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Datasheet for the decision of 19 March 2015

Case Number: T 2294/10 - 3.4.01

Application Number: 08010594.3

Publication Number: 2045874

IPC: H01Q1/28, H01Q11/10

Language of the proceedings: EN

Title of invention:
RF receiving and transmitting apparatuses having a microstrip-slot log-periodic antenna

Applicant:
ALLIANT TECHSYSTEMS INC.

Headword:

Relevant legal provisions:
EPC 1973 Art. 56
EPC Art. 123(2)
RPBA Art. 13(1)

Keyword:
- inventive step (no; main request and auxiliary request I)
- added subject-matter (yes; auxiliary requests II to IV)
- late-filed requests (not admitted; auxiliary requests V and VI)

Decisions cited:

Catchword:

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Case Number: T 2294/10 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 19 March 2015

Appellant: (Applicant)	ALLIANT TECHSYSTEMS INC. 7480 Flying Cloud Drive MN05-1W Minneapolis, MN 55344 (US)
Representative:	Lang, Johannes Bardehle Pagenberg Partnerschaft mbB Patentanwälte, Rechtsanwälte Prinzregentenplatz 7 81675 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 20 July 2010 refusing European patent application No. 08010594.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Assi
Members:	H. Wolfrum
	J. Geschwind

Summary of Facts and Submissions

I. The application was refused by a decision of the examining division dispatched on 20 July 2010, for the reason of lack of inventive step (Article 56 EPC 1973) of the subject-matter of a main request then on file. A late-filed auxiliary request was not admitted into the proceedings under Rule 137(3) EPC because it was considered to lead to new objections regarding added subject-matter (Article 123(2) EPC) and not to overcome the objections as to lack of inventive step.

II. The applicant lodged an appeal against the decision and paid the prescribed fee on 22 September 2010. On 11 November 2010 a statement of grounds of appeal was filed. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of a respective set of claims according to a main request or one of four auxiliary requests, all filed with the statement setting out the grounds of appeal.

An auxiliary request for oral proceedings was filed.

III. On 27 November 2014 the appellant was summoned to oral proceedings.

In a communication annexed to the summons, the Board drew the appellant's attention to deficiencies concerning added subject-matter and lack of clarity for the requests on file and doubted that the claimed subject-matter, to the extent that it was understood and disclosed, involved an inventive step.

The Board made reference to the following documents :

D1 : EP-A-1 646 110;
D2 : US-B-6 703 975; and
D3 : US-A-4 336 543.

IV. In response, the appellant filed by letter of 18 February 2015 amended sets of claims according to a main request and four auxiliary requests.

V. Oral proceedings were held on 19 March 2015.

As regards the subject-matter of claim 1 of each of the main request and auxiliary request I filed by letter of 18 February 2015, the issue of inventive step was discussed, whereas for claim 1 of each of auxiliary requests II to IV filed by letter of 18 February 2015 the debate concerned problems as to added subject-matter and lack of clarity.

The appellant then filed a further set of claims according to auxiliary request V, and thereafter another set of claims according to auxiliary request VI.

For the Board's final decision, the appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the sets of claims according to a main request and auxiliary requests I to IV, as filed with the letter of 18 February 2015, or in the alternative on the basis of the sets of claims according to auxiliary requests V and VI, as filed during the oral proceedings.

The Board found none of the main request and auxiliary requests I to IV to be allowable and did not admit the late-filed auxiliary requests V and VI into the proceedings.

VI. Claim 1 of the **main request** reads as follows :

"*1. A radio frequency (RF) apparatus suitable to be disposed on at least one of a fuselage (1310) and a lifting surface (1360) of an air vehicle (1300), comprising:*

at least one of an RF transmitter and an RF receiver; and

an array of antenna pairs (1210,1350) operably coupled to the at least one of an RF transmitter and an RF receiver,

characterized in that

the array of antenna pairs (1210,1350) is conformally disposed on at least one of the fuselage (1310) and the lifting surface (1360),

wherein each antenna pair (500) of the array (1210,1350) comprises:

a first log-periodic antenna element (410) having a first phase center (415) oriented in a forward direction relative to the respective fuselage (1310) or lifting surface on which the array of antenna pairs is disposed and comprising a first slot log-periodic antenna portion (220) in proximity to a first microstrip log-periodic antenna portion (110), and a dielectric medium (120) interposed therebetween; and

