



Engineering and Testing for EMC and Safety Compliance

Certification Report

FCC Part 90

K & A Wireless LLC
2617 Juan Tabo Blvd., NE, Suite A
Albuquerque, NM 87112

MODEL: EV-TX-3000

FCC ID: OPH-EV3000

July 17, 2006

Standards Referenced for this Report	
Part 2: 2005	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 90: 2005	Private Land Mobile Radio Services
ANSI/TIA-603-C-2004	Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards

Frequency Range (MHz)	Output Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
2458 and 2474	0.9	10.3	18M6F3F

Report Prepared By Test Engineer: Dan Baltzell

Document Number: 2006075/QRTL06-244



Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 200061-0.

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1 General Information

The following Certification Report is prepared on behalf of K&A Wireless, LLC in accordance with the Federal Communications Commission. The Equipment Under Test (EUT) was Model # EV-TX-3000; FCC ID: OPH-EV3000. The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47 Part 90 and ANSI/TIA-603-C-2004. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 2000, submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

1.2 Related Submittal(s)/Grant(s)

This is an original application report.

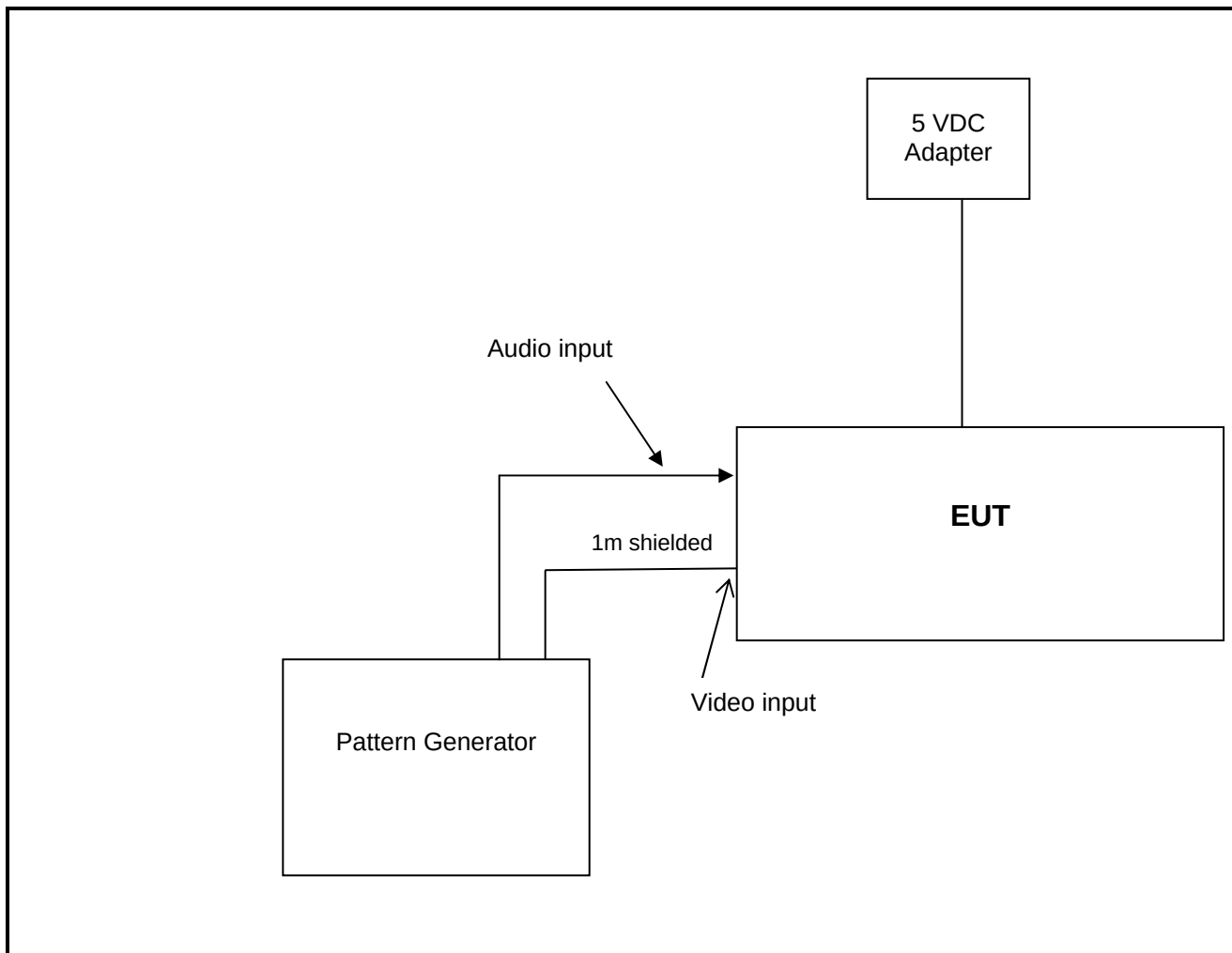
2 Tested System Details

The test sample was received on June 12, 2006. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

Table 2-1: Equipment Under Test (EUT)

