

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

Part 2 & 90 Testing

JOEY II Synthesized FM Voice Transmitter/Solid State Recorder

FCC ID: IP975XVI

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 IP975XVI
- (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 500mw. @ 9.0 Volts
- (7) Maximum Power Rating is 500mw.
- (8) All of the Pre-amp sections run off of regulated +3.3 Volts, and the RF Final transistor runs off of regulated 4.0 Volts.
- (9) Tune up procedure are 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)]

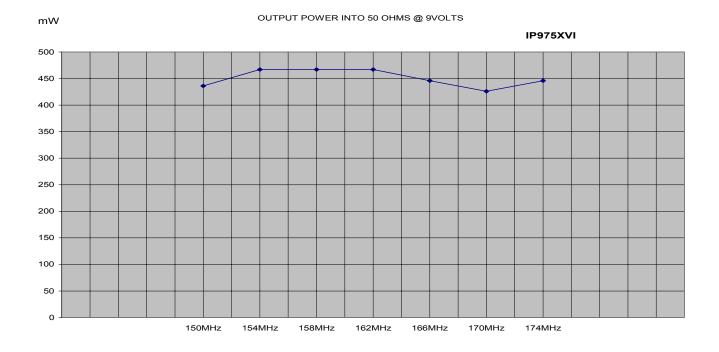
Power output measurements were made at the RF connector. This test was done with an unmodulated carrier in accordance with part 90.205(d)

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 0i.

The RF power output was measured from 150 Mhz – 174 Mhz

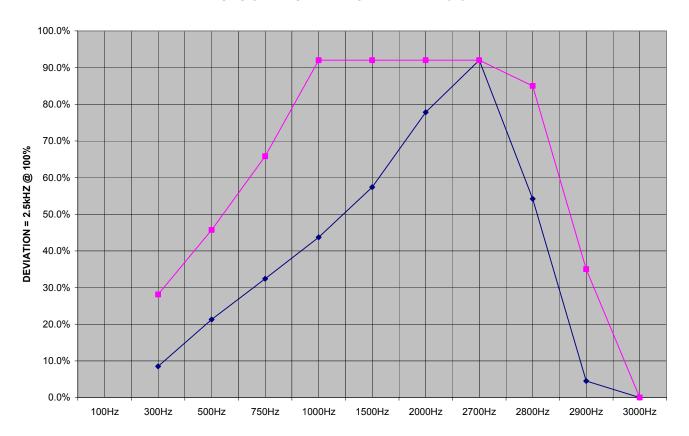
The RF output power did not vary with changes in the supply voltage, due to the system regulation.



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.

INPUT SIGNAL VS. DEVIATION FCC ID # IP975XVI

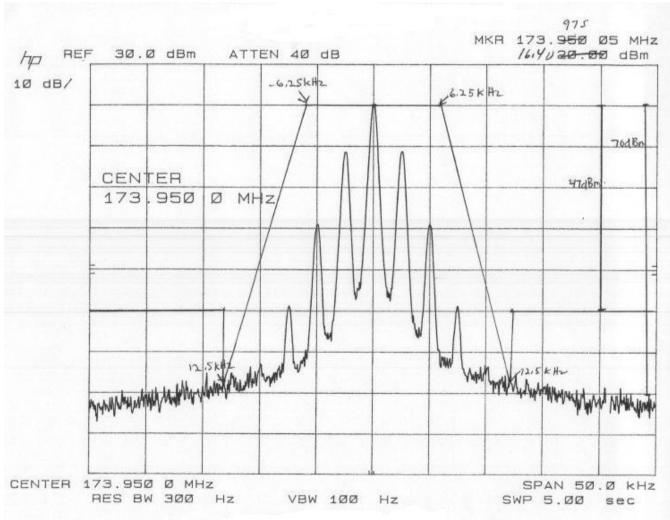


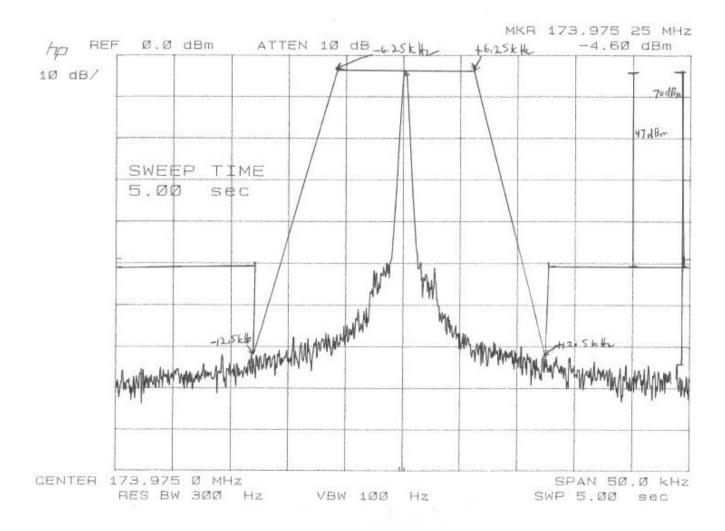
3. OCCUPIED BANDWIDTH - Paragraphs [2.1049, 90.210]

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.



