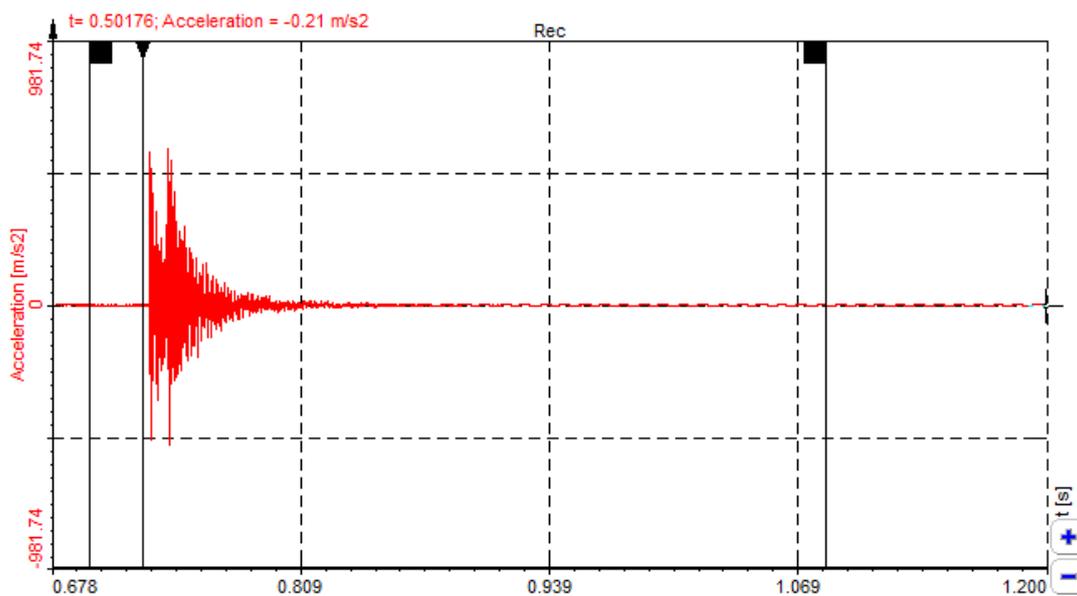![DEWESoft® measurement innovation]

SRS – shock response spectrum

Document type: Manual, Version: 1.1., Date: 19.04.17

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1. Revision history

Revision	Author	Date	Comment
1.0	DEWESoft d.o.o.	15/12/16	Initial version
1.1	DEWESoft d.o.o.	19/04/17	Added names for SRS instances

2. Introduction

Mechanical shock pulses are often analysed in terms of shock response spectrum. The shock response spectrum assumes that the shock pulse is applied as a base input to an array of independent single-degree-of-freedom systems. SDOF system assumes that each system hat its own natural frequency. The shock response spectrum gives the peak response of each system.

3. Shock response spectrum model

The shock response spectrum is a calculated function based on the acceleration time history. It applies an acceleration time history as an excitation to an array of single degree-of-freedom (SDOF) systems. Each system is assumed to have no mass-loading effect on the base input.
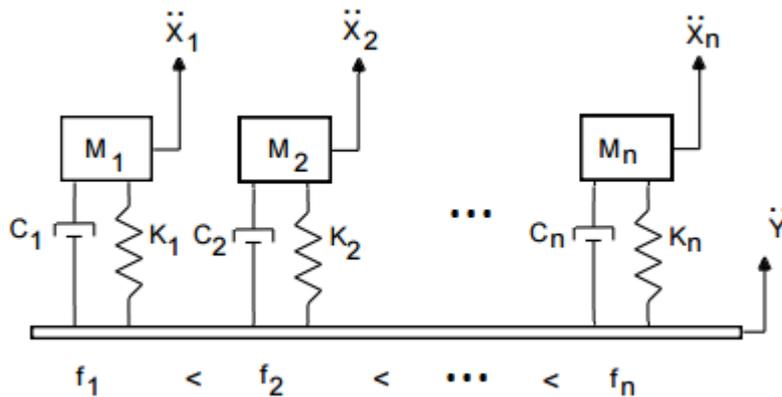

