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(54) INDICATING COUNTRY DEPENDENT SPEED LIMITS

(57) The present invention relates to a method of outputting general speed limits in a vehicle, comprising receiving radio signals including Programme Identification, PI, codes at least from one radio station by means of a radio receiver installed in the vehicle, determining a country in which the vehicle is driving based on the Programme Identification, PI, codes, and determining and outputting the general speed limits that are valid in the determined country. Moreover, it is provided an apparatus installed in a vehicle, in particular, an automobile, comprising a radio receiver, configured for receiving radio signals from a radio station, the radio signals including Programme Identification, PI, codes, a processor configured for determining a country in which the vehicle is driving based on the PI codes and for determining general speed limits that are valid in the determined country and output means controlled by the processor and configured for outputting the determined general speed limits.

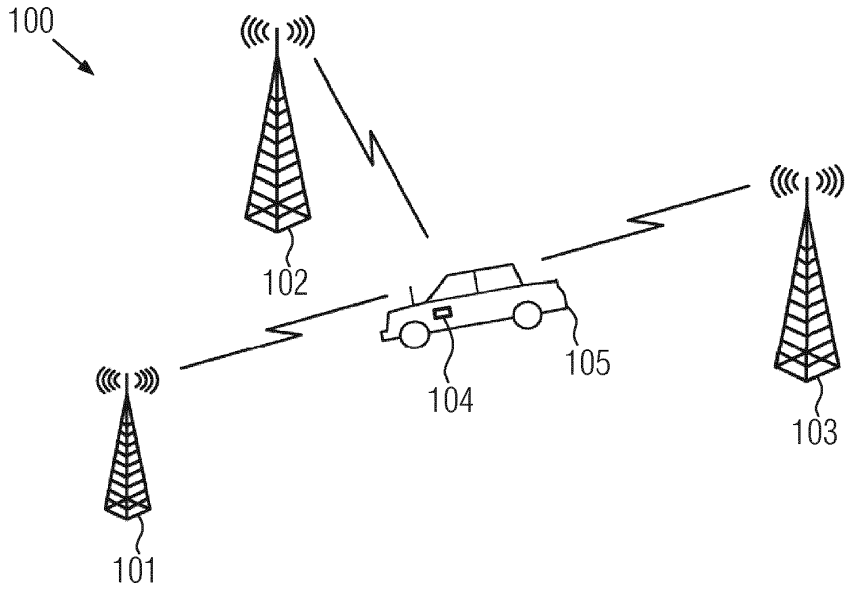

FIG. 1

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Description

Field of Invention

[0001] The present invention relates to a method and an apparatus for informing the driver of a vehicle on general speed limits that are to be observed in a country in that the driver is driving the vehicle.

Background of the invention

[0002] In different countries different general speed limits are observed when driving a vehicle. General speed limits are hold for different classes (categories) of roads and streets and in different kinds of towns/villages in different countries or states. General (permanent) speed limits have to be distinguished from temporary speed limits that are indicated on particular traffic signs. For example, in Europe borders of different countries may frequently be passed during one single trip. Since the speed limits heavily differ from one country to another a driver must be informed on the relevant speed limits. Usually, at a border between one country and another, the valid speed limits are shown on particular designed signs. However, usually the general speed limits that are valid in a country are only shown once, namely, at or close to the border. Once the driver has passed the border he may forget the information about the general speed limit presented at the border or the driver may have overseen it at all.

[0003] Therefore, there is a need for providing the driver with information on general speed limits in a country he is driving in after the driver has passed the border. Such kind of information is presented in advance navigation systems that are equipped with GPS receivers. However, if the vehicle is not provided with a navigation system and the driver does not posses a mobile navigation system, he/she will have no opportunity to learn about general speed limits during his/her travel.

[0004] In view of the above, it is an object of the present invention to provide means for informing a driver about general speed limits that hold in a country he/she is driving in a situation in that no information from a navigation system is obtainable.

Description of the Invention

[0005] The present invention addresses the above-mentioned object and provides a method of outputting general speed limits in a vehicle (in which, in particular, no navigation system is installed), comprising the steps of receiving radio signals including Programme Identification, PI, codes at least from one radio station by means of a radio receiver installed in the vehicle;
determining a country in which the vehicle is driving based on the Programme Identification, PI, codes; and
determining and outputting (visually or acoustically) the general speed limits that are valid in the determined country.

