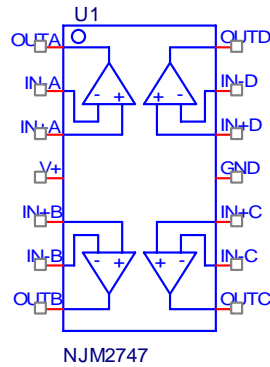# Device Modeling Report

COMPONENTS : OPERATIONAL AMPLIFIER
PART NUMBER : NJM2747
MANUFACTURER: NEW JAPAN RADIO

Bee Technologies Inc.

SPICE MODEL

U1
NJM2747

```
*$
*PART NUMBER: NJM2747
*MANUFACTURER: NEW JAPAN RADIO
*OPAMP
*All Rights Reserved Copyright (c) Bee Technologies Inc. 2006
.subckt njm2747 OUTA IN-A IN+A V+ IN+B IN-B OUTB
+ OUTC IN-C IN+C GND IN+D IN-D OUTD
X_U1 IN+A IN-A V+ GND OUTA njm2747_s
X_U2 IN+B IN-B V+ GND OUTB njm2747_s
X_U3 IN+C IN-C V+ GND OUTC njm2747_s
X_U4 IN+D IN-D V+ GND OUTD njm2747_s
.ends njm2747
.subckt njm2747_s    1 2 3 4 5
   c1     11 12 .79386E-12
   c2      6   7 28.300E-12
   dc       5 53 dy
   de      54   5 dy
   dlp    90 91 dx
   dln    92 90 dx
   dp       4   3 dx
   egnd 99    0 poly(2) (3,0) (4,0) 0 .5 .5
   fb       7 99 poly(5) vb vc ve vlp vln 0 373.25E3 -1E3 1E3 370E3 -370E3
