

**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:           **October 28, 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:           **October 28, 2002**

POSITION:       **Engineering Manager**

**SUBMITTED MEASURED DATA -- INDEX**

<b><u>EXHIBIT</u></b>	<b><u>DESCRIPTION</u></b>
11A	RF Output-Data
11B-1	Modulation Characteristics -- Audio Frequency Response, 12.5 kHz Channels
11B-2	Modulation Characteristics -- Audio Frequency Response, 25 kHz Channels
11D-1	Modulation Characteristics -- Modulation Limiting, 12.5 kHz Channels
11D-2	Modulation Characteristics -- Modulation Limiting, 25 kHz Channels
11F	Occupied Bandwidth - Power Output at 110 Watts
11F-1	Carrier with 9600 BPS Digitized Voice (Project 25), 12.5 kHz Channels
11F-2	Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels
11F-3	Carrier with 2500 Hz Audio Tone and 150 Hz Private Line (PL) Tone, 12.5 kHz Channels
11F-4	Carrier with 3600 BPS Channel Control Data, 12.5 kHz Channels
11F-5	Carrier with 2500 Hz Audio Tone, 25 kHz Channels
11F-6	Carrier with 2500 Hz Audio Tone and 150 Hz Private Line (PL) Tone, 25 kHz Channels
11F-7	Carrier with 3600 BPS Channel Control Data, 25 kHz Channels
11G	Conducted Spurious Emissions: Setup, Specifications, and Index
11G-1	Conducted Spurious Emissions, Harmonics, Power Output at 110 Watts
11G-2	Conducted Spurious Emissions, Harmonics, Power Output at 10 Watts
11G-3	Conducted Spurious Emissions, Close-In, Power Output at 110 Watts (500 kHz Span)
11G-4	Conducted Spurious Emissions, Close-In, Power Output at 110 Watts (1 MHz Span)
11H	Radiated Spurious Emissions: Setup, Specifications, and Index
11H-1	Radiated Spurious Emissions, Power Output at 110 Watts
11H-2	Radiated Spurious Emissions, Power Output at 10 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
11K-3	Frequency Transient Behavior, 25 kHz Channel Key-Up
11K-4	Frequency Transient Behavior, 25 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>110</u></b>	Watts
DC Voltage	<b><u>28.5</u></b>	Volts
DC Current	<b><u>10.5</u></b>	Amperes
DC Input power for final RF amplifying device(s)	<b><u>300</u></b>	Watts
Primary Supply Voltage	<b><u>120</u></b>	Volts AC
Minimum Measured RF output	<b><u>10</u></b>	Watts
Normal DC Voltage	<b><u>28.5</u></b>	Volts
Normal DC Current	<b><u>2.65</u></b>	Amperes
DC Input power for final RF amplifying device(s)	<b><u>76</u></b>	Watts
Primary Supply Voltage	<b><u>120</u></b>	Volts AC

**AUDIO FREQUENCY RESPONSE - MODULATION CHARACTERISTICS****SPECIFICATION REQUIREMENT:****Reference: TIA 603****AUDIO FREQUENCY RESPONSE, 12.5 kHz CHANNELS**

The audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level, with an additional 6 dB per octave attenuation allowed from 500 Hz to 300 Hz. An additional 6 dB per octave rolloff is allowed from 2300 Hz to 2700 Hz, and an additional 12 dB per octave is allowed from 2700 Hz to 3000 Hz in equipment operating in the 896 MHz to 940 MHz range or for 12.5 kHz channel operation.

**AUDIO FREQUENCY RESPONSE, 25 kHz CHANNELS**

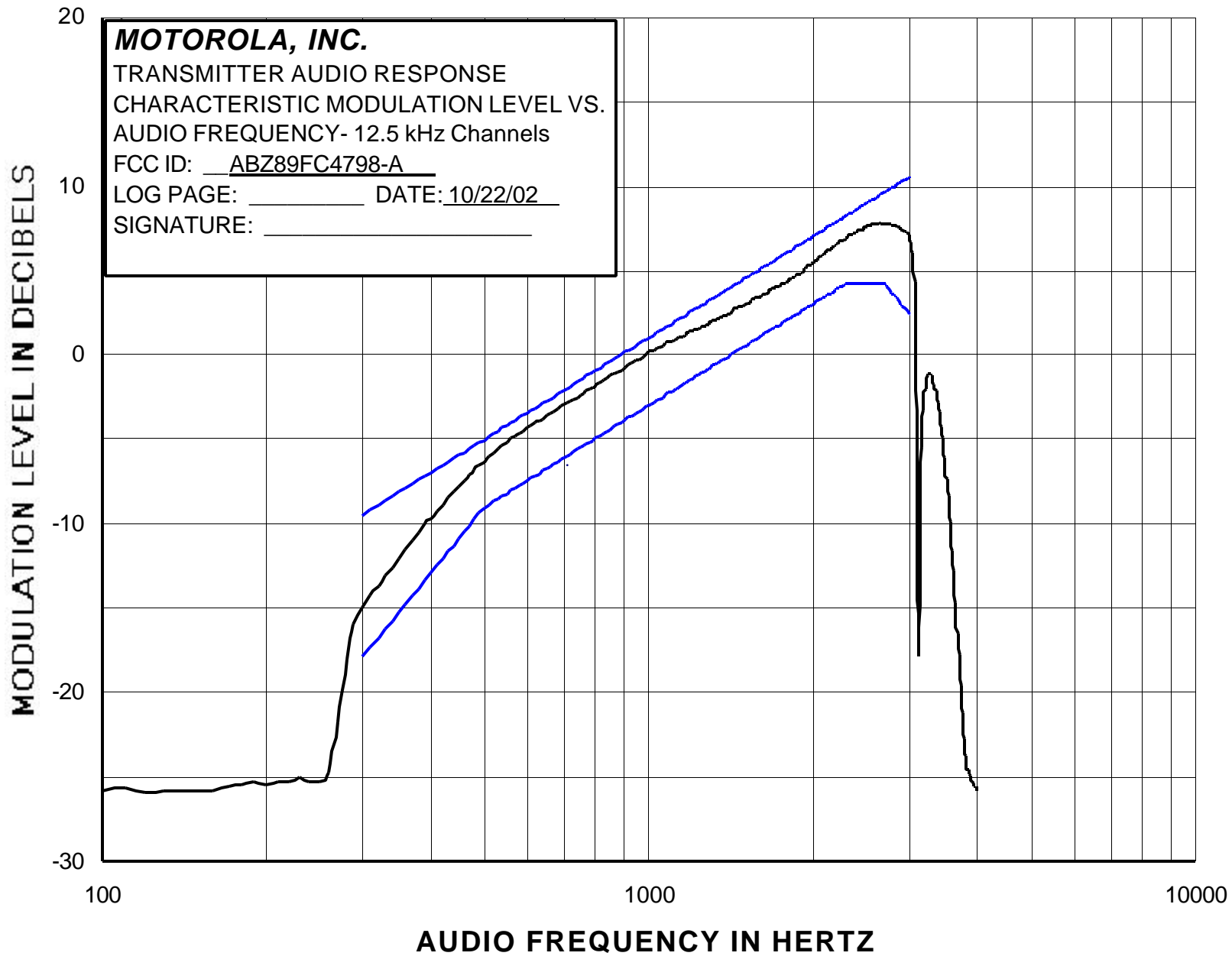
The audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level, with an additional 6 dB per octave attenuation allowed from 500 Hz to 300 Hz in equipment operating in the 25 MHz to 869 MHz range.

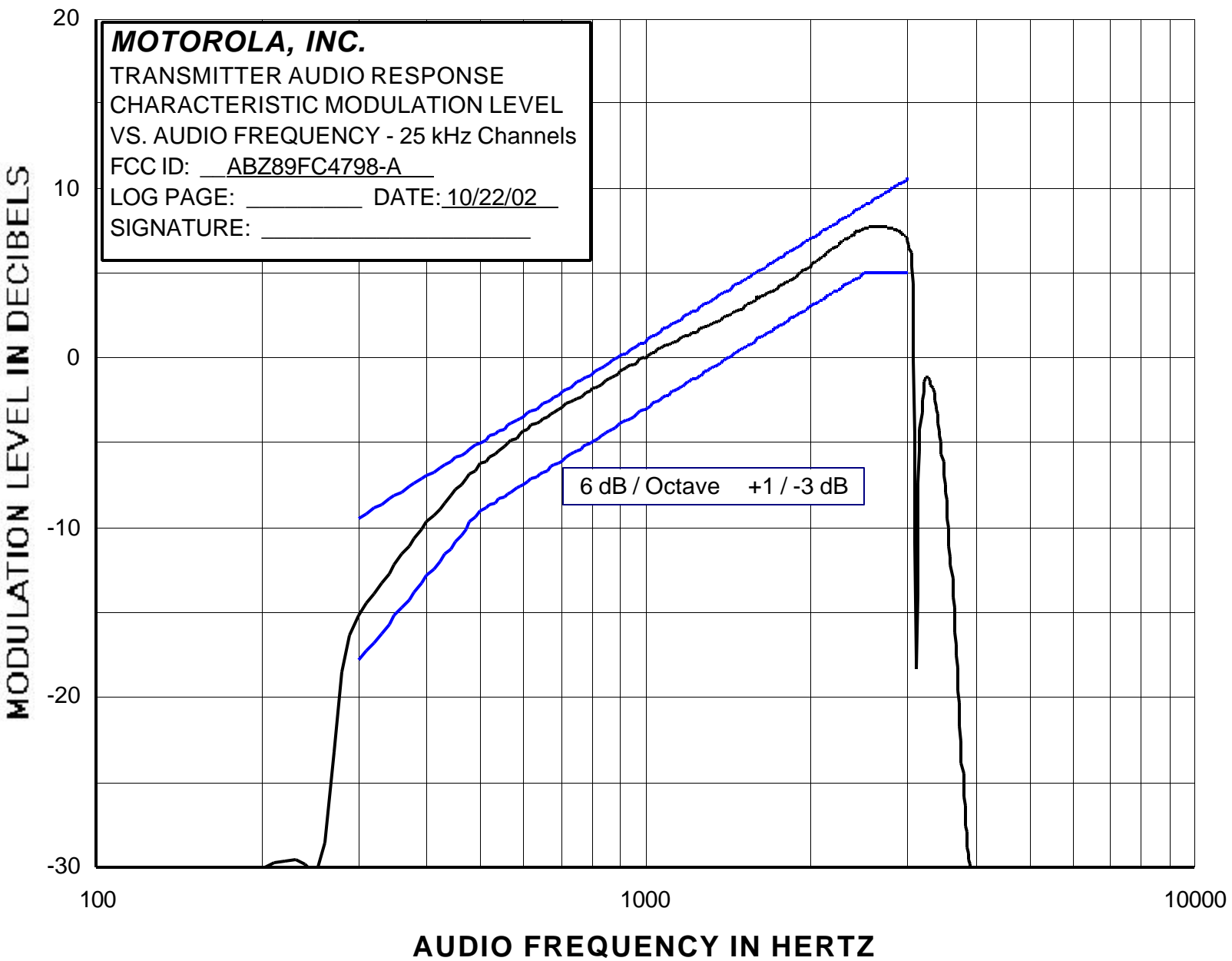
Modulation: Audio Test Tone

Carrier Frequency: A carrier at 406.0125 MHz was measured. This frequency is near the center of the operating band 380-433 MHz.

**AUDIO FREQUENCY RESPONSE PLOTS:****EXHIBIT      DESCRIPTION**

- |       |   |
|-------|---|
| 11B-1 | Audio Frequency Response, 12.5 kHz Channels |
| 11B-2 | Audio Frequency Response, 25 kHz Channels   |





**MODULATION LIMITING - MODULATION CHARACTERISTICS**

**SPECIFICATION REQUIREMENT:**

Reference: TIA 603

**MODULATION LIMITING RESPONSE, 12.5 kHz CHANNELS**

- The maximum instantaneous peak and steady state deviations shall not exceed the rated system deviation of +/- 2.5 kHz at any audio frequency or change in level as specified in the method of measurement.
- The minimum value of modulation limiting shall be at least 60% of the rated system deviation, or 1.5 kHz.

**MODULATION LIMITING RESPONSE, 25 kHz CHANNELS**

- The maximum instantaneous peak and steady state deviations shall not exceed the rated system deviation of +/- 5 kHz at any audio frequency or change in level as specified in the method of measurement.
- The minimum value of modulation limiting shall be at least 60% of the rated system deviation, or 3 kHz.

