

TIMCO ENGINEERING INC.

849 NW State Road 45

Newberry, Florida 32669

<http://www.timcoengr.com>

888.472.2424 F 352.472.2030 email: sid@timcoengr.com



Test Report

Product Name: RADIO TRANSCEIVER

FCC ID: Q9S07161688P

Applicant:

**ADVANCED WIRELESS COMMUNICATIONS
20809 KENSINGTON BLVD.
LAKEVILLE MINNESOTA 55044**

Date Receipt: OCTOBER 20, 2004

Date Tested: OCTOBER 25, 2004

APPLICANT: ADVANCED WIRELESS COMMUNICATIONS

FCC ID: Q9S07161688P

REPORT #: A\ADVANCED WIRELESS_Q9S\1435AUT4\1435AUT4TestReport.doc

COVER SHEET

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GENERAL INFORMATION REQUIRED FOR CERTIFICATION OF A LICENSED TRANSMITTER

2.1033(c)(1)(2) ADVANCED WIRELESS COMMUNICATIONS will manufacture the FCCID: Q9S07161688P UHF TRANSCEIVER in quantity, for use under FCC RULES PART 90.

ADVANCED WIRELESS COMMUNICATIONS
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LAKEVILLE, MINNESOTA 55044

2.1033(c) TECHNICAL DESCRIPTION

2.1033(c)(3) **Users Manual:** A draft copy of the instruction manual is included.

2.1033(c) (4) Type of Emission: 10K4F3E
90.209
90.207 Bn = 2M + 2DK
M = 3000
D = 2200
Bn = 2(3000) + 2(2200) = 10.4k

2.1033(c)(5) Frequency Range: 460 - 470 MHz
90.209 (b)(5)

2.1033(c)(6)(7) Power Output shall not exceed 59 Watts into a 50 ohm resistive load. There are no user power controls.
90.205

2.1033(c)(8) DC Voltages and Current into Final Amplifier:
POWER INPUT:

FINAL AMPLIFIER ONLY

INPUT POWER: (4.5 V)(1.40 A) = 6.30 Watts

2.1033(c)(9) **Tune-up procedure.** The tune-up procedure is included.

2.1033(c)(10) **Complete Circuit Diagrams:** The circuit diagram and block diagram are included.

2.1033(c)(11): Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description.

2.1033(c)(12) A photograph or drawing of the equipment identification label is included.

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2.1033(c)(12) Photographs of the equipment of sufficient clarity to reveal equipment construction and layout and label location are included.

2.1033(c)(13): Digital Modulation is not allowed

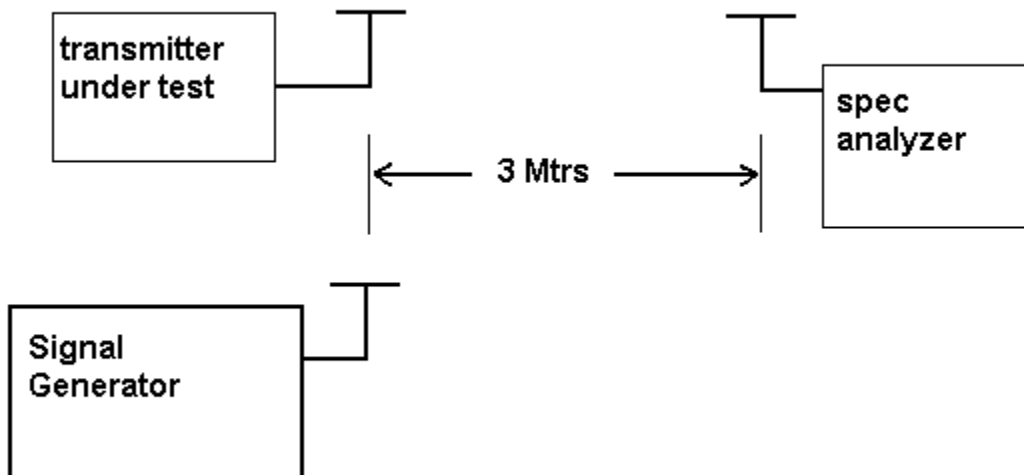
2.1033(c)(14) The data required for 2.1046 through 2.1057 is submitted below.

