

THE CONSTRUCTION AND PERFORMANCE ENHANCEMENTS OF ULTRA HIGH-FREQUENCY RANGE FOR THE INDOOR AND OUTDOOR ANTENNAS IN BUILT-IN COMMUNICATION NETWORKS

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Abstract

Digital terrestrial television is a good budget alternative to satellite TV. Its main advantages are excellent image and sound quality and no subscription fees. There is a set-top box (receiver) and antenna for digital TV in smart homes, and a great picture on any TV is guaranteed. The accurate picture is achieved due to a different quality signal transmission system than analogue TV. The digital signal is not subject to interference and interference and depends very little on the distance to the transmitter. The proposed antenna design provides enhancements to the Ultra High Frequency (UHF) range for indoor and outdoor antennas. There are indoor and outdoor antennas for the home and Dutch, respectively, where the antenna is installed. They are divided into active and passive depending on the presence of a built-in signal amplifier operating from the network. If the cable is long, the signal attenuation will be strong, which is very important for receiving meter waves unlike UHF, for which the length of the wire is also important, but not so much.

Keywords:

Digital Television, Set-Top Box, Transmission System, Ultra High Frequency, Indoor Antennas, Outdoor Antennas

1. INTRODUCTION

In General, if you live near a TV tower, a passive (without an amplifier) indoor antenna is recommended for reception: signal amplification may distort it [1]. When moving away from the TV tower, for example, in a Dutch or a country house and there are obstacles (trees, buildings), an external antenna with a built-in or external signal amplifier is required [2]. The main condition when choosing an antenna for digital television should be reliable reception in the UHF range. Focus External Antennas In the section you can find External Antennas for Digital TV. The UHF antenna can be made from a wire in the shape of the number 8. To make such a receiver, you can use copper or aluminium wire with a diameter of 3 to 5 mm, as well as a PK75 cable [3]-[5].

During the manufacturing process, you will also need a glue gun. Such a UHF receiver can be placed anywhere and does not require an amplifier [6]. Besides, if the device is external, an amplifier may be required if the cable length is significant. In this case, to compensate for the signal loss, you must install it [7]. Usually, you decide to watch your favourite TV show in the evening and suddenly the TV stops showing [8]. Or another case: you came to the Dutch, already prepared for the rest, but the same situation again - not even a single channel worked [9]. You need to build the antenna for the TV with your own hands because often there is a reason for the breakdown of this device [10]. Next, we will consider the least available tools and simple build options that require time. The TV antenna can be made from a simple metal-plastic tube [11]. This will create a device for receiving UHF in

the possible range of 480 MHz to 1000 MHz. This “model” uses a pipe with a diameter of 16 mm and a cable of 5.5 m. The ring will require 55 cm of pipe, and the rack - 14 cm, which is equal to a quarter of the wavelength [12]. This allows the outer casing of the cable to be better fitted and reduced to high-frequency currents. The cable outlet in this design is made through a pipe hole [13].

The cable braid should be attached with a clamp to the removed part of the pipe. The centre core of the cable is attached to the loop (you can use a screw with a washer and nut) [14]. Such a homemade product works well as a room antenna in apartments with reinforced concrete walls that do not transmit TV waves well [15]. Thanks to the extended cable, you can carry it on the balcony or put it in the window - the reception quality will only improve. Buying antennas can help save money, and in some cases get out of the situation when the TV is on, but the standard antenna is irregular, or it is not. Also, the quality of getting homemade products is not worse than factory counterparts. If you do not want to build the device yourself, you will need information about it in the store [16].

Despite the large number of numbers specified in the product passport, only one parameter is important to a simple consumer - the gain factor. The unit of measurement for performance is the decibel, the higher the number, the higher the efficiency of the antenna and the greater the efficiency of the signal amplifying device [17]. However, not in all cases, too much power will provide a high-quality image. The size of the device must correspond to the location of its installation. If the product quality is low, the coefficient that is not in the technical description will be specified. All figures above 45 dB should be carefully checked, and values between 80 and 120 dB are a clear disappointment. Most often, it is difficult for buyers to decide which antenna is best, as it has different models and device selection criteria.

Removing the cable sheath is a very simple process that does not require skills. All you need is a sharp tool. The main thing in the removal process is that the copper wire itself cannot be damaged, which is theoretically possible with excessive zeal. The bonding points should be sealed with ordinary rubber glue. The resulting design is reliable and easy to use. If you have the finished material and tools, it will load in an hour. It saves from three thousand rubles and more, as far as you can remember [18]. But number eight is not the only antenna for digital TV, you can do it yourself. There are many more interesting options. The antenna for the long-distance signal is used in most cases in terms of squares. It is a dual square antenna, three or a “square”. These are all different changes, improvements of the same pattern. It is difficult to understand what works best. It probably depends on the type of terrain. However, such a design has proven to be almost the best solution for decimeter signals. Transmission

interruption occurs at a distance of ten kilometres without additional funding. But if long distances are required, the device is simply fitted with an amplifier, which increases the reception level by a large percentage.

