CREEPER: The First Indigenously Developed Hand-Held Digital Mobile Radio (DMR) in Sri Lanka

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Abstract**:** *Communication plays a crucial role in the context of military operations. The Revolution of Hand-Held radio from Analogue to Digital Technology reached up to many advanced radios with the application of Modern Technology. A famous means of communication which is utilized in modern military warfare is Digital Mobile Radio (DMR). However, due to highly expensive DMRs, it cannot be easily catered to suit various requirements. This paper aims to discuss the first Hand-Held DMR designed and developed for the Sri Lanka Military named the Creeper (The unique bird who can sing vast frequency bands). Creeper aims to reduce the capital cost investment on expensive DMR and provide flexibility for future improvements. The Creeper DMR is checked against existing DMRs such as Racal Cougar, tested on the field, and made many improvements. A Voice Coder (Vocoder) is used to meet the VHF frequency bands designed and then further developed to work on both VHF and UHF bands. The test results were satisfactory in the field and are currently same being used by Tri-services in Sri Lanka. Creeper has successfully provided a cost-effective solution and would stand out as possible future foreign market.*

Keywords*: Creeper, Digital Mobile Radio, Military communication, UHF, VHF, Vocoder*

1. Introduction

Early communication was mainly based on smoke, hand gestures and signal flags, which then evolved to communication via Morse code and Telegraph. However, these modes of communication were constrained by different terrain features and distance constraints. With the advent of military warfare, communication tactics had a drastic transformation from communication by means of animals to radios ("War Communication during WWI," n.d.). World War II, which took place from 1914 to 1918, played a major role in developing military communication. The Motorola SCR-300 was the original walkie-talkie radio used by the Army Signal Corps, which allowed real-time communication on the battlefield despite the harsh terrain (The History of Radio, 2022). Also, with the development of digital signal processing techniques, a more robust set of radios replaced the old bulky analogue-based radios with digital technology. These Digital Mobile Radios (DMR) is a system that sends digital signals to small devices called radios (DMR Radio Facts and Figures: A Look at the Current State of DMR Radio. - Newshunt360, 2021). It was standardized under the European Telecommunications Standards Institute (ETSI) Standard TS 102 361 parts 1-4, which is later commercialized for worldwide use (About ETSI, 2013).

Digital Mobile Radios (DMRs) have become a popular candidate in enabling efficient communications, especially in military communication. DMRs, in general, provide both Digital and Analogue mode compatibility. Also, they are embedded with noise cancellation and

secure measures to overcome eavesdropping and spoofing attacks (DMR Radios - Digital Mobile Radios | Hytera, 2022). These features of the DMR are the facilitating advantages for the popularity of DMR. However, the main disadvantage of DMR includes the inability to radio build quality over the whole spectrum.

Sri Lanka Army, Navy, Air Force and Police use various types of radio transceivers in order to achieve their daily operations. The most common type of currently used radio set for this purpose is the infamous Racal CougarNet System (COUGARNET, 2021). However, these radio transceivers are very expensive and no spares available. Also, require a considerable capital cost. In order to overcome these implications, Centre for Defence Research and Development (CDRD) consider addressing this issue as both an opportunity and a challenge. This paper mainly focuses on providing a viable and robust solution, which has already been tested and successfully deployed on the field by initiating the first hand-held Digital Radio Set for Sri Lankan Military named as Creeper. The product was released in three different versions and improved based on previous feedbacks and timely requirements. The first version of the Creeper DMR (V1.1) only was capable of communicating in the VHF frequency band. In the second version (V1.2), UHF frequency band was included along with Global Positioning System (GPS) for navigation. For the latest of third version (V1.3) has IP67 standard were included in order to adhere to Ingress Protection Regulations.

Figure 1. Creeper Logo

The research project aimed to produce the following research objectives:

i. Locally producing operationally viable and economically advantageous DMR for military services.

ii. Addressing custom requirements tailored as per the services of operation.

The paper is structured as follows; Literature review section will shortly describe previous similar work that has been undertaken. Following that Methodology section will discuss the design and development procedure as proposed. The results and discussion section will present the results and further improvements. Finally, the conclusion section will conclude the paper.

