

TELSTRA GO SMART REPEATER - MOBILE

3G / 4G / 4GX

TECHNICIAN/INSTALLER GUIDE

Issue 1

11/04/2017

Purpose

The purpose of this document is to provide information to suitably qualified technicians/installers, as a guide to installing the TELSTRA GO SMART REPEATER - MOBILE inside a motor vehicle.

It is not intended as an instruction for general Telstra customers, or the general public.

What is the TELSTRA GO SMART REPEATER - MOBILE?

The TELSTRA GO SMART REPEATER - MOBILE is a device designed for repeating/enhancing Telstra Mobile Phone Network signals when user equipment/handsets are being used in fast moving situations, such as inside a vehicle.

In simple terms, it receives Telstra's Mobile Phone Network signals from outside the vehicle using its external antenna, then it amplifies these signals and re-transmits them inside the vehicle. This improves the Telstra Mobile Phone Network signal inside the car thanks to the higher gain external antenna, plus the added RF gain of the TELSTRA GO SMART REPEATER amplifier module. It also amplifies the signals in the reverse direction i.e. signals coming from the handset inside the car, back to the Telstra Mobile Phone Network.

Hardware

The TELSTRA GO SMART REPEATER - MOBILE has four main hardware components:

- A magnetic base antenna which is mounted on the outside of the vehicle
- A small antenna which is mounted inside the vehicle
- The main Cel-Fi Go amplifier module.
- A +12V to +24V power plug (cigarette plug style)



Note: At the time of writing, the antennas to be supplied with the TELSTRA GO SMART REPEATER - MOBILE have not yet been finalised, and they may be different to the antennas shown in this document. However, the installation procedures outlined in this document are still applicable, because these guidelines and the performance optimisation procedure are both generic and apply regardless of the antennas supplied.

Installation

To eliminate the risks, Telstra recommends that the TELSTRA GO SMART REPEATER - MOBILE is only installed as a permanent installation, completed by a suitably qualified professional installer. This will ensure that the best possible performance of the TELSTRA GO SMART REPEATER - MOBILE is achieved, and customer expectations are met.

Telstra takes no responsibility for any adverse effects to the vehicle or its occupants if customers choose to install the TELSTRA GO SMART REPEATER - MOBILE by themselves, or if the installation is not completed by a suitably qualified technician/installer.

Recommended Installer Qualifications

Telstra recommends that only appropriately qualified technicians/installers complete the installation of the TELSTRA GO SMART REPEATER - MOBILE to ensure that:

- The safety of vehicle occupants is maintained.
- The best performance of the TELSTRA GO SMART REPEATER - MOBILE is achieved.
- The existing vehicle safety equipment is not compromised (such as airbags, seat belt tensioners, sensors, controls etc)
- Correct power connections are made to the existing vehicle electrical power system.
- The vehicle finish/trim is not damaged during installation, or over the life of the installation.

Acceptable installer qualifications may include (but are not limited to):

- Auto Electricians (with at least Certificate II in Automotive Electrical Technology qualifications)
- Professional Car radio/entertainment installers
- Professional RF Communication installers (for example, members of Australian Radio Communications Industry Association)

In all cases, installers must also have read and understood this document, to ensure that they understand how to optimise the TELSTRA GO SMART REPEATER - MOBILE for best performance.

Pre-Installation Assumptions

Since it is assumed that a suitably qualified installer/technician is completing the TELSTRA GO SMART REPEATER - MOBILE installation, then practical details relating to the installation of electrical equipment inside a vehicle will not be covered in this document.

It is also assumed that the correct RF assessment has already been made of the customer's situation, and that it has already been determined that the TELSTRA GO SMART REPEATER - MOBILE is a suitable product to meet the customer's expectations.

Finally it is assumed that the installer has already read and understood the Quick Start Guide, which explains the basic set-up and operation of the TELSTRA GO SMART REPEATER - MOBILE unit. The Quick Start Guide also explains the use of the Mode button and the meaning of the Status Indicator light.

TELSTRA GO SMART REPEATER - MOBILE Installation

This document will explain the specific installation requirements to ensure that the TELSTRA GO SMART REPEATER - MOBILE is installed to achieve best possible RF performance.