Description	Manufacturer	Model	Serial No.	FCC ID	Cable Descriptions	RTL Bar Code
Transmitter Module	K&A Wireless, LLC	EV-TX-3000	EV-TX-000976	OPH-EV3000	Unshielded Power	17280

Figure 2-1: Configuration of Tested System



3 FCC Rules and Regulations Part 2 §2.1046(a): RF Power Output: Conducted

3.1 Test Procedure

ANSI/TIA-603-C-4, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

3.2 Test Data

The carrier (in MHz) was tested: 2458 and 2474

Table 3-1: RF Power Output: Carrier Output Power (Unmodulated)

Channel	Frequency (MHz)	RF Power Measured (Watt)*
1	2474	0.9
2	2458	0.9

* Measurement accuracy: +/- .02 dB (logarithmic mode)

Table 3-2: RF Power Output (Rated Power)

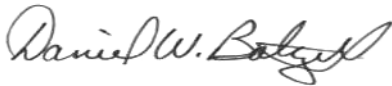
Rated Power (W)
0.9

Table 3-3: Test Equipment Used For Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	9/21/06
901356	Agilent	E9323A	Power Sensor	31764-264	9/21/06

TEST PERSONNEL:

Daniel W. Baltzell
Test Engineer



Signature

June 16, 2006
Date Of Test

4 FCC Rules and Regulations Part 2 §2.1051: Spurious Emissions at Antenna Terminals

4.1 Test Procedure

ANSI/TIA-603-C-4, Section 2.2.13: The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.

TRANSMITTER INPUT MODULATION: The test signal modulating the main carrier consists of a standard NTSC video signal with two audio sub-carriers at 6.0 MHz and 6.5 MHz and 2 Vpp audio levels respectively. The NTSC video signal has a 1 Vpp maximum level. The transmitter is designed for pre-emphasis audio and video NTSC standard signals only. The content of the video signal in conjunction with the pre-emphasis network ensures that the occupied bandwidth will not exceed the limit as defined by the calculated necessary bandwidth and §90.210(b). The test signal used for measuring occupied bandwidth was a color bar (75% color bars from a video pattern generator) which contains high frequency content at amplitudes that far exceed that which would be received from an NTSC video camera. Under conditions of extreme brightness, a video camera is incapable of generating a signal that would cause the transmitter's occupied bandwidth to exceed that measured using the 75% color bar signal. Therefore, the 75% color bar signal represents a worst case modulation condition.

4.2 Test Data

Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: Mask B (dBm): $P(\text{dBm}) - (43 + 10 \times \log P(\text{W}))$

The carrier was investigated at 2458 and 2474 MHz. The worse case (unwanted emissions) data are shown below. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

Table 4-1: Conducted Spurious Emissions Carrier – 2458 MHZ

(2458 MHz; Conducted Power = 0.9 W)

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
4916.0	75.0	42.5	-32.5
7374.0	63.1	42.5	-20.6
9832.0	75.4	42.5	-32.9
12290.0	93.4	42.5	-50.9
14748.0	81.4	42.5	-38.9
17206.0	102.6	42.5	-60.1
19664.0	80.0	42.5	-37.5
22122.0	71.9	42.5	-29.4
24580.0	92.5	42.5	-50.0

Table 4-2: Conducted Spurious Emissions Carrier – 2474 MHz

(2474 MHz; Conducted Power = 0.9 W)

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
4948.0	71.9	42.5	-29.4
7422.0	59.8	42.5	-17.3
9896.0	69.2	42.5	-26.7
12370.0	83.5	42.5	-41.0
14844.0	70.4	42.5	-27.9
17318.0	106.9	42.5	-64.4
19792.0	81.6	42.5	-39.1
22266.0	70.4	42.5	-27.9
24740.0	92.5	42.5	-50.0

Table 4-3: Test Equipment Used For Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40 dB	BK5883	1/13/09

TEST PERSONNEL:

Daniel W. Baltzell
Test Engineer



Signature

June 16, 2006
Date Of Test

5 FCC Rules and Regulations Part 2 §2.1053(a): Field Strength of Spurious Radiation

5.1 Test Procedure

ANSI/TIA-603-C-4, section 2.2.12; the transmitter is terminated with a 50 Ω load. The spurious emissions levels were measured and the device under test was replaced by a substitution antenna connected to a signal generator. The signal generator level was then corrected by subtracting the cable loss between the substitution antenna and the signal generator. The gain of the antenna was further corrected to a half wave dipole.

TRANSMITTER INPUT MODULATION: The test signal modulating the main carrier consists of a standard NTSC video signal with two audio sub-carriers at 6.0 MHz and 6.5 MHz and 2 Vpp audio levels respectively. The NTSC video signal has a 1 Vpp maximum level. The transmitter is designed for pre-emphasis audio and video NTSC standard signals only. The content of the video signal in conjunction with the pre-emphasis network ensures that the occupied bandwidth will not exceed the limit as defined by the calculated necessary bandwidth and §90.210(b). The test signal used for measuring occupied bandwidth was a color bar (75% color bars from a video pattern generator) which contains high frequency content at amplitudes that far exceed that which would be received from an NTSC video camera. Under conditions of extreme brightness, a video camera is incapable of generating a signal that would cause the transmitter's occupied bandwidth to exceed that measured using the 75% color bar signal. Therefore, the 75% color bar signal represents a worse case modulation condition.

