Exhibit 3 – Description

Motorola Head-end Transceiver (HUB)

FCC ID: MIJTELHUB-USB-01

Telaxis Model No. ST4-31-UB1H-R1-E

3.0 Transmitter Description

The Telaxis' (formerly Millitech) Head-End Transceiver, or 'Hub', is part of an LMDS point to multi-point wireless networking system. It is an outdoor unit that is physically located at the head-end side of the LMDS wireless link. The Hub functions as a wireless transceiver to bridge the gap between head-end router equipment and FCC allocated LMDS broadcast frequencies. The head-end router and wireless signals that interface to the Hub will be referred to as IF and RF signals respectively for the remainder of this document. Figure 3.0-1 depicts the major functional interfaces of the Hub.

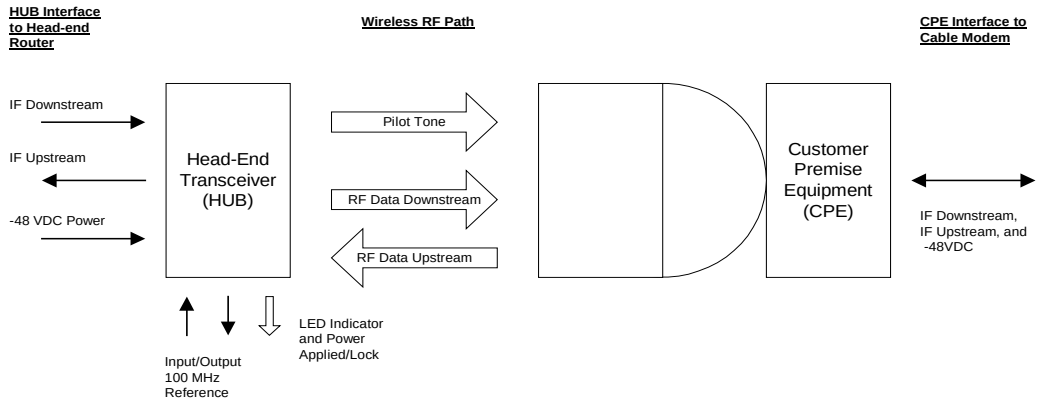

Figure 3.0-1 Major Functional Interfaces

The Hub IF signals interface with a Head-End Router that is located at the Head-End of the LMDS link. Two coax connectors on the Hub are used to carry IF signals upstream and downstream, a third connector is used for DC power. A red LED indicator is illuminated on the Hub connector plate to indicate the Hub is transmitting RF power and that all internal oscillators are locked to the reference frequency. Three sector horn antennas are used to carry the RF interface including upstream data to the Hub, a pilot tone, and downstream data to the CPE. The maximum transmitted RF output power is limited by the saturated output power of the last amplifier stage. The typical saturated output power from the Hub is 0.500 watts. Nominal output power from the Hub is 0.250 watts. Each sector antenna has a nominal gain of 15 dBi with a half power beamwidth of 64 or 90 degrees in azimuth. Transmit and receive signals are copolarized relative to each other for a given Hub. Hubs are provided in both E and H field vertical configurations and are typically alternated in adjacent 90-degree sectors so that 4 Hubs (2 E-Plane; 2 H-Plane) are required to provide 360 degrees of RF coverage.

3.1 Transmitter Technical Characteristics

millitech

HFC Hub, US Block B1
Model: ST4-31-UB1H-R1-E

Preliminary Data Sheet

Part Number: 903131810/ (01 for E-Plane Tx, 02 for H-Plane Tx)
Ser. No. 992728862 | *Tested By:* P.LAZARZ | *Date:* 9/30/99

