

Features

- 14 dB Gain at 2000 MHz
- 27 dBm P1dB at 2000 MHz
- 42 dBm OIP3 at 2000 MHz
- ACLR @ WCDMA 4FA: -51 dBc @ Pout = +13 dBm, +/- 5 MHz offset
- MTTF > 100 Years
- Single Supply

Description

The ASX415, a power amplifier MMIC, has a high linearity, high gain, and high efficiency over a wide range of frequency, being suitable for use in both receiver and transmitter of telecommunication systems up to 4 GHz. The amplifier is available in a SOT89 package and passes through the stringent DC, RF, and reliability tests.



Package Style: SOT89

Typical Performance

(Supply Voltage = Device Voltage, $T_A = +25\text{ }^\circ\text{C}$, $Z_0 = 50\ \Omega$)

Parameters	Units	Typical				
Frequency	MHz	900	2000	2000	2000	2600
Gain	dB	20.0	14.5	14.3	14.0	11.5
S11	dB	-14	-7	-7	-7	-7
S22	dB	-13	-11	-11	-11	-10
Output IP3 ¹⁾	dBm	42.5	46.0	42.0	40.0	37.0
Noise Figure	dB	4.2	5.6	4.6	4.1	4.2
Output P1dB	dBm	29.0	29.0	27.0	26.5	29.0
Current	mA	155	185	155	123	155
Device Voltage	V	+5.00	+5.30	+5.00	+4.75	+5.00

1) OIP3 is measured with two tones at an output power of +8 dBm/tone @ +5.30 V, +6 dBm/tone @ +5.00 V, +4 dBm/tone @ +4.75 V separated by 1 MHz.

Application Circuit

- IF (433 ~ 444 MHz)
- CDMA
- Satellite Phone
- WCDMA
- WiMAX
- LTE (2300 ~ 2700 MHz)

Product Specifications

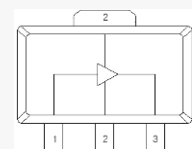
Parameters	Units	Min	Typ	Max
Testing Frequency	MHz		2000	
Gain	dB	13.5	14.3	
S11	dB		-9	
S22	dB		-11	
Output IP3	dBm	40	42	
Noise Figure	dB		4.6	
Output P1dB	dBm	26.5	27.0	
Current	mA	140	155	170
Device Voltage	V		+5	

Absolute Maximum Ratings

Parameters	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+6 V
Operating Junction Temperature	+150 °C
Input RF Power (Continuous)*	+22 dBm
Thermal Resistance	24 °C/W

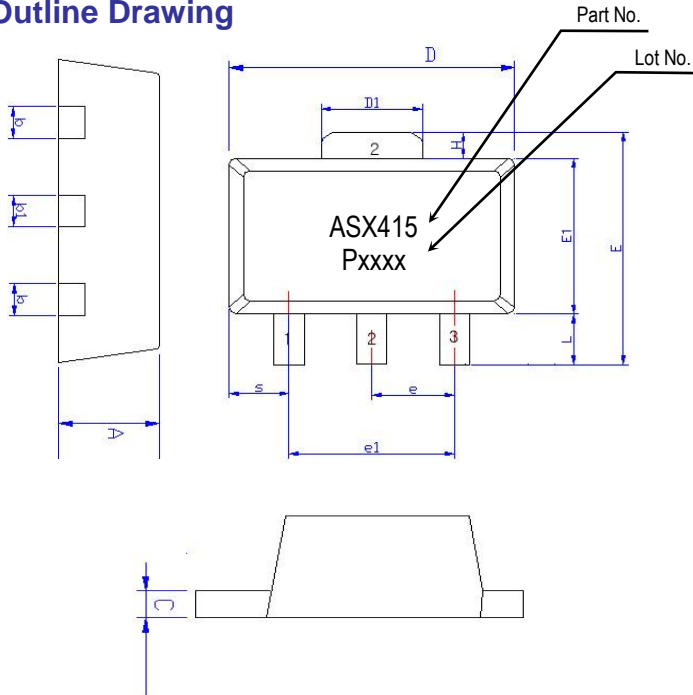
* Please find the max. input power data from http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf

Pin Configuration



Pin No.	Function
1	RF IN
2	GND
3	RF OUT / Bias

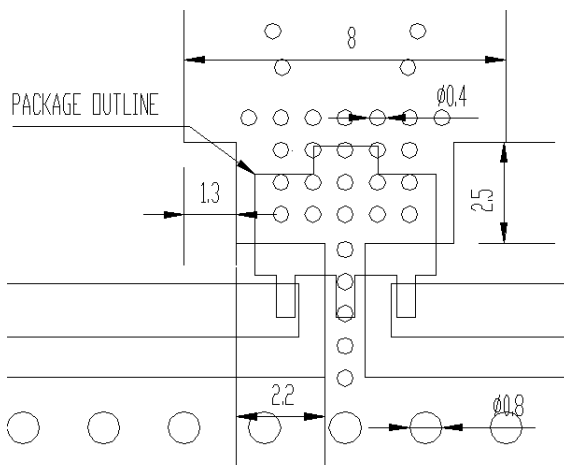
Outline Drawing



Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	1.40	1.50	1.60
L	0.89	1.04	1.20
b	0.36	0.42	0.48
b1	0.41	0.47	0.53
C	0.38	0.40	0.43
D	4.40	4.50	4.60
D1	1.40	1.60	1.75
E	3.64	---	4.25
E1	2.40	2.50	2.60
e1	2.90	3.00	3.10
H	0.35	0.40	0.45
S	0.65	0.75	0.85
e	1.40	1.50	1.60

Pin No.	Function
1	RF IN
2	GND
3	RF OUT / Bias

Mounting Recommendation (In mm)



- Note:**
1. The number and size of ground via holes in a circuit board is critical for thermal and RF grounding considerations.
 2. We recommend that the ground via holes be placed on the bottom of the lead pin 2 and exposed pad of the device for better RF and thermal performance, as shown in the drawing at the left side.

ESD Classification & Moisture Sensitivity Level

ESD Classification

HBM	Class 1B Voltage Level: 500 V ~ 1000 V
MM	Class A Voltage Level: <200 V

CAUTION: ESD-sensitive device!

Moisture Sensitivity Level (MSL)

Level 3 at 260 °C reflow

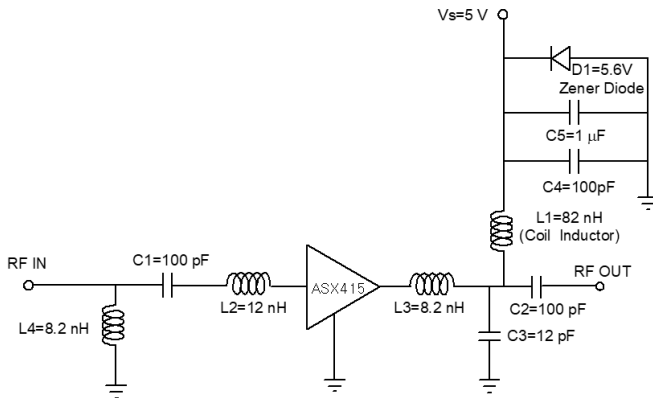
APPLICATION CIRCUIT

IF
433 ~ 444 MHz
+5 V

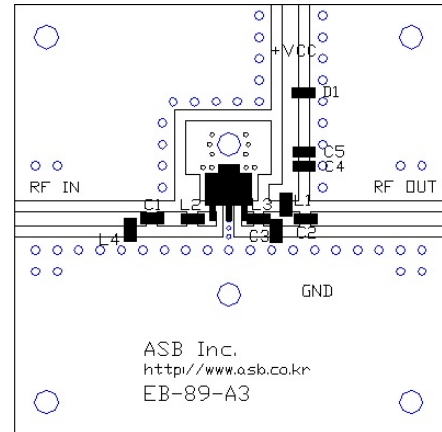
Frequency (MHz)	433	444
Magnitude S21 (dB)	22.0	22.0
Magnitude S11 (dB)	-18	-18
Magnitude S22 (dB)	-16	-15
Output P1dB (dBm)	28	28
Output IP3 ¹⁾ (dBm)	35	37
Noise Figure (dB)	6.5	6.0
Device Voltage (V)	+5	+5
Current (mA)	155	155

1) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1 MHz.

