

# **CERTIFICATION**

TEST REPORT PREPARED ON BEHALF OF

**SB TECHNOLOGY, INC.**

FOR THE

**FCC ID: OTVSBTFR530-2**

Under Part 95, Family Radio Service

Prepared

By

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March 23, 2000

## CERTIFICATION

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**TEST: RF POWER OUTPUT**

FCC ID: OTVSBTFR530-2

Grantee: SB Technology, Inc.

Serial No.: none

Manufacture Rating: .3 Watt

Equipment Authorization  
Procedure: Para. 2.985 (a)

Duty Cycle: PTT

Frequency Measured: 462.7125 and 467.5625 MHz  
Mid Lower and Upper FRS Band

| Freq.<br>MHz | Horz.<br>dBuV | Ant-F | Cable<br>Loss | dBuV/m | V/m      | mWatts |
|--------------|---------------|-------|---------------|--------|----------|--------|
| 462.6375     | 96.33         | 22.3  | 1.17          | 119.8  | .977237  | .2864  |
| 467.6375     | 96.67         | 22.3  | 1.17          | 120.14 | 1.016248 | .3098  |

We used the following formula to convert from field strength (FS) in volts/meter to transmitter output power (TP) in Watts, where D is the distance in meters between the two antennas and G is the numerical gain referenced to isotropic gain. Due to the integral whip antenna, G = 1.0 (unity gain) was assumed.

$$TP = \frac{(FS \times D)^2}{30 \times G}$$

Maximum Measured Transmitter Output Power: .3098 mWatt

Note: Due to the product design with surface mount components it was not practical to physically measure the collector current (IC) and collector voltage (VC) directly for the exciter input.

**TEST: MODULATION CHARACTERISTICS**

FCC ID: OTVSBTFR530-2

Grantee: SB Technology, Inc.

Serial No.: none

Minimum Standard Specified: Para. 95.633 & 95.635

Test Results: Equipment is Compliant with Standard

Equipment Authorization Procedure: Para. 2.1047

**MEASUREMENT DATA**

Audio Frequency Response see Pg. 3

Input: the audio was fed to a dummy microphone circuit  
and into the FR530-2 external speaker/mic input jack.

Output: demodulated output of FM service monitor.

