AMENDED CLAIMS

1. A method for reading data from a storage medium using a reader, the method comprising:

reading a first signal with a reader head of the reader at a first position of the storage medium, wherein the first signal includes a first portion corresponding to a first track and a second portion corresponding to a second track;

reading a second signal with ~~a~~the reader head of the reader at a second position of the storage medium~~;~~, wherein the second signal includes a third portion corresponding to the first track and a fourth portion corresponding to the second track;

estimating, based on the first portion and the second portion, (i) a first ratio of an amplitude of the first signal contributed by the first track with the reader head of the reader at the first position and (ii) a second ratio of the amplitude of the first signal contributed by the second track with the reader head of the reader at the first position;

estimating, based on the third portion and the fourth portion, (i) a third ratio of the amplitude of the second signal contributed by the first track with the reader head of the reader at the second position and (ii) a fourth ratio of the amplitude of the second signal contributed by the second track with the reader head of the reader at the second position; and

determining data stored at a pre-determined position of the storage medium based on the estimated first ~~signal and based on~~ratio, the estimated second ~~signal~~ratio, the estimated third ratio, and the estimated fourth ratio,

wherein the storage medium comprises a plurality of tracks including the first track and the second track, each track having a width smaller than a width of the reader head of the reader.

~~2. The method of claim 1,~~

~~wherein the storage medium comprises a plurality of tracks, each track having a width smaller than a width of a reader head of the reader.~~

2~~3~~. The method of claim 1,

wherein for at least one of the first position or the second position ~~a~~the reader head of the reader covers ~~a~~the first track and ~~a~~the second track.

3~~4~~. The method of claim 2~~3~~,

wherein the pre-determined position comprises one of a pre-determined position on the first track or a pre-determined position on the second track.

4~~5~~. The method of claim 3, wherein:

~~wherein~~ the first track ~~and~~is adjacent to the second track ~~are adjacent~~.

5~~6~~. The method of claim 1, further comprising:

reading a plurality of signals, wherein for each signal ~~a~~the reader head of the reader is at a different position of the storage medium; and

determining data stored at the pre-determined position of the storage medium based on the plurality of signals.

6~~7~~. The method of claim 1, further comprising:

reading a frequency burst signal with ~~a~~the reader head of the reader at a position of the storage medium comprising a frequency burst provided before a data drack written at the same time when data is written on the storage medium;

wherein determining the data stored at the pre-determined position both down track and cross track of the storage medium is further based on the frequency burst signal.

7~~8~~. The method of claim 1, wherein:

the storage medium comprises a plurality of tracks having a width smaller than a width of ~~a~~the reader head of the reader; and

~~wherein~~ the storage medium comprises at least one track having a width equal to or larger than the width of the reader head of the reader.

~~9. The method of claim 1,~~

~~wherein determining of the data stored at a pre-determined position of the storage medium is further based on determining an amplitude coefficient, the amplitude coefficient indicating a contribution of data stored at the first position of the recording medium.~~

8~~10~~. The method of claim 1, wherein:

determining the data stored at the pre-determined position of the storage medium is further based on determining a phase offset of data stored at the second position of the recording medium.

9~~11~~. A storage device comprising:

a storage medium;

a reader configured to (i) read a first signal with a reader head of the reader at a first position of the storage medium ~~and configured~~, wherein the first signal includes a first portion corresponding to a first track and a second portion corresponding to a second track, and (ii) read a second signal with ~~a~~the reader head of the reader at a second position of the storage medium, wherein the second signal includes a third portion corresponding to the first track and a fourth portion corresponding to the second track; and

a data determination circuit configured to

estimate, based on the first portion and the second portion, (i) a first ratio of an amplitude of the first signal contributed by the first track with the reader head of the reader at the first position and (ii) a second ratio of the amplitude of the first signal contributed by the second track with the reader head of the reader at the first position,

estimate, based on the third portion and the fourth portion, (i) a third ratio of the amplitude of the second signal contributed by the first track with the reader head of the reader at the second position and (ii) a fourth ratio of the amplitude of the second signal contributed by the second track with the reader head of the reader at the second position, and

determine data stored at a pre-determined position of the storage medium based on the estimated first ~~signal and based on~~ratio, the estimated second ~~signal~~ratio, the estimated third ratio, and the estimated fourth ratio,

wherein the storage medium comprises a plurality of tracks including the first track and the second track, each track having a width smaller than a width of the reader head of the reader.

~~12. The storage device of claim 11,~~

~~wherein the storage medium comprises a plurality of tracks, each track having a width smaller than a width of a reader head of the reader.~~

10~~3~~. The storage device of claim 9~~11~~, wherein:

~~wherein~~ for at least one of the first position or the second position ~~a~~the reader head of the reader covers ~~a~~the first track and ~~a~~the second track.

11~~4~~. The storage device of claim 10~~3~~, wherein:

~~wherein~~ the pre-determined position comprises one of a pre-determined position on the first track or a pre-determined position on the second track.

12~~5~~. The storage device of claim 10~~3~~, wherein:

~~wherein~~ the first track ~~and~~ is adjacent to the second track ~~are adjacent~~.

13~~6~~. The storage device of claim 9~~11~~, wherein:

~~wherein~~ the reader is further configured to read a plurality of signals, wherein for each signal ~~a~~the reader head of the reader is at a different position of the storage medium; and

~~wherein~~ the determination circuit is further configured to determine data stored at the ~~pre-determined~~predetermined position of the storage medium based on the plurality of signals.

14~~7~~. The storage device of claim 9~~11~~, wherein:

~~wherein~~ the reader is further configured to read a frequency burst signal with ~~a~~the reader head of the reader at a position of the storage medium comprising a frequency burst provided before a data drack on the storage medium; and

~~wherein~~ the determination circuit is further configured to determine the data stored at the pre-determined position of the storage medium further based on the frequency burst signal.

15~~8~~. The storage device of claim 9~~11~~, wherein:

~~wherein~~ the storage medium comprises a plurality of tracks having a width smaller than a width of ~~a~~the reader head of the reader; and

~~wherein~~ the storage medium comprises at least one track having a width equal to or larger than the width of ~~a~~the reader head of the reader.

~~19. The storage device of claim 11,~~

~~wherein the determination circuit is further configured to determine the data stored at a pre-determined position of the storage medium further based on determining an amplitude coefficient, the amplitude coefficient indicating a contribution of data stored at the first position of the recording medium.~~

16~~20~~. The storage device of claim 9~~11~~, wherein:

the determination circuit is further configured to determine the data stored at ~~a~~ the pre-determined position of the storage medium further based on determining a phase offset of data stored at the second position of the ~~recording~~ storage medium.