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Broadband Optical Transport Microcell Connection Service - Interface and Performance Specifications

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1. INTRODUCTION

1.1. General

This document describes the network interface and service performance specifications for Microcell Connection Service. This service is intended to provide broadband transport over fiber optic media of signals within the radio frequency spectrum used for cellular mobile telephone service in the United States.

1.2. Purpose

The purpose of this document is to provide customers, service providers and equipment manufacturers with the performance specifications and interface requirements associated with Microcell Connection Service.

1.3. Revisions

When revisions to this document are issued, this paragraph will provide a summary of the reasons for the revisions.

2. SERVICE DESCRIPTION

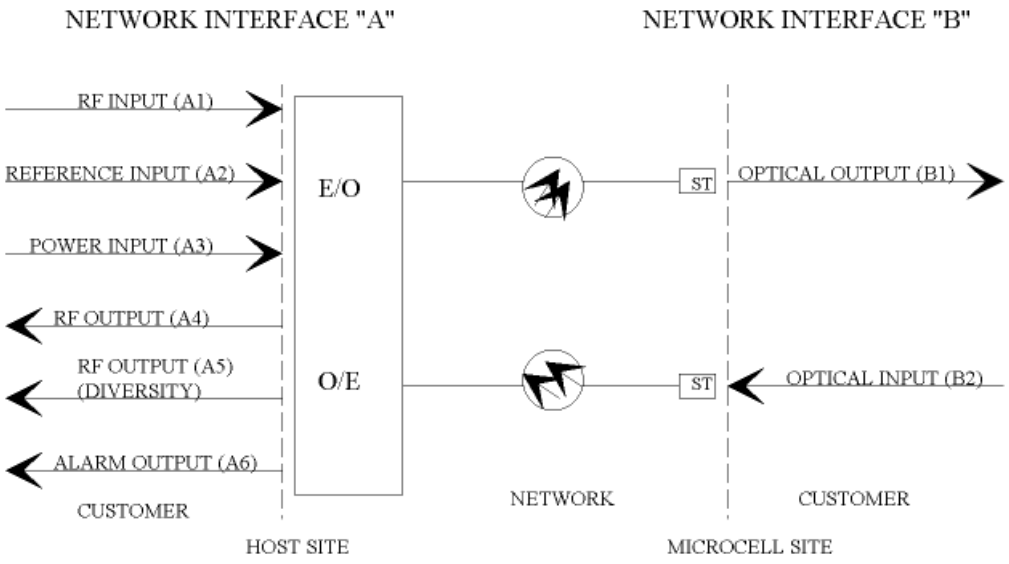
2.1. Overview

Microcell Connection Service provides for the bidirectional transport of signals within the radio frequency spectrum bandwidth of 824 MHz assigned to cellular mobile telephone services in the United States. This service would typically be employed for transport of cellular service signals between a cellular mobile carrier's radio frequency (RF) transceiver location ("microcell site") and another location ("host site") for RF signal processing. A provision is also made for the transport of cell site diversity radio receiver translated and presented in the radio frequency spectrum bandwidth between 702 MHz and 727 MHz.

2.2. Architecture

Cellular RF bandwidth signals carried by a Microcell Connection Service channel will be transported between sites over single-mode fiber optic transmission media. Interfaces to Microcell Connection Service channels are portrayed in Figure 1. The Microcell Connection Service channel interface specifications pertain to two interfaces: one electrical interface designated Network Interface "A" in Figure 1 and one optical interface designated Network Interface "B" in Figure 1.

Figure 1. MICROCELL CONNECTION SERVICE NETWORK INTERFACE DEFINITION



The broadband RF electrical signals presented as an input to the Microcell Connection Service channel at Network Interface “A” are converted to an optical signal via an intensity modulation process. The optical signal presented to the Microcell Connection Service channel at Network Interface “B” is converted to broadband RF electrical signals via a direct photo-detection de-modulation process.

The transport distance for Microcell Connection Service between Network Interface “A” and Network Interface “B” is limited by the insertion loss of the optical fiber to be less than 10 dB as measured at an optical wavelength of 1310 nanometers.

Powering for the Microcell Connection Service network equipment located at the host site will be provided by the customer according to the requirements specified in Section 3.1 for Network Interface “A”. No power interface requirements exist for Network Interface “B” at the microcell site.

