

SigFX LLC Experimental License Application
Additional Information
FCC Form 442
File No: 0020-EX-PL-2002

MAIN FORM FIELD 7:

SigFX seeks an experimental license to continue testing its wireless digital communications technology, which carries voice and data messages on the vertical blanking interval ("VBI") of a broadcast signal. SigFX is concluding its initial phase of testing pursuant to Commission special temporary authority ("STA") (File No. 0280-EX-ST-2001). Under the requested experimental license, SigFX intends to expand the scope of its performance testing to verify its ability to:

1. operate a complete communications system, using broadcast spectrum, that is capable of two-way data and/or voice communications in the VBI;
2. improve signal quality, particularly in the return path, based on what SigFX learned during the first testing phase;
3. deliver unique communications calls to and from mobile subscriber units that are operating simultaneously;
4. implement a communications network using fixed and mobile subscriber units;
5. test new proprietary modulation schemes that improve on the current direct sequence spread spectrum technology that SigFX uses currently;
6. expand the radius of the SigFX communications network without causing interference or reducing call reliability;
7. operate the SigFX communications network from a higher power broadcast station;
8. expand from testing the outbound and return path scenario on the same channel to testing variations (*i.e.*, outbound on one channel, inbound on a different channel); and
9. communicate between mobile and fixed subscriber units served by different broadcast stations.

More specifically, in the testing covered by the requested experimental license, SigFX will deliver telecommunications data over W46CW Channel 46 and WBMS-LP Channel 10 broadcast spectrum. Channel 46 is a low power broadcast station with a signal coverage area of approximately 26 kilometers. Channel 10 is a low power broadcast station with a signal coverage area of approximately 40 kilometers. SigFX will test its subscriber units within each station's entire coverage area. The testing will involve no more than 100 subscriber units, each with a power level of .6 watts. The testing will be designed so that no more than 40 subscriber units will be operating simultaneously.

SigFX will ensure that its testing is in compliance with the Commission's rules for delivering telecommunications services in the VBI and is conducted only with the consent of the

broadcaster. SigFX initial testing demonstrates that it is unlikely that its technology will create interference issues with Channel 46's or Channel 10's broadcast signal, or with other licensed communications transmissions in the testing area. (See status report sent to Mr. Carl Huie on January 30, 2002). It is SigFX's belief, based on the testing it has conducted to date, that its technology generates communications signals at such low power and emissions levels relative to the broadcast signal that interference during testing under the requested experimental license will not become an issue. However, SigFX agrees to curtail testing in instances where its service causes interference to Channel 10 or 46.

Description of the Equipment

Under the experimental license, SigFX will test two equipment components used in its wireless communications system – a software defined, intelligent wireless radio device and return signal processor.

SigFX's wireless communications system consists of an intelligent subscriber wireless device that constantly measures the characteristics of the wireless spectrum. SigFX's intelligent communication devices have the ability to seamlessly modify their operating frequency, coding schemes, and compression algorithms. These patented technologies have been incorporated into the two primary equipment components that SigFX has tested under the STA and intends to continue testing pursuant to the requested experimental license – a software defined, intelligent wireless radio device and return signal processor ("RSP").

SigFX's intelligent wireless device is a hand-held radio unit with a consumer function akin to that used currently with cellular, personal communications and specialized mobile radio systems. However, SigFX's software defined radio may be adapted to support multiple standards and add new service features through software, as opposed to hardware, modifications.

SigFX's RSP is the network component deployed at or near the broadcast station's antenna location. The RSP operates as a multi-mode/multi-frequency call-processing device capable of discerning communications signals embedded in the VBI of a broadcast signal, regardless of the coding scheme or frequency used. SigFX believes that the RSP and its software-defined radio can support a variety of coding schemes including:

- GSM
- HSCSD
- GPRS
- TDMA
- EDGE
- 1XRTT
- CMDA
- CDMA 2000
- CDMA 1xEV
- W-CDMA
- TD-SCDMA

Finally, SigFX has developed a frequency-agile, intelligent antenna that has the ability to electronically direct a signal at the appropriate transmitter. This results in increased coverage and improved overall signal quality.

The Specific Objectives

SigFX seeks an experimental license to continue testing its two-way VBI communications technology so that it may ultimately secure equipment authorizations from the Commission for all transmitting equipment associated with its system and so that it may work with broadcasters to deploy PCS-like communications systems as part of their service offerings.

Theory of Operation

SigFX has created a means for deploying a PCS-like communications system using television broadcast spectrum. This is achieved by encoding and delivering communications messages in the VBI of a television broadcast signal. Using SigFX technology, subscribers are assigned a universal personal telecommunications number that correlates to a mobile or stationary communications device. This allows the user to send and receive communications calls (*e.g.*, voice or data) just as they would with a wireless telephone. However, rather than construct a separate wireless network to receive and deliver communications signals between a subscriber and other communications entities (*e.g.*, wireline and other wireless subscribers, host computers, etc.), SigFX has invented a technology that allows communications signals to be transmitted and received by subscribers over the television broadcast network.

