

STATEMENT: OCCUPIED BANDWIDTH

FCC PART: 2.1046 & 2.1049

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

MODEL: JMX-141

TYPE OF UNIT: VHF-FM Handheld Transceiver

FCC ID: AIERIT14-141

DATE: Aug 30, 2000

The JMX-141 is capable of supporting wide band voice modulation (20K0F3E) or narrow band voice modulation on a 12.5 kHz channel (11K2F3E). The voice is pre-emphasized and clipped before modulating the VCO.

The JMX-141 is also capable of supporting a minimum of 4800 bits per second per 6.25 kHz of channel bandwidth on a narrow band 12.5 kHz channel (11K2F1D) per (90.203 (j))(3). In this mode the radio acts as a modem receiving 9600 bit per second data from the 3.5 mm programming plug. The microcontroller will then generate 1 of 4 levels for every 2 bits and sends them through a 5th order 3 kHz low pass filter before modulating the VCO. Here this 4 level FSK waveform occupies 11 kHz of bandwidth.

The JMX-141 can also support 1200 bit per second AFSK data on a narrow band channel (11K2F2D). Operation is similar to the 9600 bps data except the microcontroller will generate a 1200 Hz tone for a zero or 1800 Hz tone for a 1. Tones are phase contiguous to conserve bandwidth. Here the binary AFSK waveform occupies 11 kHz of bandwidth. Both modulation modes are used for low duty cycle data reporting.

Summary of JMX-141 Emissions Types:

<u>Modulation Type</u>	<u>Emissions Designator</u>	<u>Occupied Bandwidth</u>
Narrowband Voice	11K2F3E	11 kHz
Wideband Voice	20K0F3E	20 kHz
Narrowband 4FSK Data	11K2F1D	11 kHz
Narrowband AFSK Data	11K2F2D	11 kHz

TYPE OF TEST: OCCUPIED BANDWIDTH for 9600 bps DATA (11K2F1D)

FCC PART: 2.1049 (c)(1) per 90.210 (d) and 90.203 (j)(3)

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505 West Carmel Drive
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MODEL: JMX-141

TYPE OF UNIT: VHF-FM Handheld Transceiver

FCC ID: AIERIT14-141

DATE: July 26, 2000

PROCEDURE:

- 1) The JMX-141 was programmed on channel (1) for transmitter operation on 153.500 MHz, was set for 12.5 kHz bandwidth operation, and the deviation was adjusted for +/- 2.0 kHz at 1000 Hz as outlined in the Manual. Two plots are shown. The first is a typical spectrum generated from random data on channel (3). The second is the worse case spectrum from channel (4) (see (4) below).
- 2) The RF output of the JMX-141 was measured with a HP8920A communications test set wattmeter. This value was recorded as POWER OUTPUT. Power was supplied to the JMX-141 via a BK1730 power supply set at +7.2 VDC.
- 3) The antenna terminal P201 was connected to the HP8920A communications test set. The spectrum analyzer was set up for:
 - 300 Hz Resolution
 - 25 kHz span
 - 32 dBm Reference
 - 10 dB per Vertical Division
- 4) The JMX-141 microcontroller was flashed programmed for the modem mode of operation. The first spectrum results from a random 4 level FM modulated carrier. A random symbol rate of 4800 symbols per second with two bits per symbol yielding 9600 bits per second was generated by the microcontroller. The second spectrum is the worst case spectrum resulting where data alternates form 0 to 3. That is, no 1's and 2's are present only the maximum FM deviations for the 9600 bps rate. The equivalent modulation is a 2400 Hz square wave.
- 5) The spectrum analyzer was centered on the sideband being read. Readings of the sideband levels in dBm were recorded and a graph of the spectrum analyzer output was plotted.

