Title: SPORT EVENT TRANSDUCER

Abstract: A sport event transducer having an output element that can emit a perceivable output in response to an event that relates to a sport team, for example by emitting an audio-visual output when a particular football team scores. The transducer can be removable attached to a sport garment such as a cap or jersey, or can be an integral part of the garment. A transmission system remotely controls such transducers in response to sport team events by broadcasting an RF signal carrying team event messages, for example by transmitting an FM radio-data broadcast that carries a team event message embedded in the FM signal as RDS data. The sport event transducer receives and decodes such RF broadcast signals. If the transducer receives a team event message that relates to the transducer’s affiliated team, the transducer's output element emits an audio and/or visual output signal in response to the message.
Sport Event Transducer.

Field of the Invention.

The present invention relates generally to sport team merchandise and in particular to sport garments such as caps and jerseys that bear team logos or other graphic images relating to a sport team, such as popular national sports teams as well as local or regional sports teams and the like. Such merchandise is typically worn or carried by fans to show their loyalty to and interest in a particular team or player.

Background.

Many sports fans wear caps or other items that bear the logos or other indicia of a team or player they support. When attending games, some fans carry posters, signs or flags bearing pictures or text for display to others in the audience or to television cameras that broadcast the event. These items often bear a team logo or other indicia.

U.S. patent number 6,511,198 describes a jersey having a fabric made of light emitting polymers for electronically displaying a team logo or other sports related message. The message can be modified to remain up to date. For example, the patent says that the “user may alter the display to read ‘New York Yankees - World Champions 1999.’"

Disclosure of the Invention.

The invention relates generally to a Sport Event Transducer and a method of operating the transducer so that it emits a perceivable output in response to an event relating to a sport team or player, such as for example, by emitting an audio-visual output when a particular football team or player scores a touchdown. In one embodiment, the Sport Event Transducer receives and decodes a signal that carries team event messages. If a team event message relates to a team or player affiliated with that transducer, the transducer emits an audio and/or visual output signal in response to the message.

Brief Description of Drawings.

Fig. 1 illustrates a garment having output elements and an intelligent controller with an FM radio receiver.

Fig. 2 is a block diagram of a radio-data receiver/decoder.

Fig. 3 is a diagram of a transmission system for preparing and transmitting RDS team event messages.

Figs. 4a and 4b are diagrams of the structure of an RDS data group specified in the RBDS standard.

Fig. 5 is a diagram of a type “3A” group for notifying Sport Event Transducers of a selected group type for use in carrying team event messages.
Fig. 6 is a diagram of an RDS data group of type 11A that carries a team event message.

Fig. 7 is a flow chart of a controller module within a Sport Event Transducer for receiving and decoding an RDS team event message.

Figure 8 is a diagram of a transmission system that includes a plurality of FM stations under the control of a central server. The system also includes cable TV networks, and "hot spots," under the control of a central server.

Figure 9 is a flow chart of the general operation of a central server of figure 8.

Figure 10 is flow chart of the general operation of a station server of figure 8.

Modes For Carrying Out the Invention.

Figure 1 depicts a Sport Event Transducer in the form of a garment 10 that includes one or more display elements 11 and one or more speaker elements 12, as well as a controller 13 for controlling the output of these elements. The garment includes a portable power source, such as a lithium-ion battery, that has the capacity to supply power to the electronics, the display and the speaker elements. The power source supplies the output elements with sufficient energy that they can be seen and heard in either an indoor environment or in an outdoor setting such as a sports stadium where the ambient light and sound can be substantially greater.

Garment 10 will typically bear a logo or other marking or indicia of a sport team or player. (To avoid the need to repeatedly use the phrase "sport team or player." the word "team" will be used herein when referring to a team or player that is affiliated with a Sport Event Transducer). Regardless of whether the garment bears such markings of a particular team, the garment includes a team identifier for electronically identifying a sport team associated with the garment. For example, the controller 13 includes memory 18 that can be loaded with an identification code that corresponds to a particular sport team. The team identifier can be in the form of a predetermined memory location or register that stores the identification code. It can also be embedded in processor instructions or micro-code for the garment’s controller. Any type of team identifier can be used, as long as it can specify the garment’s team affiliation to the controller.

