

Radio Shack, A Division of Tandy Corporation, 20-423 (PRO-2017)

Date of Test: October 25, 1999

TEST REPORT**0.0 Summary of Test Results**

Radio Shack, A Division of Tandy Corporation - Model: 20-423 (PRO-2017)
FCC ID: AAO2000423

TEST	REFERENCE	RESULTS
Radiated Emission	15.109	Complies
Conducted Emission	15.107	Complies

We attest to the accuracy of this report:


Barry Smith
Test Engineer


David Chernomordik
EMC Site Manager

1.0 General Description

1.1 Product Description

The General Research of Electronics, Inc. Model No.: 20-423 (PRO-2017) is a scanning receiver used to listen to police and fire departments, ambulance services, government agencies, private companies, amateur radio services, aircraft and military operations.

Please refer to the attached users manual for more details.

A pre-production version of the sample was received on October 22, 1999 in good condition.

1.2 Related Submittal(s) Grants

This is an Application for Certification of a scanning receiver.

1.3 Test Methodology

Both AC mains line-conducted (if applicable) and radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in Open Area Test Sites. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Data Section" of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is Site 1. This test facility and site measurement data have been fully placed on file with the FCC.



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TOKYO, JAPAN

Tokyo: AUG. 20. 1999

Reference No. 99013

SPECIFICATION

SUBJECT : VHF/UHF DIRECT ENTRY PROGRAMMABLE AM/FM SCANNER
PRO-2017 CAT. NO. 20-423 (USA and CANADA MODELS)

1. GENERAL

- 1 Programmable channel : 10 bank 20 channel (200 channel) memory banks
4 pre-programmed band search
Direct search
20 monitor channels
50 frequency-skip memories in search mode
200 channels lock-out in scan mode
7 WX pre-programmed frequencies with 1050Hz alert system
1 Priority channel
- 2 Receiving system : PLL synthesizer dual-conversion superheterodyne
1st IF 10.7MHz : The 1st Local OSC frequency for VHF Lo and AIR Band employs upper side of receiving frequency range.
: The 1st Local OSC frequency for VHF Hi and UHF Low Band employs lower side of receiving frequency range.
2nd IF 455kHz : The 2nd Local OSC frequency employs lower side of 1st IF.
- 3 Wire programming : PC to Earphone Jack
- 4 Frequency range :

	<u>Freq.</u>	<u>Step</u>	<u>Mode</u>
	29.0000 ~ 54.0000MHz	5.0kHz	FM
	108.0000 ~ 136.9875MHz	12.5kHz	AM
	137.0000 ~ 174.0000MHz	5.0kHz	FM
	380.0000 ~ 512.0000MHz	12.5kHz	FM
- 5 Pre-programmed band search : Fire/Police (FD/PD)
Ham
Air
Marine

- cont'd -

PRODUCT DEVELOPMENT & MANUFACTURING

- 6 WX 7 Frequencies : 162.400, 162.425, 162.450, 162.475, 162.500, 162.525,
with alert function 162.550MHz
- 7 Scanning rate : 25 channels/sec.
- 8 Search rate : 50 steps/sec.
- 9 Display : LCD w/backlighting
- 10 Speaker : Built-in 77mm 8 ohms dynamic speaker
- 11 Audio output : 1.0W
- 12 Operating voltage and: 120V AC, 60Hz 8W
power consumption use: AC-DC adaptor
- 13 Dimension : Approx. 210 (W) x 175 (D) x 52 (H) mm
- 14 Weight : Approx. 680g
- 15 Accessory : Telescopic-antenna, UL/CSA listed AC-DC adaptor
and Owner's manual
- 16 Memory backup : Capacitor

2. ELECTRICAL

		<u>Nominal</u>	<u>Limit</u>
-1	Frequency range : VHF Low AIR VHF High UHF Low		29- 54MHz 108-136.9875MHz 137-174MHz 380-512MHz
-2	Sensitivity : VHF Low (S+N)/N=20dB DEV. : 3kHz at 1kHz MOD. : 60% at 1kHz	0.5 μ V 1 μ V 0.5 μ V 0.7 μ V	1 μ V 3 μ V 2 μ V 3 μ V
-3	Tone decode sensitivity : WX Alert 1050Hz 4kHz dev. at 162.400MHz	0.5 μ V	2 μ V
-4	Image ratio : All band		Not specified
-5	Squelch sensitivity (Band center) Threshold : FM and AM Tight: (S+N)/N : FM : AM	0.5 μ V 25dB 20dB	2 μ V 15dB 10dB

