FIG. 1A

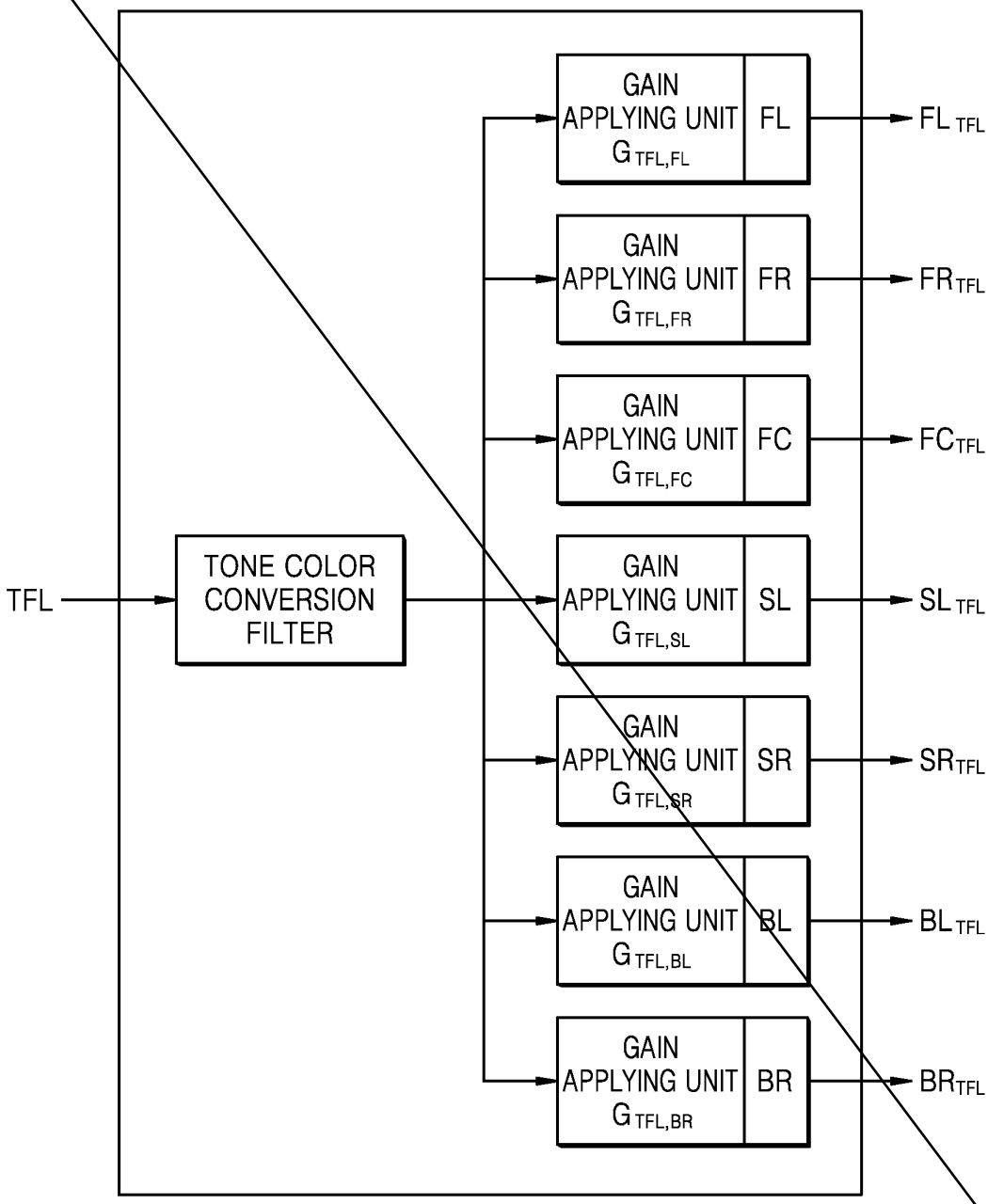

TFL
TONE COLOR CONVERSION FILTER
GAIN APPLYING UNIT $G_{TFL,FL}$
FL
FL_{TFL}
GAIN APPLYING UNIT $G_{TFL,FR}$
FR
FR_{TFL}
GAIN APPLYING UNIT $G_{TFL,FC}$
FC
FC_{TFL}
GAIN APPLYING UNIT $G_{TFL,SL}$
SL
SL_{TFL}
GAIN APPLYING UNIT $G_{TFL,SR}$
SR
SR_{TFL}
GAIN APPLYING UNIT $G_{TFL,BL}$
BL
BL_{TFL}
GAIN APPLYING UNIT $G_{TFL,BR}$
BR
BR_{TFL}

FIG. 1B

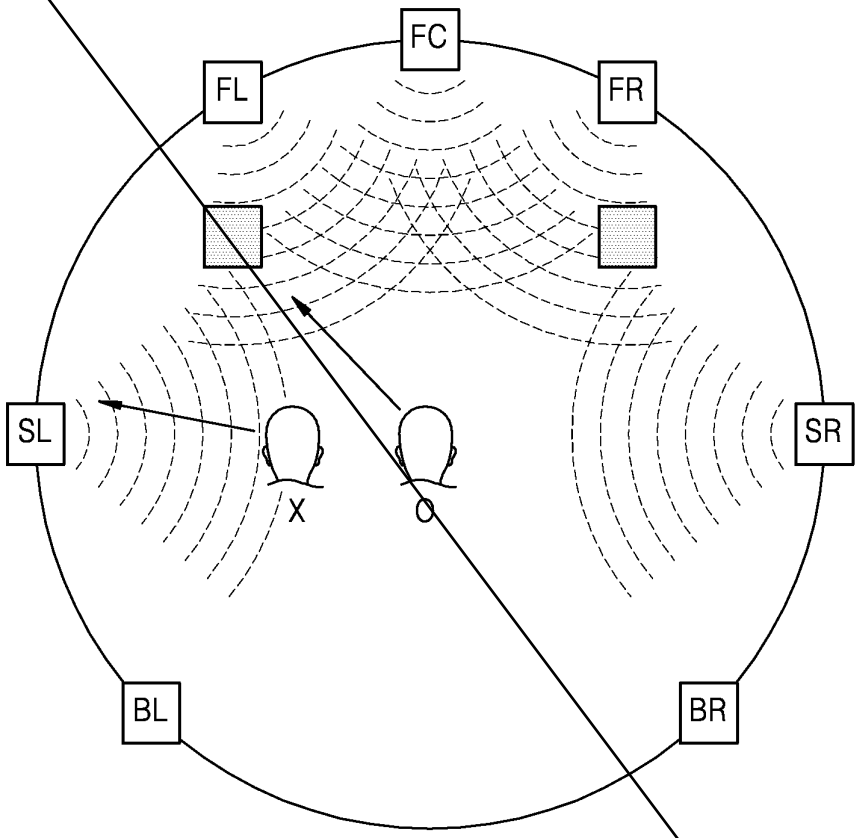


FIG. 2

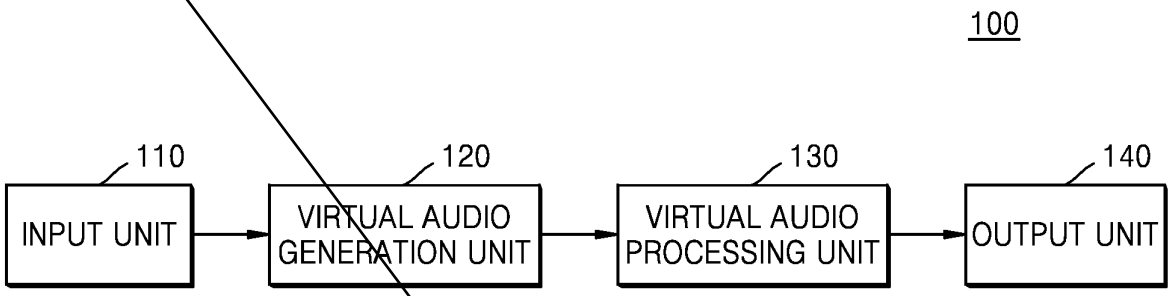

100
110
INPUT UNIT
120
VIRTUAL AUDIO GENERATION UNIT
130
VIRTUAL AUDIO PROCESSING UNIT
140
OUTPUT UNIT

FIG. 3

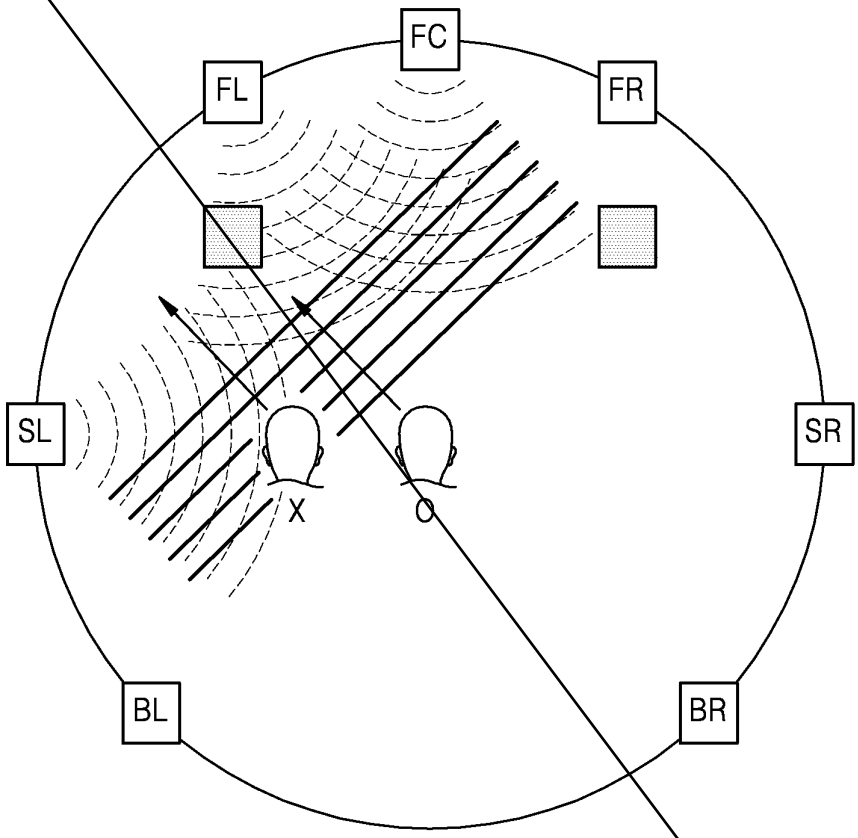


FIG. 4

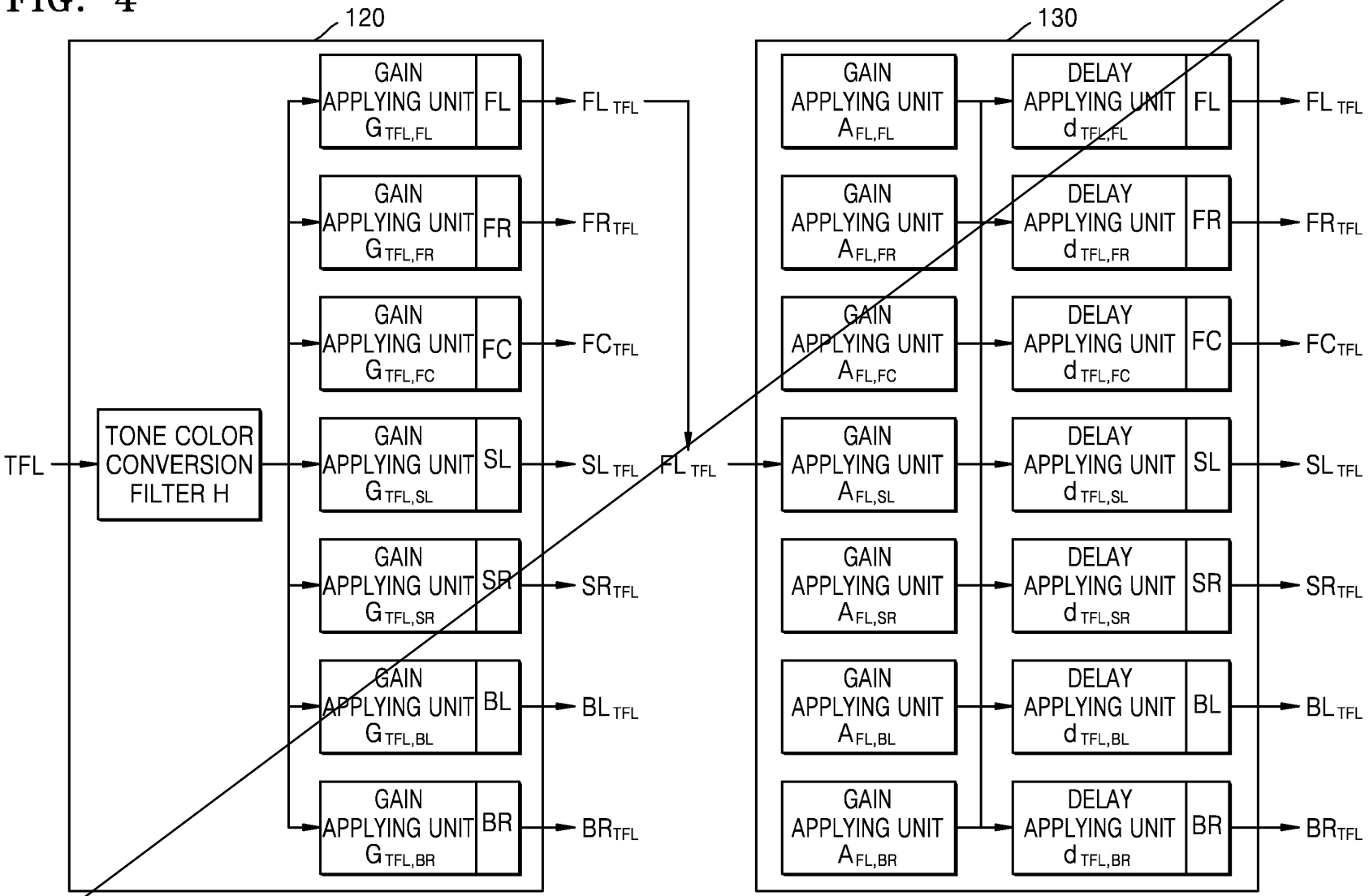

120
130
TFL
TONE COLOR CONVERSION FILTER H
GAIN APPLYING UNIT $G_{TFL,FL}$
GAIN APPLYING UNIT $G_{TFL,FR}$
GAIN APPLYING UNIT $G_{TFL,FC}$
GAIN APPLYING UNIT $G_{TFL,SL}$
GAIN APPLYING UNIT $G_{TFL,SR}$
GAIN APPLYING UNIT $G_{TFL,BL}$
GAIN APPLYING UNIT $G_{TFL,BR}$
FL
FR
FC
SL
SR
BL
BR
FL_{TFL}
FR_{TFL}
FC_{TFL}
SL_{TFL}
SR_{TFL}
BL_{TFL}
BR_{TFL}
GAIN APPLYING UNIT $A_{FL,FL}$
GAIN APPLYING UNIT $A_{FL,FR}$
GAIN APPLYING UNIT $A_{FL,FC}$
GAIN APPLYING UNIT $A_{FL,SL}$
GAIN APPLYING UNIT $A_{FL,SR}$
GAIN APPLYING UNIT $A_{FL,BL}$
GAIN APPLYING UNIT $A_{FL,BR}$
DELAY APPLYING UNIT $d_{TFL,FL}$
DELAY APPLYING UNIT $d_{TFL,FR}$
DELAY APPLYING UNIT $d_{TFL,FC}$
DELAY APPLYING UNIT $d_{TFL,SL}$
DELAY APPLYING UNIT $d_{TFL,SR}$
DELAY APPLYING UNIT $d_{TFL,BL}$
DELAY APPLYING UNIT $d_{TFL,BR}$

FIG. 5

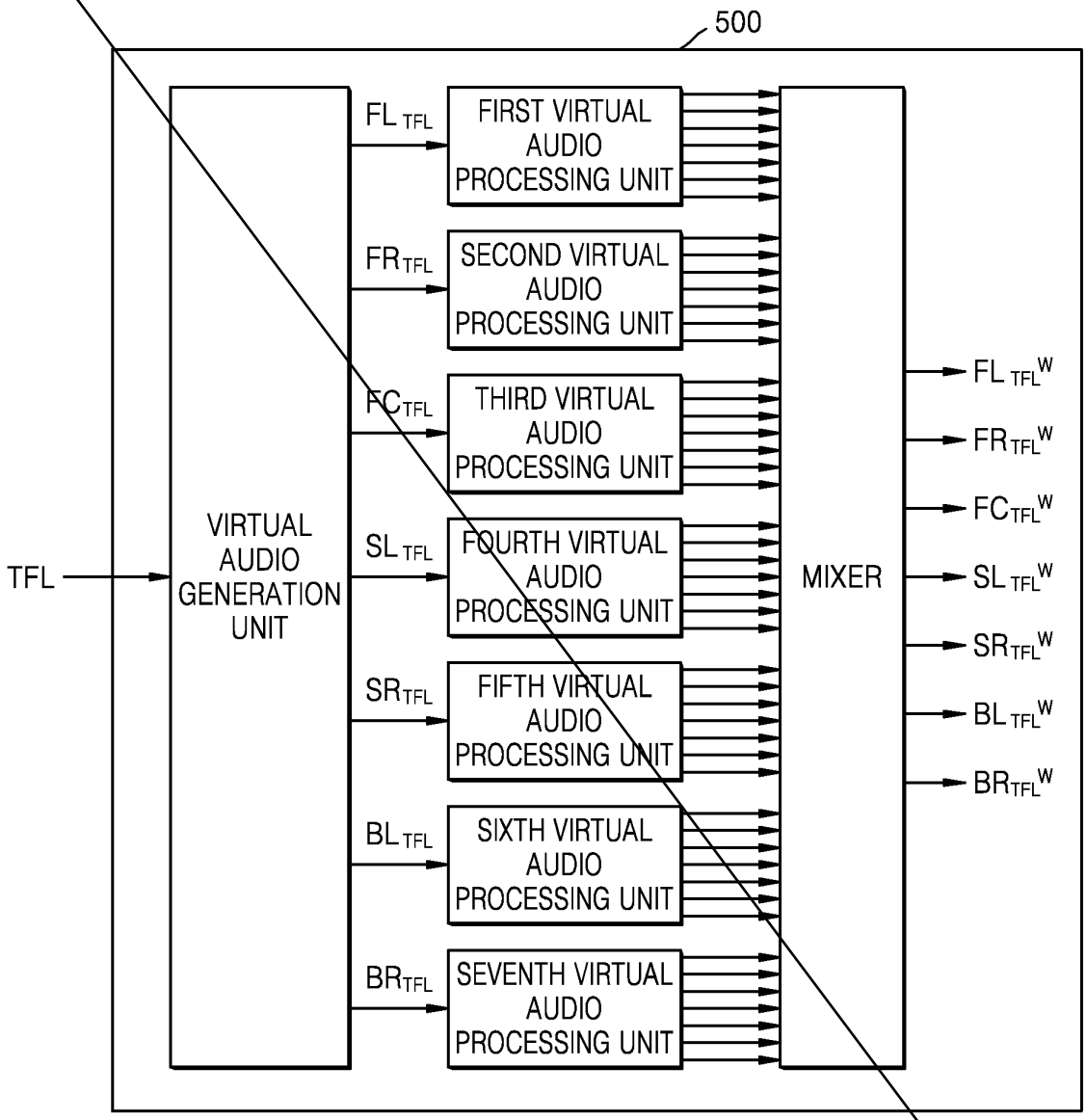

500
TFL
VIRTUAL AUDIO GENERATION UNIT
FL TFL
FR TFL
FC TFL
SL TFL
SR TFL
BL TFL
BR TFL
FIRST VIRTUAL AUDIO PROCESSING UNIT
SECOND VIRTUAL AUDIO PROCESSING UNIT
THIRD VIRTUAL AUDIO PROCESSING UNIT
FOURTH VIRTUAL AUDIO PROCESSING UNIT
FIFTH VIRTUAL AUDIO PROCESSING UNIT
SIXTH VIRTUAL AUDIO PROCESSING UNIT
SEVENTH VIRTUAL AUDIO PROCESSING UNIT
MIXER
FL TFL W
FR TFL W
FC TFL W
SL TFL W
SR TFL W
BL TFL W
BR TFL W

