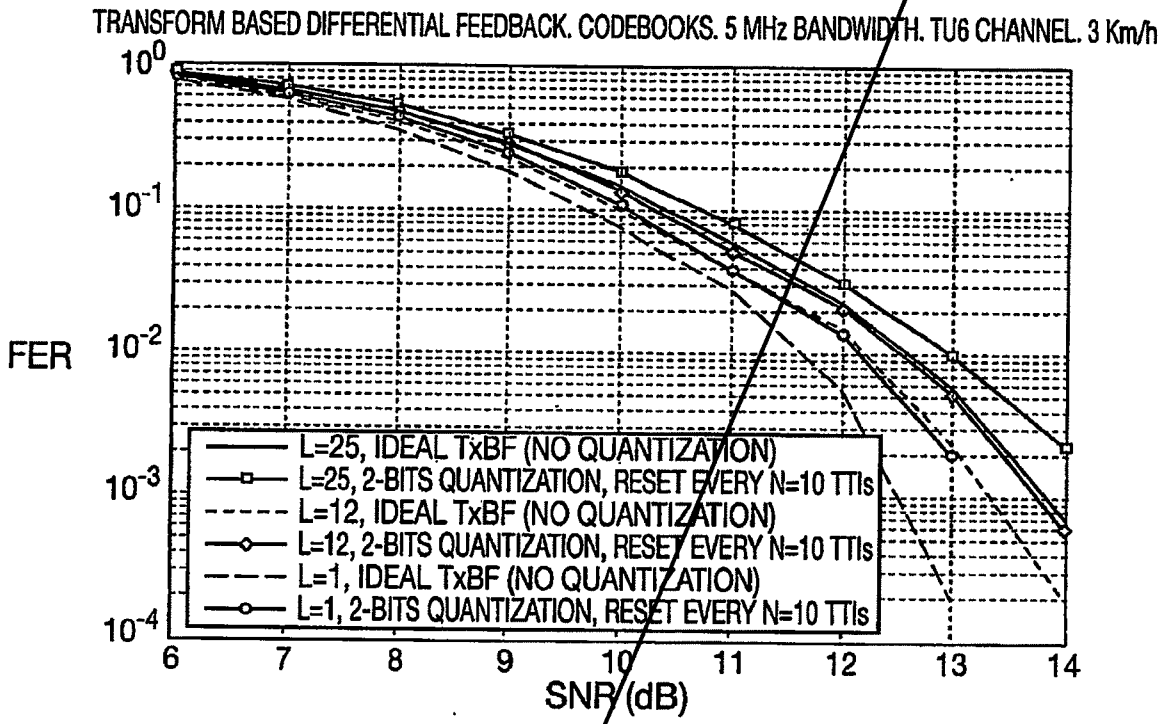

TRANSFORM BASED DIFFERENTIAL FEEDBACK. CODEBOOKS. 5 MHz BANDWIDTH. TU6 CHANNEL. 3 Km/h
FER
SNR (dB)
L=25, IDEAL TxBF (NO QUANTIZATION)
L=25, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs
L=12, IDEAL TxBF (NO QUANTIZATION)
L=12, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs
L=1, IDEAL TxBF (NO QUANTIZATION)
L=1, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs

FIG. 1

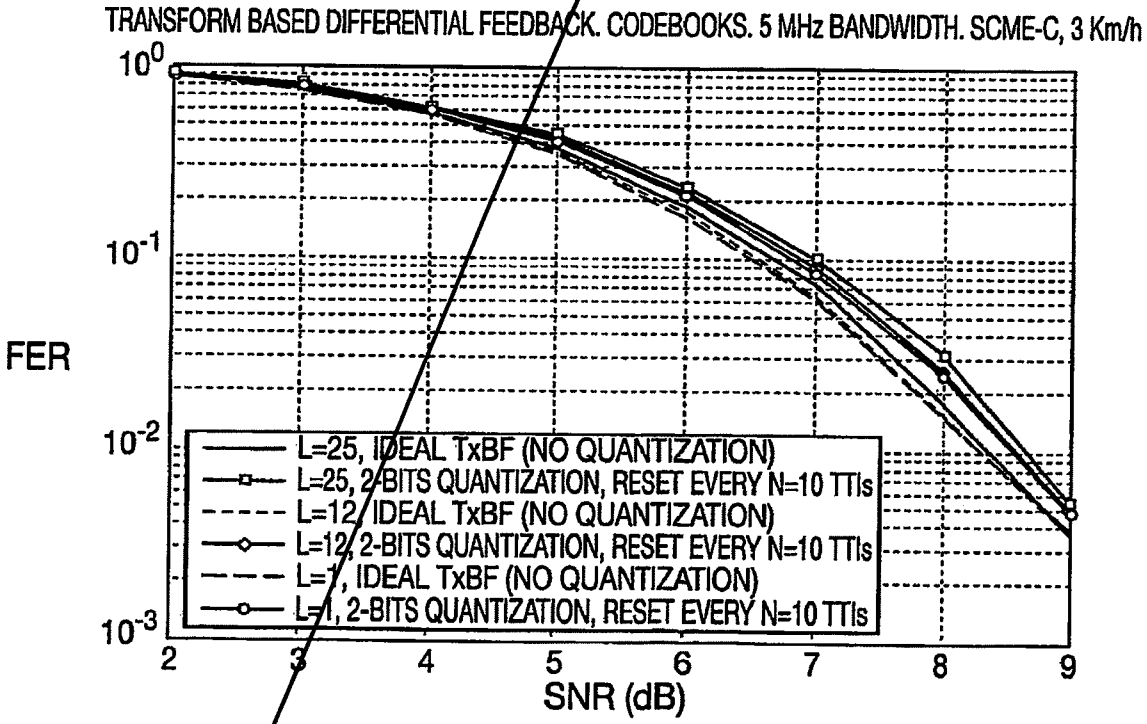

TRANSFORM BASED DIFFERENTIAL FEEDBACK. CODEBOOKS. 5 MHz BANDWIDTH. SCME-C, 3 Km/h
FER
SNR (dB)
L=25, IDEAL TxBF (NO QUANTIZATION)
L=25, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs
L=12, IDEAL TxBF (NO QUANTIZATION)
L=12, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs
L=1, IDEAL TxBF (NO QUANTIZATION)
L=1, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs

FIG. 2

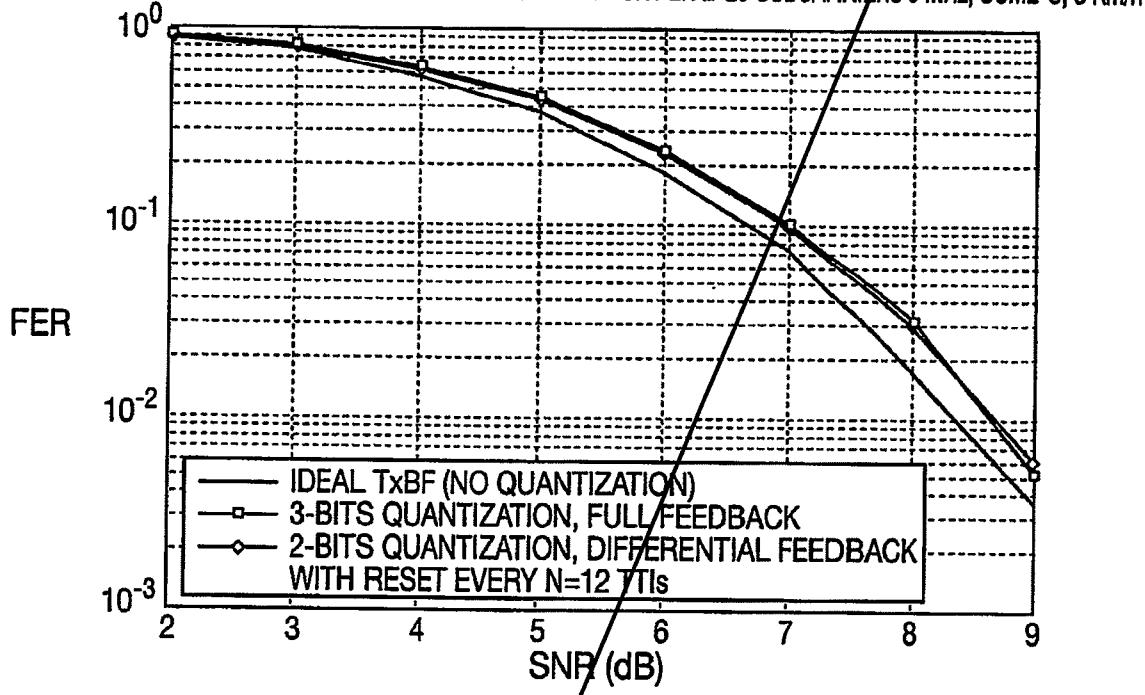

TRANSFORM BASED FEEDBACK. CODEBOOKS. FEEDBACK PER L=25 SUBCARRIERS 5 MHz, SCME-C, 3 Km/h
FER
SNR (dB)
IDEAL TxBF (NO QUANTIZATION)
3-BITS QUANTIZATION, FULL FEEDBACK
2-BITS QUANTIZATION, DIFFERENTIAL FEEDBACK WITH RESET EVERY N=12 TTIs

FIG. 3

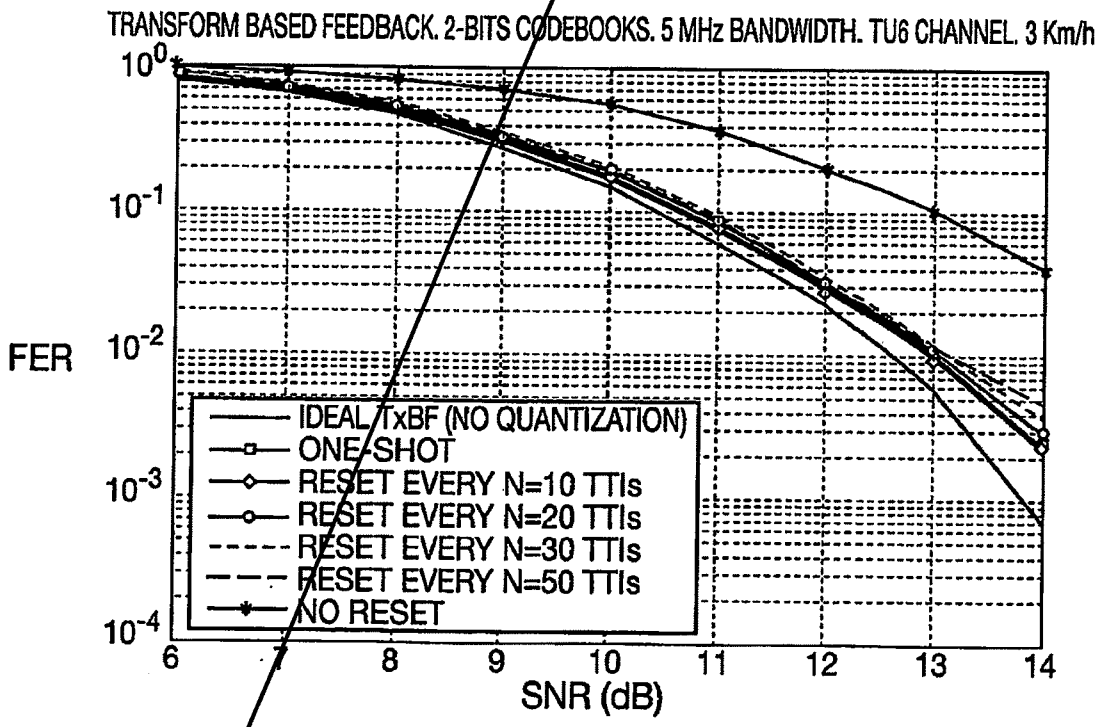

TRANSFORM BASED FEEDBACK. 2-BITS CODEBOOKS. 5 MHz BANDWIDTH. TU6 CHANNEL. 3 Km/h
FER
SNR (dB)
IDEAL TxBF (NO QUANTIZATION)
ONE-SHOT
RESET EVERY N=10 TTIs
RESET EVERY N=20 TTIs
RESET EVERY N=30 TTIs
RESET EVERY N=50 TTIs
NO RESET

