EXAMPLE 4

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                    INSTITUTE FOR TELECOMMUNICATIONS SCIENCES

                         GROUND WAVE VOICE OF AMERICA(GWVOA)
                 over Smooth and Irregular Homogeneous or Inhomogeneous
                              Earth with Linear Atmosphere
                                  Version 6.1, 4/01/86
                              FRI 25 APR 1986  12:40:42

CHOOSE FROM THE MENU:
     H=HELP
     D=PROGRAM DESCRIPTION
     C=CONCISE DIALOG
     V=VERBOSE DIALOG
     E=EDIT DATA
     S=SUMMARY OF DATA
     P=PROCEED
     Q=QUIT

MENU(VERBOSE)=?

     1 - RECEIVED SIGNAL/NOISE; SINGLE FREQ & DIRECTION (SN)
     2 - RECEIVED SIGNAL/NOISE; MULTIPLE INPUT          (NM)
     3 - ACHIEVABLE DISTANCE; MULTIPLE INPUT            (DM)
PROCESSING OPTION( 1) >?2
INPUT DATA
CR TO SPECIFY DEFUALT OPTIONS AS SHOWN IN PARENS

     1 - DISTANCE UNIT = KM, HEIGHT UNIT = METERS
     2 - DISTANCE UNIT = MILES, HEIGHT UNIT = FT.
METRIC OR ENGLISH( 1) >?

1) FREQUENCY (MHZ)
    UP TO 7 VALUES.  999 INDICATES END OF LIST.
FREQUENCY NO. 1>1
FREQUENCY NO. 2>10
FREQUENCY NO. 3>999

TRANSMITTER ANTENNA HEIGHT (     0.0 TO  12000.0 )
 2) TRANSMITTER ANTENNA HEIGHT(     2.0 M. )? 0

RECEIVER ANTENNA HEIGHT (    0.0 TO  12000.0 )
 3) RECEIVER ANTENNA HEIGHT(    2.0 M. )? 0

     1 - LATS AND LONGS OF BOTH ANTENNAS
     2 - LAT&LONG OF TRANSMITTER, BEARING AND DISTANCE TO RECEIVER
 4) ANTENNA RANGE OPTIONS          ( 1) >?2

DISTANCE BETWEEN ANTENNAS (    1.00 TO 21000.00 )
 5) DISTANCE BETWEEN ANTENNAS(  1.00.00 KM.)?
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TRANSMITTER LATITUDE (-89.99 TO   89.99 )
INPUTS OF THE FORM X,Y,Z IMPLY DEGREES,MINUTES,SECONDS
INPUTS OF THE FORM X.Y IMPLY DECIMAL DEGREES
 6) TRANSMITTER LATITUDE(  40.03 )?

TRANSMITTER LONGITUDE (-180.00 TO  180.00 )
 7) TRANSMITTER LONGITUDE(-105.30 )?

INITIAL BEARING (  0.00 TO 360.00 )
11) INITIAL BEARING( 10.00 )?

BEARING INCREMENT (   .01 TO 360.00 )
12) BEARING INCREMENT( 10.00 )?

FINAL BEARING (  0.00 TO 360.00 )
13) FINAL BEARING(100.00 )? 20

     1 - VERTICAL   (V)
     2 - HORIZONTAL (H)
14) ANTENNA POLARIZATION              ( 1) >

     1 - VERTICAL MONOPOLE                 (VM)
     2 - 3 MONOPOLE ARRAY                  (3M)
     3 - 4 MONOPOLE ARRAY                  (4M)
     4 - 6 MONOPOLE ARRAY                  (6M)
     5 - FERRITE LOOP                      (FL)
     6 - FIELD STRENGTH OPTION             (FS)
     7 - USER GAIN INPUT                   (UG)
15) TRANSMITTER ANTENNA TYPE          ( 1) >?7
FREQUENCY = 1.000

TRANSMITTER GAIN (-100.000 TO  100.000 )
TRANSMITTER GAIN(   0.000 )>? 2
FREQUENCY = 10.000

TRANSMITTER GAIN (-100.000 TO  100.000 )
TRANSMITTER GAIN(   0.000 )>? 7

     1 - VERTICAL MONOPOLE                 (VM)
     2 - 3 MONOPOLE ARRAY                  (3M)
     3 - 4 MONOPOLE ARRAY                  (4M)
     4 - 6 MONOPOLE ARRAY                  (6M)
     5 - FERRITE LOOP                      (FL)
     6 - FIELD STRENGTH OPTION             (FS)
     7 - USER GAIN INPUT                   (UG)
16) RECEIVER ANTENNA TYPE             ( 1) >?7
FREQUENCY =  1.000

RECEIVER    GAIN (-100.000 TO  100.000 )
RECEIVER    GAIN(   0.000 )>? 2
FREQUENCY = 10.000
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EXAMPLE 4 (cont.)

