

BR 01 Repeater

Unication Two-Way Radio System



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A SPECIFICATION

A TX01 Transmitter RF specifications								
A1	Power Output	<ol style="list-style-type: none"> VHF / UHF : 10 to 100 watts in steps of 1 watt increments, selectable under CR01 software control. 700/800MHz : 10 to 130 watts in steps of 1 watt increments, selectable under CR01 software control. WLB: 10 to 75 watts in steps of 1 watt increments, selectable under CR01 software control. 						
A2	Power Output accuracy	<ol style="list-style-type: none"> VHF / UHF : 10 to 100 watts : +/- 0.6 dB over temperature, AC & DC input voltage, after PA calibration. 700/800MHz : 10 to 130 watts : +/- 0.6 dB over temperature, AC & DC input voltage, after PA calibration. WLB : 10 to 75 watts : +/- 0.6 dB over temperature, AC & DC input voltage, after PA calibration 						
A3	Power Supply Input	<ol style="list-style-type: none"> Standard : AC Main input option : 85 to 264 VAC, 47 to 63 Hz (no DC input) Option : 85 to 264VAC, 47 to 63Hz plus +/-48VDC automatic switchover backup 						
A4	Frequency bands (electronic bandwidth)	30 to 88 MHz	136 to 174 MHz	400 to 470 MHz	300 to 400 MHz	450 to 520 MHz	762-776, 851-870 MHz	792-806, 806-825 MHz
A5	Channel Switch time	8.75 ms						
A6	TX01 Current Drain	<ol style="list-style-type: none"> Transmit : 10 amp at 48 VDC battery voltage input, at 100 watt TX power, 12VDC regulated 3 amp current limited auxiliary out, Fan running at maximum speed. PA Standby (Idle): 1 amp at 48 VDC battery voltage input, fan is running at low speed. 						
A7	CR01 Current Drain	2 amp at +12VDC.						
A8	Temperature	<ol style="list-style-type: none"> Ambient Operating : -30 to +50°C. Storage Temperature : -45 to +85°C. 						
A9	Transmitter noise at 1 MHz from carrier	<-148 dB / Hz	<-148 dB / Hz	<-142 dB / Hz	<-148 dB / Hz	<-148 dB / Hz	<-148 dB / Hz	<-148 dB / Hz
A10	TX01 Protection	<ol style="list-style-type: none"> Thermal, VSWR, power reduction followed by shut off, reset upon return to normal temperature and VSWR. Power falls back 6 dB on : High Reverse power or PA high temperature CR01 reads the alarms periodically with period less than or equal to 1 second and when the alarms start to get into the warning (yellow) level, the CR01 will start to reduce the PA output power. TX01 has self-protection in case that CR01 communications is lost or cable disconnected In this case TX01 will power off. TX01 will stay in off condition until CR01 communications is restored and instructed to turn on by CR01. TX01 will self-power off when reference signal is lost. TX01 reports immediately to the CR01 with the fan failure in the event that the fan stops working. When alarms approach serious level, such as PA temperature or synthesizer lock problem (i.e.,RED), the TX01 shall automatically cut power to the RF PA via hardware method (self protect). If the PA power has been cut off due alarms or via CR01 command, the TX01 digital interface to CR01 shall continue to be powered up and function so that the CR01 can continue to communicate to the TX01. 						

A TX01 Transmitter RF specifications		
A11	Alarms and information reported to CR01	<ol style="list-style-type: none"> 1. TX01 Temperature (PA, Driver, & PA), ambient temperature on fan controller, heatsink, power supply 2. Forward power after isolator 3. Reverse power after isolator 4. PA DC input voltage & current 5. AC & DC input voltage at TX01 AC & DC terminal 6. Synthesizer (LO & modulator) 7. PA AND Power supply fan speed & rotation 8. PA driver currents 9. AC main failure / running on battery backup 10. Power supply voltage 11. MSN of all boards. 12. PCB revisions stored in EEPROM
A12	Channel Bandwidths	1. 12.5 kHz and 25 kHz. Selected dynamically via software control from the CR01.
A13	Output Impedance	50 Ohms
A14	Reference Oscillator	1. Uses external reference oscillator input from CR01 reference module, 50 ohms, 13MHz
A15	TX Intermodulation Attenuation at antenna connector	<ol style="list-style-type: none"> 1. VHF / UHF / 700/800 : > 55 dBc (includes integrated isolator) 2. WLB : > 40 dBc
A16	Modulation	<ol style="list-style-type: none"> 1. Analog : FM TIA603C 2. Digital : CFSK (DMR, P25 Phase I, etc.).
A17	Modulation limiting	<ol style="list-style-type: none"> 1. +/- 2.5 kHz for 12.5 kHz channel bandwidth 2. +/- 5.0 kHz for 25 kHz channel bandwidth
A18	FM Hum and Noise	<ol style="list-style-type: none"> 1. Better than -40 dB for 12.5kHz channel bandwidth 2. Better than -45 dB for 25kHz channel bandwidth
A19	Integrated Isolator	<ol style="list-style-type: none"> 1. VHF / UHF / 700/800 MHz : 20 dB typical, 18 dB minimum 2. WLB : no isolator
A20	Conducted spurious and harmonic emissions attenuation at antenna connector	<ol style="list-style-type: none"> 1. VHF / UHF / 700/800 : Less than -36dBm for below 1 GHz Less than -30dBm for above 1 GHz 2. WLB : less than -20 dBm
A21	Operating VSWR	The output power shall be reduced gracefully under software control as a function of VSWR when the VSWR is > 3:1. Use the TIA specifications, if applicable, for operation when the VSWR > 3:1.
A22	Audio Response	TIA603C
A23	Audio Distortion	< 2 %

