

Electronic Protection – the lost art Army MUST rediscover

By SGT Gavin Wilson

Historically, the Australian military has keenly exploited the electromagnetic spectrum (EMS) as technological understanding and advances have made new options possible. The rewards of EMS have been leveraged to enable manoeuvre, increased battlefield awareness, improved C2, and empowered the application of offensive effects.

Before delving in too deep, I think a ‘soldier’s five’ is required here to explain what EMS is and how and with what general means the Australian Army utilises it.

Recent events around the world clearly demonstrate that access to EMS can no longer be guaranteed. The situation now dictates that use of EMS is contested – some state and trans-state actors have capabilities which will prevent our ability to access EMS for periods of time.

It is therefore necessary to adjust our thinking regarding communications and our behaviour with regard to its use. It is no longer sufficient to think that, communications-wise, everything beyond talking or sending data is a ‘6 Shop’ or RASigs consideration or function. All users must adapt to this new operational paradigm.

Awareness

The first thing that needs to change is our mindset. To date, use of communications has been relatively unrestricted. Given the operational environments we have been involved over the last several decades, this use was acceptable. Now there is a real need to ask whether using a radio is necessary? We must understand that EMS is a domain. We can’t see or touch it, but it exists nonetheless.

There are elements who watch EMS closely. I know – I am one of those elements. Therefore, to use a radio without thought is the electronic equivalent of sitting on top of a ladder at night, wearing a luminous balaclava and smoking endless cigarettes. Understand that using radios compromises your location, no matter how well camouflaged you are. The techniques that follow are designed to reduce your electronic profile to make you a smaller, harder target.

Techniques

Minimise radio traffic. As much as possible. If you must send a long message by voice (which should be the last option, not the first!) break up the transmission and be as brief as possible.

Combat arms equivalent – you don’t fire your weapons just because you feel like it. Your radios should be treated the same way as your weapons; be proficient, use as little ammunition as possible to do the job and only use them when necessary.

High frequency is your friend. Due to the way it transmits, high frequency (HF) can be used for anything from local communications, from 0 – 20 km, all the way up to intercontinental communications of thousands of kilometres. This makes it especially difficult to survey. There are other factors which further complicate surveying this band, so HF is your friend!

Combat arms equivalent – make best use of cover. You wouldn’t ignore good cover so make use of the electronic cover HF provides.

Historically, HF has been difficult to use; however, modern Software-Defined Radios (SDRs) remove these difficulties. Additionally, a HF SDR features include an interference monitoring capability. If

conditions on a frequency degrade, a HF SDR network will automatically change frequencies. This makes them very difficult to jam.

Combat arms equivalent – make best use of the technology and tools we have.

Use of terrain. Whenever possible, terrain should be used to shield radio transmissions from enemy Electronic Warfare (EW) elements. If there are large features between you and the enemy, they will find it much more difficult to intercept and locate you.

Combat arms equivalent – use of terrain to shield movement from enemy observation.

Routines. These should be avoided. Where there is a need for regular transmissions, these should be sent using a rota so they aren't always sent at the same time. So, instead of sending a SITREP on the quarter hour every six hours, the timings would be shifted to disguise or hide them. Equally, staying on the same frequency for days on end, or the same frequency hop set, is the equivalent of standing still and upright in a firefight.

Combat arms equivalent – you don't go on patrol at the same time and on the same route every day, so why use your radios that way?

Burst transmissions. This function is available on some radios. It allows a relatively large amount of data to be transmitted in fractions of a second. When available, it should be used as much as possible. It is ideal for things like SITREPs, LOCSTATs, supply demands and so on.

Combat arms equivalent – when you have to expose yourself to the enemy, minimise the time you do so as much as possible.

Directional antennae. These focus the signal in a specific direction. Thus, when pointed away from the enemy, they reduce your electronic profile. When in a static position beyond a few hours, these are effective not only in reducing your signature but are also more energy efficient. This allows either the same range on lower power settings or further range on normal power settings. Observation posts can make use of these particularly if they use HF.

Combat arms equivalent – if the enemy can't see you, they can't shoot you. This technique makes it considerably harder for adversary EW to detect you.

Near Vertical Incidence Skywave (NVIS). This is a type of HF transmission which, due to the way it transmits, CANNOT be located, even if detected. Previously having a minimum range of 50 km, new vehicle-mounted antennae systems overcome this issue. This means NVIS could be employed in a tactical role for many elements, particularly long-range elements.

Combat arms equivalent – making yourself as difficult to engage as possible.

Remoting of antennae. It may be possible to move antennae to a location off your position. The possible distance of such separation will be dictated by the length of coaxial cable available. Knowing that such separation does not disable or degrade your communications, and the time it takes to set up and tear down the antennae, you have to ask yourself, 'is the juice worth the squeeze?'

