snapped, and crashed to the ground. The mast narrowly missed the transmitter building and machinery house, but did little damage beside breaking a few windows. The bottom 100ft section fell to the north, and the remaining 320ft fell backwards (south) as the tower buckled. The top section fell from such a height that it was deeply embedded in the ground and the tube was completely flattened, but even the bottom section was smashed and twisted beyond repair. The 70 tons of metalwork that had taken months to painstakingly erect was in a few moments rendered into a wrecked mass of shapeless metal. The financial loss to Fessenden's new company was huge, and despite the site managers (Mr H.J.Glaubitz) press statement that the mast would soon be rebuilt, within weeks the staff had left, the sites six year lease was terminated and the station was soon dismantled. Fessenden's dream of transatlantic communication by voice now lay in pieces amongst the jagged rocks and foaming seas of a remote Scottish headland.

Fessenden picked himself up from the disaster, organised his famous Christmas broadcasts, and then quickly followed these with other distance records. In 1907 Fessenden provided the first really practical use of telephony by successfully transmitting several urgent messages to a small fishing boat some miles off the coast. By July 1907 Fessenden was also able to maintain regular wireless conversations between Brant Rock and Jamaica Long Island (where there was a 180ft wooden mast), a distance of 200 miles in daylight, with over 75% of the signal path overland. The articulation of the received speech was thought by all to be clearer than that available on the land lines between the two places. The outlook seemed bright for Fessenden's experiments, but the strain of increasing complexity, coupled with lack of time and funds was to place great burdens on the inventor.

Fessenden was forced to watch his dreams crumble around him, and while his company failed, many others got rich from his ideas and inventions. He was undoubtedly a genius, and showed the way for the modern age of telephony broadcasting even if he was to take no further part in it. Not long after the First World War the Institute of Radio Engineers awarded their Medal of Honour, to Reginald Fessenden for outstanding scientific achievement. His greatest rival, Marconi, had won it years before. Fessenden had invented single handed over 500 different devices and was second only to Edison in the number of patents to his name. From his inventive magic came a microfiche system to hold in miniature his huge collection of records and notes, a sensitive detector (the liquid barretter), a reliable HF alternator, the first radio compass and a heterodyne receiver. Fessenden also experimented with early television (with a screen 4ft by 4ft) and

invented an ingenious method of preventing crosstalk on radio signals that consisted of splitting the speech into spectrum bands and then transmitting each element separately, recombining them at the receiver. This patent was banned from publication in 1915 for reasons of secrecy but not all Fessenden's work was of a radio nature. He also produced new gunsights, a system for ranging artillery by sound alone, a form of rudimentary sonar, and even anti-gas barriers consisting of a wall of burning petrol. Many of his ideas were never tried, including an revolutionary aeroplane engine and an electrically driven battleship, but little of his work is remembered today.

Marconi, Fessenden and DeForest all succeeded in obtaining venture capital in substantial quantities to back their wireless enterprises, and all three undoubtedly had their own brands of inventive skill and genius. But it was only the Marconi companies who had sound management, and it only they who survived, for after the collapse of the National Electric Signalling Company no wireless company ever bore Fessendens name.

Reginald Aubrey Fessenden died in his house by the sea in Bemuda on 22nd July 1932. His work had been lost in the shuffle of time, and he had missed fame by a hairs breath. His tombstone is inscribed:–

> His mind illumined the past,
> And the future,
> And Wrought greatly
> From the present.

Below in Egyptian hieroglyphs it also reads:–

> "I am yesterday and I know tomorrow."

APPENDIX C

GRINDELL MATTHEWS

"The North Sea Ghost"

Grindell Matthews was born on 17th March 1880 at Winterbourne in Gloucestershire. After being invalided out of the army, having been twice wounded in the Boer War, he soon decided to dedicate the rest of his life to invention. His early experimenting, like Marconi 15 years before, saw him ringing bells across a pond and broadcasting birthday messages from another room to one of his assistants, Miss Foster.

However within two years he had established reliable telephonic communication between two points half a mile apart and become the consulting engineer to Lord de la Warr on his Bexhill-on-Sea estate. His experiments were soon to catch the eye of the Press. The Pall Mall Gazette on 3rd September 1907, reported under the headline 'Military Notes':–

> "It is quite cheering to be able to announce that an English inventor is now making rapid strides in perfecting his new machine for receiving and transmitting wireless vibrations. We must congratulate ourselves on no longer playing the role of silent sister in electrical progress. Mr Grindell Matthews, of Bexhill-on-Sea, has for some time been working on a machine which will carry out the duties of wireless telephony and act as a detonator exploder as well. From an army point of view, constant communication and connection can be carried on, not only with bases, but also with parallel columns marching on given points."

Once prompted, the press refused to let go. Headlines, anecdotes, historical and futuristic pieces on Matthews work regularly appeared often in the most unlikely journals. Typical was a full page illustrated article in 'Black and White', 19th February 1910:–

A WIRELESS TELEPHONE

MARVELLOUS NEW INVENTION – THE AEROPHONE
AN INSTRUMENT WHICH ANNIHILATES SPACE

> "As the result of nine years of experimental work, the Aerophone has recently been brought to perfection, and ranks among the most

startling of the many great advances which modern science has made during the last fifty years."

"Consisting of a small portable set of electrical apparatus, with a receiver similar to that of the telephone, this appliance enables one to converse at a distance without any connecting wires of any kind. The possibilities of this device, originated and developed by the young inventor, Mr Grindell Matthews, are obviously enormous. Even in its initial stages, messages could be distinctly and accurately heard at a distance of over seven miles; the voice is as audible as in an ordinary telephone, no matter what obstacles in the shape of brick and mortar or other substances intervene between the speaker and the listener."

The uses depicted in the article included:–

"For universal use; officer of a reconnoitring party 'phoning headquarters; telephoning from an aeroplane and from a train en route; telephoning from a motor-car while in motion, and also from a ship to sea."

On 13th April 1910 Matthews gave a demonstration of wireless telephony at the premises of Messrs. Wernher & Beit, a London Wall diamond merchants. As a challenge to the penetration of his wireless waves Matthews agreed to broadcast from within a locked strong room. It was a tremendous success, witnesses could even hear the inventors wrist watch ticking over the airwaves through the intervening walls. One of the observers was heard to comment:–

"Two hundred years ago people were burnt at the stake for performing feats far less wonderful than those we have just seen!"

Many other Aerophone demonstrations were to take place over the next 12 months, including on the 23rd September 1911 the world's first successful ground to air communication of speech by wireless. Matthews installed aerial wires all over the aeroplane and set up his transmitter near the hangar. The dashing aviator, a Mr C.B Hucks than loaded the large receiver aboard, clamped his headphones to his ears and struggled into the air. The fragile craft climbed to the dizzy height of 700 feet, and circled over the Ely race course at the colossal speed of nearly 60 miles an hour. Above the roar of the engine, howl of slipstream and guy wires, the aviator clearly heard Grindell Matthew's voice wishing him a safe flight. The press were amazed and delighted by the feat for history had been made, but were somewhat disappointed by the pioneer's cautious comment:–

"I am satisfied with the progress made. It is what I expected to prove – Mr Hucks heard my voice distinctly."

The magazine Vanity Fair reported:–

> "This is the first message delivered by wireless telephony and Mr Hucks is the first man to receive it."

It is strange that these feats were momentarily forgotten when the episode of the North Sea Ghost occurred. Matthew's late night testing led the Daily Mirror to report:–

The Voice of the North Sea Ghost.

Mysterious Banjo Tune Picked up by Wireless.

Whistling and Singing.

"Who is he? The Daily Mirror has been asked to lift the cloak of mystery which shrouds the man whose speech can be heard along the shores of two countries.

Last Thursday afternoon the songs and whistlings of the North Sea 'Ghost' were heard by Mr Ross, who has a private wireless installation at his home in Dalston, NE London. Mr Ross is a member of a wireless club – each member has manufactured his own apparatus, and their great pastime is to tap the secrets with which the air is crammed. Mr Ross kept an exact record of what happened:

'3.45 pm., Jan 25th. Hearing voices speaking, It says 'Ninety-nine', 'Twenty Four', 'One, two, three, four, five, six, seven, eight, nine, ten.'. It also whistled a tune.

At 3.56 pm. Scheveningen station called up the North Foreland station and asked: 'Could you hear words spoken? I heard plain language spoken ten minutes ago as over a telephone!'

The North Foreland station then replied: 'Yes, we heard it some weeks ago. Good afternoon!.'

At 4.35 pm.- 'Still hearing voice reciting figures, whistling and singing, also sound of musical instrument, as of banjo or mandoline."'

A letter has been received from a gentleman in Somerset confirming Mr Ross's report.

Grindell Matthews readily admitted that he was the ghost but despite his past record the authenticity of his claims was doubted. To prove his case Matthews accepted a challenge from Mr Ross via the Daily Express to broadcast test speech numbers and a well known tune while Mr Ross listened in. The tune was to be decided by the Paper's Editor on the morning of the test, designated as the 5th April 1912. However on that February night the County was engulfed by the worst blizzard in living memory, with crashing chimney pots and flying slates making conditions far from ideal for the new science of wireless.

Matthews was due to transmit at eight o'clock. While he waited Ross, with the Daily Express journalist watching in awe, fiddled with his equipment and exchanged morse code messages with other stations. On the stroke of eight Ross made a final adjustment and a voice ! – the ghost spoke.

> "Ross, Ross, Hello, Matthews here, Hello Ross. Can you hear me, 1,2,3,4,5,6,7,8,9,10,99 Matthews calling. Can you hear me Ross? Can the Daily Express reporter hear me? I'm going to play 'Two Eyes of Grey'. I hope you can hear it."

Hear it they could, over 110 miles on an atrocious night. The ghost had been laid, but as Matthews said:–

> "There's a dickens of a lot of work to be done on the invention yet, remember."

