EQUIPMENT REQUIRED

Refer to Appendix A of this manual to obtain the list of equipment required to perform this exercise.

PROCEDURE

Setting Up the Central Office

☐ 1. Make sure that the Reconfigurable Training Module, Model 9431, is connected to the TTS Power Supply, Model 9408.

Make sure that there is a network connection between the Reconfigurable Training Module and the host computer.

Install the Dual Analog Line Interface, Model 9475, into one of the analog/digital (A/D) slots of the Reconfigurable Training Module.

Connect two analog telephone sets to the Dual Analog Line Interface. Make sure that the tone dialing mode is selected on the analog telephone sets.

CAUTION!

High voltages are present on the standard telephone connectors of the Dual Analog Line Interface. Do not connect or disconnect the analog telephone sets when the Reconfigurable Training Module is turned on.

Connect the AC/DC power converter supplied with each analog telephone set to one of the AC power outlets on the TTS Power Supply. Connect the DC power output jack of each AC/DC power converter to the DC power input connector on either one of the analog telephone sets.

Note: *The analog telephone set requires an auxiliary DC power source for the digital display to be operative.*

☐ 2. Turn on the host computer.

Turn on the TTS Power Supply then the Reconfigurable Training Module.

☐ 3. On the host computer, start the Telephony Training System software, then download the CO program to the Reconfigurable Training Module. The CO program configures the Reconfigurable Training Module so that it operates as a central office.

Note: *If the host computer is unable to download the CO program to the Reconfigurable Training Module, it may not be using the proper IP address. Have your instructor or the LAN administrator check if the host computer uses the proper IP address to communicate with the Reconfigurable Training Module.*

Observation of DTMF Dialing Signals in both the Time and Frequency Domains

☐ 4. On the host computer, go to the Call Processor and disable the telephone number detection to make the central office insensitive to dialing signals. This will allow you to dial as many digits as you wish and observe the resulting DTMF signals, with no response from the central office that can disturb your observations.

☐ 5. On the host computer, zoom in on ANALOG LINE INTERFACE A, connect Oscilloscope Probe 1 and the Spectrum Analyzer Probe to TP3 (AC signal on the telephone line), and start the Oscilloscope.

Note: *Probe 1 is associated with channel 1 of the Oscilloscope.*

☐ 6. Make the following settings on the Oscilloscope:

Channel 1
- Mode . . . . . Normal
- Sensitivity . . . . . 0.2 V/div
- Input Coupling . . . . . AC

Time Base . . . . . 0.5 ms/div

Trigger
- Source . . . . . Ch 1
- Level . . . . . 0 V
- Slope . . . . . Positive (+)

Display Refresh . . . . . Continuous

☐ 7. Lift off the handset of telephone set A and press different keys on the keypad while listening to the handset earpiece and observing the signals on the Oscilloscope screen.

Describe what happens whenever a key on the telephone set is depressed.

_____

_____

Describe the waveform of the DTMF dialing signals.

_____

_____

☐ 8. On the host computer, start the Spectrum Analyzer.

Make the following settings on the Spectrum Analyzer:

Center Frequency	800 Hz
Frequency Span	200 Hz/div
Amplitude Scale	Logarithmic
Maximum Input	0 dBV
Display Refresh	Continuous

☐ 9. Press different keys on the keypad of telephone set A while observing the waveform and the frequency spectrum of the DTMF dialing signals displayed on the Oscilloscope and the Spectrum Analyzer.

What does the frequency spectrum of each DTMF dialing signal contain?

_____

_____

☐ 10. Make the following setting on the Oscilloscope and the Spectrum Analyzer:

Display Refresh	Manual

Press each key on the keypad of telephone set A. For each key, record the frequency spectrum of the DTMF dialing signal using the Spectrum Analyzer. Use the vertical cursors of the Spectrum Analyzer to determine the frequency of each component in the spectrum of the DTMF dialing signal. Record your results in the following table.

Note: *You can print the frequency spectrum of each DTMF dialing signal if a printer is available.*

KEY	FREQUENCY COMPONENTS (Hz)
1	1.19 kHz
2	1.30 kHz
3	712.4 Hz
4	771.8 Hz
5	340 Hz
6	734.1 Hz
7	700 Hz
8	532.7 Hz
9	376.3 Hz
*	630.4 Hz
0	1.35 kHz
#	1.52 kHz

Table 1-2. Frequency components of the DTMF signal associated with each key of a telephone set using tone dialing.

☐ 11. Using the results you recorded in Table 1-2, determine the frequency associated with each row and column of the telephone keypad. Record these frequencies in the blank spaces of Figure 1-13.

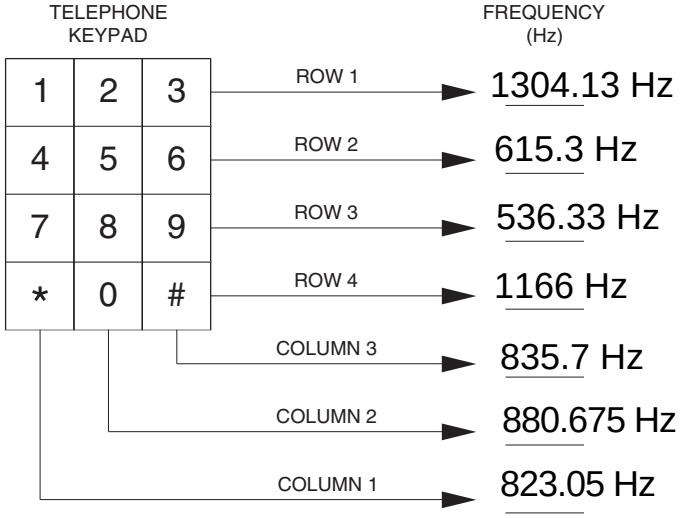

Figure 1-13. Frequencies associated with the rows and columns of the telephone keypad.

Are the frequencies you recorded in Figure 1-13 close to the nominal frequencies indicated in Figure 1-11 of the discussion?

☐ Yes ☐ No

☐ 12. On the host computer, close the Telephony Training System software.

Turn off the TTS Power Supply as well as the host computer (if it is no longer required).

Disconnect the AC/DC power converters from the TTS Power Supply and the analog telephone sets.

Disconnect the analog telephone sets from the Dual Analog Line Interface.

Remove the Dual Analog Line Interface from the Reconfigurable Training Module.

CONCLUSION

In this exercise, you learned that tone dialing is a means of transmitting telephone numbers to the central office. You saw that tone dialing assigns a specific frequency to each row and column of the telephone keypad. You observed (in both the time and frequency domains) that when a key is depressed, a dual-tone audio signal consisting of the frequencies associated with the corresponding row and column of the keypad is output to the telephone line. You learned that these audio signals are referred to as dual-tone multiple frequency (DTMF) dialing signals. You saw that number detection at the central office is achieved by determining the two frequency components in each DTMF dialing signal and translating these components into the corresponding digit.

REVIEW QUESTIONS

1. What is DTMF tone dialing used for?

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2. Briefly describe DTMF tone dialing.

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