

SUMMARY OF CONTENTS OF DOCUMENTS IN FILE NR. I.2.060C-02427 OF  
THE CORPORATE ARCHIVES AT DEUTSCHES TECHNIK MUSEUM BERLIN

- **Ref. 204A:**
  - Title: “Schreibanzeige-Gerät für Flugzeugbordanlage “Ulrich”” [airborne printer-indicator]
  - Letter from Mr Runge and Mr Lohmann of Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK) to Dr Zimmermann of Siemens & Halske A.G., Wernerwerk X, Dept. T-Sondertelegraphen [special telegraphy equipment], 8 October 1940, 1 page.
  - The “Schreibanzeige-Gerät für Flugzeugbordanlage “Ulrich”” [printer-indicator for the on-board “Ulrich” system] shall be developed with RLM [German Ministry of Aviation] priority level “Sonderstufe”, as it is to be tested as an improvement of the **Knickebein** system,
  - also see ref. 204F (“Printator” disk printer)
  - 2017-04-27\_DTM\_059-Uhlich.pdf
- **Ref. 204B:**
  - Title: “NF-Weiche für Anlage “Bernhardine”” [audio filter]
  - Internal memo from Mr Schmeisser to Dr. Hartmann, Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK), 9 May 1941, 1 page.
  - The Hell-printer for the “Bernhardine” system was ordered by the RLM [German Ministry of Aviation] directly from the Hell Co., and the associated audio filter directly from Siemens & Halske (S&H). However, the development and improvement of these equipment items was substantially supported by TFK Mr. Lohmann. So TFK should have certain proprietary rights. To be evaluated by the development department.
  - 2017-04-27\_DTM\_058-Hell-brnhrdne.pdf
- **Ref. 204C:**
  - Title: “Patentanmeldung II 153 264 VIII/21e, 11; vom 8.10.1937” [patent application]
  - Letter from Mr Lohmann of Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK) to Dr. Rudolf Hell in Berlin-Dahlem, 17 May 1941, 2 pages.
  - Minutes of meeting between TFK (Mr Lohmann and Mr Herbert Muth) and Dr Hell on 13-May-1941. The problem statement for using a Hellschreiber to plot/print a varying signal-strength level, came from TFK (Mr Muth). Dr Hell came up with the solution of using a superimposed sawtooth signal, with a period equal to that of one revolution of the Hell-printer spindle. Unclear is whether the idea came from TFK/Muth or Dr Hell, to present the signal trace as a sequence of adjacent line segments, the height of which corresponds to the momentary signal level. However, this is basically state-of-the-art. TFK considers this to be a joint/shared invention, as the TFK problem statement has clearly affected the solution, or is even completely based on it. TFK proposes a joint application, with both parties having free rights to use and license the invention, the latter subject to mutual agreement in each case. TFK recognizes that that Dr Hell has actually proposed a fee-based usage right to TFK.
  - Note the actual patent (nr. 737102) was only applied for by, and awarded to, Dr Hell.
  - 2017-04-27\_DTM\_048-49-Hell-4chan.pdf
- **Ref. 204D:**
  - Title: ““Bernhardine“-Großserie, Einschaltung der Firmen Dr. Hell und S. & H.” [mass production]
  - Internal memo to Dr Rottgardt and Mr Lohmann from Mr Tätz, Dept V [“Verkauf”, sales], Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK), 28 May 1941, 1 page.
  - It was decided in the latest “Bernhardine” meeting with Mr. Von Hauenschild and Mr Görke of the RLM [German Ministry of Aviation] that TFK should start working on the design and development for large-scale production of the “Bernhardine” system. Originally, the RLM intended to contract the design and development of the printer to the Hell Co., and for the audio filter to Siemens & Halske

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(S&H), and later on, contracts for series production to the same companies. The sales dept. of TFK managed to get the overall contract for design, development, and series production of the entire system awarded to TFK. Design of the printer and audio filter could be done at TFK, or be sub-contracted to the Hell Co. and S&H. The latter should be avoided. TFK could consider the possibility of obtaining only the electro-magnet printer module from the Hell Co. The printer for Printator foil medium should be designed and developed by TFK, independent of S&H. The audio filter should clearly be designed and developed completely without S&H. However, the procurement of styroflex capacitors from the Hydra company must be clarified, even though this not an option for the current limited-volume production of 2000 units. In preparation for full-scale production, Hydra capacitor samples should be ordered. To be decided how to protect our rights with the Hell Co., regarding their current RLM-contract for 2000 printers.

