TECHNICAL ASSISTANCE PAPER

"ASSIGNMENT PLAN OF DIGITAL TERRESTRIAL TELEVISION NETWORKS IN ALBANIA IN THE 470-694 MHZ BAND"

Version 1.0

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1. Introduction

The documentation is prepared in the frame of the ITU Twinning Program regarding the preparation of a DTT frequency plan for Albania in the 470-694 MHz band. The documentation is connected to the phase of the preparation of the assignment plan.

During the project frequency distribution plans at allotment level were prepared in several versions. The first version of the allotment plan was based on basic information provided by Albania. This version contains large SFN areas and keeps the existing GE06 frequencies and rights as much as possible. Afterwards, additional requirements were shared by Albania. It was important not to connect more than 4 allotment areas together as an SFN, to keep the currently operating frequencies in the networks, as much as possible, to use 5-6 frequencies to one layer. In the different versions (versions 2-5) it was tried to fulfil the above mentioned requirements step by step, but it was possible only by making compromises. All the needs could not be fulfilled at the same time. Version 6 was prepared by AMA, Albania, based on their concept and ideas regarding SFN and network structures, and it was fine-tuned during the process. It was also important, that the plan needs to fulfil the adjacent channel specifications as well to get implementable networks to the current operators of multiplexes. Because of this, version 7 has bee prepared, which also take the current distribution of networks by operators into account and this version were fine-tuned by taking some additional facts and requirements into account. Finally, the version 7.4 was chosen as acceptable for Albania. The calculations, analyses and examinations found in this documentation are based on this version 7.4 of frequency distribution plan. The table of the version 7.4 could be found below.

Allotment/ layer	AL001D	AL002D	AL003D	AL004D	AL005D	AL006D	AL007D	AL008D	AL009D	AL010D	AL011D	Number o frequenci
1	33**	33	42	33	33	42	31	36	27	37	31	6
2	34	34	40	34	34	40	39	41	28	38	39	6
4	21*	36	38	21*	21	48	21	48	48	48	28	5
5	22	22	24	22	22	24	27	47	24	26	27	5
7	23	23	25	23	23	25	35	32	21	35	35	5
3	28	28	30	28	28	30	29	30	45	29	23	5
6	45	45	32	45	45	46	43	43	43	44	43	5
local	29!	26?	27	29!	-	37	-	34	-	42	-	

Legend

GE06

new

new, other country needs to change its current plan

local (in use)

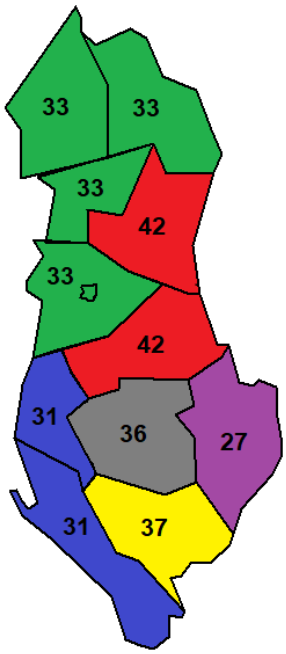
Notes

* MNE COAST SOUTH 21 and PODGORICA 21 change to ch 41

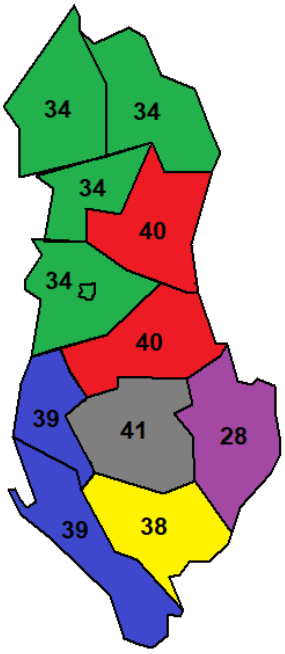
** MNE PODGORICA 33 change to ch 48

! Local multiplexes should use the same infrastucture than the nationwide, adjecent channel

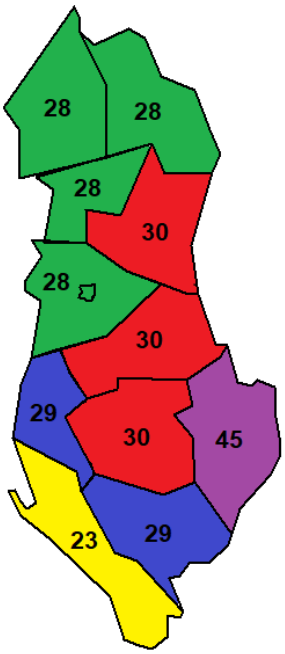
The following maps show the frequency distributions of Albanian allotments for 7 nationwide layers according to the allotment plan version 7.4.



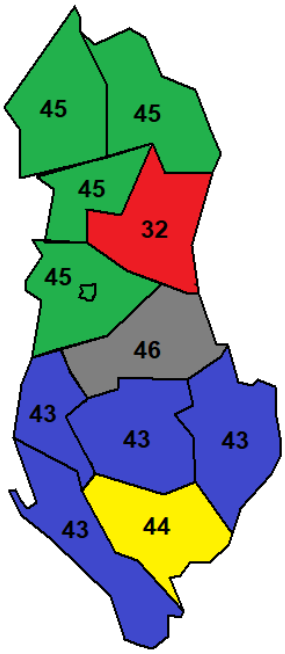
Layer 1 (public)



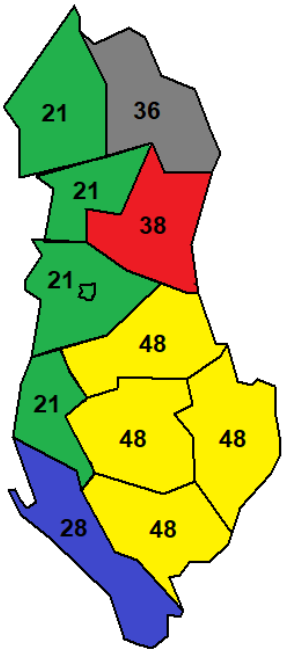
Layer 2 (public)



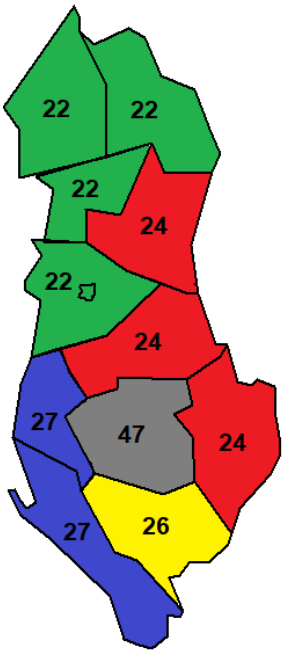
Layer 3 (commercial)



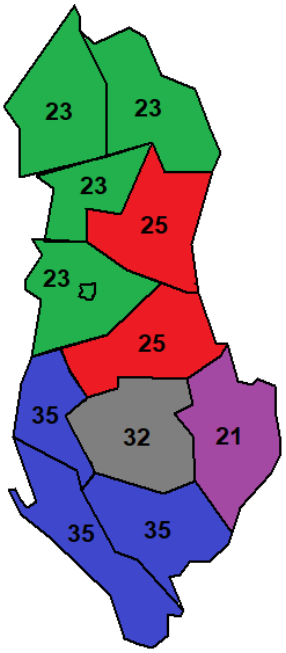
Layer 6 (commercial)



Layer 4 (commercial)



Layer 5 (commercial)



Layer 7 (commercial)

2. Calculation method

The technical calculations, simulations were carried out by the CHIRplus_BC v7.3.1.0. software. The Albanian assignments were prepared using the information provided by Albania and the frequencies according to the table above. Before calculations Albania confirmed the assignment parameters. Information about interfering transmitters of neighbouring countries of Albania was also provided. Besides, the technical parameters of these transmitters were downloaded from the ITU database and from the SEDDIF meetings sharefolder.

