A zero-EMF cell phone system

A prototype of a zero-EMF cell phone system has been developed for use where there is no telephone landline available. The system is not transportable and NOT available for sale.

Keywords: Zero EMF cell phone, no radiation, electrical hypersensitivity, low EMF cellular phone, Home Phone Connect, cell phone docking station, landline dismantling, EMC, fixed wireless

A handyman installs the solar panel on the antenna post. The buried electronic box is to the right.

Introduction

Telephone landlines are being dismantled in several countries, forcing people to use cell phones or internet phones. Neither of these alternatives is suitable for people with electrical hypersensitivity (EHS).

Some people with electrical hypersensitivity may wish to move to a remote area, beyond the electrical grid, where there is little human development, no ground currents and a big distance to transmission towers. Such areas rarely have telephone landlines, and are unlikely to get them in the future.

A zero-EMF cell phone was developed for someone with severe EHS, who had a house built in a remote part of the Arizona desert. The system has been rebuilt and refined over four years, and is now in daily use, though it is still a work in progress.

Early experiments

It was clear from the start that it is necessary to split the system into two parts: a wireless part and a human interface. The wireless transmitter needed to be at least 60 ft (20 meters) from the user, and preferably much further away.

The first attempts used a cell phone docking station. A docking station uses an ordinary cell phone to communicate with the cell tower, while it also has an outlet for a regular landline telephone. The telephone is then used like an ordinary phone connected to a landline.

A CellSocket docking station was purchased, together with a cell phone that fit the socket. The CellSocket was powered by 12 volt DC, which is normally provided by a power supply.

In the first experiment, the CellSocket was placed on the roof of a car, with the CellSocket powered by the car's 12 volt battery. A very long telephone cord was strung into a house, about 75 ft (25 meters) away.

A low-EMF "tube phone" was used inside the house. The house itself was built of steel, and provided some shielding of RF signals.

The first test went very poorly. The sensitive person trying the setup is normally a very calm person, but he quickly felt agitated and irritable using the phone. The reason for the failure was probably high-frequency signals travelling into the

house on the phone wire, and then radiating from the wires as well as the telephone itself.

The experiment was repeated several times in the following months, using various forms of line filters, ferrites, etc. These helped, but the phone was still not acceptable. It was clear that a major effort, involving military-grade filters, shielded conduits and stringent workmanship would be required to improve the system further. This didn't seem feasible at the time.

Another engineer in Arizona was also looking at the issue of living beyond any telephone landline, for his own needs. He had gone in a different direction, customizing a cell phone with a remote control unit. This remote control unit included actuators to press on two of the buttons on the cell phone, and a speaker and a microphone for audio control. The cell phone could be voice controlled, which was done through the audio interface.

A copy of this setup was built, but it was never successful. There were all sorts of problems getting it to work, so this Rube Goldberg contraption was abandoned. The original inventor of this idea has since gotten his own system to work well, and he is currently using it daily, though it has various limitations. It is customized to work with a particular phone, which is no longer available.

An attempt at building a remote-controlled cell phone. It had an activated to press the PWR/END button. Under the phone was placed a small magnet, to fool the "phone closed" sensor. An electromagnet mounted on the phone negated the magnet, when the phone needed to believe it was opened up. Dialing was limited to using the phone's voice-control interface. This project was abandoned.

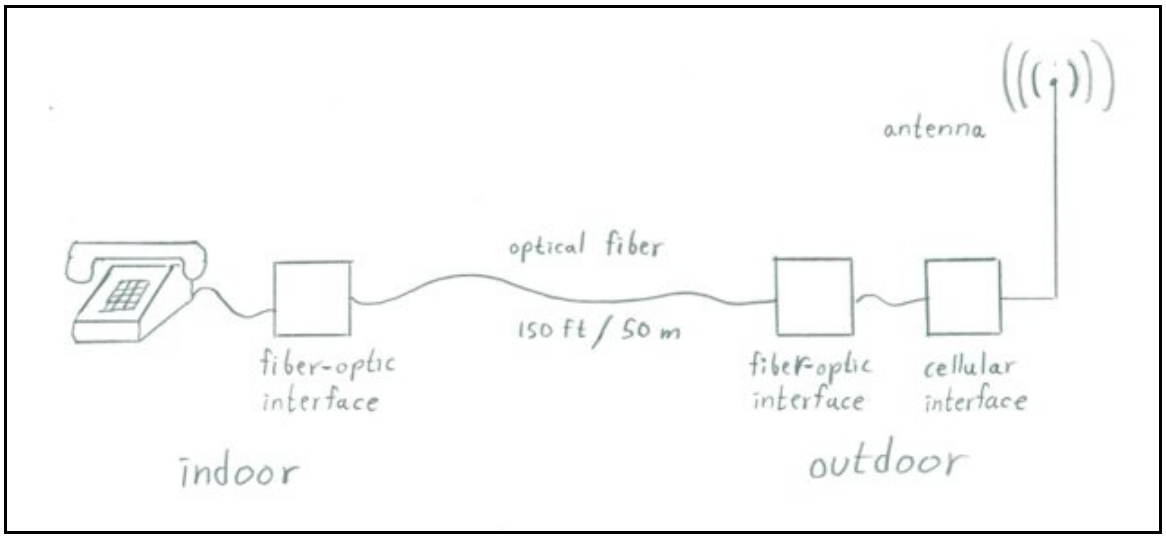
The present system

The present system consists of an outdoor unit, an underground fiber-optic cable, and an in-house unit.

