

# FCC PART 68: RECENT CHANGES AND DIGITAL TESTING REQUIREMENTS

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New sets of rulemaking orders for Part 68 have been issued, but actual simplification is yet to be achieved.

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The EIA Seminar and FCC Part 68 Tenth Anniversary Public Meeting on November 4, 5, and 6, 1985, in Washington, DC held some surprises in the announcement of new rulemaking orders for Part 68. There are three sets of new rulemaking orders: Simplification, Omnibus, and Digital.

The Simplification Order, effective December 12, 1985, consists of four changes to Part 68 that did little to simplify Part 68 itself. The application approval period has been shortened by decreasing the public notice period to five days. The FCC will attempt to complete the processing in three weeks. Owners of terminal equipment systems no longer have to notify their telephone companies of registration information, but only furnish that information upon request. Three connectors have been eliminated from 68.502(f)(1): RJ12C, RJ13C, and RJ45X. The mechanical shock test in the packaged configuration has been eliminated from 68.302(c)(1). The other parts of the mechanical shock tests are also under consideration for changes.

There are extensive changes in the Omnibus Order, effective December 11, 1985.

The DC on-hook impedance level is now 5 megohms (68.312(b)(1)(i)).

Make-busy leads are approved and will use two new jacks, RJ18C and RJ2MB (68.3(b), 68.200(j)(1) and 68.502).

PR/PC leads are subject to Part 68 testing (68.200(j)(4)).

A new jack has been added for jumpering CY1 and CY2 leads, RJ38X (Subpart F.)

The telephone company does not have to be informed of the use of specialty adapters (68.200(j)(3)).

FCC registration labels now have to specify country of origin (68.300(b)(4)).

Local Area Data Channel (LADC) equipment is included in Part 68 registration. There is an 18-month grandfather period. A new loop simulator circuit for LADC is specified. The RJ48C and RJ48M jacks will be used with LADC equipment.

An alternative termination circuit is specified for loop and off-premises circuits.

Addition of Ringing Type Q (20 Hz) (68.312).

Auto-dialers are limited to 15 attempts. Does not apply to manual re-dial. It is yet to be determined how to control computer and modem auto-dial (68.318(c)).

Consecutive wiring of services on Part 68 jacks allowed (68.2(h)).

Customer owned and installed premises wiring allowed (68.2(h)).

Loopstart, ringdown, inband and voiceband metallic private lines are required to pass Part 68 (68.308(b)(1)(vi)-(vii)). There is a grandfather period of 18 months.

The FCC has issued a rulemaking permitting the registration of digital interfaces under FCC Rules, Part 68, effective December 2, 1985. A digital interface is defined as the interface between a digital system and a digital transmission facility. The types of digital interfaces have been divided into two major sections: first, Subrate Digital Service providing transmission at speeds of 2.4, 4.8, 9.6 or 56 Kbps; and, second, 1.544 Mbps Digital Service at a speed of 1.544 Mbps. There is an 18-month grandfather period for digital equipment.

## DEFINITIONS OF DIGITAL TRANSMISSION SERVICES

**Direct Digital Interface.** An interface between a digital PBX and a digital transmission facility.

**Digital Tandem 4-Wire Interface.** A 4-wire digital interface between digital terminal equipment and a digital transmission facility operating at 1.544 Mbps or subrate connecting terminal equipment that provides tandem connections.

**Digital Satellite 4-Wire Interface.** A 4-wire digital interface between digital terminal equipment and a digital transmission facility operating at 1.544 Mbps or subrate connecting terminal equipment that does not provide tandem connections to other digital terminal equipment.

**1.544 Mbps Digital CO 4-Wire Interface.**

A 4-wire digital interface between

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digital terminal equipment and a digital transmission facility operating at 1.544 Mbps connecting to a central serving office.

**Subrate Digital Service.** A digital service providing for the full-time simultaneous two-way transmission of digital signals at synchronous speeds of 2.4, 4.8, 9.6, or 56 Kbps.