The main steps for correct installation of the TELSTRA GO SMART REPEATER - MOBILE are outlined below:

1. Download and install the Cel-Fi WAVE App.
2. Move the vehicle to a location where Telstra's Mobile Phone Network signals are low (otherwise the installation of the TELSTRA GO SMART REPEATER - MOBILE cannot be optimised).
3. Temporarily install the TELSTRA GO SMART REPEATER - MOBILE inside the vehicle using the magnetic mount antennas, and adjust antenna positions to best performance (as shown by the Cel-Fi WAVE App).
Alternatively if the antenna positions are pre-determined and cannot be moved, then temporarily locate the antennas in these locations and check that the TELSTRA GO SMART REPEATER - MOBILE performance is sufficient (as shown by the Cel-Fi WAVE App).
4. After the appropriate antenna locations are confirmed, complete the final permanent installation.

Installation – Step 1

Go to the Cel-Fi website, and download the free WAVE App.

<http://www.cel-fi.com.au/cel-fi-go-telstra-nextg-4gx-repeater-booster.html>

Download the appropriate software via the link [Bluetooth WAVE App for iPhone, Android & Computers](#)

For Computers:

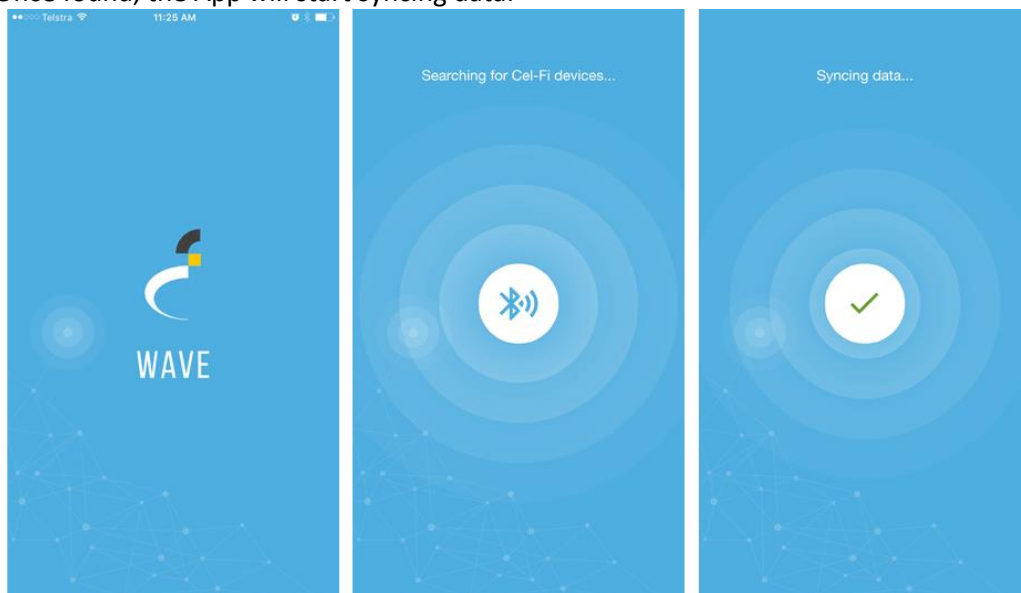
Download and install the software/WAVE app. Connect a USB cable in between the Coverage Unit and your computer. Note that a micro-USB port is located on the side of the TELSTRA GO SMART REPEATER - MOBILE amplifier module (next to the power plug port).

For Smart Phones:

For smart phones, search for 'Cel-Fi WAVE' on the iPhone (iTunes) or Android store (Google Play), and install the free WAVE app on your smart phone.

