(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 708 455 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
28.12.2022 Bulletin 2022/52

(21) Application number: **18875609.2**

(22) Date of filing: **10.05.2018**

(51) International Patent Classification (IPC):
B61L 15/00 *(2006.01)* ***H04B 1/40*** *(2015.01)*
B61L 27/00 *(2022.01)*

(52) Cooperative Patent Classification (CPC):
B61L 15/0027; B61L 3/125; B61L 27/70

(86) International application number:
PCT/CN2018/086261

(87) International publication number:
WO 2019/091075 (16.05.2019 Gazette 2019/20)

(54) **BTM DEVICE FOR MULTI-INFORMATION FUSION TRANSMISSION BETWEEN HOST AND ANTENNA UNIT**

BTM-VORRICHTUNG ZUR DURCHFÜHRUNG VON MEHRINFORMATIONSFUSIONSÜBERTRAGUNG ZWISCHEN HOST UND ANTENNENEINHEIT

DISPOSITIF BTM POUR UNE TRANSMISSION À FUSION D'INFORMATIONS MULTIPLES ENTRE UN HÔTE ET UNE UNITÉ D'ANTENNE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **10.11.2017 CN 201711106342**

(43) Date of publication of application:
16.09.2020 Bulletin 2020/38

(73) Proprietor: **CRSC Research & Design Institute Group Co., Ltd.**
Beijing 100070 (CN)

(72) Inventors:
- **YANG, Guanglun**
  Beijing 100070 (CN)
- **ZHANG, Shengwen**
  Beijing 100070 (CN)
- **YAN, Bing**
  Beijing 100070 (CN)
- **SUN, Guoying**
  Beijing 100070 (CN)
- **YE, Feng**
  Beijing 100070 (CN)
- **ZHANG, Qinghua**
  Beijing 100070 (CN)
- **ZHENG, Guiyan**
  Beijing 100070 (CN)
- **YUAN, Xu**
  Beijing 100070 (CN)
- **LV, Xianliang**
  Beijing 100070 (CN)
- **LI, Zhiyu**
  Beijing 100070 (CN)
- **LIU, Zhen**
  Beijing 100070 (CN)
- **CHENG, Bangfeng**
  Beijing 100070 (CN)

(74) Representative: **Würmser, Julian**
Meissner Bolte Patentanwälte
Rechtsanwälte Partnerschaft mbB
Postfach 86 06 24
81633 München (DE)

(56) References cited:
CN-A- 103 178 328
CN-A- 104 052 519
CN-A- 107 933 614
US-A1- 2014 326 835
US-A1- 2015 080 041
US-A1- 2015 198 712
US-A1- 2015 198 712

- **WANG, KUN: "Study on Control System of Transponder Dynamic Detection of CTCS-2 Level Train", Master Thesis, 31 January 2016 (2016-01-31), pages 1-55, XP009520873,**

Processed by Luminess, 75001 PARIS (FR)

(Cont. next page)

- **YANG, SHUYIN: "Railway Signalling & Communication Engineering (RSCE)", Design and Application of CTCS-2 Point Transponder Transmission Module, vol. 13, no. 5, 31 October 2016 (2016-10-31), pages 18-20, XP009520874, DOI: 10.3969/j.issn.1673-4440.2016.05.006**

Description

[0001] The present application claims priority of Chinese Patent Application No. 201711106342. 1filed on November 10, 2017.

TECHNICAL FIELD

[0002] The present disclosure belongs to a railway signal control field, and particularly, to a BTM device and an implementation method of multiple information fusion and transmission between a host and an antenna unit.

BACKGROUND

[0003] A BTM (Balise Transmission Module) device is an important part of a balise system, and is mainly used for receiving balise information transmitted by a ground balise, processing the balise information to obtain a balise message, and reporting the balise message to a train operation control system, so as to facilitate the train operation control system to control operation of the train.

[0004] The BTM device is mainly composed of a host and an antenna unit, and signals on a cable between the host and the antenna unit include:

An energy signal D1: transmitted from the host to the antenna unit, radio frequency energy (corresponding to A4 described in European Standard Balise Specification SUBSET-036) being transmitted to the ground balise by the antenna unit, for activating the balise to work;

[0005] A balise message signal D2: transmitted from the antenna unit to the host, an uplink balise message (corresponding to A1 described in European Balise Specification SUBSET-036) being transmitted to the antenna unit by the balise, and the balise message being processed by the host.

[0006] A self-check signal D3: transmitted from the antenna unit to the host, an uplink self-check signal generated by the antenna unit, for monitoring working state of the antenna unit by the host;

[0007] A self-check trigger signal D4: transmitted from the host to the antenna unit, generated by the host according to certain rules, triggering a self-check of the antenna unit after provided to the antenna unit.

[0008] In prior art, multiple cables or multi-core cables are used for transmitting the 4-way signals described above.

[0009] The prior art has disadvantages as follows:

Cost of the multiple cables or multi-core cables is high;

[0010] The multiple cables or multi-core cables increase connecting pieces of the host and the antenna, and the multi-core cables are susceptible to shrinkage due to influence of wiring and stretching, i.e., failure rate of the solution is increased.

