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(54) METHOD FOR DISCOVERY AND INSTALLATION OF DIGITAL AUDIO/VIDEO SERVICES AND CORRESPONDING DEVICES

(57) Embodiments of the present principles provide service discovery and installation for digital radio frequency broadcast services receivers. A service discovery and installation (SD&I) server or service installation server transmits a request to a receiver to establish a reception report. The request comprises a list with one or more transponders to test by the receiver. The receiver tunes to at least one transponder to test and retrieves reception data for each transponder tuned to, stores the retrieved reception data in a report and transmits the report to the SD&I server. Based on the data in the report, the SD&I server returns SD&I information to the receiver that is adapted to the receiver's reception environment and reception conditions.

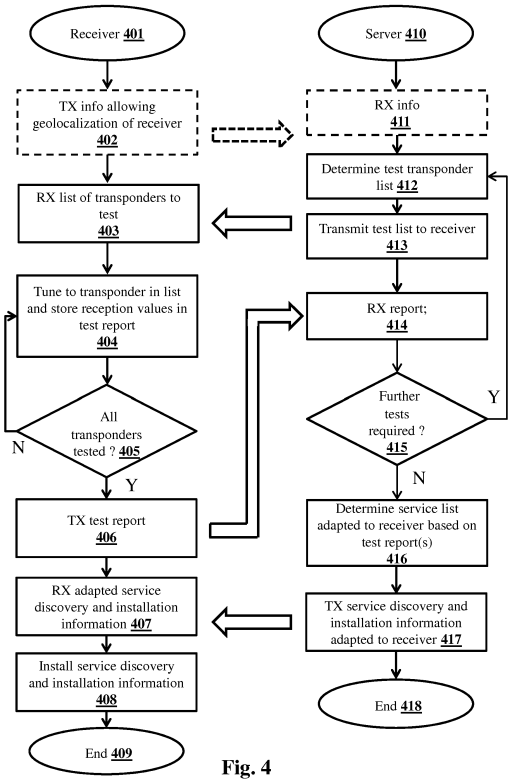

Fig. 4

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Description

1. Technical field.

[0001] The present principles generally relates to the reception of digital audio/video broadcast services and in particular to discovery and installation of digital audio/video services devices such as receivers of digital satellite, terrestrial and cable broadcast audio/video services and the like.

2. Technical background.

[0002] Service discovery and installation (SD&I) or in short service installation is the process of discovery of services offered by a provider and the acquisition of information for channel selection and for Electronic Program Guides (EPG) in a receiver of digital audio/video services. In the context of digital satellite, terrestrial and cable television, service discovery and installation generally requires scanning a frequency band, detecting carrier frequencies, tuning to carrier frequencies and acquiring signalization comprising SD&I information. Information acquired from SD&I signalization enables for example to find service coordinates (i.e. transmission frequencies) of transport stream multiplexes and enables to find individual services in a transport stream multiplex, e.g. from MPEG PSI (Program Specific Information). Information that enables to link various elementary streams into coherent programs e.g. SI (Service Information) is acquired from this signalization during service discovery and installation or during channel change. The SD&I information can further comprise human-readable descriptions for EPG and channel selection. SD&I information is conveyed in the form of tables and descriptors according to different standardizations and normalizations that are used in various countries and geographical regions.

[0003] Manufacturers of receivers for satellite, terrestrial or cable transmission have to design their hard- and software to many different broadcasting standards for transmitting SD&I information. For example, in Europe, the DVB-SI standard is commonly used for signalization of metadata related to service information, while MPEG PSI is used for signalization of metadata related to program specific information. In the US, ATSC-SI is required. For Asia and some countries of Latin America, ISDB-SI is defined. This means that receivers that are to be employed in many different countries must be shipped with different software that is adapted to the particular transmission standard used in the particular country or region it is shipped for. Engineers have to develop a service discovery and installation algorithm for each different broadcasting standard. Broadcasters have to maintain a backward compatible SD&I information signalization so that an installed base of receivers will continue to function after an update in which tables and descriptors are used differently. Alternatively, new software has to be developed and distributed to the installed base or receivers so that a transition to a modified use of tables and descriptors will be successful.

[0004] In a receiver of digital audio/video services, the service discovery and installation is a time-consuming process that can take up to several minutes.

[0005] For terrestrial broadcasting of audio/video services, a receiver of audio/video services can sometimes receive a same transport stream multiplex from several emitters on different frequencies with different reception qualities, due to the receiver being located in a transmission cell boundary or due to particular propagation conditions caused by the proximity of other buildings reflecting radio frequency (RF) signals. This further complicates the service discovery and installation process.

[0006] There is thus a need for a solution that enables a same receiver to be used in different countries/regions with different broadcasting standards, under different reception conditions, and that is less time-consuming.

3. Summary.

[0007] The present principles aim at alleviating some of the deficiencies of prior art.

[0008] To this end, the present principles comprise a method for service installation of digital services in a receiver for reception of digital services via a radio frequency receiver arrangement. The method is implemented by said receiver and comprises: receiving from a server a request to establish a reception report, said request comprising a list of transponders to tune to; tuning to at least one transponder in the list and retrieving reception data for each transponder tuned to for establishing the reception report; transmitting to the server the reception report comprising, for the at least one transponder in the list, the reception data; receiving from the server service installation information that is adapted to the receiver according to the reception report transmitted to the server.

[0009] According to a variant embodiment of the method, the reception data is at least one of: data acquired on a digital stream present on a transponder in the list; a carrier reception quality measured on a transponder in the list; or an error rate measured on a transponder in the list.

[0010] According to a variant embodiment of the method, the method further comprising a step of transmitting information to the server enabling the server to establish a geographical location of the receiver and to generate the list of transponders to tune to according to the geographical location of the receiver.

[0011] According to a variant embodiment of the method, the information transmitted to the server is any of: a subscriber identifier of a user of the receiver; an Internet Protocol address of the receiver; geographical coordinates of a location of the receiver.

[0012] According to a variant embodiment of the method, the receiver comprises an Internet Protocol network interface for reception of digital audio/video services via an Internet Protocol network, and the service installation

information received by the receiver comprising, for services for which the quality of reception measured by the receiver is below a threshold, alternative services receivable through the Internet Protocol network interface.

[0013] The present principles also relate to a method for installation of digital audio/video services for a receiver of digital audio/video services. The method is implemented by a server device and comprises: transmitting to the receiver a list of transponders to tune to and for which the receiver is to establish a reception report; receiving the reception report from the receiver, comprising for at least one transponder in the list at least one value of a reception parameter measured by the receiver; establishing service installation information adapted to the receiver based on the reception report; and transmitting service installation information to the receiver that is adapted to the receiver according to the reception report.

[0014] According to a variant embodiment of the method for installation of digital audio/video services for a receiver of digital audio/video services, the list of transponders to tune to by the receiver is a default list of transponders chosen to establish the service installation information adapted to the receiver through an elimination process.

[0015] According to a variant embodiment of the method for installation of digital audio/video services for a receiver of digital audio/video services, the method comprises a step of receiving information from the receiver enabling the server device to establish a geographical location of the receiver and to construct the list of transponders to tune to according to the geographical location of the receiver.

[0016] According to a variant embodiment of the method for installation of digital audio/video services for a receiver of digital audio/video services comprises: executing a frequency scan on a frequency band chosen as a function of the reception report; extraction of service information from digital services discovered during the frequency scan; and generating the service installation information based on the extracted service information.

[0017] The present disclosure also relates to a receiver device. The device comprises: a network interface configured to receive from a server a request to establish a reception report, the request comprising a list of transponders to tune to; a radio frequency interface configured to tune to at least one transponder in the list and retrieving reception data for each transponder tuned to for establishing the reception report; the network interface being further configured to transmit to the server the reception report comprising, for the at least one of the transponders in the list, the reception data; and the network interface being further configured to receive from the server service installation information that is adapted to the receiver according to the reception report transmitted to the server.