		<u>Nominal</u>	<u>Limit</u>
-6	Selectivity : -6dB -50dB	$\pm 10\text{kHz}$ $\pm 18\text{kHz}$	$\pm 14\text{kHz}$ $\pm 25\text{kHz}$
-7	Spurious rejection : VHF Low at 40MHz (Except Primary image) VHF High at 154MHz UHF Low	50dB 50dB	30dB 30dB Not specified
-8	IF rejection : 10.7MHz at 154MHz	70dB	60dB
-9	Acceptable radio frequency: VHF 154MHz displacement at EIA RS-204D	$\pm 6\text{kHz}$	$\pm 3\text{kHz}$
-10	Signal to noise ratio : VHF Low at 40MHz RF : $100\mu\text{V}$ AIR at 124MHz DEV. : 3kHz at 1kHz VHF High at 154MHz MOD. : 60% at 1kHz UHF at 450MHz	50dB 45dB 45dB 35dB	30dB 30dB 30dB 25dB
-11	Residual noise : at 154MHz Vol. min. and Squelched	1mV	3mV
-12	Scanning rate :	25ch/sec.	22-28ch/sec.
-13	Search rate :	50 steps/sec.	45-55 steps/sec.
-14	Scan and Search delay time:	2sec.	1-3sec.
-15	Priority sampling :	2sec.	1.5-2.5sec.
-16	Priority CH checking time : WX Frequency Other Frequency	140msec. 40msec.	200msec. 50msec.
-17	Audio output (T.H.D. 10%) : RF input : $100\mu\text{V}$ at 154MHz 8 Ω R Load 1kHz	0.8W	0.5W
-18	T.H.D. at 0.5 watt output : RF input : $100\mu\text{V}$ at 154MHz	3%	8%
-19	Audio max. power : RF input : $100\mu\text{V}$ at 154MHz 8 Ω Internal speaker 32 Ω earphone mon/stereo (each phone)	1.0W 17/10mW	0.8W 25mW
-20	Audio frequency response : RF input : $100\mu\text{V}$ at 154MHz at -6dB	300Hz 2.0kHz	200Hz-400Hz 1.5kHz-3.0kHz
-21	Intermediate frequency : 1st 10.7MHz 2nd 455kHz		

- 22 Operating voltage and power consumption : 120V AC 60Hz 8W 10W
- 23 Memory hold time 10 Hours 1 Hour
- 24 Birdies and step frequency: Under discussion when search
- 25 Filter : Monolithic crystal filter for 10.7MHz and ceramic filter for 455kHz
- 26 Antenna impedance : 50 ohms
- 27 Temperature range : Test to specification between: +18°C - +35°C
Operate (Need not meet spec.): 0°C - +43°C

3. OPERATING CONTROL

- 1 Volume control
- 2 Squelch control
- 3 Power switch
- 4 Keyboard (22 keys)
- 5 LCD indicator:
 - 7 digits frequency with MHz
 - 3 digits memory channel
 - 5 band search
 - FD/PD
 - AIR
 - HAM
 - MARINE
 - WX
 - 10 banks indication
 - Receiver condition
 - SRCH
 - SCAN
 - MAN
 - PGM
 - DLY
 - L/O
 - PRI
 - ▲ and ▼
 - M for monitor
 - d- for Direct search
 - b- for Band search
 - L-r for Frequency lock-out Review
 - ALERT for Alert mode
 - Wired for wired programming mode
- 6 Motorola type antenna connector
- 7 12V DC power jack
- 8 Reset switch
- 9 Earphone/pc jack (D=3.5mm stereo)

4. KEY FUNCTION

BAND
ALERT/PRIority
WX
MANUAL
SCAN
MONitor/CLeAr
▲ and ▼
ProGraM
Lock-Out ReVieW/Lock-Out
ENTER
Decimal point/DELAY
10 numeric key/bank selector

