

## W-LAN/WiMAX Application

### 3. 2.3~2.7GHz BAND APPLICATION

#### 3-1 SUMMARY

The characteristics of 2.3~2.7GHz band have evaluated as follows. The evaluation circuit structure and measured data are reviewed.

#### 3-2-1 MEASURED DATA1 (DC)

General conditions:  $V_{DD}=V_{INV}=2.7V$ ,  $T_a=+25^{\circ}C$ ,  $Z_s=Z_l=50\Omega$

Parameter	Symbol	Conditions	Measurement data	Unit
Operating Voltage	$V_{DD}$		2.7	V
Inverter Voltage	$V_{INV}$		2.7	V
Control Voltage (High)	$V_{CTL(H)}$		1.85	V
Control Voltage (Low)	$V_{CTL(L)}$		0	V
Operating current	$I_{DD1}$	RF OFF, $V_{CTL}=1.85V$	2.03	mA
Operating current	$I_{DD2}$	RF OFF, $V_{CTL}=0V$	0.04	$\mu A$
Inverter current	$I_{INV1}$	RF OFF, $V_{CTL}=1.85V$	81.8	$\mu A$
Inverter current	$I_{INV2}$	RF OFF, $V_{CTL}=0V$	14.0	$\mu A$
Control current	$I_{CTL}$	RF OFF, $V_{CTL}=1.85V$	3.6	$\mu A$

### 3-2-2 MEASURED DATA2 (LNA HIGH GAIN MODE)

General conditions:  $V_{DD}=V_{INV}=2.7V$ ,  $V_{CTL}=1.85V$ ,  $f_{RF}=2302.5\sim 2695MHz$ ,  $T_a=+25^\circ C$ ,  $Z_s=Z_l=50\Omega$   
with application circuit

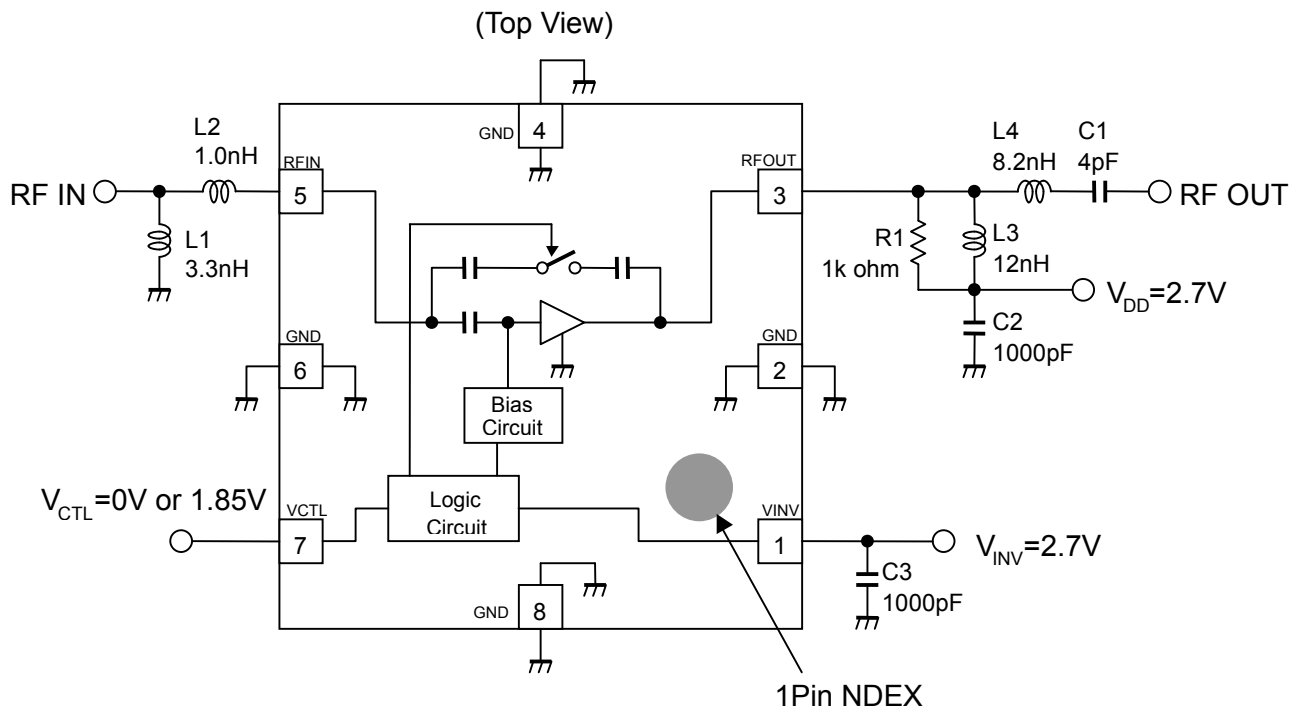
Parameter	Symbol	Conditions	Measurement data	Unit
Operating current	$I_{DD}$	RF OFF	2.03	mA
Small signal gain	Gain		10.4 ~ 11.3	dB
Isolation	ISO		-32.4 ~ -31.8	dB
Noise figure	NF	Exclude PCB/Connector losses (0.11dB)	1.66 ~ 2.03	dB
Pin at 1dB compression point	P-1dB(IN)		-3.0 ~ -1.4	dBm
Input 3rd order intercept point	IIP3	$f_1=f_{RF}$ , $f_2=f_{RF}+100kHz$ , Pin=-32dBm	-0.7 ~ +1.9	dBm
RF Input port VSWR	VSWRi		1.85 ~ 2.07	
RF Output port VSWR	VSWRo		1.66 ~ 2.92	