2.1046(a)

RF POWER OUTPUT

RF power is measured as ERP as the antenna is permanently attached. The substitution method was used. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

OUTPUT POWER: 1 Watt



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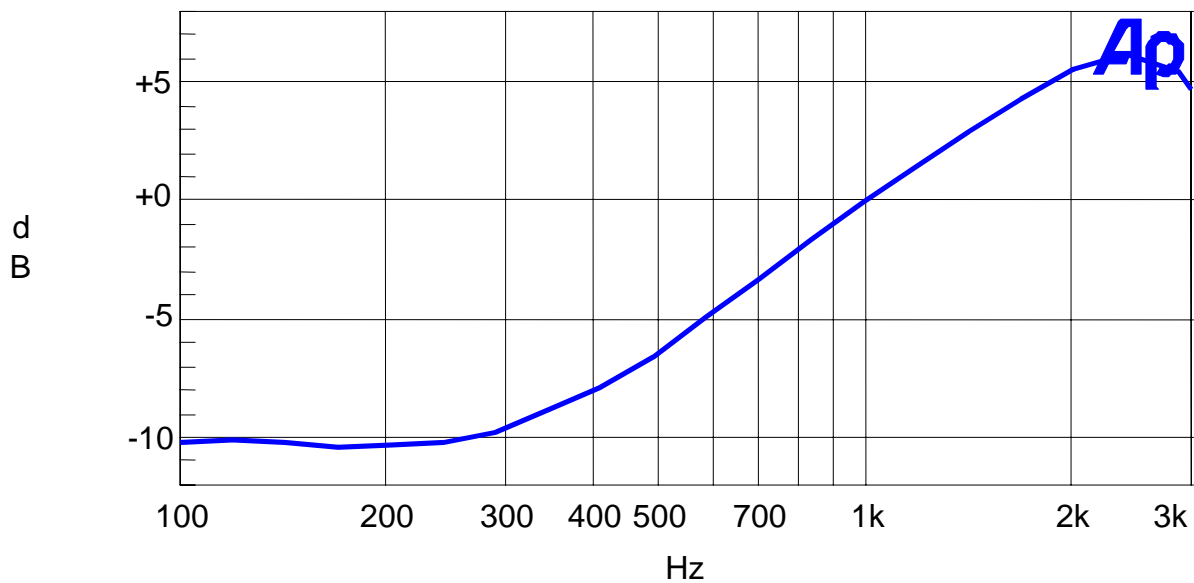
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2.1047(a)(b) Modulation characteristics:

AUDIO FREQUENCY RESPONSE

The audio frequency response was measured in accordance with TIA/EIA Specification 603. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 - 5000Hz shall be submitted. The audio frequency response curve is shown below.

