

TIMCO ENGINEERING INC.

849 NW State Road 45
Newberry, Florida 32669
<http://www.timcoengr.com>
888.472.2424 F 352.472.2030 email: tei@timcoengr.com



Test Report

Product Name: CONGITIVE RADIO

FCC ID: TR4-A4XG1-2170

Applicant:

**ADAPT4 LLC.
605 N. JOHN RODES BLVD.
MELBOURNE FL 32934
USA**

APPLICANT: ADAPT4 LLC.

FCC ID: TR4-A4XG1-2170

REPORT #: U:\A\Adapt4\2441ZUT5\2441ZUT5TestReport.doc

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EXHIBITS CONTAINING:

REQUEST FOR CONFIDENTIALITY
BLOCK DIAGRAM
SCHEMATIC
PARTS LIST
USERS MANUAL
LABEL SAMPLE
LABEL LOCATION
EXTERNAL PHOTOGRAPHS
INTERNAL PHOTOGRAPHS
TUNING PROCEDURE
OPERATIONAL DESCRIPTION
TEST SET UP PHOTOGRAPH

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GENERAL INFORMATION REQUIRED **FOR CERTIFICATION OF A LICENSED TRANSMITTER**

2.1033(c)(1)(2) ADAPT4 LLC. will manufacture
the FCCID: TR4-A4XG1-2170 CONGITIVE RADIO in
quantity, for use under FCC RULES PART 90.

ADAPT4 LLC.
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2.1033(c) **TECHNICAL DESCRIPTION**

2.1033(c)(3) Instruction book. A draft copy of the instruction
manual is included.

2.1033(c)(4) Type of Emission: 6K0F1D
90.209
90.207 $B_n = 2M + 2DK$
 $M = 4800$
 $D = 600$
 $B_n = 2(4800/2) + 2(600) = 6.0k$

2.1033(c)(5) Frequency Range: 217-220 MHz
90.209 (b)(5)

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

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

FINAL AMPLIFIER ONLY

INPUT POWER: $(12.0 \text{ V})(0.5A) = 6.00 \text{ Watts}$

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

2.1033(c)(10) Complete Circuit Diagrams: The circuit diagram is
included. The block diagram is 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)(13) Photographs of the equipment of sufficient clarity to reveal equipment construction and layout and label location are included.

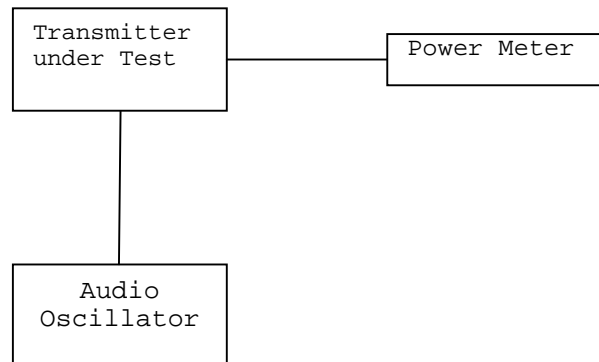
2.1033(c)(14) For equipment employing digital modulation, a detailed description of the modulation technique. This UUT uses FSK to modulate the transmitter.

2.1033(c)(15) The data required for 2.1046 through 2.1057 is submitted below.

2.1046(a) **RF POWER OUTPUT**

RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

OUTPUT POWER: 0.812 Watts Conducted



2.1047(a) **Voice modulation characteristics:**
This UUT does not have an audio frequency responses plot.

2.1049 **Audio Low Pass Filter**
This UUT does not have a low pass filter.

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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:

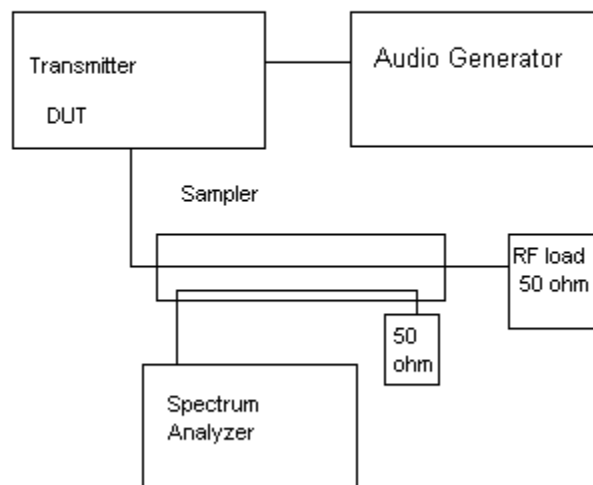
- (1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3.0 \text{ kHz})$ 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.

