

Invalidity of U.S. Patent No. 10,129,590 in view of Honkanen '076

This chart pertains to U.S. Patent No. 10,129,590 (the “’590 patent”). This chart is subject to all reservations, objections, and disclaimers in Samsung’s Invalidity Contentions and any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. This chart refers to the following prior art references:

US20060135076A1 (“Honkanen ’076”) was filed on November 22, 2005 and published June 22, 2006 and therefore qualifies as prior art to the ’590 patent under at least pre-AIA 35 U.S.C. § 102(a), (b), and (e).

Discovery is ongoing and Samsung will update this chart pursuant to Federal Rule of Civil Procedure 26(e), the Local Rules, and the Orders of record in this matter subject to further investigation and discovery regarding the reference, the Court’s construction of the claims at issue, and discovery generally, including third-party discovery.

Honkanen ’076 discloses the Asserted Claims of the ’590 Patent (claims 1, 5, 9–12, 15–20, and 23–25, as set forth in Maxell’s infringement contentions, served on January 11, 2024). To the extent it is found Honkanen ’076 does not expressly disclose certain limitations in the Asserted Claims, Honkanen ’076 renders obvious the Asserted Claims, either alone or in combination with other prior art identified in the cover pleading or herein, and/or in combination with the general knowledge of a person having ordinary skill in the art. In these contentions, Samsung has relied in part on Maxell’s infringement contentions. In those contentions, Maxell appears to pursue overly broad claim constructions in an effort to assert infringement where none exists and to accuse products that do not infringe the claims. Samsung’s assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Maxell’s apparent claim interpretations. Samsung does not admit that Maxell’s apparent claim interpretations are supportable or proper or that the claim limitations in question are definite or otherwise amenable to construction.

Samsung has endeavored to cite to the most relevant portions of the identified prior art, but other portions of the identified prior art may additionally disclose, either expressly or inherently, and/or render obvious one or more limitations of the asserted claims. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. These citations to portions of any reference in this chart are exemplary only. Thus, Samsung reserves the right to rely on: (1) uncited portions of the identified prior art; (2) other prior art not identified herein; (3) references that show the state of the art (irrespective of whether such references themselves qualify as prior art to the asserted patents); (4) factual testimony from the inventors or authors of the prior art references, or purveyors of prior art devices; and/or (5) expert testimony, to provide context to or aid in understanding the prior art and the state of the art at the time of the alleged inventions.

’590 Patent Claim Limitation	Honkanen ’076 Exemplary Disclosure
[1pre] 1. A video processing apparatus, comprising:	To the extent the preamble is limiting, Honkanen ’076 discloses “[a] video processing apparatus.” For example: Honkanen ’076 at ¶ 21 Next, a structure of a communication device employing a number of simultaneous radio connections will be described with reference to FIG. 1. The communication device 100 may be for example a personal communication device such as a mobile communication device, a computer, a laptop, or a PDA (Personal

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Digital Assistant). The communication device 100 may also be a combination of two electronic devices, such as a computer with a mobile communication device connected to the computer. An example of a combination of a PDA and a mobile communication device is the Nokia Communicator®. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1a] a first radio communication circuit implementing a first transmission scheme having a first modulation scheme and a first transmission frequency band, the first radio communication circuit capable of transmitting video information by radio or receiving information by radio using the first transmission frequency band;	Honkanen '076 discloses “a first radio communication circuit implementing a first transmission scheme having a first modulation scheme and a first transmission frequency band, the first radio communication circuit capable of transmitting video information by radio or receiving information by radio using the first transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

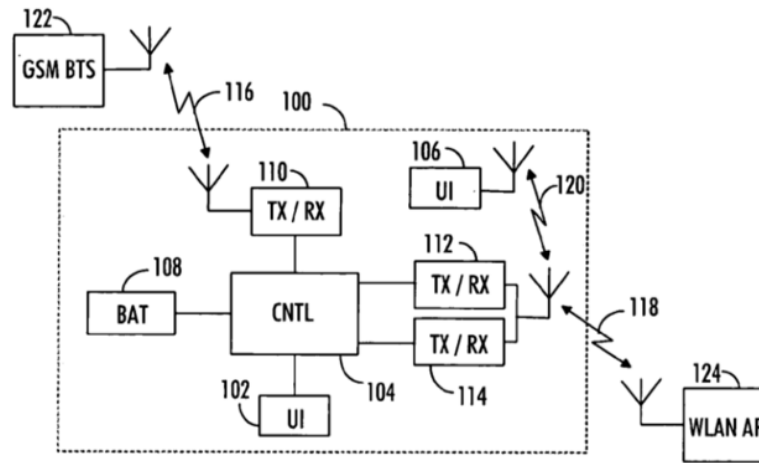


Fig. 1

Honkanen '076 at Fig. 2

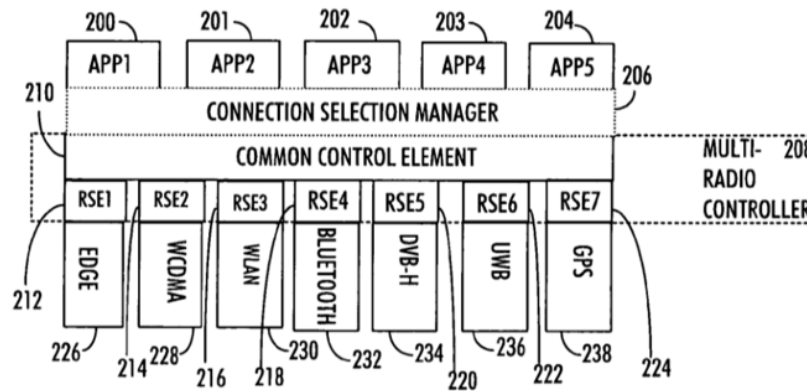


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

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	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

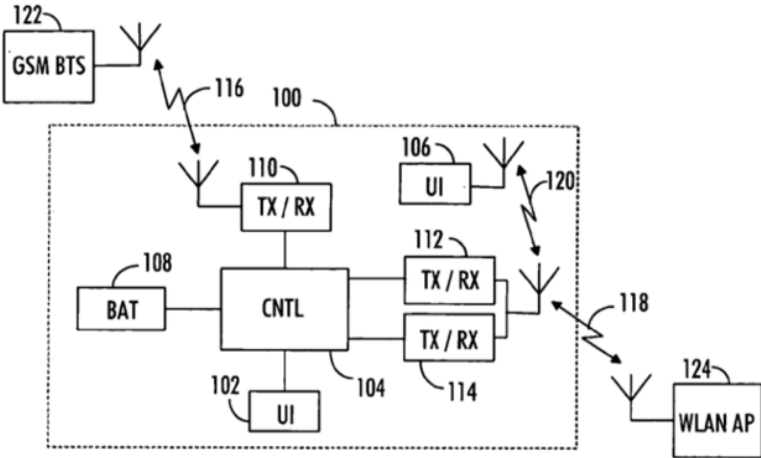
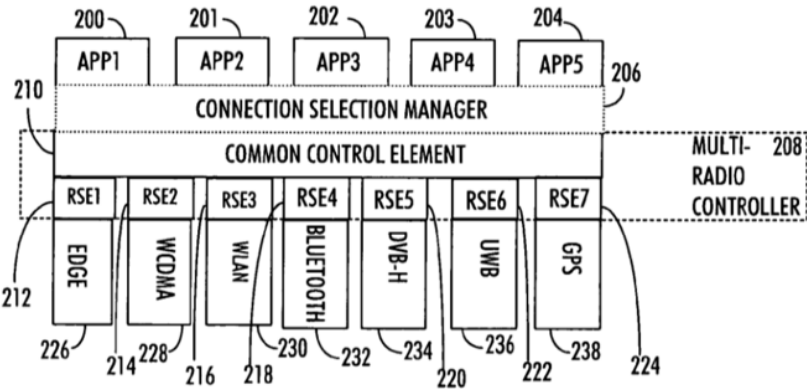
Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

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	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1b] a second radio communication circuit implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band, the second radio communication circuit capable of connecting by radio to an internet or a home	Honkanen '076 discloses “a second radio communication circuit implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band, the second radio communication circuit capable of connecting by radio to an internet or a home network to transmit and receive information using the second transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
network to transmit and receive information using the second transmission frequency band;	Honkanen '076 at Fig. 1  Fig. 1 Honkanen '076 at Fig. 2  Fig. 2

Honkanen '076 at ¶ 1

The invention relates to controlling a number of simultaneous radio connections in a communication device.

Honkanen '076 at ¶ 2

The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example.

Honkanen '076 at ¶ 3

If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one.

Honkanen '076 at ¶ 4

If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance.

Honkanen '076 at ¶ 8

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication

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	device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection

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	selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection.

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	If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available. Honkanen '076 at ¶ 40 A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'. Honkanen '076 at ¶ 41 The parameters of the connections that are held in the radio record block 302 may comprise the center frequency of the connection as well as a spreading code, channel code, modulation technique, power level, timing parameters, data rate, packet type, link type, automatic repeat request (ARQ) scheme etc. The properties of the connections that are held in the radio record block 302 may comprise the BER or FER of the connection as well as other measured or detected properties of the connection. Honkanen '076 at ¶ 42 The radio record block 302 may also comprise information on all possible parameters specific to each radio access technology employed in the communication device and not just the ones that are currently being used. This information may comprise all the possible frequency bands, modulation and coding schemes, waveforms, etc. of each radio access technology. The radio record block 302 may also comprise information on the measured or detected non-idealities of the connections, such as spectral leakage or spurious emissions of radio signals. This information may then be used when controlling a number of simultaneously operating radio connections.

Honkanen '076 at ¶ 45

The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system).

Honkanen '076 at ¶ 58

If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection.

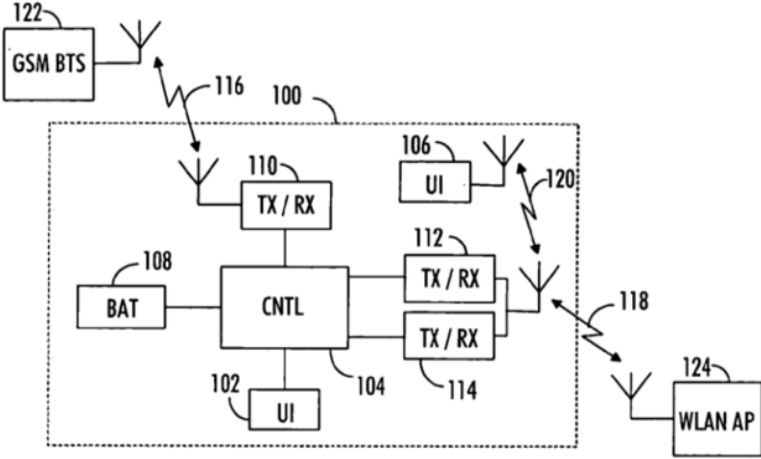
Honkanen '076 at ¶ 61

Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction).

Honkanen '076 at ¶ 69

If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided.

To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
[1c] a third radio communication circuit capable of transmitting information and using a third transmission frequency band;	Honkanen '076 discloses “a third radio communication circuit capable of transmitting information and using a third transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized. Honkanen '076 at Fig. 1  Fig. 1

Honkanen '076 at Fig. 2

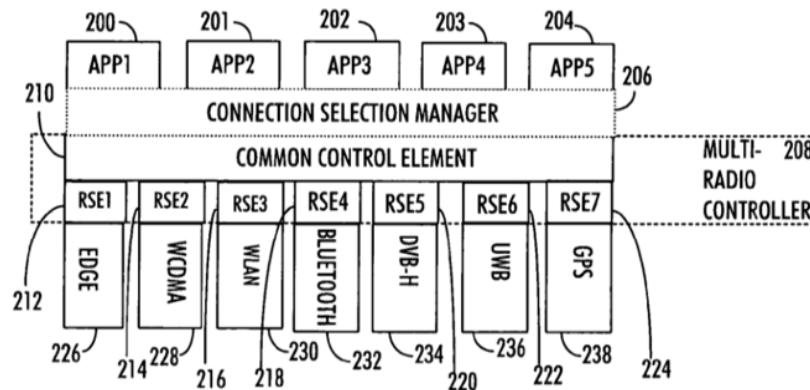


Fig. 2

Honkanen '076 at ¶ 1

The invention relates to controlling a number of simultaneous radio connections in a communication device.

Honkanen '076 at ¶ 2

The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example.

Honkanen '076 at ¶ 3

If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication technologies are also possible to be implemented in the communication device according to the invention.

Honkanen '076 at ¶ 29

FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers.

Honkanen '076 at ¶ 30

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available. Honkanen '076 at ¶ 40 A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is

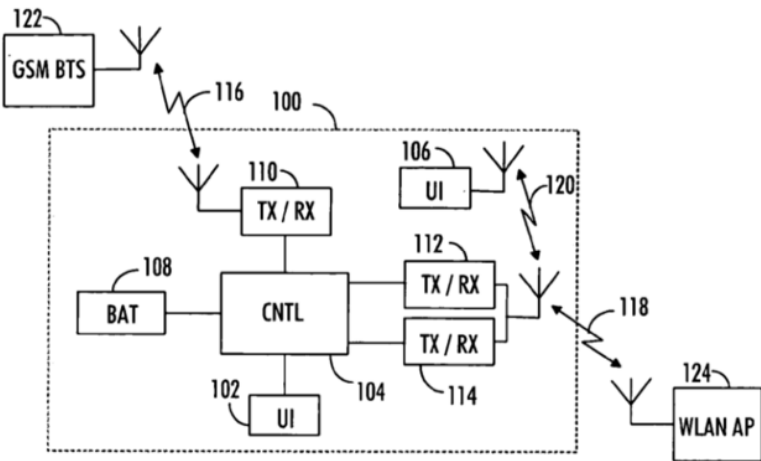
'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'. Honkanen '076 at ¶ 41 The parameters of the connections that are held in the radio record block 302 may comprise the center frequency of the connection as well as a spreading code, channel code, modulation technique, power level, timing parameters, data rate, packet type, link type, automatic repeat request (ARQ) scheme etc. The properties of the connections that are held in the radio record block 302 may comprise the BER or FER of the connection as well as other measured or detected properties of the connection. Honkanen '076 at ¶ 42 The radio record block 302 may also comprise information on all possible parameters specific to each radio access technology employed in the communication device and not just the ones that are currently being used. This information may comprise all the possible frequency bands, modulation and coding schemes, waveforms, etc. of each radio access technology. The radio record block 302 may also comprise information on the measured or detected non-idealities of the connections, such as spectral leakage or spurious emissions of radio signals. This information may then be used when controlling a number of simultaneously operating radio connections. Honkanen '076 at ¶ 45 The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions. Honkanen '076 at ¶ 47 If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 48 Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible. Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction).