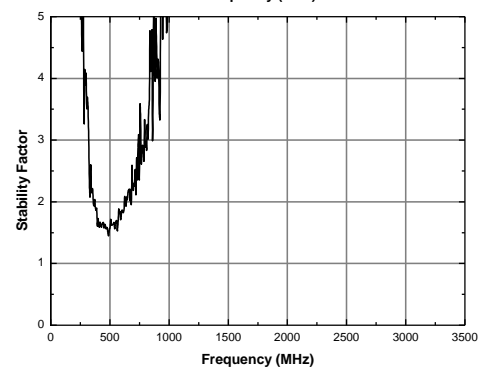
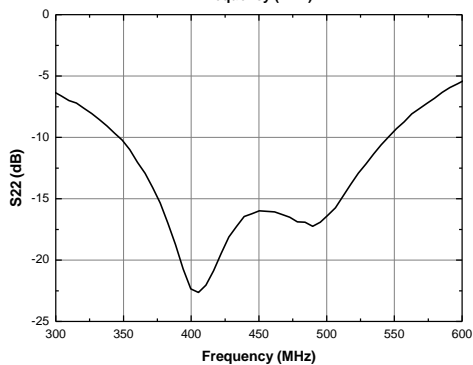
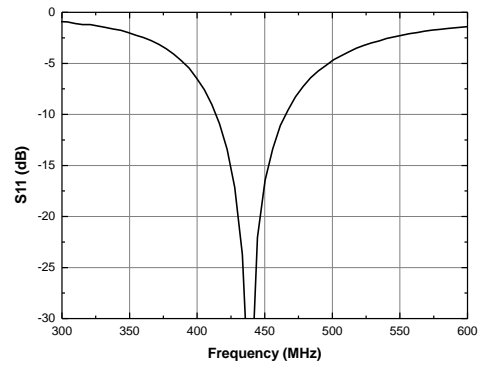
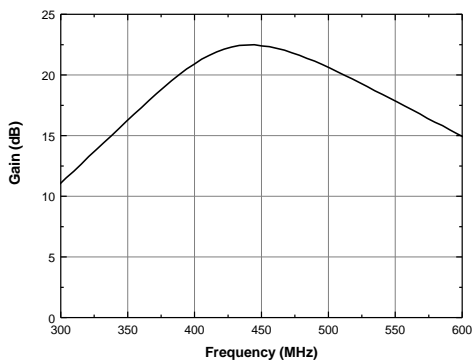
Schematic



Board Layout (FR4, 40x40 mm², 0.8T)



S-parameters & K-factor



APPLICATION CIRCUIT

CDMA Rx

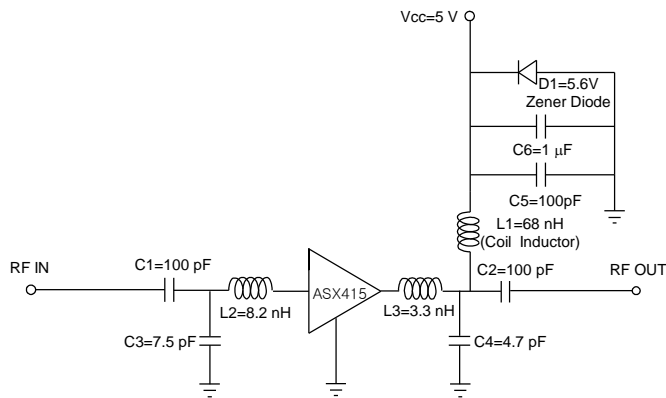
824 ~ 849 MHz

+5.30 V, +5.00 V, +4.75 V

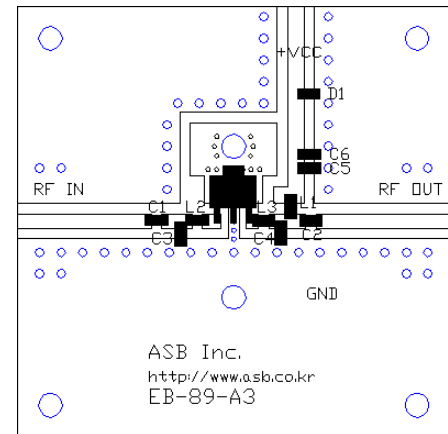
Frequency (MHz)	824 ~ 849		
Magnitude S21 (dB)	20.3	20.0	19.8
Magnitude S11 (dB)	-15	-15	-14
Magnitude S22 (dB)	-12	-12	-12
Output P1dB (dBm)	28.5	28.5	28.0
Output IP3 ¹⁾ (dBm)	45	41	35
Noise Figure (dB)	5.2	4.4	4.2
Device Voltage (V)	+5.30	+5.00	+4.75
Current (mA)	185	155	123

1) OIP3 is measured with two tones at an output power of +7 dBm/tone @ +5.30 V, +6 dBm/tone @ +5.00 V, +4 dBm/tone @ +4.75 V separated by 1 MHz.

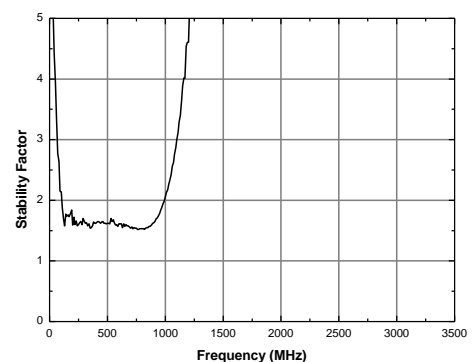
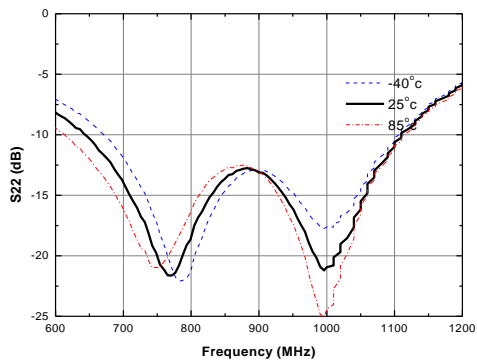
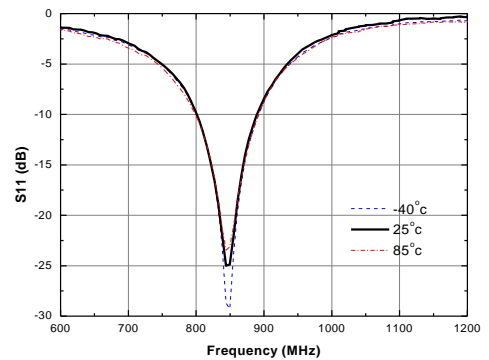
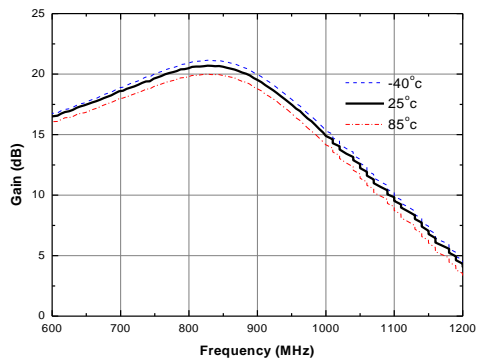
Schematic



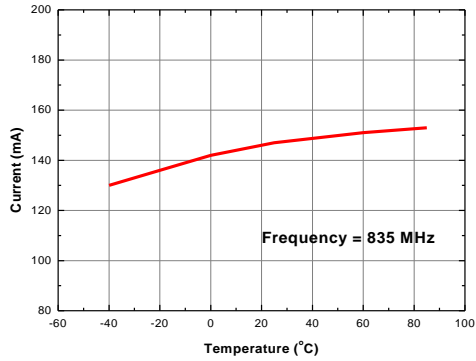
Board Layout (FR4, 40x40 mm², 0.8T)



