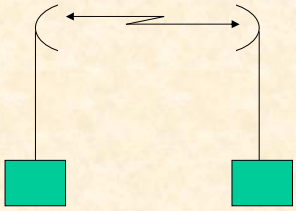
1. **Point-to-area communication**
2. **Coordination**
3. **Interference**

SMS4DC training seminar
27 November – 1 December 2006

Type of communications (ITU-R V.662-3) **:**

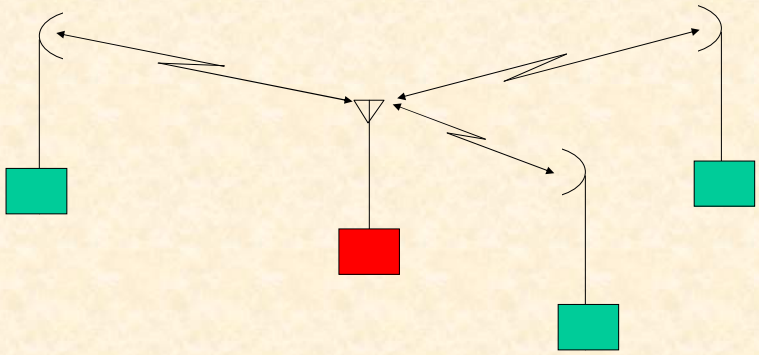
- **point-to-point communication (2.07)**
- **point-to-multipoint communication (2.08)**
- **point-to-area communication (2.09)**

Point-to-point communication:
Communication provided by a link, for example, a radio-relay link between two stations located at specified fixed points



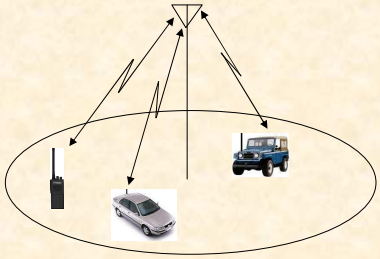
Point-to-multipoint communication:

Communication provided by links, for example, radio-relay links between a single station located at a specified fixed point and a number of stations located at specified fixed points.

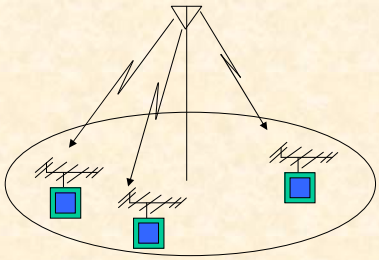


Point-to-area communication:

Communication provided by links between a station located at a specified fixed point and any number of stations located at non-specified points in a given area which is the *coverage area* of the station located at the fixed point.



Land Mobile



Broadcasting

ITU-R recommendations for point-to-area communication :

- P.370 (Broadcasting)

  VHF AND UHF PROPAGATION CURVES FOR THE FREQUENCY RANGE FROM 30 MHz TO 1 000 MHz

  Broadcasting services

- P.529 (Land Mobile)

  PREDICTION METHODS FOR THE TERRESTRIAL LAND MOBILE SERVICE IN THE VHF AND UHF BANDS

- P.1546 (Land Mobile & Broadcasting)

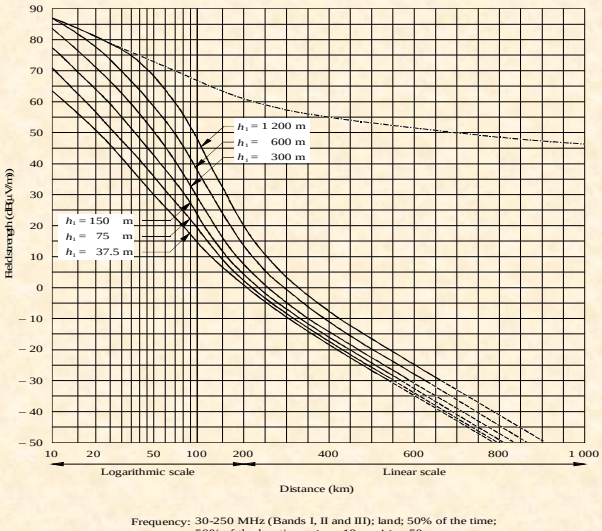
  METHOD FOR POINT-TO-AREA PREDICTIONS FOR TERRESTRIAL SERVICES IN THE FREQUENCY RANGE 30 MHz TO 3 000 MHz

P.370

h1 : the effective height of the transmitting antenna is defined as its height over the average level of the ground between distances of 3 and 15 km from the transmitter in the direction of the receiver

FIGURE 1a

Field strength (dB(μV/m)) for 1 kW e.r.p.



Frequency: 30-250 MHz (Bands I, II and III); land; 50% of the time; 50% of the locations; h_2 = 10 m; Δh = 50 m

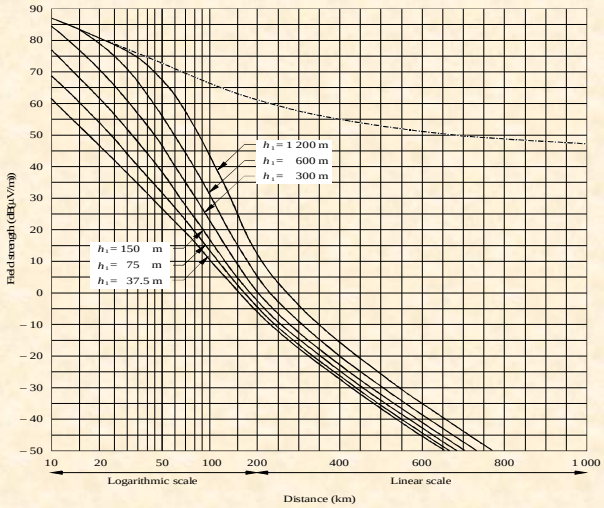
Free space

D01

P.370 (Cont.)

FIGURE 9

Field strength (dB(μV/m)) for 1 kW e.r.p.



Frequency: 450-1 000 MHz (Bands IV and V); land; 50% of the time; 50% of the locations; h_2 = 10 m; Δh = 50 m

Free space

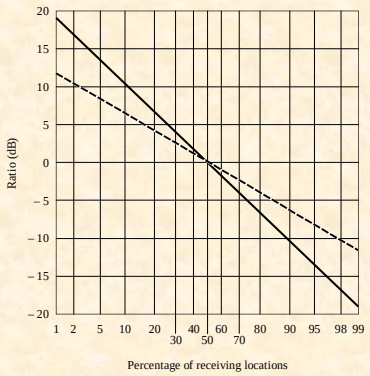
D16

P.370 (Cont.)

For locations other than 50%, probability distribution curves are presented in Figs. 5 and 12.

FIGURE 5

Ratio (dB) of the field strength for a given percentage of the receiving locations to the field strength for 50% of the receiving locations



Frequency: 30-250 MHz (Bands I, II and III)

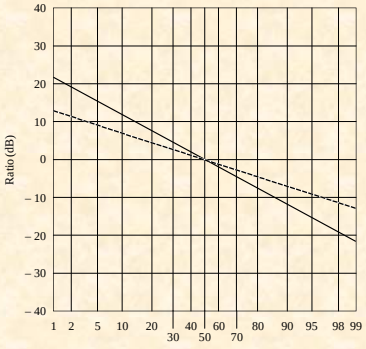
Analogue systems

Digital systems (>1.5 MHz bandwidth)

D12

FIGURE 12

Ratio (dB) of the field strength for a given percentage of the receiving locations to the field strength for 50% of the receiving locations



Frequency: 450-1 000 MHz (Bands IV and V)

Analogue systems

Digital systems (>1.5 MHz bandwidth)

D19

P.370 (Cont.)

Δ*h* : the parameter Δ*h* is used to define the degree of terrain irregularity; for broadcasting services it is applied in the range 10 km to 50 km from the transmitter.

FIGURE 6
Application of the parameter Δ*h* for broadcasting services

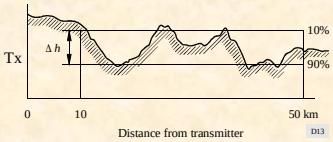


FIGURE 7
Attenuation correction factor as a function of the distance *d* (km) and Δ*h*

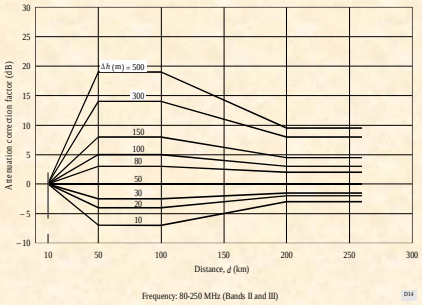
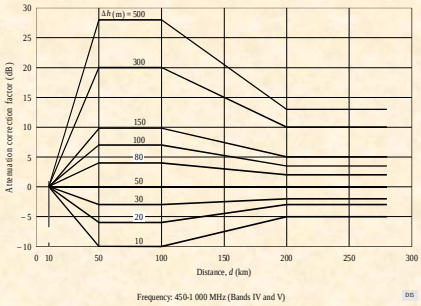
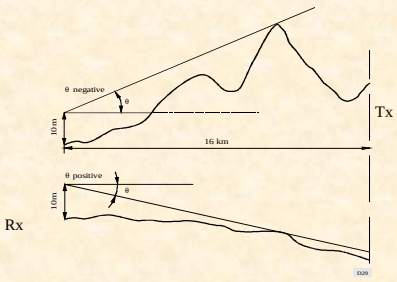


FIGURE 8
Attenuation correction factor as a function of the distance *d* (km) and Δ*h*



P.370 (Cont.)

FIGURE 19
Terrain clearance angle

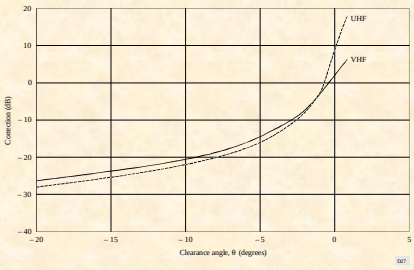


Terrain clearance angle :

This angle, **θ**, should be representative of those angles in the reception area, which are measured between the horizontal at the receiving antenna and the line which just clears all obstacles within 16 km in the direction of the transmitter. The example in Fig. 19 also indicates the sign convention which is negative if the line to the obstacles is above the horizontal.

If more precision is required for predicting the field strength for reception conditions in specific areas, e.g. in a small receiving area, a correction may be made based on a "**terrain clearance angle**".

FIGURE 17
Terrain clearance angle correction factor



Where the relevant terrain clearance angle information is available, **Fig. 17** (or the equivalent equations) should be used **in place of the Δ*h*** correction .

