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Datasheet for the decision of 18 October 2010

Case Number: T 0588/08 - 3.5.03

Application Number: 02786142.6

Publication Number: 1458108

IPC: H04B 1/18

Language of the proceedings: EN

Title of invention:
Dual resonance antenna apparatus

Applicant:
MURATA MANUFACTURING CO., LTD.

Headword:
Dual resonance antenna apparatus/MURATA

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step - yes (after amendment)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0588/08 - 3.5.03

D E C I S I O N
of the Technical Board of Appeal 3.5.03
of 18 October 2010

Appellant: MURATA MANUFACTURING CO., LTD.
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Decision under appeal: **Decision of the examining division of the European Patent Office posted 4 December 2007 refusing European patent application No. 02786142.6 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: A. S. Clelland
Members: F. van der Voort
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division to refuse European patent application No. 02786142.6 (publication No. EP 1458108 A) which was originally filed as international application No. PCT/JP2002/013260.

II. The reason given for the refusal was that the subject-matter of claim 1 then on file lacked an inventive step having regard to the disclosure of D4, i.e. GB 816 463 (Articles 52(1) and 56 EPC).

III. The following documents were referred to in the decision under appeal and/or cited in the international search report or the supplementary European search report for the application in suit:

D1: EP 0 126 340 A;
D2: Patent Abstracts of Japan, vol. 2000, no. 24, 11 May 2001 & JP 2001 185937 A;
D3: WO 00/19629 A;
D4: GB 816 463;
D5: Patent Abstracts of Japan, vol. 2000, no. 24, 11 May 2001 & JP 2001 185936 A;
D6: JP 59 097232 A;
D7: US 5 867 127 A;
D8: JP 2001-36328 A;
D9: JP 1-151829 A; and
D10: JP 2001-185949 A.

IV. With the statement of grounds of appeal the appellant requested that the decision be set aside and a patent be granted on the basis of claims of a main request or,

alternatively, on the basis of claims of an auxiliary request, both requests as filed with the statement of grounds of appeal. Oral proceedings were conditionally requested.

V. The board issued a communication in which it raised objections under Articles 84 and 123(2) EPC in respect of the claims of both main and auxiliary requests and raised an objection under Rules 42(1)(c) and 48(1)(c) EPC.

VI. With a letter dated 4 September 2010 in response to the board's communication, the appellant filed, by way of replacement, amended claims of a main and an auxiliary request together with amended pages of description. The appellant implicitly requested that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

description:

- pages 1 to 4, 8 to 12, 17 and 20 to 23 as filed; and
- pages 5 to 7, 13 to 16, 18 and 19 as filed with the letter dated 4 September 2010;

drawings:

- Figs 1 to 13 as filed; and

claims:

- either claims 1 and 2 of the main request or claims 1 and 2 of the auxiliary request, both sets of claims as filed with the letter dated 4 September 2010.

VII. In the letter dated 17 September 2010 the appellant informed the board that the request to schedule a date for oral proceedings was withdrawn should the board remit the case to the examining division.

VIII. Claim 1 of the main request reads as follows:

"A multi-resonant antenna device (21; 51) comprising;
an antenna element (22; 52),
a feeding point (24; 54) connected to a power supply circuit (23),
an inductance element (27) connected between the feeding point (24) and ground, and
an LC resonance circuit (31; 55, 60) connected between the antenna element (22; 52) and the feeding point (24; 54) and making the antenna element (22; 52) resonate in a plurality of frequency bands,
wherein the LC resonance circuit (31; 55, 60) comprises:

a first circuit branch composed of a capacitance element (28) and an inductance element (25) in series between the antenna element (22) and the feeding point (24) or composed of a capacitance element (C2), an inductance element (L2) and a diode switching circuit (60) in series between the antenna element (52) and the feeding point (54), and

a second circuit branch in parallel to the first circuit branch and composed of a T-type circuit, said T-type circuit composed of two capacitance elements (29, 30; 57, 58) connected in series between the antenna element (22; 52) and the feeding point (24; 54) and an inductance element (26: 56) connected between a connection point between the two capacitance elements (29, 30; 57, 58) and ground,

wherein the LC resonance circuit (31; 55, 60) is configured such that a first resonance appears in a first frequency band and a second resonance appears in a second frequency band and such that the impedance of the resonance circuit (31; 55, 60) is prevented from becoming infinite in a certain frequency band between the first and second frequency bands."

