USER GUIDE
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COM3010 SERVICE MONITOR

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1.00 INTRODUCTION

1.01 Opening the Box

1.01.01 Checking Contents

Included with the COM3010 Service Monitor:

1 AC Power cord
1 Pretested 3 foot BNC to BNC Cable
1 BNC Whip Antenna
1 Operator's Manual

1.01.02 Plugging in the Battery

Before powering up the COM3010 the battery pack should be plugged into the unit so that it can charge. The battery has been placed in the battery slot for shipment.

1. Remove the rear panel Battery Compartment cover by unscrewing the two thumbscrews.
2. Take the 2.1 mm plug from the battery and plug it into the jack nearest the supplied battery inside the battery compartment.
3. If additional battery packs have been purchased slide each one into a battery slot and plug them in.
4. Replace the battery compartment cover and tighten the thumbscrews.

1.01.03 Important Battery Information

The COM3010 ships with a single, high capacity Lithium Ion battery. A single battery pack has over 2AH of charge capacity allowing a run time of about 1 1/2 hours. Two additional batteries can be added to increase the capacity to a total of 4 1/2 hours.

Lithium Ion batteries are temperature sensitive. For this reason the COM3010 is designed to automatically shut down when the temperature reaches 45° C inside of the case. The heatsink of the dummy load is adjacent to the power supply. If you are performing extended high power testing the power on the COM3010 may shut off if the unit gets too hot. This is to prevent significant problems with the batteries; the temperature circuit should not be compromised.

Lithium Ion batteries will not deliver full current capacity at low temperatures. The COM3010 may not power up below –2° C. If you're using it in very cold conditions It may be necessary to warm the COM3010 inside a vehicle, for instance. Once powered up the battery will warm itself during the discharge cycle.

Adding Batteries

All three batteries are internally connected in parallel. If you are adding another battery pack to an existing unit, discharge the already installed batteries fully by leaving the COM3010 on until it powers itself off. Only then it is safe to add the new battery pack. Otherwise the new battery arrival may be charged at too fast a rate by the battery already installed and possible damage to the battery could occur.

Due to the very specific application, these batteries are specially designed for the COM3010. Commonly available lithium batteries will not work in the COM3010. The batteries used in this design have a special voltage per cell specification due to the needed extended temperature operation. Using other lithium batteries in the COM3010 can result in overcharging causing damage to the batteries and to the COM3010. ONLY the specified batteries must be used!

For more information call Ramsey Electronics, Inc.

Batteries as Shipped

Your COM3010 includes one Li-Ion battery pack, with the option of adding two additional battery packs.

Charging

A single battery pack will charge in approximately 2 hours per cell with the COM3010 powered off but plugged in, and 4 hours per cell with the power on. When you first receive the COM3010, the batteries will arrive partially charged. These batteries do not exhibit the "memory" problems typical of other types of battery packs. They do not need to be charged fully before use, and do not need to be fully discharged before a recharge cycle.

1.02 Overview

1.02.01 Front Panel Inputs, Outputs, and Controls

A. RECEIVE IN Jack
The RECEIVE IN jack is used to receive signals using a whip antenna, cable, or a probe. Typically a x1 probe is used since a x10 attenuator is not matched for 50 ohms. The RECEIVE IN is also the frequency counter input; this input is split between the receiver and the frequency counter inside the unit.

The frequency counter starts counting at approximately 10mV. The receiver is sensitive enough to pick up and demodulate this signal level in FM mode, but the AM portion becomes overloaded around 1mV due to the pre-amplification needed to make the frequency counter sensitive.

If signals are too strong for the receiver to work reliably in AM you can use a small in-line attenuator to drop the level down to usable levels.

WARNING! The RECEIVE IN jack is fuse protected using “sacrificial” parts up to 2 watts for a short period of time. This input is not designed to handle high powers! That is reserved for the GENERATE OUT jack. If you accidentally key too much power into this input, the COM3010 will be damaged!

This input also has a 1.5dB attenuator in line to allow for a better antenna match to the first stage of amplification. You will need a DC blocker if working with signals that contain DC over 5V to prevent damage to the COM3010.

B. MOD IN Jack
The modulation input jack is used when a modulating frequency other than the built in code

and tone generation of the COM3010 is desired. This input can be set to a wide range of signal levels as the built-in AGC will change the gain to get a very specific level before modulating the RF out. This input range should be kept between 50mV pk/pk to 5V pk/pk.

When you are using this feature, and the EXT modulation is switched on, there are three different AGC modes you should be aware of. These are indicated as an icon next to the MOD IN level field on the left-hand display. If you press [SHIFT][MOD] it will cycle through the various modes. See the GENERATE DISPLAY-External Modulation section for more information.

C. MONITOR Jack
The output of the MONITOR jack is the received modulation. This is typically a 1V pk/pk signal and can be used to display on an oscilloscope or routed to other test equipment for further analysis. For example, you can view or decode received audio or digital signals.

This output is approximately 250mV/1 kHz of deviation.

D. RF OUT Jack
The RF out jack provides the output of the signal generator portion of the COM3010. It is also used as the power meter input. The power meter is located on the signal generator output to allow for simple radio checks without moving the cable.

Internal to the COM3010 is a log power detector which checks the signal present at the RF out jack. With the unit powered down, the COM3010 will, by default, shunt any power transmitted into the generator output jack to the dummy load on the back of the unit. This prevents the COM3010 from being harmed by applying power to the RF out jack within the power meter specifications even if the power fails or the battery runs out.

E. VOLUME
The volume control simply affects the speaker level. The COM3010 has 2 watts of audio power which should be adequate for most environments.

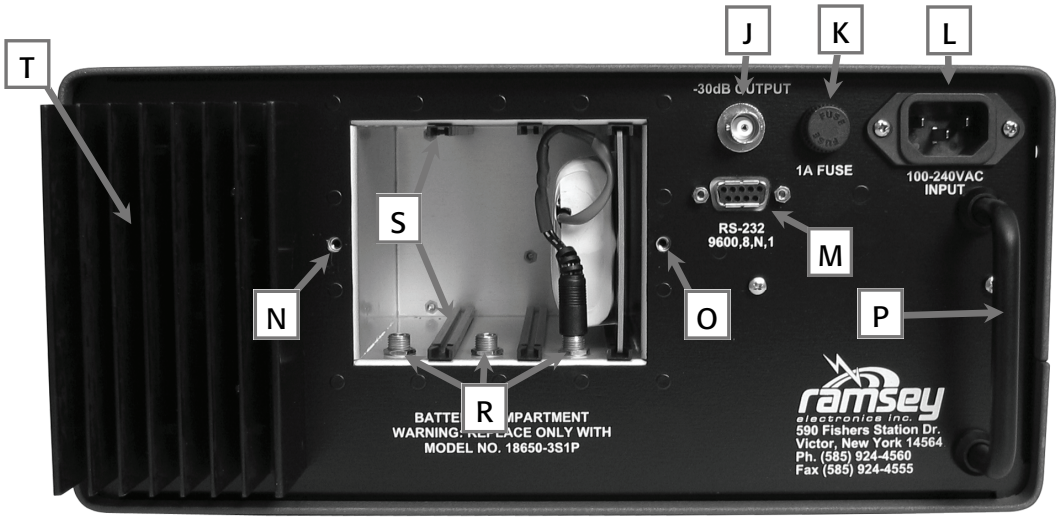
F. SQUELCH
The squelch control determines when the signal from the receiver is allowed to be detected, displayed, and fed to the speaker. This is usually set to a threshold using the RSSI bargraph meter on the top of the right hand display. A small cursor indicates at what RSSI level the squelch will open and allow audio through.

The squelch also blocks the audio to the modulation meters. To be able to measure the signals, the squelch must be open.

G. POWER Button
Use this button to turn the power of the COM3010 on and off.

H. GENERATE Function buttons
These buttons select fields to alter the generator functions.

I. RECEIVE Function buttons
These buttons select fields to alter the receiver functions.



1.02.02 Rear Panel Connections

J. -30dB Output
The power meter portion of the COM3010 uses a 100W 30dB attenuator to dissipate power on the heatsink on the back of the unit. The 30dB attenuated output is provided as a convenience to allow safe connection of an external spectrum analyzer or other equipment. For example if you transmitted 100W of power into the GEN OUT jack, 100W = +50dBm. The output of the 30dB attenuator will now be +20dBm, which is within the range of what most spectrum analyzers can safely handle.

K. Fuse
Fuse for AC line power. Replace with a standard 1A slow-blow fuse only.

L. AC Input
There is a 15VDC switching power supply internal to the COM3010 that can operate from a wide range of AC voltages without having to set any jumpers. The power supply included can handle a range from100 VAC to 240 VAC 50/60 Hz.

M. RS-232
The RS-232 jack is provided for remote control of the COM3010 and also firmware updates. At one time the software was limited to 9600:8,n,1, as shown on the back panel, but now it has the flexibility to choose a range of baud rates. See USER OPTIONS - Serial Port Options.

N,O. Battery Panel
Two thumbscrews are provided for easy removal and attachment of the rear battery panel to access the Lithium Ion batteries.

P. Handle

Allows unit to be placed upright and rest on the rear panel.

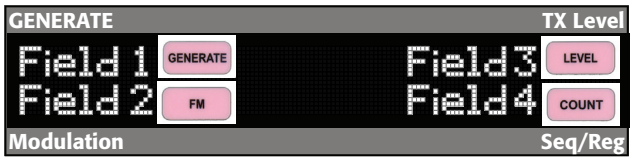
R. Battery Input Jacks
Receptacles for connecting battery packs. These can also be used to connect an external DC supply. See the BATTERY INFORMATION section for more details.

S. Battery Pack Support Rails

T. High-power attenuator heat sink
The high-power attenuator is located on the back of this heat sink inside of the case. During power meter testing, this will become quite warm. During use, allow for plenty of air circulation around the heat sink to allow normal convection cooling to occur. If this gets too hot, it may cause power supply of the COM3010 to shut down to protect the batteries from overheating. If performing a lot of power testing, it wouldn't hurt to direct air flow at the heat sink to keep it cool, though under normal testing circumstances, this will never be a problem.

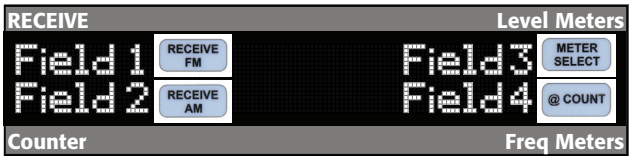
1.02.03 Field Selection and Entry

With one exception the GENERATE and RECEIVE displays are laid out in the same four quadrant format with each field's (quadrants) access key remaining the same.



GENERATE screen:

Field 1 is accessed through the ***GENERATE*** key.
Field 2 is accessed through the ***FM*** key.
Field 3 is accessed through the ***LEVEL*** key.
Field 4 is accessed through the ***COUNT*** key.



In the Receive screen:

Field 1 is accessed through the ***RECEIVE FM*** key.
Field 2 is accessed through the ***RECEIVE AM*** key.
Field 3 is accessed through the ***METER SELECT*** key.
Field 4 is accessed through the ***@COUNT*** key.

The exception to this is the standard GENERATE screen which contains five fields instead of four. Two fields appear on the upper line and three fields on the lower line. In this case the access keys are as follows.

Field 1 or Generate Frequency is accessed through the ***GENERATE*** key.
Field 2 or Modulation field is accessed through the ***FM*** or ***AM*** keys.
Field 3 or Level is always accessed through the ***LEVEL*** key.
Field 4 or memories are accessed through the ***SEQ*** or ***REG*** keys.
Field 5 or tone field is accessed through the MOD keys ***EXT***, ***INT***, ***CTS*** and ***DCS.***

2.00 BASIC OPERATION

2.01 Generating a Frequency

The Frequency Range of the Generator is 100 kHz to 1 GHz in 1 Hz steps. To enter a new generator frequency, press the ***GENERATE*** key. The "***Ft***" Icon will flash.

Enter the frequency desired by using the numerical keypad. Use either the ***MHz/-dBm*** or ***kHz/mV*** key to select your desired units. The COM3010 is now generating the frequency you entered.

Example:

2.02 Setting Frequency Steps/Increments

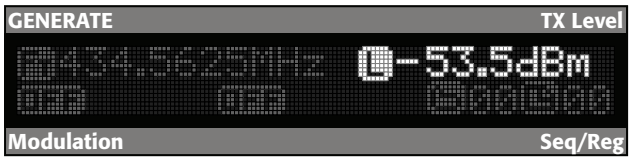
At times you may want to step through fixed increments of Generate Frequency, RF Level, and Modulation. The Receiver function will also work in this manner. To set the INCREMENT for a given function press the ***SHIFT*** key and then the proper ***FUNCTION*** key.

To Set Generator Frequency increment press the ***SHIFT*** key, then press the ***GENERATE*** key; the "***delta F***" Icon will appear in the Generator Frequency field. It will also show the value that is currently stored. Enter the new desired increment value using the numerical keypad. Press the appropriate units button for step size desired. (***MHz/-dBm***, ***kHz/mV***, or ***Hz/uV***) You may now use the ***UP*** or ***DOWN*** arrow keys to change the generate frequency by the desired increment value.

Example:

If you want to escape in the middle of an entry, press

2.03 Setting Generator Level



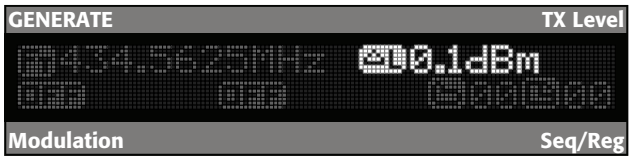
RF Level can be entered in either the dBm or Volts scale. The Range is 0 dBm (223 mV) to -140 dBm (0.022uV) in 0.1 dB steps.

To enter the Level Press the ***LEVEL*** key. The "***L***" Icon will flash. Enter the Level using the keypad, then press your desired units. The COM3010 is now generating your desired level.

Example:

To cancel an entry, press

2.04 Setting Generator Steps/Increments

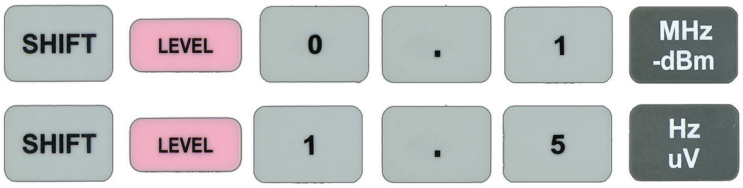


To enter a new level increment, press ***SHIFT*** then ***LEVEL*** and the current increment value will be displayed. To enter a step size of 0.1dB, enter ***0.1*** then ***-dBm/MHz***. To cancel out press ***SHIFT*** then ***ENTER***. To step the level setting make sure the level field is selected (blinking icon) or press ***LEVEL***, and use the ***UP*** and ***DOWN*** arrow keys.

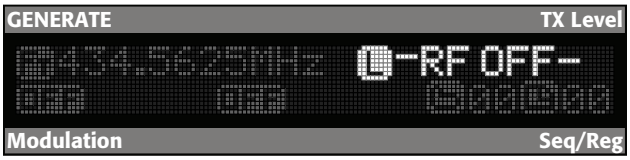
Level can be entered in dBm or volts and can be stepped in dBm or volts. dBm can be stepped in as little as 0.1 dB, and volts down to 0.1uV. Remember that the basis for dB is logarithmic and volts are linear so any steps entered in volts when viewing dBm will not directly correlate, likewise with steps entered in dBm when volts are displayed.

It is simple to determine how many volts there are in the current setting. While still in the Level field, press ***kHz/mV*** or ***Hz/uV***. The display should now show 652.4uV. To switch back, press ***MHz/dBm***.

Example:



2.05 Muting the Generator



To mute the generator at any time, press ***SHIFT*** then ***MHz/-dBm*** or end with any scaling key. This sets the generator level to –140dBm as well as setting the generator to its lowest possible level.

Example:

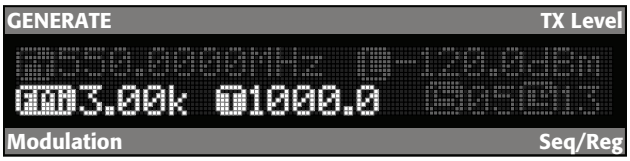
Your Notes:

2.06 Modulating the Carrier

The carrier frequency can be modulated with either amplitude modulation (AM) or frequency modulation (FM). In AM mode it is possible to generate either a single tone or external modulation; DCS and CTS are not enabled in AM modes. The following combinations are possible in FM :

- No modulation
- Tone Only
- Tone + CTS
- Tone + DCS
- External
- External + CTS
- External + DCS
- Two Tone only
- Two Tone + CTS

2.06.01 Generating a Test Tone



To generate an internal tone, press ***INT***. The LED next to the ***INT*** key will light and the COM3010 will display the last deviation used which is indicated by the FMi icon (stands for FM internal), and the last tone used indicated by the T icon. If the T icon is not already flashing, press the ***INT*** button to select the tone field.

To enter a 1 kHz tone press ***1, kHz/mV***. You can enter between 0.1Hz to 3 kHz into this field.

Example:

To toggle the internal tone if you are already in the internal tone field, press ***INT*** once, or twice, once to get there, and another to toggle it off.

Example:

To enter a new tone deviation, press ***FM***. The selected field will become the FMi for entering deviation. To enter +/-3 kHz of deviation, press ***3, kHz/mV***. You can enter between 0.1 Hz and 75 kHz in this field.

Example:

2.06 Modulating the Carrier *(Continued)*

To generate AM tones press the ***AM*** key; the FMi icon will be replaced with AM and % modulation will be displayed.

