

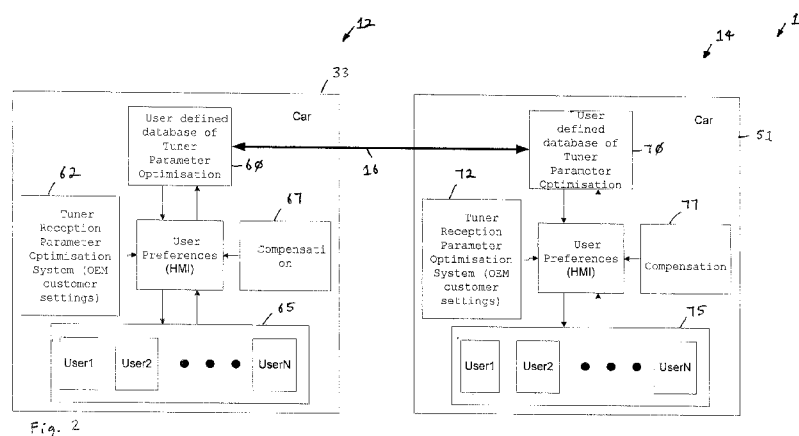


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(54) **Title:** IMPROVING UTILIZATION OF INTELLIGENT TUNER RECEPTION PROFILES BY CORRELATION OF USER INFORMATION AND LEVELS



(57) **Abstract:** The application provides a mobile radio receiver for a vehicle. The mobile radio receiver comprises a tuner front-end section, a location data port, a sensor port, a mobile radio receiver communication port, and a data processing unit. In use, the location data port receives tuner location data. The sensor port receives at least one sensor signal. The mobile radio receiver communication port receives at least one tuner front-end section parameter. The data processing unit is operably connected with the tuner front-end section, with the location data port, with the sensor port, and the mobile radio receiver communication port. The data processing unit comprises at least two pre-determined tuner location data and at least two pre-determined relationship data sets for determining a set of tuner front-end section parameters based on the at least one sensor signal.

IMPROVING UTILIZATION OF INTELLIGENT TUNER RECEPTION PROFILES
BY CORRELATION OF USER INFORMATION AND LEVELS

The application relates to a system and a method for improving the tuner reception of a mobile radio receiver of a car.

Automotive vehicles are commonly equipped with radios for receiving wireless broadcast radio frequency (RF) signals. These radios process the received RF signals and then broadcast audio sounds together with other information to passengers in the vehicles while the automotive vehicles travel amongst various locations.

The radio typically includes various electronics that comprises an RF tuner. The RF tuner selects a frequency bandwidth of input RF signals and outputs audio signals. The audio signals are typically amplified for broadcasting via audio speakers. The RF tuner may include a frequency modulated (FM) module for receiving FM modulated signals and amplitude modulated (AM) module for receiving AM signals.

Conventional vehicle radio receivers are typically programmed with pre-set tuning parameters that determine tuner settings. The tuning parameters typically include parameters that adjust gain of an automatic gain control (AGC), parameters that adjust intermediate frequency (IF) bandwidth, parameters that adjust audio channel separation, parameters that adjust audio high frequency roll-off, and parameters that adjust audio amplitude. The pre-set or pre-programmed tuning parameters typically do not change and are selected initially in an attempt to accommodate a wide range of signal reception conditions.

It is an object of the application to provide an improved mobile radio receiver.

It is believed that a performance of a tuner can be improved by using its actual performance information to generate new tuner parameters with pre-determined tuner relationship information.

The application provides a mobile radio receiver for a vehicle, such as a car, a ship, or an aircraft.

The mobile radio receiver includes a tuner front-end section, a location data port, a sensor port, a mobile radio receiver communication port, and a data processing unit. The term location refers to a geographical area or region and not to specific geographical point.

Put differently, the location can relate to geographical coordinates defining a region or an area, such as Europe, India, China, or North America.

The tuner front-end section is used for receiving radio signals from an antenna and for processing the received radio signals. The tuner front-end section provides a hardware that can be adjusted according to input front-end section parameters, such as gain or attenuation. The adjustment can be done by a programmable tuner front-end integrated circuit through settings of software parameters or by using a D/A (digital to analogue) converter.

The location data port is used for receiving tuner location data.

The sensor port is used for receiving one sensor or more signals. The sensor signals can originate from one or more internal or external measuring devices. The internal measuring de-

vices generate internal measurement signals that are derived from radio signals received after an antenna plug. The internal measurement signals can include a front-end section signal or an audio signal that is produced after the front-end section, wherein the measurement signals can relate to Signal to Noise Ratio (SNR), Total Harmonic Distortion (THD), multipath, or field strength. In contrast, the external measuring devices are provided by external sensors for measuring external conditions, such as ambient weather parameter, examples of this are temperature and humidity. Another example the external conditions relate to signal strength that is measured by a microphone.

The mobile radio receiver communication port is provided for receiving one or more preferred user tuner front-end section parameters from another mobile radio receiver of another vehicle.

The data processing unit is operably connected with the tuner front-end section, with the location data port, with the sensor port, and with the mobile radio receiver communication port. The data processing unit includes a processor, such as a microprocessor or an audio signal Digital Signal Processor.

The data processing unit also includes two or more pre-determined tuner location data and two or more pre-determined relationship data sets for determining a set of tuner front-end section parameters based on the sensor signals.

The tuner location data and the relationship data sets are often stored using a tuner parameter database. In a special case, the relationship data set comprises only one single tuner front-end section parameter. The pre-determined relationship data set together with a pre-determined data operation

defines a relationship between the sensor signal and the tuner front-end section parameters.

The mobile radio receiver provides a mobile radio receiver communication port reception mode, an operational mode, a checking mode, a tuner parameter adjustment mode, and a tuner parameter application mode.

One or more of the modes may occur at the same time. For example, the operational mode and the checking mode can occur at the same time. From time to time or depending on the sensor signals, the mobile radio receiver enters the checking mode, while still operating in the operational mode.

In particular, in the mobile radio receiver communication port reception mode, the mobile radio receiver communication port reception mode receives one or more preferred user tuner front-end section parameters from another mobile radio receiver of another vehicle.

This mode allows the users to transfer their preferred user tuner front-end section parameters from one mobile radio receiver to another mobile radio receiver. As an example, a family has more than one vehicle. When a family member uses a different vehicle, the family member can use this mode to transfer his preferred tuner setting to the vehicle, which the family member wants to drive.

In the operational mode, the tuner front-end section operates according to one or more sets of tuner front-end section parameter, which includes the preferred user tuner front-end section parameters and to the preferred user tuner front-end section parameters.

In the checking mode, the data processing unit receives the sensor signals and it checks the sensor signals against one or more pre-determined thresholds. In many cases, the mobile radio receiver enters or changes to the parameter adjustment mode when one or more sensor signals exceed the threshold whilst the mobile radio receiver enters the operational mode when the sensor signal data falls or drops below the threshold.

In the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters based on the tuner location data, on the above-mentioned relationship data set and on the sensor signal. The present sets of the tuner front-end section parameter are often updated with the new set of tuner front-end section members. After this, the mobile radio receiver often enters the parameter application mode.

In the parameter application mode, the data processing unit updates the tuner front-end section with the new set of tuner front-end section parameters. The mobile radio receiver later often enters the operational mode.

This mobile radio receiver allows sharing of preferred user parameters. A user can store his preferred front-end section parameters in one mobile radio receiver. When the user uses another vehicle, his stored preferred front-end section parameters can be transferred to a mobile radio receiver of the other vehicle. The user does not need to input again his preferred front-end section parameters to the other mobile radio receiver.

The mobile radio receiver communication port is often includes a preferred user tuner front-end section parameter server port

for communicating with a preferred user tuner front-end section parameter server. This server stores a collection of preferred user tuner front-end section parameters. This server also stores corresponding user identifiers for easy retrieval of the preferred user tuner front-end section parameter server. Put differently, it stores preferred user tuner front-end section parameters of different users and their user identifiers.

The user tuner front-end section parameter server is often located in a computing cloud, which can be accessed easily via the Internet. The server port can then obtain easily the desired preferred user tuner front-end section parameters from the said front-end section parameter server via the Internet.

The tuner location data can include actual geographic data, actual time data, or both actual geographic data and actual time data. The geographic data, the time data, or both can be used for retrieving or selecting the relationship data sets. This allows for an improved receiver, especially when location comprises actual time, because during night time the correlation between sensor values may be different from the correlation during daytime.

In a special case, the tuner location data includes data related to signal conditions of a location. Examples of the signal condition data are location data of radio transmitters and structures affecting radio signals such as tall buildings and tunnels.

In a database type of implementation, the data processing unit includes two or more tuner parameter records. Each tuner parameter records comprise a pre-determined tuner location data and a pre-determined relationship data set. In the parameter

adjustment mode, the data processing unit determines a new set of tuner front-end section parameters by retrieving a tuner parameter record using the tuner location data. The new tuner front-end section parameters are then generated with this tuner parameter record.

In this aspect of the application, the relationship between the sensor data and the tuner front-end section parameters is kept in at least two individual data sets. This provides an improved operation as compared with a receiver that provides only one single relationship between the sensor data and the tuner front-end section parameters, which is often adjusted at the time of producing the receiver. While the performance of a receiver with a set relationship between the sensor data and the tuner front-end section parameters can only be improved marginally by controlling parameters such as RF gain or IF gain, the application provides a set of radios with very different characteristics. For instance, according to one data set for determining the tuner front-end section parameters, the attenuator and the RF selectivity would be fully set in order to cope with two strong and interfering transmitters that are in the close vicinity of the radio receiver. According to another data set for determining the tuner front-end section parameters, the attenuator would be set to zero and the RF selectivity would be set to "broad", while the IF selectivity is set to "narrow" in order to listen to a weak signal from a single distant transmitter.