FIG. 4

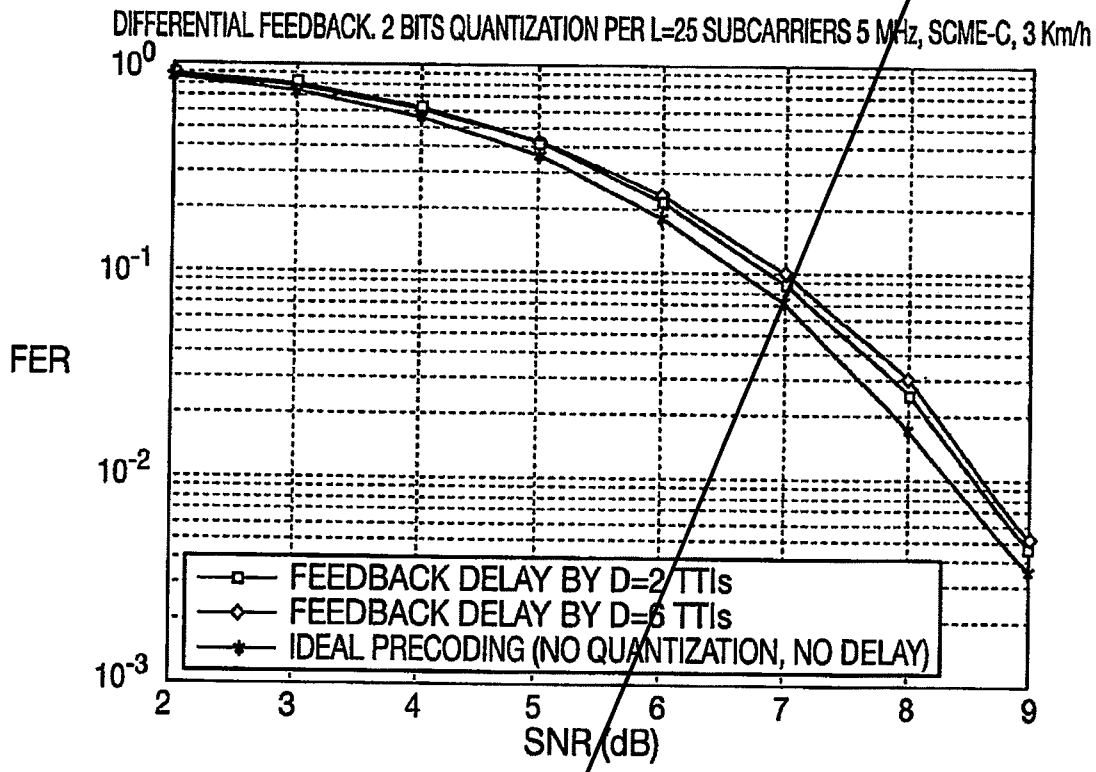

DIFFERENTIAL FEEDBACK. 2 BITS QUANTIZATION PER L=25 SUBCARRIERS 5 MHz, SCME-C, 3 Km/h
FER
SNR (dB)
FEEDBACK DELAY BY D=2 TTIs
FEEDBACK DELAY BY D=6 TTIs
IDEAL PRECODING (NO QUANTIZATION, NO DELAY)

FIG. 5

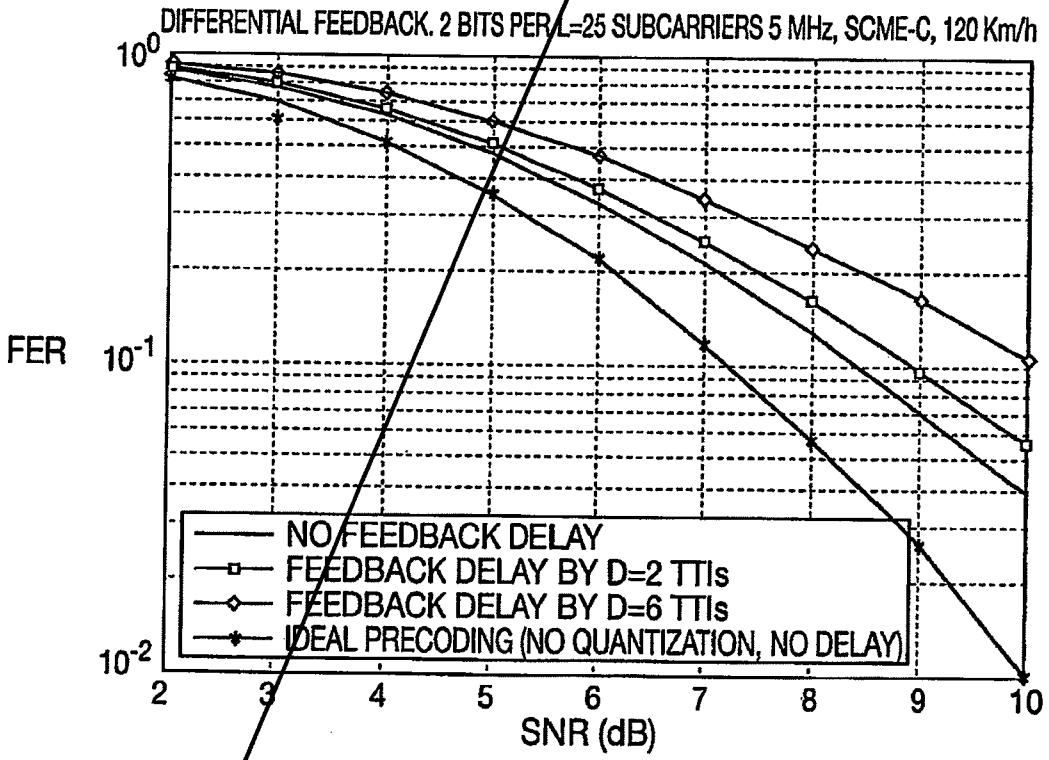

DIFFERENTIAL FEEDBACK. 2 BITS PER L=25 SUBCARRIERS 5 MHz, SCME-C, 120 Km/h
FER
SNR (dB)
NO FEEDBACK DELAY
FEEDBACK DELAY BY D=2 TTIs
FEEDBACK DELAY BY D=6 TTIs
IDEAL PRECODING (NO QUANTIZATION, NO DELAY)