P.1546

FIGURE 1
100 MHz, land path, 50% time

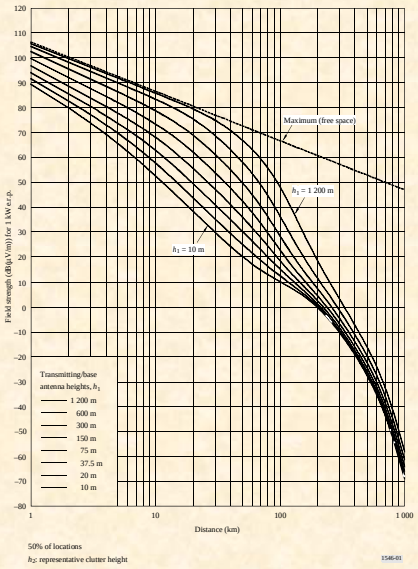
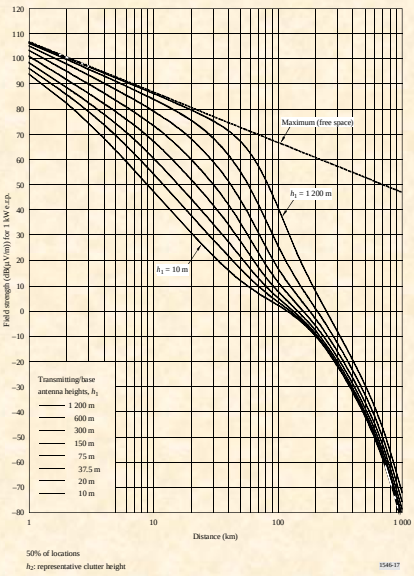


FIGURE 17
2 000 MHz, land path, 50% time



P.1546 (Cont.)

FIGURE 26a
Terrain clearance angle: the general case

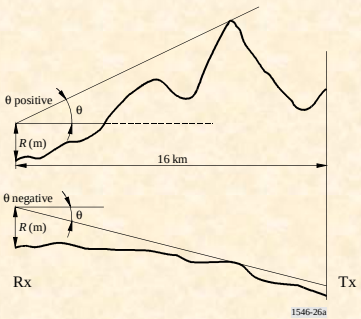
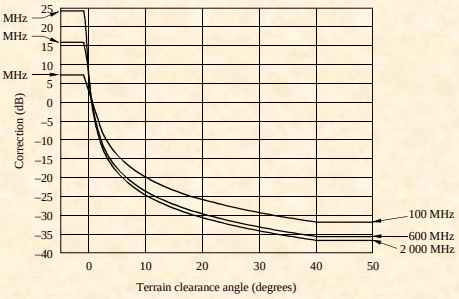


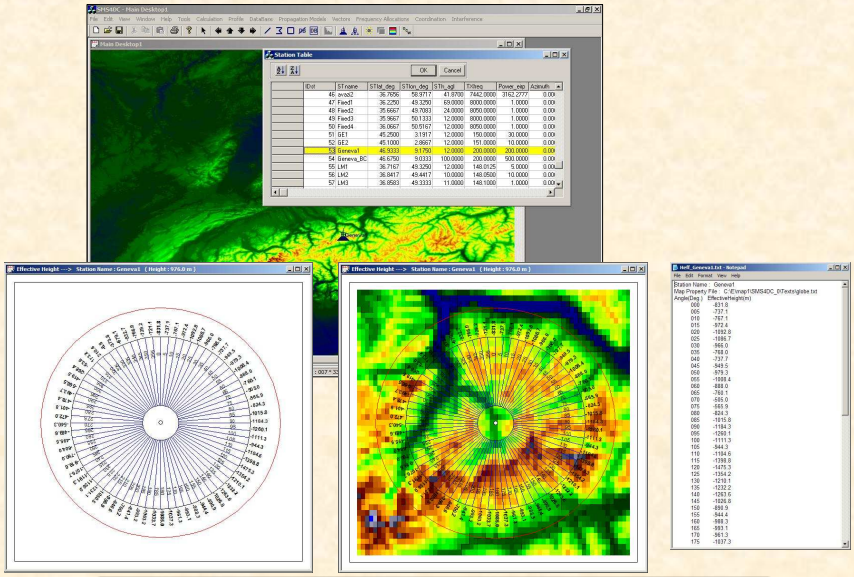
FIGURE 27
Terrain clearance angle correction



This angle, **θ**, is measured relative to the line from the receiving/mobile antenna which just clears all terrain obstructions in the direction of the transmitter/base antenna over a distance of up to 16 km but not going beyond the transmitting/base antenna.

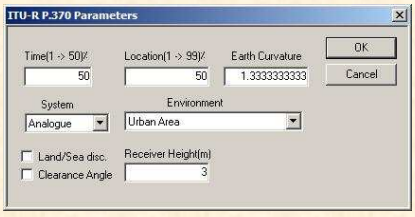
Effective height clculation

Spreadsheet of stations and picture of effective height of a station

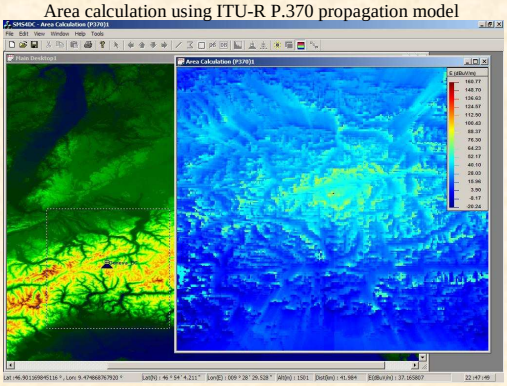


P.370 : point-to-area calculation

- Time percentage (1 to 50%)
- Location percentage (1 to 99%)
- Earth Curvature (k-factor)
- System type (Analog and digital)
- Environment (Urban Area, Rural Area, Suburban Area)
- Land/See Discrimination key,
- Clearance Angle key,
- Receiver height

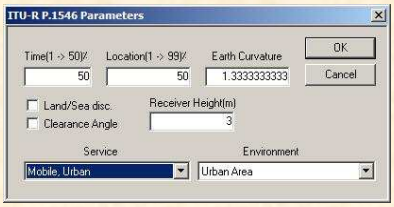


Area calculation using ITU-R P.370 propagation model

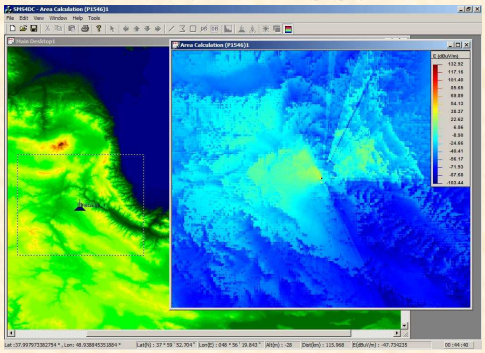


P.1546 : point-to-area calculation

- Time percentage (1 to 50%)
- Location percentage (1 to 99%)
- Earth Curvature (k-factor)
- Land/See Discrimination key,
- Clearance Angle key,
- Service (Urban Mobile, Suburban or Rolling hills Mobile, Analog Broadcasting, Digital broadcasting)
- Receiver height
- Environment (Open Area, Rural Area, Urban Area, Dense Urban Area, Suburban Area)

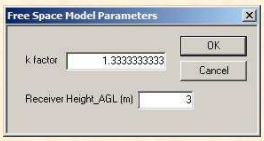


Area calculation using ITU-R P.1546 propagation model

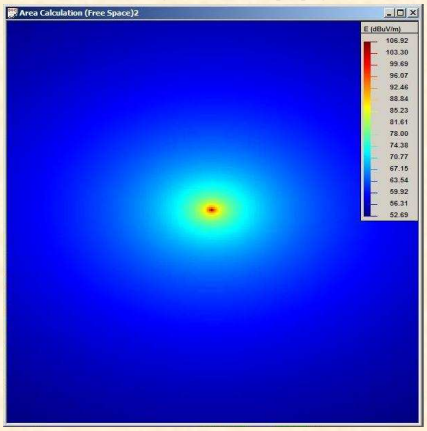


P.525 : point-to-area calculation

- k-factor
- Receiver height

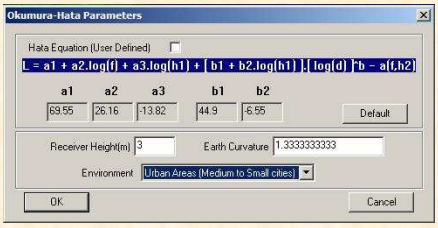


Area calculation using ITU-R P.525 propagation model

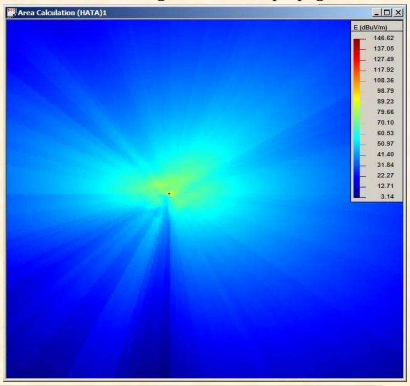


Hata : point-to-area calculation

- Hata Equation (User Defined): Lets user to customize equation coefficients
- Receiver height
- Earth Curvature (k-factor)
- Environment (Open Area, Rural Area, Urban Area, Dense Urban Area, Suburban Area)

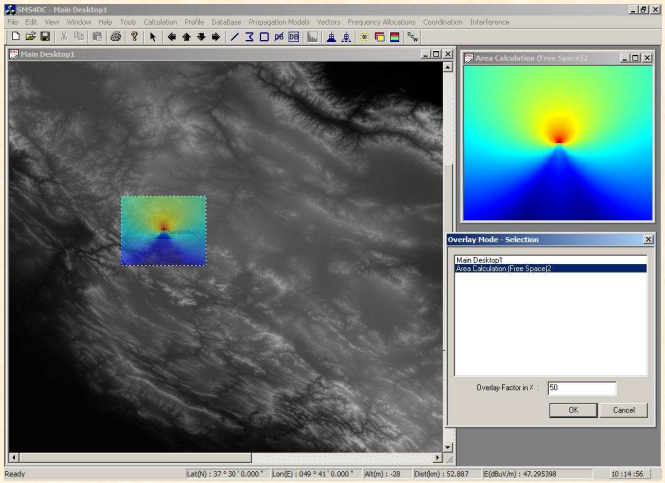


Area calculation using ITU-R P.529 propagation model



Overlay Calculation

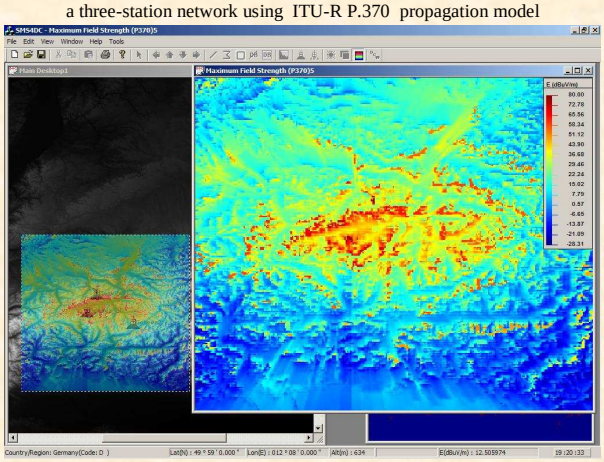
An example for application of "Overlay Calculation"



