European Radiocommunications Committee (ERC)
within the European Conference of Postal and Telecommunications Administrations (CEPT)

IMPLEMENTATION OF THE CHESTER AGREEMENT

Naples, January 2000

Implementation of the Chester Agreement

This report contains information on the implementation of the Chester 97 Agreement (CH97). It shows the collective experience of CEPT administrations in applying the Chester procedures and resolutions from mid 1997 to the end of 1999 together with outline plans regarding developments expected during the following years.

Additional information is given regarding ideas which have been developed to assist in the interpretation of certain parts of CH97.

Further monitoring of the implementation of the CH97and the preparation of a conference to revise the Stockholm Agreement of 1961 will take place in project team FM PT24.

Contents

1 SUMMARY OF MAIN ISSUES IN THE REPORT

Section 2: Proposals for modifications of planning criteria

No changes to the Chester Agreement should be considered for the time being.

Section 3: Information on coverage and network planning methods

The way to deal with closely spaced stations, low power stations, stations with very small coverage radius and predictions over distances less than 15 km have been clarified as has the location of coverage boundary test points in those cases where a transmitter is situated outside its own country boundary.

Terrain data with a resolution of 30-arc sec are now freely available on internet. These data can be used to improve the field strength prediction accuracy by means of the terrain clearance angle in co-ordination on a bilateral basis. This facility has been incorporated in the ERO software (COCOT).

Frequency offset conditions have been clarified. It is explained that reception is possible at some locations outside the planned service area for some percentage of the time.

Section 4: Application of CH97 procedures

A great number of points which arise in the application of the CH97 procedures are pointed out.

In general there are no great difficulties in applying CH97 procedures, however strict application leads to severe restrictions on proposed digital stations. A number of administrations are applying more relaxed criteria.

The non-availability of reliable reference values (see section 5) may cause problems for early co-ordinations.

The Chester Agreement is currently signed by 34 administrations, 5 administrations still need to ratify or confirm the signature.

A considerable amount of available software produced by ERO and EBU has been listed. The software is available on the COCOT CD-ROM (last version COCOT 5).

Section 5: Implementation of CH97 resolutions

Television station data have been received from 36 CEPT administrations. Data for a further 6 CEPT administrations were derived by the ERO from ST61 data. Data for 12 countries neighbouring CEPT countries were derived by the ERO from ST61 data. The data will be used for calculating the reference values for co-ordination.

An amended procedure has been adopted for sending in corrected and missing stations; the final results of coverage calculations using the corrected data will be available on 19/5/2000.

This procedure includes provisions of dealing with disputed stations.

The television data is contained on the COCOT CD-ROM (latest version COCOT 5).

Section 6: Information on DVB-T implementation

Three countries have now launched DVB-T services and several others are currently expected to launch services in the next two to three years. Test transmissions and pilot projects are underway in 16 countries.

A total of 20 countries are undertaking DVB-T planning and have provided information on the current situation regarding the introduction of DVB-T. Sixteen of them have co-ordination in progress.

Section 7: Ideas on the approach to an all digital plan

It is considered that a Planning Conference is necessary to migrate from analogue to digital television. The ERC has agreed that the Secretary-General of the ITU should be requested by a sufficient number of CEPT countries in accordance with Article 27 of the ITU Convention to apply the relevant procedure for the convening of a regional conference at the request of Member States.

Initial estimates indicate that to provide for six multiplexes per area in Europe will require access to at least 42 channels.

The success of an all-digital plan will be dependent on finding an acceptable means to migrate from the pre existing situation.

2 PLANNING CRITERIA

2.1 Recommendation ITU-R BT.1368

ITU-R S.G 11 has proposed a draft revision of Recommendation ITU-R BT.1368-1 for adoption by correspondence by the end of 1999.

In this draft revision the planning parameters for planning digital terrestrial television are incorporated including protection ratios to and from analogue services.

The protection ratios for analogue systems are incorporated in Rec.655.

In the draft revision of Rec. 1368-1 the co-channel and adjacent channel protection ratios values for analogue TV interfered with by DVB-T are proposed to be the same for both 7 and 8 MHz DVB-T systems.

Protection ratios for wanted SECAM systems interfered with by DVB-T systems have been harmonised to 35 dB which is now in line with the Chester 97 reference reception conditions.

Some changes are proposed for protection ratios for the overlapping channel cases.

Increased production of consumer receivers is expected in the near future. It will then be possible to verify some existing protection ratios values.

Working Party FM-PT24 is therefore of the opinion that no changes to Chester Agreement should be considered for the time being.

Consolidated tables will be produced in the course of next year when data become available.

2.2 Receiver design

Due to the frequency spectrum needs for DVB-T, services in VHF Band III will also be used in a number of European countries (see also Section 7.5.5). It is therefore extremely important to draw to the attention of television receiver manufacturers the need for DVB-T receivers to be capable of operation in 7 MHz channel also. In this case special care should be taken to guarantee suitable rejection of adjacent channel signals.

Receiver manufacturers have indicated that they are able to produce receivers which can deal with both 7 and 8 MHz channel rasters in Band III but such receivers will have a somewhat higher cost than receivers with only an 8 MHz bandwidth. In the future the receiver manufacturers would prefer to have a single bandwidth, either 7 or 8 MHz (and preferably the latter) in Band III. Receiver manufacturers have also indicated that 100% of receiver production would achieve a noise figure no greater than 8 dB. Project Team FM 24 agreed to continue to base planning on a noise figure of 7 dB.

3 INFORMATION ON METHODS OF COVERAGE ANALYSIS

3.1 Planning parameters

The planning parameters used are those given in CH97. It is recognised that Rec. ITU-R BT.1368 contains protection ratios and other planning parameters to be used in connection with DVB. At present, however, the differences between the values given in the Final Acts of CH97 and Rec. ITU-R BT.1368 are few and mainly insignificant. Therefore the values to be used remain those given in CH97.

3.2 Closely spaced analogue stations

It appears from the data sent in to the ERO that in a number of cases co-channel or adjacent channel stations are located close to each other within one and the same country. Generally, this leads to a higher than expected usable field strength for these stations.

In the case of co-channel or adjacent channel stations located closer than 25 km from each other mutual interference is disregarded if both stations belong to the same administration. However, for all other stations (co-channel and adjacent channel) both transmitters are treated as interferers, increasing the usable field strength for these other stations.

3.3 Low power analogue stations

In order to save time during initial coverage calculations, simple rules are applied to low power stations. A station is regarded as a low power station if the maximum e.r.p. **in both** of the two planes of polarisation is lower than 20 dBW. In such cases, only a single test point is created (in place of the 36 test points for higher power stations) and this is situated at the transmitter site.

3.4 Minimum coverage radius

During initial coverage calculations, the minimum coverage radius has been set to 1 km.

3.5 Effective antenna height

In Rec. ITU-R P.370 the definition of the effective antenna height involves the ground height in the distance range 3 to 15 km. This leads to unsatisfactory results for stations with a coverage radius less than 15 km. In order to overcome this problem an interpolation formula for the effective antenna height has been derived and implemented for distances up to 15 m. This formula (given in Annex 1 to Section 3) is applicable to calculations where the effective transmitting antenna height and the transmitting antenna height above ground level are known and where terrain data are not used (see also Section 3.8).

3.6 Field strength predictions at short distances

To carry out field strength predictions at shorter distances than 10 km the propagation curves given in ITU-R Rec. 370 have been extended to less than 1 km by extrapolation.

3.7 Offset on analogue stations

When calculating the coverage area for a given analogue station the information about the offsets is used as follows:

If either the wanted or the unwanted stations:
uses the offset type "U";

the protection ratio for non-precision non-offset is used.

If either the wanted or the unwanted stations:
uses the offset type "N"; and,
neither of them uses offset type "U";

the protection ratios for non-precision offset are used.

If both the wanted and the unwanted stations:
use the offset type "P";

the protection ratios for precision offset are used.

It should be noted that in the case where the two stations both use precision offset with the same value of offset in Hz the protection ratios for non-precision non-offset apply.

If both the wanted and the unwanted stations:
use the offset type "S"; and,
have the same offset value in Hz; and,
radiate the same programme; and,
belong to the same administration

they are assumed to be synchronised.

In the absence of precise information concerning protection ratios for synchronised analogue television transmitters the protection ratios for 1/4 line precision offset are used. Where any of the "anded" conditions is not met, the stations are assumed to use precision offset.

3.8 Use of Country boundary test points

The set of test points representing the boundary of a country is dealt with in Section 6.1.2 of Annex 1 of the Chester Agreement. These test points are required for the application of Annex 6 (Conversions).

In generating test points representing coverage areas, if the contour of a coverage area crosses the country boundary, additional boundary test points may be generated according to Section 6.1.1.

It is not explicitly stated in the Chester Agreement how to deal with these test points in terms of the level to be protected. (See Annex 2 to Section 3)

3.9 Transmitter sites outside country boundary

A difficulty arises where a transmitter site is outside all of the boundaries for the relevant administration, with respect to the location of test points. Firstly it must be determined whether the transmitter site is really intended to be outside the country boundaries. If this is the case, then it may be necessary to consider the intended service area which requires protection, so as to determine the location of the test points. A proposal is made in Annex 5 to Section 3.

3.10 Use of terrain data

In the calculation of the reference situation terrain data are not taken into account.

Terrain data may be used in co-ordination on a bilateral basis. Terrain data with a resolution of 30 arc sec. covering the CEPT area is contained on the COCOT5 CD-ROM and is also freely available, for example, on the Internet. A method of using terrain data to derive effective antenna height values for short distance paths is given in Annex 2 to Section 3; information is given in Annex 3 to Section 3 for the general case. Information about extraction of data from a terrain databank is given in Annex 4 to Section 3.

3.11 SFN coverage

Some studies have indicated that coverage within an SFN is highly dependent upon the type of coverage required (fixed or portable), the coverage percentage required, the data capacity required and the number of transmitter sites to be used (same as analogue network or an increased number). These elements are inter-dependent and, in particular, to achieve high percentage coverage for portable reception requires an increase in the number of transmitter sites (compared with an analogue network designed for fixed reception) or a reduced data capacity. In this respect a receiver incorporating improved performance after the end of the guard interval can improve the coverage. The CD3 receiver design, proposed by the RAI, provides this improved performance.

However, further work is needed to establish an agreed method for the calculation of interference from SFNs and to establish methods for the calculation of coverage in SFNs.

3.12 Initial assessments of DVB-T coverage

Some remarks have been made with regards to the coverage achieved by early DVB-T stations which suggests that reception is possible outside of the predicted service-area.

Service areas may reduce in size as more, analogue or digital stations are brought into operation. Such new analogue and digital stations may already be planned and have had their interference impact taken into account.

Service areas are planned for defined coverage criteria (percentage locations, percentage time). Because of the behaviour of digital television, where the screen may blank if a certain level of signal impairment occurs, the service areas are planned to be protected against noise and interference for 99% of time and for a high percentage of locations, generally higher than is regarded as applicable for analogue television. Therefore reception is possible in some locations outside of the planned service area for a percentage of time which is not considered acceptable according to the planning criteria.

Annex 1 to Section 3: Predictions using Rec. 370 for path lengths less than 15 km in cases where terrain data are not available

Introduction

Within ITU-R Rec. P.370, the effective transmitting antenna height is an important parameter in the field strength prediction process. However, the definition of the effective antenna height involves consideration of the mean ground height in the distance range 3 to 15 km from the transmitter site. There is an evident uncertainty if the distance for which a prediction is needed is less than 15 km.

It has become increasingly apparent that there is a problem to be addressed. It is common for lower powered stations (that is, stations with a relatively low e.r.p.) to have coverage radii of less than 15 km and it can be difficult to automate a coverage calculation when the basis for the calculations is questionable. The problem is particularly acute when the effective antenna height is negative. Although a negative effective height value may be valid for interference calculations, it is very unlikely to provide a valid estimate for the coverage radius.

An obvious solution to the problem identified would be to adopt a new definition of effective antenna height. However, this is unlikely to be acceptable to the users as the effective antenna height is an inherent part of many broadcasting frequency plans.

Discussion

In most cases, the height of the transmitting antenna above ground level is known, in addition to its effective height above mean terrain. For the distance range up to 15 km, it is thus possible to interpolate between the antenna height above ground level and the effective height. It has to be accepted that this can only be an approximation because nothing is (necessarily) known about the ground slopes in the distance range up to 15 km.

It must be noted that the definition of the effective height only involves the ground heights in the distance range from 3 km to 15 km. It is thus appropriate to restrict any interpolation process to the distance range 3 to15 km.

Proposal

In the expressions given below, the transmitting antenna height, h_t, to be used in the application of Rec. 370 is:

Distance $\geq$ 15 km, use effective antenna height, h_{eff}

$$h_t = h_{eff}$$

Distance $\leq$ 3 km, use actual antenna height above ground level, h_{ant}.

$$h_t = h_{ant}$$

Distance > 3 km but < 15 km, interpolate from h_{ant} to h_{eff}:

$$h_t = h_{ant} + (h_{eff} - h_{ant}).(dist - 3)/12$$

Annex 2 to Section 3: Calculation of effective transmitting antenna height in cases where terrain data are available

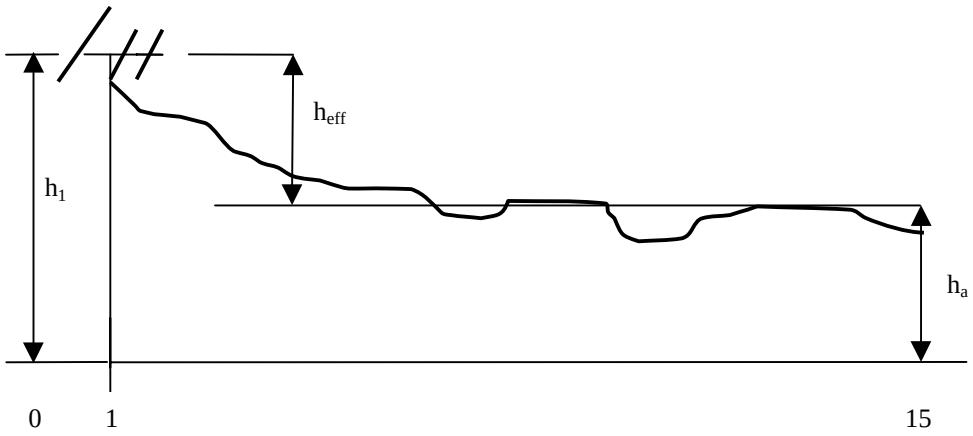
1. For distances ≤ 1 km: use actual antenna height above ground level:

$$h_{eff} = h_{ant}$$

2. For distances 1 < d ≤ 15 km:

$$h_{eff} = h_1 - h_a$$

where
h_1 is physical height of the antenna above the sea level.
h_a is the average height of the terrain above the sea level between 1 km and the actual receiving point.



