CLAIMS

1. A microwave amplifier for amplifying electromagnetic (EM) signals at a fundamental frequency, the amplifier comprising:

a transistor configured to provide an amplified microwave signal at an output thereof; and

a load network coupled to the output for shaping a waveform of the amplified microwave signal,

wherein the load network comprises:

a fundamental matching network that is tunable to provide impedance matching at the fundamental frequency;

a half wave transmission line for a second harmonic frequency of the amplified microwave signal, the half wave transmission line being disposed between the output and the fundamental matching network;

a quarter wave stub and a five quarter wave stub for a third harmonic frequency of the amplified microwave signal arranged on the half wave transmission line to provide an open circuit condition at the third harmonic frequency; and

a quarter wave stub for the second harmonic frequency and a quarter wave stub for the fundamental frequency, arranged on the half wave transmission line to provide a short circuit condition at the second harmonic frequency.

2. A microwave amplifier according to claim 1, wherein the quarter wave stub and the five quarter wave stub for the third harmonic frequency are arranged to oppose each other at a distance along the half-wave transmission line equal to a quarter-wave for a third harmonic frequency.

3. A microwave amplifier according to claim 1 or claim 2, wherein the quarter-wave stub for the second harmonic frequency and the quarter-wave stub for the fundamental frequency are arranged to oppose each other at an output of the half-wave transmission line.

4. A microwave amplifier according to any preceding claim, wherein a bias voltage is applied to the transistor

through the quarter-wave stub for the fundamental frequency.

5. A microwave amplifier according to claim 4, further comprising a capacitor arranged between the bias voltage input and the quarter-wave stub for the fundamental frequency.

6. A microwave amplifier according to any one of the preceding claims, wherein the half-wave transmission line for the second harmonic frequency comprises a quarter-wave transmission line for a third harmonic frequency, the quarter-wave stub and five-quarter-wave stub for the third harmonic frequency being arranged to oppose each other at the output of the quarter-wave transmission line for the third harmonic frequency.

7. A microwave amplifier according to any one of the preceding claims, wherein the transistor is a GaN-based HEMT.

8. A microwave signal generator for generating high power microwave electromagnetic (EM) radiation, the generator comprising:

a microwave source arranged to generate microwave EM radiation at a first power, and

a microwave amplifier according to any one of claims 1 to 7, wherein the microwave amplifier is arranged to amplify the microwave EM radiation from the first power to a second power that is higher than the first power.

9. A microwave signal generator according to claim 8, further comprising a direct current (DC) power source for supply DC energy.

10. An electrosurgical apparatus for performing electrosurgery, the apparatus comprising:

a microwave source arranged to generate microwave electromagnetic (EM) radiation at a first power;

a microwave amplifier according to any one of claims 1 to 7, arranged to amplify the microwave EM radiation from a first power to a second power that is higher than the first power;

a probe arranged to deliver the microwave EM radiation at ~~the~~ a second power from a distal end thereof for treating biological tissue;

a microwave amplifier mounted in the probe and arranged to amplify the microwave EM radiation from the~~a~~ first power to the~~a~~ second power that is higher than the first power; and

a feed structure for conveying microwave EM energy from ~~the~~ a microwave ~~generator~~ source to the microwave amplifier and to the probe,

wherein the probe is arranged at a distal end of the feed structure, and

wherein the microwave amplifier comprises:

a transistor configured to provide an amplified microwave signal at an output thereof; and

a load network coupled to the output for shaping a waveform of the amplified microwave signal,

wherein the load network comprises:

a fundamental matching network that is tunable to provide impedance matching at the fundamental frequency;

a half-wave transmission line for a second harmonic frequency of the amplified microwave signal, the half-wave transmission line being disposed between the output and the fundamental matching network;

a quarter-wave stub and a five-quarter-wave stub for a third harmonic frequency of the amplified microwave signal arranged on the half-wave transmission line to provide an open circuit condition at the third harmonic frequency; and

a quarter-wave stub for the second harmonic frequency and a quarter-wave stub for the fundamental frequency, arranged on the half-wave transmission line to provide a short circuit condition at the second harmonic frequency.

2. The electrosurgical apparatus according to claim 1, wherein the quarter-wave stub and the five-quarter wave stub for the third harmonic frequency are arranged to oppose each other at a distance along the half-wave transmission line equal to a quarter-wave for ~~a~~the third harmonic frequency.

3. The electrosurgical apparatus according to claim 1 or claim 2, wherein the quarter-wave stub for the second

harmonic frequency and the quarter-wave stub for the fundamental frequency are arranged to oppose each other at an output of the half-wave transmission line.

4. The electrosurgical apparatus according to any preceding claim, wherein a bias voltage is applied to the transistor through the quarter-wave stub for the fundamental frequency.

5. The electrosurgical apparatus according to claim 4, further comprising a capacitor arranged between the bias voltage input and the quarter-wave stub for the fundamental frequency.

6. The electrosurgical apparatus according to any one of the preceding claims, wherein the half-wave transmission line for the second harmonic frequency comprises a quarter-wave transmission line for ~~a~~the third harmonic frequency, the quarter-wave stub and five-quarter-wave stub for the third harmonic frequency being arranged to oppose each other at the output of the quarter-wave transmission line for the third harmonic frequency.

7. The electrosurgical apparatus according to any one of the preceding claims, wherein the transistor is a GaN-based HEMT

~~11~~8. ~~An~~ The electrosurgical apparatus according to ~~claim 10~~any one of the preceding claims, further comprising a direct current (DC) power source for supplying DC energy to the microwave ~~signal generator~~source, wherein the DC power source is integrated with the probe.

~~12. An electrosurgical apparatus according to any one of claims 10 or 11, wherein the microwave amplifier is mounted in the probe.~~

~~13~~9. ~~An~~ The electrosurgical apparatus according to any one of ~~claims 10 to 12~~the preceding claims, wherein the microwave ~~signal generator~~source is mounted in the probe.

~~14~~10. ~~An~~ The electrosurgical apparatus according to any one of ~~claims 10 to 13~~the preceding claims, wherein the apparatus further comprises a scoping device having a body and an instrument cord, wherein an instrument channel extends through the instrument cord, and wherein the probe is insertable through the instrument channel.

~~15~~11. ~~An~~ The electrosurgical apparatus according to any one of ~~claims 10 to 14~~the preceding claims, wherein the apparatus further comprises a handle connected to the probe via a flexible shaft.