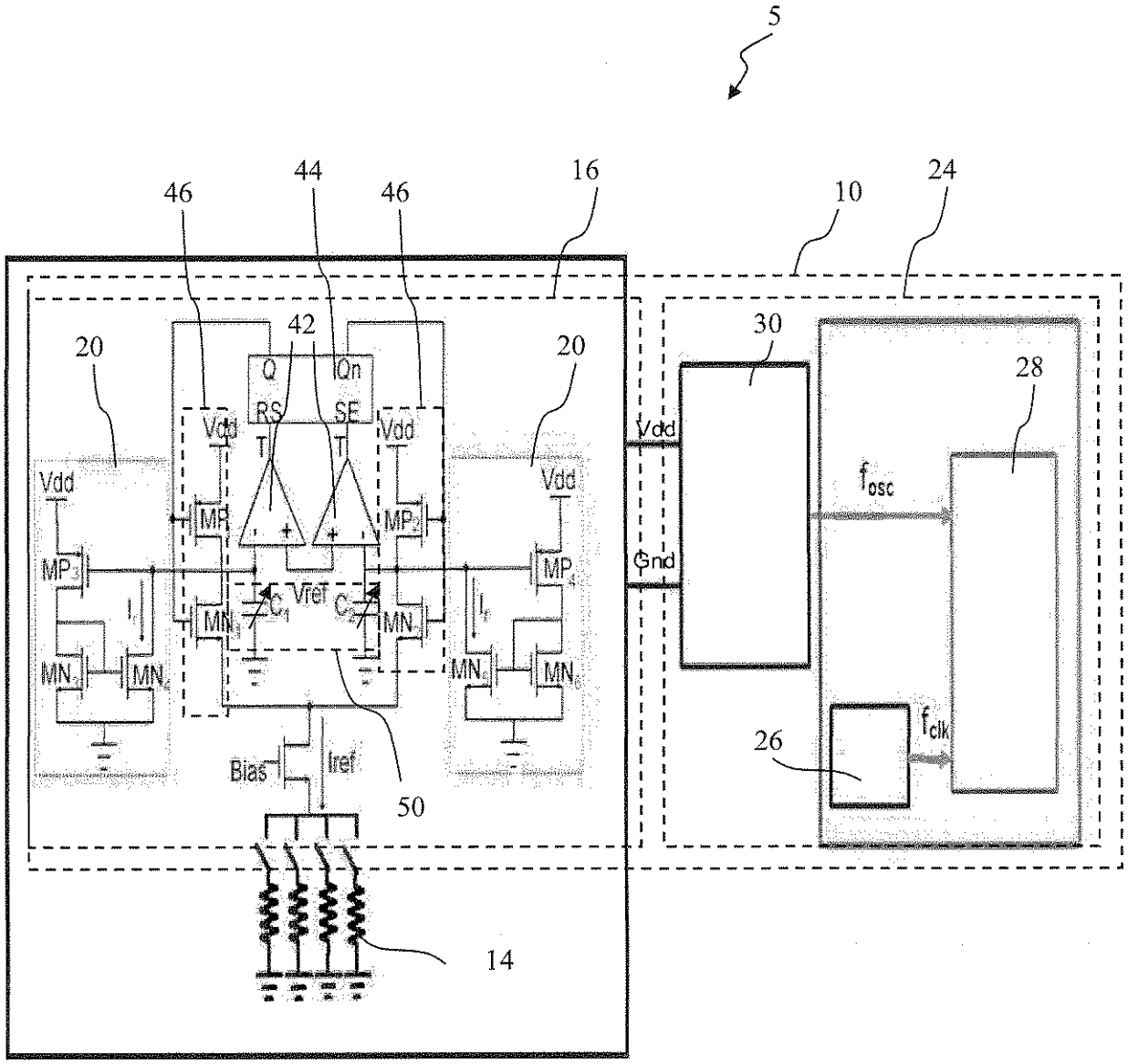
5
46
44
46
16
10
24
20
42
20
30
28
Q
Qn
RS
SE
Vdd
Vdd
Vdd
Vdd
Vdd
MP1
MP2
MP3
MP4
Vref
C1
C2
MN1
MN2
MN3
MN4
MN5
MN6
Gnd
fosc
fclk
26
Bias
Iref
50
14

FIG. 1

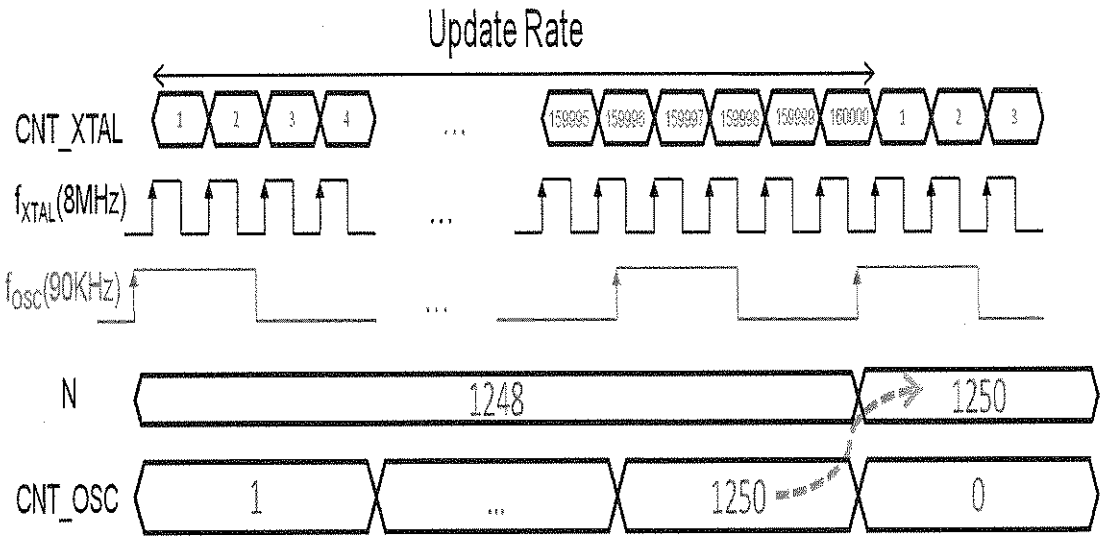
Update Rate
CNT_XTAL
1
2
3
4
...
159995
159996
159997
159998
159999
160000
1
2
3
$f_{XTAL}$(8MHz)
$f_{OSC}$(90KHz)
N
1248
1250
CNT_OSC
1
...
1250
0