Item	Description	Specification	Results ✓ = Comply (INSPECT or TEST)
2.1	**Downstream IF Interfaces**		
2.1.1	IF Characteristics	498 to 570 MHz	✓
2.1.2	IF Connector	75 ohm, female type-N	✓
2.1.3	IF Return Loss	≥-10 dB	✓
2.1.4	Maximum Output Level	+13dBm max	By DESIGN
2.1.5	Max Input Level w/o Damage	+10 dBm signal at any frequency	By DESIGN
2.2	**Upstream IF Interfaces**		
2.2.1	Upstream IF Frequencies	17 to 42 MHz	✓
2.2.2	Upstream IF Connector	75 ohm, female type-N	✓
2.2.3	IF Return Loss	10 dB Min	✓
2.2.4	Maximum Output Level	+13 dBm Max.	By DESIGN
2.2.5	Maximum Input level Without Damage	+13 dBm Min.	By DESIGN
2.3	**Reference Out Interfaces**		
2.3.1	Reference Out Frequency	100 MHz (qty 4) 24.414KHz (qty 1)	✓ ✓
2.3.2	Reference Out Connectors	100 MHZ - Type SMA 24KHz – Type BNC	✓ ✓
2.3.3	Return Loss	10 dB Min	✓
2.3.4	Maximum Output Level	+13 dBm Max	By DESIGN
2.3.5	Maximum Input Level Without Damage	+13 dBm Min	By DESIGN
2.4	**Reference In Interface**		
2.4.1	Reference In Connector	Type SMA (female)	✓
2.4.2	Return Loss	10 dB Min	✓
2.4.3	Maximum Input level Without Damage	+13 dBm Min	By DESIGN
2.5	**DC Power Interface**		
2.5.1	Connector Type	MS3474W1412P (on Hub) MS3476W1412S (mate for cable)	✓ ✓
2.5.2	Pin Assignment	Pin L …Shield/Chassis Pin K … -48 Vdc Pin J … DC Return	✓ ✓ ✓
2.5.3	DC Power		

Block B Hub Data Sheet - Draft Page 1 of 4 *Revised 9/30/99 1:02 PM*

Millitech Proprietary Information

Figure 3.1-1 HUB transmitters technical data sheet, 1 of 4

millitech

HFC Hub, US Block B1
Model: ST4-31-UB1H-R1-E

Preliminary Data Sheet

Part Number: 90313181 01 (01 for E-Plane Tx, 02 for H-Plane Tx)

Ser. No. 99272862 | *Tested By:* P. LAZARZ | *Date:* 9/30/99

Item	Description	Specification	Results
2.5.3.1	Maximum DC Voltage	Unit shall survive the application of any DC voltage between ±60 VDC to the power pins	By DESIGN
2.6	**Antenna Interfaces**		
2.6.1	Air Interface Frequencies	Downstream: 31003 to 310075 MHz Pilot: 31000 to 31003 MHz Upstream: 31225 to 31250 MHz	✓ ✓ ✓
2.6.2	HSU Antenna Gain	15 ±1 dBi	By DESIGN
2.6.3	HSU Antenna Beamwidth	64° HPBW	By DESIGN
2.6.4	HSU Antenna Polarization	Orthogonal	By DESIGN
2.6.5	Maximum Output EIRP	+50 dBm Max.	By DESIGN
2.6.6	Maximum Input level Without Damage	0 dBm Min	By DESIGN
3.0	**FUNCTIONAL PERFORMANCE**		
3.1	**Reference Oscillator**	Frequency locked to an external or internal 100MHz reference.	✓
3.1.1.1	Frequency	100 MHz ± 5 ppm	✓
3.1.1.2	Output Power	TBD (+10) dBm ±3 dB	✓
3.1.2.2	Input Power	TBD (+8) dBm ±5 dB	✓
3.1.3	Reference Lock Indication	LED lock indicator	✓
3.2	**Downstream Pilot Transmitter**		
3.2.1	Pilot Transmit Power	+16 dBm ±1 dB	✓ +17 dBm
	Pilot Modulation Frequency	24414.0625 Hz (100 MHz/4096)	✓
3.2.4	Pilot Modulation Frequency Stability	±5 ppm of the specified frequency for at least 5 years	By DESIGN
3.2.5	Pilot Channel Power	99.99% of the pilot signal power shall be within ±1.5 MHz of the pilot center frequency	By DESIGN
3.2.6	Spurious Emissions in Downstream Bands	< -35 dBm	✓
3.2.7	Out-of-Band Spurious Emissions	< TBD dBm	NO SPEC
3.3	**Upstream RF Converter**		
3.3.1	Dynamic Range	RF converter requirements shall be met with upstream IF output powers in the range from –35 to –25 dBm at the IF port unless otherwise specified	

Block B Hub Data Sheet - Draft

Page 2 of 4

Revised 9/30/99 1:02 PM

Millitech Proprietary Information

Figure 3.1-2 HUB transmitters technical data, sheet 2 of 4

millitech

HFC Hub, US Block B1
Model: ST4-31-UB1H-R1-E

Preliminary Data Sheet

Part Number: 90313181 0/ (01 for E-Plane Tx, 02 for H-Plane Tx)

