Part No.
7-9352-4

Installation and Setup Manual
for the Two-Way Signal Booster System
Model Number 61-89A-50-A18-G1

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Version Number	Version Date
1	12/11/00
2	01/15/04
3	01/26/04
4	01/27/04

Warranty

This warranty applies for one year from shipping date.

TX RX SYSTEMS INC. warrants its products to be free from defects in material and workmanship at the time of shipment. Our obligation under warranty is limited to replacement or repair at our option, of any such products (with the exception of tubes) which shall have been defective at the time of manufacture. TX RX SYSTEMS INC. reserves the right to replace with merchandise of equal performance although not identical in every way to that originally sold. TX RX SYSTEMS INC. is not liable for damage caused by lightning or other natural disasters. No product will be accepted for repair or replacement without our prior written approval.

All Shipping charges on returned products must be prepaid by the purchaser. TX RX SYSTEMS INC. shall in no event be liable for consequential damages, installation costs or expenses of any nature resulting from the purchase or use of products, whether or not they are used in accordance with instructions. This warranty is in lieu of all other warranties, either expressed or implied, including any implied warranty of merchantability or of fitness. No representative is authorized to assume for TX RX SYSTEMS INC. any other liability or warranty than set forth above in connection with our products or services.

Disclaimer

Product part numbering in photographs and drawings is accurate at time of printing. Part number labels on TX RX products supercede part numbers given within this manual.

Symbols Commonly Used

WARNING

CAUTION or ATTENTION

High Voltage

Electrical Shock Hazard

Use Safety Glasses

Hot Surface

ESD Electrostatic Discharge

Important Information

For Class A Unintentional Radiators

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or modifications not expressly approved by TX RX System Inc. could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

WARNING

To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 1.0 Meters or more should be maintained between the UPLINK antenna of this device and persons during device operation. To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 0.2 Meters or more should be maintained between the DOWNLINK antenna of this device and persons during device operation. To ensure compliance, operations at closer than these distances is not recommended.

The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

Antenna System Installation

The antenna or signal distribution system consists of two branches. An uplink branch typically uses an outdoor mounted, unidirectional gain antenna such as a yagi and a downlink signal radiating system consisting of a network of zero-gain whip antennas or lengths of radiating cable usually mounted inside of the structure.

Even though the antenna system may not be supplied or installed by TX RX Systems. The following points need to be observed because both the safety of the user and proper system performance depend on them.

1) Antenna system installation should only be performed by qualified technical personnel.

2) The following instructions for your safety describe antenna installation guidelines based on FCC Maximum RF Exposure Compliance requirements.

3) The uplink antenna is usually mounted outside and exchanges signals with the repeater base station or donor site. It is typically mounted permanently-attached to the building wall or roof. The gain of this antenna should NOT exceed 10 dB. Only qualified personnel should have access to the antenna and under normal operating conditions, no one should be able to touch or approach it within 1 meter (40 inches).

4) The downlink or in-building signal distribution system is connected to the downlink booster port using coaxial cable. The distribution system may use radiating coaxial cable or a network 1/4 wave whip antennas whose gain does not exceed 0 dB for any radiator. These antennas should be installed so that the user cannot approach any closer than 0.2 meters (8 inches) from the antenna.

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illustrations & Tables

Model 61-89A-50-A18-G1 Specifications

Electrical	
Frequency Range:	806-869 MHz
FCC Identification Number:	EZZ5PI031202
Number of Passbands:	2
Passband Frequencies:	806-824 / 851-869 MHz
Minimum Passband Separation:	45 MHz
Pass Bandw idth:	18 MHz
Gain:	+80 dB
Guardband:	27 MHz
Output Level Control Range:	60 dB (less user programmed digital attenuation)
System Noise Figure at Maximum Gain:	3.5 dB maximum
Pow er Output 806-824 MHz ((total composite)	1.3 Watts
Pow er Output 851-869 MHz (total composite)	1.6 Watts
Third Order Output Intercept Point:	+55 dBm minimum, w ith no attenuation
Primary Supply Voltage:	100-240 VAC; 50-60 Hz
Automatic Battery Backup Option:	+24 to +30 VDC
Mechanical	
Height:	24"
Width:	24"
Depth:	8"
Weight	85 lbs.
Housing Type:	Painted Steel
Enclosure Type:	NEMA 4 Standard

GENERAL DESCRIPTION

Signal boosters extend radio coverage into areas where abrupt propagation losses prevent reliable communication. This system receives an RF signal, raises its power level, and couples it to an antenna or leaky (radiating) coaxial cable system so that it can be re-radiated. No frequency translation (conversion) occurs with this device.

The two-way signal booster model 61-89A-50-A18-G1 (shown in **Figure 1**) is a broadband, bidirectional dual branch (uplink and downlink) system with an 18 MHz passband. The booster passes uplink signals from 806 to 824 MHz and downlink signals from 851 to 869 MHz. Linear RF active amplifiers, filters, and DC power sources are used to adequately boost and re-radiate the passband signals.

The system is hardware configurable to operate at one of two coarse gain levels including medium (+60 dB gain max) or high (+80 dB gain max). The coarse gain adjustments is made by physically removing the low level amplifier card (part# 3-19575) from the branch. Without the low level card in place the system gain will be +60 dB max. The coarse gain of the uplink or downlink branch can be adjusted independently of each others. In addition, for fine adjustment the gain of a branch can be reduced up to 30 dB in 0.5 dB increments via software interface regardless of which coarse gain setting the branch is configured for.

The output level of any signal passing through a signal booster is determined by the systems gain specification. All signals passing through a properly operating signal booster are amplified by the same amount but will come out at power levels that are related to their respective input level by the gain specification. Signal leveling is not an intended function of a signal booster. Amplifier stages used in this signal booster system may be damaged by excessively strong input signal levels. The system is equipped with Output Leveling Circuitry (OLC) to protect the amplifiers and reduce spurious signals. It is interesting to note that the total power for the multicarrier condition is always less than the maximum single carrier rating. As the number of carriers increases, the difference between the single carrier maximum and the total power of all carriers grows even greater.