[0011] The cables are buried in a body of train, replacement is time-consuming and replacement process is complicated.

[0012] Therefore, it is imperative to adopt effective means to remove these problems.

SUMMARY

[0013] An objective of the present disclosure is to present a BTM device and an implementation method of multiple information fusion and transmission between a host and an antenna unit, with respect to the problems existing in the prior art that high failure rate and complicated maintenance procedures are caused by using the multiple cables and multi-core cables, so as to realize multiple information fusion and transmission between the host and the antenna unit.

[0014] The invention is set out in the appended set of claims. A technical solution of the present disclosure is that:

There is provided a BTM device of multiple information fusion and transmission between a host and an antenna unit, comprising a host unit, an antenna unit and a coaxial cable; the host unit is used for generating a radio frequency energy signal, decoding a balise message and transmitting the balise message to a train operation transmission system; the antenna unit is used for transmitting radio frequency energy and transmitting uplink and downlink signals; the coaxial cable is used for connecting the host unit and the antenna unit through coaxial connectors on both ends thereof, and transmitting information between the host and the antenna unit; the host includes a host side filter circuit, for separating signals of different frequencies; and the antenna unit includes an antenna side filter circuit, for separating signals of different frequencies.

[0015] Further, the host side filter circuit includes a filter 1 and a filter 2; the filter 1 performs high impedance to an energy signal, a balise message signal and a self-check signal, and performs low impedance to a self-check trigger signal, the self-check trigger signal being transmitted to the antenna unit through the filter 1; the filter 2 performs high impedance to the energy signal and the self-check trigger signal, the balise message signal and the self-check signal being decoded in the host after passing the filter 2, and the energy signal being directly transmitted to the antenna unit without passing the filter 1 and filter 2. The energy signal transmits radio frequency energy for activating a balise to work. The self-check signal transmits an uplink self-check signal from the antenna unit to the host for monitoring a working state of the antenna unit by the host. The self-check trigger signal, transmitted from the host to the antenna unit, triggers a self-check of the antenna unit.

In one embodiment, the antenna side filter circuit includes a protective circuit, a transmitting ring, a receiving ring of an antenna unit, a self-check module and a filter;

The protective circuit is used for protecting components in an electronic circuit from being damaged by overvoltage, overcurrent, surge, electromagnetic in-

terference and so on;
The transmitting ring of the antenna unit is used for transmitting an energy signal;
The receiving ring of the antenna unit is used for receiving a balise message signal, and receiving a self-check signal generated by a self-check module;
The self-check module is used for implementing a self-check function of the antenna unit according to the received self-check trigger signal;
The filter, located in a front end of the self-check module, performs high impedance to the energy signal, the balise message signal and the self-check signal, and performs low impedance to the self-check trigger signal;

[0016] The self-check trigger signal triggers a self-check function of the antenna unit in the self-check module after passing the filter; the energy signal is transmitted by the transmitting ring of the antenna unit; the receiving ring of the antenna unit receives the balise message signal, receives the self-check signal generated by the self-check module, and transmits these signals directly to the host without passing the filter.

[0017] In one embodiment, the transmitting ring and the receiving ring of the antenna unit do not need to be arranged separately, and a same circuit is multiplexed in a frequency division way.

[0018] The following embodiments are not part of the invention but are useful for highlighting specific aspects of the claimed invention. In particular, there is provided an implementation method of multiple information fusion and transmission between a host and an antenna unit, for a BTM device, comprising steps of:

Step 1: analyzing characteristics of signals transmitted between a host and an antenna unit of a BTM device;
Step 2: analyzing characteristics of a coaxial cable required for transmitting respective signals, according to the characteristics of the signals;
Step 3: defining customizable signals, so as to make the customized signals and other signals be transmitted on a same coaxial cable;
Step 4: determining the characteristics of the coaxial cable, and selecting the coaxial cable to transmit the signals between the host and the antenna unit, according to actual project;
Step 5: adding a filter circuit on a BTM host side, to separate signals of different frequencies.
Step 6: adding a filter circuit on a BTM antenna unit side, to separate signals of different frequencies.

[0019] Further, transmission signals in step 1 are as follows: an energy signal, a balise message signal, a self-check signal and a self-check trigger signal.

[0020] Further, the energy signal is a continuous signal, and has a magnetic field frequency of 27.095 MHz±5 kHz; the balise message signal has a center frequency of 4.234 MHz±0.175 MHz, a frequency offset of 282.24×(1±7%) kHz; the self-check signal and the balise message signal have same characteristics; and the self-check trigger signal is customizable.

[0021] Further, electrical characteristics of the coaxial cable in step 2 are that: the coaxial cable is a 50 ohm radio frequency coaxial cable, and the length is an integral multiple of half wavelength of a frequency of a transmitted signal in a transmission medium.

[0022] Further, the customizable signal in step 3 is a self-check trigger signal; the customizable setting referring to set the self-check trigger signal to a pulse signal having a voltage equal to an operating voltage of the antenna unit.

[0023] Further, the operating voltage of the antenna unit is 24 V.

