

GSM
 , 가 가
 가
 . ISDN
 VLSI(Very Large Scale Integra
 tion)

1989 , ETSI(European Telecommunications Standards Institute) GSM . 19
 90 , 가 , GSM 1 가 1991 . 1991
 Global System for Mobile Communications(GSM)
 1992 , GSM 가 가
 가 . 129
 () 324 GSM , GSM . 1999 1
 , GSM Memorandum of Understanding Association , GSM 1 2 가 .
 2001 2 5 GSM 가 가 . , GSM
 1 1 , 60% 가 .

25MHz 2 GSM . 1a , 890 - 915MHz " "
 " (-) , 935 - 960MHz " " (-)
 10MHz 가 . (2 35MHz)
 GSM(EGSM; Extended GSM) . EGSM , 880 - 915MHz ,
 925 - 960MHz (1b). GSM EGSM 가 , GSM
 (880 - 890MHz 925 - 935MHz) . , 890 - 915MHz 935 - 960MHz
 1 GSM(PGSM; Primary GSM) , GSM (35MHz)

GSM , 900MHz . ETSI
 1989 GSM 1 1800MHz (DCS GSM 1800) . DCS , 17
 10 - 1785MHz , 1805 - 1880MHz (1c). , FCC(Federal Communications
 Commission) 1900MHz , PCS(Personal Communication Service)
 0 . PCS , 1850 - 1910MHz , 1930 - 1990MHz (1d).
 GSM PCS GSM 190

GSM 가 , , 895.2MHz
 . GSM(900MHz) , 45MHz가 .
 , 940.2MHz가 . DCS PCS ;
 . DCS , 95MHz , PCS , 80
 MHz .

GSM (20) 가 2 . GSM (20) 4
 : (MS)(30), (BSS)(40),
 (NSS)(50) (OSS)(60). , MS(30)
 가 ; BSS(40) MS(30) MS NSS(50) ; NSS(50)
 PSTN ISDN ; OSS(60) G
 SM .

(30) (ME)(32) 가 (SIM)(34) . ME(32)
 가 . SIM(34) 가 가 .
 , GSM . SIM(34)
 가 IMSI(International Mobile Subscriber Identity)
 IMEI(International Mobile Equipment Identity)가 . SIM GSM
 GSM (PIN) GSM SIM(34)

MS(30) " Um" (36) BSS(40) . BSS(40)
 (BTS; base transceiver stations)(42) (BSC; base station controllers)(44)
 . BTS
 Um . BTS
 BSC(44) BTS(42) . BTS - BSC " Abis" (46)
 , BTS GSM . BSC
 (handover)

BSS(40) BSC GSM " A" (51) (50) . A
 SS7
 (MSC; Mobile Switching Center)(52) NSS(50) 1 . MSC(52) 가
 가 (70) . MSC(52)가 (70) ISDN
 (Integrated Services Digital Network)(72), PSTN(Public Switched Telephone Network)(74), PLMN(Publ
 ic Land Mobile Network)(76) PSPDN(Packet Switched Public Data Network)(78)가 .

MSC(52) 4 . HLR(Home Location Regi
 ster)(54) MSC 가 가
 , 가
 ster)(56) MSC 가 . VLR(Visitor Location Regi
 ntity Register)(58) . EIR(Equipment Ide
 l ME
 가
 . AuC(Authorization Center)(59) 가

GSM OSS(60) OMC(Operation Maintenance Centers)

GSM 200kHz TDMA(Time Division Multiple Access)
 TDMA (80) 4.615ms 8 TDMA " " 8 0.577ms (0-7)

TDMA TDMA (80) 1 1
 4 8 1 8

3 GSM 가 GSM
 가 가

GSM, DCS, PCS 가

(IF) 가 (SAW) 가

(4011) (RF) (4005) (LO) (4008) 1 (4012)
 001) (4006) (BPF)(4003)
 2 (4002) (IF) (4010)
 (4002) (LO) (4009) (4002) (4014) (4015)
 (LPF)(4004) LPF(4004) (4007)

1 (4001) RF LO
 RF (4011) f_{RF} , LO f_{LO1} RF

(4012) $(f_{RF} - f_{LO1})$ $(f_{RF} + f_{LO1})$ 1 가 (f
 $f_{RF} - f_{LO1}$) f_{IF} , f_{RF} 900MHz , f_{LO1} 450MHz , f_{IF} 450MHz
 1 1350MHz 450MHz

BPF(4003) F_{IF} , IF 1 ,
 ($f_{RF} + f_{LO1}$) . BPF(4003) $f_{RF} - f_{LO1}$
 (4002) (4002) (4010) .
 (4002) LO (f_{LO2}) (4010)
 (f_{IF}) (4002) 2 , (4014)
 (f_{IF}) 2 가 . 1 가 , 가 ,
 (4002) LPF(4004) . LPF(4004) (4002)
 (4002) f_{IF} 2 .
 (4007)
 20 RF (4011)
 가 (4001) , 1
 1 2 1 BPF(4002) (4002)
 , LPF(4004) , LPF(4004)
 , 10 2 1 , RF
 2 , 1 (4001)
 BPF(4003) , 2 (4002) LPF(4004) .
 20 , 20 ,
 IF RF (blocker)
 DC (self - conversion) .
 4 , 4
 LO") (211) (RF) (219) (200) (211) (")
 (214), (201) , LO LO ,
 (f_{RF}) 4 , LO (f_{LO}) RF
 (201) (f_{BB}) 1 , $f_{LO} = f_{RF}$ 가 (211)
 LO) 1 LO RF 2 (2f
 (214) (201) (213) LPF(212) . LPF(212) ($2f_{LO}$)
 (f_{BB}) (211) LPF(212) . LPF(212)
 (200) RF (215) .
 4 RF IF 2 , 가
 RF IF

4 , LO (216) 가 RF (211) LO , LPF(212) , (215)

RF 가 LO RF (211) (215) 4 217

RF LO RF 4 218 , LO 가 (200) LO

GSM , 4 ,

RF LO 가 900MHz , ,

DC 가 DC DC GSM 가 ,

가 가 ,

" MULTI - BAND TRANSCEIVER UTILIZING DIRECT CONVERSION RECEIVER" 1999 8 31
 09/386,865 " DIRECT CONVERSION RECEIVER" 1999 3 2
 09/260,919 가 ,
 " PREPROCESSOR AND RELATED FREQUENCY TRANSL
 ATOR" 1999 3 2 09/261,056 " DIRECT CONVERSION RECEIVER EM
 PLOYING SUBHARMONIC FREQUENCY TRANSLATOR ARCHITECHTURE AND RELATED PREPROCESSOR"
 1999 8 27 09/386,956 , 가 ,

RF
 가 GSM D
 CS , GSM, DCS PCS ,

(DCR) 가 . 가

1 2 . 1 가 1 , 2 가 2 ,
 , 3 가 가

1 , 가 . 가 DCR
 1 (f₁) , DCR
 (1/n)f₂ , 2 n 1 . (f₂) n , n 1 . , f₁ " "
 " " " " " " . 가 .)

1 f₁ , f₂ . n . , (f₂)
 가 . , 2 n
 2 가 1 (f₁) f₁ , f₂ . ,

1 2 , 1 2 가 . , 2 . , 2
 1 (f₂) (f₁) , 1 DCR (f₁)

1 2 n (f₁) . n (f₁)
 . , 1 2
 가 (f₁)

가 가 ,

가 . ,

가 , 1/4 , , 1/4 , 1/4 .

1 , 1/4 .

n n DCR

, 1/4 가 가

가 1 , ,

가 , 가 n

, n 1 .

가 1/4 ,

RF , LO 가 (f₁) 2 가 RF LO , 2 (f₂) 1/2 .

DCR , 가 GSM DCS , DCR GSM 925 - 960MHz /

13MHz 480MHz 가 . PLL 2 DCR DCS (PLL) . PLL 1805 - 1880MHz N . PLL 450.25MHz . PLL 1 DCR LO 가 . PLL 2 DCR LO 가 .

GSM DCS , PLL , PLL 가 GSM DCS 1/2 1/4 가 1/2 , DCS , DCS DCR LO 가 DCS

, 1/4
 , 1/4
 95MHz , PCS , GSM 80MHz , DC 45MHz
 가 , GSM , 13MHz 가 , 3
 , 39MHz , DCS , 13MHz 가 ,
 7 , 91MHz
 , (division factor) PLL
 , GSM , 450 - 480MHz PLL 가 ,
 10 , 45 - 48MHz PLL , 450 - 480MHz PLL
 가 , 5 , 90 - 96MHz
 , 1/4
 1/4 1/4
 가 , DCS , 1710 - 1785MHz , GSM , 890
 - 915MHz
 , PLL , PLL
 PLL LO 가 , DCS LO , GSM
 LO 가 , PLL PLL
 ;
 , n ; , n 1 ;
 ;
 1 2 가 ,
 1 2
 1 2
 RF 1 , 1 , 2 2
 ,
 ,
 1 1 가 , 2 , 2
 2 가 3 , 가 2 , 1

1 2

1 가 2
 , 2 :f₁ nf₂.
 1

1 2 2
 n

2 n , n f₁ f₂

1
 가

n 2
 2 , n 2

가 1

가

(1)

1/n 2

1 2

1 2
 , f₂ 1/nf₁
 f₁ nf₂

2
 (f₂)
 2 , f

2

1

2

2

2

2

1

가

LO 가 RF

가

가 RF

20

, BPF 4003 . IF

(4002)

, IF

RF LO RF RF RF RF LO
 2 (LO 가)
 2 RF f_{BB}

- 1a GSM ;
- 1b EGSM ;
- 1c GSM 1800 DCS ;
- 1d GSM 1900 PCS ;
- 2 GSM ;
- 3 TDMA ;
- 4 ;
- 5 ;
- 6 - ;
- 7 ;
- 8 1 ;
- 9 2 ;
- 10 3 ;
- 11A - 11F ;
- 12a - 12b ;
- 13 ;
- 14a - 14b ;

15a - 15b ;
 16 ;
 17 ;
 18A - 18C 13 ;
 19 ;
 20 가 ;
 21 RF LO ;
 22 ;
 23 (a) - (d) 22 ;
 24 ;
 25 ;
 26 1 ;
 27 2 .

A.

1.

GSM MHz	, " GSM" ; " DCS" ; " PCS"	880 - 915MHz 1710 - 1785MHz 1850 - 1910MHz	925 - 960MHz 1805 - 1880 1930 - 1990MHz
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RF

가 GSM, DCS PCS

가 GSM DCS

5 (30) 02) 10)	(100) GSM DSP(102)가 (114)	, 가 2 (30) (112) (116)	(100) GSM (20) (116) DSP(102)	(100) (20) (DSP)(1) (1) DSP(102)
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DSP(102)가 (104) (106)
 (104) GSM (106)
 , DSP(102) 160 - 12 x 12mm , DSP(102) 128 - TQFP (CABGA)
 (114) , DSP(102) IC(108) (110), (112) (114)
 . IC(108) DSP(102) (110), (112) (114)
 , ADC DAC CODEC (ADC), (DAC)
 , DSP(102) (114) IC(108) ADC
 DAC , I O I Q IC(108)
 (116) (110) (116)
 I Q , IC(108) , DSP(102) (112)
 IC(108) . IC(108) 100 - TQFP, 100 - 10 x 10mm CABGA
 IC(PMIC)(118) (120) , (100)

(100) 가 가 , 가 ,

(100) , GSM, DCS PCS ,
 200kHz () ,
 ; DCS , 95MHz ; PCS , 45MHz 80MHz

(100) ,
 , GSM, DCS GSM DCS , GSM
 , GSM PCS GSM , (- GSM)

2.

6 (110) (110) (320), (3
 21), / (306) (307) .

(321) (301), (303) (302) (110)
(320) (311), (312), (DCR)(309), (308), (L
NA)(309), (313)

/ (306) (110)
/ (306) (554) PA(304) (307)
/ (306) (555) (307) (308)

, / (306)
/ (306) (321) (556)
/ (306) (320) (557)

(300) (300) (302)
(300) (300) , 가 (301)

(302)
, 45MHz ; DCS GSM
PCS , 80MHz . 95MHz ;

(303) (320)
311) n (n 1) (323) (323) (
, VCO 가 가 (VCO)
VCO VCO , (301) / (306)

(321) PA (305) (303) (PA)(30
4) 가 . PA (305) PA PA(304) PA(304) PA
(305) PA(304) . PA(304)
PA (305) PA(304) , PA(304)
, PA(304) PA 가 , (301)
/ (306) PA PA ,

, (307) / (306) (308) (307)
(308) 가 . (308) 가 ,
, (308) 가 . GSM
(308) 925 - 960MHz ; DCS
(308) 1805 - 1880MHz ; PCS
(308) 1930 - 1990MHz . (308)

/ (313) / (306)

(308) 가 , (LNA)(309) , LNA(309) LNA
 LNA , / (313) / (306)

3.

LNA(309) (DCR)(310) (310) 7
 (438) 7 (438) 1
 (432) 2 (430) 가 1 (432) 1 (431)
 , 2 (433) 2 (430) , (311) (223)
 , (438) 1 (431) , (311) (312)
 , (311) (311)
 가 , (312)
 m(, m 1) m , (311)

(323) (f₁) (323)가 (324) (f₂),
 n (n 1) 가 (311) (312)
 2 , f₁ ≐ (1/n)f₂ (, n 1) (324) (438)
 (430) 가 .

1 (432) f₂, f₁, f₂ n
 f₂ (431) (432) f₁ f₂ . f₂ (1/n)f₂
 GSM 88dB .
 , 2 (433) f₂, f₁, f₂ n
 . f₂ (1/n)f₂ f₁
 (433) (433) . GSM 88dB

f₁ 1 2
 (308) (307) (433)
 , (432) , f₂ 2 1
 , (438) 1 2
 (438) 1 (431) 가 f₁ n
 (, n 1) f₁ n 가 f₁

(438) LO RF 가 , - 15a 15B , , LO (438)
 f_{LO} RF 가 f_{RF} 1/2 , f_{LO}

15a (1100) $f_{RF} - f_{LO}$ 가 (1101) $f_{RF} + f_{LO}$ (1102) 가 (1103) f_{RF} (1104) $2f_{RF}$ (1105) f_{RF}
 , OHZ ,

$$(A \cos 2\pi f_{RF} t) \times (B \cos 2\pi f_{LO} t) = 1/2 AB [\cos 2\pi (f_{RF} - f_{LO}) t] + 1/2 AB [\cos 2\pi (f_{RF} + f_{LO}) t]$$

$$f_{LO} \approx \frac{1}{3} f_{RF} \quad , \quad \frac{1}{2} f_{RF} \quad f_{LO} \quad ,$$

15b (1103) f_{LO} , (1104) $2f_{RF}$ (1105) f_{RF}
 $2f_{LO}$,

17 , 2000 , 1
 가 1) 2 , 2001 2 가 1 1/n (,
 n 1) 2 , 2002 , 1 가 2
 , 2003 2 가 1

2004 , 1 가 2 n , 2 n 1

RF RF 가 RF , - , 1 LO LO 가 L
 O , 2 , 1/2 .

11A LO 가 LO 11A - 11F 가 RF
 가 RF , 11C , LO RF RF
 1/2 .

11B , 11C RF 11D LO 2 RF
 , 11D .

12a , LO (607) (LPF)(609)
 9) , RF (600) (HPF)(608) . LPF(609) (606)
 , (602) SPDT (603) LO 2

HPF(408) +1 (610) -1 (611) (603)가 ,
 +1 (610) (605) , 가 , -1 (611)
 (605) (605) HPF(608) RF , LO 2 +1 -1
 가 가 , LO - ,
 , LO 2
 (1)LO 2
 ; (2) RF .