To enter a new AM value of 50%, press ***AM, 5, 0, ENTER/%***. The COM3010 will now be generating AM with 50% modulation and a 1 kHz tone.

Example:

Your Notes:

2.06.02 Generating Using External MOD IN

The external modulation mode allows modulation from an external source via the MOD IN jack. The value you enter for deviation or % AM is followed exactly, and is automatically adjusted by the AGC (automatic gain control).

Any level from an external generator between 100mV and 2V peak will be compensated with the AGC circuit. Remember there are three types of AGC supported by the COM3010. These three modes are cycled using ***SHIFT, EXT***. To enter tone mode, press

until you see the SIN waveform icon for tone mode. The FM field will already be selected since you cannot enter a tone frequency here, so then enter ***3, kHz/mV***.

To enter a tone mode with 50% of AM modulation, press

making sure the AGC icon still indicates tone mode.

AGC Icon	Mode Name	Description
	Tone AGC	Tone AGC: The AGC will attack (reduce the level) quickly, but decay (increase the level) slowly. This allows tone signals to be as steady as possible in level.
	Voice AGC	Voice AGC: Attack and decay are both fast to track voice levels and bring them to an acceptable level. Peaks will be limited to the set modulation.
	Digital AGC	Digital AGC allows attack only, no decay. This prevents overmodulation at the start of a data stream when sending certain paging formats. This special mode allows for 4-level paging without "breathing" of the AGC. Breathing is a term used for AGC that is adjusting too rapidly. This mode must be "trained" for two seconds with the source to stop the AGC from adjusting. Once trained, the AGC turns off.
	Off	Off mode sets the gain of the COM3010 to give approximately 5KHz deviation for a 1 Vpp input signal.

2.06.03 Generating CTS

To generate a CTS tone, press ***CTS***. Current parameters are now shown on the display. To enter a new CTS tone you will need to know its frequency, not the tone #. Use the chart at the end of the manual for standard CTS tones. This field will accept any selected frequency from 0.1Hz to 999Hz, so non-standard tones may be used.

Example: To enter a new CTS frequency of 78.5Hz, press

The tone may be toggled on and off by pressing

To enter a deviation value, press

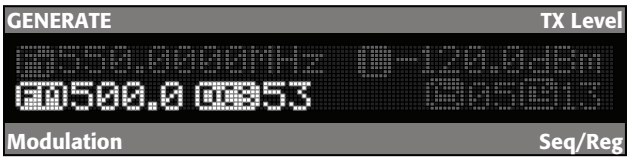
to select the FM field; the icon will blink. To enter a deviation of 300.0Hz, press

Standard CTS deviation is typically 0.75 kHz. Deviation values range from 0.1Hz to 2.5 kHz.

You can set a step/increment value for deviation in the CTS deviation field by pressing the

arrow buttons to test tone decoder sensitivity. To cancel out of either entry press

2.06.04 Generating DCS



To activate DCS, press DCS

The LED will light indicating it is on. The DCS code field is now active as indicated by the blinking icon.

You must enter the DCS code with the ***UP / DOWN*** keys. You will be selecting from an internal list stored in the COM3010. To select a code of 53, use the ▲ ▼ keys to select the code.

For inverted digital code, press ***SHIFT, DCS***; press them again to return to normal. Note the "N" or "I" on the end of the code. To invert or de-invert the DCS code, press ***SHIFT, DCS*** to toggle the code.

For example: If you had 53N selected for a code, pressing SHIFT DCS will select 53I.

To enter a new deviation value for DCS code generation, press ***FM*** followed by the deviation level desired, followed by ***Hz/uV***.

Example: (For 500Hz deviation)

FM 5 0 0 Hz uV

To turn off DCS, press DCS

Your Notes:

2.06.05 Modulation Steps

You may enter a STEP/Increment value for FM deviation or AM modulation in any of the modulation modes. This entry will also be used for all other format's deviation steps.

For FM press ***SHIFT, FM*** and enter in a value from 0.1 Hz to 1 kHz followed by ***Hz/uV***.

Example:

To enter a value of 50Hz

For AM press ***SHIFT, AM*** and enter a value from 1% to 50% followed by ***ENTER / %***

Example:

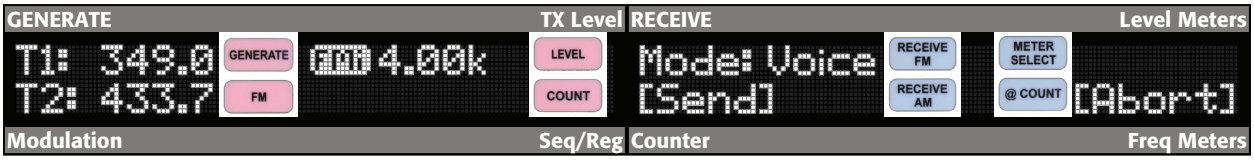
To enter a value of 10%, press

To cancel out press ***SHIFT, ENTER / %***

Your Notes:

2.06.06 Generating Two-Tone Paging Signals

The COM3010 can also generate two tone sequential paging signals. Because there are two tones involved, both displays are used with their corresponding function keys. It is important to remember that each of the display fields is controlled by a specific function key. The 2nd tone parameters are displayed in the RECEIVE display, and controlled by the corresponding RECEIVE function keys (*RECEIVE FM, RECEIVE AM, METER SELECT, and @COUNT*).



Eight display fields are ALWAYS controlled by these corresponding function keys

In two-tone signal generation, the function keys are re-assigned to their nearest field rather than the specific function that does not have it's own function key. The function keys associated with two-tone sequential paging are as follows:

T1 (Tone one)	***GENERATE***
T2 (Tone two)	***FM***
Tone Mode	***RECEIVE FM***
Send	***RECEIVE AM***
AFMi (FM Internal)	***LEVEL***
Abort	***@COUNT***

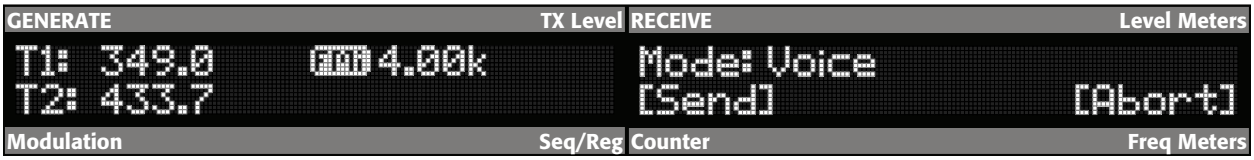
To encode a two-tone page, press ***SHIFT***, ***INT*** to select internal generator. Then press ***GENERATE*** (selects T1) followed by the frequency of tone one and then ***HZ /uV***. Then enter the second tone by pressing ***FM*** (selects T2) followed by the frequency of tone two and then ***HZ / uV***. The deviation level is then set by pressing ***LEVEL*** followed by the desired deviation level and the ***kHz / mV*** key (Default level is factory set at 4 kHz). Your two-tone frequencies are now setup.

Set the paging mode using the ▲ ▼ function keys as follows:

PAGING MODE	T1 LENGTH	T2 LENGTH	SQUELCH WAIT TIME
Tone Only	0.4 seconds	0.8 seconds	1.3 seconds
Tone/Voice	1.0 second	3.0 seconds	1.3 seconds
Battery Save	2.7 seconds	0.8 second	1.3 seconds
Group Call	Not Sent	8.0 seconds	1.3 seconds

See two-tone paging examples on the following page.

2.06.06 Generating Two-Tone Paging Signals *(Continued)*



You wish to generate a typical two-tone, tone only paging signal. Tone one is 349.0 Hz, and tone-two is 433.7 Hz.

Sets tone one to 349 Hz.

Sets tone two to 433.7 Hz.

Sets tone deviation level to 3.5 kHz. (Default level is 4 kHz and does not need to be entered if default level is suitable)

Sets two-tone, tone only mode (third mode).

Sends the tone sequence.

It is not necessary to change all fields every time; typically you will only need to change the two tones and send.

Two tone uses its own deviation setting. It will not affect the internal setting.

As an added feature, CTS tones can be generated at the same time as two-tone pages for radios that require a Two-Tone signal to open the squelch, and a CTS tone to keep the squelch open. Simply turn on the CTS mode and select the required tone (see generating CTS tones) before sending the Two-Tone page.

2.07 Receiving a Frequency

Setting the receive frequency is performed in a similar manner to setting the generator.

To receive a frequency, press ***RECEIVE FM***, or ***RECEIVE AM***, followed by the frequency, followed by ***KHz /mV*** or ***MHz / -dBm***.

Example, to receive 162.400 MHz FM:

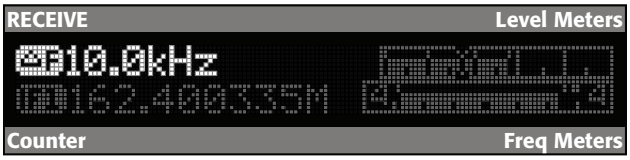
You can toggle the receive mode simply by pressing:

toggles current frequency to receive the AM component and,

toggles to the FM to receive that portion of it.

The metering will reflect the mode you have selected. Information on that is reserved for the next few sections.

2.08 Setting a Receiver Step/Increment



Rather than having to move the cursor to a specific digit to increment frequency, the COM3010 employs increments for important fields. To access an increment for the field of interest, press ***SHIFT*** then the field such as ***RECEIVE FM***; the old increment value will appear

To enter a new increment for the generate field, any frequency from 1Hz to 100 MHz can be used. Typically you would choose your channel spacing as the step size.

Example: To set the step increment for receive FM to 10 kHz.

If you want to escape in the middle of an entry, press

2.09 Using the Frequency Counters

Your COM3010 contains three different RF frequency counters. Each frequency counter has two gate times. The value counted is the signal presented at the RECEIVE IN jack.

COM3010 Frequency Counters

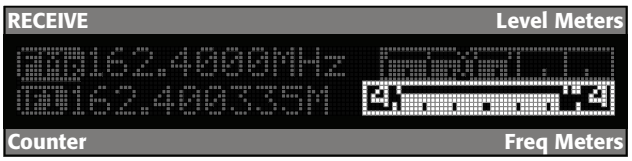
Counter Icon	Mode	Gate	Description
IF	Receiver IF Counter	0.1s	Used to calibrate received transmissions. As sensitive as the receiver. (<5uV). Good for counting signals +/-7 kHz away from the receiver's set frequency.
IFL	Receiver IF Counter	1.0s	
RF	Counter, 100Hz-70 MHz	0.1s	Used for measuring signals in the lower frequency range of the COM3010. Does not use a frequency prescaler so accuracy is 1Hz maximum. Worst case sensitivity of 10mV. Only displays strongest signal.
RFL	Counter, 100 Hz-70 MHz	1.0s	
RFH	Counter, 70 MHz-1 GHz	0.1s	Used for measuring signals in the upper frequency range of the COM3010. Uses a divide by 10 prescaler, so the maximum accuracy is 10Hz. Worst-case sensitivity of 10mV. Only displays strongest signal.
RFH	Counter, 70 MHz-1 GHz	1.0s	

To select the different counters press:

… until the counter you want is selected.

This field is tied to the @ ***COUNT*** key on the receive side and ***COUNT*** on the generate side. By pressing @ ***COUNT***, the current frequency count is copied to the receive field. By pressing the ***COUNT*** button the current frequency count is copied to the generator field.
Note: The count is rounded to the nearest set step size that has been set in the Receive or Generate field. For example if the frequency count was 10.000123 MHz, and the step size set for the Receive field is 5 kHz, the frequency copied into the Receive field will be rounded to the 5 kHz step, so it will be set to 10.0000 MHz.

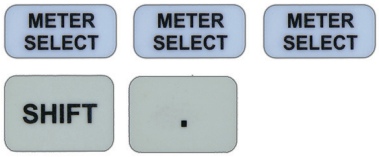
2.10 Using the Frequency Meters



The frequency meters are selected by pressing ***METER SELECT*** multiple times. There are meters unique to both RECEIVE AM and RECEIVE FM modes.

Any of these meters may be zoomed for a larger display for easy viewing. To zoom a display, press ***SHIFT***, ***.*** Function keys.

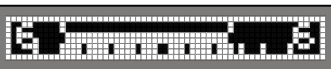
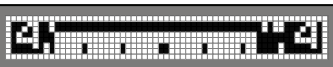
Example:

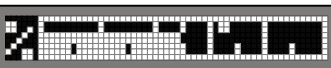


To select meter mode

To zoom a display for easy viewing

COM3010 Meter Displays

FM Mode: Meter Displayed	Description
 +/- 6 kHz FM Deviation Bargraph Meter	2.10.01 This meter displays the instantaneous modulation packet showing the minimum and maximum level. It displays a maximum of +/- 6 kHz deviation whether or not the received signal is on frequency. Each division represents 1kHz; this display is showing +3 kHz/-4.2 kHz.
 +/- 4 kHz FM Deviation Bargraph Meter	2.10.02 This reduces the scale to +/- 4 kHz. This allows more resolution for detecting smaller signals without having to zoom.
Digital FM Deviation Meter	2.10.03 This meter is a numeric version of the above meters.

FM Mode: Meter Displayed	Description
 Percent of AM Bargraph Meter	2.10.04 Displays a quickly updated percent of AM calibrated demodulation. Every tick indicates 10%. This meter indicates 50% modulation, and the slow peak-hold point (larger square) indicates a peak of 65% modulation.
Digital Percent of AM Meter	2.10.05 Displays percent of demodulated AM. Accuracy is +/- 5%, but better than +/-1% using 1kHz tones.

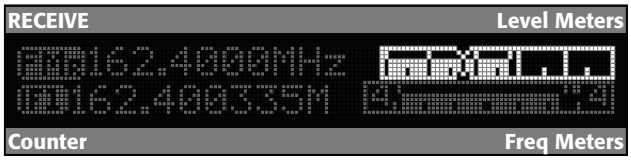
COM3010 Meter Displays *(Continued)*

Common Meter Displays	Description
Frequency Error Bargraph Scale = 1, Error Positive	2.10.06 The frequency error bargraph allows visual calibration of a frequency reference to the internal reference of the COM3010. This is scale-1, error positive. For a more precise error value see the Digital Frequency Error meter below.
Frequency Error Bargraph Scale = 2, Error Negative	2.10.07 The frequency error bargraph allows visual calibration of a frequency reference to the internal reference of the COM3010. This is scale-2, error negative. For a more precise error value see the Digital Frequency Error meter below.
1000.0 Digital Frequency Error Meter	2.10.08 The Digital Frequency Error meter will measure the difference between the COM3010's receiver frequency and counted signal. It will then display the difference digitally.
1000.0Hz Audio Frequency Meter	2.10.09 The audio frequency counter indicates the demodulated audio frequency. It is an average of counts over a period of time, and the accuracy increases as time goes on. After 10 seconds it has an accuracy of 0.1Hz for proper discovery of CTS tones. It has a count range from 60 Hz to 3 kHz.

Any of the meters can be zoomed by pressing

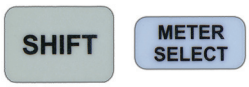
Your Notes:

2.11 Using the Level Meters



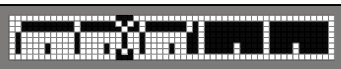
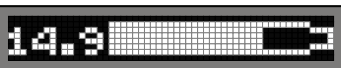
Level meters in the COM3010 are accessed by pressing ***SHIFT***, ***METER SELECT*** multiple times to cycle through the available meters. Level meters available include RSSI Bargraph, RSSI Digital Meter, Power Meter, Battery Meter, and Serial Status. Each of the meters will be displayed in the Receive/Level Meter display.

Example:



to cycle through the available meters shown below.

COM3010 Level Meter Displays

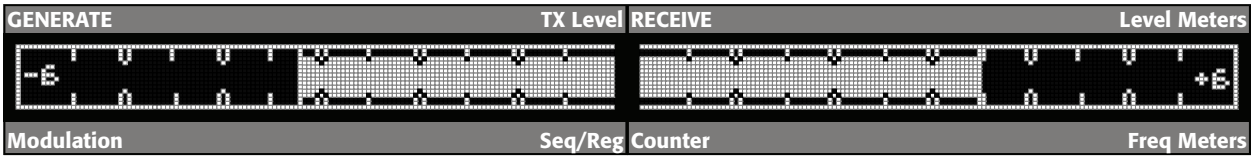
Common Meter Displays	Description
 RSSI Bargraph	2.11.01 Displays a relative RSSI meter of a received signal at the set frequency. Meter ranges from –120dBm to -30dBm. There is also a cursor indicating the current set squelch point that moves with the control. When the bar surpasses this point, the squelch opens.
RSSI Digital Meter	2.11.02 Displays absolute RSSI level of a received signal from approximately –120dBm to -30dBm. Accuracy of +/-1dBm after loop-though RSSI calibration. (See user calibration section).
Power Meter	2.11.03 Displays power as seen at the power detector. Normally when a radio is not being keyed into the generate output of the COM3010 this will display 0W. See Using the Power Meter for more information. **WARNING:** Maximum input to COM3010 is 100 Watts.
 Battery Meter	2.11.04 Displays the current battery state. Low end of battery is at 10.0V and high end is at 12.6V. The COM3010 will power itself off below 10.0V to preserve the battery.
Serial Status	2.11.05 Displays the status of the serial port while communicating. The "L" indicates logged in, A is an address match, Tx is the COM3010 transmitting data, Rx is receiving data, and Er is a communications error.