### 3-2-3 MEASURED DATA3 (LNA LOW GAIN MODE)

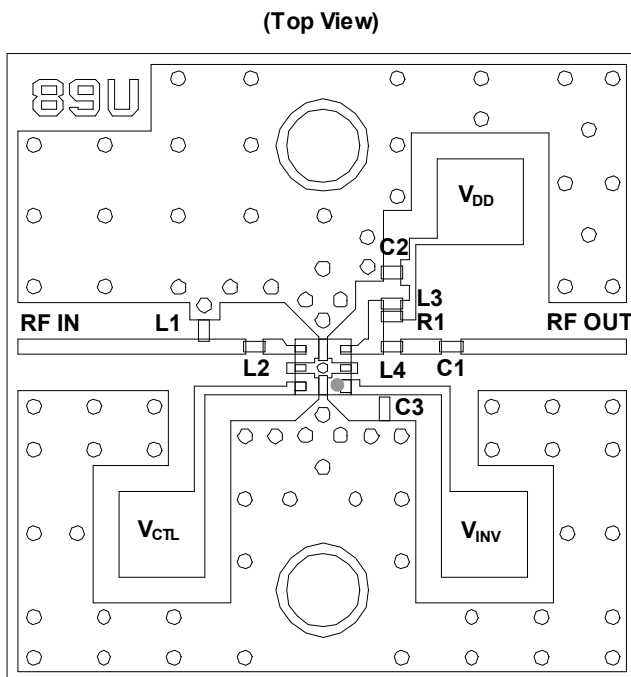
General conditions:  $V_{DD}=V_{INV}=2.7V$ ,  $V_{CTL}=0V$ ,  $f_{RF}=2302.5\sim 2695MHz$ ,  $T_a=+25^\circ C$ ,  $Z_s=Z_l=50\Omega$   
with application circuit

Parameter	Symbol	Conditions	Measurement data	Unit
Small signal gain	Gain		-10.0 ~ -9.3	dB
Isolation	ISO		-10.0 ~ -9.3	dB
Noise figure	NF	Exclude PCB/Connector losses (0.11dB)	8.8 ~ 9.9	dB
Pin at 1dB compression point	P-1dB(IN)		+9.7 ~ +10.4	dBm
Input 3rd order intercept point	IIP3	$f_1=f_{RF}$ , $f_2=f_{RF}+100kHz$ , Pin=-16dBm	+18.4 ~ +19.1	dBm
RF Input port VSWR	VSWRi		1.38 ~ 1.58	
RF Output port VSWR	VSWRo		1.25 ~ 1.95	

## 3-3 APPLICATION CIRCUIT



## 3-4 PCB DESIGN



### Parts List

Parts ID	Comment
L1~L4	TDK (MLK0603 Series)
R1	0603 size
C1~C3	MURATA (GRM03 Series)

PCB (FR-4):

t=0.2mm

MICROSTRIP LINE WIDTH

=0.4mm ( $Z_0=50\Omega$ )