The Morning Post, in March, recognised these 'Wonders of the Wireless Telephone':–

> "Of the value and possibilities of wireless telegraphy we have, of late, had some striking illustrations, notably in the case of the tragedy of the Titanic. Although it is not yet possible to achieve such results as those now accomplished by wireless telegraphy, the importance of Grindell Matthews's work may be gathered from the fact that recently the Western Mail scored a journalistic triumph by printing the first message ever transmitted by wireless telephone; the message having been sent from Newport to Cardiff – a distance of about twelve miles."

The historic event took place on the 27th February 1912. Matthews installed his apparatus in the boardroom of the Western Mail building at Cardiff, and broadcast a message of thanks to the directors of that newspaper. It consisted of over 130 words, and Matthew's technical achievement can be shown by the fact that the message was received word perfect by members of the newspaper's staff. A number of locally prominent men had been invited to witness the demonstration of what all now considered to be one of the most important inventions of modern times.

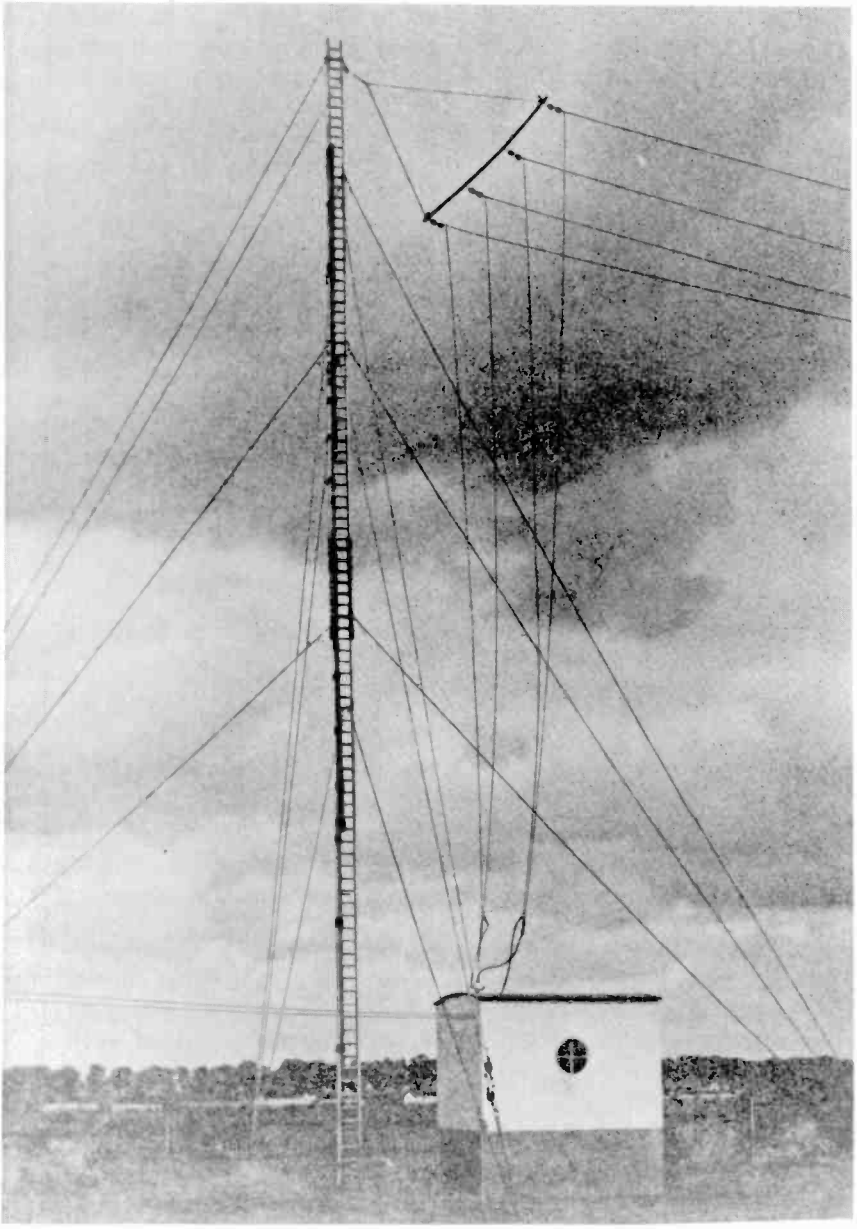
There were more successes to come. In the 'Court Circular' of The Times, published on 5th July 1912, the following announcement appeared:

> "Buckingham Palace, July 4. Her Majesty this afternoon inspected the wireless telephone invented by Mr Grindell Matthews."

VOICES IN THE AIR

THE QUEEN TALKS TO HER CHILDREN BY WIRELESS TELEPHONE

> "By Royal Command two portable sets of the Grindell Matthews apparatus were taken to the Palace, and the system was explained to



43. Grindell Matthews Transmitting Station, Letchworth. – 1913.

the Queen. The apparatus was fitted to two motor-cars furnished sumptuously and fitted with the wireless equipment in a small case. On the roof of each car was a small telescopic pole which could be raised to a height of 50 or 60 feet. The Queen entered one of the cars and directed that the other should go to the far side of the Palace grounds. The Royal children (the future King Edward VIII and King George VI *Ed.*) took their places in the second car and presently were able to 'talk to Mother' as by an ordinary telephone. It was a matter of some difficulty, indeed, to persuade them to 'ring off'. At the close of the demonstration the Queen expressed her delight with what she had seen and heard, and wished the inventor every success."

For Grindell Matthews the year 1912 was a year of continuous progress with his wireless telephone. Public interest, stirred by the phantom voice of the North Sea episode, demanded more information about 'radio stations'. On the 25th July 1912 Matthews demonstrated his invention to Mr Lloyd George (the Chancellor of the Exchequer) and Col Seely the Secretary of State for War. Matthews was a great success, patronized by press, public figures and Royalty, his experiments looked like surging ahead. In his diary he wrote:–

> "The lonely shepherd on the moor will one day receive the world's news and music as he eats his midday meal of bread and cheese. Every home can have orchestral music or song."

Matthews was set to give his ideas substance and bring broadcasting to the world.

By late in 1913 he had fully equipped two large radio stations, one in Letchworth in Hertfordshire, and the other in Northampton. Matthews' aim was to attempt Fessenden's dream of broadcasting speech across the Atlantic to Newfoundland. He was actually in Paris, working on another scheme to speak from the Eiffel Tower to a French Warship in the Mediterranean when war was declared. The official orders went out to all radio amateurs in Britain:–

> "No person shall, without the written permission of the Postmaster General, buy, sell, or have in his possession or under his control apparatus for sending or receiving messages by wireless telegraphy, or any apparatus intended for use as a component part of such apparatus."

As radio enthusiasts the length and breath of the country handed their equipment and transmitting valves into the local police, Grindell Matthews was to be no exception. He promptly received an abrupt telegram from the Postmaster General:–

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RETURN AT ONCE - STOP
DISMANTLE WIRELESS STATIONS AT LETCHWORTH AND NORTHAMPTON - STOP
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Matthews hurried home, but the ensuing chaos of war cost him four days travel, so that on his return he found that the Post Office engineers had already dismantled the aerials, sealed the locks and stationed a sentry outside the stations. It took two years of frustration and angry letters to finally gain entry to his own premises, but he found his instruments and equipment completely ruined by damp and the buildings uninhabitable through neglect. He also received the tragic news that his close friend and manager of the Grindell Matthews Wireless Telephone Company the Hon. Nelson Hood had been killed in action.

When the war ended, Matthews realised that his pre-war work was now obsolete having been overtaken by the rapid developments of war. He had no equipment, no premises, few funds and shattered dreams. His hand picked staff stood by him for six months, but he was forced to let them go, most of them eventually moving to join the Marconi Company. Grindell Matthews now devoted his undoubted genius elsewhere, to remote control torpedoes, sound tracks for the still silent cinemas and even "death rays".

There was an attempt to enlist his help in a venture to establish an offshore shipbased 'pirate' radio station, backed it is said by several Members of Parliament. This would have been anchored outside territorial waters to compete with the BBC, but Matthews was unconvinced about the reliability and safety of putting state of the art transmitters to sea. This was despite his passionate belief that the BBC should not have a monopoly, backed by the fact that many listeners seemed to prefer Radio Normandy and Radio Luxembourg to the sombre Sunday programmes transmitted from Broadcasting House.

Matthews was to watch the birth and development of British broadcasting as he predicted, but he never returned to the field that he had once pioneered. Harry Grindell Matthews died on the 11th September 1941. The pathways he pioneered were walked by many other brilliant men, who gave us radio communication as we know it today, but he will always remain the man who nearly made broadcasting.

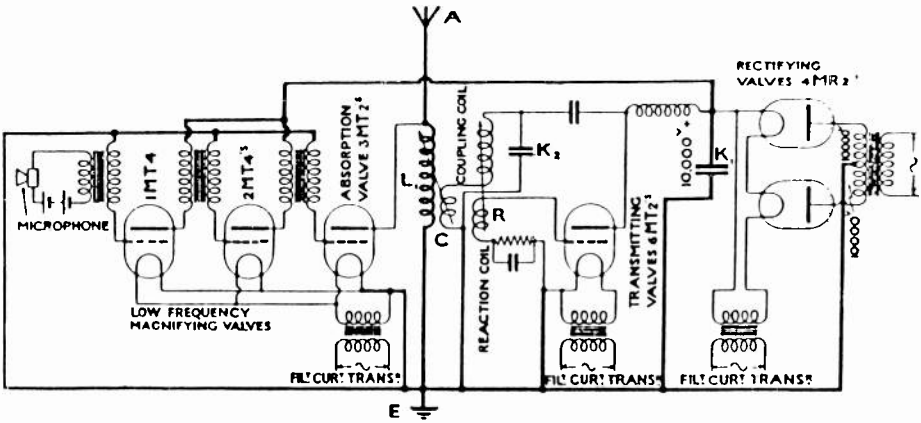
APPENDIX D

THE CHELMSFORD STATION MZX OF THE MARCONI COMPANY 1920.

The following is a technical description of the 15Kw transmitter used by the Chelmsford station MZX during the summer of 1920. It comes from an article by Frank P. Swann in The Wireless World and Radio Review, 1st May 1920.

