DESK REFERENCE

for the

MOBILE RADIO SHOP

MOBILE RADIO RANGE ESTIMATOR

DBM TO VOLTS CONVERSION SCALES

EIA STANDARD CTCSS TONES

STANDARD SIGNALING TONES

SINAD RECEIVER TESTS PROCEDURES

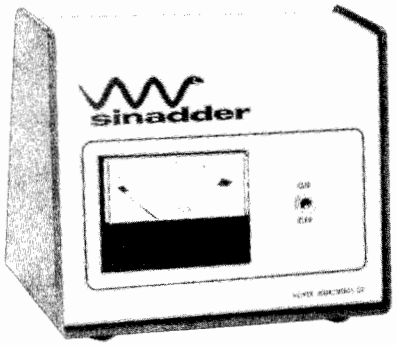
AND AN OCCASIONAL DISCRETE MENTION OF THE TIME SAVING, MONEY MAKING TEST INSTRUMENTS BY HELPER INSTRUMENT COMPANY. . .*the Sinadder People.*

HELPER INSTRUMENTS COMPANY
P. O. BOX 3628 / INDIALANTIC, FLORIDA 32903
(305) 777-1440

Instant SINAD

with the sinadder™

- A specialized distortion meter for SINAD measurements.
- No frequency, null, or level adjustments to make.
- Just connect to the audio line and read SINAD directly. Automatic gain control does the level setting for you.
- Use as an alignment aid — speeds alignment procedures.



Model S101 $162.50

Measurement by SINAD

The accepted standard of receiver sensitivity

Alignment by SINAD

Avoids alignment errors
Speeds alignment procedure
Obtains optimum receiver sensitivity

GENERAL DESCRIPTION

The SINADDER is a specialized distortion meter for making SINAD measurements on radio receivers. Special circuit design speeds and simplifies the SINAD measurement by eliminating all distortion meter adjustments.

The null circuits of the SINADDER are internally set to the 1,000 Hz tone used in SINAD measurements, and an automatic gain control eliminates the need for setting input gain to the meter.

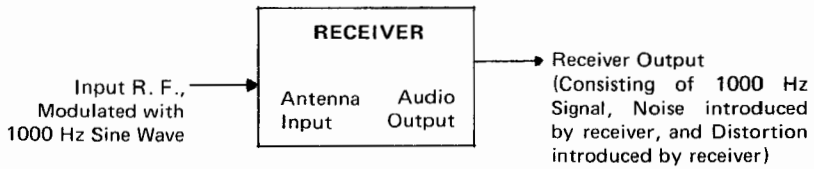
The automatic gain control feature permits the SINADDER to be used as a receiver alignment tool, providing rapid alignment of receivers for optimum performance.

SPECIFICATIONS:

Required Input Level:	20 millivolts to 4.25 volts RMS
Input Impedance:	1 Megohm in parallel with 50 picofarads
Accuracy:	±1 dB @ 12 dB
Power Requirement:	120 VAC, 60 cycles, 240 VAC on special order. Instructions for 12 VDC Operation Supplied.

THE SINAD EQUATION

$$SINAD_{(db)} = 10 \log_{10} \frac{\text{Signal + Noise + Distortion}}{\text{Noise + Distortion}}$$



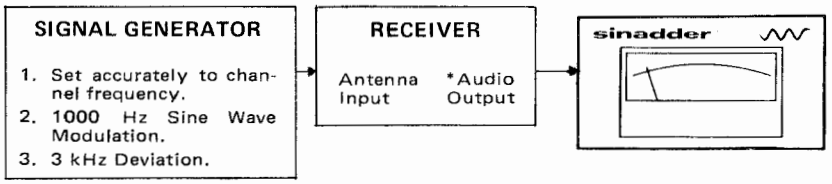
A little over three years ago Helper first introduced the SINADDER™. Prior to that time, the SINAD method of measuring receiver sensitivity was seldom used in two-way shops. The measurement was just too time consuming, and only a few "purists" used it. With the introduction of the completely automatic SINADDER™, SINAD measurements became faster and easier than the misleading 20 dB quieting measurement. . .almost as fast as guessing the sensitivity.

The big benefit from the automatic feature of the SINADDER™ is in using it as an alignment aid. Shops trying the new "Align by SINAD" method (we should say "Align by SINADDER™!") find it is faster and gives better results than the old ways.

The SINADDER™ revolution isn't limited to the service shops. Today, if you are unpacking a brand new two-way radio, it is a good bet that it was aligned at the factory using a SINADDER™, and given its final inspection "OK" on a test bench equipped with a SINADDER™. Manufacturers watch their costs very carefully, so it's natural that they would latch on to the SINADDER™ method in a hurry!