A display element can be a single light emitting diode ("LED") or multiple LEDs. Alternatively, it can be implemented using any material that glows or emits light under electronic control. For example, in one embodiment, a garment that is associated with a particular sport team is partly made of light emitting polymers such as described in U.S. patent no. 6,511,198, incorporated herein by reference. Similarly, a garment can be made using a light emitting weave as described in U.S. patent no. 6,490,402, also incorporated herein by reference. Other known display technologies can be used, such as for example electrophoretic ink displays.
A speaker element 12 can be any known acoustic transducer for emitting a sound signal
in response to a signal, such as known piezoelectric transducers or electromagnetic speakers.

The main controller 13 includes a micro-controller 17 with a related memory 18 for
controlling the display element 11 and speaker element 12. The micro-controller 17 supplies
control signals to a display driver 15 to thereby turn the display element on and off, as well as to
control the intensity and/or the color of the element. In one embodiment, the entire display-
element 11 operates as a single pixel. In this embodiment, all light emitting units within the
display element operate together, turning on and off at the same time so as to behave as a single
light source. However, in other embodiments, multiple light emitting units within the display
element operate as individual pixels that can be controlled independently of each other.

The micro-controller 17 also supplies a control signal to a multiplexer 16 for selecting an
input to an audio driver 14 that controls the sound that is output by speaker element 12. For
example, the micro-controller can retrieve from memory 18 a selected sound pattern and
forward it to the audio driver via multiplexer 16 for reproduction by the speaker element 12.

Memory 18 can be loaded with a plurality of stored sound patterns, such as a pattern that emits a
siren sound, a sound of an explosion, or any of a variety of other stored sound patterns. Those
skilled in the art will understand that such patterns can be stored in a memory and can be
compressed to reduce the amount of memory required to store the pattern. Alternatively, the
controller can direct multiplexer 16 to drive speaker 12 with the audio content of a radio signal
received by a receiver 19 within the controller 13.

In one example, the micro-controller includes a module that causes the output elements
to emit a random sequence of popping sounds and light flashes. More specifically, when a
transducer receives a command to implement this module, it's controller waits a random period
of time before driving the speaker 12 with a pop or crack sound, and driving the display with a
quick bright flash. The controller repeats this output several times, each time separated by a
random delay. The controller thereby drives the speaker and display with a sequence of
randomly separated pulses. Thus, if this module is executed by a group of sports transducers
that are in the same vicinity, they will collectively emit an audio/visual show similar to that of
fireworks.

As shown in figure 1, the controller 13 also includes a receiver 19 for receiving a
broadcast RF signal that contains commands for controlling the display element 11 and/or
speaker element 12. Preferably, the receiver is designed to receive RF signals that are
transmitted over long distances that span a wide area (such as over an entire metropolitan area),
and can penetrate buildings and other structures to thereby reach many garments for a popular
sport team in the area covered by the RF transmission. For example, the receiver can be
compatible with commercial transmitters for FM radio, AM radio, Digital Radio, terrestrial television or other signal formats used to reach audiences over a wide area. In other embodiments, any suitable technique for wireless communication can be used.

In the embodiment shown in figure 1, the receiver 19 is designed to receive and demodulate FM radio transmissions from a commercial radio station, which typically span many square miles and can penetrate homes and other buildings. More specifically, the receiver is compatible with FM station radio-data equipment that complies with the Radio Broadcast Data System ("RBDS"). The National Radio Systems Committee ("NRSC") has defined a standard for RBDS that specifies how to embed data in FM radio transmissions to thereby communicate the data (herein "RDS data") using the same radio signals that carry music or other sound content.

Referring to figure 2, the receiver 19 includes an antenna 20 and an FM tuner 22 for receiving the RF signal and isolating a particular FM channel. In the example shown, the tuner isolates an FM channel that is selected by micro-controller 17, as indicated by the "channel" signal from the microcontroller.

An FM demodulator 24 demodulates the selected channel to extract the audio content for the FM channel that is then provided to an audio decoder/amplifier 26. The FM demodulator 24 also extracts from the FM channel a subcarrier signal that is encoded with the RDS data and supplies that subcarrier signal to an RDS decoder 28.

