Community radios and Wireless IP Telephony (Infrastructure Sharing)

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Preamble

This technical report evaluates the possibility of establishing a community (broadcast) radio sharing the infrastructure of a wireless (voice-IP) community driven network. The document has gathered the necessary information to simulate FM radio coverage using Radio Mobile and a preliminary lists of cost of the major components

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1 Simulation Parameters

The following section collects some of the necessary information to simulate the coverage of FM radio station.

1.1 Frequencies and power of operation

Community Radios operating in VHF use a frequency between 87.5 to 108 Mhz and FM. Transmission power is normally regulated and depends on the type of licensing obtained. Small community radio stations use a power anywhere from 0.5 W to 10 W. Big community broadcasting stations can use as much of 50 W.

1.2 Radio Coverage

Radio coverage in FM is limited by obstruction.

Range is limited by:

Line-of-sight: How far the transmitting antenna can effectively see (Line-of-sight).

Interferences: Other stations or sources operating on the same frequency.
Transmission power: The amount of power emitted

1.3 Effective Radiate Power

ERP (Effective radiated power) is the power radiated from the antenna. The power radiated from the antenna is the result of adding to the power radiated by the transmitter minutes, the power loss in the cables and adding the gain of the antenna.

1.4 Antenna Gain

The antenna gain is measured in (dBi) and typical values range between 2 and 5 dBi for directional antennas. Price ranges between 75 and 200 USD.

1.5 Coaxial Cable

There are many types of coaxial cables that can be use in at VHF frequencies. Two common types are the RG58 (5mm, 0.2 dB/m @ 100 Mhz) and the RG213 (10mm, 0.068 dB/m).

The price of RG58 and RG213 are 2 USD/meter and 5 USD/meter respectively. RG58 is used for short distances (e.g. D $<$ 10 m)

1.6 Sensitivity

Using CCIR Recommendation 412-5 for field strength at 10 meters above the ground we found the following values:

	Mono (dBuV/m)	Stereo (dBuV/m)
Rural	48	54
Urban	60	66
Large Cities	70	74

1.7 Coverage

Assuming that the antenna has a clear view and no interferences with average quality portable receiver:

ERP	Miles	Kilometers
1	1.5	2.4
2	2.1	3.36
4	3	4.8
8	4.2	6.72
16	6	9.6
32	8.6	13.76
64	12	19.2
128	17	27.2
256	24	38.4
512	34	54.4

2 Costs

2.1 Hardware Costs

Once a tower is placed in the community to serve as a hub for a wireless community network, the basic VHF community radio costs are:

VHF Transmitter 12 W:	800 USD
Low Loss Cable (-4 dB):	200 USD (50 meters RG213)
Antenna (4 dBi):	200 USD
Mounting Brackets:	50 USD
SWR and cables:	50 USD
Total:	1300 USD

Audio and mixing equipment (300-500 USD), microphones (30-100 USD) and energy backup not included.

2.2 Audio Automation Software

Several free and open source software projects[1] provide playback and automation features for radio broadcasting stations. A FOSS project worth checking out is *Campcaster:* a free and open radio management software that provides live studio broadcast capabilities as well as remote automation in one integrated system.

1 http://dmoz.org/Computers/Multimedia/Music_and_Audio/Software/Playback_Automation/

3 VHF (FM) Broadcasting Simulation

3.1 Location

Mbale town is located in eastern Uganda 270 km from Kampala, a 4 hour drive away. The town is situated at the foot of Mount Elgon, a mountain well known for its magnificent craters, deep and narrow valleys and ridges and with a peak of 4,322m (Wagagai). With its district population of 1,120,000, it is one of Uganda's largest urban areas. The town itself hosts about 100,000 people.

The area is populated with numerous educational institutions, health-centre facilities, faith-based organizations and centres, and several NGOs. In addition to these, Mbale is a thriving hub of small and medium business enterprises. Just a couple of kilometres outside Mbale's main town however, the sub-counties tend to be extremely rural, with poor power and telecommunication infrastructure. Generally speaking, the region has good transport infrastructure, main roads are tarmac.

