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(54) **BILLBOARD**

(57) To enable a billboard to double as a film antenna, advertising characters 11a, 11b forming an advertising image are constituted by metal wire which defines the outer edges of the characters, and the advertising characters 11a, 11b are connected to each other by met-

al wire. A cold side antenna element 12 is formed on the film substrate 10 from metal wire around the advertising characters 11a, 11b and the outer periphery of the film substrate 10. The connected advertising characters 11a, 11b form a hot side antenna element 13, thus enabling the billboard 1 to operate as a film antenna.

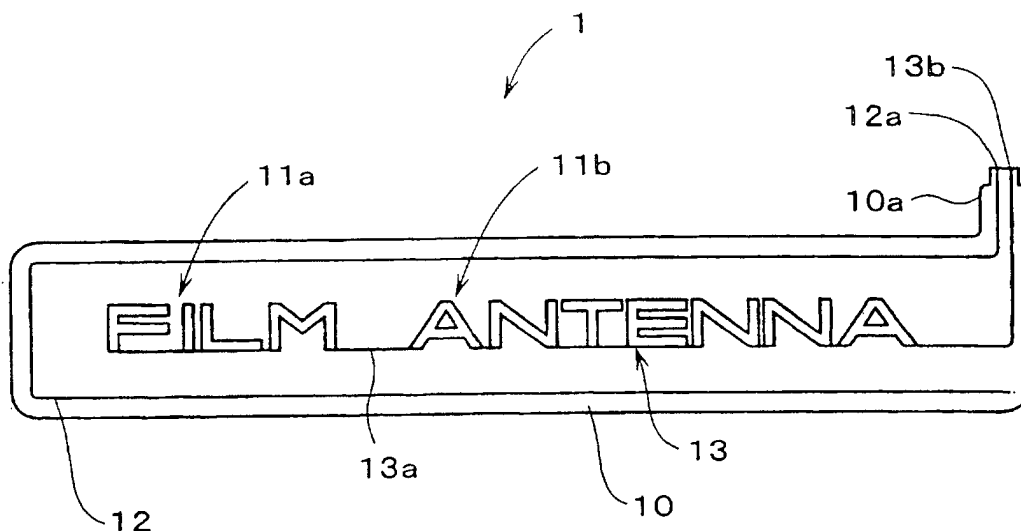


FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a billboard which comprises a film substrate and can also be used as an antenna.

BACKGROUND ART

[0002] When an advertisement board is mounted on a moving body such as an automobile, the advertisement is displayed as the moving body moves, and hence advertisements have conventionally been mounted on moving bodies. Moreover, it has become common to install a receiver such as a television or radio in automobiles, and hence the automobile is provided with a reception antenna. A film antenna formed on a typically transparent substrate that is adhered to a glass window of the automobile is known as one type of such an antenna.

[0003] Conventionally, the film antenna formed on a film substrate that is adhered to the glass window of the automobile is provided independently of the advertisement board on automobiles having an advertisement board.

DISCLOSURE OF THE INVENTION

[0004] It is therefore an object of the present invention to provide a billboard which can also be used as a film antenna.

[0005] To achieve this object, a billboard of the present invention comprises a film substrate and a linear advertising image formed on the film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms. The character units or graphic form units are connected to each other by a conductive material. By using the advertising image as an antenna element, an antenna is formed on the film substrate by the antenna element.

[0006] Another billboard of the present invention which is capable of achieving the object described above comprises a film substrate, a linear advertising image formed on the film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms, the character units or graphic form units being connected to each other by a conductive material, and a first antenna element formed on the film substrate in linear form using a conductive material. By using the advertising image as a second antenna element, an antenna is formed on the film substrate by the second antenna element and first antenna element.

[0007] In this other billboard of the present invention, the first antenna element may be formed around the outer periphery of the film substrate, and the advertising image may be formed in the area surrounded by the first

antenna element.

[0008] A further billboard of the present invention which is capable of achieving the object described above comprises a film substrate and a linear advertising image formed on the film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms. An arbitrary number of units within the plurality of character units or graphic form units are connected to each other by a conductive material to form an antenna element, and the remainder of the plurality of character units or graphic form units serves as a passive element. Thus an antenna is formed on the film substrate by the antenna element and the passive element.

[0009] A further billboard of the present invention which is capable of achieving the object described above comprises a film substrate, a linear advertising image formed on the film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms, and a first antenna element formed on the film substrate in linear form using a conductive material. An arbitrary number of units within the plurality of character units or graphic form units are connected to each other by a conductive material to form a second antenna element, and the remainder of the plurality of character units or graphic form units serves as a passive element. Thus an antenna is formed on the film substrate by the first antenna element, the passive element, and the second antenna element.

[0010] In these further billboards of the present invention, the first antenna element may be formed around the outer periphery of the film substrate, and the advertising image may be formed in the area surrounded by the first antenna element.

[0011] Also in these further billboards of the present invention, linear short-circuiting means formed from a conductive material for connecting the passive element to the first antenna element may be formed on the film substrate.

[0012] Also in these further billboards of the present invention, the plurality of character units or graphic form units constituting the passive element may be connected to each other by a conductive material.

[0013] According to the present invention, a linear advertising image formed on a film substrate using a conductive material so as to define the outer edges of a plurality of character units or graphic form units is used as an antenna element, enabling the formation of a billboard which can also be used as a film antenna.

