

LEKTRONIKA

ECE 35 CABLE EXPERT

Operating Manual For Line Qualification

460-000-000

Operating Manual 1

OM 460-22-02

2022.

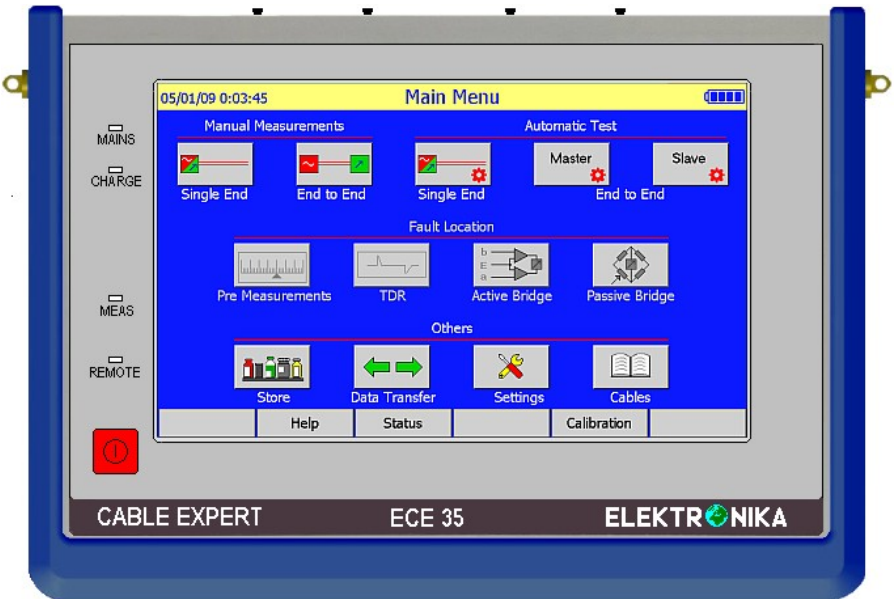
CONTENTS

1	INTRODUCTION.....	5
1.1	Keyboard and LEDs.....	5
1.2	Connectors.....	6
1.3	Start up.....	8
1.4	Self Calibration.....	8
1.5	Saving and Recall of Test Results.....	9
1.6	Display Brightness Control.....	11
2	MANUAL MEASUREMENTS.....	12
2.1	Transmitter.....	13
2.2	Selective Receiver.....	15
2.3	Wideband Receiver.....	17
2.4	NEXT Measurement.....	18
2.5	Longitudinal Balance Measurement.....	20
2.6	Return Loss Measurement.....	22
2.7	Impedance Measurement.....	24
2.8	Wideband Noise Measurement.....	26
2.9	Impulse Noise Measurement.....	28
2.10	Spectrum Analyzer.....	30
2.10.1	Spectral Trace as Reference (Option).....	33
2.10.2	Application Notes.....	37
2.11	Spectrogram (Option).....	39
2.11.1	Evaluation of Test Results.....	42
2.11.2	Searching Tools & Display Mode Setup.....	43
2.11.3	Advanced Result Saving.....	44
2.12	Interruption Analysis (Option).....	46
2.13	Telephone Simulator (Option).....	52
2.14	Single Ended Loss Estimation (Option).....	55
3	VOICE FREQUENCY SW PACKAGE (Option).....	56
3.1	Echo Test.....	56
3.2	Noise with Tone Measurement.....	57
3.3	Group Delay Distortion Measurement.....	58
3.4	Phase Jitter & Frequency Error Measurement.....	61
3.5	Simultaneous Event Counter Mode.....	62
4	AUTOMATIC MASTER SLAVE TEST OF xDSL LINES.....	64
4.1	Preparing the Program at Slave End.....	64
4.2	Preparing the Program at Master End.....	65
4.3	Running the Program.....	66
4.4	Test Results.....	67
4.5	ESEL Measurement.....	71
5	AUTOMATIC MASTER SLAVE TEST OF VF CIRCUITS.....	75
5.1	Slave Mode.....	75
5.2	Master Mode.....	77
5.3	Running the Program.....	79


5.4	Test Results.....	80
6	AUTOMATIC SINGLE END LINE TEST (Option).....	82
6.1	Preparing the Program.....	82
6.2	Running the Program.....	84
6.3	Test Results.....	85
7	DATA TRANSFER.....	86
7.1	Data transfer via USB port.....	87
7.1.1	Result Transfer from USB Stick to ECE 35.....	87
7.1.2	Result Transfer from ECE 35 to USB Stick.....	88
7.1.3	Test Setup Transfer from ECE 35 to USB Stick.....	89
7.1.4	Test Setup Transfer from USB Stick to ECE 35.....	89
7.1.5	Print Screen Transfer from ECE 35 to USB Stick.....	90
7.2	Data transfer via WiFi.....	91
7.2.1	WiFi & FTP Settings.....	91
7.2.2	Test Result Transfer from ECE 35 to FTP Server.....	94
7.2.3	Test Setup Transfer from ECE 35 to FTP Server.....	95
7.2.4	Print Screen Transfer from ECE 35 to FTP Server.....	95
7.2.5	HTTP Server Mode.....	96
8	STATUS & OPTIONS.....	97
9	GENERAL SETTINGS.....	98
10	SW UPGRADE.....	98
11	SPECIFICATIONS.....	99
11.1	General Specifications.....	99
11.2	Single End Manual Tests.....	100
11.2.1	Voice frequency SW package.....	104
11.3	Automatic Master Slave Test of xDSL Lines.....	106
11.4	Automatic Single Ended Test Sequences.....	106
11.5	Automatic Master Slave Test of VF circuits.....	107
11.6	High Impedance Probe.....	107
12	ORDERING INFORMATION.....	108

1 INTRODUCTION





1.1 Keyboard and LEDs



Controls

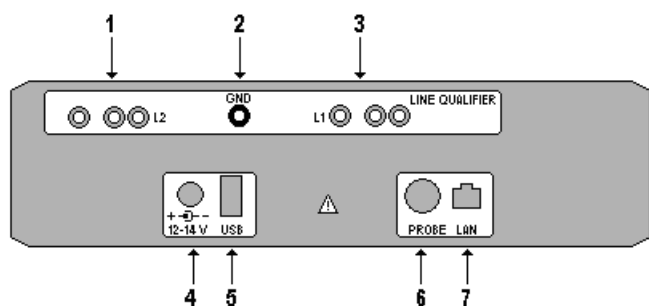
	Switches the ECE 35 on and off. The instrument has an automatic switch-off feature to save battery life: switch-off takes place automatically 10 minutes after the latest keystroke.
---	--

LEDs

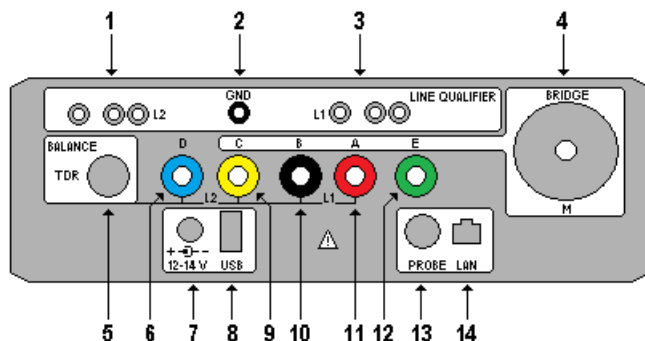
	MAINS	Mains indicator
	CHARGE	Charge indicator
	MEAS	Measurement indicator
	REMOTE	Remote control indicator

1.2 Connectors

Without Bridge



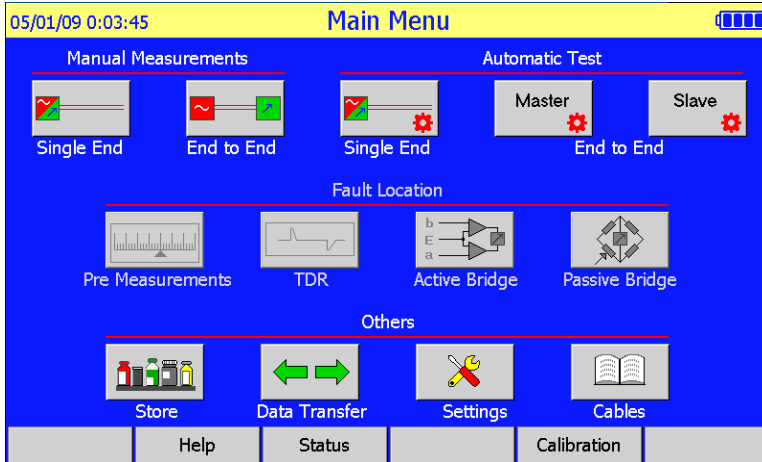
1	L 2 connector for line qualification(Tx only)
2	Ground connector for line qualification
3	L 1 connector for line qualification
4	2.1/5.5 mm coaxial connector for mains or 12V car adapter
5	USB connector for connecting an USB stick
6	Connector for high impedance probe
7	Connector for LAN

With Bridge

1	L 2 connector for line qualification(Tx only)
2	Ground connector for line qualification
3	L 1 connector for line qualification
4	Bridge balance
5	TDR balance
6	Socket to connect wire D in bridge modes, and L2 in TDR mode
7	2.1/5.5 mm coaxial connector for mains or 12V car adapter
8	USB connector for connecting an USB stick
9	Socket to connect wire C in bridge modes, and L2 in TDR mode
10	Socket to connect wire B in bridge modes, and L1 in TDR mode
11	Socket to connect wire A in bridge modes, and L1 in TDR mode
12	Socket to connect to ground in bridge modes
13	Connector for high impedance probe
14	Connector for LAN

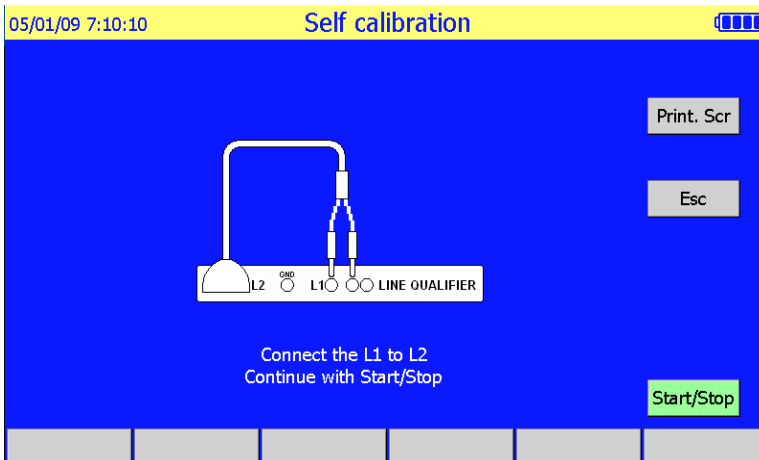
1.3 Start up

- Switch the instrument on.
- A few seconds later the **Main Menu** appears



1.4 Self Calibration

- Press the **Calibration** key of **Main Menu**.



- Connect **L1** to **L2**
- Press **Start/Stop** key

The conditions of the calibration are unchanged until the next calibration.

1.5 Saving and Recall of Test Results

When a test is completed the result can be saved in each measuring mode under a user given name. There are four identifiers of each stored results:

- **NAME** (user given name)
- **DATE** (automatically added)
- **TIME** (automatically added)
- **MODE** (automatically added)

The automatically added identifiers are very comfortable for the user, as the time is different for each test result, the same name can be used repeatedly.

Note: The operator's name would always be saved with the results as well, but it would appear on the PC after an upload of results. It should be given in before starting a measurement in **Main Menu / Settings/ Operator**.

Saving of test results:

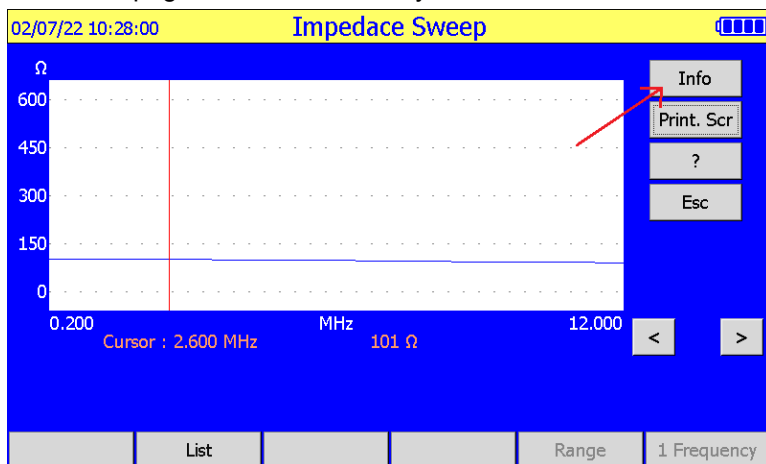
Having the test finished:

- Press the **Save** key
- Type an object name and press **Enter**

Recall of test results.

- Enter the **Main Menu / Store / Stored Results** option
- Select the required result and press **Enter**

Each result page contain an **Info** key



Pressing the **Info** key the Device information page appears:



Deleting a test result

- Enter the **Main Menu / Store / Stored Results** option
- Select the result to be deleted and press **Delete**
- If you are sure press **Yes** otherwise **No**

Deleting all the test results

- Enter the **Main Menu / Store / Stored Results** option
- Press **Empty**
- If you are sure press **Yes** otherwise **No**

1.6 Display Brightness Control

The operation time of battery is highly dependent on the brightness of display.

To increase operating time the brightness will automatically decrease if no button is pressed for 1 minute.

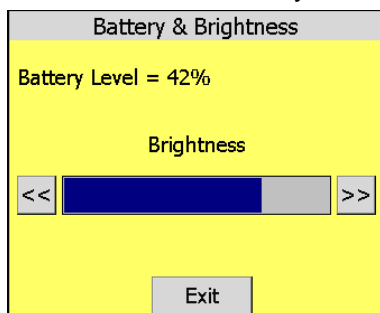
After pressing any button, the brightness returns to the previously set value.

Brightness control

- Select the **Settings** option of **Main Menu**
- Press the **Brightness** key

Doing so a panel appears providing:

- Possibility to modify the brightness
- Information about the current battery level

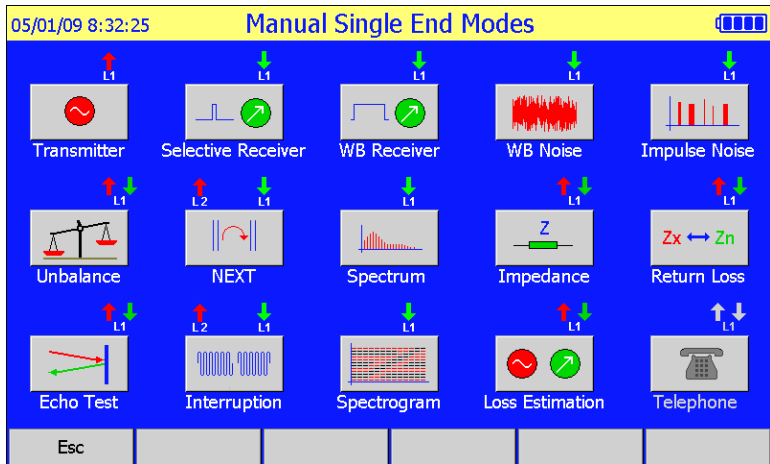


- Select the required brightness with the arrow keys
- Press the Exit key

(The Battery & Brightness panel can also be accessed from the battery symbol on the top right corner of measuring pages)

2 MANUAL MEASUREMENTS

Enter the **Manual Measurements / Single End** option of **Main Menu**.
Doing so the following display appears:



2.1 Transmitter

Test Procedure

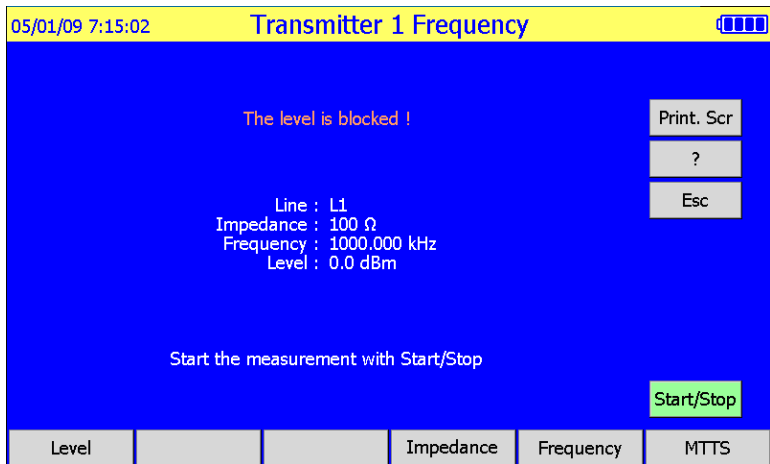
- Enter **Transmitter** mode.

Two transmitting modes are provided:

- **1 Frequency** (generation of one single frequency)
- **MTTS** (generation of 30/35 frequencies at the same time)

The required mode can be selected with the key in the lower right corner.

1 Frequency Transmitting Mode



Setting a new test-frequency

- Press the **Frequency** key Type in the required frequency and press **Enter**

Modification of the actual test-frequency

- Press the **Frequency** key
- Select the required frequency step with the horizontal cursors
- Modify the frequency with the vertical cursors
- Press **Enter**

Impedance setting

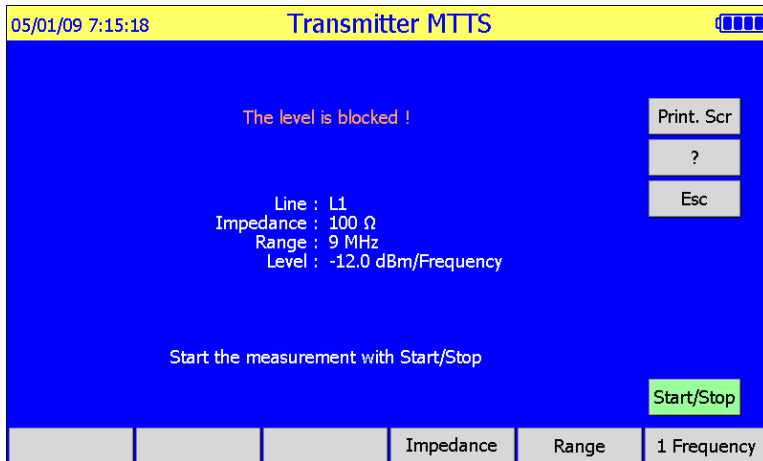
- Press the **Impedance** key and select the required impedance

Level setting

- Press the **Level** key
- Type in the required level and press **Enter**

MTTS Transmitting Mode

- Press The **MTTS** key



Frequency range setting

- Press the **Range** key and Select the required frequency range

Impedance setting

- Press the **Impedance** key and select the required impedance

The output can be enabled or disabled with the **Start/Stop** key.

2.2 Selective Receiver

Test Procedure

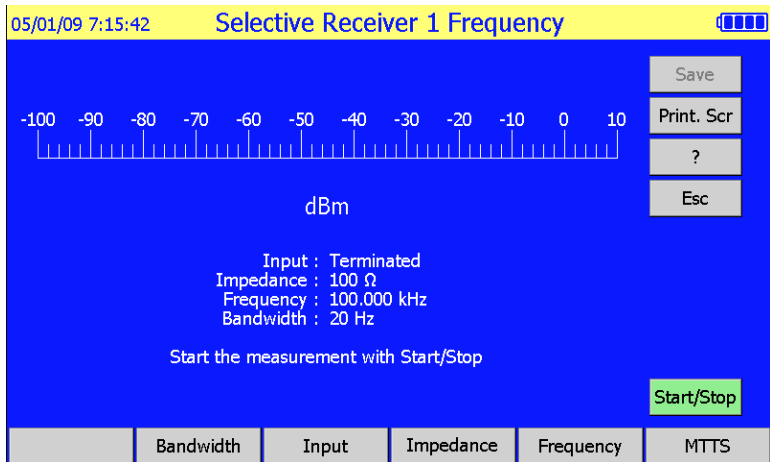
- Enter **Selective Receiver** mode

Two selective receiving modes are provided:

- **1 Frequency** (measurement on one single frequency)
- **MTTS** (measurement on 30/35 frequencies at the same time)

The required mode can be selected with the key in the lower right corner.

1 Frequency Receiving Mode



Setting a new test-frequency

- Press the **Frequency** key
- Type in the required frequency and press **Enter**

Modification of the actual test-frequency

- Press the **Frequency** key
- Select the required frequency step with the horizontal cursors
- Modify the frequency with the vertical cursors
- Press **Enter**

Band width selection

- Press the **Bandwidth** key and select the required band width

Line Termination

- Press the **Input** key and enter the required line termination.

