DESCRIPTIVE INFORMATION

FCC FILING FOR CDMA FIXED WIRELESS TERMINAL (FWT)

The information in this exhibit is in accordance with the FCC Rules and Regulations, Vol. II, Part 2, Subpart J. Sections 2.983 through 2.999 are addressed.

Section 2.983 (a) **Name of Applicant and Manufacturer:** MOTOROLA

Section 2.983 (b) **Identification of Equipment:**

FCC ID: IHET5ZA1

MODEL: ST1056B

Section 2.983 (c) **Quantity Production:** Quantity Production is Planned.

Section 2.983 (d) **Technical Description**

This Transmitter is intended for use in the Cellular Radio-telephone Service and is designed in compliance with the Code of Federal Regulations Title 47 Part 22 Subpart H and parts of TIA/EIA/IS-98-A pertaining to CDMA mode. Additionally, this transmitter is capable of spread spectrum (CDMA) operation.

(1) **Types of Emissions**

This equipment will be capable of operation using wide band spread spectrum techniques employing Direct Sequence Code Division Multiple Access (DS-CDMA) digital communication techniques.

For this transmitter, the emission designator is 1M25F9W (per 47 CFR 2.201 and 2.202).

(2) **Frequency Range**

This transmitter operates within the 824 to 849 MHz Band (per 47 CFR 22.905). This base station will support CDMA operations on channel numbers 1 through 799 and 990 through 1023 inclusive. The lowest frequency channel is 990 and is centered at 824.01 MHz. The highest channel is 799 and is centered at 848.97 MHz. Channel center spacing is at 30 kHz.

(3) **Range of Operating Power**

The range of output power for the FWT is -55 dBm to +27 dBm into a 50 Ohm load.

(4) **Maximum Power Rating**

The maximum power is defined in 47 CFR 22.913 in terms of maximum effective radiated power ERP and is 7 Watts for mobile transmitters. The output power for the FWT is 200 mW and depending on the antenna gain could be at most 1.5 Watts, which is well within the specification.

(5) **Applied voltages and currents into the final transistor elements of the transmitter output:**

Applied voltages and currents into the final transistor elements at 200 mW output:

Current 460 mA
Voltage 3.6 Vdc

(6) **Function of Each Active Device**

Refer to the Active Device List Attached to this Report.

(7) **Complete Circuit Diagrams**

Refer to the Schematic Exhibits

(8) **Outline of Instruction Manual**

Refer the Installation Manual Exhibit

(9) **Tune-Up Procedure**

Power and frequency alignment for the FWT is performed at the factory. No field adjustments are necessary.

(10) **Means for Frequency Stabilization**

Refer to the Test Report Exhibit

The reference oscillator is phase-locked to the incoming Forward channel from the base station. The frequency stability is totally dependent on the stability of the base station.

(11) Means for Attenuation of Spurious Emissions

Refer to the Test Report Exhibit

Bandpass duplexers are employed in the RF circuit to attenuate far out spurious emissions.

In addition, suppression of spurious radiated emissions is obtained by proper shielding techniques.

(11) Means for Limiting Modulation

Refer to the Test Report Exhibit

In a CDMA system, the input signal (voice for example) is sampled and coded in a vocoder. The maximum data rate for current vocoders is 13300 bits/second. This signal is then spread to 1.23 MHz by a pseudo-random spreading code. This spreading code sets the bandwidth of the spread-spectrum signal. To some extent, the bandwidth of the transmitted signal is limited by the chip rate of the PN spreading code.

Primary limiting of the CDMA signal bandwidth is accomplished by the use of Finite Impulse Response (FIR) filters.

(11) Means for Limiting Power

Open loop power control causes a CDMA mobile to monitor the received power from the base station pilot channel and continuously adjust its output power accordingly and linearly.

(12) Description of Digital Modulation Techniques

Refer to the Test Report Exhibit

Data transmitted on the Reverse CDMA Channel is grouped into 20 mS frames. All data transmitted on the Reverse CDMA Channel is convolutionally encoded, using a rate 1/n code of constraint length nine. For Rate Set 1, a rate 1/3 code is used. Symbols are repeated for the lower data rates to obtain a code symbol rate of 28800 sps. For Rate Set 2, a rate 1/2 code is used. After symbol repetition for the lower data rates, the same code symbol rate 28800 sps is obtained.