[0006] It is noted that herein, for simplicity, the term 'country' comprises the meaning of the term 'state'. The radio receiver is an RDS (Radio Data System) radio receiver (different from any navigation system) for receiving radio signals and playing back the content transmitted by radio stations, in particular, VHF (FM) radio stations or radio stations transmitting according to the North American radio broadcast data system (RBDS) standard (also referred to as NRSC-4). The structure of a PI code in Europe is defined in the standard EN 50067. A PI code is a 16 bit code wherein the country of the sending radio station is encoded at the first position (nibble) of the code. The second position represents an area code. The outputting of the general speed limits may be performed automatically upon determination of the country or it may be performed in response to a corresponding input (speech input or manual input, for example) received from the driver of the vehicle.

[0007] By means of the above-described method the user/driver is reliably provided with information on general (permanent) speed limits that are valid in the country in which he/she is driving the vehicle, particularly, in a case in that the vehicle is not equipped with a navigation system. The general speed limits may comprise speed limits of different classes/categories of roads and streets and/or towns and villages.

[0008] Information on the countries and the speed limits may be stored in a database and the step of determining the country may comprise looking-up the country and/or determining the general speed limits in a look-up table stored in a database and determining the general speed limits may comprise looking-up the general speed limits in a look-up table stored in a database, for example the look-up table stored in the database. In the look-up table each country may be associated with a particular code that is also included in the PI codes at the first positions of the same. The general speed limits may be associated with the determined countries in the look-up table. Alternatively, general speed limits may be associated with the first nibbles of the PI codes directly that are decoded based on information that is not stored in the look-up table. The radio receiver may comprise a suitably configured decoder for decoding the PI codes and, thereby, determining the country.

[0009] According to a particular embodiment of the inventive method of outputting general speed limits in a vehicle radio signals including the PI codes are received from multiple radio stations and the step of determining the country is based on a statistic of the PI codes of the received radio signals. If the vehicle is driving close to a border between two countries it may happen that multiple radio signals transmitted from radio stations on both sides of the border are received by the radio receiver. In this case, the determination of the country the vehicle is driving in can be performed based on some appropriate statistical measure(s), e.g., a mean value or a standard deviation of the received PI codes. If, based on the ap-

plied statistics, no unique country can be determined as the country the vehicle is driving in (for example, since radio signals are received from two or three countries with a non-significant difference in numbers), speed limits associated with more than one country may be output to user. If, for example, within some standard deviation as many radio signals are received from one country as from another country the speed limits of these two countries may be output. In the case that speed limits of more than one country are output it can also be output that the driver is driving close to a boundary of two or more countries. Alternatively, the more restrictive ones of the speed limits associated with the more than country might be output.

[0010] According to a particular embodiment of the inventive method of outputting general speed limits in a vehicle radio signals including the PI codes are received from multiple radio stations and the step of determining the country is based on (reception) strengths of radio signals including the PI codes. During reception of the radio signals from multiple radio stations content stemming from one radio station only may be played back by the radio receiver. Statistic measures of the strengths of the radio signals may be calculated and used when determining the country.

[0011] Moreover, if radio signals of (significantly) different strengths are received, one or more of the radio signals with the highest strengths only may be used for determining the country. Thus, in a case in that a relatively high number of PI codes indicating a first country are received with relatively low signal strengths and a relatively low number (or even only one) radio signals indicating a second country different from the first one are received with relatively high signal strengths, the relatively low number (or even only one) radio signals indicating the second country may be chosen for determining the country. If radio signals including a first PI code and radio signals including a second PI different from the first one are received without significant difference in the frequency of occurrence, the country may be determined based on the first (second) PI code, if the strengths of the radio signals including the first PI code are higher (lower) than the strengths of the radio signals including the second PI code. Again, if there is no unique determination of a country possible (based on the statistics and strengths of the received radio signals), speed limits of more than one country may be output.

[0012] According to another embodiment determining of the country is based on a change of PI codes occurring during reception of radio signals from a single radio station with constant reception frequency. Such a situation may occur when the vehicle passes a border while travelling in a tunnel connecting respective parts of a first and a second country close to the border.

[0013] Further, it is provided a computer program product, comprising one or more computer readable media having computer-executable instructions for performing one or more of the steps of the method according to one of the above-described examples.

[0014] The above-mentioned object is also addressed by an apparatus installed in a vehicle, in particular, an automobile (particularly, not being equipped with a navigation system), comprising

a radio receiver, configured for receiving radio signals from a radio station, the radio signals including Programme Identification, PI, codes;

a processor configured for determining a country in which the vehicle is driving based on the PI codes and for determining general speed limits that are valid in the determined country (for different classes/categories of roads and streets and/or towns and villages); and

output means controlled by the processor and configured for outputting the general speed limits.

[0015] The output means may comprise a display, for example, a display of the radio receiver and/or a loudspeaker, for example, a loudspeaker of the radio receiver. At least one of the output means and the processor may be part of the apparatus.

