How to Set Up Digicast Digital Satellite Receiver

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Background

Setting up a digital satellite receiver for the delivery of IP or transport stream information over an Asynchronous Serial Interface (ASI) involves more than just configuring the data related parameters. The person performing the configuration must have knowledge of both communications concepts and satellite communications. This paper will help the individual performing the configuration by explaining each parameter and what parameters must be on hand when setting up a Digicast satellite receiver.

Important Terms to Know

First, we need to identify the major components needed to accomplish over-the-air (OTA) communications:

- Earth Station – Where the transmission signal originates

- Satellite – A repeater located 22,300 miles above the Earth in geostationary orbit.

- Remote Site – Where the transmission signal terminates.

- Receiver – Digicast satellite receiver.

- Radio Frequency (RF) – the carrier frequency used to go from the Earth to the satellite and back.

- Band – The frequency bands:
    - L-Band – 950 to 2,150 MHz
    - C-Band – 3,700 to 4,200 MHz
    - X-Band – 7,000 to 12,500 MHz
    - Ku-Band –11,000 to 18,000 MHz
    - Ka-Band – 18,000 to 40,000 MHz

    The Digicast satellite receiver operates at L-Band (950 to 2,150 MHz). The LNB located up at the satellite dish, down converts the incoming satellite signal at either C-, X-, Ku- or Ka-Band to L-Band, where it is fed into the receiver.

- LNB – Low Noise Block converter.

- Downlink Frequency – The RF frequency received from the satellite to the remote site.

- Uplink Frequency – The RF frequency transmitted to the satellite from the Earth Station.

- Modulation:
    - QPSK
    - 8-PSK
    - 16-APSK

- Forward Error Correction (FEC) – Additional coding added to the transmission to enable the receiving site (Digicast satellite receiver) to detect and correct errors experienced during transmission over the satellite.

- Symbol Rate – The symbol rate for the downlink carrier in Msps (Mega symbols per second). The Symbol Rate is equivalent to the effective occupied bandwidth on the satellite transponder, but does not include the filter roll off. To determine the total occupied bandwidth on the satellite, the symbol rate is multiplied by $(1+\alpha)$, where α is the configured filter roll off of the carrier.

- Filter Roll Off – The filter roll off is known as the Alpha coefficient (α). For DVB-S, α is fixed at 35%, but for DVB-S2, α can be configured as 20%, 25% or 35%. The smaller the α, the less bandwidth will be required on the satellite.

- Local Oscillator – The frequency of the local oscillator in the Low Noise Block converter.

- Interfacility Link (IFL) – The coax connecting the LNB to the Digicast satellite receiver.

- DVB – The type of DVB transmission either DVB-S or DVB-S2.

- Backup Carrier – Whether there is a backup carrier provided.

- Polarization – The voltage provided to power the LNB:
    - None – no power is provided to the LNB
    - Horizontal – 18 VDC is provided to the LNB and can be used to switch the LNB's polarization if supported by the LNB manufacturer
    - Vertical – 13 VDC is provided to the LNB and can be used to switch the LNB's polarization if supported by the LNB manufacturer

- Spectral Inversion – Determines whether the spectrum is inverted or normal. For this parameter, it is recommended that On/Both or Off/Both be selected, since this will ensure the Digicast satellite receiver will automatically determine the correct spectrum.

- Pilots (On/Off) – DVB-S2 introduced the use of Pilots for allowing the satellite receiver to remain locked to the carrier under degraded signal conditions. The use of Pilots will allow the receiver to maintain carrier recovery, even when the user data payload cannot be decoded.   Enabling Pilots does come at a slight bandwidth cost, since the Pilot requires 36 symbols out of every 16 payload slots, but the gain in performance offsets a minimal inefficiency.

