Course: Leaky Feeder System

Module 2.5:

Gain Management Controller

RFI
TECHNOLOGY SOLUTIONS

Purpose

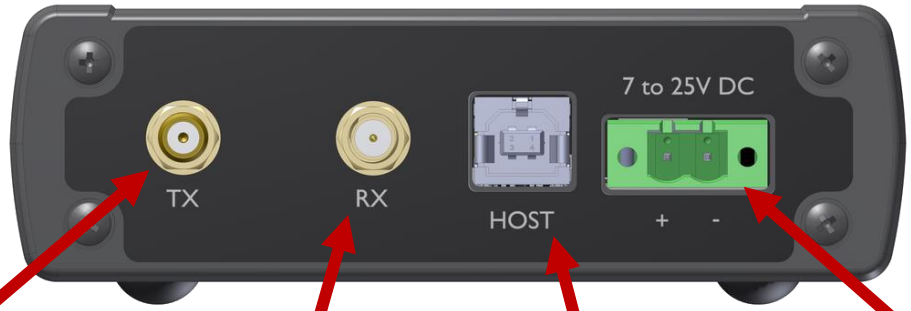
To manage the gain control settings of all RFI LineAmps on the site from a single point.

1. **Generate the beacon:** sent down the leaky feeder cable every second
2. **Centralised configuration management:**
   - Target beacon power level (used in AUTO gain control mode)
   - Target composite power level (used in PILOT gain control mode)
   - Uplink gain boost (used in all gain control modes)
3. **2-way remote diagnostics:** message protocol conversion between the diagnostics server and the devices on the leaky feeder cable.

RFI TECHNOLOGY SOLUTIONS

External connections

REAR VIEW



TX
- SMA (50 Ohm)
- Downlink transmissions

RX
- SMA (50 Ohm)
- Uplink packet reception

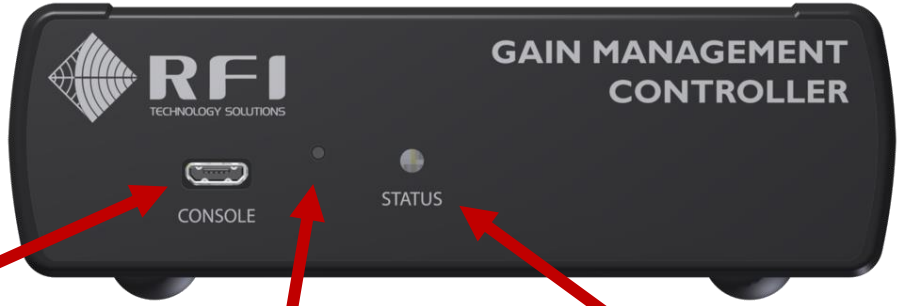
HOST
- USB Type-B
- Connects to the diagnostics server

POWER
- 7 to 25 V DC

RFI TECHNOLOGY SOLUTIONS

Configuration & status

FRONT VIEW



CONSOLE

- Micro-USB
- Virtual COM port, used for:
  - Configuration
  - Status monitoring

DEFAULT

- Hold for 10s to reset the configuration to factory settings

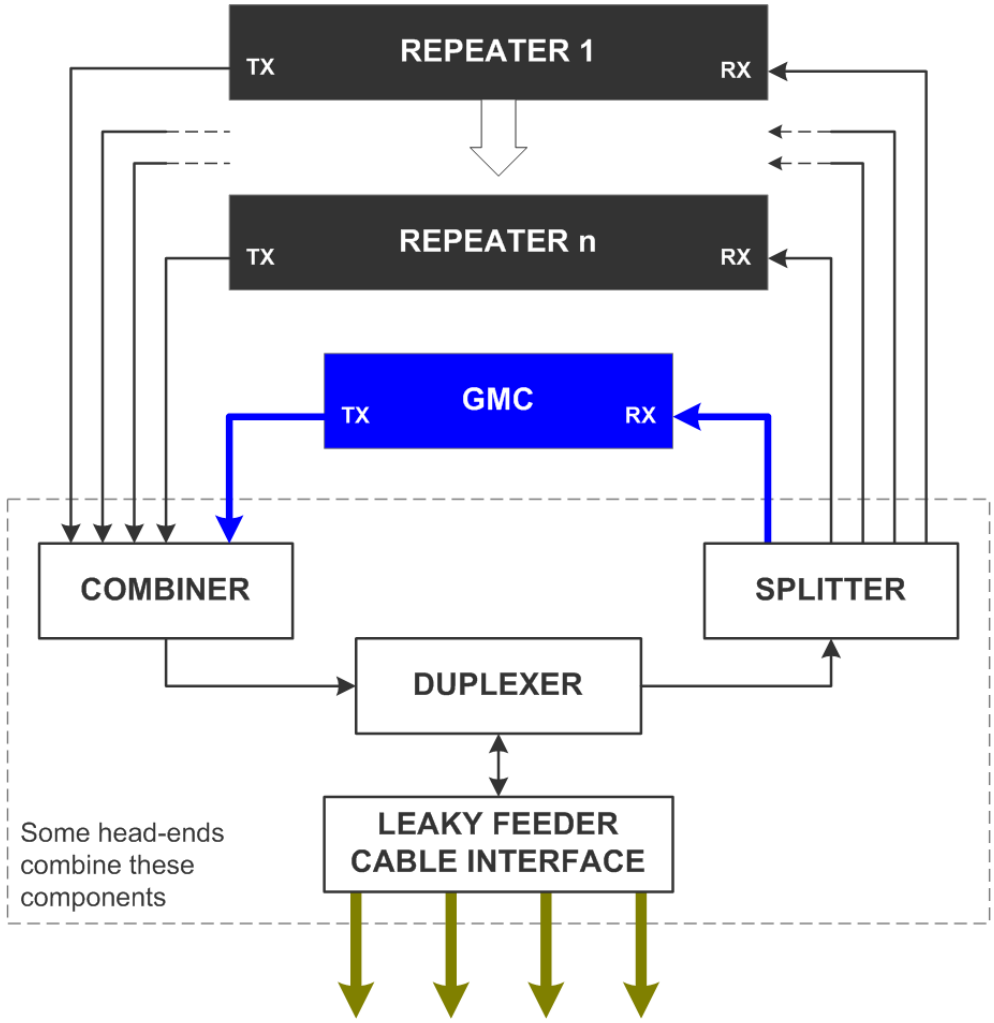
STATUS

- **Off:** Powered down
- **Green, solid:** No faults
- **Orange, flash (1 Hz):** Minor fault
- **Red, flash (4 Hz):** Major fault
- **Red, solid:** Critical fault – return to factory

