Product Specification: 710-97xx Rev 1

5.3 GHz Spread Spectrum

Broadband Wireless Internet Access

Subscriber Unit

Model: M5300S-FSU

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ENGINEERING:	**MARKETING:**
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1.0 SUMMARY

This document details the functional and parametric requirements for the FOX^{tm} subscriber unit (FSU) transceiver which, when setup in a cell having at least one access point (AP), functions as a wireless MAC layer Ethernet access solution. Each SU communicates with a unique AP using 5.3 GHz spread spectrum technology. The SU accepts full or half duplex Ethernet IEEE 802.3 data packets from a 10/100BaseT port, adds header information, scrambles the data and transmits them at 11 Mbit/sec rate over the air. The Subscriber Unit product consists of the following:

- 1 subscriber unit (SU) with integrated patch antenna
- 1 Pole/wall mount
- 1 Junction/Power adapter

2.0 FUNCTIONAL REQUIREMENTS

The paragraphs below describe the functional requirements of the transceiver.

2.1.1 GENERAL REQUIREMENTS

The unit shall be designed to be compliant with FCC part 15.407 intentional radiator requirements for a point to point system, and 15.109 unintentional radiator requirements. This requirement specifies certain maximum RF power output and spurious emissions levels. The unit shall also be compliant with ETSI EMC standards as outlined in the Parametric Specifications section.

The unit shall be designed for installation by a professional installer or the end customer.

2.1.2 HARDWARE REQUIREMENTS

2.1.2.1 User Controls and Indicators

2.1.2.1.1 LEDs

LED operational requirements are given below. It should be noted, however, that in "Survey" mode, no LEDs shall light up except the LNKST and ACTST LEDs. The unit shall have LED indicators to indicate the following:

a) NET LED

Green: Illuminated when network connection is made, regardless of whether it is 10BaseT or 100 BaseT (LNKST)

b) ACT LED

Green: Receive/Transmit Status (ACTST) for Ethernet port

c) RSSI LEDs (4)
In all modes except "Survey", the unit's four yellow LEDs shall indicates the level of RF signal being received from a valid AP.

Yellow LED 1 (leftmost): On when RSSI is greater or equal to –85 dBm
Yellow LED 2 : On when RSSI is greater or equal to –80 dBm
Yellow LED 3 : On when RSSI is greater or equal to –75 dBm
Yellow LED 4 (rightmost): On when RSSI is greater or equal to –70 dBm.

If a signal no signal is detected the LEDs will not be on at all.

The LED shall be controlled by the FPGA and is based upon the Prism RSSI register, which indicate the energy level on the antenna.

d) Association LED(green): Blinking at:

1) Once every second when unit is powered on but opmode is OFF
2) Twice per second while in SU opmode and scanning for an AP.
3) Solid after unit is associated with an AP.

2.1.2.1.2 Connectors

The unit shall have a connector for a 10/100 Base T shielded twisted pair (STP) interface cable connection.

The unit shall be powered using the unused twisted pair wires.

2.1.2.2 Power Input

The unit shall have provisions to operate from an unregulated DC power supply.

This input shall be reverse voltage polarity protected and have filtering to prevent damage from static caused by typical nearby lightning strikes and the human body ESD model.

The unit shall have automatically resetting fusing provisions in the event of an over current condition.

2.1.2.3 Digital Section

2.1.2.3.1 Microprocessor Subsystem

The unit shall utilize a 32 bit RISC microprocessor to accomplish the requirements in the software section. The subsystem shall consist of the following hardware functions:

1) 32 Bit Microprocessor with SDRAM controller and Ethernet MAC interface
2) Ethernet PHY interface
3) TTL level Serial port for debug purposes
4) Nonvolatile, writeable FLASH Memory – 512Kbyte
5) SDRAM 8 Mbytes

2.1.2.3.2 Field Programmable Gate Array (FPGA)

A field programmable gate array shall be used to accomplish the following functions:

1) 32 bit wide, 256 long word deep, full duplex FIFO for RF MAC packet transfer to and from the microprocessor subsystem to the radio section Baseband Processor (BBP)
2) Microprocessor subsystem data bus interface for transferring data between the microprocessor and the FPGA
3) Shift register for to convert RF MAC packets going between the FIFO and the BBP from parallel to serial format.
4) PLL programming for IF and RF local oscillators.
5) TX/RX switch processing.
6) BBP register read/write
7) JTAG interfacing to test equipment
8) Ranging response processing
9) Polling response processing
10) Timer to support CPU
11) RSSI LED support
12) Antenna switch control (polarization)

2.1.2.3.3 Baseband Processor (BBP), Modulator and Demodulator

The unit shall use the Intersil Prism II chipset solution for modulating and demodulating RF MAC layer packets onto the RF channel. The portion of the chipset that shall be used consists of the BBP and the Quadrature Modulator/Demodulator.