2.12 Zooming the Frequency Meters

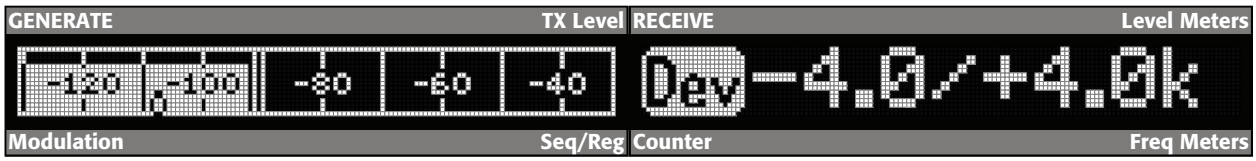
Each Frequency meter has a corresponding display in the Zoom Meter Mode. The only exception is the +/-4 kHz Deviation Bargraph Meter. The +/-6 kHz Deviation Bargraph Meter is displayed twice in the Zoom Meter Mode list.

To Zoom the display, press ***METER SELECT***, then ***SHIFT***, **. .** Once zoomed, you can continue to press ***METER SELECT*** to select other meters, or use the power meter by pressing ***SHIFT, 3***.

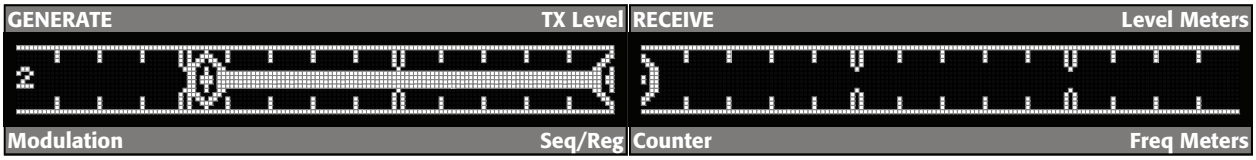
Example: METER SELECT | SHIFT | .



In the modulation meter above, each large tick represents 1 kHz, so the meter is reading –3.2/+3.5 kHz of deviation. If you want numbers instead switch to the text version of this meter by pressing ***METER SELECT*** a few times.



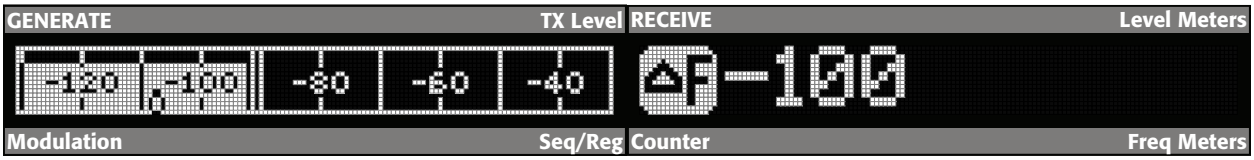
Example of the two meters displayed during zoom deviation text meter. The left meter is the signal level RSSI bargraph (currently reading –92dBm), and the deviation meter on the right.



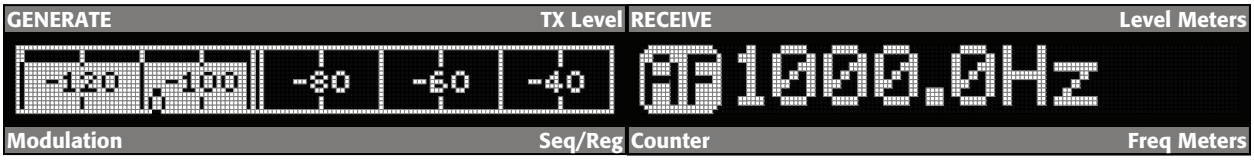
Example of the frequency error bargraph. This auto-scaling bargraph is for visual tuning, but you can derive the actual error using the tick marks and the current scaler value on the left display. The scaler is a 10^X multiplier, so for example the above display is scaled as 10^2 or 100Hz for each tick.

Depending on how different the receive frequency is from the counter frequency will be how large the scaler is and how far to either side. To quickly get the actual count value, use *METER SELECT* to switch to the text version of the error meter.

2.12 Zooming the Frequency Meters *(Continued)*



Example of the text version of the frequency error meter. It gives quick, accurate readings, but may be difficult to visualize while manually tuning an oscillator. Use the frequency error bar-graph for tuning.



This is an example of the zoomed audio frequency counter and the RSSI meter.

Your Notes:

Your Notes:

3.00 TYPICAL TEST PROCEDURES

3.00 Typical Test Procedures

This section outlines typical measurements that can be made with the COM3010. These test procedures are basic ones designed to help you get familiar with the unit. Once familiar with the COM3010 you will be able to combine and modify these procedures to fit your own operation, increasing its efficiency.

This section also assumes the user has a basic understanding of the operation of the COM3010 Service Monitor. If the user is confused about operational matters, please refer back to the appropriate section of the Owners Manual.

Your Notes:

3.10 Transmitter Tests

3.10.01 Transmitter Power, Frequency, and Modulation Measurement

This procedure allows the technical service professional the ability to measure the Transmitter Frequency Accuracy, RF Power, and FM Deviation or Percent of AM modulation. Frequency Error, FM Deviation, and AM Percent of Modulation can all be measured in both an analog or digital format. The Power measured can be displayed in Watts or dBm.

1. Connect the transmitter output to the COM3010 RF OUT jack.

   Warning - Do not under any circumstances connect a transmitter to the RECEIVE IN jack of the COM3010, or damage will result!

   Warning - Maximum RF power input to the RF OUT jack of the COM3010 is 100 W. Do not exceed this level or damage will result!

2. Connect a BNC to BNC cable from the –30dBm OUTPUT on the back panel to the RECEIVE IN jack on the front panel.

   This will take the attenuated output of the power meter circuit and return it to the receiver for further analysis

3. Select IF.1 (IF counter 0.1 second gate) by pressing the COUNTER button.
4. Enter a receive frequency into the COM3010 that matches the transmitter's transmit frequency.

   Example: 464.15 MHz.

The frequency entered into the COM3010 will be the center frequency of the bargraph meter. The transmitter frequency is shown on the bargraph in relation to the center frequency.

5. Select the Frequency Error Bargraph Meter or Digital Frequency Error Meter by pressing

   METER SELECT

   Power Measurement

6. Key the radio. The COM3010 will automatically switch to Power Meter mode and display the transmitted power in the GENERATE screen. To toggle between Watts and dBm press the LEVEL key.

Frequency Error Measurement

7. The COM3010 will also display the Counted Frequency (Lower left field) and The Frequency Error (lower right field) in the RECEIVE screen.
8. Press [SHIFT] [.] to Zoom the Frequency Error meter to the entire RECEIVE screen.
9. Adjust the transmitter's frequency until the error displayed is zeroed to the center mark of the Frequency Error Bargraph Meter or the Digital Frequency Error Meter reads zero.

Deviation Measurement

10. Press the [METER SELECT] key and select either the ± 6 kHz FM Deviation Bargraph Meter or the Digital FM Deviation Meter.
11. Inject appropriate audio signal into the transmitter under test.
12. Key the transmitter
13. Adjust the deviation on your transmitter under test as required to meet its specifications.
14. If a CTS or DCS codes are being used with transmitter under test, it is important to adjust the CTS or DCS signal levels first since these signals will be added to the voice and will increase the overall deviation.

Note: For AM Transmitter Frequency Error, Power, and Percent of Modulation Measurements use the same procedure but substitute:

Receive [RECEIVE AM] for [RECEIVE FM] function key
Percent AM Bargraph for ± 6 kHz FM Deviation Bargraph Meter.
Digital Percent of AM Meter for Digital FM Deviation Meter.

Your Notes:

3.10.02 Power Measurements

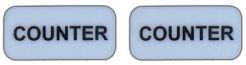
As with many power meters, the frequency to be measured must be specified for accurate power meter readings.

1. Connect the radio to the RF OUT jack.
2. Transmitter frequency can be entered into the COM3010 using one of two methods: Manually using the IF Counter Method or automatically using the RF Counter Method.

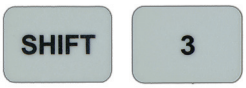
IF Counter Method:

3. Enter the frequency of the radio under test into the Receive Field by pressing ***RECEIVE FM***, the required Frequency, then press ***MHz/dBm***.

4. Select Count IF mode by pressing ***COUNTER*** until the ***IF.1*** icon is displayed.



5. The COM3010 will automatically switch to Power Meter mode when the radio is keyed, or, to enter Power Meter mode manually, press ***SHIFT, 3***.



6. Key the radio; the power reading is displayed in the Generate screen.

7. The reading can be toggled between dBm (helps with loss calculations), and watts by pressing ***LEVEL***.

RF Counter Method:

3. If the frequency of the radio under test is unknown the RF Frequency Counter can be used to measure frequency and automatically calibrate the Power Meter.
4. Connect a cable from the -30dBm OUTPUT on the back of the unit to RECEIVE IN jack on the front. This allows the frequency counter to count the transmitted RF through the attenuator out jack.
5. Select the frequency counter RF_L (below 70 MHz) or RF_H (above 70 MHz) by pressing the ***COUNTER*** button until the correct icon appears.

3.10.02 Power Measurements *(Continued)*

6. Key the radio into the COM3010; the frequency counter will begin to count the RF signal. The text to the right of the power meter will show "POWER GOOD" to indicate that the count value and calibration are correct.

7. If the counter is not registering you will see "POWER UNCAL". To remedy this, either use the COUNT IF method or make sure the radio is keyed long enough for the frequency counter to register a valid count.

8. The reading can be toggled between dBm (helps with loss calculations), and watts by pressing ***LEVEL***.

Your Notes:

3.10.03 Frequency Counter Off-Air

This test allows the user to count the frequency of a transmitter off-air. This is especially useful for identifying the frequency of unmarked radios.

1. Connect the whip antenna to the COM3010's RECEIVE IN jack.
2. Turn off all FM modulation modes by pressing [SHIFT] [COUNTER] (Mod Off).
3. Press ***COUNTER*** multiple times to select RFL, RF_L, RFH or RF_H, depending on frequency band and gate time desired. See "2.09 Using the Frequency Counters" for more information.)
4. Key the transmitter; the count will appear in the lower left field of the RECEIVE screen.
5. While still keying the radio the user can press [@ COUNT] to set the receiver to the counted frequency.
6. Pressing [COUNT] on the generator side will set the generator to the counted frequency.

Note: The counted frequency can be rounded to the nearest step size of each display. This makes it easy to check for frequency alignment since you can set the step size to the channel size.

Setting the step size to the channel size causes the COM3010 to set the Receiver or Generator to the channel frequency, not the counted frequency, which is important if the radio being tested is off frequency. The rounding function can be toggled on and off in the Options Menu.

To accomplish this press: [SHIFT] [6] [GENERATE] [LEVEL] [RECEIVE AM] [RECEIVE AM] [RECEIVE AM]

3.10.04 Frequency Counter Direct Connection

The COM3010 can be used as an RF frequency counter by connecting a Coaxial cable, 50 ohm probe, or "sniffer" loop to the RF input. The RF counter has many useful purposes including the frequency alignment of Transmitters, Receivers, and crystal oscillators.

1. Connect a 50 ohm probe, cable, or sniffer loop to the RECEIVE IN jack.

   Warning - Do not under any circumstances connect a transmitter to the RECEIVE IN jack of the COM3010 or damage will result!
2. Turn off all FM modulation by pressing [SHIFT] [COUNTER] (Mod Off).
3. Bring the loop close to the oscillator, or connect the probe to the appropriate test point.
4. Press [COUNTER] multiple times to select RFL, RF_L, RFH or RF_H, depending on frequency band and gate time desired. See "2.09 Using the Frequency Counters" for more information.)

3.10.05 CTS Tone Frequency and Deviation Measurement

The COM3010 can accurately measure the frequency and deviation level of CTS sub-audible tones. CTS tones are typically sent at ±0.75 kHz deviation while voice deviation is normally set at ±5 kHz. Therefore it is important to mute the microphone or any other audio input while measuring CTS frequency and deviation.

CTS Tone Measurement

1. Connect a BNC to BNC cable from the –30dBm OUTPUT on the back panel to the RECEIVE IN jack on the front panel. **Warning** - Do not under any circumstances connect a transmitter to the RECEIVE IN jack of the COM3010, or damage will result!
2. Connect the transmitter to be tested to the RF OUT jack.
3. Enter the Transmitter Frequency to be tested into the COM3010's RECEIVE field.

   Example Frequency : 464.15 MHz :

   RECEIVE FM | 4 | 6 | 4 | . | 1 | 5 | MHz -dBm

4. Select the AF frequency counter on the Receive screen lower right field by pressing METER SELECT
5. Key the radio while muting the microphone audio. The COM3010 will automatically switch to Power Meter Mode and display the transmitted power in the GENERATE screen.
6. The CTS frequency information will be displayed in the RECEIVE screen's AF meter (lower right field) or the user may enter Zoom mode the by pressing SHIFT . In Zoom mode the AF meter will use the entire Receive screen.
7. Un-key the transmitter when testing is complete.

Note: The AF frequency counter provides an updated value every second with a resolution accuracy of 1 Hz. After a period of 10 seconds the resolution accuracy will increase to 0.1Hz . Example: A transmitter has a CTS tone of 123.4Hz. The user keys the radio into the COM3010 as above. The first count will read 123.0Hz, the second, 123.1Hz, the third, 123.2Hz… and after ten counts, 123.4Hz. That count will remain for the duration of the transmission.

CTS Tone Deviation Measurement

8. Cycle to one of the three Modulation meters (±4 kHz, ±6 kHz FM Deviation Bargraph Meters, or Digital FM Deviation Meter) by pressing METER SELECT These meters are in the same field as the AF meter.
9. Key the transmitter and read the deviation measurement.
10. Adjust the transmitter's CTS deviation as specified in the transmitters service manual.
11. Un-key the transmitter when testing is complete.

3.20 Receiver Tests

3.20.01 Receiver Sensitivity and Centering Frequency

This procedure will give the technician a general indication of receive sensitivity and frequency accuracy. For more precise sensitivity measurements see "3.20.02 SINAD Measurements".

Receiver Sensitivity

1. Connect a test cable between the COM3010 RF OUT jack and the receiver to be tested.
2. Set the receiver to be tested to the desired test frequency. See the receiver's owners manual. Example 464.550 MHz.
3. Set the COM3010's Generator to the desired test frequency.

4. Set the COM3010's RF Level to minimum, 0.025uV.

5. Set the Level Step Size to 0.025 uV.

6. With the Level Field selected use the ***UP Arrow*** to increase the level in 0.025uV steps.

7. Increase the RF level until the squelch breaks or the receiver achieves full quieting.
8. Read the sensitivity in microvolts in the RF Level field.

Centering Frequency

9. Set the Generate Frequency Step Size to 500 Hz.

10. With the Generate field selected use the ***UP Arrow*** and ***Down Arrow*** keys *to* increase and decrease the Generator around the desired test frequency.

11. Verify that the best quieting is achieved at the desired test frequency. If not, a receiver frequency alignment will need to be done. See the radio's service manual.

3.20.02 SINAD Measurements

This test allows the user to accurately measure the sensitivity of a receiver with a built-in SINAD Test Set. The SINAD meter is accessed using the ***SHIFT, 8*** buttons. The following is a step-by-step SINAD test procedure for testing the sensitivity of a radio.

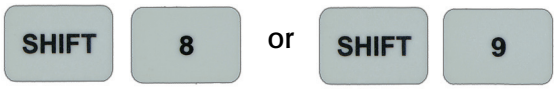
1. Connect the radio's antenna to the RF OUT jack.
2. Connect the audio out of the radio to the MOD IN of the COM3010.
3. Set the receiver's volume control to approximately mid-point (a fine adjustment will be made later).
4. Set the COM3010's Generate Frequency to the frequency of the receiver to be tested. Example: 464.55 MHz.

5. Set the output of the Generator to a level slightly greater than the expected sensitivity of the receiver under test. In this example, 2.2 uV (-100 dBm).

6. Enter the required step size for accurately finding the 12dB SINAD of the radio. In this example we'll use 0.1 uV steps.

7. Set the FM Deviation to 60% of the maximum allowable signal for the band. Example: For the 5 kHz band set the COM3010's deviation for 3 kHz (5000 * 0.6 = 3000).

8. Select ***SHIFT, 8*** for the 1kHz SINAD test, or ***SHIFT, 9*** for the 400Hz SINAD test.

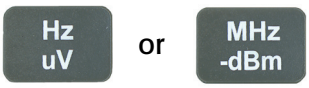


3.20.02 SINAD Measurements *(Continued)*

9. The icon displayed on the RECEIVE screen indicates the audio level from the receiver. This icon will indicate if the level is too high (straight up arrow), too low (straight down arrow), adjusting (angled arrow), or correct (flat line). When the level is correct, the SINAD measurement is accurate. Adjust the receiver's volume control for a flat line.

SINAD: Meter Displayed	Description
	When icon indicates the dash (-) it means the AGC has fully adjusted the audio level to the Sinad meter's liking and is giving accurate results.
	When icon indicates an arrow pointing to the upper right it means the AGC is adjusting the audio level and the reading will not be accurate.
	When icon indicates a downward arrow it means the audio is too low or connected improperly. The AGC cannot bring the level up high enough to compensate.
	When the icon indicates the up arrow it means the audio level is too great for the AGC to compensate. You will need to turn down the audio control or reduce the modulation used.

10. RF level is shown in the Generate screen. To display the RF level in uV, select ***Hz/uV***, and ***MHz/-dBm*** to display the level in dBm.



11. Zoom Meter mode can be toggled by pressing ***SHIFT,.*** for best presentation. If normal mode is used the SINAD meter is displayed in the lower right corner of the Receive screen.

