

# EXHIBIT 4



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(54) **WIRELESS LOCAL AREA NETWORK (WLAN) USING UNIVERSAL FREQUENCY TRANSLATION TECHNOLOGY INCLUDING MULTI-PHASE EMBODIMENTS AND CIRCUIT IMPLEMENTATIONS**

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(57) **ABSTRACT**

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Frequency translation and applications of the same are described herein, including RF modem and wireless local area network (WLAN) applications. In embodiments, the WLAN invention includes an antenna, an LNA/PA module, a receiver, a transmitter, a control signal generator, a demodulation/modulation facilitation module, and a MAC interface. The WLAN receiver includes at least one universal frequency translation module that frequency down-converts a received EM signal. In embodiments, the UFT based receiver is configured in a multi-phase embodiment to reduce or eliminate re-radiation that is caused by DC offset. The WLAN transmitter includes at least one universal frequency translation module that frequency up-converts a baseband signal in preparation for transmission over the wireless LAN. In embodiments, the UFT based transmitter is configured in a differential and multi-phase embodiment to reduce carrier insertion and spectral growth.

**Related U.S. Application Data**

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(60) Provisional application No. 60/147,129, filed on Aug. 4, 1999.

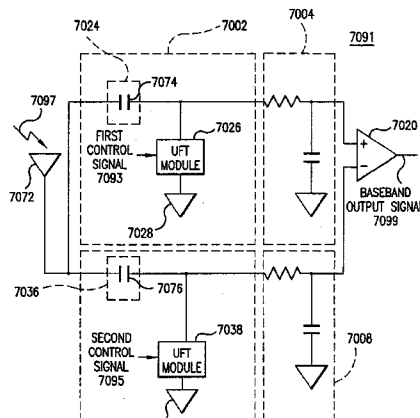
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(52) **U.S. Cl.** ..... **375/222; 375/328; 455/137**

(58) **Field of Classification Search** ..... **375/222, 375/328, 324, 349; 455/131, 137, 150.1, 455/189.1, 190.1, 313, 323, 326**

See application file for complete search history.

**32 Claims, 349 Drawing Sheets**



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