AnyDATA
AnyTime AnyPlace Any Wireless Data Solutions

SERVICE MANUAL

1.9G CDMA Wireless Kit

EMII-1900

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Introduction

The EMII-1900 is designed for the test and simulation of the CDMA wireless data communications. User can connect the EMII-1900 to your PC or Notebook and easily test the wireless communications. User can use this to develop your applications software even before user's own hardware is ready. It also can be used as a debugging during user's hardware test.

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FCC RF Exposure Information

Warning! Read this information before using this device.

In August 1996 the Federal Communications Commission (FCC) of the United States with its action in Report and Order FCC 96-326 adopted an updated safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated transmitters. Those guidelines are consistent with the safety standard previously set by both U.S. and international standards bodies. The design of this device complies with the FCC guidelines and these international standards.

CAUTION

n *Operating Requirements*

- The user can not make any changes or modifications not expressly approved by the party responsible for compliance, otherwise it could void the user's authority to operate the equipment.
- To satisfy FCC RF exposure compliance requirements for a mobile transmitting device, this device and its antenna should generally maintain a separation distance of 20cm or more from a person's body.

Special accessories

In order to ensure this device in compliance with FCC regulation, the special accessories are provided with this device and must be used with the device only. The user is not allowed to use any other accessories than the special accessories given with this device

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General Introduction

The EMII-1900 functions digital cellular module worked in CDMA (Code Division Multiple Access) mode. CDMA type digital mode applies DSSS (Direct Sequence Spread Spectrum) mode which is used in military.

This feature enables the phone to keep communication from being crossed and use one frequency channel by multiple users in the same specific area, resulting that it increases the capacity 10 times more compared with that in the analog mode currently used.

Soft/Softer Handoff, Hard Handoff, and Dynamic RF power Control technologies are combined into this phone to reduce the call being interrupted in a middle of talking over phone.

CDMA digital cellular network consists of MSC (Mobile Switching Office), BSC (Base Station Controller), BTS (Base station Transmission System), and MS (Mobile Station). Communication between MS and BTS is designed to meet the specification of IS-95A (Common Air Interface). MS meets the specifications of the below :

- IS-95A (Common Air Interface) : Protocol between MS and BTS
- IS-96A (Vocoder) : Voice signal coding
- IS-98 : Basic MS functions
- IS-126 : Voice loopback
- IS-99 : Short Message Service, Async Data Service, and G3 Fax Service

EMII-1900 is digital mode is designed to be operated in full duplex.

CHAPTER 1. System Introduction

1. System Introduction

1.1 CDMA Abstract

The cellular system has a channel hand-off function that is used for collecting the information on the locations and movements of radio mobile telephones from the cell site by automatically controlling several cell site through the setup of data transmission routes and thus, enabling one switching system to carry out the automatic remote adjustment. This is to maintain continuously the call state through the automatic location confirmation and automatic radio channel conversion when the busy subscriber moves from the service area of one cell site to that of another by using automatic location confirmation and automatic radio channel conversion functions. The call state can be maintained continuously by the information exchange between switching systems when the busy subscriber moves from one cellular system area to the other cellular system area.

In the cellular system, the cell site is a small-sized low output type and utilizes a frequency allocation system that considers mutual interference, in an effort to enable the re-use of corresponding frequency from a cell site separated more than a certain distance. The analog cellular systems are classified further into an AMPS system, E-AMPS System, NMT system, ETACS system, and JTACS system depending on technologies used.

Unlike the time division multiple access (TDMA) or frequency division multiple access (FDMA) used in the band limited environment, the Code Division Multiple Access(CDMA) system which is one of digital cellular systems is a multi-access technology under the interference limited environment. It can process more number of subscribers compared to other systems (TDMA system has the processing capacity three times greater than the existing FDMA system whereas CDMA system, about 12~15 times of that of the existing system).
CDMA system can be explained as follows: TDMA or SDMA can be used to enable each person to talk alternately or provide a separate room for each person when two persons desire to talk with each other at the same time, whereas FDMA can be used to enable one person to talk in soprano, whereas the other in bass (one of the two talkers can carry out synchronization for hearing in case there is a bandpass filter function in the area of the hearer).

Another method available is to make two persons to sing in different languages at the same time, space, and frequency when wishing to let the audience hear the singing without being confused. This is the characteristics of CDMA.

On the other hand, when employing the CDMA technology, each signal has a different pseudo-random binary sequence used to spread the spectrum of carrier. A great number of CDMA signals share the same frequency spectrum. In the perspective of frequency area or time area, several CDMA signals are overlapped. Among these types of signals, only desired signal energy is selected and received through the use of pre-determined binary sequence; desired signals can be separated and then, received with the correlator used for recovering the spectrum into its original state. At this time, the spectrums of other signals that have different codes are not recovered into its original state and instead, processed as noise and appears as the self-interference of the system.

2. Features and Advantages of CDMA Module

2.1 Various Types of Diversities

In the CDMA broadband modulation(1.25MHz band), three types of diversities (time, frequency, and space) are used to reduce serious fading problems generated from radio channels in order to obtain high-quality calls.

Time diversity can be obtained through the use of code interleaving and error correction code whereas frequency diversity can be obtained by spreading signal energy to more wider frequency band. The fading related to normal frequency can affect the normal 200~300kHz among signal bands and accordingly, serious affect can be avoided. Moreover, space diversity (also called path diversity) can be realized with the following three types of methods.

First, it can be obtained by the duplication of cell site receive antenna. Second, it can be obtained through the use of multi-signal processing device that receives a transmit signal having each different transmission delay time and then, combines them. Third, it can be obtained through the multiple cell site connection (Soft Handoff) that connects the mobile station and more than two cell sites at the same time.

2.2 Power Control

The CDMA system utilizes the forward (from a base station to mobile stations) and backward (from the mobile station to the base station) power control in order to increase the call processing capacity and obtain high-quality calls. In case the originating signals of mobile stations are received by the cell site in the minimum call quality level (signal to interference) through the use of transmit power control on all the mobile stations, the system capacity can be maximized.

If the signal of mobile station is received too strong, the performance of that mobile station is improved. However, because of this, the interference on other mobile stations using the same channel is increased and accordingly, the call quality of other subscribers is reduced unless the maximum accommodation capacity is reduced.

In the CDMA system, forward power control, backward open loop power control, and closed loop power control methods are used. The forward power control is carried out in the cell site to reduce the transmit power on mobile stations less affected by the multi-path fading and shadow phenomenon and the interference of other cell sites when the mobile station is not engaged in the call or is relatively nearer to the corresponding cell site. This is also used to provide additional power to mobile stations having high call error rates, located in bad reception areas or far away from the cell site.

The backward open loop power control is carried out in a corresponding mobile station; the mobile station measures power received from the cell site and then, reversely increases/decreases transmit power in order to compensate channel changes caused by the forward link path loss and terrain characteristics in relation to the mobile station in the cell site. By doing so, all the mobile office transmit signals in the cells are received by the cell site in the same strength.

Moreover, the backward closed loop power control used by the mobile station to control power with the commands issued out by the cell site. The cell site receives the signal of each corresponding mobile station and compares this with the pre-set threshold value and then, issues out power increase/decrease commands to the corresponding mobile station every 1.25 msec (800 times per second).

By doing so, the gain tolerance and the different radio propagation loss on the forward/backward link are complemented.

2.3 Voice Encoder and Variable Data Speed

The bi-directional voice service having variable data speed provides voice communication which employs voice encoder algorithm having power variable data rate between the mobile telephone cell site and mobile station. On the other hand, the transmit voice encoder performs voice sampling and then, creates encoded voice packets to be sent out to the receive voice encoder, whereas the receive voice encoder demodulates the received voice packets into voice samples.
One of the two voice encoders described in the above is selected for use depending on inputted automatic conditions and message/data; both of them utilize four-stage frames of 9600, 4800, 2400, and 1200 bits per second. In addition, this type of variable voice encoder utilizes adaptive threshold values when selecting required data rate. It is adjusted in accordance with the size of background noise and the data rate is increased to high rate only when the voice of caller is inputted.
Therefore, background noise is suppressed and high-quality voice transmission is possible under the environment experiencing serious noise. In addition, in case the caller does not talk, data transmission rate is reduced so that the transmission is carried out in low energy. This will reduce the interference on other CDMA signals and as a result, improve system performance (capacity, increased by about two times).

2.4 Protecting Call Confidentiality

CDMA signals have the function of effectively protecting call confidentiality by spreading and interleaving call information in broad bandwidth. This makes the unauthorized use of crosstalk, search receiver, and radio very hard substantially. Also included is the encryption function on various authentication and calls specified in IS-95 for the double protection of call confidentiality.

2.5 Soft Handoff

During the soft hand, the cell site already in the busy state and the cell site to be engaged in the call later participate in the call conversion. The call conversion is carried out through the original call connection cell site, both cell sites, and then, new cell site. This method can minimize call disconnection and prevent the user from detecting the hand-off.

2.6 Frequency Re-Use and Sector Segmentation

Unlike the existing analog cellular system, the CDMA system can reuse the same frequency at the adjacent cell and accordingly, there is no need to prepare a separate frequency plan. Total interference generated on mobile station signals received from the cell site is the sum of interference generated from other mobile stations in the same cell site and interference generated from the mobile station of adjacent cell site. That is, each mobile station signal generates interference in relation to the signals of all the other mobile signals.
Total interference from all the adjacent cell sites is the ratio of interference from all the cell sites versus total interference from other mobile stations in the same cell site (about 65%). In the case of directional cell site, one cell normally uses a 120° sector antenna in order to divide the sector into three. In this case, each antenna is used only for 1/3 of mobile stations in the cell site

and accordingly, interference is reduced by 1/3 on the average and the capacity that can be supported by the entire system is increased by three times.

