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Reuterian European Service by the Hell System
A Report on Short Wave Reception Tests carried out in Budapest, Prague, Belgrade and Bucharest

Office of the Engineer-in-Chief
(Radio Branch),
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RADIO REPORT NO. 493

NEUTERIAN EUROPEAN SERVICE BY THE HELL SYSTEM

(A REPORT ON SHORT WAVE RECEPTION TESTS CARRIED OUT IN BUDAPEST, PRAGUE, BELGRADE AND BUCHAREST)

Case No. 2142

Carried out by A. Cook and J.D. Parker,
June 15th to July 1st 1938.

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26th August, 1939.

Office of the Engineer-in-Chief,
(Radio Branch),
G.P.O.,

Rota 2927 W./39.
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REFUGERIAN EUROPEAN SERVICE BY THE HELL SYSTEM

(A Report on Short Wave Reception Tests carried out in Budapest, Prague, Belgrade and Bucharest).

June 15th to July 1st 1938.

SUMMARY

Tests were made in Budapest, Prague, Belgrade and Bucharest of the reception of telegraph emissions on short waves by the Hell Schreiber system, a crystal controlled superheterodyne receiver was used for reception. Tests proved satisfactory and recommendations for wavelengths to be used were made. A regular service is now in operation.

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INTRODUCTION

Experimental transmissions using the Hell printing system have hitherto been emitted by the Leafield long wave transmitter No. LW1 using the call sign GIX 43.2 kc/s (6950 metres) the transmitter normally employed on the Reuter Morse service. The object of the tests described in this report was to study the possibility of using short waves for the provision of a Hell service to the more distant centres and to investigate the suitability of a special receiver for such a service. Leafield short wave transmitter No.4 was used for the tests, the call signs and frequencies employed during the tests were GIN 10,960 kc/s (27.57 metres) and GIJ 6,985 kc/s (42.95 metres) and a test transmission schedule was arranged to give alternate half-daily transmissions using 10,960 kc/s and 6,985 kc/s. Tests were made at Budapest, Prague, Belgrade, and Bucharest which were visited with Mr. Davies of the Telecommunications Department (WTS).

2. RECEIVER

A short-wave receiver developed specially for the tests, together with a dipole aerial, complete with 80 ft. of screened downlead, was taken to each centre in turn. The receiver was a modified version of the E.M.I. service RR 12 receiver, which in turn was a modified standard Marconi broadcasting receiver chassis. The main alterations consisted of:

(a) The elimination of tuning controls by the provision of crystal control of the normally tunable oscillator circuit.

(b) The provision of a heterodyne oscillator.

(c) Re-arrangement of the intermediate frequency amplifier to give a narrower band width.

(d) Re-arrangement of output circuits to give higher gain and larger output in alternative impedances of 600 and 3000 ohms.

(e) The addition of more elaborate automatic gain control. This is necessary, due to the inherently poor signal handling capacity of the Hell printer.

(f) The provision of input arrangements to match the special transmission lines provided from the dipole aerial.

Such a receiver could be easily and quickly produced in quantity at an estimated price of some £50 to £60 and should be capable of long-period, unattended operation. The only precision adjustment of tuning is that required in the initial production of the controlling crystal, and the technique for doing this cheaply and quickly has already been developed for transmitter work. The circuit diagram of the receiver is given in

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3. RECEPTION IN BUDAPEST (HAGYAR TAVIRATI IRODA)

3.1. Location of Receiver

The agency is situated in the heart of the city about 250 yards from two electric tramway systems and about 100 yards from the Electro-therapeutic Hospital. The building is five storeys high, the wireless receiving-apparatus being installed on the fourth floor. Part of the building has been adapted for a broadcasting studio. The aerial system, consisting of about 30 aerials in all, is well above the roof: some aerials are hung across a quadrangle, others radiate to points on neighbouring high buildings. The aerials were found to be of good quality, indeed much better than had been expected, screened down-leads being provided where necessary and suitable matching transformers being provided at aerial and receiver ends of the screened cables. These transformers usually consisted of small, litz-wound, iron dust-cored assemblies. In addition, small wave-traps of similar design to the transformers, were provided for the elimination of powerful local signals.

A small room is allocated to each of the four Hell services - DNB, Reuter, Stefani and Havas - and the apparatus is normally left unattended. The agency had abandoned Reuter's Atlas service on Hell owing to the poor results obtained. They are still taking the Empire service, however, the signals being intercepted at the P.O. Receiving Station at Tarnok and relayed to the agency. The rooms for the Morse operators are located in a wing of the building different from that in which the Hell apparatus is located.