[0024] Further, the operating voltage of the antenna unit is 12 V.

[0025] Further, in step 5, a filter circuit added on a BTM host side includes a filter 1 and a filter 2; the filter 1 performs high impedance to an energy signal, a balise message signal and a self-check signal, and performs low impedance to a self-check trigger signal, the self-check trigger signal being transmitted to the antenna unit through the filter 1; the filter 2 performs high impedance to the energy signal and the self-check trigger signal, the balise message signal and the self-checking signal being decoded in the host after passing the filter 2, and the energy signal being directly transmitted to the antenna unit without passing the filter 1 and filter 2.

Further, a filter circuit added on a BTM antenna unit side in step 6 includes a protective circuit, a transmitting ring, a receiving ring of an antenna unit, a self-check module and a filter;
The protective circuit is used for protecting components in an electronic circuit from being damaged by overvoltage, overcurrent, surge, electromagnetic interference and so on;
The transmitting ring of the antenna unit is used for transmitting an energy signal;
The receiving ring of the antenna unit is used for receiving a balise message signal, and receiving a self-check signal generated by a self-check module;
The self-check module is used for completing a self-check function of the antenna unit according to the received self-check trigger signal;
The filter, located in a front end of the self-check module, performs high impedance to the energy signal, the balise message signal and the self-check signal, and performs low impedance to the self-check trigger signal;

[0026] The self-check trigger signal triggers a self-check function of the antenna unit in the self-check module after passing the filter; the energy signal is transmitted by the transmitting ring of the antenna unit; the receiving ring of the antenna unit receives the balise message sig-

nal, receives the self-check signal generated by the self-check module, and transmits these signals directly to the host without passing the filter.

[0027] Further, the transmitting ring and the receiving ring of the antenna unit do not need to be arranged separately, and a same circuit is multiplexed in a frequency division way.

[0028] As compared with the prior art, advantageous effects of the present disclosure are as follows: in the present disclosure, a coaxial cable is used by arranging the filter circuits on the BTM host side and the BTM antenna unit side, to complete the multiple information fusion and transmission between the host and the antenna unit. As compared with that the multiple cables or multi-core cables are used for data transmission in the prior art, the presend disclosure reduces failure rate of a BTM system, and facilitates maintenance and management in future.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

FIG. 1 is a composition diagram of a BTM device;
FIG. 2 is a processing block diagram of a host side filter circuit;
FIG. 3 is a processing block diagram of an antenna side filter circuit;
FIG. 4 is a processing flow chart of multiple information fusion of a host and an antenna unit.

[0030] Reference signs:
In FIG. 2 and FIG. 3: D1-energy signal, D2-balise message signal, D3-self-check signal, D4-self-check trigger signal.

DETAILED DESCRIPTION

[0031] Hereinafter, the technical solutions of the present disclosure will be described in a clearly and fully understandable way in connection with the drawings and specific embodiments of the present disclosure. It is obvious that the described embodiments are just a part but not all of the embodiments of the present disclosure, and the scope of the present disclosure is not limited to the embodiments described herein.

[0032] As shown in FIG. 1, there is provided a BTM device of multiple information fusion and transmission between a host and an antenna unit, comprising a host unit, an antenna unit and a coaxial cable.

[0033] The host unit is used for generating a radio frequency energy signal, decoding a balise message and transmitting the balise message to a train operation transmission system; and the host further includes a host side filter circuit, for separating signals of different frequencies.

[0034] The antenna unit is used for transmitting radio frequency energy and transmitting uplink and downlink signals; and the antenna unit further includes an antenna side filter circuit, for separating signals of different frequencies.

[0035] The coaxial cable connects the host unit and the antenna unit through coaxial connectors on both ends thereof, and transmits information between the host and the antenna unit.

[0036] As shown in FIG. 2, the host side filter circuit includes a filter 1 and a filter 2, the filter 1 shows a high impedance to an energy signal D1, a balise message signal D2 and a self-check signal D3, and perfoems low impedance to a self-check trigger signal D4, therefore, the self-check trigger signal D4 may be transmitted to the antenna unit through the filter 1; the filter 2 perfroms high impedance to the energy signal D1 and the self-check trigger signal D4, therefore, the balise message signal D2 and the self-check signal D3 are decoded in the host after passing the filter 2; and the energy signal D1 is directly transmitted to the antenna unit without passing the filter 1 and filter 2.

Preferably, as shown in FIG. 3, in the embodiment, the antenna side filter circuit includes a protective circuit, a transmitting ring, a receiving ring of an antenna unit, a self-check module and a filter;
The protective circuit is used for protecting components in an electronic circuit from being damaged by overvoltage, overcurrent, surge, electromagnetic interference and so on;
The transmitting ring of the antenna unit is used for transmitting an energy signal D1;
The receiving ring of the antenna unit is used for receiving a balise message signal D2, and receiving a self-check signal D3 generated by a self-check module;
The self-check module is used for completing a self-check function of the antenna unit according to the received self-check trigger signal D4;
The filter, located in a front end of the self-check module, performs high impedance to the energy signal D1, the balise message signal D2 and the self-check signal D3, and performs low impedance to the self-check trigger signal D4;

[0037] And thus, the self-check trigger signal D4 triggers a self-check function of the antenna unit in the self-check module after passing the filter; the energy signal D1 is transmitted by the transmitting ring of the antenna unit; the receiving ring of the antenna unit receives the balise message signal D2, and receives the self-check signal D3 generated by the self-check module, and transmits these signals directly to the host without passing the filter.

