Application Note

Practical Tips on CDMA Measurements

MT8212B

Cell Master™

Introduction

This is a practical CDMA measurement procedures note. The objective of this note is to present measurement tips and procedures which will help a field-based network technician or RF engineer conduct base transceiver station (BTS) field measurements on cdmaOne and CDMA2000 networks.

Understanding CDMA Wireless Telecommunications Standards

Code Division Multiple Access (CDMA) describes a digital air interface standard for mobile equipment and is defined in the Telecommunications Industry Association's (TIAs) Interim Standard 95 (IS-95). It enhances the capacity of older analog methods with greatly improved transmission quality and enables simultaneous digital transmission of radio signals between a mobile telephone and a base station over a shared portion of the spectrum.

Offering more than 10 times the capacity of the analog cell phone system (AMPS), CDMA is now widely used in North America. Having already proven itself as a successful wireless access technology in second generation (2G) networks, CDMA is now providing an important pathway to third generation (3G) global wireless communication systems.

Access by the subscriber to the various wireless cellular systems, like CDMA, is provided by one of several types of RF transceiver systems. With AMPS, for example, each user occupies a unique transmit and receive frequency – a method known as Frequency Division Multiple Access (FDMA). In digital TDMA systems like GSM, individual users occupy time slots on a given frequency. Each user then has a unique period of time in which to receive the transmission from the base station. In contrast, CDMA digital systems assign each user a unique digital code that is used to modulate the RF carrier with multiple users, sharing the same transmission signal in any given period. Consider, for example, a room full of people, in which everyone is trying to carry on a one-to-one conversation. With CDMA, each couple is free to talk at the same time since they are each using a different language. Because the couples only understand the language they themselves speak, the background conversations are essentially noise and don't cause any problems.

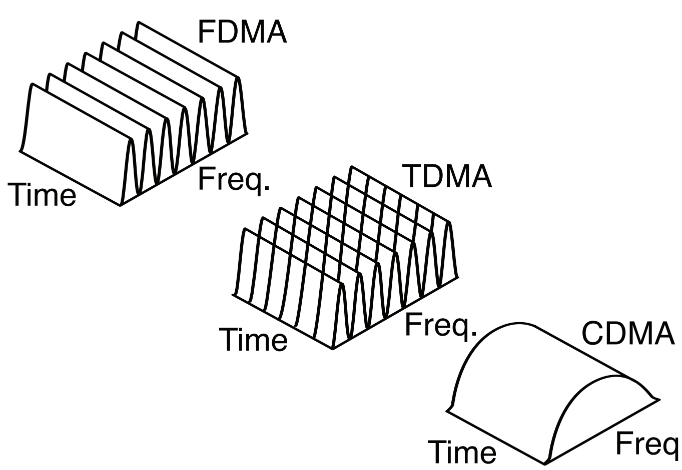

Figure. The basic waveform structures of FDMA, TDMA and CDMA signals.

cdmaOne Basics

cdmaOne is the 2G narrowband CDMA digital air interface standard that is widely used after GSM technology. It incorporates the TIA IS-95 interface standard, operates in the 450 MHz, 800 MHz or 1.9 GHz radio frequency bands, and uses 1.23~1.25 MHz-wide channel bandwidth.

cdmaOne supports 64 possible Walsh codes - each code is 64 bits long. The Walsh code is the term used for the digital modulation code that separates the individual conversations and control signals on the RF carrier transmitted from a cdmaOne base station. This code uniquely identifies each of the forward traffic channels (user conversations). In cdmaOne, the only way to address individual user channels in a transmission is to demodulate the RF signal and detect their individual Walsh codes (Pilot, Paging, Sync and traffic channels). The Pilot channel is always Walsh code Zero and is often the strongest, while the Paging channels can be found on one or more Walsh codes 1-7. The Sync channel is always Walsh Code 32. All remaining Walsh codes are traffic channels.

Figures 2A and 2B depict a typical cdmaOne BTS transmission in both the frequency and code domains (code domain data in individual code channels obtained from a demodulated signal). The data from the system as well as users is coded, spread and combined for transmission. This is then modulated onto an RF carrier, with a channel bandwidth of 1.2288 MHz.

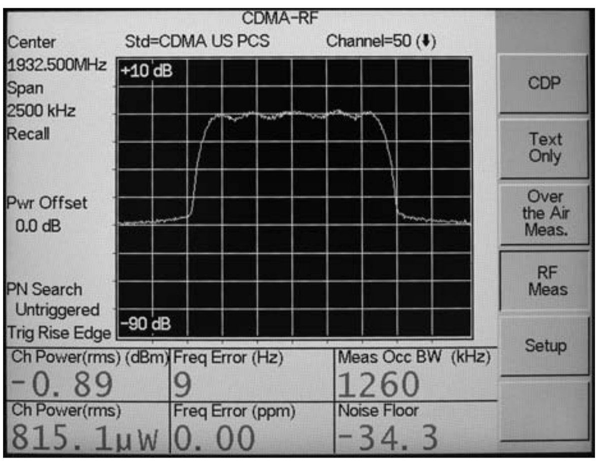

Figure 2A. The CDMA RF measurement

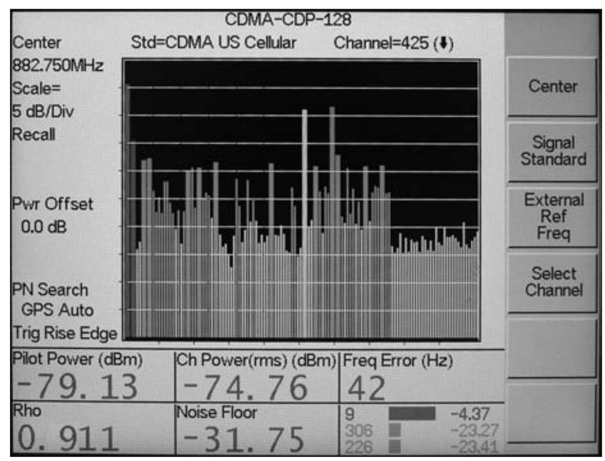

Figure 2B. CDMA signals can be demodulated

Note that RF measurements are the same for using Anritsu's Cell Master MT8212B for both cdmaOne and CDMA2000 1xRTT signals.