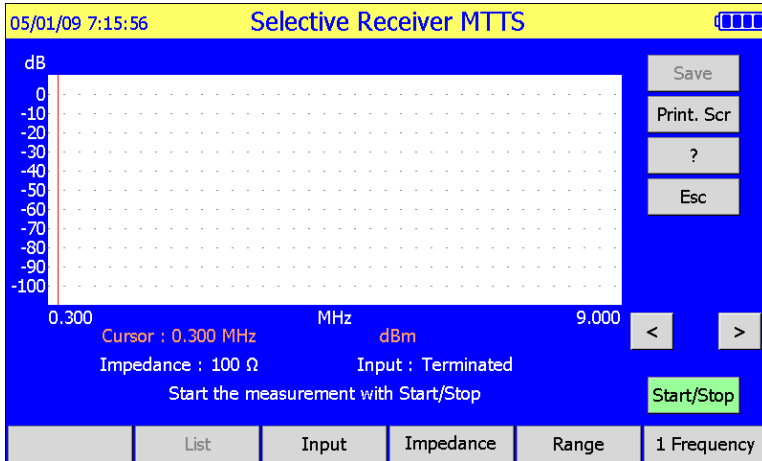
Impedance setting

- Press the **Impedance** key and enter the required impedance

For the proper dBm calculation the nominal line impedance (Z) should be given even if high input impedance is set.

MTTS Receiving Mode

- Press The **MTTS** key



Range Selection

- Press the **Range** key and select the required frequency range

Line Termination

- Press the **Input** key and enter the required line termination.

Impedance setting

- Press the **Impedance** key and enter the required impedance

For the proper dBm calculation the nominal line impedance (Z) should be given even if high input impedance is set.

Start the measurement with the **Start/Stop** key

Test Results

Test results are available both in graphic and numeric forms.

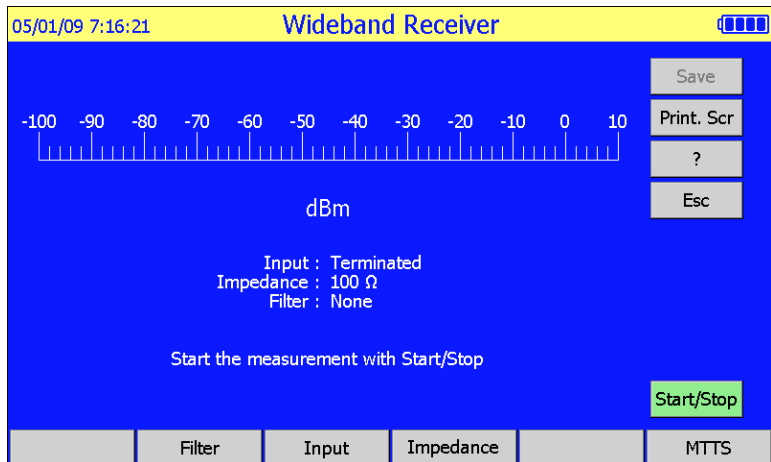
- In **1 Frequency** mode they are displayed together
- In **MTTS** mode the result is displayed first in graphic form.
- To get numeric form, press the **List** key
- To return to graphic form press **Esc**

2.3 Wideband Receiver

Test Procedure

- Enter **WB Receiver** mode

ECE 35 provides wideband level measuring modes with auto ranging. To extend the measuring range several filters are available.



Filter Selection

- Press the **Filter** key and enter the required filter option

Line Termination

- Press the **Input** key and enter the required line termination.

Impedance setting

- Press the **Impedance** key and enter the required impedance

For the proper dBm calculation the nominal line impedance (Z) should be given even if high input impedance is set.

Start the measurement with the **Start/Stop** key

Test Results

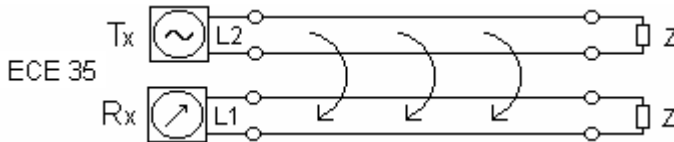
Test results are available both in graphic and numeric forms

2.4 NEXT Measurement

Test Procedure

- Enter **NEXT** mode

The NEXT can be measured by transmitting on L2 and receiving on L1.

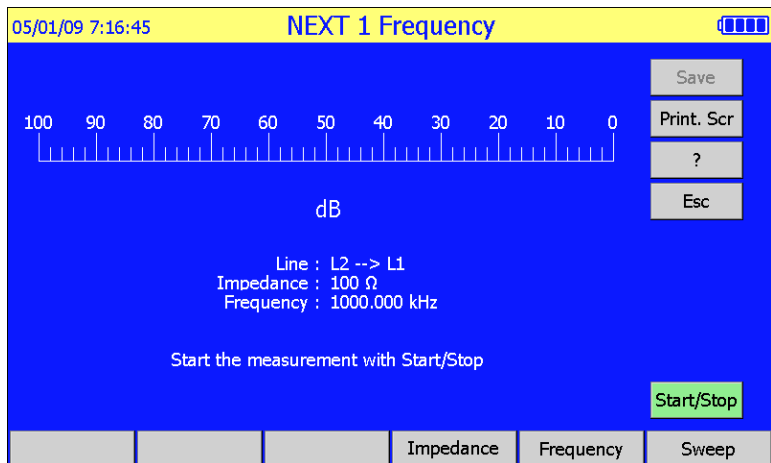


Two measuring modes are provided:

- **1 Frequency** (measurement on one single frequency)
- **Sweep** (measurement on 60 frequencies)

The required mode can be selected with the key in the lower right corner.

1 Frequency Mode



Setting a new test-frequency

- Press the **Frequency** key
- Type in the required frequency and press **Enter**

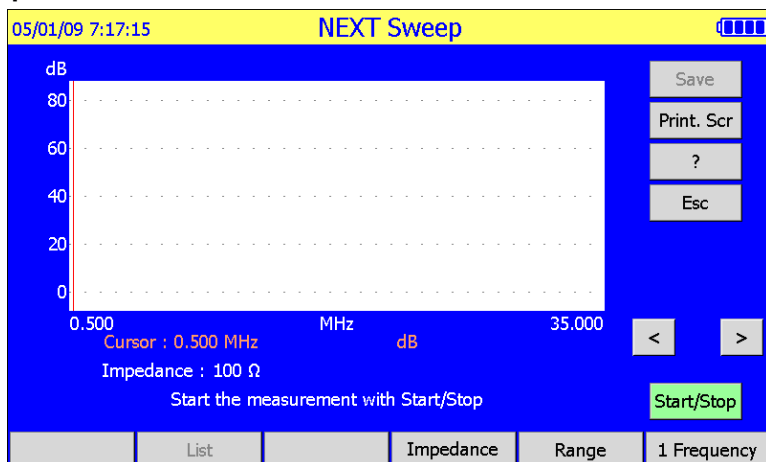
Modification of the actual test-frequency

- Press the **Frequency** key
- Select the required frequency step with the horizontal cursors
- Modify the frequency with the vertical cursors and press **Enter**

Impedance setting

- Press the **Impedance** key and enter the required impedance

Sweep Mode



Range Selection

- Press the **Range** key and select the required frequency range

Impedance setting

- Press the **Impedance** key and enter the required impedance

Start the measurement with the **Start/Stop** key

Test Results

Test results are available both in graphic and numeric forms.

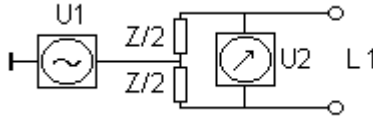
- In **1 FR** mode they are displayed together
- In **Sweep** mode the result is displayed first in graphic form.
- To get numeric form, press the **List** key
- To return to graphic form press **Esc**.

2.5 Longitudinal Balance Measurement

Test Procedure

- Enter **Balance (LCL)** mode

ECE 35 applies the test circuit recommended by ITU-T. Rec. 0.9



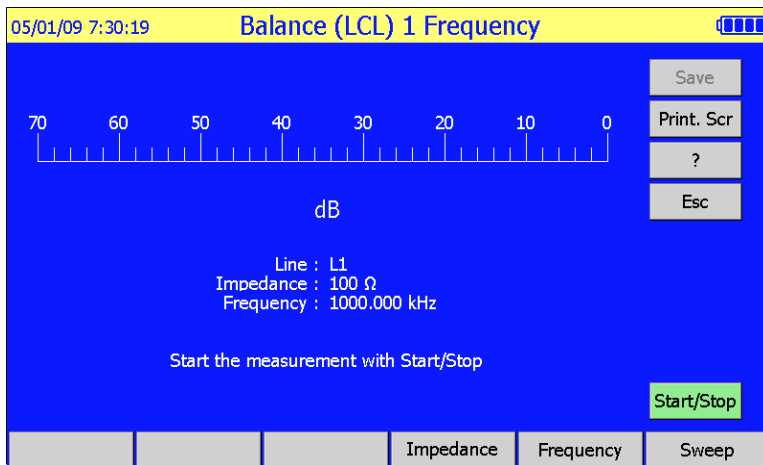
$$LCL = 20 \log U1/U2 \text{ dB}$$

Two measuring modes are provided:

- **1 Frequency** (measurement on one single frequency)
- **Sweep** (measurement on 60 frequencies)

The required mode can be selected with the **F6** key

1 Frequency Mode



Setting a new test-frequency

- Press the **Frequency** key
- Type in the required frequency and press **Enter**

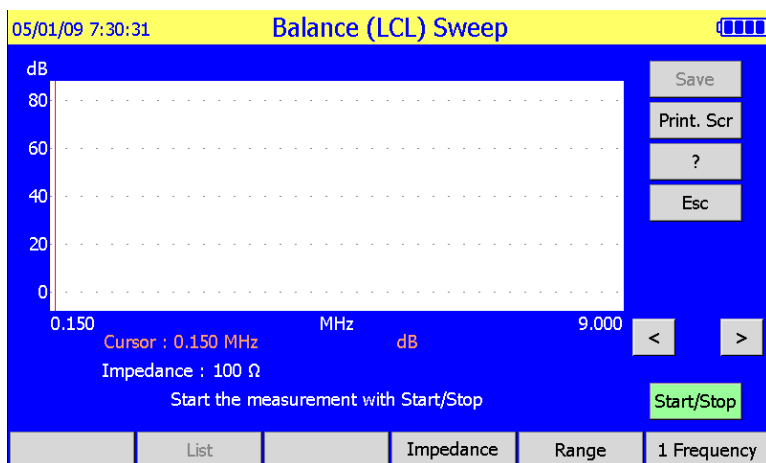
Modification of the actual test-frequency

- Press the **Frequency** key
- Select the required frequency step with the horizontal cursors
- Modify the frequency with the vertical cursors and press **Enter**

Impedance setting

- Press the **Impedance** key and enter the required impedance

- **Sweep Mode**



Range Selection

- Press the **Range** key and select the required frequency range

Impedance setting

- Press the **Impedance** key and enter the required impedance

Start the measurement with the **Start/Stop** key

Test Results

Test results are available both in graphic and numeric forms.

- In **1 Frequency** mode they are displayed together
- In **Sweep** mode the result is displayed first in graphic form.
- To get numeric form, press the **List** key
- To return to graphic form press **Esc**

2.6 Return Loss Measurement

Test Procedure

- Enter **Return Loss** mode

Return Loss factor indicates the deviation of line impedance from the nominal value.

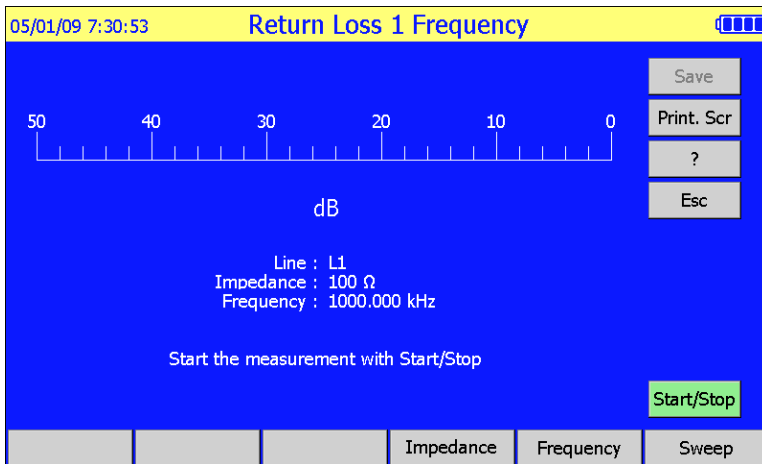
$$RL = 20 \log \left| \frac{Z_{line} + R_n}{Z_{line} - R_n} \right| \text{ [dB]}$$

Two measuring modes are provided:

- **1 Frequency** (measurement on one single frequency)
- **Sweep** (measurement on 60 frequencies)

The required mode can be selected with the **F6** key

1 Frequency Mode



Setting a new test-frequency

- Press the **Frequency** key
- Type in the required frequency and press **Enter**

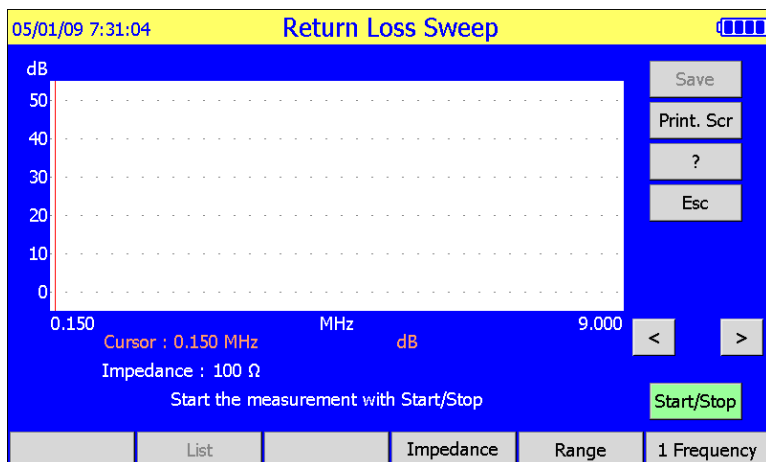
Modification of the actual test-frequency

- Press the **Frequency** key
- Select the required frequency step with the horizontal cursors
- Modify the frequency with the vertical cursors and press **Enter**

Impedance setting

- Press the **Impedance** key and enter the required impedance

Sweep Mode



Range Selection

- Press the **Range** key and select the required frequency range

Impedance setting

- Press the **Impedance** key and enter the required impedance

Start the measurement with the **Start/Stop** key

Test Results

Test results are available both in graphic and numeric forms.

- In **1 FR** mode they are displayed together
- In **Sweep** mode the result is displayed first in graphic form.
- To get numeric form, press the **List** key
- To return to graphic form press **Esc**

2.7 Impedance Measurement

Test Procedure

- Enter **Impedance** mode

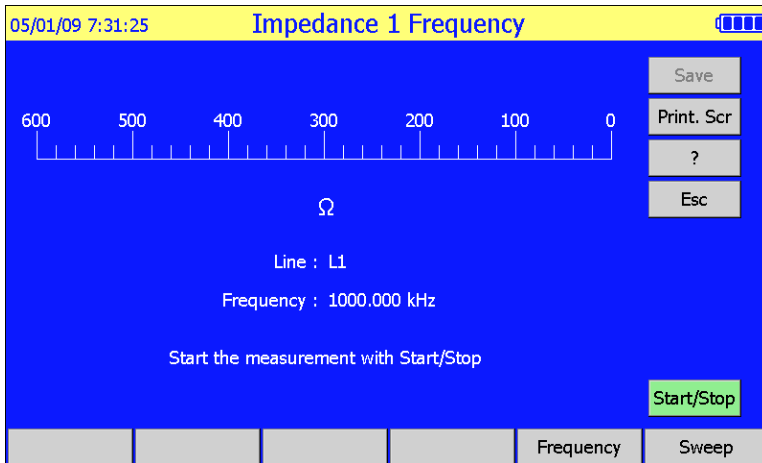
In this mode the absolute value of line impedance can be measured.

Two measuring modes are provided:

- **1 Frequency** (measurement on one single frequency)
- **Sweep** (measurement on 60 frequencies)

The required mode can be selected with the **F6** key

1 Frequency Mode



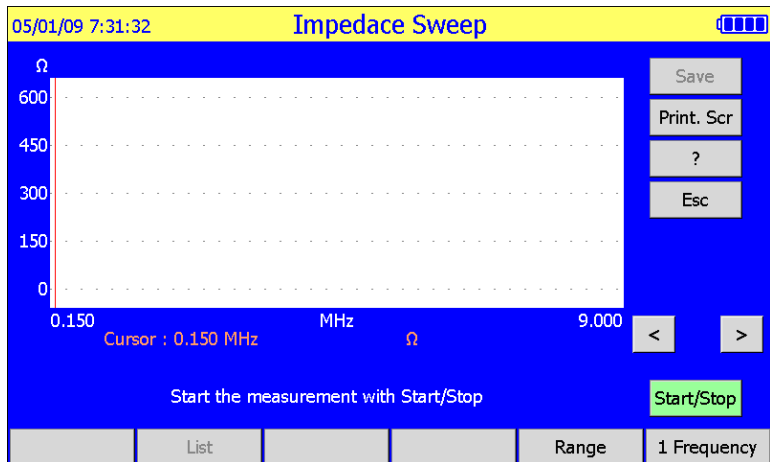
Setting a new test-frequency

- Press the **Frequency** key
- Type in the required frequency and press **Enter**

Modification of the actual test-frequency

- Press the **Frequency** key
- Select the required frequency step with the horizontal cursors
- Modify the frequency with the vertical cursors and press **Enter**

- **Sweep Mode**



Range Selection

- Press the **Range** key and select the required frequency range

Start the measurement with the **Start/Stop** key

Test Results

Test results are available both in graphic and numeric forms.

- In **1 FR** mode they are displayed together
- In **Sweep** mode the result is displayed first in graphic form.
- To get numeric form press the **List** key
- To return to graphic form press **Esc**

2.8 Wideband Noise Measurement

The received noise signal is named wideband noise when its peaks don't exceed the RMS value more than 12 dB ($U_{\text{PEAK}} < 4 U_{\text{RMS}}$)

ECE 35 provides filters for numerous European frequency band plane. The proper measurement time depends on the nature of noise. In case of a quasi stationer noise 1 to 10 sec is enough. If the noise level is slowly changing, a longer measurement time provides the proper test result.

Selectable measuring times:

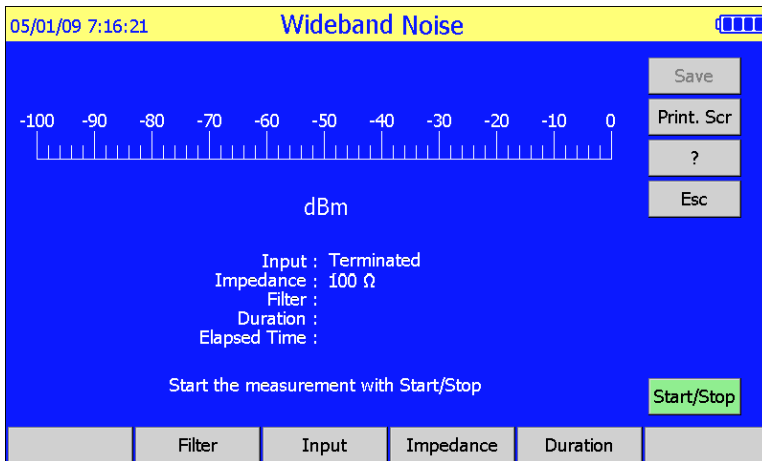
1, 5, 10, 30 sec 1, 5, 10, 30 min 1, 2, 4, 8, 12, 24, 48, 72 hours
or continuous measurement

The impairment of communication caused by noises does not depend only on the level but also on the time distribution of noise.

When >1 min measuring time is selected ECE 35 displays the noise level in histogram form with 60 time slots providing information about the time distribution.

Test procedure

- Enter **WB Noise** mode

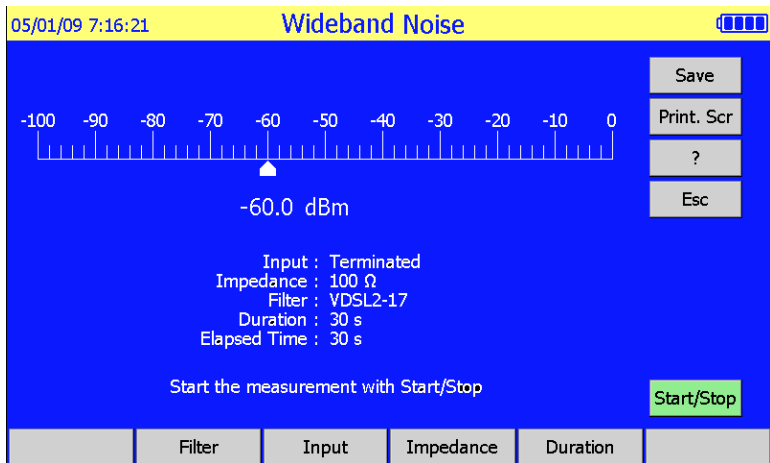


- Press the **Duration** key and enter the required measurement time
- Press the **Filter** key and enter the required filter option
- Press the **Input** key and enter the required line termination.
- Press the **Impedance** key and enter the required impedance

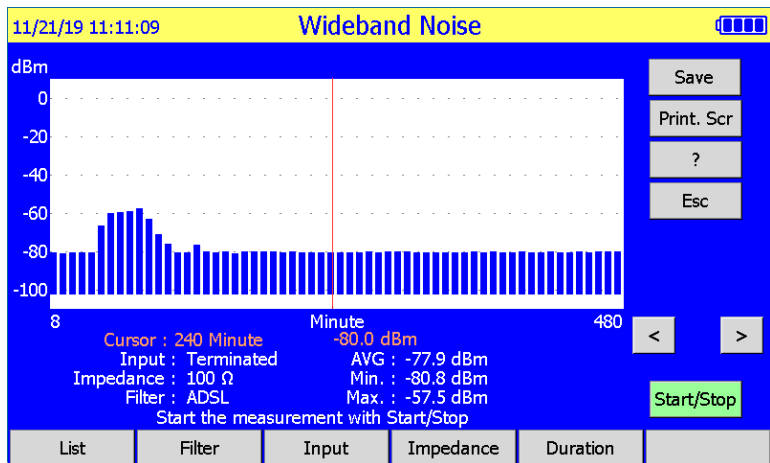
For the proper dBm calculation the nominal line impedance (Z) should be given even if high input impedance is set.