2. Literature Review

Speakeasy is a software-based digital mobile radio initiated to emulate more than five military radios (Upmal, 1995). The designed radio, however, supports a mostly outdated Frequency Division Multiple Access (FDMA) communication scheme, which imposes severe downsides when compared to modern DMR. Modern military communication methods are envisioned (Viswanathan, 1993), where Quadrature Phase Shift Keying (QPSK) digital modulation schemes and trends. As well as Very Large-Scale Integration (VLSI) technologies are expected to boom in military communication via Digital Mobile Radios. Viswanathan mainly has focused on cellular-based radios, which impose conventional implications as in conventional cellular networks. Various solutions, such as utilizing Long Term Evolution (LTE) which offers eNodeB Radio Access Network (RAN) to provide Time Division Multiple Access (TDMA) to provide a communication channel for DMR in congested regions, are evaluated (Qaddus, 2016).

Also, significant research has been conducted on the feasibility of existing Digital Audio Radio Services (DARS) for military applications (Hale & Ballinger, 2002), which are extremely expensive and cannot be deployed in the context of Sri Lanka. A narrowband communication radio was developed, which supports both UHF and VHF frequency bands, with 2.4kHz bandwidth which cannot achieve the required voice quality in the context of military applications (Boucher, Jolly, Lodge, & Dery, 1990). Moreover, this proposed tactical radio didn't have DMR capabilities.

According to the review of literature, it was evident that no progress has been made on developing a hand-held DMR counterfeit for Sri Lankan military applications. Therefore, the initiated Creeper DMR by CDRD is the first hand-held DMR to be developed customized for Sri Lankan military applications.

3. Methodology

This section discusses the methodology followed in developing the solution. Since 2015, many research officers have attended to the development of Hand-Held radio, the project initially focused on three aspects of designing. The project's initial stage aimed to produce Voltage Control Oscillator (VCO) with a phase lock loop to produce the required frequency range of interest. Then, the design of the Direct Digital Synthesis (DDS) based transceiver was to be developed to generate an analogue waveform, usually a sine waveform, by generating a time-varying signal in digital form and then performing a digital-to-analogue conversion.

In the first stage, CDRD developed a handset only with a UHF frequency band radio set and tested the prototype. However, further enhancements were proposed due to its bulky nature, the long antenna design, and less efficient battery life. Secondly, CDRD developed a VHF radio set using the Racal CougarNet System.

In the second design phase, the battery was replaced by a Ni-Cd battery, however, considerable battery life was not obtained. Moreover, the radio communication range was limited to 1km.

However, due to lack of technical feasibility and limitations, the proposed methodology has reformed, and a different approach was implemented. As the final step, a Digital Signal Processing (DSP) based programmable transceiver (RDA1846S) was developed. This can be programmed according to various operational requirements. This methodology was employed in the design phase of the initial circuit design of the proposed DMR. To design the concept as shown in figure 2. The modulation and demodulation standard intercom dedicated chip named as HR_C5000 family used to interface with trans-receiver to process communication smoothly. This chip is product of Hong Rui independent research and development in China. This is in line with standard digital intercom dedicated chip. Same used 4FSK modulation and demodulation technology, 12.5K channel using 2-slot TDMA communication mechanism to achieve 2 Way digital voice and data communication transmission, support full-duplex, half-duplex communication.

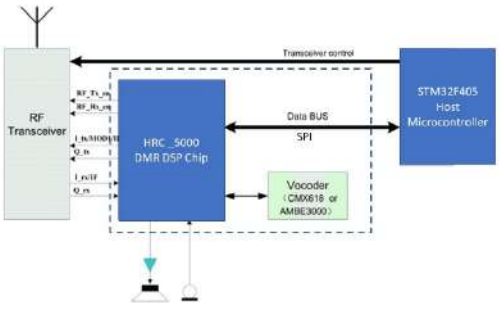

Figure 2. The block diagram of the main concept

HR_C5000 chip design with the physical layer, data link layer and call controller. Also, application of this chips are digital intercom handsets, private cluster terminals, low-speed data, voice transmission terminal applications support for trunk and end-to-end use. Chip used C-Bus and McBSP interface seamless docking of vocoder chips such as CMX638 (Consumer Microcircuits Limited) or AMBE3000 (Digital Voice Systems, Inc.). The Creeper DMR has used AMBE3000 Vocoder and same type Vocoder used by Motorola. Hence the Creeper is satisfying the Motorola communication standard Tire I and Tier II, Also, it has used standard Serial Peripheral Interface (SPI) for flexible selection of vocoder, support for encrypted voice, data interface, Digital voice recording, playback, Display connections and a tone input providing difference interface with the use of Microcontroller STM32F405. Chip built-in high-performance as shown in figure 3, dual-channel AD / DA unit to support baseband In-phase Quadrature (IQ) inputs which can be configured to IF IQ, this can be configured to IF, two Point modulation and other RF interfaces to provide independent IQ bias voltage adjustable design. In IQ modulation, it can set a standard Analog walkie-talkie processing unit to support 12.5KHz / 25KHz channel communication. The power supply of 3.3VDC to the chip is supporting built-in power management module in order to achieve low-power usage and long battery life.

