

TABLE OF CONTENTS LIST

APPLICANT: ELUTIONS INC.

FCC ID: Q4I0008837940

TEST REPORT:

PAGE	1.....	LETTER OF DESCRIPTION
PAGE	2.....	GENERAL INFORMATION & TECHNICAL DESCRIPTION
PAGE	3-5.....	TECHNICAL DESCRIPTION CONTINUED
PAGE	6.....	RF POWER OUTPUT
PAGE	7.....	OCCUPIED BANDWIDTH
PAGE	8-25.....	OCCUPIED BANDWIDTH PLOTS
PAGE	26-28.....	SPURIOUS EMISSIONS AT ANTENNA TERMINALS
PAGE	29.....	METHOD OF MEASURING SPURIOUS EMISSIONS AT ANTENNA TERM.
PAGE	30.....	FIELD STRENGTH OF SPURIOUS EMISSIONS
PAGE	31.....	METHOD OF MEASURING RADIATED SPURIOUS EMISSIONS
PAGE	32-33.....	FREQUENCY STABILITY
PAGE	34-36.....	LIST OF TEST EQUIPMENT

EXHIBITS CONTAINING:

EXHIBIT	1.....	FCC ID LABEL SAMPLE
EXHIBIT	2.....	LABEL LOCATION
EXHIBIT	3.....	SCHEMATIC
EXHIBIT	4.....	BLOCK DIAGRAM
EXHIBIT	5.....	USERS MANUAL
EXHIBIT	6.....	OPERATIONAL DESCRIPTION
EXHIBIT	7.....	EXTERNAL PHOTOGRAPHS
EXHIBIT	8.....	INTERNAL PHOTOGRAPHS
EXHIBIT	11.....	TEST SET UP PHOTOGRAPH

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

TABLE OF CONTENTS

April 28, 2003

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

SUBJECT: ELUTIONS INC.

FCC ID: Q4I0008837940

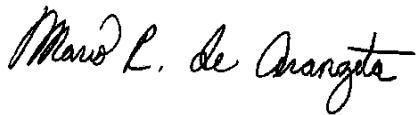
To Whom It May Concern:

The attached application is for an RF modem consisting of a GPS receiver, a single board computer, and a Motorola i30sx SMR (Nextel) radio FCC ID: AZ489FT5818 minus it's plastic case. This device is housed in an extruded aluminum case. It uses a single magnetic mount antenna model number Motorola RAF4136AMM (3 dBi gain).

The following information was derived from Motorola FCC ID: AZ489FT5818 test report:

- Page 7 Description of the spectral mask
- Pages 3-5 Description of the modulation technique
- Page 32 Description of the method for performing Temperature Stability

Sincerely,



Mario R. de Aranzeta C.E.T.

MRD/sh
Encl.

GENERAL INFORMATION REQUIRED
FOR TYPE ACCEPTANCE

2.1033 Elutions, Inc. will sell the
(c)(1)(2) FCC ID: Q4I0008837940 in quantity,
for use under FCC RULES PART 90.

2.1033 (c) TECHNICAL DESCRIPTION
2.1033 (3) User Manual See Exhibit 14

2.1033 (4) Type of Emission: 18K3D7W

90.209(b)(5)

2.1033 (5) Frequency Range: 806-825 MHz, 896-901 MHz

(6) Power Range and Controls: There are NO user Power controls.

(7) Maximum Output Power Rating -
Results on following pages.

(8) DC Voltages and Current into Final Amplifier:
Results on following pages.

(9) Tune-up procedure. The tune-up procedure is given
in EXHIBIT 8.

2.1033 (10) Complete Circuit Diagrams: The circuit diagram is
included as EXHIBIT 2. The block diagram is
included as EXHIBIT 3.

(11) Function of each electron tube or semiconductor
device or other active circuit device:
-SEE EXHIBIT 14.

(12) Instruction book. The instruction manual is included
as EXHIBIT 14.

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

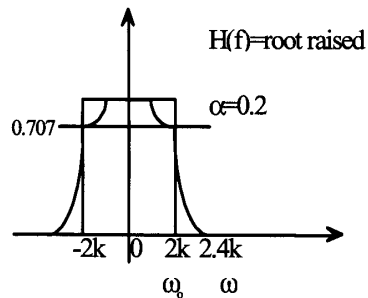
REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 2 of 36

- (10) Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description in the instruction manual.
- 2.1033(c)(11) A photograph or drawing of the equipment identification label is shown in Exhibit 1.
- 2.1033(c)(12) Photographs of the equipment of sufficient clarity to reveal equipment construction and layout and label location are shown in Exhibit 6-7.
- 2.1033(c)(13) For equipment employing digital modulation, a detailed description of the modulation technique.

Digitally encoded speech or digital data is transmitted in four sub-channels at a 4 kHz rate using M-ary symbols mapped to predetermined fixed magnitude and phase components within 1 of 3 constellations associated with a particular modulation scheme. Figure 2 illustrates symbol mapping to one of the four QPSK sub-channels constellations. Figure 3 illustrates symbol mapping to one of the four 16QAM sub-channels constellation. Figure 4 illustrates symbol mapping to one of the four 64QAM sub-channels constellation. For Quad-QPSK modulation, this mapping adjusts the amplitude and phase variations of the baseband signal to one of 4 points on the constellation. For Quad-16QAM modulation, this mapping adjusts the amplitude and phase variations of the baseband signal to one of 16 points on the constellation. For Quad-64 modulation, this mapping adjusts the amplitude and phase variations of the baseband signal to one of 64 points on the constellation. The bandwidth of the modulating signals is limited by the pair of modulation limiting low pass filters in U801. These filters serve to limit out-of-band and spurious emissions due to modulation. The necessary bandwidth of the sub-channels is limited to 4.8 kHz by the pair of modulation limiting low pass filters. The transfer response of these filters is depicted in Figure 1 where the filter excess bandwidth coefficient of 0.2 is shown. This excess bandwidth leads to the necessary bandwidth calculation of $(1 + 0.2) \times (4 \text{ kHz}) = 4.8 \text{ kHz}$. Since the sub-channels are spaced 4.5 kHz apart, the necessary bandwidth of the composite 4 sub-channel symbol streams is $4.8 + (3 \times 4.5) = 18.3 \text{ kHz}$.

Modulation Low Pass Filter Response

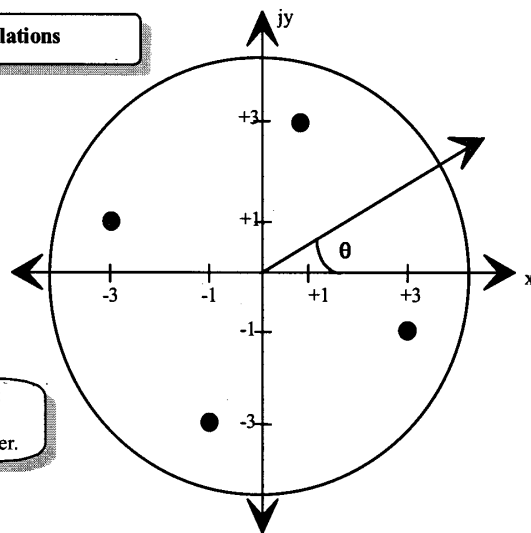
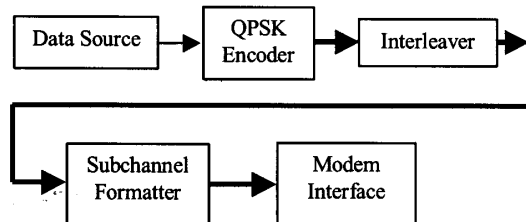


$$H(f) = \begin{cases} 1 & \text{for } |f| < 2\omega_0 - \omega \\ \cos^2(\pi/4 (|f| + \omega - 2\omega_0)/(\omega - \omega_0)) & \text{for } 2\omega_0 - \omega < |f| < \omega \\ 0 & \text{for } |f| > \omega \end{cases}$$

where $\omega_0 = 2000$ and $\omega = (1+\alpha)\omega_0 = 2400\text{Hz}$

Modulation Low Pass Filter Response

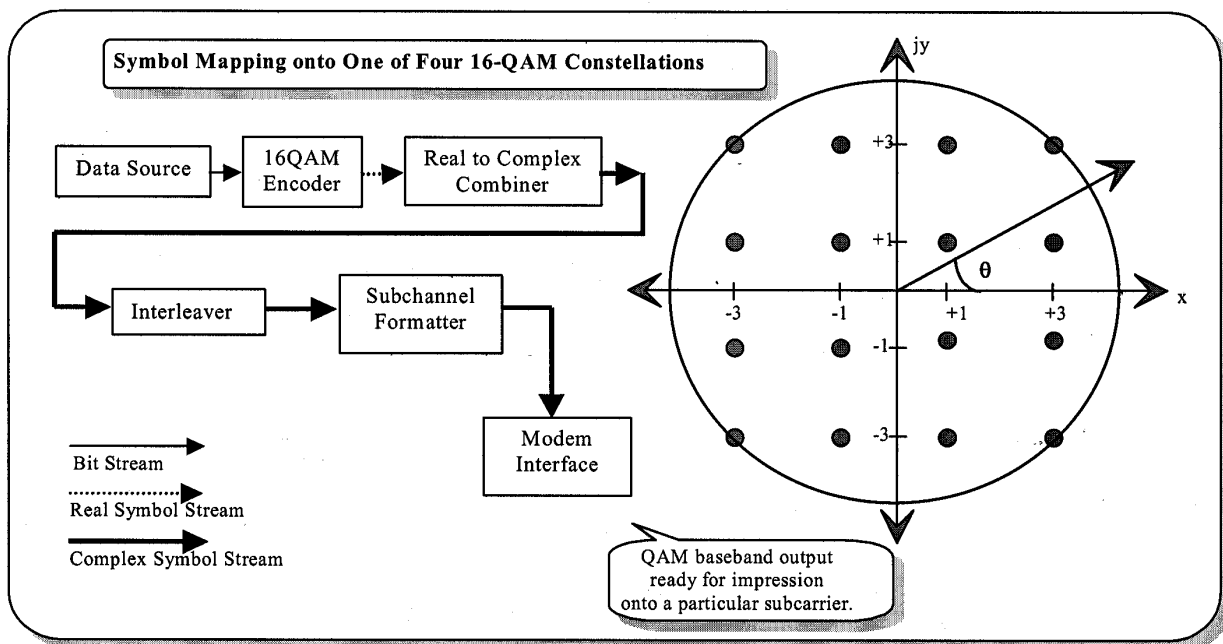
Symbol Mapping onto One of Four QPSK Constellations



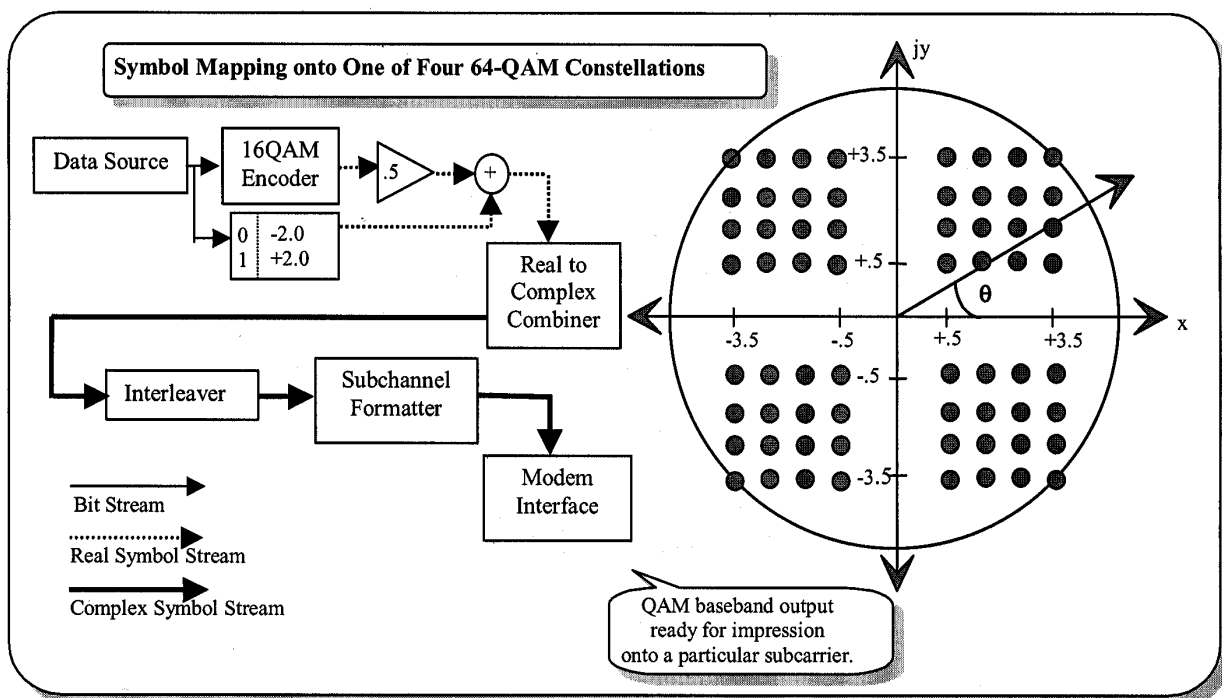
QAM baseband output
ready for impression
onto a particular subcarrier.