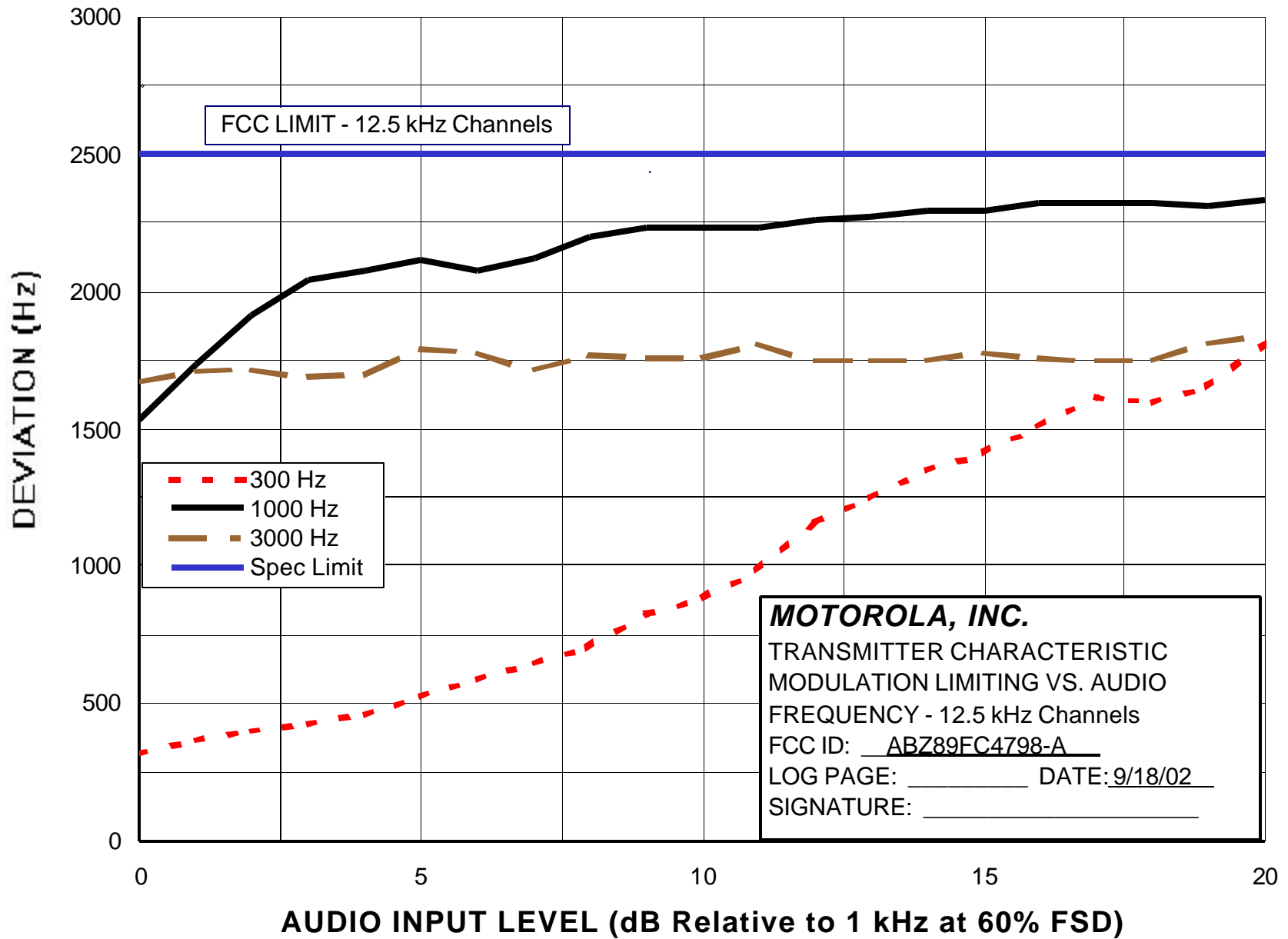
Modulation: Audio Test Tone, Varying Frequency between 300 Hz and 3000 Hz

Carrier Frequency: A carrier at 406.0125 MHz was measured. This frequency is near the center of the operating band 380-433 MHz.

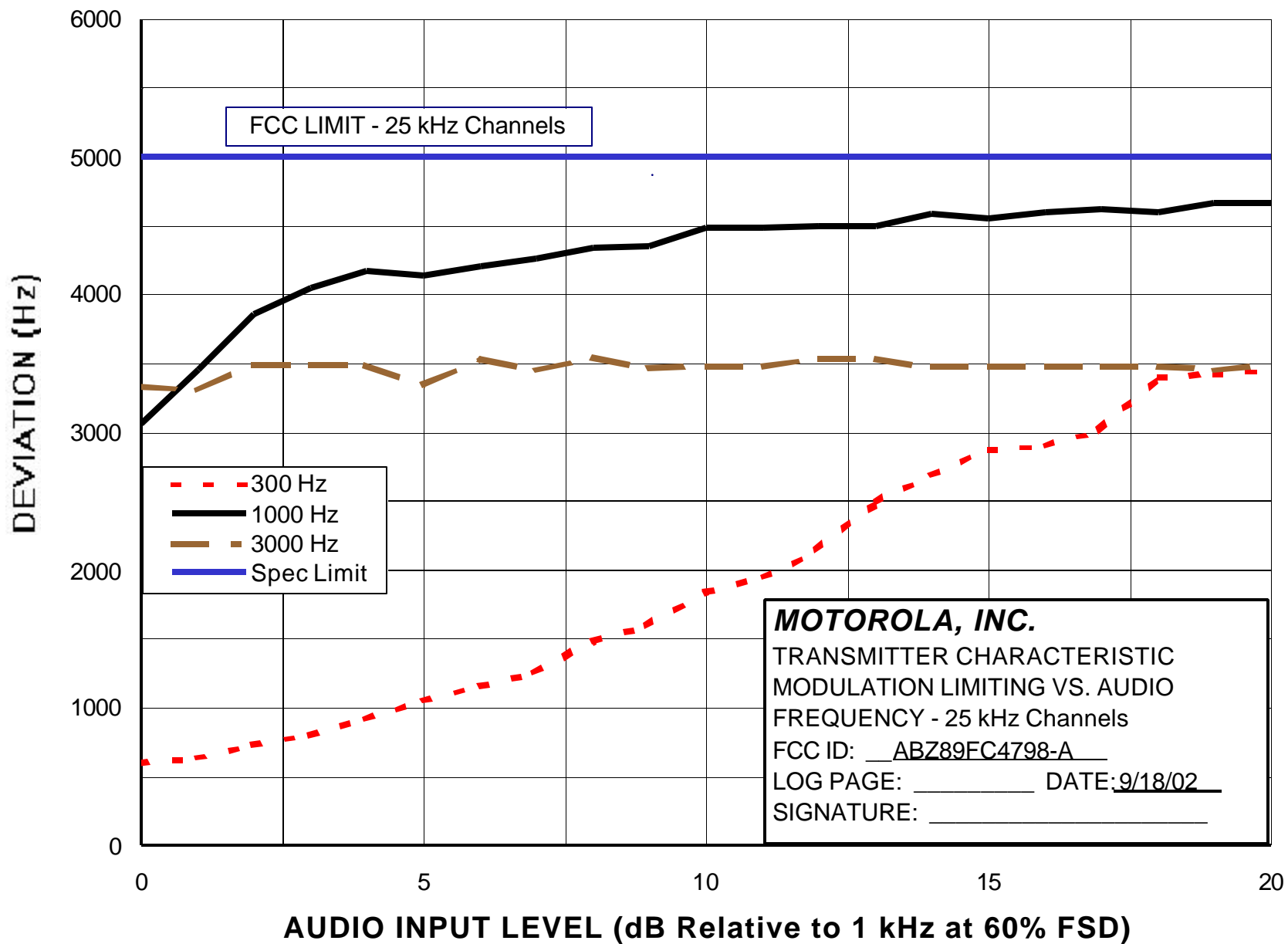
**AUDIO FREQUENCY RESPONSE PLOTS:**

**EXHIBIT      DESCRIPTION**

- |       |   |
|-------|---|
| 11D-1 | Modulation Limiting Response, 12.5 kHz Channels |
| 11D-2 | Modulation Limiting Response, 25 kHz Channels   |







**OCCUPIED BANDWIDTH**

Modulation Type: Carrier with 9600 BPS Digitized Voice  
 Emission Designator: 8K10F1E  
 Channelization: 12.5 kHz  
 Power Setting: 110-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 per TIA-102 CAAA / CAAB:**

- 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 - 110 Watts

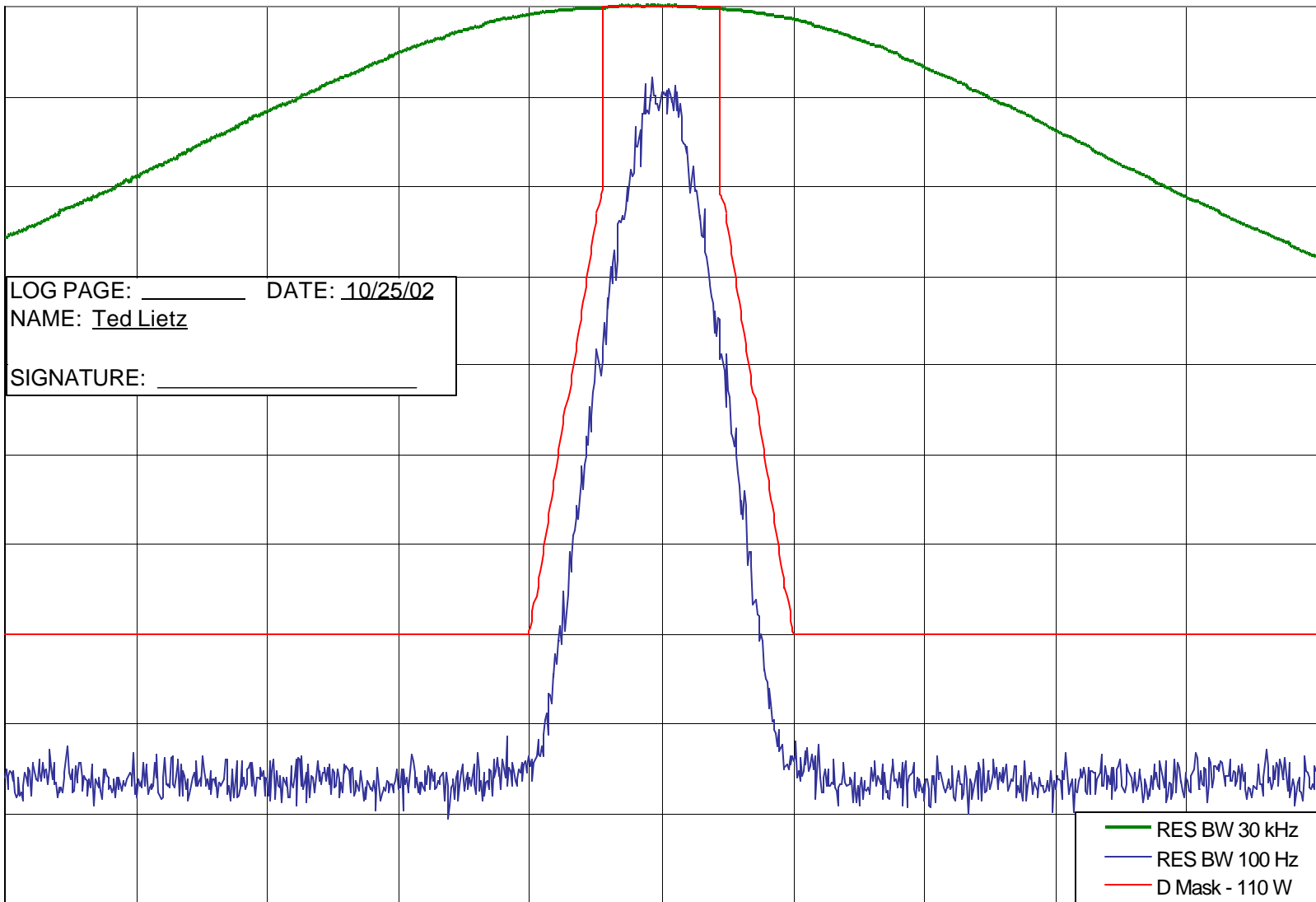
REF 7.7 dBm

ATTEN 20 dB

10 dB/  
POS PK

LOG PAGE: \_\_\_\_\_ DATE: 10/25/02  
NAME: Ted Lietz

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



CENTER 406.01250 MHz  
RES BW 100 Hz

VID BW 1 kHz

SPAN 125 kHz  
SWP 75 sec

RES BW 30 kHz  
RES BW 100 Hz  
D Mask - 110 W

**OCCUPIED BANDWIDTH**

Modulation Type: Carrier with 2500 Hz Audio Tone  
 Emission Designator: 11K0F3E  
 Channelization: 12.5 kHz  
 Deviation Limit:  $\pm 2.5$  kHz Max

**SPECIFICATION REQUIREMENT:****§ 90.210 D-Mask Emission limits:**

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  $7.27 * (f_d - 2.88 \text{ kHz})$  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 plus  $10 \log_{10}(P)$  decibels or 70 decibels (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.

**Necessary Bandwidth Calculation:**

The necessary bandwidth of the modulation signal per the formulas defined in 47 CFR 2.202 (b) is as follows:

<i>Max Mod Freq, M</i>	<i>Max Deviation, D</i>	<i><math>2*(M+D)</math></i>	<i>Nec BW</i>
3 kHz	2.5 kHz	11 kHz	11K0

**Measurement Setting and Procedure, per TIA/EIA 603:****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		

**Test Procedure:**

- 1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
- 2) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.
- 3) Allow the analyzer to sweep, and record the resultant emission levels in trace B.
- 4) Plot the resulting two analyzer traces. The occupied bandwidth mask is then added along with additional labeling as appropriate.

