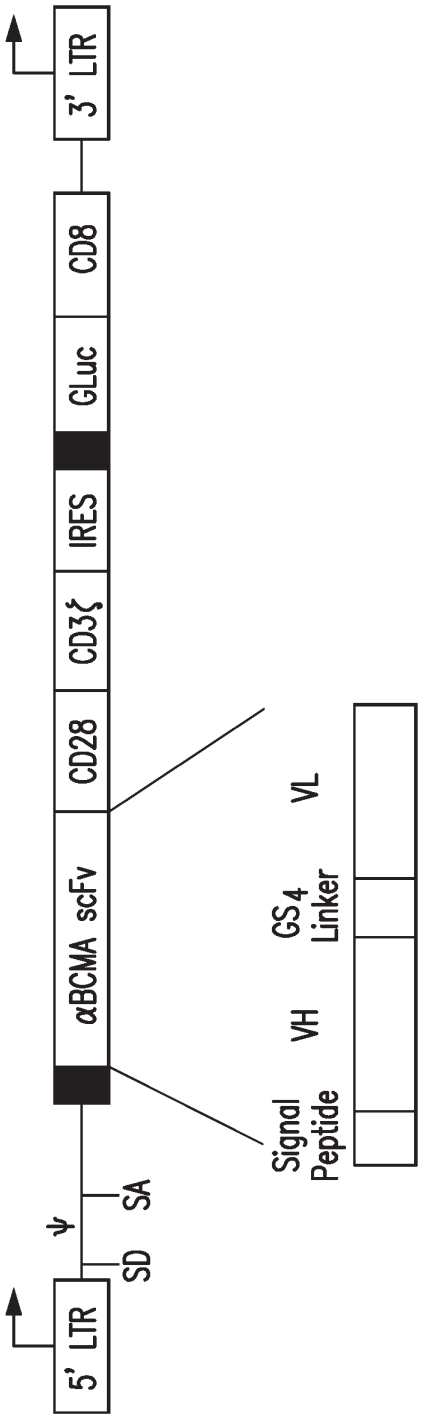

5' LTR
SD
SA
ψ
αBCMA scFv
CD28
CD3ζ
IRES
GLuc
CD8
3' LTR
Signal Peptide
VH
GS4 Linker
VL

FIG. 1

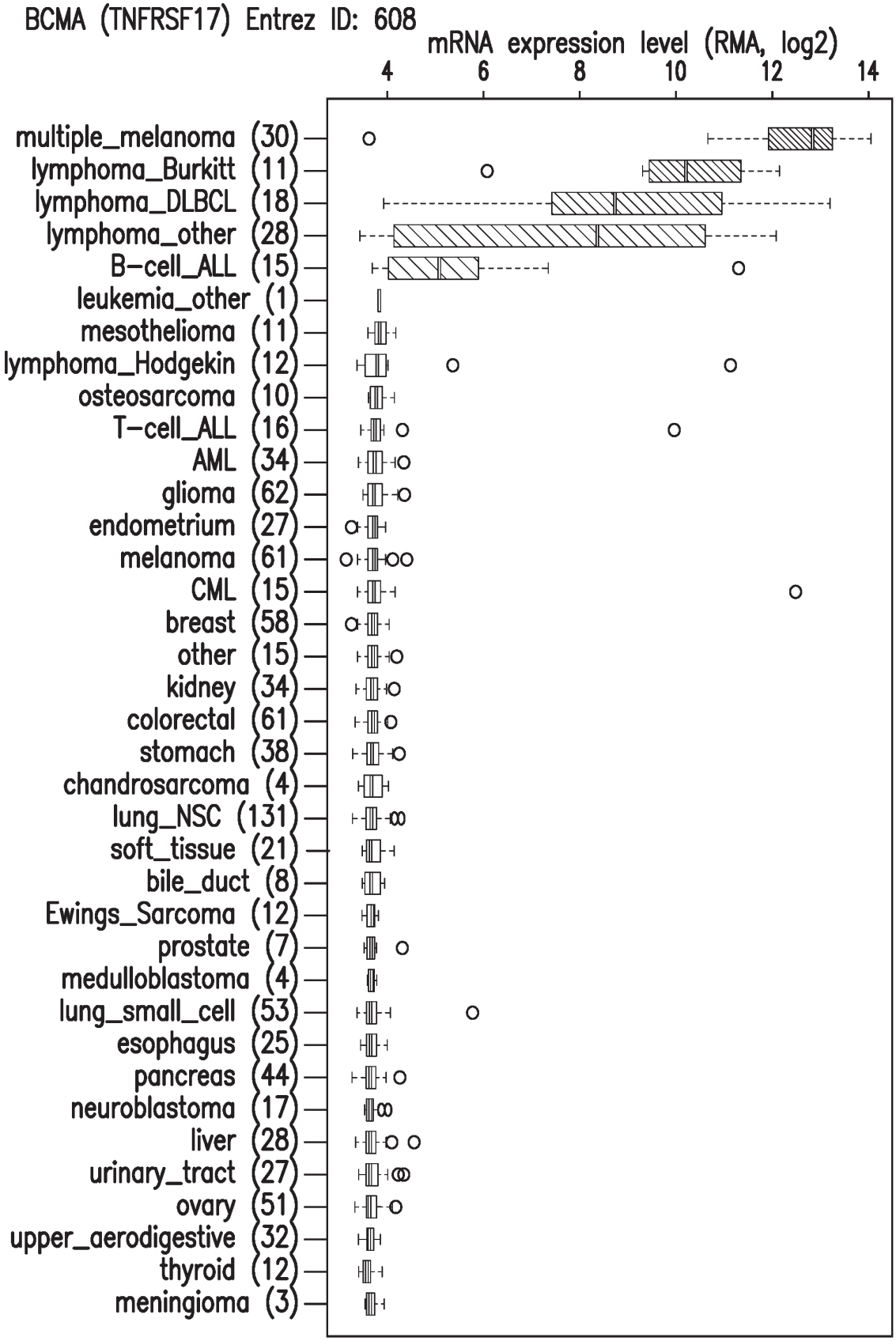

BCMA (TNFRSF17) Entrez ID: 608
mRNA expression level (RMA, log2)
4
6
8
10
12
14
multiple_melanoma (30)
lymphoma_Burkitt (11)
lymphoma_DLBCL (18)
lymphoma_other (28)
B-cell_ALL (15)
leukemia_other (1)
mesothelioma (11)
lymphoma_Hodgekin (12)
osteosarcoma (10)
T-cell_ALL (16)
AML (34)
glioma (62)
endometrium (27)
melanoma (61)
CML (15)
breast (58)
other (15)
kidney (34)
colorectal (61)
stomach (38)
chandrosarcoma (4)
lung_NSC (131)
soft_tissue (21)
bile_duct (8)
Ewings_Sarcoma (12)
prostate (7)
medulloblastoma (4)
lung_small_cell (53)
esophagus (25)
pancreas (44)
neuroblastoma (17)
liver (28)
urinary_tract (27)
ovary (51)
upper_aerodigestive (32)
thyroid (12)
meningioma (3)

FIG. 2A

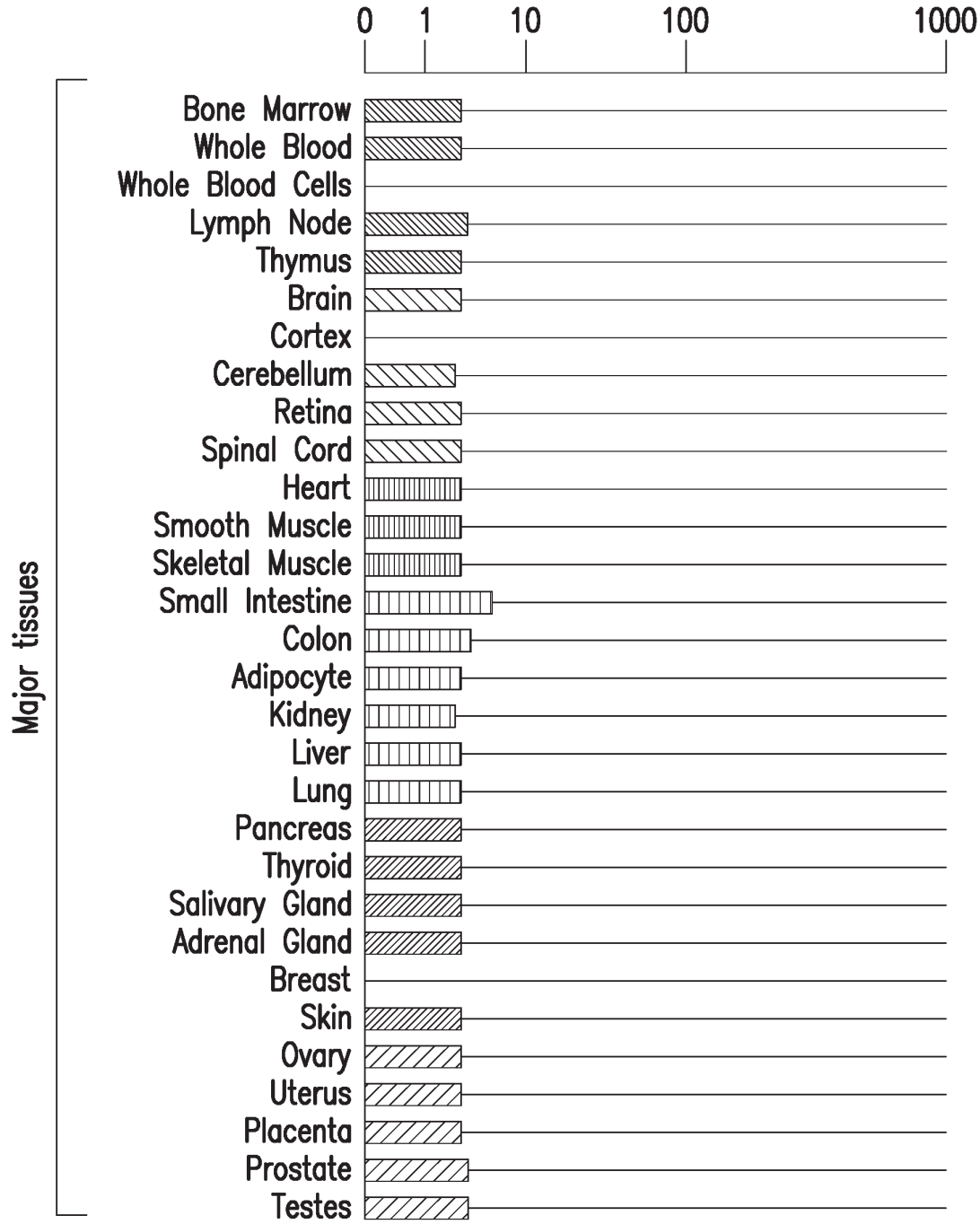

0
1
10
100
1000
Major tissues
Bone Marrow
Whole Blood
Whole Blood Cells
Lymph Node
Thymus
Brain
Cortex
Cerebellum
Retina
Spinal Cord
Heart
Smooth Muscle
Skeletal Muscle
Small Intestine
Colon
Adipocyte
Kidney
Liver
Lung
Pancreas
Thyroid
Salivary Gland
Adrenal Gland
Breast
Skin
Ovary
Uterus
Placenta
Prostate
Testes