As first step the first 20 strongest potential interfering transmitters were collected - frequency by frequency with the usage of the above mentioned information - by the planning tool. For all of the interfering and wanted transmitters field strength simulations were prepared with three different propagation models (ITU-R 1546-6 Database, ITU-R 1546-6 Terrain, IRT2D v2007). The resolution of the simulations was 688 meters, as it was the best resolution of the available DTM. The time probability of the simulations were 50 % for wanted field strengths and 1 % for interfering field strength. The receiver antenna height was 10 m (for fixed reception). Other parameters, threshold values, etc. were in line with GE06 Agreement and related Recommendations implemented in the software in use.

For each layers and networks coverage calculations (for fixed reception) were prepared. The coverage calculations were performed using the main radiation (tilt) plane values of antenna of the wanted transmitters. The DVB-T2 system parameters of given networks provided by Albania were applied during calculations. SFN synchronization (time delays) were not applied during calculations, so the results do not contain possible self-interference. In case of significant degradation of coverage could be explored on a frequency, additional simulations were prepared. These simulations show the aggregated levels of wanted field strength and interfering field strength (Steady and Tropo Sum Level).

In the absence of appropriate population database format for the used software the numbers of covered population could not be estimated. The results, covered areas are presented in OpenStreetMap maps with the contours of countries and Albanian allotment areas.

3. Results of calculations

- **MUX1**
  - **a) Wanted assignments**

Transmitter Name	Freq. (MHz)	Ch.	ERP (dBW)	Longit.	Latit.	Pol.	Site H. (m)	Ant.H. (m)	Heffm. (m)	DIR	SFN Id
TARABOSHI	570	33	42	019E26 58.000	42N02 48.000	H	574	18	591	D	AL33-1_2_4_5
MABE	570	33	25.8	019E34 35.000	41N56 20.000	H	57	18	72	ND	AL33-1_2_4_5
MIDE	570	33	39.2	019E58 26.000	42N06 43.000	H	1654	35	1243	ND	AL33-1_2_4_5
SELCI_Tamara (Hoti)	570	33	36.9	019E28 58.000	42N23 28.000	H	1076	18	1017	D	AL33-1_2_4_5
FUSHE ARRES	570	33	25.8	020E02 25.000	42N03 46.000	H	878	18	368	ND	AL33-1_2_4_5
DOBRENJI	570	33	36.5	020E09 43.000	42N17 57.000	H	1230	18	868	D	AL33-1_2_4_5
TREGTANI	570	33	38.6	020E22 20.000	42N07 37.000	H	1163	18	842	D	AL33-1_2_4_5
Q.PRUSHI	570	33	38.2	020E22 13.000	42N16 41.000	H	959	18	585	D	AL33-1_2_4_5
TRUNCI	570	33	38.1	020E23 28.000	41N53 00.000	H	1223	18	703	D	AL33-1_2_4_5
PESHKOPI (Arabaj)	642	42	37.9	020E20 01.000	41N37 26.000	H	1504	18	1068	D	AL42-3_6
PLANBARDHE	642	42	36.6	020E09 55.000	41N27 38.000	H	1012	18	687	D	AL42-3_6
BURRELI (Vinjolli)	642	42	36.5	020E07 19.000	41N37 54.000	H	1004	18	754	D	AL42-3_6
BALLDREN	570	33	25.9	019E37 02.000	41N50 21.000	H	358	18	375	D	AL33-1_2_4_5
K.RRESHEN (SHPALI)	570	33	35.7	019E57 13.000	41N50 19.000	H	747	18	554	ND	AL33-1_2_4_5
LURTHI	570	33	34.9	019E49 41.000	41N43 40.000	H	801	18	771	ND	AL33-1_2_4_5
PLLANA	570	33	35.3	019E42 06.000	41N41 38.000	H	134	18	153	ND	AL33-1_2_4_5
KURBNESHI	570	33	24.9	020E04 21.000	41N46 52.000	H	1021	18	738	D	AL33-1_2_4_5
PERLATI	570	33	25.3	019E57 40.000	41N43 23.000	H	339	18	188	ND	AL33-1_2_4_5
DAJTI	570	33	26.8	019E55 21.000	41N22 05.000	H	1580	40	1473	D	AL33-1_2_4_5
FUSHE DAJTI	570	33	41.8	019E54 49.000	41N21 36.000	H	1076	18	968	D	AL33-1_2_4_5
KODER ISHEM	570	33	36.8	019E35 50.000	41N32 12.000	H	197	18	216	D	AL33-1_2_4_5
PREZA (Maja Rrabes)	570	33	37.7	019E40 43.000	41N24 57.000	H	168	18	172	D	AL33-1_2_4_5
LAPIDARI	570	33	38.9	019E48 12.000	41N17 53.000	H	324	18	285	D	AL33-1_2_4_5
ARAPAJ DURRES	570	33	38.7	019E30 43.000	41N18 22.000	H	61	18	81	D	AL33-1_2_4_5
KRYEVIDHI	570	33	38.7	019E32 06.000	41N05 22.000	H	164	18	181	D	AL33-1_2_4_5
SESHI	570	33	25.7	019E39 38.000	41N18 42.000	H	458	18	443	ND	AL33-1_2_4_5
PSV (Durres Koder)	570	33	26.9	019E25 29.000	41N19 42.000	H	154	18	173	D	AL33-1_2_4_5
CERVENAKE	642	42	39.5	020E35 40.000	40N59 36.000	H	1498	18	916	D	AL42-3_6
GJUZAJ	642	42	38.7	019E45 37.000	40N59 59.000	H	254	18	244	D	AL42-3_6
GRAMHSI	642	42	27.9	020E09 22.000	40N52 40.000	H	520	18	348	D	AL42-3_6
LIBRAZHDI	642	42	36.1	020E19 47.000	41N11 37.000	H	506	18	254	D	AL42-3_6
PETRESHI	642	42	41.7	020E00 43.000	41N06 45.000	H	521	15	457	D	AL42-3_6
LESKOVIKU	522	27	26.2	020E36 21.000	40N09 45.000	H	1191	18	749	D	AL27-9
MORAVE (CARDHAK)	522	27	37.3	020E50 54.000	40N36 46.000	H	1793	18	945	D	AL27-9
PEPELLASH	522	27	38.2	020E41 42.000	40N28 40.000	H	1376	18	514	D	AL27-9
TUSHEMISHTI	522	27	40.2	020E44 01.000	40N54 04.000	H	957	18	286	D	AL27-9
ARDENICA	554	31	27	019E35 37.000	40N49 29.000	H	183	18	202	D	AL31-7_11
BALLSHI KODER	554	31	36.4	019E42 35.000	40N35 43.000	H	604	18	573	D	AL31-7_11
GRABJANI	554	31	37.3	019E34 03.000	40N57 23.000	H	167	18	190	D	AL31-7_11
KSAMILI	554	31	27.4	019E59 15.000	39N45 25.000	H	134	18	152	D	AL31-7_11
KUC VLORE (SHASHICA)	554	31	37.7	019E30 49.000	40N25 00.000	H	726	18	745	D	AL31-7_11
LIGOVUNI	554	31	40	019E31 37.000	40N39 52.000	H	292	18	309	D	AL31-7_11
LLOGORA	554	31	42.3	019E34 25.000	40N11 56.000	H	1344	20	1364	D	AL31-7_11
MILE	554	31	38.7	020E05 27.000	39N45 17.000	H	804	18	821	ND	AL31-7_11

SHEN VASILI	554	31	36.8	019E57 27.000	39N56 52.000	H	778	18	796	D	AL31-7_11
SOPOTI_VL	554	31	41.8	020E07 24.000	39N59 48.000	H	1573	35	1471	D	AL31-7_11
TREBLOVE	554	31	35.9	019E38 48.000	40N29 05.000	H	502	18	445	ND	AL31-7_11
ZVERNECI	554	31	44.5	019E25 08.000	40N30 33.000	H	71	15	88	D	AL31-7_11
BERAT X (Mbrestham)	594	36	38.1	019E53 28.000	40N42 55.000	H	614	18	681	D	AL36-8
BOGOVA	594	36	35.7	020E06 27.000	40N32 28.000	H	636	18	399	ND	AL36-8
COROVODA	594	36	29.7	020E13 07.000	40N30 45.000	H	561	18	233	D	AL36-8
GLLAVA	594	36	38.7	019E59 03.000	40N29 25.000	H	1120	35	830	D	AL36-8
KOSHNICA (MENDRAKA)	594	36	37.1	020E05 39.000	40N47 19.000	H	948	18	740	D	AL36-8
POLICANI	594	36	25.2	020E04 26.000	40N35 20.000	H	629	18	537	ND	AL36-8
ASIM ZENELI	602	37	39.7	020E09 44.000	40N06 05.000	H	399	18	211	D	AL37-10
CARSHOVA	602	37	25.9	020E33 27.000	40N07 03.000	H	854	18	471	D	AL37-10
PERMETI	602	37	40.9	020E23 45.000	40N13 02.000	H	452	18	239	D	AL37-10
SOPOTI_GJ	602	37	42.1	020E07 24.000	39N59 48.000	H	1573	25	1461	D	AL37-10
TEPELENA	602	37	36.9	020E01 55.000	40N18 31.000	H	331	18	203	D	AL37-10

b) Evaluation of the results of coverage calculations

The results of coverage calculations can be found in Annex 1-3 with different propagation models.