RFI TECHNOLOGY SOLUTIONS

Head-end integration

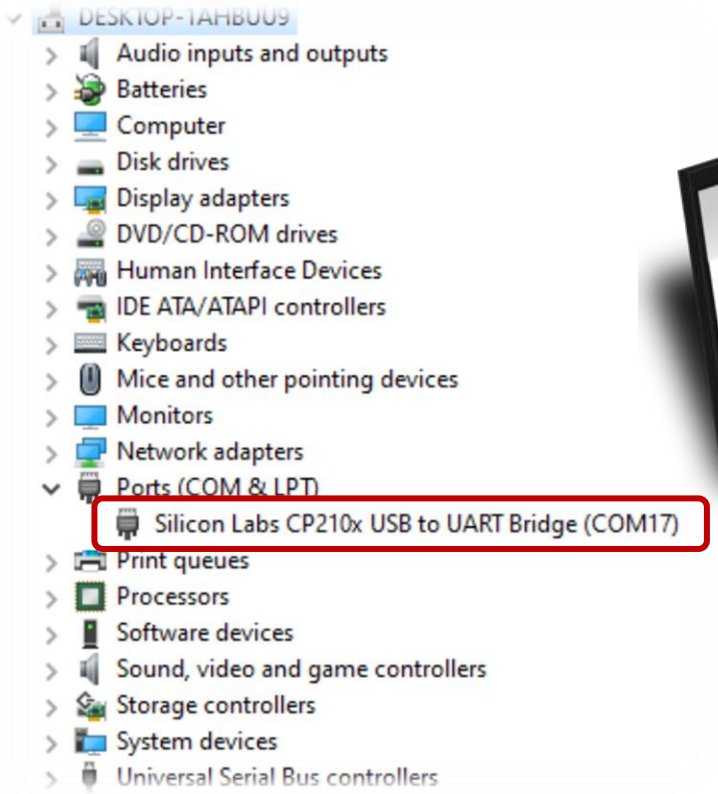
The GMC RF ports are connected to the head-end's Combiner and Splitter alongside the Repeaters.

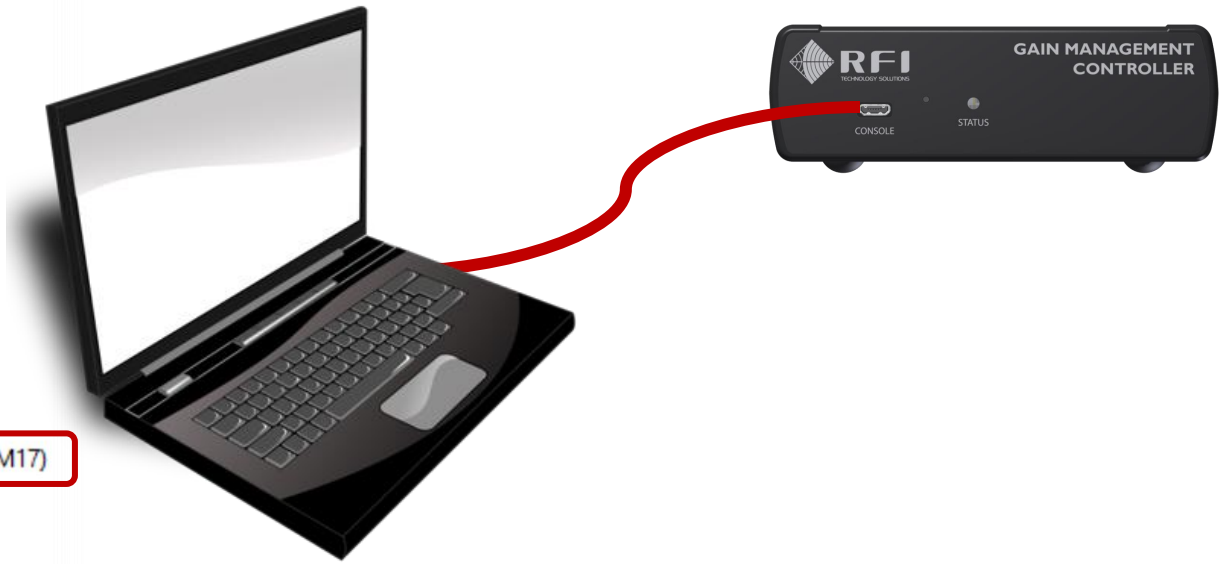


RFI TECHNOLOGY SOLUTIONS

Console - connection

The GMC appears as a virtual COM port when connected to a PC via USB cable.



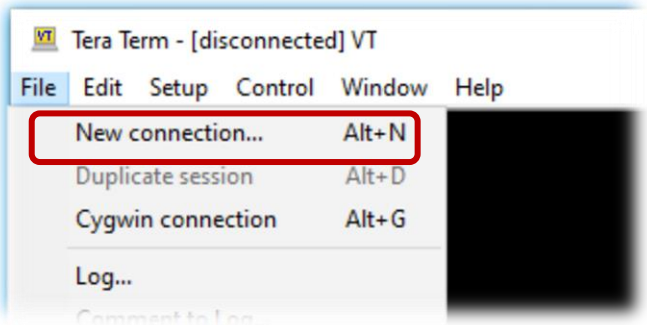


RFI TECHNOLOGY SOLUTIONS

Console – session establishment

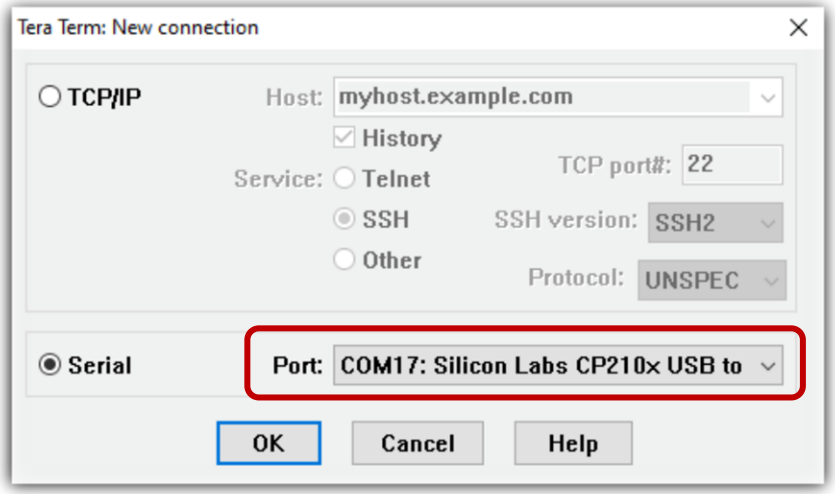
Tera Term is the recommended terminal emulator.

Create a new connection:



https://osdn.net/projects/ttsh2/releases

Using the GMC's virtual serial port:

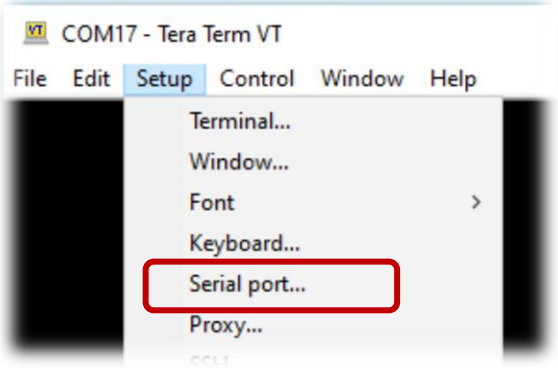


RFI TECHNOLOGY SOLUTIONS

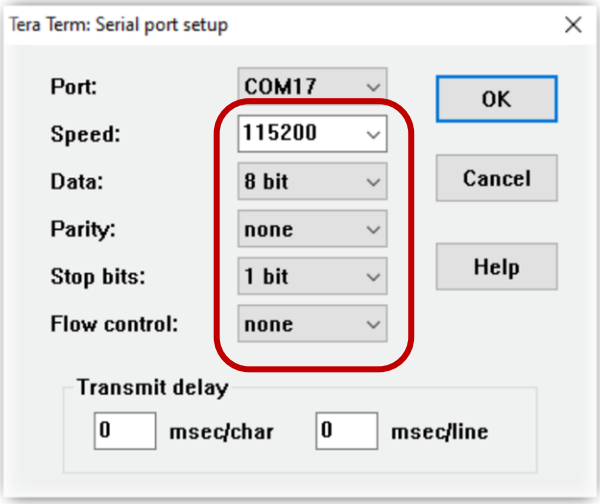
Console – serial port settings

The virtual COM port operates at a speed of **115200**, **8N1** with no flow control.

