

# Message Noise Measurement Battery Supply Circuits in Central Offices

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# 1 .General

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- 1.1 Purpose** Power plants and equipment such as fans, power supplies, filters, etc. are potential noise sources in working communications systems. This practice provides:
- Methods for measuring message noise caused by battery-supply circuit disturbances in Central Offices (COs).
  - The noise measurements that must be completed initially by Central Office Equipment Installation (COEI) and then at least annually by Maintenance.
- 1.2 Filing Instructions and Supersedures** Discard all previous issues and associated addenda of this practice and file this issue numerically in your GTE Telephone Operations practices set.
- This practice supersedes and cancels:
- All policies, procedures, general instructions, letters, and memoranda which address this subject.
  - Any document which provides information contrary to the information contained in this practice.
  - Any local practices describing the same subject.
- 1.3 Reason for Reissuing** This practice has been reissued to clarify:
- COEI's role in battery noise measurements.
  - The typical locations for measuring transmission (talk) battery.
  - Battery and Filter Circuit Noise Measurements (formerly 0000371 PS) was changed to 00-331-00001.
- 1.4 Responsibility** This practice was published by the GTE Telephone Operations Enterprise Services Department. For more information about this practice, contact the GTE Telephone Operations Headquarters COE Construction Department.
- 1.5 Disclaimer** This practice was prepared solely for the use of GTE Telephone Operations. It must be used only by its employees, customers, and end users when installing, operating, maintaining, and repairing GTE Telephone Operations' equipment, facilities, and services. Any other use of this practice is forbidden. The information contained in this practice may not be applicable in all circumstances and is subject to change without notice. By using this practice the user agrees that GTE Telephone Operations will have no liability (to the extent permitted by applicable law) for any consequential, incidental, special, or punitive damages that may result.

## 2. Overview

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### 2.1 Definitions

The following chart provides definitions for the acronyms and terms used in this practice.

Acronym or Term	Definition
AC	Alternating Current
BDFB	Battery Distribution Fuse Bay
CO	Central Office
COE	Central Office Equipment
COEC	Central Office Equipment Construction
COEI	Central Office Equipment Installation
dBm	Decibels above reference noise
dBmC	C-Message weighted noise power in dBm
DC	Direct Current
Hz	Hertz (unit of frequency)
kHz	Kilo Hertz (unit of frequency)
MLS	Measured Local Service
NMS	Noise Measuring Set
PDU	Power Distribution Unit
PDUF	Power Distribution Unit Frame
SCR	Silicon Controlled Rectifier
Vdc	Volts Direct Current

## 2. Overview, continued

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### 2.2 References

The following chart provides sources of supplementary information relating to this practice. The documents could be required for performing certain tasks.

See...	For Information About...
200-001-000	Safety Precautions -Central Office
205-000-500	Power Connections -- Central Off ice Fuse Inspection and Tightening Procedures
205-001-501	Equipment Frames Preliminary Test -- and Power-Up Procedures
205-001-502	Central Office Power Evaluation (COPE)
205-002-501	Isolated Ground Faults -- Detection and Troubleshooting -- Switching and Transmission Systems
205-005-200	Batteries -- Central Off ice and Remote -- Installation and Maintenance
205-715-100	Bay Battery Filter (H-859076-A)

### 2.3 Forms

The following forms are referenced in this practice:

- Battery/Charger Record, Form 90002546, shown in GTE Telephone Operations Practice 205-005-200.
- Battery and Filter Circuit Noise Measurements, Form 00-331-0001 (formerly 000371 PS).

Order Form 90002546 through normal supply channels.

To obtain Form 00-331-0001, prepare a Form Request (Form 900001814) and send it to Forms Administration at:

GTE Telephone Operations  
Forms Administration  
700 Hidden Ridge  
PO. Box 152092  
Irving, TX 75015-2092  
Fax : 972/718-2659

## 3. Battery Supply Disturbances

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### 3.1 Noise Types

Battery bus and power cables have different types of noise. A multitude of equipment found in the COs generate these noises. A particular piece of equipment tends to generate the most noise. Conduct monitoring (listening) with the measurements to help identify the particular noise characteristic of the noise source.

## 3. Battery Supply Disturbances, continued

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### 3.2 Battery Supply Circuits

The measurement of noise on telephone circuits and the analysis of the conditions in each CO might be facilitated by a knowledge of the sources of various possible noises originating within a CO because of battery-supply circuit disturbances. Some noise sources are:

- Office battery rectifiers.
- Dial office stepping switch equipment.
- interruptor or interrupter circuits of ringing machines.
- By induction when a battery supply lead, not closely paired with its ground, lies close to transmission path cabling.
- Bad or defective battery filters.
- Poor electrical connections on the battery, possibly due to corrosion.
- DC to AC inverters.
- DC to DC converters (e.g., subscriber carrier power supplies, MLS equipment, etc.).
- SCR in the rectifier.