a second log-periodic antenna element (420), proximate to the first log-periodic antenna element (410), having a second phase center (425) oriented in an aft direction relative to the respective fuselage (1310) or lifting surface on which the array of antenna patterns is disposed and comprising a second slot log-periodic antenna portion (220) in proximity to a second microstrip log-periodic antenna portion (110) and the dielectric medium (120) interposed therebetween,

wherein the slot log-periodic antenna portion has a perimeter that is oversized relative to the perimeter of the microstrip log-periodic [antenna] *portion by a width (311) in each of the first and the second log-periodic antenna elements.*"

Claims 2 to 4 are dependent claims.

Claim 1 of **auxiliary request I** differs from claim 1 of the main request in that in the first characterising feature the "*array of antenna pairs*" is specified to be an "*array of a plurality of antenna pairs*".

Claim 1 of **auxiliary request II** differs from claim 1 of the main request in that the first characterising feature reads "*the array of a plurality of antenna pairs (1210,1350) each having individual antenna elements of various scales is conformally disposed on at least one of the fuselage (1310) and the lifting surface (1360)*".

Claim 1 of **auxiliary request III** differs from claim 1 of the main request in that the first characterising feature reads "*the array of a plurality of antenna pairs (1210,1350) of various scales is conformally disposed on the fuselage (1310) in an annular structure to cooperatively function as a receiving or transmitting means and/or on the lifting surface (1360) for contour matching of the air vehicle skin*". Moreover, the "*dielectric medium (120)*" is specified to be "*flexible*".

Claim 1 of **auxiliary request IV** differs from claim 1 of the main request in that the first characterising feature reads "*the array of a plurality of antenna pairs (1210,1350) of various scales is conformally*

disposed on the fuselage (1310) in an annular structure to cooperatively function as a receiving or transmitting means for achieving a nearly full hemispheric coverage".

Claim 1 of **auxiliary request V** differs from claim 1 of auxiliary request III in that the term "*of various scales*" is deleted from the first characterizing feature.

Similarly, claim 1 of **auxiliary request VI** differs from claim 1 of auxiliary request IV in that the term "*of various scales*" is deleted from the first characterizing feature.

Reasons for the Decision

1. In the following reference is made to the provisions of the EPC 2000, which entered into force as of 13 December 2007, unless the former provisions of the EPC 1973 still apply to pending applications.

2. The appeal complies with the requirements of Articles 106 to 108 EPC and Rule 99 EPC and is, therefore, admissible.

3. Main request - inventive step

3.1 Uncontested by the appellant, document D1 constitutes a highly relevant piece of prior art. In fact, D1 is the publication of an application made by the present applicant, whereby the description given by paragraphs [0006] to [0029] of D1 is substantially identical to that given by paragraphs [0007] to [0027], [0034] and [0039] of the present application. Likewise, Figures 1

to 10 of D1 are identical to Figures 1 to 10 of the present application.

3.2 D1 (see in particular paragraph [0007] and Figures 1 to 4 with the corresponding description) discloses a radio frequency apparatus having pairs of first and second log-periodic antenna elements which are arranged proximate to each other and coupled to at least one of an RF transmitter and an RF receiver. In this context, the teaching of document D1 (paragraphs [0007], [0027] and [0028]) foresees "*Exemplary array embodiments of the present invention*", which "*typically include an array of at least a pair of substantially frequency-independent planar antenna array elements where the first member of the pair of antenna array elements has a phase center travel axis substantially opposite in direction to the phase center travel axis of the second member of the pair of antenna array elements*" and which "*may … afford an antenna array of forward and aft facing elements of equal or nearly equal performance*". As a matter of fact, the disclosure of "*an array of at least a pair of ... planar antenna array elements*" implies that the array can be constituted by a single pair or a plurality of pairs of antenna elements. Moreover, the teaching of D1 (paragraph [0022]) foresees that "*The substantially planar profile of the antenna array may exhibit some curvature and, whether flat or contoured, may be conformally mounted.*"

3.3 Therefore, the subject-matter of present claim 1 differs from a radio frequency (RF) apparatus as known from document D1 in essence only in that the surface on which the apparatus in the form of an "*array of antenna pairs*" is conformally disposed is "*at least one of the fuselage and the lifting surface of an air vehicle*" and the arrangement is such that the "*first log-periodic*

antenna element" has its "*phase center*" "*oriented in a forward direction relative to the ... fuselage*" and the "*second log-periodic antenna element*" has its "*phase center*" "*oriented in an aft direction relative to the ... fuselage*".

