Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 6 March 2014

Case Number: T 0259/10 - 3.5.04

Application Number: 05255191.8

Publication Number: 1631076

IPC: H04N5/44

Language of the proceedings: EN

Title of invention:
Method of reducing channel switching delay in digital broadcast receiver and digital broadcast receiver using the same

Applicant:
Samsung Electronics Co., Ltd.

Headword:

Relevant legal provisions:
EPC 1973 Art. 56

Keyword:
Inventive step - (no)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 0259/10 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 6 March 2014

Appellant: (Applicant)	Samsung Electronics Co., Ltd. 129, Samsung-ro Yeongtong-gu Suwon-si, Gyeonggi-do, 443-742 (KR)
Representative:	Instone, Terry Appleyard Lees 15 Clare Road Halifax HX1 2HY (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 22 September 2009 refusing European patent application No. 05255191.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: F. Edlinger
Members: M. Paci
B. Müller

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division refusing European patent application No. 05255191.8 published as EP 1631076 A2.

II. The documents cited in the decision under appeal included the following:

D1: US 6490001 B1 and
D3: US 5570136 A.

III. The application was refused on the grounds that the subject-matter of each of the claims according to the appellant's main or auxiliary request did not involve an inventive step (Article 56 EPC) in view of D1 and common general knowledge (complemented for claim 4 by D3 as evidence for the use of a SAW filter in the same context).

IV. With the statement of grounds of appeal the appellant (applicant) filed claims according to a main request and first and second auxiliary requests. The claims according to the main and first auxiliary requests were identical to those considered in the decision under appeal.

V. In a communication under Article 15(1) RPBA annexed to the summons to oral proceedings the board expressed the preliminary opinion that the subject-matter of the claims of each request did not involve an inventive step when starting from D1.

VI. In a letter of reply dated 6 February 2014, the appellant filed amended claims according to a main

request and an auxiliary request, replacing all claims previously on file.

VII. On 6 March 2014, the board held oral proceedings, at the end of which it gave its decision orally.

VIII. The appellant's final requests were that the decision under appeal be set aside and that a patent be granted on the basis of the claims of either the main request or the auxiliary request, both filed with letter of 6 February 2014.

IX. Claim 1 according to the appellant's **main request** reads as follows:

"A digital broadcast receiver, comprising:

a signal reception unit (10), which is operable to receive a broadcast signal and to convert the received broadcast signal into an intermediate frequency (IF) signal;

a digital demodulation unit (20), which is operable to retrieve a transport stream from the IF signal;

a demultiplexing unit (30), which is operable to extract a video signal from the transport stream by parsing the transport stream;

a video decoder (40), which is operable to retrieve a video image from the video signal by decoding the video signal; and which comprises a frame reader (42) arranged to generate an intra frame notification signal upon input of a first intra frame to the frame reader (42) after the digital broadcast receiver is switched to a new channel; and

a central processing unit (90), which controls the digital demodulation unit (20) to perform demodulation of a new channel to be switched and transmits a channel

switch notification signal to a first switch controller (16) and a second switch controller (51);

wherein the first switch controller (16) is arranged to control a first output switch (15) so that an output signal of the signal reception unit (10) is prevented from being input to the digital demodulation unit (20) when the channel switch notification signal is received, and is arranged to control the first output switch (15) so that the output signal of the signal reception unit (10) is input to the digital demodulation unit (20) when a locked state notification signal is received from a phase locked loop (PLL) circuit (14); and

wherein the second switch controller (51) is arranged to control a second output switch (52) so that a background image is output when the channel switch notification signal is received, and is arranged to control the second output switch (52) so that the video image is output when the intra frame notification signal is received."

