Tactical Technologies Inc.

1701 Second Ave
PO Box 91
Folsom, PA 19033
FAX 610-522-9430
TEL 610-522-0106

Part 2 & 90 Testing
Synthesized FM Voice Transmitter
Model CST802VI
FCC ID: IP9802VI

Tactical Technologies Inc.
1701 Second Ave
Folsom, PA 19033
610-522-0106

A. INTRODUCTION

The following data are submitted in connection with this Application for Type Certification in accordance with Part 2, Subpart J, and Part 90, Subparts B,D, and I of the FCC Rules and Regulations.

B. INFORMATION REQUIRED BY PART 2

2.1003(a) See Form 731

2.1033(b) N/A

2.1003(c)

(1) The full name and address of the applicant and manufacture for certification is:
Tactical Technologies Inc.
1701 Second Ave.
P.O. Box 91
Folsom, Pa. 19033

(2) The FCC Identifier of this device is IP9802VI

(3) Operating Instructions are included in the Exhibits.

(4) Emission: NBFM Voice – 11K2F3E
Emission Calculations are included in the Exhibits.

(5) Frequency Range 150 – 174 Mhz

(6) Output Power of the device is 200mw. @ 4.2 Volts

(7) Maximum Power Rating is 200mw.

(8) All of the Pre-amp sections and RF Final transistor run off of regulated +2.85 Volts.

(9) Tune up procedure is included in the Exhibits.

(10) Test Data required by Part 2.1046 through 2.1057, inclusive, is measured in accordance with the procedure in Part 2.1041.

C. SUBMISSION OF EQUIPMENT FOR TESTING - Paragraph 2.943

Upon request, the test sample will promptly be made available by Tactical Technologies Inc.

D. DESCRIPTION OF MEASUREMENT FACILITIES - Paragraph 2.947

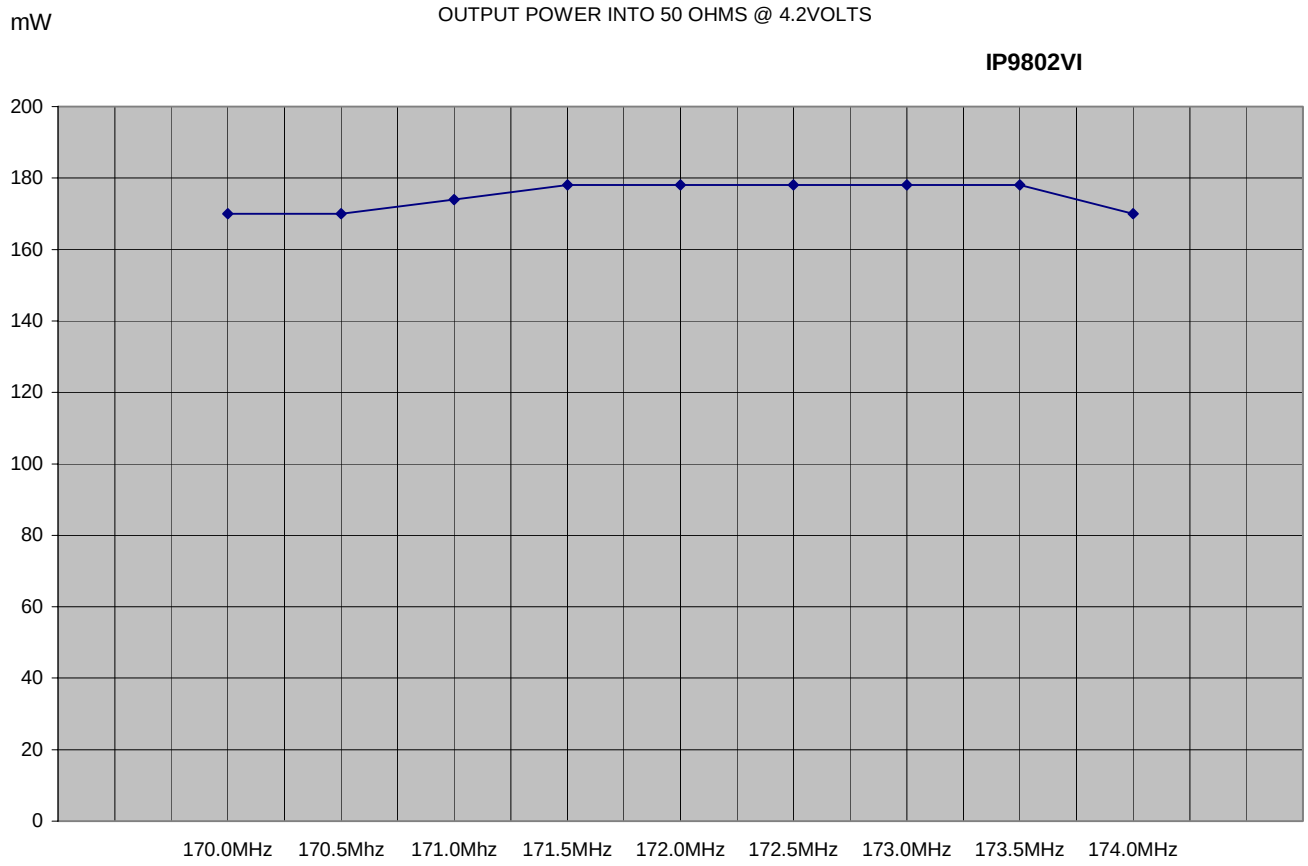
The open-field tests were performed on the 3 meter range maintained by Radiation Science Inc. Complete description and measurement data have been placed on file with the Commission.