[0018] According to a variant embodiment of the receiver device, the network interface is further configured to transmit information to the server enabling the server to establish a geographical location of the receiver and to generate the list of transponders to tune to according to the geographical location of the receiver.

[0019] According to a variant embodiment of the receiver device, the receiver comprises an Internet Protocol network interface configured to receive digital audio/video services via an Internet Protocol network, and the service installation information received by the receiver comprising, for services for which the quality of reception measured by the receiver is below a threshold, alternative services receivable through the Internet Protocol network interface.

[0020] The present principles also relate to a server device. The server device comprises: a network interface configured to transmit to a receiver a list of transponders to tune to and for which the receiver is to establish a reception report; the network interface being further configured to receive the reception report from the receiver, comprising for at least one transponder in the list at least one value of a reception parameter measured by the receiver; a processor configured to generate service installation information adapted to the receiver based on the reception report; the network interface being further configured to transmit service installation information to the receiver that is adapted to the receiver according to the reception report.

[0021] According to a variant embodiment of the server device, the network interface is further configured to transmit information to the server device enabling the server device to establish a geographical location of the receiver and to generate the list of transponders to tune to according to the geographical location of the receiver.

4. List of figures.

[0022] More advantages of the present principles will appear through the description of particular, non-restricting embodiments of the disclosure. In order to describe the manner in which the advantages of the present principles can be obtained, particular descriptions of the present principles are rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. The drawings depict exemplary embodiments of the disclosure and are therefore not to be considered as limiting its scope. The embodiments described can be combined to form particular advantageous embodiments. In the following figures, items with same reference numbers as items already described in a previous figure will not be described again to avoid unnecessary obscuring of the disclosure.

[0023] The exemplary embodiments will be described with reference to the following figures:

Figure 1 is a prior technique distribution network for distribution of broadcast audio/video services.

Figure 2 is a flow chart of a prior technique service discovery and installation.

Figure 3 is a distribution network for distribution of

broadcast audio/video services in which the present principles may be applied.

Figure 4 is a flow chart of a service discovery and installation process according to an embodiment of the present principles.

Figure 5 is an example SQL SD&I installation file.

Figure 6 is a receiver according to a particular embodiment of the present principles.

Figure 7 is an SD&I server according to an embodiment of the present principles.

Figure 8 is an example terrestrial delivery descriptor.

5. Detailed description.

[0024] **Figure 1** is a prior technique distribution network for distribution of broadcast audio/video services. Audio/video content from a service provider **10** is sent to a broadcast antenna system **11** which transmits digital audio/video programs and service information via radio frequencies to a plurality of receivers **12, 13** and **14.** Each of the receivers **12, 13** and **14** is connected to a receiver antenna, respectively **120, 130** and **140,** and each of the receivers has an interface or tuner for reception of radio frequencies respectively **121, 131** and **141** that is connected to its respective receiver antenna.

[0025] **Figure 2** is a flow chart of a prior technique service discovery and installation such as implemented by one of the prior technique receivers **12, 13** or **14** of figure 1. Step **20** is an initialization step in which parameters are initialized that are used during the service discovery and installation, such as a list of services that is set to zero. In a step **21,** a scan of a frequency band is started. The frequency band to scan and its boundaries are parameters that are obtained from configuration settings that are stored in a receiver memory, for example in a data base. The scan starts from a start boundary to search for a carrier comprising a transport stream multiplex. This is done by means of a radio frequency tuner, e.g. **121, 131** or **141.** If no such a carrier is found in step **22,** it is tested in a step **24** if the end boundary of the frequency band to scan is reached. If a carrier is found in step **22,** the SD&I information is acquired in step **23** from tables comprised in the transport stream multiplex and stored in memory. In step **24** it is verified if the end of the frequency band is reached. If the end is not yet reached, the process continues with step **21** of scanning the frequency band for carriers. If the end is reached, the processing ends in a step **25.** Additional processing, not shown in this figure for reasons of legibility, may be required to parse the tables and descriptors acquired during the SD&I process, in order to choose and eliminate duplicate services, solve problems like two services having a same number, and so on. This additional processing may require several iterations of the SD&I process.

[0026] **Figure 3** is a distribution network for distribution of broadcast audio/video services in which the present principles may be applied. Elements in figure 3 that are in common with those in figure 1 have a same function unless otherwise stated. For reasons of conciseness their function is therefore not repeated. The service provider **30** is connected to a broadcast antenna system **11** and additionally to an IP network **31.** Receivers **32, 33** and **34** each receive audio/video broadcast content from the radio frequency transmission of antenna system **11.** Each of the receivers **32, 33** and **34** is additionally connected to the IP network **31** via an IP network interface, respectively **321, 331** and **341.** Service information for service discovery and installation is received from service provider **30** via IP network **31.**

[0027] **Figure 4** is a flow chart of an embodiment of a service discovery and installation according to the present principles, such as implemented by receivers **32, 33** and **34** of figure 3 and such as implemented by a SD&I server (not shown) for example, under the control of a service provider **30** according to the present principles. Optional steps are indicated in the figures through broken lines. The receiver SD&I process starts with an initialization step **401,** in which parameters that are used during the SD&I are initialized, such as a list of services that is set to zero.

[0028] In an optional step **402,** the receiver transmits information to a server of the service provider enabling the server to geographically locate the receiver and to establish a list of frequencies for the receiver to tune to according to the established geographical location.

[0029] According to a particular embodiment, the information comprises a subscriber identifier, enabling the provider to retrieve the subscriber address and thus determine its geographical location. According to further variant embodiments that enable roaming of the receiver, the information comprises an IP address for IP based geolocation that is sufficient to determine a geographical location at the level of a country, region or area, or receiver geographical GPS coordinates for a very precise location.

[0030] On the SD&I server side, the process starts with an initialization step **410** followed by an optional step **411** in which the server receives the information that was transmitted by the receiver in step **402.** Upon receipt of this information, the server determines the geographical location of the receiver. For example, if the received information comprises a subscriber id, the server looks up the subscriber's home address in a customer database. If the received information comprises an IP address, the server uses IP geolocation to find the geographical zone of the receiver's location. If the received information comprises precise GPS coordinates, the server uses these to locate the receiver. Then, the server determines in a step **412** a list of transponders for the receiver to tune to and for which to measure a value of one or more reception parameter(s) and to report to the server the value of the one or more reception parameter(s) measured on these transponders. A transponder is characterized by a frequency plus additional parameters such as polarization, modulation type, etc.

[0031] According to a variant embodiment, the deter-

mining of the list of transponders is based on the geographical location of the receiver if the server has this information.

[0032] According to a variant embodiment, the list of transponders is based on a default list. The list of transponders can be chosen such that with only a reduced set of transponders and the reception report it is possible to know the reception conditions of the receiver and to determine e.g. by elimination the receiver location e.g. country, region or area and then to adapt the SD&I information to the environment of the receiver. For example, the server can request the receiver to tune to a transponder frequency that is only present in a particular country, region or area.

[0033] According to a variant embodiment, if the server does not receive information enabling it to determine the receiver's geographical location, the server may determine the receiver's geographical location at a later time as will be explained hereafter, and establishes in step **412** a specific list of frequencies to test, which enables the server to determine the receiver's geographical location based on a test report received from the receiver. Some transponder frequencies may not be used in some countries / regions or used for other purposes and no carrier is found on the given transponder frequency that comprises a transport stream transmitting audio/video digital services.

[0034] As a further variant embodiment, the receiver's geolocalization is determined both from imprecise information received from the receiver that is further refined by analysis of the report and the selection of particular transponders.

