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Technical Note

DSN06-001

Subject: Preliminary Application of Datum Systems PSM-500 Modems

This Tech Note is intended to provide users of the Datum Systems new PSM-500 Series of satellite modems with basic operating information until the full manual is released. The full feature set and operating modes have not been fully defined yet and may change as the series is more fully implemented. This description is shown in two forms, differences between the M500 (PSM-500) and the Previous M5 (PSM-4900) plus new feature descriptions.

Behind these changes and feature additions are an almost 10 fold increase in the amount of programmable logic in the form of Field Programmable Gate Arrays within the modem.

A. PSM-500 differences compared to the PSM-4900:

Most of our customers are already familiar with the basic operation of the PSM-4900 series modems. When transitioning to the new PSM-500 series most of that operating experience will carry over directly. But, there are some necessary changes to the structure and modes of operations that are listed here.

1. Physical Differences:

First, you will notice that physically the PSM-500 is almost identical to the PSM-4900. That includes the size, and layout of controls and connectors on both the front and rear panels. Inside, the main board is significantly different, but in most cases that does not concern a user.

- On the front panel the model number on the Lexan Overlay is changed, now saying "PSM-500". This is matched by the model number displayed on the LCD.
- On the rear panel a new USB connector has been added to aid downloading and installing new software and firmware.

2. Front Panel Indicator Action Differences:

Modulator Major Alarm on no data input - The new PSM-500 has a significantly "smarter" data interface since it can operate at much higher data rates than previous modems. It now knows if there are no data or clock transitions on the transmit input and will provide an alarm without them.

[Demodulator Major Alarm when using BER Test](#) – When the internal BER Test set is enabled on the demodulator side it will now cause an alarm on the Demodulator front panel LED. That is because there is no longer a data path from the modem out to the connector.

3. Front Panel Keypad/LCD Control & Navigation Differences:

The basic navigation procedure is the same as in the PSM-4900. Some parameters have been moved to allow monitor and control of the new features.

[New USB column under “Unit”](#) – The “IrDA” column has been replaced by a new “USB” column containing controls for the rear USB connector. This column has also moved to be displayed in sequence after the Remote Control column.

[R-S FEC controls moved](#) – The Reed-Solomon FEC controls are now under the Modulator and Demodulator “Data” column. The new standard Multiplexer retains its MUX column.

[New Multi-Entry Modes](#) – Some entries that have dependent parameters now lead you through each to insure correct settings. For example, changing the Modulation will confirm the FEC, FEC Option and Code Rate settings.

[Self Test still in development](#) – The PSM-4900 had fairly extensive self testing which could determine almost any hardware or software failure in the modem. The PSM-500 has even an even higher level of testing, but the procedures have not been finalized and will be released in a later firmware version.

[New “FEC A/B” shown in Unit Status Column.](#) The PSM-500 has two FEC slots internally allowing installation of standard and optional FEC technologies. Normally the FEC A slot will have the standard Viterbi and Reed-Solomon FECs installed. The front panel status shows this.

[New “Feature Set” in the Unit Status column](#) – The PSM-500 is capable currently of 3 different feature sets or “packages” of capabilities designed to serve specific markets and users. They include the M505 which fairly closely matches the PSM-4900 capabilities, the M511 which adds 8PSK and operation to 10 Mbps, and the M523 which adds 8PSK and 16QAM plus operation up to 20 Mbps, when selected modes permit that speed. This is not shown on initial M505 feature set modems.

[New Modulator/Demodulator “IF Filter Mask”](#) – The PSM-4900 modem only operated in what might be called a “Closed” system mode. That is, it was optimized for inter-operation with other PSM-4900 modems or

operation with other brands of modems also in a “closed” system mode. The PSM-500 modem has two IF filter masks available independently in the Modulator and Demodulator IF column. The “IESS” mask mode enabled by default and is similar to the IESS open system operating mode, while the “Legacy” mask is the same as that used in the PSM-4900. For inter-operation with the PSM-4900 the filter mask on both transmit and receive should be set to “Legacy” mode. Mixing link modes will result in an approximate 0.5 dB loss in performance.