[0016] The apparatus may further comprise a database and the processor may be configured for determining the country by looking-up the country and/or the general speed limits in a look-up table stored in the database.

[0017] According to an embodiment the radio receiver is configured for receiving radio signals including the PI codes from multiple radio stations and the processor is configured for determining the country based on a statistic of the PI codes of the received radio signals.

[0018] Furthermore, the processor may be configured for determining strengths of radio signals received by the radio receiver and including the PI codes and it may be configured for determining the country based on the determined strengths of the radio signals.

[0019] According to another embodiment, the processor is configured for determining the country based on a change of PI codes occurring during reception of radio signals from a single radio station with constant reception frequency by the radio receiver.

[0020] Additional features and advantages of the present invention will be described with reference to the drawings. In the description, reference is made to the accompanying figures that are meant to illustrate preferred embodiments of the invention. It is understood that such embodiments do not represent the full scope of the invention.

Figure 1 illustrates an example of a radio broadcast network comprising radio stations and radio receiver installed in an automobile.

Figure 2 shows a radio receiver including a data processor for determining a country encoded in PI codes of radio signals.

Figure 3 shows another example of a radio receiver in some more detail.

Figure 4 shows a process flow of an example of the

inventive method of outputting general speed limits in a vehicle based on PI codes of radio signals.

Figure 5 shows a process flow of an example of the inventive method of outputting general speed limits in a vehicle based on a statistic of PI codes of received radio signals.

Figure 6 shows a process flow of an example of the inventive method of outputting general speed limits in a vehicle based on the strengths of received radio signals.

[0021] The present disclosure will now be described with reference to the attached figures. Various structures, systems and devices are schematically depicted in the drawings for purposes of explanation only and so as to not obscure the present disclosure with details which are well known to those skilled in the art. Nevertheless, the attached drawings are included to describe and explain illustrative examples of the present disclosure. The words and phrases used herein should be understood and interpreted to have a meaning consistent with the understanding of those words and phrases by those skilled in the relevant art. No special definition of a term or phrase, *i.e.,* a definition that is different from the ordinary or customary meaning as understood by those skilled in the art, is intended to be implied by consistent usage of the term or phrase herein. To the extent that a term or phrase is intended to have a special meaning, *i.e.*, a meaning other than that understood by skilled artisans, such a special definition shall be expressively set forth in the specification in a definitional manner that directly and unequivocally provides the special definition for the term or phrase.

[0022] Figure 1 shows a radio broadcast network 100 including radio stations 101, 102 and 103 for transmitting radio signals. The radio transmission broadcasts are typically transmitted as stereo-multiplex signals in the FM frequency band. Radio data system (RDS) data can be broadcast by the radio stations 101, 102 and 103, to display information relating to the radio broadcast. For example, the station name, song title, and/or artist can be included in the RDS data. In particular, the radio signals include PI codes indicating the country of the radio station. The RDS standard is defined in the European Committee for Electrotechnical Standardization, EN 50067 standard. Another exemplary utilization of the RDS data of this disclosure is represented by the North American radio broadcast data system (RBDS) standard (also referred to as NRSC-4).

[0023] A radio receiver 104 that is installed in a vehicle 105 receives the radio signals / RDS data. The radio receiver 104 comprises a data processor 201 for determining a country based on the (first nibble) of the PI codes of the received radio signals as shown in Figure 2. Moreover, the radio receiver 104 comprises a database 202 and an antenna unit 203 for receiving the radio signals. In the database 202 data associating the first nibble of the PI codes of the radio signals and countries is provided. The data processor 201 determines the first nibble of the PI codes of the radio signals received by means of the antenna unit 203 and determines the corresponding country based on the data stored in the database 202. For example, the data processor 201 looks-up the country for a determined first nibble of a PI code of a received radio signal in a look-up table stored in the database 202. Whereas in the configuration shown in Figure 2 the database 201 is part of the radio receiver 104, alternatively, the database 102 may be provided separately of and in data connection with the radio receiver 104.

[0024] Moreover, the data processor 201 determines general speed limits that are valid in the determined country. Determination of the speed limits may also be performed by means of a look-up table, for example, the above-mentioned look-up table. Alternatively, the country may be determined based on the first nibble of the PI code based on information stored in an internal memory of the data processor 201 or the radio receiver 104 and the general speed limits only are retrieved by looking-up a look-up table stored in the database 202.

[0025] The general speed limits may comprise speed limits of different classes/categories of roads and streets and/or towns and villages, for example, highways/motorways, national highways, country roads, built-up areas, etc.

[0026] The determined general speed limits may be output visually or acoustically either automatically upon determination of the country/general speed limits or in response to a user request made manually or verbally by a driver of the vehicle 105. For example, the relevant speed limits can be displayed on a display 204 of the radio receiver 104. Moreover, a warning may be output when the vehicle 105 travels with a velocity that exceeds one of the determined general speed limits, for example, the highest one of the determined general speed limits.