Claim 2 of the main request reads as follows:

"The multi-resonant antenna device as claimed in claim 1, comprising the diode switching circuit (60), wherein the antenna element is made to resonate in a different frequency band when the diode switching circuit (60) is turned off."

In view of the board's conclusion set out below in respect of the main request, it is not necessary to give details of the auxiliary request.

Reasons for the Decision

1. *Articles 84 and 123(2) EPC*

1.1 Claim 1 of the main request is based on claims 1 and 2, page 18, line 23, to page 19, line 4, and Figs 1, 3 and 8 of the application as filed, whilst claim 2 is additionally based on claim 2 and page 22, lines 17 to 21, of the application as filed.

1.2 The board notes that in claim 1, last paragraph, even though the term "certain" does not have a precise meaning, it does not give rise to a clarity objection,

since the feature in question, i.e. "in a certain frequency band between the first and second frequency bands" is clear in the context of a multi-resonant antenna device in that it may be interpreted broadly. Further, in connection with a "feeding point" of the multi-resonant antenna device, the board interprets the "power supply circuit" referred to in claim 1, line 3, as a source of RF power.

1.3 The board is therefore satisfied that the claims of the main request do not give rise to objection under Article 84 EPC and/or Article 123(2) EPC.

2. *Articles 52(1) and 56 EPC*

2.1 As stated in the description of the application in suit, the object of the invention is to provide a multi-resonant antenna device having a transmission frequency characteristic which avoids a notch portion, i.e. a drop in gain, between two resonance frequencies of the antenna device, as present in the transmission frequency characteristic of the prior art multi-resonant antenna devices referred to in the application in suit, see the application as published, paragraphs [0002] and [0009] to [0016], and Figs 10 and 11.

2.2 The examining division considered D4 as representing the closest prior art and formulated the technical problem as that of "impedance matching the output of a power amplifier to an antenna while suppressing unwanted frequencies (e.g. harmonics)".

However, D4 relates to a band stop filter, in which the filter is based on a conventional all-pass constant-

resistance delay equaliser as used in a television cable system, to which a series-resonant device is added in order to introduce a narrow stop band (D4, page 1, lines 1 to 29 and 58 to 70, page 3, lines 101 to 113, and Figs 5 to 7). It does not disclose an antenna and/or a power amplifier. Hence, the above formulation of the technical problem contains pointers to the claimed solution and is based on hindsight knowledge of the invention. Following the well-established case law of the Boards of Appeal, this is not permitted. The examining division's subsequent conclusion that "Since matching the output impedance of a power amplifier to the impedance of an antenna by a passive LC-network at operation frequency bands is commonplace, claim 1 is far away from defining inventive subject-matter over the disclosure of D4" cannot therefore be followed.

The examining division also argued that, based on the above-mentioned formulation of the technical problem, "it is evident to the skilled person that the filter of D4 is readily applicable to solve this problem", but did not give any reasons.

Even if for the sake of argument the examining division's formulation of the problem were considered as well-known to a person skilled in the art of antennas on the basis of his/her common general knowledge at the priority date, the board sees no reason, in the absence in D4 of any disclosure of, or reference to, impedance matching of antennas to power amplifiers, why the skilled person, when faced with this problem, would consider D4.

The board therefore concludes that D4 cannot reasonably serve as a document which represents the closest prior art and that, if the skilled person were faced with the above technical problem, he/she would not consider it.

2.3 Of all prior art documents available to the board, D2 is considered as representing the closest prior art, since it also relates to a dual-resonance antenna device for transmission in two frequency bands and since it has many features in common with the claimed antenna device, in particular an antenna, a power supply circuit, an LC resonance circuit, and an impedance matching circuit.

2.4 More specifically, D2 discloses, using the language of claim 1 of the main request, a multi-resonant antenna device including an antenna element 10 (see Fig. 1), a feeding point 14 connected to a source of RF power (i.e. a power supply circuit), an inductance element 16 connected between the antenna element 10 and ground via a capacitance element and a further inductance element, and an LC resonance circuit which is connected between the antenna element and the feeding point and which makes the antenna element resonant in a plurality of frequency bands. The LC resonance circuit includes a first circuit branch composed of a T-type filter circuit 12 which is composed of two inductance elements in series between the antenna element and the feeding point and a capacitance element connected between a connection point between the two inductance elements and ground, and a second circuit branch connected in parallel to the first circuit branch via the inductance element 16 and composed of a T-type filter circuit 18 composed of two capacitance elements connected in

series between the antenna element via the inductance element 16 and the feeding point and an inductance element connected between a connection point between the two capacitance elements and ground. The LC resonance circuit is configured such that a first resonance appears in a first frequency band f1 and a second resonance appears in a second frequency band f2 (see the abstract).