WAVE App Start-up Screens

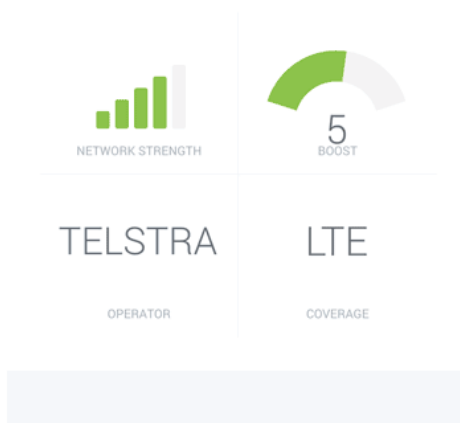
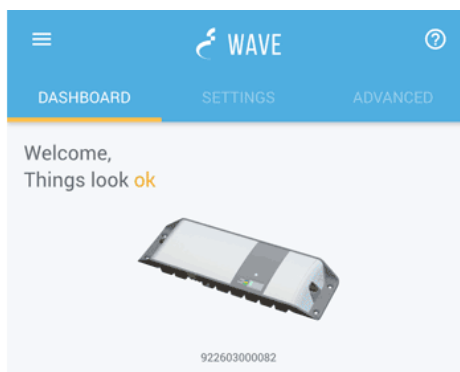
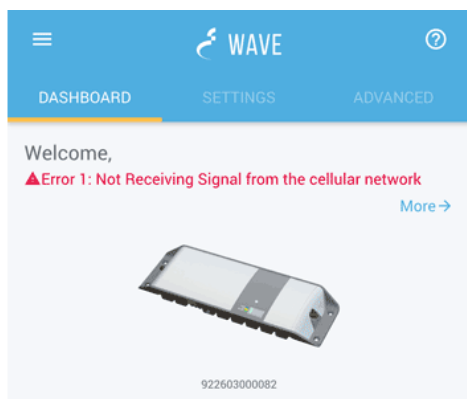
Ensure that you are within a few metres of the TELSTRA GO SMART REPEATER - MOBILE unit and start the App. Once found, the App will start syncing data.



WAVE App "DASHBOARD" Display Screen

The opening screen of the App is the dashboard screen that displays several things:

- **Errors** – an explanation of any issues with the setup or hardware.
- **Signal Strength** – from the network
- **Boost** – represented by 1 to 9, with 9 being the most boost. Isolating the indoor antenna from the outdoor antenna will assist in increasing this number and therefore improving overall performance.
- **Operator** – current operator being boosted
- **Coverage** – if the unit is boosting 3G (3G/4G will be displayed), if boosting 4G/4GX (LTE will be displayed)



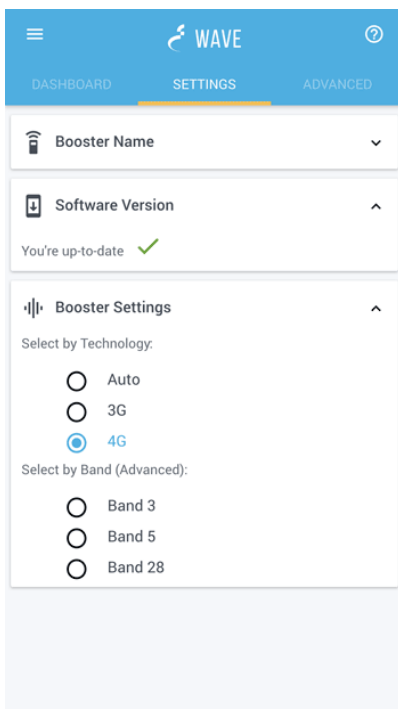
WAVE App “SETTINGS” Screen

This screen offers the ability to control what frequencies TELSTRA GO SMART REPEATER - MOBILE will boost. This is useful for optimising the unit for voice or internet, to maximise the internet speed or select a band that is compatible with all phones in a vehicle.

The settings tab displays the following:

- **Booster Name** – you can assign a name to your TELSTRA GO SMART REPEATER – MOBILE unit.
- **Software Version**
- **Select by Technology** – this allows selection of which technology is boosted (3G/4G/Auto). It is a software control which is equivalent to the physical button on the TELSTRA GO SMART REPEATER - MOBILE amplifier module. This control is useful if the TELSTRA GO SMART REPEATER - MOBILE amplifier module is mounted under a seat and cannot be easily accessed.
- **Select by Band** – this allows selection of which frequency is boosted. Band 3 = LTE1800 (4G), Band 5 = WCDMA850 (3G), Band 28 = LTE700 (4GX)

NOTE: The TELSTRA GO SMART REPEATER - MOBILE will only amplify ONE band at a time. The band can be selected manually using this screen, but if Auto is selected then the unit will automatically switch itself and choose one band to amplify.



WAVE App “ADVANCED” Screen

The Advanced screen helps with setting up and optimising TELSTRA GO SMART REPEATER – MOBILE because this screen reports system information, signal strength measurements, downlink system gain etc.

Some of the useful information that can be accessed include:

- **Donor RSSI** – measurement of the incoming mobile signal
- **Downlink Centre Frequency** – what frequency band is being amplified
- **External Antenna in Use** – if the internal or external antenna is being utilised
- **Cell ID** – ability to see nearby towers and their signal strength
- **Downlink System Gain**

Examples of the Advanced screen are shown on the following page.