Audio Input vs Modulation Limiting Capability see Pg. 4

Input: external microphone input

Output: demodulated output of FM service monitor

Frequency Response of the Audio Low Pass Filter see Pg. 5

Input: external microphone input

Output: LP filter output

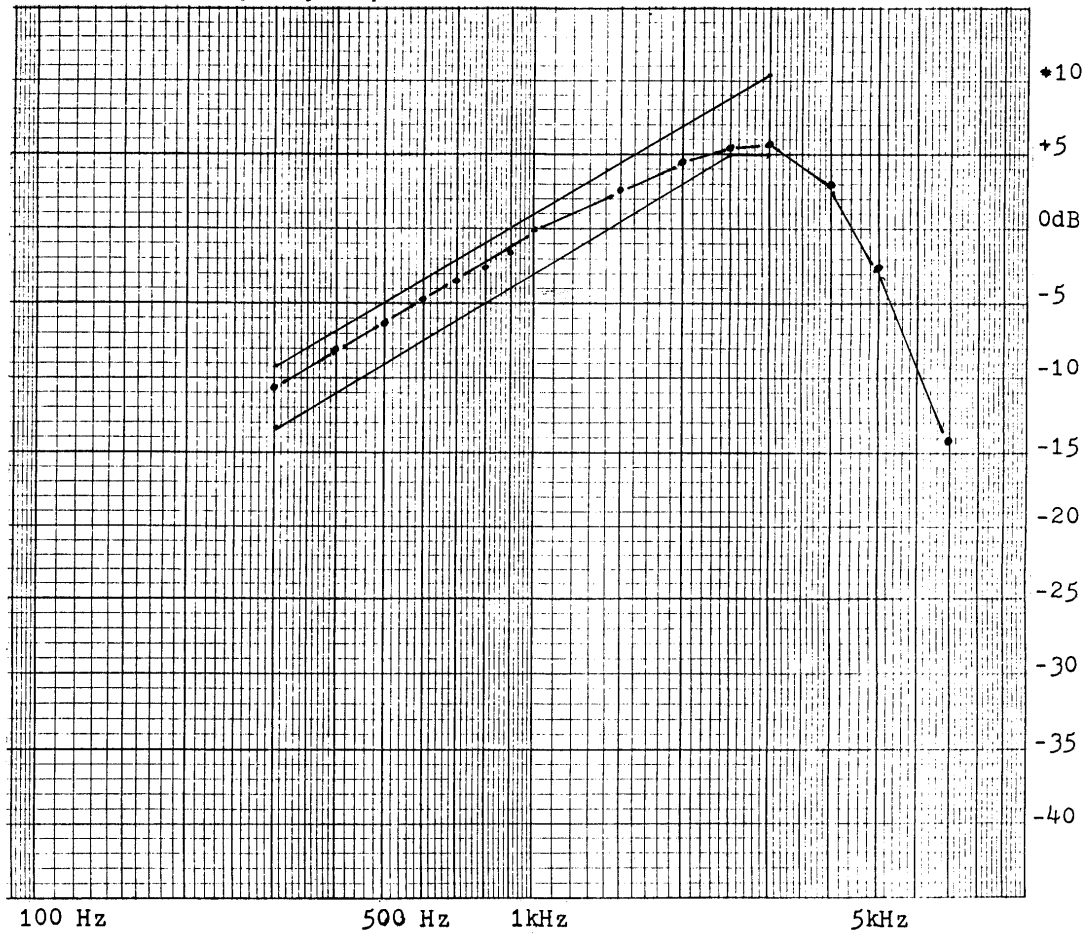


TEST: MODULATION CHARACTERISTICS

FCC ID: OTVSBTFR530-2

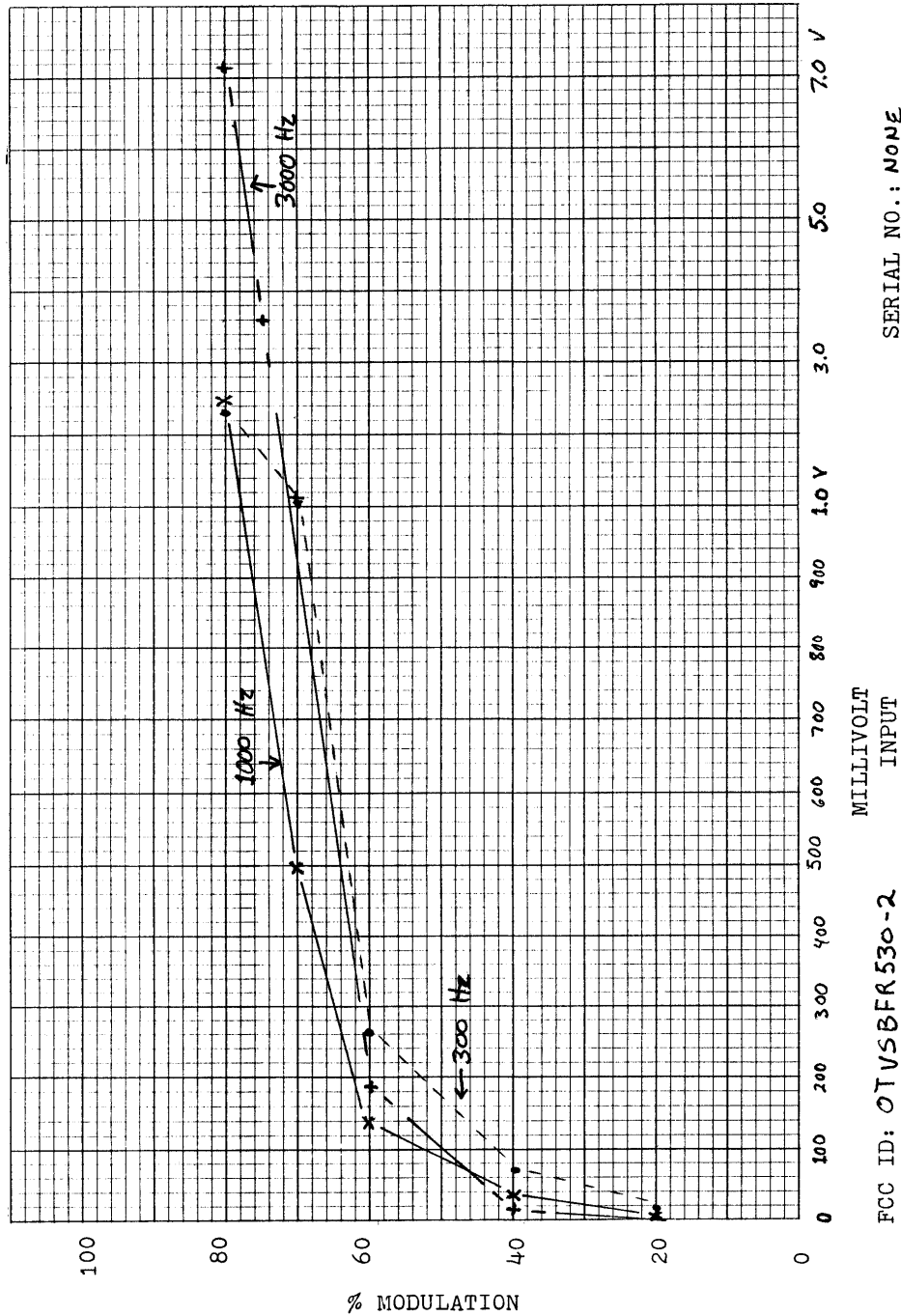
Grantee: SB Technology, Inc.