FIG. 6

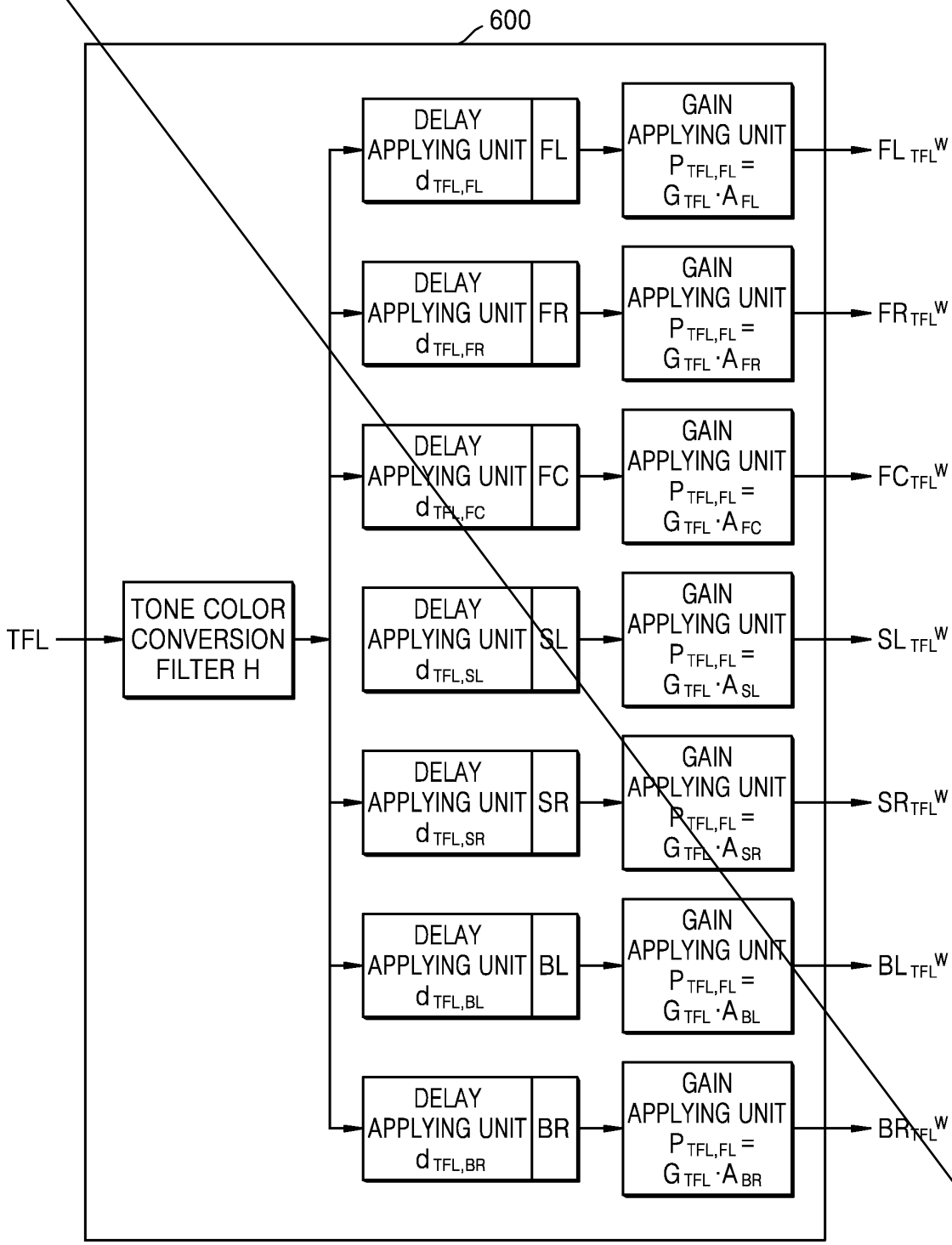

600
TFL
TONE COLOR CONVERSION FILTER H
DELAY APPLYING UNIT FL
$d_{TFL,FL}$
GAIN APPLYING UNIT
$P_{TFL,FL} = G_{TFL} \cdot A_{FL}$
FL_{TFL}^{W}
DELAY APPLYING UNIT FR
$d_{TFL,FR}$
GAIN APPLYING UNIT
$P_{TFL,FL} = G_{TFL} \cdot A_{FR}$
FR_{TFL}^{W}
DELAY APPLYING UNIT FC
$d_{TFL,FC}$
GAIN APPLYING UNIT
$P_{TFL,FL} = G_{TFL} \cdot A_{FC}$
FC_{TFL}^{W}
DELAY APPLYING UNIT SL
$d_{TFL,SL}$
GAIN APPLYING UNIT
$P_{TFL,FL} = G_{TFL} \cdot A_{SL}$
SL_{TFL}^{W}
DELAY APPLYING UNIT SR
$d_{TFL,SR}$
GAIN APPLYING UNIT
$P_{TFL,FL} = G_{TFL} \cdot A_{SR}$
SR_{TFL}^{W}
DELAY APPLYING UNIT BL
$d_{TFL,BL}$
GAIN APPLYING UNIT
$P_{TFL,FL} = G_{TFL} \cdot A_{BL}$
BL_{TFL}^{W}
DELAY APPLYING UNIT BR
$d_{TFL,BR}$
GAIN APPLYING UNIT
$P_{TFL,FL} = G_{TFL} \cdot A_{BR}$
BR_{TFL}^{W}

FIG. 7

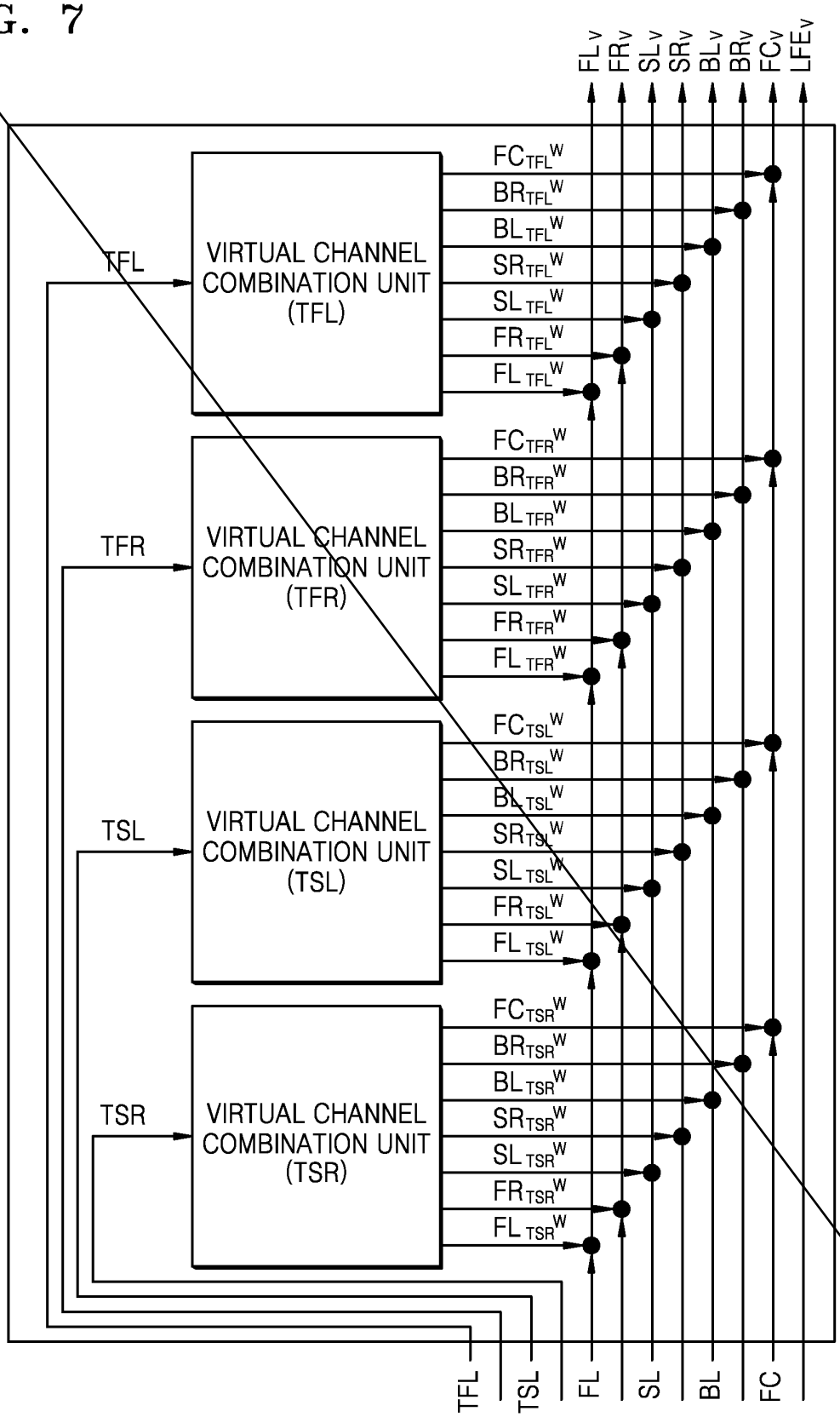

FL v
FR v
SL v
SR v
BL v
BR v
FC v
LFE v
VIRTUAL CHANNEL COMBINATION UNIT (TFL)
VIRTUAL CHANNEL COMBINATION UNIT (TFR)
VIRTUAL CHANNEL COMBINATION UNIT (TSL)
VIRTUAL CHANNEL COMBINATION UNIT (TSR)
TFL
TFR
TSL
TSR
FC TFL W
BR TFL W
BL TFL W
SR TFL W
SL TFL W
FR TFL W
FL TFL W
FC TFR W
BR TFR W
BL TFR W
SR TFR W
SL TFR W
FR TFR W
FL TFR W
FC TSL W
BR TSL W
BL TSL W
SR TSL W
SL TSL W
FR TSL W
FL TSL W
FC TSR W
BR TSR W
BL TSR W
SR TSR W
SL TSR W
FR TSR W
FL TSR W
TFL
TSL
FL
SL
BL
FC

FIG. 8

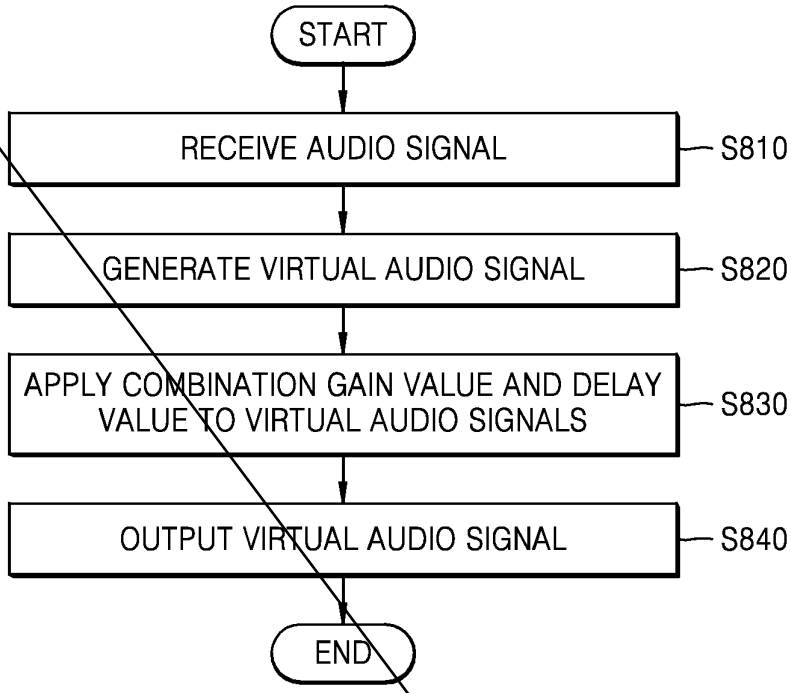

START
RECEIVE AUDIO SIGNAL
S810
GENERATE VIRTUAL AUDIO SIGNAL
S820
APPLY COMBINATION GAIN VALUE AND DELAY VALUE TO VIRTUAL AUDIO SIGNALS
S830
OUTPUT VIRTUAL AUDIO SIGNAL
S840
END

FIG. 9

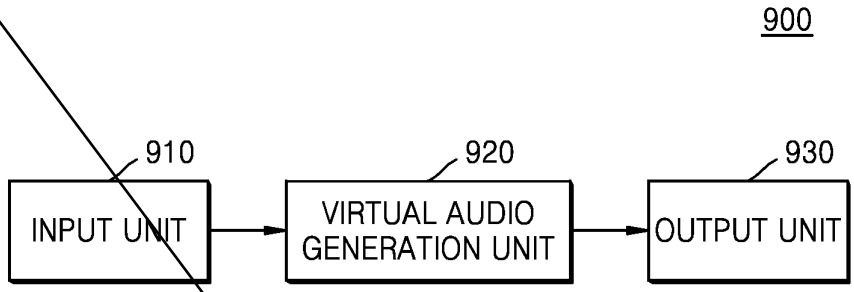

900
910
INPUT UNIT
920
VIRTUAL AUDIO GENERATION UNIT
930
OUTPUT UNIT

FIG. 10

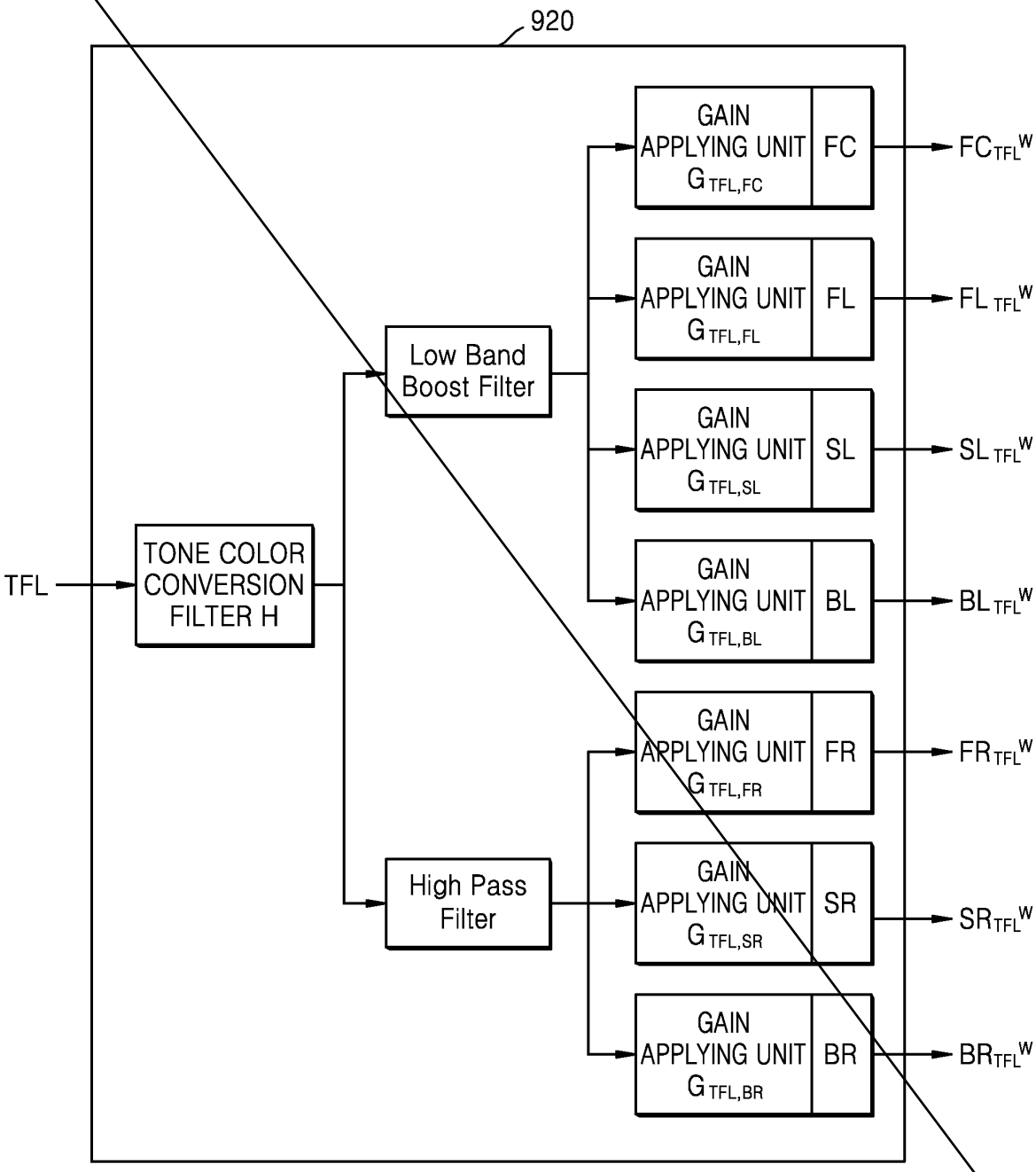

920
TFL
TONE COLOR CONVERSION FILTER H
Low Band Boost Filter
High Pass Filter
GAIN APPLYING UNIT G TFL,FC
FC
FC TFL W
GAIN APPLYING UNIT G TFL,FL
FL
FL TFL W
GAIN APPLYING UNIT G TFL,SL
SL
SL TFL W
GAIN APPLYING UNIT G TFL,BL
BL
BL TFL W
GAIN APPLYING UNIT G TFL,FR
FR
FR TFL W
GAIN APPLYING UNIT G TFL,SR
SR
SR TFL W
GAIN APPLYING UNIT G TFL,BR
BR
BR TFL W

FIG. 11

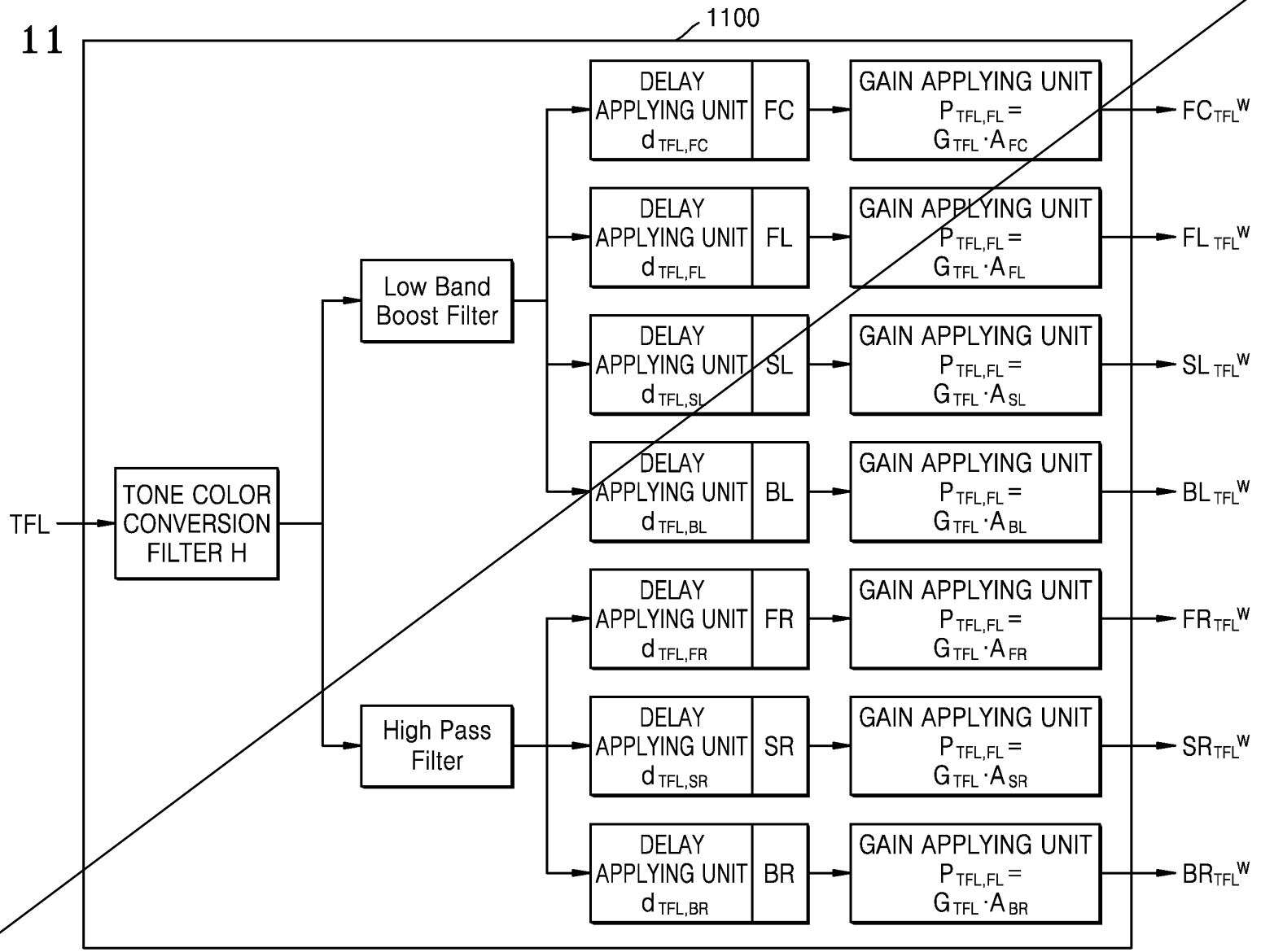

1100
TFL
TONE COLOR CONVERSION FILTER H
Low Band Boost Filter
High Pass Filter
DELAY APPLYING UNIT $d_{TFL,FC}$
FC
GAIN APPLYING UNIT $P_{TFL,FL} = G_{TFL} \cdot A_{FC}$
FC_{TFL}^{W}
DELAY APPLYING UNIT $d_{TFL,FL}$
FL
GAIN APPLYING UNIT $P_{TFL,FL} = G_{TFL} \cdot A_{FL}$
FL_{TFL}^{W}
DELAY APPLYING UNIT $d_{TFL,SL}$
SL
GAIN APPLYING UNIT $P_{TFL,FL} = G_{TFL} \cdot A_{SL}$
SL_{TFL}^{W}
DELAY APPLYING UNIT $d_{TFL,BL}$
BL
GAIN APPLYING UNIT $P_{TFL,FL} = G_{TFL} \cdot A_{BL}$
BL_{TFL}^{W}
DELAY APPLYING UNIT $d_{TFL,FR}$
FR
GAIN APPLYING UNIT $P_{TFL,FL} = G_{TFL} \cdot A_{FR}$
FR_{TFL}^{W}
DELAY APPLYING UNIT $d_{TFL,SR}$
SR
GAIN APPLYING UNIT $P_{TFL,FL} = G_{TFL} \cdot A_{SR}$
SR_{TFL}^{W}
DELAY APPLYING UNIT $d_{TFL,BR}$
BR
GAIN APPLYING UNIT $P_{TFL,FL} = G_{TFL} \cdot A_{BR}$
BR_{TFL}^{W}