FIG. 2A

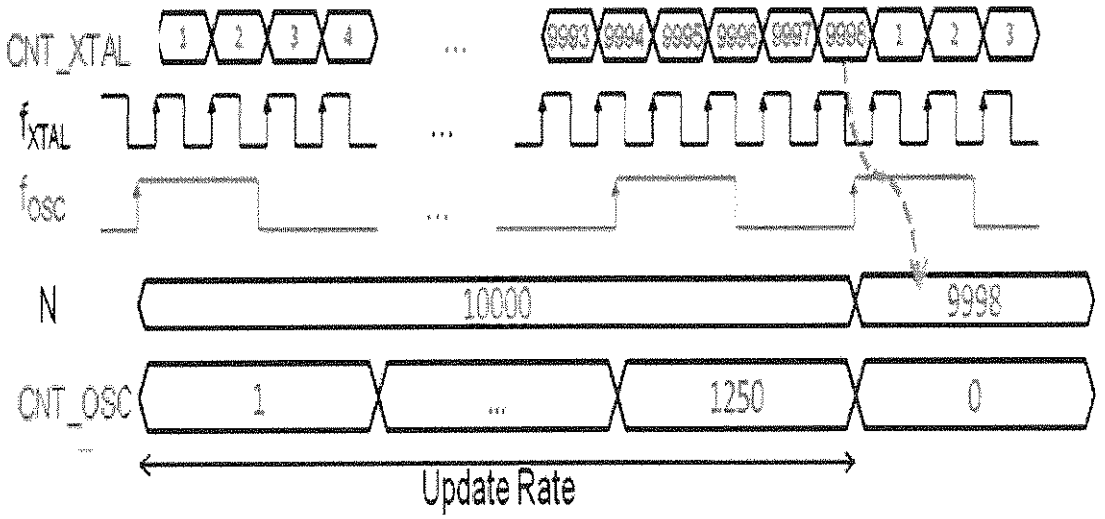
CNT_XTAL
1
2
3
4
...
9993
9994
9995
9996
9997
9998
1
2
3
$f_{XTAL}$
$f_{OSC}$
N
10000
9998
CNT_OSC
1
...
1250
0
Update Rate

FIG. 2B

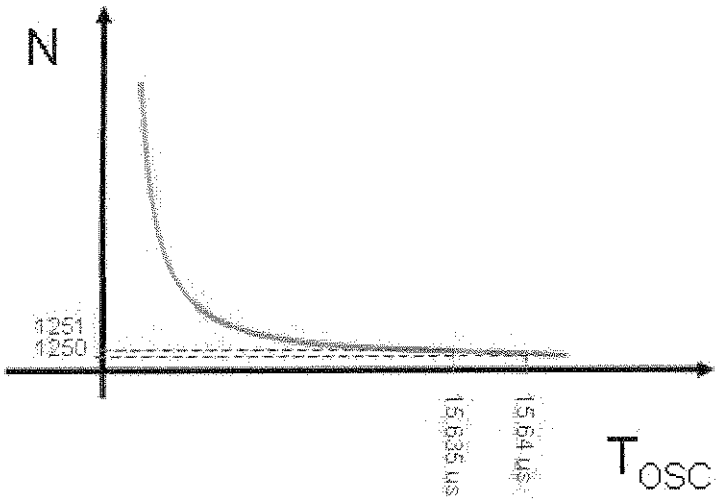
N
1251
1250
15.625 us
15.64 us
$T_{OSC}$

FIG. 3A

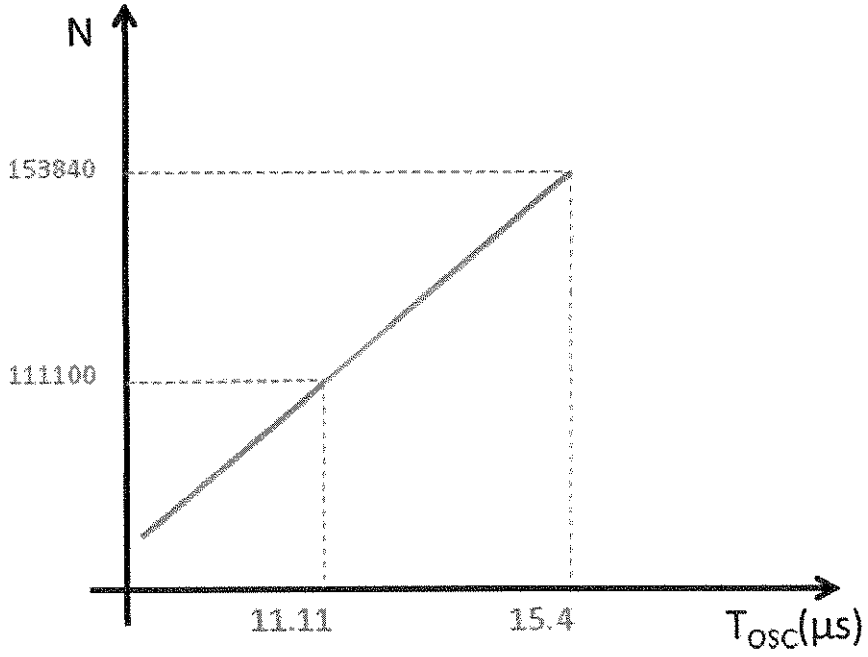
N
153840
111100
11.11
15.4
$T_{OSC}(\mu s)$