Linear power amplifiers (Class-A or Class-AB operation) are used in this application in contrast to the

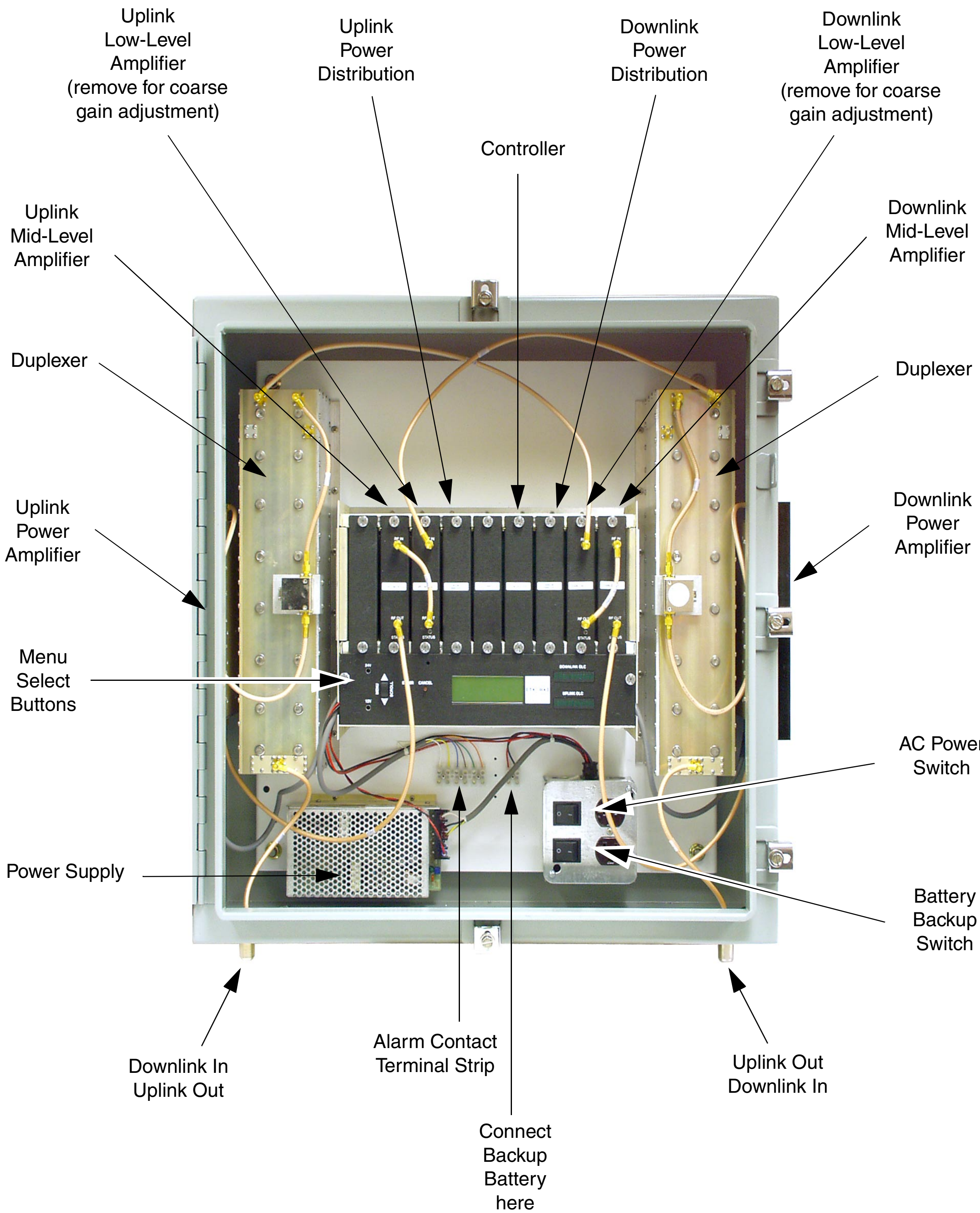

Figure 1: Front view of the model 61-89A-50-A18-G1 two-way signal booster system.

highly efficient Class-C power amplifiers used in the output stages of most FM land mobile transmitters. Linear amplifiers are biased for a relatively high continuous DC current drain. Class-A amplifiers generally have the lowest efficiency of the various amplifier types, typically in the range of 25 - 33% and Class-AB amplifiers can reach 50% efficiency. Their biggest advantage is faithful reproduction of the input waveform which results in the lowest levels of intermodulation distortion products (IM) of all the classes of amplifiers. The generation of IM distortion is a serious design consideration when two or more channels are simultaneously present in the same amplifier stage.

Filtering is used at the input and output of the signal path to help suppress any IM products that may be inadvertently generated. Signals that exceed the maximum input rating may either damage the signal booster or cause it to generate intermodulation products that exceed the maximum allowed by the FCC or other regulatory agency.

Note About Output Power Ratings
A single maximum output power rating does not apply to broadband signal boosters because the linear amplifiers used in them may have to process multiple simultaneous signals. Under these conditions, the questions of power rating becomes more complex.

When more than one signal is amplified, a number of spurious signals will also appear in the amplified output. They are referred to as intermodulation distortion products, more commonly called IM. These spurious products would not be present in a perfectly linear amplifier but as in all things, something short of perfection is realized. Accepted industry practice is to use the Third Order Intercept Point specification of a signal booster to predict the level of IM products. The intercept point is derived from the measurement of an amplifiers 1 dB compression point.

INSTALLATION

The layout of the signal distribution system will be the prime factor in determining the mounting location of the signal booster enclosure. However, safety and serviceability are also key considerations. The unit should be located where it cannot be tampered with by unauthorized personnel yet is easily accessible to service personnel using trouble shooting test equipment such as digital multimeters and spectrum analyzers. Also consider the weight and size of the unit should it become detached from its mounting surfaces for any reason.

Very little is required to install this signal booster. The unit should be bolted in its permanent position using lag bolts or other suitable fasteners. Make sure there is an unobstructed airflow over the external heatsinks. Safety and serviceability are key considerations. The signal booster cabinet will stay warm during normal operation so in the interest of equipment longevity, avoid locations that will expose the cabinet to direct sun or areas where the temperature is continually elevated.

Connection of RF to the unit is made via “N” female connectors located on bottom of the cabinet. These connectors are individually labeled “Downlink In / Uplink Out” and “Downlink Out / Uplink In”. Care should be used when making connections to these ports to insure the correct antenna cable is connected to its corresponding input / output port or the system will not work. The use of high quality connectors with gold center pins is advised. Flexible jumper cables made of high quality coax are also acceptable for connecting to rigid cable sections.

The signal booster is designed to be powered from 120 VAC and a conduit entry box is provided at the bottom of the enclosure for bringing the AC line into the cabinet. AC line connections should be made in accordance with local electrical and building codes. In addition, the unit is capable of being operated from a backup DC power source between +24 and +30 VDC. A terminal screw connector is available inside the bottom of the cabinet for connecting the backup voltage. In addition, there are also terminal screw connections inside the cabinet for alarm monitoring that are designed for connection to a customer supplied supervisory alarm system, see figure 1.

CAUTIONARY NOTE

The following cautions are not intended to frighten the user but have been added to make you aware of and help you to avoid the areas where experience has shown us that trouble can occur.