[0027] Figure 3 shows an embodiment of a radio receiver 300 for receiving and processing radio signals and for decoding and further processing RDS data in some more detail. The RDS data may be RDS-TMC data and may comprise traffic announcements, data about alternative frequencies of the tuned transmitter, etc. The radio signals include PI codes. The first nibble represents a country code, for example, "D" for Germany and "F" for France. The radio receiver 300 comprises an antenna 301 for receiving a radio signal. The received radio signal is transmitted via a tuner 302 and an Intermediate Frequency stage 303 to a stereo decoder 304 and an RDS decoder 305. The tuner 302 is controlled by a tuning circuit 306 which is set by a control circuit 307 that is connected to a control device 308 by which a user may make user inputs. The control circuit 307 is, for example, a processing circuit with peripheral circuits (not shown in Figure 2).

[0028] The stereo decoder 304 produces low-frequen-

cy stereo signals which are supplied via an audio amplifier 309 to two loudspeakers 310 and 311. The RDS decoder 305 extracts RDS-TMC (Traffic Message Channel) data from the low-frequency signal produced by the Intermediate Frequency stage 303. The RDS-TMC data and, further, a clock signal are delivered to the control circuit 307 by the RDS decoder 305.

[0029] Furthermore, a memory 312, a display 313 and a speech synthesizer circuit 314 are provided. A CD drive (not shown in Figure 3), a car telephone (not shown in Figure 3), etc. may, additionally, be coupled to the control circuit 307.

[0030] The RDS decoder 305 is configured to decode RDS data, particularly, the PI code. The control circuit 306 is configured to determine a country in which the vehicle is driving based on the (first nibble of) the Programme Identification, PI, codes and to determine and output, for example, via the display 313 or (via the speech synthesizer circuit 314 and the audio amplifier 309) the loudspeakers 310 and 311, the general speed limits that are valid in the determined country. The general speed limits are determined based on data (providing associations between the country that is determined based on the PI code and the general speed limits) and stored in the memory 312 or another database (not shown).

[0031] In the following, exemplary embodiments of a method of outputting general speed limits in a vehicle are described with reference to Figures 4 to 6. The described examples of the inventive method can be implemented in the above-described apparatuses illustrated in Figures 1 to 3.

[0032] According to an embodiment a method of outputting general speed limits in a vehicle comprises the step of receiving 401 by a radio receiver installed in a vehicle a radio signal from a radio station (see Figure 4). The radio signal transports RDS content and includes a PI code wherein the country of the radio station is encoded in the first nibble. The first nibble of the radio signal is determined 402 upon reception of the radio signal in order to determine the country. After the country of the radio station that transmitted the radio signal is determined 403 general speed limits that are valid in the country are determined. The general speed limits may be looked up in a database installed in the vehicle and associating general speed limits with countries wherein the particular general speed limits are valid.

[0033] The general speed limits that are determined based on the determined country are output 404 to a driver of a vehicle, for example, by means of a display or a loudspeaker installed in the vehicle. If, for example, the country is determined to be Austria, the output of the general speed limits comprises indications that in built-up areas a passenger car may not travel faster than 50 km/h, on a national highway a passenger car may not travel faster than 100 km/h and on a highway/motorway a passenger car may not travel faster than 130 km/h, etc. The information on the general speed limits may be restricted to general speed limits for the kind of vehicle involved.

[0034] Another embodiment of a method of outputting general speed limits in a vehicle is illustrated in Figure 5. A plurality of radio signals is received 501 by a radio receiver installed in a vehicle from multiple radio stations. The radio signals transport RDS content and include PI codes wherein the countries of the radio stations are encoded in the respective first nibbles of the PI codes. The country associated with each of the radio signals/stations is determined 502 based on the PI codes. Determination may be performed by a suitably configured decoder or by looking-up a database associating PI codes with countries. A statistic is calculated 503 for the determined countries and based on the calculated statistics general speed limits are determined 504. The thus determined general speed limits are output 505 to a user, for example, by means of a display or a loudspeaker installed in the vehicle.

[0035] For example, radio signals from n radio stations of m countries are received. In the simplest case the country will be determined to be the one in which the vehicle is travelling from which the most radio signals are received. If, for example, most of the radio signals are received from two of the m countries and a comparable number of radio signals are received from these two countries the country might be determined to be the one in which the vehicle is travelling from which the most different radio stations are sending the received radio signals. If, for example, the most radio signals are received from one radio station of one of the m countries but a relatively high number of radio signals is received from a relatively high number of the n radio stations of another one of the m countries is received, then, the other one of the m countries might be determined to be the one in which the vehicle is travelling. Any radio signals received with a frequency below a particular threshold may be disregarded when determining the country the vehicle is travelling in.