   ga       6    0 11 12 1.9038E-3
   gcm     0    6 10 99 321.43E-9
   iee      3 10 dc 99.200E-6
   hlim 90    0 vlim 1K
   q1      11    2 13 qx1
   q2      12    1 14 qx2
   r2       6    9 100.00E3
   rc1     4 11 525.26
   rc2     4 12 525.26
   re1    13 10 2.7495
```
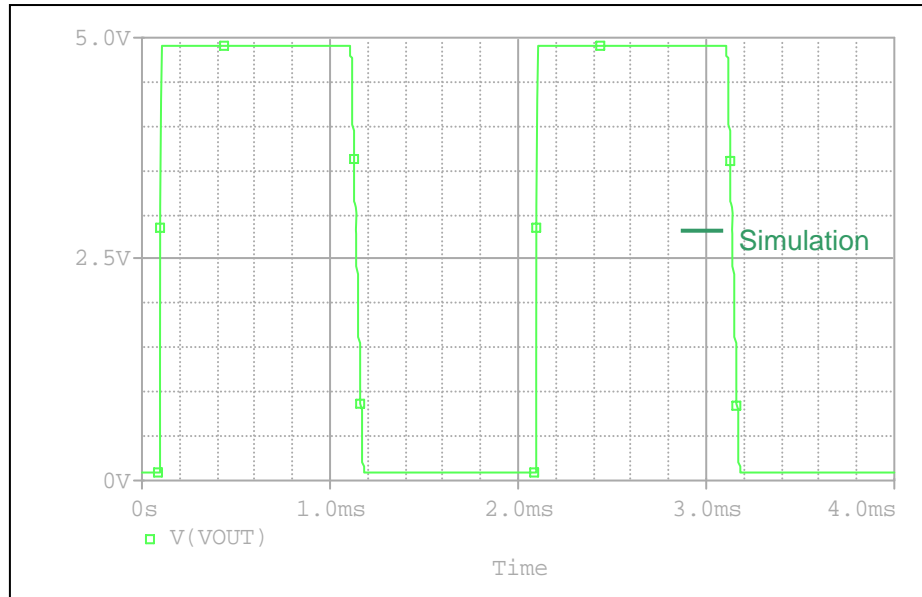
```
   re2    14 10 2.7495
   ree    10 99 2.0161E6
   ro1     8   5 50
   ro2     7 99 25
   rp      3   4 83.471
   vb      9   0 dc 0
   vc      3 53 dc .89791
   ve     54   4 dc .8085
   vlim    7   8 dc 0
   vlp    91   0 dc 20
   vln     0 92 dc 20
.model dx D(Is=800.00E-18)
.model dy D(Is=800.00E-18 Rs=1m Cjo=10p)
.model qx1 PNP(Is=800.00E-18 Bf=494.75)
.model qx2 PNP(Is=842.2140E-18 Bf=495.25)
.ends njm2747_s
*$
```
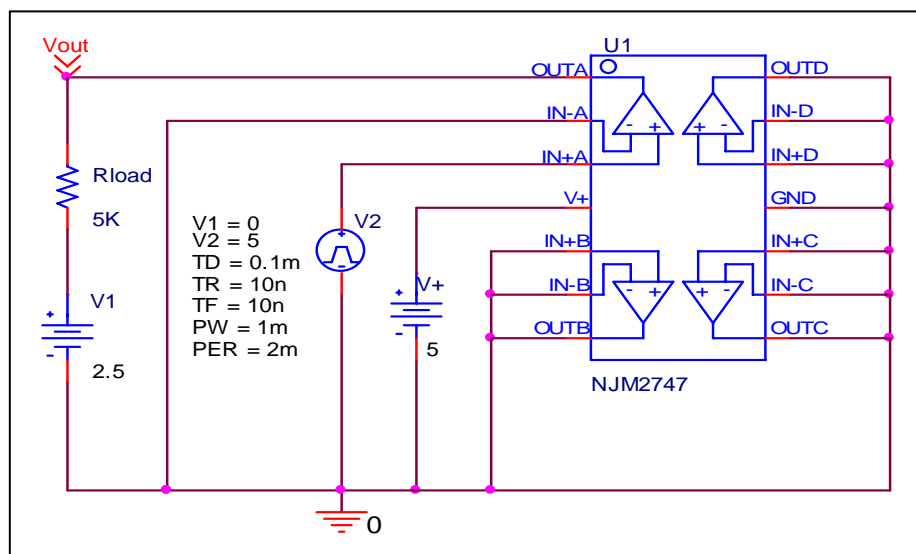
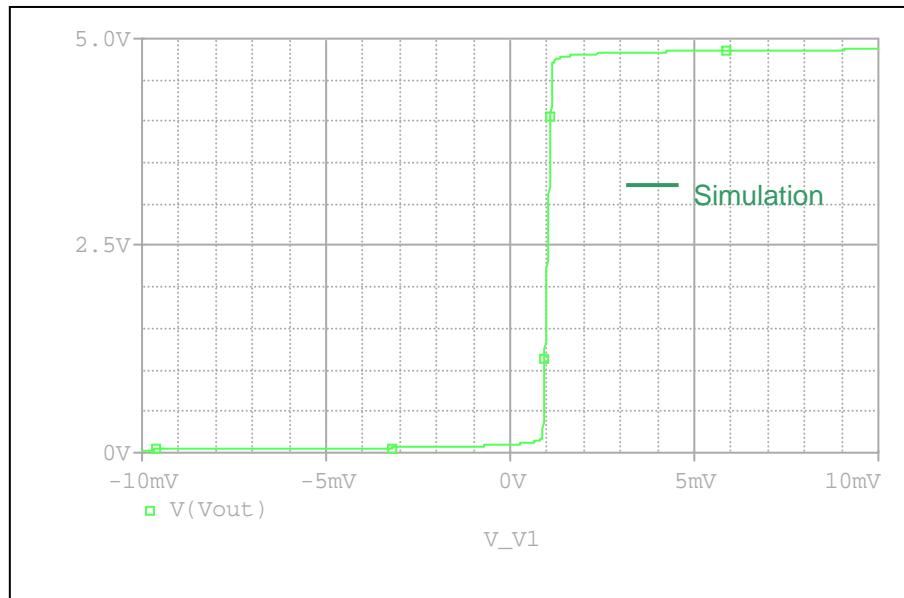# Output Voltage Swing

