

Exhibit 3 – Description

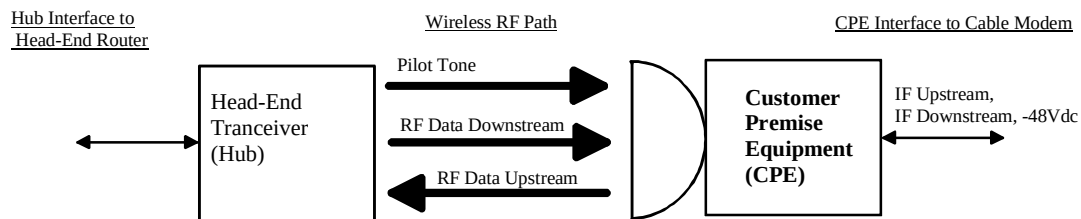
Motorola Head-end Transceiver (HUB)

FCC ID: MIJMILHUB-USA-01

Millitech Part No. 9031291001

3.0 Transmitter Description

The 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 1 depicts the major functional interfaces of the Hub.



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 .6 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		DATA SHEET	
Product Description: 28 GHz E-Plane Hub Stack, US Block A		Job No.: A9776100	
Model Number: ST4-28-UA1H-R1-E		Serial No.: 991725227	
Part Number: 9031291001		Tested By: KLL	
		Date Tested: 6/10/99	
Item	Description	Specification	Test Results
1	Configuration		
1.1	Transmitter Modules	1 pilot and 1 traffic	Comply by design
1.2	Receiver Modules	1 traffic	Comply by design
2	Transmit Frequencies		
2.1	IF Input	450 to 750 MHz	Comply by design
2.2	RF Output	28.05 to 28.35 GHz	Comply by design
2.3	Pilot (HFC only)	27.644 GHz $\pm$ 4 MHz	Comply by design
3	Receive Frequencies		
3.1	RF Input	31.076 to 31.106 GHz	Comply by design
3.2	IF Output	11 to 41 MHz	Comply by design
4	Transmitter		
4.1	Pilot Transmitter		
4.1.1	Output Power @ Transmit module output	+24 dBm at room temperature typical	27.2 dBm @ Room Temp
		+22 dBm min. (-30 to +50°C)	27.9 dBm @ -30°C
			25.5 dBm @ +50°C
4.1.2	Pilot TX Spurious Emissions		
4.1.2.1	Outside operating band	30 MHz to 21.2 GHz -60 dBm (max)	Comply by design
		21.2 GHz to 50 GHz -30 dBm (max)	-37.1 dBm
4.1.2.2	Inside operating band	27.5-28.35 GHz -50 dBc (max)	-50.7 dBc
4.2	Transmitter		
4.2.1	Output power (P _{dB}) @ Transmit module output	+24 dBm typical at room temperature	25.5 dBm @ Room Temp
		+22 dBm min (-30 to +50°C)	25.7 dBm @ -30°C
			23.6 dBm @ +50°C
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Figure 3.1-1 HUB transmitters technical data sheet, 1 of 3

millitech		DATA SHEET	
Product Description: 28 GHz E-Plane Hub Stack, US Block A		Job No.: <u>A9776-100</u>	
Model Number: <u>ST4-28-UA1H-RI-E</u>		Serial No.: <u>991725207</u>	
Part Number: <u>9031291001</u>		Tested By: <u>KLL</u>	
		Date Tested: <u>6/10/99</u>	

Item	Description	Specification	Test Results
4.2.2	Transmit gain (IF to RF) @ Band Center	+20 dB +/- 1dB at room temperature	<u>20.9</u> dB @ Room Temp
		+20 dB +/- 4dB (-30 to +50°C)	<u>27.9</u> dB @ -30°C
			<u>16.4</u> dB @ +50°C
4.2.3	Transmit gain flatness measured IF to RF at room temperature (linear operation)	+/- 3 dB (max)	+ <u>.89</u> - <u>1.27</u> dB
4.2.4	TX Spurious emissions (measured at antenna port with single carrier at P1dB)	Outside operating band: 30 MHz to 21.2 GHz -60 dBm (max)	Comply by design
		Outside operating band: 21.2 GHz to 50 GHz -30 dBm (max)	<u>-36.5</u> dBm
		Inside operating band: -50 dBc (max) (27.5-28.35 GHz)	<u>-59.3</u> dBc
5	Receiver Performance		
5.1	Receiver		
5.1.1	Noise figure (at antenna port)	6.5 dB (max) at room temperature	<u>5.61</u> dB @ Room Temp
5.1.2	Receiver gain (RF to IF) at band center	+35 dB +/- 2 dB at room temperature	<u>35.5</u> dB @ Room Temp
		+35 dB +/- 3 dB (-30 to +50°C)	<u>38.2</u> dB @ -30°C *
			<u>39.0</u> dB @ +50°C
5.1.3	Receiver gain flatness measured IF to RF at room temperature	+/- 2 dB (max)	+ <u>.45</u> - <u>.82</u> dB
6	Phase noise @ PLDRO		
6.1	Transmit	10 KHz offset -80 dBc/Hz (max)	Comply by design
		100 KHz offset -100 dBc/Hz (max)	Comply by design
6.2	Receive	10 KHz offset -80 dBc/Hz (max)	Comply by design
		100 KHz offset -100 dBc/Hz (max)	Comply by design

