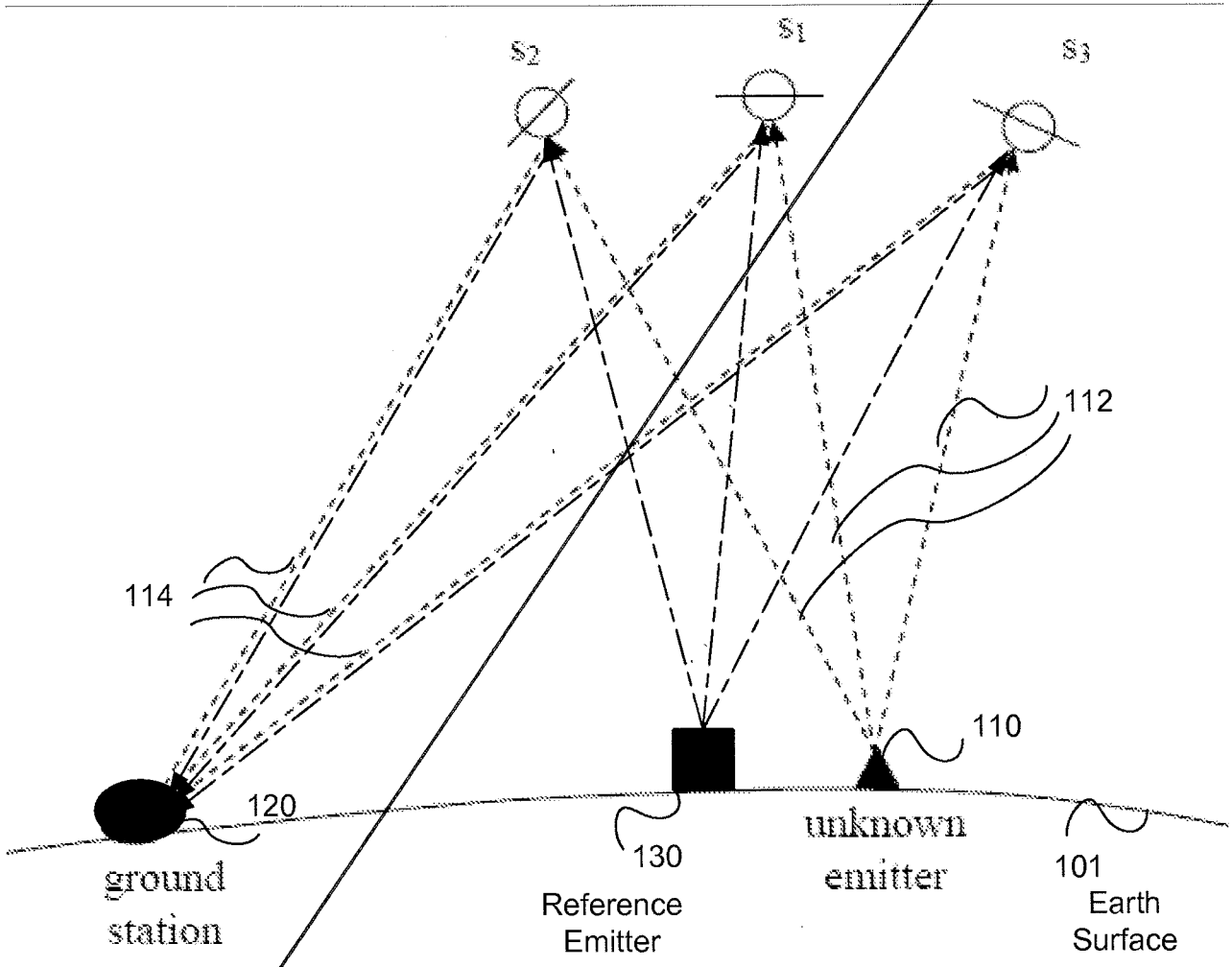

100
S2
S1
S3
112
114
110
120
130
101
ground station
Reference Emitter
unknown emitter
Earth Surface

FIG. 1

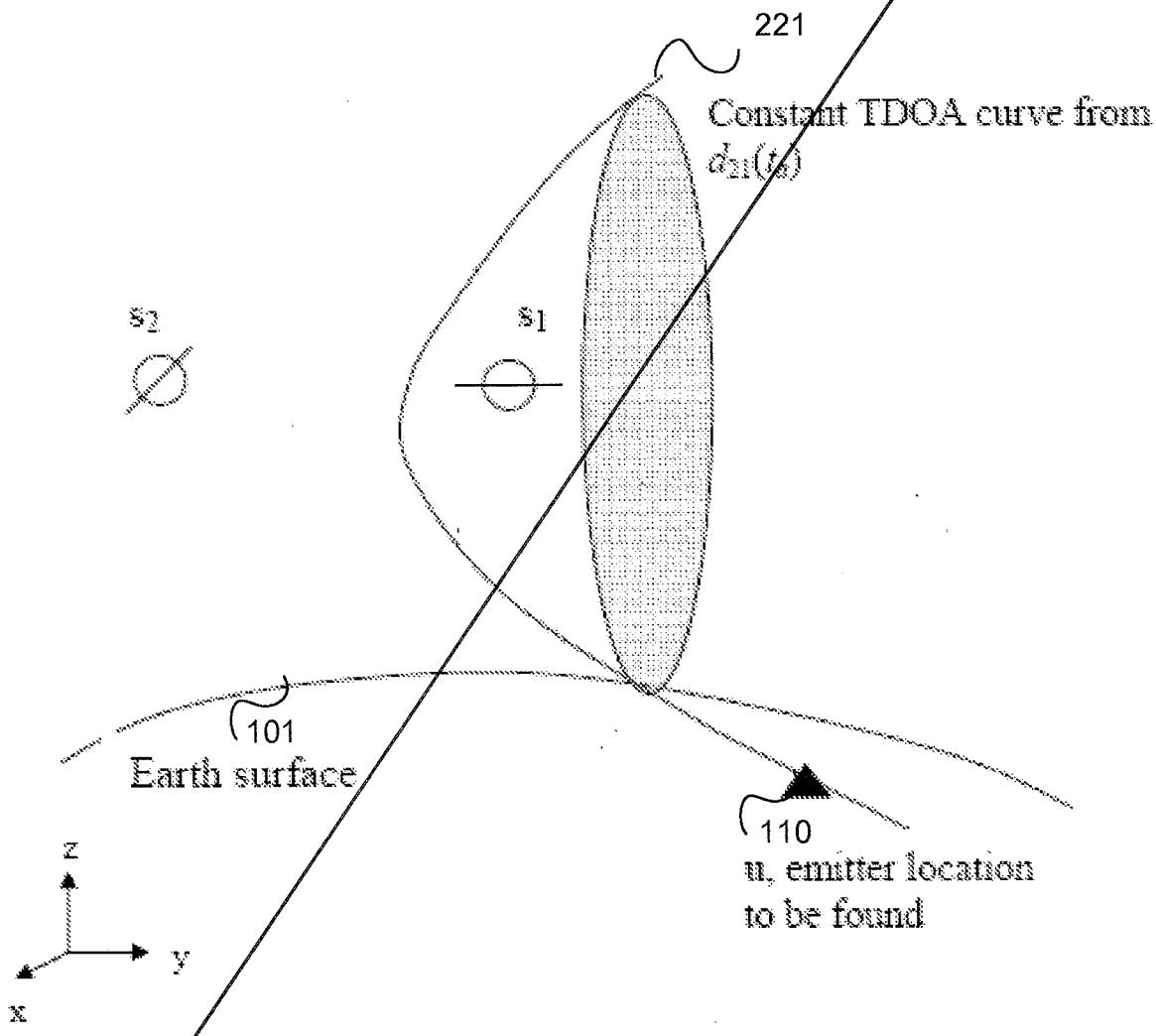

221
Constant TDOA curve from
$d_{21}(t_0)$
s_2
s_1
101
Earth surface
110
u, emitter location
to be found
z
y
x