FIG. 6

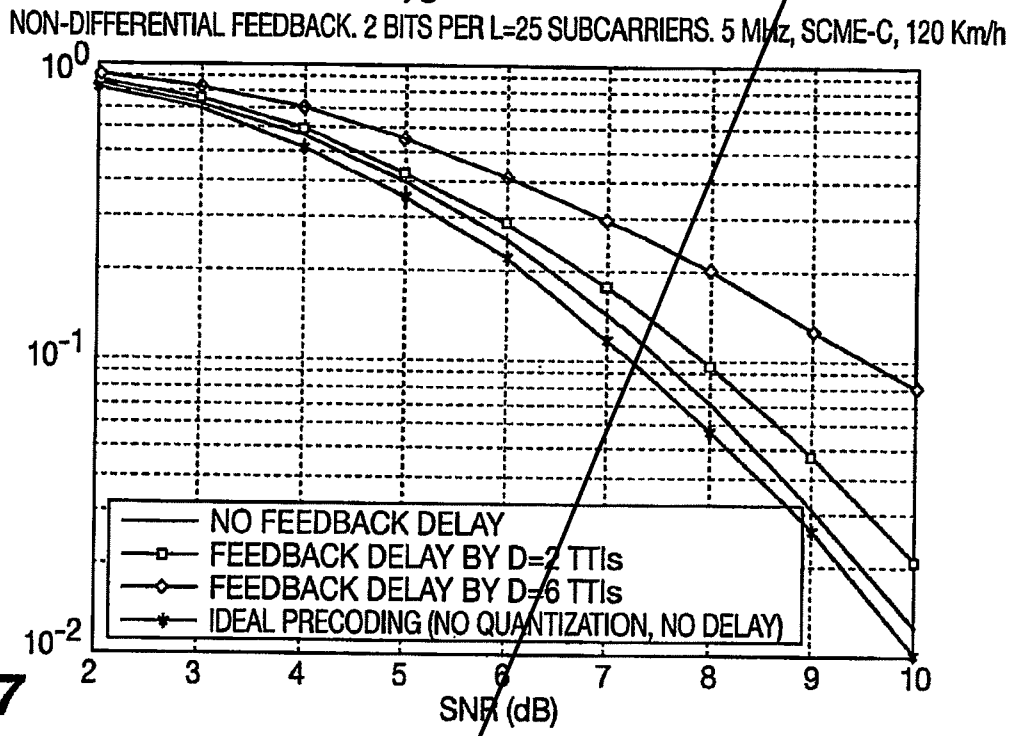


FIG. 7

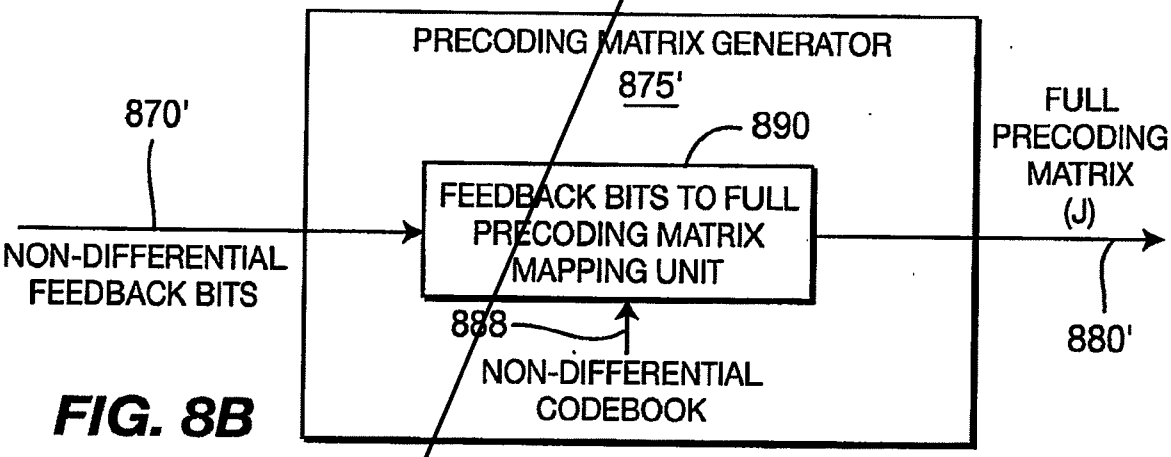


FIG. 8B

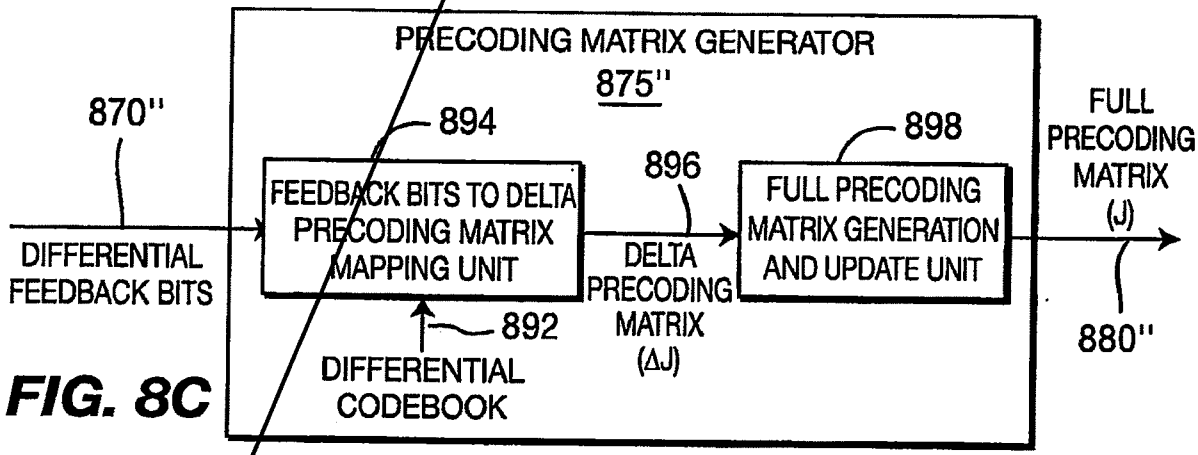


FIG. 8C

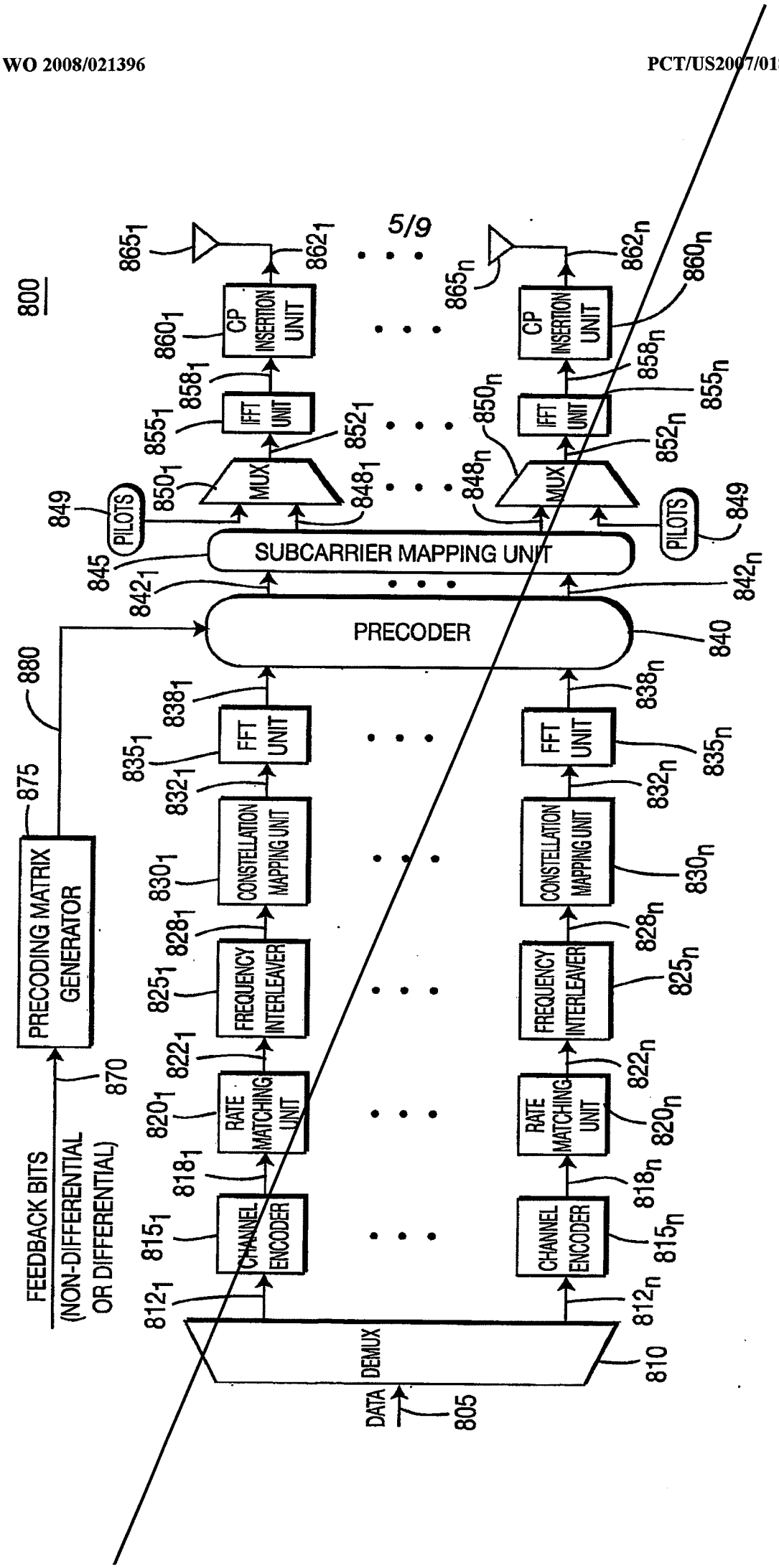

800
DATA
805
DEMUX
810
FEEDBACK BITS
(NON-DIFFERENTIAL
OR DIFFERENTIAL)
870
PRECODING MATRIX
GENERATOR
875
880
CHANNEL ENCODER
RATE MATCHING UNIT
FREQUENCY INTERLEAVER
CONSTELLATION MAPPING UNIT
FFT UNIT
PRECODER
SUBCARRIER MAPPING UNIT
PILOTS
MUX
IFFT UNIT
CP INSERTION UNIT
849
845
840

FIG. 8A

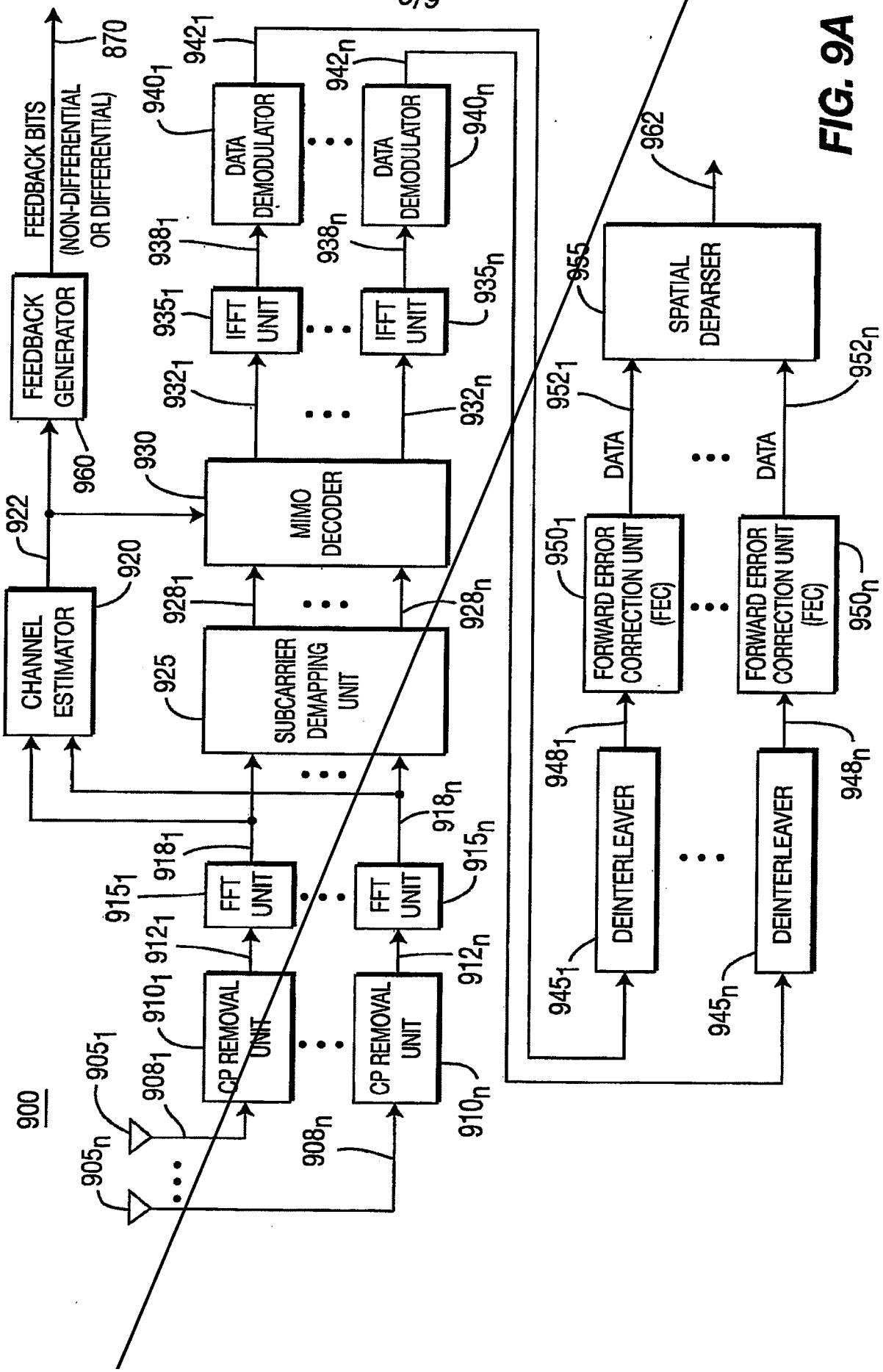

900
905$_1$
905$_n$
908$_1$
908$_n$
910$_1$
910$_n$
912$_1$
912$_n$
915$_1$
915$_n$
918$_1$
918$_n$
920
922
925
928$_1$
928$_n$
930
932$_1$
932$_n$
935$_1$
935$_n$
938$_1$
938$_n$
940$_1$
940$_n$
942$_1$
942$_n$
945$_1$
945$_n$
948$_1$
948$_n$
950$_1$
950$_n$
952$_1$
952$_n$
955
960
962
870
CP REMOVAL UNIT
FFT UNIT
CHANNEL ESTIMATOR
SUBCARRIER DEMAPPING UNIT
MIMO DECODER
IFFT UNIT
DATA DEMODULATOR
FEEDBACK GENERATOR
FEEDBACK BITS (NON-DIFFERENTIAL OR DIFFERENTIAL)
DEINTERLEAVER
FORWARD ERROR CORRECTION UNIT (FEC)
DATA
SPATIAL DEPARSER

FIG. 9A

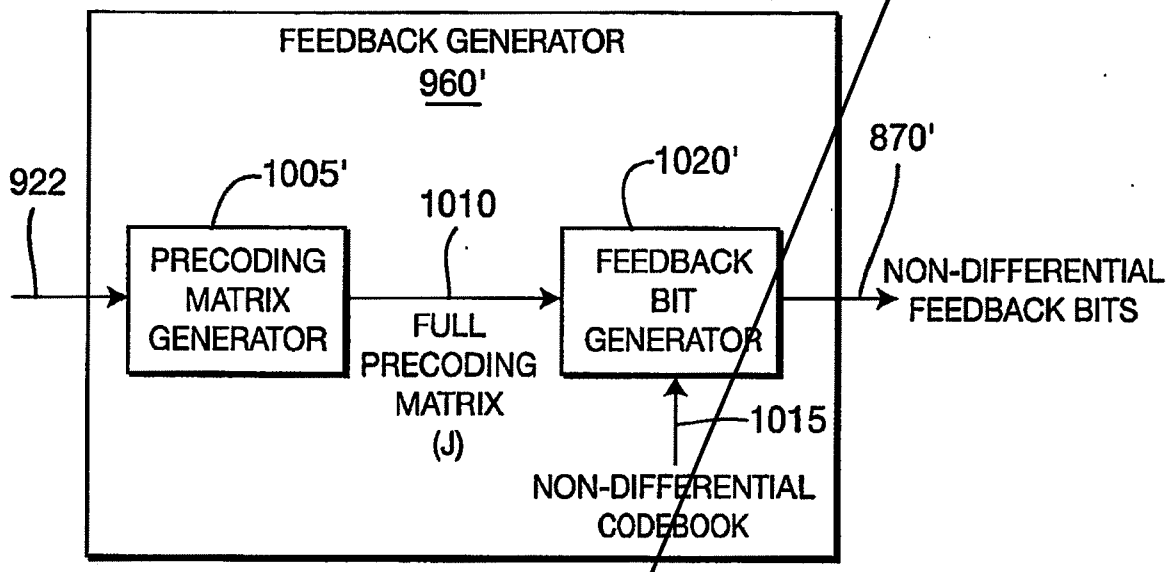

FEEDBACK GENERATOR
960'
922
1005'
PRECODING MATRIX GENERATOR
1010
FULL PRECODING MATRIX (J)
1020'
FEEDBACK BIT GENERATOR
870'
NON-DIFFERENTIAL FEEDBACK BITS
1015
NON-DIFFERENTIAL CODEBOOK