[0035] If no information is received from the receiver enabling the geolocalization of the receiver or if the information received is imprecise, the process of establishing a list of transponders to test **412,** reception of the report **414,** analysis of the test report **415,** determining transponders **412** and transmission of list of transponders to the receiver **413** may require several iterations to determine the receiver's geolocalization, as depicted by the arrow from decisional block **415** to step **412** in Figure 4.

[0036] Thus, in a step **413** the server transmits a request to establish a reception report, the request comprising a list of transponders to which the receiver can tune to. The receiver receives the request in a step **403.** In steps **404** and **405,** the receiver tests reception on the one or more transponders in the request. This testing comprises tuning to at least one of the listed transponder and acquiring reception data. The reception data is for example a carrier reception quality such as carrier power measured in dB (decibel), carrier to noise ratio (CNR, C/N), signal to noise ratio (SNR), carrier to noise density (C/No), energy per bit to noise density (Eb/No) or carrier to interferer (C/I), presence of FEC (Forward Error Correction), bit error rate (BER), Viterbi bit error rate (VBER), channel bandwidth, bit rate, and any combination or product of these. According to a variant embodiment, the reception data is data acquired by the receiver from a digital stream present on a transponder in the list and corresponding to a program identifier specified in the list and associated with the transponder. The receiver transmits the acquired data 'as is', i.e. without analysis, to the server, and the server analyzes the data transmitted to it in the receiver's report and adapts SD&I information to the receiver based on information obtained from the analysis of the report in step **416.** For example, the request may comprise a program identifier (PID) and table id of a service information table or network information table that enables the server to determine which channel is transmitted on which transponder and thus quickly determine, based on this information, SD&I information that is adapted to the receiver. E.g. the SDT (Service Description Table) is provided in MPEG transport streams with a packet ID (PID) of 0x0011. An SDT with table ID 0x42 provides details about services in the current transport stream. According to a variant embodiment, the reception report may comprise any combination of these reception data, such as, for a given transponder, CNR as well as reception data corresponding to a PID and table ID of SI information transmitted by a stream on the given transponder.

[0037] In a step **406,** the receiver transmits a test report to the server. In a step **414,** the server receives the receiver's test report. Based on the information in the test report, the server can determine if the one or more transponders listed in the test list can be received with good quality of reception, and/or the server can analyze the data acquired by the receiver on the one or more transponders. The server can either use the quality of reception data as raw data, for example a given carrier to noise ratio to determine if a given audio/video channel can be received with good quality of reception, or the server uses the information to determine a quality of reception according to a more elaborated computation, such as computing the Shannon-Hartley limit of reliable data rate of a channel as known to those skilled in the art. If the test report comprises data acquired on a transponder, the server can analyze the data, such as SI information, e.g. in order to learn the service name of an audio/video service transmitted on a transponder. Based on the analysis of the test report, the server determines in a decisional step **415** if further testing is needed or not. Further testing may be indicated if the receiver did not detect any carrier frequency on one or more of the transponders in the list of transponders to test, or if the CNR is below a certain value, or if the BER is higher than a certain value, or no audio/video stream multiplex is detected on the given transponder. Further tests may also be required to determine the geolocation of the receiver if the server did not receive information in step **411** or if the information received was insufficiently precise. If no further testing is required, the server determines a list of selectable audio/video channels for the receiver based on the analysis of the search report(s) and establishes SD&I information for the receiver based on the list of selectable audio/video channels and optionally adapted to a subscription asso-

ciated with the receiver / user of the receiver; e.g. some services may be excluded or on the contrary included according to the subscription. The determined service list is thus adapted to the receiver's reception conditions. The SD&I information comprises, for example for each service, a service coordinate (e.g. frequency of the transport stream multiplex in which the service is transmitted), polarization and modulation type, a machine readable service identifier, a human-readable service name, an elementary stream composition and PIDs (Program Identifiers) needed for demultiplexing and service selection. This service discovery and selection information may be extracted by the server from signalization associated with the services, as from transport streams transmitting SI tables, or retrieved by the server from any other means such as from an internal or external database or a web server.

[0038] If, based on the analysis of the report(s) it happens that some services cannot be received with sufficient quality of reception due to various causes including interference and multipath fading due to the presence of tall surrounding buildings for example, the SD&I information may comprise alternative service coordinates for those services or may refer to the use of other means for reception if the receiver can receive services via alternative means, such as via an IP interface.

[0039] In a step **417,** the server transmits the SD&I information to the receiver, which is received by the receiver in a step **407.** With step **418,** the server SD&I ends. Upon reception of the SD&I information the receiver installs the information in the receiver in a step **408** and stores it in memory for example in a data base, and the receiver is ready to be used, which ends the service discovery and install process for the receiver in step **409.**

[0040] The SD&I information as transmitted by the server in step **417** can have any format such as XML (extended Mark-up Language), JSON (JavaScript Object Notation) or in the form of SQL commands for creation of service installation information in the receiver's data base.

[0041] **Figure 5** depicts an example SQL file that can be transmitted by a SD&I server to a receiver according to the present principles. The receiver interprets the SQL file which starts with BEGIN TRANSACTION **500.** The receiver then receives an instruction **501** to create a *source_config* table and inserts information into this table related to a single IP service **502** and a single RF transponder **503** carrying one or more channels. In **504** a *service* table is created. The service table contains information for services carried by the transponders. In this example the multicast IP address 'udp://239.197.23.1:5555 carries only one channel 'TV1' (the single channel is comprised in an SPTS, for Single Program Transport Stream) which is inserted **507** in the *service* table. The terrestrial transponder on frequency 497991 carries 2 channels 'TF1' and 'NRJ12' (the two channels are comprised in an MPTS, for Multiple Program Transport Stream) and is inserted in the service table in **505** and **506.** Finally, the database actions **500-507** are committed with the commit instruction **508.** It can be observed that the above example SQL command file comprises references to digital terrestrial DVB services as well as IP services, and the above file is typically destined to a hybrid terrestrial/IP receiver.

[0042] Once a receiver is installed correctly, it may still be necessary to update the installation. The technical features of the present principles also enable the update of an installation of a receiver. It may be necessary to update SD&I information for a receiver because a list of channels and their coordinates (frequency, address, etc.) change. For example: 1) a channel is added or removed as part of an update of the list of services in a subscriber package; 2) a channel is moved from one transponder to another due to a reorganization of broadcast frequencies; 3) a channel is broadcasted only temporarily and is to be added for the duration of the broadcast and then be removed; 4) any number of channels can no longer be received with sufficient quality due to a change in environment of the receiver, e.g. a new building in between the transmitter antenna and the receiver antenna strongly attenuates the signal strength. Updates can be initiated by a SD&I information server or be initiated by a receiver. For example, for cases 1) to 3), the SD&I server takes the initiative to transmit updated SD&I information to any number of receivers. For case 4), a receiver takes the initiative to request updated SD&I information from the SD&I server. Such a request for update may comprise a list of services that can no longer be received with sufficient quality, and/or a list of transponders of which the services can no longer be received with sufficient quality. Alternatively, the request is a simple request for update without comprising any further information. The SD&I server, upon receipt of this type of request, may decide to directly transmit an update of SD&I information, or the process depicted in figure 4 may be initiated by the reception of the request. An update may comprise a complete SD&I information for a full install, or only a delta. The type of SD&I (complete or delta) may be indicated in the SD&I information transmitted by the SD&I server to the receiver, e.g. in the transmission **417** of figure 4. According to a variant embodiment, the SD&I update can be programmed by the SD&I server at a given time so that the receiver(s) can update the SD&I information at an appropriate moment, e.g. during nighttime; alternatively, the update can be transmitted to the receiver in advance but applied by the receiver at a moment that is appropriate e.g. that does not disturb the user of the receiver, such as at nighttime, when the receiver is in a standby state or enters a standby state, or when exiting from a standby state or powering on. According to a variant embodiment of the present principles, the server transmits the update to the receiver in advance while the update comprises a date/hour for application of the update. This is for example advantageous when the server is aware of a future change in SD&I information at a given data/time; it transmits the update in advance, and the

receiver applies the update immediately at the specified date/time.