A TX01 Transmitter RF specifications								
A24	Emission Designators	1. Analog Voice Call, 12.5 KHz channel : 11K0F3E 2. Analog Voice Call, 25kHz channel : 16K0F3E 3. Uni2TDMA voice : 7K80 FXE 4. Uni2TDMA data : 7K80 FXD 5. Uni2TDMA voice and data : 7K80 FXW 6. P25 Phase I voice : 8K20 F1E 7. P25 Phase I voice and data : 8K20 F1D						
A25	Vibration	MIL-STD-810E : The device shall be capable of withstanding a 30 to 500 Hz acceleration limited oscillation with 0.25G rms for 40 minutes on vibration table. After test, the unit shall be fully functional with no impairments and shall show no signs of physical degradation including all fastening screws.						
A26	Electrostatic discharge	1. Reference IEC 6100-4-2: +/- 15KV air, +/-8KV contact on all planes applied to any point on the TX01 unit, including all contacts and connectors.						
A27	Altitude	1. 30,000 feet for storage and shipping.						
A28	MTBF	Greater than 45,000 hours (5 years), with following assumptions : 1. 100% transmission duty cycle, 2. 100 watts output, 3. Ambient temperature = +30°C, 4. 0.1G continuous sinusoidal 30 to 500 Hz vibrations						
B CR01 Receiver & Controller RF specifications								
B1	Frequency bands (electronic bandwidth)	30 to 88 MHz	136 to 174 MHz	400 to 470 MHz	300 to 400 MHz	450 to 520 MHz	792-806, 806-825 MHz	762-776, 851-870 MHz
B2	Maximum Received power at receiver port	1. Operates up to : +27 dBm 2. Does not damage receiver for signals up to +30 dBm for 1 minute duration.						
B3	RF Input impedance	50 ohms						
B4	Temperature	1. Ambient Operating : -30 to +50°C. 2. Storage Temperature : -45 to +85°C.						
B5	Channel bandwidths	12.5 kHz and 25 kHz. Selected via PPS software control						
B6	Channel switch time	8.75 ms						
B7	Sensitivity	1. Analog, 12.5 kHz bandwidth, at 12dB Sinad: 122 dBm 2. Analog, 25.0 kHz bandwidth, at 12 dB Sinad: 122 dBm 3. Digital (C4FSK) : < 5% BER at 122 dBm (12.5kHz bandwidth)						
B8	Reference Oscillator	External reference oscillator input from CR01 reference module, 50 ohms, 13MHz, 50 ohms						
B9	Adjacent Channel Selectivity (TIA603C)	1. VHF / UHF : 12.5 kHz : > 55 dB 25.0 kHz : > 80 dB 2. WLB : 25.0 kHz : > 64 dB 3. 700/700MHz : 12.5 kHz : > 55 dB 25.0 kHz : > 80 dB						

B CR01 Receiver & Controller RF specifications								
B10	Conducted Intermodulation (TIA603C)	70 dB	78 dB	75 dB	75 dB	75 dB	75 dB	75 dB
B11	Conducted Spurious Rejection (TIA603C)	70 dB	80 dB	75 dB	75 dB	75 dB	75 dB	75 dB
C CR01 Receiver RF specifications								
C1	Rated Audio (using basic Speaker mic)	0.5 W						
C2	Audio Distortion (using basic Speaker mic) at rated audio	< 2%						
C3	Audio Response	TIA603C						
C4	FM Hum and Noise	12.5 kHz : > 40 dB 25.0 kHz : > 45 dB						
C5	Blocking	100 dB						
C6	Reference Oscillator Module	Frequency	13 MHz, ovenised, low phase noise oscillator					
		Stability over temperature and aging, free-running mode.	1. 1 year aging : +/- 0.1 ppm 2. 10 year aging : +/- 0.5 ppm					
		Stability over temperature and aging, locked mode: locked to GPS or external 1Hz pulse. External pulse is locked to GPS.	1. Over temperature : +/- 0.05 ppm 2. Over temperature and 10 year aging : +/- 0.05 ppm					
D TX01 Unit General Specifications								
D1	Main Function	Modulation of digital signal from CR01 by using exciter and RF power amplification of the transmitted signal to be transmitted into antenna maximum power.						
D2	Key Components inside TX01	<ol style="list-style-type: none"> 1. RF exciter, 2. RF PA, 3. PA controller and alarming monitor, 4. RF power detector, 5. Transmitted signal harmonic filter 6. Power supply 						
D3	Connections to CR01	<ol style="list-style-type: none"> 1. TX Interface cable. 2. TX01 is controlled by CR01, TX01 sends alarms to CR01 for processing via this cable. 3. PS and Fan control cable 4. CR01 controls the TX01 PS. Alarms from TX01 PS and fan sent to CR01 via this cable. 5. 13 MHz Reference oscillator input cable from CR01. 6. 12VDC output cable to supply power the CR01 						
D4	Transmitter Duty Cycle	100%, continuous transmission at full power						
D5	Cooling Method	<p>Integrated variable speed cooling fan on rear face of unit. Fresh air intake is via vent on front face plate, exhaust is via rear of unit.</p> <p>Fans rotation speed is a function of the internal PA temperature. the TX01 power supply reads the PA and power supply temperatures and controls the two fan speeds. The power supply also sends the alarm status if fan is rotating or not to CR01</p>						
D6	RF Isolator	Integrated single stage transmitter Isolator						

D TX01 Unit General Specifications			
D7	Power Supply	<ol style="list-style-type: none"> 1. Standard power supply is 85V to 264 VAC, 47 to 63Hz(no DC input) 2. Optional power supplies are : Option 1 : 120/240 VAC with +/-48 VDC automatic switchover backup during AC mains power loss. Switch over from AC main to battery is automatic and does not interrupt operation during loss of AC main power. 3. Indicator signal when TX01 is operating from battery is sent to CR01 via PS & Fan control cable. 4. 120/240 VAC Main Power Supply option has power factor correction included 5. The DC Battery Power Supply connects to a dedicated or shared external battery system. 	
D8	Front Face	<ol style="list-style-type: none"> 1. Air Intake Vent grill 2. AC Power ON / Battery backup LED 3. Transmit LED 4. Front panel handles 5. Carrying handles on left and right sides 6. Unication logo 	
D9	Rear Face	<ol style="list-style-type: none"> 1. Power Supply Fan exhaust(external mounted for easy replacement) 2. Earth Ground screw. Capable of supporting 6 gauge wire to earth ground copper bar. 3. 120 / 240VAC plug standard plug 4. Battery connectors (+ and -) terminal plug for +48VDC or +/-48VDC option. 5. Power Supply and Fan Control: 6 pos micro-fit connector. 6. Auxiliary 12VDC/3amp power output: 4 pos micro-fit connector. 7. TX Interface: High density DB 25 Shell, 44 pin connector. Connects to CR01 8. RX Out. type N connector Connects to CR01 RX Input for single channel repeater operation. 10. PA fan exhaust. Externally mounted for easy replacement. 11. RF TX Out: Type N. This connector supports two modes of operation: Traditional Repeater Connects to transmitter cavity RF pre-filter and duplexer for traditional dual frequency repeater operation. Unication Proprietary Single Channel Repeater Connects to RF pre-filter and antenna for Unication proprietary single channel repeater operation. 12. Reference Input: 13 MHz reference input from CR01 SMA connector.. 	
E CR01 Unit General Specifications			
E1	CR01 General	Power Supply Input	+12VDC, supplied from TX01 rear panel 12VDC power supply output.
		Current Drain	4 amp at +12VDC battery voltage input
		Temperature	<ol style="list-style-type: none"> 1. Ambient Operating : -30°C to +50°C. 2. Storage Temperature : -45°C to +85°C.