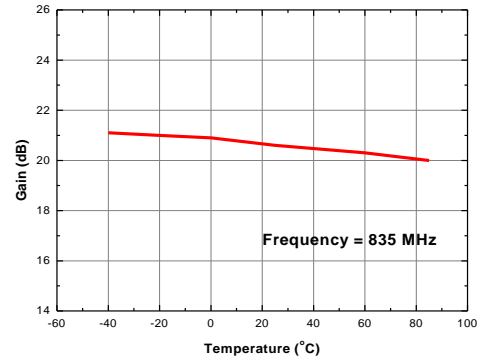
S-parameters & K-factor



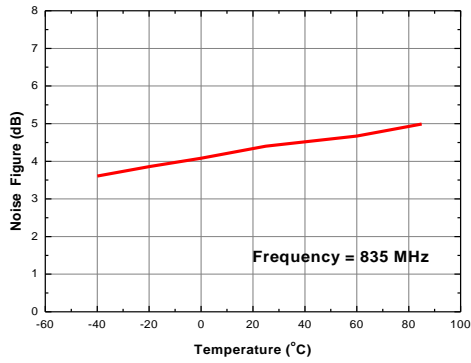
Current vs. Temperature



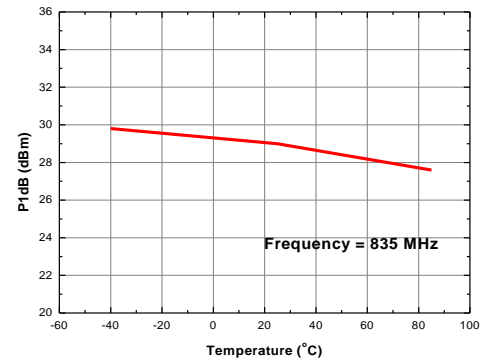
Gain vs. Temperature



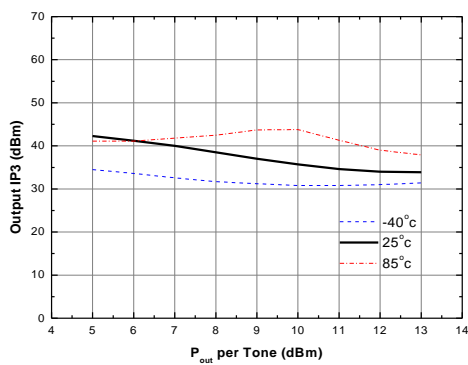
Noise Figure vs. Temperature



P1dB vs. Temperature



Output IP3 vs. Tone Power (Frequency = 835 MHz)



APPLICATION CIRCUIT

CDMA Tx

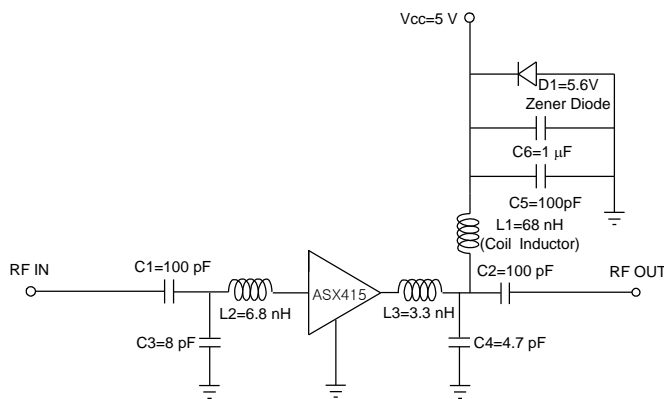
869 ~ 894 MHz

+5.30 V, +5.00 V, +4.75 V

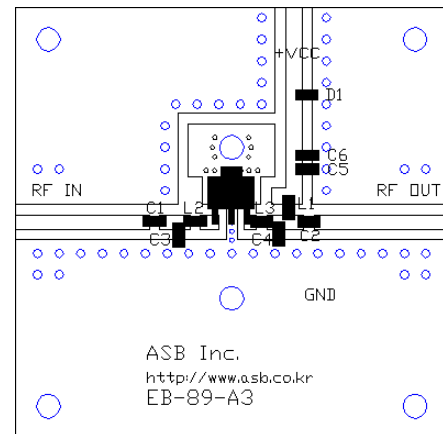
Frequency (MHz)	869 ~ 894		
Magnitude S21 (dB)	20.1	20.0	19.7
Magnitude S11 (dB)	-14	-14	-12
Magnitude S22 (dB)	-13	-13	-13
Output P1dB (dBm)	29.0	29.0	27.5
Output IP3 ¹⁾ (dBm)	45.0	42.5	39.0
Noise Figure (dB)	5.2	4.2	4.2
Device Voltage (V)	+5.30	+5.00	+4.75
Current (mA)	185	155	123

1) OIP3 is measured with two tones at an output power of +5 dBm/tone @ +5.30 V, +6 dBm/tone @ +5.00 V, +10 dBm/tone @ +4.75 V separated by 1 MHz.

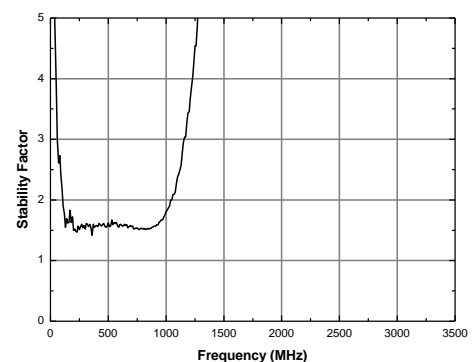
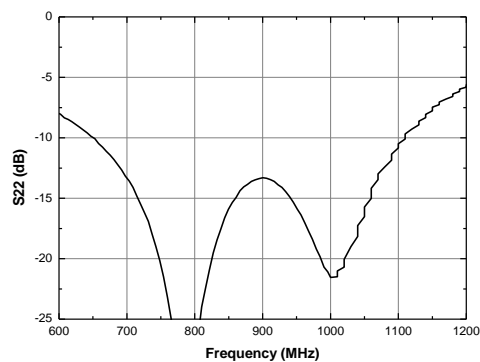
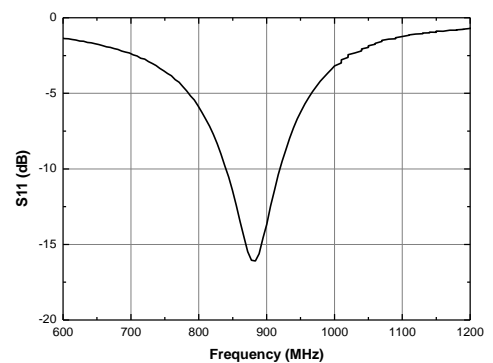
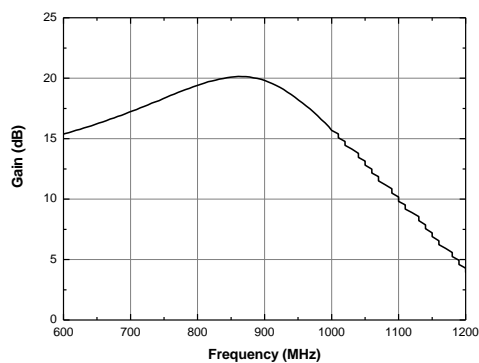
Schematic



Board Layout (FR4, 40x40 mm², 0.8T)



S-parameters & K-factor



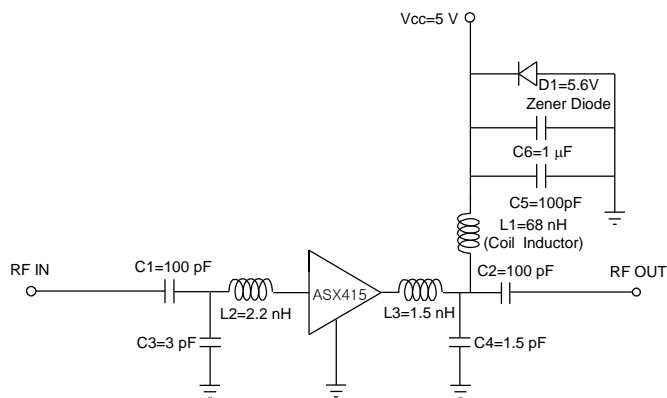
APPLICATION CIRCUIT

Satellite Phone
1626 ~ 1661 MHz
+5 V

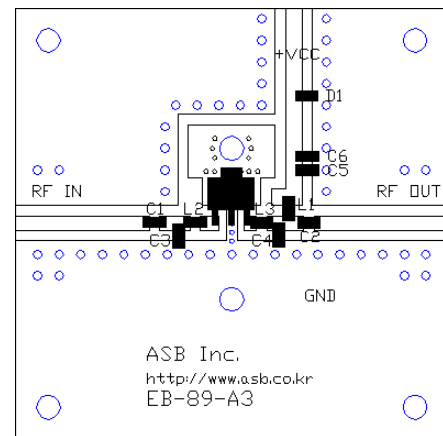
Frequency (MHz)	1626 ~ 1661
Magnitude S21 (dB)	16.5
Magnitude S11 (dB)	-14
Magnitude S22 (dB)	-18
Output P1dB (dBm)	29
Output IP3 ¹⁾ (dBm)	37.5
Noise Figure (dB)	3.8
Device Voltage (V)	+5
Current (mA)	155

1) OIP3 is measured with two tones at an output power of +6 dBm/tone separated by 1 MHz.

