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Development of an effective amateur radio voice communication network to be used during disaster situations

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Every established landline and electromagnetic forms of communication come to a standstill during a disaster. This is a result of damage to landlines, switching centres, cell sites and power supplies. Only amateur radio stations are operational during such situations due to their independent operation, portability and requirement of low power. This research was conducted with the objective of finding the most relevant modulation technique that can be effectively used during disasters without doing extraneous modifications to the existing amateur radio network. Data was collected for this study from the amateur radio community in Sri Lanka. Measurements were done to detect parameters of the present system. Generated information was used to determine the relevant method. A reliable disaster communications system must be capable of providing means for effective and efficient

communication with any two locations in the country at any given time without a break with at least four communication channels. TDD is the standard operational mode used in amateur radio transmissions. 2 m and 40 m bands are the main amateur radio bands used in inland communication. NBFM on 2 m and SSB on 40 m are the modes being used. Island-wide communication on 40 m is possible at certain intervals of a day depending on the season. Twenty four hour communication is possible on 2 m up to about 22 km distance. Long distance inland communication is being done using repeaters. Two repeaters installed in Yatiyanthota and Nuwaraeliya cover about 65 % of the total land area of the country. Local communications on 40 m band is highly susceptible to variations in ionosphere. It is impossible to rely on this band throughout the year. Resources available for 2 m band are also not sufficient due to inability to allocate more than a single channel at a time and impossibility to sufficiently cover the total land area of the country. It was understood from analysis done that the present system failed to provide reliable communications during disasters. Results confirmed that 2 m band is the most suitable band to perform reliable transmissions irrespective of the time of the day and season. Since only a single channel is available, AM, SSB and NBFM modes cannot be used to handle necessary density of traffic. Since TDMA needs centralised processing at the repeater site, its usage is non-relevant. CDMA is unusable due to the availability of only a narrow bandwidth of 50 kHz. Usage of FDMA with narrow digital channels is the only possibility. It is necessary to limit bit rate to 5 kHz s^{-1} . Quality of signal provided by this bit rate is sufficient for emergency communications. Since repeaters use non-linear amplifiers, only FSK and MSK are usable. Usage of FSK is ruled out where sharing of a narrow bandwidth is necessary for several channels. MSK is therefore the relevant mode. It is possible to allocate four (4) 12 kHz channels with a 2 kHz guard band for ISI free transmission on available 50 kHz bandwidth.

Acknowledgement: Assistance provided by The Radio Society of Sri Lanka

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