12. With the LEVEL field selected use the ***UP, DOWN*** buttons to increase or decrease the amplitude of the generator until the SINAD meter reaches an average of 12 dB SINAD. Read the current RF Level setting; this, combined with the SINAD measurement, is the sensitivity of the receiver.

Note: The SINAD meter uses the AGC of the MOD IN jack to increase its dynamic range as much as possible for an accurate reading. The AGC icon indicates the condition of the audio under test.

3.20.03 Opening Receiver Squelch Using CTS

The following procedure allows the technician to open a receiver's CTS encoded squelch. The Service Monitor uses "sub-audible" tones, usually under 300Hz at ±0.5 kHz of deviation.

1. Connect a test cable between the COM3010's RF OUT jack and the receiver under test's antenna jack.
2. Set the RF Level equal to the receiver's sensitivity: see receiver owner's manual. Example: 0.25 uV.

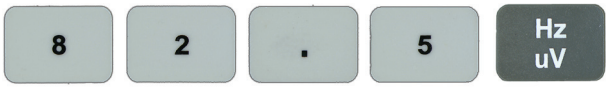
3. Set the COM3010's GENERATE Frequency to the frequency of the receiver under test. Example: 464.55 MHz.

4. Press CTS to select the CTS Mode.

   FM Modulation is automatically selected. The default deviation is 500 Hz. The deviation can be changed by pressing ***FM*** and entering a new value. Example: ±750 Hz.

   The Tone field is automatically selected unless deviation was changed in the previous step. To return to the tone field press CTS

5. This field will allow any tone from 0.1 Hz to 999.9 Hz to be entered. Enter the receiver's CTS tone. Example 82.5 Hz



6. The Squelch will open.
7. If internal or external modulation is desired with the CTS tone, Press either INT or EXT Set up the modulation information as described in "2.06 Modulating the Carrier".

3.02.04 Opening Receiver Squelch Using DCS

Opening a receivers DCS encoded squelch can be achieved by using the following procedure. The COM3010 supports all the commonly used codes, both non-inverted (N) and inverted (I).

1. Connect a test cable between the COM3010's RF OUT jack and the receiver under test's antenna jack.
2. Set the RF Level equal to the receiver's sensitivity: see receiver owner's manual. Example: 0.25 uV.

3. Set the COM3010's GENERATE Frequency to the frequency of the receiver under test. Example: 464.55 MHz.

4. Press DCS to select the DCS Mode.
5. FM Modulation is automatically selected
6. The default deviation is 500 Hz. The deviation can be changed by pressing ***FM*** and entering a new one value. Example: 250 Hz. Press

7. The Code field is automatically selected unless deviation was changed in the previous step. To return to the Code field press DCS
8. To select the required code use the ▲ ▼ arrows to scroll through the list of available codes.
9. To select inverted codes use ***SHIFT, DCS*** then use the ***UP, DOWN*** arrows to scroll through the list of codes.

10. To return to Normal DCS codes press the ***SHIFT, DCS*** keys again.
11. If the DCS code is unknown scroll through the list of codes until the squelch opens.

If internal or external modulation is desired with the CTS tone, Press either ***INT*** or ***EXT***. Set up the modulation information as described in "2.06 Modulating the Carrier".

3.20.05 Two-Tone Paging

This function allows the COM3010 user to open the squelch of a receiver using the Two-Tone Paging format.

1. Connect a whip antenna on the generator RF OUT of the COM3010.
2. Set Generate frequency. Example

3. Enter desired RF Level. Example: 4 µV Press

4. Press SHIFT INT to access the Two Tone Paging Mode.
5. Use the GENERATE button to access Tone 1 frequency (0.1Hz to 3 kHz).
6. Set Tone One, Example: 378.6 Hz

7. Use the FM button to access Tone 2 frequency (0.1Hz to 3 kHz).
8. Set Tone Two, Example: 445.7 Hz Press

9. The deviation is set to a default of 4 kHz. To change the deviation press the LEVEL button. Enter in a new deviation value. Example: 3.5 kHz, press

10. Press RECEIVE FM to access the tone type; select between the four types by using the ▲ ▼ arrows. See the chart Below.
11. Press RECEIVE AM to send the test page.

PAGING MODE	T1 LENGTH	T2 LENGTH	SQUELCH WAIT TIME
Tone Only	0.4 seconds	0.8 seconds	1.3 seconds
Tone/Voice	1.0 second	3.0 seconds	1.3 seconds
Battery Save	2.7 seconds	0.8 second	1.3 seconds
Group Call	Not Sent	8.0 seconds	1.3 seconds

3.20.06 Sending External Modulation

The COM3010 has several AGC modes available for different signaling methods. The MOD IN jack is DC coupled to allow proper transmission of digital data as well as accurate reproduction of 4-level paging formats such as FLEX.

The COM3010's AGC circuit takes whatever signal is seen on the MOD IN jack and amplifies it to a specific value to produce the proper modulation output.

Voice (Random, Audio Symbol)

1. Connect a microphone amplified to at least 50 mVpp to the MOD IN jack.
2. Set the generator to the desired RF carrier frequency. Example: 464.15 MHz

   [4] [6] [4] [.] [1] [5] [MHz -dBm]

3. Turn on external deviation pressing [EXT]
4. Select the digital AGC mode by pressing [SHIFT] [EXT] until you see the Random Audio icon in the GENERATE screen lower center field.
5. Set the desired modulation type by pressing [FM] or [AM]
6. Set the required FM deviation or AM percent of modulation. Examples: for FM 3 kHz deviation, press

   [FM] [3] [kHz mV]

   For 50% AM, press

   [AM] [5] [0] [ENTER %]

7. The AGC display (lower center of GENERATE screen) should show "Low".
8. Begin to speak into the microphone; the AGC will adjust trying to bring the level to a point that the COM3010 can fulfill the deviation or percent AM specified.

Note: Voice AGC is constantly adjusting and does not stop until it is at maximum or minimum gain. This mode should only be used for voice tests.

Tone (sine wave symbol)

Tone AGC was designed for continuous tones. Once the AGC has set the gain the AGC circuit will verify the output level and correct if necessary, approximately every two seconds.

1. Connect an audio generator such as the Ramsey SG560 to the MOD IN jack. Set the audio generator's level to approximately 1 Vpp. (50 mVpp to 5 Vpp acceptable).
2. Set the generator for desired RF frequency. Example: 464.15 MHz, Press

3. Turn on external deviation by pressing

4. Select the tone AGC mode by pressing

until you see the sine wave icon .
5. Set the desired modulation type by pressing

or

6. Set the required FM deviation or AM percent of modulation. Examples: for FM 3 kHz deviation, press

   For 50% AM, press

7. The AGC display (lower center of GENERATE screen) should show "Good". If it shows "Low" increase the audio input level. If it displays "Adj" it is internally adjusting the audio level to give the proper output modulation.
8. The COM3010 is now transmitting the tone at the requested frequency and modulation.

Your Notes:

Digital (square wave symbol)

Digital AGC helps to get the desired deviation, and it is DC biased. This means that for an input signal of 0-5V, the deviation will only go to the plus side of zero. If the input signal is –2.5V to +2.5V, it will be centered around zero. Also if a 4-level digital signal is used the step size will be an accurately scaled modulation change in relation to the peak voltage of the generator.

1. Connect a digital data source such as the Ramsey PE6400 to the MOD IN jack. Set its output around 1 Vpp.
2. Set the generator for desired RF frequency. Example: 464.15 MHz, Press

   [4] [6] [4] [.] [1] [5] [MHz -dBm]

3. Turn on external deviation by pressing [EXT]
4. Select the tone AGC mode by pressing [SHIFT] [EXT] until you see the square wave icon.
5. Set the desired modulation type by pressing [FM] or [AM]
6. Set the required FM deviation or AM percent of modulation. Examples: for FM 3 kHz deviation, press

   [FM] [3] [kHz mV]

   For 50% AM, press

   [AM] [5] [0] [ENTER %]

7. Train the AGC by sending a continuous data stream for about 2 seconds. When it is trained the AGC display shows “Good”, if not, it must be trained again. Once trained, the AGC will remain at this setting indefinitely or until External Mode has been exited and re-entered or AGC mode has been changed.

Your Notes:

3.20.07 Testing Repeater Receiver Desensitization

Repeaters operate commonly in 2 bands usually at UHF 450 – 470 MHz and 800 MHz. They are occasionally found in the 150-160 MHz VHF bands as well.

The COM3010, with its high stability accurate signal source using a calibrated isolator T connector allows you to accurately and quickly verify correct duplexer operation. It is also very easy to check Receiver Desensitization or what's often referred to as Receiver Desens. That occurs when the transmitter in a full duplex system (such as a repeater) interferes with the receiver, causing degraded sensitivity. A poorly tuned duplexer, or bad interconnect cables are the primary causes of Receiver Desens.

This tuning procedure applies to any type of duplexer such as Band Pass, Band Pass-Band Reject or Band Reject square or round cavity design.

Be sure to check the manufacturer's specifications to verify insertion loss.

The use of the calibrated isolator T assures that the COM 3010 is isolated accurately from the antenna line. This will prevent the 3010 from switching to the transmitter test mode thus turning off the internal signal generator.

IMPORTANT NOTES:

- Be sure the cables used for duplexer testing are of high quality double shielded type with the proper connectors. BNC-N and BNC-BNC, RG 142 cables from Pasternack.com or other communications distributors are a good solution.

- You will need an adjustable isolator T such as the RF industries Unidapt T and a good quality 50 Ohm load.

- The Generator output should read -dbm.

- The Receiver input should read RSSI –dbm.

- Make sure the 3010 has been calibrated.

Set up the COM 3010 to generate and monitor the same frequency. The COM 3010 can be linked for either the transmitter or receiver frequency.

STEP-1 CALIBRATING AN ISOLATION TEE (ISO-T)

1. You must calibrate the Iso-T to 40dB first in order to insure sufficient isolation and to accurately measure the receiver sensitivity.
2. The COM3010 is set up to generate at the repeater receiver frequency.
3. Attach cables, 50 ohm load and Iso-T as shown in Figure-1 below.
4. Set the generator to -60 dBm
5. Loosen the locking nut on the Iso-T and slide the adjustable stub until the receiver display is exactly at -100 dBm

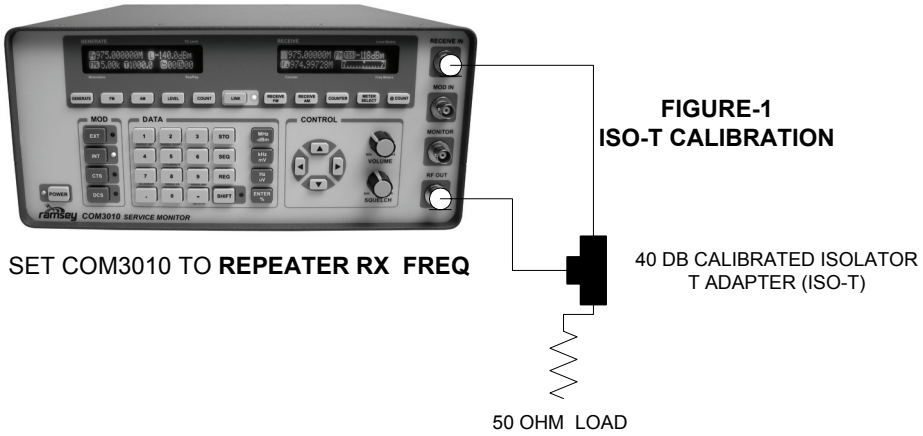


FIGURE-1
ISO-T CALIBRATION

STEP-2 RECEIVER DESENSITIZATION TEST

1. Disable the repeater function.
2. Attach a local microphone (or have a local PTT switch you can use)
3. Monitor the received signal through the local speaker only.
4. Set up the 3010 for SINAD test, attach to audio point as needed.
5. Set up the COM 3010 to generate the repeater receiver frequency.
6. Attach the already calibrated Isolator T into the transmission line as shown in Figure-2.
7. Start by injecting a signal, set generator to achieve 12dB SINAD.
8. This will be approximately -115dBm. Remember to calculate the actual value you are setting the COM3010 to an output level that is 40 dB greater due to the insertion loss of the T. Since you have already calibrated the isolator T for 40 dB of insertion loss you simply add the loss to the generator output to arrive at the repeater's true sensitivity.
9. For example if the generator is set to -75 dBm, simply add 40dB to arrive at -115 dBm actual output.
10. Record the transmitter turned off 12 db SINAD value
11. Key the transmitter with the local microphone or local PTT switch.

12. While keyed adjust the generator output as necessary to achieve 12 db SINAD.
13. Subtract the transmitter turned off SINAD from the transmitter turned on SINAD setting to arrive at the actual dB level of desensitization.
14. Typical readings are usually no more than 1 – 3 dB of measurable desensitization.

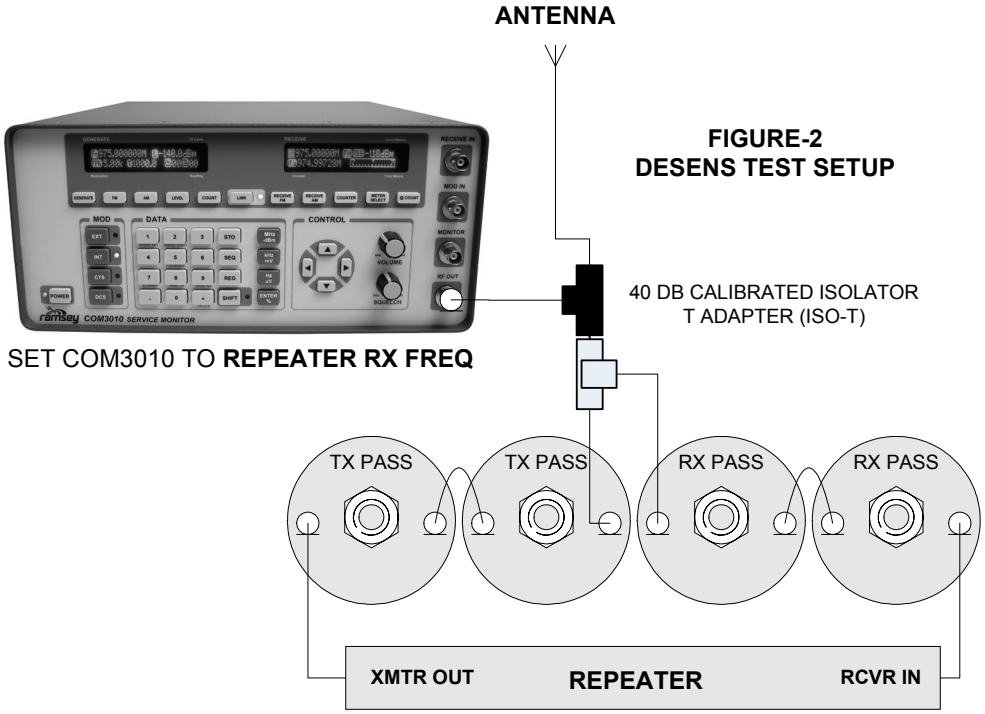


FIGURE-2
DESENS TEST SETUP

Your Notes:

3.20.08 Tuning a duplexer

The three types of duplexers commonly used in VHF, UHF and 800 MHz communication systems are:

1. Band Pass
2. Band Pass-Band Reject
3. Band Reject

The COM 3010, with its high stability accurate signal source and the associated RSSI receiver, makes accurate duplexer testing and retuning fast and easy.

This tuning procedure deals specifically with the Band Reject type, square or round cavity design. Check the manufacturer's specifications to make sure that you are tuning a Band Reject duplexer.

IMPORTANT NOTES:

- Be sure the cables used for duplexer testing are of high quality double shielded type with the proper connectors. BNC-N and BNC-BNC, RG 142 cables from Pasternack.com are a good solution.

- Before starting the tuning procedure make sure you calibrate the RSSI indicator to the generator output.

- You will be adjusting only the tuning rods or screws.

- The lock nuts on the tuning knob adjustment shafts should be loosened to allow the tuning shafts to be adjusted smoothly. Be aware that tuning is slightly affected as the lock nuts are tightened down and it will likely be necessary to readjust each notch as the lock is slowly tightened.

- The Generator output should read -dbm

- The Receiver input should read RSSI –dbm

- Record the repeater Transmit and Receive frequencies and determine the high side, low side and calculate the frequency separation. For Example, 466.500 MHz repeater receive and 461.500 repeater transmit = 5 MHz separation.

- The receiver side of the duplexer will be tuned to reject (notch) the transmitter frequency and it will be the most critical adjustment to make. This adjustment makes sure there is high isolation from the transmitter to the receiver.

- The transmit side of the duplexer will be tuned to reject (notch) the receiver frequency. This adjustment assures high isolation from the transmitter to the receiver.

- Set up the COM 3010 to generate and monitor the same frequency. The COM 3010 can be linked for either the transmitter or receiver frequency.

STEP-1 TUNING THE RECEIVER SIDE OF THE DUPLEXER (RX PASS)

1. The receive side of the duplexer is tuned to reject the transmitter noise at the transmit frequency.

2. Connect RF OUT to the duplexer antenna port as shown in FIGURE-1 below. This is done in order to inject each signal for the test. -50 dbm output is a good starting point. Do not disconnect this as it will remain connected this way for the entire procedure.

3. Set the COM 3010 Generator for the repeater transmitter frequency and generate a -50 dbm signal.

4. Attach the 50 Ohm load directly to the duplexer transmitter port.

5. Connect the RECEIVE IN to the duplexer receiver port.

6. The receiver in the RSSI mode is now connected. Adjust the cavity closest to the RECEIVE IN connection for minimum signal or greatest notch. This will also be the noisiest signal (maximum negative RSSI indication). Next, do the same for the other cavities in line.