3.4 These differences do not concern the structure of the array of antenna pairs and its elements as such but rather relate to a placement of the known array at a particular location and in a certain orientation on an air vehicle.

The appellant submitted that the objective technical problem to be solved consisted in providing an antenna array which was "*easy to integrate in an air vehicle while delivering the optimal receiving and transmitting performance*" (see point II.3, first sentence of the grounds of appeal). However, on the basis of the established differences it is difficult to clearly identify a technical problem that the claimed subject-matter would solve. A manufacturer of the antenna apparatus according to document D1 rather faces the task to sell the product and thus to find suitable uses and interested customers. For the user of the antenna apparatus in turn, the claimed placement and orientations of the phase centers of the respective antenna elements would then be an element of demand to be met rather than an element of a solution to a technical problem.

3.5 At any rate, D1 already foresees an application of the RF apparatus in "*environmentally challenging environments such as for example those encountered in moisture laden atmosphere with high dynamic pressures experienced at supersonic velocities*" (paragraph [0021]) and a forward- and aft-orientation of the

elements of the antenna array (paragraph [0027]). These hints would, at least implicitly, induce the skilled reader to think of an application of the apparatus with an airplane or rocket. Anyway, each of documents D2 (see in particular Figure 4 and the corresponding description) and D3 (see Figure 5) would explicitly show such a use for which an RF apparatus is provided on the surface of the fuselage.

3.6 The appellant argued in essence that document D1 disclosed a certain structure of pairs of oppositely arranged log-periodic antenna elements. The term "*array*" was used in D1 (paragraph [0007]) in a rather fuzzy way and rather meant an "*antenna array of forward-oriented and aft-oriented elements*" (paragraph [0027]).

In distinction thereto, the present invention concerned an "*array of antenna pairs*", in the sense of a larger number of individual antenna pairs. Moreover, in an "*array*" according to the invention these antenna pairs were distributed over an extended area and arranged in a specific forward- and aft-looking manner on the fuselage or the lifting surface of an air vehicle, all antenna pairs operating in synchrony and achieving a high level of directivity. The present invention thus provided an RF apparatus with a new structure of improved electrical behaviour in a specifically advantageous arrangement conformal to the fuselage or a lifting surface of an air vehicle. The technical problem addressed by the invention was thus to be seen in the desire for an RF apparatus of high operating efficiency and performance.

None of these aspects was derivable from document D1.

Documents D2 and D3, on the other hand, concerned quite different antenna arrangements so that the skilled person would not have combined any of their teachings with that of document D1.
Document D2 concentrated on devising an antenna structure the elements of which possessed specific polarisations. Therefore, the antenna construction was constrained to arrangements which were different from the claimed array of antenna pairs the elements of which were oriented mutually opposite to each other. Moreover, not all of the antenna elements of the RF apparatus of document D2 were of the log-periodic type. Document D3 did not refer to log-periodic antenna structures at all, but instead concerned Yagi-type antenna elements. The antenna apparatus was constrained to a linear arrangement. Since it was bulky it could not be disposed conformally on the fuselage or lifting surface but had to be placed within a cavity and to be covered by a radome.

3.7 These arguments are not convincing.

The appellant's allegations ignore the fact that the description of Figures 1 to 10 in document D1, by which the structure of antenna elements and antenna pairs as well as that of arrays thereof is explained, is identical to the respective description of the present application. Notably, the respective wording of the definition of an "*array of antenna pairs*" in paragraph [0007] of document D1 is identical to the corresponding definition in paragraph [0008] of the present application. Thus, contrary to the appellant's assertion, document D1 discloses in fact an array of antenna pairs which is identical in structure to the array according to claim 1 on file.

Moreover, the problem allegedly solved by the claimed subject-matter is not the objective problem which can be derived from the actually established differences. As explained in point 3.4 above, the claimed subject-matter addresses essentially the task to find a suitable use for the RF apparatus known from document D1.