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1d] an imaging circuit capable of receiving video information and still picture information via an optical system;	Honkanen '076 discloses “an imaging circuit capable of receiving video information and still picture information via an optical system.” For example: To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1e] a compression circuit compressing the still picture information using a first type of compression method and the video information using a second type of compression method;	Honkanen '076 discloses “a compression circuit compressing the still picture information using a first type of compression method and the video information using a second type of compression method.” For example: Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1f] an input device capable of receiving a user indication;	Honkanen '076 discloses “an input device capable of receiving a user indication.” For example: Honkanen '076 at ¶ 23 A communication interface 112 provides another wireless connection 120, using Bluetooth®-technology, with a user interface component 106. The user interface component 106 may be for example a headset of a mobile telephone, comprising a microphone, a loudspeaker, and a communication interface for a Bluetooth® connection with the mobile telephone. The user interface component 106 may also be a keyboard or a mouse operating with a computer through a Bluetooth® link. Honkanen '076 at ¶ 27 The communication device 100 further comprises a user interface 102 connected to the controlling unit. The user interface 102 may comprise a keyboard, a microphone, a loudspeaker, a display, and/or a camera. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1g] an accumulation circuit capable of accumulating video information received by the imaging circuit after the video information is compressed by the compression circuit; and	Honkanen '076 discloses “an accumulation circuit capable of accumulating video information received by the imaging circuit after the video information is compressed by the compression circuit.” For example: Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1h] a controller controlling assignment of connection of each of the first, second, and third radio communication circuits,	Honkanen '076 discloses “a controller controlling assignment of connection of each of the first, second, and third radio communication circuits.” For example: Honkanen '076 at Fig. 1  The diagram shows a mobile device 100 with a central controller (CNTL) 104. Connected to the controller are a battery (BAT) 108, a user interface (UI) 102, and two transceiver blocks (TX/RX) 110 and 112. The first transceiver 110 is connected to an external GSM Base Transceiver Station (GSM BTS) 122 via a radio link 116. The second transceiver 112 is connected to an external WLAN Access Point (WLAN AP) 124 via a radio link 118. Additionally, there is a third transceiver block 114 connected to the controller, which is further connected to a UI 106 and another transceiver block 106, which in turn connects to a radio link 120. Fig. 1

Honkanen '076 at Fig. 2

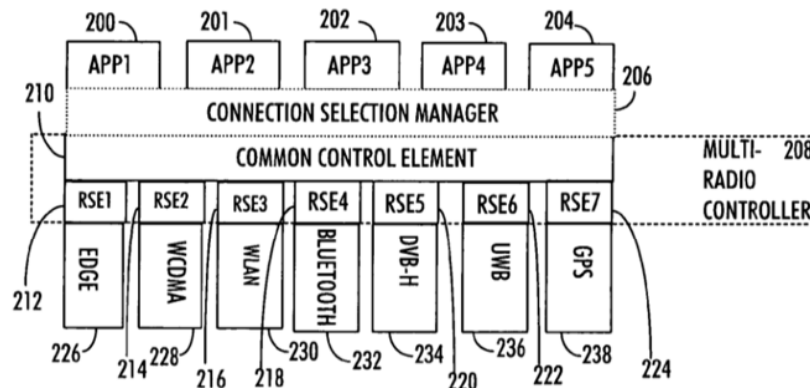


Fig. 2

Honkanen '076 at ¶ 6

According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 10

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 12

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 13 According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 26 The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC. Honkanen '076 at ¶ 32 The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections.

Honkanen '076 at ¶ 33

The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection.

Honkanen '076 at ¶ 34

The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR).

Honkanen '076 at ¶ 36

Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

Honkanen '076 at ¶ 39

A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 44

A connection parameter manager 308 determines the operational parameters of each connection. When receiving a command from the connection request processing block 304 to create a new connection, the connection parameter manager 308 checks which connections are operational, and the parameters of the operational connections. If the connection parameter manager 308 detects that there is an active connection which might interfere with the operation of the new connection (or vice versa), the connection parameter manager 308 defines the parameters of the new connection so that interference between the two connections is as minimal as possible.

Honkanen '076 at ¶ 45

The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions.

Honkanen '076 at ¶ 47

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	If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be

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	checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 59 The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306

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	may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction). Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device.

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	Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1i] wherein the first radio communication circuit can transmit video information accumulated in the accumulation circuit to an external device by radio,	Honkanen '076 discloses “wherein the first radio communication circuit can transmit video information accumulated in the accumulation circuit to an external device by radio.” For example: Honkanen '076 at ¶ 25 In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

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	technologies are also possible to be implemented in the communication device according to the invention. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1j] wherein the controller controls assignment of connection for each of the first and second radio communication circuit in response to receiving an indication from a user such that when an indication from the user indicates to transmit video information using the first radio communication circuit, the controller assigns a connection to the first radio communication circuit for transmitting the video information,	Honkanen '076 discloses “wherein the controller controls assignment of connection for each of the first and second radio communication circuit in response to receiving an indication from a user such that when an indication from the user indicates to transmit video information using the first radio communication circuit, the controller assigns a connection to the first radio communication circuit for transmitting the video information.” For example: Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[1k] wherein the controller controls each of the first and second radio communication circuit so that the first radio communication circuit transmits video information and the second radio communication circuit	Honkanen '076 discloses “wherein the controller controls each of the first and second radio communication circuit so that the first radio communication circuit transmits video information and the second radio communication circuit connects to the internet or the home network simultaneously.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the

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connects to the internet or the home network simultaneously, and	communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized. Honkanen '076 at ¶ 1 The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 3 If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the

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	connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 5 An object of the invention is to provide a solution for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 6 According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 7 According to another aspect of the invention, there is provided a method for controlling a number of simultaneously operating radio connections in a communication device. The method comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor

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	properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 10 According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 12 According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 13 According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 26 The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication

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	device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC. Honkanen '076 at ¶ 32 The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections. Honkanen '076 at ¶ 33 The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection. Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 45

The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of

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	two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce

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	poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 59 The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational

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	connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction). Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 65 If it is possible in 412 to create another connection using the same radio resources as used for an existing connection or connections, the process proceeds to 416 and 418 (optional). The new connection with parameters that allow the connection to sustain interference to some degree is created in 416. The parameters of an existing connection or connections are adjusted accordingly, when necessary. Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves

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	from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[11] wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an operating system of the video processing apparatus is available, and the video processing apparatus executes an update process such that an updated operating system of the video processing apparatus is stored in the video processing apparatus after execution of the update process.	Honkanen '076 discloses “wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an operating system of the video processing apparatus is available, and the video processing apparatus executes an update process such that an updated operating system of the video processing apparatus is stored in the video processing apparatus after execution of the update process.” For example: Honkanen '076 at ¶ 38 A block 300 comprises applications, which may need a radio connection. The operation of the applications 300 is the same as described above. The block 300 may also comprise a connection selection manager, if a connection selection manager is applied in the communication device. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5pre] 5. A display apparatus, comprising:	To the extent the preamble is limiting, Honkanen '076 discloses “[a] display apparatus.” For example: Honkanen '076 at ¶ 21 Next, a structure of a communication device employing a number of simultaneous radio connections will be described with reference to FIG. 1. The communication device 100 may be for example a personal communication device such as a mobile communication device, a computer, a laptop, or a PDA (Personal

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	Digital Assistant). The communication device 100 may also be a combination of two electronic devices, such as a computer with a mobile communication device connected to the computer. An example of a combination of a PDA and a mobile communication device is the Nokia Communicator®. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5a] a first radio communication circuit implementing a first transmission scheme having a first modulation scheme and a first transmission frequency band, the first radio communication circuit capable of receiving video information by radio or transmitting information by radio using the first transmission frequency band;	Honkanen '076 discloses “a first radio communication circuit implementing a first transmission scheme having a first modulation scheme and a first transmission frequency band, the first radio communication circuit capable of receiving video information by radio or transmitting information by radio using the first transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

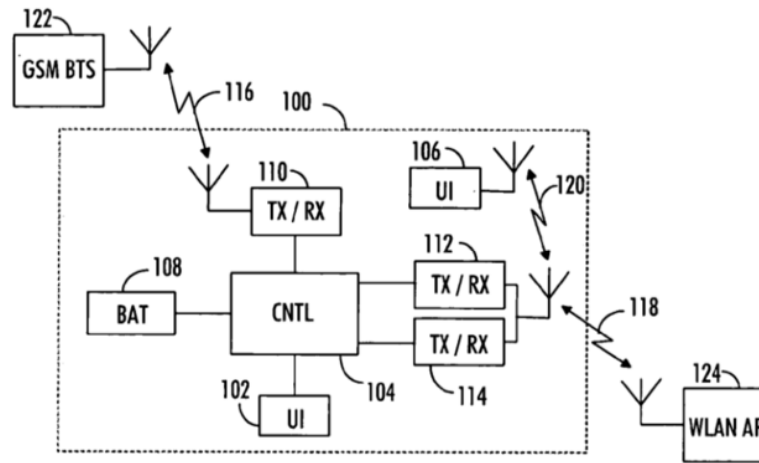


Fig. 1

Honkanen '076 at Fig. 2

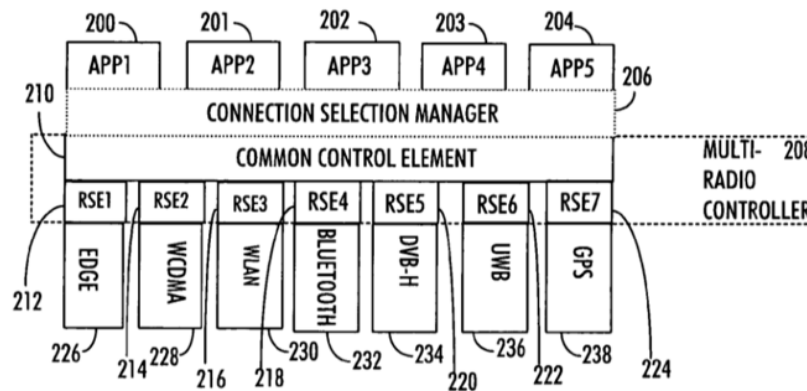


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

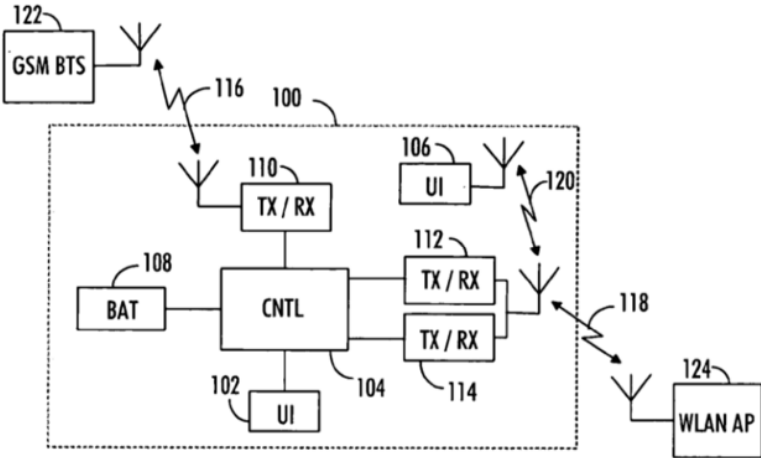
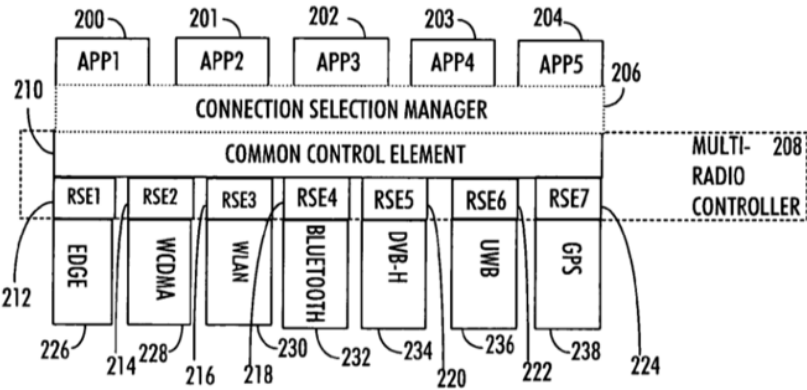
Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5b] a second radio communication circuit implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band, the second radio communication circuit capable of connecting by radio to an internet or a home	Honkanen '076 discloses “a second radio communication circuit implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band, the second radio communication circuit capable of connecting by radio to an internet or a home network to transmit and receive information using the second transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
network to transmit and receive information using the second transmission frequency band;	Honkanen '076 at Fig. 1  Fig. 1 Honkanen '076 at Fig. 2  Fig. 2

Honkanen '076 at ¶ 1

The invention relates to controlling a number of simultaneous radio connections in a communication device.

Honkanen '076 at ¶ 2

The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example.

Honkanen '076 at ¶ 4

If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance.

Honkanen '076 at ¶ 8

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 22 The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124. Honkanen '076 at ¶ 24 The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components. Honkanen '076 at ¶ 25 In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5c] a third radio communication circuit capable of transmitting information and using a third transmission frequency band;	Honkanen '076 discloses “a third radio communication circuit capable of transmitting information and using a third transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

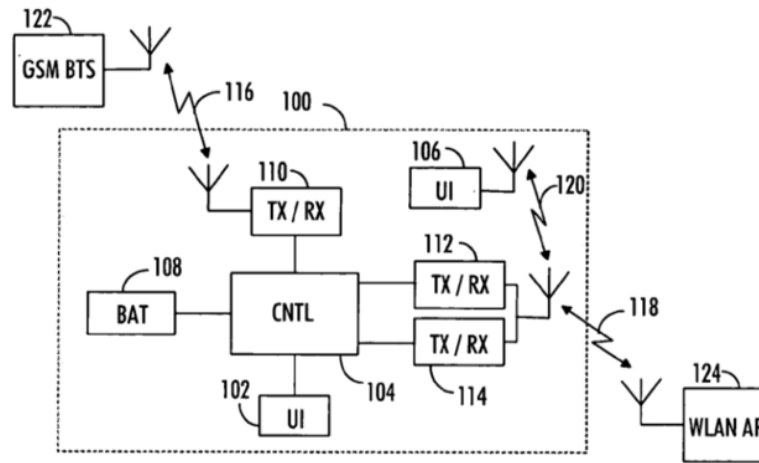


Fig. 1

Honkanen '076 at Fig. 2

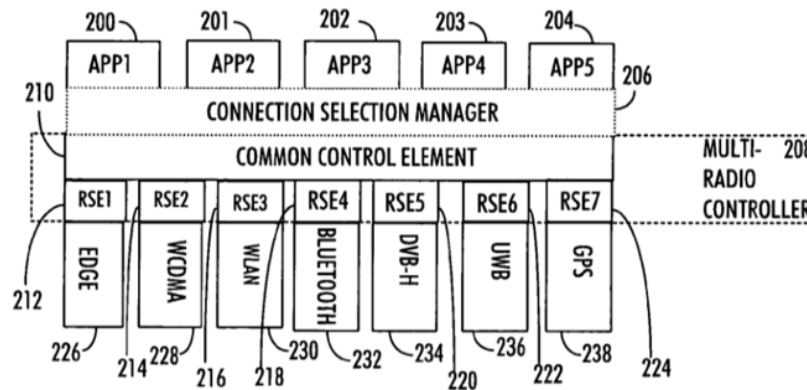


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

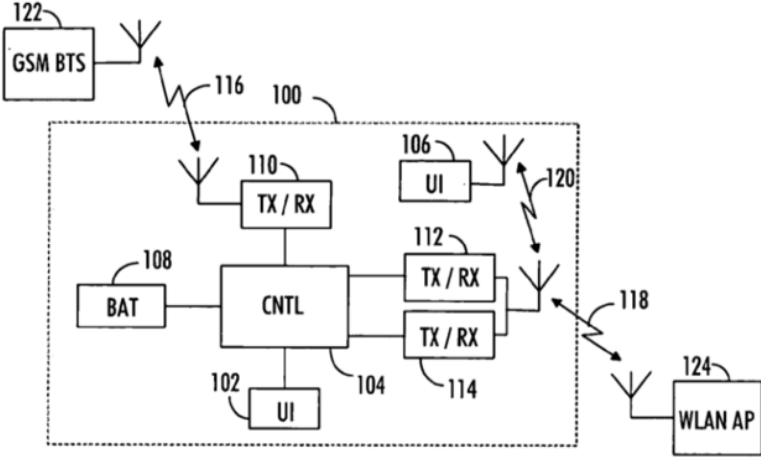
Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5d] a compression circuit capable of implementing a plurality of compression schemes including a first compression scheme, the compression circuit compressing the video information received by the first radio communication circuit using the first compression scheme;	Honkanen '076 discloses “a compression circuit capable of implementing a plurality of compression schemes including a first compression scheme, the compression circuit compressing the video information received by the first radio communication circuit using the first compression scheme.” For example: Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5e] a display capable of displaying the information received by the first radio communication circuit or the second radio communication circuit; and	Honkanen '076 discloses "a display capable of displaying the information received by the first radio communication circuit or the second radio communication circuit." For example: To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5f] a controller controlling assignment of connection of each of the first, second, and third radio communication circuits,	Honkanen '076 discloses "a controller controlling assignment of connection of each of the first, second, and third radio communication circuits." For example: Honkanen '076 at Fig. 1  The diagram illustrates a mobile device 100. Inside the device, there is a central controller (CNTL) 104. Connected to the controller are a battery (BAT) 108, a user interface (UI) 102, and two radio communication circuits (TX/RX) 110 and 112. The TX/RX 110 is connected to an antenna 116, and the TX/RX 112 is connected to an antenna 118. Additionally, there is another TX/RX block 114 connected to the controller and antenna 118. A second user interface (UI) 106 is also connected to the controller and antenna 118. The device 100 is shown communicating with a GSM Base Transceiver System (GSM BTS) 122 via antenna 116 and with a Wireless Local Area Network Access Point (WLAN AP) 124 via antenna 118. A dashed line 120 indicates a connection between the device and the WLAN AP. Fig. 1

Honkanen '076 at Fig. 2

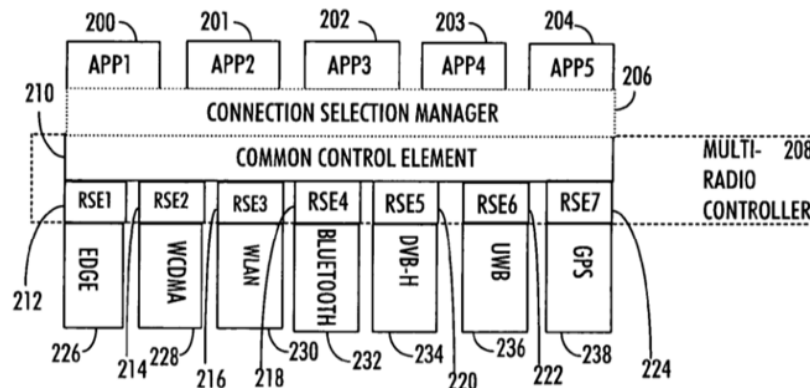


Fig. 2

Honkanen '076 at ¶ 6

According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 10

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 12

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 13 According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 26 The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC. Honkanen '076 at ¶ 32 The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections.