A general example of an RDS decoder 28 is shown in the current RBDS standard, wherein the standard depicts what it calls a "typical" decoder for extracting RDS data from such a subcarrier signal. However, any RDS decoder that is compatible with a corresponding FM radio-data transmitter can be used. For example, several companies currently supply IC chips for use in making RDS compatible FM receivers and RDS decoders, including chips from ST Microelectronics N.V, Silicon Laboratories Inc., and NXP Semiconductors Co.

The raw RDS data extracted by the RDS decoder is provided to the micro-controller 17, for example via a digital bus. The controller 17 then extracts from the raw RDS data a message that corresponds to an event relating to a sports team, herein a 'team' event message. The controller 17 includes a decoder module that determines whether the received team event message relates to the team associated with that garment, as specified by the garment's team identifier. If so, a message interpretation module within the controller causes the garment's display elements 11 and/or its speaker elements 12 to emit a corresponding output based upon the content of the team message. For example, in one application of the invention, a plurality of garments each bear the logo for a popular football team, herein "Team A." When Team A scores during a game, a broadcast transmission system broadcasts an FM radio-data signal that
contains an embedded team event message that notifies all Team A garments within the vicinity that a score has occurred. Each of the garments that receive the transmission extract the team event message from the radio broadcast. For those garments affiliated with Team A, the garments’ controllers cause the garments’ display elements and/or their speaker elements to emit a corresponding output in celebration of the touchdown.

Referring to figure 3, a sport event transducer ("SET") controller system transmits team event messages over a wide area (such as an area that encompasses the geographic market for a popular sport team) using a signal format that can penetrate homes and other buildings with sufficient strength to permit them to be decoded by Sport Event Transducers within those structures. In the example shown, the system includes an FM radio station antenna 30 that is coupled to the transmitter of conventional FM station 31 that complies with the Radio Broadcast Data System ("RBDS"). The National Radio Systems Committee ("NRSC") has defined a standard for RBDS that specifies how to embed data in FM radio transmissions to thereby communicate the data (herein "RDS data") using the same radio signals that earn music or other sound content.

Those skilled in the art know that the standard for RBDS specifies in detail the formal for RDS data, and that it shows a general technique for encoding and modulating an FM signal so that the signal carries a pair of audio signals as well as an RDS data stream. Any technique and corresponding circuitry/software can be used to prepare such FM radio-data signals that are compatible with the receivers 19 of Sport Event Transducers.

The system of figure 3 includes a Broadcast Control Module 35 for supplying RDS data to the FM station 31. As explained in greater detail below, the server 35 prepares the RDS data for transmission by the FM station 31 and its antenna 30.

The Broadcast Control Module 35 includes a data-gathering module 34 for obtaining real-time information concerning the status of certain sporting events. For example, in one embodiment, the module includes a user console 32(a) for accepting user input of sports information. In this example, a user observes a sporting event (live or remotely) and enters selected status information into the console as events occur, such as when a football team scores a touchdown. As explained below, this information can be used to trigger the broadcast of a corresponding team event message. Furthermore, the user of console 32(a) can also issue a team event message that is independent of any particular scoring event. For example, the user can issue a team event message directing all team garments and other sports transducers to light up or issue a sound blast at any moment that the user deems appropriate, such as at a moment during a game that the user considers critical or exciting.
In another embodiment, the system includes a remote user console 32(b) that operates in essentially the same way as local console 32(a), except that it supplies its input to the data-gathering module 34 from a remote location. In such embodiments, the transmissions between the remote console and data gathering module are secured to prevent unauthorized persons from triggering team event messages, for example using known cryptographic techniques to identify authorized users, or by otherwise encrypting communications between the remote console and the control server.

In other embodiments, the module 34 automatically gathers sporting information from one or more remote servers, for example via the Internet. In the example shown, there are several Real-Time Sports Data Servers 37 accessible via the Internet that provide real-time sports information, such as current scores of baseball games and other real-time game statistics. The gathering module receives such information from one or more such servers, and supplies it to a messaging module 33.

