

22

(2005-2000)

" "

GHz 30-10,7

22

(WRC-2000) 2000-

(

(

31.11 35.9

(

.3-22 2-22 1E-22 1D-22 1C-22 1B-22 1A-22

(

(

(

)

(

(

(

1

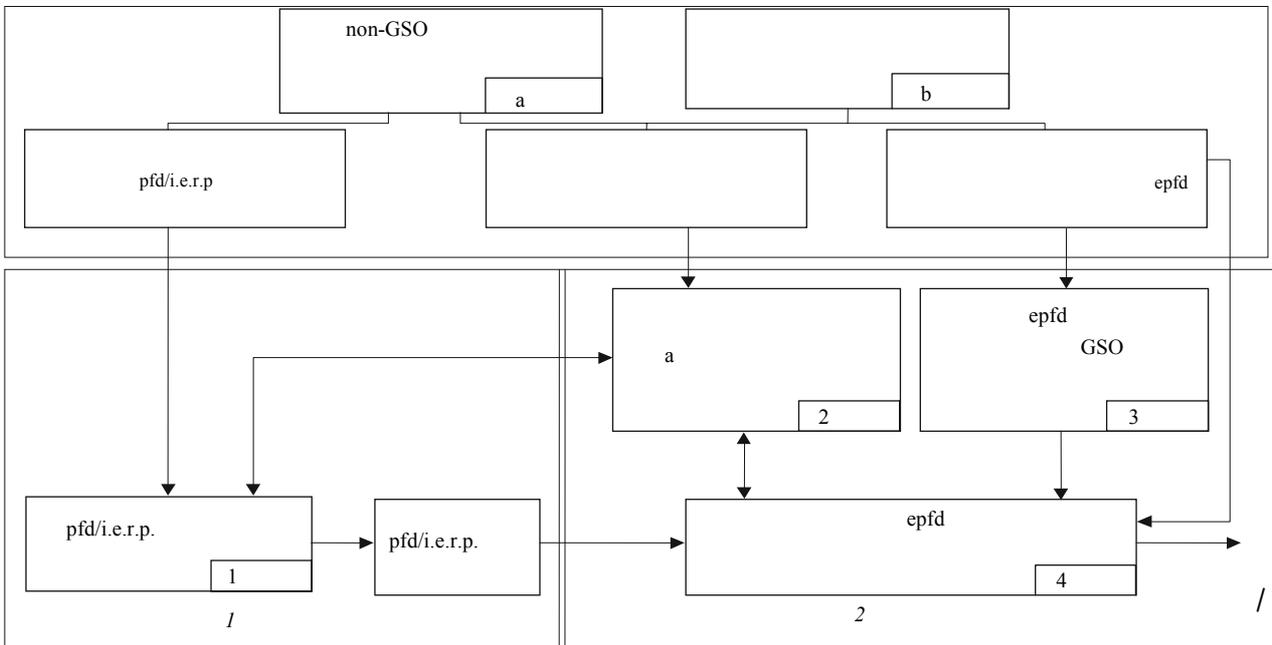
1

22 3-22 2-22 1E-22 1D-22 1C-22 1B-22 1A-22

1

2

(2) (1)
 .(3)
 (pfd) (pfd) -1
 .C
 (e.i.r.p) -2
 -3
 1 1 pfd/e.i.r.p.
 4 .
 4
 1 pfd/e.i.r.p.
 .2 .3
 1



1503-01

3.1.1

.(epfd)
 (1) :

pfd/e.i.r.p. .

pfd/e.i.r.p. .

pfd/e.i.r.p. 1

(a)

.pfd/e.i.r.p.

:

(epfd)
 (3) -

.(4) -

.(2) -

.(4) -

(a)

(b)

:

- A

- B

- C

- C'

- D

.4 3 D .

.b a

pfd/e.i.r.p.

.(1)

(2)

- H E

- G F

2.1

1

1

1

| | |
|---|--|
| | |
| (km) | |
| (s) | |
| km/s | |
| / | |
| (GHz) | |
| (KHz) | |
| dBW | |
| dB(W/Hz) | |
| dB(W/(m ² · BW _{ref})) | (pfd) |
| km ² /1 | |
| dB(W/BW _{ref}) | epfd _{IS} epfd _↓ epfd _↑ |
| dBi | |
| | |

3.1

:()

| | | | |
|--------------------------|-------------------------------|------------|--|
| | | | |
| km | 6 378,145 | R_e | |
| km | 42 164,2 | R_{geo} | |
| km^3/s^2 | ${}^5 10 \times 3,986012$ | μ | |
| km/s | ${}^5 10 \times 2,99792458$ | c | |
| / | ${}^3 10 \times 4,1780745823$ | ω_e | |
| s | 86 164,09054 | T_e | |
| km^5/s | ${}^{10} 10 \times 2,634$ | J_α | |

4.1

:

-

-

-

-

D

.D

2

:

()

A 2.2 1.2

A 3.2

$$\Delta t_{ref} = \frac{\Delta t}{N_{hit}} \quad \text{pfd}_{\downarrow}$$

(1)
$$\Delta t_{ref} = \frac{\Delta t}{N_{hit}}$$

$$\Delta t = \frac{2\varphi}{\omega} \quad \text{pfd}_{\downarrow}$$

(2)
$$\Delta t = \frac{2\varphi}{\omega}$$

$$\varphi = \frac{1}{2} \Phi_{3dB} - \arcsin \left[\frac{R_e}{R_e + h} \sin \left(\frac{1}{2} \Phi_{3dB} \right) \right]$$

$$\omega = \sqrt{(\omega_s \cos(i) - \omega_e)^2 + (\omega_s \sin(i))^2}$$

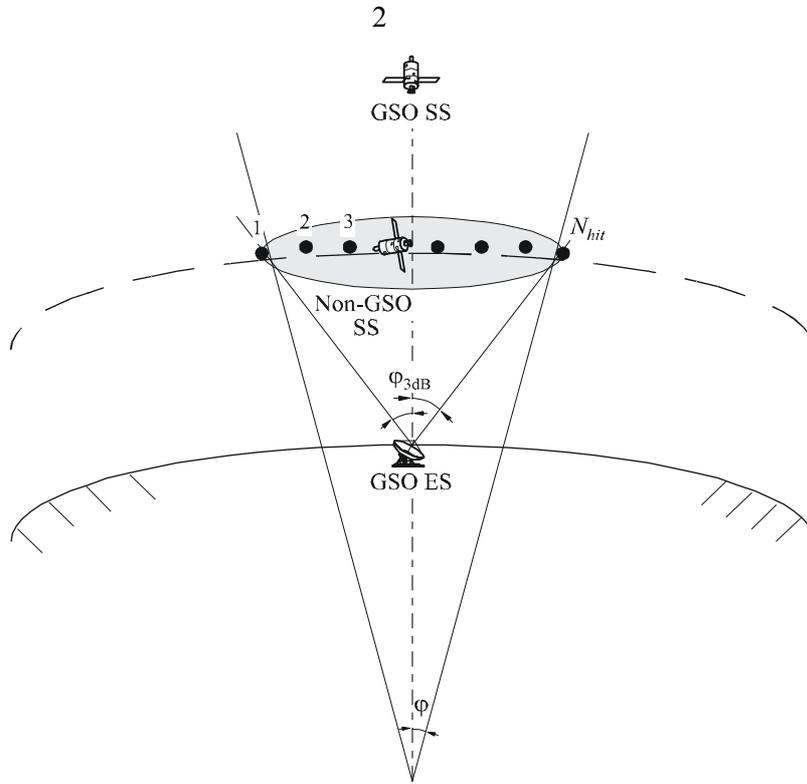
$$\omega_s = \frac{0.071}{[(R_e + h)/R_e]^{1.5}}$$

ω_s () ω_e

() dB 3
 ()
 (1) ()
 h

: i
 : Φ_{3dB}
 : R_e
 : h

-1



SS:
 ES:

1503-02

N_{hit}

5 N_{hit}

ITU-R S.1525

N_{hit}

| | | |
|---|--------------|----------|
| | | |
| | i | |
| | h | |
| | Φ_{3dB} | GSO dB 3 |
| - | N_{hit} | ↓ |

2.1.2

:

.3

: 1

-

: 2

.(2) (1)

: 3

3.1.2

)

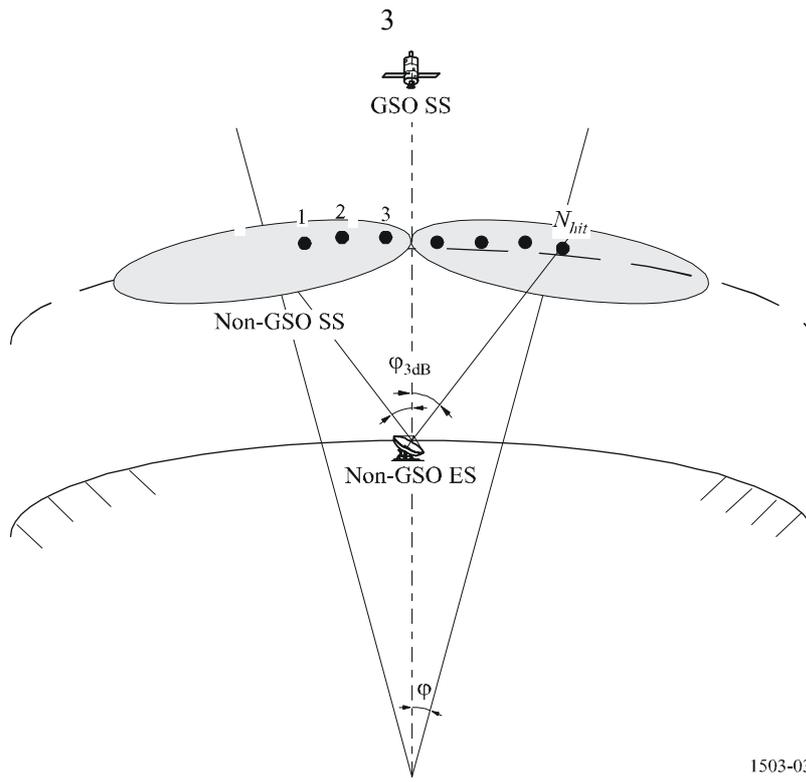
$epfd_{\uparrow}$ N_{hit}

.(

)

.(2) (1)

(3



1503-03

4

| | | |
|---|--------------|------|
| | | |
| | i | |
| | h | |
| | Φ_{3dB} | dB 3 |
| - | N_{hit} | ↑ |

4.1.2

.4 : 1

- : 2

.(2) (1)

: 3

5.1.2

N_{hit} $epfd_{is}$

:

: R_e

: h

: R_{geo}

: Φ_{3dB}

:(4)

:

$$\theta_1 = \arcsin\left(\frac{R_e}{R_{geo}}\right)$$

$$\theta_2 = 180 - \arcsin\left(\sin(\theta_1) \frac{R_{geo}}{R_e + h}\right)$$

$$\theta_3 = 180 - (\theta_1 + \theta_2)$$

$$D_1 = (R_e + h) \frac{\sin \theta_3}{\sin \theta_1}$$

$$D_2 = 2D_1 \sin\left(\frac{\Phi_{3dB}}{2}\right)$$

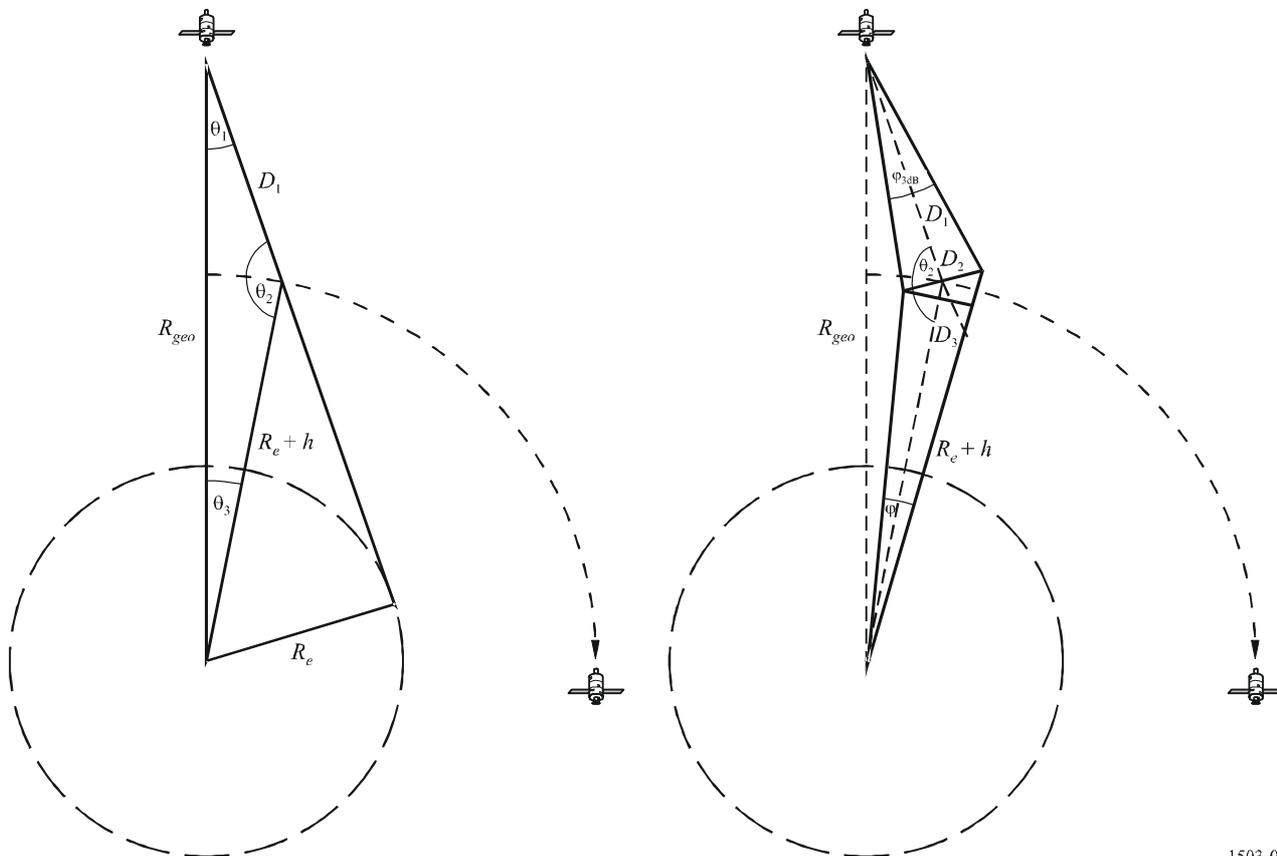
$$D_3 = D_2 \cos(180 - \theta_2)$$

:

$$(4) \quad \varphi = 2 \arctan\left[\frac{D_3/2}{(R_e + h) - (D_2/2) \sin(180 - \theta_2)}\right] \quad (2)$$

2.2

.D $epfd_{\uparrow}$ $epfd_{\downarrow}$



1503-04

5

| | | |
|---|------------|---|
| | | |
| - | | / |
| - | $N_S = 10$ | |

$$N_{min} = N_S \times 100 / (100 - (\%100 \quad 22 \quad))$$

:

$$\%99,999$$

$$N_{min} = 1\,000\,000$$

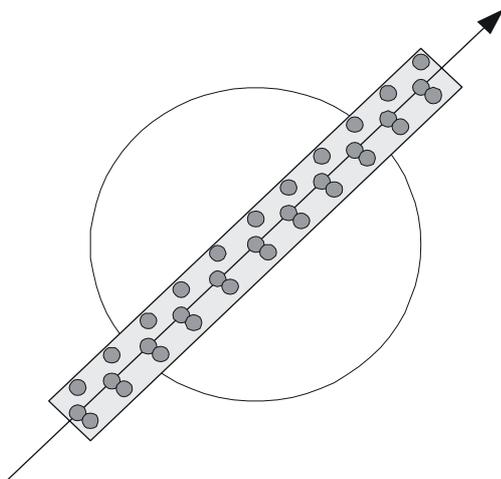
1.2.2

.D

.D

.5

5



1503-05

5

6

| | | |
|---|--------------|--|
| | | |
| s | P_{repeat} | |

:

$:N_{min}$

(s)

$:P_{repeat}$

(s)

$:T_{step}$

.ITU-R S.1325

5 =

$:N_{tracks}$

:

$$N_{repsteps} = P_{repeat}/T_{step}$$

$$T'_{step} = T_{step} (1 + N_{repsteps}) / N_{repsteps}$$

:

$$T_{sig} = N_{min} \cdot T_{step}$$

$$N_{rep} = \text{round} (T_{sig} / P_{repeat})$$

$$N_{tracks} \cdot N_{rep} \quad (\quad)$$

$$N_{run} = \max (N_{rep}, N_{tracks})$$

:

$$T_{run} = N_{run} \cdot P_{repeat}$$

:

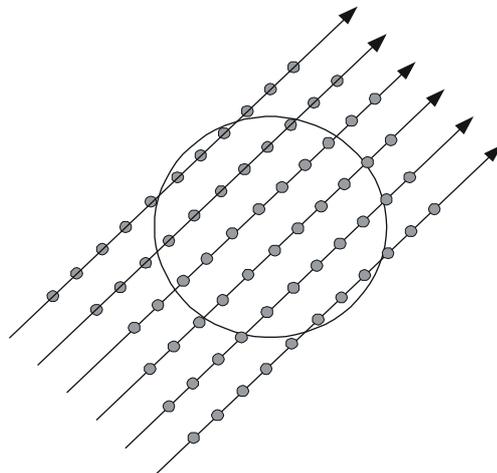
$$N_{steps} = (T_{run} / T_{step})$$

2.2.2

$$) \quad (N_{track} = N_{hits})$$

.6

6



| | | |
|---|--------------|----------|
| | | |
| | i | |
| | a | |
| | Φ_{3dB} | (1) dB 3 |
| — | N_{tracks} | |

(1)

$$e.i.r.p \quad :epfd_{is} \quad epfd_{\uparrow} \quad .epfd_{\downarrow} \quad \varphi \quad :epfd_{\uparrow}$$

(3)

$$. (4) \quad \varphi \quad : epfd_{is}$$

:

$$: S_{pass}$$

$$: S_{req}$$

:

$$: \Omega_r \quad : 1$$

$$\Omega_r = -6.91951 \times 10^{-3} \times (R_e/a)^{3.5} \cos(i) \quad /$$

:

$$. (\quad) \quad : i$$

:

$$: P_k \quad : 2$$

$$P_k = 84.48905 (a/R_e)^{1.5}$$

:

$$T_{period} = P_k \cdot 60$$

:

$$: P_n \quad : 3$$

$$P_n = P_k \{1 - [0.75 \cdot J_2 (6 - 5 (\sin i)^2) \cdot (R_e/a)^2]\}$$

$$(\quad) 0,001082636 = \quad J_2$$

$$S \quad : \quad 4$$

$$: (\quad / \quad 0,250684 = \Omega_e)$$

$$S_{pass} = (\Omega_e - \Omega_r) P_n$$

$$S_{req} \quad \cdot \quad S_{pass} \quad : \quad 5$$

$$: (3)$$

$$S_{req} = \frac{2\phi}{N_{tracks}}$$

: 6

$$N_{orbits} = \frac{180}{S_{req}}$$

N_{orbits} : 7

: : 8

$$S_{total} = N_{orbits} \cdot S_{pass}$$

: $^{\circ}360$: 9

$$N_{360} = 1 + S_{total} \text{ mod } 360$$

: :10

$$S_{actual} = \frac{360 N_{360}}{N_{orbits}}$$

: :11

$$S_{artificial} = S_{actual} - S_{pass}$$

:

$$D_{artificial} = \frac{S_{artificial}}{T_{period}} \quad /$$

\cdot D :12

:

$$T_{run} = T_{period} \cdot N_{orbits}$$

: :13

$$\cdot \quad N_{steps} = \text{Round} (T_{run} / T_{step})$$

3.2

() (6 D)
 . (

.D 4.6 3.6

B

1

1.1

:

() pfd :1 -
 .() (e.i.r.p.) :2 -
 .((epfd_↑) e.i.r.p.) (epfd_↓) :3 -
 pfd/e.i.r.p.

