
DR-142 Test Results

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DR-142

TYPE OF UNIT: VHF-FM Receiver Module

FCC ID: AIERIT17-142R

DATE: Nov 7, 2003

The following is a list of attached exhibits required by the Federal Communications Commission for the application to and grant of FCC Type Acceptance.

	FCC Rule	Page
List of Test Equipment Used	2.947 (d)	pg 2
Required Measurements	2.1033 (c)(14)	
Radiated Spurious Emissions	2.1053	pg 3
Spurious Emissions at antenna terminal	2.1051	pg 5
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TYPE OF EXHIBIT: TEST EQUIPMENT LIST

FCC PART: 2.947 (d)

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The measured data in this report was obtained using one or more of the following pieces of equipment. The particular equipment used in any one test is detailed in the procedure for that test.

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>MODEL NO.</u>	<u>SERIAL NO.</u>
Communications Test Set	Hewlett-Packard	HP8920A	3352A03633
Spectrum Analyzer	Hewlett-Packard	8560E	3720A02980
Spectrum Analyzer	Hewlett-Packard	8559A	2010A06979
Power Supply	BK/Precision	1730	263-023610
Log Periodic Antenna	Electro-Metrics	LPA-25	8-102

TYPE OF TEST: RADIATED SPURIOUS EMISSIONS

FCC PART: 2.1053 per 15.109

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505 West Carmel Drive
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TYPE OF UNIT: VHF-FM Receiver Module

FCC ID: AIERIT17-142R

DATE: Oct 24, 2003

PROCEDURE:

Field strength of spurious radiation of the DR-142 was taken on the RITRON three meter test range using the substitution method. The following procedure was used.

1. The DTX-142 was programmed to receive at the middle of both band splits which is 146 MHz for the G-band radio and 164 MHz for the O-band radio. The units were powered by a BK Precision power supply at 15 VDC.
2. The DR-142 was then terminated at the antenna port with 50 ohm power load.
3. All field strength measurements were made with the Hewlett-Packard Model 8560E Spectrum Analyzer connected to the Electro-Metrics LPA-25 log periodic receive antenna with 25 feet of RG-55 cable.
5. For each emission, the height and polarization of the field strength measuring antenna and orientation of the DTX-142 were varied to find maximum field strength.
6. The worse case emissions levels were noted.
7. Calculations were then performed to confirm compliance with the FCC limits. A sample calculation is demonstrated below:

SAMPLE CALCULATION:

The electric field intensity 3 meters from the unit tested is related to the power at the spectrum analyzer as follows.

$$E(\text{dBuV/m}) = AF + P(\text{dBm}) + 107$$

$$E(\text{uV/m}) = \text{antilog}_{10}(E(\text{dBuV/m})/20)$$

Where:

AF -The Antenna Factor for the LPA-25 Log Periodic antenna is 11.5 at 190 MHz. This includes cable loss.

P(dBm) - spectrum analyzer reading in dBm

For the G-band, spurious emission at 189.65 MHz, we have: $E(\text{dBuV/m}) = 11.5 + (-83) + 107 = 35.5$
 $E(\text{uV/m}) = \text{antilog}_{10}(35.5/20) = 59.57$

This result is well below the 150 uV/m required by the FCC.

TYPE OF TEST: RADIATED SPURIOUS EMISSIONS

FCC PART: 2.1053 per 15.109

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CALCULATION RESULT SUMMARY:

Programmed Receive Frequency (MHz)	Emissions Frequency (MHz)	Polarization	Spectrum Measured Emission (dBm)	Calculated field E(dBuV/m)	Calculated field E(uV/m)	FCC limit (EuV/m)
G-band 146	189.65	Horz	-83	35.5	59.6	150.0
		Vert	-79	39.2	91.2	150.0
O-band 164	207.65	Horz	-95	23.9	15.7	150.0
		Vert	-84	35.2	57.7	150.0

TYPE OF TEST: CONDUCTED EMISSIONS AT ANTENNA

FCC PART: 2.1051 per 15.111

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DATE: Nov 7, 2003

PROCEDURE:

The DR-142 was programmed for receiving mid-band frequencies in each of two sub-bands. Power was supplied to the DR-142 by a BK Precision Model 1730 Power Supply set to 15 VDC. A 3 foot coaxial cable connected the antenna receive port directly the HP8559A spectrum analyzer input. The following table summarizes the measurements for the two band splits.