E. TEST DATA

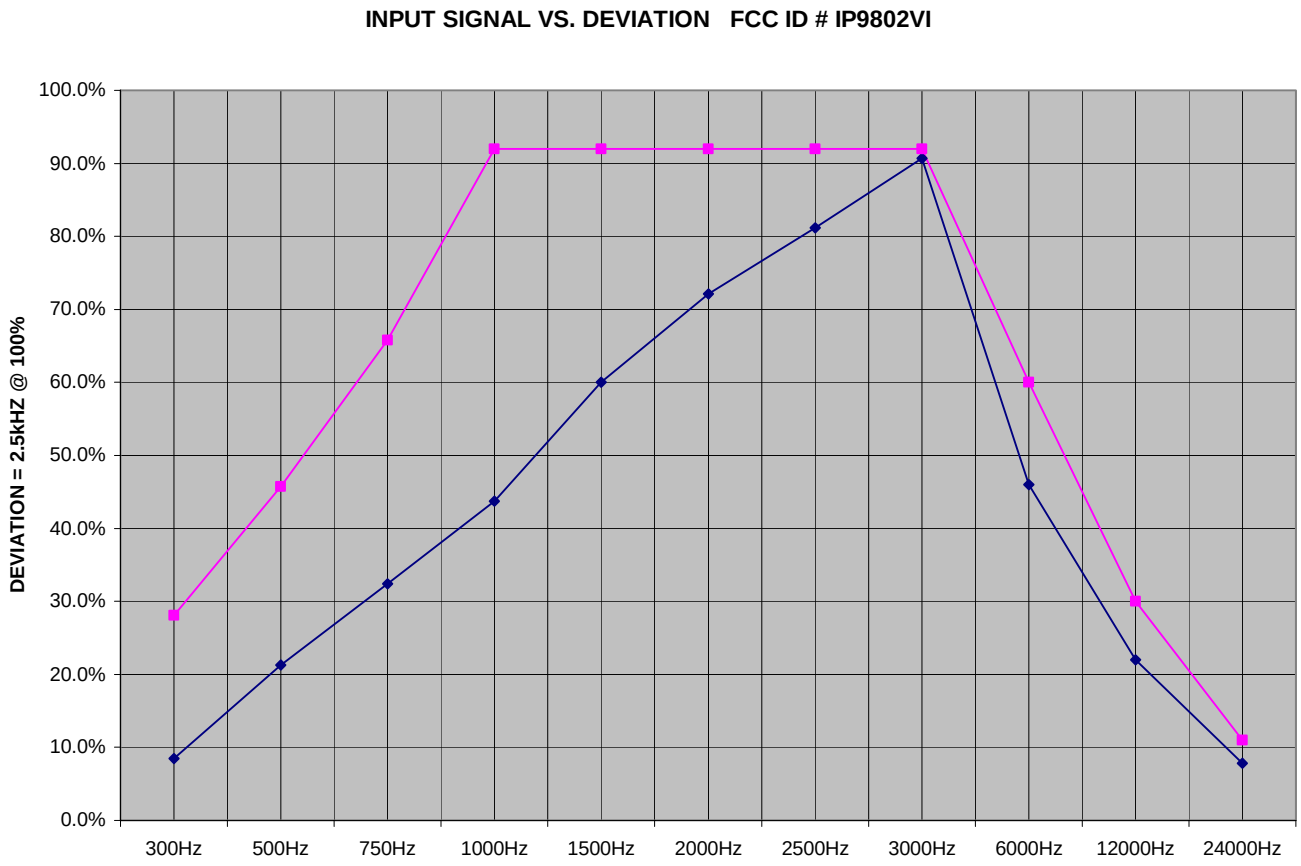
This section contains results of measurements required by Parts 2 and 90 of the rules. Data is presented in tabular and/or graphical form, and measurement procedures are described within the text of each reported test.

1. RF POWER OUTPUT - Paragraphs [2.1046(a),2.1033(c)(8),90.205(d)]

Power output measurements were made at the RF connector. This test was done with an unmodulated carrier in accordance with part 90.205(d)
The power output was measured with a Spectrum Analyzer with a series 30 dBm pad.
The electrical characteristics of the RF load was 50 ohms 0j.
The RF power output was measured from 170 Mhz – 174 Mhz
The RF output power did not vary with changes in the supply voltage, due to the system regulation.