The development in wireless telephony during the war concentrated on low power sets only, and these were for aircraft work. Since the armistice, however, rapid progress was made in the development of high power valve telegraph and telephone sets. The Marconi 6 kilowatt telegraph and telephony transmitter was one such set. Wireless telephone tests with this transmitter set were carried out in January of 1920 to Madrid, and the results with regard to both telegraph signals and speech were very successful, for both were reported at Madrid as of exceptional strength and quality.

Work was then commenced on the erection, in the experimental building of the Marconi Works at Chelmsford, of a similar but larger set than the 6Kw version, and this was the first 15 kilowatt set. The source of power was a 200 cycle per second, 500 volt, 15 kilowatt alternator, feeding the primary of a 20,000 volt transformer, the secondary or high-tension winding of which has its middle point



44. Chelmsford transmitter – circuit diagram.

brought out. By the use of two rectifying valves connected to this secondary, it is possible to charge a condenser K1 unidirectionally every half cycle; but, of course, only to half the total secondary voltage. By this means the condenser K1 is kept charged at about 10,000 volts, and acts as the source of high tension direct current supply feeding the transmitting valves and the low frequency magnifier valves. The two high frequency circuits are the aerial, AL1E, and the closed circuit L2CK2. A continuously oscillating current is maintained in L2CK2 by the transmitting valves and the reaction coil R. The energy in this circuit is transferred to the aerial by the coupling coil C.

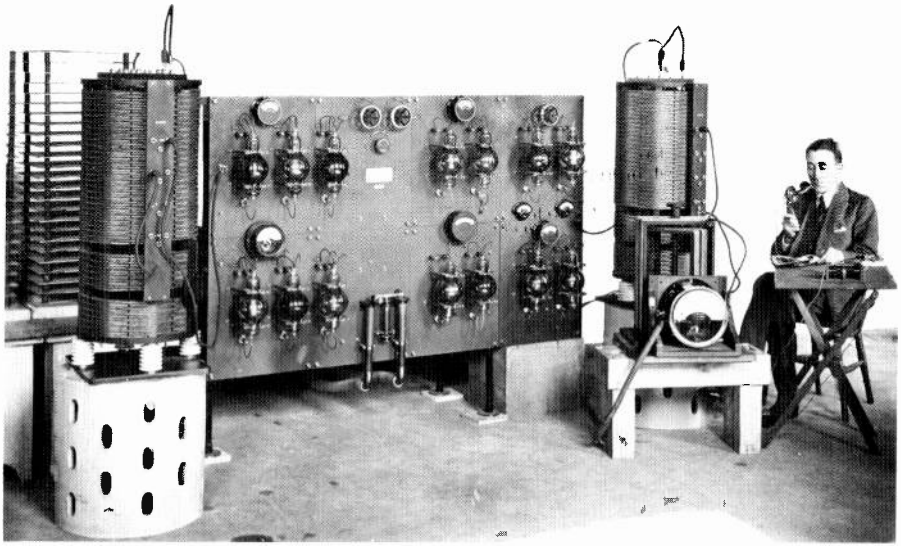
For the wavelength used the frequency of the continuous oscillations in the aerial is approximately 100,000 per second. In order that speech may be obtained at the receiving end the high frequency transmitting aerial current must be modulated in accordance with the wave forms produced by speech. An approximate value of the frequency of the speech wave may be taken as 800 cycles per second, but instead of being a sine curve, it is one which is rich in harmonics.

It is the distortion of these harmonics which produces bad quality speech. There are several methods by which the aerial current may be modulated in accordance with the speech frequencies; the one used, however, and that which is found to give the best quality speech, is to absorb the energy in the aerial in accordance with the speech waveform. The variations in the microphone current are transformed up to produce a curve of varying voltage, which is similar in shape to that for the varying current. By means of a two-stage low frequency amplifier, the amplitude of these voltage variations is magnified up, and they are then impressed on the grids of the absorption valves. The resistance of a three-electrode valve varies with the voltage impressed on the grid, and therefore the conducting power of the absorption valves will follow the varying voltage curve produced by the speech. As the absorption valves are connected across the aerial tuning inductance, these valves will absorb energy from the aerial in the varying degree to which they are made conductive by the impressed speech volts. This energy is dissipated as heat in the valves themselves, and therefore they must be big enough to stand this energy loss without getting overheated.

In spite of the many precautions that are taken, the voltage across the condenser K1 does not remain absolutely constant, but varies slightly for each half of the 200 cycle supply. The aerial current follows this slight variation of the supply volts, and this produces the hum which is heard at the receiving end when speech is not being transmitted.

The valves used in the Chelmsford transmitter were MT2 and MT4 types (also used in the 2MT transmitter), a very much enlarged form of the ordinary three-electrode receiving valve. The mechanical details of the construction of these valves were really the only novelties. Like normal valves the filaments were made of tungsten, and the anode and grid were nickel. The resistance of these valves was however much higher than that of ordinary receiving valves in order that they could withstand higher voltages, and the vacuum was made as high as possible with the best pumping appliances possessed.

Referring to the picture of the Chelmsford transmitter (with W.T Ditcham in the foreground) the six valves (MT4's) on the left-hand end of the panel are the transmitting valves. The rectifying valves (MR4's) are the four valves in the middle of the panel. Of the four valves (MT4's) on the right-hand end of the panel, three are absorption magnifying valves and one is a low frequency magnifying valve. In the middle of the panel, at the bottom edge, will be seen the electromagnetically operated key which was used for continuous wave telegraphy. During telephony, of course, it was not in operation.



W.T. Ditcham at the Chelmsford transmitter.

APPENDIX E

THE AMATEURS PROTEST

On 29th December 1921 the wireless societies of Great Britain presented a letter to the Post Office demanding that wireless telephony broadcasting be given a place in the ether.

> We, the undersigned, on behalf of the Wireless Society of London, and of most of the other societies of the country, representing in the aggregate a large number of citizens interested in wireless telegraphy, ask you to be good enough to give consideration to our views as follows:
>
> We wish to express our thanks for the courtesy and consideration which the authorities have always shown to the amateur radiotelegraphists of this country, and to state that we fully realise operations in a small and crowded country such as our own where the stringent regulations are obviously necessary to prevent undue interference.
>
> We also wish to express our satisfaction at the permission recently given to the Marconi Company to send special calibration signals from Chelmsford for the benefit of our members for a period of half an hour every week.
>
> We desire, however, to express our regret that wireless telephony has not been included in this arrangement and to say that we hope that this restriction may be considered, either with reduced power, or perhaps on a short wavelength of 200 or 300 metres, so as not to cause interference. We would point out that it is telephony in which the majority of our members are chiefly interested at the present time, this being the most recent achievement in wireless, and that in which, for moderate distances at all events, improvements such as avoidance of distortion and the production of really articulate loud speakers and such like, are most required. It is therefore primarily to serve the scientific purpose of improving the receiving arrangements that we desire to have telephony included. We would, however call attention to the following general consideration, which in our opinion, should not be overlooked by the authorities in dealing with this question.

It should be remembered that wireless telegraphy was, in the first instance, originated and has since been largely developed, by men who, at any rate to begin with, were not even electrical engineers or electricians, and still less qualified telegraphists. Many of these, when they began experimenting, were in this particular line pure amateurs, though no doubt some of them gradually attained to professional proficiency. New inventions and important improvements are still being made by this class of person and the more numerous they are the more chance there is for good and useful work to be done. In this connection it is noteworthy that it is entirely due to amateurs that all records have recently been broken by the successful transmission and reception of signals across the Atlantic (see note) and to keep them interested, it is necessary to make the occupation interesting and even entertaining; hence the need for wireless telephonic speech and even music. Furthermore the requirements of the large number of such amateur users have led to the establishment of numerous factories for the manufacture of wireless instruments and apparatus, where skilled engineers and workmen are employed and many experiments are carried out and where quite important improvements in instruments and methods are constantly being effected. Were it not for the demands of numerous amateurs, such manufacturing concerns would not exist and advance in the art would be checked. There is also the advantage in the case of any future wars, of the existence of a number of persons skilled in wireless.

The education value of wireless should not be overlooked. Just as the advent of the motor car has undoubtedly done more to disseminate a knowledge of mechanics throughout the population than all the millions of money spent annually on technical education, so also the practice of wireless is teaching thousands the principles of electrical science and of physics, and this without any expense to the State.

That the French authorities recognise the force of these considerations is evidenced by the transmission of speech and music that have already commenced under Government auspices from the Eiffel Tower. It is understood that is intended to make these a regular feature like the time signals and meteorological reports and it will be somewhat lamentable if England, where Wireless Telegraphy originated and whose Greenwich time is the time of the world, but who sends out no wireless time signals, should again fall behind other countries by reason of failure to move with events.

We are,
Your obedient servants.

The petition was signed by the Committee of the Wireless Society of London and representatives of the following Societies and Clubs affiliated with it. It not only started 2MT's Writtle career but also gave birth to broadcasting in this country.