7. You may need to increase the generator output level and readjust all in line cavities to get the best tuning points as the rejection is increased. You can determine the rejection in db by adding the generator db value to the RSSI value. Example Generator -40dbm and Receiver RSSI -110 dbm =70 db rejection

8. The locking nuts on the Cavity tuning shafts should be hand tightened and the rejection tuning re-measured.

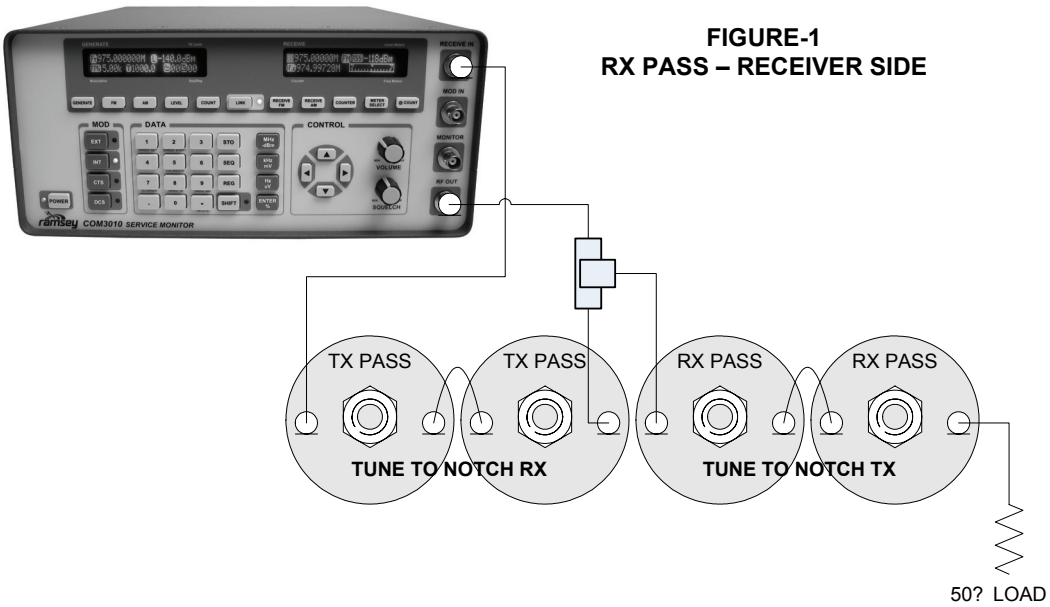


FIGURE-1
RX PASS – RECEIVER SIDE

STEP-2 TUNING THE TRANSMITTER SIDE OF THE DUPLEXER (TX PASS)

1. The transmit side of the duplexer is tuned to reject noise at the receiver frequency.
2. Set up the COM 3010 to generate and monitor the repeater receiver frequency.
3. Attach the 50 Ohm load directly to the duplexer receiver port as shown in Figure-2.
4. Connect RF OUT to the duplexer antenna port as shown. This is done in order to inject each signal for the test. -50dbm output is a good starting point.
5. Connect the RECEIVE IN to the duplexer transmitter port. The generator should be in the RSSI mode.
6. Start tuning the cavity closest to the RECEIVE IN connection for minimum signal or greatest notch. This will also be the noisiest signal (maximum negative RSSI indication). Next do the same for the other cavities in line.
7. You may need to increase the Generator output level. Readjust all the in line cavities to get the best tuning points as the rejection is increased.
8. You can determine the rejection in db by adding the generator db value to the RSSI value. Example Generator - 40 dbm and Receiver RSSI -110 dbm = 70 db rejection. It should be close to the manufacturers specifications.
9. The locking nuts on the Cavity tuning shafts should be hand tightened and the rejection tuning re-measured.

IMPORTANT: REPEAT STEPS 1 AND 2 UNTIL NO FURTHER IMPROVEMENT IN DUPLEXER ISOLATION CAN BE ACHIEVED.

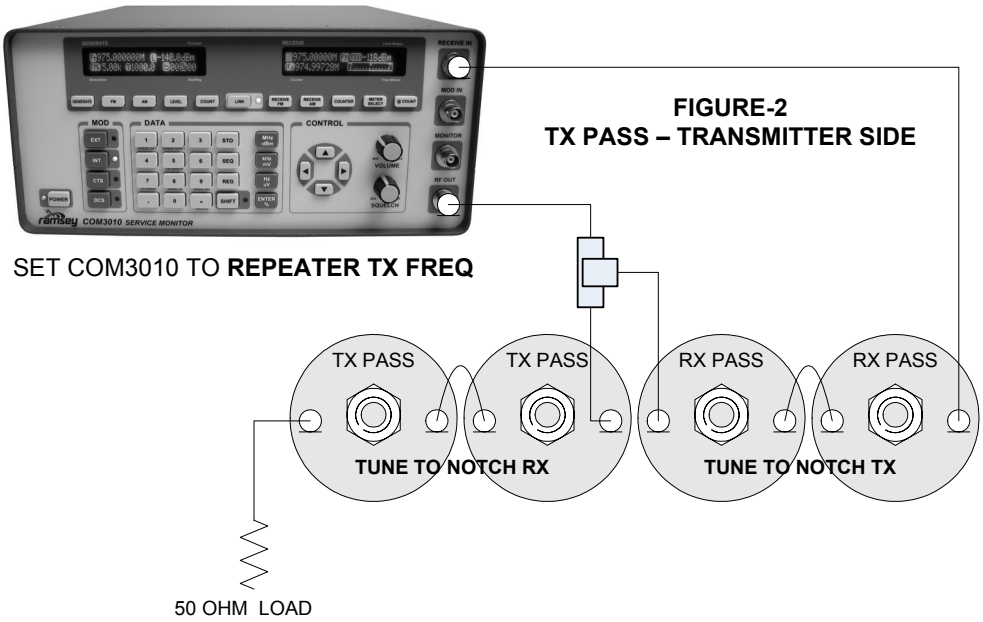


FIGURE-2
TX PASS – TRANSMITTER SIDE

STEP-3 INSERTION LOSS FINAL TEST

1. Leave the RF OUT cable connected to the duplexer antenna port. You can final test the duplexer to make sure that it is operating correctly by an insertion loss test.
2. While the RECEIVE IN is connected to the transmitter side of the duplexer, switch the generator to the repeater transmit frequency. Make sure the 50 Ohm load is connected to the repeater receiver port.
3. You can now determine the insertion loss in db by adding the generator dbm value to the RSSI value. Example Generator – 90 dbm and Receiver RSSI – 91.5 dbm = 1.5 db insertion loss. It should be close to the manufacturer's specifications.
4. Likewise move the cable from the RECEIVE IN to the receiver side of the duplexer. Switch the generator to the repeater receiver frequency. Make sure the 50 Ohm load is connected to the repeater transmitter port.
5. You can now determine the receiver insertion loss in db by adding the generator dbm value to the RSSI value. Example Generator – 90 dbm and Receiver RSSI – 91.5 dbm = 1.5 db insertion loss. It should also be close to the manufacturer's specifications.

Your Notes:

4.00 ADVANCED FEATURES

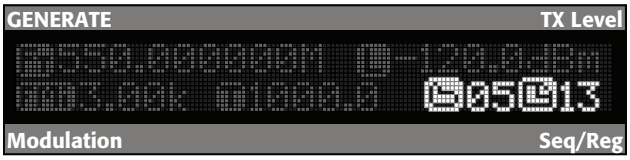
4.10 Memories

The time will probably come when you will want to store settings for repetitive testing of equipment. The COM3010 memory is broken down into Sequences that contain Registers. A Sequence can be assigned to each different piece of equipment you test. The registers in that sequence can contain all the test set-ups needed for that specific piece of equipment. A register will store most items on the display except for sweep setups.

The registers in a sequence can be used to store all test setups for a particular type of equipment, and the ***UP/DOWN*** arrows can be used to move through each test in a series. When the last saved register in a sequence has been reached, another push of the ***UP*** arrow will loop the user back to the first register. This is useful when performing identical tests on multiple units.

The COM3010 provides safeguards that allow for ease of use and prevent accidentally overwriting another memory location. For example, when saving a register to a sequence that has memories stored in it, the COM3010 will select the first empty register available. The only exception occurs when the sequence contains the maximum 100 registers, or is full. In this situation the COM3010 will select register 00 and give the operator the option of overwriting this register.

100 Sequences are available, and 100 Registers can be stored in each Sequence. Sequences and registers are displayed on the GENERATE screen in the lower right corner.



Saving to Memory

1. Enter all the information into the COM3010 that you need. This should include: Generate and Receive Frequencies, RF and Modulation levels, Increment sizes, and Meter Set-ups.
2. Press STO
3. Select a two digit Sequence Number. Example: 02

   0 2

4. The COM3010 automatically jumps to the Register field and selects the first empty register in that sequence.
5. If this sequence is full it will loop back to “00” and overwrite that register.
6. If you do not wish to overwrite, cancel by pressing SHIFT STO
7. Press ENTER % to save.

Memories *(Continued)*

Recalling Registers

1. Press SEQ
2. Enter the two digit number of the sequence you desire. Example: 02

   0 2

3. Use the Up/ Down arrows to scroll through different sequences ▲ ▼
4. Press REG Enter the two digit register number or Use the Up/Down arrows to scroll through different registers.

   0 2 or ▲ ▼

Copying Registers

1. Recall the sequence and register to be moved, then the sequence and register to be copied to. Example: Sequence 5, register 13 copied to sequence 7, register 13.

   SEQ 0 5 REG 1 3 STO 0 7

   1 3

Deleting Registers

1. Recall the register to be deleted. Example: Delete Sequence 5, register 13.

   SEQ 0 5 REG 1 3

2. Press to enable the Delete function.

   SHIFT -

3. Press ***RECEIVE AM*** to select 'yes'.

   RECEIVE AM

Memories *(Continued)*

Deleting Entire Sequences

1. Press [SEQ]
2. Enter Sequence Number. Example: Sequence 2 [0] [2]
3. Press [SHIFT] [-] to enter Delete mode.
4. Press [RECEIVE AM] to select 'yes'.

Default Sequence and Register

Sequence 99 Register 99 is reserved for power-up settings. This replaces the default start-up setting when the unit is powered on. If a new power-up setting is desired, set the Generate and Receive screens as required and save your new power-up default as normal using SEQ 99 REG 99. This can be overwritten at any time, or deleted it to return to the COM3010's original default power-up state.

[STO] [9] [9] [9] [9]

Your Notes:

4.20 Smart Link

Smart link allows the Receiver and Generator to be linked together. If the Generator and Receiver are on the same frequency they will change to the same frequency if a new one is entered in either the Generate or Receive screen. If the Generate and Receive Frequencies are different the spacing between them will remain the same when a new frequency is entered. When the ***LINK*** button is pressed and the link light is on, either the Generate or Receive increment set may be used to increase or decrease both frequencies by the same increment.

For example you can set the Generator frequency to 464.55 MHz, using this sequence:

For a 25 kHz offset in the receiver, add 25 kHz to the Generate frequency to get 464.575 MHz.

Next press:

and the value of 25 kHz is entered as the offset. Press the ***UP/DOWN*** arrow keys while in the Generate field.

The Generator and Receiver are locked together with this offset.

Alternately, the offset between the Generator and Receiver can be set by altering the offset value directly by pressing

Example: 100 kHz offset

The next time the Generate or Receive fields are altered, the alternate field will update with this offset. To try this press:

And the receiver should now display 464.4500 MHz.

The link button works under a variety of conditions and is especially useful when using the sweep generator. It allows the sweeping of filters with the Generator while watching the RSSI meter of the Receiver if they are locked with a 0Hz reference. This is covered in more detail in "4.40 Sweep Generator".

4.30 Scanner

The scanner function is used to monitor known frequencies for proper operation. The scanner function will allow sweeping through any sequence of memories that are pre-programmed into the COM3010. This allows scanning of up to100 channels in a single sweep. The more channels stored, the longer the scan times.

When setting up scan channels choose an open sequence. We recommend using a memory location in the range from 80-98 to store scanner sweeps.

It is not necessary to enter your sweep frequencies in numerical frequency order; the COM3010 will automatically sort the order. This allows for faster frequency locks during the sweep process. Keep in mind when saving frequencies that the only parts of the memories recalled during a sweep are the Receive AM/FM and the frequency. All other portions of memory are ignored to keep the sweep fast and to simplify setup.

To Set Up a Three-Frequency Sweep

1. Select RECEIVE AM or RECEIVE FM

   [RECEIVE AM] or [RECEIVE FM]

2. Enter the frequency to be scanned.

   [4] [6] [4] [.] [5] [5] [MHz -dBm]

3. Press [STO]
4. Select an unused sequence. Example: 90

   [9] [0]

5. Press [ENTER %] and the information is stored in the “00” register.
6. Enter another frequency. Example: 475.45 MHz.

   [RECEIVE FM] [4] [7] [5] [.] [4] [5] [MHz -dBm]

7. Press [STO]
8. Enter sequence number 90.

   [9] [0]

9. Press [ENTER %] and the information is stored in the “01” register.
10. Enter the last frequency in our series, 455.25 MHz.

    [RECEIVE FM] [4] [5] [5] [.] [2] [5] [MHz -dBm]

4.30 Scanner *(Continued)*

11. Press STO
12. Enter sequence number 9 0
13. Press ENTER % and the information is stored in the "02" register.
14. Press ***SHIFT, 7*** to enter the scanner mode.

    SHIFT 7

15. Enter the sequence number 9 0
16. Press ENTER %
17. Turn the squelch knob until the squelch just closes. Press ENTER % The unit will start to scan approximately 5 seconds after the squelch closes.

It is also possible to adjust the squelch to trigger and stop the sweep at a given RSSI level. While the sweep is running, cycle through the various meters such as deviation, AF count, etc. to listen to a part of the frequency being monitored. To stop scanning, begin to edit any numerical field or press ***ENTER*** while the scanner is selected.

The scanner stops at a particular frequency with the opening of the squelch. It will then pause at the frequency for 5 seconds after the squelch closes. During this period of time the active channel's bar will flash indicating that the squelch is closed but waiting to resume scanning. Adjust the squelch setting as needed to reject false signals and noise.

Notes on scanning:

The COM3010 employs a wideband receiver. If there are channels that are close together in sequence, the squelch may open on an adjacent channel. This is due to the broad channel discrimination of the COM3010. To remedy this, set the squelch a bit tighter to reject the adjacent channels and open only on the stronger RSSI signal.

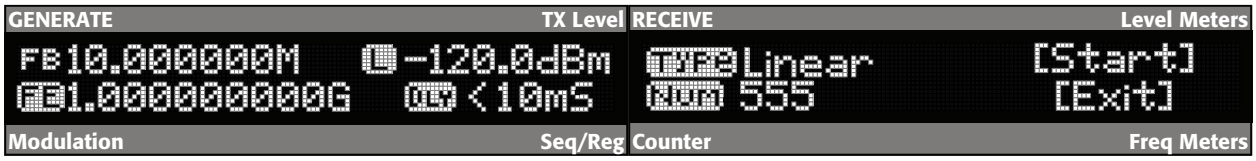
The scanner also includes the ability to skip channels, progress to the next channel, and restore skipped channels.

- Disables current channel. Channel is now indicated by slashes, and is skipped during the scanning process.

. Re-enables all disabled channels.

▶ or ◀ skips current channel.

ENTER % or SHIFT 7 Closes and exits the scanner when selected.



4.40 Sweep Generator

The sweep generator is used for testing frequency response of filters, flatness of cables, and similar tests. This function can be used in conjunction with a spectrum analyzer or the self-calibrated RSSI meter on the COM3010 with the LINK activated.

On the GENERATE screen:

The FB Field represents the Frequency at which the sweep begins. It is accessed through the ***GENERATE*** key. Any frequency from 100 kHz to 1000 MHz can be entered.

The FE Field represents the Frequency at which the sweep is to end. This is accessed through the ***FM*** key. Again any frequency from 100 kHz to 1000 MHz can be entered.

The L Field represents the RF Level to be used. It may be accessed through the ***LEVEL*** key. Levels from 0 dBm to -140 dBm can be entered and the mV and uV scales may also be used.

The DLY Field represents the time between changes in frequency. Access is obtained through the ***COUNT*** key and selected through the ***UP/DOWN*** arrow keys. The time between changes in frequency will depend on whether internal or external modulation is turned on. Usually sweeps will be performed with the modulation off. Slowing the sweep speed will allow the slower response of the receiver RSSI to be indicated when you are sweeping filters.

On the RECEIVE screen:

The TYPE field contain three types of sweeps to choose from. Access to this field is gained through the ***RECEIVE FM*** key. The Log methods will take increasingly larger steps as the sweep goes up in frequency, so there will be more points at low frequencies than at high frequencies; this is determined by the Log function selected. The types of sweeps available are:

Linear- which produces a linear sweep with even frequency spacing.
Decade- produces a sweep where the frequency step sizes increase by a factor of 10.
Octave- produces a sweep where the step sizes increase by a factor of 2.