WAVE

DASHBOARD SETTINGS **ADVANCED**

Send Log

OVERVIEW

Network Strength

A B C D

WCDMA
884.8 MHz

SUPER CHANNELS

Radio A Band 5 : WCDMA (Boosting)

Description	Value
Bandwidth	10 MHz
Downlink centre freq.	884.8 MHz
Uplink centre freq.	839.8 MHz
PRI Cell ID	265
Donor RSSI	-61 dBm
Donor RSCP	-67 dBm
Donor EC/IO	-5 dB
Downlink TX power	13 dBm
Uplink TX power	-58 dBm
Ext. antenna in use	Yes
Uplink Safe Mode Gain	72 dB
Downlink System Gain	73 dB
Uplink System Gain	0 dB
Downlink Echo Gain	9 dB
Uplink Echo Gain	-50 dB

Radio B : Unused

Radio C : Unused

Radio D : Unused

DEVICE VERSION

Software Versions

CELL DETAILS

Radio A Band 5 : WCDMA

ID	Downlink Freq.	RSCP	ECIO
265	882.4 MHz	-71 dBm	-10 dB
289	882.4 MHz	-75 dBm	-14 dB
273	882.4 MHz	-83 dBm	-19 dB
41	882.4 MHz	-82 dBm	-21 dB
265	887.2 MHz	-80 dBm	-16 dB

Radio B : Unused

Radio C : Unused

Radio D : Unused

WAVE

DASHBOARD SETTINGS **ADVANCED**

Send Log

OVERVIEW

Network Strength

A B C D

LTE
1815 MHz

SUPER CHANNELS

Radio A Band 3 : LTE (Boosting)

Description	Value
Bandwidth	20 MHz
Downlink centre freq.	1815 MHz
Uplink centre freq.	1720 MHz
PRI Cell ID	3
Donor RSSI	-65 dBm
Donor RSRP	-92 dBm
Donor RSRQ	-11 dB
Donor SINR	4 dB
Downlink TX power	-2 dBm
Uplink TX power	-96 dBm
Ext. antenna in use	Yes
Uplink Safe Mode Gain	81 dB
Downlink System Gain	74 dB
Uplink System Gain	0 dB
Downlink Echo Gain	2 dB
Uplink Echo Gain	-50 dB

Radio B : Unused

Radio C : Unused

Radio D : Unused

DEVICE VERSION

Software Versions

CELL DETAILS

Radio A Band 3 : LTE

ID	Downlink Freq.	RSRP	RSRQ
3	1815 MHz	-92 dBm	-10 dB

Radio B : Unused

Radio C : Unused

Radio D : Unused

Installation – Step 2

The TELSTRA GO SMART REPEATER - MOBILE only turns on when the Mobile Phone Network signals are at a relatively low level, and in the ranges shown below:

3G (WCDMA850):	Between -80dBm and -104dBm
4G/4GX (LTE1800/LTE700):	Between -95dBm and -119dBm

Therefore it is not possible to properly observe the operation of the TELSTRA GO SMART REPEATER - MOBILE using the Cel-Fi WAVE app, unless the installation is completed in a location where the Mobile Phone Network signals are within the ranges above.

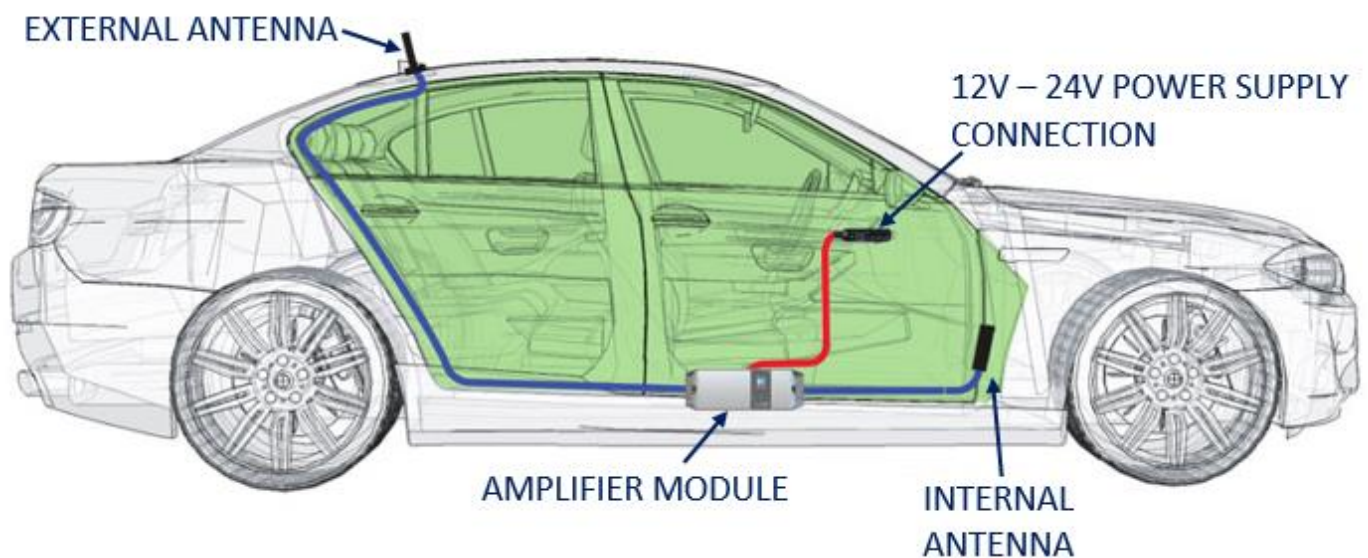
So Step 2 requires that the vehicle is moved to a location where the Mobile Phone Network signals are at a relatively low level. If this is not done, then the antenna installation positions cannot be optimised or checked for adequate performance.