[0038] When the transmitting ring and the receiving ring of the antenna unit are arranged specifically, they may be arranged separately, or a same circuit may be multiplexed in a frequency division way.

[0039] As shown in FIG. 4 in an example not part of

the invention but useful for the understanding of the invention,

[0040] the multiple information fusion and transmission between the host and the antenna unit of the BTM device is implemented in such a way that:

Step 1: analyzing characteristics of signals transmitted between a host and an antenna unit of a BTM device;

[0041] Transmission signals are as follows: an energy signal D1, a balise message signal D2, a self-check signal D3 and a self-check trigger signal D4.

[0042] Wherein, the energy signal D1 is a continuous signal, and has a magnetic field frequency of 27.095 MHz±5 kHz; the balise message signal D2 has a center frequency of 4.234 MHz±0.175 MHz, a frequency offset of 282.24×(1±7%) kHz; the self-check signal D3 and the balise message signal D2 have same characteristics; and the self-check trigger signal D4 is customizable.

Step 2: analyzing characteristics of a coaxial cable required for transmitting respective signals, according to the characteristics of the signals;

[0043] According to analysis of the signals, electrical characteristics of the coaxial cable are that: the coaxial cable is a 50 ohm radio frequency coaxial cable, and the length is an integral multiple of half wavelength of a frequency of a transmitted signal in a transmission medium.

[0044] Step 3: defining customizable signals, so as to make the customized signals and other signals be transmitted on a same coaxial cable.

[0045] According to requirements of respective signals, in order to transmit the respective signals on the 50 ohm radio frequency coaxial cable at the same time, the D4 signal may be defined as a pulse signal having a voltage equal to an operating voltage of the antenna unit, the working voltage of the antenna may be 24 V or 12 V here, and in this way, time of interference on other signals is short, and a self-check trigger circuit of the antenna unit side may be activated by detecting the voltage of the D4 signal.

[0046] Step 4: determining the characteristics of the coaxial cable, and selecting the coaxial cable to transmit the signals between the host and the antenna unit, according to actual project.

[0047] Step 5: adding a filter circuit on a BTM host side, to separate signals of different frequencies.

[0048] As shown in FIG 2, preferably, in step 5 of the embodiment, the filter circuit added on the BTM host side includes a filter 1 and a filter 2, the filter 1 performs high impedance to an energy signal D1, a balise message signal D2 and a self-check signal D3, and performs low impedance to a self-check trigger signal D4, therefore, the self-check trigger signal D4 may be transmitted to the antenna unit through the filter 1; the filter 2 performs high impedance to the energy signal D1 and the self-check trigger signal D4; therefore, the balise message signal D2 and the self-check signal D3 are decoded in the host after passing the filter 2; and the energy signal D1 is directly transmitted to the antenna unit without passing the filter 1 and filter 2.

[0049] Step 6: adding a filter circuit on a BTM antenna unit side, to separate signals of different frequencies.

As shown in FIG 3, preferably, in step 6 of the embodiment, the filter circuit added on the antenna side includes a protective circuit, a transmitting ring, a receiving ring of an antenna unit, a self-check module and a filter;

The protective circuit is used for protecting components in an electronic circuit from being damaged by overvoltage, overcurrent, surge, electromagnetic interference and so on;

The transmitting ring of the antenna unit is used for transmitting an energy signal D1;

The receiving ring of the antenna unit is used for receiving a balise message signal D2, and receiving a self-check signal D3 generated by a self-check module;

The self-check module is used for completing a self-check function of the antenna unit according to the received self-check trigger signal D4;

The filter, located in a front end of the self-check module, shows a high impedance to the energy signal D1, the balise message signal D2 and the self-check signal D3, and shows a low impedance to the self-check trigger signal D4;

[0050] Thus, the self-check trigger signal D4 triggers a self-check function of the antenna unit in the self-check module after passing the filter; the energy signal D1 is transmitted by the transmitting ring of the antenna unit; the receiving ring of the antenna unit receives the balise message signal D2, and receives the self-check signal D3 generated by the self-check module, and transmits these signals directly to the host without passing the filter.

[0051] When the transmitting ring and the receiving ring of the antenna unit are arranged specifically, they may be arranged separately, or a same circuit may be multiplexed in a frequency division way.

[0052] The embodiment indicates that, the technical solution of the present disclosure may solve the problems that high failure rate and complicated maintenance procedures are caused by using the multiple cables and multi-core cables in the prior art.