Test Results

When the selected measuring time is shorter than 5 minute:



When the selected measuring time is 5 minute or longer



The test result is displayed in histogram form

- To get numeric form, press the **List** key
- To return to graphic form press **Esc**

2.9 Impulse Noise Measurement

Impulse noise is a non-stationary cross talk from electromagnetic events in the vicinity of phone lines. Examples of impulse noise generators are as diverse as the opening of refrigerator door (the motor turns on/off), control voltages to elevators (phone lines in apartment buildings often run through the elevator shaft) and ringing of phones on lines sharing the same binder.

Any burst of noise that produces a voltage exceeding the power level of the background noise by more than 12dB is declared impulse noise.

In impulse noise-measuring mode ECE 35 operates as an impulse counter. An impulse is counted when the received noise signal exceeds a preset threshold for more than 500 ns. (The recommended threshold setting is 14 dB above the measured wideband noise level.)

The selectable measuring times:

1,5,10, 30 sec 1, 5, 10, 30 min 1, 2, 4, 8, 12, 24, 48, 72 hours

ECE 35 displays the counted impulses in histogram form with 60 time slots providing information about the time distribution.

Test Procedure

- Enter **Impulse Noise** mode

05/01/09 7:16:21 Impulse Noise

Impulse Count :

Input : Terminated
Impedance : 100 Ω
Thresholds :
Duration :
Elapsed Time :

Save
Print. Scr
?
Esc

Start the measurement with Start/Stop

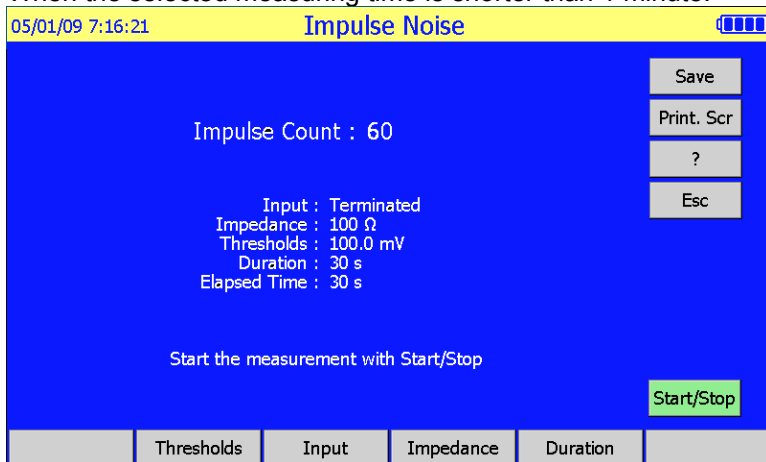
Start/Stop

Thresholds Input Impedance Duration

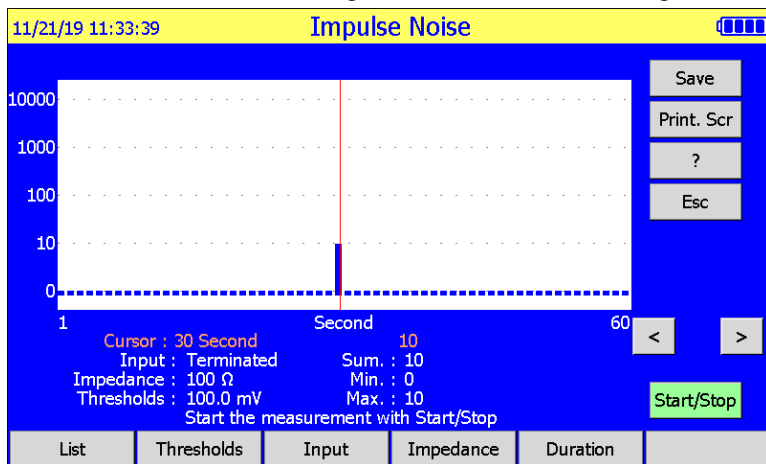
- Press the **Threshold** key and enter the required threshold level
- Press the **Duration** key and enter the required Measurement time
- Press the **Input** key and enter the required line termination.
- Press the **Impedance** key and enter the required line impedance
- Start counting by the **Start/Stop** key

Test Results

When the selected measuring time is shorter than 1 minute:



When the selected measuring time is one minute or longer:



The test result is displayed in histogram form

- To get numeric form, press the **List** key
- To return to graphic form press **Esc**

2.10 Spectrum Analyzer

In this mode ECE 35 can be used as a sophisticated spectrum analyzer.

Frequency range: 200 Hz to 35 MHz

Input modes: 100, 135, 150, 600 Ohm, Underterminated and High Imp Probe

The high impedance active probe provides 5 kOhm || 5pF input impedance.
(The 15 dB loss of high impedance probe is automatically compensated)

Display modes:

- **dBm** display mode
- **dBm/Hz** display mode

Evaluation modes:

- **Normal** Displaying the actual value of input signal
- **Peak** Displaying the peak value of input signal
- **Average** Displaying the average value of input signal
- **Slipping Avg.** Displaying the average of the last 10 measurements

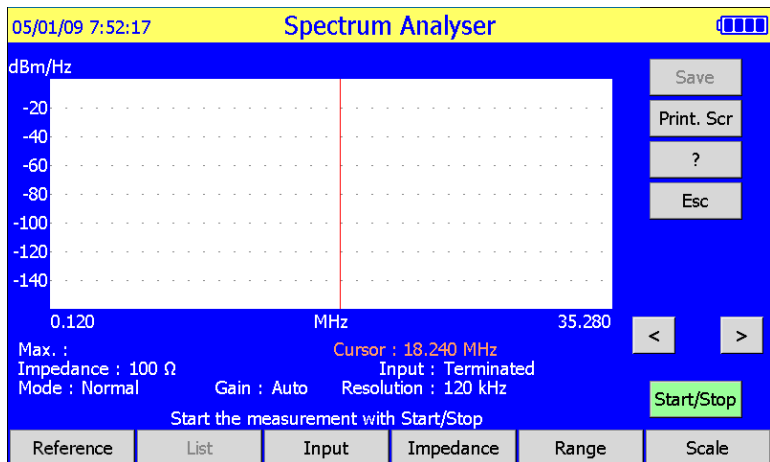
The number of displayed frequencies: 300

The selectable bandwidth depends on the selected range. The following table shows the selectable, bandwidths and frequency steps for the different frequency ranges. (ZOOM facility)

Frequency Range	Bandwidth and Frequency step
35 MHz	500 Hz to 100 kHz
18 MHz	500 Hz to 60 kHz
12 MHz	500 Hz to 40 kHz
9 MHz	500 Hz to 30 kHz
3 MHz	500 Hz to 10 kHz
1.5 MHz	500 Hz to 5 kHz
600 kHz	500 Hz to 2 kHz
300 kHz	500 Hz to 1 kHz
20 kHz	50 Hz to 100 Hz
4 kHz	10 Hz to 20 Hz
0.3 kHz	1 Hz

Test Procedure

- Enter **Spectrum** mode



Settings before the measurement

Display Mode Selection

- Select the display mode (dBm or dBm/Hz) with the **Scale** key

Range Selection

- Press the **Range** key
- Select the required frequency range

Line Termination

- Press the **Input** key and enter the required line termination.

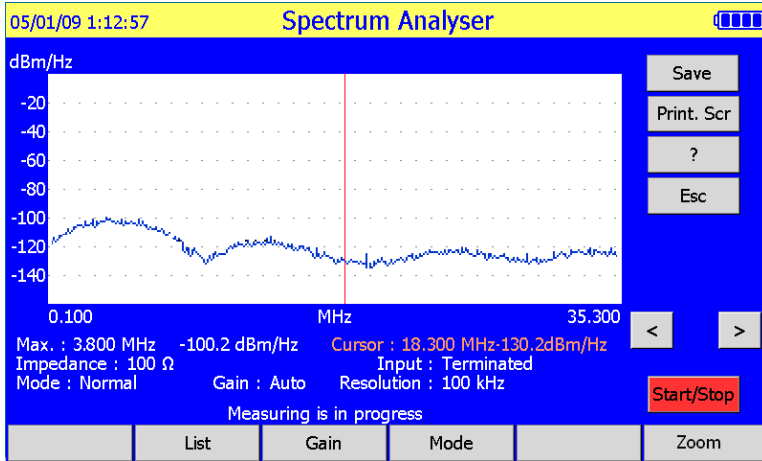
Impedance setting

- Press the **Impedance** key and enter the required impedance

Start the measurement with the **Start/Stop** key

Notice

Set the impedance even if you use the high impedance probe because it is needed for calculations as well



Settings when the measurement is running

Evaluation Mode Selection

- Press the **Mode** key and enter the required evaluation mode

Gain Selection

- Press the **Gain** key if you want to use fix gain instead of auto ranging and enter the required gain.

Zoom

- Set the cursor on the critical point of the spectrum
- Press the **Zoom** key and enter the required band width

Test Results

Test results are available both in graphic and numeric forms.

- To get numeric form, press the **List** key

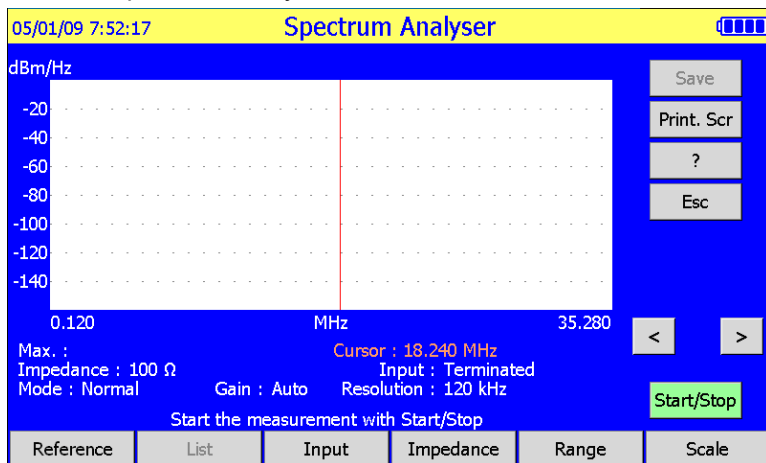
2.10.1 Spectral Trace as Reference (Option)

(Applicable if the SW 460-950-000 option is active)

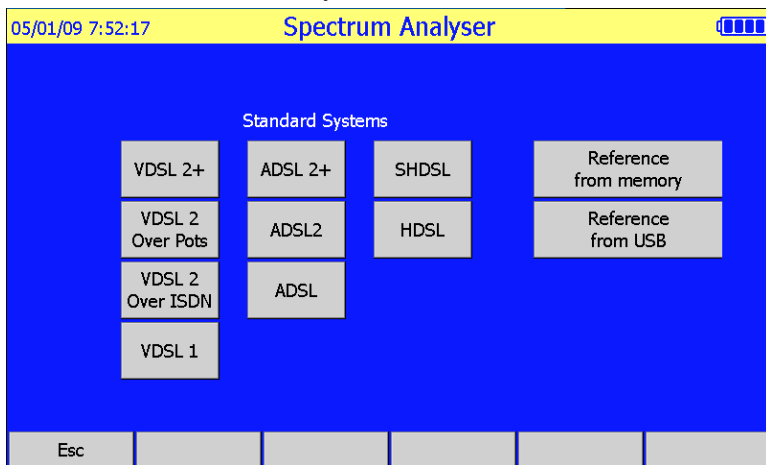
Stored Result as Reference

ECE 35 provides the possibility to display the actually obtained spectrum with an earlier stored reference trace. The reference trace can be recalled from the memory of ECE 35 or from an USB stick

- Enter Spectrum Analyser mode

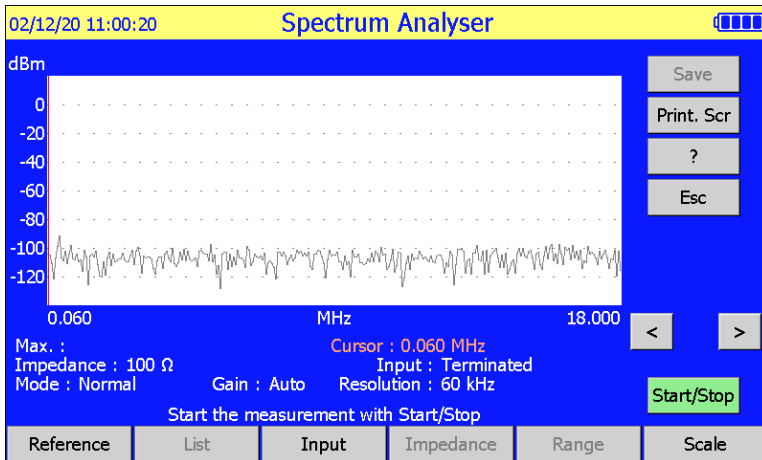


- Press the **Reference** key

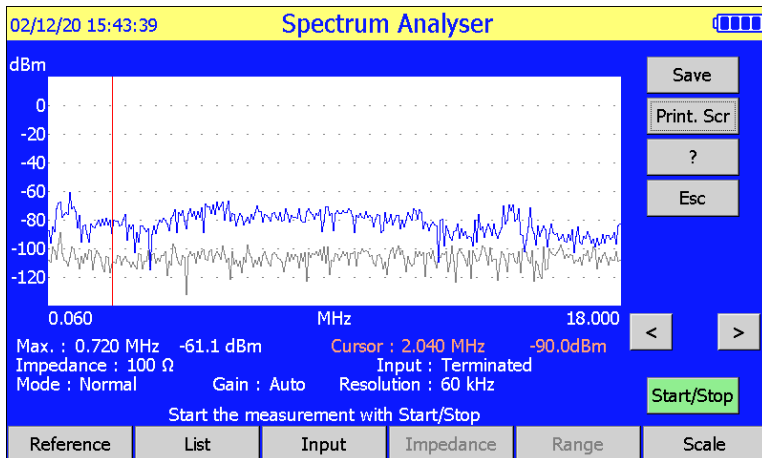


- Press the **Reference** from **memory** or from **USB** key
- Enter the stored result to be used as reference

Doing so the reference spectrum appears and ECE 35 automatically set the proper frequency range belonging to the selected reference result



- Start the measurement with the **Start/Stop** key



The actually obtained and the reference spectrum appear together

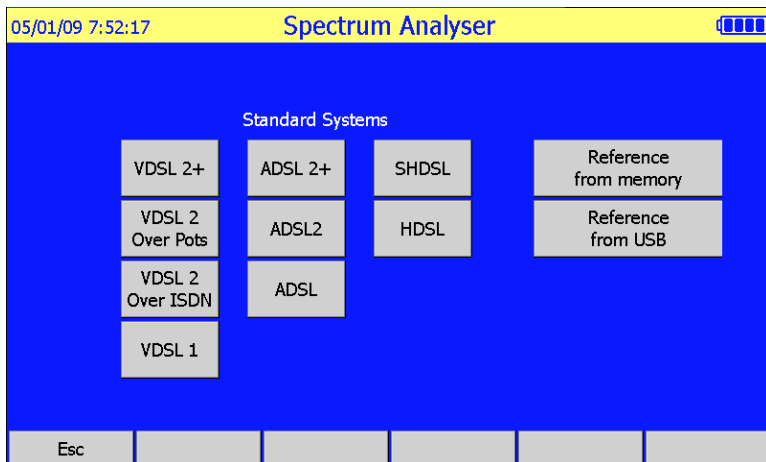
- The actually is blue
- The reference is black

ITU PSD Mask as Reference

Transmitting power of DSLAM-s are limited. The PSD of transmitted signal mustn't exceed the PSD mask recommended by ITU.

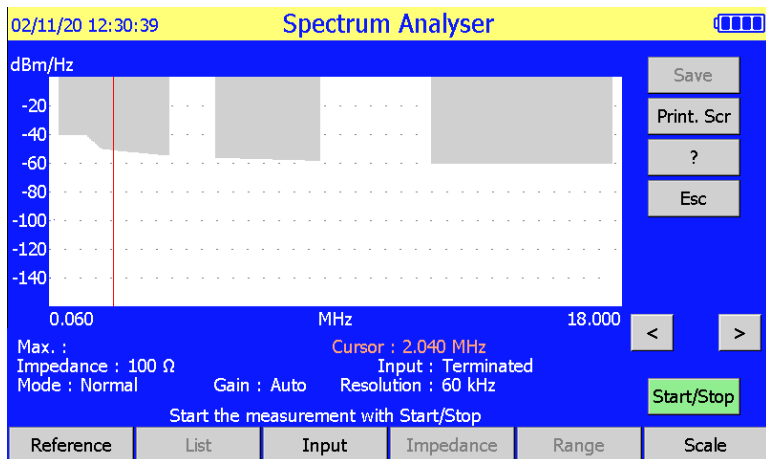
ECE 35 provides the possibility to display the actual output spectrum of an operating DSLAM together with the recommended PSD mask.

- Press the **Reference** key



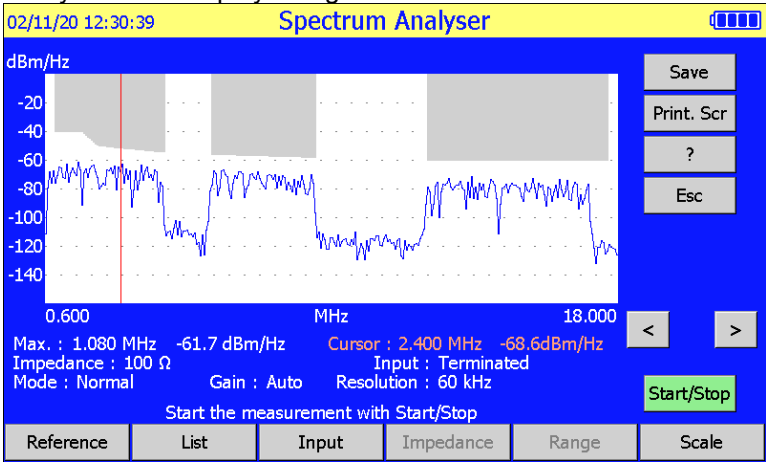
- Select a system group
- Do the DPBO adjustment if necessary and press **Enter**

Doing so ECE 35 automatically set the proper frequency range and shows the PSD mask belonging to the selected system.



- Start the measurement with the **Start/Stop** key

The actually obtained spectrum and the PSD mask belonging to the selected system are displayed together.



2.10.2 Application Notes

The accuracy of the spectrum measurement depends on the proper setting of evaluation mode, display mode and bandwidth. There are two typical measuring tasks:

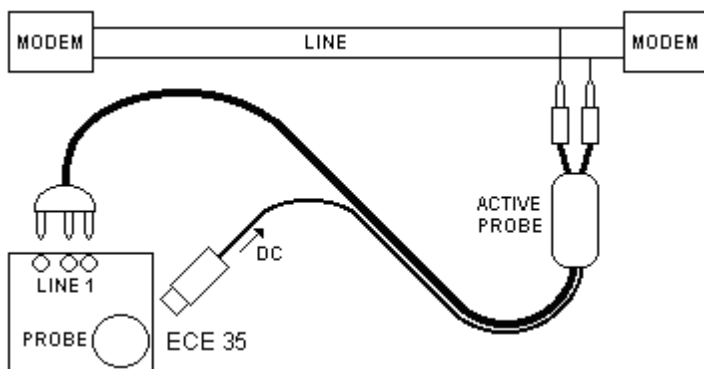
- PSD spectrum Measurement on working lines
- Noise spectrum Measurement on passive lines

PSD Spectrum Measurement on Working Lines

Line connection

In this case the test instrument should be connected parallel to the line with high impedance. The digital systems are extremely sensitive for the capacitive load therefore the regular measuring cables can not be used to connect the instrument. For line connection an optional active probe is provided to ECE 35 with a high input-impedance: $> 5 \text{ k}\Omega$ $< 5 \text{ pF}$.

The loss of high impedance probe is automatically compensated if the **High Imp. Probe** input option is selected.



The suggested settings to reach the best test results

As the actual transmit power of the tested modem is changing according to the actual data transfer situation the best is to set:

- Wide bandwidth
- **dBm/Hz** display mode
- **Average** or **Slipping Avg.** evaluation mode

Noise Spectrum Measurement on Passive Lines

Line connection

Both ends of the tested line should be terminated.