FIG. 2B

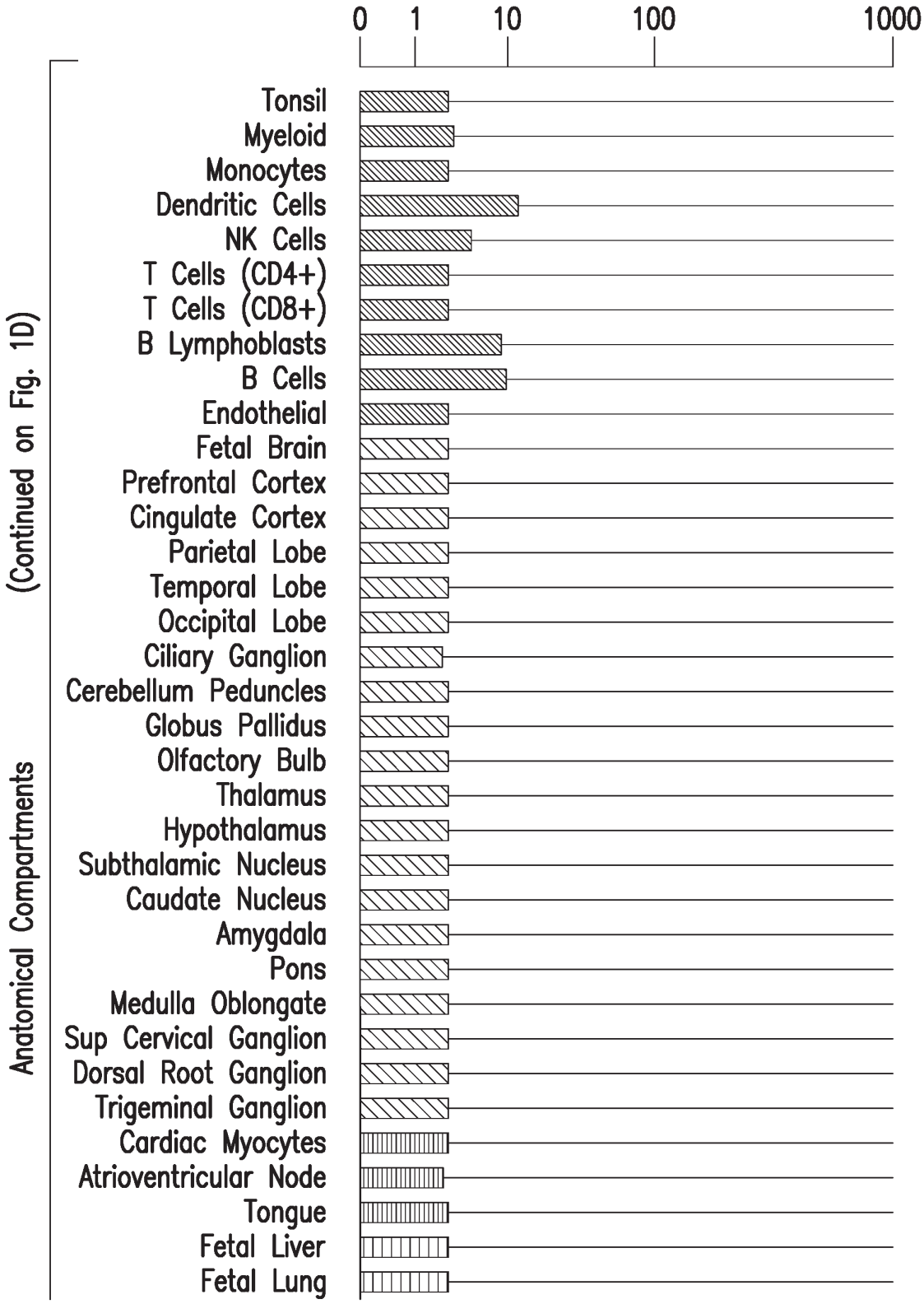

0
1
10
100
1000
Tonsil
Myeloid
Monocytes
Dendritic Cells
NK Cells
T Cells (CD4+)
T Cells (CD8+)
B Lymphoblasts
B Cells
Endothelial
Fetal Brain
Prefrontal Cortex
Cingulate Cortex
Parietal Lobe
Temporal Lobe
Occipital Lobe
Ciliary Ganglion
Cerebellum Peduncles
Globus Pallidus
Olfactory Bulb
Thalamus
Hypothalamus
Subthalamic Nucleus
Caudate Nucleus
Amygdala
Pons
Medulla Oblongate
Sup Cervical Ganglion
Dorsal Root Ganglion
Trigeminal Ganglion
Cardiac Myocytes
Atrioventricular Node
Tongue
Fetal Liver
Fetal Lung
Anatomical Compartments
(Continued on Fig. 1D)

FIG. 2C

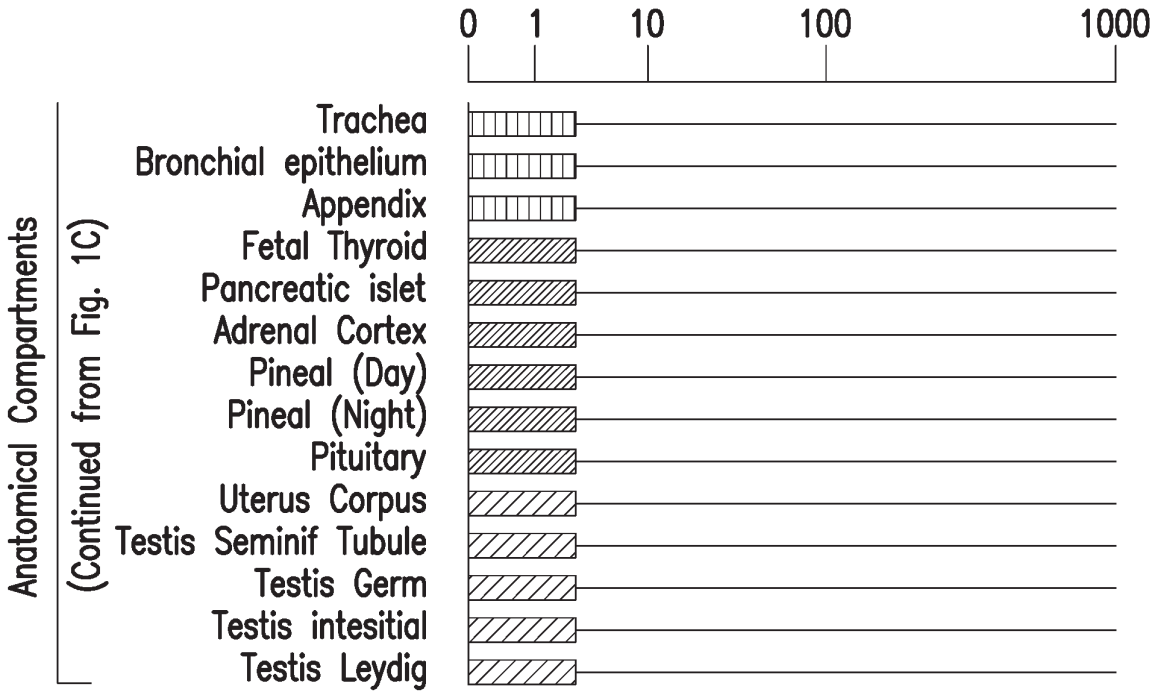

0
1
10
100
1000
Anatomical Compartments
(Continued from Fig. 1C)
Trachea
Bronchial epithelium
Appendix
Fetal Thyroid
Pancreatic islet
Adrenal Cortex
Pineal (Day)
Pineal (Night)
Pituitary
Uterus Corpus
Testis Seminif Tubule
Testis Germ
Testis intesitial
Testis Leydig

FIG. 2D

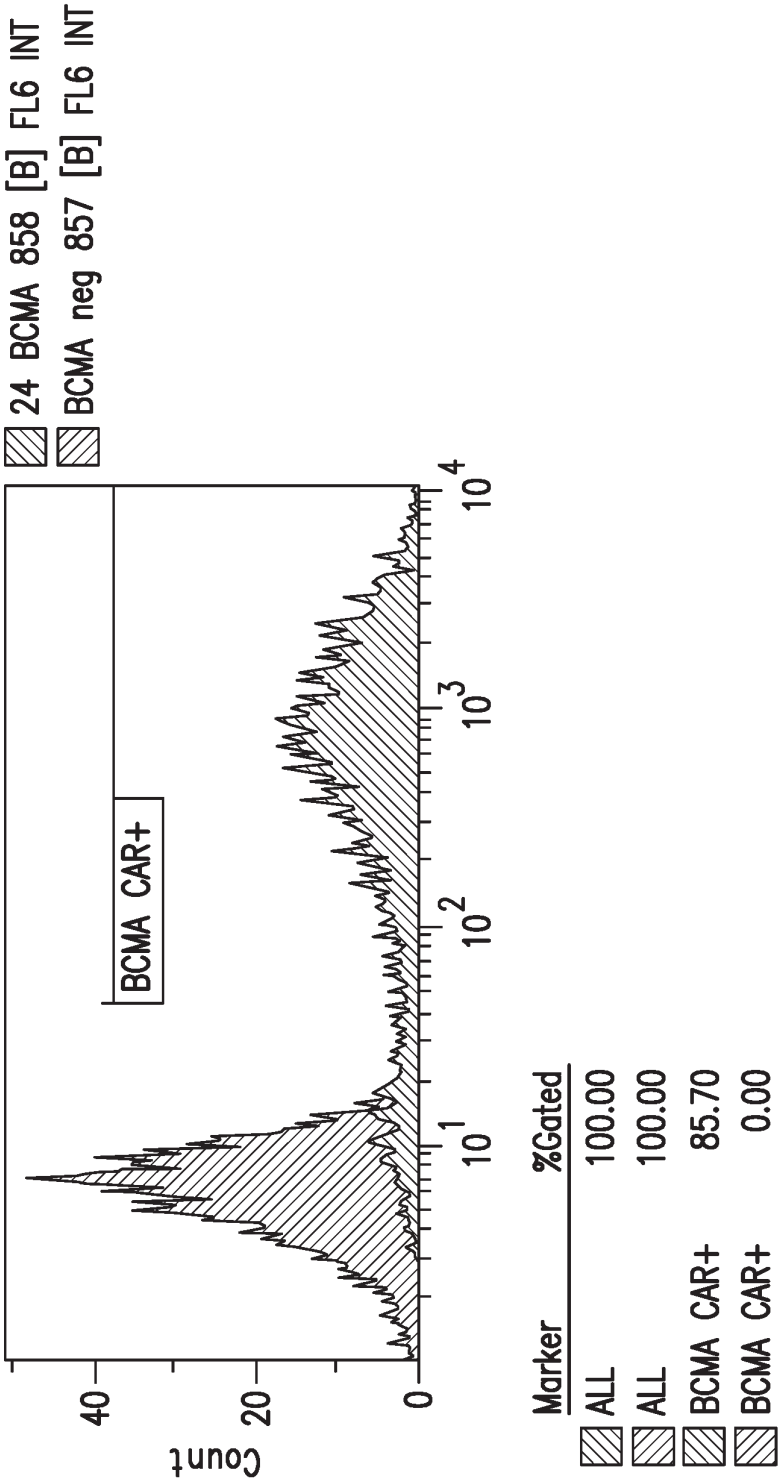

24 BCMA 858 [B] FL6 INT
BCMA neg 857 [B] FL6 INT
BCMA CAR+
Count
0
20
40
10^1
10^2
10^3
10^4
Marker %Gated
ALL 100.00
ALL 100.00
BCMA CAR+ 85.70
BCMA CAR+ 0.00

FIG. 3

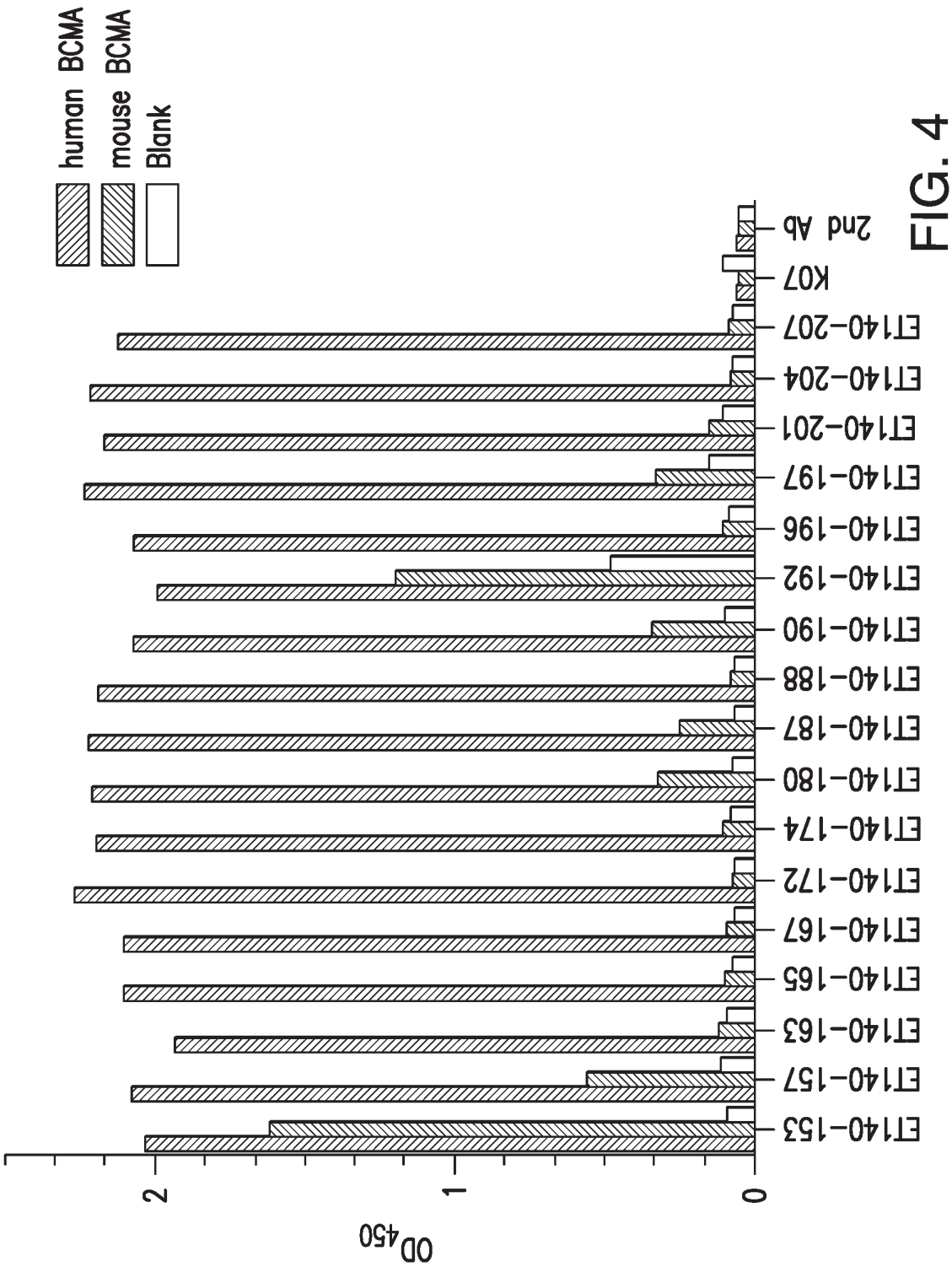

human BCMA
mouse BCMA
Blank
OD450
0
1
2
ET40-153
ET40-157
ET40-163
ET40-165
ET40-167
ET40-172
ET40-174
ET40-180
ET40-187
ET40-188
ET40-190
ET40-192
ET40-196
ET40-197
ET40-201
ET40-204
ET40-207
K07
2nd Ab