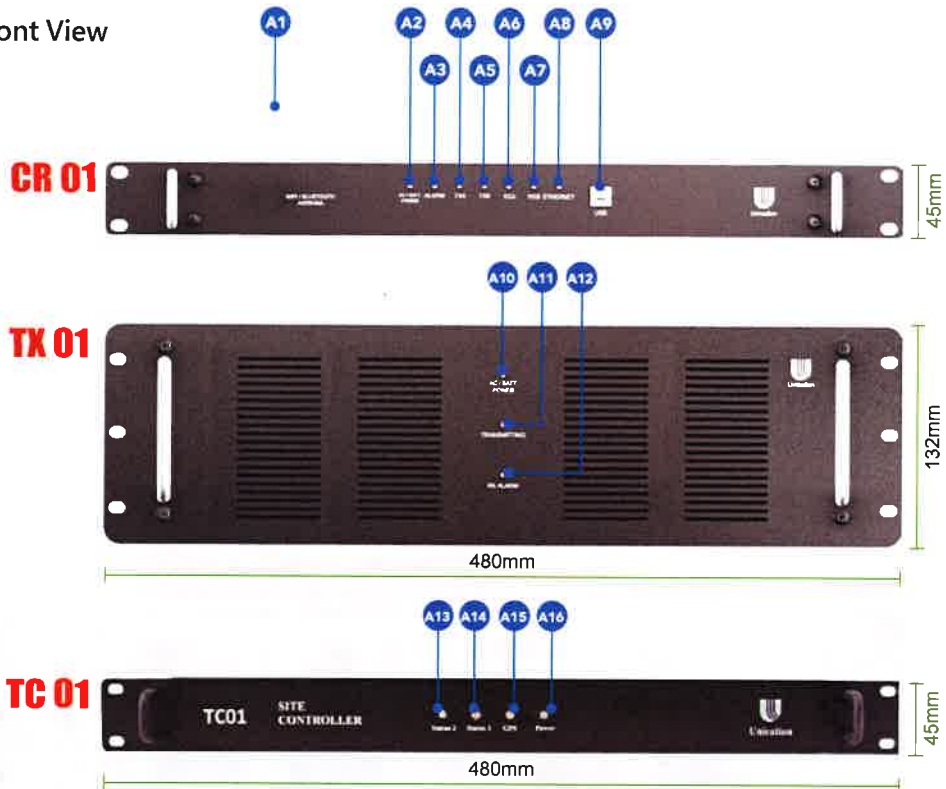
F TC01 Unit Specifications			
E1	TC01 General	Mechanical	Standard 19" wide rack mount, 14' deep, 1U height
		Power Supply Input	1. Dual redundant +10 to +16 VDC, supplied from TX01 rear panel 12VDC power supply output. 2. Nominal 13.4VDC,
		Current Drain	2.0 amp at +12VDC battery voltage input
		Temperature	1. Ambient Operating: -30 to +50°C. 2. Storage Temperature: -45 to +85°C.
		Humidity	Operating units are subjected to 50°C at 95% Non-condensing.
		Vibration	MIL-STD-810E The device shall be capable of withstanding a 30 to 500 Hz acceleration limited oscillation with 0.25G rms for 40 minutes on vibration table. After test, the unit shall be fully functional with no impairments and shall show no signs of physical degradation including all fastening screws.
		Electrostatic discharge	Reference IEC 6100-4-2.: 5KV, 10KV and 15KV on all planes applied to any point on the TC01 unit, including all contacts and connectors.
		Altitude	30,000 feet for storage and shipping.
		MTBF	Greater than 45,000 hours (5 years), with following assumptions: 1. Ambient temperature = +30°C, 2. 0.1G continuous sinusoidal 30 to 500 Hz vibrations
E2	GPS Receiver Specifications	GPS Receiver Antenna port	1. Performance: SIRF or equivalent 2. 50 ohm impedance, 3. Provides DC power to power external GPS antenna LNA: The GPS port shall provide 5VDC +/- 10%, 27mA power for the external GPS LNA. 4. Provide 1 Hz time mark output for reference oscillator and timing synchronization.
E3	Internal Ethernet Switch	Ethernet Switch	<ul style="list-style-type: none"> • Internal Ethernet switch has eight (8) ports, ports A, B, C, D, E, F, G, • Assignment of the above 7 ports is per rear face connector definition below)
E4	Trunking Controller Processor Unit (TCPU) Requirements	Trunking Controller Processor Unit hardware	1. ARM CORTEX A72, 1.5GHz 2. Memory: 4 GByte RAM, 64GByte Non-Volatile SDCARD or equivalent
		Trunking Controller Processor Unit functions	<ol style="list-style-type: none"> 1. Generates LED status on front face of TC01 2. Perform Trunking channel processing according to TIA-102 P25 specifications or Microsite Functions as outlined in functional requirements in section 4 3. TCPU has ability to power cycle the Internal Ethernet Switch via a control line 4. TCPU has ability to enable / disable the internal GPS radio module 5. TCPU watchdog hardware timer pulse signal to the internal power supply. Expiry of this watchdog timer causes the internal power supply to reset the TCPU. 6. TCPU constantly monitors each BR01 and if one unexpectedly fails or is powered down for any reason then the TCPU reassigns the control channel and traffic channels as required in order to keep the site functional