[0036] In Figure 6 another embodiment is illustrated. A plurality of radio signals is received 601 by a radio receiver installed in a vehicle from multiple radio stations. The radio signals transport RDS content and include PI codes wherein the countries of the radio stations are encoded in the respective first nibbles of the PI codes. The country associated with each of the radio signals/stations is determined 602 based on the PI codes. Determination may be performed by a suitably configured decoder or by looking-up a database associating PI codes with countries.

[0037] After reception 601 of the radio signals the strengths of the received radio signals are determined 603. The determining of the countries 602 may automatically be done by decoding of the PI codes. Alternatively, the determining of the countries 602 might only be done for radio signals with signal strengths exceeding a particular threshold. In this case, step 603 is to be performed before step 602. Based on the determined signal strengths general speed limits are determined and output

604 that are associated with a particular country that is determined based in the signal strengths of the radio signals. In the embodiment illustrated in Figure 6 the country associated with radio signals of highest signal strengths is determined to be the one in which the vehicle is travelling and, therefore, the general speed limits associated with that country are output in step 604.

[0038] The embodiments illustrated in Figures 5 and 6 can readily be combined with each other. If, for example, based on the statistics of radio signals determination of the country the vehicle is travelling cannot reliably be made (for instance, about the same number of radio signals are received from 2 of the m countries mentioned above), one may determine the country from which the strongest radio signals are received as the one the vehicle is travelling in. On the other hand, If, for example, based on the determination of the signal strengths of the radio signals determination of the country the vehicle is travelling cannot reliably be made (for instance, radio signals of about the same signal strengths are received from 2 of the m countries mentioned above), one may determine the country from which the most radio signals are received as the one the vehicle is travelling in. It is also envisaged a situation in that no unique determination of a country is made, for example, since within some range as many radio signals are received from one country as from another and with comparable (to a predetermined extent) signal strengths. In such a situation, the speed limits associated with more than one country or the more restrictive ones of these speed limits might be output. Such an output may include an indication that the vehicle is travelling close to a border of the corresponding countries.

[0039] All previously discussed embodiments are not intended as limitations but serve as examples illustrating features and advantages of the invention. It is to be understood that some or all of the above described features can also be combined in different ways.

Claims

1. A method of outputting general speed limits in a vehicle, comprising
   receiving radio signals including Programme Identification, PI, codes at least from one radio station by means of a radio receiver installed in the vehicle;
   determining a country in which the vehicle is driving based on the Programme Identification, PI, codes; and
   determining and outputting the general speed limits that are valid in the determined country.

2. The method according to claim 1, wherein the general speed limits comprise speed limits of different classes of roads and streets and/or towns and villages.

3. The method according to one of the preceding claims, wherein the determining of the country and/or determining the general speed limits comprises looking-up the country and/or the general speed limits in a look-up table stored in a database.

4. The method according to one of the preceding claims, further comprising receiving radio signals including the PI codes from multiple radio stations and wherein the determining of the country is based on a statistic of the PI codes of the received radio signals.

5. The method according to one of the preceding claims, further comprising determining strengths of radio signals that include the PI codes and are received by the radio receiver and wherein the determining of the country is based on the determined strengths of the radio signals.

6. The method according to one of the claims 1 to 3, where the determining of the country is based on a change of PI codes occurring during reception of radio signals from a single radio station with constant reception frequency.

7. The method according to one of the preceding claims, wherein outputting the general speed limits comprises displaying the general speed limits on a display of the radio receiver.

8. Computer program product, comprising one or more computer readable media having computer-executable instructions for performing one or more of the steps of the method according to one of the Claims 1-7.

9. Apparatus installed in a vehicle, in particular, an automobile, comprising
   a radio receiver, configured for receiving radio signals from a radio station, the radio signals including Programme Identification, PI, codes;
   a processor configured for determining a country in which the vehicle is driving based on the PI codes and for determining general speed limits that are valid in the determined country; and
   output means controlled by the processor and configured for outputting the determined general speed limits.

10. Apparatus according to claim 9, wherein the general speed limits comprise speed limits of different classes of roads and streets and/or towns and villages.

11. Apparatus according to claim 9 or 10, further comprising a database and wherein the processor is configured for determining the country and/or determining the general speed limits by looking-up the country

and/or the general speed limits in a look-up table stored in the database.

12. Apparatus according to one of the claims 9 to 11, wherein the radio receiver is configured for receiving radio signals including the PI codes from multiple radio stations and wherein the processor is configured for determining the country based on a statistic of the PI codes of the received radio signals.