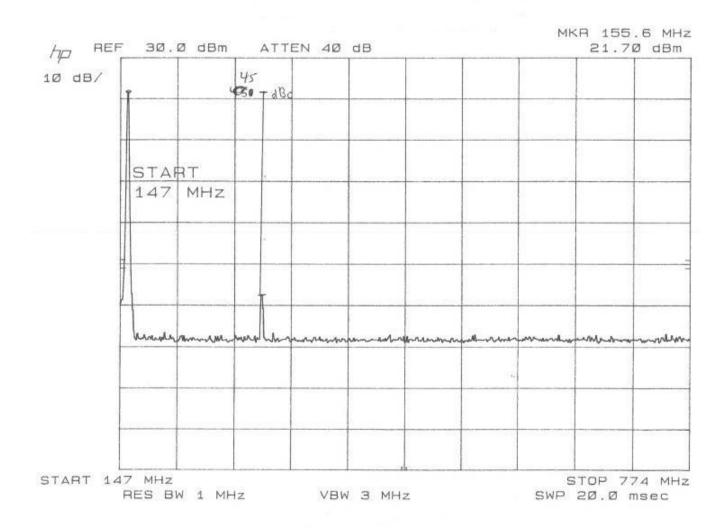


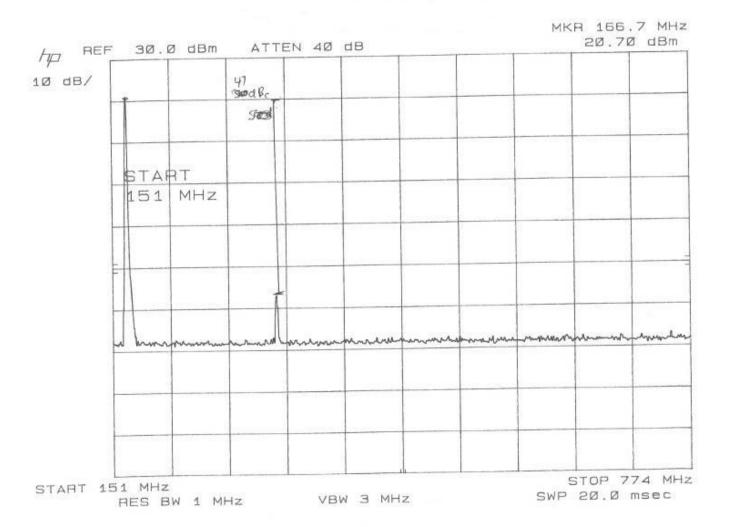


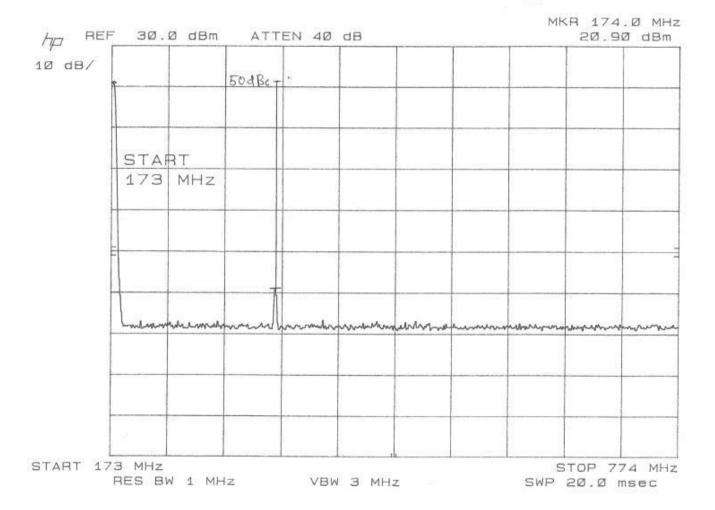
Part 90.210 Emission Mask D

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 (.468W) = 47 dB given by Section 90.210. The data in Table 1 verifies that the test sample complies with Paragraph







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 = 2.77 V/M = 128.8 dBu/m

The permissible value of spurious emissions is equal to less than $128.8 \text{ dBu/m} - 50 + 10\log(.5) = 82.2 \text{ dBu/m}$.