FIG. 3B

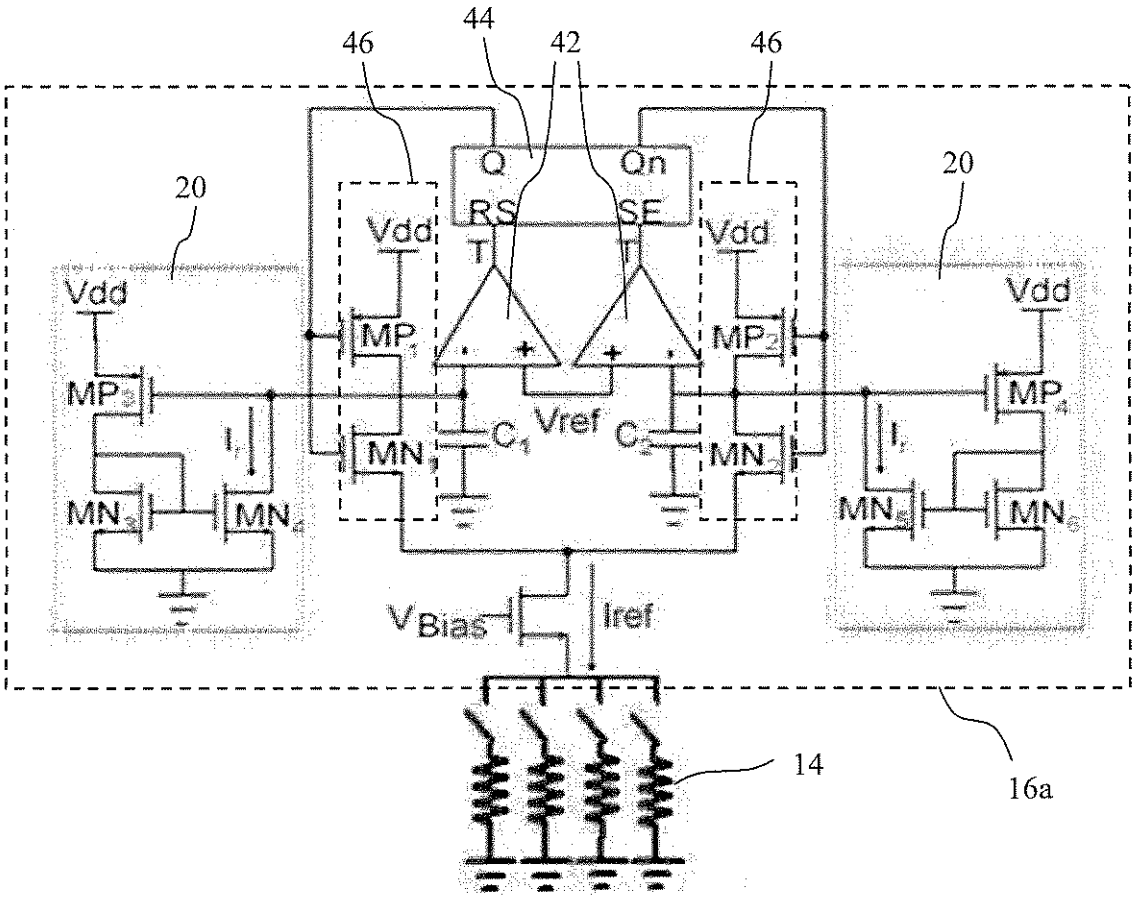
46
44
42
46
20
20
Q
Qn
RS
SE
Vdd
Vdd
Vdd
Vdd
T
T
MP1
MP2
MP3
MP4
MN1
MN2
MN3
MN4
MN5
MN6
C1
C2
Vref
Ir
Ir
VBias
Iref
14
16a

FIG. 4

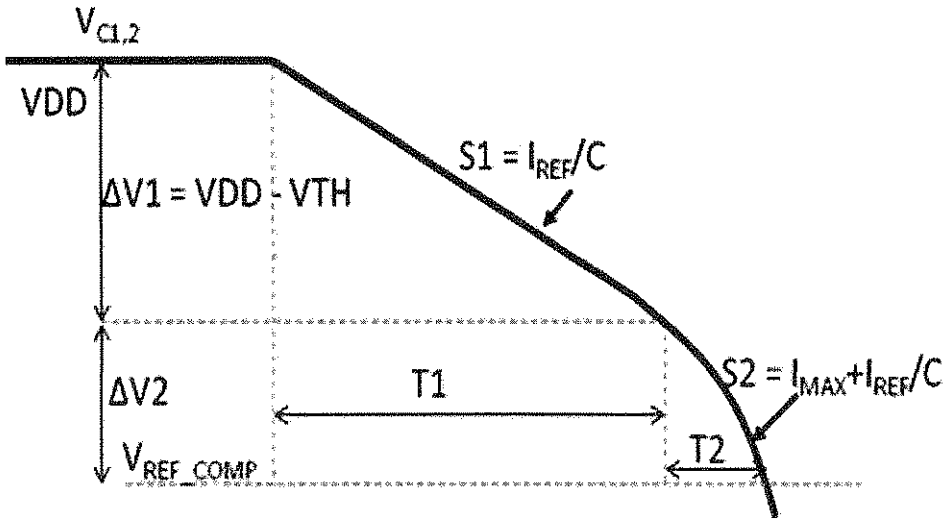
VC1,2
VDD
ΔV1 = VDD - VTH
S1 = IREF/C
ΔV2
T1
S2 = IMAX+IREF/C
T2
VREF_COMP

FIG. 5

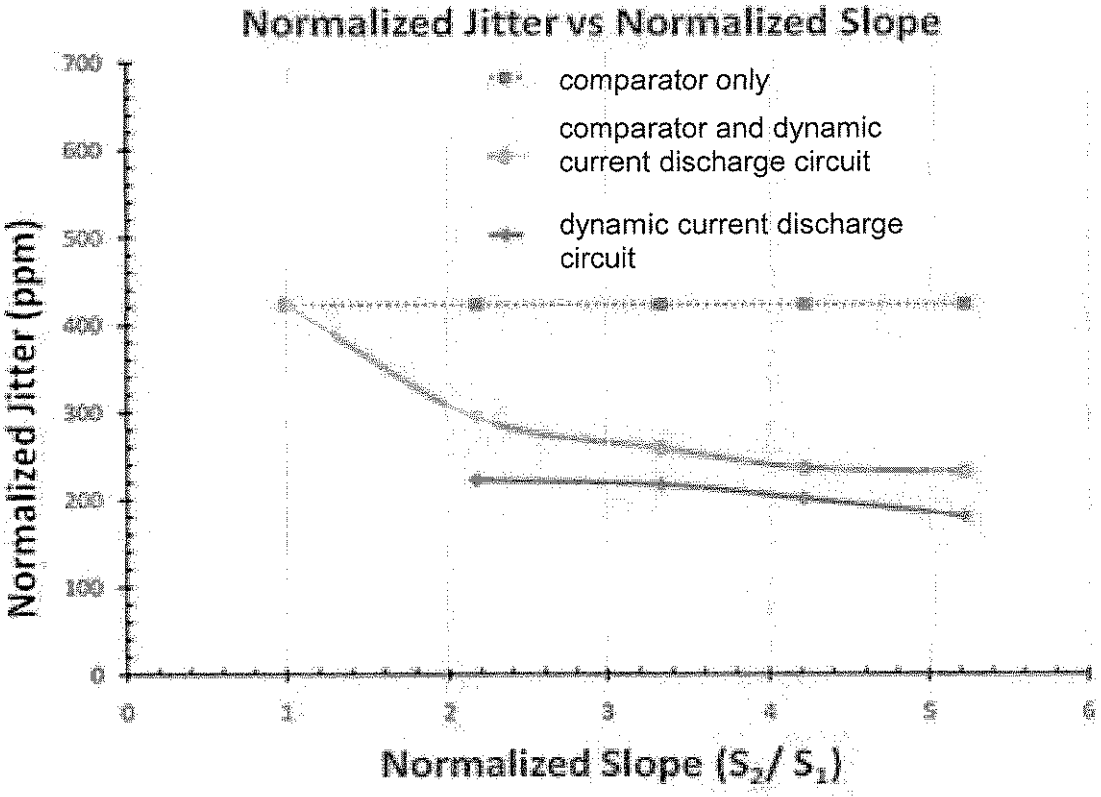
Normalized Jitter vs Normalized Slope
comparator only
comparator and dynamic current discharge circuit
dynamic current discharge circuit
Normalized Jitter (ppm)
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
Normalized Slope (S2/ S1)

