November 11, 2020

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INTRODUCTION

This presentation highlights the main new features and other changes introduced in **HTZ Communications and HTZ Warfare, v.22.9.9.**

For more information, refer to the online “HTZ News and modification” document available in the ATDI doc center or contact support@atdi-group.com

For sales enquiry for maintenance support contract renewal, please contact: contact@atdi-group.com

AGENDA

- **User Interface:**
  - New drag and drop on map of vector files
- **Satellite: a new function to process massive constellation**
  - EPDF (Equivalent Power Flux-Density) calculation and examination
- **Broadcast (RRC06): direct connection to RRC06 from HTZ, without ICS manager**
  - RN (Reference Network) and RPC (Radio Planning Configuration) capabilities
  - Polygon Threshold Limit calculation
- **Mobile (4G/5G): a new algorithm to enhance calculation efficiency and visualization of the conflict check**
  - Root sequence index allocation
  - Physical layer cell identities

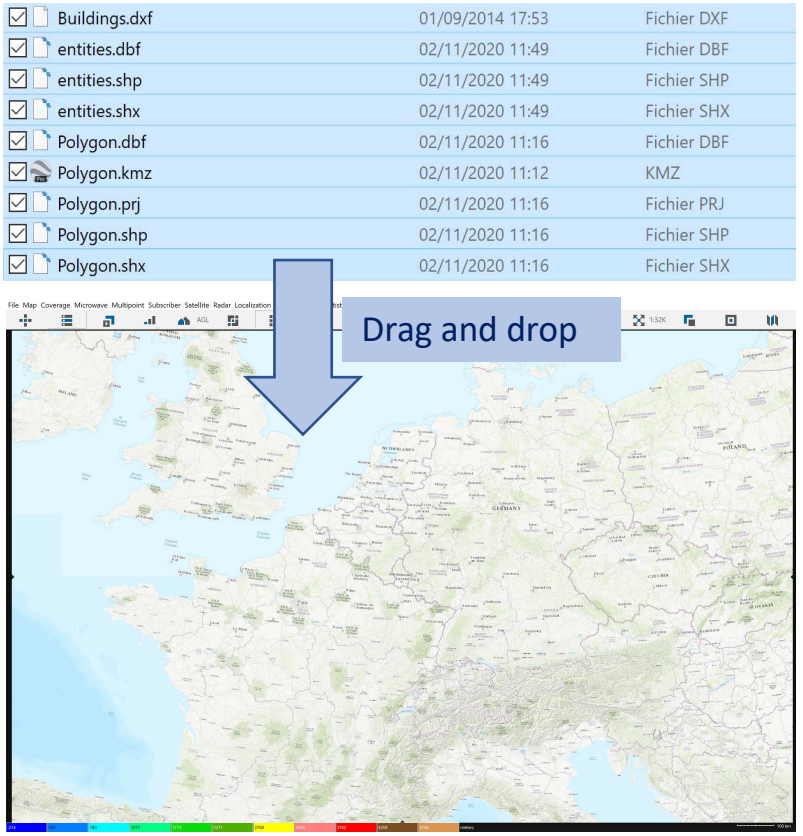
INTERFACE: Drag and drop of vector files on map

It is now possible to drag and drop vector files

- Formats:

  KML/.KMZ/.MIF/.GEOJSON/.SHP/.DGN/
  .OSM/.PBF/.DWG./.DXF

- Notes:
  - DXF format: only coordinates in 4DEC (EPSG:4326) are supported
  - DWG (Autocad): some versions of DWG format are not compatible



EPFD EXAMINATION : Concept and criterions

- ITU Resolution: Article 22 (RR), appendix 5
- EPFD (Equivalent Power Flux-Density) limits enable non-GSO FSS systems to share frequencies with and protect GSO systems without requiring individual coordination with all the systems worldwide
- EPFD limits contained in Tables 22-1A, 22-1B, 22-1C, 22-1D, 22-1E, 22-2 and 22-3 (Article 22)
- EPFD takes into account the aggregate of the emissions from all non-GSO satellites in the direction of any GSO earth station, taking into account the GSO antenna directivity

Fig 1: Effect of interferences from several sources

EPFD Limits Regulatory Frameworks

Article 9 – Coordination trigger limit (EPFD):

- Specific large Earth Station requires coordination under RR No. 9.7A with respect to any existing non-GSO satellite systems using the coordination triggers in RR Appendix 5; or
- FSS non-GSO satellite systems requires coordination under RR No. 9.7B with respect to any large earth station (under certain conditions) using the coordination triggers in RR Appendix 5.
- Coordination EPFD trigger limits enable protection of very large specific GSO earth stations.