FIG. 12

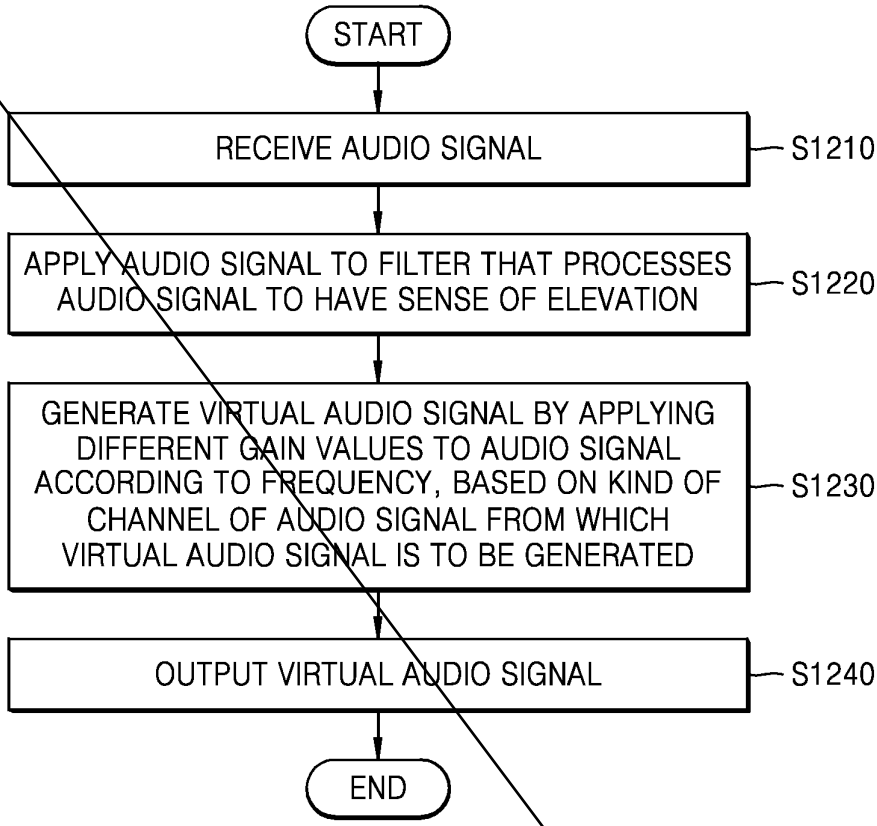

START
RECEIVE AUDIO SIGNAL
S1210
APPLY AUDIO SIGNAL TO FILTER THAT PROCESSES AUDIO SIGNAL TO HAVE SENSE OF ELEVATION
S1220
GENERATE VIRTUAL AUDIO SIGNAL BY APPLYING DIFFERENT GAIN VALUES TO AUDIO SIGNAL ACCORDING TO FREQUENCY, BASED ON KIND OF CHANNEL OF AUDIO SIGNAL FROM WHICH VIRTUAL AUDIO SIGNAL IS TO BE GENERATED
S1230
OUTPUT VIRTUAL AUDIO SIGNAL
S1240
END

FIG. 13

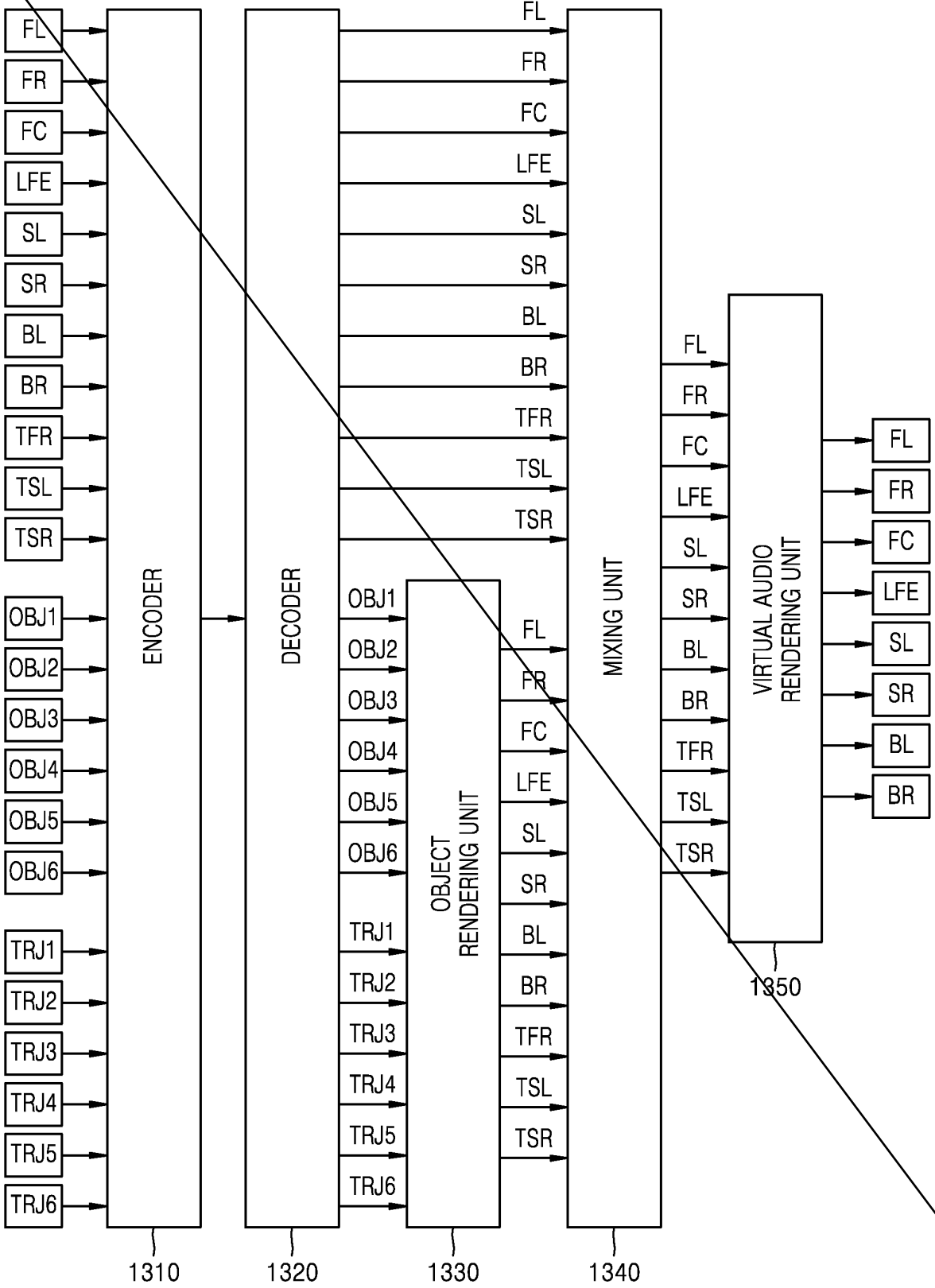

FL
FR
FC
LFE
SL
SR
BL
BR
TFR
TSL
TSR
OBJ1
OBJ2
OBJ3
OBJ4
OBJ5
OBJ6
TRJ1
TRJ2
TRJ3
TRJ4
TRJ5
TRJ6
ENCODER
DECODER
OBJECT RENDERING UNIT
MIXING UNIT
VIRTUAL AUDIO RENDERING UNIT
1310
1320
1330
1340
1350

FIG. 14

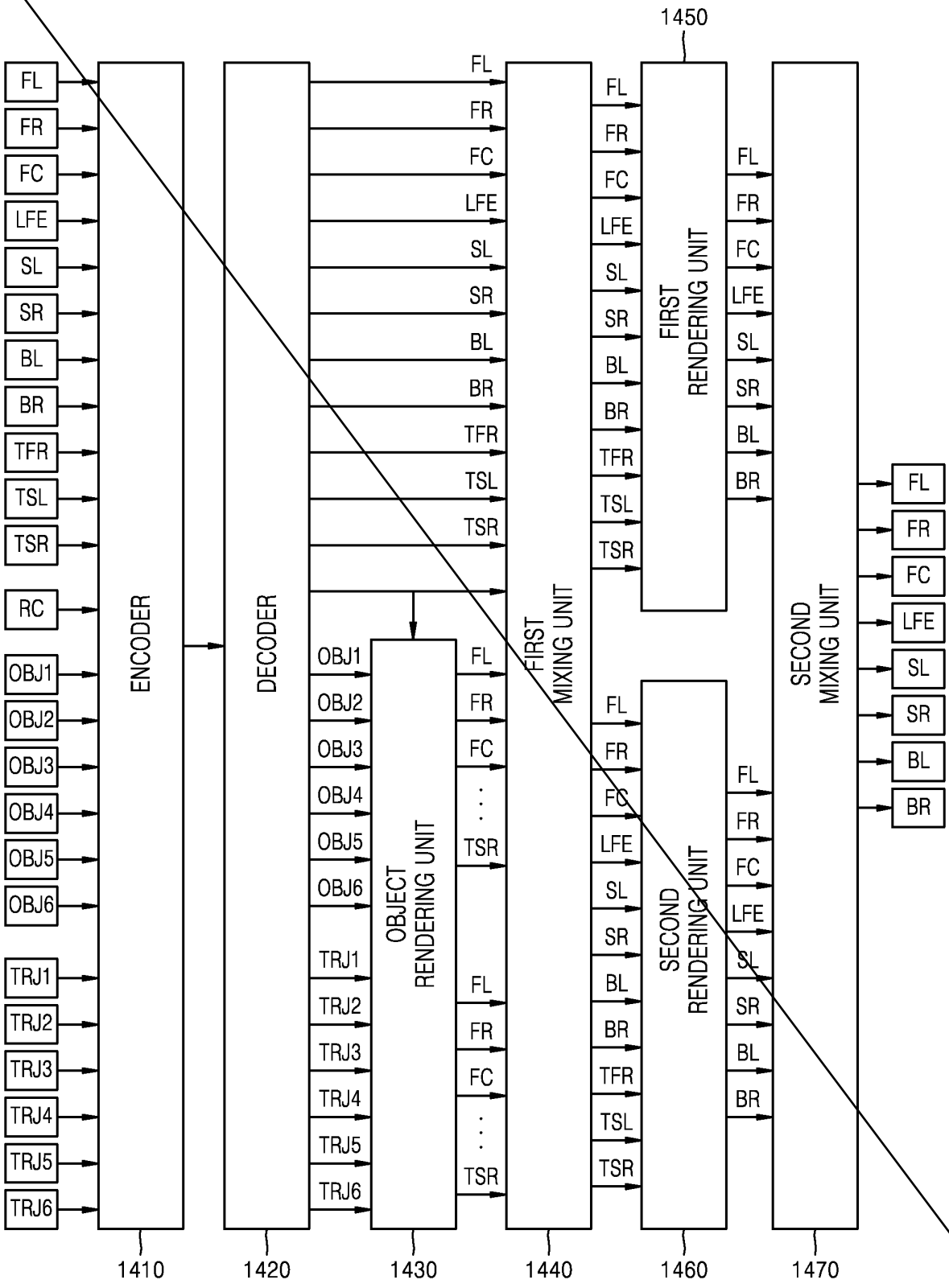

1450
FL
FR
FC
LFE
SL
SR
BL
BR
TFR
TSL
TSR
RC
OBJ1
OBJ2
OBJ3
OBJ4
OBJ5
OBJ6
TRJ1
TRJ2
TRJ3
TRJ4
TRJ5
TRJ6
ENCODER
DECODER
OBJECT RENDERING UNIT
FIRST MIXING UNIT
FIRST RENDERING UNIT
SECOND RENDERING UNIT
SECOND MIXING UNIT
1410
1420
1430
1440
1460
1470

FIG. 15

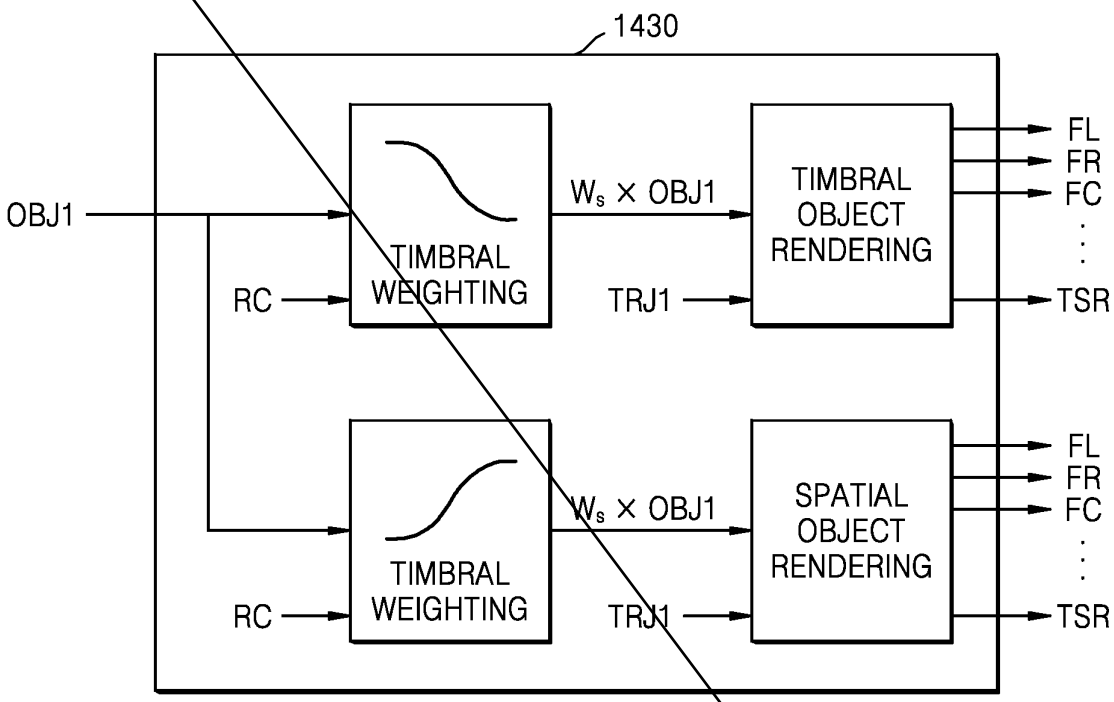

1430
OBJ1
RC
TIMBRAL WEIGHTING
$W_s \times OBJ1$
TRJ1
TIMBRAL OBJECT RENDERING
FL
FR
FC
TSR
RC
TIMBRAL WEIGHTING
$W_s \times OBJ1$
TRJ1
SPATIAL OBJECT RENDERING
FL
FR
FC
TSR

FIG. 16

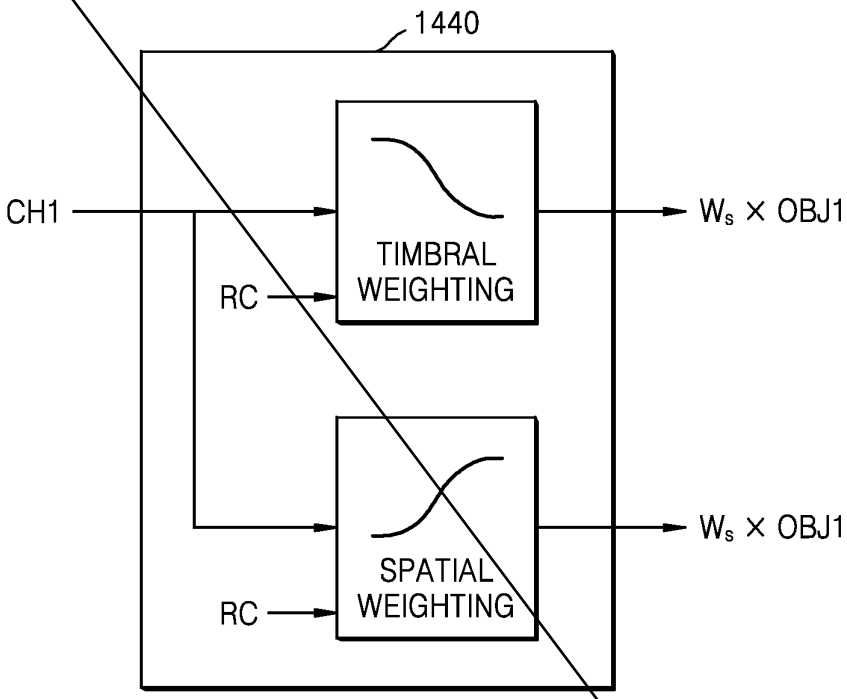

1440
CH1
RC
TIMBRAL WEIGHTING
$W_s \times OBJ1$
RC
SPATIAL WEIGHTING
$W_s \times OBJ1$

FIG. 17

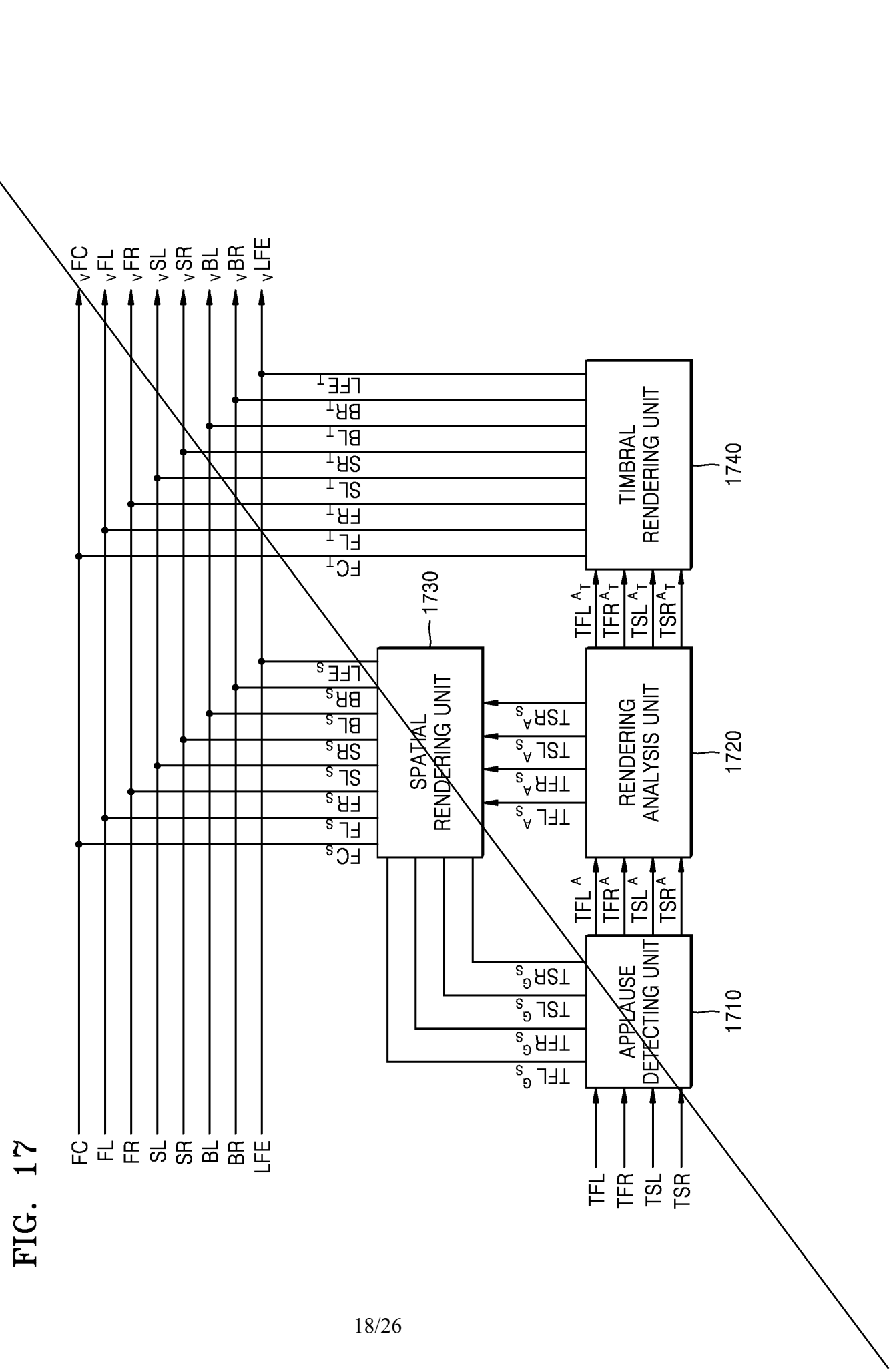

FC
FL
FR
SL
SR
BL
BR
LFE
TFL
TFR
TSL
TSR
APPLAUSE DETECTING UNIT
1710
RENDERING ANALYSIS UNIT
1720
SPATIAL RENDERING UNIT
1730
TIMBRAL RENDERING UNIT
1740