FIG. 6

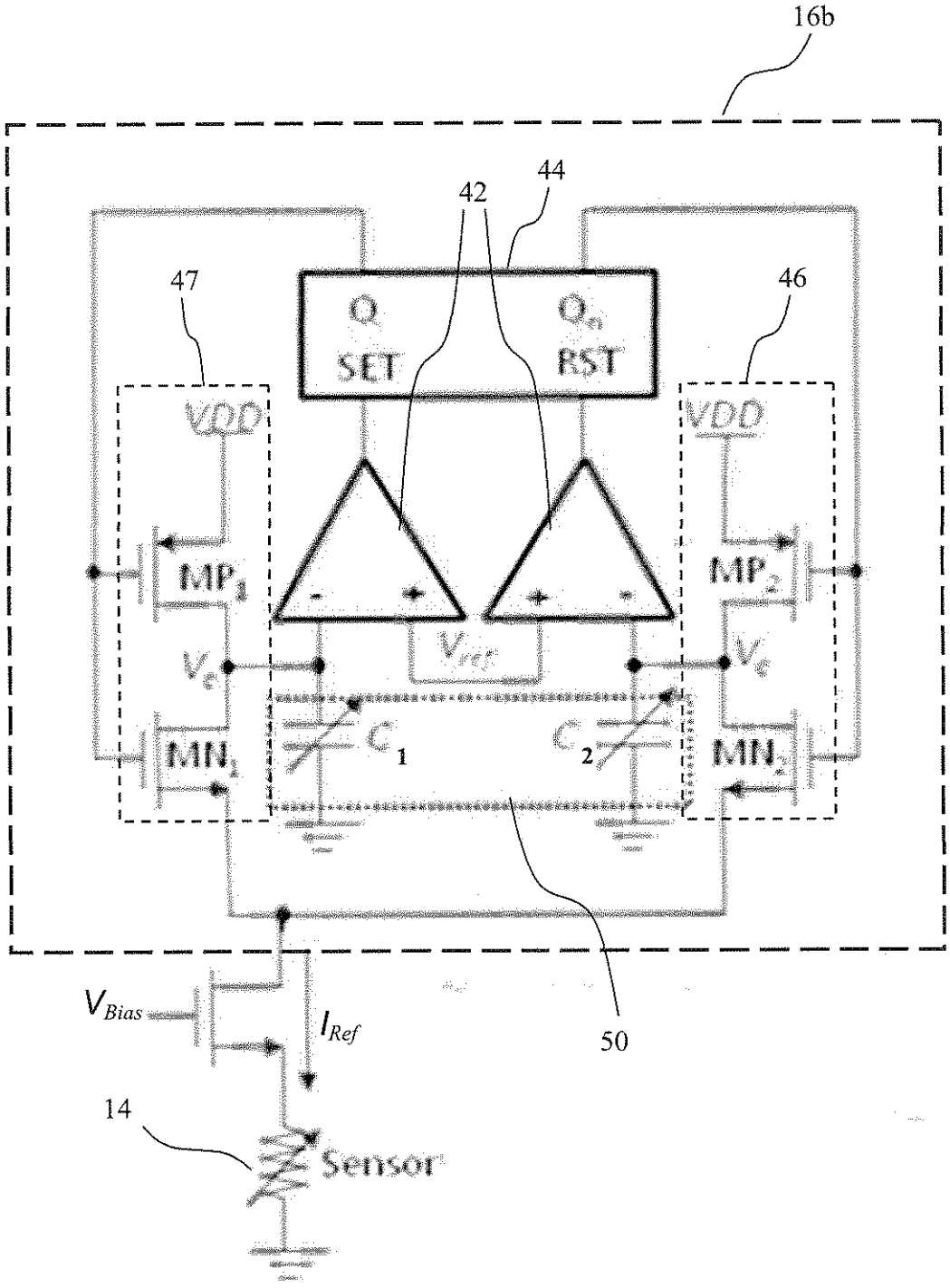
16b
44
42
47
46
Q
SET
$Q_c$
RST
VDD
VDD
$MP_1$
$MP_2$
$V_c$
$V_{ref}$
$V_c$
$C_1$
$C_2$
$MN_1$
$MN_2$
$V_{Bias}$
$I_{Ref}$
50
14
Sensor

FIG. 7

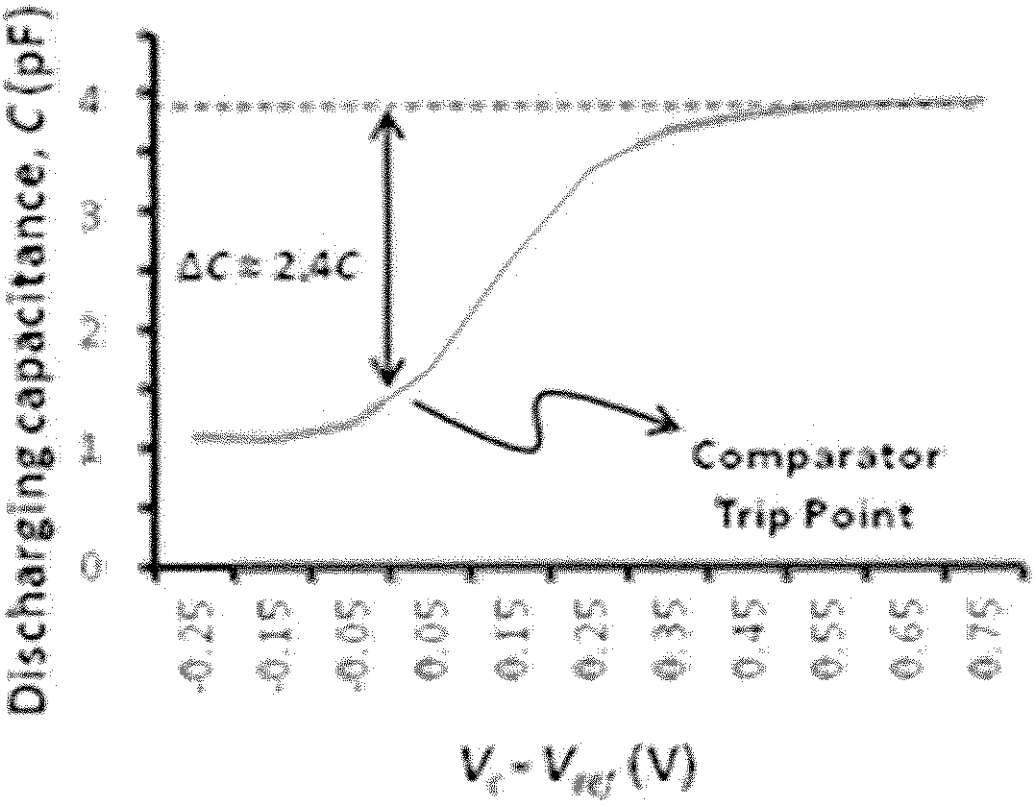
Discharging capacitance, C (pF)
ΔC ≈ 2.4C
Comparator
Trip Point
$V_c - V_{ref}$ (V)