Looking for a suitable application of the RF apparatus of document D1, it does not matter that the respective antenna structures shown in documents D2 and D3 are not identical to that of document D1. What matters instead is that each of documents D2 and D3 provides evidence for the fact that it was well-established practice to dispose arrays of RF antenna elements on the fuselage and/or lifting surfaces of air vehicles. Moreover, contrary to the appellant's assertion, there are no combinatory or surprising effects associated with the claimed forward- or aft-looking orientation of the antenna elements of the arrays on the fuselage. The claimed arrangement rather constitutes the result of an input specification according to a given demand concerning the direction of the field of view to be covered by an RF apparatus of document D1, e.g. when disposed on an aircraft.

3.8 It follows from the above considerations that the subject-matter of claim 1 of the main request does not involve an inventive step, contrary to the requirements of Articles 52(1) and 56 EPC 1973.

The main request is therefore not allowable.

4. Auxiliary request I - inventive step

Claim 1 of auxiliary request 1 differs from claim 1 of the main request only by the amendment that the "*array of antenna pairs*" is expressly defined as an "*array of a plurality of antenna pairs*".

Given the fact that, as noted in point 3.7 above, the definition of the "*array*" in the application description is identical in wording to that given in document D1, the amendment does not further distinguish the claimed subject-matter from the teaching of document D1.

Therefore, the subject-matter of claim 1 of auxiliary request I does not involve an inventive step for the same reasons as given for the main request.

Consequently, auxiliary request I is also not allowable.

5. Auxiliary requests II to IV - basis of disclosure

5.1 Claim 1 of auxiliary request II further specifies the plurality of antenna pairs by the phrase "*each having individual antenna elements of various scales*" and claim 1 of each of auxiliary requests III and IV refers to "*antenna pairs ... of various scales*".

5.2 According to the appellant, these amendments were disclosed in paragraphs [0033] and [0036] of the application as originally filed. The skilled person readily understood that scaling the size of the antenna pairs allowed covering a plurality of frequency bands.

5.3 However, it will become apparent from the following observations that the amendments in question introduce

technical information which has no basis of disclosure in the application documents as originally filed.

5.3.1 In fact, the term "*various scales*" is mentioned only in two passages of the original description, *i.e.* in paragraph [0033] : "*While cylindrical or round embodiments of an array of antenna elements or pairs of elements have been shown in the example of an air vehicle fuselage, these elements, of one or various scales, may be applied to oval, rectangular and multisided structures, such as hexagons and octagons. Antenna elements, of one or various scales, may also be embedded into surfaces of wings along an axis rather than or in addition to an array disposed circumferentially about the fuselage*" and in paragraph [0036] : "*Being readily scalable, the various scaled embodiments of the exemplary antenna may be applied to a variety of structures due in part to their functioning at the various scaled sizes.*"

5.3.2 Notably, the cited passages do not provide a basis of disclosure for "*antenna pairs ... of various scales*" [emphasis added] (as presently claimed by claim 1 of auxiliary requests III and IV and implied according to a potential interpretation of claim 1 of auxiliary request II), neither as such nor in the context of other features comprised in claim 1 of each one of auxiliary requests II to IV. Instead, the cited passages refer to "*antenna elements*" of "*various scales*".

Moreover, there is no disclosure of an "*array of a plurality of antenna pairs ... of various scales*", *i.e.* of an array operating in various frequency bands, in the claimed combination with a single RF transmitter and RF receiver.

Still further, the passage cited from paragraph [0033] of the original description does not divulge in an unambiguous manner the feature that antenna elements of various scales would be disposed on the fuselage of an air vehicle. Instead, the passage in question refers to elements "*of one or various scales*" when "*applied to oval, rectangular and multisided structures, such as hexagons and octagons*".

Finally, as regards an arrangement of antenna elements on a lifting surface, the cited passage continues to state that "*Antenna elements, of one or various scales, may also be embedded into surfaces of wings …*". Although in that case the antenna elements may be arranged "*along an axis*" there is no disclosure that the elements would be oriented in a forward direction and an aft direction, respectively, relative to the fuselage, as claimed by the auxiliary requests under consideration.

5.3.3 As far as auxiliary request II is concerned, the specific wording of the amendment can for instance be interpreted as meaning that the individual antenna elements of a given pair have a different scale. Such a structure has, however, no basis of disclosure in the original application documents.