A 1.2

.3

.2

2.1

B 2
 B 5 4 3
 - 2 (B 3) -1 :
 -3 (B 4)
 .(B 5)

3.1

.B 2

| | | | |
|---|-----|-------------------------------------|----|
| | | | |
| C | 4-1 | pfd /e.i.r.p | -1 |
| D | 6-1 | epfd _↓ epfd _↑ | -2 |
| E | | | -3 |

2

1.2

B 1

4

2.2

| | | |
|----------|--|---------------------------|
| (dB 0,1) | | D S_B 5.4.1.4 5.4.3 5.2 |
| (/) 1 | | REGION1_UP D 1.1.4 |
| (/) 1 | | REGION1_DOWN D 1.3 |
| (/) 2 | | REGION2_UP D 1.1.4 |
| (/) 2 | | REGION2_DOWN D 1.3 |
| (/) 3 | | REGION3_UP D 1.1.4 |
| (/) 3 | | REGION3_DOWN D 1.3 |

| | | |
|---|----|--------------------------|
| (KHz) | | REFBW D 1.3 |
| (epfd _↓) | | NEPFD_DOWN D 1.3 |
| (dB(W/m ²)) NEPFD_DOWN | 22 | EPFD_DOWN_RR[I] D 1.3 |
| 22 (%) (dB(W/m ²)) NEPFD_DOWN | | DOWN_PC_RR[I] D 1.3 |

| | |
|-------------------------------------|--------------------------|
| (kHz) $epfd_{\uparrow}$ | RAFBW D 1.1.4 |
| $epfd_{\downarrow}$ | NEPFD_UP D 1.1.4 |
| 22 (dB(W/m ²)) NEPFD_UP | EPFD_UP_RR[I] D 1.1.4 |
| 22 NEPFD_UP | UP_PC_RR[I] D 1.1.4 |

| | |
|-------|----------------------------------|
| (GHz) | F_DOWN _{sat} D 2.4.3 |
| / | Nfreq D 2.4.3 |
| (°) | GSO_SEPARATION D 5.2 |
| () | GSO_LONG D 3.4.1.4 3.4.3 |
| () | GSO_ES_LAT D 3.4.3 |
| () | GSO_ES_LONG D 3.4.3 |
| D 5.5 | GSO_ES_PATTERN D 3.4.3 |
| | GSO_ES_D_ANT D 3.4.3 1.3 |

| | |
|---------|------------------------------------|
| | BS_LAT D 3.4.1.4 2.1.4 |
| | BS_LONG D 3.4.1.4 2.1.4 |
| (GHz) | ES_F D 2.4.1.4 |
| D 2.5.5 | GSO_SAT_PATTERN D 2.4.1.4 1.1.4 |
| | GSO_SAT_PEAKGAIN D 1.1.4 |
| | GSO_SAT_BEAMWIDTH D 1.1.4 |

| | |
|----------------------------------|-----------------------|
| (kHz) $epfd_{is}$ | RIFBW D 1.2.4 |
| $epfd_{is}$ | NEPFD_IS D 1.2.4 |
| NEPFD_IS (dB(W/m ²)) | EPFD_IS[I] D 1.2.4 |
| NEPFD_IS | IS_PC[I] D 1.2.4 |

| | |
|-------------------|-------------------|
| (GHz) $epfd_{is}$ | IS_F D 2.4.2.4 |
|-------------------|-------------------|

:

| | |
|-----|------------------------|
| () | PHISTEPCG D 4.4.3 |
| () | THETASTEPCG D 4.4.3 |
| () | PHISTEPFG D 4.4.3 |
| () | THETASTEFG D 4.4.3 |

3

1.3

| | |
|-----|---|
| | N_{sat} D 2.4.1.4 2.4.3 |
| lat | $N_{co}[\text{latitude}]$ D 2.4.3 |
| () | $A[N]$ D 2.4.1.4 2.4.3 |
| | $E[N]$ D 2.4.1.4 2.4.3 |
| () | $I[N]$ D 2.4.1.4 2.4.3 |
| () | $O[N]$ D 2.4.1.4 2.4.3 |
| () | $W[N]$ D 2.4.1.4 2.4.3 |
| () | $V[N]$ D 2.4.1.4 2.4.3 |
| | W_{delta} D 2.4.1.4 2.4.3 |
| () | H_{MIN} D 2.4.3 |
| | ORBIT_PRECESS 4.4.1.4 4.4.3 D 4.4.2.4 |

| | |
|------------------------|-----------------------------|
| | non_GSO_ES_PATTERN C 3.3 |
| (dBW) | <i>P</i> C 4.3 |
| (GHz) | FSTART_UP D 1.1.4 |
| (GHz) | FEND_UP D 1.1.4 |
| 1 | REGION1_UP D 1.1.4 |
| 2 | REGION2_UP D 1.1.4 |
| 3 | REGION3_UP D 1.1.4 |
| | ES_TRACK D 2.4.1.4 |
| RAFBW (e.i.r.p.) (dBW) | ES_EIRP D 2.4.1.4 |
| () | ES_MINELEV D 2.4.1.4 |
| () | ES_MIN_GSO D 2.4.1.4 |
| (²) | ES_DENSITY D 2.4.1.4 |
| () | ES_DISTANCE D 2.4.1.4 |

2.2.3

| | |
|----------------|-----------------------------------|
| (GHz) | FSTART_DOWN D 3.1 |
| (GHz) | FEND_DOWN D 3.1 |
| 1 | REGION1_DOWN D 3.1 |
| 2 | REGION2_DOWN D 3.1 |
| 3 | REGION3_DOWN D 3.1 |
| <i>i</i> (dBW) | P_i C 1.3.2 |
| (dBi) | G C 1.3.2 |
| (dBi) | G_{cross} C 1.3.2 |
| | N_{co} C 1.3.2 |
| | N_{cross} C 1.3.2 |
| :) / (| ANTENNA POINTING C 2.4.2 1.4.2 |

epfd_{is}

3.2.3

| | |
|--------------------------|------------------------------|
| (GHz) epfd _{is} | FSTART_IS D 1.2.4 |
| (GHz) epfd _{is} | FEND_IS D 1.2.4 |
| 1 | REGION1_IS D 1.2.4 |
| 2 | REGION2_IS D 1.2.4 |
| 3 | REGION3_IS D 1.2.4 |
| RIFBW (dBW) | non_GSO_SS_EIRP D 2.4.2.4 |

3.3

4.3

1.4.3

| | |
|-----|-------|
| () | C 2.2 |
|-----|-------|

2.4.3

| | |
|-----|-------|
| () | C 2.2 |
|-----|-------|

epfd_↑

4

epfd_↓

1.4

.1.3 B

2.4

| | | |
|-------|--------------|---|
| | | MIN_EXCLUDE D 2.4.3 |
| : | | 1 (ΔL (X)) pfd_mask C 2 |
| | α | - |
| | α . | - |
|) | X | - |
| | ΔL | - |
| | (X) α | - |
| : | | 2 (E1 Az) pfd_mask C 2 |
| 3.4.5 | D | - |
| 3.4.5 | D | - |

3.4

| | | |
|------------------|-----|------------------------------|
| () | | C 2.2 |
| | | ES_EIRP[θ] C 1.3 |
| | | ES_TRACK D 2.4.1.4 |
| | () | ES_MINELEV D 2.4.1.4 |
| () | | ES_MIN_GSO D 2.4.1.4 |
| (²) | | ES_DENSITY D 2.4.1.4 |
| () | | ES_DISTANCE D 2.4.1.4 |

4.4

1.4.4

()

2.4.4

5

.B 1 3

1

B

4

4

8

)

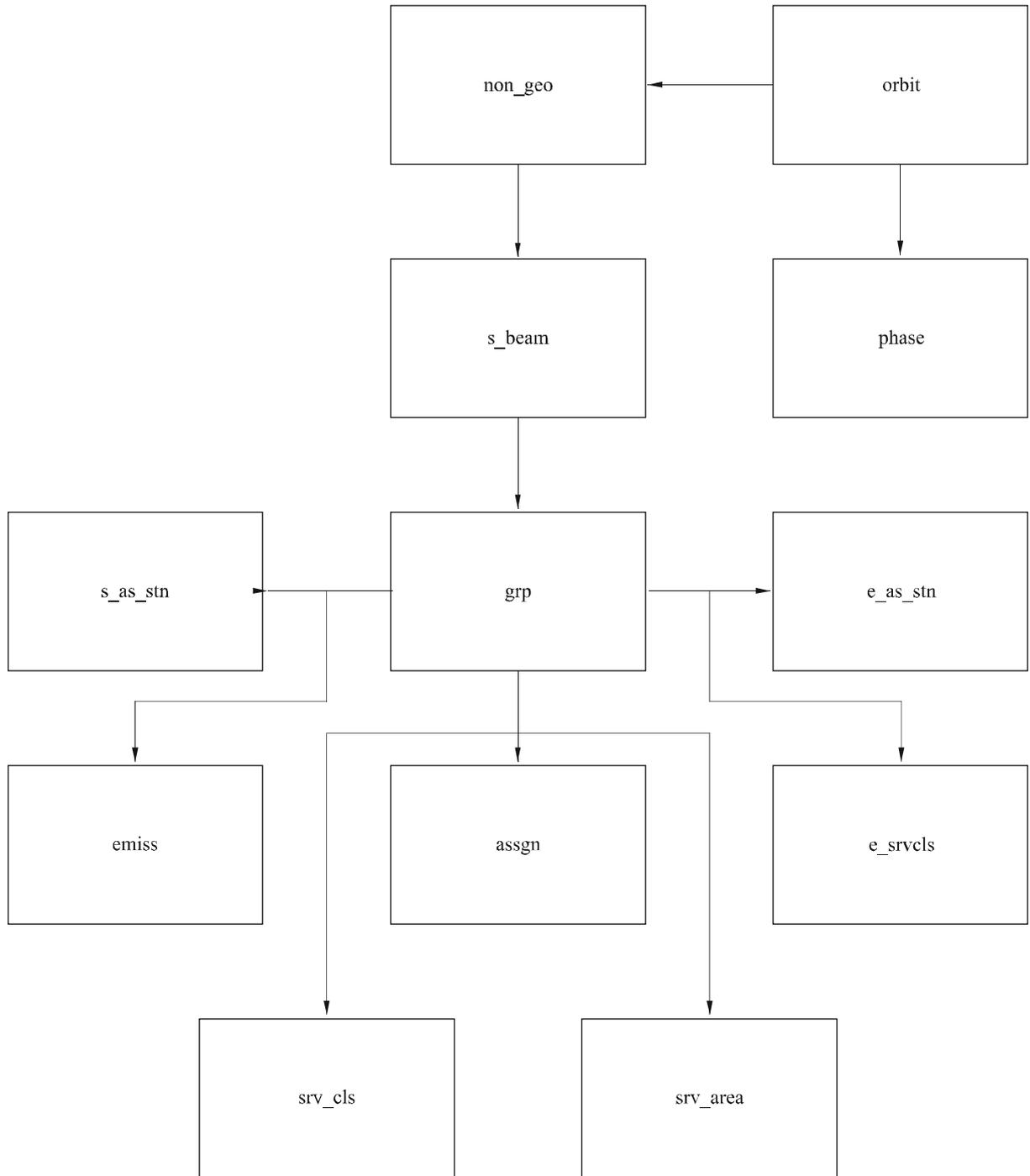
(BR)

(SNS)

7

.(WRC-03) (03-

8



II/4

| | | 4/II | | 4 | | |
|--|-------------------------|------|-----------|----------|-----------------|-----------------|
| | | | | | | assgn |
| | | x | 9(9) | | <i>grp_id</i> | |
| | | x | 9(4) | | <i>seq_no</i> | |
| | [G] [M] [K] | x | X | C2a1a | freq_sym | |
| | | x | 9(5).9(5) | C2a1b | freq_assgn | |
| | MHz | | 9(6).9(6) | BR | freq_mhz | |
| | [E] [N] [B] . [X] | | X | BR | f_cmp_rec | |
| | | | | | | e_as_stn |
| | | x | 9(9) | | <i>grp_id</i> | |
| | | x | 9(4) | | <i>seq_no</i> | |
| | | x | X(20) | 1.b.10.C | <i>stn_name</i> | |
| | | x | XXX | | ctry | |
| | | x | X | | act_code | |
| | [T] [S] | x | X | 2.b.10.C | stn_type | |
| | | x | 999 | 1.c.10.C | long_deg | |
| | [W] [E] : | x | X | 1.c.10.C | Long_ew | |
| | | x | 99 | 1.c.10.C | Long_min | |

() 8

| | | | | | | |
|--|-----------|------|------------|--------------|--------------|-----------------|
| | | 4/II | | 4 | | |
| | | x | 99 | 1.c.10.C | long_sec | e_as_stn |
| | | x | 99 | 1.c.10.C | lat_deg | |
| | [S] [N] : | x | X | 1.c.10.C | lat_ns | |
| | | x | 99 | 1.c.10.C | lat_min | |
| | | x | 99 | 1.c.10.C | lat_sec | |
| | | x | 9(6) | 6.d.10.C | noise_t | |
| | | x | S99.9 | 3.d.10.C | gain | |
| | | x | 999.99 | 4.d.10.C | bmwidth | |
| | | x | 9999 | 1.a.5.d.10.C | pattern_id | |
| | | x | 9999 | 1.a.5.d.10.C | pattern_id_x | |
| | | x | 99 | 2.a.5.d.10.C | diag_e | |
| | | x | 99 | 2.a.5.d.10.C | diag_e_x | |
| | | x | X(20) | C10b | stn_old | |
| | | | S9(3).9(4) | | long_dec | |
| | | | S9(2).9(4) | | lat_dec | |

() 8

| | | | | | | |
|--|-----------------|------|-----------|-----------------------|-----------------|-----------------|
| | | 4/II | | 4 | | |
| | () () | X | 9(3).9(4) | /7.d.10.C 8.d.10.C | ant_diam | e_as_stn |
| | | | S9(5) | | ant_alt | |
| | | | X | | clim_zone | |
| | | | X | | rcp_type | |
| | () dBW | | S99.99 | 1.g.8.C | pwr_max | |
| | () | | 9(6) | 2.g.8.C | bdwidth_aggr | |
| | () | | X | 3.g.8.C | f_trp_band | |
| | [X] [E] [N] [B] | | X | | f_cmp_rec | |
| | | x | | | | e_srvcls |
| | | x | 9(9) | BR | <i>grp_id</i> | |
| | | x | 9(4) | | <i>seq_e_as</i> | |
| | | x | 9(4) | | <i>seq_no</i> | |
| | | x | XX | 1.d.10.C | stn_cls | |
| | | x | XX | 1.d.10.C | nat_srv | |
| | | | | | | |

() 8

| | | | | | | |
|--|----------|------|--------|-----------------|---------------|--------------|
| | | 4/II | | 4 | | |
| | | | | | | emiss |
| | | x | 9(9) | | <i>grp_id</i> | |
| | | x | 9(4) | | <i>seq_no</i> | |
| | | x | X(9) | a.7.C | Design_emi | |
| | [dBW] | x | S99.9 | 1.b.8.C/1.a.8.C | Pwr_tot_pk | |
| | [dBW/Hz] | x | S999.9 | 2.b.8.C/2.a.8.C | pwr_ds_max | |
| | [dBW] | x | S99.9 | 1.c.8.C | pwr_min_pk | |
| | [dBW/Hz] | x | S999.9 | 3.c.8.C | pwr_ds_min | |
| |) | x | S99.9 | 1.e.8.C | c_to_n | |
| | (| | S999.9 | i.8.C/h.8.C | pwr_ds_nbw | |
| | [dBW/Hz] | | S999.9 | i.8.C/h.8.C | pwr_ds_nbw | |
| | | x | X | b.8.C/a.8.C | f_emi_type | |
| | | x | 99 | 2.c.8.C | attch_pep | |
| | | x | 99 | 4.c.8.C | attch_mpd | |
| | | x | 99 | 2.e.8.C | attch_c2n | |
| | [E] | | X | | f_cmp_rec | |
| | [N] | | | | | |
| | [B] | | | | | |
| | [X] | | | | | |
| | | | | | | grp |
| | | x | 9(9) | | <i>grp_id</i> | |
| | | x | 9(9) | | <i>ntc_id</i> | |

() 8

| | | | | | | |
|-------|---------|------|--------|-----------------|------------|------------|
| | | 4/II | | 4 | | |
| | [R] [E] | x | X | 2.B | emi_rcp | grp |
| | | x | X(8) | a.1.B | beam_name | |
| () | | x | 9(4) | | page_no | |
| | | x | X | | act_code | |
| | | x | XX | a.3.B | adm_resp | |
| | (kHz) | x | 9(8) | a.3.C | bdwidth | |
| | | x | 9(8) | a.2.A | d_inuse | |
| | | x | 9(6) | a.5.C | noise_t | |
| | | x | 999 | a.3.A | op_agcy | |
| |) (| x | XX | a.6.C | polar_type | |
| | () | x | 999.99 | b.6.C | polar_ang | |
| | | x | 99 | a.11.C | diag_area | |
| 11A.9 | | x | 99 | 2.c.9.C | diag_spect | |
| | | x | 99 | b.2.A | prd_valid | |
| | 13C | x | X(30) | | remark | |
| | | x | 9(9) | | tgt_grp_id | |
| | dBW dBW | x/- | S99.9 | 1.g.8.C/1.d.8.C | pwr_max | |