11E 11F
 LO 11A , 11E
 RF 11C (OUT⁺), 11F , OUT⁺
 (OUT⁻), 11D (OUT⁻) 가 ,
 OUT

12b 12a ,
 12b (628) LO (627) RF RF 1/2

, HPF(608) RF , LPF(609) LO
 . LPF(609) (634) SPDT (633) OUT⁻ (635)
 . SPDT (633) 2 OUT⁺ 11D - 11E RF

12a - 12b , LO RF

12a - 12b LO RF n (n 1)
 , LO RF 1/n ,
 SPDT (603, 633) LO n 가 .
 RF , 1301 RF 1/2 LO , 1300
 LO 가 RF , 1302
 RF 가 LO
 1304 LO 2
 RF 가 ,
 LO 2 +1 -1

RF

RF

가 13
 RF (700), LO (701), (702) (703)
 , RF LO 2 (702)
 (703) , LO RF 1/2 , (702)
 LO 2

18A - 18C ; 18B (700) 18A (701) LO
 RF ; 18C (703)
 가 , LO (703) LO

RF LO RF LO 14a - 14b
 B - B' 14a RF LO
 13 LO
 14b LO RF A - A'
 13 RF

4.

6 가 , DCR(310) DCR 가 ,
 LPF DCR DCR DCR 1
 n (, n 1) HPF DCR
 DCR (313) / (306)

6 (110) ,
 n (, n 1) (311)가 / (312) (323) 가
 (302)

3 TDMA 가 0.577mS , 4 4
 2.308mS 가 (110)

LNA(309) (307) (308)
 (324) , DCR(310) DCR(310)
 (313) DCR(323) (314) DCR(435)

(300) (302)

(312) (323) (303)

f_4 f_1 , f_1 f_3 , (302)

n : f_4 $nf_1 - f_3$ (305) (307)

(302), (301) (303)가 6 (303)가

(301) (302)가 가

1 8 6

GSM DCS

(306) T_x/R_x (306) (306) GSM

가 (550) ; DCS 가 (551) ; GSM

가 (552) ; DCS 가 (553) (307)

(311), (312), DCR(310a, 310b), LNA(309a, 309b), (308a, 3

08b), (313) (304a, 304b) (305) (302),

(301), (303), (305)

(311) (515) (PLL), (580),

(PFD)(516), (517), (VCO)(518) N (529)

13MHz (580) 13

(517) / VC

O GSM 1/2 DCS 1/4 , 50kHz 가 450.25MHz - 480MHz

N 0.05 가 450.25 480

2 A B N N+1

:

$((\frac{A}{A+B}) \times N) + ((\frac{B}{A+B}) \times (N+1))$

, 450.35 , N 450 , A 65 , B 35

. VCO(518) 1MHz . GSM VCO

, N, A B DCS , VCO

1/2

1/4

(519) VCO(518) (312) , DCR(310a) LO (516a)
 (303) (512) 가 (312) VCO(518)
 2 , DCR(310b) LO (561b) (303) (513)

DCR(310a, 310b) LO (561a, 561b) RF (560a, 560b) 가 LPF(525) DCR(310a) LO (561a) , LPF(570) DCR(310b) LO
 (561b) , LPF(525) 500MHz 가 , LPF(570) 1GHz
 가 HPF(521) DCR(310a) RF (560a) , HPF(526) DCR(310b) RF
 , HPF(521) 0.85GHz , HPF(526) 1.7GHz

1/4 , DCR(310a) 2 (522, 523) , DCR(310b) 2
 (527, 528) LO RF 가 LO
 (522) LO VCO(518) (522) LO
 (524) 90° , (523) LO (524)
 GSM (313) I

(527) LO (312) (529)
 90° , (528) LO (527) (313) I
 , (528) (313) Q , DC
 S

(306) (552) GSM 가 (308a) (308a) 925 - 960MHz GSM (308a) (308a)
 GSM LNA(309a) LNA(309a) DCR(310a) R
 F (560a)

(306) (553) 1805 - 1880MHz DCS 가
 (308b) (308b) DCS LNA(309b)
 LNA(309b) DCR(310b) RF (560b)

(LCO) (302) GSM 39MHz , DCS
 91MHz 1/4 (301) (531) 39M
 Hz 13MHz 3 . 91MHz 13MHz
 7 GSM 45MHz, DCS 95MHz

1/4 (301) (500, 501), (502) (503) (500)
 (300) I , LCO (302) (501)
 (300) Q , LCO (302) 90°
 (502) (503) . 2 1/4 (301)

, 1/4 (301) (303) (504), (505), (506), VCO(507), VCO(508), (509),
 (510), (511, 512, 513)

1/4 (301) (504) (504) 3
 9504 (505) (505)
 (511) (505) 2 (505) 2
 (507, 508) (505) (506) , VCO

VCO(507) (507) , 1710 - 1785MHz DCS
 VCO(508) (507)
 , 890 - 915MHz GSM

VCO(507, 508) 2 (509) , (509)
 510) RF . DCS , VCO(507) ; GSM
 VCO(508)

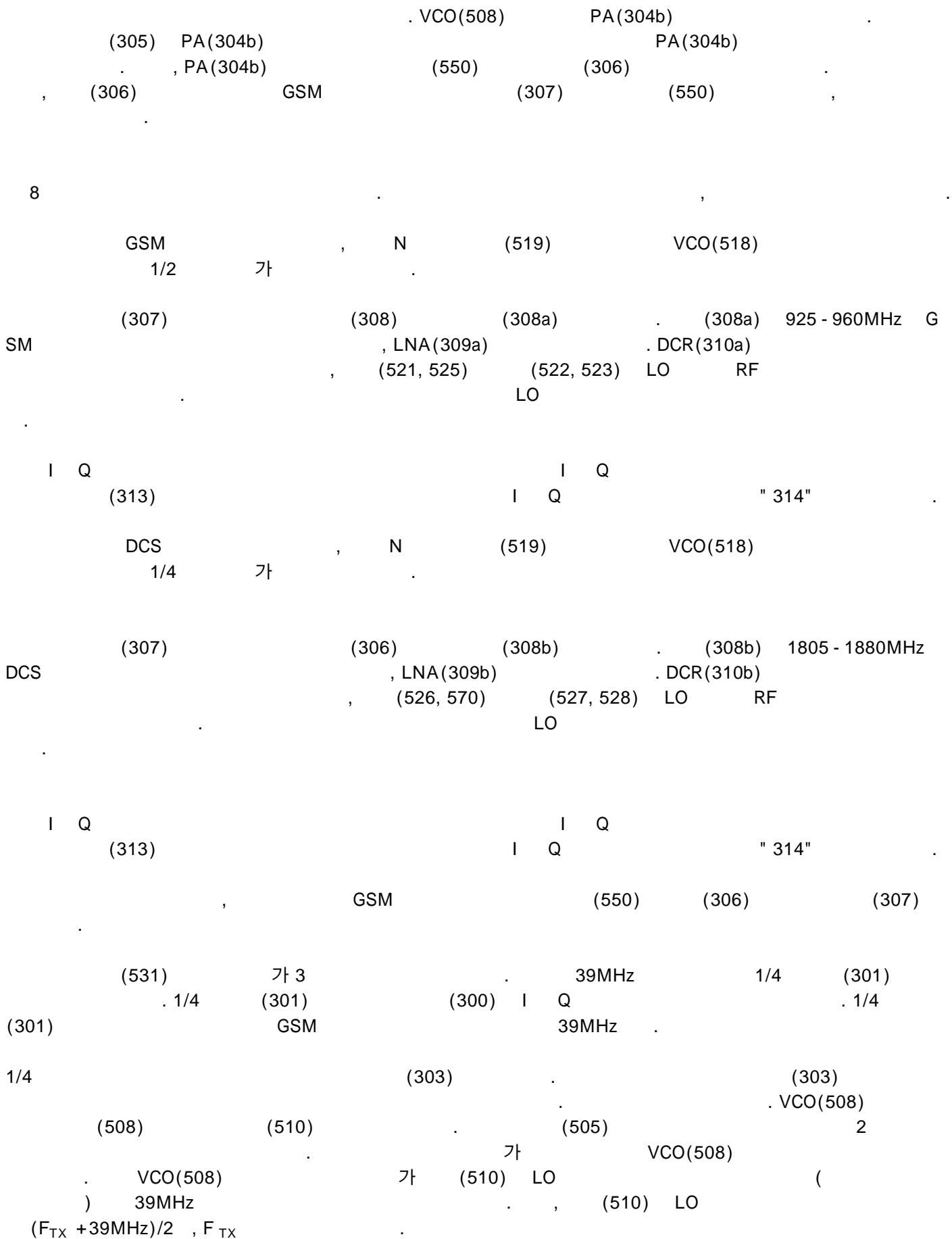
(512) VCO(508) , (512)
 500MHz (513) (312)
 (513) 1GHz

(512, 513) (571) , (510)
 RF (512, 613) (510)가 가 (510)
 510) RF (510) LO . GSM
 513) (512) (510) LO . DCS , (510)
 (510) LO

(510) LO 1/2 , D
 CS가 , LO , LO (F_{TX} + 91MHz)/2 . GSM
 , LO (F_{TX} + 39MHz)/2 (510)
 2 가 (511) (510)
 (505)

DCS , VCO(507)
 VCO(507) PA(304a)
 (305) PA(304a) PA(304a)
 , PA(304a) (551) (306)
 , (306) DCS (307) (551)

GSM , VCO(508)



DCS , (551) (306) (307) .

(531) 가 7 91MHz 1/4 (301)

(301) 1/4 (301) (300) I Q 1/4

DCS 91MHz .

1/4 (303) . (303)

(509) (510) (505) VCO(507)

가 VCO(507) (510) LO (510) LO

(F_{TX} +91MHz)/2 , F_{TX}

2 9 9 LCO (302) LOC (302) 8

48.00MHz , 10 , GSM (580) (580) VCO(518)

DCS 90.00 - 96.00MHz , 5 , 9 DCS GSM 45.00 -

3 10 1/4 (301) LCO (302) (532)가

가 (303) (505) , 10 , 1/4 (301)

(532)

(532) 가 1/4 (301) (301)

GSM , 3 ; DCS 7 (301)

(504) (504)

(505) (505) 2

, 2

LCO (302) (511) (510) 가 ,

(515) 13MHz (532)

GSM 39MHz ; DCS 91MHz

(522) (504) (505) 13MHz

8

2 19 3000 , GSM, D

CS PCS , GSM DCS , 3001 , 3002 ,

가 , 1/2 (GSM) 1/4 (DCS) (30MHz) 가 , VCO IF

B.

1. :

RF (4111) LO (4114) (4101) 가 RF LO (4119) (4100) f_{LO} RF f_{RF} f_{LO} ≅ f_{RF} (4111) (4101) f_{BB} 1 2 LO RF , 2f_{LO} 1 가 .

(4114) (4101) (4113) LPF(4112) . LPF(4112) (4111) . LPF(4112) f_{BB} . RF (4100)

20 21 , 21 (BPF(4003)), RF IF

21 , LO " 4116" RF LO (4111) , LPF(411) 2) (4115) (4100)

21 , RF " 4117" LO RF (4111) , (4115)

RF LO 가 , LO 가 (4100) RF
 21 " 4118" LO
 21 가 GSM ,
 RF LO ,
 900MHz ,
 가 . ,
 DC GSM , DC
 가 DC

2.

1 22 (4334) (4300) RF
 1 1 , 1
 (4334)
 (4338)가 1 1 (4330), 1 (4331) (4339)
 , 1 (4330) f₁ (4334) (()
 LO) 2 f₂ 2 RF 2 LO
 , 2 f₂ 2
 , 1 f₁ 가 2 f₂ 2 f₂
 n 2 , 2 1 f₁ f₁ ≅ nf₂, n RF 1/2 ,
 2 LO , 1 RF , n 2 LO RF 1/2
 1/2

(4333, 4332)가 (4333) (4338) 1
 (4330) / 가 , (4332) (4338) 2 (4331)
 f₂ 1 2 (4330, 4332) (4333)
 , (4332) f₁ , (4333)
 (4332) (4331) (4333) (4330)

(4338) (4333, 4332) 1 2 (4330, 4331)
 1 2 , (4339)

(4338) 1 f2 n 가
 . 15 (a) , LO 가 RF (4338) 15 (a) - (b)
 LO RF 1/2 LO " 900" RF
 LO 3 1/2 RF 2 1 " 1101" 1
 LO 3/2 RF " 1102" 2

$$(A \cos 2\pi f_{RF} t) \times (B \cos 2\pi f_{LO} t) = \frac{1}{2} AB [\cos 2\pi (f_{RF} - f_{LO}) t] + \frac{1}{2} AB [\cos 2\pi (f_{RF} + f_{LO}) t]$$

1 1/2 f_{RF} f_{LO} , 2 3/2 f_{RF} 3f_{LO} ,

15 (b) , LO 2
 " 1103" RF " 1104, " 110
 5" 2 1 " 1104" 1
 , " 1105" 2 RF 2 2f_{RF} 1
 15 (b) 15 (a)

3 (a) 2 LO , 23 (a) - (d) . 2
 . LO RF 1/2 , 23 (c) 1 RF
 23 (b) 23 (c) RF 23 (d)
 . LO 2 RF
 23 (d)

12a , LO (607) (LPF)
 (609) , RF (600) (HPF)(608) . LPF(609)
 P (603) 2 LO +1 -1 (602) DTS
 (606)
 HPF(608) +1 (610) -1 (611) (603) 가 +1
 (605) (610) (605) , 가 -1 -1 (611)
 (605) 가 (605) , HPF(608) RF

1/2 RF LO 가 2 LO

(2) RF , (1) 2 LO ;

5001 LO 26 1/2 RF , 5000 RF RF ,
 5002 LO RF
 5003 RF LO , LO
 5004 RF LO , LO
 2 5005 , 2 LO RF

RF
 22 1 , 27 2 , 6000 1
 2 6001 2 1 1/n (n)
 6002 1 2
 6003 2 1

6004 , 1 2 n 2
 6005 , n 2 1
 21 가 2 1 2 , f2 ≅ 1/nf
 1 1 1 2 , f2
 1 1 2 , f1 ≅ nf2
 , f1 ≅ nf2

2 , (22 4334) 1
 가 2 , 2
 , 가 2 가 2
 1 가 가

21 21
 20 BPF(4003) IF 가 (4002) IF ,
 - IF - (off - chip)
 - (on - chip)

RF LO , 80 - 90dB 1 2 GSM/DCS

가 , 1/2 , 가 2
 LO , 1 2 , 가 1/2 RF ,

1

RF (700), LO (701), (702) 1 13
 , RF LO 2 (703) (702)
 (703) , LO 가 RF 1/2 ,
 (702) LO 18 (a) - (c) ; 18 (b) (700)
 rf RF 18 (a) (701) LO ; 18 (c) (703)
 , LO 가
 , (703) LO

2

RF (4602), LO (4601), 2 24
 , RF LO (4600) (4603) , L
 O 가 RF 1/2 , (4600) LO

3

RF (4702), LO (4701), 3 25
 , LO 가 RF 1/2 , (4700) (4603)
 , (4700) LO

4

RF LO RF LO 14a RF LO 14a - 14b
 13, 24 - 25 LO B - B' LO

14b LO

RF

A - A'

RF

13, 24 - 25

가

(57)

1.

;

가

;

가

;

;

:

가

$n(n - 1)$

(subharmonic)

1

1

2

1

2

1

(translator),

1

1

2

1

n 가

2

2.

1

1

3.

2

4.

3 ,

5.

4 ,

6.

4 ,

7.

3 ,

8.

4 ,

2 , 1 1 , 2 ,

(downconversion)

1 n 가 2

9.

1 ,

GSM DCS

10.

1 ,

11.