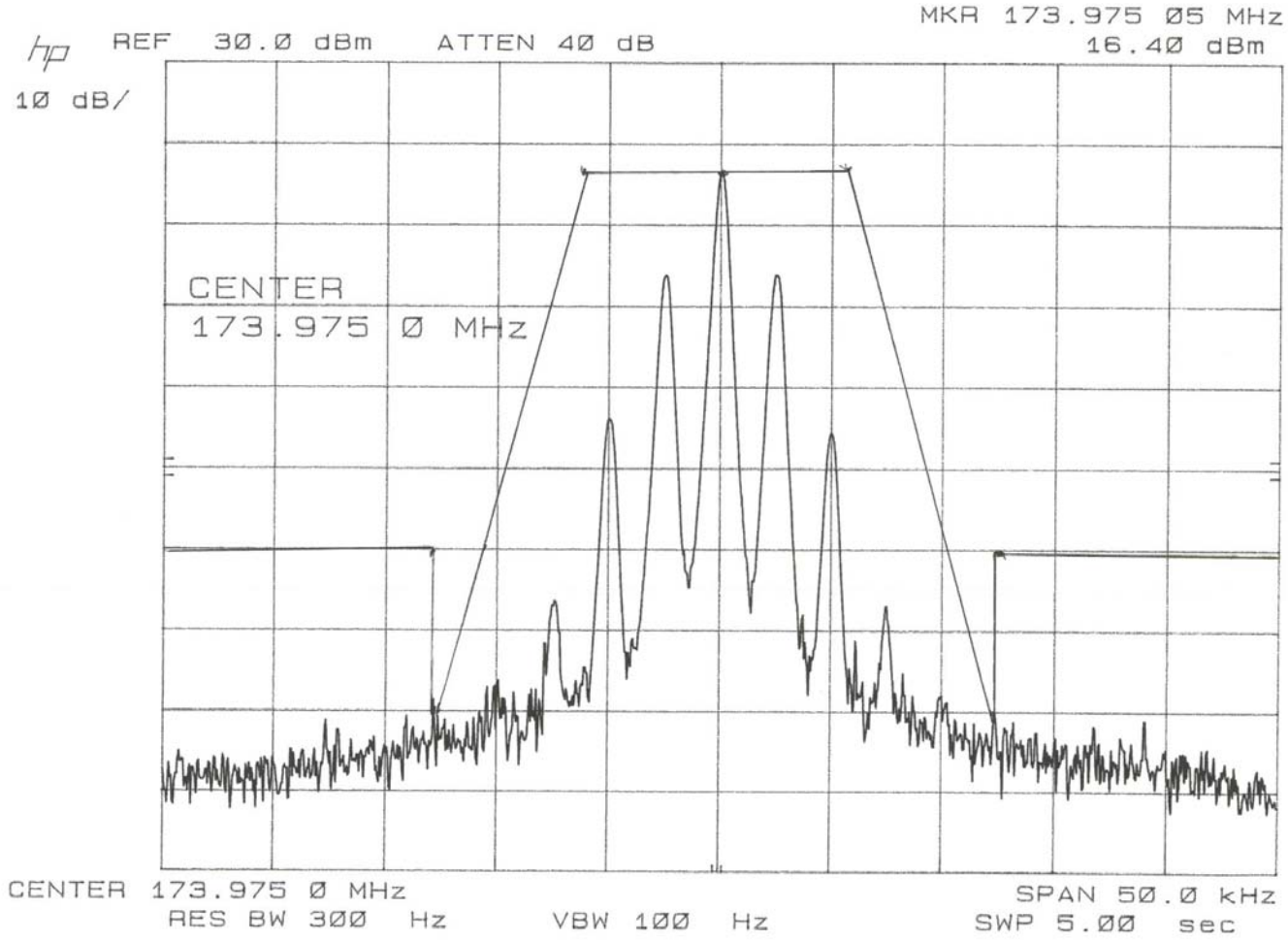
2. MODULATION CHARACTERISTICS - Paragraph [2.1047(a), TIA/EIA -603 3.2.6]
Measurement data showing the frequency response of the transmitter is shown in the graph below. The blue line is the 6 dBm / Octive, and the pink line is the modulation limiting. A signal generator was connected to the transmitters mic input, and the audio output was measured from a communication receivers demod output. The pink lines input was 20 dBm greater then the blue lines input.

