

**STATEMENT OF CERTIFICATION**

The technical data supplied with this application, having been taken under my supervision is hereby duly certified. The following is a statement of my qualifications:

College Degree: BSEE, Valparaiso University, Valparaiso, Indiana, USA  
MSEE, Illinois Institute of Technology, Chicago, Illinois, USA

20 years of Design and Development experience in the field of two-way radio communication.

NAME: Ken Weiss

SIGNATURE: \_\_\_\_\_

DATE: November 8, 2002

POSITION: Lead Electrical Engineer

I hereby certify that the above application was prepared under my direction and that to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct:

NAME: Steve Noskowicz

SIGNATURE: \_\_\_\_\_

DATE: November 8, 2002

POSITION: Engineering Manager

APPLICANT: MOTOROLA INC.

EQUIPMENT TYPE: ABZ89FC3774-D

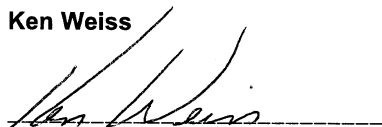
**STATEMENT OF CERTIFICATION**

The technical data supplied with this application, having been taken under my supervision is hereby duly certified. The following is a statement of my qualifications:

College Degree: BSEE, Valparaiso University, Valparaiso, Indiana, USA  
MSEE, Illinois Institute of Technology, Chicago, Illinois, USA

20 years of Design and Development experience in the field of two-way radio communication.

NAME: Ken Weiss

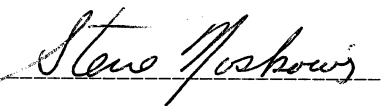
SIGNATURE: 

DATE: November 8, 2002

POSITION: Lead Electrical Engineer

I hereby certify that the above application was prepared under my direction and that to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct:

NAME: Steve Noskowicz

SIGNATURE: 

DATE: November 8, 2002

POSITION: Engineering Manager

**SUBMITTED MEASURED DATA -- INDEX****EXHIBIT    DESCRIPTION**

|       |                                                                                                            |
|-------|------------------------------------------------------------------------------------------------------------|
| 11A   | RF Output-Data                                                                                             |
| 11F   | Occupied Bandwidth - Power Output at 25 Watts<br>12.5 kHz, Carrier with 9600 BPS Digitized Voice (APCO 25) |
| 11G   | Conducted Spurious Emissions: Setup, Specifications, and Index                                             |
| 11G-1 | Conducted Spurious Emissions, Harmonics, Power Output at 25 Watts                                          |
| 11G-2 | Conducted Spurious Emissions, Harmonics, Power Output at 6 Watts                                           |
| 11G-3 | Conducted Spurious Emissions, Close-In, Power Output at 25 Watts, Span 500 kHz                             |
| 11G-4 | Conducted Spurious Emissions, Close-In, Power Output at 25 Watts, Span 10 MHz                              |
| 11H   | Radiated Spurious Emissions: Setup, Specifications, and Index                                              |
| 11H-1 | Radiated Spurious Emissions, Power Output at 25 Watts                                                      |
| 11H-2 | Radiated Spurious Emissions, Power Output at 6 Watts                                                       |
| 11J   | Frequency Stability: Setup, Specifications, and Index                                                      |
| 11J-1 | Frequency Stability Vs Temperature                                                                         |
| 11J-2 | Frequency Stability Vs Voltage                                                                             |
| 11K   | Frequency Transient Behavior: Setup, Specifications, Index                                                 |
| 11K-1 | Frequency Transient Behavior, 12.5 kHz Channel Key-Up                                                      |
| 11K-2 | Frequency Transient Behavior, 12.5 kHz Channel De-key                                                      |

**RF POWER OUTPUT DATA**

The RF power output was measured with the indicated voltage applied to and current into the final RF amplifying device. The DC current indicated is the total for the final RF amplifier stage, consisting of four parallel power transistors.

|                                                  |                   |          |
|--------------------------------------------------|-------------------|----------|
| Measured RF output                               | <b><u>25</u></b>  | Watts    |
| DC Voltage                                       | <b><u>14</u></b>  | Volts    |
| DC Current                                       | <b><u>4.5</u></b> | Amperes  |
| DC input power for final RF amplifying device(s) | <b><u>65</u></b>  | Watts    |
| Primary Supply Voltage                           | <b><u>120</u></b> | Volts AC |
|                                                  |                   |          |
| Minimum Measured RF output                       | <b><u>6</u></b>   | Watts    |
| Normal DC Voltage                                | <b><u>14</u></b>  | Volts    |
| Normal DC Current                                | <b><u>2.1</u></b> | Amperes  |
| DC input power for final RF amplifying device(s) | <b><u>30</u></b>  | Watts    |
| Primary Supply Voltage                           | <b><u>120</u></b> | Volts AC |

**OCCUPIED BANDWIDTH**

Modulation Type: Carrier with 9600 BPS Digitized Voice  
Emission Designator: 8K10F1E  
Channelization: 12.5 kHz  
Power Setting: 25-Watts

**SPECIFICATION REQUIREMENT:****§ 90.210(d) Emission Mask Requirements for 12.5 kHz Channel Bandwidth Equipment, Emission Mask D:**

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 removed 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  $7.27 \cdot (f_d - 2.88 \text{ kHz})$  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).
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed.

Necessary Bandwidth Calculation: An occupied bandwidth of 8.10 kHz was measured for this emission, per 2.202 paragraph (a) of the Rules and Regulations, as that bandwidth which contains 99% of the power in the transmitted signal. For this system, the necessary bandwidth has been chosen to be the same as the occupied bandwidth, thereby per paragraph (b) (2), the necessary bandwidth is 8K10.

**Reference Calibration Analyzer Settings:**

|                |                                |                       |         |
|----------------|--------------------------------|-----------------------|---------|
| Horizontal:    | 12.5 kHz per Division          | Resolution Bandwidth: | 30 kHz  |
| Vertical:      | 10 dB per Division             | Video Bandwidth:      | 100 kHz |
| Sweep Time:    | 75 Seconds (<2000 Hz / Second) | Span:                 | 125 kHz |
| Detector Mode: | Positive Peak                  |                       |         |

**Emission Measurement Analyzer Settings:**

|                |                                |                       |         |
|----------------|--------------------------------|-----------------------|---------|
| Horizontal:    | 12.5 kHz per Division          | Resolution Bandwidth: | 100 Hz  |
| Vertical:      | 10 dB per Division             | Video Bandwidth:      | 1 kHz   |
| Sweep Time:    | 75 Seconds (<2000 Hz / Second) | Span:                 | 125 kHz |
| Detector Mode: | Positive Peak                  |                       |         |

**Measurement Procedure:**

- 1) Adjust the spectrum analyzer per the values specified in the Reference Calibration Analyzer Settings.
- 2) Modulate the transmitter with the appropriate signaling pattern, (psuedorandom data) and key the transmitter at the full carrier power rating. Use the analyzer controls to set this signal to the full-scale reference line. Allow the analyzer to sweep fully and store the sweep.
- 3) Adjust the analyzer per the Emission Measurement Analyzer Settings.
- 4) Allow the analyzer to sweep, and record the resultant emission levels.
- 5) Capture / plot the resulting analyzer trace and the emission mask limit. Add labeling as appropriate.

