LS-11-M3
Portable Multi-Mode RF Test Transmitter w/PCM Simulator and PRN Generator

User's Manual

Lumistar Inc.

3186 Lionshead Ave, Suite 100
Carlsbad, California 92010
(760) 431-2181

Lumistar Inc.
3186 Lionshead Ave., Suite 100
Carlsbad, CA 92010
(760) 431-2181
(760) 431-2665 Fax
www.lumistar.net

Table of Contents

List of Figures

List of Tables

Acronyms/Definitions

BAUD – Bits at Uniform Density

BER - Bit Error Rate

BERT - Bit Error Rate Test

Bps – Bits Per Second

BW – Bandwdith

dB – Decibel

dBm – Decibel milliwatts

CCITT – Consultive Committee for International Telephony and Telegraphy

CLK – Clock

CRC – Cyclical Redundancy Checks

DAT - Data

DSP - Digital Signal Processor or Digtial Signal Processing

FAC- Frame Alternate Compliment

FCC - Frame Code Compliment

FEC- Forward Error Correction

FFID – Frame Format Indentification

FLASH – Electronically Eraseable Memory

FPGA – Field Programmable Gate Array

GUI – Graphical User Interface

Hz - Hertz

INV - Invert

IRIG - Inter-Range Instrumentation Group

KB – Kilobyte

kHz - KiloHertz

LDPS – Lumistar Data Processing System

LED - Light Emitting Diode

LSB - Least Significant Bit

Mbps - Mega Bits Per Second

MHz - Mega Hertz

MSB - Most Significant Bit

OS - Operating System

PCM - Pulse Code Modulation

PRN – Pseduo Random Number

RF – Radio Frequency

SE - Single-Ended

SFID – Sub Frame Identification

TX – Transmit

URC - Unique Recycling Code

USB - Universal Serial Bus

1   Introduction

1.1   General

The following document contains design information on the Lumistar LS-11-M3 Portable multi-mode, RF Test Transmitter with PCM Simulator and PN Generation product manufactured by Lumistar Inc. The intent is to familiarize the user with the device's mechanical, electrical, and interconnection aspects as well as introduce and train the user in the operations of the supplied software control applications provided as part of the device delivery.

Consult the web site for the most recent release of all related product documentation.

1.2   Document Outline

This document contains the following sections:

- Section 1 provides a document overview as well as a brief on the LS-11-M3 design
- Section 2 provides information on the hardware interfaces of the device
- Section 3 Standalone User Operational Interface
- Section 4 Users Software Application Install and Operation

The document will occasionally utilize document flags to highlight important factors.   These flags can appear in any location and relate to any topic. A document flag will always be placed in close proximity to pertinent information. Document flag examples appear in Figure 1-1.

Warning:
(Critical Device Operational Information)

Caution:
(Cautionary Device Information)

Information:
(Emphasized Operational Information)
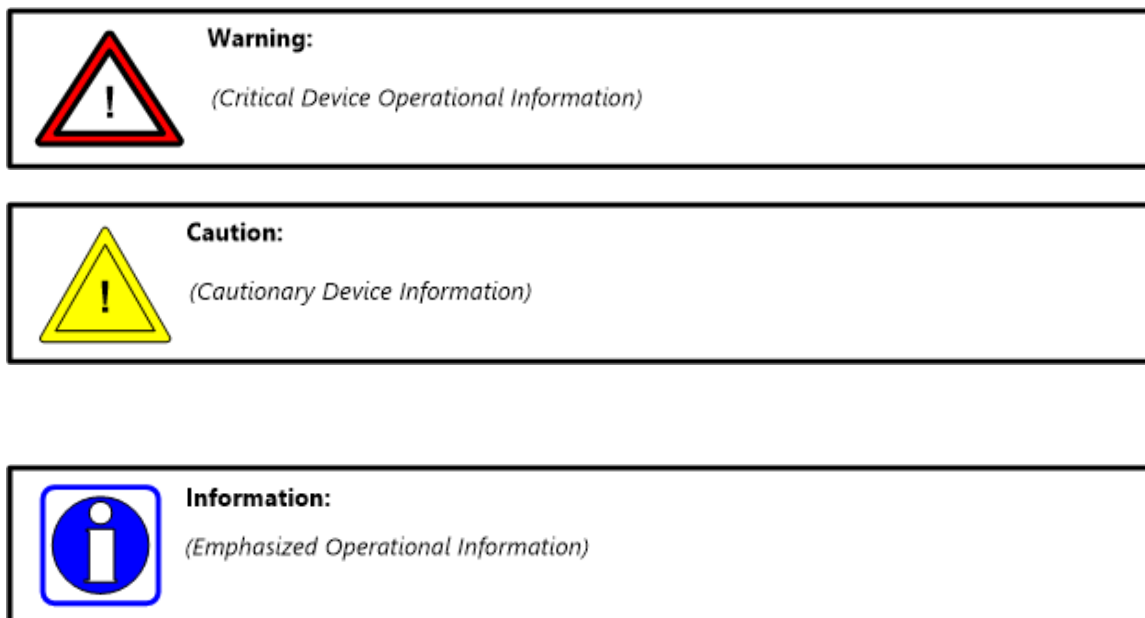
Figure 1-1 Document Flag Formats

1.3 Device Description

The LS-11-M3 is a sophisticated, portable, battery powered, multi-mode test transmitter with an on-board PCM data source. The on-board PCM source is cable of providing IRIG PCM frame formats as well and PRN patterns, with and without errors. The unit is also capable of accepting external clock and data sources for test modulation, by-passing the on-board PCM generation source.

The system includes a user software application which allows the user to configure PCM simulation frames, tune frequencies and other configuration data and then download the setups to the unit for use in a stand-alone mode. The unit is delivered in a portable case with a latching cover. The unit is shipped with an internal battery which will provide up to 8 hours of continuous operation per charge. The LS-11-M3 contains an internal intelligent battery charger to recharge the internal power source. A general LS-11-M3 block diagram is shown in Figure 1-2.
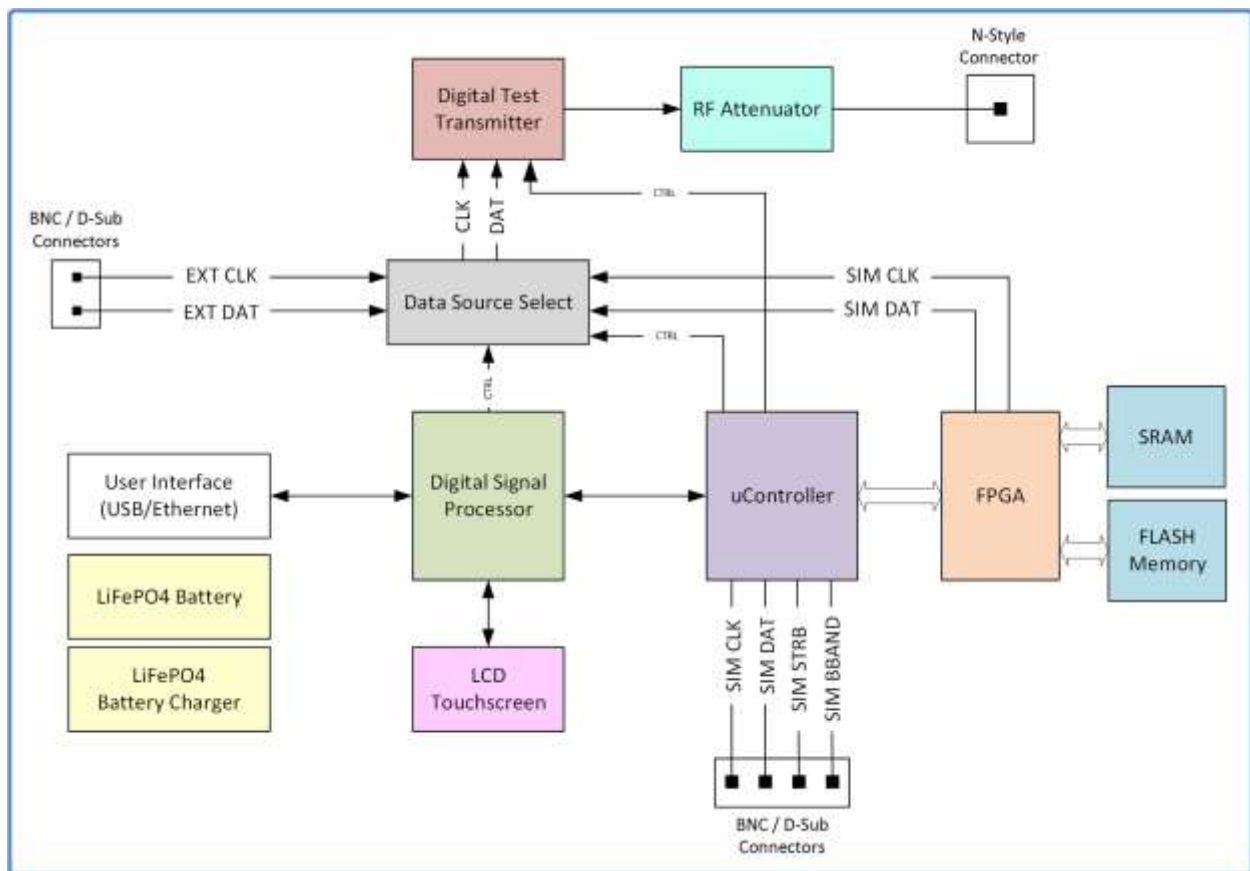
Figure 1-2 General Block Diagram of the LS-11-M3

The LS-11-M3 is interfaced in two different operational modes: the "connected mode" where user software is in control of the device, and the "standalone mode" where the customer utilizes the LCD multi-tab touchscreen control the device functions. In the "connected mode" user software is connected via USB 2.0 or 100Mbps Ethernet *(future)*.