Claims

1. A Balise Transmission Module, BTM,

device of multiple information fusion and transmission between a host and an antenna unit, comprising a host unit, an antenna unit and a coaxial cable;

the host unit (host), for generating a radio frequency energy signal, decoding a balise message and transmitting the balise message to a train operation transmission system;

the antenna unit (Antenna unit), for transmitting radio frequency energy and transmitting uplink and downlink signals, wherein
the coaxial cable (Coaxial cable), for connecting the host unit and the antenna unit through coaxial connectors on both ends thereof, and transmitting information between the host and the antenna unit;
wherein, the host includes a host side filter circuit, for separating signals of different frequencies; and the antenna unit includes an antenna side filter circuit, for separating signals of different frequencies;
wherein the host side filter circuit includes a filter 1 and a filter 2; the filter 1 performs high impedance to an energy signal (D1), a balise message signal (D2) and a self-check signal (D3), and performs low impedance to a self-check trigger signal (D4), the self-check trigger signal (D4) being transmitted to the antenna unit through the filter 1; the filter 2 performs high impedance to the energy signal (D1) and the self-check trigger signal (D4), the balise message signal (D2) and the self-check signal (D3) being decoded in the host after passing the filter 2, and the energy signal (D1) being directly transmitted to the antenna unit without passing the filter 1 and filter 2;
wherein the energy signal (D1) transmits radio frequency energy being transmitted to a balise by the antenna unit for activating the balise to work;
wherein the self-check signal (D3) transmits an uplink self-check signal from the antenna unit to the host for monitoring a working state of the antenna unit by the host; and
wherein the self-check trigger signal (D4), transmitted from the host to the antenna unit, triggers a self-check of the antenna unit.

2. The BTM device according to claim 1, wherein, the antenna side filter circuit includes a protective circuit, a transmitting ring, a receiving ring of an antenna unit, a self-check module and a filter;

the protective circuit, for protecting components in an electronic circuit from being damaged by overvoltage, overcurrent, surge, electromagnetic interference and so on;
the transmitting ring of the antenna unit, for transmitting an energy signal (D1);
the receiving ring of the antenna unit, for receiving a balise message signal (D2), and receiving a self-check signal (D3) generated by a self-check module;
the self-check module, for implementing a self-check function of the antenna unit according to the received self-check trigger signal (D4);
the filter, located in a front end of the self-check module, performing a high impedance to the energy signal (D1), the balise message signal (D2) and the self-check signal (D3), and performing a low impedance to the self-check trigger signal (D4);
the self-check trigger signal (D4) triggering a self-check function of the antenna unit in the self-check module after passing the filter; the energy signal (D1) being transmitted by the transmitting ring of the antenna unit; the receiving ring of the antenna unit receiving the balise message signal (D2), and receiving the self-check signal (D3) generated by the self-check module, and transmitting these signals directly to the host without passing the filter.

3. The BTM device according to claim 1 or claim 2, wherein, the transmitting ring and the receiving ring of the antenna unit do not need to be arranged separately, and a same circuit is multiplexed in a frequency division way.

Patentansprüche

1. Balisentransmissionsmodul, BTM,

zur Mehrfachinformationsfusions- und Übertragungsvorrichtung zwischen einem Host und einer Antenneneinheit, umfassend eine Host-Einheit, eine Antenneneinheit und ein Koaxialkabel;
die Host-Einheit (der Host), die zum Erzeugen eines Funkfrequenzenergiesignals, Decodieren einer Balisennachricht und Übertragen der Balisennachricht an ein Zugbetriebsübertragungssystem bestimmt ist;
die Antenneneinheit (Antenneneinheit), die zum Übertragen von Funkfrequenzenergie und netzsaufwärtsgerichteter und netzabwärtsgerichteter Signale bestimmt ist, wobei
das Koaxialkabel (Koaxialkabel), zum Verbinden der Host-Einheit und der Antenneneinheit durch Koaxialverbinder an beiden Enden von diesem, und zum Übertragen von Information zwischen dem Host und der Antenneneinheit bestimmt ist;
wobei der Host eine hostseitige Filterschaltung enthält, um Signale verschiedener Frequenzen zu trennen; und die Antenneneinheit eine antennenseitige Filterschaltung enthält, um Signale verschiedener Frequenzen zu trennen;
wobei die hostseitige Filterschaltung ein Filter 1 und ein Filter 2 enthält; das Filter 1 hohe Impedanz an einem Energiesignal (D1), einem Balisennachrichtsignal (D2) und einem Selbstprüfungssignal (D3) durchführt, und niedrige Impedanz an einem Selbstprüfungsauslösesignal (D4) durchführt, wobei das Selbstprüfungsaus-

lösesignal (D4) an die Antenneneinheit durch das Filter 1 übertragen wird; das Filter 2 hohe Impedanz am Energiesignal (D1) und Selbstprüfungsauslösesignal (D4) durchführt, wobei das Balisennachrichtsignal (D2) und das Selbstprüfungssignal (D3) im Host decodiert werden, nachdem sie das Filter 2 durchlaufen haben, und das Energiesignal (D1) direkt an die Antenneneinheit übertragen wird, ohne das Filter 1 und Filter 2 zu durchlaufen;
wobei das Energiesignal (D1) Funkfrequenzenergie überträgt, die an eine Balise durch die Antenneneinheit übertragen wird, um die Balise zum Arbeiten zu aktivieren;
wobei das Selbstprüfungssignal (D3) ein netzaufwärtsgerichtetes Selbstprüfungssignal von der Antenneneinheit zum Host überträgt, um einen Arbeitsstatus der Antenneneinheit durch den Host zu überwachen; und
wobei das Selbstprüfungsauslösesignal (D4), das vom Host an die Antenneneinheit übertragen wird, eine Selbstprüfung der Antenneneinheit auslöst.

