30TH WORLD RADIOCOMMUNICATION SEMINAR

24 – 28 October 2022
Geneva, Switzerland

GE84 calculations on eTools

https://www.itu.int/ITU-R/eTerrestrial/eBroadcasting/ECalculations

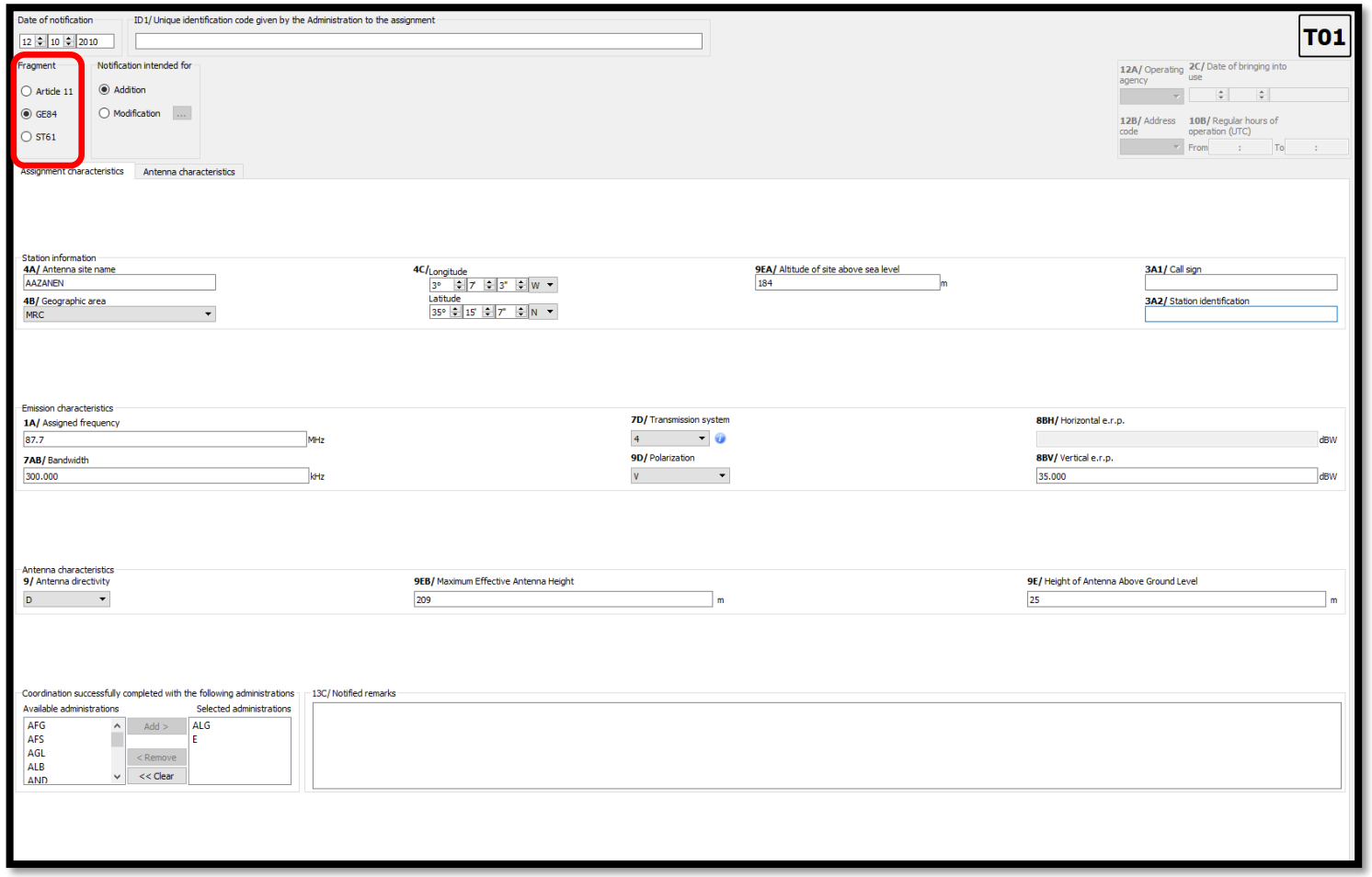
www.itu.int/go/wrs-22

#ITUWRS

Compatibility Analysis

Notices accepted: T01 (TB5 also accepted)

CAUTION: Fragment should be **GE84**

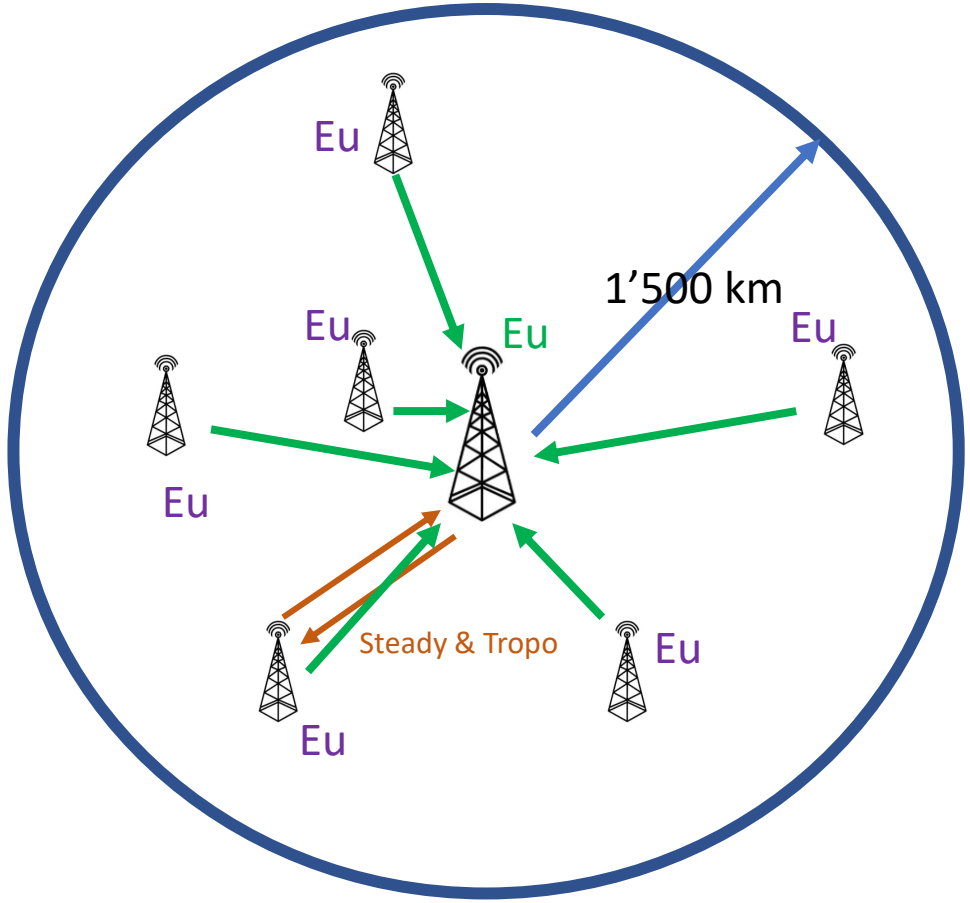


Some definitions

- ***Nuisance field strength(NFS)***
  - The field strength of the interfering transmitter (at its pertinent e.r.p.) modified by the relevant protection ratio.
  - It is a **single** source interference (SSI)

- ***Usable field strength (Eu)***
  - **Minimum value of the field strength necessary to permit a desired reception quality,** under specified receiving conditions, **in the presence of natural and man-made noise and interference.**
  - It considers **multiple sources of** interference (MSI) involving all relevant SSIs
  - For the application of the Article 4 procedure, a statistical computation method for MSI is used: the **simplified multiplication method described in** Chapter 4 of Annex 2