F TC01 Unit Specifications			
E5	Local and Remote Connections	TC01 Local/Remote Connections	<ol style="list-style-type: none"> 1. Remote connection via RJ45 connected to local PC or via dual redundant secure Ethernet links (Microwave/Fibre/VPN) and/or via optional WIFI secure Internet (VPN) 2. Connectivity includes these functions: <ol style="list-style-type: none"> a. Alarming & Status <ol style="list-style-type: none"> i. Retrieves alarms and status from each of the four (4) BR01' s (see CR01 alarms) ii. Reports and displays alarms and status via local PC display or remotely using IP connection, RJ45. iii. Retrieves alarms and status from the TC01 processor. b. Remote software download to TC01 and to each BR01 via dual redundant secure Ethernet links (Microwave/Fibre/VPN). c. Remote configuration (PPS) via dual redundant secure Ethernet links (Microwave/Fibre/VPN). d. Operates the front face status LEDs
E6	Front Face Indicators	LED indicators	<p>There are four front face LED indicators:</p> <ol style="list-style-type: none"> 1. Power <ul style="list-style-type: none"> • States: Green, OFF 2. GPS, 1 Hz time mark pulse <ul style="list-style-type: none"> • States: Flashing Green at 1 Hz when GPS radio is locked, OFF when GPS signal is lost 3. TC01 status #1, Trunking controller Alarm: <ul style="list-style-type: none"> • States: Green = TCPU controller running properly, Red = Alarm (specific TC01 alarm is read on alarm screen) 4. TC01 status #2, BR01 alarm: <ul style="list-style-type: none"> • States: one of the BR01' s is generating alarm (specific alarm is read on the TC01 alarm screen)
E7	Connectors on rear face of TC01 unit	Redundant 13.8 VDC power input #1	<ul style="list-style-type: none"> • 2 pins: + 13.8 VDC and GND input • Source: from BR01 #1 (TX01 13.8VDC output) • 3 pin micro-fit latching connector #1, reverse polarity protection.
		Redundant 13.8 VDC power input #2	<ul style="list-style-type: none"> • 2 pins: + 13.8 VDC and GND input • Source: from BR01 #3 (13.8VDC output) • 3 pin micro-fit latching connector #2, reverse polarity protection • This redundant input is in case of maintenance or failure of BR01 #1 (or vice versa)
		13.8 VDC power output	<ul style="list-style-type: none"> • Power output to the RX LNA/Splitter • 2 Pins: + 13.8 VDC and GND • 4 pin micro-fit latching connector #3, reverse polarity protection
		GPS RF + LNA DC power	<ul style="list-style-type: none"> • Type N connector, • Used to connect to GPS antenna coax cable to roof top GPS pre-filtered active LAN antenna. • Provides 5VDC power output to the GPS LNA
		Ethernet	<p>Standard RJ45 connectors with following eight (8) ports and assignments:</p> <ol style="list-style-type: none"> 1. Port A: Rooter WAN IP 2. Port B: CR01 #1 3. Port C: CR01 #2 4. Port D: CR01 #3 5. Port E: CR01 #4 6. Port F: CR01 #5 7. Port G: CR01 #6

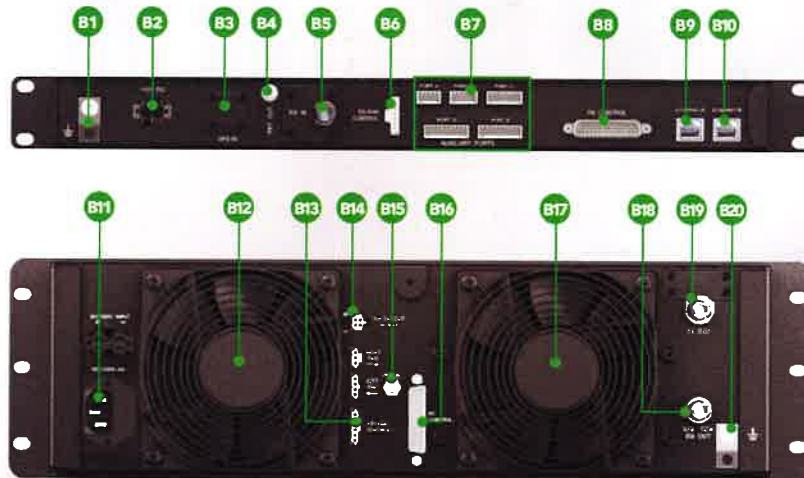
F TC01 Unit Specifications			
E7	Connectors on rear face of TC01 unit	GPS 1 Hz clock	<ul style="list-style-type: none"> • 1 Hz GPS output, 5V TTL, pins, • Connected to BR01 #1, 1 Hz daisy chain input. The 1 Hz daisy chain output is connected to BR01 #2, etc. • 4 pin micro-fit latching connector #4
		General Purpose Input	<ul style="list-style-type: none"> • Quantity four (4) general purpose inputs, • 5V TTL, open collector, • Connected to CPU controller unit, • 16 pin micro-fit latching connector #5: <p>1. Input #1 2. Input #2 3. Input #3 4. Input #4</p>
		General Purpose Output	<ul style="list-style-type: none"> • Quantity four (4) general purpose outputs, • 5V TTL, open collector, • Connected to CPU controller unit, • 16 pin micro-fit latching connector #5: <p>1. Output #1 2. Output #3 3. Output #2 4. Output #4</p>
		I2C	<ul style="list-style-type: none"> • Quantity 2 I2C for general purpose accessories such as radio room and cabinet temperature • Connect to CPU controller unit, • 16 pin micro-fit latching connector #5
		SPI	<ul style="list-style-type: none"> • Quantity 4 SPI for diagnostic purposes • Connect to CPU controller unit, • 16 pin micro-fit latching connector #5
		Earth ground lug	<ul style="list-style-type: none"> • Supports gauge #2 • Connected to the copper ground bar inside cabinet

B Overview

• Front View



• Rear View



A : Front View

A1	Bluetooth Antenna(Optional)	A9	USB Port
A2	AC/BAT Power Indicator	A10	AC/BAT Power Indicator
A3	ALARM Indicator	A11	Transmitting Indicator
A4	TXA Indicator	A12	PA Alarm Indicator
A5	TXB Indicator	A13	Status 2
A6	RXA Indicator	A14	Status 1
A7	RXB Indicator	A15	GPS
A8	Ethernet Indicator	A16	Power

B : Rear View

B1	Ground screw	B8	PA Control	B15	Reference Input
B2	CR01 12VDC Power Input	B9	Ethernet Port A	B16	PA Control
B3	GPS Antenna (Option)	B10	Ethernet Port B	B17	PA Fan Control
B4	Reference Out	B11	AC Input	B18	Uni Scr (R&R)
B5	RX Connector	B12	Power Supply Fan		RX Out (Option)
B6	PA Fan Control	B13	PA Fan Control	B19	TX Connector
B7	Accessory Connector	B14	CR01 12VDC Power	B20	Ground Screw

C Installation and Setting

1. Installation

This document briefly describes the cable and coax connections for the standard BR01 Repeater Unit.

PLEASE READ SAFETY INFORMATION IN PART D BEFORE INSTALL THE BR01 REPEATER.

1.1: BR01 front and rear panels

The below image shows the front and rear panel of the BR01 repeater with no cables installed. The BR01 has been designed to be rack mounted into a standard 19 inch wide equipment rack.

