

WHAT IS CLAIMED IS:

1. At a network component, a method for providing increased signature space for multiplexed transmissions for a plurality of users, the method comprising:

obtaining a set of basic signatures in a first space;

generating a second space of virtual signatures, wherein each virtual signature is generated using a combination operation on at least two of the basic signatures, the second space of virtual signatures being larger than the first space of basic signatures; and

provisioning each virtual signature in the set of the virtual signatures as a basic resource unit (BRU) for a corresponding user transmission.

2. The method of claim 1, wherein the obtaining the set of basic signatures includes generating the basic signatures using a low density signature generation method.

3. The method of any one of the preceding claims, wherein the combination operation is one of:

a row-wise permutation for combining, in each of the virtual signatures, rows of corresponding basic signatures, each of the rows includes a same basic signature selected from the set of basic signatures, and wherein the rows represent sequences of frequency bands at one time interval or sequences of allocated time intervals at one frequency band;

a column-wise permutation for combining, in each of the virtual signatures, columns of corresponding basic signatures, each of the columns includes a same basic signature selected from the set of basic signatures, and wherein the columns represent sequences of time intervals at one frequency band or sequences of frequency bands at one time interval; and

an intra-BRU hopping to add, in each of the virtual signatures, a hopping sequence of basic signatures, and wherein each of the virtual signatures includes rows, columns, or both rows and columns each including a sequence of the basic signatures.

4. The method of any one of the preceding claims wherein provisioning comprises:
generating a plurality of BRU sets, each set comprising a combination of BRU's; and
provisioning each of the BRU sets for a corresponding user.
5. The method of claim 4, wherein provisioning each virtual signature as a BRU further
5 comprises defining a first BRU set and a second BRU set, wherein the first BRU set
comprises a first combination of BRU's corresponding to a first combination of virtual
signatures, and wherein the second BRU set comprises a second combination of BRU's
corresponding to a second combination of virtual signatures.
6. The method of claim 5, wherein each of the BRU sets comprises a same number of
0 BRU's, and wherein a total number of BRU sets is equal to all possible combinations of
BRU's in a BRU set.
7. The method of any one of the preceding claims, wherein each of the virtual signatures
comprises a same number of basic signatures, and wherein a total number of virtual signatures
is equal to a total number of basic signatures raised to a power of the number of basic
5 signatures in a virtual signature.
8. The method of any one of the preceding claims further comprising generating a
quantity of the virtual signatures greater than a quantity of the basic signatures and greater
than or equal to a quantity of pilot signals.
9. At a network component, a method supporting low density signatures for multiplexed
20 transmissions for a plurality of users, the method comprising:
receiving a plurality of sets of basic resource units (BRU's) for a plurality of users,
wherein the BRU's are comprised of virtual signatures, each virtual signature including a
combination of low density signatures;

decorrelating the virtual signatures in the sets of BRU's to narrow down a list of pilot signals, wherein a total number of configured virtual signatures exceeds a total number of available low density signatures; and
estimating channels using the narrowed down list of pilot signals.

- 5 10. The method of claim 9 further comprising:
obtaining a set of active virtual signatures from the list of pilot signals, wherein the set
of active virtual signatures is a subset of the virtual signatures;
processing the estimated channels using the set of active virtual signatures;
decoding data of the users according to the processed estimated channels; and
0 providing updated a priori probabilities for the virtual signatures and the pilot signals
according to the processed estimated channels.

11. The method of any one of claims 9 or 10 further comprising mapping the virtual
signatures in a one-to-one mapping to a complete pool of available pilot signals, wherein
decorrelating the virtual signatures to narrow down the list of the pilot signals includes
5 removing a pilot signal mapped to an inactive virtual signature from the list of pilot signals
upon detecting the inactive virtual signature.

12. The method of any one of claims 9 to 11, wherein the virtual signatures comprise a
first virtual signature and a second virtual signature, wherein the first virtual signature
comprises a first combination of basic signatures, and wherein the second virtual signature
20 comprises a second combination of basic signatures.

13. A network component for supporting increased signature space for multiplexed
transmissions for a plurality of users, the network component comprising:
a processor; and

a computer readable storage medium storing programming for execution by the processor, the programming including instructions to:

receive a plurality of sets of basic resource units (BRU's) for a plurality of users, wherein the BRU's are comprised of virtual signatures, each virtual signature including
5 a combination of basic signatures;

decorrelate the virtual signatures in the sets of BRU's to narrow a list of pilot signals, wherein a total quantity of configured virtual signatures exceeds a total quantity of available basic signatures; and

estimate channels using the narrowed down list of pilot signals.

0 14. The network component of claim 13, wherein the programming includes further instructions to:

obtain a set of active virtual signatures from the list of pilot signals, wherein the set of active virtual signatures is a subset of the virtual signatures;

process the estimated channels using the set of active virtual signatures;

5 decode data of the users according to the processed and estimated channels; and

provide updated a priori probabilities for the virtual signatures and the pilot signals according to the processed and estimated channels.

15. The network component of any one of claims 13 or 14, wherein the instructions to receive the plurality of BRU's includes instructions to receive the basic signatures, the basic
20 signatures being generated using a low density signature generation method

16. The network component of any one of claims 13 to 15, wherein the programming further includes instructions to:

map the virtual signatures in a one-to-one mapping to a pool of available pilot signals,

wherein the instructions to decorrelate the virtual signatures to narrow the list of the pilot signals includes instructions to remove a pilot signal mapped to an inactive virtual signature from the list of pilot signals upon detecting the inactive virtual signature.

17. The network component of any one of claims 13 to 16, wherein the programming
5 further includes instructions to receive a plurality of BRU sets for the users, each BRU set comprising a combination of BRU's.

18. The network component of claim 17, wherein the BRU sets comprise a first BRU set
and a second BRU set, wherein the first BRU set comprises a first combination of BRU's
corresponding to a first combination of virtual signatures, and wherein the second BRU set
0 comprises a second combination of BRU's corresponding to a second combination of virtual
signatures.

19. The network component of any one of claims 13 to 18, wherein each of the virtual
signatures comprises a same number of basic signatures, and wherein a total number of
virtual signatures is equal to a total number of basic signatures raised to a power of the
5 number of basic signatures in a virtual signature.