[0014] Furthermore, by having a part of the linear characters or graphic forms formed on the film substrate using a conductive material so as to define the outer edges of the advertising image serve as a passive element, or short-circuiting these characters or graphic forms to a first antenna element on the cold side, the impedance, element duration, and so on of the film antenna can be adjusted, enabling an improvement in the

reception sensitivity of the film antenna.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a view showing the constitution of a first example of a billboard according to an embodiment of the present invention;

Fig. 2 is a view showing the frequency characteristic of return loss in a film antenna serving as a further use of the billboard in the first example of this embodiment of the present invention;

Fig. 3 is a view showing the constitution of a second example of a billboard according to this embodiment of the present invention;

Fig. 4 is a view showing the frequency characteristic of return loss in a film antenna serving as a further use of the billboard in the second example of this embodiment of the present invention;

Fig. 5 is a view showing the constitution of a third example of a billboard according to this embodiment of the present invention;

Fig. 6 is a view showing the frequency characteristic of return loss in a film antenna serving as a further use of the billboard in the third example of this embodiment of the present invention;

Fig. 7 is a view showing the constitution of a fourth example of a billboard according to this embodiment of the present invention; and

Fig. 8 is a view showing the frequency characteristic of return loss in a film antenna serving as a further use of the billboard in the fourth example of this embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0016] The constitution of a first example of a billboard according to an embodiment of the present invention is shown in Fig. 1.

[0017] A billboard 1 shown in Fig. 1 is constituted by a thin, transparent, elongated, rectangular film substrate 10, and adhered to the window glass of an automobile. In this case, the film substrate 10 is made from a material having a certain degree of flexibility so that the billboard 1 can be adhered to the curved front window or rear window. Advertising characters 11a serving as an advertising image are formed on the film substrate 10 from metal wire so as to define the outer edges of the characters "FILM", and advertising characters 11b serving as an advertising image are formed from metal wire so as to define the outer edges of the characters "ANTENNA". The "F", "I", "L", and "M" in the advertising characters 11a are connected to each other by the metal wire, as are the "A", "N", "T", "E", "N", "N", and "A" of the advertising characters 11b. The final "M" of the advertising characters 11a and the initial "A" of the advertising characters 11b are also connected by a connecting wire 13a

constituted by metal wire.

[0018] The metal wire is drawn out from the final "A" of the advertising characters 11b to form a hot side leader line 13b in a connecting portion 10a which is formed so as to protrude from the elongated rectangular film substrate 10. Further, a cold side antenna element 12 of a predetermined length is formed from metal wire on the film substrate 10 around the outer periphery of the elongated rectangular film substrate 10, starting from the connecting portion 10a. At the connecting portion 10a, the cold side antenna element 12 serves as a cold side leader wire 12a. By attaching the connecting portion 10a to the terminal of a cable that is led in from a receiver, the film antenna formed from the billboard 1 can be connected to the receiver. Note that the metal wire may be formed by depositing or coating a conductive material onto the film substrate 10 in linear form.

[0019] Fig. 2 shows the frequency characteristic of return loss occurring when the film antenna serving as a further use of the billboard 1 shown in Fig. 1 is provided as a film antenna for an in-vehicle TV. Note that the VHF band frequency and UHF band frequency of the television are set to 90-222MHz and 470-770MHz respectively. Referring to Fig. 2, it can be seen that here, a particularly favorable return loss characteristic is obtained on channel 4 (171.25MHz) of the VHF band and channel 38 (621.25MHz) of the UHF band.

[0020] Incidentally, the advertising image constituted by the advertising characters 11a, 11b on the billboard 1 may be formed into a product name, a nickname, a company name, and so on, thus altering the content of the advertisement, and therefore the sensitivity of the film antenna is not necessarily improved by using all of the advertising characters 31a, 31b as antenna elements. Fig. 3 shows a second example of the billboard according to this embodiment of the present invention, in which the sensitivity of the film antenna serving as a further use of the billboard is improved by using a part of the advertising image on the film antenna as a passive element.

[0021] A billboard 2 shown in Fig. 3 is not provided with the metal wire connecting portion 13a between the final "M" of advertising characters 21a and the initial "A" of advertising characters 11b, and hence the advertising characters 21a serve as a passive element 23a. Moreover, the "T" and "E" in the advertising characters 21b are separated from the other characters and thus serve as passive elements 23b. Otherwise, the constitution of the billboard 2 in the second example is identical to that of the billboard 1 in the first example shown in Fig. 1.

[0022] More specifically, the billboard 2 shown in Fig. 3 is constituted by a thin, transparent, elongated, rectangular film substrate 20, and adhered to the window glass of an automobile. In this case, the film substrate 20 is made from a material having a certain degree of flexibility so that the billboard 2 can be adhered to the curved front window or rear window. The advertising characters 21a serving as an advertising image are

formed on the film substrate 20 from metal wire so as to define the outer edges of the characters "FILM", and the advertising characters 21b serving as an advertising image are formed from metal wire so as to define the outer edges of the characters "ANTENNA". The "F", "I", "L", and "M" of the advertising characters 21a are connected to each other by the metal wire to form a non-connected passive element 23a. The "A", "N", "N", "N", and "A" of the advertising characters 21b are connected to each other by metal wire to form a hot side antenna element 23, whereas the "T" and "E" in the advertising characters 21b are not connected to the other characters of the advertising characters 21b, and thus form the non-connected passive elements 23b.

[0023] The metal wire is drawn out from the final "A" of the advertising characters 21b to form a hot side leader line 23b in a connecting portion 20a which is formed so as to protrude from the film substrate 20. Further, a cold side antenna element 22 of a predetermined length is formed from metal wire on the film substrate 20 around the outer periphery of the elongated rectangular film substrate 20, starting from the connecting portion 20a. At the connecting portion 20a, the cold side antenna element 22 serves as a cold side leader wire 22a. By attaching the connecting portion 20a to the terminal of a cable that is led in from a receiver, the film antenna provided on the billboard 2 can be connected to the receiver. Note that the metal wire may be formed by depositing or coating a conductive material onto the film substrate 10 in linear form.