Honkanen '076 at ¶ 33

The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection.

Honkanen '076 at ¶ 34

The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR).

Honkanen '076 at ¶ 36

Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

Honkanen '076 at ¶ 39

A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 44

A connection parameter manager 308 determines the operational parameters of each connection. When receiving a command from the connection request processing block 304 to create a new connection, the connection parameter manager 308 checks which connections are operational, and the parameters of the operational connections. If the connection parameter manager 308 detects that there is an active connection which might interfere with the operation of the new connection (or vice versa), the connection parameter manager 308 defines the parameters of the new connection so that interference between the two connections is as minimal as possible.

Honkanen '076 at ¶ 45

The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions.

Honkanen '076 at ¶ 47

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 59 The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction). Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5g] wherein the controller controls assignment of connection for each of the first and second radio communication circuits in response to receiving an indication from a user such that when an indication from the user indicates to use the first radio communication circuit, the controller assigns a connection to the first radio communication circuit for receiving the video information or transmitting the information by radio,	Honkanen '076 discloses “wherein the controller controls assignment of connection for each of the first and second radio communication circuits in response to receiving an indication from a user such that when an indication from the user indicates to use the first radio communication circuit, the controller assigns a connection to the first radio communication circuit for receiving the video information or transmitting the information by radio.” For example: Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5h] wherein the controller controls each of the first and second radio communication circuits so that the first radio communication circuit receives video information and the second radio communication circuit connects to the internet or the home network simultaneously, and	Honkanen '076 discloses “wherein the controller controls each of the first and second radio communication circuits so that the first radio communication circuit receives video information and the second radio communication circuit connects to the internet or the home network simultaneously.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized. Honkanen '076 at ¶ 1 The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 3 If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 5 An object of the invention is to provide a solution for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 6 According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 7 According to another aspect of the invention, there is provided a method for controlling a number of simultaneously operating radio connections in a communication device. The method comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that interference between the radio connections is minimized if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 8

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 10

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 12

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 13

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 26 The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC. Honkanen '076 at ¶ 32 The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections. Honkanen '076 at ¶ 33 The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection.

Honkanen '076 at ¶ 36

Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 45

The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections.

Honkanen '076 at ¶ 57

The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system).

Honkanen '076 at ¶ 58

If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection.

Honkanen '076 at ¶ 59

The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction). Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 65 If it is possible in 412 to create another connection using the same radio resources as used for an existing connection or connections, the process proceeds to 416 and 418 (optional). The new connection with parameters that allow the connection to sustain interference to some degree is created in 416. The parameters of an existing connection or connections are adjusted accordingly, when necessary.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[5i] wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an operating system of the display apparatus is available, and the display apparatus executes an update process such that an updated operating system of the display apparatus is stored in the	Honkanen '076 discloses “wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an operating system of the display apparatus is available, and the display apparatus executes an update process such that an updated operating system of the display apparatus is stored in the display apparatus after execution of the update process.” For example: Honkanen '076 at ¶ 38 A block 300 comprises applications, which may need a radio connection. The operation of the applications 300 is the same as described above. The block 300 may also comprise a connection selection manager, if a connection selection manager is applied in the communication device.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
display apparatus after execution of the update process.	To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9pre] 9. A method for video processing, comprising:	To the extent the preamble is limiting, Honkanen '076 discloses "[a] method for video processing." For example: Honkanen '076 at ¶ 21 Next, a structure of a communication device employing a number of simultaneous radio connections will be described with reference to FIG. 1. The communication device 100 may be for example a personal communication device such as a mobile communication device, a computer, a laptop, or a PDA (Personal Digital Assistant). The communication device 100 may also be a combination of two electronic devices, such as a computer with a mobile communication device connected to the computer. An example of a combination of a PDA and a mobile communication device is the Nokia Communicator®. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9a] receiving video information and still picture information via an optical system by an imaging circuit of a video processing apparatus;	Honkanen '076 discloses "receiving video information and still picture information via an optical system by an imaging circuit of a video processing apparatus." For example: To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9b] compressing the still picture information using a first type of compression method and the video information using a second type of compression method;	Honkanen '076 discloses "compressing the still picture information using a first type of compression method and the video information using a second type of compression method." For example: Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9c] accumulating video information received by the imaging circuit after the video information is compressed by the compression circuit;	Honkanen '076 discloses “accumulating video information received by the imaging circuit after the video information is compressed by the compression circuit.” For example: Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9d] implementing a first transmission scheme having a first modulation scheme and a first transmission frequency band;	Honkanen '076 discloses “implementing a first transmission scheme having a first modulation scheme and a first transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

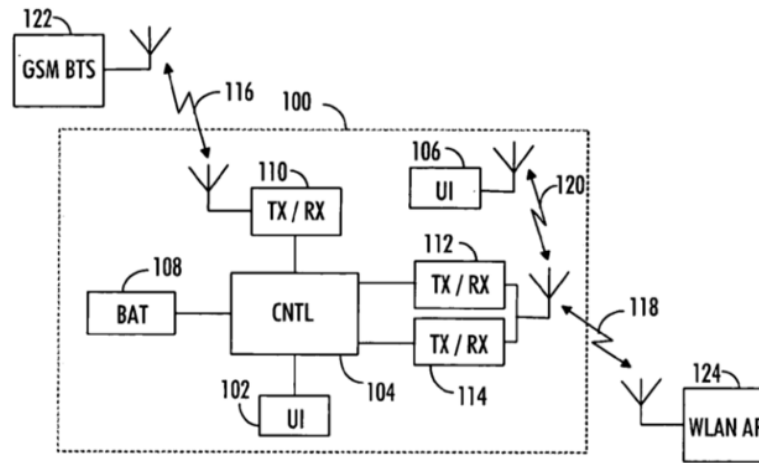


Fig. 1

Honkanen '076 at Fig. 2

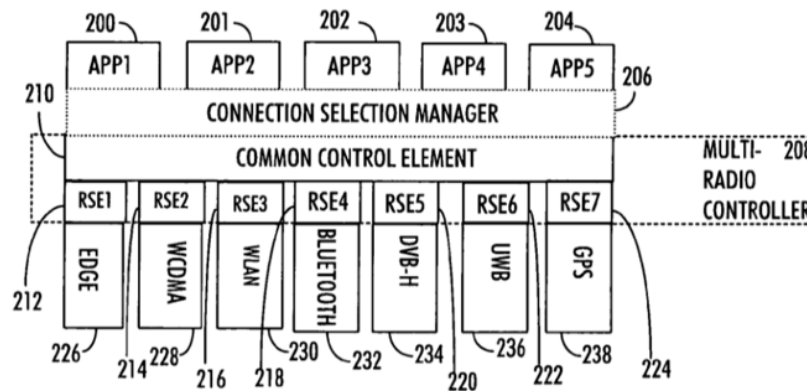


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9e] transmitting, using the first transmission frequency band, the video information to an external device by radio, via a first radio communication circuit;	Honkanen '076 discloses “transmitting, using the first transmission frequency band, the video information to an external device by radio, via a first radio communication circuit.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

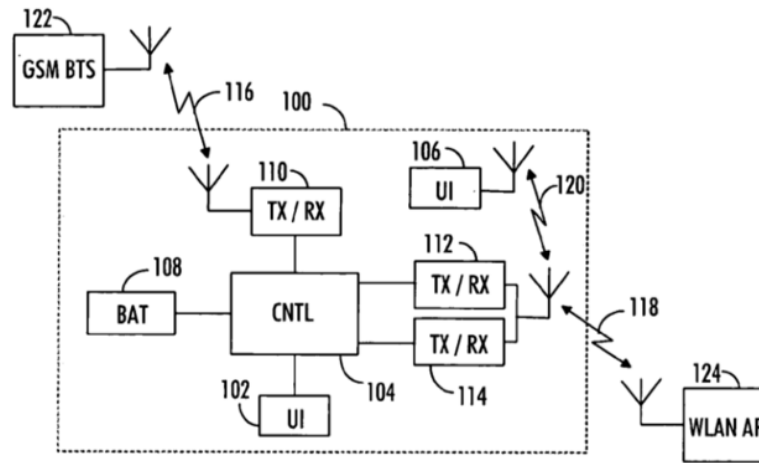


Fig. 1

Honkanen '076 at Fig. 2

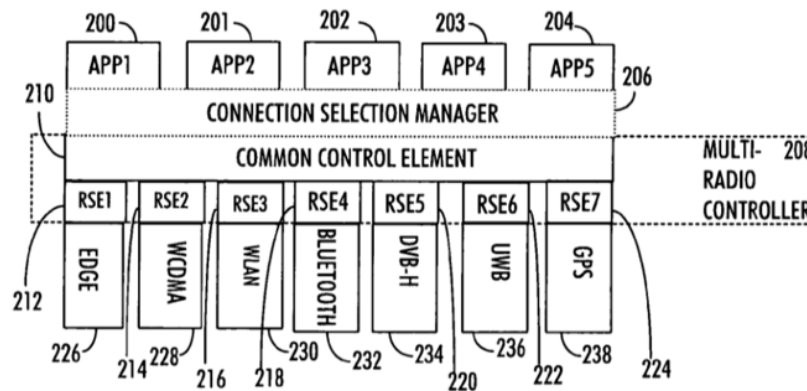


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

	Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 22 The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124. Honkanen '076 at ¶ 24 The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components. Honkanen '076 at ¶ 25 In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication
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'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

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	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

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	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9f] implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band;	Honkanen '076 discloses “implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

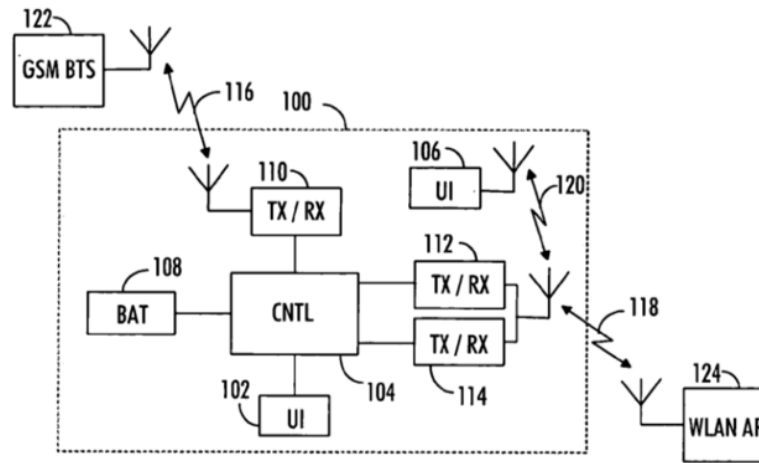


Fig. 1

Honkanen '076 at Fig. 2

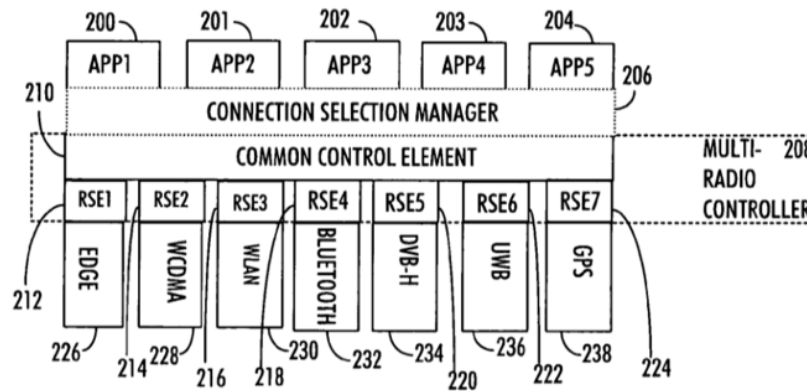


Fig. 2

Honkanen '076 at ¶ 1

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	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

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	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

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	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

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	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9g] connecting, by radio, to an internet or a home network to transmit and receive information using the second transmission frequency band, via a second radio communication circuit; transmitting, via a third radio communication circuit, information using a third transmission frequency band;	Honkanen '076 discloses “connecting, by radio, to an internet or a home network to transmit and receive information using the second transmission frequency band, via a second radio communication circuit; transmitting, via a third radio communication circuit, information using a third transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

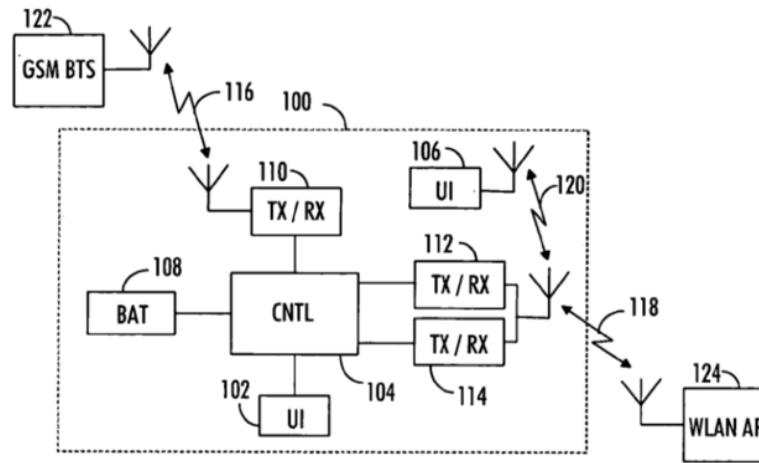


Fig. 1

Honkanen '076 at Fig. 2

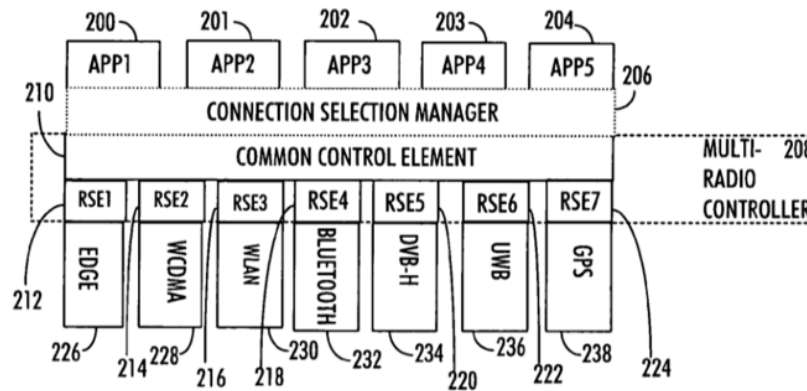


Fig. 2

Honkanen '076 at ¶ 1

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Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