The following image depicts all of these terms and where they apply:
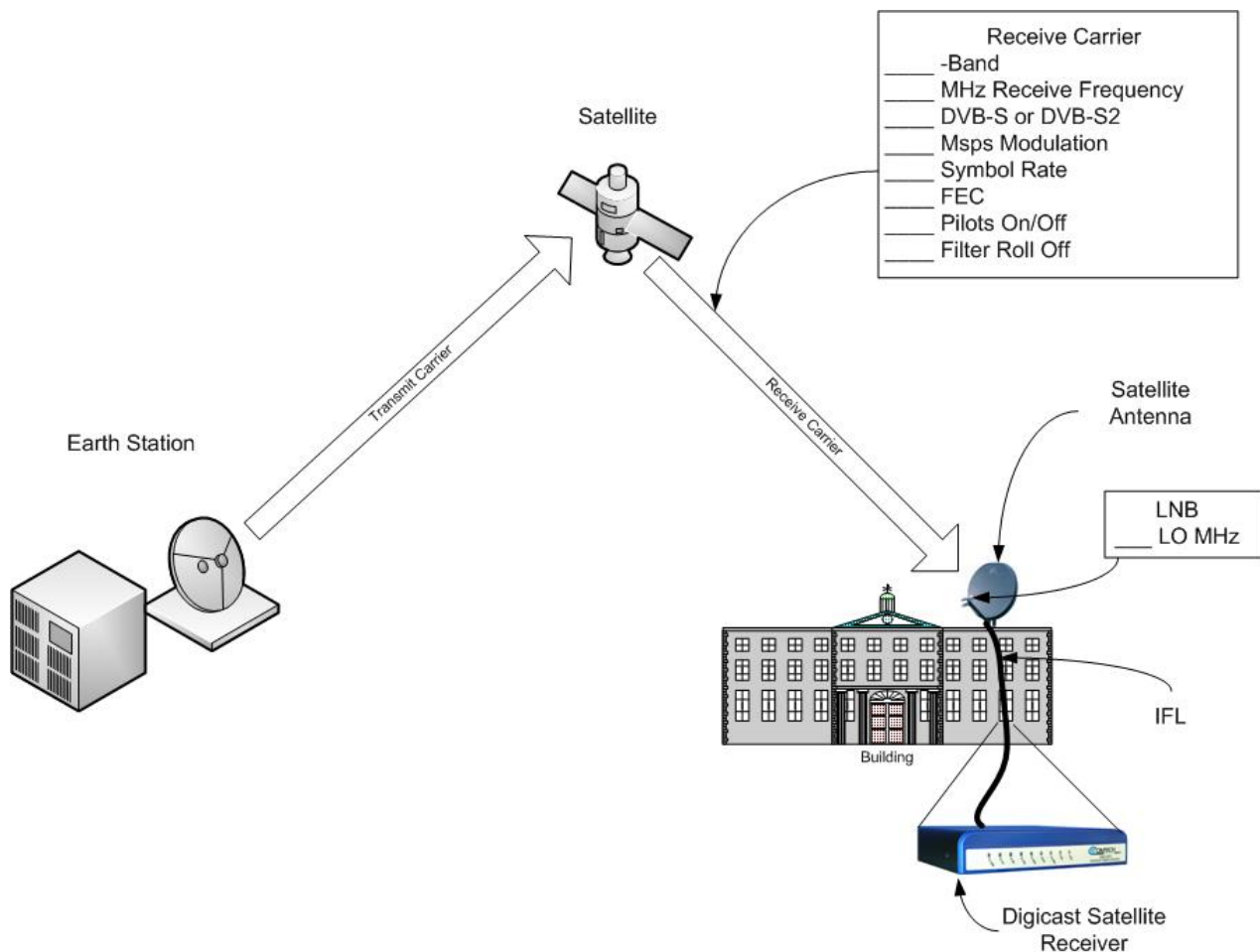
Gathering the Data

To set up the Digicast receiver for receiving a live satellite feed, the following information must be known:

1. What frequency band is being used?	☐ C-Band ☐ X-Band ☐ Ku-Band ☐ Ka-Band
2. What is the downlink frequency of the carrier from the satellite?	_____MHz
3. Local Oscillator of the LNB?	_____MHz
4. DVB Type?	☐ DVB-S ☐ DVB-S2
5. Symbol Rate?	_____Msps
6. Modulation of the carrier from the satellite?	☐ QPSK ☐ 8-PSK ☐ 16-APSK
7. FEC of the carrier from the satellite?	_____¼ FEC to 9/10 FEC
8. Pilots:	☐ On ☐ Off
9. Filter Roll Off (for DVB-S2 Only)?	☐ 20% ☐ 25% ☐ 35%
10. Secondary (backup) Carrier?	☐ Enabled ☐ Disabled
11. LNB Power Requirements?	☐ None ☐ 13 VDC ☐ 18 VDC
12. Spectral Inversion?	☐ On ☐ Off ☐ On/Both ☐ Off/Both

Setting up the Receiver

The information gathered in the previous section allows the user to enter the proper parameters into the Digicast receiver to make it operational. However, before this can be done, several values must be verified:

1. Verify the downlink frequency provided falls into the proper band?
   a. C-Band – 3,700 to 4,200 MHz
   b. X-Band – 7,000 to 12,500 MHz
   c. Ku-Band –11,000 to 18,000 MHz
   d. Ka-Band – 18,000 to 40,000 MHz

   If the downlink frequency does not fall within proper band, contact the space-link provider for clarification.

2. Determine the values to set for the LO and downlink frequency on the Digicast satellite receiver. There are two ways the frequencies can be loaded into the Digicast satellite receiver: Directly entering the downlink and LO frequencies or by entering the values as L-Band frequencies.