The data processing unit can include a pre-determined set of correlations among two or more sensor signals. This set of correlation is then used to determine a new set of tuner front-end section parameters. Specifically, in the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters based on the tuner loca-

tion data, on a relationship data set, on the sensor signal, and on the set of correlations.

Often, the data processing unit comprises two or more correlation records. Each correlation record includes a pre-determined tuner location data and a pre-determined set of correlations.

In the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters by retrieving the correlation record using the tuner location data. The new tuner front-end section parameters are then generated with the set of correlation of this correlation record.

To cater for situations in the mobile radio receiver travels to a new location, the checking mode often include a step of the data processing unit checking the tuner location data against pre-determined location data. The mobile radio receiver enters the parameter adjustment mode when the tuner location data is different from the pre-determined location data. This allows the mobile radio receiver to adjust its parameters when the mobile radio receiver enters a new location.

In practise, the tuner front-end parameters often comprise a signal sensitivity parameter. The signal sensitivity is intended for adjusting a gain, attenuation, or multipath parameter of the tuner front-end section.

The mobile radio receiver can include an input device, such as a touch screen or a button, for receiving an input from a user. The input can be used receive permission for the user to accept or to use the new tuner front-end parameter.

The data processing unit can include user preference data. These data has user preference information and can be used for determining acceptance of the new tuner front-end section parameter.

The application provides a network of at least two mobile radio receivers. Each mobile radio receiver comprises the above radio receiver communication port, which transmits one or more preferred user tuner front-end section parameter.

The application also provides a method of operating a mobile radio receiver for a vehicle.

The method comprises a mobile radio receiver communication port reception step, an operation step, a check step, a parameter adjustment step, and a parameter application step.

The mobile radio receiver communication port reception step comprises receiving at least one preferred user tuner front-end section parameter from another mobile radio receiver.

The operation step comprises operating a front-end section of the mobile radio receiver according to at least one predetermined tuner front-end section parameter, which includes the preferred tuner front-end section parameter to the least one preferred user tuner front-end section parameter. The mobile radio receiver then often performs the check.

The check step comprises an act of receiving one or more sensor signals from a sensor port. The sensor signals are then checked against one or more pre-determined corresponding thresholds by a data processing unit. The mobile radio receiver then performs the parameter adjustment when one of the sensor signals exceeds its corresponding threshold. Similarly,

the mobile radio receiver performs the operation when the sensor signals falls or drops below its corresponding thresholds.

The parameter adjustment step comprises an act of determining or generating a new set of tuner front-end section parameter based on the tuner location data, on a relationship data set, and on the sensor signal by the data processing unit. The relationship data set is used for determining a set of tuner front-end section parameters based on the at least one sensor signal. The mobile radio receiver often then performs the parameter application.

The parameter application step comprises an act of updating the tuner front-end section with the new set of tuner front-end section parameter together with its corresponding tuner location data by the data processing unit. The mobile radio receiver often later performs the operation.

The mobile radio receiver communication port reception step often receives the at least one user tuner front-end section parameter from a user tuner front-end section parameter server.

The operation can comprise an act or step of recording sensor signal data into a memory unit of the data processing unit.

The sensor signal data can be recorded together with its corresponding time stamp data. This provides a time parameter for adjusting a tuner parameter. The recorded sensor signal data can be averaged to reduce effects of glitches or one-time events.

The check can include an act of checking the tuner location data against pre-determined location data by the data pro-

cessing unit. The mobile radio receiver then enters the parameter adjustment act when the tuner location data is significantly different from the pre-determined location data. The term significant is in reference to a notable audio influence that is decided by a user of the mobile radio receiver.

The parameter adjustment can comprise an act of requesting permission from a user to apply or use the new tuner front-end parameter.

The parameter adjustment can comprise checking whether the new tuner front-end parameter is different significantly from the predetermined tuner front-end parameter. The mobile radio receiver then enters the operation when the checking determines that the new tuner front-end parameter is essentially same as the pre-determined tuner front-end parameter.

In short, this application provides a method to improve tuner unit performance. The method includes a step of a tuner unit recognizing characteristics of a tuner unit for an automobile system. The tuner unit then adjusts intelligently its tuner unit characteristics to improve tuner unit performance. The adjustments are intelligent in that the tuner unit characteristics are adapted dynamically according to actual tuner unit performance.

The method also uses locations of the automobile systems, which are already provided by components blocks of the automobile system. The method is able of improving tuner unit performance using one single tuner without additional investment in existing automotive infrastructure.

This application provides a device to improve tuner unit performance. The device includes parts that are similar to parts

of many existing implementations of automobiles. The device also has pre-calibrated data that serves as initial settings of the tuner unit and an algorithm for intelligent processing of received signals. The processing is intelligent in that parameters of the tuner unit adapt dynamically according to actual tuner unit performance.

In addition, the tuner unit parameters are then stored according to regions, which are pre-defined or are pre-determined in a module of the device. As automobile carrying the device travels to a particular region, the device would use the stored tuner unit parameters of the particular region. The tuner unit may request confirmation of the new tuner parameters from the user before storing and before using the new tuner parameters.

These above steps are done repeatedly to improve further the tuner unit performance. Therefore, the regions used more frequently by the end-user would have better tuner unit performance.

The improved tuner unit performance has an advantage of improving driver experience and improving ease of getting audio and information from tuner stations due to better tuner unit performance.

This is different from most current implementations of radio and navigation systems in which their tuners are adjusted with the use of field-testing. This field-testing uses one fixed test route to cover requirements of customers who may reside in different regions and in different countries.

The test route is used to provide a majority of scenarios or environmental and signal conditions, which includes a per-

ceived worst-case scenario that the tuner would be subjected to. In other words, the field-testing adjusts or improves a tuner performance based on one fixed test route. However, in use, the test route is not able to cover all environmental and signal conditions that these tuners would face due to many variations in operating environmental conditions and due to many variations in weak or in strong interfering points from signal transmitters of radio broadcasting stations.

- Fig. 1 illustrates a block diagram of a network of car radios,
- Fig. 2 illustrates parts of a car radio of the radio network of Fig. 1,
- Fig. 3 illustrates a spider web presentation of different kinds of front-end tuner section parameter values of a car radio of the car radio network of Fig. 1,
- Fig. 4 illustrates a bar chart presentation of the different sets of front-end tuner section parameter values of Fig. 2,
- Fig. 5 illustrates different listening preferences for different users of the car radio of the car radio network of Fig. 1,
- Fig. 6 illustrates a flow chart of a method of using the car radio 12 of the radio network of Fig. 1,
- Fig. 7 illustrates an example of using the flow chart of the method of Fig. 6,
- Fig. 8 illustrates another example of using of using the flow chart of the method of Fig. 6, and
- Fig. 9 illustrates another network of car radios.

In the following description, details are provided to describe embodiments of the application. It shall be apparent to one skilled in the art, however, that the embodiments may be practiced without such details.

Some parts of the embodiments have similar parts. The similar parts may have the same names or the similar part numbers. The description of one similar part also applies by reference to another similar parts, where appropriate, thereby reducing repetition of text without limiting the disclosure.

For sake of shortness, the embodiment of application PCT/IB2010/054929 with its alternatives and implementations is included here as a reference. The embodiment is shown from page 14, line 4 to page 31, line 17 together with Figs. 1 to 13 of the application PCT/IB2010/054929. The embodiment relates to a radio tuner unit and to a method of using the radio tuner unit. The radio receiver is intended for installing in an automobile structure.

In particular, the method includes an act of the radio tuner unit collecting information, which may related to physical location, to information received from automobile on-board sensors, and to weather information. The radio tuner unit then derives tuner parameters according to the collected information. The radio tuner unit later operates according to the derived tuner parameters, which allow the radio tuner unit to provide an optimized or an improved tuner performance for a particular operating condition.

The embodiment of application PCT/IB2011/053591 with its alternatives and implementations is also included here as a reference. The embodiment is shown from line 22 of page 22 to line 2 of page 41 together with Figs. 1 to 5 of the application PCT/IB2011/053591. The embodiment relates to an improved radio tuner system.

Fig. 1 shows a block diagram of a network 10 of car radios.

The car radio network 10 includes a car radio 12 and a car radio 14, and a communication link 16 between the car radio 12 and the car radio 14. The car radio 12 is located in a car while the car radio 14 is located in another car.

The car radio 12 includes a radio receiver 18 that comprises a front-end tuner section 21, a car radio communication port 23, a user Human Machine Interface (HMI) 25, and a data processing unit 28. The data processing unit 28 includes a processor 31 and a memory unit 33.

Similarly, the car radio 14 includes a radio receiver 37 that comprises a front-end tuner section 39, a car radio communication port 41, a user Human Machine Interface (HMI) 43, and a data processing unit 46. The data processing unit 46 includes a processor 49 and a memory unit 51.

In use, the car radio communication ports 23 and 41 communicates with each other for exchanging user-defined front-end tuner section parameter values and radio hardware compensation factors. The car radio communication ports 23 and 41 uses Wifi protocol, Bluetooth protocol, or other wireless protocol to perform this exchange.

As seen in Fig. 2, the user Human Machine Interfaces (HMI) 25 and 43 receive user-defined front-end tuner section parameter values from a user. The user refers to a driver or a passenger, in the car, who listens to the car radio.