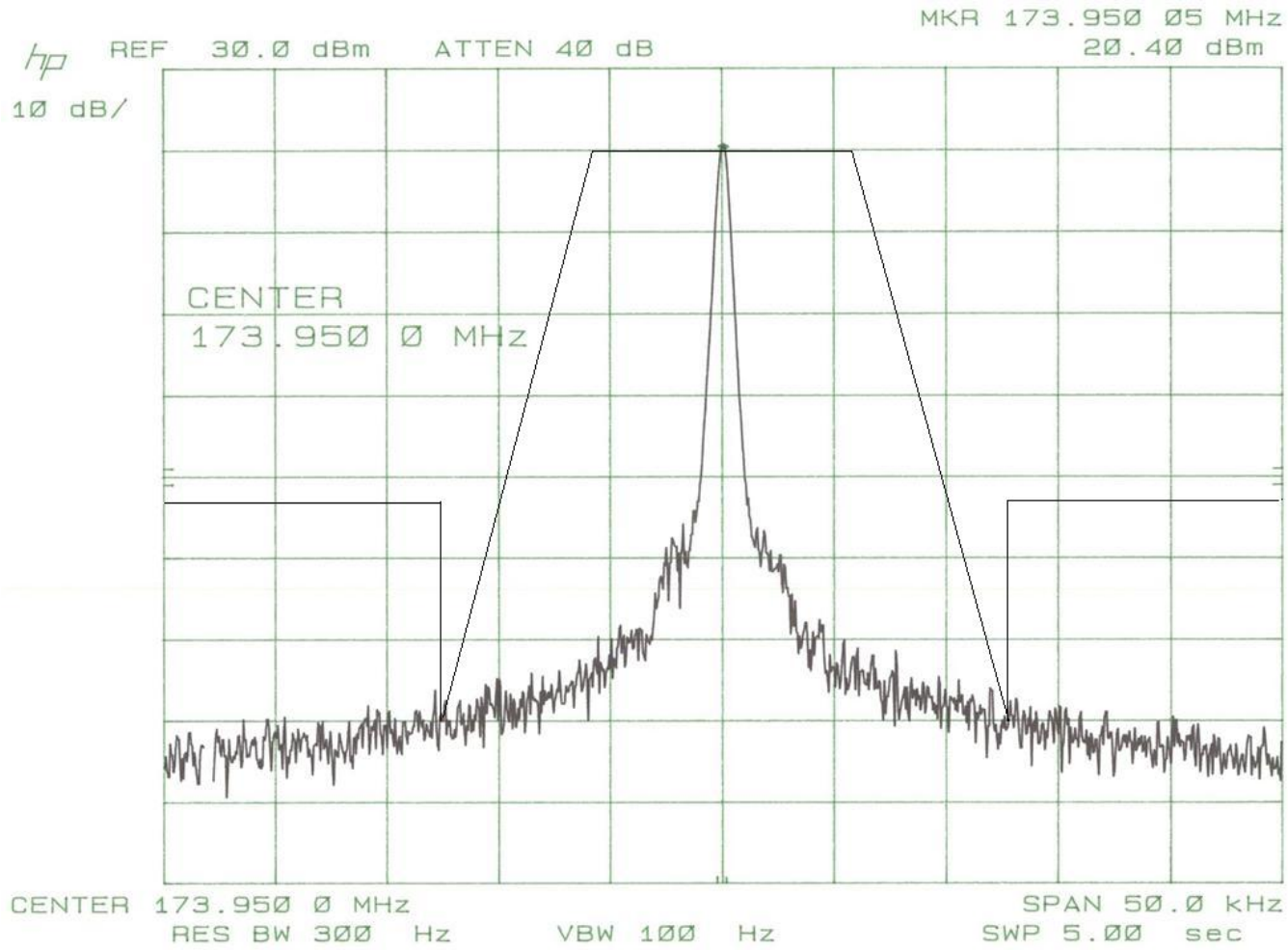


3. OCCUPIED BANDWIDTH - Paragraphs [2.1049, 90.210]
Figures 3 and 4 contain pictures taken from a Spectrum Analyzer. The transmitter was modulated with a sine wave tone at 2500 Hz at a level 16 dB above the required to produce 50% modulation at the frequency maximum response. Paragraph 90.210(d) requires that the mean power of emissions shall be attenuated below the mean output power of the transmitter by the following amounts:

-- On any frequency removed from the center of the authorized bandwidth f0 to 5.625 khz removed from f0; Zero db.
-- On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in khz) of more than 5.625 khz but no more than 12.5 khz. At least (fd – 2.88khz)db.
-- On any frequency removed from the center of the authorized Bandwidth by a displacement frequency (fd in khz) of no more than 12.5 khz. At least 50 + log(P) or 70db, whichever is the lesser attenuation.