EPFD Equation

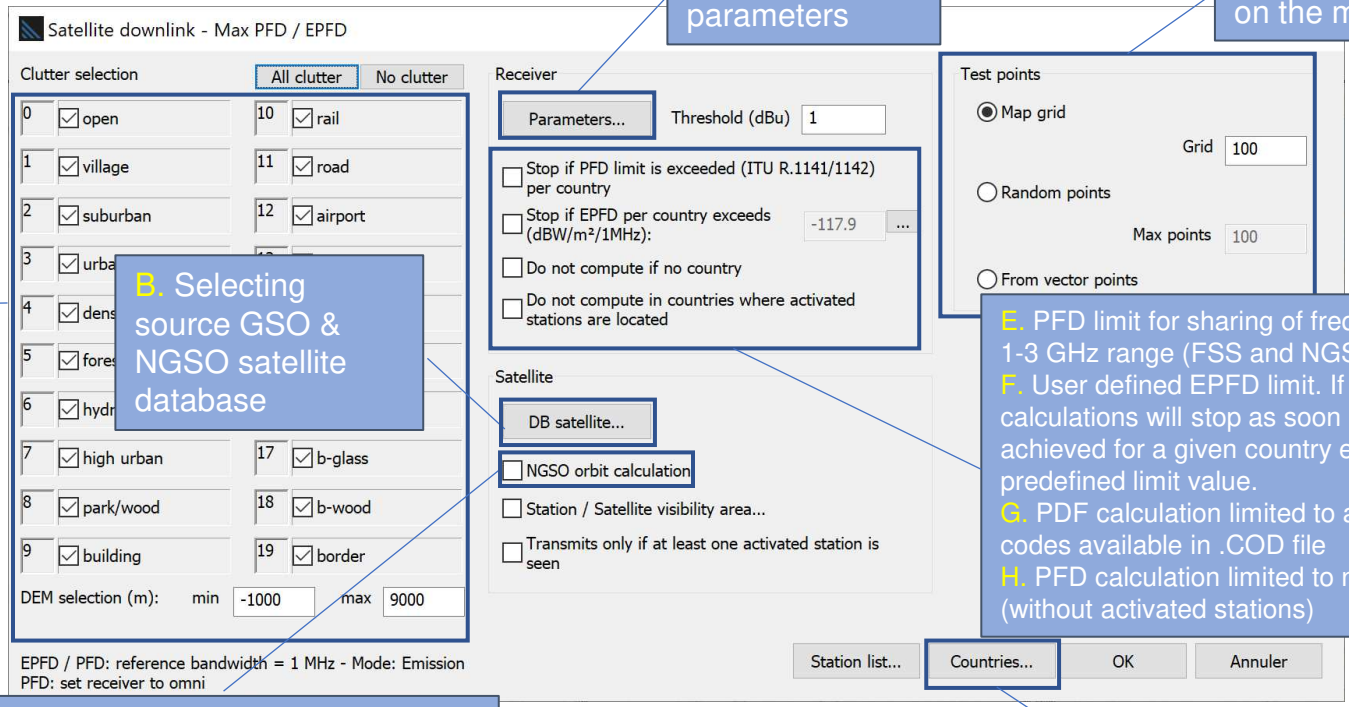
EPFD equation looks daunting, but at its core it is relatively straight-forward and builds on the concept of the PFD (Power Flux Density).

As the EIRP could vary depending upon the direction (for example if the transmitter didn't use an isotropic antenna), the term depends upon angle, here identified using theta. The idea of the EPFD is that in many cases the victim receiver has a directional antenna and so the impact of PFD on its performance will depend upon the relative gain towards the interfering station. Hence: EPFD = EIRP(theta) / $4\pi d^2$ * Gr.rel(phi)

- with Gr.rel(phi) = Gr(phi) / Gr.max
- with Gr = Receiver antenna gain

EPFD EXAMINATION - INTERFACE OPTIONS

Menu: *"Satellite/Satellite PFD/EPFD map…"*



A. Clutter and DEM selection

B. Selecting source GSO & NGSO satellite database

C. Earth station parameters

D. Points selection on the map

E. PFD limit for sharing of frequency bands in the 1-3 GHz range (FSS and NGSO MSS)

F. User defined EPFD limit. If checked, calculations will stop as soon as the PDF value achieved for a given country exceeds the predefined limit value.

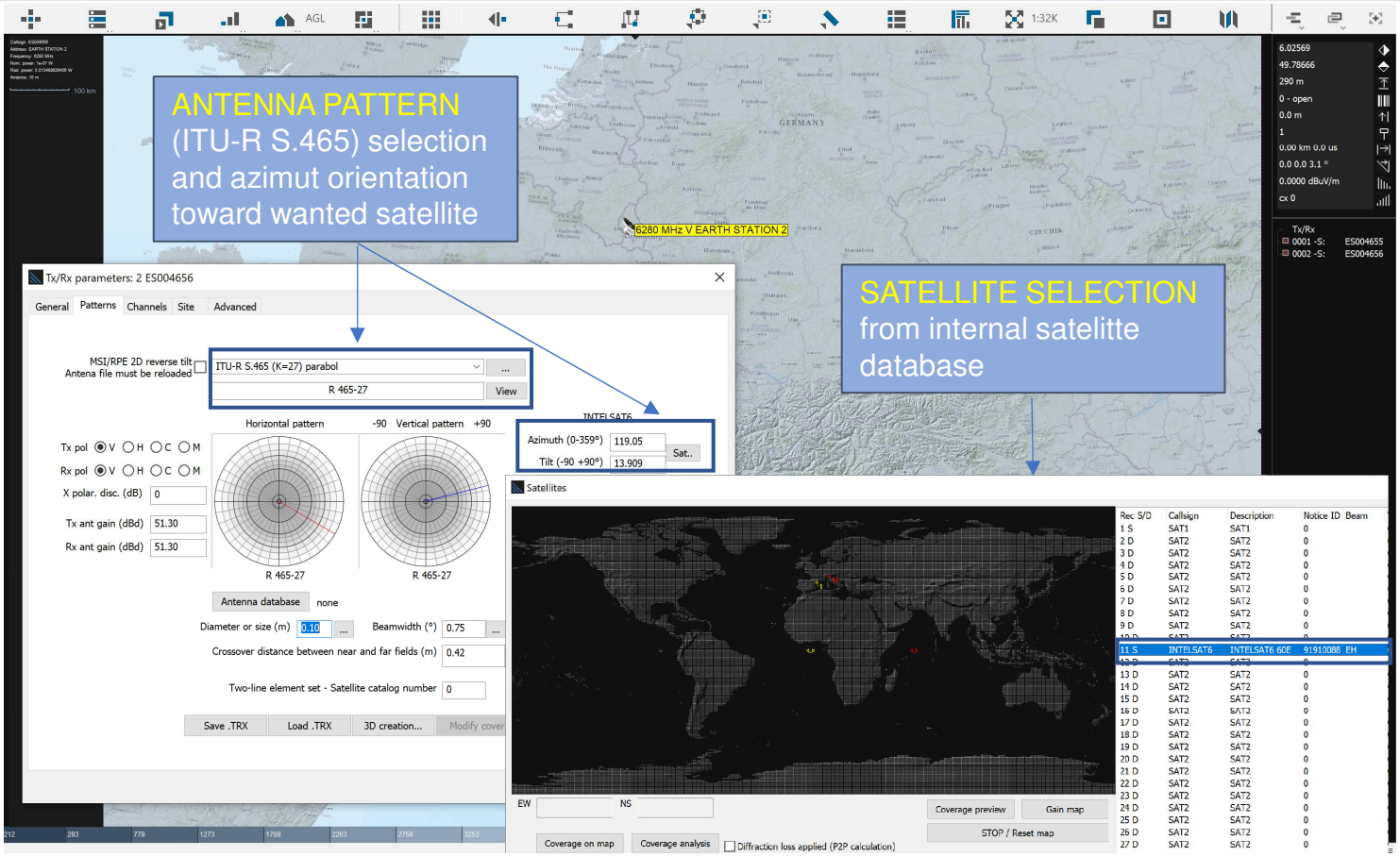
G. PDF calculation limited to administrations codes available in .COD file