X. Claim 1 according to the appellant's **auxiliary request** reads as follows:

"A digital broadcast receiver, comprising:

a signal reception unit (10), which is operable to receive a broadcast signal and to convert the received broadcast signal into an intermediate frequency (IF) signal;

a digital demodulation unit (20), which is operable to retrieve a transport stream from the IF signal;

a demultiplexing unit (30), which is operable to extract a video signal from the transport stream by parsing the transport stream;

a video decoder (40), which is operable to retrieve a video image from the video signal by decoding the video signal; and

an output selection unit (50), operable to select between

a) outputting a background image pre-stored in the receiver and

b) preventing the background image from being output and outputting the resulting decoded video image after receiving an intra-frame notification signal from the video decoder (40) and decoding a first intra frame of the video signal input to the video decoder (40) after the digital broadcast receiver (100) is switched to a new channel;

characterized in that:

the signal reception unit (10) comprises:

a tuner (12), which is operable to convert the received broadcast signal into an IF signal;

a surface acoustic wave (SAW) filter (13), which is operable to remove signals of channels adjacent to the channel of the IF signal and noise signals; and

a phase locked loop (PLL) circuit (14), which is operable to control a signal output from the SAW filter (13) to enter a locked state and to transmit a locked state notification signal to a first switch controller (16) when the output signal of the SAW filter (13) enters the locked state;

wherein the first switch controller (16) is operable to control a first output switch (15), operable to be turned on and off by the first switch controller (16), so that an output signal of the signal reception unit (10) is prevented from being input to the digital demodulation unit (20) when the digital broadcast receiver (100) is switched to the new

channel, and to control the first output switch (15) so that the output signal of the signal reception unit (10) is input to the digital demodulation unit (20) when the locked state notification signal is received from the PLL circuit (14); and

the video decoder (40) comprises a frame reader (42) arranged to transmit an intra frame notification signal to the output selection unit (5) upon input of a first intra frame to the frame reader (42) after the digital broadcast receiver (100) is switched to a new channel; and

the output selection unit (50) comprises:

a second output switch (52); and

a second switch controller (51), which is operable to control the second output switch (52) so that the background image is output when the digital broadcast receiver (100) is switched to the new channel and to control the second output switch (52) so that the video image is output when the intra frame notification signal is received."

XI. The examining division's reasoning for refusing the requests then on file, in as far as it remains relevant for the present decision, can be summarised as follows:

Main request - independent claim 1

D1 represents the closest prior art.

The subject-matter of claim 1 of the main request differs from the digital broadcast receiver of D1 solely by the point in time at which the receiver stops outputting the pre-stored background image and, instead, outputs the decoded video image of the new channel. In claim 1 (then on file), this point in time

is "after sensing and decoding a first intra frame of the video signal input to the video decoder (40)".

The objective technical problem is to reduce the waiting time after a channel switch.

It was well-known in the art that an (MPEG) video decoder decodes packet headers in order to find out the type of a packet. Therefore, a packet containing an intra frame is implicitly sensed in every decoder. To the skilled person, it would have been obvious to start decoding and displaying the program of the new channel after the first intra frame was sensed.

Hence, the subject-matter of claim 1 does not involve an inventive step in view of D1 and common general knowledge.

Main request - dependent claim 4

The additional features of claim 4 which are not known from D1 solve the following partial problems:
- allowing tuning to a channel in a digital broadcast receiver (solved by a tuner, a surface acoustic wave (SAW) filter and a phase-locked loop (PLL) circuit) and
- after a channel switch, starting demodulation as soon as possible after the PLL circuit has reached a locked state (solved by forwarding the output of the PLL circuit to the digital demodulation unit as soon as a locked-state notification signal is received).

The use of SAW filters and PLL circuits was already well-known in digital broadcast receivers, as evidenced by D3, and it would have been obvious for the skilled

person to observe the state of the PLL circuit in order to find out when the locked state had been reached.

Hence the subject-matter of dependent claim 4 does not involve an inventive step in view of D1 and common general knowledge as evidenced in D3.

Auxiliary request

Claim 1 according to the auxiliary request only replaces the word "sensing" by "receiving an intra-frame notification signal from the video decoder (40)". It is merely a clarification which adds nothing inventive.

Hence the subject-matter of claims 1 and 4 of the auxiliary request lacks an inventive step for the same reasons as for the main request.