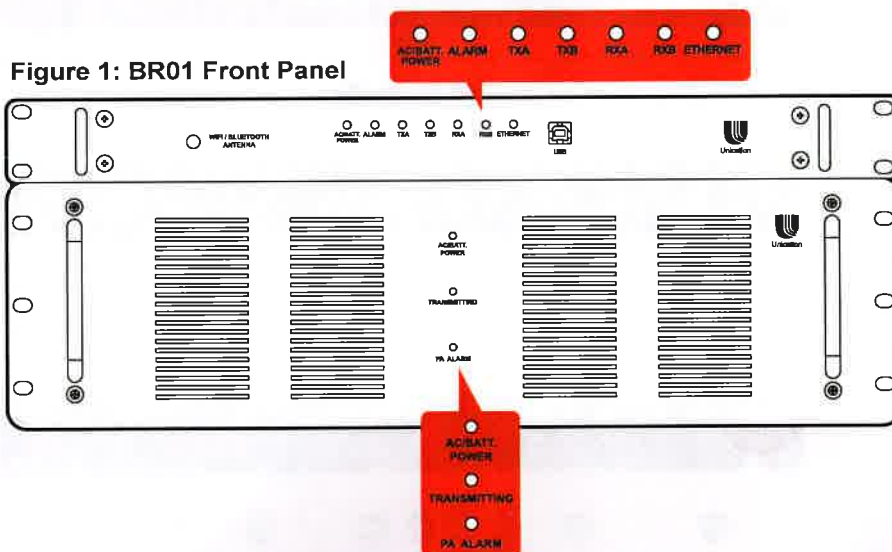
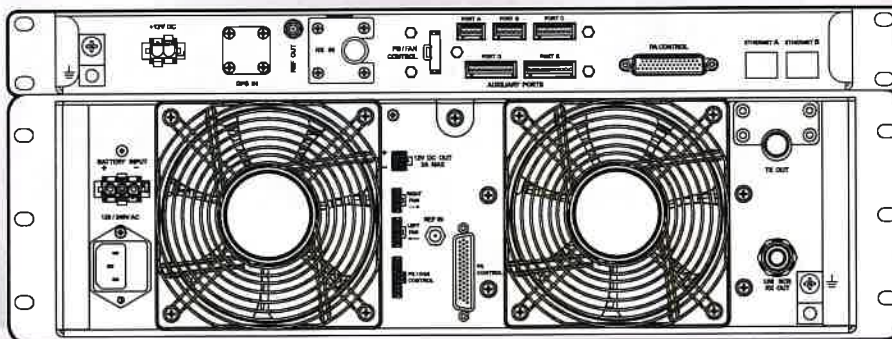


Figure 2: BR01 Rear Panel



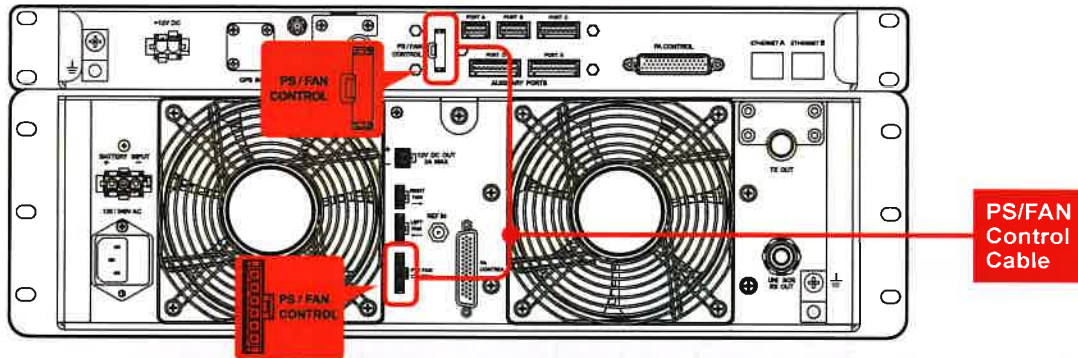
1.2: BR01 Cable and Coax Connections

The following sections document the cable and coaxial connections that are required to be completed for the BR01 repeater to be operational. This includes interconnect, Grounding/Earthing, RF and AC power.

1.2.1: Install the PS/Fan interconnect cable

Connect the PS/Fan cable between the CR01 'PS/Fan Control' to the TX01 'PS/Fan Control' connections.

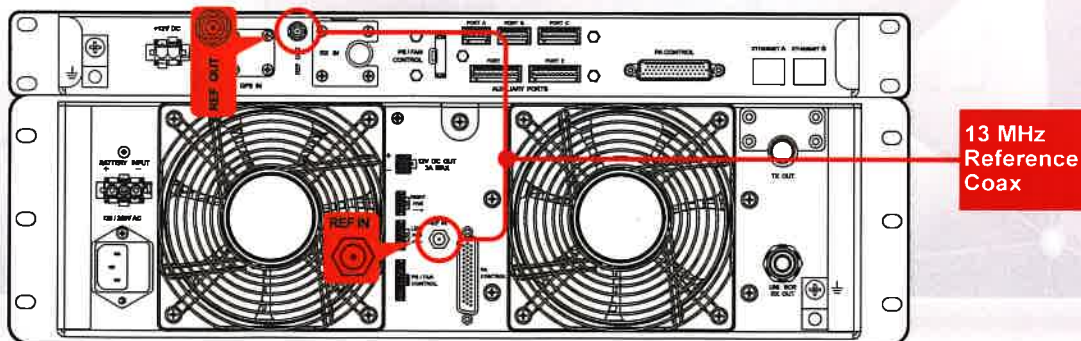
Figure 3: BR01 with PS/FAN Control Cable Installed



1.2.2: Install the 13MHz Reference Coax Cable

Connect the 13MHz reference coax between the CR01 'Ref Out' SMA connector and the TX01 'Ref In' SMA connector. Please remember to use a SMA torque wrench so as not to over tighten the connections.

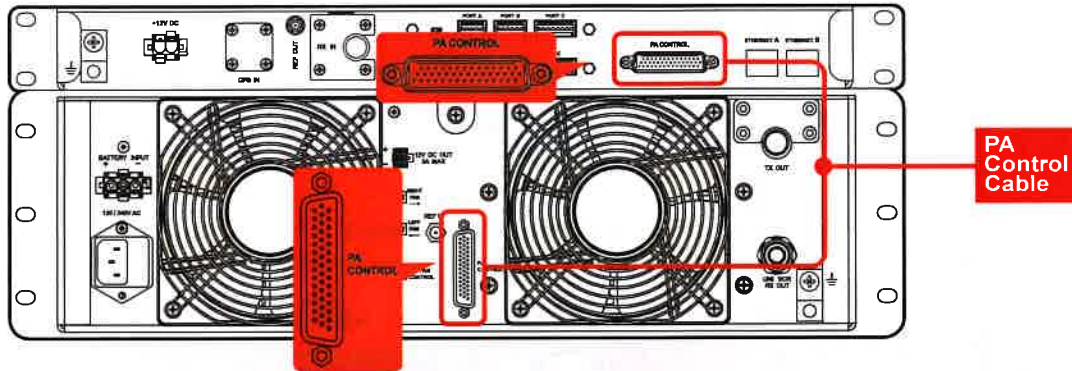
Figure 4: BR01 with Reference Coax Installed



1.2.3: Install the PA Control Cable (DB44)

Connect the PA Control Cable (DB44) between the CR01 'PA Control' and TX01 'PA Control' connections.