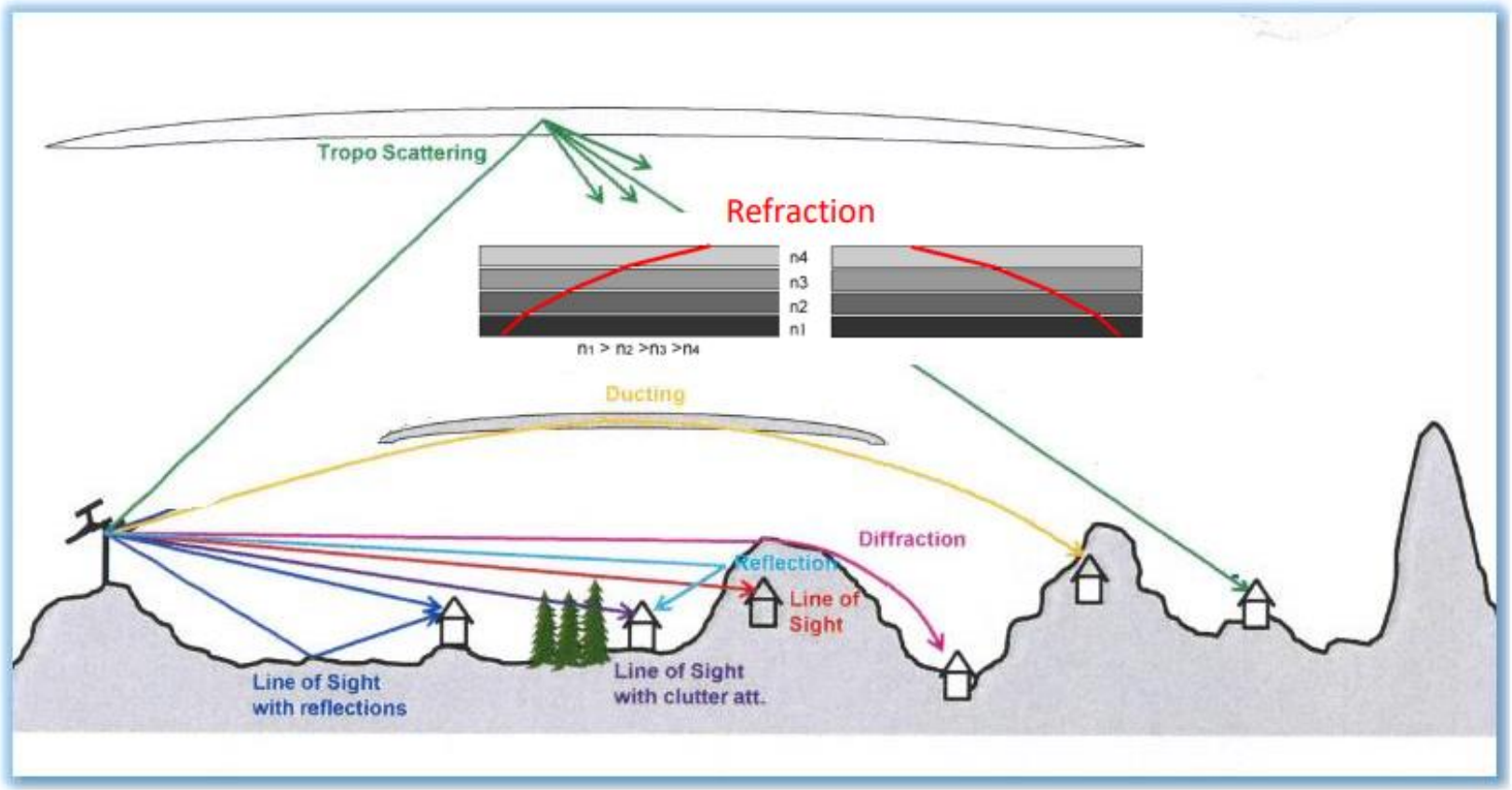
Basis of calculations Compatibility analysis



Based on the coordinates of a station, the tool assesses all identified interference sources within a radius of **1’500 km** for **a given frequency** and **adjacent frequencies** up to **±400 kHz**.

Rec. ITU-R P. 1812

Propagation mechanisms in the VHF/UHF band



Adapted from LS Telecom Propagation training material

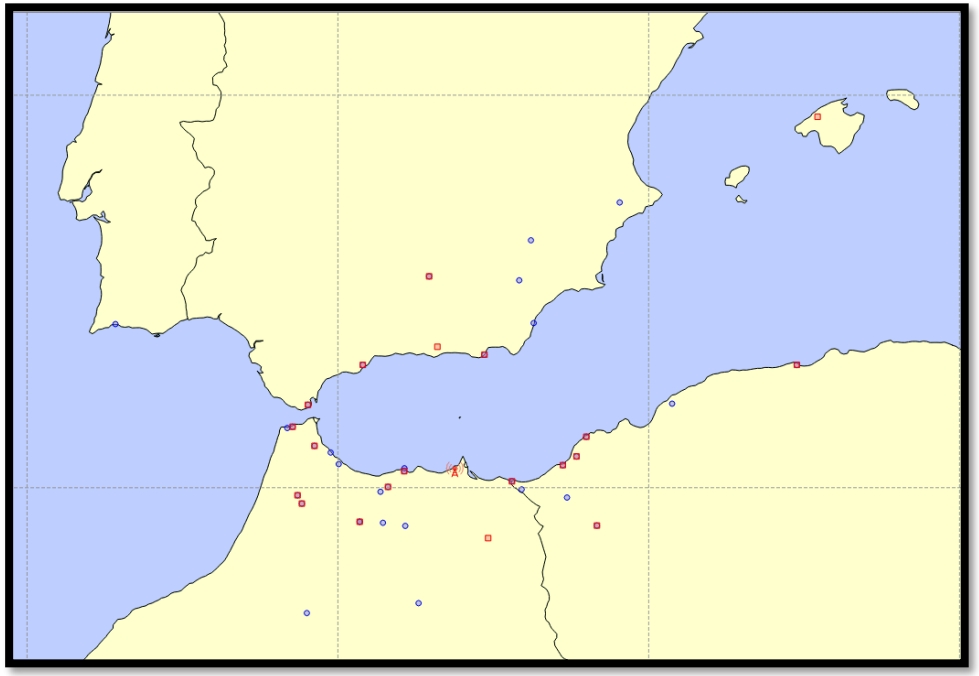
Compatibility Analysis §4.3.7 of the GE84 Agreement

- 4.3.7 If the administration consulted is responsible for:
- 4.3.7.1 a sound broadcasting station, it should normally accept the proposed modification provided that:
- – **the resulting usable field strength is not greater than 54 dB(µV/m);** or
- – **the resulting usable field strength is greater than 54 dB(µV/m), but is increased by 0.5 dB or less compared with the reference usable field strength.**
- An increase of more than 0.5 dB is open to negotiations, in which more detailed calculation methods may be used

Coordination Exam and Compatibility analysis

Coordination Examination

Compatibility Analysis



Coordination Examination: Services likely to be affected

4.2 *Initiation of the modification procedure*

4.2.1 Any administration proposing to modify the characteristics of an assignment appearing in the Plan or to add a new assignment to the Plan shall obtain the agreement of any other administration whose services are likely to be affected.

4.2.2 *a)* The sound broadcasting stations of an administration are likely to be affected by a proposed modification to the Plan if the distance from the station under consideration to the nearest point on the boundary of the country of that administration is less than the limit indicated in Annex 4, Chapter 1.

Other VHF-FM sound broadcasting stations

4.2.2 *b)* The televisi
Stockholm
from the sta
is less than t

4.2.2 *c)* The stations
band 87.5 -
indicated in

4.2.2 *d)* The station
coordinated
the Plan if t

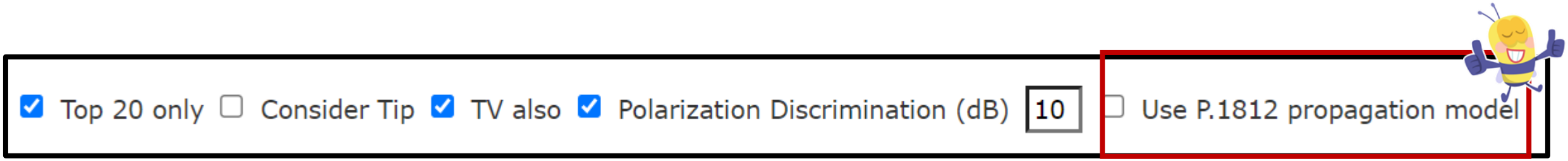
4.2.2 *e)* The stations
in Region 1
basis until
appropriate

Administration	Coordination Status	Coordination Provision	Source of Status	Date of Coordination Status	Declared Affected
COD	COORD REQUIRED	4.2.2.A	ITU	4 Mar 2020	ITU
COD	COORD REQUIRED	4.2.2.F	ITU	4 Mar 2020	ITU
KEN	COORD REQUIRED	4.2.2.F	ITU	4 Mar 2020	ITU
KEN	COORD COMPLETED	COORD	AFFECTED	3 Apr 2020	ITU
RRW	COORD REQUIRED	4.2.2.A	ITU	4 Mar 2020	ITU
RRW	COORD REQUIRED	4.2.2.F	ITU	4 Mar 2020	ITU
RRW	COORD COMPLETED	COORD	NOTIFIER	2 Mar 2020	NOTIFIER
TZA	COORD REQUIRED	4.2.2.A	ITU	4 Mar 2020	ITU
TZA	COORD REQUIRED	4.2.2.F	ITU	4 Mar 2020	ITU
TZA	COORD COMPLETED	COORD	AFFECTED	20 Apr 2020	ITU
TZA	COORD COMPLETED	COORD	NOTIFIER	2 Mar 2020	NOTIFIER
UGA	COORD REQUIRED	4.2.2.A	ITU	4 Mar 2020	ITU
UGA	COORD REQUIRED	4.2.2.F	ITU	4 Mar 2020	ITU
UGA	OBJECTION BY	COORD	AFFECTED	1 Jun 2020	ITU

4.2.2 *f)* The stations in the aeronautical radionavigation service of an administration in the band 108 - 117.975 MHz are likely to be affected by a proposed modification to the Plan if the distance from the station under consideration to the nearest point on the boundary of the country of that administration is less than the limit indicated in Annex 4, Chapter 3. In this case, the procedure to be applied is contained in Article 5.

