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Report of Committee on Radio Monitoring Police Networks

In pursuance to the Office Order No. A.20011/1/2018-Admin I dated 05.07.2019, the report of committee on Radio Monitoring Police Networks is as under:

A. General Requirements

1. The objective is to deploy receivers at multiple locations and connect them over an IP link to a central server. These receivers should also be accessible locally & remotely simultaneously over IP connection.
2. The hardware profile will essentially be based on an SDR (Software Defined Radio) architecture, which will act as the Receiver cum Signal Processing unit and work both with and without local operator.
3. The receiver should have an on-board processor to perform certain tasks such as frequency sweeps, IQ data recording, signal classification, demodulated audio recording, and logging autonomously without the need of an external processor or dedicated operator.
4. The receiver should be light-weight, rugged for outdoor deployment and easily configurable.
5. Local & Central Server should be able to perform multiple tasks such as spectrum sweeps, demodulation, recording, view spectrum, etc. simultaneously.
6. The receiver should provide single RF channel with instantaneous bandwidth of 50 MHz. The receiver should enable monitoring of multiple frequencies within the instantaneous bandwidth and outside the instantaneous bandwidth simultaneously.
7. The system should enable measurements as per ITU standards and guidelines

B. Features required at Local Monitoring

1. The Monitoring application software shall include a GUI which will be installed on the Data Terminal equipment (DTE) at a remote location to enable scanning, monitoring and recording of multiple frequencies simultaneously.
2. The software should enable management and control of different tasks and operations.
3. Monitoring application software should be compatible with Windows OS and the license should be bound to DTE or network hardware.
4. It should be possible to save the complete working settings including open windows and modules in a configuration file and open the same as and when required.
5. Monitoring and demodulation should be performed simultaneously for all the active transmissions that have been selected by the operator for monitoring.
6. Recording of Demodulated Voice and IQ Data should be possible.
7. Operator should have the option to either initiate recording of AM/FM/USB/LSB demodulated voice or baseband IQ data, or both.
8. Software should be upgradeable and there should be interface to integrate with third party software for demodulation of Digital networks (DMR/TETRA/APCO etc.)
9. GUI should have Spectrum, Spectrogram and Oscilloscope for data visualization. Also, it should be possible to zoom in, zoom out and pan spectrum, spectrogram, and oscilloscope with mouse/trackpad.
10. Software should have capability to sweep the entire frequency range of receiver and display spectrum and spectrogram

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11. It should be possible to connect to multiple receivers in the same software and perform independent operations.
12. The Sweep parameters viz frequency band, start frequency, stop frequency, step size, etc should be configurable.
13. Operator should be able to create a configurable scan profile by adding multiple frequencies for monitoring. These frequencies can be within the Instantaneous bandwidth or outside the Instantaneous bandwidth. Operator should be able to select bandwidth and demodulation type for each frequency in scan profile.
14. There should be individually configurable squelch setting for all the monitoring frequencies.
15. It should be possible to stream IQ data of individual channel/monitoring frequency to other software for integration with other tools and software.
16. Software should have provision to work with GPS receivers and use the data from GPS receivers to precisely time-tag the recorded data.
17. Software should have option to set frequency masks and trigger alarm, log files and record data upon breakage.

C. Features required at Central Server

1. The central server should be capable of management, control and monitoring of all the receivers deployed over IP link.
2. Software along with license to be included with receiver and should not be required to purchase separately.
3. It should generate analytics and reports from data gathered from receivers. Formats for the data logs should be in excel/doc/pdf/text format for better presentation.
4. There should be provision to generate and display a list of signals active at the time of scanning, providing information on frequency, BW, type of modulation, date/time of first seen and power.
5. Must have provision of recording the captured spectrum for later analysis.
6. Server should be capable to select the range of frequencies and there may be mapping of frequency spots with the location/organization to whom frequency is assigned.
7. A GUI based platform should be available which can be access by the all remote locations over IP and all rights for creating/ deleting profiles/ assign passwords for remote location should be provided by central server.
8. Software should be capable to map frequencies of various Networks viz VHF/HF/UHF for various locations and accordingly logs should generate automatically.
9. Logs should generate in a manner which can clearly indicate the frequency along with respective network and location to whom it belongs.
10. The up-gradation of firmware and software of all the deployed receivers must be from Central Server.
11. Server should be upgradeable and there should be provision to interface and integrate with third party systems.
12. The software should enable autonomous monitoring without operator intervention and provide reports regarding spectrum usage.
13. Server should be able to perform following tasks:
 - a. Schedule frequency sweep measurements by defining parameters such as start frequency, stop frequency, step size, etc, and the results should be available in a graphical dashboard. The server should be able to assign a flexible schedule for repetitive measurements.