1) Just like the feedback squeal that can occur when the microphone and speaker get too close to each other in a public address system, a signal booster can start to self oscillate. This will occur when the isolation between the input

antenna or signal source and the output distribution system does not exceed the signal boosters gain by at least 15 dB. This condition will reduce the effectiveness of the system and may possibly damage the power amplifier stages.

2) The major cause of damage to signal boosters is the application of input RF power levels in excess of the maximum safe input. This can happen inadvertently when connecting a signal generator with full power out to one of the inputs or by a very strong signal that is far stronger than expected. Following the pre-RF connection checks listed next will help to avoid these two problems.

PRE-RF CONNECTION TESTS

Certain characteristics of the signal distribution system should be measured before connecting it to the signal booster. This step is necessary to insure that no conditions exist that could possibly damage the signal booster and should not be skipped for even the most thoroughly designed system. Two characteristics need to be measured; antenna isolation and input signal levels.

Test Equipment

The following equipment is required in order to perform the pre-installation measurements.

1) Signal generator for the frequencies of interest capable of a 0 dBm output level. Modulation is not necessary.

2) Spectrum analyzer that covers the frequencies of interest and is capable of observing signal levels down to -100 dBm.

3) Double shielded coaxial test cables made from RG142 or RG55 coaxial cable.

Antenna Isolation

Antenna isolation is the signal path isolation between the two sections of the signal distribution system that are to be connected to the signal boosters antenna ports. Lack of isolation between the input and output antennas can cause the amplifiers in the system to oscillate. This can hap-

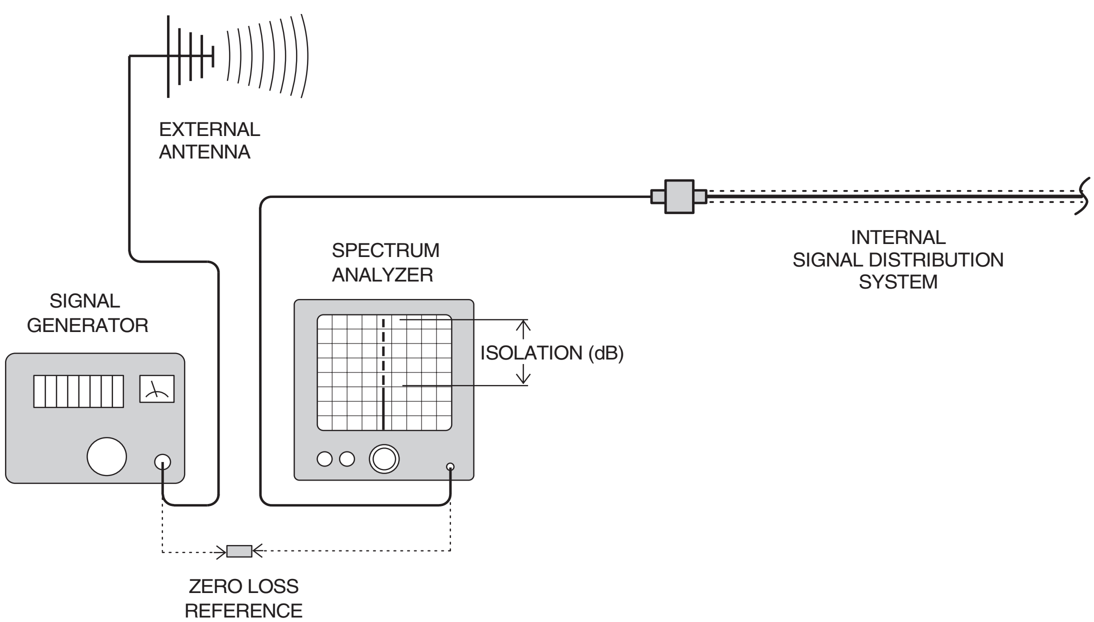

Figure 2: Typical test equipment setup for measuring antenna isolation.

pen at a high enough level to damage the power amplifier stages. In general, if one or both antenna ports are connected to sections of radiating coaxial cable (lossy cable) the isolation will be more than adequate because of the high coupling loss values that are encountered with this type of cable. When a network of antennas are used for the input and output, this problem is much more likely. Isolation values are relatively easy to measure with a spectrum analyzer and signal generator.

EXAMPLE

Gain Reduction (dB) = Minimum Isolation (dB) - Measured Isolation (dB)

If the measured isolation is -75dB and the minimum isolation is -80dB then the amount of gain reduction required is: -80dB - (-75) = -5 dB

Procedure for Measuring Antenna Isolation

1) Set the signal generator for a 0 dBm output level at the center frequency of one of the signal boosters passbands.

2) Set the spectrum analyzer for the same center frequency and a sweep width equal to or just slightly greater than the passband chosen in step one.

3) Connect the test leads of the signal generator and the spectrum analyzer together using a female barrel connector, see **Figure 2**. Observe the signal on the analyzer and adjust the input attenuator of the spectrum analyzer for a signal level that just reaches the 0 dBm level at the top of the graticule.

4) Referring to figure 2, connect the generator test lead to one side of the signal distribution system (external antenna) and the spectrum analyzer lead to the other (internal distribution system) and observe the signal level. The difference between this observed level and 0 dBm is the isolation between the sections. If the signal is too weak to observe, the spectrum analyzer's bandwidth may have to be narrowed and its input attenuation reduced. Record the isolation value. **The isolation value measured should exceed the signal boosters gain figure by at least 15 dB.**

It is wise to repeat the procedure listed above for measuring antenna isolation, with the signal generator set to frequencies at the passbands edges in order to see if the isolation is remaining relatively constant over the complete width of the passband.

Increasing Isolation

If the measured isolation does not exceed the signal boosters gain figure by at least 15 dB then modification of the signal distribution system is required. Alternately, the gain of the signal booster can also be reduced to insure the 15 dB specification is met. If the isolation cannot be increased then the amount of gain reduction required is determined as shown in the following example.