CDMA2000 1xRTT Basics

cdmaOne networks can be upgraded to the CDMA2000 broadband standard for migration to 3G mobile telephony. Originated in North America, CDMA2000 is the first 3G technology to be deployed. It enhances cdmaOne networks by providing higher capacity in the same amount of spectrum to meet International Mobile Telecommunications (IMT)-2000 global wireless communication specifications. Operators can now have access to 3G data-rate performance on their existing cdmaOne networks, with minimal infrastructure changes. CDMA2000 is being introduced in three phases: CDMA2000 1xRTT (radio transmission technology), CDMA2000 1xEV-DO (Evolution Data Optimized) and CDMA2000 3x.

Parameters	CDMA2000 1xRTT	CDMA2000 1x EV-DO	CDMA2000 3x
Bandwidth	1.25 MHz	1.25 MHz	3.75 MHz
Network Type	Voice and Data	Data only	Voice and Data
Maximum Downlink Data Rates	144 kbps	3.072 Mbps	4 Mbps
Walsh Codes (Spreading Factor)	64 or 128	16~128	256

Table 1. Comparison of CDMA2000 digital air interface standards.

CDMA2000 1xRTT is a cdmaOne system enhancement with twice the number of Walsh Codes (128), a two-fold increase in voice capacity and standby time, and advanced packet data services, as well as greatly extended battery life and improved sleep mode technology – all for data communications on a single existing cdmaOne carrier. CDMA2000's improved power control, voice codecs, and other system improvements provide an effective data rate in the range of 40-70 kbps.

The CDMA2000 1xEV-DO enhancement to the 1xRTT system supports asymmetric, non real-time data packet services of up to 3.072 Mbps in the forward link and 153.3 kbps in the reverse link, using just 1.25 MHz of spectrum, and has a typical cell radius of 5 to 15 km. It uses the same frequency band, channel bandwidth (1.23 MHz) and chip rate (1.2288 Mcps) as cdmaOne and CDMA2000 1xRTT. Each chip lasts for a duration of 0.8138 microseconds. The third phase, CDMA2000-3x, specifies 256 Walsh codes and is still in the research phase.

A typical CDMA2000 1xRTT BTS transmission in the frequency domain is identical to that of cdmaOne with a channel bandwidth of 1.2288 MHz. In the code domain, power is displayed in the Walsh code channels as shown in Figure 3a and Figure 3b. Signals transmitted on the forward traffic channel are specified by the radio configuration (RC). CDMA2000 specifies nine RCs in the forward link; five for 1xRTT spreading rates and four for 3xRTT. MT8212B displays CDMA2000 1xRTT Walsh codes in bit reversed order. Here Walsh codes are not arranged by sequential order; they are displayed based on their relation to other codes that could be used to group them for higher data rates.

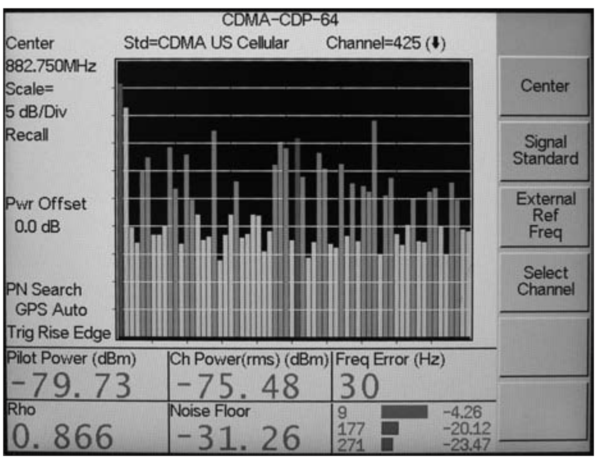

Figure 3a. This Code Domain Power display depicts a cdmaOne signal, 64 codes normal sequence.

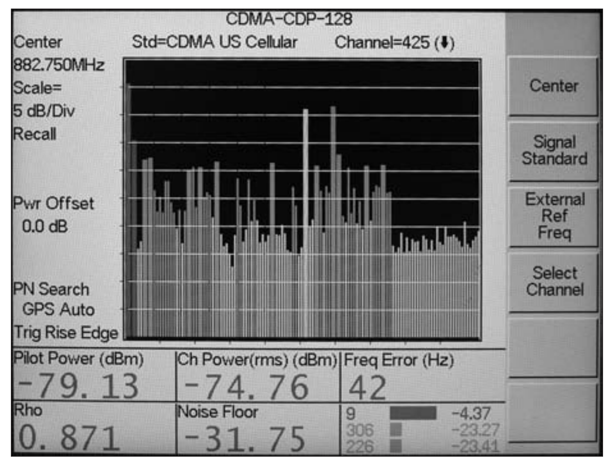

Figure 3b. This Code Domain Power display depicts a CDMA2000 1xRTT signal, 128 codes bit reversed sequence.

Note that both the cdmaOne and CDMA2000 1xRTT standards specify that certain types of traditional measurement tools be used in checking the RF signal performance of a BTS transmitter. These tools include a spectrum analyzer, a power meter, cable and antenna analyzer, and a waveform-quality/code-domain power measurement device. While these tools may be used as separate instruments, test equipment like the Cell Master MT8212B combines many of these functions into a single package.

cdmaOne Versus CDMA2000 1xRTT

cdmaOne is the commercial term branded by the CDMA Development group (CDG) for all IS-95 based CDMA systems. CDMA2000 is a name identifying the 3G technology that is an evolutionary outgrowth of cdmaOne. It provides for a doubling of overall capacity, faster data rates (up to 144 kbps) and always-on packet data connections.

As shown in Table 2, there are a number of differences between cdmaOne and CDMA2000 1xRTT. Perhaps the most significant difference though is that CDMA2000 1xRTT has a higher number of Walsh codes -128- as compared to cdmaOne's 64. The result is increased capacity and variable spreading factors, which enable CDMA2000's higher data rates. The new system trades off spreading factor for data rate. The data rate capability of an individual call can be described by the spreading factor of the code channel it occupies – the lower the spreading factor, the wider the code channel and the higher the data rate. The narrowest code channels are those at the highest spreading factor, which in the case of 1xRTT is a maximum of 128. The Cell Master MT8212B in CDMA2000 1xRTT mode always displays 128 Walsh codes.