1 ,
n=2 .

12.

1 ,
, 가 ,
가 ,

13.

8 ,
1 가 ,
1 가 .

14.

1 .

15.

14 , , , .

16.

1 , .

17.

;
가 ;
가 ;
;
,
:

가 ,
 $n(n-1)$, 1 1
 $\frac{1}{2}$, 1 ,
 $\frac{1}{2}$, 1
 $\frac{1}{2}$, 2 , 1
 $\frac{1}{2}$, 2 , 1
 1 n 가 2
 ,
 1 .

18.

14 ,

1 , 2 , 1
 , 2 , 1
 1 n 가 2
 .

19.

;
 가 , ;
 가 ;
 ;
 ,
 ,
 ;

가 ,
 $n(n-1)$, 1 1
 $\frac{1}{2}$, 1 ,
 $\frac{1}{2}$, 1
 $\frac{1}{2}$, 2 , 1
 $\frac{1}{2}$, 2 , 1
 1 n 가 2
 .

1 n 가

2

,

가

.

20.

18

.

21.

18

,

(doubler)

.

22.

20

,

DCS

가

.

23.

18

,

,

,

가

24.

18

,

,

가

,

25.

22

,

.

26.

23

,

(divider)

27.

18

28.

n

$n(n - 1)$

1

1

2

(full du

plex)

29.

27

2

1

30.

28

2

31.

27

GSM DCS

32.

1 2 1 2 1 1 1/n(n) 2
 (multiplication factor) 1 (multiplier);

1 1/n(n) 2 2 2
 ;

1 2 1 ;

2 1 2 ;

3 .

33.

32 ,

n 2 .

34.

32 ,

1 RF .

35.

32 ,

2 LO .

36.

32 ,

.

37.

32 ,

1 1 .

38.

32 ,

2 2 .

39.

32 ,

1 .

40.

32 ,

2 .

41.

32 ,

3 .

42.

1 1 1 , 1 $\frac{1}{n(n-1)}$ 2 ;

1 $\frac{1}{n}$ 2 2 2 ;

1 2 1 ;

2 1 2 ;

3 , .

43.

1 ,

1 1 ;

1 $\frac{1}{n(n-1)}$ 2 2 ;

2 1 ;

1 2 ;

2 n 1 ,

;

1 .

44.

43

1

RF

1

.

45.

43

2

LO

1

.

46.

43

n^2

1

.

47.

1

가

,

1

1

;

1

$1/n(n)$

)

2

2

;

2

1

;

1

2

;

2

n

1

,

;

1

가

.

48.

1

1

,

1

$1/n(n)$

)

2

2

,

1

2

1

;

1

$1/n(n)$

)

2

2

2

2

;

1

2

3

;

2

1

4

;

,

5

49.

1 1 ;
 1 1/n(n) 2 2 ;
 2 1 ;
 1 2 ;
 1 2 ;