FIG. 8

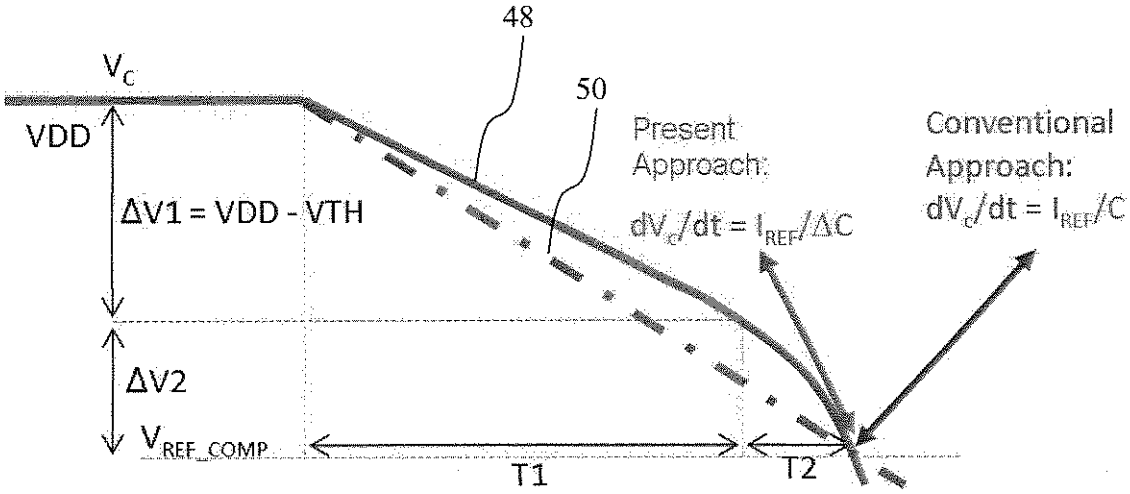
48
50
$V_C$
VDD
ΔV1 = VDD - VTH
ΔV2
$V_{REF_COMP}$
Present
Approach:
$dV_c/dt = I_{REF}/\Delta C$
Conventional
Approach:
$dV_c/dt = I_{REF}/C$
T1
T2

FIG. 9

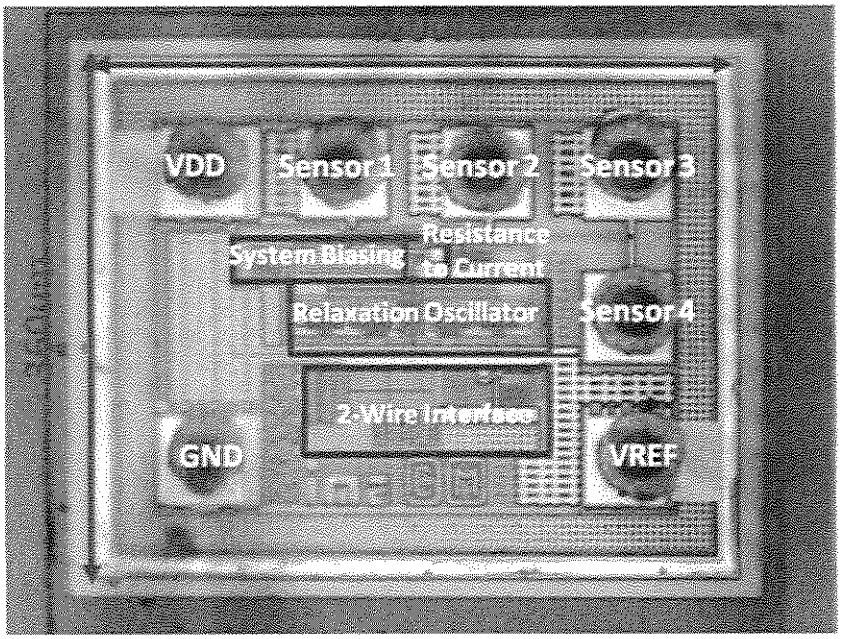
VDD
Sensor 1
Sensor 2
Sensor 3
System Biasing
Resistance
& Current
Relaxation Oscillator
Sensor 4
2-Wire Interface
GND
VREF