3. For distances > 15 km: use effective antenna height, h_{eff}, as defined in Rec. 370 (i.e. h_a is an average height of terrain in 3 - 15 km range).

Remark: The proposed points 1 and 2 are based on the work related to the Vienna Agreement 1993 for fixed and land mobile services in the frequency range 29.7 to 960 MHz. However, this proposal should be revised in accordance with possible future changes in Rec. 370, in particular with respect to shorter distances.

Annex 3 to Section 3: Use of terrain data to improve propagation predictions

Introduction

The use of a terrain database for field strength calculations can improve the quality of results to a certain degree. In this Annex, consideration is given to the possibility of including a terrain database in the CH97 process.

Chester 97

For the purpose of this document Ch97 calculations can be divided into two parts, the definition of the reference situation and evaluation of the influence of changes on this reference.

Ch97 calculations are based on the ITU-R 370 propagation model. The influence of the terrain on propagation of radio waves is taken into account by using effective antenna heights which are a part of the input data. This is perfectly adequate for establishment of the reference situation and there is no other realistic alternative. However detailed analysis of compatibility with regard to this reference situation, as foreseen by Chester97, could be significantly improved using a terrain database.

Terrain data availability

Terrain databases are available in many European administrations, unfortunately in a number of incompatible formats (the exception being the Vienna Agreement database for HCM). In addition the set of data in a 30 second raster covering the whole Globe recently became publicly available (GTOPO).

Use of terrain data

The software developed in the EBU and the ERO is instrumental to the Chester 97 process. The inclusion of terrain data into this will further increase the usability of this software. Considering the architecture of this software this inclusion of terrain data seems to be feasible.

Possible solutions

A number of solutions to the problem of using heterogeneous data sets in shared software were proposed in recent years, e.g. proposal of ERC PT11, or P-Interface which is now being completed under ERO's supervision, which are very promising. Both solutions basically de-couple the user's software from the notion of the underlying database structure thus making it possible to share the software among users with different terrain databases. This is made possible by defining a standard interface to the terrain database which only has to fulfil certain (and rather trivial) conditions.

Technically the problem of de-coupling of the user's software seems to be less complex than e.g. separation of the CTP2 software from underlying transmitter database which was successfully presented on COCOT5 CD-ROM.

Conclusion

It is suggested that FM24 considers the feasibility of inclusion of terrain data into software which is being delivered as a part of the Chester97 process support. Considering the current technical possibilities as well as the skills available it can be concluded that there is a substantial potential to further improve the process with a reasonably low additional workload.

Annex 4 to Section 3: Implementation of DTM server

Introduction

The purpose of this document is to give information about the DTM Server developed within ERO in support of the Chester 97 process.

Background

The issue of the use of DTM (Digital Terrain Model) data to help the interpretation of data obtained in the reference situation calculations was raised at the November 1998 FM 24 meeting. The applicability of the DTM data was discussed with the conclusion that "real terrain" data can significantly improve the evaluation of a situation in a test point after it has been determined by procedures defined in Chester 97. It was reiterated that it is not possible and indeed not desirable to introduce DTM, were it possible, into Chester 97 procedures.

Considering the fact that there is a considerable experience with DTM-related issues FM24 asked the ERO to evaluate the possibility of DTM inclusion into software tools which are being developed by the ERO in support of the Chester 97 process.
The evaluation by the ERO shown that there is enough material to build on and to implement a full-blown DTM Server.

DTM Server

History

The problem of an Europe-wide implementation of a the DTM system was studied by ERO in the framework of activity of the Vienna Agreement HCM, in ERC PT11 and in ERC PT13. The basic concept of the DTM Server was defined and proven in a prototype "OLDA" prepared for the WGSE. It was concluded that the concept of the DTM Server is viable and that the advances in computing technology are making its implementation feasible.

Data availability

Studies mentioned above were based on the fact that there is no homogenous data set available which would cover the European area. Therefore the emphasis was put on features of the DTM Server allowing the operation with heterogeneous data coming from individual countries.

The DTM data covering the entire globe in a 30-second raster (GTOPO30) appeared recently in the public domain. This made a number of related things easier, however it is vital that the server is still able to cope with heterogeneous data.

DTM Server concept

The basic concept of the DTM Server lies in the definition of a standard interface to the server which is completely independent of the underlying data structures.

Application programmes are in this case completely shielded from the complexity of data and it depends on the implementation of the DTM Server how it deals with heterogeneous data formats.

This concept, shown in a simplified view, looks as follows:

Application 1	Application 2	….	Application 3

COM Interface

OLDA2 (standard interface to DTM server)

DTM Server implementation

Data access for data in format A	Data access for data in format B

Implementation specific data access

File A1	File A2	File A3	File A4	File A5	File B1	File B2	File B3

Applications, i.e. the top layer in the above view, interact with the DTM Server using an agreed interface based on standard technology. This interface exposes the DTM in geodetic terms and completely hides all implementation details such as the raster in which data is stored, organisation of data, database engine used for data access, etc.

The DTM Server, in the middle layers, must conform to the agreed interface and deliver to application data items as requested. It is up to the implementation of the server how the DTM data is accessed, should it be located either in simple files or in a complex database system.

In this arrangement the implementation of the server can be changed in order to enhance its performance or to change the underlying terrain database. As far as the user is concerned, since the interface remains unchanged, there is no need to reflect upon these changes.

Supported data formats

Two data formats were identified for implementation of DTM Server by ERO, files containing GTOPO30 data (G1) and Vienna Agreement HCM data (H1 and H2).

G1 format

The original GTOPO30 files are too large for direct use. Therefore original files were split into a number of files each covering 10 * 10 degree area. An attribute indicating the position of each point (land/cold sea /warm sea /hot sea) was included into these files. The absolute position of data contained in the file is indicated by the file name, e.g. file **E010N50.10D** contains data for a region with south/west co-ordinate 010E00, 50N00. The type of file, G1, is indicated by the extension "10D". A set of G1 data covering whole European area is included on the COCOT 5 CD-ROM.

In mode G1 the DTM Server works with a set of files derived from the GTOPO30 database located in one subdirectory.

HCM data

The specification for DTM data in a 3 seconds raster was developed by the Vienna Agreement HCM (Harmonised Calculation Method) team. The DTM data in the HCM format is available in a number of European administrations.

H1 format

In mode H1 a set of HCM files is used which is located in subdirectories following the structure defined by the HCM is used. This set can be located in any subdirectory.

H2 format

In mode H2 a set of HCM files is used which is located in one subdirectory. This mode was introduced to relax the requirements of the HCM specification, which are unnecessary here.

Results

Implementation

The DTM Server was implemented as ActiveX server in a Windows 32 environment. The interface, OLDA2, was designed in a minimalist way in order to make its replication by users with proprietary DTM databases as easy as possible.

An advanced caching mechanism was used yielding a very good performance.

Applications

The use of the ActiveX technology makes the use of the DTM Server reasonably easy, and there is no problem to access DTM data e.g. from an Excel spreadsheet. A couple of simple graphic applications are included on COCOT 5 CD-ROM.

CTP2

A coverage calculation programme CTP2, as one of the pivotal elements of the Chester 97 process was enabled for use of the DTM Server. In accordance with FM24 deliberations this additional functionality is used to allow better interpretation of calculated results. Test points are calculated without using the DTM Server.

Conclusions

The results of the DTM Server implementation by ERO are reported. Details of the implementation and of data formats can be found on a COCOT 5 CD-ROM.

4 APPLICATION OF THE PROCEDURES OF CHESTER 97 AGREEMENT (CH 97)

4.1 Introduction

This section presents the experiences of a number of CEPT members in applying CH97. It indicates a number of topics which require further study and investigation.

Annex 1 to Section 4 contains a list of Administrations that have signed or acceded to the Chester 97 Multilateral Agreement for DVB-T.

4.2 Experience in co-ordination

4.2.1 Countries within co-ordination distance

The use of the co-ordination distances, given in Annex 1 of ST 61 and reproduced in the Chester Multilateral Agreement 97 is considered to be valid for DVB-T. This issue is being considered by the ITU and a Preliminary Draft New Recommendation (ITU-BR BT. 11/94) has been submitted for consideration through ITU-R SG 11.

4.2.2 Protection of a conversion

A number of administrations have sent out their co-ordination requests for new digital stations. In analysing the impact of these new digital stations it appears that the protection of future digital stations resulting from the conversion of an analogue station is far more restrictive than protection of the original analogue station. This is mainly because of the loss of receiving antenna discrimination in the digital television case.

4.2.3 Protection of new DVB-T stations

According to the CH97 rules, new DVB-T stations should be protected for the situation where all analogue stations have been converted to digital. This is a hypothetical case.

Coverage of a new DVB-T station in the current situation (where most analogue stations are not yet converted) is generally larger than for the all-digital case because of the difference in protection ratios. Thus part of the current digital coverage may be lost when an analogue station is converted, there could also be a loss of coverage when a new DVB-T station is co-ordinated.

4.2.4 The 0.3 dB rule

It appears that the increase of 0.3 dB in the usable field strength which should normally be accepted restricts the implementation of new digital stations to a very great extent. This requires that the nuisance field of the new digital station should be at least 13 dB below the reference usable field strength. Several administrations are bi-laterally looking for ways to use more relaxed (that is, larger) values of increase, especially when both countries are interested in an early introduction of DVB-T.

The level of calculated wanted field strength at a test point is sometimes much greater than the reference usable field strength. This applies to a point which is moved from the periphery of the coverage area to a national boundary. The higher level of wanted field strength at this point can provide flexibility in the application of the 0.3 dB rule. Such values are already included in the coverage results included in the COCOT 5 CD-ROM.

Actual values of interfering and wanted levels may be significantly different from those calculated using Rec. ITU-R P.370 as proposed in CH97, due to terrain. Therefore the application of the 0.3 dB rule should be used with care.

4.2.5 SFNs

SFN calculations are not fully covered by CH97. More investigation will be needed to assess in detail the impact of interference to an SFN.

The conversion of an analogue assignment to an SFN could require additional digital transmitter sites if the SFN is to cover an area greater than the original analogue coverage area. The best way to treat this is to consider it in two parts; a conversion of the analogue station and new digital stations using the same frequency.

4.2.6 Time scale for co-ordination

The volume of incoming co-ordination requests has caused difficulties for some administrations in giving a full response within the time scale given in Article 4.

It should be noted that according to the general principles given in Annex 2 of CH 97 "if co-ordination requests may have major implications on the development of DVB-T plans of other administrations, the requesting administration should inform the countries affected prior to sending out co-ordination requests."

4.2.7 Co-ordination of new analogue stations

The Stockholm Agreement does not provide a detailed method for assessing the compatibility of analogue television stations. Therefore there is scope for different administrations to interpret this Agreement somewhat differently from one another. Additionally, the Chester Agreement does not explicitly consider the compatibility of existing analogue services with new analogue television stations.

Therefore it is important that if a new analogue television station is introduced both of the following are considered:

i. the protection of existing analogue services

ii. the protection of the conversion to digital of existing analogue services.

The latter should be carried out in accordance with the Chester Agreement, (Annex 4 Section A). In the past agreements have been made between administrations on how the former assessment is to be carried out; for example, by consideration of precision offset usage and by use of different permitted increases of interference.

It is important to realise, however, that it is not possible, *a priori*, to determine whether satisfying one of the above points automatically satisfies the other and thus both must be checked.

4.3 Receiver issues

The use of VHF bands for DVB-T is regarded as important by some broadcasters who consider that the extra cost for a UHF/VHF receiver compared to a UHF only receiver is small and may completely disappear with the emerging zero IF technology.

Before co-ordination it is necessary to make preliminary national plans. For these national plans, in absence of consumer receivers, assumptions about receiver performance have been made in the planning which may later turn out to be incorrect.

This is especially valid for the noise figure. A figure of 7 dB has been agreed in CH97. If the value increases a loss of coverage will result as power cannot be increased due to co-ordination issues.

Some European countries are planning to use 7 MHz raster in the VHF band, therefore, the implementation of receivers capable of operating in 7 and 8 MHz channels is required.

Image channel rejection of 50 dB, as indicated by EACEM, may be better than originally assumed.

4.4 Planning criteria

4.4.1 Minimum field strength and implementation margin

The minimum field strength values for DVB-T are given in the tables in Annex 1 of the Chester Agreement for a set of nominal C/N values. It is necessary to add the implementation margin, nominally 3 dB, to the values for the system variants given in Table A1.1 of Annex 1 and use the resultant value when interpolating between the nominal C/N values shown in Tables A1.5 to A1.7 and A1.11 to A1.16.

4.4.2 Implementation Margin

The values given in Table A.1.1 of Annex 1 to CH97 were derived by calculations based on theoretical considerations. It is to be expected that practical receiver implementations will require minimum C/N values which are slightly higher than the values shown in Table A.1.1. Tests on practical receivers have confirmed that this is the case. The difference between the theoretical and practical values is called the "implementation margin".