Channel	cdmaOne	CDMA2000 (1xRTT)
Forward	RC1, RC2	RC1-RC5
Network type	Voice and Data	Voice and Data
Date Rate	14.4 kbps	144 kbps
Walsh Codes (Spreading Factor)	64 fixed	4-128 variable

Table 2. Comparison of cdmaOne and 1xRTT

Understanding CDMA Measurements

CDMA signals are far more complex than those found in analog systems. Sophisticated code domain modulation and spread-spectrum schemes, handoff control and power management functions are but a few of the new technology challenges. Overall power level and frequency versus time measurements alone cannot verify performance or isolate problems in these new systems. To properly characterize complex CDMA signals, field technicians must now measure many different types of parameters. The CDMA measurements that can be made with the Cell Master MT8212B include:

Transmitter Frequency Error

Frequency error is the difference between the received center frequency and the center frequency (or channel) specified by the user. This value is only as accurate as the frequency reference used and is typically only useful with a good external frequency reference. This measurement is used in cases where a transmitted signal is slightly “off-center” from a designated frequency.

Note that standards specify for PCS bands, 0.05 PPM (parts-per-million). This equates to only 95 Hz at a carrier frequency of 1900 MHz or 45 Hz at 900-MHz cellular frequencies.

PN Offset

Offset is one of the 512 short code sequences used to differentiate sectors on base stations for communication with mobile units. PN stands for pseudo random noise that appears in a repetitive manner. The PN sequence forms a “short” code that is 32,768 chips in length and repeats every 26.666 milliseconds. This short code is combined with the data and transmitted in each of the forward channels. 512 points within the sequence have been selected as the PN offsets (from 0-511). Each base station uses a different point in the sequence to create a unique PN offset or identifier in its pilot signal which can be used to identify the base station sector.

Pilot Time Tolerance (τ)

Tau (τ) is the timing offset, or the difference in time between, when the PN sequence (or short code) restarts, and when the PN sequence should restart. All base stations must be synchronized within a few microseconds for station ID mechanisms to work reliably. CDMA2000 networks use GPS to maintain system time. The Tau measurement ensures that the pilot signal for any given sector of a base station is “tracking” with the network’s system time. Tau cannot be measured if the PN search is set to No Trigger in the MT8212B.

Note that any error in time is reported as Tau in ms, with about 1 ms for every 980 feet. During Over The Air (OTA) measurements, Tau increases as the Cell Master MT8212B gets farther from the transmitter due to the finite speed of the radio wave. If the Cell Master MT8212B is connected to the base station, a Tau of 10 µs or less is specified; 5 µs is typical. Timing errors may occur when:

- The propagation delay is too long. In this case the received PN Offset may be different from the value designated on the Sync channel causing the handoff to fail.
- Another cause of timing error is a bad GPS receiver or timing distribution network within the base station.

Note also that if a particular site loses its reference to GPS time, its reference signals will begin to drift over time. Phones already using the site can remain on the air because they derive their timing from the signals transmitted by the base station. However, phones using other sites/sectors may be prevented from using the site because they are confused by the error in frequency. This creates what is known as the “island cell” effect. By itself, the cell is still functional. To the rest of the system, it’s inaccessible. This island cell effect can be caused by a failure in the site’s GPS receiver and timebase distribution network. Using the test set’s Internal GPS receiver provides an independent time reference that will allow the technician to determine if this cell site is out of sync with the rest of the network (“island cell” effect). If the time offset t is large then the island effect will occur.

Waveform Quality - Rho (ρ)

Rho is a measure of modulation quality of the transmitted CDMA signal. It measures the amount of power correctly transmitted. An estimated Rho of 1.0 is associated with a perfect signal, indicating that all of the power is being transmitted correctly without any multipath. The CDMA standard requires >0.912. Common measurements indicating a healthy base station are >0.94. Due to environmental factors, estimated Rho values are typically poor (<0.9) when measured over the air.

Uncorrelated power appears as interference to the mobiles, poor Rho performance will affect the sector's capacity. Added interference may require that the signal on traffic channels be raised to overcome the interference.

Note that Rho failures can indicate problems in:

- Compression in linear amplifiers
- Magnitude and phase errors in the IQ modulator
- Phase non-linearity (group delay)
- Spurious signals in the transmission path
- Carrier Feedthrough

Total Power or Channel Power RMS

Channel power is the total power broadcast in the 1.25 MHz wide CDMA channel specified. It is defined in dBm or watts. For OTA measurements, the channel power will vary as the signal path from the transmitter to receiver varies.

To account for the loss of the test cable and high power attenuator, the monitor point can be set by selecting Amplitude and Power Offset. When the channel power is lower than expected:

- Verify that you have a good connection to the RF output of the base station.
- Verify that the cable you are using to connect to the base station is not faulty.

Note that low channel power may indicate a bad power amplifier. Inaccurate channel power (high or low) may also indicate an incorrect power setting at the base station.

Pilot Power

Pilot power is the total power in the pilot channel. This value is expressed in dBm and is normally constant for a base station. An unexpected pilot power reading may indicate an incorrect power setting at the base station. With Cell Master MT8212B connected to the base station, check that the entered power offset is correct and that the connections are tight. It may also indicate that a change has been made to the digital gain setting of the pilot channel. For OTA measurements, the pilot power will vary as the signal path from the transmitter to receiver varies.

Code Domain Power (CDP)

In a CDMA system, individual user transmissions are isolated by their codes. Code domain power displays how much of the channel power is in each Walsh code. CDP is expressed in dB relative to the total transmitter power in the channel. Power is normalized to the channel power, so if a code reads –20 dB, it means that the power in that code is 1/100th of the channel power.

A base station's ability to accurately control the power in individual Walsh codes is a prerequisite to properly handle multiple user links with varying RF losses. It also ensures interference-free transmissions.