2. BTM-Vorrichtung nach Anspruch 1, wobei die antennenseitige Filterschaltung

eine Schutzschaltung, einen Übertragungsring, einen Empfangsring einer Antenneneinheit, ein Selbstprüfungsmodul und ein Filter enthält;
die Schutzschaltung dazu bestimmt ist, Komponenten in einer elektronischen Schaltung davor zu schützen, durch Überspannung Überstrom, Stoßstrom, elektromagnetische Interferenz und so weiter beschädigt zu werden;
der Übertragungsring der Antenneneinheit dazu bestimmt ist, ein Energiesignal (D1) zu übertragen;
der Empfangsring der Antenneneinheit dazu bestimmt ist, ein Balisennachrichtsignal (D2) zu empfangen und ein Selbstprüfungssignal (D3) zu empfangen, das durch ein Selbstprüfungsmodul generiert wird;
das Selbstprüfungsmodul dazu bestimmt ist, eine Selbstprüfungsfunktion der Antenneneinheit entsprechend dem empfangenen Selbstprüfungsauslösesignal (D4) zu implementieren;
das Filter, das sich in einem vorderen Ende des Selbstprüfungsmoduls befindet, eine hohe Impedanz am Energiesignal (D1), Balisennachrichtsignal (D2) und Selbstprüfungssignal (D3) durchführt und eine niedrige Impedanz am Selbstprüfungsauslösesignal (D4) durchführt;
das Selbstprüfungsauslösesignal (D4) eine Selbstprüfungsfunktion der Antenneneinheit im Selbstprüfungsmodul auslöst, nachdem es das Filter durchlaufen hat; das Energiesignal (D1) durch den Übertragungsring der Antenneneinheit übertragen wird; der Empfangsring der Antenneneinheit das Balisennachrichtsignal (D2) empfängt und das Selbstprüfungssignal (D3) empfängt, das durch das Selbstprüfungsmodul generiert wird, und diese Signale direkt an den Host überträgt, ohne das Filter zu durchlaufen.

3. BTM-Vorrichtung nach Anspruch 1 oder Anspruch 2, wobei der Übertragungsring und der Empfangsring der Antenneneinheit nicht separat angeordnet zu werden brauchen und eine gleiche Schaltung auf eine Frequenzteilungsweise multiplexiert wird.

Revendications

1. Dispositif de module de transmission par balise, BTM,

pour la fusion et la transmission de multiples informations entre un hôte et une unité d'antenne, comprenant une unité d'hôte, une unité d'antenne et un câble coaxial ;
l'unité d'hôte (hôte) étant destinée à générer un signal d'énergie de radiofréquence, décoder un message de balise et transmettre le message de balise à un système de transmission de conduite de train ;
l'unité d'antenne (unité d'antenne) étant destinée à transmettre une énergie de radiofréquence et transmettre des signaux en liaison montante et descendante, sachant que
le câble coaxial (câble coaxial) est destiné à connecter l'unité d'hôte et l'unité d'antenne via des connecteurs coaxiaux aux deux extrémités de ceux-ci et à transmettre des informations entre l'hôte et l'unité d'antenne ;
sachant que l'hôte inclut un circuit de filtre côté hôte destiné à séparer des signaux de fréquences différentes ; et l'unité d'antenne inclut un circuit de filtre côté antenne destiné à séparer des signaux de fréquences différentes ;
sachant que le circuit de filtre côté hôte inclut un filtre 1 et un filtre 2 ; le filtre 1 réalise une impédance haute sur un signal d'énergie (D1), un signal de message de balise (D2) et un signal d'autocontrôle (D3) et réalise une impédance basse sur un signal de déclenchement d'autocontrôle (D4), le signal de déclenchement d'autocontrôle (D4) étant transmis à l'unité d'antenne via le filtre 1 ; le filtre 2 réalise une impédance haute sur le signal d'énergie (D1) et le signal de déclenchement d'autocontrôle (D4), le signal de message de balise (D2) et le signal d'autocontrôle (D3) étant décodés dans l'hôte après être passés par le filtre 2, et le signal d'énergie (D1) étant directement transmis à l'unité d'antenne sans passer par le filtre 1 et le

filtre 2 ;
sachant que le signal d'énergie (D1) transmet une énergie de radiofréquence qui est transmise à une balise par l'unité d'antenne afin d'activer la balise pour qu'elle fonctionne ;
sachant que le signal d'autocontrôle (D3) transmet un signal d'autocontrôle en liaison montante depuis l'unité d'antenne au hôte afin de surveiller un état de fonctionnement de l'unité d'antenne par le hôte ; et
sachant que le signal de déclenchement d'autocontrôle (D4), transmis depuis l'hôte à l'unité d'antenne, déclenche un autocontrôle de l'unité d'antenne.