Test procedure: TIA/EIA-603 para 2.2.11.

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT

Occupied BW Test Equipment Setup



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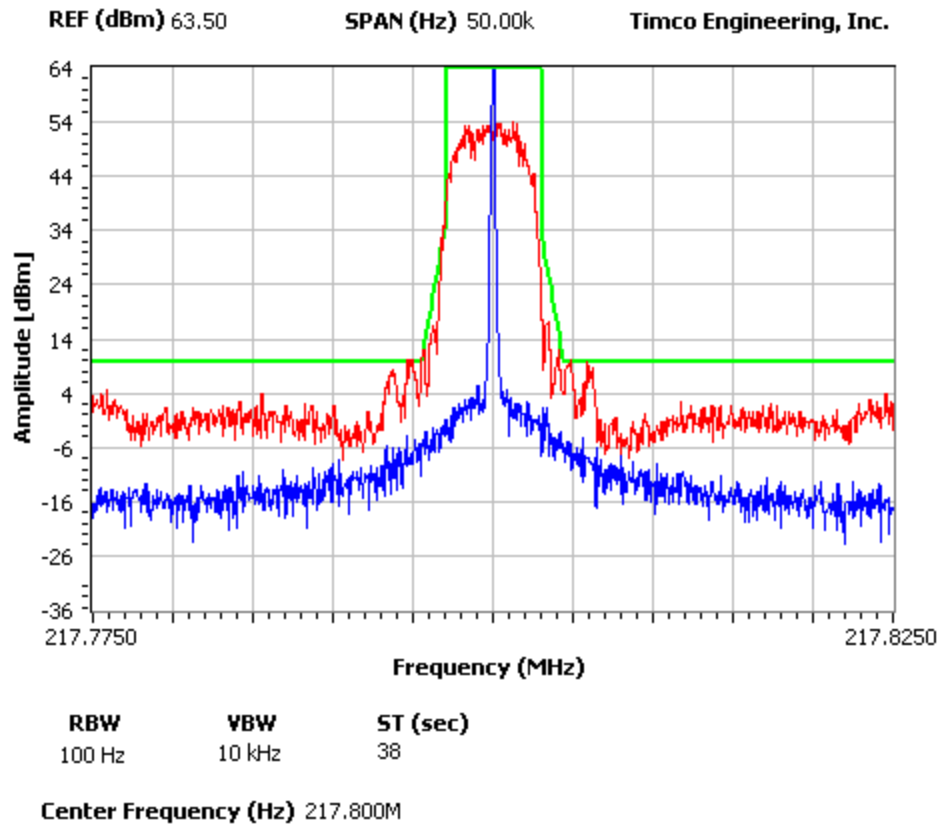
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OCCUPIED BANDWIDTH PLOT

NOTES: Adapt4

FCC 90.210 Mask E



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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: $55+10\log(.812) = 54.1$

TEST DATA:

TF	EF	dB below carrier
217.8	217.8	0
	435.6	63.2
	653.4	73.2
	871.2	74.4
	1089	66.5
	1306.8	NF
	1524.6	NF
	1742.4	NF
	1960.2	NF
	2178	NF

NF = NO EMISSIONS FOUND

TF	EF	dB below carrier
219.4	219.4	0
	438.8	64.2
	658.2	NF
	877.6	72.2
	1097	72.3
	1316.4	NF
	1535.8	68.8
	1755.2	NF
	1974.6	NF
	2194	NF

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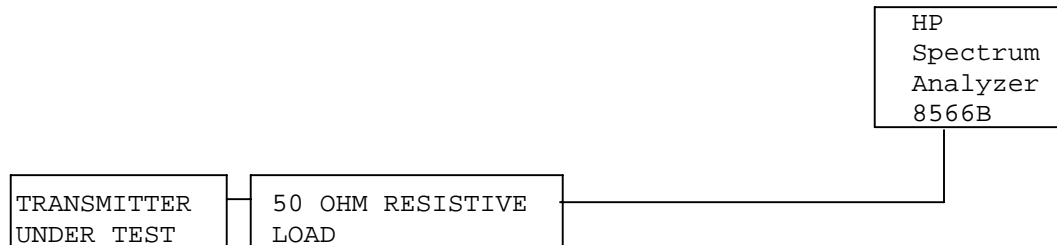
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Method of Measuring Conducted Spurious Emissions



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:

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
205.50	H	84.41
229.90	H	84.65
399.84	H	85.15
653.40	H	72.62
826.88	H	76.63
871.20	H	58.48
1089.00	V	55.87
1524.60	H	58.78
1960.20	H	69.01

