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Foundation: Centre for German Communication and related Technology 1920-1945

*Pater Pirestraat 29
1111 KR Diemen
Tel. 0031 20 6996262, 6002205
Fax 0031 20 6991848
The Netherlands
E-mail: stgcdv&t@xs4all.nl*

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***Some aspects of the German military “Abwehr” wireless service,
during the course of World War Two***

Synopsis

Clandestine Radio, the subject chosen for the 2003 Autumn DEHS symposium at Bournemouth University, is a study of a facet of history which I feel can hardly be considered high technology in respect to the objectives of defence electronics. However, I would not deny that its implications were sometimes significant.

This particular area of radio history has not been of special interest to me but, nonetheless, I have realised that time is passing and surviving Germans involved in this field are now in their eighties and should be approached quickly for any useful memories.

Fortunately, I have managed to renew contact with Rudolf Staritz (born in 1921) who, as a young serviceman in 1940, was posted to the design department of the German military intelligence in Berlin-Stahnsdorf. This was a branch of the much wider military security organisation known as the Abwehr which was under command of the illustrious Admiral Canaris.

Considering that one of the objectives of our Foundation is to bridge both technical and historical gaps between the German and Anglo-Saxon speaking communities, I would like to offer this brief paper detailing some of the aspects of German clandestine radio.

Arthur O. Bauer

Introduction

The Abwehr branch in which Rudolf Staritz became involved was officially designated as "Der geheime Funkmeldedienst des OKW-Amt Ausland" (secret military wireless services for operations abroad). The use of the designation OKW implies that it was officially responsible for all three military organisations i.e. Army, Navy and Air Force.

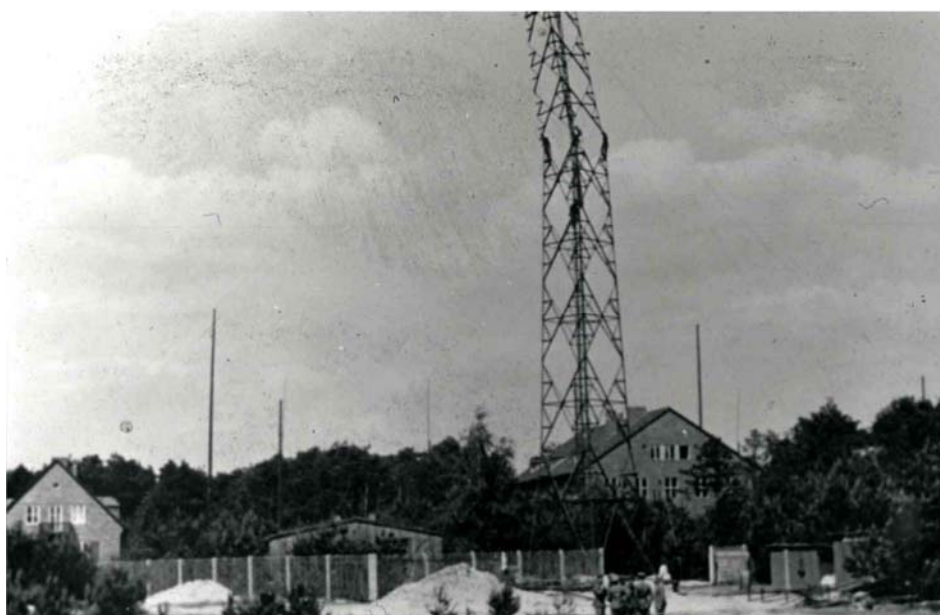


Figure 1
This photo was taken during the erection of an antenna mast. The buildings at this compound housed the so-called Funkzentrale (wireless-service bureau). It was used since 1936 for wireless directed secret-operations and it incorporated the receiver, as well

as the transmitter section. It is evident that this was not an optimal solution regarding the prevention of signal interference in addition to which, after the war had started, there was the increasing danger of the bureau being easily attacked by the Royal Air Force, due to its location in the vicinity of Berlin.



Figure 2
The new location at Belzig (west of Berlin). This latter and the previous location, both covered wireless operations in the European theatres. The radio receiver section was located in these buildings and transmitters were now allocated to another site. However, the

radio operators at the receiving site still had control over the transmitters and could answer a message instantly, as the morse-key was still installed at their desks.



Figure 3
In the background we see some of the antenna masts. This photo could only have been taken with official permission as it was taken at the “Day of the Army” (Tag der Wehrmacht). Locals were invited to visit the army institutions on special days to get an impression of what was

generally going on! Nevertheless, they got no access to restricted areas. However, they could enjoy free beer and sausages, without spending their food coupons!



Figure 4
This luxury villa in Wohldorf, north of Hamburg, accommodated the “Übersee-Funkzentrale” or wireless services for overseas operations. This organisation was responsible for the signal traffic with South and North America, the Middle East and, the Far East. They

were also involved in directing the wireless operations in the preparatory phase to the invasion of Russia (known as operation “Barbarossa”, which started on 22 June 1941) and, some time thereafter, in theatre “Don” (the Don is the major river in the Ukraine). The services for South America were called “Bolivar-Netz” which involved, according to Staritz, eight wireless stations and about forty secret-agents. The Middle East services were centred on Teheran. The Far East was mainly concerned with the operation centre “Funkstelle der KO” (=Kriegsorganisation) in, or around, Shanghai. Wireless operators (or “Funk-Offiziere”) for this area were mostly recruited from stuck German merchant ships. These ships sheltered,

for the rest of the war, in Japanese controlled ports as at that time, Japan ruled most of the eastern provinces of China (U-boats tended to prefer Penang).



Figure 5

Shown here is a section of the so-called "Overseas receiver room" at Wohldorf. They employed, for example, the Körting receiver type KST, which was a copy based on the HRO receiver design but with typical German ceramic insulators and Telefunken metal

valves of the 11-series (which were in Germany known as "Stahlröhre" or "steel valves"). Nonetheless, genuine HRO parts in the form of the tuning capacitor and tuning dial were obtained via Portuguese channels and used on the KST.



Figure 6

Shown here is the Siemens receiver type R IV, which differed from the HRO and KST in that the interchangeable coil-boxes were mounted on top of the receiver. However, it still employed the genuine HRO tuning gear (obtained via Portugal).

According to Staritz, they also utilized the Hammerlund Super Pro and the Hallicrafter type Skyriders receivers, presumably obtained through Portuguese sources as well.