FIG. 4

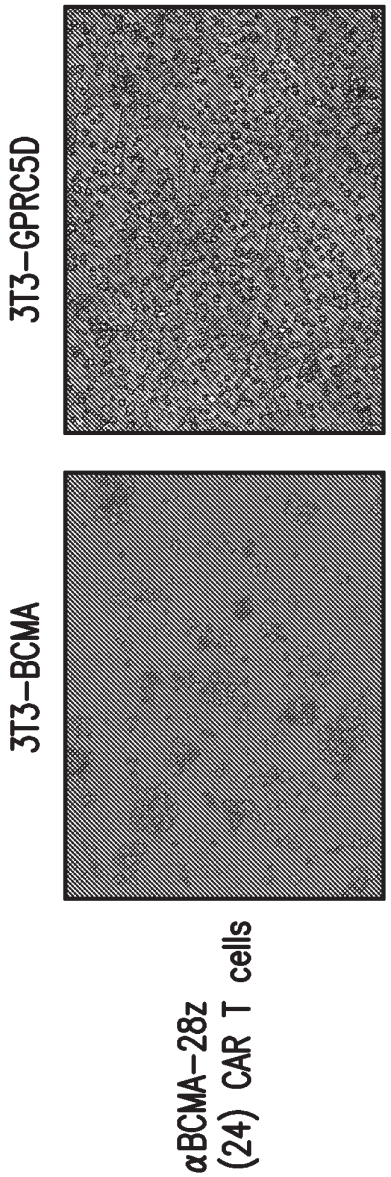


FIG. 5

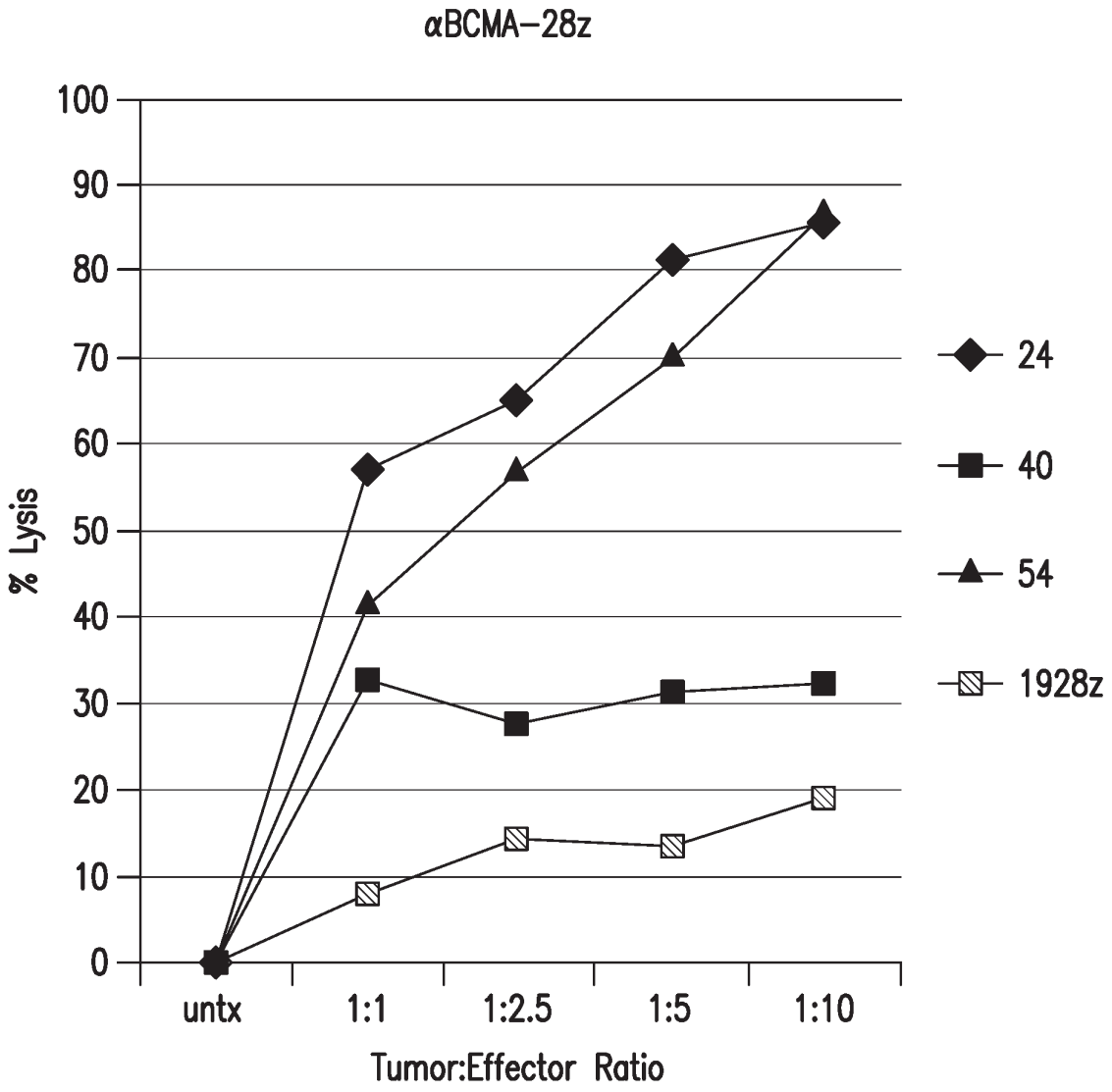

αBCMA-28z
100
90
80
70
60
50
40
30
20
10
0
% Lysis
untx
1:1
1:2.5
1:5
1:10
Tumor:Effector Ratio
24
40
54
1928z

FIG. 6

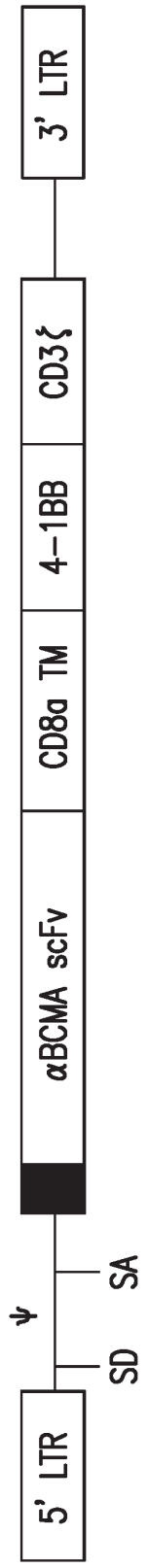


FIG. 7

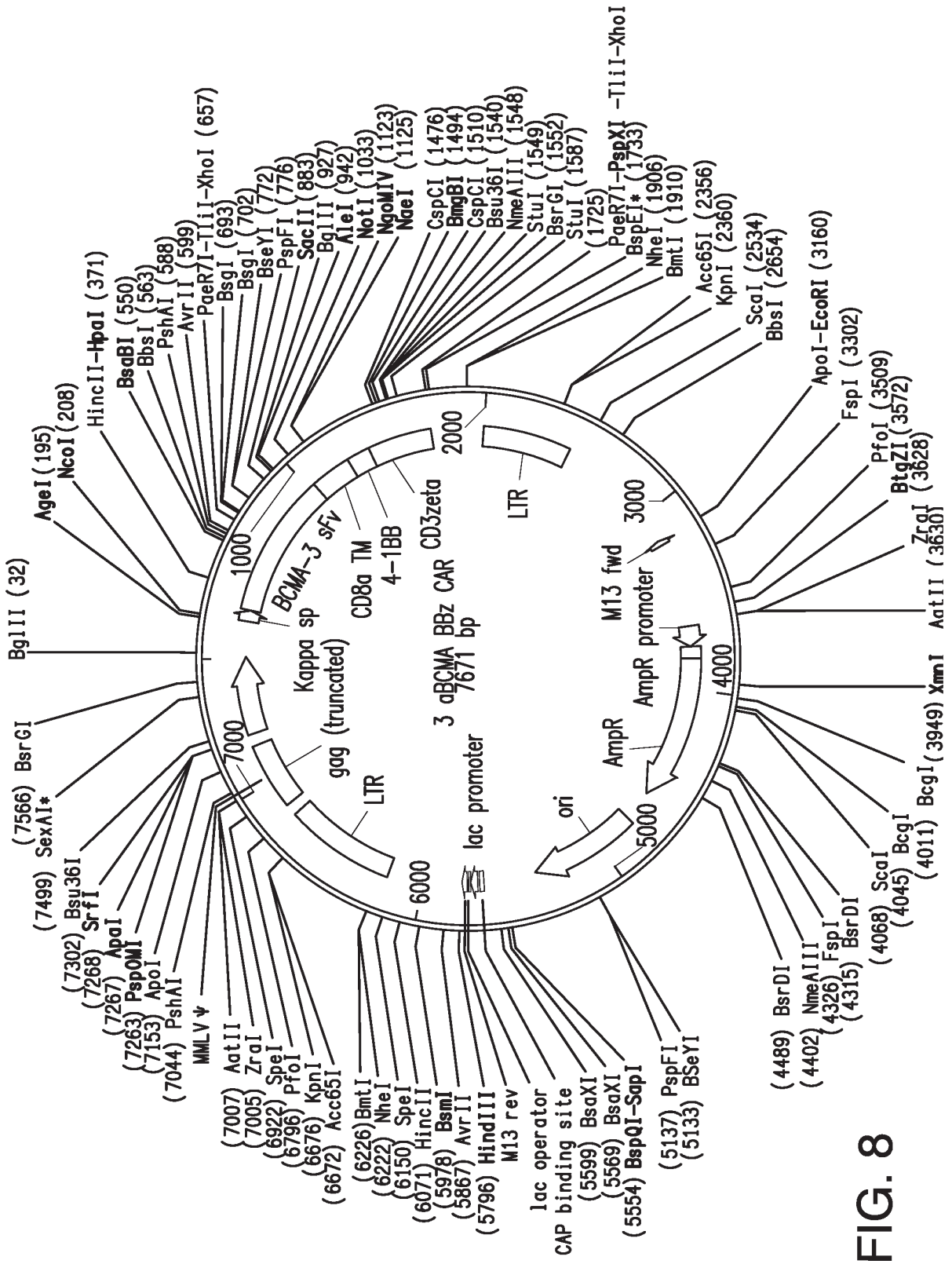

3 aBCMA BBz CAR
7671 bp
1000
2000
3000
4000
5000
6000
7000
BCMA-3 sFv
Kappa sp
gag (truncated)
LTR
CD8a TM
4-1BB
CD3zeta
LTR
M13 fwd
AmpR promoter
AmpR
ori
lac promoter
M13 rev
lac operator
CAP binding site
(195) AgeI
(208) NcoI
(371) HincII-HpaI
(550) BsaBI
(563) BbsI
(588) PshAI
(599) AvrII
(657) PaeR7I-TliI-XhoI
(693) BsgI
(702) BseYI
(772) PspFI
(776) SacII
(883) BglII
(927) AleI
(942) NotI
(1033) NgoMIV
(1123) NgeI
(1125)
(1476) CspCI
(1494) BmgBI
(1510) CspCI
(1540) Bsu36I
(1548) NmeAIII
(1549) StuI
(1552) BsrGI
(1587) StuI
(1725)
(1733) PaeR7I-PspXI-TliI-XhoI
(1906) BspEI*
(1910) NheI
(2356) BmtI
(2360) Acc65I
(2534) KpnI
(2654) ScaI
BbsI
(3160) ApoI-EcoRI
(3302) FspI
(3509) PfoI
(3572) BtgZI
(3628) ZraI
(3630) AatII
(3949) XmnI
(4011) BcgI
(4045) ScaI
(4068) BcgI
(4315) BsrDI
(4326) FspI
(4402) NmeAIII
(4489) BsrDI
(5133) BseYI
(5137) PspFI
(5554) BspQI-SapI
(5569) BsaXI
(5599) BsaXI
(5796) HindIII
(5867) AvrII
(5978) BsmI
(6071) HincII
(6150) SpeI
(6222) NheI
(6226) BmtI
(6672) Acc65I
(6676) KpnI
(6796) PfoI
(6922) SpeI
(7005) ZraI
(7007) AatII
(7044) PshAI
MMLV Ψ
(7153) ApoI
(7263) PspOMI
(7267) ApaI
(7268) SrfI
(7302) Bsu36I
(7499) SexAI*
(7566) BsrGI
BglII (32)