The suggested settings to reach the best test results

There are two typical types of noises:

- Wide band cross-talk noises caused by other xDSL systems
- Discrete frequency noises caused by radio stations

For the analysis of wide band cross talk noises the best is to set:

Wide bandwidth

- **dBm/Hz** display mode
- **Normal** evaluation mode

For the analysis of discrete frequency noises the best is to set:

- The narrowest bandwidth
- **dBm** display mode
- Average or Slipping Avg. evaluation mode

2.11 Spectrogram (Option)

(Applicable if the SW 460-570-000 option is active)

That method is an excellent tool to discover the disturbers causing considerable service impairment to communication systems.

The biggest problem is that long time spectrum observation is necessary because the disturbers appear in unpredictable times and frequency ranges.

ECE 35 performs spectrum measurements in every second

The results are displayed in the form of “water-fall” diagram.

The results are displayed on a 3 dimensional picture

- The time is on the vertical axis
- The frequency is on the horizontal axis
- The level is interpreted in form of color

The obtained results are stored in the memory or in a connected USB stick

The large memory capacity allows the storage the results of long test sequences up to several days

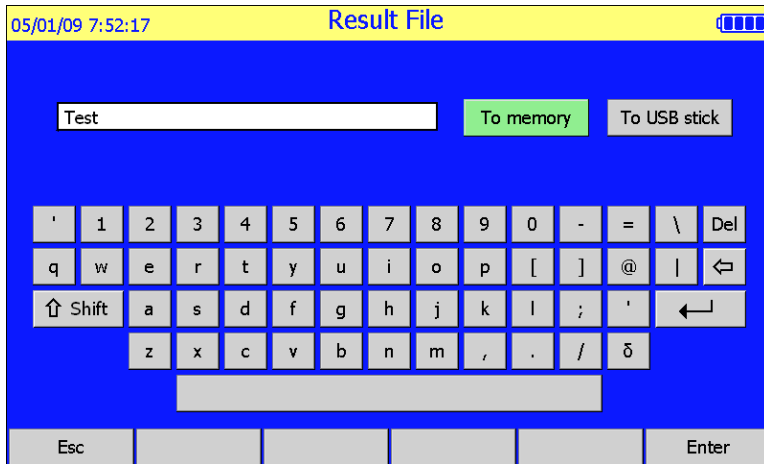
Mode Selection

- Enter the **Single End / Spectrogram** mode.

Range	Imped	Input	Gain		
4 kHz	3 MHz	100 Ohm	Terminated	Auto	Esc
20 kHz	9 MHz	120 Ohm	Unterminated	0 dB	PrtScr
0.3 MHz	12 MHz	135 Ohm	High imp probe	10 dB	Start
0.6 MHz	18 MHz	150 Ohm		20 dB	?
1.5 MHz	35 MHz	600 Ohm		30 dB	
				40 dB	
Name					

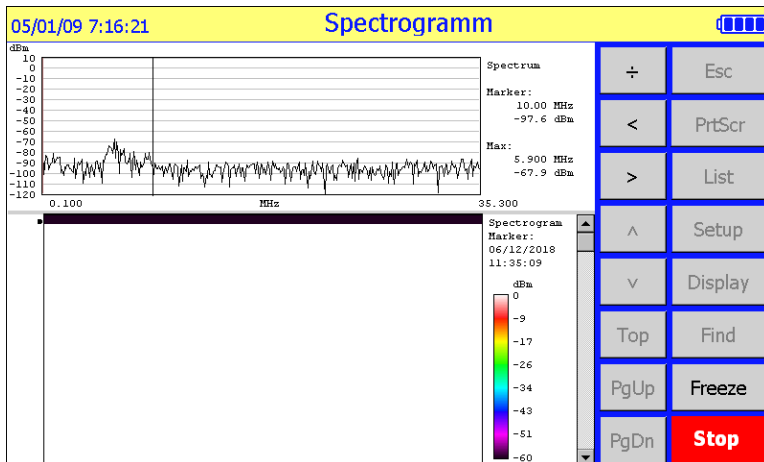
When the **Setup** display appears:

- Select the required frequency range
- Select the required input
- Select the required impedance
- Select the gain of pre-amplifier (The default is Auto)
- Press the **Name** key



- Type in a result name
- Select the place you want to save the result (Memory or USB Stick)
- Press **Enter**
- Start the test sequence with the **Start** key

Doing so, the measuring display appears:

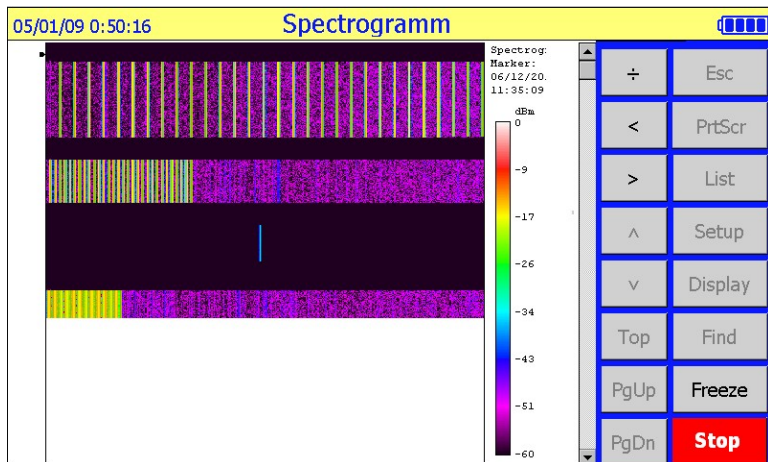
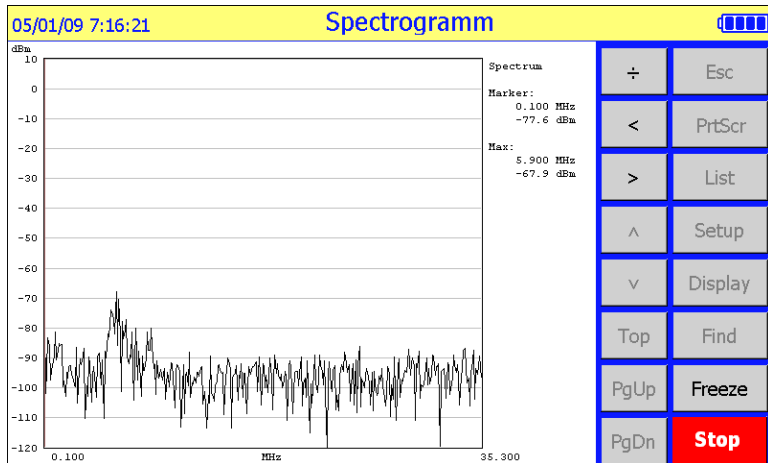


The display field is vertically shared into two parts:

- The upper part shows the result of the last performed measurement
- The lower part is the three dimensional “water-fall” diagram showing all the former obtained test results

Using the \div key the two display parts can be separated to show only:

- The last performed measurement
- The three dimensional “water-fall” diagram



- The screen updating can be temporary interrupted with the **Freeze** key
- The test sequence can be finished with the **Stop** key

Having the test sequence stopped all the result will be automatically stored under the earlier given name.

2.11.1 Evaluation of Test Results

During the run time several spectrum measurements are performed. The results will be displayed below each other in the “water-fall” diagram.

In case of long run time the results fill more then one page.

Any result can be reached using the **PgDn** and **PgUp** keys.

Any result can be displayed in details.

To select a result:

- Touch the display around the selectable result (rough setting)
- Select the required result with the \wedge , \vee keys (fine setting)

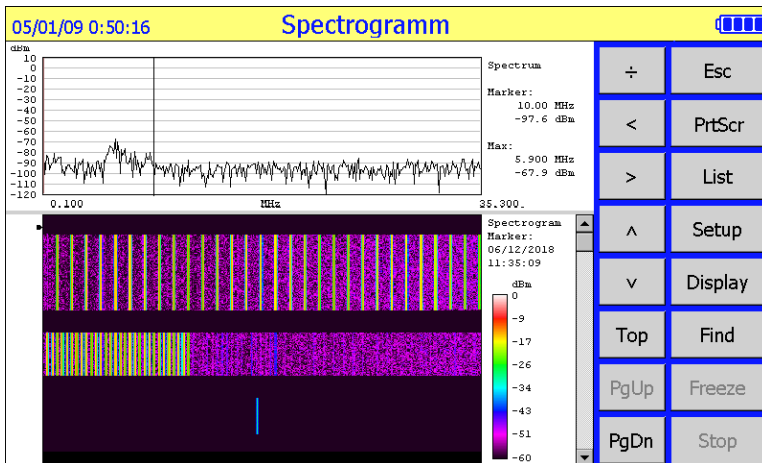
The detailed result will appear on the upper part of the display

- To get the result in numeric form, press the **List** key

The detailed results can be analyzed by the help of marker

To set the marker:

- Touch the display around the required point (rough setting)
- Set the marker to the required point with the \langle , \rangle keys (fine setting)



The received level can be displayed in dBm or dBm/Hz and characterized by colors in a preset level range.

- Maximum is white
- Minimum is black.

For the sake of the optimal evaluation of test results the display range can be modified free

2.11.2 Searching Tools & Display Mode Setup

ECE 35 provides searching tools

to find two subsequent measurements with the following criteria:

- The measured levels are around a preset threshold value.
(One of them is under the other one is over the threshold)
- The level difference exceeds a preset value (optional)
(Smaller level differences will be neglected)

To activate the searching tools

- Press the **Find** key
- Select the required result with the \wedge , \vee keys

To modify the actual setup:

- Press the **Display** key and the following display appears

Modification of scale and level display range

- Press the **dBm** or **dBm/Hz** key
- Press the **White** or **Black level** key and enter the required value

Modification of search criteria

To define the frequency where the searching is performed

- Press the **at marker** or **at any frequency** key

To preset the threshold level:

- Press the **Threshold** key enter the required value

To preset the level change

- Press the **Difference** key enter the required value

To switch on the level change searching option

- Press the **Use** key

2.11.3 Advanced Result Saving

ECE 35 provides two advanced result saving options:

- Adding notes to the saved result
- A section of the result can be saved as a separate result

Adding notes to the saved results

- Press the **Setup** key and the **Test setup** display appears

The screenshot shows the 'Test setup' screen with a yellow header bar containing the date/time '01/04/19 9:30:35' and the title 'Test setup'. The main area displays the following parameters:

Test setup	
Result name	jjjhhh
Device	
Serial number	
SW version	0.01
Test mode	Spectrogram
Start time	01/04/2019-09:30:04
Stop time	01/04/2019-09:30:16
Range	3 MHz
Imped	100 Ohm
Input	Terminated
Gain	Auto
Operator	Nyúl Béla
Notes	

On the right side, there is a vertical sidebar with buttons: Esc, PrtScr, Notes, Section, PgUp, and PgDn. The 'Notes' button is highlighted in blue.

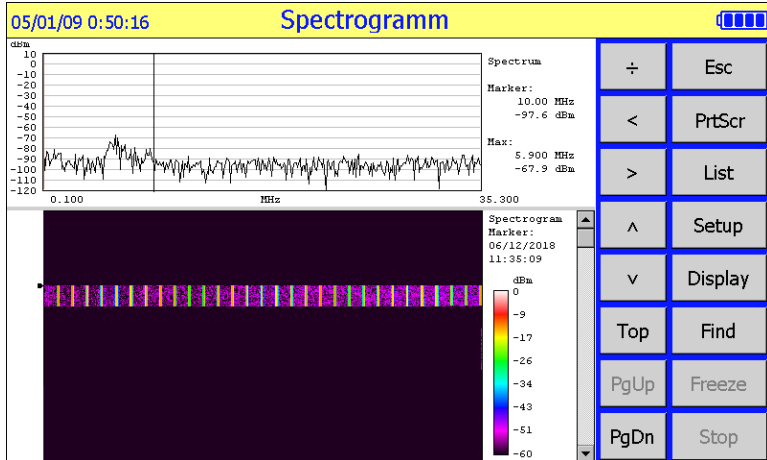
- Press the **Notes** key and enter the notes to be added

The screenshot shows the 'Write notes' screen with a yellow header bar containing the date/time '05/01/09 7:52:17' and the title 'Write notes'. The main area features a large white text input field at the top. Below it is a virtual keyboard with the following layout:

'	1	2	3	4	5	6	7	8	9	0	-	=	\	Del
q	w	e	r	t	y	u	i	o	p	[]	@		↵
↑ Shift	a	s	d	f	g	h	j	k	l	;	'	←		
	z	x	c	v	b	n	m	,	.	/	õ			
Esc														
Enter														

Saving a section of the result as a separate result

Sometimes the disturbers appear for a short time during the long time spectrum observation. In that case only a short time section of “water-fall” diagram contains useful information.



To save the useful section of result two times should be declared

- Starting time of section
- Ending time of section

To set the starting time

- Set the vertical time marker of “water-fall” diagram to the starting time of section
- Press the **Setup** key
- Press the **Section** key
- Press the **Get Starting Time** key
- Press the **Esc** key twice

To set the ending time

- Set the vertical time marker of “water-fall” diagram to the ending time of section
- Press the **Setup** key
- Press the **Section** key
- Press the lower **Get Ending Time** key

When the setting of times is completed

- Press the **Save** key
- Type in a result name
- Select the place you want to save the result (Memory or USB Stick)
- Press Enter

2.12 Interruption Analysis (Option)

(Applicable if the SW 460-530-000 option is active)

Principles of Operation

A micro interruption is a temporary line interruption due to external mechanical action on the copper wires constituting the transmission path, for example, at a cable splice. Splices can be hand-made wire-to-wire junctions, and during cable life oxidation phenomena and mechanical vibrations can induce micro interruptions at these critical points.

The effect of a micro interruption on the transmission system can be a failure of the digital transmission link. In the presence of an interruption of specified maximum length the xDSL modem may reset.

ECE 35 detects the micro interruptions using 1020 Hz test tone

An interruption is detected when the level of the received test tone drops below a designated threshold for more than 0.6 ms.

The detected interruptions are divided into five categories by duration:

- 0.6 ms to 3 ms
- 3ms to 30 ms
- 30 ms to 300 ms
- 300 ms to 1min
- >1min

The threshold level is adjustable in steps to the values 3, 6, 10 and 20 dB below the normal test signal level. The measuring time is adjustable between 4 min and 72 hours.

ECE 35 provides detailed information about

- Number of interruptions divided into five categories.
- Relative duration of interruptions.
- Error seconds.
- Time distribution of interruptions in 240 time slots.

The interruption Measurement can be performed in:

- Single Ended mode with loop back using the same ECE 35 for transmitting and receiving.
- End to End mode using two ECE 35-s connected to the ends of the tested pair. In this case one of them transmits a test tone the other one receives and evaluates it.

Disabling of power down function

To save the battery life ECE 35 has a power down facility switching the instrument off after a preset time. Therefore in case long time interruption Measurement ECE 35 should be used with mains adapter. If it is not possible then the power off function should be disabled before starting a long time test like interruption

- Press the **Settings** key of **Main Menu**
- Press the **Power Off Time / OFF** key and press **Esc**

Test Setup in Single Ended Mode

- Enter **Interruption Analysis Rx** mode

Category	Count
0.6 ms - 3 ms :	---
3 ms - 30 ms :	---
30 ms - 300 ms :	---
300 ms - 1 min :	---
> 1 min :	---
Relative Duration :	---
Errored Seconds :	---
Reference Level :	
Start Time :	
Elapsed Time :	
Duration :	4 min
Thresholds :	3 dB
Frequency :	1.020 kHz
Impedance :	600 Ω
Input :	L1

Start the measurement with Start/Stop

Buttons: Save, Print. Scr, ?, Esc, Start/Stop, Thresholds, Duration

- Press the **Duration** key and select the required measuring time
- Press the **Threshold** key and select the required threshold level
- Start the Measurement by pressing the **Start/Stop** key. Doing so the 1020 Hz test tone automatically appears on connector **L2**.

Test Setup in End to Ended Mode

- Enter **Interruption Analysis Tx mode**

01/07/19 9:28:50 Interruption Analysis

Signal transmitting for interruption analysis

The level is blocked !

Line : L1
Impedance : 600 Ω
Frequency : 1.020 kHz
Level : 0.0 dBm

Measuring is in progress

Print. Scr
?
Esc

Start/Stop

- Start the signal transmitting by pressing the **Start/Stop** key.

At the other end of the tested line

- Enter **Interruption Analysis Rx mode**

02/04/22 14:42:27 Interruption Analysis

Category	Count
0.6 ms - 3 ms :	---
3 ms - 30 ms :	---
30 ms - 300 ms :	---
300 ms - 1 min :	---
> 1 min :	---

Relative Duration : ---
Errored Seconds : ---
Reference Level : ---
Start Time : ---
Elapsed Time : ---

Duration : 4 min
Thresholds : 3 dB
Frequency : 1.020 kHz
Impedance : 600 Ω
Input : L1

Start the measurement with Start/Stop

Save
Print. Scr
?
Esc

Start/Stop

Thresholds Duration

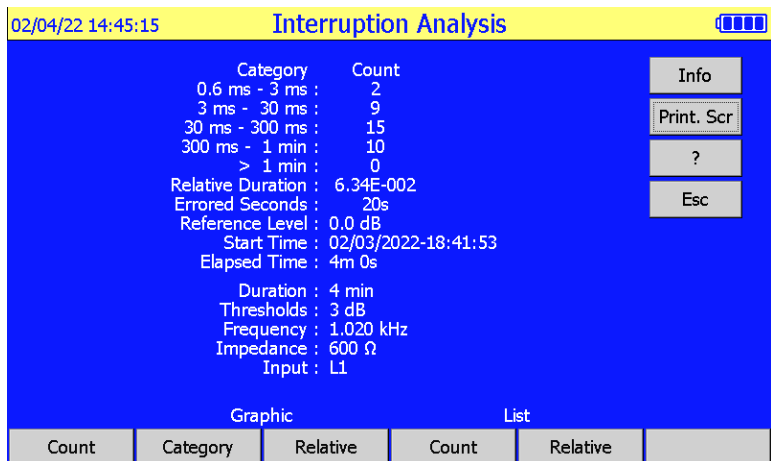
- Press the **Duration** key and select the required measuring time
- Press the **Threshold** key and select the required threshold level
- Start the Measurement by pressing the **Start/Stop** key.

Measuring process

The measuring process consists of two parts.

- First when the Measurement is started ECE 35 measures the level of the received test tone and stores that value as **Reference Level** of the Measurement.
- Having the Reference Level stored ECE 35 **starts to count** interruptions.

The following picture is displayed during and after the Measurement keeping the user informed about the actual count of interruptions and the measuring time left:



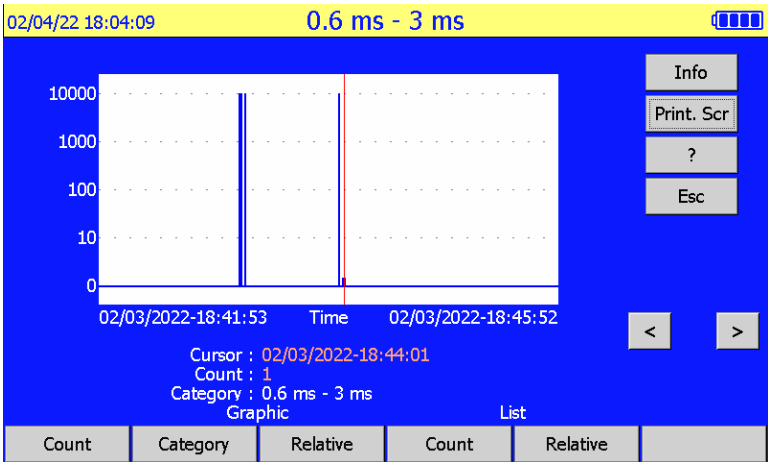
When the Measurement is ready the user can get immediate information about the:

- Number of interruptions divided into five categories.
- Relative duration of interruptions.
- Errored seconds.

In addition ECE 35 provides detailed information about the time distribution of interruptions. The measuring time is divided into 240 time slots.

Number of interruptions in a time slot

- Press the **Category** key and select a category.
The appearing display shows the time distribution for the selected category as a vertical bar graph.
- To see the count of interruptions in a given time slot, use the horizontal cursors.



- To see the count of interruptions in numeric form, press the **List / Count** key. The appearing list shows the count for each category and time slots together.

02/04/22 14:44:27 Count

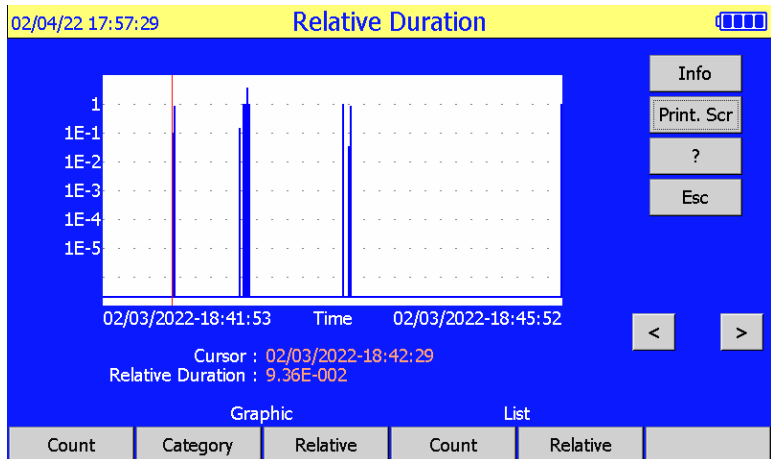
Time	-3ms	-30ms	-300ms	-1min	> 1min
18:42:27	0	0	0	0	0
18:42:28	0	0	1	1	0
18:42:29	0	0	1	0	0
18:42:30	0	0	2	1	0
18:42:31	0	1	0	1	0
18:42:32	0	0	0	1	0
18:42:33	0	0	2	0	0
18:42:34	0	0	0	0	0
18:42:35	0	0	0	0	0
18:42:36	0	0	0	0	0
18:42:37	0	0	0	0	0
18:42:38	0	0	0	0	0
18:42:39	0	0	0	0	0
18:42:40	0	0	0	0	0

Previous Next

- To return press **Esc**

Relative duration of interruptions in a time slot

- Press the **Graphic / Relative** key
The appearing display shows the relative duration of interruptions as a vertical bar graph
- To see the relative duration in a given time slot, use the horizontal cursor keys.