Network Processor : Maximum Field Strength

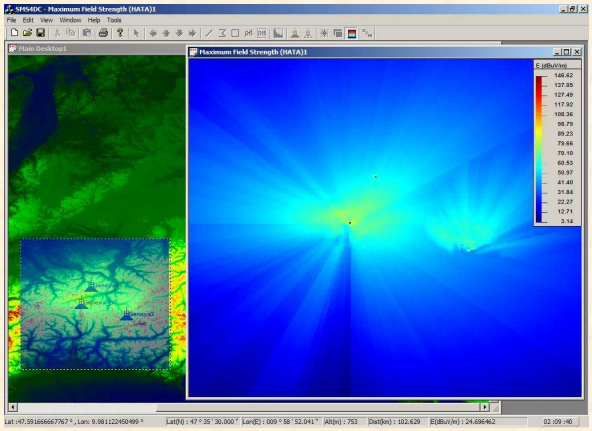
Item to calculate and visualize the maximum value of field strength values produced by more than one transmitting stations at any point inside a predefined rectangular area.

Application of maximum field strength method in analysis of a three-station network using ITU-R P.370 propagation model



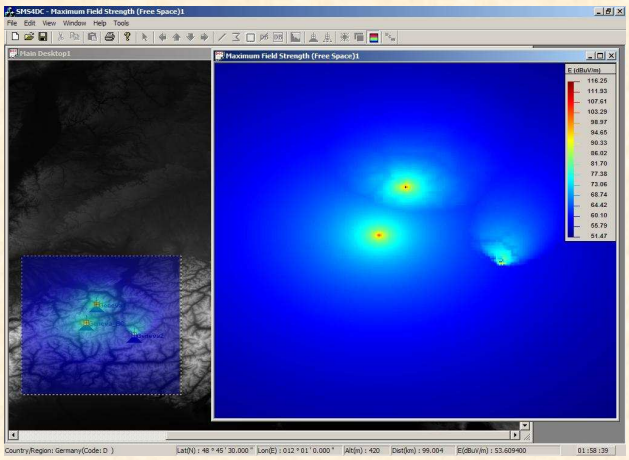
Network Processor : Maximum Field Strength (Cont.**)**

Application of maximum field strength method in analysis of a three-station network using Okumora-Hata propagation model



Network Processor : Maximum Field Strength (Cont.**)**

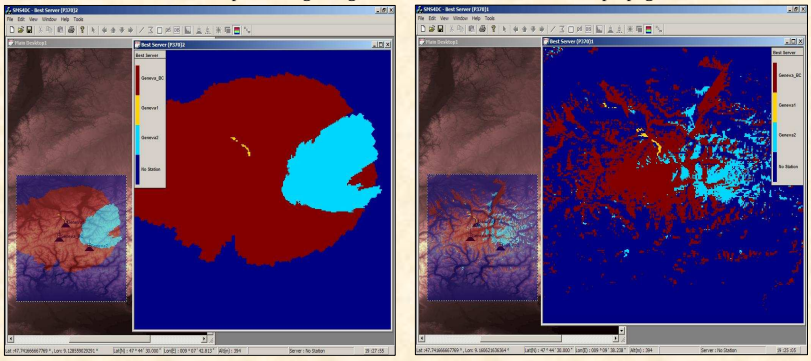
Application of maximum field strength method in analysis of a three-station network using Free-Space propagation model



Network Processor : Best Server

Item to calculate and visualize the best serving station at each point among various stations inside a predefined rectangular area.

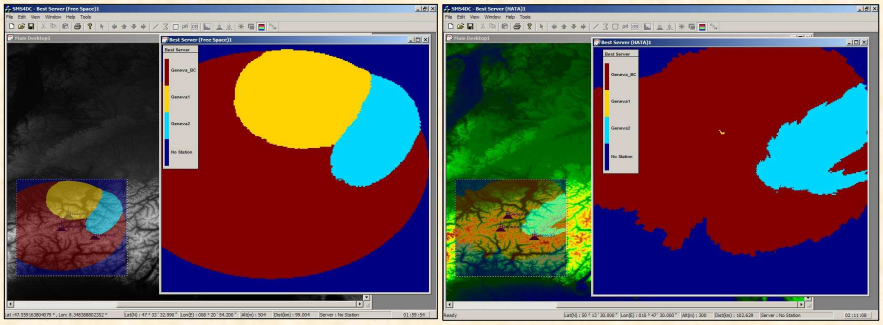
Three-station network processing using best server method under P.370 propagation model



(a) Best server result without considering clearance angle (b) Best server result considering clearance angle

Network Processor : Best Server (Con.**)**

Application of best server method in analysis of a three-station network



(a) Using Free-Space propagation model

(b) Using Okumora-Hata propagation model

Contour calculation

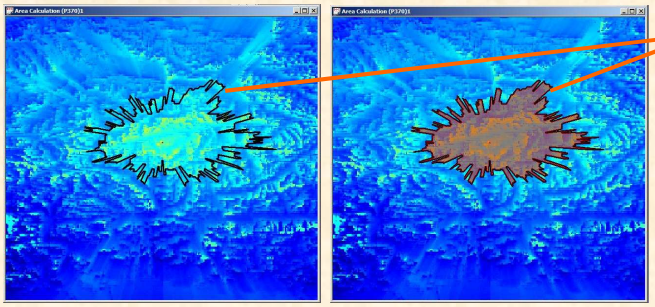
By selection of this item, users could define a threshold value.

Area calculation

1) Tx location
2) Rx location → **4) Field Strength**
3) Model

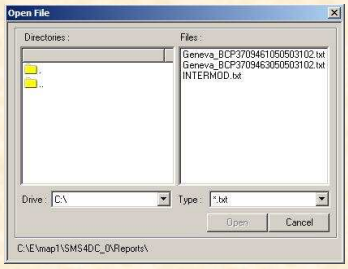
Contour calculation

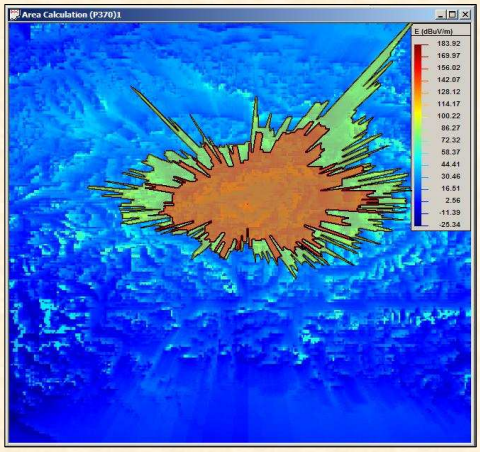
1) Tx location
2) Field Strength → **4) Rx location**
3) Model



Contour calculation (Cont.**)**

Draw Contour from File: Item to load and display saved vectors on active area calculation result window.



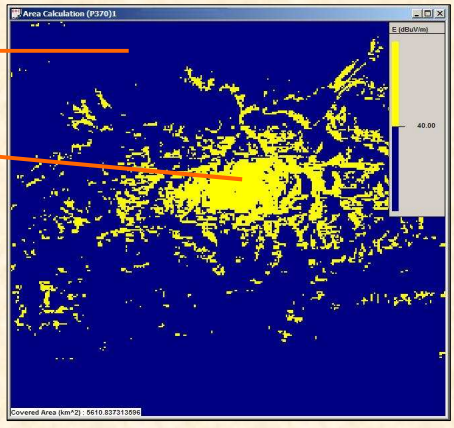


Coverage Area

Item to calculate area in km2 where inside the area, the field strength value is higher than a threshold value.

E < Threshold Value

E > Threshold Value



Coordination

GE84

final acts

of the Regional Administrative Conference
for the Planning of VHF Sound Broadcasting
(Region 1 and Part of Region 3)
Geneva, 1984

**Regional Agreement relating to the Use of the Band 87.5 - 108 MHz
for FM Sound Broadcasting
(Region 1 and Part of Region 3)**

Democratic Republic of Afghanistan, Socialist People's Republic of Albania, People's Democratic Republic of Algeria, Federal Republic of Germany, People's Republic of Angola, Kingdom of Saudi Arabia, Austria, Belgium, People's Republic of Benin, Byelorussian Soviet Socialist Republic, Republic of Botswana, People's Republic of Bulgaria, Burkina Faso, Republic of Cameroon, Republic of Cyprus, Vatican City State, People's Republic of the Congo, Republic of the Ivory Coast, Denmark, Arab Republic of Egypt, Spain, Finland, France, Gabonese Republic, Greece, Republic of Guinea, Hungarian People's Republic, Islamic Republic of Iran, Republic of Iraq, Ireland, State of Israel, Italy, Hashemite Kingdom of Jordan, Republic of Kenya, State of Kuwait, Kingdom of Lesotho, Socialist People's Libyan Arab Jamahiriya, Principality of Liechtenstein, Luxembourg, Republic of Mali, Republic of Malta, Kingdom of Morocco, Monaco, Mongolian People's Republic, Norway, Sultanate of Oman, Republic of Uganda, Kingdom of the Netherlands, People's Republic of Poland, Portugal, State of Qatar, Syrian Arab Republic, German Democratic Republic, Ukrainian Soviet Socialist Republic, Socialist Republic of Romania, United Kingdom of Great Britain and Northern Ireland, Republic of San Marino, Republic of Senegal, Sweden, Confederation of Switzerland, Kingdom of Swaziland, United Republic of Tanzania, Republic of Chad, Czechoslovak Socialist Republic, Togolese Republic, Tunisia, Turkey, Union of Soviet Socialist Republics, Yemen Arab Republic, People's Democratic Republic of Yemen, Socialist Federal Republic of Yugoslavia, Republic of Zambia, Republic of Zimbabwe.