Open the serial port settings:



Verify that 115200 8N1 is being used:

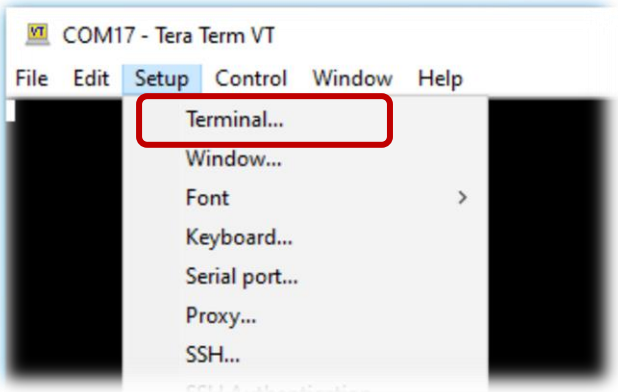


RFI TECHNOLOGY SOLUTIONS

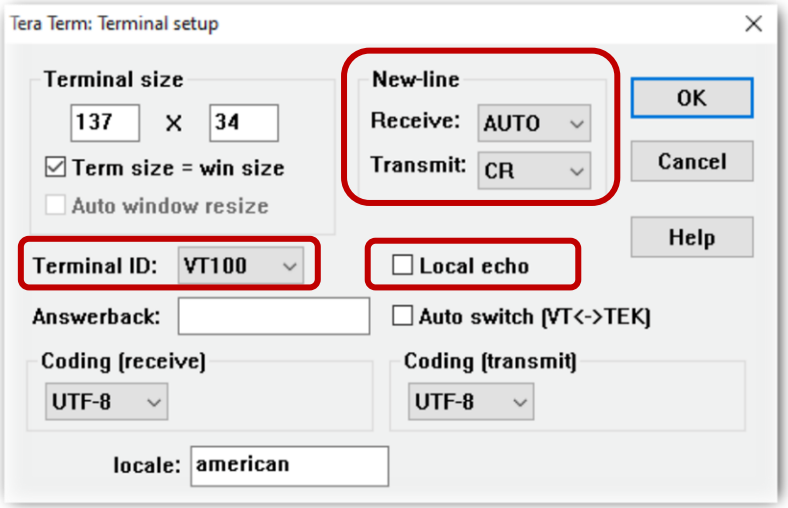
Console – terminal parameters

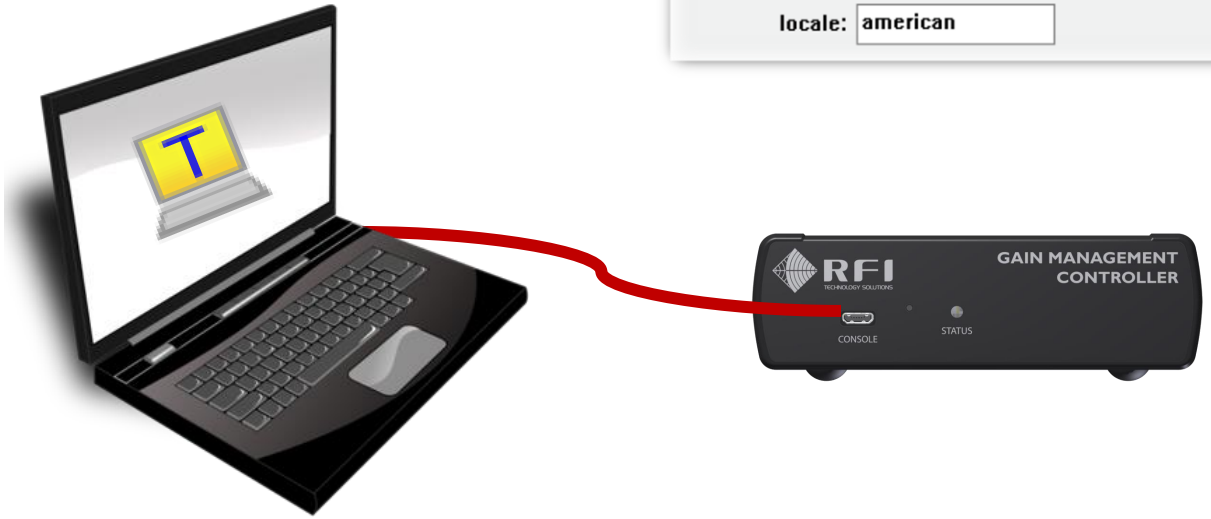
The terminal operates best in VT100 mode without local echo and using CR for line endings.

Open the terminal settings:



Verify the following values:



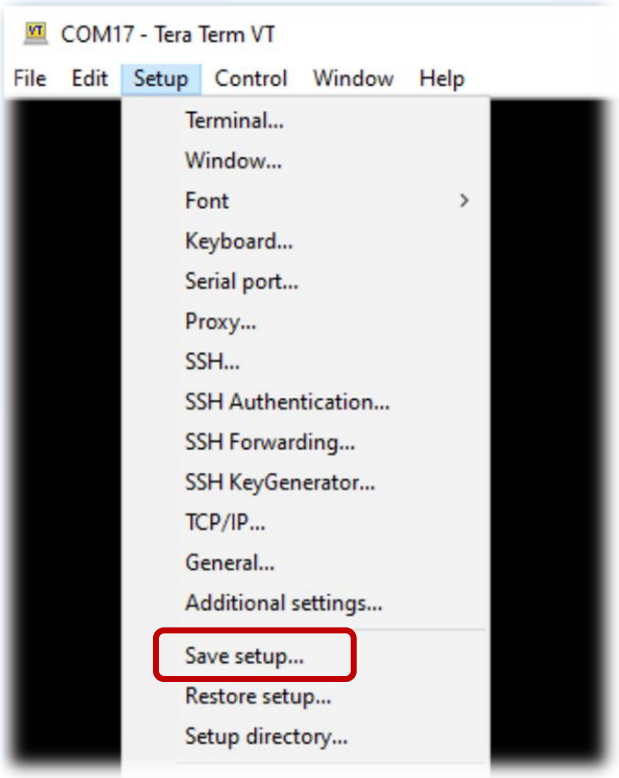


RFI TECHNOLOGY SOLUTIONS

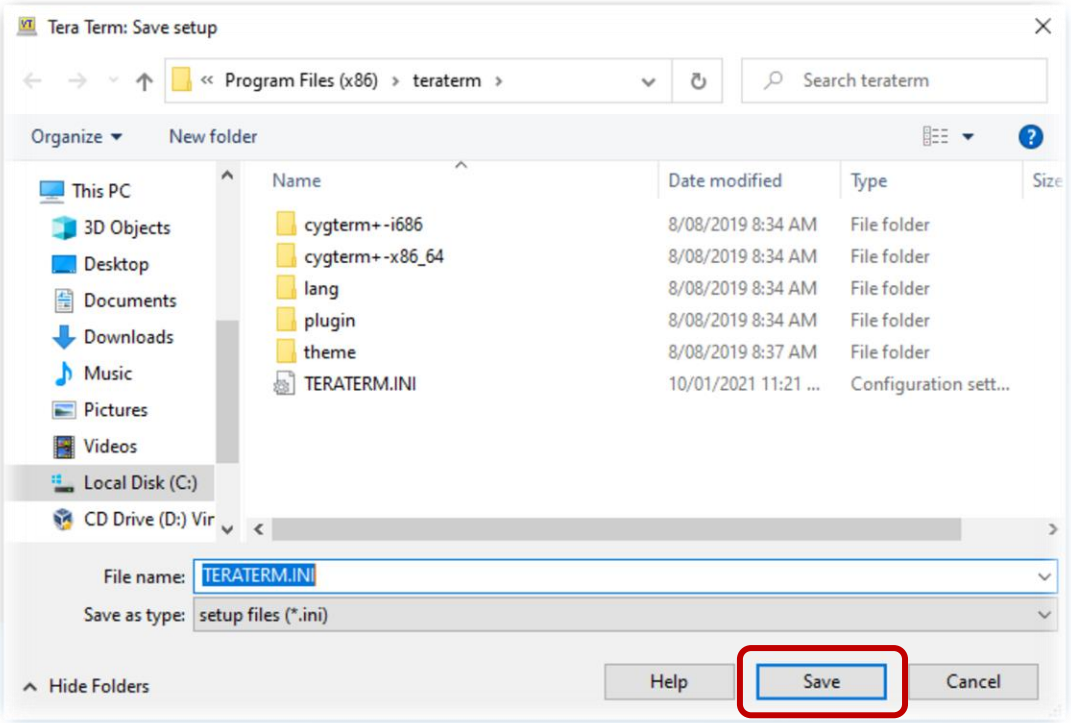
Console – saving the configuration

To avoid reconfiguring the parameters each time Tera Term is started, save the configuration.

Save the setup:



Over-writing the default config file:

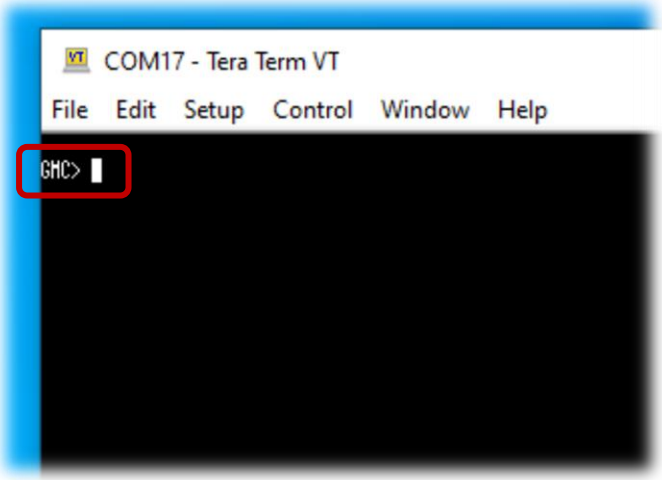


RFI TECHNOLOGY SOLUTIONS

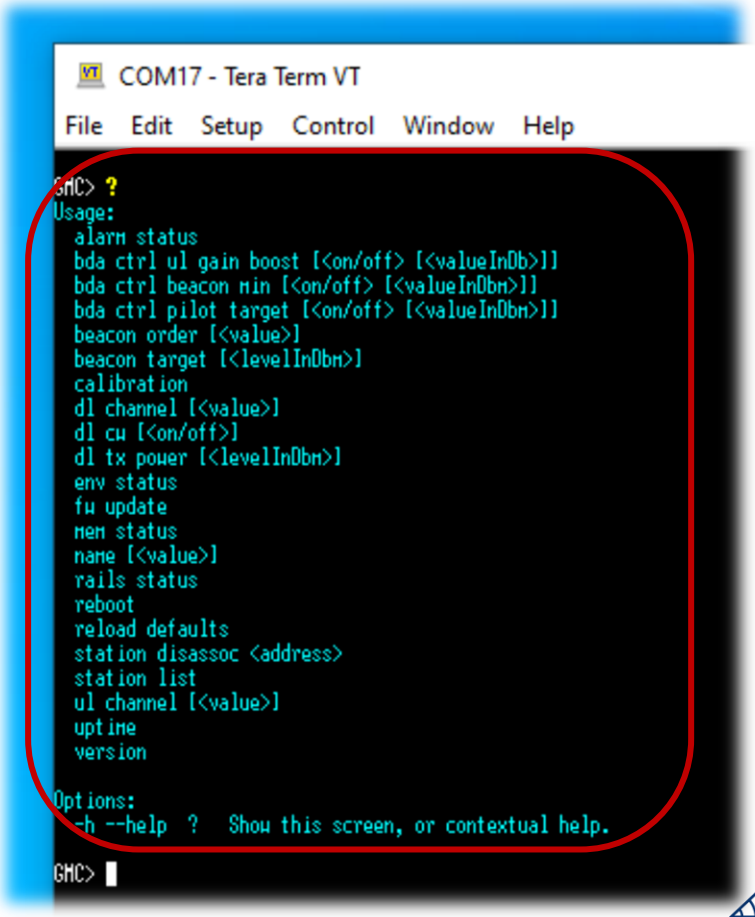
Console – verify the session

Press **ENTER** to display a command prompt, and **?** to display the available commands.

Press <ENTER>:



Type ?, then <ENTER>:



RFI TECHNOLOGY SOLUTIONS

Selecting the downlink frequency

The downlink frequency should be close to the voice radio carriers and chosen from the hard coded list of frequencies that LineAmps scan.

Channel	Frequency (MHz)
20	145.2500
40	145.5000
60	145.7500
80	146.0000
100	146.2500
120	146.5000
140	146.7500
160	147.0000
180	147.2500
200	147.5000
220	147.7500
240	148.0000
260	148.2500
280	148.5000
300	148.7500
320	149.0000
340	149.2500
360	149.5000
380	149.7500
400	150.0000

Channel	Frequency (MHz)
410	150.1250
420	150.2500
430	150.3750
440	150.5000
450	150.6250
460	150.7500
470	150.8750
480	151.0000
490	151.1250
500	151.2500
510	151.3750
520	151.5000
530	151.6250
540	151.7500
550	151.8750
560	152.0000
570	152.1250
580	152.2500
590	152.3750
600	152.5000

Channel	Frequency (MHz)
620	152.7500
640	153.0000
660	153.2500
680	153.5000
700	153.7500
720	154.0000
740	154.2500
760	154.5000
780	154.7500
800	155.0000
880	156.0000
896	156.2000
904	156.3000
912	156.4000
920	156.5000
928	156.6000
936	156.7000
944	156.8000
952	156.9000
960	157.0000

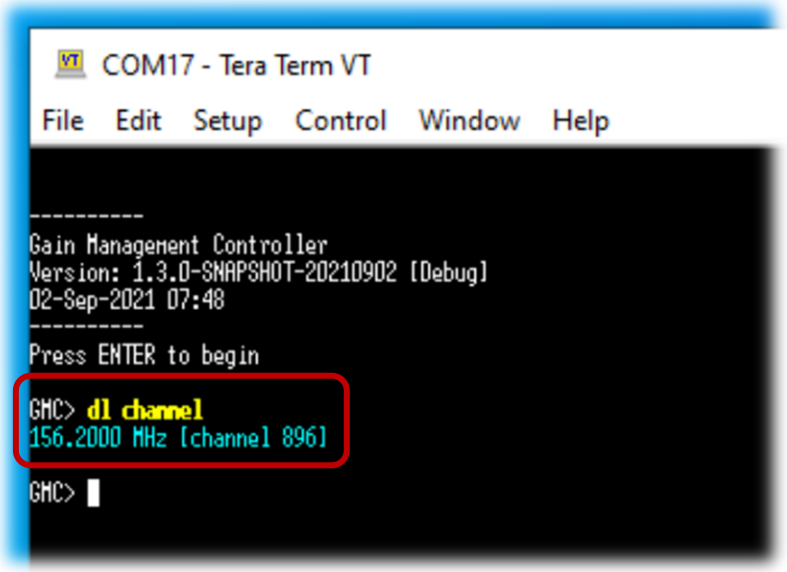
Rules for choosing the downlink frequency:

1. Greater than the lowest frequency voice radio carrier in the downlink direction.
2. Less than the highest frequency voice radio carrier in the downlink direction.
3. At least 50 kHz away from any of the downlink voice radio carriers.
4. Does not reside on an inter-modulation product.
5. Is listed in the tables shown on the left.