5.2 Test Data

5.2.1 CFR 47 Part 90.210 Requirements

The worst case emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

Table 5-1: Field Strength of Spurious Harmonic-Carrier at 2458 MHz

Radiated Spurious Emissions; Limit = $43 + 10 \log P = 42.5$ dBc; Conducted Power = 39.5 dBm = 0.9 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Limit (dBc)	Margin (dB)
4948.0	46.8	-47.2	5.8	10.3	72.2	42.5	-29.7
7422.0	39.5	-50.0	8.9	10.9	77.5	42.5	-35.0
9896.0	31.5	-50.2	9.8	12.0	77.5	42.5	-35.0
12370.0	31.2	-48.5	11.2	13.1	76.1	42.5	-33.6
14844.0	33.3	-39.0	12.5	12.1	68.9	42.5	-26.4
17318.0	32.8	-39.7	13.6	12.8	70.0	42.5	-27.5
19792.0	32.3	-42.0	14.9	14.2	72.2	42.5	-29.7

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the $\frac{1}{2}$ wave dipole antenna.

Table 5-2: Field Strength of Spurious Harmonic-Carrier at 2474 MHz

Radiated Spurious Emissions; Limit = $43 + 10 \log P = 42.5$ dBc; Conducted Power = 39.5 dBm = 0.9 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Limit (dBc)	Margin (dB)
4916.0	48.7	-45.6	5.7	10.3	70.5	42.5	-28.0
7374.0	41.7	-47.6	8.8	11.0	74.9	42.5	-32.4
9832.0	33.8	-48.4	9.7	11.9	75.7	42.5	-33.2
12290.0	31.3	-48.4	11.0	12.9	76.0	42.5	-33.5
14748.0	33.0	-38.3	12.5	11.8	68.5	42.5	-26.0
17206.0	32.5	-40.5	14.1	13.2	70.9	42.5	-28.4
19664.0	32.8	-41.6	14.6	14.1	71.6	42.5	-29.1

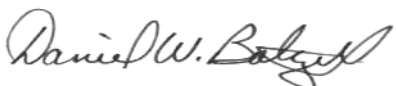
*This insertion loss corresponds to the cable connecting the RF Signal Generator to the $\frac{1}{2}$ wave dipole antenna.

Table 5-3: Test Equipment Used For Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	11/1/06
901365	Miteq	JS4-00102600-41-5P	Amplifier, 15 V, 0.1-26 GHz, 28 dB gain, power 5 dB	1094152	3/24/07
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
900928	Hewlett Packard	83752A	Synthesized Sweeper (0.01 - 20 GHz)	3610A00866	11/10/06
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	12/12/06
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	12/12/06
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/12/06
900151	Rohde and Schwarz	HFH2-Z2	Antenna (Loop antenna, 9 kHz - 30 MHz)	827525/019	8/25/06
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 - 20 GHz)	3610A00866	11/10/06
900905	Rhein Tech Labs	PR-1040	OATS 1 Preamplifier 40 dB (30 MHz – 2 GHz)	1006	3/15/07
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	5/20/07
900321	EMCO	3161-03	Horn Antennas (4 - 8,2 GHz)	9508-1020	5/20/07
900323	EMCO	3160-7	Horn Antennas (8,2 - 12,4 GHz)	9605-1054	5/20/07
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	5/20/07
900325	EMCO	3160-9	Horn Antennas (18 - 26.5 GHz)	9605-1051	5/20/07
900814	Electro-Metrics	EM-6961 (RGA-60)	Double Ridged Guide Antenna (1 - 18 GHz)	2310	3/30/09
900154	Compliance Design	Roberts Dipole	Adjustable Elements Dipole Antenna (30 – 1000 MHz)	N/A	12/21/06
900660	Philips	PM-5418TDS	TV Generator	LO 604891	Not Required

TEST PERSONNEL:

Daniel W. Baltzell
Test Engineer



Signature

June 16, 2006
Date Of Test

6 FCC Rules and Regulations Part 2 §2.1049(c)(1): Occupied Bandwidth

Occupied Bandwidth - Compliance with the emission masks

Note regarding Mask selection: Part 90.210 does not have a specific mask for equipment operating in the 2458 – 2474 MHz frequency range. Mask B and C are specified for “all other bands”, for equipment with an audio low pass filter and for equipment without an audio low pass filter, respectively. While the equipment in this application does not have an audio low pass filter, Mask C is not appropriate as it does not allow for equipment with the designated bandwidth in this application. Therefore, compliance is shown with Mask B.