The coverage results are almost the same, the coverage could be satisfactory. The results with IRT2D and ITU-R 1546 Terrain seem more realistic.

There are two cases, where notable coverage degradation could be present, in AL007D and in AL0011D on channel 31. The wanted and interfering field strength levels were analysed. The results of aggregated level simulations can be found in Annex 4-7.

In AL007D the wanted field strength values seem to be satisfactory, but in AL0011D the wanted field strength values are not so high in some areas of the allotment. At the same time the Tropo Sum Level calculation shows that the interference level could be high in AL007D, which interference is stemming from the assignment LOVCEN (MNE) mainly (strongest interferer). In AL011D the interference level is not so high, the strongest interferer assignment is AKARNANIKA (GRC) and LOVCEN.

Channel 31 is GE06 right for LOVCEN and for AL007D, and in AL007D it is on operation as well. Channel 31 is allotment extension for Akarnanika assignment and for AL0011D as well.

With the current system parameters self-interference could appear in some areas (mainly in AL001-02-04-05), because the size of SFNs are increased. Time delays could be applied, or the Guard Interval parameter should be increased. If the Guard Interval parameter are increased, to achieve the approximately same bitrate, the Code Rate parameter should be decreased at the same time.

Proposed changes is system parameters:

Bandwidth: 8 MHz
Modulation: 256 QAM
FFT mode: 32k
Code rate: CR ¾ → 4/5 / 5/6
Guard Interval: GI 1/16 (224 us, 67 km) → 1/8 (448 us)
Pilot Pattern: PP4 → PP2

Rotated Mode:	yes
Extended Mode:	yes
Total data rate:	40.5 Mbit/s → 40.01 Mbit/s / 41.68 Mbit/s

- **MUX2**

a) Wanted assignments

Transmitter Name	Freq. (MHz)	Ch.	ERP (dBW)	Longit.	Latit.	Pol.	Site H. (m)	Ant.H. (m)	Heffm. (m)	DIR	SFN Id
TARABOSHI	578	34	42	019E26 58.000	42N02 48.000	H	574	18	591	D	AL34-1_2_4_5
MABE	578	34	25.8	019E34 35.000	41N56 20.000	H	57	18	72	ND	AL34-1_2_4_5
MIDE	578	34	39.2	019E58 26.000	42N06 43.000	H	1654	35	1243	ND	AL34-1_2_4_5
SELCI_Tamara (Hoti)	578	34	36.9	019E28 58.000	42N23 28.000	H	1076	18	1017	D	AL34-1_2_4_5
FUSHE ARRES	578	34	25.8	020E02 25.000	42N03 46.000	H	878	18	368	ND	AL34-1_2_4_5
DOBRENJI	578	34	36.5	020E09 43.000	42N17 57.000	H	1230	18	868	D	AL34-1_2_4_5
TREGTANI	578	34	38.6	020E22 20.000	42N07 37.000	H	1163	18	842	D	AL34-1_2_4_5
Q.PRUSHI	578	34	38.2	020E22 13.000	42N16 41.000	H	959	18	585	D	AL34-1_2_4_5
TRUNCI	578	34	38.1	020E23 28.000	41N53 00.000	H	1223	18	703	D	AL34-1_2_4_5
PESHKOPI (Arabaj)	626	40	37.9	020E20 01.000	41N37 26.000	H	1504	18	1068	D	AL40-3_6
PLANBARDHE	626	40	36.6	020E09 55.000	41N27 38.000	H	1012	18	687	D	AL40-3_6
BURRELI (Vinjolli)	626	40	36.5	020E07 19.000	41N37 54.000	H	1004	18	754	D	AL40-3_6
BALLDREN	578	34	25.9	019E37 02.000	41N50 21.000	H	358	18	375	D	AL34-1_2_4_5
K.RRESHEN (SHPALI)	578	34	35.7	019E57 13.000	41N50 19.000	H	747	18	554	ND	AL34-1_2_4_5
LURTHI	578	34	34.9	019E49 41.000	41N43 40.000	H	801	18	771	ND	AL34-1_2_4_5
PLLANA	578	34	35.3	019E42 06.000	41N41 38.000	H	134	18	153	ND	AL34-1_2_4_5
KURBNESHI	578	34	24.9	020E04 21.000	41N46 52.000	H	1021	18	738	D	AL34-1_2_4_5
PERLATI	578	34	25.3	019E57 40.000	41N43 23.000	H	339	18	188	ND	AL34-1_2_4_5
DAJTI	578	34	26.8	019E55 21.000	41N22 05.000	H	1580	40	1473	D	AL34-1_2_4_5
FUSHE DAJTI	578	34	41.8	019E54 49.000	41N21 36.000	H	1076	18	968	D	AL34-1_2_4_5
KODER ISHEM	578	34	36.8	019E35 50.000	41N32 12.000	H	197	18	216	D	AL34-1_2_4_5
PREZA (Maja Rrabes)	578	34	37.7	019E40 43.000	41N24 57.000	H	168	18	172	D	AL34-1_2_4_5
LAPIDARI	578	34	38.9	019E48 12.000	41N17 53.000	H	324	18	285	D	AL34-1_2_4_5
ARAPAJ DURRES	578	34	38.7	019E30 43.000	41N18 22.000	H	61	18	81	D	AL34-1_2_4_5
KRYEVIDHI	578	34	38.7	019E32 06.000	41N05 22.000	H	164	18	181	D	AL34-1_2_4_5
SESHI	578	34	25.7	019E39 38.000	41N18 42.000	H	458	18	443	ND	AL34-1_2_4_5
PSV (Durres Koder)	578	34	26.9	019E25 29.000	41N19 42.000	H	154	18	173	D	AL34-1_2_4_5
GJUZAJ	626	40	38.7	019E45 37.000	40N59 59.000	H	254	18	244	D	AL40-3_6
LIBRAZHDI	626	40	36.1	020E19 47.000	41N11 37.000	H	506	18	254	D	AL40-3_6
PETRESHI	626	40	41.7	020E00 43.000	41N06 45.000	H	521	15	457	D	AL40-3_6
CERVENAKE	626	40	39.5	020E35 40.000	40N59 36.000	H	1498	18	916	D	AL40-3_6
GRAMHSI	626	40	27.9	020E09 22.000	40N52 40.000	H	520	18	348	D	AL40-3_6
ARDENICA	618	39	27	019E35 37.000	40N49 29.000	H	183	18	202	D	AL31-7_11
BALLSHI KODER	618	39	36.4	019E42 35.000	40N35 43.000	H	604	18	573	D	AL31-7_11
GRABJANI	618	39	37.3	019E34 03.000	40N57 23.000	H	167	18	190	D	AL31-7_11
LIGOVUNI	618	39	40	019E31 37.000	40N39 52.000	H	292	18	309	D	AL31-7_11
KSAMILI	618	39	27.4	019E59 15.000	39N45 25.000	H	134	18	152	D	AL31-7_11
KUC VLORE (SHASHICA)	618	39	37.7	019E30 49.000	40N25 00.000	H	726	18	745	D	AL31-7_11
LLOGORA	618	39	42.3	019E34 25.000	40N11 56.000	H	1344	20	1364	D	AL31-7_11
MILE	618	39	38.7	020E05 27.000	39N45 17.000	H	804	18	821	ND	AL31-7_11
SHEN VASILI	618	39	36.8	019E57 27.000	39N56 52.000	H	778	18	796	D	AL31-7_11
SOPOTI_VL	618	39	41.8	020E07 24.000	39N59 48.000	H	1573	35	1471	D	AL31-7_11
TREBLOVE	618	39	35.9	019E38 48.000	40N29 05.000	H	502	18	445	ND	AL31-7_11
ZVERNECI	618	39	44.5	019E25 08.000	40N30 33.000	H	71	15	88	D	AL31-7_11
BERAT X (Mbrestham)	634	41	38.1	019E53 28.000	40N42 55.000	H	614	18	681	D	AL41-8
BOGOVA	634	41	35.7	020E06 27.000	40N32 28.000	H	636	18	399	ND	AL41-8
COROVODA	634	41	29.7	020E13 07.000	40N30 45.000	H	561	18	233	D	AL41-8

