



## QUESTIONNAIRE ON SPECTRUM REQUIREMENTS FOR TERRESTRIAL TELEVISION BROADCASTING IN CONNECTION WITH WRC-15 AGENDA ITEM 1.2

**Name of the Administration/Sector Member:** Teracom AB

**For sector members please indicate the geographical area over which you operate:**

Sweden, Denmark and Finland. In Sweden and Denmark the Teracom Group operates the DTT networks and in all three countries the Teracom Group runs pay-TV operations in DTT. The answers to the questionnaire primarily relates to Sweden.

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- Q 1**
- a) What standards have you adopted for digital terrestrial television broadcasting?
  - b) Have you started introduction of digital terrestrial television services?
  - c) If yes, please provide further detail on the number of multiplexes in use, their technical specifications, the percentage of geographic area or population they are intended to cover and the total spectrum use to inform WP 6A.

**Reply:**

- a) DVB-T and DVB-T2 are used for DTT in Sweden. MPEG-2 and MPEG-4 are used for video compression.
- b) DTT was taken into operation in 1999.
- c) Totally 7 multiplexes are in operation in Sweden using all the available frequencies in the band 470-790 MHz in GE06. Multiplex 1-5 use DVB-T and multiplex 6-7 use DVB-T2. Multiplex 1 contains Public Service free-to-air channels and covers more than 99.8% of the population. Multiplex 2-5 contain commercial free-to-air and pay-tv services and cover more than 98% of the population. Some of the programmes in multiplex 1-5 use MPEG-2 compression and some use MPEG-4 compression. In multiplex 6-7 currently 8 HDTV services are provided, 2 Public Service and 6 commercial channels. HDTV services use 720p format and MPEG-4 compression. Multiplex 6-7 will cover more than 98% of the population when completed in early autumn 2012. In June 2012 five additional national services and one local service were licensed for DTT, while at the same time 21 license applications were rejected. Currently, the

Swedish DTT network is filled to capacity and cannot accommodate any additional programme channels. In total there are today 55 national and 7 local DTT programme licences. More details are given in Annex 1.

- Q 2**
- a) Have you commenced analogue television switch-off?
  - b) If you have any such plans, when do you expect to have completed the analogue switch-off process?

**Reply:**

- a) Yes.
- b) Terrestrial analogue TV switch-off in Sweden was completed in October 2007.

- Q 3**
- a) What is the percentage of viewer uptake of terrestrial television in your country, including those whose service provider uses terrestrial broadcast re-transmission (e.g. in cable networks)?
  - b) If possible, please also provide details of the number or proportion of users who receive television primarily by terrestrial means.

**Reply:**

- a) Currently 38 % of Swedish households are directly using terrestrial distribution for one or more television sets (Ref: Mediavision market survey December 2011). In addition, in principle all cable TV operators are using the DTT network to receive and redistribute several programme channels, especially those with local and regional content. These cable TV networks serve more than 50% of the population.
- b) 25 % of Swedish households use terrestrial reception for their primary TV set in their permanent residence (Ref: Mediavision market survey December 2011).

- Q 4**
- a) Indicate how many analogue television transmitters use channels in the frequency sub-band 694-790 MHz (as indicated in Resolution **232 (WRC-12)**).
  - b) How many are in the remaining part of the UHF band.

**Reply:**

- a) There are no analogue transmitters in use in Sweden today.
- b) See a).

- Q 5**
- a) What frequencies/channels are currently used or intended to be used by digital terrestrial television broadcasting in your country? Please distinguish between those in use and those intended to be used.
  - b) If allotments/SFNs are in use, a sketch map of frequency allocations could be included, with an accompanying table of allocations, as shown in Annex 2. Otherwise, it might be possible to show main transmitters and channels, grouped in layers, in a table.

- c) Please indicate how many digital television assignments/allotments use channels in the frequency sub-band 694-790 MHz (as indicated in Resolution **232 (WRC-12)**), and
- d) How many are in the remaining part of the UHF band.