6.1 Test Procedure

ANSI/TIA-603-C-4, section 2.2.11

TRANSMITTER INPUT MODULATION: The test signal modulating the main carrier consists of a standard NTSC video signal with two audio sub-carriers at 6.0 MHz and 6.5 MHz and 2 Vpp audio levels respectively. The NTSC video signal has a 1 Vpp maximum level. The transmitter is designed for pre-emphasis audio and video NTSC standard signals only. The content of the video signal in conjunction with the pre-emphasis network ensures that the occupied bandwidth will not exceed the limit as defined by the calculated necessary bandwidth and §90.210(b). The test signal used for measuring occupied bandwidth was a color bar (75% color bars from a video pattern generator) which contains high frequency content at amplitudes that far exceed that which would be received from an NTSC video camera. Under conditions of extreme brightness, a video camera is incapable of generating a signal that would cause the transmitter's occupied bandwidth to exceed that measured using the 75% color bar signal. Therefore, the 75% color bar signal represents a worst case modulation condition.

6.2 Emission Mask B Calculation

Rated power output: 0.9 watt

Authorized bandwidth: 18.6 MHz (measured at –26 dBc, modulated)

FCC Part 90.210(b)1

On any frequency removed from the assigned frequency by more than 50%, but not more than 100% or the authorized bandwidth: At least 25 dB

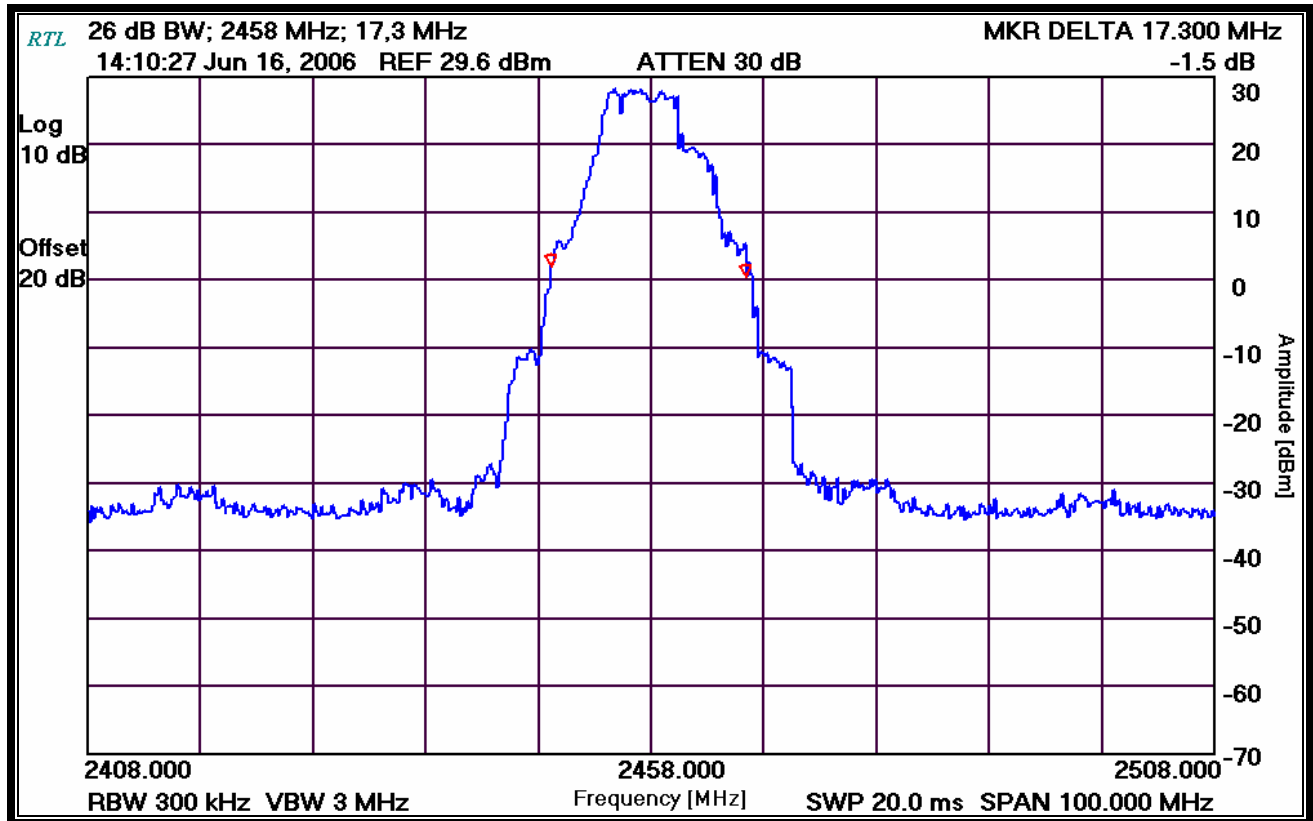
FCC Part 90.210(b)2

On any frequency removed from the assigned frequency by more than 100%, but not more than 250% or the authorized bandwidth: At least 35 dB

