1. GENERAL INFORMATION

The CDMA Channelized Repeater is used to extend coverage of a base station. The repeater is well suited for providing RF coverage into shopping centers, convention centers, tunnels, office buildings, and other areas where the signal blockage does not allow direct coveage from the base station

The repeater is designed for ANSI J-STD-008 titled "Personal Station Base Station Compatibility Requirements for 1.8 to 2.0 Ghz Code Division Multiple Access (CDMA) Personal Communications Systems (PCS)." Operations, Administration and Maintenacne (OA&M) functionality of the equipment provides the system operator with remote alarms and control of the repeater. The repeater will use the same standard protocol to remote this functionality to a host computer or the the operators OMC as the rest of Ortel's family of repeaters. The system will provide over 10,000 user defined address to allow over 10,000 repeaters in the operators system. Local technician access is provided through a RS232 port on the equipment. Remote access is provided through a RS232 modem via a CDMA subscriber unit mounted in the repeater. Two levels of security are provided to prevent unauthorized access to the unit.

An aluminum case houses the repeater. Cooling fins for the amplifiers are located on the rear of the unit. The choice of aluminum as the case material gives a lightweight design with good heat conduction and weatherproof protection. The housing conforms to IP65 standards.

Both transmit and receive 7/16" antenna connections are located on the underside of the repeater. The external connections on the bottom are protected from unauthorized access with a cover which can be opened only from the inside of the repeater.

The repeater is avaliable on any bands A-F and can be programmed to operate on any frequency in the assigned band.

MirrorCell CDMA Model Numbers and Frequencies

MirrorCell Model Numbers				
Model #	Part #	Version	Uplink	Downlink
CDR1901-1-A		1 Ch. A-Band	1850 -1865 MHz	1930 - 1945 MHz
CDR1901-1-B		1 Ch. B-Band	1870 - 1885 MHz	1950 - 1965 MHz
CDR1901-1-C		1 Ch. C-Band	1895 - 1910 MHz	1975 - 1990 MHz
CDR1901-1-D		1 Ch. D-Band	1865 -1870 MHz	1945 - 1950 MHz
CDR1901-1-E		1 Ch. E-Band	1885 - 1890 MHz	1965 - 1970 MHz
CDR1901-1-F		1 Ch. F-Band	1890 - 1895 MHz	1970 - 1975 MHz

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2. COMPONENTS OF THE CSR 1902 REPEATER

1 DC/DC Power Supply
2 AC/DC Power Supply
3 Downlink LNA
4 Chan. Module Uplink
5 Chan. Module Downlink
6 Status & Control Module
7 Uplink LNA
8 Donor Duplex Filter
9 Server Duplex Filter
10 Power Amp. -Uplink
11 Power Amp. -Downlink

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3. DESCRIPTION OF THE MODULAR COMPONENTS

3.1 Channel Modules

Each channel module consists of a preamplifier, a baseband downconverter with SAW filters, a baseband upconverter, and a post amplifier. The module includes power level control functionality.

3.2 Power Amplifiers

The power amplifiers are designed for an output power of 2.5 watts, which when passed through the duplexer modules provides 2 watts of power at the antenna ports. The power amplifiers are designed to meet ANSI J-STD-008 CDMA Spectral Regrowth requirments and FCC intermodulation and spurious requirments

3.3 Power Supply Module

The power supply is designed for an input voltage range of 90-130VAC. In addition, the AC input is equipped with a surge suppression filter.

3.4 Duplex Filter

The transmit and receive antennas are combined with duplex filters operating in the PCS frequency band. The filters consist of comb line cavity bandpass filters which provide excellent isolation against out-of-band signals.

3.5 Status and Control Module

The monitor and control of the repeater is enabled by use of a status and control module. This module determines the status of all channel modules and identifies all failure conditions. When an alarm occurs, the status and control module can send a message by dialing out using a mobile handset or to a PC over a serial data link. The PC connection is over a serial port through an RS232 interface to a VT-100 terminal. The status and control module sends and receives channel and amplification data on the addressed channel modules.

