MDX420
Input Level

Field Calibration Procedure

AN227
Rev. 1.0

<table>
<tr><td colspan="3">

MDX420 Input Level
Field Calibration Procedure
AN227 - Record of Revisions

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Revision Level	Date	Reason for Change
1.0	04-01-2008	Initial Release

Revision Approval

Revision Level	Engineering Approval Printed Name, Date, and Signature	Production Approval Printed Name, Date, and Signature
1.0		

MDX420 Input Level
Field Calibration Procedure

1.0   Introduction

The purpose of this document is to provide the instructions for calibration of the input level on the MDX420 SkyWire Gateway.

2.0   Required Items

1.   MDX420 Gateway
2.   AN220 MDX420 Firmware Upgrade Procedure
3.   TM131 MDX420 SkyWire Satellite Network Gateway Installation and Operation Manual
4.   L-Band variable attenuator (1 dB step preferred 10 dB minimum required)
5.   50-75Ohm conversion transformer
5.   Computer
6.   RS232 cable

3.0   MDX420 SkyWire Input Level

The MDX420 SkyWire gateway has an input level that scales with the symbol rate of the demodulator using the formula: Level (dBm) = $10*\text{Log}_{10}$(Symbol Rate) – 122 dBm $\pm$ 12 dB
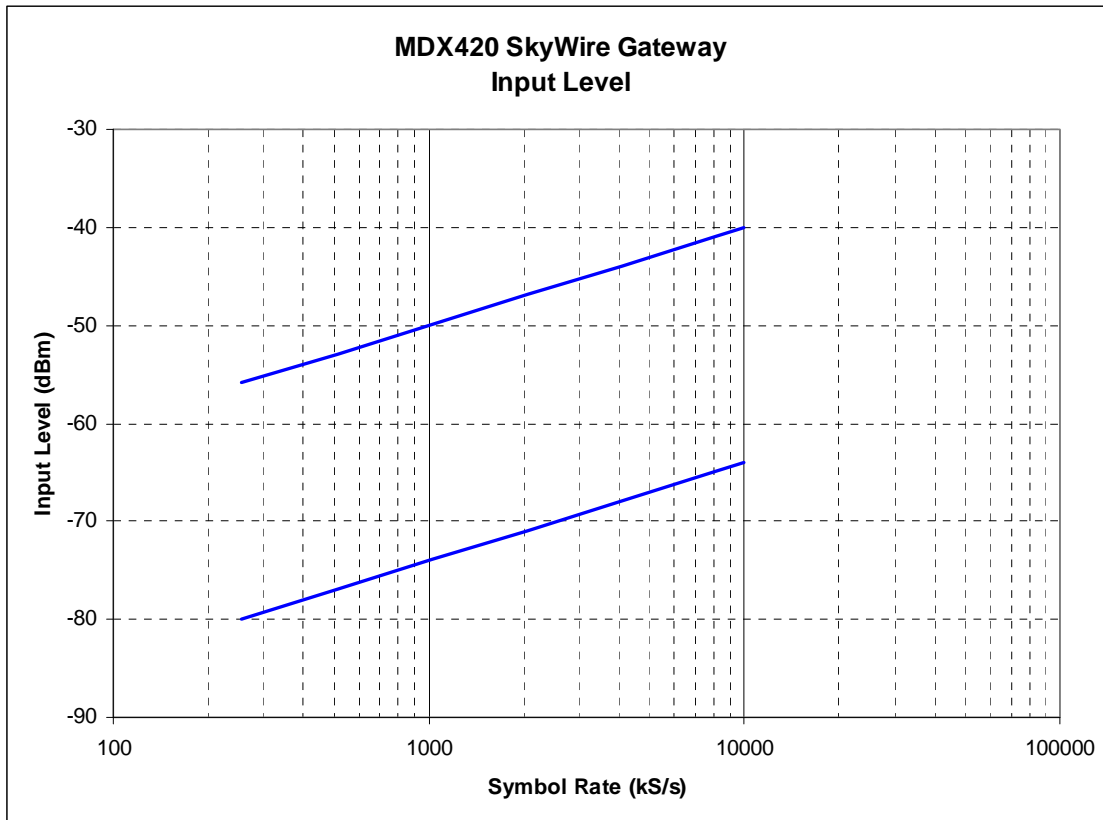
Figure 1 - MDX420 SkyWire Input Level Range

4.0   Procedure (Input Level Calibration)

4.1   Initial Setup

1.   Cable the MDX420 Gateway per Figure 2.

> A.   From the N-type TX-IF (J9) of the source unit through a variable step attenuator
> B.   From the variable step attenuator to F-Type RX-IF via 50-75 Ohm transformer (J8) of the unit to be calibrated
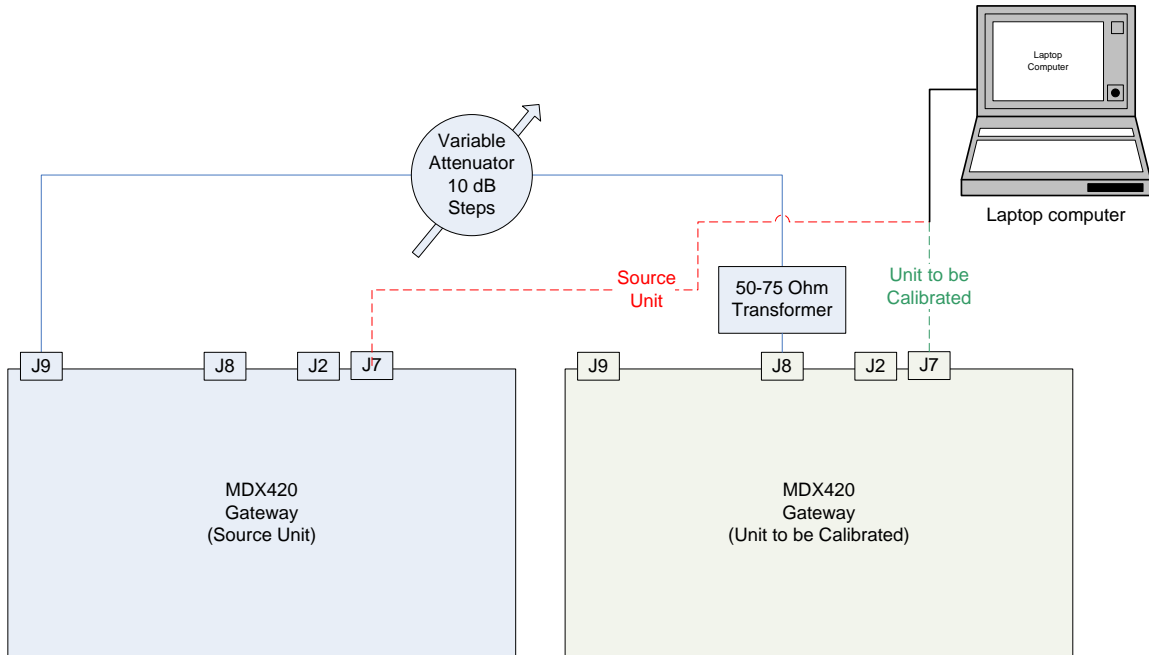
Figure 2 - MDX420 Input Level Calibration Setup

2.   Connect a computer to the DB9 service port (J7) of the source MDX420 Gateway using an RS232 cable.

> ### NOTE
>
> *This cable will be moved between the source unit and the unit being calibrated. See TM131 section 4.4.3 for instructions on connecting the dumb terminal to the MDX420 gateway service port.*

3.   Upgrade the MDX420 Skywire Gateway firmware to F05804-C or higher, see AN220 MDX420 Firmware Upgrade Procedure for instructions on upgrading the Gateway firmware.

4.   Power on the MDX420 Gateways.

4.2   Source Unit (Modulator Setup)

1.   Log into the MDX420 Gateway and set the source unit for the following output, see Figure 3 through Figure 9.
a.   Frequency (per Table 1)
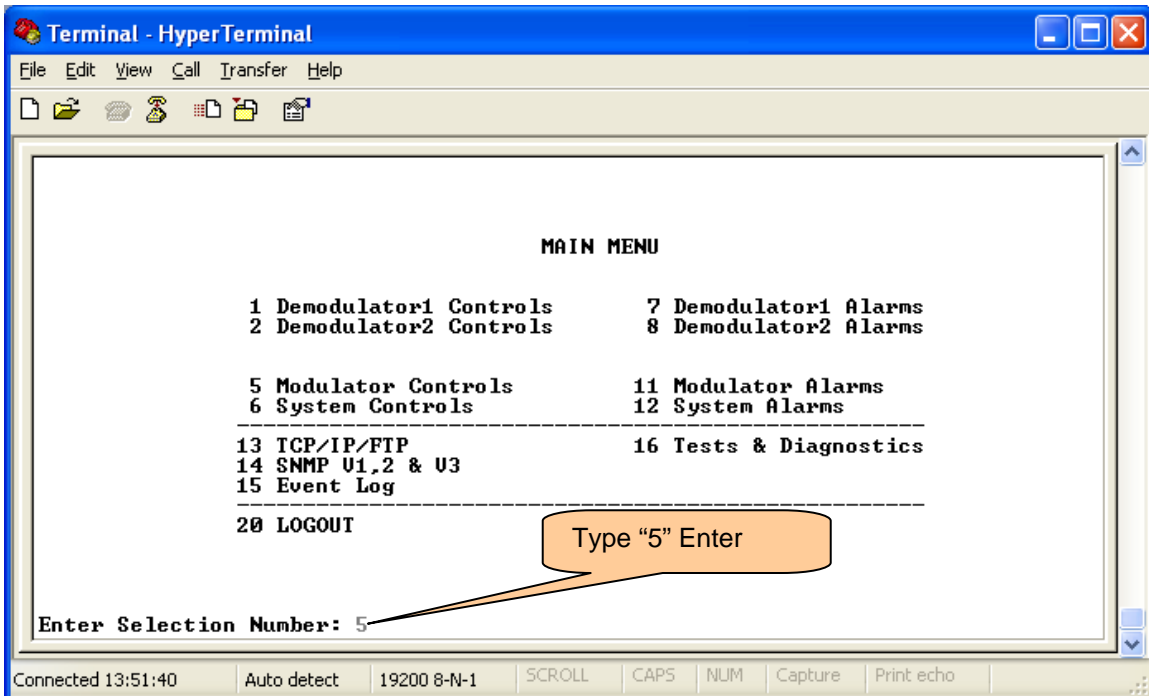   b.   Data Rate to 1000000 bits per second
      c.   Code Rate to TPC 0.793

