Search for new FM frequencies in the GE84 Optimization process

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GE84
Plan
optimization

Overview

- Tools to be used

- Frequency band and assigned frequencies

- Technical basis for the GE84 Opt process

- Process diagrams

- Preparation of requirement (examples)

- Compatibility calculations

- Analysis of the results

- Exercise

Tools to be used

eBCD 2.0
Broadcasting Online

eQry ePub
eTools myAdmin

TerRaQ

TerRaNotices

WISFAT

Frequency band and assigned frequencies

✓ **Frequency band: 87.6 - 107.9 MHz**

✓ **Assigned frequencies: 87.6; 87.7;…; 107.8; 107.9 MHz (100 kHz step)**

✓ **Special case ("flexible frequency (flexible channel)"):**

"flexible channel" – means that during compatibility calculations, the software will scan all frequencies in the frequency band mentioned above and show electromagnetic situation on each co- and adjacent frequencies.
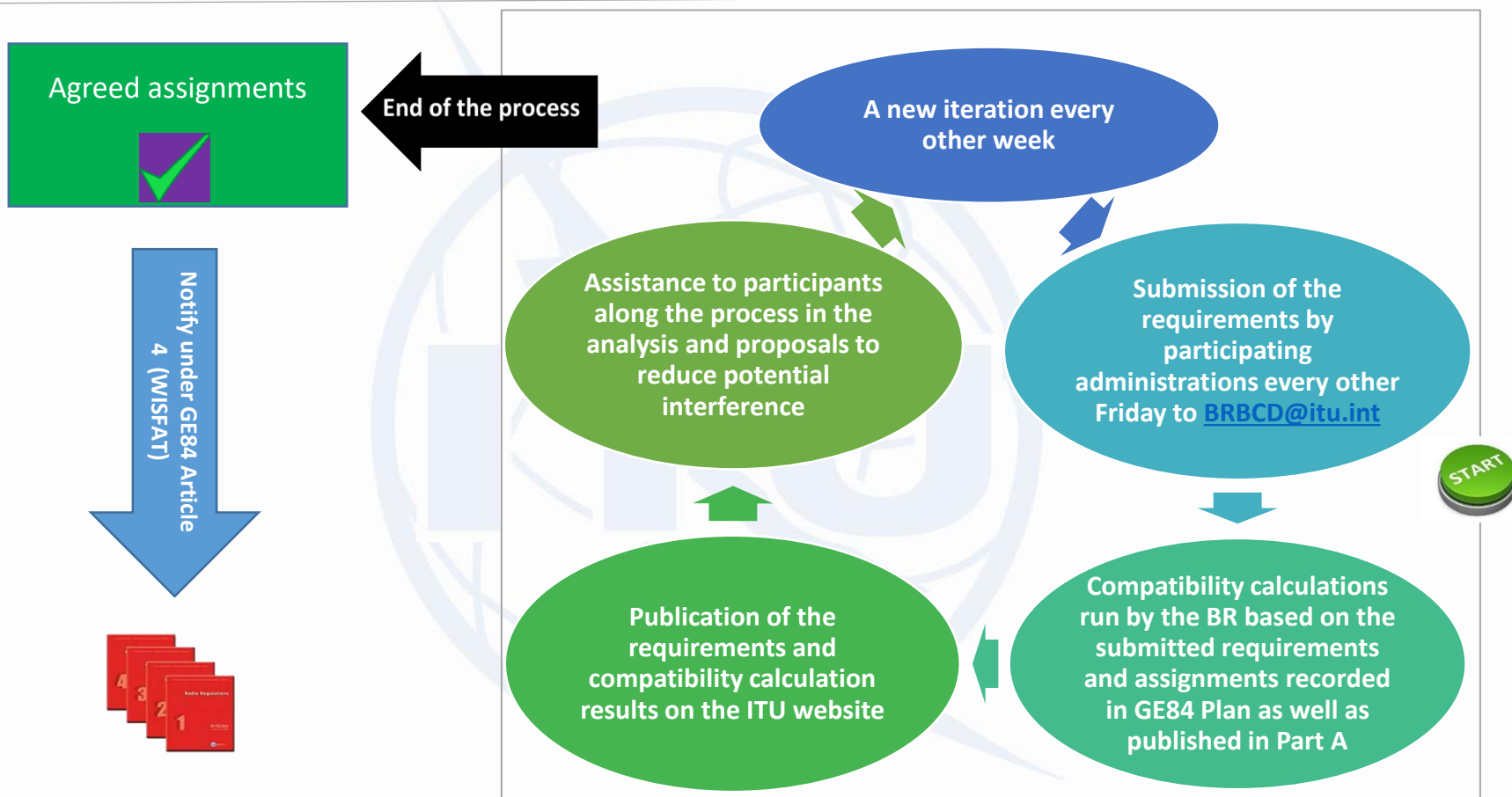
Technical basis for GE84 Optimization process

