## Dual Band Wideband Chirp Channel Sounder Receiver for Spectrum Occupancy Measurements

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Over the last decade, it has been found that the radio spectrum is underutilized in time, frequency and space dimensions or any of their combination. Spectrum occupancy measurements provides a knowledgebase to quantify spectrum utilization and more importantly valuable to define opportunistic spectrum access methods where unused portion of the radio spectrum can be reutilized, to improve utilization, provided its interference free to local users of the network.

The reliable detection of unused portions of the radio spectrum depends on both the measuring system and the detection algorithm. Particularly, for the measuring system, it depends on the time-frequency resolutions, bandwidth, sensitivity and instantaneous dynamic range. In [1], we have proposed a chirp channel sounder receiver which has a maximum programmable bandwidth up to 750 MHz in 2.2 to 2.95 GHz band and supports high time-frequency resolutions to detect signals at the packet level based on the received power.

In this work, we have extended the receiver to a lower band, 250-1000 MHz, to detect signals from radio technologies like TETRA, TV and GSM 900 based on the received power. The performance of the receivers is evaluated for continuous wave signal and it is found that the receiver in this band has a sensitivity of -100 dBm with supported minimum frequency resolution of 200 kHz over 750 MHz bandwidth.

To quantify spectrum utilization in both supported bands of the receiver, high time-frequency resolutions spectrum occupancy measurements are conducted in Durham City, UK in both indoor and outdoor environments. It is found that less than 10 % of the radio spectrum is utilized in both bands over the time and frequency dimensions at the measurement location.

[1] A. A. Cheema and S. Salous, "High resolution temporal occupancy measurements to characterize idle time window in ISM band," in *General Assembly and Scientific Symposium (URSI GASS), 2014 XXXIth URSI*, 2014, pp. 1-4.