# Occupied Bandwidth - 12.5 kHz Channel - Carrier with 2500 Hz Audio Tone

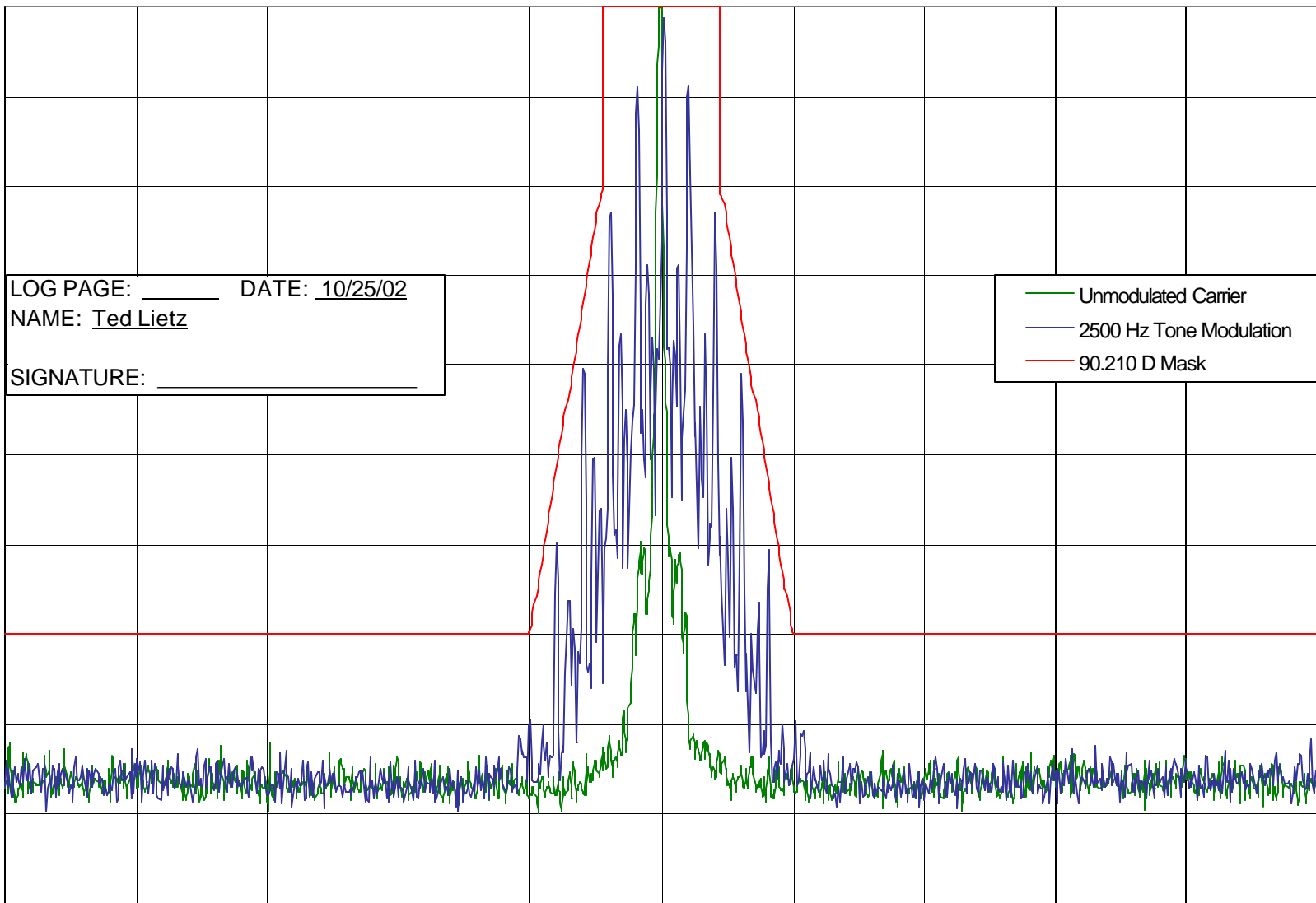
REF 7.7 dBm

ATTEN 20 dB

10 dB/  
POS PK

LOG PAGE: \_\_\_\_\_ DATE: 10/25/02  
NAME: Ted Lietz  
SIGNATURE: \_\_\_\_\_

— Unmodulated Carrier  
— 2500 Hz Tone Modulation  
— 90.210 D Mask



CENTER 861.0125 MHz  
RES BW 100 Hz

VID BW 1 kHz

SPAN 125 kHz  
SWP 75 sec

**OCCUPIED BANDWIDTH**

Modulation Type: Carrier with 2500 Hz Audio Tone and 150 Hz Private Line (PL) Tone  
 Emission Designator: 11K0F3E  
 Channelization: 12.5 kHz  
 Deviation Limit:  $\pm 2.5$  kHz Max

**SPECIFICATION REQUIREMENT:****§ 90.210 D-Mask Emission limits:**

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:

- (2) 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  $7.27 * (f_d - 2.88 \text{ kHz})$  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 plus  $10 \log_{10}(P)$  decibels or 70 decibels (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.

**Necessary Bandwidth Calculation:**

The necessary bandwidth of the modulation signal per the formulas defined in 47 CFR 2.202 (b) is as follows:

<i>Max Mod Freq, M</i>	<i>Max Deviation, D</i>	<i><math>2*(M+D)</math></i>	<i>Nec BW</i>
3 kHz	2.5 kHz	11 kHz	11K0

**Measurement Setting and Procedure, per TIA/EIA 603:****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		

**Test Procedure:**

- 1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
- 2) Modulate the transmitter with a 2500 Hz sine wave and PL tone at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.
- 3) Allow the analyzer to sweep, and record the resultant emission levels in trace B.
- 4) Plot the resulting two analyzer traces. The occupied bandwidth mask is then added along with additional labeling as appropriate.

# Occupied Bandwidth - 12.5 kHz Channel - Carrier with 2500 Hz Audio Tone and PL

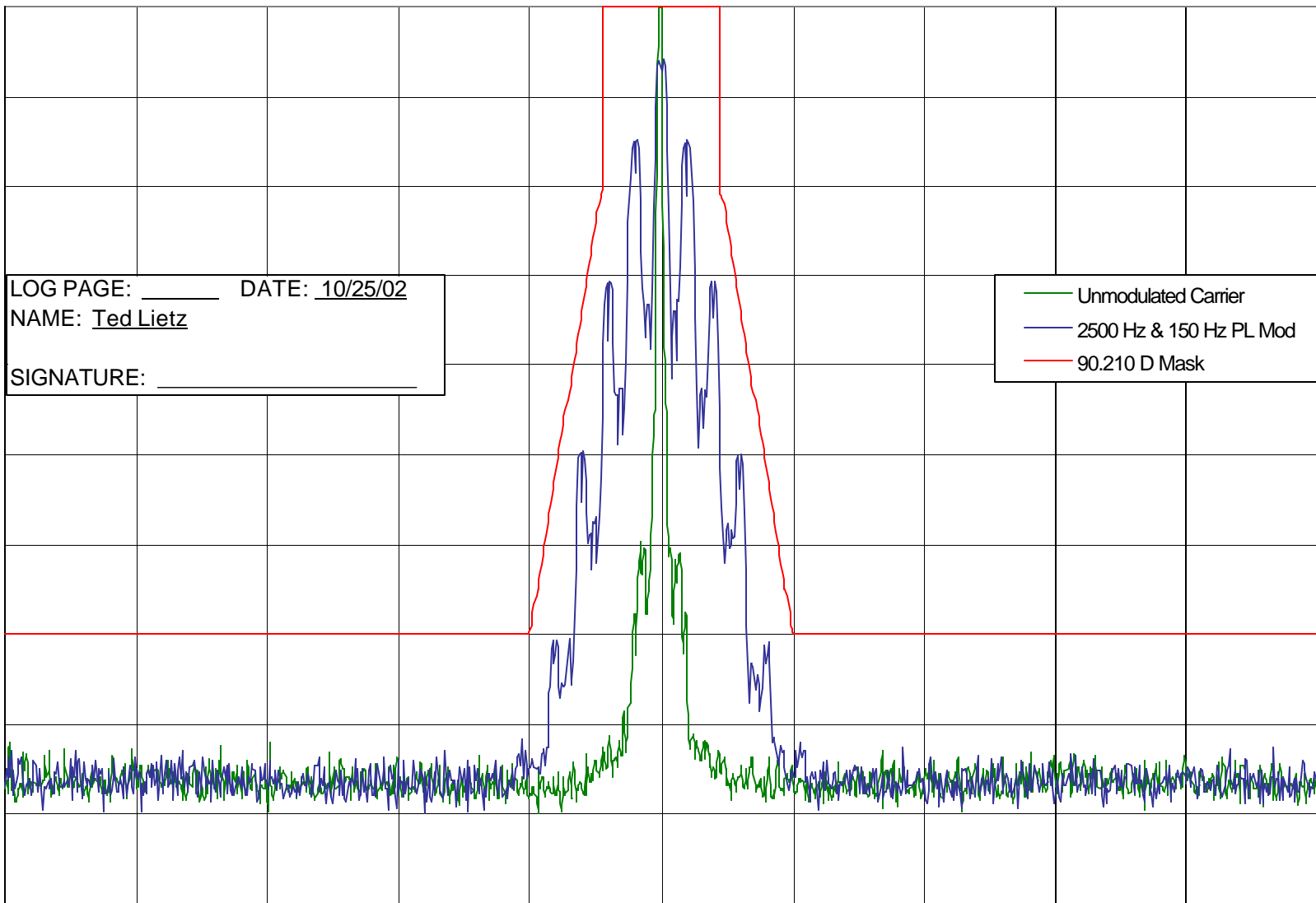
REF 7.7 dBm

ATTEN 20 dB

10 dB/  
POS PK

LOG PAGE: \_\_\_\_\_ DATE: 10/25/02  
NAME: Ted Lietz  
SIGNATURE: \_\_\_\_\_

— Unmodulated Carrier  
— 2500 Hz & 150 Hz PL Mod  
— 90.210 D Mask



CENTER 861.0125 MHz  
RES BW 100 Hz

VID BW 1 kHz

SPAN 125 kHz  
SWP 75 sec

OCCUPIED BANDWIDTH

Modulation Type: Carrier with 3600 BPS 'Hi Speed' Control Data  
 Emission Designator: 10K0F1D  
 Channelization: 12.5 kHz

**SPECIFICATION REQUIREMENT:****§ 90.210 D-Mask Emission limits:**

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:

- (3) 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  $7.27 * (f_d - 2.88 \text{ kHz})$  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 plus  $10 \log_{10}(P)$  decibels or 70 decibels (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.

**Necessary Bandwidth Calculation:**

The necessary bandwidth of the modulation signal per the formulas defined in 47 CFR 2.202 (b) is as follows:

<i>Max Mod Freq, M</i>	<i>Max Deviation, D</i>	<i>2*(M+D)</i>	<i>Nec BW</i>
1.8 kHz	3.1 kHz (overshoots)	9.8 kHz	10K0

**Measurement Setting and Procedure, per TIA/EIA 603:****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		

**Test Procedure:**

- 1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
- 2) Setup the station for 3600 BPS control data using appropriate commands.
- 3) Key the station with the 3600 BPS modulation pattern, allow the analyzer to sweep, and record the resultant emission levels in trace B.
- 4) Plot the resulting two analyzer traces. The occupied bandwidth mask is then added along with additional labeling as appropriate.



# Occupied Bandwidth - 12.5 kHz Channel - Carrier & 3600 bps Channel Control Data

REF 7.7 dBm

ATTEN 20 dB

10 dB/  
POS PK

LOG PAGE: \_\_\_\_\_ DATE: 10/25/02  
NAME: Ted Lietz  
SIGNATURE: \_\_\_\_\_

— Unmodulated Carrier  
— 3600 bps CC Data  
— 90.210 D Mask

CENTER 861.0125 MHz  
RES BW 100 Hz

VID BW 1 kHz

SPAN 125 kHz  
SWP 75 sec

**OCCUPIED BANDWIDTH**

Modulation Type: Carrier with 2500 Hz Audio Tone  
 Emission Designator: 16K0F3E  
 Channelization: 25 kHz  
 Deviation Limit:  $\pm 5.0$  kHz Max

**SPECIFICATION REQUIREMENT:****§ 90.210 B-Mask Emission limits:**

For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:

On any frequency removed from the assigned frequency by a displacement frequency ( $F_d$  in kHz) of:

- |                                       |  |
|---------------------------------------|--|
| a) >10 kHz up to and including 20 kHz | <i>At least 25 dB;</i>   |
| b) >20 kHz up to and including 50 kHz | <i>At least 35 dB;</i>   |
| c) >50 kHz                            | <i>at least <math>43 + 10 * \log_{10}(P)</math> dB or 80 dB;</i> |
|                                       | <i>(whichever is the lesser attenuation).</i>                    |

**Necessary Bandwidth Calculation:**

The necessary bandwidth of the modulation signal per the formulas defined in 47 CFR 2.202 (b) is as follows:

<i>Max Mod Freq, M</i>	<i>Max Deviation, D</i>	<i><math>2*(M+D)</math></i>	<i>Nec BW</i>
3 kHz	5 kHz	16 kHz	16K0