FIG. 8

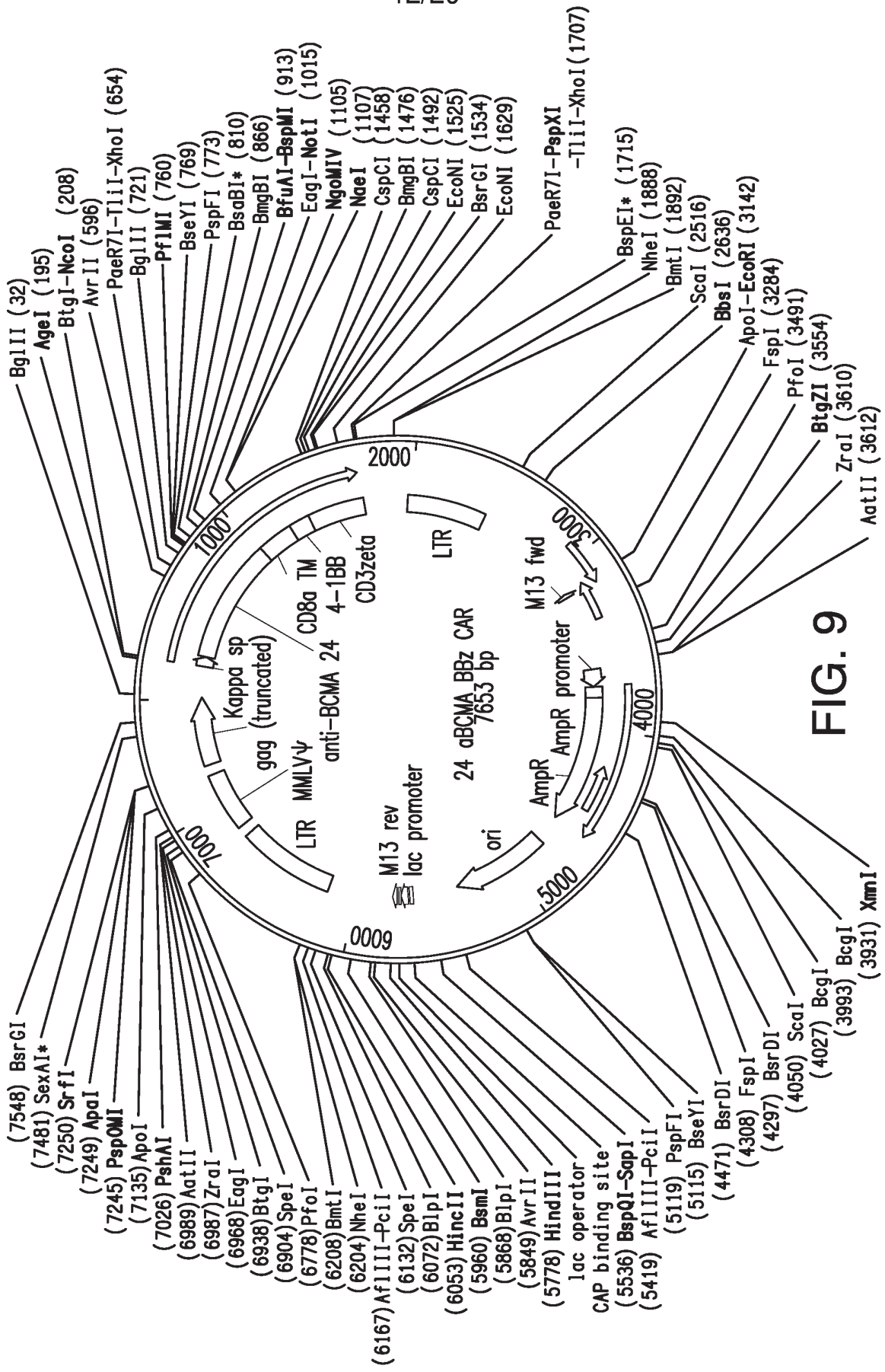

BglII (32)
AgeI (195)
BtgI-NcoI (208)
AvrII (596)
PaeR7I-TliI-XhoI (654)
BglII (721)
PflMI (760)
BseYI (769)
PspFI (773)
BsaBI* (810)
BmgBI (866)
BfuAI-BspMI (913)
EagI-NotI (1015)
NgoMIV (1105)
NaeI (1107)
CspCI (1458)
BmgBI (1476)
CspCI (1492)
EcoNI (1525)
BsrGI (1534)
EcoNI (1629)
PaeR7I-PspXI
-TliI-XhoI(1707)
BspEI* (1715)
NheI (1888)
BmtI (1892)
ScaI (2516)
BbsI (2636)
ApoI-EcoRI (3142)
FspI (3284)
PfoI (3491)
BtgZI (3554)
ZraI (3610)
AatII (3612)
XmnI
(3931)
BcgI
(3993)
BcgI
(4027)
ScaI
(4050)
BsrDI
(4297)
FspI
(4308)
BsrDI
(4471)
BseYI
(5115)
PspFI
(5119)
AflIII-PciI
(5419)
BspQI-SapI
(5536)
CAP binding site
lac operator
HindIII
(5778)
AvrII
(5849)
BlpI
(5868)
BsmI
(5960)
HincII
(6053)
BlpI
(6072)
SpeI
(6132)
PciI
(6167)
AflIII-PciI
NheI
(6204)
BmtI
(6208)
PfoI
(6778)
SpeI
(6904)
BtgI
(6938)
EagI
(6968)
ZraI
(6987)
AatII
(6989)
PshAI
(7026)
ApoI
(7135)
PspOMI
(7245)
ApaI
(7249)
SrfI
(7250)
SexAI*
(7481)
BsrGI
(7548)
1000
2000
3000
4000
5000
6000
7000
LTR
MMLVψ
gag
Kappa sp
(truncated)
anti-BCMA 24
CD8a TM
4-1BB
CD3zeta
LTR
M13 fwd
24 aBCMA BBz CAR
7653 bp
AmpR promoter
AmpR
ori
M13 rev
lac promoter

FIG. 9

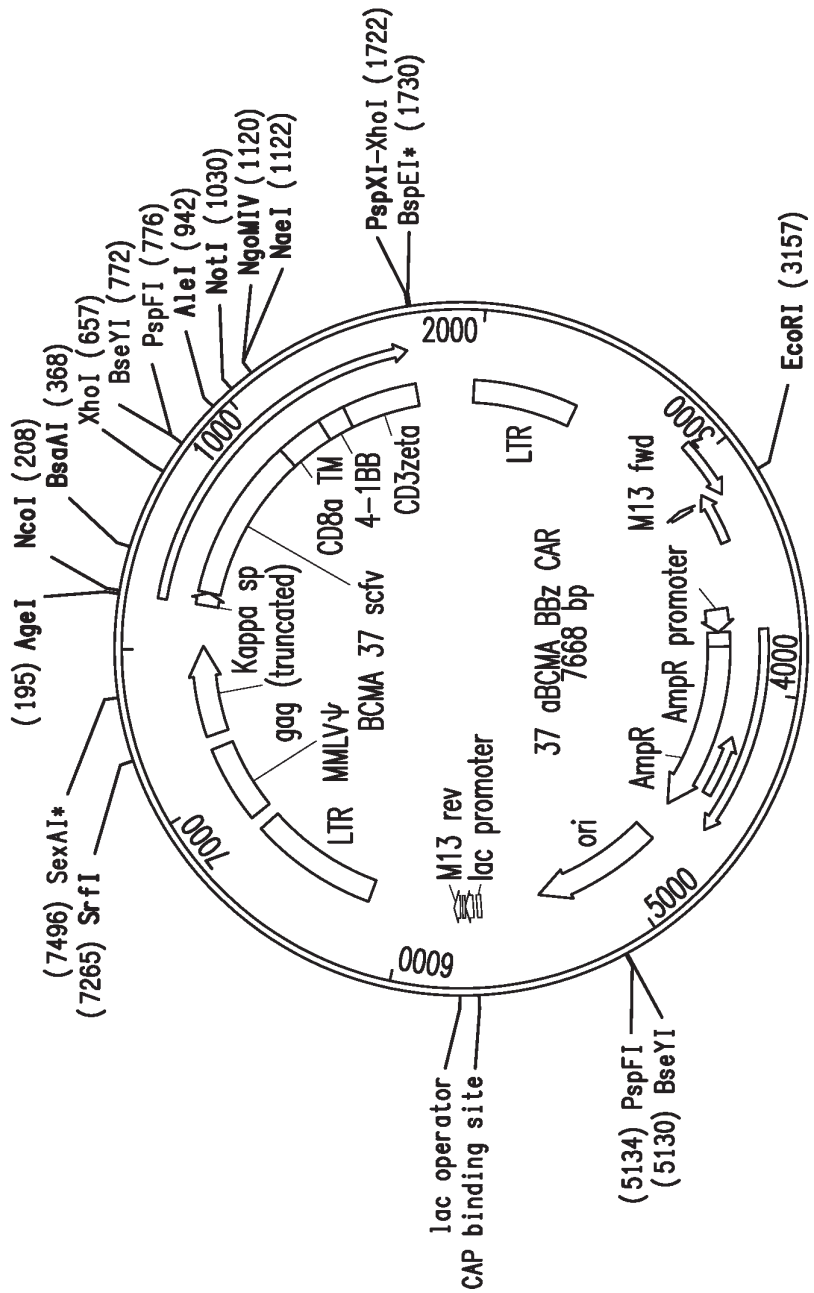

(195) AgeI
NcoI (208)
BsaAI (368)
XhoI (657)
BseYI (772)
PspFI (776)
AleI (942)
NotI (1030)
NgoMIV (1120)
NaeI (1122)
PspXI-XhoI (1722)
BspEI* (1730)
EcoRI (3157)
(7496) SexAI*
(7265) SrfI
1000
2000
3000
4000
5000
6000
7000
LTR
MMLVψ
gag
Kappa sp
(truncated)
BCMA 37 scfv
CD8a TM
4-1BB
CD3zeta
LTR
37 aBCMA BBz CAR
7668 bp
M13 fwd
AmpR promoter
AmpR
ori
M13 rev
lac promoter
lac operator
CAP binding site
(5134) PspFI
(5130) BseYI

FIG. 10

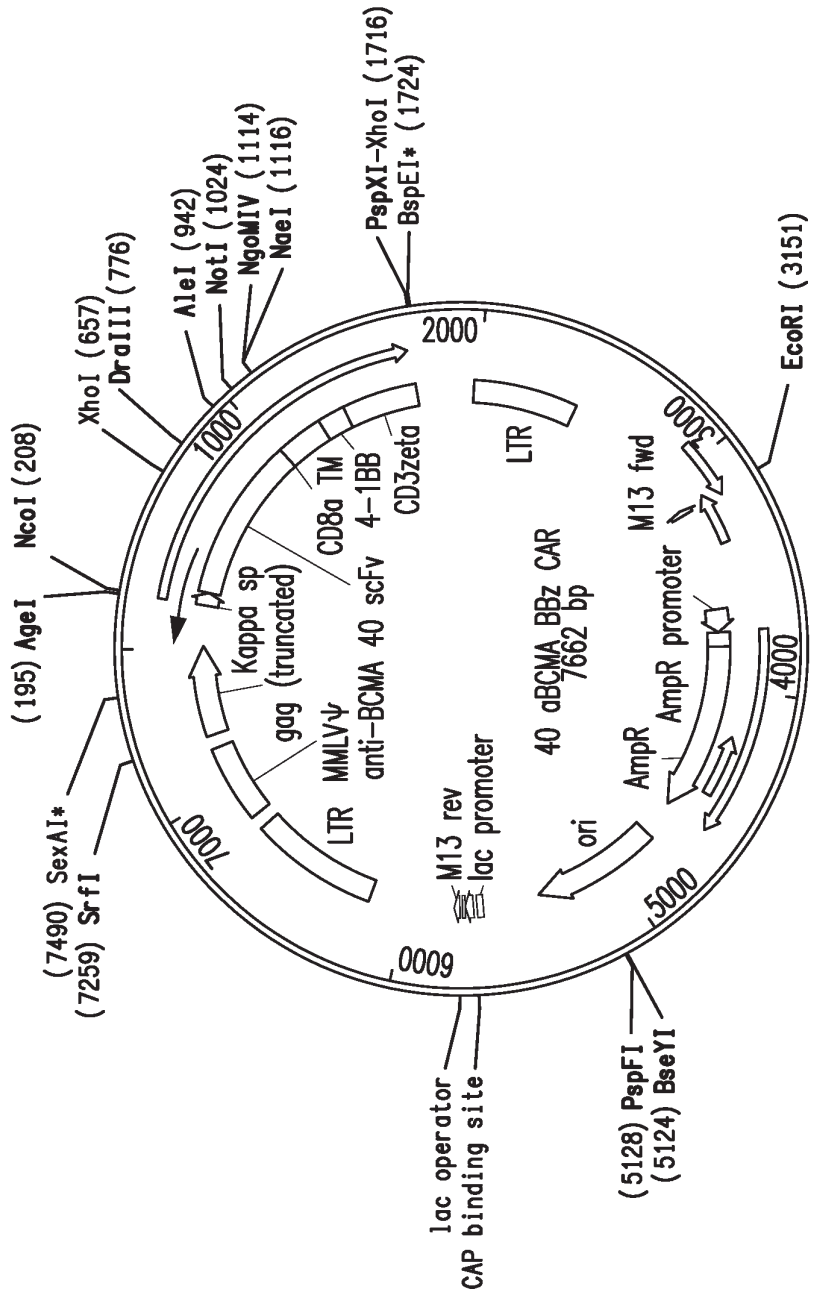

(195) AgeI
NcoI (208)
XhoI (657)
DraIII (776)
AleI (942)
NotI (1024)
NgoMIV (1114)
NaeI (1116)
PspXI-XhoI (1716)
BspEI* (1724)
EcoRI (3151)
(7490) SexAI*
(7259) SrfI
lac operator
CAP binding site
(5128) PspFI
(5124) BseYI
1000
2000
3000
4000
5000
6000
7000
LTR
MMLVψ
gag
Kappa sp
(truncated)
anti-BCMA 40 scFv
CD8a TM
4-1BB
CD3zeta
LTR
40 aBCMA BBz CAR
7662 bp
M13 fwd
AmpR promoter
AmpR
ori
M13 rev
lac promoter