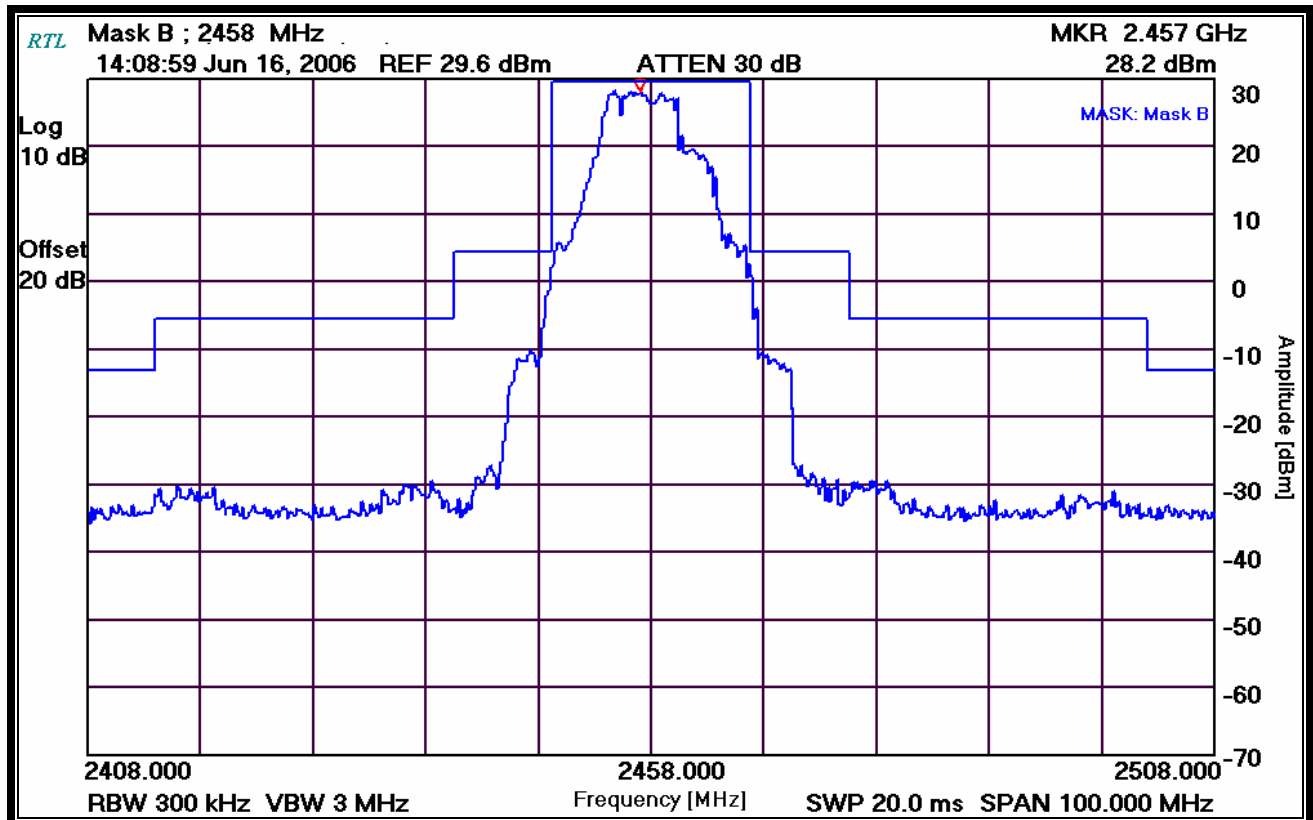
FCC Part 90.210(c)3

On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth:
At least $43 + 10 \log(p)$ dB