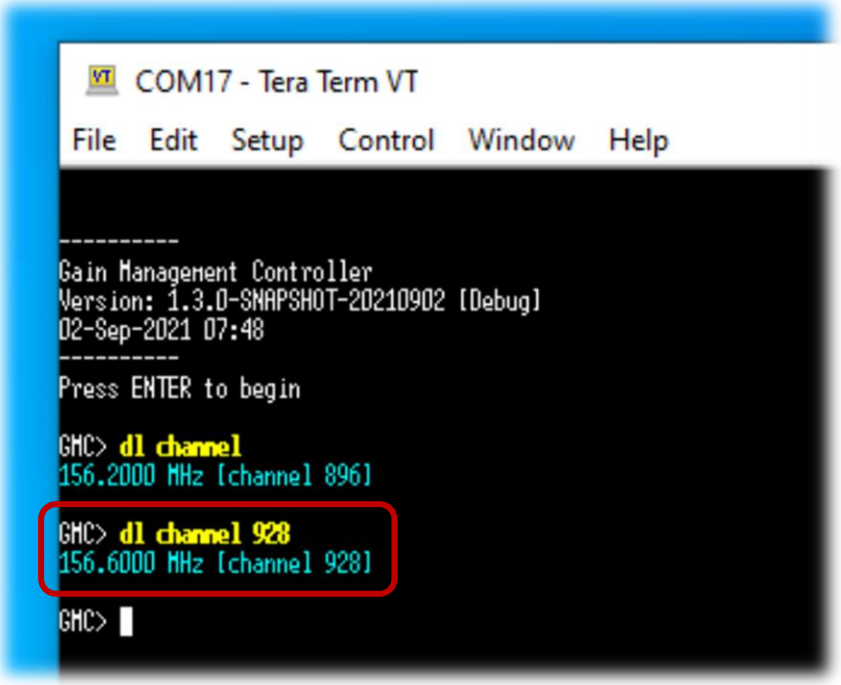
Setting the downlink frequency

The downlink frequency is set via a terminal session with the CONSOLE port.

Display the current downlink channel / frequency:



Set the downlink channel / frequency:



The change takes effect immediately, without requiring a reboot

RFI TECHNOLOGY SOLUTIONS

Selecting the uplink frequency

The uplink frequency should be close to the voice radio carriers.

Rules for choosing the uplink frequency:

1. Greater than the lowest frequency voice radio carrier in the uplink direction.
2. Less than the highest frequency voice radio carrier in the uplink direction.
3. At least 50 kHz away from any of the uplink voice radio carriers.
4. Does not reside on an inter-modulation product.

Uplink channel =

(*<uplink frequency>* - 170,000,000) / 12,500

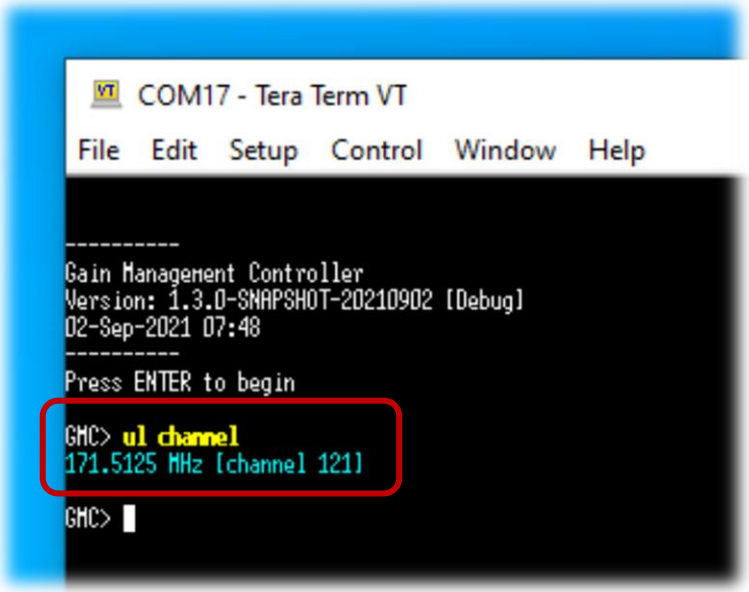
Examples:

- 171.5125 MHz = channel 121
- 174.2500 MHz = channel 340

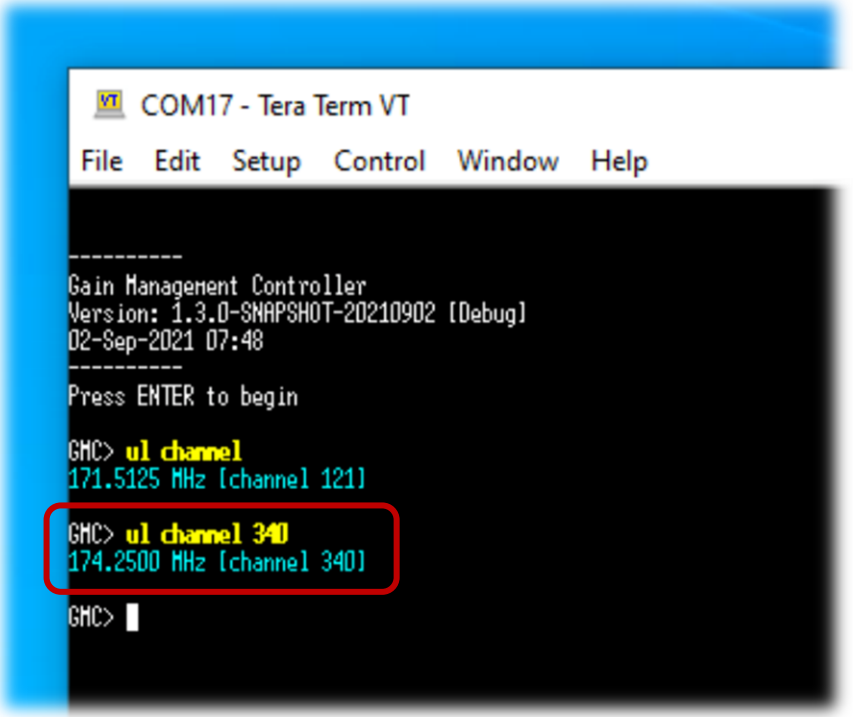
Setting the uplink frequency

The uplink frequency is set via a terminal session with the CONSOLE port.