TYPE OF TEST: OCCUPIED BANDWIDTH for 9600 bps FSK DATA (11K2F1D)

FCC PART: 2.1049 (c)(1) per 90.210 (d) and 90.203 (j)(3)

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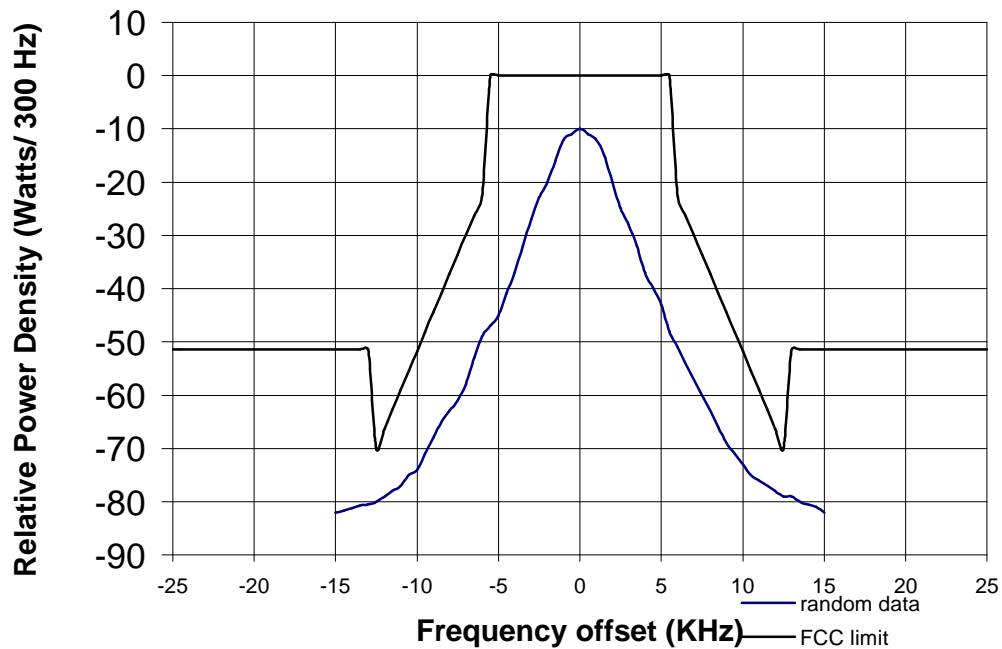
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Typical 9600 bps Occupied BW



TYPE OF TEST: OCCUPIED BANDWIDTH for 9600 bps FSK DATA (11K2F1D)

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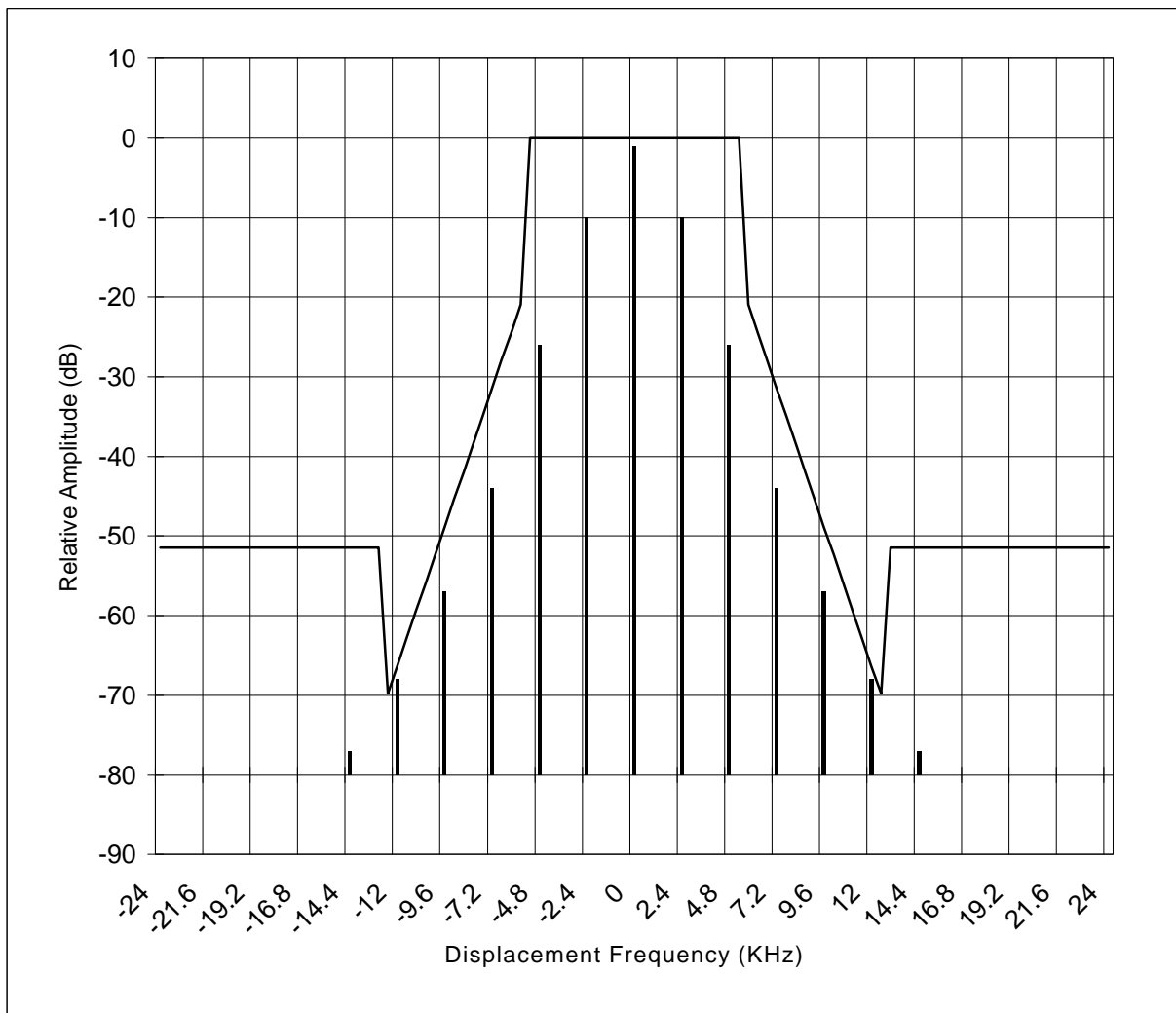
MODEL: JMX-141