The memory units 33 and 51 have different databases for storing different kinds of radio parameter values.

In particular, the memory unit 33 includes a database 60 of user-defined front-end tuner section parameter values, a database 62 of radio OEM front-end tuner section parameter values, a database 65 of preferred parameter values of several users, and a database 67 of radio hardware compensation factors.

Similarly, the memory unit 51 includes a database 70 of user-defined front-end tuner section parameter values, a database 72 of radio OEM front-end tuner section parameter values, a database 75 of preferred parameter values of several users, and a database 77 of radio hardware compensation factors.

Fig. 3 shows a spider web presentation 80 of different sets of front-end tuner section parameter values, wherein the parameter value sets are provided by a radio designer, a car manufacturer, and a user for a car radio of the car radio network of Fig. 2.

This figure shows that different listening preferences leads to different preferred parameter values.

The web presentation 80 includes a set 82 of radio OEM front-end tuner section parameter values, a set 84 of car front-end tuner section parameter values, and a set 86 of user-defined front-end tuner section parameter values.

The set 86 of user-defined front-end tuner section parameter values is provided by a user of the car radio. These user-defined radio parameter values reflect the listening preference of this user of the car radio.

Examples of the front-end tuner section parameter values include multipath parameter values, soft-mute parameter values,

and high-cut parameter values. The high-cut level refers to high frequency filter cut-off level.

The user may select the radio parameter values according to user desired listening experience or to user mood. The user can revert back to the default or original parameter values by activating a restore factory setting function.

Similarly, the set 82 of radio OEM front-end tuner section parameter values is provided by a radio designer of the car radio in accordance with the listening preference of the said radio designer.

The set 84 of car front-end tuner section parameter values are provided by a car tuning expert of a car manufacturer. These parameter values reflect the listening preference of the car tuning expert.

Fig. 4 shows a bar chart presentation 90 of the different sets of front-end tuner section parameter values of Fig. 3.

Fig. 5 shows different listening preferences 95 for different users of the car radio of the car radio network of Fig. 2.

The listening preference of the car tuning expert may be different from the listening preference of the actual user. Because of this, the car tuning expert can select a set of car front-end tuner section parameter values, which is significantly different from a set car front-end tuner section parameter values of the user that is selected by the actual user. This difference is illustrated in Figs. 4 and 5.

The databases 77 and 67 each store predetermined compensation factors that are selected according to architecture of the re-

spective car radio. The radio architecture includes tuner type, such as single tuner or double tuner, and to a phase-diversity type. In other words, the compensation factor is selected according to a hardware configuration of the respective car radio.

Different car radios often have different features or architecture. Because of this, the different car radios also have difference front-end tuner section parameter values for producing the same sound that is preferred by the user.

For example, one car radio may have phase diversity (double tuner), thereby having a method to reduce noise when direct and reflected signals are simply added to the antenna. Another radio that does not have phase diversity would then use another method, which is different.

The user databases 65 and 75 contain different preferred front-end tuner section parameter values of different users. These section parameter values are selected according to different feelings and listening preferences of the users. These section parameter values can be shared with car radios of other cars when the users drive the other cars.

The car radio communication port of one car radio has a benefit allowing user-defined front-end tuner section parameter values of a user to be transferred to another car radio. In other words, this allows a user to transfers his listening preference to another car when the user uses the other car.

Fig. 6 shows a flow chart 100 of a method of using the car radio 12.

The flow chart 100 includes a step 102 of a driver entering a car, wherein the car radio 12 of the car detects an identity of the driver based on sensors on the driver. One example of the sensors is a Radio Frequency Identifier (RFID) tag.

The car radio 12 then requests the driver, via the HMI 25, for inputs regarding selection of modes to optimize or improves its tuner front-end section parameter values, in a step 105.

If an automatic mode is selected, the car radio 12 later improves its tuner front-end section parameter values automatically according to its sensor readings, in a step 108.

If a manual mode is selected, the driver afterward chooses among default factory tuner front-end section parameter values, stored front-end section parameter values that are generated earlier by the car radio 12, and the user-defined tuner front-end section parameter values, in a step 110.

When the default factory tuner front-end section parameter values are selected, the car radio 12 then operates according to the factory default tuner front-end section parameter values, in a step 113.

On the other hand, when the stored tuner front-end section parameter values are selected, the car radio 12 then operates according to the stored tuner front-end section parameter values, in a step 115.

When the user-defined tuner front-end section parameter values are selected, the car radio 12 then ports or transfers remotely the user-defined front-end tuner section parameter values, which is stored in the user-defined front-end tuner section parameter values database 60 of the other car radio 12 via the

communication port 23, via the communication link 16, to the communication port 41 of the car radio 14. The car radio 12 then operates according to the selected user preference tuner front-end section parameter values and to the compensation factors from the radio hardware compensation factors database 67. The compensation factors adapt the user preference tuner front-end section parameter values to the different hardware configurations of the car radio 12.

In some cases, the user may manually adjust the tuner front-end section parameter values for a specific location according to location information from a navigation module, in a step 120.

The driver can later adjust the present selected tuner front-end section parameter values. If the user chooses to adjust these parameter values, a warning message may be shown to the user regarding changes of the present selected tuner front-end section parameter values.

The driver is afterward prompted regarding saving of the present tuner front-end section parameter values, in a step 123.

The driver can later choose to save the present tuner front-end section parameter values, in a step 125.

If the present tuner front-end section parameter values are not saved, they are not retained when the car radio 12 switches off. Once driver selects to save the parameter values, the corresponding current parameter values will be replaced by the present parameter values.

Fig. 7 shows an example 130 of using the flow chart 100 of the method of using the car radio.

In this example 130, a family of a user 132 and a user 135 owns two vehicles, namely a car 137 and a car 139 respectively.

The user 132 uses the car 137 while the user 135 uses the car 139. Both the user 132 and the user 135 have different preferred parameter settings for the radios of the cars 137 and 139, which are travelling in a tunnel 141 that goes through a mountain 143.

The user 132 has a high tolerance for noises in radio programs of radio broadcasting stations being played by the radio of the car 137. The user 132 likes to be able to tune in to the radio broadcasting station, even if the radio programs of this radio broadcasting station is mostly noise with just a small discernible voice. The user 132 would then not change the radio parameter values when the said radio has a poor signal reception in the tunnel 141.

On the other hand, the user 135 prefers little or no noise in the radio programs, which are played by the car radio of the car 139. In other words, the user 135 likes to hear radio programs with high audio quality and low multipath. The user 135 would then activate a parameter setting for a soft-mute function of the said radio when the radio has poor signal reception is in the tunnel 141.

Later, the user 135 drives the car 137. The car radio of the car 137 detects the presence of the user 135 and then receives the user parameter values from the car radio of the car 139. After this, the car radio of the car 137 operates according to the received parameter values, which shows the user listening preferences.

In other words, this embodiment also allows the user 135 to transfer or port his specific set of preferred radio parameter settings to a radio of the car 137 when the user 135 is in the car 137. This thus allows the user 135 to enjoy radio programs of the radio of the car 137, with parameter values that reflect his listening preferences.

Additionally, the users 132 and 135 can also restore the radio parameter values to its default radio parameter values, which are provided by a manufacturer of the car radio, when needed.

Fig. 8 shows another example 150 of using the flow chart 100 of the method of using the car radio.

In this example 150, a user 152 may drive a car 154 or a car 156. The car 154 has a car radio with a single antenna system 160 while the car 156 has a car radio with a dual antenna phase diversity system 164.

The user 152 has a preference for lower noise effects that can be caused by multipath in a dense urban area with many high buildings. The user 152 uses different radio settings for the different car radios 154 and 156 to overcome different noises that are received by the different antennas of the car radios 154 and 156.

When the user 152 drives the car 156, the user 152 uses a radio parameter value for less soft-mute for its car radio to overcome little multipath noises that are received by the dual antenna phase diversity system 164 of the said car radio.

Similarly, when the user 152 drives the car 154, the user 152 uses a radio parameter value for more soft-mute for its car

radio to overcome loud disturbing multipath noises that are received by the single antenna system 160 of the car radio.

This difference of radio parameter values can be represented by a hardware compensation factor for adapting the radio parameter values to the different in hardware configuration.

The above embodiment has several advantages. It allows the car radio preferred front-end tuner section parameter values of its user to be transferred to another car radio. In this manner, the user can use another car while enjoying sounds produced according to his listening preference without changing the parameter values of the car radio. The car radio is also able to store front-end tuner section parameter preference of several users. In other words, a car can be driven by several users, wherein the users are able to enjoy sounds according to each user listening preference.

In short, the embodiment provides a tuner reception parameter optimization system that has some intelligence to optimize its tuner parameters on a predetermined and continuously learning manner.

The system has a database of tuner parameters that stores user tuner parameters that are reflect specific listening preferences of the user.

The user tuner parameters can be ported remotely between cars such that the car radio can provide essentially produce the same kind of sound, and thereby allowing the user to enjoy the same kind of sound.

The user can select tuner parameters of different databases, such as default factory setting and user tuner parameter values.

The embodiment provides a hardware compensation factor for applying to the tuner parameters such different car radios can essentially produce the same sound.

Fig. 9 shows another network 200 of car radios. The car radio network 100 that the network 10 of Fig. 1.

The car radio communication port 23 of the radio receiver 18 of the car radio 12 is connected to a user tuner parameter server 210 via the Internet. The server 210 is located in a computing cloud 200.

Similarly, the car radio communication port 41 of the radio receiver 37 of the car radio 14 is connected to the user tuner parameter server 210 via the Internet.