4.4.3 Protection criteria for television

Only some protection ratio values for adjacent channels are given in CH97. The absence of a complete set of values may make co-ordination difficult in border areas as there is a risk of lack of protection or of unnecessary restrictions.

4.4.4 Spectrum Mask

Spectrum masks for radio regulatory purposes have been submitted to the ITU. These masks are more relaxed than those given in CH 97. The spectrum masks contained in CH 97 are intended to define the out-of-band characteristic for DVB-T transmitters to be used in network planning and international co-ordination in accordance with CH 97. For DVB-T stations which are not subject to co-ordination and where the level of out-of-band emission is not critical with the respect to television or other services the relaxed spectrum masks may be sufficient.

4.4.5 Protection criteria for other services

Protection criteria for other services are not always available or are based on assumptions rather than measurements. Therefore investigations to complete this information should be monitored carefully as protection of other services can already lead to large power restrictions for new digital stations.

According to CH97, when a new digital television station is being co-ordinated interference from existing stations is not considered when calculating the protection of other services. This leads to an over-estimate of the potential impact of the new digital station. When interference from existing stations is taken into account in bi-lateral negotiations, it may make the implementation of new digital stations easier.

4.5 Practical experience

4.5.1 Tests

Although tests have proved that adjacent channel (either analogue-and-digital or digital-and-digital) operation can be satisfactory at the transmitting station although additional filtration will be needed in the analogue-and-digital case and may be needed in the digital-and-digital case. Investigations will be needed to demonstrate that consumer receivers and relay stations can also operate with digital and analogue services adjacent channel.

4.5.2 Frequency Offset

In order to protect PAL I NICAM or SECAM L AM sound, a positive frequency offset of 166.7 kHz for the digital transmitter or negative frequency offset for the analogue transmitter is necessary for upper adjacent channel operation of the digital service.

4.5.3 System variants

In practice the C/N of the system variant actually chosen for use by a given country could be different from that of the reference system (20 dB) agreed in CH97. In this case the actual digital coverage could be different from that obtained for the characteristics of the reference system.

4.6 Prediction methods

4.6.1 Rec. 370

There are problems with the definition of land/sea propagation in accordance with Rec. ITU-R P.370. Further investigation is necessary. The results of the calculation of the location of some test points representing the coverage areas of analogue stations may depend upon the precision of the coastline and the calculation method.

4.6.2 Detailed Coverage Predictions

For the solution of difficult co-ordination problems more detailed coverage prediction methods, probably based on terrain data banks, should be very helpful (see also Section 3.8).

4.7 Location of Country boundary test points

Country boundary test points have been provided by ERO.

Concerns were expressed over the extension of country boundaries into territorial water in the selection of these tests points. It seems that this could lead to overprotection in some cases.

4.8 Availability of Information and Software

4.8.1 Databases

The time scales as agreed in CH97 for the provision of information on transmitter data, test points and reference usable field strengths may cause problems for early co-ordinations.

In a number of cases it is arguable if the formal ST61 station characteristics or the real characteristics of a station should be included in the ERO database. Administrations have to decide this for each individual case.

Section 5 deals with the need for additional analogue transmitter data and for corrections to some of the data already submitted. The calculation of analogue coverage areas will not be correct until after the transmitter data have been completed and corrected.

4.8.2 Software

A list of software for data management and compatibility analysis is provided in Annex 3 to Section 4.

4.8.3 Calculation of Reference Interference Situation

Some detailed proposals for improvement of the calculation of the reference interference situation have been identified in Section 3 this report.

Annex 1 to Section 4: List of Administrations that have signed or acceded to Chester 97 Multilateral Agreement for DVB-T

(a) CEPT administrations that signed on 25 July 1997 (Agreement entered into force on 25 September 1997)

	Austria		Luxembourg
	Belgium		Moldova
	Bulgaria		Netherlands
*	Croatia		Norway
	Czech Republic		Poland
	Denmark		Portugal
	Estonia		Romania
	Finland		Russian Federation
	France		Slovak Republic
	Germany	*	Slovenia
*	Greece		Spain
*	Hungary		Sweden
	Ireland		Switzerland
	Italy		Ukraine
	Latvia		United Kingdom
	Lithuania		Vatican City State

* subject to ratification or confirmation (not yet received).

(b) CEPT administrations acceding to Chester 97 Agreement after 25 July 1997

Turkey	w.e.f. 31 October 1997
Malta	w.e.f. 6 January 1998

(c) CEPT administrations not signing on 25 July 1997 (i.e. not attending) and yet to accede

Albania	Liechtenstein
Andorra	Monaco
Bosnia and Herzegovina	San Marino
Cyprus	The Former Yugoslav Republic of Macedonia
Iceland	

(d) Administrations in ITU European Broadcasting Area not covered by (a), (b) or (c) notified of Chester 97 Agreement (excluding Libya and Iraq)

Algeria	Morocco
Belarus	Saudi Arabia
Egypt	Yugoslavia
Israel	Syria
Jordan	Tunisia
Lebanon	

(e) Administrations bordering countries in (d) and not already covered in (a), (b) or (c) notified of Chester 97 Agreement (excluding North Korea)

Armenia	Mali
Azerbaijan	Mauritania
Bahrain	Mongolia
Chad	Niger
China	Oman
Georgia*	Qatar
Iran	Sudan
Kazakhstan	United Arab Emirates
Kuwait	Yemen

* expressed interest in acceding to Chester 97 Agreement

Annex 2 to Section 4: Software for data management and compatibility analysis

Main modules

N°	REFERENCE	WHAT to do	WHO will do	REMARK
1	CH97 – Res 1	Facilitate Data collection for broadcasting stations and stations of other services. Verification of data Data management for transmitter information	ERO	Soft: *cocedit, cockquick, cocutils*
2	CH97 - Annex 1 Item 6.2	a) Calculation of the location of the test points and the initial value of Usable Field Strength b) Mixed digital-and-analogue reference scenario c) All digital scenario	EBU and ERO	a) Calculation done by EBU and distributed by ERO. Also included in ERO modules for individual stations b) Main features done c) Main features done CTP 2 + EBU Calc
3	CH97 - Res 1	Data management for test points of stations	ERO	EROsoft: *test point BndryTP*
4	Ch97 – Annex 1 Item 6.1.2	Generation of country boundary test points	ERO	Test points available on CD ROM COCOT 5
5	CH97 - Res 1	Data management for boundary test points	ERO	Soft: *BndryTP*
6	CH97 - Annex 7	Is a new station within the co-ordination distance?	ERO	Implicit in soft CTP *2* (no interferer in the list) Explicit to be developed
7	CH97 - Annex 4 Section A	Compatibility analysis for DVB-T interfered with by analogue Television	EBU	Tools are available in EROsoft: *signal,* CTP 2 Composite software is still needed
8	CH97 - Annex 4 Section B	Compatibility analysis for Analogue television interfered with by DVB-T	EBU	CTP 2
9	CH97 - Annex 4 Section C	Compatibility analysis for DVB-T interfered with by DVB-T	EBU	CTP 2
10	CH97 - Annex 4 Section D	Compatibility analysis for services other than broadcasting interfered with by DVB-T	EBU	
11	CH97 - Annex 4 Section E	Compatibility analysis for DVB-T interfered with by services other than broadcasting	EBU	
12	CH97 - Annex 6	Analogue to digital conversion	EBU	CTP2 + DeltaCTP
13	WI95 with CH97 – Annex 1 item 4.5	Compatibility analysis for DVB-T interfered with by T-DAB	EBU	
14	WI95 with CH97 – Annex 1 item 4.6	Compatibility analysis for T-DAB interfered with by DVB-T	EBU	
15	ST61 and CH97 Annex	Compatibility analysis for analogue television interfered with by analogue television	EBU	Part of item N° 2 CTP 2
16	ITU-R	Compatibility analysis for analogue television interfered with by services other than broadcasting	EBU	Lower Priority
17	ITU-R	Compatibility analysis for services other than broadcasting interfered with by analogue television	EBU	Lower Priority
18	CH97 – Annex 1 Item 6.2	Calculation of points indicating the interference limited coverage contour for a DVB-T station	EBU ERO	EROSoft: *CTP2*
19	CH97 – Annex 1 Item 6.2	Calculation of points indicating the interference limited coverage contour for an analogue television station	EBU ERO	Part of item N° 2 EROsoft: *CTP2*

Independent modules

N°	REFERENCE	WHAT to do	WHO will do	REMARK
30	CH97 - Annex 1 Section 2	Rec. ITU-R P. 370 propagation model	EBU	Available on EBU ftp server. Used by ERO in COM modules which are available on COCOT 5 *Cocr370.dll, Propag*
31	ITU-R Rec. 370	Generation of higher resolution coastline for calculation of land/sea propagation	EBU	
32	CH97 and ITU-R	Determination of the relevant protection ratio	ERO EBU	EROSoft: *signal* Included in module *CocSignal.dll*
33	ERC/EBU report	Combination of nuisance field strengths	ERO EBU	Soft: *cocutils* Available for special cases
34	To be developed within B/TDP	Terrain data based propagation model	EBU	Longer timescale
35	To be developed within the successor of B/TVP	Combination of field strengths (wanted and unwanted) in an SFN	EBU	Available for special cases

Further programmes for planning

N°	REFERENCE	WHAT to do	WHO will do	REMARK
40	To be developed	Calculation of the coverage area for an analogue station on pixel basis	EBU	Longer timescale
41	To be developed	Calculation of the coverage area for a DVB-T station on pixel basis	EBU	Longer timescale
42	To be developed	Calculation of the coverage area for an SFN on pixel basis	EBU	Longer timescale
43	To be developed	Spectrum analysis for identification of channels potentially available in individual areas	EBU	
44	To be developed	Assistance with characteristics of stations	EBU	

The specific programs can be found on ERO CD-ROM or ERO FTP server.

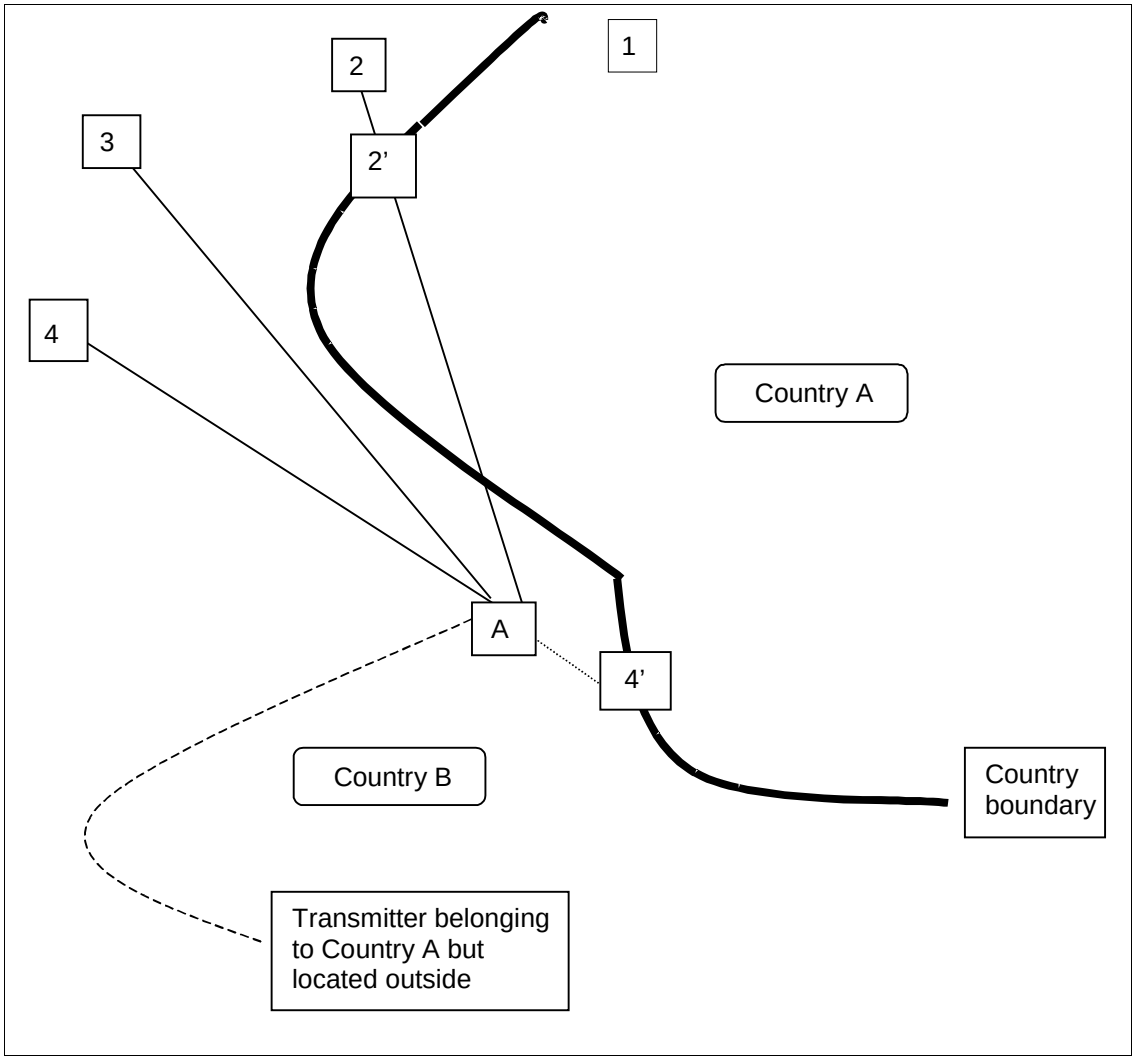
Annex 3 to Section 4: Country boundary considerations

In all cases where a station was not considered to be low-power, a check was made to see if the transmitter site was inside any of the country boundaries for the
responsible administration. Two cases may be distinguished:

- where the transmitter site is inside a relevant boundary;
- where the transmitter site is outside all of the boundaries for the relevant administration.