The Agency, which is State-subsidised, is more concerned with Reuter's Commercial Service, and as this is sent largely in 5-figure code, anything short of 100 per cent reception is regarded as unsatisfactory.

An engineer - ex Siemens (Berlin) - is permanently employed for maintaining the Hell apparatus.

The test equipment was installed in one of the small Hell reception rooms and the aerial erected 20 feet clear of the roof, 70 feet from the ground.

3.2. Test Programme

Tests were carried out according to schedule as follows:

18th June Leafield transmitter GIJ 0800 - 1100 GMT

" " GIN 1330 - 2230 GMT

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19th/
19th June Leafield transmitter GIN 0800 - 1100 GMT

20th June GIN 0800 - 1100 GMT

At first it was necessary due to lack of spare equipment at the agency to use a remote amplifier for operating the printer mechanism, but this arrangement was soon abandoned as causing unnecessary complication and difficulty of control and arrangements were made to remove the amplifier to a position near the receiver.

3.3 Results of Tests

GIN was unusable during the day, signals being very weak but improving towards night. The results were marred by local noise and interference from Morse and telephone stations (amateurs).

GIN was well-received during the day. The signals faded out by 8 p.m. on the first day, but on the second and subsequent days satisfactory results were obtained until the close of the tests at 11 p.m.

Conditions of the R.O. Receiver and the local Hell Amplifier were varied during the tests and under certain conditions double printing was occasionally in evidence, particularly with GIN, when full amplification, both on Receiver and Hell Amplifier, was necessary.

Normally letter code would have to be sent twice and figure code spelled and possibly sent twice as well.

The receiver functioned in a satisfactory manner, the frequency being well held by the crystal.

4. RECEPTION IN PRAGUE (CESKOLICENSKA TISKOVA)

4.1 Location of Receiver

As in the case of Budapest, the Agency is situated in the heart of the City, being about 150 yards from the main thoroughfare and being more or less surrounded by bus and tram routes. The building is a modern one of seven storeys, wireless equipment occupying the top floor. The four main Hell services are intercepted in addition to CIT and certain GBR Morse services, the apparatus for the Hell services being segregated in one large room and that for the Morse service in another. There is no provision for remote reception as at Budapest. There is also an outgoing Hell service (7-line) for reception in Belgrade, Ankara and Warsaw. Twelve well-elevated and well-constructed aerials, not provided with screened down-leads, are available for the various services (Hell and Morse). All equipment is maintained at a high standard of efficiency, a mechanic of wide
experience being employed for the purpose.

This Agency, too, is subsidised by the State.

The special receiver was installed in an attic room in one wing of the building. The aerial was slung between masts at a height of only some 7 ft. from the roof and under existing aerials. This position could be considerably improved upon for a permanent aerial.

4.2 Tests

Interception tests were made as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>22nd June</td>
<td>1330</td>
<td>GIN</td>
</tr>
<tr>
<td>23rd June</td>
<td>0800</td>
<td>GIJ</td>
</tr>
<tr>
<td></td>
<td>1330</td>
<td>GIJ</td>
</tr>
<tr>
<td>24th June</td>
<td>0800</td>
<td>GIJ</td>
</tr>
<tr>
<td></td>
<td>1330</td>
<td>GIW</td>
</tr>
</tbody>
</table>

4.3 Results

As was the case at Budapest, the GIJ signals were very poor and did not appear at all until about 5 p.m. When they eventually became stronger their strength was still so poor that interference marred the results. In addition, double printing was quite often obtained. It is thought that this was due to the necessity of using the beat oscillator and almost maximum amplification on the very weak signal.

GIN signals gave very encouraging results, which greatly impressed the staff at the Kancela. As soon as the Receiver was switched on and warmed up on the first test period after erecting the apparatus, good slip was obtained, fades being infrequent and rarely causing obliteration. As some signs of double printing were observed, attempts were made to locate the cause of the trouble by varying the levels and by observing the effect of the beat oscillator, but no conclusive result could be obtained since on strong signals almost any adjustment gives good results. The double printing on weak signals seems due in part to the beats between the modulation and the resulting beat note when using the beat oscillator, and in part to distortion in the Bell amplifier when used in a condition of maximum amplification.

At Prague, although the equipment was working in a very bad place from the radio viewpoint, with interference of all kinds in the immediate vicinity, the results from GIN proved very good during the whole of the period over which a news service would require to operate. GIJ, which should have been good in the evening period, proved almost unusable.