FIG. 9B

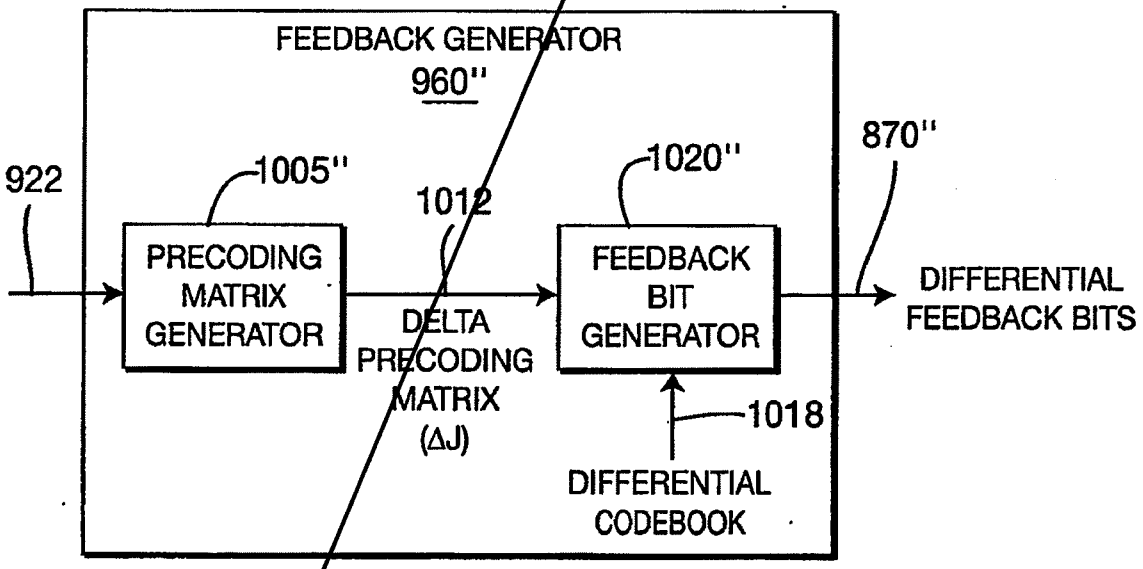

FEEDBACK GENERATOR
960''
922
1005''
PRECODING MATRIX GENERATOR
1012
DELTA PRECODING MATRIX (ΔJ)
1020''
FEEDBACK BIT GENERATOR
870''
DIFFERENTIAL FEEDBACK BITS
1018
DIFFERENTIAL CODEBOOK

FIG. 9C

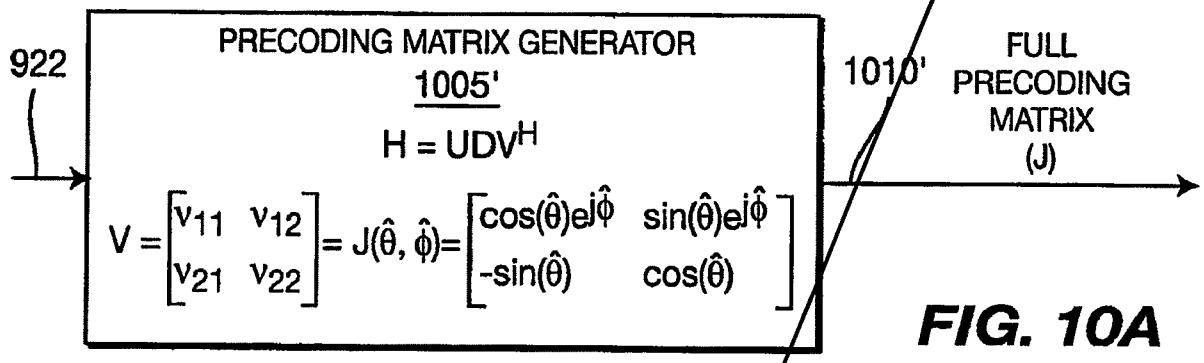


FIG. 10A

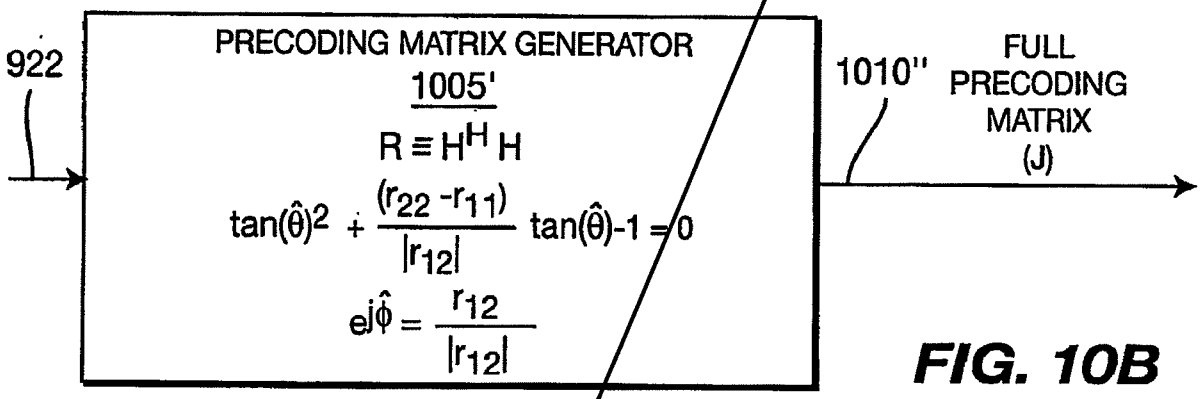


FIG. 10B

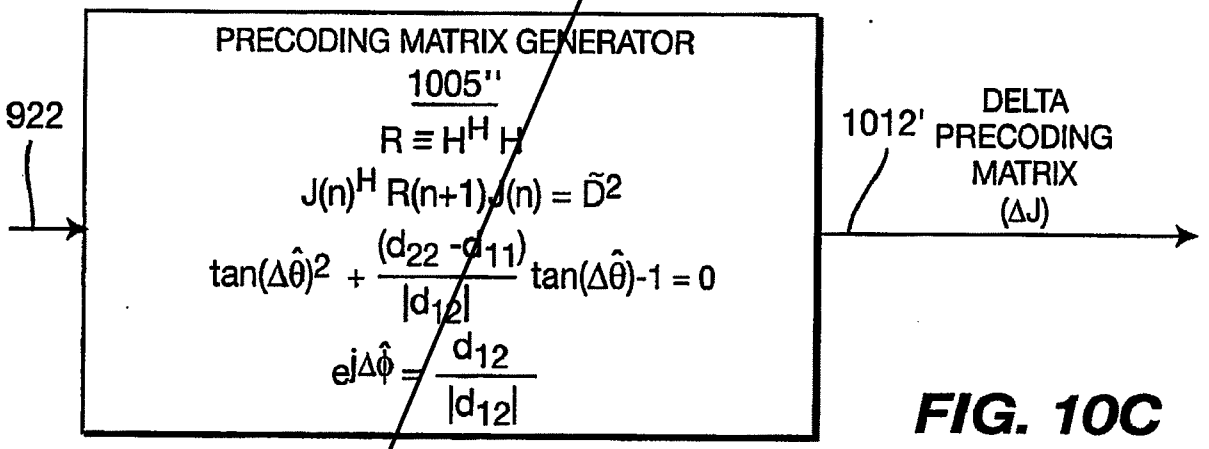


FIG. 10C

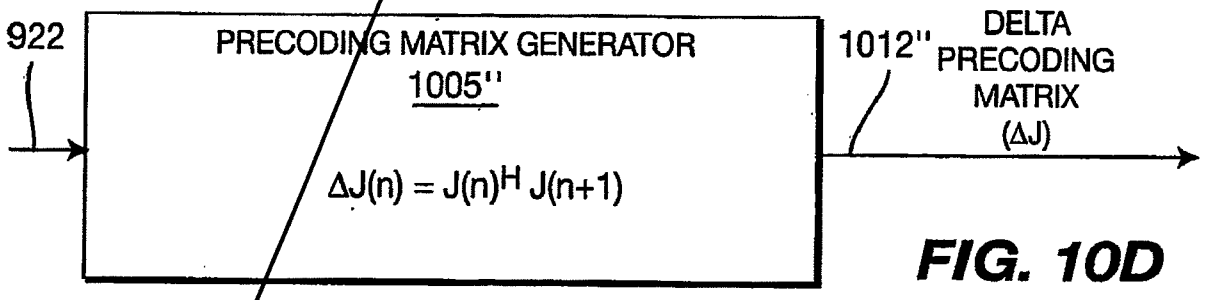


FIG. 10D

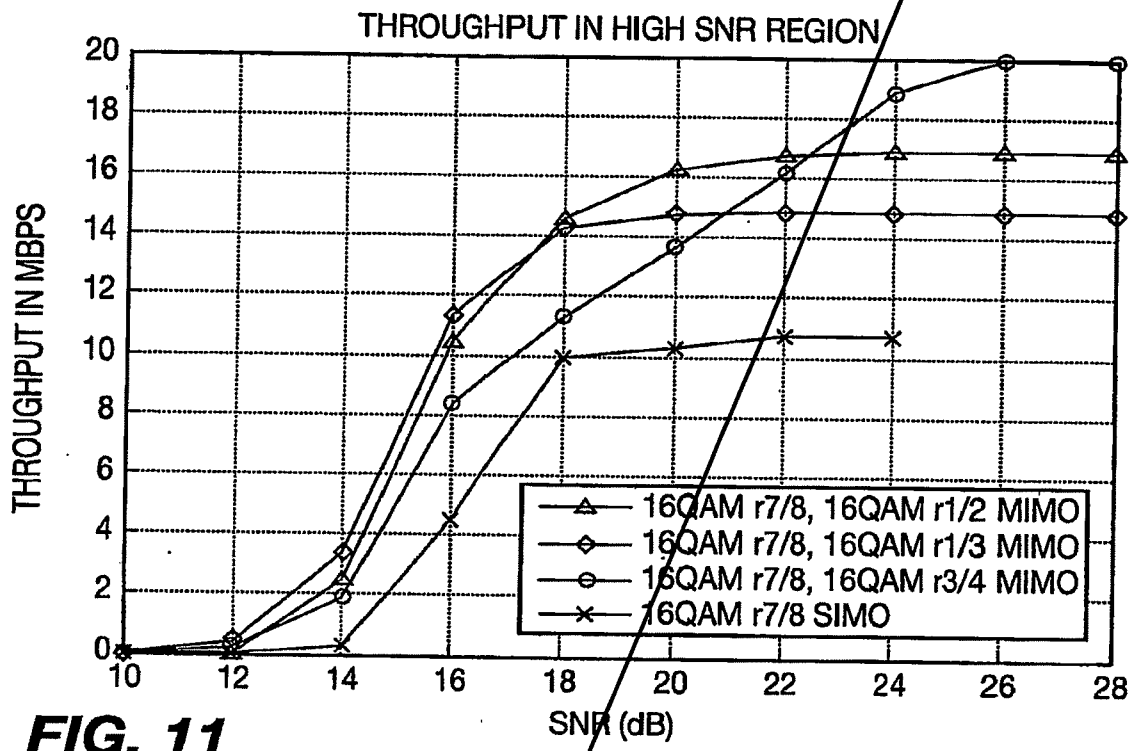

THROUGHPUT IN HIGH SNR REGION
THROUGHPUT IN MBPS
SNR (dB)
16QAM r7/8, 16QAM r1/2 MIMO
16QAM r7/8, 16QAM r1/3 MIMO
16QAM r7/8, 16QAM r3/4 MIMO
16QAM r7/8 SIMO