**Audio Frequency Response**



MODULATING FREQUENCY IN HERTZ

TEST: MODULATION LIMITING CAPABILITY



SERIAL NO.: NONE

PARA: 2.987 (b)

MILLIVOLT  
INPUT

FCC ID: OTVSBFR530-2

GRANTEE: SB TECHNOLOGY INC

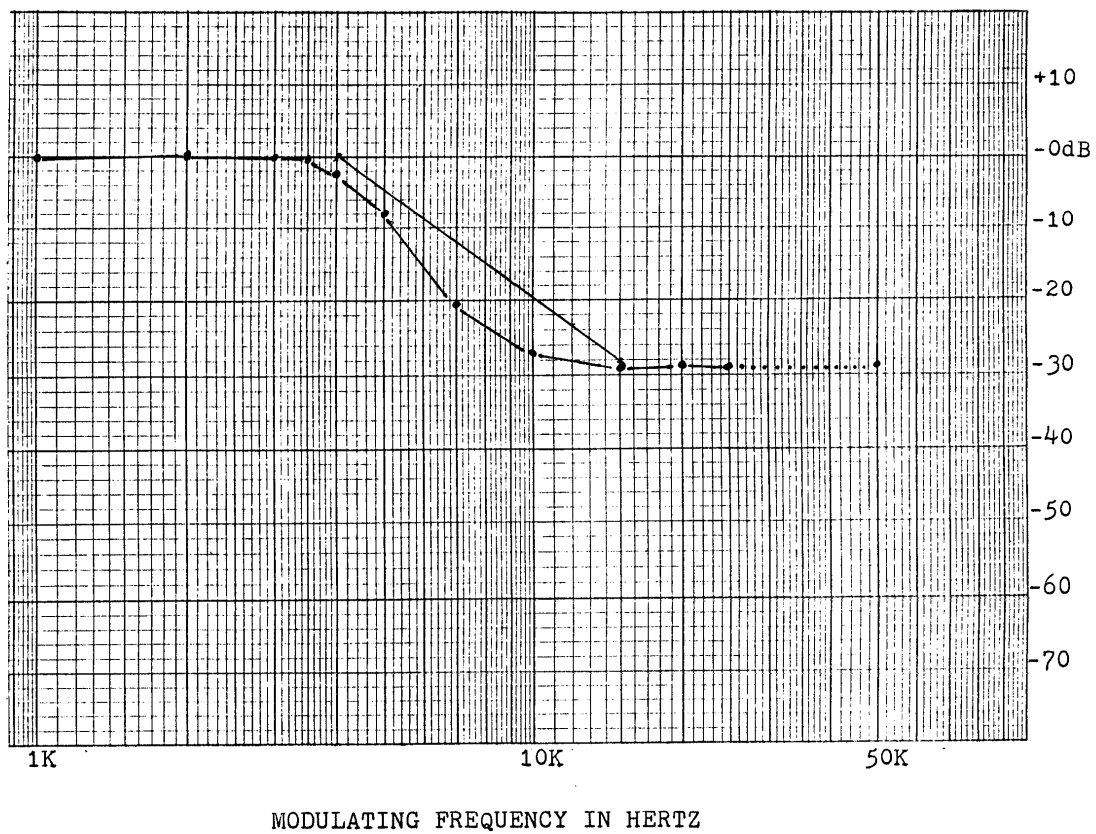
2/8/2000

TEST: MODULATION CHARACTERISTICS

FCC ID: OTVSBTFR530-2

Grantee: SB Technology, Inc.

**Frequency Response of the Audio Low Pass Filter**





**TEST: OCCUPIED BANDWIDTH**

FCC ID: OTVSBTFR530-2

Grantee: SB Technology, Inc.