- 2017-04-27\_DTM\_057-Hell-brnhrdne.pdf

- **Ref. 204E:**

- Title: “Anzeigergerät für “Bernhardine”“ [indicator]
- Internal memo from Mr Lohmann to Mr Tätz, Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK), 10 June 1941, 4 pages [= response to ref. 204D].
- The idea to print the signals from the rotating beacon came from Mr Muth (TFK), early 1935. The concept was demonstrated with a 1-channel strip-chart recorder. The experiments raised the problem that exactly when the bearing (azimuth) information was most needed, the antenna radiation pattern had a deep null. This led to the invention by Mr Lohmann of using a second, separate transmitter to send the bearing information, with a special radiation pattern, and print that information as a separate trace, or on top of the signal with the null. TFK was contracted [by the RLM, the German Ministry of Aviation] to build 3 test beacon stations, per the new [2 channel] method. A 2-channel wax-paper strip-chart recorder was built by the M-Werk (Messgerätewerk, Wernerwerk M) of Siemens & Halske, per TFK inputs. The amplitude of both the null-pointer signal and the bearing signal was plotted; the latter signal was Morse-like [i.e., a sequence of dots and dashes]. The strip-chart recorder could be used by specialists, but was absolutely unsuitable for practical operation. During the spring of 1937, concept validation testing was completed with the wax-printer. A practical printer implementation had to be found. At this time, the tasks of the RLM had already changed significantly, in that the print-out should be easily readable and interpretable, and an accuracy of 0.1 degree was no longer required. This led Mr Lohmann to propose to replace the Morse- encoding of the bearing value with a Hell-printer. This had already been suggested by Mr Muth from the beginning. Printing characters with the Hell-method was already state-of-the-art at the time. Several weeks ago, Mr Johannesson [TFK], Mr Muth [TFK] and Dr Hell tried in vain to figure out who originally came up with the idea of printing the amplitude of the received signal from the rotating 2-lobe antenna pattern (“Gebirgesschreiber”, mountain-peak printing) with a Hell-printer. But it was Dr Hell who proposed (and patented) the method of superimposing a sawtooth signal on top of the signal envelope, to generate pulses that are printed as line segments with varying length. Dr Hell modified a standard Hell Morse “Übungsschreiber” [lit. practice printer], and in November of 1937, the system was demonstrated for the first time in flight. During the spring of 1938, it was decided to build a practical demonstration system. The only printer aspect still to be clarified was the use of [erasable] Printator-foil tape as medium to print on [instead of paper tape]. Additional requirements were: 1) there should be 4 parallel printer traces, to enable simultaneous printing of 2 beacon stations; 2) a station-identifier letter was to be added to the bearing value transmission; 3)