In use, the car radio communication ports 23 and 41 sends and receives preferred user-defined front-end tuner section parameter values to the user tuner parameter server 210.

The user tuner parameter server 210 stores a collection of preferred user-defined front-end tuner section parameter values. For easy identification, the user tuner parameter server 210 also stores corresponding user identifier.

A user can then store his preferred front-end tuner section parameter values on the user tuner parameter server 210. When the user changes to use another car, the user can download his preferred front-end tuner section parameter values from the user tuner parameter server 210.

In this manner, the user avoid manually enter his preferred tuner settings in the new car, allowing ease of use.

The embodiments can also be described with the following list of features being organized into an item list. The respective combinations of features which are disclosed in the item list are regarded as independent subject matter, respectively, that can also be combined with other features of the application.

1. A mobile radio receiver for a vehicle comprising
 - a tuner front-end section,
 - a location data port for receiving tuner location data,
 - a sensor port for receiving at least one sensor signal,
 - a mobile radio receiver communication port for receiving at least one user tuner front-end section parameter,
 - and
 - a data processing unit being operably connected with the tuner front-end section, with the location data port, ~~and~~ with the sensor port, and the mobile radio receiver communication port,
 - the data processing unit further comprising at least two pre-determined tuner location data and at least two pre-determined relationship data sets for determining a set of tuner front-end section parameters based on the at least one sensor signal,
 - the mobile radio receiver providing a mobile radio receiver communication port reception mode, an operational mode, a checking mode, a tuner parameter adjustment mode, and a tuner parameter application mode,

- wherein in the mobile radio receiver communication port reception mode, the mobile radio receiver communication port reception mode receiving at least one user tuner front-end section parameter,
 - wherein in the operational mode, the tuner front-end section operates according to at least one set of tuner front-end section parameter and to at least one user tuner front-end section parameter,
 - wherein in the checking mode, the data processing unit checks the at least one sensor signal against at least one pre-determined threshold, such that the mobile radio receiver enters the parameter adjustment mode when the at least one sensor signal exceeds the at least one threshold, and
 - wherein in the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters based on the tuner location data, on a relationship data set and on the sensor signal, and
 - wherein in the parameter application mode, the data processing unit updates the tuner front-end section with the new set of tuner front-end section parameters.
2. The mobile radio receiver according to item 1, wherein the mobile radio receiver communication port comprises a user tuner front-end section parameter server port.
 3. The mobile radio receiver according to item 1 or 2, wherein the tuner location data comprises actual geographic data.
 4. The mobile radio receiver according to one of the aforementioned items, wherein the tuner location data comprises actual time data.

5. The mobile radio receiver according to one of the aforementioned items, wherein
 - the data processing unit comprises at least two tuner parameter records, each tuner parameter records comprising a pre-determined tuner location data and a pre-determined relationship data set, wherein further,
 - in the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters by retrieving a tuner parameter record using the tuner location data and by generating the new tuner front-end section parameters with this tuner parameter record.
6. The mobile radio receiver according to one of the aforementioned items, wherein
 - the data processing unit further comprises
 - a pre-determined set of correlations among at least two sensor signals, wherein
 - in the parameter adjustment mode,
 - the data processing unit determines a new set of tuner front-end section parameters based on the tuner location data, on a relationship data set, on the sensor signal, and on the set of correlations.
7. The mobile radio receiver according to item 6, wherein
 - the data processing unit comprises at least two correlation records, each correlation record comprising a pre-determined tuner location data and a pre-determined set of correlations, wherein further,
 - in the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters by retrieving a correlation record using the tuner location data and by generating the new tuner

front-end section parameters with the set of correlation of this correlation record.

8. The mobile radio receiver according to one of the aforementioned items, wherein the sensor port receives at least one internal measurement signal.
9. The mobile radio receiver according to one of the aforementioned items, wherein the sensor port receives at least one external measurement signal.
10. The mobile radio receiver according to one of the aforementioned items, wherein the checking mode is further characterised in that the data processing unit checks the tuner location data against pre-determined location data, wherein the mobile radio receiver enters the parameter adjustment mode when the tuner location data is different from the pre-determined location data.
11. The mobile radio receiver according to one of the aforementioned items, wherein the tuner front-end parameters comprises a signal sensitivity parameter.
12. The mobile radio receiver according to one of the aforementioned items further comprising an input device for receiving an input from a user to grant permission for accepting the new tuner front-end parameter.

13. A network of at least two mobile radio receivers, each mobile radio receivers comprises a radio receiver communication port according to one of the aforementioned items, wherein the radio receiver communication port transmits at least one tuner front-end section parameter.
14. A method of operating a mobile radio receiver for a vehicle, the method comprising
 - a mobile radio receiver communication port reception step, an operation step, a check step, a parameter adjustment step, and a parameter application step,
 - wherein the mobile radio receiver communication port reception step comprises receiving at least one user tuner front-end section parameter,
 - wherein the operation step comprises operating a front-end section according to at least one predetermined tuner front-end section parameter and to the at least one user tuner front-end section parameter,
 - wherein the check step comprises checking at least one sensor signal against at least one threshold such that the mobile radio receiver performs the parameter adjustment when the at least one sensor signal exceeds the at least one threshold,
 - wherein the parameter adjustment step comprises determining a new set of tuner front-end section parameter based on tuner location data, on a relationship data set, and on the at least one sensor signal, and
 - wherein the parameter application step comprises updating the tuner front-end section with the new set of tuner front-end section parameter.
15. The method according to item 14, wherein

the mobile radio receiver communication port reception step receives the at least one user tuner front-end section parameter from a user tuner front-end section parameter server.

16. The method according to item 14 or 15, wherein the operation further comprises recording sensor signal data.
17. The method according to item 16, wherein the sensor signal data is recorded together with time data.
18. The method according to item 16 or item 17, wherein the recorded sensor signal data is averaged.
19. The method according to one of items 14 to 18, wherein the check further comprises checking the tuner location data against pre-determined location data such that the mobile radio receiver enters the parameter adjustment act when the tuner location data is different from the pre-determined location data.
20. The method according to one of items 14 to 19, wherein the parameter adjustment further comprises requesting permission from a user to apply the new tuner front-end parameter.
21. The method according to item 20, wherein the parameter adjustment further comprises checking whether the new tuner front-end parameter is different from the predetermined tuner front-end parameter such that

the mobile radio receiver enters the operation when the checking determines that the new tuner front-end parameter is same as the pre-determined tuner front-end parameter.

Although the above description contains much specificity, this should not be construed as limiting the scope of the embodiments but merely providing illustration of the foreseeable embodiments. The above stated advantages of the embodiments should not be construed especially as limiting the scope of the embodiments but merely to explain possible achievements if the described embodiments are put into practice. Thus, the scope of the embodiments should be determined by the claims and their equivalents, rather than by the examples given.

REFERENCE

10	car radio network
12	car radio
14	car radio
16	communication link
18	radio receiver
21	front-end tuner section
23	car radio communication port
25	user Human Machine Interface (HMI)
28	data processing unit
31	processor
33	memory unit
37	radio receiver
39	front-end tuner section
41	car radio communication port
43	user Human Machine Interface (HMI)
46	data processing unit
49	processor
51	memory unit
60	user-defined front-end tuner section parameter values database
62	radio OEM front-end tuner section parameter values database
65	database of preferred user parameter values
67	radio hardware compensation factors database
70	user-defined front-end tuner section parameter values database
72	radio OEM front-end tuner section parameter values database
75	database of preferred user parameter values
77	radio hardware compensation factors database
80	spider web presentation

82 radio OEM front-end tuner section parameter values set

84 car front-end tuner section parameter values set

86 user-defined front-end tuner section parameter values set

90 bar chart presentation

95 listening preferences

100 flow chart

102 step

105 step

108 step

110 step

113 step

115 step

120 step

123 step

125 step

130 example

132 user

135 user

137 car

139 car

141 tunnel

143 mountain

150 example

152 user

154 car

156 car

160 single antenna system

164 dual antenna phase diversity system

200 computing cloud

210 server

CLAIMS

1. A mobile radio receiver for a vehicle comprising
 - a tuner front-end section,
 - a location data port for receiving tuner location data,
 - a sensor port for receiving at least one sensor signal,
 - a mobile radio receiver communication port for receiving at least one user tuner front-end section parameter,
 - and
 - a data processing unit being operably connected with the tuner front-end section, with the location data port, ~~and~~ with the sensor port, and the mobile radio receiver communication port,

the data processing unit further comprising at least two pre-determined tuner location data and at least two pre-determined relationship data sets for determining a set of tuner front-end section parameters based on the at least one sensor signal,

the mobile radio receiver providing a mobile radio receiver communication port reception mode, an operational mode, a checking mode, a tuner parameter adjustment mode, and a tuner parameter application mode,

 - wherein in the mobile radio receiver communication port reception mode, the mobile radio receiver communication port reception mode receiving at least one user tuner front-end section parameter,
 - wherein in the operational mode, the tuner front-end section operates according to at least one set of tuner front-end section parameter and to at least one user tuner front-end section parameter,

- wherein in the checking mode, the data processing unit checks the at least one sensor signal against at least one pre-determined threshold, such that the mobile radio receiver enters the parameter adjustment mode when the at least one sensor signal exceeds the at least one threshold, and
 - wherein in the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters based on the tuner location data, on a relationship data set and on the sensor signal, and
 - wherein in the parameter application mode, the data processing unit updates the tuner front-end section with the new set of tuner front-end section parameters.
2. The mobile radio receiver according to claim 1, wherein the mobile radio receiver communication port comprises a user tuner front-end section parameter server port.
 3. The mobile radio receiver according to claim 1, wherein the tuner location data comprises actual geographic data.
 4. The mobile radio receiver according to claim 1, wherein the tuner location data comprises actual time data.
 5. The mobile radio receiver according to claim 1, wherein
 - the data processing unit comprises at least two tuner parameter records, each tuner parameter records comprising a pre-determined tuner location data and a pre-determined relationship data set, wherein further,
 - in the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters by retrieving a tuner parameter record using the tuner location data and by generating the new

tuner front-end section parameters with this tuner parameter record.