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Worse Case Occupied Bandwidth for 9600 bps FSK



TYPE OF TEST: OCCUPIED BANDWIDTH for 1200 bps AFSK DATA (11K2F2D)

FCC PART: 2.1049 (c)(1) per 90.210 (b)(d)

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

MODEL: JMX-141

TYPE OF UNIT: VHF-FM Handheld Transceiver

FCC ID: AIERIT14-141

DATE: Aug 29, 2000

PROCEDURE:

- 1) The JMX-141 was programmed for transmitter operation on 153.500 MHz , was set for 12.5 KHz bandwidth operation, and the deviation was adjusted for +/- 2.5 KHz. The carrier is modulated with one of two tones. A 1200 Hz tone is a space and 1800 Hz tone a mark. The tones are phase contiguous to minimize spectral usage. The data rate is 1200 bits per second. An alternating 0101 ... continuous data stream is generated by the microcontroller for demonstration purposes.
- 2) The RF output of the JMX-141 was measured with a HP8920A communications test set wattmeter. This value was recorded as POWER OUTPUT. Power was supplied to the JMX-141 via a BK1730 power supply set at +7.2 VDC.
- 3) The antenna terminal P201 was connected to the HP8920A communications test set. The spectrum analyzer was set up for:
 - 300 Hz Resolution
 - 25 kHz span
 - 32 dBm Reference
 - 10 dB per Vertical Division
- 5) The spectrum analyzer was centered on the sideband being read. Readings of the sideband levels in dBm were recorded and a graph of the spectrum analyzer output was plotted

TYPE OF TEST: OCCUPIED BANDWIDTH for 1200 bps AFSK DATA (11K2F2D)

FCC PART: 2.1049 (c)(1) per 90.210 (b)(d)

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MODEL: JMX-141

TYPE OF UNIT: VHF-FM Handheld Transceiver

FCC ID: AIERIT14-141

DATE: Aug 29, 2000

DATA: Carrier Frequency: 153.5 MHz
Power Output: 1.40 Watts
Power Output: 31.46 dBm
Mean Reference Power: 31.46 dBm
Channel Bandwidth: 12.5 KHz
Occupied Bandwidth: 11.0 KHz