1

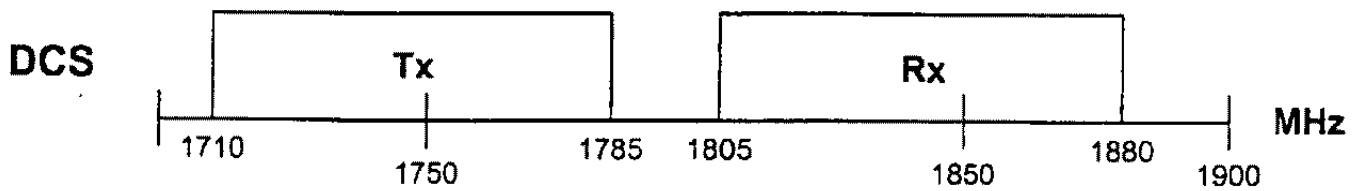
1a



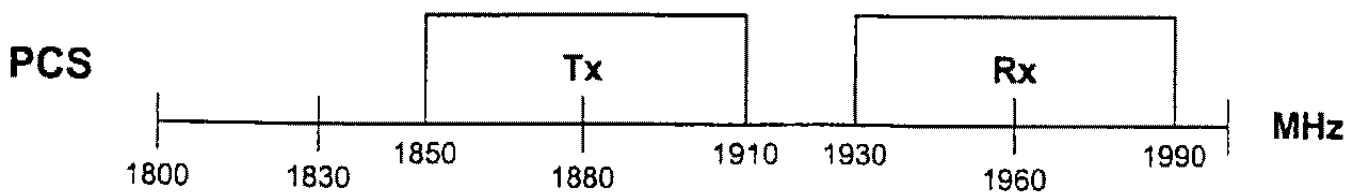
1b

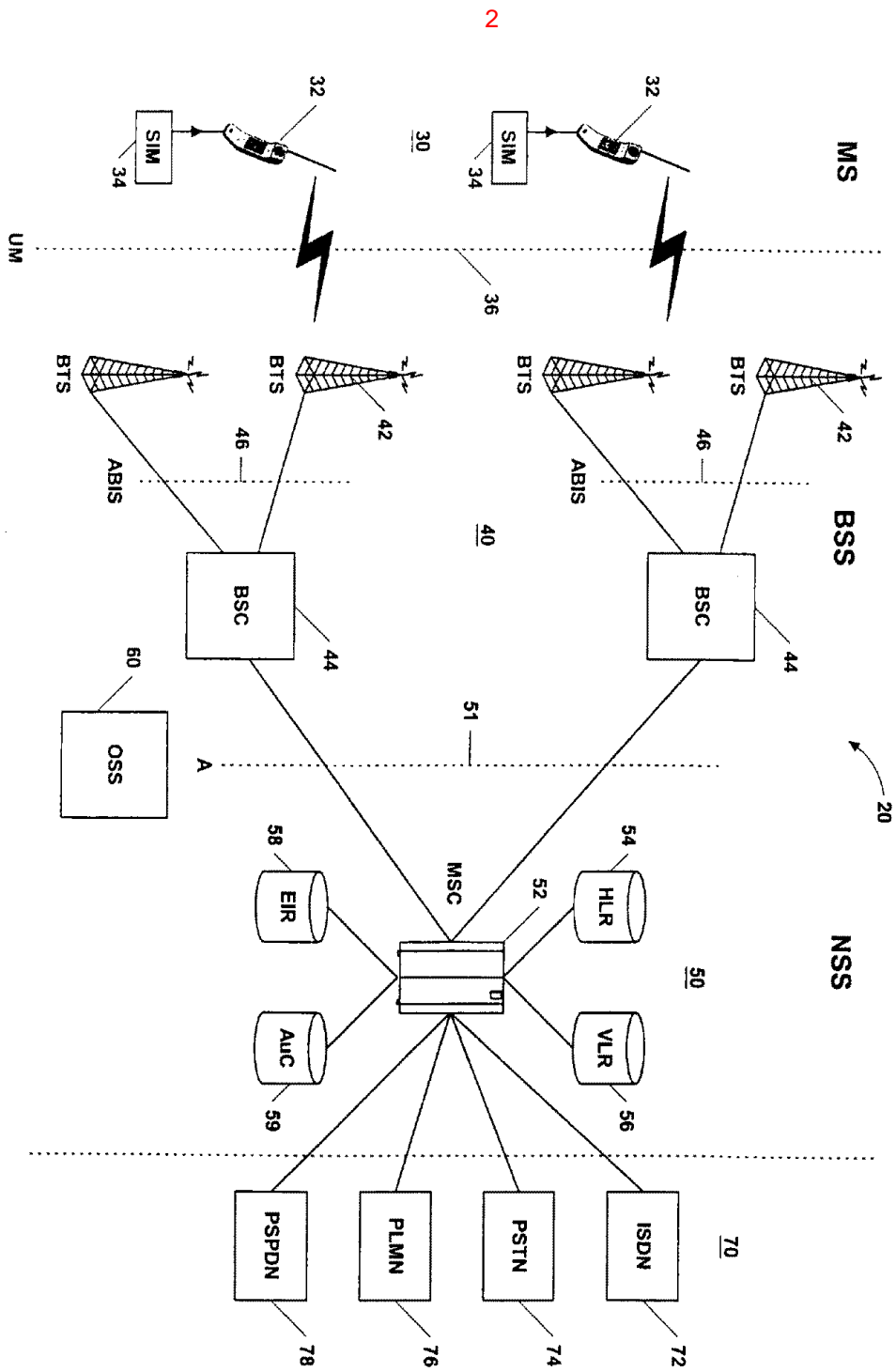


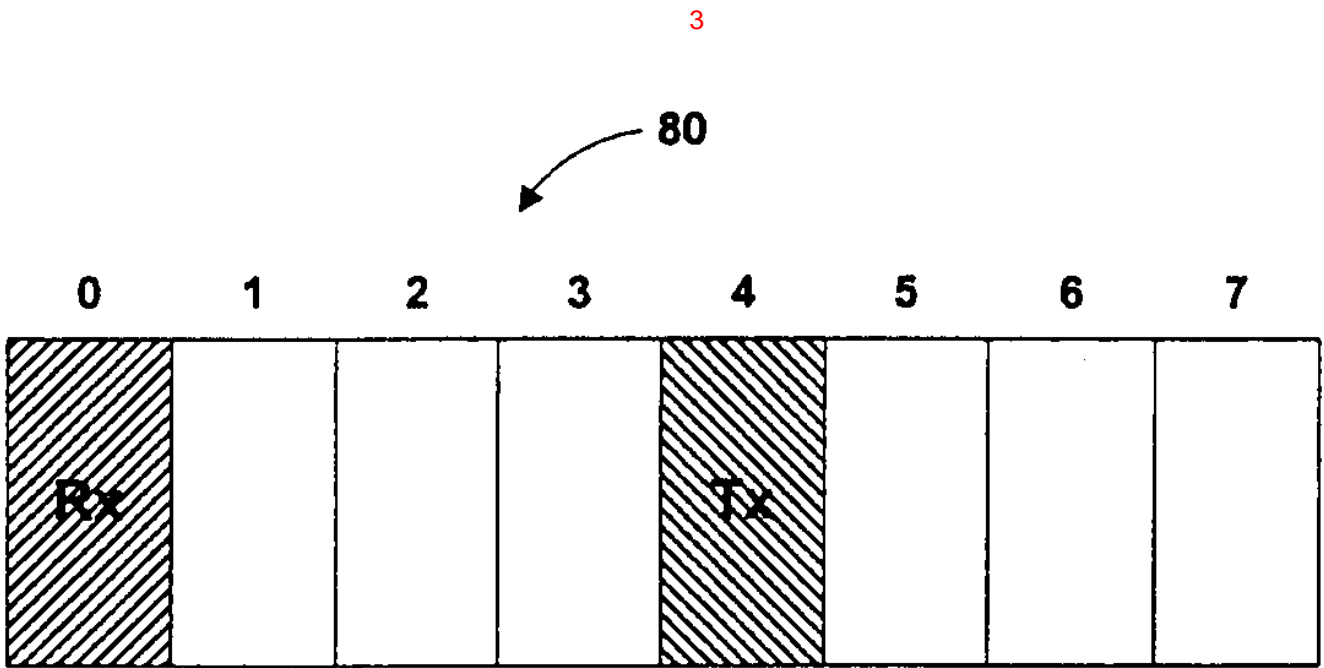
1c



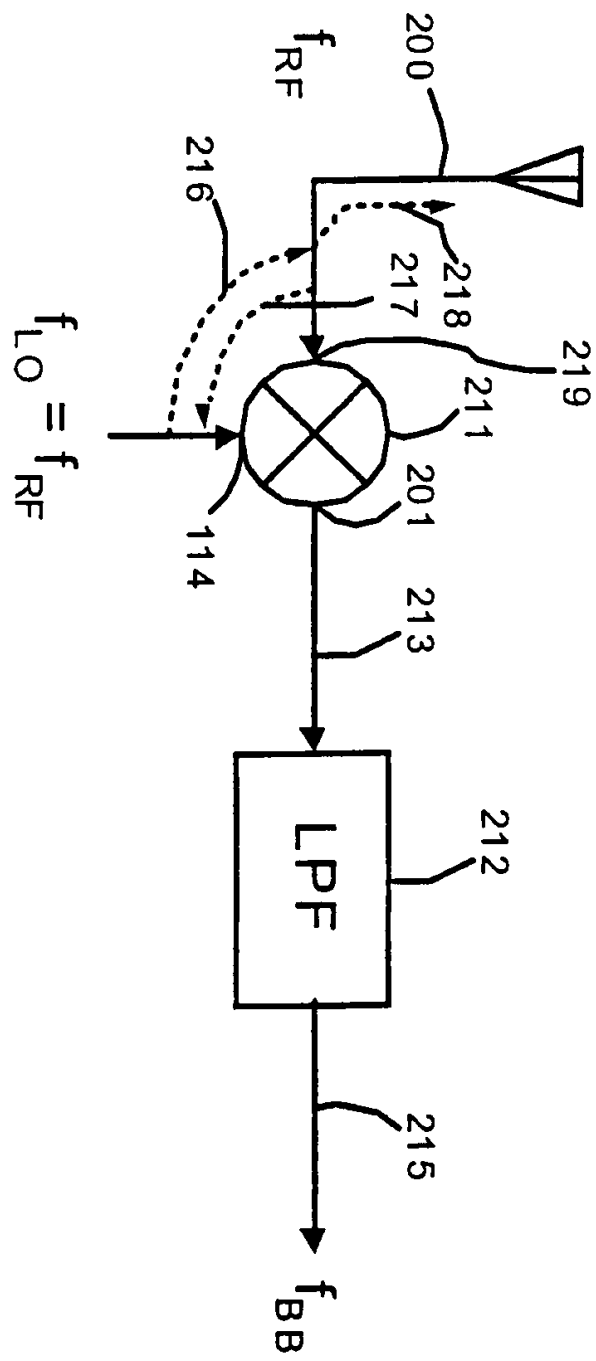
1d



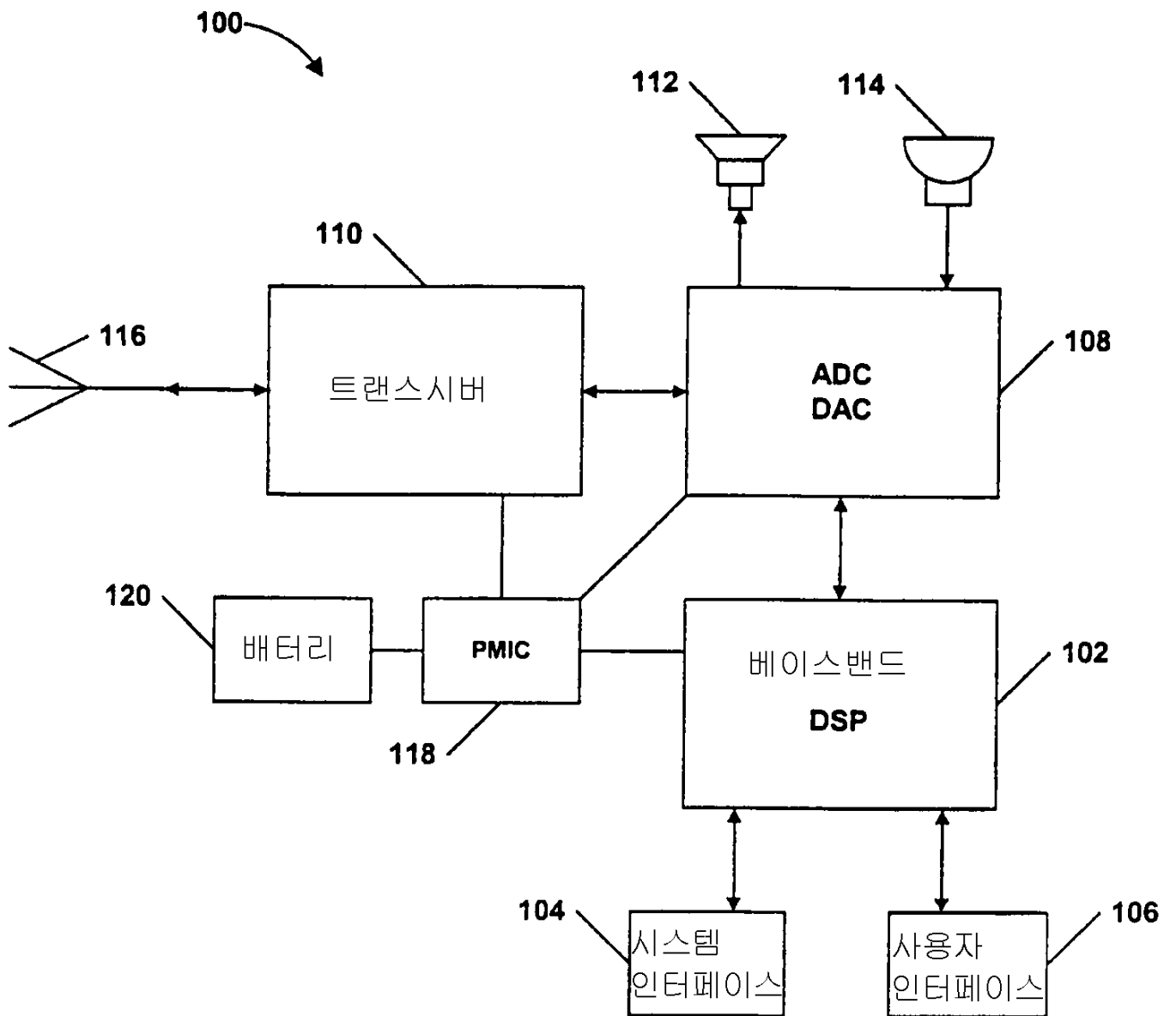


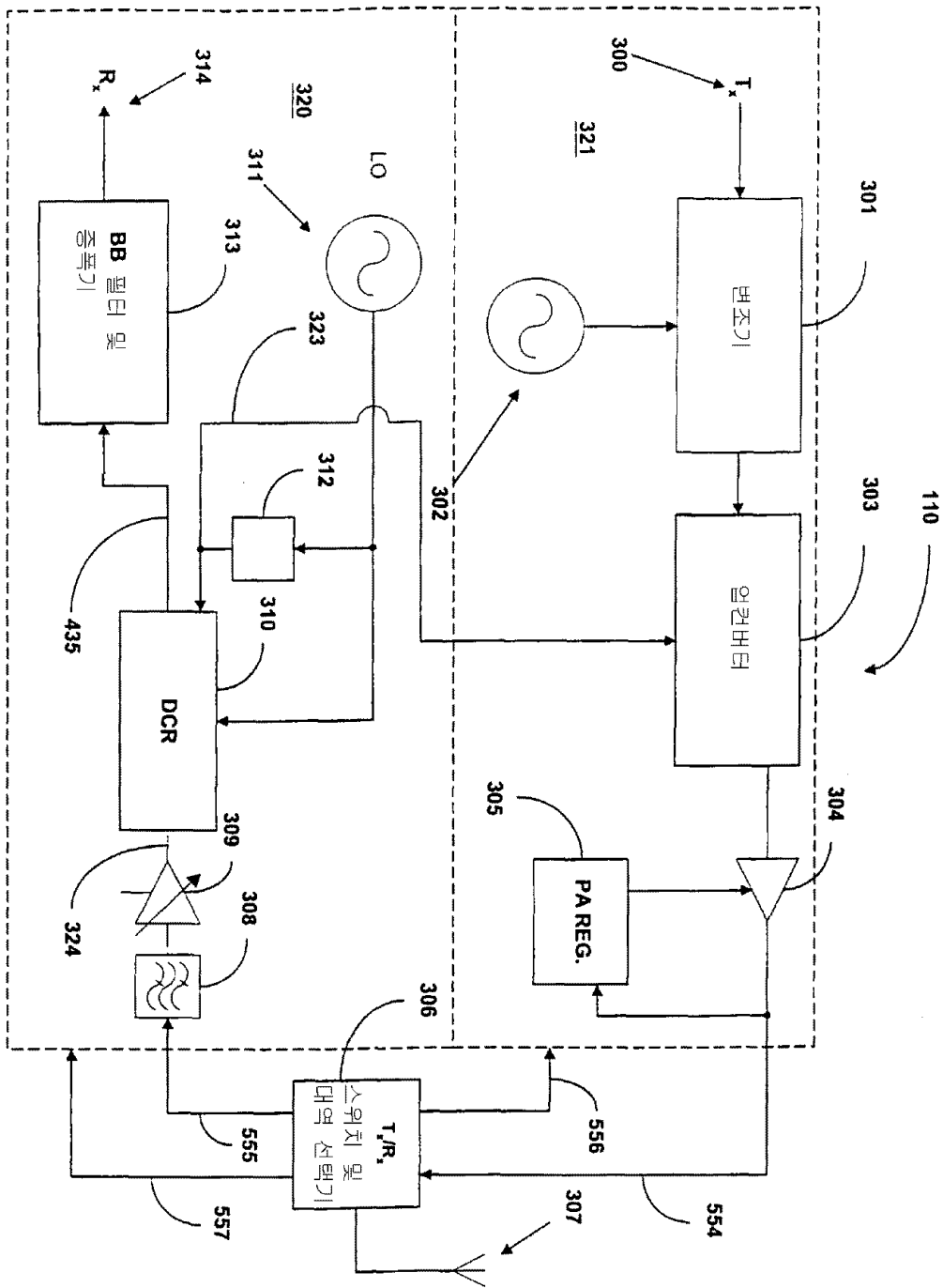


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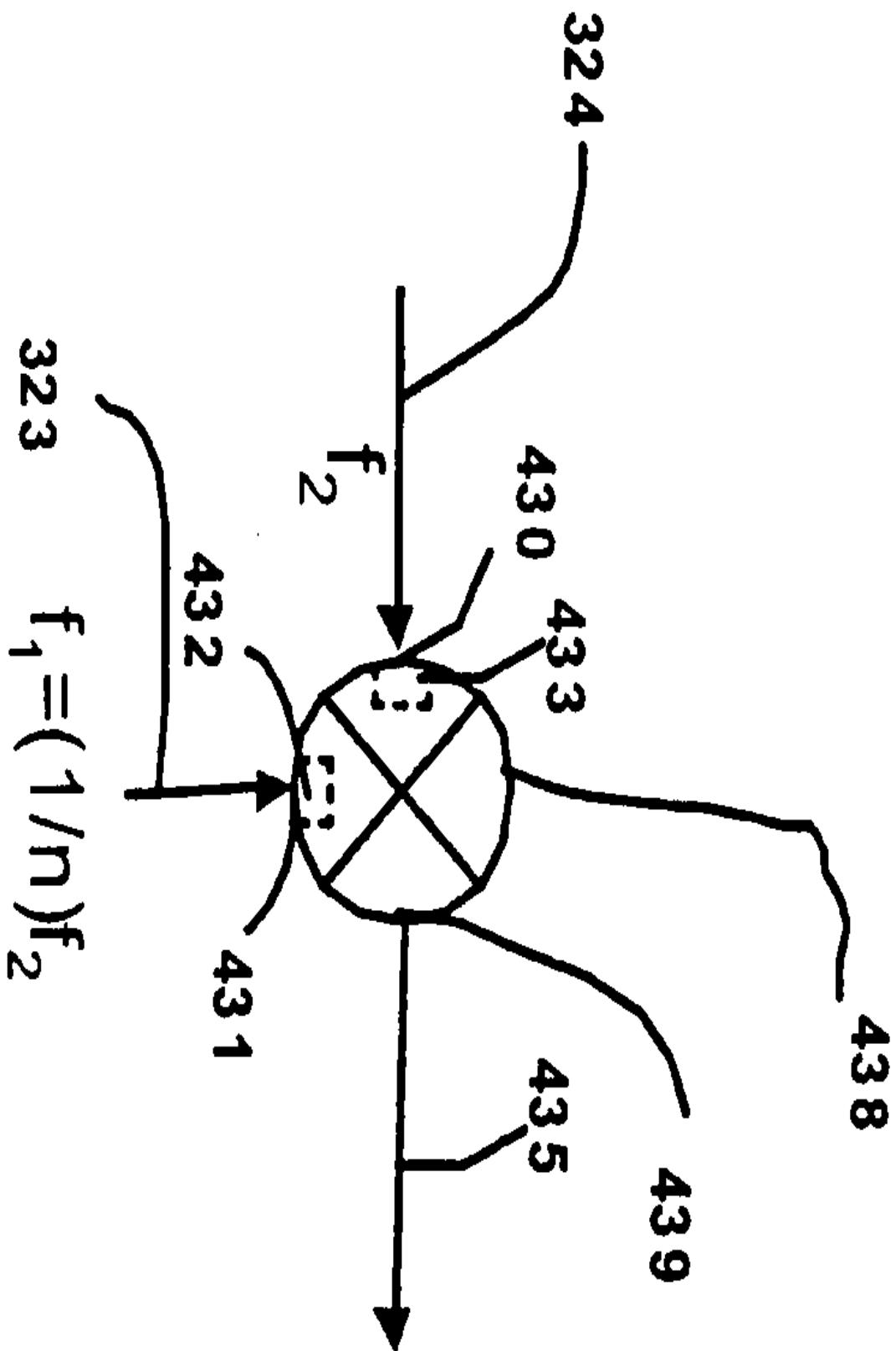