FIG. 18

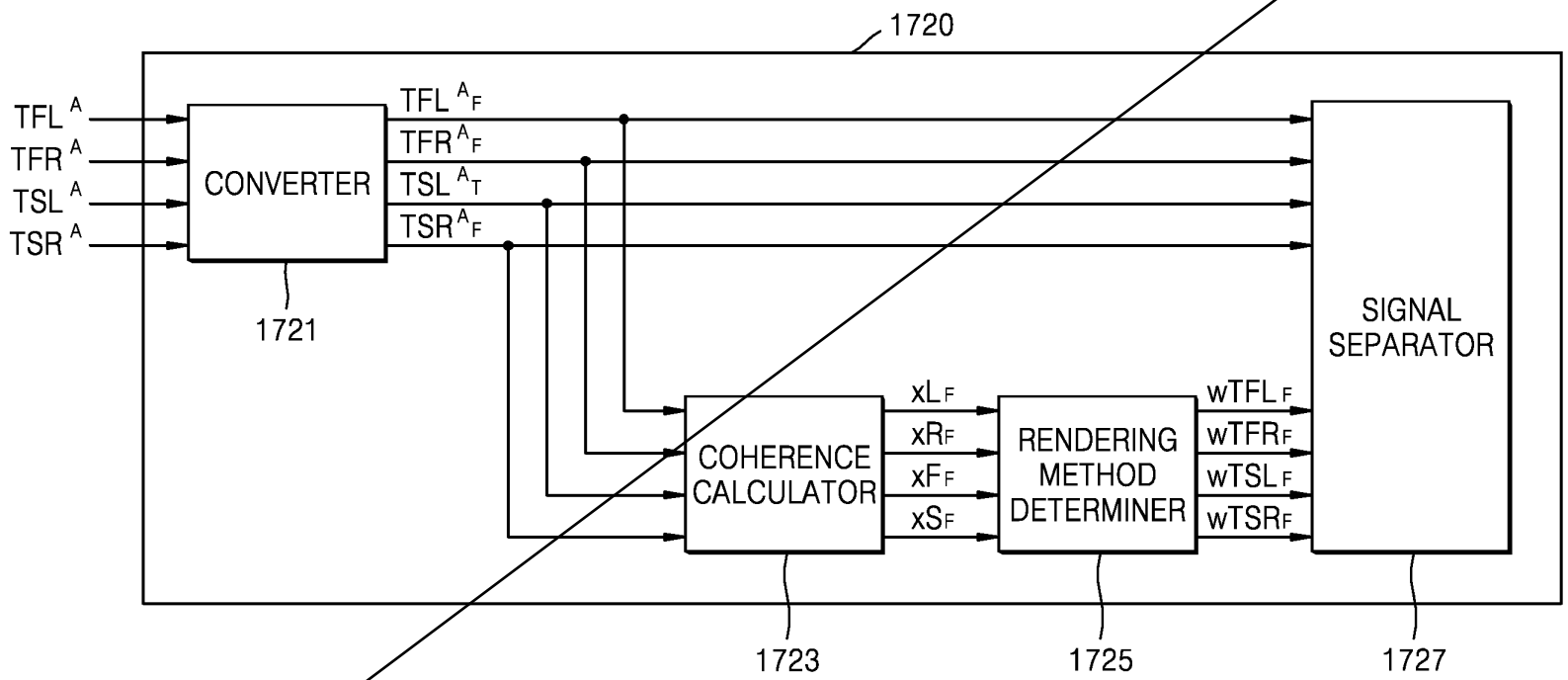

1720
TFL A
TFR A
TSL A
TSR A
CONVERTER
1721
TFL AF
TFR AF
TSL AT
TSR AF
COHERENCE CALCULATOR
1723
xLF
xRF
xFF
xSF
RENDERING METHOD DETERMINER
1725
wTFLF
wTFRF
wTSLF
wTSRF
SIGNAL SEPARATOR
1727

FIG. 19

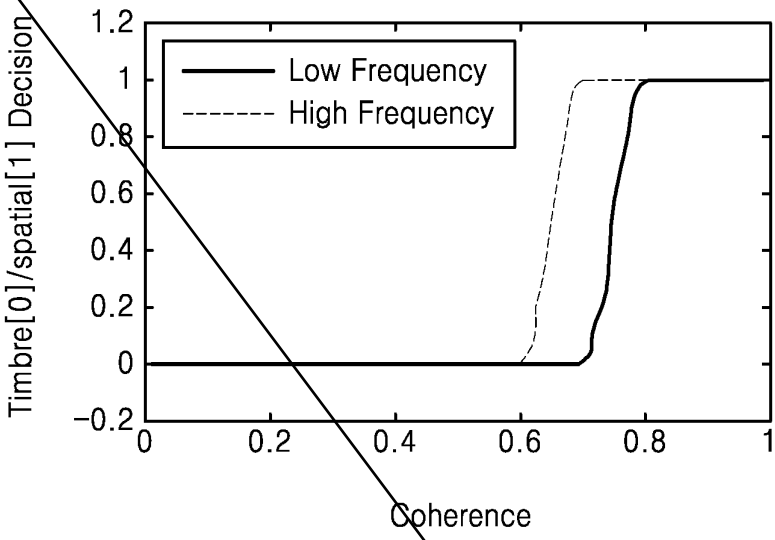

Timbre[0]/spatial[1] Decision
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
0
0.2
0.4
0.6
0.8
1
Low Frequency
High Frequency
Coherence

FIG. 20

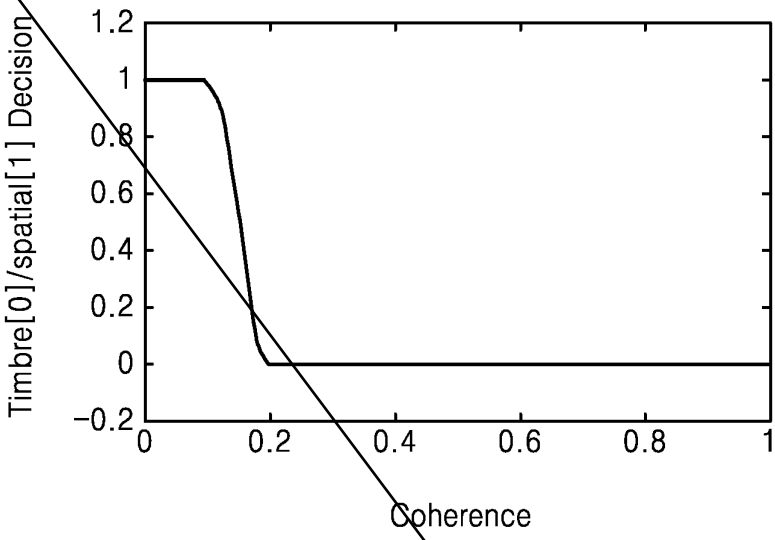

Timbre[0]/spatial[1] Decision
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
0
0.2
0.4
0.6
0.8
1
Coherence

FIG. 21

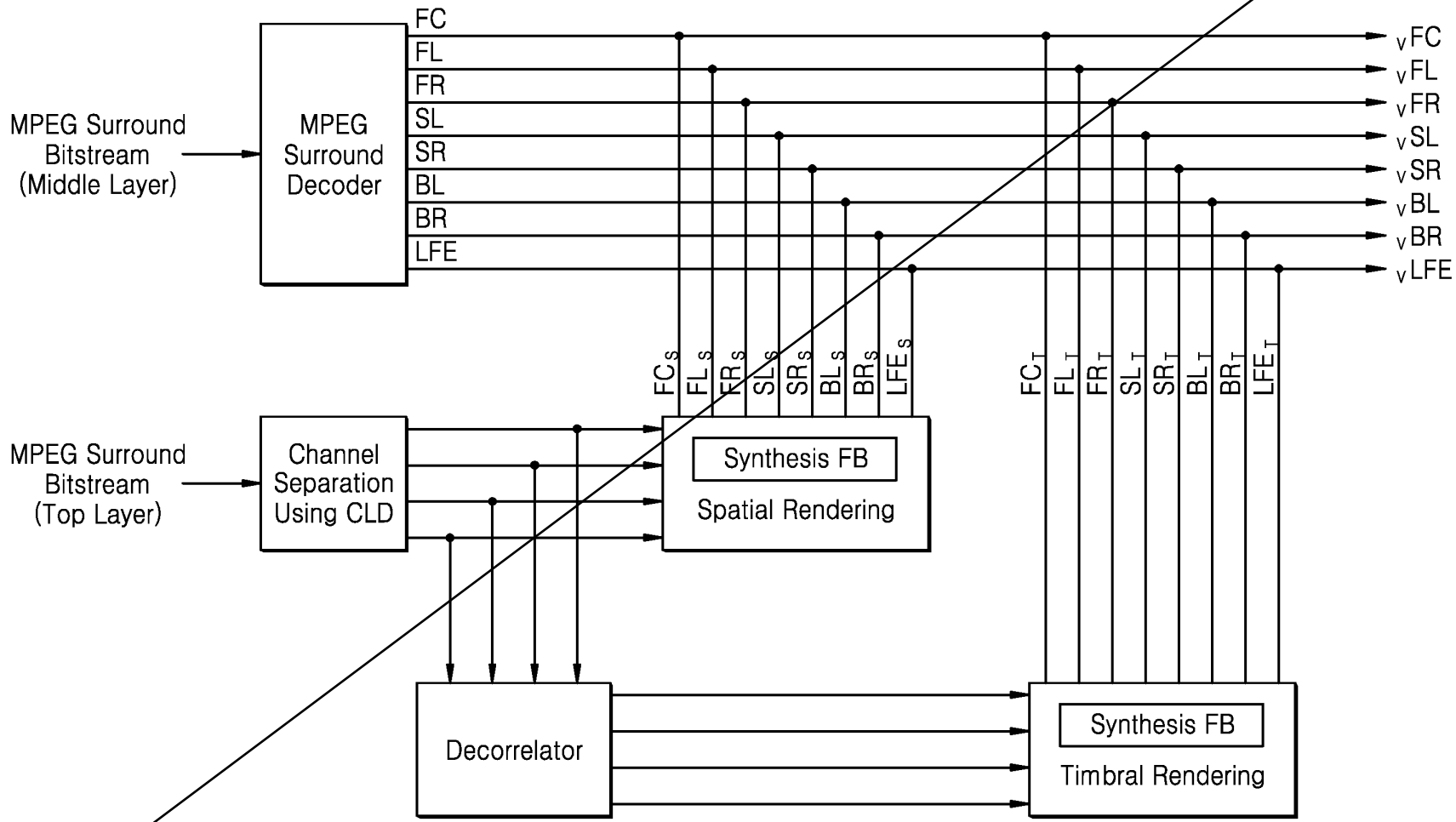

MPEG Surround Bitstream (Middle Layer)
MPEG Surround Decoder
FC
FL
FR
SL
SR
BL
BR
LFE
vFC
vFL
vFR
vSL
vSR
vBL
vBR
vLFE
MPEG Surround Bitstream (Top Layer)
Channel Separation Using CLD
Synthesis FB
Spatial Rendering
Decorrelator
Synthesis FB
Timbral Rendering

FIG. 22

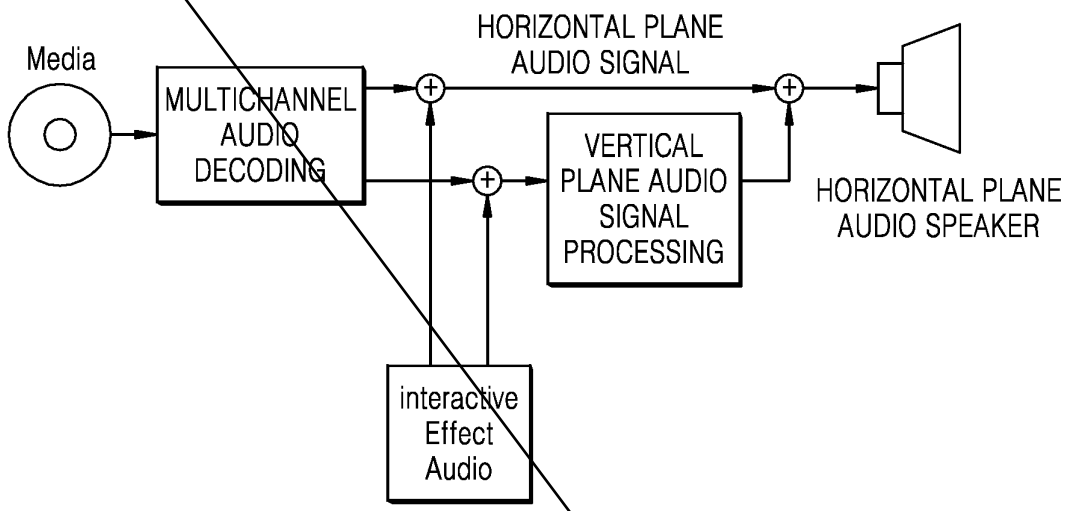

Media
MULTICHANNEL AUDIO DECODING
HORIZONTAL PLANE AUDIO SIGNAL
VERTICAL PLANE AUDIO SIGNAL PROCESSING
HORIZONTAL PLANE AUDIO SPEAKER
interactive Effect Audio

FIG. 23

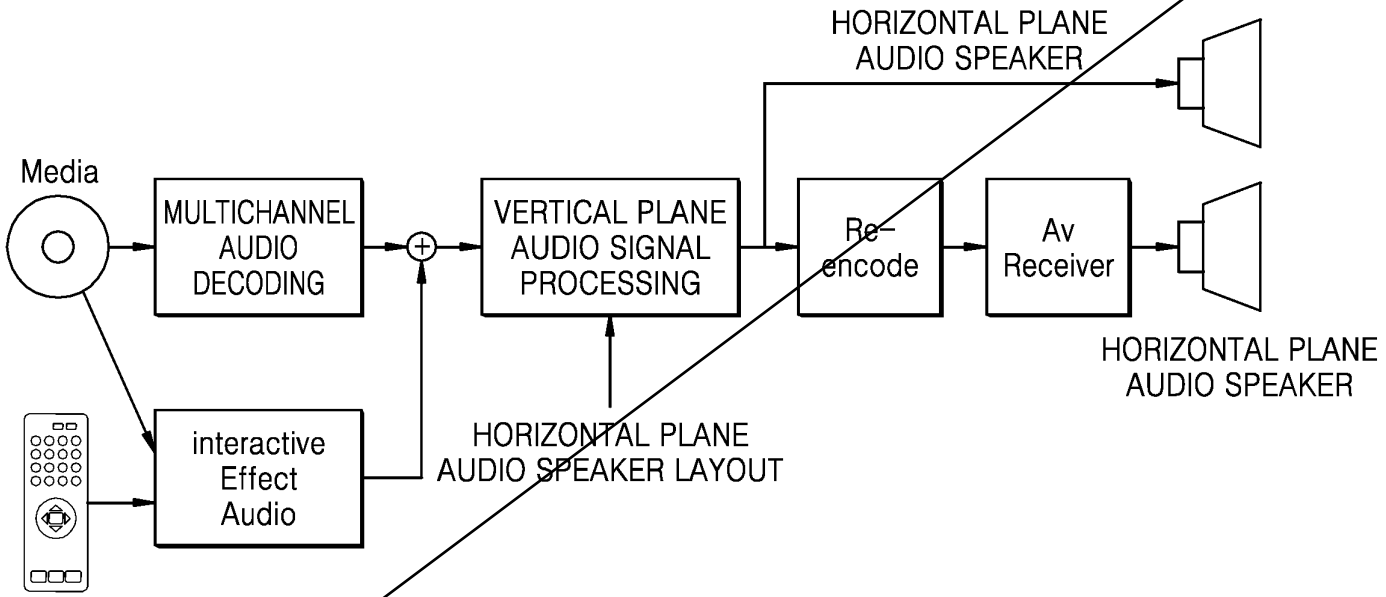

HORIZONTAL PLANE
AUDIO SPEAKER
Media
MULTICHANNEL
AUDIO
DECODING
VERTICAL PLANE
AUDIO SIGNAL
PROCESSING
Re-
encode
Av
Receiver
HORIZONTAL PLANE
AUDIO SPEAKER
interactive
Effect
Audio
HORIZONTAL PLANE
AUDIO SPEAKER LAYOUT

FIG. 24

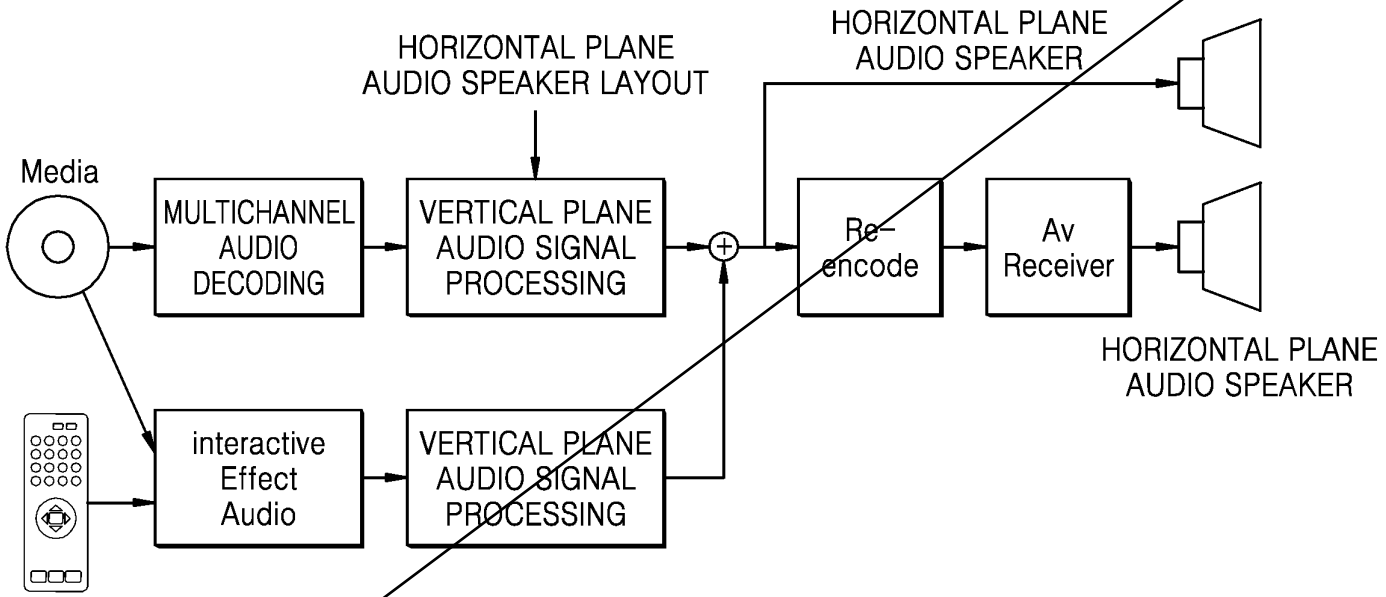

HORIZONTAL PLANE
AUDIO SPEAKER LAYOUT
HORIZONTAL PLANE
AUDIO SPEAKER
Media
MULTICHANNEL
AUDIO
DECODING
VERTICAL PLANE
AUDIO SIGNAL
PROCESSING
Re-
encode
Av
Receiver
interactive
Effect
Audio
VERTICAL PLANE
AUDIO SIGNAL
PROCESSING
HORIZONTAL PLANE
AUDIO SPEAKER