FIG. 2

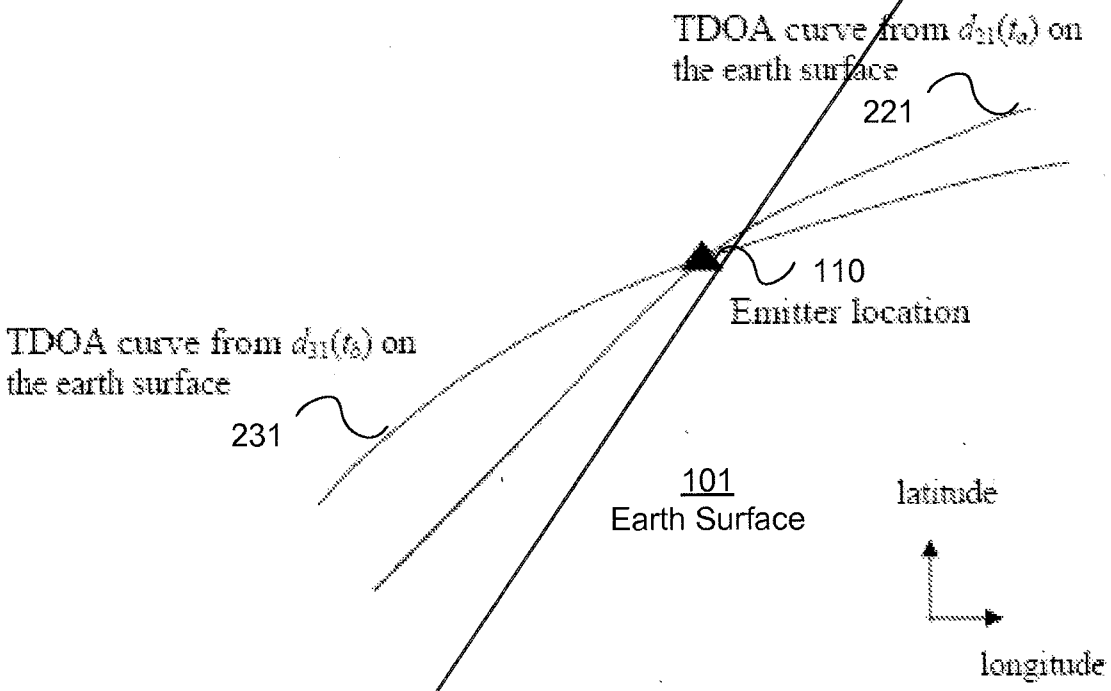

TDOA curve from $d_{21}(t_0)$ on the earth surface
221
110
Emitter location
TDOA curve from $d_{31}(t_0)$ on the earth surface
231
101
Earth Surface
latitude
longitude

FIG. 3A

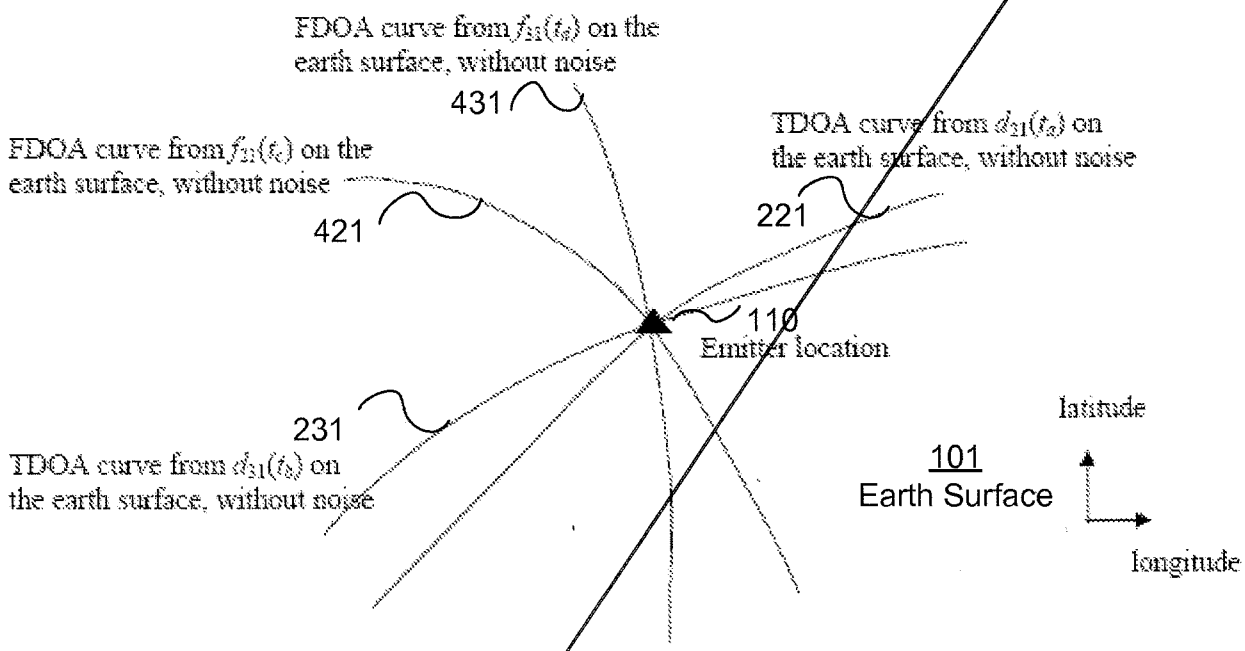

FDOA curve from $f_{21}(t_a)$ on the earth surface, without noise
431
FDOA curve from $f_{21}(t_c)$ on the earth surface, without noise
421
TDOA curve from $d_{21}(t_a)$ on the earth surface, without noise
221
110
Emitter location
231
TDOA curve from $d_{31}(t_b)$ on the earth surface, without noise
latitude
101
Earth Surface
longitude