GLLAVA	634	41	38.7	019E59 03.000	40N29 25.000	H	1120	35	830	D	AL41-8
KOSHNICA (MENDRAKA)	634	41	37.1	020E05 39.000	40N47 19.000	H	948	18	740	D	AL41-8
POLICANI	634	41	25.2	020E04 26.000	40N35 20.000	H	629	18	537	ND	AL41-8
LESKOVIKU	530	28	26.2	020E36 21.000	40N09 45.000	H	1191	18	749	D	AL28-9
MORAVE (CARDHAK)	530	28	37.3	020E50 54.000	40N36 46.000	H	1793	18	945	D	AL28-9
PEPELLASH	530	28	38.2	020E41 42.000	40N28 40.000	H	1376	18	514	D	AL28-9
TUSHEMISHTI	530	28	40.2	020E44 01.000	40N54 04.000	H	957	18	286	D	AL28-9
ASIM ZENELI	610	38	39.7	020E09 44.000	40N06 05.000	H	399	18	211	D	AL38-10
CARSHOVA	610	38	25.9	020E33 27.000	40N07 03.000	H	854	18	471	D	AL38-10
PERMETI	610	38	40.9	020E23 45.000	40N13 02.000	H	452	18	239	D	AL38-10
SOPOTI_GJ	610	38	42.1	020E07 24.000	39N59 48.000	H	1573	25	1461	D	AL38-10
TEPELENA	610	38	36.9	020E01 55.000	40N18 31.000	H	331	18	203	D	AL38-10

b) Evaluation of the results of coverage calculations

The results of coverage calculations can be found in Annex 8-10 with different propagation models.

The coverage results are almost the same, the coverage could be satisfactory. The results with IRT2D and ITU-R 1546 Terrain seem more realistic.

There are two cases, where notable coverage degradation could be present, in AL009D on channel 28 and in AL0002D on channel 34. The wanted and interfering field strength levels were analysed. The results of aggregated level simulations could be found in Annex 11-16.

In AL009D and in AL002D the wanted field strength values seem to be satisfactory. At the same time the Tropo Sum Level calculation shows that the interference level could be high in some area of AL009D, which interference is stemming from the assignment STOGOVO (MKD) (strongest interferer). In some area of AL002D the interference level is also high, the strongest interferer assignment is KOPAONIK (SRB).

Channel 28 is GE06 right for STOGOVO and for AL009D, but in AL009D it is not in operation. Channel 34 is allotment extension for AL002D and a GE06 right for KOPAONIK.

With the current system parameters self-interference could appear in some areas (mainly in AL001-02-04-05), because the size of SFNs are increased. Time delays could be applied, or the Guard Interval parameter should be increased. If the Guard Interval parameter are increased, to achieve the approximately same bitrate, the Code Rate parameter should be decreased at the same time.

Proposed changes is system parameters:

Bandwidth:	8 MHz
Modulation:	256 QAM
FFT mode:	32k
Code rate:	CR ¾ → 4/5 / 5/6
Guard Interval:	GI 1/16 (224 us, 67 km) → 1/8 (448 us)
Pilot Pattern:	PP4 → PP2
Rotated Mode:	yes
Extended Mode:	yes
Total data rate:	40.5 Mbit/s → 40.01 Mbit/s / 41.68 Mbit/s

- **MUX3**

a) Wanted assignments

Transmitter Name	Freq. (MHz)	Ch.	ERP (dBW)	Longit.	Latit.	Pol.	Site H. (m)	Ant.H. (m)	Heffm. (m)	DIR	SFN Id
TARABOSH	530	28	20	019E27 00.200	42N02 54.000	H	582	15	597	ND	AL28-1_2_4_5
MAJA E RABES	530	28	20	019E39 59.000	42N22 58.000	H	2177	15	1274	ND	AL28-1_2_4_5
MIDE	530	28	20	019E58 24.300	42N06 48.200	H	1680	25	1259	D	AL28-1_2_4_5
KUKES	530	28	18.4	020E25 16.000	42N04 35.000	H	326	25	-30	ND	AL28-1_2_4_5
MIDE	530	28	18.4	019E58 23.800	42N06 47.800	H	1680	25	1259	D	AL28-1_2_4_5
QAFE PRUSH	530	28	18.4	020E21 53.000	42N16 45.000	H	951	15	562	ND	AL28-1_2_4_5
BAJRAM CURRI	530	28	18.4	020E04 19.900	42N21 31.100	H	396	15	17	ND	AL28-1_2_4_5
TYRBE LEZHE	530	28	33.8	019E39 37.900	41N46 42.600	H	408	5	364	ND	AL28-1_2_4_5
RRESHEN	530	28	33.8	019E52 50.300	41N46 26.000	H	160	20	-3	ND	AL28-1_2_4_5
KODER ISHEM	530	28	33.8	019E35 49.000	41N32 19.000	H	136	15	138	D	AL28-1_2_4_5
DAJT	530	28	25.5	019E55 18.000	41N22 01.000	H	1613	15	1482	ND	AL28-1_2_4_5
KAVAJE	530	28	25.5	019E33 48.600	41N10 54.500	H	36	35	66	ND	AL28-1_2_4_5
KODER ISHEM	530	28	25.5	019E35 49.000	41N32 19.000	H	136	15	138	D	AL28-1_2_4_5
ARDENICE	538	29	34.8	019E35 37.900	40N49 29.000	H	160	50	205	ND	AL29-7_10
BALLSH	538	29	34.8	019E43 07.000	40N35 20.100	H	463	8	394	ND	AL29-7_10
GLLAVE	538	29	29.7	019E59 02.000	40N29 26.000	H	1120	35	828	D	AL29-7_10
KERCULLE	538	29	29.7	020E07 53.000	40N04 25.000	H	428	15	233	ND	AL29-7_10
LIKOVUN	538	29	34.8	019E31 01.000	40N40 38.000	H	239	15	239	ND	AL29-7_10
PERMET	538	29	29.7	020E20 56.200	40N14 14.800	H	428	13	-4	ND	AL29-7_10
PESHKOPI	546	30	24	020E25 56.400	41N41 08.200	H	693	10	199	ND	AL30-3_6
HOMESH	546	30	24	020E22 01.800	41N32 48.000	H	1520	32	974	ND	AL30-3_6
BURREL	546	30	24	020E00 38.100	41N36 25.900	H	320	22	159	ND	AL30-3_6
BERAT KALA	546	30	21.8	019E56 43.000	40N42 28.000	H	176	6	132	ND	AL30-3_6_8
CERVENAKE	546	30	35.4	020E35 41.800	40N59 37.400	H	960	12	910	D	AL30-3_6_8
COROVODE	546	30	21.8	020E15 07.100	40N30 11.100	H	839	15	470	ND	AL30-3_6_8
GLLAVE	546	30	21.8	019E59 02.400	40N29 25.800	H	1120	35	828	D	AL30-3_6_8
KOSHNICE	546	30	21.8	020E17 38.000	40N43 55.700	H	1717	10	1281	ND	AL30-3_6_8
LIBRAZHD	546	30	35.4	020E19 52.000	41N11 42.000	H	520	7	244	ND	AL30-3_6_8
PETRESH	546	30	35.4	020E00 31.200	41N06 48.100	H	560	12	489	D	AL30-3_6_8
CARDHAK	666	45	26.8	020E50 49.700	40N36 47.000	H	1760	10	897	ND	AL45-9
CERVENAKE	666	45	26.8	020E35 42.000	40N59 37.000	H	960	12	910	D	AL45-9
ERSEKE	666	45	26.8	020E40 50.000	40N20 19.800	H	960	20	128	ND	AL45-9
LLOGORA	490	23	17.6	019E34 24.700	40N11 56.700	H	1340	50	1390	D	AL23-11
MILE	490	23	17.6	020E05 27.000	39N45 16.000	H	820	6	830	ND	AL23-11
SOPOT	490	23	17.6	020E07 23.000	39N59 49.000	H	1573	7	1442	ND	AL23-11
TREBLOVE	490	23	17.6	019E38 43.000	40N29 05.000	H	491	10	418	ND	AL23-11
ZVERNEC	490	23	17.6	019E24 32.000	40N30 13.000	H	60	27	87	ND	AL23-11

b) Evaluation of the results of coverage calculations

The results of coverage calculations can be found in Annex 17-19 with different propagation models.

