Typical Diplexer/LNA/PA Configuration For a 4-Watts CDMA Cellular Phone Base Station

As shown in **FIG. 1** of a 4-Watts CDMA RF section, Diplexer/LNA/PA unit, the diplexer and LNA, such as WA08-2433A, are integrated in a diplexer housing with a directional coupler at the input of the antenna port. A high linear power amplifier (PA), such as WLPA08-5260A, is connected to the TX input of the Diplexer+LNA unit.

A TX input signal is applied to the input of the power amplifier. The output power of 37 dBm (5 Watts) is applied to the diplexer from the output of the PA with the PA input signal power level of –15 dBm. The total output power of 36.2 dBm is presented at the antenna port ANT. The insertion loss of the TX filter plus the direction coupler is 0.50 dB. The cable insertion loss between the PA and the diplexer is 0.2 dB.

The WLPA08-5260A provides 52 dB of gain with output power more than 37 dBm. The IMD performance is better than 55 dBc. The efficiency is better than 15%.

A 27 V DC power is applied to the PA with the total DC current of 1.1 A. An alarm is provided from the PA to monitor the normal operation of the PA. The Alarm output voltage is 4.5~5.0 V under the normal operation of the PA and 0 V when the PA or 27 V power supply fails.

The directional coupler is used to monitor the transmitting power and the VSWR of the antenna through the two coupling ports FWD and REF. FWD stands for the forward monitoring port and REF stands for the reflect monitoring port. Usually the coupling factor is 30 dB and isolation of the REF port is no less than 30 dB and 20 dB in FWD port.

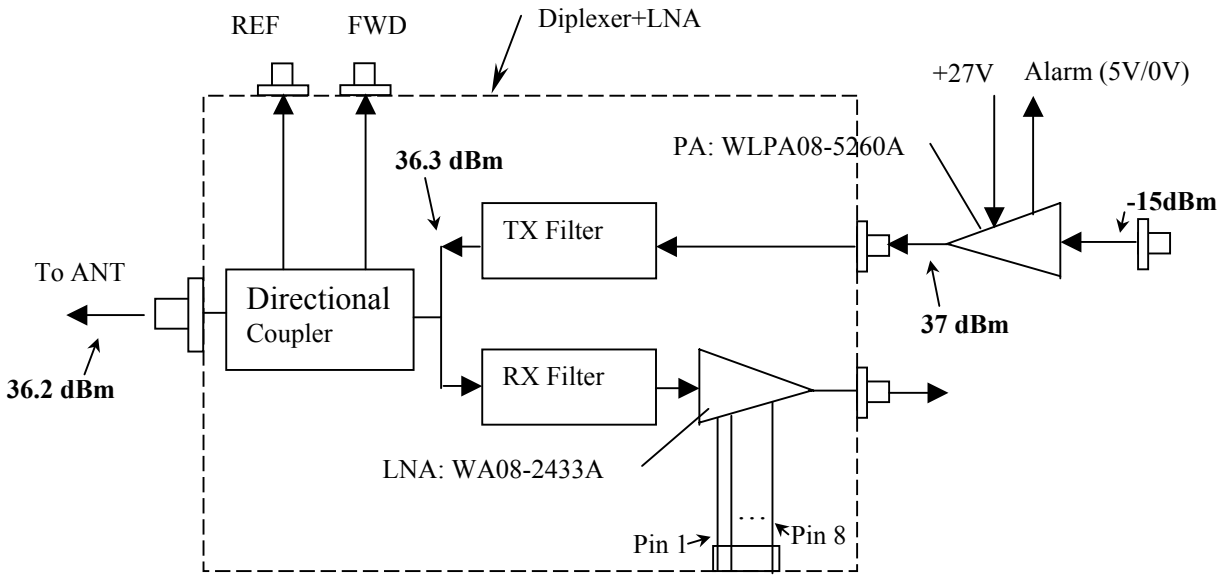

Figure 1 A typical CDMA Diplexer/LNA/PA Configuration.

The balanced type LNA, WA08-2433A, provides 25 dB gain and typical noise figure of 0.5 dB with output IP3 of 33 dBm. The DC power supply for the LNA is +5V with total current of 120 mA. The LNA also provides the following alarms: Soft Alarm, Hard Alarm, Soft Alarm Open Collector, Hard Alarm Open Collector, Branch 1 Alarm, Branch 2 Alarm.

Soft Alarm monitors each branch amplifier of the LNA. It outputs a failure alarm signal should one of the branch amplifier fails. The Soft Alarm signal is also presented to the base of an internal open collector transistor to provide the fail-safe alarm port, Soft Alarm Open Collector. The collector will go to high voltage with an external pull up resistor and DC bias should the Soft Alarm go off.

Hard Alarm goes off should both branch amplifiers fail. The Hard Alarm Open Collector provides the fail-safe hard alarm port, similar to the Soft Alarm Open Collector.

Branch 1 Alarm and Branch 2 Alarm monitor each branch amplifier.

Any alarm output voltage, expect Open Collector, is 4.5 ~ 5.0V when the amplifier is under normal operation mode and 0 V under failure mode.