13. Apparatus according to one of the claims 9 to 12, wherein the processor is configured for determining strengths of radio signals including the PI codes and determining the country based on the strengths of the radio signals.

14. Apparatus according to one of the claims 9 to 12, wherein the processor is configured for determining the country based on a change of PI codes occurring during reception of radio signals from a single radio station with constant reception frequency by the radio receiver.

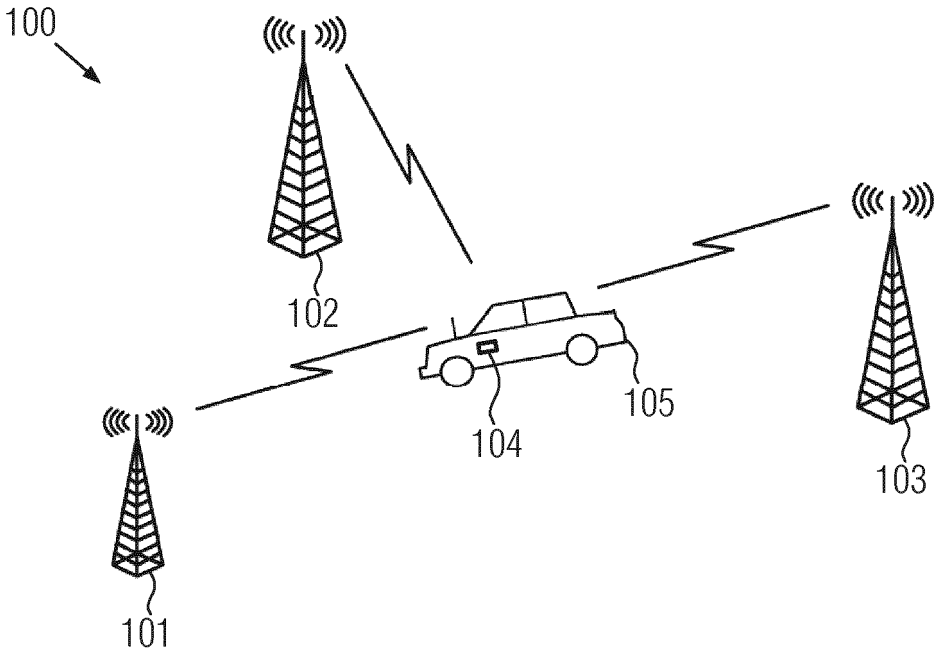