5

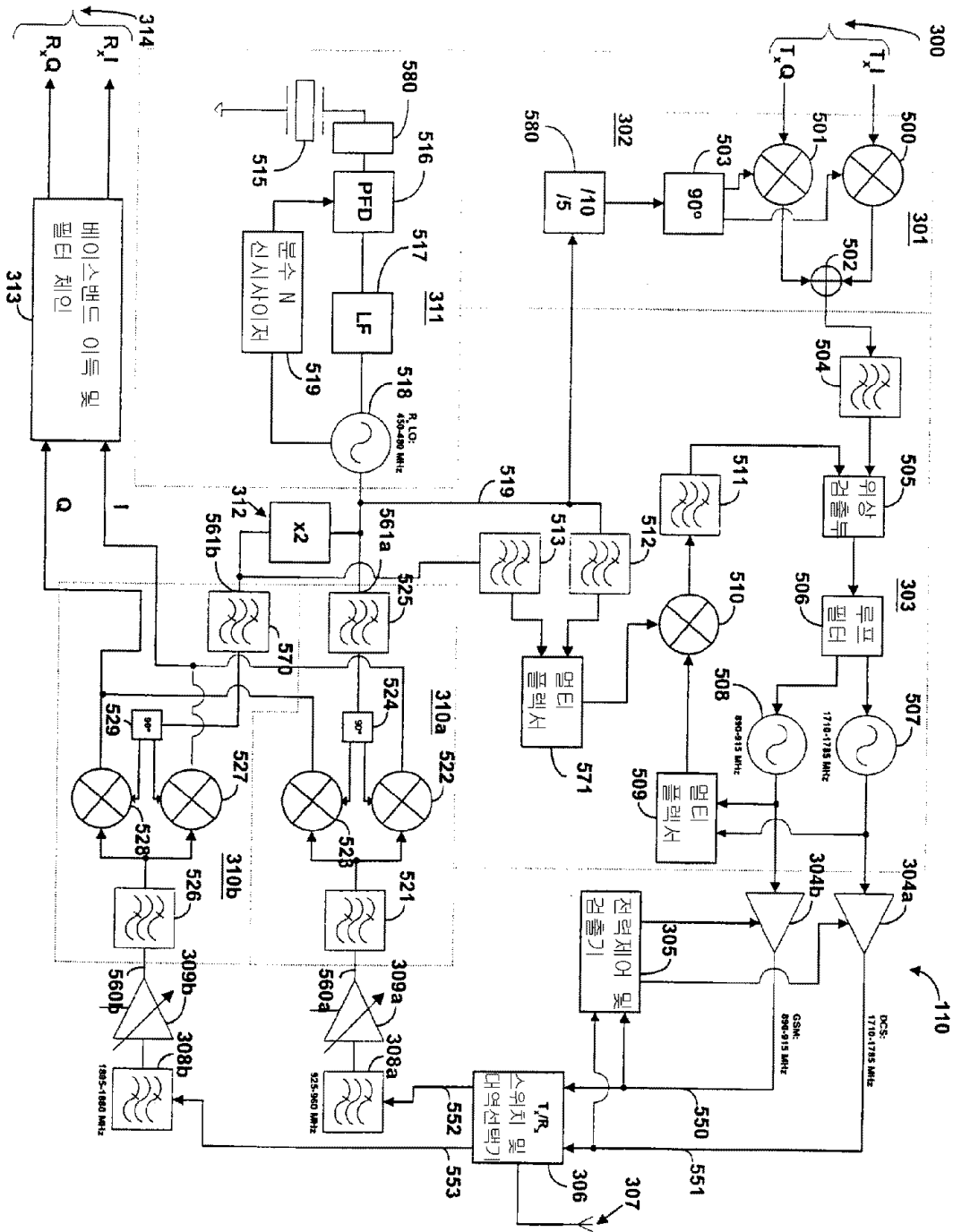


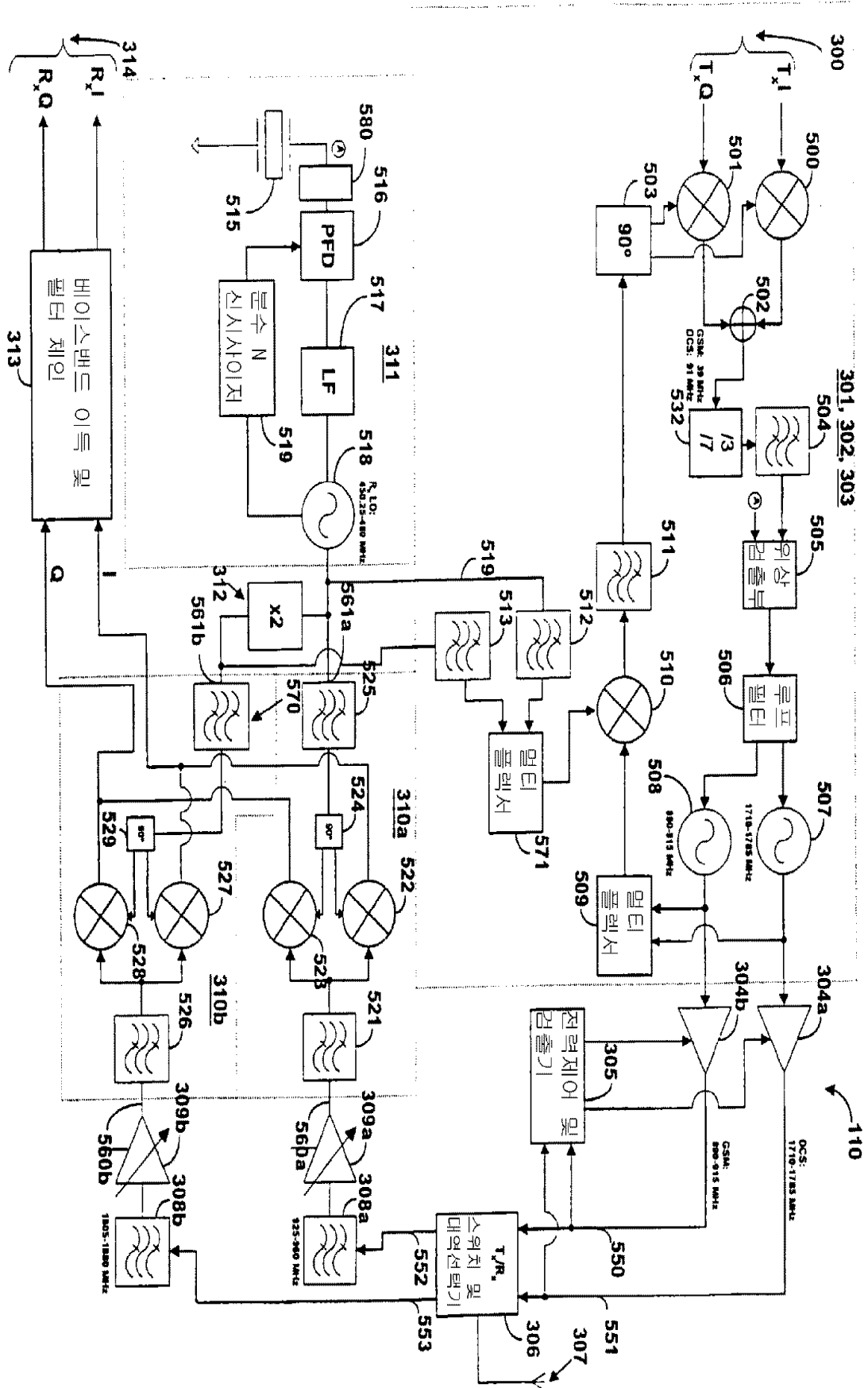


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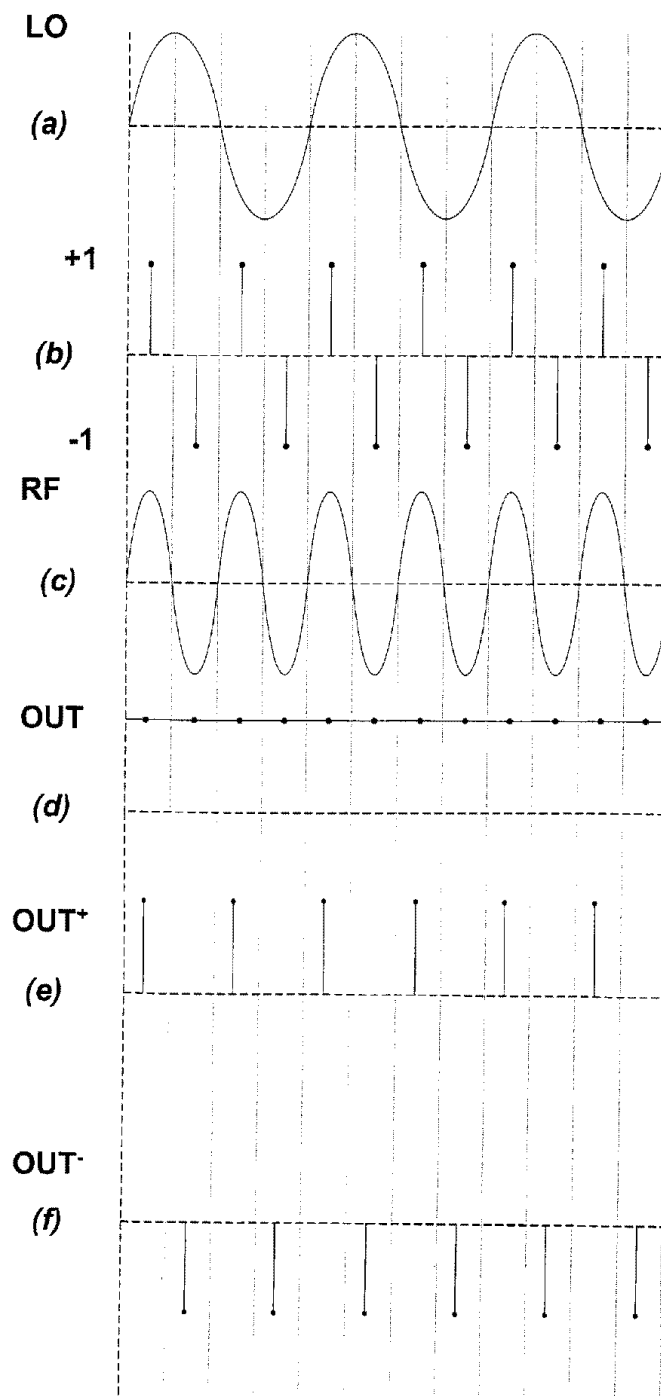


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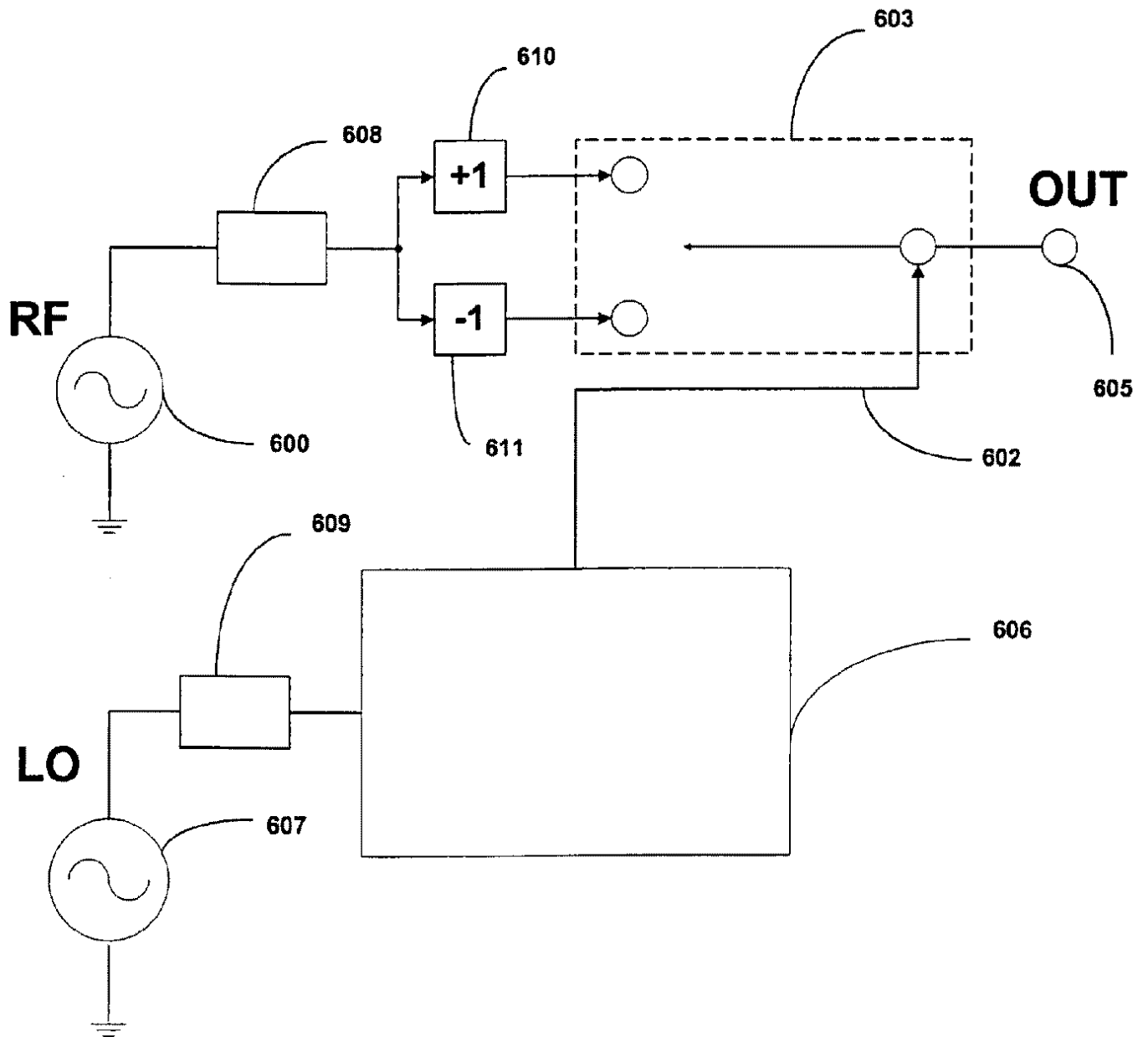




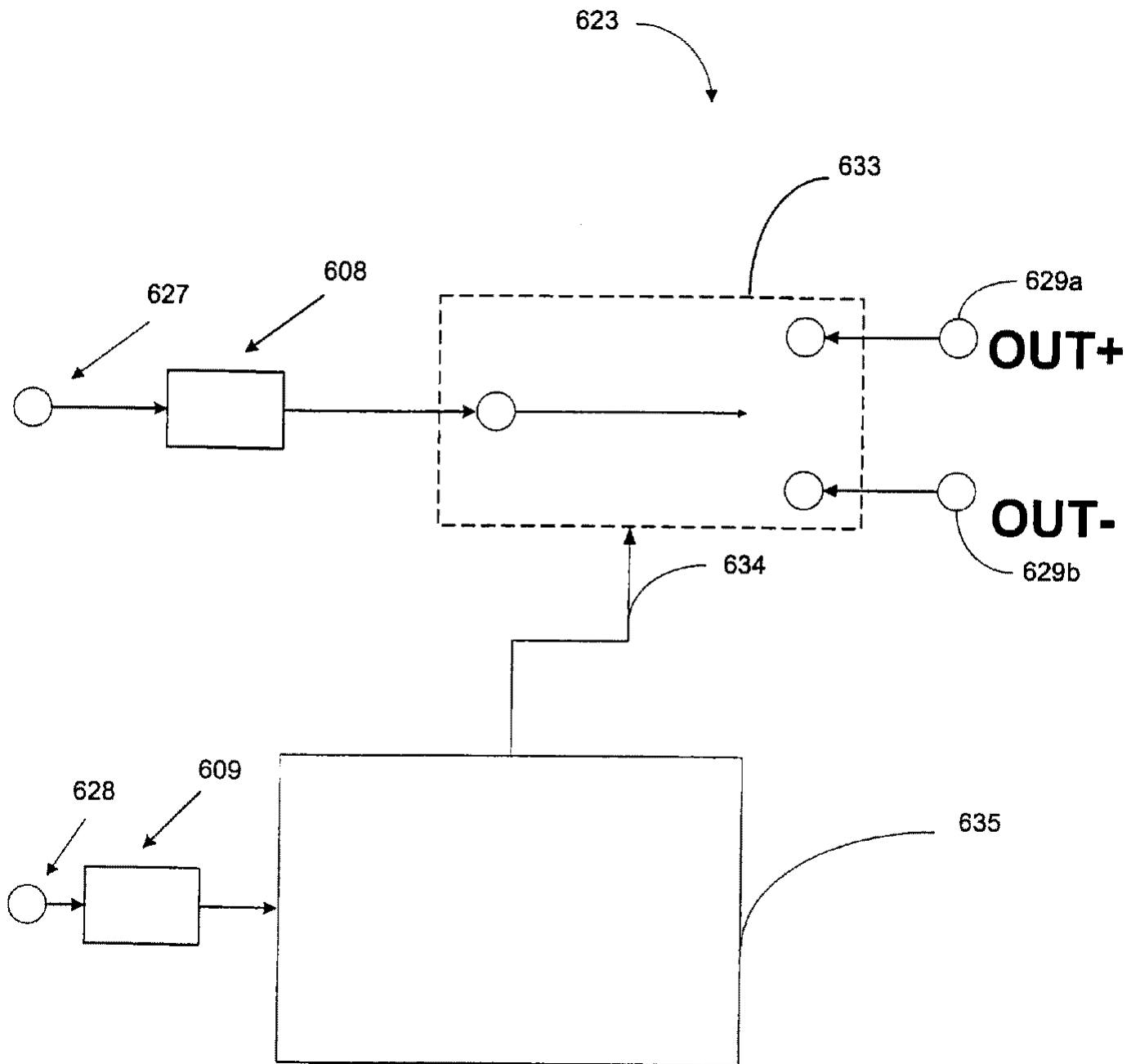
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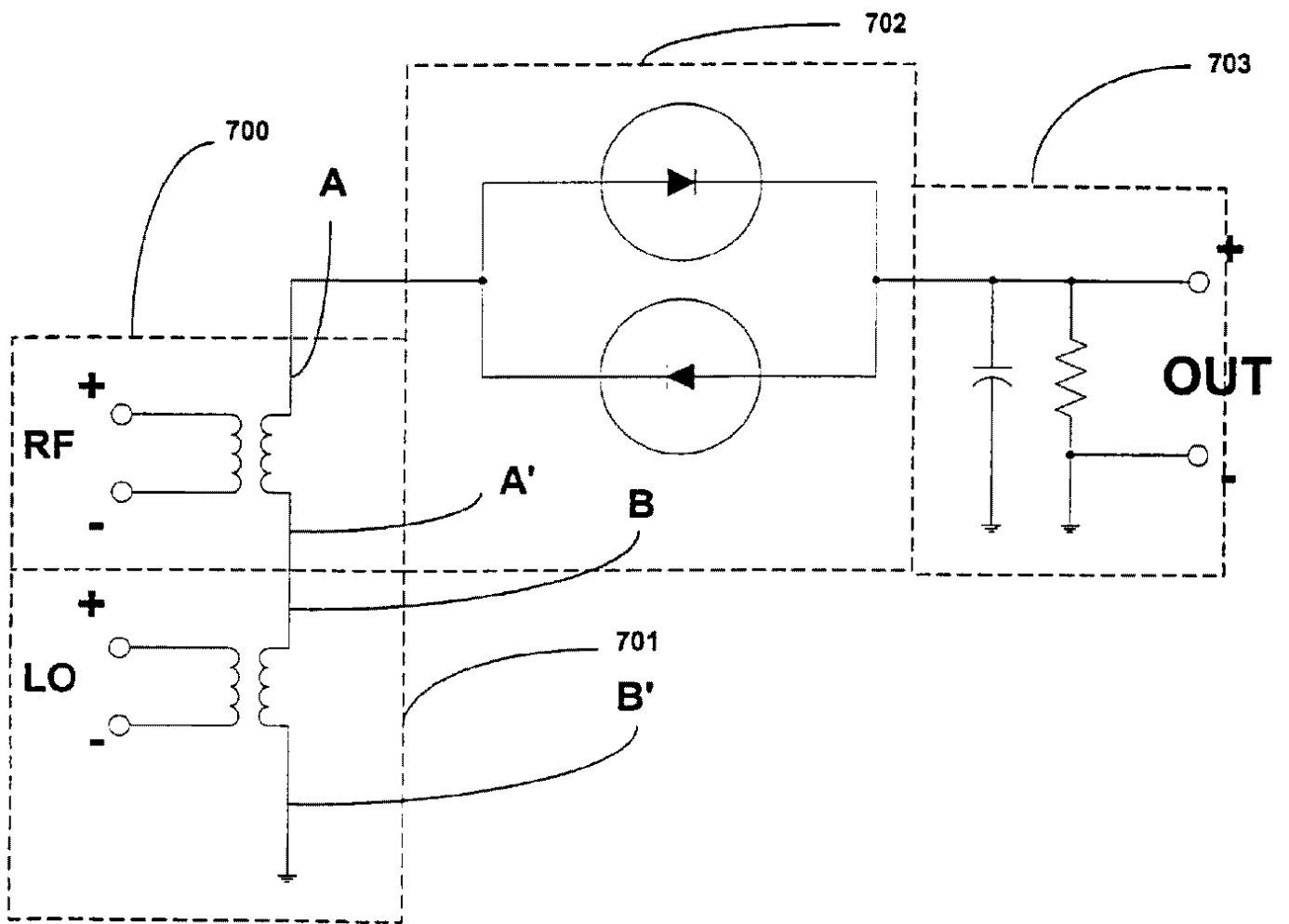