For construction, you will need aluminium wire of circular cross-section. It is not difficult to find and everyone in the house may have the remains of such items. Depending on the specific type of antenna for digital TV DVB t2 it is necessary to create two, four or six squares from it. Next, build a transformer to stabilize the signals. This is done as a withdrawal. The last step is final soldering and the application of copper wire to the surface of the structure [19]. It is logical to assume that the signal is amplified and diverted to our antenna. You can create it yourself, but let's talk about it another time. You can buy this at speciality stores. It's not as expensive as some satellite dishes, so it's very possible to get out without serious damage to the budget.

There are some subtleties in installing the amplifier, and safety precautions, one might say. First, the installation is carried out at a distance of three meters from the main reception source. This will only amplify the signal at such a distance, place it somewhere in the back of the house and it will not work in the shed, remember. Second, it is important to understand the reason for using an amplifier. If the signal is very stable, you can only receive it through a single TV antenna [20]. The additional installation of an amplifier is the result of an excess of signal strength. This can lead to a decline in transmission quality, floating images, and undesirable interference. Therefore, it is necessary to calculate in advance how far the signal should be enhanced and how far the broadcast tower is.

2. LITERATURE REVIEW

Ikram et al. [1] discussed the Room type of device with an amplifier. The decimeter captures a signal in two forms in the range. The gain is 28 dB. The device cable must be purchased separately. The Room type device with amplifier. Power comes directly from the injector or the set-top box. The gain varies from 20.5 to 25.0 dB. Device dimensions: length - 22 cm; Width - 33.6 cm; Height - 83 cm. Weight not exceeding 250 g.

Chen et al. [2] discussed that versatile devices can be installed with indoor and outdoor antennas. The suitable receiving channels are constructed in two formats- digital and analogue.

Kouhalvandi et al. [3] discussed the kit includes a special bracket for adjusting the device, a power supply, a cable and a stand for installation on a horizontal surface.

Jilani et al. [4] discussed the depending on the number of channels gained: 6 to 12 channels - 30 dB; 21 to 60 - 36 dB. The Small-scale model of the exterior type is attached to the wall or balcony grill. The gain is 13.5 dB. Device dimensions: length - 60 cm; Width - 30 cm; Height - 20 cm. Product weight 900 g. Small-sized outdoor type device that can be mounted on a wall or balcony frame. The gain varies from 5.8 to 7.2 dB. Device dimensions: length - 41 cm; Width - 42 cm; Height - 29 cm. Weight approximately 450 grams.

Wang et al. [5] discussed the small-sized exterior type device, fixed on the window or balcony grill, you can mount the device on the wall. The gain ranges from 10 to 12 dB. Device dimensions: length - 60 cm; Width - 42 cm; Height - 36 cm. The

mass of the antenna is slightly more than one kilogram. When choosing an antenna, do not buy too expensive models. It is better to live in outdoor type models with average performance, which will be enough to watch the hijacked channels.

Othman et al. [6] discussed all supplied models of external devices can be fitted with the additional amplifier by selecting the appropriate gain. It cannot catch a transaction with interruption, poor quality, or disappearance. So, in most cases, homemade will not be lost on the paid plate.

Klionovski et al. [7] discussed the acceptance rate of the antenna is poor, although this is done by non-professionals in the conditions of artisans. However, it does not matter if you were able to catch the signal in principle. If it is, it will be one hundred percent quality. Often, looking at the answers to the question – of how to build an antenna for digital TV DVB t2, you will notice that on the network it is sometimes called a satellite.

Zhang et al. [8] discussed that construction is a major mistake because it has nothing to do with it. After all, this broadcasting technique uses a superior satellite respectively, which provides a different type of channel.