Figure 3 – "5" MDX420 Modulator Controls
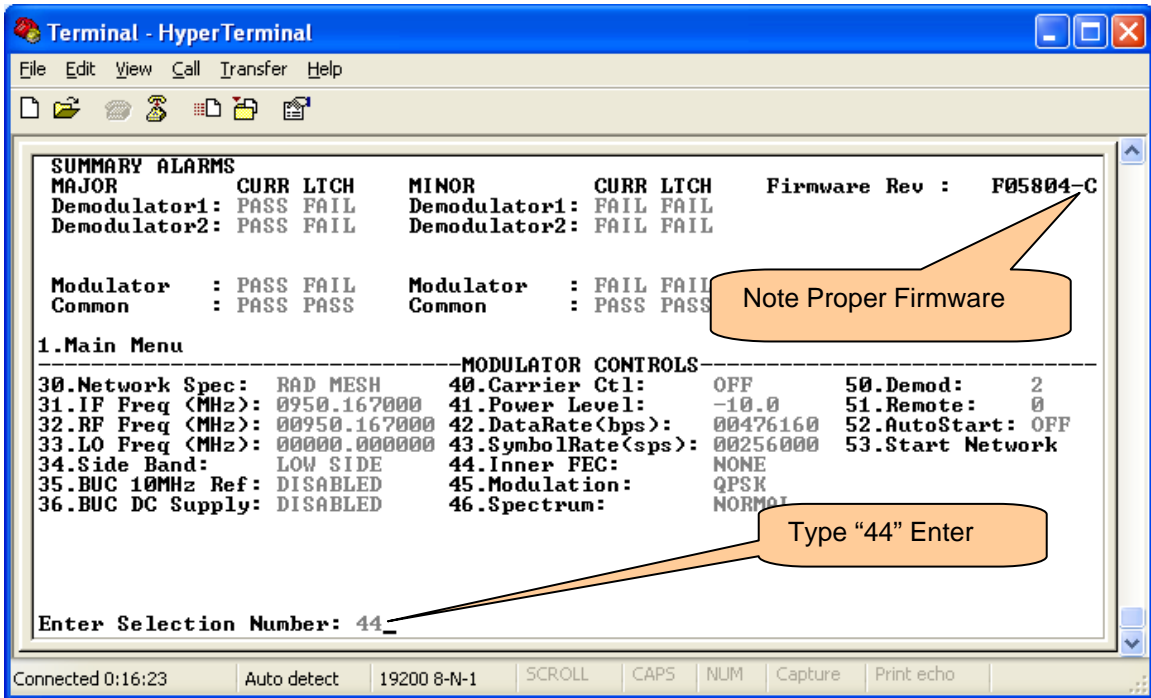
Figure 4 – "44" MDX420 Modulator Code Rate
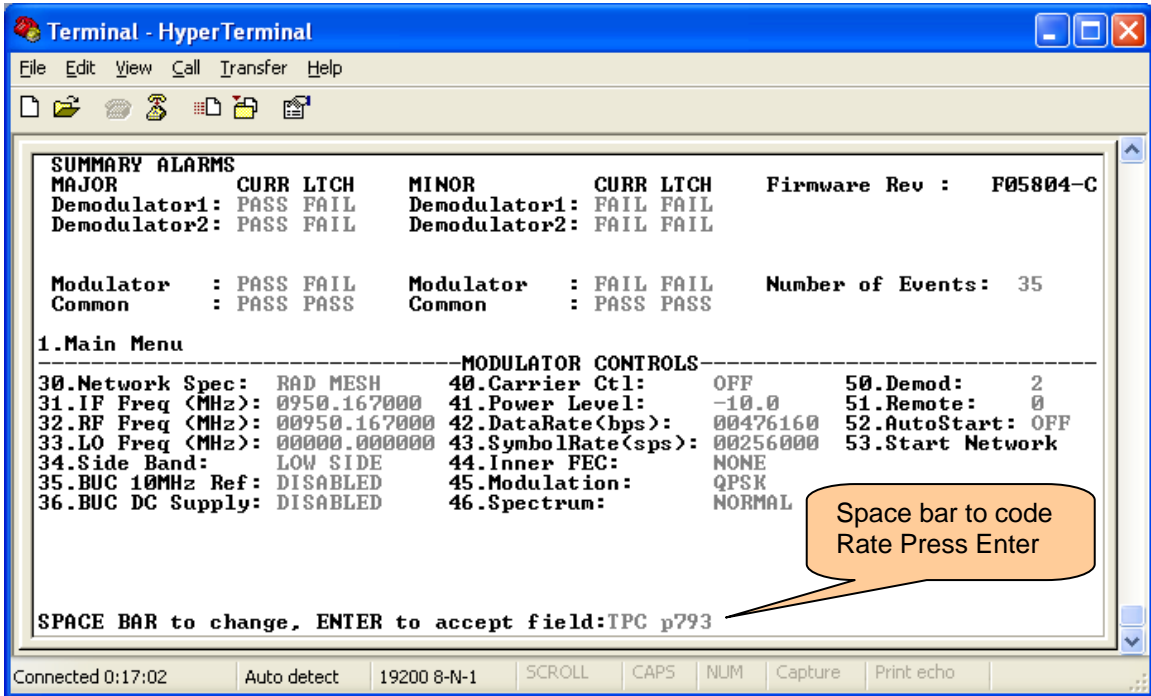
Figure 5 – Entering MDX420 Modulator Code Rate
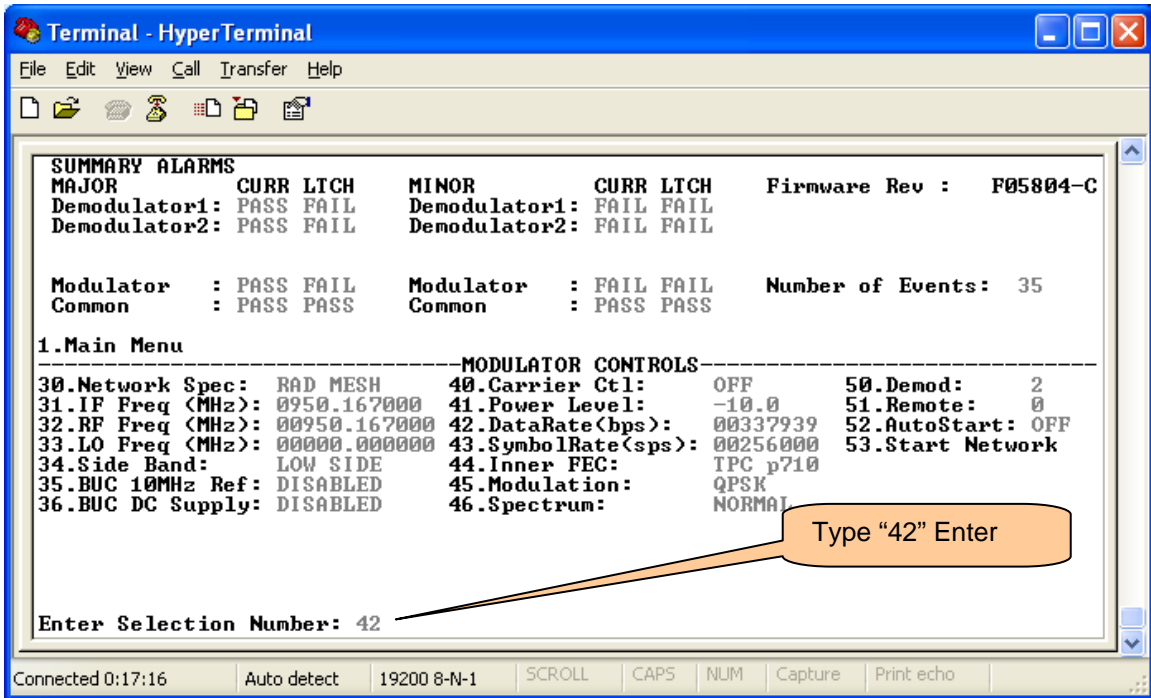
Figure 6 – "42" MDX420 Modulator Data Rate
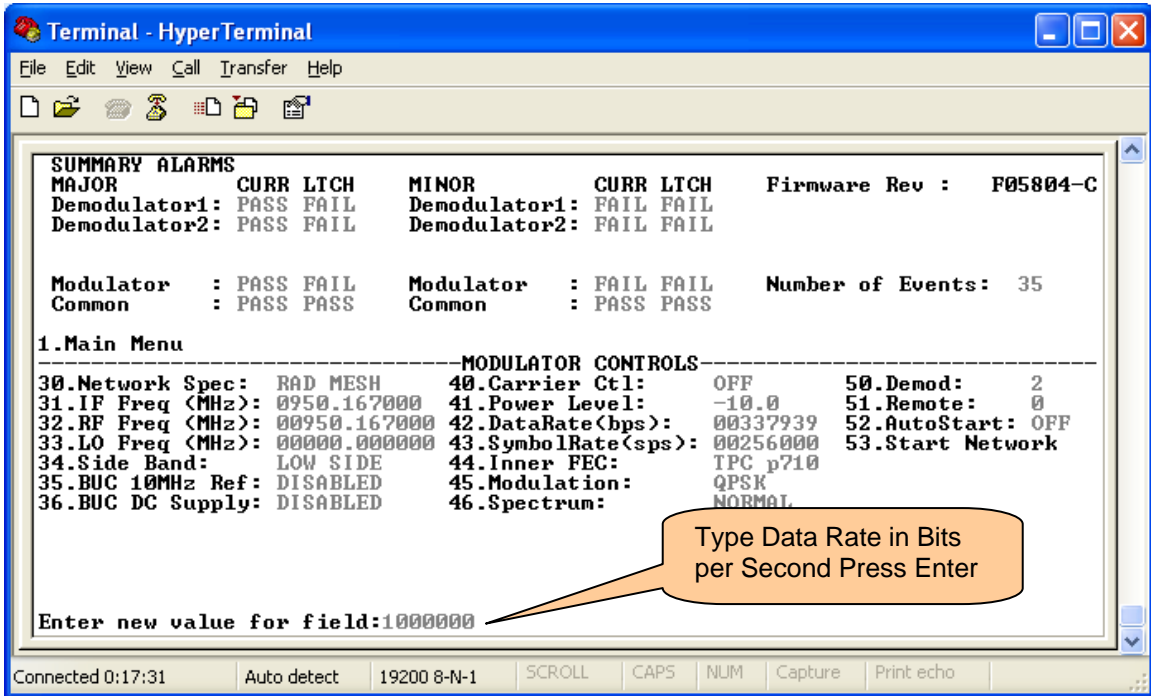
Figure 7 – Entering Data Rate in Bits per Second
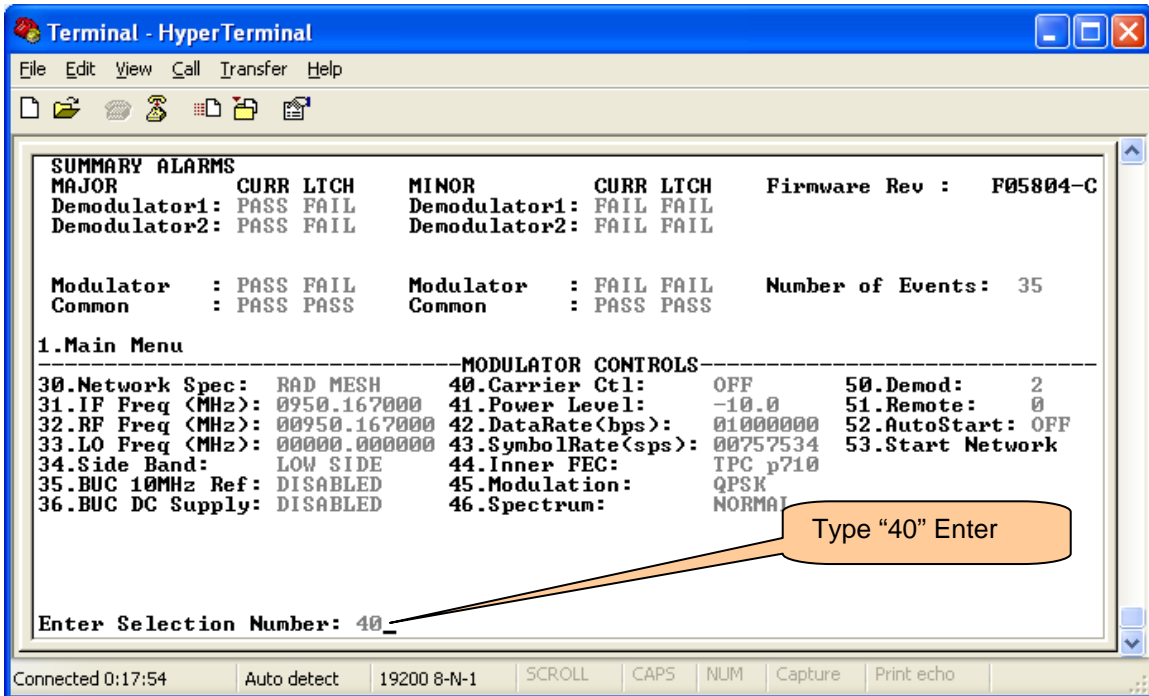
Figure 8 – "40" MDX420 Modulator Carrier Control
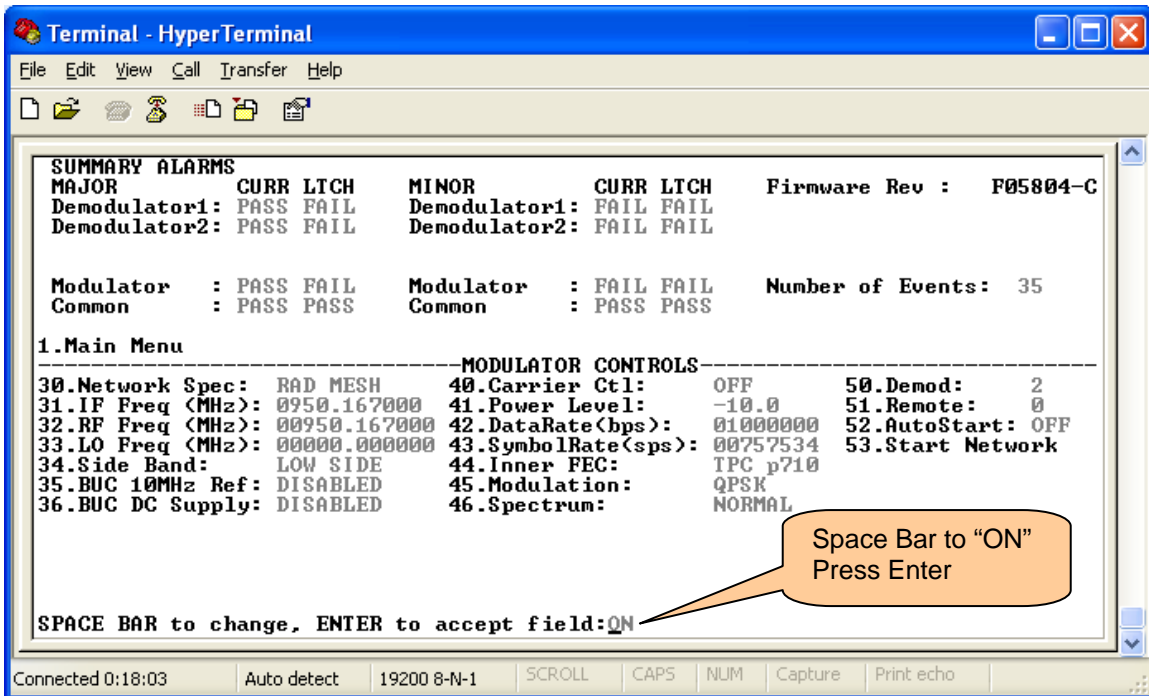

Figure 9 – Enabling the modulator carrier on the MDX420

4.2.1   Output Power Calculations

1.   Output power of the SkyWire gateway source unit and the attenuator accounting for the loss of the transformer and cabling to achieve a signal level of -40 dBm. This is the signal that will be applied to the Rx port on the unit being calibrated.