Serial No.: none

Minimum Standard Specified: Para. 95.633

Test Results: Equipment is Compliant with Standard

Equipment Authorization  
Procedure: Para. 2.1049

Test Equipment Set Up: Please refer to Block Diagram #1

**MEASUREMENT DATA**

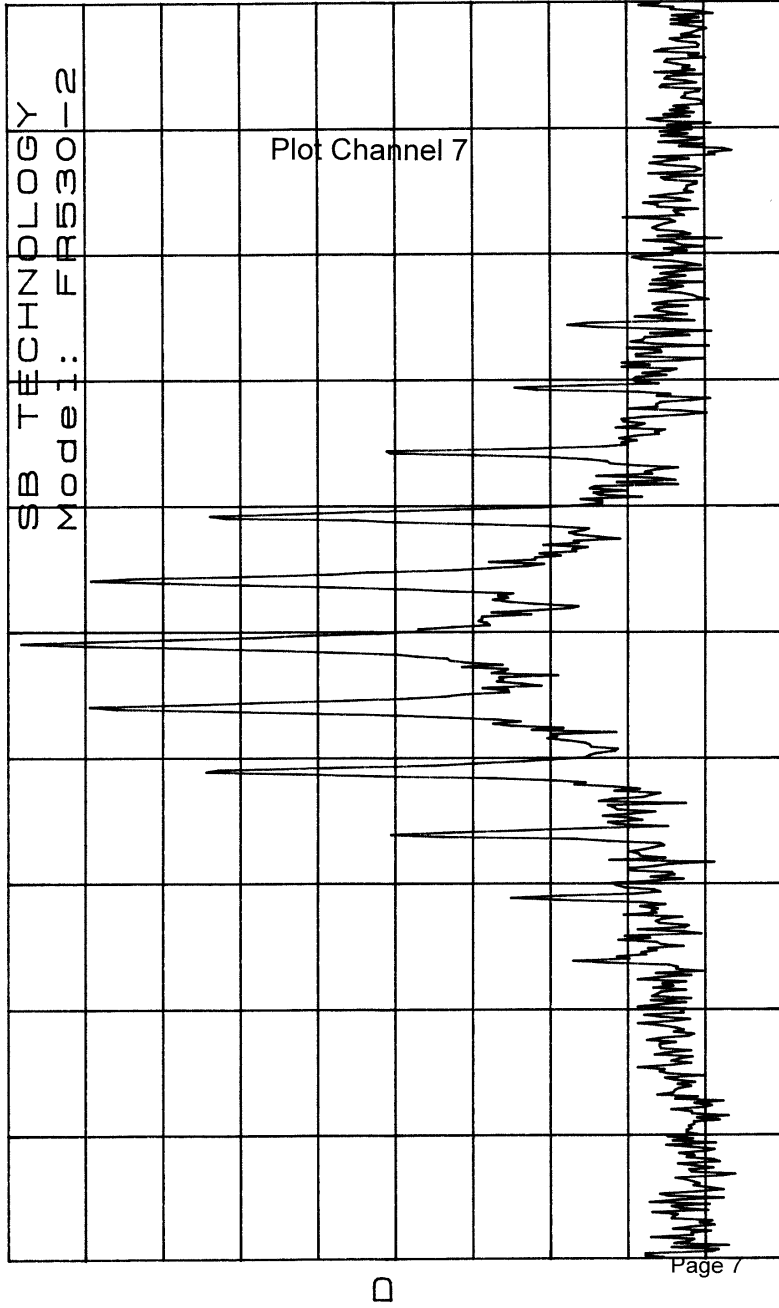
Spectrum Analyzer: Hewlett Packard 8562A

| Test Plots Located on Page:     | Pg. 7    | Pg. 8    |      |
|---------------------------------|----------|----------|------|
| Settings: Resolution Bandwidth: | 100      | 100      | kHz  |
| Video Filter:                   | 100      | 100      | kHz  |
| Sweep Time:                     | 20       | 20       | sec. |
| Scan Width:                     | 50       | 50       | kHz  |
| Center Frequency:               | 462.1725 | 467.5625 | MHz  |

The transmitter was modulated with a 2500 Hz tone fed in to the external microphone input. The transmitter deviation was measured at 2.2 kHz as set by the manufacturer. The measurements were made antenna to antenna. An unmodulated carrier was set to the reference line.