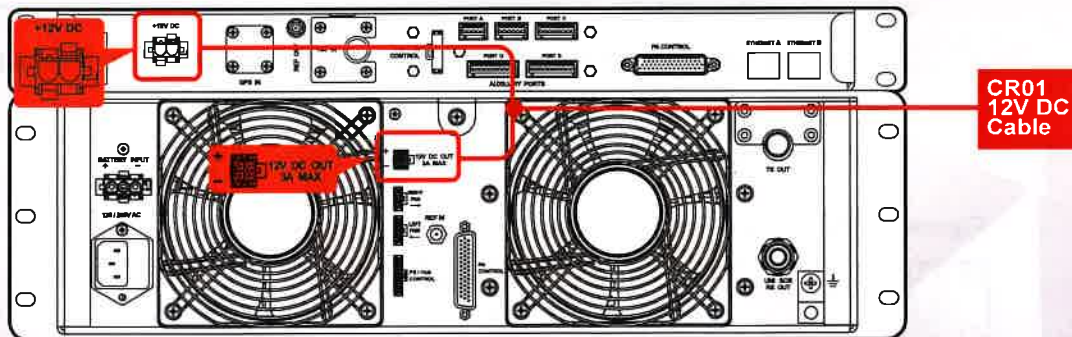
Figure 5: BR01 with PA Control Cable Installed



1.2.4: Install the CR01 12Vdc Power cable

Connect the CR01 12Vdc power cable between the TX01 '12V DC Output' and CR01 '+12V DC' Input connectors.

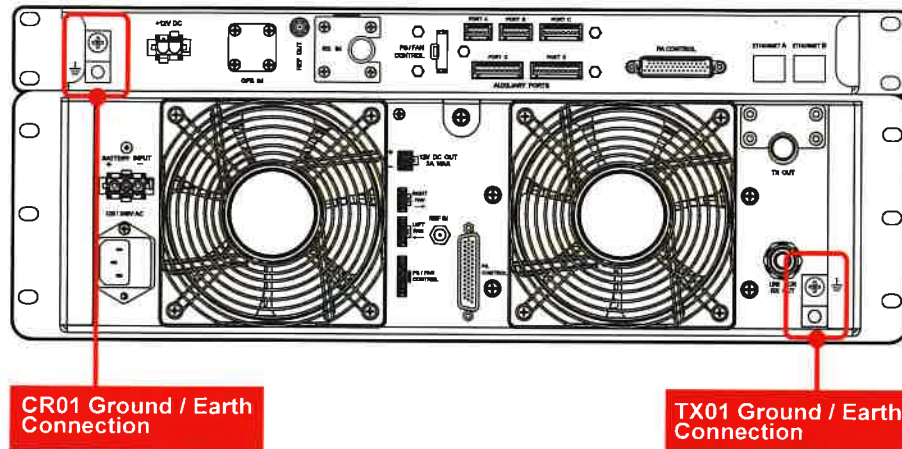
Figure 6: BR01 with CR01 12V DC Power Cable Installed



1.2.5: Install the BR01 Equipment Grounding (Earth)

Install acceptable equipment grounding/earth cables to both the TX01 and CR01 screw terminal connections in accordance with approved equipment grounding standards.

Figure 7: BR01 with two equipment ground connections attached.



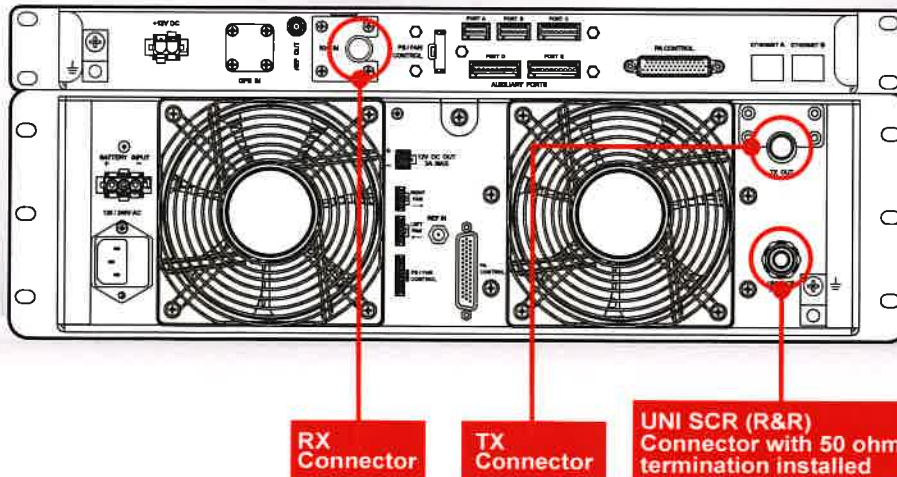
1.2.6: Install RX and TX RF Coax Cables

Connect the receiver antenna coax cable into the CR01 'RX In' N-Type RF connector.

Connect the Transmitter antenna coax cable into the TX01 'TX Out' N-Type RF Connector.

Note: Please make sure the N-type 50 ohm termination is connected to the TX01 'UNI SCR RX Out (R&R)' N-Type RF Connector.

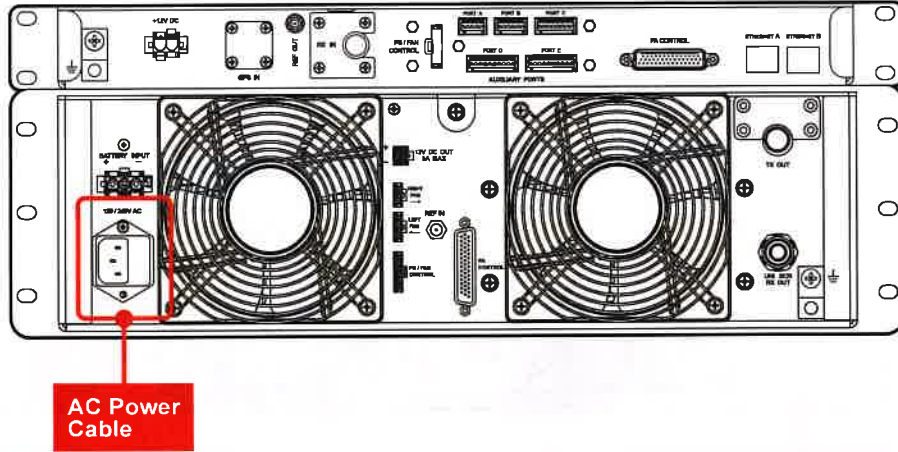
Figure 8: BR01 with RX and TX Coax Cables Installed



1.2.7: Install the AC Power Cable into TX01

Insert AC power cable into the TX01 '120/240V AC' connector.