The Halifax Wireless Club
The Wireless Society of Manchester
The Sheffield and District Wireless Society
The Wireless and Experimental Association
The Wireless Society of Blackpool and Fylde District
The Burton-on-Trent Wireless Club
The Wireless Society of Luton
The Leeds and District Amateur Wireless Society
The Wireless Society of Altringham
The Birmingham Experimental Wireless Club
The Bradford Wireless Society
The Wireless Society of Preston
The North Middlesex Wireless Club
The Wireless Society of Handsworth
The Cardiff and South Wales Wireless Society
The Wireless Society of Wimbledon and District
The North London Wireless Association
The Wireless Society of Kings College
The Wireless Society of Ilford
The Wireless Society of Ipswich and District
The Cambridge and District Wireless Society
The Edinburgh and District Wireless Society
The Wireless Society of Smethwick
The Wireless Society of York
The Willesden Wireless Society
The Radio Scientific Society
The Woolwich Radio Society
The Wireless Society of Newcastle on Tyne
The Wireless Society of Leicestershire
The West London Wireless and Experimental Association
The South Woodford Radio Society
The Dundee and District Amateur Wireless Association
The Folkestone and District Wireless Society
The Southport Wireless Society
The Sussex Wireless Research Society
The Wireless Society of Coventry
The Borough of Tynemouth YMCA Amateur Wireless Society
The Portsmouth and District Wireless Association
The Wireless Society of Lincoln

The Wireless Society of Stoke on Trent
The Wireless Society of Kensington
The Wireless Society of Wickford Essex
The Radio Society of Hull and District
The Wireless Society of St. Austell
The Brighton Radio Society
The Wireless Society of Southend on Sea
The Wireless Society of Highgate
The Wireless Society of Newark on Trent
The Bradford on Avon District Society
The Wireless Society of Epsom
The Wireless Society of Lowestoft and District
The Wireless Society of Dartford
Bristol and District Wireless Association
The Wireless Society of Gloucester
The Wireless Society of East Dorsetshire
The Plymouth Wireless and Scientific Society
The Rugby and District Wireless Club
The Wireless Society of Hounslow
The Wireless Society of North Staffordshire
The Wireless Society of Margate and District
The Glevum Radio and Scientific Society
The Guildford and District Wireless Society
The Liverpool Wireless Association

Note. This occurred on 8th December 1921 when the first transatlantic shortwave radio transmission on 200m was received by W.F. Burne (callsign 2KW) at Sale in Cheshire.

APPENDIX F

The DUTCH RADIO STATION
PCGG

The Dutch wireless station callsign PCGG is widely quoted as beginning transmission on the 29th April 1920, from the Philips Company in the Hague. However research in Holland by Dutch radio amateurs has shed further light on PCGG's history. The station was organised by the impressively named Hanso Hericus Schotanus à Steringa Idzerda, who transmitted an experimental 'Radio Soiree-Musicale', on Thursday 6th November 1919, between 8 and 11 O'Clock. He had obtained his transmitter licence on the 14th August 1919, and was allocated the callsign PCGG, together with the Philips company, who were given the callsign PCJJ. The terms of the licence allowed the broadcast of speech and music via radio, provided the station callsign was repeated five times per message. The station began testing on the 22nd August 1919, from military stations nominated by the Engineer in Chief of Military radio. On the 1st September 1919 the monthly magazine 'Radio News' announced:–

> "Every Thursday evening there will be continuous wave transmissions from 8 O'Clock until 10 O'Clock"

The first broadcast concert was advertised on November 5th, in the Dutch newspaper 'De Nieuwe Rotterdamse Courant', which cheerfully stated:–

> "Everybody who possesses a simple radio receiver may listen to music in the comfort of his own home. With the aid of amplifiers it can be made audible across the entire room."

The first 'Soiree Musicale' was repeated a week later, with the third broadcast on the 20th November being repeated on the 27th of November. After these the repetition of broadcasts stopped and Idzerda introduced some new features into the schedule. On the 11th December he announced that listeners who gave the station accurate reception reports would get a personal answer on air the following Sunday, so introducing a second weekly broadcast.

During the Christmas week listeners on Wednesday 24th December could also tune in between 8-11pm, and on Friday afternoons from 3 until 5pm. Considering the medium was so young, perhaps this was broadcasting proper. Like KDKA in America, the Hague broadcasts were intended to promote sales of broadcast

receivers and amplifiers built by Idzerda's small crystal set and radio component company, Nederlandse Radio-Industrie. Hans Idzerda had been instrumental in persuading the Philips company (N.V Philips Gloeilampenfabrieken to give them their full title) to first manufacture radio valves in late 1917 by agreeing to buy 180 valves a year. Philips commenced production of the Philips-Ideezet (or Ideezetlamp) 'soft' valves in early 1918, although apparently the inventor and the company later parted, despite initial sales by December 1918 of over 1,200 valves. It was at the end of April that Idzerda first organised special concerts for English listeners, commented on by Wireless World in June 1920. The stations output during 1920 consisted of a Monday and Thursday evening programme together with a weekly 'Dutch Concert' from 3 pm to 5.40 pm on Sundays. The station from across the water originally broadcast on 670 metres, but by 1922 the usual frequency quoted was 1,050 metres with 1,300 metres also being occasionally used. During the concerts all broadcast announcements were repeated in Dutch, French and English. The station was heard throughout Britain with regular listeners tuning in from Dumfries in Scotland to Honiton in Devon. Reception was usually excellent although occasionally Croydon air traffic control caused some listeners problems.

The station's single (Marconi) valve transmitter was designed, built and patented by Hans Idzerda, was rated at 500 watts, but produced some 75 watts at the aerial. The circuit design used actually employed a form of narrowband frequency modulation, which was best received slightly detuned so as to actually slope detect the signal. However in the winter of 1921 the broadcasts ran into severe financial trouble, but they were saved by an appeal in the 3rd September 1921 edition of Wireless World. This fund raising drive was led by the Managing Director of Burnham and Co, Mr W.W Burnham, (which later became Burndept Ltd) and it very quickly raised over 750 pounds. The Daily Mail, incensed at the cancellation of the Chelmsford station's broadcasting licence also agreed to sponsor Idzerda's English broadcasts for a whole year.

Station PCGG continued to transmit until October 1924, and is regarded by the Dutch as the earliest broadcasting station in the world. It is tragic to note that Hans Idzerda was executed on the 3rd November 1944, by the German army of occupation, after being caught using a clandestine radio set, and trespassing on the site of a V2 rocket crash.

APPENDIX G

EMMA TOC

Any newcomer to amateur radio will probably not recognise these famous phonetics for (2) MT. The history of communication has seen many phonetic alphabets employed to clarify the spelling of a word, name or callsign, in fact far too many to record here. The two well-known alphabets are the war-time interservices version which gave us the Dambusters, S-Sugar and B-Baker, and the official NATO alphabet where S-Sierra and B-Bravo have taken their place. The alphabet that gave us T-Toc is a Military Exercises alphabet, but amateurs are renowned for inventing their own versions and fortunately M-monkey soon became M-mma or more commonly M-emma. In America, amateur callsigns phonetics have become famous in their own right, WA8TQD (Ten Quacking Ducks), W8KFC (Kentucky Fried Chicken) and K2NBN (No Bad News) are well known on the airwaves. An unofficial international alphabet runs along the lines of A-Amsterdam, B-Baltimore, C-Casablanca, the old Post Office training version, A-Andrew, B-Benjamin, C-Charles with the oldest being the Western Union Telegraph Companies A-Adam, B-Boston. The final word belongs not unusually to that man Peter Eckersley, when broadcasting from the BBC's experimental station at Hendon. Its callsign was originally 6BBC but soon changed to 2OO (Two-oh-oh). Eckersley's voice calling this, or more politely "Hello CQ! Two 'orace onion' calling" was almost as popular as his famous "2 Emma-Toc W-r-rrittle".

APPENDIX H

RADIO RECEPTION

The science of radio wave propagation is extremely complex and was for many years not fully understood. 2MT Writtle received constant reports of severe fading in some more distant parts of the country, but were never able to come up with a valid scientific reason or solution. One of the worst areas seemed to be Edinburgh, in desperation Eckersley was forced to blame it either on the geological strata or the new telephone system, but he regarded neither as a sensible cause.

There are two main modes of propagation of electromagnetic waves, the term used by physicists for radio waves, that could have affected these early broadcasts.

These are: (a) Ground wave sometimes called surface wave. (b) Ionspheric wave, sometimes called Skywave.

The mode of propagation that actually occurs between any two points on the surface of the earth depends on the frequency (wavelength) used, but there is no sharp transition from one mode to another as the frequency increases.

The main mode of the propagation that would have affected the Writtle transmissions and to which most listeners would have tuned into, is the groundwave, where the radiated wave follows the surface of the earth. At the frequencies used by Writtle:

$c = f \times \lambda$ where:–

c = the speed of light, 300,000,000 m/s
f = frequency (cycles per second or hertz)
λ = wavelength in metres

$$f = \frac{300}{400} = 0.75 \text{ MHz}$$

At this frequency the ground wave attenuation by the atmosphere is very low, such that world wide communication may well have been possible, had the world been listening and the radiated power high enough. The ground wave is also not severely affected by atmospheric effects, or by the time of day as other modes are. It is just possible that some of the long distance reports that Writtle received, from North Scotland or the South or France may have been due to Ionospheric propagation, where the radio signal is refracted, or bent back to the earth by layers of ionized gas. This is the normal mode of propagation for todays amateurs over

the frequencies of around 1MHz to 30MHz. The reflecting layers are known as the F2 layer (height between 300-400km) and the F1 layer (at about 200km) and the E layer at 120km. The ionization is in fact a mixture of oxygen, nitrogen and nitric oxide in the rarefied atmosphere, which splits into ions and free electrons under the influence of the ultra violet and Xrays in sunlight.

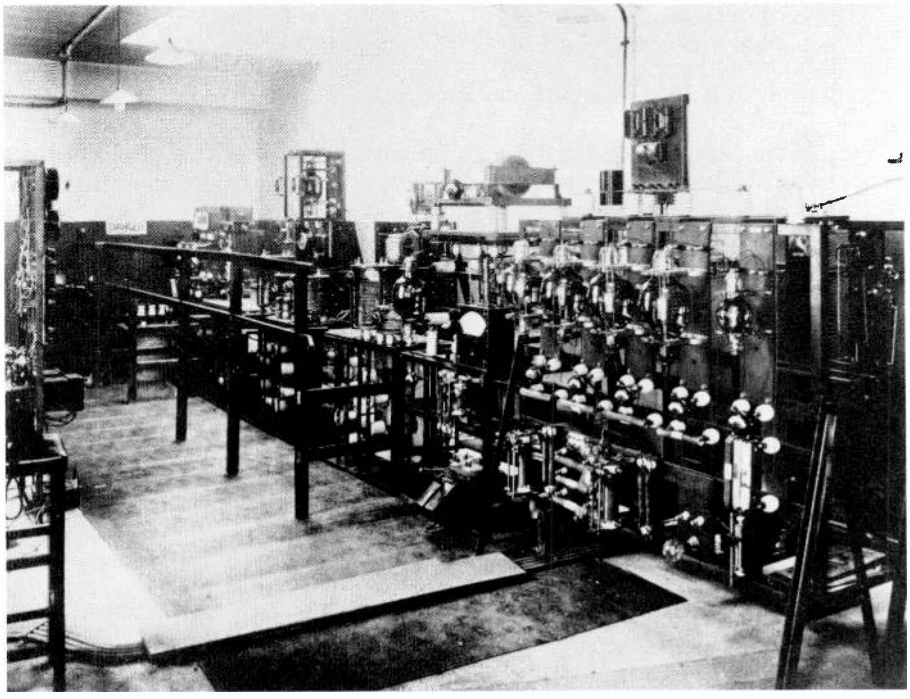
Although the Writtle engineers could never have known, this propagation mode may well have been the reason for severe fading experienced in some of the more distant areas. This is known as the skip zone or dead zone. At Writtle's wavelength the distance between the decay of the ground wave signal, and the start of the skywave may well have led to such localised areas of fading. The signal received at any given point is rarely constant because of the continuing changing conditions in the ionosphere, so the fading would have drifted up and down the country, just as the listeners reported. Today it has also been realised that reception of both the ground and the skywave at a single location can also give rise to very deep fading, due to the signals arriving in and out of phase as the ionosphere continually changes.

