NETWORKTV

Terrestrial TV DVB-T Reception

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Terrestrial TV Reception

DVB-T2 is the world's most deployed digital terrestrial television (DTT) system owing to its superior robustness, flexibility and efficiency. It supports SD, HD, UHD, mobile TV, radio, and any combination thereof.

DVB-T2 uses OFDM (orthogonal frequency division multiplex) modulation with a large number of sub-carriers delivering a robust signal, and offers a range of different modes, making it a very flexible standard. DVB-T2 uses the same error correction coding as used in DVB-S2, offering a very robust signal. The number of carriers, guard interval sizes and pilot signals can be adjusted, so that the overheads can be optimized for any target transmission channel.

Additional technologies used in DVB-T2 are:

- Multiple Physical Layer Pipes allow separate adjustment of the robustness of each delivered service within a channel to meet the required reception conditions (for example indoor or roof-top antenna). It also allows receivers to save power by decoding only a single service rather than the whole multiplex of services.
- Alamouti coding is a transmitter diversity method that improves coverage in small-scale single-frequency networks.
- Constellation Rotation provides additional robustness for low order constellations.
- Extended interleaving, including bit, cell, time and frequency interleaving.
- Future Extension Frames (FEF) allow the standard to be compatibly enhanced in the future.

DVB-T/T2

At the end of the nineties, a decision was made about the digitization of terrestrial TV in Europe. It was decided that digital terrestrial TV would be broadcast in accordance with DVB coding and modulation schemes. Digital Video Broadcasting Project (DVB), established in September 1993, is a consortium gathering over 200 broadcasters, manufacturers, network operators, software providers and regulatory bodies in over 30 countries, established to develop open standards for delivering digital television, multimedia and data services. The main task of the DVB organization was to "develop and agree specifications which are then passed to the European standards body for media systems, the EBU/CENELEC/ETSI Joint Technical Committee, for approval. The specifications are then formally standardized by either CENELEC or, in the majority of cases, ETSI" (European Telecommunications Standards Institute). The standards include satellite TV (DVB-S and DVB-S2), cable TV (DVB-C) and terrestrial TV (DVB-T and DVB-T2, generally called DTT - digital terrestrial television).

Although some countries have adopted DVB-T MPEG-4 (H.264) as the main digital terrestrial television (DTT) standard, the final standard in Europe is to be DVB-T2 MPEG-4 (H.264). The first country in Europe that began official emissions in DVB-T2 was the United Kingdom, seven years ago. Since that time there has been a number of European countries which use the most modern system of terrestrial television: Croatia, Denmark, Finland, Italy, Russia, Serbia, Sweden, Ukraine. Less or more advanced tests are conducted in the following 8 countries: Belarus, Estonia, France, Germany, Poland, Slovenia, Spain and Switzerland. In Poland, the change from DVB-T to DVB-T2 is expected to take place by June 30, 2022.

What are the benefits of digital terrestrial television?

Among the many advantages of the new system, DVB-T2 standard is characterized by better bandwidth utilization (higher multiplex capacity) and a much more effective data compression – High Efficiency Video Codec (HEVC) /H.265. DVB-T enables sending approx. 24.88 Mbps in one 8 MHz channel, while DVB-T2 can extend this value to 40 Mbps. On the consumer side, the most important limitation of the DVB-T standard is the inability to get terrestrial television channels in a resolution higher than HD (720p) or Full HD (1080p). The use of the much more effective compression standard will allow the transmission of more TV channels in one multiplex, it will also be possible to broadcast channels in 4K / Ultra HD image resolution.

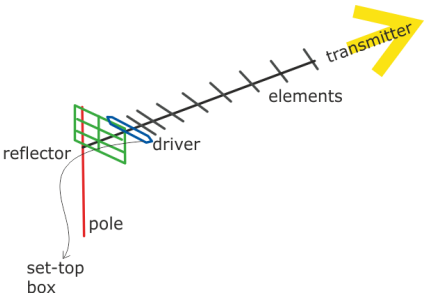
How to choose a television for DVB-T/T2?

DVB-T2 transmission is carried out using image coding in accordance with the HEVC standard (also known as H.265 or MPEG-H part 2). So, only televisions capable of decoding such a compressed signal are able to correctly receive the broadcast television programs. So, anyone intending to buy a new TV, should make sure that the TV set is capable of receiving content broadcast in the new format. Many commercially available TV sets are already equipped with a DVB-T2 decoder but can only decode an image encrypted according to the older video coding standard (AVC, also known as H.264 or MPEG-4 part 10). These TV sets, after the introduction of the DVB-T2/ HEVC transmission standard in any country will stop "recognizing" the broadcast content and will require to connect an external decoder.