2.7 Soft Capacity

The subscriber capacity of CDMA system is flexible depending on the relation between the number of users and service classes. For example, the system operator can increase the number of channels available for use during the busy hour despite the drop in call quality. This type of function requires 40% of normal call channels in the standby mode during the handoff support, in an effort to avoid call disconnection resulting from the lack of channels.

In addition, in the CDMA system, services and service charges are classified further into different classes so that more transmit power can be allocated to high class service users for easier call set-up; they can also be given higher priority of using hand-off function than the general users.

3. Structure and Functions of CDMA Module

The mobile station of CDMA system is made up of a radio frequency part and logic/control (digital) part. The mobile station antenna is connected with the transmitter/receiver via a duplexer filter so that it can carry out the transmit/receive function at the same time.

The transmit frequency is the 60MHz band of 1851.25 ~ 1908.75MHz, whereas the receive frequency is the 60MHz band of 1931.25 ~ 1988.75MHz. The transmit/receive frequency is separated by 80MHz. The RF signal from the antenna is converted into intermediate frequency(IF) band by the frequency synthesizer and frequency down converter and then, passes the bandpass SAW filter having the 1.25MHz band. IF output signals that have been filtered from spurious signal are converted into digital signals via an analog-to-digital converters(ADC) and then, sent out respectively to 5 correlators in each CDMA de-modulator. Of these, one is called a searcher whereas the remaining 4 are called data receiver(finger). Digitalized IF signals include a great number of call signals that have been sent out by the adjacent cells. These signals are detected with pseudo-noise sequence (PN Sequence). Signal to interference ratio (C/I) on signals that match the desired PN sequence are increased through this type of correlation detection process. Then, other signals obtain processing gain by not increasing the ratio. The carrier wave of pilot channel from the cell site most adjacently located is demodulated in order to obtain the sequence of encoded data symbols. During the operation with one cell site, the searcher searches out multi-paths in accordance with terrain and building reflections. On three data receivers, the most powerful four paths are allocated for the parallel tracing and receiving. Fading resistance can be improved a great deal by obtaining the diversity combined output for de-modulation. Moreover, the searcher can be used to determine the most powerful path from the cell sites even during the soft handoff during the two cell sites. Moreover, four data receivers are allocated in order to carry out the de-modulation of these paths. Data output that has been demodulated change the data string in the combined data row as in the case of original signals(deinterleaving), and then, are de-modulated by the forward error correction decoder which uses the Viterbi algorithm.

On the other hand, mobile station user information sent out from the mobile station to the cell site pass through the digital voice encoder via a mike. Then, they are encoded and forward errors are corrected through the use of convolution encoder. Then, the order of code rows is changed in accordance with a certain regulation in order to remove any errors in the interleaver. Symbols made through the above process are spread after being loaded onto PN carrier waves. At this time, PN sequence is selected by each address designated in each call.

Signals that have been code spread as above are digital modulated (QPSK) and then, power controlled at the automatic gain control amplifier (AGC Amp). Then, they are converted into RF band by the frequency synthesizer synchronizing these signals to proper output frequencies.

Transmit signals obtained pass through the duplexer filter and then, are sent out to the cell site via the antenna.

4. Specification

4.1 General Specification

4.1.1 Transmit/Receive Frequency Interval : 80 MHz

4.1.2 Number of Channels (Channel Bandwidth)

CDMA : 42 CH (BW: 1.23MHz)

41.3 Operating Voltage : DC 6~12V

4.1.4 Operating Temperature : -30° ~ +60°

4.1.5 Frequency Stability

CDMA : ±150 Hz

4.1.6 Antenna : Whip Type, 50 W

4.1.7 Size and Weight

1) Size : 121mm x 47mm x 24mm (L x W x D) with case

2) Weight : 112g

4.1.8 Channel Spacing

CDMA : 1.25MHz

4.2 Receive Specification

4.2.1 Frequency Range

Digital : 1931.25 MHz ~ 1988.75 MHz

4.2.2 Local Oscillating Frequency Range : 1749.62MHz ±30MHz

4.2.3 Intermediate Frequency : 210.38MHz

4.2.4 Sensitivity

less than -104dBm

4.2.5 CDMA Input Signal Range

- Dynamic range : -104~ -25 dBm (more than 80dB) at the 1.23MHz band.

4.3 Transmit Specification

4.3.1 Frequency Range

1851.25MHz ~ 1908.75MHz

4.3.2 Local Oscillating Frequency Range : 1749.62MHz ± 30MHz

4.3.3 Intermediate Frequency : 130.38 MHz

4.3.4 Max Output Power

CDMA : 0.3W

4.3.5 Interference Rejection

1) Single Tone : -101dBm with Jammer of -30dBm at 1.25MHz
2) Two Tone : -101dBm with Jammer of -43dBm at 1.25MHz & 2.05MHz

4.3.7 CDMA TX Frequency Deviation : ±150Hz or less

4.3.8 CDMA TX Conducted Spurious Emissions

- less than - 54 dBc/30kHz @1.98MHz

4.3.9 CDMA Minimum TX Power Control : less than - 50dBm

4.4 MS (Mobile Station) Transmitter Frequency

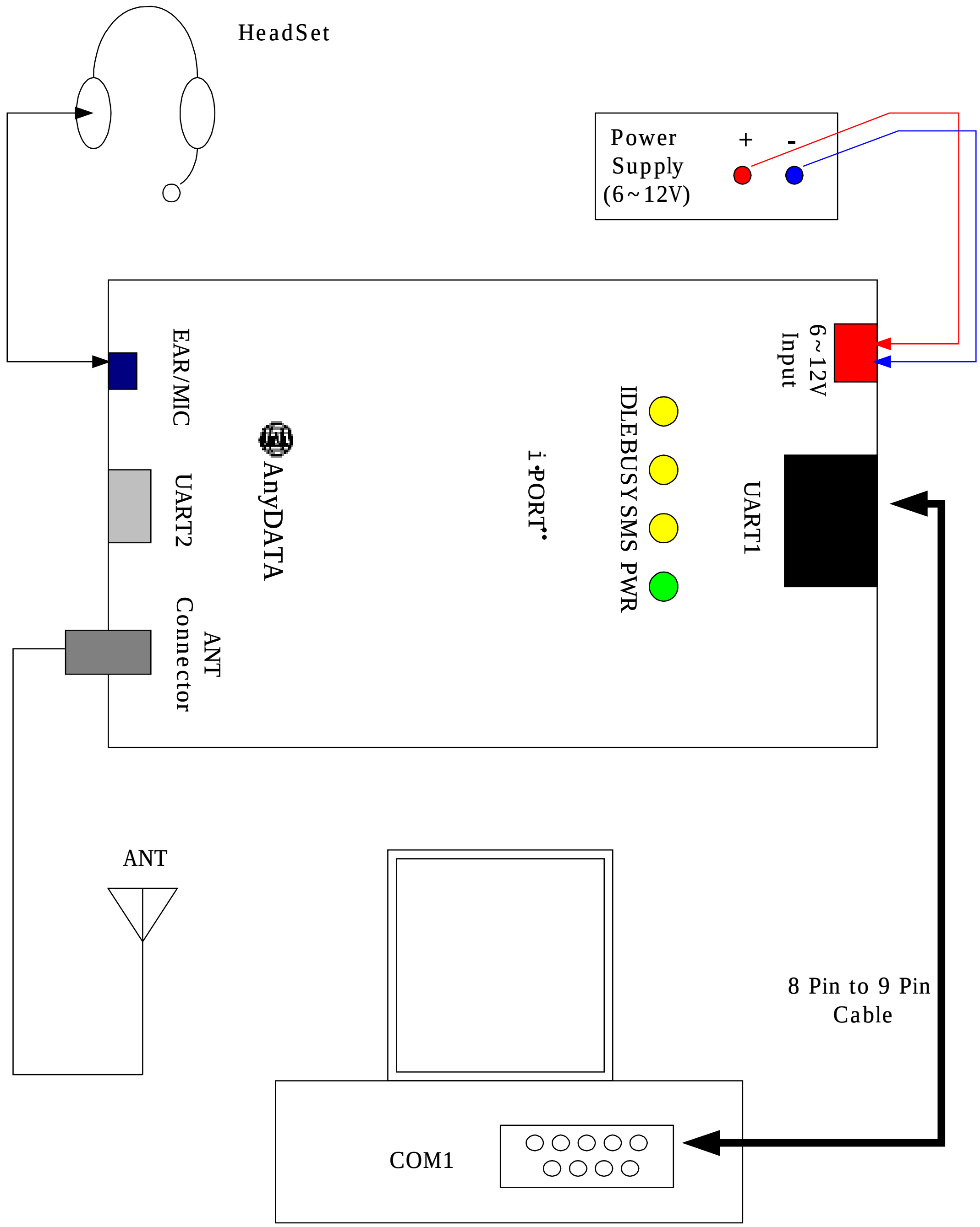
FA NO.	CH.NO.	CENTER FREQUENCY	FA NO.	CH.NO.	CENTER FREQUENCY
1	25	1851.25 MHz	22	600	1880.00 MHz
2	50	1852.50MHz	23	625	1881.25 MHz
3	75	1853.75 MHz	24	650	1882.50 MHz
4	100	1855.00 MHz	25	675	1883.75 MHz
5	125	1856.25 MHz	26	725	1886.25 MHz
6	150	1857.50 MHz	27	750	1887.50 MHz
7	175	1858.75 MHz	28	775	1888.75 MHz
8	200	1860.00 MHz	29	825	1891.25 MHz
9	225	1861.25 MHz	30	850	1892.50 MHz
10	250	1862.50 MHz	31	875	1893.75 MHz
11	275	1863.75 MHz	32	925	1896.25 MHz
12	325	1866.25 MHz	33	950	1897.50 MHz
13	350	1867.50 MHz	34	975	1898.75 MHz
14	375	1868.75 MHz	35	1000	1900.00 MHz
15	425	1871.25 MHz	36	1025	1901.25 MHz
16	450	1872.50 MHz	37	1050	1902.50 MHz
17	475	1873.75 MHz	38	1075	1903.75 MHz
18	500	1875.00 MHz	39	1100	1905.00 MHz
19	525	1876.25 MHz	40	1125	1906.25 MHz
20	550	1877.50 MHz	41	1150	1907.50 MHz
21	575	1878.75 MHz	42	1175	1908.75 MHz