### 3.3 Battery Filters

Battery filters can experience a variety of problems. The following is a list of the more common problems that could be experienced:

- Filter capacitor not connected because of failure to install capacitor fuses.
- Blown capacitor fuse undetected. Caused by the fuse alarm not being connected or no tell-tale indication.
- Ground side of filter capacitor connected to frame ground instead of battery ground return.
- Load connected to the input side of the filter.

**NOTE: The exception is the MLS filter.**

- Filter output strapped to office (signal) battery at the fuse panel.
- Aged filter capacitor (electrolyte dried out).

The Bay Battery Filter H850076-A (or equivalent) provides at least 15 to 25 dBm noise attenuation over a frequency bank of 300 - 4000 Hz. By measuring both the input and output of the filter, it can be determined if the filter is functioning properly.

**CAUTION: Use care when working and making measurements on CO batteries. The current that is produced by a short-circuit can cause small gauge conductors to fuse quickly, which exposes personnel to burns and flashes. Larger metallic objects (tools), if allowed to short-circuit the battery, might do serious damage to the batteries, battery conductors, or even cause a major service outage.**

## 4. Equipment

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### 4.1 Test Equipment

The following test form record and typical types of test equipment are required when performing battery circuit noise measurements:

- Record test results on the Battery and Filter Circuit Noise Measurements, Form 00-331-0001, Exhibit 1.
- Transmission Test Set. Use one of the following or its equivalent for voice-frequency message noise measurements.
  - Telecommunications Technology, inc., Model TTI-1120 Transmission Test Set?
  - Tripiett Model 7 GTE Loop Tester?
  - Type TTS-37B Transmission Test Set<sup>™</sup>.
  - Halcyon 702/704 Transmission Test Set<sup>™</sup>.
  - Wiicom Model T 136BGM Noise Measuring Set?
- Frequency Selective Voltmeter. Use one of the following or its equivalent for carrier-frequency message noise measurements. Equip test leads with a 1 amp fuse in each lead:
  - Cushman Model CE-24<sup>™</sup>.
  - Sierra Model 128A<sup>™</sup>.

## 5. Noise Limits

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### 5.1 Tables

See Exhibit 2 for the following noise reading limits.

Table	Noise Limits for...
1	Talk (Transmission) battery for analog, electronic, and digital switches.
2	Office battery (signal) for the various voltages found in the CO.
3	Carrier-frequency for the 130 Vdc battery supply and the -48 Vdc battery used for carrier power supply (analog carrier only).

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All marks are the property of their respective owners.

# 6. Measurements

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## 6.1 General

COEC performs the initial noise measurement during:

- Off ice conversions.
- New power plant construction.
- Power plant growth.
- Racks/frames with "noisy" equipment (e.g., fans, inverters, rectifiers, battery filters, etc.).

Take measurements at the battery string. If the reading is high, take another reading at the PDUF. If the reading is still high, take a reading at the equipment end. Take measurement readings before and after equipment installation and power up. Record battery string readings on the Battery/Charger Record, Form 90002546. COE maintenance personnel take noise measurements annually. When troubleshooting and doing maintenance at the equipment end, use Battery and Filter Circuit Noise Measurements, Form OO-331-0001, Exhibit 1.

## 6.2 Voice-Frequency Message Noise

The following chart shows the typical settings to use when performing the voice-frequency message noise measurements using the Transmission Test Set.

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Switch	Setting
INPUT/OUTPUT	RCV BRDG
IMPEDANCE	600 OHMS
FILTER	C-MSG OR 3 kHz

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**NOTE:** Do not correct the noise reading for the impedance mismatch between the Transmission Test Set and the point of measurement.

## 6.3 Talk/ Transmission Battery Measurements

Perform the following talk/transmission battery measurements at the fuse panel of the typical type frames during the busy-hour periods of the CO (see Exhibit 2). They include all racks/frames:

- Requiring battery supply and filters.
- With power supply and/or inverters.
- With fans.

**NOTE:** Refer to Sections 3 and 8 of GTE Telephone Operations Practice 205-001-502.

## 6. Measurements, continued

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### 6.4 Office Signal Battery Measurements

Perform the office (signal) battery measurements at the following typical test locations during the busy-hour periods of the CO:

- Each 48V battery string.
- NOTE:** Also record the battery string reading on the storage battery/charger. Refer to GTE Telephone Operations Practice **205-005-200** for the Battery/Charger Record, form **90002546**.
- Rear of the Main Power Board.
  - Each PDU.
  - At the top and bottom of **all** BDFBs in the CO.
  - At the MLS filter's input and output.

### 6.5 Carrier- Frequency Message Noise Analog Carrier Only

Perform the measurements using the carrier-frequency noise measuring set with the following settings.

Switch	Setting
INPUT	BRDG
IMPEDANCE	135 ohms

With the arrangement shown in Exhibit 2 the reading is in dBm, and a simple conversion (to dBrn = 90 + dBm) gives the results in dBrn 3kHz flat as desired.