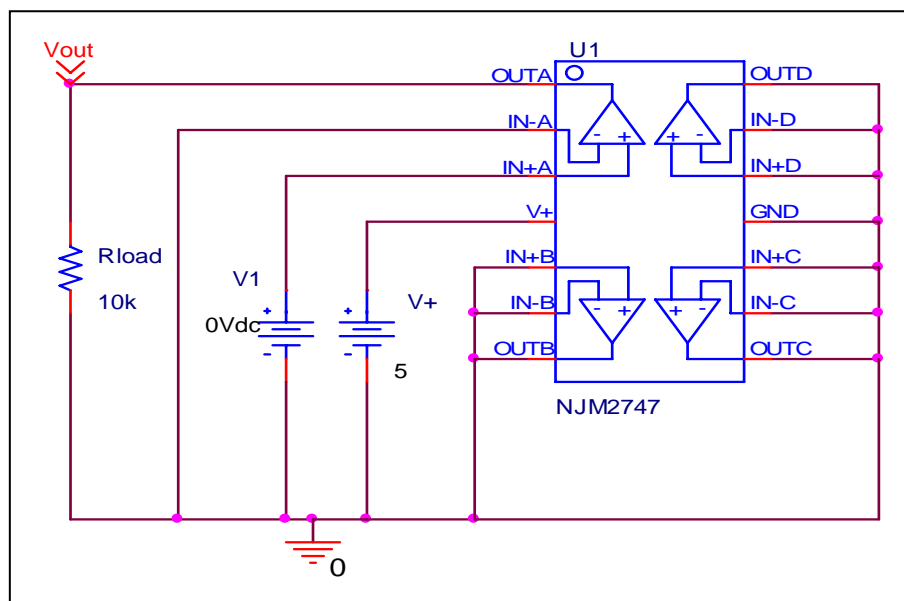## Simulation result

Evaluation circuit

Comparison Table

R_L = 5 kΩ to 2.5 V	Measurement	Simulation	%Error
V_{OH} (V)	4.9	4.9002	0.004
V_{OL} (V)	0.1	0.099967	-0.033