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5. RECEPTION IN BELGRADE (AGENCE AVALA)

5.1 Location of Receiver

The Agency is situated in a busy part of the town in a street lying between two tramway routes. It is a five-storey building, equipped with lifts, and is of very modern construction. The Radio Room occupies the whole of the top floor of the building and houses a very comprehensive set of equipment.

Provision is made for the reception of Havas, of D.N.B., and Stefani, by Hell methods, the whole of the equipment being mounted on a large wooden rack at one end of the room. The reception from all these centres is of only medium quality, due to the combined effects of distance, atmospherics and interference, so that the possible advent of short-waves was regarded very favourably. In addition to the Hell receiving equipment, provision is made for long-wave reception (aural) and short-wave reception.

The Radio Room also houses two transmitters, one working on approximately 70 - 100 metres with a power of some 500 watts for transmission to centres in Belgrade. The second transmitter was provided for direct, short-wave working to America, but its low power (only some 500 watts) precludes its use for a regular service. Both transmitters are of local design and construction, based on American amateur practice and embodying many American components. Creed automatic senders are used to key outgoing transmissions.

The aerials are of the simple Marconi type, the feeders running out at the end of the room, remote from the Receiving Equipment.

A further facility provided at this Agency, is a remote receiving station for the reception of Morse messages, chiefly from Reuter's. This station is connected by a private wire to the Receiving room and, in addition, a Creed Teleprinter link is provided. Reception in the Radio room is thus very difficult, due to interference of almost all kinds. In addition, thunderstorms are very frequent over Belgrade, and these make long-wave unworkable. During one such storm, a successful reception of GIN, unaffected by the disturbances, greatly impressed the staff.

The equipment is very well maintained by the operating staff, the Chief Operator being responsible for the whole apparatus. The staff are very keen on hearing from Reuters of the short-wave Hell test; they immediately installed a short-wave receiver, a National 80X, and carried out tests on their own initiative. They had obtained very good results on GIN, and when we arrived, the Chief Operator greeted us with the remark/
remark "How soon can we have GIN permanently?"

The special receiver when it arrived was installed in this room and was thus subject to all the interference from the teleprinters and transmitters, as the other receiver.

The Agency is subsidised by the State and appeared to be run in close collaboration with the Post Office, who provided much of the equipment in use.

5.2 Tests

Owing to transport and Customs delay, the equipment arrived from Prague two days late. It was possible, however, to carry out tests according to schedule, the Agency's own short-wave receiver being used. This receiver was of American manufacture - a National 80X Receiver.

On the arrival of the Post Office apparatus on the third day, tests were carried out on both Receivers for comparative purposes. The National receiver proved to be capable of a very good performance, but since tuning adjustments had to be effected, some degree of skill in short-wave operation was necessary. All the controls, however, handled as well as is possible in such a receiver and no difficulty was found in obtaining good results. Due to the presence of two transmitters working in the same room, it was found impossible to use the National receiver with an aerial of any size, the best results being obtained with only some 6 ft. of wire hung vertically above the receiver. The sensitivity of the receiver and the strength of the GIN signal were adequate, however, to provide a good signal/noise ratio, even with this poor collector.

Compared with the National receiver, the E.M.I. receiver taken for these tests showed up remarkably well. Notwithstanding the fewer number of valves, the sensitivity was not greatly inferior. In addition, the receiver proved somewhat less susceptible than the National receiver to interference from the local transmitters, and it was possible to work the receiver with the dipole aerial taken for the tests, an arrangement which did not give satisfactory results with the National 80X. This may be due to the fact that the E.M.I. receiver employs a radio-frequency pentode-type high-frequency amplifying valve in its first stage, whereas the first stage of the National 80X consists of a frequency-changer valve. Thus, when the sensitivity-control of the National receiver and E.M.I. receivers are both reduced to compensate for the increased signal strength obtained with the dipole, the susceptibility to cross-modulation is reduced.
reduced more in the case of the E.M.I. receiver than in the case of the H.R.O. receiver, due to the inherently better signal-handling capacity of the high frequency pentode type of valve compared with the frequency changer type of valve, when operated with large values of grid bias.

5.3 Results

As GIG was again found to be very poor, arrangements were made for the use of this frequency to be abandoned and the tests continued on GIN only.

GIN gave excellent results on the National Receiver and even when the local short-wave transmitters were keyed and the perforator and Teleprinter operated all simultaneously, results were very good. The aerial employed in conjunction with the receiver was only 6 ft. in length, since with the longer aerial the interference from the transmitter was more marked. GIN was strong throughout the day, although there was a detectable reduction of strength in the middle of the day. It was interesting to find that the Morse transmission on GIN were better received at the Agency direct than the GIX Morse signals after being relayed from the remote station.