\*ATTEN 10dB  
RL 0dBm

10dB/

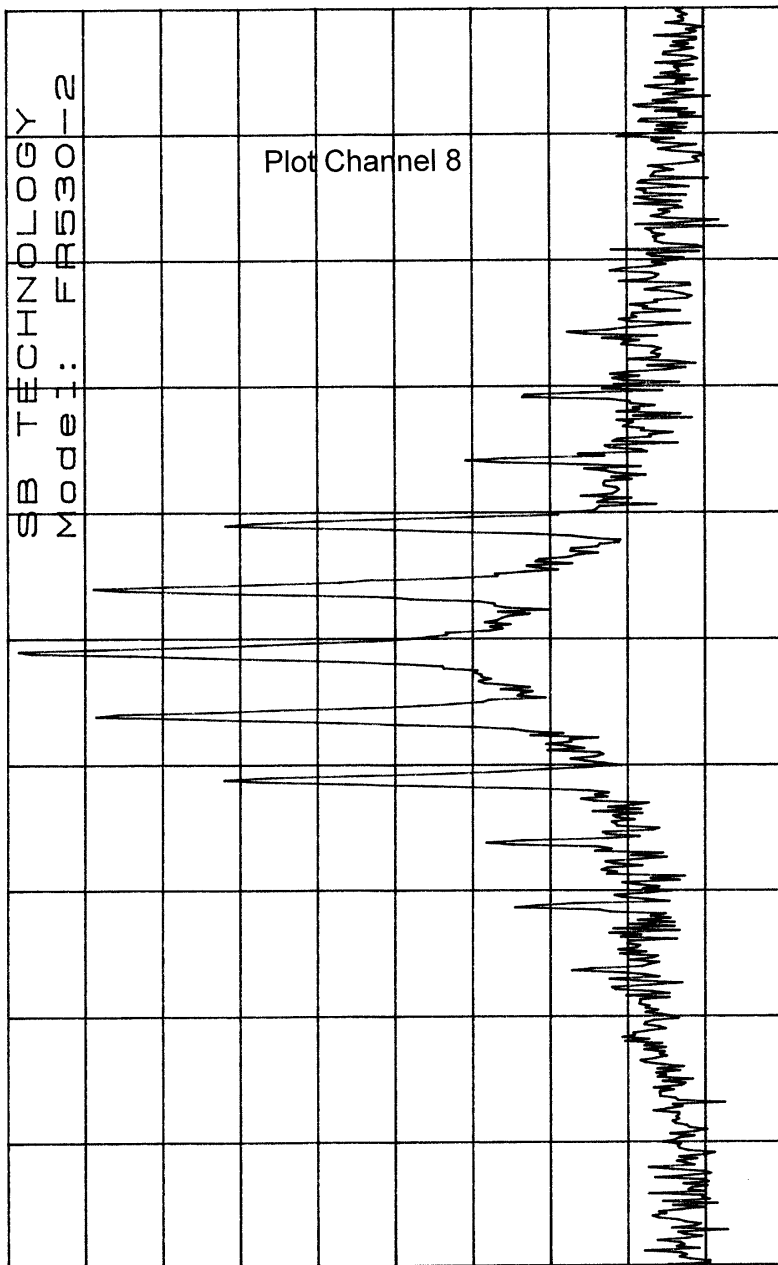


CENTER 462.71250MHZ SPAN 50.00KHZ  
\*RBW 100HZ VBW 100HZ SWP 20sec

\*ATTEN 10dB

RL 0dBm

10dB/



Page 8

CENTER 467.56250MHZ

\*RBW 100HZ

VBW 100HZ

SPAN 50.00KHZ

SWP 20sec

36/100

**TEST: FIELD STRENGTH OF SPURIOUS RADIATION**

FCC ID: OTVSBTFR530-2

Manufacturer: SB Technology, Inc.

Serial No.: none

Minimum Standard Specified: Para. 95.

Test Results: Equipment complies with standard

Equipment Authorization Procedure: Para. 2.1053

Equipment Set Up: See Photo of EUT Setup

Frequency Range Observed: 0 to 4.67375 GHz, Para. 2.1057 10<sup>th</sup> harmonic of the highest fundamental frequency

Operating Frequency: 462.6375 MHz Chan. 4 mid-low group  
467.6375 MHz Chan. 11 mid-high group

Power Output: .309 mWatt power (peak)

Spurious Limit =  $43 \text{ dB} + 10\text{Log}_{10}(\text{PO}) = 43 + 10\text{Log}_{10}(.309) = 37.89 \text{ dB}$

Note: Measurements were made as required by Para. 95.635(a) with and without an optional speaker microphone attached. The worst case results reported were with the option attached.

100 kHz RBW and VBW was used below 1 GHz  
1 MHz RBW and VBW was used above 1 GHz

The worst case peak, max-hold, field strength is reported for the two mid band channels observed on the following page.

**TEST: FIELD STRENGTH OF SPURIOUS RADIATION**

Mid-Low Group FRS Channel 4 462.6375 MHz

Test Date 3/14/00

| Freq.<br>MHz &<br>GHz | Vert.<br>Ant.<br>dBuV | Horz.<br>Ant.<br>dBuV | Ant-F | Cable<br>Loss | BPF<br>Loss<br>used >1<br>GHz | dBuV/m | Limit<br>37.89 dB<br>Margin<br>in dB |
|-----------------------|-----------------------|-----------------------|-------|---------------|-------------------------------|--------|--------------------------------------|
|-----------------------|-----------------------|-----------------------|-------|---------------|-------------------------------|--------|--------------------------------------|