[0024] Fig. 4 shows the frequency characteristic of return loss occurring when the film antenna serving as a further use of the billboard 2, in which the advertising characters 21a are separated from the hot side antenna element 23 and some of the advertising characters 21b are not connected to the other advertising characters 21b, thus serving as passive elements, is provided as a film antenna for an in-vehicle TV. Note that the VHF band frequency and UHF band frequency of the television are set to 90-222MHz and 470-770MHz respectively. Referring to Fig. 4, it can be seen that here, a favorable return loss characteristic is obtained on channel 3 (103.25MHz) through channel 8 (193.25MHz) of the VHF band and channel 38 (621.25MHz) through channel 50 (693.25MHz) of the UHF band. By providing the passive elements 23a, 23b in this manner, the impedance, element duration, and so on of the hot side antenna element 23 can be adjusted, enabling an improvement in the reception sensitivity of the film antenna for an in-vehicle TV provided on the billboard 2.

[0025] Fig. 5 shows a third example of the billboard according to this embodiment of the present invention, in which a part of the advertising image on the film antenna serving as a further use of the billboard is separated to form a cold side antenna element, thereby improving the sensitivity of the film antenna.

[0026] In a billboard 3 shown in Fig. 5, the advertising characters 21a on the billboard 2 shown in Fig. 3 are

connected to a cold side antenna element 32a. Otherwise, the constitution of the billboard 3 in the third example is identical to that of the billboard 2 in the second example shown in Fig. 3.

[0027] More specifically, the billboard 3 shown in Fig. 5 is constituted by a thin, transparent, elongated, rectangular film substrate 30, and adhered to the window glass of an automobile. In this case, the film substrate 30 is made from a material having a certain degree of flexibility so that the billboard 3 can be adhered to the curved front window or rear window. Advertising characters 31a serving as an advertising image are formed on the film substrate 30 from metal wire so as to define the outer edges of the characters "FILM", and advertising characters 31b serving as an advertising image are formed from metal wire so as to define the outer edges of the characters "ANTENNA". The "F", "I", "L", and "M" of the advertising characters 31a are connected to each other by the metal wire, and moreover, the "F", "L", and "M" are connected to the cold side antenna element 32a, which is bent into a C shape, by respective short circuit wires 32c. Thus the advertising characters 31a form a cold side antenna element 32b. The "A", "N", "N", "N", and "A" of the advertising characters 31b are connected to each other by metal wire to form a hot side antenna element 33, whereas the "T" and "E" in the advertising characters 31b are not connected to the other characters of the advertising characters 31b, and thus form non-connected passive elements 33a.

[0028] The metal wire is drawn out from the final "A" of the advertising characters 31b to form a hot side leader line 33b in a connecting portion 30a which is formed so as to protrude from the film substrate 30. Further, the cold side antenna element 32a of a predetermined length is formed from metal wire on the film substrate 30 around the outer periphery of the elongated rectangular film substrate 30, starting from the connecting portion 30a. At the connecting portion 30a, the cold side antenna element 32a serves as a cold side leader wire 32d. By attaching the connecting portion 30a to the terminal of a cable that is led in from a receiver, the film antenna provided on the billboard 3 can be connected to the receiver. Note that the metal wire may be formed by depositing or coating a conductive material onto the film substrate 30 in linear form.

[0029] Fig. 6 shows the frequency characteristic of return loss occurring when this film antenna, in which the advertising characters 31a are connected to the cold side antenna element 32a by the three short circuit wires 32c and some of the advertising characters 31b are not connected to anything, thus serving as non-connected passive elements, is provided as a film antenna for an in-vehicle TV. Note that the VHF band frequency and UHF band frequency of the television are set to 90-222MHz and 470-770MHz respectively. Referring to Fig. 6, it can be seen that here, a favorable return loss characteristic is obtained on channel 1 (91.25MHz) through channel 3 (103.25MHz) of the VHF band and

before and after channel 38 (621.25MHz) of the UHF band. By connecting the advertising characters 31a to the cold side antenna element 32a using the three short circuit wires 32c and using some of the advertising characters 31b as non-connected passive elements in this manner, the reception sensitivity of the film antenna for an in-vehicle TV, serving as a further use of the billboard 3, can be improved.

[0030] A fourth example, which is a modified example of the third example shown in Fig. 5, is shown in Fig. 7.

[0031] Similarly on a billboard 4 shown in Fig. 7, the advertising characters 31a of the billboard 3 shown in Fig. 5 are connected to the cold side antenna element 32a. Otherwise, the constitution of the billboard 4 in the fourth example is identical to that of the billboard 3 of the third example shown in Fig. 5.

[0032] More specifically, the billboard 4 shown in Fig. 7 is constituted by a thin, transparent, elongated, rectangular film substrate 40, and adhered to the window glass of an automobile. In this case, the film substrate 40 is made from a material having a certain degree of flexibility so that the billboard 4 can be adhered to the curved front window or rear window. Advertising characters 41a serving as an advertising image are formed on the film substrate 40 from metal wire so as to define the outer edges of the characters "FILM", and advertising characters 41b serving as an advertising image are formed from metal wire so as to define the outer edges of the characters "ANTENNA". The "F", "I", "L", and "M" of the advertising characters 41a are connected to each other by the metal wire, and moreover, the "F" and "M" are connected to one cold side antenna element 42a, which is bent into a C shape, by respective short circuit wires 42c. Thus the advertising characters 41a form a cold side antenna element 42b. The "A", "N", "N", "N", and "A" of the advertising characters 41b are connected to each other by metal wire to form a hot side antenna element 43, whereas the "T" and "E" in the advertising characters 41b are not connected to the other characters of the advertising characters 41b, and thus form non-connected passive elements 43a.