The coverage results are very different. The ITU-R 1546 models simulated very poor coverage. According to this models SRDJ and SV. ILIJA (HRV) assignments interfere the whole northern part of Albania. The result with IRT2D seems more realistic.

There is one case, where notable coverage degradation could be present, in AL002D on channel 28. The wanted and interfering field strength levels were analysed. The results of aggregated level simulations could be found in Annex 20-23.

In AL002D the wanted field strength values are not so high and not continuous. At the same time the Tropo Sum Level calculation shows that the interference level could be high in some area of AL002D, which interference is stemming from the assignment KOPAONIK (SRB) (strongest interferer).
Channel 28 is GE06 right for KOPAONIK, but this channel is an allotment extension for AL002D.

With the current system parameters self-interference could appear in some areas (mainly in AL001-02-04-05), because the size of SFNs are increased. Time delays could be applied, or the Guard Interval parameter should be increased. If the Guard Interval parameter are increased, to achieve the approximately same bitrate, the Code Rate parameter should be decreased at the same time.

Proposed changes is system parameters:

Bandwidth:	8 MHz
Modulation:	256 QAM
FFT mode:	32k
Code rate:	CR 2/3 → 3/4
Guard Interval:	GI 19/256 (266 us) → 1/8 (448 us)
Pilot Pattern:	PP4 → PP2
Rotated Mode:	yes
Extended Mode:	yes
Total data rate:	36 Mbit/s → 37.51 Mbit/s

- **MUX4**

a) Wanted assignments

Transmitter Name	Freq. (MHz)	Ch.	ERP (dBW)	Longit.	Latit.	Pol.	Site H. (m)	Ant.H. (m)	Heffm. (m)	DIR	SFN Id
TARABOSH	474	21	20	019E27 00.200	42N02 54.000	H	582	15	597	ND	AL21-1_4_5_7
MAJA E RABES	474	21	20	019E39 59.000	42N22 58.000	H	2177	15	1274	ND	AL21-1_4_5_7
MIDE	474	21	20	019E58 24.300	42N06 48.200	H	1680	25	1259	D	AL21-1_4_5_7
TYRBE LEZHE	474	21	33.8	019E39 37.900	41N46 42.600	H	408	5	364	ND	AL21-1_4_5_7
RRESHEN	474	21	33.8	019E52 50.300	41N46 26.000	H	160	20	-3	ND	AL21-1_4_5_7
KODER ISHEM	474	21	33.8	019E35 49.000	41N32 19.000	H	136	15	138	D	AL21-1_4_5_7
DAJT	474	21	25.5	019E55 18.000	41N22 01.000	H	1613	15	1482	ND	AL21-1_4_5_7
KAVAJE	474	21	25.5	019E33 48.600	41N10 54.500	H	36	35	66	ND	AL21-1_4_5_7
KODER ISHEM	474	21	25.5	019E35 49.000	41N32 19.000	H	136	15	138	D	AL21-1_4_5_7
ARDENICE	474	21	34.8	019E35 37.900	40N49 29.000	H	160	50	205	ND	AL21-1_4_5_7
BALLSH	474	21	34.8	019E43 07.000	40N35 20.100	H	463	8	394	ND	AL21-1_4_5_7
LIKOVUN	474	21	34.8	019E31 01.000	40N40 38.000	H	239	15	239	ND	AL21-1_4_5_7
KUKES	594	36	18.4	020E25 16.000	42N04 35.000	H	326	25	-30	ND	AL36-2
MIDE	594	36	18.4	019E58 23.800	42N06 47.800	H	1680	25	1259	D	AL36-2
QAFE PRUSH	594	36	18.4	020E21 53.000	42N16 45.000	H	951	15	562	ND	AL36-2
BAJRAM CURRI	594	36	18.4	020E04 19.900	42N21 31.100	H	396	15	17	ND	AL36-2
PESHKOPI	610	38	24	020E25 56.400	41N41 08.200	H	693	10	199	ND	AL38-3
HOMESH	610	38	24	020E22 01.800	41N32 48.000	H	1520	32	974	ND	AL38-3
BURREL	610	38	24	020E00 38.100	41N36 25.900	H	320	22	159	ND	AL38-3
BERAT KALA	690	48	21.8	019E56 43.000	40N42 28.000	H	176	6	132	ND	AL48-6_8_9_10
CARDHAK	690	48	26.8	020E50 49.700	40N36 47.000	H	1760	10	897	ND	AL48-6_8_9_10
CERVENAKE	690	48	35.4	020E35 41.800	40N59 37.400	H	960	12	910	D	AL48-6_8_9_10
CERVENAKE	690	48	26.8	020E35 42.000	40N59 37.000	H	960	12	910	D	AL48-6_8_9_10
COROVODE	690	48	21.8	020E15 07.100	40N30 11.100	H	839	15	470	ND	AL48-6_8_9_10
ERSEKE	690	48	26.8	020E40 50.000	40N20 19.800	H	960	20	128	ND	AL48-6_8_9_10
GLLAVE	690	48	21.8	019E59 02.400	40N29 25.800	H	1120	35	828	D	AL48-6_8_9_10
GLLAVE	690	48	29.7	019E59 02.000	40N29 26.000	H	1120	35	828	D	AL48-6_8_9_10
KERCULLE	690	48	29.7	020E07 53.000	40N04 25.000	H	428	15	233	ND	AL48-6_8_9_10
KOSHNICE	690	48	21.8	020E17 38.000	40N43 55.700	H	1717	10	1281	ND	AL48-6_8_9_10
LIBRAZHD	690	48	35.4	020E19 52.000	41N11 42.000	H	520	7	244	ND	AL48-6_8_9_10
PERMET	690	48	29.7	020E20 56.200	40N14 14.800	H	428	13	-4	ND	AL48-6_8_9_10
PETRESH	690	48	35.4	020E00 31.200	41N06 48.100	H	560	12	489	D	AL48-6_8_9_10
LLOGORA	530	28	17.6	019E34 24.700	40N11 56.700	H	1340	50	1390	D	AL28-11
MILE	530	28	17.6	020E05 27.000	39N45 16.000	H	820	6	830	ND	AL28-11
SOPOT	530	28	17.6	020E07 23.000	39N59 49.000	H	1573	7	1442	ND	AL28-11
TREBLOVE	530	28	17.6	019E38 43.000	40N29 05.000	H	491	10	418	ND	AL28-11
ZVERNEC	530	28	17.6	019E24 32.000	40N30 13.000	H	60	27	87	ND	AL28-11

b) Evaluation of the results of coverage calculations

The results of coverage calculations can be found in Annex 24-26 with different propagation models.

The coverage results are very different. The ITU-R 1546 models simulated very poor coverage. The results with IRT2D seem more realistic.

There are more cases, where notable coverage degradation could be present, in AL001D, AL004D, AL005D and AL007D on channel 21 and in AL011D on channel 28. The wanted

and interfering field strength levels were analysed. The results of aggregated level simulations could be found in Annex 27-30.

In AL004D, AL005D and AL007D the wanted field strength values seem to be satisfactory, but in AL001D and in AL011D there are areas with low level of wanted field strength. At the same time the Tropo Sum Level calculation shows that the interference level could be medium and high in some area of AL001-4-5-7 and AL011D, which interference is stemming from the assignment SV.ILIJA (HRV), CVILJEN (SRB), STOGOVO (MKD), as well as AKARNANIKA and AINOS (GRC) (strongest interferers).
Channel 21 is GE06 right for STOGOVO, for KOSOVO and for AL005D, but extension in AL001D, AL004D and AL007D. In AL005D it is in operation. Channel 28 is GE06 right for AKARNANIKA, but extension in AL011D. In AL007D it is in operation, but it would be released.