**1.544 Mbps Digital Service.** A full-time dedicated private line circuit used for the transmission of digital signals at a speed of 1.544 Mbps.

## EVALUATION METHODS

New technical requirements have been added to Part 68, Subpart D to permit registration of digital interfaces. The following is a brief description of the requirements and the test methods that may be used to show compliance with the digital interface requirements.

**Through Transmission - 68.308(b)(5).** Additional entries have been added to the through-

transmission matrix in Section 68.308 to include the digital interfaces. Figure 1 shows a typical test arrangement for measuring the through transmission from a digital port to a digital port.

**Pulse Repetition Rate - Subrate Services - 68.308(g)(1)(i).** The pulse repetition rate shall be synchronous with 2.4, 4.8, 9.6 or 56.0 kilobits per second. Figure 2 shows a typical test arrangement for measuring the pulse repetition rate.

**Output Pulse - Subrate Services - 68.308(g)(1)(ii).** The output pulse template is determined by passing an ideal rectangular pulse through a specified filter.

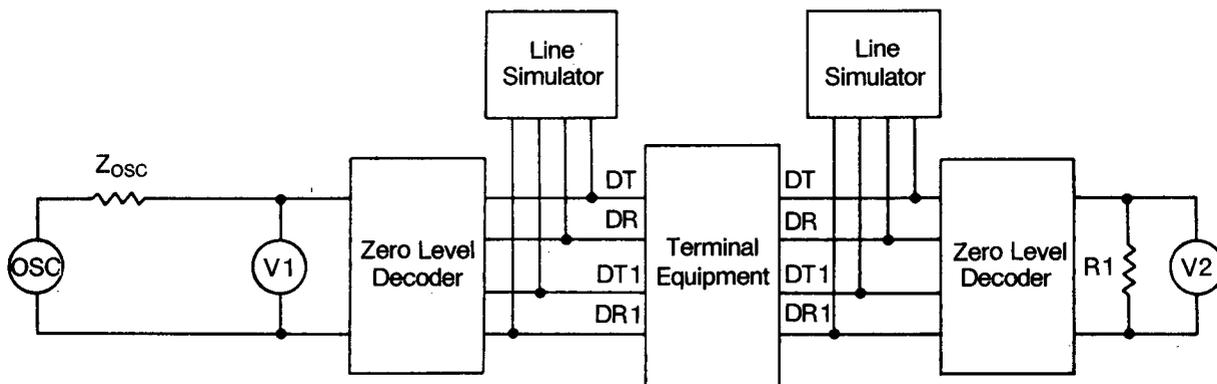
**Average Power - Subrate Services - 68.308(g)(1)(iii).** The average output power when a random signal sequence (O) or (1) equiprobable in each pulse interval, is being produced as measured across a 135 ohm resistance, and shall not exceed 0dBm for 9.6 Kbps or +6dBm for 2.4 Kbps, 4.8 Kbps and 56 Kbps.

**Encoded Analog Content - Subrate Services - 68.308(g)(1)(iv).** Digital signals which are intended for eventual conversion into voiceband analog signals are required to meet signal power requirements. The maximum equivalent power of encoded analog signals for other than live voice shall not exceed -12dBm and network control signals shall not exceed -3dBm. A typical test arrangement is shown in Figure 3.

**Pulse Repetition Rate - 1.544 Mbps Digital Services - 68.308(g)(2)(i).** The pulse repetition rate shall be within 75 pulses per

Subpart D, Section	Significant Differences
68.302 Environmental Simulation	None
68.304 Leakage Current Limit	None
68.306 Hazardous Voltage Limit	None
68.308 Signal Power Limitations	Through Transmission
Subrate Digital Services	Pulse Repetition Rate Output Pulse Average Power Encoded Analog Content
1.544 Mbps Digital Services	Pulse Repetition Rate Output Pulse Adjustment of Signal Volt Output Power Encoded Analog Content
68.310 Longitudinal Balance	200 Hz to 1.544 MHz
68.312 On-Hook Impedance Limit	Does Not Apply
68.314 Billing Protection	2 Second Delay Signaling Interference On-Hook Level Off-Hook Signal
68.316 Hearing Aid	Does Not Apply
68.318	Additional Limitations

Table 1. Summary of Digital Interface Technical Requirements.