   Entering the values directly provides the least confusion, since the user simply enters the downlink frequency and LO directly into the Digicast satellite receive.

Entering the values as an L-Band frequency requires some math to be performed, but allows those who are more comfortable with L-Band values to be used.

To utilize L-Band frequencies in the configuration, the LO frequency must be set to 0 MHz. The downlink frequency is determined by taking the absolute difference of the actual downlink frequency at (C-Band, X-Band, Ku-Band or Ka-Band) and subtracting the two and using the absolute result (a non-negative number). Once this number has been found, the difference will be the L-Band frequency that can be entered into the downlink frequency on the Digicast satellite receiver. The following examples are given:

Example 1: Ku-Band LO = 10,750 MHz Downlink Frequency = 11,895 MHz L-Band Frequency = | 11,895 MHz – 10,750 MHz | L-Band Frequency = 1,145 MHz	**Example 3:** C-Band LO = 5,150 MHz Downlink Frequency = 3,920 MHz L-Band Frequency = | 3,920 MHz – 5,150 MHz | L-Band Frequency = | - 1,230 MHz | L-Band Frequency = 1,230 MHz
Example 2: Ku-Band LO = 10,600 MHz Downlink Frequency = 12,010 MHz L-Band Frequency = | 12,010 MHz – 10,600 MHz | L-Band Frequency = 1,410 MHz	

In the following graphic for the Web interface, the data is entered two separate ways for the primary and secondary frequency configuration. The primary frequency is as follows:

Primary (entered as L-Band format):
Ku-Band
LO = 10,750 MHz
Downlink Frequency = 12,425 MHz
L-Band Frequency = | 12,425 MHz – 10,750 MHz |
L-Band Frequency = 1,675 MHz
Symbol Rate = 32 Msps
DVB Type = DVB-S2
Modulation = 8-PSK
FEC = 9/10
Spectral Inversion = Both/Off
Pilot = On (DVB-S2 Only)
Filter Roll Off = 20% (DVB-S2 Only)

Secondary (entered as standard format):
Ku-Band
LO = 10,750 MHz
Downlink Frequency = 12,177 MHz
Symbol Rate = 23 Msps
DVB Type = DVB-S
Modulation = QPSK
FEC = 3/4
Spectral Inversion = Both/Off
Pilot = Off (DVB-S2 Only)
Filter Roll Off = 35% default (DVB-S2 Only)

In the following graphic for the terminal interface, the data is entered the same way for the primary and secondary frequency configuration. The primary frequency is as follows:

Primary (entered as L-Band format):
Ku-Band
LO = 10,750 MHz
Downlink Frequency = 11,890 MHz
L-Band Frequency = | 11,890 MHz – 10,750 MHz |
L-Band Frequency = 1,140 MHz
Symbol Rate = 32 Msps
DVB Type = DVB-S2
Modulation = 8-PSK
FEC = 9/10
Spectral Inversion = Both/On
Pilot = On (DVB-S2 Only)
Filter Roll Off = 20% (DVB-S2 Only)

Secondary (entered as standard format):
Ku-Band
LO = 10,750 MHz
Downlink Frequency = 12,700 MHz
Symbol Rate = 30 Msps
DVB Type = DVB-S2
Modulation = 8-PSK
FEC = 9/10
Spectral Inversion = Both/On
Pilot = Off (DVB-S2 Only)
Filter Roll Off = 35% (DVB-S2 Only)

```
Tera Term - COM1 VT
File  Edit  Setup  Control  Window  Help

                        Tuner Configuration Menu
            LNB   Down  Symbol  Modulation         Polar Spec   22K Roll Plt DSeq
            Freq  Freq  <Msps                            Inv   Tone Off
<P> Prime..[10750  11890 32.000 DVB-S2 8PSK 9/10    Off OnBoth Off 20%    On Off]
<B> BkUp...[10750  12700 30.000 DVB-S2 8PSK 9/10 Horiz OnBoth Off 35%    On Off]
<W> Swtch..[Disabled]
<T> EbNoTh.[0.0 dB]
    Current[Primary]
    Status.[Initialized,  address = 05]
    State..[Not locked]
    Lock...[pll=N demod=N ldpc=N viterbi=N bch=N rs=N bchlp=N]
    Port...[Not Locked]

<L> Load Configuration
<S> Save Configuration

Please select an option or X for previous menu ->
```

Conclusion

Setting up the CMR Digicast satellite products is simple to accomplish, but a minimum number of parameters must be known. Once the unit is configured, the unit should continue to operate for many years with little to no user intervention. Should you require assistance in setting up the product, please contact Comtech EF Data Customer Support Center at:

<div align="center">

Telephone +1.480.333.2433
Web http://www.comtechefdata.com/support.asp
E-mail cdmipsupport@comtechefdata.com

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