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Datasheet for the decision of 11 December 2018

Case Number: T 0695/13 - 3.4.01

Application Number: 04250287.2

Publication Number: 1443591

IPC: H01Q1/24, H01Q1/38, H01Q9/42, H01Q1/36

Language of the proceedings: EN

Title of invention:
Printed circuit board antenna structure

Applicant:
Invensys Metering Systems/North America Inc.

Headword:
Antenna structure / INVENSYS METERING SYSTEMS

Relevant legal provisions:
EPC 1973 Art. 84, 56
EPC Art. 123(2)

Keyword:
Inventive step - (yes)

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Case Number: T 0695/13 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 11 December 2018

Appellant: (Applicant)	Invensys Metering Systems/North America Inc. 450 N. Gallatin Avenue Uniontown, PA 15401 (US)
Representative:	Somervell, Thomas Richard Marks & Clerk LLP Alpha Tower Suffolk Street Queensway Birmingham B1 1TT (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 27 August 2012 refusing European patent application No. 04250287.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	P. Scriven
Members:	P. Fontenay
	R. Winkelhofer

Summary of Facts and Submissions

I. The Examining Division refused European patent application No. 04 250 287.

II. The application was refused because it did not meet the requirements of Article 52(1) EPC as to the existence of an inventive step (Article 56 EPC). Concretely, the Examining Division held that the subject-matter of independent claim 1 of the main request and first and second auxiliary requests lacked inventive step in view of documents:

D1: US-A-2002/101382 or
D3: EP-A-1 248 316.

Reference was also made to the common general knowledge of the skilled person as illustrated by document:

D4: WO-A-01/80355.

III. The appellant (applicant) filed an appeal against the decision and requested that it be set aside and that a patent be granted on one of the sets of claims filed during the examination procedure as a main, first and second auxiliary requests, or as filed with the statement of grounds of appeal as a third auxiliary request.

IV. In a communication under Article 15(1) RPBA, the appellant was informed of the Board's preliminary view.

The Board pointed to a lack of clarity in the claim wording, as a consequence of which, the fact that the antenna structure was formed on the same printed circuit that included the antenna driving circuit was also missing in the claims' definition. This feature was considered essential in view of the problem to be solved.

With regard to the objection of lack of an inventive step, it was acknowledged that the objective problem to be solved, identified by the Examining Division, appeared to involve elements of the solution in that it anticipated the fact that the antenna driving circuit was to be positioned on the printed circuit board. The objective problem needed to be reformulated.

In the Board's view, the prior art identified by the applicant in paragraph [0003] of the published application appeared to constitute a valid starting point for the assessment of inventive step, in addition to D1 and D3. Said prior art was referred to as D0.

V. On 9 November 2018, an amended version of the main request was filed as well as amended auxiliary requests 1 to 3. As put forward by the appellant, the requests had been amended in reaction to the Board's comments with regard to the clarity of the claims.

VI. During oral proceedings before the Board, the appellant filed an amended version of the main request and made it the final and sole request on which the Board had to adjudicate.

VII. Claim 1 of the appellant's request reads:

A printed antenna assembly (10) for the transmission of radio frequency signals, the printed antenna comprising:

a planar printed circuit board (16) having a first planar surface (22) and a second planar surface (24), the first and second planar surfaces being parallel and spaced by a material thickness (A), the printed circuit board including a mounting section (26) and an antenna section (28) integrally formed with each other;

an antenna driving circuit (30) mounted to the first planar surface of the mounting section for generating the radio frequency signals to be transmitted by the printed antenna;

a layer of electrically conductive material (32) on the second planar surface of the mounting section of the printed circuit board, which forms a ground plane for the printed circuit board antenna and provides a first radiating element of a half-wavelength dipole antenna;

a radiating strip (46) formed on the antenna section of the printed circuit board and coupled to the ground plane and forming a second radiating element of the half-wavelength dipole antenna; and

an impedance matching strip (56) formed on the antenna section of the printed circuit board and coupled to the radiating strip, the impedance matching strip having a length selected to match the impedance of the antenna driving circuit, wherein the

impedance matching strip (56) and the radiation strip (46) are formed on the second planar surface (24) of the printed circuit board (16) and contained entirely on the antenna section so as to be spaced from and not overlie any portion of the layer of electrically conductive material.

Reasons for the Decision

1. Clarity (Article 84 EPC), added subject-matter (Article 123(2) EPC)

1.1 Both the present application and various items of prior art use the term "ground plane". It is important to note, however, that the role played by the "ground plane" according to the claimed invention, i.e. in the context of a dipole antenna, differs from the role played by the "ground plane" of a monopole antenna. As emphasised throughout the application, the ground plane according to the claimed invention effectively acts as a radiating element for transmitting electromagnetic waves generated by the antenna driving circuit (cf. for example, paragraphs [0010], [0023], [0026]).

1.1.1 The objections regarding clarity of the claims which were raised in the Board's provisional opinion no longer apply in view of the amendments made.

1.1.2 By referring consistently to the printed circuit board (PCB) claim 1's definition makes it clear that the driving circuit, the ground plane and the radiating

elements are positioned on one and the same PCB. This feature is considered essential in order to solve the problem addressed by the invention of the need for a compact antenna structure.

1.1.3 The claim further clarifies that the ground plane is to be construed in the context of a dipole antenna and refers to one of the two radiating elements of such an antenna construction, as emphasised throughout the application.