Directional combo DVB-T antennas with changeable polarization (VHF+UHF)

Your ability of receive all the Freeview transmissions depends on the suitability of aerial

- the design style,
- the "group", and
- its physical location.



The Yagi-Uda or Yagi antenna is one of the most popular antenna designs, due to a comparatively simple construction and high gain. Yagi-Uda antennas can operate in the HF to UHF bands (3 MHz to 3 GHz), but often within a limited bandwidth around the center frequency. In the case of DVB-T bands, the parameters are chosen so as to maintain the balance between the range of channels that can be received and the average gain within the frequency band. Another aspect is the polarization of the transmitted signals. The antenna elements (directors, dipole, reflector) have to operate in accordance with the polarization of the signals, otherwise the gain of the antenna would disappear. Usually, all transmitters in an area operate with the same polarization in one band (UHF or VHF), but the polarization of the broadcasts in the UHF and VHF bands can be different. The new MUX-8 is transmitted in the VHF band with vertical or horizontal polarization, depending on the area. The appropriate polarization of the receiving antenna is essential for the proper reception of the DVB-T broadcasts.

The Yagi aerial is mounted on a pole, and consists of a rod with a reflector (shown green) at the back and many spiky elements (in grey) at the front. The connecting cable connects to the element nearest the reflector, known as the driver (shown in blue).

These Yagi aerials are directional and so pick up signals best from a transmitter that the rod points towards. The more elements the aerial has, the better it picks up a signal and becomes more directional.

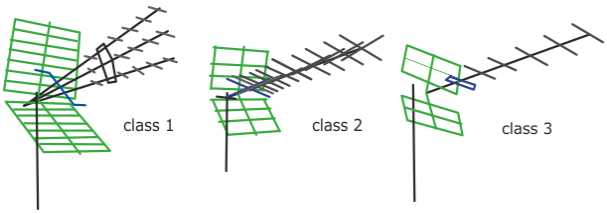
A standard-type aerial is all that is required for digital TV reception in most places. These antennae have between 10 and 18 elements and a single reflector. These are recommended for new installations for good digital television reception, but will more often than not function perfectly in good reception areas.

Typically these aerials are designed to receive only some transmission frequencies - see "groups" below.

Thanks to a universal construction, many antennas allow VHF and UHF antenna segments to be independently set to the vertical (V) or horizontal (H) polarization of the received signals. These are specially designed for receiving DVB-T broadcasts with different polarizations in VHF and UHF bands.

High Gain aerials

These aerials are designed for poor digital reception areas, and have two reflectors. For maximum signal strength, some digital high gain aerials have up to 100 elements. Since the switch-over to digital-only transmissions back in October 2012, most UK households now have good quality digital TV signals.



A more expensive aerial is only required where the signal strength is low, but can often provide the whole Freeview reception where it might otherwise be impossible.

The CAI (that represents aerial installers) has four standards for digital TV aerials. The highest standard "1" is for homes on the fringes of coverage areas, intermediate standard "2" is suitable for use within the coverage area; minimum standard "3" is for good coverage conditions.

These aerials can be either wideband, or receive only selected frequencies - see "groups" below.

You may haved used a 'Grid aerial' for analogue reception, but as they are generally unsuitable for Freeview reception, they have now generally been replaced by the Yagi type. However in some places a Grid aerial installation may work for Freeview: otherwise replace with a standard Yagi aerial.

Indoor

Indoor aerials are generally not suitable for Freeview reception. In areas of good signal strength it is often possible to receive some transmissions. Even where an aerial works, people often find that may get interruptions to their viewing (or recording).

Loft mounted

Loft mounted arrivals are not generally recommended for Freeview reception, as the roof tiles and plumbing will degrade the signal. Some compensation for this loss of signal can be made by using satellite-grade cable to connect the set top box to the aerial.

Positioning

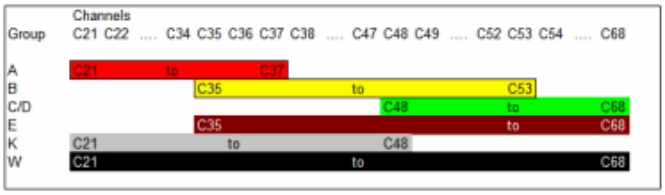
The best position for a TV aerial is mounted outdoors, as high from the ground as possible, pointing directly at the transmitter. The signal can be blocked by hills and tall buildings. It should be positioned away from any other aerials.