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handling of the tape should be adapted to operation in an aircraft. No progress was made for several months, as the Hell company was enormously overloaded with work, until Mr Lohmann provided some design drawings to Dr Hell. On the outside, the printer resembled the TFK proposal, but the actual printer system was done by Dr Hell, as it is very specialized and beyond the know-how of TFK. The 4-channel printer was finished during the fall of 1938, and the complete [beacon + printer] system proved usable. Despite the success, Hell did not want to work on the Printator-foil printer tape version, and neither did TFK departments LN3 and LN4. Hence, Mr Lohmann and a mechanical designer modified the aforementioned "Übungsschreiber", and showed that it worked in principle. This Printator-printer prototype was demonstrated to Dr Hell during the spring of 1939, who continued to decline to work on it, for workload and "other" reasons. Outbreak of the war interrupted the entire project. However, early 1940, the RLM suddenly issued a contract for full development. TFK decided to involve Siemens & Halske (S&H) in the development of the Printator-printer and the required 2-channel audio filter. This was presented to Prof. Küpfmüller (S&H) by TFL (Messrs. Lohmann, Runge, Maas) in May of 1940. Prof. Küpfmüller immediately recognized the importance of the Printator-printer for this special application. Nothing happened at S&H until the fall of 1940, due to lack of development capacity. Meanwhile, TFK dept. LN3 made some design drawings, based on ideas from Mr Lohmann. Several patents were applied for. The advanced design was presented to, and discussed with, S&H during the fall [of 1940]. S&H then developed a printer that corresponded to the TFK and RLM wishes. TFK provided test equipment for the Printator to S&H on 7 June 1941, and test at S&H are expected to begin shortly. The opinion of TFK dept. V that everything could have been done differently is correct, but it was not because it was in the self-interest of TFK dept. E to outsource this potential TFK business to S&H and Hell, but because it was impossible to do the development in-house at TFK, due to lack of developers, mechanical designers, workshop/factory. It is in the interest of TFK, as prime contractor to the RLM for the "Bernhardine" system, that the indicator works properly. So, TFK should be glad that it found S&H willing to take care of the manufacturing of the printer. We hope that S&H, with its long experience and significantly larger capacity than the Hell Co., will make this highly complex equipment work dependably, as required for operation of the "Bernhardine". It is excluded that TFK can successfully build and test such a printer in large numbers. This should be left with S&H, though the RLM should be convinced to issue the contract for the complete "Bernhardine" system to TFK, such that the deliveries of the Printator-printer are done via TFK.

- 2017-04-27\_DTM\_053-56-Hell-brnhrdne.pdf

- **Ref. 204F:**

- Title: "Chronik des Printator-Schreib-Anzeigegerät für Drehfunkfeuer" [1937-1941 chronicle]
- internal memo from Mr Lohmann of Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK), 10 July 1941, 2 pages.
- Dr Hell recorded on 24-Nov-1939 the TFK/Lohmann request for a Hellschreiber with Printator foil tape. The first lab test took place the same day, with a hand-cut tape. The first test flight with a Hellschreiber took place on 11-Nov-1937. A 4-channel receiver/Hell-printer system for simultaneous reception of 2 beacons was demonstrated to the RLM [German Ministry of Aviation]. TFK/Lehmpull finished the design drawing for a Printator printer on 20-Oct-1938; it was used to build the first prototype. A patent was filed on 11-Mar-1939 and already awarded on 13-june-1941. A Printator prototype was shown to the RLM during the spring of 1939, and considered by the RLM for introduction. Siemens & Halske (S&H, Mr Küpfmüller) and TFK (Mr Rottgardt) agreed on 1-Mar-1940

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that S&H would develop the Printator under contract to TFK. TFK showed S&H a prototype drum-based Printator mid-April 1940. TFK provided design drawings for a Printator Hell-printer using a Printator-foil disk [instead of foil tape] to S&H on 15-May-1940. S&H was given the contract for the latter printer on 8-Oct-1940, in the framework of the "Knickebein" beacon system [also see ref. 204N]; the contract has RLM priority level "Sonderstufe" per RLM secret letter of 2-Dec-1940.

- [FD: this was the intermediate of the three priority levels, i.e., "kriegswichtig mit der Dringlichkeit "Sonderstufe" (SS) = "special level", in between level "S" ("Standard") and level "DE" ("Dringlichkeitsentwicklung", urgent development). Ref: first page of "Die PTR als Wehrmachtsbetrieb", Jürgen Müller, PTB-Mitteilungen (Journal of the Physikalisch-Technische Bundesanstalt), Vol. 123 (2013), Nr. 1, pp. 16-33

- [https://www.ptb.de/cms/fileadmin/internet/publikationen/ptb\\_mitteilungen/mitt2013/Heft1/PTB-Mitteilungen\\_2013\\_Heft\\_1.pdf](https://www.ptb.de/cms/fileadmin/internet/publikationen/ptb_mitteilungen/mitt2013/Heft1/PTB-Mitteilungen_2013_Heft_1.pdf)

TFK provided a printer amplifier and test equipment for the Printator-printer to S&H on 8-June-1941, without which the S&H printer cannot be tested.