4.5 MS (Mobile Station) Receiver Frequency

FA NO.	CH.NO.	CENTER FREQUENCY	FA NO.	CH.NO.	CENTER FREQUENCY
1	25	1931.25 MHz	22	600	1960.00 MHz
2	50	1932.50MHz	23	625	1961.25 MHz
3	75	1933.75 MHz	24	650	1962.50 MHz
4	100	1935.00 MHz	25	675	1963.75 MHz
5	125	1936.25 MHz	26	725	1966.25 MHz
6	150	1937.50 MHz	27	750	1967.50 MHz
7	175	1938.75 MHz	28	775	1968.75 MHz
8	200	1940.00 MHz	29	825	1971.25 MHz
9	225	1941.25 MHz	30	850	1972.50 MHz
10	250	1942.50 MHz	31	875	1973.75 MHz
11	275	1943.75 MHz	32	925	1976.25 MHz
12	325	1946.25 MHz	33	950	1977.50 MHz
13	350	1947.50 MHz	34	975	1978.75 MHz
14	375	1948.75 MHz	35	1000	1980.00 MHz
15	425	1951.25 MHz	36	1025	1981.25 MHz
16	450	1952.50 MHz	37	1050	1982.50 MHz
17	475	1953.75 MHz	38	1075	1983.75 MHz
18	500	1955.00 MHz	39	1100	1985.00 MHz
19	525	1956.25 MHz	40	1125	1986.25 MHz
20	550	1957.50 MHz	41	1150	1987.50 MHz
21	575	1958.75 MHz	42	1175	1988.75 MHz

CHAPTER 2. NAM Input Method

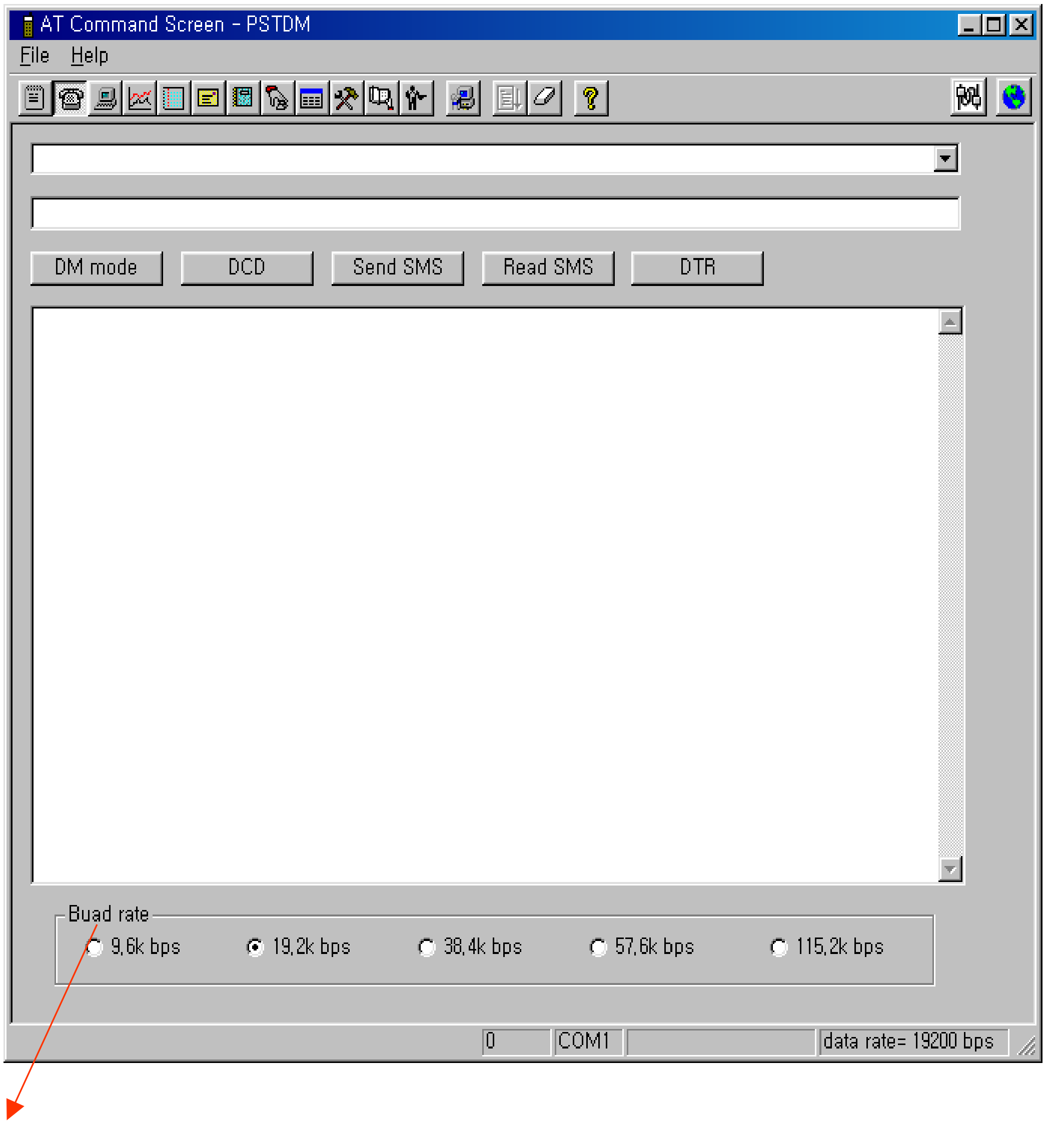
1.INSTALLATION METHOD



1) Supply the voltage of 6~12V to 2pin Connector of the EMII-1900.
2) Connect the UART1 to PC COM1 port with the RS-232C cable.
3) Install the operating program.

