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CLAIMS

1 1. An apparatus comprising:
2 a first circuit in a substrate and comprising a first
3 diode and a second diode (i) connected as anti-parallel diodes
4 and (ii) physically adjacent to each other in said substrate; and
5 a second circuit in said substrate and comprising a
6 third diode and a fourth diode (i) connected as anti-parallel
7 diodes and (ii) physically adjacent to each other in said
8 substrate, wherein (A) said first circuit and said second circuit
9 are (a) connected in parallel, (b) physically adjacent to each
10 other in said substrate and (c) configured to mix two input
11 signals to generate an output signal and (B) each neighboring
12 physical structure in said first circuit and said second circuit
13 that forms a diode junction is physically oriented in an opposite
14 direction along a surface of said substrate.

1 2. The apparatus according to claim 1, wherein (i)
2 said two input signals comprise a radio frequency signal and a
3 local oscillator signal and (ii) said output signal comprises an
4 intermediate frequency signal.

1 3. The apparatus according to claim 1, wherein said
2 output signal has a lower frequency than both of said two input
3 signals.

1 4. The apparatus according to claim 1, wherein (i)
2 said two input signals comprise an intermediate frequency signal
3 and a local oscillator signal and (ii) said output signal
4 comprises a radio frequency signal.

1 5. The apparatus according to claim 1, wherein said
2 output signal has a higher frequency than both of said two input
3 signals.

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1 6. The apparatus according to claim 1, wherein a
2 common spacing exists from said first diode to said second diode,
3 from said second diode to said third diode, and from said third
4 diode to said fourth diode.

1 7. The apparatus according to claim 1, wherein a
2 first cathode of said first diode is connected to a second anode
3 of said second diode and a first anode of said first diode
4 connected to a second cathode of said second diode.

1 8. The apparatus according to claim 7, wherein a
2 third cathode of said third diode is connected to a fourth anode
3 of said fourth diode and a third anode of said third diode is
4 connected to a fourth cathode of said fourth diode.

1 9. The apparatus according to claim 1, wherein (i)
2 said first circuit and said second circuit are part of a sub-
3 harmonic mixer and (ii) said output signal (OUT) is related to
4 said two input signals (IN1 and IN2) in a down-conversion mode
5 as

$$6 \quad \text{OUT} = 2 \times N \times \text{IN1} \pm M \times \text{IN2},$$

7 where N and M are harmonic integers.

1 10. The apparatus according to claim 1, wherein (i)
2 said first circuit and said second circuit are part of a sub-
3 harmonic mixer and (ii) said output signal (OUT) is related to
4 said two input signals (IN1 and IN2) in an up-conversion mode as

$$5 \quad \text{OUT} = 2 \times N \times \text{IN1} \pm M \times \text{IN2},$$

6 where N and M are harmonic integers.

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1 11. The apparatus according to claim 1, further
2 comprising a band-pass filter configured to filter a first input
3 signal of said two input signals.

1 12. The apparatus according to claim 11, further
2 comprising a high-pass filter configured to filter a second input
3 signal of said two input signals.

1 13. The apparatus according to claim 12, further
2 comprising a low-pass filter configured to filter said output
3 signal.

1 14. The apparatus according to claim 11, further
2 comprising a low-pass filter configured to filter a second input
3 signal of said two input signals.

1 15. The apparatus according to claim 14, further
2 comprising a high-pass filter configured to filter said output
3 signal.