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RECEIVER    GAIN (-100.000 TO  100.000 )
RECEIVER    GAIN(   0.000 )>? 7

ACTUAL TRANSMITTER INPUT POWER (     .0001 TO 10000.0000 )
18) ACTUAL TRANSMITTER INPUT POWER(   1.0000 Kw)?

21) LOCAL TIME OF DAY (FORMAT HHMM)
    UP TO 24 VALUES.  999 INDICATES END OF LIST.
TIME      NO. 1>1200
TIME      NO. 2>1800
TIME      NO. 3>999

22) SEASONS
    UP TO 4 VALUES, 999 INDICATES END OF LIST.
1 - DEC,JAN,FEB(DJF)
2 - MAR,APR,MAY(MAM)
3 - JUN,JUL,AUG(JJA)
4 - SEP,OCT,NOV(SON)
SEASON    NO. 1>1
SEASON    NO. 2>2
SEASON    NO. 3>999

REQUIRED RELIABILITY (   .01 TO 100.00%)
23) REQUIRED RELIABILITY( 90.00%)?

     1 - 127.2   BUSINESS
     2 - 131.5   RESIDENTIAL
     3 - 136.8   RURAL
     4 - 150.4   QUIET RURAL
24) MAN MADE NOISE(-DBW) AT 1 MHZ ( 1) >?

     1 - SMOOTH EARTH            (SE  )
     2 - SMOOTH EARTH, MIXED PATH(SEMP)
26) PROCESSING METHOD            ( 1) >?

EARTH RADIUS RATIO ( .500 TO 3.000 )
27) EARTH RADIUS RATIO(1.333 )?

     1 - SINGLE CALCULATION AT THE RECEIVER
     2 - INCREMENTAL CALCULATIONS BETWEEN XMITTER AND RECEIVER
28) TYPE OF OUTPUT                ( 1) >?2
FIELD CALCULATIONS WILL BE PERFORMED ACCORDING TO THE FOLLOWING PARAMETERS.

MINIMUM DISTANCE FROM XMITTER (    .3000 TO  100.0000 )
29) MINIMUM DISTANCE FROM XMITTER( 100.0000 KM.)? 20

INCREMENTAL DISTANCE (   .00010 TO 100.00000 )
30) INCREMENTAL DISTANCE(  1.00000 KM.)? 20

MAXIMUM DISTANCE FROM XMITTER (  20.0000 TO  100.0000 )
31) MAXIMUM DISTANCE FROM XMITTER( 100.0000 KM.)?
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MENU(SUMMARY)=?P

     1 - YES(Y)
     2 - NO (N)
DO YOU WISH TO PROCESS THIS DATA SET( 1) >?

INPUT TITLE 1 TO 80 CHARACTERS
EXAMPLE 4

INPUT GROUND CONSTANTS FOR BEARING =  10.00
SIGMA = CONDUCTIVITY (.00001 - 100. SIEMENS/METER)
EPSILON = RELATIVE PERMITTIVITY (1 - 100)