Example (1):   *Using 10 dB step attenuator with the Gateway output power to fine tune.*

SkyWire (source) Output = -14.3 dBm
Attenuator = 20 dB
Transformer = 5.7 dB

= -40 dBm Signal

SkyWire (source) Output = -8.3
Attenuator = 50 dB
Transformer = 5.7 dB

= -64 dBm Signal

SkyWire (source) Output = -14.3
Attenuator = 60 dB
Transformer = 5.7 dB

= -80 dBm Signal

Example (2):   *Using 10/1 dB step attenuator for all level changes.*

SkyWire (source) Output = -10.3 dBm
Attenuator = 24 dB
Transformer = 5.7 dB

= -40 dBm Signal

SkyWire (source) Output = -10.3
Attenuator = 48 dB
Transformer = 5.7 dB

= -64 dBm Signal

SkyWire (source) Output = -10.3
Attenuator = 64 dB
Transformer = 5.7 dB

= -80 dBm Signal

> **NOTE**
>
> *These are just example calculations; the numbers may vary depending on equipment chosen to perform this calibration.*

> **NOTE**
>
> *For best results target close to -10 dBm modulator output.*

> **NOTE**
>
> *For best results the actual input signal may be measured using a power meter setup to receive a CW (pure carrier) signal. This will verify the calculations and quantify and additional external losses due to equipment or cabling.*

4.2.2   Modulator Output Power Setup

1.   Put the source unit carrier type into CW mode see Figure 10 through Figure 13.
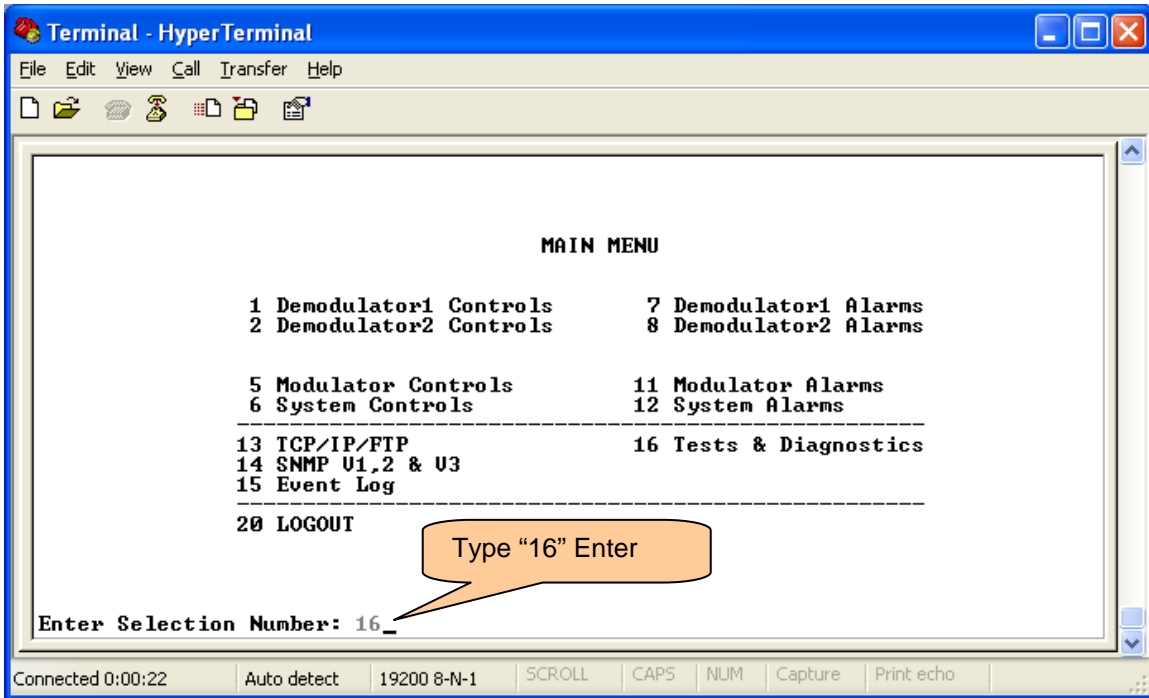
Figure 10 – 16 Tests and Diagnostics
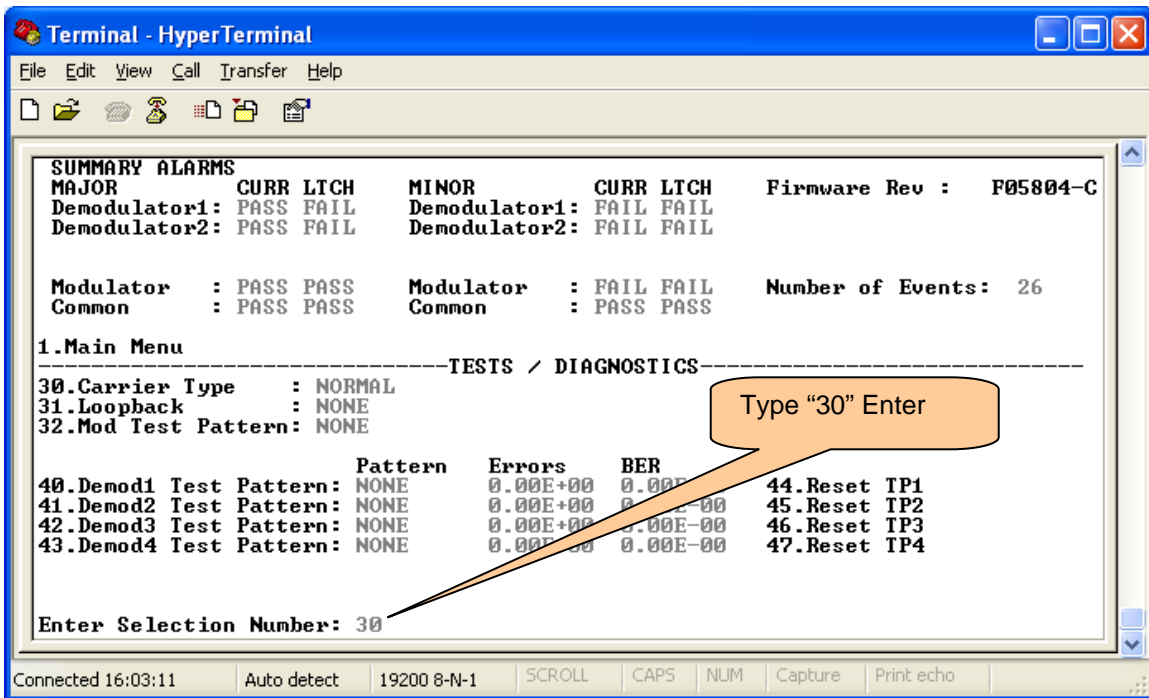
Figure 11 – 30 Carrier Type Selection
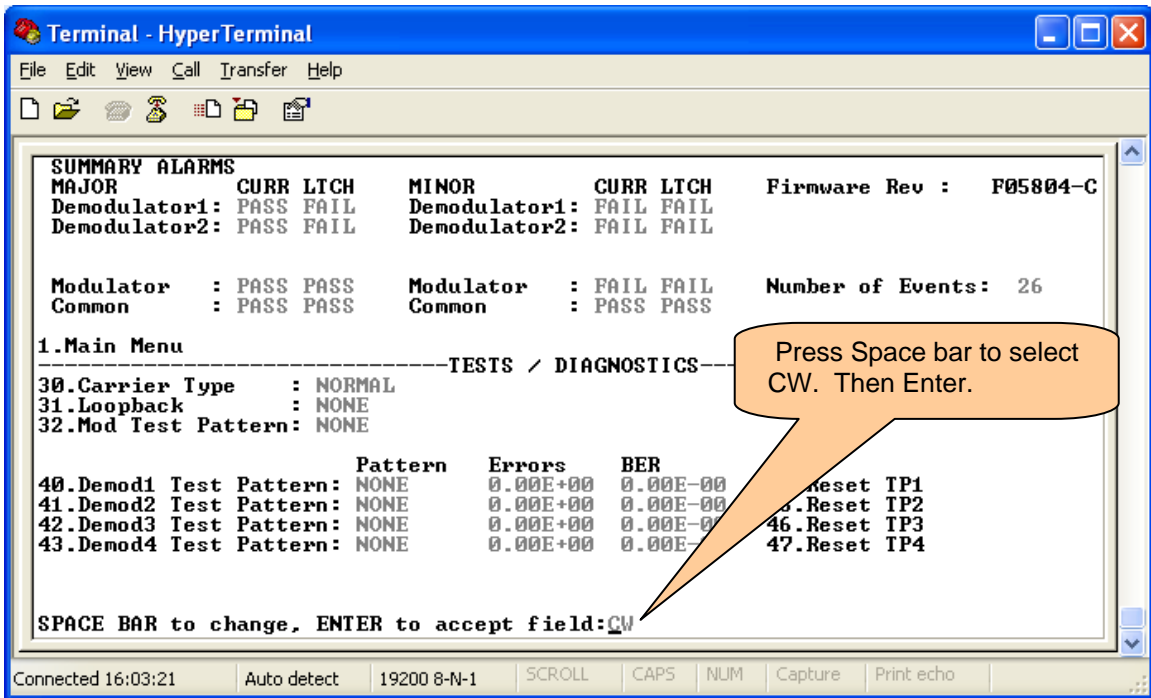
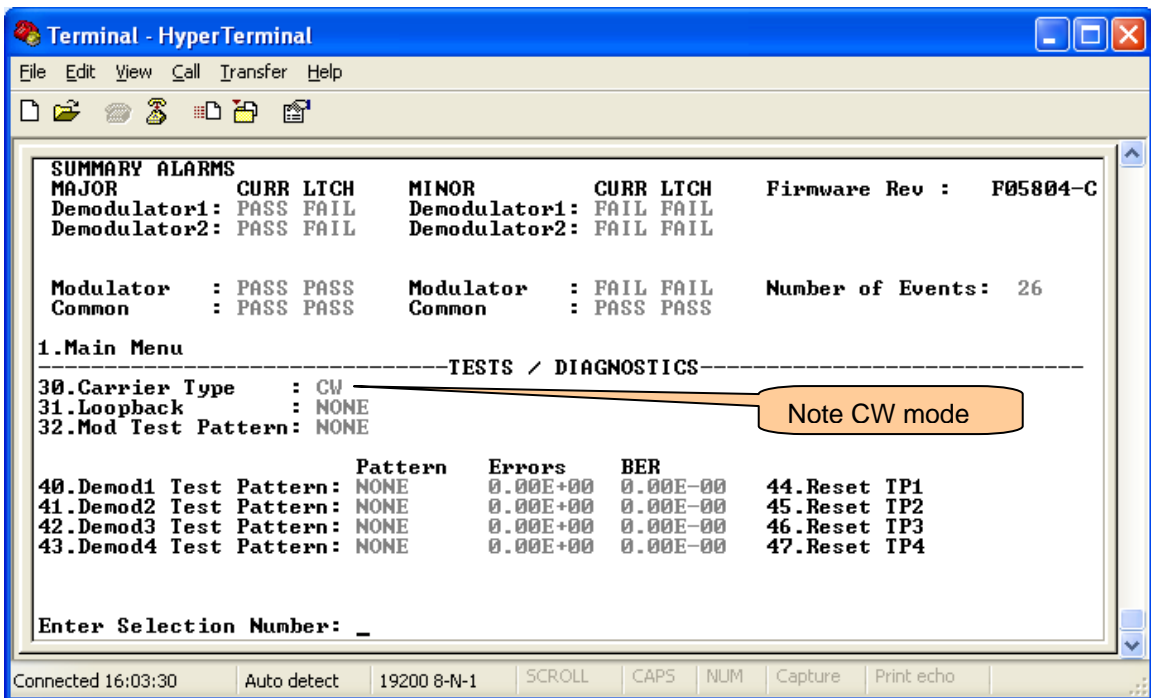**Figure 12 – CW (Pure Carrier) Mode**