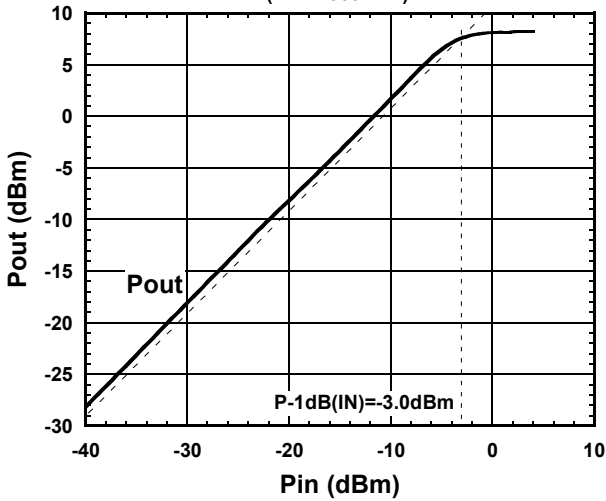
PCB SIZE=17.0mm x 17.0mm

## 3-5-1 TYPICAL CHARACTERISTICS (LNA High Gain Mode)

Condition:  $T_a=+25^{\circ}\text{C}$ ,  $V_{DD}=V_{INV}=2.7\text{V}$ ,  $V_{CTL}=1.85\text{V}$ ,  $Z_s=Z_l=50\Omega$