3.6 LNA Module

The LNA module consists of a low-noise amplifier. The module provides the initial gain for a good noise figure.

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4. RF and ELECTRICAL SPECIFICATIONS

	UPLINK	DOWNLINK
Frequency	See Tables 7.1-7.3	See Tables 7.1-7.3
Channel bandwidth	1250 kHz	1250 kHz
Output Power limit	2 Watts Composite	2 Watts Composite
Noise Figure at max gain Noise Figure at min gain	≤8 dB ≤8 dB	≤8 dB N/A
Gain at Max setting	85 dB nominal	85 dB nominal
Spurious @ Max Gain	<-45 dBc @ +/- 885 KHz <-13 dBm@ +/- 1.25mhz <-13 dBm Out of Band	<-45 dBc@ +/- 885 KHz <-13dBm@ +/- 1.25Mhz <-13 dBm Out of Band
Spurious @ Min Gain	<-13 dBm Out of Band	<-45 dBc@ +/- 885 KHz <-13dBm@ +/- 1.25Mhz <-13 dBm Out of Band
Return Loss (Donor and Server ports)	>14 dB	>14 dB
Signal Delay	11 usec Typ	11 usec Typ
Connectors	7/16 Female	7/16 Female
Adaptor optional	7/16 to N-Fem. Opt	7/16 to N-Fem. Opt
Impedance	50 ohm	50 ohm
Flatness over 200 KHz	1 dB	1 dB
Gain change over channel range	+/- 1 dB	+/- 1 dB
Variation of gain over temperature	+/- 3 dB	+/- 3 dB
Gain Steps	2 dB +/- 0.5	2 dB +/- 0.5

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5.0 MECHANICAL and ELECTRICAL SPECIFICATIONS

MECHANICAL SPECIFICATIONS	
Housing (W x H x D)	12 x 17.9 x 9.5 inches
Housing, with metal cover and anchorable feet	15.2 x 19.9 x 11.8 inches
Weight	44 +/- 2 pounds, completely loaded
Housing Material	aluminum
Connection Panel	protected against unauthorized access
Primary AC pwer	90 - 130 VAC, 50-60 Hz
Optional Battery Back UP	24 VDC input
Color	grey (painted)
Cooling	external convection; no ventilation slots

6.0 ENVIRONMENTAL SPECIFICATIONS

ENVIRONMENTAL SPECIFICATIONS	
EMI	Meets specifications for influx of an electromagnetic field of 10V/m between 100 kHz-1 GHz, excluding band of operation.
Operating Temperature	-25 to 50 C, conforms to Bellcore specification GR-487-CORE
Storage Temperature	-30 to 75 C
Weather Resistance	NEMA 4 rated
Shipping	Conforms to Bellcore specification GR-63-CORE

7.0 OTHER SPECIFICATIONS

OTHER SPECIFICATIONS	
Aprroval US	FCC, UL
Aprroval Canadian	DOC, CES
Lifetime	MTBF > 50,000 h

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8.0 CHANNEL AND FREQUENCY PLAN

8.1 FREQUENCY BLOCKS

Block Designator	Reverse Frequency	Foward Frequency
A	1850 - 1865 Mhz	1930 - 1945 Mhz
B	1870 - 1885 Mhz	1950 - 1965 Mhz
C	1985 - 1910 Mhz	1975 - 1990 Mhz

8.2 CHANNEL PLAN

	CDMA Channel Nubmer	Center Frequency of CDMA Channel in Mhz
Reverse Channels	0< N < 1199	1850.000 +0.050 N
Foward Channels	0< N < 1199	1930.000 +0.050 N

8.3 PREFERRED SET CHANNEL NUMBERS - A BAND

CHANNEL	FORWARD (MHz)	REVERSE (MHz)
25	1931.25	1851.25
50	1932.50	1852.50
75	1933.75	1853.75
100	1935.00	1855.00
125	1936.25	1856.25
150	1937.50	1857.50
175	1938.75	1858.75
200	1940.00	1860.00
225	1941.25	1861.25
250	1942.50	1862.50
275	1943.75	1863.75