() 8

| | | | | | | |
|---------|----------|------|------|-----------------|---------------|------------|
| | | 4/II | | 4 | | |
| | () | x | 9(6) | 2.g.8.C/2.d.8.C | bdwidth_aggr | grp |
| |) | | X | 3.g.8.C | f_trp_bdwidth | |
| 11A.9 | | x | 99 | 1.c.9.C | attch_mux | |
| | | x | 99 | a.11.C | area_no | |
| | | | XX | a.13.C | observ_cls | |
| | UTC | | 9(4) | a.11.A | reg_op_fr | |
| | UTC | | 9(4) | b.11.A | reg_op_to | |
| (/ /) | (SNS) | | 9(8) | | d_upd | |
| | | | XX | BR | st_cur | |
| | | | 9(8) | BR | d_st_cur | |
| | WIC/IFIC | | 9(4) | | wic_no | |
| | | | X | | wic_part | |
| (/ /) | | | 9(8) | | d_wic | |

ITU-R S.1503-1

() 8

| | | | | | | |
|---------|---------------------------|------|----------|-----------------|------------|-----|
| | | 4/II | | 4 | | |
| (/ /) | 1154-1148 1065-1061 | | 9(8) | | d_prot_eff | grp |
| | 13A : (13A1) (IFL) | | XX | | fdg_reg | |
| | 13A : (13A2) (IFL) | | XX | | fdg_plan | |
| | 13A : (13A3) (1FL) | | XX | | fdg_tex | |
| | 13A : (13B2) (1F3) 13B | | X(4) | | fdg_observ | |
| | | | 9(9) | | spl_grp_id | |
| | | | X(30) | | comment | |
| | | | X(20) | a.11.C | area_name | |
| 11A.9 | | x | 99 | C.11.b | attach_reg | |
| | (VLBI) | x | S9(3).99 | c.13.C/4.b.14.A | elev_min | |
| | | x | 99.99 | 5.b.14.A | gso_sep | |
| | | | X(12) | | prov | |

() 8

| | | | | | | |
|-------|--------------------------------|------|-----------|---------|-------------|------------|
| | | 4/II | | 4 | | |
| | | | X(6) | | srv_code | grp |
| | (-) (MHz) | | 9(6).9(6) | | freq_min | |
| | (+) (MHz) | | 9(6).9(6) | | freq_max | |
| | 4.4 | x | X | | f_no_intfr | |
| 11A.9 | 5± 7 (s-E) MHz 075-6 700 | x | S999.9 | 5.b.4.B | pfid_pk_7g | |
| | | | 9(8) | BR | d_rcv | |
| | C3b | | X | b.13.C | ra_stn_type | |
| | | | X | | f_fdg_reqd | |
| | (grp-id) | | 9(9) | | cmp_grp_id | |
| | | | | | f_cost_rec | |
| | [E] [N] [B] [X] | | X | | f_cmp_str | |
| | [E] [N] [B] .[X] | | X | | f_cmp_rec | |
| | [E] [N] [B] [X] | | X | | f_cmp_freq | |

() 8

| | | | | | | |
|--|------------|------|-----------|------------------------------------|----------------|------------|
| | | 4/II | | 4 | | |
| | [E] [N] | | X | | f_cmp_emi | grp |
| | [B] [X] | | X | | f_cmp_eas | |
| | [E] [N] | | X | | f_cmp_prov | |
| | [B] [X] | | X | | f_cmp_sas | |
| | [E] [N] | | X | | f_cmp_gpub | |
| | [B] [X] | | X | | f_cmp_fdg | |
| | | | | | | |
| | | x | 9(9) | /1.a.14.A /1.b.14.A 1.c.14.A | <i>mask_id</i> | |
| | [GHz] | x | 9(6).9(6) | /2.a.14.A /2.b.14.A 2.c.14.A | freq_min | |

() 8

| | | | | | | |
|--|-------------|------|-----------|------------------------------------|-----------------|------------------|
| | | 4/II | | 4 | | |
| | [GHz] | x | 9(6).9(6) | /3.a.14.A /3.b.14.A 3.c.14.A | freq_max | mask_info |
| | [P] [S] [E] | x | X | | f_mask | |
| | | | | | | mask_lnk1 |
| | | x | 9(9) | | <i>grp_id</i> | |
| | | x | 9(4) | | <i>seq_no</i> | |
| | | x | 9(9) | | <i>ntc_id</i> | |
| | | x | 9(4) | | orb_id | |
| | | x | 9(4) | | sat_orb_id | |
| | | x | 9(9) | /1.a.14.A /1.b.14.A 1.c.14.A | mask_id | |
| | | | | | | mask_lnk2 |
| | | x | 9(9) | | <i>grp_id</i> | |
| | | x | 9(4) | | <i>seq_e_as</i> | |
| | | x | 9(4) | | <i>seq_no</i> | |
| | | x | 9(9) | | ntc_id | |
| | | x | 9(4) | | orb_id | |
| | | x | 9(4) | | sat_orb_id | |
| | | x | 9(9) | /A.14.a.1 /A.14.b.1 A.14.c.1 | mask_id | |

() 8

| | | | | | | |
|--|----------------|------|--------|-------------|---------------|----------------|
| | | 4/II | | 4 | | |
| | | x | | | | non_geo |
| | | x | 9(9) | | <i>ntc_id</i> | |
| | | x | X(20) | a.1.A | sat_name | |
| | | x | X | 2.b.4.A | ref_body | |
| | | x | 999 | a.3.b.4.A | nbr_sat_nh | |
| | | x | 999 | b.3.b.4.A | nbr_sat_sh | |
| | | x | 99 | 1.b.4.A | nbr_plane | |
| | | x | 9(4) | a.7.b.4.A | nbr_sat_td | |
| | ² | x | 9(6) | b.7.b.4.A | density | |
| | | x | 9(3).9 | c.7.b.4.A | avg_dist | |
| | : [N] X [Y] | x | X | 1.d.7.b.4.A | f_x_zone | |
| | | x | 99.9 | 2.d.7.b.4.A | x_zone | |
| | | x | X | a.15.A | f_epfd | |
| | [I] [A] | | X | | f_active | |
| | () | x | | 3.d.7.b.4.A | attch_x_zone | |

() 8

| | | | | | | |
|--|----------------------------------|------|---------|-------------|-------------|---------|
| | | 4/II | | 4 | | |
| | dB(W/(m ² · MHz) 129- | x | X | a.17.A | f_pfd_limit | non_geo |
| | | x | | | | orbit |
| | | x | 9(9) | BR | ntc_id | |
| | | x | 99 | | orb_id | |
| | | x | 99 | b.4.b.4.A | nbr_sat_pl | |
| 11A.9 | | x | 999.99 | a.5.b.4.A | right_asc | |
| | | x | 999.9 | a.4.b.4.A | inclin_ang | |
| | | x | 999 | 1.c.4.b.4.A | prd_ddd | |
| | | x | 99 | 2.c.4.b.4.A | prd_hh | |
| | | x | 99 | 3.c.4.b.4.A | prd_mm | |
| 99 999 < "apogee" () "apog_exp" ⁵ 10 × 1,25 = 125 000 : | - | x | 9(5).99 | d.4.b.4.A | apog | |
| 1 °10 0 ²10 2 ¹10 | 10 | x | 99 | d.4.b.4.A | apog_exp | |

() 8

| | | | | | | |
|--|------------------|------|---------|-----------|------------|--------------|
| | | 4/II | | 4 | | |
| "perigee" 99 999 < () "perig_exp" $^5 10 \times 1,25 = 125\ 000$: | - | x | 9(5),99 | e.4.b.4.A | perig | orbit |
| 1 °10 0 $^2 10$ 2 °10 | 10 | x | 99 | e.4.b.4.A | perig_exp | |
| 11A.9 | () | x | 999.9 | c.5.b.4.A | perig_arg | |
| "op_ht" 99 < () "op_ht_exp" $^2 10 \times 2,5 = 250$: | | x | 99.99 | b.6.b.4.A | op_ht | |
| 1 °10 0 $^2 10$ 2 °10 | 10 | x | 99 | b.6.b.4.A | op_ht_exp | |
| | [Y] [N] | x | X | c.6.b.4.A | f_stn_keep | |
| | (s) | x | 999 | d.6.b.4.A | rpt_prd_dd | |
| | (s) | x | 99 | d.6.b.4.A | rpt_prd_hh | |
| | (s) | x | 99 | d.6.b.4.A | rpt_prd_mm | |
| | (s) | x | 99 | d.6.b.4.A | rpt_prd_ss | |
| | [N] [Y] J_2 | x | X | e.6.b.4.A | f_precess | |

() 8

| | | | | | | |
|--|------------------------------------|------|--------|-----------|-------------------|--------------|
| | | 4/II | | 4 | | |
| | J_2 | x | 999.99 | f.6.b.4.A | precession | orbit |
| | j (0° = $j < 360^\circ$) | x | 999.99 | g.6.b.4.A | long_asc | |
| | | x | 99.9 | i.6.b.4.A | keep_rnge | |
| | [E] [N] [B] [X] | | X | | f_cmp_rec | |
| | [E] [N] [B] | | X | | f_cmp pha | |
| | | x | | | | |
| | | x | 9(9) | | <i>ntc_id</i> | |
| | [R] [E] | x | X | 2.B | <i>emi_rcp</i> | |
| | | x | X(8) | a.1.B | <i>beam_name</i> | |
| | | x | 9(4) | 1.a.4.B | <i>orb_id</i> | |
| | | x | 9(4) | 2.a.4.B | <i>orb_sat_id</i> | |

() 8

| | | | | | | |
|-----------------|-----------------------|------|-------------|-------------------------|--|-------------------|
| | | 4/II | | 4 | | |
| | | x | | | | phase |
| | | x | 9(9) | | | <i>ntc_id</i> |
| | | x | 99 | | | <i>orb_id</i> |
| | | x | 99 | | | <i>orb_sat_id</i> |
| 11A.9 | | x | 999.9 | b.5.b.4.A | | phase_ang |
| | Ω_j | x | 9(8) , 9(6) | /i.6.b.4.A h.6.b.4.A | | d_ref |
| | [E] [N] [B] [X] | | X | | | f_cmp_rec |
| | | x | | | | s_as_stn |
| | | x | 9(9) | | | <i>grp_id</i> |
| | | x | X(20) | 1.a.10.C | | <i>sat_name</i> |
| | | x | X(8) | | | <i>beam_name</i> |
| | | x | X | | | act_code |
| | | x | X(8) | | | beam_old |
| | | x | X(20) | | | sat_old |
| | [G] : [N] | x | X | 10.C | | stn_type |
| 180,00+ 179,99- | “+” “-” | x | S999.99 | 2.a.10.C | | long_nom |

() 8

| | | | | | | |
|-------|-----------------------|------|-------|-----------|------------|----------|
| | | 4/II | | 4 | | |
| | [E] [N] [B] [X] | | X | | f_cmp_rec | s_as_stn |
| | | x | | | | s_beam |
| | | x | 9(9) | | ntc_id | |
| | [R] [E] | x | X | 2.B | emi_rcp | |
| | | x | X(8) | a.1.B | beam_name | |
| | 191.1) (| x | X | c.1.B | f_steer | |
| | | x | X | | act_code | |
| 11A.9 | | x | 999.9 | a.1.b.4.B | ang_alpha | |
| 11A.9 | | x | 99.9 | b.1.b.4.B | ang_beta | |
| 11A.9 | | x | X(8) | | beam_old | |
| | | x | 99 | a.1.c.3.B | diag_e | |
| | | x | 99 | a.2.c.3.B | diag_e_x | |
| 11A.9 | | x | 99 | 2.b.4.B | diag_elev | |
| | | x | 99 | 1.b.3.B | diag_gain | |
| | | x | 99 | e.3.B | diag_orb_e | |
| | ant_type | | 99 | b.1.c.3.B | pattern_id | |

| | | | | | | |
|-------|-----------------|------|-----------|-----------|--------------|---------------|
| | | 4/II | | 4 | | |
| | ant_type | | 99 | b.2.c.3.B | pattern_id_x | s_beam |
| | | x | S99.9 | 1.a.3.B | gain | |
| 11A.9 | | x | 99 | 3.b.4.B | loss_attch | |
| | | x | 9.99 | d.3.B | pnt_acc | |
| 11A.9 | kHz 4 | x | S99.9 | a.4.b.4.B | pwr_max_4k | |
| 11A.9 | kHz 4 | x | S99.9 | b.4.b.4.B | pwr_avg_4k | |
| 11A.9 | MHz 1 | x | S99.9 | c.4.b.4.B | pwr_max_1m | |
| 11A.9 | MHz 1 | x | S99.9 | d.4.b.4.B | pwr_avg_1m | |
| | | | 99.9 | | beamlet | |
| | | | S999.99 | a.1.f.3.B | bore_long | |
| | | | S99.99 | b.1.f.3.B | bore_lat | |
| | | | 99.99 | c.2.f.3.B | maj_axis | |
| | | | 99.99 | d.2.f.3.B | min_axis | |
| | | | S9(3).99 | b.2.f.3.B | orient | |
| | | | 9.99 | a.2.f.3.B | rot_acc | |
| | () | | 99.9 | 2.a.3.B | gain_x | |
| | | | 9(3).9(2) | a.12.C | prot_ratio | |
| | | | 9(4) | 2.b.3.B | diag_gainx | |
| | (-) | | 9(6).9(6) | | freq_min | |
| | (+) | | 9(6).9(6) | | freq_max | |

() 8

| | | | | | | |
|--|-----------------------|------|------|--------|---------------|-----------------|
| | | 4/II | | 4 | | |
| | | | X | | f_fdg_reqd | s_beam |
| | / ntc_id / | | 9(9) | | cmp_ntc_id | |
| | | | X(8) | | cmp_beam | |
| | [E] [N] [B] [X] | | X | | f_cmp_str | |
| | [E] [N] [B] [X] | | X | | f_cmp_rec | |
| | | x | | | | |
| | | x | 9(9) | | <i>grp_id</i> | srv_area |
| | | x | XXX | a.11.C | <i>ctry</i> | |
| | | x | | | | srv_cls |
| | | x | 9(9) | | <i>grp_id</i> | |
| | | x | 9(4) | | <i>seq_no</i> | |
| | | x | XX | a.4.C | stn_cls | |
| | | x | XX | b.4.C | nat_srv | |

C

(pfd/e.i.r.p.)

/

1

(pfd)

.pfd

pfd

2

1.2

(pfd)

pfd

:

:

:1

-

-

α

-

α

X)

(

ΔL

-

(X) α

:

:2

-

-

3.4.5 D

-

.3.4.5 D

-

(X α)

.

()

GSO

pdf

X α

$\cdot \text{epfd}_{\downarrow}$

2.2

$\cdot \text{epfd}_{\uparrow}$

:
:

$\cdot () \alpha_0$

:

α_0

:

X

$\cdot X_0$

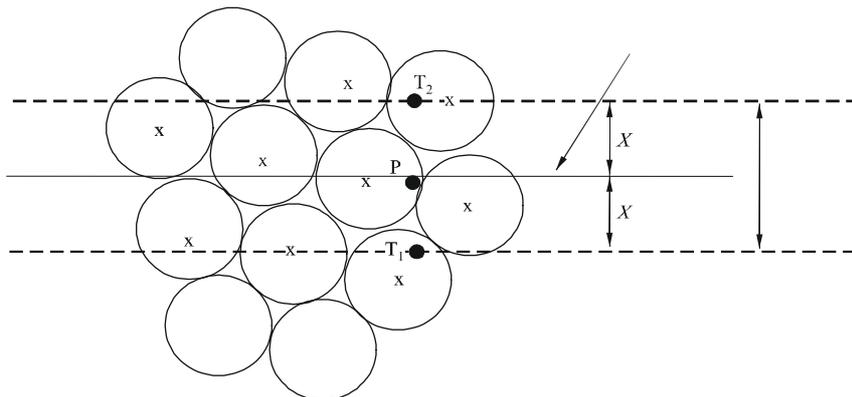
X

pdf

$\cdot X$ α

8b 8a

8a

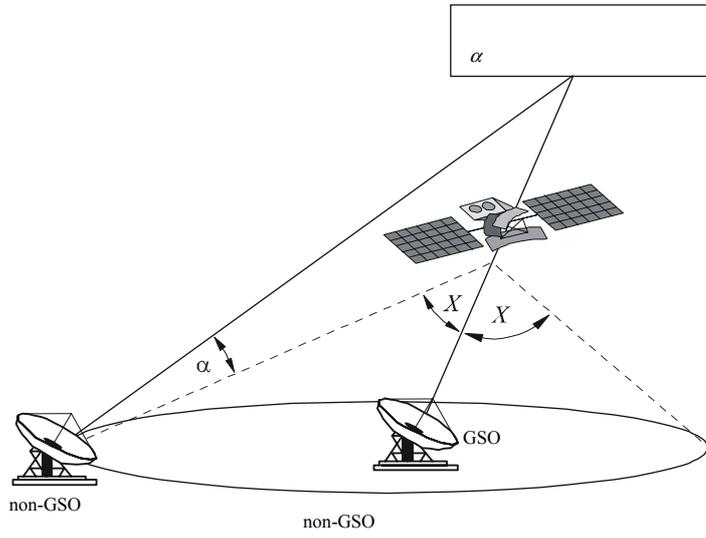


:X

8b

X

α



1503-08b

pdf **3.2**

pdf **1.3.2**

pdf

pdf
.pdf

()
()

.dB 3 + dB 30-

.dB 0,048

$$pfd = 10 \log \left(\sum_i^{N_{co}} 10^{pfd_co_i/10} + \sum_j^{N_{cross}} 10^{pfd_cross_j/10} \right)$$

(dB(W/m²))

:pfd

:i

:N_{co}

dB((W/m²))

pfd :pfd_{co_i}

:j

:N_{cross}

pfd :pfd_{cross_j}

(dB(W/m²))

$$pfd_co_i = P_i + G_i - 10 \log_{10} (4 \pi d^2)$$

(dB(W/BW_{ref}))

i

:P_i

(KHz)

:BW_{ref}

i

:G_i

(dBi)

:d

d

.() (

$$pfd_cross_j = P_j + G_cross_j - 10 \log_{10} (4 \pi d^2)$$

.(dBi)

:G_{cross_j}

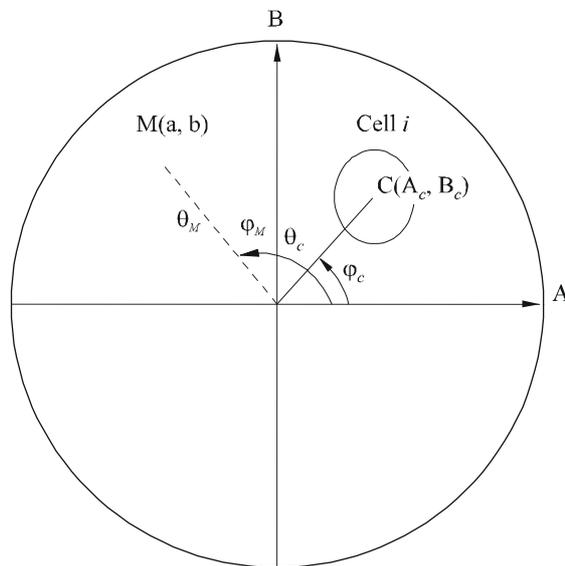
pfd/e.i.r.p.