FIG. 25

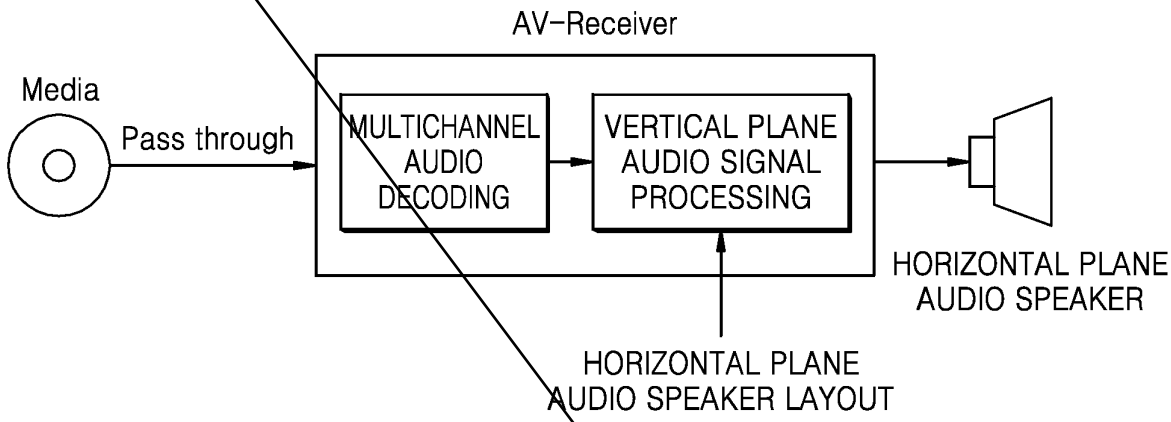

AV-Receiver
Media
Pass through
MULTICHANNEL AUDIO DECODING
VERTICAL PLANE AUDIO SIGNAL PROCESSING
HORIZONTAL PLANE AUDIO SPEAKER
HORIZONTAL PLANE AUDIO SPEAKER LAYOUT

FIG. 1A

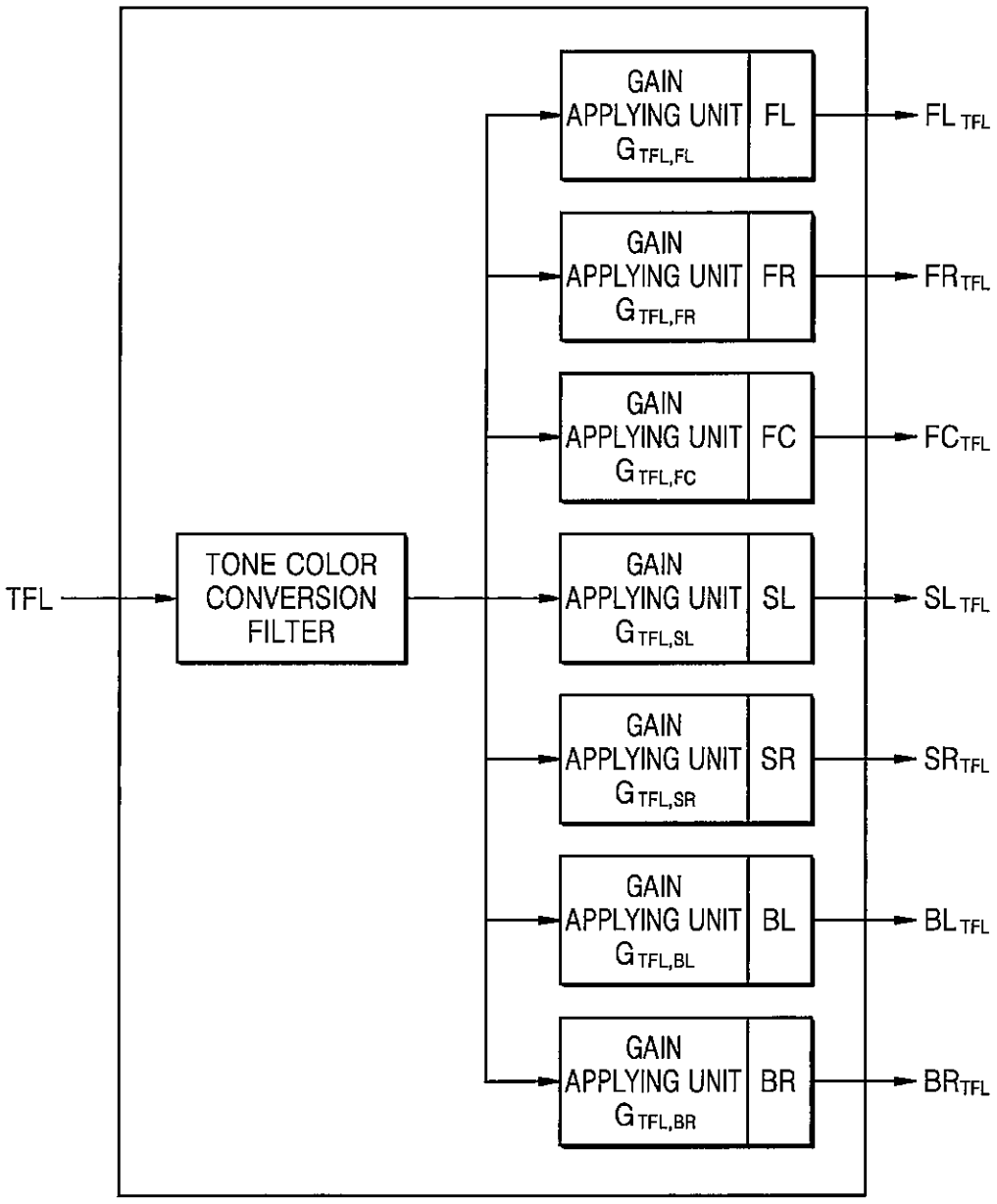

TFL
TONE COLOR CONVERSION FILTER
GAIN APPLYING UNIT $G_{TFL,FL}$
FL
FL_{TFL}
GAIN APPLYING UNIT $G_{TFL,FR}$
FR
FR_{TFL}
GAIN APPLYING UNIT $G_{TFL,FC}$
FC
FC_{TFL}
GAIN APPLYING UNIT $G_{TFL,SL}$
SL
SL_{TFL}
GAIN APPLYING UNIT $G_{TFL,SR}$
SR
SR_{TFL}
GAIN APPLYING UNIT $G_{TFL,BL}$
BL
BL_{TFL}
GAIN APPLYING UNIT $G_{TFL,BR}$
BR
BR_{TFL}

FIG. 1B

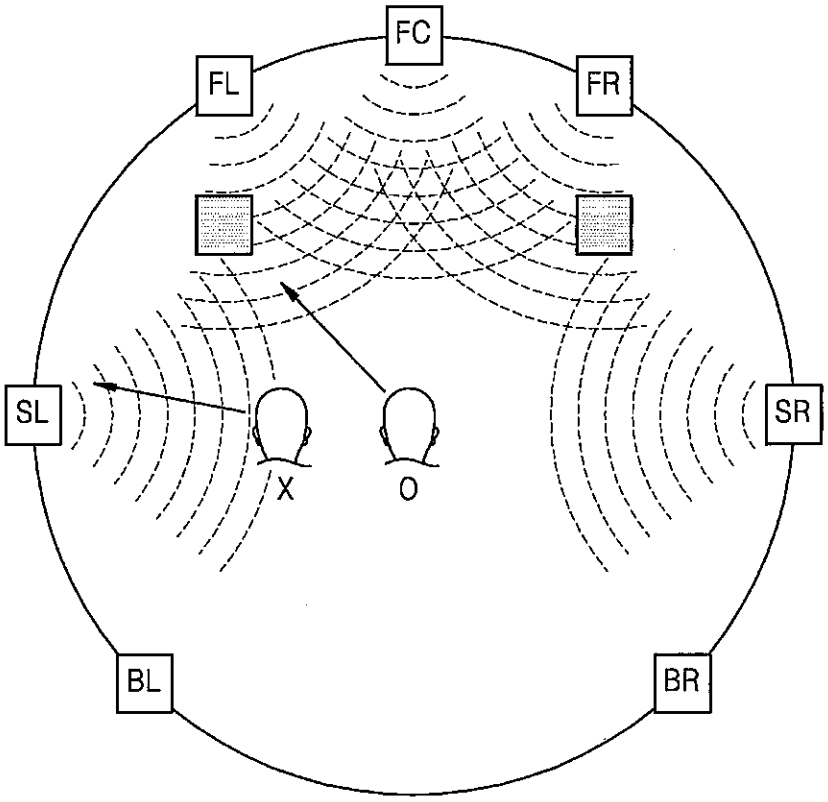


FIG. 2

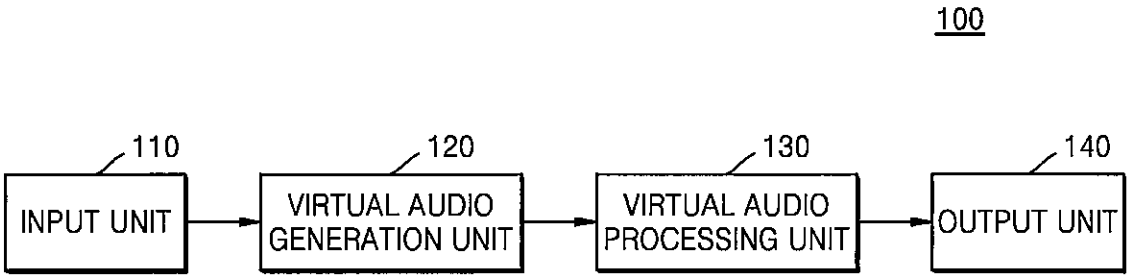

100
110
INPUT UNIT
120
VIRTUAL AUDIO GENERATION UNIT
130
VIRTUAL AUDIO PROCESSING UNIT
140
OUTPUT UNIT

FIG. 3

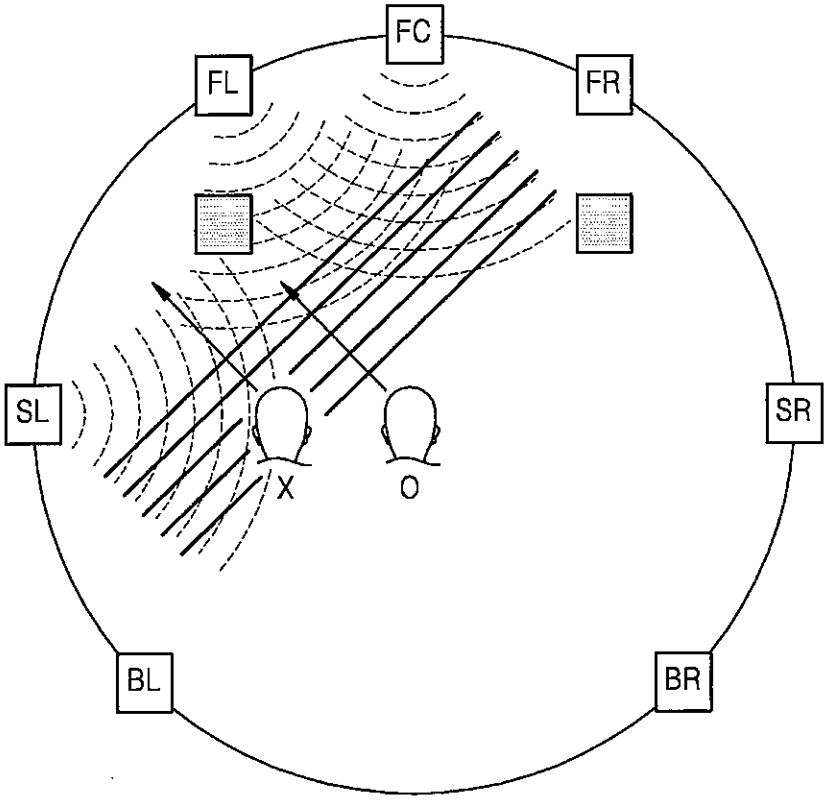


FIG. 4

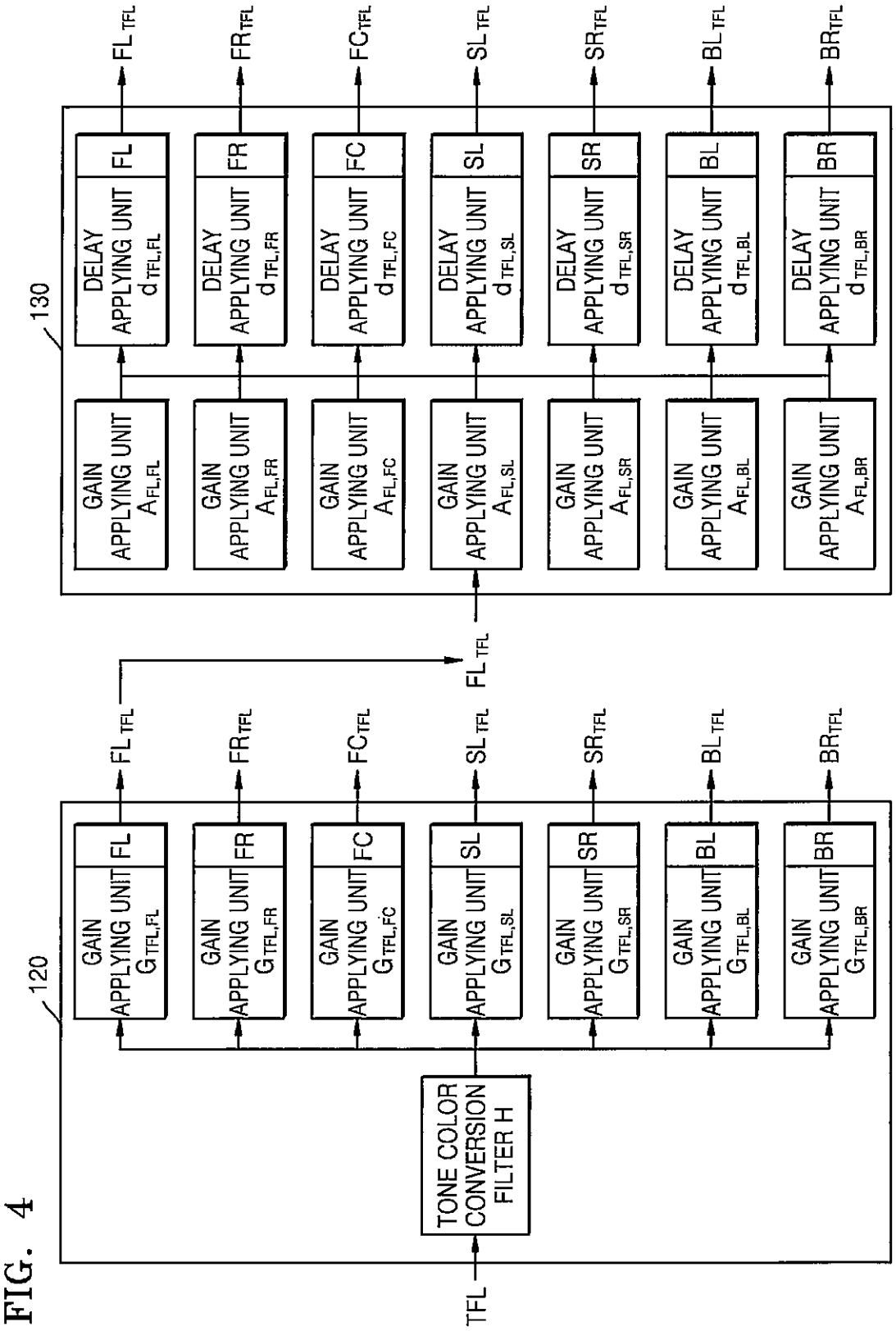

TFL
TONE COLOR CONVERSION FILTER H
120
GAIN APPLYING UNIT $G_{TFL,FL}$
GAIN APPLYING UNIT $G_{TFL,FR}$
GAIN APPLYING UNIT $G_{TFL,FC}$
GAIN APPLYING UNIT $G_{TFL,SL}$
GAIN APPLYING UNIT $G_{TFL,SR}$
GAIN APPLYING UNIT $G_{TFL,BL}$
GAIN APPLYING UNIT $G_{TFL,BR}$
FL
FR
FC
SL
SR
BL
BR
FL_{TFL}
FR_{TFL}
FC_{TFL}
SL_{TFL}
SR_{TFL}
BL_{TFL}
BR_{TFL}
130
GAIN APPLYING UNIT $A_{FL,FL}$
GAIN APPLYING UNIT $A_{FL,FR}$
GAIN APPLYING UNIT $A_{FL,FC}$
GAIN APPLYING UNIT $A_{FL,SL}$
GAIN APPLYING UNIT $A_{FL,SR}$
GAIN APPLYING UNIT $A_{FL,BL}$
GAIN APPLYING UNIT $A_{FL,BR}$
DELAY APPLYING UNIT $d_{TFL,FL}$
DELAY APPLYING UNIT $d_{TFL,FR}$
DELAY APPLYING UNIT $d_{TFL,FC}$
DELAY APPLYING UNIT $d_{TFL,SL}$
DELAY APPLYING UNIT $d_{TFL,SR}$
DELAY APPLYING UNIT $d_{TFL,BL}$
DELAY APPLYING UNIT $d_{TFL,BR}$
FL
FR
FC
SL
SR
BL
BR
FL_{TFL}
FR_{TFL}
FC_{TFL}
SL_{TFL}
SR_{TFL}
BL_{TFL}
BR_{TFL}

FIG. 5

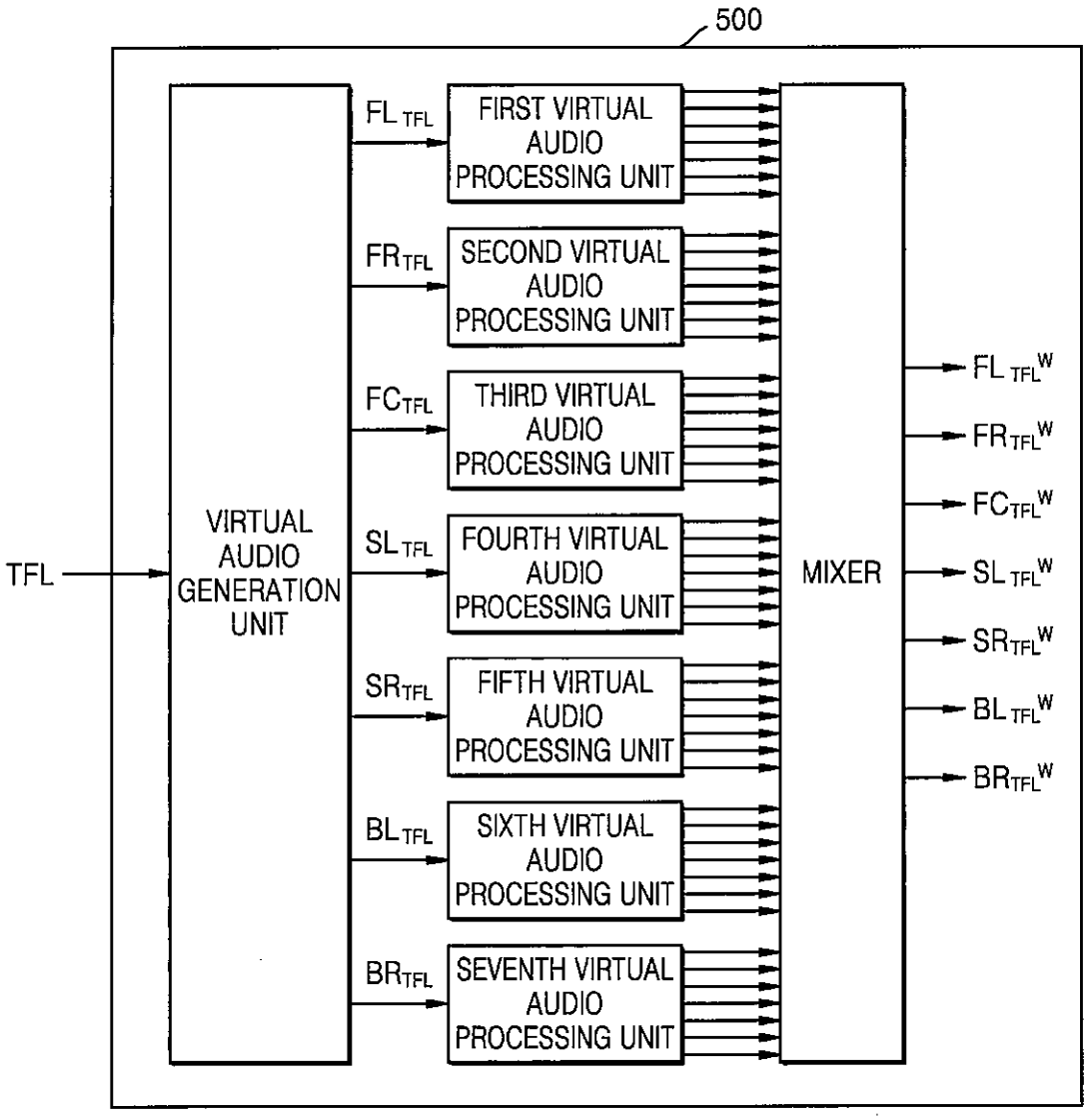

500
TFL
VIRTUAL AUDIO GENERATION UNIT
FL TFL
FR TFL
FC TFL
SL TFL
SR TFL
BL TFL
BR TFL
FIRST VIRTUAL AUDIO PROCESSING UNIT
SECOND VIRTUAL AUDIO PROCESSING UNIT
THIRD VIRTUAL AUDIO PROCESSING UNIT
FOURTH VIRTUAL AUDIO PROCESSING UNIT
FIFTH VIRTUAL AUDIO PROCESSING UNIT
SIXTH VIRTUAL AUDIO PROCESSING UNIT
SEVENTH VIRTUAL AUDIO PROCESSING UNIT
MIXER
FL TFL W
FR TFL W
FC TFL W
SL TFL W
SR TFL W
BL TFL W
BR TFL W