12a

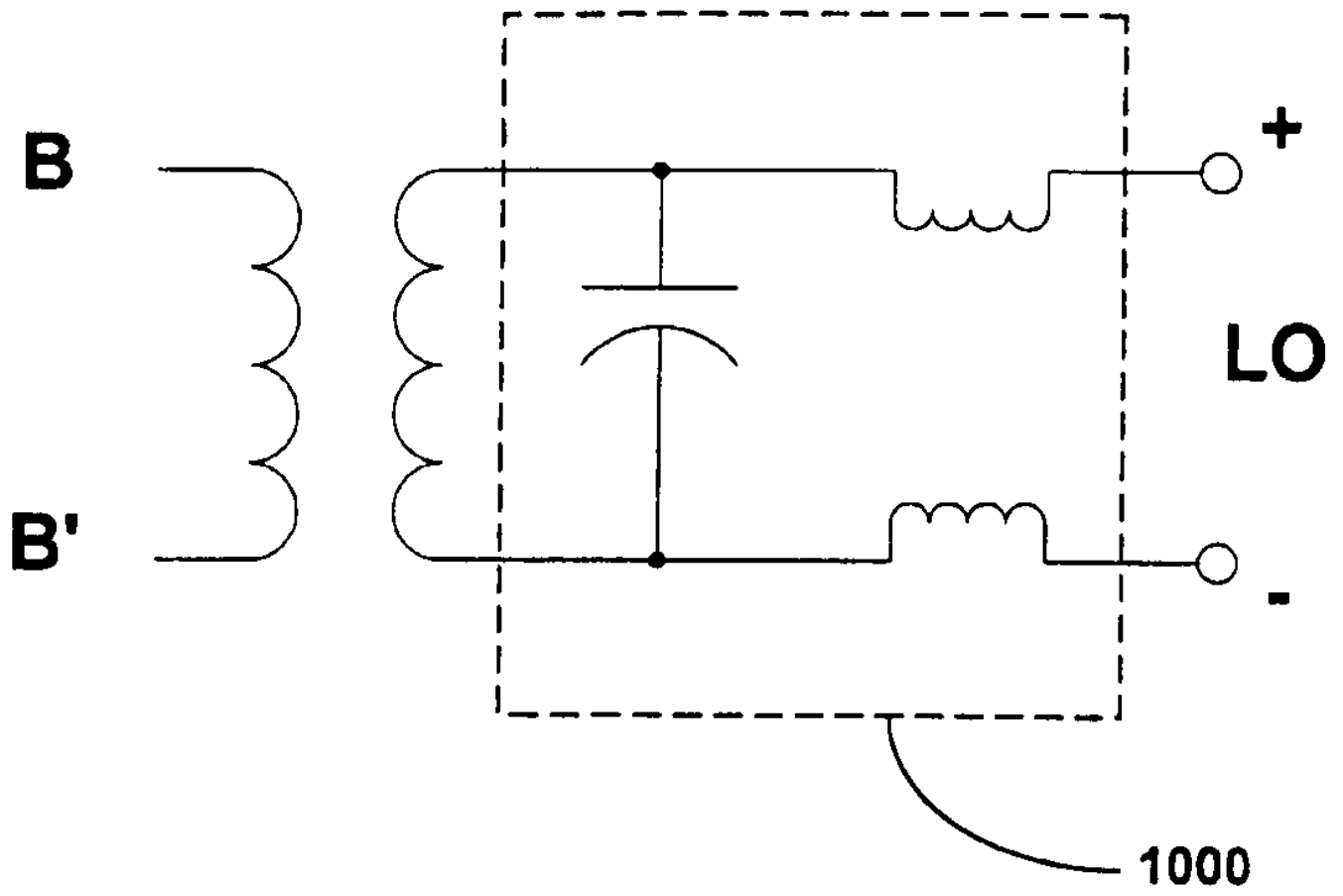


12b

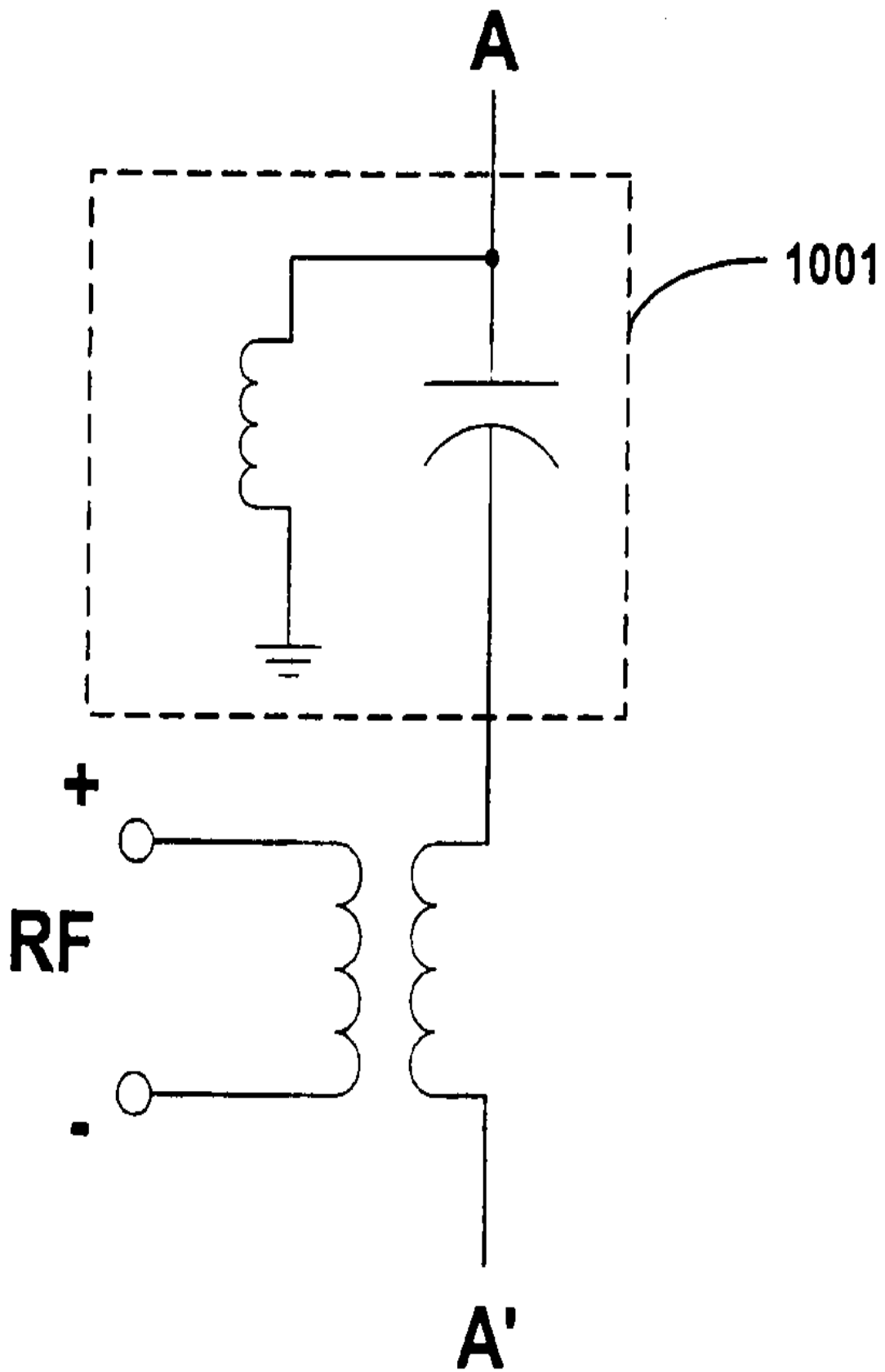




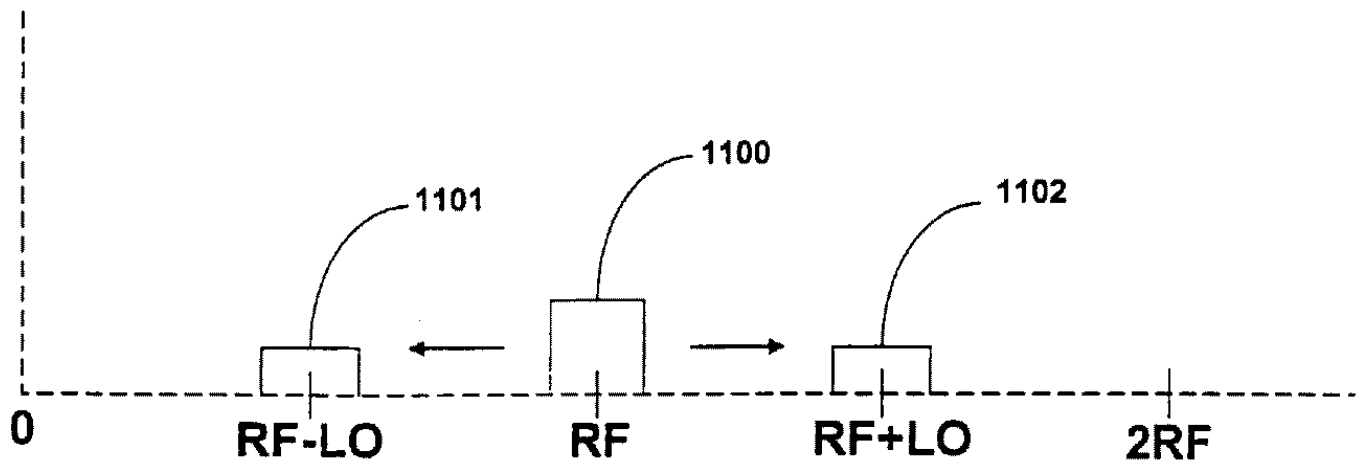
14a



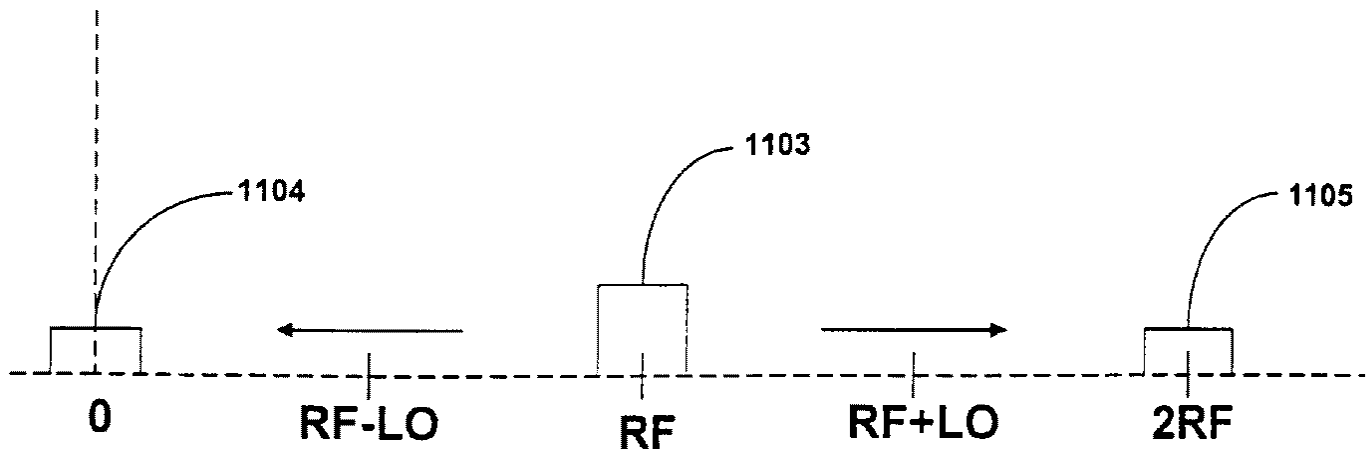
14b



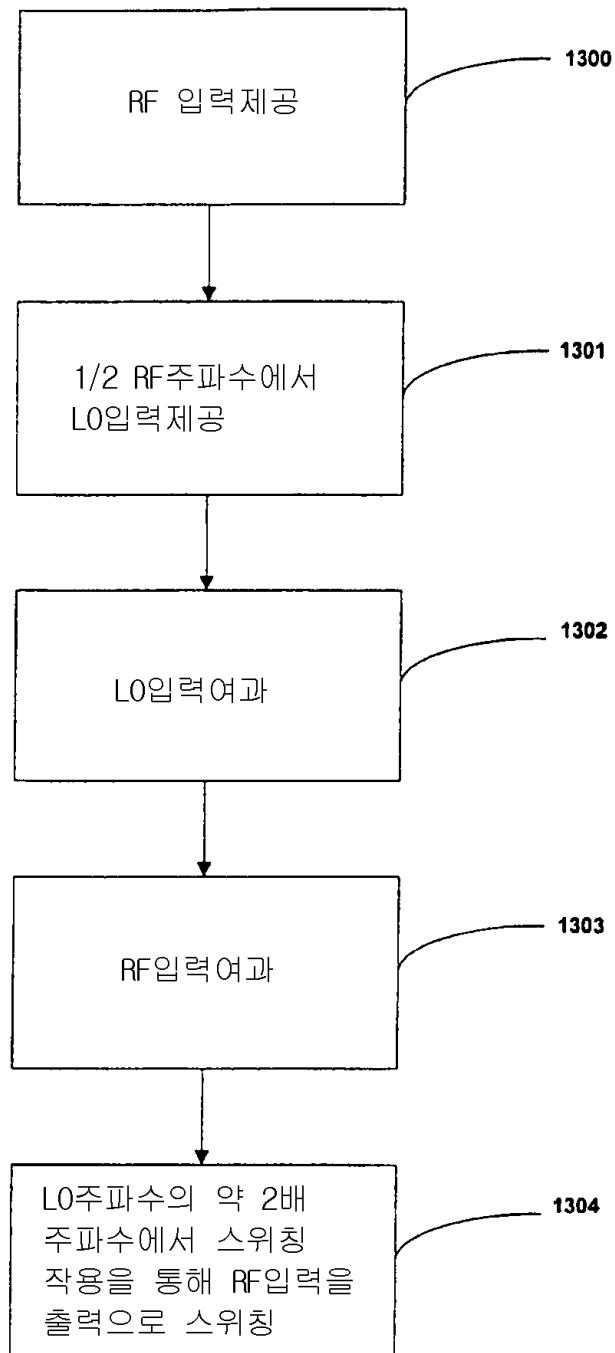
15a