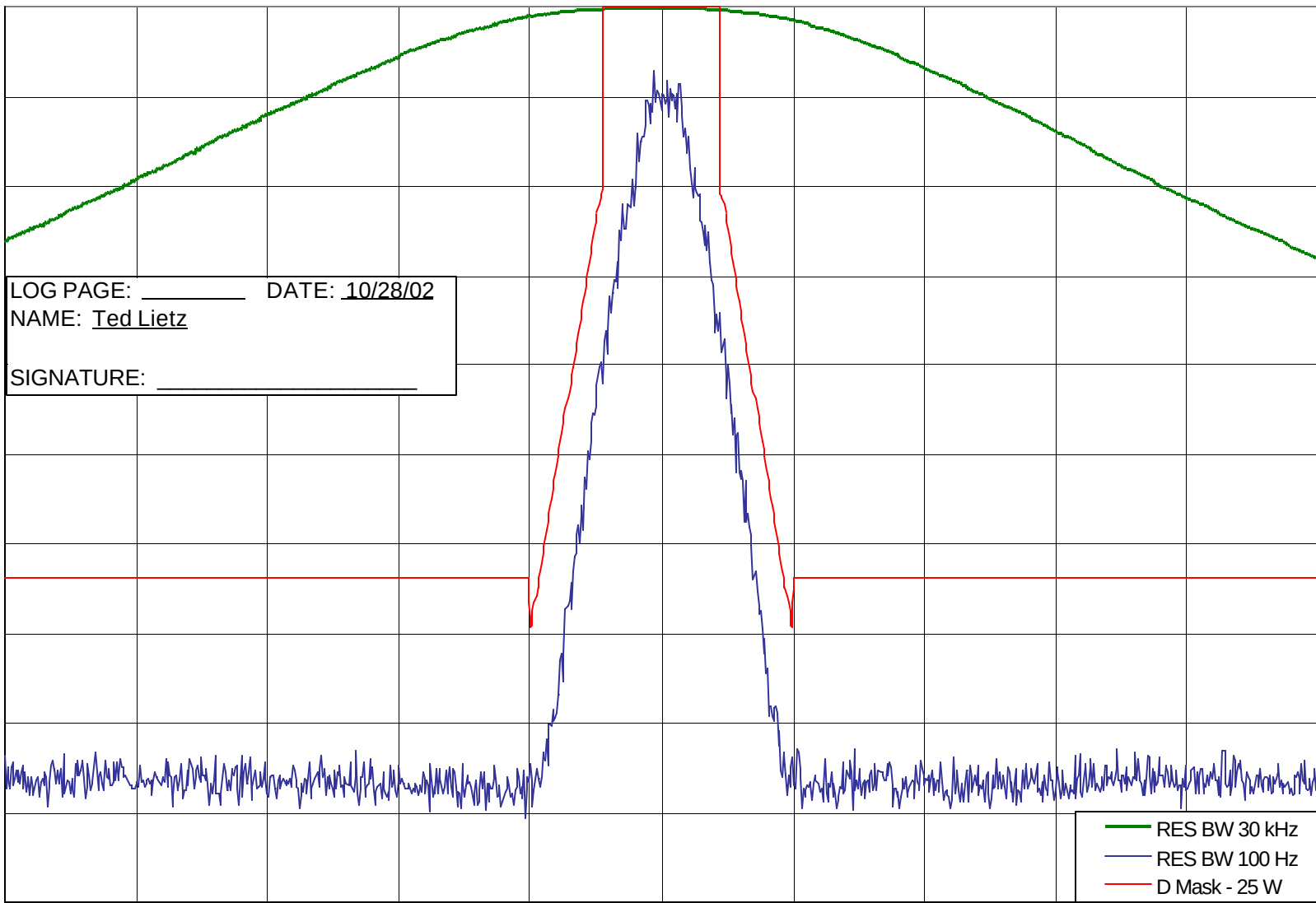
# Occupied Bandwidth -- Digitized Voice - 8K10F1E - 25 Watts

REF 16.6 dBm

ATTEN 40 dB

10 dB/  
POS PK

LOG PAGE: \_\_\_\_\_ DATE: 10/28/02  
NAME: Ted Lietz  
SIGNATURE: \_\_\_\_\_



CENTER 150.0125 MHz  
RES BW 100 Hz

VID BW 1 kHz

SPAN 125 kHz  
SWP 75 sec

**CONDUCTED SPURIOUS EMISSIONS****SPECIFICATION REQUIREMENT:****§ 90.210(d) Emission Mask Requirements for 12.5 kHz Channel Bandwidth Equipment, Emission Mask D:**

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:

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).

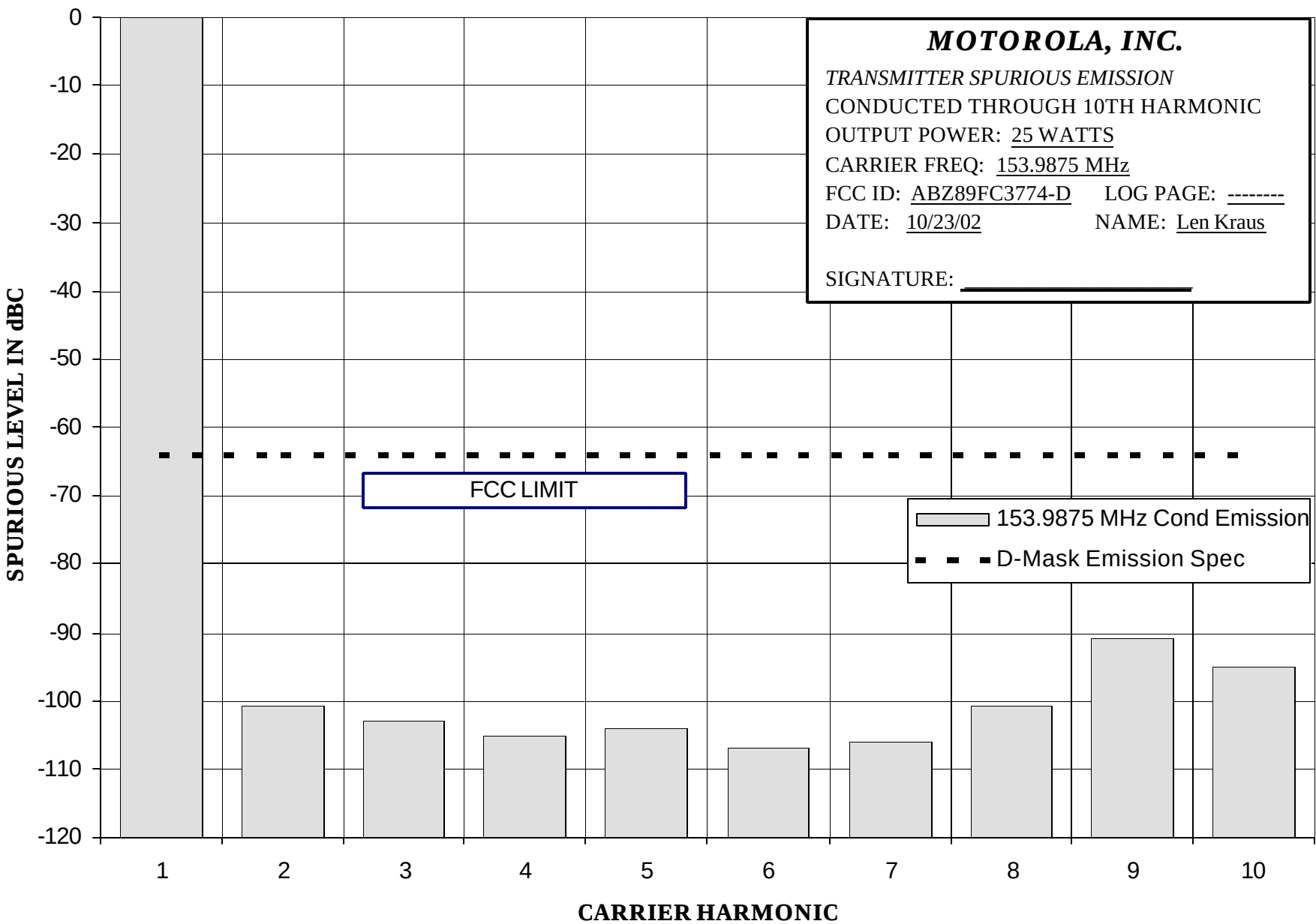
(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. A sufficient number of sweeps must be measured to ensure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, a resolution of at least 10 kHz must be used for frequencies below 1000 MHz. Above 1000 MHz the resolution bandwidth of the instrumentation must be at least 1 MHz. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, then an alternate procedure may be used provided prior Commission approval is obtained.