Audio Frequency Response



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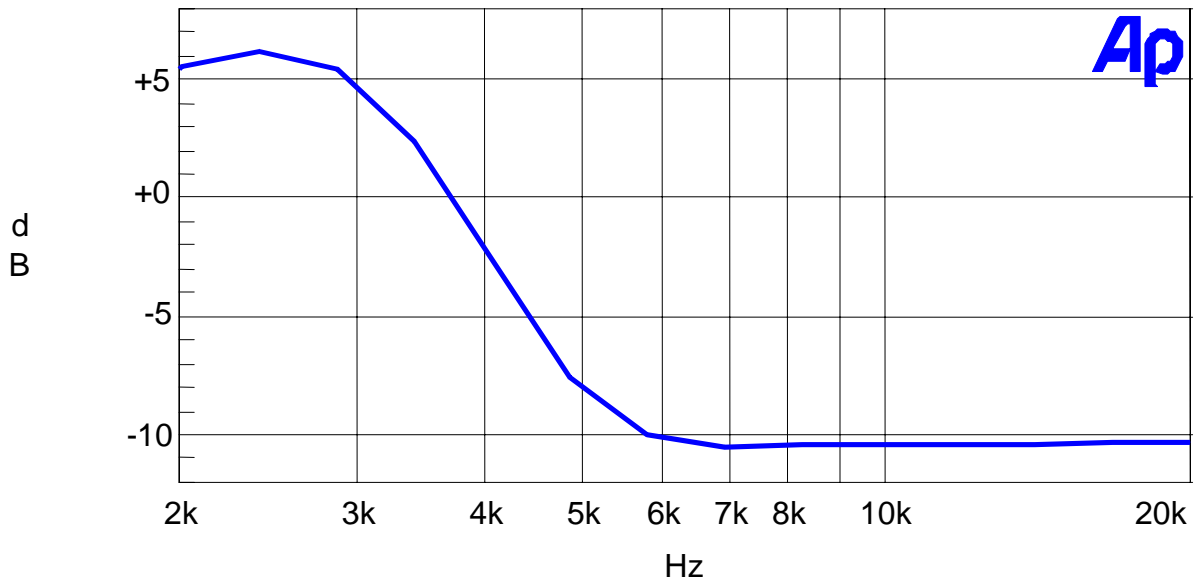
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2.1047(a)

Voice modulated communication equipment:

For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Audio Low Pass Filter



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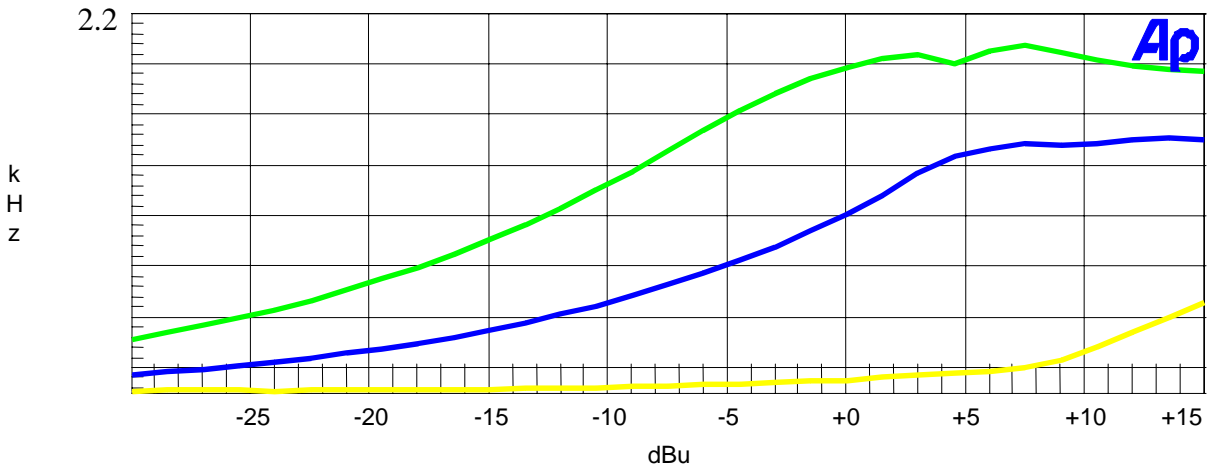
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2.1047(b)

Audio input versus modulation

The audio input level needed for a particular percentage of modulation was measured in accordance with TIA/EIA Specification 603. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 2500 Hz.

Modulation Limiting Plots:
2.5 KHz (Green), 1.0 KHz (Blue), and 300 Hz (Yellow)



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2.1049 Occupied bandwidth:

2.1049(c) EMISSION BANDWIDTH:

90.210(b) 25kHz Channel Spacing:

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least $43 + 10\log(P)$ dB.

90.210(c) 12.5kHz Channel Spacing Not Equipped with a Low Pass Filter:

For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz but not more than 10 kHz: At least $83 \log(f_d/5)$ dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least $29 \log(f_d^2/11)$ dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least $43+10 \log(P_o)$ dB.