Figure 7
Adjacent to the windows, we see two Lorenz transmitters type Lo 150 FK 38. The designation FK stands for “Fern-Kurz” (short-long). The German Navy distinguished between short waves (in respect to communication distance), with an upper frequency at

about 7 MHz and long-distance (=Fern) wireless traffic, implying the use of frequencies up to about 25 MHz. Navy wireless communication equipment often carried as its first symbol(s) the designated design company for example, Lo stands for **L**orenz and **T**elefunken was, for example, designated with the character T xxx. The number 150 gives the antenna output power and the suffix 38 symbolizes the year of its introduction into military service.

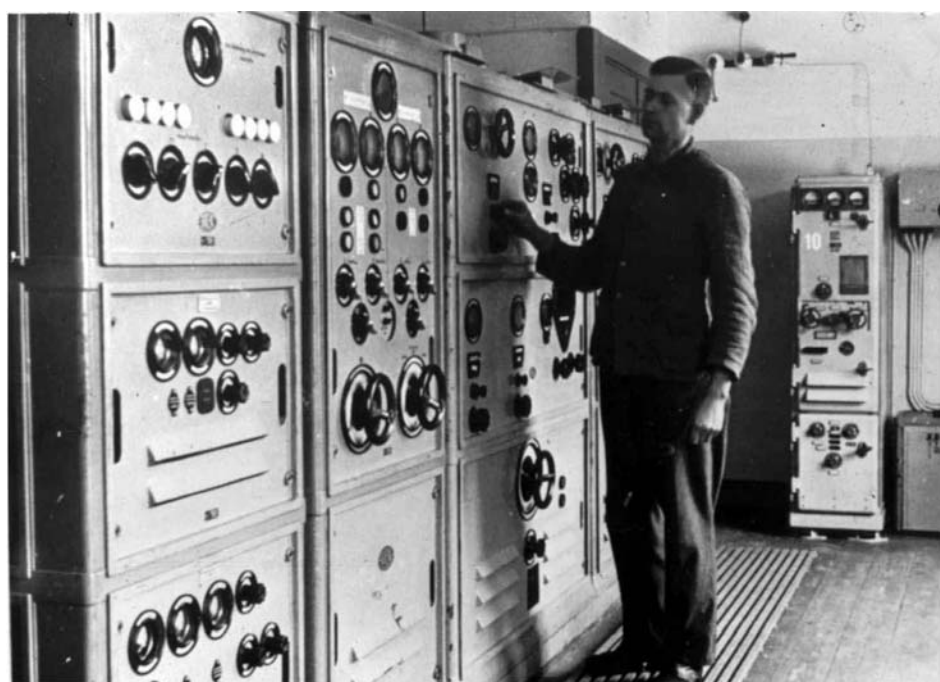


Figure 8
Shown here is the left-hand section of the previous room (see Fig. 7). The transmitters were obtained from the former wireless room station of the battle cruiser Scharnhorst, whose original equipment was installed about 1932!

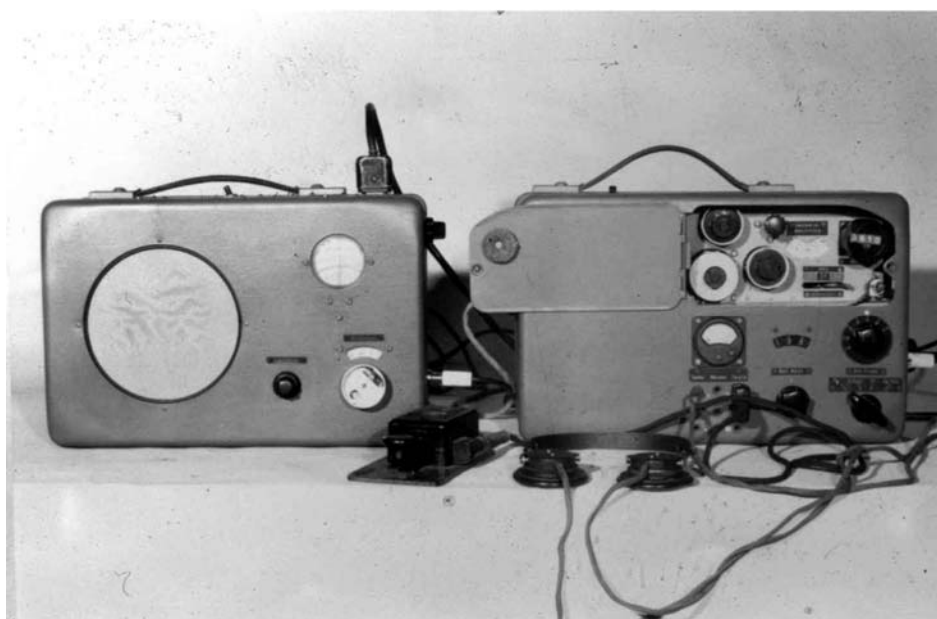


Figure 9
The left-hand set is the Radione receiver type R 3 and to the right the transmitter type RS 20M. These sets were designed to work in conjunction with each other, but could also be operated separately. The receiver and transmitter could be operated either

from the mains or from a car battery (types were made for operations at: 6, 12 or 24 V). The super heterodyne receiver (with BFO) was equipped with Telefunken metal valves of the 11 series. The transmitter gave 20 watt antenna power up to about 14 MHz. In contrast to the receiver R 3, the RS 20M was frequency controlled by means of quartz crystals. The circuit incorporated two LV 1 valves and an LS 50 power valve). Each set was equipped with a box of crystals for the required frequency bands. All accessories could be stored inside the transport boxes. The Abwehr station designation was called “Kleinabwehrstelle für Abwehrkommandos (beweglich)”. Which may be translated as, small portable station for intelligence operations. The generally employed frequency band for European operations was between 3 – 6.5 MHz (whereas the British used up to 9 MHz).