3. PROPOSED MODEL

Two or more TVs can be connected to a digital TV antenna. However, if you use a receiver for reception, each TV will show the same channel. To watch different channels at the same time, you need to buy receivers for other TVs. The delivery department will deliver your selected goods anywhere in Moscow and the Moscow region. Although there are a large number of TV antennas in the consumer market that can be easily purchased at any electronics store, the interest in how to make a TV antenna that you can make yourself will not fade. Such curiosity can be explained by reluctance to spend money to buy an antenna, staying away from retail outlets (if you are abroad or in the country) or the failure of one purchased. The proposed design antennas for TV receivers can be divided into several types shown in Fig.1,

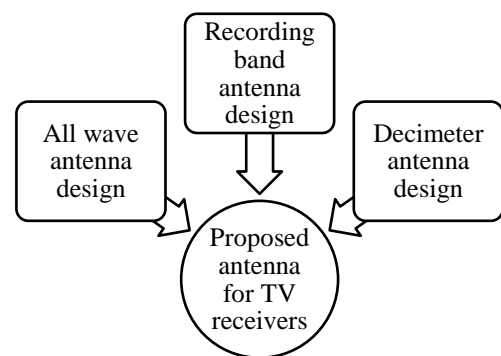


Fig.1. The proposed design antennas for TV receivers

- All wave antenna- design is easy to manufacture and can be made from simple upgraded materials. It receives the digital signal well outside the city without much interference. When located near the broadcast tower, it can receive analog television.
- The recording band is easy to the antenna. It has perfect integration with the feeder at all limits, without changing the

parameters in it. This design has average technical parameters so it can be used as an indoor antenna in a country or city.

- **Decimeter Antenna:** A simplified modification of the Z-antenna is often used, which works well regardless of signal reception conditions.

All wave TV signal catchers are also called frequency-independent (CNA). Their design may be different. Copper wire can be taken in any diameter; it does not play a special role. The ends of the wire are connected at a distance of 20 to 30 mm from each other. The plates with the other ends of the wire connections should be located at a distance of 10 mm from each other. Since the design of the antenna has a square shape, its height is equal to the width and the angle between the canvases is 90 degrees. Zero is marked in yellow on the potential point. No need to solder the cable braid at this point - a tight tie will suffice. The television signal received in this way in the form of two magazines is capable of receiving all decimeter channels and one meter. Also, it captures the signal well in all directions. But if you install CNA in the bad signal reception zone from the TV tower, it will only work normally with the amplifier.

The TV antenna can be made in the shape of a butterfly. To build this very powerful antenna yourself, you need to make a board or plywood with dimensions of 550 x 70 x 5 mm, a wire with a 4mm copper core and, accordingly, a PK75 cable. To make this you have to follow the methods developed in the Eastern form.

Step 1: Mark the holes in the plywood and drill them. The dimensions in the picture are in inches. Below the image is a table for converting inches to mm.

Step 2: From the copper wire, it is necessary to cut 8 pieces 37.5 cm long.

Step 3: At the centre of each wire, remove the insulation from certain sections (2 cm each) at certain intervals.

Step 4: After that, you need to cut 2 more pieces of wire, already 22 cm each, divide them into 3 equal parts and remove the insulation at the separation points.

Step 5: Attach parts V-shape. Care should be taken to maintain a distance of 7.5 cm between the ends of the wire. This is optimal for receiving a clear signal.

Step 6: Make 2 pieces of wire of the required length to connect the "antenna" to the socket.

Step 7: Screw the socket on the plank and attach all the elements.

Step 8: Preparation of the routine requires the use of a wood shaker, a pair of self-tapping screws, electrical tape or adhesive tape and, if possible, a soldering iron with tin.

The simple design for getting UHF can be done with your own hands in a short time from upgraded materials. All you need is a coaxial cable and the right size plywood. Now all of these should be collected:

- Prepare a section of coaxial cable (PK75) 530 mm long (from which a loop will be made);
- Cut another section of cable 175 mm long - this will be a loop;
- Make a ring (1), solder a loop (2) and attach a cable (3) to the TV;

- Fix everything on plywood paper and direct the TV signal receiver towards the TV tower.

A recording antenna (LPA) can be used to receive radio waves at both the meter and decimeter ranges. To make such a signal receiver, you can use a 10 mm diameter aluminium tube and metal wires (studs), which can be purchased at a stand that sells fasteners. There are several criteria for classifying devices. The proposed model for digital television is offered in several variants are shown in Fig.2.

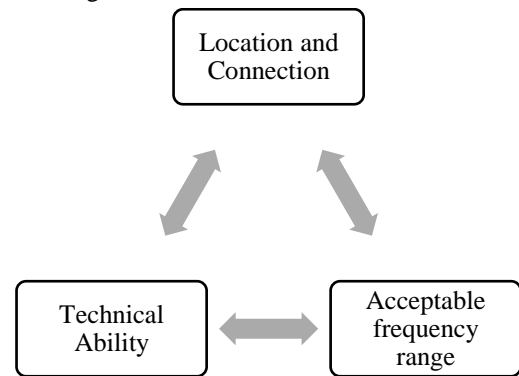


Fig 2: The proposed model variants for the construction of an antenna

- According to the location of the connection;
- Technical ability to amplify the signal;
- Within the sample acceptable frequency range.