[0043] According to a variant embodiment of the present principles, the SD&I server associates with a receiver e.g. a receiver that requests an update; once the SD&I server has determined the update resulting from a cooperation with the associated receiver e.g. according to the process depicted in figure 4, it distributes updates to other receivers that are in a similar geographical area as the associated receiver.

[0044] A problem of scalability can occur when an installation is to be updated for a plurality of receivers. For example, a transmitter technical failure or an update of a service plan. Even if those cases can be local to a given area they can potentially concern many receivers. If all receivers take the initiative to contact a same SD&I server simultaneously, this may cause unacceptable delay times for the updates to be transmitted to all receivers if the SD&I server infrastructure is not dimensioned correctly. When an update is known and can be programmed at a given time, it can be transmitted in advance to receivers that are concerned by the update in advance according to the previous discussed variant embodiment and the problem can be avoided. However when a problem arises that was not planned, other measures can help. A plurality of SD&I servers may be deployed in an SD&I server infrastructure that is adapted to handle many incoming requests in an acceptable time. According to a variant embodiment, a receiver that observes a problem requiring it to contact the SD&I server, respects a random back off interval before transmitting a request to the SD&I server, so that at the SD&I server end all requests will not arrive simultaneously. According to a variant embodiment, the SD&I server can verify if requests come from receivers in a close geographical region. If so, it can conclude that the receivers are concerned by a same problem. It then can transmit a hold message to the receivers in the concerned geographical area and program an update for a later time.

[0045] Embodiments of the present principles thus advantageously enable a receiver device to avoid the time consuming process of prior technique SD&I, i.e. including scanning of a frequency band, tuning to transport stream multiplexes, and extracting information from tables and descriptors. Embodiments of the present principles thus advantageously enable receivers to be agnostic with regard to the system/standard used for transmitting SD&I information. For example, according to the present principles, a same receiver embedded software or hardware will be operable for use in audio/video services distribution networks corresponding to different standards for transmitting service discovery and selection information, which makes the software and/or hardware easier to maintain and reduces manufacturing and maintenance costs.

[0046] **Figure 6** is a receiver device **6** according to a particular embodiment of the present principles. The device comprises a central processing unit **60,** a non-volatile memory **61,** a volatile memory **62,** a tuner **63** with a connection to an antenna device, a clock unit **64,** an audio/video driver **65** provided with an audio/video output, and an IP interface **66** that is connected to an IP network. All of these are interconnected by means of an internal data- and communication bus **67.** The IP interface **66** is configured to receive from an SD&I server a request to establish a reception report, the request comprising a list of transponders to tune to. The radio frequency interface or tuner **63** is configured to tune to at least one of transponders in the list and to retrieve reception data for each transponder tuned to. The IP interface **66** is further configured to transmit to the SD&I server the reception report comprising, for each of the transponders in the list that was tuned to, the reception data; and the IP interface **66** is further configured to receive from the SD&I server SD&I information that is adapted to the receiver according to the reception report transmitted to the SD&I server.

[0047] **Figure 7** is a SD&I server device **7** according to a particular embodiment of the present principles. The device comprises a central processing unit **70,** a non-volatile memory **71,** a volatile memory **72,** a clock unit **74,** and an IP interface **76** that is connected to an IP network. All of these are interconnected by means of an internal data- and communication bus **77.** The IP network interface **76** is configured to transmit to a receiver (e.g. **6)** a list of transponders to tune to and for which the receiver is to establish a reception report. The IP network interface **76** is further configured to receive the reception report from the receiver, comprising for each transponder in the list that was tuned to at least one value of a reception parameter measured by the receiver. The processor **70** is configured to establish/generate service discovery and installation information adapted to the receiver based on the reception report. The IP network interface **76** is further configured to transmit service discovery and installation information to the receiver that is adapted to the receiver according to the reception report.

[0048] Those skilled in the art should appreciate that the present principles are not limited to Set-Top Box like receiver devices. In other embodiments, the receiver device is integrated into a rendering device, such as a digital television comprising a digital television decoder arrangement.

[0049] Those skilled in the art should appreciate that the present principles are not limited to satellite transmission and reception, and that the present principles equally apply to cable transmission or to any radio frequency broadcast technology.

[0050] As discussed in the background section, in the case of terrestrial broadcasting of audio/video services, it may occur that a receiver of audio/video services can receive a same transport stream multiplex from several emitters on different frequencies with different reception qualities, when the receiver is located in a transmission cell boundary or due to particular propagation conditions caused by the proximity of other buildings reflecting RF signals. Transmission of DTT broadcast is used per ge-

ographical area or transmission cell. In each area the DTT is broadcasted on a set of transponders and each transponder is characterized by 'frequency', 'bandwidth', 'constellation' etc., see for example a DVB terrestrial delivery descriptor **800** reproduced in **Figure 8.** The terrestrial delivery descriptor comprises a descriptor tag **801,** a descriptor length field **802,** a center frequency value **803,** a bandwidth value **804,** a priority field **805,** a time slicing indicator **806,** an MPE-Forward Error Control indicator **807,** a constellation value field **809,** a hierarchy information field **810,** a code rate of HP stream **811,** a code rate of LP stream **812,** a guard interval value **813,** a transmission mode field **814** and another frequency value field **815.** Spare space for future use is reserved in fields **808** and **816.**

[0051] A given transponder in a cell carries some channels. These channels may not be the same in each cell. Some transponders are not carried by the same delivery system in the different cells; this is done voluntary to avoid creating interferences in cell boundaries. As a consequence, a transponder may be received twice. For example, in a cell boundary a transponder R1 is received from cell 1 (c1) and from cell 2 (c2). R1-c1 can be received with a given reception quality and comprises channels CH1, CH2, CH3, CH4. R1-c2 can be received with a higher reception quality and comprises channels CH1, CH2, CH3, and CH5. A SD&I server according to an embodiment of the present principles may comprise in its frequency list transmitted to a receiver different frequencies of same channels from different transponders to verify if the receiver is located in a cell boundary. Based on the report from the receiver, the SD&I server may adapt the installation information destined to the receiver so that CH1, CH2, CH3, CH5 is received on frequencies corresponding to R1-c2, while CH4 is received on a frequency corresponding to R1-c1. The process of SD&I is thus greatly simplified for the receiver; it merely has to tune to some transponders, transmit a report to the SD&I server and receive a list of services adapted to the receiver's reception conditions in accordance with embodiments of the present principles.

[0052] Some elements in the drawings may not be used or be necessary in all embodiments. Some operations may be executed in parallel. Variant embodiments other than those illustrated and/or described are possible.

[0053] As will be appreciated by one skilled in the art, aspects of the present principles can be embodied as a system, method or computer readable medium. Accordingly, aspects of the present principles can take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code and so forth), or an embodiment combining hardware and software aspects that can all generally be defined to herein as a "circuit", "module" or "system". Furthermore, aspects of the present principles can take the form of a computer readable storage medium. Any combination of one or more computer readable storage medium(s) can be utilized.

[0054] Thus, for example, it will be appreciated by those skilled in the art that the diagrams presented herein represent conceptual views of illustrative system components and/or circuitry embodying the principles of the present disclosure. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable storage media and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

[0055] A computer readable storage medium can take the form of a computer readable program product embodied in one or more computer readable medium(s) and having computer readable program code embodied thereon that is executable by a computer. A computer readable storage medium as used herein is considered a non-transitory storage medium given the inherent capability to store the information therein as well as the inherent capability to provide retrieval of the information there from. A computer readable storage medium can be, for example, but is not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. It is to be appreciated that the following, while providing more specific examples of computer readable storage mediums to which the present principles can be applied, is merely an illustrative and not exhaustive listing as is readily appreciated by one of ordinary skill in the art: a portable computer diskette; a hard disk; a read-only memory (ROM); an erasable programmable read-only memory (EPROM or Flash memory); a portable compact disc read-only memory (CD-ROM); an optical storage device; a magnetic storage device; or any suitable combination of the foregoing.