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	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

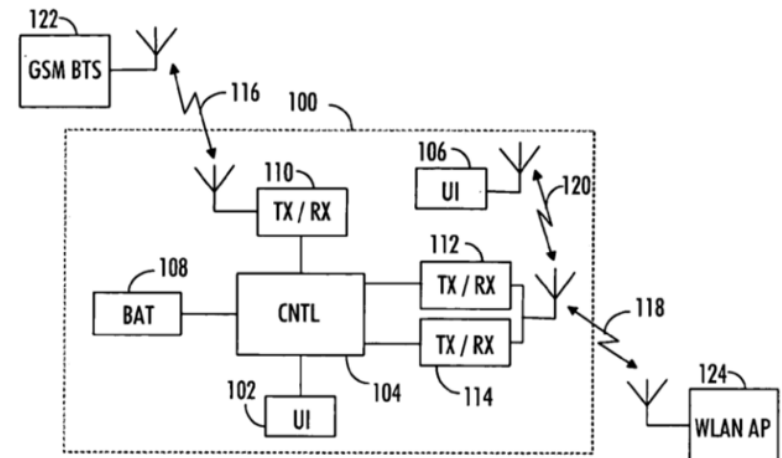
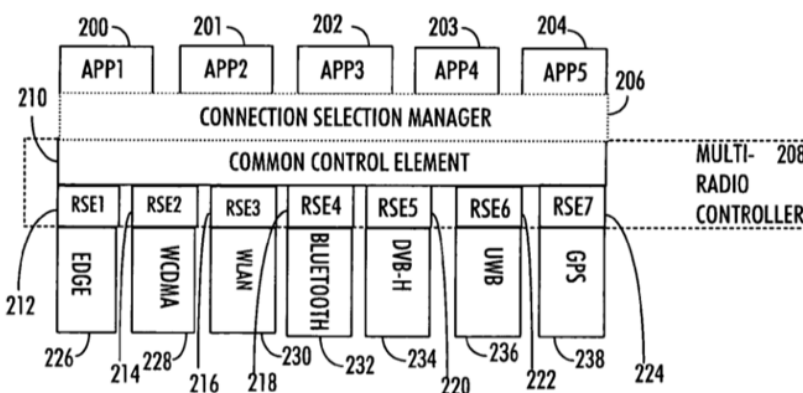
Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9h] controlling, via a controller, assignment of connection of each of the first, second, and third radio communication circuits, wherein assignment of connection for each of the first and second radio communication circuit is controlled in response to receiving an indication from a user such that when an indication from the user indicates to transmit video information using the first radio	Honkanen '076 discloses “controlling, via a controller, assignment of connection of each of the first, second, and third radio communication circuits, wherein assignment of connection for each of the first and second radio communication circuit is controlled in response to receiving an indication from a user such that when an indication from the user indicates to transmit video information using the first radio communication circuit, a connection is assigned to the first radio communication circuit for transmitting the video information.” For example:

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
communication circuit, a connection is assigned to the first radio communication circuit for transmitting the video information,	Honkanen '076 at Fig. 1  Fig. 1 Honkanen '076 at Fig. 2  Fig. 2

Honkanen '076 at ¶ 6

According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 10

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 12

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 13

According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 26

The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC.

Honkanen '076 at ¶ 31

On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves.

Honkanen '076 at ¶ 32

The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections.

Honkanen '076 at ¶ 33

The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available. Honkanen '076 at ¶ 44 A connection parameter manager 308 determines the operational parameters of each connection. When receiving a command from the connection request processing block 304 to create a new connection, the connection parameter manager 308 checks which connections are operational, and the parameters of the operational connections. If the connection parameter manager 308 detects that there is an active connection which might interfere with the operation of the new connection (or vice versa), the connection parameter manager 308 defines the parameters of the new connection so that interference between the two connections is as minimal as possible. Honkanen '076 at ¶ 45 The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions. Honkanen '076 at ¶ 47 If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly.

Honkanen '076 at ¶ 54

After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below.

Honkanen '076 at ¶ 55

Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections.

Honkanen '076 at ¶ 57

The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306

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	detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 59 The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly.

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	Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction). Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9i] wherein the transmitting and connecting is controlled so that the first radio communication circuit is configured to transmit video information and the second radio communication circuit is configured to connect to the internet or the home network simultaneously;	Honkanen '076 discloses “wherein the transmitting and connecting is controlled so that the first radio communication circuit is configured to transmit video information and the second radio communication circuit is configured to connect to the internet or the home network simultaneously.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized. Honkanen '076 at ¶ 1 The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 3 If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 5 An object of the invention is to provide a solution for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 6 According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 7 According to another aspect of the invention, there is provided a method for controlling a number of simultaneously operating radio connections in a communication device. The method comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 10 According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 12

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 13

According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 26

The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC.

Honkanen '076 at ¶ 32

The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections.

Honkanen '076 at ¶ 33

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	The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection. Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 40 A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'. Honkanen '076 at ¶ 45 The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions. Honkanen '076 at ¶ 47 If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 59 The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction).

Honkanen '076 at ¶ 62

If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410.

Honkanen '076 at ¶ 65

If it is possible in 412 to create another connection using the same radio resources as used for an existing connection or connections, the process proceeds to 416 and 418 (optional). The new connection with parameters that allow the connection to sustain interference to some degree is created in 416. The parameters of an existing connection or connections are adjusted accordingly, when necessary.

Honkanen '076 at ¶ 67

FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device.

Honkanen '076 at ¶ 69

If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided.

To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
[9j] receiving, via the second or third radio communication circuits a signal from the internet indicating that an update for an operating system is available;	Honkanen '076 discloses “receiving, via the second or third radio communication circuits a signal from the internet indicating that an update for an operating system is available.” For example: Honkanen '076 at ¶ 38 A block 300 comprises applications, which may need a radio connection. The operation of the applications 300 is the same as described above. The block 300 may also comprise a connection selection manager, if a connection selection manager is applied in the communication device. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[9k] executing the update process; and storing an updated operating system after execution of the update process.	Honkanen '076 discloses “executing the update process; and storing an updated operating system after execution of the update process.” For example: Honkanen '076 at ¶ 38 A block 300 comprises applications, which may need a radio connection. The operation of the applications 300 is the same as described above. The block 300 may also comprise a connection selection manager, if a connection selection manager is applied in the communication device. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[10pre] 10. A method, comprising:	The preamble is not limiting.
[10a] implementing a first transmission scheme having a first modulation scheme and a first transmission frequency band;	Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

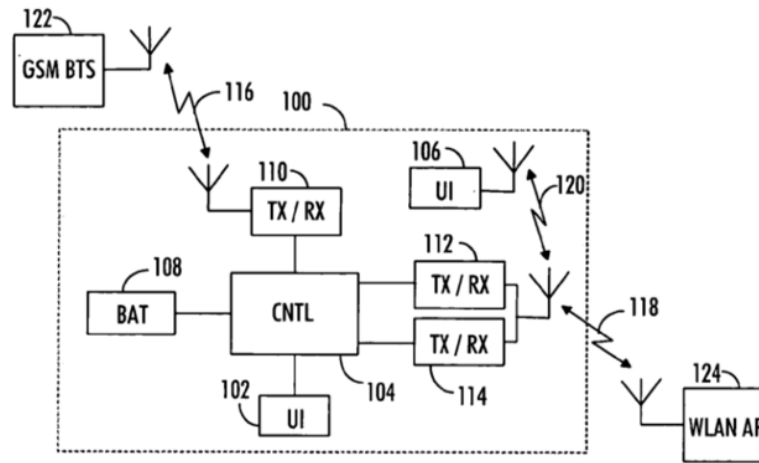


Fig. 1

Honkanen '076 at Fig. 2

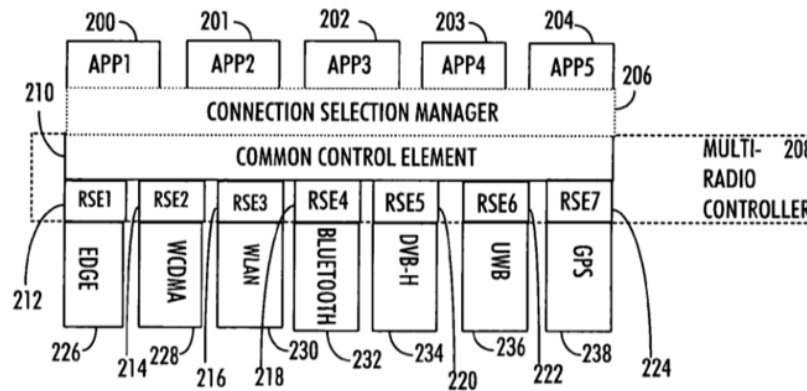


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

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	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below.
[10b] implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band;	Honkanen '076 discloses “implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

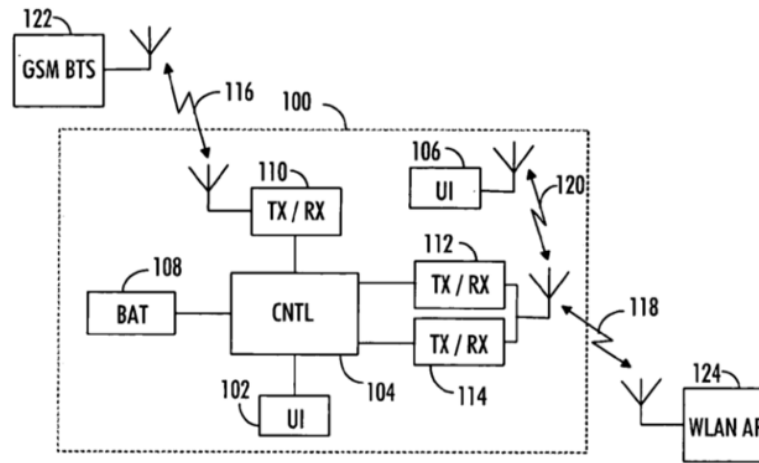


Fig. 1

Honkanen '076 at Fig. 2

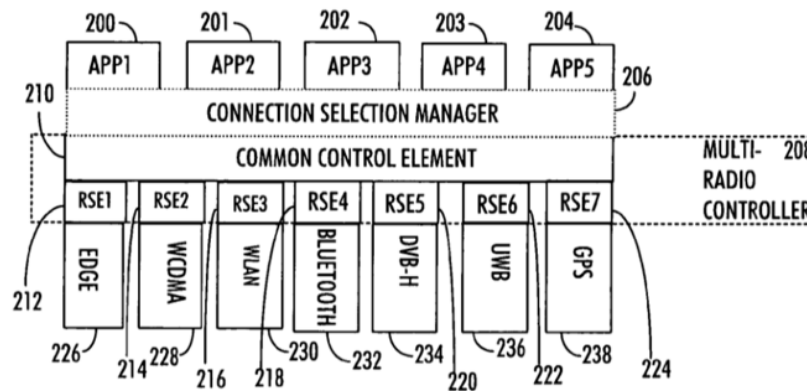


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[10c] receiving video information by radio using the first transmission frequency band, via a first radio communication circuit and connecting by radio to an internet or a home network to transmit and receive information using the second transmission frequency band, via a second radio communication circuit;	Honkanen '076 discloses “receiving video information by radio using the first transmission frequency band, via a first radio communication circuit and connecting by radio to an internet or a home network to transmit and receive information using the second transmission frequency band, via a second radio communication circuit.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

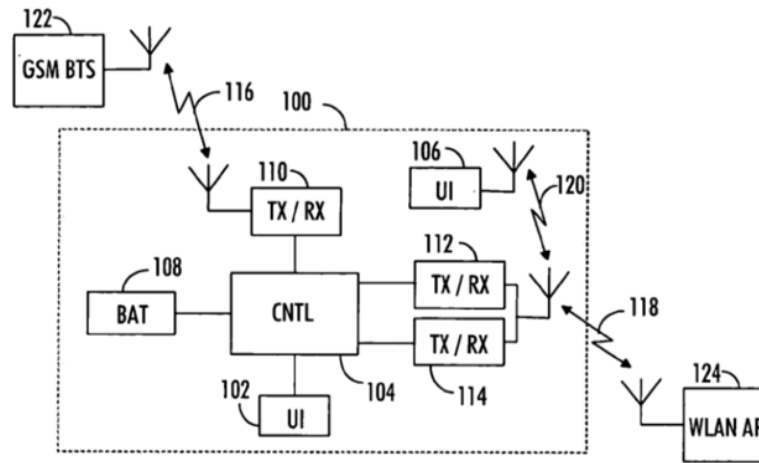


Fig. 1

Honkanen '076 at Fig. 2

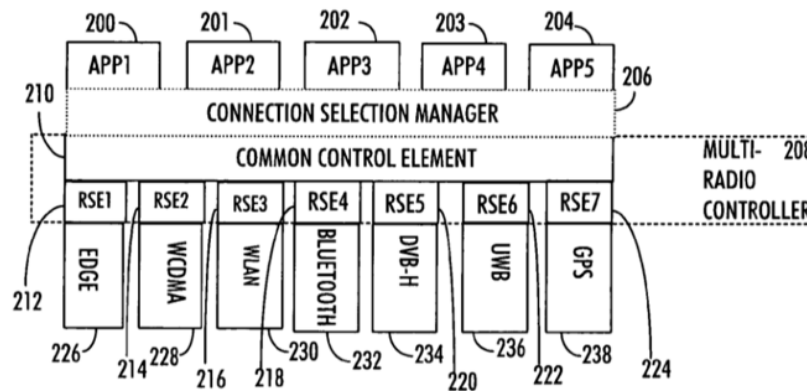


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

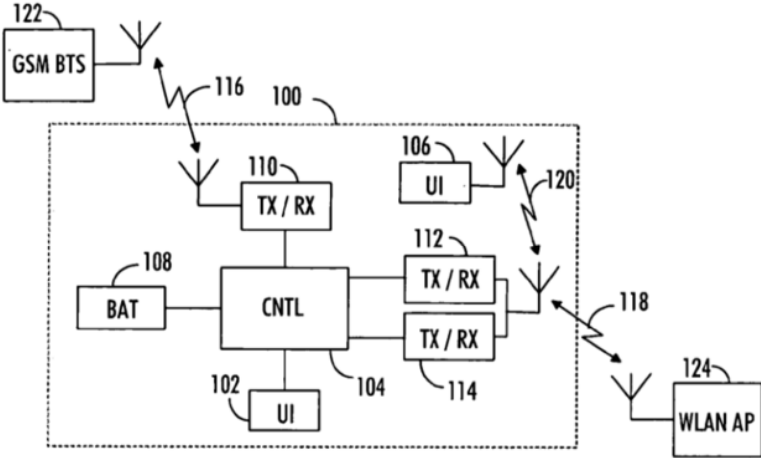
Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[10d] compressing the video information received by the first radio communication circuit using a first compression scheme;	Honkanen '076 discloses “compressing the video information received by the first radio communication circuit using a first compression scheme.” For example: Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[10e] transmitting, via a third radio communication circuit, information using a third transmission frequency band;	Honkanen '076 discloses “transmitting, via a third radio communication circuit, information using a third transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized. Honkanen '076 at Fig. 1  Fig. 1

Honkanen '076 at Fig. 2

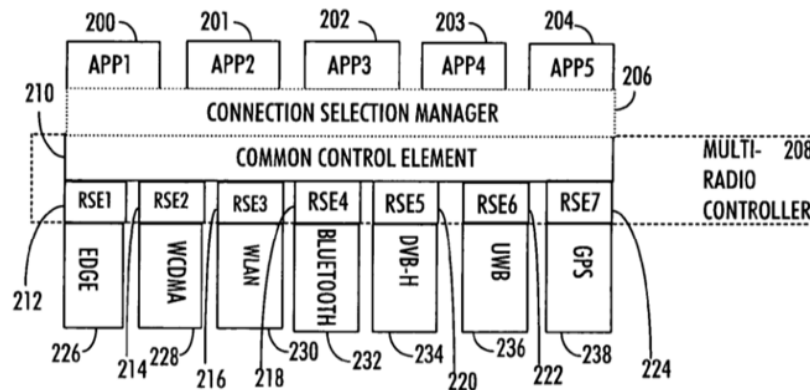


Fig. 2

Honkanen '076 at ¶ 1

The invention relates to controlling a number of simultaneous radio connections in a communication device.