Figure 1: Shock response spectrum model

$\ddot{Y}$ is the base input for each system, and $\ddot{X}$ is the absolute response of each system to the input (double-dot denotes the acceleration). M is the mass, C is the damping coefficient, and K is the stiffness for each system. Natural frequency for each system is marked with **f**.
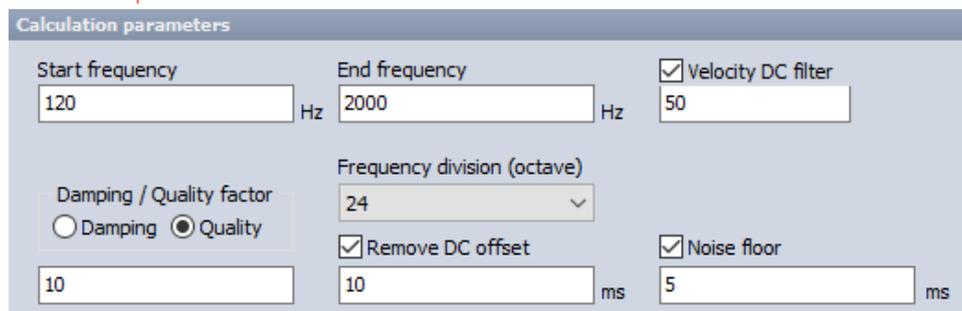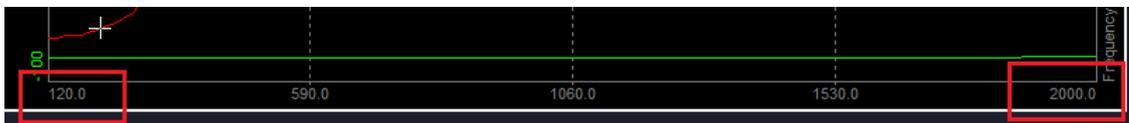
4. DEWESoft SRS plugin

a) Input signal

The input signal in the SRS plugin is an impulse shock time signal, usually measured with an accelerometer.
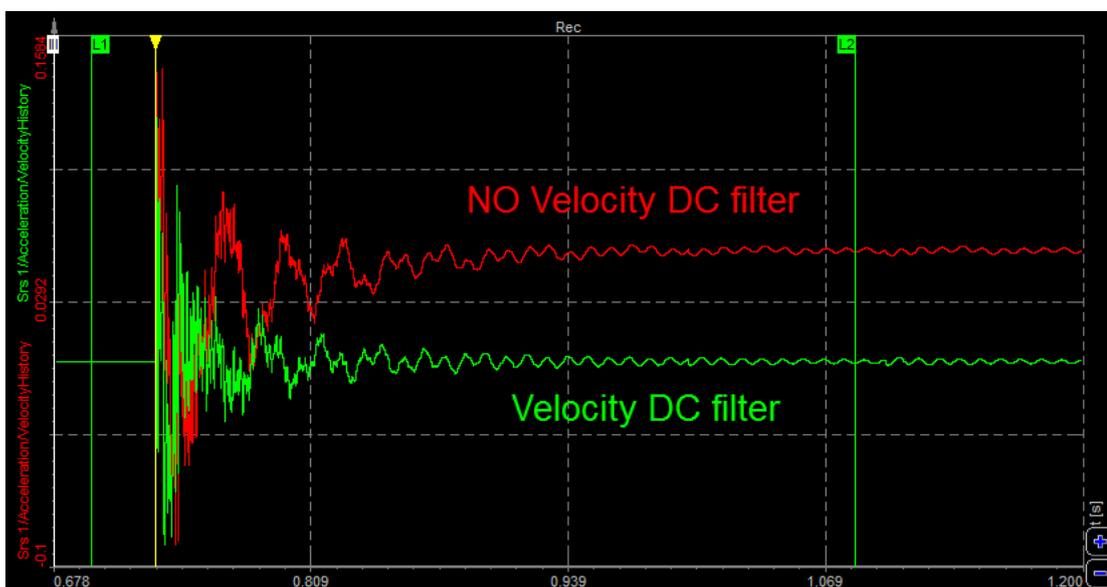