FIG. 6

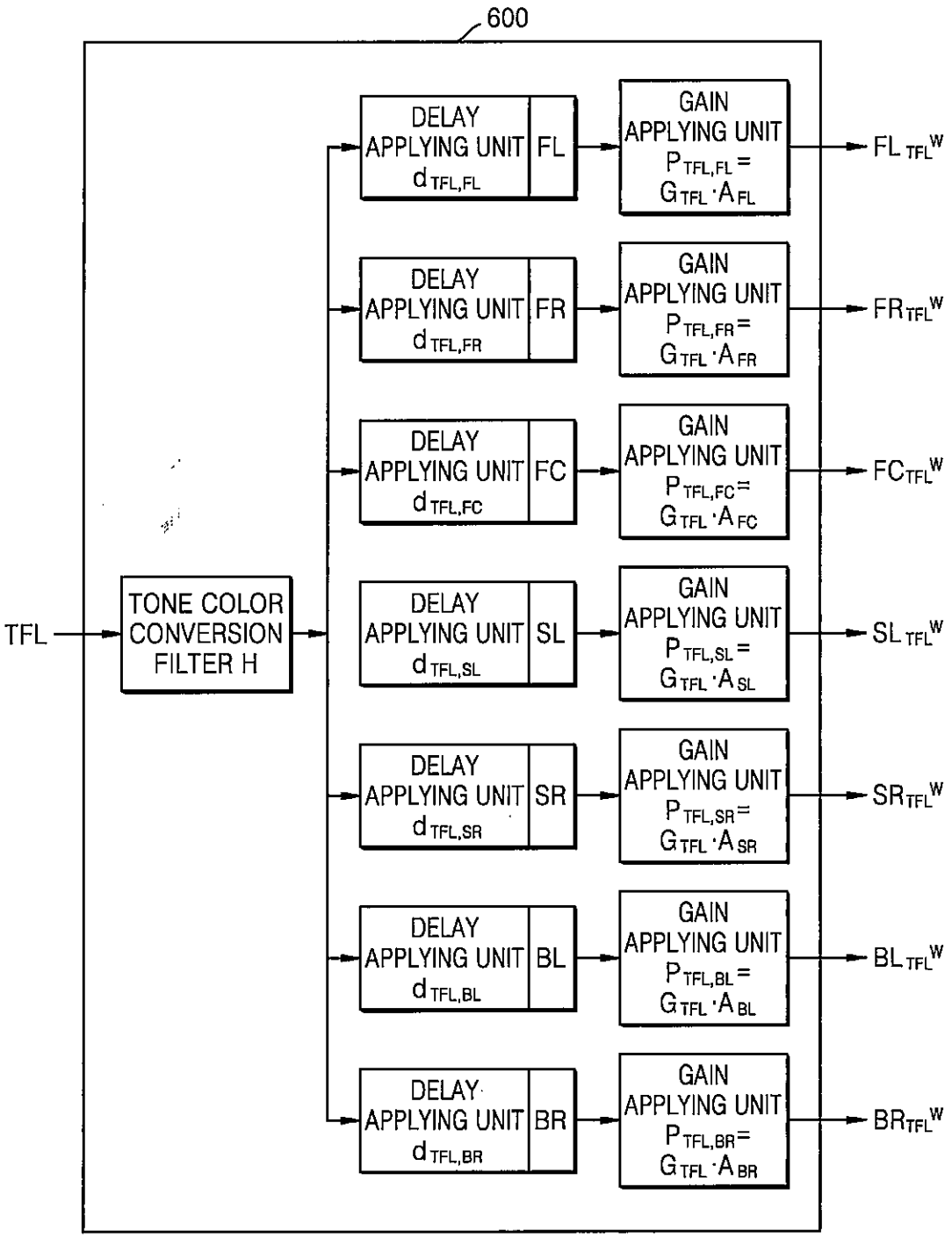

600
TFL
TONE COLOR CONVERSION FILTER H
DELAY APPLYING UNIT FL
$d_{TFL,FL}$
GAIN APPLYING UNIT
$P_{TFL,FL} = G_{TFL} \cdot A_{FL}$
FL_{TFL}^{W}
DELAY APPLYING UNIT FR
$d_{TFL,FR}$
GAIN APPLYING UNIT
$P_{TFL,FR} = G_{TFL} \cdot A_{FR}$
FR_{TFL}^{W}
DELAY APPLYING UNIT FC
$d_{TFL,FC}$
GAIN APPLYING UNIT
$P_{TFL,FC} = G_{TFL} \cdot A_{FC}$
FC_{TFL}^{W}
DELAY APPLYING UNIT SL
$d_{TFL,SL}$
GAIN APPLYING UNIT
$P_{TFL,SL} = G_{TFL} \cdot A_{SL}$
SL_{TFL}^{W}
DELAY APPLYING UNIT SR
$d_{TFL,SR}$
GAIN APPLYING UNIT
$P_{TFL,SR} = G_{TFL} \cdot A_{SR}$
SR_{TFL}^{W}
DELAY APPLYING UNIT BL
$d_{TFL,BL}$
GAIN APPLYING UNIT
$P_{TFL,BL} = G_{TFL} \cdot A_{BL}$
BL_{TFL}^{W}
DELAY APPLYING UNIT BR
$d_{TFL,BR}$
GAIN APPLYING UNIT
$P_{TFL,BR} = G_{TFL} \cdot A_{BR}$
BR_{TFL}^{W}

FIG. 7

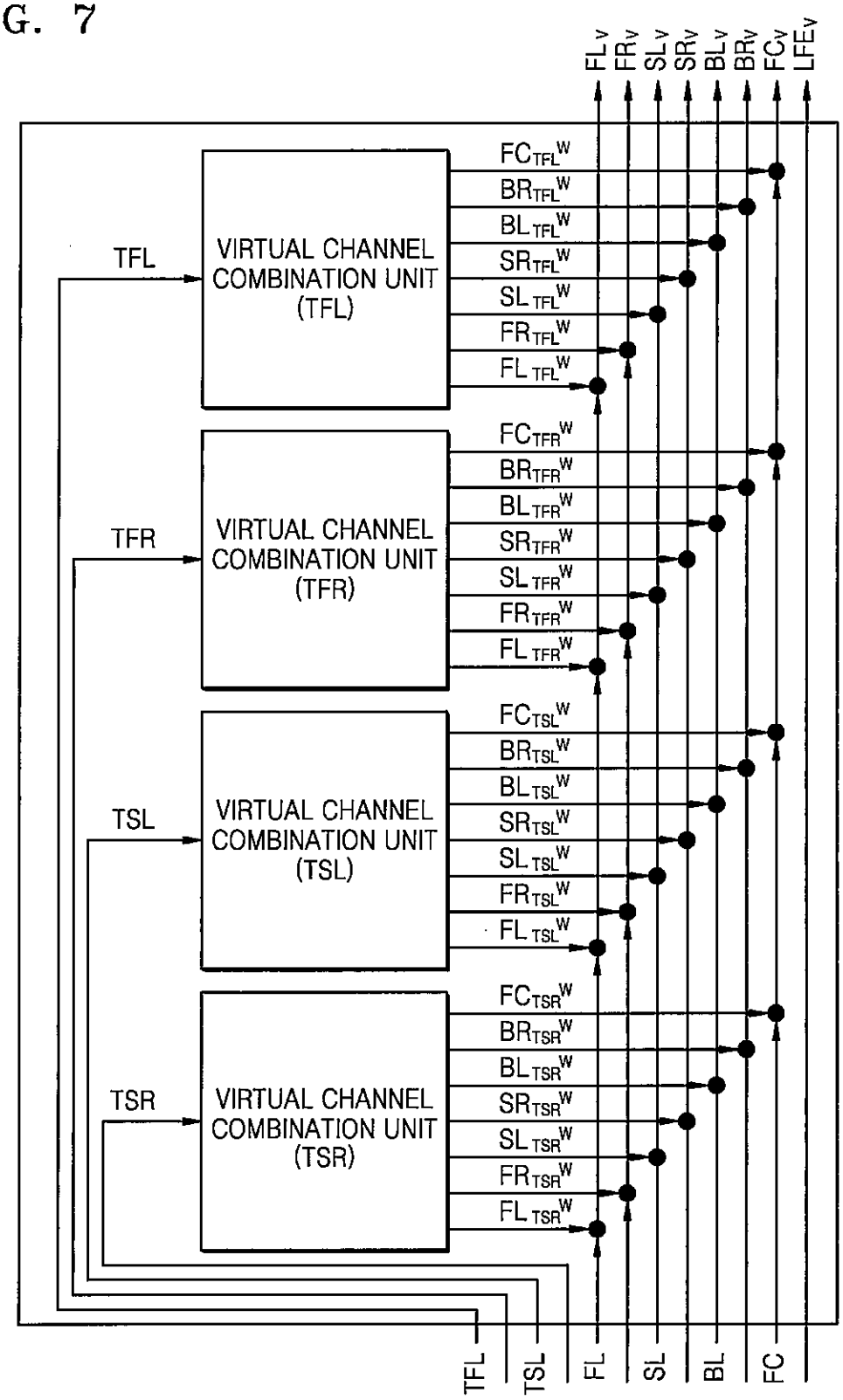

FLv
FRv
SLv
SRv
BLv
BRv
FCv
LFEv
VIRTUAL CHANNEL COMBINATION UNIT (TFL)
VIRTUAL CHANNEL COMBINATION UNIT (TFR)
VIRTUAL CHANNEL COMBINATION UNIT (TSL)
VIRTUAL CHANNEL COMBINATION UNIT (TSR)
TFL
TFR
TSL
TSR
FC_TFL^W
BR_TFL^W
BL_TFL^W
SR_TFL^W
SL_TFL^W
FR_TFL^W
FL_TFL^W
FC_TFR^W
BR_TFR^W
BL_TFR^W
SR_TFR^W
SL_TFR^W
FR_TFR^W
FL_TFR^W
FC_TSL^W
BR_TSL^W
BL_TSL^W
SR_TSL^W
SL_TSL^W
FR_TSL^W
FL_TSL^W
FC_TSR^W
BR_TSR^W
BL_TSR^W
SR_TSR^W
SL_TSR^W
FR_TSR^W
FL_TSR^W
TFL
TSL
FL
SL
BL
FC

FIG. 8

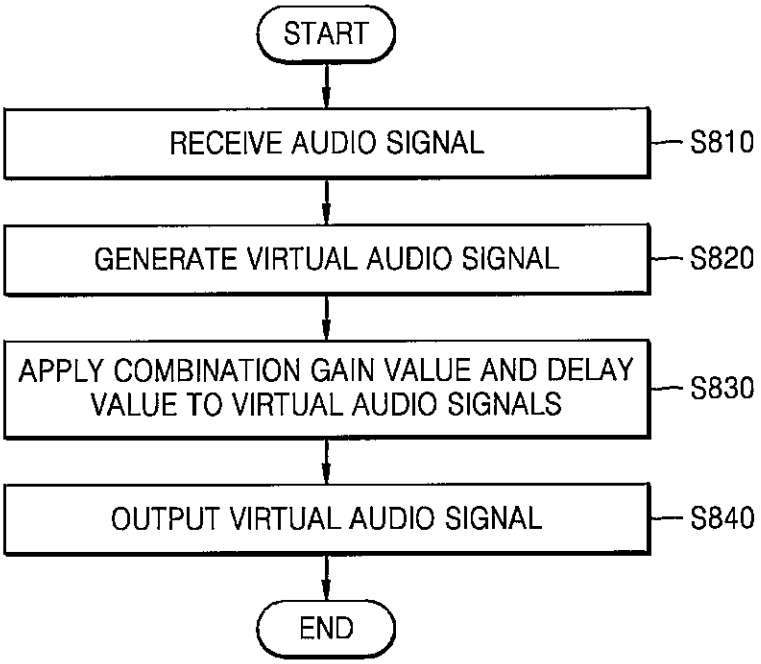

START
RECEIVE AUDIO SIGNAL
S810
GENERATE VIRTUAL AUDIO SIGNAL
S820
APPLY COMBINATION GAIN VALUE AND DELAY VALUE TO VIRTUAL AUDIO SIGNALS
S830
OUTPUT VIRTUAL AUDIO SIGNAL
S840
END

FIG. 9

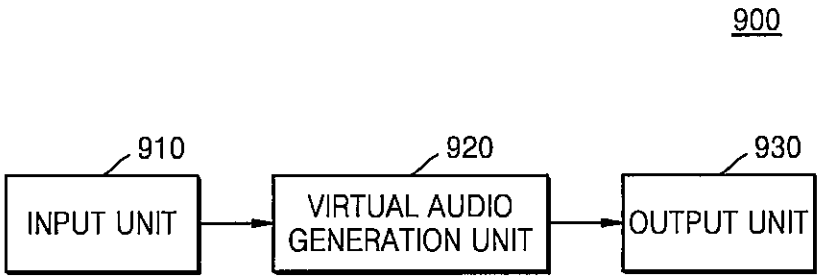

900
910
INPUT UNIT
920
VIRTUAL AUDIO GENERATION UNIT
930
OUTPUT UNIT

FIG. 10

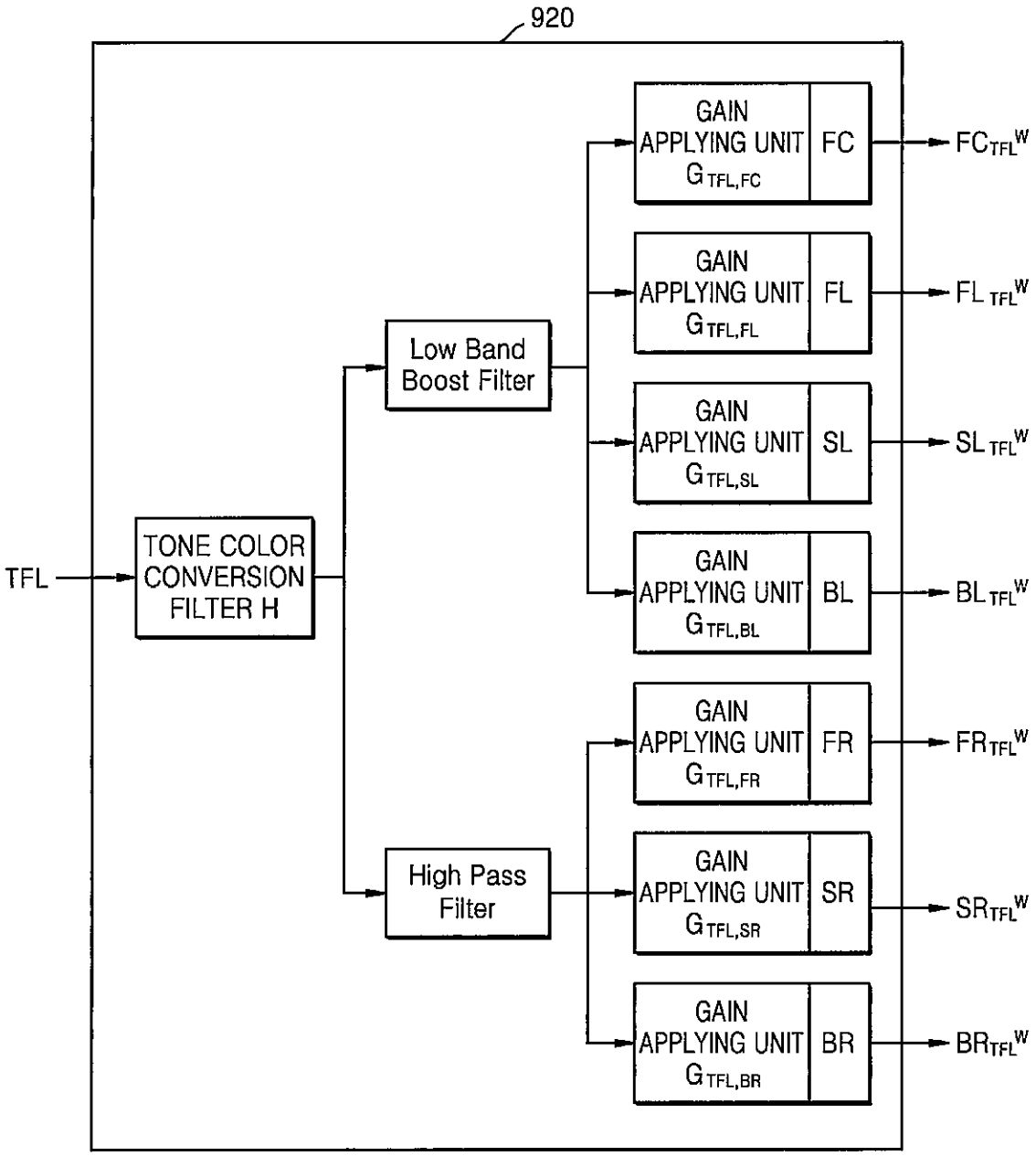

920
TFL
TONE COLOR CONVERSION FILTER H
Low Band Boost Filter
High Pass Filter
GAIN APPLYING UNIT $G_{TFL,FC}$ FC
GAIN APPLYING UNIT $G_{TFL,FL}$ FL
GAIN APPLYING UNIT $G_{TFL,SL}$ SL
GAIN APPLYING UNIT $G_{TFL,BL}$ BL
GAIN APPLYING UNIT $G_{TFL,FR}$ FR
GAIN APPLYING UNIT $G_{TFL,SR}$ SR
GAIN APPLYING UNIT $G_{TFL,BR}$ BR
FC_{TFL}^{W}
FL_{TFL}^{W}
SL_{TFL}^{W}
BL_{TFL}^{W}
FR_{TFL}^{W}
SR_{TFL}^{W}
BR_{TFL}^{W}

FIG. 11

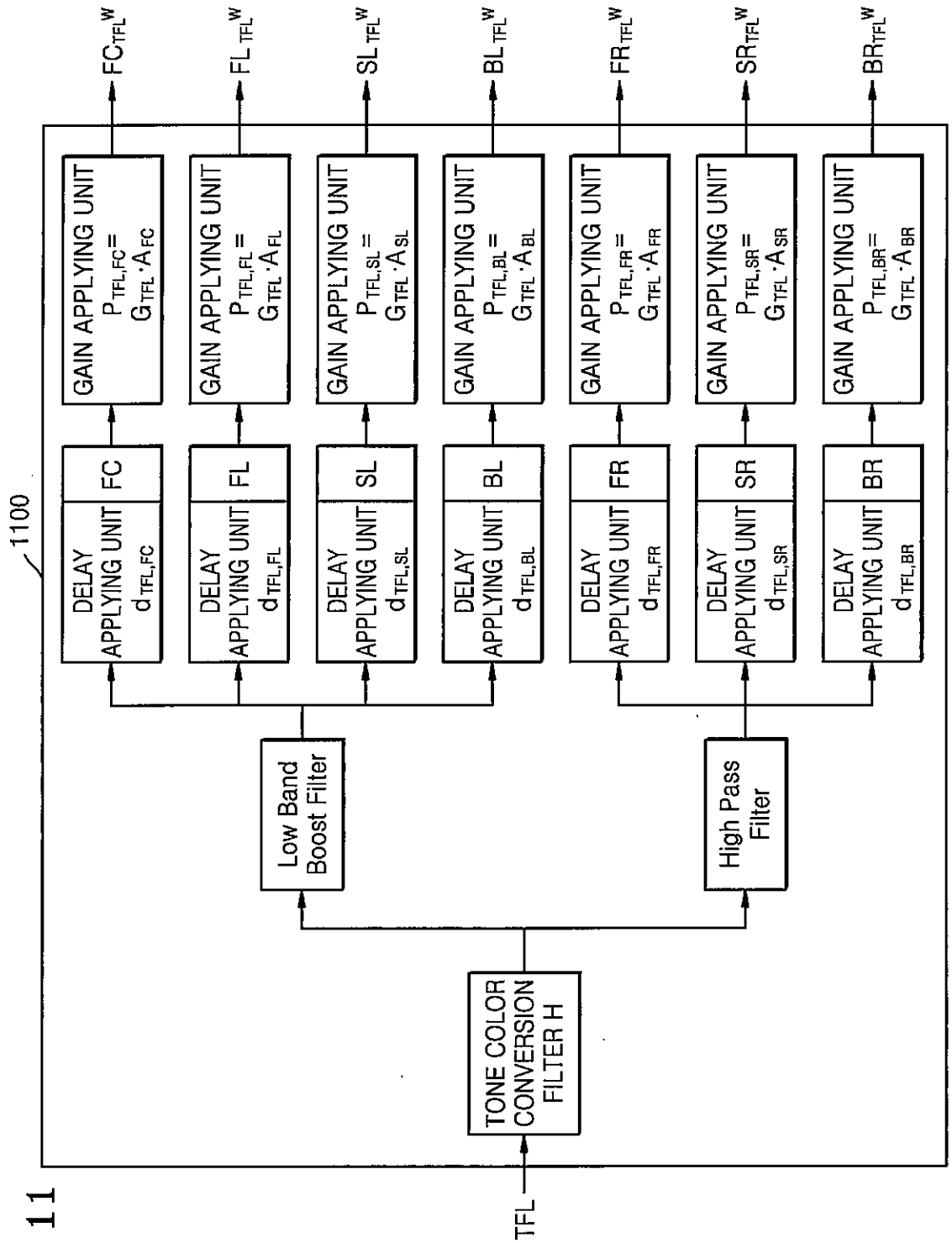

1100
TFL
TONE COLOR CONVERSION FILTER H
Low Band Boost Filter
High Pass Filter
DELAY APPLYING UNIT $d_{TFL,FC}$
FC
DELAY APPLYING UNIT $d_{TFL,FL}$
FL
DELAY APPLYING UNIT $d_{TFL,SL}$
SL
DELAY APPLYING UNIT $d_{TFL,BL}$
BL
DELAY APPLYING UNIT $d_{TFL,FR}$
FR
DELAY APPLYING UNIT $d_{TFL,SR}$
SR
DELAY APPLYING UNIT $d_{TFL,BR}$
BR
GAIN APPLYING UNIT $P_{TFL,FC} = G_{TFL} \cdot A_{FC}$
GAIN APPLYING UNIT $P_{TFL,FL} = G_{TFL} \cdot A_{FL}$
GAIN APPLYING UNIT $P_{TFL,SL} = G_{TFL} \cdot A_{SL}$
GAIN APPLYING UNIT $P_{TFL,BL} = G_{TFL} \cdot A_{BL}$
GAIN APPLYING UNIT $P_{TFL,FR} = G_{TFL} \cdot A_{FR}$
GAIN APPLYING UNIT $P_{TFL,SR} = G_{TFL} \cdot A_{SR}$
GAIN APPLYING UNIT $P_{TFL,BR} = G_{TFL} \cdot A_{BR}$
FC_{TFL}^{W}
FL_{TFL}^{W}
SL_{TFL}^{W}
BL_{TFL}^{W}
FR_{TFL}^{W}
SR_{TFL}^{W}
BR_{TFL}^{W}