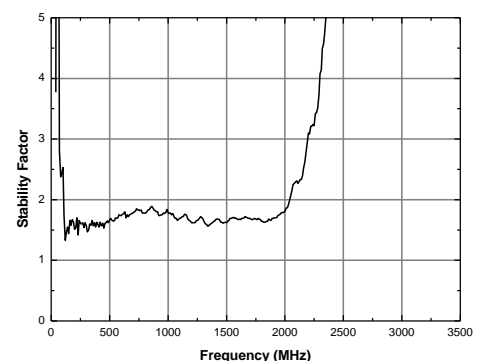
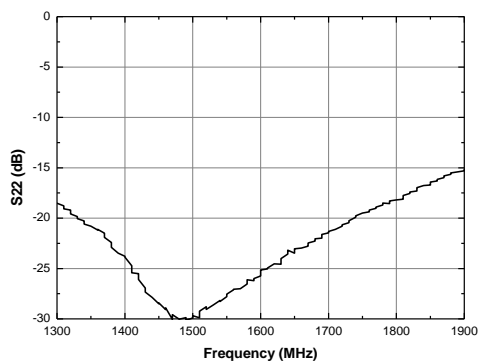
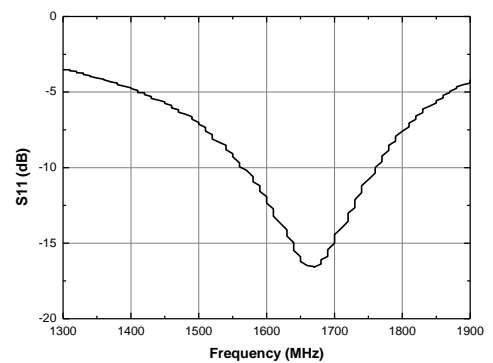
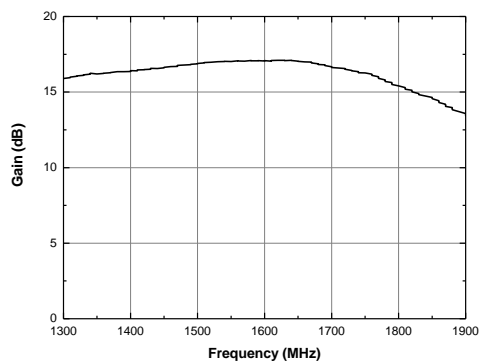
Schematic



Board Layout (FR4, 40x40 mm², 0.8T)



S-parameters & K-factor



APPLICATION CIRCUIT

WCDMA Rx

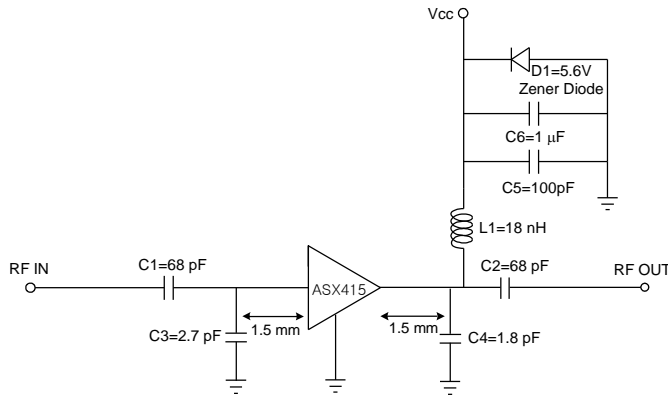
1920 ~ 1980 MHz

+5.30 V, +5.00 V, +4.75 V

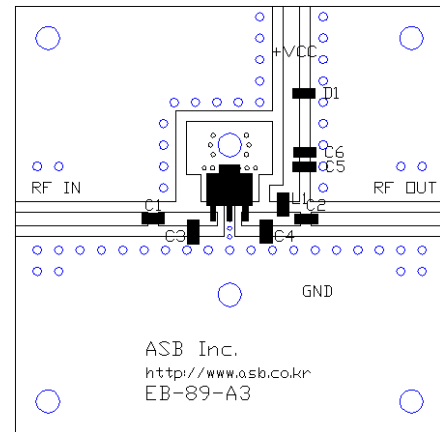
Frequency (MHz)	1920 ~ 1980		
Magnitude S21 (dB)	14.5	14.3	14.0
Magnitude S11 (dB)	-7	-7	-7
Magnitude S22 (dB)	-11	-11	-11
Output P1dB (dBm)	29.0	27.0	26.5
Output IP3 ¹⁾ (dBm)	46	42	40
Noise Figure (dB)	5.6	4.6	4.1
Device Voltage (V)	+5.30	+5.00	+4.75
Current (mA)	185	155	123

1) OIP3 is measured with two tones at an output power of +8 dBm/tone @ +5.30 V, +6 dBm/tone @ +5.00 V, +4 dBm/tone @ +4.75 V separated by 1 MHz.

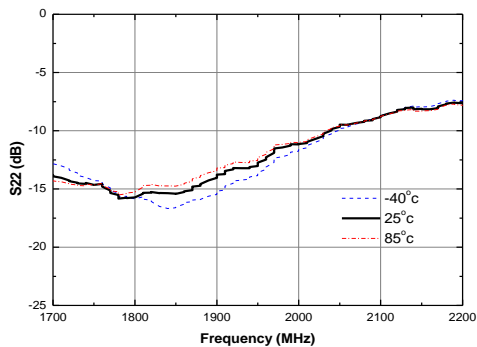
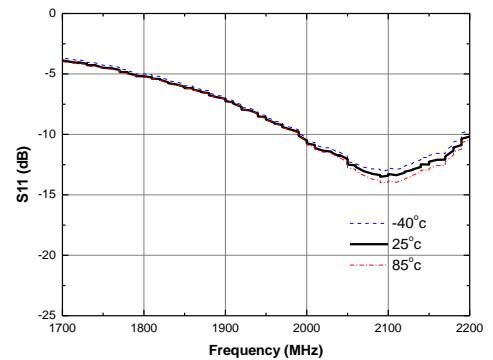
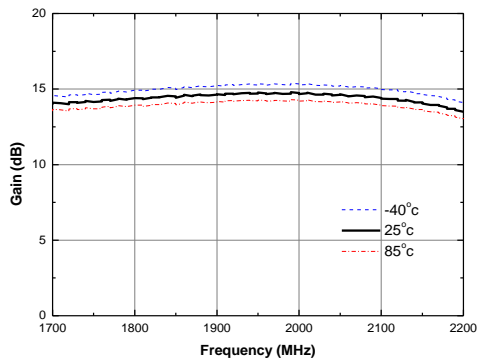
Schematic



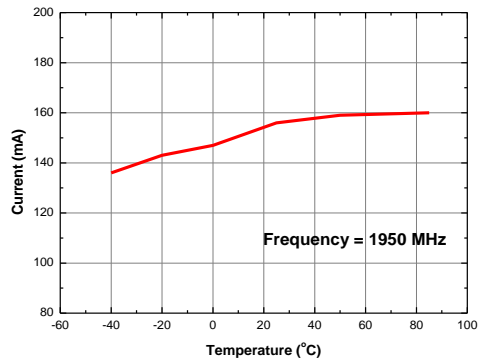
Board Layout (FR4, 40x40 mm², 0.8T)



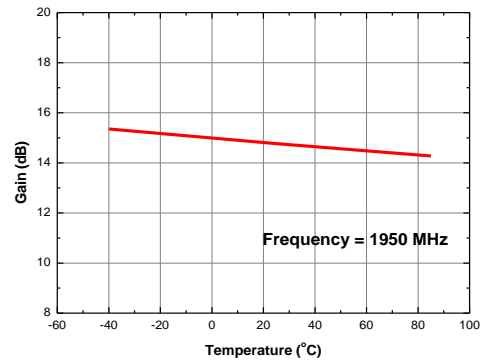
S-parameters & K-factor (+5 V)