Claims

1. A method for service installation of digital services in a receiver (32, 33, 34) for reception of digital services via a radio frequency receiver arrangement, the method being implemented by said receiver and comprising:

   receiving (403) from a server a request to establish a reception report, said request comprising a list of transponders to tune to;
   tuning (404, 405) to at least one transponder in said list and retrieving reception data for each transponder tuned to for establishing said reception report;
   transmitting (406) to said server said reception report comprising, for said at least one transponder in said list, said reception data;
   receiving (407) from said server service installation information that is adapted to said receiver

according to said reception report transmitted to said server.

2. The method according to claim 1, wherein the reception data is at least one of:

data acquired on a digital stream present on a transponder in said list;
a carrier reception quality measured on a transponder in said list; or
an error rate measured on a transponder in said list.

3. The method according to claim 1, comprising a step of transmitting information (402) to said server enabling said server to establish a geographical location of said receiver and to generate said list of transponders to tune to according to said geographical location of said receiver.

4. The method according to claim 3, wherein said information transmitted to said server is any of:

a subscriber identifier of a user of said receiver;
an Internet Protocol address of said receiver;
geographical coordinates of a location of said receiver.

5. The method according to any of claims 1 to 4, wherein said receiver comprises an Internet Protocol network interface for reception of digital audio/video services via an Internet Protocol network, and said service installation information received by said receiver comprising, for services for which said quality of reception measured by said receiver is below a threshold, alternative services receivable through said Internet Protocol network interface.

6. A method for installation of digital audio/video services for a receiver (32, 33, 34) of digital audio/video services, the method being implemented by a server device and comprising:

transmitting (413) to said receiver a list of transponders to tune to and for which said receiver is to establish a reception report;
receiving (414) said reception report from said receiver, comprising for at least one transponder in said list at least one value of a reception parameter measured by said receiver;
establishing (416) service installation information adapted to said receiver based on said reception report;
transmitting (417) service installation information to said receiver that is adapted to said receiver according to said reception report.

7. The method according to claim 6, wherein the list of transponders to tune to by said receiver is a default list of transponders chosen to generate said service installation information adapted to said receiver through an elimination process.

8. The method according to claim 6, comprising a step of receiving (411) information from said receiver enabling said server device to establish a geographical location of said receiver and to construct said list of transponders to tune to according to said geographical location of said receiver.

9. The method according to claim 6 or 7, comprising:

executing a frequency scan on a frequency band chosen as a function of said reception report;
extraction of service information from digital services discovered during said frequency scan; and
generating said service installation information based on said extracted service information.

10. A receiver device (6), comprising:

a network interface (66) configured to receive (403) from a server (7) a request to establish a reception report, said request comprising a list of transponders to tune to;
a radio frequency interface (63) configured to tune (404, 405) to at least one transponder in said list and retrieving reception data for each transponder tuned to for establishing said reception report;
said network interface being further configured to transmit (406) to said server said reception report comprising, for said at least one of said transponders in said list, said reception data; and
said network interface being further configured to receive (407) from said server service installation information that is adapted to said receiver according to said reception report transmitted to said server.

11. The receiver device according to claim 10, wherein said network interface is further configured to transmit information (402) to said server enabling said server to establish a geographical location of said receiver and to generate said list of transponders to tune to according to said geographical location of said receiver.

12. The receiver device according to claim 10 or 11, wherein said receiver device further comprises an Internet Protocol network interface configured to receive digital audio/video services via an Internet Protocol network, and said service installation information received by said receiver comprising, for serv-

ices for which said quality of reception measured by said receiver is below a threshold, alternative services receivable through said Internet Protocol network interface.

13. A server device (7), comprising:

a network interface (76) configured to transmit (413) to a receiver (6) a list of transponders to tune to and for which said receiver is to establish a reception report;
said network interface being further configured to receive (414) said reception report from said receiver, comprising for at least one transponder in said list at least one value of a reception parameter measured by said receiver;
a processor (70) configured to generate (416) service installation information adapted to said receiver based on said reception report;
said network interface being further configured to transmit (417) service installation information to said receiver that is adapted to said receiver according to said reception report.

14. The server device according to claim 13, wherein the list of transponders to tune to by said receiver is a default list of transponders that are selected by said processor to generate said service installation information adapted to said receiver through an elimination process.

15. The server device according to claim 13, wherein said network interface is further configured to receive information from said receiver enabling said processor of said server device to determine a geographical location of said receiver and wherein said processor is further configured to construct said list of transponders to tune to according to said geographical location of said receiver.

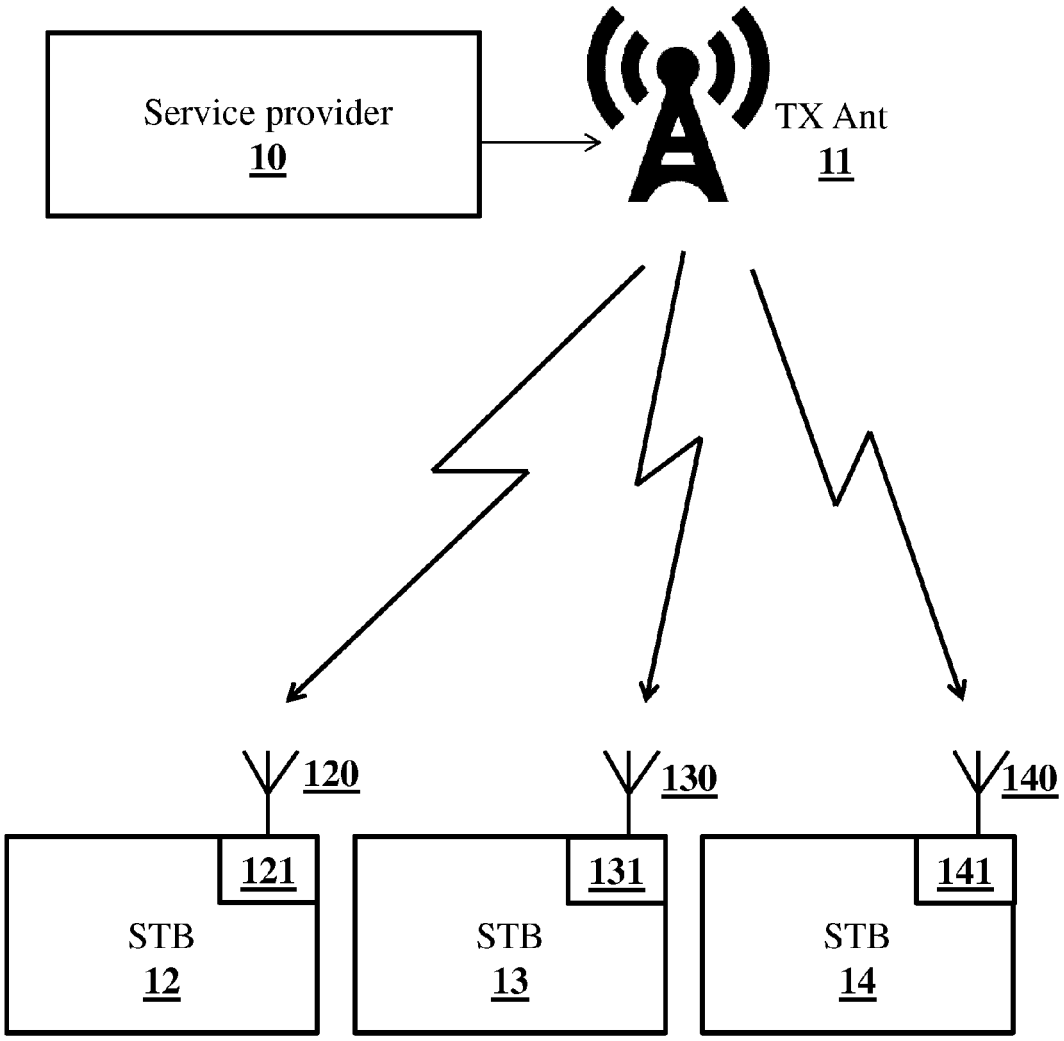
Service provider
10
TX Ant
11
120
130
140
121
131
141
STB
12
STB
13
STB
14