The NUM field selects the number of points or frequencies to be included in the sweep. It is accessed through the ***RECEIVE AM*** key. The user can select from 1 to 10,000 points by direct entry from the keypad or scrolling with the ***UP/DOWN*** arrows. For example, if there are 555 points for a sweep from 10 MHz to 1 GHz they will be stepped at 25mS intervals which will be an entire sweep time of 0.025*555 = 13.8 seconds. The steps are rounded to the nearest Generate Frequency step size unless you have rounding turned off in the Options menu. If the step size is set to a large value and the number of points you wish to sweep makes for a smaller step size, the COM3010 will display an error telling you that some of the points will not be swept. The remedy is to reduce the Generate Frequency step size before sweeping. This feature allows you to sweep directly on channel steps if desired.

4.40 Sweep Generator *(Continued)*

The START field is accessed with the ***METER SELECT*** key.

The EXIT field is accessed with the ***@COUNT*** key.

To set up a sweep from 10 MHz to 1GHz (1000 MHz) with a level of –120dBm, linear, with 100 steps, follow these keystrokes:

1. To enter the sweep function, press ***SHIFT,1***.

   SHIFT 1

2. Enter 10 MHz in the BE field.

   GENERATE 1 0 MHz -dBm

3. Enter 1000 MHz in the FB field.

   FM 1 0 0 0 MHz -dBm

4. Set LEVEL to –120 dBm.

   LEVEL 1 2 0 MHz -dBm

5. Set TYPE to linear.

   RECEIVE FM ▲

6. Set the number of points to 100 in the NUM field.

   RECEIVE AM 1 0 0 ENTER %

7. Press ***METER SELECT*** to start the sweep, or ***@COUNT*** to exit with the changes saved so you can start the sweep later using the ***SHIFT, 2*** function of Sweep Start.

   METER SELECT or @ COUNT

8. ***SHIFT, 1*** will stop the sweep.

   SHIFT 1

These sweep settings are saved to NVRAM memory each time you change them so the next time you power the unit these values will be restored. They are not saved in the individual memories.

GENERATE	TX Level	RECEIVE	Level Meters
[Options] [Serial Port]		[Info] Zoom SINAD ◉	
<Setup Mems> [Clear Mems]		[Exit] 500Hz: ◉	
Modulation	Seq/Reg	Counter	Freq Meters

4.50 User Options:

The user options for the COM3010 are available by pressing ***SHIFT, 6***. This brings you to the Main Options Menu. This menu is displayed on both the GENERATE and RECEIVE Screens. The options listed that are available to the user are in brackets. The options between the '<' '>' signs are password protected and only available to qualified COM3010 service technicians. The reason for this is that modifying these options can change or erase unit calibrations that only a qualified COM3010 technician with appropriate calibrated test equipment can properly adjust.

On the GENERATE screen:

The [Options] field contains most of the available user options; see "General Options". This field is accessed using the ***GENERATE*** Key.

<Setup Mems> is not available to the COM3010 user.

The [Serial Port] field allows the user to configure the serial port and is accessed using the ***LEVEL*** key.
The [Clear Mems] clears stored memories and is selected using the ***COUNT*** key.

On the RECEIVE screen:

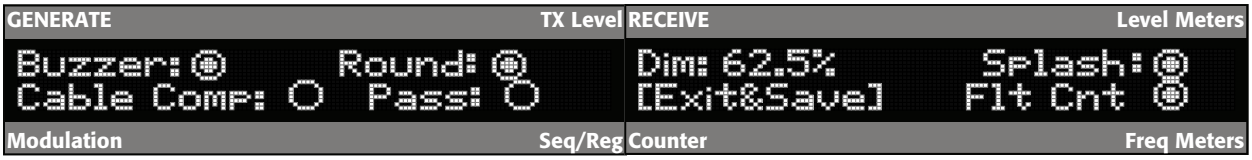
[INFO] is accessed through the ***RECEIVE FM*** key and provides basic information about the system. such as:

- Software Version
- Number of times the unit has been powered-up
- Number of crashes
- Hours of operation
- A number of professionals at Ramsey Electronics who have worked on this product.

[Exit] allows you to exit this menu and save settings using the ***RECEIVE AM*** key.

Zoom SINAD, when selected, automatically uses the Zoom Meter Mode for the SINAD Meter when one of the SINAD functions is selected. This is toggled using the ***METER SELECT*** key.

The 500Hz checkbox option, when selected, sets the Generate and Receive resolution to 500 Hz, rather than the standard Generate resolution of 1 Hz and the Receive resolution of 10 Hz. This option is toggled by the ***@COUNT*** key.



General Options:

These are accessed by pressing ***SHIFT, 6***, then the ***GENERATE*** key.

On the GENERATE screen:

The Buzzer is toggled on and off using the GENERATE key and turns all buzzer events on or off.

Cable Comp: adds 1 dB to the power reading at 1 GHz, linearly declining to 0 dB of added power at 0 Hz. Use the FM button to toggle this feature on and off.

The Round function turns the rounding feature of the ***COUNT*** buttons on or off. To select press the LEVEL key until the circle is filled.

The Pass function will prevent the use of the COM3010 until the proper password is entered. Pressing the COUNT key allows the user to change the password. Password security on the COM3010 is tight! If you forget your password the only way to unlock the COM3010 is to send it in for repair! The standard repair fee applies for Ramsey to reset the password. As soon as you change the password, **WRITE IT DOWN IN THIS MANUAL!!!** Many users will change the password to see how it works and immediately forget their newly created password. This password was designed to discourage equipment from being stolen since it will render the COM3010 useless to anyone but the person with the password. The modem password for serial access is separate from the user interface password.

By default, the password is set to **1234.** If you wish to change it, the new password should be something that is easily recalled. Please write it where it will not be lost. The password can be from1 to 9 characters long.

To Enter a new password

1. Press COUNT
2. Enter the new password using the numerical keypad. Example: 5678.

   5 6 7 8

3. Press ENTER % twice.
4. Re-enter the new password even though the old password appears in the display.

   5 6 7 8

5. Press ENTER % twice.
6. Write the new password down!

General Options *(Continued)*

On the RECEIVE screen:

The Dim function allows the user to use the ***UP/DOWN*** arrows to select the display intensity. Access this option using the [RECEIVE FM] button.

[Exit&Save] exits this menu and saves all option settings using the [RECEIVE AM] key.

Splash allows disabling of the start up splash screen and is toggled using the [METER SELECT] key.

The Flt Cnt (Counter Filter) function allows disabling of the frequency counter filter. Press the [@ COUNT] key to toggle this function.

GENERATE	TX Level	RECEIVE	Level Meters
Baud:57600:8,n,1 Address:555		Reset Pwd: NO [Exit&Save]	
Modulation	Seq/Reg	Counter	Freq Meters

Serial Port Options

[SHIFT] [6] [LEVEL] will activate the Serial Port Menu and give you the following choices:

Serial Port Name:	Choices	Default	Description
Baud	300, 600, 1200, 2400,4800, 9600, 14400, 9200,28800, 57600, 115200	57600	Sets the Baud Rate of the COM3010 Serial Port, always defaults in 8,n,1 communications.
Address	000 to 999	555	Allows user to view or change the Serial Port Address
Reset Pwd	YES / NO	No	If set to 'YES' upon exiting menu it will reset the Serial Password to 1234.
Exit & Save			Saves settings

Clear Memories:

Clear Memories is an option that allows you to clear all registers and sequences including the special 99.99 registers. This allows you to “clean up” the COM3010 if planning on setting it up for a new test bench or other purpose.

To get to the Clear Mems function, press [SHIFT] [6] [COUNT]
The [RECEIVE AM] button selects [YES] to delete all memory locations or the [@ COUNT] button selects [NO] and exits to the Main Options Menu.

4.60 Battery Power Saver

This function will blank both the displays. When operating from batteries Power Saver extends the operating time by about 1/3. For a single battery, power-on time is extended by approximately 20 minutes. Press any key to restore the display.

[SHIFT] [0]

Your Notes:

Your Notes:

5.00 USER CALIBRATIONS

RECEIVE	Level Meters	GENERATE	TX Level
[RSSI Meter]	[Freq Ref]	<Pwr Meter>	<Lvl & Freq>
[MOD Meter]		[exit]	<AM%>
Counter	Freq Meters	Modulation	Seq/Reg

5.00 USER CALIBRATIONS

Several features of the COM3010 can be calibrated by the user: The RSSI Meter, the Master Time Base, and the Modulation Bargraph Meter.

When displaying the calibration screens items surrounded by '[']' indicate user functions, where the '<' '>' indicate password functions. Password functions are reserved for technicians with proper equipment only.

5.10 Calibrate the RSSI Meter

Calibrating the RSSI Meter allows the user to "Null-out" cabling losses. This ensures that the interface cable's response is not part of the RSSI measurement. When the unit is finished calibrating it will perform numerous calculations and produce a table for reference. This table will then be stored in the COM3010's Flash Memory for later use. The RSSI meter can display any level between –40dBm and -120dBm to an accuracy of ± 1 dB.

1. Set the Squelch Control fully counterclockwise.
2. Select a Cable or series of cables and connectors to be used for testing.
3. Press [SHIFT] [5] to enter the Main Calibration Menu.
4. Press [GENERATE] to select RSSI Meter Cal.
5. Remove any cables from the RECEIVE IN jack. This allows the Meter to get a baseline calibration with no signal.
6. Press [RECEIVE AM] to continue.
7. Connect your selected cable between the RECEIVE IN jack and the RF OUT jack.
8. Press any key to start the automatic RSSI calibration. The COM3010 will now run through a series of frequencies and levels taking measurements for each.
9. When complete the unit will beep and display "Changes saved!" in the Receive screen. This process will take approximately 2 ½ minutes.
10. Press any key to return to the Main Calibration Screen.
11. Press [RECEIVE AM] to EXIT and return to normal operation mode.

5.20 Calibrate the Master Time Base

The COM3010's Master Time Base is a voltage controlled TCXO with an accuracy of better than ± 0.1ppm (part per million)over a given time and temperature. The time base is easily adjusted to any calibrated standard or reference available.

The time base can be calibrated in either Automatic or Manual mode. Automatic mode calibrates the time base to 0.01ppm. The COM3010 uses your reference signal and the internal IF Frequency Counter to calibrate the time base. Due to the resolution of the IF Frequency counter, Automatic mode requires that frequencies between 100 MHz and 1000 MHz be used as a reference. In Manual mode any frequency between 1 MHz and 1000 MHz may be used as a reference; however, the lower the frequency the less accurate the calibration will be. Using a 10 MHz reference the best accuracy that can be achieved is 0.1 ppm. A 1 MHz reference will only be able to achieve an accuracy of 1 ppm. Both automatic and manual mode require a minimum signal level of –85dBm.

The layout of the Frequency Calibration Menu is as follows:

On the GENERATE screen:

The Cal: Field displays the DAC (digital to analog converter) value. This value can be any digit from 0 to 4095.

The FR Field displays the Receiver Frequency. It should be set to the user's reference frequency. The default frequency is 999.15MHz. This is the frequency that is used at the factory to calibrate the unit during final testing.

The IF.1 Field is the frequency counted by the IF counter.

The [Auto Cal] field selects the automatic calibration feature.

On the RECEIVE screen:

[Abort] allows the user to exit the Frequency Calibration Menu without making any changes to the COM3010's calibration.

[Exit&Save] allows the user to Exit the Frequency Calibration Menu and save all changes made to the COM3010's calibration.

The ppm Meter displays the difference in parts per million between the Receive Frequency Setting and the actual received signal counted by the IF counter.

The RSSI Meter provides an indication of receive signal strength.

5.20 Calibrate the Master Time Base *(Continued)*

Warning: Due to the resolution of the COM3010's IF Frequency counter, reference frequencies below 10MHz will not be able to achieve the 0.1ppm specification of the time base.

1. Connect an accurate reference frequency source to the COM3010's RECEIVE IN jack.
2. Press [SHIFT] [5] to enter the Main Calibration Menu.
3. Press [LEVEL] to select [Freq Ref]. Note the warning about having a good reference.
4. [RECEIVE AM] selects [YES] to continue and enters the Frequency Calibration menu.
5. Press [FM] and enter the source frequency. Example: 955 MHz.

   [9] [5] [5] [MHz -dBm]

6. Verify reception of the desired reference frequency by checking the RSSI Meter in the lower right of the RECEIVE screen. This signal must measure at least –85dBm, which is represented by four divisions. If your reference signal is below 100 MHz the automatic mode will not be able to calibrate the time base. See step 10 below for manual calibration mode.
7. Press [COUNT] The reference source was connected in Step 1.
8. Press any key to automatically calibrate the COM3010 using [AutoCal].
9. When the GENERATE screen reads "Frequency calibrated Press any key", press any key to return to the Frequency Calibration screen.
10. To manually calibrate or fine tune the Auto Cal, press [GENERATE] to enter the Cal: field.
11. The [▲] [▼] can be used to zero the IF.1 or the PPM fields. Calibration values may also be directly entered into the Cal: field via the keypad.
12. Press either [RECEIVE AM] to exit and save the calibration value or [RECEIVE FM] to abort and restore old values.
13. Press any key to exit to the Main Calibrations Menu.
14. Press [RECEIVE AM] to return to Operational Mode.

Your Notes:

5.30 Calibrate the Modulation Meter

Occasionally the quadrature detector of the COM3010 may need alignment to center the modulation meters.

1. Connect the RF OUT to the RECEIVER IN using a BNC to BNC cable.
2. Press SHIFT 5 to enter the Main Calibration Menu.
3. Press FM to enter Mod Meter calibration.
4. Press RECEIVE AM to restore to system default of zero or press @ COUNT to continue with calibration.
5. Press any key to begin meter calibration.
6. The COM3010 will go though a simple procedure of generating and receiving a modulated carrier, finding the center of the meter, and re-centering it.
7. When calibration is complete press any key to return to the Main Calibrations Menu.
8. Press RECEIVE AM to return to Operational Mode.

Your Notes:

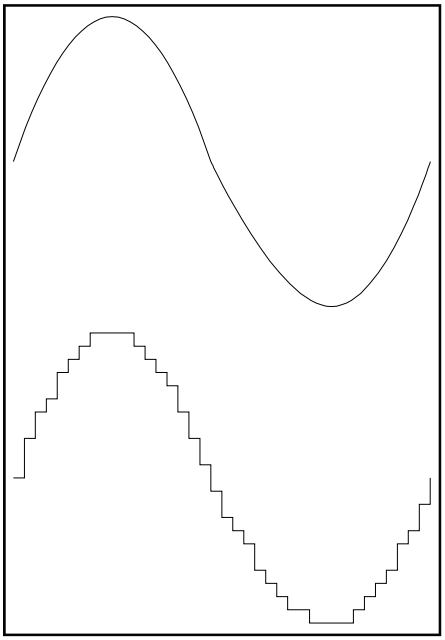
Your Notes:

6.00 DETAILED INFORMATION

6.10 Digital Modulation on the COM3010

When connecting the COM3010 an external broad-band modulation analyzer, the analyzer will typically see a larger deviation than expected. It may be as much as 5%. This is due to the very fast frequency changes used to "emulate" FM by digitally switching frequencies in steps.

The upper line is the desired modulating waveform at 1 kHz, and the lower line is what is needed digitally to re-create this same signal. As can be seen the upper line is continuous and smooth while the lower is in steps at regular intervals. This rate of level change is called the sample rate. The small steps with sharp edges create a high frequency component in the waveform at multiples of the sampling frequency. If the sampling frequency is 10 kHz you will have some spurs on the signal 10 kHz away from the carrier, as well as 20 kHz, 30 kHz… determined by the modulating waveform.



The same rules of thumb which apply to digital to analog converters apply to digital modulation. Typically the highest frequency signal we can re-create is at ½ the sampling frequency, or the Nyquist frequency. It is good practice to stay below 1/3 the sampling frequency so the sampling components can be filtered out with a simple low-pass filter.

Typically the radios that will be tested with the COM3010 are narrow-band. This means the total bandwidth they are able to receive is +/- 5 kHz, depending on the model. This translates to a 5 kHz low pass filter in the audio demodulated before any further processing. The radios typically have more audio filtering to allow signals in the voice band of 300Hz to 3 kHz, and signals below 300 Hz are interpreted for squelch control signals like CTS and DCS. This means that the artifacts of the digital signals are filtered off for us by the radios themselves! The 10 kHz, 20 kHz etc. are well above the audio bandwidth that the radios can receive.

Modulation analyzers, however, have extremely wide reception bandwidths of over 1 MHz. They see the audio signals the COM3010 is creating, as well as the digitizing artifacts. The modulation analyzer will record a wider than expected modulation unless the proper low pass filter is selected on the analyzer. Typically, the 3 kHz filter switch should be IN to get proper readings of the modulation waveform.

6.20 Advanced Power Meter Information

The COM3010 power meter is a voltage mode power meter.

The COM3010 power meter is not a true RMS type of power meter, meaning that it will measure your primary carrier voltage accurately and convert it to a power in dBm. It is possible for harmonics and other signals to cause error. Measurement is performed internally using a broadband log detector IC with 70 dB of dynamic range. The incoming RF voltage level is detected and converted to a log value on the output, digitized, and then converted to a power value based on a calibration table and sent to the display. This method is used since it offers the greatest flexibility and dynamic range.

The power meter is very accurate with a single carrier with harmonics at least 30dB down, but when harmonics increase over this level, and especially if there are high levels of multiple harmonics, the error factor will increase. The amount of error depends on the phase of the harmonics in respect to one another, along with other factors, and is unpredictable.

Automatic Power Meter Switchover of the COM3010

The COM3010 power detector is set at a threshold of approximately 0.25 W of RF before a relay trips and the power meter is activated. However, under 70 MHz this value increases, and reaches roughly 2-3W around 10 MHz.

By default, if you are planning on testing the output power of radios in these frequency ranges, manually switch in the power meter using ***SHIFT, 3*** before keying the radio.