H. PFD calculation limited to neighbor countries (without activated stations)

I. If option checked orbital planes will be computed and take into account during PDF calculation

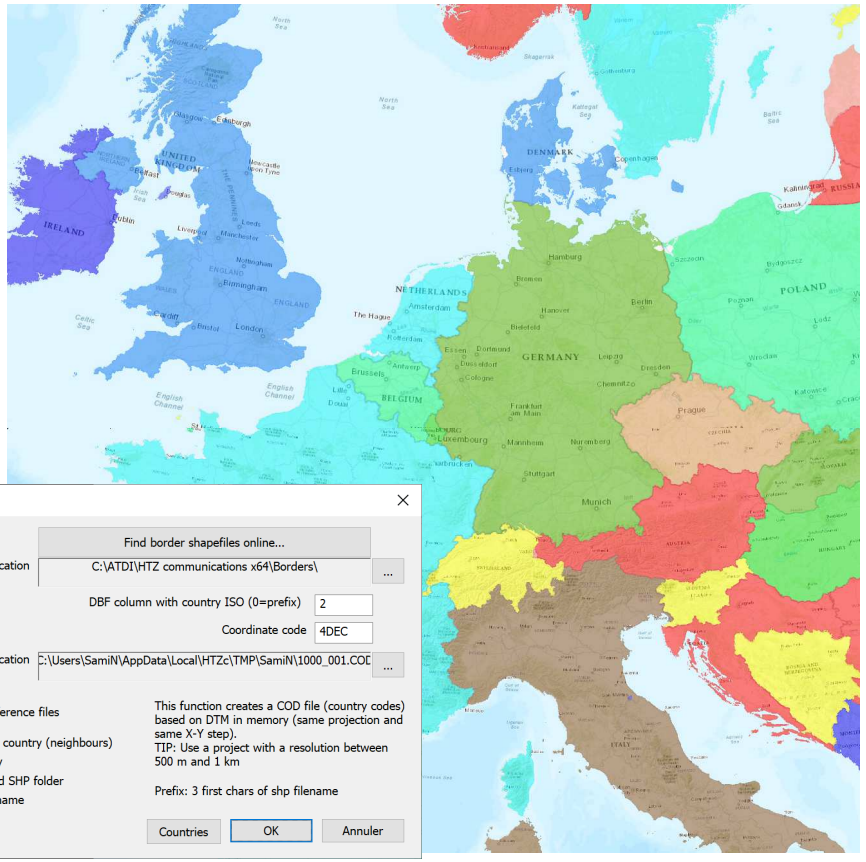
J. Selection of the .COD country file

Earth station configuration

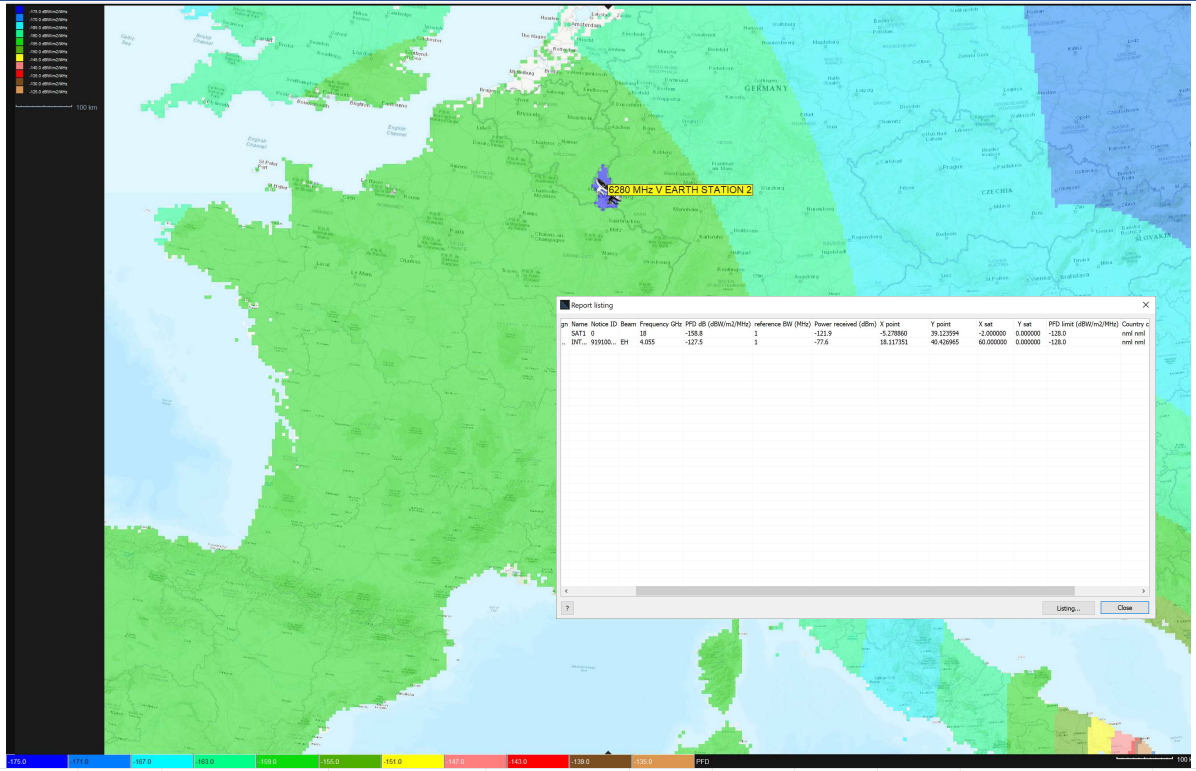


.COD (Country Code) File

- ".COD" (Country Code file): raster file describing the administration code and border countries.
- Mainly used for international coordination purposes.
- Can be built from the menu: "*Map/Border/Border Builder…*"



Example of EPFD result : EPFD >= -117.9 dB(w/m²)