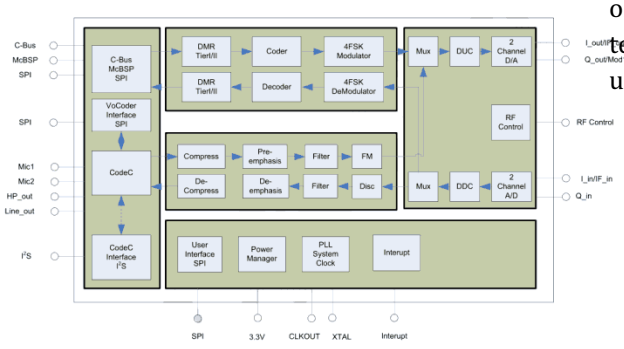

Figure 3. The block diagram of main hardware

With this initial technical knowledge and experience, CDRD Radio and Electronics Wing abled to design indigenous Creeper DMR Set for the first time in Sri Lanka. This was developed in three different versions with the customization with difference end users from Tri-servicers. A summary of the version-wise features is listed in Table 1.

Table 1. Version wise features of Creeper DMR

Version	Chip used	VHF Band	UHF Band	GPS facility	IP67 Standard
V1.1	HR_C 5000	√	-	-	-
V1.2	HR_C 6000	√	√	√	-
V1.3	HR_C 7000	√	√	√	√

For the Creeper, 2000mAh Li-Ion battery was used. Also, two types of Antennas of whip antennas were designed, as shown in Figure 4. The extended Antenna is capable of operating in long range. Where, the short Antenna is capable of operating in short ranges. During range testing it was found that range difference while using both Antennas are 2 to 3 Km.

Figure 4. Two types of whip Antennas

It has been faced major difficulties in designing in such complex circuit boards and enclosures. To address that various software on enclosure and circuit designing tools such as AutoCAD, MATLAB and Applied Wave Research (AWR) software were used. This software had utilized to designed and finalized the two layers PCBs and enclosures. Due to the lack of technical feasibility, resources, requirements and knowledge gap on ability to design of PCBs in Sri Lanka, it found difficult in fabricating PCBs and enclosure in Sri Lanka. Hence a different approach was implemented. As all PCBs and enclosures sent to China for fabrication. The footprint of the circuit board is shown in the figure 5 and figure 6. Printed Circuit Board (PCB) design consisted of Eight layers is shown in figure 7.

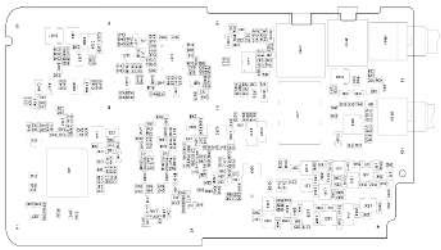

Figure 5. Footprint - Top Layer

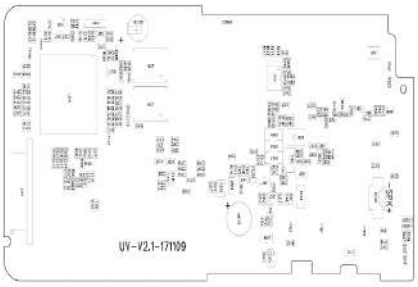

Figure 6. Footprint - Bottom Layer

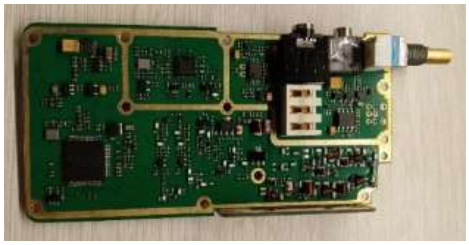

Figure 7. Final PCB Design

Moreover, to the requirement, the initial battery charger pack was custom-made to enable two charging slots to reduce the charging time and enhance the product efficiency, Figure 8.