- V1, V2: Noise Measuring Set
- OSC: Audio Oscillator 200 Hz - 4000 Hz
- Z<sub>osc</sub>: 600 Ohm Source Impedance
- R1 = 600 Ohms

Figure 1. Test Circuit Through Transmission, Digital to Digital.

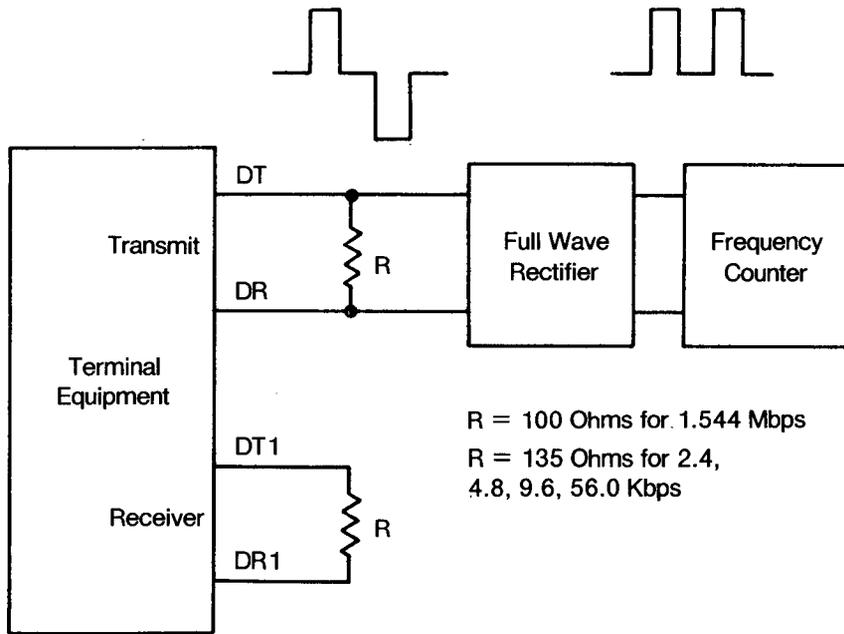


Figure 2. Test Circuit for Measuring Pulse Repetition Rate.