With the current system parameters self-interference could be appeared in some areas (mainly in AL001-04-05-07), because the size of SFNs are increased. Time delays could be applied, or the Guard Interval parameter should be increased. If the Guard Interval parameter are increased, to achieve the approximately same bitrate, the Code Rate parameter should be decreased at the same time.

Proposed changes is system parameters:

Bandwidth:	8 MHz
Modulation:	256 QAM
FFT mode:	32k
Code rate:	CR ¾ → 5/6
Guard Interval:	GI 1/32 (112 us) → 1/8 (448 us)
Pilot Pattern:	PP4 → PP2
Rotated Mode:	yes
Extended Mode:	yes
Total data rate:	42.4 Mbit/s → 41.68 Mbit/s

- **MUX5**

a) Wanted assignments

Transmitter Name	Freq. (MHz)	Ch.	ERP (dBW)	Longit.	Latit.	Pol.	Site H. (m)	Ant.H. (m)	Heffm. (m)	DIR	SFN Id
TARABOSH	482	22	20	019E27 00.200	42N02 54.000	H	582	15	597	ND	AL22-1_2_4_5
MAJA E RABES	482	22	20	019E39 59.000	42N22 58.000	H	2177	15	1274	ND	AL22-1_2_4_5
MIDE	482	22	20	019E58 24.300	42N06 48.200	H	1680	25	1259	D	AL22-1_2_4_5
KUKES	482	22	18.4	020E25 16.000	42N04 35.000	H	326	25	-30	ND	AL22-1_2_4_5
MIDE	482	22	18.4	019E58 23.800	42N06 47.800	H	1680	25	1259	D	AL22-1_2_4_5
QAFE PRUSH	482	22	18.4	020E21 53.000	42N16 45.000	H	951	15	562	ND	AL22-1_2_4_5
BAJRAM CURRI	482	22	18.4	020E04 19.900	42N21 31.100	H	396	15	17	ND	AL22-1_2_4_5
TYRBE LEZHE	482	22	33.8	019E39 37.900	41N46 42.600	H	408	5	364	ND	AL22-1_2_4_5
RRESHEN	482	22	33.8	019E52 50.300	41N46 26.000	H	160	20	-3	ND	AL22-1_2_4_5
KODER ISHEM	482	22	33.8	019E35 49.000	41N32 19.000	H	136	15	138	D	AL22-1_2_4_5
DAJT	482	22	25.5	019E55 18.000	41N22 01.000	H	1613	15	1482	ND	AL22-1_2_4_5
KAVAJE	482	22	25.5	019E33 48.600	41N10 54.500	H	36	35	66	ND	AL22-1_2_4_5
KODER ISHEM	482	22	25.5	019E35 49.000	41N32 19.000	H	136	15	138	D	AL22-1_2_4_5
PESHKOPI	498	24	24	020E25 56.400	41N41 08.200	H	693	10	199	ND	AL24-3_6_9
HOMESH	498	24	24	020E22 01.800	41N32 48.000	H	1520	32	974	ND	AL24-3_6_9
BURREL	498	24	24	020E00 38.100	41N36 25.900	H	320	22	159	ND	AL24-3_6_9
CARDHAK	498	24	26.8	020E50 49.700	40N36 47.000	H	1760	10	897	ND	AL24-3_6_9
CERVENAKE	498	24	35.4	020E35 41.800	40N59 37.400	H	960	12	910	D	AL24-3_6_9
CERVENAKE	498	24	26.8	020E35 42.000	40N59 37.000	H	960	12	910	D	AL24-3_6_9
ERSEKE	498	24	26.8	020E40 50.000	40N20 19.800	H	960	20	128	ND	AL24-3_6_9
LIBRAZHD	498	24	35.4	020E19 52.000	41N11 42.000	H	520	7	244	ND	AL24-3_6_9
PETRESH	498	24	35.4	020E00 31.200	41N06 48.100	H	560	12	489	D	AL24-3_6_9
GLLAVE	514	26	29.7	019E59 02.000	40N29 26.000	H	1120	35	828	D	AL26-10
KERCULLE	514	26	29.7	020E07 53.000	40N04 25.000	H	428	15	233	ND	AL26-10
PERMET	514	26	29.7	020E20 56.200	40N14 14.800	H	428	13	-4	ND	AL26-10
ARDENICE	522	27	34.8	019E35 37.900	40N49 29.000	H	160	50	205	ND	AL27-7_11
BALLSH	522	27	34.8	019E43 07.000	40N35 20.100	H	463	8	394	ND	AL27-7_11
LIKOVUN	522	27	34.8	019E31 01.000	40N40 38.000	H	239	15	239	ND	AL27-7_11
LLOGORA	522	27	17.6	019E34 24.700	40N11 56.700	H	1340	50	1390	D	AL27-7_11
MILE	522	27	17.6	020E05 27.000	39N45 16.000	H	820	6	830	ND	AL27-7_11
SOPOT	522	27	17.6	020E07 23.000	39N59 49.000	H	1573	7	1442	ND	AL27-7_11
TREBLOVE	522	27	17.6	019E38 43.000	40N29 05.000	H	491	10	418	ND	AL27-7_11
ZVERNEC_5	522	27	17.6	019E24 32.000	40N30 13.000	H	60	27	87	ND	AL27-7_11
BERAT KALA	682	47	21.8	019E56 43.000	40N42 28.000	H	176	6	132	ND	AL47-8
COROVODE	682	47	21.8	020E15 07.100	40N30 11.100	H	839	15	470	ND	AL47-8
GLLAVE	682	47	21.8	019E59 02.400	40N29 25.800	H	1120	35	828	D	AL47-8
KOSHNICE	682	47	21.8	020E17 38.000	40N43 55.700	H	1717	10	1281	ND	AL47-8

b) Evaluation of the results of coverage calculations

The results of coverage calculations can be found in Annex 31-33 with different propagation models.

The coverage results are very different. The ITU-R 1546 models simulated very poor coverage. SRDJ and SV. ILIJA (HRV), PELLISTER (MKD) and KOPAONIK (SRB) assignments interfere the whole northern part of Albania. The results with IRT2D seem more realistic.

There are two cases, where notable coverage degradation could be present, in AL001D, AL004D and AL005D on channel 22 and in AL0007D and AL011D on channel 27. The wanted and interfering field strength levels were analysed. The results of aggregated level simulations can be found in Annex 34-37.

In AL001-4-5 and in AL007D the wanted field strength values seem to be satisfactory, but in AL002D and in AL011D there are areas with low level of wanted field strength. At the same time the Tropo Sum Level calculation shows that the interference level could be high in some area of AL007D and AL011D, which interference is stemming from the assignment LOVCEN (MNE) (strongest interferer) and AKKARNANIKA (GRC). In some area of AL002D and AL005D the interference level is medium, the strongest interferer assignments are SV. ILIJA (HRV), PELLISTER (MKD) and KOPAONIK (SRB). In AL001D and AL004D the interference level is satisfactory.
Channel 22 is GE06 right for PELLISTER, for KOPAONIK and for AL001D, but extension in AL002-4-5D. In AL001D it is in operation. Channel 27 is GE06 right for LOVCEN, for AKARNANIKA and for AL007D, but extension in AL011D. In AL007D it is in operation.

With the current system parameters self-interference could be appeared in some areas (mainly in AL001-02-04-05 and AL007-11), because the size of SFNs are increased. Time delays could be applied, or the Guard Interval parameter should be increased. If the Guard Interval parameter are increased, to achieve the approximately same bitrate, the Code Rate parameter should be decreased at the same time.