FIG. 11

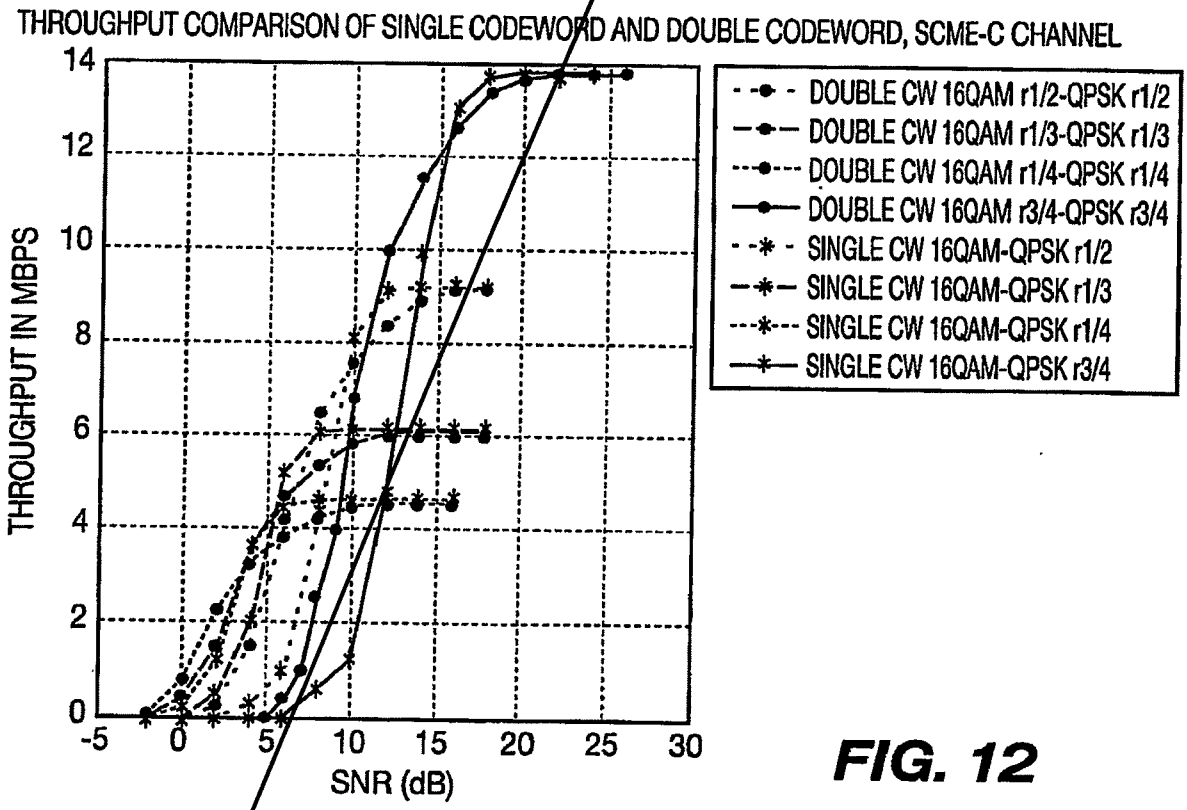

THROUGHPUT COMPARISON OF SINGLE CODEWORD AND DOUBLE CODEWORD, SCME-C CHANNEL
THROUGHPUT IN MBPS
SNR (dB)
DOUBLE CW 16QAM r1/2-QPSK r1/2
DOUBLE CW 16QAM r1/3-QPSK r1/3
DOUBLE CW 16QAM r1/4-QPSK r1/4
DOUBLE CW 16QAM r3/4-QPSK r3/4
SINGLE CW 16QAM-QPSK r1/2
SINGLE CW 16QAM-QPSK r1/3
SINGLE CW 16QAM-QPSK r1/4
SINGLE CW 16QAM-QPSK r3/4

FIG. 12

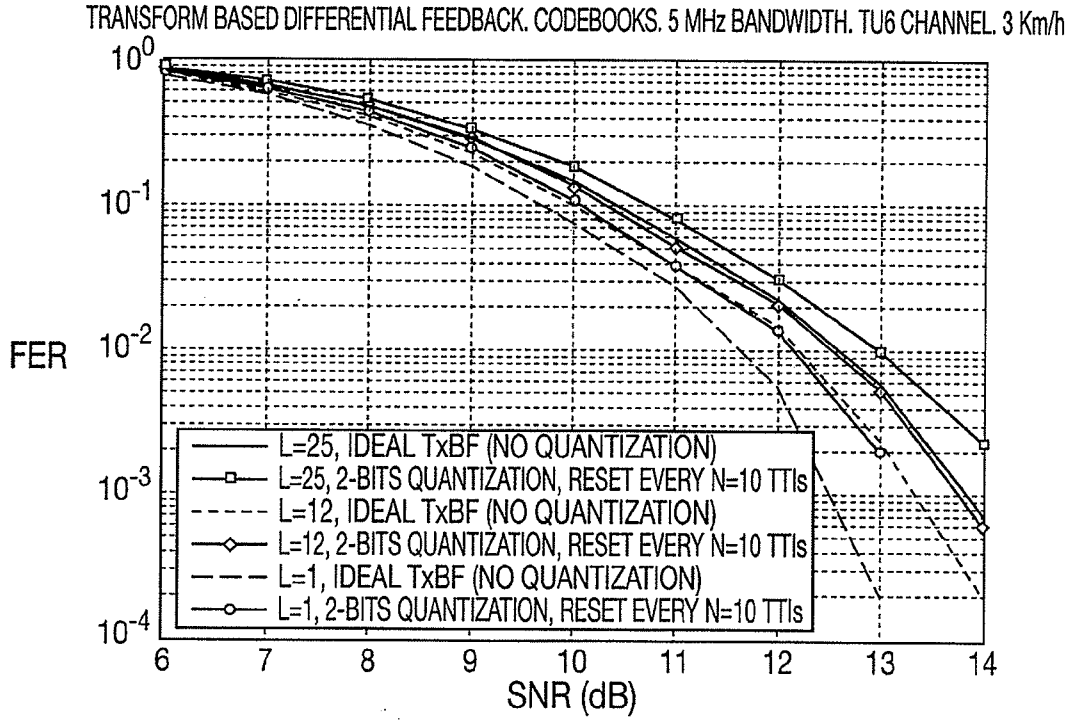

TRANSFORM BASED DIFFERENTIAL FEEDBACK. CODEBOOKS. 5 MHz BANDWIDTH. TU6 CHANNEL. 3 Km/h
FER
SNR (dB)
L=25, IDEAL TxBF (NO QUANTIZATION)
L=25, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs
L=12, IDEAL TxBF (NO QUANTIZATION)
L=12, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs
L=1, IDEAL TxBF (NO QUANTIZATION)
L=1, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs

FIG. 1

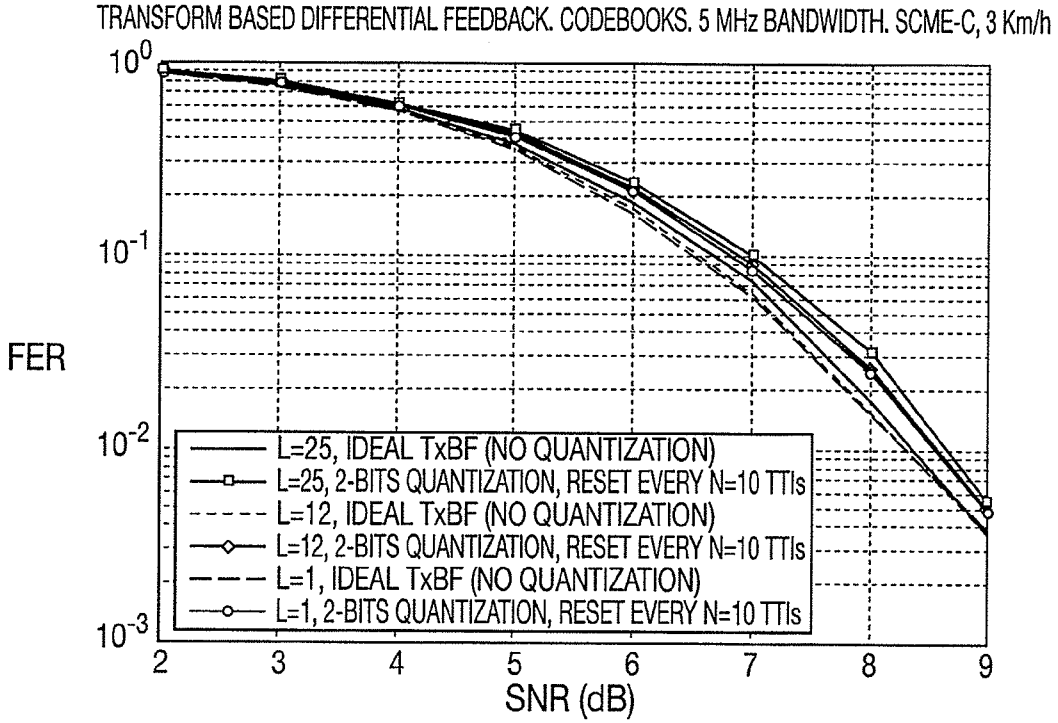

TRANSFORM BASED DIFFERENTIAL FEEDBACK. CODEBOOKS. 5 MHz BANDWIDTH. SCME-C, 3 Km/h
FER
SNR (dB)
L=25, IDEAL TxBF (NO QUANTIZATION)
L=25, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs
L=12, IDEAL TxBF (NO QUANTIZATION)
L=12, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs
L=1, IDEAL TxBF (NO QUANTIZATION)
L=1, 2-BITS QUANTIZATION, RESET EVERY N=10 TTIs

FIG. 2

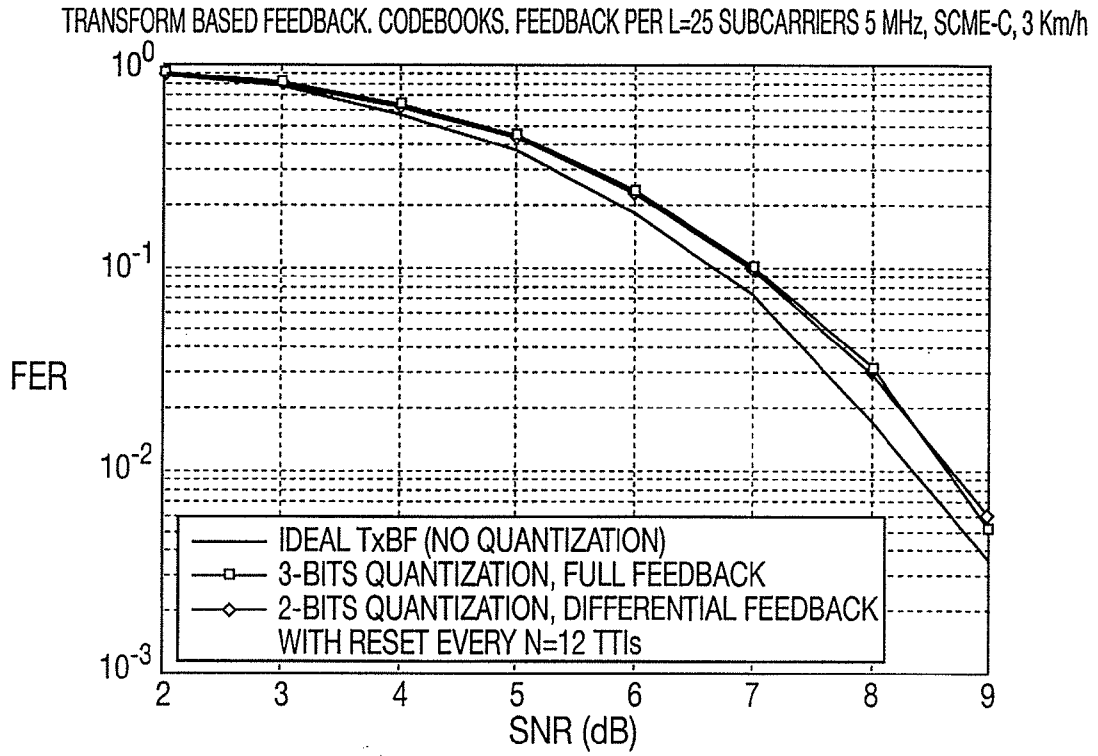

TRANSFORM BASED FEEDBACK. CODEBOOKS. FEEDBACK PER L=25 SUBCARRIERS 5 MHz, SCME-C, 3 Km/h
FER
SNR (dB)
IDEAL TxBF (NO QUANTIZATION)
3-BITS QUANTIZATION, FULL FEEDBACK
2-BITS QUANTIZATION, DIFFERENTIAL FEEDBACK WITH RESET EVERY N=12 TTIs