Aeronautical radionavigation services

Compatibility Analysis: Selection criteria



- Only the 20 main contributors are considered for the Eu calculations
- Consideration of notices present in the TIP
- Consideration of TV stations recorded in the ST61 Plan in the band 87.5-100 MHz
- Polarization discrimination in case of orthogonal polarisation (V->H or H->V)
- Propagation model to be used:

  - Propagation model as described in Chapter 2 of Annex 2 to the GE84 Agreement (by default) or

  - ITU-R P.1812 propagation model in conjunction with SRTM3 digital terrain map

Compatibility Analysis

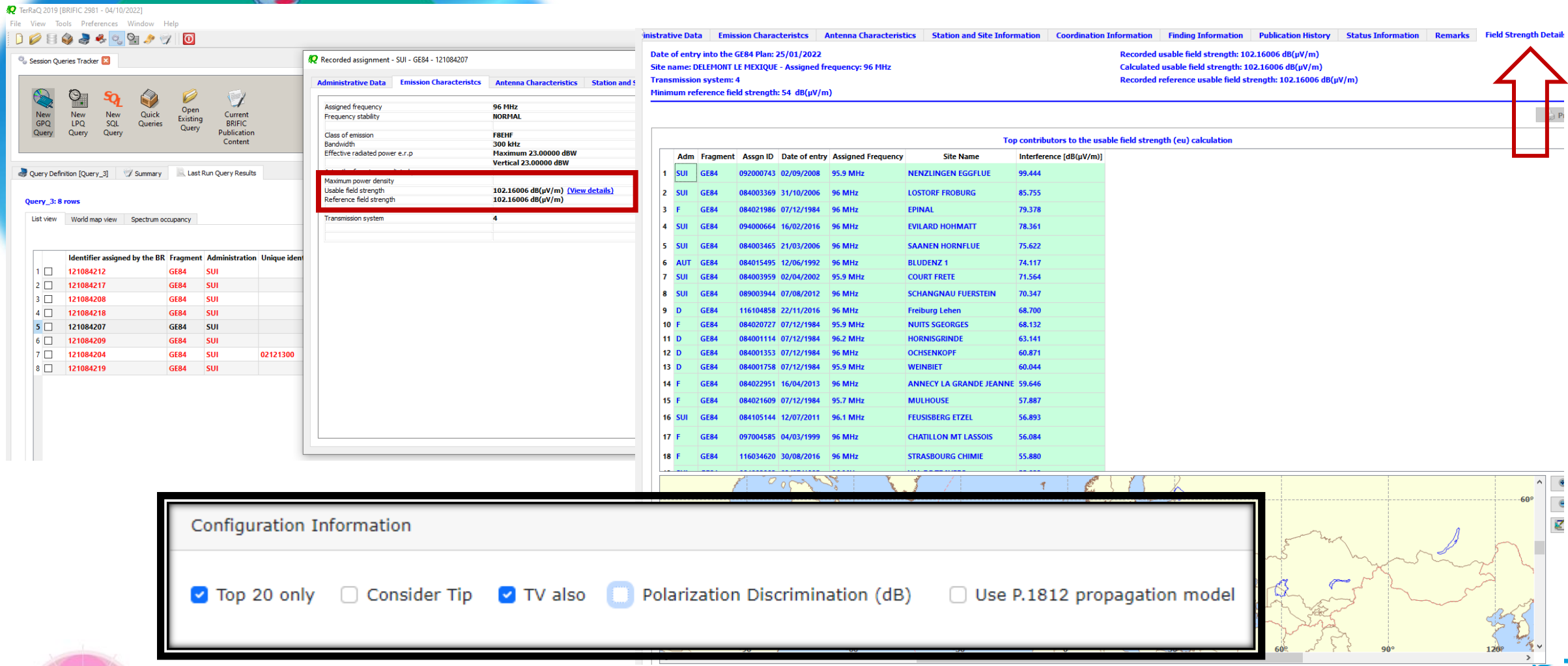
Helping administrations for the planning and coordination of their VHF-FM sound broadcasting services, in the frequency band 87.5-108 MHz, in accordance with the GE84 Agreement

Analyzing the impact to and from other emissions for a new or existing FM service, using method in Annex 2 of Chapter 4, showing the NFS and Eu calculations at the transmitter site.

Taking into account the proposed modification and other assignments in the GE84 Plan (recorded assignments and, possibly, proposed modifications)

Caution: The analysis considers the notices submitted independently of each other

BRIFIC Publication



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Compatibility analysis: Results

Interference received by the proposed modification

Affected administration All

Showing 1 to 1 of 1 entries Show 25 entries Search:

Proposed Modification	Administrations with which the limits of 4.3.7.1/4.3.7.2 are exceeded	Eu (dB(µV/m))
87.7MHz_AAZANEN_003°07'03"W-35°15'07"N-Id:1	ALG E MRC	88.85

Previous 1 Next

Select the proposed modification

87.7MHz_AAZANEN_003°07'03"W-35°15'07"N-Id:1

Result | Affected | Interferers

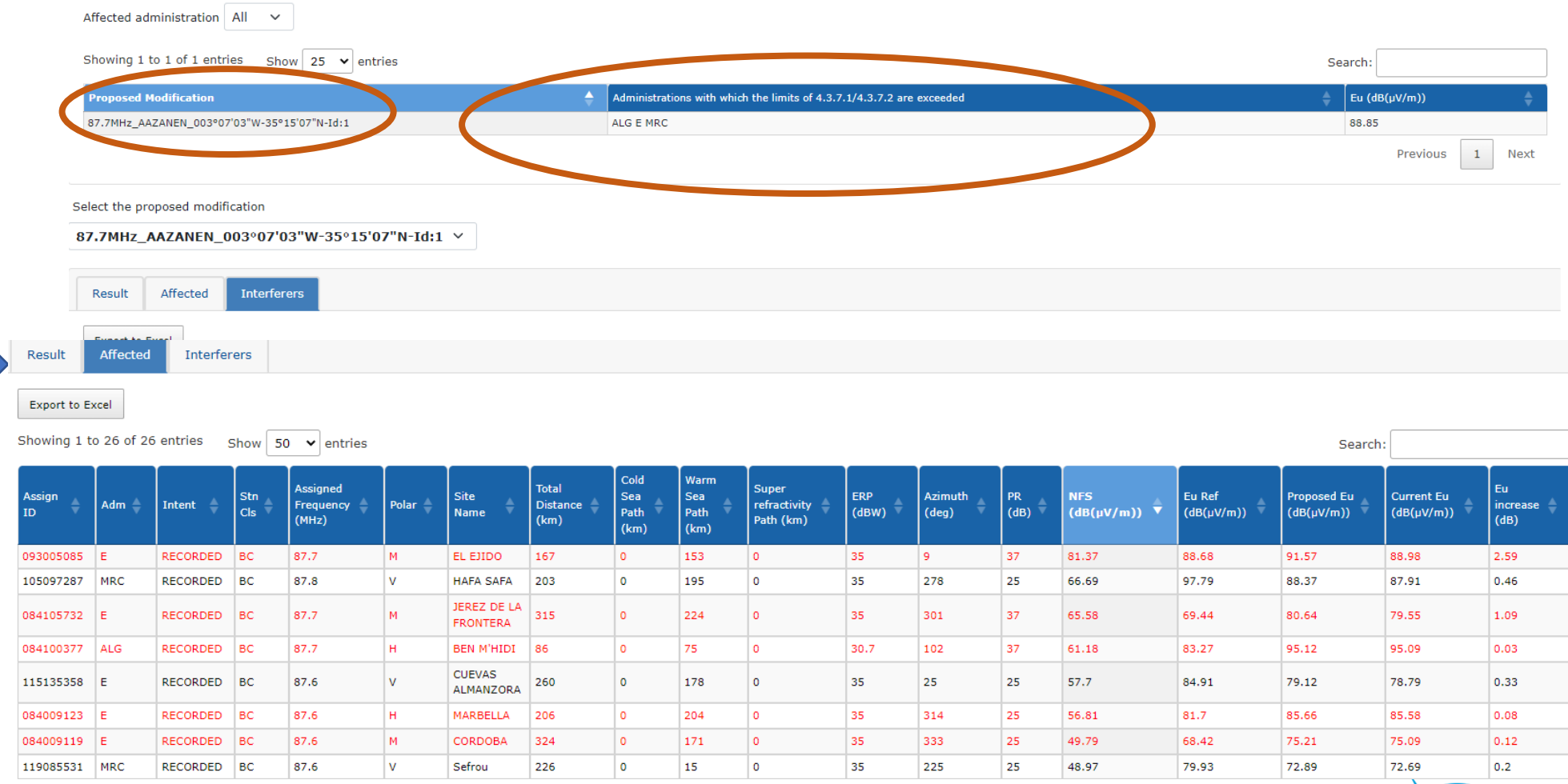
Export to Excel

Showing 1 to 20 of 20 entries Show 50 entries Search:

Assign ID	Adm	Intent	Stn Cls	Assigned Frequency (MHz)	Polar	Site Name	Total Distance (km)	Cold Sea Path (km)	Warm Sea Path (km)	Super refractivity Path (km)	ERP (dBW)	Azimuth (deg)	PR (dB)	NFS (dB(µV/m))
084004713	MRC	RECORDED	BC	87.6	H	ZAIO	58	0	6	0	38.1	323	33	86.41
084033664	ALG	RECORDED	BC	87.7	H	AIN-N'SOUR	389	0	289	0	50	260	37	67.58
105097287	MRC	RECORDED	BC	87.8	V	HAFA SAFA	203	0	195	0	32	97	25	66.6
093005085	E	RECORDED	BC	87.7	M	EL EJIDO	167	0	153	0	22.8	189	37	65.71
084100377	ALG	RECORDED	BC	87.7	H	BEN M'HIDI	86	0	75	0	20	283	37	65.57
084105732	E	RECORDED	BC	87.7	M	JEREZ DE LA FRONTERA	315	0	224	0	37.8	120	37	65.08

Compatibility analysis: Results

Interference generated
by the proposed modification
&
Adms affected



Affected administration All

Showing 1 to 1 of 1 entries Show 25 entries Search:

Proposed Modification	Administrations with which the limits of 4.3.7.1/4.3.7.2 are exceeded	Eu (dB(µV/m))
87.7MHz_AAZANEN_003°07'03"W-35°15'07"N-Id:1	ALG E MRC	88.85

Previous 1 Next

Select the proposed modification

87.7MHz_AAZANEN_003°07'03"W-35°15'07"N-Id:1

Result Affected Interferers

Result Affected Interferers

Export to Excel

Showing 1 to 26 of 26 entries Show 50 entries Search:

Assign ID	Adm	Intent	Stn Cls	Assigned Frequency (MHz)	Polar	Site Name	Total Distance (km)	Cold Sea Path (km)	Warm Sea Path (km)	Super refractivity Path (km)	ERP (dBW)	Azimuth (deg)	PR (dB)	NFS (dB(µV/m))	Eu Ref (dB(µV/m))	Proposed Eu (dB(µV/m))	Current Eu (dB(µV/m))	Eu increase (dB)
093005085	E	RECORDED	BC	87.7	M	EL EJIDO	167	0	153	0	35	9	37	81.37	88.68	91.57	88.98	2.59
105097287	MRC	RECORDED	BC	87.8	V	HAFA SAFA	203	0	195	0	35	278	25	66.69	97.79	88.37	87.91	0.46
084105732	E	RECORDED	BC	87.7	M	JEREZ DE LA FRONTERA	315	0	224	0	35	301	37	65.58	69.44	80.64	79.55	1.09
084100377	ALG	RECORDED	BC	87.7	H	BEN M'HIDI	86	0	75	0	30.7	102	37	61.18	83.27	95.12	95.09	0.03
115135358	E	RECORDED	BC	87.6	V	CUEVAS ALMANZORA	260	0	178	0	35	25	25	57.7	84.91	79.12	78.79	0.33
084009123	E	RECORDED	BC	87.6	H	MARBELLA	206	0	204	0	35	314	25	56.81	81.7	85.66	85.58	0.08
084009119	E	RECORDED	BC	87.6	M	CORDOBA	324	0	171	0	35	333	25	49.79	68.42	75.21	75.09	0.12
119085531	MRC	RECORDED	BC	87.6	V	Sefrou	226	0	15	0	35	225	25	48.97	79.93	72.89	72.69	0.2

Compatibility analysis: details concerning NFS calculations

In this example : NFS = interference generated by the contributor to the proposed modification

Assign ID	Adm	Intent	Stn Cls	Assigned Frequency (MHz)	Polar	Site Name	Total Distance	Cold Sea Path (Km)	Warm Sea Path (Km)	Super refractivity Path (Km)	ERP (dBW)	Azimuth (deg)	Protection Ratio (dB)	NFS (dB(µV/m))
084004713	MRC	RECORDED	BC	87.6	H	ZAIO	58	0	6	0	38.1	323	33	86.41
084033664	ALG	RECORDED	BC	87.7	H	AIN-N'SOUR	389	0	289	0	50	260	37	67.58
105097287	MRC	RECORDED	BC	87.8	V	HAFA SAFA	203	0	195	0	32	97	25	66.6
093005085	E	RECORDED	BC	87.7	M	EL EJIDO	167	0	153	0	22.8	189	37	65.71
084100377	ALG	RECORDED	BC	87.7	H	BEN M'HIDI	86	0	75	0	20	283	37	65.57
084105732	E	RECORDED	BC	87.7	M	JEREZ DE LA FRONTERA	315	0	224	0	37.8	120	37	65.08

Distance site to site & information concerning the various paths

- Total distance (land and sea)*
- Cold sea path**
- Warm sea path**
- Super refractivity path**

* For co-sites, a distance of 1 km is indicated.

** Shown for GE84 propagation model only

e.r.p at pertinent azimuth

NFS see 3.5 of Annex 2

Protection ratio (see Tables 2.1 to 2.3 of Annex 2 of GE84 Agreement) depending on:

- Frequency spacing
- Transmission System
- Steady/tropospheric interference

Compatibility analysis: Results

interference generated by the proposed modification

Result | Affected | Interferers

Export to Excel

Showing 1 to 16 of 16 entries Show 50 entries Search:

Assign ID	Adm	Intent	Stn Cls	Assigned Frequency (MHz)	Polar	Site Name	Total Distance (km)	Cold Sea Path (km)	Warm Sea Path (km)	Super refractivity Path (km)	ERP (dBW)	Azimuth (deg)	PR (dB)	NFS (dB(µV/m))	Eu Ref (dB(µV/m))	Proposed Eu (dB(µV/m))	Current Eu (dB(µV/m))	Eu increase (dB)
093005085	E	RECORDED	BC	87.7	M	EL EJIDO	166	-	-	-	35	9	37	84.08	88.68	89.8	83.75	6.05
084009123	E	RECORDED	BC	87.6	H	MARBELLA	206	-	-	-	35	314	25	71.2	81.7	89.09	88.34	0.75
115135358	E	RECORDED	BC	87.6	V	CUEVAS ALMANZORA	260	-	-	-	35	25	25	70.26	84.91	80.33	77.71	2.62
084100377	ALG	RECORDED	BC	87.7	H	BEN M'HIDI	86	-	-	-	30.7	102	45	66.05	83.27	81.06	79.92	1.14
105097287	MRC	RECORDED	BC	87.8	V	HAFA SAFA	203	-	-	-	35	278	33	60.13	97.79	72.12	70.08	2.04
084105732	E	RECORDED	BC	87.7	M	JEREZ DE LA FRONTERA	315	-	-	-	35	301	37	59.37	69.44	78.1	77.51	0.59
119085531	MRC	RECORDED	BC	87.6	V	Sefrou	225	-	-	-	35	225	25	53.35	79.93	68.54	67.55	0.99
084009119	E	RECORDED	BC	87.6	M	CORDOBA	324	-	-	-	35	333	25	46.95	68.42	69.4	69.14	0.26

NFS = interference generated by the proposed modification to the affected station
Eu Ref = Eu calculated at the time the assignment entered the Plan (n/a if not yet RECORDED).
Current Eu = Eu calculated for the affected station, considering all the interferers (or top 20), But NOT considering the proposed modification
Proposed Eu = Eu calculated for the affected station, considering all the interferers (or top 20), AND considering the proposed modification

Compatibility analysis: Results

interference generated by the proposed modification

Result | Affected | Interferers

Export to Excel

Showing 1 to 16 of 16 entries Show 50 entries Search:

Assign ID	Adm	Intent	Stn Cls	Assigned Frequency (MHz)	Polar	Site Name	Total Distance (km)	Cold Sea Path (km)	Warm Sea Path (km)	Super refractivity Path (km)	ERP (dBW)	Azimuth (deg)	PR (dB)	NFS (dB(µV/m))	Eu Ref (dB(µV/m))	Proposed Eu (dB(µV/m))	Current Eu (dB(µV/m))	Eu increase (dB)
093005085	E	RECORDED	BC	87.7	M	EL EJIDO	166	-	-	-	35	9	37	84.08	88.68	89.8	83.75	6.05
084009123	E	RECORDED	BC	87.6	H	MARBELLA	206	-	-	-	35	314	25	71.2	81.7	89.09	88.34	0.75
115135358	E	RECORDED	BC	87.6	V	CUEVAS ALMANZORA	260	-	-	-	35	25	25	70.26	84.91	80.33	77.71	2.62
084100377	ALG	RECORDED	BC	87.7	H	BEN M'HIDI	86	-	-	-	30.7	102	45	66.05	83.27	81.06	79.92	1.14
105097287	MRC	RECORDED	BC	87.8	V	HAFA SAFA	203	-	-	-	35	278	33	60.13	97.79	72.12	70.08	2.04
084105732	E	RECORDED	BC	87.7	M	JEREZ DE LA FRONTERA	315	-	-	-	35	301	37	59.37	69.44	78.1	77.51	0.59
119085531	MRC	RECORDED	BC	87.6	V	Sefrou	225	-	-	-	35	225	25	53.35	79.93	68.54	67.55	0.99
084009119	E	RECORDED	BC	87.6	M	CORDOBA	324	-	-	-	35	333	25	46.95	68.42	69.4	69.14	0.26

The line is red:

- If the NFS >= 54 dB(µV/m), for protection of FM stations and 52 dB(µV/m), for protection of TV stations, or
- If the resulting Eu, taking into consideration the proposed modification -- “Eu with wanted” -- is increased by more than 0.5 dB compared with the Eu Ref

Note : If the proposed modification is a MODIFY notice, its target is considered in the evaluation of the Eu current. It is replaced by the MODIFY notice for the evaluation of the Eu proposed.