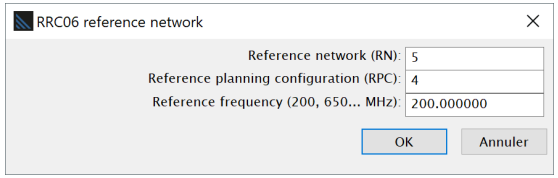
Callsign	Name	Notice ID	Beam	Frequency GHz	PFD dB (dBW/m2/MHz)	reference BW (MHz)	Power received (dBm)	X point	Y point	X sat	Y sat	PFD limit (dBW/m2/MHz)	Country codes	Delta PFD dB	Country...
INTELSAT6	INTELSAT6	91910088	EH	4.055	-127.5	1	-77.6	18.11735	40.42697	60	0	-128	nml nml	1	I

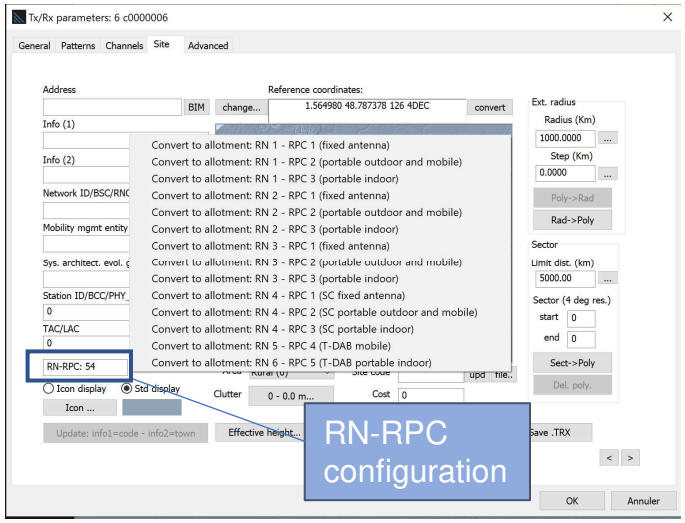
RN (Reference Network) creation

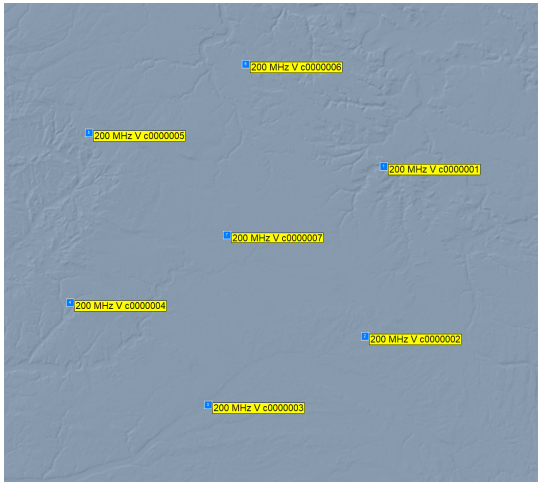
Menu: *“Right-click on map/Add station /RR06 reference network…”*

This feature creates a Reference Network(for allotment) according to RCC06 agreement and RN, RPC and reference frequency parameters

Note: RNRPC field added (integer) in StationX64 table (and EWX).



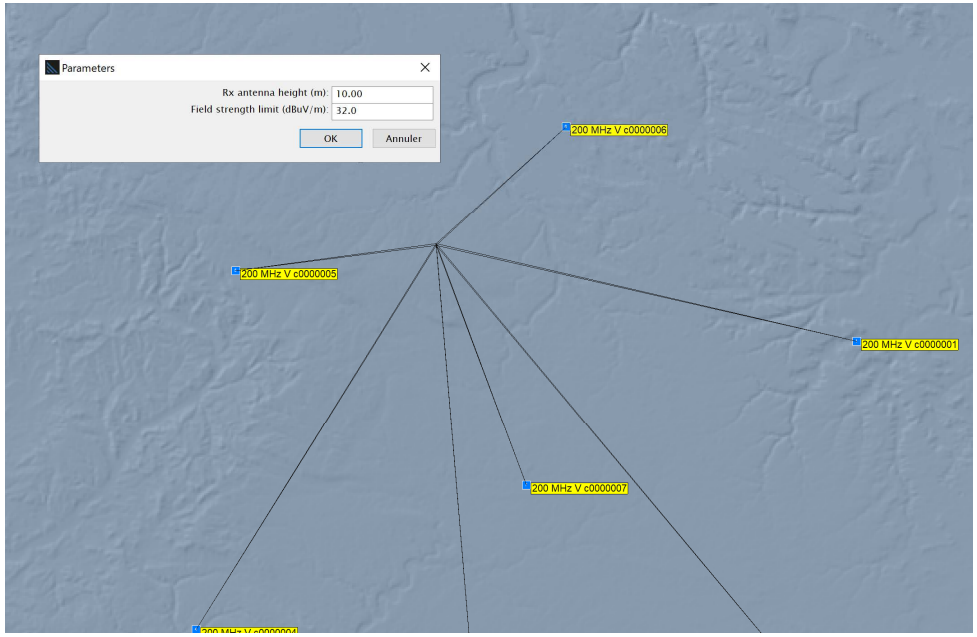




RN (Reference Network) creation

Menu: *“Right-click on map/Point to Point/received (fixed elevation)”*

If station = Allotment and RN/RPC value is valid, the FS will be calculated according to RRC06 reference network.



Report

TRANSMITTER RECEIVED - Rx: 10.00 m

BST	Callsign	Address	FSR dBuV/m	PR dBm	RS dBm	Freq (MHz)	Dist (km)	Az (°)	ToA (usec)	From	Path
5	c0000005		42.0	-79.12	-79.12	200.000000 V	33.56	75.87	111.96	p2p	NLOS
6	c0000006		49.6	-71.50	-71.50	200.000000 V	29.30	221.06	97.74	p2p	NLOS

Types of Reference Network (RN1, RN2, RN3, RN4)

Appendix 3.6 (RCC06 agreement) :

- **RN1 (intended for large service area SFN coverage):**

  The network consists of seven transmitters situated at the center and at the vertices of a hexagonal lattice , as indicated in Fig. A.3.6-1. This reference network (RN 1) is applied to different cases: fixed (RPC 1), outdoor/mobile (RPC 2) and indoor (RPC 3) reception, for both Band III and Bands IV/V.