5.3.4 With regard in particular to auxiliary requests III and IV, it is noted that the original application documents do not disclose an array of antenna pairs "*of various scales*" disposed "*in an annular structure*".

An annular arrangement of antenna pairs around the fuselage of an aircraft is disclosed by Figures 12 and 13 of the application. However, according to this piece

of disclosure, the antenna pairs are all of the same size.

Besides, an annular array of antenna pairs of various scales would not allow achieving hemispheric coverage for any given frequency band so that in particular claim 1 of auxiliary request IV does not define a technically meaningful arrangement of antenna elements.

5.3.5 Likewise, the appellant failed to provide any evidence for a basis of disclosure of "*antenna pairs of various scales*" being disposed on the lifting surface "*for contour matching*", as it is claimed by claim 1 of auxiliary request III.

5.4 In summary, none of auxiliary requests II, III and IV complies with the requirement of Article 123(2) EPC.

Auxiliary requests II, III and IV are therefore not allowable, either.

6. Auxiliary requests V and VI - admissibility

6.1 Auxiliary requests V and VI were filed in the oral proceedings of 19 March 2015 one after the other in piecemeal fashion when the Board had found unallowable the auxiliary requests which had been filed in preparation of the oral proceedings.

6.2 Auxiliary requests V and VI are based on auxiliary requests III and IV, respectively, from both of which the amendment "*of various scales*" has been deleted. In addition, from claim 1 of auxiliary request VI the alternative "*and/or the lifting surface (1360) for contour matching of the air vehicle skin*" has been deleted.

6.3 In the appellant's view, auxiliary requests V and VI should be admitted into the proceedings because the amendments which were made constituted a reaction to a fresh objection of added subject-matter raised by the Board in the oral proceedings.

Moreover, the amendments could not come as a surprise to the Board since the claimed subject-matter resembled that of auxiliary requests III and IV and thus could be easily dealt with by the Board without adjournment of the oral proceedings.

Furthermore, the claimed subject-matter was novel and inventive with respect to the available prior art because none of documents D1 to D3 showed an array of a plurality of antenna pairs disposed in an annular structure on the fuselage of an aircraft.

6.4 The appellant's allegation that the objection as to added subject-matter concerning the feature "*antenna pairs of various scales*" was raised for the first time in the oral proceedings before the Board is unfounded. In fact, the Board had already pointed to a problem of disclosure concerning the feature "*antenna pairs of various scales*" in its communication of 27 November 2014 annexed to the summons to oral proceedings (see point 3.2). Nevertheless, the appellant had decided to submit by letter of 18 February 2015 new requests in which the feature in question was still comprised.

More generally, the Board refers to a well-established principle of the case law of the boards of appeal according to which a request that is filed at an extremely late stage of the appeal proceedings, such as towards the end of oral proceedings when its filing is

subsequent to an extensive debate of a number of earlier filed requests, is - as a rule - not admitted into the proceedings, unless the request overcomes all the objections raised and is thus clearly allowable.

This is not the case for auxiliary requests V and VI under consideration. As a matter of fact, judged on a *prima facie* basis, it is immediately apparent that claim 1 of each of auxiliary requests V and VI lacks an inventive step essentially for the same reasons as set out above for the auxiliary request I. Contrary to the appellant's argumentation the specific arrangement of antenna elements "*in an annular structure*" is already known from document D2 (see in particular column 5, lines 38 to 56), which shows in Figure 4 an array of eight log-periodic antenna elements equidistantly distributed around the fuselage of an aircraft.

Moreover, having regard to auxiliary request VI, a problem of lack of clarity arises from the fact that claim 1 refers in its preamble to an RF apparatus suitable to be disposed on at least one of a fuselage and a lifting surface of an air vehicle, whereas according to the characterising portion the array of antenna pairs is exclusively disposed on the fuselage.

6.5 In summary, it is noted that auxiliary requests V and VI filed in the oral proceedings of 19 March 2015 do not overcome previously raised objections as to lack of inventive step of the claimed subject-matter and, as far as auxiliary request VI is concerned, even give rise to a new clarity objection.

Consequently, pursuant to Article 13(1) RPBA, auxiliary requests V and VI are not admitted into the proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

R. Schumacher G. Assi

Decision electronically authenticated