GE84 : BC to BC Coordination Distance

TABLE 4.1

Coordination distances, D_L, in km, for propagation paths over land

Effective radiated power		Effective antenna height (m)							
		10	37.5	75	150	300	600	1200	1800
dBW	W	Coordination distances (km)							
55	300k	520	520	530	540	560	600	630	670
50	100k	460	460	470	490	510	540	580	610
45	30k	410	410	420	430	450	480	520	560
40	10k	350	350	370	380	400	430	470	500
35	3k	300	300	310	330	340	380	420	450
30	1k	250	250	260	270	290	320	360	400
25	300	140	190	210	220	240	280	320	350
20	100	70	140	160	180	190	230	270	300
15	30	45	100	130	140	150	190	230	260
10	10	35	65	90	100	120	150	190	220
5	3	30	45	65	75	95	120	160	180
0	1	20	35	50	60	80	100	140	150

TABLE 4.2

Coordination distances, D_{SC}, in km, for propagation paths over cold sea

Effective radiated power		Effective antenna height (m)							
		10	37.5	75	150	300	600	1200	1800
dBW	W	Coordination distances (km)							
55	300k	790	790	800	820	850	880	910	950
50	100k	680	680	700	720	740	770	810	850
45	30k	590	590	610	630	650	670	730	750
40	10k	510	510	530	540	560	590	640	670
35	3k	440	440	460	470	490	530	570	600
30	1k	380	380	390	400	430	460	500	530
25	300	320	320	330	350	370	400	440	470
20	100	260	260	280	290	310	350	380	420
15	30	150	210	220	240	260	300	340	360
10	10	75	150	170	180	200	250	290	300
5	3	40	100	120	130	150	200	240	260
0	1	25	65	80	95	120	150	200	210

GE84 : BC to BC Coordination Distance (Cont.)

TABLE 4.3

Coordination distances, D_{SW}, in km, for propagation paths over warm sea

Effective radiated power		Effective antenna height (m)							
		10	37.5	75	150	300	600	1200	1800
dBW	W	Coordination distances (km)							
55	300k	1300	1300	1300	1300	1300	1300	1300	1300
50	100k	1300	1300	1300	1300	1300	1300	1300	1300
45	30k	1100	1100	1130	1150	1170	1200	1230	1280
40	10k	800	800	840	870	900	940	970	1010
35	3k	610	610	650	680	700	740	780	800
30	1k	490	490	520	550	560	600	650	670
25	300	390	390	410	440	460	490	540	560
20	100	310	310	330	360	370	400	440	480
15	30	210	240	260	290	300	330	360	400
10	10	85	170	200	220	240	270	300	340
5	3	40	110	140	160	190	220	250	290
0	1	25	70	90	120	140	170	200	240

TABLE 4.4

Coordination distances, D_{SS}, in km, for propagation paths in areas of superrefractivity

Effective radiated power		Coordination distances
dBW	W	D_{SS} (km)[1)]
55	300k	1480
50	100k	1400
45	30k	1320
40	10k	1230
35	3k	1150
30	1k	1070
25	300	980
20	100	900
15	30	820
10	10	730
5	3	650
0	1	560

[1)] Independent of effective antenna height.

GE84 : BC to BT Coordination Distance

TABLE 4.5

Coordination distances, D_L, in km, for propagation paths over land

Effective radiated power		Effective antenna height (m)							
		10	37.5	75	150	300	600	1200	1800
dBW	W	Coordination distances (km)							
55	300k	660	660	670	690	710	740	780	810
50	100k	600	600	620	630	650	680	720	760
45	30k	550	550	560	580	600	630	670	700
40	10k	500	500	510	520	540	570	610	650
35	3k	440	440	450	470	490	520	560	590
30	1k	390	390	400	410	430	460	500	530
25	300	330	330	340	360	370	410	450	480
20	100	280	280	290	300	320	360	390	430
15	30	200	230	240	250	270	300	340	380
10	10	110	170	190	200	220	260	300	330
5	3	60	130	150	160	180	210	260	280
0	1	45	90	110	120	140	170	220	240

TABLE 4.6

Coordination distances, D_{LC}, in km, for propagation paths over cold sea

Effective radiated power		Effective antenna height (m)							
		10	37.5	75	150	300	600	1200	1800
dBW	W	Coordination distances (km)							
55	300k	1160	1160	1190	1220	1240	1250	1270	1300
50	100k	990	990	1000	1040	1050	1070	1130	1160
45	30k	860	860	870	890	910	940	980	1010
40	10k	750	750	760	780	800	840	870	910
35	3k	640	640	660	680	700	730	780	810
30	1k	560	560	580	590	610	640	700	720
25	300	480	480	500	510	530	570	610	640
20	100	410	410	430	440	470	500	540	570
15	30	350	350	370	380	400	440	480	510
10	10	300	300	310	320	350	380	420	450
5	3	230	240	260	270	290	330	360	390
0	1	110	190	200	220	230	280	320	340

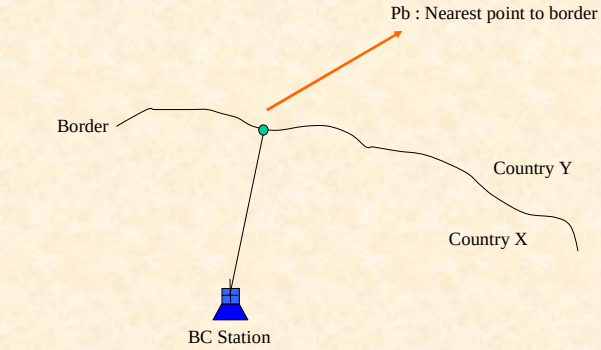
GE84 : BC to BT Coordination Distance (Cont.)

TABLE 4.7

Coordination distances, D_{SW}, in km, for propagation paths over warm sea

Effective radiated power		Effective antenna height (m)							
		10	37.5	75	150	300	600	1200	1800
dBW	W	Coordination distances (km)							
55	300k	1300	1300	1300	1300	1300	1300	1300	1300
50	100k	1300	1300	1300	1300	1300	1300	1300	1300
45	30k	1300	1300	1300	1300	1300	1300	1300	1300
40	10k	1300	1300	1300	1300	1300	1300	1300	1300
35	3k	1300	1300	1300	1300	1300	1300	1300	1300
30	1k	950	950	990	1020	1050	1080	1110	1150
25	300	720	720	750	780	810	850	890	920
20	100	560	560	600	620	640	680	730	750
15	30	440	440	480	500	520	560	600	620
10	10	350	350	380	400	420	460	500	510
5	3	280	280	300	330	350	370	400	450
0	1	140	210	230	260	280	300	340	370

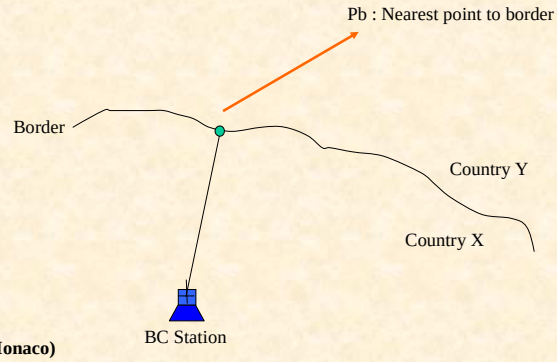
GE84 : BC to FX Coordination



E(Pb) > 0
REGION Y : 3
⇨ **FX stations in Country Y are affected**

(GE84 Final acts Chapter 5)

GE84 : BC to LM Coordination (Cont.)



Country Y : MCO(Monaco)
E(Pb)>14 & H polarization
E(Pb)>6 & (V or M) polarization

Region Y : 3
E(Pb)>18 & H polarization
E(Pb)>0 & (V or M) polarization

⇨ **LM stations in Country Y are affected**

(GE84 Final acts Chapter 4)

Definitions

Minimum usable field strength (GE89 CHAPTER 1***)***
Minimum value of field strength necessary to guarantee satisfactory service quality in the presence of natural and man-made noise but *in the absence of interference* from other transmitters.

Reference usable field strength (GE89 CHAPTER 1***)***
The agreed value of the usable field strength that serves as a reference or basis for the Plan.

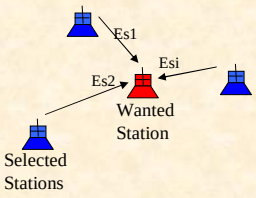
Protection ratio *(RR 1.170)*
The minimum value of the wanted-to-unwanted signal ratio, usually expressed in decibels, at the receiver input, determined under specified conditions such that a specified reception quality of the wanted signal is achieved at the receiver output.

GE84 : Interference from (Usable Fst.)

Interference from selected stations to wanted station

Es1, Es2,....., Esi ⇨ Eu

(Determination of the usable field strength by the simplified multiplication method)



Protection ratio :

TABLE 12

Protection ratios required by broadcasting services in band 8 (VHF) using a maximum frequency deviation of ±75 kHz

Frequency spacing (kHz)	Protection ratio (dB)						
	Monophonic				Stereoph		
	Steady interference		Tropospheric interference		Steady interference		Tr
	FM	AM	FM	AM	FM	AM	
0	36.0	36.0	28.0	28.0	45.0	45.0	
25	31.0	31.0	27.0	27.0	51.0	51.0	
50	24.0	24.0	22.0	22.0	51.0	51.0	
75	16.0	16.0	16.0	16.0	45.0	45.0	
100	12.0	12.0	12.0	12.0	33.0	33.0	
125	9.5	9.5	9.5	9.5	24.5	24.5	
150	8.0	8.0	8.0	8.0	18.0	18.0	
175	7.0	7.0	7.0	7.0	11.0	11.0	
200	6.0	6.0	6.0	6.0	7.0	7.0	
225	4.5	4.5	4.5	4.5	4.5	4.5	
250	2.0	2.0	2.0	2.0	2.0	2.0	
275	−2.0	−2.0	−2.0	−2.0	−2.0	−2.0	
300	−7.0	−7.0	−7.0	−7.0	−7.0	−7.0	
325	−11.5	−7.0	−11.5	−7.0	−11.5	−7.0	−
350	−15.0	−7.0	−15.0	−7.0	−15.0	−7.0	−
375	−17.5	−7.0	−17.5	−7.0	−17.5	−7.0	−
400	−20.0	−7.0	−20.0	−7.0	−20.0	−7.0	−

TABLE 13

Protection ratios required by broadcasting services in band 8 (VHF) using a maximum frequency deviation of ±50 kHz