90.210(d) Emission Mask D - 12.5 kHz channel BW equipment:

For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27 (f_d - 2.88 \text{ kHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10\log(P)$ dB or 70 dB, whichever is the lesser attenuation.

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90.210(e) Emission Mask E - 6.25 kHz channel BW equipment:

For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

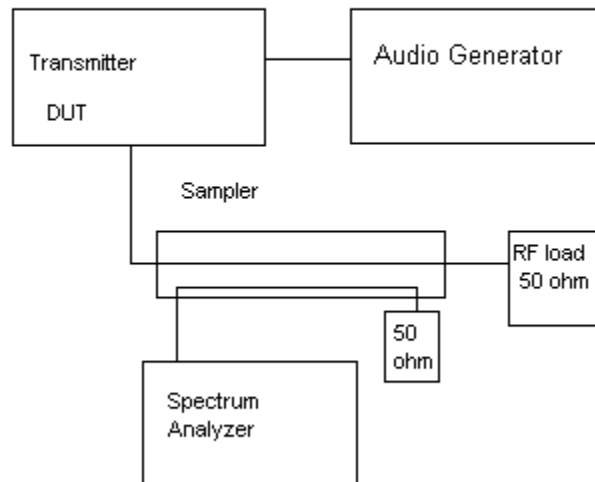
- (1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3.0 \text{ kHz})$ or $55 + 10 \text{ Log}(P)$ or 65, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least $55 + 10 \text{ log}(P)$ dB or 65 dB, whichever is the lesser attenuation.

Radiotelephone transmitter with modulation limiter:

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT

Occupied BW Test Equipment Setup



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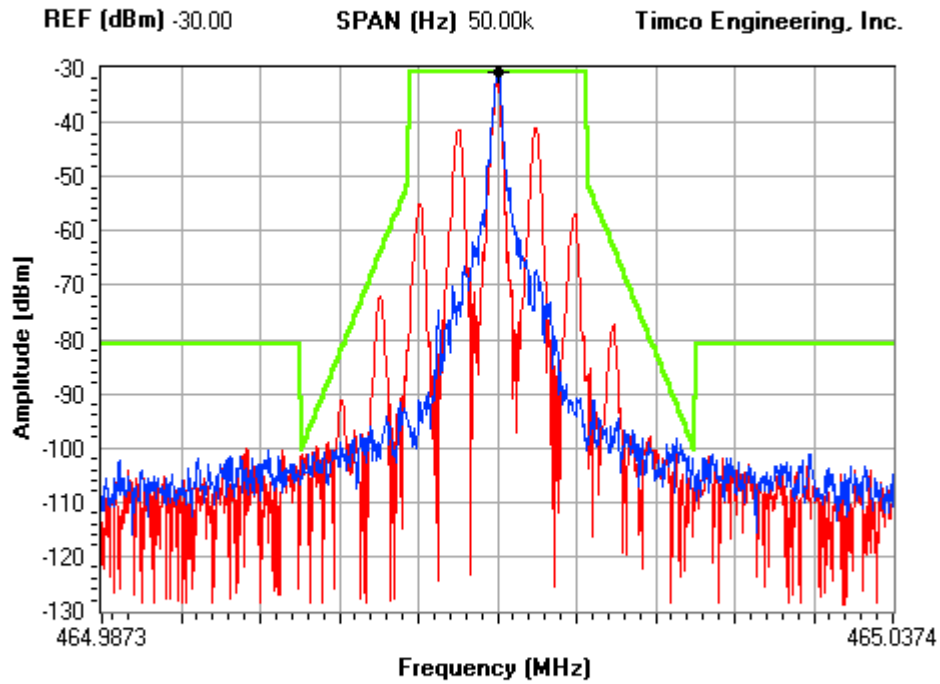
90.210(d) Emission Mask D - 12.5 kHz channel

OCCUPIED BANDWIDTH PLOT

NOTES:

ADVANCED WIRELESS COMMUNICATIONS - FCC ID: Q9SAWR1688P
 OCCUPIED BANDWIDTH PLOT

FCC 90.210 Mask D



RBW **VBW** **ST (sec)**
 300 Hz 100 kHz 1

Center Frequency (Hz) 465.012M

Marker Delta (Hz) 0.00

Peak	465.012	-30.80	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MKR2	0.000	0.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKR3	0.000	0.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HWMK	23.076	6.27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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2.1051(a) Spurious emissions at antenna terminals (conducted):

Data below shows the level of conducted spurious responses. The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603.