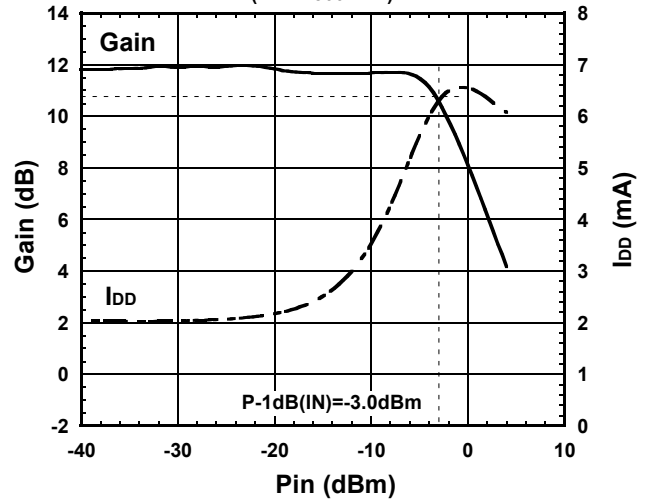
**NJG1126HB6 @High Gain**

**Pout vs. Pin**  
(fRF=2500MHz)



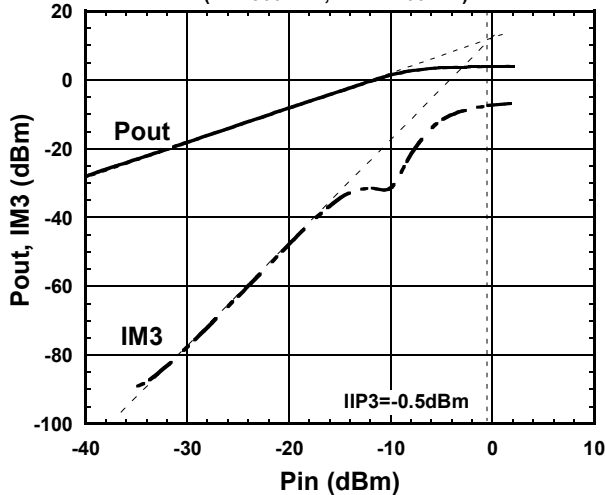
**NJG1126HB6 @High Gain**

**Gain, Idd vs. Pin**  
(fRF=2500MHz)



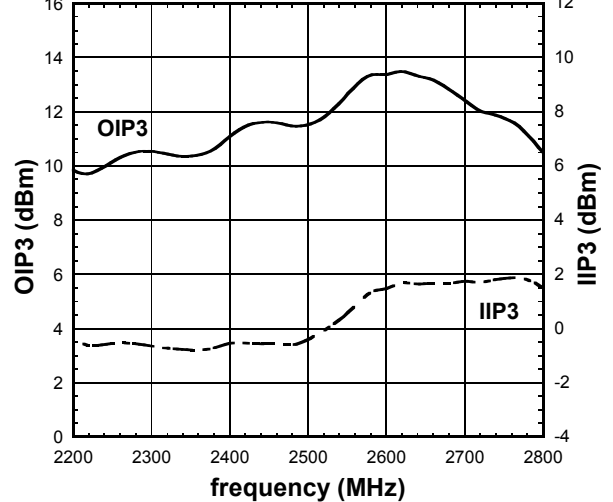
**NJG1126HB6 @High Gain**

**Pout, IM3 vs. Pin**  
(f1=2500MHz, f2=f1+100kHz)



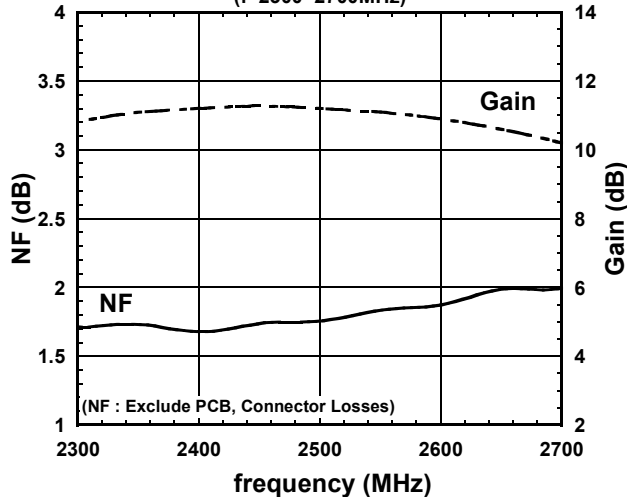
**NJG1126HB6 @High Gain**

**OIP3, IIP3 vs. frequency**  
(f1=2200~2800MHz, f2=f1+100kHz, Pin=-32dBm)



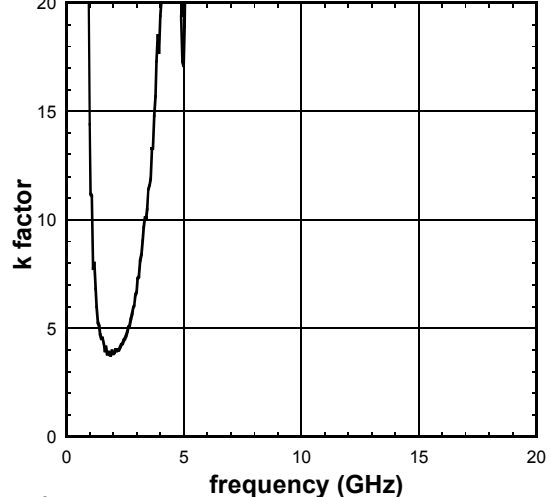
**NJG1126HB6 @High Gain**

**NF, Gain vs. frequency**  
(f=2300~2700MHz)