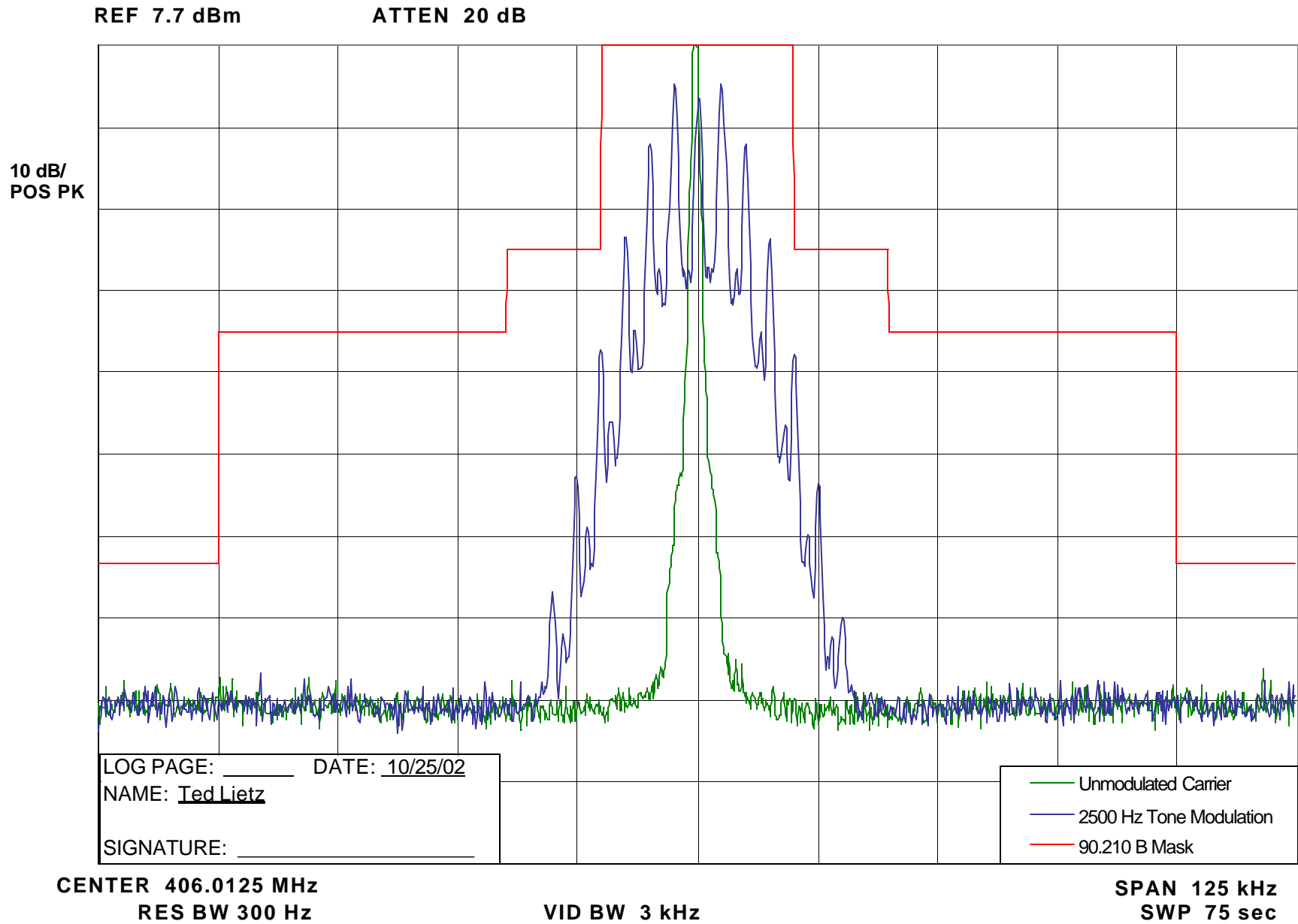
**Measurement Setting and Procedure, per TIA/EIA 603:****Analyzer Settings:**

Horizontal:	12.5 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	30 kHz
Sweep Time:	75 Seconds (<2000 Hz / Second)	Span:	125 kHz
Detector Mode:	Positive Peak		

**Test Procedure:**

- 1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
- 2) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.
- 3) Allow the analyzer to sweep, and record the resultant emission levels in trace B.
- 4) Plot the resulting two analyzer traces. The occupied bandwidth mask is then added along with additional labeling as appropriate.

# Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio Tone



**OCCUPIED BANDWIDTH**

Modulation Type: Carrier with 2500 Hz Audio Tone and 150 Hz Private Line (PL) Tone  
 Emission Designator: 16K0F3E  
 Channelization: 25 kHz  
 Deviation Limit:  $\pm 5.0$  kHz Max

**SPECIFICATION REQUIREMENT:**

**§ 90.210 B-Mask Emission limits:**

For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:

On any frequency removed from the assigned frequency by a displacement frequency ( $F_d$  in kHz) of:

- a)  $>10$  kHz up to and including 20 kHz *At least 25 dB;*
- b)  $>20$  kHz up to and including 50 kHz *At least 35 dB;*
- c)  $>50$  kHz *at least  $43+10 * \log_{10}(P)$  dB or 80 dB;*  
*(whichever is the lesser attenuation).*

**Necessary Bandwidth Calculation:**

The necessary bandwidth of the modulation signal per the formulas defined in 47 CFR 2.202 (b) is as follows:

<i>Max Mod Freq, M</i>	<i>Max Deviation, D</i>	<i><math>2*(M+D)</math></i>	<i>Nec BW</i>
3 kHz	5 kHz	16 kHz	16K0

**Measurement Setting and Procedure, per TIA/EIA 603:**

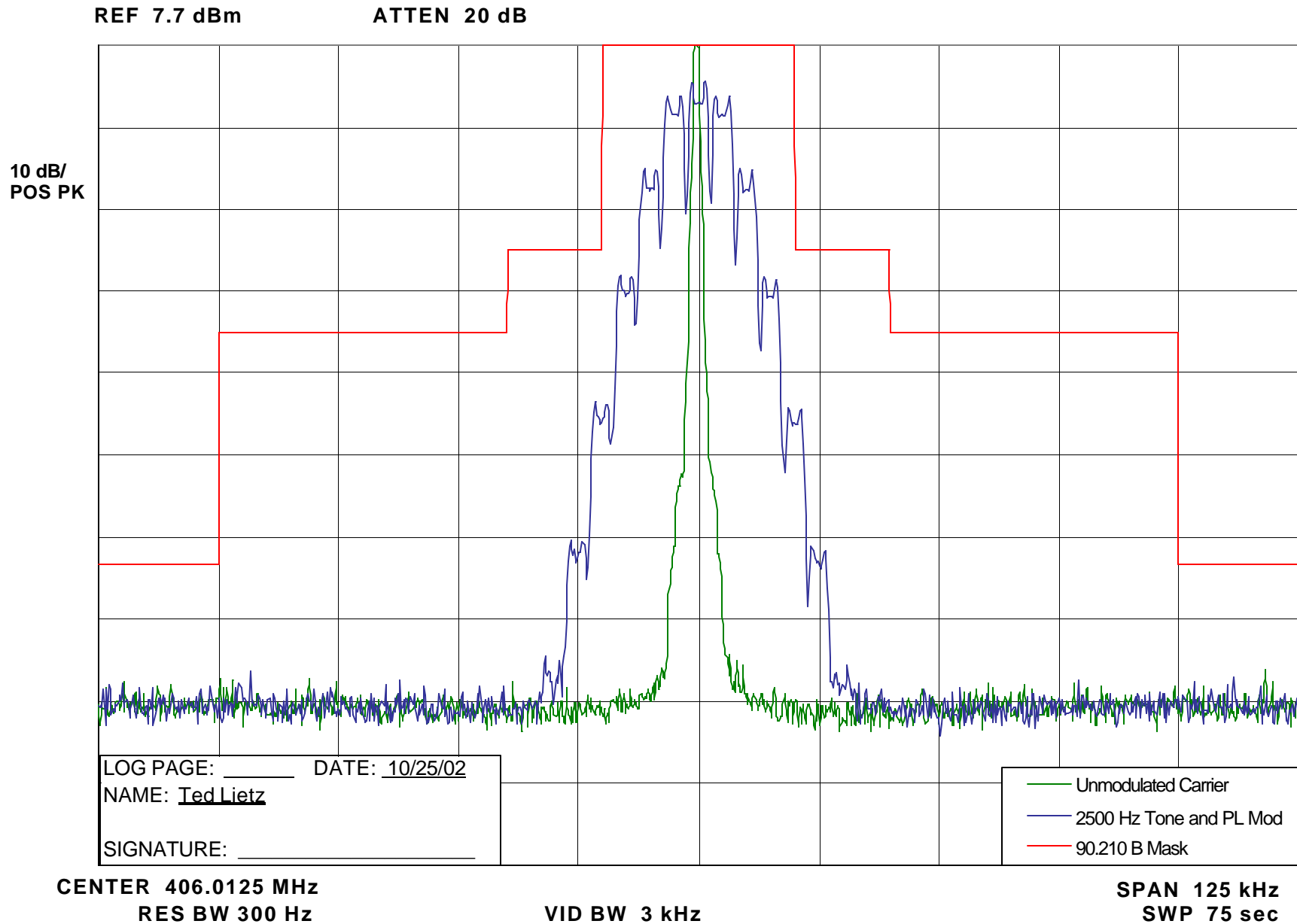
**Analyzer Settings:**

Horizontal:	12.5 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	30 kHz
Sweep Time:	75 Seconds ( $<2000$ Hz / Second)	Span:	125 kHz
Detector Mode:	Positive Peak		

**Test Procedure:**

- 1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
- 2) Modulate the transmitter with a 2500 Hz sine wave and PL tone at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.
- 3) Allow the analyzer to sweep, and record the resultant emission levels in trace B.
- 4) Plot the resulting two analyzer traces. The occupied bandwidth mask is then added along with additional labeling as appropriate.

# Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio Tone and PL



OCCUPIED BANDWIDTH

Modulation Type: Carrier with 3600 bps 'Hi Speed' Control Data  
 Emission Designator: 16K0F1D  
 Channelization: 25 kHz  
 Deviation Limit:  $\pm 5.0$  kHz Max

SPECIFICATION REQUIREMENT:

\*\*\* Generic part 22. Part 90, <896, 901-935, >940 \*\*\*

— The power of any emission shall be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $F_d$  in kHz) of:

- a) >5 kHz up to and including 10 kHz .....At least  $83 * \log_{10} (F_d / 5)$  dB;
- b) >10 kHz up to and including 50 kHz .....At least  $116 * \log_{10} (F_d / 6.1)$  dB;  
 or ..... $50 + 10 * \log_{10} (P)$  dB;  
 or .....70 dB;  
 (whichever is the lesser attenuation).
- c) greater than 50 kHz.....at least  $43 + 10 * \log_{10} (P)$  dB or 80 dB;  
 (whichever is the lesser attenuation).

**Calibration**

Horizontal:	5 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	3 kHz
Sweep Time:	30 Seconds (< 2000 Hz per second)		
Detector Mode:	Positive Peak		

**Necessary Bandwidth Calculation:**

The necessary bandwidth of the modulation signal per the formulas defined in 47 CFR 2.202 (b) is as follows:

<i>Max Mod Freq, M</i>	<i>Max Deviation, D</i>	<i><math>2*(M+D)</math></i>	<i>Nec BW</i>
1.8 kHz	6.2 kHz (overshoots)	16.0 kHz	16K0

**Measurement Setting and Procedure, per TIA/EIA 603:**

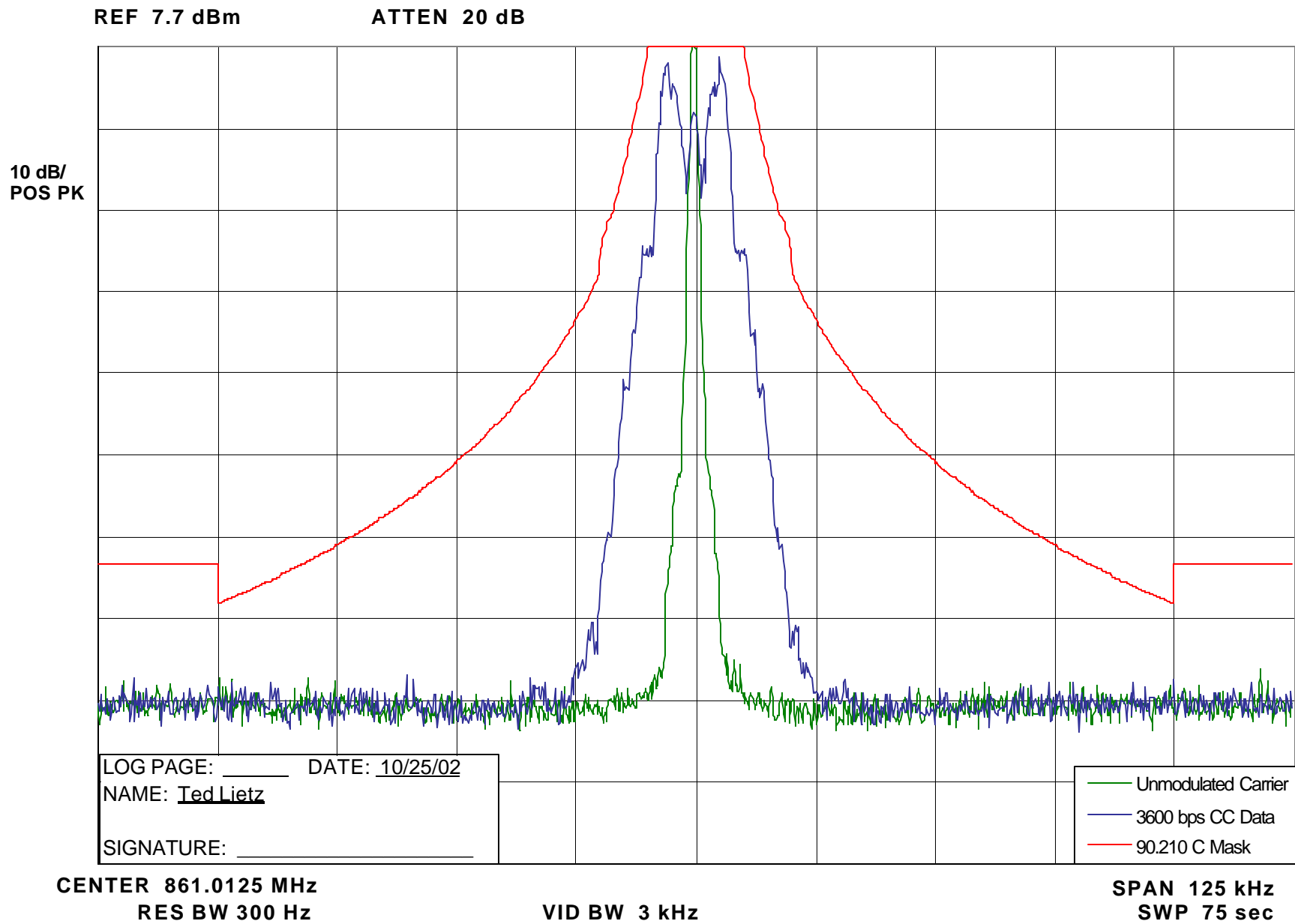
Analyzer Settings:

Horizontal:	12.5 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	30 kHz
Sweep Time:	75 Seconds (<2000 Hz / Second)	Span:	125 kHz
Detector Mode:	Positive Peak		

Test Procedure:

- 1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
- 2) Setup the station for 3600 BPS control data using appropriate commands.
- 3) Key the station with the 3600 BPS modulation pattern, allow the analyzer to sweep, and record the resultant emission levels in trace B.
- 4) Plot the resulting two analyzer traces. The occupied bandwidth mask is then added along with additional labeling as appropriate.

# Occupied Bandwidth - 25 kHz Channels - Carrier & 3600 bps Channel Control Data



**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 401.0000 MHz was measured. This frequency is near the center of the operating band 380-433 MHz.

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

11G-1	Conducted Spurious Emissions, Harmonics, Power Output at 110 Watts The specification limit is -70.0 dBC
11G-2	Conducted Spurious Emissions, Harmonics, Power Output at 10 Watts The specification limit is -60.0 dBC
11G-3	Conducted Spurious Emissions, Close-In, Power Output at 110 Watts (500 kHz Span) The specification limit is -70.0 dBC
11G-4	Conducted Spurious Emissions, Close-In, Power Output at 110 Watts (1 MHz Span) The specification limit is -70.0 dBC



**MOTOROLA, INC.**

TRANSMITTER SPURIOUS EMISSION

CONDUCTED THROUGH 10TH HARMONIC

OUTPUT POWER: 110 WATTS

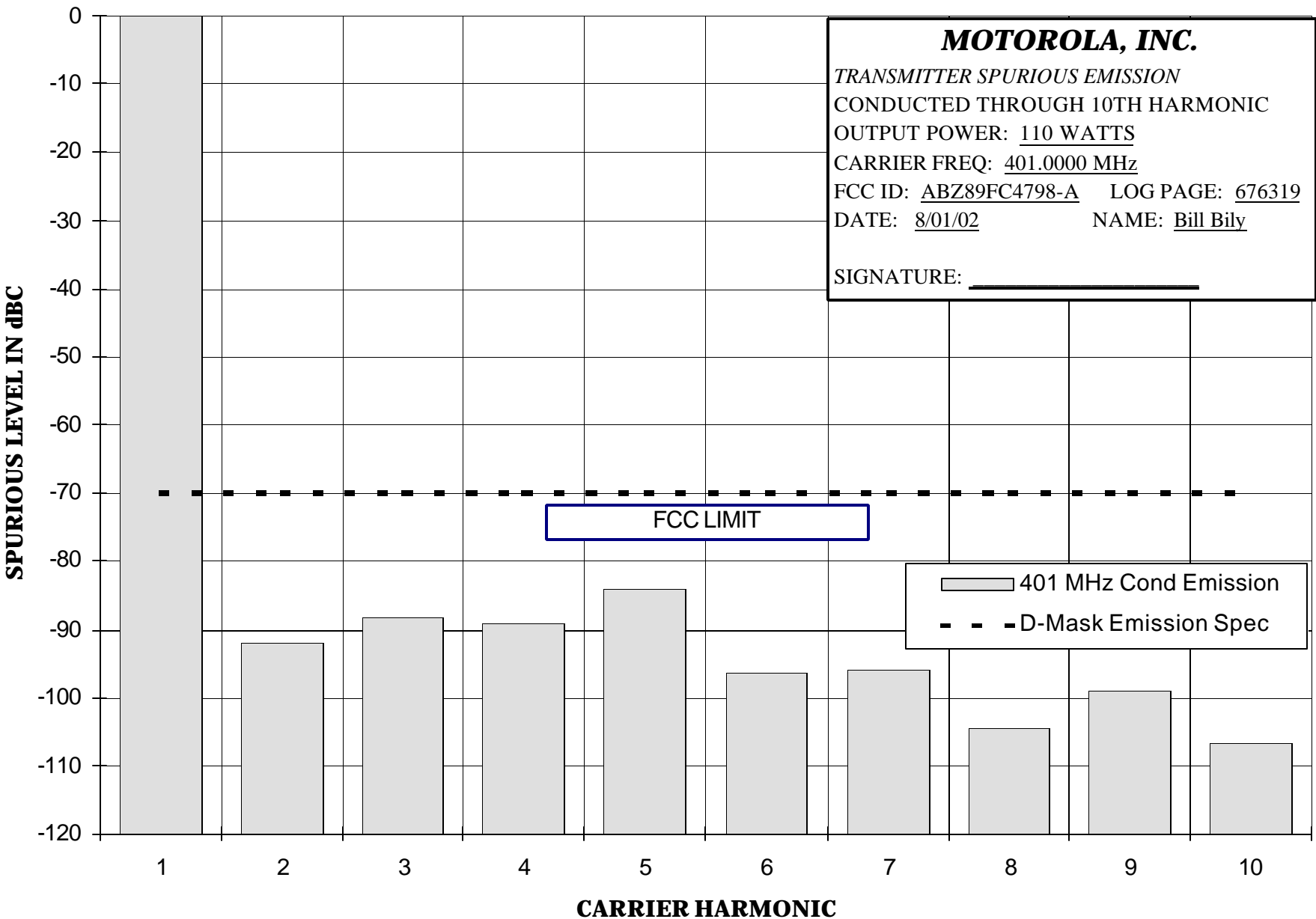
CARRIER FREQ: 401.0000 MHz

FCC ID: ABZ89FC4798-A LOG PAGE: 676319

DATE: 8/01/02

NAME: Bill Bily

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



**MOTOROLA, INC.**

TRANSMITTER SPURIOUS EMISSION

CONDUCTED THROUGH 10TH HARMONIC

OUTPUT POWER: 10 WATTS

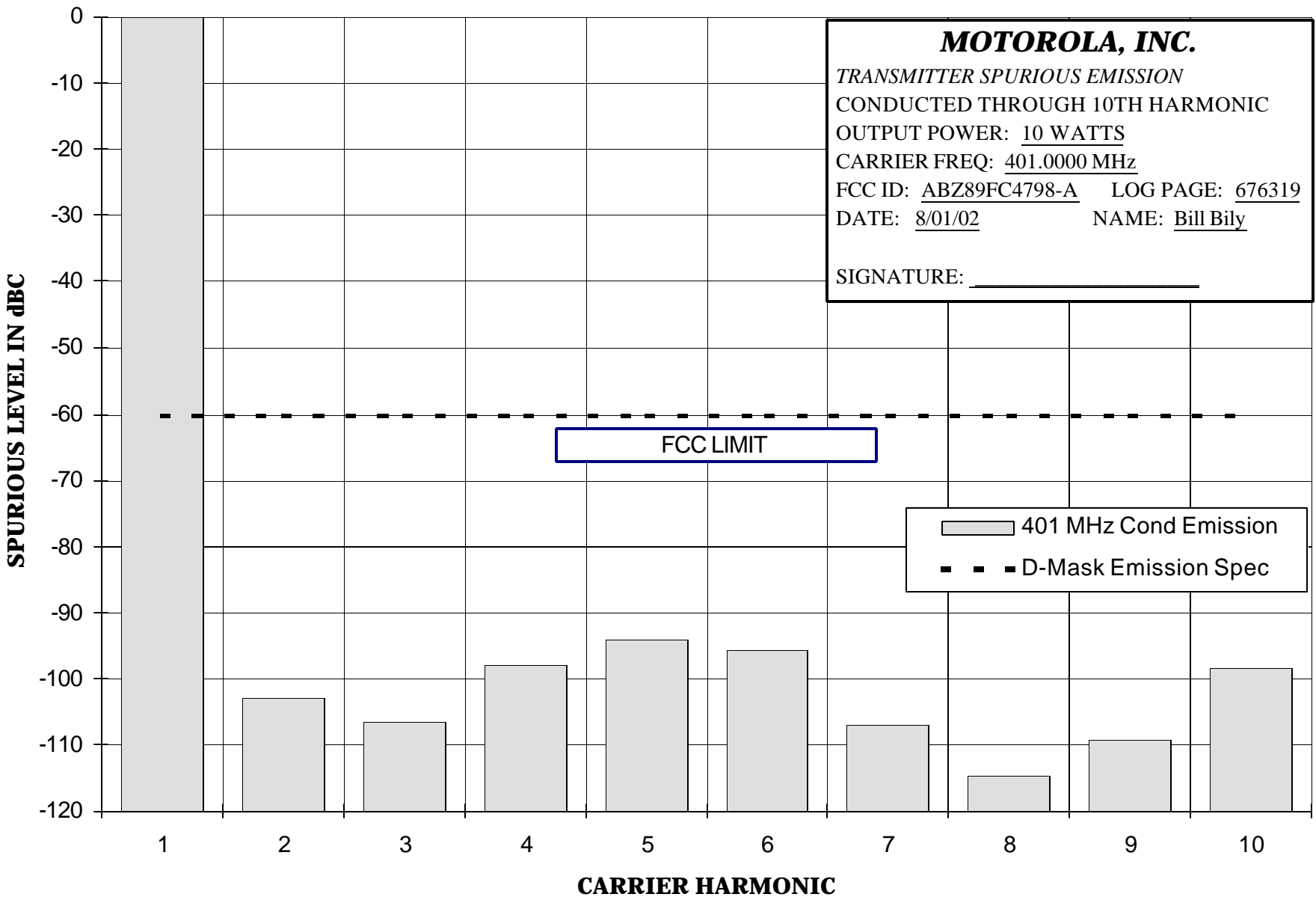
CARRIER FREQ: 401.0000 MHz

FCC ID: ABZ89FC4798-A LOG PAGE: 676319

DATE: 8/01/02

NAME: Bill Bily

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



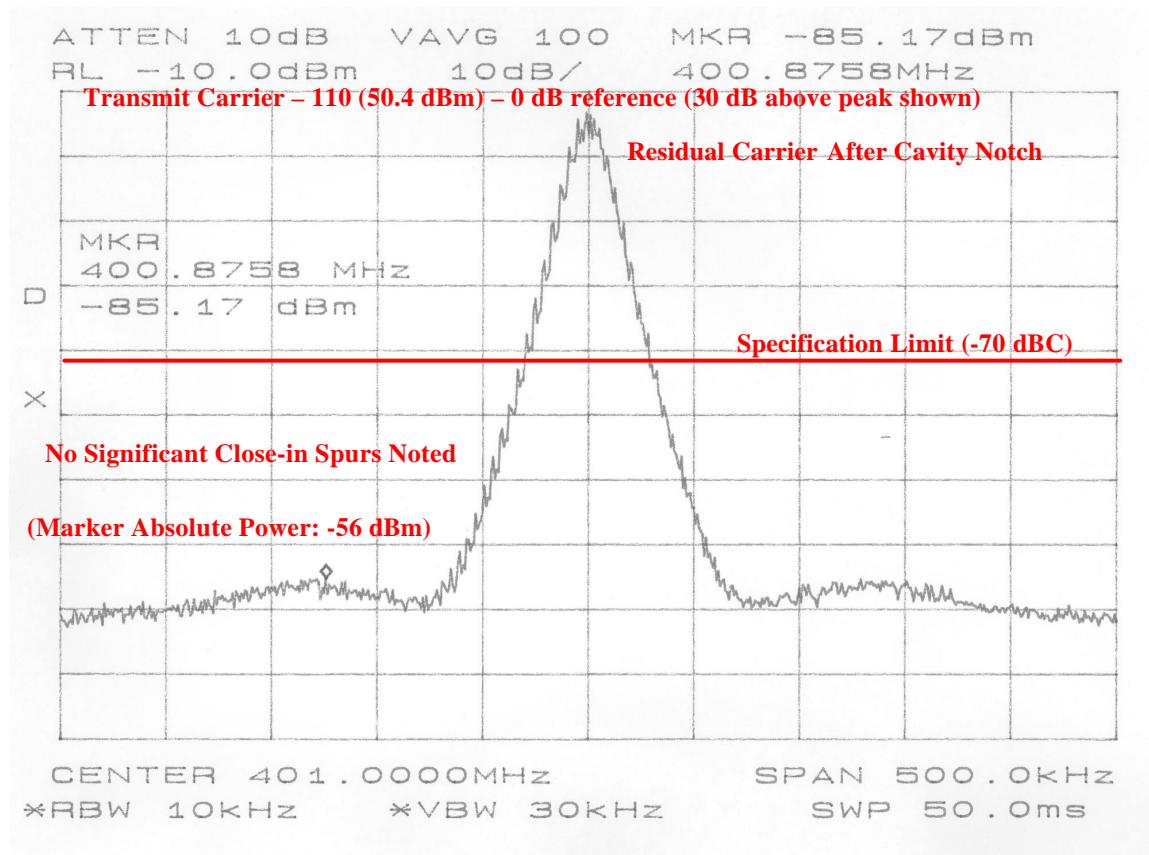
**CLOSE-IN CONDUCTED SPURIOUS EMISSIONS*****MOTOROLA, INC.***