Frequency spacing (kHz)	Protection ratio (dB)							
	Monophonic				Stereophonic			
	Steady interference		Tropospheric interference		Steady interference		Tropospheric interference	
	FM	AM	FM	AM	FM	AM	FM	AM
0	39.0	39.0	32.0	32.0	49.0	49.0	41.0	41.0
25	32.0	32.0	28.0	28.0	53.0	53.0	45.0	45.0
50	24.0	24.0	22.0	22.0	51.0	51.0	43.0	43.0
75	15.0	15.0	15.0	15.0	45.0	45.0	37.0	37.0
100	12.0	12.0	12.0	12.0	33.0	33.0	25.0	25.0
125	7.5	7.5	7.5	7.5	25.0	25.0	18.0	18.0
150	6.0	6.0	6.0	6.0	18.0	18.0	14.0	14.0
175	2.0	2.0	2.0	2.0	12.0	12.0	11.0	11.0
200	−2.5	−2.5	−2.5	−2.5	7.0	7.0	7.0	7.0
225	−3.5	−3.5	−3.5	−3.5	5.0	5.0	5.0	5.0
250	−6.0	−6.0	−6.0	−6.0	2.0	2.0	2.0	2.0
275	−7.5	−7.5	−7.5	−7.5	0.0	0.0	0.0	0.0
300	−10.0	−10.0	−10.0	−10.0	−7.0	−7.0	−7.0	−7.0
325	−12.0	−10.0	−12.0	−10.0	−10.0	−7.0	−10.0	−7.0
350	−15.0	−10.0	−15.0	−10.0	−15.0	−7.0	−15.0	−7.0
375	−17.5	−10.0	−17.5	−10.0	−17.5	−7.0	−17.5	−7.0
400	−20.0	−10.0	−20.0	−10.0	−20.0	−7.0	−20.0	−7.0

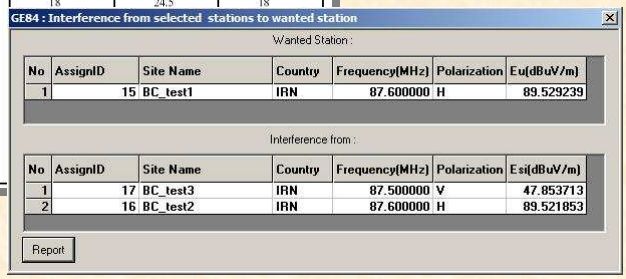
(SM.851)

GE84 : Interference from (Usable Fst.) (Cont.)

TABLE 2.3

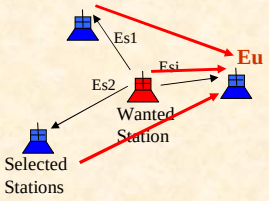
Frequency spacing (kHz)	Maximum frequency deviation: wanted transmitter ± 50 kHz interfering transmitter ± 75 kHz		Maximum frequency deviation: wanted transmitter ± 75 kHz interfering transmitter ± 50 kHz	
	Radio-frequency protection ratio (dB) stereophonic		Radio-frequency protection ratio (dB) stereophonic	
	Steady interference	Tropospheric interference	Steady interference	Tropospheric interference
0	49	41	45	37
25	53	45	51	43
50	51	43	51	43
75	45	37	45	37
100	33	25	33	25
125	25	18	24.5	18
150	18			
175	12			
200	7			
225	5			
250	2			
275	0			
300	−7			
325	−10			
350	−15			
375	−17.5			
400	−20			

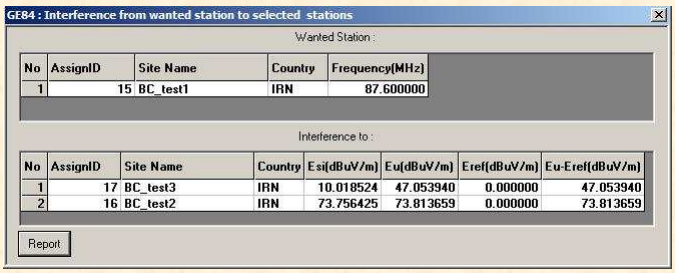
If (E50+As) ≥ (Et+At)
Protection ratio = As
else
Protection ratio = At



GE84 : Interference to (Usable Fst.)

Interference from wanted station to selected stations





ST61 : [BC , BT] to [BC , BT] - Coordination Distance

final acts

of the European Broadcasting Conference
in the VHF and UHF bands

Stockholm, 1961

REGIONAL AGREEMENT

for the

EUROPEAN BROADCASTING AREA

Concerning the use of Frequencies by the Broadcasting Service in the VHF and UHF Bands

The undersigned Delegates of the Administrations of the following countries:

Austria, Belgium, Bielorussian Soviet Socialist Republic, People's Republic of Bulgaria, Republic of Cyprus, Vatican City State, Denmark, Spain, Finland, France, Greece, Hungarian People's Republic, Ireland, Iceland, State of Israel, Italy, Lebanon, Luxembourg, Kingdom of Morocco, Monaco, Norway, Kingdom of the Netherlands, People's Republic of Poland, Portugal, Federal Republic of Germany, Federal People's Republic of Yugoslavia, Ukrainian Soviet Socialist Republic, Roumanian People's Republic, United Kingdom of Great Britain and Northern Ireland, Sweden, Confederation of Switzerland, Czechoslovak Socialist Republic, Overseas Territories for the international relations of which the Government of the United Kingdom of Great Britain and Northern Ireland are responsible, Turkey, Union of Soviet Socialist Republics,

For simplicity, the frequency bands are designated as follows:

41-68 Mc/s	Band I
87.5-100 Mc/s	Band II
162-230 Mc/s	Band III
470-582 Mc/s	Band IV
582-960 Mc/s	Band V

TABLE A – BAND I

Effective Radiated Power (E.R.P.)	Limiting distances in km for different effective antenna heights h								
	h = 75 m			h = 300 m			h = 1200 m		
	Land	Sea (generally)	Sea Mediterranean	Land	Sea (generally)	Sea Mediterranean	Land	Sea (generally)	Sea Mediterranean
300 kW	660	920	*)	680	970	*)	760	1 050	*)
100	600	830	1 050	630	870	*)	700	950	*)
30	540	740	920	565	780	970	650	850	1050
10	480	630	830	520	670	870	590	750	950
3	430	530	740	465	570	780	540	650	850
1	370	450	630	420	490	670	480	560	750
300 W	320	370	530	360	410	570	420	480	650
100	270	300	450	310	330	490	370	410	560
30	220	230	370	260	270	410	330	340	480
10	170	170	300	205	205	330	290	290	410
3	130	130	230	160	160	270	240	240	340
1	100	100	170	135	135	205	200	200	290
300 mW	70	70	130	100	100	160	160	160	240
100	50	50	100	80	80	135	140	140	200
30	35	35	70	60	60	100	120	120	160
10	25	25	50	50	50	80	100	100	140
3	25	25	35	35	35	60	80	80	120
1	25	25	25	30	30	50	65	65	100

TABLE B – BAND II

Effective Radiated Power (E.R.P.)	Limiting distances in km for different effective antenna heights h								
	h = 75 m			h = 300 m			h = 1200 m		
	Land	Sea (generally)	Sea Mediterranean	Land	Sea (generally)	Sea Mediterranean	Land	Sea (generally)	Sea Mediterranean
300 kW	470								
100	420								
30	360								
10	310								
3	260								
1	210								
300 W	160								
100	120								
30	90								
10	60								
3	50								
1	40								
300 mW	35								
100	30								
30	25								
10	20								
3	20								
1	20								

TABLE C – BAND III

Effective Radiated Power (E.R.P.)	Limiting distances in km for different effective antenna heights h								
	h = 75 m			h = 300 m			h = 1200 m		
	Land	Sea (generally)	Sea Mediterranean	Land	Sea (generally)	Sea Mediterranean	Land	Sea (generally)	Sea Mediterranean
300 kW	580	810	1000	620	850	1060	690	930	*)
100	530	720	910	560	750	950	630	820	1030
30	470	610	810	510	650	850	580	720	930
10	420	520	720	450	550	750	520	630	820
3	360	430	610	400	470	650	470	540	720
1	310	350	520	340	390	550	410	460	630
300 W	260	280	430	290	320	470	360	390	540
100	210	220	350	240	250	390	320	330	460
30	160	160	280	190	190	320	270	270	390
10	120	120	220	150	150	250	230	230	330
3	90	90	160	120	120	190	190	190	270
1	60	60	120	90	90	150	160	160	230
300 mW	45	45	90	70	70	120	130	130	190
100	30	30	60	55	55	90	110	110	160
30	25	25	45	45	45	70	90	90	130
10	20	20	30	35	35	55	75	75	110
3	20	20	25	25	25	45	60	60	90
1	20	20	20	20	20	35	45	45	75

TABLE D 1 – BANDS IV AND V

(h <= 75 m)

Effective Radiated Power (E.R.P.)		Limiting distances in km										
		Land path all areas	Mixed paths-General					Mixed paths-Mediterranean area				
			Proportion of path lying over sea					Proportion of path lying over sea				
Band IV	Band V		20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
1000 kW	–	465	490	540	650	945	*)	500	595	750	*)	*)
300	1000 kW	410	430	490	600	895	*)	450	555	690	1000	*)
100	300	360	390	440	555	830	*)	400	475	620	945	*)
30	100	310	340	395	510	775	*)	350	415	565	865	*)
10	30	270	295	350	460	710	*)	300	375	525	805	*)
3	10	230	250	310	410	640	*)	255	320	440	730	*)
1	3	185	210	255	360	570	980	210	260	375	650	*)
300 W	1	150	170	210	305	505	850	170	210	315	585	*)
100 W	300 W	110	130	170	250	440	725	135	180	265	515	980
30	100	80	100	140	205	385	620	105	145	230	460	850
10	30	60	75	110	175	340	510	80	125	200	415	725
3	10	45	60	90	155	310	410	65	100	180	380	620
1	3	35	50	75	140	290	315	50	85	160	340	510
300 mW	1	25	40	65	130	235	235	40	70	145	320	410
100	300 mW	20	30	55	120	155	155	30	60	130	300	315
–	100	15	25	50	105	105	105	25	50	120	235	235

TABLE D 2 – BANDS IV AND V

(75 m < h <= 300 m)

Effective Radiated Power (E.R.P.)		Limiting distances in km										
		Land path all areas	Mixed paths-General					Mixed paths-Mediterranean area				
			Proportion of path lying over sea					Proportion of path lying over sea				
Band IV	Band V		20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
1000 kW	–	500	520	570	700	990	*)	550	645	815	*)	*)
300	1000 kW	445	470	525	650	920	*)	485	575	735	*)	*)
100	300	395	420	475	600	860	*)	435	515	665	970	*)
30	100	345	380	430	540	795	*)	390	455	610	900	*)
10	30	300	330	385	490	715	*)	340	415	545	835	*)
3	10											
1	3											
300 W	1											
100 W	300 W											
30	100											
10	30											
3	10											
1	3											
300 mW	1											
100	300 mW											
–	100											