Your Notes:

6.30 30 dB Rear Panel Attenuator Output.

The 30dB attenuator output on the back of the COM3010 can be used for a variety of external hookups such as spectrum analyzers, modulation analyzers, and other test gear. It can also be used to loop back into the receiver input on the front to obtain good frequency counts during power testing.

The Receiver Input on the COM3010 is a sensitive circuit which is sent not only to the Receiver, but also the Frequency Counters. It is recommended that the input is never driven with more than +20dBm (100 mW) of signal. When keying a 100W (+50 dBm) radio into the COM3010 power meter the 30dB attenuator will have about +20dB of signal on the output; this is right at the limit of the Receiver Input.

The 30dB power attenuator is nominally 30dB of attenuation over the 100kHz to 1GHz band of the COM3010.

The RF signal from the RF OUT jack to the 30dB attenuator output passes through cables, connectors, the main PCB, a relay, and the attenuator before it reaches the output jack on the back. This chain of connections has a predictable amount of loss from front to back, and is in part used during the power meter calibration in the lab. The following table will help if using the 30dB output jack in another method of measuring power.

Take the dBm reading at the output of the 30dB attenuator and the frequency under test, and look up the closest value in the attenuator table below. Add this value to the result to find the level present on the RF OUT jack. This will allow measurement of power and signal levels lower than the COM3010 will display, which is limited to 0.1W.

Attenuator Table

MHz	Atten	MHz	Atten	MHz	Atten	MHz	Atten	MHz	Atten
10	29.60	220	30.20	440	30.59	660	30.93	880	31.24
20	29.62	240	30.22	460	30.63	680	30.99	900	31.41
40	29.71	260	30.26	480	30.68	700	31.01	920	31.31
60	29.78	280	30.30	500	30.71	720	31.03	940	31.35
80	29.84	300	30.35	520	30.75	740	31.12	960	31.39
100	29.89	320	30.38	540	30.72	760	31.15	980	31.36
120	29.98	340	30.43	560	30.80	780	31.17	1000	31.54
140	30.03	360	30.46	580	30.79	800	31.23		
160	30.09	380	30.48	600	30.85	820	31.21		
180	30.12	400	30.51	620	30.89	840	31.30		
200	30.17	420	30.57	640	30.90	860	31.29		

6.40 Advanced SINAD Information

What is SINAD?

SINAD is a parameter which provides a convenient measurement of the quality of an audio signal from a radio or other communications device. SINAD is a simple measurement of the power ratio between signal + noise + distortion to just noise + distortion. To remove the signal to calculate the SINAD, a narrow band-stop filter is employed. Then an RMS value is found for the unaltered signal, and another RMS value for the filtered signal. Then these two values are compared using the formula:

$$SINADdb := 20 * \log10(RMS(S+N+D) / RMS(N + D))$$

In many applications, a standard 1kHz tone and band-stop filter is used for the SINAD test, primarily since it is in the middle of most narrow-band audio transmissions and it happens to be roughly the center of the standard voice band. In the COM3010 this is provided though FM modulation at 1kHz, or AM modulation at 1kHz, when set in the modulation fields (using ***SHIFT, 8*** sets up the COM3010 automatically). On rare occasions other tones are used, such as 400Hz on very narrow-band transmissions. The COM3010 allows the flexibility of any tone, and the band-stop filter coefficients are calculated on-the-fly for the chosen generated tone frequency.

When the 1kHz tone is generated by the COM3010, a fairly distortion-free modulated signal is created due to the digital modulation methods used. This allows the COM3010 to accurately measure the SINAD in a receiver under test, including the COM3010's own receiver. If you want to test the SINAD meter out, connect a cable between GEN OUT and RECEIVE IN, and another between MONITOR and EXT IN. Set the generator and receiver to the same frequency, say 146.52MHz (Hint: After setting receive and generate to the same value, you can LINK the receive frequency to the generate frequency to test other frequencies). Now press ***SHIFT, 8*** and SINAD mode will be activated. Now press [LEVEL] and step the level down until the SINAD meter shows roughly 12dB. Note the value will go around a bit since that is the nature of measuring a noisy signal. Some averaging is applied to the SINAD measurement, but in the interest of speedy meter updates you will need to average the rest of the way by eye. Now you can switch the level setting from dBm to uV by pressing either ***dBm*** or ***mV/uV***. At the point where the SINAD is reading 12dB, it is considered the SINAD rating of the radio under test.

A widely accepted value of 12dB of SINAD is considered the useable threshold of sensitivity for a radio, but that depends on the manufacturer specifications. Values less than 12dB of SINAD are considered to be unintelligible for many people. Some manufactures like to use 20dB of SINAD instead, typically meaning their radios have very conservative sensitivity specifications, and are typically very sensitive. Remember that the higher the dB of SINAD, the better the quality of signal. You will need to review the radio's specifications for sensitivity to know what level of SINAD is acceptable.

The External modulation input used during the SINAD test has a digitally controlled gain with customizable AGC which is controlled by the main microcontroller. The AGC makes sure to

bring up any incoming audio level used during test to a point that the sampling circuit can use it to full advantage and best dynamic range. The COM3010 can amplify fairly low level signals up to a usable level so that you don't add distortion errors to your measurement by turning up the volume of a radio so high that it ruins the SINAD test reading. Remember that distortion is part of the measurement, and adding it by turning up the volume too loud will make the receiver seem less sensitive than it really is.

Since the audio sampler is only 8 bits of resolution, this gives us a theoretical limit of 48.5dB according to the device data sheet. This is directly related to the maximum dB of SINAD that the meter will read. However with narrow-band radios and general background noise, 30dB of SINAD is typically about the best you will see with this implementation, but more than adequate for measuring between 12dB and 20dB.

The SINAD meter of the COM3010 is very accurate for the application of radio testing since both the generator tone and the SINAD calculations are digitally realized. This means that the generated tone accuracy is +/-0.1%, and the SINAD sampling frequency and filter are tied directly to the generator frequency, canceling out error in the generated tone to 0%. This also means that the notch filter is very deep, and has steep sides which are ideal. The bandwidth of the filter is 150Hz, so it is very narrow as to allow much of the noise and distortion through as possible while still removing the signal. Since it is digitally realized, the filter will never need tuning and calibration, so you can always be assured the SINAD meter is accurate. The filtered and unfiltered tones are also sampled with true RMS, another important part of measuring accurate SINAD. Many SINAD meters do not use RMS detectors to find the ratio, and results in substantial error. In all, the SINAD meter can be trusted for years of accurate measurements on your COM3010.

Your Notes:

6.50 RS232 Communications

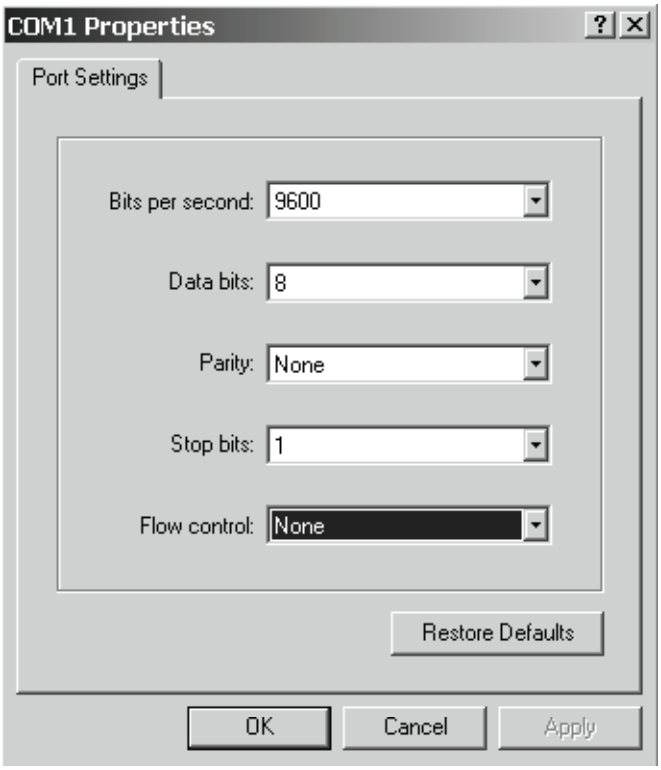
The serial remote control function of the COM3010 provides all the same operations that can be accessed from the front panel except for the scanner and sweep functions. The serial port on the back of the COM3010 is filtered to prevent RF leakage. This filtering may cause errors at baud rates over 57.6K; therefore, it is best to use 57.6K baud and lower with the COM3010. Since a limited amount of data must be transferred to operate serially a lower baud rate is adequate. A terminal program is required and they are typically included in most operating systems. A standard 9-pin serial cable is also required.

The COM3010 is addressable meaning that it is possible to change the address on each of several different units and have them in series, but only the unit with the correct address will respond to your commands. By default this address is **555** and this is entered via the SYS OPEN command. By default the serial password is disabled. If the serial password has been enabled, the factory default password is "1234".

6.50.01 Connecting to Host

Example of how to log in.

1. Connect a standard 9 pin non-null serial modem cable between PC and COM3010.
2. Start terminal software with serial settings to 9600,8,N,1 with no hardware flow control (as shown below). Be sure to select the correct serial port!



3. [SHIFT] [6] To enter the Options Screen.
4. [LEVEL] Selects Serial Options.
5. Use the [▲] [▼] buttons to select 9600 baud.
6. [RECEIVE AM] [RECEIVE AM] [RECEIVE AM] to exit, save changes, and return to Operational Mode.
7. Press [SHIFT] [METER SELECT] several times until the serial status is displayed on the COM3010. This meter will normally only be used to troubleshoot communications problems.
8. Type "SYS OPEN 555" [ENTER] (No quotes) in the terminal software
9. The COM3010 should respond with "Welcome from unit 555" and give you an access prompt of ">>".

Problems?

If the COM3010 does not respond but the Rx light flickers as you type, there can be two possible problems. The first is that you have the COM3010 set to an address other than 555 from a previous session. You will have to use the previously set address instead of the default 555 address. The addresses are set up to run multiple COM3010s from the same serial lines so only one addressed COM3010 will respond at a time.

The other issue is a problem with the HyperTerminal software in Windows when you use no Flow Control. HyperTerminal will not turn off the Flow Control setting for the serial port unless you go through the following procedure:

1. Set the COM3010 baud rate for 9600:8,n,1 (See previous example)
2. Disconnect HyperTerminal (Using the Off-Hook Phone Icon).
3. Set the appropriate COM port in HyperTerminal, but a different baud rate than what you plan to use. To access the properties screen go to File->Properties->Connect To and select the COM port, then Configure... Press OK.
4. Hit Enter three times; you should see the Rx icon twinkle and the Er icon may illuminate on the COM3010.
5. Disconnect again (Using the Off-Hook Phone icon).
6. Go back to File->Properties->Connect To then Configure… and set baud rate back to 9600. Press OK.
7. Type "SYS OPEN 555" [ENTER] (No quotes) in the terminal software
8. The COM3010 should respond with "Welcome from unit 555" and give you an access prompt of ">>".
9. Type "SYS CLOSE" [ENTER]
10. The COM3010 will reply with "Disconnecting, Bye."
11. Save the HyperTerminal session.

Using this saved session will allow you to bypass the above procedure in future communications. If you start a totally new HyperTerminal Session the above procedure will be required

again. Other terminal software should not exhibit this problem.
Testing with some legitimate commands:

Enter "SYS OPEN 555" [ENTER], and the COM3010 should connect.
Enter "SET GF 403.25M" [ENTER]; this will set the generator frequency to 403.25MHz.
Enter "SET GL –45dBm" [ENTER]; this will set the level to –45dBm
Now that you are finished, type "SYS CLOSE [ENTER]"
The COM3010 will reply with "Disconnecting, Bye." and will not respond until you issue another "SYS OPEN 555" command.

All communications with the COM3010 are performed similarly using the commands listed. You can also write up a text batch file and use the terminal software to send a batch file up to 4096 bytes in size which will allow for long scripts. There are delay functions to allow measurements to settle or an automated test bench to get operations in place.

An example script used for automatic testing can be sent to the COM3010's serial port as a text file.

```
sys open 555     ;Opens default addressed COM3010
sys prompt on         ;Turns on system prompt
sys echo off     ;Turns off character echo
set level -35    ;Set level to -35dBm
set gf 985.56M   ;Set generator frequency
set rf 985.56M   ;Set receiver frequency
set gfm    ;Set generator in FM mode
set rfm    ;Set receiver in FM mode
set inttone 1.2k ;Set internal tone to 1.2kHz
set intdev 5k    ;Set internal deviation to 5kHz
set mint on      ;Set internal modulation on
set countermode 6     ;Set RF counter to RF High, 1.0S gate.
sys pause 20     ;Wait 2 seconds for count to settle
get rfcount      ;Get the count
sys pause 10     ;Wait 1 second
get rfcount      ;Get next count
sys close  ;Done, close communications.
```

The COM3010 serial interface is well-suited to allow for creating programs to control the COM3010 in remote locations. A good environment to use is Visual Basic since a program can be "whipped up" in very short order that will provide an easy interface to perform multiple tasks in an automated fashion.

6.50.02 SYS Commands

Major Command	Sub-Command	Format	Low	High	Returns	Description
System Commands						
SYS	OPN/OPEN	###	0	999	OK/BAD	Opens serial communications with this COM3010 if address matches setting.
SYS	CLS/CLOSE				OK/BAD	Closes serial communication. After this, nothing is sent or received.
SYS	ADR/ ADDRESS	###.###	0.0	999.999	OK/BAD	Once open, this changes to a new address, and leaves session open. First address must match old address, second address must be within 0->999
SYS	ECH/ECHO	ON/OFF	ON	OFF	OK/BAD	If echo is on, COM3010 sends back everything it receives through the RS232 port.
SYS	TIMEOUT	#	0	7200	OK/BAD	Sets serial comm timeout from 1 to 30 minutes. 0 = No timeout, time in seconds
SYS	HELP	AAA			List of commands	Lists commands with associated Major Command.
SYS	PASSWORD	AAAAAAAA AAAAAAAA A			Confirnation, OK/BAD	Changes the password to that specified
SYS	SECURE	ON/OFF	ON	OFF	Confirmatio n,OK/BAD	Secure Enables and Disables the password.
SYS	PAUSE	###			OK/BAD	Pauses serial interpreter for specified 10's of milliseconds.
SYS	PROMPT	ON/OFF	ON	OFF	OK/BAD	Turns the command prompt on and off. Default ON

6.50.03 SET Commands

Major	Sub-Command	Format	Low	High	Returns	Description
Generator Side						
SET	GF	###.##### #MHz	0.100000MHz	1000.000000 MHz	OK/BAD	Set Generator frequency
SET	GL,LVL,LEVEL	-###.#dBm	-120	0	OK/BAD	Set Generator Level
SET	MEXT	ON/OFF	ON	OFF	OK/BAD	Set Mod External
SET	MINT	ON/OFF	ON	OFF	OK/BAD	Set Mod Internal
SET	MCTS	ON/OFF	ON	OFF	OK/BAD	Set Mod CTS
SET	MDCS	ON/OFF	ON	OFF	OK/BAD	Set Mod DCS
SET	MALLOFF		N/A	OFF	OK/BAD	Turn off all modulations
SET	GFM					Set Generator in FM mode
SET	GAM					Set generator in AM mode
SET	EXTDEV	##.####kHz	0Hz	75.0000kHz	OK/BAD	Set FM modulation deviation
SET	EXT%	##%	0%	75%	OK/BAD	Set AM modulation percent
SET	INTTONE	#.####kHz	0.1Hz	3.0000kHz	OK/BAD	Set FM Tone frequency
SET	INTDEV	##.####kHz	0Hz	75kHz	OK/BAD	Set FM modulation deviation
SET	INT%	##%	0%	75%	OK/BAD	Set AM modulation percent
SET	AGC	#	1	4	OK/BAD	Set Internal Modulation AGC Mode (See valid AGC mode list)
SET	CTS	###.#Hz	0	999.9	OK/BAD	Set CTS tone in Hz
SET	CTSDEV	#.####kHz	0.1Hz	2.000kHz	OK/BAD	Set CTS Deviation
SET	DCS	###	See appendix C for valid lists.		OK/BAD	Set DCS code
SET	DCSDEV	#.####kHz	0.1Hz	2.000kHz	OK/BAD	Set DCS Deviation

6.50.03 SET Commands (Continued…)

SET	GSTEP	###.##### #MHz	0.0MHz	1000.000000 MHz	OK/BAD	Get generator frequency step
SET	GUP				OK/BAD	Generator up one step
SET	GDOWN				OK/BAD	Generator down one step

Receiver Side						
Major Command	**Sub-Command**	**Format**	**Low**	**High**	**Returns**	**Description**
SET	RF	###.#### #MHz	0.100000 MHz	1000.00000 MHz	OK/BAD	Set Receiver frequency
SET	RAM					AM Receive mode
SET	RFM					FM Receive Mode
SET	COUNTERMODE	#	1	6	OK/BAD	Set Counter Mode (see counter mode lists)
SET	LMETER	#	1	8	OK/BAD	Set Lower Meter Mode (See valid meter mode lists) Except for Sinad Mode (9)
SET	UMETER	#	1	4	OK/BAD	Set Upper Meter Mode (See valid meter mode list)
SET	POWERMETER	ON/OFF	ON	OFF	OK/BAD	Sets the power meter display on or off (big meter). You will need to turn it off to regain generator control after testing power. Returns BAD if power still present and cannot be turned off. ON forces meter on without power present.
SET	RSTEP	###.#### ##MHz	0.0MHz	1000.000000 MHz	OK/BAD	Set receiver step size
SET	RUP				OK/BAD	Receiver up one step
SET	RDOWN				OK/BAD	Receiver down one step