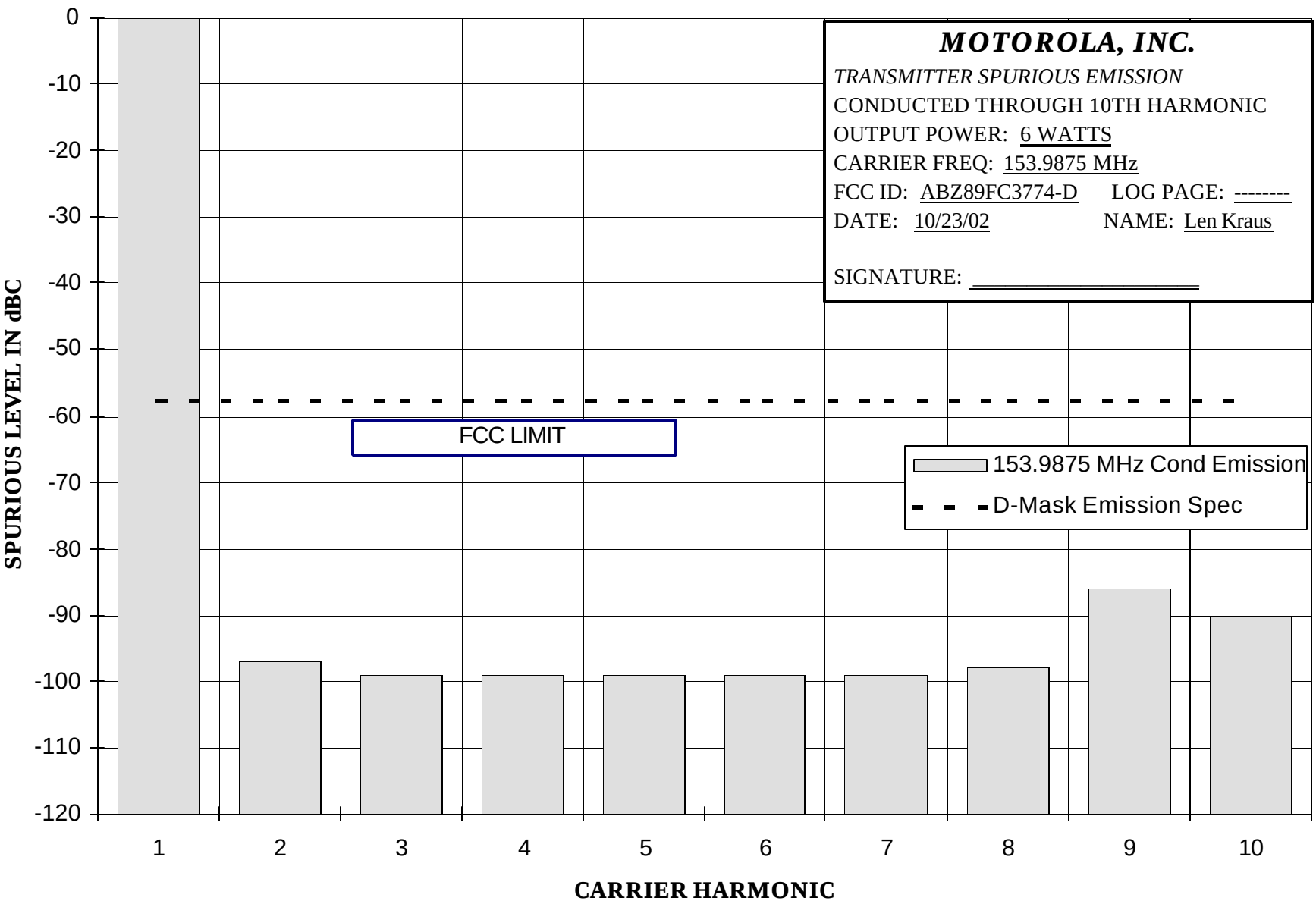
Modulation: Psuedorandom data

Carrier Frequency: A carrier at 153.9875 MHz was measured for carrier harmonics, and a carrier at 150.0125 MHz was measured for close-in spurious. These frequencies are near the center of the operating band 132 – 174 MHz.

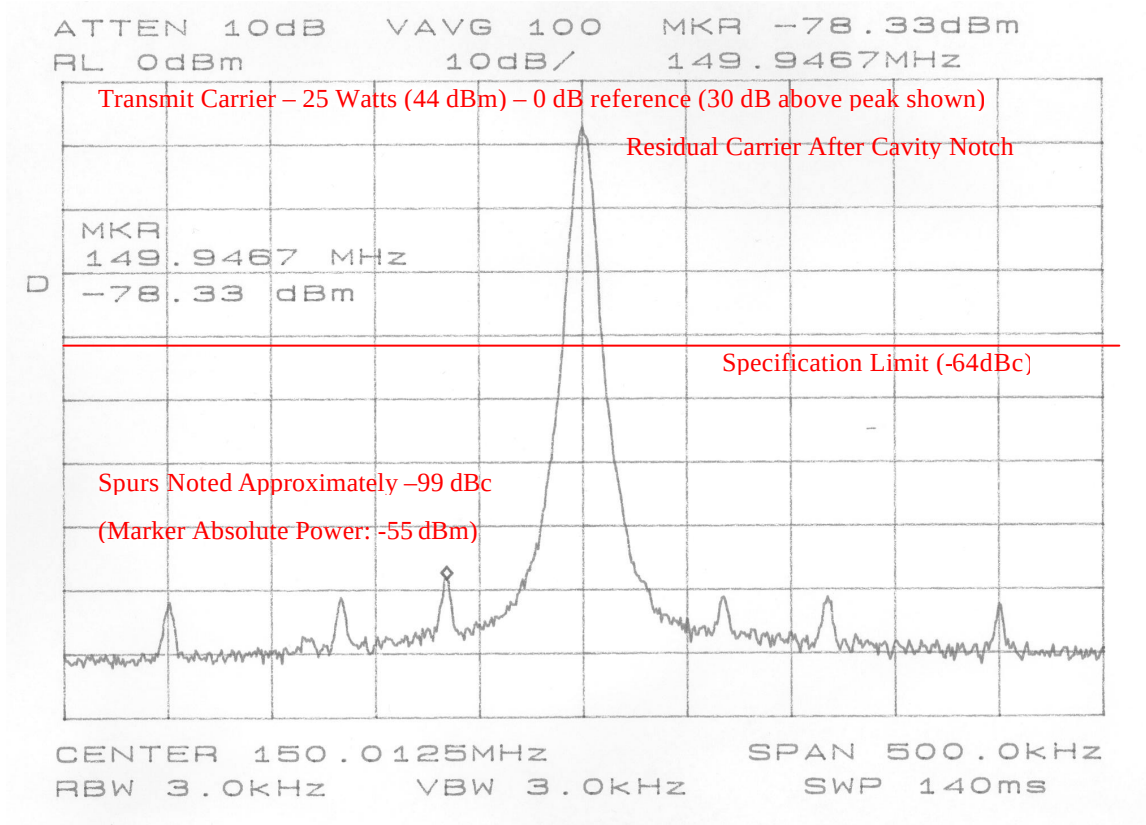
**SPURIOUS EMISSION PLOTS:****EXHIBIT DESCRIPTION**