Ser. No. 992728867 | *Tested By:* P. LAZARZ | *Date:* 9/30/99

Item	Description	Specification		Results
3.3.2	Conversion Gain at Ambient Temperature	56 ±3 dB for ambient temperatures of 25°C ±5°C		✓ 57 dB
3.3.3.	Conversion Gain Temperature Variation	ó dB max variation over the full temperature range		✓ 56 dB @ +50C 58 dB @ -40C
3.3.4	intermodulation Distortion	Upstream RF converter shall have a total output third order intercept point (OIP3) > +0 dBm		✓ 18 dBm
3.3.6	Noise Figure	7 dB max		4.2 dB ✓
3.3.7	Phase Noise	Offset Frequency	SSB Phase Noise Max., (dBc/Hz)	14.6 GHz DRO
		1 kHz	-45	-94 ✓
		10 kHz	-75	-106
		100 kHz	-100	-110
		>1 MHz	-120	-129
3.3.8	Residual AM	< 1.0% peak-peak when measured using a 3 MHz single-pole LPF		NO TEST / By DES.
3.3.9	In-Band Spurious Emissions at IF Output	Within ±1.56 MHz of any upstream carrier shall be -50 dBc max		✓
3.3.10	Out-of-Band Spurious Emissions at IF Output	Below 17 MHz and between 42 an 75 MHz shall be < -35 dBm		✓
3.3.11	Downstream Band Immunity	Meet all requirements while receiving a signal at TBD (-75) dBm in any of the downstream frequency bands		TBD
3.3.12	IF Port Stability	RF converter shall be stable over all operating conditions into any load up to and including an ∞:1 VSWR (open or short) at the IF port over all phase angles.		By DESIGN
3.4	**Downstream Channel RF Converter**			
3.4.1	Conversion Gain at Ambient Temperature	33 ±3 dB for ambient temperatures of 25°C ±5°C		35 dB ✓
3.4.2	Conversion Gain Temperature Variation	ó dB max variation		✓ 34dB @ +50C 35dB @ -50C
3.4.3	Linearity	OIP3 > +28 dBm when measured using a two-tone test with total output signal power of +16 dBm		✓ INFO: +32 dBm

Block B Hub Data Sheet - Draft

Page 3 of 4

Revised 9/30/99 1:02 PM

Millitech Proprietary Information

Figure 3.1-3 HUB transmitters technical data sheet, 3 of 4

millitech

HFC Hub, US Block B1
Model: ST4-31-UB1H-R1-E

Preliminary Data Sheet

Part Number: 9031318101 (01 for E-Plane Tx, 02 for H-Plane Tx)

Ser. No. 9927288C2 | *Tested By:* P. LAZARZ | *Date:* 9/30/99

Item	Description	Specification		Results
3.4.4.	Conversion Frequency Stability	Freq. locked to the pilot frequency over the full temperature range.		✓
3.4.5	Noise Figure	≤20 dB		✓ 18.2dB
3.4.6	Phase Noise	Offset Frequency	SSB Phase Noise (dBc/Hz) Max.	System ϕ NOISE
		1 kHz	-45	-91
		10 kHz	-75	-103
		100 kHz	-100	-102
		>1 MHz	-120	-120
3.4.7	Residual AM	< 1.0% peak-peak when measured using a 3 MHz single-pole LPF		NO TEST; BY DESIGN
3.4.8	In-Band Spurious Emissions	Within ±3 MHz of any downstream carrier shall be < -50 dBc		✓
3.4.9	Spurious Emissions in Downstream Bands	Within any of the downstream bands shall be -35 dBm Max		✓
3.4.10	Spurious Emissions in Upstream Bands	Within any of the downstream bands shall be TBD (-55) dBm max		✓
3.4.11	Out-of-Band Spurious Emissions	< TBD (-35 dBm)		✓
5.1	Size and Weight	Size: ≤60 x 45 x 45 cm Weight: ≤25 kg		BY DESIGN
5.7.2	Operating temp Range	Shall meet all specifications operating between -40°C to +50°C with 1120 W/m^2 solar loading. An interior heater is allowed.		✓ TESTED -40C to +50C (NO TEST; SOLAR LOADING)
5.8	Warm-Up Time	ODU shall meet all specifications within a warm-up time of 3 minutes at ambient temperatures ≥ 0°C and 20 minutes at temperatures < 0°C		✓
6.2	**Power Dissipation**	Maximum power dissipating shall be < 130 Watts		✓
6.3	**DC Voltage**	Shall meet all requirements with supply voltages between +38 and +56 VDC and nominal operating voltage of +48 VDC		BY DESIGN
7.2	**Production Burn-In**	48-hours Min. at +50C		✓

Block B Hub Data Sheet - Draft

Page 4 of 4

Revised 9/30/99 1:02 PM

Millitech Proprietary Information

Figure 3.1-4 HUB transmitters technical data sheet, 4 of 4

3.1.1 RF Power Output

The specified output power for the HUB Data transmitter is +24 dBm. The specified output power for the HUB Pilot transmitter is +16 dBm ± 1 dB.