FCC Limit for: 12.5 kHz Spacing = 50.00

TEST DATA:

TF	EF	dB below carrier	TF	EF	dB below carrier
460	460	0.0	465	465	0.0
	920	69.0		930	70.0
	1380	73.0		1395	70.8
	1840	70.1		1860	66.3
	2300	67.7		2325	69.1
	2760	59.7		2790	64.7
	3220	71.3		3255	78.1
	3680	76.7		3720	73.8
	4140	65.5		4185	73.0
	4600	91.9		4650	85.5

TF	EF	dB below carrier
470	470	0.0
	940	69.0
	1410	73.1
	1880	67.5
	2350	55.8
	2820	52.8
	3290	67.2
	3760	61.2
	4230	55.1
	4700	71.2

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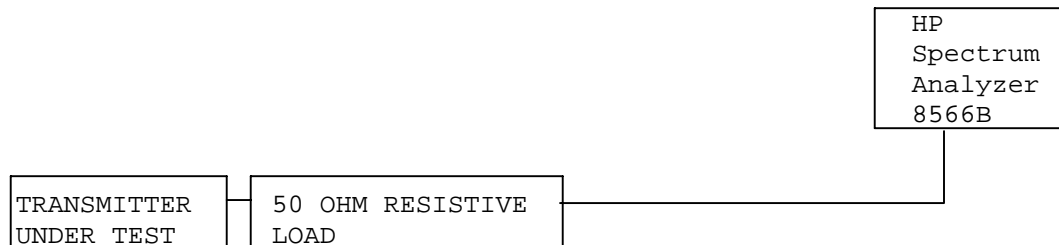
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Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD without any exceptions. The measurements were made at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

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2.1053 Field strength of spurious emissions:

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: The FCC Limits for radiated emissions are the same as previously stated for the conducted emissions.

TEST DATA (460 MHz):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
460.00	V	30.40	0	-0.49	0
920.00	V	-37.10	0	-0.79	67.8
1380.00	V	-35.20	1.08	4.47	61.72
1840.00	V	-25.10	1.17	5.22	50.96
2300.00	V	-35.30	1.26	6.19	60.28
2760.00	V	-32.10	1.33	6.96	56.38
3220.00	H	-41.90	1.37	7.33	65.85
3680.00	H	-39.90	1.42	7.59	63.64
4140.00	H	-32.30	1.46	7.82	55.85
4600.00	H	-41.60	1.52	8.13	64.9

TEST DATA (465 MHz):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
465.00	V	30.65	0	-0.51	0
930.00	V	-39.30	0	-0.91	70.35
1395.00	V	-37.80	1.08	4.53	64.49
1860.00	V	-26.10	1.17	5.24	52.17
2325.00	V	-29.10	1.27	6.26	54.25
2790.00	V	-32.70	1.33	6.98	57.19
3255.00	H	-35.90	1.38	7.35	60.07
3720.00	H	-33.00	1.42	7.59	56.97
4185.00	V	-31.20	1.47	7.87	54.94
4650.00	H	-35.80	1.53	8.07	59.4

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2.1053 Field strength of spurious emissions:

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: The FCC Limits for radiated emissions are the same as previously stated for the conducted emissions.