Part 90.210 Emission Mask D

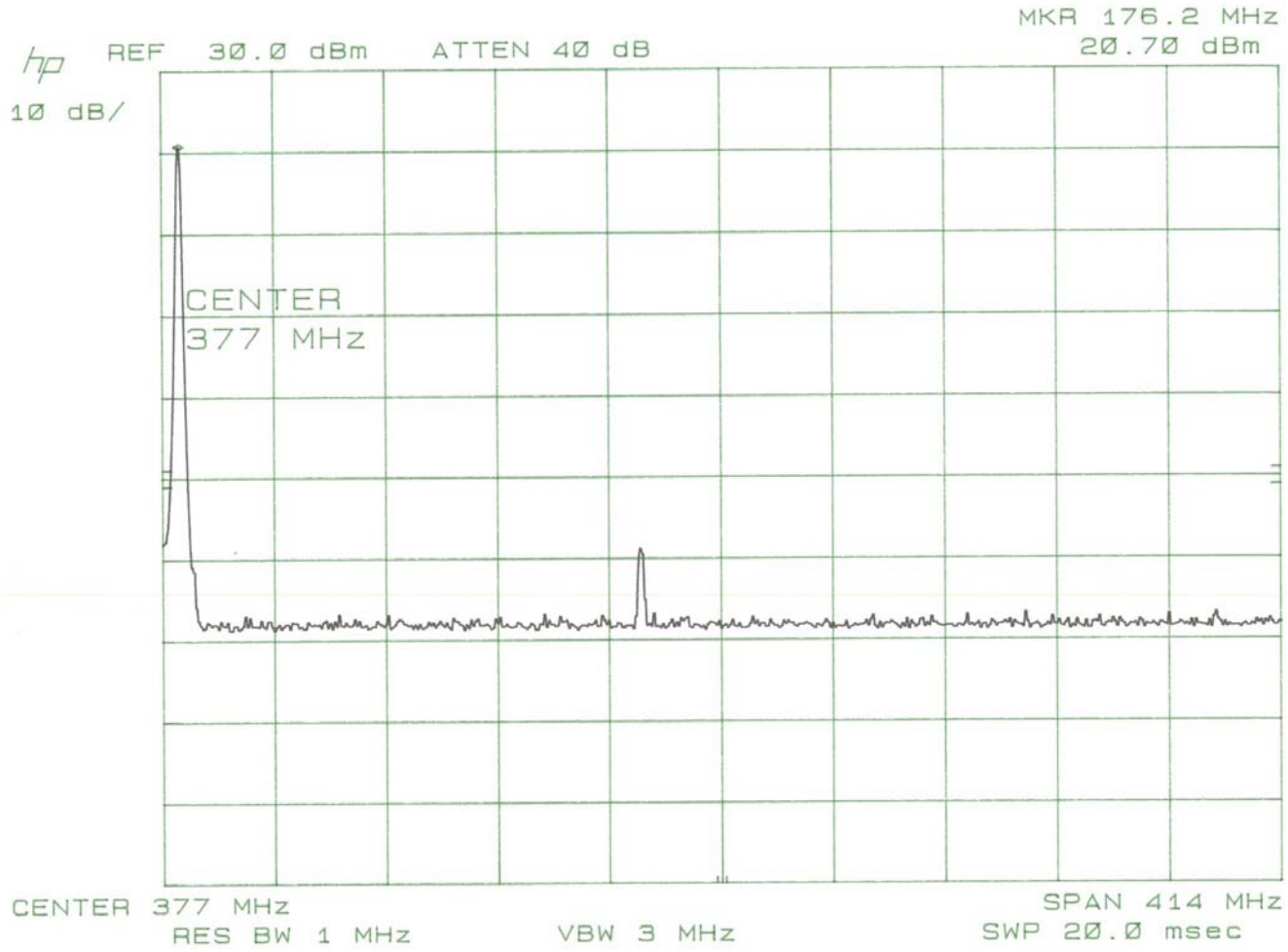




Part 90.210 Emission Mask D

4. SPURIOUS EMISSIONS AT THE 50 OHM TEST POINT ON THE TRANSMITTER [2.1053, 90.210 Emission Mask D]

The transmitter was modulated per paragraph 2.1053. The spectrum was checked with the spectrum analyzer from 10 MHz to the 10th harmonic of the carrier frequency. Observed emissions not reported are attenuated more than 20 dB below the permissible value of 40 dB, i,e., 50 +10log (.20W) = 43 dB given by Section 90.210. The data in Table 1 verifies that the test sample complies with Paragraph



5. FIELD STRENGTH OF SPURIOUS RADIATION - Paragraphs [2.1053, 90.210]

Measurements were made on the three meter range maintained by Radiation Science Inc. to quantify spurious emission level that] are radiated directly from the cabinet, control circuits, power leads and intermediate circuit elements under normal conditions of installation and operation. Particular attenuation was paid to harmonics of the carrier frequency as well as those frequencies removed from the carrier by multiples of the oscillator frequency.

Data is submitted in Table 2 showing the magnitude of harmonics and other spurious emissions from 30 MHz through the 10th harmonic. The test sample was placed on a non-conductive table one meter above the ground plane in order to determine the maximum level at each emission. Both horizontal and vertical site antenna polarization were employed. The antenna was raised 1 to 4 meters in height and the equipment under test was rotated 360 degrees to minimize the emission. The reference level for spurious radiation was taken as an ideal dipole excited by the measured output power according to the following relationship:

E = (49.2 P)1/2 / R Where: E = electric-field intensity in Volts/meter
P = transmitted power in Watts
R = distance in meters

For this case: E = 1.81 V/M = 124.8 dBuv/m

The permissible value of spurious emissions is equal to less than 124.8 dBuv/m – (50 + 10log(.2)) = 81.8 dBuv/m.

The test sample (IP9802VI) was also tested with a 50 ohm dummy load connect to the RF output of the devise, which sample was placed on a non-conductive table one meter above the ground plane in order to determine the maximum level at each emission. Both horizontal and vertical site antenna polarization were employed. The antenna was raised 1 to 4 meters in height and the equipment under test was rotated 360 degrees to minimize the emission. The test sample complies with the TIA603 section 2.2.12, where all radiated spurious emissions were > 20 dBm below the FCC limit of 81.8 dBuv.

The antenna gain of the device is equal to or less then an ideal dipole.

Electromagnetic Emission Test

EUT	**Manufacturer:** Tactical Tech **Model#** CST802 **Serial #** 0001 **Mode:** TRANSMITTER ON	**Date:** 3/30/05 **Test Instruments:** RSI # 75, 80, 391, 501, 502, 503, 708 **Frequency Range:** 30MHz – 1000MHz	Test Code **RE** Technician Engineer

Temperature: 55°F **Humidity:** 34%	**Additional Info:**	**Test Spec:** FCC Part 15 Sub.C

Radiated Distance: 3 meter Antenna: Bicon / Log.P.	[X] HORIZ. [ ] BB [X] NB [X] VERT. [ ] H [X] E	**Conducted** Line: Function: [ ] BB [ ] NB

FREQ.	IND. Level		Correction Factors			Final Level	Antenna Height	EUT Azimuth	Remarks
			ANT.	Cable loss					
MHz	**dBµV**		**dB**	**dB**		**dBµV/m**	**Meters**	**Degree**	
160.95	53.9		12.7	2.1		**68.7**	1.35	0	Vertical
321.9	9.8		14.0	3.1		**27.8**	1.44	0	
482.85	-1.5		18.3	4.4		**21.2**	1.00	0	
643.8	19.8		20.7	4.6		**45.7**	1.00	0	
804.75	9.3		22.8	5.2		**37.3**	1.00	0	
965.7	2.0		24.5	5.7		**31.7**	1.00	0	
1126.65	23.0		24.2	6.0		**55.2**	1.00	0	
1287.6	24.0		25.0	6.5		**55.5**	1.00	0	
1448.5	23.8		25.2	7.5		**56.5**	1.00	0	
1609.5	25.8		25.9	7.7		**59.4**	1.00	0	
160.95	59.0		12.1	2.1		**73.2**	2.12	0	Horizontal
321.9	9.6		14.7	3.1		**27.4**	1.00	0	
482.85	-1.1		18.6	4.4		**21.9**	1.00	0	
643.8	13.4		20.4	4.6		**38.4**	3.35	0	
804.75	21.9		23.1	5.2		**50.2**	1.00	0	
965.7	1.7		24.7	5.7		**32.1**	1.00	0	
1126.65	23.9		24.2	6.0		**54.1**	1.00	0	
1287.6	24.7		25.0	6.5		**56.2**	1.00	0	
1448.5	24.2		25.3	7.5		**57.0**	1.00	0	
1609.5	25.7		25.9	7.7		**59.3**	1.00	0	

IP9802VI

Frequency Stability (2.1055)

Frequency stability measurements were made over the temperature range of -30C to +60C. This test was performed at Tactical Technologies Inc. which is not a certified
Lab, but was allowed to perform this test due to the lack of a temperature chamber at
Radiation Science Inc. The DC voltage was varied by more than 30% lower and 15% higher then the rated voltage (4.2VDC). The Frequency measurements were made using a direct 30 dBm attenuator connected to a HP5245L Frequency Counter that has its reference connected to a JK1100T Frequency Standard.
Power variations were done with a variable regulated DC power supply, the temperature chamber was a VK1108 Associates Testing Lab and the temperature measurements were monitored with a CIE306. The temperature was lowered to -30C and soaked for 1 hour and the frequency of the transmitter was recorded 15 seconds after the unit was turned ON. Then the temperature was increased to the next temperature setting and soaked for an hour.