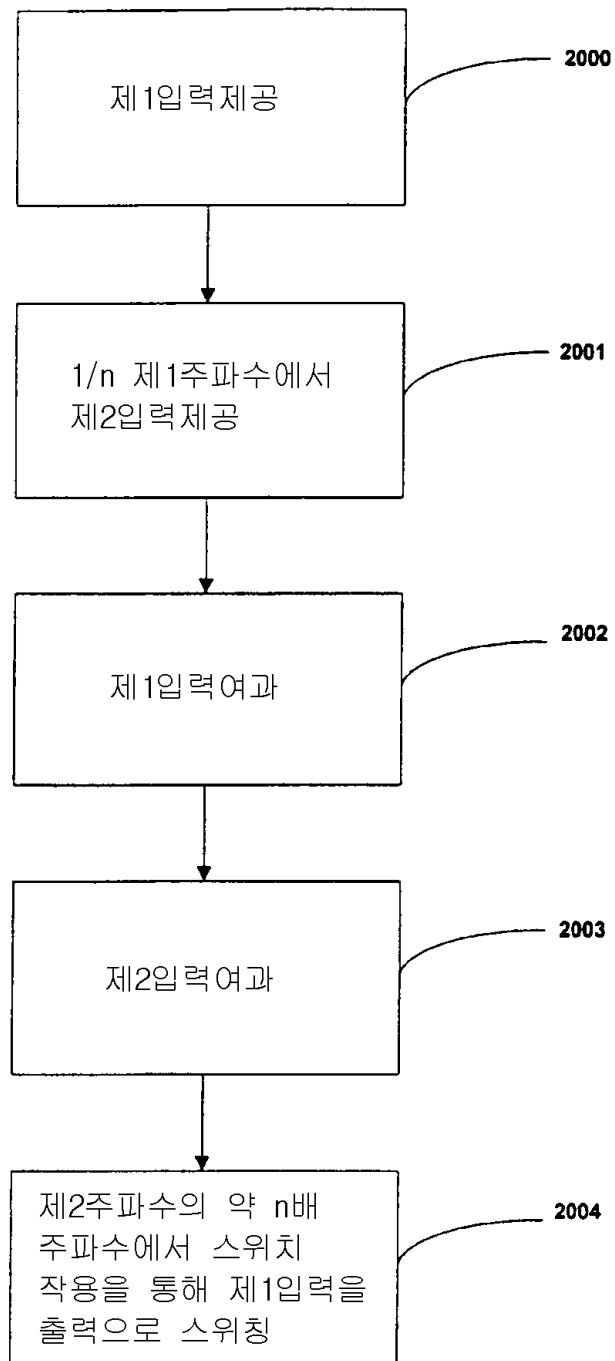
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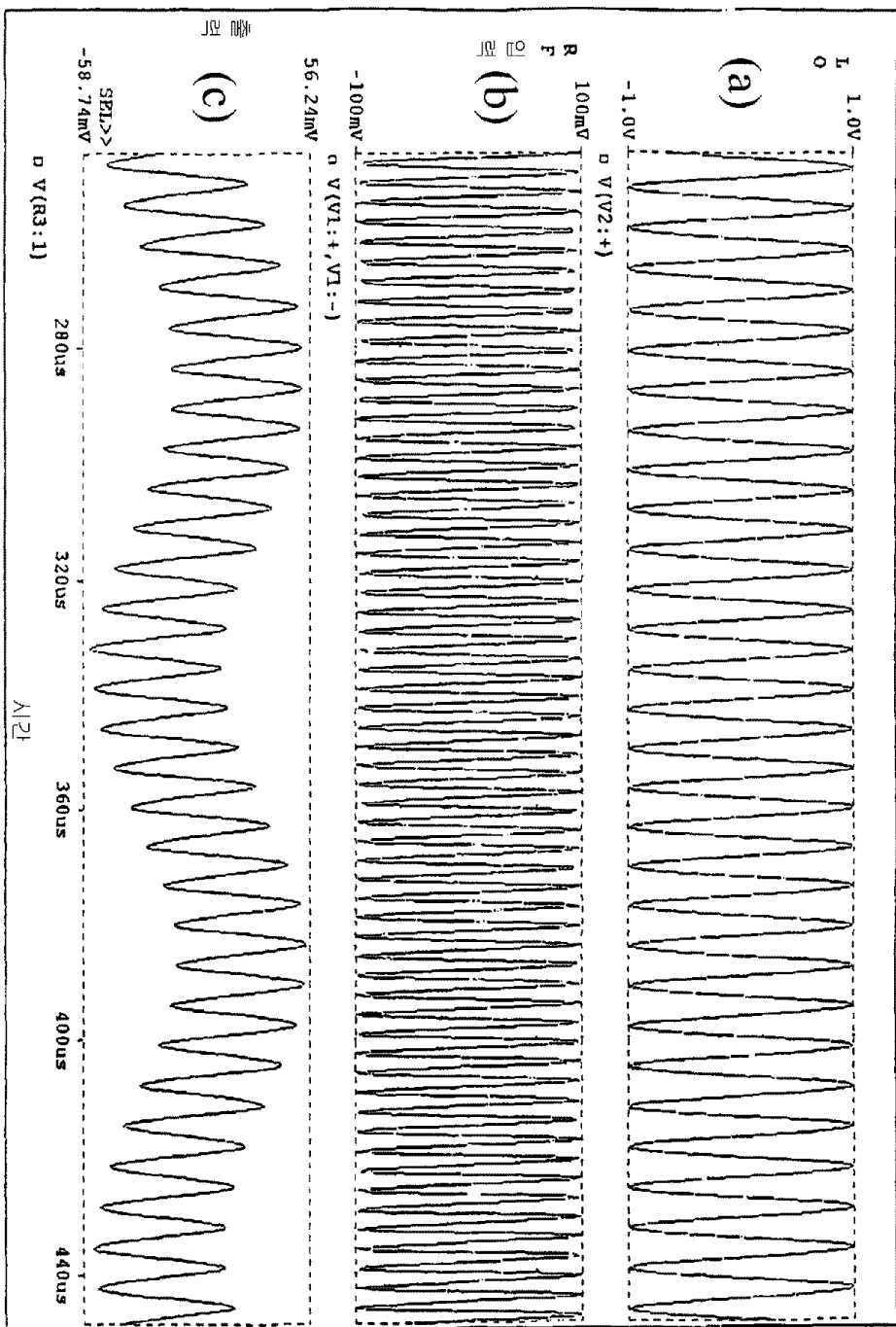


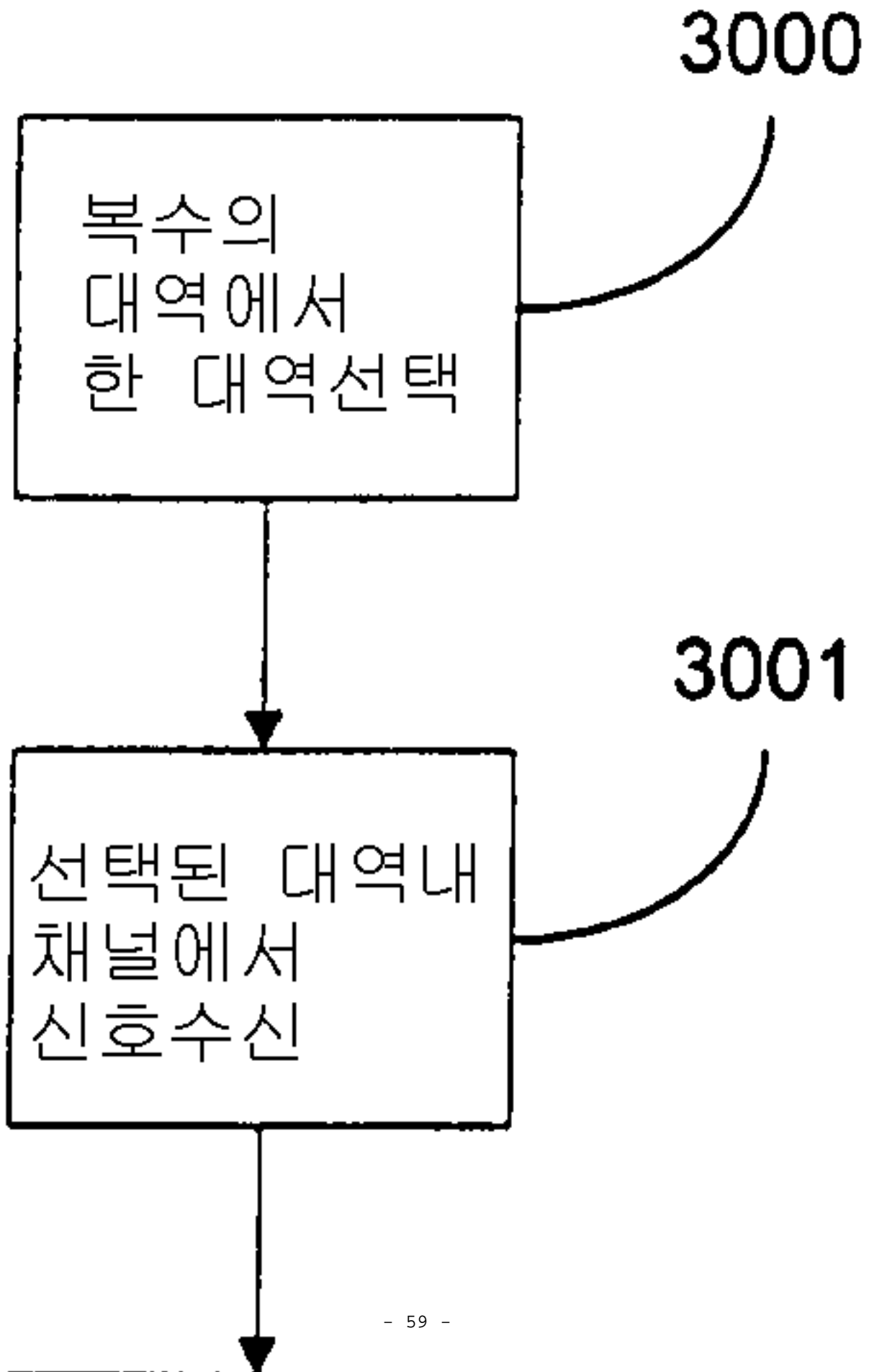
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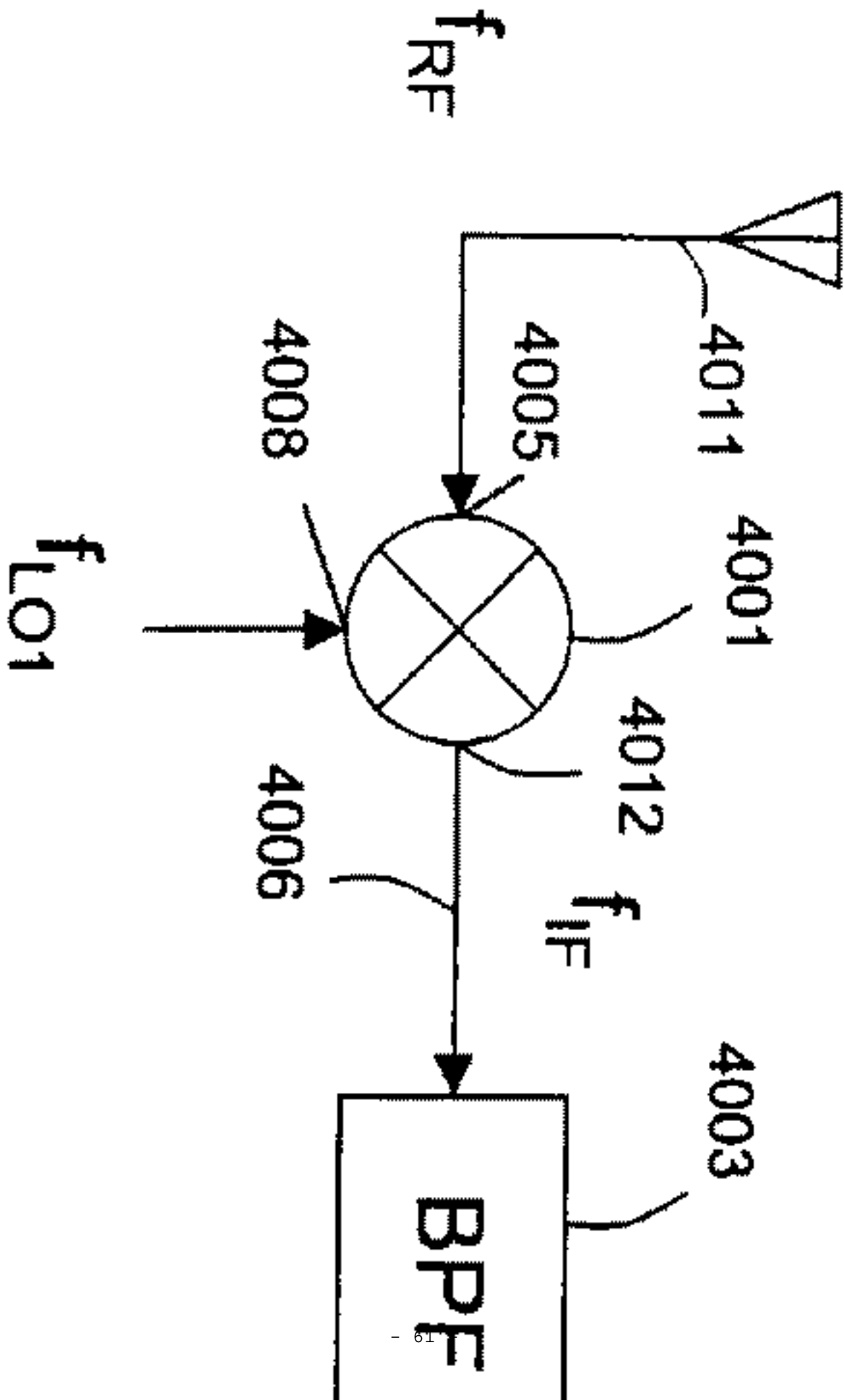