FIG. 11

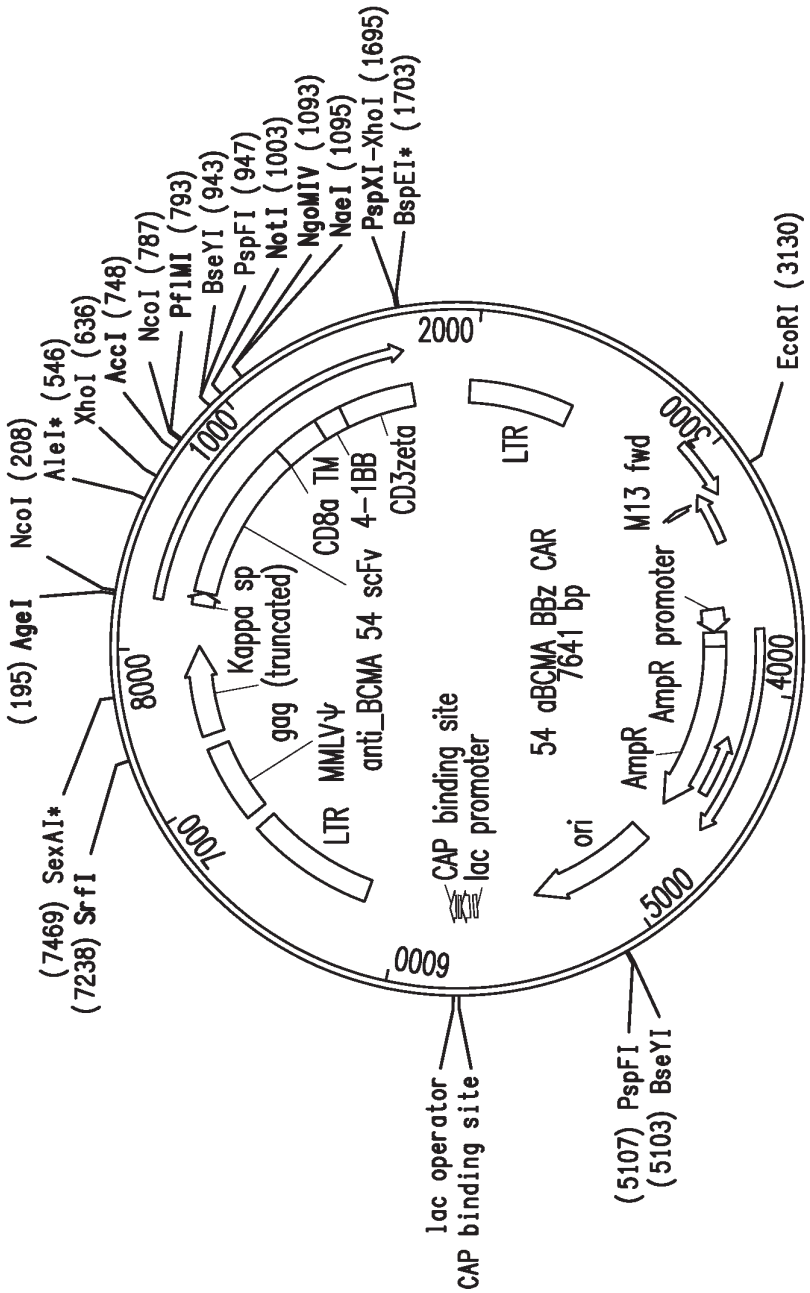

(195) AgeI
NcoI (208)
AleI* (546)
XhoI (636)
AccI (748)
NcoI (787)
PflMI (793)
BseYI (943)
PspFI (947)
NotI (1003)
NgoMIV (1093)
NaeI (1095)
PspXI-XhoI (1695)
BspEI* (1703)
EcoRI (3130)
(7469) SexAI*
(7238) SrfI
lac operator
CAP binding site
(5107) PspFI
(5103) BseYI
1000
2000
3000
4000
5000
6000
7000
8000
LTR
MMLVψ
gag
Kappa sp
(truncated)
anti_BCMA 54 scFv
CD8a TM
4-1BB
CD3zeta
LTR
54 aBCMA BBz CAR
7641 bp
M13 fwd
AmpR promoter
AmpR
ori
CAP binding site
lac promoter

FIG. 12

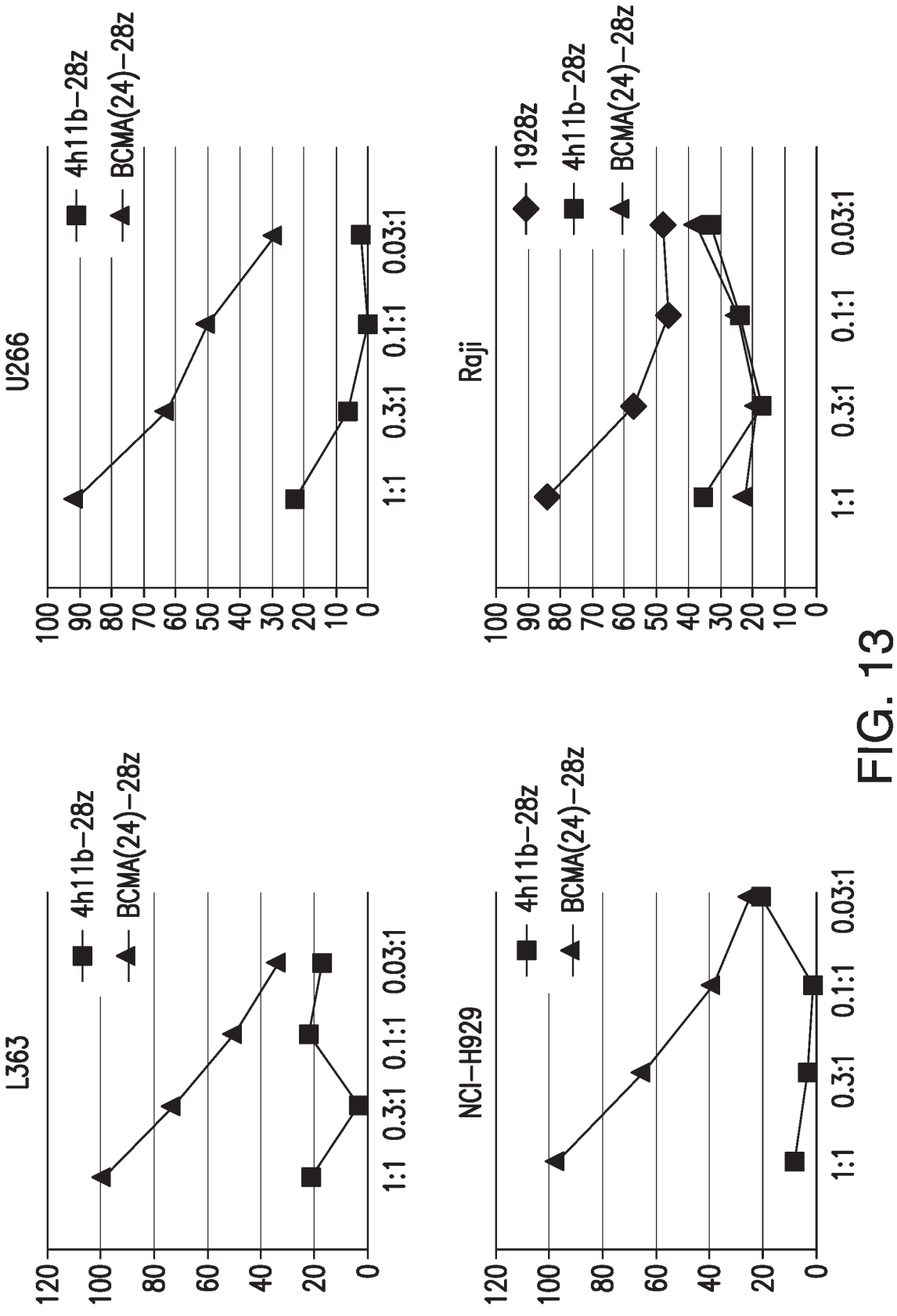

U266
4h11b-28z
BCMA(24)-28z
100
90
80
70
60
50
40
30
20
10
0
1:1 0.3:1 0.1:1 0.03:1
Raji
1928z
4h11b-28z
BCMA(24)-28z
100
90
80
70
60
50
40
30
20
10
0
1:1 0.3:1 0.1:1 0.03:1
L363
4h11b-28z
BCMA(24)-28z
120
100
80
60
40
20
0
1:1 0.3:1 0.1:1 0.03:1
NCI-H929
4h11b-28z
BCMA(24)-28z
120
100
80
60
40
20
0
1:1 0.3:1 0.1:1 0.03:1

FIG. 13

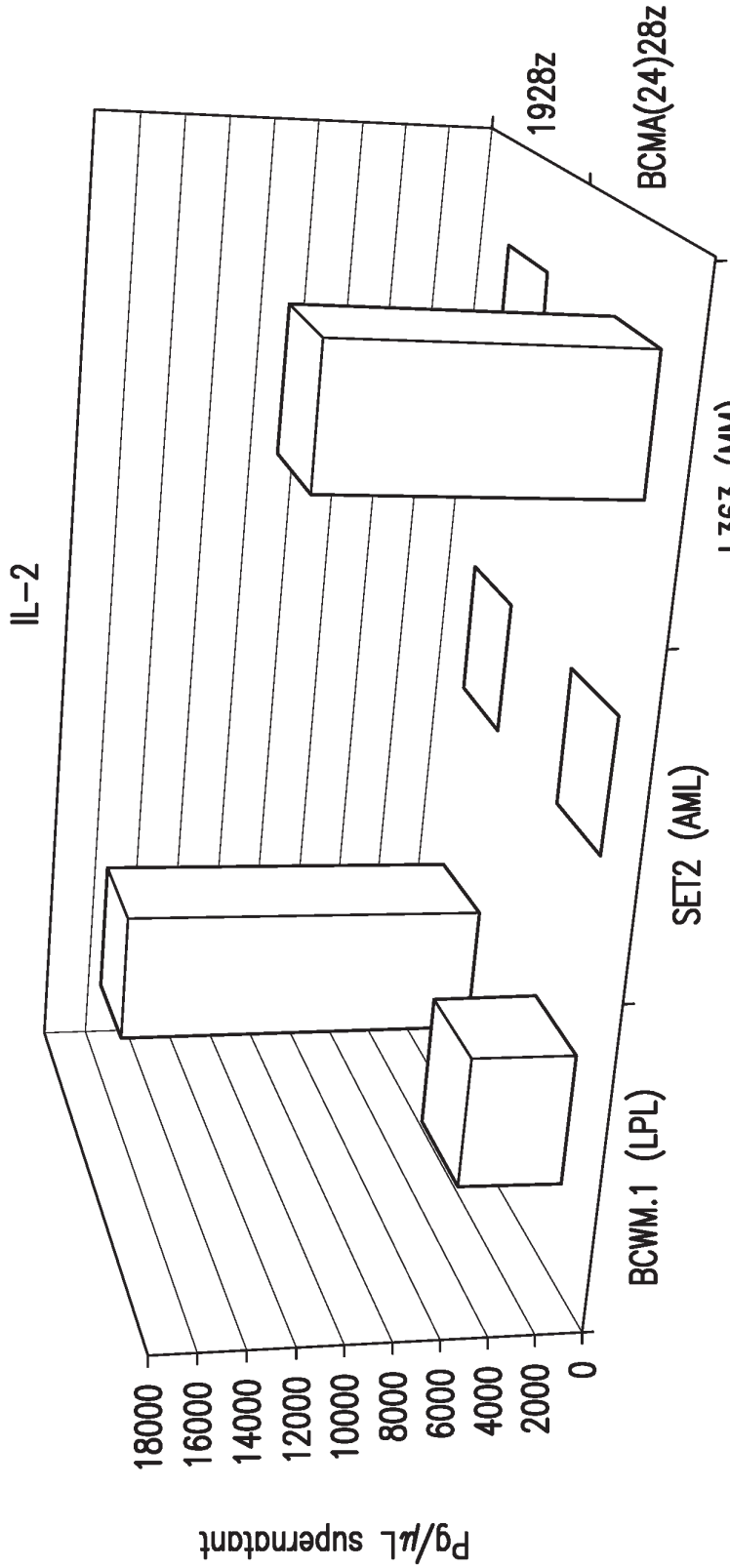

IL-2
1928z
BCMA(24)28z
L363 (MM)
SET2 (AML)
BCWM.1 (LPL)
IFNg, IL-6, TNFa, sCD40L, GM-CSF
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Pg/μL supernatant

FIG. 14

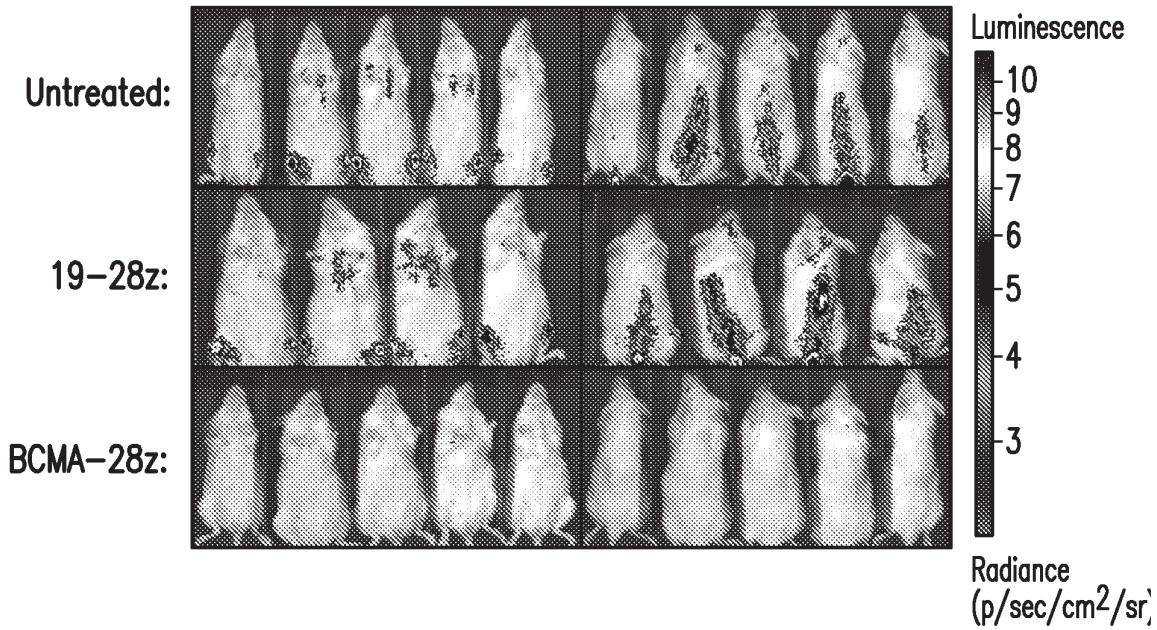

Untreated:
19-28z:
BCMA-28z:
Luminescence
10
9
8
7
6
5
4
3
Radiance
(p/sec/cm2/sr)