Note that during the Code Domain Power measurement, test equipment demodulates the transmitted signal to analyze power levels in each of the 64 or 128 forward-link Walsh codes. Code domain power can be verified with the base station sector producing a combination of Pilot, Sync, Paging and traffic channels.

Codes	Walsh Code Number	Color	Description
Pilot	0	Red	Continuously repeats a signal at a high power level to ensure that mobile phones can easily find the base station.
Sync	32	Blue	Continuously repeats a signal carrying timing and system configuration messages.
Paging	1-7	Green	Notifies mobiles of incoming calls from the network and handles their responses in order to assign them traffic channels.
Quick Page	80	Purple	A burst channel that is not on all the time.
IS-95 traffic	Other than Pilot, Sync and paging codes	Yellow	Representation of user conversations in the forward link of the cdmaOne network
CDMA 2000 1xRTT Traffic	Other than Pilot, Sync and paging codes	Orange	Representation of user conversations in the forward link of the CDMA2000 network
Noise	Other than Pilot, Sync paging and traffic codes	Grey	Inactive Walsh codes which are less than 27 dB or more below the total output power.
Unknown	Other than Pilot, Sync paging, traffic and noise codes	Light Blue	Codes which are higher than noise codes and which cannot be identified as other codes.

Table 3. Walsh Codes

Noise Floor
Noise Floor is the average power in the unused Walsh codes that is displayed in Code Domain Power and OTA measurement displays. A good Noise Floor value is below –35dB. When the Noise Floor is above these values, for example –20 dB, the modulator may be the source of the added noise. Another possibility is a problem with the base station's channel card. The channel card generates the individual Walsh codes.

Ec/Io
The pilot power compared to the total channel power.

Carrier Feedthrough (FT)
Carrier FT measures the amount of unmodulated signal that is leaking through the transmitter. It is a common cause of bad Rho. It can be caused by the lack of isolation across the mixer and cavity of the transmitter's I/Q modulator. Shielding can help reduce Carrier Feedthrough.

A good level for the Carrier FT is <–25 dB. The CDMA2000 1xRTT standard does not specify Carrier Feedthrough, however this measurement provides an additional tool to troubleshoot the base station's transmitter. In the frequency domain, Carrier FT shows as an uncorrelated energy spike that can be seen on the spectrum analyzer by closely spanning into the top of the CDMA signal. It can also show as higher noise levels on the Code Domain Power screen. Note that the inactive Walsh codes will be below the –27 dB specification for noise.

PN Scan (available only with Over The Air Option 33)
The strongest six PNs received are displayed. The length of the bar represents the relative strength in the channel. To the right of the bar is displayed timing offset Tau in microseconds and the power of that pilot compared to the total channel power (Ec/Io). To the left of the bar is displayed the PN number of that pilot. This graph is not meaningful if the PN search is set to No Trigger.

Multipath (available only with OTA- Option 33)
The length of the bar represents the relative strength in the channel. To the right of the bar is displayed the power of that signal compared to the total channel power. To the left of the bar is displayed the timing offset (Tau). Timing offset will not be displayed if the Cell Master MT8212B is set to No Trigger.

Pilot Dominance (available only with OTA - Option 33)
The strength of the strongest pilot compared to the next strongest pilot in the same channel. This value should be >9 dB to make good measurements.

Multipath Power (available only with OTA - Option 33)
The amount of power in the dominant signal which is being spread in time due to multipath echoes. This value should be <0.4 dB to make good measurements.

Δ*Sync*
Sync Walsh code power relative to the pilot power.

Δ*Page*
Page Walsh code power relative to the pilot power.

Δ*QPage*
Quick Page Walsh code 80 power relative to the pilot power.

Making CDMA Measurements

Anritsu's Cell Master MT8212B can measure CDMA performance in one of two ways, either:

- Over The Air (OTA) with an antenna
- Via Direct Connection of MT8212B to the base station

Figure 4a. The Cell Master MT8212B measures CDMA performance in one of two ways.

Figure 4b. The Cell Master MT8212B can measure CDMA performance via Direct Connection to the base station.

Figure 4c. The Cell Master MT8212B can measure CDMA performance Over The Air (OTA) with an antenna.

Set-Up

Making CDMA measurements with Cell Master requires some initial setup, regardless of whether the measurement will be taken Over The Air or via a Direct Connection. Cell Master must be configured to tune to the frequency being output by the base station. To choose the specific standard for your application:

1. Switch on Cell Master and press MODE to select CDMA.
2. Press the FREQ/DIST key.
3. Press the Signal Standard and Select Standard soft keys. A table of currently selected, common signal standards will be displayed. To view all the signal standards in the instrument, press the Show All soft key and select/deselect standards using the Select/Deselect key. The currently selected signal standards will be marked on that list with an asterisk. Using the UP/DOWN arrow key select the desired signal standard and press ENTER.

NOTE: If the signal standard is not in the Show All list, create the standard using Handheld Software Tools and download into the Cell Master.

4. Press the Select Channel soft key to choose the appropriate channel for the selected standard. Cell Master will automatically adjust the span for the CDMA signal.

The Cell Master will automatically change attenuation, preamplifier and digital gain settings to make the best CDMA measurements.

With the initial set-up complete, you are now ready to begin making CDMA measurements.

Making Direct Connect Measurements

To connect the base station to Cell Master, connect the power amplifier of the base station to the Cell Master's RF In port using a coupler or attenuator.

Note that the maximum input power (without damage) is +43 dBm on the RF In port, and +23 dBm on the RF Out port. To prevent damage, always use a coupler or high power attenuator as shown in figure 5.

Cell Master can demodulate the CDMA signal by connecting to the base station as shown in Figure 6.

If you choose to measure CDMA performance by connecting the base station directly to the Cell Master MT8212B, additional set-up for frequency reference and timing is required to make accurate results.