Input Offset Voltage

Simulation result
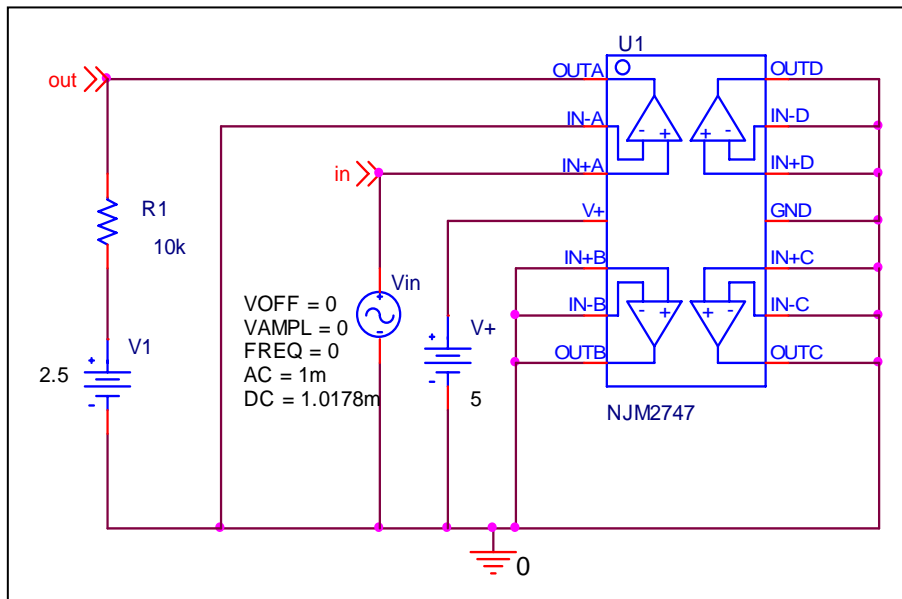

Evaluation Circuit

Comparison Table

Input offset Voltage	Measurement	Simulation	%Error
V_{OS} (mV)	1	1.0178	1.78

Open loop Voltage Gain

Simulation result
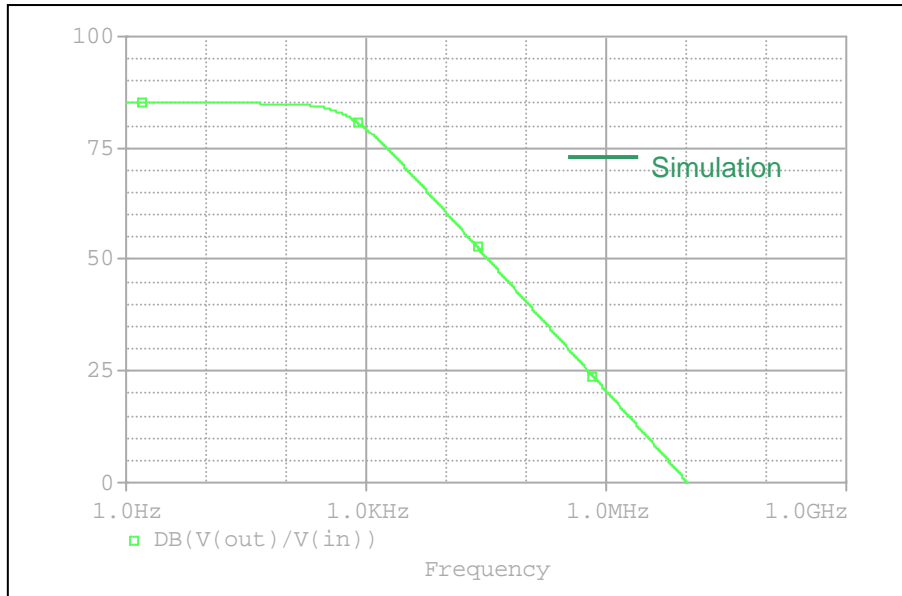
Evaluation Circuit

Comparison Table

	Measurement	Simulation	% Error
Av (dB)	85	85.005	0.006
f-0db (MHz)	10	10.294	2.940

Input Current
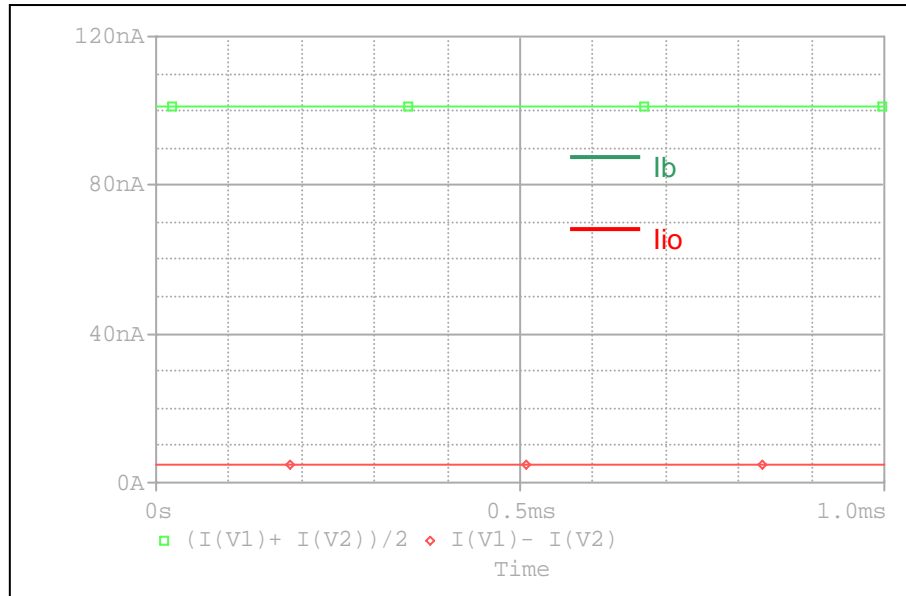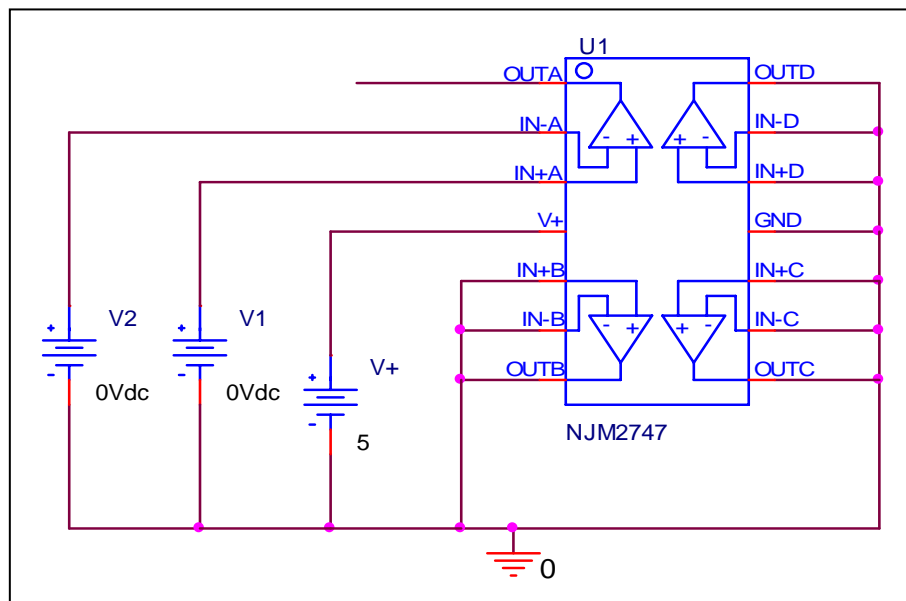
Input Current	Measurement	Simulation	% Error
I_b (nA)	100	100.928	0.928
I_{io} (nA)	5	5.0595	1.190