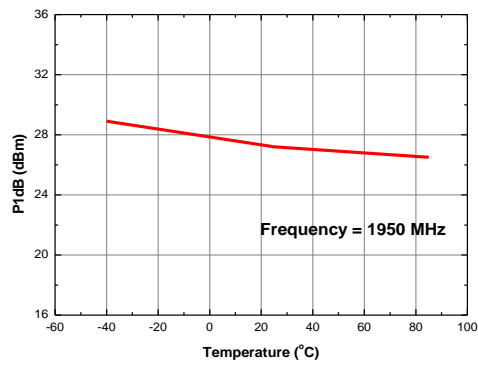
Current vs. Temperature



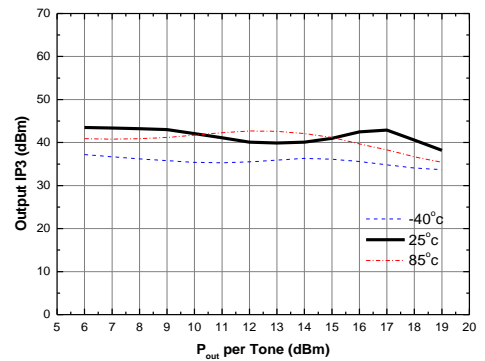
Gain vs. Temperature



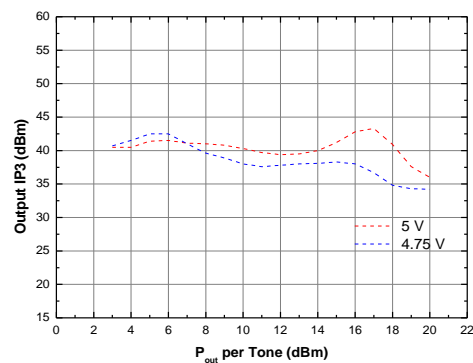
P1dB vs. Temperature



Output IP3 vs. Tone Power (Frequency = 1950 MHz)

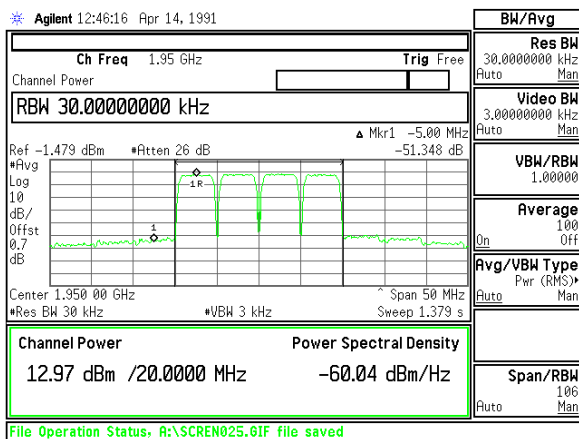


Output IP3 vs. Tone Power (Frequency = 1950 MHz)

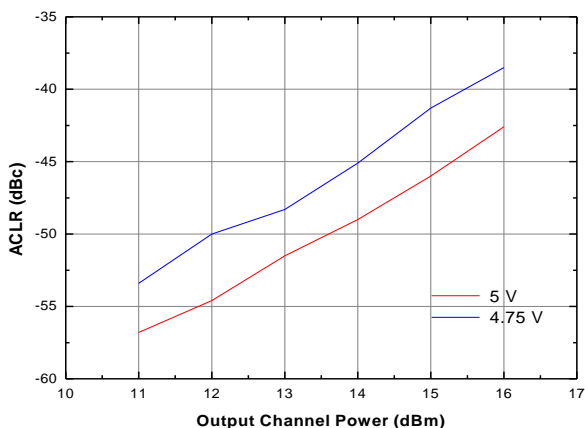
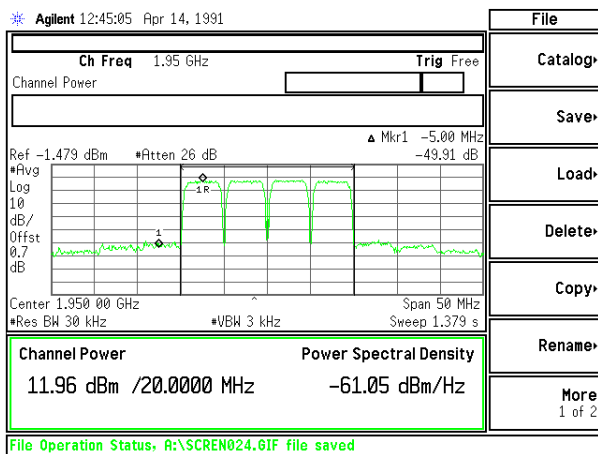


WCDMA ACLR – 4FA

+5 V, 155 mA

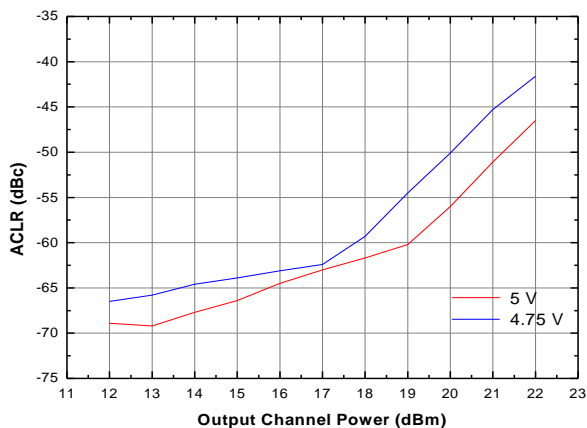


+4.75 V, 123 mA



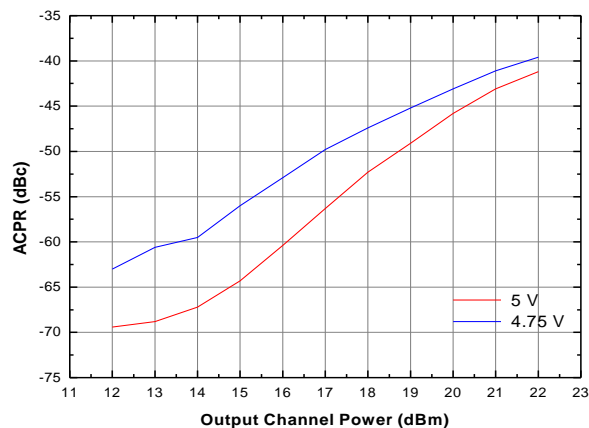
• Test Source: WCDMA 4FA (3GPP 3.4 12-00), Test Model1 w/64 DPCH, PAR = 13 dB @ 0.01 % probability on CCDF, 1950 MHz, 5 MHz offset

WCDMA ACLR – 1FA



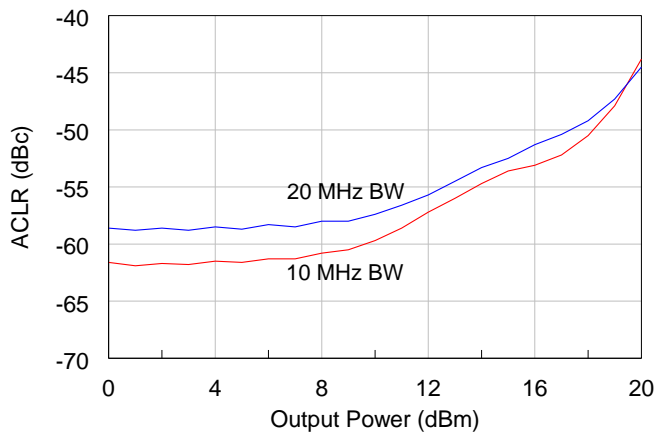
• Test Source: WCDMA 1FA (3GPP 3.4 12-00), Test Model1 w/64 DPCH, PAR = 13 dB @ 0.01 % probability on CCDF, 1950 MHz, 5 MHz offset