FIG. 3

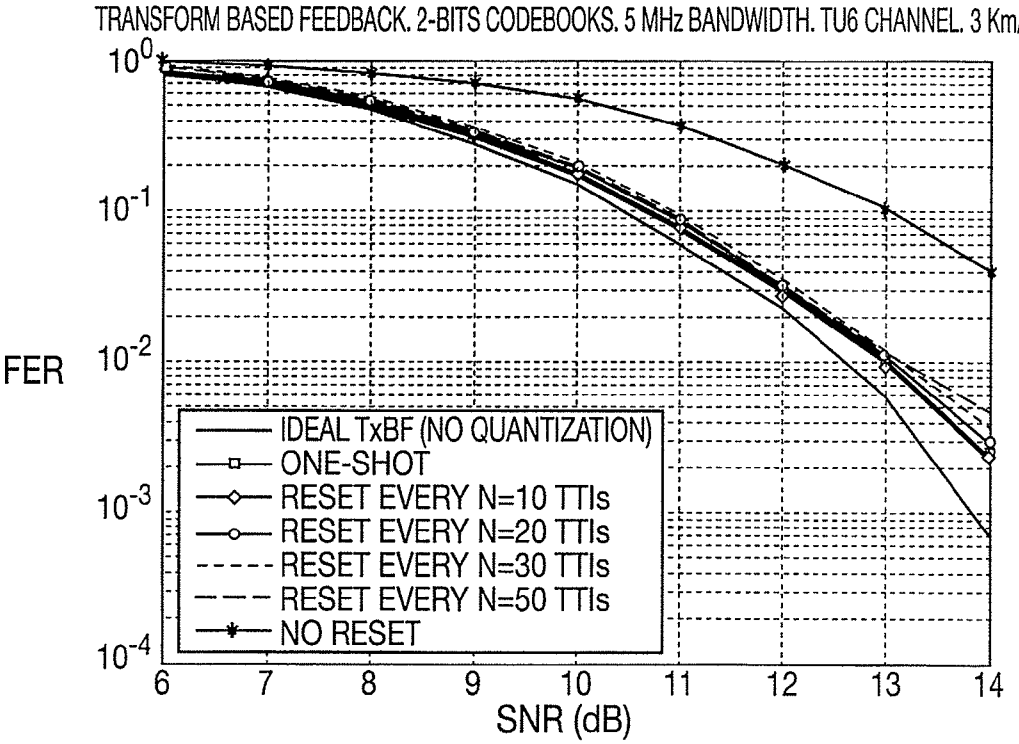

TRANSFORM BASED FEEDBACK. 2-BITS CODEBOOKS. 5 MHz BANDWIDTH. TU6 CHANNEL. 3 Km/h
FER
SNR (dB)
IDEAL TxBF (NO QUANTIZATION)
ONE-SHOT
RESET EVERY N=10 TTIs
RESET EVERY N=20 TTIs
RESET EVERY N=30 TTIs
RESET EVERY N=50 TTIs
NO RESET

FIG. 4

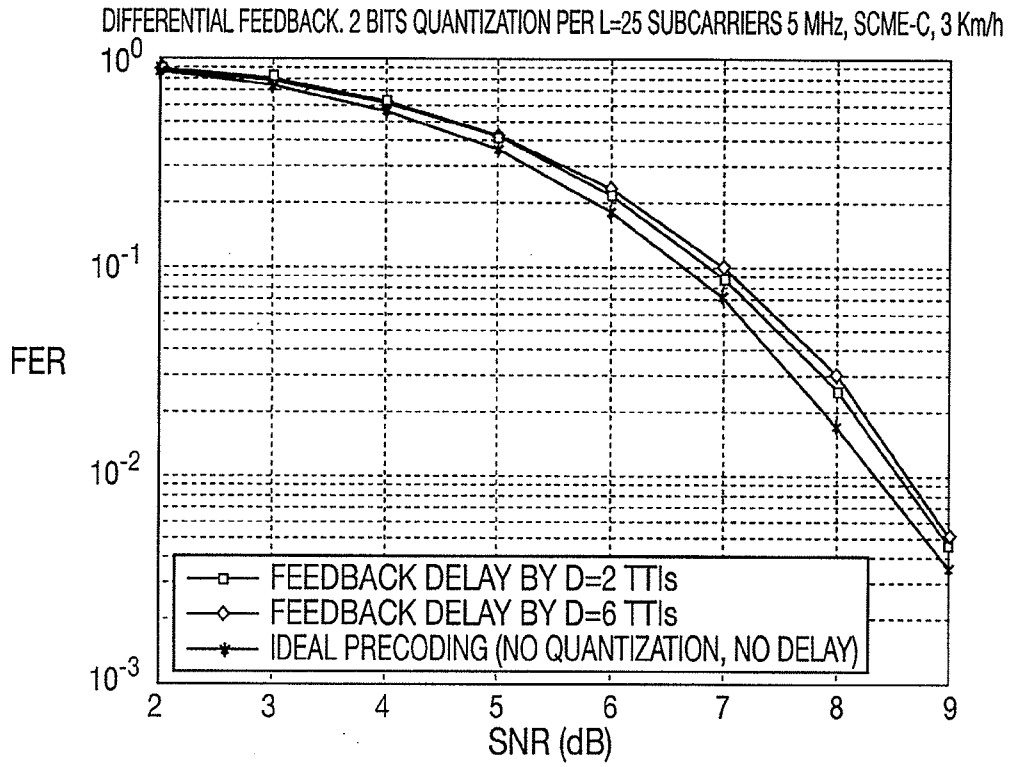

DIFFERENTIAL FEEDBACK. 2 BITS QUANTIZATION PER L=25 SUBCARRIERS 5 MHz, SCME-C, 3 Km/h
FER
SNR (dB)
FEEDBACK DELAY BY D=2 TTIs
FEEDBACK DELAY BY D=6 TTIs
IDEAL PRECODING (NO QUANTIZATION, NO DELAY)

FIG. 5

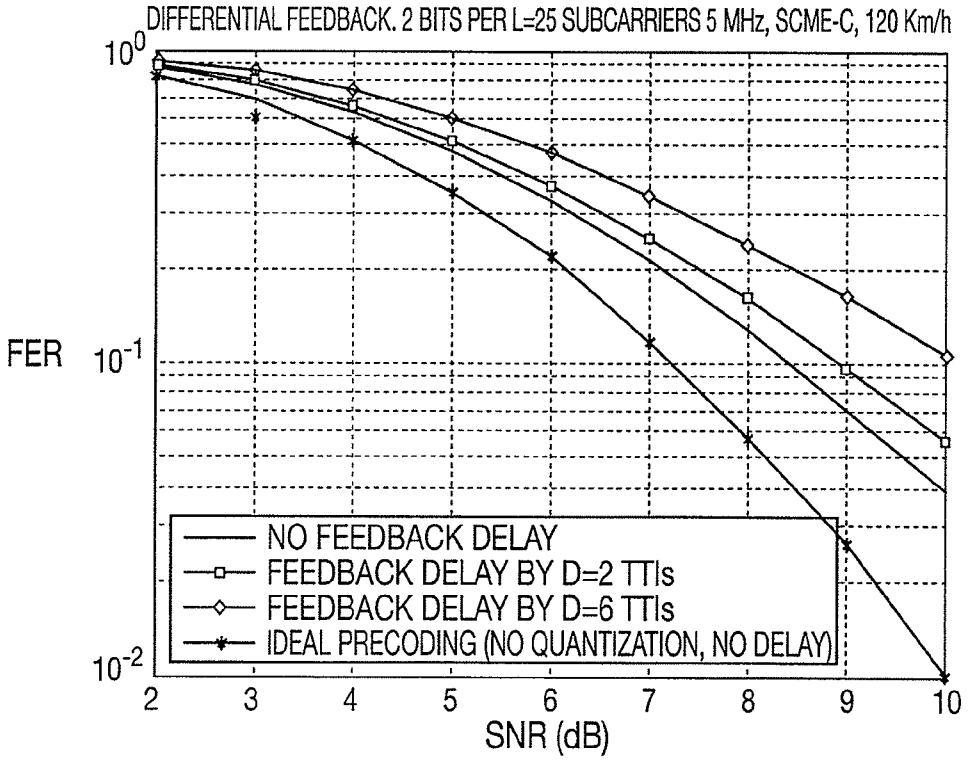

DIFFERENTIAL FEEDBACK. 2 BITS PER L=25 SUBCARRIERS 5 MHz, SCME-C, 120 Km/h
FER
SNR (dB)
NO FEEDBACK DELAY
FEEDBACK DELAY BY D=2 TTIs
FEEDBACK DELAY BY D=6 TTIs
IDEAL PRECODING (NO QUANTIZATION, NO DELAY)