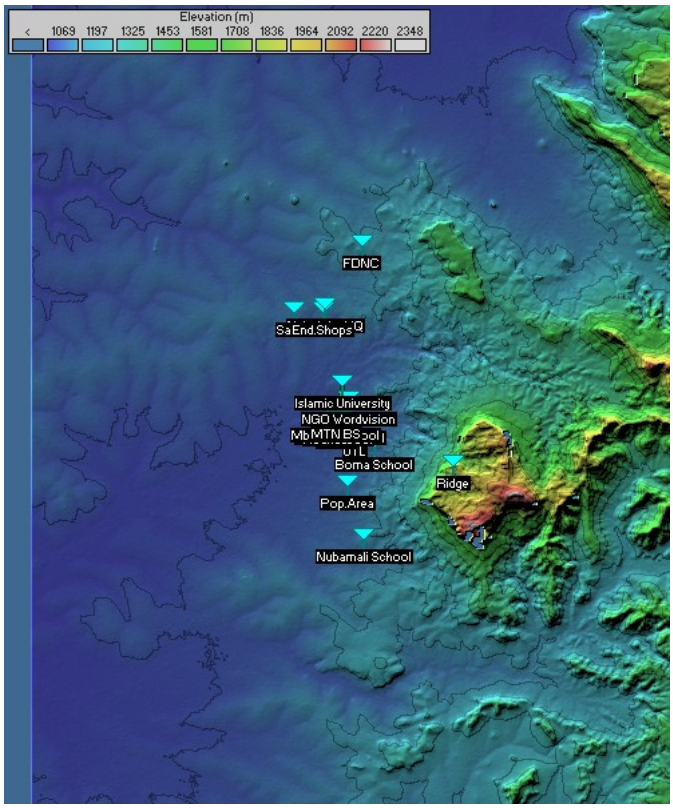
The district's indigenous population comprises Bamasaba people. Other ethnic groups found in the district include Adholas, Etesots, Banyoli and Sabiny. The main language spoken in Mbale is Masaba (Lumasaba) also referred to as Lugisu, which is a Bantu language spoken by about 750,000 people in eastern Uganda.

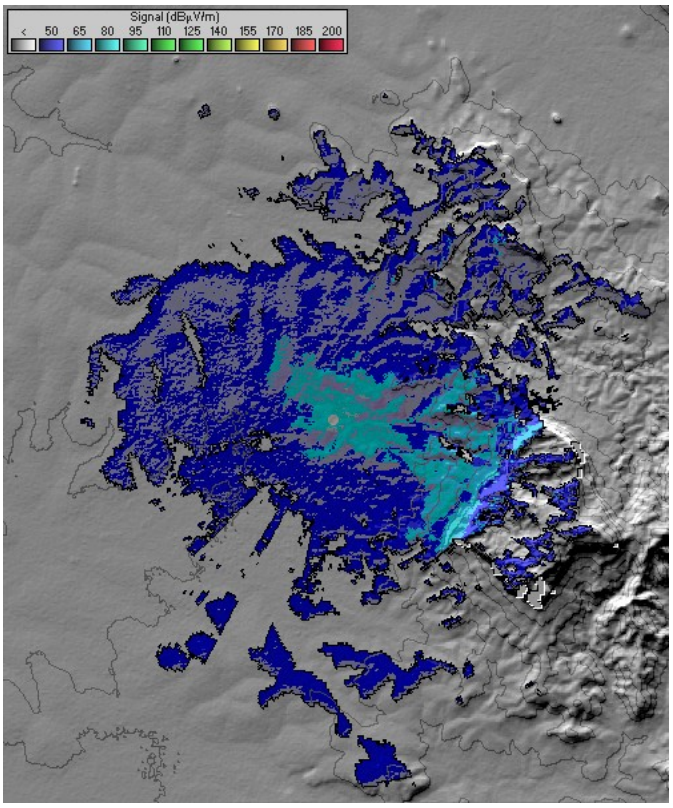
A set of 10 potential partners where identified in Mbale to be members of a wireless community radio. The following simulation studies the possibility of establishing a community radio broadcast station in the same radio mast.

Using the parameters outlined in the previous sections we have performed a set of simulations to estimate the coverage area of a 10 W (ERP) FM radio station.

3.2 Coverage

A simulation using the previous specifications has been conducted for a site in Mbale (Uganda). The simulation shows that 10 W radio transceiver placed at the top of the GSM radio mast (30 meters) provides FM radio coverage to all the partners can be covered.





Scale 1:50 000
Image 1: Community Wireless Partners in Mbale (Uganda).
Image 2: Radio Coverage (E-field > 50 dBuV). Coverage area of 235 Km² (aprox. 15 x 15)