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**ITU-T**

**0.27**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**SPECIFICATIONS FOR MEASURING EQUIPMENT**

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**IN-STATION ECHO CANCELLER TEST  
EQUIPMENT**

**ITU-T Recommendation 0.27**

(Extract from the *Blue Book*)

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## NOTES

1 ITU-T Recommendation O.27 was published in Fascicle IV.4 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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**Recommendation O.27**

**IN-STATION ECHO CANCELLER TEST EQUIPMENT**

(Melbourne, 1988)

**1 General**

The in-station echo canceller test equipment (ISET) is intended to test type C and D echo cancellers including tone disablers as specified in Recommendation G.165 [1]. Two test modes are provided as described below. The tests performed in each test mode are listed in Table 1/O.27.

**2 Test modes**

**2.1 Routine test mode**

In this test mode, ISET provides 7 simplified tests of echo canceller performance under normal circuit conditions with the adaptation and non-linear processing logic activated. Access to the echo canceller being tested is on a 4-wire basis, and these simple performance tests are made by applying test signals to the receive-in ( $R_{in}$ ) and the send-in ( $S_{in}$ ) ports of the echo canceller. Test results are measured at the send-out ( $S_{out}$ ) port. A functional block diagram of the test arrangement is shown in Figure 1/O.27.

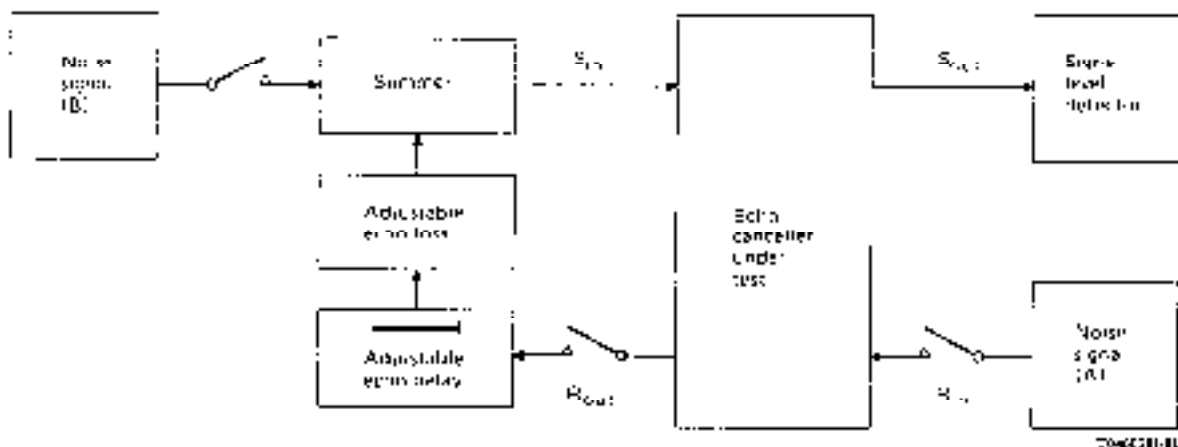


FIGURE 1/O.27

**Functional block diagram of test arrangement**

**2.2 Diagnostic test mode**

In this mode, all performance tests are made according to procedures specified in Recommendation G.165 [1]. The adaptation and non-linear processing logic is disabled when necessary by controlling the echo canceller that is being tested.

### 3 Operating principles

#### 3.1 Method of access

When an echo canceller to be tested is fitted to a particular circuit, a reserved echo canceller should be substituted so that the tests can be made without causing any disturbance to the circuit. If no reserved echo canceller is available, the circuit should be blocked from service while the tests are being performed.

ISET may be connected to an echo canceller under test either manually at local access points or remotely by access arrangements through a switching system. Administrations may wish to provide remote access capability to echo cancellers for routine tests as shown in Figure 2/O.27. Local access as shown in Figure 3/O.27 is for diagnostic tests where the use of control signals to inhibit the H register, adaptation and center clipper logic are needed.