The messaging module 33 detects from this input the occurrence of certain predefined events and, in response, instructs the FM station 31 to broadcast a corresponding team event message to Sport Event Transducers of a specified type, thereby simultaneously notifying a plurality of Sport Event Transducers of the event in real-time. Returning to the example above, if Team A scores a goal, the data-gathering module 34 quickly learns of that event and promptly notifies the messaging module 33. In response, the messaging module prepares a corresponding team event message and forwards the message to the FM station 31 for transmission in a format that is compliant with RBDS.

The RBDS standard allows FM radio stations to transmit data on an FM channel by encoding the data into a subcarrier signal that is injected into an FM audio signal to thereby form a composite FM signal. The standard specifies how to encode several pre-defined types of data into the composite signal. For example, it defines how to encode data that tunes radio receivers, and data called "radio text" that is displayed by the receiver, such as the name of a song currently playing on the FM channel.

The RBDS standard also describes a protocol for encoding data for undefined applications called "Open Data Applications." The standard allows for over 65,000 open data applications, each of which can be assigned a unique sixteen-bit identification code called the "Application Identifier" or "AID." Such AID numbers are assigned by an RDS Registration Office in response to requests from those wishing to transmit data for an application that is not pre-defined in the RBDS standard.
In one embodiment of the present invention, a user obtains from an RDS Registration Office, an AID code for the sports event transducer application. This AID code is then used to identify team event messages broadcast in accordance with the RDS system as explained below.

RDS data is formatted in "groups" of 104 bits that are arranged in four "blocks" of twenty-six bits each, as shown in figures 4a and 4b (reproduced from the industry standard). The second block of each group includes a five-bit "group type" code that specifies the group's purpose, as shown in table 3 of the RBDS specification. For example, the group type "OA" is used to transmit data for tuning FM receivers, while group type "2A" is used for transmitting radio text. The RBDS specification allocates only nineteen group types for use by Open Data Applications ("ODAs"). Since there are far more than nineteen possible ODAs, the ODAs must share the nineteen ODA group types.

The messaging module 33 uses ODA group types for carrying team event messages as follows. First, the messaging module 33 (and/or the FM station 31) selects one of the available ODA group types. It then notifies all sports event transducers in the area of the selection by broadcasting a type "3A" group as shown in figure 5.

Field 56 of the type 3A group contains the AID that is registered for the Sport Event Transducer Application, thereby indicating to all receivers that this type 3A group is for the Sport Event Transducer Application. Field 52 provides an Application Group Type Code that identifies the ODA group type that was selected for the Sport Event Transducer Application. In this example, the Application Group Type Code equals 10110, thereby indicating that group type 11A was chosen. Thus, the type 3A group shown in figure 5 notifies all receivers that ODA group type 11A will carry data for the Sport Event Transducer Application.

The type 3A group also includes a field 54 that can carry other information for sports event transducers. For example, in the embodiment shown, the field 54 contains a team class identifier that identifies a team or a group of teams to whom this type 3A group is directed. For example, if a given radio station is using type 11A groups to carry team event messages for all of the major teams in the area around Boston, Massachusetts, then field 54 contains a team class identifier indicating this fact. Alternatively, if the radio station uses group type 11A only to carry messages for one team (such as the New England Patriots), then the patriots' team identifier would be placed in field 54. In this manner, a radio station can assign one or more teams to a selected ODA group.

Once the selected group type 11A has been broadcast to the sports event transducers in the region, message module 33 and FM station 31 begin transmitting type 11A groups filled with team event messages. Figure 6 depicts the format of a type 11A group that is encoded with a team event message.
Referring to figure 6, field 60 of the group contains the code for type 11A, i.e., 001 10, and field 62 carries the team event message. In this example, the message is thirty-seven bits long because type 11A groups have a thirty-seven-bit payload. However, type B groups can also be used to carry messages, in which case the team event message would have only twenty-one bits.

The team event message 62 includes a team identifier code 64 (or "garment type code" for garment-type transducers) that identifies a particular team to which the message is directed, such as Team A in the above examples. The message also includes a function code 66 that specifies the type of event that has occurred (or a particular function to be performed), such as for example a code that indicates that a touchdown has occurred. As explained below, sports event transducers receive and decode such team event messages and perform a corresponding function or action.

