REMARKS

The Applicants appreciate the thorough examination of this application. By this amendment, changes have been made in certain claims as set forth above to overcome the Examiner's rejections and more concisely and specifically claim and describe the present invention. Claims 2, 3, 4, 5, 8, 10, 14, 17, 25, 26, 34, 35, 36, 54 and 55 remain in the application for reconsideration by Examiner Wimer. The Examiner's allowance of all pending claims is solicited.

PROVISIONAL DOUBLE PATENTING REJECTION

Claims 1-57 of the present application are provisionally rejected over application number 11/252,248. The cited application is a co-pending and commonly owned application and the parent of the present application; it was recently allowed by Notice of Allowance mailed on October 2, 2009. The Applicants will pay the issue fee and the application will issue as a patent. The provisional double patenting rejection set forth in the present application will then become an obviousness-type double patenting rejection. The Applicants are prepared to file a terminal disclaimer in the present application to overcome the obviousness-type double patenting rejection when application 11/252,248 issues as a patent.

CLAIM REJECTIONS UNDER SECTION 103

Claims 1-57 stand rejected under Section 103(a) as unpatentable over Cooper (US Patent Number 4564843) in view of Harrington (US Patent Number 4165493).

Multiple claims and claim groups have been canceled to focus the present application on one embodiment of the invention and reduce the claim amending and claim examination burdens on the Applicants and Examiner Wimer.

As discussed in detail below, the Applicants invention is not based on combinations of elements known in the art, but instead represents new and non-obvious concepts in the antenna and communications system art.

Cooper relates to the problem of retuning an antenna to follow the frequency of a frequency-hopping signal. Cooper's antenna comprises a capacitive radiating/receiving element with a plurality of discrete tuning inductors in series therewith. See Cooper column 1 beginning at line 55 and continuing to line 62. See also Cooper column 3 lines 19 and 20. Each inductor is shunted by a short-circuiting switch for short circuiting the inductor and thus tuning the resonant frequency of the antenna. As a consequence of tuning Cooper's antenna, it will present different impedances to the radio frequency input/output connector 12 in Cooper's Figure 2.

Harrington relates to protecting a power amplifier from failure or damage due to antenna loads that may cause such a failure. Harrington therefore controls the power supplied by the power amplifier to the antenna load without violating any operating parameters or limits of the power amplifier. To accomplish this objective, Harrington discloses limiting the power dissipation of the power amplifier by limiting the level of the signal input to the power amplifier. He controls the level of the input signal by monitoring device dissipation and the instantaneous output voltage.

As Harrington states beginning at line 13 of column 2, "the input signals on line 10 [input to the power amplifier/automatic level control] are modified in amplitude in accordance with the input on line 18 [a control signal derived from various operating parameters of the power amplifier elements, as illustrated in Harrington's Figure 1 and including the collector voltage, the average input power, the dissipation, the average power, the peak power and whether the output signal exceeds a threshold as determined by the threshold detector] before they are output on line 14 [the output from the power amplifier/automatic level control]." Thus to ensure that the power amplifier does not operate in a potentially damaging region, Harrington discloses limiting the amplitude of the input signal to a value that ensures no damage will be sustained as the input signal is processed through the various power amplifier stages before it is supplied to the antenna coupler 60.

Harrington explains further (beginning at line 64 in column 4) that when the antenna is tuned to a desired frequency, the load impedance presented to the power

amplifier may be non-optimal. If the antenna impedance is very low a large current is conducted through the power amplifier and if the antenna impedance is very high damaging voltages can be induced on the output transistors of the power amplifier. Thus during tuning Harrington discloses inserting an attenuator to maintain the power amplifier load impedance within prescribed limits.

Harrington explains the function of the antenna coupler 60 at lines 18-22 of column 5. The antenna coupler is required because the impedance seen looking into the antenna from the output of the power amplifier varies from 50 ohms as the frequency of the signal presented to the antenna varies from the resonant frequency of the antenna. If the signal frequency never changed, the power amplifier could be designed with an output impedance that matched the antenna input impedance at the fixed signal frequency. However, since the signal frequency does change, the antenna coupler 60 imposes an impedance transformation so that the power amplifier is always seeing about 50 ohms irrespective of the actual input impedance of the antenna. In this way the operating parameters of the power amplifier are limited to safe values.

Further, Harrington's antenna coupler 60 operates on the antenna impedance to present an appropriate impedance to the power amplifier, i.e., about 50 ohms. See Harrington's column 5, lines 18-22. Harrington does not appreciate that a "power amplifier output impedance varies according to the output power" as claimed in Applicants' amended claim 34. Thus Harrington does not match the antenna input impedance to the varying power amplifier output impedance.

The Applicant's invention is different in that the Applicants teach that the power amplifier for most efficient operation does not always want to see 50 ohms. Instead, recognizing that the power amplifier output impedance changes as the power amplifier power output (i.e., the power level of the output signal) changes, the Applicants teach "the structural elements controlled increase a power amplifier efficiency." This control of the antenna input impedance maximizes power transfer into the antenna.

Harrington states, unequivocally, that "the antenna coupler 60 operates on the amplifier load impedance [the antenna] to match the antenna and the output of the amplifier so as to present the appropriate (in one embodiment approximately 50 ohms) impedance to the amplifier 16." Harrington focuses on the change in the antenna impedance as the antenna operates at different frequencies. The Applicants focus on changes in the power amplifier output impedance as the power amplifier output power changes.