In the first of these cases, the location of each test point is examined to determine if it is outside the same boundary. If it is outside, then the location is moved back to the boundary and new values of ufs and wanted field strength for that location are determined. Otherwise, the test point is accepted and in this case the ufs and the wanted field strength are identical. (This process is applied to all test points).

In the second of the two cases identified above, no additional checks are made on the test point locations. Clearly, this process can lead to some test points being left inside some other country or in the sea outside all country boundaries. A new proposal is given below. However, it is first necessary to check to see if the transmitter site is really intended to be outside the country boundaries as it is quite clear that this is not always the case.



Test point 1 is inside country A and is left unchanged.

Test point 2 moved to 2'along line towards transmitter A.

Test point 3 is deleted as no point on the line through 3 and transmitter A touches the boundary of country A.

Test point 4 moved to 4'along line through Transmitter A, and extended beyond it.

5 IMPLEMENTATION OF CH97 RESOLUTIONS

5.1 Television station data collection

As of 31.05.99, television station data had been received from 36 CEPT administrations.

Data for a further 6 CEPT administrations were derived by the ERO from ST61 data. These 6 administrations were:

Albania
Vatican City State
Cyprus
Monaco
San Marino
Former Yugoslav Republic of Macedonia

It was noted that no television transmitting station is registered for Liechtenstein.

Data for 12 countries neighbouring CEPT countries were derived by the ERO from ST61 data. These additional countries were:

Algeria
Bielorussia
Egypt
Iraq
Israel
Jordan
Lebanon
Libya
Morocco
Syria
Tunisia
Yugoslavia

New data files were received in October 1999 from:

Germany
Italy
Russian
Switzerland
Ukraine

5.2 Differences of opinion between administrations concerning the data for television stations

5.2.1 Background

In some cases, the data supplied by a given administration have not been agreed by one or more neighbouring administrations. It is, however, necessary to have agreed data for the stations to be included in a coverage analysis.

5.2.2 Action proposed to assist in the resolution of differences of opinion

It must be stressed that the course of action proposed here is intended only to produce data for a coverage analysis for the reference situation. It does not imply that any disputed stations included in such a coverage analysis can be considered as co-ordinated.

It is proposed to carry out two coverage analyses in 1999. The first of these analyses will include the data for all supplied stations, regardless of whether there are differences of opinion or not. A further analysis carried out towards the end of 1999, will include only stations which are not the subject of any dispute.

The time table proposed for the process of data collection, analysis and resolution of differences was:

Supply of corrected data to ERO:	28.2.99
Distribution of data by ERO: (data will also be placed on the ftp server as they arrive)	12.3.99
Notification of a difference of opinion to be sent by a concerned administration **to** the relevant administration with a **copy** to the ERO by:	31.5.99
Results of coverage analyses to be supplied by EBU to ERO by:	28.5.99
Results of coverage analyses to be distributed by ERO by:	18.6.99
Administrations to notify **all** differences of opinion **to** the relevant administrations, with a **copy** to the ERO by: (all other differences will be assumed to have been resolved)	30.9.99
Calculation of reference situation including only stations for which there are no differences of opinion to be sent by EBU to ERO by:	29.10.99
Results of reference situation calculations to be distributed by ERO by:	19.11.99

However, it was found that there was a large number of data corrections which were needed in order to make a meaningful set of coverage analysis calculations. This process included the supply of corrected data from some administrations. As a result, as set of corrected data files was supplied by the EBU to the ERO and placed by the latter on the ERO ftp server on 21 July 1999. In the same time frame, the results of the coverage area calculations was supplied by the EBU and distributed by the ERO.

It was note that there was some duplication of station data on the file from the Italian administration and at the FM 24 meeting in Bern (27 to 29 September 1999), it was confirmed that theses duplications involved some 25 % of the stations on the Italian data file. It was thus decided to request a new Italian data file and repeat part of the data collection and analysis. At the same time, some stations which had been omitted from some of the files of 21 July would be re-inserted.

The revised time table for the remainder of the data collection and analysis is:

Corrected Italian data file to be supplied to the ERO by:	31.10.99
Data on the ftp server to be updated by ERO by	14.11.99
Results of coverage analyses to be supplied by EBU to ERO by:	16.12.99

Results of coverage analyses to be distributed by ERO by:	7. 1.00
Administrations to notify **all** differences of opinion **to** the relevant administrations, with a **copy** to the ERO by: (all other differences will be assumed to have been resolved)	30. 3.00
Calculation of reference situation including only stations for which there are no differences of opinion to be sent by EBU to ERO by:	29. 4.00
Results of reference situation calculations to be distributed by ERO by:	19. 5.00

It must be noted that administrations are required to re-notify all differences of opinion to the ERO. Because of changes of the reference number for some stations, any old notifications of differences of opinion are no longer valid.

5.2.3 Agreements between administrations concerning test point data

Any agreements reached between administrations concerning test point locations and field strength values which have been derived by other calculation methods are to be sent to the ERO for inclusion as an Annex to the reference situation.

5.3 Supply of data for DVB-T stations

Data for DVB-T stations should be supplied to the ERO in electronic form using the data format given in section 3.6 of Annex 1 to Section 5.

5.4 ITU-BR forms of notice

Annex 2 to Section 5 gives information about a programme produced by the ERO which produces station data in the paper formats used by the ITU-BR.

Annex 1 to Section 5: Generator of ITU Forms of Notice

Introduction

The purpose of this document is to inform about the software programme developed by ERO that is designed to help interfacing between Chester 97 and ITU registers.

Background

A close relationship exists, between Chester 97 data kept in COCOT database, and Stockholm 61 data maintained in the ITU register. In order to ease the interaction between the two a number of steps are being taken. While the standard COCOT software provides for export of ST61 data into the COCOT format, the opposite direction was, so far, not supported. Following a number of requests from Chester process participants to address this aspect a piece of software, **ITUForm.exe**, was developed in ERO.

Description of the programme

The programme **ITUForm.exe** is a simple stand-alone programme which generates files which conform to the specification contained in the BR Circular-letter CR/99 of 27 July 1998 "Forms of notice and formats for electronic notification of VHF/UHF television and VHF sound broadcasting assignments". Data can be entered into this programme either manually, from the COCOT database, from the TerRaSys SGML file or by combination thereof.

Programme functions

Basic functions of the programme are:

Reading COCOT database

The programme can browse the TVA1 file and loads data from a selected record. Relevant data items are displayed in a form. Since a user can define the extent of data to be read for each individual record a combination of data from several records is also possible.

Reading the TerRaSys SGML file

A basic navigation in and a structured view on a TerRaSys SGML file are supported. Selected NOTICE section can be loaded into the form.

Manual edit

The form is designed to allow interactive editing of loaded data to the usual extent.

Generation of CR99 Annex2 forms

The CR99 Annex2 forms are generated into Word tables (version 2/6/95/97 compatible). The output document is suitable for further editing in Word.

Amend of TerRaSys SGML file

Data from the form can be stored in a new TerRaSys file, added as a new section to an existing file or amend a selected section in this file.

It is important to note that the file generated, as far as the specification of the TerRaSys SGML file is concerned, is neither complete, nor checked for consistency. The programme is designed to help the data conversion and not intended as an SGML tool.

Availability

The programme is posted on the ERO FTP server and is included on COCOT 5 CD-ROM.

Conclusions

A utility for data conversion from the COCOT database was developed in ERO. A brief description hereof was given in this document. It is believed that the tool will contribute to the Chester 97 follow-up process.

6 INFORMATION ON DVB-T IMPLEMENTATION IN EUROPE

6.1 Introduction

Resolves 1 of Resolution 2 of CH97 asks "that the CEPT should follow the growth of DVB-T and arrange a preparatory planning meeting as soon as practicable when a significant degree of penetration has been reached".

In order to inform WG FM on the implementation of DVB-T FM-PT24 have produced an overview. It consists of a table with figures on frequencies, transmitters and receivers. Additional information is provided in the text following the table in the form of short notes for each country.

The table and the notes are updated at each FM-PT24 meeting.

A significant number of countries has now made a commitment to DVB-T with pilot or test transmissions taking place and planning studies under way for nation-wide coverages. Two countries have already launched services whilst others have announced firm launch dates, or are close to doing so – see Figure 1.

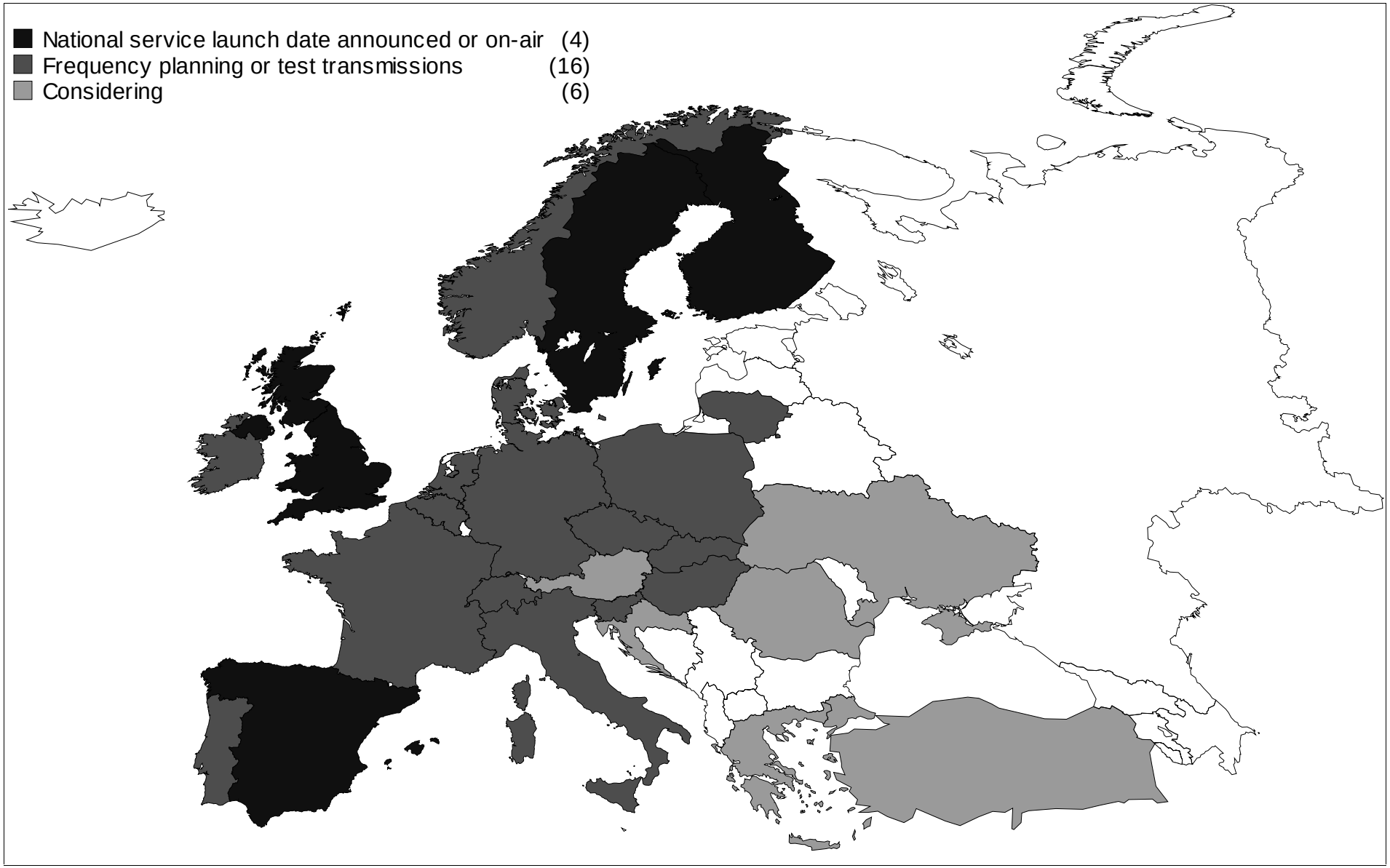


Figure 1: DVB-T the picture in Europe (November'99)

6.2 DVB-T implementation progress overview

6.2.1 Introductory notes

This overview contains a table presenting the actual situation in the individual countries.

In the table the columns under the heading “Number of transmitters...” should be understood as the number of physical transmitters (transmitter equipment) already in operation or expected to start within the next year (the number given could be more than 1 per transmitting station).

The columns under the heading “Percentage of households that can receive...” should be interpreted as follows:

Max. 1 MPX: Percentage of the total number of households in the country that can, or are expected to, receive at least one multiplex in the near future.

Max. 2 MPX: Percentage of the total number of households in the country that can, or are expected to, receive at least two multiplexes in the near future.

Max. 3 MPX: Percentage of the total number of households in the country that can, or are expected to, receive at least three multiplexes in the near future - and so on.

DVB-T implementation progress overview

Country	Co-ordination in progress	Number of transmitters (not number of stations)				Percentage of households that can already, or are expected in the near future to, receive the quoted number of multiplexes						Number of DVB-T receivers sold or rented	Date of last update
		Total at end of 1 year		In operation									
(ITU Code)	(yes / no)	e.r.p. < 1kW	e.r.p. ≥ 1kW	e.r.p. < 1kW	e.r.p. ≥ 1kW	1 MPX	2 MPX	3 MPX	4 MPX	5 MPX	6 MPX or more		
AUT	No												28-09-99
BEL	Yes		2			12	12						28-09-99
CZE	Yes		5			10							28-09-99
D	Yes	6(1)	52(1)	3(1)	12(1)								28-09-99
DNK	Yes	1	2			35							28-09-99
E	Yes												
F	Yes	3	6	1	3								28-09-99
FIN	Yes		15		4	40						~ 30	28-09-99
G	Yes	226	266	128	250	90	89	88	86	75	70	400,000	28-09-99
HOL	Yes	3	25	0	2	18							28-09-99
HRV	No	1	1			20							28-09-99
I	No	8		1	2	10						150	28-09-99
IRL	Yes												28-09-99
NOR	Yes		6		1(1)	25	22						28-09-99
POL	Yes												28-09-99
LTU	Yes												
POR	Yes			1(1)	2(1)								28-09-99
S	Yes	10-20	80-90	6	45	50	50	50	50			~1,000	28-09-99
SUI	No			1(1)	1(1)								28-09-99
SVK	No				1	10							28-09-99
TUR	No												28-09-99

(1) Test transmissions

6.2.2 Additional notes for individual countries:

Situation reported to PT24 as of last quarter 1999. It is to be noted that the type of information contained below can change rapidly.