CDMA ACPR – 1FA



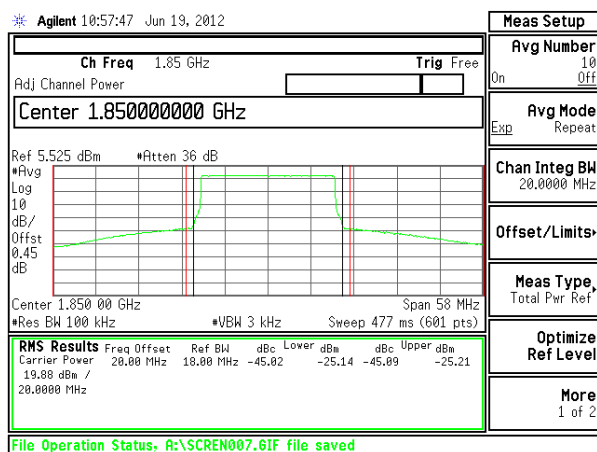
• Test Source: IS-95, 9ch. Forward 30 kHz Meas BW, 1950 MHz, 750 kHz offset

LTE ACLR – 10 MHz & 20 MHz



1) Test Source : LTE_FDD_test model 3.1, BW: 10 MHz & 20 MHz, Test Frequency: 1850 MHz

LTE ACLR – 20 MHz



2) Test Source : LTE_FDD_test model 3.1, BW: 20 MHz, Test Frequency: 1850 MHz

APPLICATION CIRCUIT

WCDMA Tx

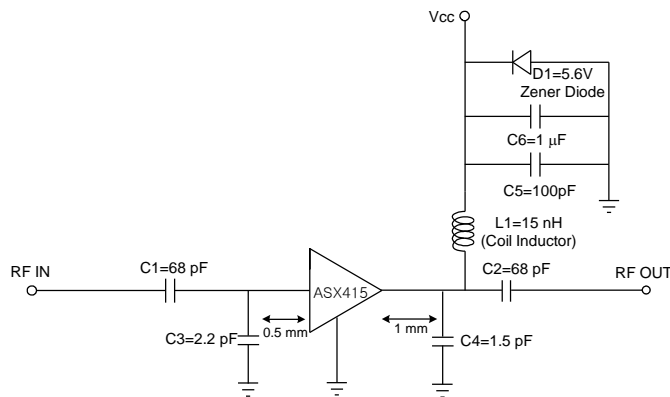
2110 ~ 2170 MHz

+5.30 V, +5.00 V, +4.75 V

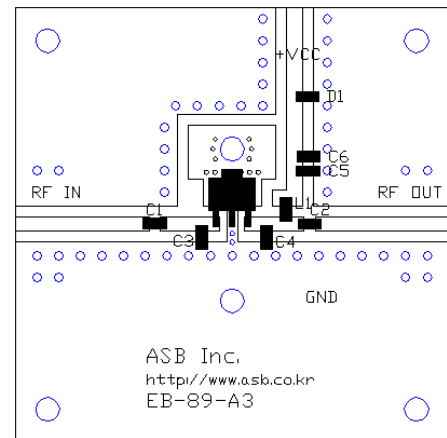
Frequency (MHz)	2110 ~ 2170		
Magnitude S21 (dB)	13.2	13.0	12.8
Magnitude S11 (dB)	-6	-6	-6
Magnitude S22 (dB)	-12	-12	-12
Output P1dB (dBm)	28.5	27.5	27.0
Output IP3 ¹⁾ (dBm)	46.0	40.5	39.5
Noise Figure (dB)	6.0	4.9	4.5
Device Voltage (V)	+5.30	+5.00	+4.75
Current (mA)	185	155	123

1) OIP3 is measured with two tones at an output power of +8 dBm/tone @ +5.30 V, +6 dBm/tone @ +5.00 V, +4 dBm/tone @ +4.75 V separated by 1 MHz.

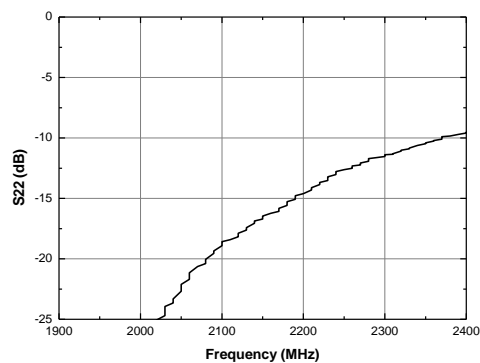
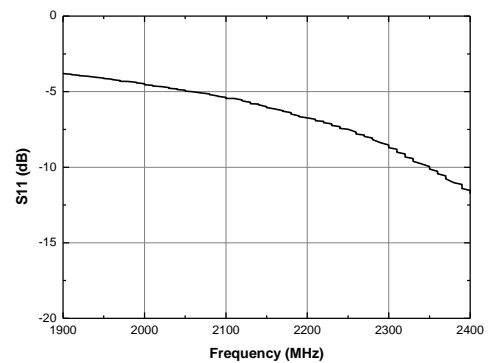
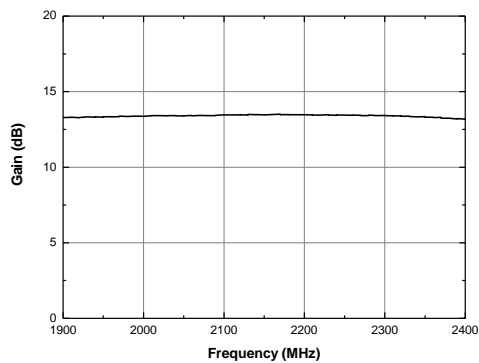
Schematic



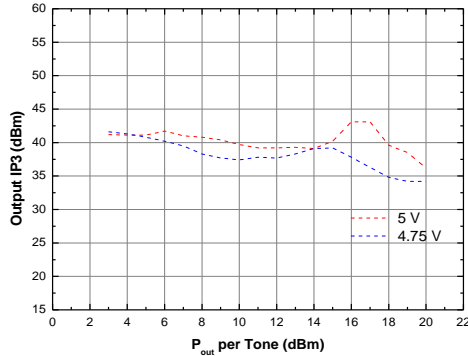
Board Layout (FR4, 40x40 mm², 0.8T)



S-parameters & K-factor (+5 V)

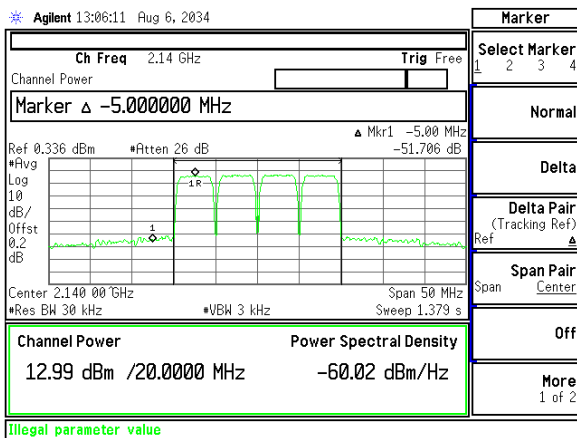


Output IP3 vs. Tone Power (Frequency = 2140 MHz)

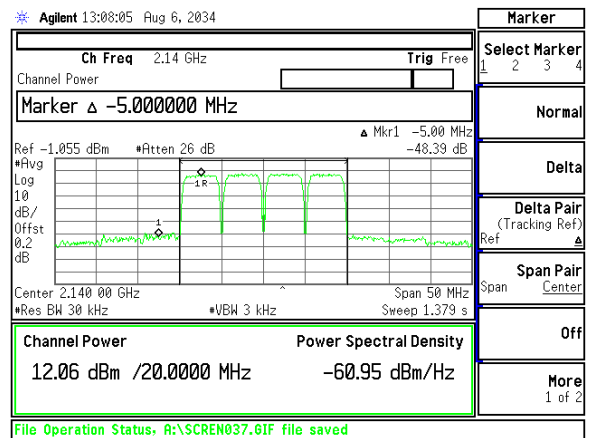


WCDMA ACLR

+5 V, 155 mA



+4.75 V, 123 mA



• Test Source: WCDMA 4FA (3GPP 3.4 12-00), Test Model1 w/64 DPCH, PAR = 13 dB @ 0.01 % probability on CCDF