TEST DATA (470 MHz):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
470.00	V	30.70	0	-0.53	0
940.00	V	-38.00	0	-1.03	69.2
1410.00	V	-43.70	1.08	4.59	70.36
1880.00	V	-30.40	1.18	5.25	56.5
2350.00	V	-34.50	1.27	6.33	59.61
2820.00	V	-35.30	1.33	7.01	59.79
3290.00	V	-43.70	1.38	7.38	67.87
3760.00	V	-34.60	1.43	7.6	58.6
4230.00	H	-32.80	1.47	7.93	56.51
4700.00	H	-37.40	1.54	8.01	61.1

APPLICANT: ADVANCED WIRELESS COMMUNICATIONS

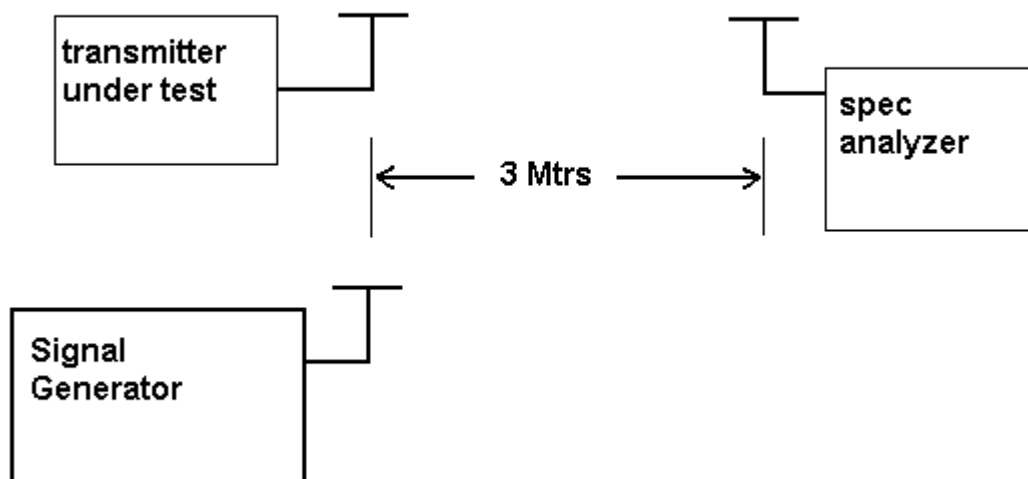
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Method of Measuring Radiated Spurious Emissions



METHOD OF MEASUREMENTS: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method. Measurements were made at the open field test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

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2.1055 **Frequency stability:**
90.213(a)(1)
90.266(b)(3)

Frequency Stability Requirement: 5 ppm

Temperature range requirements: -30 to +50° C.

Voltage Variation +,- 15%.

Measurement procedure per TIA/EIA 603.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 464.987 517 MHz

<u>TEMPERATURE °C</u>	<u>FREQUENCY MHz</u>	<u>PPM</u>
REFERENCE	464.987 517	00.0
-30	464.987 748	+ 0.50
-20	464.987 614	+ 0.21
-10	464.987 496	- 0.05
0	464.987 455	- 0.13
+10	464.987 491	- 0.06
+20	464.987 517	0.00
+30	464.987 477	- 0.09
+40	464.987 377	- 0.30
+50	464.987 203	- 0.67
<u>%BATT.</u>	<u>DATA</u>	<u>PPM</u>
-15%	464.987 529	+ 0.03

RESULTS OF MEASUREMENTS: The test results indicates that the EUT meets the requirements.

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2.1055(a)(1) **Frequency stability:**
90.214 Transient Frequency Behavior

REQUIREMENTS: Transmitters designed to operate in the 150 - 174 MHz and 421 - 512 MHz frequency bands must maintain transient frequencies within the maximum transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz

Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels

t_1^4	± 25.0 kHz	5.0 mS	10.0 mS
t_2	± 12.5 kHz	20.0 mS	25.0 mS
t_3^4	± 25.0 kHz	5.0 mS	10.0 mS

Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

t_1^4	± 12.5 kHz	5.0 mS	10.0 mS
t_2	± 6.25 kHz <td>20.0 mS</td> <td>25.0 mS</td>	20.0 mS	25.0 mS
t_3^4	± 12.5 kHz <td>5.0 mS</td> <td>10.0 mS</td>	5.0 mS	10.0 mS

Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels

t_1^4	± 6.25 kHz	5.0 mS	10.0 mS
t_2	± 3.125 kHz <td>20.0 mS</td> <td>25.0 mS</td>	20.0 mS	25.0 mS
t_3^4	± 6.25 kHz <td>5.0 mS</td> <td>10.0 mS</td>	5.0 mS	10.0 mS

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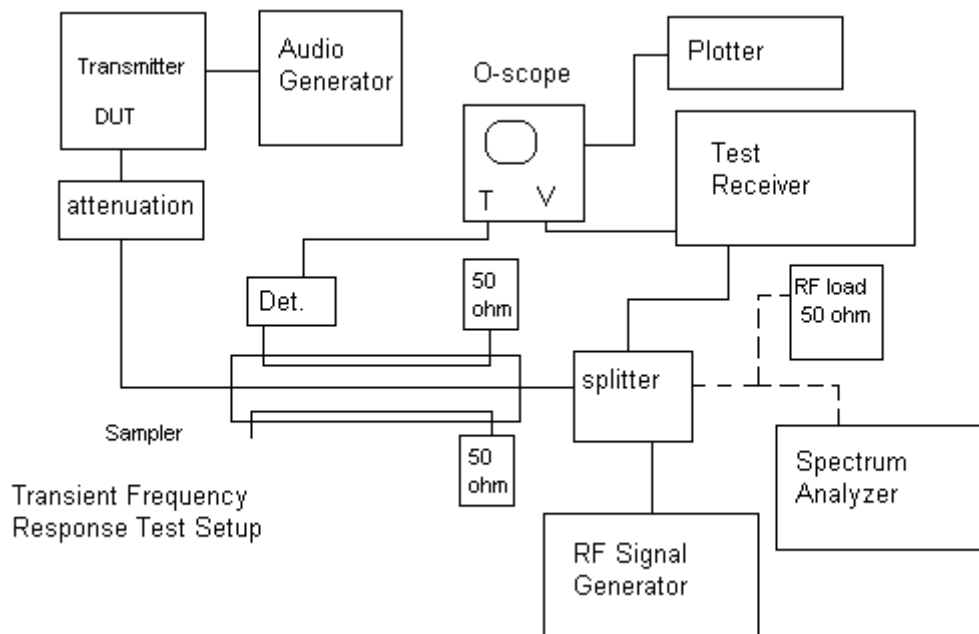
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TEST PROCEEDURE: TIA/EIA TS603 PARA 2.2.19, the levels were set as follows;

1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator through-out the test.
3. Reduce the attenuation between the transmitter and the RF detector by 30 dB.
4. With the levels set as above the transient frequency behavior was observed & recorded.