XII. The appellant's arguments regarding claim 1 according to its final requests can be summarised as follows:

Main request

Claim 1 of the main request has been amended to include specific features, such as a locked-state notification signal, an intra frame notification signal, a frame reader, first and second output switches and switch controllers operating in parallel in order to ensure the shortest possible delay time after a channel switch command is received, while also ensuring that the video signal of the new channel is "clean" (i.e. stable and substantially noise-free).

The objective technical problem compared to the closest prior art D1 should be seen as providing a further

reduction in delay time before a video signal is displayed after a channel switch.

In D1, this problem is addressed by calculating a "safe" wait time based on calculation and prior storage of channel types (analog or digital) and equaliser coefficients. However, the wait time in D1 is long because it must include a safety margin to cover the worst-case time lag between successive intra frames.

Moreover, D1 does not mention the additional risk that an unstable image may be displayed if the background image is replaced by the output of the video decoder before the output of the PLL circuit has reached a stable ("locked") state.

Finally, there is a synergistic effect between the features associated with the locked-state notification signal and those associated with the intra frame notification signal: the former ensure that a "clean" signal is output from the PLL circuit as early as possible, whilst the latter ensure that the clean video image is output from the video decoder as early as possible. They thus work together to minimise the waiting time after a channel switch.

Hence, starting from D1, the skilled person would not have arrived at the subject-matter of claim 1 without inventive step.

Auxiliary request

Claim 1 of the auxiliary request, although worded differently, includes all the features of claim 1 of the main request, as well as additional features such

as a SAW filter. The arguments for inventive step are the same as those for the main request.

Reasons for the Decision

1. The appeal is admissible.

Main request - inventive step

2. Closest prior art

The appellant did not dispute that the digital broadcast receiver of D1 (the second embodiment thereof, shown in figure 14) may represent the closest prior art.

The receiver of D1 comprises the following features of claim 1:

A digital broadcast receiver comprising *[see figure 14 and column 20, lines 25 to 29]:*

a signal reception unit, which is operable to receive a broadcast signal and to convert the received broadcast signal into an intermediate frequency (IF) signal *[see column 8, lines 50 to 54]*;

a digital demodulation unit, which is operable to retrieve a transport stream from the IF signal *[see column 8, lines 58 to 61]*;

a demultiplexing unit, which is operable to extract a video signal from the transport stream by parsing the transport stream *[see column 8, lines 58 to 61, and column 9, lines 37 to 40]*;

a video decoder, which is operable to retrieve a video image from the video signal by decoding the video signal *[see column 9, lines 40 to 46]*; and

a central processing unit, which controls the digital demodulation unit to perform demodulation of a new channel to be switched *[see column 11, lines 15 to 18]* and transmits a channel switch notification signal to a switch controller *[see figure 14, implicit switch controller inside control section 31 which controls switch 25 when a channel switch command is received]*;

wherein the switch controller is arranged to control an output switch so that a background image is output when the channel switch notification signal is received, and is arranged to control the output switch so that the video image is output *[see output switch 25 in figure 14 and column 20, lines 19 to 65]*.

3. Distinguishing features

The digital broadcast receiver of claim 1 thus differs from that of D1 by the following features:

(a) the central processing unit transmits the channel switch notification signal to a first switch controller arranged to control a first output switch so that an output signal of the signal reception unit is prevented from being input to the digital demodulation unit when the channel switch notification signal is received, and arranged to control the first output switch so that the output signal of the signal reception unit is input to the digital demodulation unit when a locked-state notification signal is received from a phase-locked loop (PLL) circuit;

(b) a frame reader arranged to generate an intra frame notification signal upon input of a first intra frame to the frame reader after the digital broadcast receiver is switched to a new channel; and

(c) the second output switch is controlled to output the video image when an intra frame notification signal is received.

4. Objective technical problem

The appellant submitted that the objective technical problem should be defined as to provide a further reduction in delay time before a video signal is displayed after a channel switch.

The board has no objection to that formulation of the objective technical problem.

