Laws of physics apply to antennas too - although we wish otherwise

We speak to many customers about antennas and one thing stands out in the conversations – the quest to have a high gain for the particular style of antenna and application. Often, it's a bit like asking for tyres with the most grip for your car when a better solution would be to work on the suspension to achieve great road holding. It is similar with antennas.

The need for high gain antennas often masks deficiencies elsewhere. As with extreme tyres the highest gain antennas come with drawbacks. The higher the gain of the antenna the larger it must be physically – and- the more distorted it becomes in what direction you get the high gain in. Since antennas do not amplify signal, if the gain is increased in one direction it is decreased in another direction. The power going into an antenna is all that is radiated from it (barring normal losses). So, if more is radiated in one direction, less is radiated elsewhere. Some of the requests we see for antennas are impossibilities given the size of the antenna required, the omnidirectional nature wanted and then the high gain. Something has to give….

To lessen the need for a higher gain antenna and all that goes with it, a good look at the losses incurred around the antenna would be useful. Long cable lengths attenuate much of the signal to or from an antenna. The cable length should be as short as you can possibly make it. Halving the length of the cable could easily halve the gain that you notionally need for your antenna. Additionally, low loss cable is available with many antennas. This has the effect of reducing signal loss by up to 50% over standard cable (depending on the cable and frequency). Here are two easily thought out ways of not needing a high gain antenna and thereby being able to use a physically small antenna and one that has the directional qualities that you desire.

Another approach would be to start your equipment design with the antenna and make it the largest you can physically in your equipment. That way you will naturally get a higher gain antenna. So often the antenna is the last thing in a design to be considered and therefore it is consigned to a small corner or has to be put somewhere else via long cable. Enter the request for a high gain antenna. Sorry to say that the 2nd law of thermodynamics is alive and well. (Matter and energy are neither created or destroyed). Whatever gets to the antenna gets radiated – what gets lost along the way to the antenna – is lost.