Device specifications are listed in Table 1-1. Consult the factory for option ordering information.

| Category:	Specifications:	Details:
Mechanical	Envelope Dimensions	9.00"(L) x 6.00"(W) x 7.50" (H)
	Form Factor	Aluminum Enclosure with hinged, latched, cover
	Weight	~ 10lbs.
Electrical	AC Input Power requirements	90-240VAC; 50/60Hz; 1.5A Max.
	Total Power	~ 12 Watts (mode and data rate dependent)
	Battery	LiFePO$_4$ Type; ~8-hour operation per charge
	Battery Lifespan/Charge cycle life	Up to 8 years/2200+ Cycles to 80% Capacity
	Battery Self Discharge Rate	5% month
	Battery Discharge Depth	20% of capacity
Software Interface	User Software Interface	USB 2.0; 38.4K BAUD; 100Mbps Ethernet *(future)*
RF Band (Options)	Lower L-Band	1435.5-1534.5MHz
	Upper L-Band	1750.5-1855.5MHz
	S-Band	2200.5-2394.5MHz
	C1 Band	4400.5-4940.5MHz
	C2 Band	5091.5-5150.5MHz
	C2E Band	5091.5-5250.5MHz
	Custom	Other offerings available; Consult factory
	Number of RF Bands Per Unit	1 to 5
RF Output Power	Variable in 5dB steps	+5 to -70dBm typical; 80dB range; 16 steps
Modulation (Options)	PCMFM, SOQPSK-TG, MH-CPM	Other offerings available; Consult factory
Baseband Filters	8 Selections; Low-Pass Baseband Output Filtering Cutoff Frequency	500kHz, 1MHz, 2MHz, 4MHz, 6MHz, 8MHz, 10MHz, 15MHz
PCM Simulator	Stored Format Selections	Up to four
	Word Length	3 to 16 bits/word
	CRC/CCITT	CRC16 and CCITT
	Minor Frame Length	2-8192 Words/Minor Frame
	Major Frame Length	1 to 1024 minor frames
	Bit Order	MSB/LSB
	Frame Sync Pattern	7 to 32 bits
	Major Frame Sync	None, SFID
	Dynamic Words	Up to 5
	Unique Words	Up to 7
PN Pattern Generation	Four patterns	2^11-1, 2^15-1, 2^11-1 w/Error, 2^15-1 w/Error
Bit Rate Support	Tier 0 (PCMFM)	50kbps – 14Mbps
	Tier 1 (SOQPSK-TG)	100kbps-15Mbps SIM/PRN; 100kbps-28Mbps ext.
	Tier 2 (MH-CPM)	100kbps-15Mbps SIM/PRN; 100kbps-28Mbps ext.
	Internal Simulator/PN Generator	100-20Mbps
	External Bit Rate Limits	Consult factory for external data rate limits; Simulator/PRN limits are fixed as listed above.
PCM Formats	PCM Output Encoding	NRZ-L/M/S, BIO-L/M/S, DM-M/S, M^2, M^2-S, Inv BIO-L, Inv NRZ-L, RZ, Inverted RZ
Connectors	Single-Ended BNC Jacks	(6) SIM CLK, SIM DAT, EXT CLK, EXT DAT, SIM FSTRB, SIM BBAND
	HD-26 Female AUX IO	(1) MicroDSub-26; Female
	Power	(1) IEC320-C14
	RF Output	(1) N-Style - Female
Environmental	Temperature, Operational	-20 to 50 Celsius
	Temperature, Storage	-40 to 70 Celsius
	Humidity, non-condensing	<40C 0-90%, >40C 0-75%

Table 1-1 General Device Specifications Table

2   Hardware Interface

This document section will examine hardware design aspects including the physical outline of the device, and electrical interface standards involved with the user connections.

2.1 Mechanical Outline

The LS-11-M3, a portable device designed to be used in a standalone mode, is delivered in a portable aluminum chassis with a carry handle.   Figure 2-1 provides a mechanical outline diagram of the package. Figure 2-2 provides an enlarged view of the control panel of the LS-11-M3.

The enclosure cover can be removed if necessary. This can be achieved by removing the hinge pins with a small circular tool.
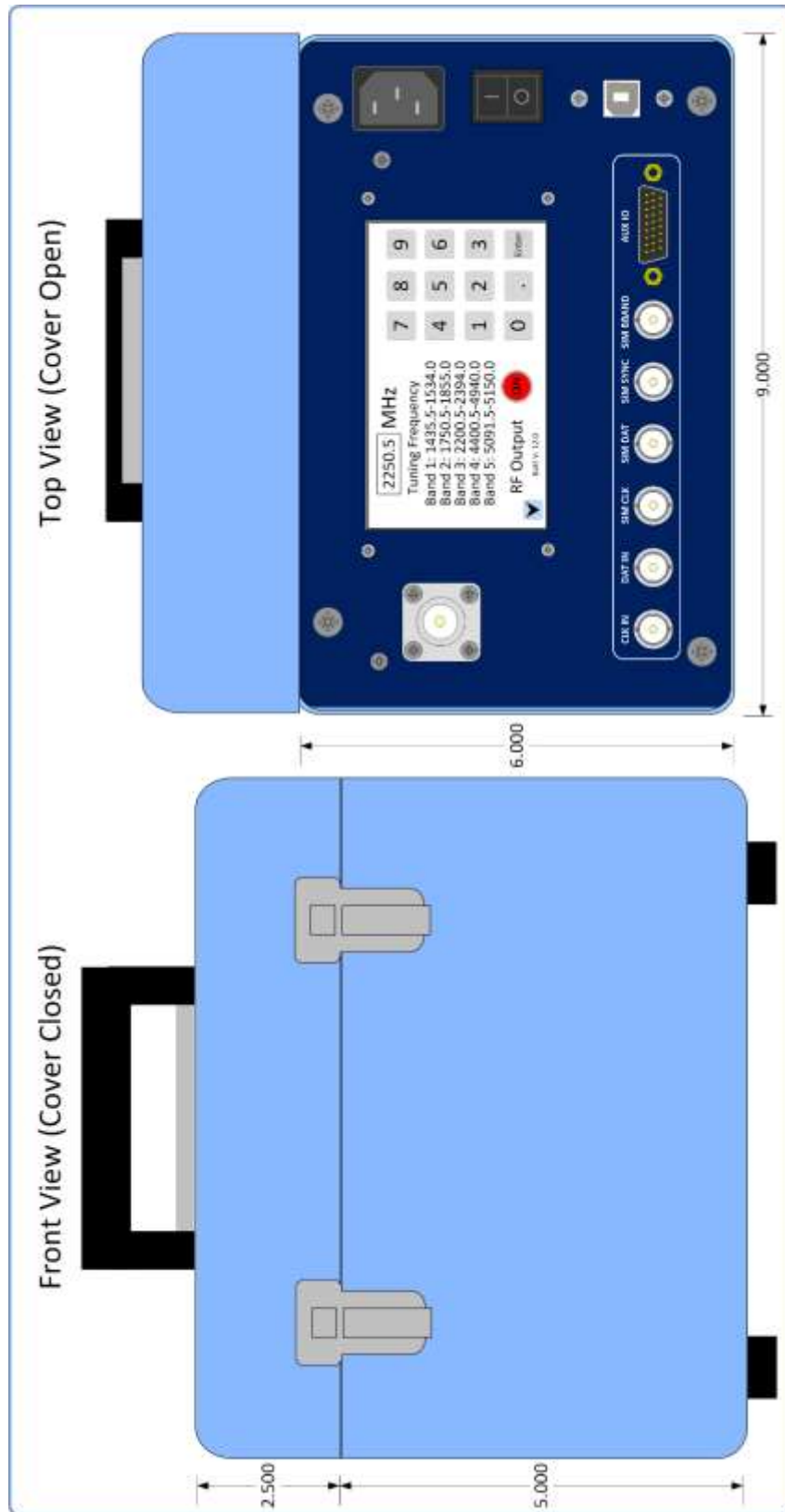
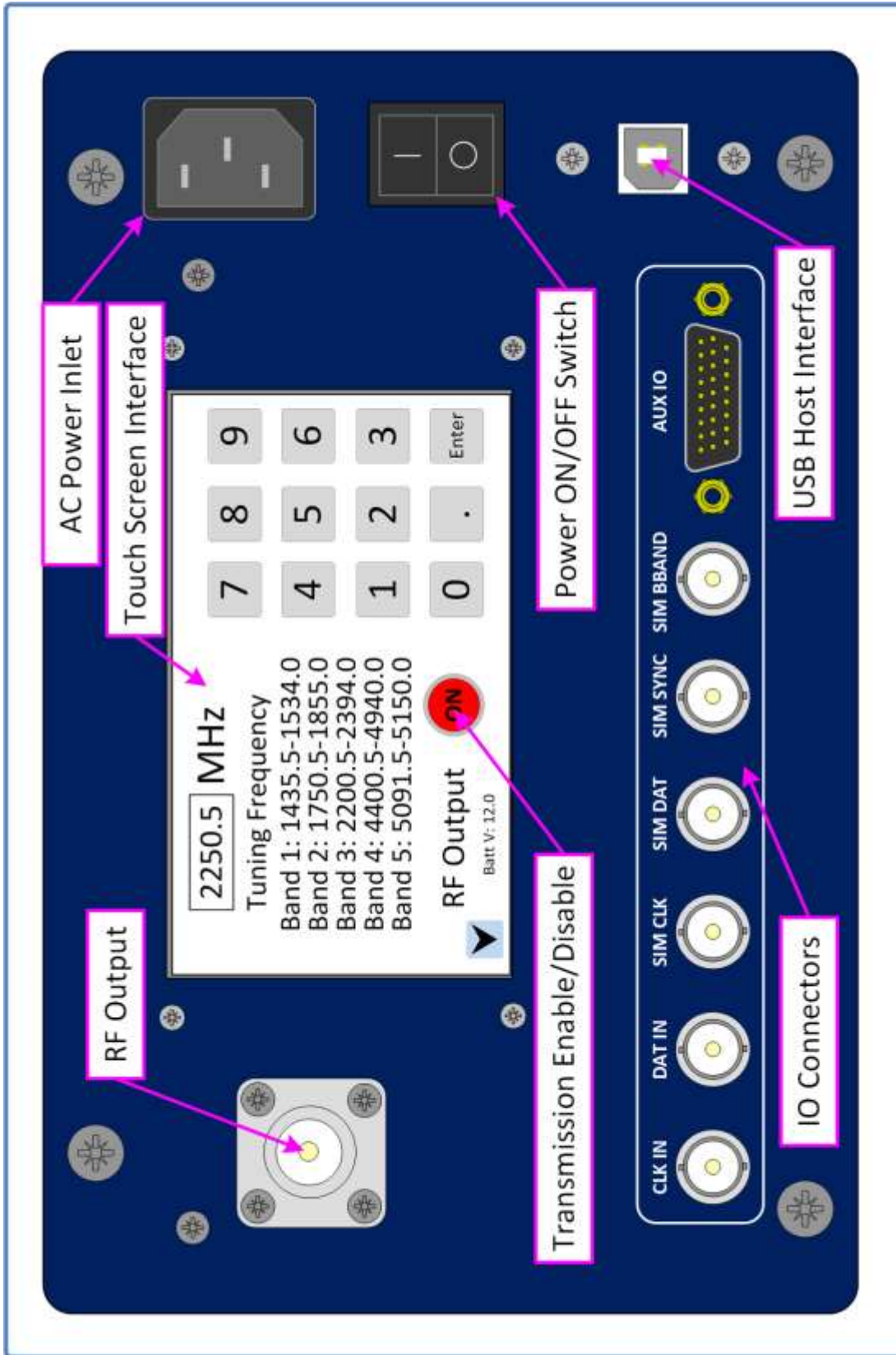**Figure 2-1** Mechanical Outline of the LS-11-M3 Assembly