The solar radiation that causes the ionization also constantly varies, and has been found to depend upon the number of sunspots, areas of cooler than normal gas on the surface of the sun. This number varys cyclically, with maximum activity occurring at regular intervals, every 11 years. It is interesting to note that when Marconi's morse code 'S' crackled across the Atlantic in 1901, the sunspot cycle was approaching its maximum, two cycles later, 2MT Writtle turned her voice to the heavens.

APPENDIX I

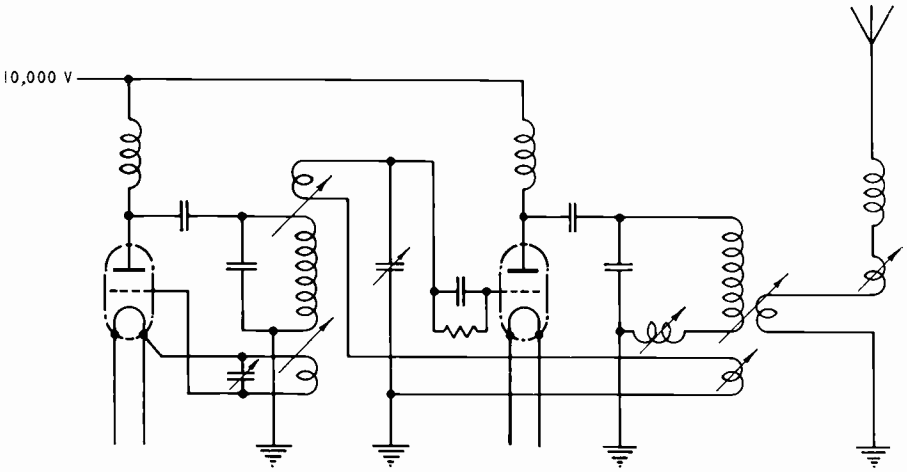
THE LONDON STATION
2LO
OF THE BRITISH BROADCASTING COMPANY.

This comprehensive technical description of the new 2LO transmitter comes from the a letter to the Marconi archives from Mr R.H White, M.I.E.E, M.I.R.E. It should perhaps not be attempted by the non technical!



45. 2LO – The new transmitter.

Power is taken from the Electric Supply Co.'s mains, which in this case is taken at a pressure of 200 volts D.C. (!) Arrangements are made so that the supply may be changed over from the ordinary supply network to the London theatre supply main; we are thus assured of two separate and distinct sources of supply. The



46. 2LO – outline circuit diagram for the new transmitter.

direct current is taken through a switch-board and so to a 10 h.p. direct current motor which is directly coupled to a 6 kilowatt single phase 300 cycle alternator. This alternator supplies power at 500 volts A.C. thus providing an ample margin for any increase in power which may be authorised at a later date. The present power is 1.5K.W. to the oscillation valve. The motor alternator sets are also in duplicate, and are arranged so that a single throw-over switch disconnects one set and connects the other.

Arranged on the wall above these sets are 2 remote control automatic starters which are operated from the wireless room at the top of the building. The alternating current from these sets is taken by cable to the top of the building, where it is supplied to the primary of a 6 kilowatt transformer which again has a second transformer installed beside it with a changeover switch so that either transformer may be used. The secondary winding of these transformers gives a normal working potential of 22,500 volts, and they are connected to a high tension link board so that either transformer may be connected to the wireless transmitter.

We now come to the actual wireless transmitter which consists of four separate panels as shown in the photograph. Each panel is mounted in a frame entirely enclosed in plate glass or metal so that all the apparatus mounted within the frame is thoroughly protected from dust, special ventilation is provided for the valves, this protection also prevents the danger of electrical shock to persons having access to the wireless room. The first of these panels is called the rectifying panel, and its function is to convert the alternating current into direct current at a pressure of approximately 10,000 volts. The method by which this function is performed is that now common to wireless practice, i.e. by the use of two thermeonic rectifying valves. The filaments of these valves are lighted from a

highly insulated transformer, the primary of which is connected to the 500 volt alternating current supply through a variable inductance and also through a compensating inductance. The function of the former is to regulate the filament voltage, whilst that of the latter is to compensate for line drop when the power load is thrown on to the line. This is accomplished by means of an automatic switch which short circuits the compensating inductance the moment the load is switched on. The secondary winding of each power transformer has a central connection which is joined to the earth of the wireless system. The two ends of the secondary winding are joined to the anodes of the rectifying valves. The filaments of these two valves become the positive high tension direct current pole of the wireless circuit. As soon as the alternating voltage is applied to the rectifier lighting transformer the filaments are lighted and the alternating current is applied to rectifier anodes. The current will pass through the rectifying valves in one direction only, alternating first through one and then through the other at the frequency of the alternator, i.e. 500 times per second through each valve, and in such a manner that both sides of the alternating wave are rectified so that we have a undirectional current having a ripple on it of 500 per second. This current is then applied to a smoothing or filtering system which consists of a large condenser connected between the earth and the positive direct current side. This condenser tends to smooth out the ripple which is on top of the direct current. The current after passing through this condenser has to flow through a large iron cored inductance, and so to a second smoothing condenser of a similar capacity to the former. By the time the current leaves the second condenser it is to all intents and purposes a smooth direct current, and is in fact far smoother than the current which would be obtained from a direct current generator, as such a current has always a certain amount of ripple caused by commutation and also an irregularity caused by slight brush-sparking. Directly connected across the last condenser is a very high resistance with a voltmeter in series with it. This voltmeter serves two purposes – first it measures direct current voltage and secondly it automatically discharges the condensers after the current has been interrupted. This prevents danger from shock which would occur if this leak were not connected. The high tension direct current passes through a milliammeter and so to the second panel.

The second panel consists of an oscillatory circuit which in this instance is called the drive oscillator. The circuit is one which is common to most wireless transmitters and consists of a closed circuit composed of an inductance and condenser. One end of the inductance and one end of the condenser being connected to earth, whilst the high potential end of the condenser is connected to the anode of the oscillating valve, and the grid of the same valve is inductively coupled to the same inductance. The grid is also connected to earth through a high resistance across which is a small condenser. The anode of this valve is fed from the positive busbar through a milliammeter, whilst the valve filament is connected – one end to the negative earth busbar and the other through a variable resistance to the positive low tension busbar. These two busbars, i.e. positive and negative low tension, are continuous throughout the drive panel as well as the amplifier

panel, which we are about to consider, and the modulator panel. They are connected by means of a switch-board to a low tension accumulator battery of 40 volts and 330 ampere hour capacity. The next panel to be considered is the amplifier panel, and this panel is in many respects identical with the Drive Panel. In it are mounted a closed oscillating circuit consisting of an inductance and capacity, one end of the condenser and one end of the inductance being connected to the earth busbar as in the drive panel. Connected to the high potential end of the inductance is the anode of the second valve which in its turn is again fed from the high tension busbar, whilst its grid is connected back to the drive panel, and is there taken through an inductance which is coupled to the oscillating circuit of that panel. At the same time this grid is connected to another inductance which is coupled to the closed oscillating circuit of the amplifier. We thus have a transmitting valve, the grid potential of which is controlled from two sources i.e. the drive or the amplifier. The setting of these two reaction coils is of considerable importance, and should be so arranged that the grid is maintained in a state of varying potential by the oscillator, whilst the other reaction coil which is coupled to the amplifier is used merely to stabilise this action.

In the positive high tension lead to this valve is inserted a large inductance which is known as a speech choke and it is by means of this choke that the potential to the anode of the oscillating valve is varied. Each variation is carried through the aerial and this superimposes on the carrier wave from the aerial a complex ripple corresponding to the speech modulation. The aerial circuit is also connected in this panel and consists of an aerial terminal and a variable inductance known as the aerial variometer and a coupling coil which is coupled inductively to the primary oscillating circuit. The end of this coil is connected through the aerial ammeter to the negative earth busbar.

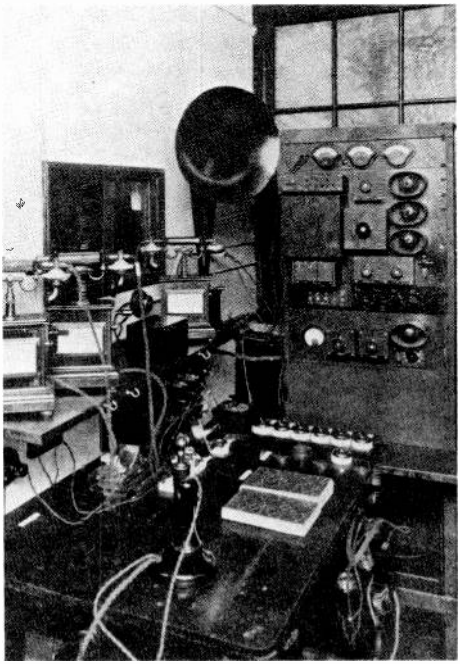
We now come to the modulator panel which consists of 2 valves – the first of which is the control valve, whilst the second is the sub-control valve. Both these valves are lighted from the common low tension busbars which, as already mentioned are connected to the low tension accumulator battery. The anode of the first valve is connected through the high resistance and through a protective choke to the speech choke, which is also connected to the positive high tension busbar. The grid of this valve also takes its high tension current for the anode through a resistance and the protector choke from the positive high tension busbar, whilst its grid is connected through a transformer to the negative busbar. The primary of this transformer is connected to the Microphone in the Concert Room. When the Microphone is spoken or sung into the variation in its resistance produced by the voice causes a variation of the current flowing through the speech transformer, and causes a varying potential on the grid of the sub-control valve which in its turn causes a still larger variation on the grid of the main control valve, whilst this varies the anode potential of the amplifier valve, thus causing a speech ripple on the top of the carrier wave which is being radiated from the aerial.