Figure 9: BR01 AC Power Cable Installed



2. Software Configuration

Please follow steps below to setup the BR01:

Step 1: Power on the CR01 and TX01.

Step 2: Connect the USB cable from the PC with PPS to the front USB port of the CR01.

Step 3: Start the BR01 PPS.



Step 4: Select “Create New Repeater Profile” and “New”.



Step 5: Enter a “Repeater Name” and select “Protocol”. Click “Next”.



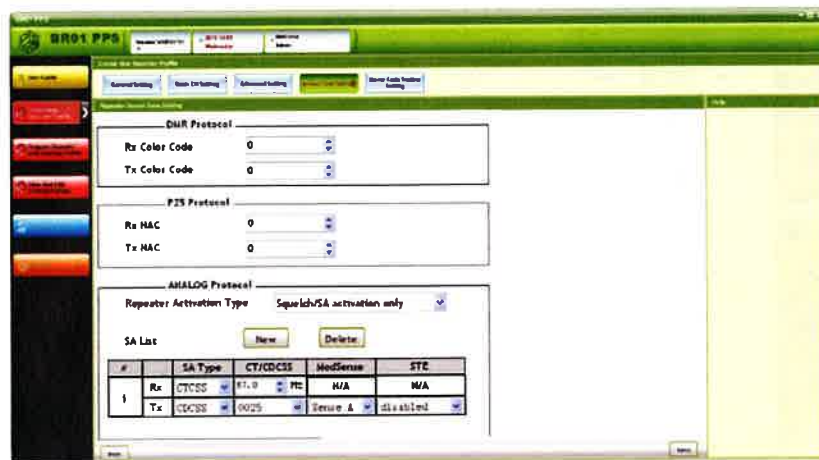
Step 6: Enter repeater RX and TX frequencies and click “Next”.

The screenshot shows the 'Repeater Side Setting' and 'Transmitter Side Setting' sections of the BRD1 PPS software. The 'Repeater Side Setting' section includes fields for Rx Frequency (155000000 Hz), Rx BandWidth (12.5 kHz), and SINAD (5 dB). The 'Transmitter Side Setting' section includes fields for Tx Frequency (155000000 Hz), Tx BandWidth (12.5 kHz), and Tx Power Level (10 W). The interface has a green header and a sidebar on the left with various colored buttons.

Step 7: Set the “Advanced Settings” if needed and click “Next”.

The screenshot shows the 'Advanced Settings' section of the BRD1 PPS software. It includes three sub-sections: 'Channel Advance' with a Hang Time of 50 (100ms); 'ANALOG Protocol Advance' with Emphasis and Compressor both set to Disabled; and 'DMR Protocol Advance' with Private Call Hang Up Time (9000 ms), Group Call Hang Up (9000 ms), and Emergency Call Hang Up Timer (9000 ms). The interface features a green header and a sidebar on the left.

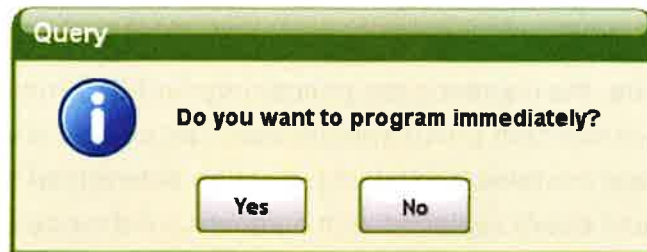
Step 8: Set the “Access Code Setting” and click “Next”.



Step 9: Enter the “Repeater ID”; set the parameters and click “Save”.



Step 10: Click “Yes” to program the repeater.



Step 11: Click “Connect” to confirm the setting and programming.



D SAFETY INFORMATION

Product Maintenance Philosophy

Due to the high percentage of surface-mount components and multi-layer circuit boards, the maintenance philosophy for this product is one of Field Replaceable Unit (FRU) substitution. The station is comprised of self-contained modules (FRUs) which, when determined to be faulty, may be quickly and easily replaced with a known good module to bring the equipment back to normal operation. The faulty module must then be shipped to the Unication System Support Center for further troubleshooting and repair to the component level.

Scope of Manual

This manual is intended for use by experienced technicians familiar with similar types of equipment. In keeping with the maintenance philosophy of Field Replaceable Units (FRU), this manual contains functional information sufficient to give service personnel an operational understanding of all FRU modules, allowing faulty FRU modules to be identified and replaced with known good FRU replacements. The information in this manual is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction are added to the manuals as the engineering changes are incorporated into the equipment.

GENERAL SAFETY INFORMATION

The following general safety precautions must be observed during all phases of operation, service, and repair of the equipment described in this manual.

The safety precautions listed below represent warnings of certain dangers of which we are aware. One must follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

General Safety Precautions

- **Read and follow all warning notices and instructions marked on the product or included in this manual before installing, servicing or operating the equipment. Retain these safety instructions for future reference. Also, all applicable safety procedures, such as Occupational Safety and Health Administration (OSHA) requirements, National Electrical Code (NEC) requirements, local code requirements, safe working practices, and good judgment must be used by personnel.**
- **Refer to appropriate section of the product service manual for additional pertinent safety information.**
- **Because of danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modifications of equipment.**
- **Identify maintenance actions that require two people to perform the repair.**

Two people are required when :

A repair has the risk of injury that would require one person to perform first aid or call for emergency support. An example would be work around high voltage sources. A second person may be required to remove power and call for emergency aid if an accident occurs to the first person.

Note: Use the National Institute of Occupational Safety and Health (NIOSH) lifting equation to determine whether one or two person is required when a system component must be removed and replaced in its rack.
- **If troubleshooting the equipment while power is applied, be aware of the live circuits.**
- **DO NOT operate the transmitter of any radio unless all RF connectors are secure and all connectors are properly terminated.**

- **All equipment must be properly grounded in accordance with Unication Standards and Guideline for Radio Sites and specified installation instructions for safe operation.**
- **Slots and openings in the cabinet are provided for ventilation. To ensure reliable operation of the product and to protect from overheating, these slots and openings must not be blocked or covered.**
- **Only a qualified technician familiar with similar electronic equipment should service equipment.**
- **Some equipment components can become extremely hot during operation. Turn off all power to the equipment and wait until sufficiently cool before touching.**

FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) the device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: Unication Co., Ltd is not responsible for any changes or modifications not expressly approved by the party responsible for Compliance. Such modifications could void the user's authority to operate the equipment.

Note: 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.