Turn the page for more on alignment by SINADDER™

RECEIVER SENSITIVITY MEASUREMENT BY THE SINAD METHOD



1. Adjust output of Signal Generator to obtain a 12 dB SINAD reading on the SINADDER™.
2. The Signal Generator output, in microvolts is the 12 dB SINAD sensitivity of the receiver.

*For specification testing, the receiver audio output should be terminated in a resistor equal to the normal load, and the volume control adjusted to give rated audio output. Operating the receiver into its loudspeaker at a comfortable volume level gives adequate accuracy for most purposes.

ALIGNMENT BY SINAD

1. Use the equipment hookup shown at the top of this page.
2. Adjust signal generator output attenuator to obtain a 12 dB SINAD reading on the SINADDER™.
3. Make alignment adjustments for minimum SINADDER™ meter deflection.
4. As alignment progresses, reduce signal generator output to keep SINADDER™ reading close to 12 dB.

If you haven't adopted the SINAD method for receiver alignment, you are missing an opportunity to save a lot of time and eliminate a lot of callbacks. Customers repeatedly tell us that they wouldn't touch a receiver without the SINADDER™ now that they have learned how fast and accurate alignment can be.

The way to learn is to connect a SINADDER™ to a receiver, apply 1,000 Hz modulation to your signal generator and proceed with your alignment in the usual way, keeping an eye on the SINADDER™ meter. You'll soon find yourself depending on the SINADDER™ meter instead of the usual metering indications. You won't have to rig up for "sweeping" the crystal filter adjustments. . .just tune them for optimum by the SINADDER™ indication. When it comes to "tweaking" the antenna tuning and RF stage, you'll find that SINADDER™ always leads you to the best sensitivity, while the usual limiter metering indcation may not.

MODULATION ACCEPTANCE TEST

Modulation Acceptance is a term used to express the ability of an FM receiver to receive modulated signals. In the typical land mobile system, with 5 kHz peak deviation, it follows that a receiver should have a modulation acceptance of at least 5 kHz, plus some extra to handle any frequency difference between the receiver and the distant transmitter.

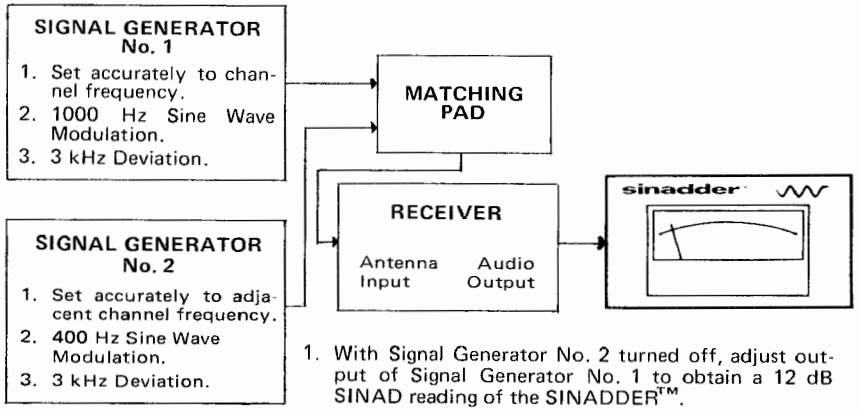
The instructions below show how to test for Modulation Acceptance. Values between 6.5 and 7.5 kHz are common in land mobile work.

If you come up with a value that is much below these values, you will probably notice "squelch clippings" when receiving heavily modulated signals, or when receiving slightly off-frequency signals. Touching up the IF alignment and the local oscillator frequency adjustment by tuning for an optimum SINAD with the signal generator deviation set up to about 6 kHz will usually fix things, unless some design problem or component failure is the cause. Be sure that the signal generator is exactly on the channel center while doing this.

The SINADDER™ makes Modulation Acceptance measurements rapid and easy.

1. Use hookup shown on previous page.
2. Adjust signal generator output attenuator to obtain a 12 dB SINAD reading on the SINADDER™. (Using 3 kHz modulation deviation)
3. Increase signal generator output by 6 dB. (SINAD reading will improve to better than 12 dB.)
4. Increase modulation deviation until SINAD reading is again 12 dB.
5. The modulation deviation value found in the above step is the MODULATION ACCEPTANCE.

ADJACENT CHANNEL SELECTIVITY AND DESENSITIZATION TEST



1. With Signal Generator No. 2 turned off, adjust output of Signal Generator No. 1 to obtain a 12 dB SINAD reading of the SINADDER™.
2. Increase output of Signal Generator No. 2 until the SINAD is reduced to 6 dB.
3. The ratio of the output levels of the Signal Generators, expressed in dB, is the Adjacent Channel Selectivity.
4. Test should be made on both high & low adjacent channels. The smaller ratio, expressed in dB, should be used in specifying Selectivity.

sinadder 3

S-103
$249.00

THE SINADDER 3™ COMBINES SEVERAL UNIQUE RELATED FUNCTIONS INTO ONE COMPACT UNIT. IT IS AN IDEAL INSTRUMENT FOR EITHER THE BENCH OR THE SERVICE TRUCK.

