



PARADISE DATACOM APPLICATION NOTE

Embedded Paired Carrier Quick Start Guide

EVO_AN_026A

Summary

This procedure describes how to establish a *Paired Carrier* link between two Paradise modems. *Paired Carrier* does not work with cross-strapped transponders or where there has been any form of signal regeneration (demodulation and remodulation) of the signal on the transponder.

Method



You must get each link working correctly as a normal link prior to switching *Paired Carrier* on! You must ensure that there is no spectral inversion in the RF chain – if there is then this must be corrected by re-inverting it for *Paired Carrier* operation to work.

1. Ensure modem software version 1.9.66 or above is being used (Main, 3:View, 1:Unit) and configure the modems as for a normal link.
2. Ensure that the modem is *Paired Carrier* capable (Main, 3:View, 2:SAF and down arrow to PCMAx settings).
3. Ensure *Paired Carrier* is switched off (Main, 2:Edit, 3:Rx, 7:Carrier, 4:Advanced, 2:PCMA, 1:Enable and set to OFF).
4. Before starting, it is strongly recommended to prepare for a BER data transparency test, using data test sets connected to each modem, or using the modem internal PRBS BER test feature, which can be temporarily enabled if necessary.
5. Configure both Modems for identical services, including the same Tx and Rx frequencies.



Different PRBS test patterns must be used in each direction (e.g. for Modem 1 Tx to Modem 2 Rx use 2¹⁵-1 and for Modem 2 Tx to Modem 1 Rx use 2²³-1). This ensures that the two signals are sufficiently different from each other to allow *Paired Carrier* to work.

6. Check the Tx power level setting is correct and bring up the first carrier (using the selected common transmission frequency) and
 - Check the receive signal level, Eb/No, spectrum and constellation are as expected.
 - Check the received signal is data transparent.
7. Switch the first carrier off.
8. Check the Tx power level setting is correct and bring up the second carrier (using the selected common transmission frequency) and
 - Check the receive signal level, Eb/No, spectrum and constellation are as expected.
 - Check the received signal is data transparent.
9. Switch the second carrier off.



To avoid non-linear distortion, ensure adequate HPA back-off when using multiple carriers through a single amplifier, particularly with higher order modulations when testing at a single site.

10. At each modem, set either location information or, alternatively, the round trip delay to satellite (Main, 2:Edit, 3:Rx, 7:Carrier, 4:Advanced, 2:PCMA, 2:

- Round Trip Delay). If location information is entered for the modem position then the satellite delay will be calculated automatically. To minimise acquisition time when using a round trip delay, the delay should be specified to within ± 1 ms of the nominal value that you have calculated.
11. Enable the Tx carrier in the first modem. Both demodulators should lock (Rx traffic LED should go green).
 12. Enable the Tx carrier in the second modem. Both demodulators should go out of lock (Rx traffic LED should go out). Please note: the combined carrier power will increase by 3dB's when the second carrier is enabled. (Refer to your link budget)
 13. Enable *Paired Carrier* in the first modem (Main, 2:Edit, 3:Rx, 7:Carrier, 4:Advanced, 2:PCMA, 1:Enable and set to ON). Its demodulator should lock (Rx traffic LED should go green).
 14. Enable *Paired Carrier* in the second modem (Main, 2:Edit, 3:Rx, 7:Carrier, 4:Advanced, 2:PCMA, 1:Enable and set to ON). Its demodulator should also lock (Rx traffic LED should go green).
 15. Enable the BER test and check for data transparency in both directions. Inject errors via the BER testers in both directions and ensure they are received correctly.
 16. If the modems do not lock or are not data transparent then
 - Ensure there is no spectral inversion in the RF chain. If there is, then this must be corrected by re-inverting it for *Paired Carrier* operation to work.
 - Check the modem/satellite location information or round trip time that has been set in each modem. The range entered for the round trip time must cover the actual distance to the satellite. Try widening out the round trip delay to ensure that it definitely covers the actual time delay to satellite. Try switching from location to round trip delay or vice versa.
 - Switch *Paired Carrier* off and on again in each modem (to counter the possibility of a false lock).
 - If this does not work then switch the carrier off and on again in each modem.
 - Check the receive signal level and Eb/No are correct.
 - Check the spectrum and constellation for signs of signal degradation such as noise or interference.
 - Otherwise check the general modem settings for correct configuration and overlap of the two carriers (note that there are restrictions on the supported level of power asymmetry and symbol rate asymmetry).
 17. If the modems take a long time to lock then
 - Narrow the difference between the minimum and maximum round trip delay times (if these are being used) to minimise the uncertainty in the range to the satellite (Main, 2:Edit, 3:Rx, 7:Carrier, 4:Advanced, 2:PCMA, 2: Round Trip Delay). This has a significant effect on acquisition time. If using a round trip delay then try switching to using location information.
 - Check for signs of signal degradation such as poor Eb/No values or poor spectrum and constellation.