5. FEATURES

- 1 200 channel memories plus 20 monitor memories
- 2 200 channels automatic scanning for VHF to UHF band
- 3 Pre-programed FIRE/POLICE, AIR, HAM, MRN and WX bands search
- 4 QUICK PROGRAM when receive signals up to 200 channels
- 5 INTELLIGENT SEARCH, 50 frequency-skip memories in search mode
- 6 HYPERSCAN, 25 channels/sec. scanning rate and 50 steps/sec. searching rate
- 7 "Zeromatic" tuning system
- 8 10 digit channel and frequency display with all function indicators
- 9 200 channels lock-out in scan mode
- 10 Built-in Priority channel
- 11 Built-in WX alert system
- 12 Built-in wired programming system
- 13 Lock/Out ReVieW key to confirm lock out frequency sequentially
- 14 20 monitor memory
- 15 Change search direction by ▲ (up) or ▼ (down)
- 16 2 second scan and search delay
- 17 Manual selection for channel
- 18 Scan mode [cleared channels (000.000 freq.) do not scan]
- 19 Direct search
- 20 Program mode
- 21 Key tone
- 22 LCD backlighting
- 23 Duplicate frequency check

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How to calculate CAT. NO. 20-423 (PRO-2017) OSC Frequency

1. Cat. No. 20-423 (PRO-2017) formula for 1st Local OSC are different due to frequency.

- 1 Receive Freq. at 29MHz - 54MHz (VHF Low Band)

$$\text{OSC Freq. (MHz)} = \text{Receive Freq. (MHz)} + 10.7 \text{ (MHz)}$$

- 2 Receive Freq. at 108MHz - 136.9875MHz (AIR Band)

$$\text{OSC Freq. (MHz)} = \text{Receive Freq. (MHz)} + 10.7 \text{ (MHz)}$$

- 3 Receive Freq. at 137MHz - 174MHz (VHF Hi Band)

$$\text{OSC Freq. (MHz)} = \text{Receive Freq. (MHz)} - 10.7 \text{ (MHz)}$$

- 4 Receive Freq. at 380MHz - 512MHz (UHF Low Band)

$$\text{OSC Freq. (MHz)} = \{\text{Receive Freq. (MHz)} - 10.7(\text{MHz})\} / 3$$

2. Example

- 1 Receive Freq. at 29MHz (VHF Low Band)

$$\begin{aligned}\text{OSC Freq.} &= 29 \text{ (MHz)} + 10.7 \text{ (MHz)} \\ &= 39.7 \text{ (MHz)}\end{aligned}$$

- 2 Receive Freq. at 108MHz (AIR Band)

$$\begin{aligned}\text{OSC Freq.} &= 108 \text{ (MHz)} + 10.7 \text{ (MHz)} \\ &= 118.7 \text{ (MHz)}\end{aligned}$$

- 3 Receive Freq. at 137MHz (VHF Hi Band)

$$\begin{aligned}\text{OSC Freq.} &= 137 \text{ (MHz)} - 10.7 \text{ (MHz)} \\ &= 126.3 \text{ (MHz)}\end{aligned}$$

- 4 Receive Freq. at 380MHz (UHF Low Band)

$$\begin{aligned}\text{OSC Freq.} &= \{380 \text{ (MHz)} - 10.7 \text{ (MHz)}\} / 3 \\ &= 123.1 \text{ (MHz)}\end{aligned}$$

2.0 System Test Configuration

2.1 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For the measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power without modulation.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Detector function is in peak mode. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance if measured at a closer distance.

2.2 EUT Exercising Software

For emissions testing, the units were setup to receive continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

2.3 Mode of Operation

The EUT was tested in two modes and the worst case emission was recorded:

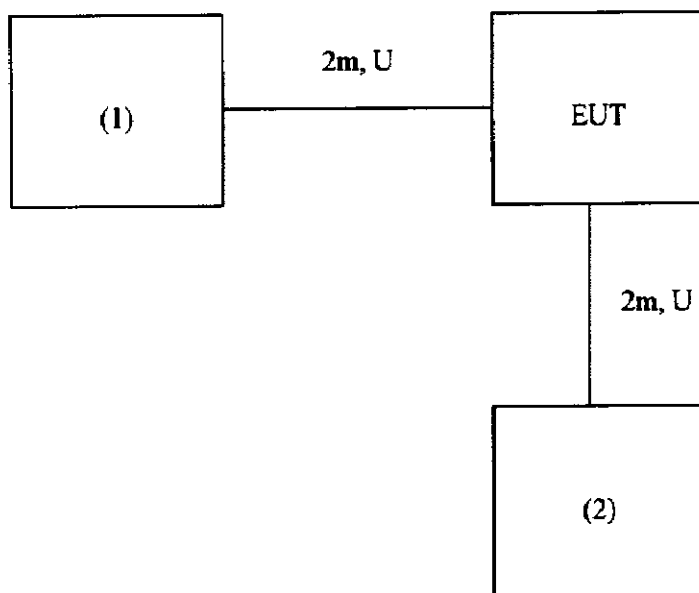
1. EUT was set to constantly receive at a particular frequency.
2. EUT was set to constantly scan and receive a particular band.