IT'S A SINADDER™

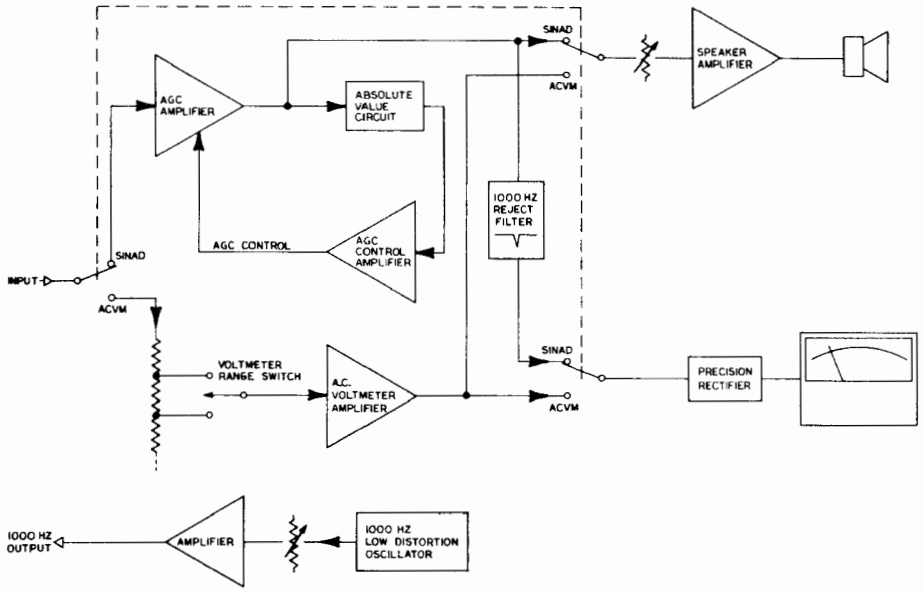
★ ★ ★ PUSH THE SINAD BUTTON: It's a SINADDER™ the revolutionary automatic distortion meter for measuring SINAD sensitivity and for rapid alignment by the SINAD method. No frequency, null, or level adjustments to make. Just connect to the audio line and read SINAD directly. Automatic gain control does the level setting for you. An internal 1 kHz generator provides an accurate tone to modulate your signal generator or monitor for SINAD measurement and alignment. A monitor loudspeaker enables you to listen to the audio output of beepers and other receivers where a loudspeaker may not be provided.

IT'S AN AC VOLTMETER

★ ★ ★ PUSH THE AC VOLTS: It's an AC VOLTMETER and MORE. 9 ranges from 10 mV full scale to 100 Volts full scale. Check audio circuits from microphone to loudspeaker levels. An internal audio amplifier and loudspeaker controlled by the range switch and front panel pot maintains proper sound level regardless of input.

IT'S AN AUDIO SIGNAL TRACER

★ ★ ★ USE AS AN AUDIO SIGNAL TRACER. Listen to phone lines, listen to audio in speech amplifiers and repeaters while measuring the level. Track down audio distortion, locate defective audio stages. Use the 1 kHz tone as a test tone for setting transmitter modulation and remote control volume levels. Ideal for checking telephone control lines – you can hear the audio as well as measure it.



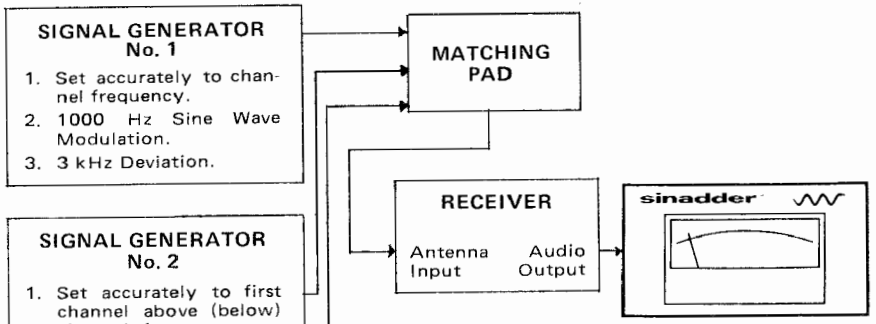
SINADDER 3™ BLOCK DIAGRAM

SINADDER 3™

Specifications:

Panel Controls:	push-push power switch; push/AC VOLTS – push/SINAD switch; rotary AC VOLTS range switch; 1 kHz tone output level control; internal speaker control.
Input:	permanently affixed shielded test cable w/miniclips.
SINADDER™ Input Level:	20 mV to 10 V. RMS
SINADDER™ Input Impedence:	100 K ohm
SINADDER™ Accuracy:	± 1 dB @ 12 dB
AC Voltmeter Ranges:	Nine: 10 mV, 30 mV, 100 mV, 300 mV, 1 V, 3 V, 10 V, 30 V, 100 V.
AC Voltmeter Input Impedence:	1 Megohm
AC Voltmeter Accuracy:	± 3% of full scale ± 0.25 dB, 100 Hz to 20 kHz
Audio Amplifier:	in SINADDER™ mode, AGC controlled constant volume to internal speaker. in VOLTMETER mode, range switch and front panel pot control volume.
Internal Tone:	1000 Hz ± 1 Hz, 1.5 V. RMS into 500 ohm load. Front panel controlled.
Power:	115/230 VAC Strap selectable 50/60 CPS ± 15% 13.5 VDC ± 15%
Size:	8.75" W x 3.25" H x 7" D

INTERMODULATION SPURIOUS RESPONSE ATTENUATION

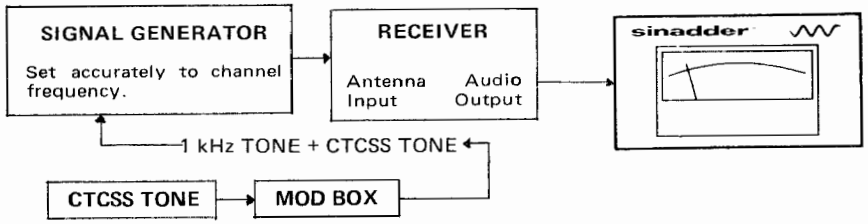


1. With Signal Generators No. 2 and No. 3 turned off, adjust output of Signal Generator No. 1 to obtain a 12 dB SINAD reading on the SINADDER™.
2. Increase outputs of Signal Generators No. 2 and No. 3 in unison, keeping their outputs equal until the SINAD is reduced to 6 dB.
3. Adjust frequency of Signal Generator No. 3 slightly to produce minimum SINAD before making final measurement.
4. The ratio of the output level of Signal Generators No. 2 and No. 3 to the output level of Signal Generator No. 1 is the Intermodulation Spurious Response Attenuation.

TONE SQUELCH OPENING SINAD

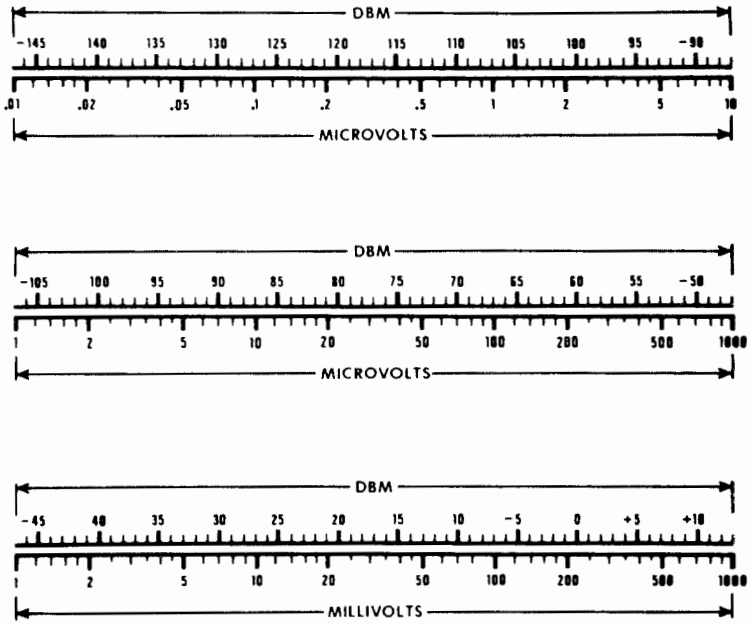
A receiver with tone squelch (CTCSS) may work fine on the bench, receiving a tone squelch modulated signal only. But, put it out in the real world where it must receive both the tone squelch and voice modulation, and it may clip out badly on voice peaks, or it may clip out with a combination of a week signal and voice peaks.

A test for TONE SQUELCH OPENING SINAD will help you get to the root of such problems. No need to undermine your professional image by asking the customer to "take it out in the fringe area and see how it works."



1. Modulate the signal generator with a composite of a 1000 Hz tone and the tone squelch (CTCSS) tone. Set the modulation deviation for 1000 Hz tone to 3 kHz. Set the CTCSS tone deviation to the lowest tone deviation used on the system.
2. Increase the signal generator output until the tone squelch just opens.
3. Remove the CTCSS tone modulation, and switch the receiver tone circuit to the "monitor" condition, and observe the SINAD indication on your SINADDER™.
4. If the SINADDER™ reading is less than 6 dB, you can assume that the tone squelch isn't going to keep out any signals that are strong enough to be intelligible.