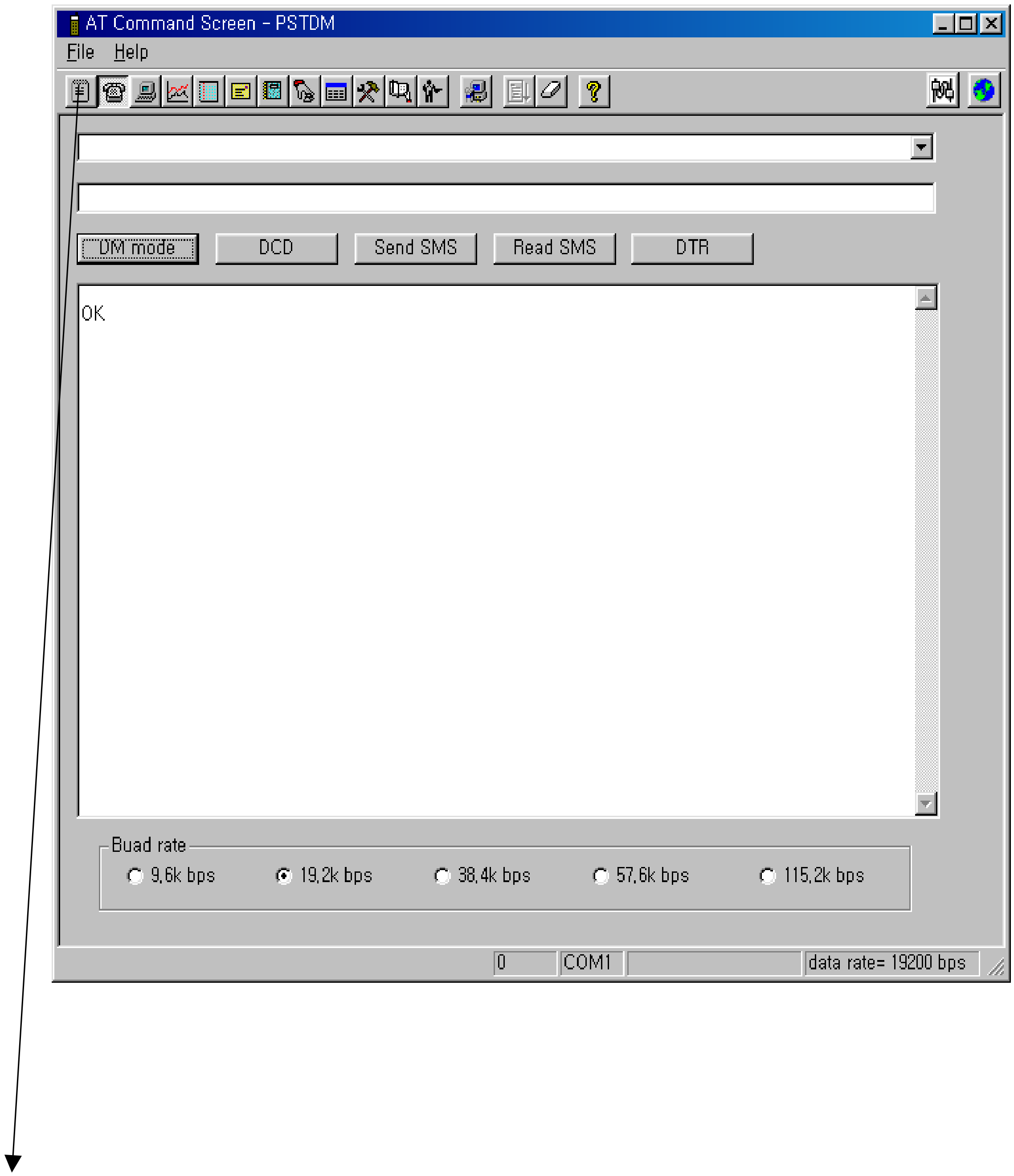
2. OPERATION METHOD

1) Run PSTDM program at Windows95 or Windows98



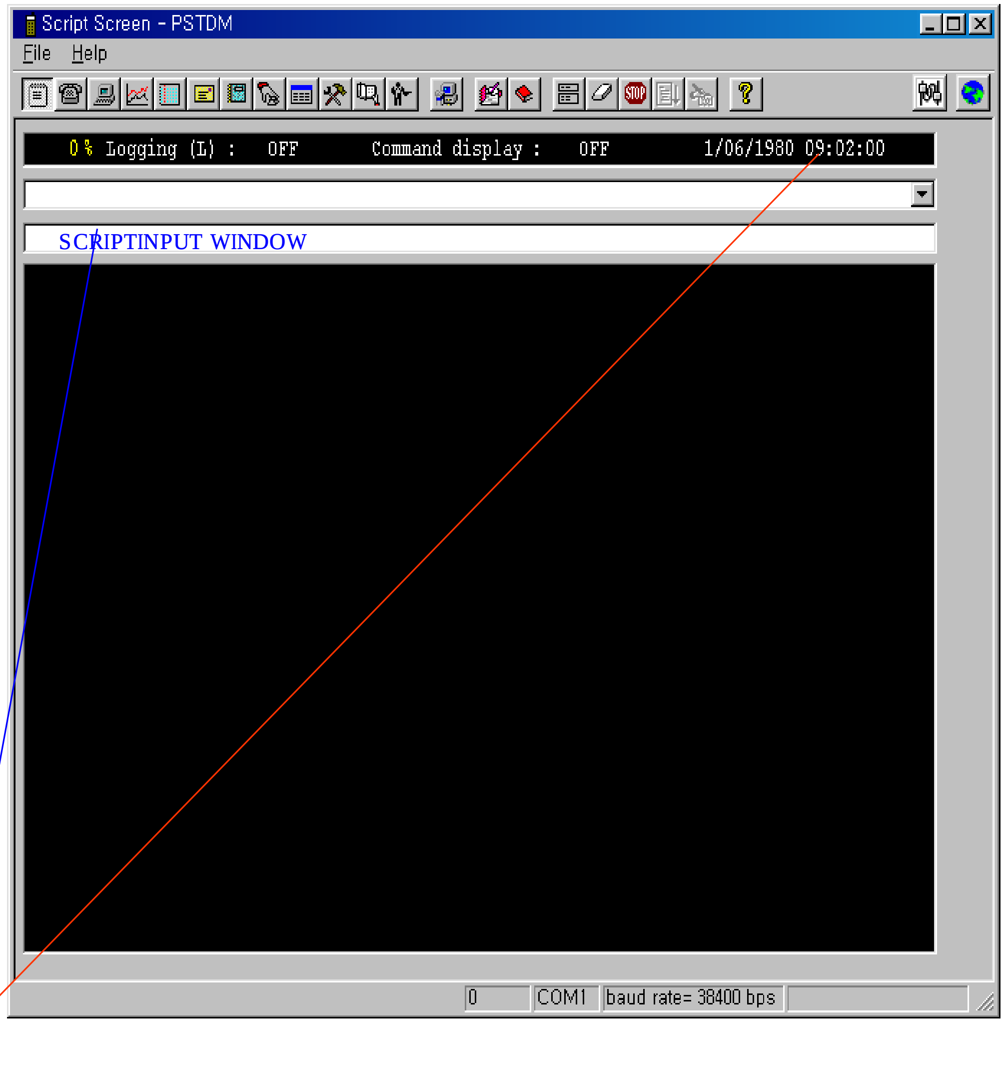
2) Set Buad rate to the modem's.

3) Click [DM mode]



4) If OK is displayed in the message box, modem is now ready for communication with PC.

5) Click MENU BAR icon.



6) As shown in the picture above, service file input plane will be displayed

(See if clock is running. If it isn't, communication with PC is not activated.

Repeat step 1 through 5, or reset the power of modem and repeat step 1 through 5)

7) Type NAM Programming script like the example shown below,

<NAM Programming script example>

Mode offline-d [ENTER]

nv_write name_nam {0," AnyDATA telecom "} [ENTER]

nv_write name_nam {1," AnyDATA telecom "} [ENTER]

Mode reset [ENTER]

CHAPTER 3. Circuit Description

1. Overview

RFT3100 receives modulated digital signals from the MSM of the digital circuit and then, changes them into analog signals by the digital/analog converter (DAC, D/A Converter) in order to create baseband signals. Created baseband signals are changed into IF signals by RFT3100 and then, fed into the Mixer after going through AGC. IF signals that have been fed are mixed with the signals of VCO and changed into the RF signals and then, they are amplified at the Power AMP. Finally, they are sent out to the cell site via the antenna after going through the isolator and duplexer.

2. RF Transmit / Receive Part

2.1 CDMA Transmit End

8 bit I and Q transmit signals are inputted into 2 DACs (DIGITAL-TO-ANALOG CONVERTER) from the output terminal I_DATA, I_DATA\, Q_DATA, Q_DATA\ of MSM through the input terminals I_DATA, I_DATA\, Q_DATA, Q_DATA\ of RFT3100. Transmit signal input speed is two times of TXCLK+, TXCLK- which are two transmit/receive reference frequency.

Among transmit signals being inputted, signals are inputted into I signal DAC when the transmit clock is in the rise edge, whereas signals are inputted into Q Signal DAC during the drop edge. I and Q transmit signals are compensated and outputted at MSM in order to compensate the 1/2 clock time difference generated between reference clocks. In the signals coming out from the output terminal of DAC, there are spurious frequency ingredients resulting from DAC output transition edge and parasite ingredients, transmit clock frequencies and harmonics which are unwanted signals. Accordingly, spurious ingredients are removed by passing the signals through LPF of passband 6.30KHz. Unlike the receive end, the transmit end LPF requires no OFFSET adjustment. Analog baseband signals that have passed the CDMA LPF are mixed with I and Q signals of frequency 130.38 MHz (260.76 MHz created in the RFT3100 internal VCO are divided by half into frequency 130.38MHz having the phase difference of 90 degrees) in two mixers. The mixed signals are added again and converted into IF frequency 130.38 MHz ±630 KHz (CDMA Spread Power Density Modulated Signals) and then, outputted.

2.2. Tx IF/Baseband Processors, RFT3100 (U102)

The RFT3100 includes digital-to-analog converters(DAC) for converting digital baseband to analog baseband, low-pass filters, a mixer for up-converting to IF and an 85 dB dynamic range Tx AGC amplifier. The RFT3100 has an IF mixer for upconverting analog baseband to IF, a programmable PLL for generating Tx IF frequency, single sideband upconversion from IF to RF, two cellular and two PCS driver amplifiers. The RFT3100 will operate over the follow Tx frequency ranges :

Cellular band 824MHz ~ 925MHz

PCS band 1750MHz ~1910MHz

2.3. Transmit End Bandpass Filter (F102, F103)

Transmit signals that have been converted from IF signals into RF signals after passing through the RFT3100(U102) are inputted into the Power Amp (U103) after passing once again through RF BPF (F101) in order to filter out noise signals amplified during the amplification of RF signals after going through RFT3100(U102). This is carried out in order to create power level inputted to the Power AMP via RF BPF (F101). IL of a RF BPF is 2dB as a maximum, whereas the ripple in the passing band is 2dB(maximum). The degree of the suppression of transmit signals on receive band is at least 20dB or greater. The maximum power that can be inputted is about 25dBm.

2.4. Power Amplifier (U102)

The power amplifier U102 that can be used in the CDMA and FM mode has linear amplification capability, whereas in the FM mode, it has a high efficiency. For higher efficiency, it is made up of one MMIC (Monolithic Microwave Integrated Circuit) for which RF input terminal and internal interface circuit are integrated onto one IC after going through the AlGaAs/GaAs HBT (heterojunction bipolar transistor) process. The module of power amplifier is made up of an output end interface circuit including this MMIC. The maximum power that can be inputted through the input terminal is +17dBm and conversion gain is about 28dB. RF transmit signals that have been amplified through the power amplifier are sent to the duplexer and then, sent out to the cell site through the antenna in order to prevent any damages on circuits, that may be generated by output signals reflected from the duplexer and re-inputted to the power amplifier output end.

2.5. Description of Frequency Synthesizer Circuit

2.5.1 Voltage Control Temperature Compensation Crystal Oscillator(TXC201, VCTCXO)

The temperature range that can be compensated by TCX201 which is the reference frequency generator of mobile terminal is -30 ~ +80 degrees. TCX201 receives frequency tuning signals called TRK_LO_ADJ from MSM as 0.5V~2.5V DC via R and C filters in order to generate the reference frequency of 19.68MHz and input it into the frequency synthesizer of UHF band. Frequency stability depending on temperature is ± 2.0 ppm.

2.5.2 UHF Band Frequency Synthesizer (U202)

Reference frequency that can be inputted to U202 is 3MHz~40MHz. It is the dual mode frequency synthesizer (PLL) that can synthesize the frequencies of RF band 50MHz~1200MHz and IF band 20MHz~300MHz. U202 that receives the reference frequency of 19.68MHz from TCX201 creates 30kHz comparison frequency with the use of internal program and then, changes the frequency of 1750MHz band inputted from U204 which is the voltage adjustment crystal oscillator into the comparison frequency of 30kHz at the prescaler in U202. Then, two signal differences are calculated from the internal phase comparator. The calculated difference is inputted to DC for adjusting the frequency of U174 through U172 No.2 PIN and external loop filter in order to generate UHF signals. In addition, outputs of other PIN17 are inputted into BBA after going through the VRACTOR diode and tank circuit so that the outputs of BBA internal receive end VCO are adjusted to 170.76MHz.