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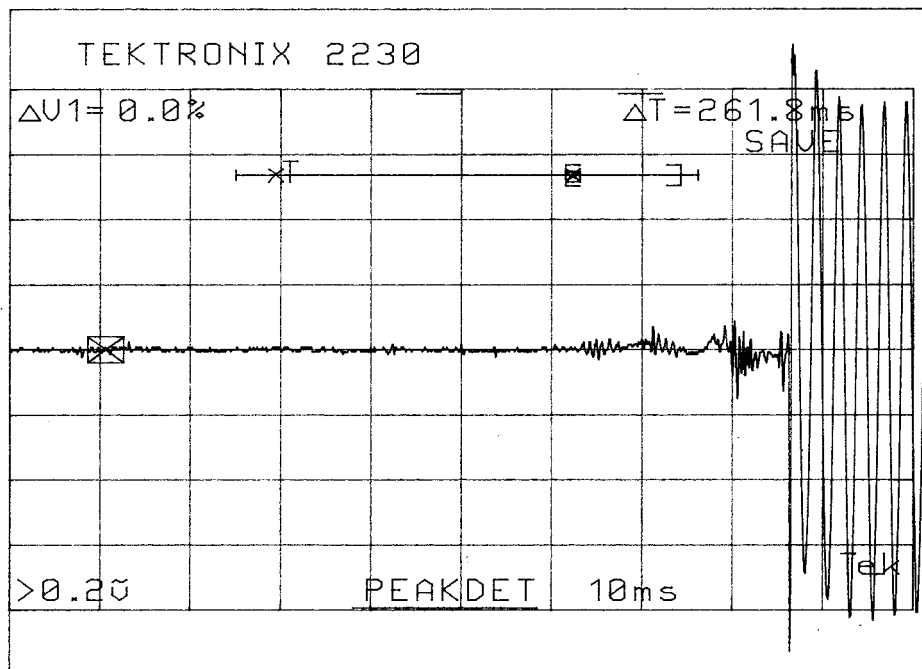
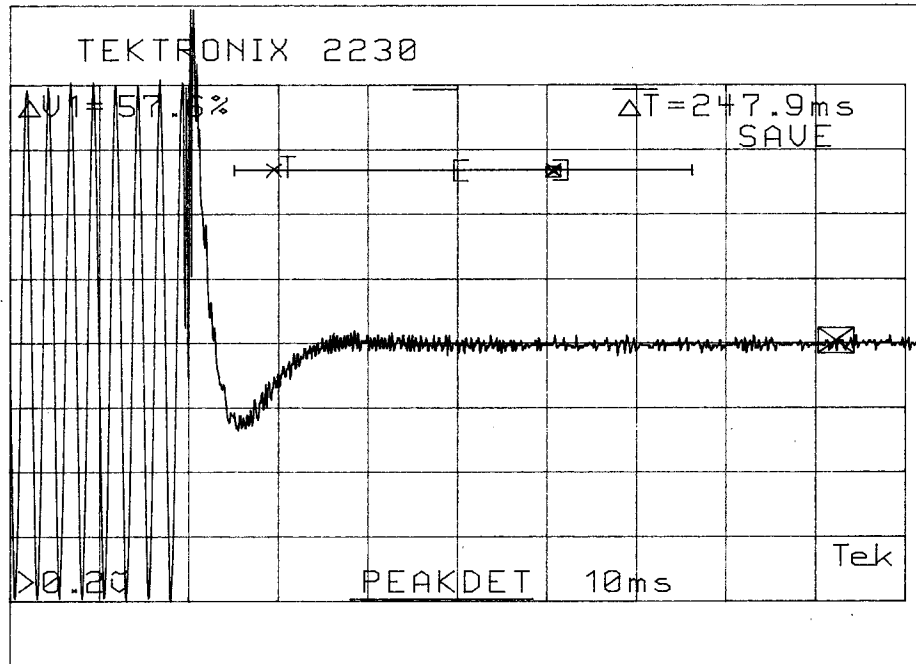
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TRANSIENT FREQUENCY RESPONSE 12.5 kHz



APPLICANT: ADVANCED WIRELESS COMMUNICATIONS

FCC ID: Q9S07161688P

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TIMCO ENGINEERING INC.

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EMC Equipment List

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 9/23/03	9/23/05
Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 9/23/03	9/23/05
Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 9/23/03	9/23/05
Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 9/23/03	9/23/05
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 8/17/04	8/17/06
Log-Periodic Antenna	Electro-Metrics	LPA-25	1122	CAL 8/14/04	8/26/04
Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 2/17/03	2/17/05
LISN	Electro-Metrics	ANS-25/2	2604	CAL 8/27/04	8/27/06
Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 7/16/04	7/16/04
Oscilloscope	Tektronix	2230	300572	CAL 7/3/03	7/3/05
Peak Power Meter	HP	8900C	2131A00545	CAL 7/2/03	7/2/05
Power Sensor	Agilent Technologies	84811A	2551A02705	CAL 7/2/03	7/2/05
Power Meter	HP	432A	1141A07655	CAL 4/15/03	4/15/05
Digital Thermometer	Fluke	2166A	42032	out for cal	
Frequency Counter	HP	5352B	2632A00165	CAL 8/3/04	8/3/06
Signal Generator	HP	8640B	2308A21464	CAL 8/26/04	8/26/04

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