|          |       |       |          |       |       |       |       |
|----------|-------|-------|----------|-------|-------|-------|-------|
| 462.6375 | 94.83 | 96.33 | 22.3     | 1.17  | 0     | 119.8 | -0-   |
| 925.275  | 40.17 | 37.83 | 28.2     | 2.10  | 0     | 70.47 | 11.44 |
| 1.38790  | 45.33 | 44.17 | 23.21    | 1.05  | .67   | 70.26 | 11.65 |
| 1.85054  | 48.17 | 43.5  | 27.15    | 1.22  | .67   | 77.21 | 4.7   |
| 2.31317  | 44.50 | 41.5  | 28.37    | 1.38  | .67   | 74.92 | 6.99  |
| 2.77580  | 40.83 | 39.71 | 31.01    | 1.67  | .67   | 74.18 | 7.73  |
| 3.23846  | 35.0  | 35.17 | 32.45    | 1.8   | .67   | 70.09 | 11.82 |
| 3.70111  | 35.0  | 34.5  | Analyzer | Noise | Floor |       |       |
| 4.16373  | 33.0  | 34.17 | "        |       | "     |       |       |
| 4.62637  | 33.67 | 35.83 | "        |       | "     |       |       |

Mid-High Group FRS Channel 11 467.6375 MHz

|          |       |       |          |       |       |        |               |
|----------|-------|-------|----------|-------|-------|--------|---------------|
| 467.6375 | 92.67 | 96.67 | 22.3     | 1.17  | 0     | 120.14 | -0-           |
| 935.282  | 41.0  | 40.0  | 28.2     | 2.10  | 0     | 71.3   | 10.95         |
| 1.40298  | 45.5  | 47.0  | 23.21    | 1.05  | .67   | 71.93  | 10.32         |
| 1.87055  | 46.0  | 48.67 | 27.15    | 1.22  | .67   | 77.71  | 4.54          |
| 2.33819  | 40.67 | 44.33 | 28.37    | 1.38  | .67   | 74.75  | 7.5           |
| 2.80583  | 41.5  | 46.33 | 31.01    | 1.67  | .67   | 79.68  | <b>2.57 *</b> |
| 3.27346  | 38.33 | 35.0  | 32.45    | 1.8   | .67   | 73.25  | 9.0           |
| 3.74111  | 35.33 | 35.33 | Analyzer | Noise | Floor |        |               |
| 4.20874  | 35.17 | 34.83 | "        |       | "     |        |               |
| 4.67638  | 34.0  | 34.33 | "        |       | "     |        |               |

\* Worst case

The highest level dBuV, either Vertical or Horizontal is calculated. The other reading is provided for information only. No other radiated emissions were measurable when measured at three meters EUT to antenna spacing and 1 MHz RBW and VBW.

**TEST:                      FREQUENCY STABILITY**

FCC ID:                      OTVSBTFR530-2

Grantee:                      SB Technology, Inc.

Serial No:                      none

Minimum Standard Specified:                      Para. 95.627(b)                      Limit +/- .00025%

Equipment Authorization Procedure:                      Para. 2.1055                      -30 to +50 degrees C

Test Frequency: Channel 1 FRS                      462.5625 MHz                      2.5 ppm = +/- 1156 Hz

The default power on channel is channel 1. So it was used for convenience to eliminate having to change channels which would require opening the chamber to physically push the program buttons on the front of the FR530-2, rather than just applying power and remotely keying with the external microphone.

The measurement data is graphically reported on the following page. The frequency was observed when the transmitter was keyed, immediately following power up. This value was recorded and is reported. Measurements at -30, 0 and +50 degrees C showed that the transmitter was within the 2.5 ppm limit at nominal voltage and at battery end point. The equipment power was off during changes in ambient temperature.

Two temperature probes connected to a Fluke 52, were used during the measurements. The first probe was placed in contact with one of the largest internal masses in the transmitter which in this case was part of a shield covering the LO. The other probe was outside of the transmitter within the chamber at a location with good air circulation to accurately measure the internal chamber temperature for comparison the internal transmitter temperature and insure that the equipment was properly stabilized at a given temperature.

The voltages used for measurements at -30, 0, & +50 degrees Celsius were supplied by a regulated power supply to allow variation in voltage as required:

|         |     |                                      |
|---------|-----|--------------------------------------|
| + 15 %  | N/A | battery powered                      |
| Nominal | 4.5 | VDC                                  |
| 15 %    | 3.3 | VDC manufacturer's battery end point |

This device is normally battery powered with 3 AAA batteries.