Figure 7 depicts the general steps performed by the garment's micro-controller 17 for receiving and decoding such embedded RDS messages. Once the controller 13 is powered on (step 700), the FM receiver 19 and micro-controller 17 together begin scanning the FM radio channels (step 702) to locate one earing team event messages. The micro-controller first directs the FM receiver 19 to tune to a particular channel. It then listens to the channel's signal to determine if it contains a type 3A RDS group for the Sports Event Transducer Application (steps 704 - 708).

Toward this end, it monitors the RDS stream for a group whose type field contains the code for type 3A (i.e., 001 10) and whose AID field contains the code registered for the Sport Event Transducer application (Step 708). (If the team class option is used, the controller also determines if field 54 contains a team class code for that transducer (Step 708)). If no such group arrives within a specified period of time, the controller 17 directs the receiver 19 to scan to another channel (Steps 702 - 706). If the controller detects such a type 3A group, then it extracts the "Application Group Type Code" which species the group type chosen to carry data for this type of transducer, in this example group type 11A. (Step 710).

The controller then begins listening for a type 11A group (Step 712). If no type 11A group is received within a predetermined period of time, the controller returns to scanning the channels (Step 714, 702). However, if a type 11A group arrives, the controller extracts the team event message (Step 716) and compares the message's team identifier to the controller's team identifier (Step 718). If they match, the controller decodes the function code and directs the display element 11 and/or speaker element 12 to emit a corresponding output for that function (Step 720). If they do not match, the controller returns to scanning the FM channels. (Steps 718 - 702). In this example, the controller assumes that the selected FM channel uses type 11A
groups to carry messages for only a single team and therefore returns to scanning channels if a
message is received for some other team. However, in other embodiments wherein the channel
uses type 11A groups to carry messages for multiple teams, the controller returns to listening for
the next type 11A group (step 712) if the latest message is addressed to a different team.

It is possible that a garment that has been tuned to a particular FM channel and a
particular selected RDS group type will move beyond the territory of the corresponding FM
transmitter. If so, the controller 17 should resume scanning the FM channels to determine if a
different channel is carrying team event messages in the new territory. For example, the
controller 17 can return to the scanning step 702 if no team event message is received over a
predetermined period of time, or it can periodically repeat the scanning step.

A sport event transducer control system can include multiple radio stations 31 that
collectively reach a much larger geographic region than any single station. Figure 8, for
example, depicts a system having a large number of radio stations (“FM1 - FMn”) that are
located in different sites. For example, they can all be located within a market for a particular
sports team. In some embodiments, the radio stations can be located in different countries
throughout the world, depending on the geographic coverage that is desired.

The system includes a Central Control Server 38 that receives sports related data from a
variety of sources, such as from a Real-Time Sports Data Server 37 coupled to the internet 36 or
from an operator console 32. The embodiment shown in figure 8 also includes a mobile
operator console 32c that communicates with the Central Control Server 38 via a wireless cell
interface 39, to thereby provide real-time sports data and operator generated team event
messages via a cell phone interface as shown.

In general, the Central Control Server receives real-time sports event data from these
sources, analyzes the data to identify the occurrence of certain predefined events, and in
response, instructs selected FM stations to broadcast team event messages via their FM
broadcasts.

For each FM station, the system includes a Broadcast Control Module 35 that couples
the station to the Internet 36 (or other network) for receiving data that instructs the station to
emit team event messages via that station’s FM transmission, and for controlling the FM station
31 to implement these instructions.

The general operation of the Central Control Server is depicted in figure 9. The server
receives real-time sports data from any of a variety of sources (Step 900). In response, it
analyzes the data to determine if a predetermined type of event has occurred (Step 902). These
predefined events include particular types of events for which the Central Control Server will
cause a team event message to be broadcast. For example, for a football team, events that could
trigger a team event message might include a score by the team (e.g. touchdown, field goal etc.), a turnover in favor of the team, or a penalty call against the opposing team. For a baseball team, the events could include a home run, strike-out of an opposing player, or the victorious end to the game.

If the Central Control Server detects the occurrence of such a predefined event for a team, it sends a message to selected FM stations to cause them to broadcast a team event message as explained below (steps 906 - 910). Similarly, the Central Control Server will cause a team event messages to be broadcast if an operator manually requests one (Step 904).