- **Technical criteria used for compatibility calculations – GE84 Agreement (uniform 100 kHz frequency step, protection ratios, propagation model etc.)**

- **Assignments recorded in the GE84 Plan and as well as assignments published in Part A of Special Sections GE84 are taken into account**

- **Assignments to other primary services in adjacent bands are not taken into account**

- **It is proposed that participating administrations agree:**
  - **To stop submissions of new modifications to the GE84 Plan until the end of the coordination meetings;**
  - **To submit their requirements every other Friday to brbcd@itu.int for next iteration. If an administration does not submit its requirements, the requirements used for the previous iteration will be taken;**
  - **General maximum acceptable Nuisance Field Strength (NFS) value is 54 dB(μV/m). This value can be reviewed by involved administrations during bilateral/multilateral negotiations**
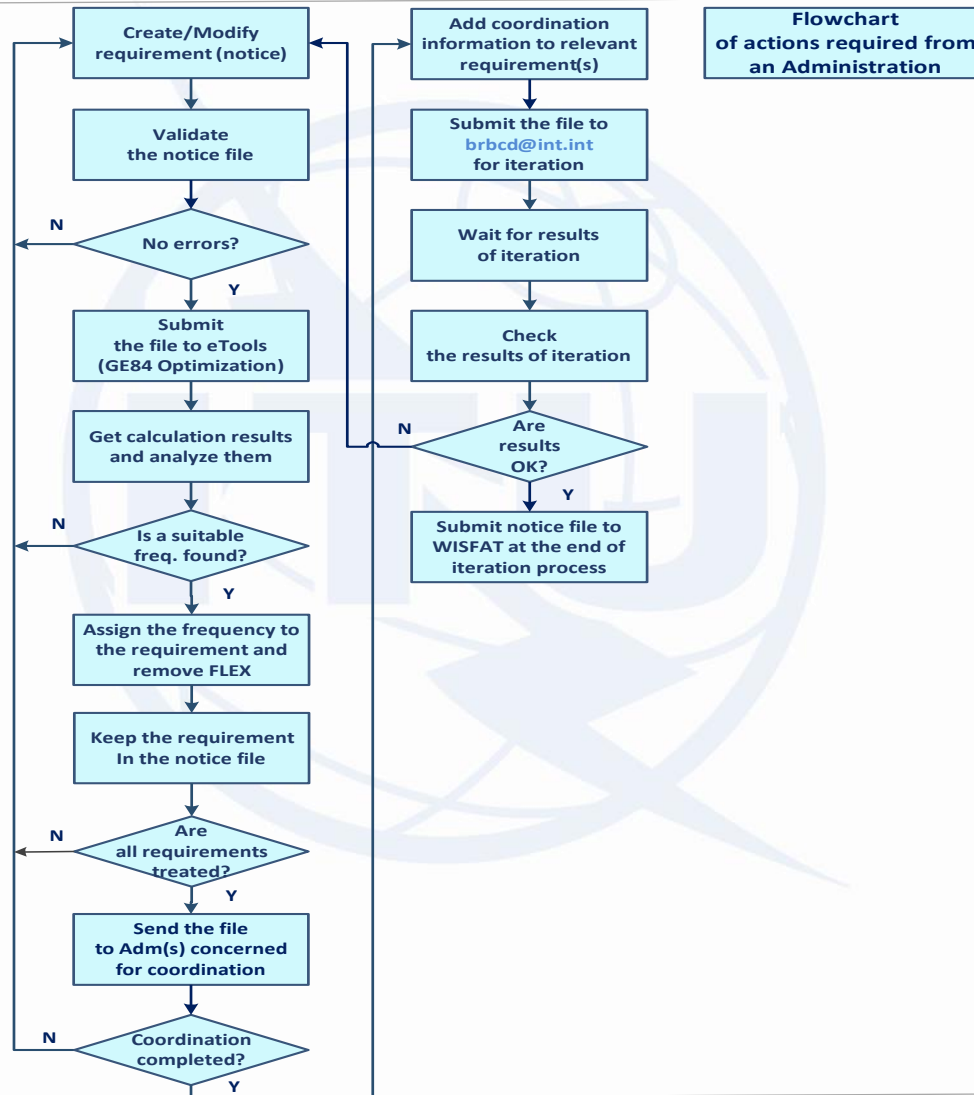
GE84 Optimization process and BR assistance