Figure 8. Two-way battery charger for Creeper DMR

The Creeper DMR chip HR_C5000 by default has a programmable user-friendly software. Same has design and modified and customized accordingly requirement mainly focusing on military use. The main window of the software is shown in Figure 9.

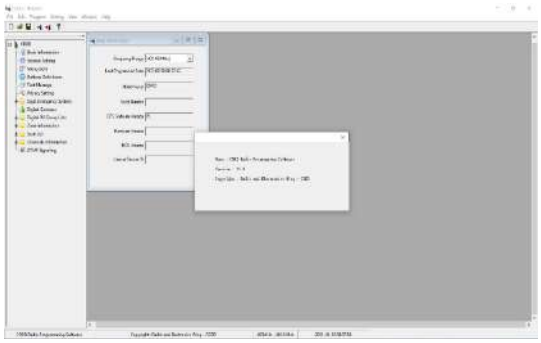

Figure 9. Software Main Window

The same software can be used to read and write necessary information to the radio. Moreover, it is capable of altering general settings of the radio such as Radio Name, Radio ID, Power ON Password, Alert ON and PC Programming Password. As well as Channel Settings which include settings such as Channel Mode (Analogue/Digital), Channel Name, Channel Bandwidth, RX / TX Frequency and Power Output (1W / 5W).

4. Results and Discussion

This section will describe product specifications and briefly discuss its significance. Then, tested results on field testing are provided to validate the operational and functional features of the DMR in the field.

The product is based on main communication chip of HR_C5000/HR_C6000 (Miklor, 2017). The Creeper V 1.2 and V 1.3 is operated in both VHF and UHF frequency bands. The VHF band frequency band is 136 - 174 MHz and UHF frequency band is from 400 - 480 MHz. These radios use technology on either Frequency-Division Multiple Access (FDMA) or Time-Division Multiple Access (TDMA) technologies. The final product Three versions of 'CREEPER' as shown in the figure 10.

Figure 10. The CREEPER

The Creeper uses TDMA as the digital function. TDMA is a less power-consuming scheme when compared to FDMA, which consumes power. Moreover, the FDMA scheme is only feasible where the number of channels is small and FDMA cannot afford high transmission speed. In contrast, TDMA in an environment of small multipath delay TDMA can achieve high transmission speed. Also, the spread spectrum technique can increase the number of transmission channels using the TDMA scheme (Jiang, 1987).

For the basic encryption, the DMR is built with software-based encryption. Software-based encryption is vital in ensuring unauthorized eavesdropping. However, the launch of signaling and user identification is unencrypted. Further security is guaranteed using Dual Tone Multi-Frequency (DTMF) function, which allows operating the radio when there is interference in the radio system.

Main features of DMR are listed below:

i. Frequency Band VHF 136 MHz – 174 MHz
ii. 1000 Programmable Channels
iii. 250 Programmable Zones
iv. Voice Operated Exchange (VOX)
v. Digital Coded Squelch (CTCSS / DCS)
vi. High / Low Power Modes
vii. Wide / Narrow Bandwidth

Technical specification of the developed DMR is listed below:

i. Frequency Range: VHF channels: 136 - 174 MHz

   UHF channels: 400 - 480 MHz

ii. Channel Spacing: 12.5 kHz

iii. Operating Voltage: 7.4 V

iv. Operating Temperature: +5 º C to +40 ºC

v. Audio Output Power: ≤1000mW @ 16 Ω

vi. Dimension: 131 x 61 x 36 (mm)

vii. Weight: 258g

viii. Output Power: ≤5W (HIGH) / ≤ 1W (LOW)

ix. Vocoder Type: AMBE+2TM

x. Spurious Radiation: Antenna: 9 kHz – 1 GHz ≤-57 dBm / 1 GHz – 12.75 GHz ≤ -47 dBm

Further functional and operational details are given in the own created user Manual with the product for reference. The main parts of the Creeper DMR are shown in Figure 11.