FIG. 6

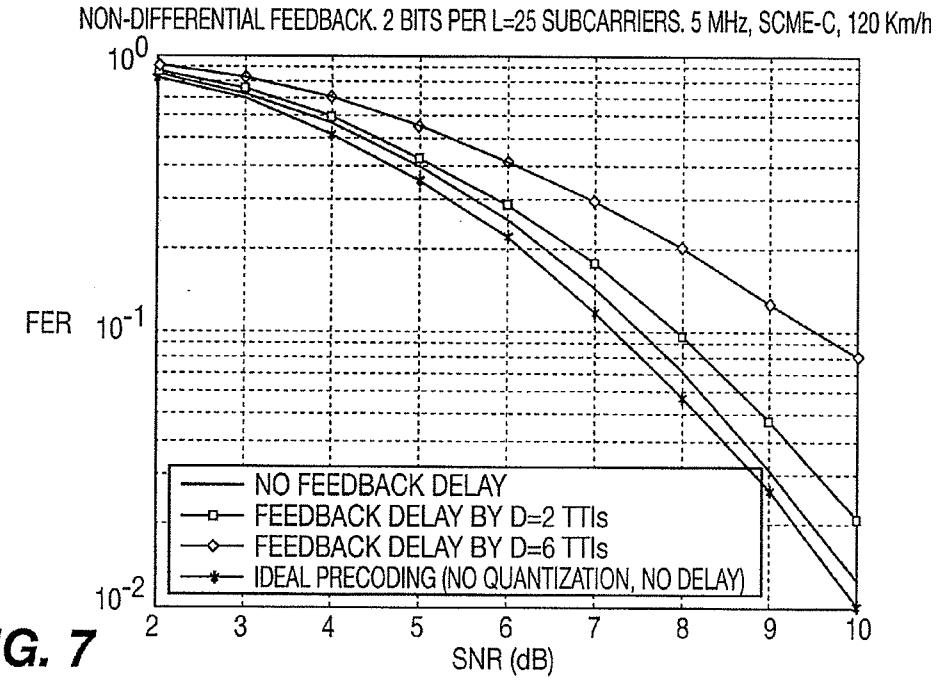


FIG. 7

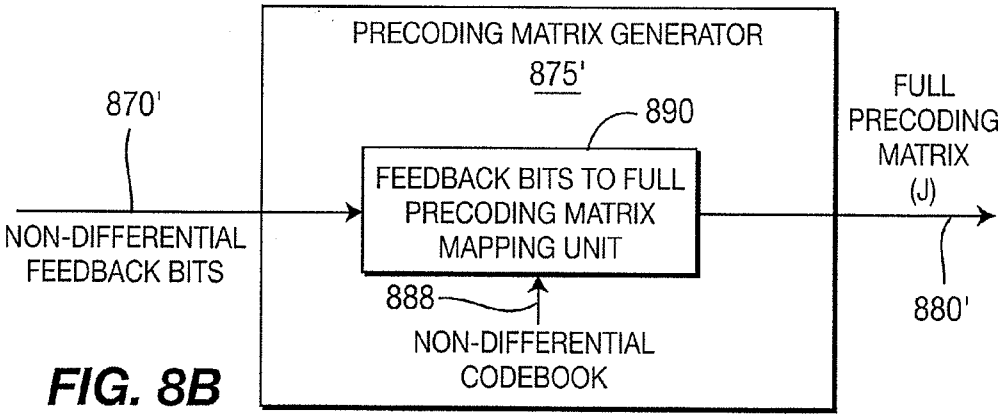


FIG. 8B

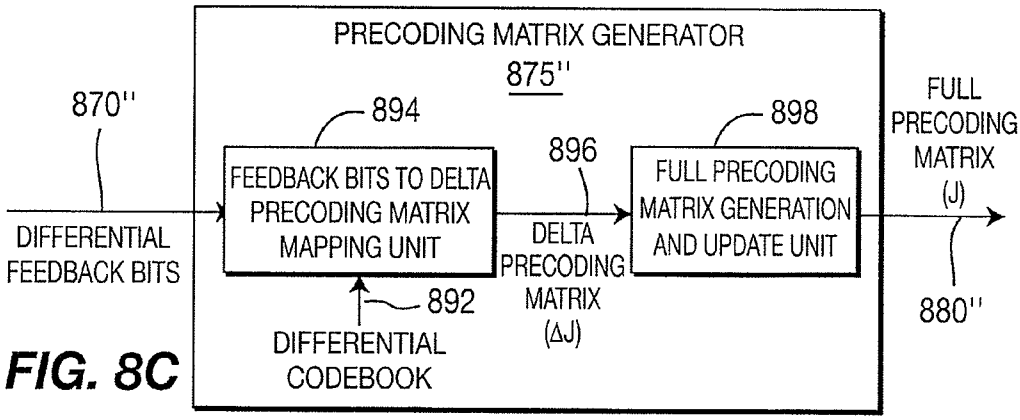


FIG. 8C

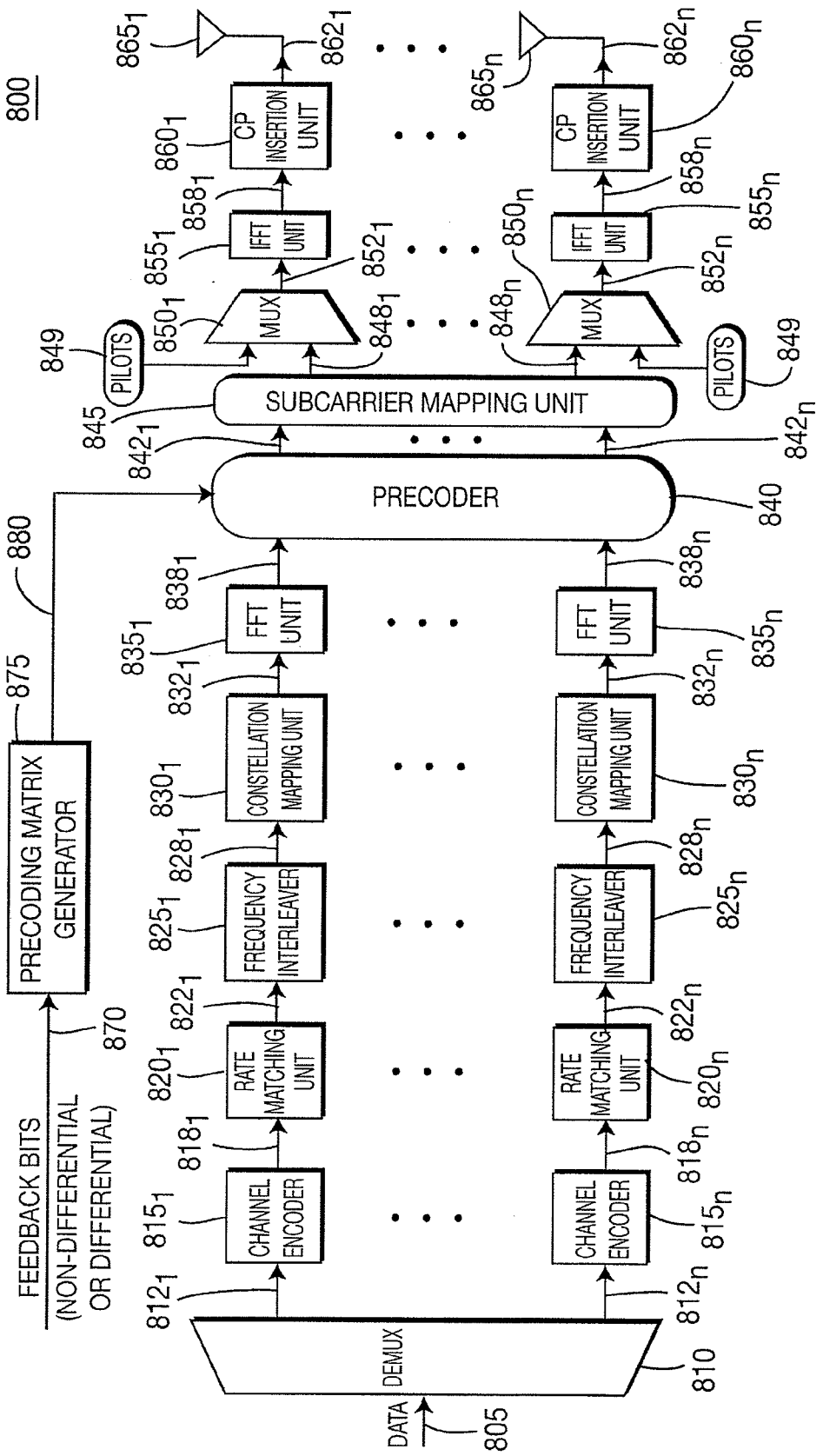

800
DATA
805
DEMUX
810
FEEDBACK BITS
(NON-DIFFERENTIAL
OR DIFFERENTIAL)
870
PRECODING MATRIX
GENERATOR
875
880
CHANNEL ENCODER
RATE MATCHING UNIT
FREQUENCY INTERLEAVER
CONSTELLATION MAPPING UNIT
FFT UNIT
PRECODER
840
SUBCARRIER MAPPING UNIT
845
PILOTS
849
MUX
IFFT UNIT
CP INSERTION UNIT

FIG. 8A

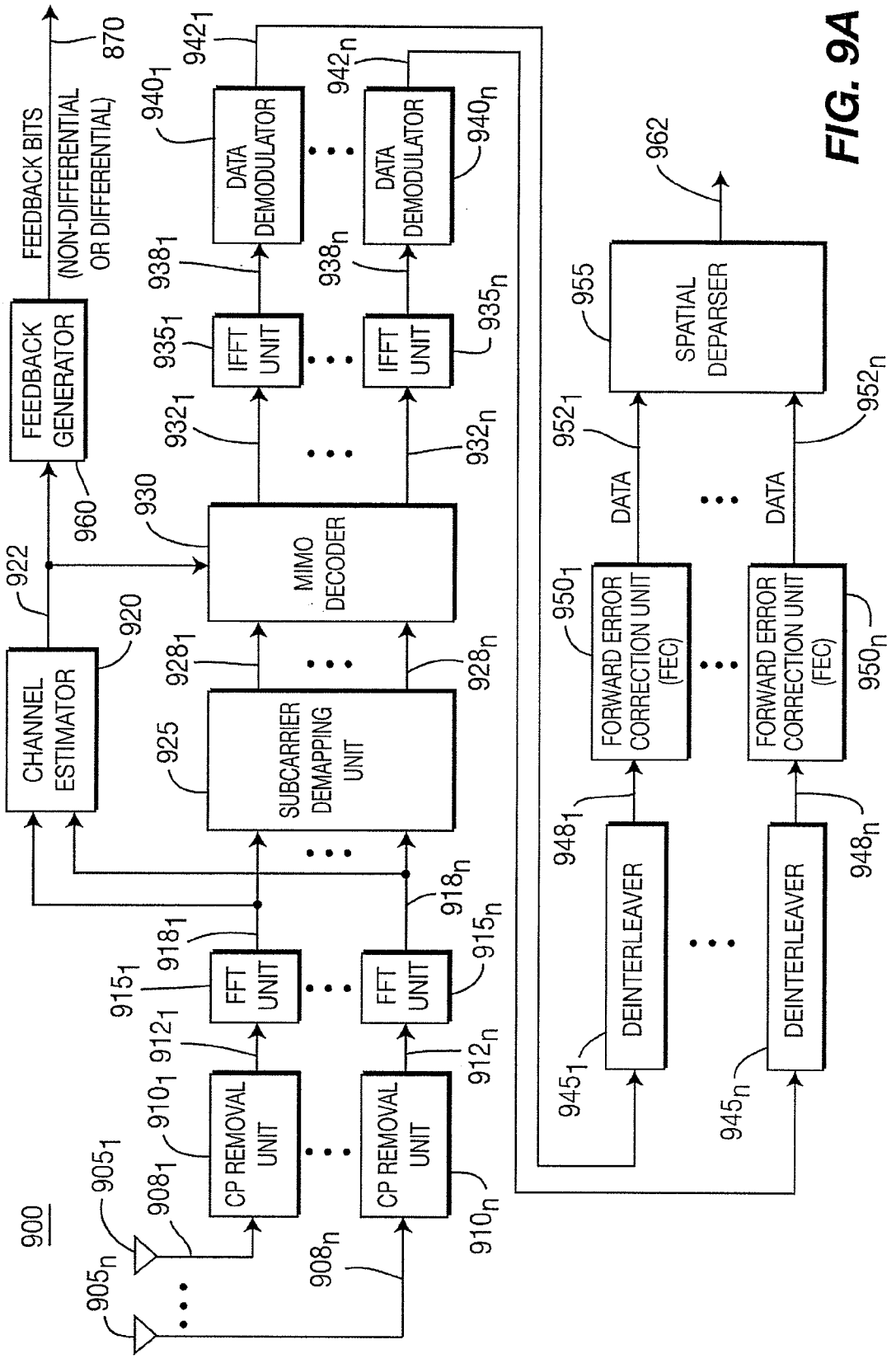

900
905n
905 1
908n
908 1
CP REMOVAL UNIT
CP REMOVAL UNIT
910n
910 1
912n
912 1
FFT UNIT
FFT UNIT
915n
915 1
918n
918 1
CHANNEL ESTIMATOR
920
922
SUBCARRIER DEMAPPING UNIT
925
928n
928 1
MIMO DECODER
930
932n
932 1
IFFT UNIT
IFFT UNIT
935n
935 1
938n
938 1
DATA DEMODULATOR
DATA DEMODULATOR
940n
940 1
942n
942 1
FEEDBACK GENERATOR
960
FEEDBACK BITS (NON-DIFFERENTIAL OR DIFFERENTIAL)
870
FORWARD ERROR CORRECTION UNIT (FEC)
FORWARD ERROR CORRECTION UNIT (FEC)
950n
950 1
952n
952 1
DATA
DATA
SPATIAL DEPARSER
955
962
DEINTERLEAVER
DEINTERLEAVER
948n
948 1
945n
945 1

FIG. 9A

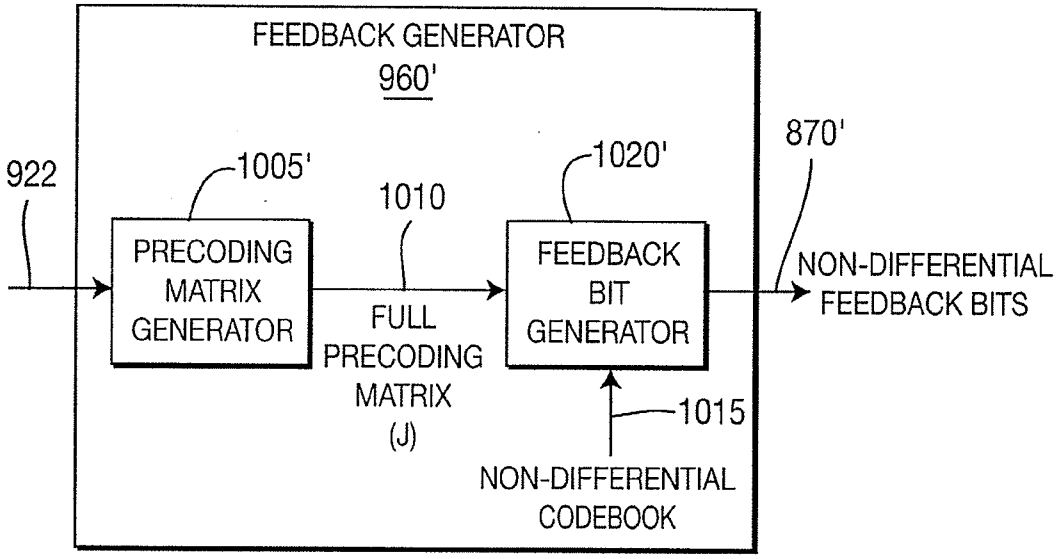

FEEDBACK GENERATOR
960'
922
1005'
PRECODING MATRIX GENERATOR
1010
FULL PRECODING MATRIX (J)
1020'
FEEDBACK BIT GENERATOR
870'
NON-DIFFERENTIAL FEEDBACK BITS
1015
NON-DIFFERENTIAL CODEBOOK

FIG. 9B

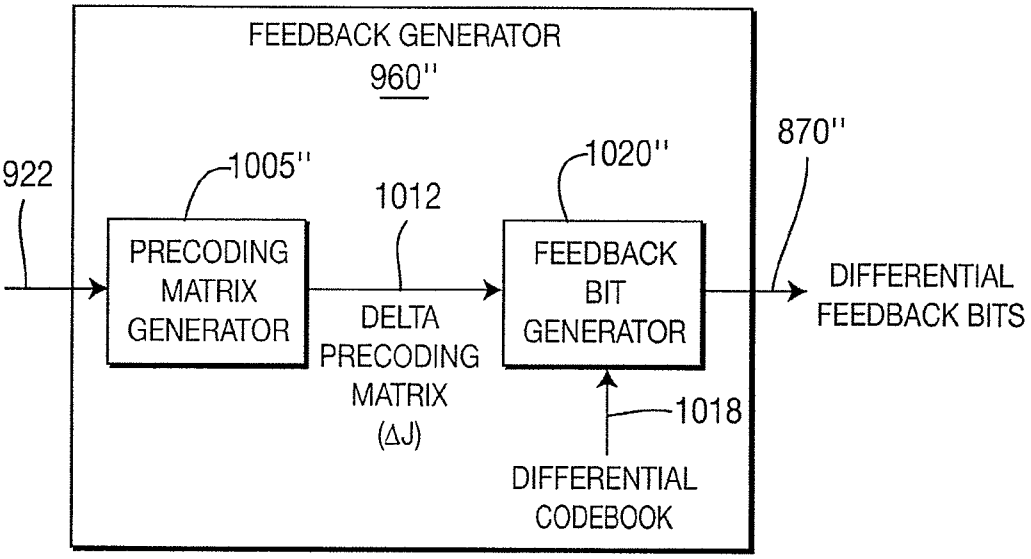

FEEDBACK GENERATOR
960''
922
1005''
PRECODING MATRIX GENERATOR
1012
DELTA PRECODING MATRIX (ΔJ)
1020''
FEEDBACK BIT GENERATOR
870''
DIFFERENTIAL FEEDBACK BITS
1018
DIFFERENTIAL CODEBOOK