Upon detection of such an event for a team, e.g., Team A, the Central Control Server determines the identity of all stations that are designated for broadcasting messages for Team A (Step 906). It prepares an instruction packet or packets for each such station and transmits the packet(s) to the station's Broadcast Control Module 35 via the Internet or other network (Steps 908 - 910).

Figure 10 depicts the operation of each Broadcast Control Module 35 in response to the receipt of such a team event packet or packets. Upon receipt of such a packet (Step 1000), the Broadcast Control Module determines the identity of the team or teams to which the packet relates (Step 1002). If an Open Data Application group type has already been selected for that team's event messages, the Broadcast Control Module encodes data from the packet into a team event message using the selected group type (Step 1012) and instructions the station 31 to broadcast the group as described above (step 1014).

If an ODA group type has not been previously selected, the Broadcast Control Module selects an available ODA group type for use in communicating with the sport event transducers (Step 1006) and notifies all transducers of the selection by broadcasting a type 3A group as demonstrated in figure 4 (Step 1008). The Broadcast Control Module then encodes the team event message in the selected group type (as demonstrated in figure 6) and instructs the station's radio-data equipment 31 to broadcast the encoded message (Step 1001). Thus, each selected Broadcast Control Module receives a packet containing instructions for forming a team event message and processes it in this manner. Thus the selected group of stations collectively broadcast the team event message over a wide area determined by the combined ranges of the selected FM stations.

The system of figure 8 also includes other types of broadcast networks, such as one or more cable TV networks 40. In this embodiment, the cable company supplies its customers with cable TV decoder boxes 42 that include a local wireless transmitter 42(a) for emitting local wireless signals into the customer's home or business, such as for example in the WIFI or
Bluetooth format. However, the cable boxes can use any wireless format that is compatible with the wireless receivers found in sports event transducers.

With this arrangement, the Central Control Server 38 can send packets to a cable company server 44 via the internet, instructing the cable company server to broadcast team event messages via the wireless transmitters 42(a) of selected cable boxes 42. For example, if the packet contains a team event message that indicates that Team A has scored in a game, the cable company instructs all cable boxes 42 that are tuned to a televised broadcast of the game to transmit the team event message on their wireless transmitters. In this situation, there will likely be sports event transducers in the room where game is being televised, and any such sport event transducers will therefore receive the team event message and respond accordingly.

The transmission system of figure 8 can also transmit packets to selected hot spot wireless transmitters 48 that emit localized wireless signals that span a small region or "hot spot," such as signals in the WIFI or Bluetooth formats. Each hot spot location includes a server 47 for receiving packets from the Central Control Server 38 via the Internet. In response, the server 47 instructs a wireless transmitter 48 to emit a wireless signal embedded with the team event message. For example, a hot spot could be the home of a sports fan, a business location such as a sports bar, or a sports arena where a game is played.

The system of figure 8 also includes a mobile hot spot 46. Mobile device 46 includes a cell phone receiver for receiving a cell phone transmission from the Central Control Server 38. The mobile device also includes a local wireless transmitter for transmitting wireless signals such as those emitted by transmitters 42(a) and 48, but preferably in a very short-range wireless format such as Bluetooth. Thus, mobile device 46 receives from Central Control Server 38 a cell phone transmission instructing the device to emit a team event message. In response, the mobile device emits a team event message via its wireless transmitter for sports event transducers in close proximity to the device 46. In some embodiments, the mobile device 46 is itself a sports event transducer that responds directly to a team event message from central server 38.

The system can also include mechanisms for discouraging unauthorized Sport Event Transducers from responding to team event messages. For example, a Broadcast Control Module 35 or the Central Control Server 38 can encrypt each team event message so that only devices with a proper cryptographic key can decipher the team event messages. Furthermore, these servers can occasionally emit decoy RDS groups that have the selected group type for a team event message, but whose data field 62 lacks a legitimate team event message, to thereby make it more difficult for unauthorized devices to know when legitimate team event messages are being issued.
The same architecture can be used to broadcast team event messages for all kinds of sporting events, wherein each Sport Event Transducer responds only to those broadcasts that relate to a particular team or player of interest. For example, the team identifiers can include a bit that indicates whether the team of interest is a local team (known only in the region of an FM transmitter, such as a little league team) or a more widely known team (such as a national football team). This allows the system to efficiently distinguish between a very large number of teams throughout the country or world. Furthermore, in other embodiments, team event messages can be emitted for events other than sporting competitions. For example, during a parade, learn event messages can be emitted to control garments worn by persons marching in the parade as well as persons watching the parade, to thereby generate an audio/visual demonstration.