FIG. 12

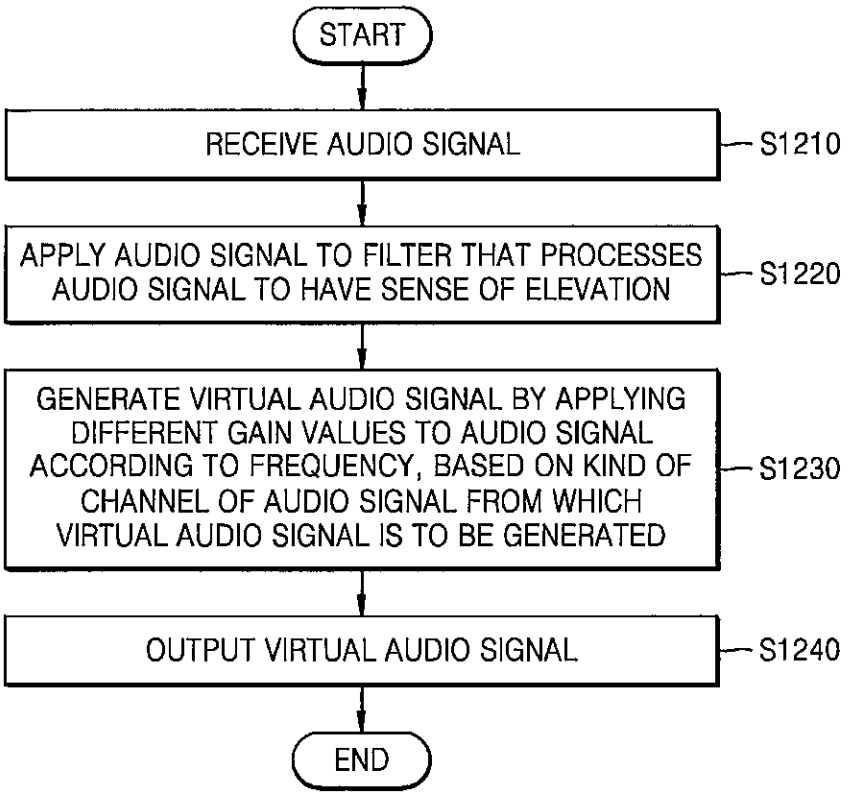

START
RECEIVE AUDIO SIGNAL
S1210
APPLY AUDIO SIGNAL TO FILTER THAT PROCESSES AUDIO SIGNAL TO HAVE SENSE OF ELEVATION
S1220
GENERATE VIRTUAL AUDIO SIGNAL BY APPLYING DIFFERENT GAIN VALUES TO AUDIO SIGNAL ACCORDING TO FREQUENCY, BASED ON KIND OF CHANNEL OF AUDIO SIGNAL FROM WHICH VIRTUAL AUDIO SIGNAL IS TO BE GENERATED
S1230
OUTPUT VIRTUAL AUDIO SIGNAL
S1240
END

FIG. 13

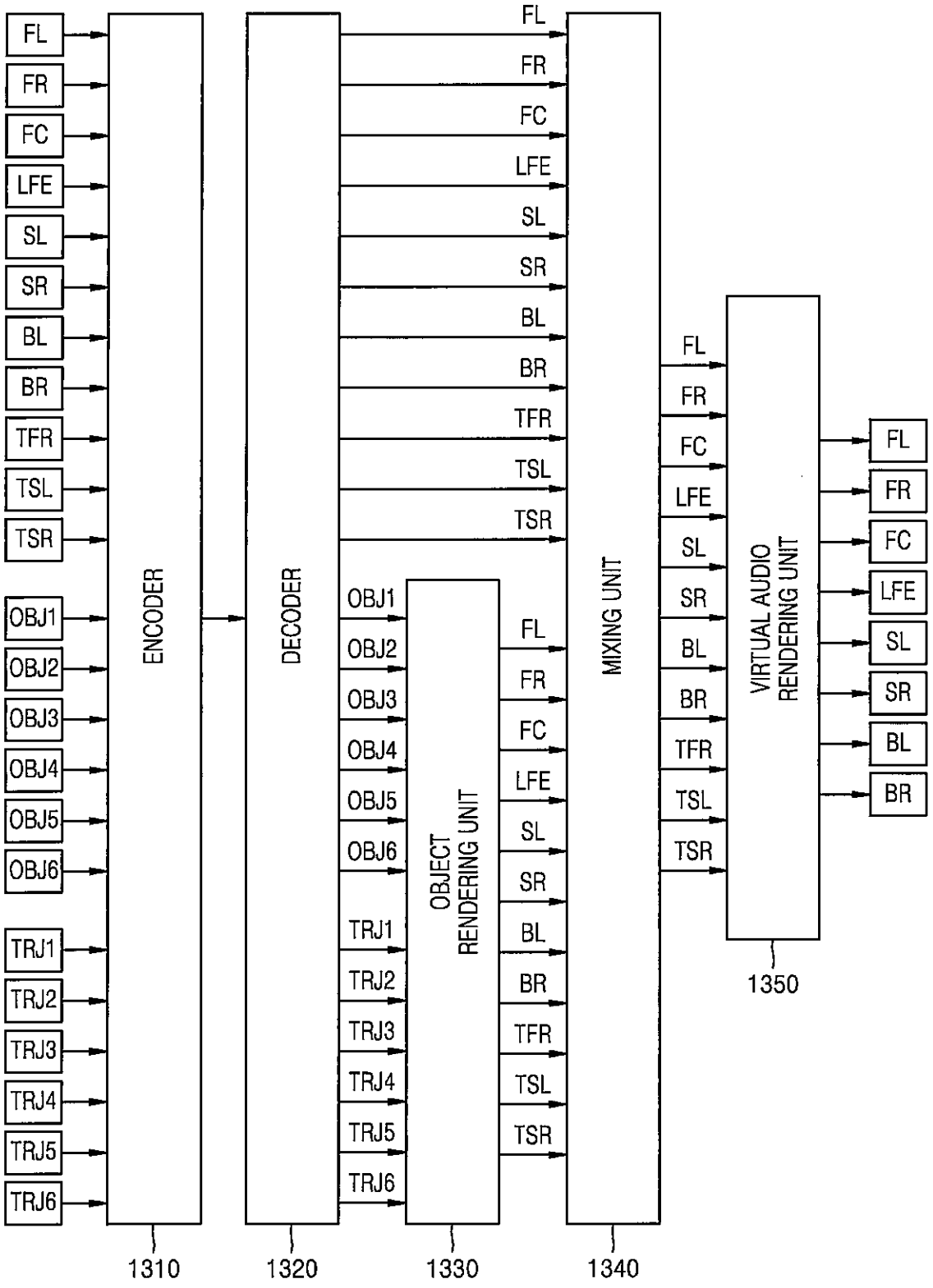

FL
FR
FC
LFE
SL
SR
BL
BR
TFR
TSL
TSR
OBJ1
OBJ2
OBJ3
OBJ4
OBJ5
OBJ6
TRJ1
TRJ2
TRJ3
TRJ4
TRJ5
TRJ6
ENCODER
DECODER
OBJECT RENDERING UNIT
MIXING UNIT
VIRTUAL AUDIO RENDERING UNIT
1310
1320
1330
1340
1350

FIG. 14

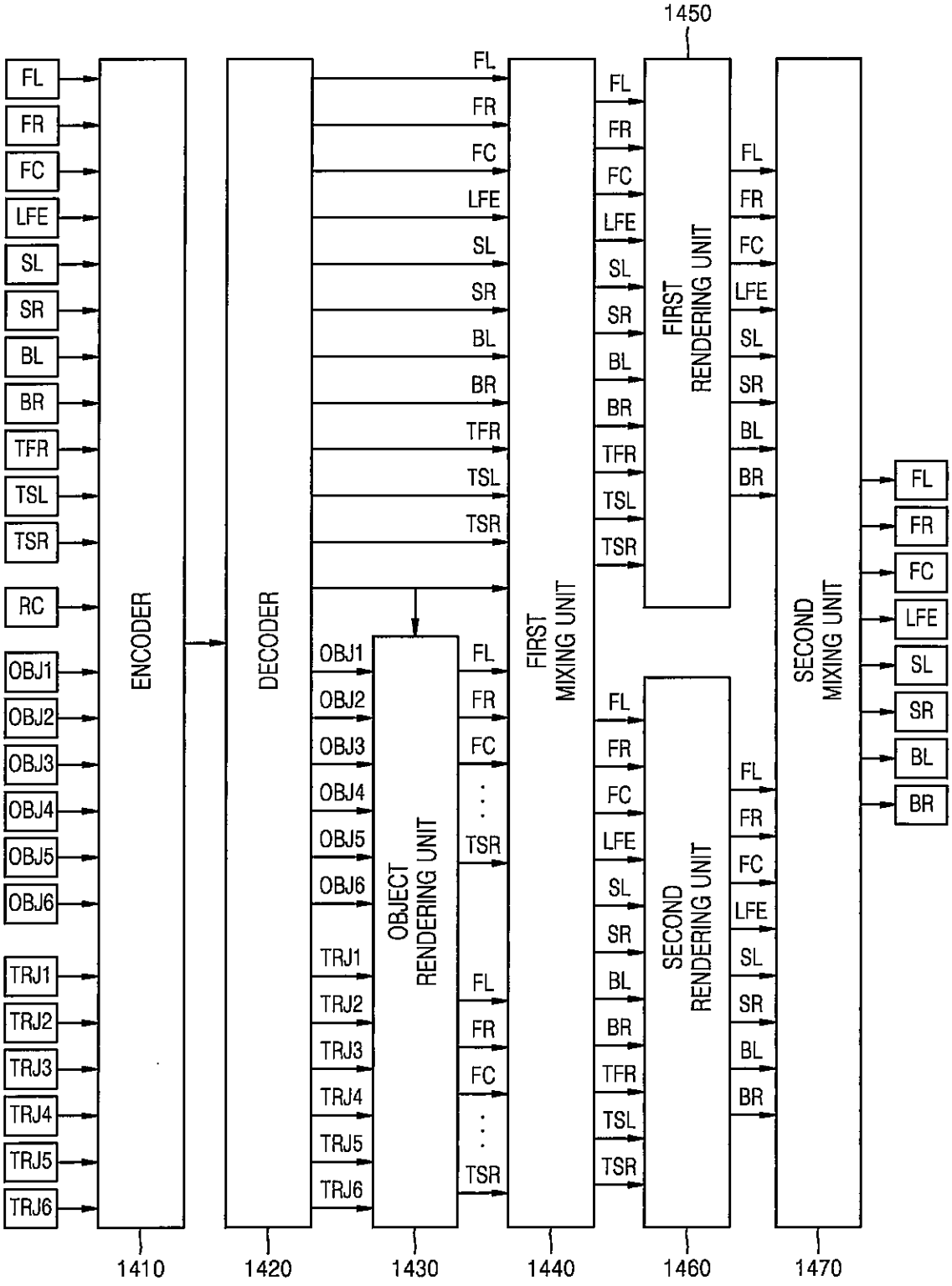

1450
FL
FR
FC
LFE
SL
SR
BL
BR
TFR
TSL
TSR
RC
OBJ1
OBJ2
OBJ3
OBJ4
OBJ5
OBJ6
TRJ1
TRJ2
TRJ3
TRJ4
TRJ5
TRJ6
ENCODER
DECODER
OBJECT RENDERING UNIT
FIRST MIXING UNIT
FIRST RENDERING UNIT
SECOND RENDERING UNIT
SECOND MIXING UNIT
1410
1420
1430
1440
1460
1470

FIG. 15

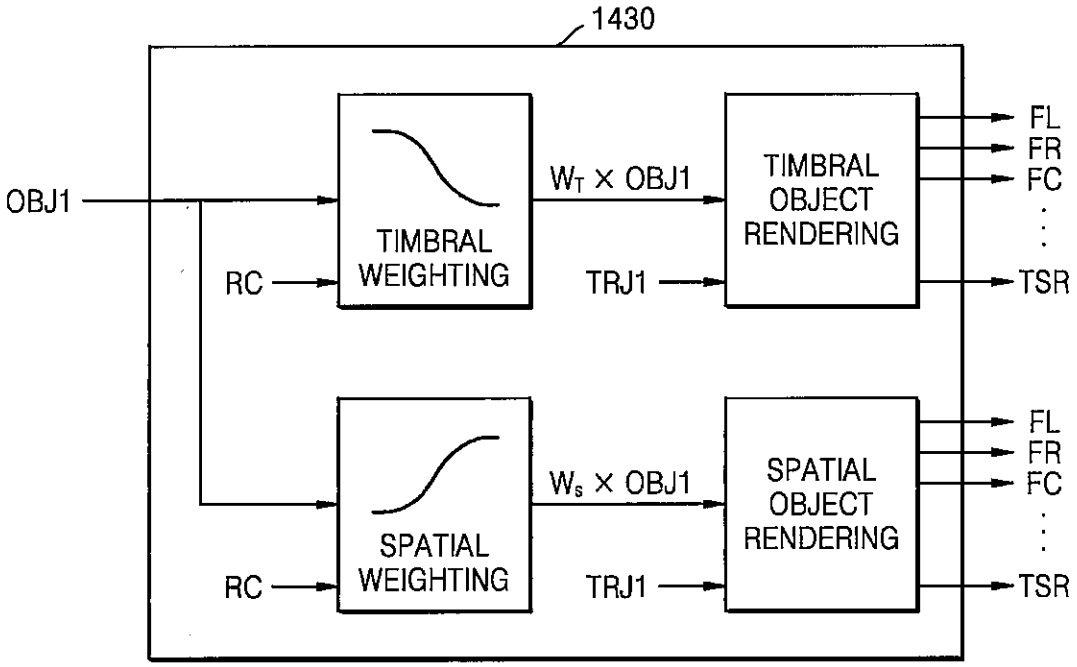

1430
OBJ1
RC
TIMBRAL WEIGHTING
$W_T \times OBJ1$
TRJ1
TIMBRAL OBJECT RENDERING
FL
FR
FC
TSR
RC
SPATIAL WEIGHTING
$W_S \times OBJ1$
TRJ1
SPATIAL OBJECT RENDERING
FL
FR
FC
TSR

FIG. 16

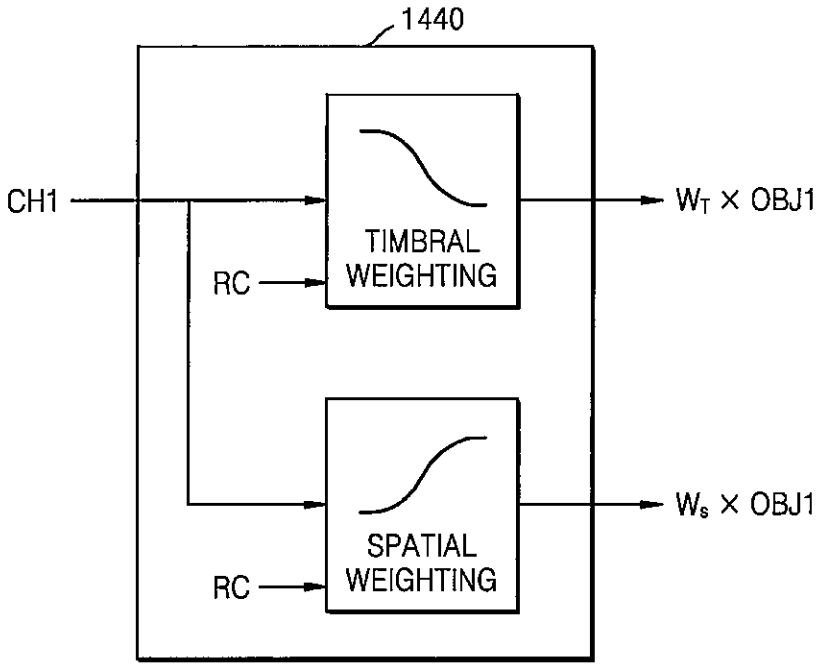

1440
CH1
RC
TIMBRAL WEIGHTING
$W_T \times OBJ1$
RC
SPATIAL WEIGHTING
$W_s \times OBJ1$

FIG. 17

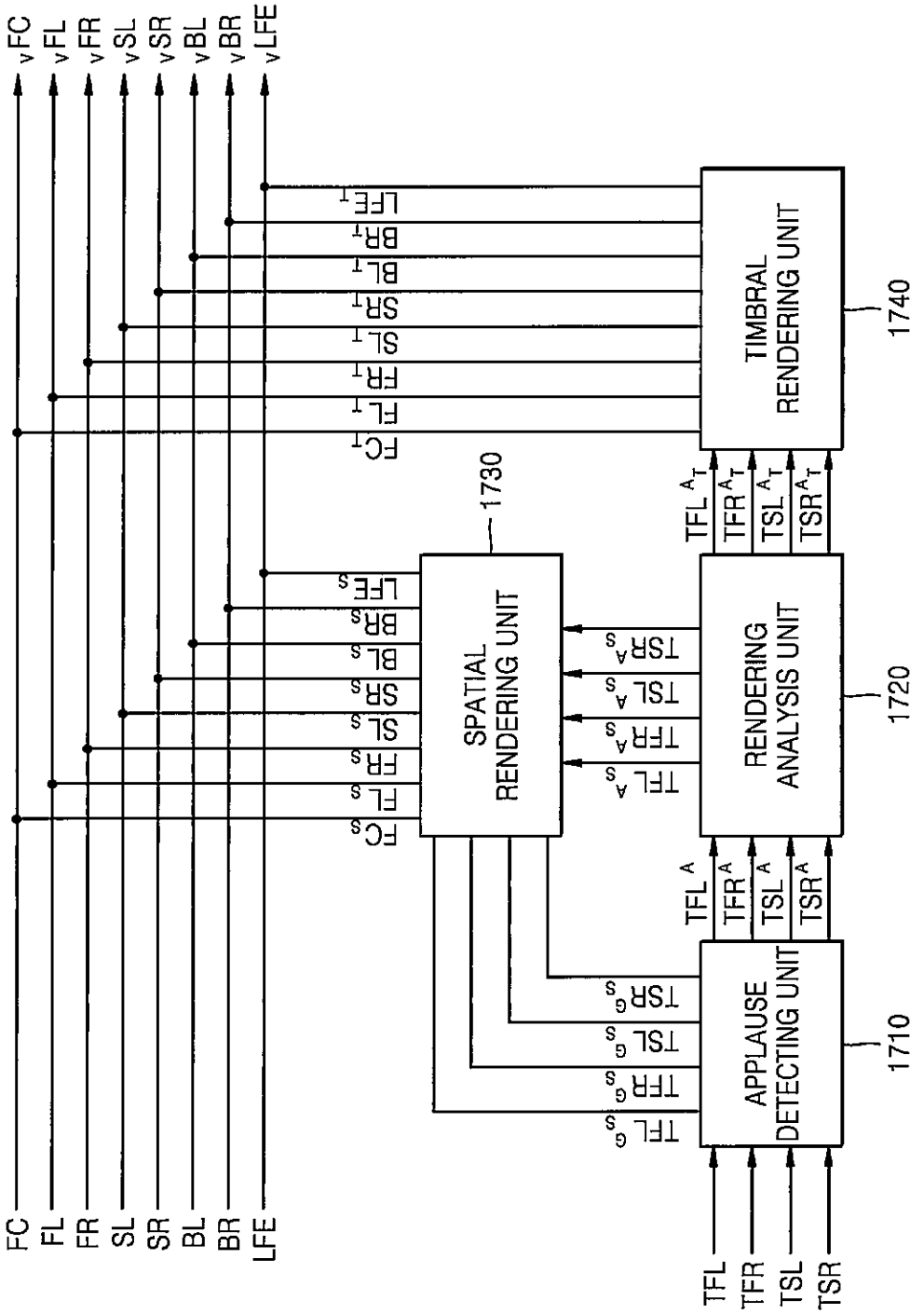

FC
FL
FR
SL
SR
BL
BR
LFE
vFC
vFL
vFR
vSL
vSR
vBL
vBR
vLFE
TFL
TFR
TSL
TSR
APPLAUSE DETECTING UNIT
1710
RENDERING ANALYSIS UNIT
1720
SPATIAL RENDERING UNIT
1730
TIMBRAL RENDERING UNIT
1740