Bit Stream →
Complex Symbol Stream →

Symbol Mapping onto One of Four QPSK Constellations



Symbol Mapping onto One of Four 16-QAM Constellations



Symbol Mapping onto One of Four 64-QAM Constellations

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 of 4.0 VDC, and the transmitter properly adjusted the RF output measures:

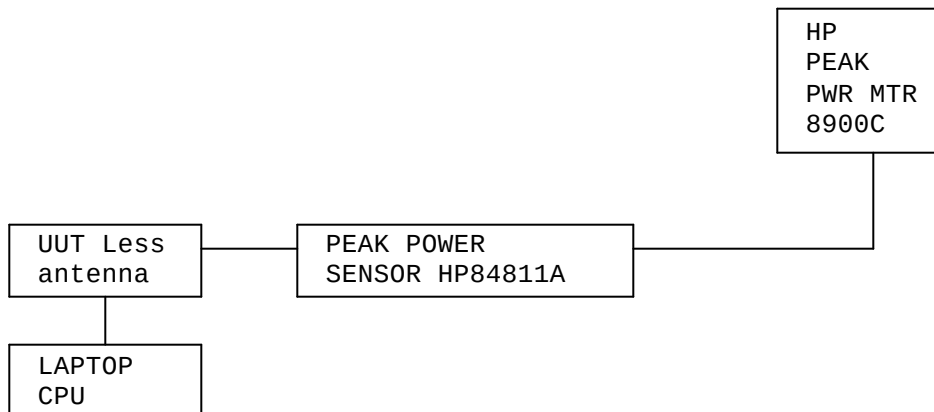
The transmitter is a variable power type used in a SMR trunking system. Output power(as defined in 47 CFR 90.7) is dynamically controlled by sensing the quality of the received base station signal, then automatically adjusting an attenuator in approximately 1 dB steps over the range from 0 to 34 dB attenuation.

Maximum output power rating: 730 milliwatts (28.63 dBm) (Pulse average power)

Nominal output power rating: 600 milliwatts (27.78 dBm) (Pulse average power)

	800MHz	800MHz	900MHz	900MHz
	MAXIMUM POWER	MINIMUM POWER	MAXIMUM POWER	MINIMUM POWER
DC VOLTAGE	4 Volts	4 Volts	4 Volts	4 Volts
DC CURRENT	1.2 Amps	0.44 Amps	1.25 Amps	0.44 Amps
OUTPUT POWER	580 mW	0.23 mW	600 mW	0.24 mW

METHOD OF MEASURING RF POWER OUTPUT



APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 6 of 36

2.1047(a) Voice Modulation characteristics:
NOT APPLICABLE,

2.1049 Occupied bandwidth:
90.210(c,)

(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 up to and including 10 kHz:

At least $83 \log_{10}(f_d/5)$ decibels.

(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 up to and including 250 percent of the authorized bandwidth:

At least $116 \log_{10}(f_d/6.1)$ decibels or 50 plus $10 \log_{10}$ (Unmodulated Carrier Power) decibels or 70 decibels, whichever is lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth:

At least 43 plus $10 \log_{10}$ (Output Power in Watts) decibels or 80 decibels, whichever is lesser attenuation.

b.) Per EA SMR Emission Mask, 47 CFR 90.691(a)

Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees.

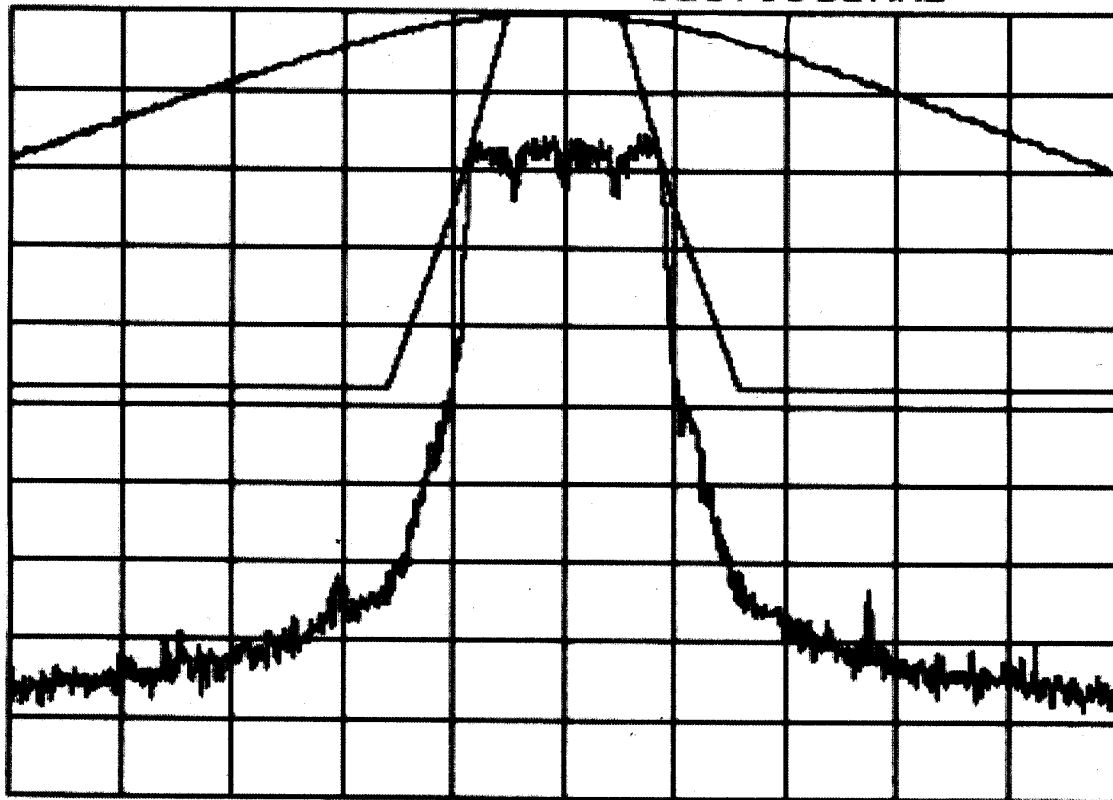
(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center channel of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels (i.e. -13 dBm) or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