- Pressing the **List / Relative** key the test relative duration of interruptions appears in graphic form.

02/04/22 14:43:52 **Relative Duration** [Battery Icon]

Time	Relative
02/03/2022-18:42:21	0.00E+000
02/03/2022-18:42:22	0.00E+000
02/03/2022-18:42:23	0.00E+000
02/03/2022-18:42:24	0.00E+000
02/03/2022-18:42:25	0.00E+000
02/03/2022-18:42:26	0.00E+000
02/03/2022-18:42:27	0.00E+000
02/03/2022-18:42:28	0.00E+000
02/03/2022-18:42:29	9.36E-002
02/03/2022-18:42:30	8.47E-001
02/03/2022-18:42:31	0.00E+000
02/03/2022-18:42:32	0.00E+000
02/03/2022-18:42:33	0.00E+000
02/03/2022-18:42:34	0.00E+000

Info
Print. Scr
?
Esc

Previous Next

- To return press **Esc**

2.13 Telephone Simulator (Option)

(Applicable if the 460-400-000 Active bridge option is active)

ECE 35 is able to:

- Receive a call sent by another user
- Send a test call to another user and talk with him
- Allow a conversation between the two users
- Measure the battery and ringing voltage & ringing frequency

Test Procedure

- Enter **Telephone** mode

The default is the call waiting (On hook state)

In this state ECE 35 is waiting for a call from the other end of the line and measures the ringing voltage and frequency.



To receive the call

- Pick up the handset by pressing the green telephone symbol.
- In this state, the ECE 35 measures the loop current
- You can speak when the **Microphone** button is pressed.
- Having the conversation finished, press the red telephone symbol

To make a call

- Select the required dial mode with the **Mode** key
- Type in the required phone number.
- Pick up the handset by pressing the green telephone symbol.
- You can speak when the **Microphone** button is pressed.
- Having the conversation finished, press the red telephone symbol



Modification of DTMF or pulse parameters

- Press the **Parameter** key

01/09/19 10:48:22 Test Setup

	Tone Parameter		
Level	1	-6.0 dBm	Print. Scr
	2	-8.0 dBm	?
			Esc
	Pulse Parameter		
Time	3	40 ms	
	4	60 ms	

Load defaults

- Do the modification
- Press **Esc**
- To return to the standard values press the **Load defaults** key

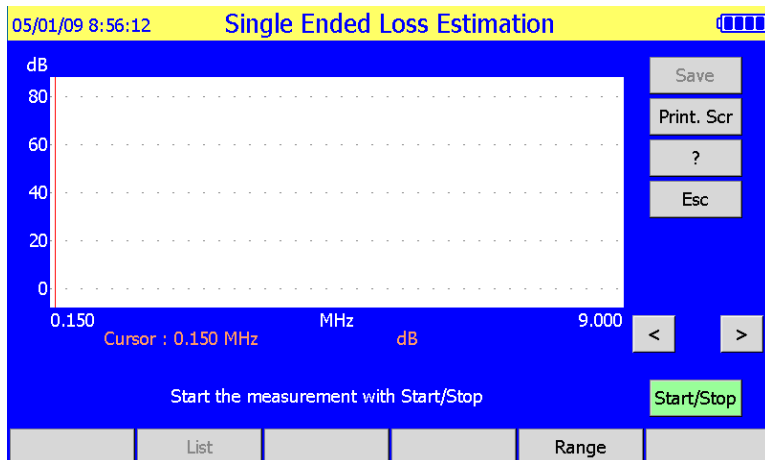
2.14 Single Ended Loss Estimation (Option)

(Applicable if the SW 460-640-000 option is active)

ECE 35 provides single ended loss estimation

Test Procedure

- Enter **Loss Estimation** mode



Range Selection

- Press the **Range** key and select the required frequency range

Start the measurement with the **Start/Stop** key

Test Results

Test results are available both in graphic and numeric forms.

- To get numeric form, press the **List** key
- To return to graphic form press **Esc**

3 VOICE FREQUENCY SW PACKAGE (Option) (Applicable if the SW 460-940-000 option is active)

3.1 Echo Test

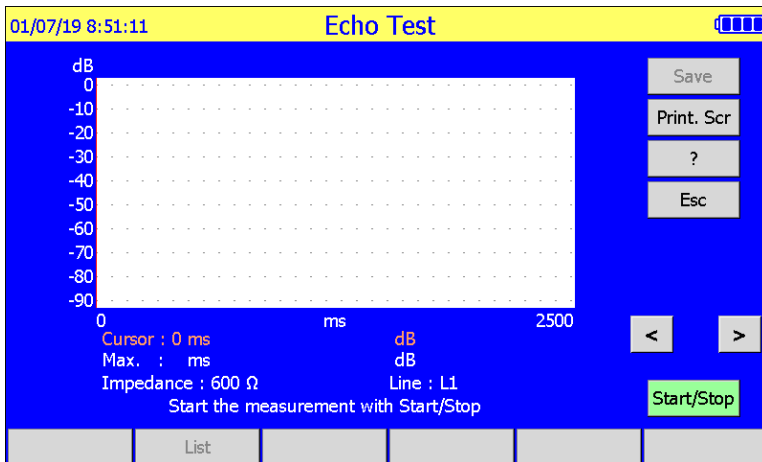
There are several reasons for the undesirable quality degradation and the appearance of audible echoes is one of them. This kind of quality degradation is inherent in the network equipment and the end-user phone devices. ECE 35 provides the test of disturbing echoes. ECE 35 transmits short ~1020 Hz signal packets with proper amplitude shaping and measures the amplitude and the traveling time of the reflected signal.

Measuring ranges:

- Traveling time range: 15 to 2500 ms
- Time resolution: 5 ms
- Amplitude indication: down to -60 dBm

Test Procedure

- Press the **Manual Single End** key of **Main Menu**
- Enter **Echo Test**



The measurement can be started or interrupted by the **Start/Stop** key

Test Results

Test results are available both in graphic and numeric forms. The result is displayed first in graphic form.

- To get numeric form, press the **List** key

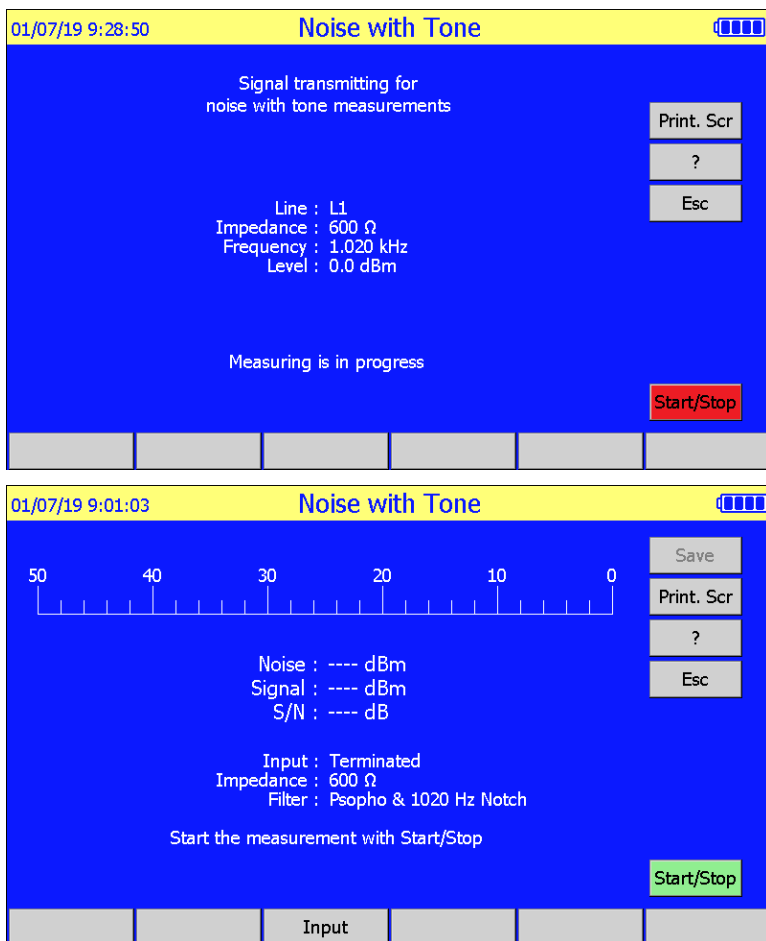
To return to graphic form press **Esc**

3.2 Noise with Tone Measurement

This measurement needs two instruments connected to the ends of the tested pair. One of them transmits 1020 Hz the other one performs noise measurement.

Test Procedure

- Press the **Manual End to End** key of **Main Menu**
 - Press the **Noise with Tone Tx or Rx** key
- Doing so the related display appear



- The measurement can be started or interrupted by the **Start/Stop** key.

3.3 Group Delay Distortion Measurement

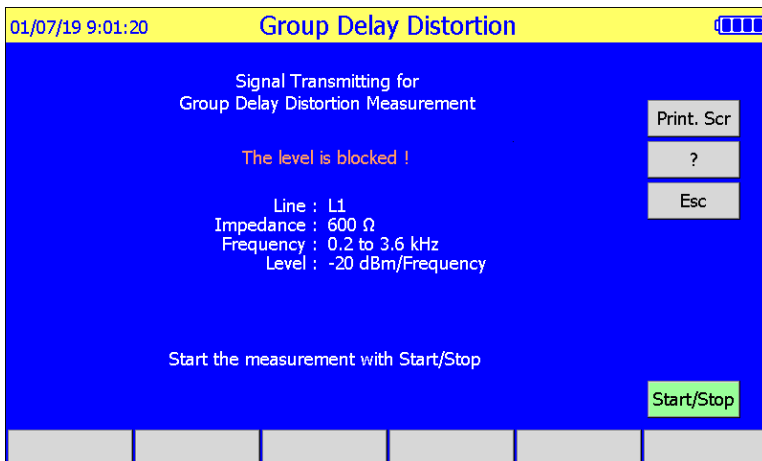
ECE 35 provides group delay distortion measurement with multi tone method described in the recommendation ITU-T O.81 Appendix I

The group delay distortion measurement needs two ECE 35 instruments connected to the ends of the tested pair. One of them transmits a test tone the other one receives and evaluates it. ECE 35 performs Group delay distortion and level measurements simultaneously:

Test Procedure

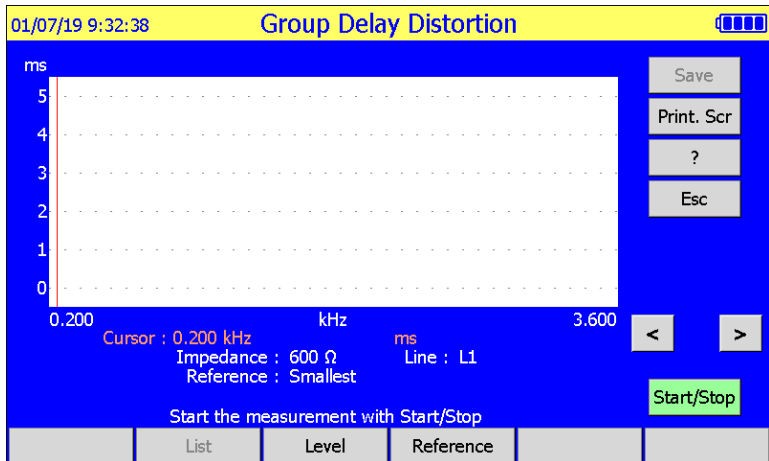
- Press the Manual End to End key of Main Menu
- Press the **Group Delay Distortion Tx or Rx** key
Doing so the related display appear

Transmitting



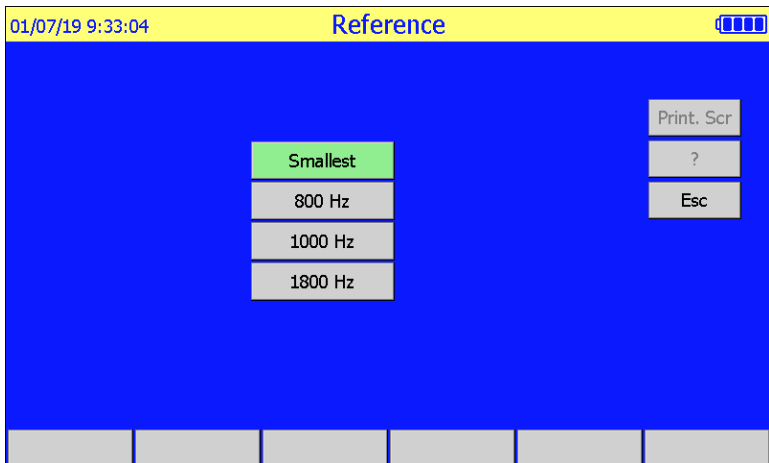
The output can be enabled or disabled with the **Start/Stop** key

Receiving



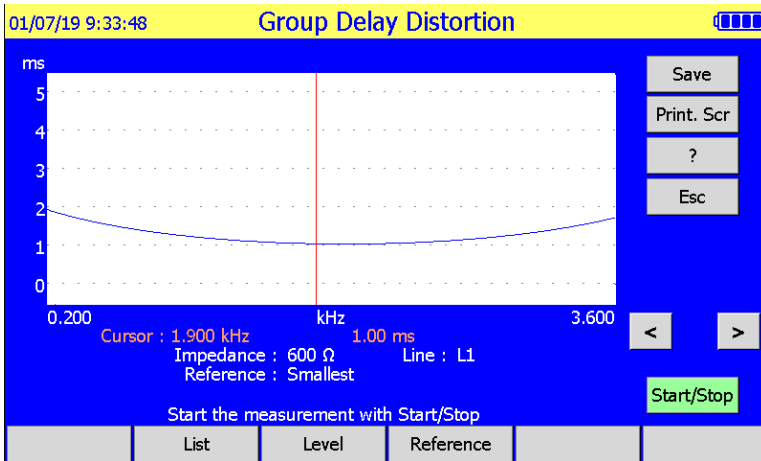
To change the reference value

- Press the **Reference** key
- Select the required option

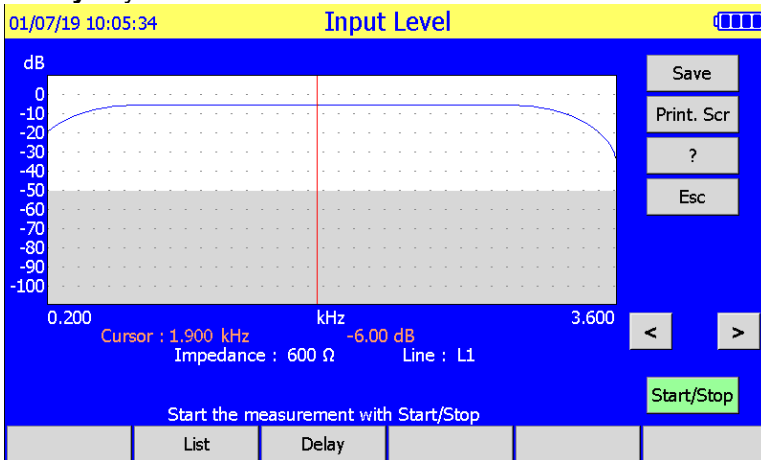


The measurement can be started or interrupted by the **Start/Stop** key.

Test Results



The display can be changed between group delay and level with the **Level/Delay** key



The test results are displayed in graphic form during the measurement.
To get numeric form:

- Interrupt the measurement with the **Start/Stop** key,
- Press the **List** key and the result appears in numeric form.

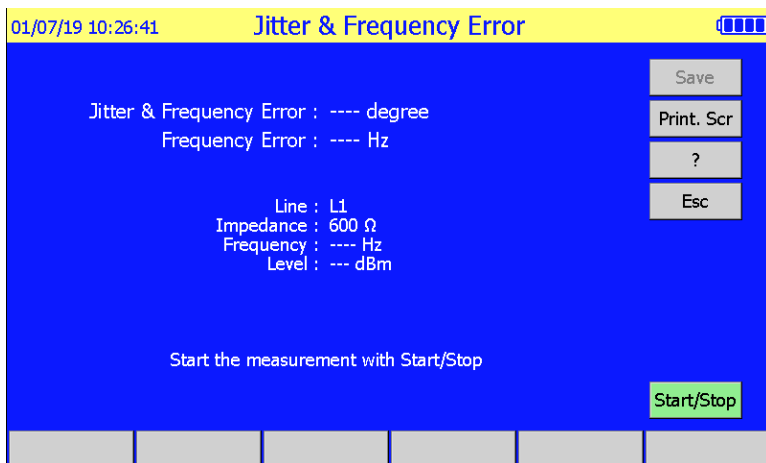
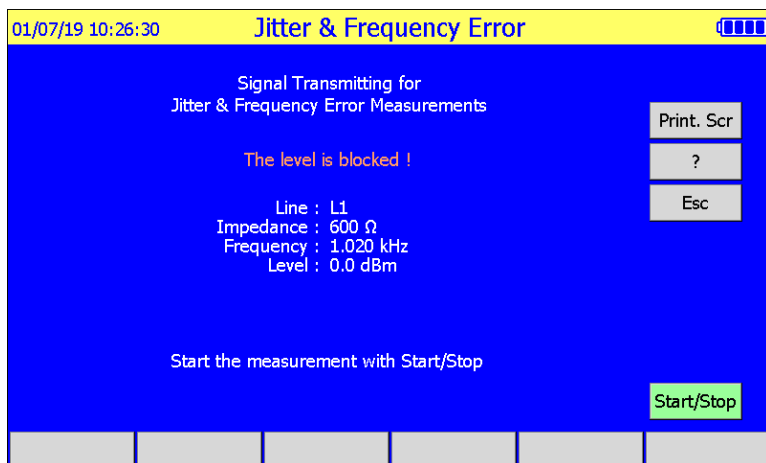
The result can be saved with the **Save** key

3.4 Phase Jitter & Frequency Error Measurement

That measurement needs two instruments connected to the ends of the tested pair. One of them transmits a jitter-free quartz accurate 1020 Hz test tone the other one receives and evaluates it. ECE 35 performs the two measurements simultaneously according to rec. ITU-T O.91

Test Procedure

- Press the Manual End to End key of Main Menu
- Press the **Jitter & Frequency Error /Tx or Rx** key
Doing so the related display appear



- The measurement can be started or interrupted by the **Start/Stop** key.

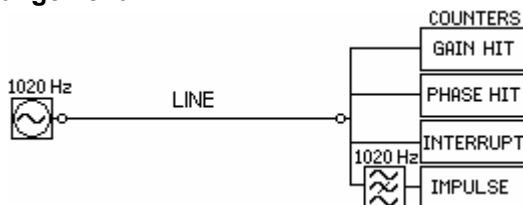
3.5 Simultaneous Event Counter Mode

ECE 35 provides simultaneous counting of events like:

- Amplitude hits (described in rec. ITU-T O.95)
- Phase hits (described in rec. ITU-T O.95)
- Interruptions (described in rec. ITU-T O.61)
- Noise impulses (described in rec. ITU-T O.71)

The event test needs two instruments connected to the ends of the tested pair. One of them transmits a test tone the other one receives it and simultaneously counts the number of events like:

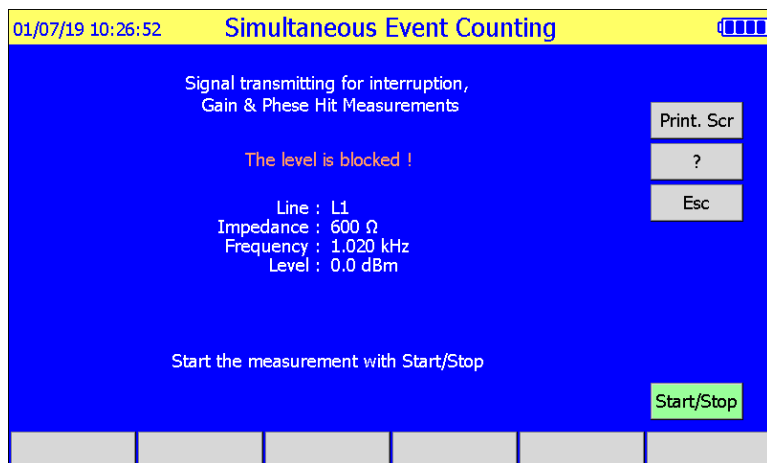
Measuring arrangement:



Test Procedure

- Press the **Manual End to End** key of **Main Menu**
 - Press the **Simultaneous Event Counting Tx or Rx** key
- Doing so the related display appear

Transmitting



Receiving

01/07/19 10:27:07		Simultaneous Event Counting		[Battery Icon]	
Category	Count				
Amplitude Hit :	---	Save			
Phase Hit :	---	Print. Scr			
Interruption :	---	?			
Impulse Noise :	---	Esc			
Reference Level : --- dBm					
Amplitude Hit Threshold : 2 dB					
Phase Hit Threshold : 5 degree					
Interruption Threshold : 6 dB					
Impulse Noise Threshold : 0 dBm					
Duration : 5 min					
Elapsed Time : ---					
Impedance : 600 Ω					
Start the measurement with Start/Stop					Start/Stop
Thresholds				Duration	

- Press the **Duration** key and enter the required measuring time.
- Press the **Thresholds** key and enter the required thresholds.
- Start the measurement with the **Start/Stop** key

The measuring process

The process consists of two parts.