[0033] The metal wire is drawn out from the final "A" of the advertising characters 41b to form a hot side leader line 43b in a connecting portion 40a which is formed so as to protrude from the film substrate 40. Further, the cold side antenna element 42a of a predetermined length is formed from metal wire on the film substrate 40 around the outer periphery of the elongated rectangular film substrate 40, starting from the connecting portion 40a. At the connecting portion 40a, the cold side antenna element 42a serves as a cold side leader wire 42d. By attaching the connecting portion 40a to the terminal of a cable that is led in from a receiver, the film antenna provided on the billboard 4 can be connected to the receiver. Note that the metal wire may be formed by depositing or coating a conductive material onto the film substrate 40 in linear form.

[0034] Fig. 8 shows the frequency characteristic of re-

turn loss occurring when this film antenna, in which the two end portions of the advertising characters 41a are connected to the cold side antenna element 42a by the respective short circuit wires 42c and some of the advertising characters 41b are not connected to the other advertising characters 41b, thus serving as non-connected passive elements, is provided as a film antenna for an in-vehicle TV. Note that the VHF band frequency and UHF band frequency of the television are set to 90-222MHz and 470-770MHz respectively. Referring to Fig. 8, it can be seen that here, a favorable return loss characteristic is obtained on channel 3 (103.25MHz) through channel 4 (171.25MHz) of the VHF band and channel 38 (621.25MHz) through channel 50

(693.25MHz) of the UHF band. By connecting the two sides of the advertising characters 41a to the cold side antenna element 42a using the respective short circuit wires 42c in this manner, the reception sensitivity of the film antenna for an in-vehicle TV, serving as a further use of the billboard 4, can be improved.

[0035] In the above description, the film antenna comprises a hot side antenna element and a cold side antenna element, but the present invention is not limited to this constitution, and may comprise the hot side antenna element alone. In this case, the vehicle body of the automobile may be used as an earth in place of the cold side antenna element. Moreover, only advertising characters are displayed on the billboard, but the present invention is not limited to this constitution, and graphic forms of symbols, marks, or the like illustrating a productname, anickname, a company name, and so on may be displayed on the billboard. Furthermore, the film substrate which forms the billboard is described as being transparent, but the present invention is not limited to this constitution, and may be opaque or colored. The metal wire which forms the advertising image may also be colored.

INDUSTRIAL APPLICABILITY

[0036] In the present invention as described above, a linear advertising image formed on a film substrate using a conductive material so as to define the outer edges of each unit of a plurality of characters or graphic forms is used as an antenna element. As a result, a billboard which can also be used as a film antenna is provided.

[0037] Moreover, by having a part of the linear characters or graphic forms formed on the film substrate using a conductive material so as to define the outer edges of the advertising image serve as a passive element, or short-circuiting these characters or graphic forms to a first antenna element on the cold side, the impedance, element duration, and so on of the film antenna can be adjusted, enabling an improvement in the reception sensitivity of the film antenna.

Claims

1. A billboard comprising:

a film substrate; and
a linear advertising image formed on said film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms, said character units or graphic form units being connected to each other by a conductive material,

characterized in that by using said advertising image as an antenna element, an antenna is formed on said film substrate by said antenna element.

2. A billboard comprising:

a film substrate;
a linear advertising image formed on said film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms, said character units or graphic form units being connected to each other by a conductive material; and
a first antenna element formed on said film substrate in linear form using a conductive material,

characterized in that by using said advertising image as a second antenna element, an antenna is formed on said film substrate by said second antenna element and said first antenna element.

3. The billboard according to claim 2, **characterized in that** said first antenna element is formed around the outer periphery of said film substrate, and said advertising image is formed in the area surrounded by said first antenna element.

4. A billboard comprising:

a film substrate; and
a linear advertising image formed on said film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms,

characterized in that an arbitrary number of units within said plurality of character units or graphic form units are connected to each other by a conductive material to form an antenna element, and the remainder of said plurality of character units or graphic form units serves as a passive element, and thus an antenna is formed on said film substrate by said antenna element and said passive element.

5. A billboard comprising:

a film substrate;
a linear advertising image formed on said film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms; and
a first antenna element formed on said film substrate in linear form using a conductive material,

characterized in that an arbitrary number of units within said plurality of character units or graphic form units are connected to each other by a conductive material to form a second antenna element, and the remainder of said plurality of character units or graphic form units serves as a passive element, and thus an antenna is formed on said film substrate by said first antenna element, said passive element, and said second antenna element.

6. The billboard according to claim 5, **characterized in that** said plurality of character units or graphic form units constituting said passive element are connected to each other by a conductive material.

7. The billboard according to claim 5, **characterized in that** linear short-circuiting means formed from a conductive material for connecting said passive element to said first antenna element are formed on said film substrate.

8. The billboard according to claim 7, **characterized in that** said plurality of character units or graphic form units constituting said passive element are connected to each other by a conductive material.

9. The billboard according to claim 5, **characterized in that** said first antenna element is formed around the outer periphery of said film substrate, and said advertising image is formed in the area surrounded by said first antenna element.

10. The billboard according to claim 9, **characterized in that** said plurality of character units or graphic form units constituting said passive element are connected to each other by a conductive material.

11. The billboard according to claim 9, **characterized in that** linear short-circuiting means formed from a conductive material for connecting said passive element to said first antenna element are formed on said film substrate.

12. The billboard according to claim 10, **characterized in that** linear short-circuiting means formed from a conductive material for connecting said passive element to said first antenna element are formed on

said film substrate.

1. (Delete)

2. (Delete)

3. (Delete)

4. A billboard comprising:

a film substrate; and
a linear advertising image formed on said film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms,

characterized in that an arbitrary number of units within said plurality of character units or graphic form units are connected to each other by a conductive material to form an antenna element, and the remainder of said plurality of character units or graphic form units serves as a passive element, and thus an antenna is formed on said film substrate by said antenna element and said passive element.