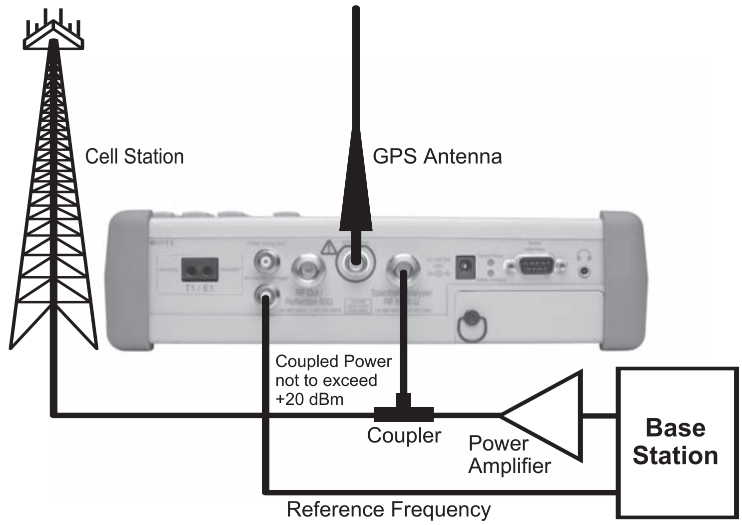

Figure 5. The connection required to make CDMA measurements using Cell Master via Direct Connection to the base station.

While use of an external reference frequency is not mandatory, it is critical for getting accurate frequency measurements. Frequency Error measurements are only as accurate as the reference frequency.

In order to get accurate frequency measurements, an external reference frequency must be attached to the Cell Master Ext Ref Freq input. Most base stations have a reference frequency available on a BNC connector. Cell Master is able to lock to different frequencies. To configure Cell Master to use an external reference frequency:

1. Press FREQ/DIST and External Ref Freq soft key and use the keypad or Up/Down arrow keys to enter the frequency. Press ENTER to select.

As Cell Master locks to the source, the message "Ext Ref Unlocked" may briefly flash on the display. If this message stays on, check that Cell Master is set to the correct external frequency. If the message "External reference unavailable. Using internal reference" is displayed then there is no reference frequency present on the Ext Ref Freq input.

Figure 6. Cell Master can demodulate the CDMA signal by connecting to the base station.

Cell Master needs a timing reference to determine PN Offset and timing errors. This reference comes from the base station when it is connected to Cell Master or it can be recovered from GPS when a GPS antenna is connected to Cell Master. The setup menu for this function is available through the MEAS/DISP key, setup and PN Search. The Direct Connect timing reference options include:

- **GPS (Auto or Manual)** – Cell Master uses GPS as the timing reference. In Auto mode Cell Master automatically detects the strongest pilot, while in Manual mode it searches only for the specified PN. Either way, connect the Cell Master to the base station GPS connector or connect the Anritsu GPS antenna to the Cell Master GPS antenna connector. GPS must be turned on under "Sys|GPS|GPS On/Off". Note that the GPS must be locked to the satellites before GPS Auto or GPS Manual can be used.
- **External (Auto or Manual)** – Cell Master uses an external even second time mark as the timing reference. The time mark is usually available at the base station on a BNC connector labeled "ESTM" or "PP2S". ESTM must be connected to the CDMA Timing Input connector on Cell Master. In Auto mode, Cell Master will automatically detect the strongest pilot. In Manual mode, Cell Master searches only for the specified PN.
- **No Trigger** – If both GPS and external timing are unavailable, you may choose No Trigger for the PN search. (Note: For demo purposes first use no trigger and activate GPS to show the three strongest PN's).

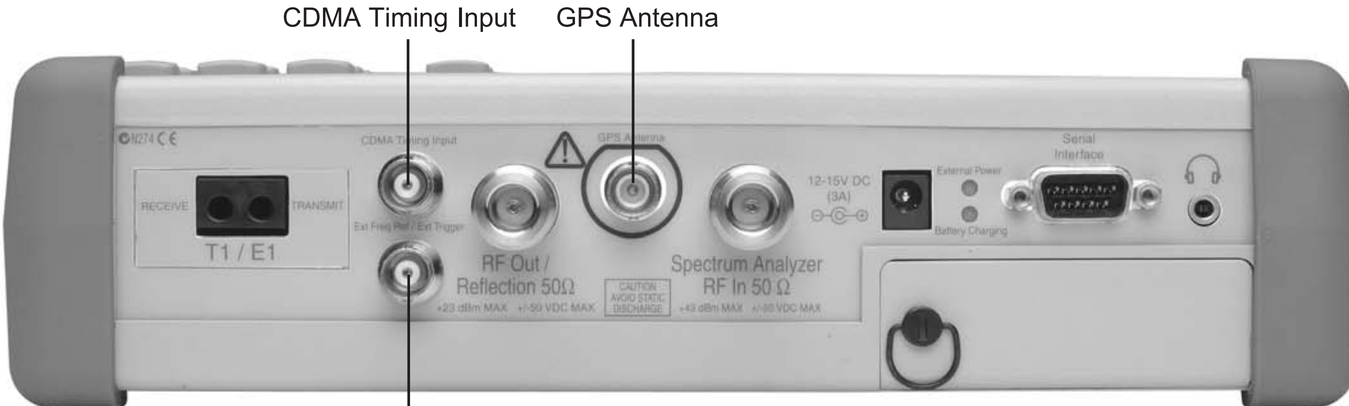

Figure 7. Top view of Cell Master MT8212B.

Making Over The Air Measurements

The OTA method is considered the most preferable means of measuring CDMA BTS performance, as it offers a more cost-effective, time-efficient approach to testing. Its proactive nature reduces the amount of time that performance degradations exist within a base station and minimizes the likelihood of a catastrophic failure. When a problem is detected, the OTA test provides insight into the cause, enabling the technician to ensure that the right tools and parts are available when the time comes to fix the problem on site.

Using the OTA test, technicians can execute a diagnostic test in less than five minutes without even getting out of their vehicles, although the vehicle should be parked close to the site. To get accurate results, the pilot dominance reading should be more than 9 dB. If the pilot dominance is lower than 9 dB, the technician should move the car and find the right location to make measurements for that sector.