Figure 2-2 Mechanical – Control. Panel

2.2 LS-11-M3 Interface Signals

Figure 2-2 presents a view of the LS-11-M3 control panel. BNC IO connectors contain two signal types: signal outputs from the on-board PCM simulator and direct external inputs to the internal RF modulator.

Simulator outputs include the following:

SIM CLK – The on-board PCM simulator and PN Pattern Generator clock signal. The signal is applied to the internal RF transmitter when using the PRN PATTEN and PCM FORMAT selections on the LCD Source Select Page or via the User Software application.

SIM DAT – The on-board PCM simulator and PN Pattern Generator data signal. The signal is applied to the internal RF transmitter when using the PRN PATTEN and PCM FORMAT selections on the LCD Source Select Page or via the User Software application.

SIM SYNC – The on-board PCM generator Frame and PRN Pattern generator sync pulse. This connector provides an indication of the start of the frame sync pattern when the on-board PCM generator is in the FORMAT mode and the start of a repeat of the PRN sequence in the event that the on-board PCM generator is in the PRN mode.

SIM BBAND - The on-board PCM generator provides Frame and PRN Pattern generation in a bipolar, filtered output. The PCM data is filtered through one of eight low-pass filters. The desired low-pass filter is selected in the User software application as well as via the MODULATION/FILTER LCD control page. This signal is sometimes used to stimulate the inputs to bit synchronizers or as a pre-modulation filter source for analog transmitters.

AUX IO – This is a 26-pin high-density D-Sub receptacle which primarily contains differential counterparts to the BNC panel IO signals. The pin-out of this connector is shown in Figure 2-3. Lumistar does not provide a cable assembly to attach to this connector as a standard delivery item do to the vast variations of differential connector styles and keying that can be required by the customer. Custom cable assemblies can be accommodated. Consult the factory for further details.
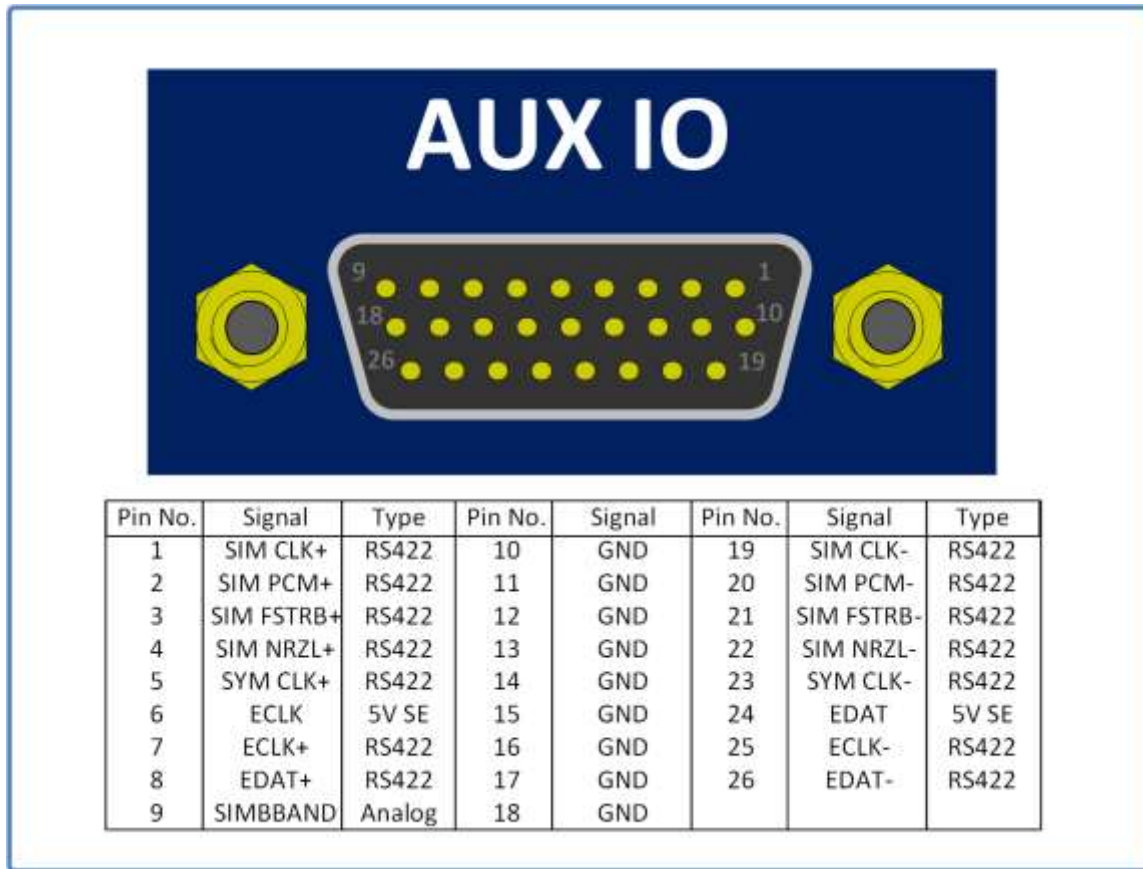
Figure 2-3 LS-11-M3 AUX IO Panel Pin-out

2.3 Interface Signals: Electrical Definitions/Characteristics

The interface signals of the LS-11-M3 vary in type and electrical characteristics. There are several different types of signals deployed as detailed in Table 2-1.