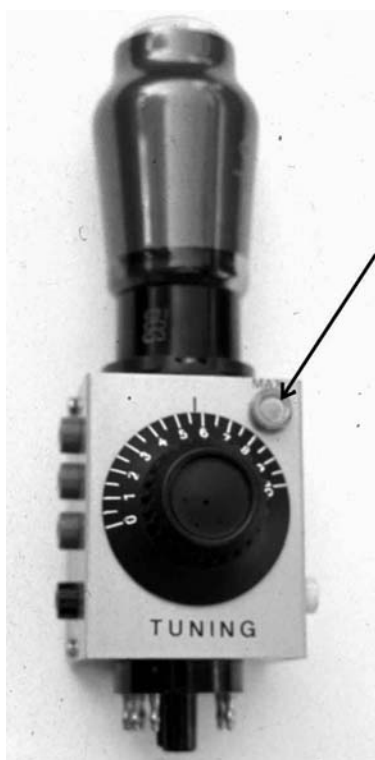


Figure 10

These kinds of adapters were designed to be used in conjunction with a regular broadcast receiver, whereby the power amplifier valve was pulled out and refitted on top of the transmitter module. All kinds of valve base sockets were available, depending upon the circumstances. During transmitting, the broadcast receiver had to be switched for pick-up operations. This replica is equipped for an EL 11 valve. Notice the small white indicator lamp for the antenna current. It is evident that these kinds of simple transmitters had to rely upon quartz crystal control. These types of devices were mainly used before the invasion of France (May-June 1940), though also for operations in the territory of the French “Vichy Government”, prior to the German occupation in 1942.

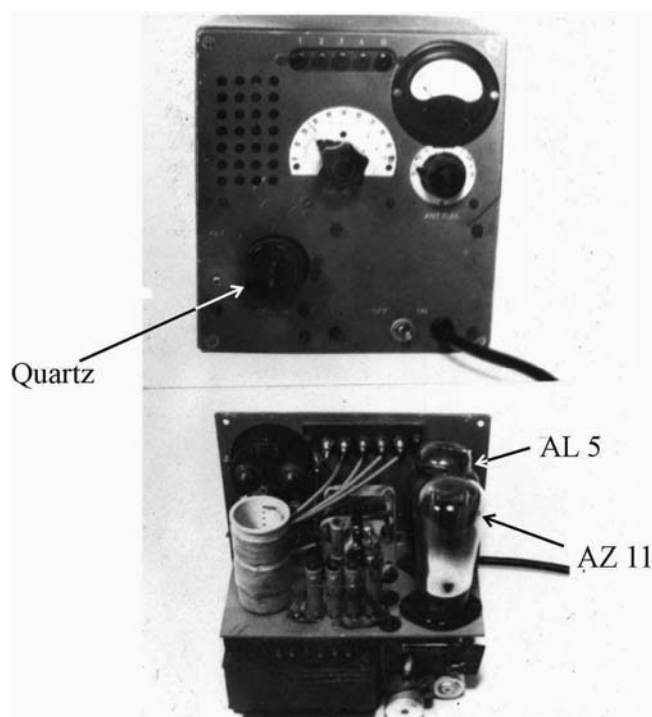


Figure 11

Shown here is the transmitter set S 85/14: "S" stands for transmitter (Sender), 85 is the design and/or drawing number; the figure 14 refers to the antenna output power. Most of these kinds of modules were an integral part of a suitcase station (see later). The British sometimes utilized these types of suitcase stations too, such as John Brown's famous B2 set. Carrying such a case during wartime was highly risky and, most likely to be lethal! During wartime, the German DF services of the ORPO issued an instruction manual which explained as to how spy-agents had to be trapped by the DF operators in the "near-field" of HF signals (especially causing problems in urban areas). In this respect we also have to think of the Russian, the Polish and, of course, the

well known British spy sets. About twenty years ago Cor Moerman, who worked at that time for the Dutch special DF services to counter "clandestine radio" operations (RCD), told me that they still approached these kinds of near field signals as was explained and illustrated in this German wartime manual!

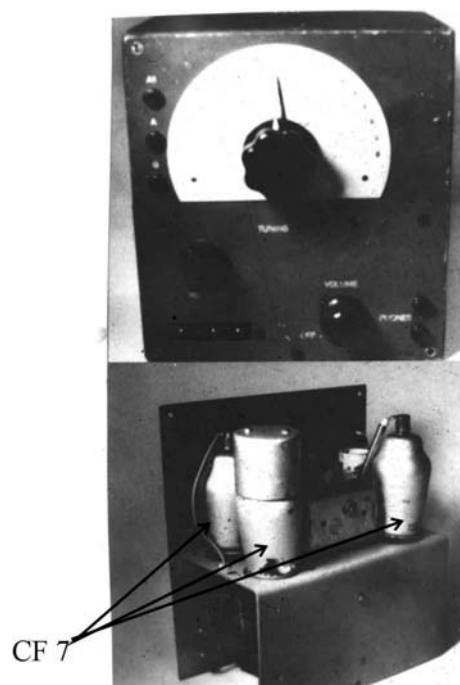


Figure 12

This apparatus is the receiver module E 85 (E = Empfänger = receiver), which belongs to the previous station (figure 11). It relied on a so-called 1 V 1 design. The prefix 1 tells us, that its circuitry utilized a pre-amplifier (nowadays we would say at the "front-end"); V is the detector stage which created considerable selectivity and amplification parameters, which were encompassed due to the "negative resistance" loading of the detector tuned circuitry. This phenomenon occurs when the feedback control has been adjusted properly, just near or shortly after the starting point of oscillation. The last number signifies that the receiver employed an audio amplifier stage too. These straight-forward receiver circuits are perhaps better known as TRF (tuned radio frequency). This set used three valves of type CF 7. The Germans sometimes used on their "spy-sets" inadequate expressions for various controls on the front panel; such as Reg.-Control (feedback control, the

German word would have been Rückkopplung), or Mains, where the word power would have been more appropriate (in respect to the area of operations in a foreign country).

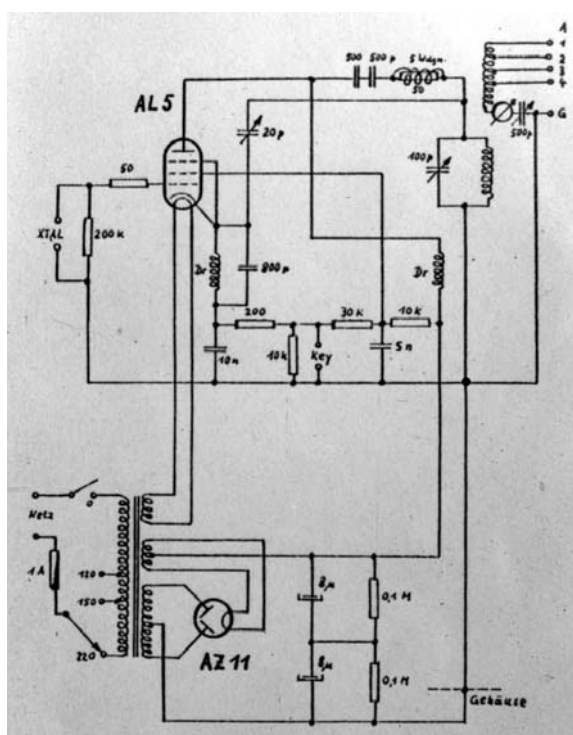


Figure 13

This schematic diagram is of transmitter type S 85/14 (see figure 11). Its design simplicity is apparent. It is evident that the frequency had to be determined by a suitable quartz crystal.