i M
 $:$
 $:\varphi$
 $v = \sin \theta \sin \varphi \quad u = \sin \theta \cos \varphi \quad :v$
 $B = \theta \sin \varphi \quad A = \theta \cos \varphi \quad :B$
 $\tan (Az) = \tan \theta \cos \varphi \quad \sin (El) = \sin \theta \sin \varphi \quad : (Az, El)$
 $.(B \ A)$

.(A B) 9

9

(B A)



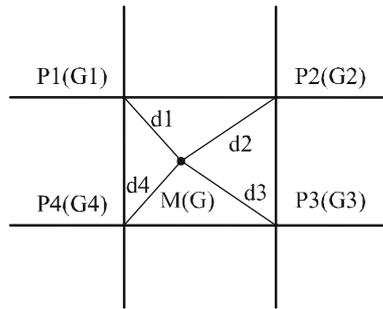
1503-09

$(\varphi_M \ \theta_M)$ $(B \ A)$ $(b \ a)$ M

$(\varphi_c \ \theta_c)$ $(B \ A)$ $(B_c \ A_c)$ i C
 M (\quad)

$M(a, b) \ C(A_c, B_c)$

(B A) M(a, b) (B A)
 .P4(G4) P3(G3) P2(G2) P1(G1) M



1503-09bis

M P_i
 (j = 1, ..., 4) d_j P_j (B A) (b_j a_j)
 .M P_j :

$$d_j = \sqrt{(a - a_j)^2 + (b - b_j)^2}$$

$$G_i(P_j) = G_i(M) \quad 0 = d_j$$

$$m_j = \frac{\frac{1}{d_j}}{\sum_{k=1}^4 \frac{1}{d_k}}$$

$$G_i(M) = 10 \log_{10} \left(\left(\sum_{j=1}^4 m_j \sqrt{10 \frac{G_i(P_j)}{10}} \right)^2 \right)$$

.M

i

G_i(M)

.pdf

1 1.4.2

α pfd
 X
 ΔL

1
 X
 pfd

α

ΔL

pfd

-
-
-
-

pfd

N_{total} :1

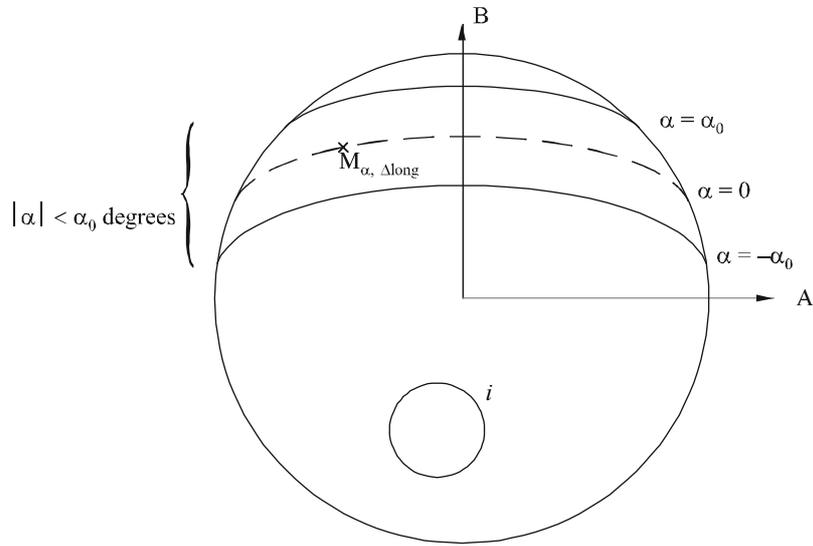
iso- α

:2

$(11 \ 10) \alpha$

10

(1)



1503-10

$:\Delta L$

iso- α

:3

$.(X) \alpha$

pdf

$.n \dots 2 \quad 1=k$

$M_{\alpha,k} \quad n$

iso- α

ΔL

:4

$.n \dots 2 \quad 1=k$

$M_{\alpha,k}$

pdf

α

pdf

$M_{\alpha,k} \quad i$

$M_{\alpha,k}$

$M_{\alpha,k} \quad \text{pdf}$

N_{total}

-

N_{co}

N_{cross}

$N_{cross} \quad N_{co}$

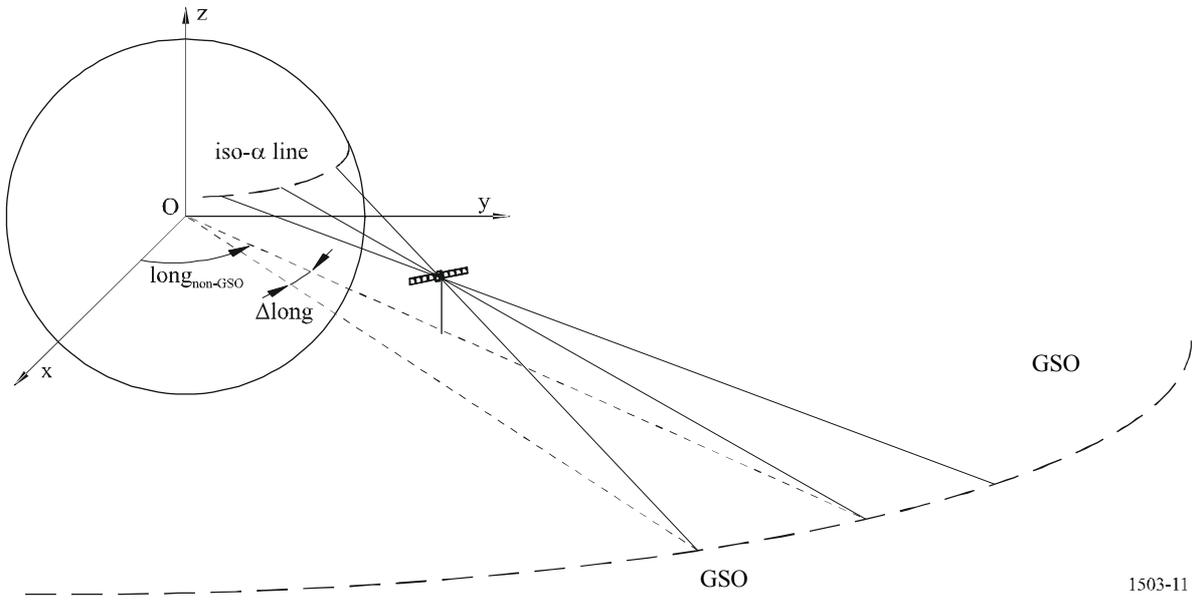
-

-

-

11

iso- α



1503-11

pdf

:5

:

:

α_0

$|\alpha| \leq \alpha_0$

iso- α

:

α_0

iso- α

:

X

X_0

X

:

ΔL

α

pdf

:6

$$\text{pdf}(\alpha, \Delta L) = \max_{k=1, 2, \dots, n} (\text{pdf}(M_{\alpha, k}))$$

pdf

iso- α

:7

pdf

.(

) pdf

:8

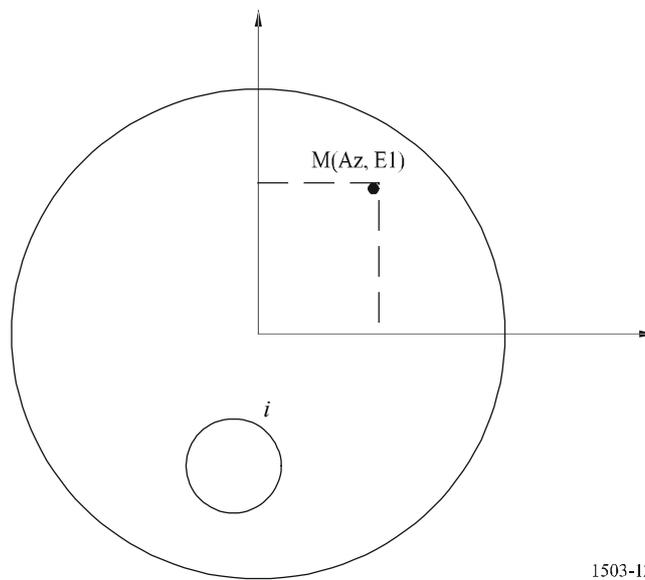
2 2.4.2

pdf

pdf

12

(2)



1503-12

pdf

N_{total} :1

$M_{\alpha,k}$

pdf

$M(Az, El)$

pdf

:2

$M(Az, El)$

$M_{\alpha,k}$ pdf

N_{total}

N_{co}

N_{cross}

$N_{cross} N_{co}$

-

pdf

:3

:

:

α_0

-

$|\alpha| \leq \alpha_0$

iso- α

:

-

α_0

iso- α_0

:

-

X

X_0

X

-

.(

) pdf

:4

.(

) pdf

:5

e.i.r.p.

3

e.i.r.p.

1.3

1.1.3

e.i.r.p.

e.i.r.p.

()

2.1.3

.(2.2 C) epfd \uparrow

3.1.3

e.i.r.p.

4.1.3

e.i.r.p.

e.i.r.p. :/

:

$$ES_EIRP(\theta) = G(\theta) + P$$

:

(dB(W/BW_{ref}))

:ES_EIRP

:θ

()

(dBi)

:G(θ)

(dB(W/BW_{raf}))

:P

.(kHz)

:BW_{raf}

:2

e.i.r.p.

2.3

e.i.r.p.

e.i.r.p.

1.2.3

e.i.r.p.

e.i.r.p.

:

$$NGSO_SS_EIRP(\theta) = G(\theta) + P$$

:

(dB(W/BW_{ref}))

:NGSO_SS_EIRP

:θ

()

(dBi)

:G(θ)

(dB(W/BW_{rif}))

:P

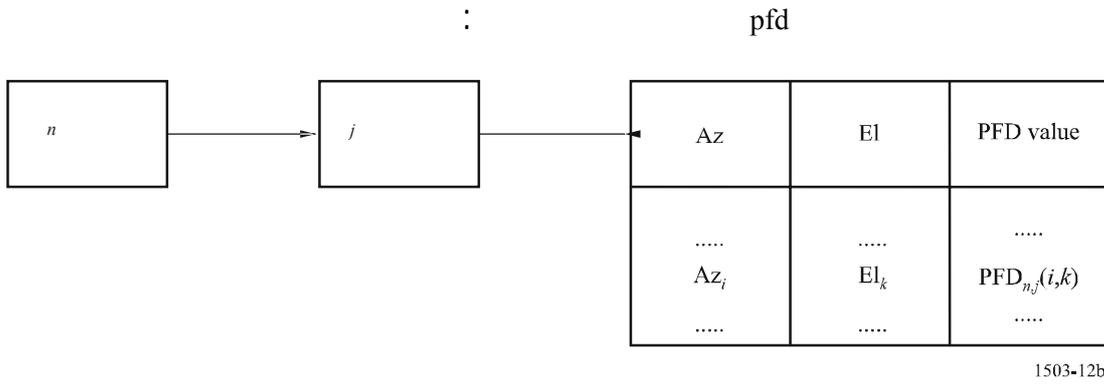
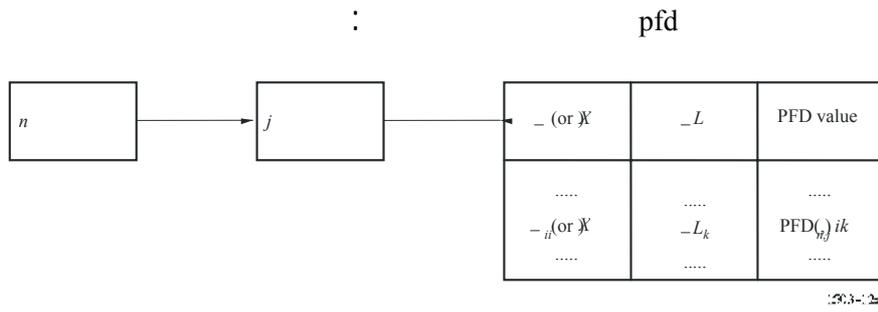
(kHz)

:BW_{rif}

pdf

4

.(4 pdf)



C'

(epfd)
(GSO)

$epfd_{\downarrow}$

$(X) \alpha$

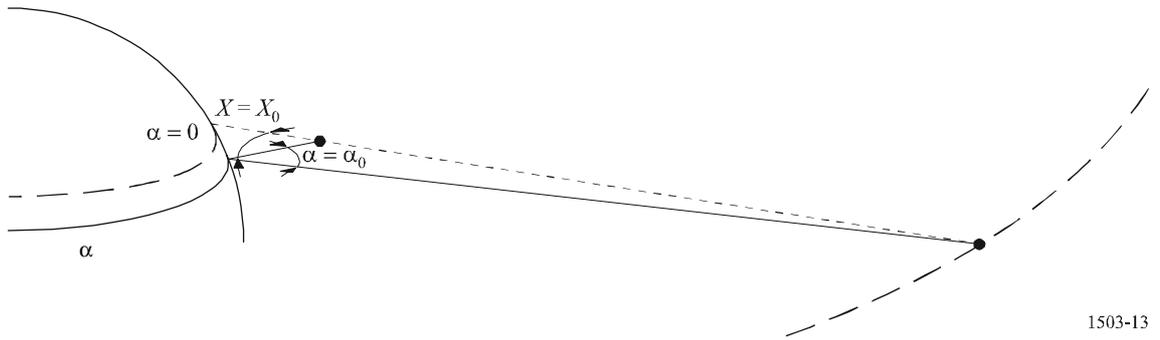
epfd

(13)

pfd

.Along

13



1503-13

22

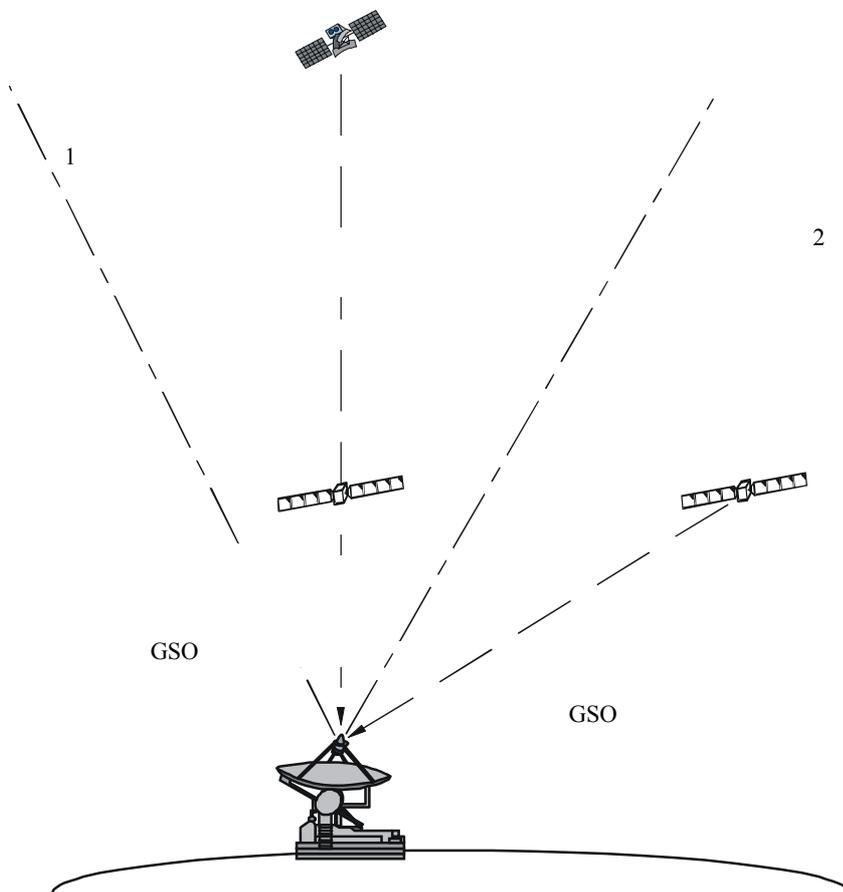
epfd

:

:1

:2

14



1503-14

$epfd_{\downarrow}$

Lat(non-GSO)

$\alpha_0 (X_0)$

$epfd_{\downarrow}$

3.1

:pfd

$(\alpha, \Delta long)$

(pfd)

-

$(X, \Delta long)$

(pfd)

-

(α, X)

(pfd)

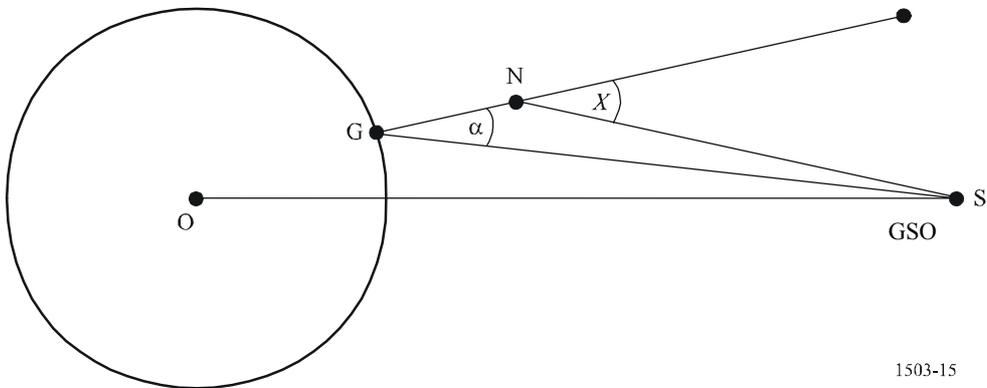
-

$X \alpha$

15

15

EPFD



1503-15

EPFD

EPFD

$$AzEl = PFD$$

$$AzEl_{EPFD}$$

$$(\alpha) = PFD$$

$$_{EPFD}$$

$$X = PFD$$

$$X_{EPFD}$$

"Unknown PFD mask type"

(endif)

AzEl EPFD

PFD

PFD

T

T

N

PFD

PFD

(el az)

L

L

L

L

G

N

G

(α) alpha

S α

Gain(α)

$$PFD(az,el) + Gain(\alpha) = EPFD_{max}(az, el)$$

$$G \quad 22 \quad EPFD_{limit}$$

$$[EPFD_{max}(az, el) - EPFD_{limit}]$$

(G S)

(end if)

(end if)

(G S)

G

GSO ES

S

$$EPFD(az, el)$$

(end if)

Alpha EPFD

PFD

PFD

T

T N

0= α Δ long

N Δ long GSO S L

N S L

L L

L G

$PFD(0, \Delta long) = EPFD_{max}(\alpha, \Delta long)$

G 22 $EPFD_{limit}$

$[EPFD_{max}(\alpha, \Delta long) - EPFD_{limit}]$

(G S)

(end if)

(end if)

Δ long

($\alpha = \alpha$ Δ long

NGS α GSO G ()

$\Delta long = S N$

G ()

G

Gain(α)

$EPFD_{max}(\alpha, \Delta long) = Gain(\alpha) + PFD(\alpha, \Delta long)$

G 22 $EPFD_{limit}$

$[EPFD_{max}(\alpha, \Delta long) - EPFD_{limit}]$

(G S)

(end if)