3.1.2 Frequency Range

The HUB utilizes two single frequencies in the frequency range of 31.000 to 31.075 GHz. The Data signal is at 31.048 GHz and the Pilot signal is at 31.0015 GHz.

3.1.3 Frequency Stability

Frequency stability is 0.001% by design.

3.1.4 Emission Designator

The HUB itself uses no Data modulation techniques. Modulation necessary to support the LMDS link is performed by the equipment external to the CPE. However, based on the DOCIS signal, the Data signal emission designator (5M85D1D) is based on the following:

- D - Emissions in which the main carrier is amplitude and angle-modulated either simultaneously or in a pre-established sequence
- 1 - A single channel containing quantized or digital information without the use of a modulating subcarrier, excluding time division multiplex
- D - Data transmission, telemetry, telecommand

The Pilot tone is FM modulated by the HUB's internal 100 MHz crystal oscillator divided down to 24.414 kHz. The Pilot signal emission designator (2M28F1D) is based on the following:

- F - Emissions in which the main carrier is amplitude and angle-modulated – frequency modulated
- 1 - A single channel containing quantized or digital information without the use of a modulating subcarrier, excluding time division multiplex
- D - Data transmission, telemetry, telecommand

3.1.5 DC Voltage

The HUB operating voltage range is –48 volts ± 20%.

3.2 Transmitter Application

3.2.1 Power Supply Available

The HUB transceiver operates from –48Vdc power with a maximum current draw of 2.1 amperes.

3.2.2 Antenna Available

Figure 3.2-1 and Figure 3.2-2 provide the elevation and azimuth antenna gain patterns for the HUB antenna. The HUB utilizes three E-plane horn antennas with a gain of 15 dBi (typical). Separate antennas for Data transmit, Data Receive and Pilot transmit.