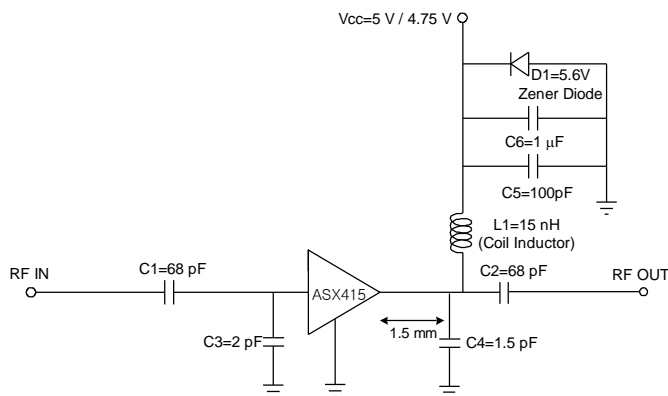
APPLICATION CIRCUIT

WiMAX
2500 ~ 2700 MHz
+5.00 V, +4.75 V

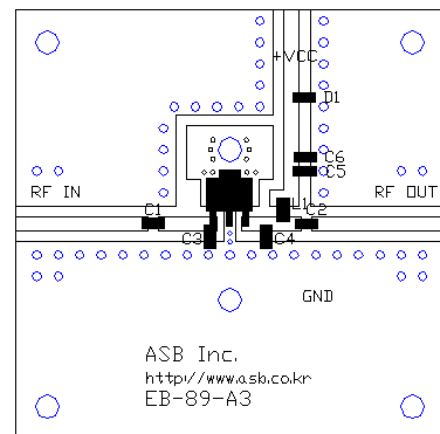
Frequency (MHz)	2500 ~ 2700	2500 ~ 2700
Magnitude S21 (dB)	11.5	11.5
Magnitude S11 (dB)	-7	-7
Magnitude S22 (dB)	-10	-10
Output P1dB (dBm)	29.0	28.5
Output IP3 ¹⁾ (dBm)	37	36
Noise Figure (dB)	4.2	3.9
Device Voltage (V)	+5.00	+4.75
Current (mA)	155	123

1) OIP3 is measured with two tones at an output power of +6 dBm/tone @ +5 V, +4 dBm/tone @ +4.75 V separated by 1 MHz.

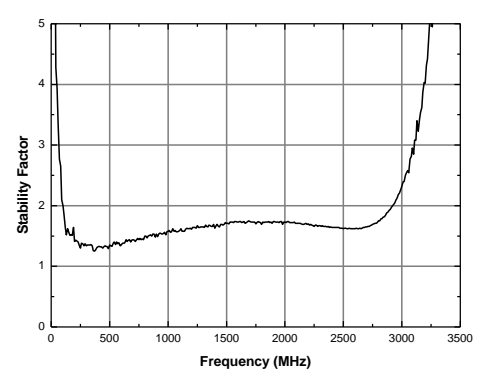
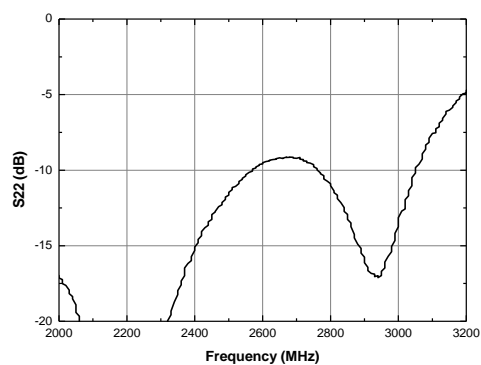
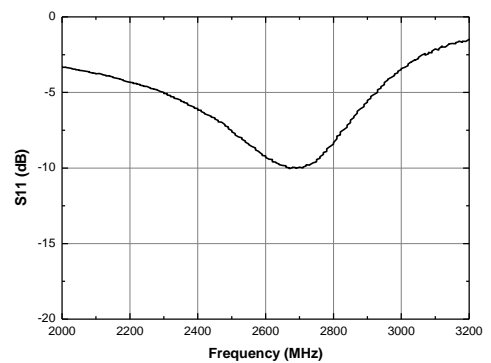
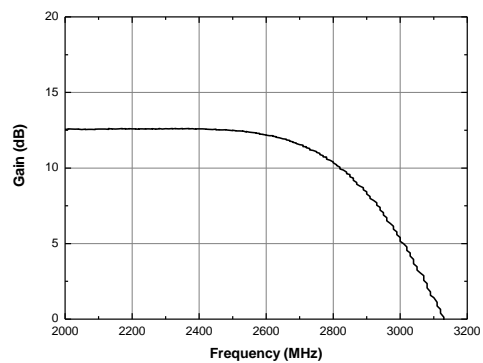
Schematic



Board Layout (FR4, 40x40 mm², 0.8T)



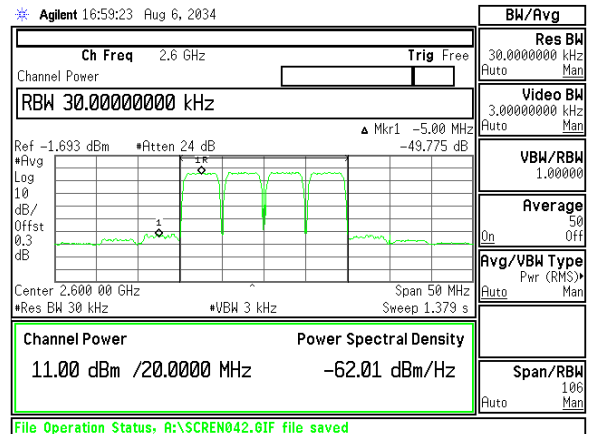
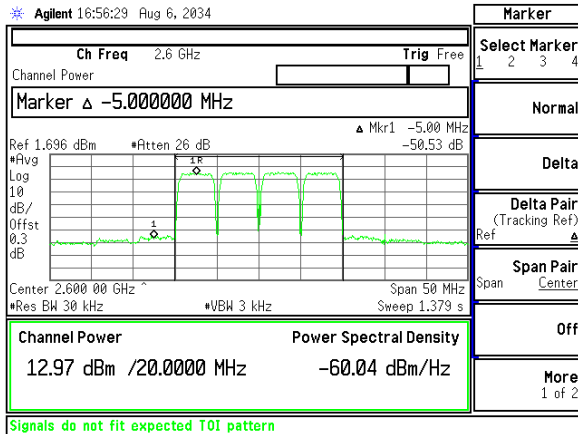
S-parameters & K-factor



WCDMA ACLR

+5 V, 155 mA

+4.75 V, 123 mA



• Test Source: WCDMA 4FA (3GPP 3.4 12-00), Test Model1 w/64 DPCH, PAR = 13 dB @ 0.01 % probability on CCDF

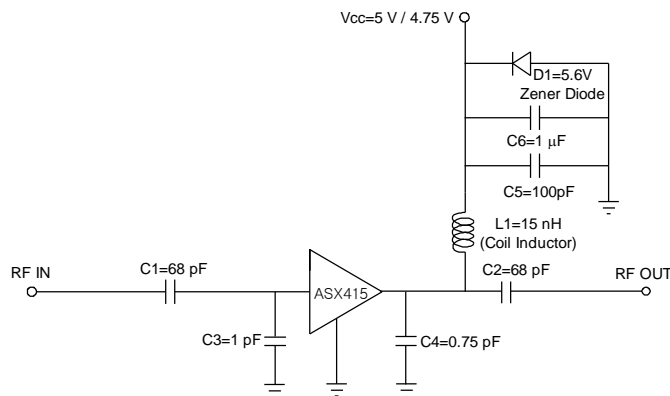
APPLICATION CIRCUIT

WIMAX
3500 MHz
+5.00 V, +4.75 V

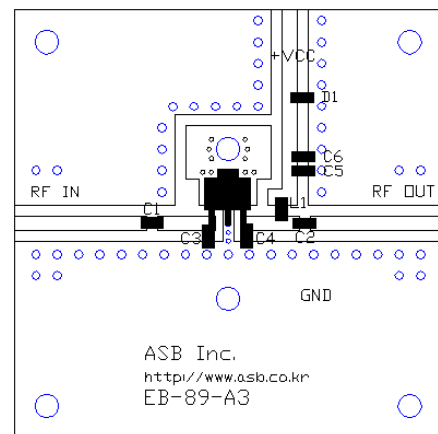
Frequency (MHz)	3500	3500
Magnitude S21 (dB)	9.0	9.0
Magnitude S11 (dB)	-7	-7
Magnitude S22 (dB)	-11	-11
Output P1dB (dBm)	25.0	24.5
Output IP3 ¹⁾ (dBm)	42	40
Noise Figure (dB)	5.4	4.8
Device Voltage (V)	+5.00	+4.75
Current (mA)	155	123

1) OIP3 is measured with two tones at an output power of +14 dBm/tone @ +5 V, +13 dBm/tone @ +4.75 V separated by 1 MHz.