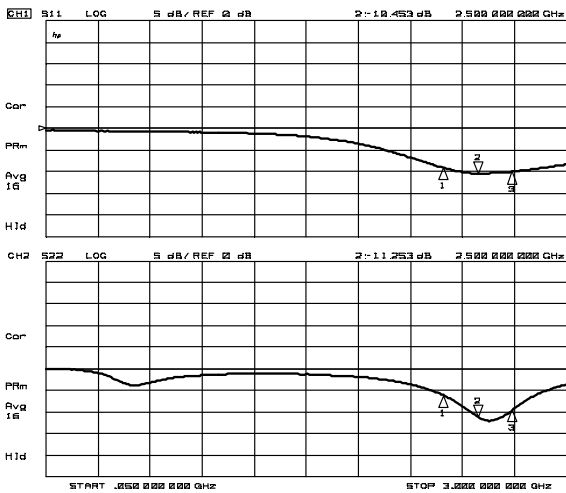
**NJG1126HB6 @High Gain**

**k factor vs. frequency**  
(f=50MHz~20GHz)

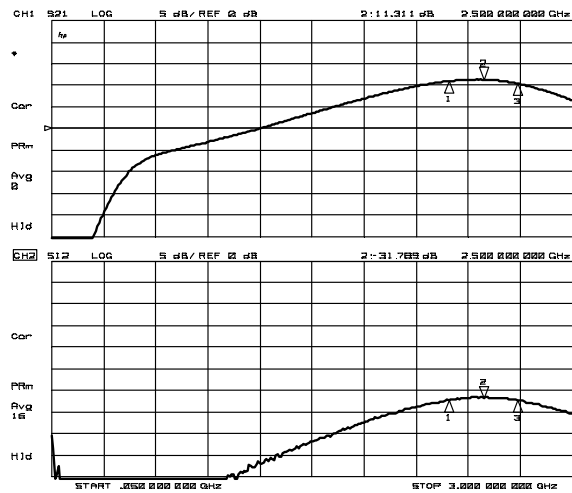


## 3-5-2 TYPICAL CHARACTERISTICS (LNA HIGH GAIN MODE)

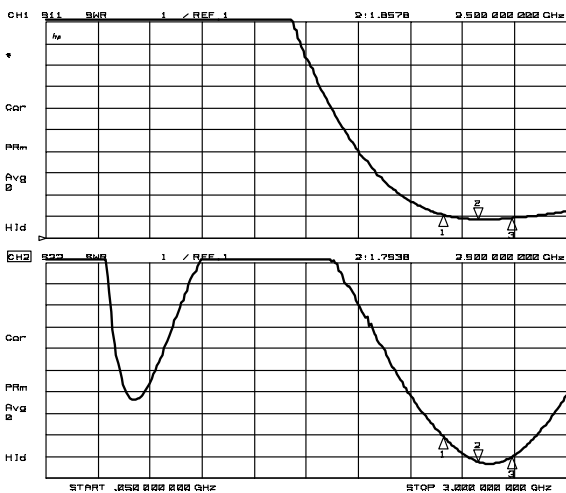
Condition:  $T_a=+25^{\circ}\text{C}$ ,  $V_{DD}=V_{INV}=2.7\text{V}$ ,  $V_{CTL}=1.85\text{V}$ ,  $Z_s=Z_l=50\Omega$



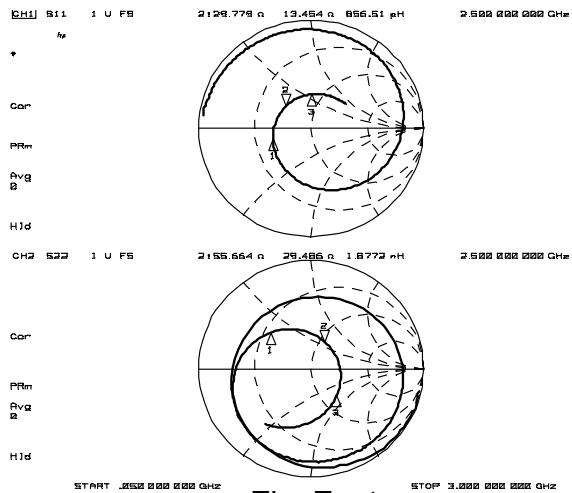
S11, S22



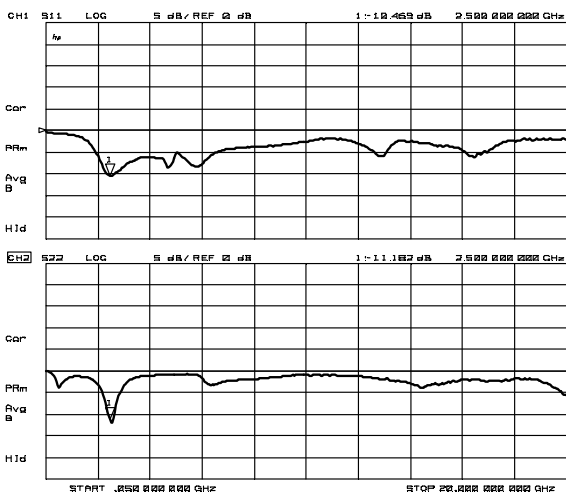
S21, S12



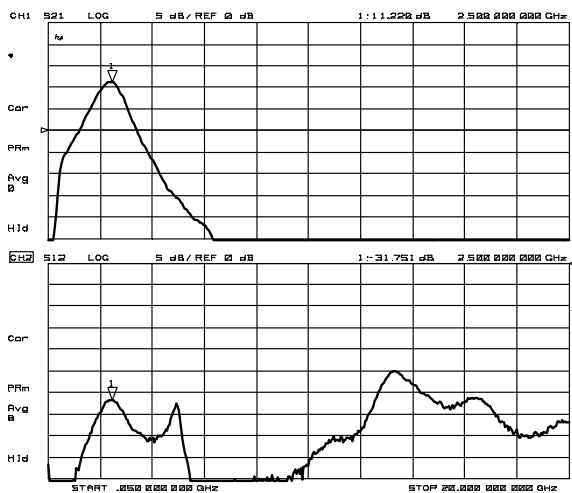
VSWR



Zin, Zout



S11, S22 (f=50MHz ~ 20GHz)