APPENDIX J

THE BBC

The growth of the new BBC was meteoric. The Glasgow station 5SC (SCotland, 405.4m/420m) opened on March 6th, the Aberdeen station 2BD (aBerDeen, 495/500m) on October 10th, and the Bournemouth station 6BM (BourneMouth, 385m) on October 17th. The BBC also estimated that by late 1922 the various wireless stations of the BBC could now be heard by 55% of the country at a strength suitable for reception on a crystal set.

On 31st October 1922 the Post Office announced that it had issued some 18,061 radio receiver licences in this country, but was unable to cope with the flood of applications, indeed by March of 1923 some 32,285 experimental licences were still awaiting attention. The 1928 BBC handbook charted the growth of radio in this country.

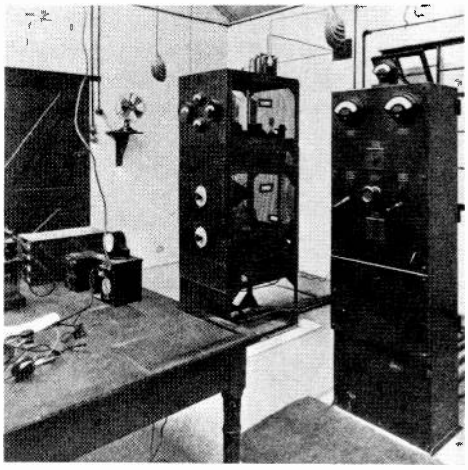


47. BBC Station 5IT – Birmingham speech input control room.

Date.	Licences Issued.	Sep 1925	1,464,674
Dec 1923	595,311	Dec 1925	1,645,207
Mar 1924	748,396	Mar 1926	1,964,174
Jun 1924	823,894	Jun 1926	2,076,230
Sep 1924	998,657	Sep 1926	2,104,198
Dec 1924	1,129,578	Dec 1926	2,178,259
Mar 1925	1,348,874	Mar 1927	2,263,854
Jun 1925	1,387,993	Jun 1927	2,998,220

However by the end of 1923 it was estimated that there were some 200,000 homebuilt sets evading the licence fee and listening in for free. Peter Eckersley as he toured the stations made repeated appeals for the guilty persons to own up. From every radio set in the land rang his call:–

"Is it fair ?"
"Is it British ?"
"Do you want others to pay for your service ?"



48. BBC Station 5IT – transmitter and power panels.

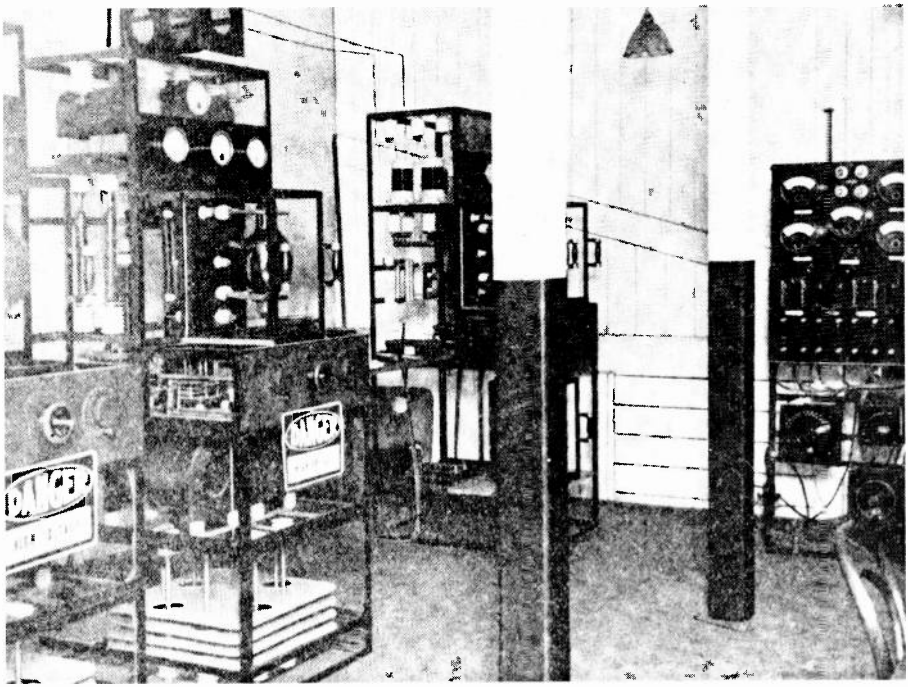
Despite the fact that someone once whispered "Yes" behind him, the morning after his broadcasts would see long queues at the Post Office, but in the years 1923 to 1926 it was estimated that 25% of listeners failed to pay their licence dues.

From November 1923 to December 1924 the BBC set up a further ten relay stations of 100-200 watt transmitters throughout the country. These were placed on top of factory chimneys or any other secure high point, to relay the programmes from London, Glasgow, and Cardiff main stations, except in the afternoons and on one evening a week. The new relay stations were:–

Sheffield	6FL,	303m on November 16th 1923.	(later 272.7m)
Plymouth	5PY,	335m on March 28th 1924.	(later 400.0m)
Edinburgh	2EH,	325m on May 1st 1924.	(later 288.5m)
Liverpool	6LV,	318m on June 11th 1924.	(later 297.0m)
Leeds/Bradford	2LS,	346m on July 8th 1924.	(later 277.8 & 252.1m)
Hull	6KH,	320m on August 15th 1924.	(later 294.1m)
Nottingham	5NG,	340m on September 16th 1924.	(later 275.2m)
Stoke-on-Trent	6ST,	306m on October 21st 1924.	(later 294.1m)
Dundee	2DE,	331m on November 9th 1924.	(later 294.1m)
Swansea	5SX,	318m on December 12th 1924.	(later 294.1m)

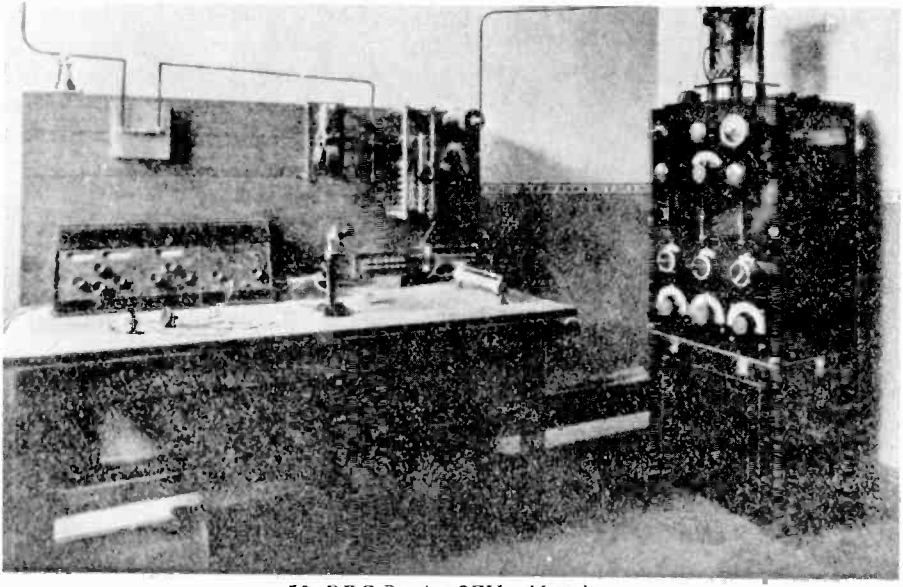
(Bradford was a relay station for the Leeds programme on 310m.)
(Later wavelengths from the 1928 BBC Handbook.)

Each main station had its own programme, with the BBC now offering a wide diversity of material, including the output of 25 permanent orchestras whose salary bill alone cost over 100,000 pounds. The BBC also broadcast from the major London theatres, and transmitted live performances of 'The Lady and the Rose', 'Polly', 'Battling Butler', and 'The Last Waltz'. However in April 1923 all broadcasts from theatres, music halls and live concerts ceased until the Autumn of 1924 as the new BBC was opposed by theatrical, musical and booking organisations who imposed a total ban on all live broadcasting. Even though Dame Nellie Melba could not be heard, the exception was the British National Opera Company whose broadcasts both from theatres in London and in the provinces proved very popular.



49. BBC Station 5NO – Newcastle.

These concerts were transmitted at intervals from Monday 8th January 1923, when the first outside broadcast was undertaken of Mozarts 'Magic Flute', performed at the British National Opera Company and relayed from the Royal Opera House in Covent Garden via an underground cable to the 2LO transmitter site in the Strand. The engineers took the lull in live broadcasting as their que to move the premises of the BBC to a new building at No2 Savoy Hill in London.



50. BBC Station 2ZY – Manchester.

51. BBC Station 5WA – Cardiff.

On 23rd November 1923 another technical innovation was introduced by the BBC engineers. The first act of the opera 'La Traviata' performed at the 'Old Vic' Theatre in London was relayed to the 2LO studio by wireless. The small 50watt single valve transmitter fed a single 25ft wire aerial at the theatre, and the received signal was retransmited simultaneously from London (by 2LO), Manchester (by 2ZY), and Glasgow (by 5SC). This was the first time that wireless was used to relay a concert and this technique was developed as the only alternative was over eight miles of telephone cable that included three exchanges. This would have meant that the higher musical speech frequencies would have been lost and line noise and interference would have been considerable.