Display the current uplink channel / frequency:



Set the uplink channel / frequency:



The change takes effect immediately, without requiring a reboot

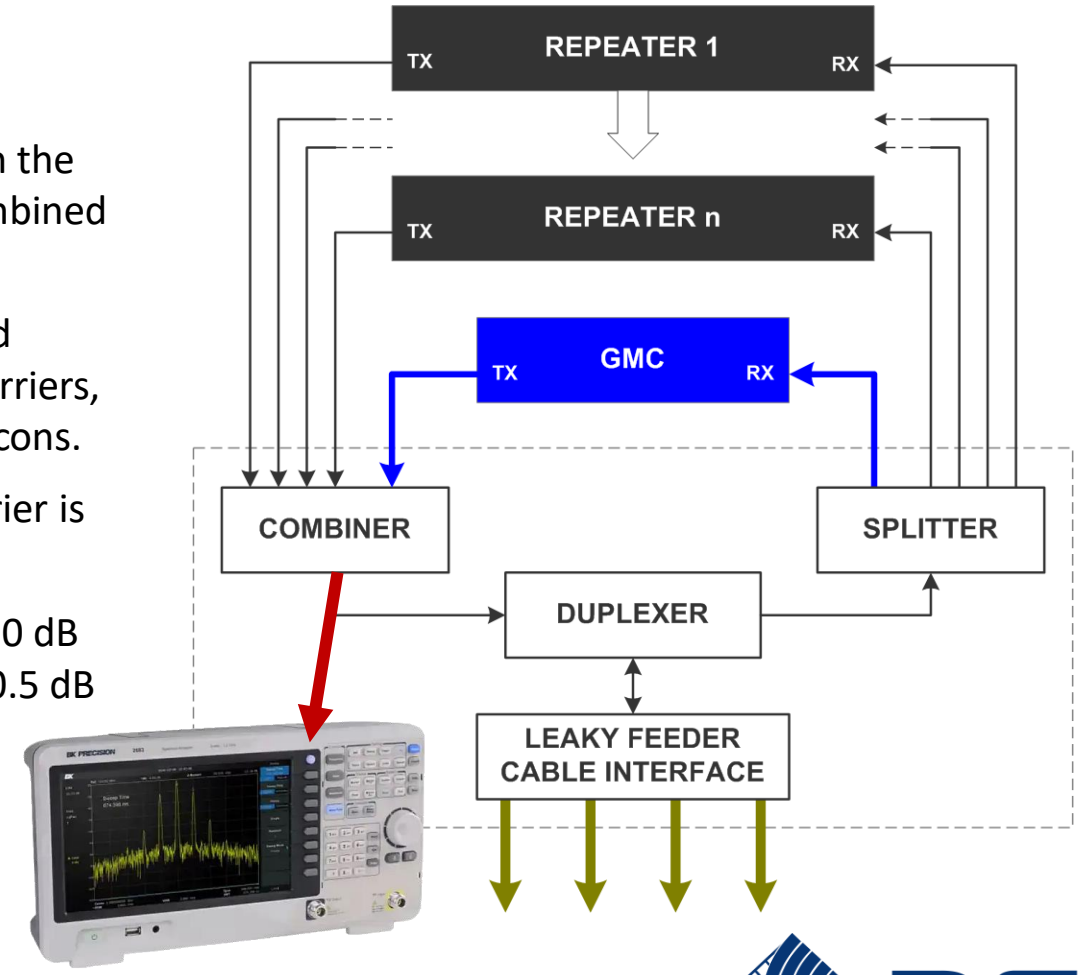
RFI TECHNOLOGY SOLUTIONS

Downlink TX power – verification process

A spectrum analyser is required to verify that the downlink TX level is 20 dB below the voice radio carriers.

Process:

1. Connect the spectrum analyser to a point in the signal chain after the GMC TX has been combined with the Repeater TX signals.
2. Operate the spectrum analyser in Peak Hold mode and key up each of the voice radio carriers, while the GMC is continuously sending beacons.
3. Verify that the level of each voice radio carrier is the same.
4. Verify that the level of the GMC beacon is 20 dB lower than the voice radio carriers (within 0.5 dB tolerance).
5. If the GMC beacon level is not correct:
   - Change the GMC downlink TX power.
   - Clear the spectrum analyser results.
   - Repeat from Step 2.



RFI TECHNOLOGY SOLUTIONS

Downlink TX power – expected results

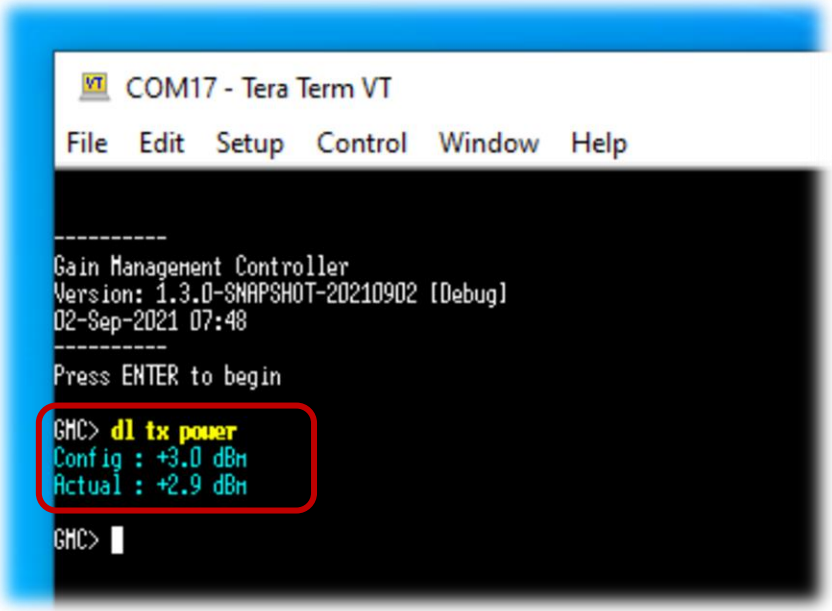
Adjust the downlink TX power level until the GMC beacon is 20 dB below the voice radio carriers.

RFI TECHNOLOGY SOLUTIONS

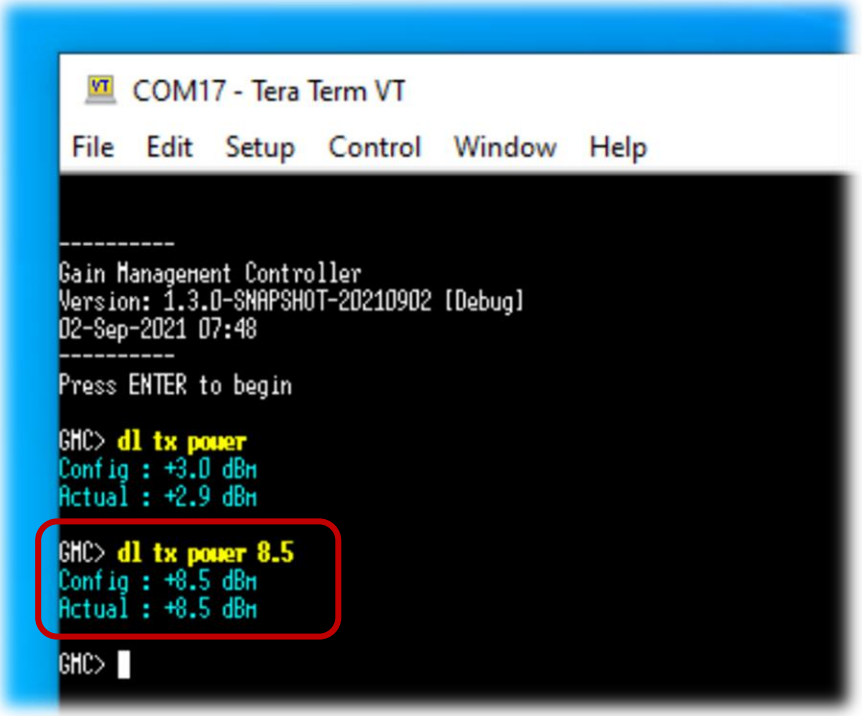
Downlink TX power – setting the value

The downlink TX power is set via a terminal session with the CONSOLE port.