The test sample (IP975XVI) 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 87 dBuv.

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

	Manufacturer: Tactical Tech					3/03/05	Test Code RE			
	Model# CST751XVI (JOEY II)					Test Instruments: RSI # 75, 80,91, 391, 501, 502, 503, 708			T. d. d. d.	
	Serial # J2-00005					301, 302, 303, 708			Technician	
	Mode: LOWBAND- 151.95MHz					Frequency Range: 151MHz – 1519.5MHz			Engineer	
Tempera	ture: 32.3°F		Additional Info:		I			-	FCC Part 15 Sub. B	
Humidity: 26%								Class A		
Radiated			X HORIZ. BB X		NB				BB	
Distance:	3 meter Bicon / Log.P./I	Horn	XVERT. H		Ε	E Line: Function:			\square_{NB}	
7 tinterina.	Dicon / Eog.1 ./I	10111	Correction			T unction.			I TAB	
FREQ.	IND.		Fac			Final	Antenna	EUT	Remarks	
	Level		ANT.	Cable loss		Level	Height	Azimuth		
MHz	dΒμV		dB	dB		dBμV/m	Meters	Degree		
151.95	93.0		12.3	2.0		107.3	1.00	0	Vertical	
303.9	48.7		14.0	3.0		65.7	1.37	0		
455.8	11.0		18.0	3.7		32.7	1.38	0		
759.75	14.0		21.7	4.9		40.6	1.38	0		
911.7	0.6		24.1	5.5		30.2	1.00	0		
1063.65	29.3		24.3	6.0		59.6	1.00	0		
1215.6	28.8		24.6	6.5		59.9	1.00	0		
1367.55			25.0	6.9		62.6	1.00	0		
1519.5	30.1		25.4	7.4		62.9	1.00	0		
151.95	83.8		12.3	2.0		98.1	2.02	0	Horizontal	
303.9	24.8		14.1	3.0		41.9	2.33	0		
455.8	2.0		17.7	3.7		23.4	1.00	0		
759.75	18.0		22.1	4.9		45	1.00	0		
911.7	21.0		24.3	5.5		50.8	1.00	0		
1063.65	-		24.3	6.0		60.2	1.00	0		
1215.6	29.7		24.6	6.5		60.8	1.00	0		
1367.55	_		25.0	6.9		61.6	1.00	0		
1519.5	30.9		25.4	7.4		63.7	1.00	0	<u> </u>	
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	Manufacturer					 3/03/05 nstruments: 1	Test Code RE		
E U	Model# CST751XVI (JOEY II) Serial # J2-00005					02, 503, 708	Technician		
T	Mode: MIDBA	AND			Frequ	ency Range:	Engineer		
Temperature: 32.3°F Additional Info:							Test Spec:	FCC Part 15 Sub. B	
Humidity: 26%					Class			A	
Radiated X HORIZ. BB X			NB	Conducted			ВВ		
Distance:	3 meter Bicon / Log.P./	Horn	XVERT.	\square_{H}	Ε	Line: Function:			□ □ NB
7 Kiiteiiia.			Corre						ļ <u> ND</u>
FREQ.	IND. Level		Fac	tors Cable	_ Final Level		Antenna Height	EUT Azimuth	Remarks
	Level		ANT.	loss		Level	Treight	7121111411	
MHz	dΒμV		dB	dB		dBµV/m	Meters	Degree	
163.95	98.3		13.0	2.1		113.4	1.00	0	Vertical
327.9	39.4		16.0	3.1		58.5	1.23	0	
491.85	10.0		18.4	3.9		32.3	1.00	0	
655.8	7.0		20.6	4.6		32.2	1.00	0	
819.75 933.7	1.0		23.2	5.2 5.6		29.4 39.9	1.00	0	
1147.65			24.5	6.2		60.4	1.00	0	+
1311.6	31.5		24.3	6.8		63.2	1.00	0	
1475.55			25.2	7.3		61.8	1.00	0	
1639.5	30.3		26.0	7.8		64.1	1.00	0	▼
100010	30.3		20.0	7.0		0111	1.00		
163.95	87.4		12.1	2.1		101.6	2.76	0	Horizontal
327.9	25.4		15.3	3.1		43.8	1.70	0	
491.85	10.0		18.2	3.9		32.1	1.00	0	
655.8	5.0		20.8	4.6		30.4	1.00	0	
819.75	0.2		23.4	5.2		28.8	1.00	0	
933.7	0.6		24.1	5.6		30.3	1.00	0	
1147.65			24.5	6.2		61.7	1.00	0	
1311.6			24.9	6.8		60.6	1.00	0	
1475.55			25.2	7.3		62.5	1.00	0	
1639.5	30.1		26.0	7.8		63.9	1.00	0	
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	Manufacturer: Tactical Tech					3/3/05	Test Code RE			
	Model# CST751XVI (JOEY II)					nstruments: I	Taribuition			
	Serial # J2-000	05			501, 502, 503, 708				Technician	
	Mode: HIGHB	AND			Frequ	Frequency Range: 173MHz – 1739.5MHz			Engineer	
Tempera	ture: 32.3°F		Additiona	l Info:	I			-	FCC Part 15 Sub. B	
Humidity: 26%				Class					A	
Radiated		X HORIZ. BB X		NB	Conducted			BB		
Distance:	3 meter Bicon / Log.P./I	Jorn	XVERT. H X		Ε	Line: Function:			\square_{NB}	
Amemia.	Dicon / Log.r./I	10111	Correction		Function.				L NB	
FREQ.	IND.		Fac	tors		Antenna	EUT	Remarks		
	Level		ANT.	Cable loss		Level	Height	Azimuth	Kemar Ks	
MHz	dΒμV		dB	dB		dBμV/m	Meters	Degree		
173.95	1 1		13.2	2.1		117.7	1.00	0	Vertical	
347.9	33.5		15.4	3.2		52.1	1.23	0		
521.85	9.8		18.5	4.1		32.4	1.00	0		
695.8	15.4		21.9	4.7		42	1.00	0		
869.5	10.0		24.5	5.4		39.9	1.00	0		
1043.7	27.0		24.3	5.9		57.2	1.00	0		
1217.65	28.0		24.6	6.5		59.1	1.00	0		
1391.6	28.0		25.0	7.0		60	1.00	0		
1565.55	28.0		25.6	7.5		61.1	1.00	0	V	
1739.5	30.0		26.5	8.1		64.6	1.00	0		
173.95			12.3	2.1		104.4	2.94	0	Horizontal	
347.9	19.6		15.6	3.2		38.4	1.44	0		
521.85	1.7		18.3	4.1		24.1	2.09	0		
695.8	3.3		21.7	4.7		29.7	1.00	0		
869.5	0.2		23.3	5.4		28.9	1.00	0		
1043.7	+		24.3	5.9		60	1.00	0		
1217.65			24.6	6.5		61.1	1.00	0		
1391.6	30.2		25.0	7.0		62.2	1.00	0		
1565.55			25.6	7.5		63.4	1.00	0	—	
1739.5	27.7		26.5	8.1		62.3	1.00	0		