FIG. 18

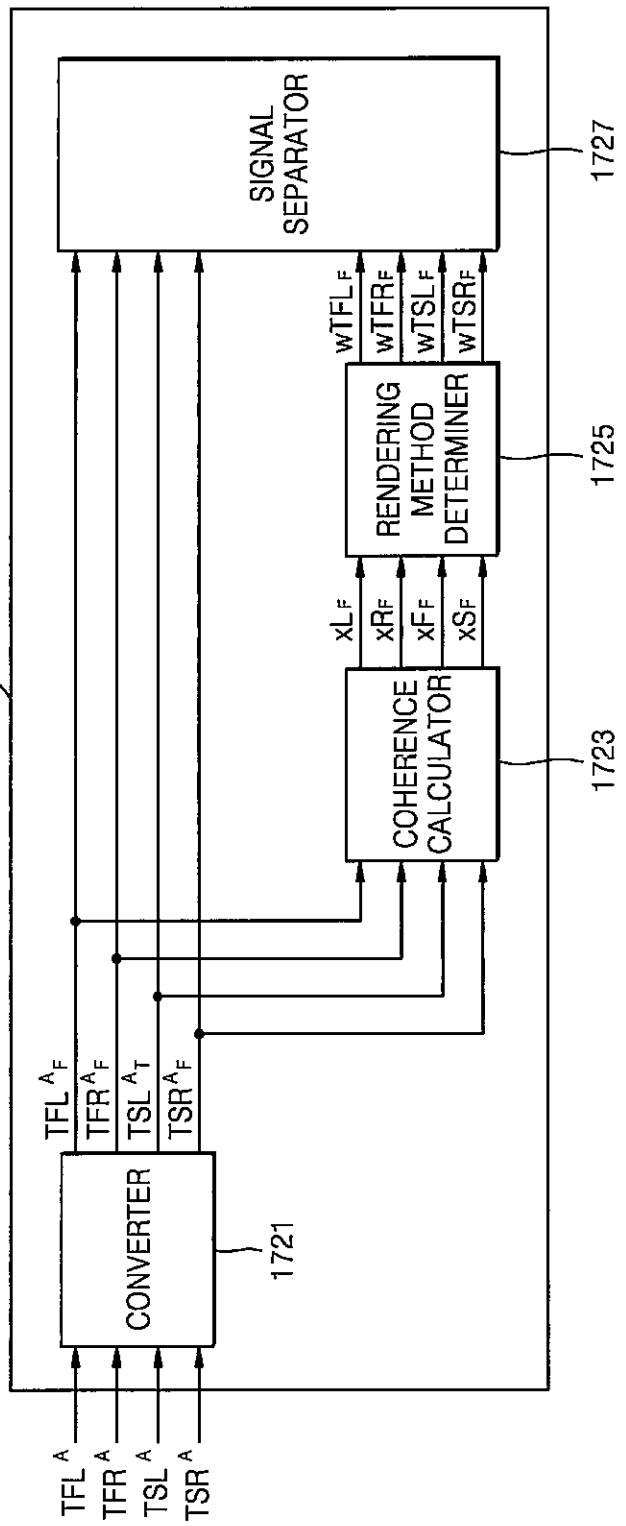

1720
SIGNAL SEPARATOR
1727
RENDERING METHOD DETERMINER
1725
COHERENCE CALCULATOR
1723
CONVERTER
1721
TFL A
TFR A
TSL A
TSR A
TFL AF
TFR AF
TSL AT
TSR AF
xLF
xRF
xFF
xSF
wTFLF
wTFRF
wTSLF
wTSRF

FIG. 19

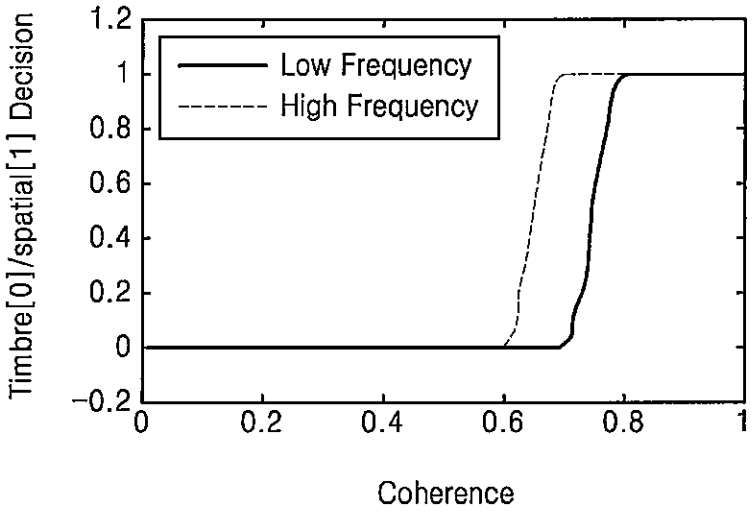

Timbre[0]/spatial[1] Decision
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
0
0.2
0.4
0.6
0.8
1
Low Frequency
High Frequency
Coherence

FIG. 20

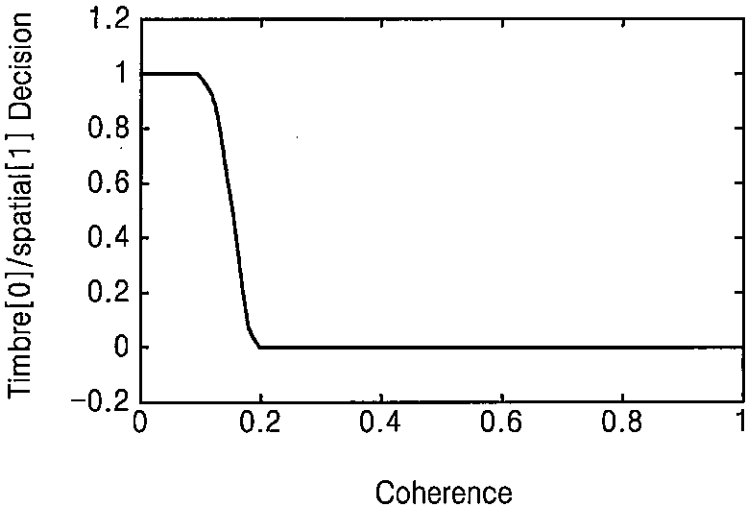

Timbre[0]/spatial[1] Decision
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
0
0.2
0.4
0.6
0.8
1
Coherence

FIG. 21

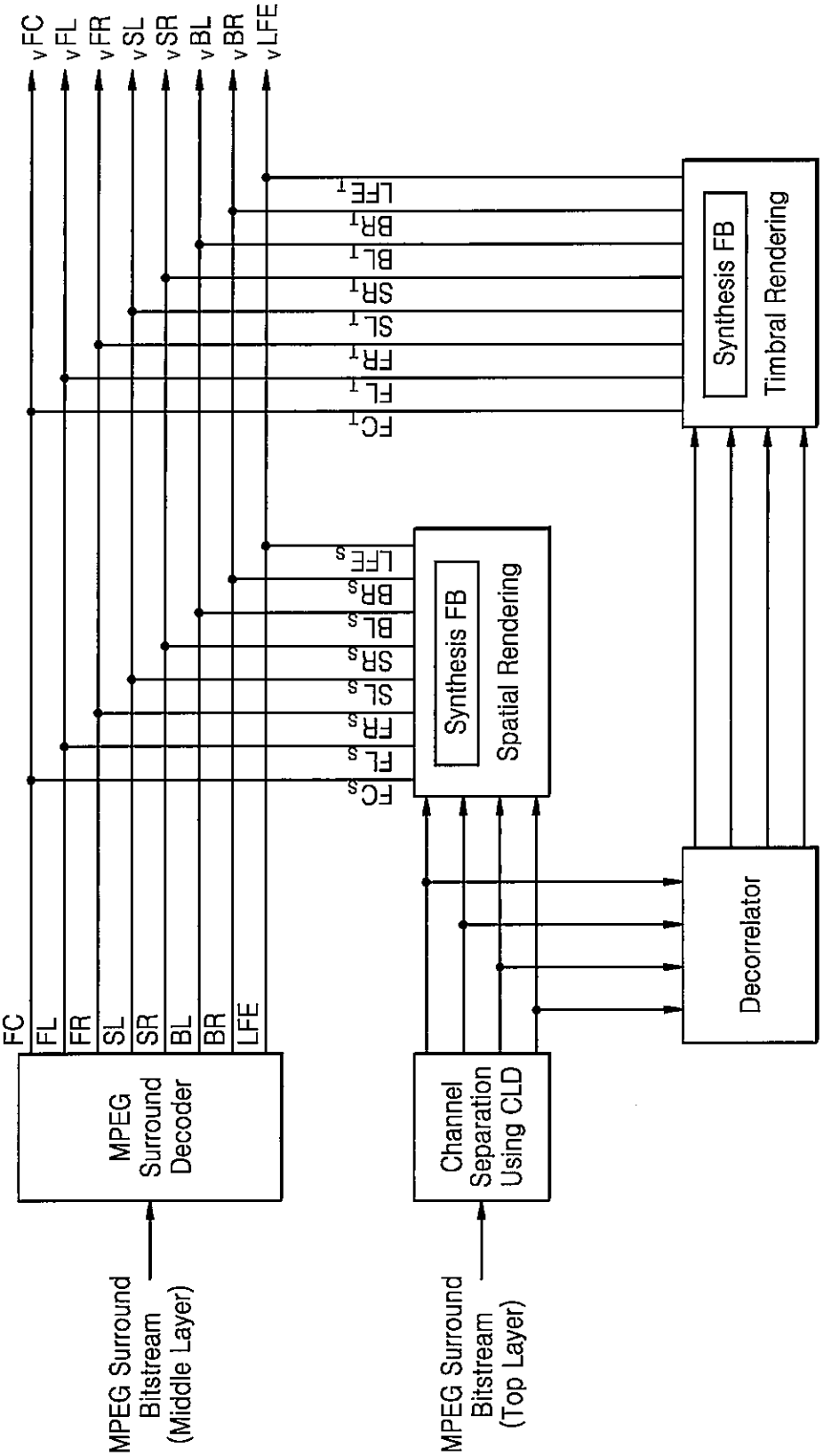

MPEG Surround Bitstream (Middle Layer)
MPEG Surround Decoder
FC
FL
FR
SL
SR
BL
BR
LFE
vFC
vFL
vFR
vSL
vSR
vBL
vBR
vLFE
MPEG Surround Bitstream (Top Layer)
Channel Separation Using CLD
Synthesis FB
Spatial Rendering
Decorrelator
Synthesis FB
Timbral Rendering

FIG. 22

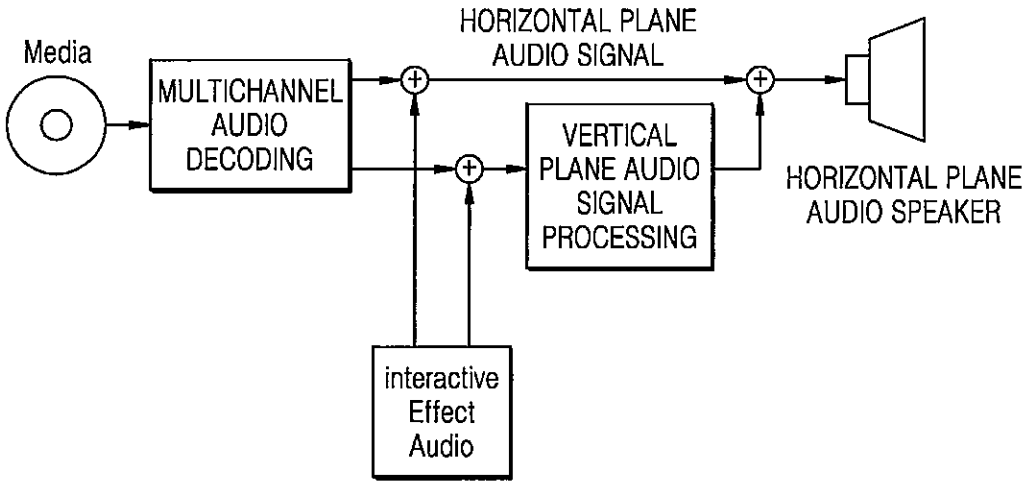

Media
MULTICHANNEL AUDIO DECODING
HORIZONTAL PLANE AUDIO SIGNAL
VERTICAL PLANE AUDIO SIGNAL PROCESSING
HORIZONTAL PLANE AUDIO SPEAKER
interactive Effect Audio

FIG. 23

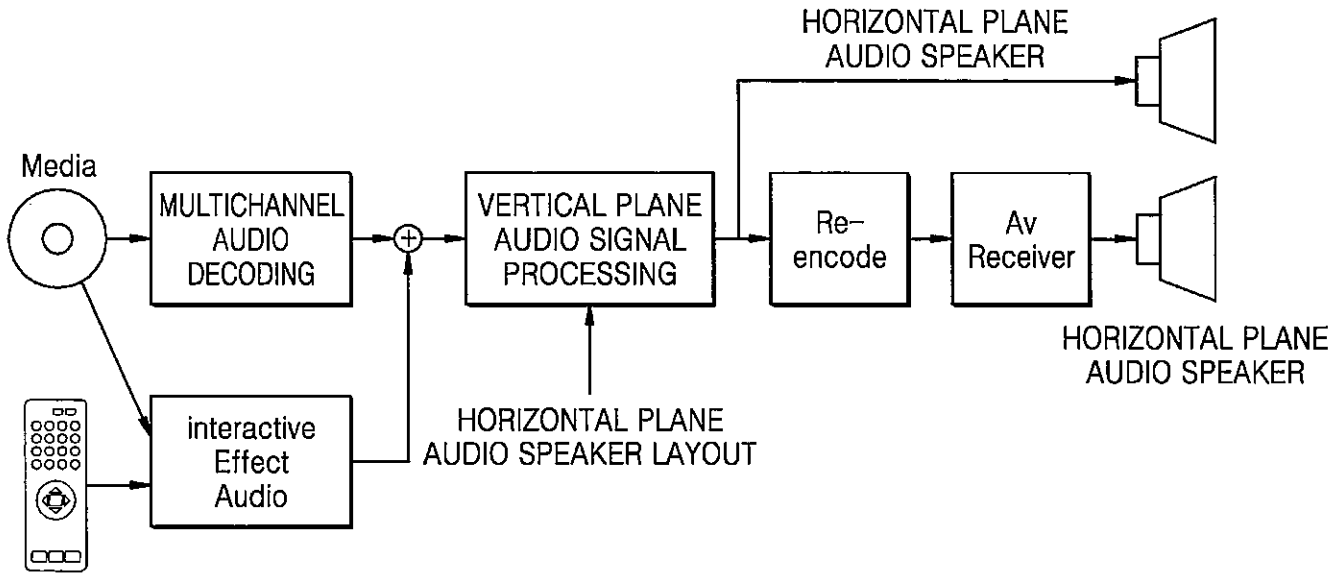

HORIZONTAL PLANE
AUDIO SPEAKER
Media
MULTICHANNEL
AUDIO
DECODING
VERTICAL PLANE
AUDIO SIGNAL
PROCESSING
Re-
encode
Av
Receiver
HORIZONTAL PLANE
AUDIO SPEAKER
interactive
Effect
Audio
HORIZONTAL PLANE
AUDIO SPEAKER LAYOUT

FIG. 24

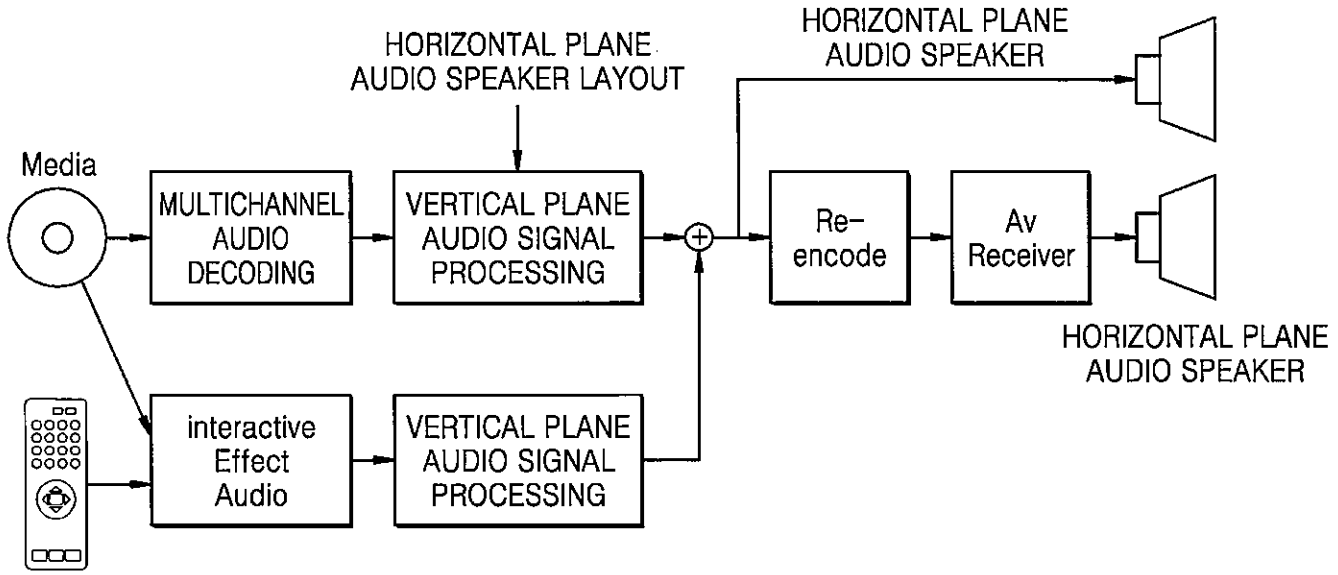
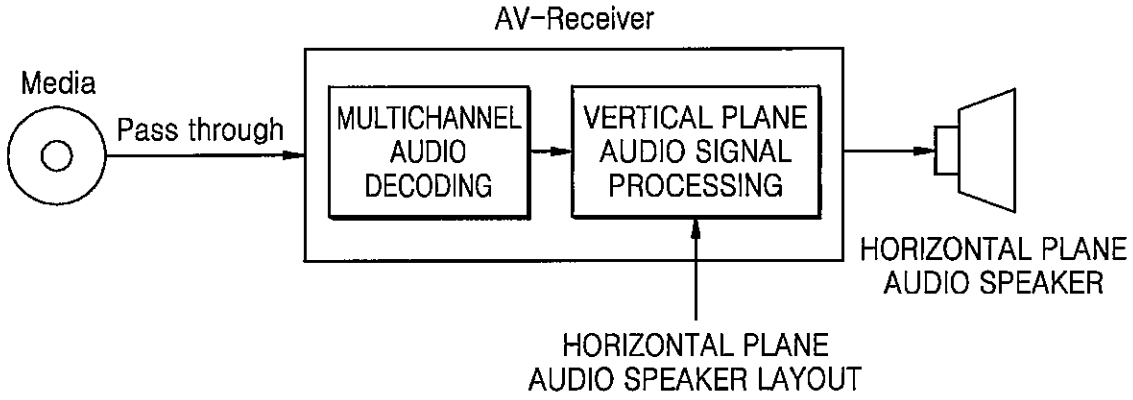

HORIZONTAL PLANE
AUDIO SPEAKER LAYOUT
HORIZONTAL PLANE
AUDIO SPEAKER
Media
MULTICHANNEL
AUDIO
DECODING
VERTICAL PLANE
AUDIO SIGNAL
PROCESSING
Re-
encode
Av
Receiver
HORIZONTAL PLANE
AUDIO SPEAKER
interactive
Effect
Audio
VERTICAL PLANE
AUDIO SIGNAL
PROCESSING

FIG. 25


AV-Receiver
Media
Pass through
MULTICHANNEL AUDIO DECODING
VERTICAL PLANE AUDIO SIGNAL PROCESSING
HORIZONTAL PLANE AUDIO SPEAKER
HORIZONTAL PLANE AUDIO SPEAKER LAYOUT