Functions of the solution that shall be utilized:

1) Data Transmit
2) Data Receive
3) Data scrambling.
4) IF AGC
5) Received Signal Strength monitoring
6) Clear Channel Assessment.
7) RF power output adjustment

2.1.2.4 RF/Analog Section

The unit RF section shall be designed as a half duplex transceiver.

The unit shall use a single-conversion receiver architecture.

The unit shall have provisions for multilevel power control at the IF to mitigate the near-far problem encountered during subscriber setup. The unit shall have provisions to control the power output over temperature based on the AP temperature and periodic power leveling.

The unit shall have provisions for sending accurate signal strength measurement to the microprocessor and FPGA.

2.1.2.5 Packaging/Mounting

The packaging shall be designed for outdoor operation in 100 % humidity conditions.

The packaging shall be designed for outdoor pole or wall mounting with grounding provisions.

The packaging shall be designed to comply with EMC standards as noted in the parametric specifications section.

2.1.3 SOFTWARE REQUIREMENTS

The software requirements outlined herein pertain to the 32 bit RISC microprocessor section only.

2.1.3.3 Bootstrap Load Program

The bootstrap load program shall wait for 5 seconds after power on to load the Gate Array and upgrade the firmware from the serial port. After 5 seconds the bootstrap will load the current firmware into SDRAM and transfer control to the main program.

2.1.3.4 Real Time Multi-tasking Operating System (RTOS)

The operating system (kernel) is the lowest layer program that always runs in the microprocessor. It shall allocate system resources to all functions that are covered in this section.

The realtime kernel shall have the following features and functions:

2.1.3.4.3 Cooperative Scheduler

Cooperative based upon unique task priority, round robin on equal priority.

2.1.3.4.4 Realtime Interrrupt handler

Time critical tasks such as the FIFO management are handled by interrupt control.

2.1.3.4.5 Multitasking capability.

The ability to run multiple tasks by context switching. The minimum time slice is 1 millisecond.

2.1.3.4.6 Dynamic Memory Allocation.

2.1.3.5 Administrator Interface

This section covers the Administrator interface that shall be implemented over HTTP connection.

2.1.3.5.3 HTTP Activation

HTTP Shall be active for the first 2 minutes after power is applied, and the Opmode shall be "off". After the two minute period, the unit shall enter opmode "SU" and begin searching through the scan table for an AP.

2.1.3.5.4 HTTP Functions

See Firmware requirements.

2.1.3.6 Communication Protocols for Ethernet Packets

The subscriber unit shall treat all data arriving at the Ethernet port as data to be transferred across the wireless link to the AP. In essence the SU shall function as a repeater. (Note for manual: If the end user wishes to free up more air time, packet filtering via a router, switch or similar should be done before the data enters the SU.

The SU shall Provide packet filtering shall be provided as a software selectable option for Layer 2: Multicast and local traffic filter based on dynamic MAC table.

2.1.3.7 Smart Polling Protocol

The unit shall be a remote terminal in a star configuration wireless multipoint network supporting up to 512 subscriber units. The functional description of the protocol is as follows:

The AP unit acts as a hub in a star configuration wireless multipoint network supporting up to 512 subscriber units. The functional description of the protocol is as follows:

The AP unit, hardwired to a Point of Presence, polls each subscriber unit SU in a round robin format to determine if the SU has data to transfer. The SU only transmits the data "upstream" to the AP when the AP gives authorization via a transmit grant. The SU parses every "downstream" data packet from the AP and identifies packets intended for it.

Normally the administrator will first add the MAC address and ID number of the SU to the user database of the AP with which the SU will associate. Then, the SU will be installed by the end user or a technician at the subscriber premises.

When power is first applied to the SU and it finishes loading the firmware from FLASH, it will scan all the channels in its scan table, searching for an AP that is sending transmit grants for the SU. The SU will then stop on that channel and respond to the AP using maximum RF power. Before the AP can add the SU to the polling list, it must authenticate the SU by verifying the MAC address, and performing a ranging operation to the SU. This process involves sending a special command to the SU and getting an instantaneous reply from the SU.

Upon successfully locating and ranging the SU, The AP will then add the SU to the normal polling list and level the RF transmit power level from the SU to set a good signal-to- noise ratio at the AP.

The AP uses several parameters to determine how often each SU is polled for data, and the conditions of any data transfer, as follows:

1) Committed Information Rate (CIR)
2) Maximum Information Rate (MIR)
3) Priority
4) Poll response timeout

All the above parameters are set in the AP by the system administrator and cannot be controlled at the SU.

