

RESEARCH DEPARTMENT

SECOND INTERIM REPORT ON WROTHAM FM AERIAL AND
SUTTON COLDFIELD TELEVISION AERIAL

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TELEVISION AERIAL

SUMMARY

This report summarises the progress made in the development of the FM aerial for Wrotham and the television aerial for Sutton Coldfield, since the last reports were written.

Research Department Report No. E.034, Serial No. 1948/19, described the work carried out on the Wrotham FM aerial up to July, 1948, and Research Department Report No. E.032, Serial No. 1947/36, the corresponding progress on the Sutton Coldfield television aerial up to May, 1948.

Since these reports were issued the mast contractor has been selected, and detailed design of the mast structure has commenced. In addition, a development programme, on which the final aerial design will be based, has been agreed with the aerial contractor. In the case of the Sutton Coldfield aerial this work is now well advanced, but in the case of the Wrotham aerial, little further progress has yet been made.

In both cases it has been found necessary to concentrate more BBC technical effort on these projects than was at first expected, and this has delayed other important work.

1. INTRODUCTION

The same type of mast is to be erected at both the Sutton Coldfield and Wrotham stations. It consists of a triangular support portion, a slotted cylinder above the support mast, comprising the FM aerial, and a cantilever top-mast carrying the television aerial.

At Sutton Coldfield the overall mast height will be 750'. It is not intended to provide the FM feeder system at this station in the first place.

At Wrotham the overall mast height will be 500', and although provision will be made for a top-mast to carry a television aerial, this will not be erected in the first place.

The aerials to be used for both the television and FM services have already been described in the following reports:-

E.034, Serial No. 1948/19 - "Interim Report on FM Aerial for Wrotham and Sutton Coldfield"

E.032, Serial No. 1947/36 - "Interim Report on Sutton Coldfield Television Aerial".

It is assumed that the reader is familiar with these two earlier reports.

The progress made since the issue of the above reports may conveniently be divided into work on the mast structure including the slot aerial, the feeder system for the FM aerial, and the television aerial including the top-mast. The work on the development of the main feeders for both the television and FM services will not be included, since this is entirely the responsibility of the aerial contractors, Marconi's Wireless Telegraph Company, Ltd.

2. THE MAST STRUCTURE, INCLUDING THE FM SLOTS

The specification of the mast structure, including the FM slots, was prepared by the BBC, after discussions between the Civil Engineer, Building Department, Planning and Installation Department, and Research Department. Marconi's Wireless Telegraph Company, Ltd., the sub-contractors for both of these aerials, had however agreed to the clauses relating to the FM aerial portion, basing their agreement on a knowledge of the experimental work initiated by the BBC Research Department.

The specification for the mast was issued for tender by the Civil Engineer in March, 1948, and Callenders Cables Ltd. were eventually selected as the mast contractors.

The mast will take the form of a stayed lattice steel support mast of triangular section, on top of which there will be a cylindrical portion approximately 100' long, and 6'6" diameter, which will include the FM slots. A cantilever top-mast will be erected at the top of the cylindrical portion at Sutton Coldfield. A similar provision will be made at Wrotham, but it is not intended to erect the top-mast in the first place. A number of discussions between Callenders Cables Ltd., Marconi's Wireless Telegraph Company, Ltd., and the BBC have been held since the mast contract was placed, to agree on details of the mast design, in so far as they affect the aerial performance. These details have so far been of a comparatively minor nature, and do not warrant mention in this report.

It is expected that mast erection work on site will be complete at Sutton Coldfield by May, 1949, and at Wrotham by April, 1949.

3. THE FM FEEDER SYSTEM

From the work described in Research Department Report No. E.034, it appeared that a practicable feeder system could be designed to fulfil the specified aerial performance. Nevertheless, at the time of writing this report, the mast contractor had not been selected, and the exact form of the final aerial structure was not then known.

When detailed proposals were eventually received from Callenders Cables Ltd., a meeting was held, attended by Marconi's and BBC engineers, to decide on the further programme of work. It was agreed that, since up to that time no experimental work had been carried out by the Marconi Company, the BBC Research Department proposal for feeding the slots should be adopted, and that the efforts of the Marconi Company should be concentrated on the engineering of this arrangement. It was also considered desirable to carry out further measurements on a single stack full-scale model of the Callender proposal, to ascertain how the differences between this arrangement and that previously tested by the BBC would affect the design of the feeder system. Means for controlling the slot impedance over a limited range were also required, in order to match the aerial to the feeder system.

Although it was agreed that it was most important to obtain this information, the Marconi Company felt that they were too heavily involved in the development of the television aerial to undertake any of this work before the full-scale model aerial was available. The only alternative, therefore, was for the BBC to continue measurements at Oxford, leaving Marconi's to concentrate on the mechanical design and construction of the feeder system. The BBC are now, therefore, constructing a full-scale model of the latest Callender proposal, and further tests will be made when this is completed.