6. The mobile radio receiver according to claim 1, wherein the data processing unit further comprises a pre-determined set of correlations among at least two sensor signals, wherein in the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters based on the tuner location data, on a relationship data set, on the sensor signal, and on the set of correlations.
7. The mobile radio receiver according to claim 6, wherein
 - the data processing unit comprises at least two correlation records, each correlation record comprising a pre-determined tuner location data and a pre-determined set of correlations, wherein further,
 - in the parameter adjustment mode, the data processing unit determines a new set of tuner front-end section parameters by retrieving a correlation record using the tuner location data and by generating the new tuner front-end section parameters with the set of correlation of this correlation record.
8. The mobile radio receiver according to claim 1, wherein the sensor port receives at least one internal measurement signal.
9. The mobile radio receiver according to claim 1, wherein the sensor port receives at least one external measurement signal.
10. The mobile radio receiver according to claim 1, wherein

the checking mode is further characterised in that the data processing unit checks the tuner location data against pre-determined location data, wherein the mobile radio receiver enters the parameter adjustment mode when the tuner location data is different from the pre-determined location data.

11. The mobile radio receiver according to claim 1, wherein the tuner front-end parameters comprises a signal sensitivity parameter.
12. The mobile radio receiver according to claim 1 further comprising
an input device for receiving an input from a user to grant permission for accepting the new tuner front-end parameter.
13. A network of at least two mobile radio receivers, each mobile radio receivers comprises a radio receiver communication port according to claim 1, wherein the radio receiver communication port transmits at least one tuner front-end section parameter.
14. A method of operating a mobile radio receiver for a vehicle, the method comprising
a mobile radio receiver communication port reception step, an operation step, a check step, a parameter adjustment step, and a parameter application step,
 - wherein the mobile radio receiver communication port reception step comprises
receiving at least one user tuner front-end section parameter,
 - wherein the operation step comprises

operating a front-end section according to at least one predetermined tuner front-end section parameter and to the at least one user tuner front-end section parameter,

- wherein the check step comprises checking at least one sensor signal against at least one threshold such that the mobile radio receiver performs the parameter adjustment when the at least one sensor signal exceeds the at least one threshold,
- wherein the parameter adjustment step comprises determining a new set of tuner front-end section parameter based on tuner location data, on a relationship data set, and on the at least one sensor signal, and
- wherein the parameter application step comprises updating the tuner front-end section with the new set of tuner front-end section parameter.

15. The method according to claim 14, wherein the mobile radio receiver communication port reception step receives the at least one user tuner front-end section parameter from a user tuner front-end section parameter server.
16. The method according to claim 14, wherein the operation further comprises recording sensor signal data.
17. The method according to claim 16, wherein the sensor signal data is recorded together with time data.
18. The method according to claim 16, wherein the recorded sensor signal data is averaged.
19. The method according to claim 14, wherein

the check further comprises checking the tuner location data against pre-determined location data such that the mobile radio receiver enters the parameter adjustment act when the tuner location data is different from the pre-determined location data.

20. The method according to claim 14, wherein the parameter adjustment further comprises requesting permission from a user to apply the new tuner front-end parameter.
21. The method according to claim 20, wherein the parameter adjustment further comprises checking whether the new tuner front-end parameter is different from the predetermined tuner front-end parameter such that the mobile radio receiver enters the operation when the checking determines that the new tuner front-end parameter is same as the pre-determined tuner front-end parameter.

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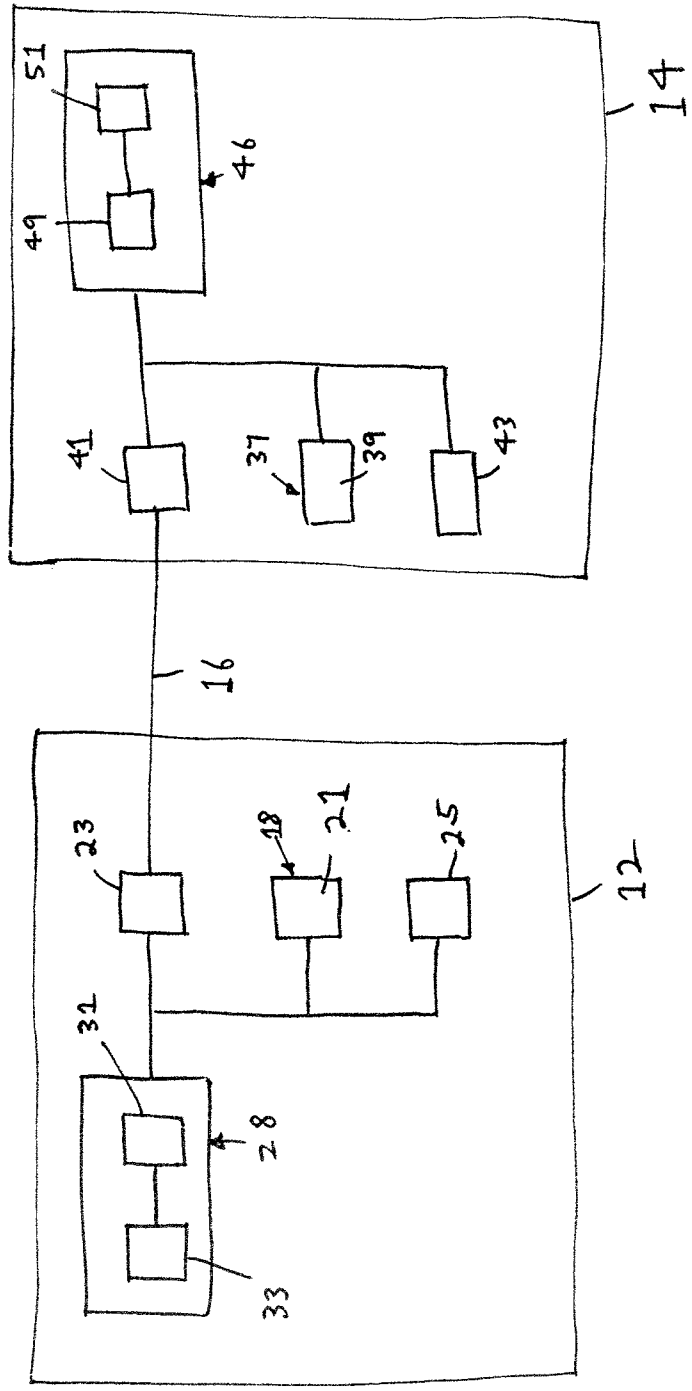