Temperature	Frequency (Hz) @9V
+60C	162499973
+50C	162500021
+40C	162500034
+30C	162500018
+20C	162500011
0C	162500046
-10C	162500012
-20C	162499988
-30C	162500105

The above results for this test was < 1 ppm over the temperature range of -30C to +60C.

Power Supply Voltage (v)	Frequency (Hz)
6.0	162500015
6.5	162500011
7.0	162500006
7.5	162500010
8.0	162500008
8.5	162500008
9.0	162500005
9.5	162500012
10	162500012
10.5	162500009

CST802VI
Frequency Range 150 - 174 MHz
FCC ID# IP9802VI
Tuning Procedure

1. Apply 4.2 volts to the unit

2. Measure the output of the voltage regulator (U4) 2.85 volts.
   Measure the voltage on the output FET (L7) 2.85 volts
   Connect a 30 dbm pad from the RF connector on the transmitter to a Spectrum Analyzer. Using a Communications Receiver verify that the output frequency is that of the desired frequency (174Mhz).
   Measure the voltage with a volt meter at the junction of R16 and C21 2.75 volts +/- .2volts.
   Change the frequency of the transmitter to 150 Mhz repeat the measurement at the junction of R52 and C11 .65 volts +/- .2 volts

3. Using a Spectrum Analyzer probe the collector of Q4, and this junction the output power is 20 mw.

4. Connect a T tap connector to the 30 Dbm attenuater into a watt meter, and the Spectrum Analyzer to the tap Connection. Adjust C39 and C40 to obtain 200mw +/- 1 dBm while monitoring the harmonics so that they are >43 Dbc. Measure the transmitters total current ~ 140ma.

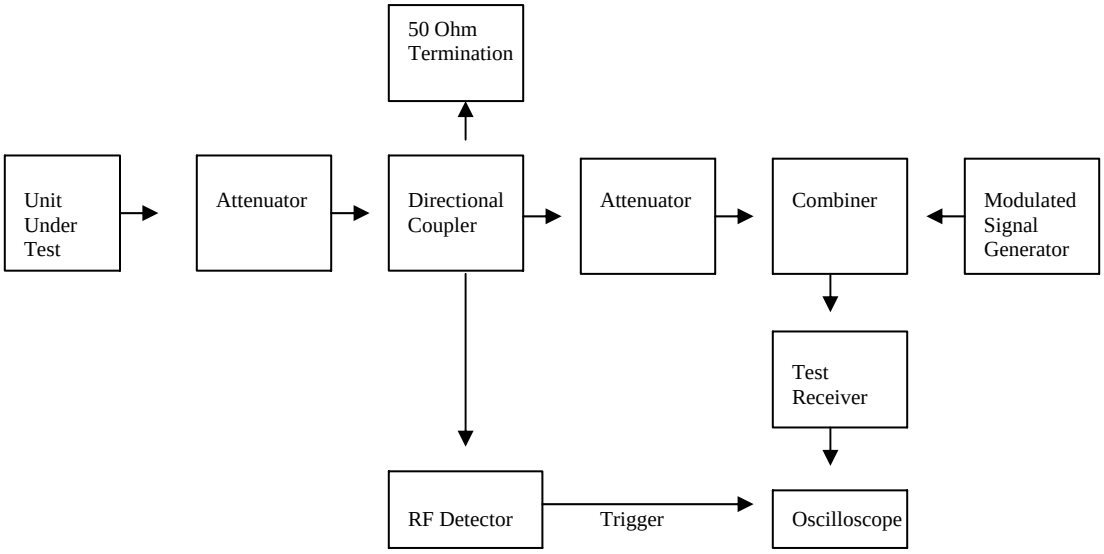
5. Using a Communications Receiver adjust (R11) TXCO to the desired frequency +/- 50Hz

6. Set the frequency of the transmitter to 174Mhz. Connect a audio generator with a 100:1 resistive pad to the microphone connector on the transmitter, apply 250 mv p-p at 3000Hz monitor the deviation with a Communications Receiver adjust (R35) for 2.3 Khz of deviation. Then apply 2.5 v p-p and monitor deviation with the Communications Receiver and adjust R35 to max. deviation of 2.3 Khz.

7. Using a Spectrum Analyzer connect a test antenna to the input of the analyzer. With the transmitter in its case adjust the antenna trimmer while monitoring the radiated power on the spectrum analyzer and the total current of the transmitter, for maximum radiated power @ ~ 140ma.