Parameters of RN 1 (large service area SFN)

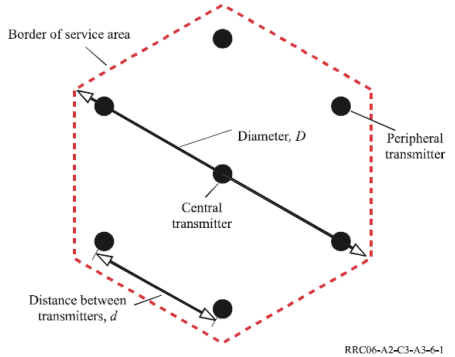
RPC and reception type		RPC 1 Fixed antenna	RPC 2 Portable outdoor and mobile	RPC 3 Portable indoor
Type of network		Open	Open	Open
Geometry of service area		Hexagon	Hexagon	Hexagon
Number of transmitters		7	7	7
Geometry of transmitter lattice		Hexagon	Hexagon	Hexagon
Distance between transmitters *d* (km)		70	50	40
Service area diameter *D* (km)		161	115	92
Tx effective antenna height (m)		150	150	150
Tx antenna pattern		Non-directional	Non-directional	Non-directional
e.r.p.* (dBW)	Band III	34.1	36.2	40.0
	Bands IV/V	42.8	49.7	52.4

The e.r.p. is given for 200 MHz in Band III and 650 MHz in Bands IV/V; for other frequencies (*f* in MHz) the frequency correction factor to be added is: 20 $\log_{10}$ (*f*/200 or *f*/650) for RPC 1 and 30 $\log_{10}$ (*f*/200 or *f*/650) for RPC 2 and RPC 3.

* The e.r.p. values indicated in this table incorporate an additional power margin of 3 dB.

FIGURE A.3.6-1

RN 1 (large service area SFN)



Types of Reference Network (RN1, RN2, RN3, RN4)

- **RN2 (small service area SFN, dense SFN):**

  The network consists of three transmitters situated at the vertices of an equilateral triangle. The service area is assumed to be hexagonal, as indicated in Fig. A.3.6-2. This reference network (RN 2) is applied to different cases: fixed (RPC 1), outdoor/mobile (RPC 2) and indoor (RPC 3) reception, for both Band III and Bands IV/V.

Parameters of RN 2 (small service area SFN)

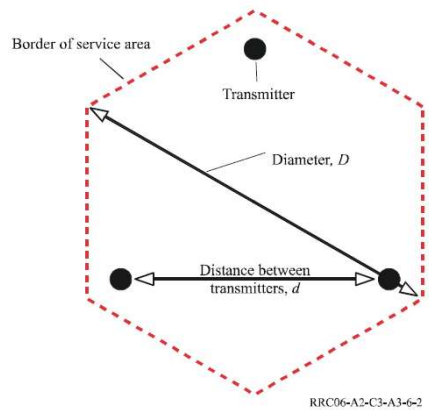
RPC and reception type		RPC 1 Fixed antenna	RPC 2 Portable outdoor and mobile	RPC 3 Portable indoor
Type of network		Open	Open	Open
Geometry of service area		Hexagon	Hexagon	Hexagon
Number of transmitters		3	3	3
Geometry of transmitter lattice		Triangle	Triangle	Triangle
Distance between transmitters *d* (km)		40	25	25
Service area diameter *D* (km)		53	33	33
Tx effective antenna height (m)		150	150	150
Tx antenna pattern		Non-directional	Non-directional	Non-directional
e.r.p.* (dBW)	Band III	24.1	26.6	34.1
	Bands IV/V	31.8	39.0	46.3

The e.r.p. is given for 200 MHz in Band III and 650 MHz in Bands IV/V; for other frequencies (f in MHz) the frequency correction factor to be added is: 20 $\log_{10}$ (f/200 or f/650) for RPC 1 and 30 $\log_{10}$ (f/200 or f/650) for RPC 2 and RPC 3.

* The e.r.p. values indicated in this table incorporate an additional power margin of 3 dB.

FIGURE A.3.6-2

RN 2 (small service area SFN)



Types of Reference Network (RN1, RN2, RN3, RN4)

- **RN3 (small service area SFN for urban environment):**
  The geometry of the transmitter lattice of reference network 3 (RN 3) and the service area are identical to those of RN 2. (See Fig. A.3.6-2.). RN 3 is applied to different cases: fixed (RPC 1), outdoor/mobile (RPC 2) and indoor (RPC 3) reception, for both Band III and Bands IV/V.

Parameters of RN 3 (small service area SFN for urban environment)

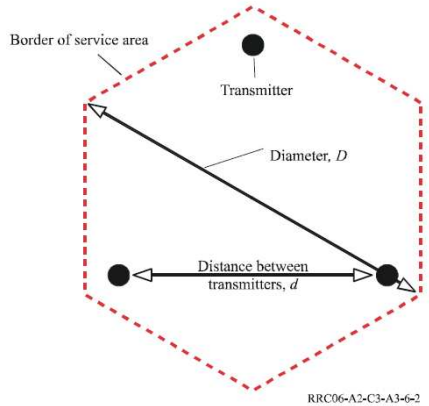
RPC and reception type		RPC 1 Fixed antenna	RPC 2 Portable outdoor and mobile	RPC 3 Portable indoor
Type of network		Open	Open	Open
Geometry of service area		Hexagon	Hexagon	hexagon
Number of transmitters		3	3	3
Geometry of transmitter lattice		Triangle	Triangle	Triangle
Distance *d* (km)		40	25	25
Service area diameter *D* (km)		53	33	33
Tx effective antenna height (m)		150	150	150
Tx antenna pattern		Non-directional	Non-directional	Non-directional
e.r.p.* (dBW)	Band III	24.1	32.5	40.1
	Bands IV/V	31.8	44.9	52.2

The e.r.p. is given for 200 MHz in Band III and 650 MHz in Bands IV/V; for other frequencies (f in MHz) the frequency correction factor to be added is: 20 $\log_{10}$ (*f*/200 or *f*/650) for RPC 1 and 30 $\log_{10}$ (*f*/200 or *f*/650) for RPC 2 and RPC 3.