6.50.04 MEM Commands

Major Com-mand	Sub-command	Format	Low	High	Returns	Description
Memories						
MEM	GET	##.##	00.00	99.99	OK/BAD	Recall Memory from sequence.register
MEM	NXT				OK/BAD	Recall next memory in the sequence
MEM	PREV				OK/BAD	Recall previous memory in the sequence
MEM	SAVE	##.##	00.00	99.99	OK/BAD	Save memory in specified sequence.register
MEM	DEL	##.##	00.00	99.99	OK/BAD	Delete specified sequence.register

Your Notes:

6.50.05 GET Commands

Major Command	Sub-command	Low	High	Returns	Description
Bottom Meters					
GET	RFCOUNT	0	1200.000000MHz	####.#####MHz	Get current RF frequency count specified by the current counter mode (see counter mode lists)
GET	AFCOUNT	0	6000	####.#kHz	Get current AF count, only if AF counter is selected as one of the meters
GET	FMDEV	0	+/-7kHz	+#.##kHz/-#.##kHz	Get current FM deviation (numerically)
GET	DELTAF			+/-####.#####MHz	Get frequency error from current receive frequency (see counter mode lists)
GET	DBSINAD,SINAD,SIN	0dB	40dB	##.#dB	Get dB SINAD (see valid meter mode lists)
GET	AM%	0	100%	###%	Get AM percent reading if in AM receive mode and proper meter is selected.
Top Meters					
GET	POWER	0	100W	###W	Get Measured power
GET	BAT	10V	16V	##.#V	Get Battery Voltage
GET	RSSI	-100dBm	-30dBm	##dBm	Get receiver RSSI
GET	SQUELCH	O (OPEN)	C (CLOSED)	O/C	Get squelch state

6.50.05 GET Commands *(Continued…)*

Major Command	Sub-Command	Low	High	Returns	Description
Operating Values					
GET	GF	100kHz	1000.000000MHz	####.#####MHz	Get Generator Frequency
GET	GEN,GENSTATE	OFF	ON	ON/OFF	Gets the current state of the generator.
GET	GL,LVL,LEVEL	-120.0dBm	0dBm	###.#dBm	Get Generator Level
GET	MEXT	OFF	ON	ON/OFF	Get External Modulation State
GET	MINT	OFF	ON	ON/OFF	Get Internal Modulation State
GET	MCTS	OFF	ON	ON/OFF	Get CTS Modulation State
GET	MDCS	OFF	ON	ON/OFF	Get DCS Modulation State
GET	GAMFM	FM	AM	AM/FM/OFF	Get Genrator AM/FM state
GET	EXTDEV	0Hz	75.0000kHz	##.####kHz	Get FM modulation deviation
GET	EXT%	0%	75%	##%	Get AM modulation percent
GET	INTTONE	0.1Hz	3.0000kHz	#.####kHz	Get FM Tone frequency
GET	INTDEV	0Hz	75kHz	##.####kHz	Get FM modulation deviation
GET	INT%	0%	75%	##%	Get AM modulation percent
GET	AGC	1	4	#	Get Internal modulation AGC Mode (See valid AGC mode list)
GET	CTS	0.0Hz	999.9Hz	###.#Hz	Get CTS generator tone frequency
GET	CTSDEV	0.0Hz	2.000kHz	#.###kHz	Get CTS generator deviation setting
GET	DCS	000	777	###	Get DCS generator code
GET	DCSDEV	0.0Hz	2.000kHz	#.###kHz	Get DCS generator deviation setting
GET	RF	100kHz	1000.00000MHz	####.#####MHz	Get Receiver Frequency

6.50.05 GET Commands *(Continued…)*

GET	RAMFM	AM	FM	AM/FM	Get Receiver AM/FM mode
GET	COUNTERMODE	1	6	#	Get Counter Mode (see counter mode lists)
GET	LMETER	1	9	#	Get Lower Meter Mode (See valid meter mode lists)
GET	UMETER	1	4	#	Get Upper Meter Mode (See valid meter mode lists)
GET	POWER METER	OFF	ON	ON/OFF	Returns the large power meter to the display

Your Notes:

6.50.06 Various Meter Mode Options

Lower Meter Mode Table			
Mode #	**Mode Name**	**Valid in AM**	**Valid in FM**
1	FM Modulation Graphic +/-6kHz	No	Yes
2	FM Modulation Graphic +/-4kHz	No	Yes
3	FM Modulation Text	No	Yes
4	AM Percent Graphic	Yes	No
5	AM Percent Text	Yes	No
6	Frequency Error Graphic	Yes	Yes
7	Frequency Error Text	Yes	Yes
8	Audio Frequency Counter	Yes	Yes
9	Sinad Meter	Yes	Yes

Upper Meter Mode Table	
1	RSSI Bargraph
2	RSSI Text
3	RF Power
4	Power Supply State/Voltage

Counter Mode Table	
Mode #	**Mode Name**
1	Direct RF counter, 100KHz-70MHz, 0.1S gate
2	Direct RF counter, 100-70MHz, 1S gate
3	Direct RF counter, 70-1000MHz, 0.1S gate
4	Direct RF counter, 70-1000MHz, 1S gate
5	IF Frequency Counter (based on receiver frequency), 0.1S gate
6	IF Frequency Counter (based on receiver frequency), 1S gate

6.50.07 Various Mode Options

Sweep Mode Table	
1	Decade
2	Octive
3	Linear

External AGC Mode Table	
1	Tone
2	Voice
3	Digital
4	Off

Sweep Speed Mode Table	
1	<10mS
2	10mS
3	25mS
4	50mS
5	100mS
6	250mS
7	500mS
8	1S

7.00 APPENDIX

APPENDIX A
BUTTON REFERENCE CHART:

Button	Description	Shift	Description
POWER	Turns power on and off.	None	
EXT	Toggles external modulation mode and selects deviation.	EXT AGC	Cycles the various AGC modes for the external input.
INT	Toggles the internal modulation mode and selects tone.	PAGING	Accesses the various paging modes that the COM3010 supports (Two Tone)
CTS	Toggles CTS tone and selects tone.	None	
DCS	Toggles DCS mode and selects code.	INVERT DCS	Uses the current code, but inverts it before sending.
GENERATE	Enters the generate frequency field	GEN STEP	Sets the generator step and rounding size.
FM	Sets generator in FM mode	None	
AM	Sets generator in AM mode	None	
COUNT	Sets generator to the current counter reading	None	
LINK	Locks receive and transmit at the current difference.	SET OFFSET	Allows entry of an offset, valid at the next step in frequency.
1	Enters a “1”	SWEEP SET	Allows setup of sweep generator
2	Enters a “2”	SWEEP START	Starts the sweep generator.
3	Enters a “3”	POWER	Forces power meter mode.
4	Enters a “4”	None	
5	Enters a “5”	CALIBRATE	Entry into calibration screens
6	Enters a “6”	OPTIONS	Entry into the options screens
7	Enters a “7”	SCANNER	Starts the scanner function

Button	Description	Shift	Description
8	Enters an “8”	SINAD1K	Macro for setting up SINAD testing.
9	Enters a “9”	SINAD400	Macro for setting up SINAD testing.
0	Enters a “0”	PWR SAVE	Turns off the displays to save power.
.	Enters a “.”	ZOOM METER	Zooms the current Freq Meter.
-	Enters a “-”	DELETE	Deletes current memory
STO	Starts memory save	None	
SEQ	Selects a sequence	None	
REG	Selects a register	None	
SHIFT	Selects the shift function		
MHZ/-dBm	Enters units for active field	GEN ON/OFF	Toggles the generator on and off.
kHz/mV	Enters units for active field	GEN ON/OFF	Toggles the generator on and off.
Hz/uV	Enters units for active field	GEN ON/OFF	Toggles the generator on and off.
ENTER	Enter on the current field	ESCAPE	Aborts entering of the current field.
RECEIVE FM	Sets receiver into receive FM mode	RX STEP SIZE	Allows entry of the frequency step and rounding size.
RECEIVE AM	Sets receiver into AM mode	RX STEP SIZE	Allows entry of the frequency step and rounding size.
COUNTER	Cycles through the available frequency counters	MOD OFF	Turns off all active modulation modes.
METER SELECT	Cycles through the bottom measurement meters	ALT METER	Cycles through the top measurement meters
@COUNT	Sets receiver to the current frequency count	None	
Nav Buttons	Allows cycling through lists and entering values	BKSPC/DEL	Can delete characters during entry

APPENDIX B
CTS TONE FREQUENCY LIST:

Standard EIA CTS Tones (Hz)									
67.0	79.7	91.5	103.5	118.8	136.5	156.7	179.9	210.7	241.8
71.9	82.5	94.8	107.2	123.0	141.3	162.2	186.2	218.1	250.3
74.4	85.4	97.4	110.9	127.3	146.2	167.9	192.8	225.7	
77.0	88.5	100.0	114.8	131.8	151.4	173.8	203.5	233.6	

APPENDIX C
DCS CODE LIST:

023N	074N	165N	261N	364N	464N	631N
025N	114N	172N	263N	365N	465N	632N
026N	115N	174N	265N	371N	466N	654N
031N	116N	205N	266N	411N	503N	662N
032N	122N	212N	271N	412N	506N	664N
036N	125N	223N	274N	413N	516N	703N
043N	131N	225N	306N	423N	523N	712N
047N	132N	226N	311N	431N	526N	723N
051N	134N	243N	315N	432N	532N	731N
053N	143N	244N	325N	445N	546N	732N
054N	145N	245N	331N	446N	565N	734N
065N	152N	246N	332N	452N	606N	743N
071N	155N	251N	343N	454N	612N	754N
072N	156N	252N	346N	455N	624N	
073N	162N	255N	351N	462N	627N	

APPENDIX D
TWO TONE MODES:

Paging Mode	Tone 1 length	Tone 2 length	Wait for squelch delay
Tone Only	0.4 Seconds	0.8 Seconds	1.3 Seconds
Voice	1 Second	3 Seconds	1.3 Seconds
Battery Save	2.7 Seconds	0.8 Seconds	1.3 Seconds
Group Call	0 Seconds (Not sent)	8 Seconds	1.3 Seconds

APPENDIX E
GENERAL OPTIONS TABLE

Option Name:	Choices	Default	Description
Buzzer	ON / OFF	ON	Turns all buzzer sounds on or off.
Cable Comp	ON / OFF	OFF	If on, adds 1dB to the power reading at 1GHz, linearly declining to 0dB of added power at 0Hz.
Round	ON / OFF	ON	Turns the “rounding to nearest step size” feature of the COUNT buttons and SWEEPS on and off.
Pass	ON / OFF	OFF	Turns the system password on and off. When selected on, it will prompt for the new password twice.
Dim	12.5%-100%	62.5%	Allows the selective dimming of the displays. Helps in dark environments. Does not save on battery power.
Splash	ON / OFF	ON	Allows disabling of the startup splash screen
Flt Cnt	ON / OFF	ON	Allows disabling of the frequency counter filter.
Exit			Exits the menu.

Features:

- **Display:** 2 Vacuum Fluorescent graphical displays, 16 x 140 pixels
- **Memories:** 100 sequences of 100 registers, plus system memories
- **Sweep Features:** Linear, octave, and decade of up to 1000 pts for sweeping generator
- **Scanner Mode:** Allows scanning through a sequence of 100 stored settings
- **Sinad Meter:** Display reading from –30 dB of SINAD to 0 dB. Loop-back audio for tested equipment
- **Frequency Counter:** Measures frequency error to 1Hz in three counter modes
- **Battery Meter:** Displays charge left in batteries
- **Reverse Power Protection:** Generate output protected, switches into 100 watts internal load and automatically displays power in dBm or watts
- **Power Meter:** Displays power when unit is keyed into the generator output. Reads from 23 dBm to +50 dBm, 0.5 dB, selectable dBm or watts
- **Attenuator Output:** -30 dB attenuator output from internal load for monitoring
- **Calibrated RSSI Meter:** 80 dB of range on receiver side., -40 dBm to -120 dBm

Generate:

- **Frequency:** 100 kHz to 1.0 GHz, 1 Hz steps
- **Frequency Accuracy:** 0.1ppm standard
- **RF output Level:** -140 dBm to 0 dBm, 0.1 dBm steps
- **Level Accuracy:** 1 dB , 500 kHz to 1.0 GHz; 2 dB 100 kHz to 500 kHz
- **Units:** dBm, uV ,mV
- **Leakage:** Better than 1 uV, 2 turn loop, 1" dia. at 1"

Spurious:

- **Harmonics:** -30 dBc typical above 1 MHz
- **Non-harmonics:** -50 dBc typical
- **FM Modulation:** 75 kHz max in 0.1 Hz steps
- **FM Bandwidth:** 0.1 Hz to 75 kHz
- **Accuracy:** 0.1ppm
- **AM Modulation:** 0 to 75% in 1% steps to -100 dBm, 0-50% to -140 dBm
- **AM Bandwidth:** 10 Hz to 10 kHz
- **Accuracy:** 5%
- **Distortion:** Less than 5%

Modulation Types

- **Internal:** 0.1 Hz to 3000.0 Hz, 0.1 Hz steps
- **External:** 0.1 Hz to 3000.0 Hz, 0.1 Hz steps, digital and analog selectable
- **CTS Encode:** 0.1 Hz to 999.9 Hz at .75 Hz default deviation, variable from 0.1 Hz to 2 kHz deviation
- **DPL Encode:** 750 Hz, variable from 0.1 Hz to 2 kHz, all supported codes
- **Two-Tone Paging** Each tone, 0.1 Hz to 3000.0 Hz, Group, Voice, Tone, Battery Save page modes.

Receiver:

- **Frequency:** 100 kHz to 1.0 GHz
- **Step size:** 10 Hz
- **Sensitivity:** Less than 2 uV, 1 MHz to 512 MHz; less than 3 uV, 512 MHz to 1 GHz; unspecified, 100 kHz to 1 MHz
- **FM Demod:** 0 to 7 kHz, 0 to 4 kHz
- **AM Demod:** 0 to100%
- **CTS Decode:** In AF frequency count
- **Frequency error:** 0 to1 MHz, two methods of bargraph and count
- **AF Demod output:** 1 Vp-p for 7 kHz deviation
- **Gates:** 0.1 Sec, 1 Sec

Audio counter:

- **Frequency Range:** 60 Hz to 3000 Hz
- **Gates:** 10 Sec variable gate for 1 Sec quick updates
- **Sensitivity:** 35 mV at demod audio, 750 Hz deviation

Frequency counter:

- **Frequency Range:** 100 kHz to 1.0 GHz
- **Low Band Sensitivity:** Less than 10 mV under 70 MHz, 1 Hz and 10 Hz resolutions
- **High Band Sensitivity:** Less than 10 mV, 70 MHz to 1.0 GHz, 10 Hz and 100 Hz resolutions with divide by ten pre-scaler
- **IF Frequency:** Receiver sensitivity. Frequency range limited to bandwidth of current set receive frequency, 10 kHz. 1 Hz and 10 Hz resolutions

General:

- **Receiver input** has diode protection and fused parts
- **Battery life:** 1 hour per battery pack, 3 battery packs maximum
- **Controls:** Elastomeric
- **RS232 Control:** Serial interface provides external function control and automated calibration
- **Dummy Load:** 100W 30 dB attenuator included, 25% duty cycle for rated power, 30dB sample port on rear panel
- **Primary Power:** 100-240 VAC, .6A, 50/60 Hz. Built-in 1 hour battery pack (holds 2 additional battery packs for 3 hour battery life
- **Stand:** Bottom mounted tilt bail stand included
- **Supplied Accessories:** 110 VAC EIA power cord, BNC-BNC test cable, whip antenna, one BP3010 Li-Ion battery
- **Case color:** Mist gray epoxy powder coat
- **Dimensions:** 6" H x 11.9375" W x 14.75" D (152.4 mm H x 303.21 mm W x 374.65 mm D)
- **Weight:** 14 lbs (6.5kg)

Accessories:

- **Battery Pack:** BP3010 additional battery pack to extend battery life (1 pack supplied, 3 max)
- **Carrying Case:** CC3010 custom Cordura® padded travel case w/ strap

Certification

Ramsey Electronics, Inc. certifies that this product meets its published specifications at the time of manufacture, and that the calibration measurements are traceable to the United States National Bureau of Standards.

Warranty

Ramsey Electronics, Inc. warrants this product against defects in materials and workmanship for a period of one year from the original manufacture date. Ramsey Electronics, Inc., at its option, will repair or replace this product at no cost to the original owner during the warranty period, provided the product is proved to be defective.

Warranty Service

To obtain warranty service, please contact Ramsey Electronics, Inc. technical support:

RAMSEY ELECTRONICS, LLC
Technical Support
590 Fishers Station Drive
Fishers, NY 14564
585-924-4560
techsupport@ramseyelectronics.com

Tech Support will help you diagnose your problem and, if necessary, issue an RMA for the return of your COM3010. Equipment cannot be returned without a proper RMA number.

With your return, please include specific descriptions of the problem encountered as well as detailed contact information including daytime telephone number, E-Mail address, and complete return shipping address information.

Limitations

This warranty shall not apply to products that have been improperly cared for, abused, or used outside the operating specifications of the product. This warranty shall not apply to products repaired or altered by persons not authorized by Ramsey Electronics, Inc. This warranty is in lieu of all other warranties, expressed or implied, and is solely for the use of the original product purchaser.

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