|       |                                                                                                                        |
|-------|------------------------------------------------------------------------------------------------------------------------|
| 11G-1 | Conducted Spurious Emissions, Harmonics, Power Output at 25 Watts<br>The specification limit is –64.0 dBC              |
| 11G-2 | Conducted Spurious Emissions, Harmonics, Power Output at 6 Watts<br>The specification limit is –57.8 dBC               |
| 11G-3 | Conducted Spurious Emissions, Close-In, Power Output at 25 Watts, 500 kHz Span<br>The specification limit is –64.0 dBC |
| 11G-4 | Conducted Spurious Emissions, Close-In, Power Output at 25 Watts, 10 MHz Span<br>The specification limit is –64.0 dBC  |



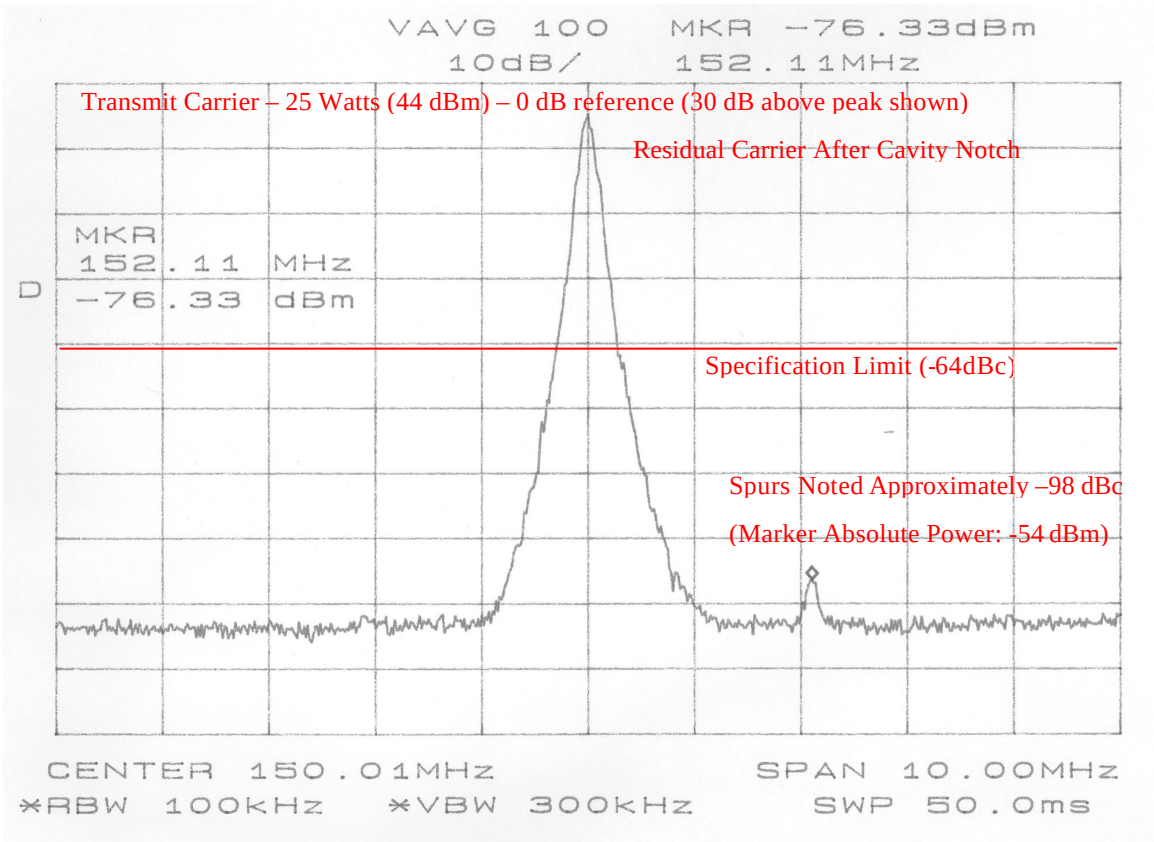


|                                   |                         |
|-----------------------------------|-------------------------|
| <b>MOTOROLA, INC.</b>             |                         |
| TRANSMITTER SPURIOUS EMISSION     |                         |
| CLOSE-IN CONDUCTED                |                         |
| OUTPUT POWER: <u>25 WATTS</u>     |                         |
| CARRIER FREQ: <u>150.0125 MHz</u> |                         |
| FCC ID: <u>ABZ89FC3774-D</u>      | LOG PAGE: <u>000754</u> |
| DATE: <u>10/29/02</u>             | NAME: <u>Tim Mosher</u> |
| SIGNATURE: _____                  |                         |



The absolute power of the spur was verified using the substitution method. A signal generator was fed into the same notch test setup as the transmitter. The power level of a 149.9467 MHz signal was adjusted until equivalent power level as the spur shown above (-78.33 dBm) was observed at the spectrum analyzer. This absolute power level was then compared to the power level of the transmitter to obtain the spur power level referenced to the carrier power.

**MOTOROLA, INC.**  
 TRANSMITTER SPURIOUS EMISSION  
 CLOSE-IN CONDUCTED  
 OUTPUT POWER: 25 WATTS  
 CARRIER FREQ: 150.0125 MHz  
 FCC ID: ABZ89FC3774-D    LOG PAGE: 000754  
 DATE: 10/29/02            NAME: Tim Mosher  
 SIGNATURE: \_\_\_\_\_



The absolute power of the spur was verified using the substitution method. A signal generator was fed into the same notch test setup as the transmitter. The power level of a 152.11 MHz signal was adjusted until equivalent power level as the spur shown above (-76.33 dBm) was observed at the spectrum analyzer. This absolute power level was then compared to the power level of the transmitter to obtain the spur power level referenced to the carrier power.

**RADIATED SPURIOUS EMISSIONS****SPECIFICATION REQUIREMENT:****§ 90.210(d) Emission Mask Requirements for 12.5 kHz Channel Bandwidth Equipment, Emission Mask D:**

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:

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).