Groups of six code symbols are used to select one of 64 different orthogonal Walsh functions for transmission. The

Walsh function chips are combined with the long and short PN codes. Note that this use of the Walsh function is different than on the Forward CDMA Channel. On the Forward CDMA Channel, the Walsh function is determined by the personal station's assigned code channel, while on the Reverse CDMA Channel the Walsh function is determined by the information being transmitted. The use of the Walsh function modulation on the Reverse CDMA Channel is a simple method of obtaining 64-ary orthogonal modulation. The 64-ary demodulation can be done by a Fast Hadamard Transform. The Fast Hadamard Transform is similar to a Fast Fourier Transform except that it requires only additions and subtractions and thus simplifies demodulator implementation. Also note that on the Forward CDMA Channel, the Pilot Channel signal is shared among all the personal stations and is used as a reference for coherent demodulation. The Reverse CDMA Channel uses orthogonal modulation with non-coherent demodulation.

A "channel" on the Reverse CDMA Channel consists of a signal centered on the assigned frequency, offset quadriphase modulated by a pair of PN codes, biphase modulated by a long PN code with address determined code phase, and biphase modulated by the Walsh encoded and convolutionally encoded digital information signal.

Section 2.983 (e) **Standard Test Conditions**

The following conditions and procedures were followed during testing of this transmitter:

Room Temperature	+25 °C
Room Humidity	50 %
DC Supply Voltage	13.5 VDC (Nominal)

Prior to testing, the unit was tuned up according to the Manufacturer's Alignment Procedure. All data presented represents the worst case parameter being measured. All test data required by 47 CFR 2.985 through 2.997 can be found in Exhibits 7 through 12.

Section 2.983 (f) **Equipment Identification**

A drawing of the equipment identification nameplate appears in Exhibit 1. The FCC ID number IHET5ZA1 shall be added at the reserved location once grant is issued. The location of the label will be on the bottom side of the housing of the FWT (as shown in Exhibit 13).

The labeling requirements specified in 47 CFR 15.19 (c) will apply to ST1056B Fixed Wireless Terminal. In particular, the appropriate paragraphs will be placed in the instruction manual.

Section 2.983 (g) **Photographs**

The photographs showing external and internal construction are contained in the Internal and External Photo Exhibits.

Section 2.985(d) Measurements Required: **RF power output**

Refer to Test Report Exhibit

DEFINITION

The mobile station estimates its open loop mean output power from its mean input power (TIA/EIA/IS-98-A).

MINIMUM STANDARD

With minimum Forward CDMA Channel power, the FWT shall transmit an output power of +19 dBm to the specified maximum (+27 dBm).

METHOD OF MEASUREMENT

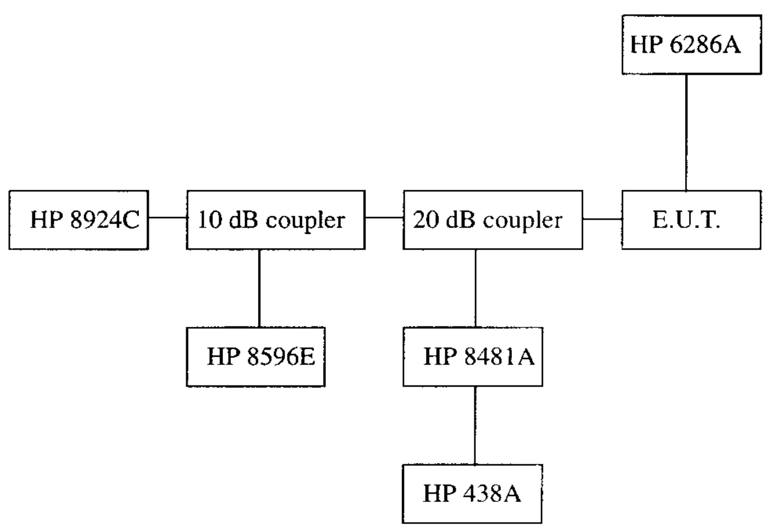

Figure 1: FWT Type Acceptance Test Setup

Using the equipment setup in Figure 1, setup a call with a Forward Link Channel power of -105 dBm (maximum transmit power per 47 CFR 2.985 (a)). Record the output power on a spectrum analyzer HP 8596E with the CDMA Personality Option HP 85725B. Note the HP 8924C is a 50 Ohm load for the FWT.

Section 2.987(d) Measurements Required: **Modulation Characteristics**

Refer Test Report Exhibit

Waveform Quality (ρ)

DEFINITION

Transmit waveform quality is the normalized correlated power between the actual waveform and the ideal waveform. The range of values for the transmit waveform quality is from 1.0, a perfect CDMA waveform, to 0.0, a non-CDMA signal. As an example, a mobile station with a 0.27 dB degradation in its transmit waveform would have a quality (ρ) of 10^(-0.27/10) = 0.94.

MINIMUM STANDARD

The minimum waveform quality figure for a spread-spectrum CDMA signal is 0.94 as measured with a Rho meter. (Per EIA IS-98-A).

METHOD OF MEASUREMENT

Using the setup in Figure 1, setup a call, and measure Rho.