The alarms output and DC power are assigned in the Alarm/PWR I/O of the LNA as following:

ALARM OUTPUT/PWR
Molex No.: 53048-0810

Molex Connector Pin	**Alarm Output Function**
1	Hard Alarm
2	Alarm 1
3	Soft Alarm Open Collector
4	Hard Alarm Open Collector
5	Soft Alarm
6	Alarm 2
7	Ground
8	+5V

Properly connect the needed alarms and the +5 V power supply to the base station system.

The total noise figure of 1.30 dB can be achieved at room temperature and 1.6 dB at 85 °C, assume the RX filter has 0.6 dB insertion loss.

A typical measured Diplexer/LNA/PA is shown as following:

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Gain at  MAX RX  915.325- 924.675 MHz   24.3   [ =<25   ] dB      PASSED

Gain at  MIN RX  915.325- 924.675 MHz   23.9   [ =>23   ] dB      PASSED

TX-ANT IL        843 - 870        MHz   0.45   [ =<0.50 ] dB      PASSED
Current consumption (+5V)                120    [ =< 200 ] mA      PASSED
Amplitude Ripple 915.325- 924.675 MHz   0.20   [ =<0.35 ] dB      PASSED
Amplitude Ripple 843 - 870        MHz   0.15   [ =<0.30 ] dB      PASSED
Phase Error      915.325- 924.675 MHz   0.00   [ =<0.005] Rad^2   PASSED
Phase Error      843- 870         MHz   0.00   [ =<0.005] Rad^2   PASSED

Attenuation:
             ANT to RX
                 Dc-832           MHz   70.3   [ => 63  ] dB      PASSED
                 898-903          MHz   45.0   [ => 38  ] dB      PASSED
                 903-912          MHz   48.5   [ => 43  ] dB      PASSED
                 928-1100         MHz   51.0   [ => 43  ] dB      PASSED
                 1100-2000        MHz   95.7   [ => 88  ] dB      PASSED

             TX to ANT,

                 Dc-822           MHz   47.0   [ => 41  ] dB      PASSED
                 880-3000         MHz   27.6   [ => 23  ] dB      PASSED
                 1686-1740        MHz   39.5   [ => 33  ] dB      PASSED
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	2529-2610	MHz	50.6	[=> 33] dB		PASSED
TX	to RX,					
	843.870	MHz	110	[=> 89] dB		PASSED
	898-925	MHz	118	[=> 98] dB		PASSED
RL at ANT.	843 - 870	MHz	22.0	[>= 17] dB		PASSED
RL at ANT.	915.325-924.675	MHz	20.3	[>= 17] dB		PASSED
RL at TX	843 - 870	MHz	20.8	[>= 17] dB		PASSED
RL at Rx	915.325-924.675	MHz	23.9	[>= 17] dB		PASSED
FWD						
RL at Coupled	843 - 870	MHz	23	[>= 20] dB		PASSED
RL at Coupled	915.325-924.675	MHz	25	[>= 20] dB		PASSED
REV						
RL at Coupled	843 - 870	MHz	25	[>= 20] dB		PASSED
RL at Coupled	915.325-924.675	MHz	23	[>= 20] dB		PASSED
Noise figure(MAX)	915.325-924.675	MHz	1.30	[=< 2.0] dB		PASSED
Pwr Handling TX	843 - 870	MHz	50	[>=15] W		PASSED
PEP Power Handling			1000	[> 400] W		PASSED
IM from TX to RX						
Freq. Ranges	f1 f2 f3					
	845 870 920 (5^{th} harmonic)		-123	[=<-116] dBm		
IP3 RX/LNA						
Freq. Ranges	f1 f2 f3					
	919 920 921		33	[=> 27] dBm		PASSED

Coupling:

FWD						
TX to ANT	843 - 870	MHz	30	[30+- 0.8] dB		PASSED
RX to ANT	915.325-924.675	MHz	30	[30+- 0.8] dB		PASSED
Variation	843 - 870	MHz	0.2	[=<0.4] dB		PASSED
Variation	915.325-924.675	MHz	0.2	[=<0.4] dB		PASSED
Harmonics Bands						
	1686-1740	MHz	28.0	[26±1.5] dB		
	2529-2610	MHz	27.3	[27±1.5] dB		
REV						
ANT to TX	843 - 870	MHz	30	[30+- 0.8] dB		PASSED
ANT to RX	915.325-924.675	MHz	30	[30+- 0.8] dB		PASSED
Variation	915.325-924.675	MHz	0.25	[=<0.4] dB		PASSED
Variation	843- 870	MHz	0.25	[=<0.4] dB		PASSED
Directivity						
FWD						
	843 - 870	MHz	20	[>=16] dB		PASSED
	915.325-924.675	MHz	20	[>=16] dB		PASSED
REV	843 - 870	MHz	35.5	[>=30] dB		PASSED
	915.325-924.675	MHz	33.0	[>=30] dB		PASSED
Soft Alarm			4.5	[>3.80] V		PASSED
Hard Alarm			4.5	[>3.80] V		PASSED

Output RF Power @ ANT: Pin=-15 dBm, f0=850 MHz 36.3 dBm
TX Output IMD: f1=950 MHz, f2=950.1 MHz. Pout=33 dBm each tone: 57 dBc

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