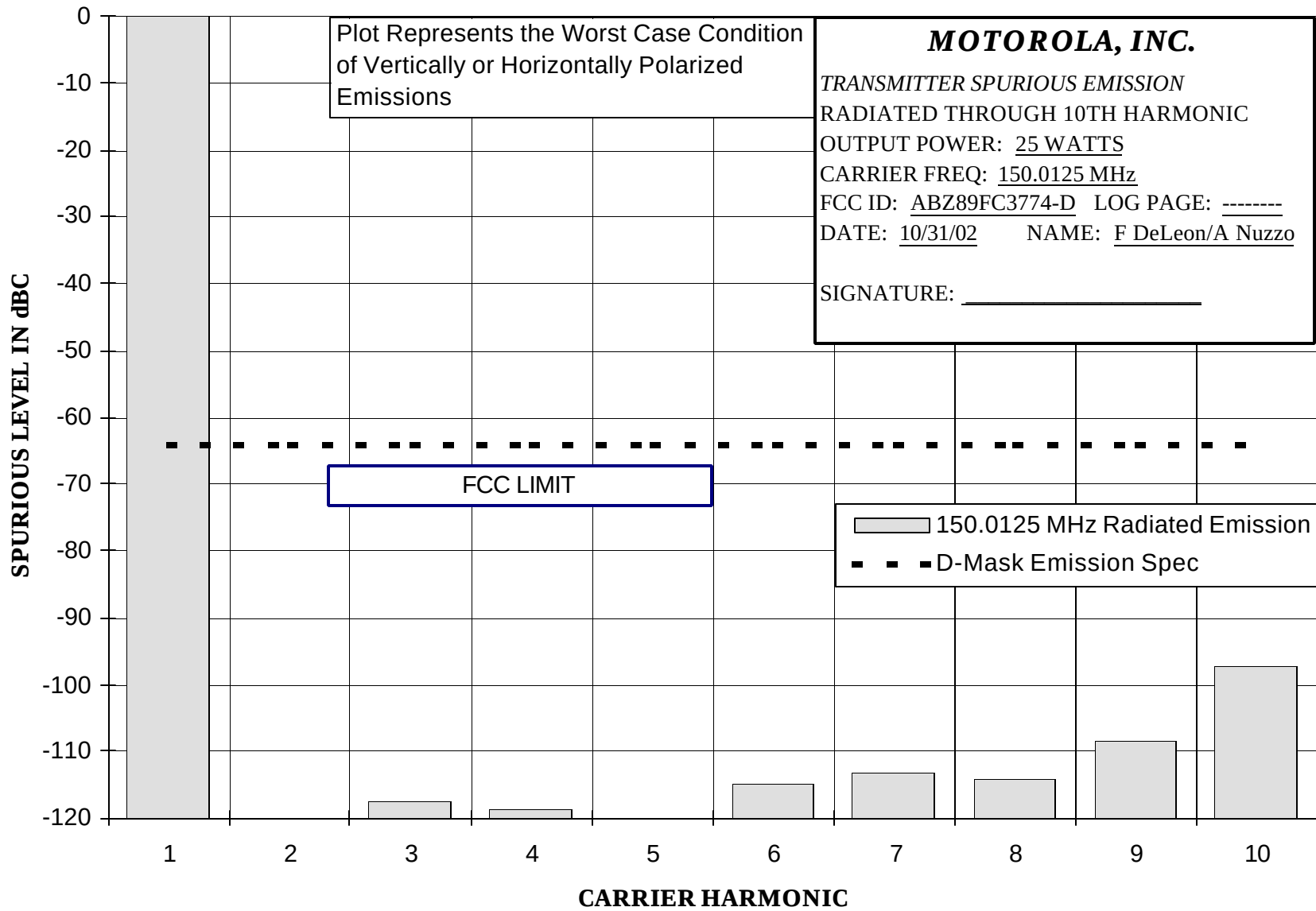
(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. A sufficient number of sweeps must be measured to ensure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, a resolution of at least 10 kHz must be used for frequencies below 1000 MHz. Above 1000 MHz the resolution bandwidth of the instrumentation must be at least 1 MHz. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, then an alternate procedure may be used provided prior Commission approval is obtained.

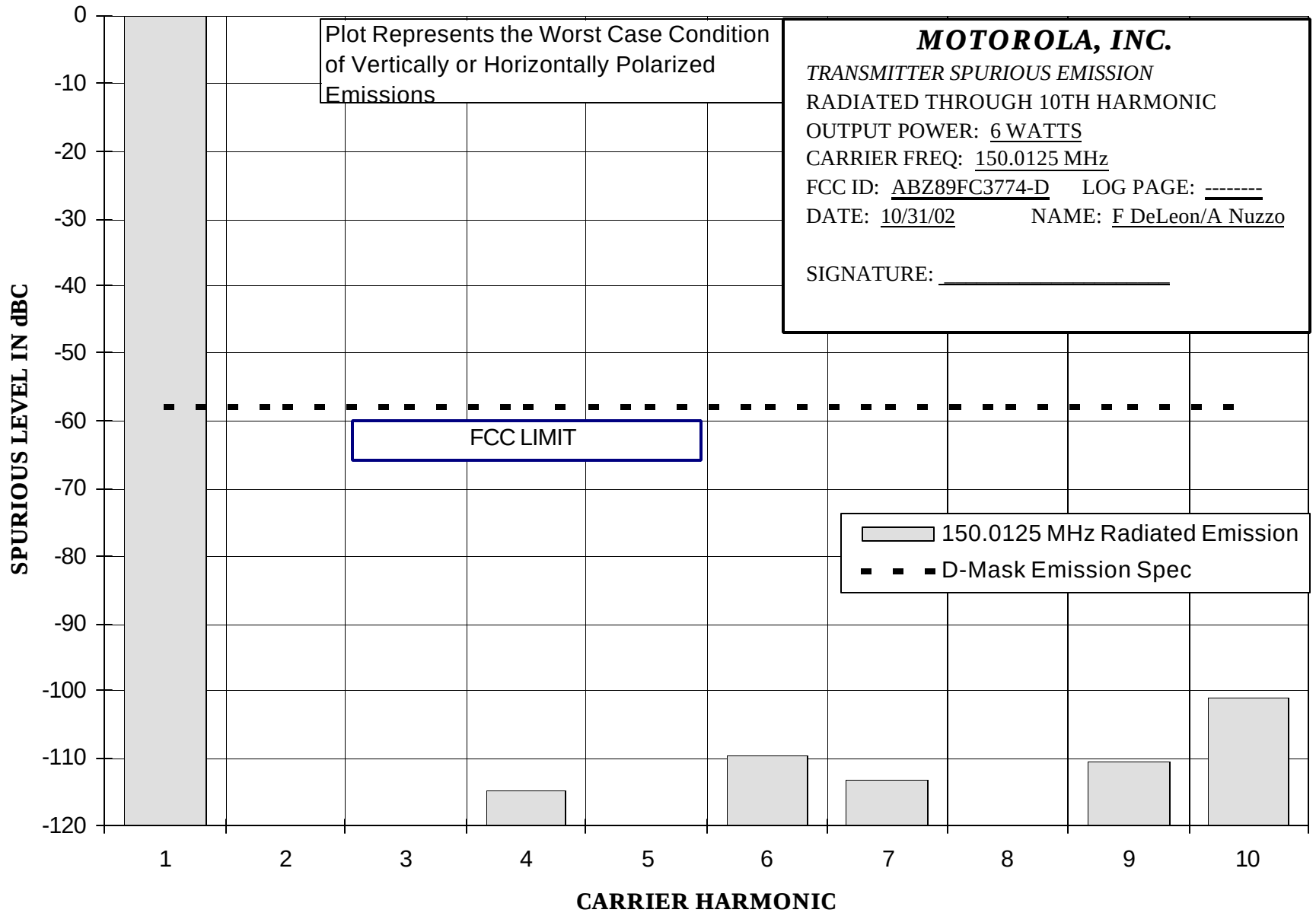
Modulation: Psuedorandom data

Carrier Frequency: A carrier at 150.0125 MHz was measured. This frequency is near the center of the operating band 132 – 174 MHz.