Section 2.989(c) Measurement Required: **Occupied Bandwidth**

Refer to Test Report Exhibit

DEFINITION

The occupied bandwidth is the frequency bandwidth of a modulated carrier within which a total of 99% of the rated power appears. Data on the bandwidth occupied by this transmitter is presented in the form of plots taken from a spectrum analyzer. For CDMA, the bandwidth is primarily determined by a 47 tap FIR filter used to filter the I and Q channel modulating signals. Per TIA/EIA/IS-95-A Section 6.1.3.1.10, the filter is defined to have a one-sided 1.5 dB ripple bandwidth of 590 kHz minimum and a 40 dB minimum stopband at 740 kHz maximum. Computer simulations show that the occupied bandwidth, as defined in 47 CFR 2.202 (a), is 1.25 MHz (emissions designator 1M25). Note that the emissions designator is defines the minimum value of necessary bandwidth sufficient to ensure the transmission of data (47 CFR 2.202 (b)).

Section 6.1.4.1 further defines the limitations on emissions for bandwidth occupied as modulation products in a bandwidth of 30 kHz centered ±900 kHz from the channel center frequency should be at least 45 dB and shall be at least 42 dB below the mean output power level. The definition of occupied bandwidth is the same for both base stations and mobiles.

MINIMUM STANDARD

Following 47 CFR 22.901 (d)(2) for alternative technologies and 47 CFR 2.989 (h) and (i) regarding bandwidths, the transmit occupied bandwidth for a spread-spectrum CDMA signal is:

a) Modulation products in a bandwidth of 30 kHz centered 900 kHz from the channel center frequency should be at least 45 dB and shall be at least 42 dB below the mean output power level.

METHOD OF MEASUREMENT

Using the test setup in Figure 1, setup the FWT to transmit at full power. Using a Hewlett-Packard spectrum analyzer HP 8596E ,measure the occupied bandwidth. Exhibit 7 is a spectrum analyzer plot showing the IS-95-A transmit mask. Exhibit 9 shows spectrum analyzer plots measuring the occupied bandwidth for the middle channel.

Section 2.991 Measurement Required: **Spurious & Harmonic Emissions at the Antenna Terminals**

Refer to Test Report Exhibit

DEFINITION

Conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside the authorized bandwidth of the transmitter. Reduction in the level of these spurious emissions will not affect the quality of the information being transmitted.

MINIMUM STANDARD

Per 47 CFR 22.917 and TIA/EIA/IS-98-A, the minimum standards for Transmit Port Conducted Spurious Emissions are as follows:

Transmit Conducted Spurs:

Using a HP 8596E spectrum analyzer set to a resolution bandwidth of 30 kHz, the spurious emissions shall be attenuated below the mean output power according to the following specification:

a) For offset frequencies greater than 900 kHz from the CDMA Channel center frequency, at least 42 dBc (TIA/EIA/IS-98-A).

b) For offset frequencies greater than 1980 kHz from the CDMA Channel center frequency, at least 54 dBc (TIA/EIA/IS-98-A).

b) For all other frequencies not within the operators allocated band, at least 60 dBc or43 + 10 log(P) dBc, whichever is the lesser attenuation.

METHOD OF MEASUREMENT

Using the test setup in Figure 1, connect a HP 8596E spectrum analyzer to the RF Transmit Port of the FWT. Set the unit at one of the three channels (low, mid or high), and transmit at full power.

Measure the power level at the carrier frequency. Sweep the spectrum analyzer from 30 kHz to the tenth harmonic of the highest carrier frequency and record all spurious emissions. In the test report exhibit is a spectrum analyzer plot showing the IS-98-A transmit mask as described above in (a) and (b).

Note: Plots in the data exhibit show data for the fundamental and the second harmonic of the low, mid, and high channels. All conducted spurious emissions from 30 MHz up to the tenth harmonic were measured below the noise floor. All emissions in the base station frequency range of 869 to 894 MHz were less than -80 dBm (47 CFR 22.917 (f)).

Section 2.993 Measurement Required: **Field Strength of Spurious & Harmonic Radiation**

Refer to Test Report Exhibit

DEFINITION

Radiated spurious and harmonic emissions are emissions from the equipment when loaded into a non-radiating load on a frequency or frequencies that are outside an occupied band sufficient to assure transmission of information with required quality for the class of communications desired. The reduction in the level of these spurious emissions will not affect the quality of the information being transmitted.

MINIMUM STANDARD

The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under the conditions specified in the alignment procedure, shall not be less than 43 + 10*log(mean output power in Watts) dB below the mean power output.