The outdoor unit is housed in two boxes, which are partially buried to protect them against heat and cold. One of the boxes contains the electronics, while the other holds a large battery and a solar charge controller. Insulating coolers are used as these boxes.

Next to the buried boxes is a six-foot (2 m) post with a 20 watt solar panel and an antenna.

The inventor installs the latest version of the system during a 2013 visit. The Verizon Home Phone Connect is seen on the ground.



Overview of the entire telephone system.

The battery box contains an RV/marine lead-acid battery, which is charged by the solar panel. There is also a solar charge controller with a temperature sensor, so the battery is charged correctly according to temperature. The charger also has a low voltage disconnect, so the electronics are turned off if the battery gets too low. There is plenty of battery capacity, however.

The battery is kept separate from the electronics to prevent corrosive gases from harming the electronics.

The 20 watt solar panel is grossly oversized for sunny Arizona, except for the coldest winter days in northern Arizona, when a small heating element is used to keep the electronics warm.

The outdoor electronics box contains the cellular interface and the fiber-optic interface.

The cellular interface communicates with a cell tower many miles away, using the booster antenna on the post. The cellular interface was purchased ready-made. It was originally a CellSocket, but it has since been replaced with a Home Phone Connect device from Verizon.

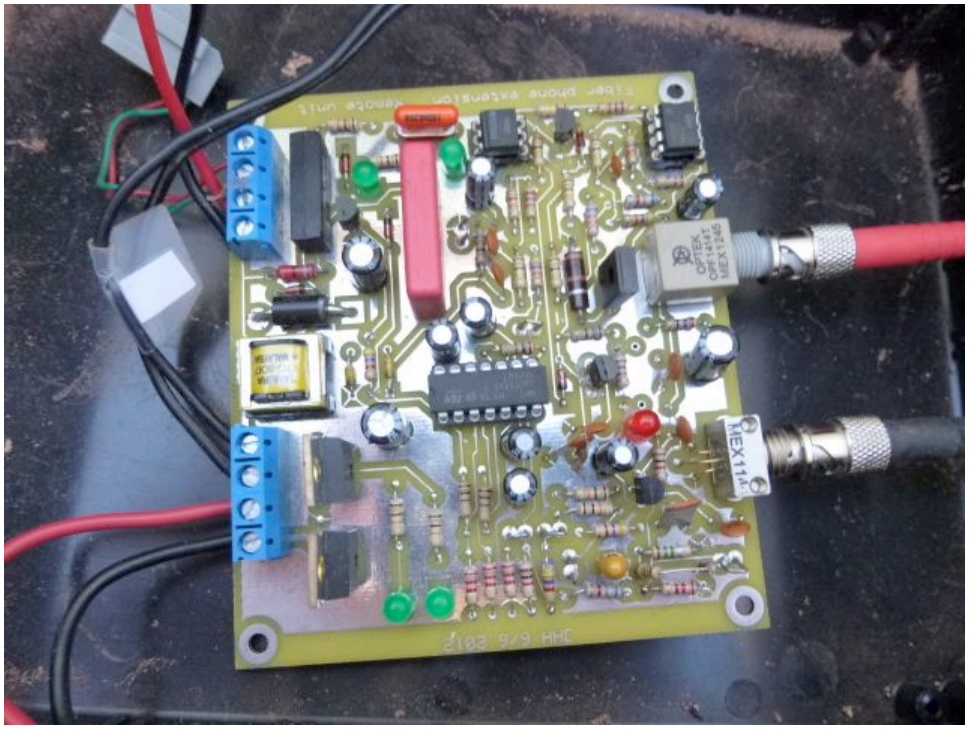
The cellular interface handles all the wireless communication, and is very easy to install. It has a regular RJ11 phone outlet, to be used by a regular landline telephone. In this case, it communicates with the custom-built fiber-optic interface instead, which appears to be a regular telephone for the cellular interface to see.

The fiber-optic interface unit is custom built. Together with the in-house unit, it is basically a phone-line extender. It has a standard RJ11 phone outlet in each end.

The fiber-optic interface has some additional features, however. It is entirely analog, both in terms of the signals it produces as well as the electronic components. Digital electronics are a problem for sensitive people, as digital components and their associated wiring and circuit boards radiate troublesome frequencies.

The fiber-optic interface is essentially a line filter between the outdoor equipment and the in-house receiver. The fibers provide total separation, so no radio-frequency transients can be transferred into the house.