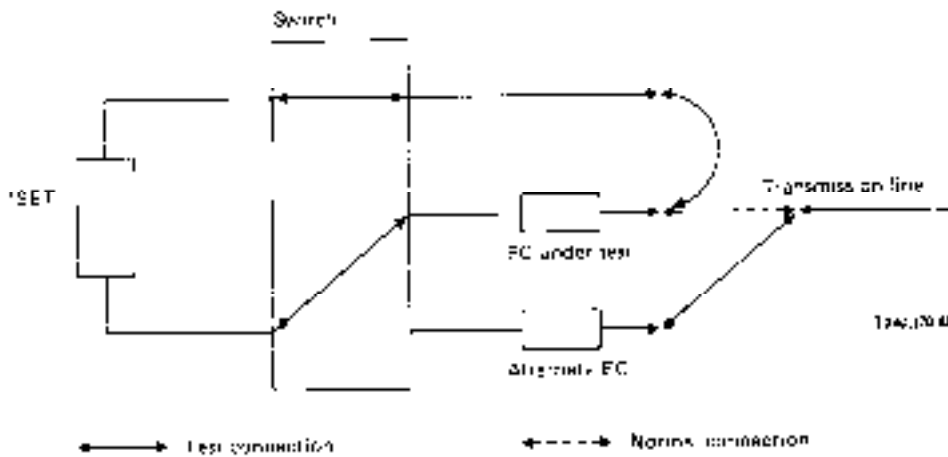
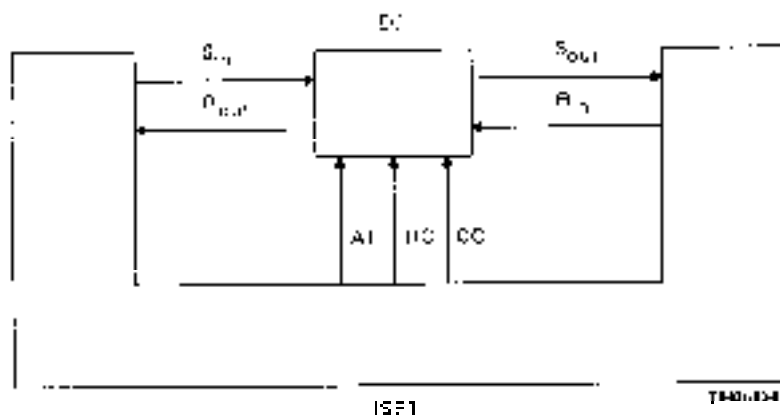


FIGURE 2/O.27

Configuration for routine test mode



- AI      Adaptation inhibit
- HC      H register clear
- CO      Centre clipper off
- EC      Echo canceller
- ISET    In-station echo canceller tester

FIGURE 3/O.27

Configuration for diagnostic test mode

### 3.2 Testing sequences

When access has been established, a series of tests is performed manually or automatically. The tests to be performed in the routine and diagnostic test modes are given in Table 1/O.27. Measurement results for each test shall be provided to the maintenance personnel by a visual display or printed message.

If an echo canceller fails any of the routine tests, it should be completely tested in the diagnostic test mode.

TABLE 1/O.27  
Test Procedures

No.	Type of Test	G.165 [1] Reference	Test modes	
			Routine	Diagnostic
1	Steady state residual and returned echo level test	3.4.2.1	0	0
2	Convergence test	3.4.2.2	0	0
3	Double talk detection oversensitivity test	3.4.2.3.1	0	0
4	Double talk detection undersensitivity test	3.4.2.3.2	0	0
5	Leak rate test	3.4.2.4		0
6	Infinite return loss convergence test	3.4.2.5	0	0
7	Tone disabler send side sensitivity test	4.2	0	0
8	Tone disabler receive side sensitivity test	4.2	0	0
9	Tone disabler guard band test	4.3		0
10	Tone disabler holding band test	4.4		0
11	Tone disabler operate time test	4.5		0
12	Tone disabler release time test	4.8		0
13	External disabler control test	3.3		0

## 4 Test procedures and test requirements

### 4.1 Routine test mode

Figure 1/O.27 shows a functional arrangement for the routine test mode. The following seven tests should be repeated with an appropriate echo path delay  $\Delta$  ms<sup>1</sup> set in the adjustable echo delay unit.

At the beginning of each of the seven tests, a conditioning tone is applied for 1 second to the R<sub>in</sub> port for initialization of the echo canceller to be tested. The conditioning tone is a 2100 Hz signal of -10 dBm<sub>0</sub> with periodic phase reversals occurring every 0.45 seconds and is also used to disable echo cancellers. During this initialization period the H register of the canceller is cleared. After the conditioning tone is disconnected, no signal is applied to the canceller for at least 0.4 seconds to allow it to return to an enabled state. Further information on the characteristics of echo canceller tone disablers may be found in § 4 and Annex B of Recommendation G.165 [1].