**SPURIOUS EMISSION PLOTS:****EXHIBIT DESCRIPTION**

|       |                                                                                                           |
|-------|-----------------------------------------------------------------------------------------------------------|
| 11H-1 | Conducted Spurious Emissions, Harmonics, Power Output at 25 Watts<br>The specification limit is –64.0 dBC |
| 11H-2 | Conducted Spurious Emissions, Harmonics, Power Output at 6 Watts<br>The specification limit is –57.8 dBC  |





**OSCILLATOR FREQUENCY STABILITY**

**SPECIFICATION REQUIREMENT:**

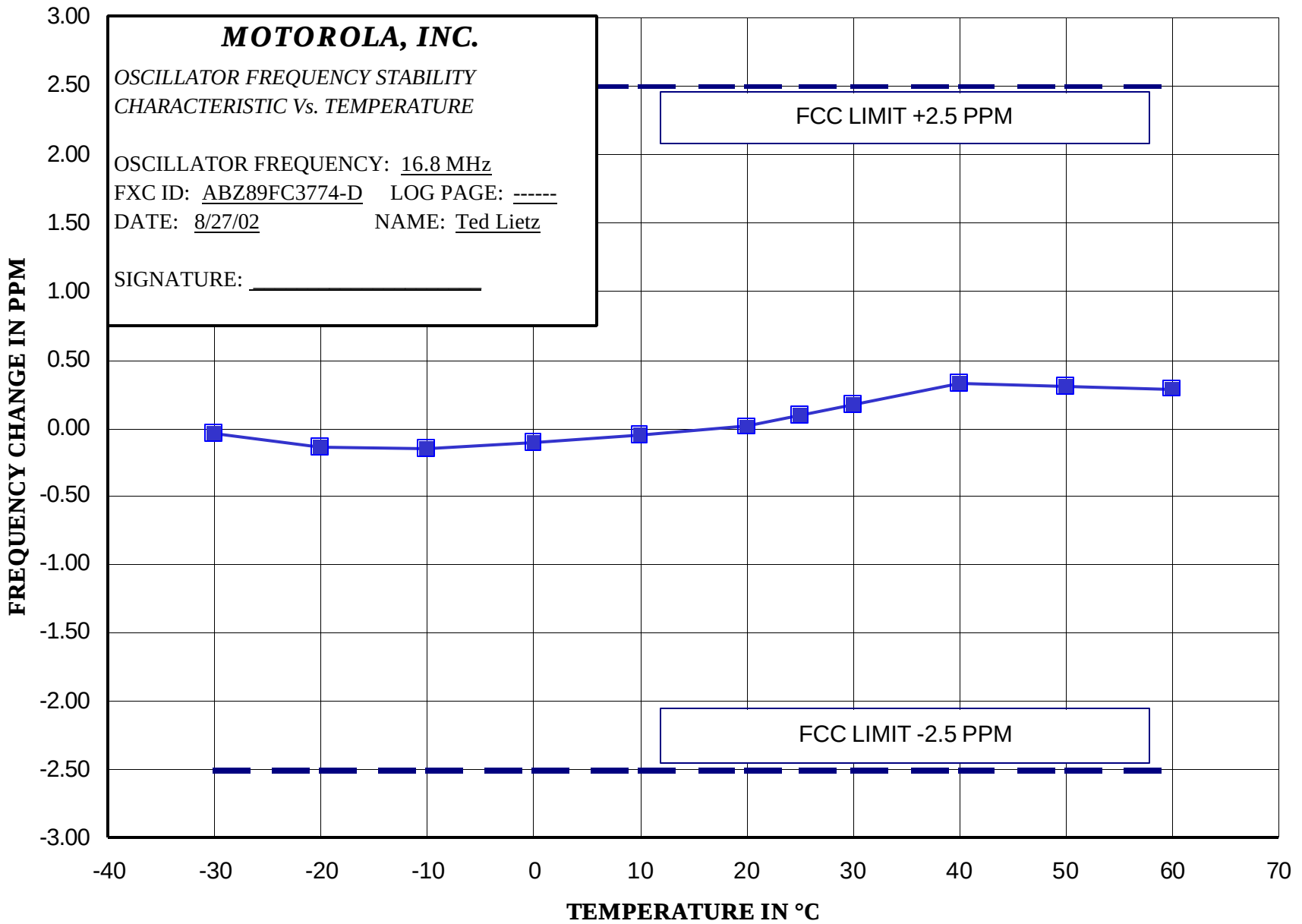
**Reference: Part 90.213**

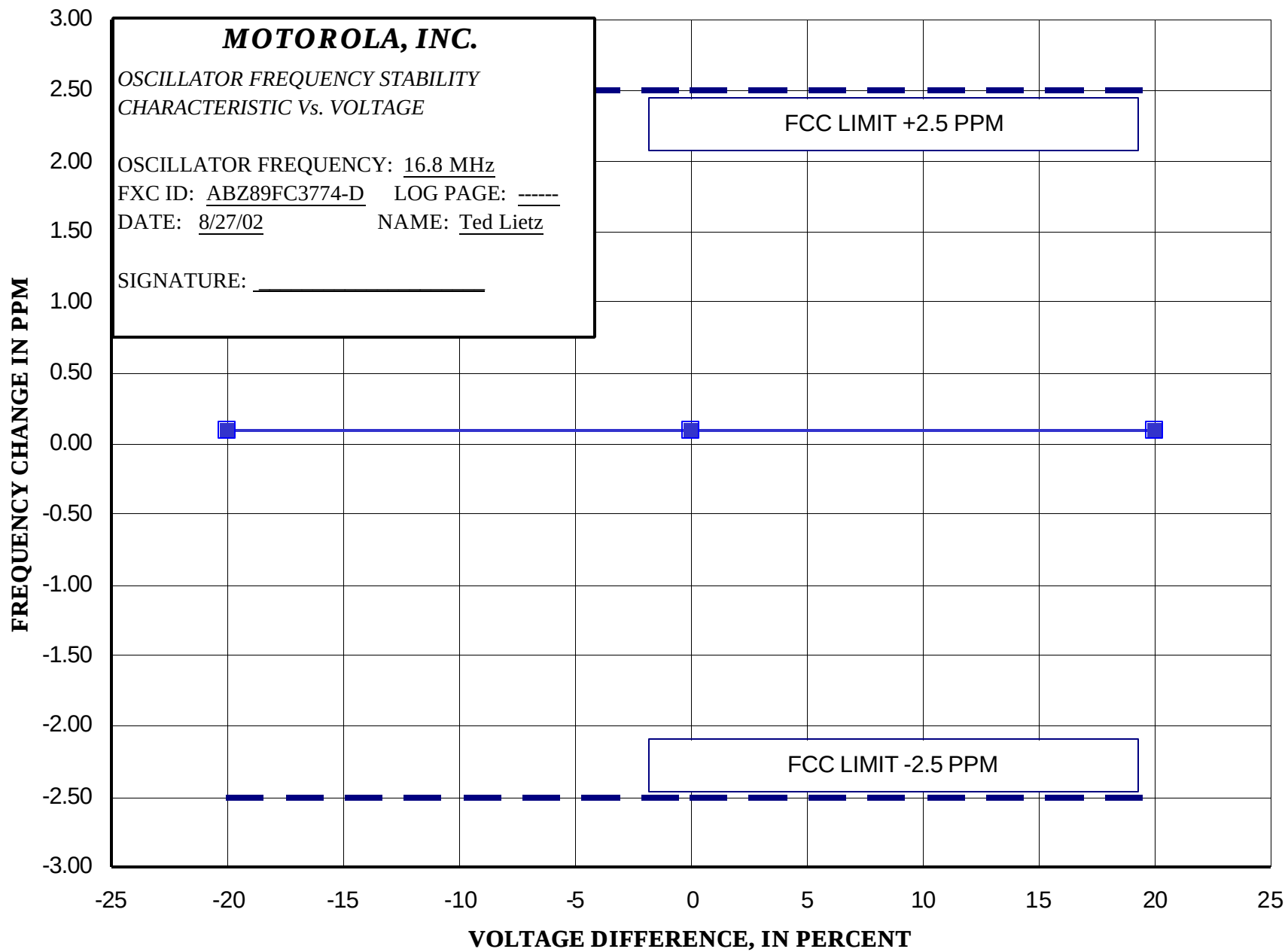
Fixed and Base stations with 25 kHz channel bandwidth, operating at 150-174 MHz, must have a frequency stability of better than 5 PPM.