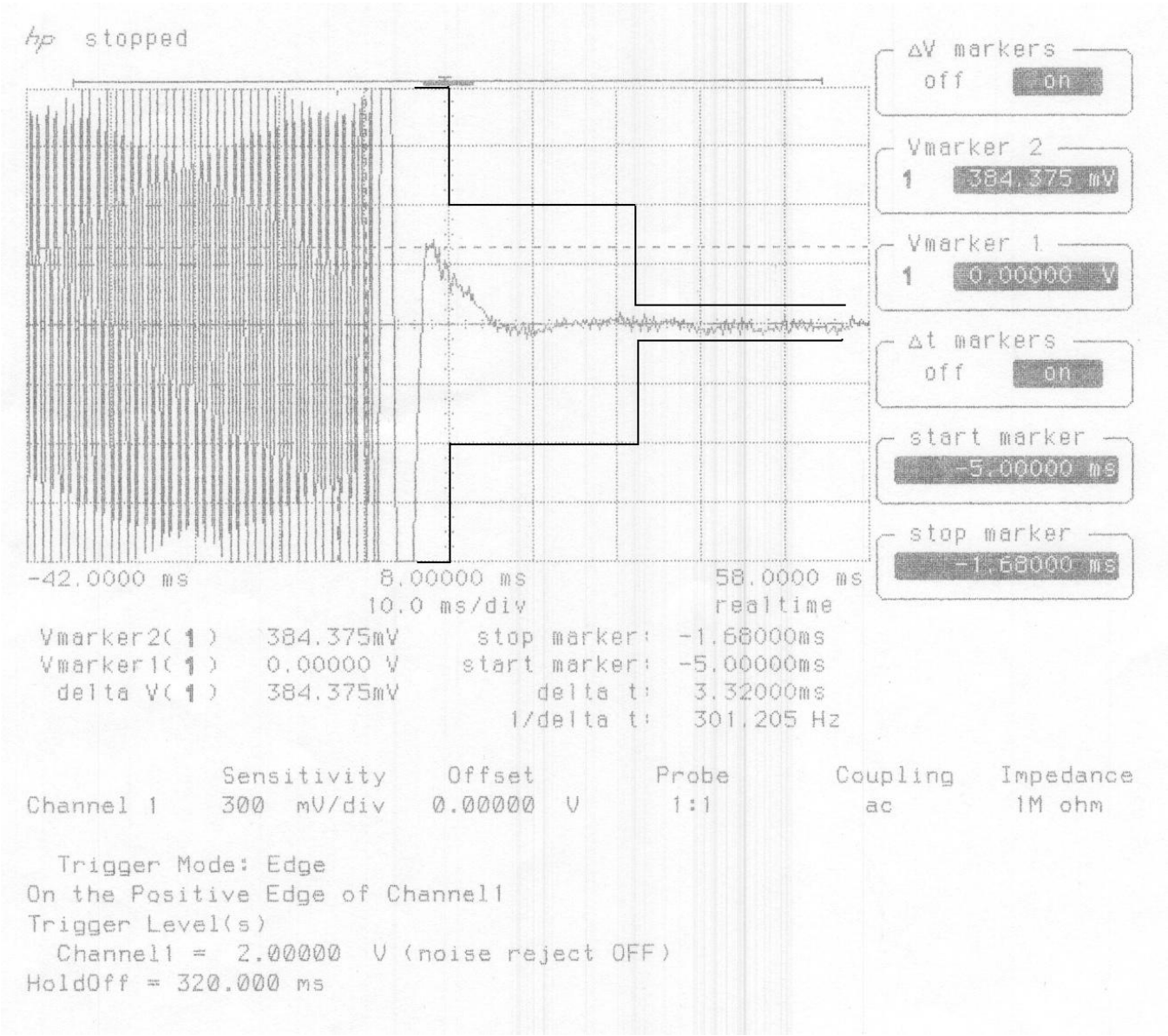
BLOCK DIAGRAM
FCC ID: IP9802VI

Transient Frequency Behavior 90.214

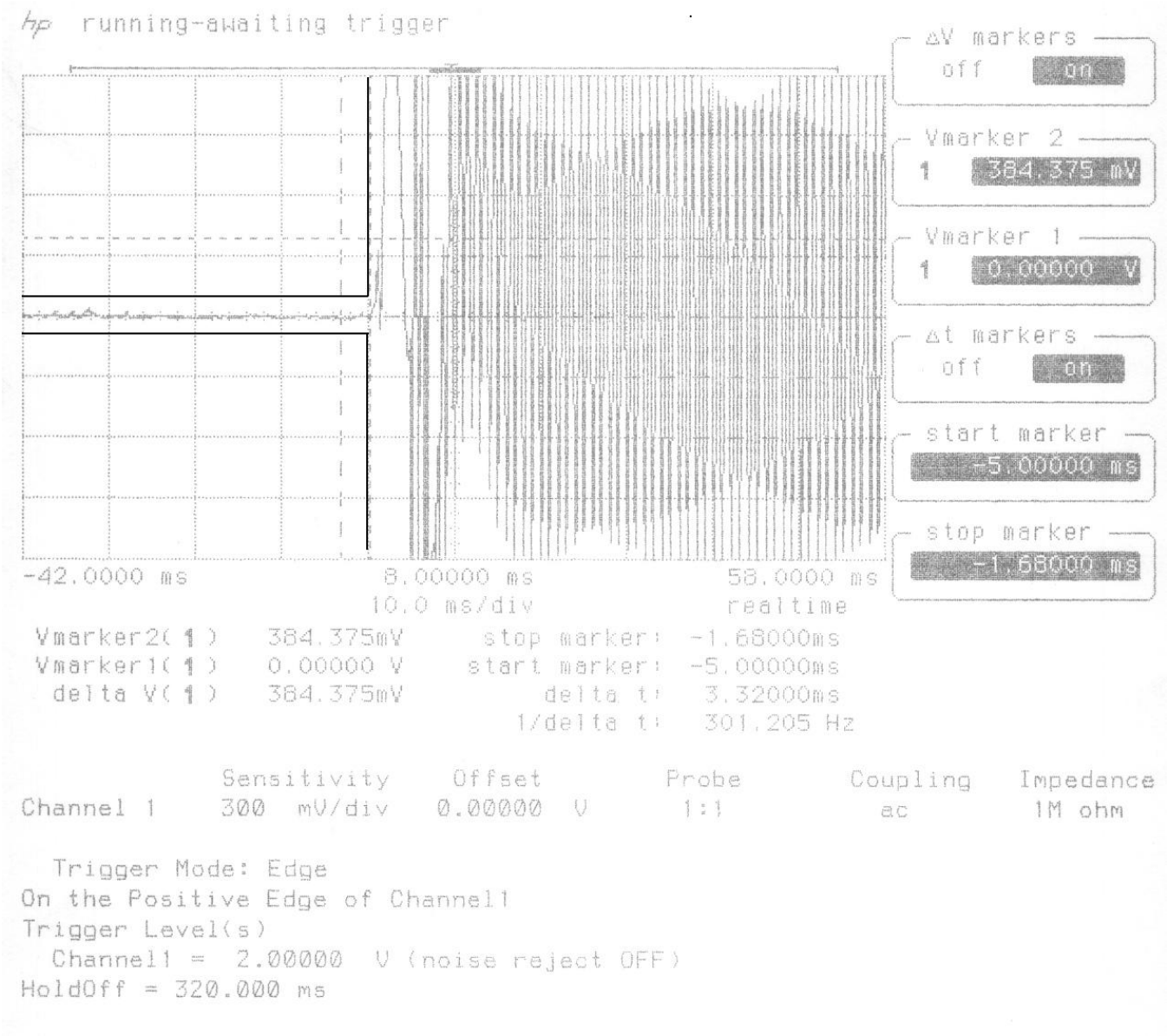


The unit under test (IP9802VI) was connected to a Directional Coupler. The two outputs from the coupler were connected to a RF Detector Diode and the other output from the coupler was combined with a 12.5kHz FM modulated test signal. The output from the combiner was connected to a test receiver, the demodulated audio from the receiver was connected to the oscilloscope input and the external trigger input on the oscilloscope was connected to the output of the RF diode detector. Power was applied to the test unit from a power supply, and the unit was turned OFF/ON manually with a test lead applied to the positive terminal of the power supply.

Three time periods were captured on the storage oscilloscope and recorded. The two pictures below (Figure 5) show the turn on and turn off points and the related frequency displacement. The t1 and t2 mask limits are superimposed on the TOP photograph (ON to OFF), and the t3 mask limit is superimposed on the BOTTOM photograph (OFF to ON).


stopped
ΔV markers
off
on
Vmarker 2
1
384.375 mV
Vmarker 1
1
0.00000 V
Δt markers
off
on
start marker
-5.00000 ms
stop marker
-1.68000 ms
-42.0000 ms
8.00000 ms
10.0 ms/div
58.0000 ms
realtime
Vmarker2(1) 384.375mV
Vmarker1(1) 0.00000 V
delta V(1) 384.375mV
stop marker: -1.68000ms
start marker: -5.00000ms
delta t: 3.32000ms