- Also see ref. 204A.
- 2017-04-27\_DTM\_051-52-Hell-4chan.pdf
- **Ref. 204G:**
  - Title: "Dr. Rudolf Hell"
  - Letter from Dr Johannesson *et al* of Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK) to the patent dept. of Siemens & Halske A.G. (S&H), 11 June 1941, 1 page.
  - TFK provided the problem to be solved, as covered by the patent application [see ref. 204C], to Dr Hell. However, the solution belongs solely to Dr. Hell. At the time of the patent application, TFK did not have a development contract in place with Dr Hell. So it is necessary to contact Dr Hell, in order to straighten out the industrial/intellectual property rights.
  - 2017-04-27\_DTM\_027-Hell-rights.pdf
- **Ref. 204H:**
  - Title: "Fertigung der Vierspuren-schreiber für Bernhardine" and "Printator-Schreiber und NF-Weiche für Bernhardine, entwickelt bei Siemens & Halske" [4-channel Hell-printer, Printator-printer, and audio filter developed at S&H]
  - Internal memo from Dr Johannesson of Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK), 11 June 1941, 1 page.
  - The Hell Co. manufactures 4-channel Hellschreibers for the "Bernhardine" system, under contract to the RLM [German Ministry of Aviation], and sells them directly to the RLM. Dr. Hell had a TFK development contract for these printers, and used ideas provided by TFK. The rights to the 4-channel printer must be cleared contractually. There is no need for a special agreement between TFK and Siemens & Halske (S&H) for the 2-channel audio filter and Printator printer developed by S&H for the "Bernhardine" system, as this is covered by existing and future agreements between TFK and S&H.
  - 2017-04-27\_DTM\_046-Hell-4chan.pdf
- **Ref. 204J:**
  - Title: "Drehfunkschreiber DFS 120 nach dem Printatorprinzip für die Anlage "Bernhardine"" [chronicle]
  - Internal memo of Mr Schmeisser to Dr Schumacher, Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK) dept FN/TV-Bord in Berlin-Zehlendorf, 12 October 1942, 1 page.
  - In August of 1941, Siemens & Halske A.G. (S&H) received a contract from TFK for the production of 2400 "Drehfunkschreiber" for the TFK "Bernhardine" system [bearing printers for rotating radio

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navigation beacon]. The underlying ideas and predevelopment are from TFK. However, S&H is marking the design drawings only with "S&H", and listing itself as supplier instead of TFK. Chronicle per TFK/Lohmann: 24-Nov-1937, TFK/Lohmann mentioned the Printator principle to Hell Co. 20-Oct-1938 TFK completed design drawings and built first prototype. TFK applied for patent on 11-Mar-1939, awarded 13-June-1941. TFK presented prototype to the RLM [German Ministry of Aviation] during spring of 1939, and RLM took its introduction into consideration. TFK and S&H agreed on 1-Mar-1940 that S&H should further develop the Printator, under contract to TFK. TFK provided prototype of Printator drum-printer to S&H mid-April-1940. TFK provided design drawings to S&H on 15-May-1940, for a printer with disk-shaped Printator foil [instead of tape]. TFK provided a Printator printer amplifier and tester to S&H on 8-June-1941. TFK provided many design/construction inputs to S&H during the development. This issue is to be cleared with S&H, and S&H must mark TFK on the drawings.

- 2017-04-27\_DTM\_042-DFS120.pdf

- **Ref. 204K:**

- No title
- Internal memo of Mr Hartmann of Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK), 8 December 1942, 1 page.
- In 1941, Siemens & Halske (S&H) has developed a Printator-Peilschreiber [bearing printer] for the TFK "Bernhardine" system, based on a prototype, drawings, and other inputs from TFK. TFK has heavily supported the S&H development. However, S&H marks the design drawings only with S&H, and only lists S&H as the manufacturer. S&H knows that it is TFK who will supply the first 2000 units to the RLM [German Ministry of Aviation], and in this respect, S&H is only manufacturer of TFK. TFK reserves the right to refer to the Printator-printer as a TFK product, and that the drawings reflect that the development was done by S&H on behalf of TFK. A build-license contract must be put in place.
- 2017-04-27\_DTM\_043-DFS120.pdf