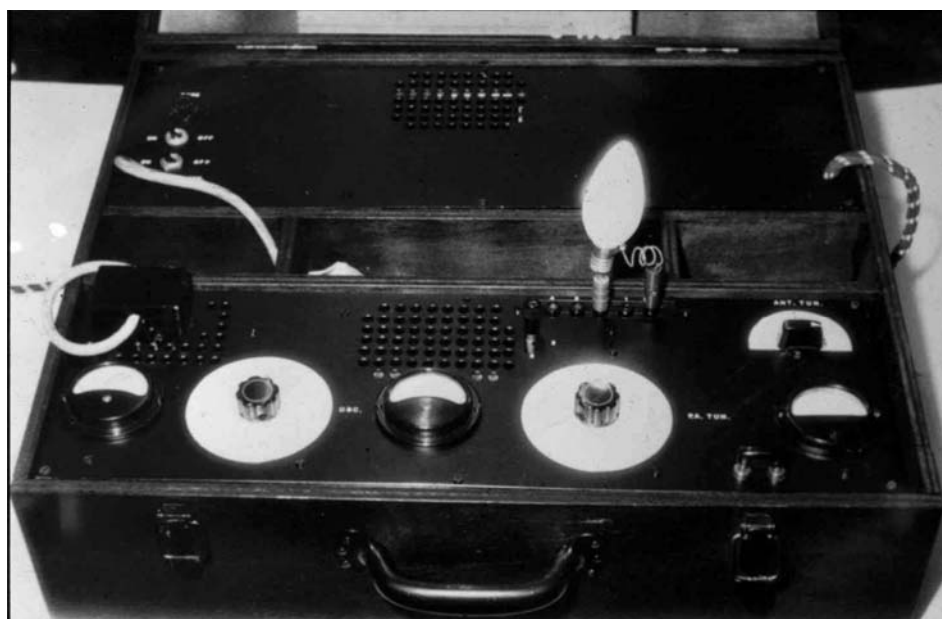


Figure 14

The “suitcase” station type S 89/80, is a very rare artefact. It was found in a lake in southern Germany in the late 1980s, where it was covered in mud. Enthusiasts carefully restored it in the early 1990s. Its relatively high antenna output

power of 80 watts indicates that it could be utilized for long distance communications. According to Staritz, these kinds of sets were used for communication with South-America and, presumably, also for South-Africa operations too. For this type of operation the set covered a wider frequency range of up to about 18 MHz.



Figure 15
This portable suitcase station type SE 90/40 was fairly commonly in use by the Abwehr services on the European continent. The prefix SE means transmitter/receiver, drawing design-designation number 90, supplying 40 watts into the antenna. The left module contains the receiver and

the right-hand module the transmitter. The unit above is the power supply. It was designed about 1940/1941.



Figure 16
Until now, we have generally considered mains powered systems but, it is clear that battery powered stations were also operated. The type SE 92/3 (3 watt) was used in Western Europe as well as in Russia. For the latter theatre it was packed in a canvas cover. The

original "Petrix" (brand-name) batteries allowed operation for about one year (based on a maximum usage of 15 minutes per day)!

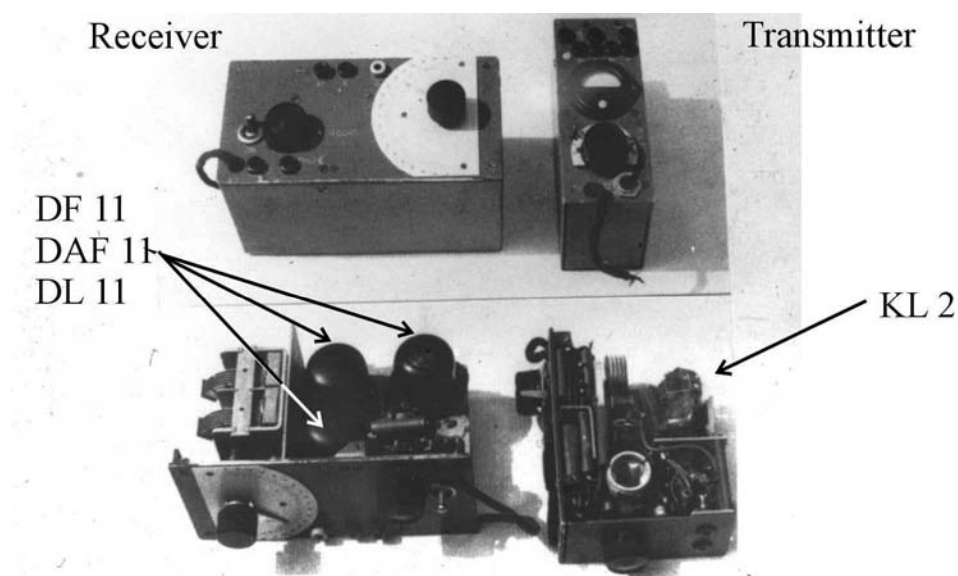


Figure 17
The open and closed receiver and transmitter modules of the battery set type SE 98/3. According to Staritz, this set was widely used and more were produced than most of all other Abwehr sets. The receiver design was again based on the 1 V 1

concept.