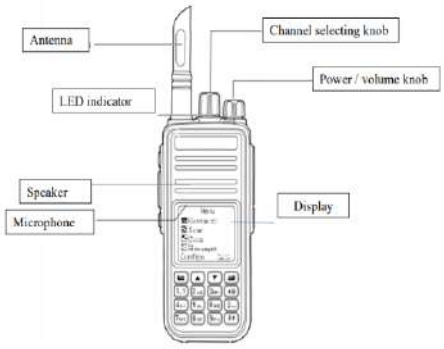

Figure 11. Main Parts of the Creeper DMR

The performance of the DMR is first predicted on the basis of the specification given in details during research phase and same tested by the CDRD with available resources. Range testing has carried out in difference terrain in various weather conditions. Table 2 summarizes the maximum distance achieved in different terrains

Table 2. Maximum distance achieved in different terrains

Terrain	Distance
Flat Ground with no many obstructions (LOS)	10-12 km
Urban/Jungle Area	4-5 km
Inside multi-stories buildings	Upto 20 floors

However, on several fields tests the DMR underperformed the specifications provided as expected. According to the Sri Lanka Navy field test (DGL, SLN HQ letter DGL.560/C/SD/1/2021 dated 12 August 2021), suggestions were made to adhere to Ingress Protection (IP Ratings) and GPS facility to help navigation. These were then considered and included in the latest versions of the DMR. Especially for Sri Lankan Navy, IP67 was included in the latest version to adhere for the Ingress Protection Rating, where it is totally protected from dust and from immersion between 15cm and 1m for 30 minutes (IP Ratings Explained | IP Rating Chart - Rainford Solutions, 2014).

After the modifications of all end user requirements, the CDRD was finally succeeded to deliver 200 numbers of Creeper DMR V 1.3 to Sri Lanka Navy. During the second field test conducted by Sri Lanka Navy, (SLN HQ letter CWL/05/05 dated 21 February 2022), tested each and every parameter of the Creeper DMR and from the given data following test results were observed for analyzation.

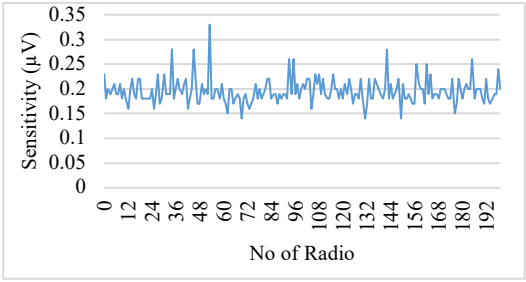

Figure 12. Sensitivity of radios

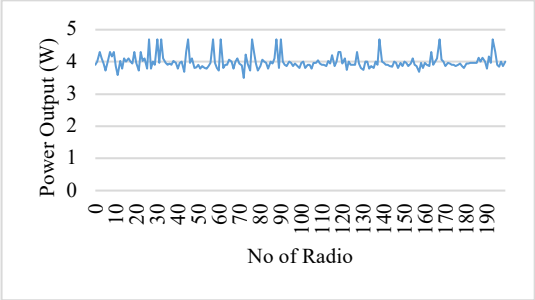

Figure 13. Power Output of radios

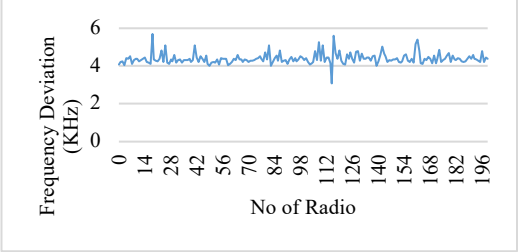

Figure 14. Frequency Deviation of radios

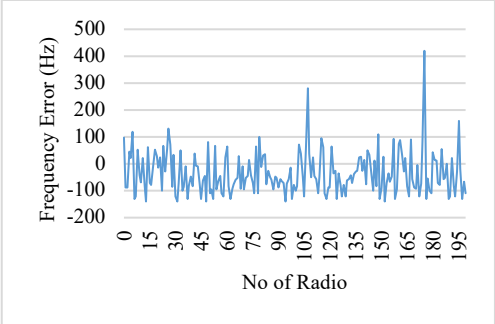

Figure 15. Frequency Error of Radios

According to the data obtain from test results from Sri Lanka Navy field test above graphs are plotted. figure 12 shows the voltage sensitivity of the Creeper. In general, as per naval standard any given hand-held communication set receiver sensitivity to be read as less than 0.25 μv. In the plot in figure 12, 07 No's radios have exceeded aforesaid value. Then only 3.5% radios voltage sensitivity given some high values. This can be neglect when communication process doing in Digital mode.