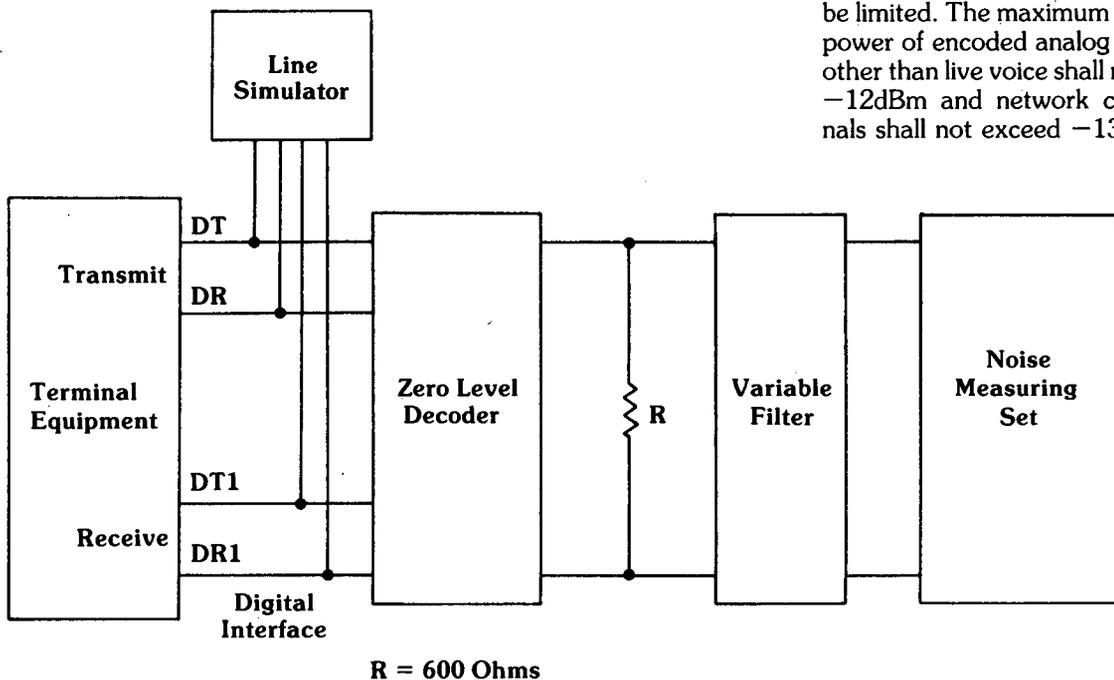


Figure 3. Test Circuit for Encoded Analog Content.

second of  $1.544 \times 10^6$  pulses per second.

**Output Pulse Template - 1.544 Mbps Digital Services - 68.308(g)(2)(ii).** The registered terminal equipment shall be capable of optionally delivering three sizes of output pulses. Specific templates are defined for each of the three output pulses.

**Adjustment of Signal Voltage - 1.544 Mbps Digital Services - 68.308(g)(2)(iii).** The signal voltage at the network interface must be limited so that the range of pulse amplitudes received at the first telephone company repeater is controlled to within 4dB. This limitation is achieved by implementing the appropriate output pulse option.

**Output Power - 1.544 Mbps Digital Services - 68.308(g)(2)(iv).** The output power, in a 3 kHz band on either side of 772 kHz, when an "all ones" signal sequence is being produced, as measured across a 100-ohm terminating resistance, shall be within the following limits: Option A, 12 to 19dBm; Option B, 4.5 to 11.5dBm; Option C, -3 to +4dBm. The power in a 3 kHz band on either side of 1.544 MHz shall be at least 25dB below that of a 3 kHz band on either side of 772 kHz.

**Encoded Analog Content - 1.544 Mbps Digital Services - 68.308(g)(v).** Digital signals which contain encoded analog signals must be limited. The maximum equivalent power of encoded analog signals for other than live voice shall not exceed -12dBm and network control signals shall not exceed -13dBm. Fig-

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ure 3 shows a typical test arrangement for measuring the encoded analog content.

**Longitudinal Balance Limitations - 68.310(1).** The longitudinal balance requirements for digital services are expanded. The longitudinal balance criteria is limited to the frequency range applicable to the equipment under test.

**Billing Protection - 68.314(a).** The billing protection requirements of this section apply to the digital interfaces when such digital interfaces are interconnected with the analog telephone network. Figure 3 shows the test arrangement for measuring the encoded analog signals contained in the digital signal.

**Signaling Interference - 68.314(d).** Digital transmissions shall not have encoded analog energy in the 2450 to 2750 Hz frequency band unless at least an equal amount of encoded analog energy is present in the 800 to 2450 Hz band. The encoded analog test circuit shown in Figure 3 permits the measurement of the signal level in the two frequency bands.

**On-Hook Signal Requirements - 68.314(f).**

The on-hook signal power derived by a zero level decoder shall not exceed -55dBm. The test circuit shown in Figure 3 is used to measure the on-hook signal level.

**Off-Hook Signal Requirements - 68.314(g).** In response to alerting for analog substrate channels, upon entering the normal off-hook state, registered terminal equipment shall continue to transmit the signaling bit sequence representing the off-hook state for 5 seconds, unless the equipment is returned to the on-hook state during the above 5-second interval.

**Additional Limitations - 68.318.** Digital equipment shall assure a continuity of output signals. This may be achieved by either (1) the outgoing signal meets the minimum pulse density requirement, or (2) one of the specified keep-alive signals is transmitted.

Power to operate this equipment shall come from the line. A direct current connection shall be provided between the simplexes of the transmit and receive pairs. The telephone company will drive 60mA through this connection with a constant current source. The voltage between

the transmit and receive pairs with 60mA flowing shall not exceed 67 volts.