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8.4 PREFERRED SET CHANNEL NUMBERS - B BAND

CHANNEL	FORWARD (MHz)	REVERSE (MHz)
425	1951.25	1871.25
450	1952.50	1872.50
475	1953.75	1873.75
500	1955.00	1875.00
525	1956.25	1876.25
550	1957.50	1877.50
575	1958.75	1878.75
600	1960.00	1880.00
625	1961.25	1881.25
650	1962.50	1882.50
675	1963.75	1883.75

8.5 PREFERRED SET CHANNEL NUMBERS - C BAND

CHANNEL	FORWARD (MHz)	REVERSE (MHz)
925	1976.25	1896.25
950	1977.50	1897.50
975	1978.75	1898.75
1000	1980.00	1900.00
1025	1981.25	1901.25
1050	1982.50	1902.50
1075	1983.75	1903.75
1100	1985.00	1905.00
1125	1986.25	1906.25
1150	1987.50	1907.50
1175	1988.75	1908.75

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9. ATTENUATION CONTROL OF THE AMPLIFIER

Nominal Gain Setting (dB)	Attenuation
85	0
83	2
81	4
79	6
77	8
75	10
73	12
71	14
69	16
67	18
65	20
63	22
61	24
59	26
57	28
55	30

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10. DESCRIPTION OF THE CONTROL MODULE

10.1 General

The repeater is equipped with a control module. This module allows the monitoring and control of various parameters such as channel number, attenuation, temperature, status of door, etc., either with a local terminal or via OMC. The communication interface between the local terminal and the control module is set up as a self-explanatory menu for simple manual control and monitoring. This way, the parameters can be easily read off and set up from the display. See table 11.10 and 11.11 for complete details of parameters.

10.2 Settings

The physical interface to the control module consists of a VT-100 terminal, connected via RS-232 cable with a male DB9 connector on the repeater end.

Communication format: 9600 baud, 8bit, 1 stop bit, no parity, no flow control

10.3 Login via Local Maintenance Terminal (LMT)

When the PC is connected, the login sequence is activated by user-input keystrokes.

WARNING: Login activation may take several seconds if the control module is busy with a transmission, reception, or interrogation of new short messaging service information.

The login sequence begins by asking for username and password. Different user accounts may have different authorities. The default login parameters are:

Username	Password	Authority
USERNAM1	PASSWRD1	read/write
USERNAM2	PASSWRD2	read/write
USERNAM3	PASSWRD3	read only
USERNAM4	PASSWRD4	read only

WARNING! The username and password should be changed during installation. See section 10.10.3.

The allowable number of failed login attempts is logged by the control module. If this count exceeds the user defined maximum (default = 8), then future login attempts are no longer allowed. The false login count value is decremented by one every hour. This means that it takes one hour after reaching the maximum number of failed login attempts, before a successful login can be initiated.

10.4 Commands

The control module does not differentiate between upper- and lower case characters.

Available commands:

ADDRESS gives information about the current address configuration
CLEAR clears the display
CLOCK displays a real-time clock
DISABLE SMS turns off the SMS section
ENABLE SMS turns on the SMS section
HELP displays a quick overview of commands
LOG shows the alarm log
LOGOUT ends the work session
SEND sends an SMS message to a selectable recipient
STATUS displays the RF parameters (channel number, attenuation, etc.), as well as peripheral parameters (current draw, status of cover)
SYSTEM shows system data (numbers of received/transmitted messages)
SILENT OFF/ON silent on: no SMS messages displayed on the LMT
silent off: displays which messages have been transmitted and received
SET,GET These commands allow the monitor and control of the repeater parameters.

WARNING: The command fields must be completely used, otherwise an error results.

SET example:
SET CHA 1 800 02 16
sets channel number 1 to channel 800, and sets the attenuation to 2dB in the uplink and 16dB in the downlink.