ATTEN 40dB
RL 24.9dBm

10dB/

MKR 3.57dBm
820.9900MHz



CENTER 820.9900MHz
*RBW 300Hz VBW 1.0kHz SPAN 100.0kHz
*SWP 20.0sec

QUAD-QPSK MASK 47 CFR 90.210 (g)
MAXIMUM POWER

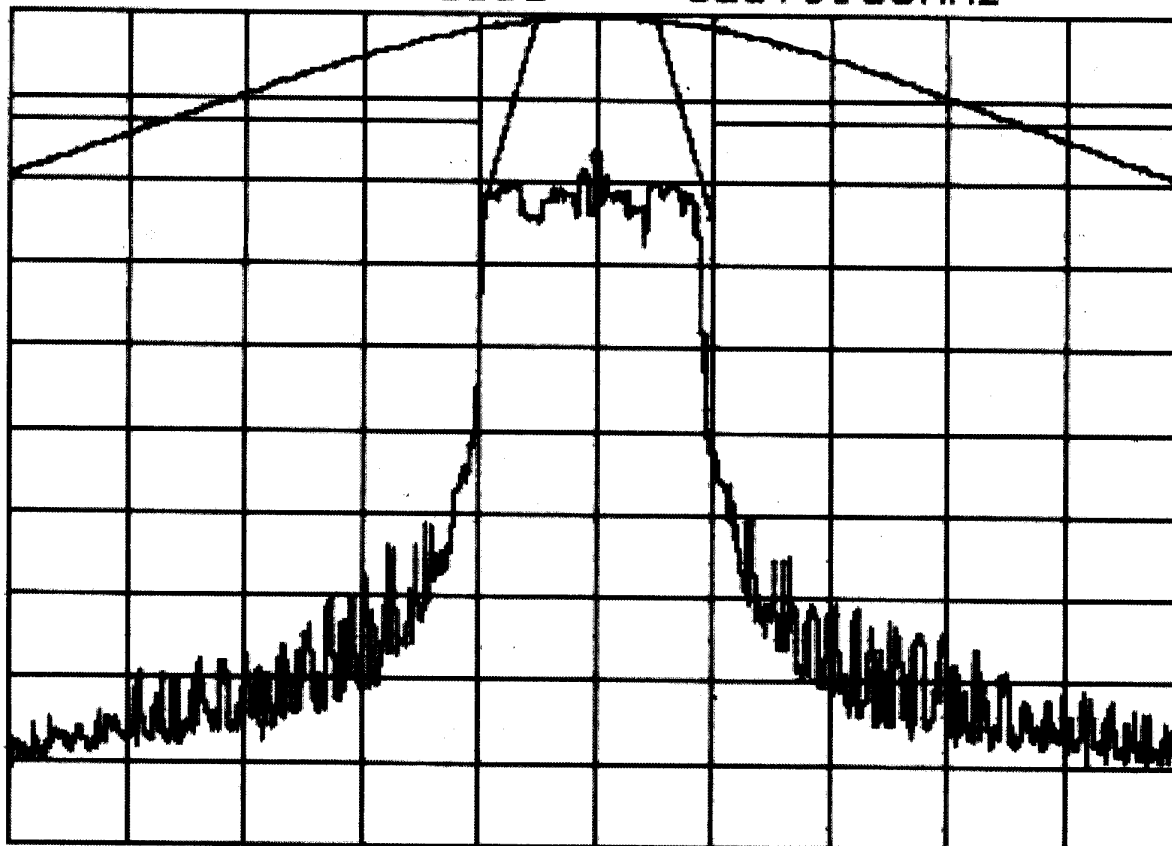
ATTEN 10dB

RL -0.8dBm

10dB/

MKR -19.00dBm

820.9905MHz



CENTER 820.9905MHz

*RBW 300Hz

VBW 1.0kHz

SPAN 100.0kHz

*SWP 20.0sec

QUAD-QPSK MASK 47 CFR 90.210 (g)
MINIMUM POWER

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

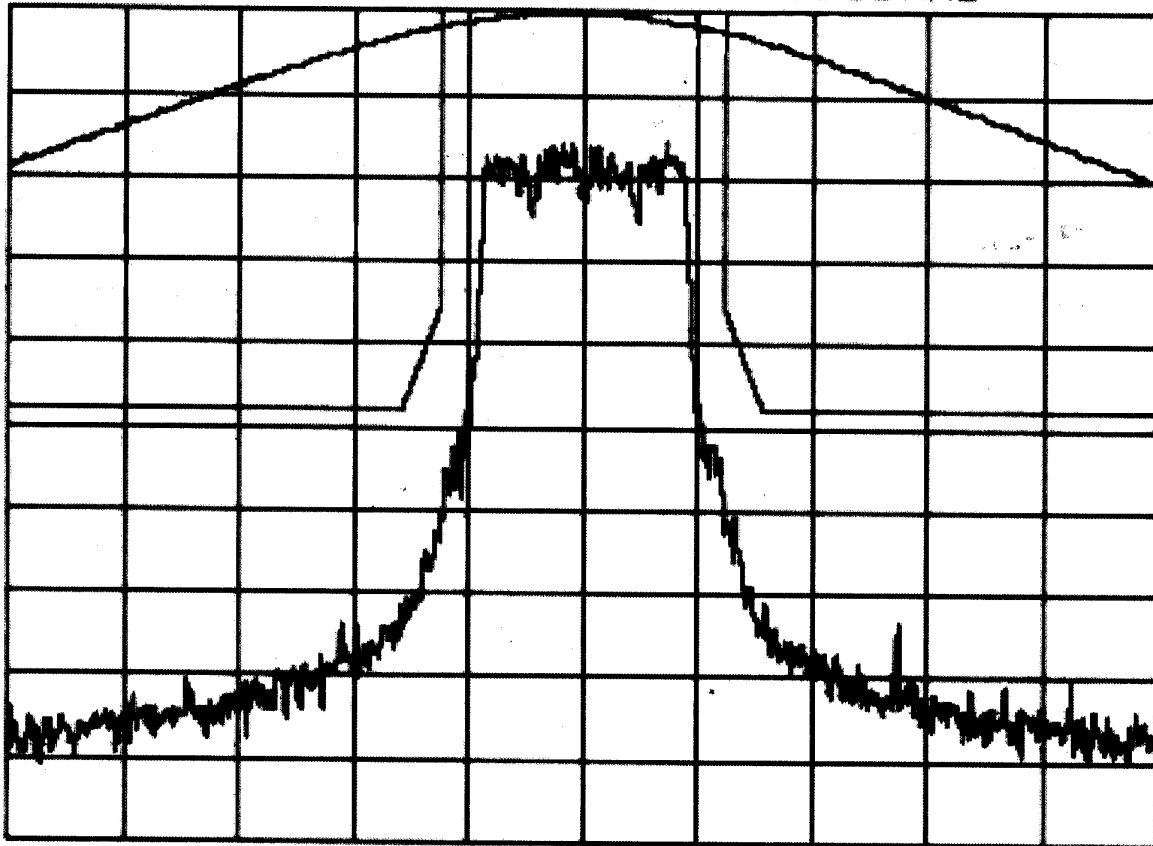
REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 9 of 36

ATTEN 40dB
RL 24.9dBm

10dB/

MKR 2.40dBm
820.9900MHz



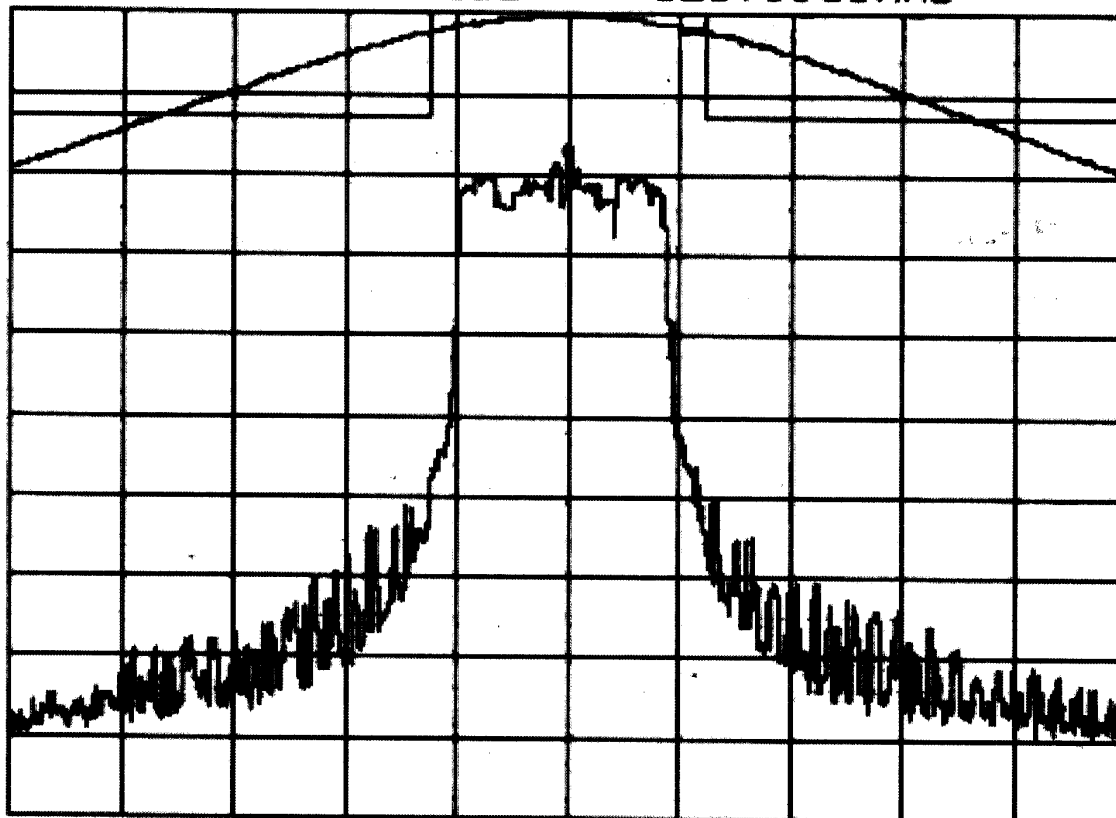
CENTER 820.9900MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 20.0sec

QUAD-QPSK MASK 47 CFR 90.691
MAXIMUM POWER

ATTEN 10dB
RL -.8dBm

10dB/

MKR -19.00dBm
820.9905MHz



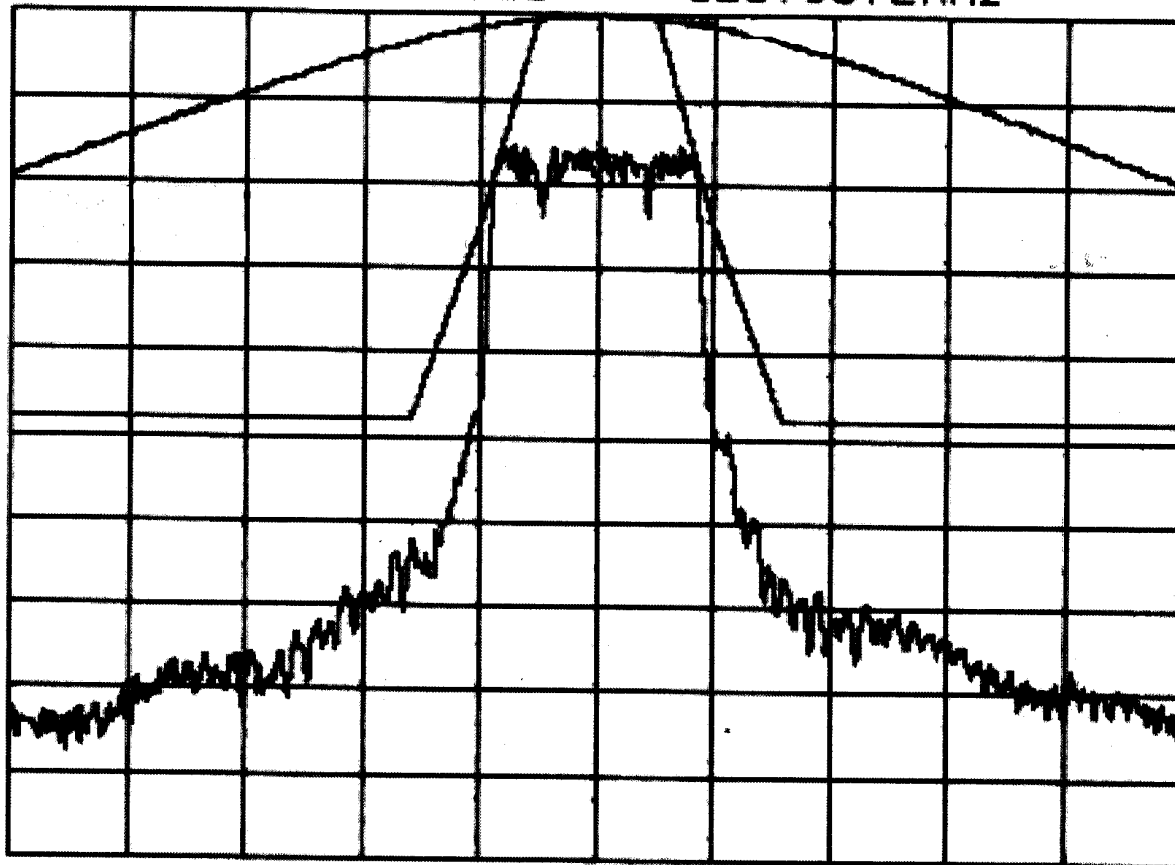
CENTER 820.9905MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 20.0sec