Signal Name	Interface Direction	Interface Type	Input Voltage Range	Output Voltage	Output Ω	See Note(s)
SIM CLK	O	Digital Logic		TTL		2, 10
SIM DAT	O	Digital Logic		TTL		2, 10
SIM SYNC	O	Digital Logic		TTL		2, 6, 10
SIM BBAND	O	Analog Video		~2Vp-p@HighZ	50Ω	1,4
CLK IN	I	Digital Logic	TTL			2
DAT IN	I	Digital Logic	TTL			2
SIM CLK +/-	O	Differential		RS422		2
SIM PCM +/-	O	Differential		RS422		2, 9
SIM FSTRB +/-	O	Differential		RS422		6
SIM NRZL +/-	O	Differential		RS422		2, 8
SYM CLK +/-	O	Differential		RS422		2, 7
ECLK +/-	I	Differential	RS422			3
EDAT +/-	I	Differential	RS422			3
ECLK	I	Digital Logic	TTL			2
EDAT	I	Digital Logic	TTL			2
SIM BBAND	O	Analog Video		~2Vp-p@HighZ	50Ω	1,4

Notes:

1.) Bipolar analog signal.

2.) TTL Logic Level

3.) Output Driver: AM26LS31. RS422 Compliant.

4.) Input Receiver: AM26LS32A. RS422 Compliant.

5.) SIM BBAND signal is shared between the HD26 pin and the BNC connector. Do not use both simultaneously.

6.) Sync pulse coincides with the signal leading edge. Pulse is 100nsec wide.

7.) Symbol clock may be half the rate of the data clock when PCM encoding is self-clocked.

8.) This signal is always NRZL is not routed through the PCM encoder.

9.) This signal is encoded per the selections made for output type.

10.) BNC outputs are not capable of driving 50 ohm loads with the exception of the SIM BBAND output.

Table 2-1 IO Signal Electrical Definitions

2.4 AC Power and Battery Power

The LS-11-M3 may be powered from AC power or battery power. In the event that AC power is available, use of the AC power will automatically be the primary source of power for the LS-11-M3 and the battery will be charged is needed. If the AC power is removed while the unit is operational, power will automatically switch to the battery in a seamless manner. In the event that the unit is powered down, and the AC power is connected, battery charging will continue until the battery charge cycle is complete.

The internal battery is a 12V/10AH Lithium Ferrous (Iron) Phosphate (LiFePO$_4$) design. There are a wide variety of battery technologies available which could be utilized in the design of the LS-11-M3 design. Previous generations of this product line have contained Seal-Lead Acid (SLA) batteries. However, the LiFePO$_4$ battery technology offers many advantages over the SLA technology.   Table 2-2 provides a comparison of SLA batteries to the LiFePO$_4$.

Characteristic	SLA Battery	LiFePO$_4$ Battery
Battery weight	5.52lbs	2.75lbs
Battery Capacity	7.2AH	10AH
Discharge time at typical load	7.3 hours	10.2 hours
Self-Discharge at 30 days	Up to 30%	2%
Maximum Current (Sustained for 1 hour)	5A	20A
Charge Cycle Lifespan	200	2200+
Discharge Floor (capacity)	40%	20%
Safe charge time from 50% discharge (charger dependencies)	20 hours	4 hours
Operating Temperature Range	-20 to 50C	-30 to 50 C
Charge Temperature Range	-15 to 60C	0-60C

Table 2-2 SLA versus LiFePO$_4$ Battery Comparisons

LiFePO$_4$ batteries contain Lithium ions for power transfer and thus have a very high discharge and storage capacity.   These traits can be dangerous, and even explosive in certain circumstances. However, the construction of LiFePO$_4$ batteries is very different than that of other Lithium batteries in that the molecular structure of the cathode material in the battery making the structure very stable versus LiCoO$_2$ batteries usually associated with Lithium battery fires and explosions. LiFePO$_4$ batteries are considered to be very safe and somewhat "explosion proof".

This internal battery charger is an "intelligent" design which is suited for the LiFePO$_4$ battery enclosed. The charger is specifically designed for the battery chemistry and prevents overcharging and proper charging cycle rates.

The internal battery can be replaced in the field if required. The replacement battery should only be a LiFePO$_4$ battery to maintain compliance with the internal charger. To utilize the existing connectors, the replacement battery should contain F2 terminals for termination.

2.5 Thermal Considerations

The LS-11-M3 contains a digital RF test transmitter which is mounted to a large heat-sink mass that runs the length of the rear wall of the enclosure. During normal operations, this thermal mass should be

sufficient to dissipate heat from the test transmitter. If the unit is being utilized in very high temperature environments at very high data rates, continuous operation may result in transmitter overheating. This will typically result in erratic behavior and a stalled LCD user interface. If this is observed, discontinue use for up to half an hour allowing the transmitter time to cool.

3   LCD Interface

The LS-11-M3 design contains a stand-alone touch-screen LCD control interface. This interface contains six display pages: a power-up logo page, a home page, a modulation/baseband filter page, a source select page, a PCM control page, and an attenuator control page. All but the power-up page offer touch-screen interaction for the user.

3.1 LCD Interface Pages

At system power-up, the page shown in Figure 3-1 will appear for approximately 4 seconds. This operation continues while processors are booting up and data is being retrieved from on-board storage.

Figure 3-1 LCD Interface – Power Up Logo Page

Once the power-up cycle completes, the page 1 HOME page shown in Figure 3-2 will be presented. This page is the primary control and status page for the stand-alone operation of the unit. Lower level menus offer a quick "return" key to get back to this primary page.

Controls include:

Control Keypad – this number entry pad is used to program the RF tune frequency.

ON/OFF Button – this button controls the RF transmission of the unit. When OFF, no RF transmission power will be observed from the RF N-style panel connector. When ON, the button will be illuminated red which indicates that the RF transmission will be output at the power directed by the attenuator settings on the ATTENUATOR CTRL page.

> **Information:**
> The LS-11-M will never power up with RF transmissions automatically enabled. This helps to eliminate unwanted or unexpected RF transmissions. The user must enable RF transmissions manually.

Page Scroll Button – this button allows access to the lower level control and status pages.

Status Includes:

RF Tune Frequency – this status provides the present RF tune frequency.

Installed RF Bands – this list provides the user information on the tune frequencies allowed by the test transmitter. Tune frequencies outside these ranges will be ignored.

Battery Voltage – this status provides the user with a gauge of the internal battery charge state.
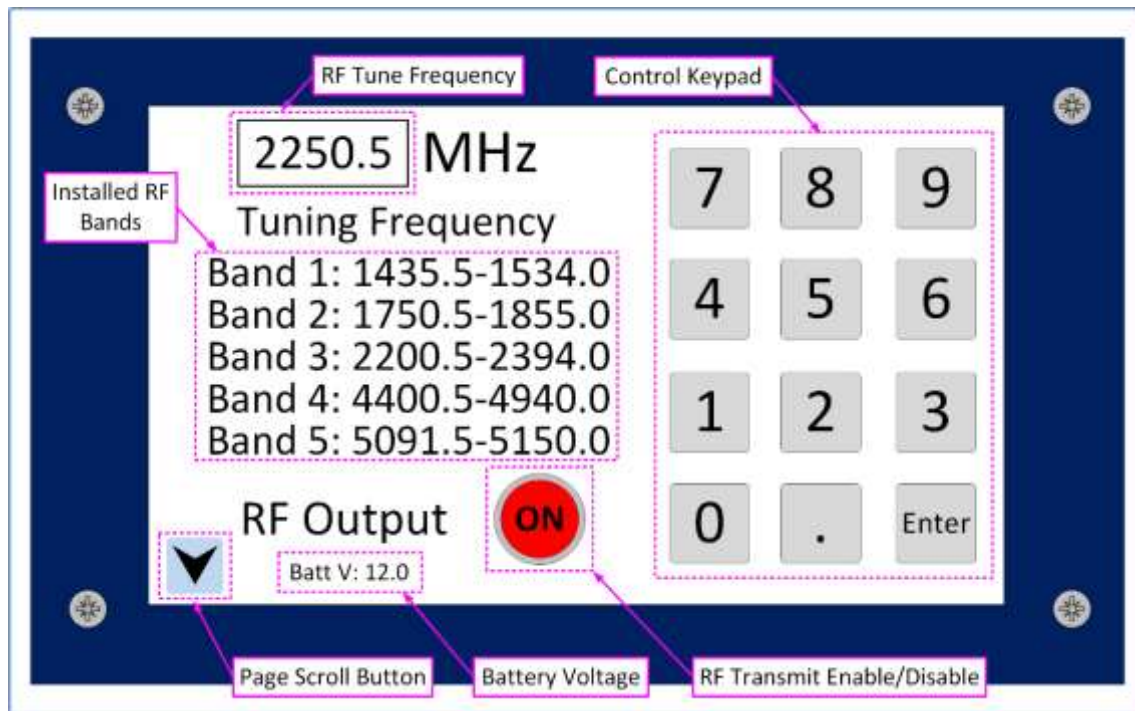

Figure 3-2 LCD Interface Page 1 – HOME Page

Page 2 of the LCD control and status interface contains controls for the test transmission modulation type and the selection of the PCM baseband output low-pass filtering. This page is shown in Figure 3-3.