5. A billboard comprising:

a film substrate;
a linear advertising image formed on said film substrate using a conductive material so as to define the outer edge of each unit of a plurality of characters or graphic forms; and
a first antenna element formed on said film substrate in linear form using a conductive material,

characterized in that an arbitrary number of units within said plurality of character units or graphic form units are connected to each other by a conductive material to form a second antenna element, and the remainder of said plurality of character units or graphic form units serves as a passive element, and thus an antenna is formed on said film substrate by said first antenna element, said passive element, and said second antenna element.

6. The billboard according to claim 5, **characterized in that** said plurality of character units or graphic form units constituting said passive element are connected to each other by a conductive material.

7. The billboard according to claim 5, **characterized in that** linear short-circuiting means formed from a conductive material for connecting said passive element to said first antenna element are formed on said film substrate.

8. The billboard according to claim 7, **characterized**

in that said plurality of character units or graphic form units constituting said passive element are connected to each other by a conductive material.

9. The billboard according to claim 5, **characterized in that** said first antenna element is formed around the outer periphery of said film substrate, and said advertising image is formed in the area surrounded by said first antenna element.

10. The billboard according to claim 9, **characterized in that** said plurality of character units or graphic form units constituting said passive element are connected to each other by a conductive material.

11. The billboard according to claim 9, **characterized in that** linear short-circuiting means formed from a conductive material for connecting said passive element to said first antenna element are formed on said film substrate.

12. The billboard according to claim 10, **characterized in that** linear short-circuiting means formed from a conductive material for connecting said passive element to said first antenna element are formed on said film substrate.

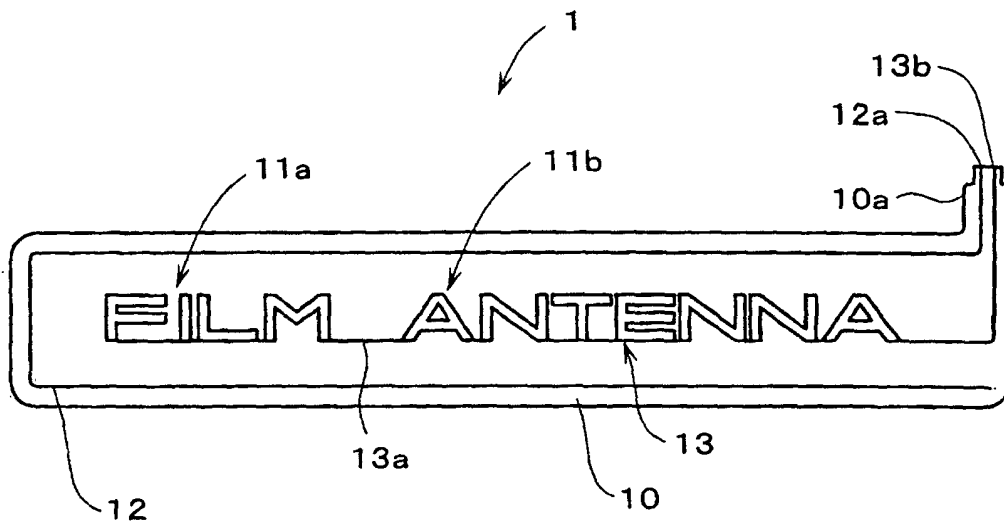
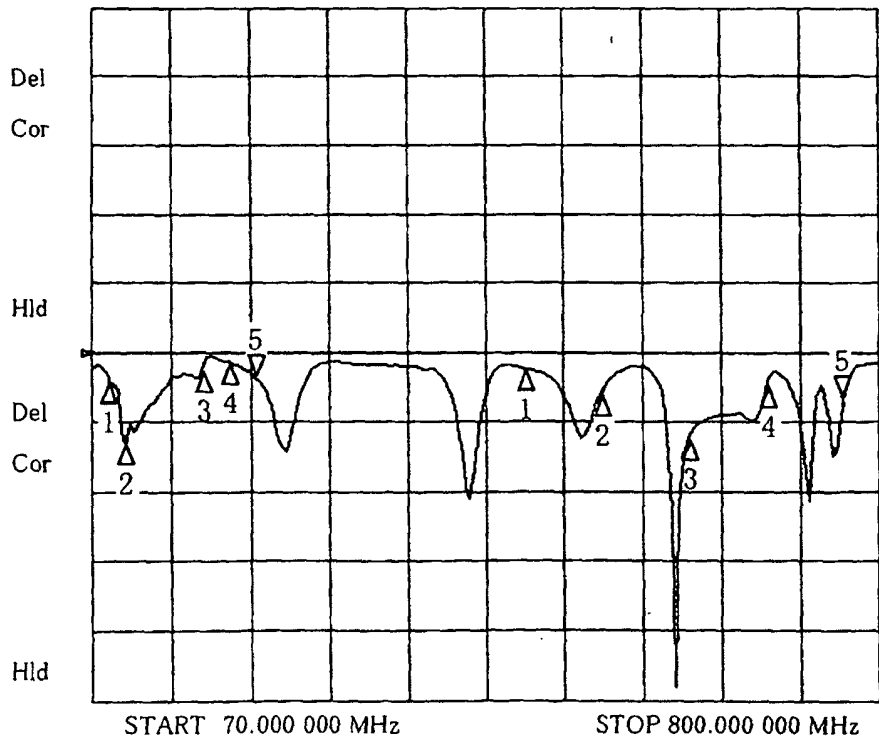


FIG. 1

CH1 S11 LOG 5 dB/REF 0 dB 5:-1.6055 dB 217.250 000 MHz
 CH2 S11 LOG 5 dB/REF 0 dB 5:-3.7362 dB 765.250 000 MHz



CH1 Markers

1:-2.1522 dB
 91.250 MHz
 2:-6.4300 dB
 103.250 MHz
 3:-1.1288 dB
 171.250 MHz
 4:-.65680 dB
 193.250 MHz