TRANSMITTER SPURIOUS EMISSION

CLOSE-IN CONDUCTED

OUTPUT POWER: 110 WATTSCARRIER FREQ: 401.0000 MHzFCC ID: ABZ89FC4798-A LOG PAGE: 000751DATE: 10/25/02 NAME: Tim Mosher

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



Note: The absolute power at the marker was verified using a signal generator, which was fed into the same notch test setup as the transmitter. The power level of a 400.8758 MHz signal was adjusted until equivalent power level as the noise floor marker shown above (-85.17 dBm) was observed at the spectrum analyzer. This absolute power level was then compared to power level of transmitter to obtain level of noise floor referenced to carrier power. The noise floor is better than 100 dB below the carrier power using this setup.

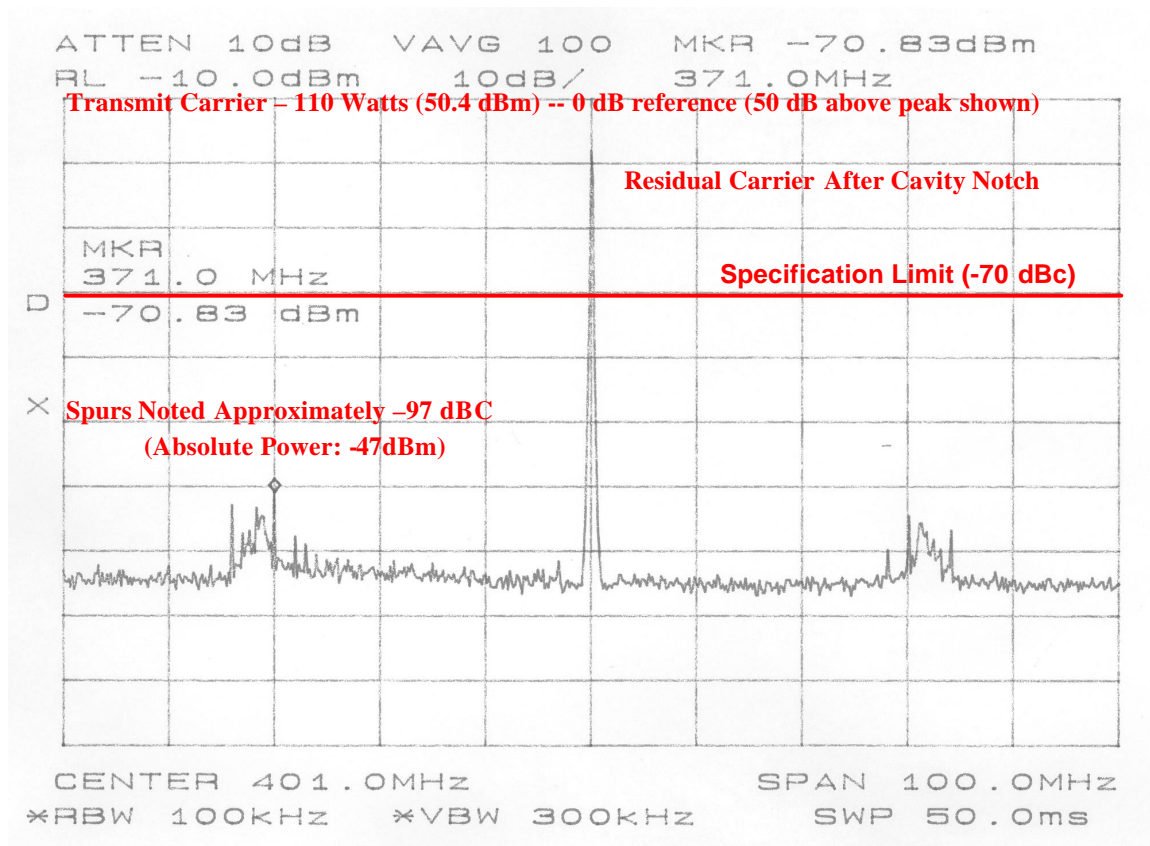
**CLOSE-IN CONDUCTED SPURIOUS EMISSIONS****MOTOROLA, INC.**

TRANSMITTER SPURIOUS EMISSION

CLOSE-IN CONDUCTED

OUTPUT POWER: 110 WATTSCARRIER FREQ: 401.0000 MHzFCC ID: ABZ89FC4798-A LOG PAGE: 000751DATE: 10/25/02 NAME: Tim Mosher

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



Note: The absolute power of the spur was verified using a signal generator, which was fed into the same notch test setup as the transmitter. The power level of a 371.0 MHz carrier was adjusted until equivalent power level as the spur shown above (-70.83 dBm) was observed at the spectrum analyzer. This absolute power level was then compared to the power level of the transmitter to obtain the level of the spur referenced to 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).

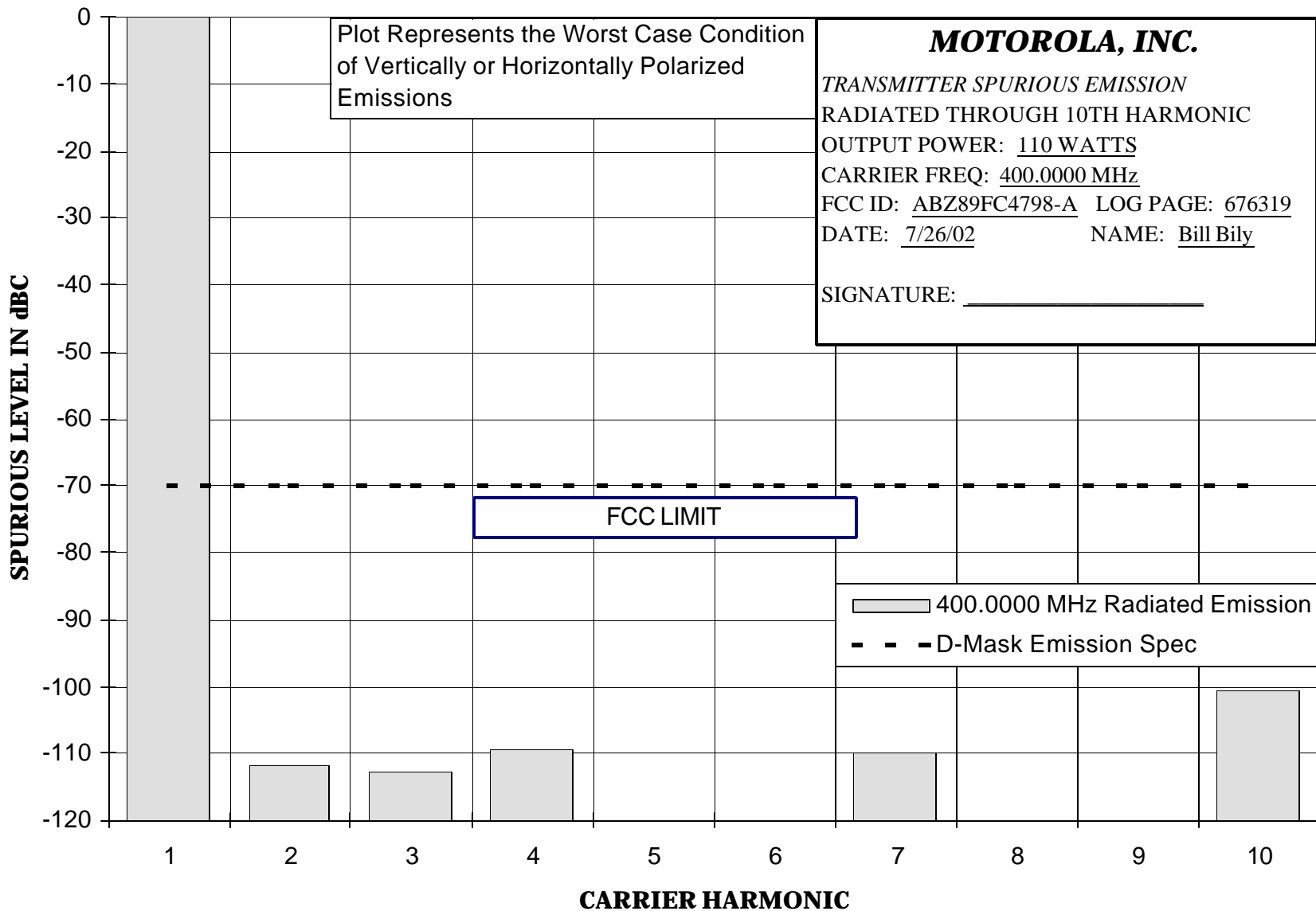
(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide to capture the true peak emission of the equipment under test. A sufficient number of sweeps must be measured to ensure that the emission profile is developed. If 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.

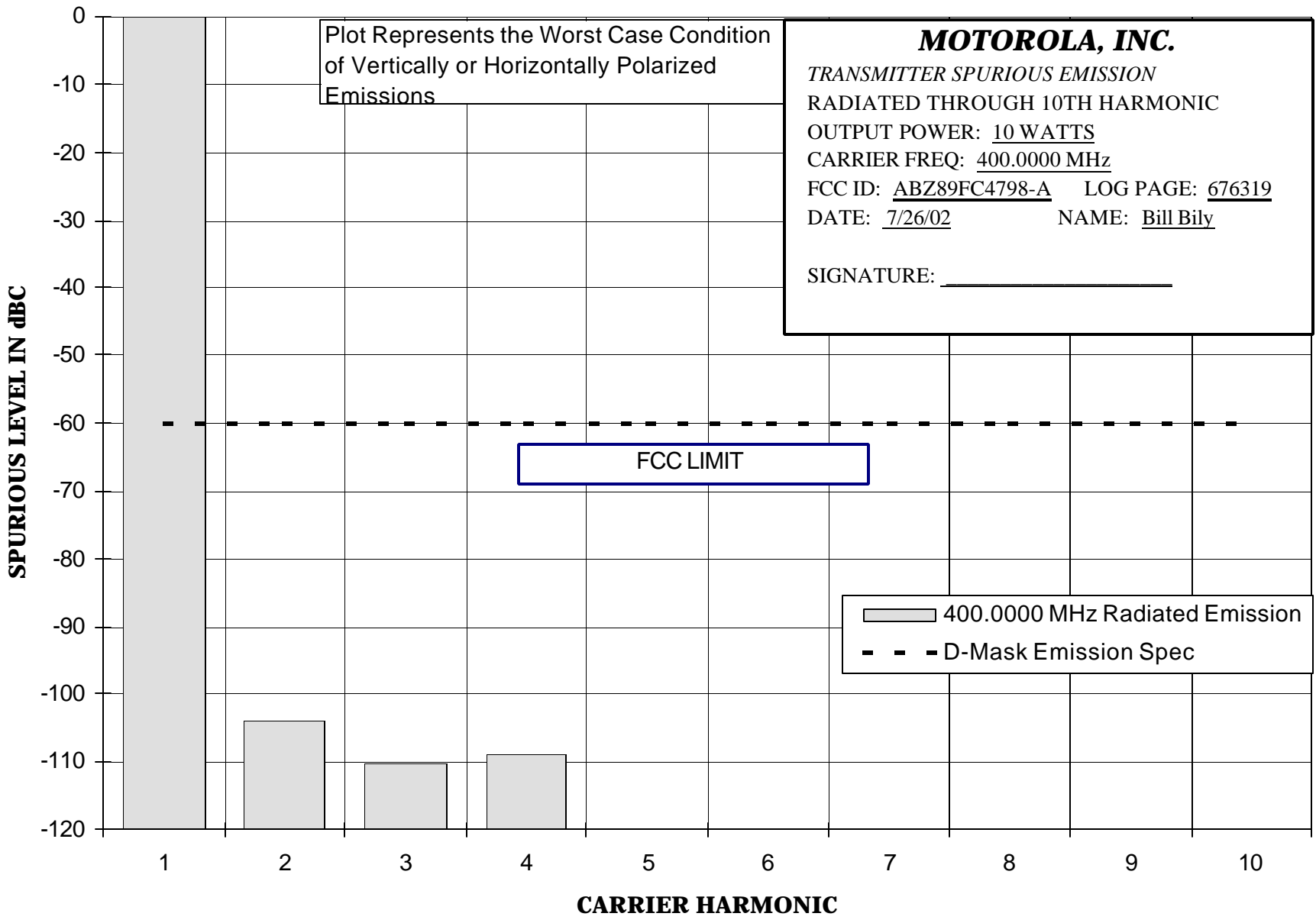
Modulation: Psuedorandom data

Carrier Frequency: A carrier at 400.0000 MHz was measured. This frequency is near the center of the operating band 380 – 433 MHz.