FIG. 9C

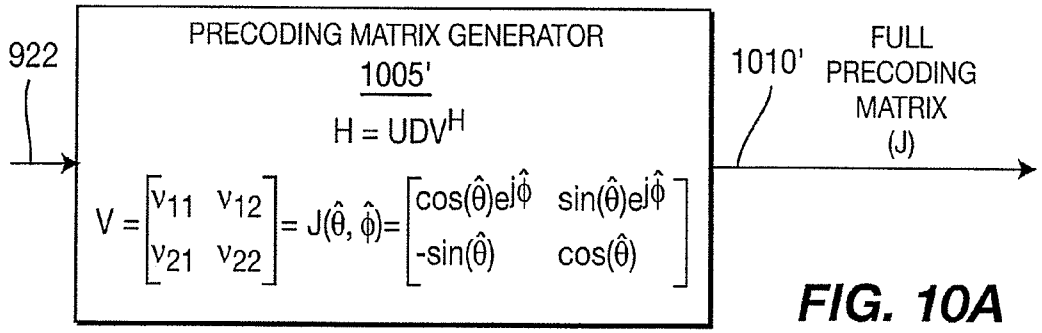


FIG. 10A

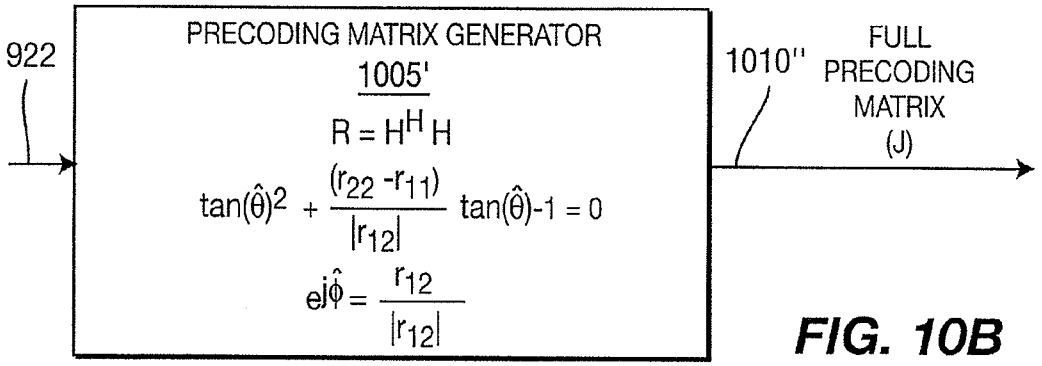


FIG. 10B

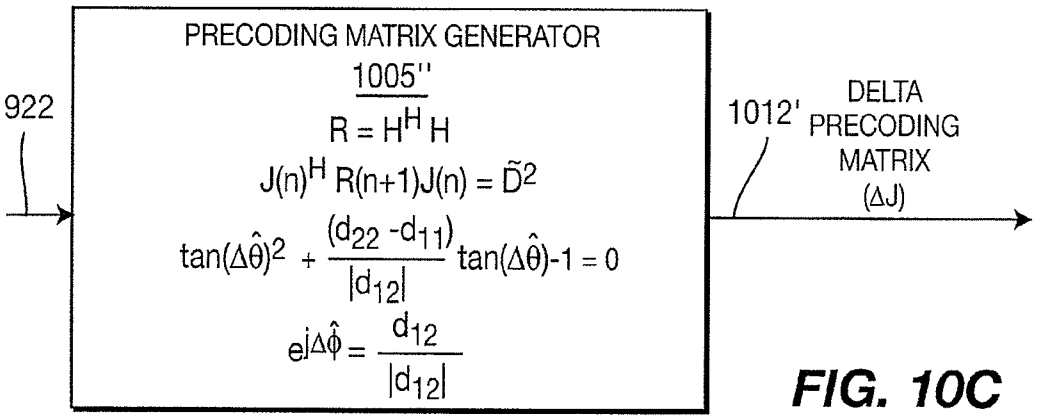


FIG. 10C

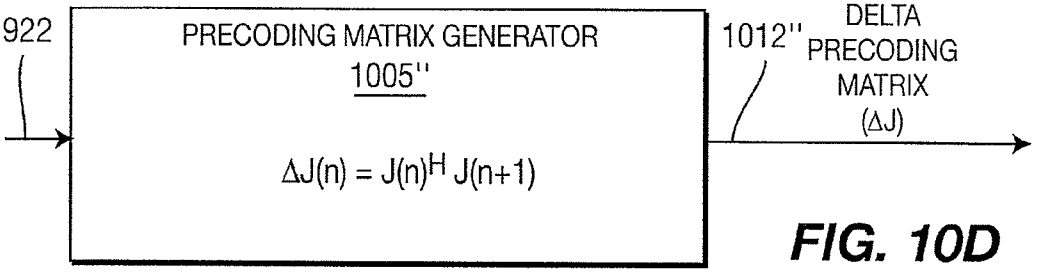


FIG. 10D

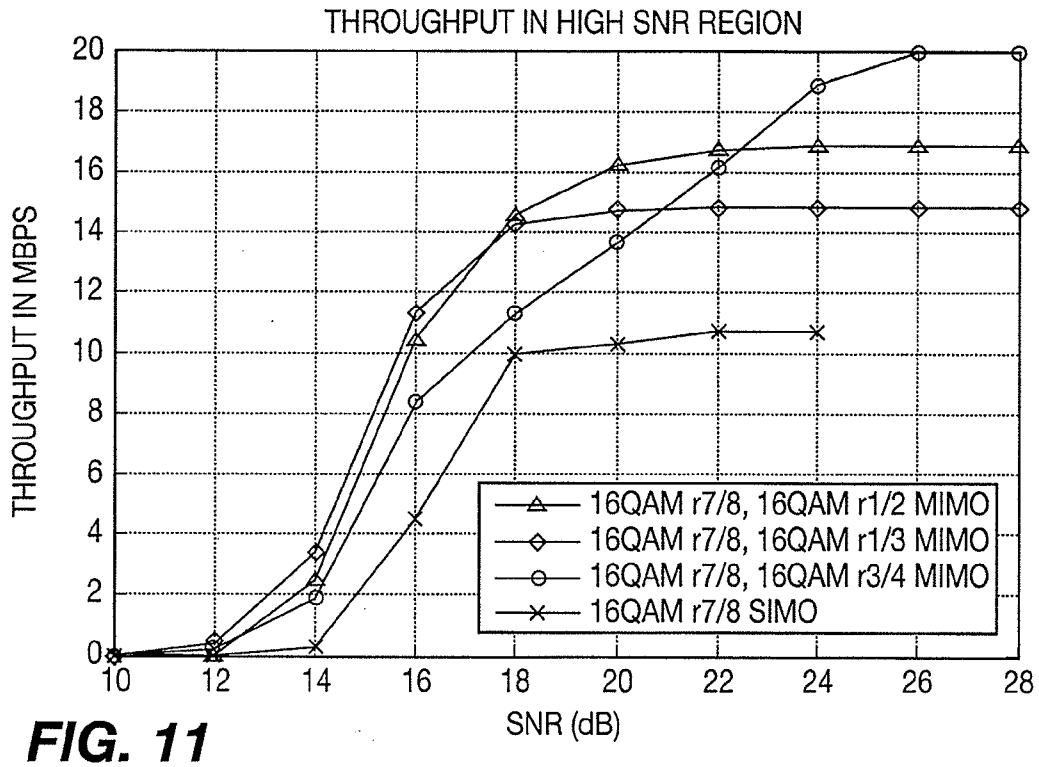

THROUGHPUT IN HIGH SNR REGION
THROUGHPUT IN MBPS
SNR (dB)
16QAM r7/8, 16QAM r1/2 MIMO
16QAM r7/8, 16QAM r1/3 MIMO
16QAM r7/8, 16QAM r3/4 MIMO
16QAM r7/8 SIMO

FIG. 11

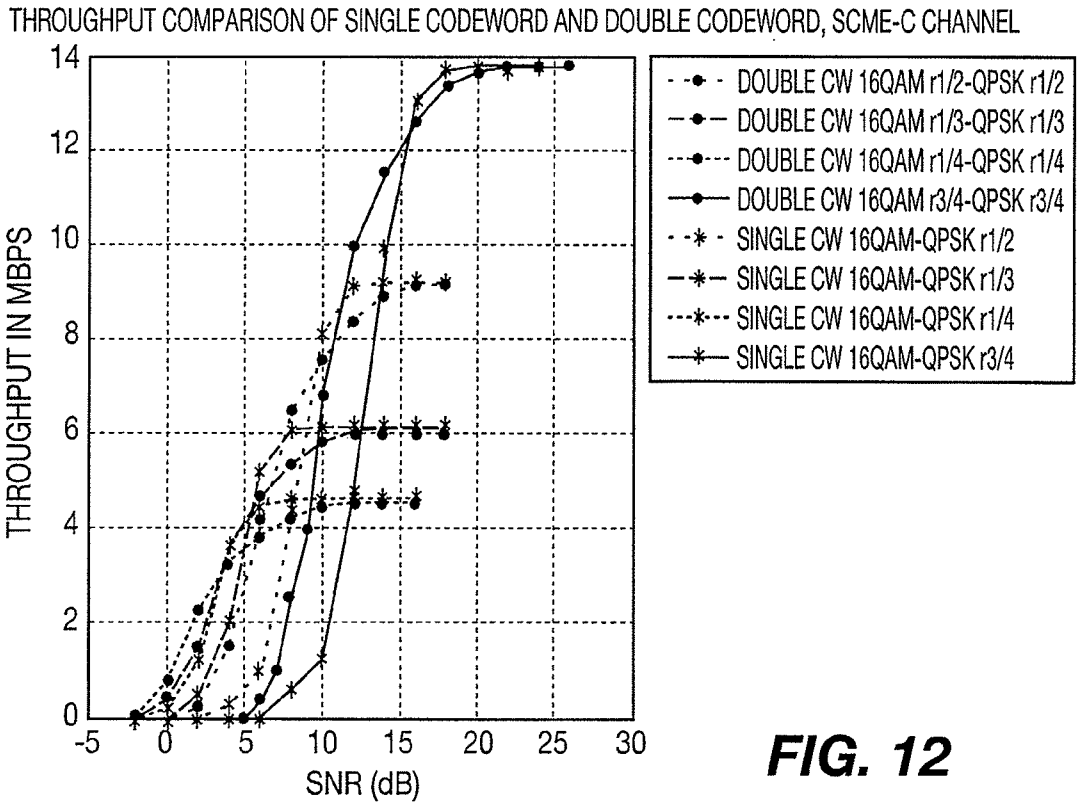

THROUGHPUT COMPARISON OF SINGLE CODEWORD AND DOUBLE CODEWORD, SCME-C CHANNEL
THROUGHPUT IN MBPS
SNR (dB)
DOUBLE CW 16QAM r1/2-QPSK r1/2
DOUBLE CW 16QAM r1/3-QPSK r1/3
DOUBLE CW 16QAM r1/4-QPSK r1/4
DOUBLE CW 16QAM r3/4-QPSK r3/4
SINGLE CW 16QAM-QPSK r1/2
SINGLE CW 16QAM-QPSK r1/3
SINGLE CW 16QAM-QPSK r1/4
SINGLE CW 16QAM-QPSK r3/4

FIG. 12