Horizontal or vertical?

The transmitter will either use vertical mode which requires the elements of your aerial to be up-down, or horizontal mode which requires them to be level with the ground.

Groups

Both analogue and digital television is transmitted the same group of transmission frequencies (known as channel 21 through to 60). A coloured marking on the aerial shows the group.



To create the best possible analogue picture, TV transmissions from adjacent transmitters have been designated to several different groups of frequencies. By using an aerial that receives only the channels in the correct group, the analogue picture can be kept free from interference.

To receive Freeview transmissions from the same transmitter it has been sometimes necessary to use frequencies that are not part of the transmitter's normal group. When this has occurred, the aerial will need to be replaced with a "wideband" aerial (also known as group W) - one that covers every group.

As Ofcom is planning to move the TV frequencies again with the 8Mhz frequencies being used by 5G it may be wise to use a wideband aerial if you can to ensure you can keep viewing Freeview for many years to come.

References:

Ukfreetv: www.ukfree.tv
ETSI: www.etsi.org

Abbreviations Used in DVB Transmissions

For the purposes of the present document, the following list of abbreviations may help:

1PPS	One-pulse-per-second (signal from GPS receiver or other timing reference)
ACE	Active Constellation Extension
AGC	Automatic Gain Control
ASI	Asynchronous Serial Interface
AWGN	Additive White Gaussian Noise
BCH	Bose-Chaudhuri-Hocquenghem multiple error correction binary block code
BER	Bit Error Ratio
BPSK	Binary Phase Shift Keying
BUFS ISSY	variable indicating the maximum size of the requested receiver buffer to com ensate delay variations
CA	Conditional Access
CDS	Carrier-Distribution Sequence
COFDM	Coded Orthogonal Frequency Division Multiplexing CP Continual Pilot
CPE	Common Phase Error
CSI	Channel State Information
CSP	Common Simulation Platform
CW	Continuous Wave
DFT	Discrete Fourier Transform
DJB	De-Jitter Buffer
EIT	Event Information Table
FEC	Forward Error Correction
FEF	Future-Extension Frame
FFT	Fast Fourier Transform
FIFO	First-In First-Out buffer
FPGA	Field Programmable Gate Array

NOTE: Also known as highest common factor.

GCS	Generic Continuous Stream
GFPS	Generic Fixed Packet size Stream
GIF	Guard-Interval Fraction (TG/TU)
GPS	Global Positioning System
GSE	Generic Stream Encapsulated
HEM	High Efficiency Mode
I/L	Frame InterLeaving Frame
IC	Integrated Circuit
ICI	Inter-Carrier Interference
ID	Iterative Demapping
IFFT	Inverse Fast Fourier Transform
ISI	Intersymbol Interference

Abbreviations cont.

ISSY	Input Stream SYnchronizer
LDPC	Low Density Parity Check (codes)
LLR	Log Likelihood-Ratio
MER	Modulation Error Ratio
MFN	Multiple Frequency Network
MIMO	Multiple Input Multiple Output
MIP	Megaframe Initialisation Packet
MODCOD	MODulation and CODing

NOTE: This term is used to refer to a particular combination of constellation, LDPC code rate and block length.

NIT	Network Information Table
NM	Normal Mode
NPD	Null-Packet Deletion
OFDM	Orthogonal Frequency Division Multiplexing PAPR Peak-to-Average Power Ratio
PAT	Program Association Table
PCR	Programme Clock Reference
PCT	Parity and Column Twist
PLP	Physical Layer Pipe
PN	Pseudo Noise
PSI/SI	Program Specific Information / Service Information
QEF	Quasi-Error-Free
QPSK	Quaternary Phase Shift Keying
RF	Radio Frequency
RMS	root mean square
SDT	Service Description Table
SFN	Single-Frequency Network
SI	Service Information
SNR	Signal-to-Noise Ratio
SP	Scattered Pilot
Statmux	Statistical multiplex
SYNCD	the distance in bits from the beginning of the DATA FIELD of a BBFRAME to be ginning of the first transmitter User Packet that starts in the DATA FIELD
T2dsd	DVB-T2 delivery system descriptor
T2-MI	DVB-T2 Modulator Interface
TDI	Time De-Interleaver
TFS	Time Frequency Slicing
TI-block	Time-Interleaving block
TR	Tone Reservation
TS	Transport Stream
UHF	Ultra High Frequency (band)
VBR	Variable Bit Rate