2.3 Support Equipment List and Description

- a) The FCC ID's for all equipment used in the tested system (included inserted cards, which have grants) are:

Item #	Description	Model No.	Serial No.	FCC ID
1	Sony Speaker	N/A	N/A	N/A
2	Radio Shack DC Power Supply	JOD-41U-02	N/A	N/A

- b) Equipment Setup Block Diagram



m: Length in meters

U: Unshielded cable

2.4 Equipment Modification

Any modifications installed previous to testing by Radio Shack, A Division of Tandy Corporation will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services.

3.0 Emission Results

AC line conducted emission measurements were performed from 0.45 MHz to 30 MHz. Analyzer resolution is 10 kHz or greater.

Radiated emission measurements were performed from 30 MHz to 5000 MHz. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection unless otherwise specified.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG + DF$$

where FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

DF = Distance Factor

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where FS = Field Strength in dB μ V/m

RR = RA - AG in dB μ V

LF = CF + AF + DF in dB

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$DF = 0 \text{ dB}$$

$$AF = 7.4 \text{ dB}$$

$$RR = 23.0 \text{ dB}\mu\text{V}$$

$$CF = 1.6 \text{ dB}$$

$$LF = 9.0 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

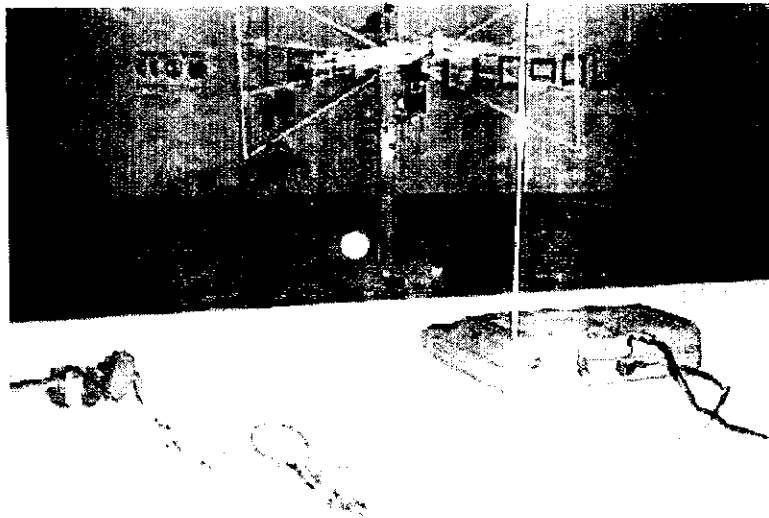
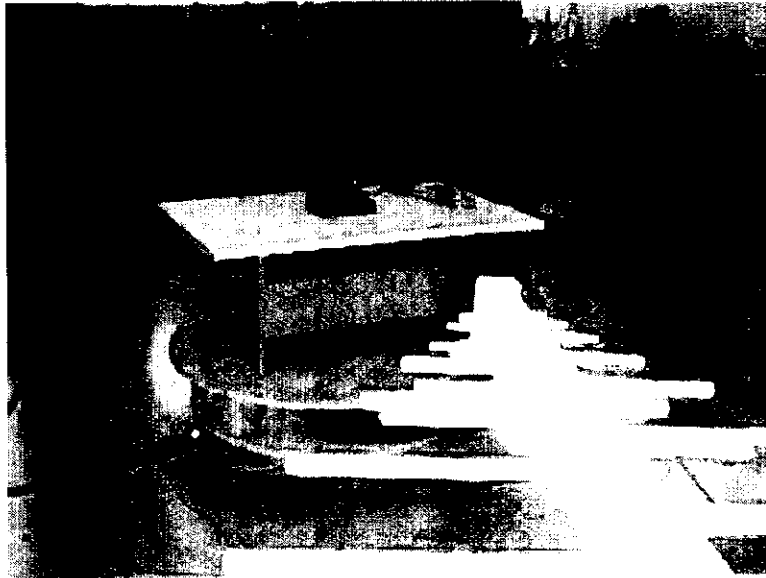
$$FS = RR + LF$$

$$FS = 23 + 9 = 32 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

3.2 Radiated Emission Configuration Photograph

Worst Case Radiated Emission
at 143.3 MHz



3.3 Radiated Emission Data

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Judgement: Passed by 8.6 dB at 143.3 MHz