Controls include:

Modulation Selection – these buttons allow selection of the various modulation capabilities of the RF test transmitter installed. The highlighted button represents the presently enabled modulation mode.

Baseband Filter Selection – the on-board PCM generator data is provided for external use as a bipolar analog filtered signal via a panel BNC connection (consult section 2.2 for details). Low-pass cutoff filtering the is selected by these buttons. The selection of these filters ONLY effects the baseband PCM output frequency response and has no effect on the modulated RF signal.

> **Information:**
>
> Baseband output low-pass filter settings have no effect on the modulated RF signal.

Page Scroll Buttons – these buttons allow access to the lower and upper control and status pages.

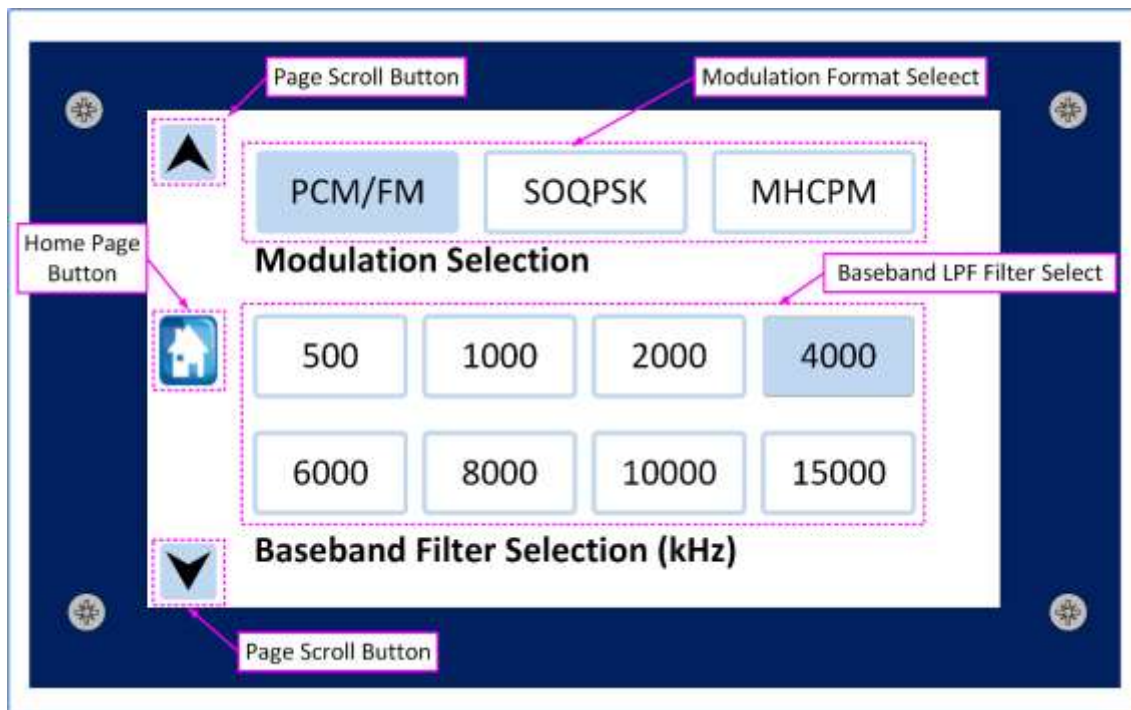**HOME Button** – this button returns directly to the HOME page.

Figure 3-3 LCD Interface Page 2 – Modulation/Baseband Filter Page

Page 3 of the LCD control and status interface contains source controls for the test transmitter. Sources controls are one of three types: external data inputs, the on-board PCM PRN generator, and the on-board PCM Simulator Frame data. Figure 3-2 shows the PCM Format page. Figure 3-5 shows the PRN Source page. Figure 3-6 shows the External Source Select page. All source selection changes will halt the RF transmission so that no inadvertent emissions are transmitted. The user will have to initialize the transmissions from the HOME page to start RF transmission.

> **Information:**
> All changes to source selection changes will result in the disabling of the RF transmission. The user will have to return to the HOME tab to reestablish transmission.

Controls include:

PCM Format – this is one of four source control buttons. Once selected, the screen in Figure 3-4 will be initiated with the PCM Format button highlighted. The stored named PCM formats will appear in the lower half of the screen. Users can select the stored format desired and the RF tune frequency, data rate and PCM format will be initiated accordingly. Any changes made on this page will result in the RF transmission being halted.

PRN Pattern – this is one of four source control buttons. Once selected, the screen in Figure 3-5 will be initiated with the PRN Pattern button highlighted. The available PRN formats will appear in the lower half of the screen. Two pattern selections are provided as well as the same two with a single bit error injected in each pattern sequence. Any changes made on this page will result in the RF transmission being halted.

External SE/External Diff – this is one of four source control buttons. Once selected, the screen in Figure 3-6 will be initiated and the associated External source button will be highlighted. External single-ended signals will come from the EXT CLK and EXT DAT BNC on the faceplate and be routed directly to the internal test transmitter. External differential signals will be routed to the internal transmitter from the AUX IO connector. Consult Figure 2-2 and Figure 2-3 for connection assignments.

Page Scroll Buttons – these buttons allow access to the lower and upper control and status pages.

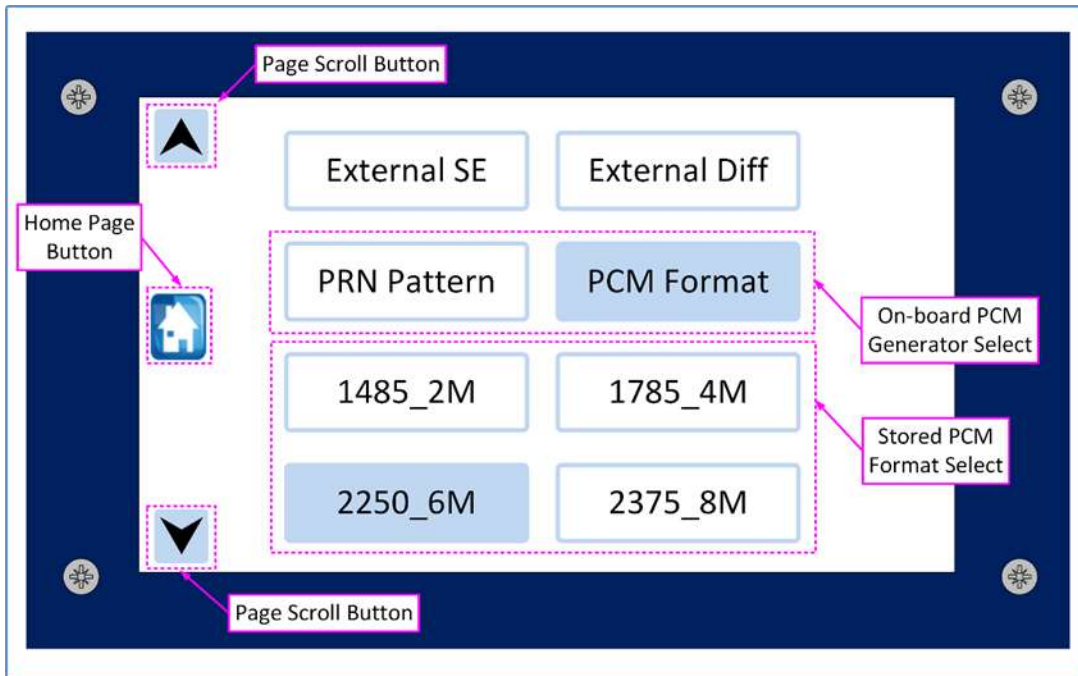**HOME Button** – this button returns directly to the HOME page.