b) Calculation parameters

Start and **end frequency** define the calculation range for the frequency spectrum. The upper limit is set to 2000 Hz.
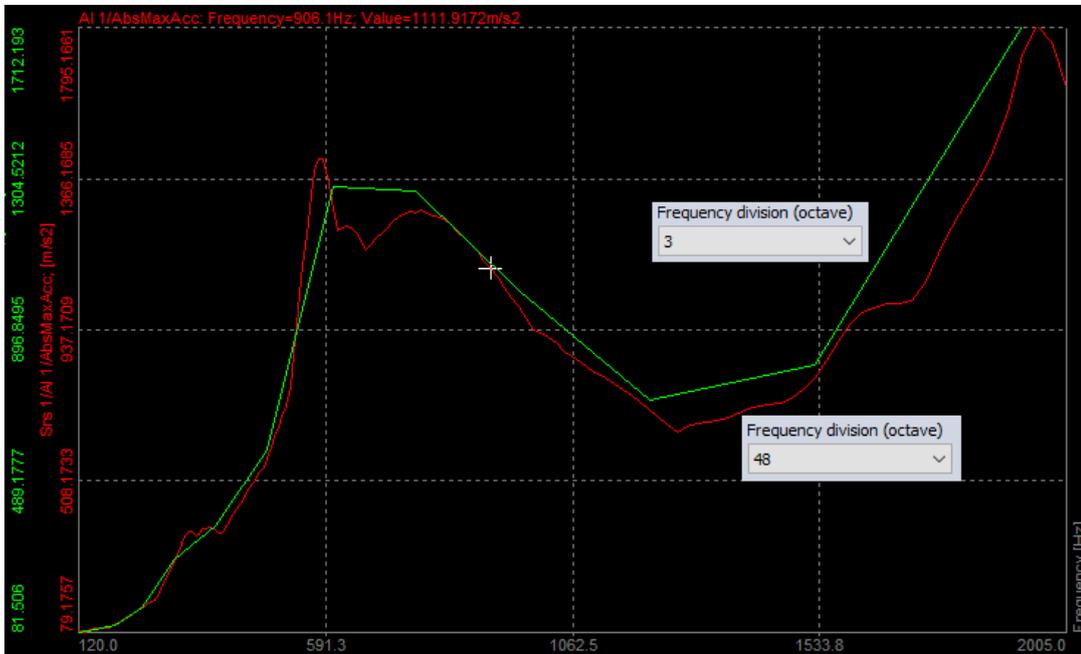

Velocity DC filter removes the DC component of the calculated time signal "InputChannel"/VelocityHistory.

NO Velocity DC filter

Velocity DC filter

Frequency division (octave) defines the resolution of the spectrum in frequency domain. Higher the number, better the resolution.

Different **damping factors** produce different SRSs for the same shock waveform. Zero damping will produce a maximum response and very high damping produces a horizontal line. The standard value for relative damping of 5% results in a Q (quality factor) of 10.
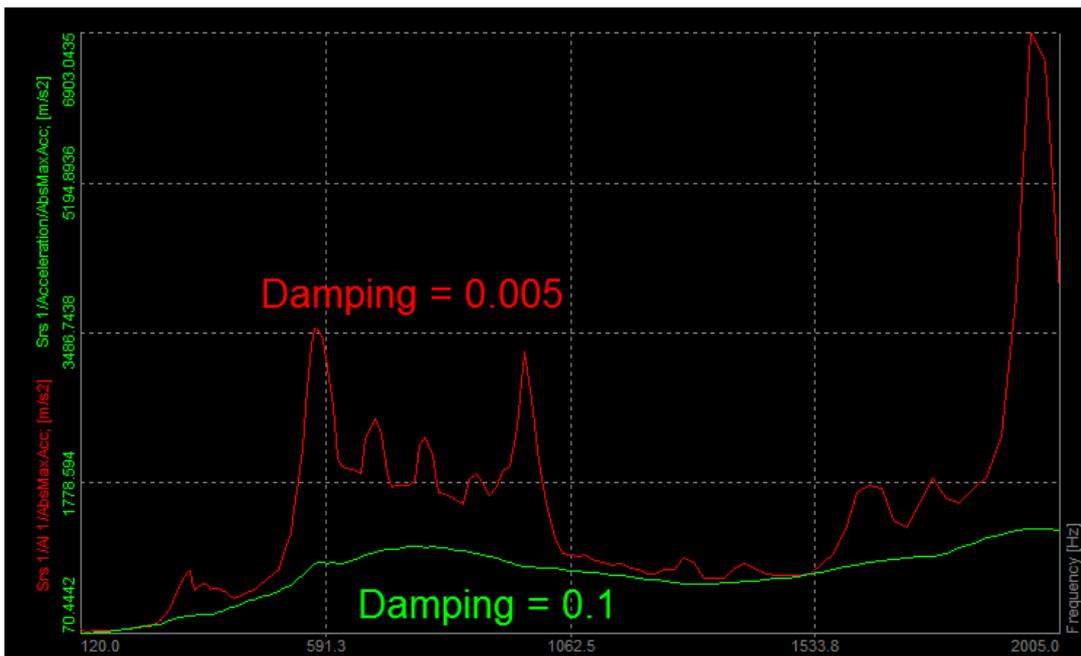
Remove DC offset (in milliseconds) removes the DC component of the input time signal. The DC will be calculated the defined time interval behind the position of the first cursor.

