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FILING DATE: *May 20, 2014*

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PTO/SB/16 (11-08)
Approved for use through 05/31/2015. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1 — Remove

Given Name	Middle Name	Family Name	City	State	Country
Doron		RAINISH	Ramat Gan		IL

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. — Add

Title of Invention	A METHOD FOR REDUCING INTERFERENCE IN SATELLITE COMMUNICATIONS
Attorney Docket Number (if applicable)	P074.US.Prov

Correspondence Address

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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

- ◉ No.
- ○ Yes, the invention was made by an agency of the United States Government. The U.S. Government agency name is:
- ○ Yes, the invention was under a contract with an agency of the United States Government. The name of the U.S. Government agency and Government contract number are:

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Entity Status
Applicant asserts small entity status under 37 CFR 1.27 or applicant certifies micro entity status under 37 CFR 1.29

- (●) Applicant asserts small entity status under 37 CFR 1.27
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Signature	/Gil Ingel/			Date (YYYY-MM-DD)	2014-05-20
First Name	Gil	Last Name	INGEL	Registration Number (If appropriate)	

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A Method for Reducing Interference in Satellite Communications

Field of the Disclosure

The present disclosure relates to the field of communications and in particularly to communications being held between satellites and terminals associated therewith.

Background of the invention

Interference occurring due to transmissions sent from/to neighbor satellites, using the same frequencies as well as interference occurring due to communications transmitted along satellites beams using the same frequencies, tend to degrade the reception performance and to limit the maximal channel throughput.

Satellite communications' standards, such as DVB-S2 and DVB-S2x define a continuous transmission in the forward link (transmissions being sent from the satellite(s) towards the terminals), and define that whenever the (hub) transmitter has no data to transmit, "dummy frames" will be transmitted. These dummy frames contain no information, create interference to adjacent beams and satellites, and as a result increase satellite power consumption.

Summary of the Disclosure

According to the solution provided by the present invention, in order to reduce interference occurring due to transmissions sent from/to neighbor satellites using the same frequencies and/or interference occurring due to communications transmitted along satellites beams using the same frequencies, a method is provided whereby in a TDM continuous satellite forward channel, such as DVB-S2 and DVB-S2x, dummy frames' headers are transmitted or the dummy frames headers and pilot signals are transmitted instead of full dummy frames. In addition, the dummy frames' headers and/or pilot signals may be transmitted at a reduced power.

In accordance with another embodiment of this invention, the timing of the dummy frames is optimized so that the system performance is enhanced (e.g. the system throughput is increased). To this end, the transmitting timing of dummy frames, dummy frames headers or dummy frames headers and pilot signals in each beam, in a multi beam

system, is controlled in such a way that the inter-beam interference is minimized (at the cost of some additional delays). That is, dummy frames are inserted in a beam, even if this beam's queue is not empty, in order to reduce interference to some frame or frames at another beam or beams. The decision on whether to insert a dummy frame, and thus delay a frame, may depend on that frame time sensitivity or other quality of service parameters associated therewith.

According to prior art protocols, dummy frames are transmitted only when there is no data to send. In accordance with another embodiment of the present invention, dummy frames, dummy frame headers or dummy frames headers and pilot signals are inserted at some of the beams (preferably at those that are less occupied with communications), also when there is data to send in order to reduce interference in other beams, at a cost of delaying the data frames.

Brief description of the drawings

The present invention will be more fully understood from the following detailed description of the embodiments thereof, taken together with the drawings in which:

FIG. 1 – illustrates a prior art transmission sequence of satellite communications;

FIG. 2 – demonstrates one embodiment of the solution provided by the present invention whereby only the header of dummy frames are transmitted together with pilot signals (in the example illustrated in this Fig., two pilot signals are inserted during the interval at which the dummy frame's payload would have been transmitted if the prior art protocol illustrated in Fig. 1 were to be followed), instead of full dummy frame's payload;

FIG. 3 – demonstrates another embodiment of the solution provided by the present invention whereby only the header of dummy frames are transmitted instead of the full dummy frames; and

FIG. 4 – illustrates yet another embodiment of the solution provided by the present invention whereby dummy frames are inserted at some of the beams also when there is data to send along these beams (illustrated at the right part of the FIG.), as opposed to a standard complying system (illustrated at the left part of the FIG.).