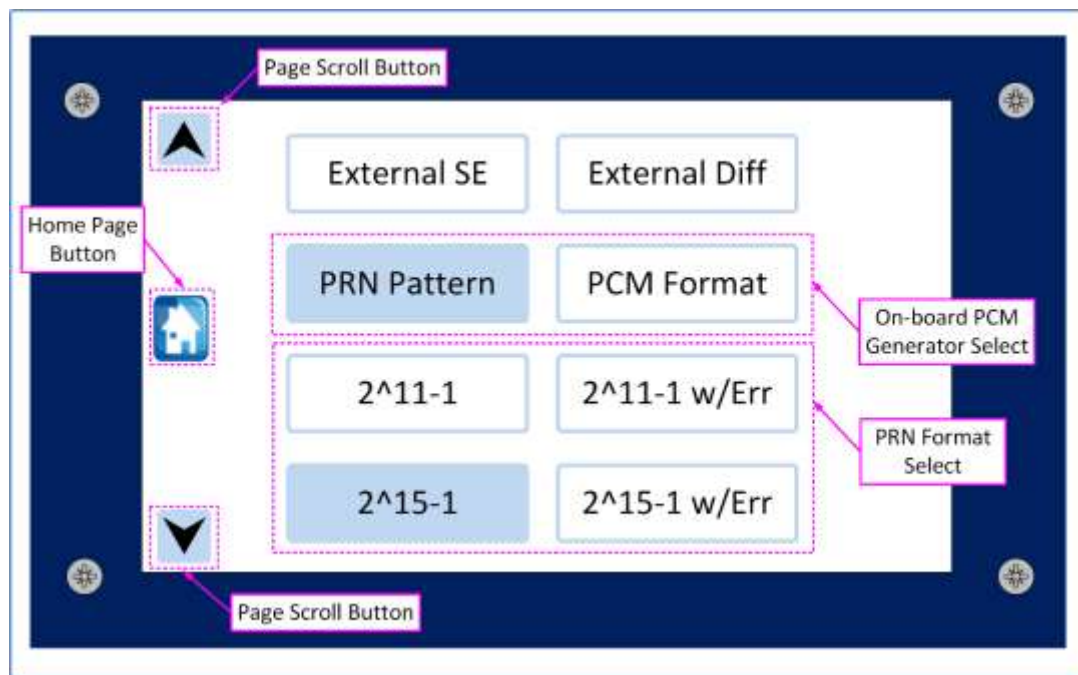**Figure 3-4** LCD Interface Page 3 – Source Select Page: PCM Format

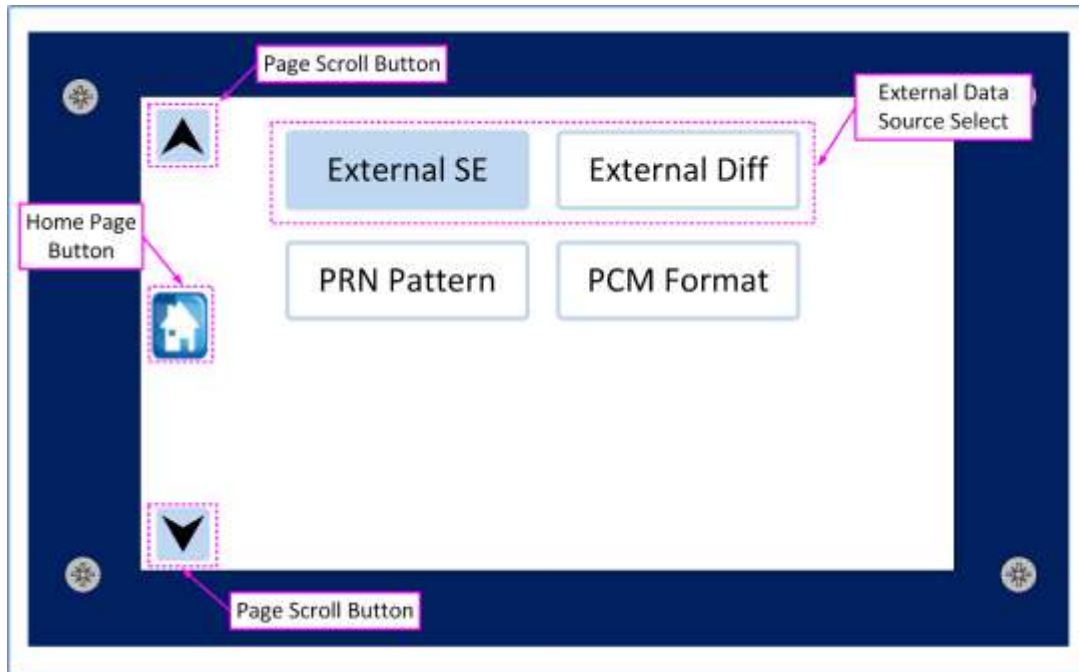**Figure 3-5** LCD Interface Page 3 – Source Select Page: PRN Pattern

Figure 3-6 LCD Interface Page 3 **–** Source Select Page: External Source Select

Page 4 of the LCD control and status interface contains source controls and status PCM generation. Figure 3-7 illustrates the PCM Control page.

Controls include:

Control Keypad – this number entry pad is used to program the PCM bit rate of the on-board Simulator or PRN generator. This keypad will have no impact if the external source inputs are being utilized.

PCM Encoder Scroll Buttons – these arrow buttons allow the user to change the PCM output encoder format. This will change the SIM BBAND output, the SIM CLK and SIM DATA outputs, and the internally generated PCM source of data to the internal RF transmitter.   These selections will have no impact if the external inputs are being utilized.

Page Scroll Buttons – these buttons allow access to the lower and upper control and status pages.

HOME Button – this button returns directly to the HOME page.

Status Includes:

PCM Bit Rate – this status provides the rate of the internally generated clock and data sources.

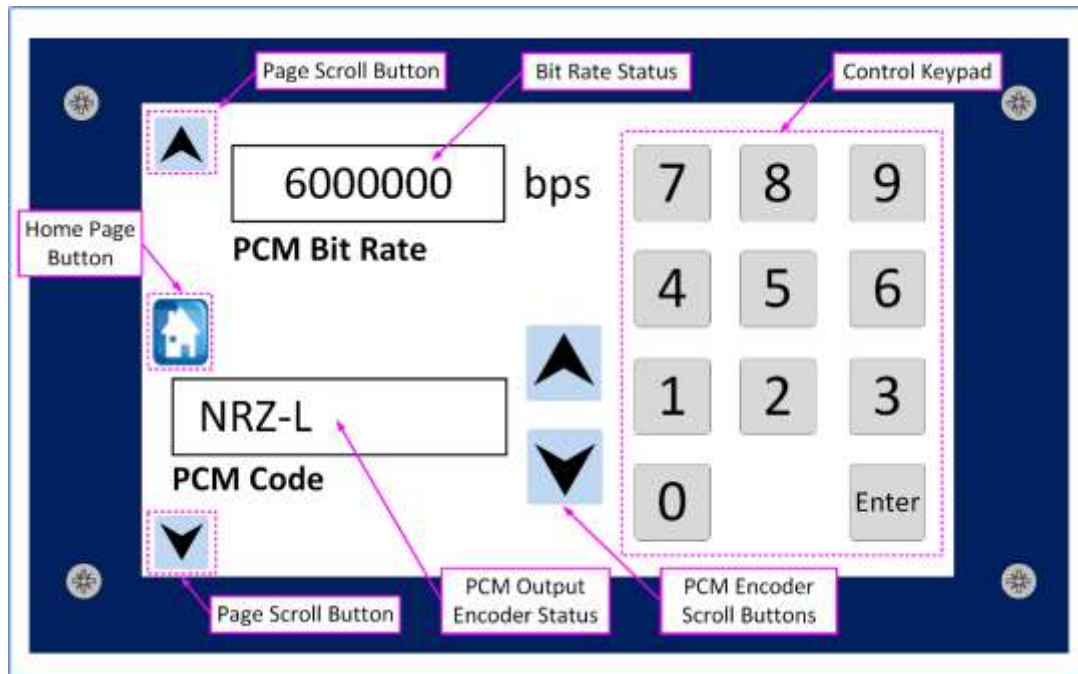**PCM Code** – this status of the PCM encoder setting for the internally generated PCM data.

Figure 3-7 LCD Interface Page 4 – PCM Control Page

Caution:

The simulator bit rate settings can exceed the limitations of the internal transmitter to provide modulated RF signals. Simulator settings outside these ranges will still be provided to IO connections at the panel.

Page 5 of the LCD control and status interface contains source controls and status for the RF Attenuation. Figure 3-8 illustrates the Attenuator Control page.

Controls include:

Attenuator Scroll Buttons – these arrow buttons allow the user to change the RF output power level in 5dB steps. These selections are functional regardless of data source selection to the internal RF transmitter.

Page Scroll Button – this button allows access to upper control and status pages.

HOME Button – this button returns directly to the HOME page.

Status Includes:

Output Power Level – this status provides the approximate power level of the RF output.

DSP Firmware Version – this status provides maintenance information on the internal DSP firmware version.

Controller Firmware Version – this status provides maintenance information on the internal PCM Simulator and associated Controller.