Emission Frequency Offset (KHz)	Measured Relative Amplitude (dBm)	Corrected Analyzer Amplitude Reading (dBm) (dbm)		FCC Limit (dBm)	Power (Watts)	Percent MRP (%)	Occupied Bandwidth (%)
-12.5	-73.36	-41.90	-43.00	-38.48			
-12.0	-71.36	-39.90	-41.00	-34.84			
-11.5	-71.36	-39.90	-41.00	-31.21			
-11.0	-66.36	-34.90	-36.00	-27.57			
-10.5	-64.36	-32.90	-34.00	-23.94			
-10.0	-62.36	-30.90	-32.00	-20.30			
-9.5	-60.36	-28.90	-30.00	-16.67			
-9.0	-56.36	-24.90	-26.00	-13.03			
-8.5	-56.36	-24.90	-26.00	-9.40			
-8.0	-50.36	-18.90	-20.00	-5.76			
-7.5	-46.36	-14.90	-16.00	-2.13			
-7.0	-50.36	-18.90	-20.00	1.51			
-6.5	-39.36	-7.90	-9.00	5.14			
-6.0	-41.36	-9.90	-11.00	8.78			
-5.5	-37.36	-5.90	-7.00	31.46	257.0E-6	0.02%	
-5.0	-28.36	3.10	2.00	31.46	2.0E-3	0.15%	
-4.5	-36.36	-4.90	-6.00	31.46	323.6E-6	0.02%	
-4.0	-28.36	3.10	2.00	31.46	2.0E-3	0.15%	
-3.5	-19.36	12.10	11.00	31.46	16.2E-3	1.16%	
-3.0	-21.36	10.10	9.00	31.46	10.2E-3	0.73%	
-2.5	-16.36	15.10	14.00	31.46	32.4E-3	2.31%	
-2.0	-11.36	20.10	19.00	31.46	102.3E-3	7.31%	
-1.5	-8.36	23.10	22.00	31.46	204.2E-3	14.58%	
-1.0	-11.96	19.50	18.40	31.46	89.1E-3	6.37%	
-0.5	-11.96	19.50	18.40	31.46	89.1E-3	6.37%	

0.0	-6.96	24.50	23.40	31.46	281.8E-3	20.13%	99.96%
0.5	-11.96	19.50	18.40	31.46	89.1E-3	6.37%	
1.0	-11.96	19.50	18.40	31.46	89.1E-3	6.37%	
1.5	-8.36	23.10	22.00	31.46	204.2E-3	14.58%	
2.0	-10.96	20.50	19.40	31.46	112.2E-3	8.01%	
2.5	-15.86	15.60	14.50	31.46	36.3E-3	2.59%	
3.0	-20.16	11.30	10.20	31.46	13.5E-3	0.96%	
3.5	-18.36	13.10	12.00	31.46	20.4E-3	1.46%	
4.0	-27.86	3.60	2.50	31.46	2.3E-3	0.16%	
4.5	-36.86	-5.40	-6.50	31.46	288.4E-6	0.02%	
5.0	-28.86	2.60	1.50	31.46	1.8E-3	0.13%	
5.5	-38.36	-6.90	-8.00	31.46	204.2E-6	0.01%	
6.0	-41.86	-10.40	-11.50	8.78			
6.5	-40.36	-8.90	-10.00	5.14			
7.0	-51.36	-19.90	-21.00	1.51			
7.5	-47.36	-15.90	-17.00	-2.13			
8.0	-51.36	-19.90	-21.00	-5.76			
8.5	-57.36	-25.90	-27.00	-9.40			
9.0	-57.36	-25.90	-27.00	-13.03			
9.5	-62.36	-30.90	-32.00	-16.67			
10.0	-64.36	-32.90	-34.00	-20.30			
10.5	-66.36	-34.90	-36.00	-23.94			
11.0	-67.36	-35.90	-37.00	-27.57			
11.5	-74.36	-42.90	-44.00	-31.21			
12.0	-72.36	-40.90	-42.00	-34.84			
12.5	-74.36	-42.90	-44.00	-38.48			

TYPE OF TEST:

OCCUPIED BANDWIDTH for 1200 bps AFSK DATA (11K2F2D)

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Occupied Bandwidth for 1200 bps AFSK Narrowband Data (11K2F2D)