Display the current downlink TX power:



Set the downlink TX power:

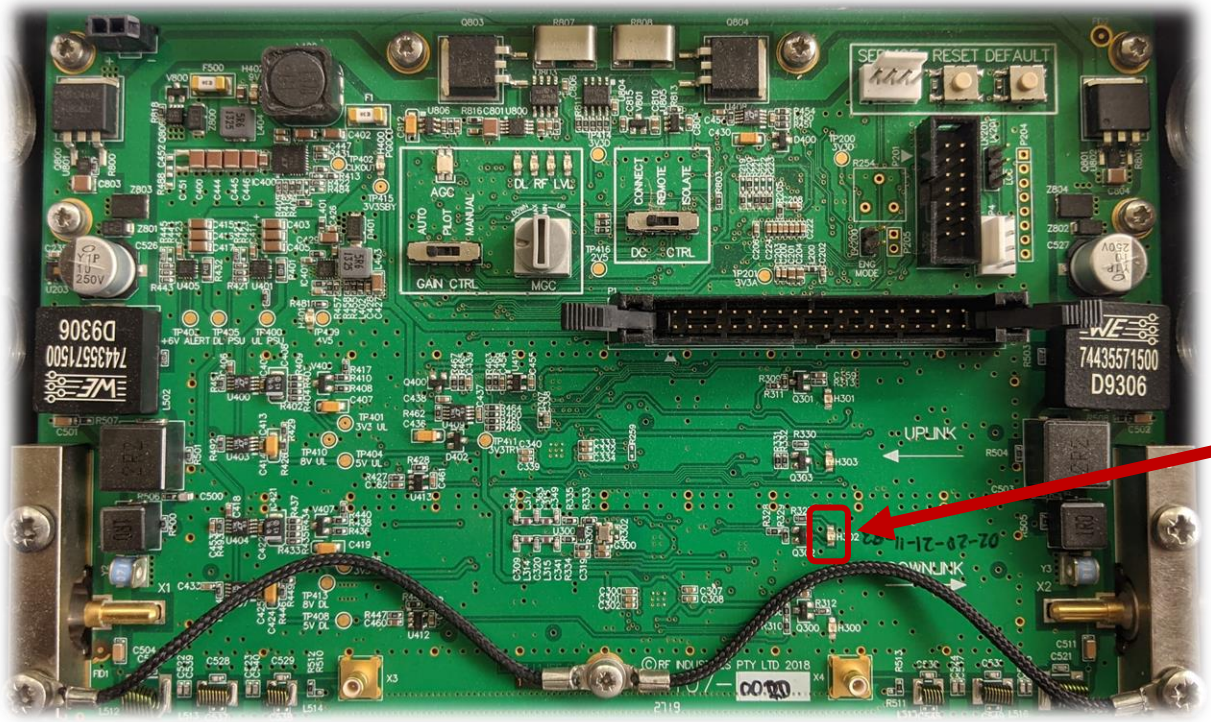


The change takes effect immediately, without requiring a reboot

RFI TECHNOLOGY SOLUTIONS

Verifying beacon reception

Once the GMC downlink channel and TX power is configured, LineAmps will find the beacon and receive it every second.



DOWNLINK RX INDICATOR

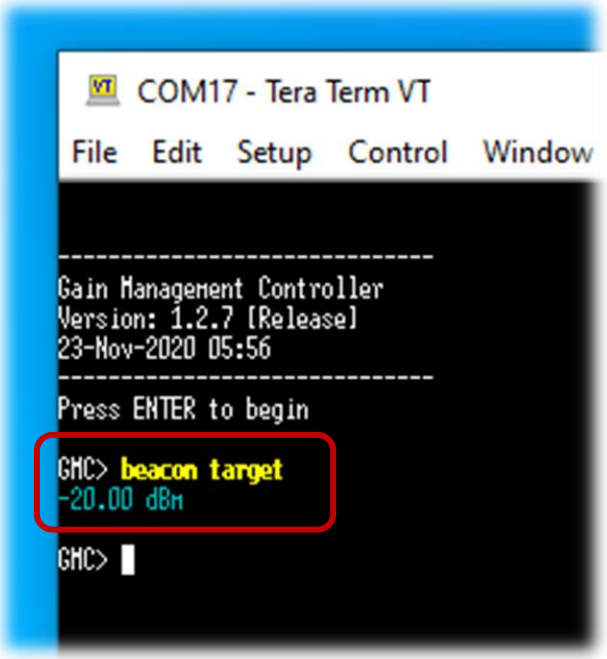
- Blinks green every second as a beacon packet is received.
- The beacon packet contains site-wide gain control settings.

RFI TECHNOLOGY SOLUTIONS

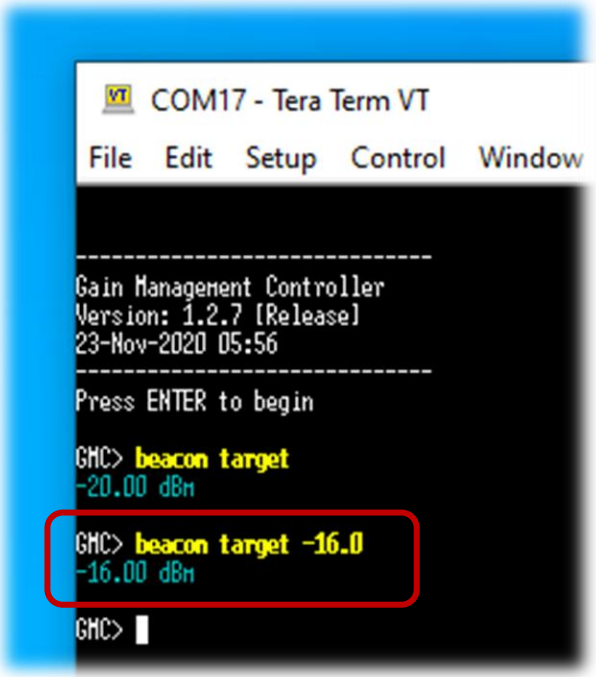
Centralised config management – Beacon power target

The beacon power target can be pushed out to all LineAmps via the GMC's beacon message.