Fig. 1

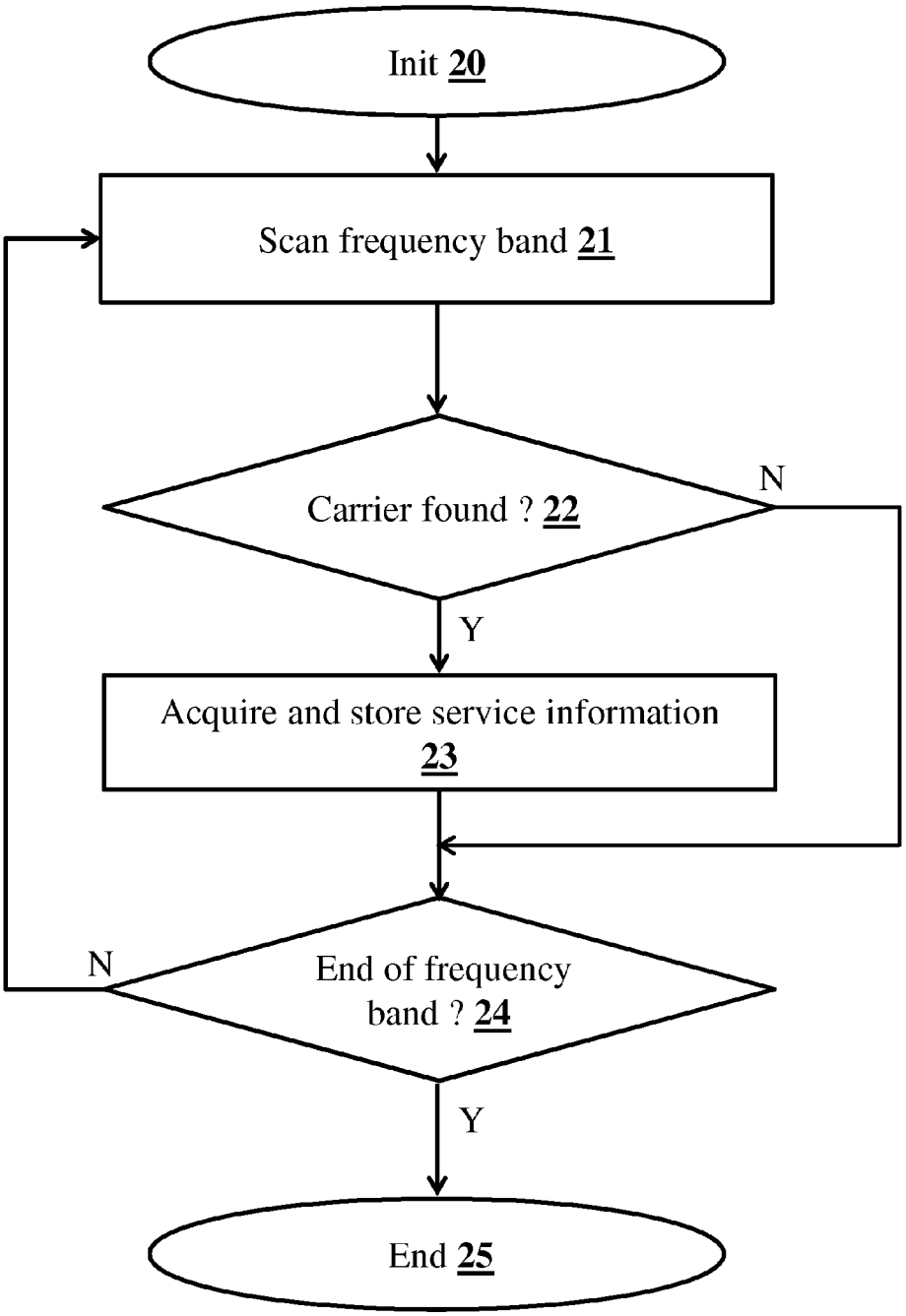
Init 20
Scan frequency band 21
Carrier found ? 22
N
Y
Acquire and store service information 23
End of frequency band ? 24
N
Y
End 25

Fig. 2

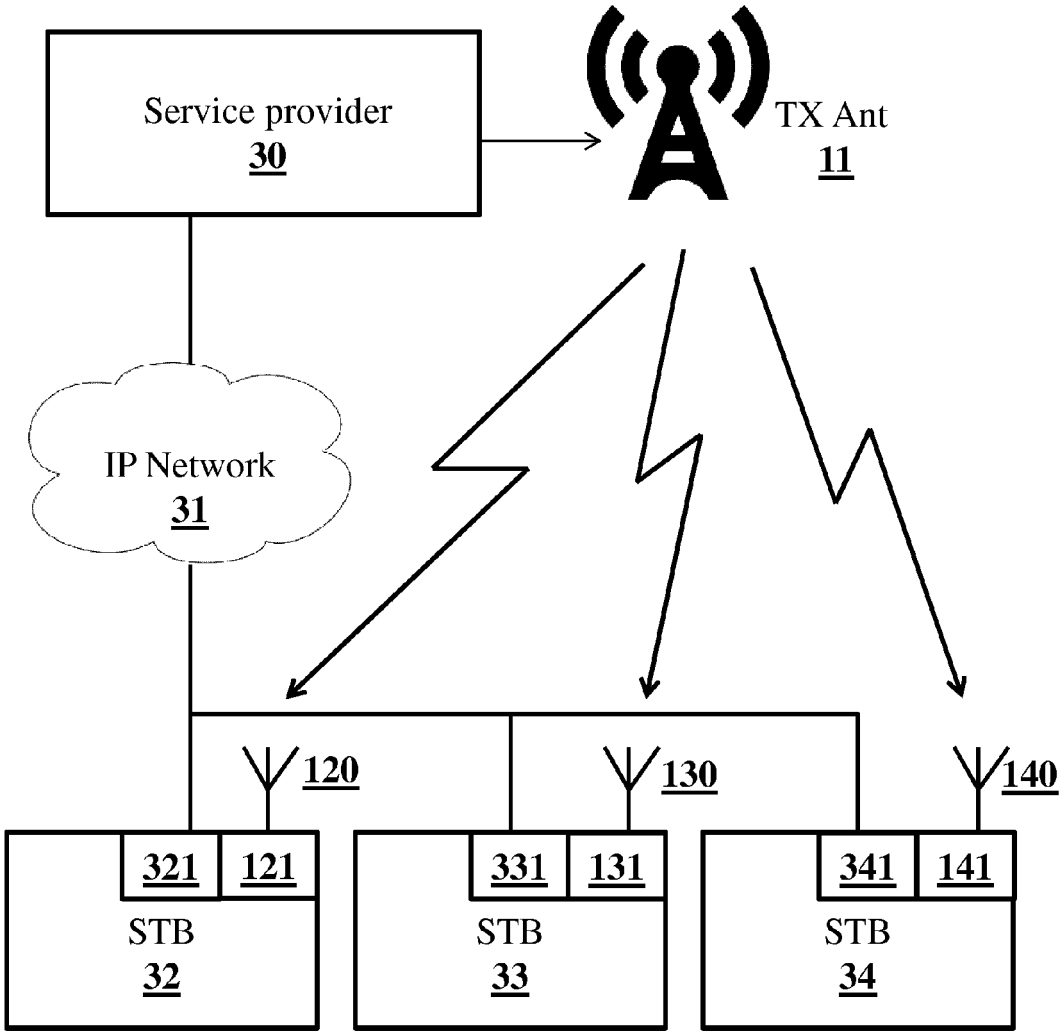
Service provider
30
TX Ant
11
IP Network
31
120
130
140
321
121
331
131
341
141
STB
32
STB
33
STB
34