E	Manufacturer: Ta				3/03/05 nstruments: F	Test Code RE			
U	Model# CST751X Serial # J2-00005	(VI (JOEY II)		502, 5	03, 708	Technician			
T	Mode: RECORD/	Frequency Range: 30MHz – 1000MHz				Engineer			
Tempe	erature: 32.3°F	Additiona	l Info:	l			-	FCC Part 15 Sub. B	
Humid	lity: 26%						Class A		
Radiated Distance: 3 meter Antenna: Bicon / Log.P.			XHORIZ. BB X XVERT. H X		Conducted Line: Function:			□ BB	
1 1111			Correction						
FREQ	. IND. Level	ANT.	ANT. Cable loss		Final Level	Antenna Height	EUT Azimuth	Remarks	
MHz	dBμV	dB	dB		dBµV/m	Meters	Degree		
30.0	•	12.5	0.8		25.3	1.00	0	Vertical	
80.0	12.0	7.9	1.5		21.4	1.00	0		
120.0	5.0	11.1	1.9		18	1.00	0		
200.0	4.0	14.0	2.3		20.3	1.00	0		
500.0	-1.1	18.5	4.0		21.4	1.00	0		
700.0	0.2	21.8	4.7		26.7	1.00	0		
1000.0	0.6	24.4	5.8		30.8	1.00	0	—	
30.0	2.0	14.1	0.8		16.9	1.00	0	Horizontal	
80.0	10.0	8.2	1.5		19.7	1.00	0		
120.0	5.0	10.9	1.9		17.8	1.00	0		
200.0		13.9	2.3		22.2	1.00	0		
500.0		18.4	4.0		21.3	1.00	0		
700.0		21.7	4.7		26.6	1.00	0		
1000.0	0.6	24.8	5.8		31.2	1.00	0	↓	
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IP9CST75XVI

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 (9VDC). 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.