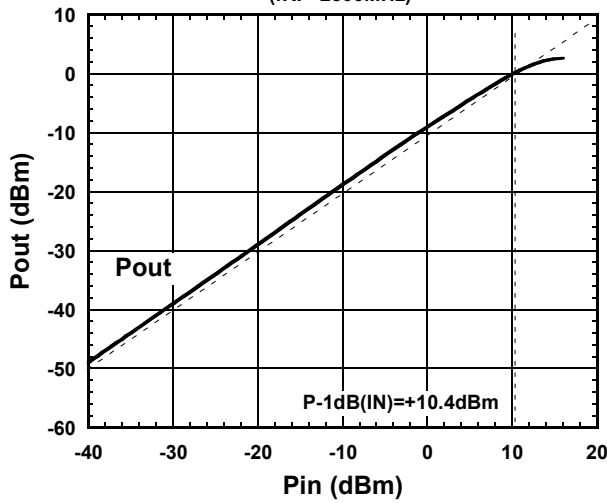
S21, S12 (f=50MHz ~ 20GHz)

### 3-5-3 TYPICAL CHARACTERISTICS (LNA Low Gain Mode)

Condition:  $T_a=+25^{\circ}\text{C}$ ,  $V_{DD}=V_{INV}=2.7\text{V}$ ,  $V_{CTL}=0\text{V}$ ,  $Z_s=Z_l=50\Omega$