Slew Rate

Simulation result
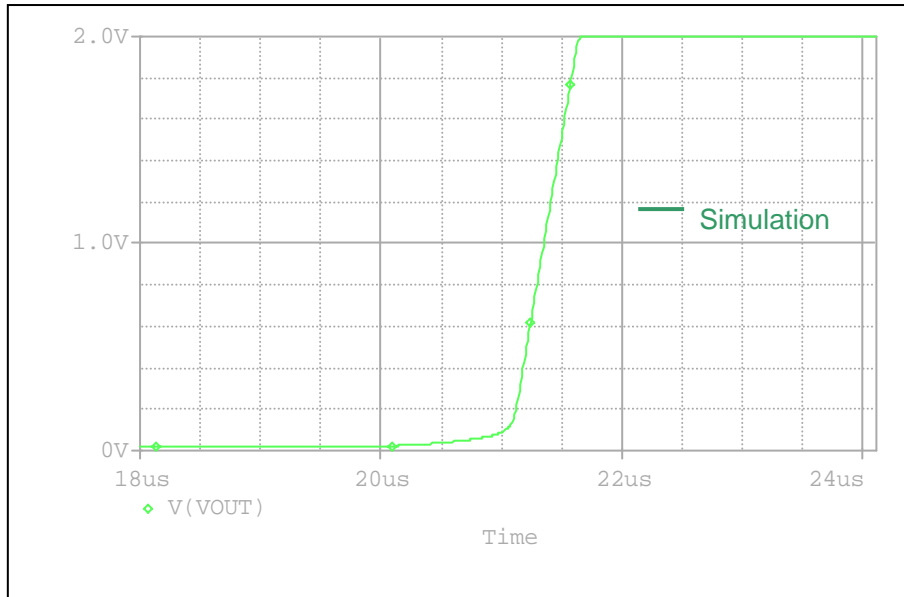
Evaluation Circuit
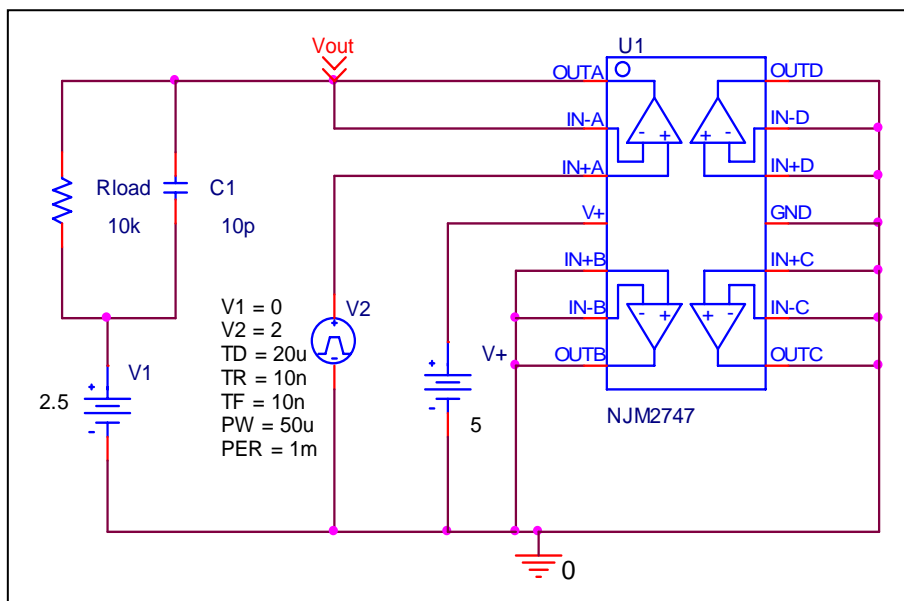
Comparison Table