2.5.3 Voltage Control Crystal Oscillator (U204)

U204 that generates the LO frequency (1750MHz) of mobile terminal receives the output voltage of PLL U202 and then, generates the frequency of 1720MHz at 0.7V and the frequency of 1780MHz at 2.7V. The control voltage sensitivity is 23MHz/v and the output level is 1dBm(maximum). Since LO frequency signal is very important for the sensitivity of mobile terminal, it must has good spurious characteristics. U204 is -70dBc(maximum).

3. Digital/Voice Processing Part

3.1 Overview

The digital/voice processing part processes the user's commands and processes all the digital and voice signal processing in order to operate in the phone. The digital/voice processing part is made up of a receptacle part, voice processing part, mobile station modem part, memory part, and power supply part.

3.2 Configuration

3.2.1 Voice Processing Part

The voice processing part is made up of an Integrated codec with microphone and earphone amplifiers, two microphone inputs and one Auxiliary audio input, internal vocoder supporting 13kbps EVRC and digital audio interface via USB. The anplifing voice signals out of MSM send to the earpiece or speaker and signals coming out from MIC transfer to the audio processor

3.2.2 MSM (Mobile Station Modem) Part

MSM5105 is the core elements of CDMA terminal and carries out the functions of CPU, encoder, interleaver, deinterleaver, Viterbi decoder, Mod/Demod, and vocoder.

3.2.3 Memory Part

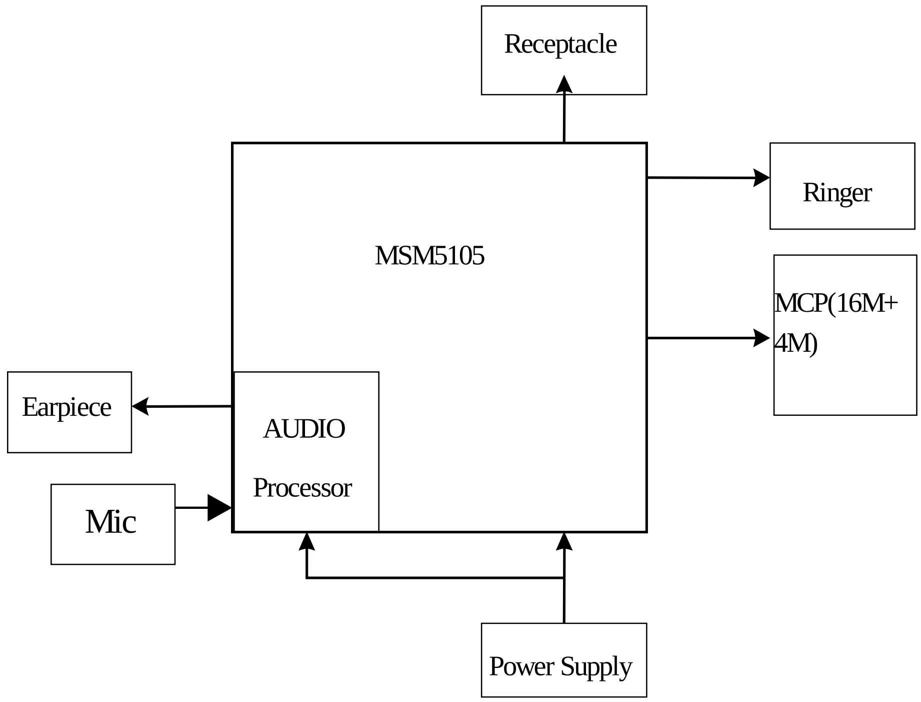
The memory part is made up of a stacked MCP(Multi-Chip Package) Flash memory and SRAM cmos.

3.2.4 Power Supply Part

The power supply part is made up of circuits for generating various types of power, used for the digital/voice processing part.

+4.0V from external DC(6~12V) is fed into six regulators(U601, U602, U603, U606, U607, U609). The five regulators produces +3.0V for the Rx parts, Tx parts, Memory and MSM. The one regular produces +2.7V ,VDD_A, VDD_C for the MSM.

3.3 Circuit Description



[Figure 3-1] Block Diagram of Digital/Voice Processing Part

3.3.1 MSM Part

MSM5105, which is U401, is the core element of CDMA system terminal that includes ARM7TDMI microprocessor core. It is made up of a CPU, encoder, interleaver, deinterleaver, Viterbi decoder, MOD/DEM, and vocoder. MSM5105, when operated in the CDMA mode, utilizes CHIPX8 (9.8304MHz) as the reference clock that is received from IFR3000, and uses TCXO (19.68MHz) that is received from TCX201. CPU controls the terminal operation. Digital voice data that have been inputted are voice-encoded and variable-rated. Then, they are convolutionally encoded so that error detection and correction are possible. Coded symbols are interleaved in order to cope with multi-path fading. Each data channel is scrambled by the long code PN sequence of the user in order to ensure the confidentiality of calls.

Moreover, binary quadrature codes are used based on Walsh functions in order to discern each channel. Data created thus are 4-phase modulated by one pair of Pilot PN code and they are used to create I and Q data.

When received, I and Q data are demodulated into symbols by the demodulator and then, de-interleaved in reverse to the case of transmission. Then, the errors of data received from Viterbi decoder are detected and corrected. They are voice decoded at the vocoder in order to output digital voice data.

3.3.2 Memory Part

Memory part, MCP consists of 16M Flash memory and 4M static RAM.
In the MCP, there are programs used for terminal operation. The programs can be changed through down loading after the assembling of terminals and data generated during the terminal operation are stored temporarily and non-volatile data such as unique numbers (ESN) of terminals are stored.

3.3.3 Power Supply Part

When the input voltage (4.0V) in the DTSS-1900 is fed to the five regulators generated +3.0V and the one regular generated +2.7V. The generated voltages are used for MSM5105, RFT3100, IFR3000 and other LOGIC parts. PWR ASIC is operated by the control signal SLEEP/ from MSM5105 and POWER_EN signal.

3.3.4 Logic Part

The Logic part consists of internal CPU of MSM, MCP. The MSM5105 receives TCXO (=19.68Mz) from VC-TCXO and CHIPX8 clock signals from the IFR3000, and then controls the module during the CDMA and the FM mode. The major components are as follows:

CPU : ARM7TDMI core
MEMORY : MCP (MB84VD21182A-85-PBS : U505)

CPU

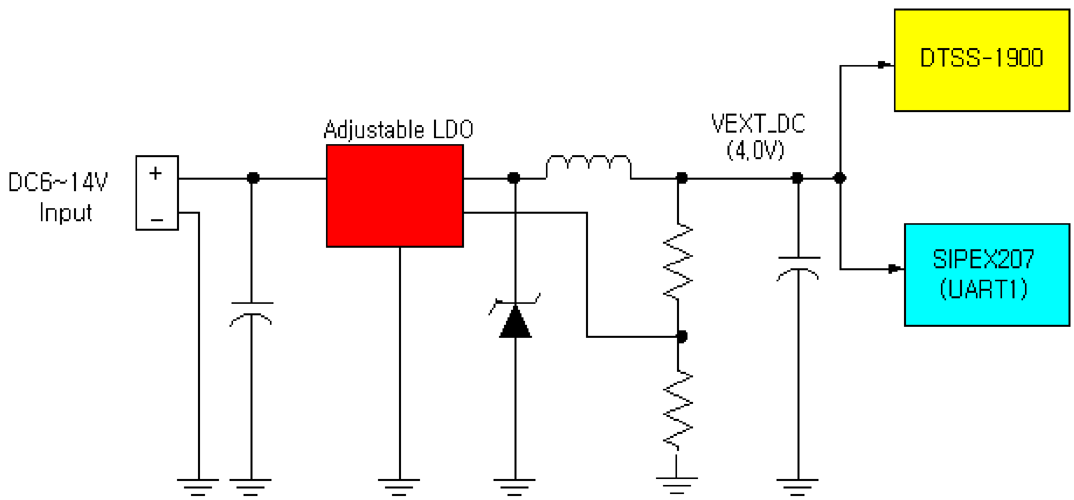
ARM7TDMI CMOS type 16-bit microprocessor is used and CPU controls all the circuitry. For the CPU clock, 32.768KHz is used.

MCP(16M +4M)

MCP is used to store the terminal's program. Using the down-loading program, the program can be changed even after the terminal is fully assembled.
SRAM is used to store the internal flag information, call processing data, and timer data.

4. Level Translator Part

4.1 EMII-1900 supply power to Modem(4.0V).



[Fig 4-1] The Block Diagram of Source (in brief)

4.2 UART Interface

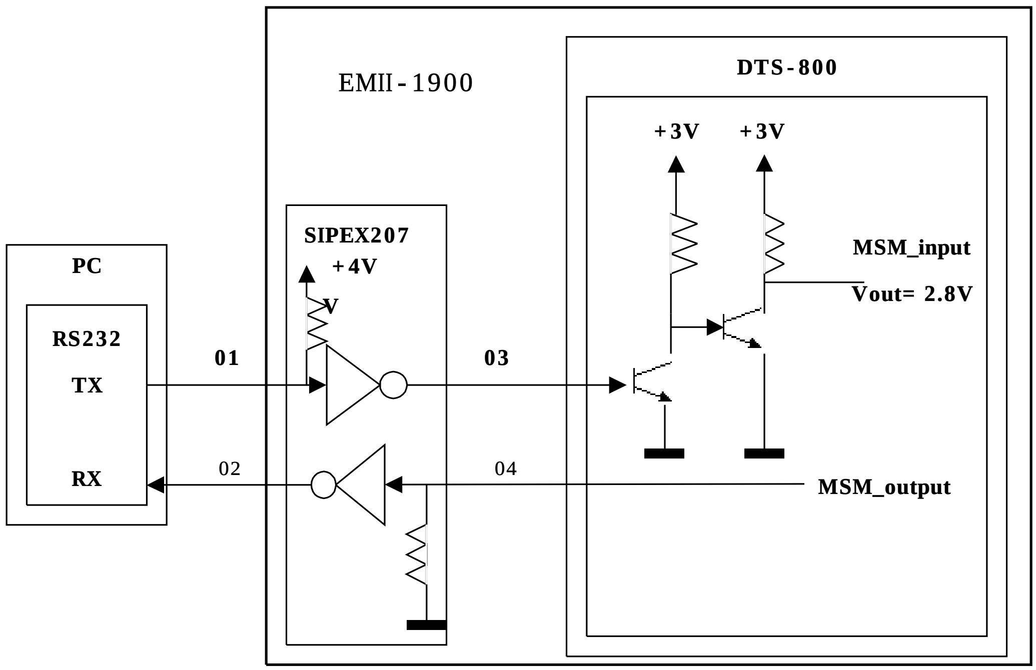
The Universal Asynchronous Receiver Transmitter (UART) communicates with serial data that conforms the RS-232 Interface protocol. The modem provides 3.0V CMOS level outputs and 3.0V CMOS switching input level. And all inputs have 5.0V tolerance but 3.0V or 3.3V CMOS logic compatible signals are highly recommended.
All the control signals of the RS-232 signals are active low, but data signals of RXD, and TXD are active high.