Honkanen '076 at ¶ 2

The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example.

Honkanen '076 at ¶ 4

If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 22 The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication technologies are also possible to be implemented in the communication device according to the invention.

Honkanen '076 at ¶ 29

FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers.

Honkanen '076 at ¶ 30

On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available. Honkanen '076 at ¶ 40 A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'. Honkanen '076 at ¶ 47 If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

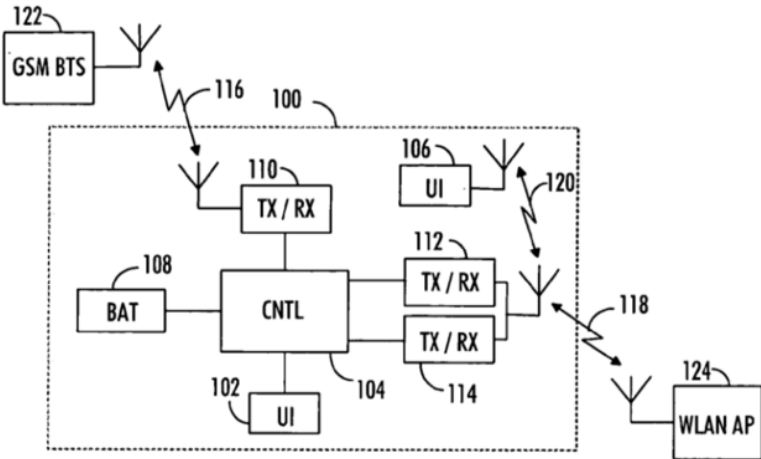
Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly.

Honkanen '076 at ¶ 54

After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below.

To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[10f] displaying, via a display circuit, information received by the first radio communication circuit or the second radio communication circuit;	Honkanen '076 discloses “displaying, via a display circuit, information received by the first radio communication circuit or the second radio communication circuit.” For example: To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[10g] controlling, via a controller, assignment of connection of each of the first, second, and third radio communication circuits, wherein assignment of connection for each of the first and second radio communication circuit is controlled in response to receiving an indication from a user such that when an indication from the user indicates to use the first radio communication circuit, the controller assigns a connection to the first radio communication circuit for receiving the video information,	Honkanen '076 discloses “controlling, via a controller, assignment of connection of each of the first, second, and third radio communication circuits, wherein assignment of connection for each of the first and second radio communication circuit is controlled in response to receiving an indication from a user such that when an indication from the user indicates to use the first radio communication circuit, the controller assigns a connection to the first radio communication circuit for receiving the video information.” For example: Honkanen '076 at Fig. 1  The diagram shows a mobile device 100 with a central controller (CNTL) 102. It is connected to a battery (BAT) 108, a user interface (UI) 104, and a first transceiver (TX/RX) 110. The first transceiver 110 is connected to a GSM Base Transceiver Station (GSM BTS) 122 via a radio link 116. The controller 102 is also connected to a second transceiver (TX/RX) 112, which is connected to a third transceiver (TX/RX) 114. The third transceiver 114 is connected to a WLAN Access Point (WLAN AP) 124 via a radio link 118. A user interface (UI) 106 is connected to the second transceiver 112 via a radio link 120. Fig. 1

Honkanen '076 at Fig. 2

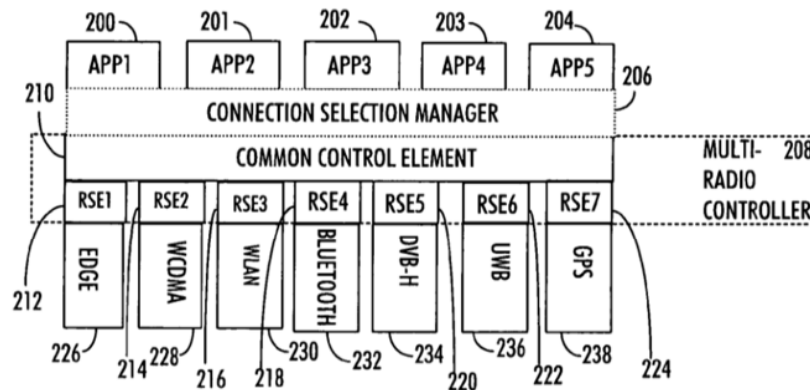


Fig. 2

Honkanen '076 at ¶ 6

According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 10

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 12

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 13 According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 26 The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves.

Honkanen '076 at ¶ 32

The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections.

Honkanen '076 at ¶ 33

The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection.

Honkanen '076 at ¶ 34

The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR).

Honkanen '076 at ¶ 36

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available. Honkanen '076 at ¶ 44 A connection parameter manager 308 determines the operational parameters of each connection. When receiving a command from the connection request processing block 304 to create a new connection, the connection parameter manager 308 checks which connections are operational, and the parameters of the operational connections. If the connection parameter manager 308 detects that there is an active connection which might interfere with the operation of the new connection (or vice versa), the connection parameter manager 308 defines the parameters of the new connection so that interference between the two connections is as minimal as possible. Honkanen '076 at ¶ 45 The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions. Honkanen '076 at ¶ 47 If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection.

Honkanen '076 at ¶ 59

The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations.

Honkanen '076 at ¶ 60

FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network.

Honkanen '076 at ¶ 61

Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction).

Honkanen '076 at ¶ 62

If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[10h] wherein the receiving and connecting is controlled so that the first radio communication circuit is configured to receive video information and the second radio communication circuit is configured to connect to the	Honkanen '076 discloses “wherein the receiving and connecting is controlled so that the first radio communication circuit is configured to receive video information and the second radio communication circuit is configured to connect to the internet or the home network simultaneously.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
internet or the home network simultaneously;	communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized. Honkanen '076 at ¶ 1 The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 3 If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 5 An object of the invention is to provide a solution for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 6 According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 7 According to another aspect of the invention, there is provided a method for controlling a number of simultaneously operating radio connections in a communication device. The method comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 10 According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 12 According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 13 According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 26 The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC. Honkanen '076 at ¶ 32 The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections. Honkanen '076 at ¶ 33 The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection. Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 45

The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 49

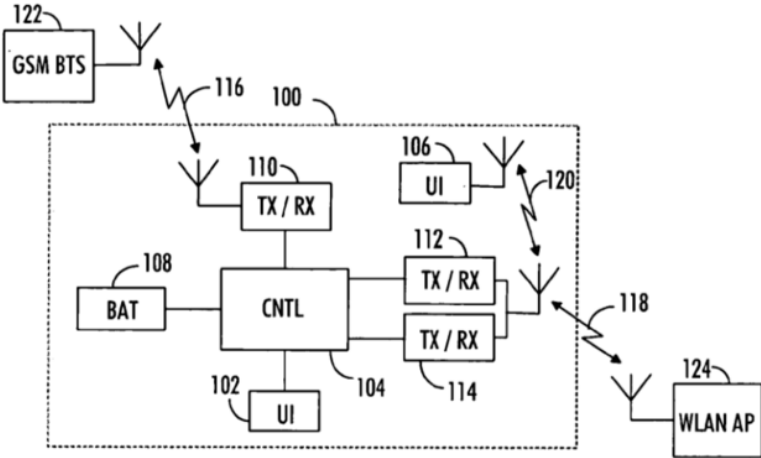
When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 59 The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction). Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 65 If it is possible in 412 to create another connection using the same radio resources as used for an existing connection or connections, the process proceeds to 416 and 418 (optional). The new connection with parameters that allow the connection to sustain interference to some degree is created in 416. The parameters of an existing connection or connections are adjusted accordingly, when necessary. Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves

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	from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[10i] receiving, via the second or third radio communication circuits, a signal from the internet indicating that an update for an operating system is available; executing the update process; and storing an updated operating system after execution of the update process.	Honkanen '076 discloses “receiving, via the second or third radio communication circuits, a signal from the internet indicating that an update for an operating system is available; executing the update process; and storing an updated operating system after execution of the update process.” For example: Honkanen '076 at ¶ 38 A block 300 comprises applications, which may need a radio connection. The operation of the applications 300 is the same as described above. The block 300 may also comprise a connection selection manager, if a connection selection manager is applied in the communication device. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[11pre] 11. The video processing apparatus of claim 1, further comprising	Honkanen '076 discloses “[t]he video processing apparatus of claim 1.” See above.
[11a] a fourth radio communication circuit capable of transmitting information and using a fourth transmission frequency	Honkanen '076 discloses “a fourth radio communication circuit capable of transmitting information and using a fourth transmission frequency band that is different from the first, second, and third transmission frequency bands, wherein the controller controls assignment of connection of each of the first, second, third, and fourth radio communication circuits.” For example:

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band that is different from the first, second, and third transmission frequency bands, wherein the controller controls assignment of connection of each of the first, second, third, and fourth radio communication circuits.	Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized. Honkanen '076 at Fig. 1  The diagram illustrates a communication device 100. Inside the device, there is a central controller (CNTL) 104. Connected to the controller are a battery (BAT) 108, a user interface (UI) 102, and two sets of transceiver components. The first set includes a transceiver (TX/RX) 110 and an antenna 116. The second set includes two transceivers (TX/RX) 112 and 114, each with its own antenna 120 and 118 respectively. A third user interface (UI) 106 is also connected to the controller. Outside the device, a GSM Base Transceiver Station (GSM BTS) 122 is connected to antenna 116, and a Wireless Local Area Network Access Point (WLAN AP) 124 is connected to antenna 118. Signal paths are indicated by arrows between the antennas and the transceivers. Fig. 1

Honkanen '076 at Fig. 2

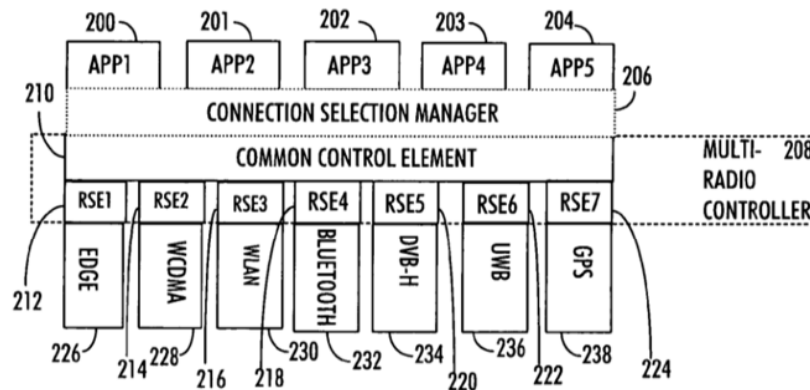


Fig. 2

Honkanen '076 at ¶ 1

The invention relates to controlling a number of simultaneous radio connections in a communication device.

Honkanen '076 at ¶ 2

The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example.

Honkanen '076 at ¶ 3

If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication technologies are also possible to be implemented in the communication device according to the invention.

Honkanen '076 at ¶ 29

FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers.

Honkanen '076 at ¶ 30

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	On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available. Honkanen '076 at ¶ 40 A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'. Honkanen '076 at ¶ 41 The parameters of the connections that are held in the radio record block 302 may comprise the center frequency of the connection as well as a spreading code, channel code, modulation technique, power level, timing parameters, data rate, packet type, link type, automatic repeat request (ARQ) scheme etc. The properties of the connections that are held in the radio record block 302 may comprise the BER or FER of the connection as well as other measured or detected properties of the connection. Honkanen '076 at ¶ 42 The radio record block 302 may also comprise information on all possible parameters specific to each radio access technology employed in the communication device and not just the ones that are currently being used. This information may comprise all the possible frequency bands, modulation and coding schemes, waveforms, etc. of each radio access technology. The radio record block 302 may also comprise information on the measured or detected non-idealities of the connections, such as spectral leakage or spurious emissions of radio signals. This information may then be used when controlling a number of simultaneously operating radio connections. Honkanen '076 at ¶ 45 The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions. Honkanen '076 at ¶ 47 If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 48 Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible. Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction).

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[12pre] 12. The video processing apparatus of claim 1,	Honkanen '076 discloses "[t]he video processing apparatus of claim 1." See above.
[12a] wherein the third transmission frequency band is different from the first and second transmission frequency bands.	Honkanen '076 discloses "wherein the third transmission frequency band is different from the first and second transmission frequency bands." For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

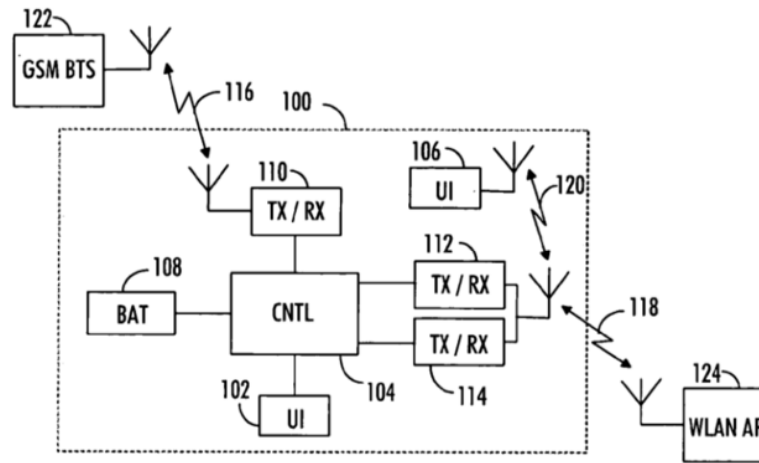


Fig. 1

Honkanen '076 at Fig. 2

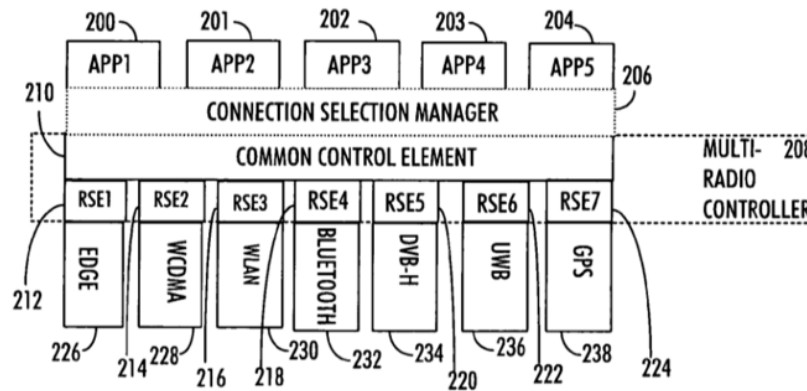


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 3 If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance.

Honkanen '076 at ¶ 8

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection

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	selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 40 A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources,

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	for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'. Honkanen '076 at ¶ 41 The parameters of the connections that are held in the radio record block 302 may comprise the center frequency of the connection as well as a spreading code, channel code, modulation technique, power level, timing parameters, data rate, packet type, link type, automatic repeat request (ARQ) scheme etc. The properties of the connections that are held in the radio record block 302 may comprise the BER or FER of the connection as well as other measured or detected properties of the connection. Honkanen '076 at ¶ 42 he radio record block 302 may also comprise information on all possible parameters specific to each radio access technology employed in the communication device and not just the ones that are currently being used. This information may comprise all the possible frequency bands, modulation and coding schemes, waveforms, etc. of each radio access technology. The radio record block 302 may also comprise information on the measured or detected non-idealities of the connections, such as spectral leakage or spurious emissions of radio signals. This information may then be used when controlling a number of simultaneously operating radio connections. Honkanen '076 at ¶ 45 The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions. Honkanen '076 at ¶ 47 If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may

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	also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 48 Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible. Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring

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	and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction).