5. Obviousness

5.1 In D1, the stated objective is to reduce "effectively and apparently" the waiting time after a switch to a digital channel (see column 1, lines 54 to 67, and column 2, lines 29 to 33). This objective is essentially the same as the one leading to the above objective technical problem.

In D1, the waiting time is reduced "effectively" by the following measures described with respect to the first embodiment, but which are also included in the second embodiment (see column 20, lines 6 to 14), of D1:
- storing in a non-volatile memory (33) equaliser coefficients of the digital tuner (21) for each digital channel, rather than computing them (see figure 3A; column 10, lines 22 to 44; and column 15, lines 53 to 65), and
- storing a "channel map" indicating for each channel whether it is analog or digital (see figure 3B and from column 10, line 61, to column 11, line 30).

The above measures aim at the same objective as the invention, but **not** by the means set out in distinguishing features (a) to (c) *supra*.

5.2 Re distinguishing features (b) and (c)

However, in D1, the waiting time is also reduced "apparently", i.e. subjectively from the user's point of view, by displaying a pre-stored "wait time display image" (i.e. a "background image") during the waiting time between when the change-channel command is received and when a video output signal of the new channel is obtained (see column 20, lines 19 to 51, and figures 14 and 15A to 15C). The background image is stored in memory 34 and transmitted to display 43 via switch 25 (see figure 14) which can switch between two positions: one passing the output of MPEG decoder 24 to display 43, the other one passing the background image stored in memory 34 to display 43. The position of switch 25 is controlled by central processing unit 31.

D1 states that switch 25 switches from the background image to the output of MPEG decoder 24 when a video output signal for the new channel is obtained (see column 20, lines 39 to 44), but does not explain how the receiver knows when the video output signal is obtained. The skilled person would thus have had to fill this information gap in order to implement the receiver of D1.

In D1, the video decoder 24 is a decoder according to the well-known MPEG standard. It is common general knowledge of the skilled person in the field of digital video encoding/decoding that in order to decode an MPEG video signal, the video decoder must start from a reference frame, i.e. from **an intra frame or I-frame,**

because the other frames, the so-called P-frames and B-frames, are all defined relative to an I-frame.

In view of this, the board considers that it would have been obvious to the skilled person to control switch 25 to switch from the background image to the output of MPEG decoder 24 at the earliest time after a first intra frame is sensed and decoded, in order to minimise the waiting time for the user. Since MPEG decoder 24 must detect the type (I, B or P) of each frame it receives, it must include a "frame reader" and the signal indicating that a first intra frame has just been received (i.e. an "intra frame notification signal") thus necessarily comes from this "frame reader".

For these reasons, the skilled person, when starting from D1, would have arrived at **distinguishing features (b) and (c)** of claim 1 without inventive step.

5.3 Re distinguishing feature (a)

The following facts about the digital broadcast receiver shown in figure 14 of D1 have not been disputed by the appellant:

- the digital tuner section 21 (corresponding to the "signal reception unit" in claim 1) comprises a PLL circuit which needs some time after a channel change command to reach a stable ("locked") state;
- before the PLL circuit has reached its locked state, the signal output by this circuit is meaningless or, at best, full of errors;
- there is no mention of a detection of when the locked state is reached by the PLL circuit; and

- there is no mention of any switch for controlling whether the output of digital tuner section 21 should be passed on to the next circuit.

The examining division held that, one way or another, the digital broadcast receiver **must know** that the PLL circuit has reached its locked state and thus that a clean signal is output from the PLL circuit which, after passing through the subsequent demodulation, demultiplexing and decoding stages, will produce video images of the current channel on display 43.

The appellant countered that the receiver of D1 **need not know** when the PLL circuit has reached its locked state because control section 31 can simply control switch 25 to allow the output of MPEG decoder 24 to be sent to display 43 after a predetermined period of time (after a channel change command), that period being chosen to be long enough to ensure even in the worst-case scenario that the PLL circuit has stabilised and that demodulator 22, demultiplexor 23 and MPEG decoder 24 have properly performed their respective functions.