* The e.r.p. values indicated in this table incorporate an additional power margin of 3 dB.

FIGURE A.3.6-2

RN 2 (small service area SFN)



Types of Reference Network (RN1, RN2, RN3, RN4)

- **RN4 (semi-closed small service area SFN):**

  The geometry for RN 4 is identical to that for RN 2, except for the antenna patterns of the transmitters, which have a reduction of the outgoing field strength of 6 dB over 240°. The service area of this RN is shown in Fig. A.3.6-3. RN 4 is applied to different cases: fixed (RPC 1), outdoor/mobile (RPC 2) and indoor (RPC 3) reception, for both Band III and Bands IV/V.

Parameters of RN 4 (semi-closed small service area SFN)

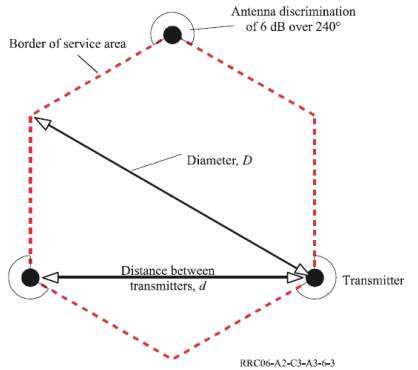
RPC		RPC 1	RPC 2	RPC 3
Type of network and reception type		Semi-closed Fixed antenna	Semi-closed Portable outdoor and mobile	Semi-closed Portable indoor
Geometry of service area		Hexagon	Hexagon	Hexagon
Number of transmitters		3	3	3
Geometry of transmitter lattice		Triangle	Triangle	Triangle
Distance between transmitters *d* (km)		40	25	25
Service area diameter *D* (km)		46	29	29
Tx effective antenna height (m)		150	150	150
Tx antenna pattern		Directional 6 dB reduction over 240°	Directional 6 dB reduction over 240°	Directional 6 dB reduction over 240°
e.r.p.* (dBW)	Band III	22.0	24.0	32.5
	Bands IV/V	29.4	37.2	44.8

The e.r.p. is given for 200 MHz in Band III and 650 MHz in Bands IV/V; for other frequencies (f in MHz) the frequency correction factor to be added is: 20 $\log_{10}$ (f/200 or f/650) for RPC 1 and 30 $\log_{10}$ (f/200 or f/650) for RPC 2 and RPC 3.

* The e.r.p. values indicated in this table incorporate an additional power margin of 3 dB.

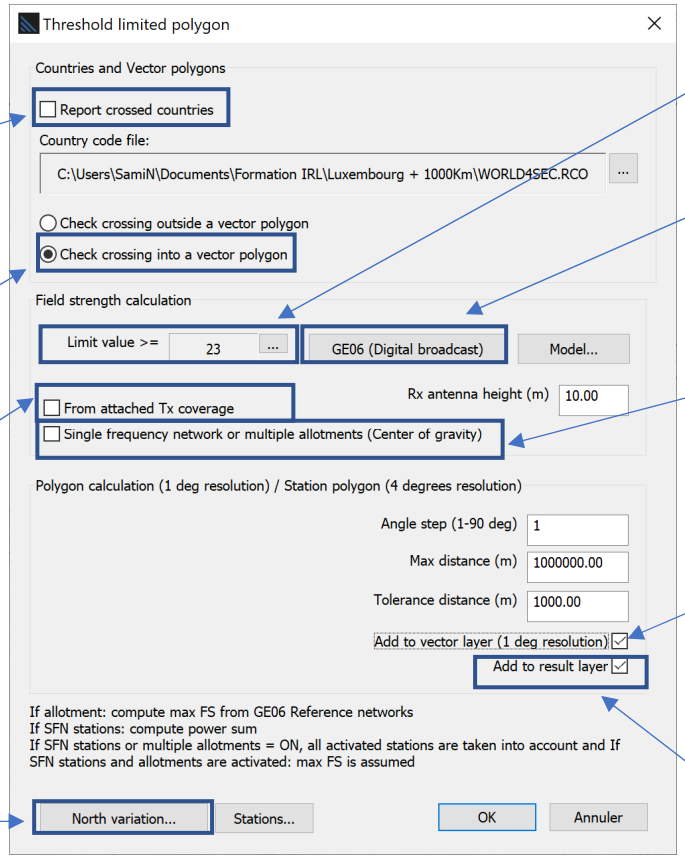
FIGURE A.3.6-3

RN4 (semi-closed small service area SFN)



Threshold Polygon limited (RRC06)

Menu: *"Spectrum/Threshold Polygon calculation…"*



Check this option to report crossed country

The report will say if an existing vector polygon is crossed or not by the coordination contour (inside or outside that polygon).

If checked and if the station has a coverage attached (previously performed), the field strength received values will be extracted from that coverage. Otherwise, point to point calculations will be made.

Set the True North correction (offset between projected map North and True North).

