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DR-442 Test Results

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

MODEL: DR-442

TYPE OF UNIT: UHF-FM Receiver Module

FCC ID: AIERIT17-442R

DATE: May 12, 2005

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

TYPE OF EXHIBIT:	TEST EQUIPMENT LIST
FCC PART:	2.947 (d)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	DR-442
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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.

ITEM	**MANUFACTURER**	**MODEL NO.**	**SERIAL NO.**
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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DATE: May 12, 2005

PROCEDURE:

Field strength of spurious radiation of the DR-442 was taken on the RITRON three-meter test. The following procedure was used.

1. The DR-442 was programmed to receive at the middle of both band splits which is 410.1 MHz for the G-band radio and 460.1 MHz for the O-band radio. The units were powered by a BK Precision power supply at 15 VDC.

2. The DR-442 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 DR-442 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.

$$E(dBuV/m) = AF + P(dBm) + 107$$

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

Where:

AF -The Antenna Factor for the LPA-25 Log Periodic antenna is 19 at the local oscillator frequency of 366.45 MHz for the G-band. This includes cable loss. The antenna factor is 20.5 at 416.45 MHz on the 0-band.

P(dBm) - spectrum analyzer reading in dBm

For the G-band, spurious emission at 366.45 MHz, we have: $E(dBuV/m) = 19 + (-92) + 107 = 34$
$E(uV/m) = \text{antilog}_{10}(34/20) = 50.1$ This result is well below the 200 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						
410.1	366.45	Horz	-99.0	27.0	22.4	200.0
		Vert	-92.0	34.0	50.1	200.0
O-band						
460.1	416.45	Horz	-100.0	27.5	23.7	200.0
		Vert	-101.0	26.5	21.1	200.0

TYPE OF TEST: CONDUCTED EMISSIONS AT ANTENNA

FCC PART: 2.1051 per 15.111

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DATE: May 12, 2005

PROCEDURE:

The DR-442 was programmed for receiving mid-band frequencies in each of two sub-bands. Power was supplied to the DR-442 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)
410.1	366.45	-72	2	-57.0	15.0

O-BAND

Receive Frequency (MHz)	Local Osc Frequency (MHz)	Measured Emission (dBm)	FCC limit (nW)	FCC limit (dBm)	Margin (dB)
460.1	416.45	-75	2	-57.0	18.0

TYPE OF TEST: AC POWERLINE CONDUCTED EMISSIONS

FCC PART: 2.1033 per 15.107

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The DR-442 was powered by a RITRON RPS-1A 13-volt power supply plugged into a line impedance stabilization network. The outputs were monitored by an HP8560E from 150 kHz to 30 MHz. The following table shows the FCC limits and conversion calculations to dBm for spectrum analyzer measurement:

Frequency of Emission	**FCC Conducted limit, Quasi-peak**		
(MHz)	**(dBuV)**	**(volts)**	**(dBm)**
0.15	66*	.002	-41
0.5	56*	.00063	-51
0.5-5	56	.00063	-51
5-30	60	.001	-47

*Decrease with the log of frequency

In the above table volts are derived from dBuV as $v = .000001 * 10^{(dBuV/20)}$

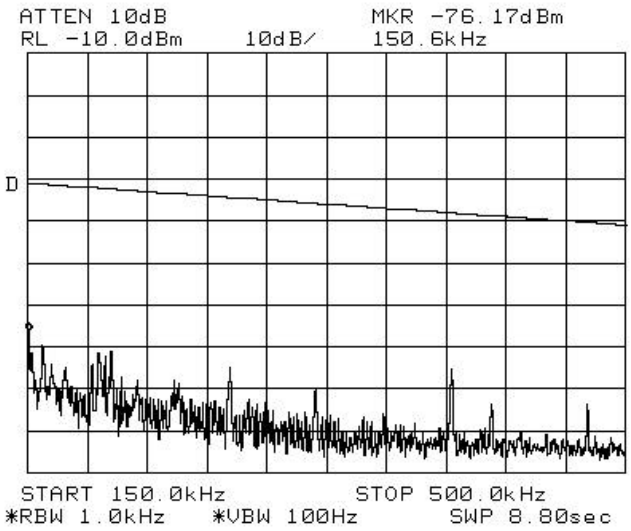
Power is derived as:

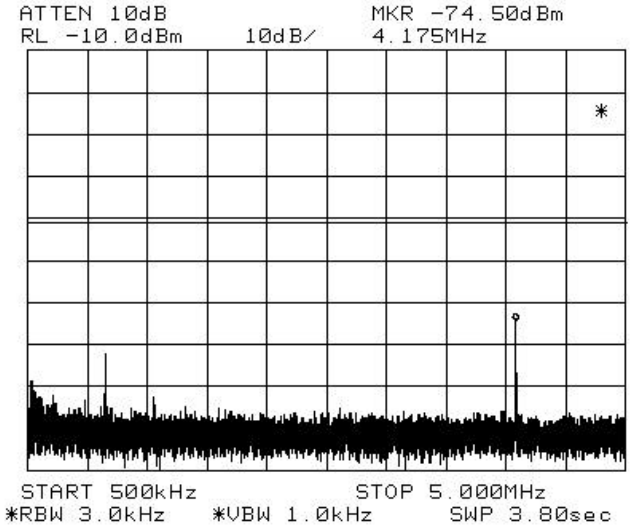
$P(watts) = V^2/R$

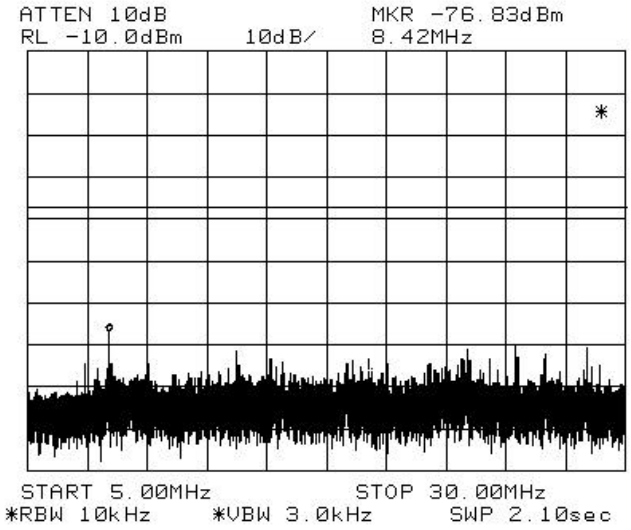
$P(dBm) = 10 * \log(P/.001)$

Where: P is power in watts or dB compared to a milliwatt
V is voltage in volts
R is the analyzer input impedance in ohms (50)

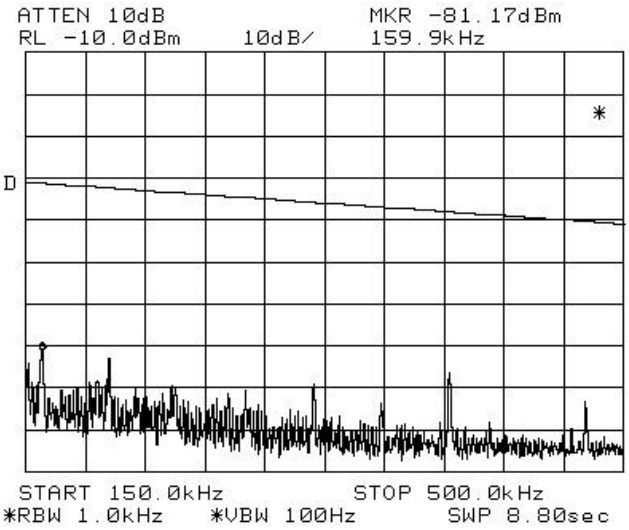
The following spectrum analyzer plots show the conducted emissions on the neutral line and hot line for three frequency bands. The first three plots are for the neutral line emissions and the second three for the hot line emissions. An FCC limit line is drawn on each of the plots. All conducted emissions fall below FCC limits.

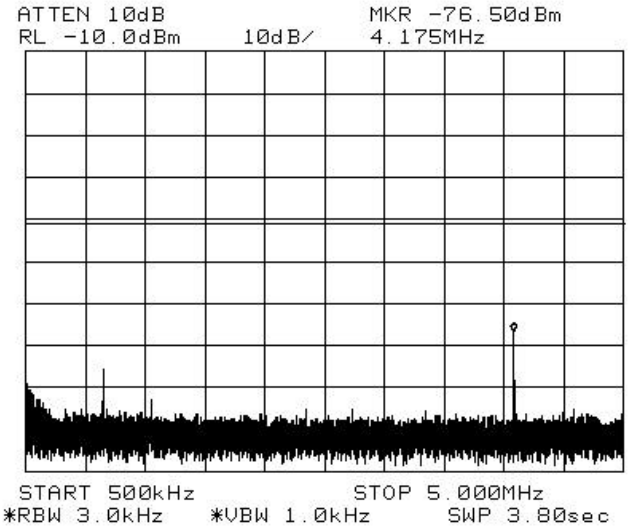


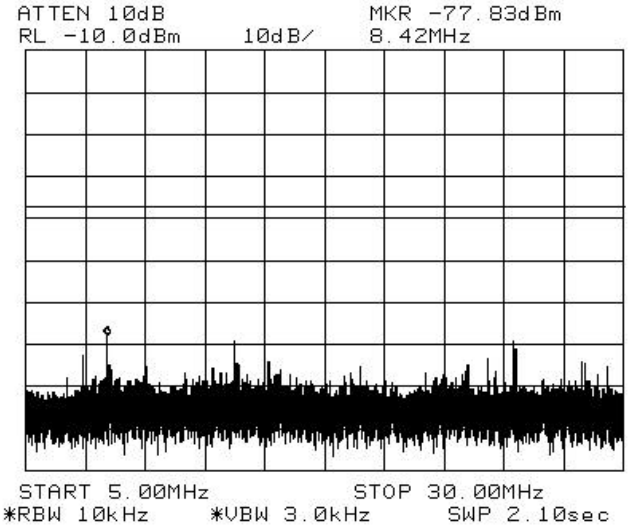




AC conducted emissions on neutral line







AC conducted emissions on hot line