Input Signal Levels

Excessive input signal levels can damage the signal booster. Although this problem is less severe in OLC protected systems, strong signals may cause sudden reductions in gain and an associated decrease in the desired output signal strength. Even in the most carefully designed signal distribution systems, unpredictable situations can arise that can cause this trouble. A few of the more common causes are:

a) Unintended signals entering the system. Primarily caused by radios operating on channels that are within the operational bandwidth of the signal booster. Sometimes this will be a transient problem caused by mobile units when they transmit while in close proximity to your system.

b) Hand-held and mobile units that approach much closer than expected to one of the antennas in the signal distribution system.

c) Unexpected signal propagation anomalies. Building geometry can cause signal ducting and other phenomena that cause signal levels that are much stronger (or lower) than expected.

d) Lower than estimated signal attenuation causes signals to be unusually strong. Higher losses can also occur giving weaker signals than desired.

e) Signal booster model with excessive gain. In systems that have an existing signal booster, it is sometimes assumed that an identical unit should be installed when expanding the system

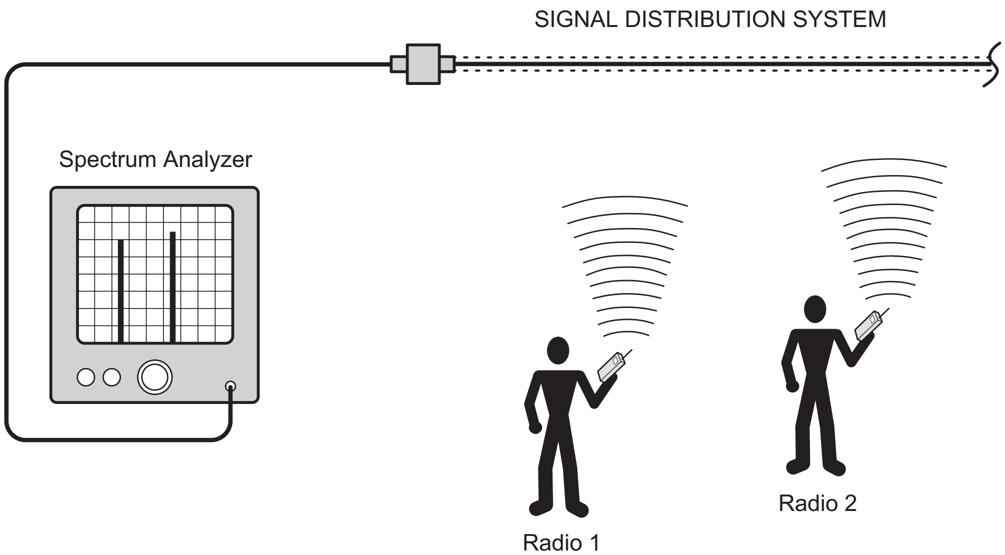

Figure 3: Typical test equipment setup for measuring input signal levels.

to provide extended coverage. In most cases, a signal booster with far less gain than the first is required.

f) Improper installation or application of signal splitters or directional couplers in the signal distribution system. This is usually the cause of too low a signal level but deserves mentioning here. Signal splitting needs to be done with constant impedance signal splitters so that the proper power splitting ratios and VSWR are maintained. Using tee connectors by themselves is inviting trouble. Directional couplers must be connected with regard to their directionality and coupling levels or improper system signal levels may result.

Procedure for Measuring Input Signal Levels

1) Set a spectrum analyzer for the center frequency of one of the signal boosters passbands.

2) Set the analyzers sweep width so that the entire passband frequency range can be observed.

3) The analyzers input attenuator should be set in order to observe input signal levels from approximately -80 dBm to 0 dBm.

4) Connect the analyzer to the section of the signal distribution system that is going to serve as the input (see **Figure 3**).

5) Record the power level (in dBm) of all carriers in the passband frequency range that are significantly greater than the noise floor displayed on the analyzer.

6) To find the total power being applied the calculations listed below must be performed. The conversion chart at the rear of the manual can be used. Here are the steps:

   a) Convert all values in dBm to Watts
   b) Total the power for all carriers in Watts
   c) Convert the total power in Watts to dBm

Example: suppose we have a signal booster with a maximum gain of 70 dB. After checking the input signal levels, it was determined that there are three signals that are significantly greater than the noise floor displayed on the analyzer. These signals have strengths of -45 dBm, -43 dBm and -41 dBm.

First we use the conversion chart at the end of this manual to convert the power levels in dBm to watts

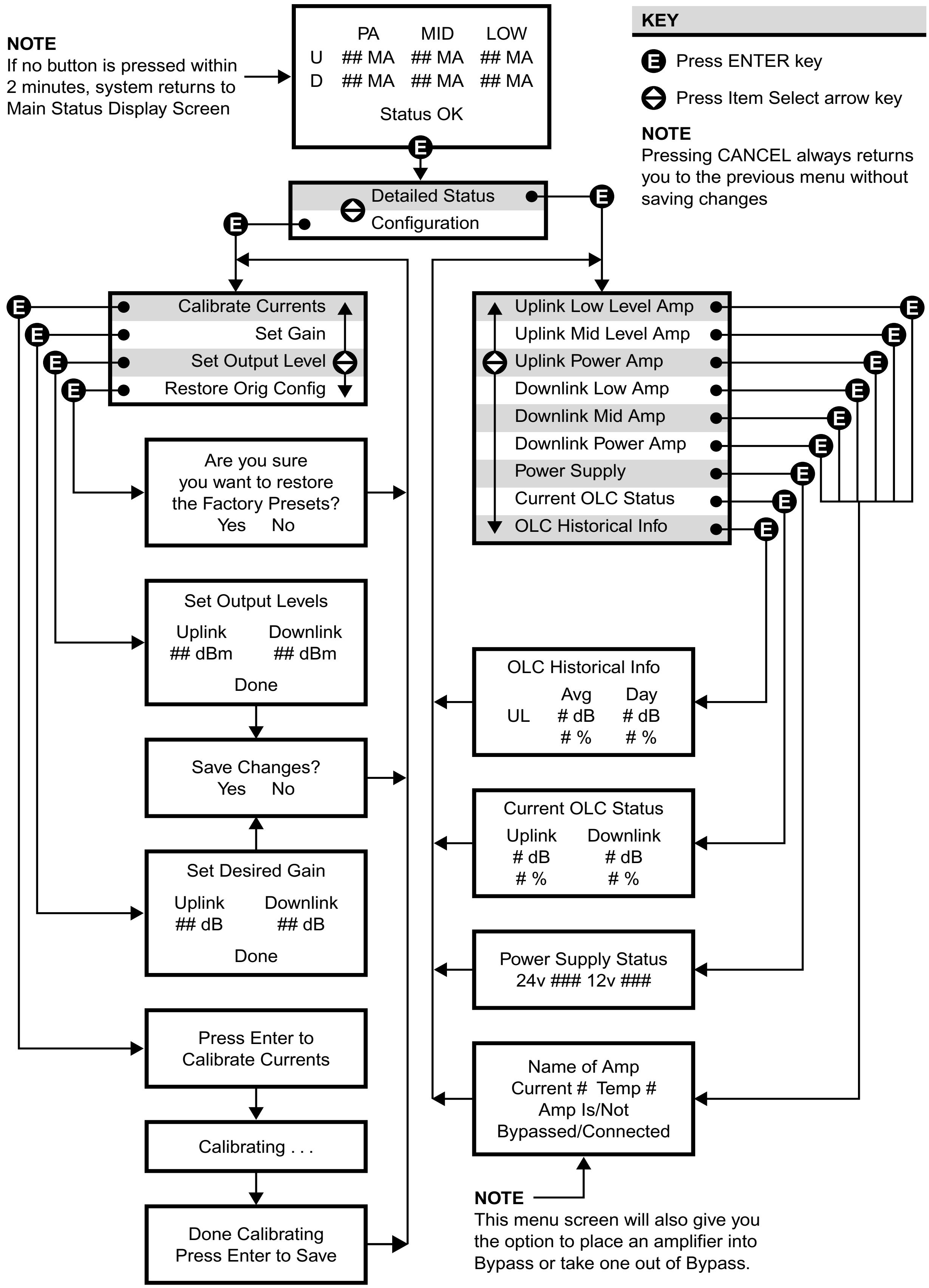

Figure 4: Software flow chart.