**Reply:**

- a) All channels and all available plan entries in the GE06 Plan for Sweden in the band 470-790 MHz are today in operation.
- b) The DTT network in Sweden is based on 54 high power main transmitter sites and 533 gap-fillers and repeater sites for additional coverage. The multiplexes are planned using a mixture of MFN:s and regional SFN:s in various areas. SFN:s are used where this has been desirable from a network planning and frequency co-ordination perspective. The SFN areas consist of 1-3 main transmitters and a number of fill-in stations. SFN and MFN areas are planned to provide for regional breakdown possibilities. A large and growing number of the programme services are divided into different local/regional editions. Additional information is given in Annex 2.
- c) There are totally 406 assignments in the frequency range 694-790 MHz in operation or about to be put into operation in the near future.
- d) There are totally 1083 assignments in the frequency range 470-694 MHz in operation or about to be put into operation in the near future.

- Q 6**
- a) Are those frequency bands also shared with other primary services?
  - b) If yes, please give details of those systems and their spectrum use.

**Reply:**

- a) There are no other primary services using the band 470-790 MHz in Sweden.

- Q 7**
- a) Are those frequency bands also shared with secondary services such as PMSE (Programme Making and Special Events), radio astronomy or wind-profile radar?
  - b) If yes, please give details of those systems and their spectrum use.

**Reply:**

- a) The band 470-790 MHz is also used for PMSE services, primarily wireless microphones, on a non-interference, non-protected basis.

- Q 8**
- a) Do you foresee the adoption or expansion of television services broadcast using second-generation systems such as DVB-T2?
  - b) If yes, please give indicative details of the planned transition, including any simulcast period.

**Reply:**

- a) DVB-T2 is already being used for two multiplexes in Sweden.

- b) In a long term perspective all multiplexes are expected to be migrated to DVB-T2. It must be emphasized that a migration of all services to DVB-T2 will require careful planning and will only be feasible with a fairly long period with parallel transmissions and simulcast of at least all major programme services. The two DVB-T2 multiplexes are used for HDTV services and it is envisaged that further introduction of DVB-T2 will go hand in hand with migration of existing channels from SDTV to HDTV. There may be a need for political decisions before existing SDTV programme channels can be switched off, in particular with regard to public service channels. For the moment there are no decisions to upgrade any of the current DVB-T multiplexes to DVB-T2.

- Q 9**
- a) Do you foresee a requirement for new and enhanced services, including HD and 3D television, on the terrestrial television platform?
- b) If yes, please give indicative details of the number and nature of services planned, and if known, the expected timeframe for their introduction.

**Reply:**

- a) It is evident that consumers are expecting better and better sound and picture quality for their TV service. Market data show that TV sets with increasingly large screen sizes are sold. Broadcasters are launching an increasing number of HDTV services and all distribution platforms are expanding their HDTV offer. Broadcasters and other content producers indicate that the majority of all new programme content will be produced in HDTV format already within a few years. This implies a clear need for improved sound and picture quality in all TV distribution platforms, including DTT. In a longer perspective demand for even higher picture quality can be envisaged, which in turn may call for a further step and the introduction of UHDTV.

For 3DTV services there is a growing, but for the moment limited, market. Teracom has already performed a number of event related transmissions of 3DTV in the DTT network. If the market develops towards increased demand for 3DTV it will be necessary also for the DTT network to carry such services.

- b) HDTV was introduced in the Swedish DTT platform in 2010 and there are presently 8 HDTV services in operation, using two national multiplexes. Teracom predicts that practically all TV services will need to be transmitted in HDTV in a few years time. This will require upgrading of the existing DVB-T multiplexes to DVB-T2. A general upgrade to HDTV and DVB-T2 needs careful planning and a fairly long period with parallel transmissions and simulcast of at least the major programme services.

- Q 10**
- a) Are there plans in your country to launch more multiplexes in the future?
- b) If yes, how many more and when? Please also indicate the expected timeframe for their introduction.