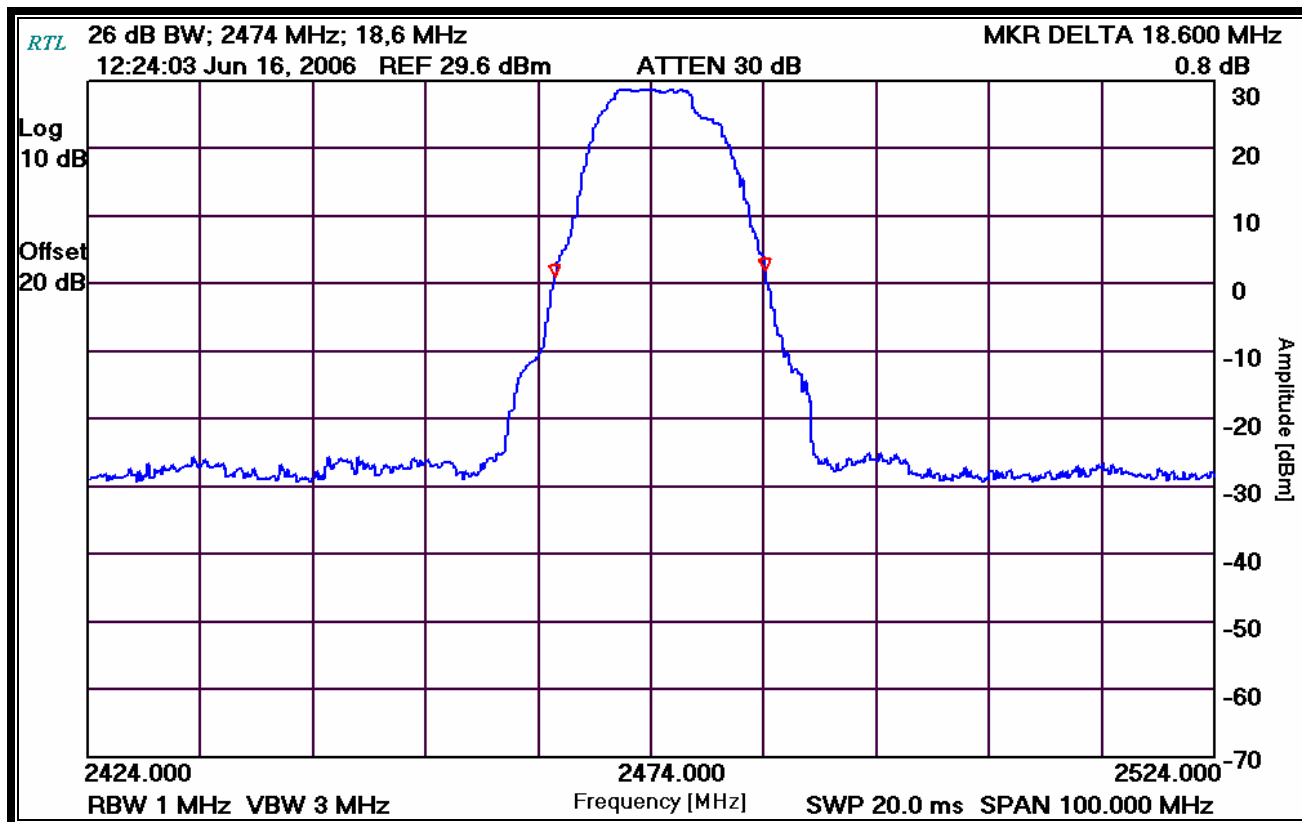
6.3 Test Data



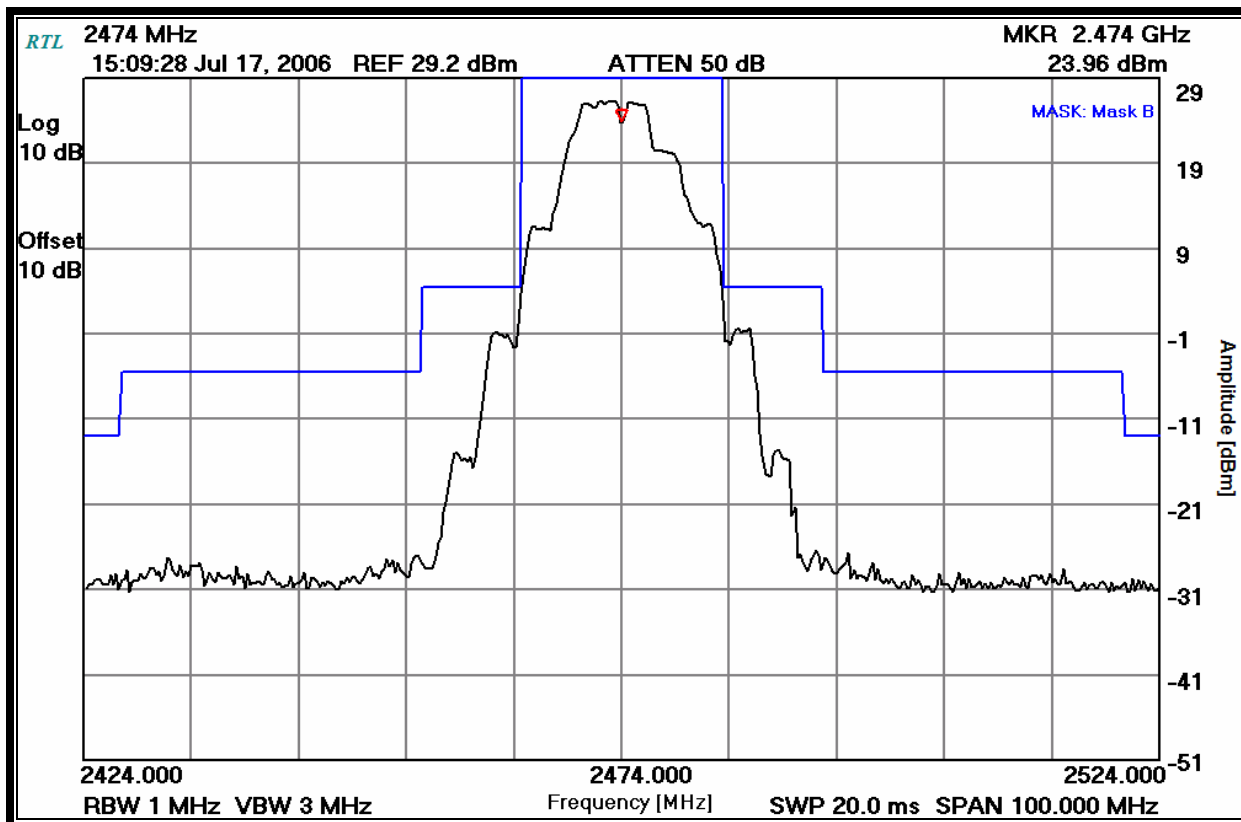
Plot 6-1: 26 dB Bandwidth; 2458 MHz



Plot 6-2: Occupied Bandwidth; 2458 MHz



Plot 6-3: 26 dB Bandwidth; 2474 MHz



Plot 6-4: Occupied Bandwidth; 2474 MHz

Table 6-1: Test Equipment Used For Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/3/06
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100 W 40 dB	BK5883	1/13/09
900660	Philips	PM-5418TDS	TV Generator	LO 604891	Not Required

TEST PERSONNEL:

Daniel W. Baltzell
Test Engineer

Daniel W. Baltzell
Signature

June 16, 2006
Date Of Test

7 FCC Rules and Regulations Part 2 §2.202: Necessary Bandwidth and Emission Bandwidth

The modulating signal consists of a video carrier and two audio sub-carriers. The mean radiated power from each of the sub-carriers is less than 0.5 percent of the total mean radiated power, therefore, only the characteristic video component of the modulating signal are considered when calculating the necessary bandwidth.