Soldier personal radio. These ultra-high frequency (UHF) short-range radios are considered 'Low Probability of Intercept'. Testing has demonstrated they are exceptionally difficult to detect beyond short distances. For the majority of EW elements, (even dismounted EW), this is much closer than they plan to collect and it puts them inside the engagement range of many units. Despite being unencrypted, use of these radios should be considered relatively safe.

Frequency hopping (FH). Historically, this has been an effective countermeasure to adversary EW. By very quickly changing frequencies, users could not be located (even if they were detected) and the FH systems were also immune to the effects of jamming. Modern FH systems are able to switch frequencies in fractions of a second; however, this comes with a disadvantage, namely transmission range reduction.

Technology has now caught up with FH. Although the systems are still secure, they can now be located and jammed. FH is still useful to 'harden' users, particularly when widely used, which makes identifying hop sets of individual nets more difficult; however, FH enabled users must understand that they are no longer invulnerable. Therefore, the rules for single channel users (use only when necessary, be brief etc) still apply to them.

Combat arms equivalent – new technology may be useful, but it doesn't often change the basic rules.

Encryption. Do not be tempted to drop encryption if communications degrade – that's what adversary EW want you to do! Savvy EW operators will interfere with the communications of one or two stations. The intent is to persuade the station(s) that they *have* an encryption problem and to drop encryption. In this event, it is wiser to change to an alternate, encrypted means to talk to other stations. Also, submit a Signals, Interference and Jamming Warning Report (SIJWR). Use encryption – ALWAYS. NOTHING gives EW operators more intelligence than unencrypted communications.

Combat arms equivalent – when in cover, you don't shoot wildly at the enemy because a few stray rounds pass near you. Why? It would reveal your location. Encryption is similar to cover. Do not willingly surrender it!

Global Positioning Systems (GPS). These are relatively weak signals, making them easy to jam. Some adversary nations have a wide range of GPS jamming systems. Observation of operations in Ukraine, Iraq and Syria informs us that these systems are effective. With regards to navigation, units should do what they can to practice navigation without GPS.

Combat arms equivalent – go back to basics so that when technology fails, you don't.

In addition to being used for navigation, GPS signals are commonly used as timing synchronisation signals for digital networks such as the Battle Management System (BMS). Some digital networks can be synchronised manually; however, this is not straightforward. It is recommended that the technique be practiced regularly to enable network wide competence.

Combat arms equivalent – we never practise any important technique just once and consider it to be mastered, or even sufficiently practiced. We practice it until there is a level of individual and collective competency.

GPS equipment may be protected from jamming by terrain or features. Depending on the power of the active GPS system, a vehicle may be sufficient to shield a device from jamming. As a rule of thumb, the more powerful the GPS jammer, the larger the feature required to protect the device from the jamming. If you experience GPS jamming, it is unlikely you will know how powerful a GPS jammer is so look for the largest available vehicle or building to shield you.

PACE plan. PACE stands for Primary, Alternate, Contingency and Emergency. It should be routine that there are alternate means of communications. It is appreciated that having four means of communications is not always possible; however, elements should always have at least two communications means, ideally more. In this way, if the primary means cannot be accessed, the

alternate should be used. A common problem is the PACE plan never being practised because it is considered less important than tactical training outcomes. This needs to change.

Combat arms equivalent – we are never proficient in drills we do not practise. If we deploy on operations, we don't want to try to figure out how to use our PACE plan on a live, two-way range.

Training. Many users of communications have little idea of their vulnerability, much less the countermeasures they can use to harden themselves against adversary EW. Formations and units need to begin to train for the operational conditions that are now known to exist. This will require getting used to having to fight for communications (PACE plan), use different means (HF/FH satellite etc) and techniques to reduce your electronic profile (terrain shielding, directional antennae etc). EMS is no longer owned by us. It is contested and we will have to fight for access in order to communicate. We must train that way to allow us to become proficient in the various techniques available to give ourselves the best chance of being able to communicate up and down the chain of command.

Utilising techniques described in this article, specifically in combinations, will make users much harder targets. For example, an element using terrain to shield burst transmissions, with a directional antenna on HF would be practically impossible for adversary land EW elements to detect, much less intercept. I appreciate that these techniques will not be practical at all times; however, whenever a technique is practical, it should be used

Conclusion

To date, access to EMS has been a given. This is no longer the case. The entire Army needs to realise our adversaries intend to challenge our use of and even prevent ADF from accessing EMS. Army needs to begin training for this new operational paradigm. This includes measures to reduce units' electronic profile in order to make the job of adversary EW more difficult, and afford each unit the best chance of being able to communicate internally and externally to other units.

This will require that Army undertakes a fundamental shift in culture, thinking and training. If we want to win the fights we are sent to in the future, it is vital that we begin to do so now.

This article has described a number of techniques to enhance and/or protect EMS. These techniques are not exhaustive. If in doubt, reach out to your nearest Signal PI/Tp or Signal Unit for further information or advice.