Figure 13 – CW (Pure Carrier) Mode

2. On the source gateway unit, set the output power level appropriately per the calculation to achieve an appropriate output based on the calculations of step 1 of 4.2.1 (Example 1 or 2). See Figure 14 through Figure 17.
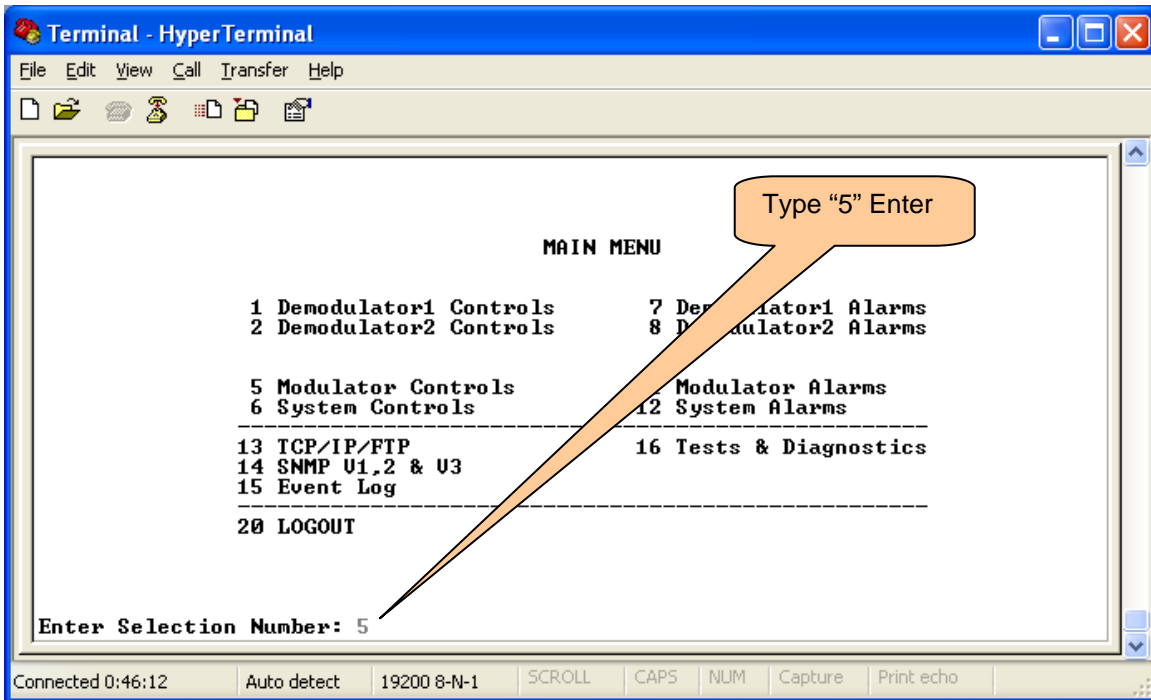
Figure 14 – Modulator Controls
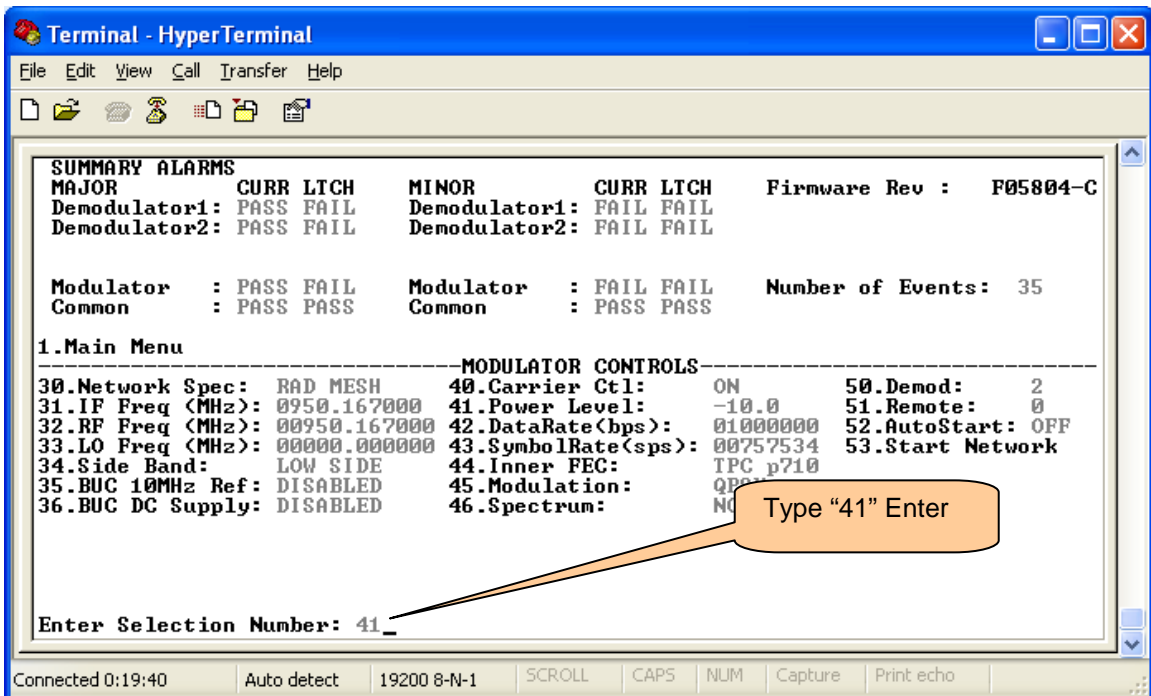
Figure 15 – 41 Power Level
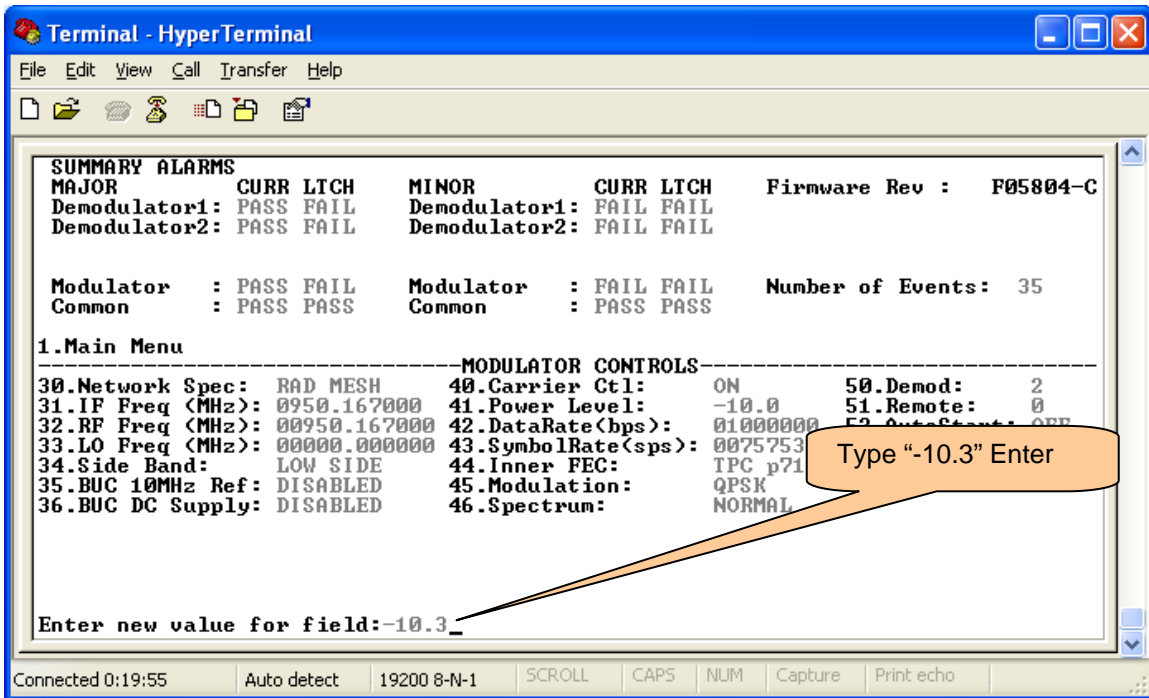
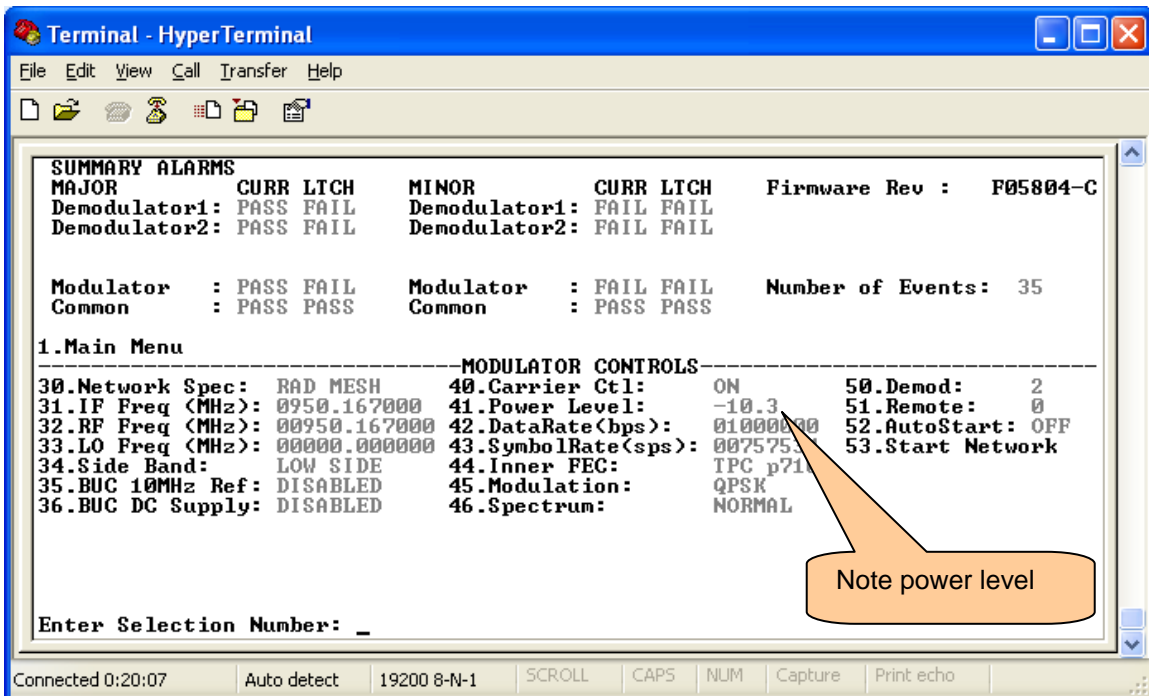**Figure 16 – Set Output Power Level for -10.3dBm.**

Figure 17 – Output Power Level

4.3 Unit To Be Calibrated (Demodulator Setup)

1. Move the RS232 terminal service cable to the unit to be calibrated and login to the
   Gateway. Set up **ALL** populated demodulators; see Figure 18 through Figure 22.
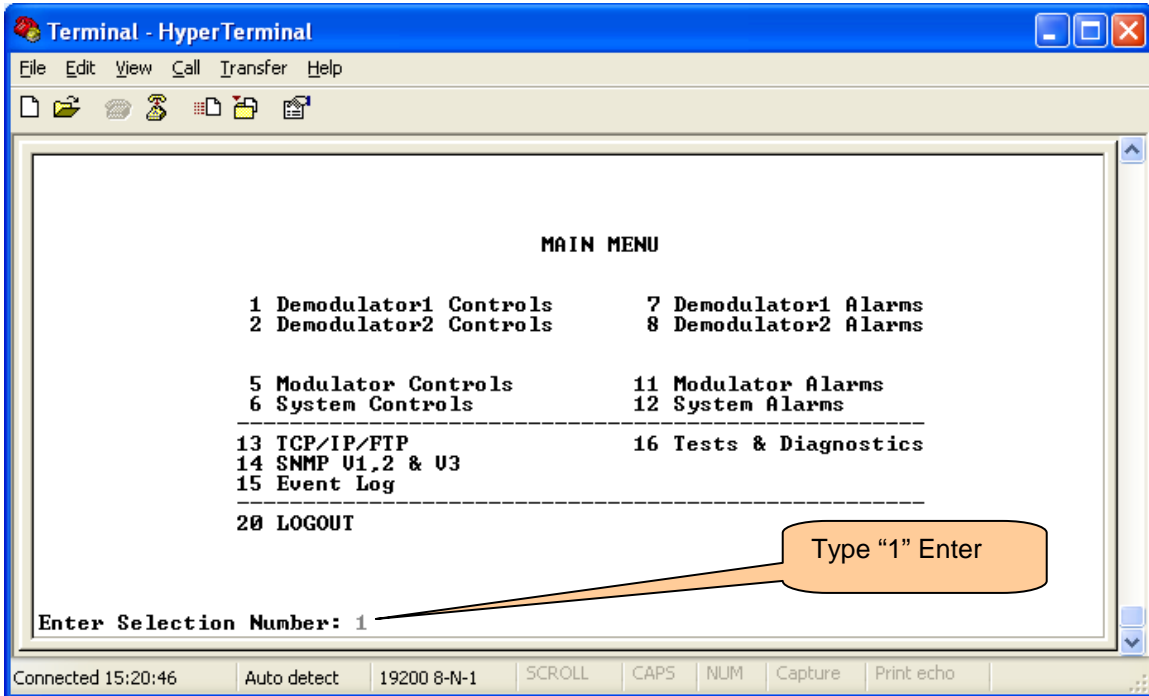   a. Data Rate 1000000
   b. Code Rate TPC 0.793