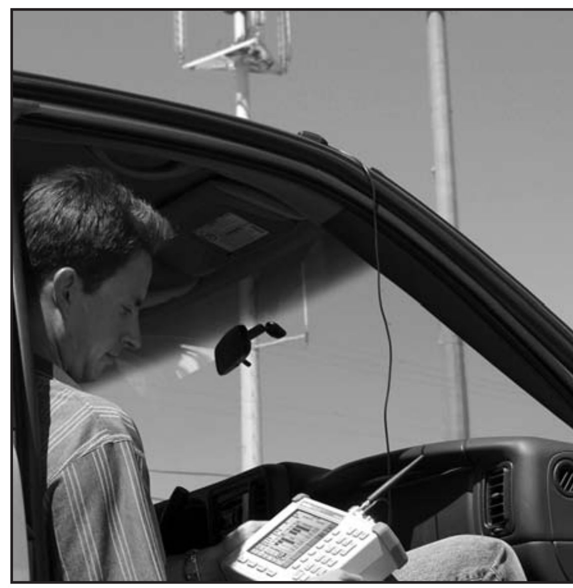

Figure 8. The Cell Master MT8212B can also demodulate the CDMA signal using an over the air antenna. A built-in GPS feature provides users with UTC time and location information.

OTA test also provides field technicians with the ability to monitor hard to reach pole-top base stations. Traditionally, the repair process for pole-top base stations entailed pulling down the failed base station, then installing a new one. The failed base station was then returned to the manufacturer or repair depot for service. If a base station was determined to be healthy – no trouble found (NTF) – the cost of the process was incurred unnecessarily. OTA testing provides information about the health of the base station, thereby improving the likelihood that a correct decision will be made with regard to the base station. The result is fewer NTFs and elimination of its associated costs.

If you choose to measure CDMA performance over the air with an antenna then additional set-up is required, as the Cell Master needs a timing reference to determine PN Offset and timing errors. This reference comes from the base station when it is connected to the Cell Master or it can be recovered from GPS when a GPS antenna is connected to Cell Master. The set-up menu for this function is available through the MEAS/DISP, Setup and PN search keys. The OTA timing reference options include:

- **GPS (Auto or Manual)** – Cell Master used GPS as the timing reference. In Auto mode Cell Master automatically detects the strongest pilot, while in Manual mode it searches only for the specified PN. Either way, the Anritsu GPS antenna must be connected to the Cell Master GPS antenna connector. GPS must be turned on under “Sys|GPS|GPS On/Off”. Note that the GPS must be locked to the satellites before GPS Auto or GPS Manual can be used.
- **No Trigger** – If GPS is unavailable, you may choose No Trigger for the PN search.

OTA measurements are accurate when pilot dominance is greater than 9 dB and multipath power is less than 0.4 dB.

Measurement Quality	Pilot Dominance	Multipath Power
Very good	>12 dB	<0.1 dB
Fair	>9 dB	<0.4 dB
Marginal	>6 dB	<0.7 dB

CDMA RF Measurements

CDMA RF measurements are channel power, occupied bandwidth, carrier frequency, frequency error and noise floor. CDMA RF measurements are accurate when the Cell Master is connected to the base station. To make this connection, follow the direct connect procedure, and then Press the MEAS/DISP key and select the RF Meas soft key to display the RF Measurements screen (Figure 9).

Demodulating CDMA Signals

Demodulation is the process whereby the changes imposed on the carrier at the receiver are removed to reveal the message at the receiver. Cell Master demodulates cdmaOne and CDMA2000 1xRTT signals either by connecting directly to the base station or over the air with an antenna.

To demodulate cdmaOne and CDMA2000 1xRTT signals, using direct connect follow the procedure listed in the direct connect setup section on page 8. Connect the Cell Master to the base station according to the following steps:

1. Press the MEAS/DISP key and select the Setup soft key to open Setup menu.
2. Press the PN Search soft key and choose External Auto when the Cell Master is connected to the base station following the setup instructions.
3. Press Back to go to the previous menu.
4. Press the Walsh Codes soft key to choose 64 or 128 codes depending on the transmitting signal. If the transmitted signal is cdmaOne choose 64 codes and if the signal is CDMA2000 1xRTT choose 128 codes. If 128 Walsh codes are selected for cdmaOne signal the codes will be repeated. The 128 Walsh codes are interleaved.
5. Press Back twice to go back to the measurements menu.
6. Press the CDP soft key to display the Code Domain Power of 64 or 128 Walsh codes.
7. Press the Text Only soft key to display the text screen (Figure 11).

As shown in Figure 12, Markers can be used to read the individual code power and type of code like traffic, pilot, paging or sync.

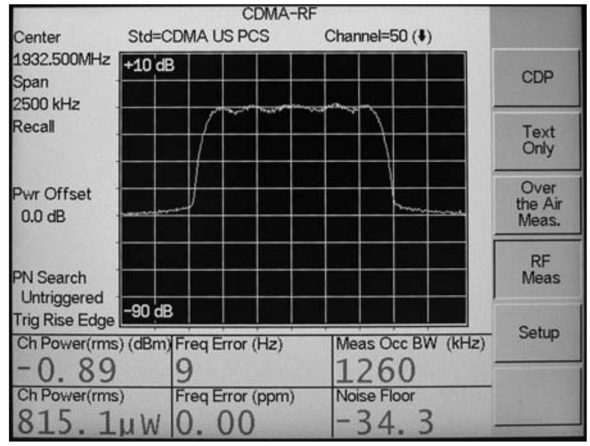

Figure 9. The Cell Master CDMA RF measurement screen. The RF measurements on both cdmaOne and CDMA2000 1xRTT are similar.

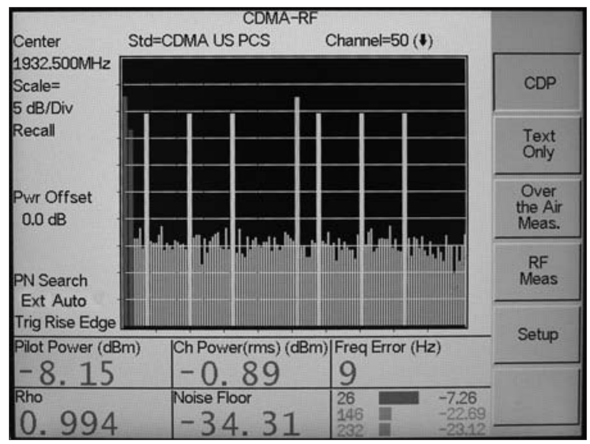

Figure 10. CDMA code domain power display of 128 Walsh codes.