- First when the measurement is started ECE 35 measures the level of the received test tone and stores that value as **Reference Level**
- Having the Reference Level stored ECE 35 starts to count the events. The elapsed time is continuously indicated.

Having the measurement completed and stopped the result can be saved with the **Save** key.

Important Note:

The use of mains adapter is recommended to avoid the discharge of battery during a long time test!

4 AUTOMATIC MASTER SLAVE TEST OF XDSL LINES

In this test group ECE 35 provides automatic bi-directional Measurement of principal characteristics of the subscriber line using two instruments. They are connected to the ends of the tested pair in MASTER-SLAVE arrangement. The two instruments communicate over the tested pairs.

- The Master initializes the measurements and collects the results.
- The Slave performs the measurements according to the Master's commands and sends back the results.

Numerous pre-programmed parameter sets are available for different xDSL systems containing system parameters and cable parameter limits.

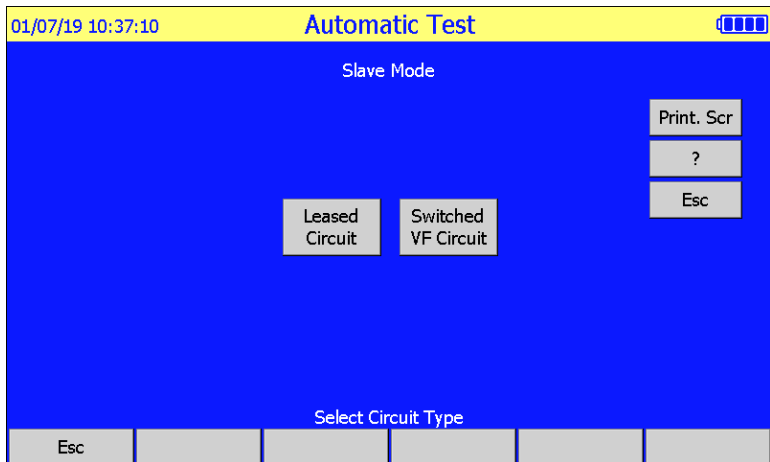
Pre-programmed system independent test sequences with ten frequency ranges are provided for trouble-shooting.

ECE 35 Provides:

- ESEL and KLo dependent data rate calculation and ESEL Measurement up to 120 dB
- Non-disturbing measuring method for the test of cables containing vectored groups.

4.1 Preparing the Program at Slave End

- Press the **Slave** option of **Main Menu**
Doing so the following display appears

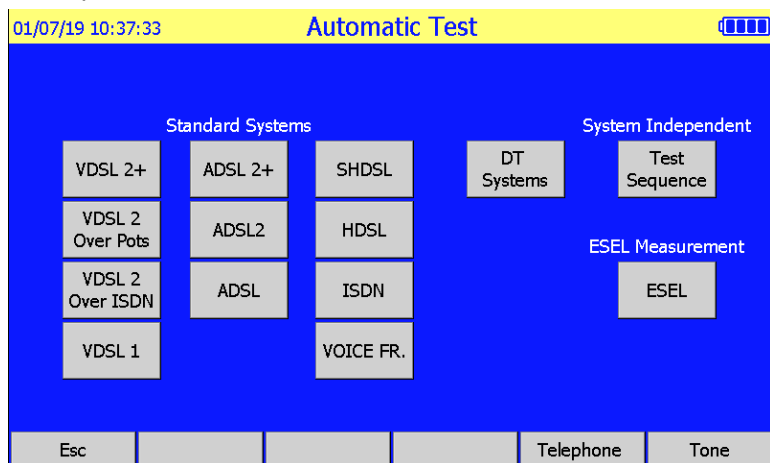


- Select the **Leased Circuit** option

4.2 Preparing the Program at Master End

- Press the **Master** option of **Main Menu**

When **Master** mode is selected the **Automatic Test** appears providing xDSL system dependent and system- independent automatic test sequence options.



- Enter the required system group (E.g. VDSL +)



- Select the required system by the corresponding key

When DPBO is necessary

- Switch the DPBO on with the **DPBO** key
- Enter the required **ESEL** and **MUS** values using the corresponding keys.

When UPBO is necessary

- Switch the UPBO on with the **UPBO** key
The amount of UPBO changes automatically with the electrical length of loop (Loss at 1 MHz) or according to a user predicted value. To set a predicted KL value:
- Press the **klo** key and enter the required value.

4.3 Running the Program

When the setting of test parameters is completed press **Enter** and then the automatic program start display appears

01/07/19 10:56:57		Automatic Test		[Battery Icon]	
Loss		System:	998-ADE35-M2x-BV	Print. Scr	
Noise		Measuring Time:		?	
Return Loss		Slave:	Not ready	Esc	
Impedance		Qualification:			
Balance					
NEXT					
FEXT					
S/N & Bitrate					
Select the required tests and Start the measurement with Start/Stop when the slave is ready. Master at Central End				Start/Stop	
Telephone		Master		Speed Parameter	

In case of ADSL or VDSL systems the master position should be declared

- . It can be changed with the **Master** key.

You can reach service telephone mode by pressing **Telephone**

- Select the required tests by the corresponding keys
- Start the program with the **Start/Stop** key

Important note:

Before starting the program be sure that the slave is ready!

The progress of program is continuously indicated

01/07/19 10:39:04		Automatic Test			
Loss	✗	System: 998-ADE35-M2x-BV Measuring Time: 66 s Slave: Ready Qualification:	Print. Scr		
Noise	✓		?		
Return Loss	✓		Esc		
Impedance	✗				
Balance					
NEXT					
FEXT					
S/N & Bitrate					
Measuring is in progress Master at Central End				Stop	
Telephone		Master		Speed Parameter	

4.4 Test Results

Short Form Test Result

When the test program is completed a short form result page appears with immediate **Pass / Fail** information and with the list of detailed result pages. When the qualification is **Fail** the reasons are marked with red color


01/07/19 10:39:04		Automatic Test			
Loss	✗	System: 998-ADE35-M2x-BV Measuring Time: 66 s Slave: Ready Qualification: Fail	Save		
Noise	✓		Print. Scr		
Return Loss	✓		?		
Impedance	✗		Esc		
Balance	✓				
NEXT					
FEXT					
S/N & Bitrate	✓				
Master at Central End					
Telephone		Master		Speed Parameter	

- To study a result page press the corresponding key.
- To return to short form press the **Esc** key.

Pressing the **Speed** key the following display appears:

02/06/22 15:31:11

Speed



Down	MarginD1 [dB]	MarginD2 [dB]	MarginD3 [dB]	Bitrate [kbit/s]	Print. Scr
Attainable	0.00	0.00	0.00	154752	?
Default	6.00	6.00	6.00	123136	Esc
Current	6.00	6.00	6.00	123136	

Up	MarginU0 [dB]	MarginU1 [dB]	MarginU2 [dB]	Bitrate [kbit/s]
Attainable	0.00	0.00	0.00	49216
Default	6.00	6.00	6.00	41231
Current	6.00	6.00	6.00	41231

MarginD1	MarginD2	MarginD3	MarginU0	MarginU1	MarginU2
----------	----------	----------	----------	----------	----------

The speed table gives prompt information about:

- the achievable data rates with 0 dB margin values
- the data rates with default margin values.

If the bit rate is too low, a recalculation with smaller margin values can be carried out without starting a new measurement.

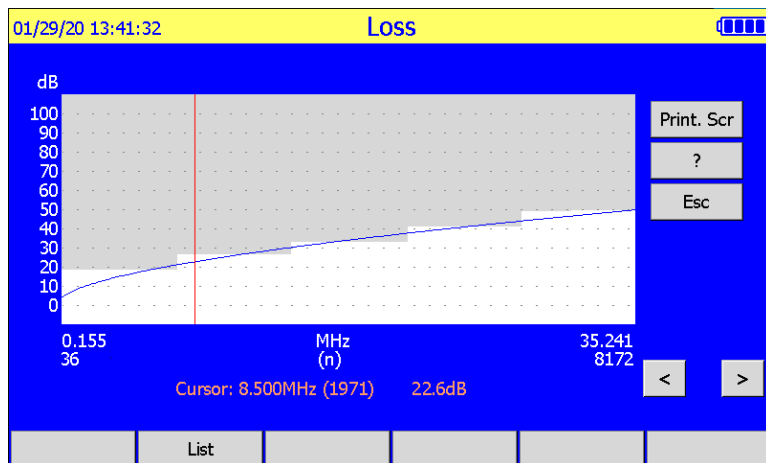
If necessary, you can change all six margin values here.

Detailed Test Results

The result pages generally show:

- The selected parameter in graphic format as a function of frequency
- The tolerance masks after which the Pass/Fail decision was made.

Selecting for example the **Loss** result the loss/frequency diagram and the template for pass/fail decision are shown

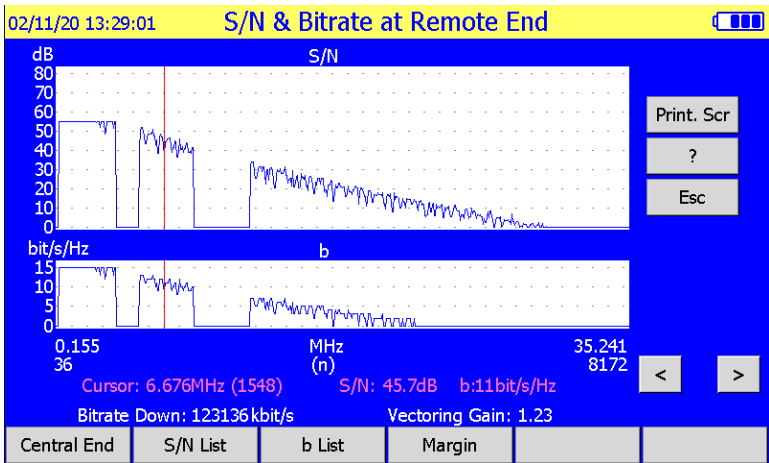


Moving the cursor line by the horizontal arrow keys, the loss and frequency values belonging to the cursor position are displayed.

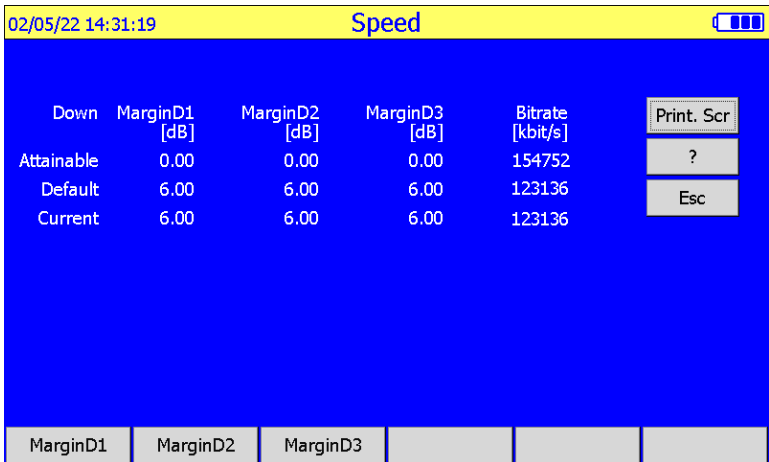
- Pressing the **List** key the test result appears in list form.
- To return to graphic format press the **Esc** key.

The **S/N & Bitrate** page contains more than the others.

- It shows the bitrate calculated with the preset margins
- Provides the possibility to modify the margin values



Pressing the **Margin** button, the following screen appears



If the bit rate is too low, a recalculation with smaller margin values can be carried out without starting a new measurement.

If necessary, you can also change the margin values here.

4.5 ESEL Measurement

ECE 35 provides ESEL measurement until 120 dB

When the DPBO method is necessary the amount of power reduction depends on the attenuation of the main cable. The attenuation of the main cable between the exchange and the local DSLAM is characterized by the so-called ESEL (Exchange Side Electrical Length) value

$$\text{Electrical length} = \text{Loss at 1 MHz}$$

The purpose of ESEL option is to measure the electrical length of exchange side cable up to 120 dB.

In case of long exchange side cables the loss measurement at 1 MHz is problematic because of to the crosstalk noises

At the lower part of the frequency range (where the cable attenuation is relatively low) the S/N ratio is generally high the accuracy of loss measurement is satisfactory.

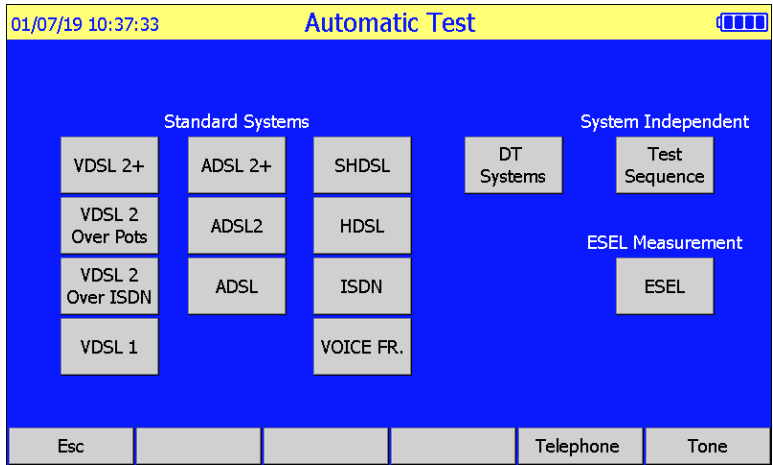
At the upper part of the range where the S/N ratio is low because of to the crosstalk noises the accuracy of loss measurement is generally not satisfactory therefore the ESEL measurement requires special measuring method.

During the ESEL measurement ECE 35 performs selective loss and noise measurements over the 1 MHz frequency range and calculates the S/N ratio for each test frequencies. At the upper part of the frequency range where the accuracy of loss measurement wouldn't be satisfactory ECE 35 applies extrapolation.

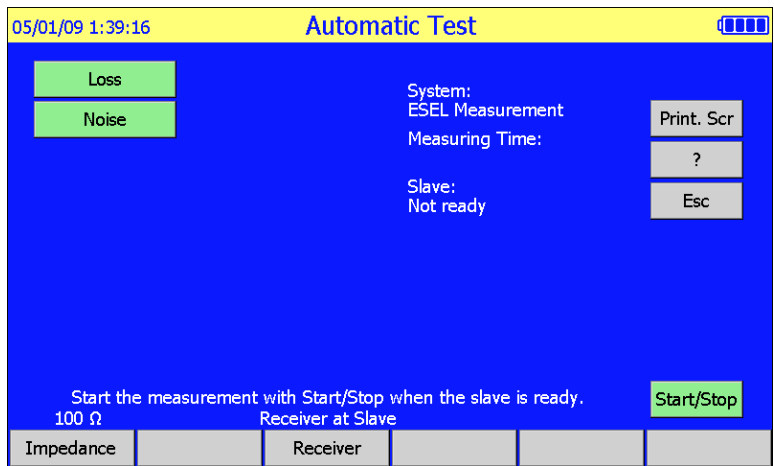
At ESEL measurement two instruments should be used connected to the central and remote ends of the tested line. One of them is working as transmitter the other one as receiver

Tasks at the MASTER Side

- Press the **Master** option of **Main Menu**



- Press the **ESEL** Key
Doing so the **ESEL-MEASUREMENT** display appears

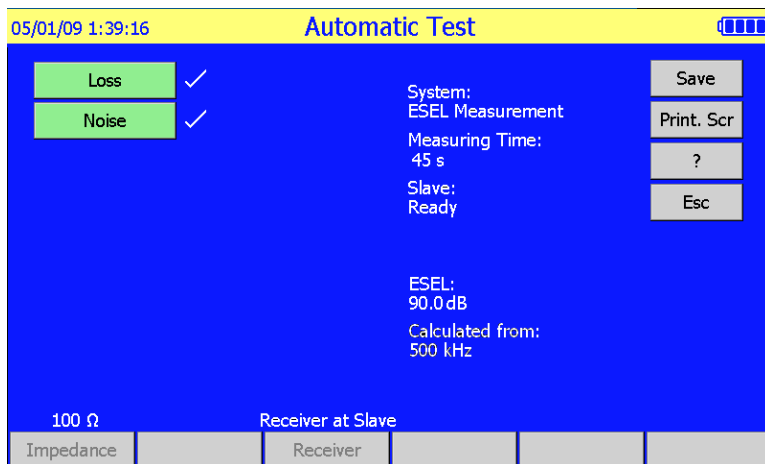


- Select the location of receiving with the **Receiver** key
- Start the measurement with the **STAR/STOP** key

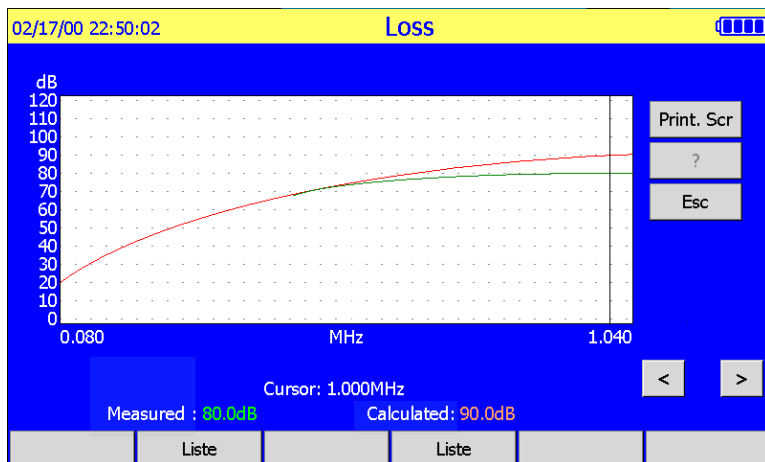
Important Note:
At this measurement the RECEIVER must be at the REMOTE end!

Test Results

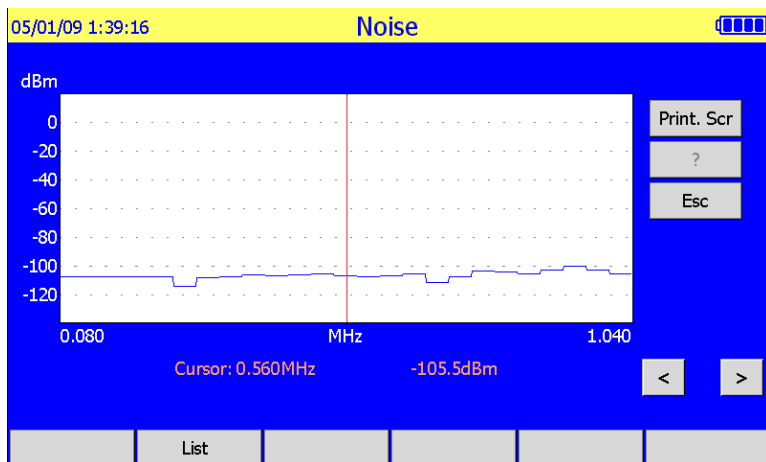
When the test sequence is ready the appearing result display shows the calculated **ESEL** value and the number of the last sub carrier over which extrapolation is applied.



Pressing **Loss** key the **Loss** display appears showing the calculated and the measured loss characteristics. The measuring results are available in numeric form as well. To see the numeric values press the corresponding **List** key



To see the noise level press the **Noise** key



- To see the numeric values press the **List** key

5 AUTOMATIC MASTER SLAVE TEST OF VF CIRCUITS

Two instruments perform automatic bi-directional Master-Slave measurement of principal characteristics of the tested circuit.

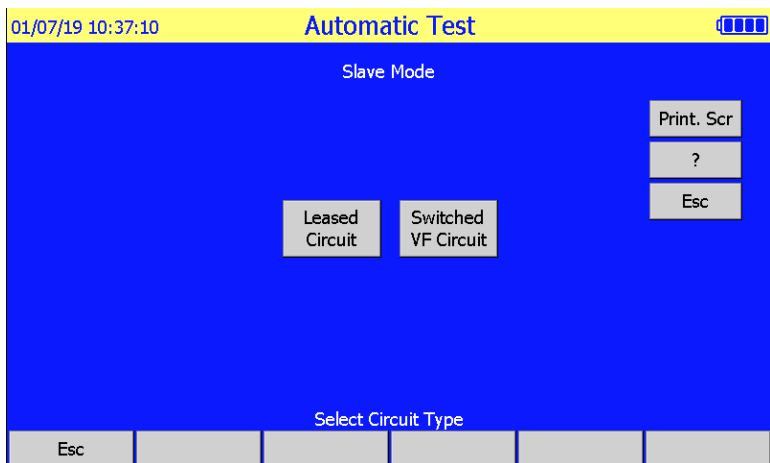
The two instruments communicate over the tested line.