Proposed changes is system parameters:

Bandwidth:	8 MHz
Modulation:	256 QAM
FFT mode:	32k
Code rate:	CR ¾ → 5/6
Guard Interval:	GI 1/32 (112 us) → 1/8 (448 us)
Pilot Pattern:	PP4 → PP2
Rotated Mode:	yes
Extended Mode:	yes
Total data rate:	42.4 Mbit/s → 41.68 Mbit/s

- **MUX6**

a) Wanted assignments

Transmitter Name	Freq. (MHz)	Ch.	ERP (dBW)	Longit.	Latit.	Pol.	Site H. (m)	Ant.H. (m)	Heffm. (m)	DIR	SFN Id
PESHKOPI	562	32	24	020E25 56.400	41N41 08.200	H	693	10	199	ND	AL32-3
HOMESH	562	32	24	020E22 01.800	41N32 48.000	H	1520	32	974	ND	AL32-3
BURREL	562	32	24	020E00 38.100	41N36 25.900	H	320	22	159	ND	AL32-3
ARDENICE	650	43	34.8	019E35 37.900	40N49 29.000	H	160	50	205	ND	AL43-7_8_9_11
BALLSH	650	43	34.8	019E43 07.000	40N35 20.100	H	463	8	394	ND	AL43-7_8_9_11
BERAT KALA	650	43	21.8	019E56 43.000	40N42 28.000	H	176	6	132	ND	AL43-7_8_9_11
CARDHAK	650	43	26.8	020E50 49.700	40N36 47.000	H	1760	10	897	ND	AL43-7_8_9_11
CERVENAKE	650	43	26.8	020E35 42.000	40N59 37.000	H	960	12	910	D	AL43-7_8_9_11
COROVODE	650	43	21.8	020E15 07.100	40N30 11.100	H	839	15	470	ND	AL43-7_8_9_11
ERSEKE	650	43	26.8	020E40 50.000	40N20 19.800	H	960	20	128	ND	AL43-7_8_9_11
GLLAVE	650	43	21.8	019E59 02.400	40N29 25.800	H	1120	35	828	D	AL43-7_8_9_11
KOSHNICE	650	43	21.8	020E17 38.000	40N43 55.700	H	1717	10	1281	ND	AL43-7_8_9_11
LIKOVUN	650	43	34.8	019E31 01.000	40N40 38.000	H	239	15	239	ND	AL43-7_8_9_11
LLOGORA	650	43	17.6	019E34 24.700	40N11 56.700	H	1340	50	1390	D	AL43-7_8_9_11
MILE	650	43	17.6	020E05 27.000	39N45 16.000	H	820	6	830	ND	AL43-7_8_9_11
SOPOT	650	43	17.6	020E07 23.000	39N59 49.000	H	1573	7	1442	ND	AL43-7_8_9_11
TREBLOVE	650	43	17.6	019E38 43.000	40N29 05.000	H	491	10	418	ND	AL43-7_8_9_11
ZVERNEC	650	43	17.6	019E24 32.000	40N30 13.000	H	60	27	87	ND	AL43-7_8_9_11
GLLAVE	658	44	29.7	019E59 02.000	40N29 26.000	H	1120	35	828	D	AL44-10
KERCULLE	658	44	29.7	020E07 53.000	40N04 25.000	H	428	15	233	ND	AL44-10
PERMET	658	44	29.7	020E20 56.200	40N14 14.800	H	428	13	-4	ND	AL44-10
TARABOSH	666	45	20	019E27 00.200	42N02 54.000	H	582	15	597	ND	AL45-1_2_4_5
MAJA E RABES	666	45	20	019E39 59.000	42N22 58.000	H	2177	15	1274	ND	AL45-1_2_4_5
MIDE	666	45	20	019E58 24.300	42N06 48.200	H	1680	25	1259	D	AL45-1_2_4_5
KUKES	666	45	18.4	020E25 16.000	42N04 35.000	H	326	25	-30	ND	AL45-1_2_4_5
MIDE	666	45	18.4	019E58 23.800	42N06 47.800	H	1680	25	1259	D	AL45-1_2_4_5
QAFE PRUSH	666	45	18.4	020E21 53.000	42N16 45.000	H	951	15	562	ND	AL45-1_2_4_5
BAJRAM CURRI	666	45	18.4	020E04 19.900	42N21 31.100	H	396	15	17	ND	AL45-1_2_4_5
TYRBE LEZHE	666	45	33.8	019E39 37.900	41N46 42.600	H	408	5	364	ND	AL45-1_2_4_5
RRESHEN	666	45	33.8	019E52 50.300	41N46 26.000	H	160	20	-3	ND	AL45-1_2_4_5
KODER ISHEM	666	45	33.8	019E35 49.000	41N32 19.000	H	136	15	138	D	AL45-1_2_4_5
DAJT	666	45	25.5	019E55 18.000	41N22 01.000	H	1613	15	1482	ND	AL45-1_2_4_5
KAVAJE	666	45	25.5	019E33 48.600	41N10 54.500	H	36	35	66	ND	AL45-1_2_4_5
KODER ISHEM	666	45	25.5	019E35 49.000	41N32 19.000	H	136	15	138	D	AL45-1_2_4_5
CERVENAKE	674	46	35.4	020E35 41.800	40N59 37.400	H	960	12	910	D	AL46-6
LIBRAZHD	674	46	35.4	020E19 52.000	41N11 42.000	H	520	7	244	ND	AL46-6
PETRESH	674	46	35.4	020E00 31.200	41N06 48.100	H	560	12	489	D	AL46-6

b) Evaluation of the results of coverage calculations

The results of coverage calculations can be found in Annex 38-40 with different propagation models.

The coverage results are very different. The ITU-R 1546 models simulated very poor coverage. A lot of assignments interfere almost in whole Albania. The results with IRT2D seem more realistic.

There are more cases, where notable coverage degradation could be present, in AL001D, AL002D and AL004D on channel 45 and in AL0007D and AL011D on channel 43. The wanted and interfering field strength levels were analysed. The results of aggregated level simulations could be found in Annex 41-44.

In AL001-4-5 and in AL007D the wanted field strength values seem to be satisfactory, but in AL002D and in AL011D there are areas with low level of wanted field strength. At the same time the Tropo Sum Level calculation shows that the interference level could be high in some area of AL007D and AL011D, which interference is stemming from the assignment STOGOVO (MKD) (strongest interferer) and AKKARNANIKA (GRC). In some area of AL002D and AL004D the interference level is medium, the strongest interferer assignments are SV. ILIJA (HRV) and JASTREBAC (SRB). In AL001D and AL005D the interference level is satisfactory in practice.
Channel 45 is GE06 right for JASTREBAC, for D09 allotment (HRV) and for AL001D, but extension in AL002-4-5D. In AL001D it is in operation. Channel 43 is GE06 right for STOGOVO, for AKARNANIKA and for AL011D, but extension in AL007D. In AL011D it is in operation.

With the current system parameters self-interference could appear in some areas (mainly in AL001-02-04-05), because the size of SFNs are increased. Time delays could be applied, or the Guard Interval parameter should be increased. If the Guard Interval parameter are increased, to achieve the approximately same bitrate, the Code Rate parameter should be decreased at the same time.

Proposed changes is system parameters:

Bandwidth:	8 MHz
Modulation:	256 QAM
FFT mode:	32k
Code rate:	CR 5/6
Guard Interval:	GI 19/256 (266 us) → 1/8 (448 us)
Pilot Pattern:	PP4 → PP2
Rotated Mode:	yes
Extended Mode:	yes
Total data rate:	45 Mbit/s → 41.68 Mbit/s