so that we can add them together. The power in watts is written in scientific notation but the chart uses computer notation. For example, in the chart, an exponent may be written as E-08. In conventional mathematical notation E-08 is written 10^{-8}. The total power must be written as a number between 0 and 10 to use the chart. Look up 1.611E-7 in the Watts column. This number falls between -38 and -37 dBm so we chose -37 because it is the next higher value.

Figure 5: Software version is displayed briefly during the boot-up sequence.

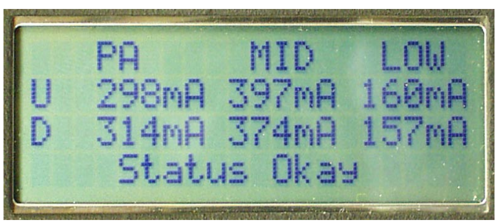

Figure 6: Main Status Display Screen.

Power (dBm)	Power (watts)
-45 dBm	3.16 x 10^{-8}
-43 dBm	5.01 x 10^{-8}
-41 dBm	7.94 x 10^{-8}
TOTAL	**16.11 x 10^{-8}**

Reduction of Incoming Signal Strength

Reducing the strength of offending signals may require some or all of the following steps:

a) The addition of extra filtering. Consult TX RX System's sales engineers for help in this respect.

b) Modification of the signal distribution layout by changing the type or location of pickup antennas. This has to be approached in an empirical way, that is, change-and-try until you get the desired results. Sometimes changing from omni to directional antennas will correct the problem.

OPERATION

Power is applied to the signal booster by turning on the AC power switch located on the junction box inside the cabinet, refer to figure1. This will turn on the power supply assembly and the LED indicator on the power supply should come on indicating the assembly is functioning normally.

The model 61-89A-50-A18-G1 signal booster system is software controlled. Interface to the system is done through the LCD display screen and the menu select buttons located on the display panel, see figure 1. A flow chart showing all of the possible user menu selections is shown in **Figure 4**. Each menu selection will be discussed in detail below. Upon power up the system will begin to cycle through its normal boot-up sequence during which time the LCD display will briefly show the current software version, see **Figure 5**.

Main Status Display Screen

Once the boot-up sequence is completed (after several seconds) the LCD display will switch to the main status display screen as shown in **Figure 6**. This is the normal display screen for the signal booster. The system will return to this screen from any other screen if no menu interface buttons are pressed within 2 minutes.

The main status display screen shows the current draw of all 6 amplifiers in the system. First the uplink amplifiers, power (PA), mid-level (MID), and low-level (LOW) then the three downlink amplifiers. The current value will flash on and off for any amplifier in error. The last line of the main display screen gives a summary status message for the entire signal booster. In this example “Status Okay” is being displayed. Pressing the “ENTER” button will move you from the main status display screen into the menu selections and will permit interaction with the system. There are two main functions available within the software menus including configuration settings and detailed status displays.

Configuration Settings
These items allow system configuration changes to be made. The final selection in this group “Restore Orig Config” will restore all configurable settings to their original factory default values. Each configurable item is discussed below in detail.

CALIBRATE CURRENTS
Selecting this function automatically calibrates the current alarm “trip” point of each amplifier in the system. Due to manufacturing tolerances there are small differences in current draw between amplifier assemblies. This software function matches the alarm sensing circuit to the respective amplifier assembly and should be repeated whenever an amplifier assembly is replaced for maintenance purposes.

SET GAIN
This function allows the user to electronically reduce the gain of the booster up to 30 dB in increments of 0.5 dB. Gain can be adjusted independently for both the uplink and downlink channels.

SET OUTPUT LEVEL
Allows the output levels for the uplink and downlink channels to be independently adjusted in 1 dB increments up to +30 dBm. Note that the OLC circuitry will make every effort to maintain the systems output level at the values you have selected in this menu.

Detailed Status Screens
These items allow a detailed examination of system components including; all amplifiers, the power supply, and the OLC function. Each item is discussed below in detail.

AMPLIFIERS
A separate status screen is available for each amplifier in the system. When an amplifier is selected this function will display the present current draw of that amp as well as its present operating temperature in degrees Celsius. In addition, a status message will indicate if the amplifier is connected and whether the amplifier is bypassed or not bypassed. This menu selection also provides the option of placing an amplifier in bypass or taking an amplifier out of bypass.

POWER SUPPLY
This function displays the real time power supply voltages for both 24 volt and 12 volt supplies.

OLC
This screen shows the amount of attenuation presently being used by the OLC for both the uplink and downlink channels. In addition, the percentage of OLC presently being used is also shown.

NOTE The amount of OLC currently being used in either the uplink or downlink channels is also indicated by LED bar graph displays located on the display panel.

OLC HISTORICAL INFO
This screen displays the OLC historical data over the past 100 days for both uplink and downlink. The average OLC attenuation used when the OLC was active is given both for individual days and over the entire past 100 days. The percentage of time the OLC was active is also given for both individual days and over the past 100 days. This archived information will permit the creation of a user signal profile to facilitate optimum system configuration and performance.

Alarms
The system continuously monitors the current draw and operating temperature of each amplifier as well as the voltage level of the +12 and +24 VDC supplies. If any of these parameters exceed normal operating levels by a factory preset percentage the system enters an alarm condition. Notification of an alarm condition is provided by LED indicators and Form-C contacts available via the alarm terminal screws.

LED INDICATORS
There are LED indicators for each amplifier in the system as well as the +12 and +24 VDC power supply voltages. The LED indicators for the low and mid level amplifiers are located on the individual plug-in module. These are tri-color LED’s with green representing NORMAL operation, orange representing a WARNING condition, and red indicating a FAULT condition. A warning condition occurs when the current draw of the amplifier exceeds nominal by +/- 20%. Fault conditions occur when the current draw exceeds +/- 30% or the amplifiers operating temperature exceeds 80° Celsius.