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- b. The software should perform signal classification and alert may be generated in case of any anomaly from pre-defined data.
 - c. The server should be able to perform ~~it~~ frequency occupancy measurements for a defined time period and the result should be available in a graphical dashboard.
 - d. Simultaneous monitoring and sweep in the complete frequency band of receivers should be possible.
 - e. Simultaneous monitoring and demodulation of frequencies outside the instantaneous bandwidth should be possible. The receiver should have the capability to automatically optimize the scheduling.

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TECHNICAL SPECIFICATIONS

S/ No	Parameter	Requirement
1. Receiver (SDR) System:		
RF Specifications		
1.1.	Frequency Range	9 KHz to 8 GHz
1.2.	Receiver Channel	1 channel receiver
1.3.	Realtime Bandwidth	50 MHz
1.4.	Tuning Resolution	1 Hz
1.5.	Noise Figure	<13dB; for 9 KHz to 200 MHz <8dB; for 200MHz to 8 GHz
1.6.	Phase Noise	<-122 dBc/Hz at 20kHz offset; for input <1.5 GHz <-112 dBc/Hz at 20kHz offset; for input >1.5 GHz
1.7.	Frequency reference	Selectable- Internal, External or GPS
1.8.	Internal clock stability	< +/- 1ppm over the operational temperature range
1.9.	External clock input	10 MHz
1.10.	GPS antenna input	1 connector for passive or active GPS antenna
1.11.	Third Order Intercept point	+36 dBm
1.12.	Spur Free Dynamic Range (SFDR)	75 dBc
1.13.	Sweep speed	> 400 GHz /sec @ 1 MHz RBW
1.14.	Analog to Digital Converter (ADC) resolution	16-bit
1.15.	Antenna Input	SMA or N type
System Specifications for receiver		
1.16.	Processor	On-board processor for autonomous operation
1.17.	Storage	250GB SSD for recording
1.18.	Data and Control Interface	1 Gbit ethernet IP along with provision to connect with external cellular network.
Power, Mechanical and Environmental Specifications		
1.19.	Power Supply	1. 10VDC to 50VDC 2. 100-240 VAC, 50-60 Hz 3. Battery along with battery charger for adequate backup upto 02 Hrs or better while monitoring. 4. Power over Ethernet (PoE)
1.20.	Power Consumption	<40W
1.21.	Operating Environment	Outdoor
1.22.	Ingress Protection	IP67
1.23.	Operating Temperature	-20 to +55 C
1.24.	Portability	5 Kg Weight
1.25.	Mounting capability	Should have provision to attach with Mast or Pole. Accordingly all necessary accessories (connectors, clamps etc) to be provided.
2. Antenna		
2.1	Antenna	Omni Directional Antenna(s) with 1 dBi gain that must be capable to capture entire range of operations of frequencies. i. HF Operation ii. VHF / UHF Operation

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S/No	Parameter	Requirement
2.2	Feeder	Antenna(s) feeder must be at least of 25 Meter in length with required connectors.

3. DTE for Remote End Monitoring:

DTE should be able to fulfil all the requirements and features mentioned in Local monitoring software and should meet following specifications:

3.1.	Processor	Latest generation of Intel i7 hexa core processor or equivalent
3.2.	Processor Speed	2.2 GHz
3.3.	Hard Disk	512 GB SSD with 250 MB/sec of sustained write speed
3.4.	RAM	16 GB DDR4-2400 MHz
3.5.	OS	Windows 10 or latest home version
3.6.	Display	15.6-inch Full HD Display
3.7.	Wireless Connectivity	802.11 ac WiFi
3.8.	LAN	1 Gbit Ethernet
3.9.	USB	Minimum 2 nos. USB 3.0 ports
3.10.	Audio	Mic In and Speaker Out
3.11.	HDMI Port	01 No. Full HD

4. Server at Central Control Centre:

Server should be able to gather data and compile data from remote monitoring locations and should meet following specifications:

4.1.	Processor	Minimum 18 core generation processor for support of operation
4.2.	Processor Speed	2.2 GHz
4.3.	Hard Disk	16 TB SSD
4.4.	RAM	2*16 GB DDR4-2400 MHz
4.5.	OS	Latest Windows Server <i>(Linux based Server)</i>
4.6.	Display	2*External monitors, each with 32-inch Full HD Display
4.7.	Wireless Connectivity	802.11 ac WiFi
4.8.	LAN	Quad 1Gbit Ethernet
4.9.	USB	Minimum 2 nos. USB 3.0 ports
4.10.	Audio	Mic In and Speaker Out
4.11.	HDMI	Full HD
4.12.	Power Supply	Hot redundant (1+1) 750W

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