SigFX's technology has the potential to fulfill a long-felt need for two-way VBI communications that allows both the transmit and receive portion of a call to be delivered over the same or different broadcast carriers on a point-to-point basis. This is an improvement over past VBI communications technologies that required that the communications signals be sent on different carriers within the broadcast system, or that delivered and received signals via a hybrid system of communications paths (*e.g.*, signals carried on the VBI in one direction and on a wireless, wireline or satellite path in the other direction), as well as solutions that only supported point-to-multipoint information delivery.

Using SigFX's approach, an outgoing signal with an embedded VBI message is received by a low power VBI transceiver or, alternatively, a VBI/PCS composite transceiver for receiving and transmitting messages for VBI and/or PCS communications. The transceiver includes an antenna capable of transmitting a return signal or message on the same VBI carrier at low power and relatively low frequencies. The return signal is detected by the RSP housed at the broadcast location. The RSP extracts the low power communications return signal from the VBI, processes the message and transmits the message to its ultimate address via an interface with the public telecommunications network (*e.g.*, wireline, wireless or satellite).

SigFX has developed a wireless digital communication system with a broadcast interface that encodes communications message information on the VBI. The broadcasting system receives the signal with the encoded communications message from the broadcast interface and transmits the encoded communications message on a carrier of the outgoing broadcast signal. A mobile or fixed subscriber unit that includes a transceiver detects and receives the outgoing

signal. When the subscriber unit receives a signal, the transceiver uses its decoding function to separate the communications message from the remainder of the broadcast signal so that the subscriber can listen to or see the communications message. The transceiver also includes input, encoding and VBI modulating capabilities that allow the subscriber to respond with return message information, encoding the return message information and inserting the VBI-modulated return message signal on the out-going signal of the broadcast. The return signal can be transmitted on the same channel used for the outgoing signal or on a different channel.

An antenna associated with the RSP allows the RSP to detect the return signal from the carrier of the outgoing signal of the broadcast and a message processor ("MESP") decodes the message information from the return signal. The MESP is adapted to transmit the message information to public or private communications networks or public switches.

Based on its testing to date, SigFX believes that it can implement such a network without interfering with the television broadcast content and ancillary features and functions, such as closed captioning or electronic program guides, and without increasing appreciably the emissions associated with the broadcast station.

Specific Findings Under the STA Which SigFX Intends to Address Pursuant to the Experimental License

SigFX's initial round of testing under the STA focused on two component parts of the communications system: 1) the downlink path in which an incoming communications signal from the public telephone network ("PTN") is delivered to a SigFX mobile subscriber unit; and 2) the return path in which a communications signal is sent from a SigFX mobile subscriber unit to the PTN.

Broadcast Station Interference

Based on the testing it has conducted thus far, SigFX has not witnessed any interference to the carrier broadcast station – UHF Channel 46 in Ridgeland Mississippi – when SigFX inserts and delivers communications signals in the VBI. There is no interference from the downlink voice data in the broadcast signal. Moreover, SigFX has not been made aware that its testing has caused interference to other neighboring broadcast or wireless services.

The Downlink Path

In order to deliver two-way voice or data services using the SigFX network, SigFX must be able to deliver incoming communications to its mobile subscriber units. SigFX tested its ability to take an incoming call from a wireline or wireless telephone on the PTN, route the incoming call to SigFX's transmit/receive board, encode, digitize and insert the incoming communications into the VBI of Channel 46 and deliver a reliable communications signal to a SigFX mobile subscriber unit operating within a one mile radius of the television station. This chain of events represents the downlink path. It occurs when a communications call is first initiated from a wireline or wireless PTN user to the SigFX subscriber and repeatedly during the course of a typical two-way conversation. SigFX is attempting to perfect its technology so that it can establish and maintain communications on the downlink path with low bit loss and high

content clarity that allows the recipient to comprehend the communications message without unreasonable strain.

During its initial testing under its STA, SigFX found that it had little difficulty delivering a reliable signal to a single SigFX mobile subscriber unit. However, SigFX encountered some challenges when it attempted to encode two unrelated communications signals that had to be delivered simultaneously to the correct unique mobile subscriber units. SigFX has determined how to eliminate the encoding problem and intends to further test, pursuant to the requested experimental license, its ability to encode, insert and deliver simultaneously more than two communications signals to the correct mobile subscriber unit.

The Return Path

The second aspect of SigFX's initial round of testing involved the return path. The return path consists of a communications link from the SigFX mobile subscriber unit to the PTN. The RSP detects and extracts the communications return signal from the VBI, processes the message and transmits the message to its ultimate address via an interface with the PTN. SigFX began its field testing of the return path in December 2001.