Claims

1. A method for reducing interference occurring due to transmissions sent from/to neighbor satellites using the same frequencies and/or interference occurring due to communications transmitted along satellites beams using the same frequencies, whereby in a TDM continuous satellite forward channel, instead of transmitting full dummy frames, transmitting only their respective headers.

2. The method according to claim 1, further comprising a step of inserting at least one pilot sequence at at least one gap formed by transmitting only a dummy frame's header rather than a full dummy frame that comprises said dummy frame's header and its respective payload.

3. The method according to claim 1, wherein said dummy frame's header is transmitted at a reduced power.

4. The method according to claim 1, wherein said at least one pilot signal is transmitted at a reduced power.

5. The method according to claim 1, further comprising a step of inserting dummy frames at at least one of the beams when there is data to send along that at least one beam.

Abstract

The present invention provides a solution to reduce interference occurring due to transmissions sent from/to neighbor satellites using the same frequencies and/or interference occurring due to communications transmitted along satellites beams using the same frequencies, whereby in a TDM continuous satellite forward channel, such as DVB-S2 and DVB-S2x, only dummy frames' headers are transmitted or dummy frames' headers and pilot signals. In addition, the dummy frames' headers and/or pilot signals may be transmitted at a reduced power.

FIG 1 – PRIOR ART

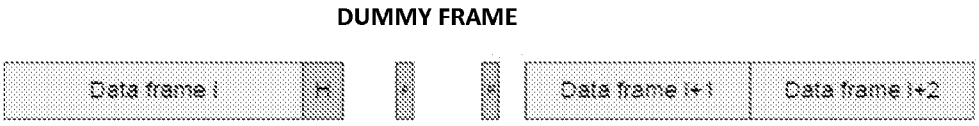

FIG. 2

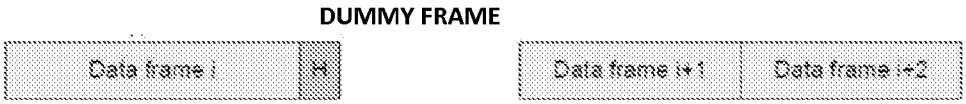

FIG. 3

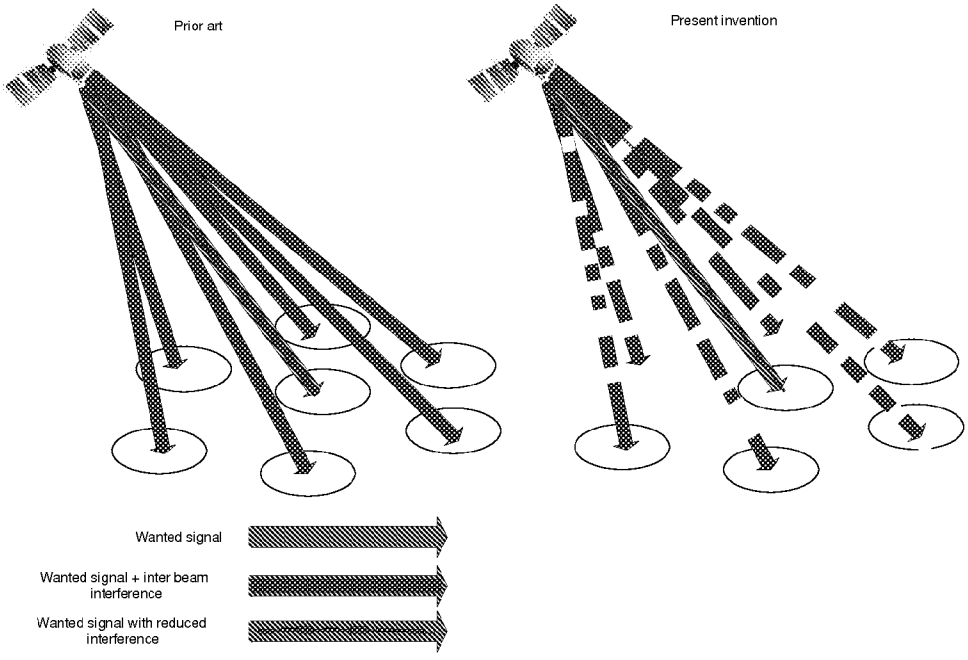

FIG. 4