Installation – Step 3

This is a critical step in the installation of the TELSTRA GO SMART REPEATER - MOBILE, and it must not be skipped before moving on to Step 4 (permanent installation).

To ensure that the TELSTRA GO SMART REPEATER - MOBILE is working properly (ie. achieves either the best possible performance possible, or at least sufficient performance to meet customer expectations), the TELSTRA GO SMART REPEATER - MOBILE must be temporarily installed and the positions of the external and internal antennas must be adjusted/optimised.

An example of a temporary installation is shown below. The external antenna is mounted outside the vehicle using the magnetic mount base, the TELSTRA GO SMART REPEATER - MOBILE amplifier module is located somewhere inside the vehicle (so that DC power can be reached). Exact antenna positions are not critical at this initial stage, however the whole aim of this Step 3 is to conduct measurements to determine the best antenna locations for the permanent installation.



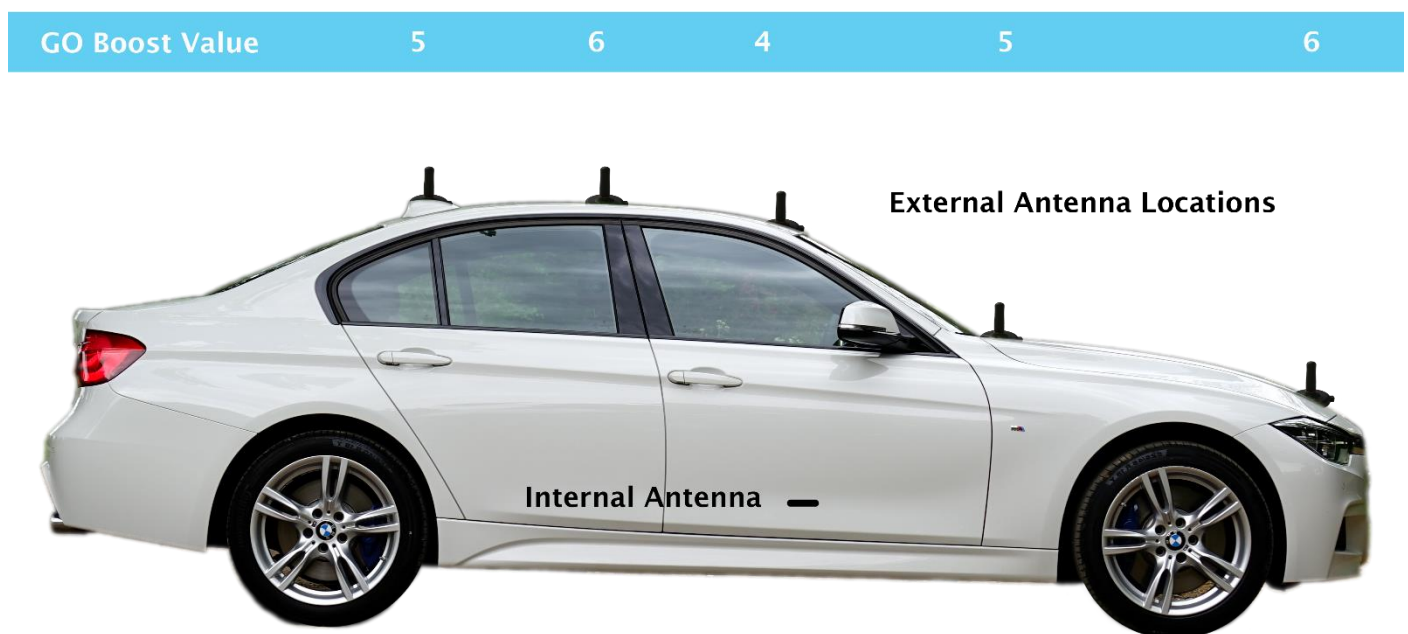
The best antenna positions can be assessed by looking at the Cel-Fi WAVE app Dashboard screen (as shown previously in Step 1) and making sure that the reported value of BOOST is maximised.