FIG. 1

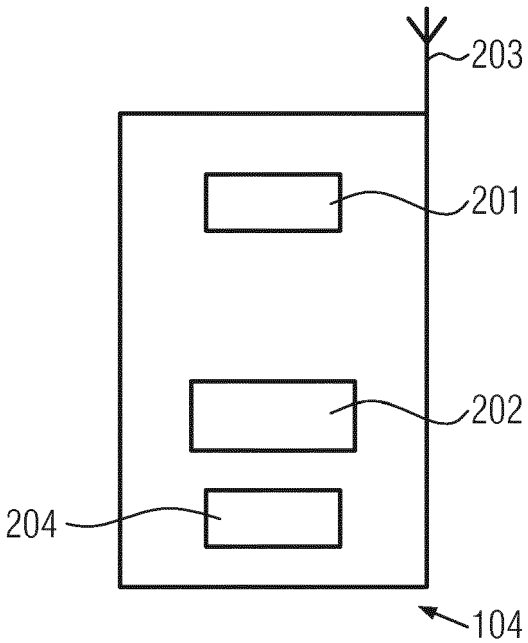

FIG. 2

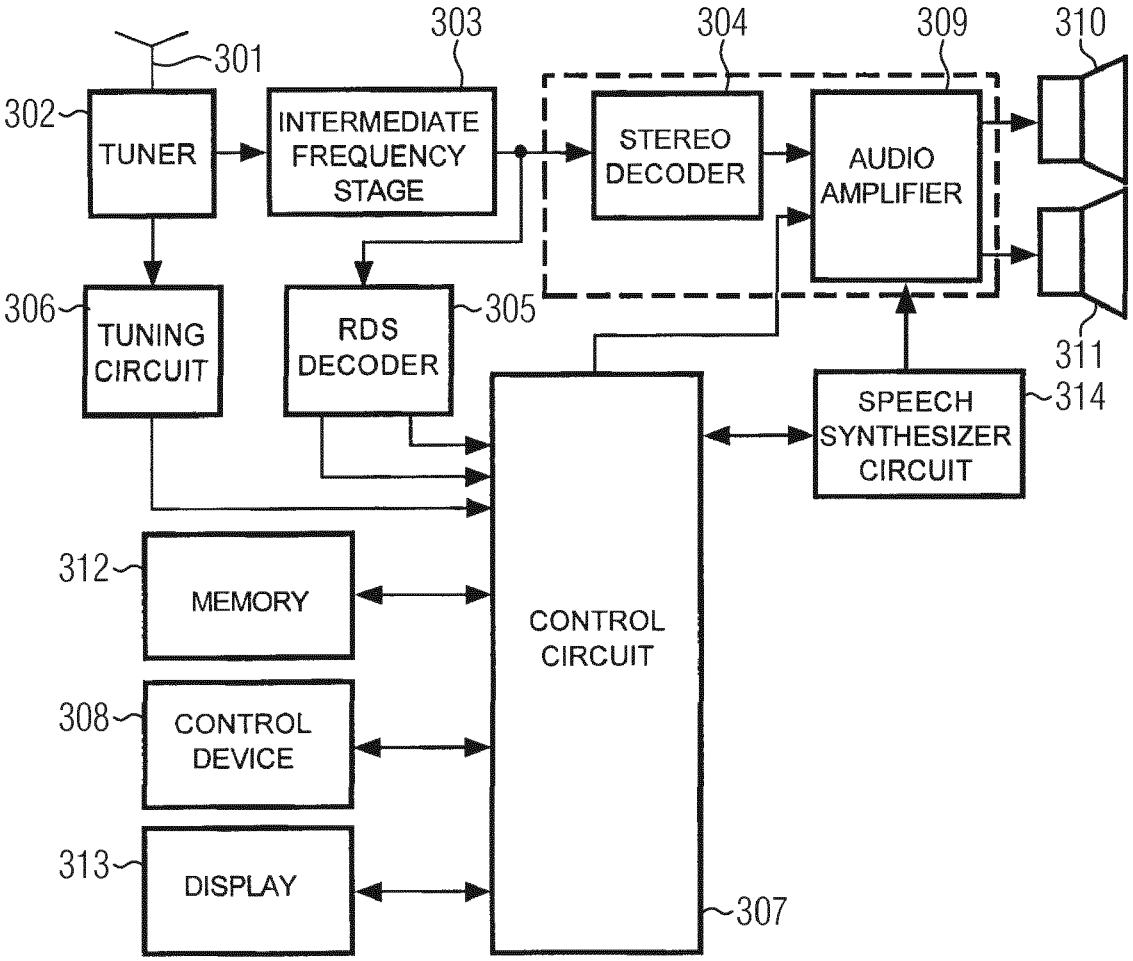
301
302
TUNER
303
INTERMEDIATE FREQUENCY STAGE
304
STEREO DECODER
309
AUDIO AMPLIFIER
310
311
306
TUNING CIRCUIT
RDS DECODER
305
SPEECH SYNTHESIZER CIRCUIT
314
312
MEMORY
CONTROL CIRCUIT
308
CONTROL DEVICE
313
DISPLAY
307

FIG. 3

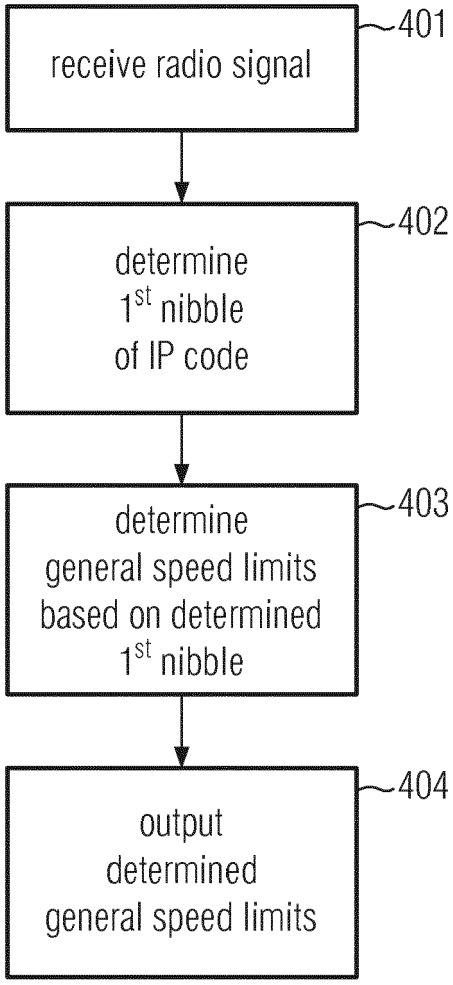
receive radio signal
401
determine 1st nibble of IP code
402
determine general speed limits based on determined 1st nibble
403
output determined general speed limits
404