The LED indicators for the power amplifiers are located on the assembly next to the RF input connector and are dual color LED’s. Green represents NORMAL operation while red indicates a FAULT

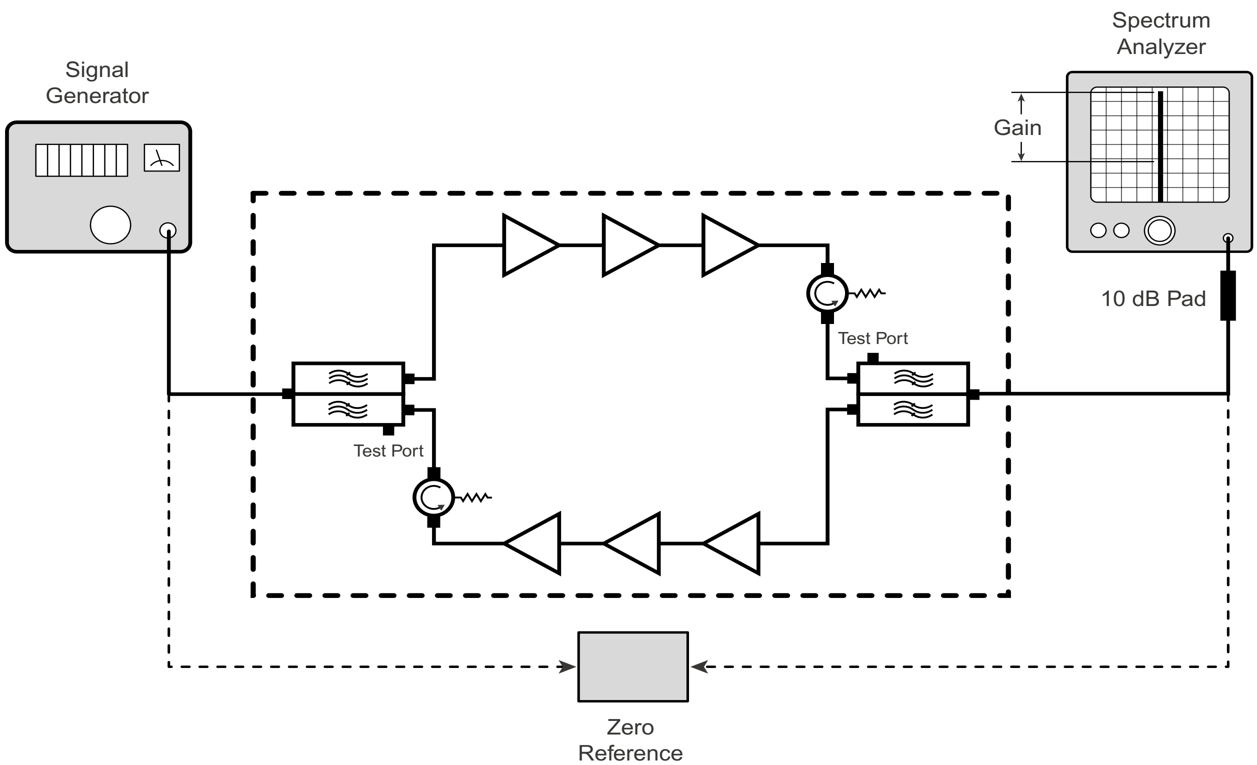

Figure 7: Test equipment interconnection for measuring signal booster gain.

condition. Fault conditions occur when the current draw exceeds +/- 30% or the amplifiers operating temperature exceeds 80° Celsius. The power amplifiers do not have a warning state.

The power supply LED indicators are located on display panel next to the menu selection buttons and are also dual color. Green representing normal operation and red a fault condition. A fault condition for the +24 VDC supply occurs whenever the voltage potential drops below +16 VDC (30% below nominal). Likewise, a fault for the +12 VDC supply occurs when the potential is below +8 VDC (30% below nominal).

FORM-C CONTACTS

Form-C contacts are available inside the cabinet next to the power supply assembly, see figure1. These screw terminals are intended for connection to the customers supervisory alarm or data acquisition system. One set of terminals is notification of any alarm condition occurring and the second set of contacts indicate the system is operating on battery backup power.

PERFORMANCE SURVEY

It is a good idea to document the performance of the system after installation so that a reference exists for future comparisons. This information can make troubleshooting an interference problem or investigation of a complaint about system performance much easier. If there are coverage problems with a system, this survey will usually reveal them allowing corrective measures to be taken before the system is put into routine use. The following is an outline of how to do such a survey. Because the nature of each installation can be quite different, only a broad outline is given.

1) Measure the gain of the signal booster being careful not to exceed the maximum input level. **Figure 7** shows this being done using a signal generator and spectrum analyzer. This is basically a substitution measurement. Record the measured values for each passband.

2) The signal booster is equipped with a -30 dB signal sampler port following the final output amp (part of the Duplexer assembly). This port is for the connection of test equipment such as a spectrum analyzer and will allow the observation of the amplifier output at a considerably reduced output level. This decoupling figure needs to be added to a measured signal value in order to arrive at the actual signal level.

3) With a spectrum analyzer connected to the signal sampler port (see **Figure 8**), have personnel with handheld radios move to several predetermined points and key their radios. Record the level of these signals as observed on the analyzer and also record the location of the person transmitting. In this way, a map of the systems performance can be generated.