QUAD-QPSK MASK 47 CFR 90.691
MINIMUM POWER

ATTEN 40dB
RL 24.9dBm

10dB/

MKR 7.27dBm
820.9872MHz



CENTER 820.9868MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 50.0sec

QUAD-16QAM MASK 47 CFR 90.210 (g)
MAXIMUM POWER

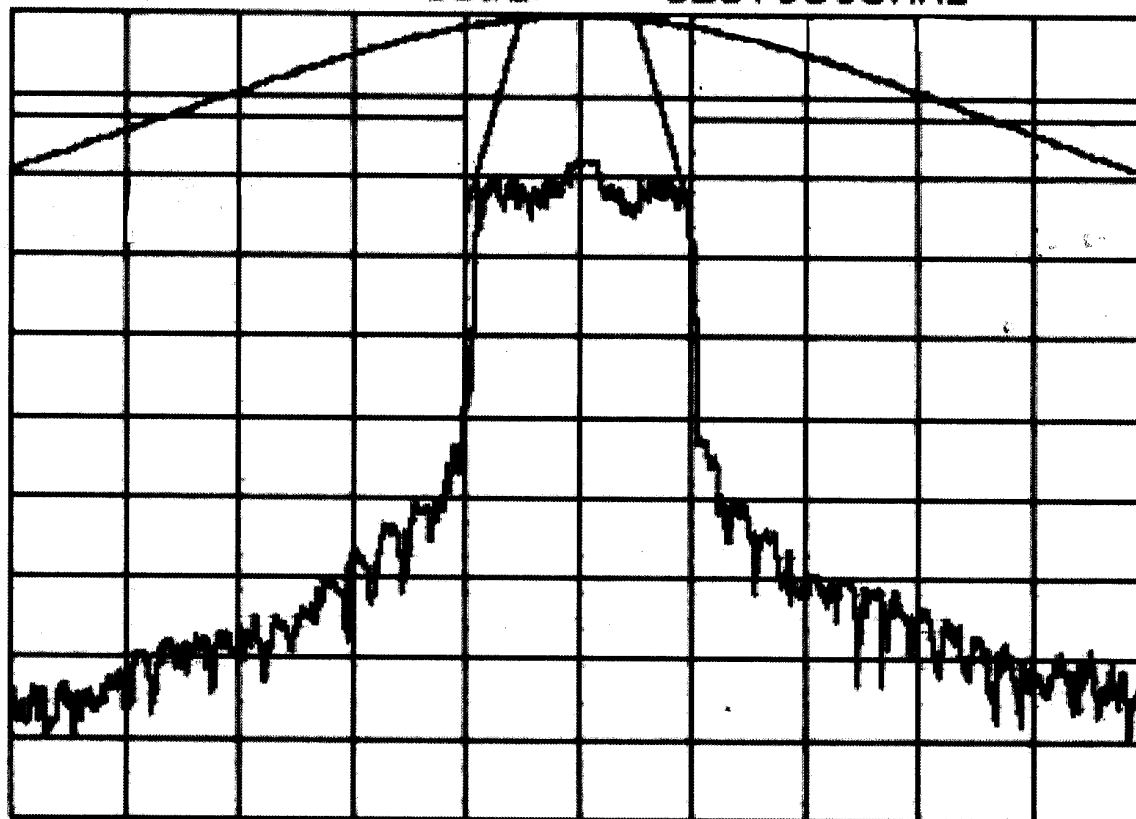
ATTEN 10dB

RL -.8dBm

10dB/

MKR -23.00dBm

820.9895MHz



CENTER 820.9920MHz

SPAN 100.0kHz

*RBW 300Hz

VBW 1.0kHz

*SWP 20.0sec

QUAD-16QAM MASK 47 CFR 90.210 (g)
MINIMUM POWER

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

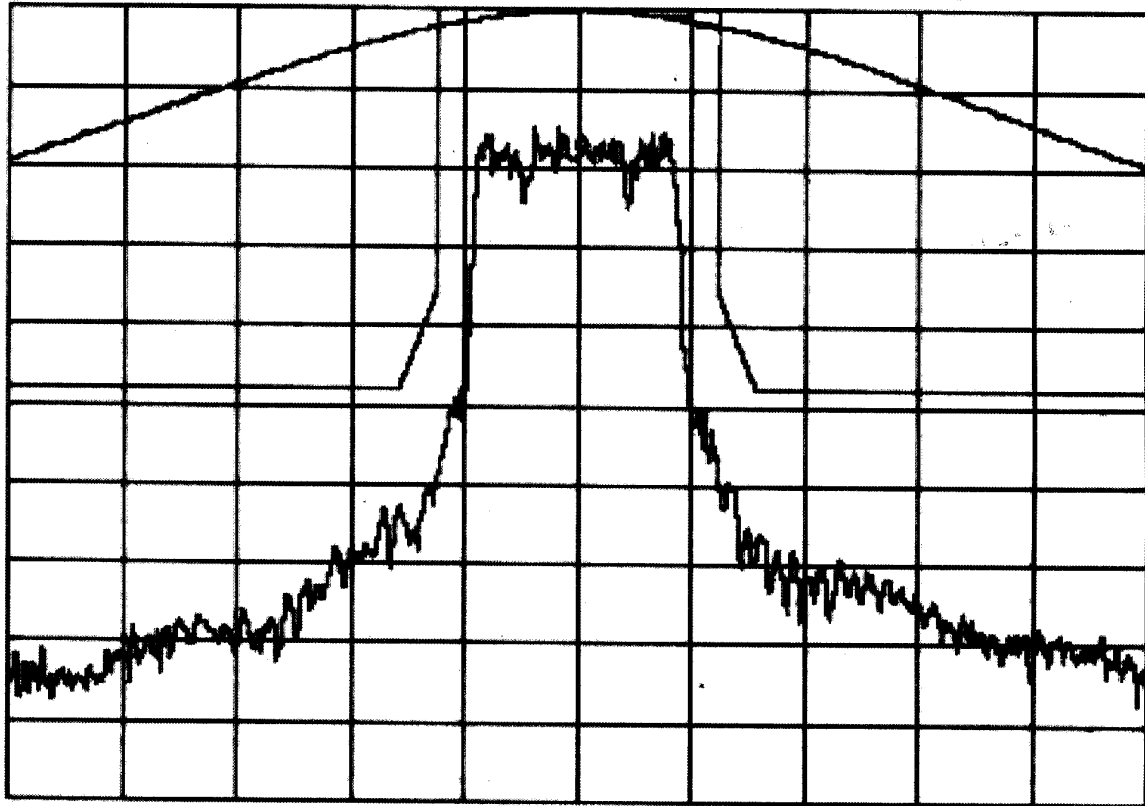
REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 13 of 36

ATTEN 40dB
RL 24.9dBm

10dB/

MKR 6.94dBm
820.9872MHz



CENTER 820.9868MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 50.0sec

QUAD-16QAM MASK 47 CFR 90.691
MAXIMUM POWER

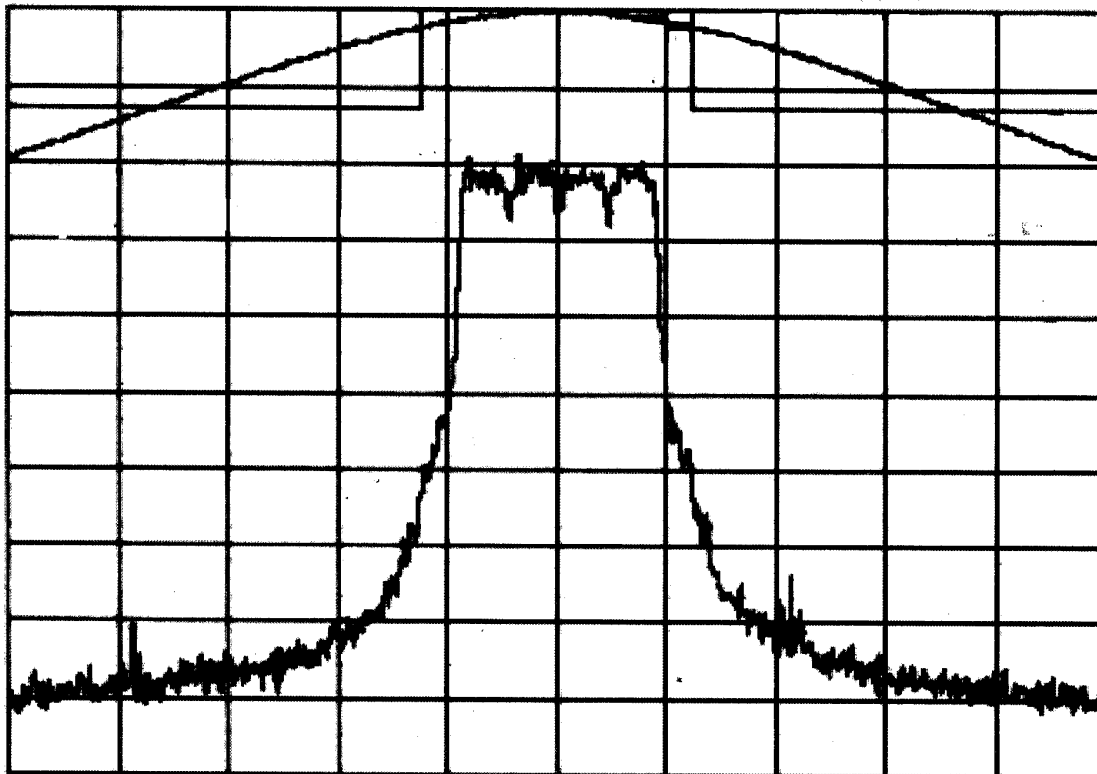
ATTEN 10dB

RL - .8dBm

10dB/

MKR -22.50dBm

820.9892MHz



CENTER 820.9895MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 20.0sec

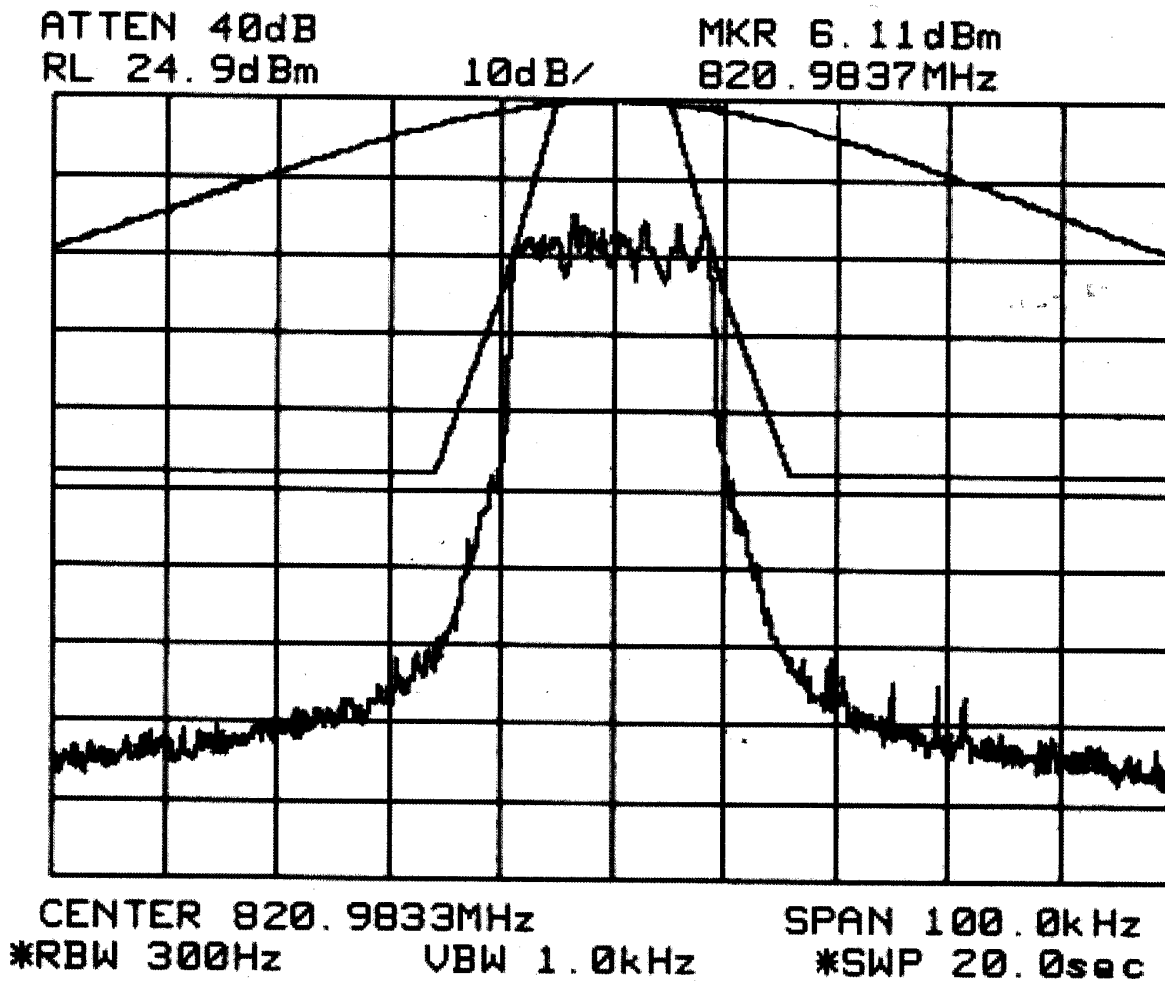
QUAD-16QAM MASK 47 CFR 90.691
MINIMUM POWER