A contracted FCC approved test site was used to measure the radiated emissions. The contracting company was KTL Dallas, 802 N. Kealy, Lewisville, TX 75057. (972)-436-9600

METHOD OF MEASUREMENT

The equipment is adjusted to obtain peak readings of received signals wherever they occur in the spectrum by:

1. Rotating the transmitter under test.

2. Adjusting the antenna height.

The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. Relative signal strength is indicated on meters built into the receiver. To obtain actual radiated signal strength, a standard signal generator with calibrated output is substituted for the transmitter under test. A range of frequencies, covering the spectrum under investigation, are broadcast and measured at the receiver. The path loss is then determined at each of these discrete frequencies based on the received signal power and the transmitted signal power. All affecting factors, such as antenna gain and cable loss, are accounted for. This table of path loss values is then used to convert a signal level measured at the receiver to the value that would be measured at the device (assuming an isotropic radiator). A summary of the worst case channel is shown in exhibit.

Section 2.995 Measurement Required: **Frequency Stability**

Refer to Test Report Exhibit

DEFINITION

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

MINIMUM STANDARD

Under 47 CFR 2.995 (a)(3), the frequency stability shall be measured from 30 to +50 degrees Celsius. 47 CFR 2.995 (d)(1) specifies the frequency stability to be measured while varying the primary supply voltage from 85 to 115 percent of the nominal voltage. For both tests, the frequency error shall be within +/- 300 Hz (TIA/EIA/IS-98-A).

METHOD OF MEASUREMENT

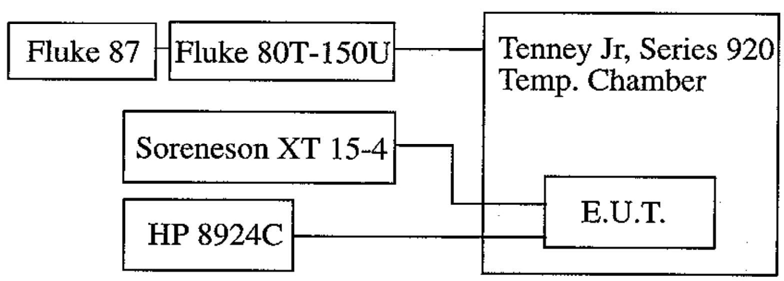

Figure 2: Frequency Stability Test Setup

Using the test setup in Figure 2, setup a call with a Forward Channel power of -73 dBm and measure Frequency Error under the TX tests option. The temperature will be increased at 10 degree intervals from -30 to +50 degrees Celsius (47 CFR 2.995 (b)). The next test has the FWT setup with a call, and the supply voltage is varied from 85 to 115 percent of the nominal voltage (13.8 V) while at 25 degrees Celsius.

Summary of Active Devices

APPLICANT: MOTOROLA **TRANSMITTER TYPE: IHET5ZA1**

Device Type	***Reference Number***	***Operating Frequencies***
P-CH MOSFET	Q2700	DC
Power FET	Q2501	120Khz
MOSFET	Q2300 Q2702	120Khz
MJD31T4 Transistor	Q2200	DC
N-Channel TMOS	Q2201 Q2701	DC
P-Channel TMOS	Q302 Q1108	DC
NPN Transistor	Q2703	DC
PNP Transistor	Q205	DC
Transistor	Q104 Q202 Q203 Q1109 Q1110 Q1111 Q2100	DC
MMBR901LT1	Q101	109.8 Mhz
MRF9511LT1	Q301	309.6 Mhz
VCO Module	U301	1004 Mhz
P Channel FET	Q2600	DC
N Channel FET	Q2601	DC
Xtal Oscillator	U307	16.8 Mhz
Custom IC Zif-Syn	U303	1004 Mhz
Temp Sensor	U1301	DC
MCU 68338	U1100	13 Mhz
CIA ASIC	U1300	16.8 Mhz
ASIC CRIB	U1400	5.6 Mhz
DSP 24BIT	U1200	65 Mhz
MC74AC04D	U1600	DC
MC74AC08D	U1106	DC
MC74AC74D	U1401	DC
Voltage Regulator	U103 U202 U306 U1302	DC
MC33172	U2102	DC
MC33174	U2700	DC
Telecom Ring Switch	U2101	DC
Low Noise Amp	U102	869-894 Mhz
X25128	U1111	1.6 Mhz
KM616U1000B	U1103 U1104 U1105	4.3 Mhz
16550 UART	U2800	1.86 Mhz
Mixer RF	U200	991.3 Mhz
Mixer	U101	1004 Mhz
Power Amplifier	U201	824-849 Mhz
Power ASIC	U2200	124 Khz
DSP ASIC	U1114	16.8 Mhz
L8560 SLIC	U2100	DC
FSRAM	U1201	65 Mhz
RS232 Trans	U2801 U2802	19.2 Khz
FLASH EPROM	U1101 U1102	4.3 Mhz
DP ASIC	U1199	DC