Noise floor (in milliseconds) will calculate the noise floor of the input time signal. The noise floor will be calculated the defined time interval behind the position of the first cursor.

c) Results

The results in frequency domain spectrum can be shown as acceleration, velocity or displacement.
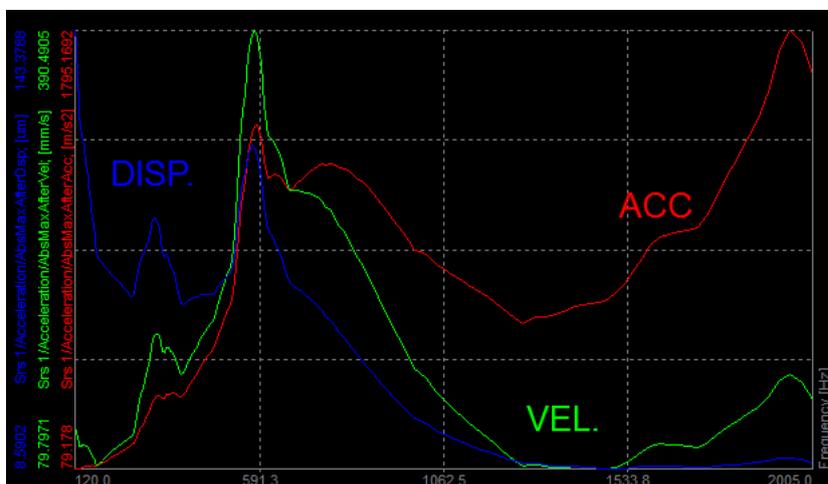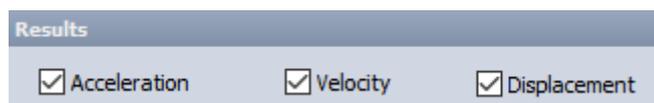
d) Output channels

As the result, we show absolute maximum, maximum and minimum of acceleration/velocity/displacement. All of those values are calculated in three different sections: during shock, after shock and during the whole measurement.

- Absolute max (whole measurement) – **composite/maximax** (the worst-case extrema for both instances). The composite shock response for the absolute maxima is the maximax.
- Max (whole measurement) - **composite/maximax** (the worst-case extrema for both instances). The composite shock response for the absolute maxima is the maximax.
- Min (whole measurement) - **composite/maximax** (the worst-case extrema for both instances). The composite shock response for the absolute maxima is the maximax.

- Absolute max during shock - **primary** (forced response, computation during the shock)
- Max during shock - **primary** (forced response, computation during the shock)
- Min during shock - **primary** (forced response, computation during the shock)