2. Le dispositif BTM selon la revendication 1, sachant que le circuit de filtre côté antenne inclut un circuit de protection, un anneau de transmission, un anneau de réception d'une unité d'antenne, un module d'autocontrôle et un filtre ;

le circuit de protection est destiné à protéger des composants dans un circuit électronique contre les dommages par surtension, surintensité de courant, pointe transitoire, interférence électromagnétique, etc. ;
l'anneau de transmission de l'unité d'antenne est destiné à transmettre un signal d'énergie (D1) ;
l'anneau de réception de l'unité d'antenne est destiné à recevoir un signal de message de balise (D2) et à recevoir un signal d'autocontrôle (D3) généré par un module d'autocontrôle ;
le module d'autocontrôle est destiné à implémenter une fonction d'autocontrôle de l'unité d'antenne en fonction du signal de déclenchement d'autocontrôle (D4) reçu ;
le filtre, situé à une extrémité avant du module d'autocontrôle, réalise une impédance haute sur le signal d'énergie (D1), le signal de message de balise (D2) et le signal d'autocontrôle (D3) et réalise une impédance basse sur le signal de déclenchement d'autocontrôle (D4) ;
le signal de déclenchement d'autocontrôle (D4) déclenche une fonction d'autocontrôle de l'unité d'antenne dans le module d'autocontrôle après être passé par le filtre ; le signal d'énergie (D1) est transmis par l'anneau de transmission de l'unité d'antenne ; l'anneau de réception de l'unité d'antenne reçoit le signal de message de balise (D2) et reçoit le signal d'autocontrôle (D3) généré par le module d'autocontrôle et transmet ces signaux directement à l'hôte sans passer par le filtre.

3. Le dispositif BTM selon la revendication 1 ou la revendication 2, sachant que l'anneau de transmission et l'anneau de réception de l'unité d'antenne ne doivent pas être agencés séparément, et un même circuit est multiplexé moyennant une division de fréquence.

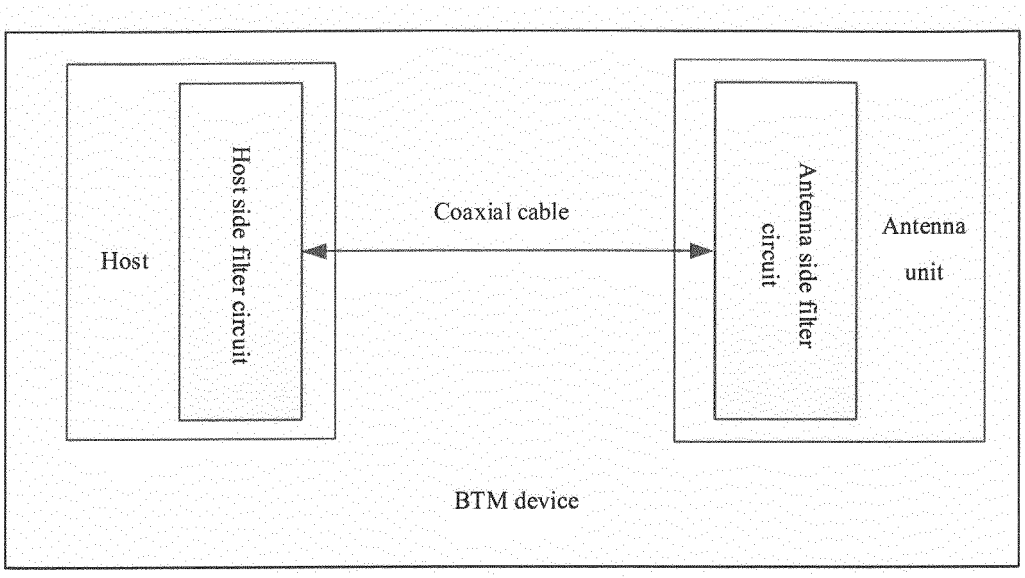

Host
Host side filter circuit
Coaxial cable
Antenna side filter circuit
Antenna unit
BTM device