DBM TO VOLTS at 50 OHMS



TO: HELPER INSTRUMENTS COMPANY
P. O. Box 3628 / Indialantic, Florida 32903
(305) 777-1440

Please ship: Price:

_____ _____

_____ _____

_____ _____

☐ Check or Money Order
Charge ☐ MC ☐ VISA
☐ Ship C.O.D.
☐ I destroyed my Radio Range Estimator when I tore this out – Please send me a new one.

Total: _____

Credit Card No. _____

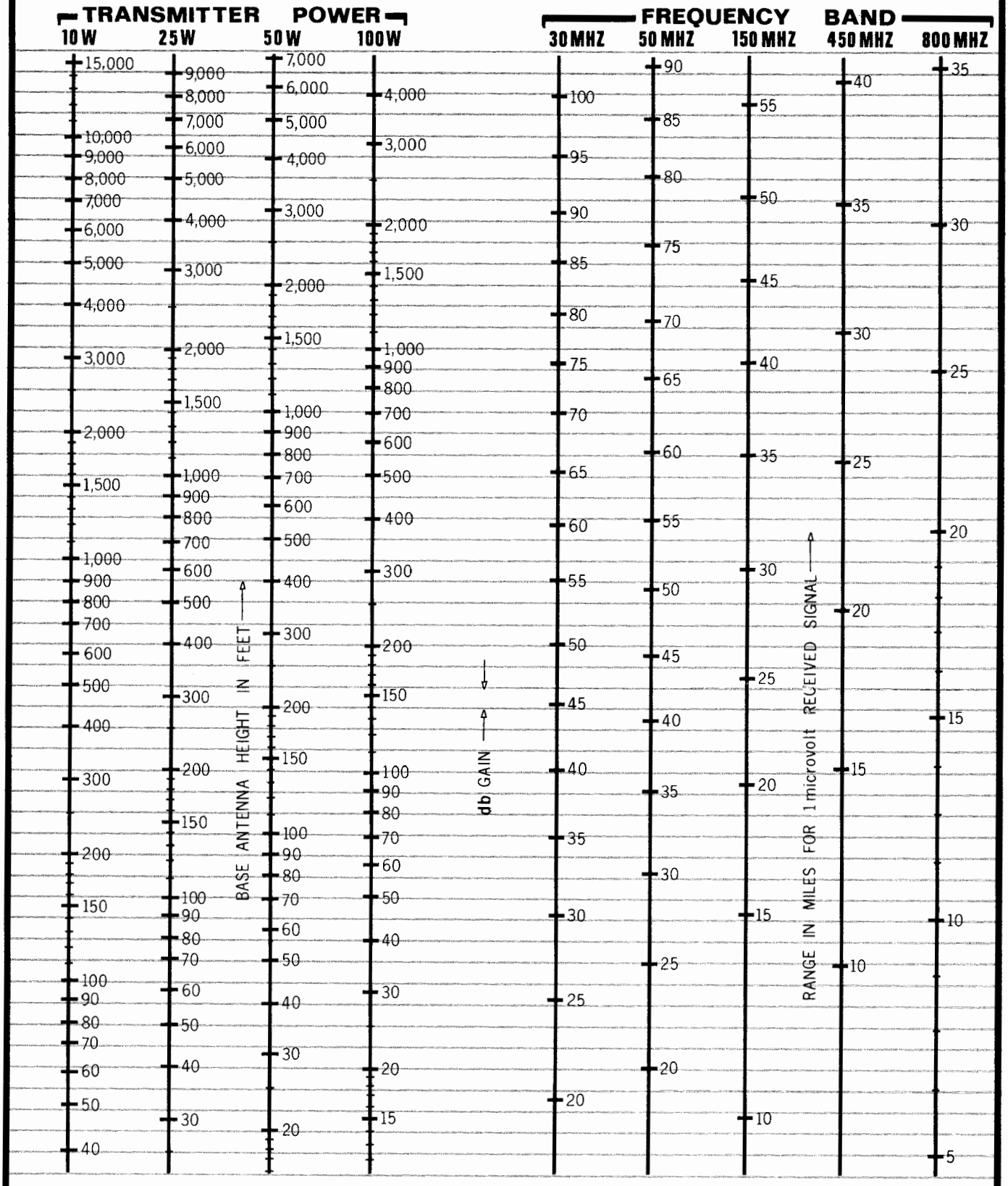
Bank No. Exp. Date

Name _____

Street _____

City _____ State _____ Zip _____

RADIO RANGE ESTIMATOR

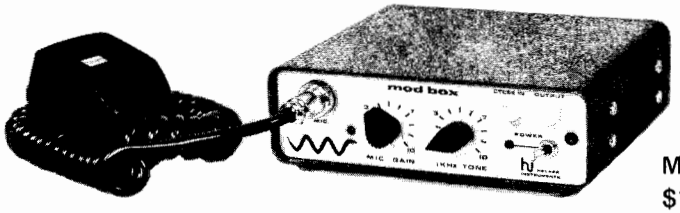


1. *Locate your base station antenna height on your correct transmitter power vertical column.*
2. *Find the horizontal line closest to that point.*
3. *Step up one line for each dB of base station antenna gain and each dB of mobile antenna gain. Step down 1 line for each dB of base station coax line loss and each dB of mobile coax line loss.*
4. *Move across to the intersection of this line and the correct vertical frequency band. The intersection is the mileage range estimate for a 1 microvolt received signal. To find the .5 microvolt range, go up 6 lines (dB's).*

BEWARE: Range estimators are nothing more than estimators. They cannot account for local conditions and terrain variations. You can improve the reliability of your estimates by comparing the results with known systems in your area. Then determine what decibel corrections are needed to match these known systems and use the corrections in your future estimates.

Field Test Your Receiver On The Bench

with the **mod box**



MB-401
$134.50 with microphone.

THE MOD BOX TESTS RECEIVERS FOR:

- SIMULTANEOUS TONE SQUELCH* AND SPEECH MODULATION.
- TONE SQUELCH OPENING SINAD PER EIA SPECIFICATION #RS 220.
- SQUELCH CLIPPING PROBLEMS.
- INTELLIGIBILITY.

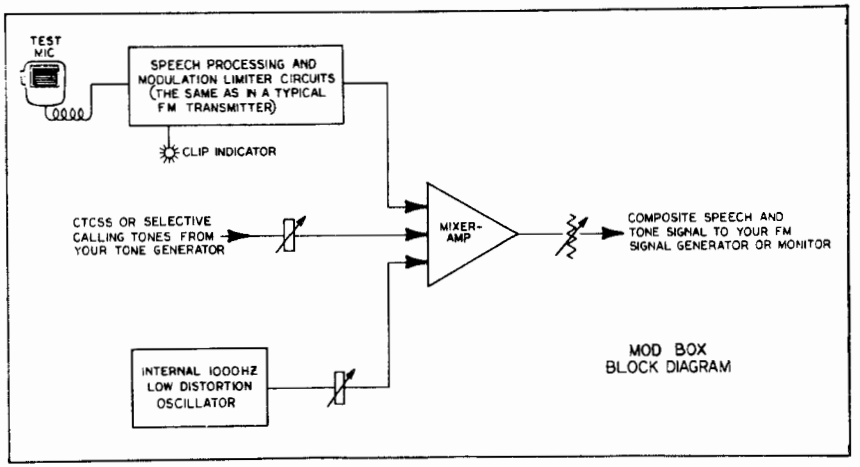
The MOD BOX™ is an accessory for use with FM signal generators (including the signal generator section of the F.M. Monitors used in servicing FM equipment.