Ideally, it is better to use soft pipes or wires instead of threaded wires. Is based on a plastic U-shaped box. Homemade decimeter signal catchers can come in a variety of shapes and designs, from the simplest to the most complex devices. If your TV receiver uses such an antenna, try to create a more sophisticated device. Functional characteristics and design features of Passive antennas are listed below,

- Amplifies the TV signal due to the technical design features of the device;
- Work without a network connection;
- There are no active components in the signal amplifying design - transistors or microcircuits;
- A passive device cannot affect the signal by its interference;
- Often the power of such a device is not enough for a good picture.

The passive type model is sufficient for rooms located near the TV tower, there are no tall buildings around, and the device is located at a height of more than ten meters. The amplification of the signal occurs with the help of technical features of the design and a built-in amplifier, which can be mounted inside the device or located separately. The equipment is powered by electricity. Sometimes the device generates interference and noise in the received signal. There may be several reasons:

- The antenna for the digital signal is used in the region of the static digital signal
- Equipment is selected incorrectly - you should not choose a model with more gain than necessary;
- Low-quality materials.

It is important to install the device properly; otherwise even the right device will not guarantee a good signal:

- The device must be directed towards the TV tower;
- For situations where the room TV tower is not noticed, a window antenna is sufficient, this device is attached to the window frame and is in no way inferior to the external device in terms of its performance, although it is considered a room model;
- To ensure that multiple TVs at homework well, you should purchase an outdoor type device that has the best performance;
- Do not install the device near objects and surfaces that create active interference, for example, near metal tiles, electrical connections and other conductive materials.

The first time you need to run the antenna without an amplifier, if the picture is of poor quality, connect the amplifier. Numerous positive reviews from experts and the general consumer confirm the effectiveness of the external models.

4. RESULTS AND DISCUSSION

The proposed smart ultra-high frequency antenna (SUHFA) model was compared with the existing smart designs like the Multi-objective Bayesian optimization (MOBO), Automated deep neural learning-based optimization (ADNLO), stacked patch antenna design (SPAD) and MM-wave dielectric resonator antenna (DRA). There are different performance parameters are listed below for the enhanced results.

4.1 PERFORMANCE OF INDOOR ANTENNA

The device is indoors. It is possible to use a room type model as the TV receives a high quality, good signal. The house should be located close to the tower. There are few places like this, because buildings, electrical connections and so on interfere with the signal. Also, indoor antennas in country houses and apartments far from the city are useless. The statement that the indoor antenna can be installed in any room and the signal is of the same quality is incorrect. For each room, it is necessary to choose a model individually shown in Table.1.

Table.1. Performance comparison of indoor antennas

Signal	MOBO	ADNLO	SPAD	DRA	SUHFA
100	60.00	58.07	46.24	78.21	90.41
200	59.50	58.07	45.15	77.95	90.30
300	58.75	57.24	44.01	77.38	90.24
400	58.75	57.97	44.37	78.52	90.19
500	59.80	59.08	45.90	79.54	90.15
600	60.08	59.48	46.54	79.78	90.12
700	59.36	58.91	45.96	79.13	90.10

The indoor antenna is a versatile concept. Many types differ in both design and function. The most common option is eight. At the same time, it is a simple antenna for digital TV DVB T2, you can do it yourself. The name is based on visual similarity. I.e., exterior design numbers eight. It is made from twisted cable

respectively. These kinds of products, or in principle, techniques, are used everywhere in different kinds of industries.

4.2 PERFORMANCE OF OUTDOOR ANTENNA

They are considered universal and are used in any geographical location, including outside the city. The installation should be carried out by an expert as some knowledge must be applied. Proper installation will allow you to receive a reliable and high-quality signal regardless of the distance and obstacles from the TV tower shown in Table.2.

Table.2. Performance comparison of outdoor antennas

Signal	MOBO	ADNLO	SPAD	DRA	SUHFA
100	60.86	59.13	49.57	81.53	90.40
200	59.57	58.38	44.95	78.13	90.30
300	59.82	58.41	44.95	78.49	90.23
400	59.95	59.23	45.42	79.68	90.19
500	59.87	59.32	45.62	79.55	90.15
600	59.88	59.45	45.88	79.53	90.12
700	60.23	59.87	46.51	79.96	90.10

If we talk about signal reception, it is no secret that the most active substance is copper. Therefore, it is logical to choose copper wire as the product material. True, in some cases the use of aluminium is allowed.