RESULTS SUMMARY:

G-BAND

Receive Frequency (MHz)	Local Osc Frequency (MHz)	Measured Emission (dBm)	FCC limit (nW)	FCC limit (dBm)	Margin (dB)
146	189.65	-65	2	-57.0	8.0

O-BAND

Receive Frequency (MHz)	Local Osc Frequency (MHz)	Measured Emission (dBm)	FCC limit (nW)	FCC limit (dBm)	Margin (dB)
164	207.65	-74	2	-57.0	17.0

TYPE OF TEST: AC POWERLINE CONDUCTED EMISSIONS

FCC PART: 2.1033 per 15.107

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DATE: Nov 18, 2003

The DR-142 was powered by a RITRON RPS-1A power supply plugged into a line impedance stabilization network. The outputs were monitored by an HP8560E from 450 kHz to 30 MHz for signals exceeding the 250 microvolt FCC limit. The following calculation converts the 250 microvolt limit to a power limit in dBm, the units read by a spectrum analyzer.

$$P = V^2/R$$

$$P(\text{dBm}) = 10 * \log(P/.001)$$

Where:

P is power in watts

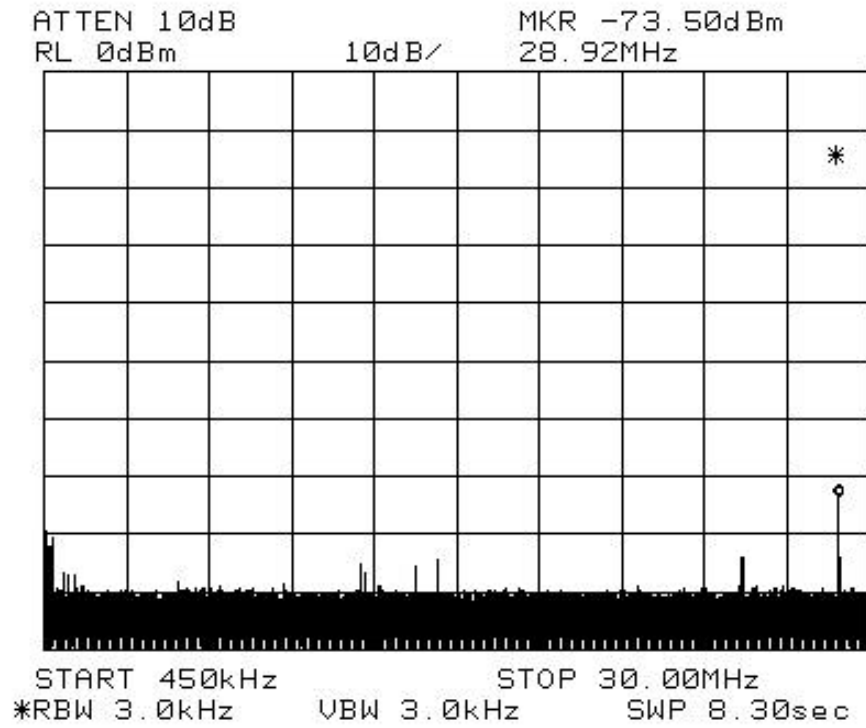
V is voltage in volts

R is the analyzer input impedance in ohms

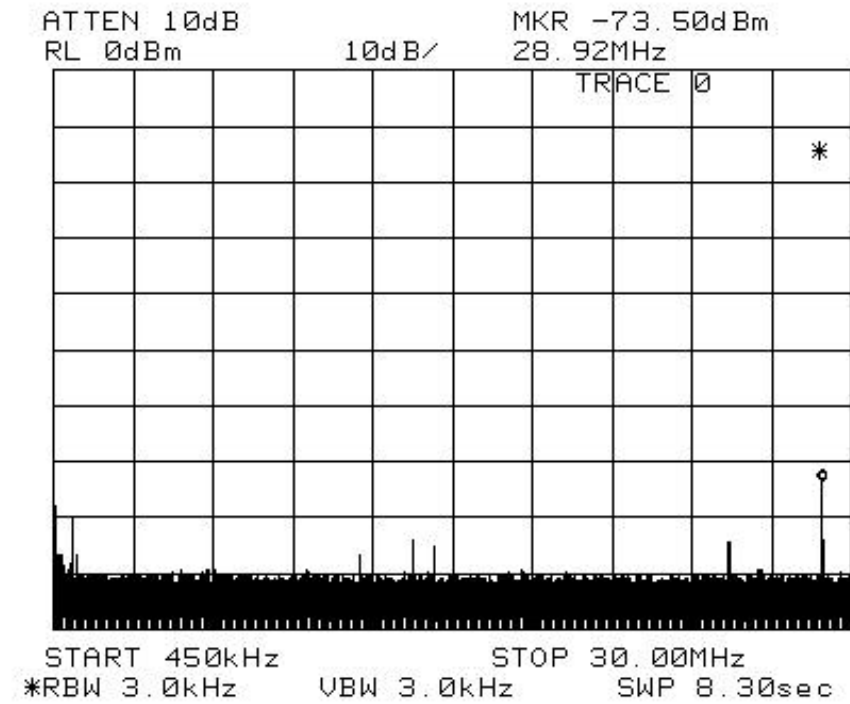
$$P = (.250 \times 10^{-6})/50 = 1.25 \times 10^{-9} \text{ W}$$

$$P(\text{dBm}) = 10 \log(1.25 \times 10^{-9}/.001) = -59 \text{ dBm}$$

The highest readings as seen in the following spectrum analyzer plots is -73.5 dBm. This gives the DR-142 a 14.5 dB margin.



DR-142 AC hot side conducted emissions



DR-142 AC ground side conducted emissions