GET example:
GET LVL yields the following display:

GET LVL:
1 30 33 2 33 33 3 00 00 4 00 00
This means that the output power is 30dBm in the channel 1 uplink and 33dBm in the channel 1 downlink, etc.

Two parameters are only writable, not readable; these are "user name" and "password" (see Table 9.10.3).

9.5 Command log

A command log, kept in the control module, stores the last ten commands that have been entered. Use the up and down arrow keys to read off these stored commands. The right and left arrow keys may then be used, along with the backspace and clear buttons, to edit the command.

9.6 Quick commands

Four quick commands are available with the function keys:

F1: help menu
F2: shows a list with the last ten entered commands
F3: status data
F4: performance data.

9.7 Configuring the external alarms

The external alarms can be configured active-low or active-high, so that the alarm is given either in the presence or absence of applied power. For configuration, use the following command:
SET EXT B C
B refers to pin 1 and C to pin 2.
B,C = 0 means that the absence of voltage is ok
B,C = 1 means that the presence of voltage is ok
The alarms are laid out so that pin 1 is read off from DA0, while pin 2 is read from DA1.

9.8 LED indicators

The LEDs on the control module are tri-color, where the illuminated colors have distinct meanings:
Green Repeater is functioning properly
Red Repeater is not functioning properly
Amber User logged in to control module.

WARNING: Depending on alarm configuration, the door alarm may go off some number of seconds after the door has been opened; in this case, the LED will turn red.

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ORTEL CORPORATION Test Data Sheet (TDS)	Effectivity: 10/17/1996	
WRITTEN BY: Brian Daly	UNIT S/N: _____	DATE: _____
MODEL #: CDR-1901-1-A (ONE CHANNEL REPEATER)	FREQUENCY BAND: A	OPERATOR: _____

TEST TITLE	SPECS		MEASURE						UNIT
			CHANNEL #: 25		CHANNEL #: 150		CHANNEL #: 275		
	Max	Min	UPLINK	DOWN-LINK	UPLINK	DOWN-LINK	UPLINK	DOWN-LINK	
FREQUENCY	---	---	1851.25	1931.25	1857.5	1937.5	1863.75	1943.75	MHz
GAIN (0dB ATTEN)	—	85							dB
GAIN (16dB ATTEN)	—	69							dB
GAIN (30dB ATTEN)	—	55							dB
FLATNESS @ 1250 KHz BW	1	---							dBp-p
Sprectral Regroth @ P_{OUT} = 33dBm (F_C + 885KHz)	—	45							dBc
(F_C - 885KHz)	—	45							dBc
(F_C + 1250KHz)	—	13							dBm
(F_C - 1250KHz)	—	13							dBm
Spurtious	—	13							dBm
NOISE FIGURE @ Min Gain	8	—							dB
NOISE FIGURE @ Max Gain	8	—							dB
OUTPUT POWER LIMITING	—	33							dBm

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1 GENERAL INFORMATION (continued)

1.2 Related Submittal/Grant

None

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1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system are:

None

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1.4 Test Methodology

Purpose of Test: To demonstrate compliance with the ANSI C63.4 setup.

Test Performed:

X 1. Conducted Emissions, FCC Part 2, Paragraph 2.991 & Part 24 Paragraph 24.238
2. Radiated Emissions EN55022: 1992 Class B limit, 30 - 1,000 MHz, 10 meters
X 3. Radiated Emission per FCC Part 2, Paragraph 2.993, 1 - 10 GHz
4. Engineering evaluations

Both Conducted and radiated testing were performed according to the procedures in FCC/ANSI C63.4 and CSA 108.8 - M1983. Radiated testing was performed at an antenna-to-EUT distance of 3 meters (1 - 10 GHz).

1.5 Test Facility

The open area test site and conducted measurement data were tested by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 619 546 3999
Fax: 619 546 0364

The Test Site Data and performance comply with ANSI 63.4 and are registered with the FCC, 7435 Oakland Mills Rd, Columbia Maryland 21046. All Measurement Data is acquired according to the content of FCC Measurement Procedure and ANSI C63.4, unless supplemented with additional requirements as noted in the test report.