Optimization Tool

This tool has been primarily developed to achieve an efficient use of the 87.5-108 MHz (FM) band for analogue sound broadcasting and to allocate new frequencies to FM broadcasting to meet the increasing need for additional frequencies in African countries.

This tool can also be used by all the administrations party to the GE84 Agreement.

Optimization Tool

Goal

- to allocate new frequencies to FM broadcasting to meet the growing need for additional frequencies

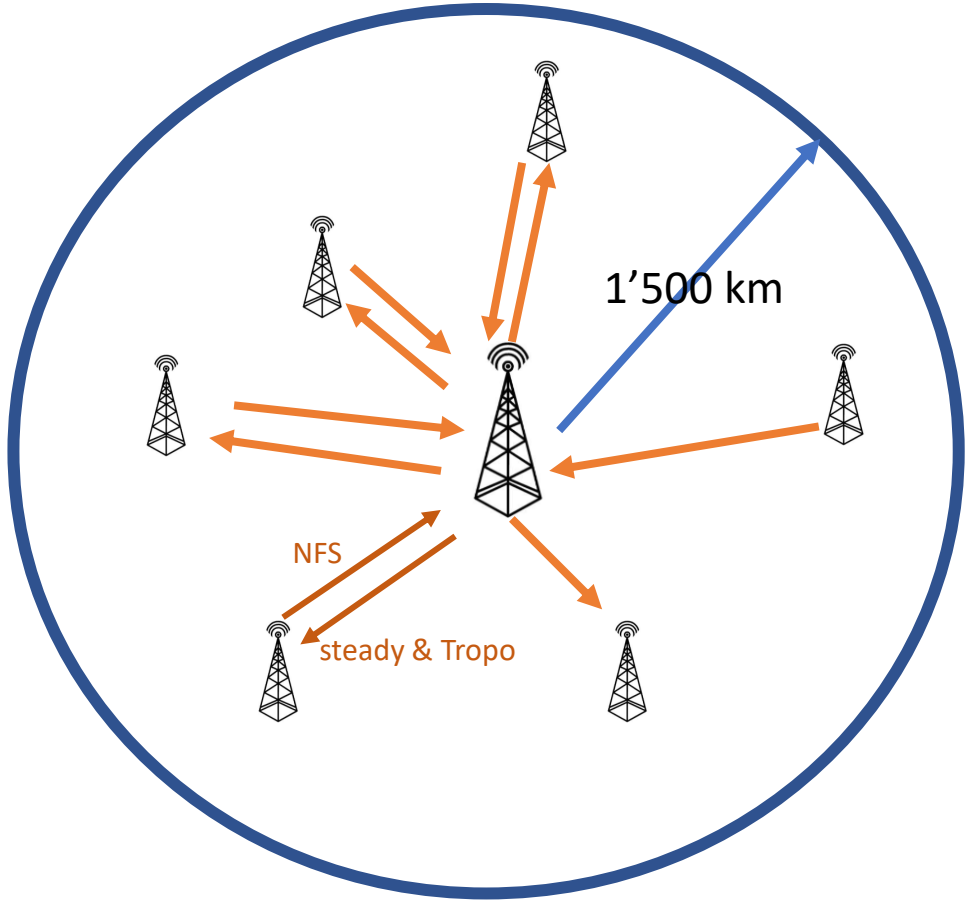
Results

- Nuisance Field strength (NFS) generated and received by a proposed requirement in view to identify additional frequencies

Analysis of the results

- Search for an assignable frequency based on predefined criteria

Optimization Tool



Based on the coordinates of a station, the tool assesses all identified interference sources within a radius of **1’500 km** for a **given frequency and adjacent frequencies** up to ±400 kHz.

Optimization Tool

Compatibility between the requirements submitted to the calculations considered

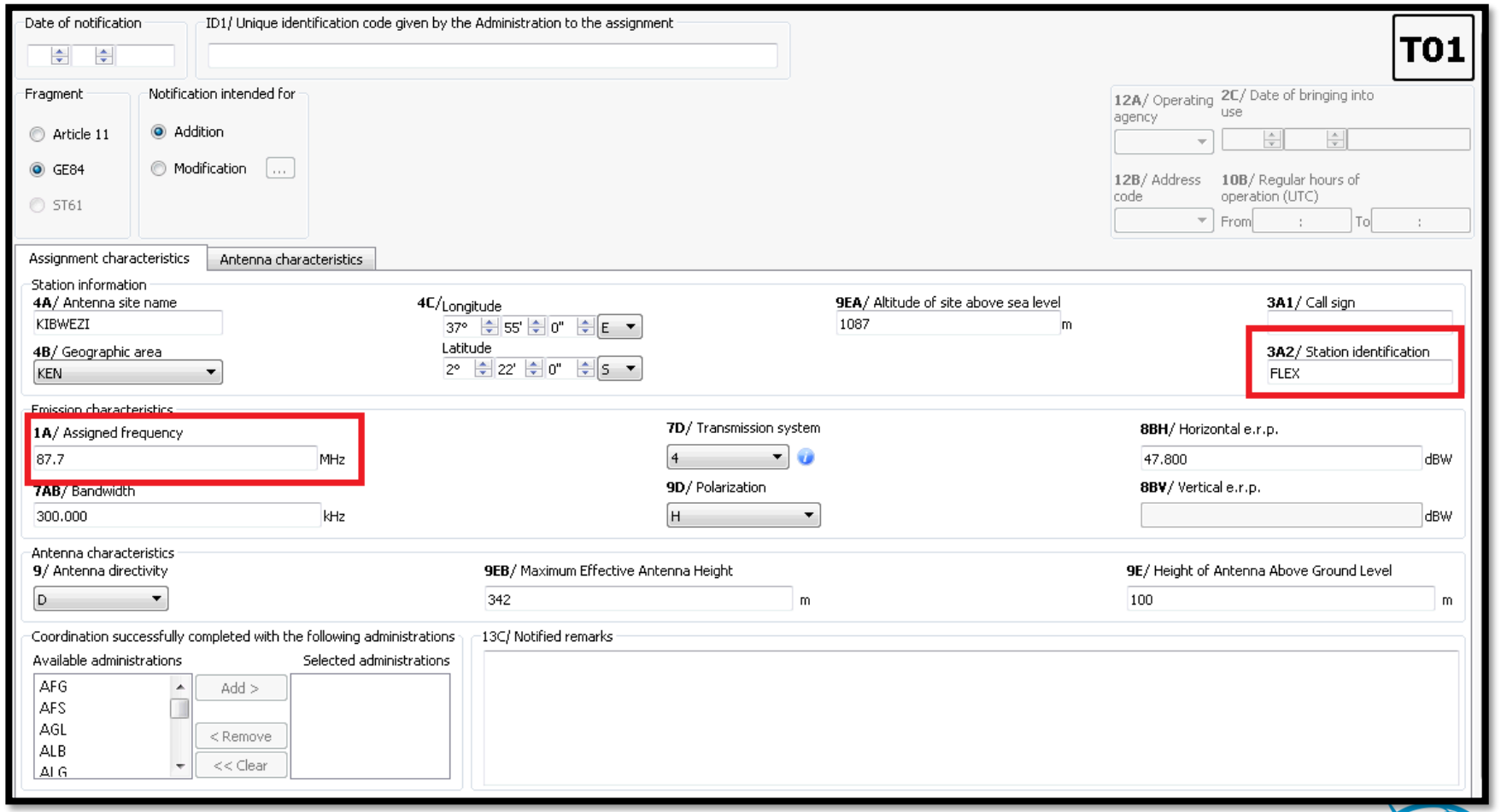
Introduction of the notion of **requirements with a flexible frequency.**

For flexible frequency requirements, **the entire FM band (87.6 to 107.9 MHz) is analysed in steps of 100 kHz.**

The objective is/was, **as a first step**, to submit **flexible frequency requirements** in order to identify the most suitable frequencies. **In the following steps**, the user can begin to fix/set frequencies until all requirements are assigned an **appropriate fixed frequency**.