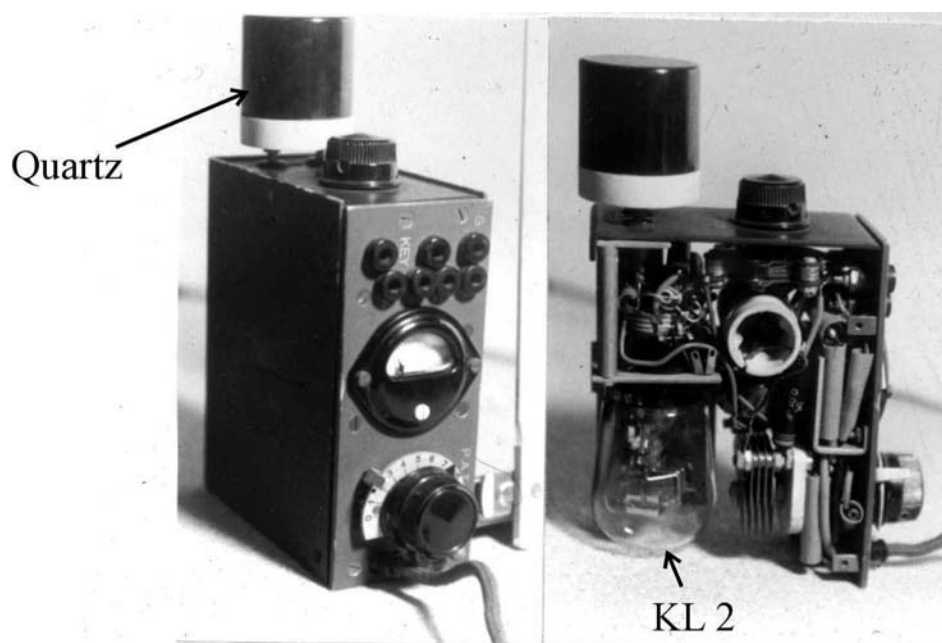


Figure 18
A detailed photo of the SE 98/3 crystal controlled transmitter-module (see previous figure 17). These stations were so compact that they could easily be carried inside a standard attaché case.

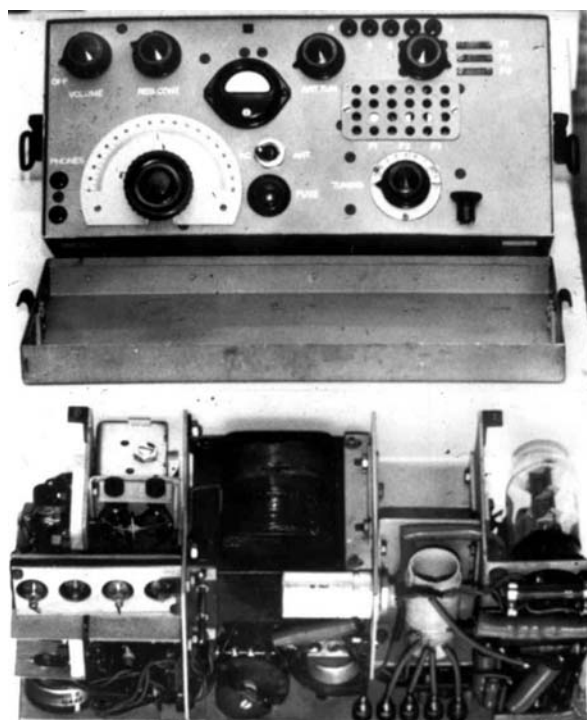


Figure 19

This rather compact 10 watt wireless station type SE 99/10 (state of the German art of 1943), used an integrated transmitter, receiver and power supply and was built so as to look like a cigar-box. The receiver was equipped with so-called “acorn valves” which were quite popular on the continent. The main valve supplier was Philips (sold in Germany under the brand-name “Valvo”) and special versions came from Lorenz. The latter supplier made 2 V and 12 V versions, whereas Philips made the 4 V and 6 V versions. The transmitter used, in its power stage, a valve type EL 2 (occasionally an EL 11). It came into service about 1943.

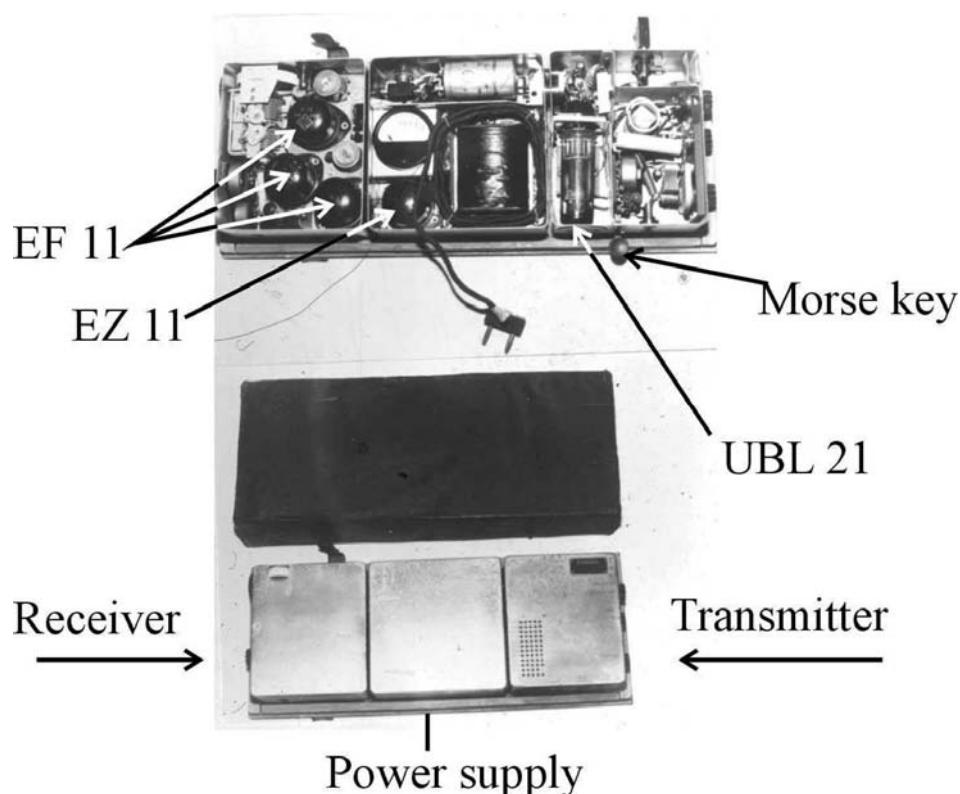


Figure 20

This, very compact, modular station SE 108/10 (10 watt antenna power) can be regarded as a change in trend. The three modules were simply clicked together and held by very special kinds of connectors, known in Germany as “Breckkopplung”. These cleverly designed devices are of a remarkable

construction such as to withstand axial pulling forces though, nevertheless, easily detached when crosswise forces are engaged. To disconnect the linked modules, they had only to be bent against each other a bit, almost like breaking a piece off a chocolate-bar. These types of

connectors were also widely used in German aircraft, so as to ease the disconnection of cables, such as for headsets (in case of emergency). One only had to pull the cable lightly (at an angle) or, simply had to move away. The receiver (left) employed three EF 11 metal valves, which were used in reflex-circuitry. The set had one or more RF stage(s) also used for audio purposes as well. The Transmitter was equipped with a valve type UBL 21 (made by Philips/Valvo or Tungsram).