The minimum acceptable pulse density is 0.125. The maximum acceptable length of a continuous sequence of "zeros" is 80 pulse positions.

The keep-alive signal shall be one of the following:

*Type 1 Keep-Alive Signal.* This signal is a consecutive sequence of all "ones."

*Type 2 Keep-Alive Signal.* This signal is a sequence of 193-bit frames consisting of a framing bit plus 192-bit sequence of consecutive "ones." The framing bit executes the following repetitive pattern every 12 frames.

1 0 0 0 1 1 0 1 1 1 0 0

*Type 3 Keep-Alive Signal.* This signal sequence is the regenerated received signal connected to the transmit port through a loop-back circuit.

Figure 4 shows a test circuit for measuring the minimum pulse density and the keep-alive signals.

There are some problems yet to be resolved concerning digital interface equipment. Longitudinal balance at 1.544 MHz is not a clear issue at this time for either the FCC

or the IEEE method. Equipment to handle substrate testing is hard to find. Fiber optic digital interfaces have not been addressed as yet. The equipment cost for a lab to implement digital interface testing will run \$10,000 to \$20,000. As of this writing, the connector jack has not been chosen for digital interfaces, but was to be decided at the TIC1.2 meeting on January 6, 1986.

In conclusion, test labs and manufacturers will be busy 18 months from now as the grandfather periods run out. These are major changes to Part 68, but the need for simplification of Part 68 to a level easily understood by manufacturers and test labs still exists. Form 730 instructions have been revised to accommodate applicable changes, but Part 68, updated to include the discussed changes, will be months in coming. Questions can be referred to William VonAlvin or Robert James at the FCC - Part 68; phone: 202-634-1833. ■

## ACKNOWLEDGEMENT

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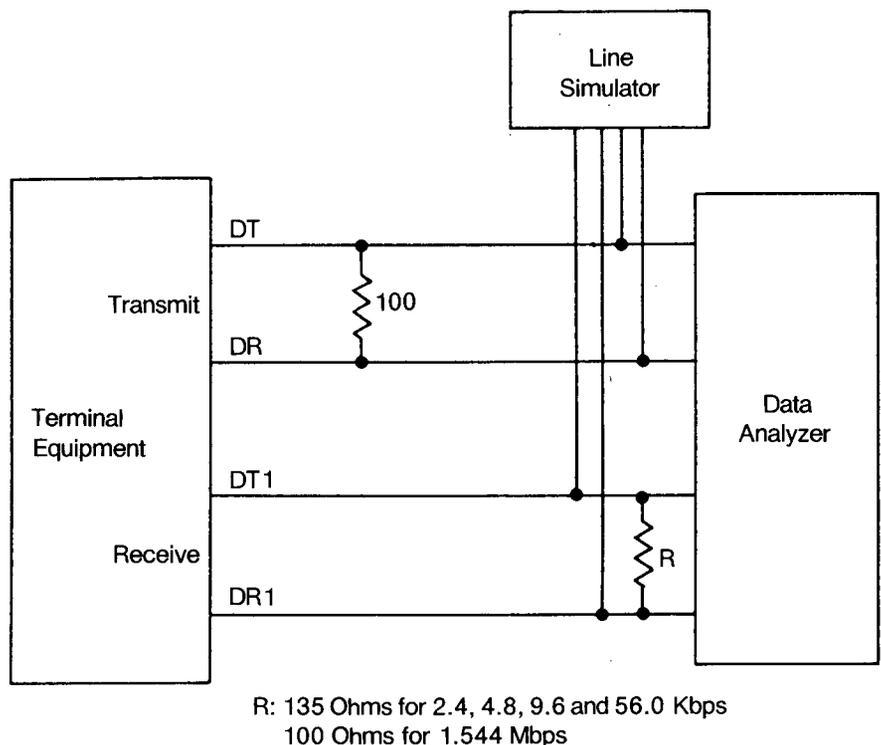


Figure 4. Test Circuit for Keep-Alive Signals.