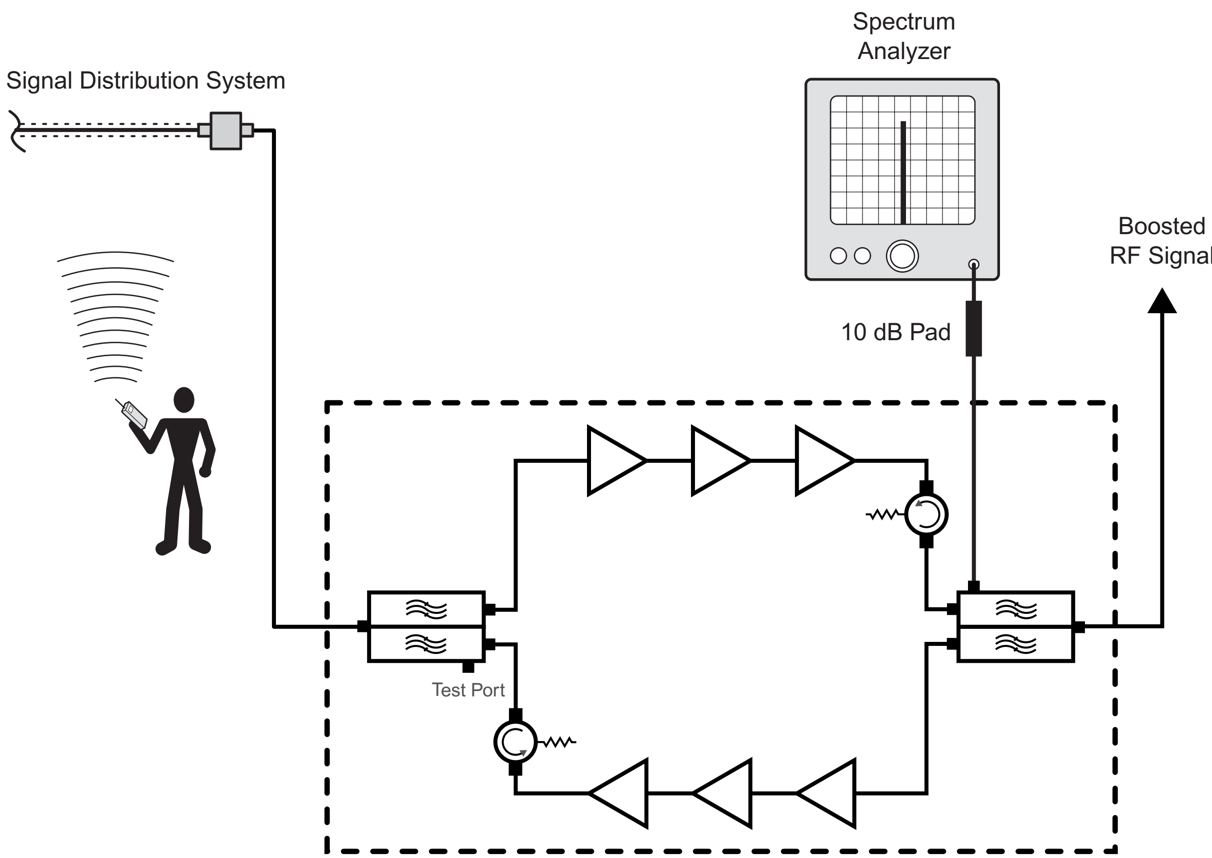

Figure 8: Test equipment interconnection for surveying performance.

4) For signals coming from a fixed antenna or station, record the level of all the desired incoming signals for future reference.

MAINTENANCE AND REPAIR

Signal boosters manufactured by TX RX Systems, Inc. can function reliably for 10 or more years with little or no maintenance. However, if the amplifiers are subjected to excessively high signal levels, power surges or lightning strikes, failures may occur. The following procedures may be followed for detecting a malfunctioning unit or as part of a periodic maintenance program.

1) The heatsink area should be cleared of dust and debris.

2) Inspect the unit to see that the power supply LED DC indicator is lit (remove any dust or debris that may obscure the LED). This will verify that DC power is flowing properly. Check all hardware for tightness.

3) Compare system performance to initial performance levels measured when the system was first installed. The lack of signal can be traced to a malfunctioning amplifier by progressive signal monitoring from the output (far end) to the input end of the system noting the area where the signal returns to normal level. The next amplifier toward the output end of the system will probably be the one that failed.

or

Measure the gain at any convenient frequency in the working frequency band to verify that the gain specification is being met. If the gain values fall below that specified for the model check the following:

A) Open the signal booster cabinet and inspect for any loose or broken connections or cables, and repair as necessary.

B) Measure the output of the power supply to see that the proper operating voltage is being maintained.

Power Conversion Chart

dBm to dBw : Watts : Microvolts

dBm	dBw	Watts	Volts (50Ω)
80	50	100000	2236.07
79	49	79432.82	1992.9
78	48	63095.74	1776.17
77	47	50118.72	1583.01
76	46	39810.72	1410.86
75	45	31622.78	1257.43
74	44	25118.86	1120.69
73	43	19952.62	998.81
72	42	15848.93	890.19
71	41	12589.25	793.39
70	40	10000	707.11
69	39	7943.28	630.21
68	38	6309.57	561.67
67	37	5011.87	500.59
66	36	3981.07	446.15
65	35	3162.28	397.64
64	34	2511.89	354.39
63	33	1995.26	315.85
62	32	1584.89	281.5
61	31	1258.93	250.89
60	30	1000	223.61
59	29	794.33	199.29
58	28	630.96	177.62
57	27	501.19	158.3
56	26	398.11	141.09
55	25	316.23	125.74
54	24	251.19	112.07
53	23	199.53	99.88
52	22	158.49	89.02
51	21	125.89	79.34
50	20	100	70.71
49	19	79.43	63.02
48	18	63.1	56.17
47	17	50.12	50.06
46	16	39.81	44.62
45	15	31.62	39.76
44	14	25.12	35.44
43	13	19.95	31.59
42	12	15.85	28.15
41	11	12.59	25.09

dBm	dBw	Watts	Volts (50Ω)
40	10	10	22.36
39	9	7.94	19.93
38	8	6.31	17.76
37	7	5.01	15.83
36	6	3.98	14.11
35	5	3.16	12.57
34	4	2.51	11.21
33	3	2	9.99
32	2	1.59	8.9
31	1	1.26	7.93
30	0	1	7.07
29	-1	0.79	6.3
28	-2	0.63	5.62
27	-3	0.5	5.01
26	-4	0.4	4.46
25	-5	0.32	3.98
24	-6	0.25	3.54
23	-7	0.2	3.16
22	-8	0.16	2.82
21	-9	0.13	2.51
20	-10	0.1	2.24
19	-11	0.08	1.99
18	-12	0.06	1.78
17	-13	0.05	1.58
16	-14	0.04	1.41
15	-15	0.03	1.26
14	-16	0.03	1.12
13	-17	0.02	1
12	-18	0.02	0.89
11	-19	0.01	0.79
10	-20	0.01	0.71
9	-21	0.01	0.63
8	-22	0.01	0.56
7	-23	0.01	0.5
6	-24	0	0.45
5	-25	0	0.4
4	-26	0	0.35
3	-27	0	0.32
2	-28	0	0.28
1	-29	0	0.25