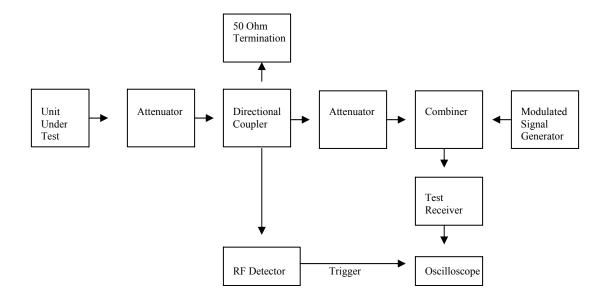
Power Supply Voltage (v)	Frequency (Hz)
6.0	162500015
6.5	162500011
7.0	162500006
7.5	162500010
8.0	162500008
8.5	162500008
9.0	162500005
9.5	162500012
10	162500012
10.5	162500009

CST75XVI Frequency Range 150 - 174 MHz FCC ID# IP975XVI Tuning Procedure

- 1. Apply 9.0 volts to the unit
- Measure the output of the voltage regulator (IC8) 3.3 volts.
 Measure the voltage on the output FET (L7) 4.0 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 R52 and C11 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 C41 to obtain 500mw +/- 1 dBm while monitoring the harmonics so that they are >47 Dbc. Measure the transmitters total current ~ 140ma.
- 5. Using a Communications Receiver adjust (R11) TXCO to the desired frequency +/- 50Hz
- 5. 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 1000Hz monitor the deviation with a Communications Receiver adjust (R26) for 1 Khz of deviation. Then apply 2.5 v p-p and adjust (R26) to 2 Khz of deviation. Then adjust (R35) to the max. deviation of 2.3 Khz.

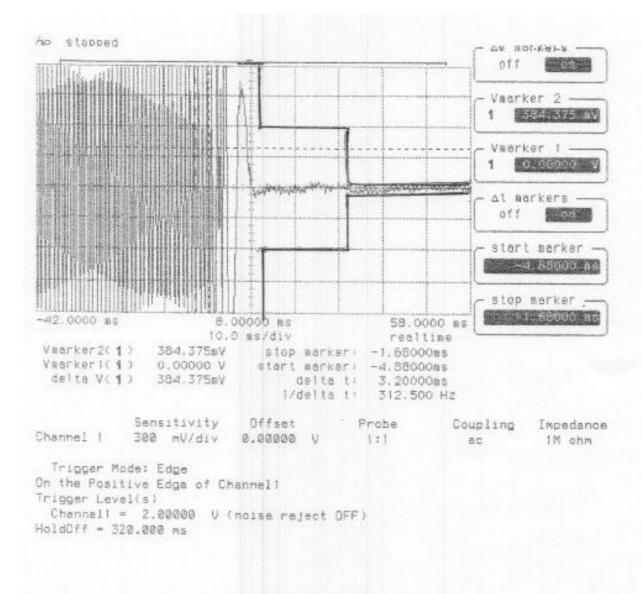
BLOCK DIAGRAM FCC ID: IP975XVI

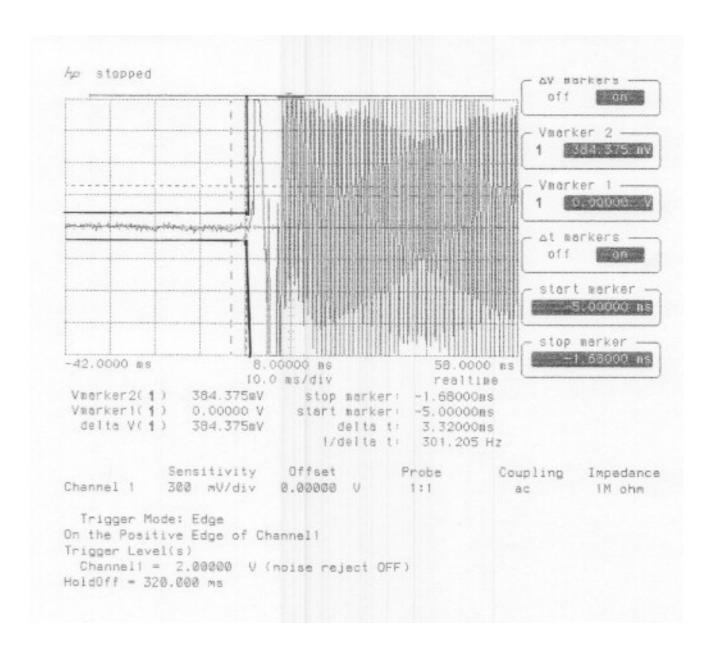
Transient Frequency Behavior 90.214



The unit under test (IP975XVI) 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).





On to OFF















Transient Frequency Behavior 90.214

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.	н.Р.	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)