**Reply:**

- a) Today it is not possible to launch any additional DTT multiplexes in Sweden given the limited amount of available DTT spectrum. All available frequencies

in the GE06 Plan in Sweden for the band 470-790 MHz are already used. However, it is considered to increase the coverage for some of the existing 7 multiplexes as all national programme licences include the right to full and complete national coverage.

In the recent DTT programme licensing process there were 21 applications that were denied a license because the DTT network is now filled to capacity and since no additional spectrum is available. To be able to grant licences to meet this demonstrated market demand at least another two multiplexes would be needed.

b) See answer to a).

**Q 11** a) What is the amount of spectrum you foresee that will be required for terrestrial television broadcasting, if plans in Questions 8, 9 and 10 are to be supported, and services identified in Questions 6 and 7 are to be taken into account? Please indicate the modes of transmission that will be used, and timeframes.

**Reply:**

a) Teracom estimates that there is a market demand for 8-9 DTT multiplexes in Sweden. This means that all the presently available spectrum for TV in UHF (470-790 MHz) will be required, noting that the current GE06 Plan for Sweden does not allow for more than the existing 7 multiplexes.

In order for DTT to be competitive and attractive for viewers a wide variety of programme services is necessary. The current demand is considered to be at least in the range 50-70 channels.

A large number of programme services will have time slots with local content, especially advertising and news, and it is important that networks and frequency plans continue to allow for adequate geographical breakdown.

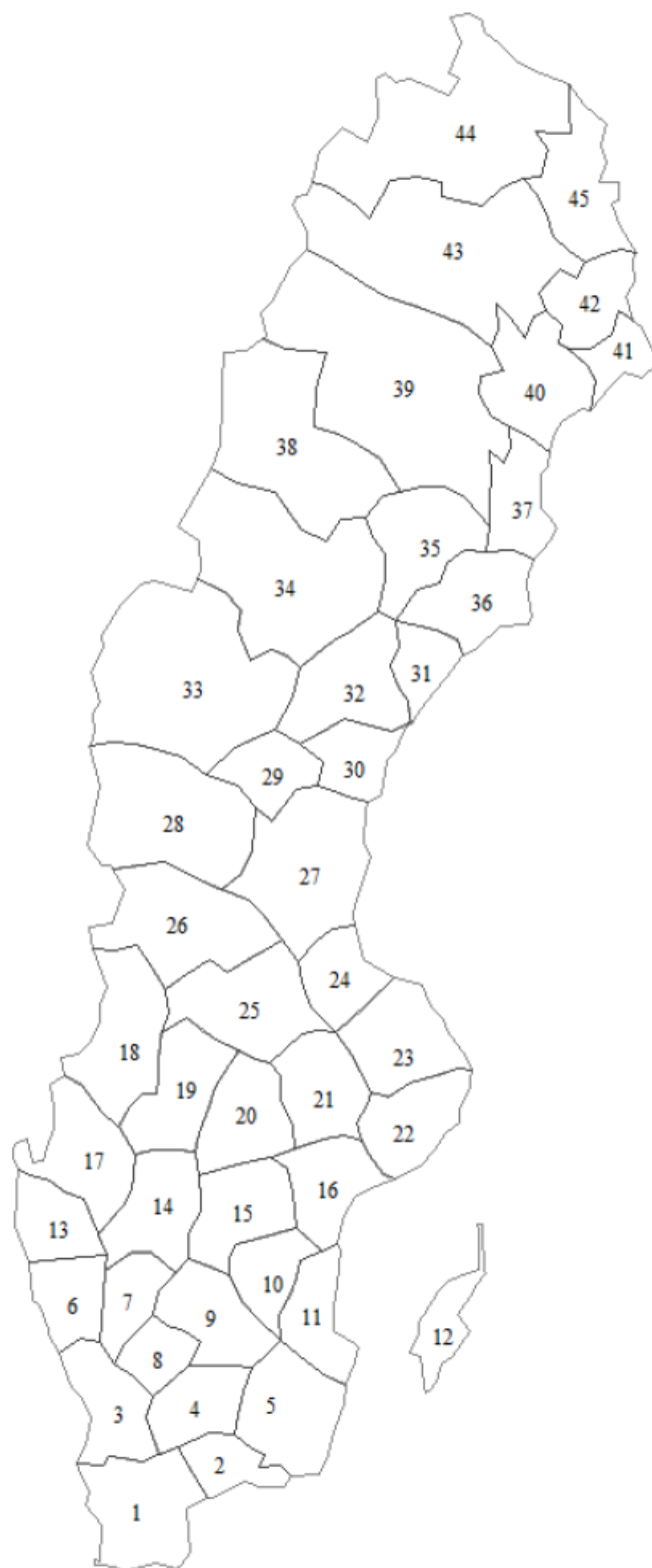
All services will in the future be transmitted in HD quality and all multiplexes are expected to be migrated to DVB-T2 eventually, to provide for the upgrade to HDTV. Such migration to DVB-T2 will need careful planning and a fairly long period with parallel transmissions and simulcast of at least all major programme services, requiring corresponding spectrum and network capacity. Switch-off of DVB-T, in particular the Public Service channels, will require a political decision. There is for the moment (July 2012) no timeframes specified for further DVB-T2 expansion, above the two already launched multiplexes.