- **Ref. 204L:**

- Title: "Peilschreiber DFS 120 nach dem Printator-Prinzip für die Telefunken-Anlage "Bernhardine""
- Letter from Mr Lohmann and Mr Hartmann (in lieu of Mr Görlitz) of Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK), to Mr Pelkmann of Siemens & Halske A.G. (S&H), Wernerwerk Z, in Berlin-Siemensstadt, 12 December 1942, 1 page.
- TFK has placed an order for 2400 bearing-printers of type DFS 120 (per the Printator principle) with Siemens & Halske (S&H), for the "Bernhardine" system. TFK states that S&H has continued development of the prototype provided during the spring of 1940, as well as design drawings and other inputs. Development in accordance with RLM priority level "Sonderstufe".
  - [FD: this was the intermediate of the three priority levels, i.e., "kriegswichtig mit der Dringlichkeit "Sonderstufe" (SS) = "special level", in between level "S" ("Standard") and level "DE" ("Dringlichkeitsentwicklung", urgent development). Ref: first page of "Die PTR als Wehrmachtsbetrieb", Jürgen Müller, PTB-Mitteilungen (Journal of the Physikalisch-Technische Bundesanstalt), Vol. 123 (2013), Nr. 1, pp. 16-33
    - [https://www.ptb.de/cms/fileadmin/internet/publikationen/ptb\\_mitteilungen/mitt2013/Heft1/PTB-Mitteilungen\\_2013\\_Heft\\_1.pdf](https://www.ptb.de/cms/fileadmin/internet/publikationen/ptb_mitteilungen/mitt2013/Heft1/PTB-Mitteilungen_2013_Heft_1.pdf)

TFK can substantiate its claim that the printer is "TFK equipment". However, TFK has learnt that S&H has issued design drawings marked "S&H", and in the S&H is listed as manufacturer in the RLM

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equipment spec sheets. TFK claims the right to be marked as the design owner in all documentation. TFK request that S&H inform the military that the printer is based on the Printator-printer developed by TFK, and is a TFK product, built by S&H for TFK. Also, S&H will need a license from TFK to build the printer and deliver to the military in the short term.

- 2017-04-27\_DTM\_040-DFS120.pdf

- **Ref. 204M:**

- Title: "Peilschreiber DFS 120 nach dem Printator-Prinzip für die Telefunken-Anlage "Bernhardine""
- Letter from Mr Zimmermann and Mr Pelkmann of Siemens & Halske A.G., Wernerwerk Z, in Berlin-Siemensstadt, to Dr Schumacher of Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK) in Berlin-Zehlendorf, 9 January 1943, 2 pages.
- Siemens & Halske (S&H) disagrees with TFK position that the printer in question is fully based on the TFK prototype that was provided in 1940. Rather, the TFK design drawings and suggestions were useless for achieving the requirements, and satisfied neither the customer, nor TFK itself. At the time, before S&H left TFK [FD: 24 September 1941, buy-out by AEG], the 1936 contract applied. The TFK prototype printer is a Siemen & Hell-printer. Per the 1936 contract, it belongs to the perimeter of S&H. S&H has performed the strenuous development at its own cost. Hence, also per the 1936 contract, this development is protected and property of S&H. Consistent with that, S&H has applied for patents. Also, S&H printer patents that pre-date the TFK prototype apply. Even if TFK has property right regarding the prototype, S&H has the usage rights, per the patent contract of 24 September 1941. I.e., the printer is not build by S&H under license. S&H will build the 2400 printers that TFK has ordered in 1941, but this does not establish any legal obligations beyond that.
- 2017-04-27\_DTM\_038-39-DFS120.pdf