Display the beacon target:



Set the beacon target:



NOTES:

- This setting is only relevant to LineAmps operating in **AUTO** gain control mode.
- On LineAmps operating in AUTO gain control mode:

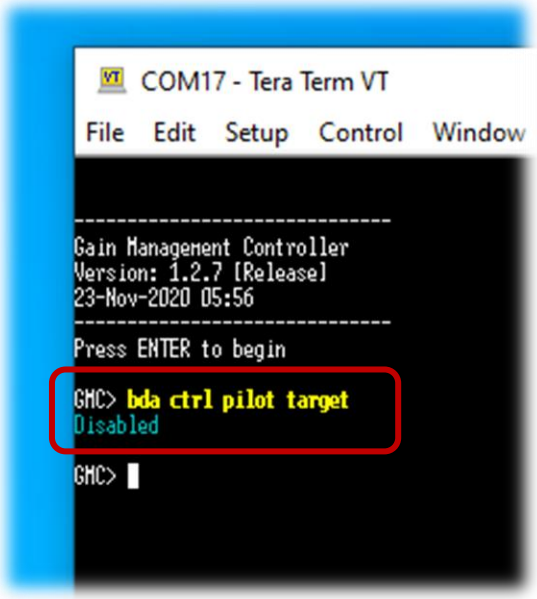
  Downlink gain = *<beacon power target>* - average incoming beacon power

RFI TECHNOLOGY SOLUTIONS

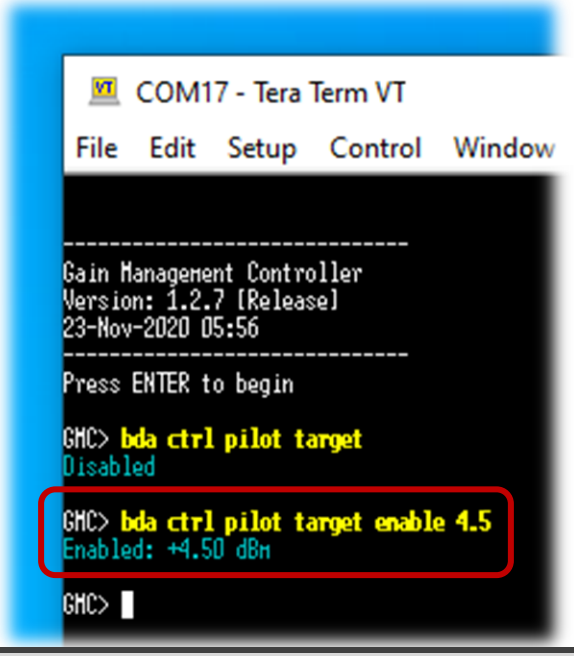
Centralised config management – Composite power target

The composite power target can be pushed out to all LineAmps via the GMC's beacon message.

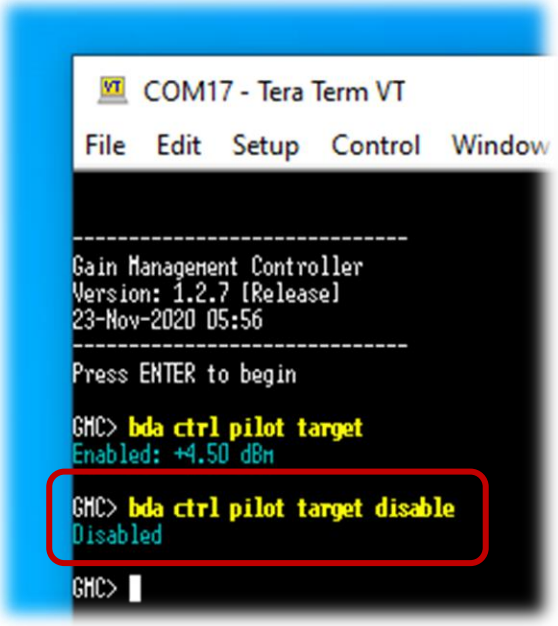
Display the current setting:



Enable centralised control of composite power target:



Disable centralised control of composite power target



NOTES:

- This setting is only relevant to LineAmps operating in **PILOT** gain control mode.
- On LineAmps operating in PILOT gain control mode:

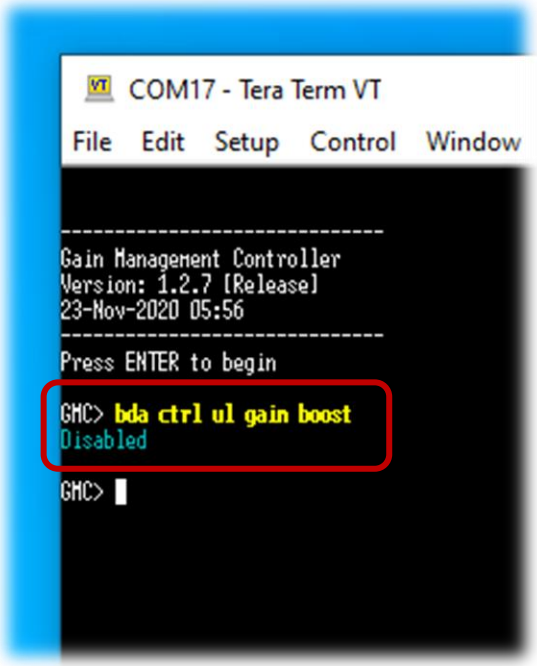
  Downlink gain = *<composite power target>* - average incoming composite power

RFI TECHNOLOGY SOLUTIONS

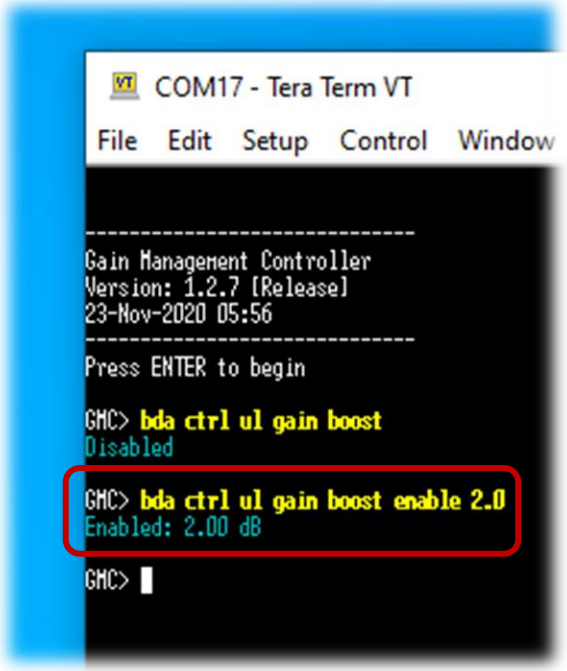
Centralised config management - Uplink gain boost

The uplink gain boost setting can be pushed out to all LineAmps via the GMC's beacon message.

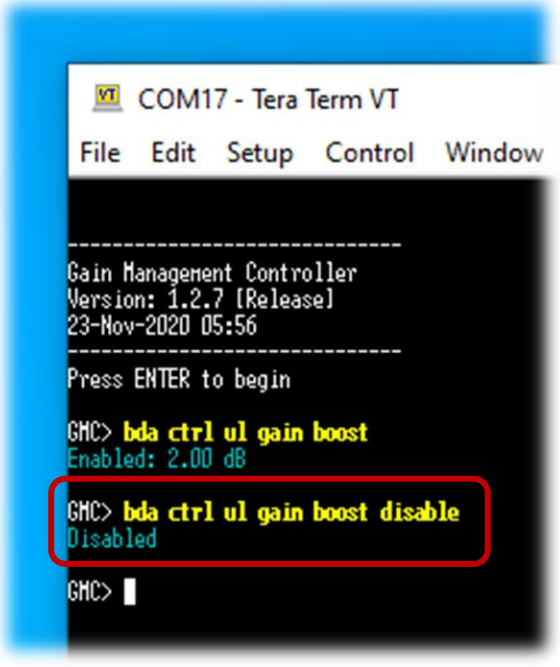
Display the current setting:



Enable centralised control of uplink gain boost:



Disable centralised control of uplink gain boost:



NOTE: On all LineAmps:

Uplink gain = downlink gain + *<uplink gain boost>*

(regardless of the gain control mode)

RFI TECHNOLOGY SOLUTIONS