<sup>1</sup> Different echo cancellers may be designed to work satisfactorily for different echo path delays depending on their application in various networks. Thus  $\Delta$  represents the echo path delay for which the echo canceller is designed. Each Administration may choose a delay value of  $\Delta$  appropriate for their equipment.

#### 4.1.1 *Check of steady state residual and returned echo level*

Step 1: A random noise signal (A) of  $-10$  dBm0 is applied to the  $R_{in}$  port. With the echo path loss set at 10 dB, an echo appears at the  $S_{in}$  port.

Step 2: After 2 seconds the returned echo level at the  $S_{out}$  port is measured.

Requirement: The returned echo level must be less than  $-65$  dBm0.

#### 4.1.2 *Check of convergence*

Step 1: A random noise signal (A) of  $-10$  dBm0 is applied to the  $R_{in}$  port. With the echo path loss set at 6 dB, an echo is appears at the  $S_{in}$  port.

Step 2: A second random noise signal (B) of  $-10$  dBm0 is applied to the  $S_{in}$  port as shown in Figure 1/O.27.

Step 3: After 0.5 seconds noise signal (B) is disconnected, and 0.5 seconds later the returned signal level at the  $S_{out}$  port is measured.

Requirement: The signal level must be less than  $-37$  dBm0.

#### 4.1.3 *Check of double talk detection oversensibility*

Step 1: A random noise signal (A) of  $-10$  dBm0 is applied to the  $R_{in}$  port. With the echo path loss set as 6 dB, an echo appears at the  $S_{in}$  port.

Step 2: After 0.5 seconds, a second random noise signal (B) of  $-25$  dBm0 is applied to the  $S_{in}$  port.

Step 3: One second later noise signal (B) is disconnected and the returned echo level at the  $S_{out}$  port is measured.

Requirement: The returned echo level must be less than  $-25$  dBm0.

#### 4.1.4 *Check of double talk detection undersensitivity*

Step 1: With the echo path loss set at 10 dB, a random noise signal (A) of  $-10$  dBm0 is applied to the  $R_{in}$  port.

Step 2: After 1 second the noise signal (A) at the  $R_{in}$  port is disconnected.

Step 3: After an interval of 0.5 seconds, the noise signal (A) is reapplied to the  $R_{in}$  port. Simultaneously a second noise signal (B) of 0 dBm0 is applied to the  $S_{in}$  port.

Step 4: 0.5 seconds later the noise signal (B) is disconnected and the residual echo level at the  $S_{out}$  port is measured.

Requirement: The returned echo level must be less than  $-26$  dBm0.

#### 4.1.5 *Check of infinite return loss convergence*

Step 1: With the echo path loss set at 6 dB, a random noise signal (A) of  $-10$  dBm0 is applied to the  $R_{in}$  port.

Step 2: After 1 second the echo path between  $R_{out}$  and  $S_{in}$  is disconnected while noise signal (A) remains connected to the  $R_{in}$  port.

Step 3: 0.5 seconds later the returned echo level at the  $S_{out}$  port is measured.

Requirement: The returned echo level must be less than  $-37$  dBm0.

#### 4.1.6 *Check of tone disabler send-side sensitivity*

There are two parts to this test to ensure that the disabler tone detection circuit on the send side is not oversensitive or undersensitive.

Step 1: A 2100 Hz signal of  $-36.5$  dBm0 with periodic phase reversals every 0.45 seconds is applied for one second to the  $S_{in}$  port.

Step 2: A random noise signal (A) of  $-10$  dBm0 is applied to the  $R_{in}$  port.

Step 3: After 0.5 seconds the returned echo level at the  $S_{out}$  port is measured.

Requirement: The returned echo level must be less than  $-32$  dBm0 to show that the disabler is not operated.