Fixed and Base stations with 12.5 kHz channel bandwidth, operating at 150-174 MHz, must have a frequency stability of better than 2.5 PPM.

**FREQUENCY STABILITY PLOTS:**

| <b><u>EXHIBIT</u></b> | <b><u>DESCRIPTION</u></b>          |
|-----------------------|------------------------------------|
| 11J-1                 | Frequency Stability Vs Temperature |
| 11J-2                 | Frequency Stability Vs Voltage     |





**TRANSIENT FREQUENCY BEHAVIOR**

**SPECIFICATION REQUIREMENT, transmitters designed to operate at 150 to 174 MHz :**

**Reference: Part 90.214**

**SPECIFICATIONS TRANSIENT FREQUENCY BEHAVIOR 25 kHz CHANNELS**

For time intervals:

- a.  $t_1 = 5 \text{ ms}$ , Maximum Frequency Difference  $\pm 25 \text{ kHz}$
- b.  $t_2 = 20 \text{ ms}$  Maximum Frequency Difference  $\pm 12.5 \text{ kHz}$
- c.  $t_3 = 5 \text{ ms}$  Maximum Frequency Difference  $\pm 25 \text{ kHz}$

Where  $t_1$  and  $t_2$  are times immediately following when the transmitter is turned on, and  $t_3$  is the time from when the transmitter is turned off.

**TRANSIENT FREQUENCY BEHAVIOR 12.5 kHz CHANNELS**

For time intervals:

- a.  $t_1 = 5 \text{ ms}$  Maximum Frequency Difference  $\pm 12.5 \text{ kHz}$
- b.  $t_2 = 20 \text{ ms}$  Maximum Frequency Difference  $\pm 6.25 \text{ kHz}$
- c.  $t_3 = 5 \text{ ms}$  Maximum Frequency Difference  $\pm 12.5 \text{ kHz}$

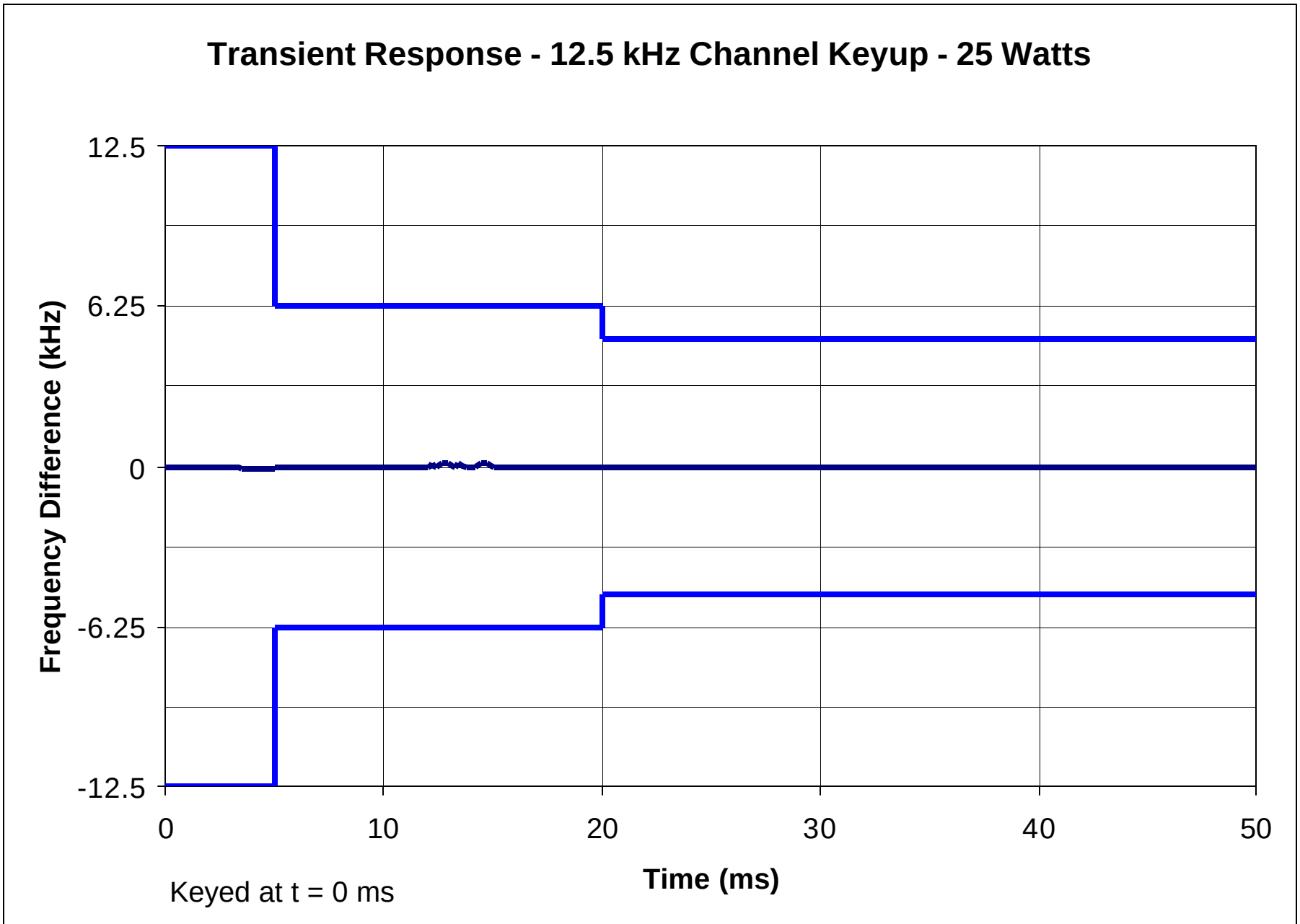
Where  $t_1$  and  $t_2$  are times immediately following when the transmitter is turned on, and  $t_3$  is the time from when the transmitter is turned off.