FIG. 10

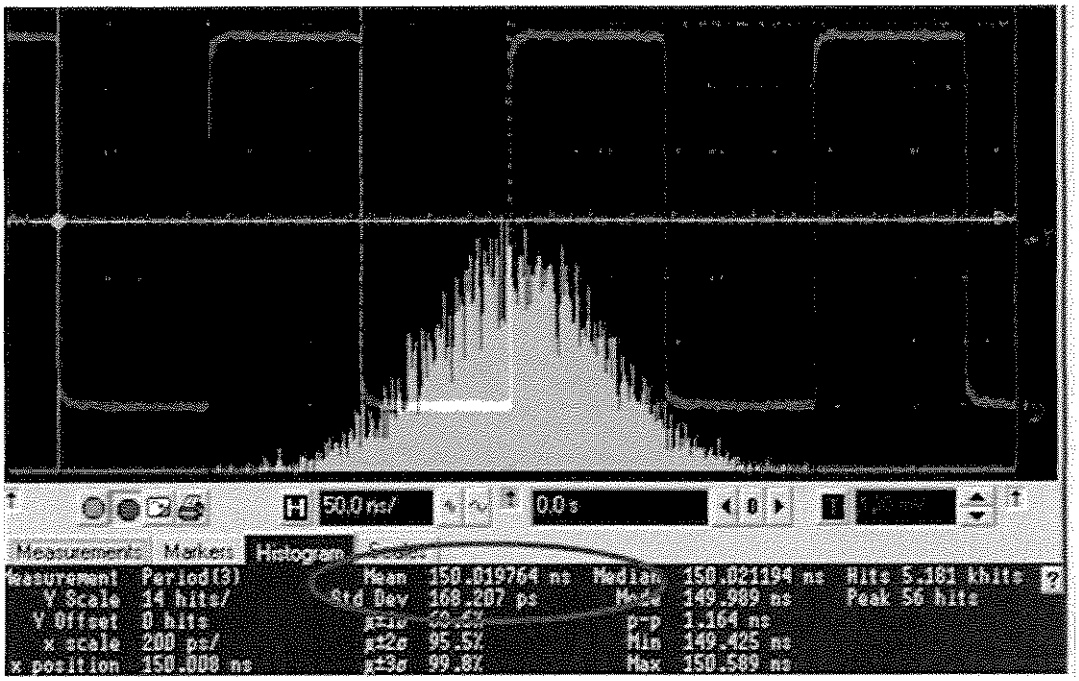


FIG. 11A

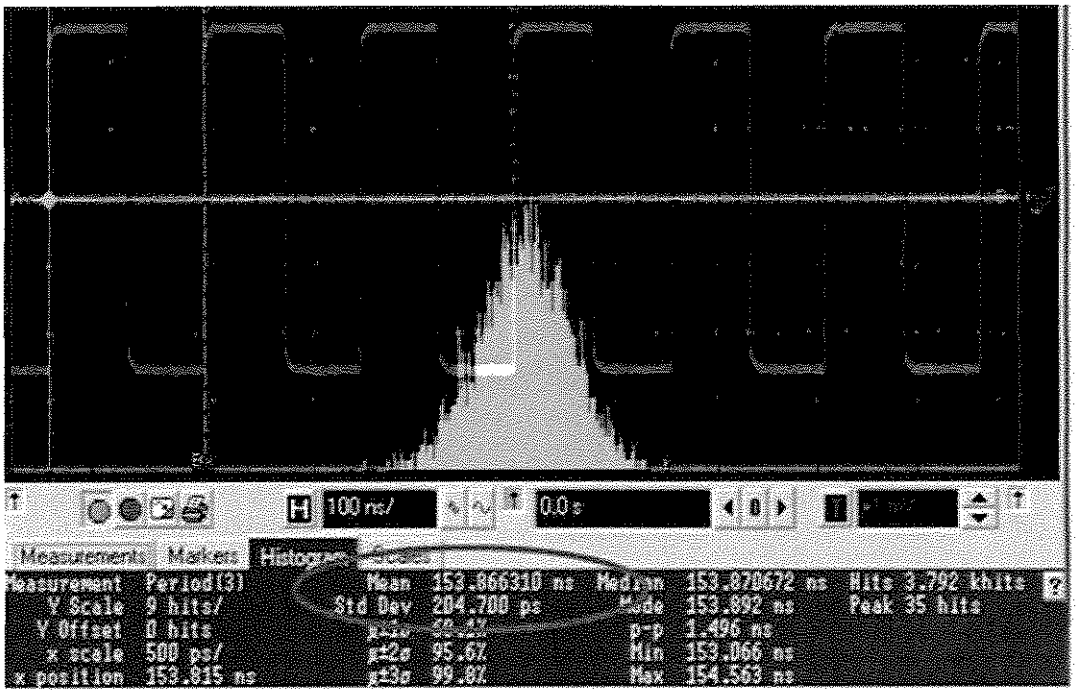


FIG. 11B

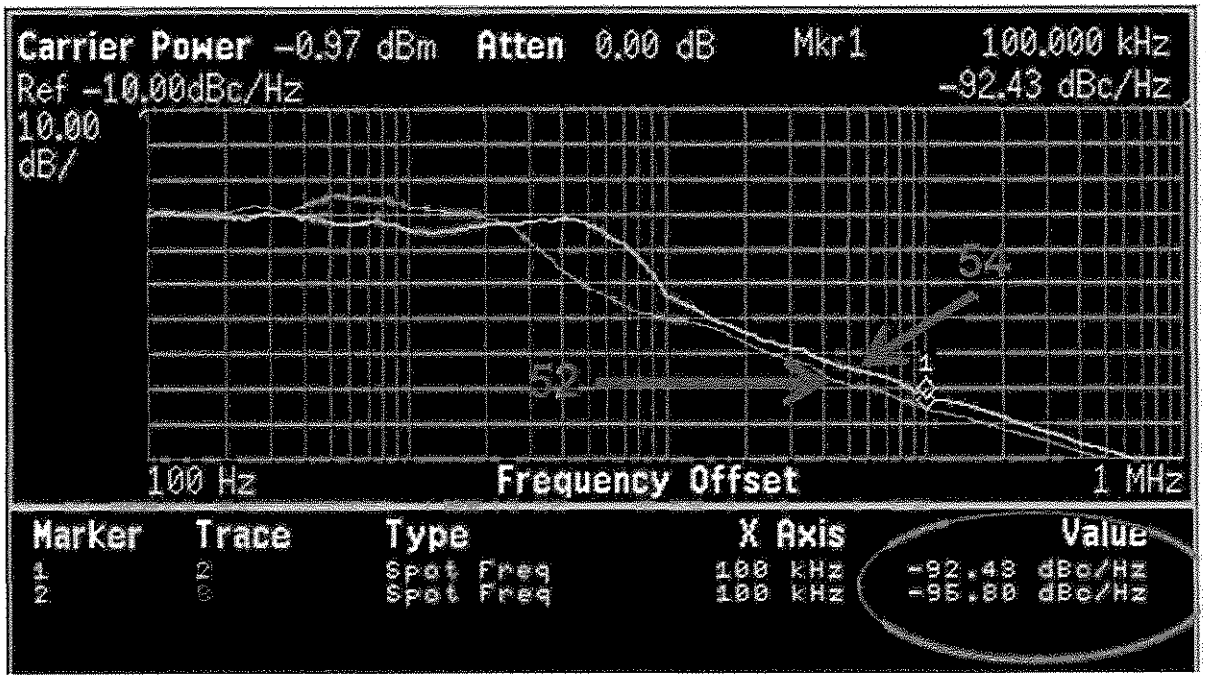
Carrier Power -0.97 dBm
Atten 0.00 dB
Mkr1
100.000 kHz
Ref -10.00dBc/Hz
-92.43 dBc/Hz
10.00
dB/
100 Hz
Frequency Offset
1 MHz
Marker
Trace
Type
X Axis
Value
1
2
Spot Freq
100 kHz
-92.43 dBc/Hz
2
Spot Freq
100 kHz
-95.80 dBc/Hz

