I Claim:

1. A satellite configured to support ground-based beamforming, the satellite comprising:

an antenna array having a plurality of antenna elements having overlapping antenna patterns, each antenna element having a corresponding antenna input;

an optical receiver configured to receive a composite optical signal from a Satellite Access Node (SAN), wherein the composite optical signal comprises a plurality of optical channel signals, each optical channel signal conveying a respective radio frequency (RF) forward beam element signal corresponding to a respective one among the plurality of antenna elements, the plurality of RF forward beam element signals being respectively weighted such that transmission of the plurality of RF forward beam element signals from the antenna array results in signal superpositions contributing to the formation of respective user spot beams corresponding to respective user beam coverage areas among a plurality of user beam coverage areas, and wherein the optical receiver comprises:

an optical demultiplexer configured to demultiplex the composite optical signal and output the plurality of optical channel signals; and

a plurality of satellite receiver optical detectors, each satellite receiver optical detector configured to output a respective one among the plurality of RF forward beam element signals from a corresponding one among a plurality of RF outputs of the optical receiver, based on detecting an intensity of a respective one among the plurality of optical channel signals;

and wherein the satellite further comprises a plurality of signal paths, each signal path

coupling one among the plurality of RF outputs of the optical receiver to the antenna input of the corresponding antenna element, each signal path comprising:

a Low Noise Amplifier (LNA) having a LNA input and a LNA output, each LNA input coupled to a corresponding optical receiver RF output of the optical receiver; and

a Power Amplifier (PA) having a PA input coupled to the LNA output of the LNA and having a PA output coupled to the antenna input of the corresponding antenna element.

2. The satellite of Claim 1, wherein each signal path further comprises an upconverter disposed between the LNA and the PA.

3. The satellite of Claim 1, wherein antenna patterns of at least some of the antenna elements overlap, and wherein the overlapping antenna patterns result in the signal superpositions.

4. The satellite of Claim 1, wherein the plurality of user beam coverage areas is distributed over a satellite service area that is larger than individual ones among the user beam coverage areas.

5. The satellite of Claim 1, wherein each optical channel signal is associated with a corresponding optical wavelength.

6. The satellite of Claim 5, wherein the wavelengths associated with the plurality of optical

channel signals are grouped in optical bands.

7. The satellite of Claim 6, wherein wavelengths in the same optical band define unique optical channels, with each optical channel conveying one among the plurality of optical channel signals.

8. The satellite of Claim 6, wherein a satellite communications system comprising the satellite is configured to transmit the RF forward beam element signals to the satellite based on transmitting respective, time-aligned subsets of RF forward beam element signals to the satellite from respective ones among two or more SANs, with each subset of RF forward beam element signals being conveyed in a respective composite optical signal and corresponding to a respective subset of antenna elements in the antenna array onboard the satellite, wherein a total number of RF forward beam element signals across the respective, time-aligned subsets of RF forward beam element signals equals a total number of antenna elements in the antenna array that are used for forming the respective user spot beams corresponding to respective user beam coverage areas, and wherein the optical receiver is one among two or more optical receivers onboard the satellite, with each optical receiver used to receive one of the respective composite optical signals, and with the satellite including a respective plurality of signal paths for each optical receiver, each respective plurality of signal paths coupling the plurality of RF outputs of the corresponding optical receiver to the antenna inputs of the respective subset of antenna elements.

9. The satellite of Claim 1, wherein the optical receiver further comprises a steerable lens that is steerable for reception of the composite optical signal from the SAN as a selected one

among a plurality of SANs.

10. The satellite of Claim 9, wherein the steerable lens is steerable via rotation about at least two axes, in response to ground commands received at the satellite.

11. The satellite of Claim 9, wherein the steerable lens is steerable via rotation about at least two axes, in response to commands generated at the satellite via on-board processing.

12. A satellite access node (SAN) configured for ground-based beamforming and comprising:

an interface configured to receive a plurality of beam element signals and form a corresponding plurality of radio frequency (RF) beam element signals weighted for transmission from corresponding ones among a plurality of antenna elements comprised in an antenna array onboard a satellite, with resulting signal superpositions contributing to the formation of respective user spot beams corresponding to respective user beam coverage areas among a plurality of user beam coverage areas; and

an optical transmitter comprising:

a plurality of optical modulators configured to modulate a plurality of optical carriers with corresponding ones in the plurality of RF beam element signals, to form a corresponding plurality of optical channel signals; and

an optical combiner configured to form a composite optical signal for transmission to the satellite, based on combining the plurality of optical channel signals.

13. The SAN of Claim 12, wherein the SAN further comprises a timing module configured to control a delay applied to the received beam element signals.

14. The SAN of Claim 12, wherein each optical carrier is at a respective optical frequency, and wherein the composite optical signal is a frequency multiplexed signal, with each optical channel signal being at the respective optical wavelength of the corresponding optical carrier.

15. The SAN of Claim 14, wherein the respective optical frequencies of the plurality of optical carriers are grouped into the four optical bands centered at approximately 1100nm, 1300nm, 1550nm, and 2100nm.

16. The SAN of Claim 12, wherein the RF beam element signals have a bandwidth of approximately 3.5 GHz.

17. The SAN of Claim 12, wherein the interface includes a plurality of baseband to intermediate frequency (IF) converters that is configured to form the RF beam elements signals from the received beam element signals.