- The Master initializes the measurements and collects the results.
- The Slave performs the measurements according to the Master's commands and sends back the results.

Using pre-programmed system parameters and cable parameter limits ECE 35 provides immediate **PASS/FAIL** qualification and detailed information about the reasons of failure.

5.1 Slave Mode

- Press the **Slave** option of **Main Menu**
Doing so the following display appears

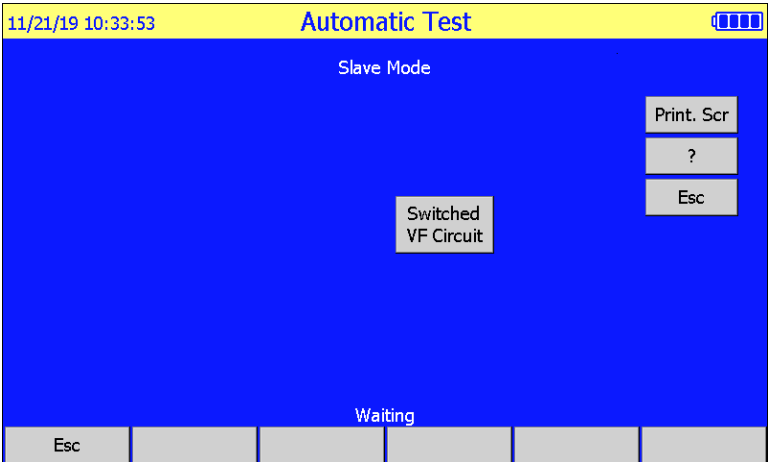
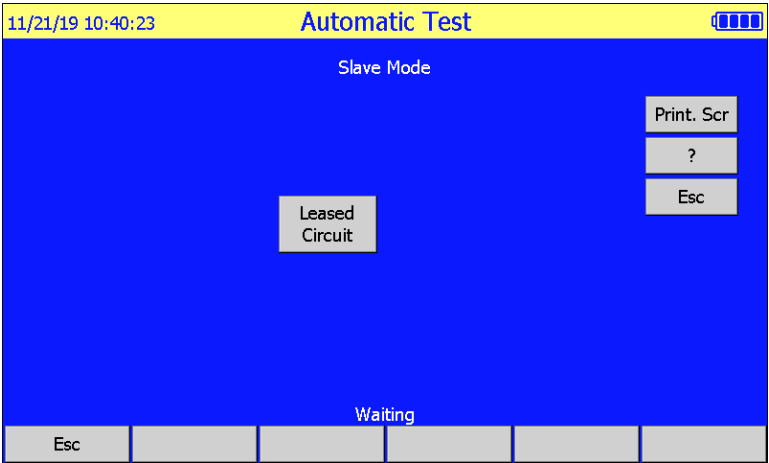


The functions of slave depend on the type of tested line. There are two possibilities: Leased or Switched circuit. (The default is Leased).

In case of switched circuit test the Master and Slave ECE 35 should communicate over an exchange.

- Enter the required circuit type and then one of the following displays appears

:



In switched circuit mode the slave behaves as a phone set with on-hook handset and waits until the master calls it.

5.2 Master Mode

Preparing the program

- Select the **Master** option of **Main Menu**
- Enter the **VOICE FR.** option

- Select the required **Circuit Quality Class** and **Circuit Type**

In case of **Switched** circuit

- Press **Edit** and enter the phone number of slave

- Having the selection completed press **Enter**
Doing so the list of selectable tests appears

Selectable
tests in
case of

Switched
Circuit

01/07/19 11:14:51

Automatic Test

Loss

Noise

Return Loss

Impedance

Balance

Total Distortion

Group Delay

Jitter & Frequ.

Event Counter

System:
ITU-T M.1040 Switched

Measuring Time:

Slave:
Not ready

Qualification:

Print. Scr

?

Esc

Select the required tests and
Start the measurement with Start/Stop when the slave is ready.

Start/Stop

Parameter

Selectable
tests in
case of

Passive
Leased
Circuit

01/07/19 11:15:25

Automatic Test

Loss

Noise

Return Loss

Impedance

Balance

NEXT

FEXT

Group Delay

Jitter & Frequ.

Event Counter

System:
ITU-T M.1020 Passive

Measuring Time:

Slave:
Not ready

Qualification:

Print. Scr

?

Esc

Select the required tests and
Start the measurement with Start/Stop when the slave is ready.

Start/Stop

Parameter

Selectable
tests in
case of

Active
Leased
Circuit

01/07/19 11:15:39

Automatic Test

Loss

Noise

Return Loss

Impedance

Balance

NEXT

FEXT

Total Distortion

Group Delay

Jitter & Frequ.

Event Counter

System:
ITU-T M.1025 Active

Measuring Time:

Slave:
Not ready

Qualification:

Print. Scr

?

Esc

Select the required tests and
Start the measurement with Start/Stop when the slave is ready.

Start/Stop

Parameter

Notice
The Total Distortion, Group Delay, Jitter & Frequ. Event Counter tests are applicable if the SW 460-940-000 option is active

5.3 Running the Program

If the test-object is a leased circuit

The master and the slave start to communicate automatically when the test sequence is started with the **Start/Stop** key.

If the test-object is a switched circuit

Pressing the **Start/Stop** key the master first dials up the slave. The user is continuously kept informed about the state of calling. When the slave is connected and the two ECE 35 instruments effected the communication the test sequence is started automatically.

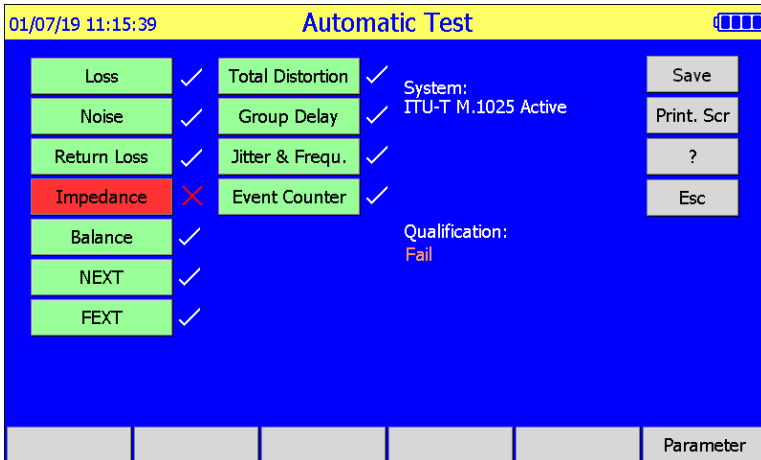
Having the automatic test program started with the **Start/Stop** key the measuring picture appears informing the user about the progress of the test sequence.

01/07/19 11:15:39		Automatic Test		[]		
Loss	✓	Total Distortion	System: ITU-T M.1025 Active Measuring Time: 01:38 Slave: Ready Qualification:			
Noise	✓	Group Delay				Print. Scr
Return Loss	✓	Jitter & Frequ.				?
Impedance	✗	Event Counter				Esc
Balance	⌚					
NEXT						
FEXT						
Measuring is in progress				Start/Stop		
				Parameter		

5.4 Test Results

Short Form Test Result

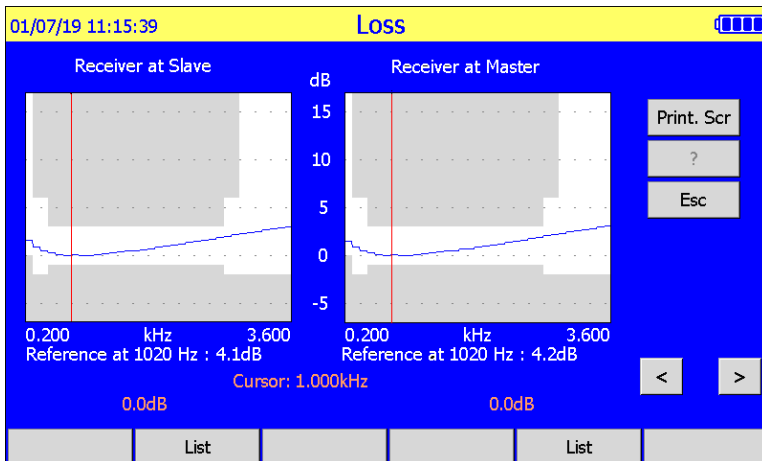
When the test program is completed a short form result page appears with immediate **Pass / Fail** information and with the list of detailed result pages. When the qualification is **Fail** the reasons are marked with red color.



To study the detailed result pages

- Press the required parameter
- To return to the short form press **Esc**

Selecting for example the **Loss** result the loss/frequency diagram and the template for pass/fail decision are shown.



- Press the **List** key to see the test result In list form

Special features

ECE 35 provides master slave measurement for the test of very long lines having very high propagation delay (Up to 10 sec).

In case of the test of circuits having high propagation delay the required receiver delay of ECE 35 can be set in the following way:

- Press the **Rec. Del** key of **Voice Frequency Circuits** menu
- Set the required receiver delay with the number keys
- Press **Enter**

6 AUTOMATIC SINGLE END LINE TEST (Option)

(Applicable if the SW 460-640-000 option is active)

ECE 35 provides single sided test sequences to estimate the data transfer capacity of tested lines used for different xDSL systems.

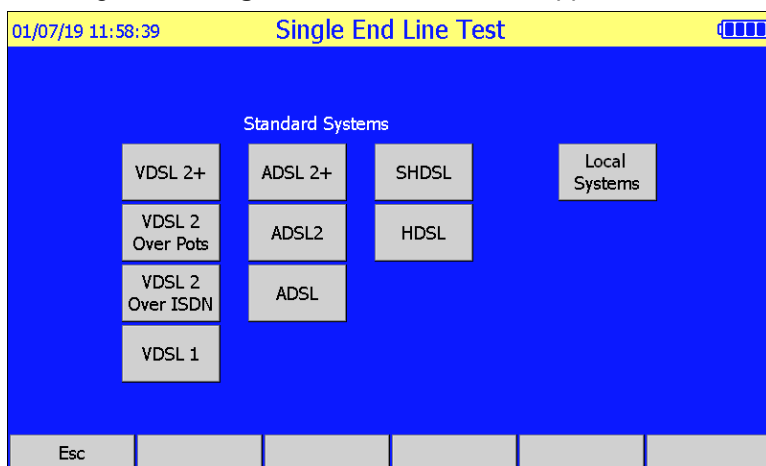
The far end of the tested line should be unterminated.

Tolerance masks of cable parameters as Loss, LCL, Return Loss, Impedance, and the principal system parameters are pre-programmed for different xDSL systems

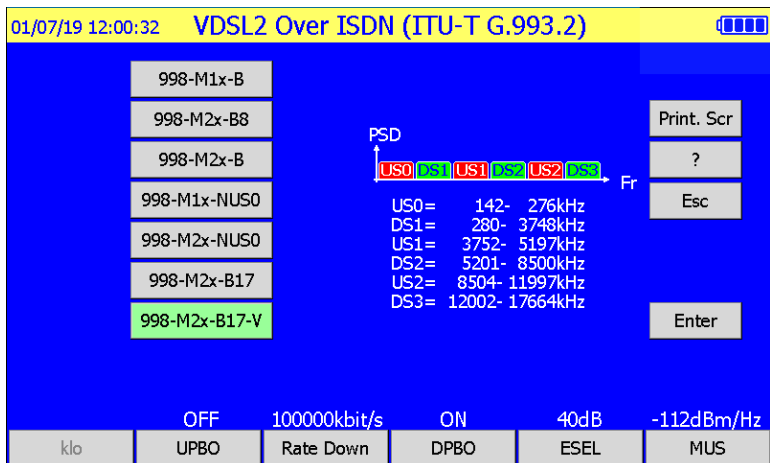
After selecting the xDSL system ECE 35 launches an automatic test sequence containing unilateral measurements

6.1 Preparing the Program

- Select the **Automatic Test / Single End** option of **Main Menu**
Doing so the **Single End Line Test** menu appears



- Enter the required system group (E.g. VDSL 2 Over ISDN)



- Select the required system by the corresponding key

When DPBO is necessary

- Switch the DPBO on with the **DPBO** key
- Enter the required **ESEL** and **MUS** values using the corresponding keys.

When UPBO is necessary

- Switch the UPBO on with the **UPBO** key
 The amount of UPBO changes automatically with the electrical length of loop (Loss at 1 MHz) or according to a user predicted value. To set a predicted KL value:
- Press the **klo** key and enter the required value.

6.2 Running the Program

Having the required system entered the start display appears

01/07/19 11:58:39		Single End Line Test			
Loss		System:	998-M2x-B17-V	Print. Scr	
Noise		Measuring Time:		?	
Return Loss				Esc	
Impedance		Qualification:			
Balance					
NEXT					
S/N & Bitrate					
Select the required tests and Start the measurement with Start/Stop ECE 35 at Remote End					Start/Stop
		ECE 35			Parameter

- In case of ADSL or VDSL systems the position of ECE 35 should be declared. It can be changed with the **ECE 35** key.
 - The program can be started or aborted by the **Start/Stop** key.
- The progress of program is continuously indicated

01/07/19 11:58:39		Single End Line Test			
Loss	✓	System:	998-M2x-B17-V	Print. Scr	
Noise	✓	Measuring Time:	66 s	?	
Return Loss	✓			Esc	
Impedance	✓	Qualification:			
Balance					
NEXT					
DMM					
S/N & Bitrate					
Measuring is in progress ECE 35 at Remote End					Stop
		ECE 35			Parameter

6.3 Test Results

Short Form Test Result

When the test program is completed a short form result page appears with immediate **Pass / Fail** information and with the list of detailed result pages. When the qualification is **Fail** the reasons are marked with red color.

01/07/19 11:58:39		Single End Line Test		[Battery Icon]	
Loss	✓	System: 998-M2x-B17-V Qualification: Fail	Save		
Noise	✓		Print. Scr		
Return Loss	✓		?		
Impedance	✓		Esc		
Balance	✓				
NEXT	✓				
DMM	✓				
S/N & Bitrate	✓				
ECE 35 at Central End					
		ECE 35			Parameter

To study the detailed result pages

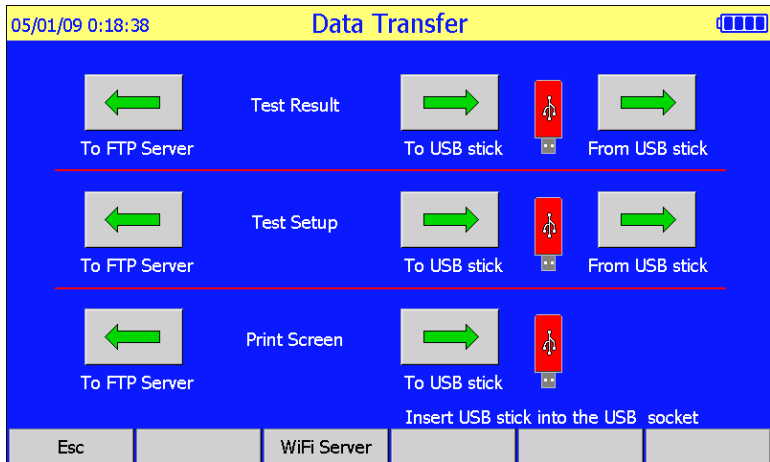
- Press the required result page
- To return to the short form press **Esc**

7 DATA TRANSFER

ECE 35 provides two ways of data transfer:

- Data transfer via **USB** port
- Data transfer via **WiFi**

To select the required one press the **Data Transfer** option of **Main Menu**
Doing so the **Data Transfer** page appears

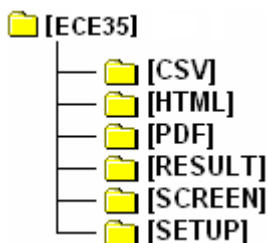


7.1 Data transfer via USB port

ECE 35 has an USB A interface for USB stick providing

- Transfer of test results
- Transfer of setups
- Transfer of print screen

ECE 35 uses the following directory structure:



In case of data transfer from PC via USB stick you have to use this structure.

7.1.1 Result Transfer from USB Stick to ECE 35

- Press the **Test Result / From USB stick** option of **Data Transfer** menu

05/01/09 7:23:13 **Result Transfer from USB Stick**

Result Name	Measuring Mode	Start Time	
Test3	Selective Receiver	01/08/19-09:05	Print. Scr
Test2	NEXT	01/08/19-09:06	?
Test	Spectrum Analyser	01/08/19-09:06	Esc

Enter

Select All	Unselect All			Prev	Next
------------	--------------	--	--	------	------

- To copy only one result press the wanted name and press **Enter**
- To copy all results press the **Select All** key and press **Enter**

7.1.2 Result Transfer from ECE 35 to USB Stick

- Press the **Test Result / To USB stick** option of **Data Transfer** menu

01/29/20 12:41:11 **Result Transfer to FTP Server**

Setup

Graphic Color

Alphanumeric B&W

List separator Semicolon

TAB

Comma

Select file format and press Enter

Yes Yes Yes Yes

RES PDF HTML CSV

Print. Scr

?

Esc

Enter

- Select the required file format(s) and press **Enter**

05/01/09 7:23:05 **Result Transfer to USB Stick**

Result Name	Measuring Mode	Start Time
Test3	Selective Receiver	01/08/19-09:05
Test2	NEXT	01/08/19-09:06
Test	Spectrum Analyser	01/08/19-09:06

Print. Scr

?

Esc

Enter

Select All Unselect All Prev Next

- To copy only one result press the wanted name and press **Enter**
- To select all results press the **Select All** key and press **Enter**

7.1.3 Test Setup Transfer from ECE 35 to USB Stick

- Press the **Test Setup / To USB stick** option of **Data Transfer** menu

05/01/09 7:23:21 Setup Transfer to USB Stick [Battery Icon]

Setup Name	Measuring Mode	Start Time	
Test3	Selective Receiver	01/08/19-09:05	Print. Scr
Test2	NEXT	01/08/19-09:06	?
Test	Spectrum Analyser	01/08/19-09:06	Esc

Enter

Select All Unselect All Prev Next

- To copy only one setup press the wanted name and press **Enter**
- To select all setups press the **Select All** key and press **Enter**

7.1.4 Test Setup Transfer from USB Stick to ECE 35

- Press the **Test Setup / From USB stick** option of **Data Transfer** menu

05/01/09 7:23:28 Setup Transfer from USB Stick [Battery Icon]

Setup Name	Measuring Mode	Start Time	
Test3	Selective Receiver	01/08/19-09:05	Print. Scr
Test2	NEXT	01/08/19-09:06	?
Test	Spectrum Analyser	01/08/19-09:06	Esc

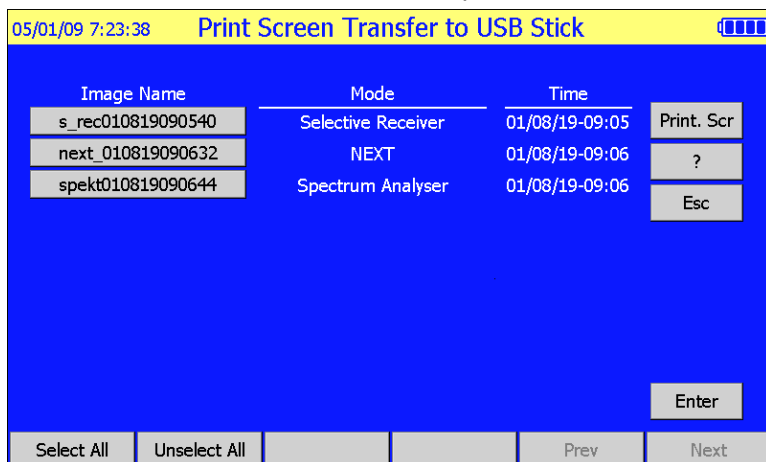
Enter

Select All Unselect All Prev Next

- To copy only one setup press the wanted name and press **Enter**
- To select all setups press the **Select All** key and press **Enter**

7.1.5 Print Screen Transfer from ECE 35 to USB Stick

- Press the **Print Screen / To USB stick** option of **Data Transfer** menu



- To copy only one image press the wanted name and press **Enter**
- To select all images press the **Select All** key and press **Enter**

7.2 Data transfer via WiFi

Using wireless connection to local area network ECE 35 provides two ways of data transfer:

- ECE 35 initiates a connection to a FTP server
- ECE 35 acts as a HTTP server

ECE 35 provides the transfer of:

- Test results
- Test setups
- Print screen images

For the connection to wireless network ECE 35 should be configured. There are two parts of the configuration:

- WiFi settings
- FTP settings

7.2.1 WiFi & FTP Settings

- Press the **Settings** key of **Main Menu**
- Press the **WiFi & FTP** key and then the following display appears:

05/01/09 8:00:31 WiFi & FTP settings [Battery Icon]

Wireless network: [Print. Scr]

Password: [?]