Figure 18 – Enter Demodulator Setup

NOTE

Demodulator Setup needs top be performed on ALL installed demodulators within the Gateway
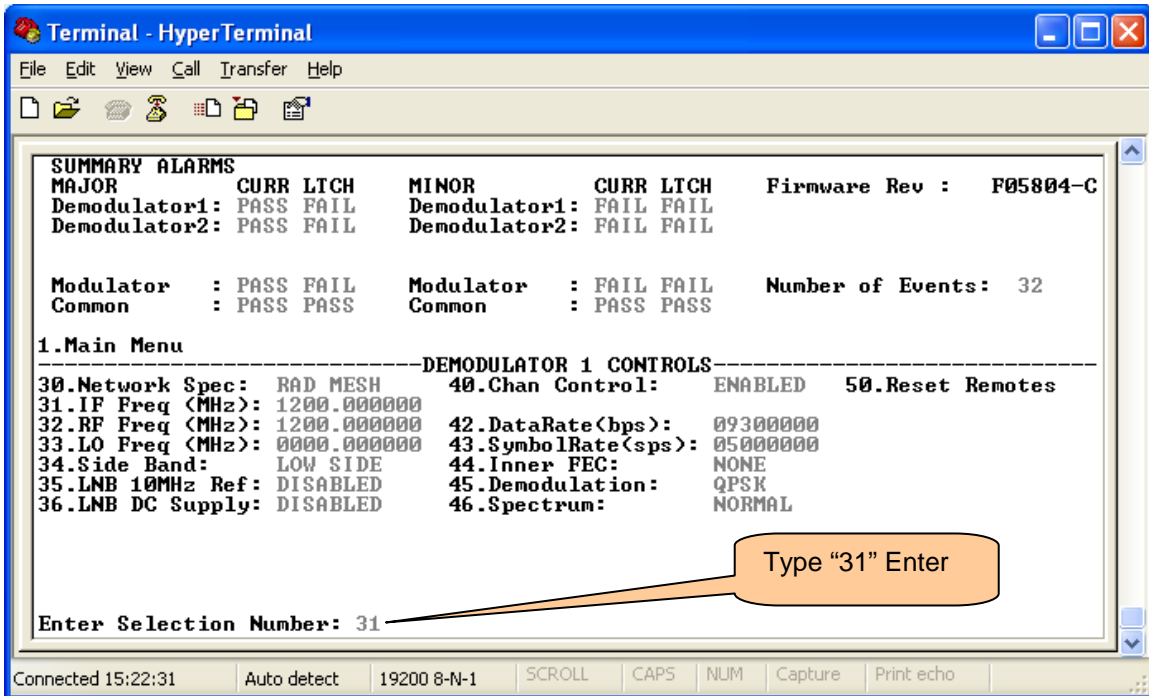
Figure 19 – "31" Enter IF Frequency
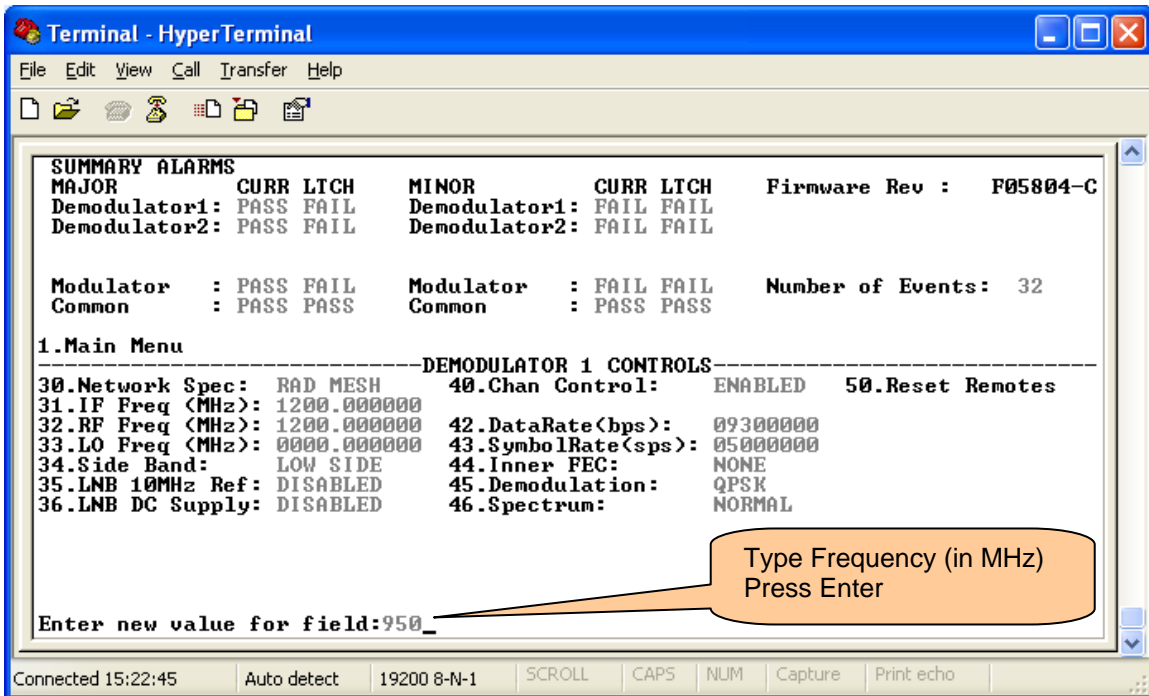
Figure 20 – Enter demodulator Frequency in MHz
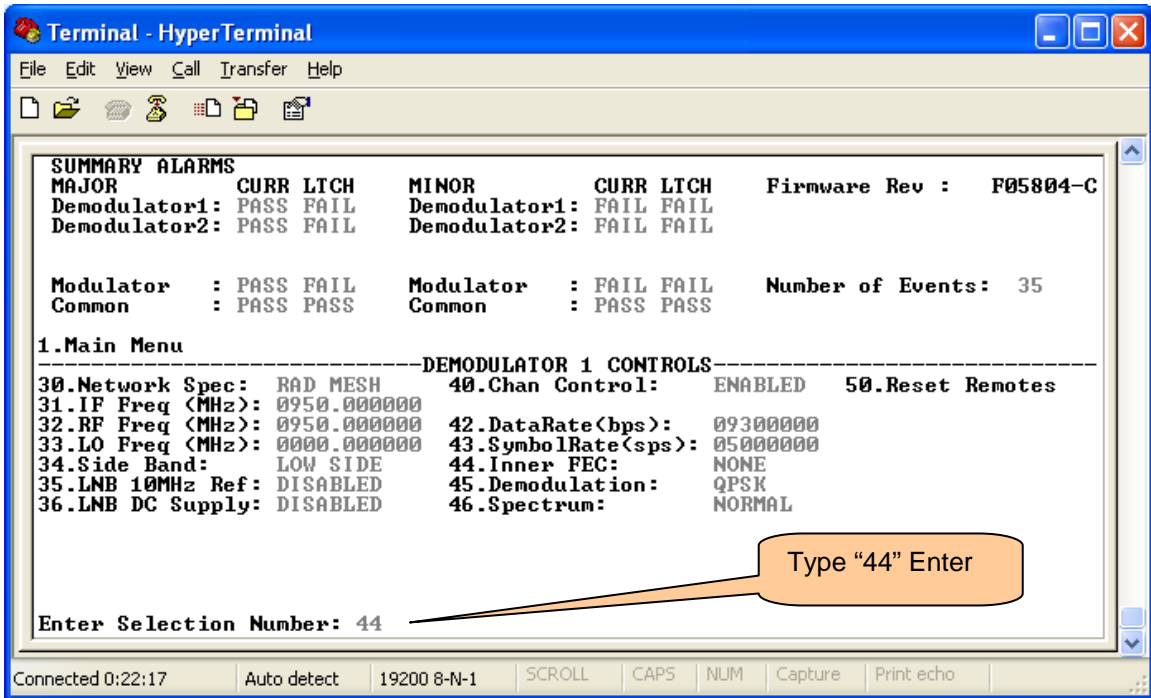
Figure 21 – "44" Enter Code Rate
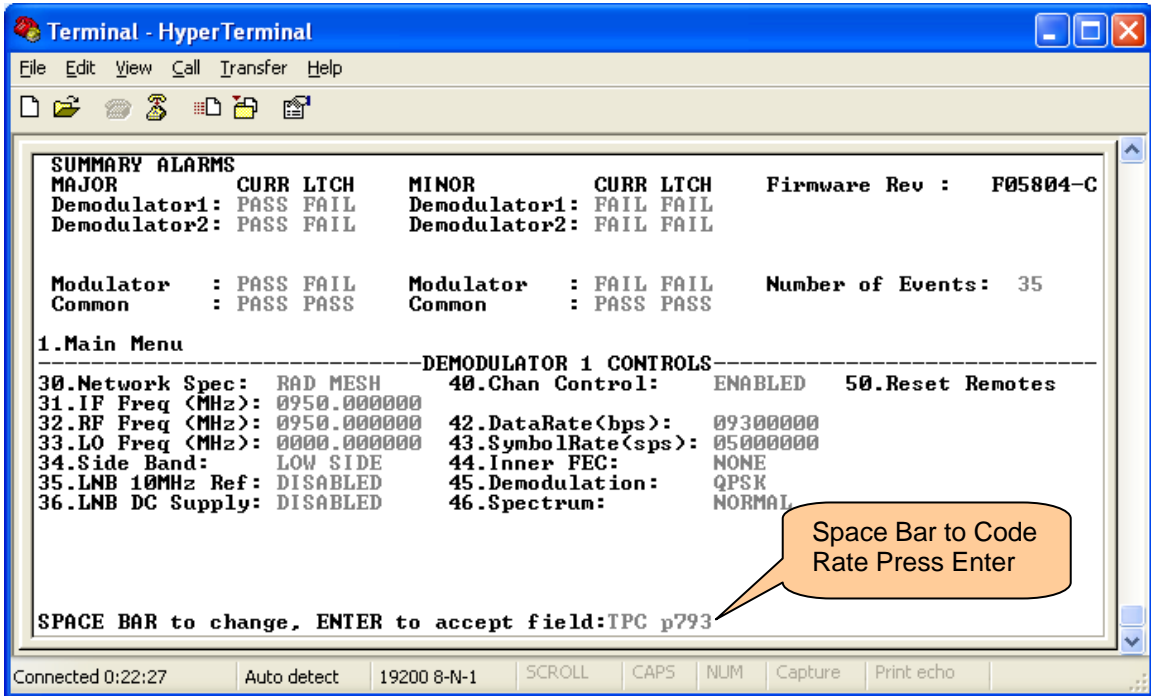
Figure 22 – Space Bar to correct Code Rate
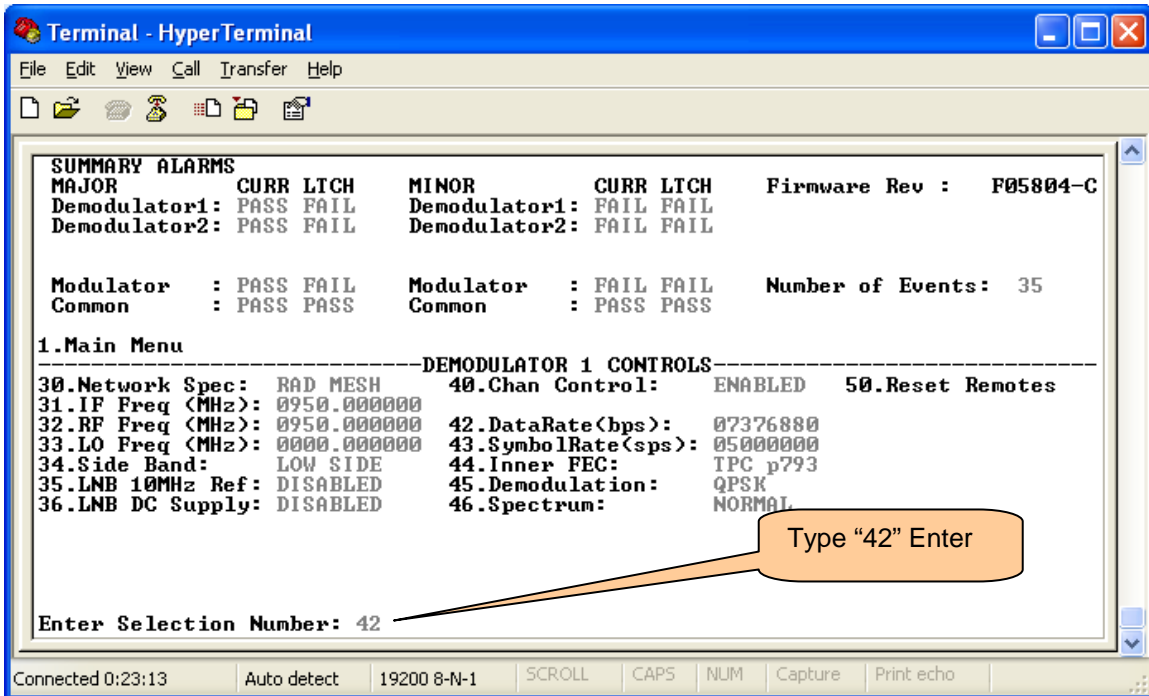
Figure 23 – "43" Enter Data Rate
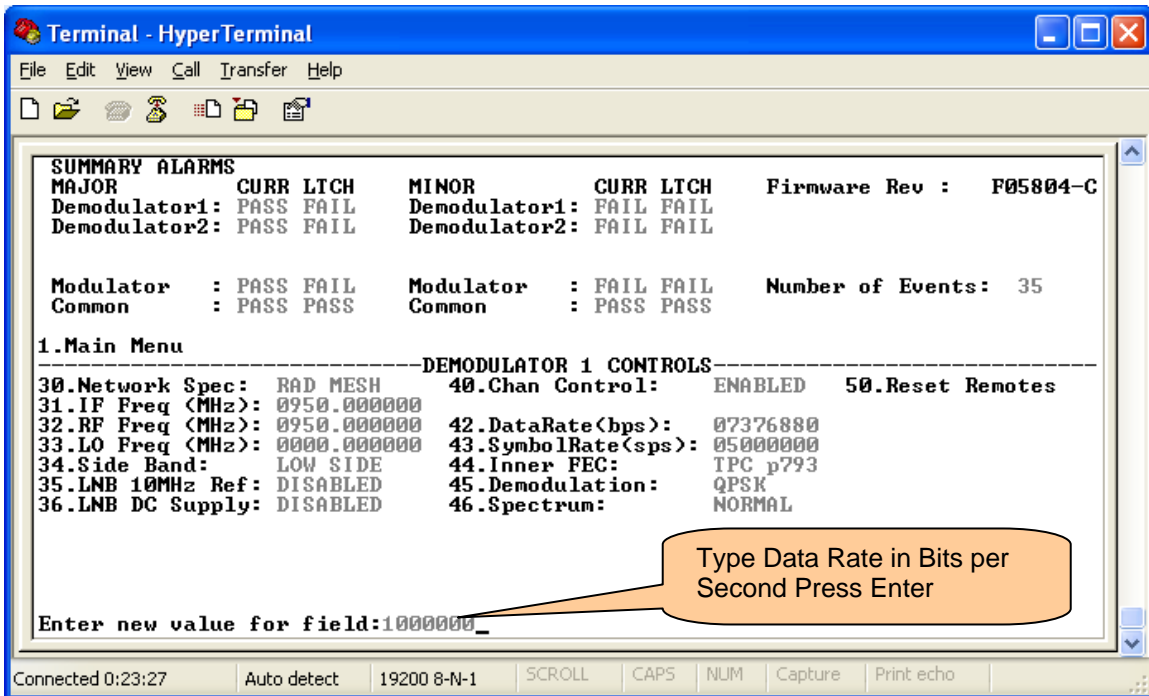
Figure 24 – Enter Data Rate in Bits per Second