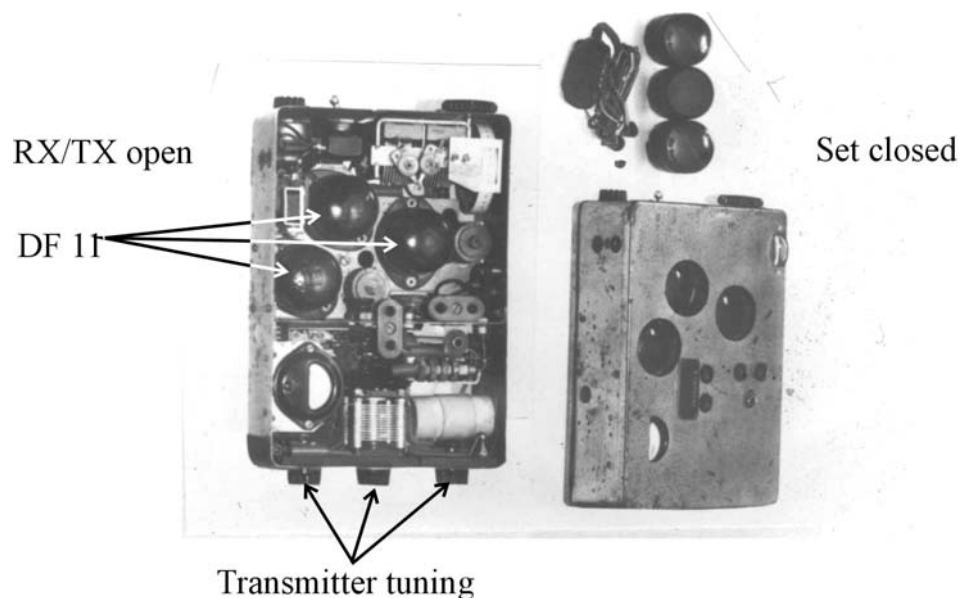


Figure 21
The receiver/transmitter unit of the battery-version type SE 108/3 of the previously shown set (figure 20). In the receiver they employed three battery valves type DF 11 and, of course, they also used reflex-circuitry. The TX section was equipped with a

special valve made by Tungsram type DLL 22T. This loctal base valve, had a rather short glass bulb so as to fit inside the space available. These series of "Spy Sets" were, of course, equipped with a tiny built-in morse key. This type was nicknamed: Keksdose (cookie box).

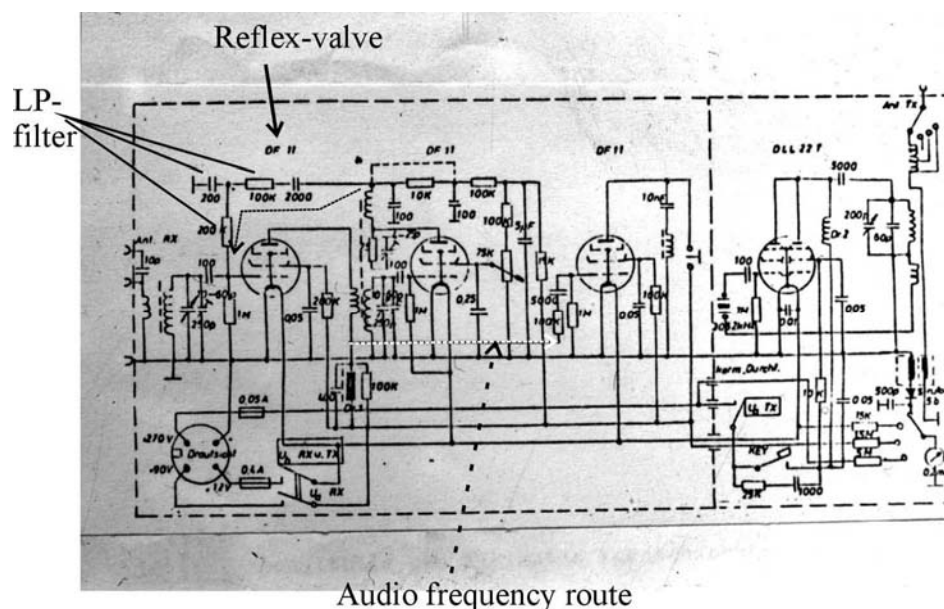


Figure 22
The circuit diagram of the SE 108/3. As can be seen was built into two modules only, whereas the AC powered version SE 108/10 necessitated, of course, an additional mains power supply module. It is clear that the receiver concept was again based upon the

1 V 1 principle. The two power pentode sections (DLL 22T) were wired in parallel to double the HF output power. The first RF stage was designed to act as a high frequency and a low frequency amplifier. The audio signal was fed via a low pass network (LP in drawing)

consisting of a capacitor of 200 pf and resistors of $100\text{ k}\Omega + 200\text{ k}\Omega$. The amplified audio signal (see dotted routes in drawing) was picked-up at the lower end of the RF coil.

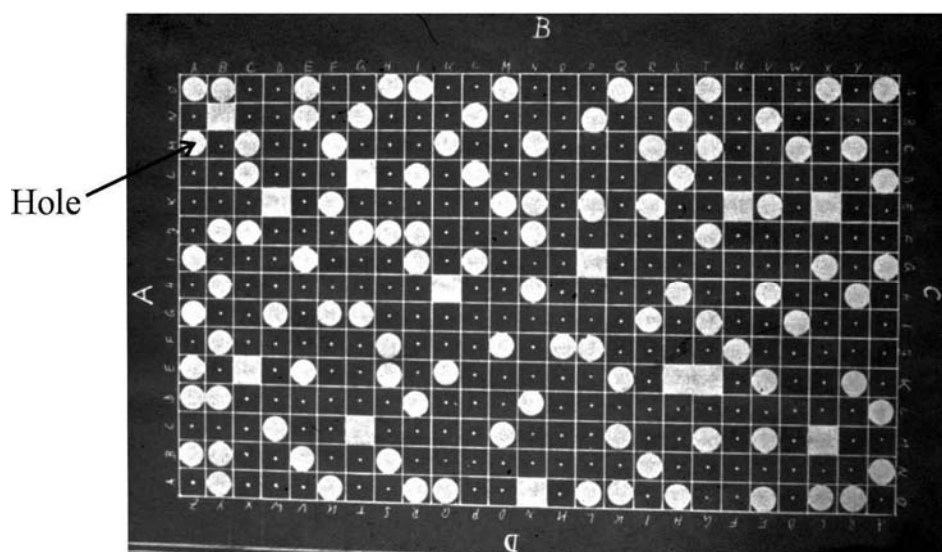


Figure 23
These kinds of coding-sheets were known as: “Chablonen-schlüssel” or “Kreuzwort-schlüssel (crossword key)” and/or Agenten-schlüssel. An alphabet was derived from a certain plain text passage, which