Radiated Emissions Test Data

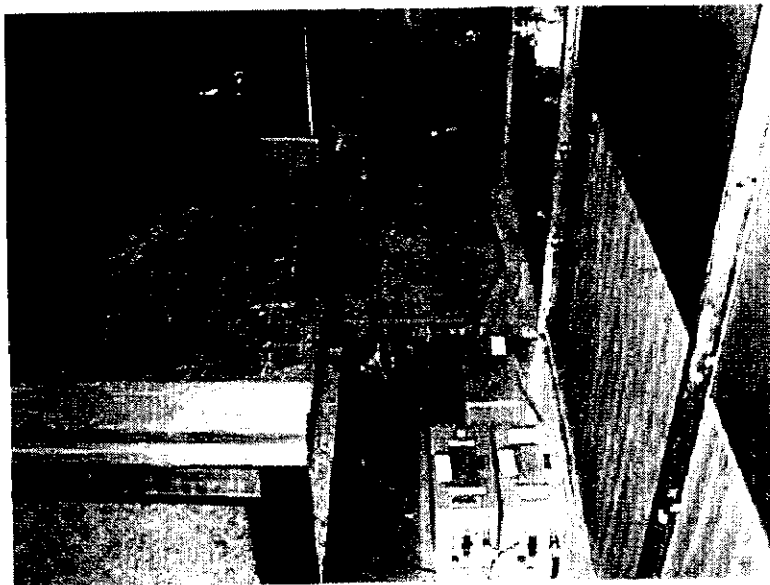
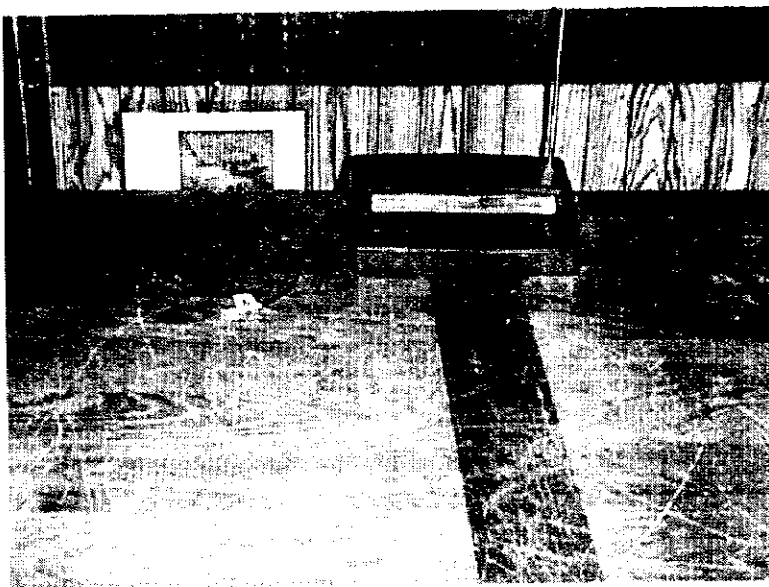
Company: GRE					Model #: 20-423 (Pro-2017)	Standard	FCC § 15.209
EUT: Radio Shack Scanning Receiver					S/N #: 000007	Limits	3
Project #: J99027232					Test Date: Oct 25, 1999	Test Distance	3 meters
Test Mode: Scanning specific frequency, monitoring L.O.					Engineer: Barry Smith	Duty Relaxation	0 dB

[illegible]

Notes:	
a) D.C.F.: Distance Correction Factor	
b) Insert. Loss (dB) = Cable A + Cable B + Cable C	
c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only)	
d) Negative signs (-) in Margin column signify levels below the limits.	
e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.	

3.4 AC conducted Emission Configuration Photograph

Worst Case Conducted Emission
at 2.15 MHz



3.5 Conducted Emission Data

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Judgement: **Passed** by 14.0 dB at 2.15 MHz