Fig. 1

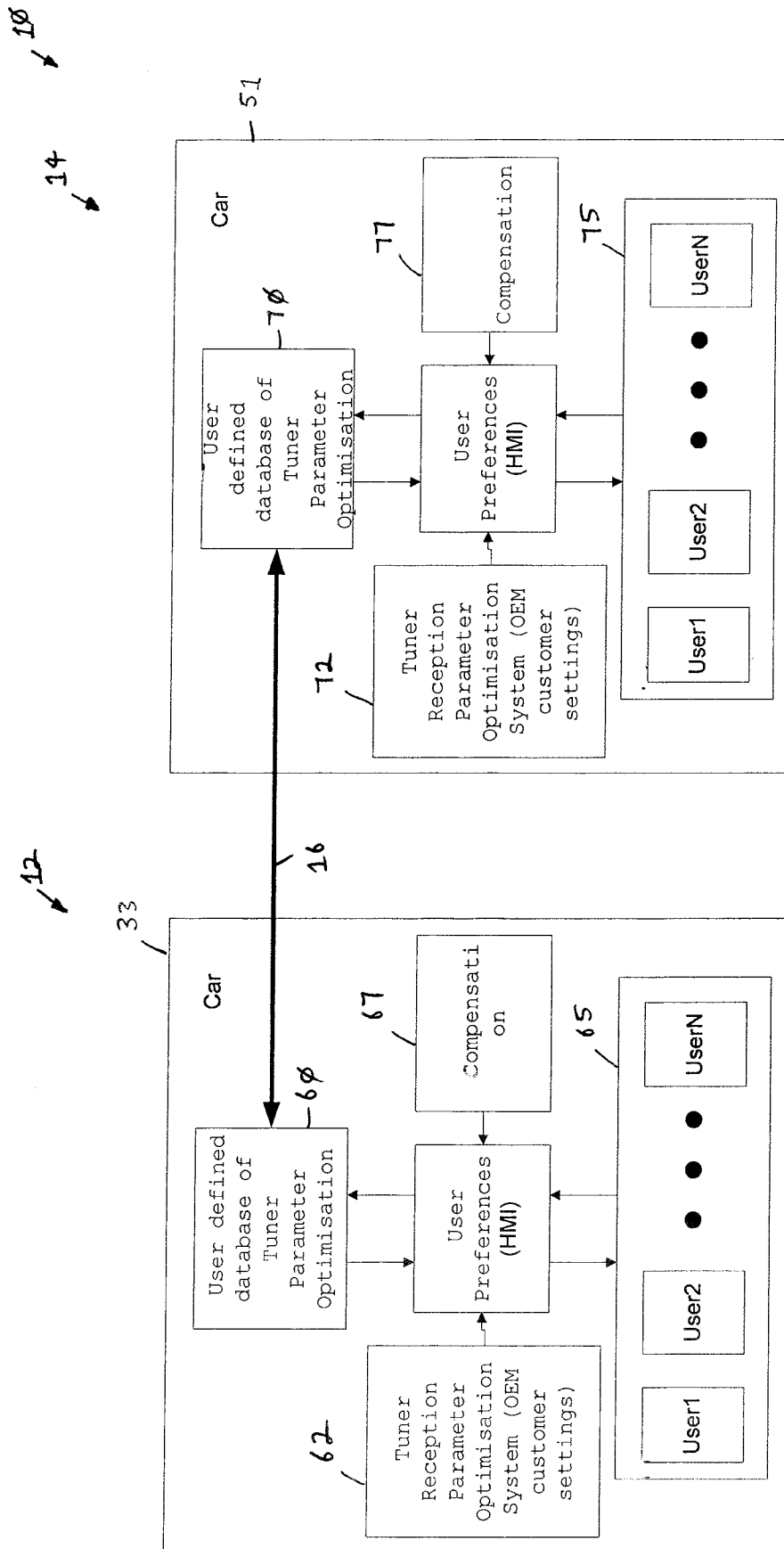


Fig. 2

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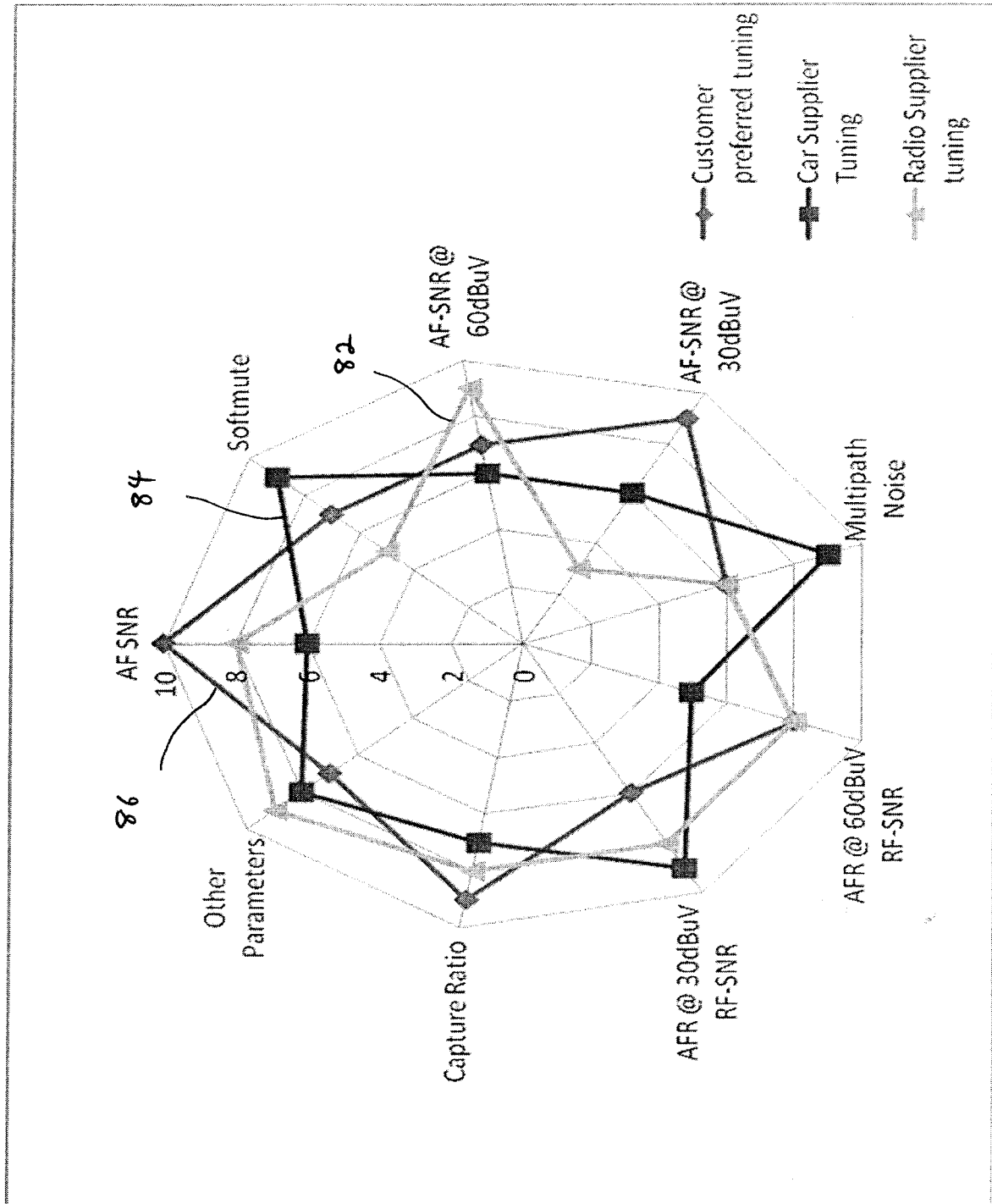


Fig. 3

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↙

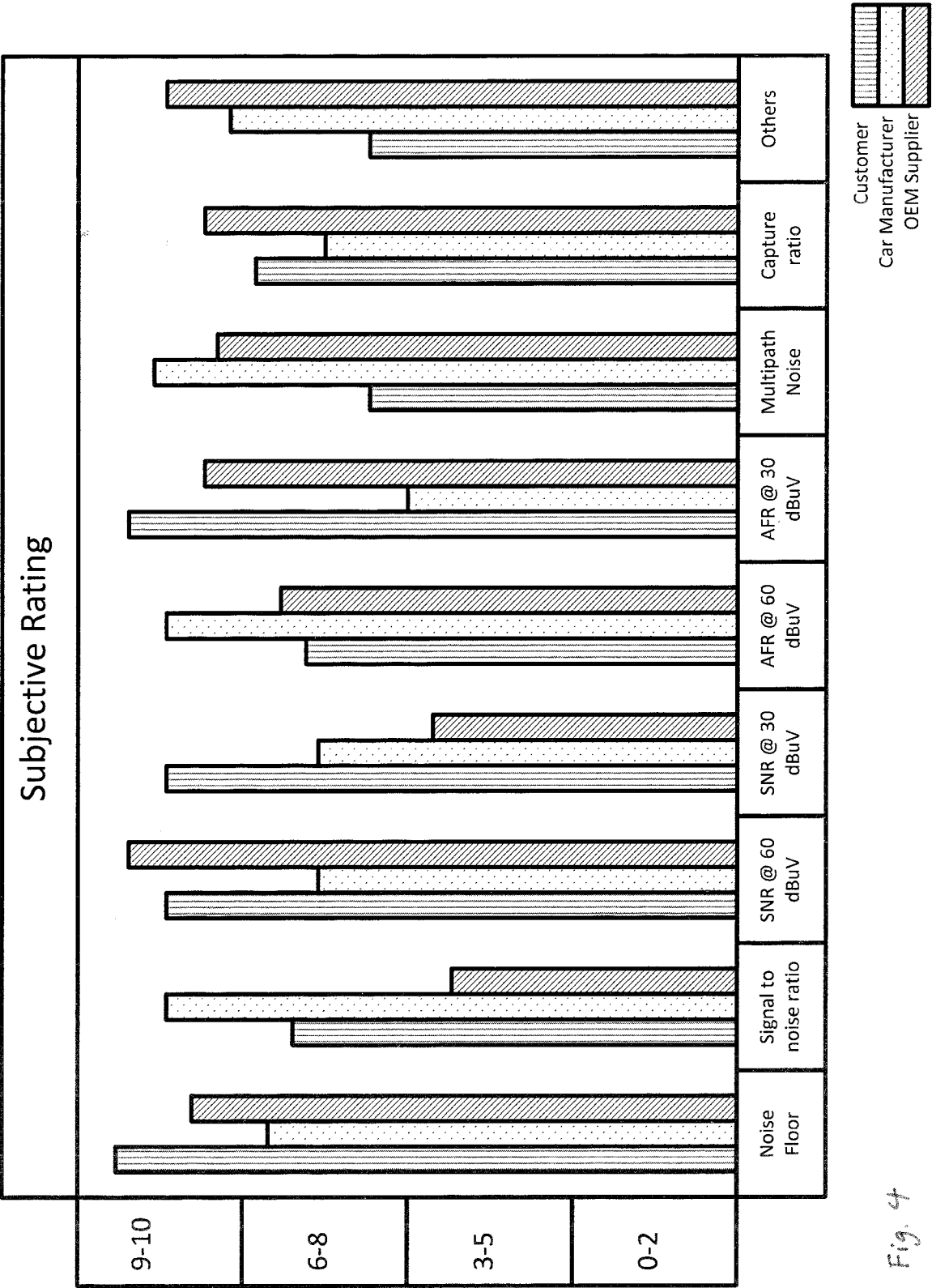
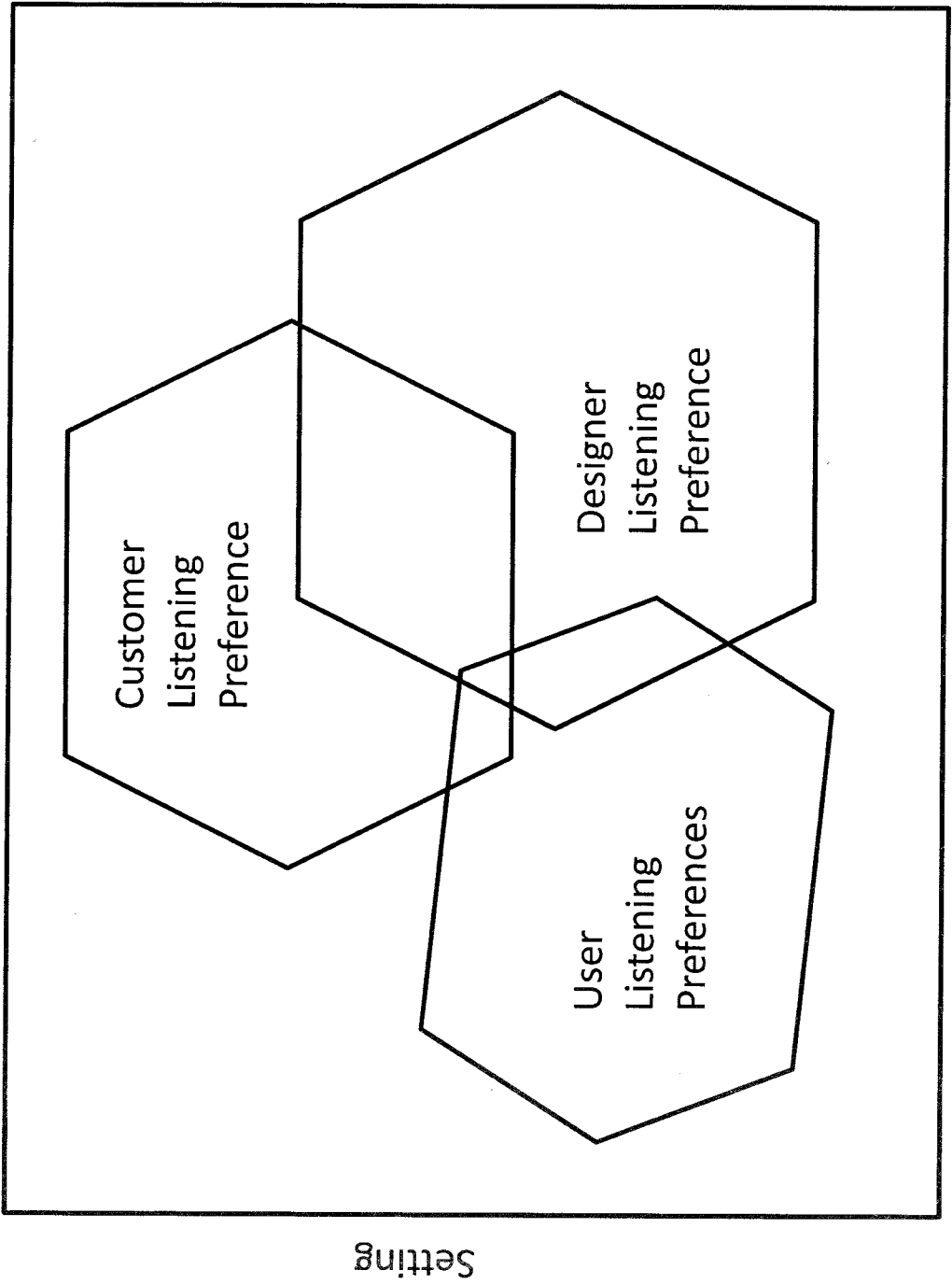