Type of Emission: F3F

Necessary Bandwidth and Emission Bandwidth:

Modulation: 1 Vpp CCIR 405 NTSC Pre-emphasis audio and Video

Calculation:

Max modulation (M) in MHz: 4.25 MHz for CCIR 405 525 lines NTSC Video

Max deviation (D) in MHz: 4

Constant factor (K): 1 (assumed)

$B_n = 2 \times M + 2 \times DK = 16.5 \text{ MHz}$

Emission designator: 16M5F3E

Measurement: 99.75% Occupied Bandwidth

$B_n = 18.6 \text{ MHz}$

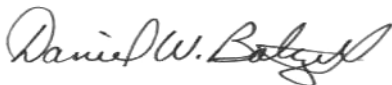
Emission designator: 18M6F3F

Table 7-1: Test Equipment Used For Necessary and Emission Bandwidth Measurements

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/3/06
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	1/13/09
900660	Philips	PM-5418TDS	TV Generator	LO 604891	Not Required

TEST PERSONNEL:

Daniel W. Baltzell
Test Engineer



Signature

June 16, 2006
Date Of Test

8 FCC Rules and Regulation Part 2 §2.1055: Frequency Stability

8.1 Test Procedure

ANSI/TIA-603-C-4, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +50°C.

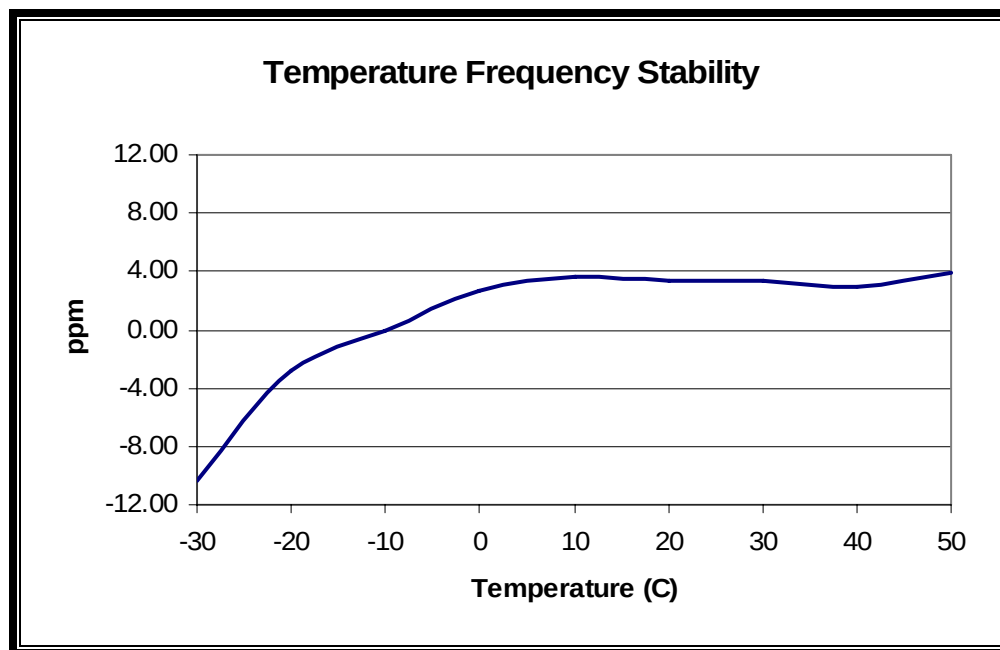
The temperature was initially set to -30°C and a 1-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A half hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied from the battery end point to maximum voltage.

The worst case test data are shown in Table 8-1.

8.2 Test Data

8.2.1 Frequency Stability/Temperature Variation

Worst case deviation was found to be -10.3 ppm at -30°C.