had to be long enough to generate all necessary characters. A second step was to place a transcription of the plain text message in the horizontal rows. The coded message was then derived from the vertical columns. These kinds of coding procedures have to be regarded as very insecure!

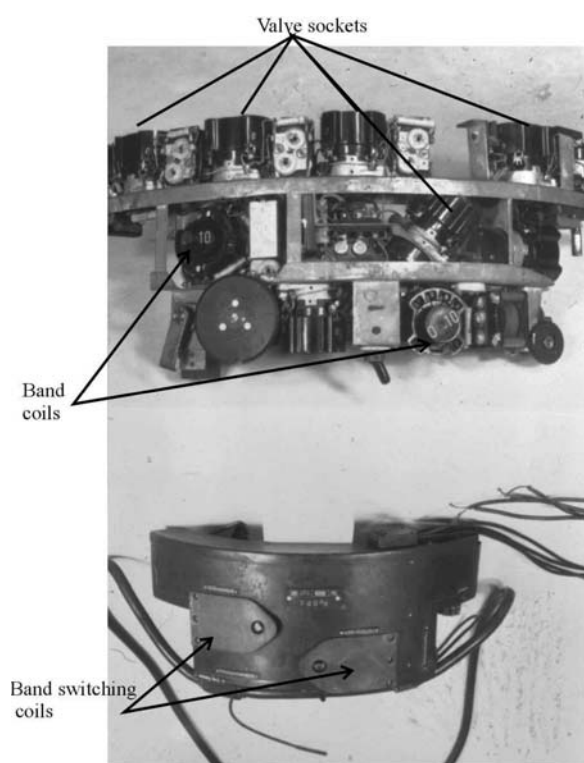


Figure 24

It is evident, that all belligerents during World War Two maintained wireless directed intelligence-networks. At the same time, all nations were keen to prevent and eliminate all elements of enemy clandestine radio services. The Germans were, in this respect, no exception. They maintained an extensive DF (direction finding) service located in all occupied territories (from Russia to Norway and all the way down to Northern Africa). As most secret agents were often hiding in populated areas like cities, the Germans deployed all sorts of inconspicuous carriers of DF equipment. Such as DFs build-in Laundry vans and even very small belt-radio-sets hidden, for example, under a (rain)coat. The Germans called this type of DF apparatus “Gurtelpeiler”. This equipment was made by the Kapsch company in Vienna (which was

then a part of the German Reich). The moving coil instrument-reading (indicating the field strength) was camouflaged by building it into a wristwatch. The one-turn DF loop antenna was bent around the rear of the operator's neck. Band switching was maintained by changing

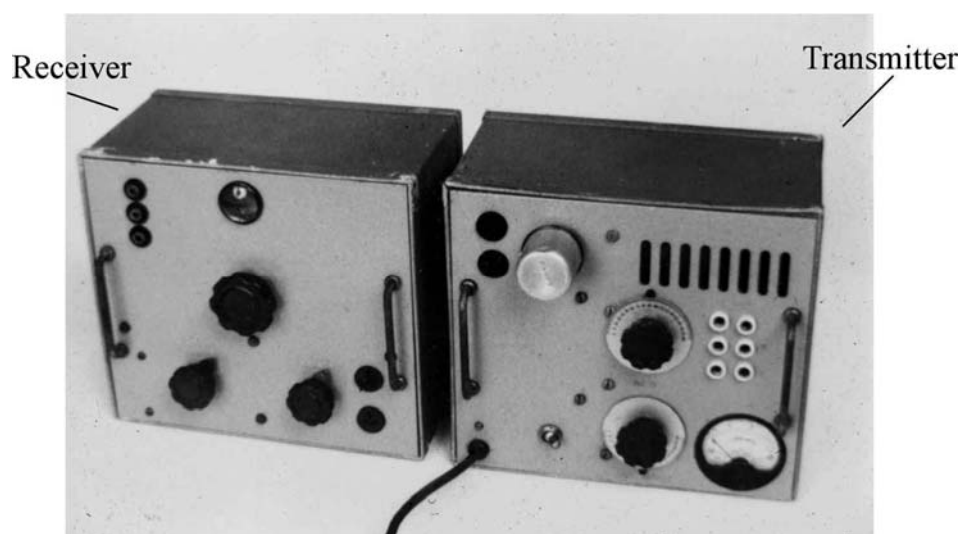
a set of two plug-in coils (10 frequency bands, covering 3 - 20 MHz). The battery valves RV 2,4P700 (five in the set) and RV 2,4H300 (two in the set) were made by Telefunken. These valves were designed for 2.4 volt operations by regular dry cells or, utilizing NiCad wet cells. These latter battery types were most popular in the Germany services. Millions of all sorts had been deployed during WW 2 on the German side. If someone ever finds one of these Nicad cells, it is quite likely that it can be operated properly, even after 60 years! They were sometimes known as “Edison-Sammler”.



Figure 25

Shown here is a Kapsch-Nahfeld-Peiler in conjunction with the FunkHE u1 (near field DF system). I am not sure when this photo was taken. German servicemen did sometimes tend to be dressed unconventionally as did service men from other countries.

However, the kind of trousers worn by the civilian person on the right, I suggest that this photo originates from post war days.