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Figure 3.1-2 HUB transmitters technical data, sheet 2 of 3



DATA SHEET

Product Description: 28 GHz E-Plane Hub
Stack, US Black A

Model Number: ST4-28-UA1H-R1-E

Part Number: 9031291001

Job No.: A9776.100

Serial No.: 491725227

Tested By: KU

Date Tested: 6/16/99

Item	Description	Specification	Test Results
7	Antennas	3 E-Plane Horns (Internal, with Radome) Separate antennas for pilot, Traffic bearing transmitter and Receiver	Comply by design
8	Mount	4" to 4.5" pole mount	Comply by design
9	Connectors		
9.1	IF Connector	Type F (female) Impedance: 75Ω	Comply by design
9.2	Reference Input and Outputs	Type SMA (female) Impedance: 50Ω	Comply by design
9.3	Power Connector	MS3474W1412P (on Hub) MS3476W1412S (mate for Cable)	Comply by design
10	Power requirements	-48V +/- 20% Ripple: <100 mV pk-pk	Comply by design
11	Power Consumption	100W (max) (2.1A (max) @ -48 Vdc)	67.2W 1.4 A @ -48Vdc
12	Weight	20 Kg (without mount) (max) 10 Kg (mount) (max)	Comply by design
13	Dimensions (mm)	457(h) x 273(w) x 350(d)	Comply by design
14	Environmental		
14.1	Operating temp	-30 to +50°C	Comply ☒ Yes ☐ No (circle one)
14.2	Non-operating	-40 to +80°C	Comply by design
14.3	Humidity	5% to 95% non condensing	Comply by design
15	Reference frequency	100 MHz +/- 100Hz (+/- 1ppm) +/- 1ppm per year aging allowance	Comply by design
16	Alarms	Lamp indicates all internal PLOs locked	Comply by design

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Drawing No: D531291001
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Sheet 3 of 3

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

3.1.1 RF Power Output

The Hub Data transmitter output power is +24dBm typical at room temperature. The Hub Pilot transmitter output power is also +24dBm typical at room temperature. The specified minimum output power is +22dBm minimum from -30° to +50° C. The HUB Data transmitter is operated at a nominal output power of +18dBm. The HUB Pilot transmitter is operated at it's saturated power output (nominal +28dBm).

3.1.2 Frequency Range

The HUB utilizes two single frequencies in the frequency range of 27.5 to 28.35 GHz. The Data signal is at 28.143 GHz and the Pilot signal is at 27.644 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 (6M00D1D) 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 (10M0F1D) 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 $-48 \text{ volts} \pm 20\%$.

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.