Agreed assignments ✓

End of the process

Notify under GE84 Article 4 (WISFAT)

A new iteration every other week

Assistance to participants along the process in the analysis and proposals to reduce potential interference

Submission of the requirements by participating administrations every other Friday to BRBCD@itu.int

Publication of the requirements and compatibility calculation results on the ITU website

Compatibility calculations run by the BR based on the submitted requirements and assignments recorded in GE84 Plan as well as published in Part A

START

GE84 Optimization process
and activity of administrations

Create/Modify requirement (notice)

Validate the notice file

No errors? — N

Y

Submit the file to eTools (GE84 Optimization)

Get calculation results and analyze them

Is a suitable freq. found? — N

Y

Assign the frequency to the requirement and remove FLEX

Keep the requirement In the notice file

Are all requirements treated? — N

Y

Send the file to Adm(s) concerned for coordination

Coordination completed? — N

Y

Add coordination information to relevant requirement(s)

Submit the file to brbcd@int.int for iteration

Wait for results of iteration

Check the results of iteration

Are results OK? — N

Y

Submit notice file to WISFAT at the end of iteration process

Flowchart of actions required from an Administration

Preparation of requirement (example 1)

Prepare a requirement (notice) on **flexible channel** assigned to a sound broadcasting station based on the information below, using TerRaNotices tool and selecting the Administration of **Namibia (NMB)** as notifying administration.

Transmitting antenna site name	ARIAMSVLEI
Coordinates of the transmitting antenna site	19°50'00''E 28°08'00''S
Height of the antenna above ground level	66 m
Effective antenna height (m) at 36 different azimuths in 10 degrees interval	To be calculated using TerRaNotices facility
Polarization	Vertical
Effective radiated power	37 dBW
Antenna directivity	ND
Transmission system	4
Necessary bandwidth*	300 kHz (see Rec. ITU-R SM. 1138)
Assigned frequency**	87.7 MHz
Station identification	FLEX
Administration's Unique identification code	Example

* For assigned frequency 87.6 MHz or 107.9 MHz the indicated necessary bandwidth shall be 200 kHz;
** For requirement on flexible channel the assigned frequency shall be 87.7 MHz.

Preparation of requirement (cont.)