The MOD BOX provides the capability of modulating these signal generators with speech signals. It also provides a low distortion 1,000 Hz signal source for modulating the signal generator in connection with SINAD measurements.

In addition, the MOD BOX provides mixing capability to provide composite modulation of speech and tone signals, thus simulating typical land mobile transmissions of voice and CTCSS (tone squelch) systems, or voice and selective tone calling systems. The mixing capability also permits modulation by a composite signal of 1,000 Hz tone and CTCSS tone.

The MOD BOX contains the amplification, pre-emphasis, speech clipping, and post limiter filter circuits to simulate modulation of transmitters in accordance with EIA specifications and FCC rules.

**Also functions with digital squelch systems.*



SPECIFICATIONS

Power Supply Voltage:	117 V.A.C., 50/60 Hz. Available on request at 220/240 V.A.C., 50/60 Hz. Internal connections provided for operation on 12 V.D.C., negative ground automotive battery.
Microphone Supplied:	Hand-held type with push-to-talk switch and reluctance cartridge.
Speech Input Required:	.5 Millivolts RMS to achieve limiting at 1,000 Hz
Pre-emphasis Characteristic:	6 db per octave between 300 and 3000 Hz, per EIA specification RS 152 B.
Post Limiter Filter	Meets the 18 dB per octave formula specified by FCC for transmitters operated above 450 mHz. Exceed the formula specified for transmitters operating below 450 mHz.
Modulation Characteristic:	When used with a signal generator having a flat input frequency characteristic, the resultant FM will meet the requirements of EIA specification RS 152 B.
Peak Output Voltage:	2 Volts Peak to Peak to 1,000 ohm load. 4 Volts Peak to Peak to 10,000 ohm load.
Distortion:	5% when input voltage set at 60% of limiting level, measured at 1,000 Hz.
1,000 Hz Oscillator Accuracy:	± 10 Hz.
1,000 Hz Oscillator Distortion:	Less than 5%, measured at the MOD BOX output terminals, at full rated output voltage.