SIGMA (   .0000001 TO 100.0000000 )
SIGMA(   .1000000 )>? .01

EPSILON (  1.000 TO 100.000 )
EPSILON(  1.000 )>? 10

MENU(EDIT)=? P
CALCULATION IN PROGRESS

EXAMPLE 4

PROCESSING METHOD = SMOOTH EARTH
TRANSMITTER ANTENNA HEIGHT =    0.0 M.
RECEIVER ANTENNA HEIGHT    =    0.0 M.
TRANSMITTER SITE                          DISTANCE
40.03N - 105.30W                       100.0KM    62.1MI
ANTENNA POLARIZATION = VERTICAL
TRANSMITTER ANTENNA TYPE = USER GAIN INPUT
FREQUENCY =   1.00   TRANSMITTER  GAIN =   1.0000
FREQUENCY =  10.00   TRANSMITTER  GAIN =   7.0000
RECEIVER ANTENNA TYPE    = USER GAIN INPUT
FREQUENCY =   1.00   RECEIVER     GAIN =   2.0000
FREQUENCY =  10.00   RECEIVER     GAIN =   7.0000
EFFECTIVE EARTH RADIUS/ACTUAL EARTH RADIUS = 1.333
ACTUAL TRANSMITTER INPUT POWER =   1.0000KW
MAN MADE NOISE(-DBW) AT 1 MHZ =  127.20DBW
REQUIRED RELIABILITY = 90.0%
PRESS CR TO CONTINUE

SIGMA(CONDUCTIVITY) =    .0100000          EPSILON(DIELECTRIC CONSTANT) =  10.00
F= 1.00MHZ  GT=   2.0  GR=   2.0   BEARING=  10.0  DEC,JAN,FEB  1200LT
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EXAMPLE 4 (cont.)

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	57.1	-23.1	-118.2	95.1	76.1	40.9	-105.1
40.00	67.3	-33.3	-118.2	84.9	65.9	40.9	-105.1
60.00	74.6	-40.6	-118.2	77.6	58.6	40.9	-105.1
80.00	80.4	-46.4	-118.2	71.8	52.8	40.9	-105.1
100.00	85.2	-51.2	-118.2	67.0	48.0	40.9	-105.1

F= 1.00MHZ GT= 2.0 GR= 2.0 BEARING= 10.0 DEC,JAN,FEB 1800LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	57.1	-23.1	-118.0	94.9	76.1	40.9	-105.1
40.00	67.3	-33.3	-118.0	84.7	65.9	40.9	-105.1

PRESS CR TO CONTINUE

60.00	74.6	-40.6	-118.0	77.4	58.6	40.9	-105.1
80.00	80.4	-46.4	-118.0	71.6	52.8	40.9	-105.1
100.00	85.2	-51.2	-118.0	66.8	48.0	40.9	-105.1

F= 1.00MHZ GT= 2.0 GR= 2.0 BEARING= 10.0 MAR,APR,MAY 1200LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	57.1	-23.1	-118.2	95.1	76.1	40.9	-105.1
40.00	67.3	-33.3	-118.2	84.9	65.9	40.9	-105.1
60.00	74.6	-40.6	-118.2	77.6	58.6	40.9	-105.1
80.00	80.4	-46.4	-118.2	71.8	52.8	40.9	-105.1
100.00	85.2	-51.2	-118.2	67.0	48.0	40.9	-105.1

F= 1.00MHZ GT= 2.0 GR= 2.0 BEARING= 10.0 MAR,APR,MAY 1800LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	57.1	-23.1	-113.6	90.5	76.1	40.9	-105.1

PRESS CR TO CONTINUE

40.00	67.3	-33.3	-113.6	80.3	65.9	40.9	-105.1
60.00	74.6	-40.6	-113.6	73.1	58.6	40.9	-105.1
80.00	80.4	-46.4	-113.6	67.2	52.8	40.9	-105.1
100.00	85.2	-51.2	-113.6	62.4	48.0	40.9	-105.1

SIGMA(CONDUCTIVITY) = .0100000 EPSILON(DIELECTRIC CONSTANT) = 10.00

F=10.00MHZ GT= 7.0 GR= 7.0 BEARING= 10.0 DEC,JAN,FEB 1200LT

EXAMPLE 4 (cont.)

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	118.8	-74.8	-145.8	71.0	39.4	40.9	-105.1
40.00	131.9	-87.9	-145.8	57.8	26.3	40.9	-105.1
60.00	140.3	-96.3	-145.8	49.5	17.9	40.9	-105.1
80.00	146.8	-102.8	-145.8	42.9	11.4	40.9	-105.1
100.00	152.5	-108.5	-145.8	37.3	5.7	40.9	-105.1

F=10.00MHZ GT= 7.0 GR= 7.0 BEARING= 10.0 DEC,JAN,FEB 1800LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	118.8	-74.8	-145.5	70.7	39.4	40.9	-105.1
40.00	131.9	-87.9	-145.5	57.6	26.3	40.9	-105.1