Fig. 4

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RF Reception Parameter

Fig. 5

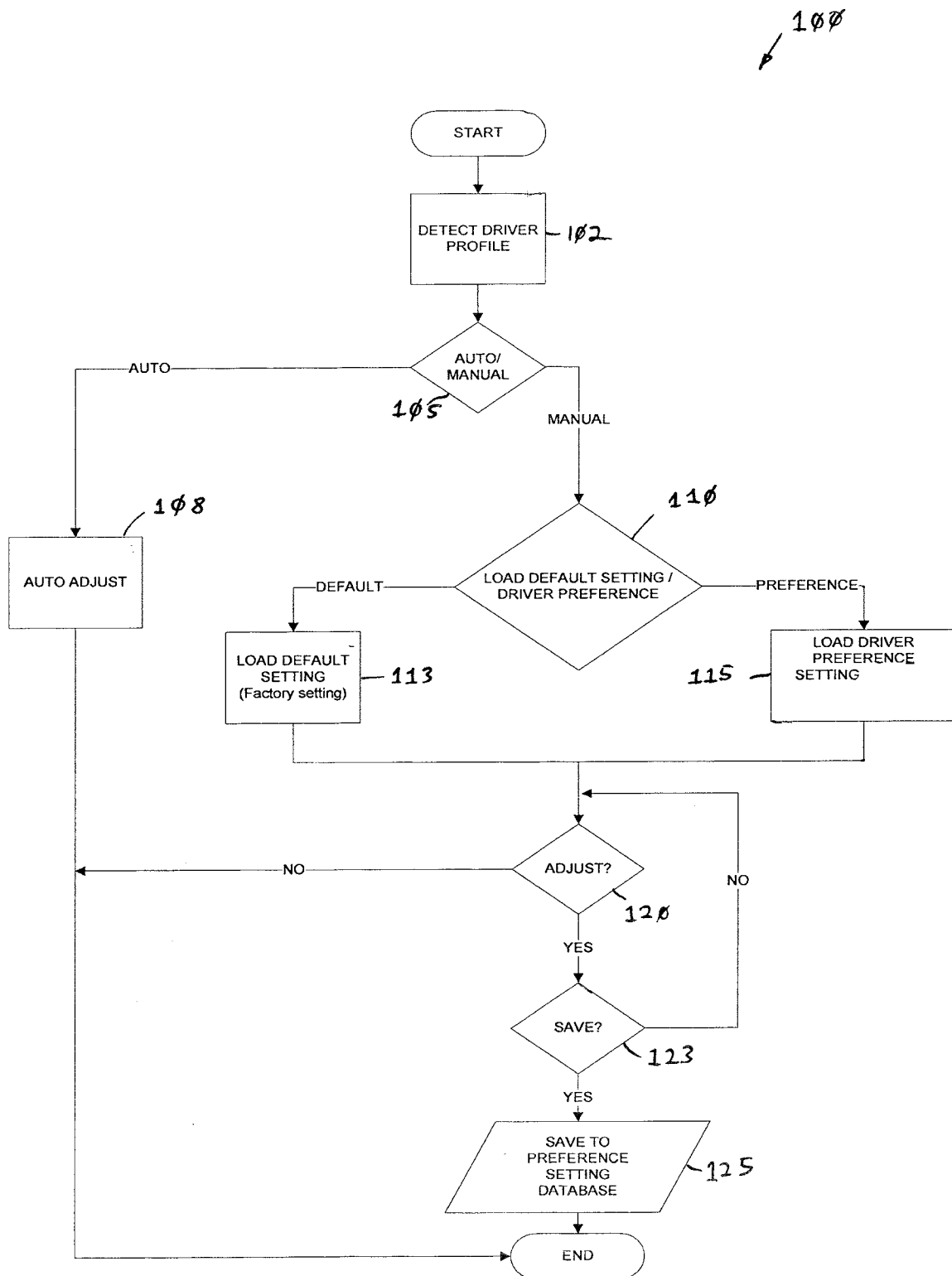


Fig. 6

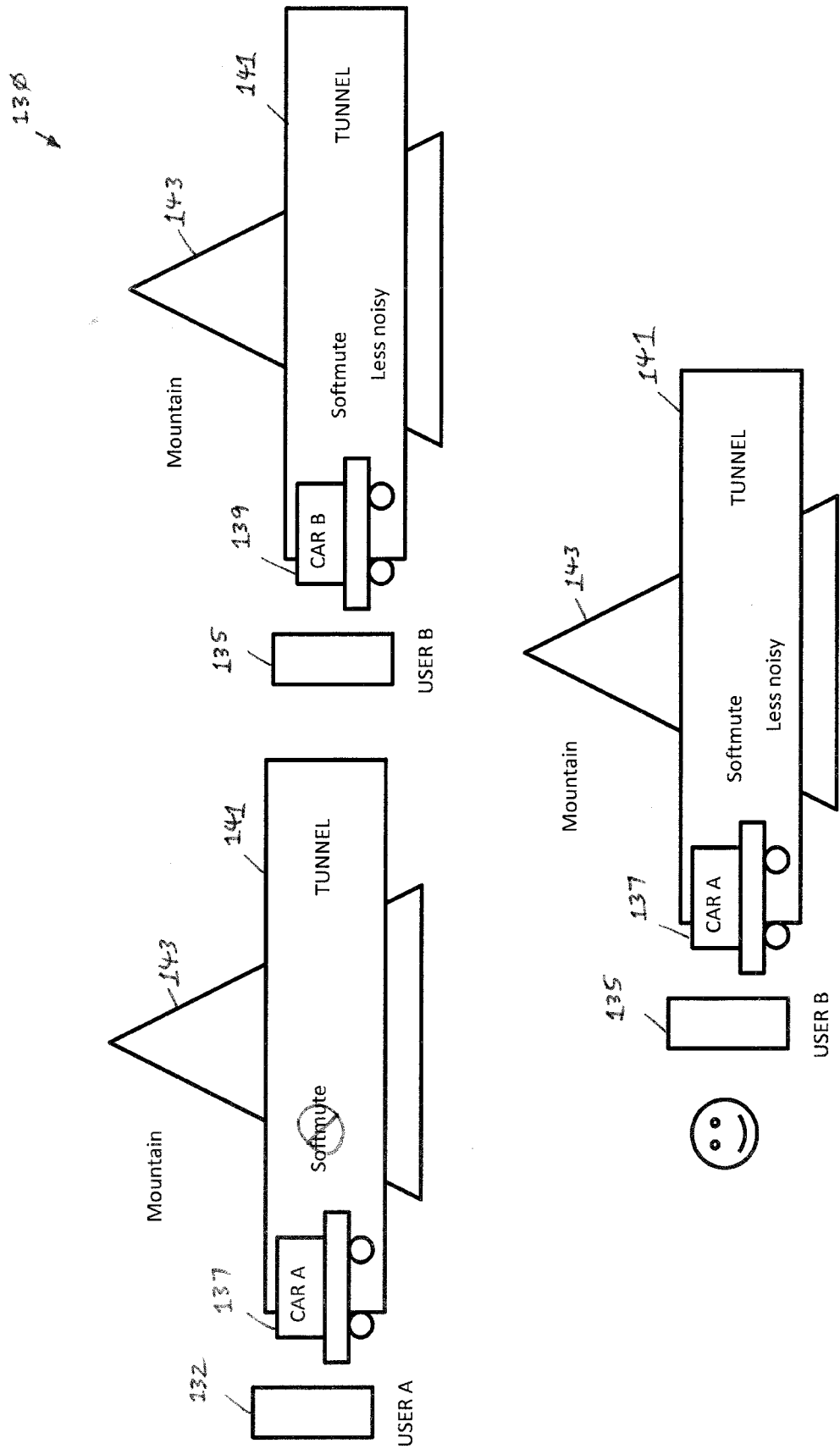


Fig. 7

150 ↗

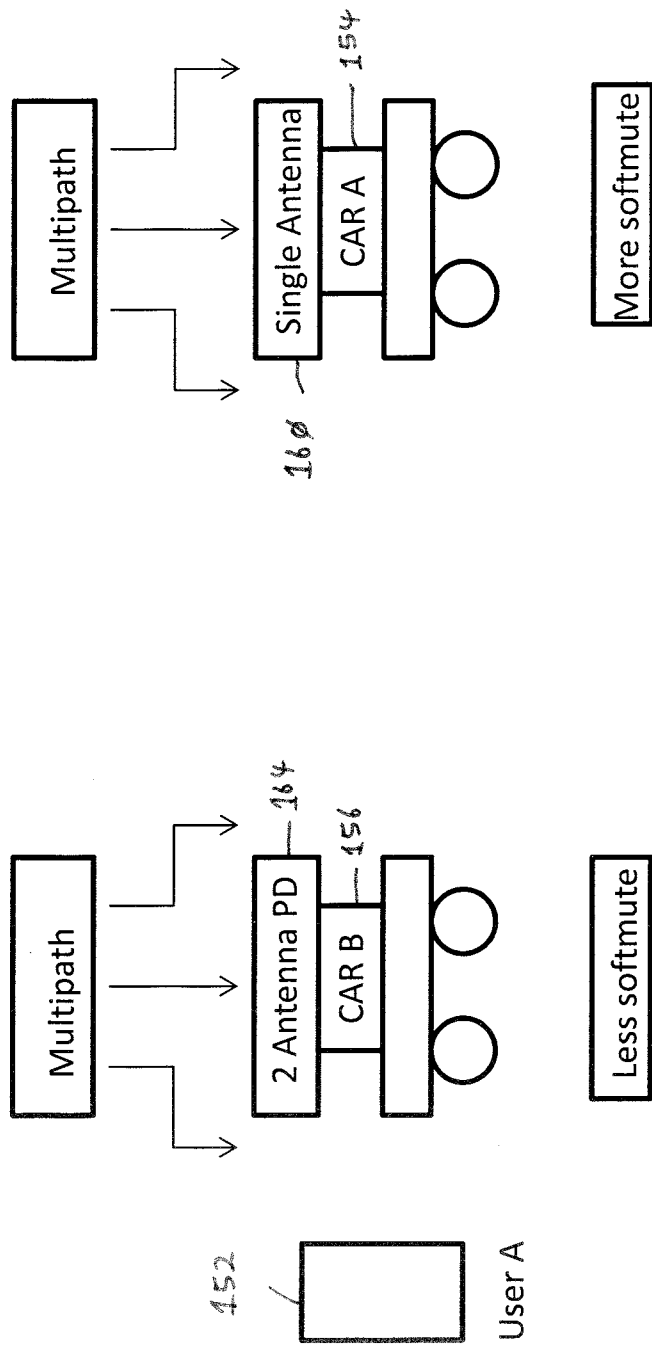


Fig. 8

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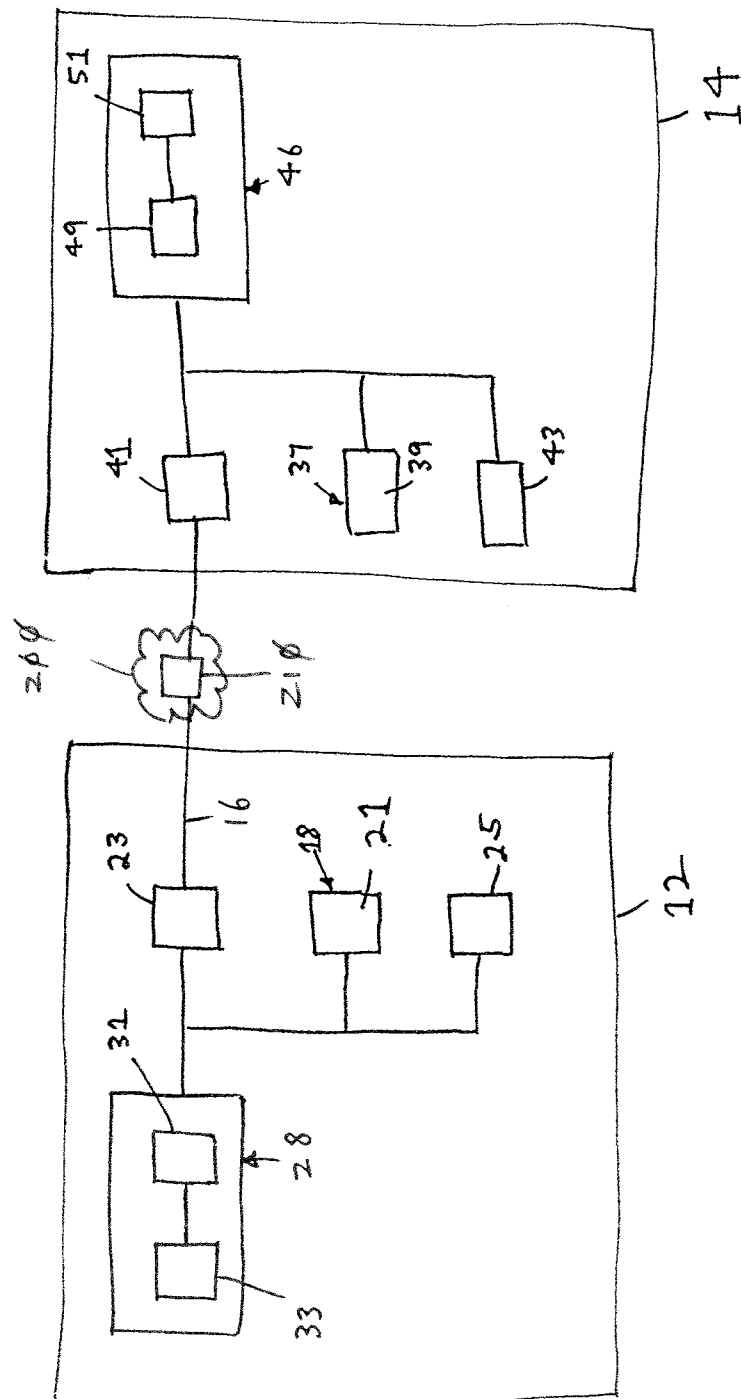


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2013/059053**A. CLASSIFICATION OF SUBJECT MATTER****H04L 29/04(2006.01)i, H04L 25/02(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L 29/04; G06F 19/00; H03G 3/20; H04B 1/06; H04Q 7/20; H04B 1/26; H04L 25/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords:mobile, radio, receiver, car, tuner, front-end, section, location, data, port, sensor, signal, communication, parameter, processing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2013-024321 A1 (CONTINENTAL AUTOMOTIVE GMBH) 21 February 2013 See page 3, lines 11-12; page 4, lines 27-29; page 5, lines 21-23; page 6, lines 4-13; page 7, lines 6-25; page 8, lines 4-5, 11-13; page 9, lines 23-24, 27-31; page 10, lines 1-6, 10-20; page 15, lines 7-10; page 16, lines 24-26; page 39, lines 1-9; claims 1-3, 7, 9-10; and figures 1-5.	1-21
Y	US 2010-0304702 A1 (FREDDY A. ANZURES et al.) 02 December 2010 See paragraphs 31-32, 36-37; and figures 2, 8.	1-21
A	US 2007-0135978 A1 (JAE MYOUNG KIM et al.) 14 June 2007 See paragraphs 29-34; and figure 3.	1-21
A	US 2013-0231155 A1 (ARNOLD SHEYNMAN et al.) 05 September 2013 See paragraphs 82-125; and figures 10-12.	1-21
A	US 2006-0142025 A1 (KUO-RONG CHEN et al.) 29 June 2006 See paragraphs 13-19; and figures 1-2.	1-21



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 June 2014 (26.06.2014)

Date of mailing of the international search report

26 June 2014 (26.06.2014)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IB2013/059053

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