(end if)

Δ long

(G S)

G GSO

S GSO

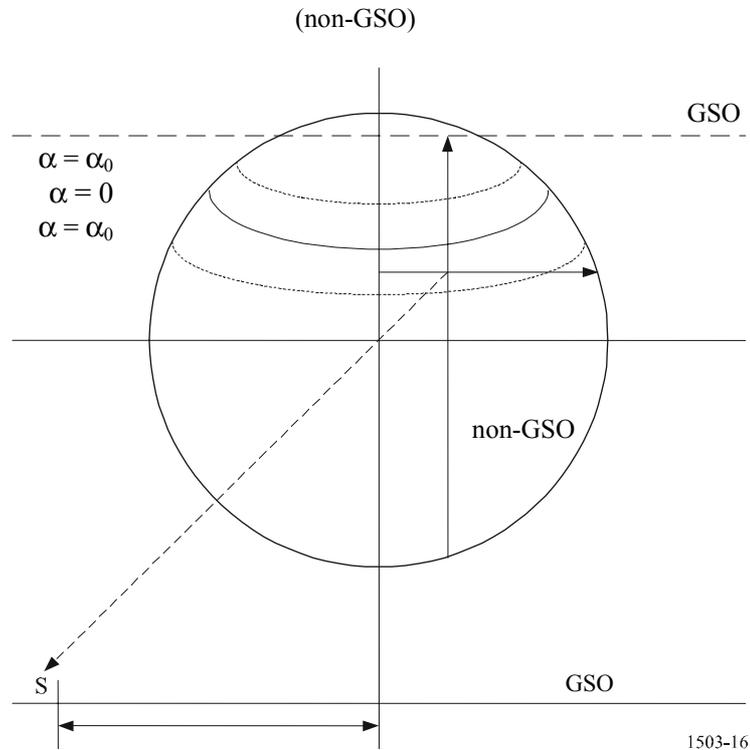
EPFD(α)

(end if)

($\Delta_{\text{long}} X \alpha N$) S 1.3.1

G
 $.G$
 $.(\Delta_{\text{long}} X) (\Delta_{\text{long}} \alpha) N$
 $.G$
 $.\alpha$
 $X \alpha$
 G
 $\Delta_{\text{long}} N$
 $.$
 $:$
 α 16
 $.\alpha/X$
 G
 $-\$
 $.\Delta_{\text{long}}$
 G
 $-\$

(Δ long α) G



:

$N =$

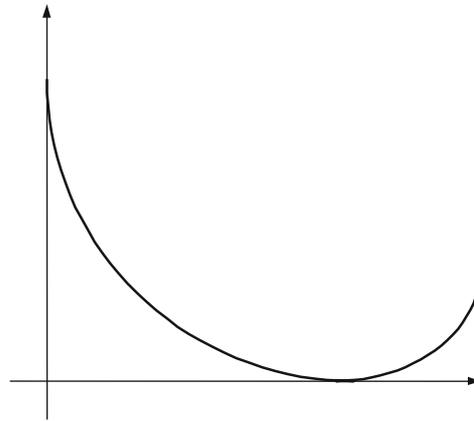
α
Longitude

(Δ long α)

(While)

17

α



1503-17

α

α

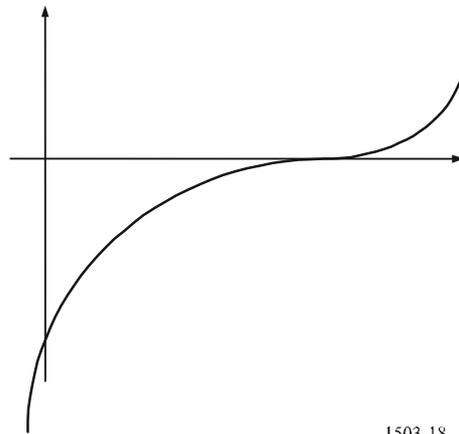
α

18
GSO

α_i

18

α



1503-18

α

:
) (h N

(GSO)

.h N

```

α = 0
: α
.
.Δlong
α G (Δlong α) .0 = α
2.3.1
N
= t
= Lat(0)
(t)
(t)
(t) = Lat(0)
Lat(t) Lat(0)
(t)
- ( 1 => )
(endif)
Wend
epfd↑ (GSO) 2
epfd↑
.epfd↑
epfd↑
GSO
dB 1,2 °10 GSO
GSO
epfd↑ GSO
GSO

```

GSO

GSO

epfd_↑

°45,5
°10

°50

GSO

.epfd_↑

.GHz 11/14

°4

GSO

°59,9

°50

GSO

GHz 20/30

.°1,55

GSO

°20

:epfd_{iS}

3

)

epfd_↑

GSO

.(2

C

1

C'

1

:

:R_e

GSO

:P(x, y, z)

GSO

:S(x_S, y_S, z_S)

:N(x_N, y_N, z_N)

2

.1

C

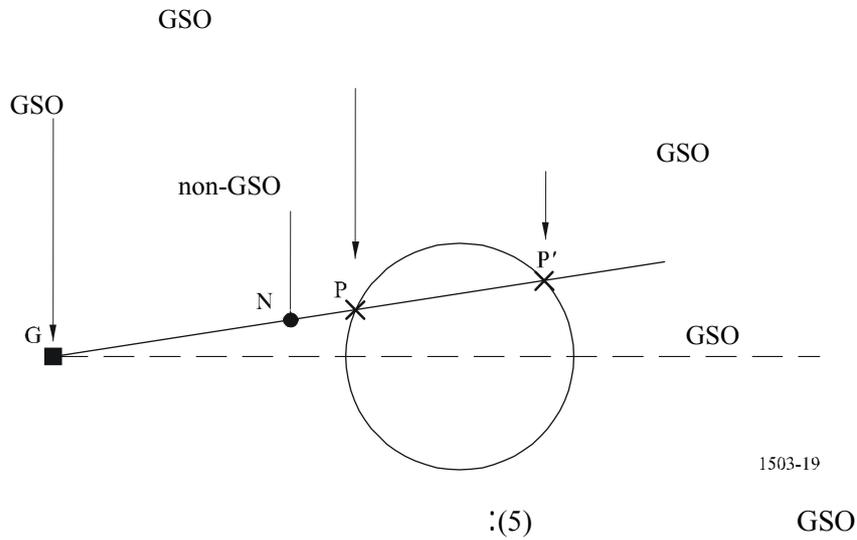
epfd_↓

GSO

epfd_↓

GSO

:



(5)

$$x^2 + y^2 + z^2 = R_e^2$$

:

$$\vec{GP} = k \cdot \vec{GN} \quad \text{with } k \in \Re$$

:

(6)

$$\begin{bmatrix} x - x_G = k(x_N - x_G) \\ y - y_G = k(y_N - y_G) \\ z - z_G = k(z_N - z_G) \end{bmatrix}$$

: (6) (5)

$$(x_G + k(x_N - x_G))^2 + (y_G + k(y_N - y_G))^2 + (z_G + k(z_N - z_G))^2 = R_e^2$$

(7)

$$k^2((x_N - x_G)^2 + (y_N - y_G)^2 + (z_N - z_G)^2) + 2k(x_G(x_N - x_G) + y_G(y_N - y_G) + z_G(z_N - z_G)) + x_G^2 + y_G^2 + z_G^2 = R_e^2$$

: k2 k1 : (7)

:

$$\Delta = 4(x_G(x_N - x_G) + y_G(y_N - y_G) + z_G(z_N - z_G))^2 - 4((x_N - x_G)^2 + (y_N - y_G)^2 + (z_N - z_G)^2)((x_G^2 + y_G^2 + z_G^2) - R_e^2)$$

$$k1 = \frac{-2(x_G(x_N - x_G) + y_G(y_N - y_G) + z_G(z_N - z_G)) - \sqrt{\Delta}}{2((x_N - x_G)^2 + (y_N - y_G)^2 + (z_N - z_G)^2)}$$

$$k2 = \frac{-2(x_G(x_N - x_G) + y_G(y_N - y_G) + z_G(z_N - z_G)) + \sqrt{\Delta}}{2((x_N - x_G)^2 + (y_N - y_G)^2 + (z_N - z_G)^2)}$$

: GSO

$$\begin{bmatrix} x = k1(x_N - x_G) + x_G \\ y = k1(y_N - y_G) + y_G \\ z = k1(z_N - z_G) + z_G \end{bmatrix} \text{ or } \begin{bmatrix} x = k2(x_N - x_G) + x_G \\ y = k2(y_N - y_G) + y_G \\ z = k2(z_N - z_G) + z_G \end{bmatrix}$$

:

GSO

$$\left\| \vec{NG} \right\| < \left\| \vec{PG} \right\|$$

$$\left\| \vec{PG} \right\|$$

:

P

$$(x_G - x)^2 + (y_G - y)^2 + (z_G - z)^2 < (x_N - x)^2 + (y_N - y)^2 + (z_N - z)^2$$

epfd_↓

3

α

1.3

GSO

epfd_↓

.α₀

:

(8)

$$\cos \alpha_0 = \frac{\vec{GN} \cdot \vec{GS}}{\|\vec{GN}\| \cdot \|\vec{GS}\|}$$

(9)

$$\sin \alpha_0 = \frac{\|\vec{GN} \times \vec{GS}\|}{\|\vec{GN}\| \cdot \|\vec{GS}\|}$$

GSO (z y x)
 GSO (z y x)
 :
 $x = R_e \cos(\text{lat}) \cos(\text{long})$
 $y = R_e \cos(\text{lat}) \sin(\text{long})$
 $z = R_e \sin(\text{lat})$

9 8

X 2.3

GSO GSO epfd_↓
 GSO GSO
 .X₀
 GSO P_{in-line}
 GSO

(10)
$$\cos X_0 = \frac{\overrightarrow{NG} \bullet \overrightarrow{NP_{in-line}}}{\|\overrightarrow{NG}\| \cdot \|\overrightarrow{NP_{in-line}}\|}$$

(11)
$$\sin X_0 = \frac{\overrightarrow{NG} \bullet \overrightarrow{NP_{in-line}}}{\|\overrightarrow{NG}\| \cdot \|\overrightarrow{NP_{in-line}}\|}$$

11 10

D

1

1.1

(SDR)

: .(epfd)

)

(9 D) (

2.1

:

epfd_↓

pfd

pfd

:epfd_↓

)

GSO

epfd_↓

(

:epfd_↑

e.i.r.p

e.i.r.p.

epfd_↑

(

)

epfd_↑

e.i.r.p.

epfd_{is}

:epfd_{is}

)

GSO

epfd_{is}

(

(SRD)

3.1

:

:2

epfd_↓

:3

epfd_↑

:1.4

epfd_{is}

:2.4

epfd

:5

:6

/

:7

4.1

| | | | | |
|-------|-------------------|-----|-------|-----|
| | | | | :A |
| () | | | | |
| . | | | | :B |
| | | | .epfd | |
| | | | (pfd) | :C |
| . | epfd _↓ | pfd | | |
| | | | epfd | :C' |
| .epfd | | GSO | | |
| | | | | :F |
| . | | | | |
| | | | | :H |
| | | | | |
| | | | | 2 |
| | | | | 1.2 |
| | | .F | | |
| | | | | 2.2 |
| | | | .H | |
| | | | | 3.2 |
| . | | | | |
| | | | | 4.2 |

:

- A

-

-
-
-
-
-
5.2

J_α

J_2

B 2.2 epdf
 $S_B = 0,1 \text{ dB}$

epdf D 13.7
.dB 0,1

D 2.4.5 $X \alpha$

.GSO_SEPARATION :

6.2

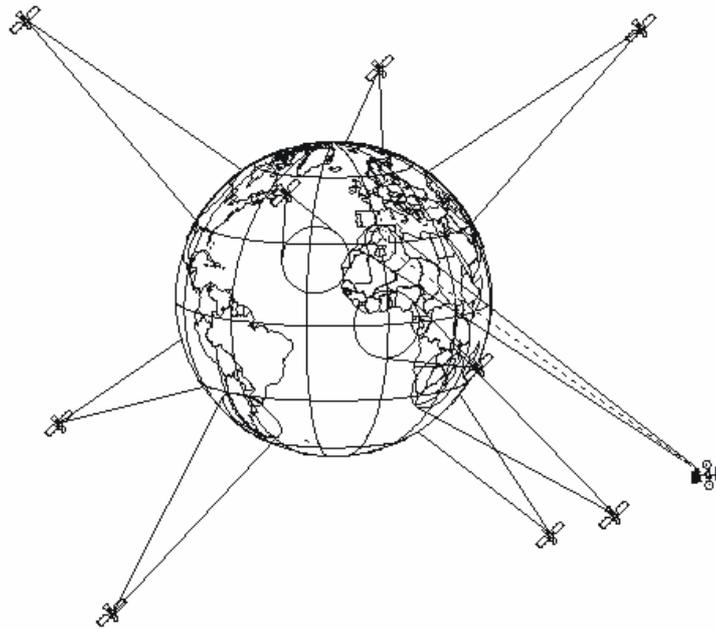
) epdf
F_(down/up/is) . ()
:F_(down/up/is)
F_(down/up/is) :0
() 2 :1
3 :2
5 4 :3
non-GSO GSO :4
F_(down/up/is) :5

epfd_↓ 3

.GSO epfd_↓
epfd_↓ pfd .pfd epfd_↓

) () .GSO
/ epfd_d (
GSO 20
.GSO

20



1503-20

epfd_↓

N

: B 2.2

| | | |
|---|----------------|------------------------------|
| | | |
| GHz | FSTART_DOWN | |
| GHz | FEND_DOWN | |
| / | REGION1_DOWN | 1 |
| / | REGION2_DOWN | 2 |
| / | REGION3_DOWN | 3 |
| m | GSO_ES_D_ANT | |
| D 5.5 | GSO_ES_PATTERN | |
| kHz | REFBW | |
| - | NEPFD_DOWN | epfd _↓ |
| dB(W/(m ² · BW _{ref})) | EPFD_DOWN[I] | NEPFD_DOWN epfd _↓ |
| % | PC[I] | NEPFD_DOWN |

: EPFD_DOWN[I]

- EPFD_DOWN[I] = EPFD_DOWN_MIN :1
- EPFD_DOWN[I] = EPFD_DOWN_MAX :2
- dB 10 EPFD_DOWN_MIN EPFD_DOWN_START :3
- dB 10 EPFD_DOWN_MAX EPFD_DOWN_END :4
- (EPFD_DOWN_END – EPFD_DOWN_START)/S_B = :5

epfd 2.3

.C' epfd GSO GSO

() 3.3

1.3.3

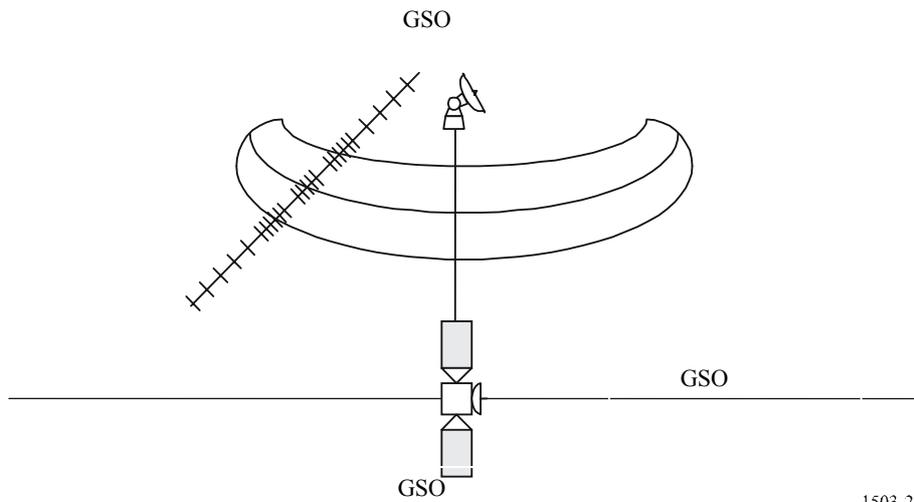
A

:

$$\begin{aligned} 0 &= X \alpha & - \\ &= X \alpha & - \end{aligned}$$

21

21



D 1.5.3
1.22 3.6 2.6 1.6 2.5 1.5

:

GSO

$$\varphi_{coarse} = 1,5^\circ$$

:

(FSR)

(

$$\varphi_r = \alpha - X \text{ GSO}$$

GSO

φ_r

$$100 < D/\lambda$$

-

$$\varphi_1 = \varphi_r = 15.85(D/\lambda)^{-0.6}$$

GSO

$$100 > D/\lambda$$

-

$$\varphi_1 = 95 \lambda/D$$

$$\varphi_r = 3,5^\circ$$

$$\varphi_{FSR_1} = \max(3,5^\circ, \varphi_1)$$

$$: (\alpha = \alpha_0 \quad X = X_0)$$

$$\varphi_{FSR_2} = \varphi_{coarse}$$

:

.(φ_{3dB}) GSO

$$N_{coarse} = \text{Floor} ((N_{hits} * \varphi_{coarse}) / \varphi_{3dB})$$

Floor

. $^\circ 1,5$

2.3.3

.D 3.6

4.3

1.4.3

.(epfd)

(non-GSO)

2.4.3

.B 1.2

| | | |
|-----|-----------------------|-----------|
| | | |
| | C | pdf |
| - | N_{sat} | |
| - | N_{freq} | (1) / |
| - | One of 1, 2 or 3 | (1) |
| GHz | F_DOWN _{sat} | (1) |
| - | Alpha or X | |
| | MIN_EXCLUDE | |
| - | N_{co} [Latitude] | f_{sat} |
| - | / | |
| - | / | |
| | W_{δ} | |
| | H_MIN | |

()

(1)

- B 1.2
 .D 1.3.5
 .N-th N-th [N]
 pfd[N] [N] pfd
 pfd(lat, az, el)
 .pfd(lat, α , Δ long) pfd(lat, X, Δ long)

| | | |
|---|--------|-----|
| | | |
| - | pfd[N] | pfd |
| | A[N] | |
| - | E[N] | |
| | I[N] | |
| | O[N] | |
| | W[N] | |
| | V[N] | |

pfd epfd_i pfd
 .pfd

GSO 3.4.3

D 2.3 GSO
 ;B 1.2

| | | |
|-------|----------------|-----|
| | | |
| | GSO_LONG | GSO |
| | GSO_ES_LAT | GSO |
| | GSO_ES_LONG | GSO |
| D 5.5 | GSO_ES_PATTERN | |
| | GSO_ES_D_ANT | |

.GSO D 2.5 1.5

4.4.3

D 3.3

:

| | | |
|---|---------------|--|
| | | |
| | TSTEP | |
| - | NSTEPS | |
| - | J2 | |
| / | ORBIT_PRECESS | |

:

| | | |
|--|-------------|--|
| | | |
| | PHISTEPCG | |
| | THETASTEPCG | |
| | PHISTEPFG | |
| | THETASTEFG | |

5.4.3

D 1.3 epfd_↓

.epfd_↓

| | | |
|---|-----------------|-------------------|
| | | |
| dB(W/m ² · BW _{ref}) | EPFD_DOWN_START | epfd _↓ |
| dB(W/m ² · BW _{ref}) | S _B | (D 5.2) |
| - | N_BINS | epfd _↓ |