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	Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[15pre] 15. The video processing apparatus of claim 1,	Honkanen '076 discloses "[t]he video processing apparatus of claim 1." See above.
[15a] wherein the input device is capable of receiving a user's selection of content to be displayed on the video processing apparatus.	Honkanen '076 discloses "wherein the input device is capable of receiving a user's selection of content to be displayed on the video processing apparatus." For example: Honkanen '076 at ¶ 23 A communication interface 112 provides another wireless connection 120, using Bluetooth®-technology, with a user interface component 106. The user interface component 106 may be for example a headset of a mobile telephone, comprising a microphone, a loudspeaker, and a communication interface for a Bluetooth® connection with the mobile telephone. The user interface component 106 may also be a keyboard or a mouse operating with a computer through a Bluetooth® link.

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	Honkanen '076 at ¶ 27 The communication device 100 further comprises a user interface 102 connected to the controlling unit. The user interface 102 may comprise a keyboard, a microphone, a loudspeaker, a display, and/or a camera. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[16pre] 16. The video processing apparatus of claim 1,	Honkanen '076 discloses "[t]he video processing apparatus of claim 1." See above.
[16a] wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an application of the video processing apparatus is available, and the video processing apparatus executes an application update process such that an updated application of the video processing apparatus is stored in the video processing apparatus after execution of the application update process.	Honkanen '076 discloses "wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an application of the video processing apparatus is available, and the video processing apparatus executes an application update process such that an updated application of the video processing apparatus is stored in the video processing apparatus after execution of the application update process." For example: Honkanen '076 at ¶ 38 A block 300 comprises applications, which may need a radio connection. The operation of the applications 300 is the same as described above. The block 300 may also comprise a connection selection manager, if a connection selection manager is applied in the communication device. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[17pre] 17. The video processing apparatus of claim 1, further comprising:	Honkanen '076 discloses "[t]he video processing apparatus of claim 1." See above.
[17a] a display for displaying a screen requesting user input, wherein the displayed screen	Honkanen '076 discloses "a display for displaying a screen requesting user input, wherein the displayed screen prompts the user for a user input that indicates whether the user allows a connection between the first radio communication circuit and the external device to be established, wherein in response to receiving the

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prompts the user for a user input that indicates whether the user allows a connection between the first radio communication circuit and the external device to be established, wherein in response to receiving the user input indicating allowance of the connection, the first radio communication circuit transmits the accumulated video information to the external device.	user input indicating allowance of the connection, the first radio communication circuit transmits the accumulated video information to the external device.” For example: Honkanen '076 at ¶ 23 A communication interface 112 provides another wireless connection 120, using Bluetooth®-technology, with a user interface component 106. The user interface component 106 may be for example a headset of a mobile telephone, comprising a microphone, a loudspeaker, and a communication interface for a Bluetooth® connection with the mobile telephone. The user interface component 106 may also be a keyboard or a mouse operating with a computer through a Bluetooth® link. Honkanen '076 at ¶ 27 The communication device 100 further comprises a user interface 102 connected to the controlling unit. The user interface 102 may comprise a keyboard, a microphone, a loudspeaker, a display, and/or a camera. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block

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	304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available. Honkanen '076 at ¶ 44 A connection parameter manager 308 determines the operational parameters of each connection. When receiving a command from the connection request processing block 304 to create a new connection, the connection parameter manager 308 checks which connections are operational, and the parameters of the operational connections. If the connection parameter manager 308 detects that there is an active connection which might interfere with the operation of the new connection (or vice versa), the connection parameter manager 308 defines the parameters of the new connection so that interference between the two connections is as minimal as possible. Honkanen '076 at ¶ 45 The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions. Honkanen '076 at ¶ 47 If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of

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	two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain

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	radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 59 The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410.

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	Honkanen '076 at ¶ 65 If it is possible in 412 to create another connection using the same radio resources as used for an existing connection or connections, the process proceeds to 416 and 418 (optional). The new connection with parameters that allow the connection to sustain interference to some degree is created in 416. The parameters of an existing connection or connections are adjusted accordingly, when necessary. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[18pre] 18. The video processing apparatus of claim 1,	Honkanen '076 discloses "[t]he video processing apparatus of claim 1." See above.
[18a] wherein the second modulation scheme comprises quadrature amplitude modulation (QAM).	Honkanen '076 discloses "wherein the second modulation scheme comprises quadrature amplitude modulation (QAM)." For example: To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[19pre] 19. The video processing apparatus of claim 1,	Honkanen '076 discloses "[t]he video processing apparatus of claim 1." See above.
[19a] wherein the second radio communication circuit is controllable to change from the second modulation scheme to a different modulation scheme.	Honkanen '076 discloses "wherein the second radio communication circuit is controllable to change from the second modulation scheme to a different modulation scheme." For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

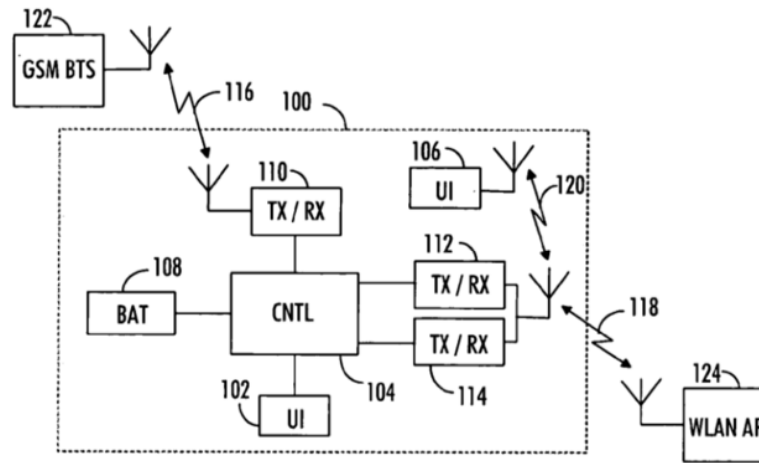


Fig. 1

Honkanen '076 at Fig. 2

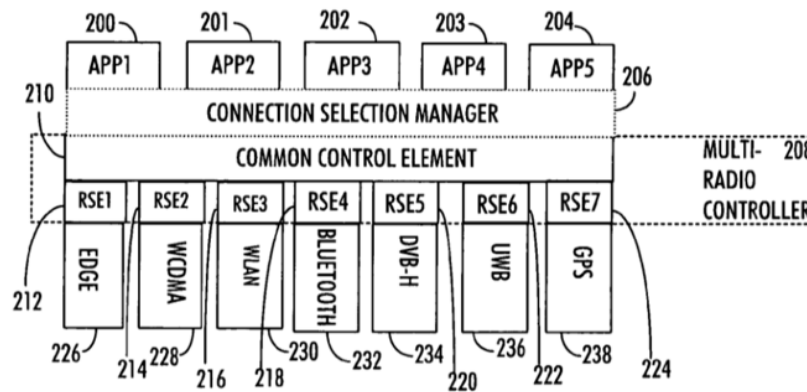


Fig. 2

Honkanen '076 at ¶ 1

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	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

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	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system).

Honkanen '076 at ¶ 58

If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection.

Honkanen '076 at ¶ 59

The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations.

Honkanen '076 at ¶ 69

If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[20pre] 20. The video processing apparatus of claim 1,	Honkanen '076 discloses "[t]he video processing apparatus of claim 1." See above.
[20a] wherein the video processing apparatus comprises a cellular phone.	Honkanen '076 discloses "wherein the video processing apparatus comprises a cellular phone." For example: Honkanen '076 at ¶ 21 Next, a structure of a communication device employing a number of simultaneous radio connections will be described with reference to FIG. 1. The communication device 100 may be for example a personal communication device such as a mobile communication device, a computer, a laptop, or a PDA (Personal Digital Assistant). The communication device 100 may also be a combination of two electronic devices, such as a computer with a mobile communication device connected to the computer. An example of a combination of a PDA and a mobile communication device is the Nokia Communicator®. Honkanen '076 at ¶ 23 A communication interface 112 provides another wireless connection 120, using Bluetooth®-technology, with a user interface component 106. The user interface component 106 may be for example a headset of a mobile telephone, comprising a microphone, a loudspeaker, and a communication interface for a Bluetooth® connection with the mobile telephone. The user interface component 106 may also be a keyboard or a mouse operating with a computer through a Bluetooth® link. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23pre] 23. A cellular phone, comprising:	To the extent the preamble is limiting, Honkanen '076 discloses "[a] cellular phone." For example:

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Honkanen '076 at ¶ 21 Next, a structure of a communication device employing a number of simultaneous radio connections will be described with reference to FIG. 1. The communication device 100 may be for example a personal communication device such as a mobile communication device, a computer, a laptop, or a PDA (Personal Digital Assistant). The communication device 100 may also be a combination of two electronic devices, such as a computer with a mobile communication device connected to the computer. An example of a combination of a PDA and a mobile communication device is the Nokia Communicator®. Honkanen '076 at ¶ 23 A communication interface 112 provides another wireless connection 120, using Bluetooth®-technology, with a user interface component 106. The user interface component 106 may be for example a headset of a mobile telephone, comprising a microphone, a loudspeaker, and a communication interface for a Bluetooth® connection with the mobile telephone. The user interface component 106 may also be a keyboard or a mouse operating with a computer through a Bluetooth® link. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23a] a first radio communication circuit implementing a first transmission scheme having a first modulation scheme and first transmission frequency band, the first radio communication circuit capable of transmitting video information by radio or receiving information by radio using the first transmission frequency band;	Honkanen '076 discloses “a first radio communication circuit implementing a first transmission scheme having a first modulation scheme and first transmission frequency band, the first radio communication circuit capable of transmitting video information by radio or receiving information by radio using the first transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

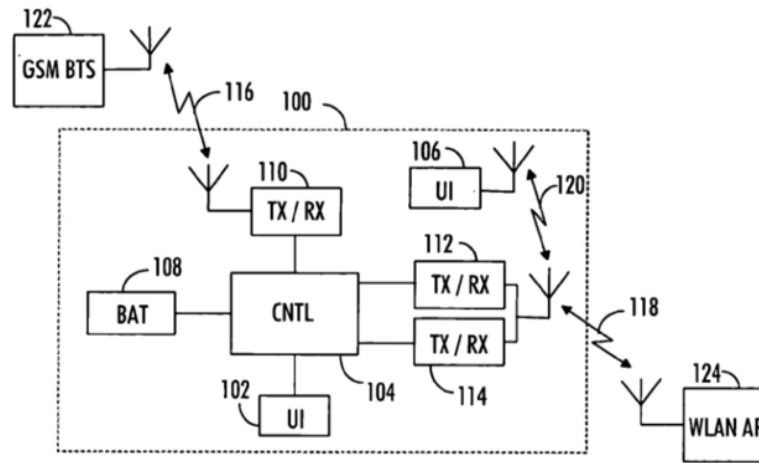


Fig. 1

Honkanen '076 at Fig. 2

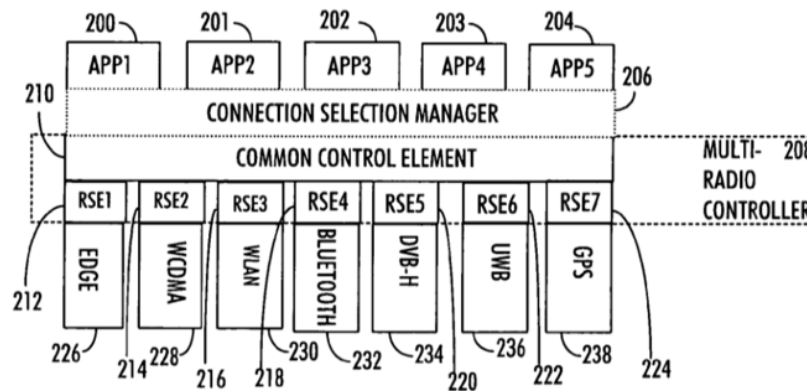


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

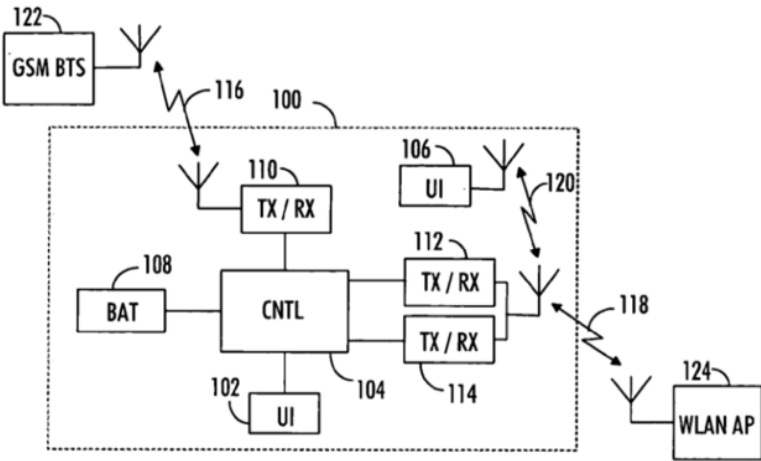
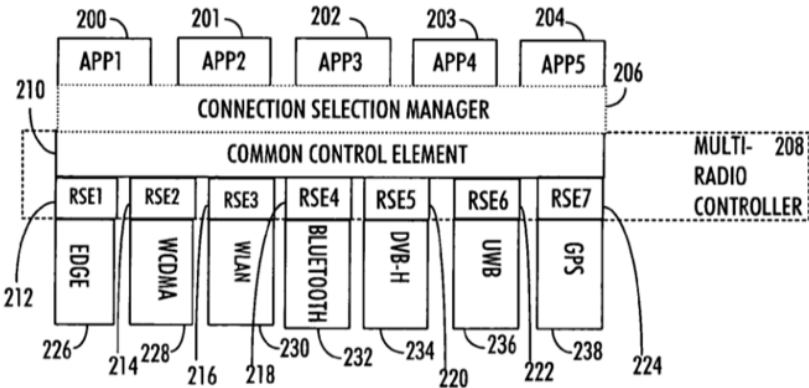
Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23b] a second radio communication circuit implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band, the second radio communication circuit capable of connecting by radio to an internet or a home	Honkanen '076 discloses “a second radio communication circuit implementing a second transmission scheme having a second modulation scheme different from the first modulation scheme and a second transmission frequency band different from the first transmission frequency band, the second radio communication circuit capable of connecting by radio to an internet or a home network to transmit and receive information using the second transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
network to transmit and receive information using the second transmission frequency band;	Honkanen '076 at Fig. 1  Fig. 1 Honkanen '076 at Fig. 2  Fig. 2

Honkanen '076 at ¶ 1

The invention relates to controlling a number of simultaneous radio connections in a communication device.

Honkanen '076 at ¶ 2

The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example.

Honkanen '076 at ¶ 4

If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance.