FIG. 15

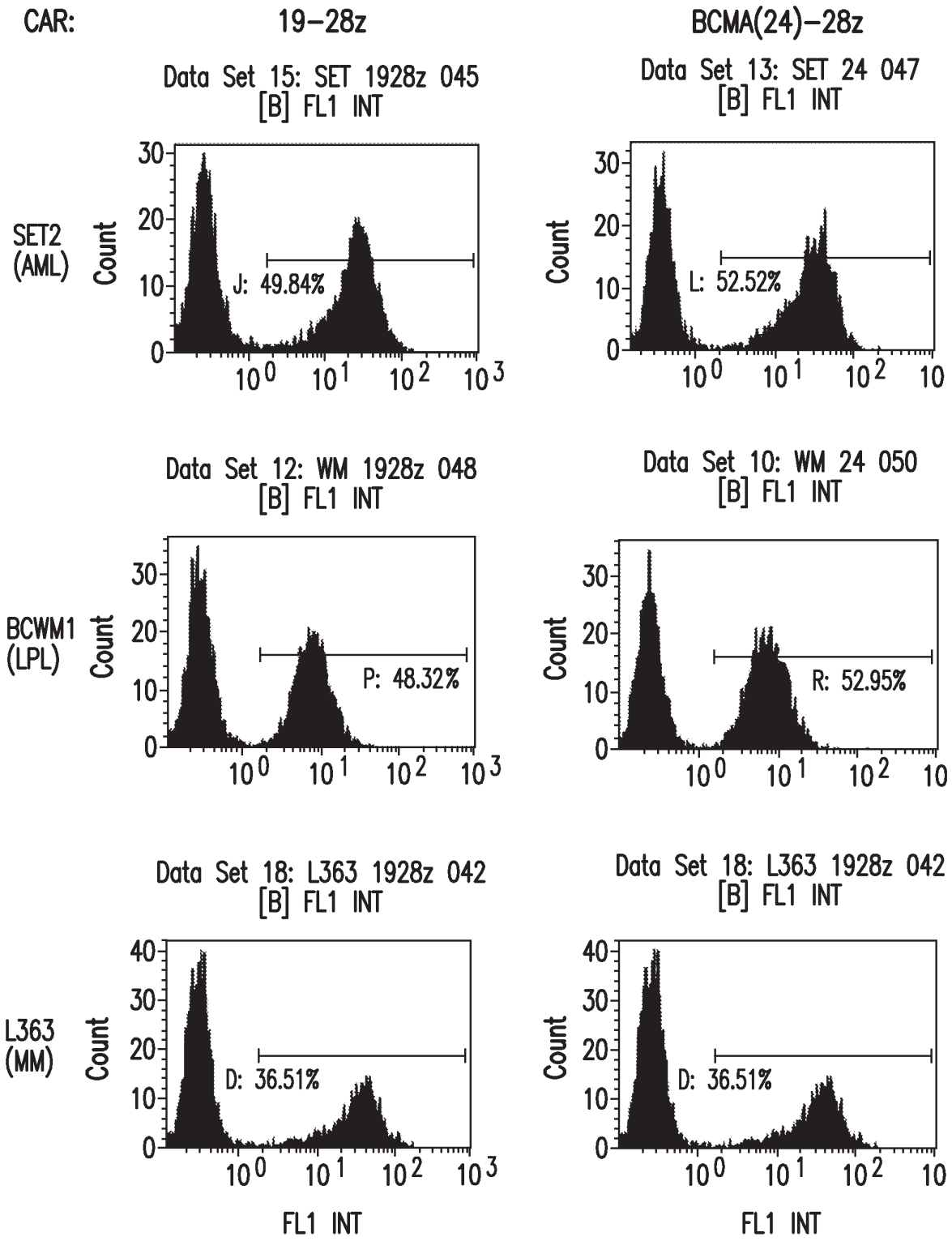

CAR:
19−28z
BCMA(24)−28z
Data Set 15: SET 1928z 045
[B] FL1 INT
Data Set 13: SET 24 047
[B] FL1 INT
SET2
(AML)
Count
J: 49.84%
L: 52.52%
Data Set 12: WM 1928z 048
[B] FL1 INT
Data Set 10: WM 24 050
[B] FL1 INT
BCWM1
(LPL)
P: 48.32%
R: 52.95%
Data Set 18: L363 1928z 042
[B] FL1 INT
Data Set 18: L363 1928z 042
[B] FL1 INT
L363
(MM)
D: 36.51%
D: 36.51%
FL1 INT
FL1 INT

FIG. 16A

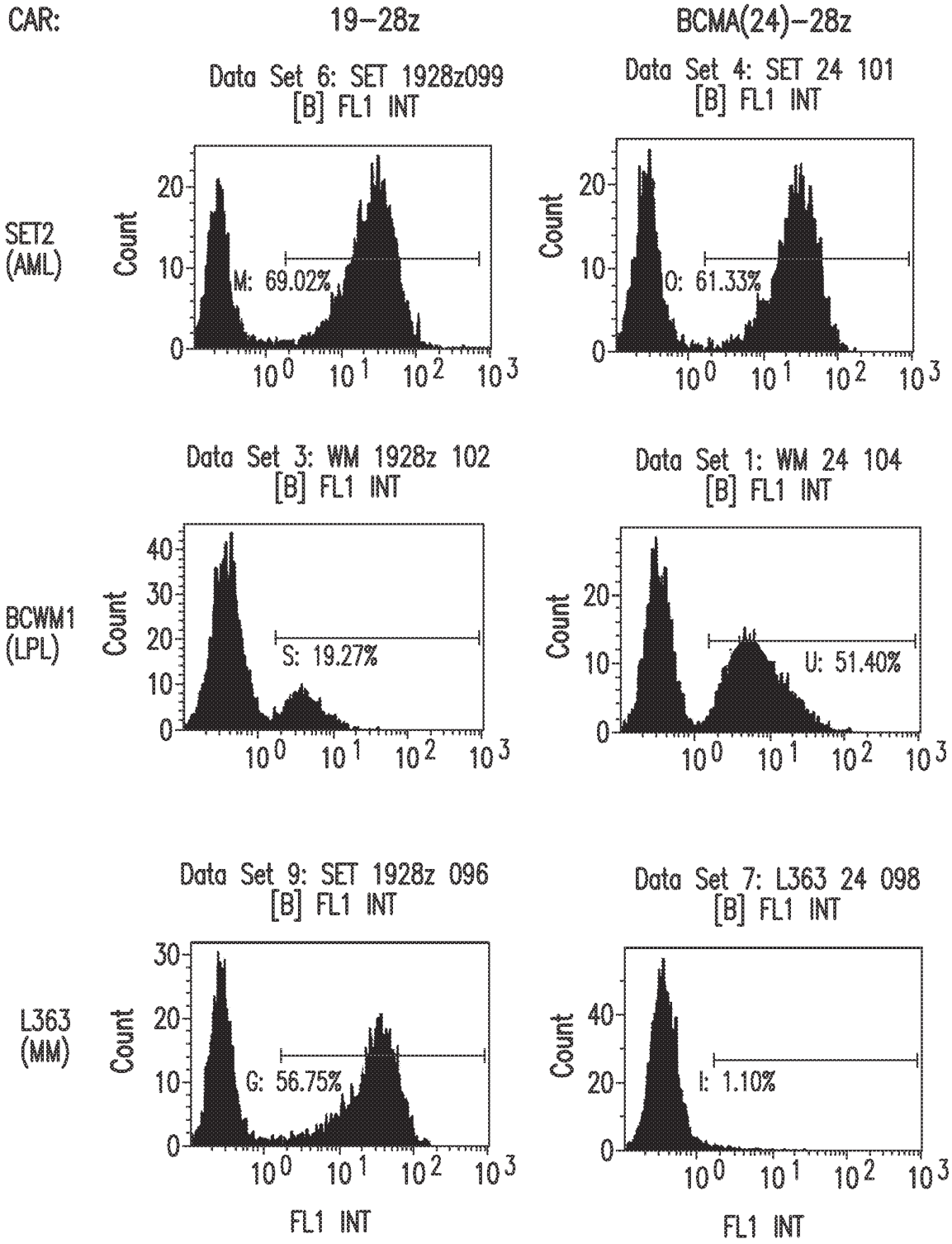
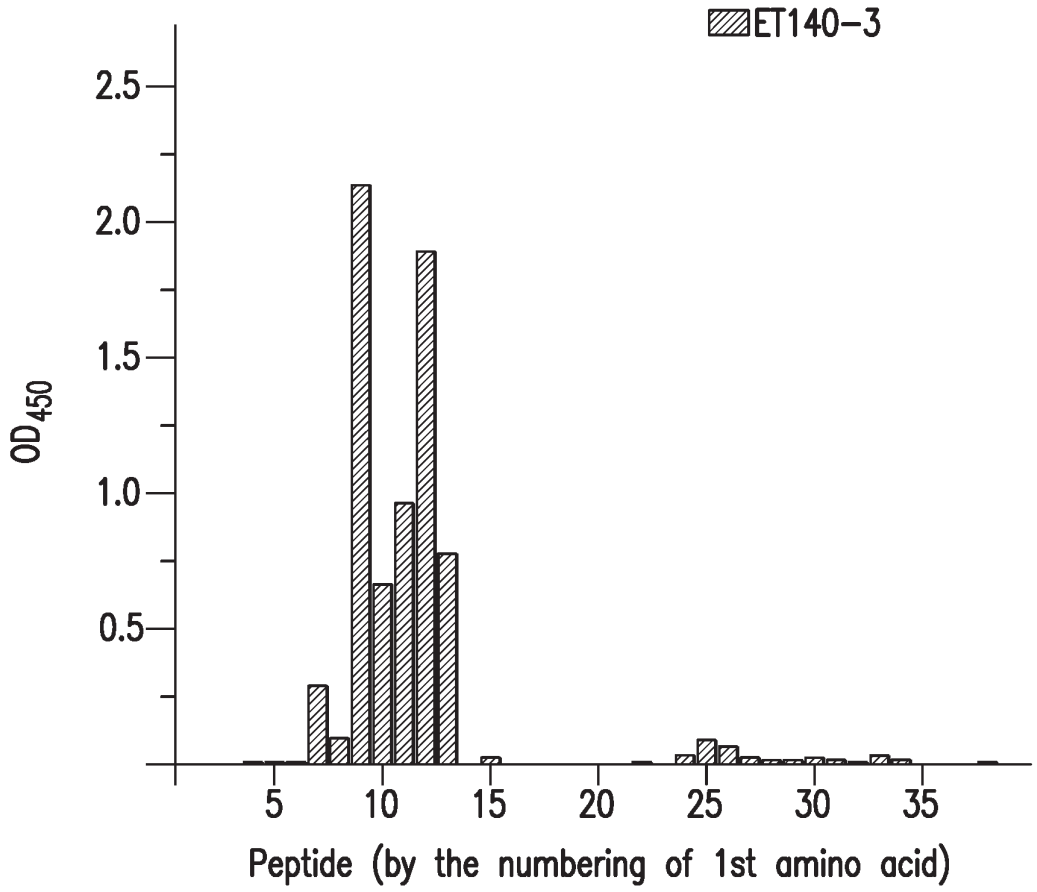

CAR:
19-28z
BCMA(24)-28z
Data Set 6: SET 1928z099
[B] FL1 INT
Data Set 4: SET 24 101
[B] FL1 INT
SET2
(AML)
Count
M: 69.02%
O: 61.33%
Data Set 3: WM 1928z 102
[B] FL1 INT
Data Set 1: WM 24 104
[B] FL1 INT
BCWM1
(LPL)
S: 19.27%
U: 51.40%
Data Set 9: SET 1928z 096
[B] FL1 INT
Data Set 7: L363 24 098
[B] FL1 INT
L363
(MM)
G: 56.75%
I: 1.10%
FL1 INT
FL1 INT