The UART has a 64byte transmit (TX) FIFO and a 64byte receive (RX) FIFO. The UART Features hardware handshaking, programmable data sizes, programmable stop bits, and odd, even, no parity. The UART operates at a 115.2kbps maximum bit rate.

4.2.1 UART Inter Pinouts

NAME	DESCRIPTION	CHARACTERISTIC
DP_DCD/	Data Carrier Detect	Network connected from the modem
DP_RI/	Ring Indicator	Output to host indicating coming call
DP_RTS/	Request to Send	Ready for receive from host
DP_TXD	Transmit Data	Output data from the modem
DP_DTR/	Data Terminal Ready	Host ready signal
DP_RXD	Receive Data	Input data to the modem
DP_CTS/	Clear to Send	Modem output signal
GND	Signal Ground	Signal ground

4.2.2 Signal level of RXD/TXD



RS232		PHONE	
TX01	RX02	TX04	RX03
V_{MAX} = 7.68V V_{MIN} = -7.68V	V_{MAX} = 6.50V V_{MIN} = -6.64V	V_{MAX} = 3.00V V_{MIN} = 0V	V_{MAX} = 3.9V V_{MIN} = 0V

[Figure 4-2] Signal Level of RXD, TXD

4.3 LED State Indication

	Name	Enable	Description
1	D1(IDLE)	Low	Stable State
2	D2(BUSY)	Low	State that Data transmit and receive between DTE and DCE
3	D3(SMS)	Low	Shot Message Service
4	D4(PWR)	Low	Power ON/OFF

4.4 The function of Real Audio Test(including Voice Test)

NAME	TYPE	DESCRIPSION
MIC+	I	Microphone audio input
MIC-	IS	Ear/microphone set detect
EAR	O	Ear audio output
GND_A		Audio ground

CHAPTER 4. FCC Notice

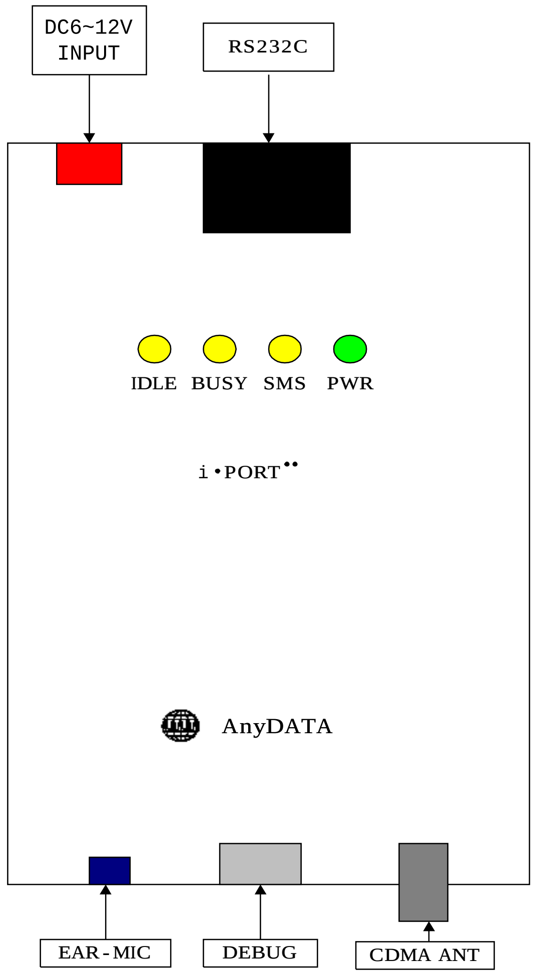
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

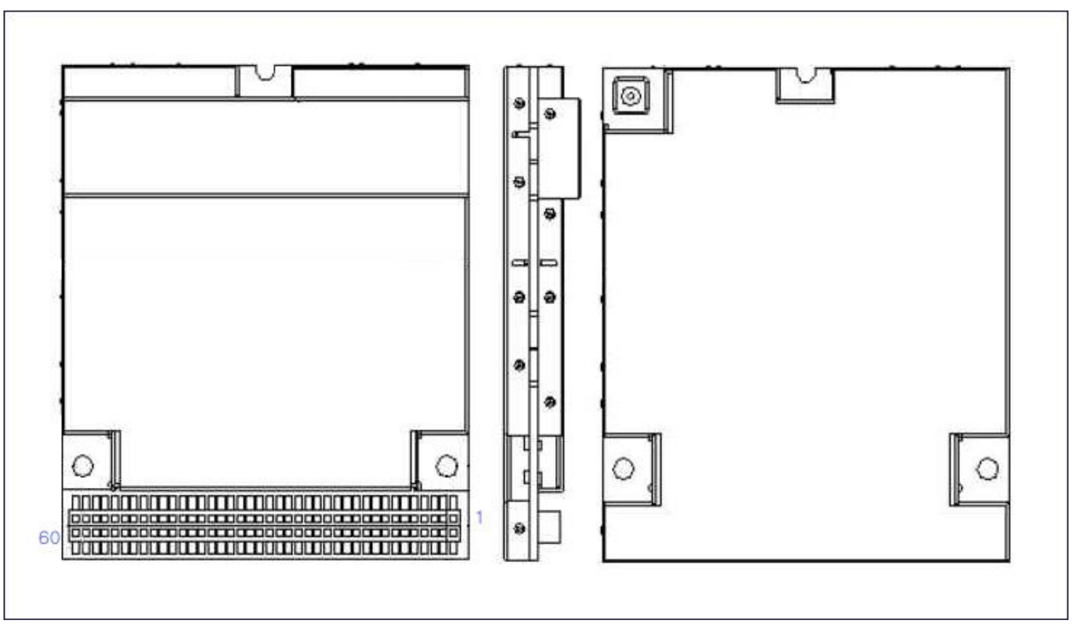
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