Alarm outputs are presented to the customer across Network Interface “A” at the host site as specified in Section 3.1. These alarms are for the purpose of indicating a failure or degraded signal condition associated with the received optical signal or the optical demodulator. These alarms are not monitored from the network - therefore it is the responsibility of the customer to notify Ameritech when maintenance action is required. No alarm output interface requirements exist for Network Interface “B” at the microcell site.

3. INTERFACE SPECIFICATIONS

3.1. Network Interface "A"

Network Interface "A", located at the Microcell Connection Service host site, consists of six sub-interfaces (A1 through A6) as indicated in Figure 1. Three sub-interfaces (A1 through A3) are inputs to the Microcell Connection Service channel. Three sub-interfaces (A4 through A6) are outputs from the Microcell Connection Service channel.

3.1.1. Physical

This interface employs five connectors of two different types. All network equipment connectors are female.

RF Input (A1), Reference Input (A2), RF Output (A4) and RF Output (Diversity) (A5) utilize individual AT&T 50-ohm impedance coaxial connectors, Code KS-22694, L10 or equivalent.

Power Input (A3) and Alarm Output (A6) utilize a multipin AT&T FASTECH(TM) connector, Code 963CM-152 or equivalent. Pin assignments are provided in Table 1.

Table 1.

Pin	Power or Alarm Signal
022	UNLOCK ALARM (Local Oscillator Out-Of-Lock Condition)
023	AVOP ALARM (Low Average Received Optical Power)
024	LASER ALARM (Failure in Laser Diode Circuit)
051 - 056	+ 24 Volts DC
218 - 224	Ground
232 - 250	Ground
251 - 256	+ 24 Volts Return

3.1.2. Electrical

Broadband RF electrical signals are presented by the customer as an input to the Microcell Connection Service channel via the RF Input (A1) and Reference Input (A2) sub-interfaces as

shown in Figure 1. Electrical signal specifications for these sub-interfaces are defined in Table 2 and Table 3, respectively.

Table 2.

RF INPUT (A1) ELECTRICAL SPECIFICATIONS:
Impedance: 50 ohms Nominal
Bandwidth: 869 to 894 MHz
Maximum Signal Level: - 34 dBm

Table 3.

REFERENCE INPUT (A2) ELECTRICAL SPECIFICATIONS:
Impedance: 50 ohms Nominal
Bandwidth: 15 MHz
Maximum Signal Level: 0 dBm

Broadband RF electrical signals are presented to the customer as an output from the Microcell Connection Service channel via the RF Output (A4) and RF Output (Diversity) (A5) sub-interfaces as shown in Figure 1. Electrical signal specifications for these sub-interfaces are defined in Table 4 and Table 5, respectively.

The RF Output (Diversity) signal is provided as an optional one-way microcell site to host site transport channel intended to be used when a diversity receive option is equipped at the cellular mobile carrier's microcell terminal equipment. Use of this channel is dependent upon the RF diversity channel modulation option being presented by the cellular mobile carrier's equipment to the Optical Input (B2) sub-interface as discussed in Section 3.2.3.

Table 4.

RF OUTPUT (A4) ELECTRICAL SPECIFICATIONS:
Impedance: 50 ohms Nominal
Bandwidth: 824 to 849 MHz
Maximum Signal Level: + 2 dBm

Maximum current at +24 volts DC on the Power Input sub-interface (A3) is 1.7 amperes. the peak-to-peak ripple voltage present on the +24 VDC Power Input sub-interface (A3) as supplied by the customer shall not exceed 250 millivolts.

Alarm Outputs (A6) are operated at standard TTL logic levels (5 volts ± 10 %). Alarms are indicated by providing a low resistance to ground. Customer supplied voltages used to sense alarms must be biased positive with respect to ground. (TTL Lo = 0 to 0.8 volts, TTL Hi = 2.0 to 5.0 volts) Maximum current supplied by the customer will not be greater than 16 milliamperes.

3.2. Network Interface "B"

Network Interface "B", located at the Microcell Connection Service microcell site, consists of two sub-interfaces (B1 and B2) as indicated in Figure 1. The Optical Output (B1) sub-interface is an output from the Microcell Connection Service channel. The Optical Input (B2) sub-interface is an input to the Microcell Connection Service channel.

3.2.1. Physical

This interface employs two connectors of the same type. Both network equipment connectors are male.

Optical Output (B1) and Optical Input (B2) utilize ST-type (ST-SUPER PC or equivalent) optical connectors for single-mode fiber optic cables. Each intermated pair of ST-type connectors used for Network Interface "B" connections shall have a maximum back reflectance specification of -40 dB or lower as measured according to the Reference in Section 6.