Fig. 3

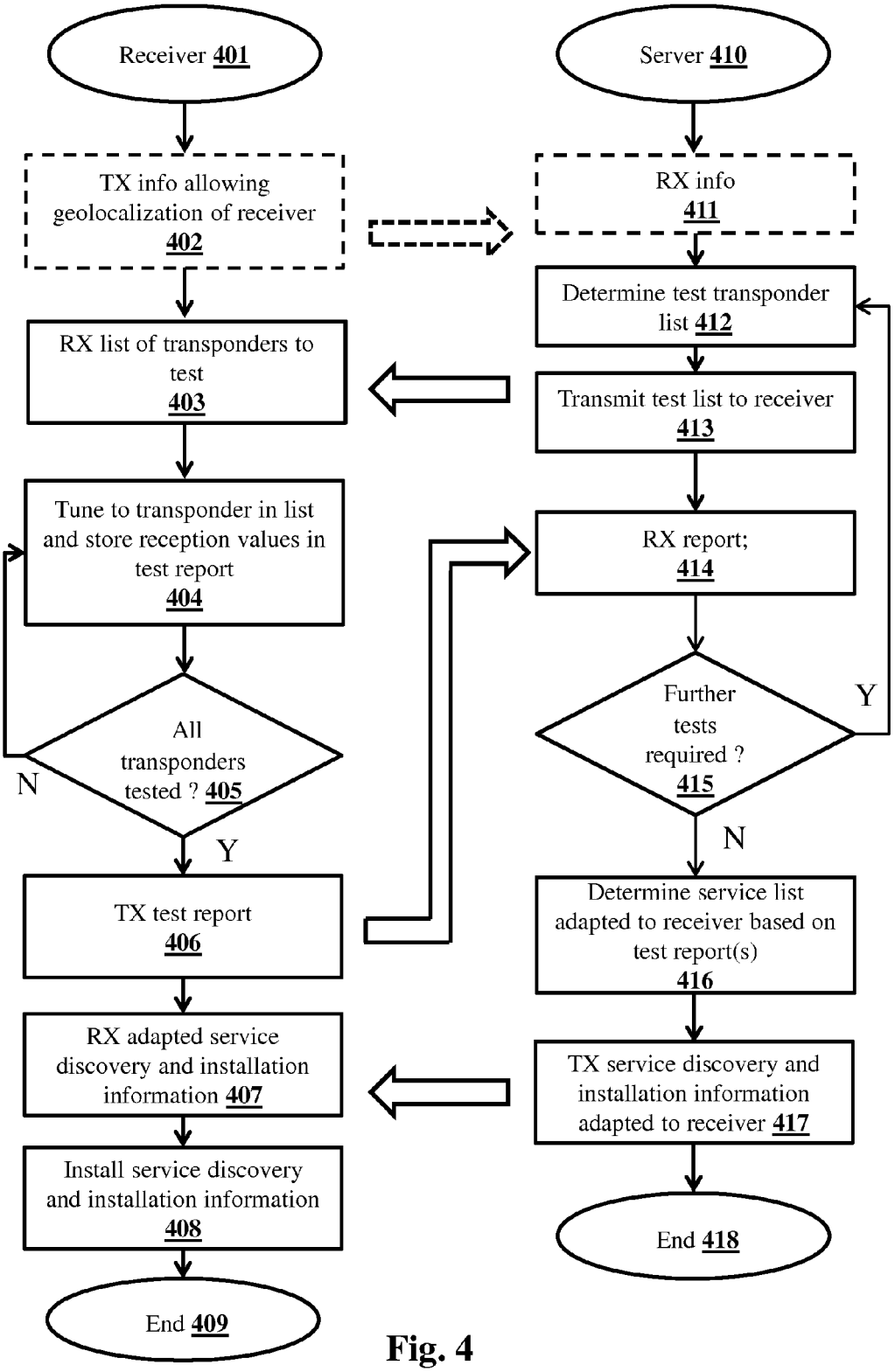
Receiver 401
Server 410
TX info allowing geolocalization of receiver 402
RX info 411
Determine test transponder list 412
RX list of transponders to test 403
Transmit test list to receiver 413
Tune to transponder in list and store reception values in test report 404
RX report; 414
All transponders tested ? 405
N
Y
Further tests required ? 415
Y
N
TX test report 406
Determine service list adapted to receiver based on test report(s) 416
RX adapted service discovery and installation information 407
TX service discovery and installation information adapted to receiver 417
Install service discovery and installation information 408
End 418
End 409

Fig. 4

```
500 BEGIN TRANSACTION;

501 CREATE TABLE source_config(SourceConfigID INTEGER
NOT NULL, SourceConfiguration TEXT NOT NULL,primary
key(SourceConfigID));

502 INSERT INTO `source_config` VALUES ('1','<?xml
version=''1.0'' ?><ConfigSrcUdp Port=''5555''
IpAddr=''239.197.23.1'' PgmNumber=''1''
ServiceURI=''udp://239.197.23.1:5555''/>');

503 INSERT INTO `source_config` VALUES
('4','<ConfigSrcTer ServiceURI="FAKE_4" SiType="0"
FrequencyKh="497991.000000" PgmNumber="0"
OptimisationData="optional data" CellId="0" Bandwidth="0"
Constellation="2" HierarchyInformation="0"
CodeRateHpStream="1" CodeRateLpStream="0" GuardInterval="0"
TransmissionMode="1" OtherFrequencyFlag="0"/>');

504 CREATE TABLE service(UniqueId INTEGER NOT
NULL,Name TEXT,Type INTEGER NOT NULL,ProgramNumber
INTEGER,ChannelNumber INTEGER NOT NULL,Uri TEXT NOT NULL,
SourceConfigID INTEGER,primary key(UniqueId),foreign
key(TransponderID) references transponder(TransponderID) on
delete restrict on update cascade);

505 INSERT INTO `service` VALUES
('65537','TF1','1','1537','4','dvb:6.8442.1537','4');

506 INSERT INTO `service` VALUES
('65538','NRJ12','1','1538','5','dvb:6.8442.1538','4');

507 INSERT INTO `service` VALUES
('2147483649','TV1','1',NULL,'1','udp://239.197.23.1:5555',
'1');
508 COMMIT;
```