17

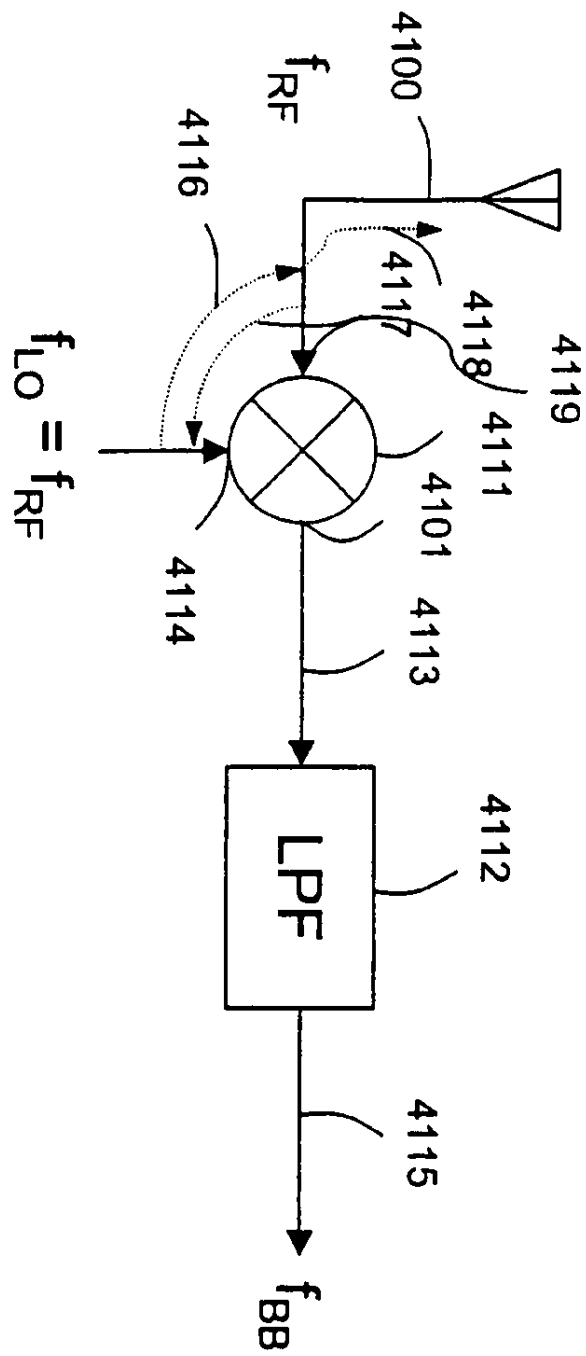


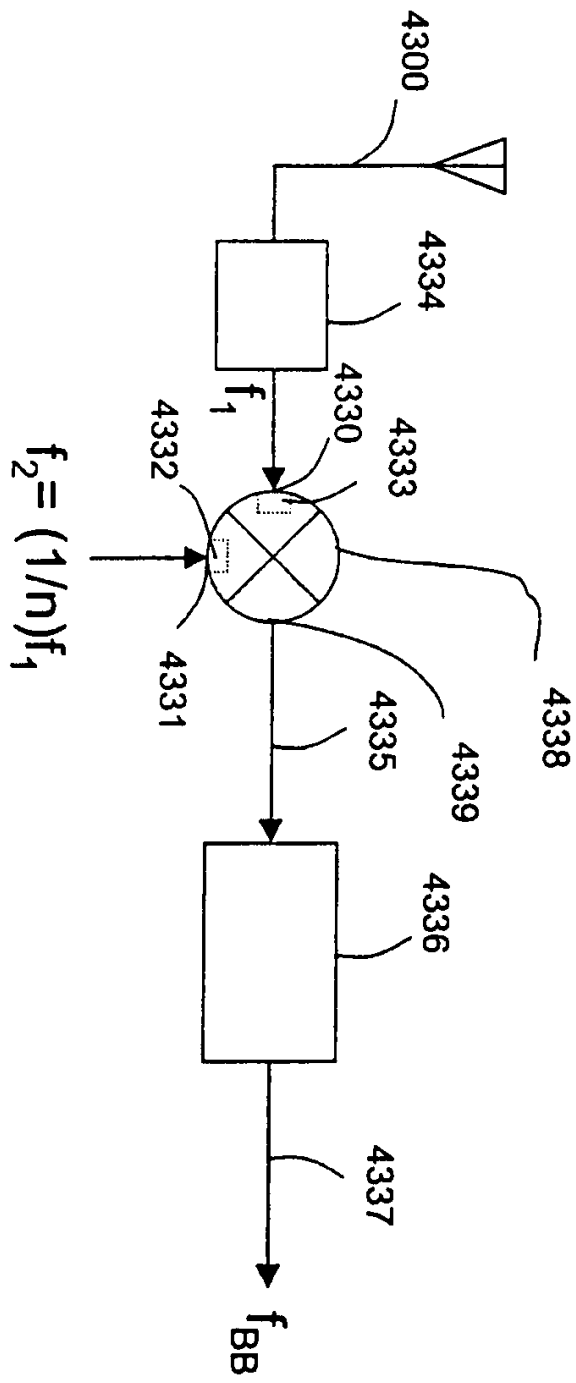




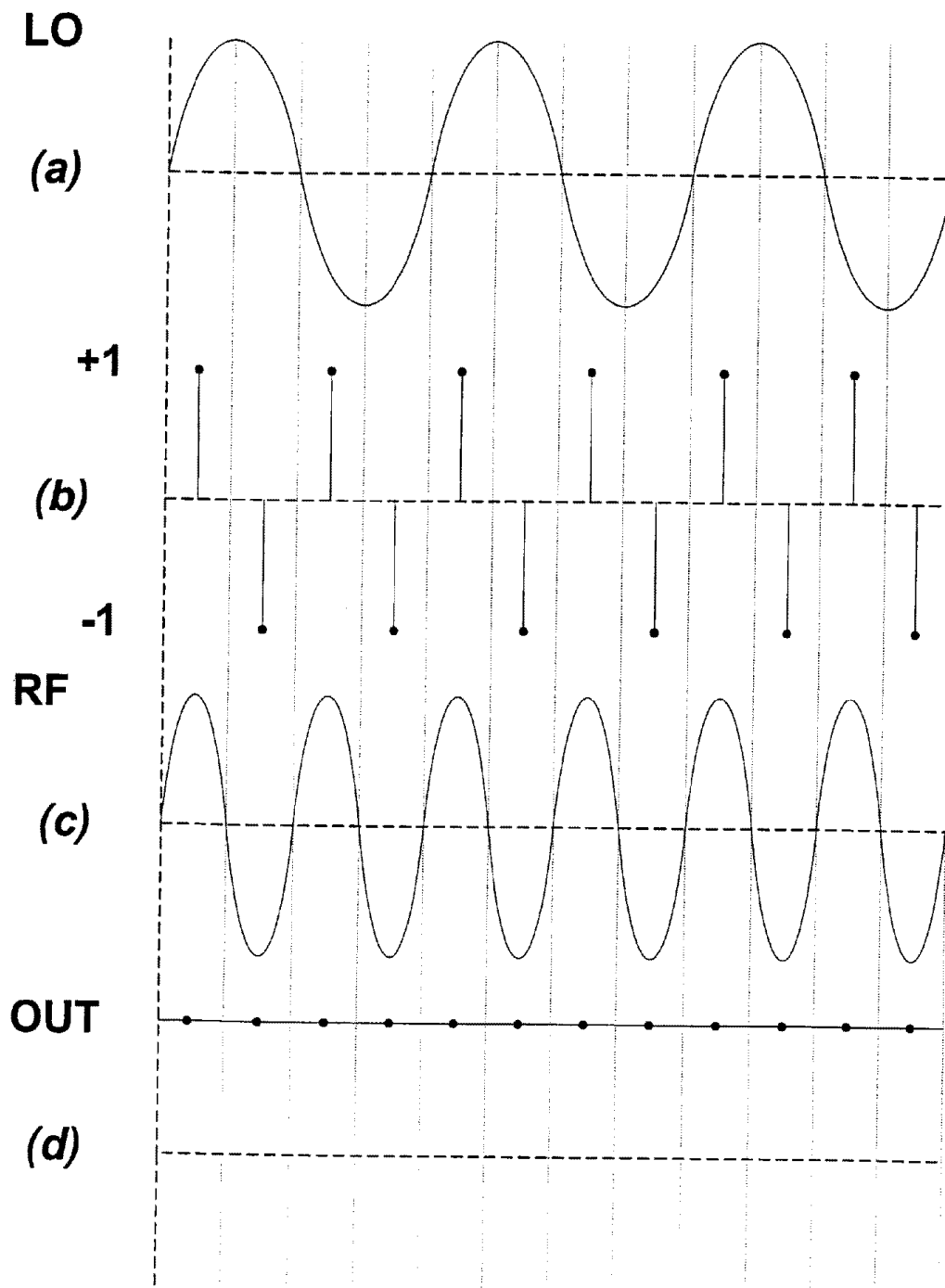


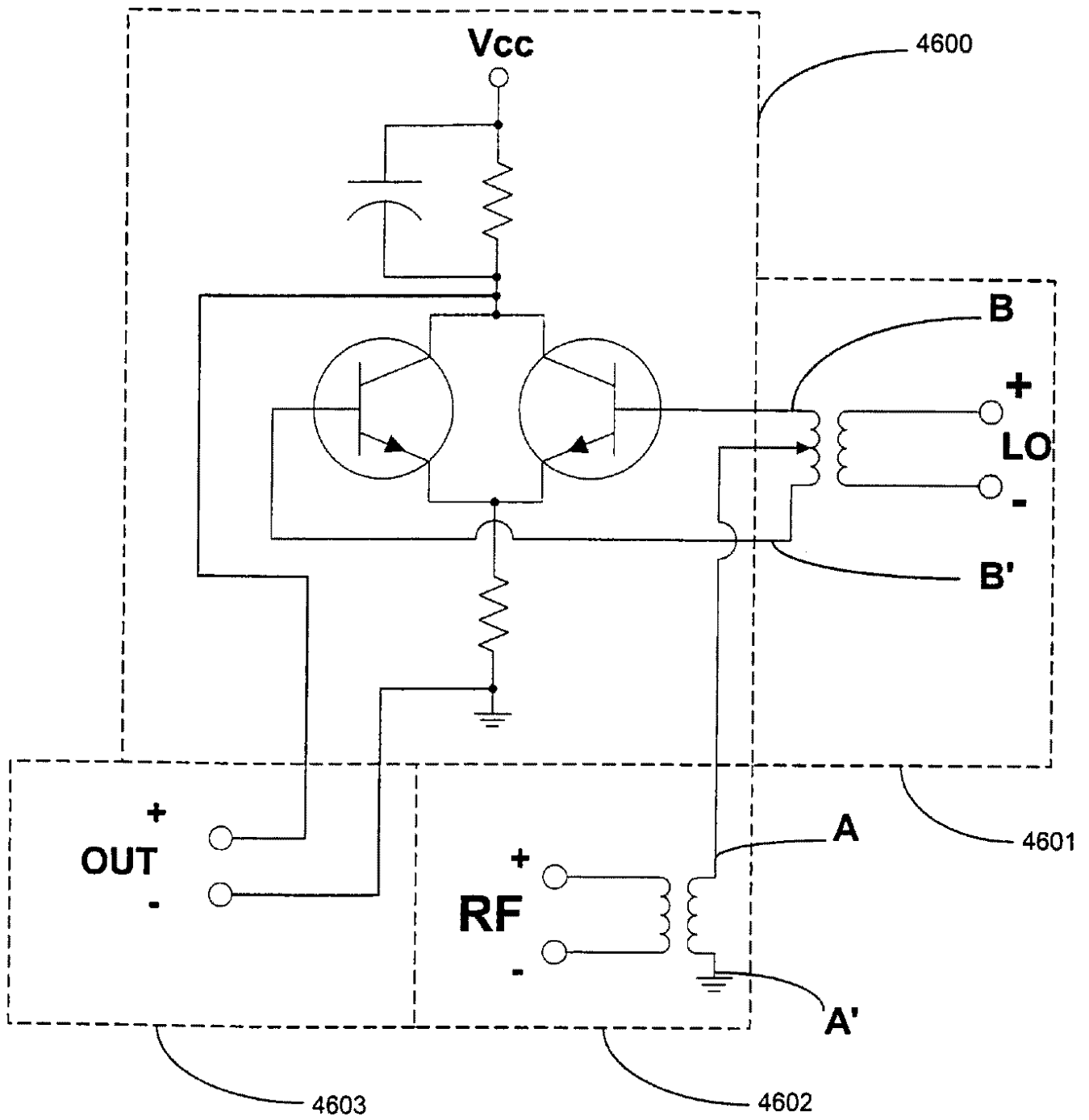
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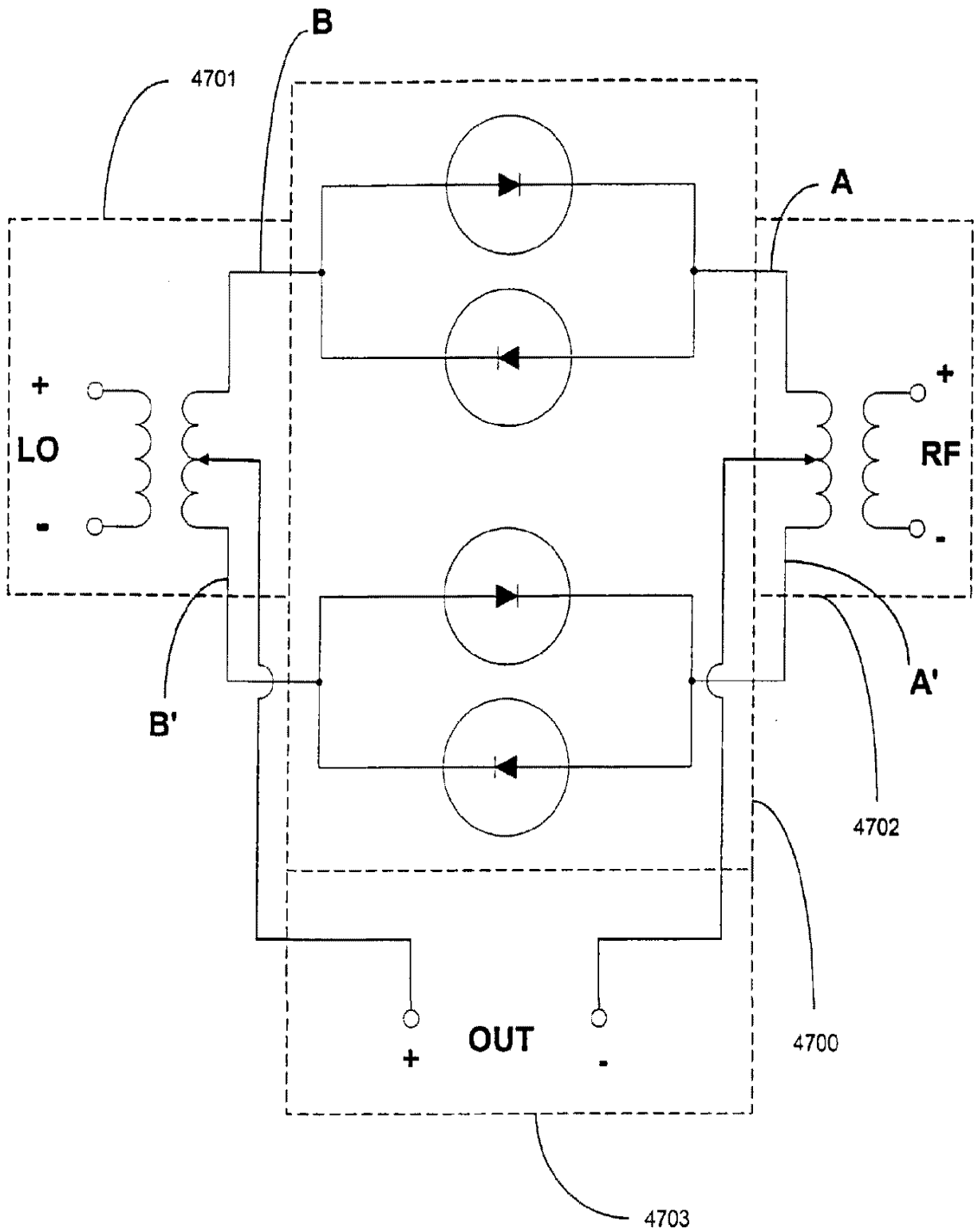




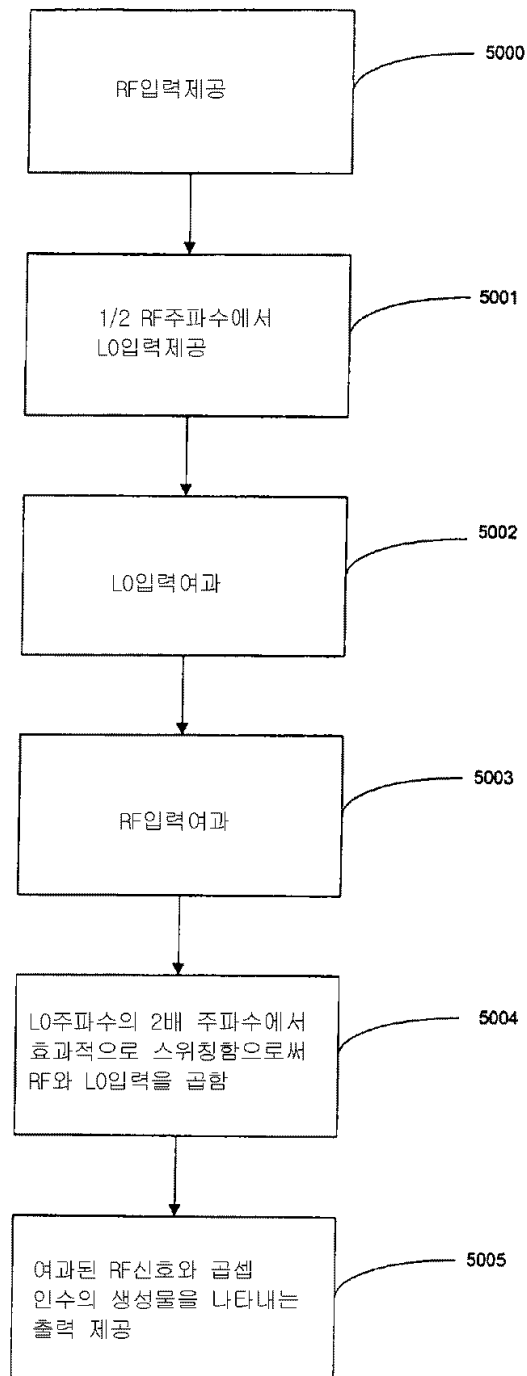
23







26



27