Validation and Submission of notice file(s) to eBCD

✓ **Validation of notice(s):**

▪ **Initial - by TerRaNotices: *File -> Validate and save file***

▪ **Deep – by Online validation tool at https://www.itu.int/ITU-R/terrestrial/OnlineValidation/Login.aspx**

▪ **The notice file shall not contain errors.**

✓ **Submission of the notices to eBCD:**

○ **Go to eBCD web-portal - eTools: https://www.itu.int/ITU-R/eBCDMVC/**

○ **Select:**

▪ ***GE84* calculation type**

▪ ***GE84 Optimization* option**

○ **Click on New calculation**

○ **Change configuration information if needed. More information and description of results can be found in *etools Documentations -> GE84 Compatibility analyses***

○ **Browse and Upload the notice file together with the notice files of neighboring countries to eBCD web-portal**

○ **Label your job and click on Submit**

Submission of the created notice file (example)

Submission of the created notice file (example)

Submission of the created notice file (example)

Submission of the created notice file (example)

eTools: Calculations on-demand

eTools Disclaimer   eTools Documentations

The processing system is currently ONLINE (28 processes available)

Please select the calculation type

GE84   **GE84 Optimization**   **Beta Release**

Back to calculation history

New Submission

The following package has been submitted

Job Summary   Cancel job ✖   Share

Job Id	Job name	Status
9599	test	Pending

Job Input

Adm	E-notice file	Number of Notices
NMB	NMB_1flex.txt	1

Configuration Information

☑ Top 20 only ☑ Consider Tip ☑ TV also ☑ Polarization Discrimination (dB) [10] ☑ Trigger NFS from proposed modification for EU calculations (dB (µV/m)) [30]

Getting Compatibility Analysis results

- ✓ **Click on** **Back to calculation history**

- ✓ **Wait for results (either email message received or by clicking time-to-time on Refresh until job status becomes** *Success***)**

- ✓ **Click on the job Id number to see the results**

- ✓ **Select desired modes for considering interference and Set Acceptable NFS**

- ✓ **Click on Evaluate Statistics**

- ✓ **Click on administration's name and on number below Submitted or Assignable**

- ✓ **Select the desired requirement for analysis**

- ✓ **Analyze the compatibility calculation results**

Getting Compatibility Analysis results

Getting Compatibility Analysis results

Job Summary

Delete ❌   Share ⟳

Job Id	Job name	Status
9744	NMB_1flex test	Success

Job Input

Adm	E-notice file	Number of Notices
NMB	NMB_1flex.txt	1

Configuration Information

☑ Top 20 only ☑ Consider Tip ☑ TV also ☑ Polarization Discrimination (dB) `10` ☑ Trigger NFS from proposed modification for EU calculations (dB (µV/m)) `30`

Job Output

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

Evaluate Statistics

Adm	Submitted	Assignable
NMB	1	1

Acceptable NFS: 54 (dB (µV/m)) | Considerning Self Interference | Considering Interference received

Adm	Submitted	Assignable
NMB	1	1

Analysis of compatibility calculation results:
Interferers

Submitted: Select modification

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

GE84 Optimization Description

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

Summary

Frequency (MHz)			Top five interferers															
Frequency (MHz)	Max NFS Generated (dB(µV/m))	Max NFS Received (dB(µV/m))	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))
87.6	49.41	64.23	084002194	NMB	RECORDED	BC	87.6	H	KEETMANSHOOP	241	0	0	0	47	136.1	37	64.23
			084000279	AFS	RECORDED	BC	87.6	H	GARIES	296	0	0	0	37	35.4	37	50.92
			084000411	AFS	RECORDED	BC	87.8	H	AUGRABIES	73	0	0	0	47	310.9	7	58.69
			084000363	AFS	RECORDED	BC	87.7	H	PRIESKA	321	0	0	0	47	301.8	25	44.8
			084000255	AFS	RECORDED	BC	87.6	H	BEAUFORT WEST	525	0	0	0	47	330.1	37	37.92
87.7	57.11	79.16	084000411	AFS	RECORDED	BC	87.8	H	AUGRABIES	73	0	0	0	47	310.9	33	79.16
			084000363	AFS	RECORDED	BC	87.7	H	PRIESKA	321	0	0	0	47	301.8	37	56.8
			084002194	NMB	RECORDED	BC	87.6	H	KEETMANSHOOP	241	0	0	0	47	136.1	25	52.23

Search:

Excel

Analysis of compatibility calculation results: Affected

Submitted: Select modification

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

GE84 Optimization Description

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

Summary

Frequency (MHz)	Top five affected

Excel

Search: [_____]