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

11H-1	Conducted Spurious Emissions, Harmonics, Power Output at 110 Watts The specification limit is –70.0 dBC
11H-2	Conducted Spurious Emissions, Harmonics, Power Output at 10 Watts The specification limit is -60.0 dBC





**OSCILLATOR FREQUENCY STABILITY**

**SPECIFICATION REQUIREMENT:**

**Reference: Part 90.213**

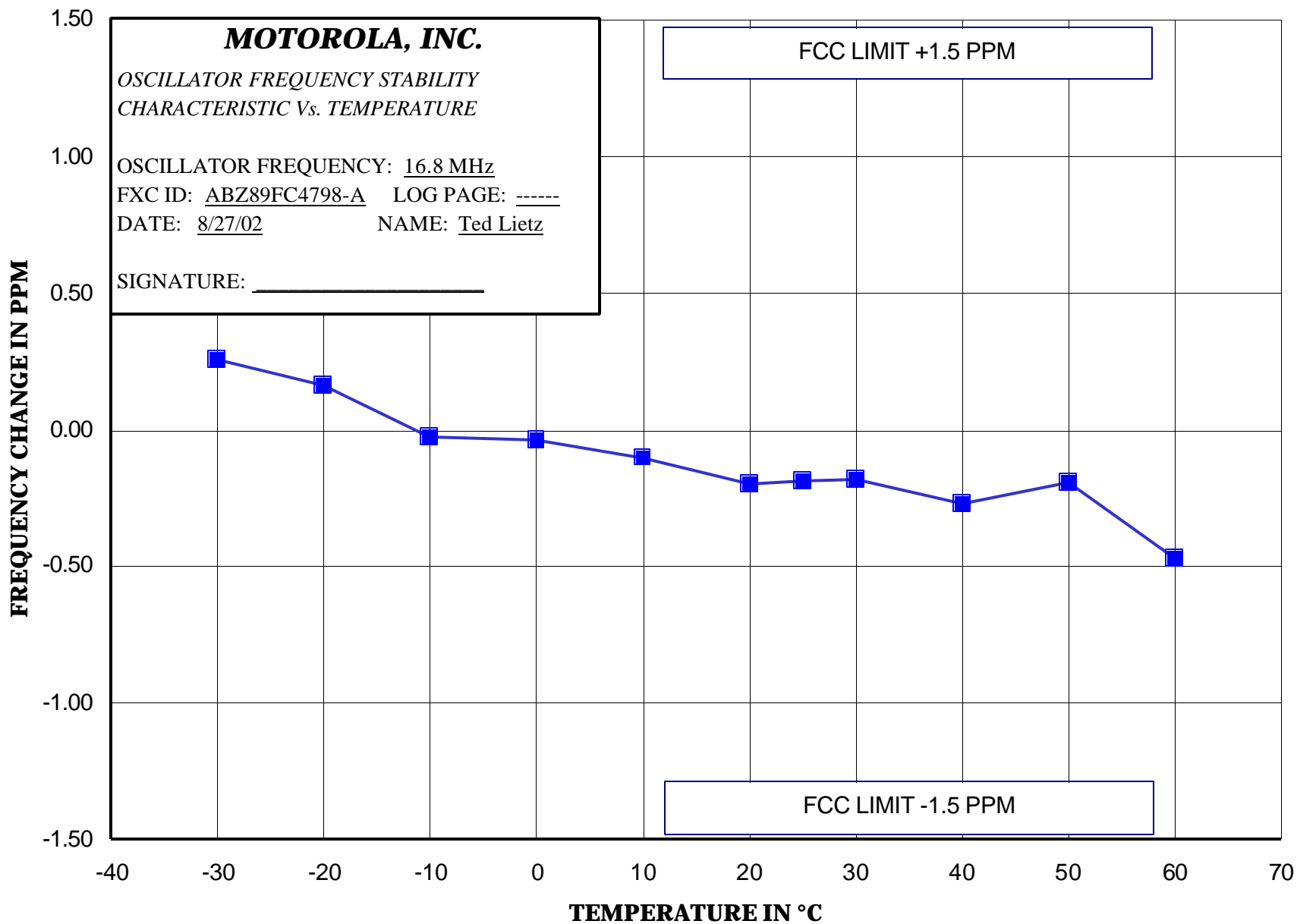
Fixed and Base stations with 25 kHz channel bandwidth, operating at 421-512 MHz, must have a frequency stability of better than 2.5 PPM.

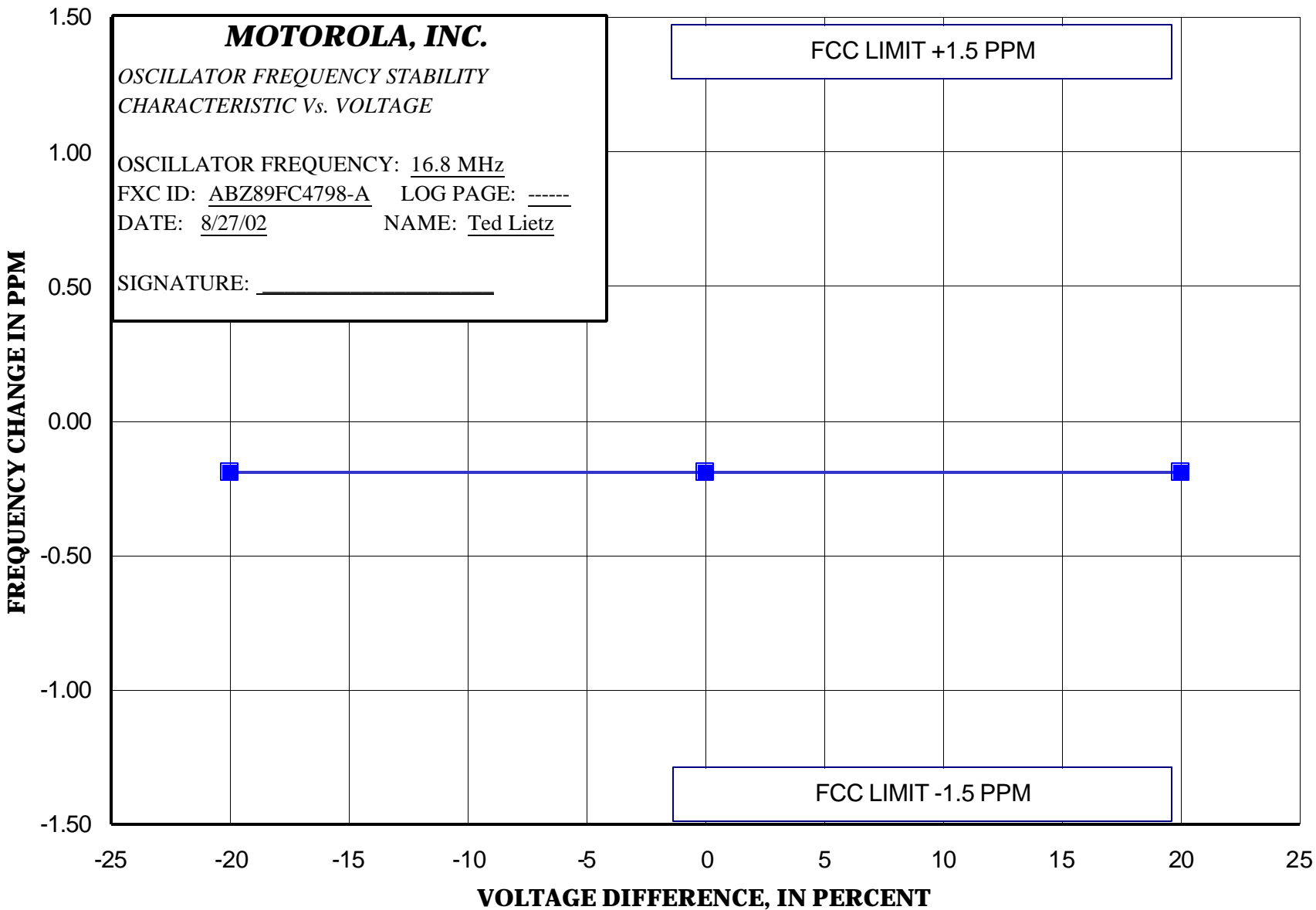
Fixed and Base stations with 12.5 kHz channel bandwidth, operating at 421-512 MHz, must have a frequency stability of better than 1.5 PPM.

**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:****Reference: Part 90.214****TRANSIENT FREQUENCY BEHAVIOR 12.5 kHz CHANNELS**

For time intervals:

- a.  $t_1 = 10$  ms      Maximum Frequency Difference  $\pm 12.5$  kHz
- b.  $t_2 = 25$  ms      Maximum Frequency Difference  $\pm 6.25$  kHz
- c.  $t_3 = 10$  ms      Maximum Frequency Difference  $\pm 12.5$  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.

**SPECIFICATIONS TRANSIENT FREQUENCY BEHAVIOR 25 kHz CHANNELS**

For time intervals:

- a.  $t_1 = 10$  ms,      Maximum Frequency Difference  $\pm 25$  kHz
- b.  $t_2 = 25$  ms      Maximum Frequency Difference  $\pm 12.5$  kHz
- c.  $t_3 = 10$  ms      Maximum Frequency Difference  $\pm 25$  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.