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 15 of 36

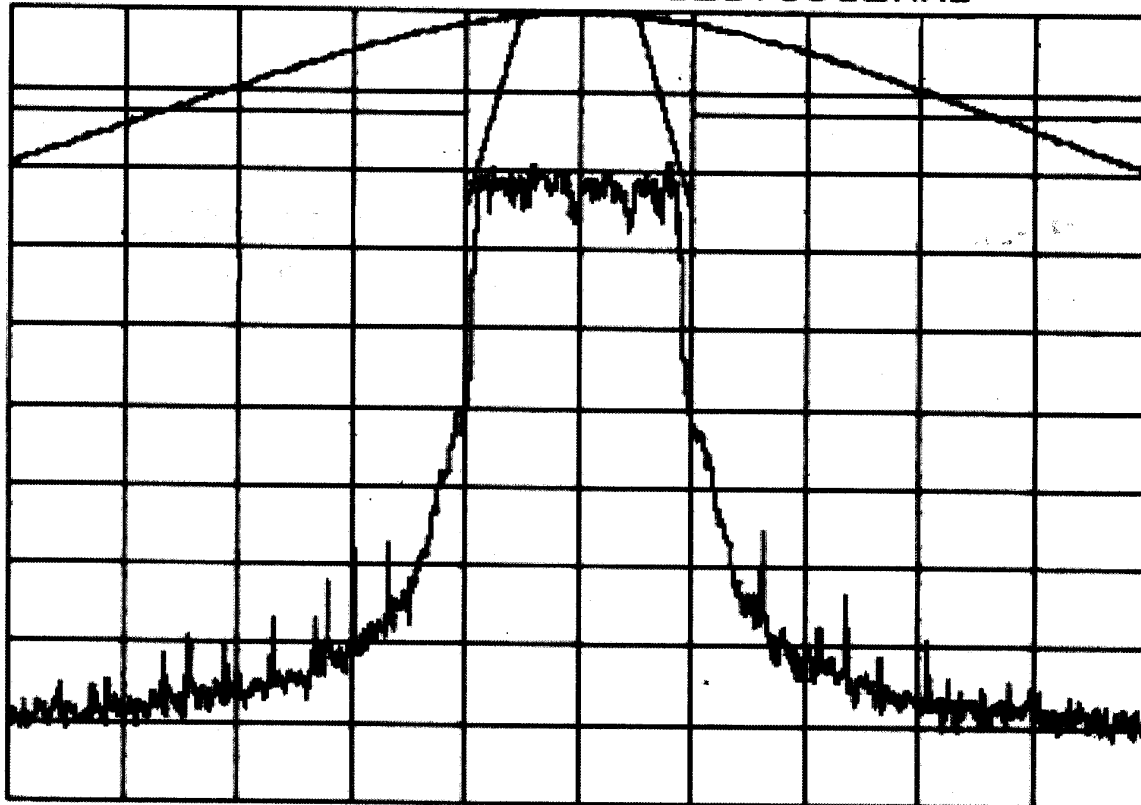


QUAD-64QAM MASK 47 CFR 90.210 (g)
MAXIMUM POWER

ATTEN 10dB
RL -.8dBm

10dB/

MKR -27.16dBm
820.9902MHz



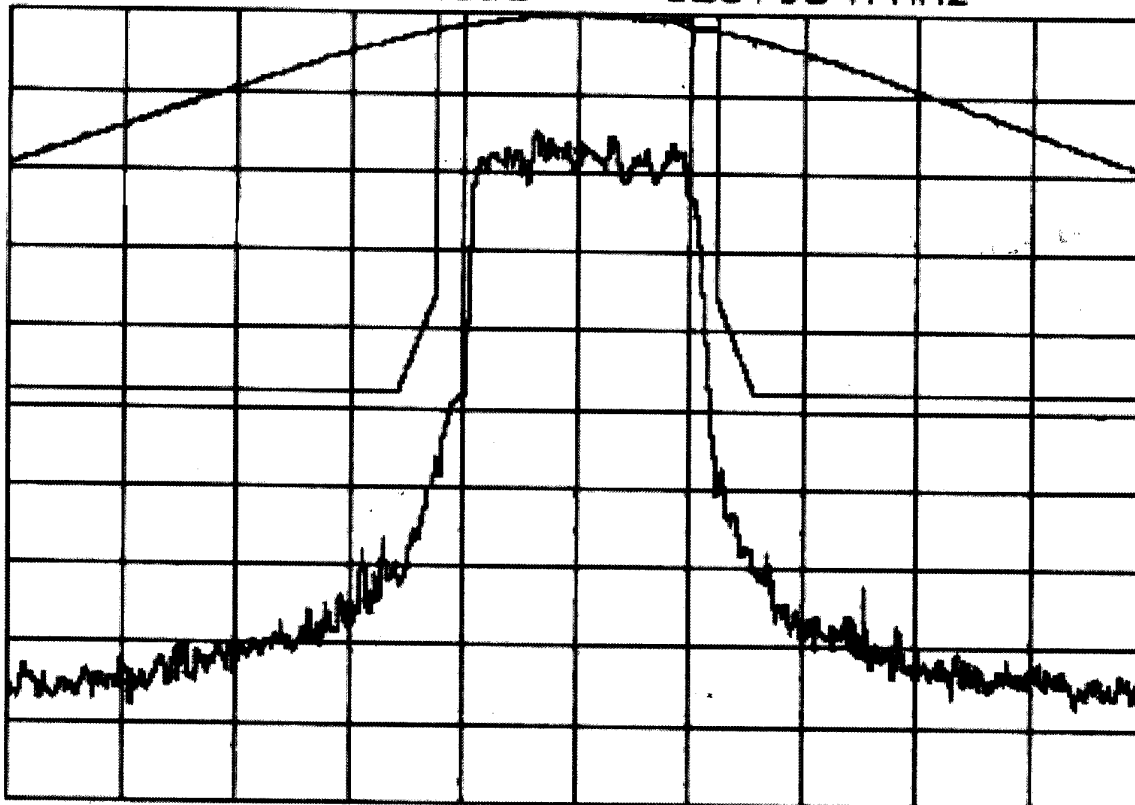
CENTER 820.9905MHz
*RBW 300Hz VBW 1.0kHz SPAN 100.0kHz
*SWP 20.0sec

QUAD-64QAM MASK 47 CFR 90.210 (g)
MINIMUM POWER

ATTEN 40dB
RL 24.9dBm

10dB/

MKR 6.77dBm
820.9847MHz



CENTER 820.9843MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 20.0sec

QUAD-64QAM MASK 47 CFR 90.691
MAXIMUM POWER

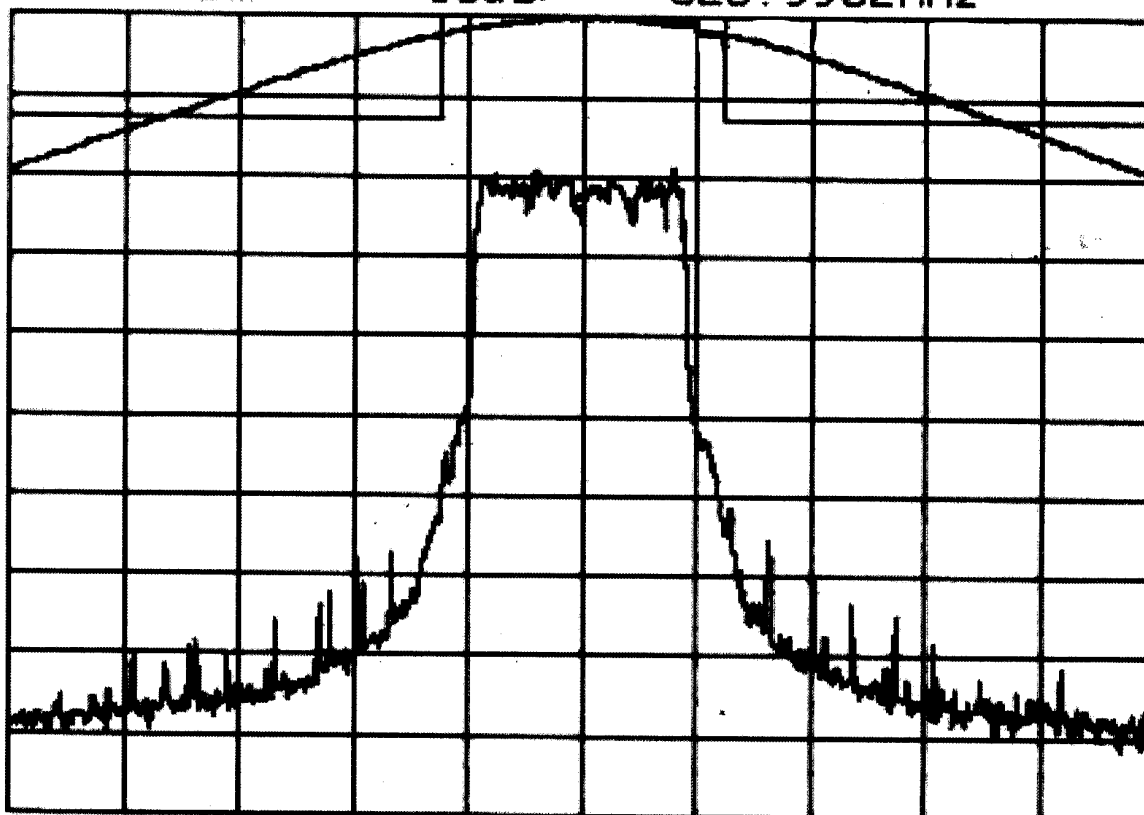
ATTEN 10dB

RL -.8dBm

10dB/

MKR -25.16dBm

820.9902MHz



CENTER 820.9905MHz

*RBW 300Hz

VBW 1.0kHz

SPAN 100.0kHz

*SWP 20.0sec

QUAD-64QAM MASK 47 CFR 90.691
MINIMUM POWER

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

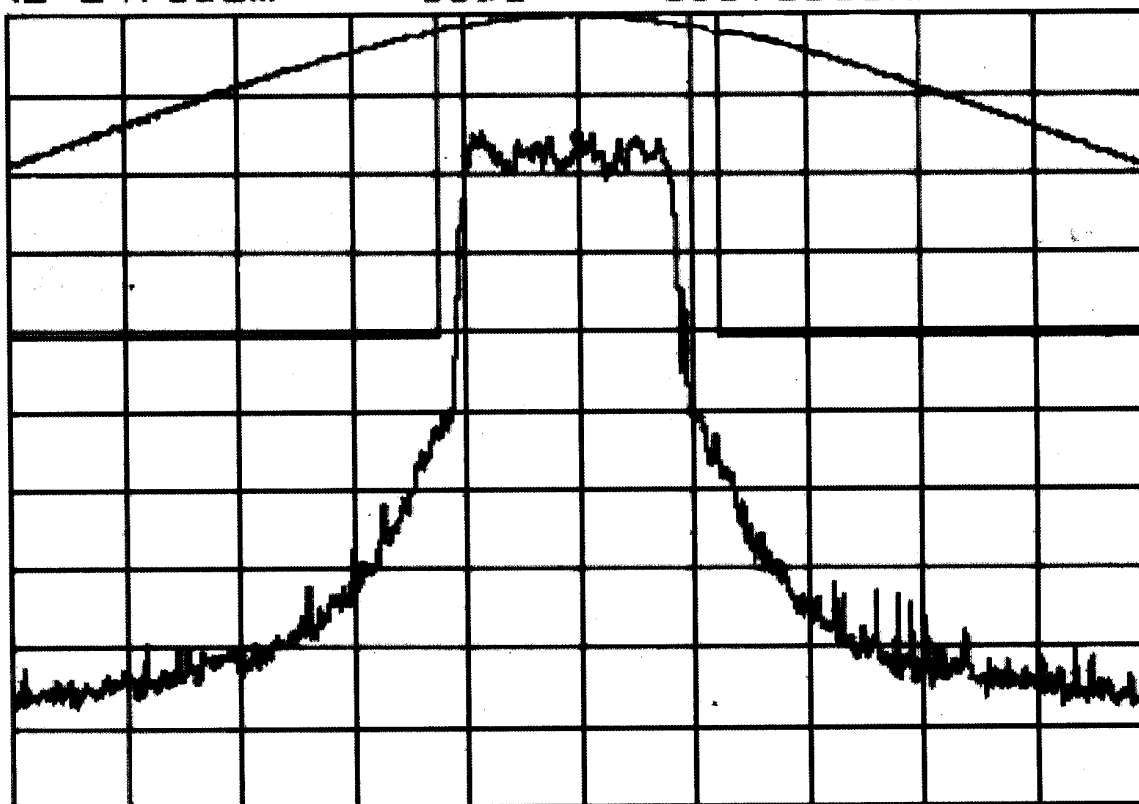
REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 19 of 36