Optimization tool

Flexible Frequency Requirement



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Optimization tool

GE84 Plan optimization

Calculation criteria

Configuration Information (only results with Nuisance Field Strength (NFS) >= 30 dB (µV/m) will be displayed):

☑ Consider Tip ☑ TV also ☑ Polarization Discrimination (dB) 10 ☐ Use P.1812 propagation model

Criteria for the definition of assignable frequencies

☐ Ignore self interference ☐ Ignore interference received Acceptable NFS (dB (µV/m)) 54

Select the Adm to be analyzed

Job Output

Input notice file validated by the OnlineValidation process on 10/10/2022 12:10:36 PM

☐ Ignore self interference ☐ Ignore interference received Acceptable NFS (dB (µV/m)) 54

Select Analysis option: Evaluate Statistics

Select Administration: SDN

Evaluate Statistics

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ITU

GE84 Optimization – Results – FLEX vs FLEX
If multiple FLEX requirements – Analyzed for co-channel interference

Summary [GALLABAT | FLEX (ADD)]

○ Show top 5 interferers in the summary ◉ Show top 5 affected in the summary ☑ Show assignable frequencies on top

GE84 Optimization Description

Frequency (MHz)	Top five affected														
	Assign ID	Adm.	Intent	Class	Freq.	Pol.	Site Name	Dist.	Cold Sea	Warm Sea	Sup. Refr.	ERP	Azim.	Prot. Ratio	NFS
FLEX	59	SDN	ADD	BC	FLEX	V	TAYA	11	0	0	0	40	270	45	125.6
	62	SDN	ADD	BC	FLEX	V	KHOUR MOBIAT	46	0	0	0	40	0	45	89.54
	39	SDN	ADD	BC	FLEX	V	GURAISHA	62	0	0	0	40	326.6	45	86.8
	61	SDN	ADD	BC	FLEX	V	KHOUR CONRY	66	0	0	0	40	11	37	77.15
	60	SDN	ADD	BC	FLEX	V	EL BEGAIYA	91	0	0	0	40	224.3	37	75.29

Excel

LEX vs FLEX
co-channel interference

	Steady interference	Tropospheric interference	Steady interference	Tropospheric interference
0	36	28	45	37
25	31	27	51	43
50	24	22	51	43
75	16	16	45	37
100	12	12	33	25
150	8	8	18	14
200	6	6	7	7
250	2	2	2	2
300	–7	–7	–7	–7
350	–15	–15	–15	–15
400	–20	–20	–20	–20

frequencies on top

GE84 Optimization Description

									Warm Sea	Sup. Refr.	ERP	Azim.	Prot. Ratio	NFS
									0	0	40	270	45	125.6
									0	0	40	0	45	89.54
								0	0	0	40	326.6	45	86.8
	61	SDN	ADD	BC	FLEX	V	KHOUR CONRY	66	0	0	0	40	11	37	77.15
	60	SDN	ADD	BC	FLEX	V	EL BEGAIYA	91	0	0	0	40	224.3	37	75.29

Excel

75.29 NFS -> FS= 75.29 – 37 = 38.29 -> PR for 2nd adjacent = 7->NFS ≈ 45.29 dB(µV/m) PR for 1st adjacent= 14 -> NFS ≈ 38.29+25= 63.29 dB(µV/m)

GE84 Optimization – Results – FLEX vs FLEX
If multiple FLEX requirements – Analyzed for co-channel interference
→click on FLEX to see all FLEX vs FLEX

Assign ID	Adm	Intent	Stn Cls	Assigned Frequency (MHz)	Polar	Site Name	Total Distance (km)	Cold Sea Path (km)	Warm Sea Path (km)	Super refractivity Path (km)	ERP (dBW)	Azimuth (deg)	PR (dB)	NFS (dB(µV/m))
5	SDN	ADD	BC	FLEX	H	KASSALA	232	0	0	0	50	182.2	37	78.11
12	SDN	ADD	BC	FLEX	H	SENGA	264	0	0	0	50	97.8	37	74.89
9	SDN	ADD	BC	FLEX	H	OUAD MEDANI	314	0	0	0	50	108.6	37	69.88
59	SDN	ADD	BC	FLEX	V	TAYA	11	0	0	0	10	90	45	66.29
60	SDN	ADD	BC	FLEX	V	EL BEGAIYA	91	0	0	0	30	44.2	37	59.19
39	SDN	ADD	BC	FLEX	V	GURAISHA	62	0	0	0	30	146.5	37	56.76
6		D	BC	FLEX	H	KHARTOUM	455	0	0	0	50	121.5	37	56.73
8	SDN	ADD	BC	FLEX	H	OMDURMAN	478	0	0	0	50	123.8	37	54.71
54	SDN	ADD	BC	FLEX	V	ELSHUWAK	134	0	0	0	30	162	37	53.7
64	SDN	ADD	BC	FLEX	H	KOURMOUK	368	0	0	0	36	35.3	37	50.63
50	SDN	ADD	BC	FLEX	V	ELHAWATA	169	0	0	0	30	96.1	37	50.33
55	SDN	ADD	BC	FLEX	V	GADARIF	129	0	0	0	30	133	37	48.84
2	SDN	ADD	BC	FLEX	H	ED DAMER	545	0	0	0	50	151.9	37	48.59

Assign Id (Interferer)

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GE84 Optimization – Results

Scan the entire band considering ONLY the non-FLEX=FIXED channel
SHOW ASSIGNABLES ON TOP → ASSIGNABLE FREQs in green
sorted by firstly Max NFS generated and secondly by Max NFS received

Summary [GALLABAT | FLEX (ADD)]

(●) Show top 5 interferers in the summary ( ) Show top 5 affected in the summary [x] Show assignable frequencies on top

GE84 Optimization Description

Frequency (MHz)	Max NFS Received (dB(µV/m))	Max NFS Generated (dB(µV/m))	Top five interferers														
			Assign ID	Adm.	Intent	Class	Freq.	Pol.	Site Name	Dist.	Cold Sea	Warm Sea	Sup. Refr.	ERP	Azim.	Prot. Ratio	NFS
91.7	44.89	52.59	084044532	SDN	RECORDED	BC	91.9	H	SENGA	264	0	0	0	50	97.8	7	44.89
			110026321	ETH	RECORDED	BC	91.7	H	WUCHALE	413	0	0	0	37	298.5	37	43.46
			110026323	ETH	RECORDED	BC	91.6	H	WUKRO	367	0	0	0	44	260.8	25	42.66
			110025992	ETH	RECORDED	BC	91.7	H	DEBRE ELIAS	354	0	0	0	27	338.2	37	40.52
97.1	45.96	49.34	110026351	ETH	RECORDED	BC	97.2	H	AXUM	283	0	0	0	37	250.4	25	45.96
			084044504	SDN	RECORDED	BC	97.2	H	OMDURMAN	478	0	0	0	50	123.8	25	42.71
			084044509	SDN	RECORDED	BC	96.9	H	OUAD MEDANI	314	0	0	0	50	108.6	7	39.88
			109115964	ETH	RECORDED	BC	97	H	GUDURU	440	0	0	0	40	15	25	33.3
			084034391	ETH	RECORDED	BC	96.9	H	BAHIR DAR	220	0	0	0	37	326.7	7	31.31
107.9	46.45	44.6	110026461	ETH	RECORDED	BC	107.8	H	ENTICIO	333	0	0	0	44	250.2	25	46.45
			110026319	ETH	RECORDED	BC	107.7	H	WORETA	216	0	0	0	44	313.5	7	40.88
99.3	48.09	50.6	110026273	ETH	RECORDED	BC	99.2	H	SEKOTA	310	0	0	0	44	283.2	25	48.09
			110026020	ETH	RECORDED	BC	99.3	H	DESE	440	0	0	0	44	303.6	37	48.02
			084044480	SDN	RECORDED	BC	99.4	H	KHARTOUM	455	0	0	0	50	121.5	25	44.73
			109116051	ETH	RECORDED	BC	99.1	H	KOLA DIBA	148	0	0	0	37	308.8	7	40.11
			110026441	ETH	RECORDED	BC	99.4	H	EDAGASILAS	258	0	0	0	27	328.9	25	36.33
107.5	48.5	74.8	110026195	ETH	RECORDED	BC	107.5	H	NEJO	434	0	0	0	44	11	37	48.5
			111127151	SDN	RECORDED	BC	107.6	V	GURAISHA	62	0	0	0	30	146.5	25	44.76
			110026319	ETH	RECORDED	BC	107.7	H	WORETA	216	0	0	0	44	313.5	7	40.88

GE84 Optimization – Results – Channels in pink (assigned freq + 1st ,2nd , 3rd adjacent freqs)