Honkanen '076 at ¶ 8

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 9 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 22 The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124. Honkanen '076 at ¶ 24 The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components. Honkanen '076 at ¶ 25 In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23c] a third radio communication circuit capable of transmitting information using a third transmission frequency band;	Honkanen '076 discloses “a third radio communication circuit capable of transmitting information using a third transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

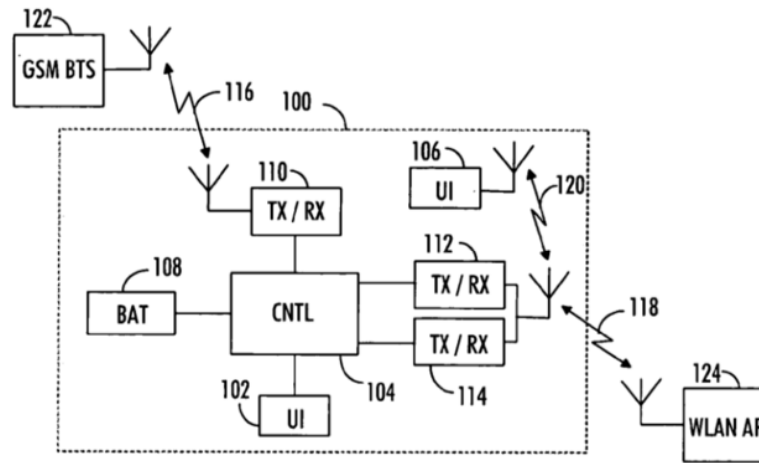


Fig. 1

Honkanen '076 at Fig. 2

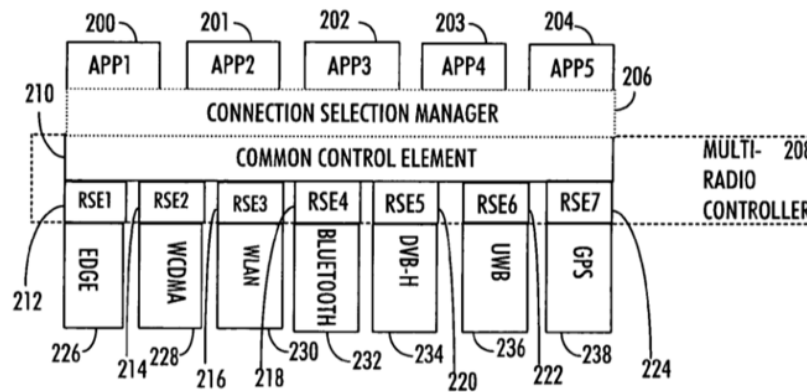


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

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	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

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	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

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	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23d] a fourth radio communication circuit capable of transmitting information using a fourth transmission frequency band;	Honkanen '076 discloses “a fourth radio communication circuit capable of transmitting information using a fourth transmission frequency band.” For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized.

Honkanen '076 at Fig. 1

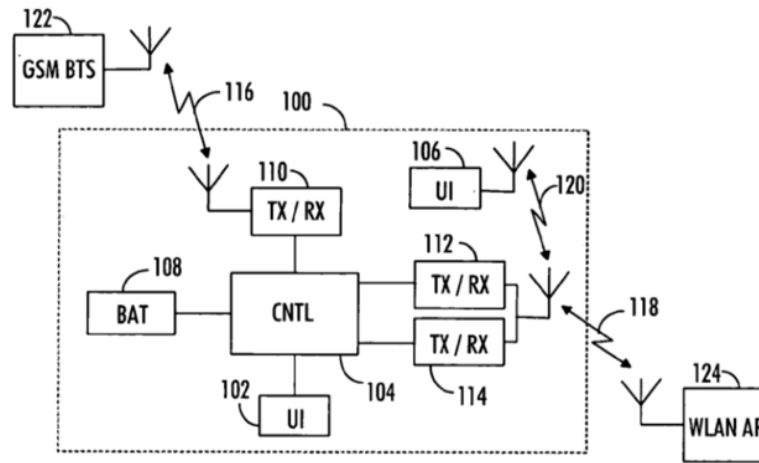


Fig. 1

Honkanen '076 at Fig. 2

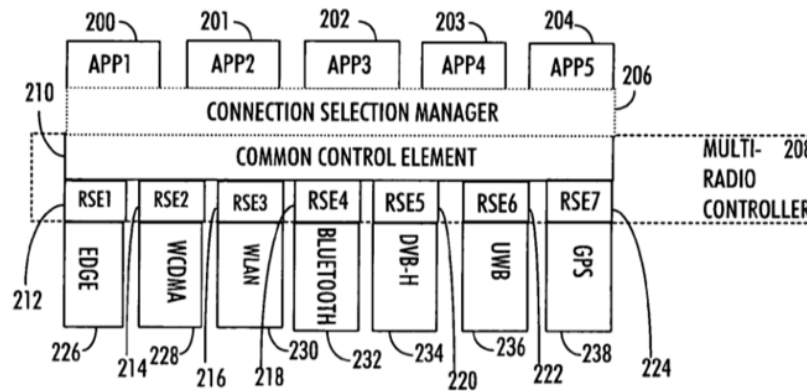


Fig. 2

Honkanen '076 at ¶ 1

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 8 According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 22

The communication device 100 comprises a number of communication interfaces 110 to 114 to provide a wireless radio connection. The communication interfaces 110 to 114 may be configured to provide connections employing different radio access technologies. In our example, the communication interface 110 provides a communication link 116 with a GSM (Global System for Mobile Communications)-system through a serving GSM base transceiver station 122. The communication interface 114 provides a WLAN (Wireless Local Area Network) connection 118 with a serving WLAN access point 124.

Honkanen '076 at ¶ 24

The communication interfaces 110 to 114 described above may be using partially the same components of the communication device 100 during the operation of radio connections 116 to 120. The communication interfaces 110 to 114 may be using for example the same antenna or antennas, radio frequency amplifier, and/or radio frequency filter. Each communication interface 110 to 114 may naturally have its own components or only some of the communication interfaces 110 to 114 may be using the same components.

Honkanen '076 at ¶ 25

In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication

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	technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 29 FIG. 2 illustrates an example of an architecture of the communication device 100. The architecture is depicted in a layered form, like an OSI (Open Systems Interconnection) model of ISO (International Organization for Standardization), with lower layers providing services to higher layers. Honkanen '076 at ¶ 30 On the highest layer are provided applications 200 to 204 that may need a radio connection. The application 200 to 204 may be for example an application handling a voice call, a web or WAP (Wireless Application Protocol) browser, an e-mail client, a GPS navigation application, a gaming application, or a media player application. The communication device 100 may also comprise other applications. Whenever an application 200 to 204 needs a radio connection to another communication device or network, the application sends a request to a lower layer to establish the connection. During the operation of the connection, the application sends data related to the application to lower layers for transmission over the connection to the other communication device. Similarly, the application receives data related to the application from the other communication device via the connection through the lower layers. When a need no longer exists to maintain the connection, the application sends a request to a lower layer to terminate the connection. Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves. Honkanen '076 at ¶ 34 The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is

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	close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_o), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR). Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. Honkanen '076 at ¶ 39 A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s).

Honkanen '076 at ¶ 48

Next, a number of examples of defining/adjusting the parameters of a radio connection in creation and/or the existing radio connection(s) will be described. The radio connection in creation may employ different radio access technology than an existing radio connection or radio connections use. Equivalently, the radio connection in creation may employ the same radio access technology than an existing radio connection or radio connections use. It should be appreciated that the operation of the connection parameter manager 308 and the multiradio controller 208 is not limited to the examples described below, but other procedures for defining/adjusting the parameters of the radio connections are also possible.

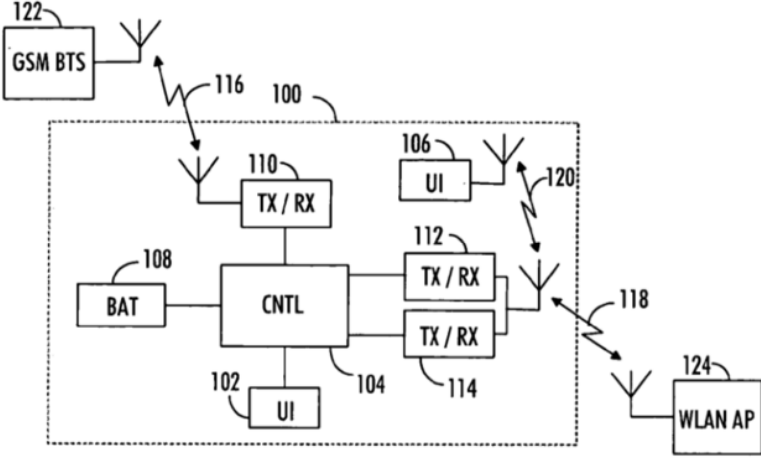
Honkanen '076 at ¶ 49

When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23e] an imaging circuit capable of receiving video information and still picture information via an optical system;	Honkanen '076 discloses “an imaging circuit capable of receiving video information and still picture information via an optical system.” For example: To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23f] a compression circuit compressing the still picture information using a first type of compression method and the video	Honkanen '076 discloses “a compression circuit compressing the still picture information using a first type of compression method and the video information using a second type of compression method.” For example:

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
information using a second type of compression method;	Honkanen '076 at ¶ 36 Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23g] a microphone receiving audio information corresponding to the video information received via the imaging circuit;	Honkanen '076 discloses “a microphone receiving audio information corresponding to the video information received via the imaging circuit.” For example: Honkanen '076 at ¶ 23 A communication interface 112 provides another wireless connection 120, using Bluetooth®-technology, with a user interface component 106. The user interface component 106 may be for example a headset of a mobile telephone, comprising a microphone, a loudspeaker, and a communication interface for a Bluetooth® connection with the mobile telephone. The user interface component 106 may also be a keyboard or a mouse operating with a computer through a Bluetooth® link. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23h] an accumulation circuit capable of accumulating video information received by the imaging circuit and audio information received by the microphone, wherein the first	Honkanen '076 discloses “an accumulation circuit capable of accumulating video information received by the imaging circuit and audio information received by the microphone, wherein the first radio communication circuit can transmit video information accumulated in the accumulation circuit to an external device by radio.” For example:

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
radio communication circuit can transmit video information accumulated in the accumulation circuit to an external device by radio;	Honkanen '076 at ¶ 25 In the example of FIG. 1 three communication interfaces 110 to 114 are provided in the communication device, these interfaces 110 to 114 providing the Bluetooth® connection 122, the GSM connection 116, and the WLAN connection 118, respectively. It should, however, be appreciated that the communication device according to the invention is limited neither to the number of communication interfaces in the communication device nor to the wireless communication technology the communication interfaces provide. Thus, the communication device may comprise several communication interfaces providing connections based on, for example, the following technologies: GSM, WLAN, Bluetooth®, WCDMA (Wideband Code Division Multiple Access), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), DVB-H (Digital Video Broadcasting for Handheld devices), UWB (Ultra Wideband), GPS (Global Positioning System), CDMA2000. Other wireless communication technologies are also possible to be implemented in the communication device according to the invention. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23i] a display displaying the video information received by the first radio communication circuit and displaying information received by the second radio	Honkanen '076 discloses “a display displaying the video information received by the first radio communication circuit and displaying information received by the second radio communication circuit via the internet or home network.” For example: To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
communication circuit via the internet or home network;	knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23j] a controller controlling assignment of connection of each of the first, second, third, and fourth radio communication circuits,	Honkanen '076 discloses “a controller controlling assignment of connection of each of the first, second, third, and fourth radio communication circuits.” For example: Honkanen '076 at Fig. 1  The diagram illustrates a mobile device 100, enclosed in a dashed box. Inside the device, there is a central controller (CNTL) 104. Connected to the controller are a battery (BAT) 108, a user interface (UI) 102, and two transceiver blocks (TX/RX) 110 and 112. The TX/RX 110 is connected to an external antenna 116, which is shown communicating with a GSM Base Transceiver Station (GSM BTS) 122. The TX/RX 112 is connected to another external antenna 118, which is shown communicating with a Wireless Local Area Network Access Point (WLAN AP) 124. Additionally, there is a second user interface (UI) 106 connected to the device, with its own antenna 120. The label 'Fig. 1' is centered below the diagram. Fig. 1

Honkanen '076 at Fig. 2

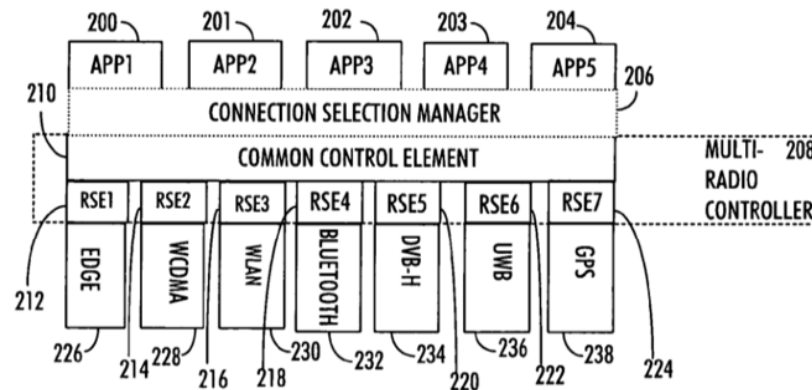


Fig. 2

Honkanen '076 at ¶ 6

According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 10

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 12

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 13 According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 26 The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC. Honkanen '076 at ¶ 32 The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections.

Honkanen '076 at ¶ 33

The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection.

Honkanen '076 at ¶ 34

The multiradio controller 208 also comprises radio-specific entities 212 to 224. Each radio-specific entity can be seen as an interface between the common control element 210 of the multiradio controller 208 and the specific radio interface. A radio-specific entity takes care of controlling one radio connection according to the parameters received from the common control element 210. A radio-specific entity is close to the physical layer of the connection, which enables rapid adaptation to the changing environment and fast control of the connection. The functionality of each radio-specific entity is radio-system-specific, which means that the parameters from the common control element 210 are applied to the standard specifications of the radio system. A radio-specific entity may also supply the common control element 210 with the measured properties of the connection it controls. The measured properties of the connection may comprise the bit error rate (BER), block error rate, or the frame error rate (FER) of the connection. The measured properties may also comprise received energy per chip divided by the noise power density in the band (E_c/N_0), interference signal code power (ISCP), received signal code power (RSCP), received signal strength indicator (RSSI), signal-to-interference-power ratio (SIR).

Honkanen '076 at ¶ 36

Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

Honkanen '076 at ¶ 39

A connection request processing block 304 processes requests for a radio connection coming from an application or from the connection selection manager. The connection request processing block 304 checks at least the validity of a request and the availability of radio resources related to the request. Checking the validity of a request comprises checking, whether or not the requested radio connection is available in the communication device. Checking the availability of the radio resources comprises checking which and how many radio connections are in operation, and whether it is possible to establish another radio connection without deteriorating or even collapsing the operation of an existing connection. If the requested connection is available and if it is possible to establish it, the connection request processing block 304 sends a command message to create the connection to a connection parameter manager 308. If the creation of the connection is not possible, the connection request processing block 304 informs the application, or the connection selection manager, that requested the connection that the requested connection is not currently available.

Honkanen '076 at ¶ 44

A connection parameter manager 308 determines the operational parameters of each connection. When receiving a command from the connection request processing block 304 to create a new connection, the connection parameter manager 308 checks which connections are operational, and the parameters of the operational connections. If the connection parameter manager 308 detects that there is an active connection which might interfere with the operation of the new connection (or vice versa), the connection parameter manager 308 defines the parameters of the new connection so that interference between the two connections is as minimal as possible.

Honkanen '076 at ¶ 45

The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions.