While the invention has been described in conjunction with the above embodiments, numerous alternatives, modifications, variations and uses will be apparent to those skilled in the art.
What is claimed is:

1. A sport event transducer for emitting a perceivable output in response to an event relating to a sport team, comprising:
   a presentation element that emits a perceivable output, wherein said output includes at least one of a light output and an audio output,
   a team identifier for electronically identifying a sport team associated with the sport team transducer,
   a receiver for receiving a signal that is encoded with a team event message,
   a decoder for determining if the team event message relates to said team identified by said team identifier, and,
   a controller for causing the presentation element to emit an output signal if the team event message relates to the team identified by said team identifier.

2. The sports event transducer of claim 1 wherein said receiver includes a wide area RF receiver for receiving a wide area RF broadcast signal encoded with a team event message.

3. The sport event transducer of claim 2 wherein said wide area RF broadcast signal is an FM radio-data signal in accordance with the radio broadcast data standard, and wherein said decoder comprises an RDS decoder for extracting RDS data from the FM radio-data signal and determining whether said extracted RDS data includes a team event message directed to sport event transducers associated with said sport team identified by said identifier.

4. The sport event transducer of claim 3 wherein said RDS decoder detects RDS groups of type 3A that contain an application identification code registered for a sport event transducer application.

5. The sport event transducer of claim 4 wherein said decoder detects RDS groups of the type corresponding to an Application Group Type Code from said type 3A group, and determines if said detected RDS group contains a team event message that relates to the team identified by said team identifier.

6. The sport event transducer of claim 5 wherein said RDS decoder determines if said type 3A group is directed to a class of teams that includes the team associated with said sport event transducer and, if so, detects RDS groups of the type identified by an application group type code provided by said type 3A group.

7. The sport event transducer of claim 3 wherein the wide area RF broadcast receiver comprises an FM tuner.

8. The sport event transducer of claim 1 wherein said output element comprises a light emitting element, and wherein said controller provides a selected light output signal to said light emitting element in response to a team event message.
9. The sport event transducer of claim 1 wherein said output element comprises an electrophoretic ink display element, and wherein said controller provides a selected output signal to said electrophoretic ink display element in response to a team event message.

10. The sport event transducer of claim 8 wherein said controller comprises a memory for storing information representative of a plurality of light outputs and wherein said controller selects at least one of the outputs for display by said light emitting element in response to a team event message.

11. The sport event transducer of claim 1 wherein said output element includes an audio transducer for emitting an audio signal and wherein said controller provides a selected audio output to said audio transducer in response to a team event message.

12. The sport event transducer of claim 11 wherein said controller comprises a memory for storing information representative of a plurality of audio outputs and wherein said controller selects at least one of the audio outputs for presentation by said audio transducer in response to a team event message.

13. The sport event transducer of claim 1 wherein said output element includes a light emitting element and an audio transducer and wherein said controller drives the light-emitting element and the audio transducer with at least one sequence of randomly spaced pulses in response to a predefined team event message.

14. The sport event transducer of claim 1 wherein said decoder determines, from said team event messages, when said sport team identified by said identifier has scored, and in response, directs said presentation element to emit a corresponding output signal.

15. The sport event transducer of claim 1 further comprising an output port coupled to an output of said FM tuner for providing an audio signal to a remote speaker element.