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1.6 Part 2 Requirements

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FCC Part 2, Para. 2.983(d)(4), Maximum Power Rating

POWER ANALYSIS

MODULES	POWER	QTY	TOTAL POWER
LNA/Splitter	.825 W	2	1.65 W
Channelizer	2.525 W	2	8.2 W
Control Unit	.85 W	1	.85 W
Power AMP DL	52.8 W	1	52.8 W
Power AMP UL	52.8 W	1	52.8 W
DC/DC Converter	40 W	1	40 W
AC Power Supply	6 W	1	6 W
TOTAL POWER			162.3 W

MODULES	VOLTAGES	I_D	POWER	QTY	POWER$_{max}$
LNA/Splitter	+11	75 mA	0.825 W		1.65 W
Channelizer	+11	300 mA	3.3 W		6.6 W
	+5	165 mA	0.325 W		1.6 W
Pwr AMP	+12	4.4 A	52.8 W	1	52.8 W
Control Unit	+24	2 mA	0.04 W		0.04 W
	+11	0.5 mA	0.005 W		0.005 W
	+5	161 mA	0.805 W		0.805 W
DC/DC Converter				1	40 W
AC Power Supply				1	6W
Pwr AMP DL	+12	4.4 A	52.8 W	1	52.8W
			162.3		

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ACTIVE COMPONENTS AND THEIR FUNCTION

FCC Part 2, Para. 2.983 (d)(5), DC Voltages and Currents

1.0 UPLINK POWER AMPLIFIER MODULE:

Purchased part - 12 VDC at 4.4 Amps Max, 2Watts rated power out (CDMA)

2.0 DOWNLINK POWER AMPLIFIER MODULE:

Purchased part - 12 VDC at 4.4 Amps Max, 2Watts rated power out (CDMA)

FCC Part 2, Para. 2.983(d)(6), Function of Active Circuit Device

3.0 CHANNELIZER MODULE:

PART RE	MFG'S PART NUMBER	DESCRIPTION	FUNCTION
U14	MB1501	Synthesizer	Frequencies Comparation for PLL Circuit
U12	LP2951	Voltage Regulator	Regulate +11V to +10V
U26	LM258H	OP-AMP	Non Inverting Amplifier
Q7	BCX71J	Transistor	Switching DC
Q2	BFQ67	Transistor	Oscillator
Q6	BFQ67	Transistor	Frequency Doubler
U13	MGA-82563	MMIC	RF Amplifier
M1, M2	BB134	Varactor Diode	Tunning Frequency (LO)
Q10	BCX70J	Transistor	DC switch
U21	TLC2740	OP Amp	RSSI level amplifier
U23	ERA-5SM	MMIC	RF Amplifier
S4	BFG540	RF Transistor	RF Amplifier
U8, U24	ESMD-C15	Mixer	Mix incoming RF with LO
T5, T17-1	BFS17A	RF Transistor	RF Amplifier
D1,2,3,4	HSMP-3800	Attenuator Diode	RF Attenuator
Q1	BCX70J	Transistor	Oscillator
U4	S87C751-2A28	Microcontroller	Frequency Synthesis
U1	LM324J	OP-AMP	Voltage Follower,comparator
U6,U16,U1	VNA-25	MMIC	RF Amplifier
U10,U25, U	MSA-3111	MMIC	RF Amplifier
U3	74HC04	Inverter	Inverter, Buffer for digital circuit

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FCC Part 2, Para. 2.983(d)(6), Function of Active Circuit Device

U20	RF2604	Attenuator	RSSI
U11	AT-220	Step Attenuator	RF Attenuator

4.0 DISTRIBUTION CARD 1:

PART R	MFG'S PART NUMBER	DESCRIPT	FUNCTION
U2, U4	LM2575T-5	Regulator	DC Regulation
U3	LT1086CT	Regulator	DC Regulation
U1	LM35DM	TEMP Sensor	Monitoring Temperature of The Repeater Base Plate
T1	BCP51	Transistor	DC Switch
T2	BCX701J	Transistor	DC Switch
D1-4	1N5819	Diode	DC Switch