2.5 The subject-matter of claim 1 of the main request differs from the antenna device disclosed in D2 at least in that according to claim 1:

i) the first circuit branch of the LC resonance circuit is composed of either a capacitance element and an inductance element connected in series between the antenna element and the feeding point or a capacitance element, an inductance element, and a diode switching circuit connected in series between the antenna element and the feeding point; and

ii) an inductance element is connected between the feeding point and ground.

2.6 Since D2 consistently teaches the use of two T-type filter circuits 12, 18 without an inductance element being connected between the feeding point and ground, cf. Figs 1 and 5, it does not suggest the inclusion of either of the above features i) and ii) in the antenna device of Fig. 1.

2.7 D4 relates to a band stop filter (see point 2.2). The board sees no reason why a skilled person, when

starting out from D2, would consider D4. In any case, if a person skilled in the art were to apply the teaching of D4 to the antenna device of D2, he/she would cascade the band stop filter of D4 and the antenna device of D2, in particular by inserting the band stop filter at the feeding point, rather than modify the existing filters 12, 16, 18, since these filters define the two antenna frequency bands f1 and f2. Further, the cut-off frequencies, i.e. resonance frequencies, of the band stop filter would be selected to be at frequencies other than the resonance frequencies of the LC resonance circuit of D2 in order to avoid an undesirable attenuation in the antenna frequency bands f1 and f2.

2.8 Documents D1, D3, D6, D8 and D9 do not disclose the above distinguishing features i) and ii):

D1 discloses an input circuit for an UHF/VHF receiver antenna 5 (Fig. 1), which includes two separate input paths 2, 3 for UHF and VHF reception, respectively, which are alternately connectable to a common output.

D3 discloses a GSM/DCS dual-mode wireless station 50 (see Fig. 3) for signals in either of two communication bands. The station includes a receiver 52 which includes a DCS filter 58 and a GSM filter 54, which may both be surface acoustic wave (SAW) filters and which are connected to an antenna 64, via an antenna interface 66, and a common amplifier 56 which includes matching circuits 72, 74 (see Fig. 4). No details of the transmitting side of the station are given, except that the transmitter is connected to an antenna

interface 66 via a switch (see Fig. 3). The antenna interface is not further described either.

D6 discloses a level adjuster 2 (see Fig. 1) which is connected between an antenna and a television receiver and which includes a first bandpass filter for receiving the VHF low band and a second bandpass filter for receiving the VHF high band.

D8 discloses an antenna device 6 (see Fig. 1) which is connected between a receiving antenna 1 and a coaxial cable 7 and which consists of an FM band pass circuit 20 including a capacitor 25 and an AM band pass circuit 30 including a transformer 3, in which the band pass circuits are connected in parallel.

D9 discloses a circuit 3, 12 (see Fig. 1) connected between a receiving antenna 1 and a television tuner 2. The circuit includes a T-type high pass filter 12 which is composed of two capacitors 13, 14 and a coil 15 and which is bridged by an extension coil 3.

It follows that D1, D6, D8 and D9 are each concerned with a receiver and, hence, do not disclose a feeding point within the meaning of claim 1, cf. features i) and ii), point 2.5. Further, as noted above, since D3 does not give details of the transmitter and the antenna interface, it does not disclose these features either.

D5 discloses a dual-mode antenna 10 (see Fig. 1) connected to a pi-matching circuit 12 consisting of an inductance element L1, which is connected between a feeding point 14 and the antenna, and two capacitance

elements C1, C2 which are connected between the feeding point and ground and between the antenna and ground, respectively. In a second embodiment (see Fig. 6), further individual elements are connected, however, only between ground and either the feeding point or the antenna. Hence, D5 does not disclose feature i).