The BOOST display is directly related to the maximum possible level of RF amplification that the unit can achieve. In technical terms, the maximum possible level of RF amplification (ie BOOST) is directly related to the RF isolation (shielding) that the unit measures between the external antenna and the internal antenna.

Therefore to achieve best performance, the RF isolation (shielding) between the external antenna and the internal antenna must be maximised. If the RF isolation between the external antenna and the internal antenna is too low, then the operation of the unit will be severely degraded, and the performance may not achieve the performance improvement that is expected by the customer.

Because the physical layout of each type of vehicle is unique, it is not possible in advance to specify the best antenna mounting positions. Furthermore, the RF isolation will also vary depending on the antenna types used.

As a guide, the following picture shows various external antenna mounting positions and the level of BOOST achieved for the particular model of vehicle shown.



The roof is a good shield but is most effective when the external antenna is mounted in the centre. The isolation will also be impacted by the type of tinting applied to the windows. Metallized tint will provide far better isolation than dyed tint.

As mentioned previously, if the antenna positions on a vehicle have been pre-determined and they cannot be moved, then by completing a temporarily installation (with the antennas temporarily mounted in the pre-determined locations) then the resulting TELSTRA GO SMART REPEATER - MOBILE performance can be assessed, before proceeding with the permanent installation.

As a suggested guide, the relationship between the performance of the TELSTRA GO SMART REPEATER - MOBILE and the reported boost value is:

BOOST 6 – 9: Very Good to Maximum performance improvement.

BOOST 4 – 5: Fair to Good performance improvement.

BOOST 0 – 3: No to Poor performance improvement.

Therefore the most critical aspect of the TELSTRA GO SMART REPEATER - MOBILE installation is to determine the optimal positions for mounting both the external and internal antennas, before the hardware is permanently installed in the vehicle.

Installation – Step 4

Once the appropriate final antenna locations have been confirmed, then the final permanent installation can be completed.

It is assumed that the permanent installation will be completed by a suitably qualified installer/technician, so the specific requirements/details showing how to complete a permanent installation will not be outlined in this document.

However, some of the key features of a permanent installation are listed below:

- External antenna is mechanically fastened (eg bolted) to the vehicle external chassis, and weatherproofed.
- External RF cables do not run across paintwork or across windows, etc.
- External RF cables do not run through door/hatch/window weather seals.
- External RF cables are not crushed by the closing of doors/hatches/windows.
- Amplifier module is securely fixed to the vehicle using suitable mounting screws/bolts.
- Amplifier module is located where it cannot be accidentally struck by vehicle occupants (eg under a car seat, inside car boot). Note that the amplifier module requires ventilation for cooling, so it should not be mounted in enclosed vehicle cavities.
- The amplifier module is located where it can be accessed (but not whilst driving), so that status LEDs can be observed and the “Mode” button can be pressed.
- All internal cabling (both power and RF cabling) is run behind vehicle trim to prevent inadvertent contact/damage by vehicle occupants. Note that care must be taken to not interfere with the vehicle’s safety equipment such as airbags, seat belt tensioners, sensors, controls etc.
- Power to the amplifier module is supplied by a direct connection to the vehicles electrical accessory circuit. (Note that the unit should not be connected to a permanent vehicle power supply, otherwise there is a risk of draining the battery).

It is expected that the qualified installer/technician will be responsible for ensuring the aspects listed above are addressed during installation.

Telstra takes no responsibility for any adverse effects to the vehicle or its occupants if customers choose to install the TELSTRA GO SMART REPEATER - MOBILE by themselves, or if the installation is not completed by a suitably qualified technician/installer.