6.4.3

() ASCII

5.3

.(MIN_OPERATING_HEIGHT) GSO

| | | | | |
|-----------------------|---|----------------------|----------------------|-------------------|
| GSO | GSO | φ | | :15 |
| | | | .non-GSO | |
| | GSO | (dB) | $= G_{RX}(\varphi)$ | :16 |
| | | .D | 5.5 | |
| | : | | epfd _{↓i} | :17 |
| .epfd _{↓i} | $= pfd(\alpha) + G_{RX}(\varphi) - G_{max}$ | G_{max} | GSO | :18 |
| | . | | epfd _↓ | :19 |
| epfd _↓ | | $N_{co}[\text{lat}]$ | 21 | :20 |
| | | | $N_{co}[\text{lat}]$ | |
| | | | GSO | |
| | | | . | |
| | | | .epfd _{↓i} | epfd _↓ |
| | | | | :21 |
| (T_{step}/T_{fine}) | | epfd _↓ | epfd _↓ | :22 |
| | epfd _↓ | | epfd _↓ | :23 |
| | | | .D | 2.1.7 |
| .D | 1.7 | | epfd _↓ | :24 |
| | | .D | 3.7 | :25 |

2.5.3

| | | | | |
|-----|------------------|------------------|-------------------|-------------------|
| GSO | | | | epfd _↓ |
| | . | | GSO | |
| .D | 2.4.3 | | | :1 |
| | | .D | 3.4.3 | GSO |
| | | epfd | | GSO |
| | | | | .D |
| | | | 2.3 | |
| | | | epfd _↓ | :4 |
| | | $\varphi-\theta$ | () | :5 |
| | $\varphi-\theta$ | | () | 23 7 |
| | | | PROB | :7 |
| | | .D | 1.6 | |
| | . | | | :8 |

| | | | | |
|--|----------------------|------------------------------|------------------------|-----|
| (|) | | | :9 |
| | | .D | 2.6 | |
| | . | 23 | 11 | :10 |
| | | | .0 = epfd _↓ | :11 |
| GSO | | | | :12 |
| | | .D | 1.4.5 | |
| | . | 19 | 14 | :13 |
| (lat, azimuth, elevation) | (lat, α or X, Δlong) | pdf | | :14 |
| | | .D | 1.5 | |
| pdf(lat, α or X, Δlong) | | pdf | | :15 |
| pdf | GSO | pdf(lat, azimuth, elevation) | | |
| | | .D | 6.3 | |
| GSO | GSO | φ | | :16 |
| | | .non-GSO | | |
| | GSO | (dB) | = G _{RX} (φ) | :17 |
| | | .D | 5.5 | |
| | . | | epfd _{↓i} | :18 |
| .epfd _i = pdf(α) + G _{RX} (φ) - G _{max} | GSO | | | :19 |
| | . | | epfd _i | :20 |
| | epfd _i | N _{co} [lat] | 21 | :21 |
| | | N _{co} [lat] | | |
| | | GSO | | |
| | . | | | |
| | .epfd _i | epfd _↓ | | :22 |
| .PROB/2 | epfd _↓ | epfd _↓ | | :23 |
| | epfd _↓ | epfd _↓ | | :24 |
| | | .D | 2.1.7 | |
| .D | 1.7 | epfd _↓ | | :25 |
| | .D | 3.7 | | :26 |

α D 2.4.5 $X \alpha$ $X \alpha$
 .
 :

$I- :$

$I+ :$

.

I

$(X \alpha) ()$

pdf

$()$

pdf

C

7.3

: (D 1.3) NEPFD_DOWN

| | | |
|---|-------------------|------------------------------|
| dB(W/(m ² · BW _{ref})) | EPFD_DOWN_CALC[I] | NEPFD_DOWN epfd _↓ |
| % | PC_CALC[I] | NEPFD_DOWN |

.EPFD_DOWN_CALC[I]

PC_CALC[I]

4

epfd_↑

1.4

epfd_↑

e.i.r.p

(e.i.r.p.)

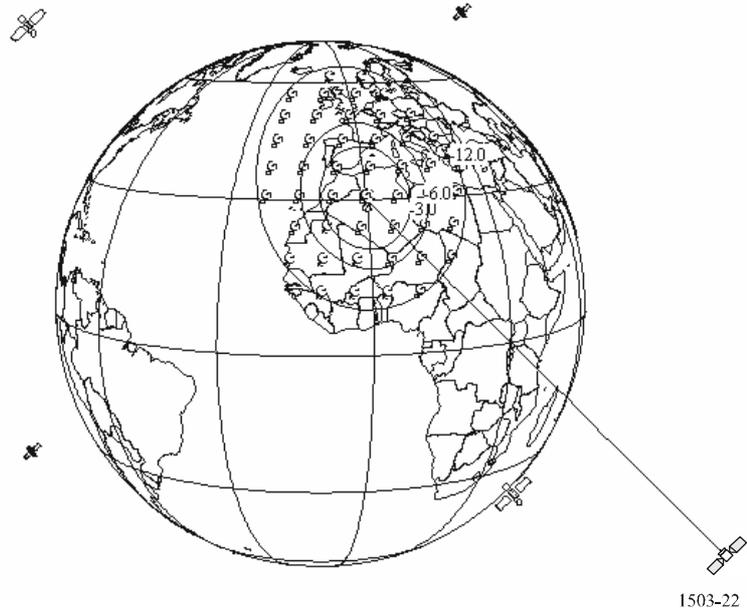
)

epfd_↑

.epfd_↑

(

22



1.1.4

epfd↑

(N)

.B 2.2

| | | | |
|---|-------------------|--|----------------|
| | | | |
| GHz | FSTART_UP | | |
| GHz | FEND_UP | | |
| / | REGION1_UP | | 1 |
| / | REGION2_UP | | 2 |
| / | REGION3_UP | | 3 |
| D 5.5 | GSO_SAT_PATTERN | | GSO |
| dB | GSO_SAT_PEAKGAIN | | GSO |
| | GSO_SAT_BEAMWIDTH | | GSO |
| kHz | RAFBW | | |
| - | NEPFD_UP | | epfd↑ |
| dB(W/(m ² · BW _{ref})) | EPFD_UP[I] | | NEPFD_UP epfd↑ |
| % | PC_UP[I] | | NEPFD_UP |

: EPFD_UP[I]

.EPFD_UP[I] = EPFD_UP_MIN :1

.EPFD_UP[I] = EPFD_UP_MAX :2

. dB 10 EPFD_UP_MIN EPFD_UP_START :3

. dB 10 EPFD_UP_MAX .EPFD_UP_END :4

.(EPFD_UP_END – EPFD_UP_START)/S_B = :5

(D 5.2) S_B

epfd↑

epfd 2.1.4

.C' GSO

3.1.4

1.3.1.4

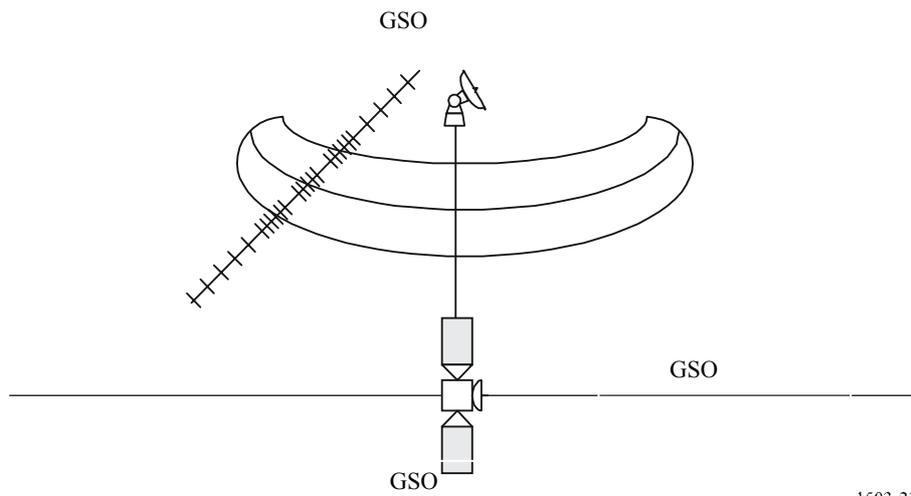
.A

:

$$0 = \alpha$$

23

23



1503-23

D 1.64
.1.24 3.7 2.7 1.7 2.6 1.6

:

.GSO

$$\varphi_{coarse} = 1,5^\circ$$

:

.(φ_{3dB})

$$N_{coarse} = \text{Floor} ((N_{hits} * \varphi_{coarse}) / \varphi_{3dB})$$

floor

1,5

2.3.1.4

.D 3.6

4.1.4

1.4.1.4

-
-
-

2.4.1.4

:B 1.2

| | | |
|---|-------------|---|
| | | |
| - | N_{sat} | |
| - | / | |
| - | / | |
| | W_{delta} | . |

B 1.2

.D 1.3.5

.N-th (N-th) [N]

| | | |
|---|------|--|
| | | |
| | A[N] | |
| - | E[N] | |
| | I[N] | |
| | O[N] | |
| | W[N] | |
| | V[N] | |

:B 1.2

| | | |
|--------------------------|-------------|----------|
| | | |
| - | ES_TRACK | |
| dB(W/BW _{ref}) | ES_EIRP | e.i.r.p. |
| - | N_{freq} | (1) / |
| - | 3 2 1 | (1) |
| GHz | ES_F | (1) |
| | ES_MINELEV | |
| | ES_MIN_GSO | |
| 2 | ES_DENSITY | |
| | ES_DISTANCE | |

.() (1)

3.4.1.4

: B 1.2

D 2.1.4

| | | |
|-------|-----------------|-----|
| | | |
| | GSO_SAT_LONG | GSO |
| | BS_LAT | GSO |
| | BS_LONG | GSO |
| D 5.5 | GSO_SAT_PATTERN | GSO |

.D 2.5 1.5

4.4.1.4

. D 3.1.4

:

| | | |
|---|---------------|--|
| | | |
| | TSTEP | |
| - | NSTEPS | |
| - | J2 | |
| / | ORBIT_PRECESS | |

:

| | | |
|--|-------------|--|
| | | |
| | PHISTEPCG | |
| | THETASTEPCG | |
| | PHISTEPFG | |
| | THETASTEFG | |

5.4.1.4

D 1.1.4 $epfd_{\downarrow}$

: $epfd_{\downarrow}$

| | | |
|------------------------------|---------------|-------------------|
| | | |
| $dB(W/(m^2 \cdot BW_{ref}))$ | EPFD_UP_START | $epfd_{\uparrow}$ |
| $dB(W/(m^2 \cdot BW_{ref}))$ | S_B | (D 5.2) |
| - | N_BINS | $epfd_{\uparrow}$ |

6.4.1.4

() ASCII

5.1.4

:

:

$$NUM_ES = ES_DISTANCE * ES_DISTANCE * ES_DENSITY$$

:

$$REP_EIRP = ES_EIRP + 10\log_{10}(NUM_ES)$$

ES_DISTANCE

ES_DISTANCE

3

.REP_EIRP

:1

e.i.r.p. :2

:3

.dB 15

:4

| | | | | | |
|------------------|---------|--------------------------------------|--------------|-----------------------|-------|
| | | | | epfd↑ | |
| : | | GSO | | . | |
| .D | 2.4.1.4 | | | | :1 |
| | | .D | 3.4.1.4 | GSO | :2 |
| | | epfd | | GSO | :3 |
| | | | | .D | 2.1.4 |
| | | | | | :4 |
| | | | | .D | 5.1.4 |
| | | epfd↑ | | | :5 |
| | | | | | :6 |
| | | | | D | 3.1.4 |
| $1 = N_{coarse}$ | 1.6 | | | | |
| | | | | | |
| | | $T_{coarse} = T_{fine} * N_{coarse}$ | | | :1.6 |
| | | | | 24 | 8 |
| | | | | | :7 |
| . | 22 | 1.7 | | | |
| | | $T_{fine} = T_{step}$ | | | :1.7 |
| | | $T_{fine} = T_{step}$ | N_{coarse} | | :2.7 |
| | | Φ_{coarse} | | α | :3.7 |
| | | $T_{coarse} = T_{step}$ | | $T_{fine} = T_{step}$ | |
| .D | 1.5 | | | | :8 |
| | | | | | :9 |
| | | | | .D | 2.5 |
| 3.5 | | | | | :10 |
| | | | | .D | |
| | | | | .0 = epfd↑ | :11 |
| | | | | 23 | 13 |
| | | | | | :12 |
| | | | | | :13 |
| | | .D | 2.4.5 | | |

| | | | | | |
|-----|---------------------------------------|---------|--|--------------------|----------------|
| .23 | 15 | GSO | | | :14 |
| . | | | 23 | 16 | :15 |
| | | | (i-th) | | :16 |
| | | | .GSO | | |
| | .23 | 18 | | | :17 |
| | | | (dB(W/BW _{raf}) | ES_EIRP | :18 |
| 3 | | | e.i.r.p. | | |
| | | | | .C | |
| | | | REP_EIRP = ES_EIRP + 10log ₁₀ (NUM_ES) | | |
| | | GSO | (dB) | = G _{RX} | :19 |
| | | | .D | 5.5 | |
| GSO | | | () | = D | :20 |
| | | | .D | 1.4.5 | |
| | | | .L _{FS} = 10 log(4π D ²) + 60 | | :21 |
| | | | : | epfd _{↑i} | :22 |
| | | | epfd _{↑i} = REP_EIRP - L _{FS} + G _{RX} - G _{max} | | |
| | | | .epfd _{↑i} | epfd _↑ | :23 |
| | | | .epfd _↑ | epfd _↑ | :24 |
| | | | : | | |
| | .T _{step} /T _{fine} | | epfd _↑ | epfd _↑ | :1.24 |
| | | | epfd _↑ | epfd _↑ | :25 |
| | | | | .D | 2.1.7 |
| | .D | 1.7 | | epfd _↑ | :26 |
| | | | .D | 2.7 | :27 |
| | | | | | 2.6.1.4 |
| | | | | epfd _↑ | |
| | | | : | GSO | |
| | .D | 2.4.1.4 | | | :1 |
| | | | .D | 3.4.1.4 | GSO |
| | | | | | :2 |
| D | 2.1.4 | | GSO | epfd | :3 |

| | | | | |
|-------|----------|------|---|-------------------|
| | | | | :4 |
| | | .D | 5.1.4 | |
| | | | epfd↑ | :5 |
| | | .φ-θ | () | :6 |
| | | φ-θ | () | :7 |
| | | | PROB | :8 |
| | | .D | 1.6 | |
| | | | | :9 |
| | | () | | :10 |
| | | | .D | 2.6 |
| | | | 25 | 12 |
| | | | .0 = epfd↑ | :12 |
| | | | 24 | 14 |
| | | | | :13 |
| | | | | :14 |
| | | .D | 2.4.5 | |
| 16 | GSO | | | :15 |
| | | | .24 | |
| | | | 24 | 17 |
| | | | (i-th) | :17 |
| | | | .GSO | |
| | | .24 | 19 | :18 |
| | | | (dB(W/BW _{raf}) ES_EIRP | :19 |
| 3 | | | e.i.r.p. | |
| | | | .C | |
| | | | REP_EIRP = ES_EIRP + 10log ₁₀ (NUM_ES) | |
| | | GSO | (dB) | = G _{RX} |
| | | .D | 5.5 | :20 |
| | GSO | | () | = D |
| | | .D | 1.4.5 | :21 |
| | | | L _{FS} = 10 log(4π D ²) + 60 | :22 |
| 5.1.4 | REP_EIRP | | epfd↑ _i | :23 |
| | | | :D | |

$$epfd_{\uparrow i} = REP_EIRP - L_{FS} + G_{RX} - G_{max}$$

.epfd_↑ epfd_{↑i} :24
 .PROB/2 epfd_↑ epfd_↑ :25
 epfd_↑ epfd_↑ :26
 .D 2.1.7
 .D 1.7 epfd_↑ :27
 .D 2.7 :28

7.1.4

: (D 1.1.4) NEPFD_↑

| | | |
|---|-----------------|----------------------------|
| dB(W/(m ² · BW _{ref})) | EPFD_UP_CALC[I] | NEPFD_UP EPFD _↑ |
| % | PC_CALC[I] | NEPFD_UP |

.EPFD_UP_CALC[I]

PC_CALC[I]

epfd_{is} 2.4

epfd_{is}
 epfd_{is} .
 . e.i.r.p.
 epfd_{is} ()

1.2.4

epfd_{is}

(N)

.B 2.2

| | | |
|---|-------------------|-----------------------------|
| | | |
| GHz | FSTART_IS | |
| GHz | FEND_IS | |
| / | REGION1_IS | 1 |
| / | REGION2_IS | 2 |
| / | REGION3_IS | 3 |
| D 5.5 | GSO_SAT_PATTERN | GSO |
| dBi | GSO_SAT_PEAKGAIN | GSO |
| | GSO_SAT_BEAMWIDTH | GSO |
| kHz | RIFBW | |
| - | NEPFD_IS | epfd _{is} |
| dB(W/(m ² · BW _{rit})) | EPFD_IS[I] | NEPFD_IS epfd _{is} |
| % | PC_IS[I] | NEPFD_IS |

:

EPFD_IS[I]

.EPFD_IS[I] = EPFD_IS_MIN :1

.EPFD_IS[I] = EPFD_IS_MAX :2

. dB 10 EPFD_IS_MIN EPFD_IS_START :3

. dB 10 EPFD_IS_MAX .EPFD_IS_END :4

.(EPFD_IS_END – EPFD_UP_START)/S_B = :5

(D 5.2) S_B

. epfd_{is}

epfd 2.2.4

.C' GSO

3.2.4

1.3.2.4

.A

2.3.2.4

()

.D 3.6

4.2.4

1.4.2.4

.

:

.