Thus clearly Harrington is not modifying the antenna to present an impedance to the power amplifier that maximizes power transfer into the antenna. The Applicants paragraph [0044] further explains this concept.

> [0044] According to another embodiment of the present invention, the antenna impedance (the PA load impedance) is controlled to present an impedance to the PA that improves a power added efficiency (PAE) of the power amplifier at a commanded PA radio frequency (RF) output power. Controlling the load impedance to present a desired impedance value from a range of impedance values permits the PA output voltage and current (which determine the PA output power) to range over values that can be supplied by the PA power supply, improving the efficiency at any commanded power level. Since many communications devices operate on battery power, improving the efficiency extends "talk time" (for a specific battery size) between battery recharges. Also, controlling the antenna (load) impedance overcomes the effects of naturally occurring antenna impedance variations as the signal frequency changes.

At the outset, it should be noted that the presented claim amendments are based on and similar to the claims (as amended) presented in the copending, commonly owned parent application 11/252,248. The two independent claims in that application (4 and 10) have been allowed.

Support for the claim amendments can be found at paragraphs [0044], [0045], [0053], [00058], and [0097], as well as other text in the application.

Amended claim 34 is based on recognizing that the power amplifier output impedance changes as the power output changes and therefor the Applicants claim controlling the antenna input impedance to increase the power amplifier efficiency.

Thus amended claim 34 includes several elements that are not present in

Cooper or Harrington and that have been combined by the Applicants into a novel and nonobvious communications apparatus. The elements include:

(1) the power amplifier output power is controllable responsive to a power related parameter of the first signal (i.e., the first signal is input to the power amplifier);

(2) the power amplifier output impedance varies according to the power amplifier output power (the Applicants state in the application that this phenomenon is known in the art);

(3) the antenna comprises controllable structural elements that are controlled to determine the antenna input impedance and therefore the impedance into which the power amplifier operates;

(4) control of the impedance into which the power amplifier operates increases the efficiency of the power amplifier;

(5) the antenna controller is responsive to the power related parameter or to the power amplifier output power or to the power amplifier output impedance for controlling the controllable structural elements; and

(6) the antenna controller also establishes the antenna resonant frequency.

The combination of Cooper and Harrington does not present nor suggest these elements of the invention.

The Applicants also now present a method claim 54 that tracks the elements of the apparatus claim 34. The method claim is therefore believed to be allowable over the cited art.

Dependent claims 2, 3, 4, 5, 8, 10, 14, 17, 25, 26, 35 and 36 depend from claim 34 and dependent claim 55 depends from claim 54. These dependent claims have been amended for consistent terminology with their respective independent claim are also believed to be allowable over the cited art due to their dependency from independent claim 34 or 54. Additionally, these dependent claims claim other patentable features of the invention.

The presented claim elements are not disclosed by the combination of Cooper and Harrington -- Harrington modifies the input signal to the power amplifier to avoid power amplifier damage while Cooper tunes the antenna resonant frequency by using tuning inductors; Cooper discloses tuning the resonant frequency dependent on the frequency of the signal to be carried on the antenna.

Although the Applicants understand that the combination of Cooper and Harrington can be used to provide a fail safe system for tuning (as in Cooper) and amplifier protection (as in Harrington), the combination cannot and does not control the structural features of the antenna to improve the power amplifier efficiency. Cooper discloses using the transformer 23 "to provide impedance matching between the 50 ohm line and the total of the radiation resistance plus the loss resistance of the antenna." This use of the transformer is standard for matching the 50 ohms of the feed line to the antenna. But there is no awareness of the problem addressed by the Applicants, that is, the power amplifier output impedance changes with the amplifier output power and further to improve the power amplifier efficiency, the antenna impedance must be changed to match, or approximately match, the power amplifier output impedance.

Harrington also refers to the impedance and explains that the coupler 60 operates on the amplifier load impedance to match the antenna and the output of the amplifier so as to present the appropriate load (in one embodiment approximately 50 ohms) to the amplifier. Here too there is no recognition of the problem addressed by the Applicants in that the amplifier output impedance changes with the amplifier output power and thus there is no disclosure in the cited art of modifying the antenna input impedance for more efficient power transfer from the amplifier as the amplifier output impedance changes. Without recognizing the Applicants' problem, it is not possible for the combination of the cited references to set forth a solution that will address the problem.

In summary, the cited art controls the antenna impedance seen by the power amplifier by controlling the seen impedance using the antenna coupler (Harrington)

and the impedance transformer (Cooper). The Applicants control the actual antenna impedance by configuring structural elements of the antenna. Advantageously, avoiding use of the coupler or transformer to change the antenna input impedance eliminates a lossy element in the signal chain.

The Applicants have responded to all of the claim rejections in the Office Action and it is believed that the claims remaining in the application are now in condition for allowance. In view of the foregoing amendments and discussion, it is respectfully submitted that the Examiner's claim rejections have been overcome. Examiner Wimer is invited to Examiner reconsider these rejections and issue a Notice of Allowance for all pending claims.

The Applicants petition for an extension of time of two months (until October 29, 2009) under 37 C.F.R. 1.136. The extension of time fee has been paid by charging to a credit card concurrent with the filing of this amendment.

If a telephone conference will assist in clarifying or expediting this Amendment or the presented claim changes, Examiner Wimer is invited to contact the undersigned at the telephone number below.

Respectfully submitted,

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