Plot 8-1: Temperature Frequency Stability

Table 8-1: Temperature Frequency Stability Carrier at 2474 MHZ

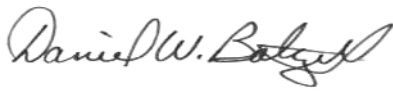
Temperature °C	Measured Frequency (MHz)	ppm
-30	2473.974510	-10.30
-20	2473.992954	-2.85
-10	2473.999840	-0.06
0	2474.006492	2.62
10	2474.008896	3.60
20	2474.008451	3.42
30	2474.008365	3.38
40	2474.007235	2.92
50	2474.009603	3.88

Table 8-2: Test Equipment Used For Testing Frequency Stability/Temperature

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	1/20/07
901300	Agilent	53131A	Universal Counter	MY40001345	11/23/06

TEST PERSONNEL:

Daniel W. Baltzell
Test Engineer

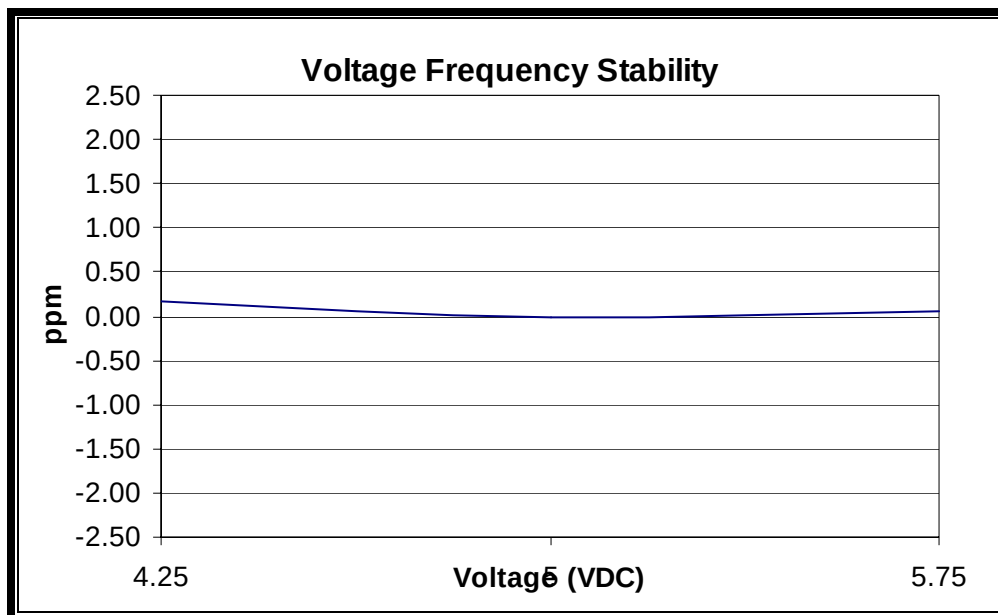


Signature

June 16 And 17, 2006
Dates Of Test

8.2.2 Frequency Stability/Voltage Variation

Worst case variation is 0.16 ppm at the 4.25 VDC.



Plot 8-2: Voltage Frequency Stability

Table 8-3: Frequency Stability/Voltage Variation Carrier at 2474 MHz

Voltage (Vdc)	Measured Frequency (MHz)	ppm
4.25	2474.000403	0.16
5.0	2474.000000	0.00
5.75	2474.000144	0.06

Table 8-4: Test Equipment Used For Testing Frequency Stability/Voltage

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100 W 40 dB	BK5883	1/13/09

TEST PERSONNEL:

Daniel W. Baltzell
Test Engineer


Signature

June 16, 2006
Date Of Test

9 FCC Part 2 §2.1047(a): Modulation Characteristics - Audio Frequency Response

9.1 Test Procedure

ANSI/TIA-603-C-4, section 2.2.6

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

The input audio level at 1000 Hz was set to produce 20% of the rated system deviation. This point is shown as the 0 dB reference level, noted DEVref. The audio signal generator was varied from 100 Hz to 5 kHz with the input level held constant. The deviation in kHz was recorded using a modulation analyzer as DEVfreq. The response in dB relative to 1 kHz was calculated as follows:

Audio Frequency Response = 20 LOG (DEVfreq/DEVref)

9.2 Test Data

Not applicable; the EUT does not contain an audio low pass filter. The EUT is designed to use pre-emphasis NTSC audio.

10 FCC Part 2 §2.1047(a): Modulation Characteristics – Audio Low Pass Filter

10.1 Test Procedure

ANSI/TIA-603-C-4, 2.2.15

The Audio Low Pass Filter Response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

10.2 Test Data

Not applicable; the EUT does not contain an audio low pass filter. The EUT is designed to use pre-emphasis NTSC audio.

11 FCC Rules and Regulations Part 2 §2.1047(b): Modulation Characteristics - Modulation Limiting

11.1 Test Procedure

ANSI/TIA-603-C-4, section 2.2.3

The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0 dB), the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500 Hz. The system deviation obtained as a function of the input level was recorded. Both positive and negative peak deviations were recorded.

11.2 Test Data

Not applicable; the EUT does not contain modulation limiting circuitry. The EUT is designed to use pre-emphasis NTSC Video.

12 FCC Rules and Regulations Part 90 §90.214; Transient Frequency Behavior

12.1 Test Procedure

ANSI/TIA-603-C-4, section 2.2.3

12.2 Test Data

Not applicable; the EUT does not contain modulation limiting circuitry or a low pass filter. The EUT is designed to use pre-emphasis NTSC audio and video.

13 Conclusion

The data in this measurement report shows that the K&A Wireless, LLC, Model # EV-TX-3000, FCC ID: OPH-EV3000, complies with all the applicable requirements of Part 90 of the FCC Rules and Regulations and ANSI/TIA-603-C-4.