CLAIMS:

We claim:

1. A method of communications with a plurality of ground terminals using a plurality of satellites transmitting time-division multiplexed signals, comprising the steps of:

transmitting from a first satellite to a first group of ground terminals using a first number of timeslots in a TDM frame period;

transmitting from said first satellite and a second satellite in alternate TDM frames to a second group of ground terminals using a second number of timeslots in said TDM frame period; and

transmitting from said second satellite to a third group of ground terminals using a third number of timeslots in said TDM frame period.

~~2. A method of relaying signals from a plurality of ground terminals~~ using time-division multiple access transmission to a plurality of orbiting satellites, comprising the steps of:

transmitting from a first group of ground terminals using a first number of TDMA timeslots intended to be relayed by a first satellite;

transmitting from a second group of ground terminals using a second number of TDMA timeslots intended to be relayed by more than one satellite; and

transmitting from a third group of ground terminals in a third number of TDMA timeslots intended to be relayed by a second satellite.

3. The method according to claim 2, further comprising:

relaying received signals received at at least said first and second satellites to a ground station for processing;

processing at said ground station signals from said first group of ground terminals relayed by said first satellite; and

processing at said ground station signals from said third group of ground terminals relayed by said second satellite.

4. The method according to claim 2, further comprising:

relaying received signals received from more than one satellite to a ground station for processing; and

jointly processing at said ground station signals from said second group of ground terminals relayed by said more than one satellite so as to improve signal quality.

12 5. The method according to claim 1, further comprising:

at least one ground terminal adapted to receive signals alternately in a TDM timeslot transmitted by said first satellite and a timeslot transmitted by said second satellite.

13 6. The method of claim 1, wherein said satellites employ electronically steered directive transmission.

14 7. The method of claim 3, said electronically steered directive transmission is performed using a phased array antenna.

15 8. The method of claim 3, wherein said directive transmissions are steered on a per-timeslot basis.

9. The method of claim 2, wherein said satellites receive said ground terminal signals for relaying with the help of directive antennas.

10. The method of claim 9, wherein said directive antennas are electronically steered.

~~11. The method of claim 10, wherein said electronic steering is~~ accomplished by relaying signals received by said directive antennas and processing them at a ground station.

12. The method of claim 10, wherein said electronic steering is accomplished with the aid of a phased array antenna.

13. The method according to claim 10, wherein said directive antennas are re-steered on a per-timeslot basis.

14. The method of claim 13, wherein directive reception directions for timeslots intended for relaying by two or more satellites are placed close together on the same carrier frequency and reception directions for other carrier ~~frequencies are spaced further apart.~~

16. Ground terminal means adapted for communicating via a plurality of orbiting satellites comprising:

receiver means for receiving a signal transmitted in a TDM timeslot from a satellite and amplifying, filtering and converting it into numerical form for processing;

timing means for adapting said receiver means to receive said TDM timeslot cyclically in different frames from each of said plurality of satellites according to a predetermined pattern; and

numerical processing means for processing said converted signals received from different satellites in such a way as to reduce the effects of signal fading.

17. The ground terminal according to claim 16, wherein said ground terminal receives signals from two satellites alternately.

17. The ground terminal according to claim 16, wherein said numerical processing means includes deinterleaving means and error-correction decoding means.

~~18. A ground terminal adapted to communicate with a ground station through use of a multi-satellite relay network, comprising:~~

~~Time-Division-Multiple-Access transmitter means for transmitting signal bursts at regular intervals in an allocated timeslot and on an allocated frequency; and~~

~~timing means for regulating said burst transmission times depending on whether said bursts are intended to be relayed by a first satellite, a second satellite or more than one satellite.~~

~~19. A ground terminal according to claim 18, wherein said timing means is controlled by commands received via said satellite network.~~

20. Timing controller means for controlling the transmit times of a plurality of satellite ground terminals in dependence on whether said transmissions are intended to be relayed by a first orbiting satellite, a second orbiting satellite or more than one orbiting satellite to avoid time overlap ..... at the front of said third group of timeslots.

21. The timing controller according to claim 20, wherein said control is effected by transmitting timing adjustment commands to said ground terminals using one or more of said orbiting satellites as a relay for said commands.

22. A timing controller according to claim 20, further including:

comparison means for comparing reception quality of a signal relayed by at least said first and said second satellite and making a decision whether said signal relayed by said first satellite or said second satellite shall be

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processed or whether signals relayed by said first and second satellites shall be jointly processed; and

determining means depending on said decision for determining a preferred value for said transmit timing of at least one of said ground terminals.

12 23. The timing controller of claim 11, further comprising:

means to transmit a command to said at least one ground terminal to adapt it to said preferred timing.

13 24. The timing controller of claim 12, wherein said command transmission means transmits commands to adapt the timing of several of said ground terminals at approximately the same time.

14 25. The timing controller of claim 13, wherein transmission of said commands causes said several ground terminals to adapt their transmit timings including an interchange of timeslots one with another.

15 26. The timing controller of claim 11, wherein said determining means determines said preferred timing so as to avoid time overlap at more than one satellite between two signals transmitted by two of said ground terminals and intended to be relayed by said more than one satellites.

16 27. A method for improving radio communication service quality between a radio communications network and subscriber stations using at least two relay stations operating to provide path diversity, comprising the steps of:

transmitting a signal burst containing a first part of an information signal using a communications channel available to a first of said at least two relay stations and transmitting a signal burst containing a second, different part of said information signal using a channel available to a second of said relay stations; and

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while said first relay station is transmitting a signal burst to a given subscriber station, using said available channel on said second relay station to transmit a burst to a different subscriber station and vice-versa.

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28. A method according to claim 27, wherein said available communications channels are each characterized by a time slot in a repetitive TDMA frame period combined with a radio frequency channel allocation.

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29. A method according to claim 27, wherein said relay stations are orbiting satellites.

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30. A subscriber terminal for providing voice or data communications with a radio communications network employing path diversity, comprising:

receiving means for receiving signal bursts alternately from a first transmitting station on a first communications channel and a second transmitting station on a second communications channel; and

processing means for jointly processing information received in successive bursts comprising information transmitted by said first station and different information transmitted by said second station in order to provide an improvement in signal quality by path diversity.

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31. A subscriber terminal according to claim 30, wherein said first and second ~~communications~~ communications channels are defined by designating a timeslot in a repetitive TDMA frame period and a first and second radio frequency channel.

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32. A subscriber terminal according to claim 31, further comprising agile channel selection means capable of adapting said terminal for operation alternately on said first and second communication channels for reception of alternate TDMA bursts.

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33. A subscriber terminal according to claim 32, wherein said agile channel selection means includes a frequency hopping synthesizer.

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23 34. A subscriber terminal according to claim 30, wherein said path diversity operation can be deactivated when not needed, and said processing means then processes information received from a single transmitting station.

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24 35. A subscriber terminal according to claim 30, wherein said transmitting stations include ground-based cellular base stations, orbiting satellites or airborne relay stations.

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25 36. A subscriber terminal according to claim 34, wherein path diversity operation is activated when said subscriber terminal can receive at least two of the transmitting stations and deactivated when said subscriber terminal can receive only one of the transmitting stations.

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26 37. A subscriber station according to claim 34, wherein diversity operation is selected when said terminal is located in a border region between two transmitting stations and deactivated otherwise, thereby effecting soft handover when transitioning between regions served by different stations.

27. Timing controller for controlling ..... along lines of constant delta-Doppler.