5.0 LNA/Splitter:

PART RE	MFG'S PART NUMBER	DESCRIPTI	FUNCTION
T1, T11,T	BFG540	RF Transistor	RF Amplifier
T2, T12, T	BCX71J	RF Transistor	RF Amplifier
D1, D11,	BAW56	Diode	Provided DC bias stability for RF AMP circuit

6.0 POWER SUPPLY

AC/DC Power Supply: VI-AIM-E1

DC/DC Power Supply: VI-251 & VI-J71

7.0 CONTROL UNIT:

PART R	MFG'S PART NUMBER	DESCRIPT	FUNCTION
U2	74HC05	Inverter	Inverter, Buffer
U13	74HC4051	Decoder	1 of 8

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FCC Part 2, Para. 2.983(d)(6), Function of Active Circuit Device

U14	LM258	OP-AMP	Non-inverting amplifier
U5	XC7236A	Logic	Provided logic functions independent of microcontroller
U3, U	74HC573	Latch	Isolated local data buses from address buses hi order bits
U11	MAX244	Line Driver	RS232 interface
U12	ST16C1451	UART	Sync. & Async. interface between microcontroller & line driver
U4	MC68HC11A1FN	Microcontroller	Control signals flow in and out of control unit
U1	1233Z	Power On Reset	Provided pwr on and interrupt reset to the microcontroller
U10	XL28C16A	EEPROM	Provided nonvolatile data and program memories
U16	PC3D17	Optoisolater	Isolate external lines
U8-9	TMS28F010A-12C4DDL	Flash Memory	Provided data and program memories for microcontroller
U6	LP2951C	Regulator	DC regulation
U17	74HC32	OR Gate	Provided logic OR of the two applied functions
D1-4	BAV99	Diode	Preventing data from going below GND or above Vcc
LED	KBL9-LED	LED	Indicator
T1-2	BCX70J	Transistor	Indicator driver

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FCC Part 2, Para. 2.983(D)(10) and 2.983(d)(11)

FREQUENCY STABILIZATION

Primary frequency stabilization for the PCS 1900 macrocell repeater is provided by a 5 MHz crystal oscillator, consisting of crystal X1, trimming capacitor M1, and series capacitors C20 and C21, transistor Q1. The crystal is trimmed by means of M1 to be within 10 ppm of nominal operating frequency. Frequency drift for crystals under normal operating conditions is very low. The crystal reference is specified to have ±15 ppm accuracy over the temperature range, to remain within the accuracy required.

The local oscillator is derived via frequency synthesis from the crystal oscillator. It uses a ceramic resonator L3 to ensure low harmonics and spurious from the VCO, and the reference spurs are rejected by the lowpass filter/integrator in the loop, consisting of U26A, C100, C102, C99, C98, R64, and R65. The same local oscillator is used for both downconversion and upconversion, making the frequency repeat exactly from input to output and avoiding any frequency drift within the repeater.

The power amplifiers are Class AB, with input filtering and output filtering to assure that noise and spurious are considerably lower than FCC requirements. The input filter is contained in the power amplifier, and the external combline filters perform output filtering.

The power output is limited by controlling the drive to the power amplifier by means of a detector in the output circuit of the power amplifier which is fed back to the channelizer module, where it is compared with a threshold and the power output of the channelizer module adjusted to compensate and limit the power.

Each of the units employing RF is within its own shielded container, and the connections are via semirigid coaxial cable or EMI filtered connectors. The non-RF units use EMI filtered connectors, and all the units are contained within the aluminum outer chassis. The power supply is within its own enclosure within the chassis, and all connections to the outside and to the units are filtered.

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FCC Part 2, Paragraph 2.983(d)(7)
Controller Module
AC/DC Power Supply
DC/DC Power Supply
Schematics
LNA/Splitter DL
LNA/Splitter UL

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