4.3 PERFORMANCE OF CHANNEL DEVICES

They are used to broadcast specific channels with specific bandwidth and, as a rule, simple viewers do not need to use these types of models. A simple device, a digital TV antenna, can greatly help with this problem. Two decades ago, almost every home was equipped with a TV with this type of device. They usually did it on their own and it didn't cause any inconvenience. In our time, demand has somewhat diminished, but not disappeared. Many people do not know how to make an antenna for digital television with their own hands. After all, analogies, finished goods, appeared shown in Table.3.

Table.3. Performance comparison of channel devices

Signal	MOBO	ADNLO	SPAD	DRA	SUHFA
100	68.29	49.54	70.75	77.05	92.41
200	69.95	55.40	63.91	83.23	92.30
300	70.40	54.26	62.62	84.72	92.24
400	65.71	55.40	60.48	87.96	92.19
500	65.32	56.28	62.05	87.24	92.15
600	65.48	57.48	63.67	87.11	92.12
700	66.22	59.13	65.47	88.38	92.10

Sizes are not strictly defined. Despite knowing the broadcast frequency, it is still impossible to calculate the best dimensions at home. So, you have to follow certain structures, and rules, nothing more than that. Our figure is equal to the height value of eight - 140 mm, width 130 mm. accordingly, even if you decide to increase or decrease the dimensions for some reason, do not forget

this ratio and keep them anyway. This is an important design feature.

4.4 PERFORMANCE OF RANGE ANTENNAS

Used were necessary to receive waves within a certain range. In particular, a device operating in the decimeter range is sufficient to broadcast channels in digital format. Unfortunately, their price can bite very strongly. Good products start for three thousand rubles and above. Because you can create DVP D2 with your own hands in a short time, the savings will become very, very decent.

When calculating the total length of copper wire required to build a DVB t2 antenna, do not forget about the loop factor shown in Table.4.

Table.4. Performance comparison of range antennas

Signal	MOBO	ADNLO	SPAD	DRA	SUHFA
100	64.35	54.00	55.50	77.63	93.41
200	65.06	56.76	55.71	80.67	93.30
300	64.99	55.78	54.45	81.21	93.24
400	62.38	56.70	53.26	83.51	93.19
500	62.65	57.70	54.84	83.57	93.15
600	62.87	58.49	56.09	83.61	93.12
700	62.93	59.02	57.00	84.02	93.10

That is, do not calculate only the length of the pages of number eight, otherwise, the section will be less than required. It is better to take an edge without triviality. After you have "folded" the eight figures, you need to solder the joints to improve performance. Of course, the cable must be protected from the outer sheath.

4.5 PERFORMANCE OF ALL WAVE ANTENNAS

Capture channels in two ranges. it is necessary to understand the operating principle of decimeter waves and the modern digital television system in the DVB t2 range shown below Table.5.

Table.5. Performance comparison of all wave antennas

Signal	MOBO	ADNLO	SPAD	DRA	SUHFA
100	63.78	63.62	53.76	81.09	92.46
200	62.49	62.87	49.14	77.69	92.36
300	62.74	62.90	49.14	78.05	92.29
400	62.87	63.72	49.61	79.24	92.25
500	62.79	63.81	49.81	79.11	92.21
600	62.80	63.94	50.07	79.09	92.18
700	63.15	64.36	50.70	79.52	92.16

Experts recommend choosing this type of device because in Russia the channels are broadcast in meter and decimeter ranges. But one question you should be very interested in and the simple self-assembled design will be just as useful as the purchase. The object is simple, whether the signal is captured or not.

5. CONCLUSION

The Television has taken to a new, previously unattainable height. That is the transition to a quality different-level broadcast in digital format. Four years later, the second generation of this system, named - DVB t2, saw the light. This technology differs favourably in single frequency transmission. That is, multiple channels were sent in a group, where each program was assigned its slot. Therefore, the antenna for digital TV has reached new milestones in popularity. The fundamental difference of the new system was that it allowed companies to significantly reduce costs. This applies to the direct organization factor of the process, as well as to the technically planned maintenance. Unfortunately, there are flaws this time around, but progress is not in its final stages. The main problem is that to receive the digital signal, the interference must be avoided. The exchange must be at a standard level. As a result, those living in rural areas far from the source are often unable to receive the digital television signal properly. At the same time, the conditions in the metropolis have their problems. Large arrays of modern buildings are constructed of reinforced concrete and act as a kind of screen that blocks the flow of decimeter waves. As a result, in some cases, there is a problem with the transfer.

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