ATTEN 40dB
RL 24.3dBm

10dB/

MKR 7.84dBm
896.0851MHz



CENTER 896.0851MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 20.0sec

QUAD-QPSK MASK 47 CFR 90.669 (a)
MAXIMUM POWER

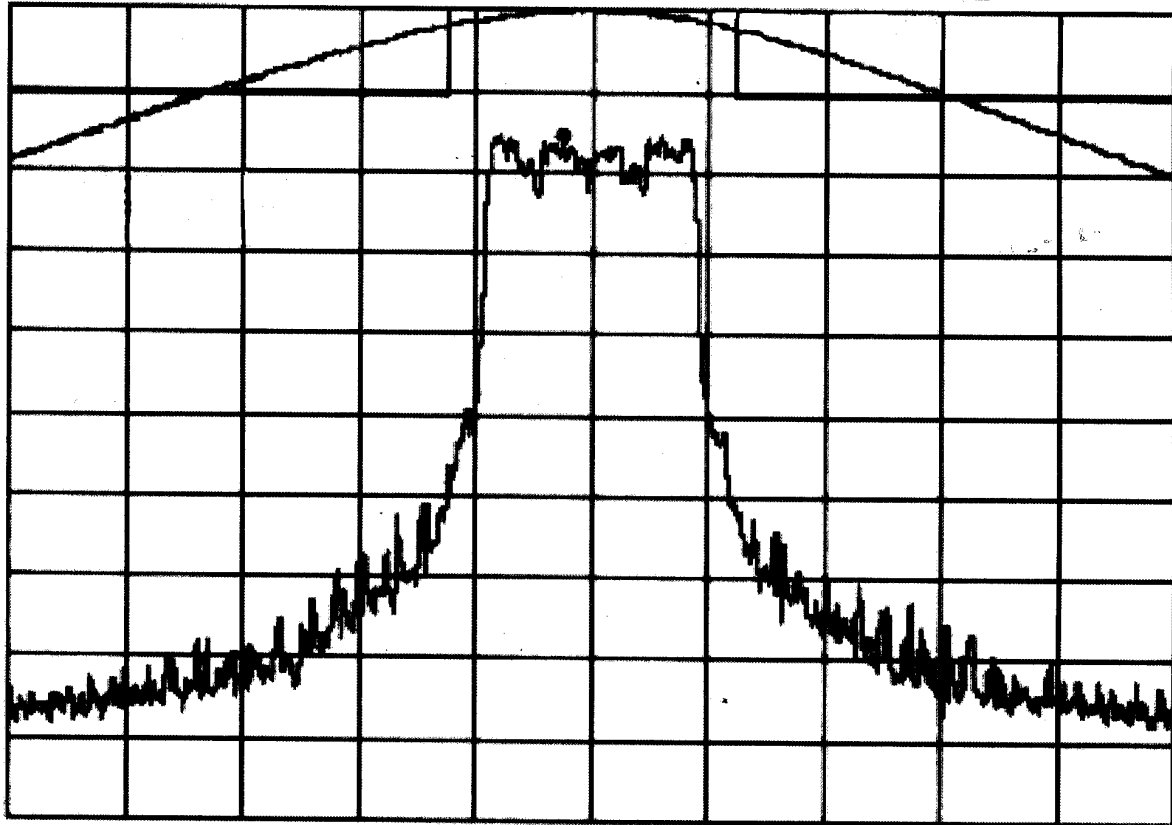
ATTEN 10dB

RL -.8dBm

10dB/

MKR -17.33dBm

896.0829MHz



CENTER 896.0854MHz

*RBW 300Hz

UBW 1.0kHz

SPAN 100.0kHz

*SWP 20.0sec

QUAD-QPSK MASK 47 CFR 90.669 (a)
MINIMUM POWER

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

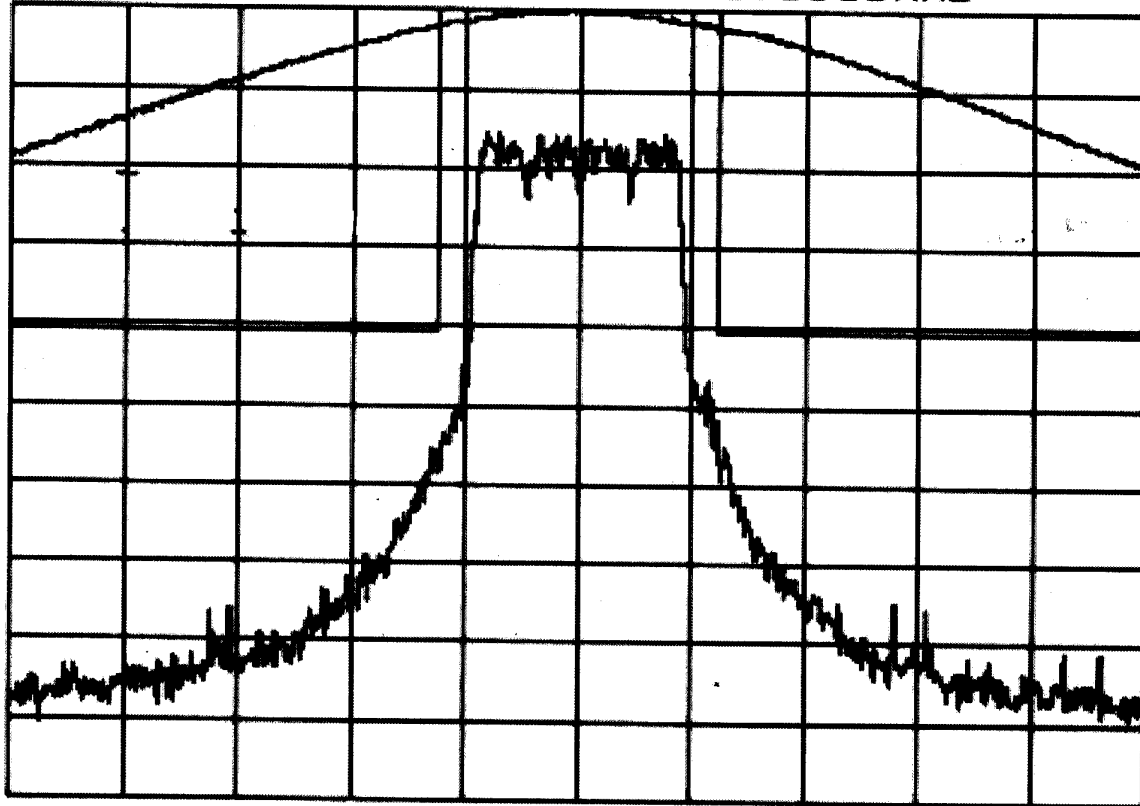
REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 21 of 36