TABLE D 3 – BANDS IV AND V

(300 m < h <= 1200 m)

Effective Radiated Power (E.R.P.)		Limiting distances in km										
		Land path all areas	Mixed paths-General					Mixed paths-Mediterranean area				
			Proportion of path lying over sea					Proportion of path lying over sea				
Bande IV	Bande V		20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
1000 kW	–	575	610	685	820	*)	*)	620	710	875	*)	*)
300	1000 kW	520	560	635	755	1000	*)	565	650	810	*)	*)
100	300	470	505	575	690	930	*)	510	600	750	*)	*)
30	100	420	455	515	625	865	*)	460	555	700	965	*)
10	30	375	400	455	570	775	*)	410	490	625	895	*)
3	10	330	360	415	510	705	*)	365	435	565	830	*)
1	3	290	315	370	455	640	980	325	395	510	755	*)
300 W	1	250	275	330	410	575	850	285	350	455	680	*)
100 W	300 W	215	235	285	365	515	730	250	310	410	610	980
30	100	185	205	250	320	455	620	220	270	360	540	850
10	30	160	180	220	285	410	510	185	230	315	485	725
3	10	135	150	185	245	355	410	160	200	275	440	620
1	3	115	130	160	205	305	315	140	175	245	390	510
300 mW	1	100	115	135	175	235	235	120	155	215	345	410
100	300 mW	85	95	110	140	155	155	100	135	190	310	315
–	100	70	75	90	105	105	105	85	115	160	235	235

GE89

FINAL ACTS

of the
Regional Administrative Conference
for the Planning of VHF/UHF
Television Broadcasting
in the African Broadcasting Area
and Neighbouring Countries

Geneva, 1989

Regional Agreement (Geneva, 1989) Relating to the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries

People's Democratic Republic of Algeria, Kingdom of Saudi Arabia, State of Bahrain, People's Republic of Benin, Republic of Botswana, Burkina Faso, Republic of Burundi, Republic of Cameroon, People's Republic of the Congo, Republic of Côte d'Ivoire, Arab Republic of Egypt, United Arab Emirates, Spain, People's Democratic Republic of Ethiopia, France, Gabonese Republic, Ghana, Republic of Guinea, Islamic Republic of Iran, Republic of Iraq, Republic of Kenya, State of Kuwait, Kingdom of Lesotho, Republic of Liberia, Socialist People's Libyan Arab Jamahiriya, Democratic Republic of Madagascar, Malawi, Republic of Mali, Kingdom of Morocco, Mauritius, Islamic Republic of Mauritania, People's Republic of Mozambique, Republic of the Niger, Federal Republic of Nigeria, Sultanate of Oman, State of Qatar, Rwandese Republic, Republic of Senegal, Kingdom of Swaziland, Republic of Chad, Togolese Republic, Yemen Arab Republic, People's Democratic Republic of Yemen, Republic of Zambia, Republic of Zimbabwe,

GE89 : BT to BT - Coordination Distance

TABLE I — *Band 47 - 68 MHz*
Coordination distance limits (km)

	Effective radiated power																	
	100 kW			10 kW			1 kW			100 W			10 W			1 W		
Hef / Z	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200
1	600	640	710	490	530	600	380	420	490	280	310	380	170	210	290	100	130	200
2	410	450	500	320	360	410	240	280	340	180	210	270	130	160	220	90	120	170
3	480	510	560	380	420	480	290	340	390	210	260	330	140	190	270	85	120	210
4	1 050	1 050	1 050	830	870	950	630	670	750	450	490	560	300	330	410	170	205	290
A	1 150	1 150	1 150	1 050	1 050	1 050	900	960	1000	640	700	800	430	470	580	240	290	410
B	1 100	1 100	1 100	1 000	1 000	1 000	760	810	880	540	590	670	360	400	490	200	240	340
C	1 500	1 500	1 500	1 200	1 200	1 200	1 050	1 050	1 050	850	850	850	550	550	550	410	410	410
C1	1 000	1 000	1 000	820	820	820	650	650	650	490	490	490	360	360	360	240	240	240

Hef.: Effective antenna height (m)
Z: Propagation zone

GE89 : BT to BT - Coordination Distance(Cont.)

TABLE II — *Band 174 - 254 MHz*
Coordination distance limits (km)

	Effective radiated power																	
	200 kW			20 kW			2 kW			200 W			20 W			2 W		
Hef / Z	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200
1	560	5																
2	370	4																
3	440	4																
4	1 100	1																
A	1 300	1																
B	1 200	1																
C	1 600	1																
C1	930	9																

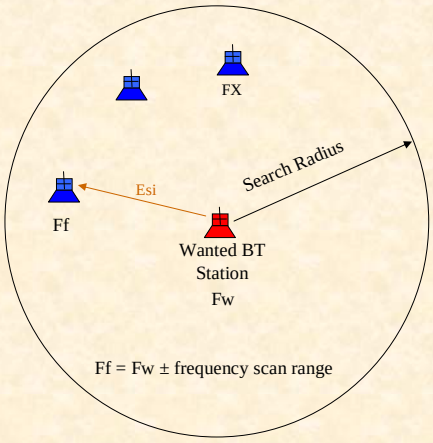
TABLE III — *Bande 470 - 582 MHz*
Coordination distance limits (km)

	Effective radiated power																	
	500 kW			100 kW			10 kW			1 kW			100 W			10 W			1 W		
Hef / Z	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200
1	380																				
2	280																				
3	200																				
4	1 300																				
A	1 400																				
B	1 350																				
C	1 500																				
C1	590																				

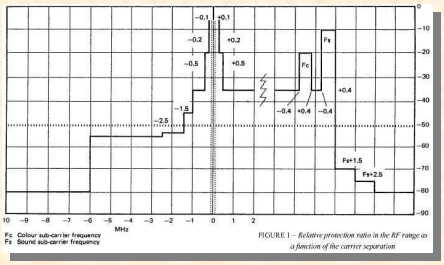
TABLE IV — *Band 582 - 862 MHz*
Coordination distance limits (km)

	Effective radiated power																				
	500 kW			100 kW			10 kW			1 kW			100 W			10 W			1 W		
Hef / Z	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200	75	300	1 200
1	330	370	460	260	300	380	170	210	280	100	150	210	60	100	160	40	60	120	25	50	90
2	240	280	340	200	230	200	150	180	240	100	130	190	60	100	150	40	65	120	25	50	90
3	260	300	370	210	250	320	160	190	260	110	150	210	60	100	160	35	65	120	20	40	90
4	1 200	1 200	1 200	1 000	1 000	1 000	800	800	800	650	650	650	550	550	550	370	370	370	230	230	230
A	1 300	1 300	1 300	1 200	1 200	1 200	1 000	1 000	1 000	800	800	800	650	650	650	550	550	550	370	370	370
B	1 250	1 250	1 250	1 100	1 100	1 100	900	900	900	700	700	700	600	600	600	460	460	460	300	300	300
C	1 400	1 400	1 400	1 250	1 250	1 250	1 100	1 100	1 100	900	900	900	700	700	700	500	500	500	270	270	270
C1	540	540	540	480	480	480	400	400	400	320	320	320	240	240	240	170	170	170	110	110	110

GE89 : BT to FX Coordination (Fst.)



RPR : relative protection ratio



$\Delta f = Ff - FvW$

$Fs = FsW - FvW$

$Fc = 3.579$ NTSC

$Fc = 4.43$ PAL or SECAM

Elimit = -2 - RPR + g(dB)

g(dB) : Δh correction factor

Esi = Et + erp - 30 + Lp

GE89 : BT to FX Coordination (Fst.) (Cont.)

Lp : Percentage of receiving locations Correction factor

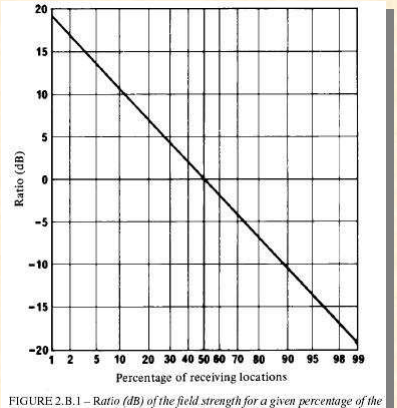


FIGURE 2.B.1 – *Ratio (dB) of the field strength for a given percentage of the receiving locations to the field strength for 50% of the receiving locations*
VHF (Bands I and III)

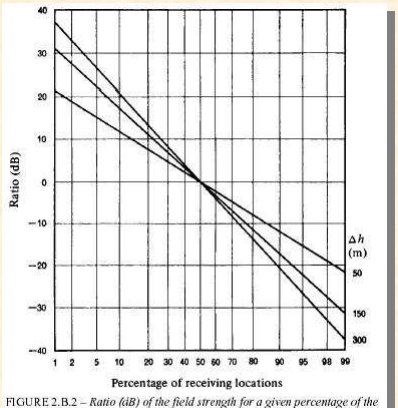
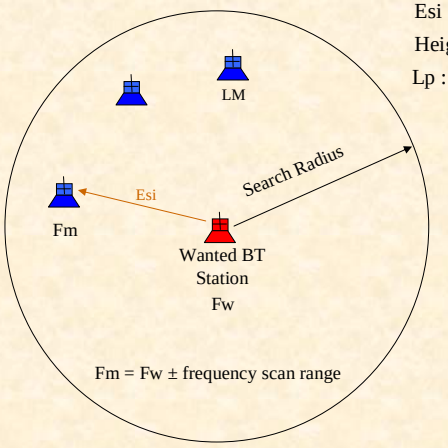


FIGURE 2.B.2 – *Ratio (dB) of the field strength for a given percentage of the receiving locations to the field strength for 50% of the receiving locations*
The parameter Δh is described in Annex 2.A
UHF (Bands IV and V)

Esi > Elimit ⇒ **FX stations are affected**

GE89 : BT to LM Coordination (Fst.)



Esi = Et + erp - 30 + Lp + Height_gain

Height_gain = 20log10(h2/10)

Lp : Percentage of receiving locations Correction factor

Frequency band (MHz)	Limit value dB (µV/m)
47 - 68	9
174 - 254	11
470 - 582	14
582 - 862	28

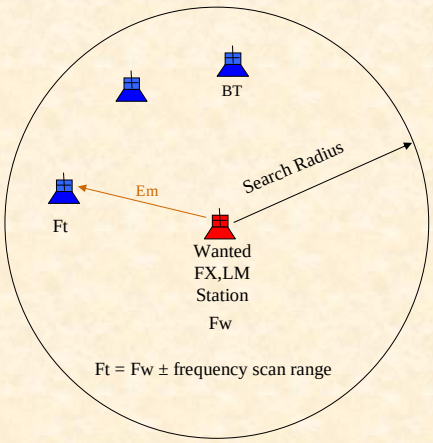
Elimit_m

Elimit = Elimit_m + g(dB)

g(dB) : Δh correction factor

Esi > Elimit ⇨ **LM stations are affected**

GE89 : FX,LM to BT Coordination (Fst.)