Top five affected

Frequency (MHz)	Max NFS Generated (dB(μV/m))	Max NFS Received (dB(μV/m))	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))
87.6	49.41	64.23	084002194	NMB	RECORDED	BC	87.6	H	KEETMANSHOOP	241	0	0	0	37	315.4	37	49.41
			084000279	AFS	RECORDED	BC	87.6	H	GARIES	296	0	0	0	37	214.5	37	44.36
			084000411	AFS	RECORDED	BC	87.8	H	AUGRABIES	73	0	0	0	37	131.1	7	39.11
			084000363	AFS	RECORDED	BC	87.7	H	PRIESKA	321	0	0	0	37	123.1	25	30.5
87.7	57.11	79.16	084000411	AFS	RECORDED	BC	87.8	H	AUGRABIES	73	0	0	0	37	131.1	25	57.11
			084000363	AFS	RECORDED	BC	87.7	H	PRIESKA	321	0	0	0	37	123.1	37	42.5
			084002194	NMB	RECORDED	BC	87.6	H	KEETMANSHOOP	241	0	0	0	37	315.4	25	37.41
			084000279	AFS	RECORDED	BC	87.6	H	GARIES	296	0	0	0	37	214.5	25	32.36

ERP of the requirement under consideration

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Summary of the compatibility calculation results
on a frequency-by-frequency basis in the range 87.6 – 107.9 MHz
(fragment of Excel file)

Frequency (MHz)	Max NFS Generated (dB(µV/m))	Max NFS Received (dB(µV/m))
...	...	...
103.8	136.95	146.95
103.9	110.95	120.95
104	96.95	106.95
104.1	83.95	93.95
104.2	37.41	52.23
104.3	49.41	64.23
104.4	57.11	79.16
104.5	69.11	91.16
104.6	57.11	79.16
104.7	39.11	58.69
104.8	42.21	56.39
104.9	52.42	67.53
105	46.89	67.61
105.1	58.89	79.61
...	...	...

Conclusions:

1) Calculated NFSs on frequency 104.2 MHz in both directions (generated and received) do not exceed the acceptable NFS value, therefore it can be assigned to this site.

2) To fix this, it is necessary to modify the initial notice containing 87.7 MHz and FLEX by changing assigned frequency to 104.2 MHz and removing FLEX.

3) Also frequencies 107.8 MHz or 107.9 MHz can be assigned to this site bearing in mind that adjacent frequencies in the range ±300 kHz from the selected frequency are considered as non-assignable.

Outcome of the compatibility analysis
General recommendation

If no assignable frequency has been found it is advisable to apply for a selected frequency:

➢ **Detailed calculations involving digital terrain map (for example based on Rec. ITU-R P.1812).**

➢ **Coordination with neighbors concerned. In case of successful coordination please don't forget to 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 (for generated NFS only).**

➢ **Removal of excessive requirements.**

➢ **Combination of above.**

If no assignable frequency has been found, 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*

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Compatibility calculations
Specific case: FLEX vs FLEX requirements

Preparation of requirement (example 2)

Prepare a requirement (notice) on **flexible channel** assigned to a sound broadcasting station based on the information below, using TerRaNotices tool and selecting the Administration of **South Africa (AFS)** as notifying administration.

Transmitting antenna site name	AUGRABIES
Coordinates of the transmitting antenna site	20°24'00'E 28°34'00''S
Height of the antenna above ground level	220 m
Effective antenna height (m) at 36 different azimuths in 10 degrees interval	To be calculated using TerRaNotices facility
Polarization	Vertical
Effective radiated power	37 dBW
Antenna directivity	ND
Transmission system	4
Necessary bandwidth*	300 kHz (see Rec. ITU-R SM. 1138)
Assigned frequency**	87.7 MHz
Station identification	FLEX
Administration's Unique identification code	Example

* For assigned frequency 87.6 MHz or 107.9 MHz the indicated necessary bandwidth shall be 200 kHz;
** For requirement on flexible channel the assigned frequency shall be 87.7 MHz.