IC RSS warning

This device complies with Industry Canada licence-exempt RSS standard (s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and**
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.**

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that, the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Human Exposure Compliance

This equipment is designed to generate and radiate radio frequency (RF) energy by means of an external antenna. When terminated into a non-radiating RF load, the base station equipment is certified to comply with Federal Communications Commission (FCC) regulations pertaining to human exposure to RF radiation in accordance with the FCC Rules Part 1 section 1.1310 as published in title 47 code of federal regulations and procedures established in TIA/EIA TSB92, Report On EME Evaluation for RF Cabinet Emissions Under FCC MPE Guidelines. Compliance to FCC regulations of the final installation should be assessed and take into account site specific characteristics such as type and location of antennas, as well as site accessibility of occupational personnel (controlled environment) and the general public (uncontrolled environment). This equipment should only be installed and maintained by trained technicians. Licensees of the FCC using this equipment are responsible for insuring that its installation and operation comply with FCC regulations Part 1 Section 1.1310 as published in title 47 code of federal regulations.

Whether a given installation meets FCC limits for human exposure to radio frequency radiation may depend not only on this equipment but also on whether the environments being assessed are being affected by radio frequency fields from other equipment, the effects of which may add to the level of exposure. Accordingly the overall exposure may be affected by radio frequency generating facilities that exist at the time the licensee's equipment is being installed or even by equipment installed later. Therefore, the effects of any such facilities must be considered in site selection and in determining whether a particular installation meets the FCC requirements.

Determining the compliance of transmitter sites of various complexities may be accomplished by means of computational methods. For more complex sites direct measurement of the power density may be more expedient. Additional information on the topic of electromagnetic exposure is contained in the Unication Standards and Guideline for Communications Sites publication.

Persons responsible for installation of this equipment are urged to consult the listed reference material to assist in determining whether a given installation complies with the applicable limits.

In general the following guidelines should be observed when working in or around radio transmitter sites :

- All personnel should have electromagnetic energy awareness training
- All personnel entering the site must be authorized
- Obey all posted signs
- Assume all antennas are active
- Before working on antennas, notify owners and disable appropriate transmitters
- Maintain minimum 5.89 meter (19.3 feet) clearance from all antennas
- Do not stop in front of antennas
- Use personal RF monitors while working near antennas
- Never operate transmitters without shields during normal operation
- Do not operate base station antennas in equipment rooms

For installations outside of the U.S., consult with the applicable governing body and standards for RF energy human exposure requirements and take the necessary steps for compliance with local regulations.

Conformité concernant l'exposition de l'homme

Cet équipement est conçu pour générer et émettre l'énergie de la radiofréquence (RF) au moyen d'une antenne extérieure. Après s'être terminé à un charge de RF non-émettant, l'équipement de la station de base est certifié qu'il se conforme aux règlements de la Commission de Communication Fédérale (FCC) appartenant à l'exposition de l'homme aux radiations de RF, conformément à l'article 1.1310 de la première partie des règles FCC publiés dans le titre 47 du code des règlements fédéraux ainsi que les procédures établies dans TIA/EIA TSB92, le Rapport d'EME Évaluation pour Émissions de Cabinets de RF Sous Indications FCC MPE. La conformité aux règlements FCC de l'installation finale doit être estimée, tenant compte des caractéristiques spécifique du site comme le type et la localisation des antennes, ainsi que l'accessibilité du site du personnel du travail (environnement contrôlé) et le public général (environnement incontrôlé). Cet équipement doit seulement être installé et maintenu par des techniciens entraînés. Détenteur d'autorisation de FCC qui utilise cet équipement est responsable d'assurer que son installation et opération se conforment à l'article 1.1310 de la première partie des règles FCC publiés dans le titre 47 du code des règlements fédéraux.

Qu'une installation donnée satisfasse ou non les limites de FCC pour l'exposition de l'homme à la radiation de radiofréquence dépendrait non seulement de cet équipement, mais aussi des environnements déjà estimés influencés ou non par des champs de radiofréquence d'autres équipements. Les effets de ces autres équipements augmenterait le niveau d'exposition. En conséquence, l'exposition totale serait influencée par des installations générant la radiofréquence qui existent au moment où l'équipement du détenteur d'autorisation est en train d'être installé ou même par des équipements installés plus tard. Par conséquent, les effets de toutes ces telles installations doivent être considérés pour la sélection du site et pour déterminer si une installation particulière se conforme aux exigences de FCC.

Le bulletin 65 de FCC OET offre des matériels pour aider à déterminer si une installation donnée se conforme aux limites de l'exposition de

l'homme à la radiation de RF. La détermination de la conformité des sites d'émetteurs des complexités variées serait accomplie au moyen des méthodes sur ordinateur. Pour des sites plus complexes, le mesurage direct de la densité de pouvoir serait plus opportun. Des informations supplémentaires au sujet de l'exposition électromagnétique sont contenues dans le Standard Unication ainsi que les Indications pour la publication des Sites de Communications. On conseille vivement aux personnes responsables de l'installation de cet équipement de consulter le matériel de référence en liste pour déterminer si une installation donnée se conforme aux limites en application.

En général, les indications ci-dessous doivent être observées pendant le travail dans ou près des sites d'émetteur de radio :

- **Tout le personnel doit être formé à la connaissance de l'énergie électromagnétique**
- **Tout le personnel entrant dans le site doit être autorisé**
- **Respecter toutes les marques affichées**
- **Assumer que toutes les antennes sont actives**
- **Avant travailler sur les antennes, notifier les propriétaires et immobiliser les émetteurs appropriés**
- **Garder au minimum 5.89 mètres (19.3 pieds) d'espace de toutes les antennes**
- **Ne pas s'arrêter devant les antennes**
- **Utiliser les moniteurs de RF personnels pendant le travail près des antennes**
- **Jamais opérer les émetteurs sans protection pendant l'opération normale**
- **Ne pas opérer les antennes de la station de base dans les cabinets d'équipement**

Pour l'installation hors des Etats-Unis, consulter l'établissement administratif en vigueur ainsi que les standards pour les exigences de l'exposition de l'homme à l'énergie RF, et prendre des mesures pour se conformer aux règlements locaux.

References

1. TIA /EIA TSB92 Report On EME Evaluation for RF Cabinet Emissions under FCC MPE Guidelines, Global Engineering Documents:
<http://globalihs.com/>
2. FCC OET Bulletin 65 Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electro- magnetic Fields
<http://www.foc.gov/oet/rtsafety/> .
3. Unication standards and Guideline for Communications Sites.
4. IEEE Recommended Practice for the Measure of Potentially Hazadous Electromagnetic Fields- RF and Micro- wave, IEEE Std C95.3-1991, Publication Sales, 445 Hoes Lane, PO, Box 1331, Piscattaway, NJ 08855- 1331
5. IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, IEEE C95.1-1991, Publication Sales, 445Hoes Lane, PO Box 1331, Piscattaway, NJ 08855-1331



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