-

-

-

2.4.2.4

:B 1.2

| | | |
|---|-------------|---|
| | | |
| - | N_{sat} | |
| - | / | |
| - | / | |
| | W_{delta} | . |

B 1.2

.B 1.3.5

.N-th

(N-th)

[N]

| | | |
|---|------|--|
| | | |
| | A[N] | |
| - | E[N] | |
| | I[N] | |
| | O[N] | |
| | W[N] | |
| | V[N] | |

:B 1.2

| | | |
|--------------------------|-----------------|----------|
| | | |
| dB(W/BW _{rit}) | non-GSO_SS_EIRP | e.i.r.p. |
| - | N_{freq} | (1) / |
| - | 3 2 1 | (1) |
| GHz | IS_F | (1) |

.() (1)

3.4.2.4

: B 1.2

D 2.5

| | | |
|----------|-----------------|-----|
| | | |
| | GSO_SAT_LONG | GSO |
| | BS_LAT | GSO |
| | BS_LONG | GSO |
| 5.5 D | GSO_SAT_PATTERN | GSO |

.D 2.5 1.5

4.4.2.4

. D 3.1.4

:

| | | |
|---|---------------|--|
| | | |
| | TSTEP | |
| - | NSTEPS | |
| - | J2 | |
| / | ORBIT_PRECESS | |

:

| | | |
|--|-------------|--|
| | | |
| | PHISTEPCG | |
| | THETASTEPCG | |
| | PHISTEPFG | |
| | THETASTEFG | |

5.4.2.4

D 1.1.4 $epfd_{is}$

: $epfd_{is}$

| | | |
|------------------------------|---------------|-------------|
| | | |
| $dB(W/(m^2 \cdot BW_{ref}))$ | EPFD_IS_START | $epfd_{is}$ |
| $dB(W/(m^2 \cdot BW_{ref}))$ | S_B | (D 5.2) |
| - | N_BINS | $epfd_{is}$ |

6.4.2.4

() ASCII

5.2.4

$$.1 = N_{coarse} epfd_{is}$$

1.5.2.4

$epfd_{is}$

:

GSO

.D 2.4.1.4

:1

.D 3.4.1.4

GSO

:2

:3

.D 2.1.4

$epfd_{is}$

:4

:5

D 3.1.4

$1 = N_{coarse}$

1.5

$T_{coarse} = T_{fine} * N_{coarse}$:1.5

19 7 :6

17 1.6

$T_{fine} = T_{step}$:1.6

$T_{fine} = T_{step} N_{coarse}$:2.6

$\Phi_{coarse} \alpha$:3.6

$T_{fine} = T_{step} T_{fine} = T_{step}$:7

.D 2.5

3.5 :8

.D

$.0 = epfd_{is}$:9

18 10 :10

:11

.D 2.4.5

:12

.18 13

e.i.r.p. (dB(W/BW_{ref})) :13

.C 3 e.i.r.p.

GSO (dB) = G_{RX} :14

.D 5.5

GSO () = D :15

.D 1.4.5

$L_{FS} = 10 \log(4\pi D^2) + 60$:16

: epfd_{isi} :17

$epfd_{isi} = e.i.r.p. - L_{FS} + G_{RX} - G_{max}$

.epfd_{isi} epfd_{is} :18

.epfd_{is} epfd_{is} :19

:

T_{step}/T_{fine} epfd_{is} epfd_{is} :1.19

| | | | | |
|----------------|-------|--------------------|-------------------------------------|------|
| | | epfd _{is} | epfd _{is} | :20 |
| | | | .D 2.1.7 | |
| .D | 1.7 | | epfd _{is} | :21 |
| | | .D | 2.7 | :22 |
| 2.5.2.4 | | | | |
| | | | epfd _{is} | |
| : | | GSO | | |
| | .D | 2.4.1.4 | | :1 |
| | | .D | 3.4.1.4 GSO | :2 |
| D | 2.1.4 | GSO | epfd | :3 |
| | | | epfd _{is} | :4 |
| | | $\varphi-\theta$ | () | :5 |
| | | . $\varphi-\theta$ | () 19 7 | :6 |
| | | | PROB | :7 |
| | | | .D 1.6 | |
| | | | | :8 |
| | | () | | :1.8 |
| | | .D | 2.6 | |
| | | | 19 9 | :2.8 |
| | | | .0 = epfd _{is} | :9 |
| | | | 18 10 | :10 |
| | | | | :11 |
| | | .D | 2.4.5 | |
| | | GSO | | :12 |
| | | | .18 13 | |
| | | | e.i.r.p. (dB(W/BW _{ref})) | :13 |
| .C | 3 | | e.i.r.p. | |
| | | GSO | (dB) = G _{RX} | :14 |
| | | | .D 5.5 | |
| | | GSO | () = D | :15 |
| | | .D | 1.4.5 | |

$$.L_{FS} = 10 \log(4\pi D^2) + 60 \quad :16$$

$$: \quad \text{epfd}_{isi} \quad :17$$

$$\text{epfd}_{isi} = e.i.r.p. - L_{FS} + G_{RX} - G_{max}$$

$$.\text{epfd}_{is} \quad \text{epfd}_{isi} \quad :18$$

$$.\text{PROB}/2 \quad \text{epfd}_{is} \quad \text{epfd}_{is} \quad :19$$

$$\text{epfd}_{is} \quad \text{epfd}_{is} \quad :20$$

$$.D \quad 2.1.7$$

$$.D \quad 1.7 \quad \text{epfd}_{is} \quad :21$$

$$.D \quad 2.7 \quad :22$$

6.2.4

$$: \quad (D \quad 1.4 \quad) \text{NEPFD}_{is}$$

| | | |
|---|-----------------|-----------------------------|
| dB(W/(m ² · BW _{rit})) | EPFD_IS_CALC[I] | NEPFD_IS EPFD _{is} |
| % | PC_CALC[I] | NEPFD_IS |

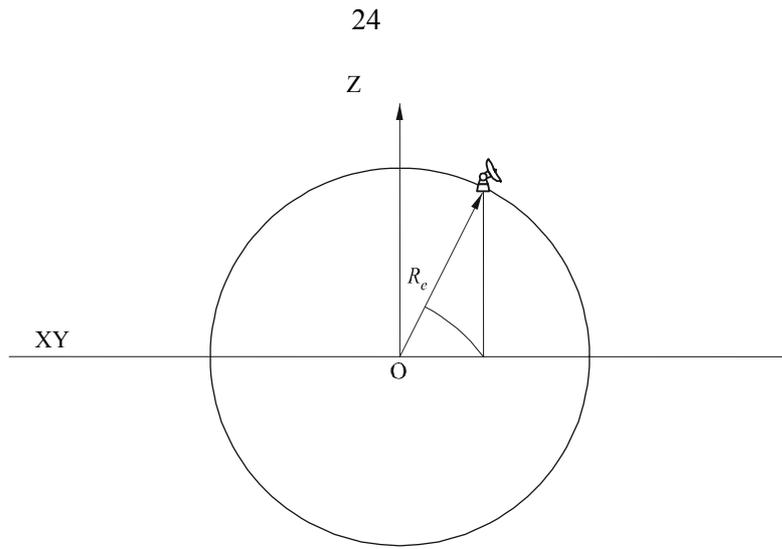
.EPFD_IS_CALC[I]

PC_CALC[I]

5

X

1.5



1503-24

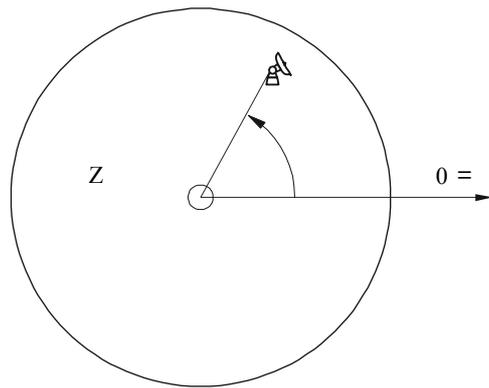
1503-24

Z R_e D 5.2 Ω_e Z
 XY .D 5.2

.XY

.25

25



1503-25

Y X XY

(12)
$$\text{Long} = \arccos\left(\frac{x}{\sqrt{x^2 + y^2}}\right) \quad \text{if } x \geq 0$$

(13)
$$\text{Long} = -\arccos\left(\frac{x}{\sqrt{x^2 + y^2}}\right) \quad \text{if } x < 0$$

(14)
$$\text{Lat} = \arctan\left(\frac{z}{\sqrt{x^2 + y^2}}\right)$$

(15)
$$x = R_e \cos(\text{lat}) \cos(\text{long})$$

(16)
$$y = R_e \cos(\text{lat}) \sin(\text{long})$$

(17)
$$z = R_e \sin(\text{lat})$$

:(z y x)

:long

:lat

(18)
$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} R_e \cos(\text{lat}) \cos(\text{lon} + \Omega_e t) \\ R_e \cos(\text{lat}) \sin(\text{lon} + \Omega_e t) \\ R_e \sin(\text{lat}) \end{bmatrix}$$

:lat

:lon

:t

: Ω_e

2.5

3.1

R_{geo}

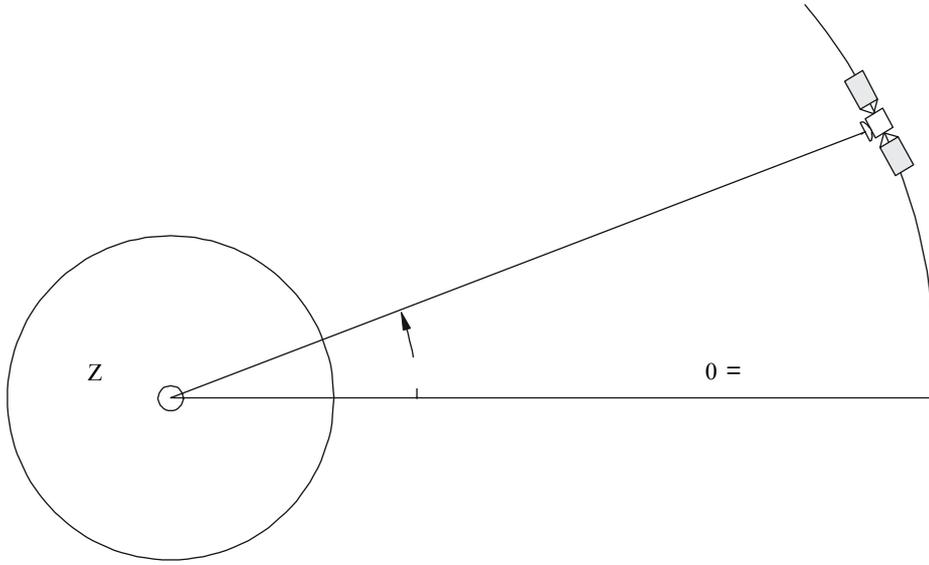
R_{geo}

XY

.26

.A

26

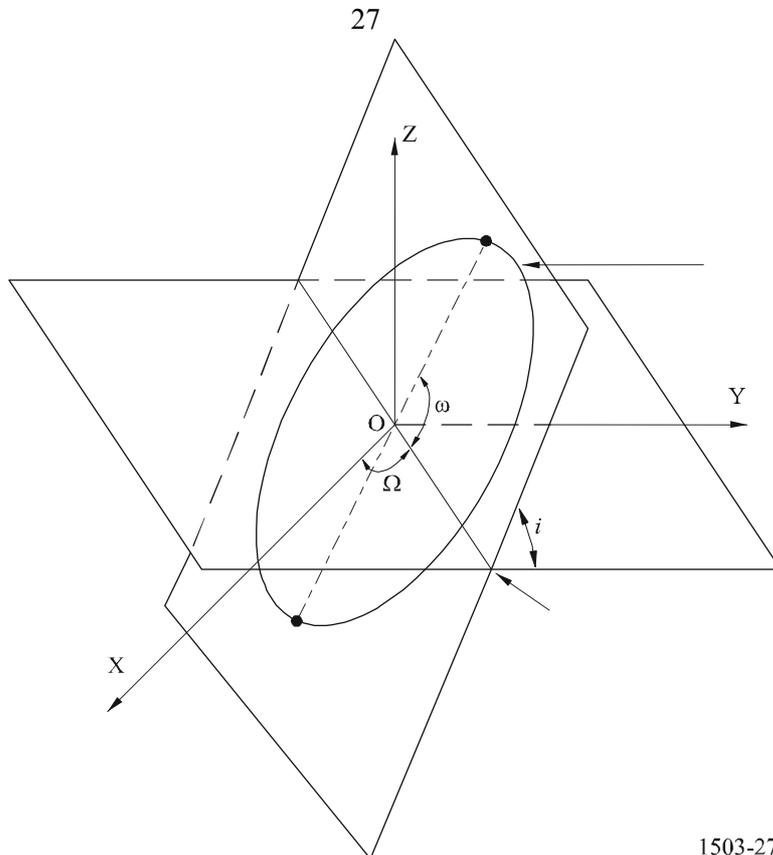


1503-26

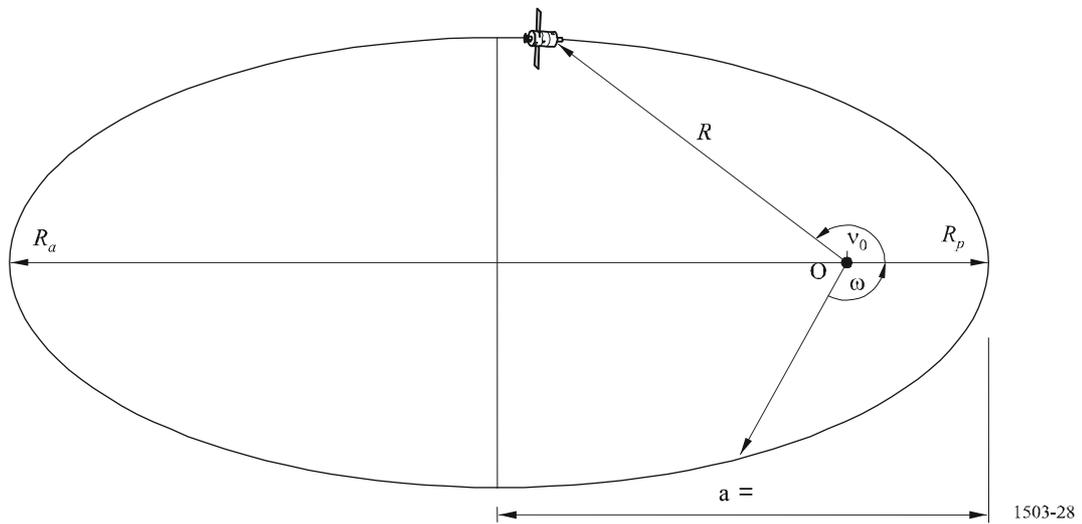
3.5

1.3.5

.27



1503-27



(19)
$$a = (R_a + R_p) / 2$$

(20)
$$e = (R_a - R_p) / (R_a + R_p)$$

:
:a
:e
:Ra
:Rp
:
:omega

:

: v_0

:

v_0

ω

(21)

$$\mu_0 = \omega + v_0$$

:

(22)

$$p = a(1 - e^2)$$

(23)

$$M = E - e \sin E$$

(24)

$$\tan \frac{v}{2} = \sqrt{\frac{1+e}{1-e}} \tan \frac{E}{2}$$

(25)

$$R = \frac{p}{1 + e \cos(v)}$$

(26)

$$T = 2\pi\sqrt{a^3/\mu}$$

:

: P

: E

: M

: T

. v

: R

.2.3.5

2.3.5

(27)

$$\bar{n} = n_0 \left(1 + \frac{3}{2} \frac{J_2 R_e^2}{p^2} \left(1 - \frac{3}{2} \sin^2(i) \right) (1 - e^2)^{1/2} \right)$$

:

$$J_2 = 1,083e-3$$

$$n_0 = \sqrt{\frac{\mu}{a^3}}$$

:

$$(28) \quad \Omega_r = -\frac{3}{2} \frac{J_2 R_e^2}{p^2} \bar{n} \cos(i)$$

$$\left(\begin{array}{c} \Omega \\ \end{array} \right) \quad \begin{array}{l} \text{(\circ90 > i)} \\ \text{(\circ90 < i)} \end{array}$$

$$(29) \quad \omega_r = \frac{3}{2} \frac{J_2 R_e^2}{p^2} \bar{n} \left(2 - \frac{5}{2} \sin^2(i) \right)$$

$$.180 = i \quad 0 = i$$

$$i_2 < i \quad i_1 > i$$

$$.116^\circ 33' 54'' = i_2 \quad 63^\circ 26' 06'' = i_1$$

$$i_2 > i > i_1$$

$$(30) \quad \omega = \omega_0 + \omega_r t$$

:

:\omega_0

:\omega_r

:

$$(31) \quad \Omega = \Omega_0 + \Omega_r t$$

:

:\Omega_0

:\Omega_r

.X

:

$$(32) \quad \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} R(\cos(v + \omega)\cos(\Omega) - \sin(v + \omega)\sin(\Omega)\cos(i)) \\ R(\cos(v + \omega)\sin(\Omega) + \sin(v + \omega)\cos(\Omega)\cos(i)) \\ R\sin(v + \omega)\sin(i) \end{bmatrix}$$

(33) $M = M_0 + \bar{n}t$

3.3.5

() $W_{\text{delta}\pm}$ $W_{\text{delta}-}$ $W_{\text{delta}\pm}$

Z

.D 4.3.5

4.3.5

.J₂

Z

(34)
$$\begin{bmatrix} x' \\ y' \\ z' \end{bmatrix} = \begin{pmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