PRESS CR TO CONTINUE

60.00	140.3	-96.3	-145.5	49.2	17.9	40.9	-105.1
80.00	146.8	-102.8	-145.5	42.7	11.4	40.9	-105.1
100.00	152.5	-108.5	-145.5	37.0	5.7	40.9	-105.1

F=10.00MHZ GT= 7.0 GR= 7.0 BEARING= 10.0 MAR,APR,MAY 1200LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	118.8	-74.8	-145.7	70.9	39.4	40.9	-105.1
40.00	131.9	-87.9	-145.7	57.8	26.3	40.9	-105.1
60.00	140.3	-96.3	-145.7	49.5	17.9	40.9	-105.1
80.00	146.8	-102.8	-145.7	42.9	11.4	40.9	-105.1
100.00	152.5	-108.5	-145.7	37.3	5.7	40.9	-105.1

F=10.00MHZ GT= 7.0 GR= 7.0 BEARING= 10.0 MAR,APR,MAY 1800LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	118.8	-74.8	-144.1	69.3	39.4	40.9	-105.1

PRESS CR TO CONTINUE

40.00	131.9	-87.9	-144.1	56.2	26.3	40.9	-105.1
60.00	140.3	-96.3	-144.1	47.8	17.9	40.9	-105.1
80.00	146.8	-102.8	-144.1	41.3	11.4	40.9	-105.1
100.00	152.5	-108.5	-144.1	35.6	5.7	40.9	-105.1

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INPUT GROUND CONSTANTS FOR BEARING = 20.00
SIGMA = CONDUCTIVITY (.00001 - 100. SIEMENS/METER)
EPSILON = RELATIVE PERMITTIVITY (1 - 100)

SIGMA (   .0000001 TO 100.0000000 )
SIGMA(   .1000000 )>? .05

EPSILON (  1.000 TO 100.000 )
EPSILON(  1.000 )>? 15
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EXAMPLE 4 (cont.)

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MENU(EDIT)=? P
CALCULATION IN PROGRESS
SIGMA(CONDUCTIVITY) =      .0500000            EPSILON(DIELECTRIC CONSTANT) = 15.00
F= 1.00MHZ  GT=   2.0   GR=   2.0   BEARING=  20.00   DEC,JAN,FEB 1200LT

                        RCV/D                     RCV/D                     RCV/R
DISTANCE   LOSS         POWER       NOISE       S/N DENS     E FIELD     COORDINATES
 ( KM.)    (DB)         (DBW)      (DBW/HZ)       (DB)        (DBU)      LAT     LONG
  20.00     53.4         -19.4      -118.2        98.8          79.8     40.9    -104.9
  40.00     60.5         -26.5      -118.2        91.7          72.7     40.9    -104.9
  60.00     65.0         -31.0      -118.2        87.1          68.2     40.9    -104.9
  80.00     68.6         -34.6      -118.2        83.6          64.6     40.9    -104.9
 100.00     71.6         -37.6      -118.2        80.6          61.6     40.9    -104.9
F= 1.00MHZ  GT=  2.0   GR=   2.0   BEARING=     20.0   DEC,JAN,FEB  1800LT

                        RCV/D                     RCV/D                     RCV/R
DISTANCE   LOSS         POWER       NOISE       S/N DENS     E FIELD     COORDINATES
 ( KM.)    (DB)         (DBW)      (DBW/HZ)       (DB)        (DBU)      LAT     LONG
  20.00     53.4         -19.4      -118.0        98.6          79.8     40.9    -104.9
  40.00     60.5         -26.5      -118.0        91.5          72.7     40.9    -104.9
PRESS CR TO CONTINUE

  60.00     65.0         -31.0      -118.0        86.9          68.2     40.9    -104.9
  80.00     68.6         -34.6      -118.0        83.4          64.6     40.9    -104.9
 100.00     71.6         -37.6      -118.0        80.4          61.6     40.9    -104.9
F= 1.00MHZ  GT=  2.0   GR=   2.0   BEARING=     20.0   MAR,APR,MAY  1200LT