Δf = Fw - FvT

Fs = FsT - FvT

Fc = 3.579 NTSC

Fc = 4.43 PAL or SECAM

Frequency band (MHz)	Limit value dB (µV/m)
47 - 68	46
174 - 254	49
470 - 582	53
582 - 862	59

FSmin

Elimit = Fsmin - 58.0 - RPR + g(dB)

Em = Et + erp - 30 + Lp

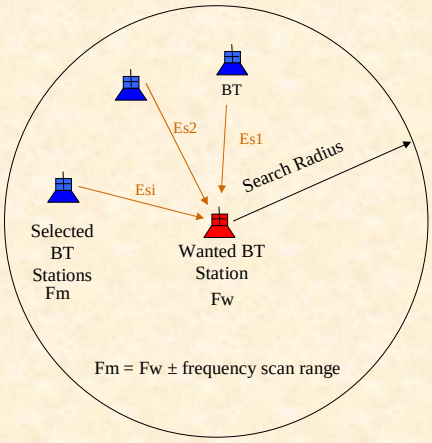
RPR : relative protection ratio

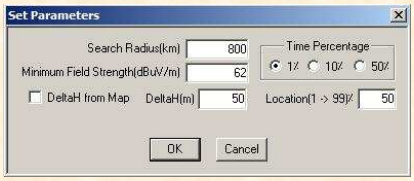
g(dB) : Δh correction factor

Em > Elimit ⇨ **BT stations are affected**

GE89 : Interference from BT - BT (Usable Fst.)

Interference from selected stations to wanted station



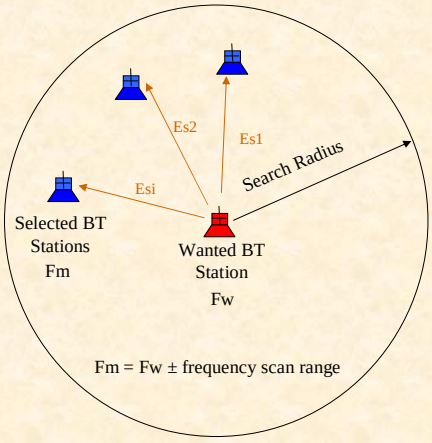


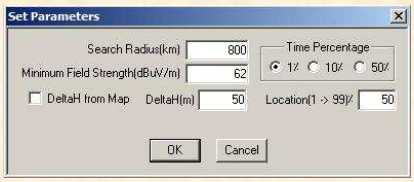
Es1, Es2,....., Esi ⇨ Eu

(Determination of the usable field strength by the simplified multiplication method)

GE89 : Interference to BT - BT (Fst.)

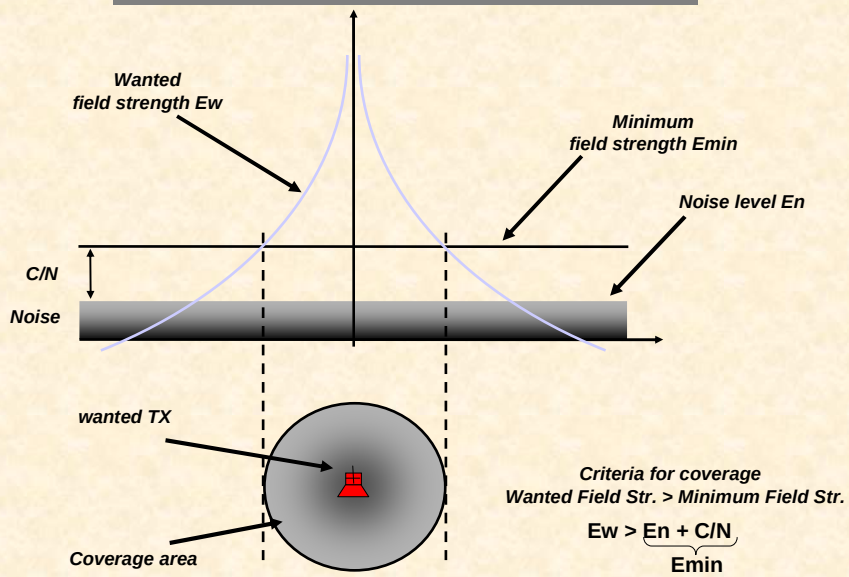
Interference from wanted station to selected stations





Interference

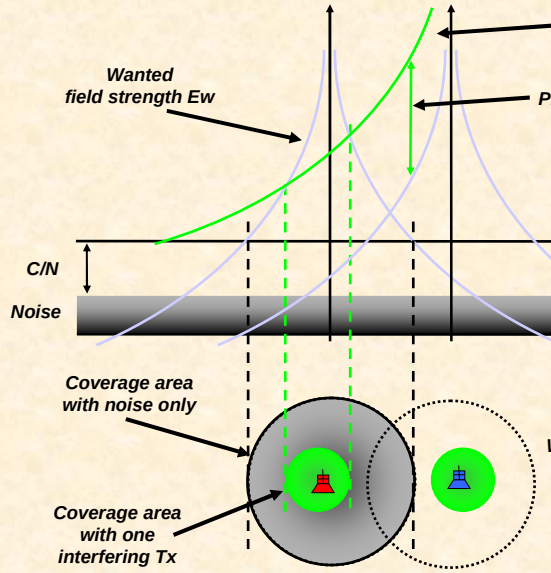
Interference by Noise



Criteria for coverage
Wanted Field Str. > Minimum Field Str.

$$Ew > \underbrace{En + C/N}_{Emin}$$

Interference by one Transmitter

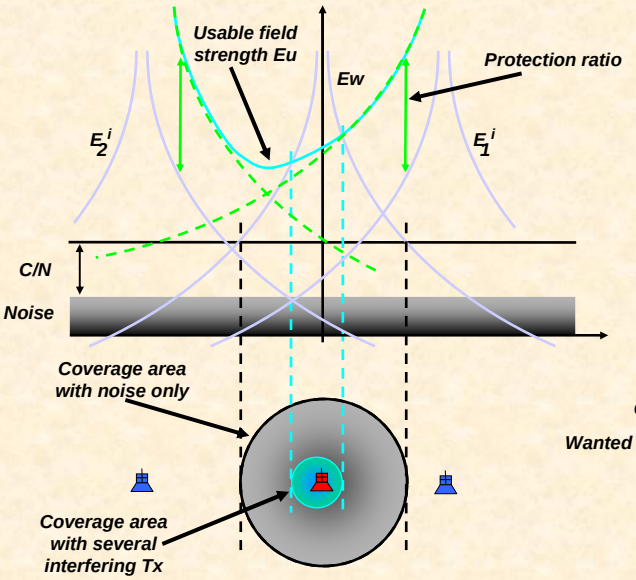


Criteria for coverage

Wanted Field Str. > Nuisance Field Str.

$$Ew > \underbrace{Ei + PR}_{En}$$

Interference by several Transmitters

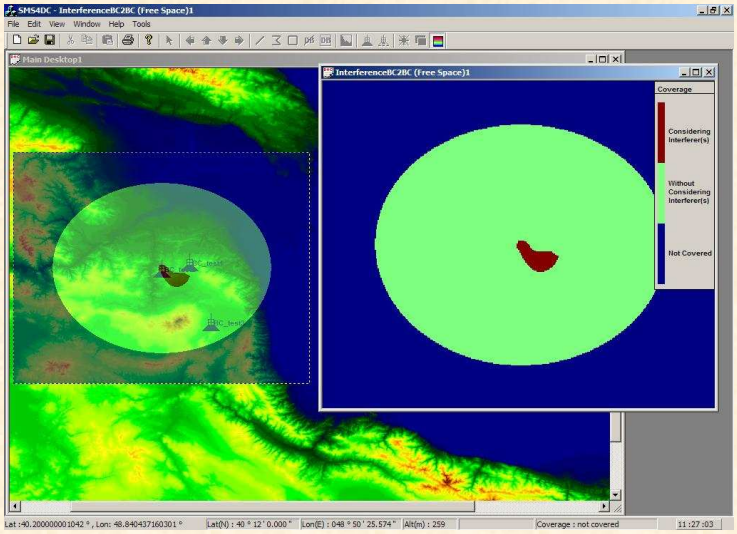


Criteria for coverage

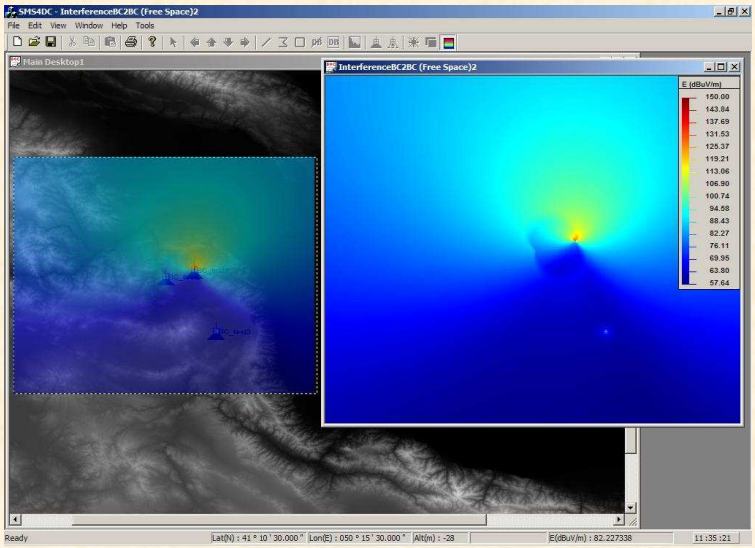
Wanted Field Str. > Usable Field Str.