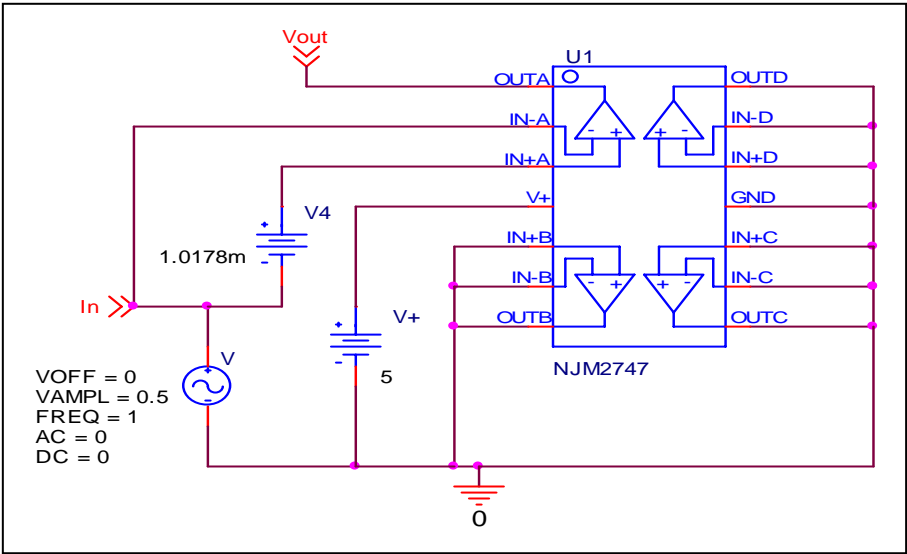| Slew Rate	Measurement	Simulation	%Error
SR (V/us)	3.5	3.483	-0.486

Common-Mode Rejection Ratio

Simulation result
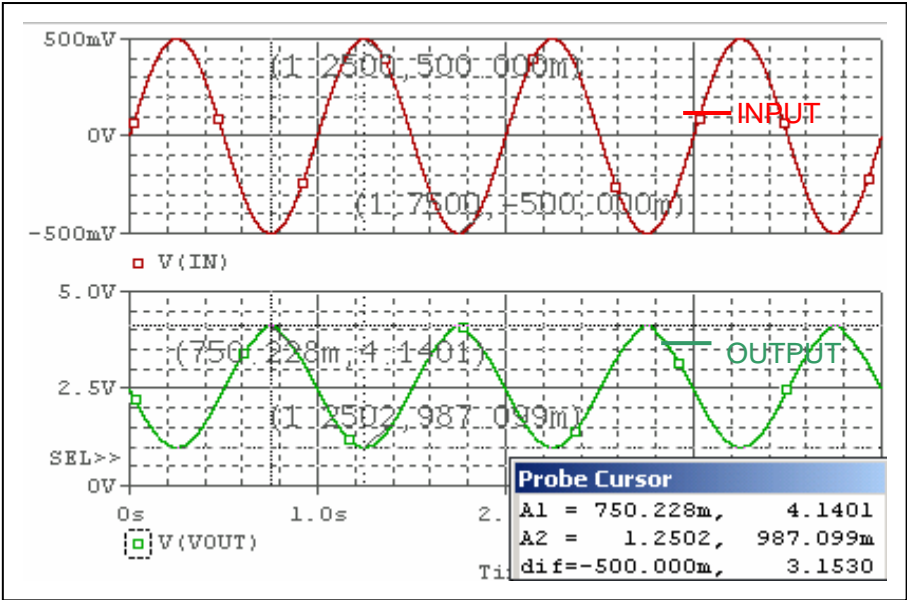
Evaluation Circuit

CMRR = AV/ACM
= 17793/(3.153/1)

Comparison Table

	Measurement	Simulation	% Error
CMRR (dB)	75	75.031	0.041