Fig. 5

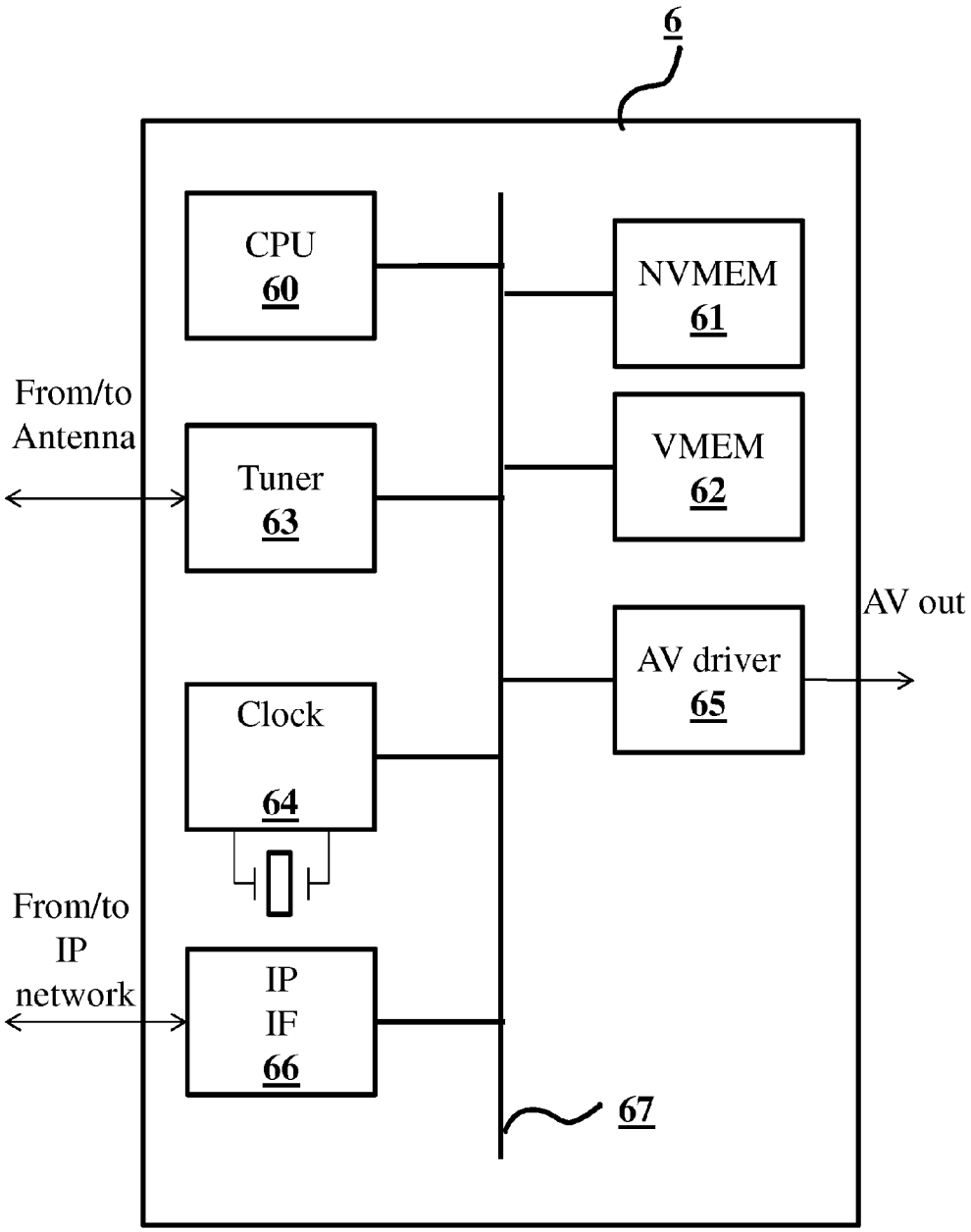
6
CPU
60
NVMEM
61
From/to
Antenna
Tuner
63
VMEM
62
AV out
AV driver
65
Clock
64
From/to
IP
network
IP
IF
66
67

Fig. 6

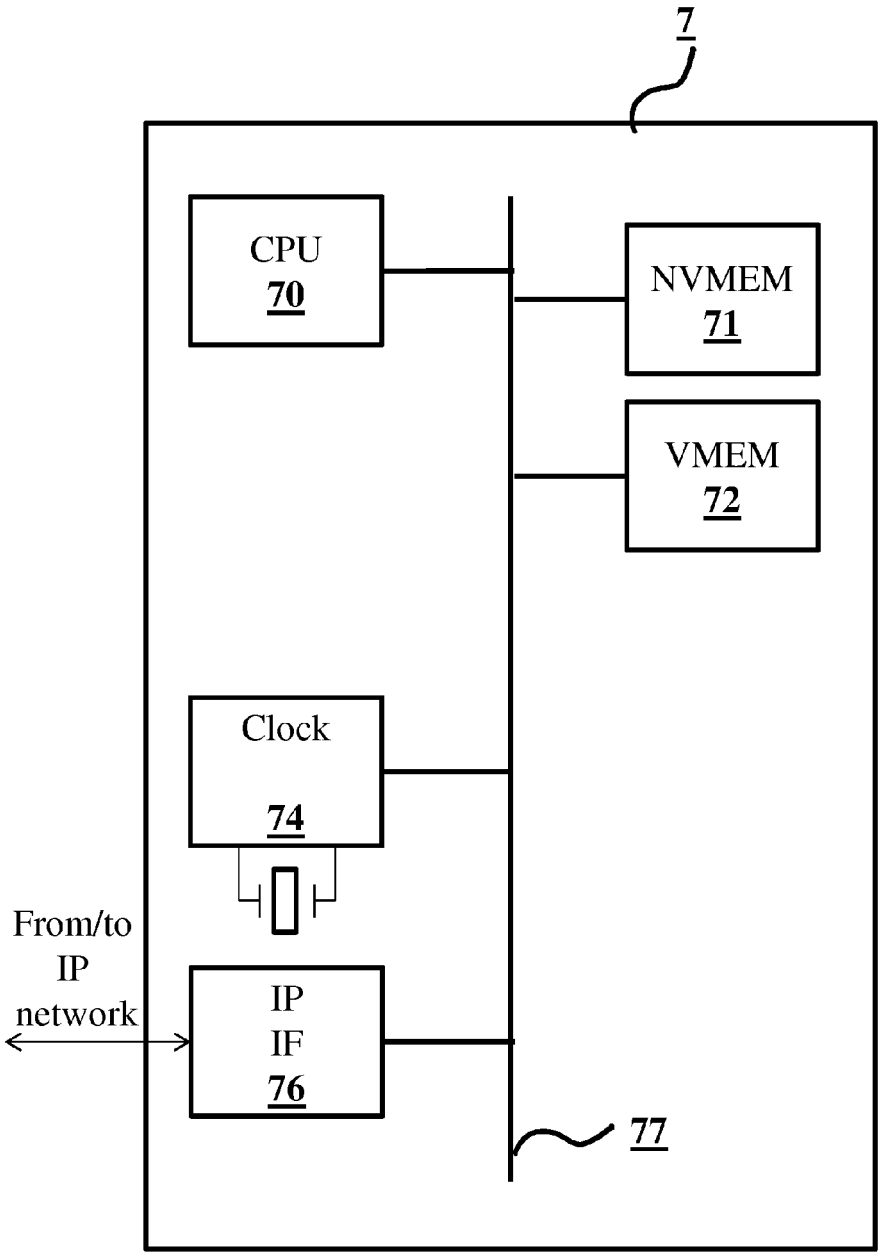

Fig. 7

800 terrestrial_delivery_system_descriptor () {
- 801 descriptor_tag
- 802 descriptor_length
- 803 centre_frequency
- 804 bandwidth
- 805 priority
- 806 Time_Slicing_indicator
- 807 MPE-FEC_indicator
- 808 reserved_future_use
- 809 constellation
- 810 hierarchy_information
- 811 code_rate-HP_stream
- 812 code_rate_LP_stream
- 813 guard_interval
- 814 transmission_mode
- 815 other_frequency_flag
- 816 reserved_future_use

}

Fig. 8

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 15 30 6667

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	US 2011/159800 A1 (UEOKA SHOHJI [JP] ET AL) 30 June 2011 (2011-06-30) * paragraphs [0021], [0023], [0056], [0070], [0087], [0095], [0207], [0212] * * paragraph [0078] - paragraph [0079] * -----	1-15	INV. H04H20/26 H04H20/57 H04H60/51

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	25 April 2016	De Haan, Aldert

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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25-04-2016

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US 2011159800 A1	30-06-2011	CN 102110136 A	29-06-2011
		US 2011159800 A1	30-06-2011

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82