**TEST: FREQUENCY STABILITY**

**FCC ID: OTVSBTFR530-2**

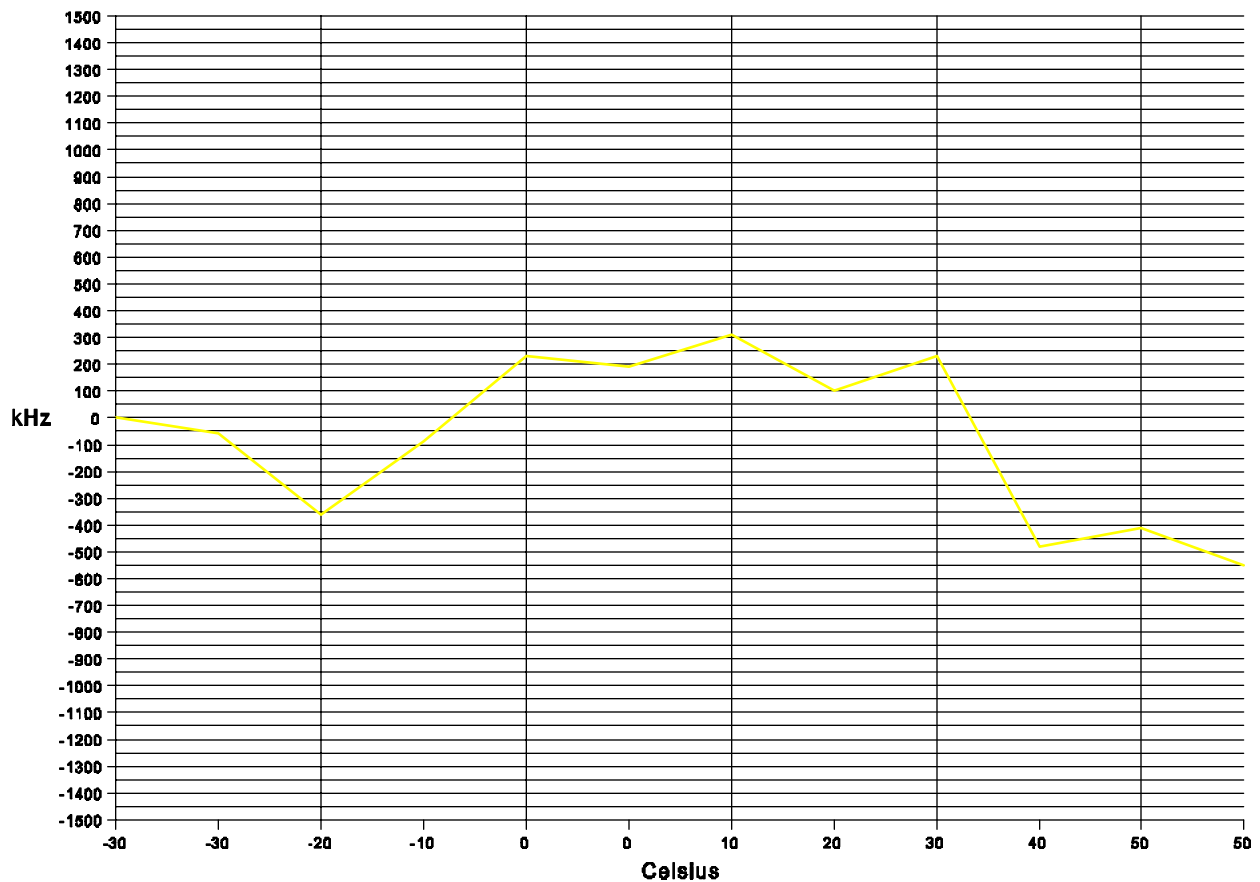
**Grantee: SB Technology, Inc.**

**Model: FR530-2**

**Minimum Standard Specified:** Para. 95.627(b) must be maintained within .00025%  
Test Frequency: 462.5625 MHz 2.5 ppm = +/-1156 Hz  
Ch. 1 of FRS Unit Channel Freq.'s listed in Para 95.627(a)