- **MUX7**

a) Wanted assignments

Transmitter Name	Freq. (MHz)	Ch.	ERP (dBW)	Longit.	Latit.	Pol.	Site H. (m)	Ant.H. (m)	Heffm. (m)	DIR	SFN Id
CARDHAK	474	21	26.8	020E50 49.700	40N36 47.000	H	1760	10	897	ND	AL21-9
CERVENAKE	474	21	26.8	020E35 42.000	40N59 37.000	H	960	12	910	D	AL21-9
ERSEKE	474	21	26.8	020E40 50.000	40N20 19.800	H	960	20	128	ND	AL21-9
TARABOSH	490	23	20	019E27 00.200	42N02 54.000	H	582	15	597	ND	AL23-1_2_4_5
MAJA E RABES	490	23	20	019E39 59.000	42N22 58.000	H	2177	15	1274	ND	AL23-1_2_4_5
MIDE	490	23	20	019E58 24.300	42N06 48.200	H	1680	25	1259	D	AL23-1_2_4_5
KUKES	490	23	18.4	020E25 16.000	42N04 35.000	H	326	25	-30	ND	AL23-1_2_4_5
MIDE	490	23	18.4	019E58 23.800	42N06 47.800	H	1680	25	1259	D	AL23-1_2_4_5
QAFE PRUSH	490	23	18.4	020E21 53.000	42N16 45.000	H	951	15	562	ND	AL23-1_2_4_5
BAJRAM CURRI	490	23	18.4	020E04 19.900	42N21 31.100	H	396	15	17	ND	AL23-1_2_4_5
TYRBE LEZHE	490	23	33.8	019E39 37.900	41N46 42.600	H	408	5	364	ND	AL23-1_2_4_5
RRESHEN	490	23	33.8	019E52 50.300	41N46 26.000	H	160	20	-3	ND	AL23-1_2_4_5
KODER ISHEM	490	23	33.8	019E35 49.000	41N32 19.000	H	136	15	138	D	AL23-1_2_4_5
DAJT	490	23	25.5	019E55 18.000	41N22 01.000	H	1613	15	1482	ND	AL23-1_2_4_5
KAVAJE	490	23	25.5	019E33 48.600	41N10 54.500	H	36	35	66	ND	AL23-1_2_4_5
KODER ISHEM	490	23	25.5	019E35 49.000	41N32 19.000	H	136	15	138	D	AL23-1_2_4_5
PESHKOPI	506	25	24	020E25 56.400	41N41 08.200	H	693	10	199	ND	AL25-3_6
HOMESH	506	25	24	020E22 01.800	41N32 48.000	H	1520	32	974	ND	AL25-3_6
BURREL	506	25	24	020E00 38.100	41N36 25.900	H	320	22	159	ND	AL25-3_6
CERVENAKE	506	25	35.4	020E35 41.800	40N59 37.400	H	960	12	910	D	AL25-3_6
LIBRAZHD	506	25	35.4	020E19 52.000	41N11 42.000	H	520	7	244	ND	AL25-3_6
PETRESH	506	25	35.4	020E00 31.200	41N06 48.100	H	560	12	489	D	AL25-3_6
BERAT KALA	562	32	21.8	019E56 43.000	40N42 28.000	H	176	6	132	ND	AL32-8
COROVODE	562	32	21.8	020E15 07.100	40N30 11.100	H	839	15	470	ND	AL32-8
GLLAVE	562	32	21.8	019E59 02.400	40N29 25.800	H	1120	35	828	D	AL32-8
KOSHNICE	562	32	21.8	020E17 38.000	40N43 55.700	H	1717	10	1281	ND	AL32-8
ARDENICE	586	35	34.8	019E35 37.900	40N49 29.000	H	160	50	205	ND	AL35-7_10_11
BALLSH	586	35	34.8	019E43 07.000	40N35 20.100	H	463	8	394	ND	AL35-7_10_11
GLLAVE	586	35	29.7	019E59 02.000	40N29 26.000	H	1120	35	828	D	AL35-7_10_11
KERCULLE	586	35	29.7	020E07 53.000	40N04 25.000	H	428	15	233	ND	AL35-7_10_11
LIKOVUN	586	35	34.8	019E31 01.000	40N40 38.000	H	239	15	239	ND	AL35-7_10_11
LLOGORA	586	35	17.6	019E34 24.700	40N11 56.700	H	1340	50	1390	D	AL35-7_10_11
MILE	586	35	17.6	020E05 27.000	39N45 16.000	H	820	6	830	ND	AL35-7_10_11
PERMET	586	35	29.7	020E20 56.200	40N14 14.800	H	428	13	-4	ND	AL35-7_10_11
SOPOT	586	35	17.6	020E07 23.000	39N59 49.000	H	1573	7	1442	ND	AL35-7_10_11
TREBLOVE	586	35	17.6	019E38 43.000	40N29 05.000	H	491	10	418	ND	AL35-7_10_11

b) Evaluation of the results of coverage calculations

The results of coverage calculations can be found in Annex 45-47 with different propagation models.

The coverage results are very different. The ITU-R 1546 models simulated very poor coverage in the northern and southern part of Albania. The result with IRT2D seems more realistic.

There is one case, where notable coverage degradation could be present, in AL007D and in AL011D on channel 35. The wanted and interfering field strength levels were analysed. The results of aggregated level simulations can be found in Annex 48-49.

In AL011D the wanted field strength values are not so high and not continuous, in AL007D these values are satisfactory. At the same time the Tropo Sum Level calculation shows that the interference level could be high in some area of AL007D, which interference is stemming from the assignment LOVCEN (MNE) (strongest interferer). In AL011D there are some areas where high interference level could be produced by AKARNANIKA and AINOS (GRC) assignment.
Channel 35 is GE06 right for LOVCEN and for AL007D and AL0010D, but this channel is an allotment extension for AL011D and AKARNANIKA. In AL007D and AL010D it is in operation.

With the current system parameters self-interference could appear in some areas (mainly in AL001-02-04-05 and AL007-10-11), because the size of SFNs are increased. Time delays could be applied, or the Guard Interval parameter should be increased. If the Guard Interval parameter are increased, to achieve the approximately same bitrate, the Code Rate parameter should be decreased at the same time.

Proposed changes is system parameters:

Bandwidth:	8 MHz
Modulation:	256 QAM
FFT mode:	32k
Code rate:	CR ¾ → 5/6
Guard Interval:	GI 1/32 (112 us) → 1/8 (448 us)
Pilot Pattern:	PP4 → PP2
Rotated Mode:	yes
Extended Mode:	yes
Total data rate:	42.4 Mbit/s → 41.68 Mbit/s

4. Summary and suggestions

First of all, it is important to note, that the simulations, calculations detailed above and can be found in the annexes are predictions. The geographical environment of Albania is not the same like in Hungary; there is propagation via warm sea, flat areas are only in the coastline, but there are high mountainous regions and narrow valleys. Because of these facts, it could occur, that some settings of the propagation models should be fine-tuned based on measurements and/or experiences of operation of the networks.

Analysing the coverage results it could be seen that the coverage of the public networks (MUX1, MUX2) are better than the commercial ones (MUX3-7). The number of transmitters are higher and the effective radiated power of each transmitters also greater. Thanks to these two facts the level of wanted field strength also could be higher, there is overlapping, which gives the robustness of the networks. In this case the network could “dealt with” higher interference levels as well. In contrast with this, the commercial networks operate with less transmitters and lower powers, which means that the wanted field strength values are lower.

These differences are very spectacular in the case of simulations with ITU-R 1546 propagation models. These models could over-predict the interfering field strength levels of transmitters which are on very high sites, mainly the 1546 Database, because this model does not take the DTM and terrain into account. Based on the experiences the IRT2D model predicts more realistic situations regarding field strength levels. The used IRT2D model is not fine-tuned to warm see propagation, in these scenarios maybe it could be developed.

By improving the number and parameters of assignments used in commercial networks the coverage of these networks could be improved as well. The interfering environment around Albania is already fixed. During SEDDIF meeting the remaining UHF Band for broadcasting (470-694 MHz) were re-planned by the neighbouring countries of Albania. It is challenging to modify frequencies in to current plan because of the domino-effect. So, the interference stemming from neighbouring countries has already been given. In some Albanian allotments there are no options to change frequencies or the changes do not complete the requirements that were settled during the re-planning process.

It is also important to note that coordination process could be performed with the antenna characteristics and ERPs of the zero plane of transmitters. From the information provided by Albania only the assignment parameters of MUX1 and MUX2 could be prepared for the zero plane.

As a general comment, it could be mentioned that the sizes of allotments are increased because of the narrower band available. In this case the currently used Guard Interval system parameters may not be so satisfactory in every cases, especially GI 1/32 (112us). It should be increased in order to avoid self-interference within the SFNs. In allotments AL001D, AL002D, AL004D and AL005D the same frequency is used in almost every cases. There are transmitters near to the edges of the allotments in the top of the mountains, far away there are flat areas (coastline), and these areas could suffer from self-interference. It is important to apply the appropriate time delays of transmitters and/or use wider guard intervals.

The current operational experiences could be used for developing the plan, mainly at assignment level in order to improve the coverage of networks.

The frequency coordination would be an important part of the re-planning process. In the light of the coordination negotiations, it could happen, that some changes should be applied in the last version of frequency distribution plan, or in the technical parameters of assignments.