FIG. 3B

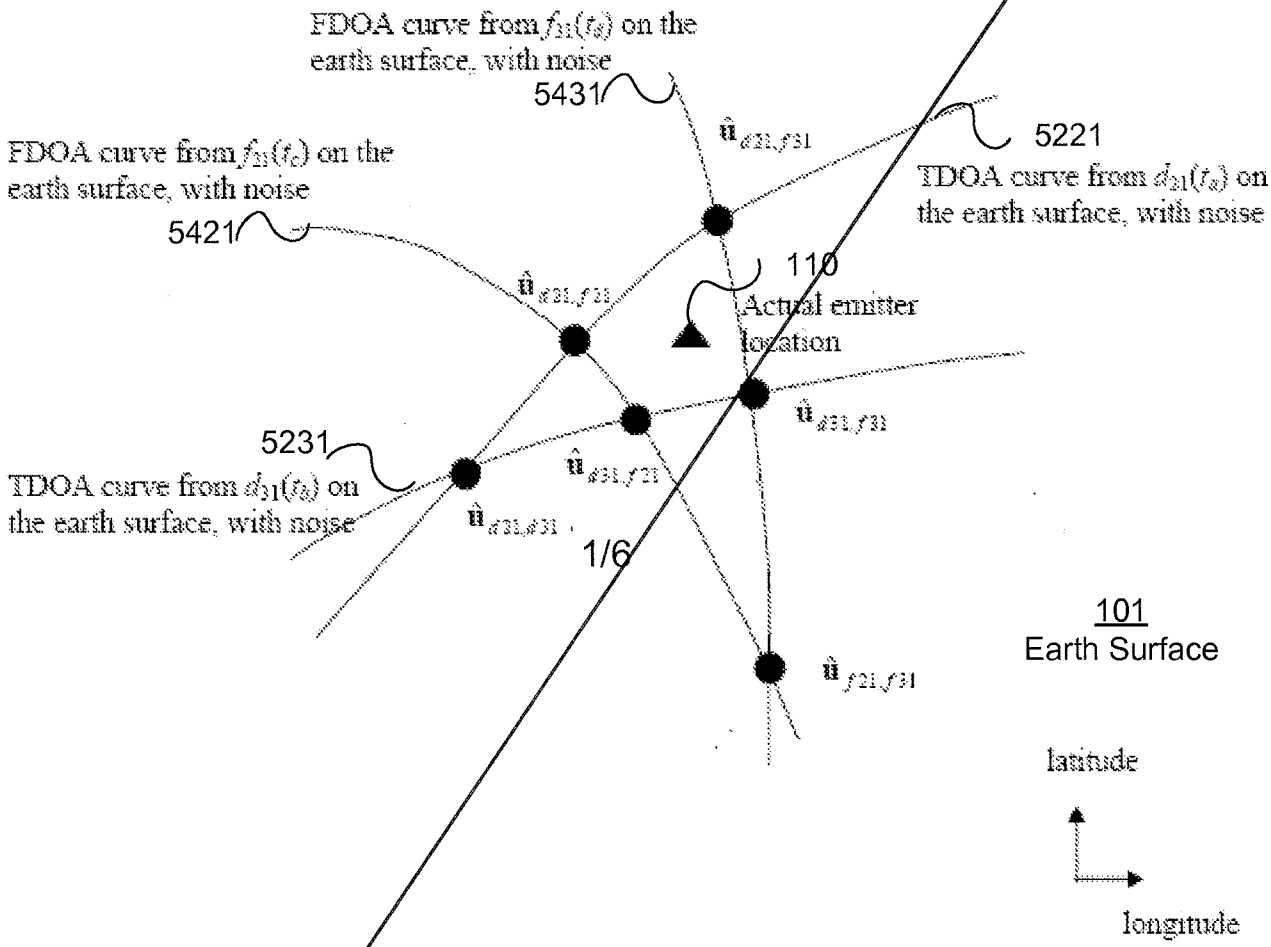

FDOA curve from $f_{21}(t_d)$ on the earth surface, with noise
5431
$\hat{\mathbf{u}}_{\hat{d}21,\hat{f}31}$
5221
TDOA curve from $d_{31}(t_d)$ on the earth surface, with noise
FDOA curve from $f_{21}(t_d)$ on the earth surface, with noise
5421
$\hat{\mathbf{u}}_{\hat{d}31,\hat{f}31}$
110
Actual emitter location
$\hat{\mathbf{u}}_{\hat{d}31,\hat{f}31}$
5231
$\hat{\mathbf{u}}_{\hat{d}31,\hat{f}21}$
TDOA curve from $d_{31}(t_d)$ on the earth surface, with noise
$\hat{\mathbf{u}}_{\hat{d}31,\hat{d}31}$
1/6
$\hat{\mathbf{u}}_{\hat{f}21,\hat{f}31}$
101
Earth Surface
latitude
longitude