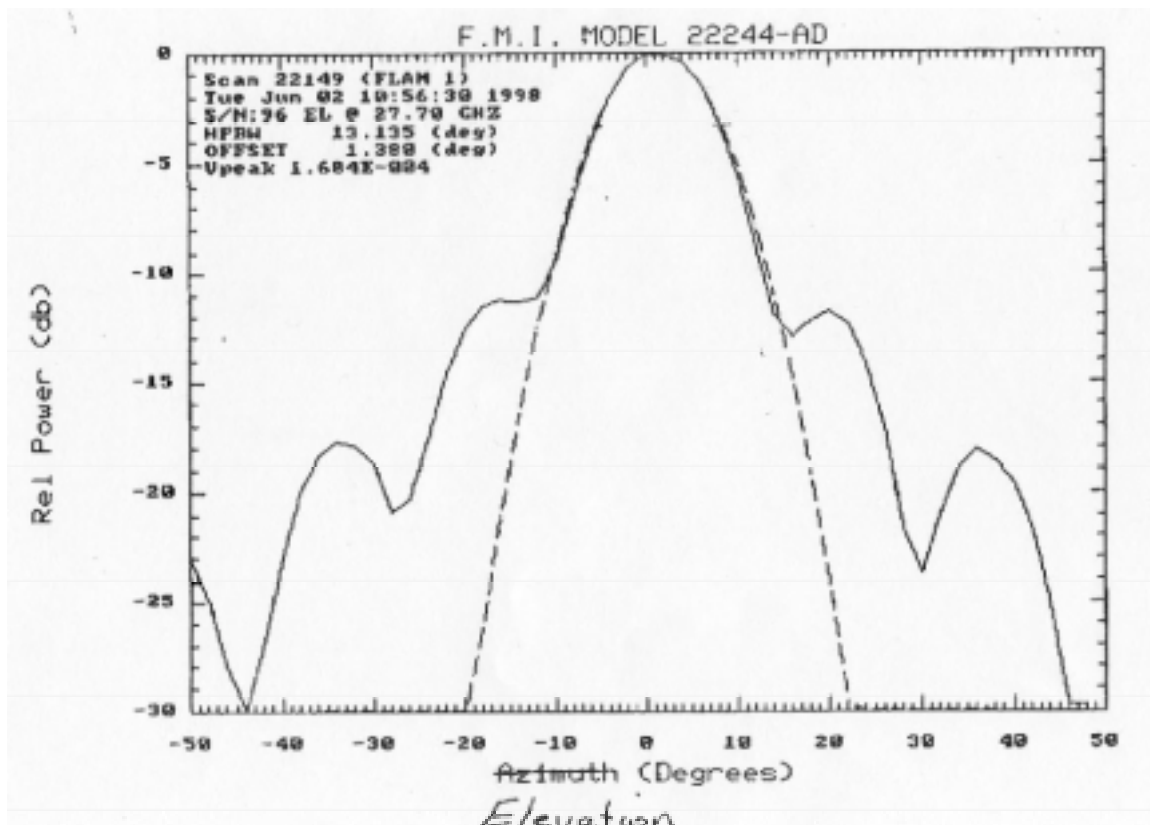


Figure 3.2-1 Elevation Beamwidth for the HUB antennas

Motorola, Inc. Proprietary Information – Not for Public Disclosure

Exhibit 3

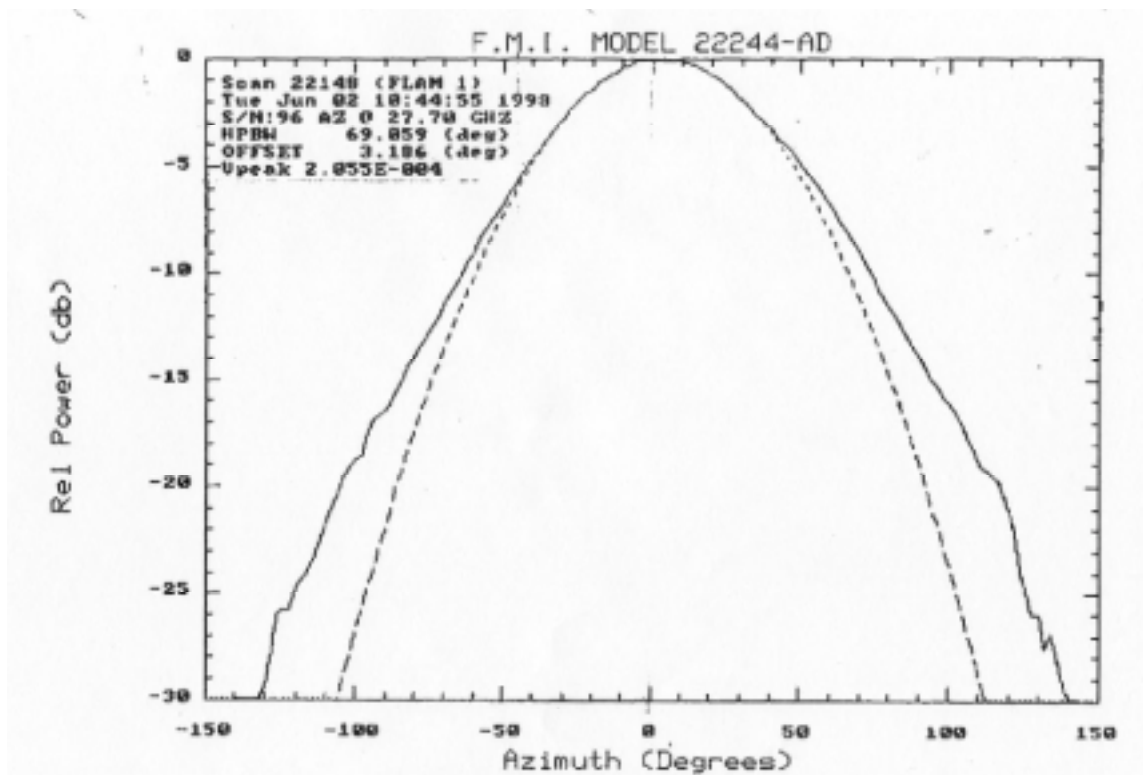


Figure 3.2-2 Azimuth Beamwidth for the HUB antennas

3.2.3 Maximum Transmit Channel Capacity

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