In the long term perspective it could be expected that enhanced services such as UHD TV and 3DTV will emerge and the DTT network will then need to be able to carry also these services.

## ANNEX 1


| Country | No of Multiplexes | System & Modulation | FEC           | GI             | Reception Mode | Capacity per multiplex (Mb/s) | Current Percentage Population Coverage | Intended Percentage Population Coverage | Content per Multiplex | Total Capacity (Mb/s) | Total Spectrum Bandwidth Used or intended for implementation (MHz) | Any additional comments                                      |
|---------|-------------------|---------------------|---------------|----------------|----------------|-------------------------------|--|---|-----------------------|-----------------------|--|--|
| S       | 1                 | DVB-T, 64-QAM       | 2/3, 3/4      | 1/4, 1/8       | Fixed          | 22.1                          | 99.8%                                  | 98-100%                                 | 5 SD MPEG2            | 178-182               | 369  | Public Service   |
|         | 2                 | DVB-T, 64-QAM       | 2/3, 3/4      | 1/4, 1/8       | Fixed          | 22.1                          | 98-99%                                 | 98-100%                                 | 7-8 SD MPEG2          |                       |  | Some services time-shared                                    |
|         | 2                 | DVB-T, 64-QAM       | 2/3, 3/4      | 1/4, 1/8, 1/32 | Fixed          | 22.1/24.1                     | 98-99%                                 | 98-100%                                 | 10-11 SD MPEG2/MPEG4  |                       |  | Regional services in some areas<br>Some services time-shared |
|         | 1                 | DVB-T2, 256-QAM     | 2/3, 3/4      | 1/16, 1/8      | Fixed          | 36.6                          | >95%                                   | 98-100%                                 | 5 HD MPEG4            |                       |  | Incl Public Service  |
|         | 1                 | DVB-T2, 256-QAM     | 3/5, 2/3, 3/4 | 19/256, 1/8    | Fixed          | 30.8                          | >95%                                   | 98-100%                                 | 3 HD, 1 SD MPEG4      |                       |  | New additional services to be included                       |