The Post Office receiver also gave excellent results. It was more stable than the National receiver and was less interfered with when the transmitters and local gear were being operated. The National receiver needed continuous monitoring to ensure continuity of good slip.

A very interesting test was made possible by the advent of a severe thunderstorm over Belgrade. The marking of the long-wave slip, due to the lightning flashes and atmospheric discharges was very severe, causing the long-wave GIX Reuters's transmission to be almost illegible. On the short-wave GIN reception, however, practically no abnormal increase of atmospherics was noticed, an achievement which greatly impressed the local staff.

6. TESTS AT BUCHAREST (AGENDE RADOR)

Conditions at Bucharest were practically identical to those at Belgrade as regards location of aerials, etc. D.N.B. and Havas were received by the Hell system but Reuters only by morse. The receivers were designed and built locally by the Agency's own engineer and appeared to be of good design and construction. D.N.B. was well received but the Havas-service was very poor. As the receiving apparatus was delayed on the journey from Belgrade, owing to Customs difficulties, it was not possible to make the tests before departure. It was arranged, however, that the Agency's engineer would carry out tests as soon as the apparatus was available. He was advised on the technical details of the equipment, its mode/
mode of erection and operation being fully described. Arrangements were made for test transmissions when he had made the equipment ready. This notification was received on 24th July and emissions made on 25th and 26th July from GIN. These tests were also observed by Ankora. The results which have so far been received have proved very satisfactory.

7. CONCLUSIONS

GIN appears to be capable of giving satisfactory results during summer months throughout most of the day, though from the fact that during one day of the tests the signal-to-noise ratio fell off badly towards the finish, it would appear that somewhat higher power is still necessary. 90 - 95% of the words were received quite clearly and in the case of messages which were not coded it was not necessary to call for repetitions.

For reception of coded material such as is used for weather reports and stock exchange prices, it might be necessary to repeat words in order to avoid ambiguity or misinterpretation.

GIN appeared to be unsatisfactory for Hell working during all the periods likely to be required for news service working. During the day, as is to be expected, it does not provide a sufficiently large signal, and by evening, when the signal is becoming stronger, interference from amateurs degrades the signal-noise ratio to such an extent as to render the results poor.

The experimental receiver, which was taken for the tests, has proved itself to be a satisfactory basis for future development. Improvements might be possible in the directions of increased stability of the beat oscillator and as regards sensitivity. It is not felt, however, that very much improvement in the latter is to be expected in the lower price ranges. The crystal control of the beat oscillator was quite effective, adjustments being held satisfactorily. When the 7-line system is standardised, certain further modifications may be necessary in order to provide facilities for the direct current recording which is employed with the latest 7-line printer. Development along these lines will be proceeded with as soon as the equipment is available.

The quality and the maintenance of apparatus and aerials at all the centres visited was of a high standard, being in fact far better than had been anticipated. In most of the Agencies, qualified men were provided to either maintain or work the Hell apparatus.

There was a keen desire on the part of the Agencies to receive Reuter which, up to now, has been practically impossible in summer, and
hope was expressed at each centre that short waves would be introduced, even on an experimental basis, as soon as possible.

During the Belgrade tests, it was also apparent that the most convenient conditions of working were those in which the modulation of the transmitter was relied on to give the necessary audio-frequency output for the operation of the printer. Under these conditions, it was not necessary to use the beat oscillator provided on the receiver, and the E.M.I. receiver thus needed no tuning adjustment of any kind.

When the signal received is very weak, as was occasionally the case at Budapest, and as quite conceivably might be the case at Belgrade, the increased sensitivity of the receiver using the beat oscillator was so much greater as to offset the additional complication involved in tuning the beat oscillator to give 900 cycles audio-frequency output for the operation of the printer. In such cases the provision of a finer control and greater stability of operation of this oscillator will affect a noticeable improvement.

In the case of the 7-line new system which Siemens intend to standardise for Hell services, the printing operation is affected by direct current instead of 900 cycles alternating current, and this provides, on the one hand, the advantage that it is not necessary to have exactly 900 cycles audio-frequency output, and on the other hand the possible disadvantage that the loss of discrimination of the printing magnet may cause spurious printing of a greater number of atmospherics than is the case with the present system.

In general, however, it can be said that the introduction of the new system should ease the difficulty attendant on exact tuning of the beat oscillator, should it be decided that sensitivity requirements necessitate its use.