



(51) International Patent Classification:
H05H 1/36 (2006.01) *H01L 21/205* (2006.01)
H01L 21/3065 (2006.01)

(74) Agent: MCCRACKIN, Ann, M.; Schwegman, Lundberg & Woessner, P.A., P.O. Box 2938, Minneapolis, MN 55402 (US).

(21) International Application Number:
PCT/US2009/047675

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(22) International Filing Date:
17 June 2009 (17.06.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/142,062 19 June 2008 (19.06.2008) US

(71) Applicant (for all designated States except US): LAM RESEARCH CORPORATION [US/US]; 4650 Cushing Parkway, Fremont, CA 94538 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): LEMING, Andres [US/US]; 7316 Cronin Circle, Dublin, CA 94568 (US). KUTHI, Andras [US/US]; 717 Pamela Wood Street, Thousand Oaks, CA 91320 (US). ANDERSON, Thomas [US/US]; 100 Anderly Court, Hayward, CA 94541 (US).

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: MATCHING CIRCUIT FOR A COMPLEX RADIO FREQUENCY (RF) WAVEFORM

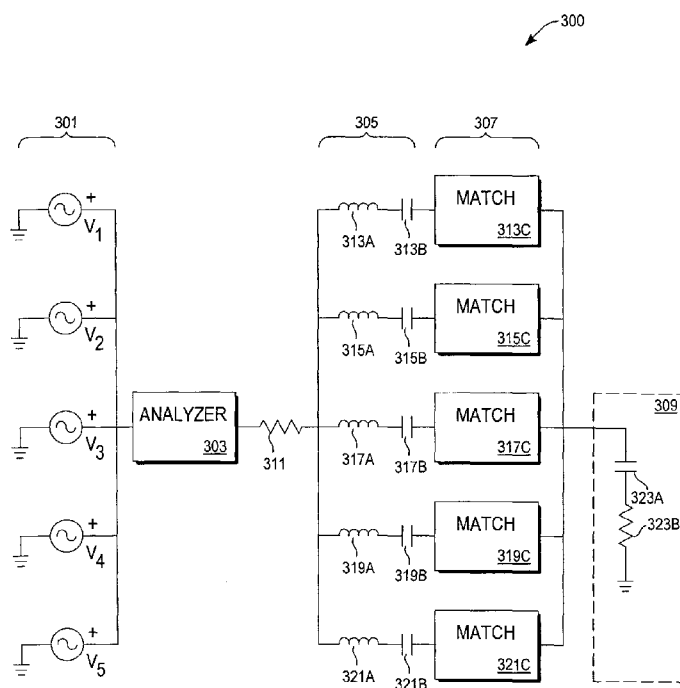


Fig. 3

(57) Abstract: A complex waveform frequency matching device is disclosed. In various embodiments, the matching device comprises a plurality of radio frequency generators coupled in parallel with one another. Each subsequent one of the plurality of radio frequency generators is configured to produce a harmonic frequency related by an integral multiple to a frequency produced by any lower-frequency producing radio frequency generator, thereby generating a complex waveform. A plurality of frequency splitter circuits is coupled to an output of the plurality of radio frequency generators, and each of a plurality of matching networks has an input coupled to an output of one of the plurality of frequency splitter circuits and an output configured to be coupled to a plasma chamber.

**Published:****(88) Date of publication of the international search report:**

25 March 2010

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*