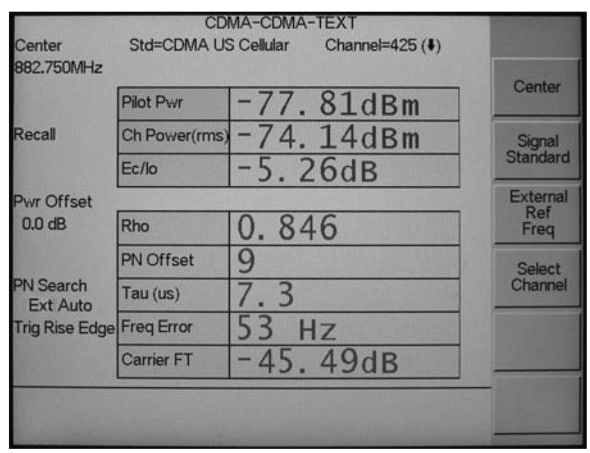

Figure 11. CDMA text only.

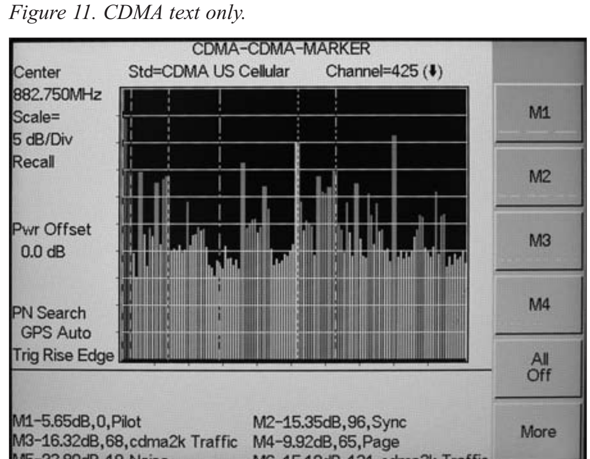

Figure 12. CDMA display with markers.

Over The Air Test

To monitor BTS performance using the OTA test, follow the OTA measurements setup:

1. Press the Cell Master's MODE key, use the Up/Down arrow key to select the CDMA mode and press ENTER.
2. Select the Signal Standard soft key and press the Select Standard soft key. Use the soft keys or the Up/Down arrow key to highlight the appropriate standard, such as CDMA US PCS, and press ENTER.
3. Press the Select Channel soft key and use the Up/Down arrow key or the numeric keypad to enter the appropriate channel, such as 50, and press ENTER.

Cell Master features a built-in GPS receiver that increases technician productivity by providing coordinated universal time (UTC) time and location (latitude, longitude and altitude) information. Timing information is crucial in order for Cell Master to accurately determine PN Offset and timing errors. In CDMA mode, the GPS clock can be used to make OTA measurements. Cell Master's GPS option is offered with a magnet mount antenna with a 15 foot (~ 5m) cable to mount on the car or other useful surface.

To set up the GPS feature:

1. Connect an Anritsu GPS antenna to the Cell Master GPS Antenna connector.
2. Press the SYS key to open the system menu.
3. Press the GPS soft key to open the GPS menu.
4. Press the GPS On/Off soft key to activate the GPS feature.
5. Press the Quality soft key to display the number of tracked satellites. When at least three satellites are being tracked, the GPS icon will change. Be sure to press the Reset soft key when activating the GPS for the first time.
6. Press the MEAS/DISP key to open the CDMA measurements and setup menu.
7. Press the Setup soft key, select PN Search and press the GPS Auto soft key. Note that if the GPS satellites are not being tracked, then GPS cannot be activated in CDMA mode.
8. Press Back to return to the previous menu.
9. Press the Walsh Codes soft key and choose 64 or 128 codes. Signals encoded with Walsh 64 will be displayed as a double bar when the unit is in 128 code mode.
10. Press Back to return to the measurement menu.
11. Press the Over The Air Meas. soft key and Pilot Scan soft keys to display the Pilot Scan readings (Figure 13).
12. Press Multipath soft key to display Multipath readings (Figure 14).

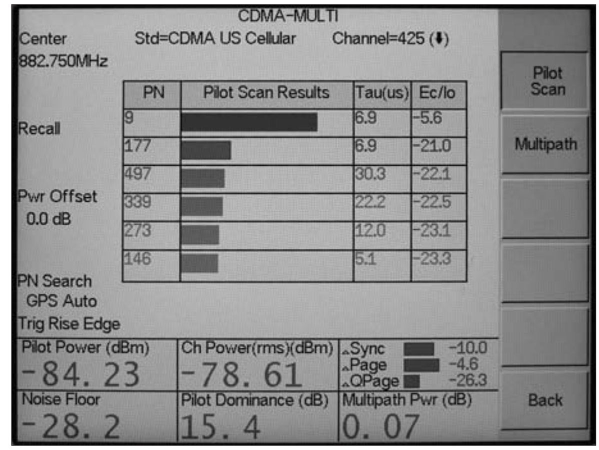

Figure 13. CDMA Pilot Scan display..

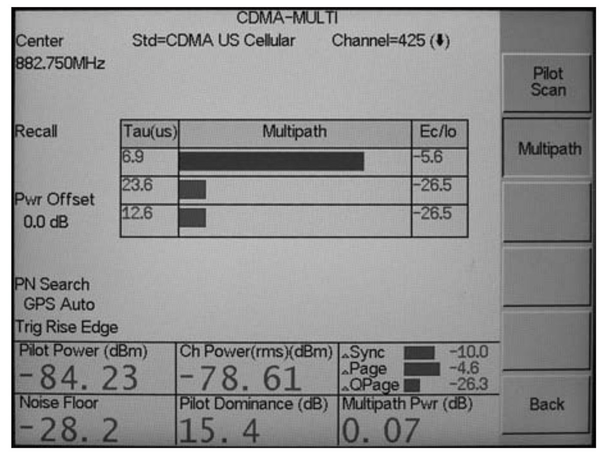

Figure 14. CDMA Multipath display.