The board agrees with the appellant that it cannot be excluded that the receiver of D1 operates as described in the previous paragraph. However, in the board's view, the skilled person would regard this mode of operation as going against the stated goal in D1 of effectively reducing the wait time after a channel change command (see point 5.1 *supra*). The skilled person would also realise that allowing the output of the PLL circuit to be passed further at all times, even when the PLL circuit has not reached a locked state and its output data is meaningless, could cause all sorts of problems further down the line in demodulator 22, demultiplexor 23 and MPEG decoder 24.

For these reasons, the board considers that the skilled person would regard it as obviously desirable that digital tuner section 21 should determine when the PLL circuit has reached a locked state and should ensure that only then is the output of the PLL circuit passed further. In this respect, the present application (see paragraphs [0007] and [0039] of the published application) merely discloses that conventionally no specific detection methods were used and that the tuner waits until the signal becomes stabilised. By contrast, in the invention the PLL circuit transmits a locked-state notification signal without disclosing how this signal is determined. Such determination could be done either by actively monitoring the state of the PLL or simply by waiting for a predetermined time, both posing no technical difficulty to the skilled person, a fact which the appellant did not dispute. The digital tuner section would thus have to include a switch and a switch controller, and the PLL circuit would have to generate a signal for controlling that switch, indicative of whether the locked state has been reached, i.e. a "locked-state notification signal", with all of these operating as set out in distinguishing feature (a) *supra*.

Hence the skilled person would have arrived at **distinguishing feature (a)** without inventive step.

5.4 Appellant's further arguments

The appellant also argued there was a synergistic effect between the features associated with the locked-state notification signal and the first output switch, on the one hand, and those associated with the intra frame notification signal and the second output switch,

on the other hand. Since the former ensure that a "clean" signal is output from the PLL circuit as early as possible, whilst the latter ensure that the clean video image is output from the video decoder as early as possible, they work together to synergistically minimise the waiting time after a channel switch, according to the appellant.

The board cannot see such a synergistic effect. Each of these two groups of features contributes to reducing the waiting time, but the overall reduction is no more than the sum of these two reductions. The effect is cumulative, not synergistic.

6. Conclusions on the main request

For the reasons set out above, the subject-matter of claim 1 according to the main request does not involve an inventive step (Article 56 EPC 1973) in view of D1.

As a consequence, the appellant's main request is not allowable.

Auxiliary request - inventive step

7. Claim 1 according to the auxiliary request differs from claim 1 according to the main request essentially in that the claimed digital broadcast receiver further comprises:
- an output selection unit;
- a tuner;
- a surface acoustic wave (SAW) filter, the output of which is sent to the PLL circuit.

These additional features do not render the claimed subject-matter inventive, for the following reasons:

The digital broadcast receiver of D1 comprises an output selection unit (see output switch 25 and switch controller 31 in figure 14).

It was well-known in digital broadcast receivers, before the priority date of the present application, to have a signal reception unit comprising a tuner, a surface acoustic wave (SAW) filter and a PLL circuit (see, for instance, circuits 1, 3 and 6 in figure 1 and circuits 20, 21 and 25 in figure 3 of D3). SAW filters were known to be a type of filter well suited for removing noise and signals from adjacent channels (see the frequency characteristics of the SAW filter in figures 2 and 5B of D3). It would have been obvious to use a SAW filter in the receiver of D1 in order to remove noise and signals from adjacent channels.

The appellant submitted no argument as to why these additional features could render the subject-matter of claim 1 of the auxiliary request inventive, and argued that the same arguments for inventive step applied as for the main request.

Hence the subject-matter of claim 1 according to the auxiliary request does not involve an inventive step (Article 56 EPC 1973) in view of D1 and common general knowledge, as evidenced in D3.

As a consequence, the appellant's auxiliary request is not allowable.

Conclusion

8. Since neither of the appellant's main and auxiliary requests is allowable, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

K. Boelicke F. Edlinger

Decision electronically authenticated