Server name: [Esc]

Username: [Enter]

Password: [Enter]

Remote folder: [Enter]

WiFi FTP

Scan Password Server name Username Password Remote f.

WiFi Setting

- Press the **Scan** key and then the list of available WiFi networks appears.

05/01/09 8:01:15Scan|||||

	SSID	Encryption	RSSI [dBm]
1	easzwlan	MIXED	-72
2	DIRECT-kzPhaser 3260	WPA2_PSK	-65

Print. Scr

?

Esc

Enter

Scan

- Select the required network and press **Enter**
- Press the **Password** key and enter the password

05/01/09 8:00:31WiFi & FTP settings|||||

Wireless network: DIRECT-kzPhaser 3260
(WPA2_PSK)

Print. Scr

Password: budapest

?

Esc

Server name:

Username:

Password:

Remote folder:

Enter

WiFi

FTP

Scan

Password

Server name

Username

Password

Remote f.

FTP Settings

- Press the **Server name** key and enter the server name
- Press the **Username** key and enter the Username
- Press the **Password** key and enter the password
- Press the **Remote f.** key and enter the Remote folder name

05/01/09 8:00:31 WiFi & FTP settings

Wireless network: DIRECT-kzPhaser 3260
(WPA2 PSK)
Password: budapest

Server name: ftp.new.upcbusiness.hu
Username: Elektronika
Password: LmCGC
Remote folder: private

Print. Scr
?
Esc

WiFi FTP Enter

Scan Password Server name Username Password Remote f.

- To complete the setting press **Enter**

7.2.2 Test Result Transfer from ECE 35 to FTP Server

- Press the **Test Result / To FTP Server** option of **Data Transfer** menu.

01/29/20 12:41:11 Result Transfer to FTP Server

Setup

Graphic Color

Alphanumeric B&W

List separator Semicolon

TAB

Comma

Select file format and press Enter

Yes Yes Yes Yes

RES PDF HTML CSV

Print. Scr

?

Esc

Enter

- Select the required file format(s) and press Enter

05/01/09 8:19:20 Result Transfer to FTP Server

Result Name	Measuring Mode	Start Time
Test3	Selective Receiver	01/08/19-09:05
Test2	NEXT	01/08/19-09:06
Test	Spectrum Analyser	01/08/19-09:06

Print. Scr

?

Esc

Enter

Select All Unselect All Prev Next

- To copy only one result press the wanted name and press **Enter**
- To select all results press the **Select All** key and press **Enter**

7.2.3 Test Setup Transfer from ECE 35 to FTP Server

- Press the **Test Setup / To FTP Server** option of **Data Transfer** menu.

05/01/09 8:19:29 Setup Transfer to FTP Server

Setup Name	Measuring Mode	Start Time	
Test3	Selective Receiver	01/08/19-09:05	Print. Scr
Test2	NEXT	01/08/19-09:06	?
Test	Spectrum Analyser	01/08/19-09:06	Esc

Enter

Select All Unselect All Prev Next

- To copy one setup press the wanted name and press **Enter**
- To select all setups press the **Select All** key and press **Enter**

7.2.4 Print Screen Transfer from ECE 35 to FTP Server

- Press the **Print Screen / to FTP Server** option of **Data Transfer** menu.

05/01/09 8:19:43 Print Screen Transfer to FTP Server

Image Name	Mode	Time	
s_rec010819090540	Selective Receiver	01/08/19-09:05	Print. Scr
next_010819090632	NEXT	01/08/19-09:06	?
spekt010819090644	Spectrum Analyser	01/08/19-09:06	Esc

Enter

Select All Unselect All Prev Next

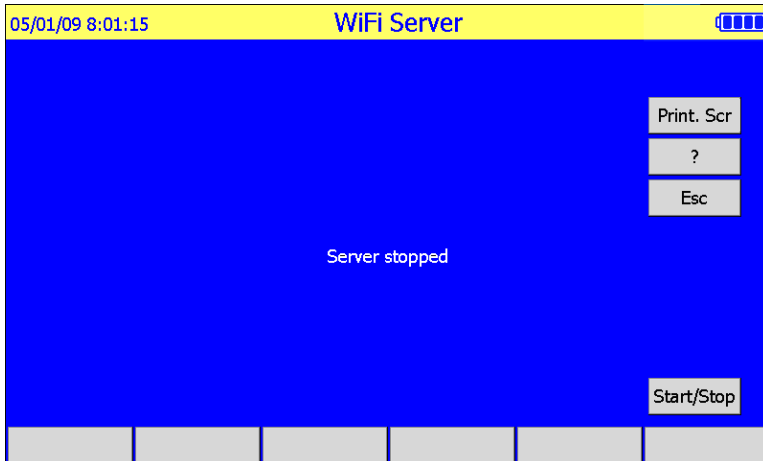
- To copy one image press the wanted name and press **Enter**
- To select all images press the **Select All (F1)** key and press **Enter**

7.2.5 HTTP Server Mode

Remote operators of the connected network can download data from the memory of ECE 35 using its URL .

Mode selection

- Press the **Data Transfer** key of **Main Menu**
- Press the **WiFi Server (F3)** key and then the following display appears:



- Press the **Start/Stop** key to start the server and the usable URL appears



8 STATUS & OPTIONS

Status point of the **Main Menu** provides useful hardware and software information:

By pressing the **Status key**, the list of options appears with the options that have been activated or can be ordered (activated / not activated).

06/15/20 11:55:21		Status			
Name:	ECE35	Single End Line Test:	Active		
Serial number:	1234	Test Beside Vectored Groups:	Active		
Internal id:	5678	Spectrogram Measurement:	Active		
CPU card number:	2193/b	Spectral Trace as Reference:	Active		
BR card number:	2195/p	VF Line qualification:	Active		
AV card number:	2194/b	Test of loaded cables:	Active		
Dll version:	v1.00	Test of multi section cables:	Active		
Pic version:	v0.00	Interruption:	Active		
Spectrogram version:	v2.00				
Calibration date:	12/31/1999				
Software version:	v2006151155				
To USB stick					
Esc			Change opt.	Save	Print Screen

If you later order software options:

- Press the **Change Opt. (F4)** key
- Follow the instructions

9 GENERAL SETTINGS

In setting mode some important parameters can be set.

The menu of **General Settings** can be reached from the **Main Menu**

06/15/20 11:31:18 General Settings					
PV Unit		Power Off Time		Language	
V/2		OFF		English	
VOP		10 min		Russian	
Slave Type		30 min		German	
None		60 min		Italian	
ELC 30		Load defaults		Brightness	
ECFL 30S		Upgrade			
Operator				Decimal symbol	
Date & Time		06/15/20 11:31:18		Point	
		Save warning		Comma	
Enter		WiFi & FTP			

Note: In **SLAVE** mode the power off system is not active.

10 SW UPGRADE

The steps of upgrade

- Press the **Upgrade** key of General settings menu
- Follow the appearing instructions.

11 SPECIFICATIONS

11.1 General Specifications

Power Supply

Internal rechargeable Lithium Ion battery pack

Operation time.....approx. 8 hours

Charging (without taking the battery pack out)

From 100 to 240 V mains.....with mains adapter

From 12 V car battery.....with car adapter

Charging time.....~ 3 hours

Connector for mains adapter.....2.1/5.5 mm coax

Display.....800 x 480 color LCD TFT

Connectors for Bridge Measurements

Ground connector.....4 mm banana socket

Line connectors.....4 pcs of 4 mm banana sockets

Connectors for Line Qualification

Ground connector.....4 mm banana socket

Line connectors.....2 pcs of 3 pol CF sockets

Connector for Data Transfer

USB A.....USB host port for USB-Stick

Over Voltage Protection

Between a and b

Fault locator500 V DC, 350 V AC

Line qualifier200V DC 160V AC

Ambient temperature ranges

Reference.....23±5°C

Rel. humidity 45% to 75%*

Normal operation.....0 to +40°C

Rel. humidity 30% to 75% *(<25g/m³)

Limits of operation.....-5 to +45°C

Rel. humidity 5% to 95% *(< 29 g/m³)

Storage and transport.....-40 to +70°C

Rel. humidity 95% at +45°C *(<35g/m³)

Protection.....IP 54

Dimensions

Without bridge.....224 x 160 x 65 mm

With bridge.....224 x 160 x 75 mm

Weight

Without bridge.....ca. 1.5 kg

With bridge.....ca. 1.8 kg

* Without condensation

11.2 Single End Manual Tests

Line Connection

Output Input.....	Balanced
Output Impedance	
200 Hz to 10 kHz.....	600 Ω
10 kHz to 35 MHz.....	100, 135, 150 Ω
Input Impedance	
200 Hz to 10 kHz.....	600 Ω , or Unterminated
10 kHz to 35 MHz.....	100, 135, 150 Ω , Unterminated

Frequency

Frequency Range.....	200 Hz to 35 MHz
Frequency resolution.....	1 Hz
Frequency accuracy.....	$2 \times 10^{-6} \pm 1$ Hz

Transmitter

Output level	
10 kHz to 35 MHz.....	+10 to -40 dBm
200 Hz to 10 kHz.....	+4 to -45 dBm
Level Resolution.....	0.1 dB
Accuracy at 0 dBm	
200 Hz to 10 kHz.....	$\pm 0,5$ dB
10 kHz to 5 MHz.....	± 0.3 dB
5 MHz to 35 MHz.....	± 1 dB

Selective Level Measurement

Measuring Range	
10 kHz to 35 MHz.....	-120 to +10 dBm
200 Hz to 10 kHz.....	-120 to +4 dBm
Level Resolution.....	0.1 dB
Band width	
200 Hz to 10 kHz.....	20 Hz
10 kHz to 6 MHz.....	20, 200 Hz, 1.74, 1.95, 3.1 kHz
6 MHz to 18 MHz.....	200 Hz, 1.74, 1.95, 3.1 kHz
18 MHz to 35 MHz.....	1.74, 1.95, 3.1 kHz
Accuracy at 0 dBm	
200 Hz to 10 kHz.....	$\pm 0,5$ dB
10 kHz to 6 MHz.....	± 0.3 dB
6 MHz to 35 MHz.....	$\pm 1,5$ dB

Wideband Level Measurement**Measuring Range**

10 kHz to 35 MHz.....-50 to +10 dBm

200 Hz to 10 kHz.....-50 to +4 dBm

Level Resolution.....0.1 dB

Filters.....NONE, PSOPHO, 3,1kHz FLAT, ADSL, ADSL2+, VDSL1,
VDSL2-8, VDSL2-12, VDSL2-17, VDSL2-30, VDSL2-35**Accuracy at 0 dBm**

200 Hz to 10 kHz.....±0,5 dB

10 kHz to 6 MHz.....±0.3 dB

6MHz to 35 MHz.....±1,5 dB

Wideband noise Measurement

Frequency range.....200 Hz to 35 MHz

Filters.....NONE, PSOPHO, 3,1kHz FLAT, ADSL, ADSL2+, VDSL1,
VDSL2-8, VDSL2-12, VDSL2-17, VDSL2+35

Measurement times:.....1sec to 72 hours

Evaluation for 1 sec to 1 min.....Quasi analogue

Evaluation over 1 min.....Histogram with 60 time slots

Impulse Noise Measurement

Pulse width.....>500 ns

Interval size.....>10 ms

Threshold range.....1 to 500 mV

Maximum count:.....65000

Measuring times.....1sec to 72 hours

Evaluation for 1 to 30 sec.....numeric

Evaluation over 30 sec.....Histogram with 60 time slots

Single-End Insertion Loss Measurement

Frequency Ranges.....1.5, 3, 9, 12, 18, 35 MHz

Line length range.....100 m to 6 km

Direct measurement.....100 kHz to 6 MHz or
Up to 45 dB cable lossExtrapolation.....Over 6 MHz or
Over 45 dB cable loss

Vertical scale.....0 to 80 dB

Accuracy.....2 to 4 dB

(The accuracy and the maximum length depends on the cable conditions)

Spectrum Analyzer

Display range.....down to -140 dBm/Hz

Maximum input level

10 kHz to 35 MHz.....+10 dBm

200 Hz to 10 kHz.....+4 dBm

With high impedance probe.....+20 dBm

Bandwidth and frequency step

Frequency Range	Bandwidth & Freq. Step
35 MHz	500 Hz to 100 kHz
18 MHz	500 Hz to 60 kHz
12 MHz	500 Hz to 40 kHz
9 MHz	500 Hz to 30 kHz
3 MHz	500 Hz to 10 kHz
1.5 MHz	500 Hz to 5 kHz
600 kHz	500 Hz to 2 kHz
300 kHz	500 Hz to 1 kHz
20 kHz	50 Hz to 100 Hz
4 kHz	10 Hz to 20 Hz
0.3 kHz	1 Hz

Number of displayed frequencies.....300

Saving of result.....the actual content of display

Evaluation.....NORM, PEAK, AVG, SAVG

Units.....dBm, dBm/Hz

LCL Balance Measurement

Display range.....0 to 70 dB

Accuracy for all impedances 35 dB

200Hz to 100 kHz.....±2 dB

100 kHz to 5 MHz.....±1 dB

Accuracy for 100 Ohm

5 MHz to 30 MHz.....±2,5 dB

Impedance Measurement

Measuring range

10 kHz to 35 MHz.....50 to 400 Ω

200 Hz to 10 kHz.....300 to 1600 Ω

Accuracy

200 Hz to 10 kHz.....± 10% ± 5 Ω

10 kHz to 18 MHz.....±5% ± 5 Ω

18 MHz to 30 MHz.....	$\pm 10\% \pm 5 \Omega$
-----------------------	-------------------------

Return Loss Measurement

Display range:.....up to 40 dB
Accuracy at 20 dB
200 Hz to 18 MHz..... ± 2 dB

NEXT Measurement

Frequency Range.....200 Hz to 35 MHz
Measuring range.....up to 80 dB

Interruption Analysis

Test Signal.....1020 Hz, 0 to -30 dBm
Selectable threshold below the normal level.....3, 6, 10, 20 dB
Measuring time adjustable.....4 min to 72 hours
Interruption Categories.....0.6 ms to >1 min
Evaluation.....Relative duration, Errored sec
Count & time distribution

Echo Test

Impedances.....600Ohm
Frequency.....~1020 Hz
Traveling time.....up to 2500 ms
Resolution.....5 ms
Amplitude indication.....down to -60 dBm

Telephone Simulator

Dialing.....Pulse & Tone
Storage of phone numbers.....Provided
Indications
Line voltage.....up to 100V
Line current.....up to 100 mA
Ringing voltage.....up to 100V p-p

11.2.1 Voice frequency SW package

Noise with Tone Measurement

Transmitter	
Impedance.....	600 Ohm
Test signal.....	1020 Hz
Output level.....	0 dBm
Receiver	
Impedance.....	600 Ohm
Measuring range.....	0 to -80 dBm
Weighting filters.....	Psophometric (O.41) 1020 Hz Notch (O.132)

Group Delay Distortion Measurement

Transmitter	
Impedance.....	600 Ohm
Test signal.....	36MTTS, 200 to 3700 Hz
Resolution.....	100 Hz
Output level.....	-20 dBm/tone (3dBm peak)
Receiver	
Impedance.....	600 Ohm
Input level range.....	-50 to -10 dB/tone
Group delay distortion range.....	0 to 5 ms
Resolution.....	1 µs
Reference	Smallest, 800 Hz, 1000 Hz, 1800 Hz

Phase Jitter & Frequency Error Measurement

Transmitter	
Impedance.....	600 Ohm
Test signal.....	1020 Hz
Output level.....	0 dBm
Receiver	
Impedance.....	600 Ohm
Input level range.....	0 to -30 dBm
<u>Phase Jitter measurement (O.91)</u>	
Measuring range.....	0.2 to 30.0 degrees p-p
Filter.....	4 to 300 Hz
<u>Frequency Error Measurement</u>	
Measuring range.....	± 30 Hz
Resolution.....	0.1 Hz

Simultaneous Event Counter**Transmitter**

Impedance.....	600 Ohm
Test signal.....	1020 Hz
Output level.....	0 dBm

Receiver

Impedance.....	600 Ohm
Input level range.....	0 to -30 dBm
Measurement times.....	5, 15, 30, 60 min
Maximum count for each counter.....	65000

Amplitude Hit Counter (O.95)

Threshold range.....	2 to 9 dB
Guard interval.....	4 ms
Dead time.....	125± 25 ms
Dead time after interruption (>10 dB drop).....	1 s

Phase Hit Counter (O.95)

Threshold range.....	5 to 45 °
Guard interval.....	4 ms
Dead time.....	125± 25 ms

Interruption counter (O.61)

Threshold.....	6, 10 dB
Guard interval.....	2 ms
Dead time.....	3± 1 ms

Impulsive Noise counter (O.71)

Filter.....	1020 Hz Notch
Guard interval.....	20 µs
Dead time.....	125 ± 25 ms
Threshold range.....	0 to -50 dBm

11.3 Automatic Master Slave Test of xDSL Lines

Selectable Line Tests	
Loss.....	Bilateral Measurement
Noise.....	Bilateral Measurement
LCL Balance.....	Bilateral Measurement
Return Loss.....	Bilateral Measurement
Impedance.....	Bilateral Measurement
NEXT.....	Bilateral Measurement
FEXT.....	Bilateral Measurement
Calculations	
S/N.....	Calculated
Data Transfer Speed.....	Up & Down Stream Calculated
Bit allocation (b).....	Up& Down Stream Calculated
Predefined Parameter Sets	
VDSL 2+.....	Version A, B, M
VDSL 2.....	Over ISDN, Over POTS, Without US0
ADSL 2+.....	Annex A, B, I, J, M
ADSL 2.....	Annex A, B, I, J, M
ADSL.....	Annex A, B
ADSL G.Lite2.....	Annex A, I
READSL2.....	Annex L
SHDSL.....	Annex B, E
HDSL.....	2B1Q, CAP
ISDN.....	Basic rate, Primary rate
ESEL Measurement	
Measuring range.....	Up to 120 dB

11.4 Automatic Single Ended Test Sequences

Selectable Line Tests	
Loss.....	Estimation
Noise.....	Measurement at near end estimation at far end
LCL Balance.....	Measurement at near end estimation at far end
Return Loss.....	Measurement at near end estimation at far end
Impedance.....	Measurement at near end estimation at far end
NEXT.....	Measurement at near end estimation at far end
Calculations (Predictions)	
S/N.....	near & far end
Data Transfer Speed.....	Up& Down Stream
Bit allocation (b).....	For VDSL & ADSL

11.5 Automatic Master Slave Test of VF circuits

Test Objects	
Passive Leased Circuit.....	Cable
Active Leased Circuit.....	Containing amplifiers or digital equipment
Switched Circuit.....	Master & Slave communicates over exchange
Selectable Line Tests	
Loss.....	Bilateral Measurement
Noise.....	Bilateral Measurement
LCL Balance.....	Bilateral Measurement
Return Loss.....	Bilateral Measurement
Impedance.....	Bilateral Measurement
Total distortion.....	Bilateral Measurement
Group Delay Distortion.....	Bilateral Measurement
Phase Jitter & Frequency Error.....	Bilateral Measurement
Simultaneous Event Test.....	Bilateral Measurement
Predefined Parameter Sets	
M 1020.....	Active, Passive, Switched
M 1025.....	Active, Passive, Switched
M 1040.....	Active, Passive, Switched

11.6 High Impedance Probe

Frequency range.....	10 kHz to 35 MHz
Attenuation.....	15 dB
Input Impedance.....	5 kOhm 5pF
Accuracy	
10 kHz to 25 kHz.....	±1dB
25 kHz to 5 MHz.....	±0.3 dB
5 MHz to 35 MHz.....	±1.5 dB

12 ORDERING INFORMATION**COPPER QUALIFIER ECE 35460-000-000****Including:**

Operating manual & Calibration Certificate

Ground connecting cable..... Y 107-421

2 Special Balanced Measuring Cables

in the set for L1 and L2..... Y 107-420

USB stick..... Y 146-019

Mains adapter..... Y 146-028

Carrying case..... Y 147-027

HW options

Active bridge, DMM, and TDR.....460-400-000

2-wire test lead (red/black)..... Y 107-426

2-wire test lead (blue/yellow)..... Y 107-427

Test lead (green)..... Y 107-425

Passive bridge (Extension of active bridge).....460-460-000

Accessories

High Impedance Probe ELQ P30.....410-000-000

Loop closing device ELC 30.....421-000-000

Intelligent Slave ECFL 30S.....425-000-000

Car lighter power adapter EAA 20.....462-000-000

SW options for xDSL line qualification

Single End Line Test.....SW 460-640-000

Single-End loss estimation and

Automatic line test with data rate estimation

Test beside Vectored Groups.....SW-460-910-000

Non-disturbing test beside VDSL2 groups

Non-disturbing test beside 35 MHz V2+ groups

Spectrogram Measurement.....SW 460-570-000

Spectral Trace as Reference.....SW 460-950-000

Stored spectrum as reference and

System dependent PSD as reference

Interruption Analysis.....SW 460-530-000

SW options for voice frequency measurement

Voice frequency SW package.....SW 460-940-000

Group delay, Jitter & Frequ Difference, Echo

Noise with tone measurements, Event counter

SW options for bridge measurement

Test of loaded cables.....SW-460-650-000

Test of multi section cables.....SW-460-660-000