

PTT Testing

The 73M2901CE integrated circuit modem provides all the microprocessor control and modulation and demodulation functions required to implement a V.22 *bis* 2400 bps modem. Equipment to be connected to the Public Switched Telephone Network (PSTN) must comply with different standards such as FCC part 68, CTR-21, or JATE. A certification process usually verifies conformity to those standards.

The certification is a combination of electrical performance testing and administrative procedures to obtain a certificate of compliance, which allows a product or equipment to be connected to and used legally on that network.

This application note is intended to explore the different configurations in which the 73M2901CE can be programmed, in order to perform the certification performance tests.

There are 4 major states in which the modem must be able to remain:

- ◆ On hook quiet state
- ◆ Off hook quiet state
- ◆ Off hook DTMF generation state
 - *Continuous tones*
 - *Dialing a number sequence*
- ◆ Off hook carrier transmission state

On-hook quiet state

The modem is basically quiet, i.e., not transmitting, and not seizing the line. Potentially the modem could be set in power down mode. This state is used usually to perform the on-hook characteristic testing such as on-hook impedance (AC and DC), insulation resistance, ringer equivalency number (REN), etc.

Command example: **ATZ<CR>**

This command resets the modem and puts the modem into the same state as after power-on reset.

Off-hook quiet state

This state is used to measure mainly the return loss, insulation resistance, in-band and out-of-band noise, etc. In this state the modem must seize the line and remain silent since any transmission may affect the measurements.

Command to be issued: **ATZH1<CR>**

Off-hook DTMF generation state

This state is used to measure the accuracy of the DTMF generator as well as the transmission levels, twist, and length of the DTMF digits. Depending on the national requirements, these tests may be performed with a continuous DTMF tone or a pattern.

The S11, S12 and S13 registers will have to be set up in order to perform these tests:

S11 = DTMF on and off dialing speed

This is the duration of the DTMF tone emitted in the case of a normal dialing sequence. This is also the off time between tones.

S12 = DTMF / Twist dial register

The DTMF tones are a combination of two frequencies, the high and low tones. Usually telephone network requires the level of those two tones to be separated by 2 dB (the higher tone at the higher amplitude). The upper nibble of this register, bits 4-6, adjust the level difference and defaults to 2 dB. This register also selects the digit to be dialed in the lower nibble.

S13 = DTMF – Data / Transmit attenuation

This register sets the transmission level for the DTMF tones. Usually networks require either –6/-8dBm or –9/-11dBm. The S13 register can be modified in order to comply with those requirements.

Command examples:

Transmission of the digit 5, with 2 dB of twist, default transmission level

```
ATS12=37S13=16J1<CR>
```

Transmission of the digits 1234567890 with a sequential digit pattern with a duration of 100ms, 2 dB of twist and default transmission level

```
ATS11=100S12=32S13=16X0DT1234567890<CR>
```

Off-hook carrier transmission state

This state is used to measure transmission levels of the different carriers, in- and-out-of-band energy and noise, and frequency accuracy when in FSK modes. Such generation requires being able to transmit the signal without being truly connected.

The different elements to take into account when generating a carrier are the modulation mode selected (V.22 *bis*, Bell 103, etc.), the mode (originate or answer), the pattern (mark or spaces) and finally the level of transmission. It should be noted that when operating in V.22 and V.22 *bis*, the scrambler must also be enabled.

	Bell 103				Bell 202		Bell 212	
	FSK				FSK		DPSK	
	Originate		Answer		Main channel		Originate	Answer
	Mark	Space	Mark	Space	Mark	Space	Dotting pattern	Dotting pattern
Modulation selection	S30=32	S30=32	S30=32	S30=32	S30=2	S30=2	S30=16	S30=16
Mode selection	S14+128	S14+128	S14-128	S14-128	N/A	N/A	S14+128	S14-128
Pattern selection	S60=1	S60=2	S60=1	S60=2	S60=1	S60=2	S60=3	S60=3
Scrambler	N/A	N/A	N/A	N/A	N/A	N/A	S60+16	S60+16
Transmission level selection	S13=16	S13=16	S13=16	S13=16	S13=16	S13=16	S13=16	S13=16
Frequency transmitted	1270Hz	1070Hz	2225Hz	2025Hz	1200Hz	2200Hz	1200Hz	2400Hz

	V.21				V.23				V.22	
	FSK				FSK				DPSK	
	Originate		Answer		Originate		Answer		Originate	Answer
	Mark	Space	Mark	Space	Mark	Space	Mark	Space	Dotting pattern	Dotting pattern
Modulation selection	S30=64	S30=64	S30=64	S30=64	S30=128	S30=128	S30=128	S30=128	S30=8	S30=8
Mode selection	S14+128	S14+128	S14-128	S14-128	S26+128	S26+128	S26-128	S26-128	S14+128	S14-128
Pattern selection	S60=1	S60=2	S60=1	S60=2	S60=1	S60=2	S60=1	S60=2	S60=3	S60=3
Scrambler	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	S60+16	S60+16
Transmission level selection	S13=16	S13=16	S13=16	S13=16	S13=16	S13=16	S13=16	S13=16	S13=16	S13=16
Frequency transmitted	980Hz	1180Hz	1650Hz	1850Hz	390Hz	450Hz	1300Hz	2100Hz	1200HZ	2400Hz

V.22bis		
QAM		
	Originate	Answer
	Dotting pattern	Dotting pattern
Modulation selection	S30=4	S30=4
Mode selection	S14+128	S14-128
Pattern selection	S60=3	S60=3
Scrambler	S60+16	S60+16
Transmission level selection	S13=16	S13=16
Frequency transmitted	1200Hz	2400Hz

The preceding tables allow selection of any modulation mode desired. Once the configuration is selected, the transmission has to be activated through the ATJ3 command.

Command example:

For instance, to generate the 450Hz V.23 originate space, the following command is entered:

```
ATS30=128S26+128S60=2S13=16J3<CR>
```

For the V.22bis, answer mode, mark carrier:

```
ATS30=4S14-128S60=1S60+16S13=16J3<CR>
```

Other states needed

Some specific testing such as call progress detection, automatic dialing requirements, ring detection, pulse dialing... are highly dependable on the national standard considered (FCC68 for the US, CTR-21 for Pan-European approval, etc.). This testing is usually performed through a standard dial (ATDT... command) and checked by the response of the modem such as successful dialing or connection failure. Although the 73M2901CE family provides a wide range of registers that can modify its performance, it also provides factory presets for specific countries such as USA or CTR-21 (refer to S99 register for complete details). Setting the proper S99 (S99=0 for CTR-21, for instance) will set all relevant registers to the values that comply with the standard's requirements, eliminating the task of setting each register separately.

It is therefore recommended using the proper S99 setting to any configuration string issued to the 73M2901CE.

Command example:

When testing the dial tone detection for the CTR-21 standard

```
ATS99=0DT555<CR>
```

For any country that is not included in the preset table, chances are that the country will have requirements close to one of the preset countries. After setting the closest configuration, selectively modify the parameters in order to meet the requirements.

Command example:

For a country close to USA settings but with a DTMF duration of 120ms

```
ATS99=1S11=120DT555<CR>
```

Revision History

Revision	Date	Description
1.2	7/07/2004	
2.0	11/12/2008	Converted original version 1.2 to Teridian format removed all reference to TDK and changed doc number from AN-2901-008 to AN_2901CE-035. There is no change to technical content.

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