FIG. 16B



Epitope: amino acid #7-27

1 11 21 31 41 51
LQMAGQ**CSQN EYFDSLLHAC IPCQLRC**SSN TPPLTCQRYC NASVTNSVKG TNA

FIG. 17

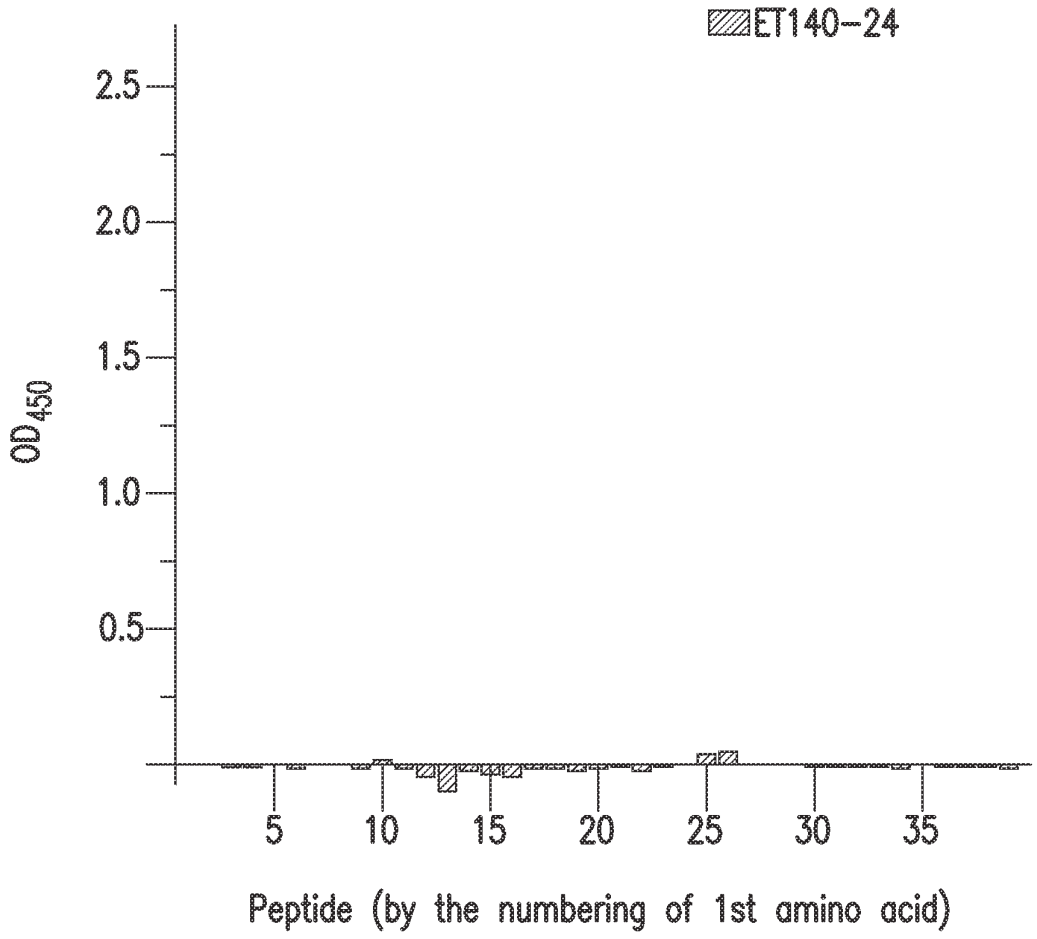

ET140-24
2.5
2.0
1.5
1.0
0.5
OD450
5
10
15
20
25
30
35
Peptide (by the numbering of 1st amino acid)

FIG. 18

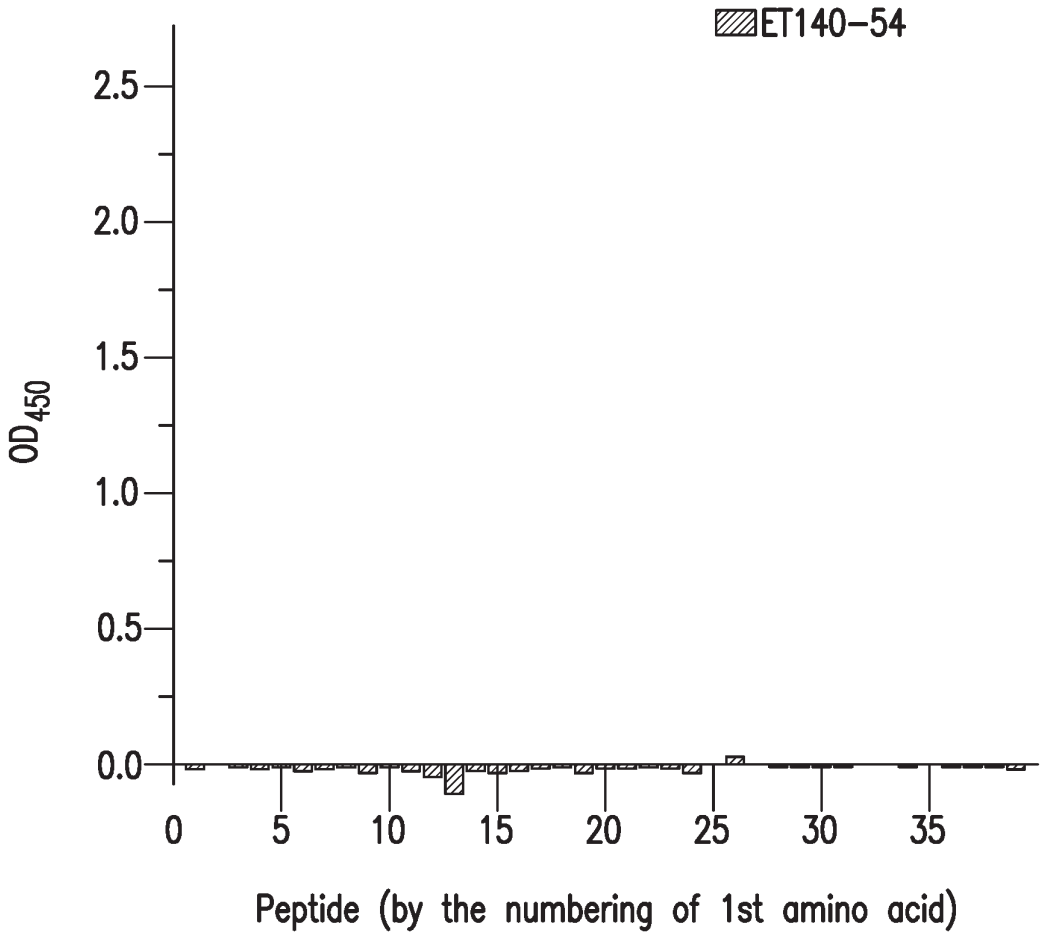

ET140-54
2.5
2.0
1.5
1.0
0.5
0.0
OD450
0
5
10
15
20
25
30
35
Peptide (by the numbering of 1st amino acid)

FIG. 19

	1	2	3	4	5	6	7	8	9	10	11	12
ET140-3 mIgG	0.084	0.076	0.086	0.094	0.08	0.127	0.381	0.178	2.249	0.758	1.067	2.08
ET140-24 mIgG	0.084	0.079	0.08	0.081	0.073	0.105	0.087	0.083	0.104	0.115	0.094	0.137
ET140-54 mIgG	0.069	0.076	0.083	0.073	0.069	0.095	0.075	0.073	0.087	0.087	0.085	0.139
901mIgG	0.084	0.075	0.089	0.088	0.073	0.118	0.087	0.078	0.116	0.094	0.108	0.186
	13	14	15	16	17	18	19	20	21	22	23	24
ET140-3 mIgG	1.027	0.124	0.328	0.266	0.155	0.097	0.098	0.087	0.089	0.131	0.113	0.382
ET140-24 mIgG	0.143	0.105	0.268	0.231	0.15	0.099	0.104	0.083	0.086	0.098	0.109	0.357
ET140-54 mIgG	0.138	0.104	0.276	0.263	0.146	0.105	0.099	0.081	0.077	0.111	0.101	0.325
901mIgG	0.252	0.126	0.305	0.282	0.162	0.112	0.126	0.094	0.089	0.12	0.114	0.354

	25	26	27	28	29	30	31	32	33	34	35	36
ET140-3 mIgG	0.583	0.225	0.12	0.109	0.109	0.111	0.107	0.099	0.116	0.099	0.072	0.089
ET140-24 mIgG	0.537	0.212	0.1	0.101	0.09	0.083	0.085	0.092	0.083	0.069	0.076	0.084
ET140-54 mIgG	0.494	0.2	0.103	0.093	0.083	0.08	0.08	0.092	0.084	0.07	0.071	0.085
901mIgG	0.492	0.162	0.098	0.096	0.09	0.086	0.087	0.094	0.086	0.079	0.072	0.088
	37	38	39									
ET140-3 mIgG	0.085	0.08	0.072	0.074	0.07	0.066	0.068	0.072	0.074	0.065	0.07	0.069
ET140-24 mIgG	0.086	0.071	0.071	0.079	0.092	0.084	0.077	0.077	0.078	0.068	0.064	0.069
ET140-54 mIgG	0.083	0.069	0.074	0.078	0.065	0.065	0.07	0.069	0.066	0.067	0.069	0.061
901 mIgG	0.09	0.075	0.085	0.083	0.084	0.078	0.071	0.075	0.068	0.066	0.064	0.066

FIG. 20

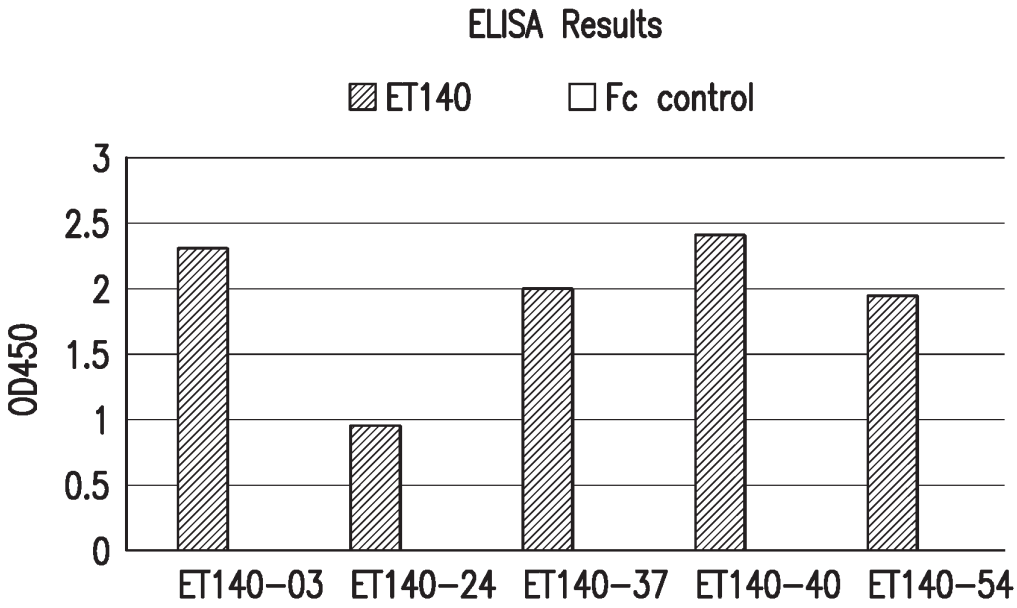

ELISA Results
ET140
Fc control
OD450
3
2.5
2
1.5
1
0.5
0
ET140-03
ET140-24
ET140-37
ET140-40
ET140-54

FIG. 21

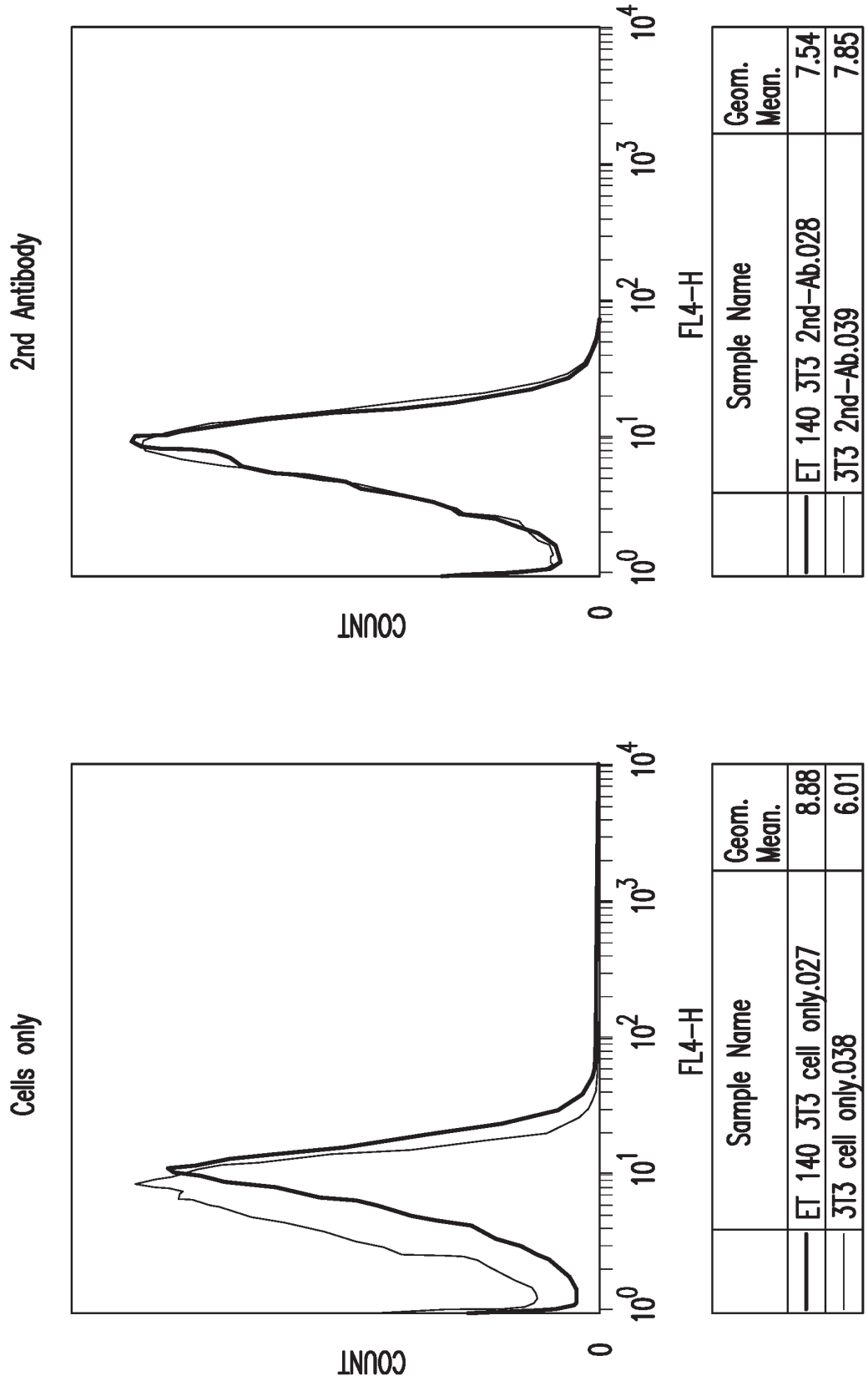

2nd Antibody
COUNT
FL4-H
Sample Name
Geom. Mean.
ET 140 3T3 2nd-Ab.028 7.54
3T3 2nd-Ab.039 7.85
Cells only
COUNT
FL4-H
Sample Name
Geom. Mean.
ET 140 3T3 cell only.027 8.88
3T3 cell only.038 6.01