- Step 4: The conditioning tone is reapplied for one second to the  $R_{in}$  port. After at least 0.4 seconds, the 2100 Hz signal with periodic phase reversals every 0.45 seconds is reapplied to the  $S_{in}$  port at a level of  $-29.5$  dBm0 for one second.
- Step 5: Then the random noise signal (A) of  $-10$  dBm0 is reapplied to the  $R_{in}$  port with the echo path loss set at 10 dB.
- Step 6: After 0.5 seconds the returned echo level at the  $S_{out}$  port is measured.
- Requirement: The returned echo level must be between  $-29.5$  dBm0 and  $-26.5$  dBm0 to show that the disabler is operated.

#### 4.1.7 *Check of tone disabler receive-side sensitivity*

There are also two parts to this test to ensure that the disabler tone detection on the receive side is not oversensitive or undersensitive.

- Step 1: A 2100 Hz signal of  $-36.5$  dBm0 with period periodic phase reversals every 0.45 seconds is applied for one second to the  $R_{in}$  port.
- Step 2: A random noise signal (A) of  $-10$  dBm0 is applied to the  $R_{in}$  port. With the echo path loss set at 10 dB, an echo appears at the  $S_{in}$  port.
- Step 3: After 0.5 seconds the returned echo level at the  $S_{out}$  port is measured.
- Requirement: The returned level must be less than  $-32$  dBm0 to show that the disabler is not operated.
- Step 4: The conditioning tone is reapplied for one second to the  $R_{in}$  port. After at least 0.4 seconds, the 2100 Hz signal with periodic phase reversals every 0.45 seconds is reapplied to the  $S_{in}$  port at a level of  $-29.5$  dBm0 for one second.
- Step 5: Then the random noise signal (A) of  $-10$  dBm0 is reapplied to the  $R_{in}$  port with the echo path loss set at 10 dB.
- Step 6: After 0.5 seconds the returned echo level at the  $S_{out}$  port is measured.
- Requirement: The returned echo level must be between  $-29.5$  dBm0 and  $-26.5$  dBm0 to show that the disabler is operated.

#### 4.2 *Diagnostic test mode*

In this mode diagnostic tests are performed as specified in Recommendation G.165. § 3.3.2 and § 4 [1].

## 5 **Specifications for transmission measuring equipment**

The following specifications apply for climatic conditions specified in Recommendation O.3.

### 5.1 *Signal generator*

#### 5.1.1 *Range of frequency*

0.3 to 3.4 kHz in 0.01 kHz steps.

#### 5.1.2 *Range of level*

$-40$  to 0 dBm0 in 0.1 dB steps.

#### 5.1.3 *Accuracy*

Frequency  $\pm 0.01$  kHz

Level  $\pm 0.1$  dB.

### 5.2 *Level meter*

#### 5.2.1 *Range of measurement*

$-70$  to  $+3.2$  dBm0.

#### 5.2.2 *Accuracy*

$\pm 0.1$  dB (above  $-40$  dBm0).

### 5.2.3 *Dynamic response time*

Under study<sup>2</sup>.

### 5.3 *Random noise source*

#### 5.3.1 *Level*

−40 to + 0 dBm<sub>0</sub>.

#### 5.3.2 *Noise signal*

The noise test signal is a band-limited white noise (300 – 3400 Hz).

### 5.4 *Echo path*

#### 5.4.1 *Echo loss*

0 dB to 40 dB in 0.1 dB steps.

#### 5.4.2 *Echo delay*

0 to  $\Delta$  ms<sup>3</sup> in 1 ms steps.

#### 5.4.3 *Bandwidth*

0.3 to 3.4 kHz.

## 6 **Calibration**

### 6.1 *Calibration of measuring equipment*

Calibration features should be provided to check that the accuracy requirements are met.

### 6.2 *Self-check of operational function*

A local self-checking facility should be provided to make sure that the testing functions are operating properly.

## 7 **Optional arrangements**

### 7.1 *Automatic test function*

A function to perform tests in sequence automatically according to the predetermined procedure, may be provided.

### 7.2 *Automatic start function*

A timed automatic start function which enables the unattended operations, may be provided.

## **References**

- [1] CCITT Recommendation *Echo Cancellers*, Vol. III, Rec. G.165.

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<sup>2</sup> A meter with a rapid response time will be needed to meet the timing requirements of some of the tests specified above.

<sup>3</sup> Different echo cancellers may be designed to work satisfactorily for different echo path delays depending on their application in various networks. Thus  $\Delta$  represents the echo path delay for which the echo canceller is designed. Each Administration may choose a delay value of  $\Delta$  appropriate for their equipment.