1.1.4 Claim 1 includes all features regarding the relative positioning of the driving circuit, the ground plane and the radiating elements required in order to provide an optimal emission characteristic symmetrical along its axis.

1.2 With regard to original claim 1, amended claim 1 clarifies the originally claimed subject-matter by incorporating the features regarding the meaning of "ground plane", which the skilled person would understand, in the light of paragraph [0026], as referring to the second radiating element of a dipole antenna.

The amendments comply with Article 123(2) EPC, because they serve to specify what the skilled person would have understood from the application as filed.

2. Inventive step (Articles 52 and 56 EPC)

2.1 Document D1 discloses a monopole antenna including a ground plane and a radiating element connected via a coaxial cable to a driving circuit (cf. paragraphs [0002], [0106], [0126]). The radiating element may be

located on a chip affixed to a circuit board or directly formed on it (cf. Figure 12).

2.2 Document D1 does not provide any concrete indication as to the driving circuit beyond the fact that it is external to the PCB and the radiating elements disposed thereon.

2.3 The claimed antenna assembly differs from this known antenna configuration, firstly, in that it consists of a dipole antenna and, secondly, in that the driving circuit is located on a first planar surface of the mounting section, that is on a surface of the PCB opposite to the ground plate.

2.4 The Examining Division's definition of the objective technical problem, consisting in determining where to provide the antenna driving circuit on the PCB, cannot be shared. As argued by the appellant, this formulation includes elements of the solution since it anticipates the fact that the antenna driving circuit is to be positioned on the PCB.

2.5 The objective technical problem has to be reformulated anyhow, to take account of the dipole configuration that is now claimed.

2.6 The dipole configuration permits the contribution of the radiating strip to be privileged in the radiating pattern. Concurrently, by limiting the contribution of the ground plane, improved flexibility is achieved for its positioning within the antenna assembly. In particular, the presence of electronic components in its neighbourhood does not substantially affect the radiating pattern.

2.7 The presence of the antenna driving circuit on the PCB permits a limitation in the size of the compartment needed to house both units, as suggested in paragraph [0003] of the published application. Although this suggestion refers to D0, the effect also applies with regard to D1. This is all the more true since, in D1, the feeding signal is provided by a coaxial cable connected to a separated driving circuit.

2.8 The objective problem solved by the invention consists thus in adapting the antenna of D1 so as to make it both compact and able to generate a satisfactory omnidirectional radiation pattern.

2.9 Even if it were assumed that the skilled person would have decided to amend the monopole assembly of D1 so that it operates as a dipole assembly, he or she would have done so in order to benefit from the radiation pattern resulting from such a configuration. This would imply rather symmetrical first and second branches for the radiating elements of the antenna, each providing a similar contribution to the intended emission pattern.

2.10 At this point, the skilled person would not have made further constructional change which would reduce the symmetry of the radiation pattern and, consequently, would have expressly excluded positioning the driving section on a surface of the PCB opposite the first or second radiating strip where it would have directly interfered with the emitted radiation field of the opposite strip.

2.11 Document D3 is less relevant than D1, since D3 not only contains no indication about the location of the antenna driving circuit but also fails to elaborate on the nature of the antenna.

2.12 D0 is also a suitable starting point for the assessment of inventive step.

2.13 D0, as described in paragraph [0003] of the published application, refers to known antenna structures consisting of a driving circuit on a PCB and a separated radiating antenna.

2.14 The problem solved by the invention is to provide a less expensive and more compact structure. This is the problem set out in paragraph [0003].

2.15 The skilled person would undoubtedly have recognised the merits of incorporating the radiating elements on the existing PCB which supports the driving circuit. This would imply enlarging its surface to incorporate said radiating elements thus arriving at an assembly with a driving circuit and radiating elements located at a certain distance from said driving circuit in order to avoid interferences.

2.16 The skilled person, aiming to further improve the compactness of the unit, might then have considered distributing the various constituting elements of the antenna on the two sides of the PCB, thus taking advantage of the free surfaces of the circuit board.

2.17 In the Board's judgment, however, the configurations which would possibly have been initially envisaged would have been rejected as unsatisfactory by the skilled person. In order to make the assembly still more compact, two options may have been considered: the two radiating elements of the dipole antenna are located on the same side of the PCB or distributed on the two sides. In order to achieve the intended compactness, both solutions require one radiating

element of the dipole antenna to be placed at least partially on the second surface of the PCB opposite the driving circuit. For this very reason, these solutions would have been rejected by the skilled person since the presence of the driving circuit would have directly affected the behaviour of the resonating elements of the antenna. There is to entice the skilled person at that stage into adapting one of the radiating strips to arrive at a ground plane in the sense of the invention.

2.18 It is acknowledged that D0 does not elaborate on the nature of the antennas referred to, which might be of the dipole or monopole type. The present analysis is based on the alternative which appears closest to the claimed invention, that is, on the case of a dipole antenna. The alternative of a monopole antenna is considered less relevant as a starting point when deciding on the existence of an inventive step.

2.19 It is the merit of the claimed invention to have envisaged modifying the shape of the second resonating element of the dipole antenna located opposite to the driving circuit so as to privilege the first resonating circuit, the latter being free from any interference with the driving circuit.

2.20 In conclusion, the subject-matter of claim 1 does not result in an obvious manner from the prior art. It does, therefore, involve an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent on the basis of claims 1 to 8 of the sole request, filed during oral proceedings before the board, and the description to be adapted as necessary.

The Registrar: The Chairman:

R. Schumacher P. Scriven

Decision electronically authenticated