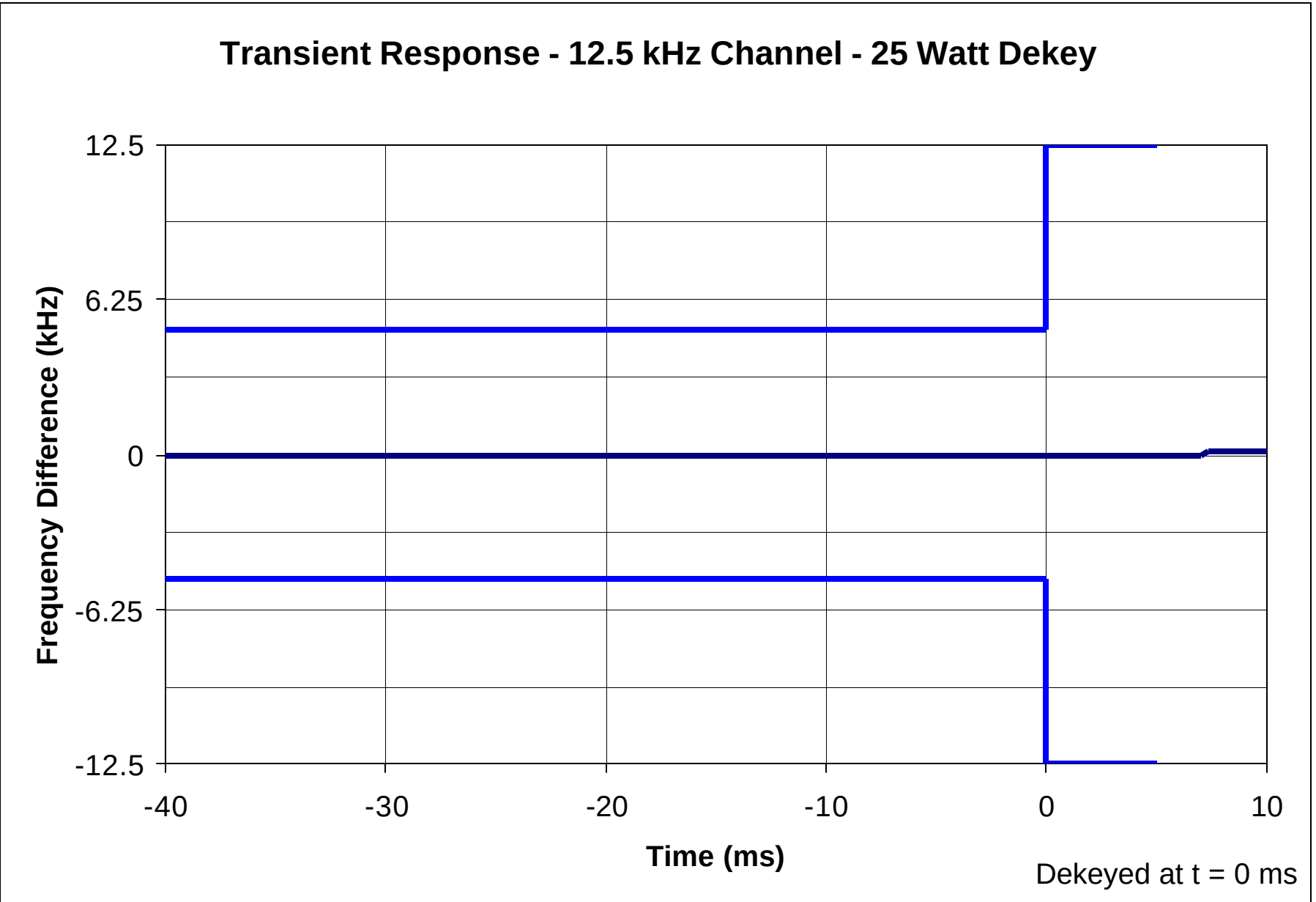
**FREQUENCY TRANSIENT BEHAVIOR PLOTS:**

| <b><u>EXHIBIT</u></b> | <b><u>DESCRIPTION</u></b>                             |
|-----------------------|-------------------------------------------------------|
| 11K-1                 | Frequency Transient Behavior, 12.5 kHz Channel Key-Up |
| 11K-2                 | Frequency Transient Behavior, 12.5 kHz Channel De-key |

The unit was tested at various power levels across the operating range. Power level was found to be irrelevant to performance according to this standard.

Note: The measurements were taken by using an HP 53310A Modulation Domain Analyzer.





**TEST EQUIPMENT LIST**

| <b>MODEL</b> | <b>MANUFACTURER</b>       | <b>DESCRIPTION</b>         | <b>Serial No.</b> | <b>Last Cal</b>         | <b>Next Cal</b> |
|--------------|---------------------------|----------------------------|-------------------|-------------------------|-----------------|
| 438A         | Hewlett Packard           | RF Power Meter             | 3513U06093        | 11/05/99                | 11/05/02        |
| 8481A        | Hewlett Packard           | RF Power Sensor            | 2702A78679        | 11/14/01                | 11/14/04        |
| 8568B        | Hewlett Packard           | Spectrum Analyzer          | 2841A04405        | 10/05/00                | 10/05/03        |
| 6071A        | Fluke                     | Signal Generator           | 3005007           | 11/17/00                | 11/17/03        |
| 83712A       | Hewlett Packard           | Signal Generator           | 3429A00455        | no calibration required |                 |
| 85460A       | Hewlett Packard           | EMI Analyzer, Filter       | 3704A00467        | 10/12/99                | 10/12/02        |
| 85462A       | Hewlett Packard           | EMI Analyzer, RF/Display   | 3906A00500        | 10/12/99                | 10/12/02        |
| (Various)    | Weinschel, Kathrein, Bird | RF Loads                   | Various           | no calibration required |                 |
| 3020A, etc.  | Narda                     | Directional Coupler        | Various           | no calibration required |                 |
| 49441A       | Hewlett Packard           | Vector Signal Analyzer     | 3416a00835        | 06/21/02                | 06/21/03        |
| 53310A       | Hewlett Packard           | Modulation Domain Analyzer | 3121A00479        | 11/15/01                | 11/15/04        |
| 8566B        | Hewlett Packard           | Spectrum Analyzer          | 2140A01273        | 11/08/01                | 11/08/02        |
| 438A         | Hewlett Packard           | RF Power Meter             | 2743A04603        | 11/15/01                | 11/15/02        |
| 8482A        | Hewlett Packard           | RF Power Sensor            | 2652A13844        | 11/07/01                | 11/07/02        |
| 8561EC       | Agilent                   | Spectrum Analyzer          | 3946A00224        | 12/18/00                | 12/18/03        |
| 8753C        | Hewlett Packard           | Network Analyzer           | 3029A01510        | 05/20/00                | 05/20/03        |
| 85047A       | Hewlett Packard           | S-parameter Test Set       | 3033A02098        | 05/20/00                | 05/20/03        |
| 8656B        | Hewlett Packard           | Signal Generator           | 3243U11940        | 06/04/01                | 06/04/04        |
| (Various)    | Weinschel                 | RF Loads                   | Various           | no calibration required |                 |
| ZAPD-21      | Mini-Circuits             | Combiner/Splitter          | None              | no calibration required |                 |
| 9T6-41       | Rockwell Ferrocom         | Circulator                 | 2191              | no calibration required |                 |
| S3-02N       | MicroLab                  | Tuner (3 stub)             | None              | no calibration required |                 |
| 5090-1-1     | Celwave                   | Cavity Filter              | 42139             | no calibration required |                 |