3.0 PARAMETRIC REQUIREMENTS

3.1 TRANSMITTER SECTION

Radio Section

Frequencies:

Storable Channels:	30 memory locations
Channel spacing:	5.26 to 5.34 GHz in 2 MHz increments
Default channel s-	Channels 1-6 not programmed Channel 7: 5.26 GHz Channel 8: 5.28 GHz Channel 9: 5.30 GHz Channel 10: 5.32 GHz Channel 11: 5.34 GHz Channels 12-30 not programmed
RF Output Power:	Max: +15 dBm +/- 2 dB Min: -12 dBm +/- 2 dB
EIRP:	+30 dBm (1 Watt) including 15 dBi patch antenna
Freq. Stability:	.00025% PLL stabilized (+/-2.5ppm) over temperature
Freq. Plan:	Single upconversion, 480 MHz IF
Modulated BW:	22 MHz (null to null, 20 dB)
2nd Harmonic atten:	Per CFR47 part 15.407
LO Supression:	Per CFR47 part 15.407
Symbol Rate:	1.375 MSPS
Modulation:	1 MBPS DBPSK for header, 11 MBPS CCK spread spectrum for payload

Data Input Section

Data Rate (User):	10 MBPS Sustained throughput
Format:	10/100 BaseT IEEE 802.3 Ethernet compliant
Ethernet packet:	Up to 1600 byte long packets
Protection:	Bi-directional transient voltage protection diodes on all data lines compliance with: IEC61000-4-2 (ESD) IEC61000-4-4 (EFT) IEC61000-4-5 (Lightning)

Power

Input Voltage:	Input voltage range at unit is 10.5 VDC to 24 VDC max

	Power is supplied on Ethernet cable using junction box provided with up to 330 foot 24 AWG STP cable.
Current Cons.:	400 mA in transmit and receive modes at max power using 20 V standard adapter (8 W)
Protection:	24 Volt Transient voltage suppression on power input. Voltages above 24 volts will cause damage to unit.

3.2 RECEIVER SECTION

Radio Section

Storable Channels:	30 memory locations
Channel spacing:	5.26 to 5.34 GHz in 2 MHz increments
Default channel s-	Channels 1-6 not programmed Channel 7: 5.26 GHz Channel 8: 5.28 GHz Channel 9: 5.30 GHz Channel 10: 5.32 GHz Channel 11: 5.34 GHz Channels 12-30 not programmed

Cascade Noise Figure:	< 6 dB
Sensitivity:	- 82 dBm typical-1600 byte packet
(1E10-6 BER)	- 87 dBm typical-64 byte packet
Adj. Channel Rejection:	> 20 dB
Image Rejection:	> 60 dB
Frequency Plan:	Single conversion, IF at 480 MHz
LO stability:	.00025% PLL stabilized (+/-2.5ppm) over temperature range
Input compression point:	> -25 dBm

Data Output Section

Data Rate (User):	10 MBPS Maximum sustained throughput
Format:	10/100 BaseT IEEE 802.3 Ethernet compliant
Ethernet Protocols:	TCP/IP, Telnet, TFTP, UDP,HTTP

3.3 MECHANICAL AND ENVIRONMENTAL

General

Material:	High Temp ABS/Polycarbonate Enclosure
Size:	6”x3”x1.5” including mounting studs
Weight:	1 lb

Mounting:	Polycarbonate Wall/Pole mount bracket

Connectors/Indicators

RF Output:	Integral internal patch antenna per Part 15C, 15.203.
FCC Compliance:	The transceiver shall comply with the following: FCC Part 15.407 FCC Part 15.207(a)
LAN Interface:	Shielded RJ45 connector
Power:	Carried on 4 unused pins of Ethernet cable

Environmental

Operating Temp:	-40 to 60 deg C
Storage:	-40 to 85 deg C
Humidity:	100 % When sealed properly
NEMA Rating:	NEMA 4
Shock:	Sustain 3 axis drop from 5 feet

3.4 STANDARD EXTERNAL POWER SUPPLY

20 Volt DC Power adapter and J-Box supplied with product.

Type:	Linear wallmount transformer
Input:	120 VAC
Output:	20 VDC +/- 1 V
Max current:	1200 mA

3.5 INTEGRATED ANTENNA

Type:	Patch Array Antenna
Polarization:	Vertical, Horizontal electrically selectable
Frequency:	5.2 to 5.9 GHz
Gain:	+15 +/- 1 dBiL
Az Beamwidth:	32 degrees (3 dB down)
El Beamwidth:	18 degrees (3 dB down)
Cross Pol:	>15 dB
Front/Back Ratio:	>20 DB as mounted in M5300S-FSU
VSWR:	< 2.0:1 over Bandwidth

APPENDIX A HARDWARE CHANGE HISTORY

Product/Rev	Change Description	FFF Chg?
M5300S-FSU rev 1 -	Baseline	