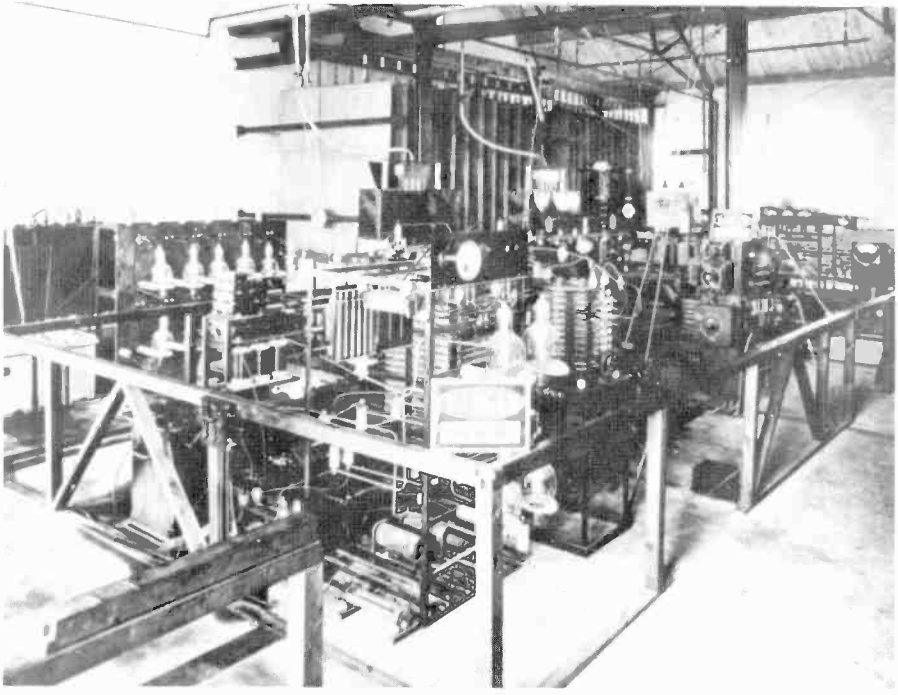
The Ninth main station of the BBC came on the air in Belfast (2BE, 306.1m, later 435m) on the 14th September 1924, and was officially opened by the Governor of Northern Ireland on 24th October 1924. The radio coverage of the county was now fairly comprehensive, but there were always problem areas and in places even Radio Paris (1,750 metres) gave far better reception. To meet this challenge, Eckersley's BBC engineering department doubled the power of the Edinburgh transmitter to cover the surrounding hills and valleys, and boosted the 2LO transmitter power to give a better signal in the Chiltern Hills. However the increased signal strength from the improved 2LO Station now caused severe interference with the Royal Navy, so the whole installation was moved and rebuilt on the roof of Selfridges department store in Oxford Street.

On the 27th July 1925 the remaining rural areas of Britain came within crystal set range when the 25Kw (later increased to 30Kw) station at Daventry started transmission relaying the London programme. This was the worlds first long wave broadcast station but it had begun life a year earlier on 21st July 1924 as an experimental station (hence the callsign 5XX), transmitting from the Chelmsford Marconi works on 1604.3 metres.

The opening programme was a special concert by Dame Clara Butt, but most broadcasts were fed to Chelmsford from the Savoy Hill studios of 2LO and then rebroadcast. The transmitter was similar in design to 2LO, but used watercooled valves with an anode current of 1.7A at 9KV. The original 5XX Chelmsford design had generated 15Kw and produced over 40 amps in the huge 450ft 'drainpipe' aerials that towered above the New Street site. Immediately the station came 'on-air' many listeners from the areas of previously poor reception wrote to both the Marconi Company and the BBC praising the new stations quality and clarity.

Despite the improved coverage the new station began to seriously interfere with Radio Paris listeners in London, so it, like the London based 2LO, had to be moved. The Managing Director of the BBC, John Reith confirmed at the Albert Hall Wireless Exhibition in 1924 that the experiment had been a success and a new permanent site would be found. Peter Eckersley, as Chief Engineer at the BBC publicly stated that the best location would be 40 miles North-West of London. However the Government decreed that due to interference problems it must be situated North of a line arbitrarily drawn between the mouth of the river Severn on

52. The refurbished 2LO transmitter installed at Selfridges, London, March 1925. In 1929 the BBC made this transmitter available to John Logie Baird after normal broadcasting hours. These vision-only experiments with Baird's television system used just 30 lines at 12.5 frames per second.



53. Station 5XX – The world's first long wave broadcast station.

the West coast and the Wash on the East. Eckersley, keen to push the new station into service as soon as possible, reluctantly agreed.

The move to the new Warwickshire site on Borough hill, Daventry, some 600 feet above sea level was accompanied by an increase in power to 30Kw. Two new steel lattice aerial masts of 800 and 500 feet in height were also built supporting a 750 ft long wire aerial. Its callsign, 5XX, was also transferred from Chelmsford, (which then took the callsign 5GB) where its wide range and reliable reception on a slightly lower frequency of 1554m would make it famous. The Daventry signal alone could be heard by 55% of this country's population and could also be heard well into Europe and Ireland. By mid 1925 over 80% of the potential listeners in this country were within crystal set range of at least one BBC station. The 29th October 1930 edition of Wireless World reported that 5XX was still the only British station of any real entertainment value, as the medium wave broadcast stations were often subject to fading and morse interference especially in fringe areas.

Wireless had now become a British craze, fuelled by the simplicity and low cost of the Crystal Set Wireless receiver. Ingenious people constructed amazing helixes and sliders and tried all manner of different crystals as their diode detector. The crystal set was a very delicate device, tickled with a fine iron wire (the Cat's Whisker) the listener had to find a 'good' spot on the crystal surface which made the signals audible. If anyone should slam the door or walk too heavily across the floor 2LO and the new BBC would disappear into the noise. Having to wear headphones to listen in was also very uncomfortable, especially for long periods of time. It was also almost inevitable that like the microphone leads in the early broadcast studios, someone would always fall over them.

The crystal set was to enjoy a very short lifespan, although it did provide a cheap, simple and effective way of listening in. It was however unable to separate two stations broadcasting on similar frequencies, and the ether was becoming ever more crowded. For these reasons the crystal set soon gave way to the valve craze, new words, rectification, reaction, reflex circuits and tuned anodes became the phrases of the moment. But the valve brought with it another problem, the early valve sets would all too easily start oscillating. This nasty effect meant that a receiver could, if improperly adjusted, act as a feeble transmitter. The unwitting operator immediately broke his licence to receive only, but more importantly, he also seriously interfered with other listeners in the area up to a radius of 30 miles. Tuning into a popular programme was in Eckersleys words, like imagining oneself in a circle of Dante's hell, the wailing and the grunting, the shrieking and the crying made listening a torture. Oscillation became another of Eckersley's causes whilst he was Chief Engineer at the new BBC. He felt it his duty to campaign against the chaos, appealing to the listening nation:–

"Was this fair ?"
"Was this British ?"
"Don't oscillate, Please don't oscillate !"

The press and his colleagues were to dub him 'Don't do it Eckersley', his special 'Don't Do It' pamphlet quickly became a best seller. The idea seemed to work, for oscillation gradually became less annoying to the listening public. It had been five years since Ditcham's first experimental reading from Chelmsford, and three years since Writtle's half hourly Tuesday night bash. Now the ordinary listener, could easily hear, in the comfort of his own home anything the BBC could broadcast. Not only this, but they could listen using relatively cheap, commercially produced equipment, on a loudspeaker, from any location in the country. Radio was no longer the preserve of the dedicated amateur enthusiast, it was now for the people.

54. Wireless for the masses.

On 27th July 1922 the Post Master General had stated that provision would be made under which radio amateurs who constructed their own receiving sets would also be allowed to use them. The Post Office believed that anyone who had sufficient knowledge to build his own equipment was also assumed to be able to make proper use of an experimental licence. This experimental licence was free from the restrictions of the normal broadcast reception licence and consequently it allowed the holder to use equipment that did not have to be approved by the Post Master General. This loophole whereby the 'tax' that had to be paid to the BBC on each set sold could be avoided was soon over exploited. Many firms began to place on the market a huge variety of ready made parts of both foreign and British origin to satisfy the demand from the eager home constructor. The circuits and designs were freely available (even on the back of cigarette cards), and in many cases they

were very simple to build. Apart from providing a new hobby for many people the main result was that the BBC quickly lost large amounts of revenue. In the January of 1923 the Post Office attempted to control the situation and announced that experimental licences would only be issued to experimenters of unquestionable qualifications. It was too late. The Post Office soon found that it was impossible to enforce the new regulations, or even take action against the large numbers of people using home constructed sets.