$$Ew > \underbrace{\sum_{j=1}^{m} E_j^n}_{Eu}$$

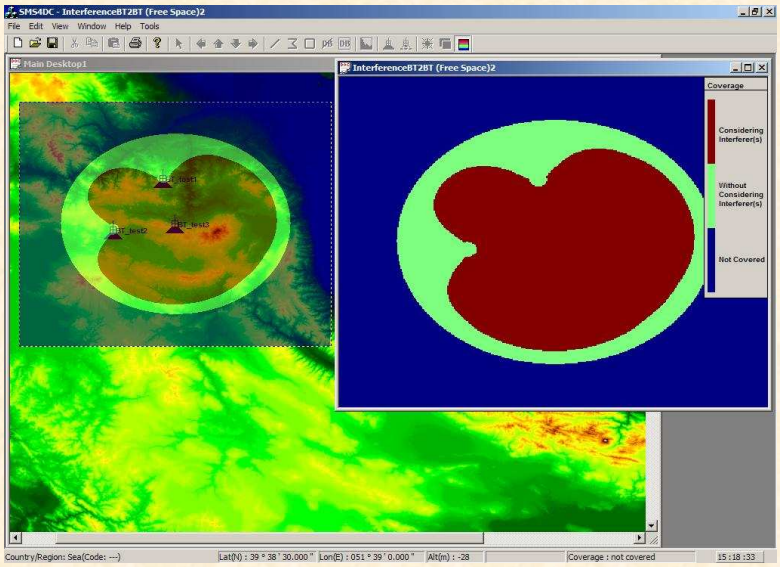
Interference BC to BC (Coverage)



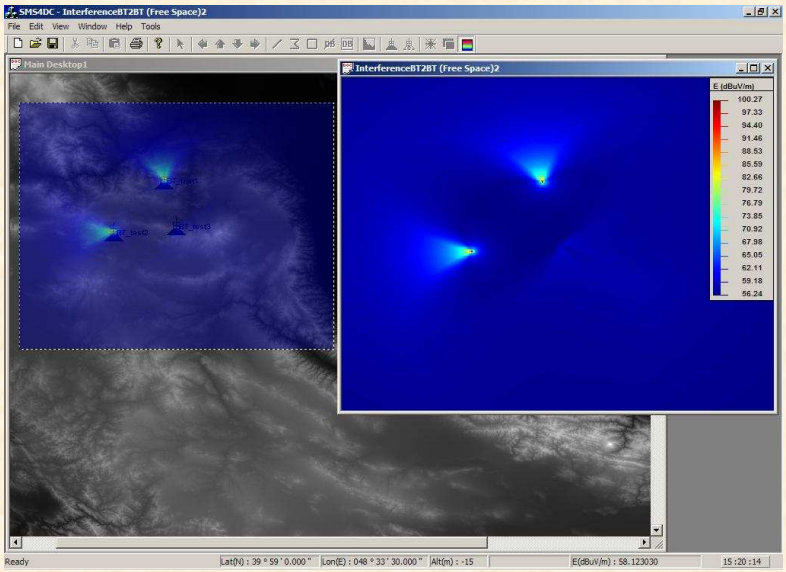
Interference BC to BC (Usable Fst.)



Interference BT to BT (Coverage)



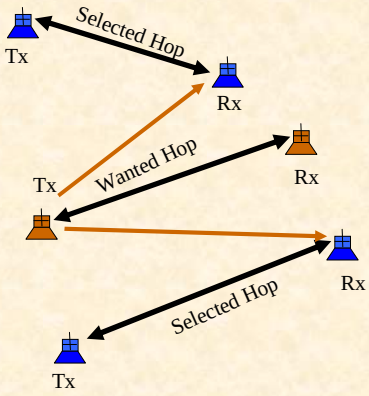
Interference BT to BT (Usable Fst.)

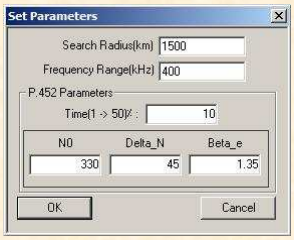


Interference : FX2FX (Link) (Interference to)

Interference from the wanted Hop to the selected Hop(s) (above 1 GHz)

Propagation Model : P.452



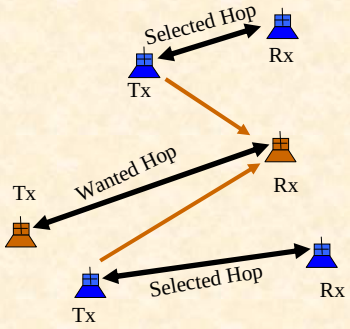


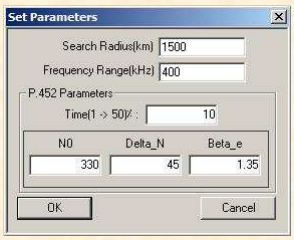
Rx frq.S = Tx frq.W ± frequency scan range

Interference : FX2FX (Link) (Interference from)

Interference from selected Hop(s) to the wanted Hop (above 1 GHz)

Propagation Model : P.452



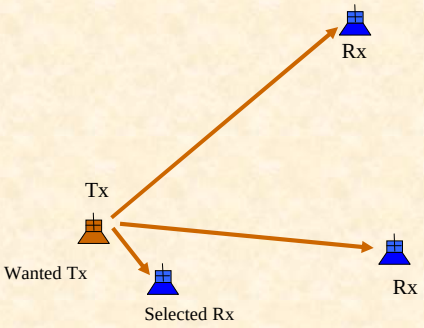


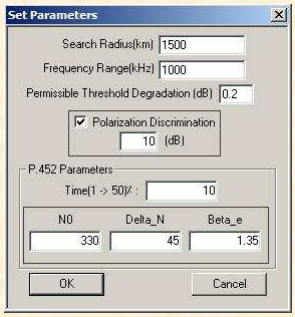
Tx frq.S = Rx frq.W ± frequency scan range

Interference : FX2FX (station) (Interference to)

Interference from the wanted Tx station to the selected RX station(s) (above 1 GHz)

Propagation Model : P.452





Rx frq.S = Tx frq.W ± frequency scan range

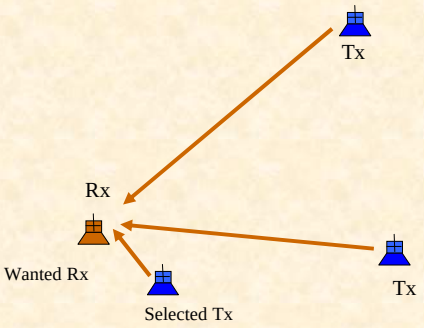
Threshold Degradation :

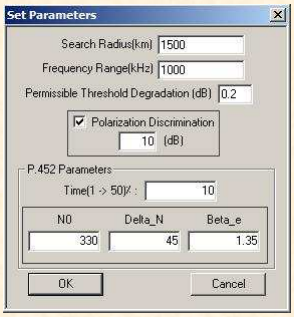
$$TD = 10\log_{10}(1+10^{(I-N)/10})\ dB$$

Interference : FX2FX (station) (Interference from)

Interference from the Tx selected station(s) to the Rx wanted station (above 1 GHz)

Propagation Model : P.452



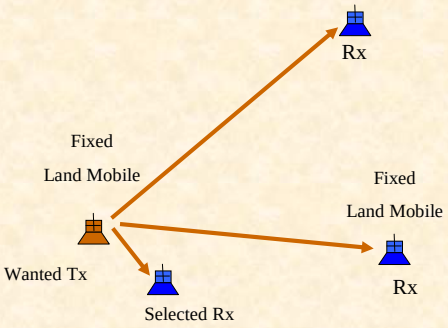


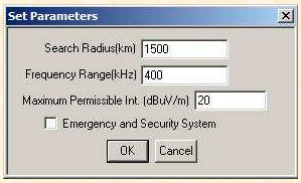
Rx frq.S = Tx frq.W ± frequency scan range

Interference : FXM (Interference to)

Interference from the wanted Tx station to the selected RX station(s) (below 1 GHz)

Propagation Model : Free Space & P.1546



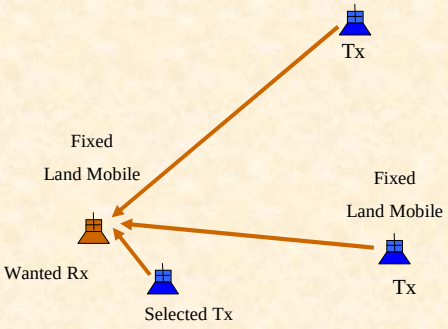


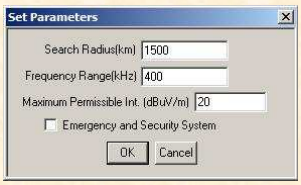
Rx frq.S = Tx frq.W ± frequency scan range

Interference : FXM (Interference from)

Interference from the selected Tx station(s) to the wanted Rx station (below 1 GHz)

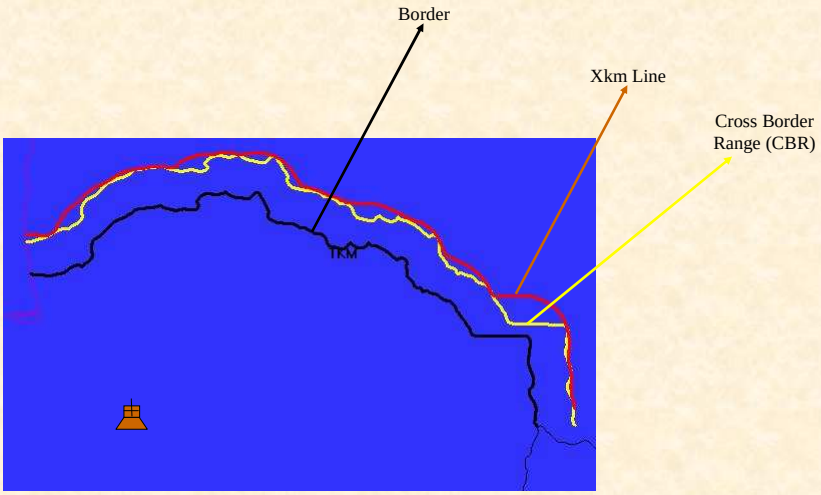
Propagation Model : Free Space & P.1546





Tx frq.S = Rx frq.W ± frequency scan range

Border Coordination



Border Coordination (Cont.)

- Model 1
  - Land Mobile
    - P.1546 → Cross Border Range (CBR) (Type A)
    - Free Space → Cross Border Range (CBR) (Type A)
  - Fixed
    - Frequency < 1GHz
      - P.1546 → Cross Border Range (CBR) (Type A)
      - Free Space → Cross Border Range (CBR) (Type A)
    - Frequency ≥ 1GHz → P.452 → Coordination Distance (Type B)
- Model 2
  - Land Mobile
    - P.1546 → Xkm Line Calculation
    - Free Space → Xkm Line Calculation
  - Fixed → Frequency < 1GHz
    - P.1546 → Xkm Line Calculation
    - Free Space → Xkm Line Calculation

User Defined Agreements