German type S 85/14

Figure 26

I would like to close this series of photographs by showing a couple of Italian “spy sets” of about 1942. This type RN-3 may be regarded as based on German equipment. According to Staritz, it was an Italian copy of the

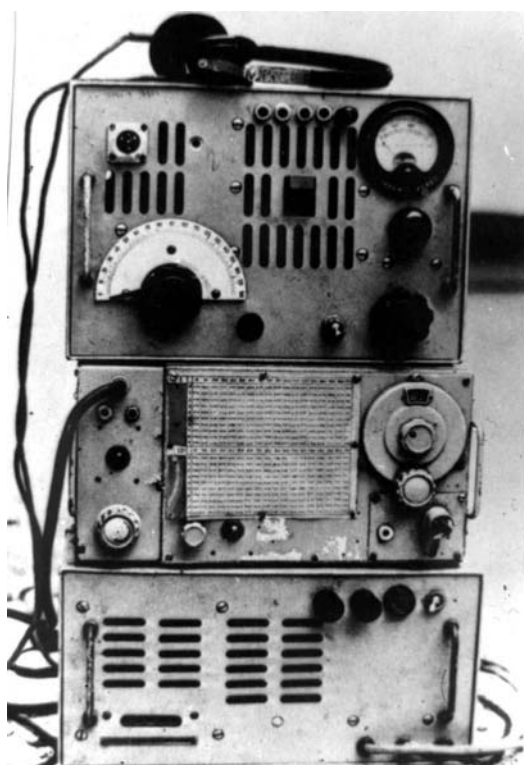


Figure 27

Finally, the Italian type RN-6, made by Nova Radio and Natali, which is, more or less, similar to the German type SE 90/40. The receiver might be, according Louis Meulstee, the Italian aircraft type B 30.

Conclusions

We have encountered a range of German “Spy Sets”, but we have not yet evaluated the operational effectiveness of the spy service (known in German services as “**A**genten**f**unk” or, abbreviated Afu). For this, we have first to go back in time to the pre-war years of the 1930s.

Apparently, during the proceeding years of the 1930s it became clear that a new war would come soon. The Germans opted for revenge on Poland and France and some other countries and it is evident that military intelligence had to play an important role.

In the initial stages of the war, military intelligence was highly successful being aided by the mobility of the Blitzkrieg tactics of the German army.

As far as Staritz was concerned, he told me that Abwehr agents operated behind the French front lines before and during the operations in Western Europe in May and June 1940. The German army advanced in France so fast, that agents only had to hide for a short period of time. Consequently, most operations proved to be successful.

The situation during the invasion of Russia was, to some extent, more or less similar. We have to emphasize that the Russians ruled (particularly in Western Russia) vast territories, whose population was, to say frankly, rather resentful against the communist regime. Countries like the three Baltic states, showed quite some animosity towards Russia. Likewise

the Ukrainians who had been treated so badly by Stalin's agricultural reforms, also showed considerable animosity toward the Communist rulers. These circumstances could easily be exploited for one of Lenin's guidelines was "The enemy of my enemy is my friend". It proved to be not too difficult to recruit locals for intelligence work and for spy-networks such as the previously mentioned "Don-Netz". Intelligence networks were active behind most front lines before and after the invasion of Russia. The Germans advanced at an unprecedented speed over thousands of kilometres in only a few weeks. Again, agents had only to hide (and act) for a short period and, as in the foregoing western campaign a year ago, most personnel survived these operations.

Nevertheless, the situation changed rapidly after the Germans were stopped in the harsh winter season of late 1941 (the coldest winter in a century). From that time onwards, the conditions for intelligence operations on Russian territory deteriorated. The Germans still recruited Russian prisoners of war to operate for them behind the frontline, but most of them were, sooner or later, caught. Some of them were turned around to operate against the German services but, from the German (Abwehr) perspective, the effectiveness of intelligence operations deteriorated in the proceeding years. Staritz told me that he was once involved with agent-dropping in the Ural region (far behind the Russian-German front lines) but, they never got contact with these poor men. Of some significance was that, in the aftermath of these parachutings the German frontline was pushed westwards for hundreds of kilometres. Consequently, from the point of radio propagation and given the considered frequency schedules, contact would have been most unlikely.

Were the German services equipped adequately to cope with intelligence as such on foreign occupied territories? In my opinion, yes they were. Allied S-Phones or other special wireless systems, sooner or later became victims of German DF services. There exists so much literature about this intriguing subject that I will neglect these aspects in this paper!

The impression we have got from the forgoing information is that German wireless conducted intelligence worked quite well in the early stages of the war. Operations became increasingly difficult after the Germans were pushed on to the defensive. We must consider their equipment being adequate at the time, as inadequate systems would have called for different designs. As we have seen, design improved as times advanced.

According to Staritz, the overseas services were reasonably successful (bearing in mind the circumstances prevailing at the time). Personally, I have no idea how far its operations proved to be useful in promoting German global interests.

Finally, I would like to recall an event which took place in Holland about 1942.

Shortly after the Germans invaded Holland in May 1940 (10 May-15 May), all licensed radio amateurs had to hand-in all their equipment, for which they got a "receipt" (announced in the newspapers on 25 June 1940). They were told that, for the time being, all equipment would be stored in a safe place until the war was over!

Who could ever imagine that someone would consider, say under German occupation, building a wireless transmitter and receiver and start to communicate with fellow radio amateurs in countries abroad? However, at least one man did! The man had the pre and post war call-sign PA 0 YF! He camouflaged his identity (during his illegal activities) by using a Portuguese call-sign. According to Staritz, who might remember the call-sign correctly, it was CT 1 LX and he operated on the 40 metre band. In fact, the late Mr G.J. Kijff (PA0YF) told me some twenty years ago, how the Germans found out about his “stupidities” (my words). Despite all DF facilities in (or around) The Hague, where Mr. Kijff lived at that time, it was the German DF organisation in Kiev (or was it Karkov) located in the Ukraine who informed the authorities in The Hague that someone was illegally operating wireless communications from there on amateur frequencies! Soon thereafter, the ORPO (**O**rdnun**s**polizei) DF’d him and he was brought before a special court. Bearing in mind that, for the years I knew Mr Kijff, he was a great fan of “low power transmitter operations” (known in amateur language as “QRP”) he might have had this bent already in the 1930s. And that he trusted that the Germans would not acknowledge his low power signals. He must have had great luck, as he survived his concentration camp sentence. He died in 2001.

Acknowledgement

I have to thank Mr. Rudolf Staritz for his kind cooperation, in supplying me with background information and lending me a selection of slides which he prepared in the last forty years. I also have to thank my friend Richard Walker for his significant support to bring this paper to fruition.