**Assessment of quality of DVB-T2 signal repeater operation under multipath reception mode**

**1. Diagram of measurements and equipment used**

Measurements are done in compliance with the diagram shown in Fig. 1.

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| Fig. 1 - Diagram of measurements |

The following equipment is used to perform the measurements:

* digital signal test transmitter
(item 1);
* attenuator (item 2);
* repeater (item 3);
* attenuator (item 4);
* spectrum analyser (item 5);
* TV signal analyser (item 6).

Attenuator (item 4) is used when necessary.

**2. Scope and terms of measurements**

2.1 The measurements are aimed at testing the quality of repeater operation under the multipath reception mode, assessing the parameters of echo in presence of which generation of signal outputs with the quality of quasi error-free reception is observed at repeater output.

2.2 The measurements are carried out at incident signal carrier frequency, chosen in compliance with the functioning TV channel grid.

2.3 The measurements are performed at 4/5 code rate.

2.4 The measurements are performed at 64QAM DVB signal modulation.

2.5 The measurements are performed at incident signal spectrum profile consistent with the multipath reception current model.

2.6 Assessment of quality of repeater-generated signal is done through approaching demodulation disturbance, accompanied with BER = 10-7 level at TV signal analyser.

**3 Measurement procedure**

The measurements are carried out through the following procedure.

3.1 Assemble the measuring bench using the diagram at Fig. 1. Turn on the used equipment and heat it during the time period specified in operating instructions.

3.2 Choose TV channel to be measured.

3.3 Set the following parameters at test transmitter:

– digital-frequency modulation standard – DVB-T2;

–output signal frequency – depends on a chosen TV channel;

– signal output modulation – 64QAM;

– code rate– 4/5;

– output signal level – minus 50 dBm;

– guard interval – 1/16.

The following parameters must be set at the repeater:

– output power level– not exceeding 1 W;

– frequency of incident and output signals – depends on a chosen TV channel;

The following parameters must be set at the TV signal analyser:

– digital-frequency modulation standard – DVB-T2;

– incident signal frequency – depends on a chosen TV channel;

The attenuator (item 2) must be provided with loss of signal, so that signal at repeater input is minus 60 dBm.

3.4 Check generic character of spectrum profile of test transmitter signal using spectrum analyser and set all the parameters required for spectrum display. Check regularity of demodulation of repeater output signal using indications of TV signal analyser.

3.5 Switch TV signal analyser into the spectrum analysis mode with the following characteristics:

– carrier frequency– depends on chosen TV channel;

– swath – 10 MHz;

– resolution bandwidth – 10…30 kHz;

– scanning mode – auto;

– scanning time – auto;

– detector – root-mean-square.

Repeater output signal spectrum must be stable and in compliance with the Gauss channel.

3.6 Switch TV signal analyser into signal analysis mode.

3.7 Turn on signal generation mode, that imitates dual path reception, at test transmitter. Set echo level equal to basic signal level. Set the required echo lag parameter.

3.8 Assess quality of repeater-generated signal on the basis of data from TV signal analyser.

3.9 Switch TV signal analyser into spectrum display mode. Repeater output signal spectrum must be stable and in compliance with the Gauss channel. Switch analyser into demodulation parameter display mode.

3.10 Find maximum permitted value at test TV transmitter through changing echo delay value. Pin the output signal spectrum envelope.

3.11 Reduce echo level by 1 dB and repeat ss. 3.8 – 3.10.

3.12 If necessary, sequentially repeat s. 3.11 until echo stops affecting repeater operation.

3.13 If possible, perform the measurements in both on and off positions of echo suppression function.

**Technique of assessment of quality of DVB-T2 signal repeater operation under transmitted signal reception mode**

**1. Diagram of measurements and equipment used**

Measurements are done in compliance with the diagram shown in Fig. 2.

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| Fig. 2.6 - Diagram of measurements |

The following equipment is used to perform the measurements:

* digital signal test transmitter
(item 1);
* radio frequency summarizer (item 2);
* TV signal analyser (item 3);
* spectrum analyser (item 4);
* repeater (item 5);
* attenuator (item 6);
* adjustable attenuator (item 7);
* radio frequency splitter (item 4).

Attenuator (item 6) is used when it is necessary to avoid overload of inputs of TV signal analyser and repeater.

**2. Scope and terms of measurements**

2.1The measurements are performed to assess quality of repeater operation when its attenuated output signal is routed to repeater input.

2.2 The measurements are carried out at incident signal carrier frequency, chosen in compliance with the functioning TV channel grid.

2.3 The measurements are performed at 64QAM modulation with 4/5 code rate, for all major channel types - Gauss, Ricean, Rayleigh.

2.4 Assessment of quality of repeater-generated signal is done through approaching demodulation disturbance, accompanied with BER = 10-7 level at TV signal analyser, and presence of short-period spectrum distortions caused by change in incident signal level.

**3 Measurement procedure**

The measurements are carried out through the following procedure.

3.1 Assemble measuring bench using the diagram at Fig. 2.6. Turn on the used equipment and heat it during the time period specified in operating instructions.

3.2 Choose a TV channel to be measured.

3.3 Set the following parameters of test transmitter:

– digital-frequency modulation standard – DVB-T2;

– output signal frequency – depends on a chosen TV channel;

– signal output modulation – 64QAM;

– code rate– 4/5;

– guard interval – 1/16.

– output signal level – minus 60 dBm;

– transmission circuit type spoof – Gauss channel.

The following parameters must be set at the repeater:

– output power level – not exceeding 1 W;

– frequency of incident and output signals – depends on a chosen TV channel;

The following parameters must be set at TV signal analyser:

– digital-frequency modulation standard – DVB-T2;

– incident signal frequency – depends on a chosen TV channel;

Set maximum attenuation at adjustable attenuator (item 7).

3.4 Check generic character of spectrum profile of test transmitter signal using spectrum analyser and set all the parameters required for spectrum display. Check regularity of demodulation of repeater output signal using indications of TV signal analyzer.

3.5 Switch TV signal analyzer into spectrum analysis mode with the following characteristics:

– carrier frequency– depends on chosen TV channel;

– swath – 10 MHz;

– resolution bandwidth – 10…30 kHz;

– scaning mode – auto;

– scaning time – auto;

– detector – root-mean-square.

Repeater output signal spectrum must be stable and in compliance with the Gauss channel.

3.6 Switch TV signal analyzer into the signal analysis mode.

3.7 Using adjustable attenuator (item 6) change attenuation and pin current level of repeater proper echo and monitor BER value changes at TV signal analyser.

3.8 When attenuation level at attenuator reaches the p. 2.4-specified criterion, pin levels of basic signal and echo supplied to repeater input from test transmitter and radio frequency splitter. Detect echo level when malperformance in repeater is observed.

3.9 Repeat pp. 3.3 - 3.8 for Ricean channel and Rayleigh channel.

3.10 If possible, perform the measurements at both on and off positions of echo suppression function.