Austria (28-09-99)

Within the Austrian Broadcasting Corporation (ORF) initial considerations have started with respect to DVB-T, but a decision concerning future plans for DVB-T has yet to be taken.

On the other hand the Austrian Government announced a new law for private analogue TV-broadcasting and for this purpose the so-called "third channels" of ST61 shall be used. Therefore these channels are not available for DVB-T in the near future.

Belgium (28-09-99)

The planning and frequency co-ordination for DVB-T is going on. As there is a very high cable penetration and only a few outdoor receiving aerials, Belgium is planning for portable reception and will use SFN networks with the 8K system and the highest guard interval.

In the course of 2000 a DVB-T station will be put into operation in the Brussels area. Two multiplexes will be radiated.

The availability of (cheap) receivers with good behaviour in large SFN networks will be a crucial factor in the development of DVB-T in Belgium.

Croatia (28-09-99)

Experimental operation of DVB-T transmitters should begin in 2000. The objective is to test different modes of operation and in particular the SFN gap fillers concept in current analogue environment. Initial considerations showed that 6 multiplexes will be needed in the future all digital era. Presently, there are no channels available to obtain national wide digital coverage. The official decision regarding introduction of DVB-T and licensing policy has not yet been approved by the government.

Czech Republic (28-09-99)

Licences for two experimental projects were issued in 1999 (one for an SFN with 3 transmitters and the second for an SFN with 2 transmitters), both of them in the Prague region.

The planning of DVB-T networks and frequency co-ordination is in progress.

Provisional DVB-T forum has been established. The concept of DVB-T introduction has been developed. Work on the implied changes in legislation is in progress.

Denmark (28-09-99)

It has been agreed by the parliament that the international co-ordination of 4 DVB-T multiplexes should be initiated. The co-ordination is in progress.

The 4 nation-wide DVB-T multiplexes will provide for a regional structure.

Test transmissions are scheduled to start in November 1999

Finland (28-09-99)

The Ministry of Transportation and Communications granted the licenses for 3 multiplexes in Finland 23.6.1999. One multiplex was given to the Finnish Broadcasting Company (Yleisradio) and the other two to commercial companies. The licenses were given for 10 years beginning from 1.9.2000. All licensed services must be in operation before 1.9.2001. At the same time it was preliminary decided that the analogue TV-services will be closed at the end of year 2006.

Test transmissions are going on in four major cities in Finland including SFN-tests in Helsinki area. The official launch of DVB-T services is targeted to September 2000 when the fixed reception coverage is planned to be 50% of population.

France (28-09-99)

TDF has implemented an experimental transmission network to cover Brittany using two high power transmitters and SFN relays. This experimental stage started with 200 receivers. Its aim is to study the future digital service aspects.
A study has been made for the government and it is proposed to plan six networks for coverage of 80% of French population. This study gives some indication of the specification of a future DTT receiver for France. Manufacturers are working on the future DTT receivers.
In July, the government has published a white book on digital broadcasting (sound and television) and a public consultation has been opened on a government website. The public was invited to give comments on the content of the document up to 30 September 1999. The comments will be taking into account for the preparation of the introduction of digital broadcasting.

Regarding the co-ordination procedures, the actions are in an advanced stage with the UK, Spain, Netherlands, and beginning with Belgium and Luxembourg.

The ANFR has ordered a study on the compatibility between military tactical relays and TV service (analogue and digital). The results show that the compatibility between the two services is quite difficult to be obtained in general. However, the studies of many cases of sharing scenarios indicate that, on a case by case basis, it is possible to view a solution.

Germany (28-09-99)

A common understanding has been achieved among all-important organisations to strengthen the efforts for an early DVB-T introduction on a nation-wide scale. It is foreseen that analogue transmission will cease in about 2010 (this date will be checked in 2003), provided that there has been a successful revision of the Stockholm Agreement.

The long-term aim is to ensure portable indoor reception and possibly mobile reception for the whole population. It is estimated that without consideration of these fundamental criteria the DVB-T introduction wouldn't be successful on the market.

First of all, the regular DVB-T transmissions will start with about three multiplexes in big cities and areas with high density of population. Later, it will be extended to the whole country step by step. Within the transition period, of one to two years, the programme distribution of the analogue and the digital services will be in parallel in the areas concerned. After this transition period all analogue distribution has to end in these areas.

The all-digital scenario based on a nation-wide SFN planning for all regions, using an 8 k system; 16 QAM-2/3 is favoured.

Before starting the official DVB-T introduction a representative number of pilot projects are necessary to gain experiences from field trials. At present two larger field trials (scheduled to start in 1999) are being prepared in Northern Germany by two to three multiplexes, MFN's and Mini-SFN's, 36 transmitters and in the extended area of Berlin by mainly four multiplexes, SFN's, 15 transmitters. All transmissions will be carried out in Band IV/V. The investigations will be concentrated to all important technical aspects (e.g. mobile and portable indoor reception conditions) as well as to market analysis and consumer acceptance. In addition, some other test operations will take place, mainly in Munich and in Cologne.

Italy (28-09-99)

A few days after the Chester meeting (July 1997), the Italian Government passed a law L249/97) which established that a new frequency assignment plan, mainly intended for analogue television broadcasting, was to be issued. According to this law (L249/97), the final plan approved by the Telecommunication Authority on 30 August 1998, reserved an amount of frequency resources for the introduction of the new digital services on terrestrial networks.

In particular, after a transition period, the following channels will be addressed to DVB-T service:

1) UHF, Band V: channels 66, 67 and 68.
2) VHF, Band III: channel 9 (resulting from the conversion of the previous Italian channel raster in Band III into the European channel raster).

Moreover, the Italian Parliament is discussing a law which should favour the transition from analogue to digital terrestrial television in the next decade.

Recently a National Committee has been set up by the Telecommunication Authority in order to define the steps to be undertaken to foster the launch of DVB-T in Italy. The work is aimed at investigating the following points:

1) Quality requirements.
2) Planning issues.
3) Economical aspects.

All the Italian broadcasters are involved in accomplishing this task.

Under the co-ordination of the Ministry of Communications, a number of pre-operating activities are being undertaken by the public and the main private Italian broadcaster.

From the side of RAI, an experimental plan has been presented to the Italian Ministry in spring 1998. This plan will last four years and will cover about 60% of Italian population, in line with the plans of other European countries.

As well as RAI, the main private broadcaster (MEDIASET) is strongly committed in conducing technical experiments on DVB-T systems to accelerate the introduction of digital terrestrial television.

MEDIASET has started the planned MFN and SFN field tests. The results will be made available to the public domain.

TELEPIU started in June 1999 a DVB-T field-test converting to digital a small transmitter near Naples. This transmitter was operating for an analogue pay-TV network. TELEPIU supplied IRDs to the customers (around 150) replacing their analogue set-top-boxes.

Ireland (07-12-99)

A consultation document on the Future Delivery of Television Services in Ireland was issued. The consultation process resulted in a wide variety of comments from industry and individuals. The ODTR subsequently published its proposals in a document entitled “The Future of TV Transmission in Ireland – The Way Forward”. Six multiplexes were identified as achievable with the possibility of some further local/regional multiplexes.

The Minister for Arts, Heritage, Gaeltacht and the Islands announced that the Government had decided that six multiplexes would be established giving national coverage of approximately 30 television channels. Following the recent publication of the Broadcasting Bill, the key concern now is the interpretation, enactment and implementation of the Bill to facilitate the introduction of DTT by September 2000. A transmission company - Digico – will be established which will be no more than 40% owned by RTE with a strategic partner sought by Government for the remaining share. Delays in the enactment of the Bill may result in a delay to the establishment of Digico. As a result DTT may not begin until 2001.

Whilst the use of interactivity within Digital Television on all platforms is of great interest to Ireland, the ODTR has not assigned any spectrum for the so called “In-Band” DVB-T return channel.

No decisions have been taken on the timing of analogue shutdown. However a date of 2015 has been suggested.

Background info: Further information is available from the ODTR web site: www.odtr.ie

Co-ordination discussions are being held with the UK. Some or all of the 6 multiplexes at six of the main Irish stations and a number of primary transposer stations have already been co-ordinated with the UK. Co-ordination of three of these stations has also been obtained with France. Agreement in principle has been reached for some multiplexes at a further two main stations. A second phase of planning has begun for secondary transposer stations.

Lithuania (28-09-99)

The planning and frequency co-ordination for DVB-T is going on. For transitional period 4 national multiplexes were planned and their international co-ordination was initiated in August 1998. They will work in parallel with analogue networks and will repeat their programmes.

For the transitional period networks are planned for fixed reception and will use SFN and MFN networks with the 8 K system.

The government made decision to start DVB-T transmissions of the national television channel. Transmissions are planned to start by the end of 2000 in the two largest cities: Vilnius and Kaunas.

Netherlands (28-09-99)

In June 1999, the former DVB-T co-ordination requests have been modified as a result of bilateral meetings and as a result of research which has been done on the use of SFN´s.

In the course of the year 2000, DVB-T services are expected to start with a pilot project in the surrounding of Amsterdam, Haarlem and Hilversum.

Most probably frequencies for multiplex will be reserved for public service broadcasting and the other the co-ordinated frequencies will be auctioned for DVB-T usage at the end of the year 2000, after which an introduction in the whole Randstad area is foreseen. The households in the Randstad could receive five multiplexes then. The television market in the Netherlands requires that DVB-T is directed to indoor reception with simple antennas and that a package of at least twenty programmes is offered.

Measurements on interference by DVB-T to cable television showed that some households with a connection to a cable-network could be interfered with, unless correctly engineered.

Norway (28-09-1999)

The basic frequency planning for three multiplexes with national coverage is finalised and a co-ordination request was initiated in May 1999.
When DTT will be officially launched to the public there will be frequencies for the distribution of two multiplexes. A period of one to two years is needed for the changing of frequencies for many transposers in the analogue networks before the third DTT multiplex can be introduced.

The network planning is mainly based on multi-frequency networks (MFN), but there will be some single-frequency networks (SFN) used for limited areas. Both MFNs and SFNs are based on the 8 K mode.

Introduction of more multiplexes can not be done before the channels 61-69 have been freed-up for broadcasting services, or the shutdown of analogue services in the UHF channels has begun. There are so far no real plans for this process.
Norkring, the main Norwegian network operator agency, has been awarded a licence for starting DTT transmissions of two multiplexes in Oslo and Bergen from the late autumn 1999. This will give DTT coverage to more than one million people in these areas, with totally 6 transmitters.

Poland (28-09-99)

A Polish DVB Platform was established on May 1997 to discuss broadcasting needs, technical questions and the issue of regulation.

The Polish DVB-T plan was developed very recently. It consists of two multiplexes on 56 existing sites. The plan has been based on the assumption that there will be no other sharing services in the frequency bands used. Co-ordination of first two MFN multiplexes has just started.

The Government has not yet made any decision regarding how to introduce DVB-T.

Portugal (28-09-99)

The Portuguese regulatory body (ICP) has prepared a strategic plan for the introduction of DVB-T in Portugal and an official approval was received in Spring 1998.

As a result of co-ordination between Portugal and Spain a bilateral plan was agreed, being composed of five coverages for Portugal (three on a national level above channel 59, one on a regional level and one on a local level).

Meanwhile a document summarising possible strategies for the introduction of DVB-T was prepared and based on it the Portuguese Government decided to open a process of public consultation, during last August and September 1998. Following several answers received a balanced strategic plan was produced and a consensus official approval is expected next year so as to become the basis for the launching of an international tender during 2000.

The experimental DVB-T network implemented in the Lisbon area by the Portuguese network operator Portugal Telecom is in operation since 2 June 1998. The main characteristics of this network considered by the manufacturers as the first worldwide
successful SFN are:

- 3 transmitters with powers of 2 kW, 1 kW and 500 W;
- SFN 8K system channel 64 (64 QAM, 2/3 code rate, ¼ guard interval)
- Broadcasting of 4 television programs (simulcast with the 4 existing analogue programs)
- Data broadcasting for test purposes;
- Sound broadcasting for test purposes.

The main transmitter (2 kW) is located in Lisbon and the other two at distances of 30 km (1 kW) and 9 km (500 W). It has been possible until now to observe successful demonstration of fixed and portable reception, besides the development of field trials and implementation studies.

Romania (28-09-99)

Any decision about how to introduce DVB-T has not made yet by the National Agency for Communications and Informatics.

The Romania DVB-T plan is intended to be developed in the next years.

Also the pilot project for test transmissions may be a subject for next year.

Slovakia (28-09-99)

In 1999, the PTT Research Institute (VUS) is preparing the frequency plan of DVB-T network for one multiplex. The proposal will be finished in November 99. Also a strategy for DVB-T implementation is being prepared in VUS and a preliminary report was delivered to the Governmental Council for Mass-media and the Ministry of Transport, Posts and Telecommunications. The comments and opinion are expected in 3 months.

On 1st of October the Slovak Telecom is starting a test transmission in the capital of Slovakia: Bratislava. Three programmes in 1 multiplex will be provided on channel 50 with 1 kW ERP. The experiment was prepared by the Slovak Telecom in co-operation with Council of the Slovak Republic for Radio and TV Broadcasting, PTT Research Institute, Ministry of Transport, Posts and Telecommunications, Telecommunications Office, programme providers and manufacturers.