HELPER INSTRUMENTS COMPANY
P.O. BOX 3628 / INDIALANTIC, FLORIDA 32903
(305) 777-1440

EIA STANDARD CTCSS (TONE SQUELCH) TONES

GROUP A	CODE	GROUP B	CODE
67 Hz	XZ	71.9 Hz	XA
77	XB	82.5	YZ
88.5	YB	94.8	ZA
100	1Z	103.5	1A
107.2	1B	110.9	2Z
114.8	2A	118.8	2B
123.0	3Z	127.3	3A
131.8	3B	136.5	4Z
141.3	4A	146.2	4B
151.4	5Z	156.7	5A
162.2	5B	167.9	6Z
173.8	6A	179.9	6B
186.2	7Z	192.8	7A
203.5	M1	210.7	M2
218.1	M3	225.7	M4
233.6	M5	241.8	M6
250.3	M7		

SETTING AND MEASURING CTCSS (TONE SQUELCH) SYSTEMS

Many CTCSS systems are very critical as to operating tone frequency. Good shop practice dictates that tone measurements be accurate to within .1 or .2 Hz for such systems. To achieve this resolution on typical frequency counters requires a 10 second count interval. Even with a 10 second count, the last digit (which corresponds to .1 Hz) cannot be depended upon. On most counters, you must wait for two successive counts to be certain you have a correct count.

The TONER speeds up measuring and setting tone frequencies. It multiplies the tone by 10 or 100 enabling you to use a count interval of 1 second or .1 second. You get the count in a hurry. . .no more ho-hum waiting!

DTMF TONES

TONE FREQUENCIES

DIGIT	LOW GROUP	HIGH GROUP
0	941 Hz	1336 Hz
1	697	1209
2	697	1336
3	697	1477
4	770	1209
5	770	1336
6	770	1447
7	852	1209
8	852	1336
9	852	1477
*	941	1209
#	941	1477

HELPER INSTRUMENTS COMPANY
P. O. BOX 3628 / INDIALANTIC, FLORIDA 32903
(305) 777-1440

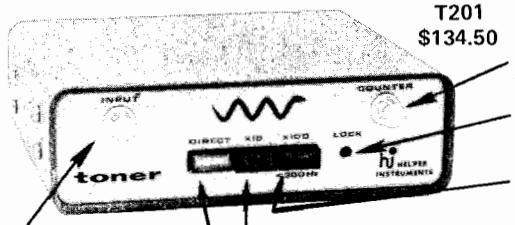
fast tone Measurements

HIGH RESOLUTION MEASUREMENTS IN A FRACTION OF THE TIME

With the **toner**

- ★ THE TONER™ MULTIPLIES TONE FREQUENCIES BY A FACTOR OF 10 OR 100.
- ★ SPEEDS UP CHECKING AND SETTING TONE FREQUENCIES.
- ★ LOW PASS FILTER FOR OFF-THE-AIR MEASUREMENTS OF TONE-SQUELCH SYSTEMS.
- ★ TONE SQUELCH MEASUREMENTS ACCURATE TO .1 Hz IN .1 SECOND.

The TONER™ is an accessory to your frequency counter to speed up the counting of tone frequencies. It multiplies tone frequencies by a factor of 10 or 100, and thereby enables you to count tone frequencies to resolutions of .1 Hertz in either .1 seconds or 1 second. In addition to the frequency multiplier circuitry, the toner has a low pass filter that permits off-the-air tone squelch measurements from a monitor receiver. Charge to your BankAmericard or Master Charge number.



T201
$134.50

To your present counter. Divide resultant readout by 10 or 100 to get actual frequency.

Flicker in lock light warns of false reading.

Incoming tone is multiplied by 100 when this switch is pushed in. Low pass filter removes speech and noise components.

Incoming tone is multiplied by 10 when this switch is pushed in.

Low frequency tone in (3.5 mv sensitivity).

Toner out of circuit when this switch is pushed in.

SPECIFICATIONS:

Input Sensitivity:	Less than 3.5 millivolts RMS.
Input Impedance:	100,000 ohms.
Frequency Ranges:	"x 10" position measures 50-5000 Hz to a resolution of .1 Hz in 1 second or a resolution of 1 Hz in .1 second.
	"x 100" position measures 50-300 Hz to a resolution of .1 Hz in .1 second or a resolution of .01 Hz in 1 second.
Low Pass Filter:	A sharp cutoff low pass filter on the "x 100" position removes noise for the off-the-air tone squelch measurements.
Voltage Requirement:	117 V.A.C. or 13.5 V.D.C. available for 220/240 V.A.C. 50/60 Hz.