- Absolute max after shock - **residual** (free vibration, computation after the shock)
- Max after shock - **residual** (free vibration, computation after the shock)
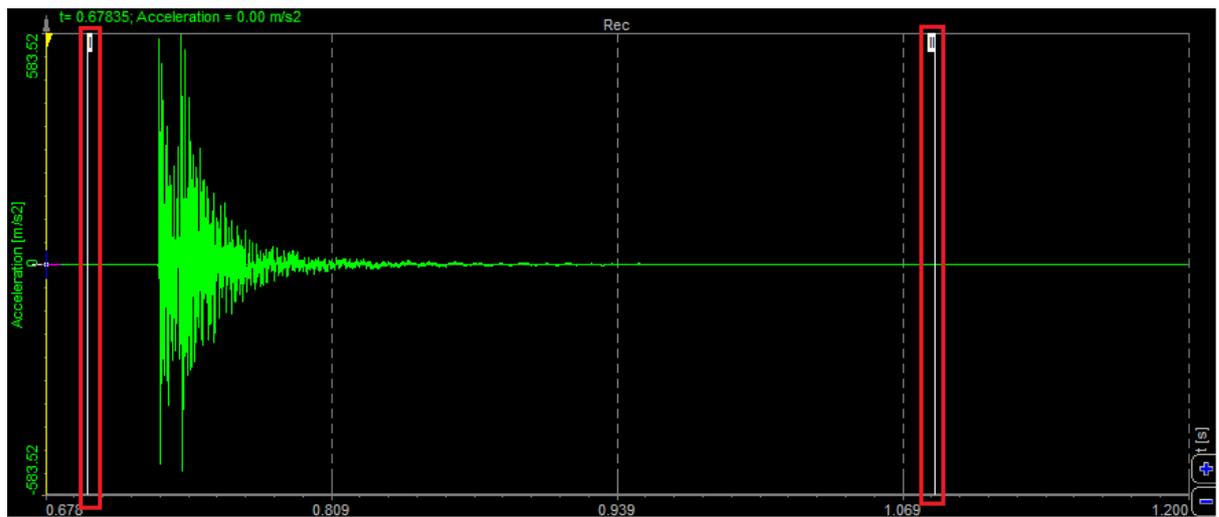- Min after shock - **residual** (free vibration, computation after the shock)

Results

a) Placing the cursors

For the right calculation, we have to place the cursors at the right positons on the recorder.
The first cursor (I) has to be placed on the noise floor signal, before the shock. Second cursor (II) has to be placed also on the noise floor, but after the shock.

After that, the cursors I and II need to be locked with the click on the buttons:
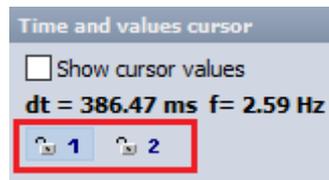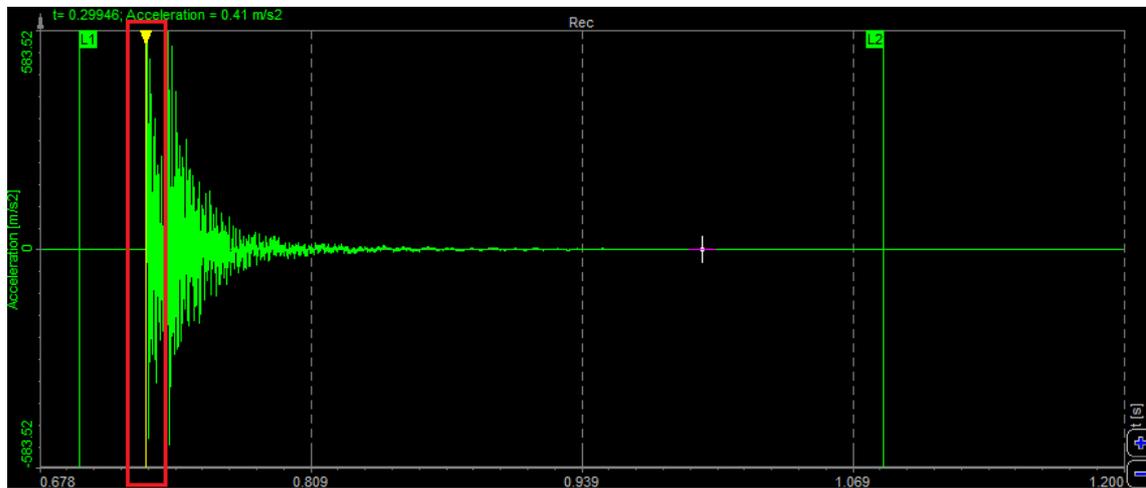