Slovenia (4-11-98)

The frequency plan for DVB-T is prepared and co-ordination is going to begin in January 2000. A study has been made and it is proposed to plan 6 multiplexes in the 470-862 MHz band. After the analogue networks will cease the following usage of the multiplexes is planned:
one national SFN for coverage 95% of the population;
three national networks consisted of a mixture of MFNs and regional SFNs for coverage of at least 80%;
two MFNs or SFNs are planned in every regional area for regional programmes;
and some local transmitters.

For both MFNs and SFNs using an 8 k system is favoured. The long-term aim is to transfer as many MFN networks as possible to SFNs and to ensure portable indoor and possibly mobile reception for the whole population.
No decisions have been taken on the timing of analogue shutdown.
The legislation concerning DVB-T is planned to be prepared in 2000.

The introduction of DVB-T will probably be possible in 2001. DVB-T test transmissions planned for 1999 are going to begin 2000 and will cover capital of Slovenia - Ljubljana with its surroundings with medium power transmitters on channel 37. The service zone of the channel 37 SFN network is planned to be expanded to the whole of Slovenia with regard to the co-ordination process.
This action must go together with re-planning of the remaining terrestrial chains. We are therefore looking forward to an all-European planning conference for revision of the ST61 plan.

Spain

The Spanish Administration is believed to be at the point of issuing DTT regulations. The networks are likely to include national, regional and local coverage using SFNs for national reach and multiple SFNs for the regional areas. Regulators have been lobbied by broadcasters to accept their views that there is no role for free-to-air programming in DTT.

The plans are expected to require setting up networks by the end of 1998, which is a very aggressive time-scale. A commercial receiver platform is also expected in that time. Analogue broadcasting licences will be renewed in 1999 on condition that services are also simulcast in DTT, and switch-off is planned for 2010. Cable installation licences are also being awarded. There is plenty of competition in platforms in Spain, with two satellite services also on offer.

Sweden (28-09-99)

On the 1st of April 1999 digital terrestrial television was officially launched in Sweden. There are now three multiplexes in operation in the 5 first stage areas covering the most densely populated parts of Sweden. The awarded licences offer a mixture of national and regional services, including all major Swedish television channels. Some of the licensed services are not yet in operation. The intention is that the coverage later will be extended to the entire country. There were more than 50 applications for licences and preparations are now under way for at least one additional multiplex. In order to make the most efficient use of the available spectrum and to ease co-ordination the planned networks consist of a mixture of MFN:s and regional SFN:s.
Due to the interest in DVB-T the Swedish government decided to open a 4th multiplex in the designated first stage area.

The Broadcasting Authority, Radio and TV-verket (RTV), was tasked with collecting the applications. More than 35 applications were received and RTV is currently analysing the applications. A report and recommendation is supposed to be delivered to the Government in December 99.

Switzerland (28-09-99)

For the moment there are no firm plans for an introduction of DVB-T in Switzerland. Test transmissions are on the air. Due to the very high cable penetration there are intentions to cease 1 or 2 national TV chains to free a part of the completely occupied TV-frequency bands. This action must go together with re-planning of the remaining terrestrial chains. Switzerland is therefore looking foreword to an all-European planning conference for revision of the ST61 plan.

Turkey (28-04-99)

In Turkey, the Terrestrial Digital Broadcasting studies for both DVB-T and T-DAB have been started at the same time. Today, the concerning Administrations are preparing a concept which will include national broadcasting strategy and the timing of analogue shutdown. After this study, a plan will be developed for introduction of DVB-T.

United Kingdom (28-09-99)

There are currently 62 transmitter sites broadcasting the six multiplexes planned for UK digital terrestrial television (which was launched on 15 November 1998). The full 81 site plan, which covers all the major towns and cities, is expected to be rolled out by the end of 1999.

There are nine free to air channels and 25 subscription channels. ON digital, the main pay-TV operator, has an estimated 400,000 subscribers using set top box receivers. Much of the increase in subscriber numbers is due to the introduction of a rental business model, which effectively provides viewers with a free set top receiver whilst they subscribe to ON digital services. Integrated digital televisions are also available from around 750 Euros (with subscription) and 1200 Euros (without subscription).

The UK is looking at equalising the coverage of the digital multiplexes. For the longer term, options for an all-digital plan are being investigated by the ITC/NTL (the Genesis project, www.itc.org.uk) and also by the BBC.

The UK culture ministry has given an indicative timetable (2006-2010) for the start of the analogue switch over process. Three criteria must be fulfilled before the process can begin:

1. the cost of receiving the public service channels digitally must be affordable for most people.
2. digital coverage, made up of satellite, terrestrial and cable, should be greater than 95% of the UK population.
3. the number of households with digital receivers should be greater than 70%.

The Government will review the development of digital television every 2 years. Further details can be found at www.culture.gov.uk.

Ukraine (28-09-99)

For the time being concerned state bodies of Ukraine are developing the strategy and the conception of DVB-T introduction. After finishing the above work Ukraine will develop the frequency plan and after its successful co-ordination will begin the introduction of DVB-T.

6.3 Commercial Interests

The Digital Terrestrial Television Action Group (DigiTAG) brings together some 70 members from broadcasting, network operations, regulatory and manufacturing organisations throughout Europe and beyond. DigiTAG aims to encourage and facilitate the implementation and introduction of digital terrestrial television services using the Digital Video Broadcasting Project's Standard (DVB-T).

DigiTAG have recently carried out a survey of members requirements on European Service Models for DVB-T. In April 1999 their initial summary of responses to the questionnaire (15 completed questionnaires, representing data from 14 European countries, namely: Norway, Sweden, Germany, France, Netherlands, Denmark,
Spain, UK and Italy, Belgium, Switzerland, Finland, Portugal) produced the following:

Main Driver:
Additional Services (80%)

Close second:
Portability (67%)
Possibility of Interactivity (67%)

Then:
Eventual Reuse of Analogue Spectrum (33%)
Widescreen (20%)
Better Quality Picture (13%)

Digital Terrestrial Service:
2 countries have already introduced DTT
8 countries are planning DTT in 2000
2 countries planning DTT in 2001
2 countries not yet committed to a date

Digital cable in service in 7 countries

Digital satellite services in 11 countries

Analogue switch-off:
Not planned before 2005 anywhere
5 countries plan for 2005-2010
5 countries plan for later than 2010
4 countries don't know

Transmission Issues:
VHF/UHF (VHF in 3 countries)
New transmitter sites planned in 6 countries
5 SFN, 3 MFN, 6 SFN/MFN
Frequency planning complete in only 4 countries

Fixed receivers dominant at introduction (80%) but reducing later (40%)

Portable reception 60% at introduction, but rising to 80% later

Mobile reception not expected at introduction, but rising to 33% later

DigiTAG are expecting to update their survey periodically to keep track of the latest developments in DVB-T implementation. Up to date information on the implementation of DVB-T through the DigiTAG server at www.digitag.org

7 IDEAS ON THE APPROACH TO AN ALL-DIGITAL PLAN

7.1 Introduction

Digital television is just starting and it offers a vast range of new possibilities; it is necessary to take advantage of these new opportunities, but it is too soon to fix the requirements, although some estimates can be made. This is in line with the CEPT Recommendation that there should be a planned time frame for the introduction of digital terrestrial television and the phasing out of analogue television services[1]. The envisaged timetable currently includes the introduction of digital terrestrial television in1998 (as now confirmed) and foresees an ITU planning meeting in the year 2005 for the:

- Determination of the future requirements for terrestrial digital television
- Revision of the Stockholm Agreement, 1961
- Planning the withdrawal of analogue services.

A further consideration could be the convening of a CEPT Planning Meeting rather than one undertaken by the ITU.

The extent to which the needs of the broadcasters can be met will not be fully established before the planning conference. An early indication of needs may be drawn from an initial EBU survey of its members foreseen requirements – see Annex 1 to Section 7.

Furthermore, it is foreseen that the phasing out of analogue television may commence in 2008 or even earlier in some countries. In the longer term, i.e. from 7-12 years after the launch of digital television in any given country, the CEPT recommends, subject to periodical review with the objective of achieving as short a transitional period as practicable, the possible use of the broadcasting bands for other services. However, the ERC also considers that the situation should be reviewed periodically.

In some countries the number of analogue television programmes transmitted terrestrially is already limited by the lack of available channels. Because DVB-T is generally more spectrum efficient than analogue television more programmes can be transmitted, thus meeting some of these requirements.

7.2 Planning Conference

7.2.1 Background

Although many countries will be introducing DVB-T under the framework of CH97, this is unlikely to result in the most effective use of the available spectrum in the longer term and could also lead to inequitable access.

The best way to achieve the desirable goals is to have a Planning Conference to revise the Stockholm 61 Plan.

Two options are considered:

1. The first step could be a CEPT meeting preferably enlarged to the European Broadcasting Area (EBA), to draw up a frequency plan and rules for transition from analogue to digital television. The second step would be an ITU Regional Conference. The timing of the meetings would be determined by the WRC schedule. However, it will not be of great importance to convene such a meeting immediately after the first meeting, since it is foreseen that all administrations in the EBA shall take part in the CEPT meeting.

[1] The Response of the ERC to the Recommendations of the Detailed Spectrum Investigation Phase II

2. An alternative would be a two part ITU Regional Conference. ITU Convention Article 3 states that a ITU Regional Radiocommunication Conference shall be convened:

a) by a decision of a Plenipotentiary Conference;
b) on the Recommendation of a previous World or Regional Radiocommunication Conference if approved by the Council;
c) at the request of at least one-quarter of the Members belonging to the Region concerned, which shall individually address their requests to the Secretary General; or
d) on a proposal of the Council.

The preferred choice is item c.

7.2.2 Considerations

Based on the assumption that Option 2 is likely to be more costly, Option 1 would be preferred.

It is essential, however, that countries not being members of the CEPT, but within the European Broadcasting Area, should be intensively involved in the planning process from the beginning, in order to assure its success and acceptance of its results. From this point of view Option 2 would be preferred.

Since ST61 is an ITU agreement and has treaty status any revision or abrogation must be made by a competent ITU Regional conference with participation from all countries that signed ST61 (other than denouncement).

Preparations for the conference could be as follows:

- Agree on how to put forward requirements
- Development of software for analysis of requirements
- Agree on timetable for submission of requirements
- Analyses
- Results of initial analyses
- Consider migration aspects

A possible time frame for the conference could be between 2003 and 2005.

At the 27th European Radiocommunications Committee Meeting, Oslo, 29 November 1999 to 3 December 1999, it was agreed by ERC that a ITU Regional Conference for the revision of the Stockholm 1961 Agreement should be convened in order to provide for the efficient implementation of terrestrial digital television broadcasting in Europe. In the view of the ERC, the transfer from analogue to digital television should be completed around the year 2010, which means that re-planning should take place in 2005 at the latest.
It was agreed that the Secretary-General of the ITU should be requested by a sufficient number of CEPT countries in accordance with Article 27 of the ITU Convention to apply the relevant procedure for the convening of a regional conference at the request of Member States.

7.3 Migration from analogue to digital television

There are basically two options for achieving an all-digital plan for terrestrial television in Europe. The first is the conversion of existing analogue assignments into digital assignments and the second, a completely new plan. Both of these options, and a number in between, must be studied together with the means on how to implement (migrate to) a new plan. The latter is major task. If one country adopts a new plan what will happen in the neighbouring countries – do they need to change at the same time, or can a phased approach be worked out?

7.3.1 Migration issues

The transition from analogue to digital is relatively easy with a conversion of ST61 Plan using the implementation of CH97 because:

- the conversions will be compatible with existing analogue services in neighbouring countries, or even in the same country;
- of the desire of countries to retain their rights to existing high power assignments;
- the existing ST61 assignments will fit easily with converted European Plans;
- the transition to an all digital situation can take place by bilateral agreement between countries;

but:

- it may not lead to equitable access;
- it is not optimised for spectrum efficiency;
- it may not result in adequate coverage in most cases.

An attractive alternative would be to start with a completely new plan which could be designed to solve the disadvantage given in the last three bullet points above. However, it may be difficult to implement because of the need to change frequencies at the existing stations and associated technical characteristics, and the need to synchronise the migrations as mentioned in 7.3 above.
It can be concluded from the above that some in-between approach might provide an acceptable solution where there is a conversion of part of the existing UHF bands and a new plan for the least used channels.

7.3.2 Analogue channel assignment in Europe

Whilst the prime objective of the transmitter data collection exercise was to facilitate planning for the introduction of DVB-T services, it also establishes the background from which Europe must start any transition to the all digital world. Figure 1 and Figure 2 in Annex 2 provide an overview number of total assignments by channel for the VHF and UHF bands respectively. It will be seen that these figures also contain the total numbers of channels for a subdivision of Europe by geographical area.

There are unlikely to be any great surprises, rather confirmation of the widespread use of the various VHF channeling systems (7 and 8 MHz), which in a significant number of cases provide national coverages. This will present a great challenge in finding a common way forward.

In the case of UHF, where a common channeling system is used throughout Europe, the situation is more straightforward. It might even be considered that the channels above 60 are the least used and therefore present the most attractive range in which to introduce new digital plans. This would, of course, need to take account of the sharing issues relevant to the other services that make use of these particular channels

7.3.3 Planning Issues

It can be assumed that in general, existing sites will be used and account should be taken of existing digital coverage as well as analogue coverage for which there are no digital replacements. On the other hand, new digital services may be temporarily restricted, for the duration of the transition. Whilst ideally there should be no constraint on the frequencies proposed for use it has to be recognised that in most CEPT countries some channels above 60 are currently also used for non-broadcast applications. In the preparation of future planning scenarios some provision will need to be made for such services.

Clearly, the migration issue is likely to form a major part of any Planning Conference.