- **Ref. 204N:**

- Title: "Chronik des Printator-Schreib-Anzeigergerät für Drehfunkfeuer" [1936-1941 chronicle]
- Internal memo from Mr Lohmann, Telefunken Ges.f.drahtl.Telegraphie m.b.H., 9 February 1943, 2 pages.
- Chronicle. The Telefunken (TFK) rotating beacon patent of 16 March 1936 covers 2-trace recording with a "pointer" trace and a "scale" trace on a single/common medium. The first time a Hellschreiber was used in an aircraft to print on paper tape with an inked spindle, was on 11 November 1937. On 24-November-1937, Dr Hell confirmed in writing having received the request for building a Hellschreiber printer using a strip of Printator foil [FD: instead of paper tape] . The Hell company performed tests with TFK/Lohmann-provided Printator foil on the same day. Several prototype Printator Hell-printers were built, based on design/construction drawings by TFK/Lehmpull of 20 October 1938. TFK performed tests during the winter of 1938, and filed a patent for the Printator principle on 11 March 1939. During the spring of 1939, the RLM considered the Printator for use with the rotating beacon system. Outbreak of the war halted further development. In March of 1940, management (TFK/Küpfmüller and S&H/Rottgardt) decided to that S&H was to develop the Printator under contract to TFK. Mid-April 1940, TFK showed S&H the prototype of a Printator printer with an endless foil on a cylindrical drum [FD: ref. patent 767513]. On 15 may 1940, TFK provided S&H with design drawings for an implementation with a disk-shaped foil. TFK placed an order (with RLM special contract priority level "Sonderstufe") with S&H on 8 October 1940, for a disk-printer; accepted/confirmed by TFK two days later. On 8 June 1941, TFK provided a printer-tester to S&H, without which S&H would not have been able to test the printer they developed.
- 2017-04-27\_DTM\_033-34-DFS120.pdf

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- **Ref. 204P:**

- Title: “Peilschreiber DFS 120 nach dem Printator-Prinzip“
- Internal memo / position paper from Mr Lohmann (Dept. EC 1) to Mr. Görlitz (Dept. Z), Telefunken Ges.f.drahtl.Telegraphie m.b.H., Berlin, 9 February 1943, 3 pages.
- Contrary to Siemens & Halske (S&H) claims [ also recorded in ref. 204F of 10 July 1941], Telefunken (TFK) provided S&H an operational Hellschreiber model at the beginning of the cooperation; came up with the idea for 2-trace recording with a “pointer” trace and a “scale” trace on a single/common medium , and use their relative positioning to determine beacon bearing (covered by the 16 March 1936 patent); provided a Printator prototype (with construction/design drawings) which TFK successfully tested during the fall of 1938. Hence, the S&H claim is false, that its printer only has the basic idea in common with the above TFK prototypes. It is recognized that S&H did introduce some of its own ideas (e.g., the foil-layers separation knife-blades, integrated with the foil) and careful construction – but all principle ideas were taken from TFK. The concept of recording the amplitude curve was explained to S&H in June of 1941. Despite multiple requests, S- H never submitted an estimate of incurred development costs, to be included in a development contract. In October of 1940, the development got the RLM contract priority level “Sonderstufe”. Patent for the Printator-principle was applied for on 11 March 1939, and first tests performed in the lab of the Hell company on 24 November 1937, with custom Printator-foil cut by the Printator company of Berlin-Weißensee during the fall of 1937. A design sketch for a Printator with disk shaped medium was provided to S&H in May of 1940, but not submitted by TFK for patent application until October of 1940, as an extension of the 11 March 1939 patent. Both patents have meanwhile been awarded as Secret Patents. Unclear to what extent the TFK Printator is covered by original Hellschreiber patents. S&H patent application for their own separator-knives makes sense, even though the use of such knives is covered by older TFK patents and has also been sued for over 25 years in the “Printator-Schreibblock” (note pad).
- 2017-04-27\_DTM\_030-32-DFS120.pdf

- **Ref. 204Q:**

- Title: “Peilschreiber DFS 120 nach dem Printator-Prinzip“
- Internal memo to Mr. Hartmann, Telefunken Ges.f.drahtl.Telegraphie m.b.H. (TFK), 2 September 1943, 1 page.
- Assessment that the DFS120 development contract with Siemens & Halske (S&H) is covered by the old AEG/S&H/TFK contract, and that the DFS120 is outside the normal product range of TFK. Hence, S&H may (at its own cost) continue development of the DFS120 and owns the associated (and protected) intellectual property. Unclear if S&H may consider the Printator an S&H product and may mark the design drawings as such.
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