FIG. 3C

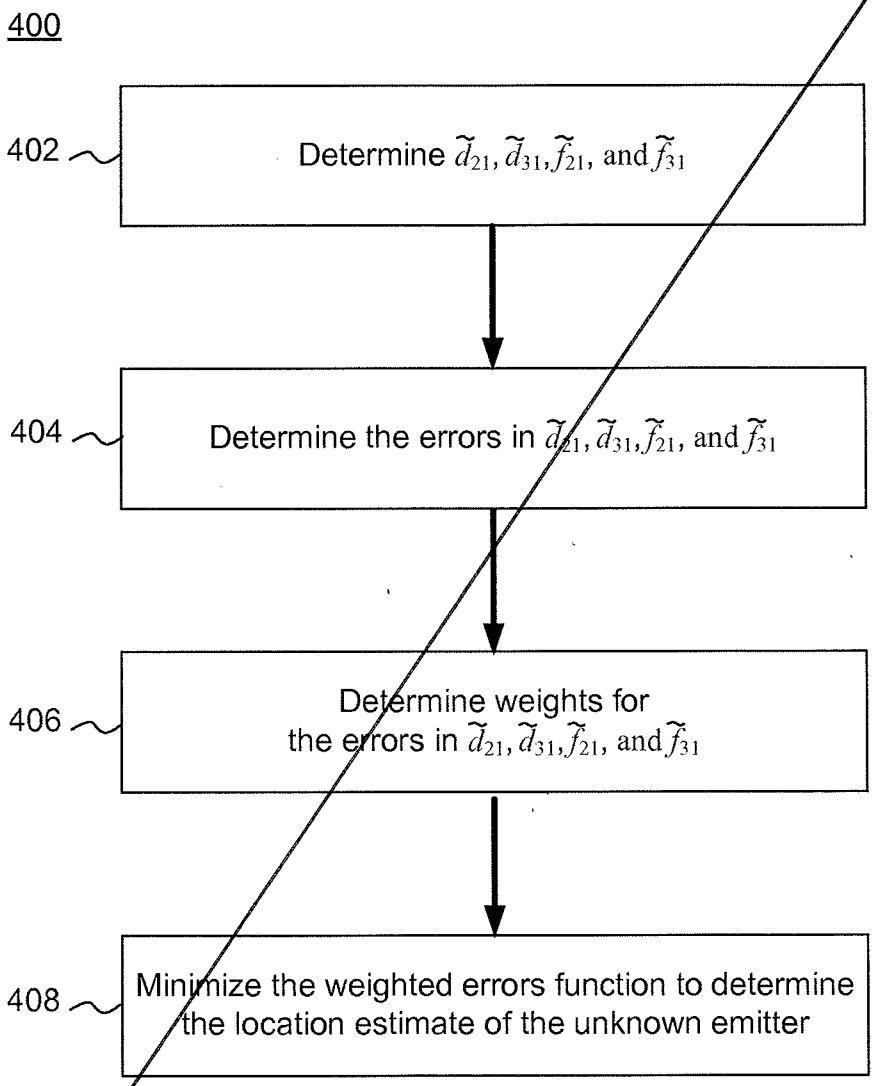

400
402
Determine $\tilde{d}_{21}, \tilde{d}_{31}, \tilde{f}_{21}$, and $\tilde{f}_{31}$
404
Determine the errors in $\tilde{d}_{21}, \tilde{d}_{31}, \tilde{f}_{21}$, and $\tilde{f}_{31}$
406
Determine weights for the errors in $\tilde{d}_{21}, \tilde{d}_{31}, \tilde{f}_{21}$, and $\tilde{f}_{31}$
408
Minimize the weighted errors function to determine the location estimate of the unknown emitter