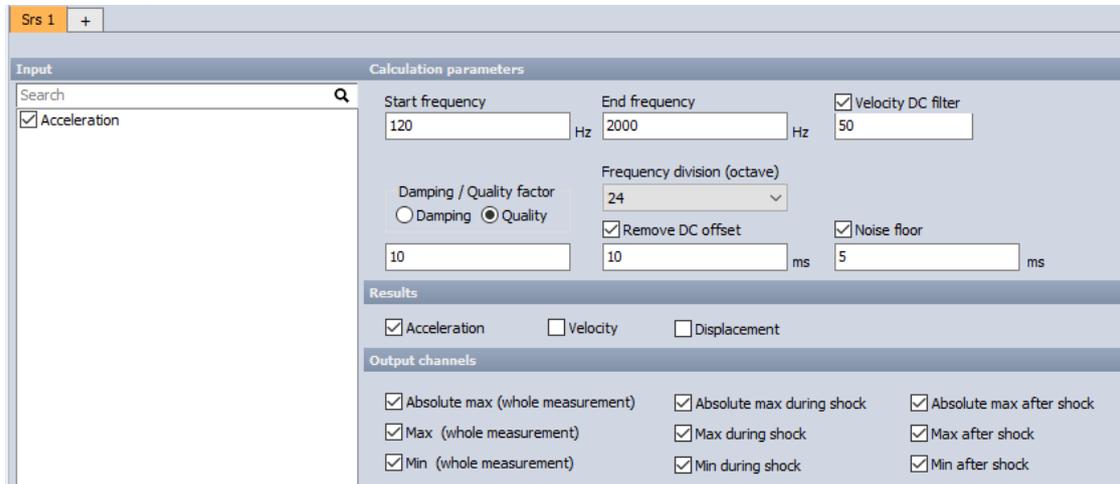After the cursors are locked, they change the colour in the recorder.
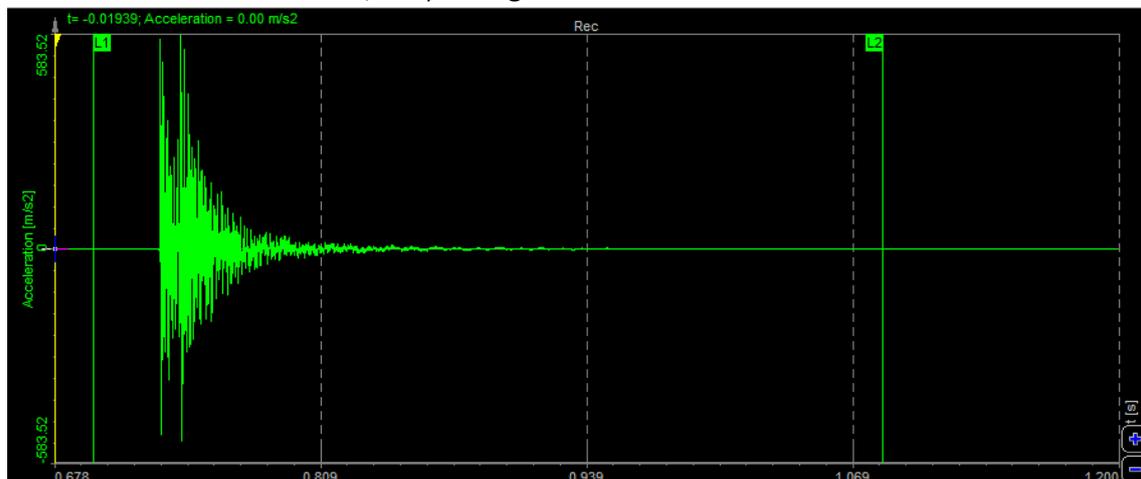
The channel cursor (yellow cursor) that indicates our position in the timeline of the datafile has to be placed at the beginning of the shock.
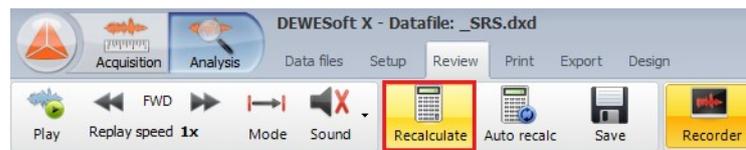
b) Setup the calculation parameters

The next step is to define the calculation parameters (frequency range, damping factor, output channels, …).

After the parameters and cursors are set, we need to Recalculate the data.

c) Displaying the results

The results of the spectrum are calculated in frequency domain and can be displayed on 2D graph ("ChannelName/VelocityHistory"is a time channel, displayed on the recorder).
Under the channel list you can select the displayed channels.