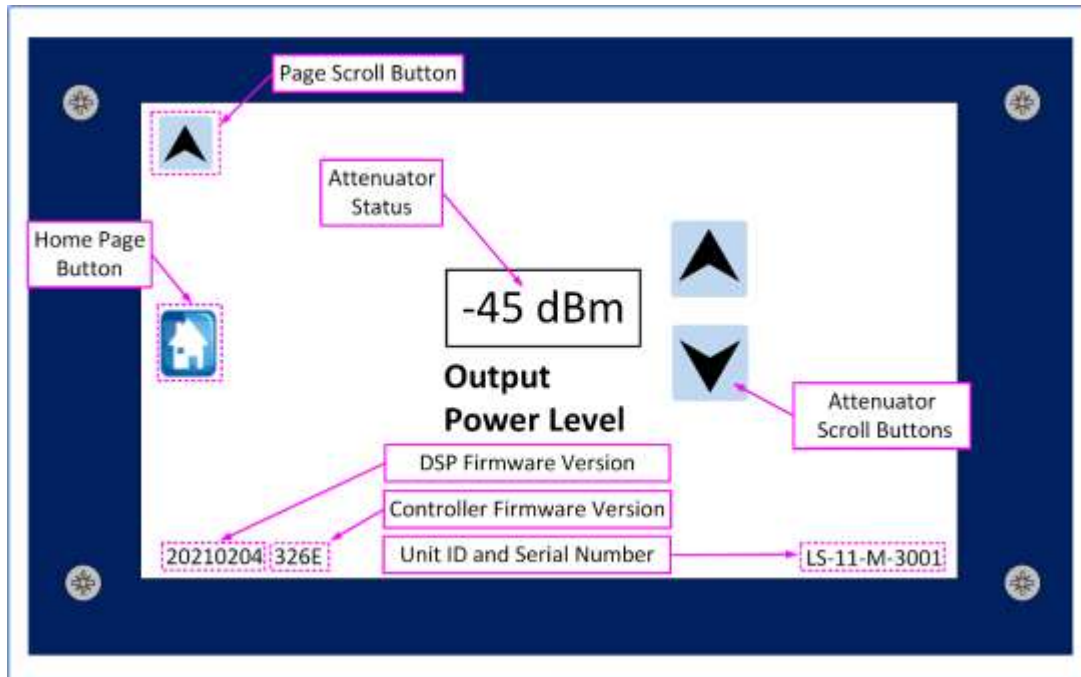**Unit ID and Serial Number** – this status provides unit model number and serial number information to the user.

Figure 3-8 LCD Interface Page 5 **–** Attenuator Control Page

3.2 Programmable Parameters in Standalone Mode

The LS-11-M3 design allows for certain parameters to be altered in the standalone operational mode. Basic simulation formats, frame sync patterns, dynamic word assignments, and frame data words are really the only thing that cannot be directly controlled during field operations. Although stored formats will contain a full set of operational parameters, the user has the flexibility to actively change any or all of the following parameters:

- RF Tune Frequency including RF Band
- RF Modulation Type
- Baseband output filter settings
- PCM Data source
- PCM data rates
- PCM encoder settings
- RF Output Level

4   User Application Software Operation

The LS-11-M3 delivery includes a User Software Setup application that will run in any version of the Microsoft Windows Operating System (OS). This software installation is provided at the time of delivery via CD disk or may be downloaded from our website.

4.1   Software installation

The software may be installed by executing the *Setup_LS11M2_215.exe* installation (or the latest version). It is preferable to install and run this application using administrative privileges.

Once the application is installed, there have been demonstrated circumstances where the execution, file loading, and file saving are exceptionally slow. The cause of this sluggish behavior is typically the host computers Malware protections. The Malware software will sometimes incorrectly interpret file retrieval and storage attempts as malware activity. To resolve this issue, select the Security Settings of the Windows host machine and create a Windows Defender "exception" for the entire install directory of the LS-11-M3 application folder. It may be necessary to add these types of "exceptions" when additional anti-virus/malware applications are being used.

4.2   Software Application – Main Menu

The main operational page appears in Figure 4-1. This page contains a main menu bar the contains the following controls:
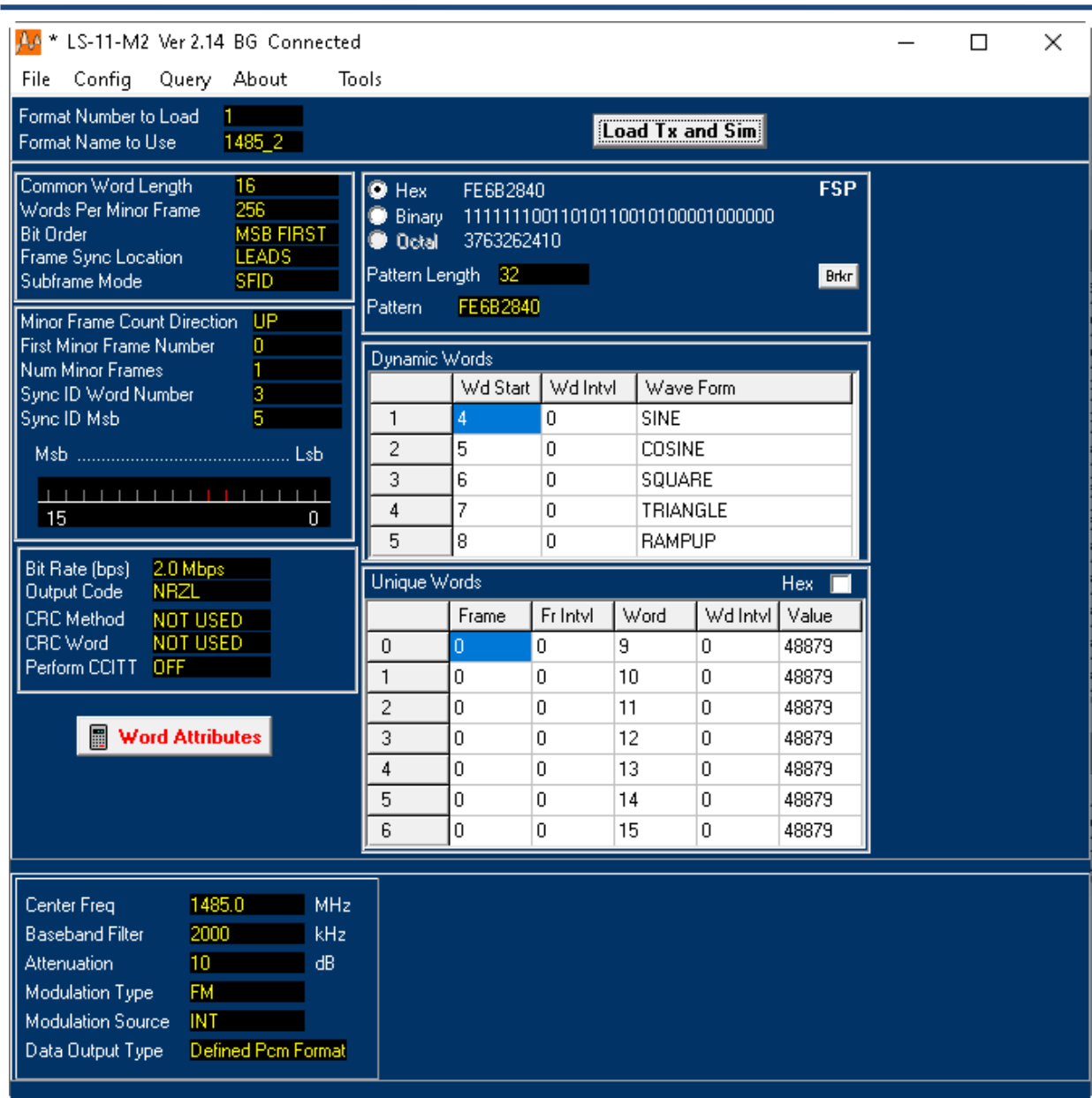
Figure 4-1 Software Application – Main Control Window

File – This menu selection allows for saving and recalling setup files created by the user. It also has an "Import Decom Setup" file browser that allows for frame setups that have been configured via the Lumistar LDPS_8x and LDPS_10x application to ease the configuring of frame setups being downloaded to the LS-11-M3. The default file extensions for import are .SCS files which are related to the LDPS_10x application setup files. If you are presenting using LDPS_8x, the .B50 setup files will need to be converted to the .SCS files. See the "Tools" menu option below for further information.

Config – This menu selection provides for the setup of the communications channel to the LS-11-M3 device. This interface setup must be performed to properly communicate with the unit visa the user application.

Communications is done via the PC COM ports. There is a driver for the USB Prolific device inside the device that is included on the software install CD in the "Utilities" subfolder. If the target host is running Windows 10 and is being updated on a regular schedule, it may not be necessary to load this driver. However, if the Windows Device Manager does not list a COM port that is a Prolific device, it will be necessary to load the drivers provided.

Once the Windows Device manager lists a Prolific COM port, enter that port number, and setup parameters in the COM setup window as shown in Figure 4-2.
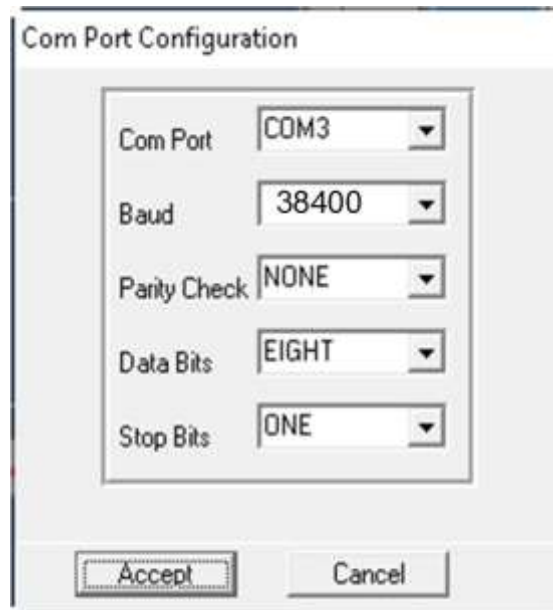
Figure 4-2 Software Application – COM Setup Window

Query – This selection queries the setup of the internal test transmitter. Results will list various parameters and setting states. A sample Query results window in shown in Figure 4-3.