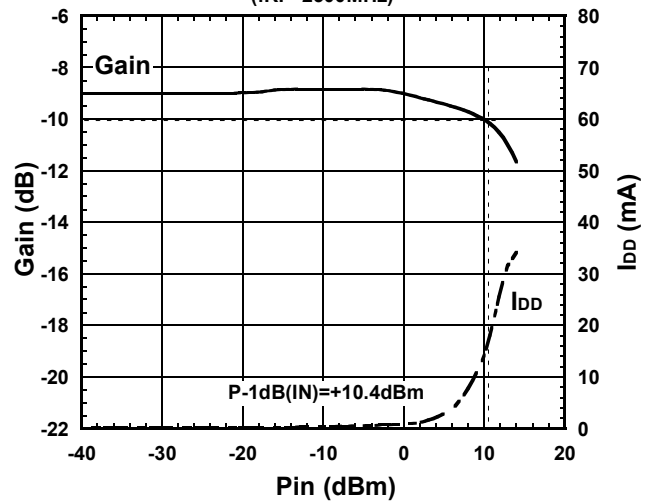
**NJG1126HB6 @Low Gain**

**Pout vs. Pin**  
(fRF=2500MHz)



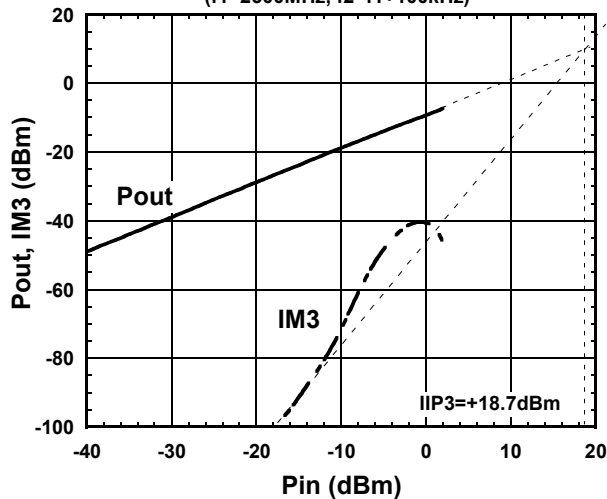
**NJG1126HB6 @Low Gain**

**Gain, I<sub>DD</sub> vs. Pin**  
(fRF=2500MHz)



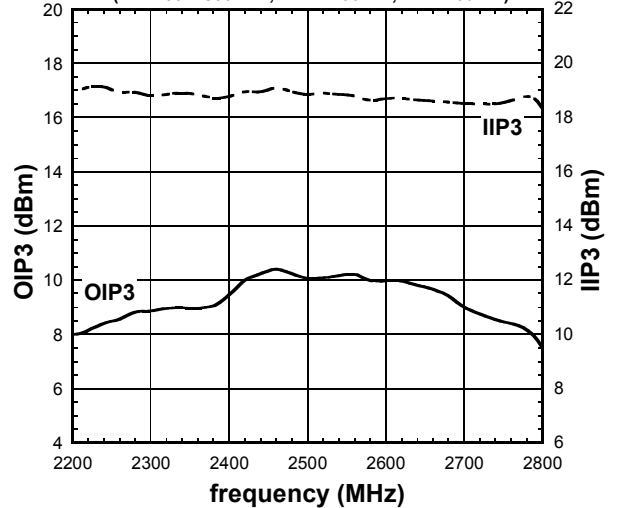
**NJG1126HB6 @Low Gain**

**Pout, IM3 vs. Pin**  
(f1=2500MHz, f2=f1+100kHz)



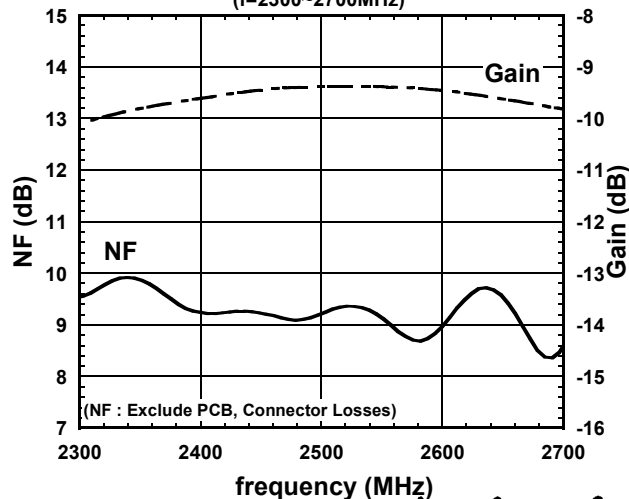
**NJG1126HB6 @Low Gain**

**OIP3, IIP3 vs. frequency**  
(f1=2200~2800MHz, f2=f1+100kHz, Pin=-16dBm)



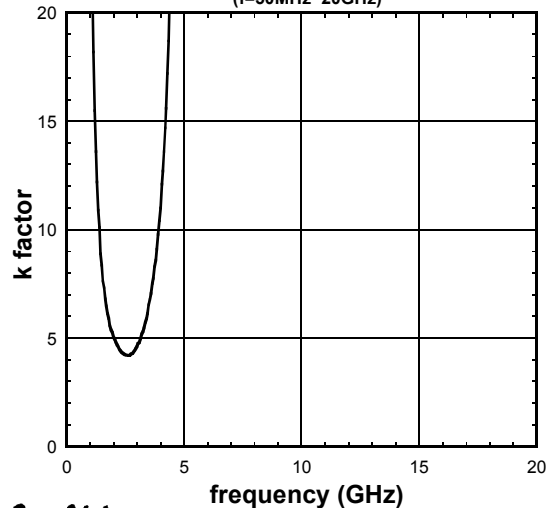
**NJG1126HB6 @Low Gain**

**NF, Gain vs. frequency**  
(f=2300~2700MHz)