The output power of the Creeper is plotted in figure 13. As per specification radio power output is 5W. However, result shows that output is varying approximately from 3.8W to 4.8W. This result shows that slightly some deviation in the expected results from the finish product. However, during range test in the difference field found all radios are working satisfactory. Moreover, this kind deficiencies will be taken in the future for upgraded Creeper versions as feasible.

Figure 14 shows the frequency deviation and figure 15 show the frequency error of Creeper. According to the plotted graphs results 09 No's radios shows that ±1 KHz deviation in frequency and only 02 No's radios given some frequency error (more than 200 Hz). That indicate 5.5% radios only have some frequency issues and all other radios are working satisfactory. When consider the average of working satisfactory percentage of Creeper radios is 95.5%.

From the test result and feedback obtain from end users following pros and cons are came up. Some pros are as follows and those deficiencies to be addressed properly in future considerations:

i. **Audio Volume and Quality**: Good response for low frequencies even in the noisiest environments.

ii. **Rugged Construction**: IP67 compliant and thus waterproof for 30 min. submerged in up to 1m of water.

iii. **Multi-colored LCD Display**: Having a multi-colored LCD display on the radio allows for easy use and programming while on the move.

iv. **Front Panel Programming**: This radio is capable of being programmed via the keypad, allowing users to make limited changes without a PC.

v. **Antenna Connector:** The Antenna connector for this radio uses a SMA connection This allows it to easily to be connected to an external Antenna.

Some cons are as follows:

i. **Software Polish:** There are a number of oddities/complexities within the firmware of the radio that impacts its overall user experience.

ii. **Bluetooth Capability:** This radio is not Bluetooth capable, so the use of wireless audio accessories is not possible.

Considering commercially available difference type of Dakota Alert, Icom, Motorola and Wouxun hand held communication sets with creeper hand held sets comparison chart is given in following table 3.

Table 3: The comparison chart of various H/H com sets

Items	Dakota Alert (M538HT)	Icom (V10MR)	Motorola (RMM2050)	Wouxun (KG-905M)	Creeper V1.1	Creeper V1.2	Creeper V1.3
Frequency band (VHF)	✓	✓	✓	✓	✓	✓	✓
Frequency band (UHF)						✓	✓
FM Radio			✓	✓	✓	✓	✓
LCD Display	✓			✓	✓	✓	✓
Adjustable Squelch		✓		✓	✓	✓	✓
Power Save	✓	✓	✓	✓	✓	✓	✓
Selectable Power Level			Hi /Lo	Hi /Lo	Hi /Lo	Hi /Lo	Hi /Lo
PC Programmable			✓	✓	✓	✓	✓
CTCSS / DCS			✓	✓	✓	✓	✓
VOX				✓	✓	✓	✓
Text Messaging				✓	✓	✓	✓
Privet calling					✓	✓	✓
GPS facility						✓	✓
IP standard		IP 67	IP 54/55	IP 55	IP 61	IP 61	IP 67

5. Discussion

Military communication plays a crucial role in military operations and in maintaining proper order and governance. With the advent of Digital Mobile Radios, rising popularity was gained by DMR, especially in the context of military communication. However, such commercialized DMR imposed a significant drawback in terms of capital cost, which also accounted for a considerable amount costing of military and security services. Identifying this issue, CDRD Radio and Electronics Wing initiated a robust solution which is also promisingly scalable to address the problem by initiating the first hand-held Digital Radio Set for Sri Lankan Military named as Creeper.

Creeper was initiated with the VHF frequency band, which then integrated UHF frequency band along with all other modern features such as GPS that are readily found in modern DMR. However, all these features were developed without incurring much of the capital cost that would otherwise be invested on importing comparably expensive DMR. It is also provided with a user manual along with the software to easily customize according to the end-user need.

According to field deployed tests and field operations, Creeper successfully achieved the expected outcome set by Radio and Electronics wing of CDRD. With that it can be concluded, all the 200 numbers of DMRs are given excellent performance according to the specification of the Creeper with some minor deficiencies. By obtaining these radios by Tri-servicers, it could save Millions of rupees flowing to other countries and saving foreign reserves in the country.

In future work, considering all minor deficiencies it is ready to produce upgraded Creeper DMR version 1.4, incorporating of the Sri Lankan Army 1:50,000 map feature as expected. Also, incorporating the Creeper in disaster management operations and developed further.