APPENDIX

1. Assembly and Disassembly Diagram
2. Block & Circuit Diagram
3. Part List
4. Component Layout

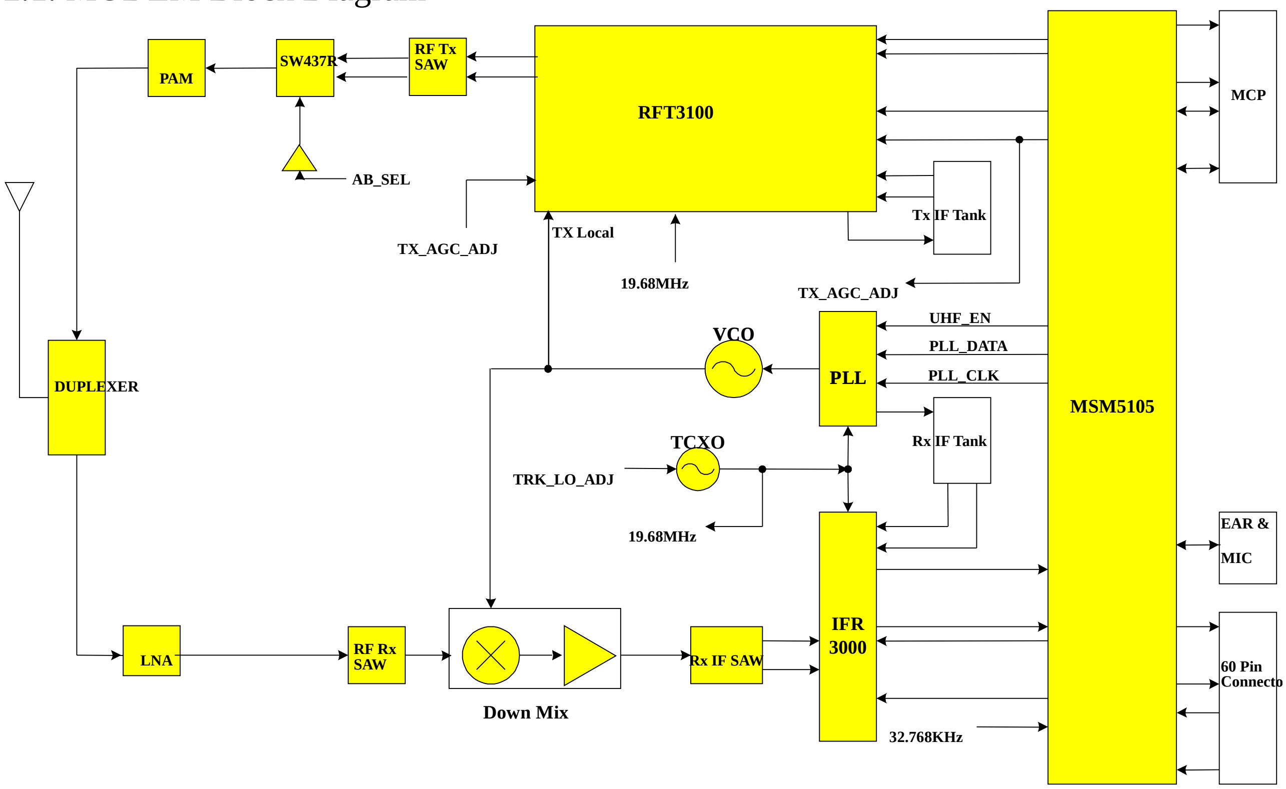
1. Assembly and Disassembly Diagram



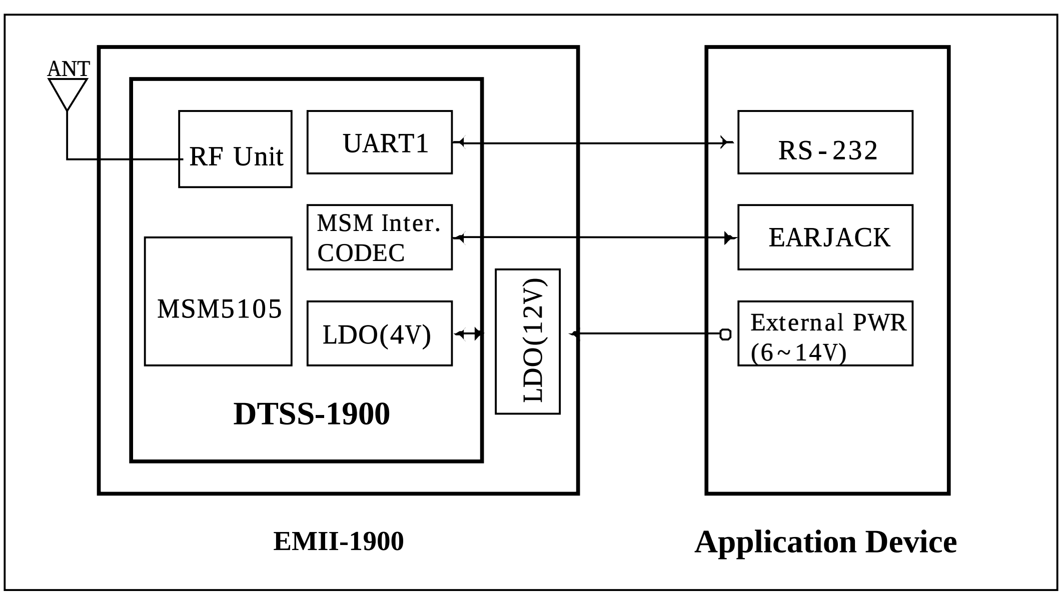


2. Block & Circuit Diagram

2.1. MODEM Block Diagram



2.2. EMII-1900 Block Diagram



3. Part List

3-1 DTSS-1900 Partlist

NO	COMPONENT NAME	DESCRIPTION	Lay.	DESIGN NUMBER	Q'ty
LOGIC					
1	MSM5105-A208FBGA-TR	MSM5105 (208P)	BOT	U401	1
2	IFR3000-48BCCF-TR	IFR3000 (48P)	BOT	U201	1
3	RFT31003-32BCCP-TR	RFT3100 (32P)	BOT	U102	1
4	MB84VD21182A-85-PBS	MCP(16M+4M)	BOT	U505	1
6	MIC5245-3.0VBM5	LDO (3.0V)	TOP	U601, U602, U603, U607, U609	5
7	MIC5245-2.7VBM5	LDO (2.7V)	BOT	U606,	1
8	TC7SHU04FU	INVERTER	TOP	U205	1
9	FDC634P	P CH-MOSFET(SSOT-6)	BOT	U104	1
10	S-80827ALNP-EDT-T2	RESET IC	TOP	U608	1
11	DTC124EE-TL	DIGITAL TR	TOP	Q102, Q302, Q303, Q304, Q305, Q307	6
			BOT	Q104,	1
12	UMC4N-TR	DIGITAL TR	TOP	Q306	1
13	UMH2N-TN	DIGITAL TR	BOT	U504	1
14	UPS5819	SCHOTTKY DIODE	TOP	ZD601	1
15	B06B-4101-606	60PIN CONNECTOR	TOP	CON301	1
16	1SV281	VARACTOR DIODE	TOP	VD201, VD202	2
			BOT	VD101, VD102	2
17	NT732ATD683K	THERMISTOR	BOT	TH201	1
18	F0805B3R00FW	FUSE (1608 Size)	TOP	FUSE1	1
RF					
1	RI23110P	PAM	TOP	U103	1
2	DFX1880J1960F	DUPLEXER(US-PCS)	TOP	DUP101	1
3	B4934	RX IF SAW FILTER(5X5)	TOP	FL103	1
4	B4135	RX RF SAW FILTER(3X3)	BOT	FL102	1
5	LJ49A	TX RF SAW FILTER(3X3)	TOP	FL101	1
6	VC_3R0A80_1750A	VCO	BOT	U204	1
7	CMY212	DOWN MIXER	TOP	U101	1
8	LMX2354SLBX	PLL	BOT	U202	1
9	KT16-DCV30L-19.68M	VC-TCXO	TOP	TCX201	1

10	SSP-T6	X-TAL(32.768K-7.0PF)	BOT	X401	1
11	BFP620	LNA	BOT	Q101	1
12	BFP420	BUFFER AMP	BOT	Q201	1
13	SW437	SW-437	TOP	SW102	1
14	MCA-ST-00T	MOBLE SWITHCH	BOT	SW101	1
INDUCTOR					
1	0603CS-22NXG-BC	CHIP COIL(2%)	TOP	L203	1
2	0603CS-27NXG-BC	CHIP COIL(2%)	BOT	L113	1
3	0603CS-39NXG-BC	CHIP COIL(2%)	TOP	L106	1
4	0603CS-56NXG-BC	CHIP COIL(2%)	TOP	L105	1
5	CI-B1005-27NSJT	IND/2.7N(+-0.3nH)	TOP	L100	1
			BOT	L111, L112	2
6	CI-B1005-33NSJT	IND/3.3N(+-0.3nH)	TOP	L120	1
			BOT	L110	1
8	CI-B1005-47NSJT	IND/4.7N(+-0.3nH)	TOP	L119	1
			BOT	L201	1
9	CI-B1005-56NSJT	*IND/5.6N (+-5%)*	TOP	L116	2
10	CI-B1005-101NSJT	IND/100N (+-5%)	BOT	L115	2
11	CI-B1608-150NJJT	IND/15N (+-5%)	BOT	L101	1
12	CI-B1608-4R7NJJT	IND/4.7N (+-5%)	BOT	L103	1
13	CI-B1608-330NJJT	IND/33N (+-5%)	BOT	L104	1
14	CI-B1608-560NJJT	IND/56N (+-5%)	TOP	L114	1
15	CI-B1608-680NJJT	IND/68N (+-5%)	TOP	L121	1
16	CI-B1608-270NJJT	IND/27N (+-5%)	BOT	L117, L118	2
17	BLM1608A601SPT	FERITE BEAD	TOP	BL102, BL605, BL607	3
			BOT	BL202, BL606	2
CAPACITOR					
1	GRM36COG0R5C50PT	0.5pF-1005 Cap	TOP	C169, C186	1
			BOT	C102	1
2	GRM36C0G1R0C50PT	1pF-1005 Cap	BOT	C173	1
2	GRM36C0G1R5C50PT	1.5pF-1005 Cap	TOP	C113	1
3	GRM36C0G2R0C50PT	2pF-1005 Cao	TOP	C135, C145, C212	1
			BOT	C249	1
5	GRM36COG040D50PT	4pF-1005 Cap	TOP	C133	4
6	GRM36COG0800D50PT	8pF-1005 Cap	TOP	C129	1
7	GRM36COG100080J50PT	10pF-1005 Cap	BOT	C107, C112, C147, C410	4
8	GRM36COG150J50PT	15pF-1005 Cap	BOT	C158, C402, C403	3

9	GRM36C0G180J50PT	18pF-1005 Cap	BOT	C130	1
10	GRM36COG220J50PT	22pF-1005 Cap	TOP	C211, C213	2
			BOT		1
11	GRM36COG240J50PT	24pF-1005 Cap	BOT	C164, C165	2
12	GRM36COG270J50PT	27pF-1005 Cap	BOT	C246	1
13	GRM36C0G390J50PT	39PF-1005 Cap	TOP	C123, C126	2
14	GRM36C0G470J50PT	47pF-1005 Cap	BOT	C152, C230, C231, C232,	
15	GRM36C0G820J50PT	82pF-1005 Cap	BOT	C146, C151,	2
16	GRM36COG101J50PT	100pF-1005 Cap	TOP	C114, C122, C132, C417, C418, C501	6
			BOT	C139, C142, C185, C280, C285, C288	5
17	GRM36COG221J50PT	220pF-1005 Cap	BOT	C155, C156	2
19	GRM36COG471J50PT	470pF-1005 Cap	TOP	C127, C306, C309, C310, C311	5
			BOT	C131, C301, C302, C303, C304, C305, C307, C308, C312, C313, C314, C315, C316, C317, C318, C319, C320, C321, C322, C323, C324, C325, C326, C327, C328, C329, C330, C331, C332, C333, C334, C335, C336, C337, C338, C339, C340, C341, C342, C343, C344, C345, C346, C347, C348, C349, C350	47
20	GRM36X7R102K50PT	1nF-1005 Cap	TOP	C118, C120, C121, C451	4
			BOT	C136, C137, C138, C141, C143, C144, C166, C191, C219, C243, C284, C289, C470	13
21	GRM36COG472J50PT	4.7nF-1005 Cap	BOT	C111,	1
22	GRM36COG103J50PT	10nF-1005 Cap	TOP	C110, C115, C128, C209, C258, C453, C455, C603, C611, C618, C620, C622, C630, C641	14
			BOT	C205, C206, C215, C216, C220, C221, C240, C250, C283, C290, C450, C460, C614	13
23	GRM36COG123J50PT	12nF-1005 Cap	BOT	C425, C427	2
24	GRM36Y5V223Z25PT	22nF-1005 Cap	TOP	C421	1