7.3.4 ST61 conversion studies

In respect of the conversion of existing analogue assignments the BBC has carried out an initial study based on nine main stations in the south east of the UK (including London). For this particular area it has been demonstrated that in terms of coverage, a conversion will provide greater fixed reception coverage than the existing analogue plan. Moreover, portable coverage (in terms of population)

approaching that of the existing fixed analogue service can also be achieved - see Annex 3 for further details.

Based on these provisional findings the value of the existing analogue television assignments are demonstrated in an all-digital scenario, but similar studies need to be carried out in other parts of Europe to confirm the results.

7.4 Planning Options

7.4.1 General

There are a number of options for an all-digital plan: SFNs, MFNs, or a combination of both - for example higher power stations with lower power SFN filler stations.

Clearly, the coding system will need to be chosen with a view to the requirements. There are now indications that portable reception will be important and that mobile reception may also be required. In the case of mobile reception the coverage needs and system requirements will be different from those for fixed and portable reception.

All of these issues need to be explored and a joint team of CEPT/EBU experts has been established to carry out the studies for various theoretical plans. See Annex 4 for a list of elements and scenarios. PT FM24 expects to receive the initial results in April 2000. In the mean time there is a number of studies from which it is possible draw some initial results - see Section 7.5.2 for further details.

7.4.2 SFN planning issues

Whilst there are benefits in term of frequency savings from the use of SFNs, such scenarios should not be over simplified. For instance, it is well known that maps can be produced using only four colours without any ambiguity, say of countries. It is often assumed that this idea can be applied to radio and television coverages where the colours can represent channels. The argument is then used that only four channels are needed to provide a single coverage and, in this case, a coverage can be equated to a multiplex of programmes.

However, when the realities of propagation and the size of coverage areas (the EBU survey indicates typically 50 to more than 100km diameter) are taken into account, it can be determined that the basic concept is false. In general terms, countries stop at their borders, but interference does not. To a somewhat lesser extent, the editorial regions into which most countries are divided for the purposes of programmes or commercials also stop at their borders, but because these borders are not really “firm”, the coverages are also often expected to extend across regional boundaries. In these cases, the interference goes even further. It is the consideration of interference that determines how many channels are needed. These concepts are demonstrated in studies carried out by the National Institute of Telecommunications, Poland and IRT in Germany.

In the continuous uniform world of lattice planning it is relatively easy to determine on a theoretical basis how many channels are needed to provide complete coverage. In the real world where the coverage areas are required to be of different sizes and are distributed in a fairly irregular fashion, it requires an extensive combination of interference analysis and coverage synthesis to determine how many channels are needed.

7.5 Initial estimates of spectrum requirements for DVB-T

In order to gain an indication of channel usage in an all-digital Europe, it is possible to make some initial estimates.

7.5.1 Number of multiplexes required

The study of spectrum requirements for DVB-T needs to begin with an assessment of the number of programme services to be provided. In some European countries, twenty or more programme services are considered to be necessary in order to provide sufficient variety to make the DVB-T service attractive to the viewer.

The number of programmes per multiplex depends on other requirements, e.g. mobile reception, more robust; higher definition reception, less robust, etc., and varies between 2 and 6 television programme services per multiplex.

Investigations and decisions in several European countries have already led to the initial requirement for 6 multiplexes in many countries - some will require 7 multiplexes or more. This is in-line with the results of the EBU survey of members foreseen requirements.

7.5.2 Number of channels required per multiplex for area coverage

An extensive SFN allotment planning exercise has been performed in Poland in order to assess, for various scenarios, the number of channels that are required to give coverage across Europe for one multiplex. The exercise indicates that 8 channels are needed for portable reception with the 64 QAM 2/3 mode. The allotment areas have a typical diameter of 150 to 200 km. With the 16 QAM 2/3 mode, 6 channels are needed per multiplex.

A similar exercise in Germany shows that 8 channels are needed to give full area coverage for one multiplex. The calculation has been made for portable reception and with the 16 QAM 2/3 mode. Here the allotment areas have a typical diameter of 150 km, which accounts for the greater number of channels needed. A corresponding MFN approach would require 14 channels per multiplex. It should be noted that the bit rate achieved in the SFN mode is 13.3 (Mbit/s) and in the MFN mode could be up to 16.9 Mbit/s.

In both of the above studies, propagation over land has been assumed. In areas where propagation over sea is involved further studies are needed to determine if more channels are required.

A recent EBU T-DAB planning exercise (for the 1500 MHz band) showed there is a need for 7 channels to provide each area (as defined by T-DAB second priority for regions) with one multiplex. The results of this exercise can be considered indicative to DVB-T planning for the case of QPSK Rate 2/3 and for moderately sized coverage requirements. For small areas there is likely to be a need for more channels.

For fixed reception, the difference in channel requirements between the SFN and MFN approach is not as great as indicated above. Whilst this may assist some countries with the introduction of DVB-T services, the requirement for an all-digital plan is likely to be for portable reception.

Thus, based on the EBU planning experiences, and given a requirement for 6 multiplexes, there is a need for at least 6 x 7 = 42 channels. In practice, the results from Poland and Germany indicate that 42 channels could be an underestimate. What is clear is that the number of channels required will depend upon the size of the coverage areas needed. Moreover, additional channels are likely to be required in areas near country borders to provide DVB-T coverage at least up to the border.

7.5.3 Spectrum sharing

The Band IV and V spectrum is at present shared with other services, such as Radio Astronomy (in a number of countries) and Military Tactical Links (in many countries), Radio Microphones, Services Ancillary to Broadcasting (SAB), Aeronautical Radio Navigation and Fixed Links. These other services limit the spectrum available to DVB-T.

Additionally, there are possible future requirements for services or applications seeking spectrum in the same frequency range. These may well include, Wind Profiler Radars, mobile services (including UMTS expansion), or the return channel for interactive television which may be considered in some countries. There is also some expectation that the European consumer will show an interest in advanced picture and sound services such as HDTV.

7.5.4 Release of spectrum

Based on these initial estimates for DVB-T, and the existence of other services in many countries, it is difficult to be precise at this time over the amount of spectrum (and its location in the frequency bands) that might be released. The various competing requirements will clearly have to be prioritised.

Current indications are that it is unlikely that any spectrum can be made available for other services until after the close-down of the analogue television services, say, around 2010- 2015. However, this date is dependent on the acceptance of DVB-T as an alternative to the present terrestrial analogue services, and possibly an extension of new digital services to as great a percentage of the population as the analogue services. A speedy take-up of DVB-T and its rapid extension to a near-universally available service would bring forward the closedown date of the analogue television services.

7.5.5 Requirement for Band III

Whilst the majority of requirements will be intended to use channels in Bands IV and V, there are some indications that the use of Band III is also being considered in some countries. This band is particularly suitable for mobile DVB-T services.

In the short term the continued use of 7 MHz and 8 MHz bandwidth channels seems to be necessary because of the need for co-existence of analogue and digital services. From the EACEM (European Association of Consumer Equipments Manufacturers) point of view, this is an additional expense for the receiver. In the longer tem, EACEM would wish to see a uniform 8 MHz bandwidth adopted for all bands. Although such a move would also assist with the planning process, the means to achieve it will be very difficult.

It must be noted that T-DAB occupies some of the channels in this band and there are some countries wishing to assign even more Band III spectrum to T-DAB services.

7.6 Interim conclusions

- It is considered that a Planning Conference is necessary to migrate from analogue to digital television
- An ERC decision needs to be taken as to whether the digital plan should be undertaken by ITU or CEPT.
- The effective use of spectrum arising from the introduction of DVB-T will not be achieved until the closure of the analogue networks is achieved (around 2010 - 2015).
- It is anticipated that the first results of EBU/CEPT theoretical planning exercises will be available in April 2000.
- In order to progress the planning work leading towards an all digital plan for Europe, it will be necessary to determine requirements of broadcasting services in each country.
- Whilst it will be possible for FM PT24 to produce an optimum all-digital plan, the success of any such plan will be determined by the possibilities for implementation. Consequently, the value of any plan can only be assessed when accompanied by an agreed migration strategy from analogue to digital television.
- Initial estimates indicate that the overall channel requirement to provide for six multiplexes per area is at least 42.
- There are countries where Band III is considered important to the future of DVB-T, particularly for portable and mobile reception. This requirement may compete with a desire for more T-DAB allocations.
- The various competing other service requirements for use of the broadcasting spectrum will have to be prioritised.

Annex 1 to Section 7: Results of an EBU survey on planning requirements for digital terrestrial television services

A questionnaire on digital terrestrial television was distributed to EBU members. The purpose of this questionnaire was to find out the present views of the broadcasters on preparation for digital TV frequency planning.

29 answers were received by the EBU (from about 45 members concerned with television broadcasting) from 25 countries.

Due to the limited number of organisations that answered, the results should not be considered as comprehensive but they can give a valuable overview of the major trends of the frequency planning requirements for DVB-T services.

Geographical service requirements

For a large majority of organisations, there is a clear need for national and regional networks. Only very few broadcasters intend to set up either regional-only or national-only networks.

In this context, a national programme chain is assumed to cover the national territory with the same programme material and without any regional variants at any time. Similarly, a regional programme chain carries the same programme material throughout a region without any sub-regional variants at any time.

Present number of regions

All answers being taken together, about half the programmes presently have national coverage. For the other half, the number of regions can vary between 2 and 24 depending (but not exclusively) on the size of the countries.

Need to subdivide the regions later

A small majority of broadcasters foresee the need for future subdivision of the existing national or regional structures.

Typical diameters of future regions

Two broadcasters mentioned diameters of 20 km. For the others, there is no typical size of the regions, which could extend from 50 km to more than 100 km.

Future DVB-T service requirements

During the transition period:

Service requirements	Number of answers
Fixed	26
Portable	24
Mobile	8

Nearly all countries are planning for fixed reception and most of them also for portable reception. Only one country, known for its high cable penetration, intends to plan only for portable reception. Even during the introductory phase, there is some interest in mobile reception.

In all-digital environment:

Service requirements	Number of answers
Fixed	25
Portable	24
Mobile	19

There is an increased emphasis on mobile reception in an all digital environment.

Closure of analogue stations or conversion to digital

About half the broadcasters expect to close analogue assignments or to convert analogue assignments to digital to facilitate the introduction of DVB-T.

Number of multiplexes needed to provide a viable DVB-T package

During the transition period:

Number of multiplexes	Number of broadcasters
1	3
2	6
3	5
4	4
5	2
6	3
>6	1
Not yet known	5

Most of the broadcasters consider that their countries need between 2 and 4 multiplexes to successfully launch DVB-T services.
In all-digital environment:

Number of multiplexes	Number of broadcasters
1	0
2	1
3	3
4	2
5	2
6	5
>6	5
Not yet known	11

Many broadcasters are not yet clear, but there is a general tendency for the final number of multiplexes to be around 6.

Org.	*Service Requirements*		*Present number of regions Prog. Chain*						*Need to subdivide Regions*		*Typical future Regions diameters*				*Possible Serv. requirements*		*Closure of analogue stations or convert digital*		*Number of multiplexes*	
	Nat	*Reg*	*1*	*2*	*3*	*4*	*5*	*6*	*Yes*	*No*	*20*	*50*	*100*	*>100*	*Trans.*	*in all dig.envir.*	*Yes*	*No*	*Near future*	*in all-digital environment*
BBC	N	Y	14	14	1	4	1		Y				100		FP	FPM		N	6	>6
Ceska Tele	Y	Y	2										100		FP	FP	Y		- Not yet known -	
CLT-UFA	Y	Y	1	1	1	1				N		50			FP	FPM	Y		2	4
ERT	Y	Y	1	1	1	13	13	13	Y				100	>100	FP	FPM	Y		2	6
HRT	Y	Y	1	7	1				Y				100	>100	FP	FPM	Y		1	3
HT	Y	Y	1	6						N		50			F	FM			1	2
IRT	Y	Y	10	1	24	15	15		Y			50	100	>100	FP	FPM	Y		3	6
JR&TV	Y		12							N		50			F	F		N	3	Not yet known
LJB	Y									N					FPM		Y		- Not yet known -	
NOS	Y	Y	1	1	1	7				N		50			FP	FP	Y		5	6
NRK	Y	Y	10	1					Y			50	100	>100	FP	FPM		N	3	5
ORF	Y	Y	1	9						N		50	100	>100	FP	FPM		N	>6	Not yet known
PBS	Y									N		50			F	F		N	- Not yet known -	
Retevision	Y	Y	1	1	6	1	1	1	Y		20	50	100		F	FP		N	5	Not yet known
RTBF	N	Y	1	1	1					N				>100	PM	PM		N	4	>6
RTM	Y	Y	1	1					Y				100		FPM	FPM	Y		2	4
RTV Slo.	Y	Y	1	1	3	3	3		Y		20	50			FPM	FPM		N	4	5
RTVE	Y	Y	17	17					Y					>100	FPM	FPM		N	6	Not yet known
SE SVT	Y	Y	1	10					(Y)			50	100	>100	FP	FPM		N	4	>6
Slovak TV	Y	Y	2	2					Y					>100	FP	FPM		N	2	3
TP	Y	Y	16	16					Y			50	100		FPM	FPM		N	- Not yet known -	
TRT	Y	Y							Y					>100	FPM	FPM		N	3	Not yet known
TV2 Dan.	Y	Y	9							N		50	100	>100	FP	FP	Y		1	Not yet known
TV2 Norway	Y	N	1							N				>100	FPM	FPM		N	2	3
VRT	N	Y	1	1						N			100	>100	P	P		N	- Not yet known -	
YLE	Y	Y	1	1					Y			50			F	F	Y		3	6
ZDF	Y	N	1							N					P	P	Y		4	>6
RAI	Y	Y	1	1	21					N			100	>100	FP	FPM	Y		2	6
TDF	Y	Y	1	1	22	1	1	9	Y			50	100	>100	FP	FPM		N	6	>6
	26 Y	24 Y							15	13	2	15	15	15	26 F	25 F	12	16		
	3 N	2 N													24 P	24 P				
															8 M	19 N				