NOTE

Each Demodulator in the system needs to be properly set for successful calibration of the system
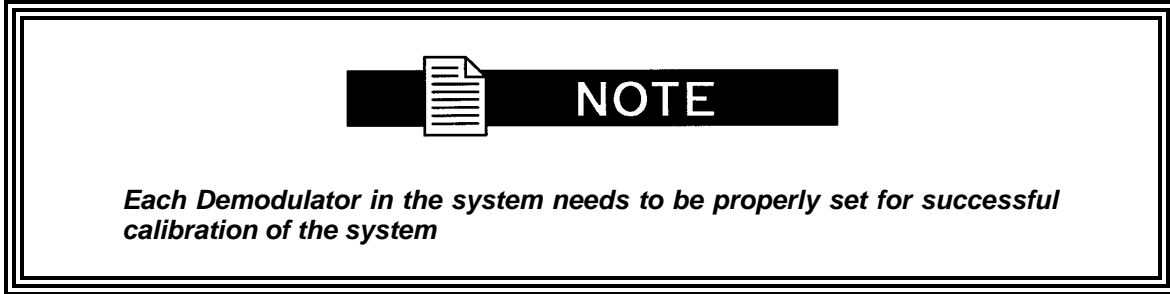
2.   Set the modulator of the unit being calibrated to a known state as shown in
   a.   Frequency (1013 MHz)
   b.   Carrier OFF This will occur automatically if the frequency is changed, if the frequency of the source is not changed, this will need to be done manually.
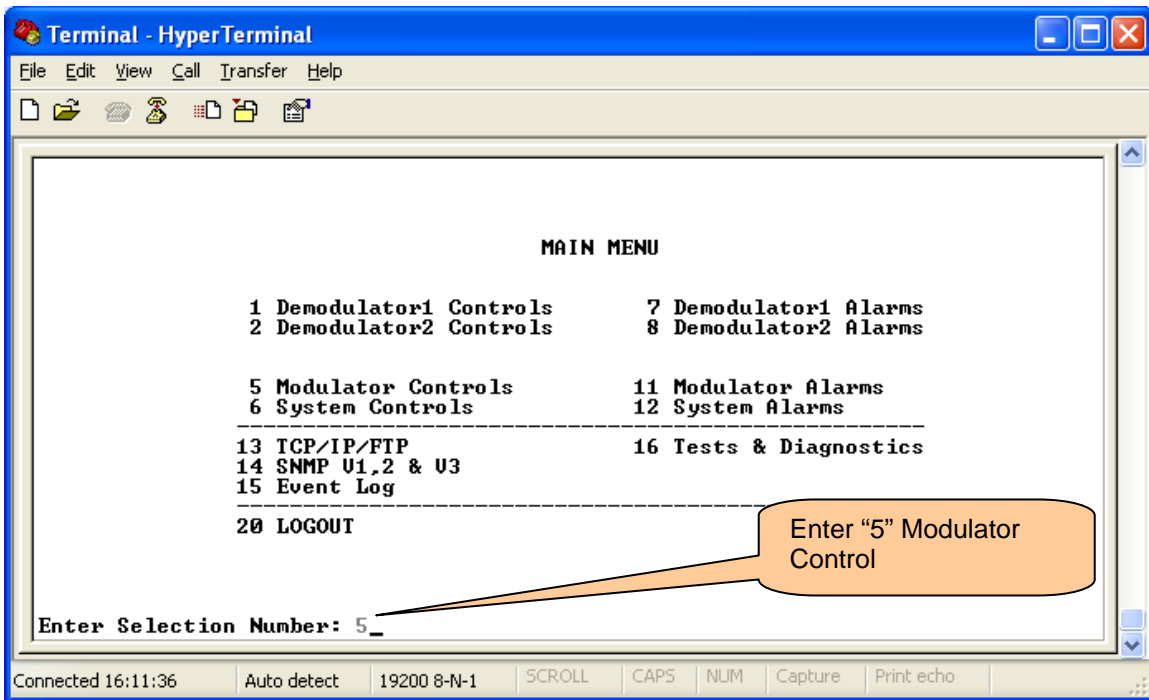
Figure 25 – "5" Enter Modulator Menu of Unit being Calibrated

Figure 26 – "31" Enter IF Frequency

Figure 27 – Enter "1013" MHz

4.4 Input Level Calibration

1. Enter the "RXLEVELCAL" screen by typing "RXLEVELCAL" <Enter> at the main screen, see Figure 28 and Figure 29.
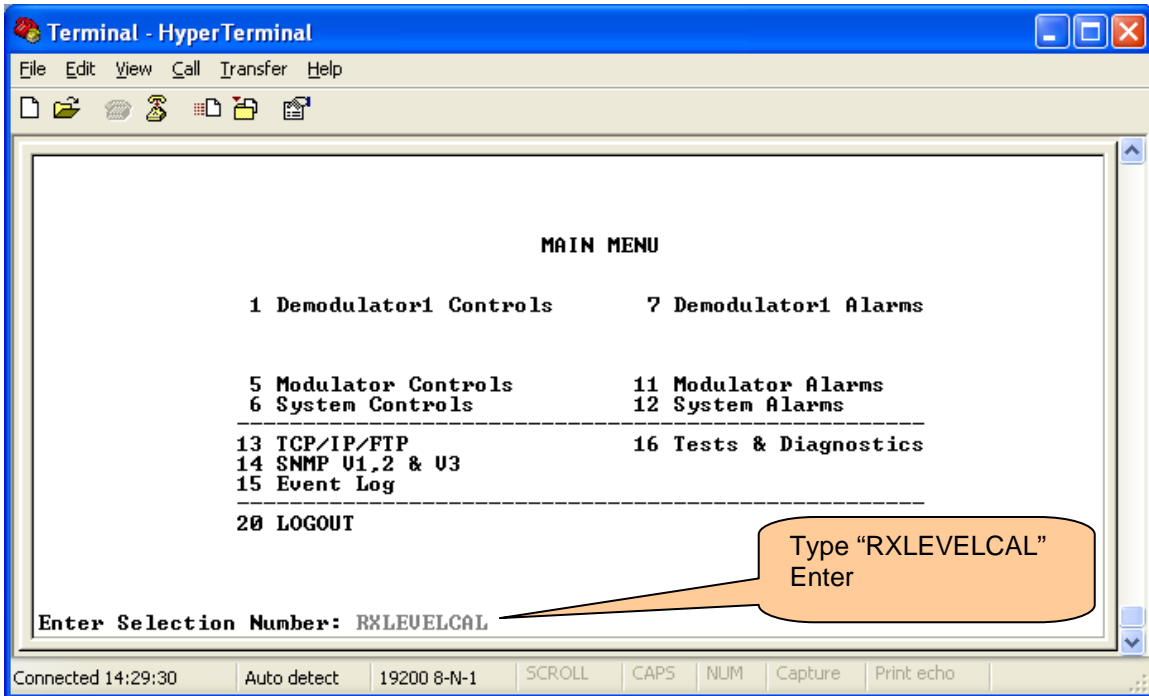
Figure 28 – RXLEVELCAL entry
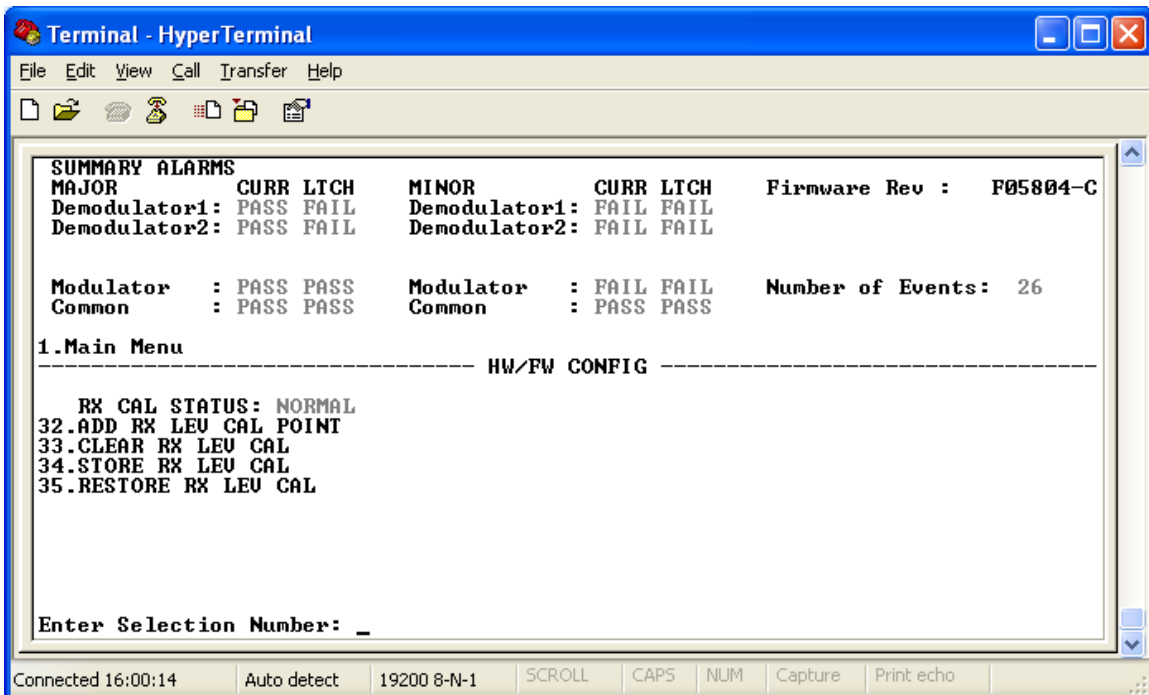
Figure 29 – RXLEVELCAL screen

