CLAIMS

[Claim 1] A radio frequency circuit, comprising:

a first dielectric substrate having a first surface;

a second dielectric substrate having a second surface, the first and second dielectric substrates being positioned relative to one another such that the second surface faces the first surface;

a transmission line formed from a conductive cladding disposed upon the first surface, the transmission line being at least partially encapsulated between the first dielectric substrate and the second dielectric substrate;

a pair of reference conductors, each of the pair of reference conductors positioned adjacent to and co-planar with the transmission line and spaced such that there is a respective gap between each of the pair of reference conductors and the transmission line, each of the pair of reference conductors disposed upon the first surface or the second surface and being at least partially encapsulated between the first dielectric substrate and the second dielectric substrate;

a first ground plane provided on a third surface of the first dielectric substrate, the third surface being an opposing and substantially parallel surface to the first surface;

a second ground plane provided on a fourth surface of the second dielectric substrate, the fourth surface being an opposing and substantially parallel surface to the second surface;

a trench formed through the first dielectric substrate and the second dielectric substrate, the trench extending between and being substantially perpendicular to the first ground plane and the second ground plane; and

a conductive material deposited in the trench, the conductive material arranged to be in electrical contact with each of the first ground plane and the second ground plane.

[Claim 2] The radio frequency circuit of claim 1 wherein the pair of reference conductors is formed from the conductive cladding disposed upon the first substrate.

[Claim 3] The radio frequency circuit of claim 1 wherein the conductive material deposited in the trench is configured to form a pair of boundary walls disposed substantially perpendicular to the first and second ground planes and the co-planar arrangement of the transmission line and the pair of reference conductors, the pair of boundary walls being electrically continuous and in electrical contact with the first and second ground planes such

that the pair of boundary walls and the first and second ground planes form a conductive electromagnetic boundary around the transmission line in at least two dimensions.

[Claim 4] The radio frequency circuit of claim 1 wherein the pair of boundary walls is in electrical contact with the pair of reference conductors.

[Claim 5] The radio frequency circuit of claim 1 further comprising an electrical conductor disposed through a hole in at least one of the first dielectric substrate and the second dielectric substrate, the electrical conductor being in electrical contact with the transmission line.

[Claim 6] The radio frequency circuit of claim 1 wherein the transmission line produces 1.2 decibels or less of insertion loss per inch at 70 GHz.

[Claim 7] A method of fabricating an electromagnetic circuit, the method comprising:

providing a first dielectric substrate having a conductive cladding disposed upon a first surface thereof;

machining the conductive cladding to remove a portion of the conductive cladding to form a transmission line, the removed portion forming a respective gap between the transmission line and a remaining portion of the conductive cladding, at least some of the remaining portion of the conductive cladding forming a pair of reference conductors on either side of, and co-planar with, the transmission line;

providing a second dielectric substrate having a second surface and positioning the second dielectric substrate so that the second surface faces the first surface, thereby at least partially encapsulating the transmission line and the pair of reference conductors between the first dielectric substrate and the second dielectric substrate;

providing the first dielectric substrate with a first ground plane disposed on a third surface, the third surface being an opposing and substantially parallel surface to the first surface, and providing the second dielectric substrate with a second ground plane disposed on a fourth surface, the fourth surface being an opposing and substantially parallel surface to the second surface, each of the first ground plane and the second ground plane being substantially parallel to each other and to the co-planar arrangement of the transmission line and the pair of reference conductors;

machining the first dielectric substrate and the second dielectric substrate to form a trench through the first dielectric substrate and the second dielectric substrate, the trench extending between and being substantially perpendicular to the first ground plane and the second ground plane; and

filling the trench with a conductive material, the conductive material arranged to be in electrical contact with each of the first ground plane and the second ground plane.

[Claim 8] The method of claim 7 wherein the conductive material is also arranged to be in electrical contact with the pair of reference conductors.

[Claim 9] The method of claim 7 further comprising:

drilling a hole in at least one of the first dielectric substrate and the second dielectric substrate to provide access to a portion of the transmission line; and

providing an electrical conductor disposed through the hole, the electrical conductor arranged to be in electrical contact with the transmission line.

[Claim 10] The method of claim 9 further comprising electrically coupling the electrical conductor to an electrical component, the electrical conductor being thereby configured to convey a signal between the transmission line and the electrical component, the electrical component being at least one of a terminal, a connector, a cable, and an electromagnetic radiator.

[Claim 11] The method of claim 7 further comprising conveying to the transmission line an electromagnetic signal having a frequency in the range of 24 GHZ to 75 GHz.

[Claim 12] The method of claim 7 wherein the conductive material arranged in the trench is configured to form a pair of boundary walls disposed substantially perpendicular to the first and second ground planes and the co-planar arrangement of the transmission line and the pair of reference conductors, the pair of boundary walls being electrically continuous and in electrical contact with the first and second ground planes such that the pair of boundary walls and the first and second ground planes form a conductive electromagnetic boundary around the transmission line in at least two dimensions.