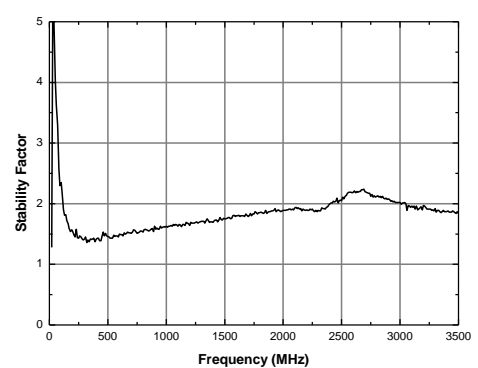
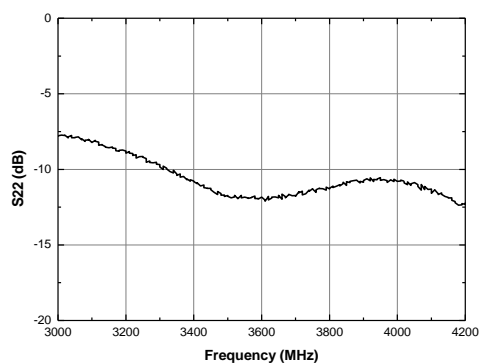
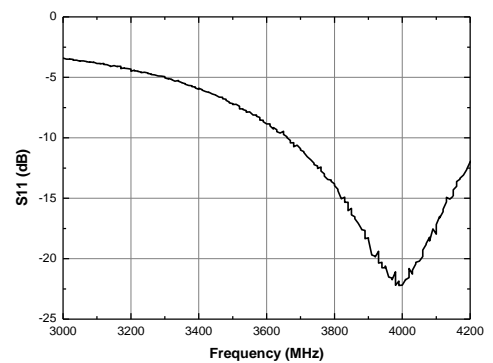
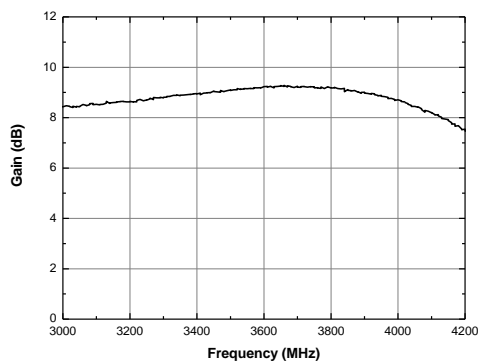
Schematic



Board Layout (FR4, 40x40 mm², 0.8T)



S-parameters & K-factor



APPLICATION CIRCUIT

LTE

2300 ~ 2700 MHz

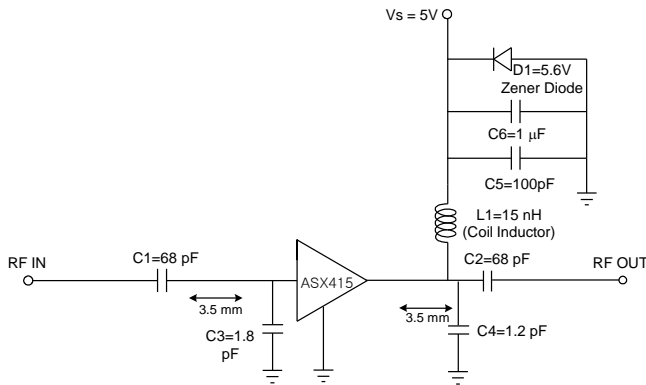
Gain Flatness < 0.5 dB

+5 V

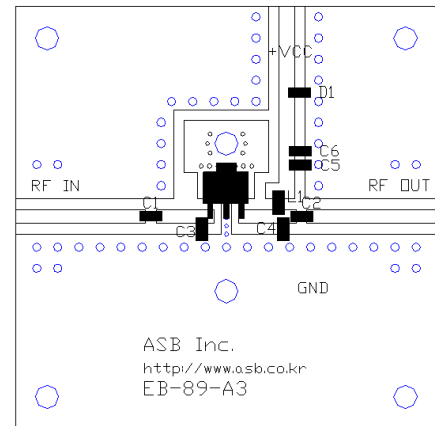
Frequency (MHz)	2300	2500	2700
Magnitude S21 (dB)	12.9	13.1	12.8
Magnitude S11 (dB)	-5	-8	-18
Magnitude S22 (dB)	-18	-18	-18
Output P1dB (dBm)	27.5		
Output IP3 ¹⁾ (dBm)	36		
Noise Figure (dB)	5.1		
Device Voltage (V)	+5		
Current (mA)	155		

1) OIP3 is measured with two tones at an output power of +6 dBm/tone separated by 1 MHz.

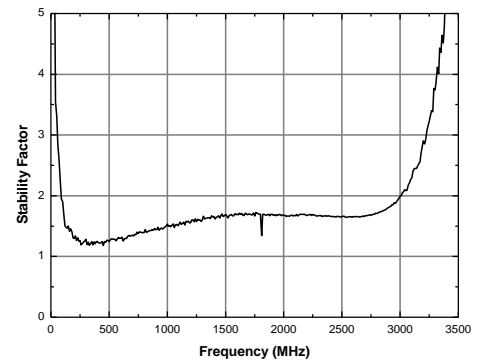
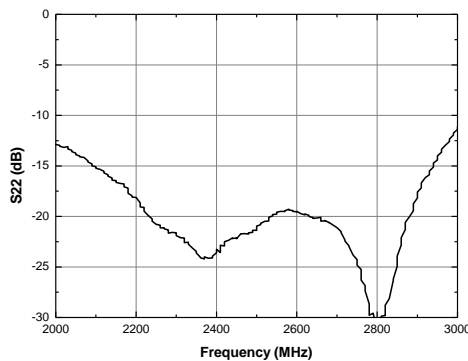
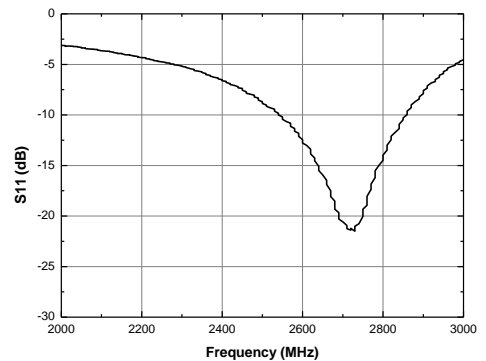
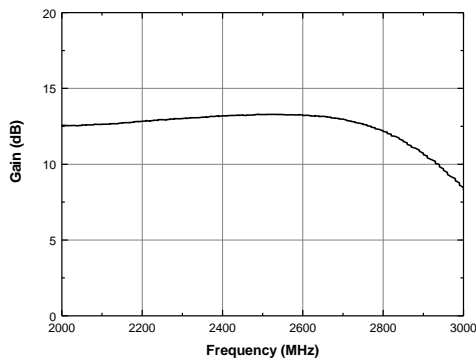
Schematic



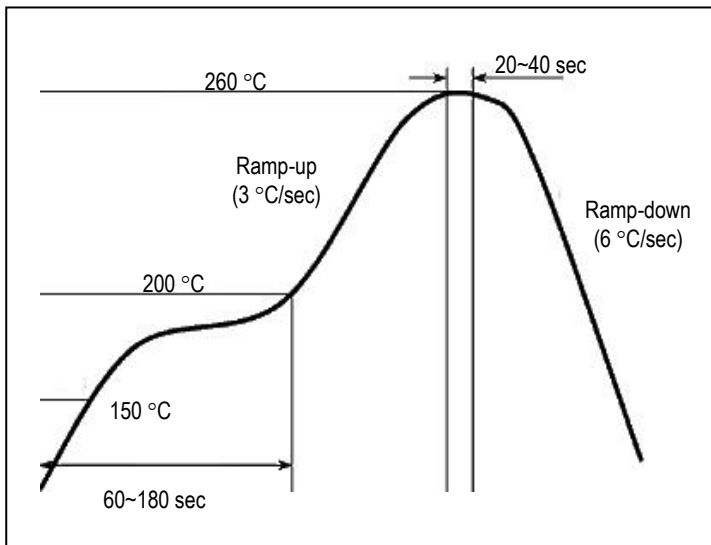
Board Layout (FR4, 40x40 mm², 0.8T)



S-parameters & K-factor



Recommended Soldering Reflow Profile



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