ATTEN 40dB
RL 24.3dBm

10dB/

MKR 3.84dBm
896.0853MHz

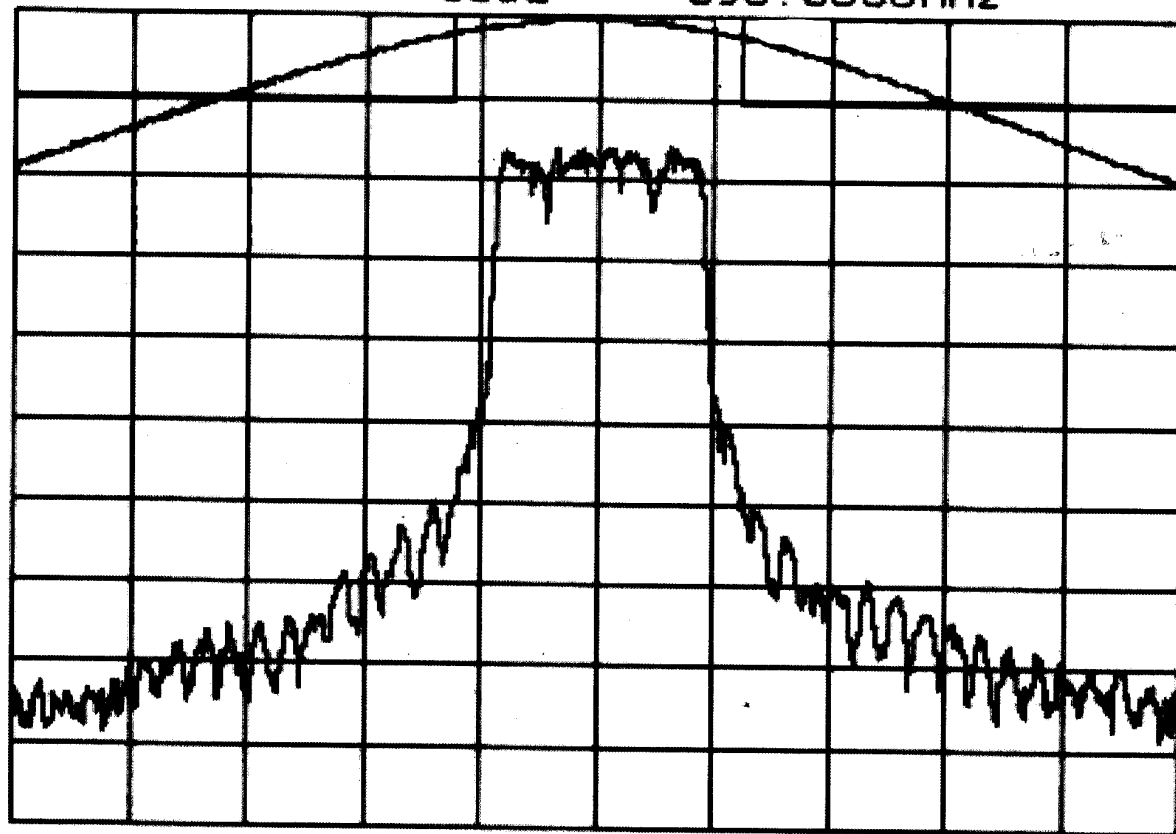


CENTER 896.0851MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 20.0sec

QUAD-16QAM MASK 47 CFR 90.669 (a)
MAXIMUM POWER

10dB✓

MKR -19.33dBm
896.0858MHz



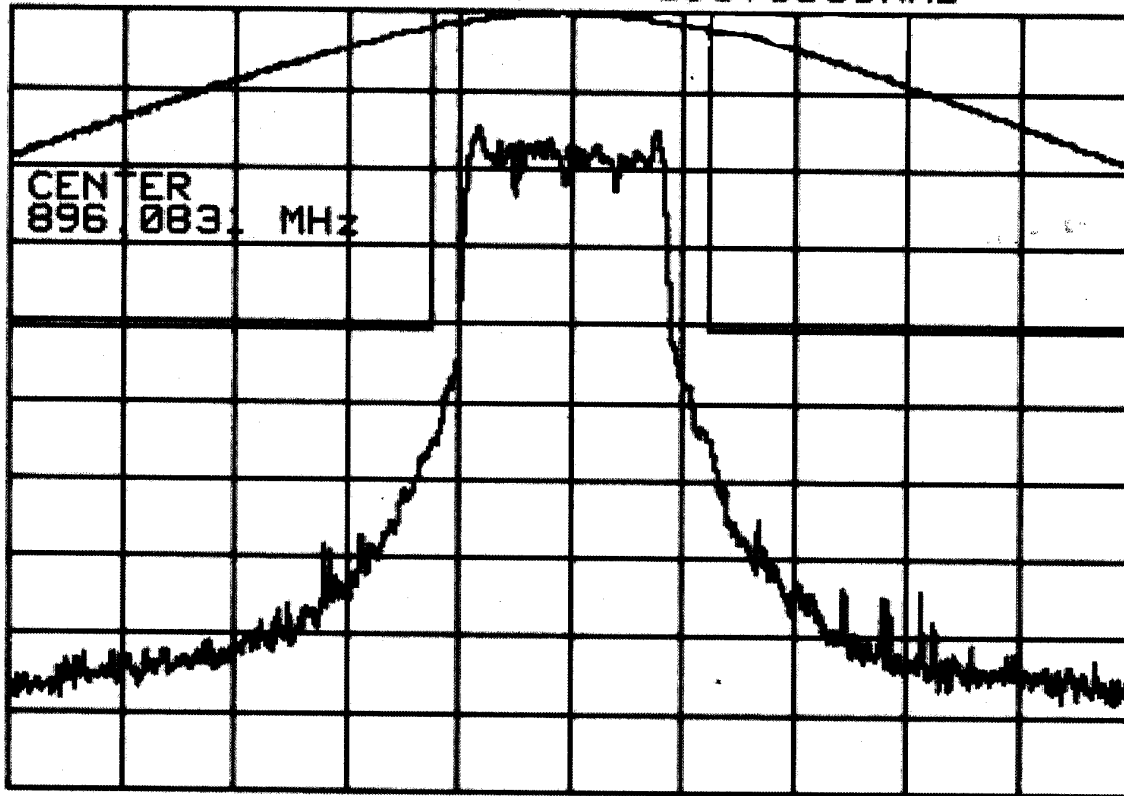
CENTER 896.0873MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 20.0sec

QUAD-16QAM MASK 47 CFR 90.669 (a)
MINIMUM POWER

ATTEN 40dB
RL 24.3dBm

10dB/

MKR 5.34dBm
896.0831MHz



CENTER 896.0831MHz SPAN 100.0kHz
*RBW 300Hz VBW 1.0kHz *SWP 20.0sec

QUAD-64QAM MASK 47 CFR 90.669 (a)
MAXIMUM POWER

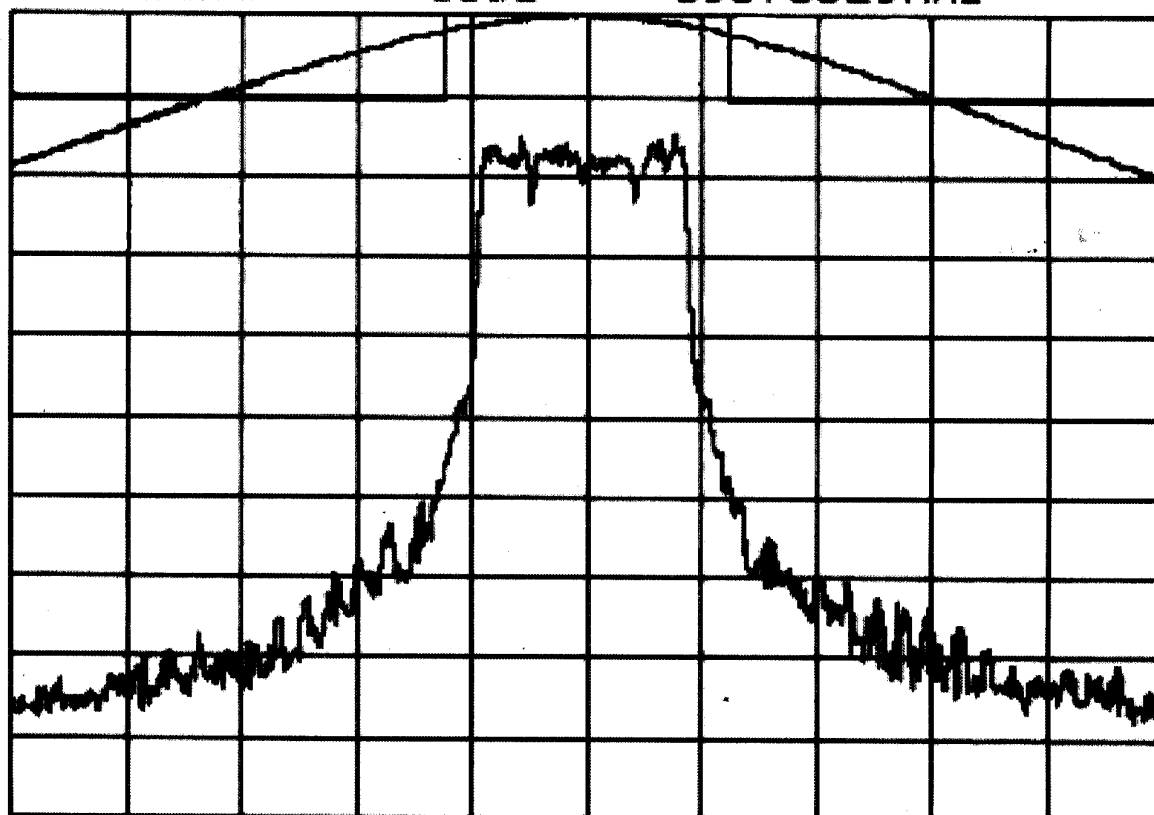
ATTEN 10dB

RL -.8dBm

10dB/

MKR -19.00dBm

896.0829MHz



CENTER 896.0854MHz

*RBW 300Hz

UBW 1.0kHz

SPAN 100.0kHz

*SWP 20.0sec

QUAD-64QAM MASK 47 CFR 90.669 (a)
MINIMUM POWER

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 25 of 36

CONDUCTED SPURIOUS EMISSIONS

FCC LIMITS

Radiated spurious emissions shall be attenuated below the maximum level of emission of the carrier frequency in accordance with the following formula:

Spurious attenuation in dB = $43 + 10 \log_{10}(P)$
(Thus the effective limit is -13 dBm for any transmitter power level).

NOTE 1: Tested at both maximum and minimum power output settings.

NOTE 2: Spurious emissions are independent of modulation type. Quad-16QAM was used to obtain the results reported.

NOTE 3: An asterisk (*) in the data indicates the spurious emissions was less than -33 dBm or could not be detected due to noise limitations or ambients.

2.1051 Spurious emissions at antenna terminals(conducted):
 2.1052 Data on the following page 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.

REQUIREMENTS: Emissions must be $43 + 10\log(P_o)$ dB below the mean power output of the transmitter.

TUNED FREQUENCY MHz	EMISSION FREQUENCY MHz	dB BELOW CARRIER HIGH POWER	dB BELOW CARRIER LOW POWER
806	806	0	0
	1612.1	57.8	61.7
	2418.2	71.3	*
	3224.2	71.2	*
	4030.3	*	*
	4836.4	*	*
	5642.4	*	*
	6448.5	*	*
	7254.6	*	*
	8060.7	*	*
813.5	813.5	0	0
	1627.1	59.6	62.9
	2440.7	70.5	*
	3254.2	74	*
	4067.8	*	*
	4881.4	*	*
	5694.9	*	*
	6508.5	*	*
	7322.1	*	*
	8135.7	*	*
820.9	820.9	0	0
	1642.0	60.6	69.8
	2463.0	75	*
	3284.0	74.2	*
	4105.0	*	*
	4926.0	*	*
	5747.0	*	*
	6568.0	*	*
	7389.0	*	*
	8210.0	*	*

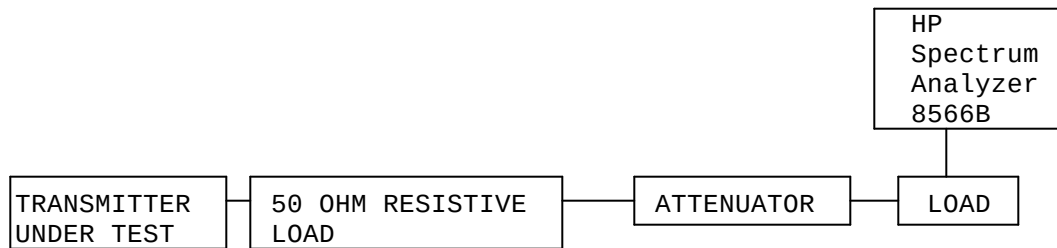
2.1053 Spurious emissions at antenna terminals(conducted):
 2.1054 Data on the following page shows the level of conducted spurious responses. The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603.

REQUIREMENTS: Emissions must be 43 +10log(Po) dB below the mean power output of the transmitter.

TUNED FREQUENCY MHz	EMISSION FREQUENCY MHz	dB BELOW CARRIER HIGH POWER	dB BELOW CARRIER LOW POWER
896.00	154.65	0	0
	309.30	*	*
	1050.67	*	*
	1205.32	*	*
	1792.04	57	*
	2688.06	71	*
	3584.08	71	*
	4480.10	*	*
	5376.11	*	*
	6272.13	*	*
	7168.15	*	*
	8064.17	*	*
	8960.19	*	*
	154.65	0	0
900.98	309.30	*	*
	1055.63	*	*
	1210.28	*	*
	1801.96	59	*
	2702.94	72	*
	3603.93	74	*
	4504.91	*	*
	5405.89	*	*
	6306.87	*	*
	7207.85	*	*
	8108.83	*	*
	9009.81	*	*

* = greater than 20 dB below FCC limits

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD without any exceptions. An audio generator was connected to the UUT through a dummy microphone circuit and the output of the transmitter connected to a standard load and from the standard load through a pre-selector filter of the spectrum analyzer. The spectrum was scanned from 400 kHz to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer. The measurements were made using the shielded room located at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 29 of 36

2.1053 Field strength of spurious emissions:

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must 43 + 10log (po) dB below the mean power output of the transmitter.

TEST DATA:

EMISSION FREQUENCY MHZ	METER READING	V or H	dBc	COAX LOSS dB	CORRECTED SIGNAL GENERATOR LEVEL dBm	DIPOLE CORRECTION FACTOR
806.00	96.0	V	0	0	29.3	0
1612.00	28.5	V	78.70	1.1	-49	5
2418.00	17.0	V	85.04	1.3	-56	5.24
3224.00	14.1	V	82.34	1.35	-53	7.3
813.50	95.2	V	0	0	28.5	0
1627.00	27.4	V	79.00	1.1	-51	5
2440.50	16.7	V	84.54	1.3	-56	5.24
3254.00	15.6	V	80.05	1.35	-52	7.3
821.00	95.3	V	0	0	28.6	0
1642.00	27.0	V	79.50	1.1	-51	5
2463.00	15.9	V	85.44	1.3	-57	5.24
3284.00	15.7	V	80.05	1.35	-51	7.3
896.00	95.5	V	0	0	28.8	0
1792.00	27.6	V	78.80	1.1	-50	5
2688.00	17.0	V	85.80	1.3	-57	6.85
3584.00	14.5	V	81.80	1.35	-53	7.3
902.00	94.90	V	0	0	28.2	0
1804.00	27.0	V	79.20	1.1	-51	5
2706.00	16.3	V	86.20	1.3	-58	6.85
3608.00	15.8	V	80.20	1.40	-52	7.55

SAMPLE CALCULATION: Corrected Signal Generator Level = Signal Generator Level + Coax Loss - Correction Factor to dipole

dBc = ERP(dBm) - Corrected Signal Generator Level

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.