New Modulator/Demodulator FEC Code Rate – The PSM-500 modem adds a new FEC rate 5/6 capability to the list of standard code rates available. When using 8PSK with Trellis Code Modulation in the M511 the only code rate available by standards is rate 2/3 due to the way that 8PSK works. If TPC or other optional FECs are installed, then they will operate at the standard code rates of $\frac{1}{2}$, $\frac{3}{4}$, 5/6 and 7/8 even in 8PSK.

New Modulator/Demodulator Scrambler Settings – The PSM-500 modem scramblers have become increasingly complex. To aid in setting them correctly a new “Auto” mode is enabled by default. This mode chooses the optimum scrambler for the selected other parameters. The scrambler may also be manually set to one of the options available for the selected FEC and other parameters.

Demodulator Receive Level now in 0.1 dB Increments – The PSM-500 carrier detection circuitry has improved and now provides very accurate receive signal level measurement in 0.1 dB increments vs. the 1 dB increments in the PSM-4900.

B. PSM-500 New Features:

The PSM-500 has multiple new features already incorporated with more to follow as they are developed

Reed-Solomon FEC and IBS Multiplexer are built-in to all standard modems – This is partly because the ability to operate in standard 8PSK with Trellis Code Modulation requires the Reed-Solomon. Once the framing functions are developed for Reed-Solomon then the IBS multiplexer is a fairly simple addition. Both of these were an extra cost option in the PSM-4900.

New Smart Data Interface - The new PSM-500 has a significantly “smarter” data interface since it can operate at much higher data rates than previous modems. It now knows if there are no data or clock transitions on the transmit input and will provide an alarm without them. It is constantly looking at the relationship between the clock and data to determine the optimum phase relationship between them. This greatly

improves the reliability of the data link at higher speeds and over long cables. This is especially true when using Terminal Timing mode.

Option for 8PSK and 16QAM with higher data rates – The PSM-500 has the ability to load new firmware into the FPGAs allowing additional modulation/demodulation modes which reduce satellite spectrum use and save link costs. 8PSK with TCM and 10 Mbps operation is available in the M511 Feature Set. 16QAM an maximum 20 Mbps operation is available in the M523 Feature Set. Other modes such as Offset QPSK (OQPSK built in now), 8APSK and 16APSK are also possible. Since these features are controlled by the firmware IP installed they can be field upgraded via software to provide these new capabilities.

New FEC technology in development – The PSM-500 has the ability to operate with no FEC, allowing use in specialized systems. It also has two FEC card slots permitting a wide variety of new TPC FEC technologies to be integrated. The same 4 k block size FEC that is used in the PSM-4900 is also available as a factory installed option on the standard FEC card, as well as a new 16 k block size TPC FEC providing improved performance.

Other FEC cards in development are the S-Tec FEC originated in Australia which provides outstanding performance at very low Eb/No even in 8SPK and 16QAM modes. Additionally a version of LDPC is also in development.

BER Test Set now able to operate on the line side – The PSM-4900 had a built-in BER Test set, but it could only be directed toward the satellite side. The new one can be directed (in DCE mode) toward the line side allowing the possibility to test external connections and cables.

C. PSM-500 Link with the PSM-4900:

Essentially the two modems should be set up the same with the following two exceptions.

- Set the PSM-500 Modulator and Demodulator IF Filter Mask to “Legacy”. This is not the default and although the link will work there is a performance penalty leaving the default “IESS” mode.
- Set the PSM-500 Modulator and Demodulator Scrambler to “Auto”. This is the default on the PSM-500. The PSM-4900 will normally be set to IESS-308 only for Viterbi and R-S operation. In TPC modes the modem will automatically set to an appropriate “TPC Sync” mode which should not be changed.

Obviously the other parameters must be set to match the link in each direction, such as frequency, data rates, code rates, etc.

MAB – version 1.1 For questions concerning this technical note please contact Datum Systems, Inc via email at support@datumsystems.com