Honkanen '076 at ¶ 47

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections. Honkanen '076 at ¶ 57 The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system). Honkanen '076 at ¶ 58 If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection. Honkanen '076 at ¶ 59 The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction). Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23k] wherein the controller controls assignment of connection for each of the first and second radio communication circuit in response to receiving an indication from a user such that when an indication from the user indicates to transmit video information using the first radio communication circuit the controller assigns a connection to the first radio communication circuit for transmitting the video information,	Honkanen '076 discloses “wherein the controller controls assignment of connection for each of the first and second radio communication circuit in response to receiving an indication from a user such that when an indication from the user indicates to transmit video information using the first radio communication circuit the controller assigns a connection to the first radio communication circuit for transmitting the video information.” For example: Honkanen '076 at ¶ 31 On the lower layer, services may be provided to the applications 200 to 204 by a connection selection manager 206. The connection selection manager 206 may select an appropriate connection for an application based on a set of connection profiles stored in its database. A user or an operator, for example, may define the connection profiles, and the profiles may be based on optimization of some criterion, for example throughput, bit error rate or cost-efficiency of the connection. The connection selection manager 206 is an optional layer in the architecture of the communication device 100, since the applications 200 to 204 may be designed to define the suitable connections by themselves.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[231] wherein the controller controls each of the first and second radio communication circuit so that the first radio communication circuit transmits video information and the second radio communication circuit connects to the internet or the home network simultaneously, and	Honkanen '076 discloses "wherein the controller controls each of the first and second radio communication circuit so that the first radio communication circuit transmits video information and the second radio communication circuit connects to the internet or the home network simultaneously." For example: Honkanen '076 at Abstract A method for controlling a number of simultaneous radio connections in a communication device is presented. The control of a number of simultaneous radio connections is carried out in the communication device. Parameters of the radio connections are controlled such that interference between the radio connections is minimized. Honkanen '076 at ¶ 1 The invention relates to controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 2 The number of different radios in mobile communication devices is steadily increasing to facilitate more flexible connectivity and a broader range of services. Cellular access alone is no longer sufficient, but new wireless technologies are integrated to communication devices now and especially in the future to enable novel connectivity solutions. Integration of multiple radios into a single terminal, however, introduces a serious integration challenge that is becoming more pronounced as the number of radios increases. One element of the integration challenge is the appropriate handling of simultaneous operation of radios. It is quite evident that users are willing to use different radios at the same time, like using a headset employing wireless Bluetooth® technology during a GSM phone call, and using a wireless local area network (WLAN) connection for Internet surfing, for example. Honkanen '076 at ¶ 3 If there are two or more operational radio connections from one communication device, the connections may very well interfere with one another. Even if the connections are not operating on the same frequency band, they may still interfere with each other due to the non-idealities in the components of the

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	communication device. The components may introduce spectral leakage, and the selectivity of receivers may not be ideal, meaning that they may also receive signal components belonging to a signal other than the desired one. Honkanen '076 at ¶ 4 If there is a number of connections simultaneously operating on the same band, interference they cause to one another is much more severe than if they were operating on separate bands. Especially on the 2.4 GHz unlicensed Industrial, Scientific and Medical (ISM) band there may be several connections, for example Bluetooth® and wireless local area network (WLAN) connections, operating on the same band simultaneously. These connections cause inter-system interference to one another, which may result in a degraded quality of service. If there are two active connections on the same band operating from the same communication device, these two connections may very well interfere with each other severely, or the connections may even block each other's usage totally. This may happen because both of the connections operate from the same communication device, and thus the radio transceivers may be located within a few centimeters from each other. They may also be using the same radio components, like an antenna, for instance. Honkanen '076 at ¶ 5 An object of the invention is to provide a solution for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 6 According to an aspect of the invention, there is provided a method for creating a new radio connection in a communication device with at least one existing radio connection. The method comprises determining whether or not an existing radio connection and a new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another. Honkanen '076 at ¶ 7 According to another aspect of the invention, there is provided a method for controlling a number of simultaneously operating radio connections in a communication device. The method comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that interference between the radio connections is minimized if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 8

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide at least one radio connection and a control unit which is configured to create at least one radio connection, process a request to create a new radio connection, determine whether or not an existing radio connection and the new radio connection interfere with one another and create the new radio connection with parameters that minimize interference between an existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 9

According to another aspect of the invention, there is provided a communication device comprising at least one communication interface to provide a radio connection and a control unit configured to monitor properties of the radio connections in order to detect interference between at least two radio connections and adjust parameters of at least one radio connection so that the interference between the radio connections is minimized, if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 10

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for creating a new radio connection in a communication device with at least one existing radio connection. The process comprises determining whether or not the existing radio connection and the new radio connection interfere with one another and creating the new radio connection with parameters that minimize interference between the existing radio connection and the new radio connection if the existing radio connection and the new radio connection interfere with one another.

Honkanen '076 at ¶ 12

According to yet another aspect of the invention, there is provided a computer program product embodied on a computer readable medium, the computer program product encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected.

Honkanen '076 at ¶ 13

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	According to yet another aspect of the invention, there is provided a computer program distribution medium readable by a computer and encoding a computer program of instructions for executing a computer process for controlling a number of simultaneously operating radio connections in a communication device. The process comprises monitoring properties of the radio connections in order to detect interference between at least two radio connections and adjusting parameters of at least one radio connection so that the interference between the radio connections is minimized if interference between the at least two radio connections is detected. Honkanen '076 at ¶ 26 The communication device 100 further comprises a control unit 104 to control functions of the device 100. The control unit 104 comprises means for creating radio connections between the communication device 100 and other communication devices or networks. The control unit 104 also comprises means for controlling a number of simultaneous radio connections in the communication device 100. The control unit 104 may be implemented with a digital signal processor with suitable software or with separate logic circuits, for example with ASIC (Application Specific Integrated Circuit). The control unit 104 may also be a combination of these two implementations, such as a processor with suitable software embedded within an ASIC. Honkanen '076 at ¶ 32 The next lower layer is a multiradio controller 208. The multiradio controller 208 establishes, controls, and terminates radio connections according to the connection requirements from the higher layers. The multiradio controller 208 is also responsible for taking care of the simultaneous operation of multiple radio connections. Honkanen '076 at ¶ 33 The multiradio controller 208 may be a two-fold entity. First of all, there is a common control element 210, which communicates with the higher layers. It receives requests for creating and terminating a radio connection from the applications 200 to 204 or, if applied, the connection selection manager 206. The common control element 210 may also check the availability of the radio connection requested from a higher layer, and either start a process for creating a radio connection or inform higher layers that the requested radio connection is not currently available. The common control element 210 is also responsible for controlling the simultaneous operation of multiple radio connections by adjusting the parameters of an existing connection whenever a new radio connection which would interfere with an existing radio connection is created, or whenever the common control element 210 detects a sufficient change in the properties of an existing connection.

Honkanen '076 at ¶ 36

Below the radio-specific entities 212 to 224 in FIG. 2 are provided the communication interfaces 226 to 238. Each communication interface takes care of encoding and decoding data into suitable electrical waveforms for transmission and reception on the specific physical media used. This process is carried out according to each radio-access-specific standard. The architecture of FIG. 2 employs physical layers of EDGE, WCDMA, WLAN, Bluetooth®, DVB-H, UWB and GPS radio access technologies, but the operation of the multiradio controller is not limited to these technologies as it can be configured to control also other wireless radio access technologies.

Honkanen '076 at ¶ 40

A radio record block 302 comprises information on the status, parameters and properties of the radio connections applied to the communication device. The status of a connection describes whether the connection is in operation, available, or disabled. When a connection is in operation, a communication link has been established using the communication interface related to that specific connection, and data is being transported through that link. When a connection is available, no communication link related to that specific connection has been established but radio resources are available for the establishment of the connection. When a connection is disabled, the connection is not available due to lack of radio resources, for example. There may also be two descriptions for the status of a radio connection. For example, if it is possible to establish a number of connections using a single communication interface, the status of the connection in the radio record block 302 may be both 'in operation' and 'available'.

Honkanen '076 at ¶ 45

The detection of possible interference between connections is based on the information on the used radio resources, available radio resources, and on the parameters of existing connections. This information is contained in the radio record block 302. The connection parameter manager 308 may first check, whether or not an existing, operational connection exists that uses the same radio resources as the newly requested connection would use. These radio resources comprise a frequency band, time domain, and space domain. The space domain is a possible radio resource in communication devices which comprise multiple antennas and an ability to control the direction of a radio beam from the antenna or antenna array. It is possible that two simultaneous radio connections are operating on the same frequency band and transmitting/receiving data at the same time, only in/from different directions.

Honkanen '076 at ¶ 47

If an operational radio connection exists that uses the same radio resource(s) as the requested new connection, the connection parameter manager 308 may define the parameters for the new connection so

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	that interference between the two connections is minimized. The connection parameter manager 308 may also adjust the parameters of the existing connection in order to minimize the interference between the two connections using the same radio resource(s). Honkanen '076 at ¶ 49 When creating a new radio connection, the connection parameter manager 308 may first check, whether existing connections exist that use the same frequency band as the requested new connection in creation would use. If an existing connection on the same frequency band exists, the connection manager may (if possible) define the frequency parameters of the connection in creation so that the frequency bands of two connections do not overlap. For example, a Bluetooth® connection and a WLAN connection operate partially on the same 2.4 Gigahertz ISM-band. Let us assume that the connection in creation is a Bluetooth® connection, and a WLAN connection in operation exists. The Bluetooth® connection is a frequency hopping spread spectrum connection. Thus, the connection parameter manager 308 may prevent the Bluetooth® connection from hopping to the frequencies the WLAN connection is using. The limitation of frequency hops of the Bluetooth® connection is naturally possible also when a Bluetooth® connection exists and the connection in creation is a WLAN connection. The frequency overlapping is naturally also possible between connections other than just Bluetooth® and WLAN ones, and the frequency parameters of these other connections may be adjusted accordingly. Honkanen '076 at ¶ 54 After the connection parameter manager 308 has decided the proper parameters for the connection in creation, and possibly the adjustable parameters for an existing connection, it sends command messages to respective radio-specific entities to create a connection with the defined parameters, or to adjust the parameters of an existing connection. It updates the status and stores the parameters of the new connection in the radio record 302. The connection parameter manager 308 also sends the parameter of the new connection as well as a command to the continuous control manager 306 to start the monitoring and control of the new connection. Functions of the continuous control manager 306 will be described below. Honkanen '076 at ¶ 55 Above, the functionality of the connection parameter manager 308 was described in the scenario where one connection is in creation and parameters of one existing connection are checked and possibly adjusted. The procedure is similar in a case where several connections exist, whose parameters need to be checked and/or adjusted in order to create a new connection. The operation of the connection parameter manager 308 is not restricted to the number of existing connections.

Honkanen '076 at ¶ 57

The continuous control manager 306 may monitor for example performance measures of operational connections. Such performance measures may be BER or FER. If the continuous control manager 306 detects too poor performance measures related to a connection, it may check whether the poor performance is associated with the use of a certain radio resource. For example when related to a Bluetooth® connection, a momentarily high bit error rate may be associated with a certain frequency hop. This may occur when an operational WLAN connection exists partially on the same band as a Bluetooth® connection, and the frequency hops to the band where WLAN is operating may produce poorer performance. If the poor performance is related to a use of a certain radio resource (or a portion of the radio resource), the continuous control manager 306 may adjust the parameters of a connection or connections so that the radio resource is not used by several connections. For instance, the parameters of a Bluetooth® connection may be adjusted so that the frequency hopping of the connection is limited to a narrower band, where no other operating connection exists. Controlling the use of time (or space) domain radio resources is carried out in a similar way, of course taking into account restrictions given by for example the radio systems (such as the time slots allocated for each connection in a GSM system).

Honkanen '076 at ¶ 58

If no alternative exists but to use the same radio resources for two (or more) connections, the continuous control manager 306 may adjust the parameters of one or more connections whose performance is too poor. The adjusted parameters may comprise a spreading code, channel code, modulation technique, power level, and/or timing parameters. If the performance of a connection or connections is still unsatisfactory, the continuous control manager 306 may temporarily shut down a connection or even terminate either the connection performing poorly or the connection interfering with the poorly performing connection.

Honkanen '076 at ¶ 59

The continuous control manager 306 may also have a pre-information on the possible combinations of connections, which may interfere with one another. For example, if the continuous control manager detects a poor performance in a Bluetooth® connection, it may automatically check, whether an operational WLAN connection (or vice versa) exists, because it has information that these connections may interfere with one another. If the continuous control manager 306 detects an operational WLAN connection, it may adjust the parameters of one or both connections. The continuous control manager 306 may take care of scheduling the transmission of packets, and changing parameters of packets to be transmitted. Possible parameters that may be changed comprise packet length, amount of data in the packet, modulation scheme, channel coding scheme, transmission frequency/rate of packets, and/or

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	format of the packet (preamble, header, payload, etc.). The continuous control manager 306 may predict possible collisions of data packets of a number of connections and adapt the scheduling accordingly. Thus, the continuous control manager 306 may have information on the possible coincidences between connections, and also a defined set of rules as to how to rapidly adapt to these situations. Honkanen '076 at ¶ 60 FIG. 4 illustrates a method for creating a radio connection in a communication device, and arranging simultaneous operation of several radio connections. The process starts in 400 with no operational connections in the communication device. In 402 a first radio connection is created according to a prior art procedure. A request to create a new radio connection is received in 404. The request may come from an application in the communication device or from an external instance, for example from a radio network. Honkanen '076 at ¶ 61 Available radio resources are checked in 406. This comprises checking the radio resources specified for the connection in creation. Available radio resources mean that there is at least a portion of one radio resource (frequency band, time slots, space) available. Although the frequency band the new connection is specified to use were in use, it may be possible to arrange the two (or more) connections to operate so that they do not transport data at the same time (or in the same direction). Honkanen '076 at ¶ 62 If radio resources are available so that a new connection can be created without using the same radio resources as used for an existing connection, the process proceeds to 408 (optional) and 410. 408 is carried out, if the parameters of an existing radio connection have to be adjusted in order to create a new connection without the connections interfering with each other. A new connection with parameters that do not interfere with another connection is created in 410. Honkanen '076 at ¶ 65 If it is possible in 412 to create another connection using the same radio resources as used for an existing connection or connections, the process proceeds to 416 and 418 (optional). The new connection with parameters that allow the connection to sustain interference to some degree is created in 416. The parameters of an existing connection or connections are adjusted accordingly, when necessary.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
	Honkanen '076 at ¶ 67 FIG. 5 illustrates a procedure for controlling a number of simultaneous radio connections in a communication device. Honkanen '076 at ¶ 69 If two connections do not interfere with each other in 506, the process returns to 504 and continues the monitoring of the properties of the connections. If two connections are detected to interfere with each other in 506, the process moves to 508, where the radio resources are checked. This comprises checking the radio resources of both connections that interfere with each other. If there are radio resources available so that the two connections can operate without interfering with each other, the process moves from 510 to 512, where the parameters of at least one connection are adjusted so that the two connections do not interfere with one another. Adjusting the parameters of one connection may suffice in some cases, but a need may exist to adjust the parameters of both connections interfering with each other. Parameters of another connection or other connections that were not involved in the interference in 506 may also need to be adjusted in some cases. This may be the case in situations where the adjustment of parameters of one connection results in interference between the adjusted connection and another connection. A precaution would be to also adjust the parameters of that other connection at the same time so that interference between these two connections would be avoided. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[23m] wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an operating system of the cellular phone is available, and the cellular phone executes an update process such that an updated operating system of the cellular phone is	Honkanen '076 discloses “wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an operating system of the cellular phone is available, and the cellular phone executes an update process such that an updated operating system of the cellular phone is stored in the cellular phone after execution of the update process.” For example: Honkanen '076 at ¶ 38 A block 300 comprises applications, which may need a radio connection. The operation of the applications 300 is the same as described above. The block 300 may also comprise a connection selection manager, if a connection selection manager is applied in the communication device.

'590 Patent Claim Limitation	Honkanen '076 Exemplary Disclosure
stored in the cellular phone after execution of the update process.	To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[24pre] 24. The cellular phone of claim 23,	Honkanen '076 discloses "[t]he cellular phone of claim 23." See above.
[24a] wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an application of the cellular phone is available, and the cellular phone executes an application update process such that an updated application of the cellular phone is stored in the cellular phone after execution of the application update process.	Honkanen '076 discloses "wherein the second or third radio communication circuits receive a signal from the internet indicating that an update for an application of the cellular phone is available, and the cellular phone executes an application update process such that an updated application of the cellular phone is stored in the cellular phone after execution of the application update process." For example: Honkanen '076 at ¶ 38 A block 300 comprises applications, which may need a radio connection. The operation of the applications 300 is the same as described above. The block 300 may also comprise a connection selection manager, if a connection selection manager is applied in the communication device. To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.
[25pre] 25. The cellular phone of claim 23,	Honkanen '076 discloses "[t]he cellular phone of claim 23." See above.
[25a] wherein the first modulation scheme comprises shift keying modulation and the second modulation scheme comprises quadrature amplitude modulation (QAM).	Honkanen '076 discloses "wherein the first modulation scheme comprises shift keying modulation and the second modulation scheme comprises quadrature amplitude modulation (QAM)." For example: To the extent Maxell contends Honkanen '076 does not disclose this limitation, a person of ordinary skill in the art would have readily arrived at this limitation by combining or modifying it in view of their general knowledge and/or the prior art references disclosed in the corresponding section of Samsung's Invalidity Contentions.