Meanwhile, Marconi's Wireless Telegraph Company, Ltd. are planning the feeder system, based entirely on the information supplied in Research Department Report No. E.034.

It was originally intended to erect four stacks of the final Wrotham aerial at Chelmsford for test purposes. It is now considered preferable to erect four stacks of a lightweight full-scale model of the aerial, and to carry out all tests on this structure. This model will be similar in all respects to the final aerial, except in the thickness of the plate forming the cylindrical portion. Marconi's Wireless Telegraph Company, Ltd. have ordered this experimental aerial, and it is expected that it will be complete together with a feeder system and ready for tests by January 1st, 1949. It is hoped that by this time the results of the BBC single stack full-scale model will be available, including proposals for controlling the slot impedance; this should help considerably to reduce the testing period at Chelmsford.

It is worth while stressing at this stage that up to the present Marconi's have done no experimental work whatsoever in connection with the design of the aerial, and do not appear to have made a very close study of the technical considerations of the problem. It has not, for instance, been possible for them to send an engineer to Oxford to take part in the work on aerial measurements, or in the development of instruments necessary for such measurements. This has, however, been entirely due to their preoccupation with the development of the Sutton Coldfield television aerial described in Section 4. It follows that the BBC must provide both technical assistance and equipment for carrying out tests on the four stack aerial, and Marconi's have already indicated that they consider this to be very desirable. Both this job and the corresponding one on the television aerial are likely to continue for a considerable time. This means, unfortunately, that the progress on other important work will be seriously affected. If, however, both these aerials are to be ready in time there appears to be no alternative to this arrangement.

4. TELEVISION AERIAL

Research Department Report No. E.032 outlines the experimental investigation which resulted in the decision to commence a joint development programme with Marconi's Wireless Telegraph Company, Ltd. based on a BBC design. Marconi's Wireless Telegraph Company, Ltd. had also done some experimental work, but this was by no means so far advanced as that of the BBC. It was eventually agreed that, if the aerial was to be ready in time, the BBC proposal should be adopted. At this time certain modifications to the aerial proposed by Marconi's Wireless Telegraph Company, Ltd., with a view to improving the mechanical design, were adopted. In addition, it was decided to incorporate the

Marconi proposals for the balanced/unbalanced transformers and the diplexer for combining the sound and vision signals. It was also agreed that the most useful division of effort would be for the BBC to concentrate on a second small-scale model, embodying all the agreed modifications, and for the Marconi Company to devote their attention to engineering the full-scale model, based on the BBC results. Testing of the full-scale model was agreed to be a joint responsibility.

This programme has been followed with excellent results. The BBC model work has always been ahead of the full-scale aerial, and was particularly valuable in determining the dimensions of the dipole elements of which the array is built. The policy of making small-scale models has been amply justified and has already resulted in a saving of time and money out of all proportion to the effort put into the work. This is all the more gratifying since this type of work was relatively new to the BBC, and a considerable amount of time had to be spent in obtaining and making equipment suitable for these high frequencies, and in becoming familiar with measuring techniques.

On their own part, Marconi's Wireless Telegraph Company, Ltd. have made good progress with the complicated problems relating to the mechanical construction of the aerial. Progress has been limited throughout by delays in completing the mechanical construction rather than due to unforeseen technical difficulties.

Co-operation in carrying out tests on the full-scale model has been extremely good. The BBC have provided a senior engineer full-time whenever testing work was in progress; in addition, an impedance bridge belonging to the BBC Research Department has been carefully tested over the relevant frequency range and lent to the Marconi Company for the duration of the tests.

The present position is that the BBC small-scale model aerial including the top-mast, dipole elements, feeder system, split drums and diplexer, has been completed. Performance tests have been made during all stages of assembling the aerial and have been satisfactory. Final tests of impedance, polar diagrams, and power gain of the complete structure are at present being carried out.

On the full-scale aerial a single pair of dipoles was first tested at Chelmsford, modified in the light of the corresponding measurements on the small-scale model, and eventually agreed to be satisfactory. A full-scale complete aerial system has now been partially completed, mounted on a lightweight rotating top-mast. Measurements on the impedance of the dipoles have been completed, and work on the

distribution feeder system is proceeding.

5. CONCLUSIONS

Progress on both the Wrotham FM aerial and the Sutton Goldfield television aerial is satisfactory. Unless unforeseen difficulties occur, both aerials will be ready by the scheduled dates.

It has been found necessary to concentrate more BBC technical effort on both these projects than was at first expected, and this has naturally meant that other important work has been left in abeyance.

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