Power Conversion Chart

dBm to dBw : Watts : Microvolts

dBm	dBw	Watts	uVolts (50Ω)
0	-30	1.0000E-03	223606.8
-1	-31	7.9433E-04	199289.77
-2	-32	6.3096E-04	177617.19
-3	-33	5.0119E-04	158301.49
-4	-34	3.9811E-04	141086.35
-5	-35	3.1623E-04	125743.34
-6	-36	2.5119E-04	112068.87
-7	-37	1.9953E-04	99881.49
-8	-38	1.5849E-04	89019.47
-9	-39	1.2589E-04	79338.69
-10	-40	1.0000E-04	70710.68
-11	-41	7.9433E-05	63020.96
-12	-42	6.3096E-05	56167.49
-13	-43	5.0119E-05	50059.33
-14	-44	3.9811E-05	44615.42
-15	-45	3.1623E-05	39763.54
-16	-46	2.5119E-05	35439.29
-17	-47	1.9953E-05	31585.3
-18	-48	1.5849E-05	28150.43
-19	-49	1.2589E-05	25089.1
-20	-50	1.0000E-05	22360.68
-21	-51	7.9433E-06	19928.98
-22	-52	6.3096E-06	17761.72
-23	-53	5.0119E-06	15830.15
-24	-54	3.9811E-06	14108.64
-25	-55	3.1623E-06	12574.33
-26	-56	2.5119E-06	11206.89
-27	-57	1.9953E-06	9988.15
-28	-58	1.5849E-06	8901.95
-29	-59	1.2589E-06	7933.87
-30	-60	1.0000E-06	7071.07
-31	-61	7.9433E-07	6302.1
-32	-62	6.3096E-07	5616.75
-33	-63	5.0119E-07	5005.93
-34	-64	3.9811E-07	4461.54
-35	-65	3.1623E-07	3976.35
-36	-66	2.5119E-07	3543.93
-37	-67	1.9953E-07	3158.53
-38	-68	1.5849E-07	2815.04
-39	-69	1.2589E-07	2508.91

dBm	dBw	Watts	uVolts (50Ω)
-40	-70	1.0000E-07	2236.07
-41	-71	7.9433E-08	1992.9
-42	-72	6.3096E-08	1776.17
-43	-73	5.0119E-08	1583.02
-44	-74	3.9811E-08	1410.86
-45	-75	3.1623E-08	1257.43
-46	-76	2.5119E-08	1120.69
-47	-77	1.9953E-08	998.82
-48	-78	1.5849E-08	890.2
-49	-79	1.2589E-08	793.39
-50	-80	1.0000E-08	707.11
-51	-81	7.9433E-09	630.21
-52	-82	6.3096E-09	561.68
-53	-83	5.0119E-09	500.59
-54	-84	3.9811E-09	446.15
-55	-85	3.1623E-09	397.64
-56	-86	2.5119E-09	354.39
-57	-87	1.9953E-09	315.85
-58	-88	1.5849E-09	281.5
-59	-89	1.2589E-09	250.89
-60	-90	1.0000E-09	223.61
-61	-91	7.9433E-10	199.29
-62	-92	6.3096E-10	177.62
-63	-93	5.0119E-10	158.3
-64	-94	3.9811E-10	141.09
-65	-95	3.1623E-10	125.74
-66	-96	2.5119E-10	112.07
-67	-97	1.9953E-10	99.88
-68	-98	1.5849E-10	89.02
-69	-99	1.2589E-10	79.34
-70	-100	1.0000E-10	70.71
-71	-101	7.9433E-11	63.02
-72	-102	6.3096E-11	56.17
-73	-103	5.0119E-11	50.06
-74	-104	3.9811E-11	44.62
-75	-105	3.1623E-11	39.76
-76	-106	2.5119E-11	35.44
-77	-107	1.9953E-11	31.59
-78	-108	1.5849E-11	28.15
-79	-109	1.2589E-11	25.09

Power Conversion Chart

dBm to dBw : Watts : Microvolts

dBm	dBw	Watts	uVolts (50Ω)
-80	-110	1.0000E-11	22.36
-81	-111	7.9433E-12	19.93
-82	-112	6.3096E-12	17.76
-83	-113	5.0119E-12	15.83
-84	-114	3.9811E-12	14.11
-85	-115	3.1623E-12	12.57
-86	-116	2.5119E-12	11.21
-87	-117	1.9953E-12	9.99
-88	-118	1.5849E-12	8.9
-89	-119	1.2589E-12	7.93
-90	-120	1.0000E-12	7.07
-91	-121	7.9433E-13	6.3
-92	-122	6.3096E-13	5.62
-93	-123	5.0119E-13	5.01
-94	-124	3.9811E-13	4.46
-95	-125	3.1623E-13	3.98
-96	-126	2.5119E-13	3.54
-97	-127	1.9953E-13	3.16
-98	-128	1.5849E-13	2.82
-99	-129	1.2589E-13	2.51
-100	-130	1.0000E-13	2.24
-101	-131	7.9433E-14	1.99
-102	-132	6.3096E-14	1.78
-103	-133	5.0119E-14	1.58
-104	-134	3.9811E-14	1.41
-105	-135	3.1623E-14	1.26
-106	-136	2.5119E-14	1.12
-107	-137	1.9953E-14	1
-108	-138	1.5849E-14	0.89
-109	-139	1.2589E-14	0.79
-110	-140	1.0000E-14	0.71
-111	-141	7.9433E-15	0.63
-112	-142	6.3096E-15	0.56
-113	-143	5.0119E-15	0.5
-114	-144	3.9811E-15	0.45
-115	-145	3.1623E-15	0.4
-116	-146	2.5119E-15	0.35
-117	-147	1.9953E-15	0.32
-118	-148	1.5849E-15	0.28
-119	-149	1.2589E-15	0.25

dBm	dBw	Watts	uVolts (50Ω)
-120	-150	1.0000E-15	0.22
-121	-151	7.9433E-16	0.2
-122	-152	6.3096E-16	0.18
-123	-153	5.0119E-16	0.16
-124	-154	3.9811E-16	0.14
-125	-155	3.1623E-16	0.13
-126	-156	2.5119E-16	0.11
-127	-157	1.9953E-16	0.1
-128	-158	1.5849E-16	0.09
-129	-159	1.2589E-16	0.08
-130	-160	1.0000E-16	0.07
-131	-161	7.9433E-17	0.06
-132	-162	6.3096E-17	0.06
-133	-163	5.0119E-17	0.05
-134	-164	3.9811E-17	0.05
-135	-165	3.1623E-17	0.04
-136	-166	2.5119E-17	0.04
-137	-167	1.9953E-17	0.03
-138	-168	1.5849E-17	0.03
-139	-169	1.2589E-17	0.03
-140	-170	1.0000E-17	0.02
-141	-171	7.9433E-18	0.02
-142	-172	6.3096E-18	0.02
-143	-173	5.0119E-18	0.02
-144	-174	3.9811E-18	0.01
-145	-175	3.1623E-18	0.01
-146	-176	2.5119E-18	0.01
-147	-177	1.9953E-18	0.01
-148	-178	1.5849E-18	0.01
-149	-179	1.2589E-18	0.01
-150	-180	1.0000E-18	0.01