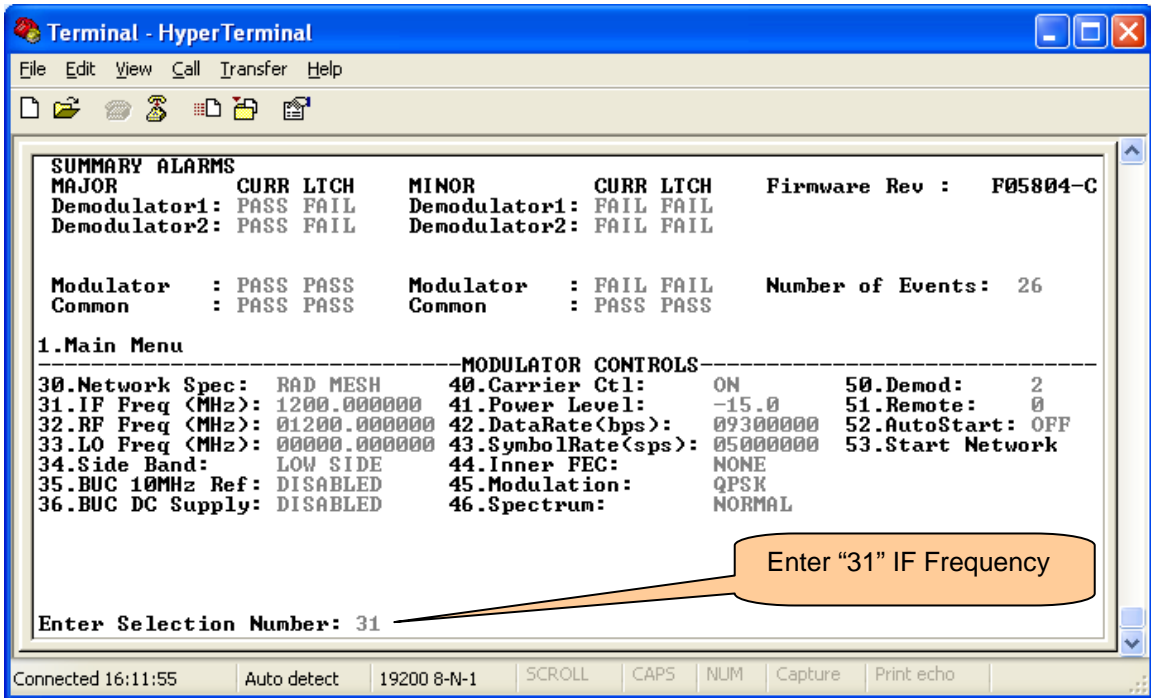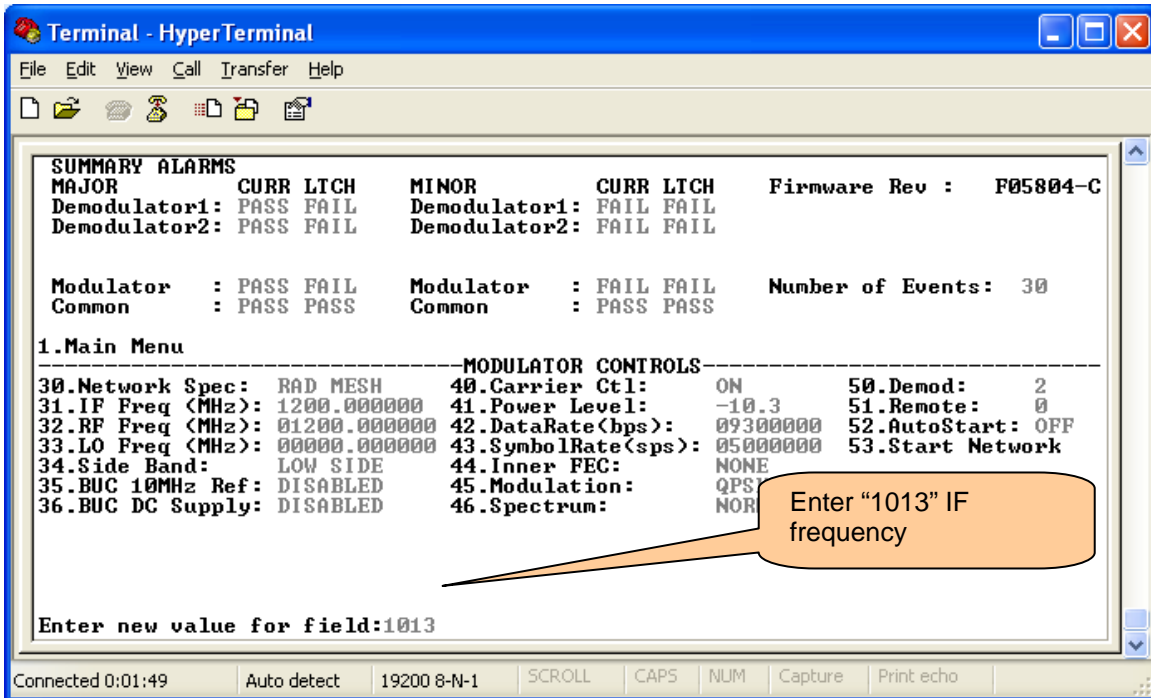2.   Clear the RX level calibration table by entering "33" <Enter>, see Figure 30.

Figure 30 – Clear Rx Level Calibration

3.   Set the attenuator in the setup to achieve a -40 dBm input based on the calculations of step 5 (Example 1 or 2). Above

4.   Enter a calibration point on the unit to be calibrated by entering a new calibration point "32" <Enter> <Freq (Hz) Level (dBm)> <Enter>, see Figure 31 and Figure 32.

NOTE

Calibration point frequencies are entered in Hertz
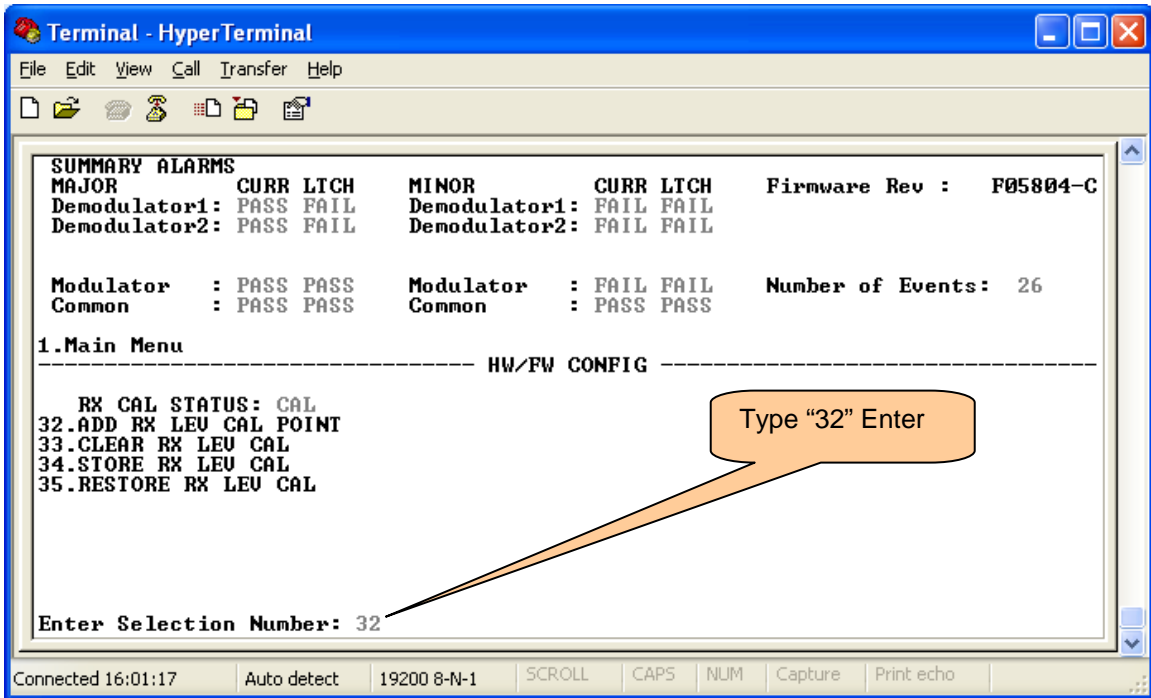
Figure 31 – Entering a *New* Calibration Point
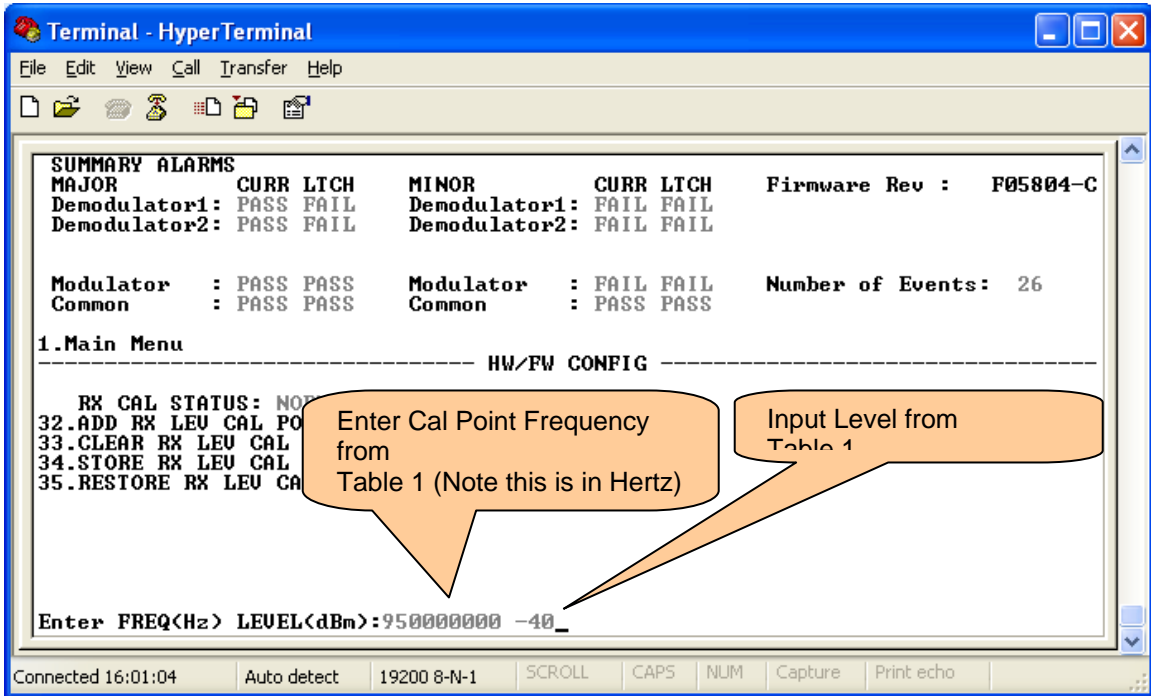
Figure 32 – Calibration Point Entry