FIG. 1

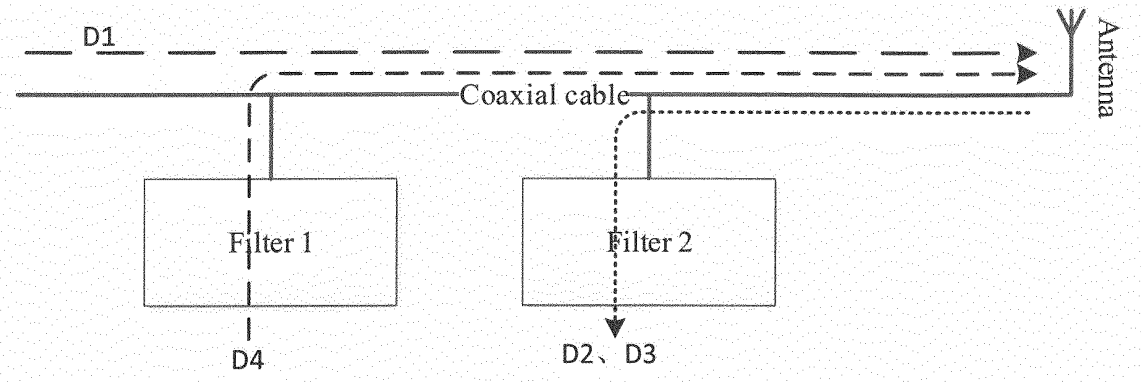
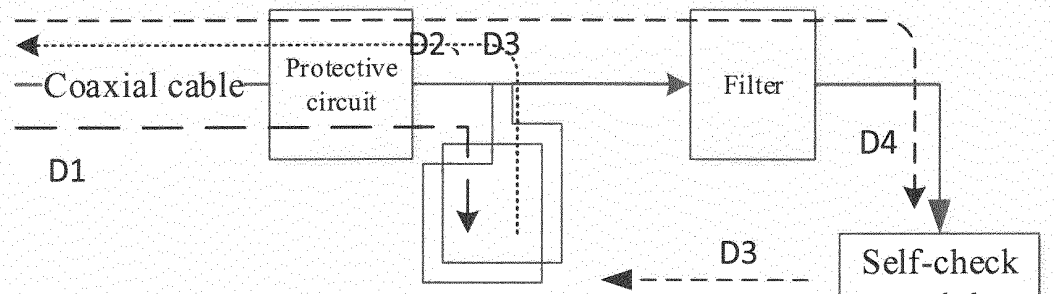


FIG. 2



Transmitting ring and receiving ring (D1, D2 and D3 signals)

FIG. 3

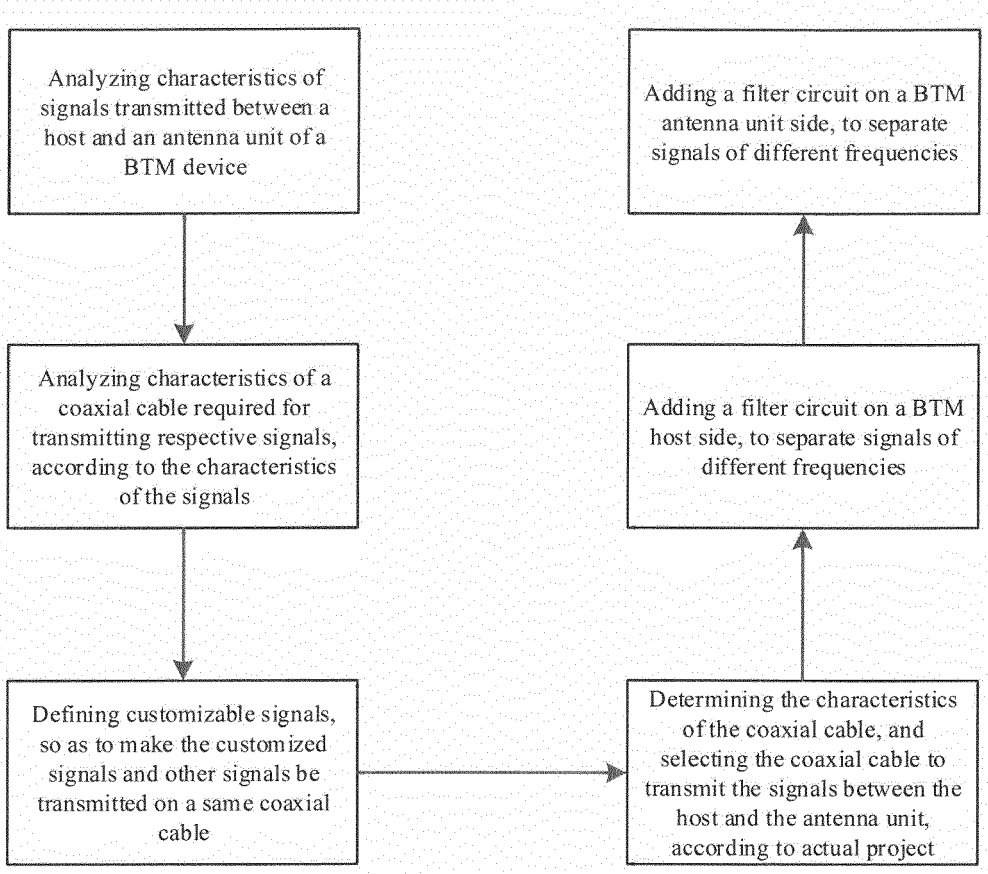

Analyzing characteristics of signals transmitted between a host and an antenna unit of a BTM device
Analyzing characteristics of a coaxial cable required for transmitting respective signals, according to the characteristics of the signals
Defining customizable signals, so as to make the customized signals and other signals be transmitted on a same coaxial cable
Determining the characteristics of the coaxial cable, and selecting the coaxial cable to transmit the signals between the host and the antenna unit, according to actual project
Adding a filter circuit on a BTM host side, to separate signals of different frequencies
Adding a filter circuit on a BTM antenna unit side, to separate signals of different frequencies

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 201711106342 **[0001]**