CH2 Markers

1:-1.2233 dB
 471.250 MHz
 2:-2.5933 dB
 543.250 MHz
 3:-6.3492 dB
 621.250 MHz
 4:-2.7950 dB
 693.250 MHz

FIG. 2

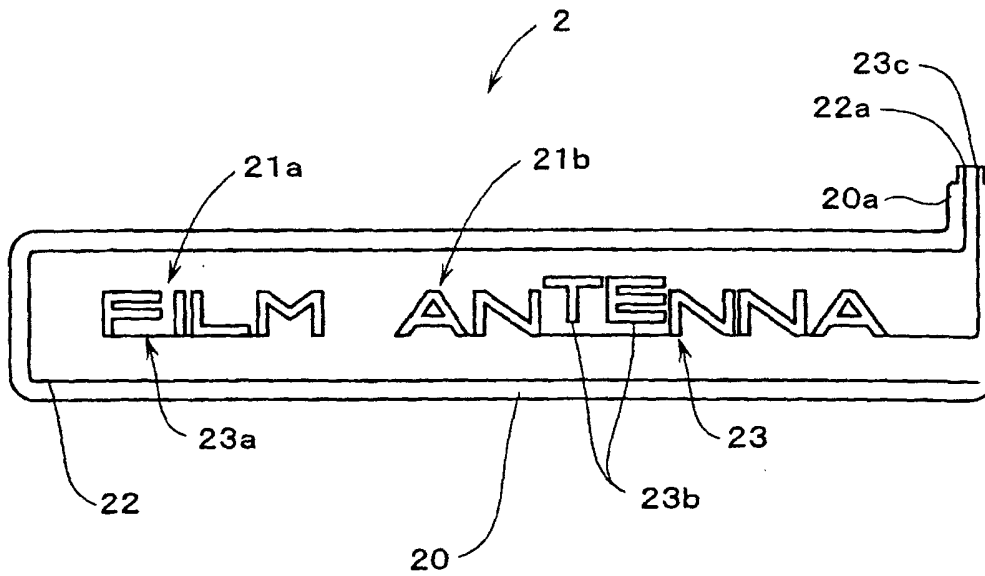


FIG. 3

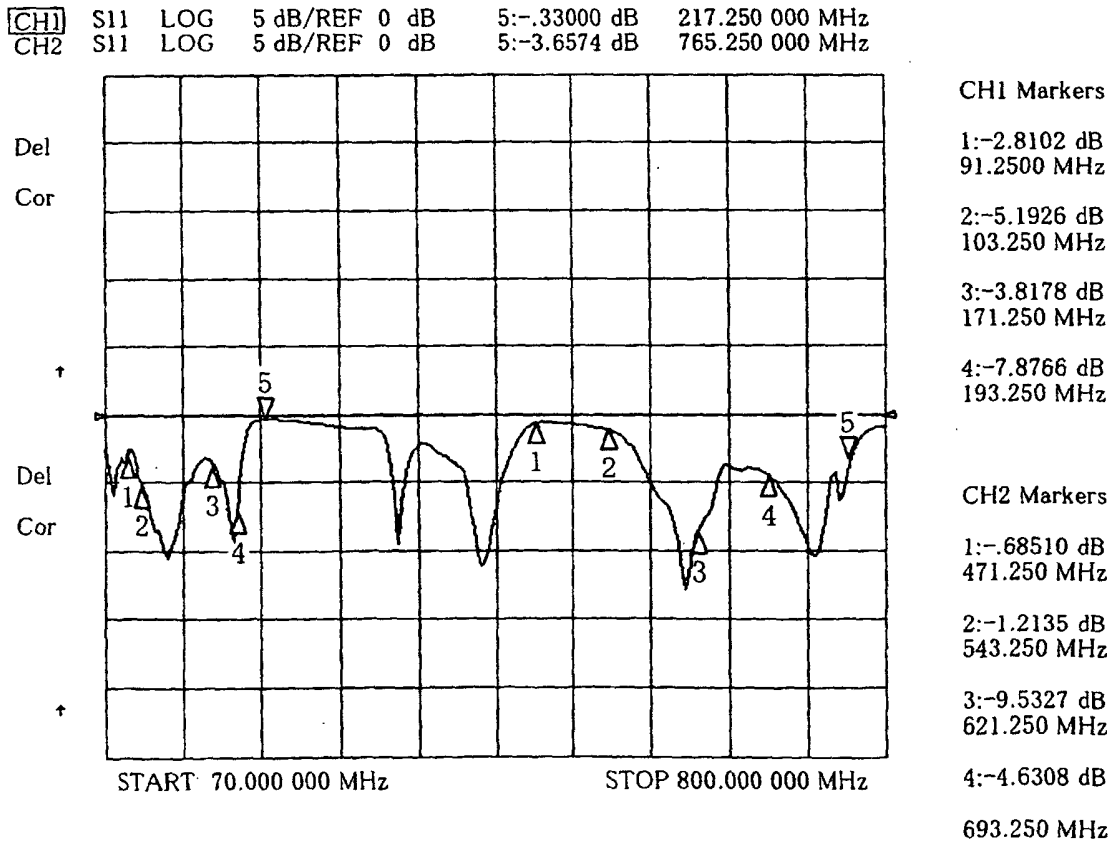


FIG. 4

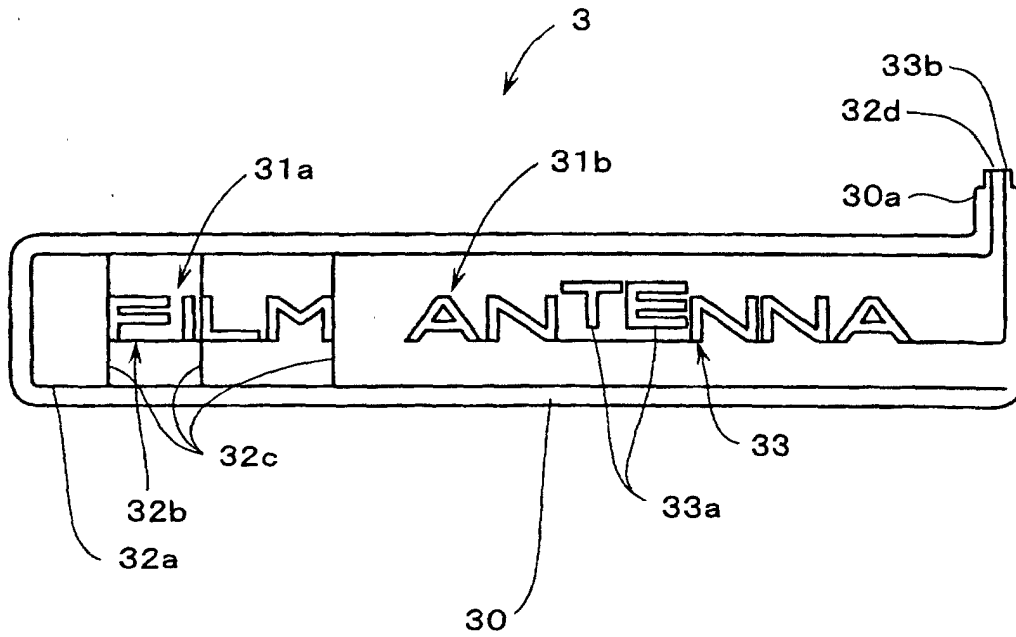
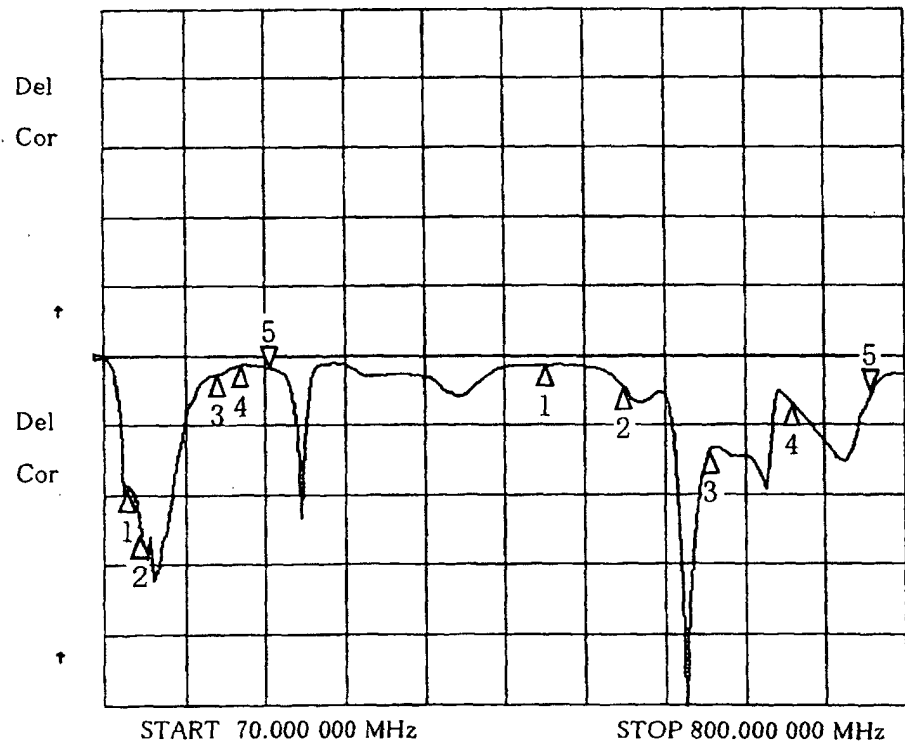


FIG. 5

CH1	S11	LOG	5 dB/REF 0 dB	5:-.86080 dB	217.250 000 MHz
CH2	S11	LOG	5 dB/REF 0 dB	5:-3.2122 dB	765.250 000 MHz



CH1 Markers

1:-9.4097 dB
91.2500 MHz
2:-13.150 dB
103.250 MHz
3:-1.4137 dB
171.250 MHz
4:-.73510 dB
193.250 MHz

CH2 Markers

1:-.76690 dB
471.250 MHz
2:-2.3792 dB
543.250 MHz
3:-6.7318 dB
621.250 MHz
4:-3.2135 dB
693.250 MHz