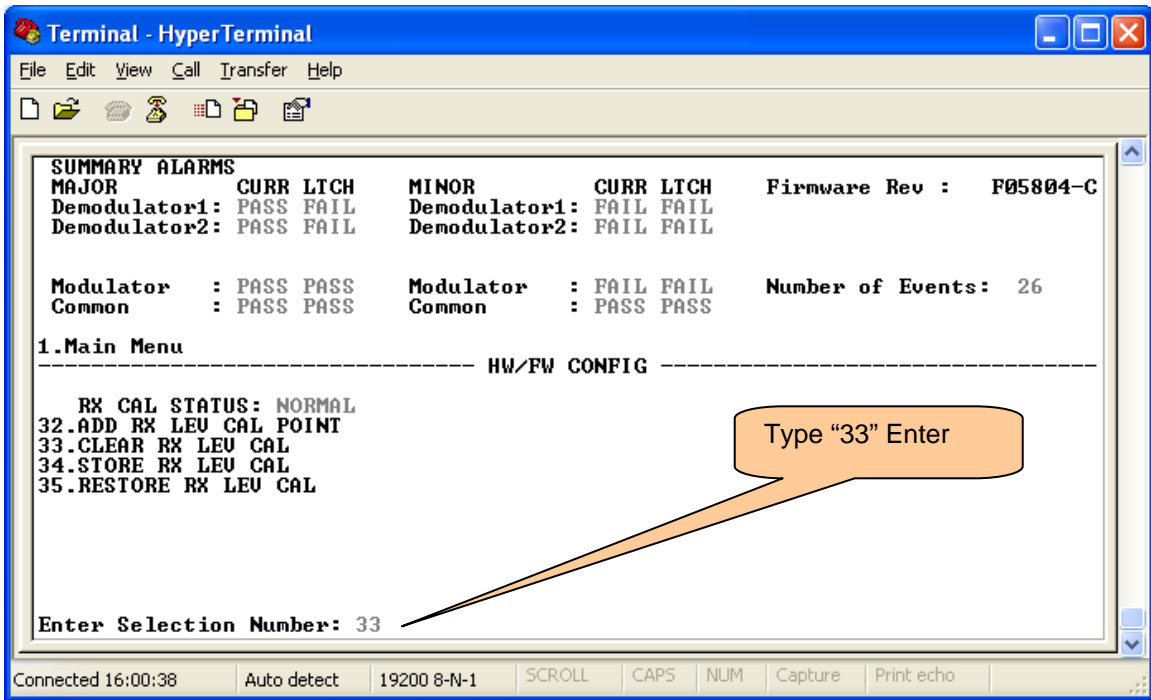5.   During the unit calibration process the status will change to "CAL". At this time the unit will be converging to the desired level and computing the required information for the calibration table entry. Once the status changes back to "NORMAL" this signals that the gateway has completed processing and is ready for the next entry, see Figure 33 and Figure 34.

Figure 33 – "CAL" - Calibration Status

Figure 34 – "NORMAL" Calibration Status

6.   Adjust the attenuator and or frequency in the source unit to repeat the input level calibration step for each frequency and level shown in

Table 1.

```
┌─────────────────────────────────────────────────────────────┐
│                                                             │
│                    📄  NOTE                                  │
│                                                             │
│   The when the Source Modulator frequency changes per       │
│   Table 1, the carrier will need to be turned back on per    │
│   Figure 8 and Figure 9.                                    │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```
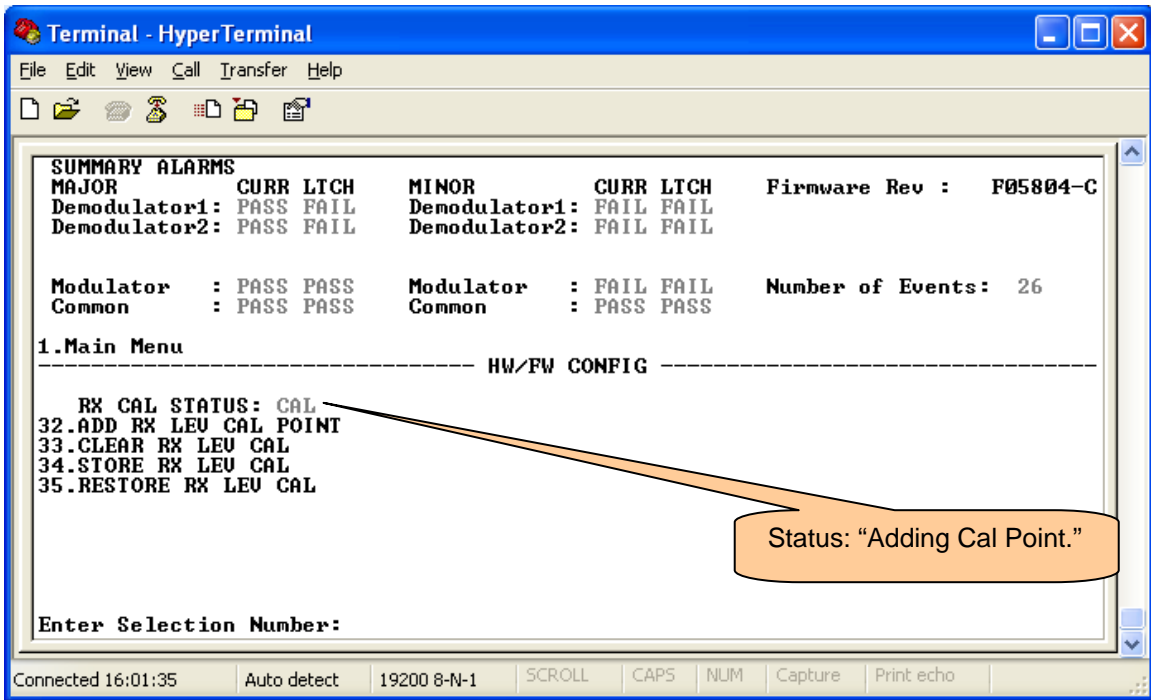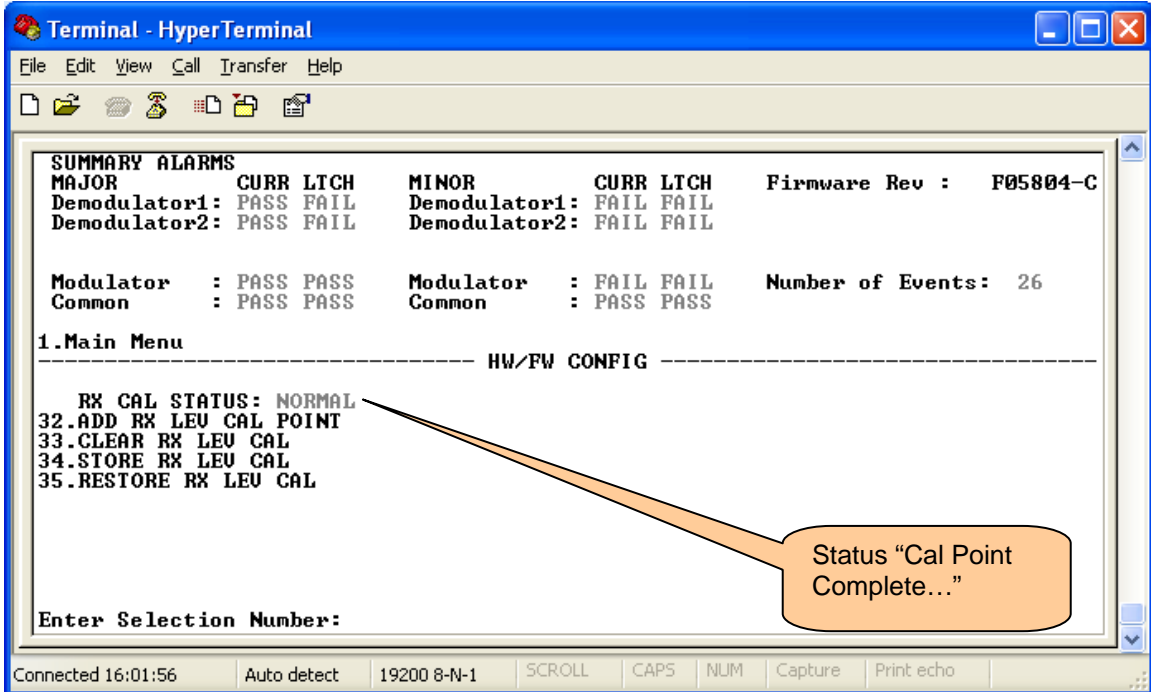
The when the Source Modulator frequency changes per
Table 1*, the carrier will need to be turned back on per Figure 8 and Figure*
9.

```
┌─────────────────────────────────────────────────────────────┐
│                                                             │
│                    📄  NOTE                                  │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```

There is no need to reset the demodulator frequency in each entry, the demodulator will automatically adjust to the calibration frequency during the addition of a calibration point.

Table 1 – MDX420 SkyWire Gateway Calibration Setup Table

Frequency (MHz) Source Unit	Frequency (MHz) Unit to be Calibrated *(For ALL Installed Demodulators)*	Carrier Level (dBm)	Completed (√)
950.167	950	-40*	
950.167	950	-64	
950.167	950	-80	
1150.167	1150	-40*	
1150.167	1150	-64	
1150.167	1150	-80	
1350.167	1350	-40*	
1350.167	1350	-64	
1350.167	1350	-80	
1550.167	1550	-40*	
1550.167	1550	-64	
1550.167	1550	-80	
1749.332	1750	-40*	
1749.332	1750	-64	
1749.332	1750	-80	

*Verify these levels with a power meter if possible.

7.   Once the calibration of all points is complete, store the calibration table to the gateways memory by entering "34" "STORE RX LEV CAL" in the terminal, see Figure 35.

> 📄 **NOTE**
>
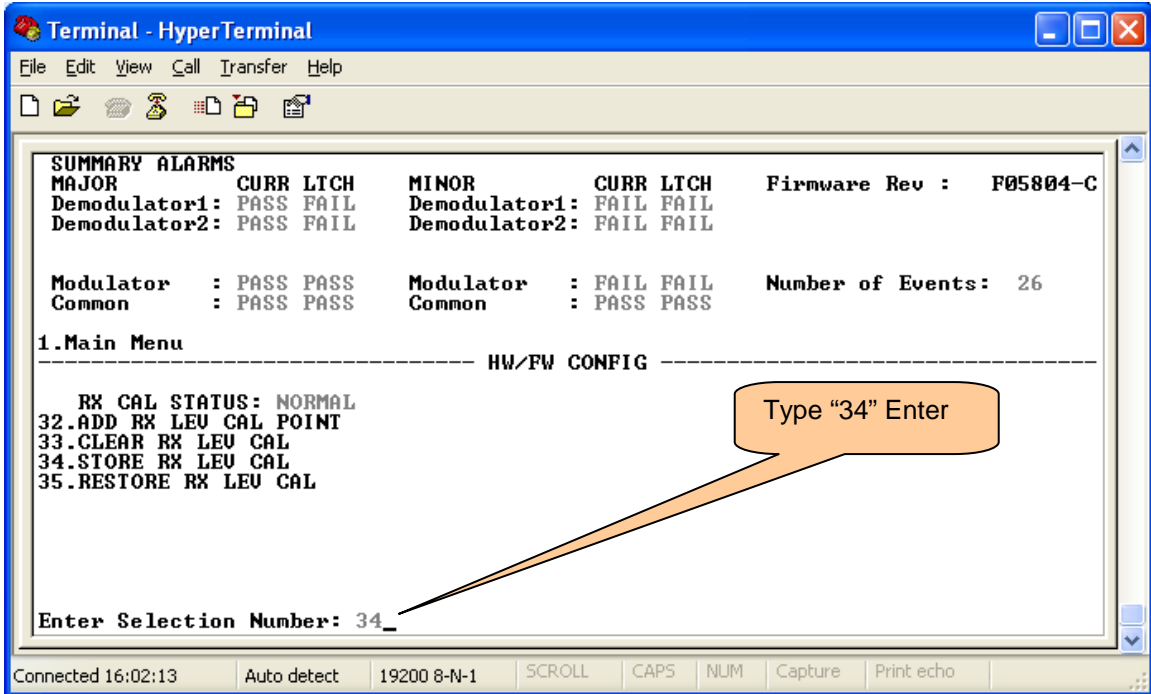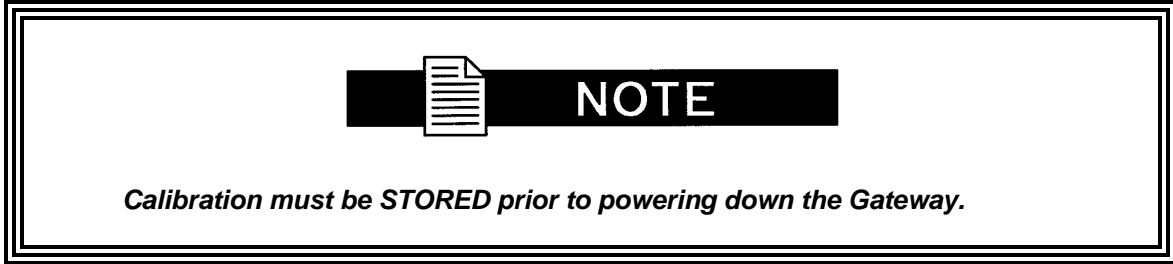> *Calibration must be STORED prior to powering down the Gateway.*

Figure 35 – Store Calibration Results

8.   Field Calibration Complete.