FIG. 12

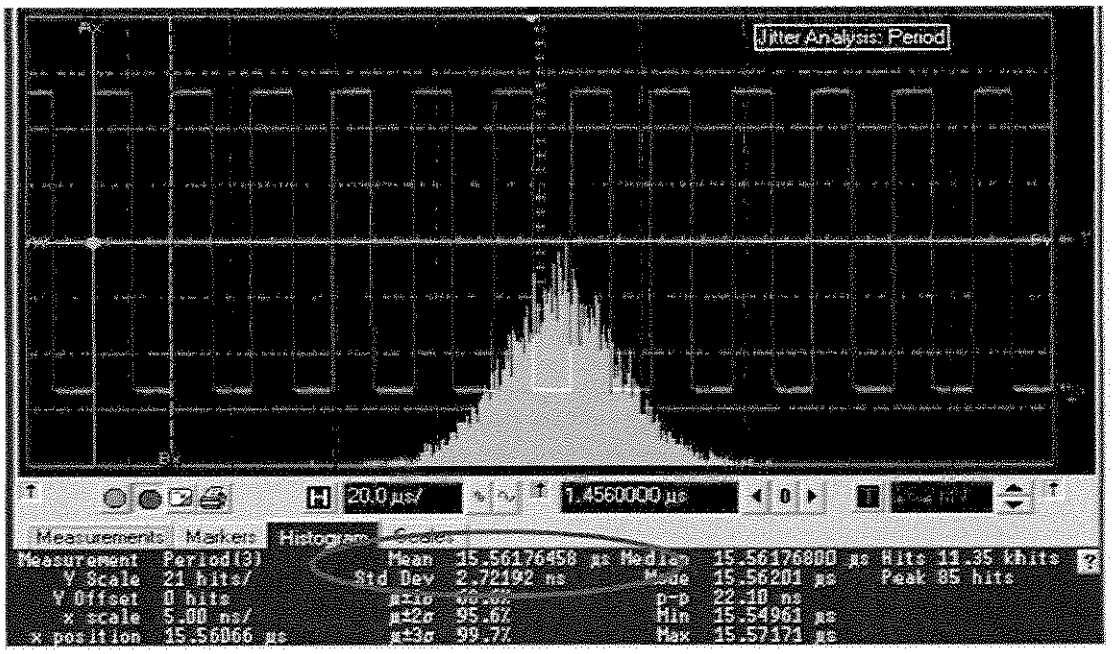


FIG. 13A

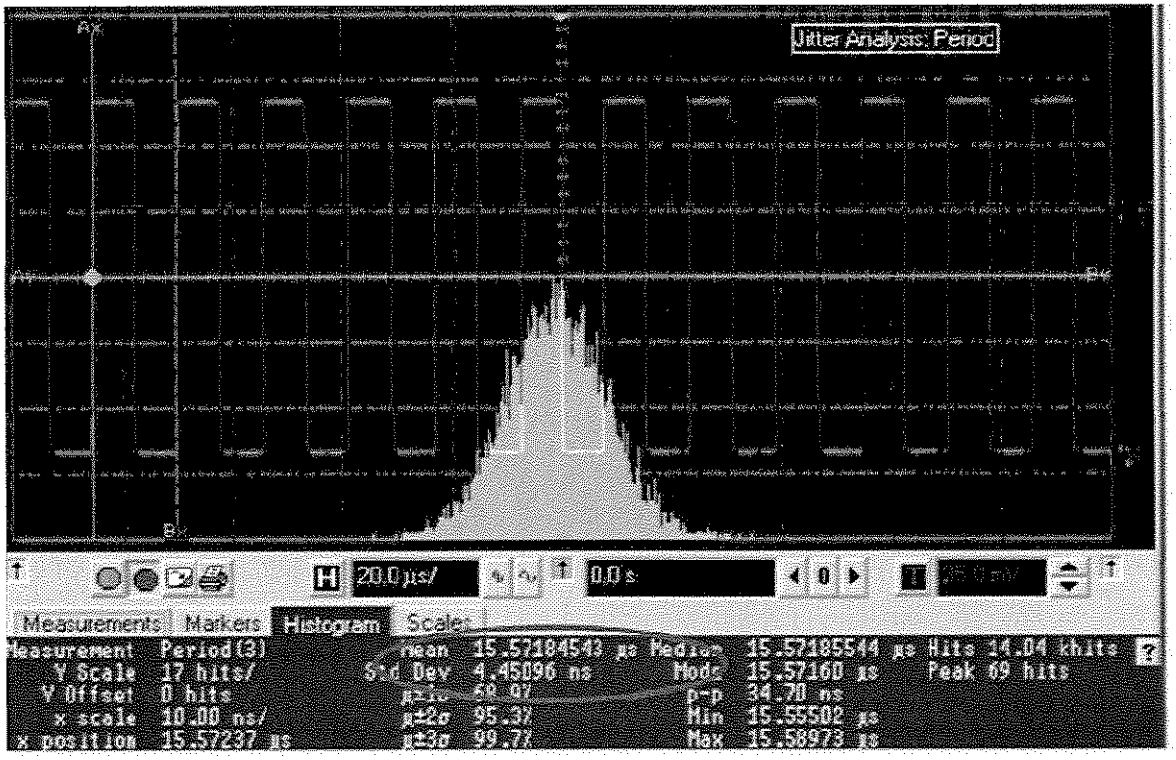


FIG. 13B

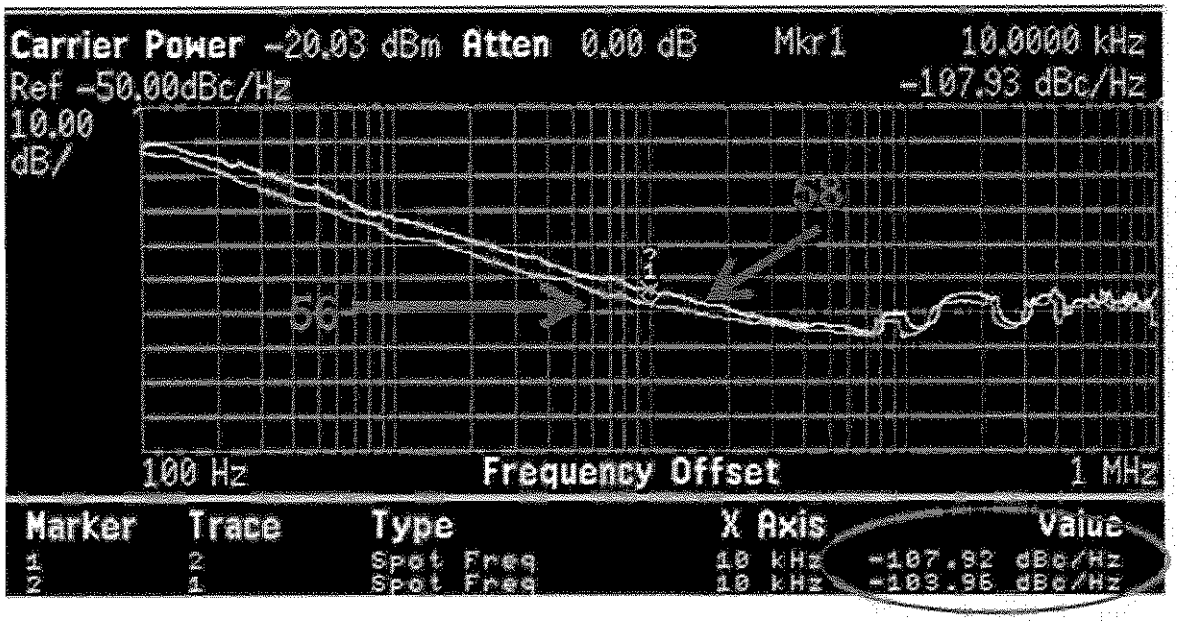
Carrier Power -20.03 dBm Atten 0.00 dB
Mkr1 10.0000 kHz
Ref -50.00dBc/Hz
-107.93 dBc/Hz
10.00