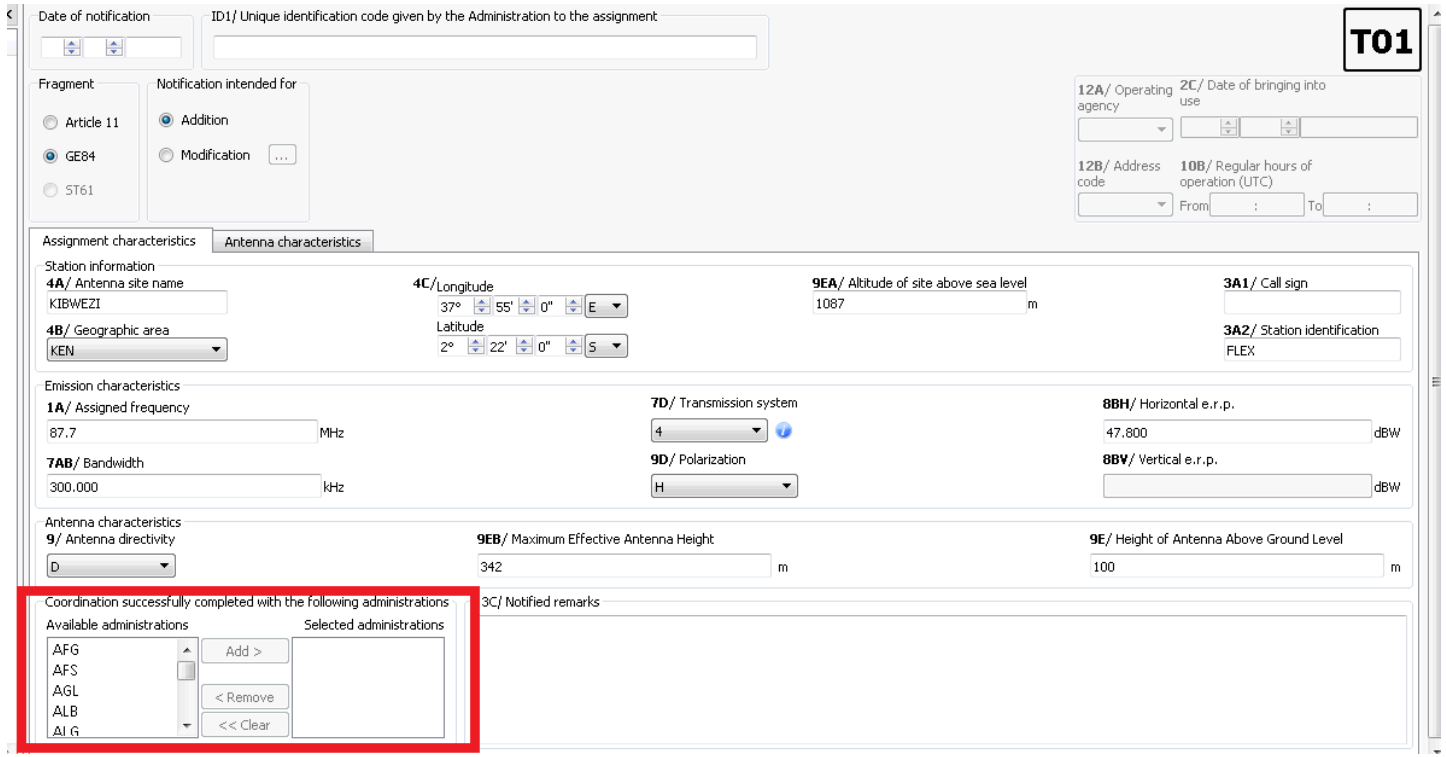
90.3	119.95	119.95	084044441	SDN	RECORDED	BC	90.6	H	ABOU HAMED	1	0	0	0	50	0	-7	119.95
90.4	133.95	133.95	084044441	SDN	RECORDED	BC	90.6	H	ABOU HAMED	1	0	0	0	50	0	7	133.95
			111127070	SDN	RECORDED	BC	90.4	V	ABOU HAMED	291	0	0	0	30	275.2	37	38.48
90.5	159.95	159.95	084044441	SDN	RECORDED	BC	90.6	H	ABOU HAMED	1	0	0	0	50	0	33	159.95
			084025243	EGY	RECORDED	BC	90.6	H	ABU SIMBIL	309	0	0	0	40	201.6	25	45.53
90.6	171.95	171.95	084044441	SDN	RECORDED	BC	90.6	H	ABOU HAMED	1	0	0	0	50	0	45	171.95
			084025243	EGY	RECORDED	BC	90.6	H	ABU SIMBIL	309	0	0	0	40	201.6	37	57.53
			084044502	SDN	RECORDED	BC	90.7	H	OMDURMAN	502	0	0	0	50	335.1	25	40.52
			084044507	SDN	RECORDED	BC	90.6	H	OUAD MEDANI	695	0	0	0	50	333.7	37	35.05
90.7	159.95	159.95	084044441	SDN	RECORDED	BC	90.6	H	ABOU HAMED	1	0	0	0	50	0	33	159.95
			084044502	SDN	RECORDED	BC	90.7	H	OMDURMAN	502	0	0	0	50	335.1	37	52.52
			084025243	EGY	RECORDED	BC	90.6	H	ABU SIMBIL	309	0	0	0	40	201.6	25	45.53
90.8	133.95	133.95	084044441	SDN	RECORDED	BC	90.6	H	ABOU HAMED	1	0	0	0	50	0	7	133.95
			084044502	SDN	RECORDED	BC	90.7	H	OMDURMAN	502	0	0	0	50	335.1	25	40.52
90.9	119.95	119.95	084044441	SDN	RECORDED	BC	90.6	H	ABOU HAMED	1	0	0	0	50	0	-7	119.95
			111127071	SDN	RECORDED	BC	90.9	V	ABOU HAMED	291	0	0	0	30	275.2	37	38.48

Optimization Tool

Introduction of Coordination

ONLY applied to Reqts with a FIXED frequency!!!!

The coordination info of the Plan Entries is <u>not taken into account</u>



Optimization Tool

Introduction of Coordination

AFS Augrabies – Agreement from NMB

GE84 Plan optimization

☐ Ignore self interference ☐ Ignore interference received Acceptable NFS (dB (µV/m)) 54

Adm	Submitted	Assignable	Non Assignable
AFS	2	1	1
NMB	1	1	0

Showing results for submitted requirements from AFS

Select requirement:

104 MHz-AUGRABIES (020°24'00"E-28°34'00"S) System 4 Polarization V

GE84 Optimization Description

Summary [104 MHz-AUGRABIES (020°24'00"E-28°34'00"S) System 4 Polarization V]

Details of the requirement under consideration

○ Show top 5 interferers in the summary ◉ Show top 5 affected in the summary

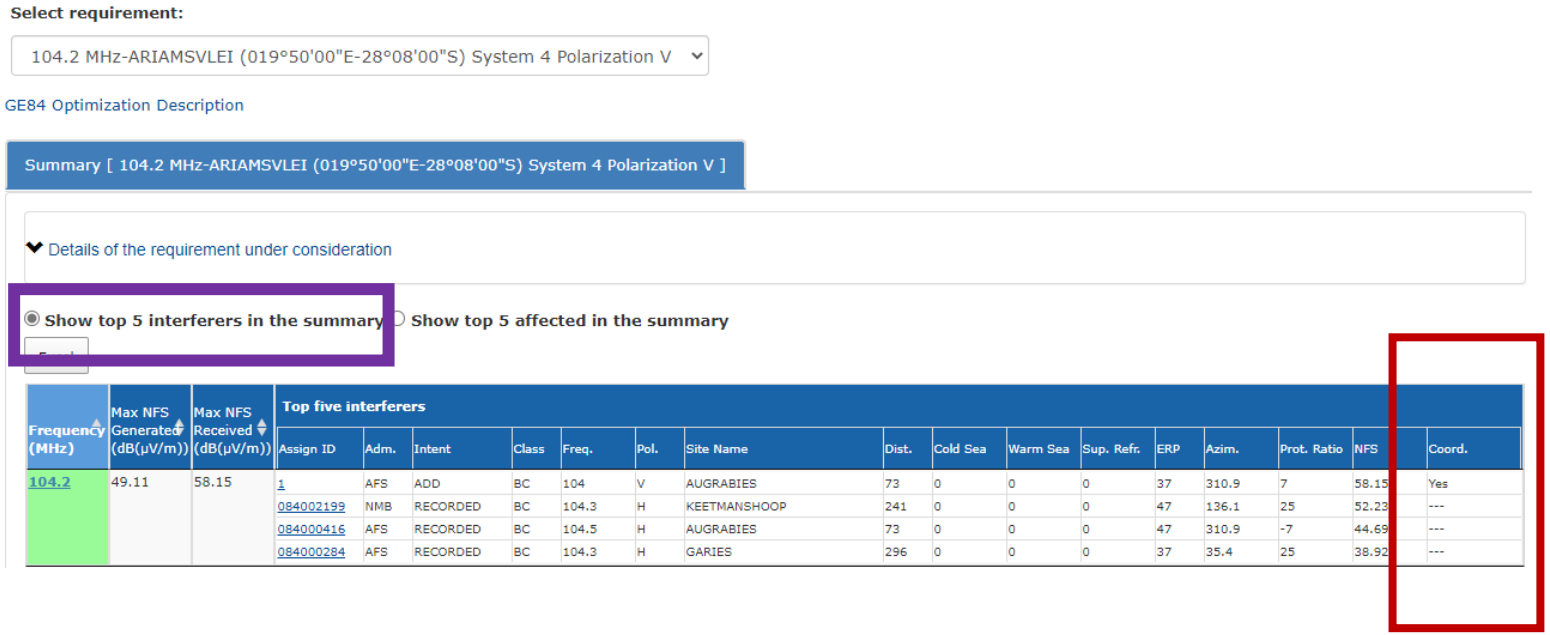
Excel

Frequency (MHz)	Max NFS Generated (dB(µV/m))	Max NFS Received (dB(µV/m))	Top five affected															
			Assign ID	Adm.	Intent	Class	Freq.	Pol.	Site Name	Dist.	Cold Sea	Warm Sea	Sup. Refr.	ERP	Azim.	Prot. Ratio	NFS	Coord.
104	58.15	50.21	3	NMB	ADD	BC	104.2	V	ARIAMSVLEI	73	0	0	0	37	310.9	7	58.15	Yes
			2	AFS	ADD	BC	104	H	DE AAR	406	0	0	0	37	122.2	37	37.45	---
			084002558	NMB	RECORDED	BC	103.7	H	ARIAMSVLEI	73	0	0	0	37	310.9	-7	34.15	Yes