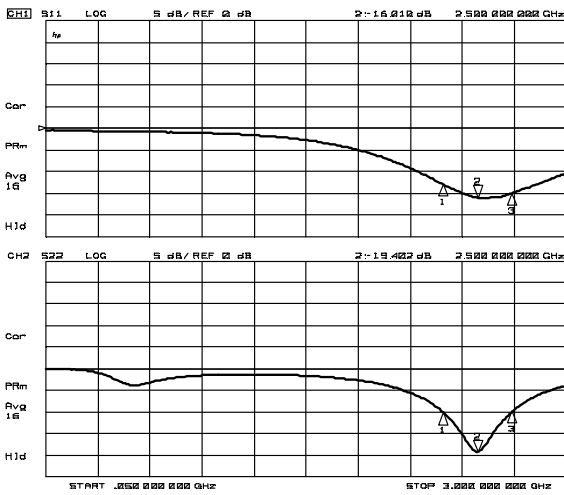
**NJG1126HB6 @Low Gain**

**k factor vs. frequency**  
(f=50MHz~20GHz)

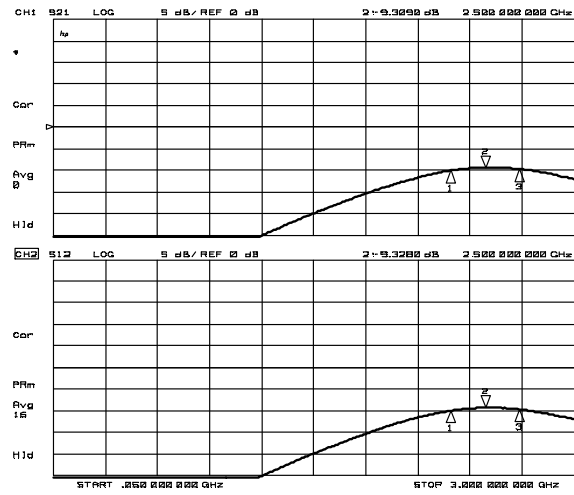


## 3-5-4 TYPICAL CHARACTERISTICS (LNA Low Gain Mode)

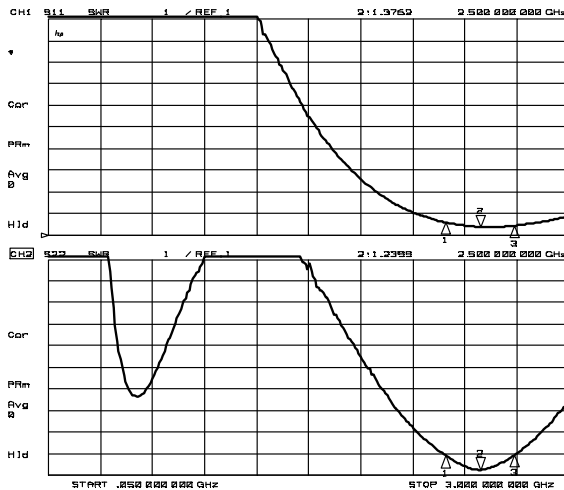
Condition:  $T_a = +25^\circ\text{C}$ ,  $V_{DD} = V_{INV} = 2.7\text{V}$ ,  $V_{CTL} = 0\text{V}$ ,  $Z_s = Z_l = 50\Omega$



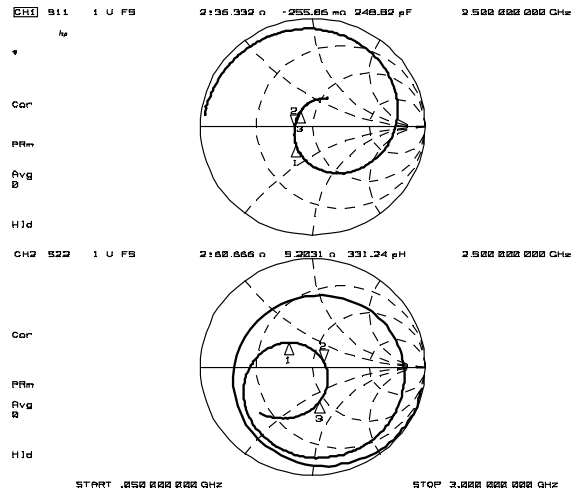
S11, S22



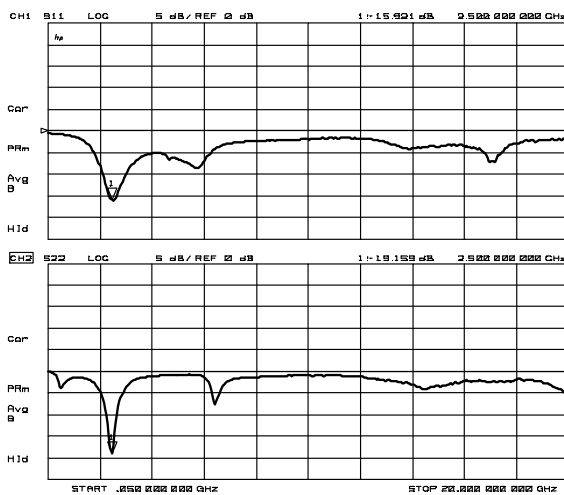
S21, S12



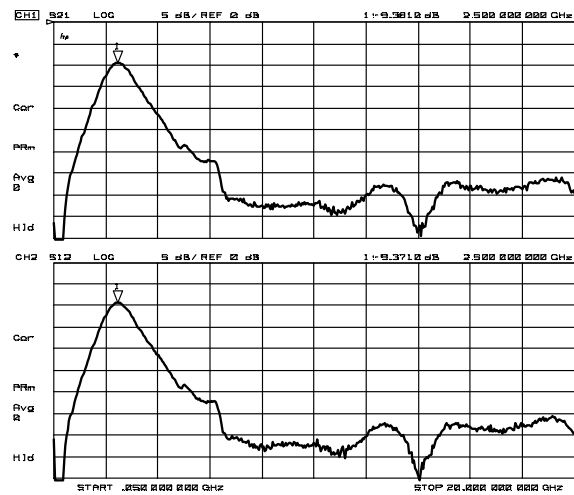
VSWR



Zin, Zout



S11, S22 (f=50MHz ~ 20GHz)



S21, S12 (f=50MHz ~ 20GHz)