After the first phase of testing, SigFX learned that it was facing signal propagation issues that appear to be tied to factors specifically related to Channel 46's station location and configuration. For example, Channel 46 is a low power UHF station that uses a relatively short tower. The tower is located in hilly terrain and is surrounded by business and residential buildings. SigFX believes that it will not encounter the same degree of signal propagation issues if it is sending communications signals on the VBI of a broadcast station with a taller tower and/or better siting. Moreover, SigFX intends to test and modify its technology to mitigate the signal propagation issues at its current location.

SigFX also has learned that its prototype transmitter needs better filtering to reduce communications noise. In the next testing phase, SigFX anticipates that it will further test its filtering technology, as well as modify gain in an attempt to reduce noise.

Multipath Effects

When testing SigFX's ability to carry communications data on the VBI, SigFX encountered multipath issues created when the broadcast signal bounces off physical structures in the Channel 46 broadcast area. Multipath creates time-delayed copies of the SigFX communications signal in the VBI that must be eliminated. Now that its testing has alerted SigFX to the negative impact of multipath on the communications signal, it is investigating ways to mitigate the problem through algorithm and equipment improvements. SigFX intends to test its solutions as part of its additional testing under the requested experimental license.

How the Program of Experimentation has a Reasonable Promise of Contributing to the Development, Extension, Expansion or Utilization of the Radio Art

SigFX believes that its technology has the potential of contributing to the radio arts in four ways.

Value-Added Spectrum Use – SigFX’s technology will give television broadcasters the option of expanding their service offerings to include voice and data communications services. This opportunity will provide local broadcasters with the ability to enhance their market position in the face of competition from cable television, satellite television and the Internet without interfering with existing broadcast services.

Spectrum Efficiency – SigFX’s technology helps to address existing spectrum shortages for wireless voice and data communications applications and improves spectrum efficiency by putting available broadcast spectrum capability to additional use.

Resource Efficient Deployment – When compared with traditional wireless networks, the voice and data communications networks possible with SigFX technology may be constructed quickly and at low cost. Unlike cellular, SMR or PCS, where multiple antennas must be deployed over a large geographic area to achieve satisfactory signal coverage, SigFX’s technology allows a large geographic area to be served by a single or smaller number of antennas, because the communications coverage area mirrors or approximates that of the broadcast signal. For example, if a broadcast signal coverage area has a radius of 100 miles, SigFX’s wireless communications network would have the same or similar signal coverage area. A PCS operator could be required to deploy a larger number of antennas to achieve the same coverage. Moreover, because SigFX’s technology can be implemented through already deployed broadcast systems, little or no additional construction or permitting will be needed to launch the communications service. The signal coverage and deployment efficiencies associated with SigFX’s solution means that wireless communications services can be launched quickly and at a reduced cost.

Bridging the Digital Divide – Because of the resource and spectrum efficiencies associated with building a wireless communications network that relies on broadcast systems, SigFX’s technology represents a tool for bringing wireless communications services to rural and economically-challenged areas. Cost is a key barrier to wireless service deployment in these areas. Service providers tend to build wireless communications systems in areas with population size and density levels, as well as income levels, that are large enough to generate the subscription and call volumes needed to allow a provider to recover the costs associated with securing spectrum and building and serving the network. Rural and economically-challenged areas do not always present enough business opportunity to justify the high cost of deploying service. SigFX’s technology helps to solve this problem because it allows a broadcaster or its business partner to avoid the costs associated with securing spectrum at auction, constructing multiple cell sites,¹ obtaining zoning permits, and deploying the necessary technology. Thus, the financial model used to determine whether a wireless communications system can be cost-justified is altered significantly because fewer subscribers and less revenue generation are needed to ensure that costs are recovered and profits are possible. SigFX expects that these benefits will provide incentive for companies to bring wireless communications systems to rural and economically-challenged areas that are being left behind currently in the digital revolution.

¹ The ability of SigFX’s technology to leverage the larger geographic coverage areas associated with television broadcast signals is particularly beneficial when trying to serve rural areas with dispersed populations.

MAIN FORM FIELD 10:

SigFX's communications messages will be transmitted to SigFX's experimental subscriber devices through W46CW Channel 46 and WBMS-LP Channel 10 broadcast antennas. SigFX may use receive-only antenna arrays to receive the return signal from the subscriber units. Consequently, SigFX will not be adding any new transmitting antennas other than those associated with its subscriber units. SigFX is not providing information concerning the Channel 46 and Channel 10 transmitting antennas because SigFX is relying on Channel 46's and Channel 10's broadcast authorizations to deliver communications signals over their broadcast systems. The information regarding these broadcast antennas is already included in Channel 46's and Channel 10's FCC and FAA authorization applications on file with these agencies. SigFX is willing to provide this information to the Commission if it will help the Commission staff process SigFX's request for an experimental license.

MAIN FORM FIELD 11:

SigFX understands that the broadcast stations on which it is testing its communications technology comply with Section 5.152.