FIG. 4

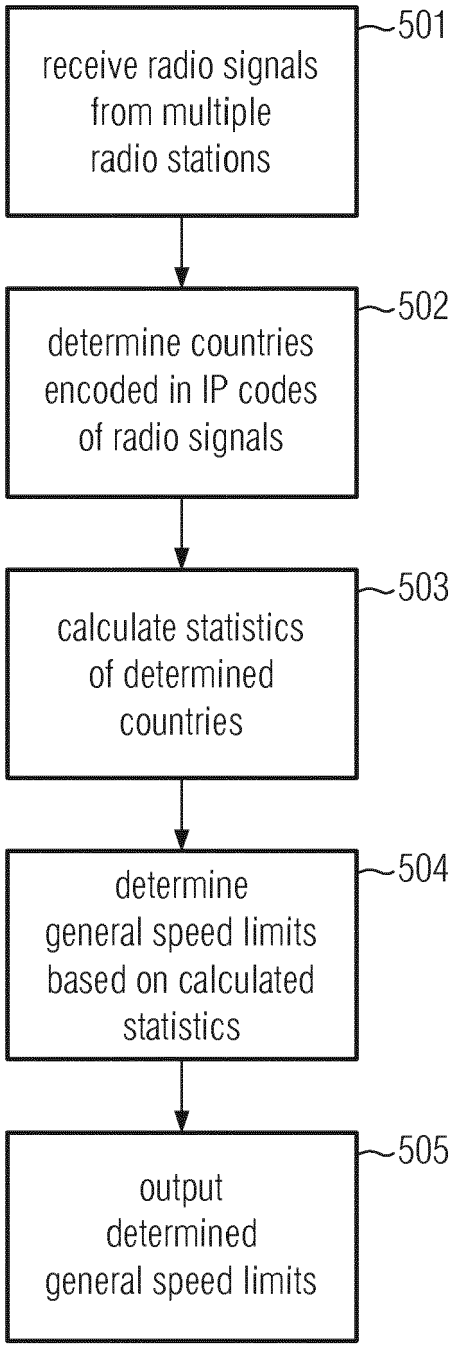
receive radio signals from multiple radio stations
501
determine countries encoded in IP codes of radio signals
502
calculate statistics of determined countries
503
determine general speed limits based on calculated statistics
504
output determined general speed limits
505

FIG. 5

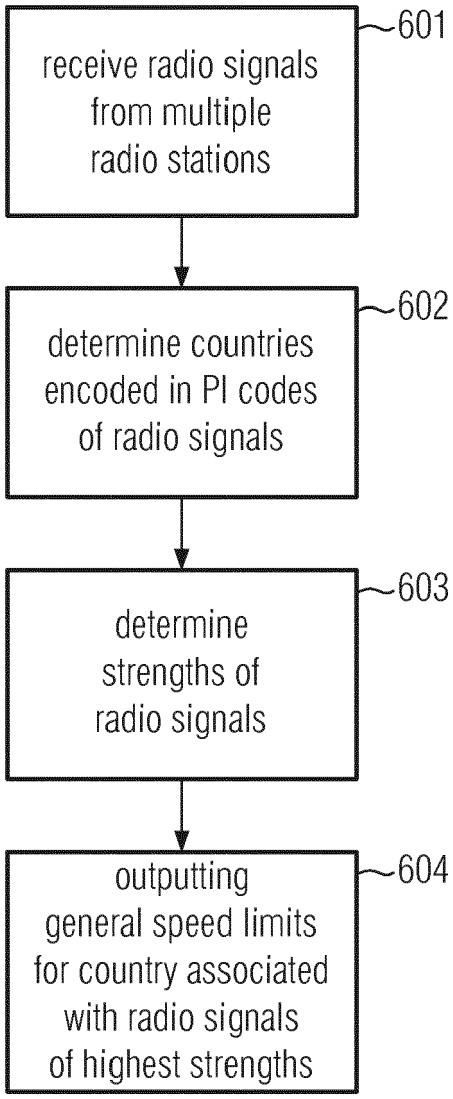
receive radio signals from multiple radio stations
601
determine countries encoded in PI codes of radio signals
602
determine strengths of radio signals
603
outputting general speed limits for country associated with radio signals of highest strengths
604

FIG. 6

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 17 18 4250

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 198 02 594 A1 (VOLKSWAGEN AG [DE]) 29 July 1999 (1999-07-29) * column 2, lines 39-42,51-67 * * column 3, lines 4-40,49-57 * * claim 3 * -----	1-14	INV. H04H60/51 H04H20/57 H04H60/37

TECHNICAL FIELDS SEARCHED (IPC)

H04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 November 2017	Iovescu, Vladimir

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 18 4250

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28-11-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19802594 A1	29-07-1999	NONE	

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