                        RCV/D                     RCV/D                     RCV/R
DISTANCE   LOSS         POWER       NOISE       S/N DENS     E FIELD     COORDINATES
 ( KM.)    (DB)         (DBW)      (DBW/HZ)       (DB)        (DBU)      LAT     LONG
  20.00     53.4         -19.4      -118.2        98.8          79.8     40.9    -104.9
  40.00     60.5         -26.5      -118.2        91.7          72.7     40.9    -104.9
  60.00     65.0         -31.0      -118.2        87.1          68.2     40.9    -104.9
  80.00     68.6         -34.6      -118.2        83.6          64.6     40.9    -104.9
 100.00     71.6         -37.6      -118.2        80.6          61.6     40.9    -104.9
F= 1.00MHZ  GT=  2.0   GR=   2.0   BEARING=     20.0   MAR,APR,MAY  1800LT

                        RCV/D                     RCV/D                     RCV/R
DISTANCE   LOSS         POWER       NOISE       S/N DENS     E FIELD     COORDINATES
 ( KM.)    (DB)         (DBW)      (DBW/HZ)       (DB)        (DBU)      LAT     LONG
  20.00     53.4         -19.4      -113.6        94.2          79.8     40.9    -104.9
PRESS CR TO CONTINUE

  40.00     60.5         -26.5      -113.6        87.1          72.7     40.9    -104.9
  60.00     65.0         -31.0      -113.6        82.5          68.2     40.9    -104.9
  80.00     68.6         -34.6      -113.6        79.0          64.6     40.9    -104.9
 100.00     71.6         -37.6      -113.6        76.0          61.6     40.9    -104.9
SIGMA(CONDUCTIVITY) =      .0500000            EPSILON(DIELECTRIC CONSTANT) = 15.00
F=10.00MHZ  GT=  7.0   GR=   7.0   BEARING=     20.0   DEC,JAN,FEB  1200LT
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EXAMPLE 4 (cont.)

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	105.5	-61.5	-145.8	84.3	52.7	40.9	-104.9
40.00	118.8	-74.8	-145.8	71.0	39.4	40.9	-104.9
60.00	127.1	-83.1	-145.8	62.7	31.1	40.9	-104.9
80.00	133.6	-89.6	-145.8	56.1	24.6	40.9	-104.9
100.00	139.3	-95.3	-145.8	50.5	18.9	40.9	-104.9

F=10.00MHZ GT= 7.0 GR= 7.0 BEARING= 20.0 DEC,JAN,FEB 1800LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	105.5	-61.5	-145.5	84.0	52.7	40.9	-104.9
40.00	118.8	-74.8	-145.5	70.7	39.4	40.9	-104.9

PRESS CR TO CONTINUE

60.00	127.1	-83.1	-145.5	62.4	31.1	40.9	-104.9
80.00	133.6	-89.6	-145.5	55.9	24.6	40.9	-104.9
100.00	139.3	-95.3	-145.5	50.3	18.9	40.9	-104.9

F=10.00MHZ GT= 7.0 GR= 7.0 BEARING= 20.0 MAR,APR,MAY 1200LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	105.5	-61.5	-145.7	84.3	52.7	40.9	-104.9
40.00	118.8	-74.8	-145.7	71.0	39.4	40.9	-104.9
60.00	127.1	-83.1	-145.7	62.6	31.1	40.9	-104.9
80.00	133.6	-89.6	-145.7	56.1	24.6	40.9	-104.9
100.00	139.3	-95.3	-145.7	50.5	18.9	40.9	-104.9

F=10.00MHZ GT= 7.0 GR= 7.0 BEARING= 20.0 MAR,APR,MAY 1800LT

DISTANCE (KM.)	LOSS (DB)	RCV/D POWER (DBW)	NOISE (DBW/HZ)	RCV/D S/N DENS (DB)	E FIELD (DBU)	RCV/R COORDINATES LAT	LONG
20.00	105.5	-61.5	-144.1	82.6	52.7	40.9	-104.9

PRESS CR TO CONTINUE

40.00	118.8	-74.8	-144.1	69.3	39.4	40.9	-104.9
60.00	127.1	-83.1	-144.1	61.0	31.1	40.9	-104.9
80.00	133.6	-89.6	-144.1	54.5	24.6	40.9	-104.9
100.00	139.3	-95.3	-144.1	48.9	18.9	40.9	-104.9

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  1 - YES(Y)
  2 - NO (N)
DO YOU WISH TO PROCESS ANOTHER DATA SET( 1) >?2
PROGRAM GWVOA COMPLETED
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