Coordination trigger limit selection

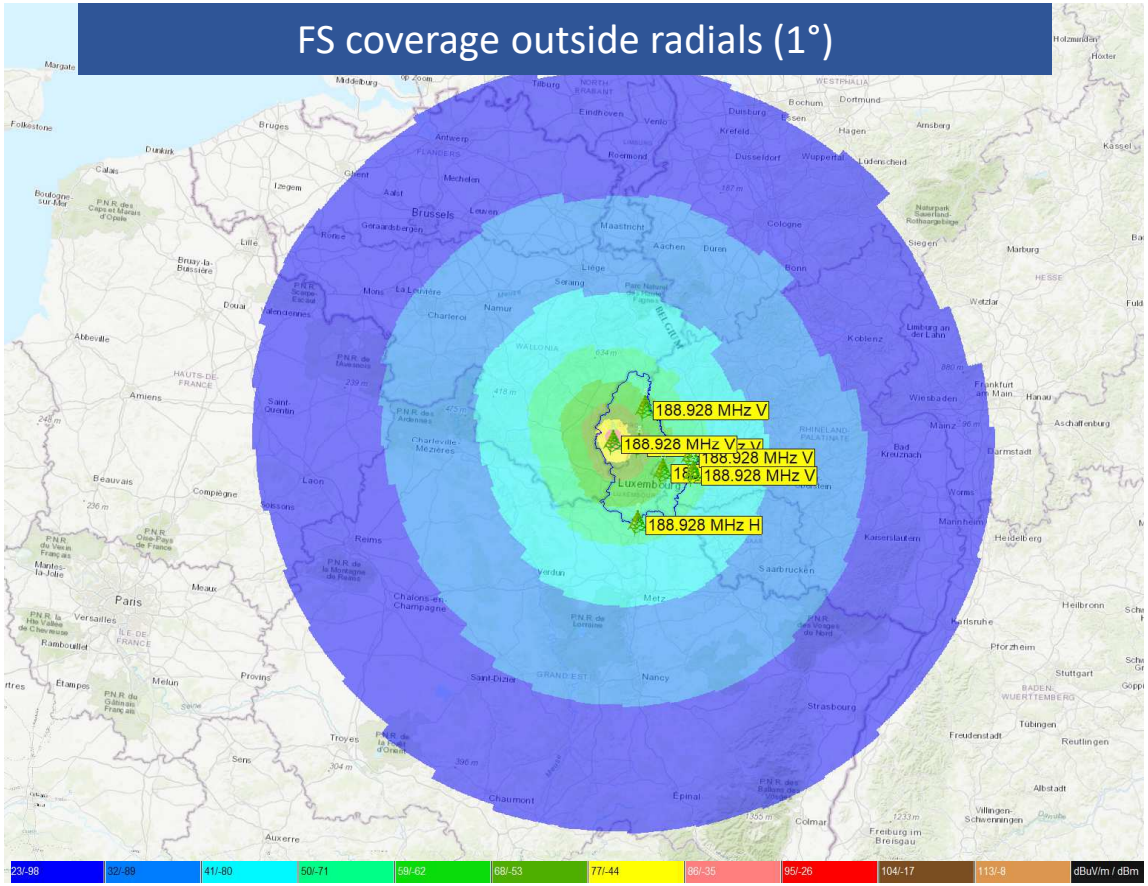
Check this option to set ITU-R P.1546-6 settings compatible with RR06 coordination method

Not used in case of a single station on the map

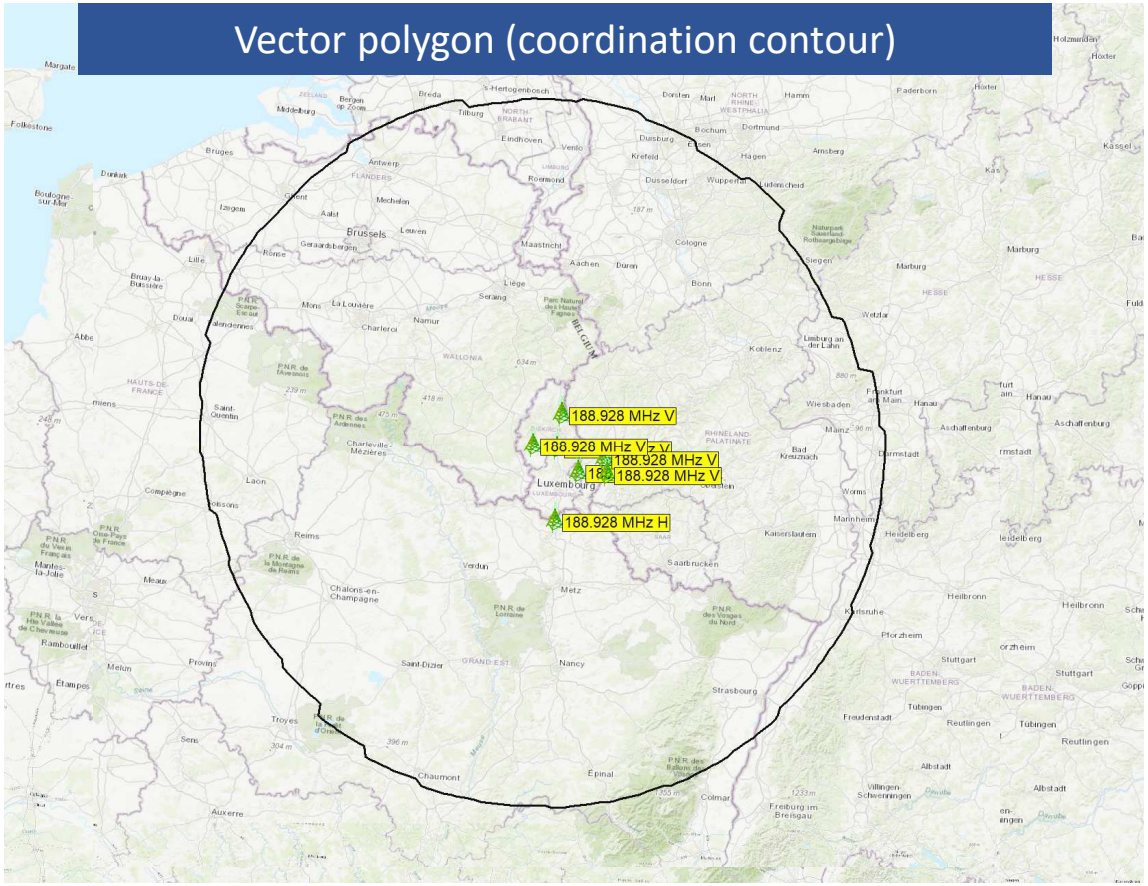
Each point of the contour will be added to a vector polygon with 1° step. Note: This function also computes a polygon attached to the station with a resolution of 4°.

