I Claim:

1. A satellite comprising:

   an optical receiver, having a plurality of radio frequency (RF) outputs;

   a plurality of LNAs, each having an input and an output, the inputs coupled to a corresponding plurality of optical receiver RF outputs; and

   a plurality of power amplifiers (PA), each having an input and an output, the inputs coupled to the outputs of corresponding LNAs; and

   an antenna array having a plurality of antenna elements, each antenna element having an input coupled to a corresponding one of the PA outputs.

2. The satellite of Claim 1, further comprising a plurality of upconverters, each having an input and an output, the each input coupled to an associated output of a corresponding LNA and each output coupled to an associated one of the plurality of antenna elements.

3. The satellite of Claims 2 or 1, wherein antenna patterns of at least some of the antenna elements overlap such that signals transmitted therefrom will be superposed upon one another and thus coherently combine to form a user spot beam.

4. The satellite of Claims 2 or 3, wherein user spot beams are directed to user beam coverage areas distributed over a satellite service coverage area that is substantially larger than user beam coverage areas.

5. The satellite of Claim 4, wherein the optical receiver comprises an optical demultiplexer having an input and a plurality of outputs, each output associated with a corresponding optical wavelength.

6. The satellite of Claim 5, wherein the wavelengths associated with the outputs of the optical demultiplexer are grouped in optical bands.

7. The satellite of Claim 6, wherein wavelengths in the same optical band define unique optical channels.

8. The satellite of Claim 6, wherein optical bands that are selected have an attenuation that is not greater than bands that are not selected.

9. The satellite of Claims 2 or 1, wherein the optical receiver comprises a plurality of satellite receiver optical detectors each having an RF output coupled to a corresponding RF output of the optical receiver.

10. The satellite of Claim 9, wherein the RF signal output from the satellite receiver optical detector has an amplitude that tracks the intensity of the optical signal applied to the satellite receiver optical detector input.

11. The satellite of Claim 10, wherein each optical receiver further comprises a steerable lens having an output coupled to the input of at least one of the plurality of satellite receiver optical detectors.

12. The satellite of Claim 11, wherein the steerable lens can be positioned by rotation about at least two axis in response to ground commands.

13. The satellite of Claim 11, wherein the steerable lens can be positioned by rotation about at least two axis in response to on-board processing.

14. The satellite of Claim 10, wherein the satellite receiver optical detector is a photo diode.

15. A satellite access node (SAN) comprising:

    a plurality of optical modulators each having an electrical input and an optical output, at least one electrical input configured to receive a beam element signal and at least one electrical input configured to receive a timing pilot signal;

    an optical combiner for combining the optical outputs of the plurality of optical modulators; and

    an optical transmitter configured to transmit an optical signal to a satellite.

16. The SAN of Claim 15, further comprising a timing module having inputs configured to receive the beam element signals and the timing pilot signal and a plurality of outputs configured to output appropriately delayed beam element signals and timing pilot signal, the output coupled to the electrical inputs of the plurality of optical modulators.

17. The SAN of Claims 15 or 16 each of the plurality of optical modulators comprise at least one light source operating at an optical wavelength within one of four optical bands.

18. The SAN of Claim 17 wherein the four optical bands are centered at approximately 1100nm, 1300nm, 1550nm and 2100nm.

19. The SAN of Claim 17 wherein the wavelength of each light source within the same optical band is approximately 0.8 nm wide.

20. The SAN of Claim 17 wherein the electrical input to the plurality of optical modulators is further configured to receive a signal having a bandwidth of approximately 3.5 GHz.

21. The SAN of Claim 15 or 16 further comprising a plurality of baseband to IF converters, each having:

    an output;

    a plurality of frequency converters having outputs; and

    a summing circuit having a plurality of inputs and an output, each input coupled to a corresponding one of the plurality of frequency converter outputs

    wherein the output of each of the plurality of baseband to IF converters is coupled to the electrical input of a corresponding one of the plurality of optical modulators.

22. The SAN of Claim 21, wherein the plurality of frequency converters have inputs configured to receive beam element signals.

23. The SAN of Claim 21, wherein at least one of the frequency converters is configured to receive a timing pilot signal.

24. The SAN of Claim 15 or 16 further comprising an optical receiver configured to receive an optical signal and to output a plurality of beam element signals.

25. The SAN of Claim 24, wherein the optical receiver is further configured to output at least one timing pilot signal.

26. A satellite system ground network comprising:

    a beamformer comprising:

    a plurality of beamformer inputs, each configured to receive signals to be directed to a user spot beam;

    a plurality of beamformer outputs, each configured to output a beam element signal;

    at least one pilot output configured to output a timing pilot signal; and

a SAN comprising:

a plurality of optical modulators each having an electrical input and an optical output, at least one electrical input coupled to a corresponding output from the beamformer and at least one electrical input configured to receive a first timing pilot signal;

an optical combiner coupled to the optical outputs of the plurality of optical modulators; and

an optical transmitter configured to transmit an optical signal to a satellite.

27. The network of Claim 26, wherein the beamformer applies beam weights to each beam element signal such that when the beam weight signals are demodulated by a satellite and transmitted by an antenna array, they superpose to form user spot beams.

28. The network of Claim 27, wherein the number of user spot beams formed is equal to the number of beamformer inputs.

29. The network of Claim 26, further comprising at least a second SAN having at least one electrical input coupled to a corresponding output from the beamformer and at least one electrical input configured to receive a second timing pilot signal, wherein the first timing pilot signal and the second timing pilot signal are aligned.

30. The network of Claim 29, wherein the beamformer further comprises a timing module, and wherein the first and second timing pilot signals are generated by the timing module.

31. The network of Claim 29, wherein the second pilot timing signal is a copy of the first timing pilot signal.

32. The network of Claim 31, wherein the number of copies of the timing pilot signals is equal to the number of SANs to which the beamformer is coupled.

33. The network of Claim 29, wherein the SANs each have a SAN optical receiver configured to receive an optical signal from a satellite and to demultiplex and demodulate a timing pilot signal from the optical signal.

34. The network of Claim 33, wherein the beamformer further comprises a timing control input, and wherein the SAN further comprises a timing pilot modem coupled to the SAN optical receiver, the timing pilot modem having an output coupled to the beamformer timing control input.

35. The network of Claim 34, wherein the timing module within the beamformer generates a delay in the transmission of beam elements signals in response to signals presented to the timing control input.

36. The network of Claim 33, where the SAN further comprises a timing module coupled between the beamformer and each optical modulator, the timing module having a timing control input coupled to receive the timing pilot signal from the SAN optical receiver.

37. The network of Claim 36, wherein the timing module within the SAN generates a delay in the transmission of beam elements signals in response to signals presented to the timing control input.