3.2.2. Optical

An optical signal is presented to the customer as an output from the Microcell Connection Service channel via the Optical Output (B1) sub-interface as shown in Figure 1. Optical signal specifications for this sub-interface are defined in Table 5.

Table 5.

OPTICAL OUTPUT (B1) OPTICAL SPECIFICATIONS:
Optical Wavelength: 1310 ± 20 nanometers
Fiber: Signal Mode 8.3 micron diameter core nominal Zero dispersion point: 1300 to 1320 nanometers
Maximum Signal Level: +5 dBm average

An optical signal is presented by the customer as an input to the Microcell Connection Service channel via the Optical Input (B2) sub-interface as shown in Figure 1. Optical signal specifications for this sub-interface are defined in Table 6.

Table 6.

OPTICAL INPUT (B2) OPTICAL SPECIFICATIONS:
Optical Wavelength: 1310 ± 20 nanometers
Fiber: Single Mode 8.3 micron diameter core nominal Zero dispersion point: 1300 to 1320 nanometers
Maximum Signal Level: +6 dBm average

3.2.3. Modulation

The broadband (869 - 894 MHz) RF signal presented by the customer as an input to the Microcell Connection Service at the RF Input (A1) and a 30 MHz reference signal derived from the Reference Input (A2) signal are combined to form the modulated signal delivered after optical transport as the content of the Optical Output (B1) signal delivered at Network Interface “B”. The modulation process used is direct intensity modulation of the optical carrier.

The optical signal presented at Network interface “B” by the customer as an input to the Microcell Connection Service at the Optical Input (B2) is demodulated after optical transport to form the broadband (824 - 849 MHz) RF signal(s) delivered as RF Output (A4) and RF Output (Diversity) (A5) at Network Interface “A”.

A signal detected in the demodulated range from 824 to 849 MHz is delivered as the RF Output (A4) signal at Network Interface “A”. A signal detected in the demodulated range from 702 to 727 MHz, if present, is frequency translated to an 824 to 849 MHz signal and delivered as RF Output (Diversity) (A5). A 30 MHz reference signal shall also be contained in the modulated Optical Input (B2) signal presented by the customer at Network Interface “B”. The demodulation process used is direct photo-detection of the received optical carrier.

Optical Input (B2) sub-interface signal modulation requirements are specified in Table 7.

Table 7.

OPTICAL INPUT (B2) MODULATION SPECIFICATIONS:
RF Receive Subcarrier: 824 to 849 MHz
RF Diversity Receive Subcarrier: 702 to 727 MHz
Reference Frequency: 30 MHz, 0 dBm

4. ENVIRONMENTAL REQUIREMENTS

4.1. Space

Space to house network equipment provided at Network Interface "A" host site locations must be provided by the customer. The space requirements are specified in Table 8.

Table 8.

HOST SITE SPACE REQUIREMENTS:
Height: 7.67 inches
Width: 2.94 inches
Depth: 14.31 inches

4.2. Temperature

The temperature of the network equipment located at Microcell Connection Service host sites must be maintained within the limits specified in Table 9.

Table 9.

HOST SITE TEMPERATURE REQUIREMENTS:
Long Term: +10 to +35 °C
Short Term (72 hours, 15 days annual manimum): +2 to +49 °C

4.3. Humidity

The humidity of the network equipment located at Microcell Connection Service host sites must be maintained within the limits specified in Table 10.

Table 10.

HOST SITE HUMIDITY REQUIREMENTS;
Long Term: 20 to 60 percent
Short Term (72 hours, 15 days annual maximum): 0 to 90 percent

5. SERVICE PERFORMANCE SPECIFICATIONS

5.1. Attenuation Distortion

Attenuation distortion shall not exceed ± 1.0 dB between 824 and 894 MHz.

5.2. Noise Contribution

The noise contributed by the network may be represented as a noise source, having a Power Spectral Density of -110 dBc/Hz, injected at the RF Input Interfaces of the Microcell Connection Service.

5.3. Intermodulation Distortion

Third order intermodulation distortion products will be limited and be at least 95 dB below the composite signal as measured by a traditional two-tone method.

6. REFERENCE

TR-NWT-000326 “Generic Requirements for Optical Fiber Connectors and Connectorized Jumper Cables” Issue 2, March 1991.

Any questions regarding this document, please contact the APEx Help Desk at 847-248-4328.