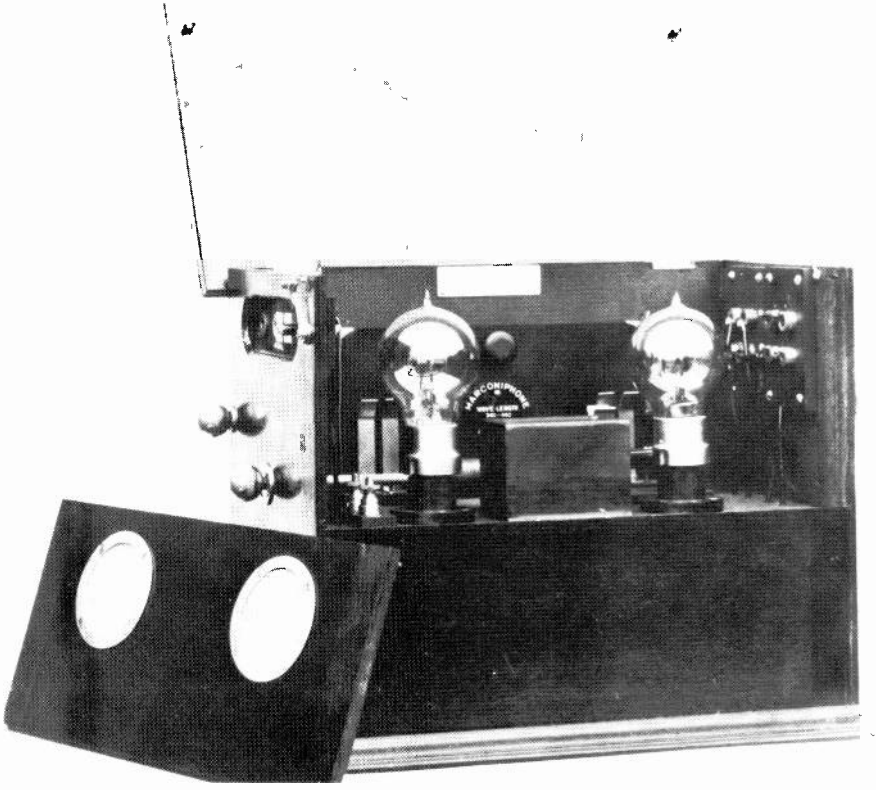
The BBC quite justly complained that the Post Office was not fulfilling its function concerning the control of licences, which inevitably led to a committee being appointed to sort the chaos out. It first met on 24th April 1923 under the Chairmanship of Major General Sir Frederick Sykes and over the next months it thoroughly investigated the whole question of broadcasting. In August 1923 the committee reported that the BBC's operating guidelines and restrictions should be completely modified. The BBC should be allowed to extend broadcasting hours and wavelengths in use, expand its news service, and should also be able to broadcast programmes provided by outside concerns.

At midnight on New Years eve, 31st December 1926 the British Broadcasting Company became the British Broadcasting Corporation under J.C.W Reith (soon Sir John, later Lord Reith) its first General Manager, now its first Director General. By this time the 'new' BBC could boast ten main transmitting stations, ten relay stations and over two million listeners. From an original staff of four the company had grown to 552 in number. Consequently on the last day of December 1926 the wireless manufacturing companies ceased to be directly responsible for broadcasting in this country.

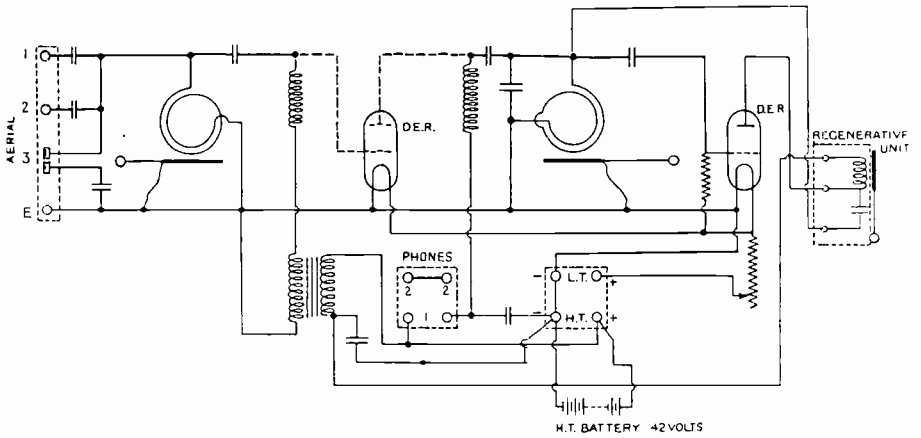
The new audience who had no technical interest in the science of radio now demanded receivers that could reproduce music and speech at least up to current gramophone standards. There was no existing natural market of retailers, and the first commercial response from the wireless companies was to sell off large stocks of surplus military components such as dials, knobs and coils. However it was not long before hardware shops sold crystals, batteries, valves, and lengths of wire, while bicycle shops and even bakers would recharge and refill wireless accumulators. Some of the large department stores like Gamages in London, a major chain of cycle shops, Currys, and the motor-bike manufacturer AJS, quickly set about organising complete 'sets' of components which enthusiasts could build up into their own wireless sets. The demand for better quality meant that the inconvenient ear-phones were soon discontinued and loudspeakers with gramophone-type horns soon became the standard, even though a crystal set could not drive one unaided. This, together with the increase in stations signalled the complete demise of the crystal set which could not separate two stations broadcasting on adjacent frequencies, their replacements being the far more selective early valve sets. The radio industry was by now well established and the valve industry grew to enormous proportions to meet the demand. Rapid technical improvements and lowered manufacturing costs signified the growth of

the radio age and the firms involved such as Marconi, Osram, Cossor, Mullard and Philips were to become household names.

On 29th December 1923 the Marconi Company had formed the Marconiphone Company to take over design, manufacture and retail of domestic receivers "For those who lacked the necessary skills to construct their own". Initially the new Marconiphone Company offered the manufacture of its wireless equipment to outside contractors, and the first major order for 5,500 Crystal sets and 5,000 V2 valve receivers was awarded to a small firm operating from two rooms in shared premises in Holloway. The contract was worth over 30,000 pounds and transformed the firm overnight. By March 1923 the Plessey Company had obtained their own factory site at Ilford and continued to make Marconiphone equipment until 1926. The facilities of the Marconiphone department at the Chelmsford works proved totally inadequate to control the huge demand, so mass production was started at the Sterling Telephone & Electric Company works in Dagenham, although research and development work continued at Chelmsford.



55. The Marconi V2 wireless set.



56. Marconi V2 Wireless – circuit diagram.

The wireless sets that Marconiphone offered were the Marconi Crystal Junior and Crystal A radio receivers, followed by the unsuccessful 'V1' radio set using a single valve as a detector and positive feedback from the anode to provide reaction or regeneration. The next set in this range was the 'V2', a two valve receiver (in its final form) which incorporated an H.F stage and detector in reflex circuit with reaction applied. The 'V2' was for a long time the most sensitive receiving set on the market, and the first to have automatic bias. The Marconiphone Company was eventually sold in 1929 to RCA later to be merged with the Gramophone Company and the Columbia Gramophone Company to form EMI of which Guglielmo Marconi became the first president.

On the 14th November 1923 the young Italian who once claimed that he could send messages over hundreds of miles, first spoke over a BBC microphone. Guglielmo Marconi, the father of radio, added his seal of approval to the huge success of broadcasting in Britain. His voice was heard over the length and breath of the country, without him ever having to shout once to cover the miles. At 10.00 pm Senatore Marchese Guglielmo Marconi GCVO LLD read a long and detailed history of radio, from the early days of telephony, through to 2MT Writtle and the birth of British broadcasting.

The BBC had come of age.

"It cannot be sufficiently emphasised that the pioneer adventure of 2MT at Writtle was born in laughter, nurtured in laughter and died in laughter."

"I want to believe that if only people would see their jobs and lives in terms of its excitement, then they would realise that a job well done deserves laughter, not the solemnity of a pompous administration on top of it."

"If we could see that the thing that we do is a good thing for heavens sake because it is creative, and it's fun, and it is exciting then I think that all these certificates and all these rules might be seen to be unnecessary, besides people who are essentially poets even though they be technicians."

Peter Eckersley.

GLOSSARY

1 **Wireless**: – The term wireless or 'wire-less' was in general use well before Marconi brought his system into widespread use. It was used to describe any sort of effect or phenomena involving what we now know as electromagnetism, including short range conductive and inductive experiments back to the work of Mahlon Loomis in 1866. After Hertz published his work the effects he described became widely known as 'Hertzian Waves' but were also called 'Maxwellian' waves and even 'Marconi' waves. Other words used were usually modifications of the terms 'telephony' or 'telegraphy' such as 'air telegraphy' or 'space telephony'. The word communication was also used and around 1900 the terms 'ether waves', 'air waves' and a new term 'radio' waves grew in popularity. Radio, based on the word radiation was first suggested as the 'correct' term at the Berlin International Wireless Telegraphy Conference in 1906 and was later informally agreed in London in 1912. However 'wire-less' still clung on and for many years the terms wireless and radio meant exactly the same thing, radio being used as the American version of the British wireless. Strictly speaking both terms are correct, but radio began to be taken as a more modern and technical version of the slightly old fashioned wireless. On 28th September 1923 the BBC officially accepted 'Radio' by publishing the Radio Times to list its programme schedules.

2 **Ether**: – (Also traditionally spelt 'æther') The 'science' of radio was long established before the means by which radio waves actually travelled through the atmosphere was fully understand. The answer did not come from radio engineers, but from Physicists attempting to unravel the secrets of the atom. Before quantum mechanics, it was thought that radio waves, like sound waves in air or even waves in water must travel in some medium, but nobody could ever find it. This all pervading, invisible fluid in which the whole material universe was supposed to float was termed the ether, and was used for many years to explain the transmission of wireless waves. We now know that it was never really there to find, but it was a useful idea at the time.

3 **CQ**: – CQ is a 'term' used by commercial, military and amateur radio operators alike as a general call over the radio to any station monitoring that frequency. Its direct derivation is unclear, but it certainly dates back to the early days of wire telegraphy. It can be taken to mean "calling all stations" or more popularly "seeking you".

4 **Telegraphy**: – The operation of telegraph apparatus, a system for sending messages (originally by morse code) through a wire, or by means of radio waves.

5 **Telephony**: – In the early days, the transmission of sound by radio was regarded simply as a new means of sending messages. Its original name, Wireless Telephony, indicates that the system was widely considered to be just a new kind of telephone. The term is now used for the science of communication by any device able to transmit intelligible speech over distances.

6 **MO Valve Company**: – Until 1919 the Marconi Company's thermeonic valve designs had been commercially manufactured for the company by the Ediswan Company. However in that year the Marconi Company and the General Electric Company pooled their resources and formed the Marconi-Osram Valve Company on the 20th October 1919. This was soon abbreviated to the M.O Valve Company on year later, with the valves being made at the Osram works at Hammersmith in London.

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Figures in italics refer to illustrations.

"I went round to my next door neighbours home
and I saw this round cone you know, on the wall.
And I went to my mother and I said . . . "

"Mother, Mrs Buckley's wall is singing !"