In present scenario, the following numbers of DMR Hand-Held Sets used in Tri-servicers and there are working satisfactorily with good performance. Very recently, due to the good performance of same, some numbers of radios have already despatched to use for peace keeping force in Mali to enhance the communication capabilities.

i. Sri Lanka Army - 110 Nos

ii. Sri Lanka Navy - 210 Nos

iii. Sri Lanka Air Force - 10 Nos

iv. VIP duties - 20 Nos

References

About ETSI. (2013). Retrieved July 13, 2022 from http://portal.etsi.org/portal/server.pt/community/ERM/306?tbId=624

Boucher, L., Jolly, Y., Lodge, J. H., & Dery, S. (1990). A narrowband tactical radio for the VHF and UHF frequency bands. In Proceedings - IEEE Military Communications Conference (Vol. 3). Retrieved from https://doi.org/10.1109/milcom.1990.117613

COUGARNET. (2021). Retrieved July 13, 2022, from https://radiohistory.uk/cougarnet.htm

DMR Radio Facts and Figures: A Look at the Current State of DMR Radio. - Newshunt360. (2021). Retrieved July 13, 2022, from https://newshunt360.com/dmr-radio-facts-and-figures-a-look-at-the-current-state-of-dmr-radio/

DMR Radios - Digital Mobile Radios | Hytera. (2022). Retrieved July 15, 2022, from https://www.hytera.com/en-products/digital-radio/dmr-two-way-radios/

Hale, A., & Ballinger, D. (2002). Military applications for Digital Audio Radio Service (DARS). IEEE Aerospace Conference Proceedings, 3. Retrieved from https://doi.org/10.1109/AERO.2002.1035232

IP Ratings Explained | IP Rating Chart - Rainford Solutions. (2014). Retrieved July 14, 2022, from https://rainfordsolutions.com/products/ingress-protection-ip-rated-enclosures/ip-enclosure-ratings-standards-explained/

Jiang, T. (1987). COMPARISON BETWEEN THE THREE MOBILE DIGITAL COMMUNICATION SYSTEMS. IEEE Vehicular Technology Conference, 359–362. Retrieved July 14, 2022 from https://doi.org/10.1109/VTC.1987.1623570

Qaddus, A. (2016). Real Time Performance Analysis of Digital Mobile Radio (DMR) and APCO Project 25 (P-25) Radio Systems in Land

Mobile Radio (LMR) Systems. International Journal of Computer Engineering and Information Technology, 8(3), 49–55. Retrieved July 15, 2022 from www.ijceit.org

The History of Radio. (2022). Retrieved July 13, 2022, from https://armedforcesentertainment.com/news/afe-presents-a-celebration-of-radio-history/

Miklor. (2017). Retrieved July 14, 2022, from https://www.miklor.com/MD380/

Upmal, D. W. (1995). Speakeasy: The Military Software Radio: The Speakeasy Phase II radio will use programmable processing to emulate more than 15 existing military radios. Speakeasy is a challenge, even with recent advancements in DSP technologies. The benefits, however, make the challenge highly worthwhile. IEEE Communications Magazine, 33(5), 56–61. Retrieved July 15, 2022 from https://doi.org/10.1109/35.392998

Viswanathan, M. S. (1993). Tactical Military Communication Networks of the Future. Defence Science Journal, 43(1), 71–78. Retrieved July 15, 2022 from War Communication during WWI. (n.d.). Retrieved July 13, 2022.

Abbrevations and Symbols

CDRD - Centre for Defence Research and Development

DMR - Digital Mobile Radio

DTMF - Dual Tone Multi Frequency

FDMA - Frequency Division Multiple Access

IQ - In-phase Quadrature

LTE - Long Term Evolution

PCB - Printed Circuit Board

QPSK - Quadrature Phase Shift Keying

SPI - Serial Peripheral Interface

TDMA - Time Division Multiple Access

Acknowladgment

CREEPER: The First Locally Developed Hand-Held Digital Mobile Radio (DMR) Set for the Sri Lanka Military which were initiated and developed by the Centre for Defence Research and Development - Ministry of Defence, Sri Lanka.

Author Biography

Captain RMGC Navarathne, is Professional, experienced Electrical, Electronics, and Telecommunication Charted Engineer with proven skill levels, with the goal of achieving the highest as an Engineer and higher skill level manager with great capacity on carrying out research & development up to culminating point and capacity to work any field of Electrical, Electronics, and Telecommunication.

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