FIG. 4

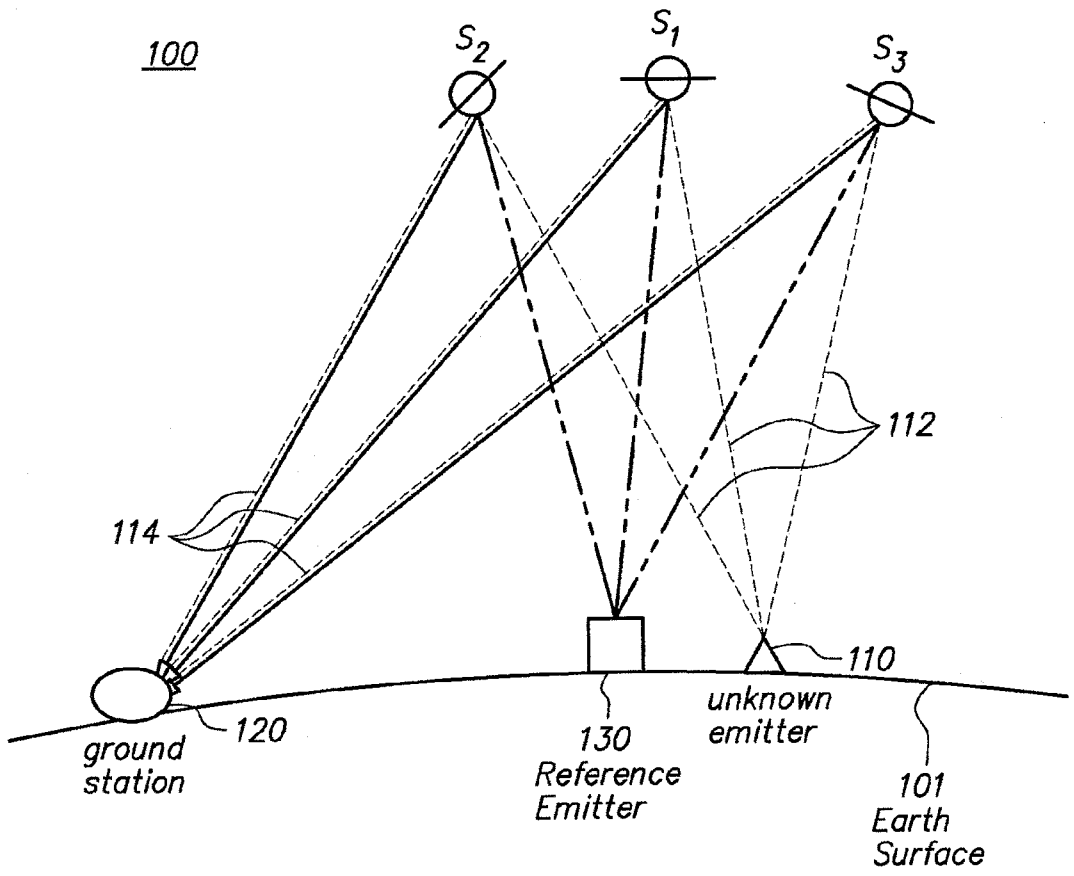

100
S_2
S_1
S_3
112
114
110
120
ground station
130 Reference Emitter
unknown emitter
101 Earth Surface

FIG. 1

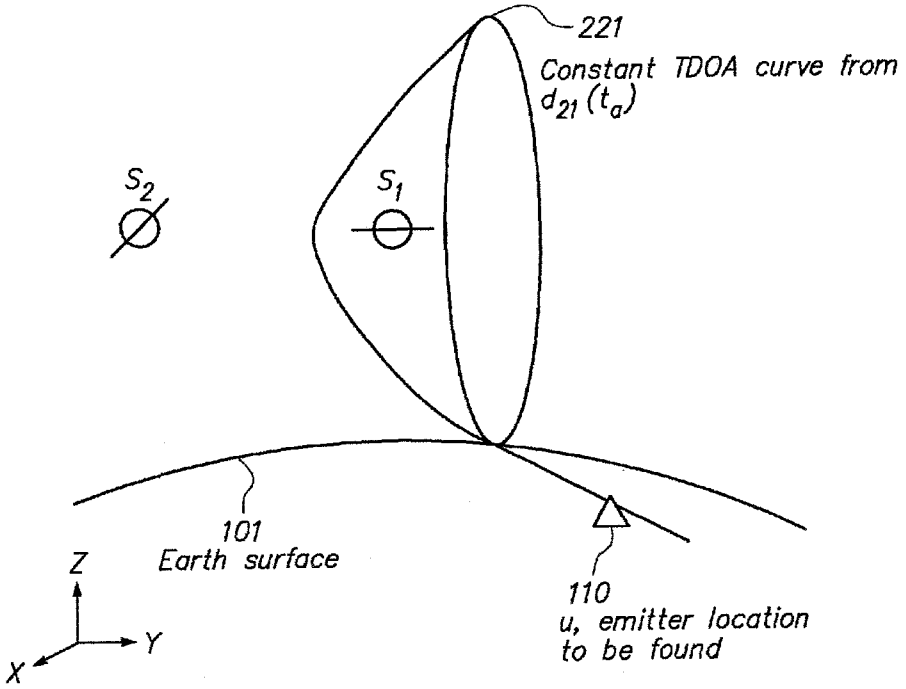

221
Constant TDOA curve from
$d_{21}(t_a)$
S_2
S_1
101
Earth surface
110
u, emitter location
to be found
Z
Y
X

FIG. 2

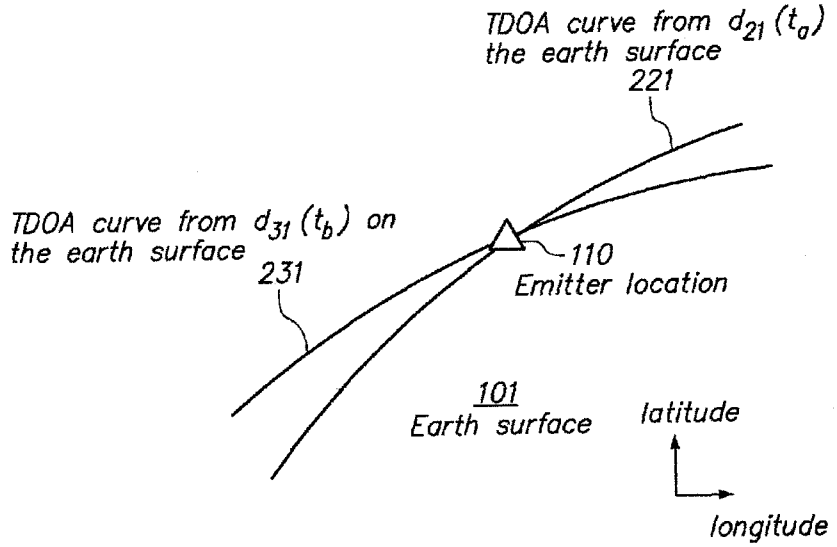

TDOA curve from $d_{21}(t_a)$ on
the earth surface
221
TDOA curve from $d_{31}(t_b)$ on