New: computes FS outside radials (1°)

Threshold Polygon limited (RRC06)



Threshold Polygon limited (RRC06)



Root Sequence Index (RSI) Allocation

Menu: *"Coverage/Planning/Root sequence index allocation..."*

4G and 5G options have been added. They are connected to the "From PRACH table (0-15)" option. PRACH optimized based on cell range profile (Long LRA = 839 / Short LRA = 139)

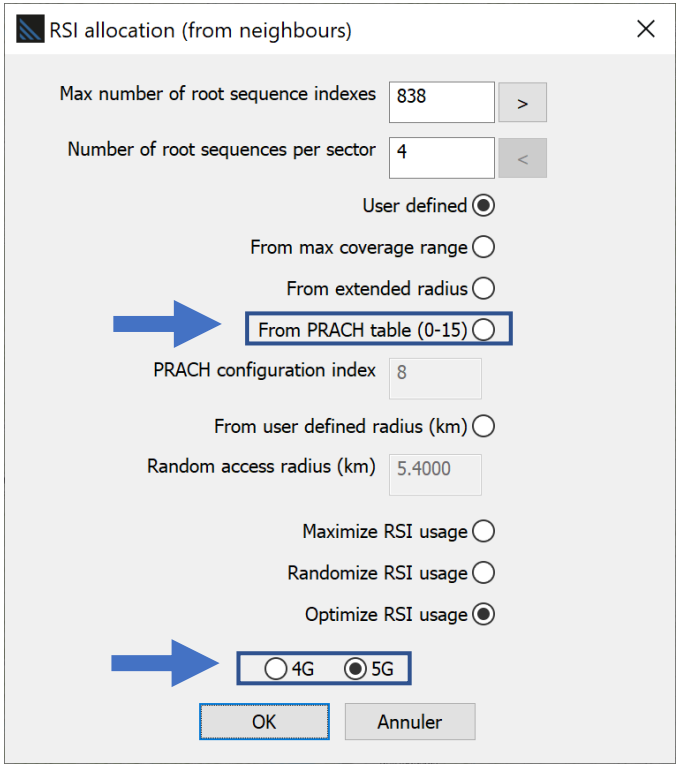


Table 6.3.3.1-7: N_{CS} **for preamble formats with** $\Delta f^{RA} = 15 \cdot 2^{\mu}$ kHz **where** $\mu \in \{0,1,2,3\}$.

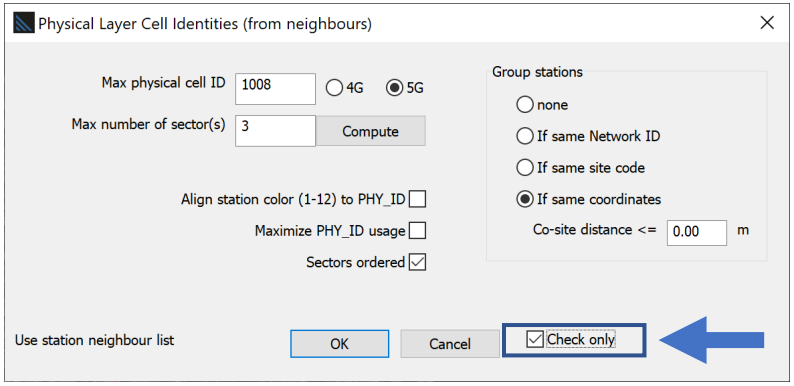
zeroCorrelationZoneConfig	Ncs value	max cell radius (meter)	Preamble quantity per root sequence
0	0	5000	1
1	2	71	69
2	4	143	34
3	6	215	23
4	8	287	17
5	10	359	13
6	12	431	11
7	13	467	10
8	15	539	9
9	17	611	8
10	19	683	7
11	23	827	6
12	27	971	5
13	34	1223	4
14	46	1654	3
15	69	2482	2

Physical Layer Cell Identities (PCI)

Menu: *"Coverage/Planning/Physical layer cell identities... ..."*

Potential conflicts analysis between the "PCI MODn" values improved:

- Intracell case:
  - MODn conflicts are checked "Max number of sector(s)".
  - For 5G stations and if Max number of sector(s)"=4, MOD-3 and MOD-4 cases are checked;
- Intercell case:
  - MODn conflicts are checked with n = 30 (for 5G stations only).



Physical Layer Cell Identities (PCI)

Menu: *“Coverage/Planning/Physical layer cell identities... ...”*

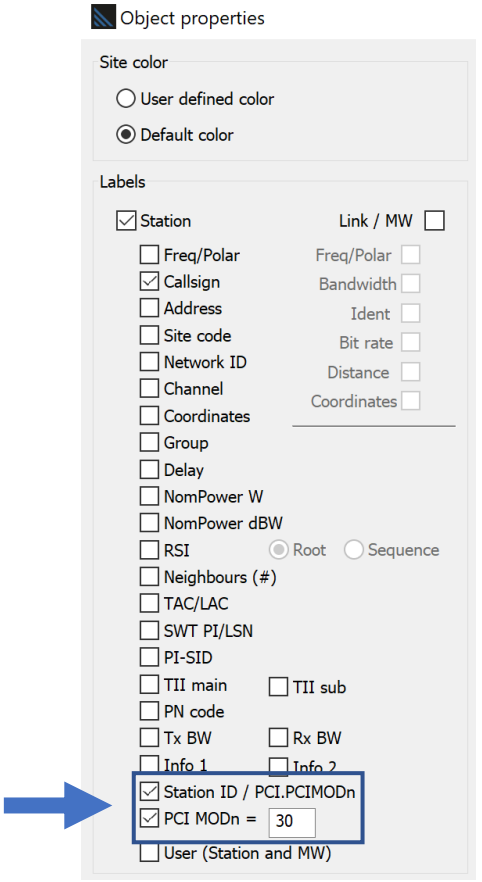
Notes about conflicts analysis between the "PCI MODn :

- Intracell : only if stations belong to the same Group
- The idea is to avoid or minimize interference on Reference Signals. Cells for which either of PCI mod 3/4/30 is equal will have increased probability of interference among each other. As such, good PCI assignment should ensure, when possible, that the PCI mod 3 and the PCI mod 4 are dissimilar among cells of a same site and that the PCI mod 30 is dissimilar among any two potentially interfering cells. Ensuring dissimilarity of PCI mod 3 and PCI mod 4 among cells on two neighboring cells is hard to achieve in practice.

Physical Layer Cell Identities (PCI)

Menu: *“Object/Object properties <F5>...”*

- "Station ID / PCI.PCIMODn" label is now displays the concatenation of the 2 following fields as set in the station parameters (Mobile):PHY_CELL_ID and PCIMODn.
- The "PCI MODn" label has been added. “n” is expected to be either be 3, 4 or 30.



Thank You

ATDI GROUP
11 BOULEVARD MALESHERBES
75008 PARIS, France

support@atdi-group.com
contact@atdi-group.com

ATDI
30 YEARS OF EXPERIENCE