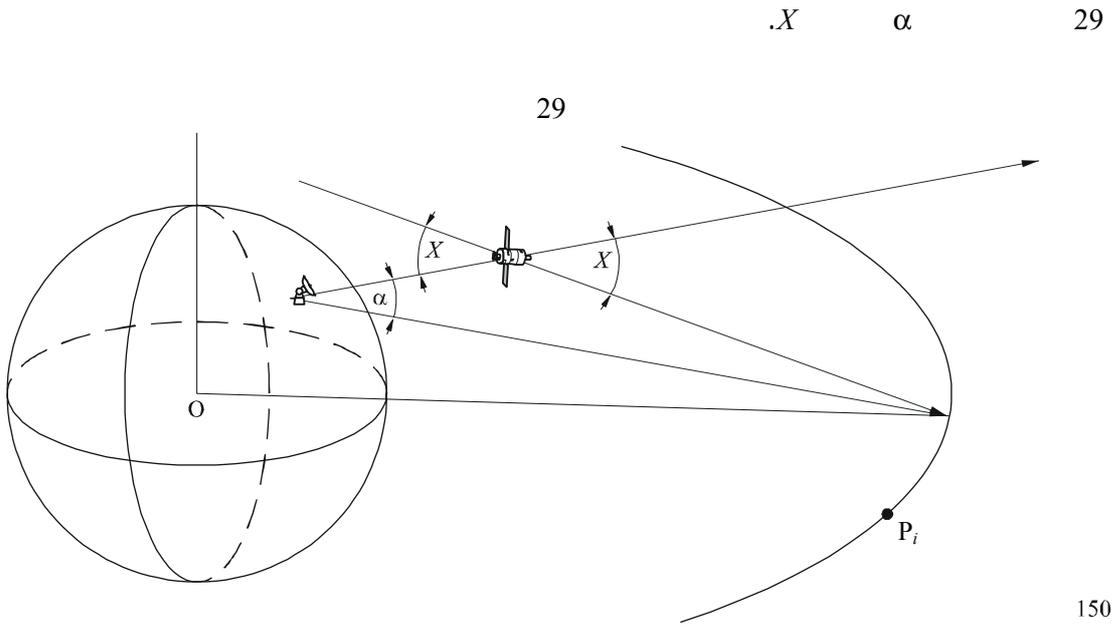
.θ

(- 1

4.5

1.4.5

.1.5



1503-29

P_i

α_i

α

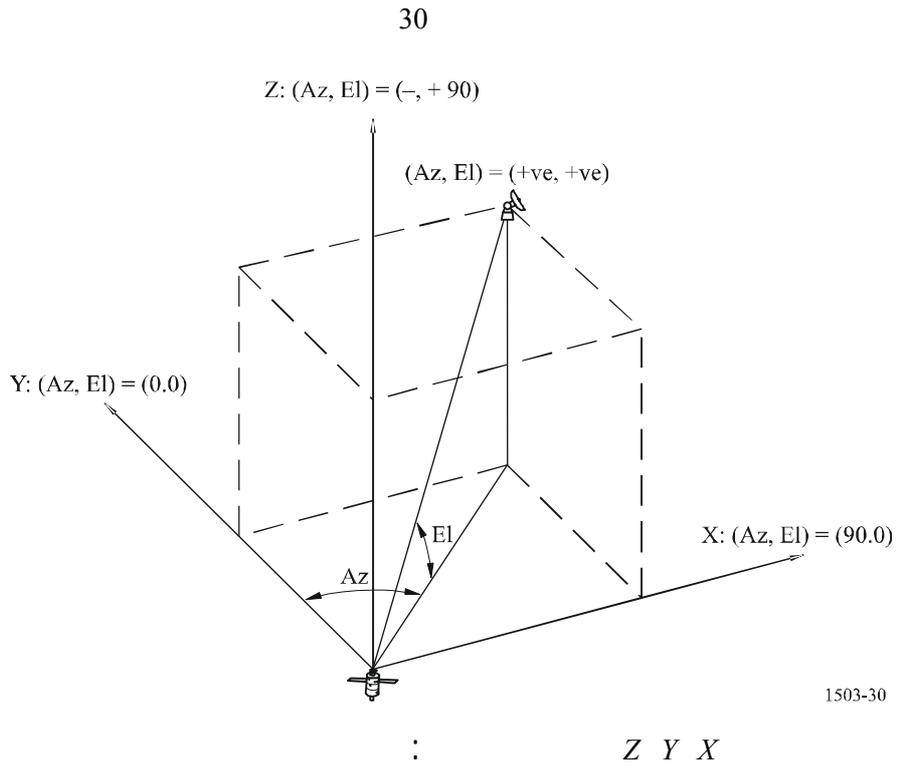
$\alpha = \min (\alpha_i)$

P_i

X_i

X

$X = \min (X_i)$



+ve :X
 :Y
 +ve :Z

5.5

1.5.5

1.1.5.5

.ITU-R S.1428

2.1.5.5

.ITU-R BO.1443

2.5.5

22

(epfd)

()

()

()

epfd

()

epfd

(θ φ) | $\mathbf{x} = (\varphi, \theta)^T$

| $p_x(\Phi, \Theta)$

.()

$\pi/2 \pm$

: (1)

$$(35) \quad p_x(\Phi, \Theta) = \begin{cases} \frac{k(1+e)}{2\pi^2} \frac{\cos\Theta}{\sqrt{\sin^2 \delta - \sin^2 \Theta}} \left[\frac{2 \sin \delta}{(1+k^2)\sin \delta - (1-k^2)g(\Theta)} \right]^2 & \text{for } -\delta < \Theta \leq \delta \\ 0 & -\pi < \Phi \leq \pi \end{cases}$$

$$(36) \quad k = \sqrt{\frac{1+e}{1-e}}$$

$$(37) \quad g(\Theta) = \cos \omega \sqrt{\sin^2 \delta - \sin^2 \Theta} + \sin \omega \sin \Theta$$

ω

35

: 35 ($e = 0 \rightarrow k = 1$ |)

(38)
$$p_x(\Phi, \Theta) = \begin{cases} \frac{1}{2\pi^2} \frac{\cos \Theta}{\sqrt{\sin^2 \delta - \sin^2 \Theta}} & \text{for } -\delta < \Theta \leq \delta \\ 0 & -\pi < \Phi \leq \pi \end{cases}$$

4A

- 1

(epfd)

$\varphi - \theta$

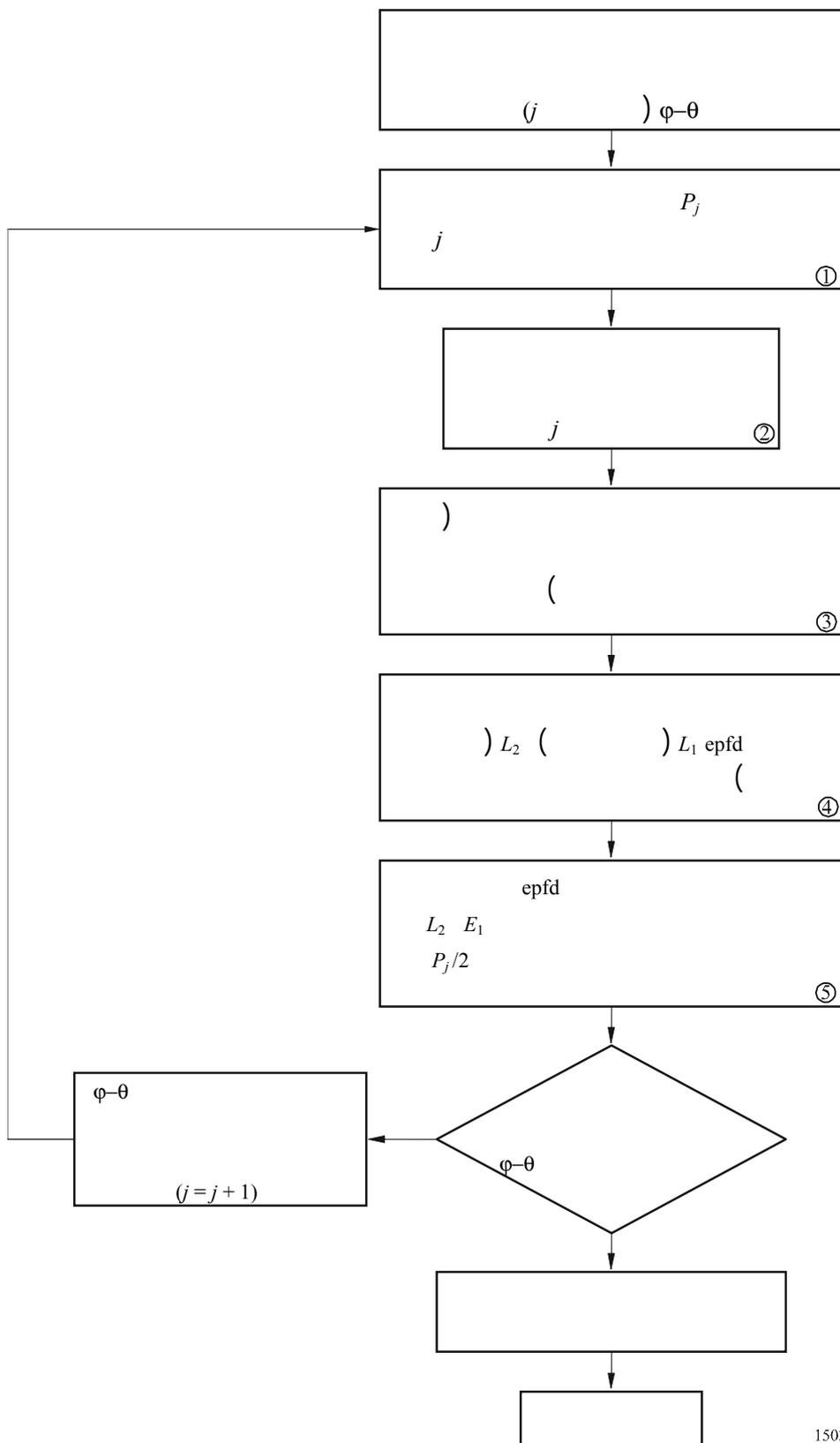
$(-\pi < \varphi \leq \pi, \delta \leq \theta \leq \delta)$

.34

31

.D 2.6.1.4 2.5.3

31



$$(39) \quad P_j = \frac{\Phi_M - \Phi_m}{2\pi} \begin{cases} [f(c_M) + f(\pi - c_m) - f(\pi - c_M) - f(c_m)] & \text{for } \theta_m \geq 0, \theta_M > 0 \\ [1 + f(c_M) + f(-\pi - c_m) - f(\pi - c_M) - f(c_m)] & \text{for } \theta_m < 0, \theta_M \geq 0 \\ [f(c_M) + f(-\pi - c_m) - f(-\pi - c_M) - f(c_m)] & \text{for } \theta_m < 0, \theta_M < 0 \end{cases}$$

:

$$(40) \quad f(x) = \begin{cases} 0 & \text{for } -\infty < x \leq -\pi \\ \frac{1}{2} - \frac{k e}{2\pi} \frac{\tan(x/2)}{\tan^2(x/2) + k^2} + \frac{1}{\pi} \arctan\left(\frac{\tan(x/2)}{k}\right) & \text{for } -\pi < x \leq \pi \\ 1 & \text{for } \pi < x < \infty \end{cases}$$

:

$$(41) \quad c_m = \arcsin\left(\frac{\sin \theta_m}{\sin \delta}\right) - \omega$$

$$(42) \quad c_M = \arcsin\left(\frac{\sin \theta_M}{\sin \delta}\right) - \omega$$

$$| e = 0 \rightarrow k = 1 \quad (42) \quad (40) \quad | \quad \omega = 0$$

:

(40)

$$(43) \quad f(x) = \begin{cases} 0 & \text{for } -\infty < x \leq -\pi \\ \frac{1}{2} \left(1 + \frac{x}{\pi}\right) & \text{for } -\pi < x \leq \pi \\ 1 & \text{for } \pi < x < \infty \end{cases}$$

2.6

| | |
|-----|-----------|
| | u |
| | δ |
| () | β |
| | ψ |
| | λ |
| () | r |
| | a |
| | e |
| | ω |

| | | | |
|-----|-----|--------------|-------------------------|
| | | z | \mathbf{k}_z |
| | l | | γ_ℓ |
| | l | | \mathbf{v}_ℓ |
| | l | | E_ℓ |
| | l | | M_ℓ |
| l | j | (i -th) | $(M_i^j)_\ell$ |
| l | j | (i -th) | $(E_i^j)_\ell$ |
| | | n (Bessel) | $J_n(\cdot)$ |
| l | j | (i -th) | $(\mathbf{v}_i^j)_\ell$ |
| l | j | (i -th) | $(\mathbf{u}_i^j)_\ell$ |
| l | j | (i -th) | $(\mathbf{p}_i^j)_\ell$ |
| l | j | (i -th) | $(r_i^j)_\ell$ |

$(\mathbf{p}_i^j)_\ell$: $l = 1, 2$; $j = 0, \dots, N_{\text{satelliteplane}} - 1$; $i = 0, \dots, N_{\text{planes}} - 1$; $\mathbf{u} = (u_x, u_y, u_z)^T$

$$(44) \quad \mathbf{n}_\ell = \begin{pmatrix} (-u_z \cos \delta - a_\ell u_y) / u_x \\ a_\ell \\ \cos \delta \end{pmatrix}$$

$$a_\ell = \frac{-u_y u_z \cos \delta + (-1)^\ell u_x \sqrt{(u_x^2 + u_y^2) \sin^2 \delta - u_z^2 \cos^2 \delta}}{u_x^2 + u_y^2}$$

$$\begin{aligned}
 \mathbf{w}_\ell &= \mathbf{k}_z \times \mathbf{n}_\ell \quad (\times) \\
 \gamma_\ell &= \arccos \left(\frac{\mathbf{u}^T \mathbf{w}_\ell}{|\mathbf{w}_\ell|} \right) \text{sgn}(u_z) \quad (\text{sgn}() \text{ T})
 \end{aligned}$$

$$v_\ell = (\gamma_\ell - \omega)_{\text{MOD } 2\pi}$$

$$k = \sqrt{\frac{1+e}{1-e}} \text{ where}$$

$$E_\ell = 2 \arctan \left(\frac{\tan(v_\ell/2)}{k} \right)$$

$$M_\ell = E_\ell - e \sin E_\ell$$

(45)

$$(M_i^j)_\ell = M_\ell + i \beta + j \lambda$$

$$(E_i^j)_\ell = (M_i^j)_\ell + 2 \sum_{n=1}^{\infty} \frac{1}{n} J_n(ne) \sin(n(M_i^j)_\ell)$$

$$(v_i^j)_\ell = 2 \arctan \left(k \tan \frac{(E_i^j)_\ell}{2} \right)$$

(46)

$$(\alpha_i^j)_\ell = (v_i^j)_\ell - v_\ell$$

:

45

 β

$$\beta = \frac{2\pi}{N_{\text{satelliteplane}}}$$

:

:3

$$(\mathbf{p}_i^j)_\ell = (r_i^j)_\ell (\mathbf{u}_i^j)_\ell$$

:

$$(r_i^j)_\ell = \frac{a(1-e^2)}{1-e \cos((v_i^j)_\ell)}$$

$$(\mathbf{u}_i^j)_\ell = \cos((\alpha_i^j)_\ell) \mathbf{M}_j \mathbf{u} + \sin((\alpha_i^j)_\ell) \mathbf{M}_j \mathbf{b}_\ell$$

:

$$\mathbf{b}_\ell = \mathbf{u} \times \mathbf{n}_\ell$$

$$\mathbf{M}_j = \begin{pmatrix} \cos j\psi & -\sin j\psi & 0 \\ \sin j\psi & \cos j\psi & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

:

$$\psi = \frac{2\pi}{N_{planes}}$$

:

3 2

$e = 0 \rightarrow k = 1 \quad r = a$

:2

$$(\alpha_i^j)_\ell = i\beta + j\lambda$$

:3

$$(\mathbf{p}_i^j)_\ell = r (\mathbf{u}_i^j)_\ell$$

:

$$(\mathbf{u}_i^j)_\ell = \cos((\alpha_i^j)_\ell) \mathbf{M}_j \mathbf{u} + \sin((\alpha_i^j)_\ell) \mathbf{M}_j \mathbf{b}_\ell$$

:

$$\mathbf{b}_\ell = \mathbf{u} \times \mathbf{n}_\ell$$

$$\mathbf{M}_j = \begin{pmatrix} \cos j\psi & -\sin j\psi & 0 \\ \sin j\psi & \cos j\psi & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

3.6

epfd

$\varphi - \theta$

$\varphi - \theta$

()

epfd

$\varphi - \theta$

.RPII

epfd

$\varphi - \theta$

$\Delta\theta_f \quad \Delta\varphi_f$

$$\Delta\varphi_f \leq \frac{\varphi}{10} \quad \text{and} \quad \Delta\theta_f \leq \frac{\varphi}{10}$$

$$.epfd_{is} \quad (4) \quad epfd_{\uparrow/\downarrow} \quad (3) \quad \varphi$$

$$: \quad \Delta\theta_c \quad \Delta\varphi_c$$

$$\Delta\varphi_c = 1,5\varphi \quad \text{and} \quad \Delta\theta_c = 1,5\varphi$$

$$.epfd_{is} \quad (4) \quad epfd_{\uparrow/\downarrow} \quad (3) \quad \varphi$$

$$\varphi-\theta \quad (\text{RPII})$$

$$) \quad . \quad ($$

$$4.6 \quad . \quad .D$$

$$\Delta \times \Delta \quad :$$

$$\Delta = 5\varphi$$

$$.epfd_{is} \quad (4) \quad epfd_{\uparrow/\downarrow} \quad (3) \quad \varphi$$

$$) \quad . \quad (\text{RPII}) \quad ($$

RPII

4.6

:

(epfd_↑)

1.4.6

()

:epfd_↑

:1

:2

.D 2.6

$$N_{non-GSOearthstations} \times N_{non-GSOsatellites} \times 2 \quad :3$$

(epfd_↓) 2.4.6

()

:epfd_↓

:1

()

:2

.D 2.6

$N_{non-GSOsatellites} \times 2$

:3

(epfd_{is}) 3.4.6

()

:epfd_{is}

$N_{GSOsatellitebeams}$:1

:2

.D 2.6

$N_{GSOsatellitebeams} \times N_{non-GSOsatellites} \times 2$

:3

5.6

((EZVR)

)

.φ-θ

:EZVR

:1

.N_{EZ}

D 2.6 N_{EZ} :2

$N_{EZ} \times N_{non-GSOsatellites} \times 2$:3

7

/ 1.7

1.1.7

2.1.7

D 5.3

:

$$CDF_i = 100 (1 - \text{SUM}(\text{PDF}_{min} : \text{PDF}_i))$$

:

dB X

PDF

:PDF_x

PDF_x

3.1.7

:

$$i \quad 4 \quad 3 \quad 2 \quad :1$$

$$(P_i J_i) \quad / \quad :2$$

$$J_i \quad (\text{dB } 0,1 \quad) \quad S_B \quad J_i \quad :3$$

.dB 0,1

$$P_t \quad :4$$

.J_i

$$: \quad P_t > P_i \quad :5$$

$$. (\quad) \quad \%100$$

.J_{max}

$$: \quad J_{100} > J_{max} \quad .J_{100} \quad \%100$$

$$: \quad J_{100} \leq J_{max}$$

4.1.7

2.7

$$(\quad)$$

3.7

:

-

-

—

—

—

epfd(↓↑)

2

%100 epfd_↓

—

%100 epfd

dB 0, X±

D 6

pdf

3

pdf

pdf

4

:

E 1

(

(

F

1

(Microsoft Windows NT)

32

98/95

() 4,0

2

(GIMS)

(SNS)

.
8

G

| | | |
|----|---|-----|
| | | 1 |
| | | 1.1 |
| | | 2.1 |
| | | 2 |
| .F | 2 | |
| | | 3 |
| | | 1.3 |
| | | 2.3 |
| | | 3.3 |
| | | 4.3 |

H

| | | | | | |
|-----|---|-------|-----|-------|------------|
| | : | | | | |
| .(| : | 2000 | NT | 98/95 | :1) 32 |
| | | .1999 | | | |
| | | | | F | |
|) | : | | | | :2 (|
| | | | | B A | |
| () | | | | | :3 |
| .(| | | | / | |
| | | | E A | | |
| () | : | | | | :4 |
| | | | | | :5 |
| () | : | | | | :6 |
| | | | / | | |
| | | | | | :7 |
| | | G | 3.3 | | |
| | : | | | | :8 |
| () | | | | | (|

6.2.4 4.2.4 4.1.4 7.3 4.3

.
.

D 7.1.4 F
:9

e.i.r.p.

:

.

.

C' C

:10
:

epfd

D

. (/)

(22)

COM / DLL

:11
:12

G

4.3

E

4

.

:

:13

:

:14
)

(. %100

D 6 E

)

9

10

10

1

1

| | | |
|---------|----|--------|
| (10 1) | | |
| | 1 | |
| | 11 | |
| | 4 | |
| | 6 | |
| | 8 | |
| | 5 | |
| | 12 | |
| | 7 | / |
| | 2 | () |
| | 3 | |
| | 9 | (c c) |
| | 10 | (D) |
| | 13 | |
| | 14 | |
| | | |