Analysis of compatibility calculation results: **Interferers**

Submitted: Select modification

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

GE84 Optimization Description

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

Summary

Frequency (MHz)	Top five interferers													
FLEX	1	AFS	ADD	BC	FLEX	V	AUGRABIES	73	0	0	0	37	310.9	45	90.24

Excel

Search:

Frequency (MHz)	Max NFS Generated (dB(μV/m))	Max NFS Received (dB(μV/m))	Top five interferers													
			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))
87.6	49.41	64.23	084002194	NMB	RECORDED	BC	87.6	H	KEETMANSHOOP	241	0	0	0	47	136.1	37	64.23
			084000411	AFS	RECORDED	BC	87.8	H	AUGRABIES	73	0	0	0	47	310.9	7	58.69
			084000279	AFS	RECORDED	BC	87.6	H	GARIES	296	0	0	0	37	35.4	37	50.92
			084000363	AFS	RECORDED	BC	87.7	H	PRIESKA	321	0	0	0	47	301.8	25	44.8
			084000255	AFS	RECORDED	BC	87.6	H	BEAUFORT WEST	525	0	0	0	47	330.1	37	37.92
87.7	57.11	79.16	084000411	AFS	RECORDED	BC	87.8	H	AUGRABIES	73	0	0	0	47	310.9	33	79.16
			084000363	AFS	RECORDED	BC	87.7	H	PRIESKA	321	0	0	0	47	301.8	37	56.8

Analysis of compatibility calculation results: Affected

Submitted: Select modification

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

GE84 Optimization Description

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

Summary

Frequency (MHz)	Top five affected												
FLEX	1	AFS	ADD	BC	FLEX	V	AUGRABIES	73	0	0	0	37	131.1	37	79.11

Excel   Search:

Frequency (MHz)	Max NFS Generated (dB(µV/m))	Max NFS Received (dB(µV/m))	Top five affected													
			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))
87.6	49.41	64.23	084002194	NMB	RECORDED	BC	87.6	H	KEETMANSHOOP	241	0	0	0	37	315.4	37	49.41
			084000279	AFS	RECORDED	BC	87.6	H	GARIES	296	0	0	0	37	214.5	37	44.36
			084000411	AFS	RECORDED	BC	87.8	H	AUGRABIES	73	0	0	0	37	131.1	7	39.11
			084000363	AFS	RECORDED	BC	87.7	H	PRIESKA	321	0	0	0	37	123.1	25	30.5
87.7	57.11	79.16	084000411	AFS	RECORDED	BC	87.8	H	AUGRABIES	73	0	0	0	37	131.1	25	57.11
			084000363	AFS	RECORDED	BC	87.7	H	PRIESKA	321	0	0	0	37	123.1	37	42.5

FLEX vs FLEX requirements

➢ **Co-channel compatibility calculations only (i.e. worst case scenario)**

➢ **To estimate a possibility of frequency re-use (sharing)**

In the example above, calculated NFSs in both directions exceed acceptable NFS value, thus between these sites frequency re-use is not possible

Exercise (optional)

➢ **Create a notice file containing 1 requirement on flexible channel per site (up to 3 sites) of your administration with no more than 100 km distance between them.**

➢ **Submit the created file to eTools.**

➢ **Analyze the results obtained.**

➢ **Assign relevant frequency for each site.**

➢ **Resubmit the obtained notice file to eTools for re-checking.**

➢ **Re-check the results.**

Some useful links

- **https://www.itu.int/en/ITU-R/terrestrial/broadcast/africa/Pages/default.aspx**

- **https://www.itu.int/en/ITU-R/terrestrial/broadcast/Pages/FMTV.aspx**

- **https://www.itu.int/en/ITU-R/terrestrial/tpr/Pages/FMTVNotices.aspx#FMTVNotices**

- **https://www.itu.int/ITU-R/eBCDMVC/**

Thank you for your attention!

Questions?

brbcd@itu.int