dB/
100 Hz
Frequency Offset
1 MHz
Marker Trace Type X Axis Value
1 2 Spot Freq 10 kHz -107.92 dBc/Hz
2 1 Spot Freq 10 kHz -103.96 dBc/Hz

FIG. 14

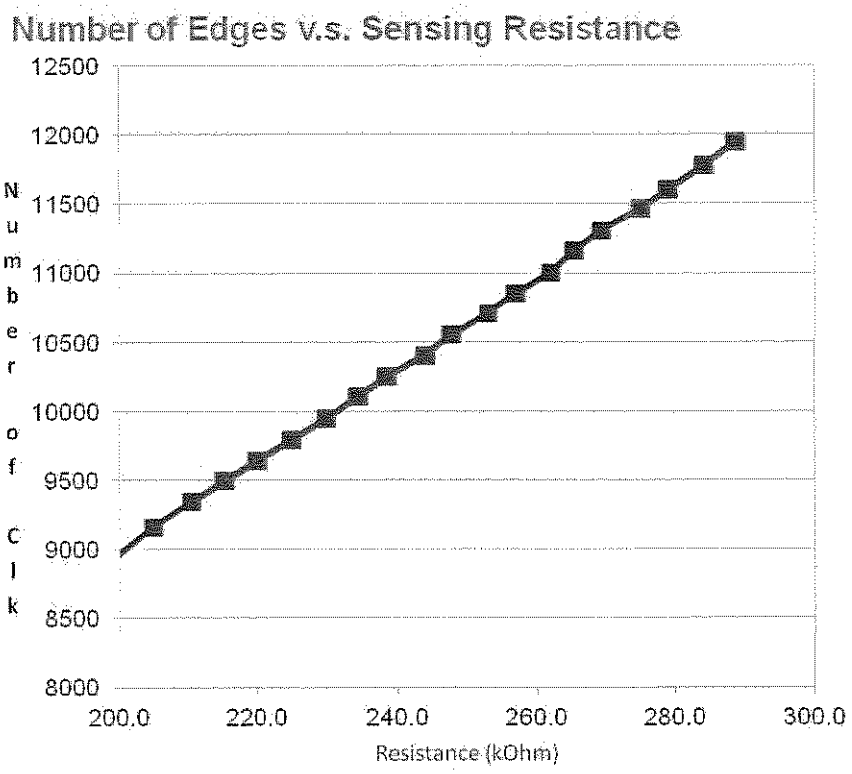


FIG. 15A

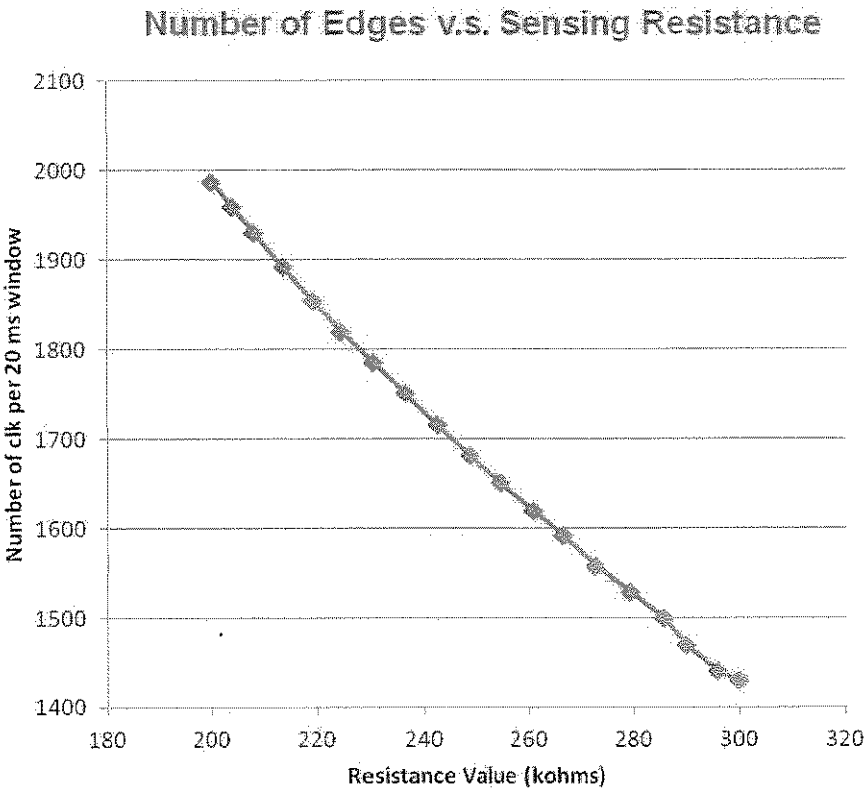


FIG. 15B