the earth surface
231
110
Emitter location
101
Earth surface
latitude
longitude

FIG. 3A

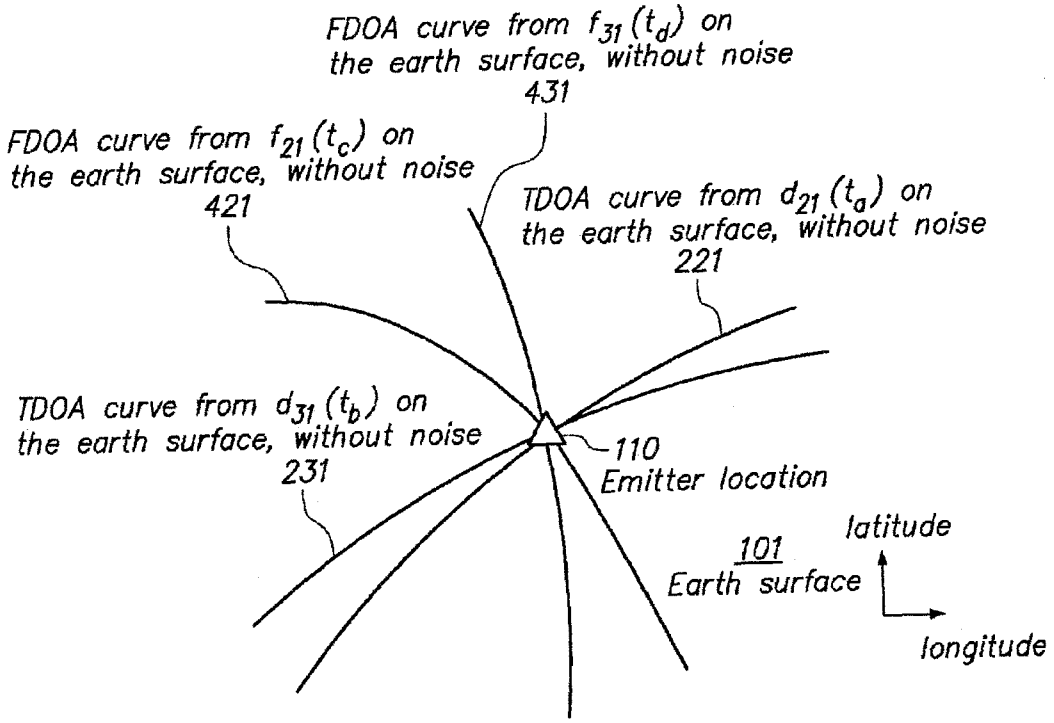

FDOA curve from $f_{31}(t_d)$ on the earth surface, without noise
431
FDOA curve from $f_{21}(t_c)$ on the earth surface, without noise
421
TDOA curve from $d_{21}(t_a)$ on the earth surface, without noise
221
TDOA curve from $d_{31}(t_b)$ on the earth surface, without noise
231
110
Emitter location
101
Earth surface
latitude
longitude