ANNEX 2



## Allotments in use

| Area  | Layer 1 | Layer 2 | Layer 3 | Layer 4 | Layer 5 | Layer 6 | Layer 7 | Main stations |
|-------|---------|---------|---------|---------|---------|---------|---------|---------------|
| 1     | 33      | 43      | 41      | 25      | 22      | 27/30   | 10      | 3             |
| 2     | 27      | 24      | 42      | 55      | 26      | 30      | 8       | 2             |
| 3     | 21      | 28      | 38      | 45      | 47      | 32      | 7       | 2             |
| 4     | 40      | 49      | 34      | 37      | 39      | 57      | 8       | 1             |
| 5     | 45      | 28      | 46      | 21      | 53      | 47      | 8       | 1             |
| 6     | 30      | 27      | 46      | 40      | 43      | 33      | 9       | 1             |
| 7     | 44      | 54      | 29      | 42      | 55      | 36      | 41      | 1             |
| 8     | 26      | 56      | 52      | 60      | 48      | 58      | 7       | 1             |
| 9     | 22/31   | 23/28   | 35      | 33      | 51      | 25      | 6       | 2             |
| 10    | 29      | 55      | 50      | 56      | 59      | 49      | 6       | 1             |
| 11    | 26      | 34      | 24      | 30      | 40      | 43      | 57      | 1             |
| 12    | 41      | 44      | 48      | 37      | 58      | 51      | 9       | 1             |
| 13    | 23      | 28      | 31      | 25      | 56      | 53      | 9       | 2             |
| 14    | 37      | 24      | 32      | 34      | 57      | 60      | 47      | 1             |
| 15    | 27      | 40      | 21      | 42      | 52      | 39      | 53      | 1             |
| 16    | 36      | 46      | 60      | 28      | 54      | 32      | 5       | 1             |
| 17    | 26      | 22      | 35      | 25      | 56      | 49      | -       | 1             |
| 18    | 36      | 39      | 50      | 53      | 47      | 60      | 7       | 1             |
| 19    | 33/43   | 23/46   | 30      | 42      | 40      | 27      | 59      | 2             |
| 20    | 35      | 29      | 25      | 49      | 55      | 58      | 48      | 1             |
| 21    | 37/44   | 31      | 22      | 34      | 38      | 51      | 57      | 1             |
| 22    | 23      | 42      | 56      | 50      | 55      | 59      | 53      | 1             |
| 23    | 40      | 21      | 43      | 26/49   | 33/48   | 58      | 6/52    | 2             |
| 24    | 27      | 24      | 32      | 30      | 46      | 50      | 9       | 1             |
| 25    | 47      | 52      | 43      | 41      | 54      | 60      | 28      | 1             |
| 26    | 22      | 25      | 35      | 42      | 44      | 51      | 38      | 1             |
| 27    | 29/31   | 44/49   | 34      | 39      | 23      | 53      | 6/60    | 2             |
| 28    | 21      | 24      | 46      | 41      | 36      | 59      | 32      | 1             |
| 29    | 42      | 37      | 57      | 28      | 55      | 52      | 22      | 1             |
| 30    | 47      | 27      | 30      | 43      | 56      | 50      | 58      | 1             |
| 31    | 23      | 21      | 34      | 25      | 42      | 39      | 29      | 1             |
| 32    | 46      | 24      | 31      | 26      | 44      | 49      | 59      | 1             |
| 33    | 27      | 45      | 58      | 53      | 54      | 56      | 48      | 1             |
| 34    | 37      | 40      | 51      | 41      | 50      | 57      | 30      | 1             |
| 35    | 45      | 53      | 22      | 28      | 48      | 58      | 38      | 1             |
| 36    | 47      | 50      | 56      | 36      | 52      | 60      | 39      | 1             |
| 37    | 23      | 26      | 49      | 43      | 59      | 46      | 6       | 1             |
| 38    | 33      | 43      | 36      | 46      | 56      | 60      | 49      | 1             |
| 39    | 21      | 24      | 30      | 34      | 42      | 57      | 51      | 1             |
| 40    | 36      | 39      | 47      | 32      | 38      | 52      | 56      | 1             |
| 41/42 | 35/45   | 29/48   | 60      | 55      | 50      | 58      | 27      | 2             |
| 43    | 33      | 26      | 40      | 28      | 46      | 43      | 22      | 1             |
| 44    | 39      | 35      | 32      | 49      | 42      | 29      | 44      | 1             |
| 45    | 34      | 23      | 31      | 37      | 54      | 47      | 51      | 1             |

 Channel in the range 694-790 MHz

There are 252 main station assignments in operation in the frequency range 470-694 MHz

There are 103 main station assignments in operation in the frequency range 694-790 MHz

SFN areas comprise 1-3 main stations