SELECTIVE CALL TONE FREQUENCIES

CODE	BRAMCO "C"	BRAMCO "D"	MOTOROLA GP.1	MOTOROLA GP.2	MOTOROLA GP.4	MOTOROLA GP.5	GE
0	321.7	330.5	330.5	569.1	321.7	553.9	682.5
1	339.6	349.0	349.0	600.9	339.6	584.8	592.5
2	358.6	368.5	368.5	634.5	358.6	617.4	757.5
3	378.6	389.0	389.0	669.9	378.6	651.9	802.5
4	399.8	410.8	410.8	707.3	399.8	688.3	847.5
5	422.1	433.7	433.7	746.8	422.1	726.8	892.5
6	445.7	457.9	457.9	788.5	445.7	767.4	937.5
7	470.5	483.5	483.5*	832.5	470.5	810.2	547.5
8	496.8	510.5	510.5	879.0	496.8	855.5	727.5
9	524.6	539.0	539.0	928.1	524.6	903.2	637.5
A	569.1	569.1	569.1	979.9	569.1	979.9	742.5

G. E. TYPE 90 TONES

1050
1200
1350
1500
1650
1800
1950
2100
2250
2400

G. E. FIVE TONE ENCODERS

LOW RANGE	HIGH RANGE
1050	1800
1200	1950
1350	2100
1500	2250
1650	2400

G. E. TYPE 99 TONES

SERIES A		SERIES B		SERIES C	
547.5	757.5	517.5	787.5	532.5	772.5
592.5	802.5	562.5	832.5	577.5	817.5
637.5	847.5	607.5	877.5	622.5	862.5
682.5	892.5	652.5	922.5	667.5	907.5
727.5	937.5	697.5	967.5	712.5	952.5
742.5		742.5		742.5	

RCA "FASTONE" FREQUENCIES

1	1200	12	1965	22	2475
2	1275	13	2000	23	2500
3	1350	14	2025	24	2550
4	1425	15	2050	25	2625
5	1500	16	2100	26	2700
6	1575	17	2150	27	2775
7	1650	18	2200	28	2805
8	1725	19	2250	29	2850
9	1800	20	2350	30	2925
10	1875	21	2400	31	3000
11	1950				

HELPER INSTRUMENTS COMPANY
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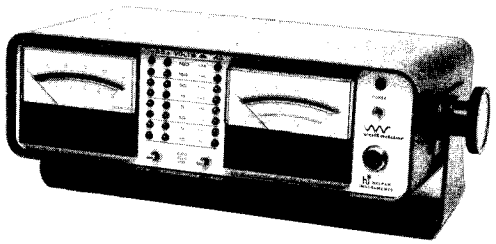
(305) 777-1440

Rapid Voltage Measurememements Automatically

with the

voltadder

By Helper Instruments



VA502 $650.00 with stand and battery pack.

From a single probe . . . . . the VOLTADDER™ displays A.C. and D.C. voltages **Simultaneously** on two mirror scaled meters. **Automatically** selects range and indicates polarity. LED's show range in use. Color coordinated scales make reading fast and easy.

SPECIFICATIONS:

GENERAL:	The VOLTADDER is an autoranging AC and DC Voltmeter. The AC and DC sections operate simultaneously and independently.
D.C. VOLTMETER SECTION:	
Ranges:	0 to .15, .5, 1.5, 15, 50, 150, 500 Volts.
Accuracy:	±3% of full scale reading.
Input Resistance:	10 Megohms, 1 Megohm in probe.
Range Selection:	Automatic.
Polarity Selection:	Automatic.
A.C. VOLTMETER SECTION:	
Ranges:	0 to .15, .5, 1.5, 15, 50, 150, 500 Volts. Calibrated in RMS equivalent average.
Accuracy:	±3% of full scale reading from 60 Hz to 100 kHz, plus 2 dB of frequency error to 500 kHz.
Input Impedance:	1 Megohm (in probe) plus 3 pf. probe capacitance.
Range Selection:	Automatic.
FRONT PANEL CONTROLS:	Power Switch, D.C. Autorange Defeat, A.C. Autorange Defeat.
POWER REQUIREMENTS:	117 VAC 50/60 Hz or 220/240 VAC 50/60 Hz, 5 Watts.
BATTERY PACK:	Optional. 12 V Internal Battery Pack permits 8 hours of continuous use. Battery Pack is automatically charged when instrument is connected to power line. Front Panel Power Light doubles as Low Battery Indicator.
DIMENSIONS (less stand):	12.2" W x 6.3" D x 5" H (31 cm W x 12.7 cm D x 16 cm H)

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