Figure 4-3 Software Application – Sample Query Results

About – This menu select initiates a standalone window that lists the version information of the software application.   See Figure 4-4 for an example.
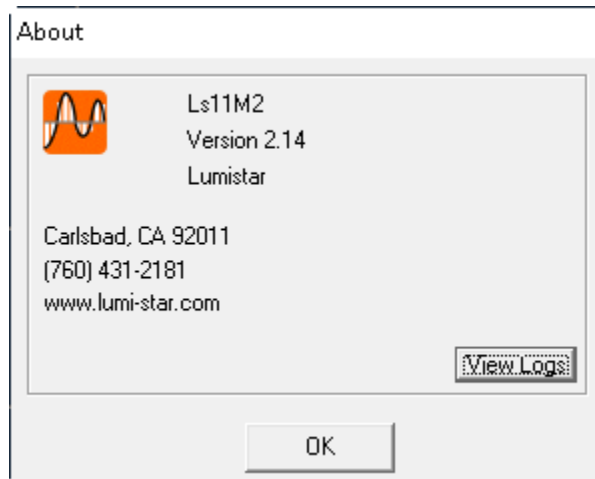

Figure 4-4 Software Application – Example of About Window

Tools – This menu item provides a direct link to the .B50 to .SCS conversion utility described in the "File" menu import discussions above. Refer to the documentation in the installed "Tools" directory for operations of the conversion utility.

4.3 Software Application – Main Control Page

The main purpose of the user application is the setup of various PCM frame simulation downloads. Refer to Figure 4-5 for the purposes of this section:
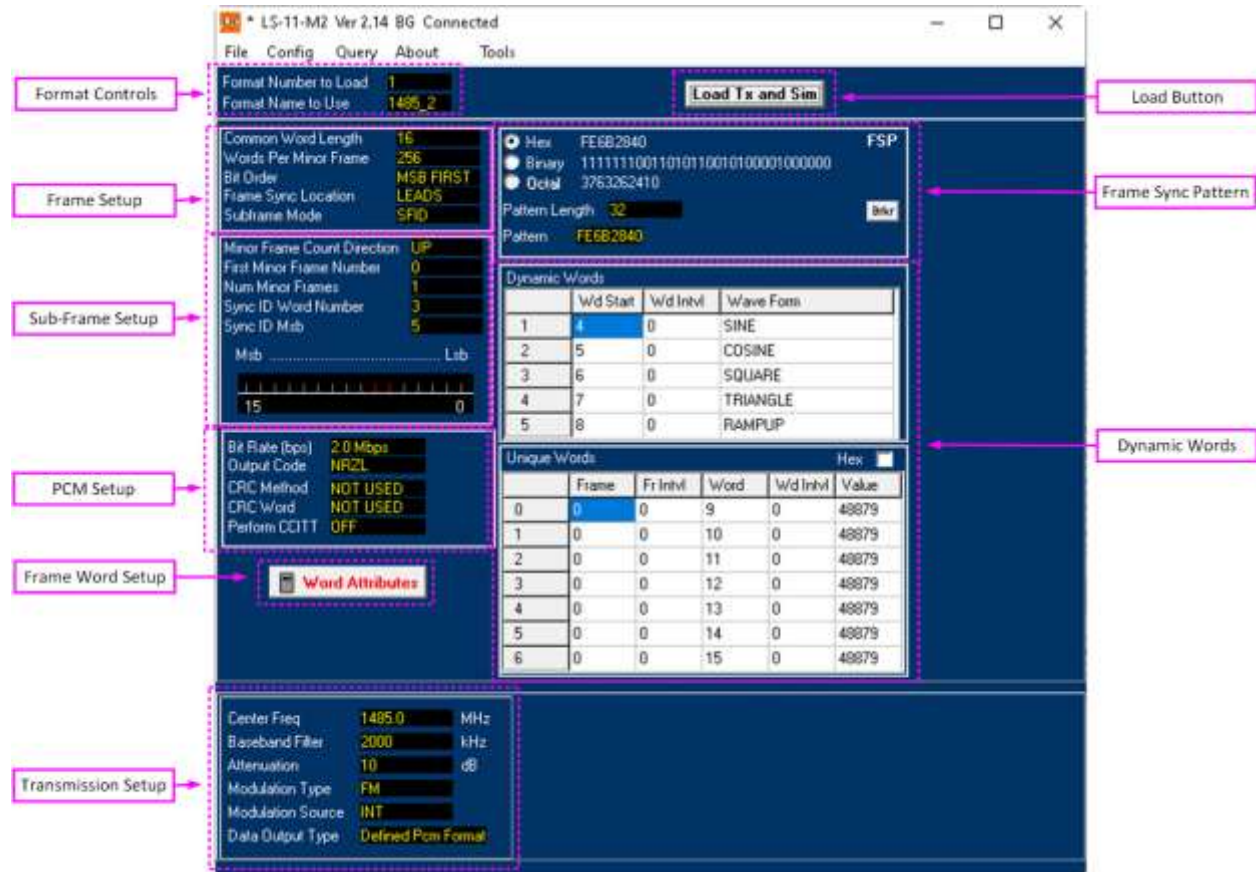

Figure 4-5 Software Application – Main Application Sections

Format Controls – Up to four PCM frame formats can be stored within the LS-11-M3 and recalled in standalone mode. These formats can be named as desired by the user for easy recall. Limitations in the download names is eight characters.

Frame Setup – Frame setup is very similar to the formats use in the Lumistar LDPS_8x and LDPS_10x software. IRIG-106 frame parameters such as word length, words per minor frame, transmission bit order, frame sync location and subframe mode selections are made in this control box.

Subframe Setup – If the simulated frame contains sub-frames, this control box allows for the minor frame count direction, first minor frame number assignment, minor frame count, the subframe sync word number and the MSB of the subframe sync word.

PCM Setup – To set the PCM encoded format style and bit rate, as well as engaging Cyclical Redundancy Codes such as CRC-16 or CCITT formats, use the controls provided by this box.

Frame Word Setup – To set the values of individual words within a frame, select this button. A window similar to the one in Figure 4-6 will be initiated.   Word values and lengths can be set in this window. Controls are provided to make the settings sequential, random, or the same to assist in value setup.
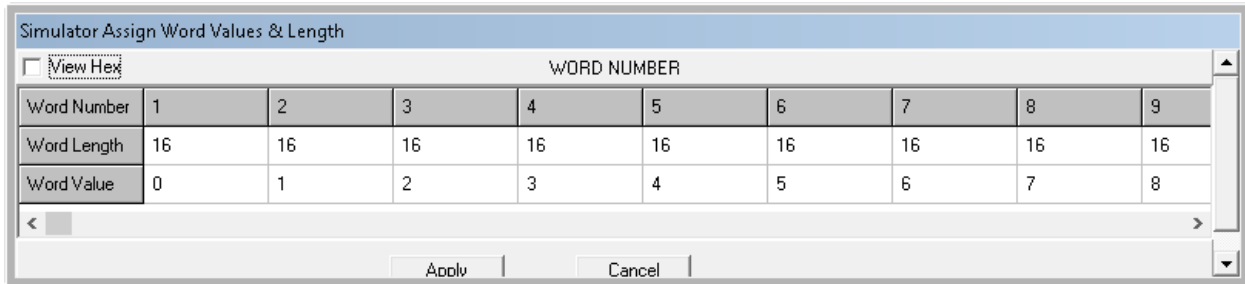

Figure 4-6 Software Application – Simulator Word Attributes Control

Transmission Setup – This control box provides for all settings associated with the RF transmission. This includes the tune frequency, the output power level, the modulation type, the modulation source, and the data type.

Frame Sync Pattern – The desired frame sync pattern (up to 32 bits) can be set in this control window. This control box includes a button to display the proper IRIG-106 specified Barker code of all Frame Sync Pattern lengths between 7 and 32 bits in length.

Dynamic Words – The user may want to have up to five of the simulator words create recognizable patterns in data like those of sine waves, ramps, triangle waves, etc. Controls within this box allow for these words to be initiated and positioned within the frame. Controls are also included to make up to 7 unique words within a simulation frame.

Load Button – Once settings are changed in any of the control boxes on the main application page, red flags will indicate that changes have been made and therefore need to be loaded. After all changes are complete, depress the load button. Upon selection, downloading of the transmitter data will begin followed by the download of the PCM format data. Once all of the data is download, the data will be transferred to internal FLASH memory.