Optimization Tool

Introduction of Coordination

AFS AUGRABIES (Assign ID 1) – Agreement from NMB – Impact on interference received for NMB ARIAMSVLEI



Select requirement:

104.2 MHz-ARIAMSVLEI (019°50'00"E-28°08'00"S) System 4 Polarization V

GE84 Optimization Description

Summary [104.2 MHz-ARIAMSVLEI (019°50'00"E-28°08'00"S) System 4 Polarization V]

Details of the requirement under consideration

Show top 5 interferers in the summary **Show top 5 affected in the summary**

Frequency (MHz)	Max NFS Generated (dB(µV/m))	Max NFS Received (dB(µV/m))	Top five interferers															
			Assign ID	Adm.	Intent	Class	Freq.	Pol.	Site Name	Dist.	Cold Sea	Warm Sea	Sup. Refr.	ERP	Azim.	Prot. Ratio	NFS	Coord.
104.2	49.11	58.15	1	AFS	ADD	BC	104	V	AUGRABIES	73	0	0	0	37	310.9	7	58.15	Yes
			084002199	NMB	RECORDED	BC	104.3	H	KEETMANSHOOP	241	0	0	0	47	136.1	25	52.23	---
			084000416	AFS	RECORDED	BC	104.5	H	AUGRABIES	73	0	0	0	47	310.9	-7	44.69	---
			084000284	AFS	RECORDED	BC	104.3	H	GARIES	296	0	0	0	37	35.4	25	38.92	---

SRTM3 limitations (NASA Shuttle Radar Topography Mission)

Analysis of FLEX requirements: If no assignable frequency has been found, it is advisable to apply the following:

- Proceed with detailed calculations involving a digital terrain map (for example based on Rec. ITU-R P.1812)
- Coordinate with neighbours concerned. In case of successful coordination insert this information in the COORD section of the notice.
- Change of technical characteristics of the requirement in question. Please keep in mind that the calculated NFSs might be changed by modifying:

  Polarization, location;

  Antenna height, Effective Radiated Power (impact on NFS generated only).

- Combination of above points
- Consider removing excessive requirements
- Consider another frequency

Analysis of FLEX requirements: If no assignable frequency has been found, it is advisable to apply the following:

- Consider assigning the 4th adjacent channel:

If still no assignable frequency has been found, by using this approach it is also possible to assign frequencies with 400 kHz difference between co-sited transmitters as shown on example rounded in green below:

Transmitter Location	CT	Freq. MHz	Station	Coverage area	Pol	ERP in dBW	Mode	Longitude	Latitude	Coord X	Coord Y	ASL
AARAU OBERHOLZ	AG	97.7	Radio 32	*Aarau, Erlinsbach, Kölliken*	V	20	S	8° 2' 28" E	47° 22' 38" N	2645490	1247555	486
AARBURG FESTUNG	AG	91.3	SRF 3	*K103 Umfahrung Aarburg*			S	7° 54' 11" E	47° 19' 34" N	2635110	1241795	406
	AG	94.0	Radio Argovia				S	7° 54' 11" E	47° 19' 34" N	2635110	1241795	406
	AG	96.0	SRF 1				S	7° 54' 11" E	47° 19' 34" N	2635110	1241795	406
	AG	97.3	Radio 32				S	7° 54' 11" E	47° 19' 34" N	2635110	1241795	406
AARBURG PARADISLI	AG	91.3	SRF 3	*K103 Umfahrung Aarburg*			S	7° 54' 22" E	47° 19' 13" N	2635340	1241155	408
	AG	94.0	Radio Argovia				S	7° 54' 22" E	47° 19' 13" N	2635340	1241155	408
	AG	96.0	SRF 1				S	7° 54' 22" E	47° 19' 13" N	2635340	1241155	408
	AG	97.3	Radio 32				S	7° 54' 22" E	47° 19' 13" N	2635340	1241155	408
ABBAYE PONT AGOUILLONS	VD	87.6	Espace 2	*Vallée de Joux*	V	30	S	6° 20' 2" E	46° 40' 14" N	2515461	1169417	1145
	VD	99.5	La Première		V	30	S	6° 20' 2" E	46° 40' 14" N	2515461	1169417	1145
	VD	101.4	Couleur 3		V	30	S	6° 20' 2" E	46° 40' 14" N	2515461	1169417	1145
ADELBODEN WINTERTAL	BE	88.1	SRF 1	*Adelboden*	V	13	S	7° 33' 5" E	46° 28' 52" N	2608648	1147773	1449
	BE	90.2	SRF 2 Kultur		V	13	S	7° 33' 5" E	46° 28' 52" N	2608648	1147773	1449
	BE	104.9	SRF 3		V	13	S	7° 33' 5" E	46° 28' 52" N	2608648	1147773	1449
AESCH HAUPTSTRASSE	BL	96.7	SRF 1	*Dornach, Gempen*	V	19	S	7° 35' 48" E	47° 28' 12" N	2611911	1257717	314
AESCH ZUERICH UETLIBERG	ZH	88.0		*A4*			S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429
	ZH	93.6	Radio 1				S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429
	ZH	94.6	SRF 1				S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429
	ZH	99.2	Radio Central				S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429
	ZH	99.6	SRF 2 Kultur				S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429
	ZH	100.9					S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429
	ZH	102.8	Radio 24				S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429
	ZH	105.8	SRF 3				S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429
	ZH	106.7	Radio Zürisee				S	8° 30' 54" E	47° 20' 39" N	2681348	1244255	429

Source: ***Swiss Federal Office of Communications (OFCOM)*** https://www.bakom.admin.ch/bakom/en/homepage/frequencies-and-antennas/broadcasting.html

Important! The procedure is not automatic. Due attention should be paid to other interferers/affected

When to use T01 ADD, MODIFY or TB5

1. In the ***compatibility analysis***:
   - If the notice to be analyzed is
     - new →ADD
     - Taken from a TIP entry in the GE84 Plan → same intent as the TIP Notice. The process will replace the TIP entry with the notice to be analyzed
     - Taken from a RECORDED entry in the GE84 Plan → Submit a Modify Notice targeting the Plan entry.

2. In the ***Optimization:***
   - If the requirement to be analyzed is
     - FLEX ADD will analyze the whole band, even if an entry for the same site coordinates is identified
     - FLEX MOD will analyze the whole band and simulate the suppression of the RECORDED target
3. TB5: will simulate the suppression or withdrawal of Plan Entries

GE84 Agreement – Chapter 3
Annex 2
Table 2.1 + transmission systems in §3.1

Frequency spacing (kHz)	Radio-frequency protection ratio (dB) for a maximum frequency deviation of ± 75 kHz			
	Monophonic		Stereophonic	
	Steady interference	Tropospheric interference	Steady interference	Tropospheric interference
0	36	28	45	37
25	31	27	51	43
50	24	22	51	43
75	16	16	45	37
100	12	12	33	25
150	8	8	18	14
200	6	6	7	7
250	2	2	2	2
300	–7	–7	–7	–7
350	–15	–15	–15	–15
400	–20	–20	–20	–20

Transmission system reference table

Transmission system	Is digital	Min bandwidth	Max bandwidth	Description
1	FALSE	0.180 MHz	0.200 MHz	Monophonic (maximum frequency deviation ± 75 kHz) (GE84)
2	FALSE	0.130 MHz	0.180 MHz	Monophonic (maximum frequency deviation ± 50 kHz) (GE84)
3	FALSE	0.180 MHz	0.300 MHz	Stereophonic, polar modulation system (maximum frequency deviation ± 50 kHz) (GE84)
4	FALSE	0.200 MHz	0.310 MHz	Stereophonic, pilot-tone system (maximum frequency deviation ± 75 kHz) (GE84)
5	FALSE	0.200 MHz	0.300 MHz	Stereophonic, pilot-tone system (maximum frequency deviation ± 50 kHz) (GE84)

Live demo

https://www.itu.int/ITU-R/eTerrestrial/eBroadcasting/ECalculations

THANK YOU!

MICHÈLE COAT DEGERT

ITU – RADIOCOMMUNICATION BUREAU

QUESTIONS TO BRMAIL@ITU.INT OR BRBCD@ITU.INT

ITUWRS GENEVA2022