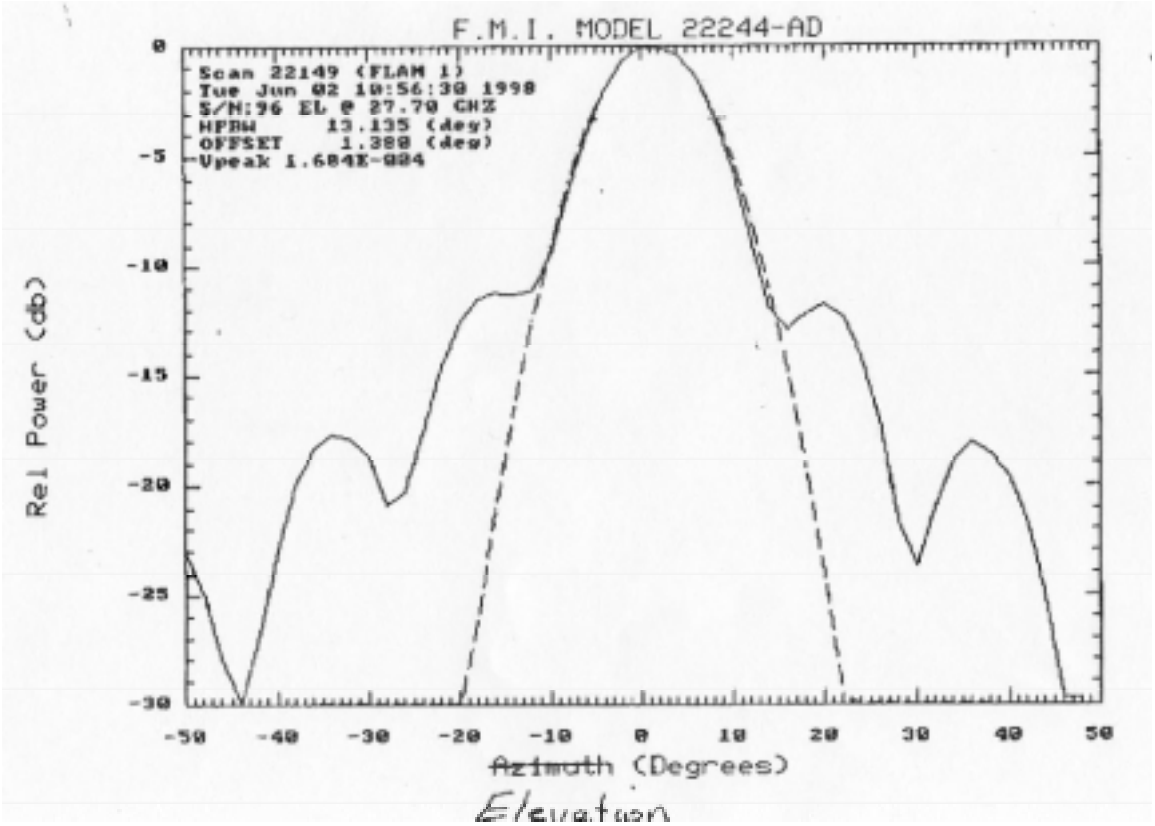

Figure 3.2-1 Elevation Beamwidth for the HUB antennas

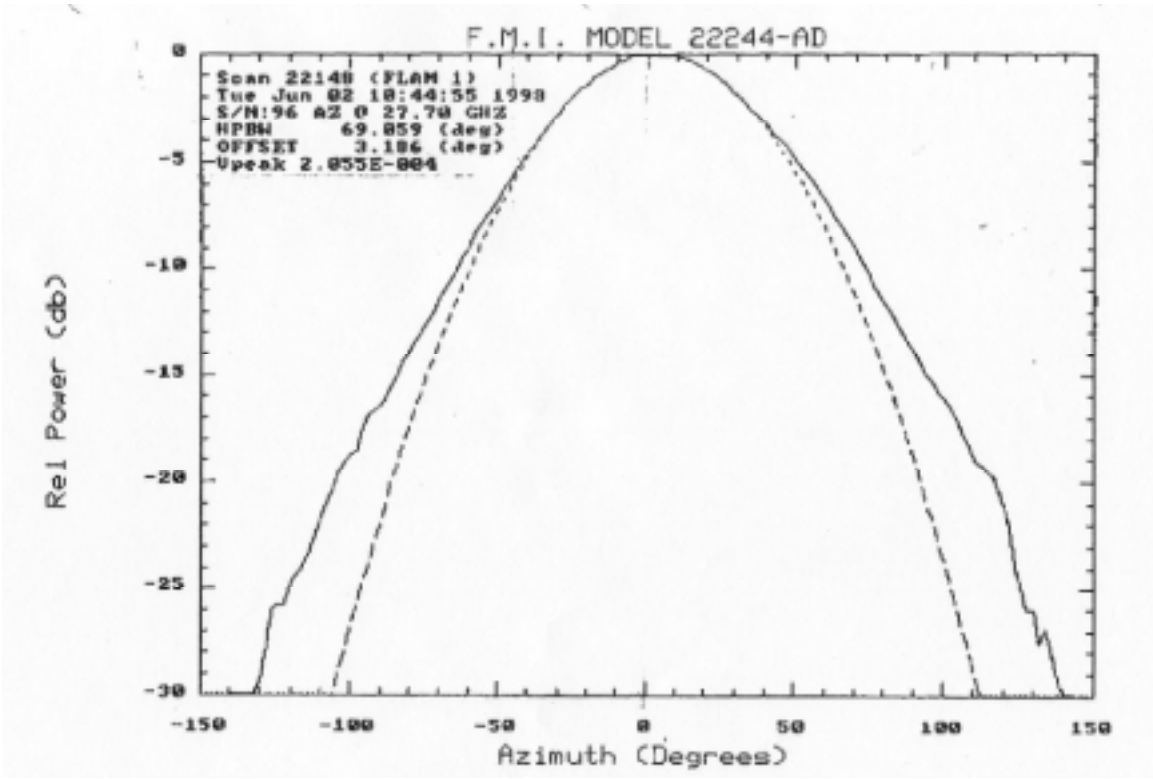

Figure 3.2-2 Azimuth Beamwidth for the HUB antennas

3.2.3 Maximum Transmit Channel Capacity

The HUB is capable of a single frequency transmit for both the Data and Pilot signals.