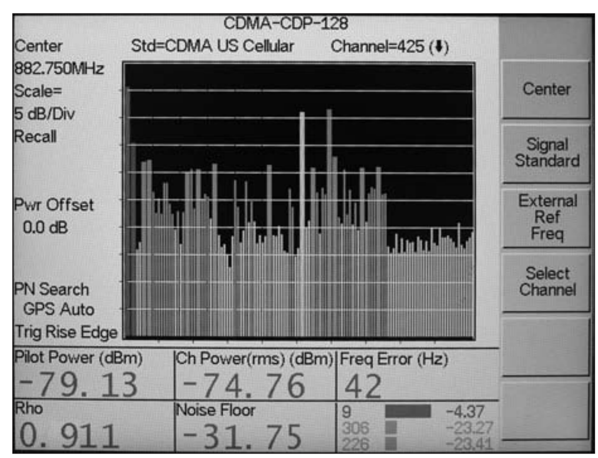

Figure 15. CDMA Code Domain Power (CDP) display.

Conclusion

Anritsu's Cell Master MT8212B provides CDMA-based measurement capabilities that provide field technicians with a quick, efficient and cost-effective means of maintaining and troubleshooting BTS performance. Its support for RF measurements, demodulation and OTA measurements in cdmaOne and CDMA2000 1xRTT wireless networks are essential to field technicians who want to zero in on problems, while minimizing service disruptions and time spent off line.

ANRITSU Corporation
5-1-1 Onna, Atsugi-shi, Kanagawa, 243-8555 Japan
Phone: +81-46-223-1111
Fax: +81-46-296-1264

- U.S.A.
ANRITSU Company
1155 East Collins Boulevard, Suite 100,
Richardson, Texas 75081
Toll Free: 1-800-ANRITSU (267-4878)
Phone: +1-972-644-1777
Fax: +1-972-671-1877

- Canada
ANRITSU Electronics Ltd.
700 Silver Seven Road, Suite 120, Kanata,
Ontario K2V 1C3, Canada
Phone: +1-613-591-2003
Fax: +1-613-591-1006

- Brazil
ANRITSU Electrônica Ltda.
Praca Amadeu Amaral, 27-1 andar
01327-010 - Paraiso, São Paulo, Brazil
Phone: +55-11-3283-2511
Fax: +55-11-3886940

- U.K.
ANRITSU EMEA Ltd.
200 Capability Green, Luton, Bedfordshire LU1 3LU, U.K.
Phone: +44-1582-433280
Fax: +44-1582-731303

- France
ANRITSU S.A.
9, Avenue du Québec Z.A. de Courtaboeuf
91951 Les Ulis Cedex, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

- Germany
ANRITSU GmbH
Nemetschek Haus, Konrad-Zuse-Platz 1
81829 München, Germany
Phone: +49 (0) 89 442308-0
Fax: +49 (0) 89 442308-55

- Italy
ANRITSU S.p.A.
Via Elio Vittorini, 129, 00144 Roma, Italy
Phone: +39-06-509-9711
Fax: +39-06-502-2425

- Sweden
ANRITSU AB
Borgafjordsgatan 13, 164 40 Kista, Sweden
Phone: +46-8-534-707-00
Fax: +46-8-534-707-30

- Finland
ANRITSU AB
Teknobulevardi 3-5, FI-01530 Vantaa, Finland
Phone: +358-20-741-8100
Fax: +358-20-741-8111

- Denmark
ANRITSU A/S
Kirkebjerg Allé 90 DK-2605 Brondby, Denmark
Phone: +45-72112200
Fax: +45-72112210

- Spain
Anritsu EMEA Ltd.
Oficina de Representación en España
Edificio Veganova
Avda de la Vega, nº 1 (edf 8, pl1, of 8)
28108 ALCOBENDAS - Madrid, Spain
Phone: +34-914905761
Fax: +34-914905762

- United Arab Emirates
ANRITSU EMEA Ltd.
Dubai Liaison Office
P O Box 500413 - Dubai Internet City
Al Thuraya Building, Tower 1, Suit 701, 7th Floor
Dubai, United Arab Emirates
Phone: +971-4-3670352
Fax: +971-4-3688460

- Singapore
ANRITSU Pte. Ltd.
10, Hoe Chiang Road #07-01/02, Keppel Towers,
Singapore 089315
Phone: +65-6282-2400
Fax: +65-6282-2533

- P. R. China (Hong Kong)
ANRITSU Company Ltd.
Suite 923, 9/F., Chinachem Golden Plaza, 77 Mody Road,
Tsimshatsui East, Kowloon, Hong Kong, P.R. China
Phone: +852-2301-4980
Fax: +852-2301-3545

- P. R. China (Beijing)
ANRITSU Company Ltd.
Beijing Representative Office
Room 1515, Beijing Fortune Building,
No. 5 , Dong-San-Huan Bei Road,
Chao-Yang District, Beijing 100004, P.R. China
Phone: +86-10-6590-9230
Fax: +82-10-6590-9235

- Korea
ANRITSU Corporation, Ltd.
8F Hyunjuk Bldg. 832-41, Yeoksam-Dong,
Kangnam-ku, Seoul, 135-080, Korea
Phone: +82-2-553-6603
Fax: +82-2-553-6604

- Australia
ANRITSU Pty Ltd.
Unit 21/270 Ferntree Gully Road, Notting Hill
Victoria, 3168, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

- Taiwan
ANRITSU Company Inc.
7F, No. 316, Sec. 1, Neihu Rd., Taipei 114, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817

- India
ANRITSU Corporation
ANRITSU Pte. Ltd.
Unit No.S-3, Second Floor, Esteem Red Cross Bhavan,
No.26, Race Course Road, Bangalore 560 001 India
Phone: +91-80-32944707
Fax: +91-80-22356648

Application Note No. 11410-00377 Rev. A Printed in United States 2007-02