FIG. 22A

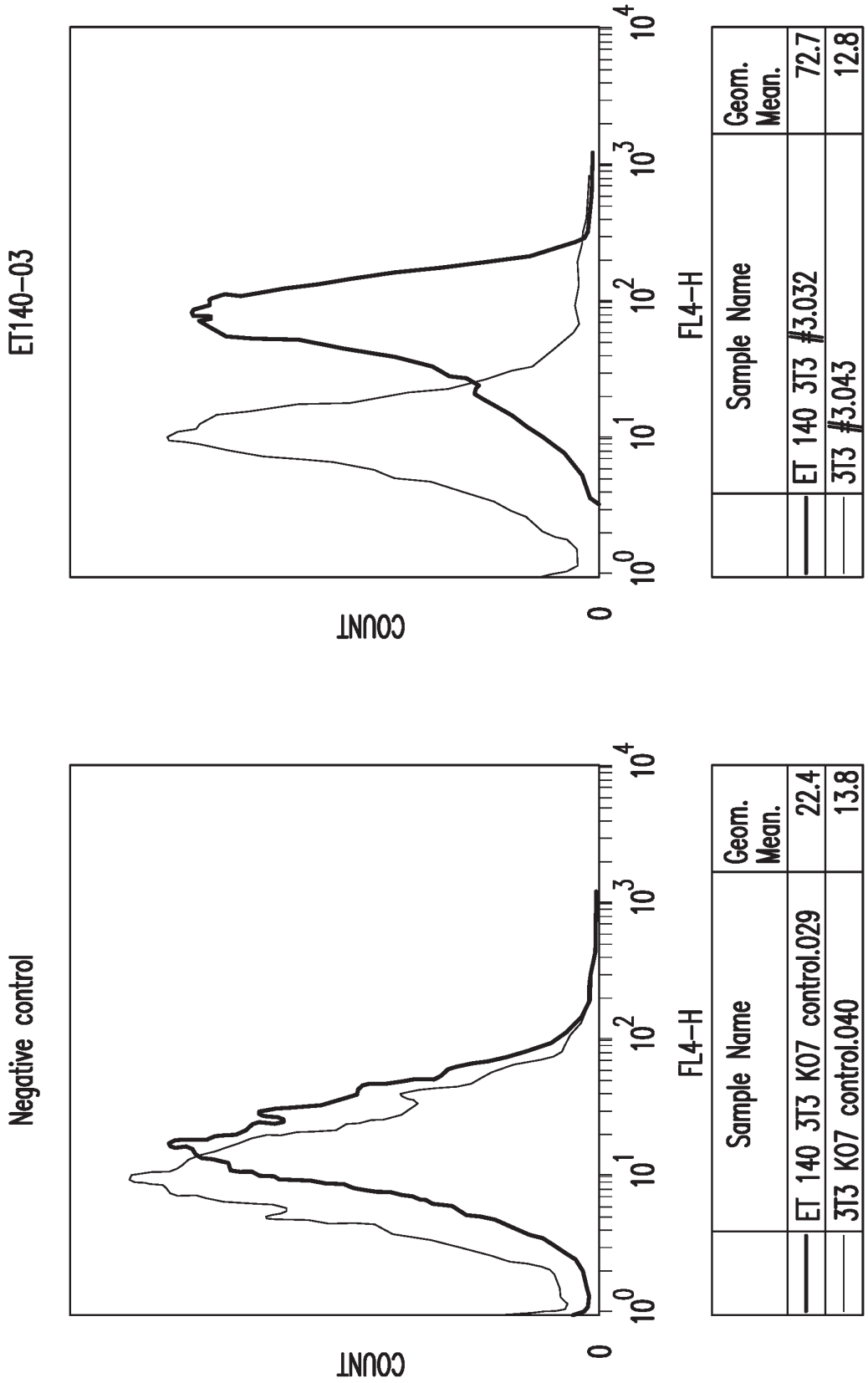

ET140-03
COUNT
FL4-H
Sample Name
Geom. Mean.
ET 140 3T3 #3.032 72.7
3T3 #3.043 12.8
Negative control
COUNT
FL4-H
Sample Name
Geom. Mean.
ET 140 3T3 K07 control.029 22.4
3T3 K07 control.040 13.8

FIG. 22B

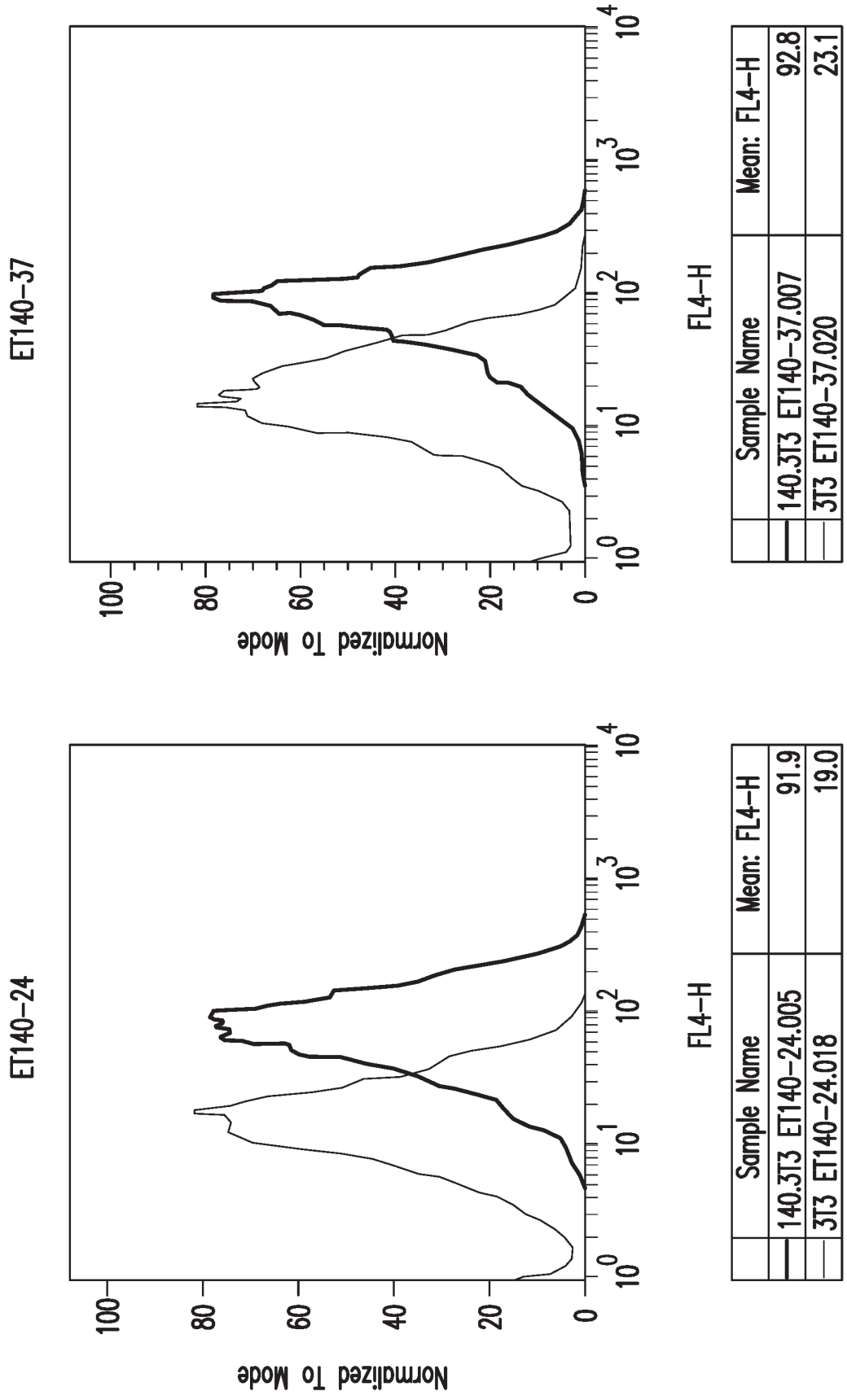

ET140-24
Normalized To Mode
100
80
60
40
20
0
10^0
10^1
10^2
10^3
10^4
FL4-H
Sample Name
Mean: FL4-H
140.3T3 ET140-24.005
91.9
3T3 ET140-24.018
19.0
ET140-37
Normalized To Mode
100
80
60
40
20
0
10^0
10^1
10^2
10^3
10^4
FL4-H
Sample Name
Mean: FL4-H
140.3T3 ET140-37.007
92.8
3T3 ET140-37.020
23.1

FIG. 22C

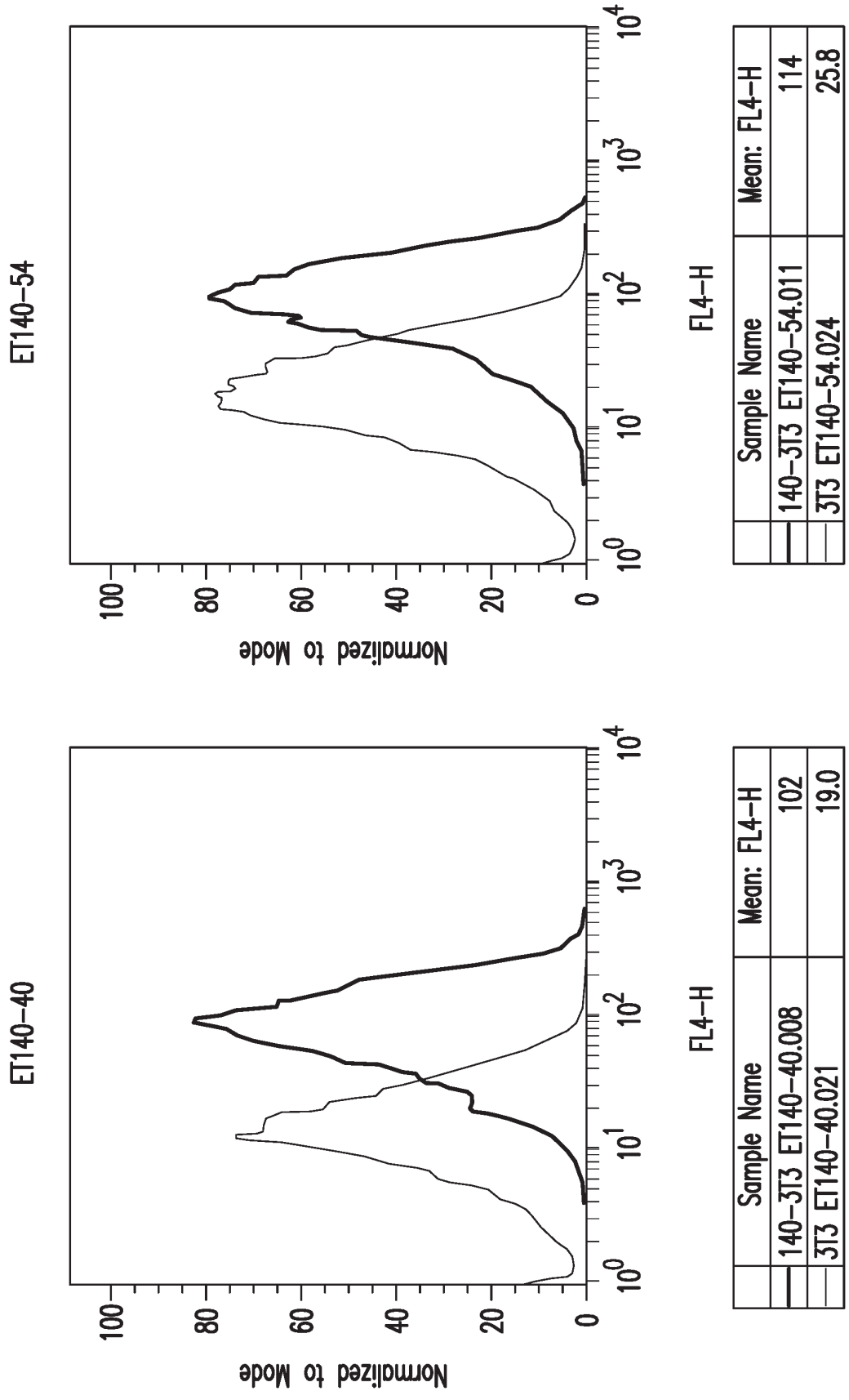

ET140-40
Normalized to Mode
100
80
60
40
20
0
10^0
10^1
10^2
10^3
10^4
FL4-H
Sample Name
Mean: FL4-H
140-3T3 ET140-40.008
102
3T3 ET140-40.021
19.0
ET140-54
Normalized to Mode
100
80
60
40
20
0
10^0
10^1
10^2
10^3
10^4
FL4-H
Sample Name
Mean: FL4-H
140-3T3 ET140-54.011
114
3T3 ET140-54.024
25.8

FIG. 22D