**Equipment Authorization Procedure:** Para. 2.1055

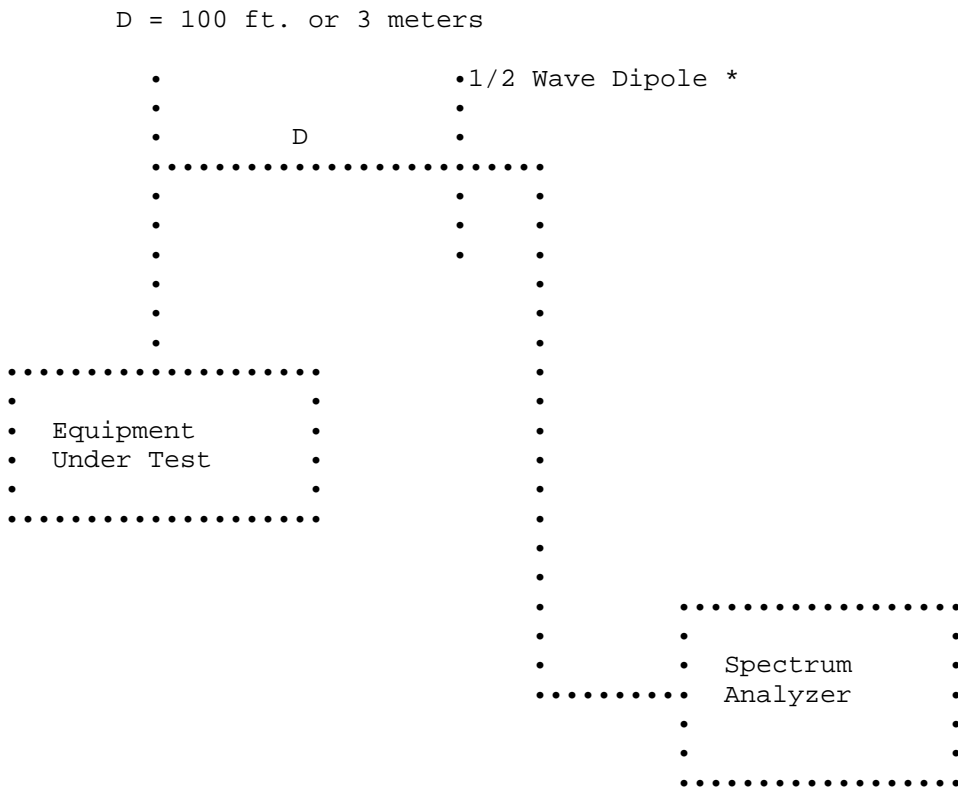
## Graph Of Frequency Stability



**Please Note:** The variation in voltage is shown on the plot above for +50, 0 and -30 C. Two readings are shown at each of these three temperatures. The left-hand reading is the 3.3 VDC, battery end point and the right hand reading is Nominal 4.5 VDC. The other reported readings are all at the Nominal 4.5 VDC.

## BLOCK DIAGRAM #1

Field Intensity Measurement Of  
Spurious Radiation Test Set Up



See Equipment List  
for Equipment Specifications

\* 1/2 Wave Dipole 30-1000 MHz  
Dual Ridged Guide Antenna or Broadband Log Periodic 1-10 GHz



# **TEST EQUIPMENT LIST A** **SPECTRUM TECHNOLOGY, INC.**

| <u>Equipment</u>                | <u>Manufacturer</u>              | <u>Serial Number</u> | <u>Cal Date/Due Date</u> |          |
|---------------------------------|----------------------------------|----------------------|--------------------------|----------|
| Spectrum Analyzer               | Hewlett-Packard 8562A            | 08562-60062          | 11/04/99                 | 11/04/00 |
| Amplifier<br>9 kHz-1300 MHz     | Hewlett-Packard 8447F<br>OPT H64 | 2727A02208           | 11/04/99                 | 11/04/00 |
| RF Signal Gen.                  | Fluke 6071A                      | 2915016              | 5/14/99                  | 4/14/00  |
| Service Monitor                 | IFR FM/AM 500A                   | 4103                 | ---                      |          |
| Oscilloscope                    | Kikusui C055060                  | 6132295              | ---                      |          |
| Power Supply                    | Astron VS35                      | 8601266              | ---                      |          |
| Voltmeter                       | Fluke 8020A                      | N2420658             | ---                      |          |
| Multimeter                      | Fluke 25                         | 3710310              | ---                      |          |
| Wattmeter                       | Bird 43                          | 56227                | ---                      |          |
| RF Termination                  | Bird 8135                        | 10004                | ---                      |          |
| Dual Phase LISN<br>50 ohm/50 uH | STI per MP-4                     | 02                   | 1/8/99                   | 1/9/00   |
| Dual Phase LISN<br>50 ohm/50 uH | Compliance Design                | 8012-50R-24-BNC      | 1/8/99                   | 1/9/00   |
| Audio Generator                 | Hewlett-Packard 205-AG           | 8689                 | ---                      |          |
| Thermometer                     | Fluke 52                         | 3965185              | ---                      |          |
| Test Line                       | Simulator, Teltone TLS-2         | none                 | ---                      |          |
| Turn Table, RC                  | EMCO 1060-2M                     | 8912-1415            | ---                      |          |
| Antenna Mast, RC                | Compliance Design, Inc. M100     |                      | ---                      |          |
| Antennas:                       |                                  |                      |                          |          |
| Dipole Set                      | EMCO Model: 3121C                | 1335                 | reference only           |          |
| Dipole Set                      | EMCO Model: 3121C                | 1336                 | reference only           |          |
| Bi-Conical                      | EMCO 3104                        | 3763                 | reference only           |          |
| Bi-Conical                      | EMCO 3104C                       | 9401-4635            | 01/24/99                 | 1/24/00  |
| Log-Periodic                    | EMCO 3146                        | 1754                 | 06/10/99                 | 6/10/00  |
| BiConiLog                       | EMCO 3141                        | 1125                 | 10/10/98                 | 04/28/00 |
| Active Loop                     | EMCO 6502                        | 9107-2645            | reference only           |          |