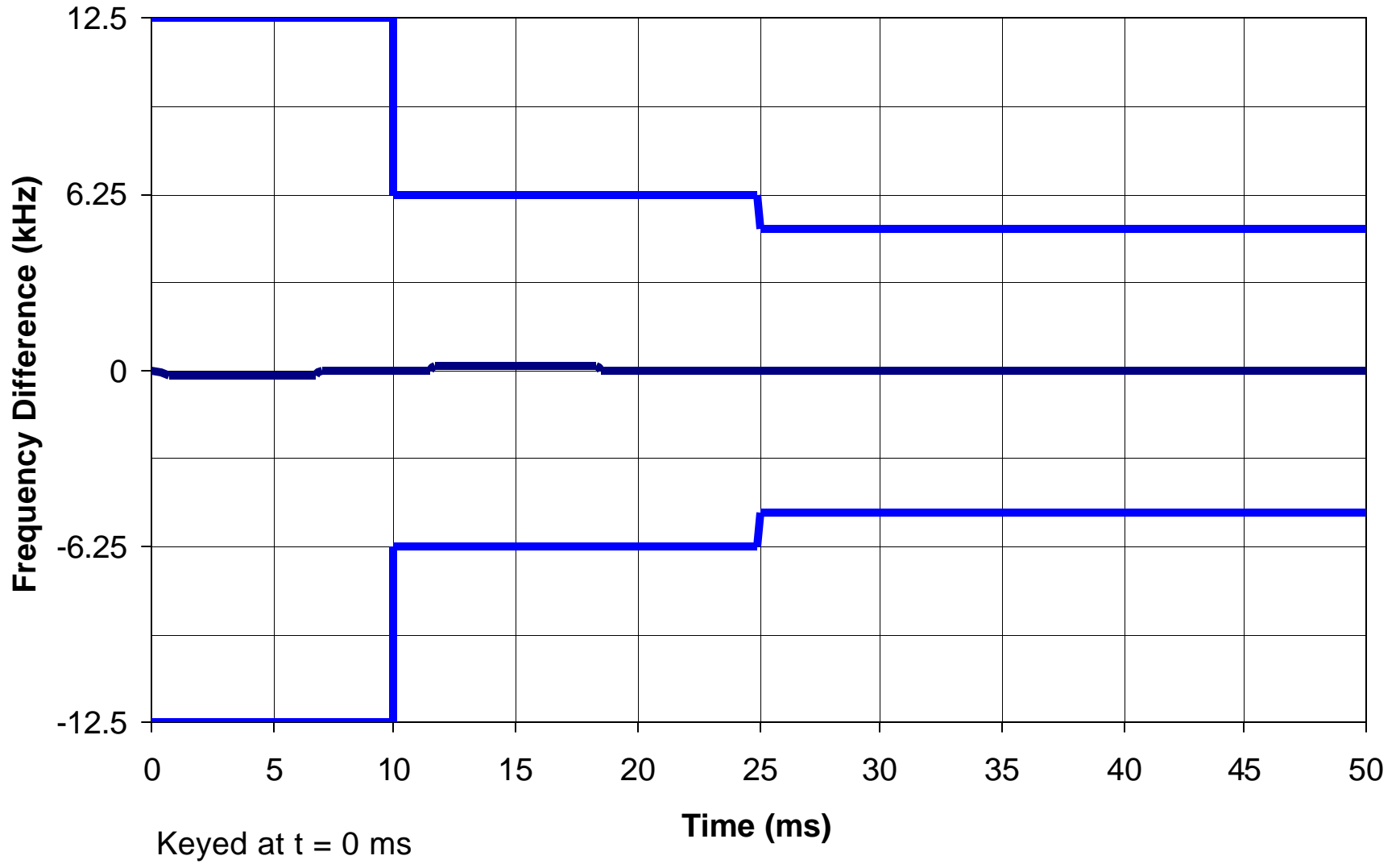
**FREQUENCY TRANSIENT BEHAVIOR PLOTS:**

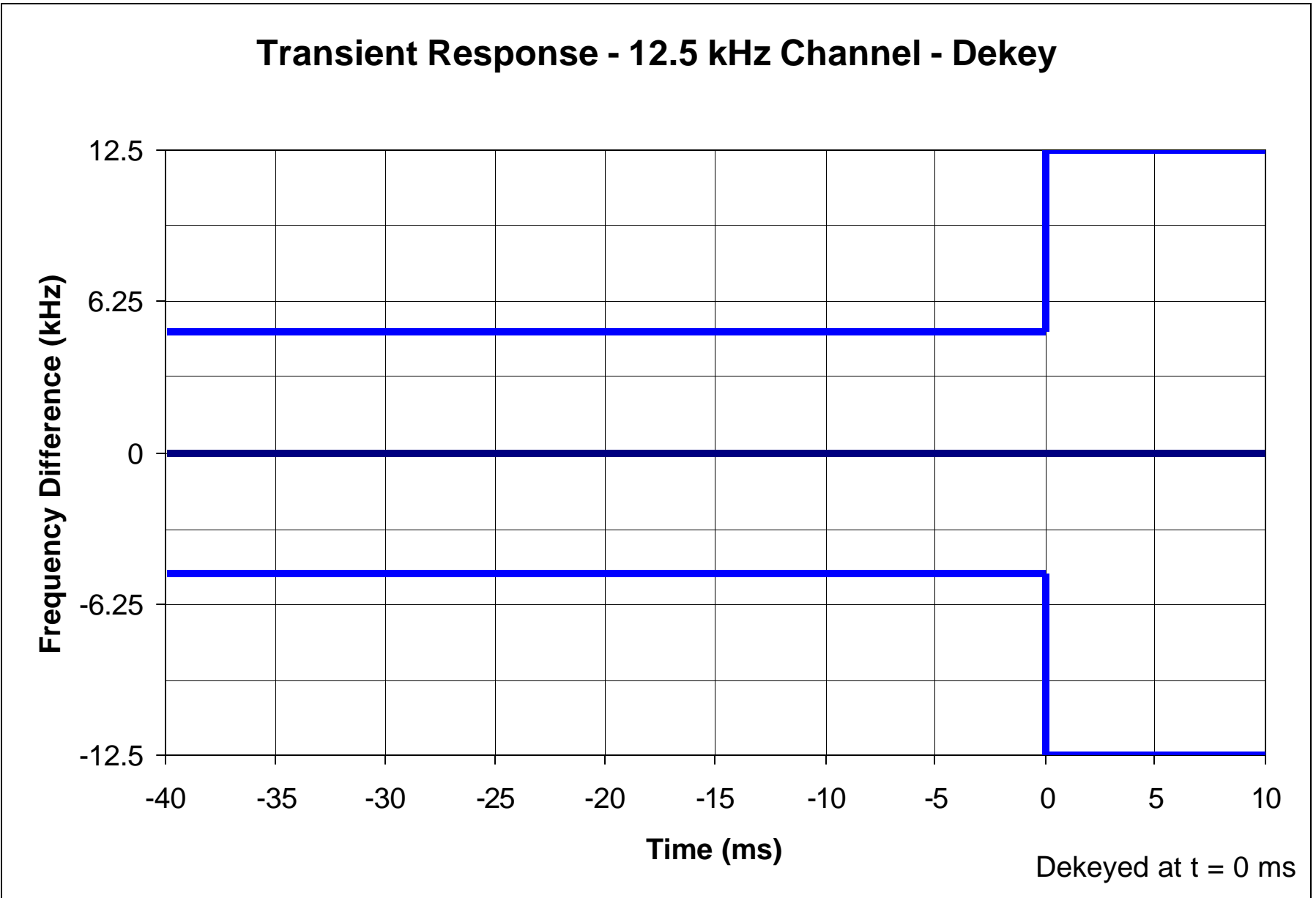
<b><u>EXHIBIT</u></b>	<b><u>DESCRIPTION</u></b>
11K-1	Frequency Transient Behavior, 12.5 kHz Channel Key-Up
11K-2	Frequency Transient Behavior, 12.5 kHz Channel De-key
11K-3	Frequency Transient Behavior, 25 kHz Channel Key-Up
11K-4	Frequency Transient Behavior, 25 kHz Channel De-key

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.

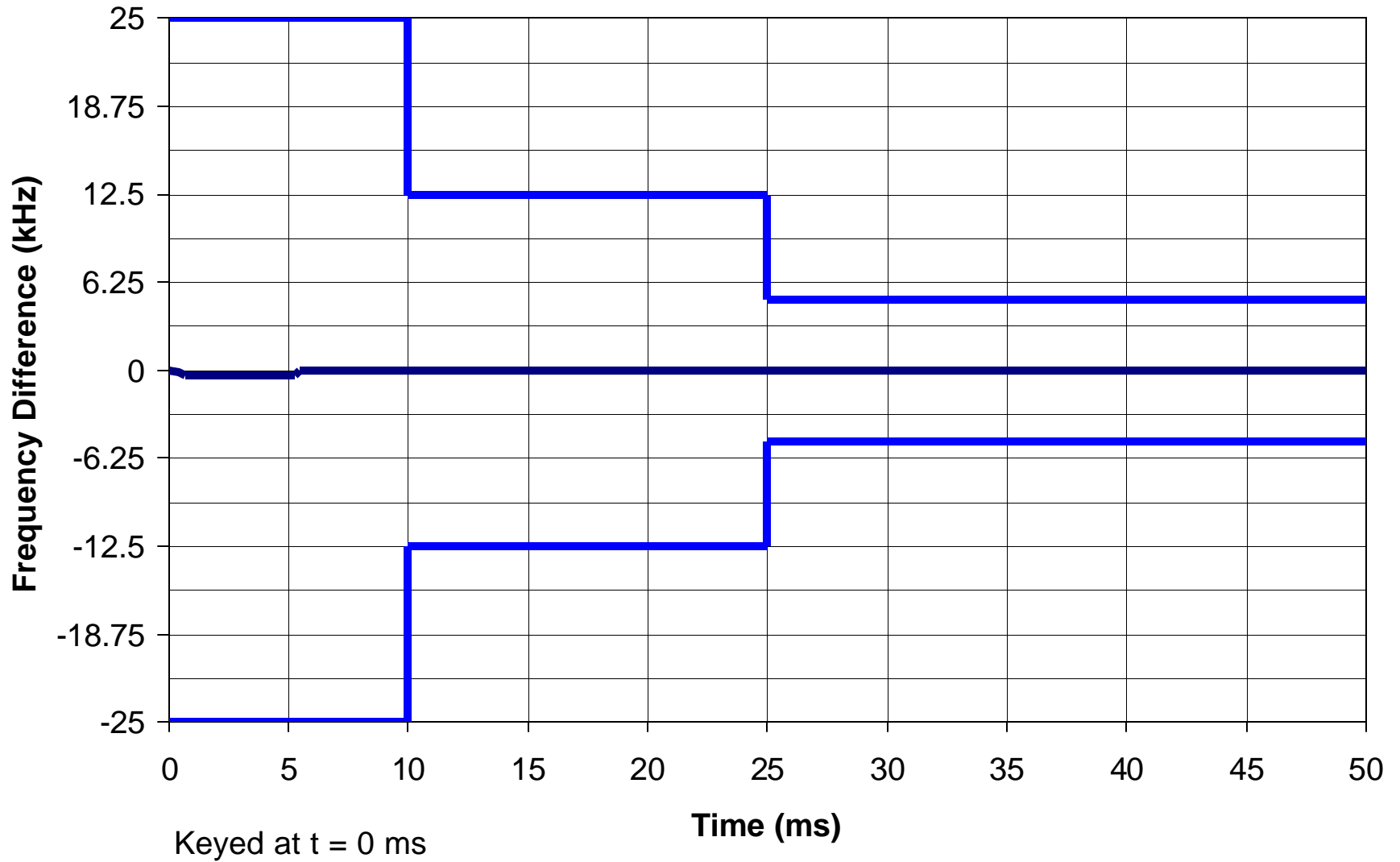
Note: The measurements were taken by using an HP 53310A Modulation Domain Analyzer.

# Transient Response - 12.5 kHz Channel Keyup

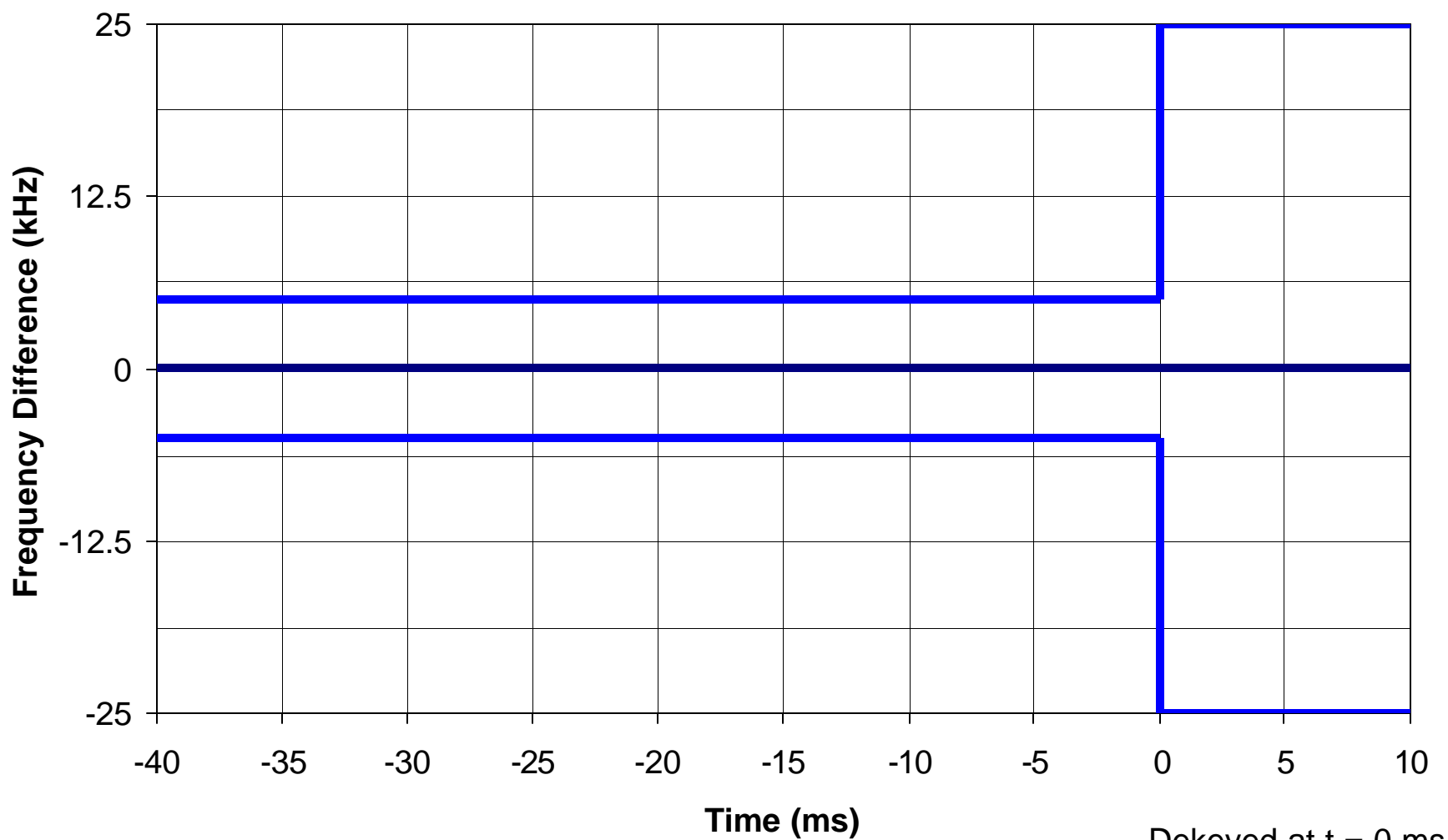




# Transient Response - 25 kHz Channel Keyup



# Transient Response - 25 kHz Channel - Dekey



**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	10/12/03
85462A	Hewlett Packard	EMI Analyzer, RF/Display	3906A00500	10/12/99	10/12/03
(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
8901A	Hewlett Packard	Modulation Analyzer	2119A01211	05/29/02	05/29/05
8903B	Hewlett Packard	Audio Analyzer	2742A03367	06/07/01	06/07/04
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	
7N013	MaCom	Circulator	1928 8750	no calibration required	
S3-02N	MicroLab	Tuner (3 stub)	None	no calibration required	
0183648X01	Celwave	Cavity Filter	377863-005	no calibration required	