FIG. 3B

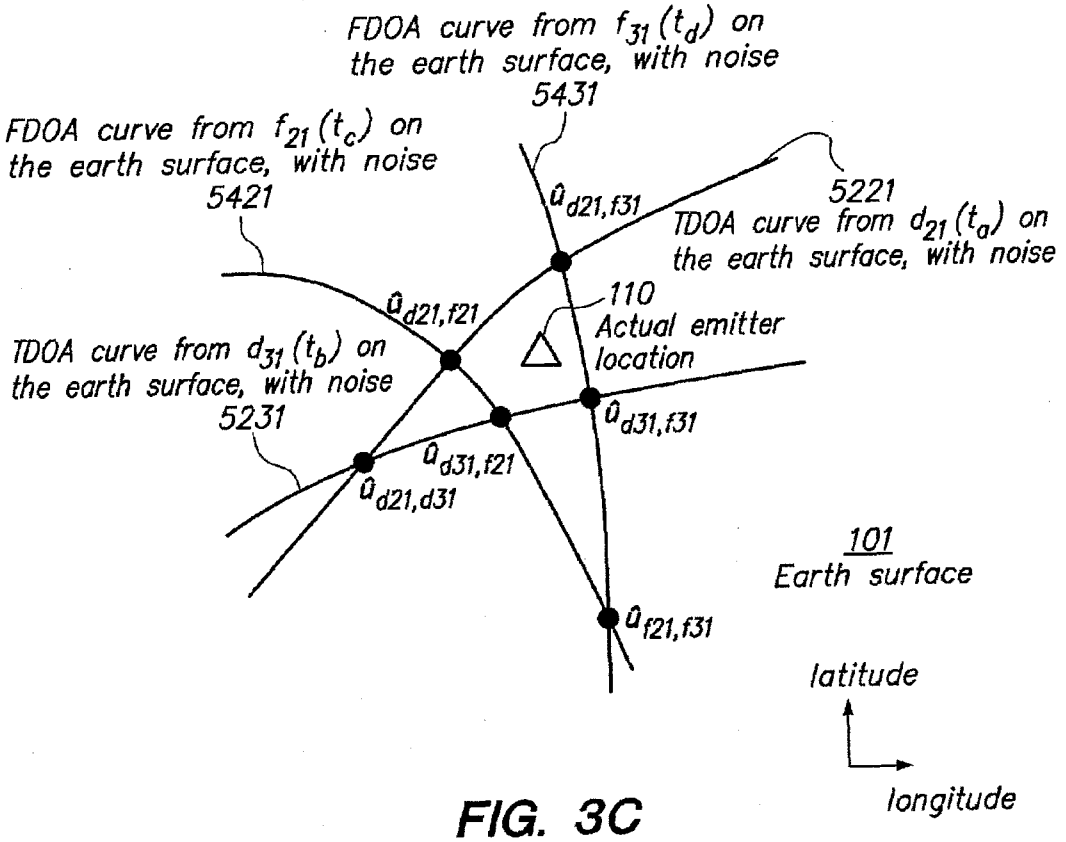

FDOA curve from $f_{31}(t_d)$ on the earth surface, with noise
5431
FDOA curve from $f_{21}(t_c)$ on the earth surface, with noise
5421
5221
TDOA curve from $d_{21}(t_a)$ on the earth surface, with noise
$\hat{u}_{d21,f31}$
$\hat{u}_{d21,f21}$
110
Actual emitter location
TDOA curve from $d_{31}(t_b)$ on the earth surface, with noise
5231
$\hat{u}_{d31,f31}$
$\hat{u}_{d31,f21}$
$\hat{u}_{d21,d31}$
$\hat{u}_{f21,f31}$
101
Earth surface
latitude
longitude

FIG. 3C

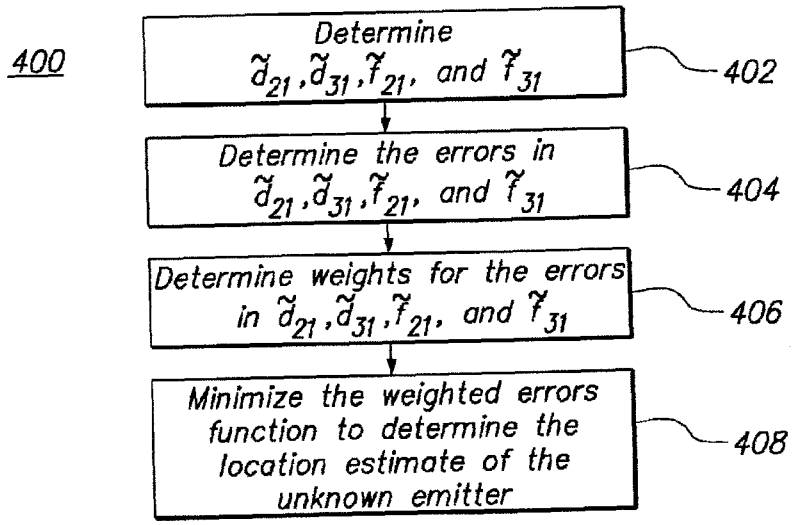

400
Determine $\tilde{d}_{21}, \tilde{d}_{31}, \tilde{f}_{21}$, and $\tilde{f}_{31}$
402
Determine the errors in $\tilde{d}_{21}, \tilde{d}_{31}, \tilde{f}_{21}$, and $\tilde{f}_{31}$
404
Determine weights for the errors in $\tilde{d}_{21}, \tilde{d}_{31}, \tilde{f}_{21}$, and $\tilde{f}_{31}$
406
Minimize the weighted errors function to determine the location estimate of the unknown emitter
408

FIG. 4