			BOT	C420	1
25	GRM36Y5V683Z25PT	68nF-1005 Cap	TOP	C150	1
26	GRM36Y5V104Z25PT	100nF-1005 Cap	TOP	C170, C259, C270, C435, C452, C454, C514, C623	8
			BOT	C159, C160, C218, C222, C223, C226, C228, C229, C235, C260, C265, C286, C287, C291, C423, C424, C426, C428, C701, C702	23
27	GRM36COG105J50PT	1uF-1005 Cap	BOT	C101, C108, C109,	3
28	GRM39COG102J50PT	1nF-1608 Cap	TOP	C253	1
			BOT	C148	1
29	GRM39Y5V103Z25PT	10nF-1608 Cap	BOT	C281	1
30	GRM39Y5V104Z25PT	100nF-1608 Cap	TOP	C207	1
31	GRM39Y5V224Z25PT	220nF-1608 Cap	TOP	C214	1
			BOT	C282	1
32	GRM39Y5V684Z25PT	680nF-1608 Cap	BOT	C149	1
33	TA-6R3TCMS100M-PR	Tan Cap (10uF/6.3V/P)	TOP	C269, C422, C625	3
34	TA-6R3TCMS4R7M-PR	Tan Cap (4.7uF/6.3V/P)	TOP	C124, C140, C604, C608, C612, C619, C621	7
			BOT	C616	1
35	TA-010TCR330K-A	Tan Cap (33uF/6.3V/A)	TOP	C419	1
36	TA-010TCR101K-A	Tan Cap(100uF/6.3V/A)	TOP	C125, C626	2
RESISTOR					
1	MCR01MZSJX000	0W 5%-1005 Resistor	TOP	R143, R100, R156, R221, R250, R611, R702, VA601, C134	6
			BOT	R140, R180, R206, R290,	5
2	MCR01MZSJX100	10W 5%-1608 Resistor	BOT	L102	1
2	MCR01MZSJX100	10W 5%-1005 Resistor	BOT	R103, R244	2
3	MCR01MZSJX101	100W 5%-1005 Resistor	TOP	R130, R280	2
			BOT	R105, R243, R246	5
4	MCR01MZSJX331	330W 5%-1005 Resistor	BOT	R231, R240, R402	3

5	MCR01MZSJX471	470W 5%-1005 Resistor	BOT	R301, R302, R303, R308, R309, R317, R318, R319, R320, R321, R322, R323, R324, R325, R326, R327, R328, R329, R340, R341, R342, R343, R344, R345, R346, R347, R348, R349, R350, R351, R352, R353, R354, R355, R356, R357, R358, R359, R360, R361, R362, R363, R364, R365, R366	45
6	MCR01MZSJX102	1KW 5%-1005 Resistor	TOP	R210, R455, R610	3
			BOT	R104, R220, R223, R224, R241, R410	6
7	MCR01MZSJX152	1.5KW 5%-1005 Resistor	TOP	R421	1
8	MCR01MZSJX182	1.8KW 5%-1005 Resistor	BOT	R115	1
9	MCR01MZSTX202	2KW 5%-1005 Resistor	BOT	R203	1
10	MCR01MZSTX222	2.2KW 5%-1005 Resistor	TOP	R200, R420	2
11	MCR01MZSJX332	3.3KW 5%-1005 Resistor	TOP	R202	1
12	MCR01MZSJX472	4.7KW 5%-1005 Resistor	TOP	R470	1
13	MCR01MZSJX512	5.1KW 5%-1005 Resistor	BOT	R201	1
14	MCR01MZSJX682	6.8KW 5%-1005 Resistor	TOP	R204, R205	2
15	MCR01MZSJX822	8.2KW 5%-1005 Resistor	BOT	R209	1
16	MCR01MZSJX103	10KW 5%-1005 Resistor	TOP	R111, R305, R307, R311, R312, R314, R316, R475, R701	9
			BOT	R102, R114, R116, R207, R208, R424, R425, R501, R502	9
17	MCR01MZSJX223	22KW 5%-1005 Resistor	TOP	R310, R315, R313, R330	4
18	MCR01MZSJX273	27KW 5%-1005 Resistor	BOT	R101	1
19	MCR01MZSJX363	36KW 5%-1005 Resistor	BOT	R211	1
20	MCR01MZSJX104	100KW 5%-1005 Resistor	TOP	R189, R253, R260	3
21	MCR01MZSJX154	150KW 5%-1005 Resistor	TOP	R263	1
22	MCR01MZSJX184	180KW 5%-1005 Resistor	BOT	R422, R423	2
23	MCR01MZSJX504	500KW 5%-1005 Resistor	BOT	R427	1
24	MCR01MZSFX1212	12.1KW 1%-1005 Resistor	BOT	R119	1
25	MCR01MZSFX1003	100KW 1%-1005 Resistor	TOP	R222	1
26	MCR01MZSFX1004	1MW 1%-1005 Resistor	TOP	R117, R118	2
기타					
1	DTSS-1800 V0.3 PCB	Main PCB			1

2	DTSS-1800 TOP COVER	TOP COVER			1
3	DTSS-1800 TOP FRAME	TOP FRAME			1
4	DTSS-1800 BOT COVER	BOT COVER			1
5	DTSS-1800 BOT FRAME	BOT FRAME			1
6	DTSS-1800 LABEL	LABEL			1
DNI					
1		RESISTOR	TOP	R150, R107, R142, R254, R370	4
			BOT	R106, R155	2
2		CAPACITOR	TOP	C168	1
			BOT	C187, C224, C352	4
3		기타	TOP	VA301, L130	1
			BOT		

3-2. EM Main Board Partlist

28. Jan. 2002

No	Commponent Name	Description	Lay	DESIGN NO		Vendor
LOGIC					1	
1	SMA R/A(F)+ MCA Cable	SMA(F) + MCA	TOP	CDMA	1	LINK Tec.
2	PH127-60SMD-16H-2.0	60pin connetor	BOT	CN1	1	SKY Elec.
3	TC7SHU04F	inverter	TOP	U19	3	TOSHIBA
4	UMT2907A	PNP TR	TOP	U14,16,17	1	ROHM
5	SP207-EA	Tranceiver IC	TOP	U2	1	SIPEX
6	MIC4576BU	LDO (TO-263)	TOP	U3	1	MICREL
7	MBRS360T3	Schottky Diode	TOP	ZD1	1	MOTOROLA
8	657PL8	8pin Modular Housing	TOP	J2	1	ARIN
9	BL-2141N	LED(Green)	TOP	D4	1	BRT
10	BL-3141N	LED(Yellow)	TOP	D1,D2,D3	3	BRT
11	HSJ1621-019011	EARJACK	TOP	U15	1	HOSIDEN
12	53047-0310	1.25mm male 3pin	TOP	CN10	1	MOLEX
13	5268	2.5mm male 3pin®	TOP	CN2	1	MOLEX
14	5268	2.5mm male 2pin®	TOP	J1	1	MOLEX
RESISTOR						
15	MCR03MZSJX000	RESISTOR(1608) 0R	TOP	R30,R31,R44,R45,	6	ROHM

				R46,R47		
16	MCR03MZSJX101	RESISTOR(1608) 100R	TOP	R7,R8,R9,R34,R35, R36,R37	7	ROHM
17	MCR03MZSJX332	RESISTOR(1608) 3.3K	TOP	R1,R2,R3	3	ROHM
18	MCR03MZSJX472	RESISTOR(1608) 4.7K	TOP	R6	3	ROHM
19	MCR03MZSJX103	RESISTOR(1608) 10K	TOP	R5	3	ROHM
CAPACITOR						
20	GR39COG471J50PT	470pF -1608 -capacitor	TOP	C9	1	MURATA
21	TA-035TCMR10M-AR	TANTAL 0.1uF/35V	TOP	C5,C6,C7,C8	3	TOWA
22	470uF/16V(10x10.5) "MVK" 85°C	Elec. Cap (chip type)	TOP	C1	1	SAMYANG
23	1000uF/6.3V(10x10.5) "RGV"85°C	Elec. Cap (chip type)	TOP	C2	1	RUBYCON
INDUCTOR						
24	PL52C-33-1000	COIL INDUCTOR (33uH)	TOP	L2	1	COOPER
The Others						
25	EM(II)_PCB _V0.1	EM(II)_PCB_MAIN_ V0.1				UNIC Elec.
26	EM-BODY-00	BODY				TOSUNG
27	EM-FRONT-00	FRONT				TOSUNG
28	EM-REAR-00	REAR				TOSUNG
DNI						
29	DNI	RESISTOR	TOP	R4,R13,R14,R15, R16, R17,R18,R19, R20,R21,R22,R23, R24,R25,R26,R27, R40,R41,R42,R43	20	
30	DNI	CAPACITOR	TOP	C3,C4	2	
31	DNI	DA114	TOP	D5	1	
32	DNI	INDUCTOR	TOP	L1	1	
33	DNI	MIC5205-3.0V	TOP	U4	1	
34	DNI	TC74HC07AF(SOP-14)	TOP	U6	1	
35	DNI	TC74HC4052AFT(SOP-16)	TOP	U5	1	
36	DNI	53047-0810(8PIN)	TOP	U7	1	
37	DNI	5268(3PIN)	TOP	CN3, CN4	2	

4. Component Layout