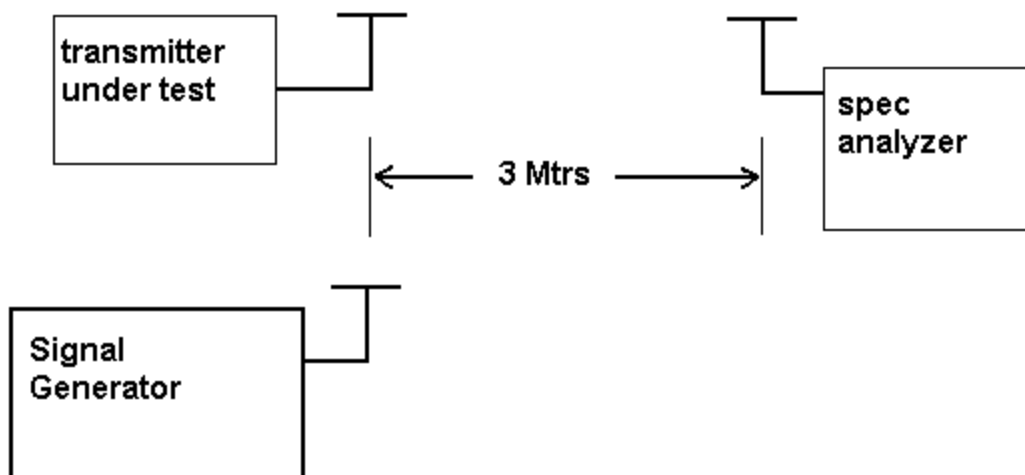
APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 30 of 36

METHOD OF MEASURING RADIATED EMISSIONS



APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 31 of 36

2.1055 Frequency stability:
90.213(a)(1)

Because of the transmitter's dependence on the stability of the base station oscillator, it is not possible to provide stability data for this transmitter as is commonly supplied for certification per 47 CFR 2.1055 for a radio with a locally stabilized oscillator.

The following information is provided to clarify how the transmitter attains the necessary accuracy of 2.5 PPM or better for 800MHz band operation and 1.5PPM or better for 900MHz band operation. The transmitter's suppressed carrier emission is produced by mixing of a modulated intermediate frequency with a higher, digitally synthesized injection frequency with a resolution of 12.5 kHz. Both of these frequencies are derived from a temperature compensated crystal oscillator (Y300). Transmission frequency accuracy is enhanced by the radio receiver circuitry, which causes the radio operating frequency to become locked to within 0.4 PPM of the base station once it has acquired the primary control channel. Thus the temperature and voltage frequency stability of the transmitter is within 0.4 PPM accuracy of the higher stability base station oscillator. The AFC routine and frequency locking mechanism are implemented using both hardware and software. The hardware and software combined provide an automatic frequency control function which locks the receiver to within 0.4 PPM of the control channel oscillator.

Since the base station stability is FCC regulated to be 1.5 PPM or better for the 800MHz band and 0.1 PPM or better for the 900MHz band, the absolute accuracy of the transmitter is inherently better than 1.9 PPM in the 800MHz band and 0.5 PPM in the 900MHz band. This is accomplished by programming U600 while the radio is in operation.

Transmitter frequency stability is guaranteed over all specified environmental operating conditions (battery voltage, temperature, humidity, etc.) because of the nature of the base station frequency locking mechanism. The frequency stability of the transmitter is maintained until the battery voltage drops below 3.55 volts. Any voltage below 3.55 volts is outside the specified operating range of the transmitter and linearity is degraded below 3.55 volts. For this reason, the radio shuts down (while in transmit mode) when the voltage drops below 3.55 volts.

Note:

Frequency stability is independent of modulation scheme (Quad -QPSK, Quad-16QAM, Quad-64QAM). The data shown in following tables was taken with the radio set to transmit a Quad-16QAM signal at 813.0625 and 899.48125 MHz while locked to a service monitor.

Readings were also taken at the end point of the battery voltage of 4.0 Vdc.

2.1055 Frequency stability Continued:

MEASUREMENT DATA:

Temperature (Degrees C)	Frequency Error (Hz)		Frequency Error (PPM)	
	800 MHz	900 MHz	800 MHz	900 MHz
-30	32	21	0.039	0.023
-20	23	59	0.028	0.066
-10	31	44	0.038	0.049
0	4	20	0.005	0.022
10	17	54	0.021	0.060
20	35	4	0.043	0.004
30	8	65	0.010	0.072
40	26	9	0.032	0.010
50	21	2	0.026	0.002
60	37	44	0.046	0.049

Power Supply Voltage (V)	Frequency Error (Hz)		Frequency Error (PPM)	
	800 MHz	900 MHz	800 MHz	900 MHz
4.3	29	12	0.036	0.013
4.2	41	46	0.050	0.051
4.1	2	13	0.002	0.014
4	22	36	0.027	0.040
3.9	57	39	0.070	0.043
3.8	42	26	0.052	0.029
3.7	36	23	0.044	0.026
3.6	0	18	0.000	0.020

RESULTS OF MEASUREMENTS: The maximum frequency variation over the temperature range was +0.046 ppm for the 800 MHz band and +0.066 ppm for the 900 MHz band.

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 33 of 36

EQUIPMENT LIST

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
X	3-Meter OATS	TEI	N/A	N/A	Listed 12/22/99	12/22/02
	3/10-Meter OATS	TEI	N/A	N/A	Listed 3/26/01	3/26/04
	Receiver, Beige Tower Spectrum Analyzer (Tan)	HP	8566B Opt 462	3138A07786 3144A20661	CAL 8/31/01	8/31/03
	RF Preselector (Tan)	HP	85685A	3221A01400	CAL 8/31/01	8/31/03
	Quasi-Peak Adapter (Tan)	HP	85650A	3303A01690	CAL 8/31/01	8/31/03
X	Receiver, Blue Tower Spectrum Analyzer (Blue)	HP	8568B	2928A04729 2848A18049	CHAR 10/22/01	10/22/03
X	RF Preselector (Blue)	HP	85685A	2926A00983	CHAR 10/22/01	10/22/03
X	Quasi-Peak Adapter (Blue)	HP	85650A	2811A01279	CHAR 10/22/01	10/22/03
X	Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
	Biconnical Antenna	Eaton	94455-1	1096	CAL 10/1/01	10/1/03
	Biconnical Antenna	Eaton	94455-1	1057	CHAR 3/15/00	3/15/02
	BiconiLog Antenna	EMCO	3143	9409-1043		
X	Log-Periodic Antenna	Electro-Metrics	LPA-25	1122	CAL 10/2/01	10/2/03
	Log-Periodic Antenna	Electro-Metrics	EM-6950	632	CHAR 10/15/01	10/15/03
	Log-Periodic Antenna	Electro-Metrics	LPA-30	409	CHAR 10/16/01	10/16/03
	Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	152	CAL 3/21/01	3/21/04
	Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 11/24/00	11/24/03
	Double-Ridged Horn Antenna	Electro-Metrics	RGA -180	2319	CAL 12/19/01	12/19/03
	Horn Antenna	Electro-Metrics	EM-6961	6246	CAL 3/21/01	3/21/03
	Horn Antenna	ATM	19-443-6R	None	No Cal Required	
	Passive Loop Antenna	EMC Test Systems	EMCO 6512	9706-1211	CHAR 7/10/01	7/10/03
	Line Impedance Stabilization . . .	Electro-Metrics	ANS-25/2	2604	CAL 10/9/01	10/9/03

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 34 of 36

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	Line Impedance Stabilization . . .	Electro-Metrics	EM-7820	2682	CAL 3/16/01	3/16/03
	Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 5/25/99	5/25/01
	Termaline Wattmeter	Bird Electronic Corporation	6104	1926	CAL 12/12/01	12/12/03
	Oscilloscope	Tektronix	2230	300572	CHAR 2/1/01	2/1/03
	Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 1/22/02	1/22/04
	AC Voltmeter	HP	400FL	2213A14499	CAL 10/9/01	10/9/03
	AC Voltmeter	HP	400FL	2213A14261	CHAR 10/15/01	10/15/03
	AC Voltmeter	HP	400FL	2213A14728	CHAR 10/15/01	10/15/03
X	Digital Multimeter	Fluke	77	35053830	CHAR 1/8/02	1/8/04
	Digital Multimeter	Fluke	77	43850817	CHAR 1/8/02	1/8/04
	Digital Multimeter	HP	E2377A	2927J05849	CHAR 1/8/02	1/8/04
	Multimeter	Fluke	FLUKE-77-3	79510405	CAL 9/26/01	9/26/03
	Peak Power Meter	HP	8900C	2131A00545	CHAR 1/26/01	1/26/03
	Digital Thermometer	Fluke	2166A	42032	CAL 1/16/02	1/16/04
	Thermometer	Traulsen	SK-128		CHAR 1/22/02	1/22/04
X	Temp/Humidity gauge	EXTech	44577F	E000901	CHAR 1/22/02	1/22/04
	Frequency Counter	HP	5352B	2632A00165	CAL 11/28/01	11/28/03
	Power Sensor	Agilent Technologies	84811A	2551A02705	CAL 1/26/01	1/26/03
	Service Monitor	IFR	FM/AM 500A	5182	CAL 11/22/00	11/22/02
	Comm. Serv. Monitor	IFR	FM/AM 1200S	6593	CAL 5/12/02	5/12/04
	Signal Generator	HP	8640B	2308A21464	CAL 11/15/01	11/15/03
	Modulation Analyzer	HP	8901A	3435A06868	CAL 9/5/01	9/5/03
	Near Field Probe	HP	HP11940A	2650A02748	CHAR 2/1/01	2/1/03
	BandReject Filter	Lorch Microwave	5BR4-2400/ 60-N	Z1	CHAR 3/2/01	3/2/03

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 35 of 36

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	BandReject Filter	Lorch Microwave	6BR6-2442/ 300-N	Z1	CHAR 3/2/01	3/2/03
	BandReject Filter	Lorch Microwave	5BR4-10525/ 900-S	Z1	CHAR 3/2/01	3/2/03
	High Pas Filter	Microlab	HA-10N		CHAR 10/4/01	10/4/03
	Audio Oscillator	HP	653A	832-00260	CHAR 3/1/01	3/1/03
	Frequency Counter	HP	5382A	1620A03535	CHAR 3/2/01	3/2/03
	Frequency Counter	HP	5385A	3242A07460	CHAR 12/11/01	12/11/03
	Preamplifier	HP	8449B-H02	3008A00372	CHAR 3/4/01	3/4/03
	Amplifier	HP	11975A	2738A01969	CHAR 3/1/01	3/1/03
	Egg Timer	Unk			CHAR 8/31/01	8/31/03
	Measuring Tape, 20M	Kraftixx	0631-20		CHAR 2/1/02	2/1/04
	Measuring Tape, 7.5M	Kraftixx	7.5M PROFI		2/1/02	2/1/04
	Coaxial Cable #51	Insulated Wire Inc.	NPS 2251-2880	Timco #51	CHAR 1/23/02	1/23/04
	Coaxial Cable #64	Semflex Inc.	60637	Timco #64	CHAR 1/24/02	1/24/04
	Coaxial Cable #65	General Cable Co.	E9917 RG233/U	Timco #65	CHAR 1/23/02	1/23/04
	Coaxial Cable #106	Unknown	Unknown	Timco #106	CHAR 1/23/02	1/23/04

APPLICANT: ELUTIONS, INC.

FCC ID: Q4I0008837940

REPORT #: T:\E\ELUTIONS_\520AUT3\520AUT3TestReport.doc

Page 36 of 36