1/delta t: 301.205 Hz
Sensitivity Offset Probe Coupling Impedance
Channel 1 300 mV/div 0.00000 V 1:1 ac 1M ohm
Trigger Mode: Edge
On the Positive Edge of Channel1
Trigger Level(s)
Channel1 = 2.00000 V (noise reject OFF)
HoldOff = 320.000 ms

OFF to ON


running-awaiting trigger
ΔV markers
off
on
Vmarker 2
1
384.375 mV
Vmarker 1
1
0.00000 V
Δt markers
off
on
start marker
-5.00000 ms
stop marker
-1.68000 ms
-42.0000 ms
8.00000 ms
10.0 ms/div
58.0000 ms
realtime
Vmarker2(1) 384.375mV
Vmarker1(1) 0.00000 V
delta V(1) 384.375mV
stop marker: -1.68000ms
start marker: -5.00000ms
delta t: 3.32000ms
1/delta t: 301.205 Hz
Sensitivity Offset Probe Coupling Impedance
Channel 1 300 mV/div 0.00000 V 1:1 ac 1M ohm
Trigger Mode: Edge
On the Positive Edge of Channel1
Trigger Level(s)
Channel1 = 2.00000 V (noise reject OFF)
HoldOff = 320.000 ms

On to OFF

RSI INV #	DESCR	MANUFACTURER	MODEL #	SERIAL #
02	PRE_AMPLIFIER	C.M.T.	LF51104N	114
32.1	SPEC. ANALY.	H.P.	8566B	3638A08767
33.1	SPEC. ANALY. DISPLY	H.P.		3701A22258
75	ANTENNA	TENSOR	4108	204
80	ANTENNA	AMP.RES.Assoc.	AT1000	4094-025
200	GEN, SIGNAL	H.P.	8656B	2542A03013
281	DMM	FLUKE	25	5450037
298	SCOPE,DIG.	H.P.	54510A	3209A02622
356	P/S	SORENSEN	QRD15-2	NSN
391	RECEIVER	R & S	ESVP	861744/015
501	MINI MAST	EMCO	2075-2	0002-2278
502	TURNTABLE	EMCO	2065-1.21	0001-2156
503	CONTROLLER	EMCO	2090	0001-1489
708	40ft Cable RG-223	PASTERNACK	BNC TO BNC	N/A

(If CAL DUE DATE = Blank Field, then no calibration is required for this item)