FIG. 6

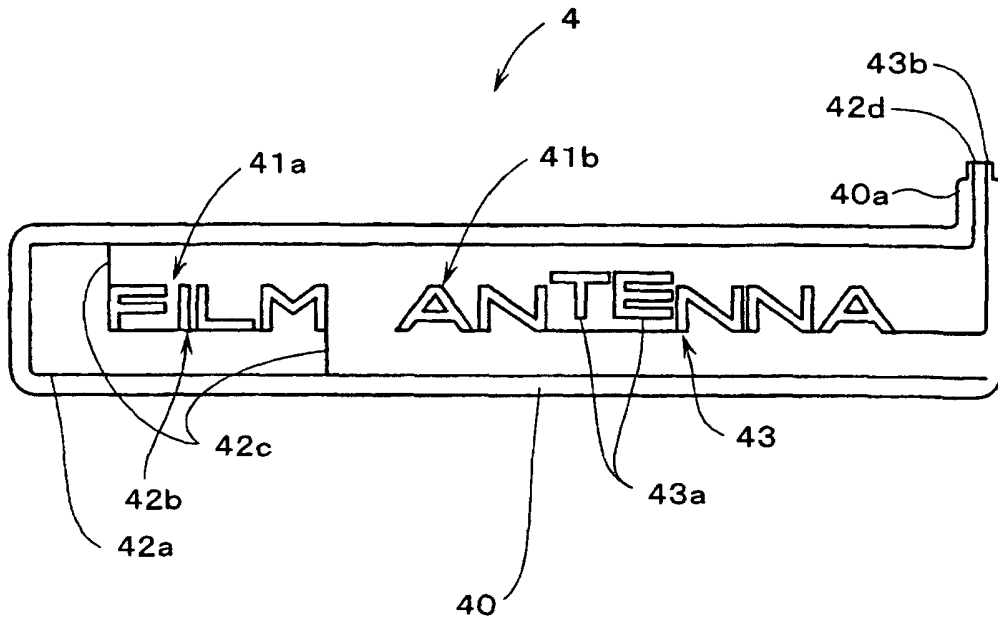


FIG. 7

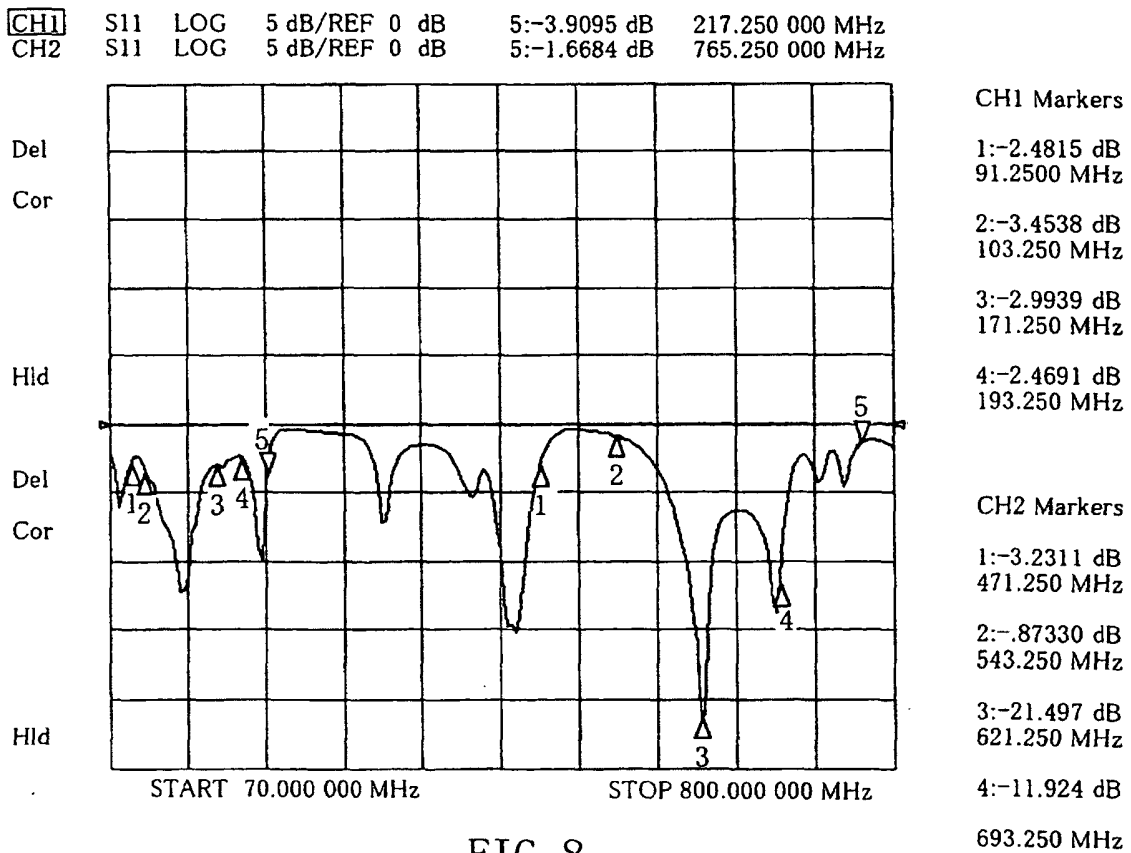


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/002135

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ H01Q1/38, G09F23/00, G09F21/04		
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) Int.Cl ⁷ H01Q1/38, G09F23/00, G09F21/04		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2004 Kokai Jitsuyo Shinan Koho 1971-2004 Toroku Jitsuyo Shinan Koho 1994-2004		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP 03-074845 B2 (Pioneer Electronic Corp.), 28 November, 1991 (28.11.91), Page 30, left column, line 3 to 22; Fig. 31 & FR 2571179 A1 & DE 3534572 A1 & US 4757322 A	1 2, 3 4-12
X Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 141781/1983 (Laid-open No. 050508/1985) (Toyota Motor Corp.), 09 April, 1985 (09.04.85), Full text; Figs. 1 to 3 (Family: none)	1 2, 3 4-12
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "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 "&" document member of the same patent family		
Date of the actual completion of the international search 02 July, 2004 (02.07.04)		Date of mailing of the international search report 20 July, 2004 (20.07.04)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/002135

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2003-017919 A (Asahi Glass Co., Ltd.), 17 January, 2003 (17.01.03), Par. Nos. [0002] to [0003]; Fig. 2 (Family: none)	2, 3
Y	JP 2002-299932 A (Central Glass Co., Ltd.), 11 October, 2002 (11.10.02), Par. Nos. [0078] to [0081]; Fig. 5 (Family: none)	2, 3
A	JP 2000-174529 A (Asahi Glass Co., Ltd.), 23 June, 2000 (23.06.00), Full text; Figs. 1 to 2 (Family: none)	4-12
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 078379/1988 (Laid-open No. 000811/1990) (Toyota Motor Corp.), 05 January, 1990 (05.01.90), Full text; Figs. 1 to 3 (Family: none)	4-12

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