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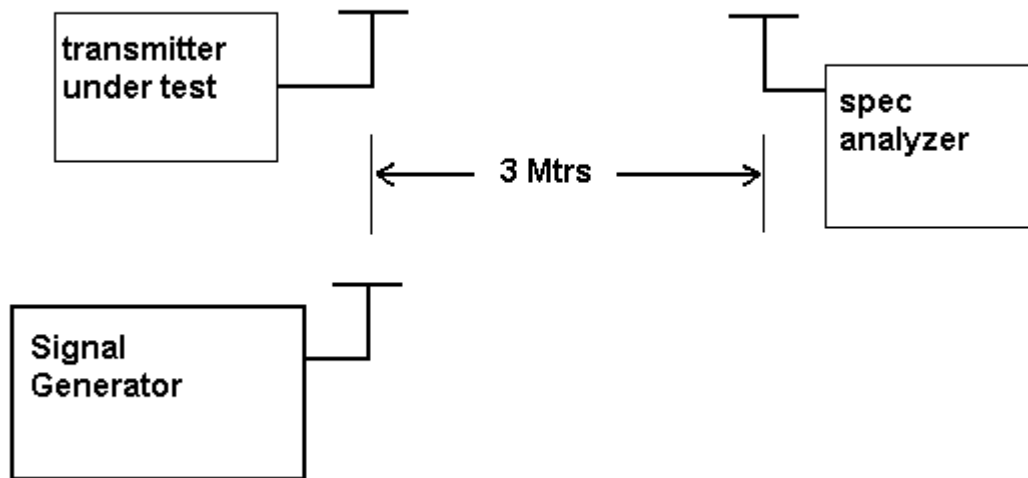
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Method of Measuring Radiated Spurious Emissions



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:

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

Voltage Variation - 15%.

Measurement procedure per TIA/EIA 603.

MEASUREMENT DATA:

Ref. Freq. 217.799751

	Data	PPM
-30C	217.799766	0.07
-20C	217.799766	0.07
-10C	217.799765	0.06
0C	217.799761	0.05
10C	217.799757	0.03
20C	217.799751	0.00
30C	217.799748	-0.01
40C	217.799741	-0.05
50C	217.799736	-0.07

Batt. Volts	Batt. Data	Batt. PPM
-15%	217.79975	0.00
+15%	217.79975	0.00

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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 12/7/05	12/7/07
Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 12/7/05	12/7/07
Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 12/8/05	12/8/07
Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 12/8/05	12/8/07
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/29/05	4/29/07
Log-Periodic Antenna	Electro-Metrics	LPA-25	1122	CAL 8/26/04	8/26/06
Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 12/29/04	12/29/06
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	7/16/06
Oscilloscope System One	Tektronix Audio Precision	2230 System One	300572 SYS1-45868	CAL 7/3/03 CHAR 4/25/02	7/3/05 4/25/04
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 1/22/02	1/22/04
Digital Multimeter	Fluke	77	35053830	CAL 8/1/05	8/1/07
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 Digital	HP Fluke	432A 2166A	1141A07655 42032	CAL 4/11/05 CAL 7/19/04	4/11/07 7/19/06
Thermometer					
Frequency Counter	HP	5352B	2632A00165	CAL 8/3/04	8/3/06
Service Monitor	IFR	FM/AM 500A	5182	CAL 11/5/04	11/5/06
Signal Generator	HP	8640B	2308A21464	CAL 8/26/04	8/26/06
Modulation Analyzer	HP	8901A	3435A06868	CAL 11/4/04	11/4/06

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MPE Calculation

For a 1 Watt transmitter operated at a 50% duty cycle. Using a 3 dBi gain antenna gives us the following:

W := 1 power in Watts D := 1 Duty Factor in decimal % (1=100%)

E := 15.0 exposure time in minutes U := 30 (use 6 for controlled and 30 for uncontrolled)

$$W_{exp} := W \cdot D \cdot \left(\frac{E}{U} \right)$$

$$PC := \frac{E}{U}$$

PC = 0.5 percent on time

W_{exp} = 0.5 Watts

Po := 1000 mWatts dBd := .85 antenna gain f := 215 Frequency in MHz

G := dBd + 2.15 gain in dBi G = 3

Gn := $10^{\frac{G}{10}}$ gain numeric S := $\frac{f}{1500}$ controlled exposure

300 for controlled

1500 for uncontrolled

Gn = 1.995 S = 0.307

$$R := \sqrt{\frac{(Po \cdot Gn)}{(4 \cdot \pi \cdot S)}}$$

$$R_{inches} := \frac{R}{2.54}$$

R = 22.754 distance in centimeters
required for compliance

Rinches = 8.958

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