D7 relates to a radio telephone which includes a matching circuit 30 (see Figs 2 and 10) for impedance matching a radio circuit 28 and a retractable antenna 42 in both a retracted and an extended position of the antenna (see the abstract). The radio circuit 28 can be a "duplexer" (i.e. a transceiver) and operates in one frequency band, preferably at frequencies about 900 MHz (see col. 4, lines 20 to 23, and col. 11, lines 16 to 22). In the embodiment of Fig. 10, a bias voltage V_B is applied to a diode 102 via a resistor 100. Further, a capacitor 107 and an inductor 104 are connected in series between the antenna 42 and a feeding point connected to the radio circuit 28. Capacitor 107 and inductor 104 are, however, not part of an LC resonance circuit, since capacitor 107 merely serves as a blocking capacitor for blocking direct current through the inductor 104 (col. 10, lines 11 to 15), whilst the inductance of the inductor 104 is chosen in order to provide, together with the parasitic capacitance of the reverse-biased diode 102 connected in parallel, a high impedance path relative to the path through the matching circuit 30 (col. 10, lines 48 to 57). Hence, D7 does not disclose feature i). Further, since in the antenna device of D2 (see point 2.4) the antenna 10 is already matched to the RF source or power supply circuit at the frequency bands f1 and f2, the board sees no reason why a person

skilled in the art would apply a further matching circuit, i.e. the matching circuit 30 of D7, to the antenna device of D2.

D10 discloses an antenna device for sending and receiving in two frequency bands. An antenna is composed of a whip antenna 10 and a helical antenna 12 (see Fig. 1). The whip antenna 10 is connected to a feeding point 18 of a power supply circuit via two inductors of a matching circuit 14 and a filter circuit 20. The helical antenna 12 is connected to the feeding point via a T-type filter circuit 20 which includes two capacitors connected in series. Hence, D10 does not disclose feature i).

2.9 The board therefore concludes that, starting out from D2, a person skilled in the art would not consider D4 and would not, if he/she were to consider any one of D1, D3 to D10 or any combination thereof, be motivated to include the above-mentioned distinguishing features i) and ii) in the multi-resonant antenna device as disclosed in D2.

2.10 Further, the board sees no reason to assume that these distinguishing features and their application to the antenna device of D2 were part of the common general knowledge of the person skilled in the art of antenna devices at the priority date.

2.11 If for the sake of argument the multi-resonant antenna device shown in Fig. 10 of the application in suit and said to be known were considered as representing the closest prior art, the subject-matter of claim 1 of the main request would differ from this prior art device in

that the claimed device further includes an inductance element and a capacitance element, which, together with capacitor 8 of Fig. 10, form the T-type circuit of the second circuit branch of the LC resonance circuit as specified in claim 1. However, since none of the prior art documents available to the board discloses or suggests replacing a single capacitor by a T-type filter or adding an inductance element and a capacitance element to the capacitor such as to form a T-type circuit of a second circuit branch of an LC resonance circuit, a person skilled in the art, starting out from the multi-resonant antenna device shown in Fig. 10 would not, on considering these documents, be motivated to modify the device accordingly. Hence, the skilled person would not arrive at the multi-resonant antenna device as claimed without the exercise of inventive skill. The same conclusion is arrived at when starting out from the dual-mode antenna device for transmission as disclosed in D5, see point 2.8 above.

2.12 The board therefore concludes that the subject-matter of claim 1 and, since it is a dependent claim, of claim 2 of the main request involves an inventive step having regard to the prior art available to the board and taking into account the common general knowledge of a person skilled in the art. The board notes that it is not aware of any other, more pertinent prior art documents.

3. *Description and drawings*

3.1 The description does not comply with the requirements of Rule 42(1)(b) EPC in that it does not indicate the background art, in particular as disclosed in D2, see points 2.3 and 2.4 above, which can be regarded as useful to understand the invention.

3.2 Further, the description is not adapted to the claims on file. In particular, the passages at page 17, line 16, to page 18, line 4, and page 22, line 22, to page 23, line 6, require amendment in view of the fact that neither the circuit as shown in Fig. 5, which includes the T-type LC circuit 50 and which is erroneously referred to as a "second embodiment", nor the modified multi-resonant antenna device circuit referred to at page 17, line 19, to page 18, line 4, falls within the scope of the claims (Rules 42(1)(c) and 48(1)(c) EPC).

4. The decision under appeal is therefore to be set aside and the case is to be remitted for further prosecution.

5. In view of the foregoing, it has not proved necessary to consider the auxiliary request.

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 for further prosecution on the basis of claims 1 and 2 of the main request.

The Registrar: The Chairman:

D. Magliano A. S. Clelland