Center the meter of the Frequency Selective Voltmeter at the desired frequency or sweep it across the carrier-frequency band.

## 7. Reducing Central Office (CO) Noise

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### 7.1 Planned Maintenance

In addition to the COEC measurements, Maintenance completes the noise measurements described in this practice annually for each office. More frequent measurements may be requested for any particular office that is out of limits or marginal with respect to meeting objectives.

## 7. Reducing Central Office (CO) Noise, continued

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### 7.1 Planned Maintenance, continued

Use the procedure for checking all battery-supply and battery filters in a CO. If the objectives in Exhibit 2 are not met, **see**:

- Section 3.
- The Bay Battery Filter information in GTE Telephone Operations Practice 205-715-I 00.
- All power connections as described in GTE Telephone Operations Practice 205-000-500.
- Isolated ground faults as described in GTE Telephone Operations Practice 205-002-501.
- COPE, GTE Telephone Operations Practice 205-001-502,

The technique of ON-OFF testing, that is selectively shutting down one or more pieces of apparatus, is sometimes effective where load conditions permit. A significant change in the noise should identify the source.

If, after completing the procedure for checking all battery-supply and battery filters in a CO, the noise level is above limits, report the problem to the local Administrator - Transmission and Protection.

### 7.2 Power Supply Noise

Use the following procedure to identify high input noise in electronic/digital equipment in power supplies.

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Step	Identifying High Input Noise
1	Check every fuse in the CO PDUs for noise using a noise measuring test set in the "Bridged," "600 ohm," and "C-Message" positions.
2	Identify the fuse with the highest noise reading using the site equipment Power Distribution and Grounding drawing to find the bay locations being fed from this fuse.
3	Check each battery and ground input on the backplane of the power supplies of each shelf in all bays fed by the fuse in Step 2 with the noise test set.
4	Replace the power supply with the highest level of noise at the input to the power supply backplane position.
5	Begin retesting again at Step 1 to find any other bad power supplies.

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# Exhibits, continued

In Item...	Entitled...	Enter...
A	Originating Office	Appropriate CO name.
B	Authority For Test	One of the following: <ul style="list-style-type: none"> <li>• Trouble Report.</li> <li>• Work Order number.</li> <li>• Subsequent period for which routine tests are made.</li> </ul>
C	Faulty Battery/Filter	Any faulty battery/filter source that is known or reported as faulty before taking measurements.
D	Date	Date measurements are taken.
E	BY	Name of individual performing test.
F	Battery Designation/Filter Bay No.	Before starting the test, the individual battery and Filter Bay designation.
G	Time in Service (Batteries Only)	Length of time the battery has been in service.
H	Point of Measurement	Location.
I	Measurement	A check for type of measurement (voice or carrier frequency).
J	NMS	The setting of the NMS, C-Message, or 3 kHz.
K	Objective	Noise measurement limits (see Exhibit 2).
L	Actual Measurement	The actual reading that is measured.
M	Acceptable	A check to determine whether the measurement in column "Actual Measurement" is acceptable or not.  If the measurement is higher than the objective in the "Objective" column, it is not acceptable.

(continued)

**Exhibit 1 - Battery and Filter Circuit Noise Measurements, Form OO-331-0001 (Page 2 of 3)**

## Exhibits, continued

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In Item...	Entitled...	Enter...
N	Corrections	<ul style="list-style-type: none"><li>• The action taken to sufficiently reduce the noise to comply with the objective in column K "Objective"</li></ul> OR <ul style="list-style-type: none"><li>• If the reading is within the further investigation range, explain what was done to prove that the reading is satisfactory (e.g., measurements taken on the transmission path).</li></ul> Refer to the CO equipment manufacturer and test equipment manufacturer documentation for identifying and reducing noise in battery/filter supply circuits, etc.

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**NOTE:** Retain copy in the local file for at least one year.

**Exhibit 1 - Battery and Filter Circuit Noise Measurements, Form 00-331-0001 (Page 3 of 3)**

NOISE LIMIT(S) TABLES

Table 1

TALK/TRANSMISSION BATTERY LIMITS	
Weighting	Limit
C-Message	30 dBrnC

Table 2

OFFICE BATTERY LIMITS		
Voltage	Weighting	Limit
-48 Vdc	C-Message	32 dBrnC
+ -24 Vdc	C-Message	32 dBrnC
+ -130 Vdc	3 kHz Flat	47 dBrn

Table 3

CARRIER FREQUENCY MESSAGE NOISE (analog carrier only)		
Voltage	Weighting	Limit
-48 Vdc	3 kHz Flat	50 dBrn
	3 kHz Flat	-40 dbn
	2.5 kHz Flat	-41 dBm
+-130 Vdc	3 kHz Flat	50 dBrn
	3 kHz Flat	-40 dbn
	2.5 kHz Flat	-41 dBm

**Exhibit 2 - Noise Limit(s) Tables**