Annex 2 to Section 7: Analysis of analogue television assignments in Europe

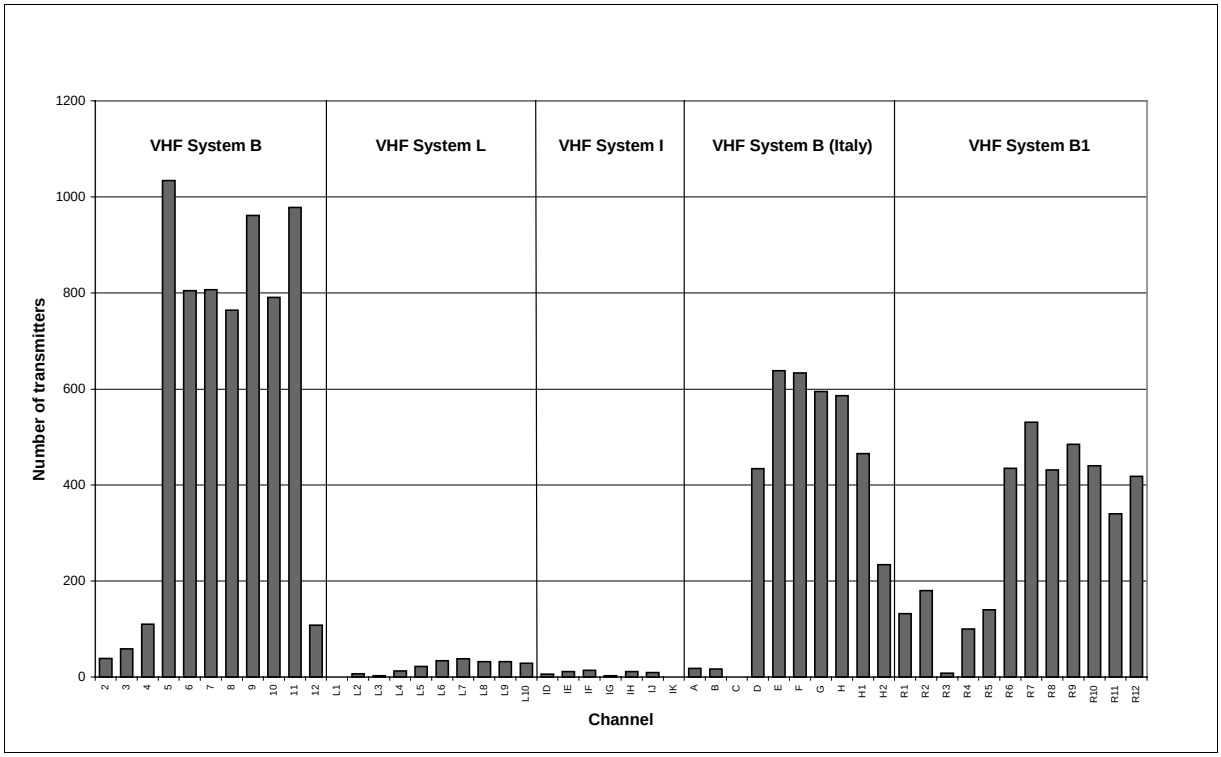


Figure 1: VHF Channel usage in Europe

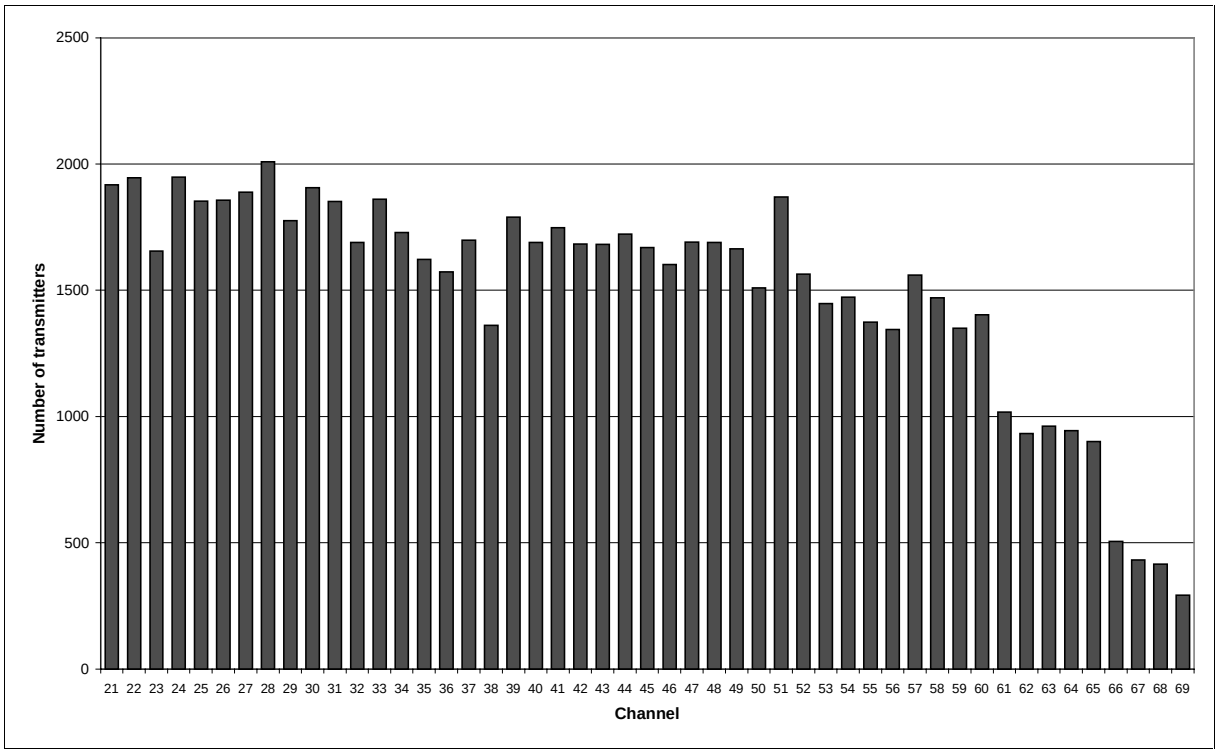


Figure 2: UHF Channel usage in Europe

Annex 3 to Section 7: Results of study into coverage achieved from ST61 conversions (using COCOT5 software) for nine main stations in the south east of the UK

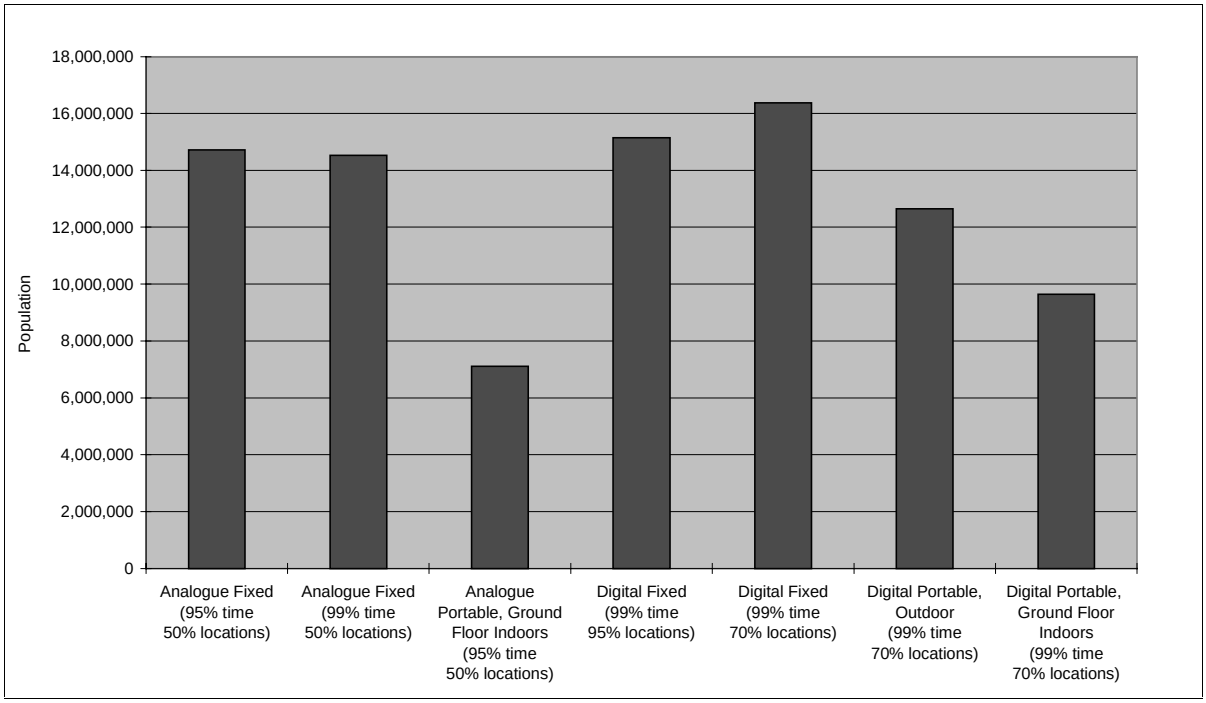


Figure 1: Total population covered in the UK by nine stations

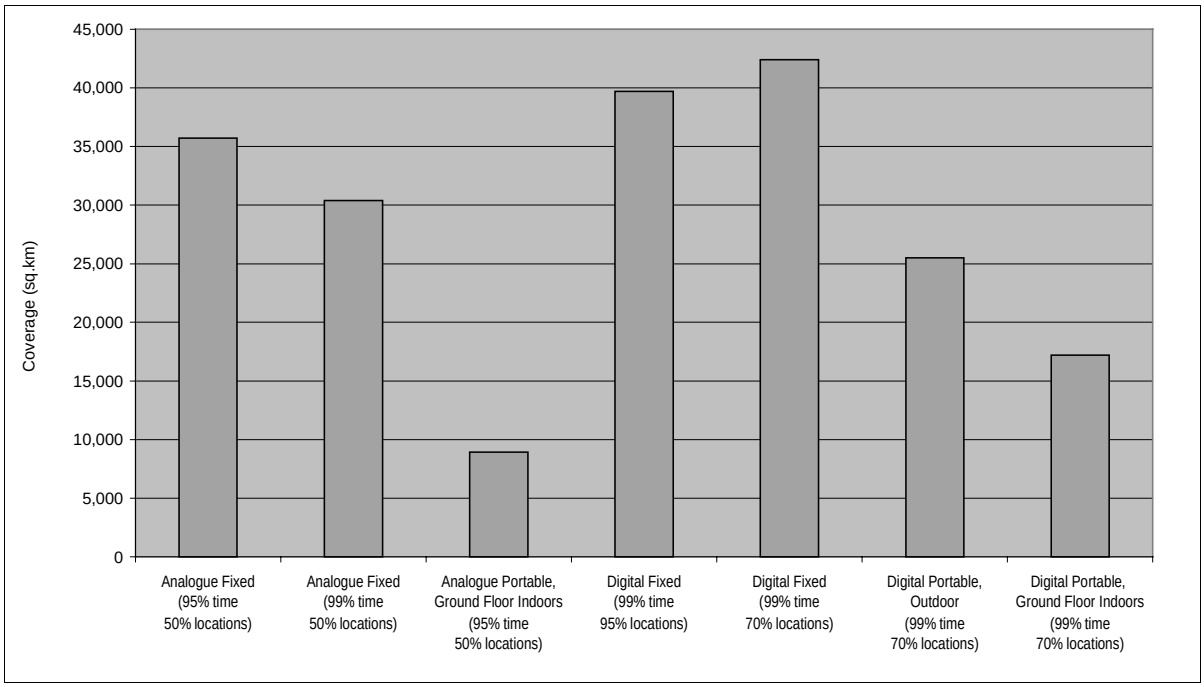


Figure 2: Total area covered within the UK by nine stations

Annex 4 to Section 7: Spectrum requirement evaluation for a theoretical network approach

A first set of studies will be carried out using theoretical lattices as the basis. The following elements represent the range of planning scenarios which will be taken into account. Further studies may be undertaken with other parameters in order to obtain more information related to cases which seem interesting.

DVB variants

V1: QPSK, 2/3
V2: 16-QAM, 2/3
V3: 64-QAM, 2/3

Reception conditions

Fixed
Portable indoor ground floor
{Mobile}

MFN-SFN

MFN
SFN (with D=224µs for 8k, 56µs for 2k)
{Mixed MFN-SFN environments**}**

Target percentage coverage

99% time protection
70, 95, {99}% locations (99% may be needed for mobile reception)
60, 80, 100 % of nominal coverage area

Network structures

MFN: transmitter separation distance range: 10 km to 250 km
Width of area to be covered by individual SFN: 20 km to 400 km
SFN configuration: Open or Closed
Transmitting antenna effective height range: 37.5 m to 1200 m

Frequency bands

VHF (band III - 200 MHz)
UHF (Bands IV and V - 630 MHz)

Number of multiplexes

To be decided later.

Note 1: Elements in "{ }" need further discussion and definition

Note 2: The initial studies will investigate the amount of spectrum required for a single multiplex. Later studies will investigate the impact of the choice of different scenarios in different countries and will thus need to consider more than one multiplex.

Consideration still required

Assignment or allotment planning :

- Selection of existing TV transmitting sites
- Reference Networks
- …

List of actions

1. To propose a time table for the theoretical calculations - first set of results in February 2000.
2. To consider the impact of spectrum masks on spectrum requirements - by February 2000.
3. To supply results from relevant national studies - continuous process.
4. To produce an interim report for the parent groups, in order to obtain their agreement on the list of items, actions and time table - this document, plus later updates.
5. To propose first ideas for possible scenarios related to a practical approach using existing transmitter infrastructures - first proposal expected in February 2000.