The outdoor fiber-optic interface controls the power to the cellular interface, so it can be turned off from inside the house. It also has a 5 watt electric heating element that can be turned on or off from inside the house. This heat is sufficient to keep the electronics box above frost during the winter. This became necessary as the CellSocket malfunctioned when it got cold. Both the CellSocket and the Home Phone Connect device were designed for use in a heated house and not intended to be operating in freezing temperatures.



The circuit board for the outdoor fiber-optic interface.

The fiber-optic cable runs to the house through a buried conduit, made of 1¼ inch (3 cm) plastic pipes. The cable has two fibers, one for transmitting, one for receiving.

The in-house fiber-optic interface has an RJ11 outlet for a telephone. It also has a switch to control the heating element in the outdoor electronic box.

The user of the system uses a Swedish "tube phone" as a telephone, to avoid the magnetic field from the speaker coil, but any other landline phone would work with the system.

The system is made modular, avoiding customized phones and cellular interfaces.

Technical details

The CellSocket cellular interface is no longer manufactured, but may be available second-hand. There were models that fit various cell phones.

The Home Phone Connect is only available for the CDMA cellular system, which is essentially only used in North America.

There are some GSM models available, such as AT&T Home Phone, Passio SVEA GSM PremiCell and Passio SVEA GSM Connector. These have not been tested for this project. Other models may become available later on, which should work as well, as long as they have a standard telephone plug.

Both the indoor and outdoor systems use 12 volt DC. The CellSocket and Home Phone Connect units both came with a 12 volt external power supply, so there was no need for any modification. The custom built fiber-optic interfaces were designed to use 12 volt DC as well.

Twelve volt DC is an excellent choice, since 12 volt DC systems can easily be powered by the sun, without any transients. It is the type of electricity most tolerable to people with EHS — if produced from a "clean" source. The only issue with a solar system is that the voltage can vary between about 11.5 and 15.0 volts, with a typical range of between 12.5 and 14.4 volts.

The fiber-optic link is fully analog. The baseline light intensity on the fibers denotes these control signals:

Outgoing fiber from in-house unit:

Level 0: No light. Power down remote unit

Level 1: Power on remote unit cellular interface

Level 2: Power on heating element and cellular interface

Level 3: Off-hook (active call, heat on). The audio signal is carried as an analog modulation

Incoming fiber to in-house unit:

Level 0: No light. Remote unit fully off.

Level 1: Remote fiber-optic interface on. Audio signal modulates this light intensity.

Level 2: Incoming ring signal

The optical components are the OPF1414T LED transmitter and OPF 482 receiver, both manufactured by TT Electronics/OPTEK. They were purchased from DigiKey, but are commonly available.

The outside fiber-optic interface has a number of indicator LEDs to aid troubleshooting:

- power on
- in-house unit on signal received
- in-house unit off-hook signal received
- heating element on signal received
- incoming call (ringing)

Installation

The system requires considerable installation work, including:

- erecting pole with antenna and solar panel
- installing the two outdoor boxes
- installing underground conduit to house
- mounting of the electronic systems
- on-site adjustments

The analog fiber-optic interfaces must be manually adjusted to work with the specific type and length of the fiber. The units were built and tested at another

location, using a different fiber, and they needed adjustments to work with the actual on-site fiber. These adjustments cannot be done by laypeople.

Experiences

The early versions of the system had a few problems with the electronics, which have been corrected in the present version. The fiber was also accidentally damaged and had to be repaired.

Analog electronics are prone to problems with voltage drifts, which is one reason digital electronics are totally dominant today. This project has had its set of such problems.

The 2013 version of the PCB had a spurious voltage leakage from the 12 volt plane that affected the voltage reference for detecting the off-hook condition. This resulted in the system suddenly dropping calls and a missing dial tone, which seemed to be depending on the temperature. The solution was to wash the circuit board with alcohol.

The failure of the CellSocket at freezing temperatures had to be mitigated. First, a manually operated 5 watt heating element was installed, which is now integrated in the new circuit board.

The sound quality was not good in the early version. The user, and other sensitive test persons, were not able to use the phone for more than 3 – 10 minutes due to the poor sound quality. The early version also had difficulty transferring the touch tones for phone menus.

The present version has much improved sound quality, especially with the installation of the Home Phone Connect device. Telephone menus now work reliably and the user can tolerate the phone for much longer.

As it still is a cellular device, it may not be possible to further improve upon the sound quality. The user reports he can use the phone for up to 30 minutes on a good day, while a landline first produces the same symptoms after an hour. This difference is considered due to the limited sound quality of telephone systems, which effect people with sound sensitivities.

Current status

The present system is version 2.1 as of fall 2013. The system is still a prototype, with further development needed. The current main development is to automate the calibration of the outdoor unit. Calibration is necessary, as the light intensities

in the fiber optic cable are dependent on the cable length, fiber type and fiber diameter.

It is not a commercial product, and only one sample exists. The inventor resides in Scandinavia and is not able to provide installation or ongoing support to others.

This system is not available for sale to the public. If a manufacturer is interested in making it into a commercial product, the inventor may consider an agreement. The editor of this website can provide the initial contact for such a case.

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