16. The sport event transducer of claim 1 comprising a garment, wherein said garment comprises said presentation element.
One group = 104 bits \( \approx 87.6 \) ms

Block 1
- First transmitted bit of group
- PI code
- Checkword + offset A
- Group type code

Block 2
- B₀, TP
- Checkword + offset B
- PTY

Block 3
- Checkword + offset C or C'

Block 4
- Checkword + offset D
- Last transmitted bit of group

Offsets:
- Offset C = version A
- Offset C' = version B

4-bit group type code
- 0 = version A
- 1 = version B

Fig. 4B (Prior Art)
Fig. 5  Type "3A" Group (00110) Example RDS Message
FIG. 6  Type 11A Group (10110) Example RDS Message
Power On 700

Seek to next FM channel 702

Listen for RDS messages 704

Received RDS messages contain “3A” Group Type Code (00110) with
1) AID for **Sports Event Transducer**
2) matching Team Class ID?

No

Timeout? 706

Yes

Extract

**Application Group Type Code**
(10110, e.g.) from type “3A” Group message 710

Wait for RDS messages with matching Group Type Code (10110, e.g.) 712

Timeout? 714

Yes

Extract data bits
(Garment Type Code / Team Identifier Code, and Function Code) 716

Does Garment Code / Team Identifier Code match? 718

Yes

Perform visual/acoustic action

Function Code 1 (Display pattern 1)
Function Code 2 (Display pattern 2)

Function Code n
(Display pattern n)

Function Code n+1
(Play stored sound m)

Function Code n+2
(Play stored sound m and display pattern n)

No

Yes 720

FIG. 7

Does the received data indicate the occurrence of a type of event that requires a Team Event Message?

Yes

For the team associated with the event, determine the identity of all stations that are designated for broadcasting the Team Event Messages.

For each Broadcast Control Module of the designated stations, prepare an instruction packet(s) containing the Team Event Message.

Send instruction packet to each designated Broadcast Control Module.

FIG. 9
Receive Instruction Packet from Central Server.

Determine the identity of the team.

Has an ODA Group Type already been selected for that Team's Event Message?

Yes

Select an available ODA Group Type.

Prepare a Type 3A message containing the codes for:
1) the selected ODA Group Type and
2) the AID for that Team's Event Message.

Broadcast the Type 3A message to notify all Sports Event Transducers of the selection.

No

Encode Team Event Message into the selected Group Type.

Provide the encoded group to FM station for broadcast.

FIG. 10
# INTERNATIONAL SEARCH REPORT

**International application No.**

PCT/US 11/46257

**A. CLASSIFICATION OF SUBJECT MATTER**

<table>
<thead>
<tr>
<th>IPC(8)</th>
<th>G08B 1/08 (2011.01)</th>
</tr>
</thead>
</table>

USPC: 340/539.17

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

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

<table>
<thead>
<tr>
<th>IPC(8)</th>
<th>G08B 1/08 (2011.01)</th>
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</table>

USPC: 340/539.17

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

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<tr>
<th>IPC(8)</th>
<th>G08B 1/08 (2011.01)</th>
</tr>
</thead>
</table>

USPC: 362/103; 313/510; 362/84; 362/85; 340/500

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

PubWEST; PGPB, USPT, EPAB, JPAB; Google Scholar; Google Patent; Search Terms: RDS radio data system protocol standard FM frequency modulation radio transceiver receiver display LED light speaker audio sport jersey hat clothing goal touchdown score home-run update data transmission code alert storage memory processor controller CPU traffic west

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 2009/0264149 A1 (Miller et al.) 22 October 2009 (22.10.2009) para. [0003] through [0102], Fig. 1-13</td>
<td>1-8 and 10-15</td>
</tr>
<tr>
<td>Y</td>
<td>US 2009/0014536 A1 (Gelbman) 15 January 2009 (15.01.2009) para. [0025] through [0027], [0036], [0037], [0046], [0051], [0084], [0087], Fig. 1, 2</td>
<td>9 and 16</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:
  * "A" - document defining the general state of the art which is not considered to be of particular relevance
  * "E" - earlier application or patent but published on or after the international filing date
  * "L" - document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  * "O" - document referring to an oral disclosure, use, exhibition or other means
  * "P" - document published prior to the international filing date but later than the priority date claimed

* T - later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
* X - document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
* Y - document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
* A - document member of the same patent family

**Date of the actual completion of the international search**

27 December 2011 (27.12.2011)

**Date of mailing of the international search report**

11 JAN 2012

Authorized officer: Lee W. Young

PCT Helpdesk: 371-272-4300

PCT OSP: 571-272-7774

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