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13	Test Equipment Used	2.1075

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

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

NAME: Ken Weiss

SIGNATURE: _____

DATE: January 15, 2001

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: Ron Wegner

SIGNATURE: _____

DATE: January 15, 2001

POSITION: Engineering Manager

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

11A RF Output-Data

11B Occupied Bandwidth

11B-1 Single Carrier – Occupied Bandwidth, Power Output at 52 Watts

11B-2 Dual Carrier – Occupied Bandwidth, Power Output at 52 Watts

11B-3 Triple Carrier – Occupied Bandwidth, Power Output at 48 Watts

11B-4 Quad Carrier – Occupied Bandwidth, Power Output at 42 Watts

11C Conducted Spurious Emissions: Setup, Specifications, and Index

11C-1 Quad Carrier - Conducted Spurious Emissions, Harmonics, Power Output at 42 Watts

11C-2 Quad Carrier - Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts

11C-3 Single Carrier - Conducted Spurious Emissions, Harmonics, Power Output at 52 Watts

11C-4 Single Carrier - Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts

11C-5 Quad Carrier - Conducted Spurious Emissions, Close-In, Power Output at 42 Watts

11C-6 Single Carrier - Conducted Spurious Emissions, Close-In, Power Output at 52 Watts

11D Radiated Spurious Emissions: Setup, Specifications, and Index

11D-1 Quad Carrier - Radiated Spurious Emissions, Power Output at 42 Watts

11D-2 Quad Carrier - Radiated Spurious Emissions, Power Output at 5 Watts

11D-3 Single Carrier - Radiated Spurious Emissions, Power Output at 52 Watts

11D-4 Single Carrier - Radiated Spurious Emissions, Power Output at 5 Watts

11E Frequency Stability: Setup, Specifications, and Index

11E-1 Frequency Stability Vs Temperature

11E-2 Frequency Stability Vs Voltage

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 six parallel modules, or twelve parallel power transistors.**

Quad Carrier Mode:

Measured RF output	<u>42</u>	Watts, Average
DC Voltage	<u>28.3</u>	Volts
DC Current	<u>10.7</u>	Amperes
Input power for final RF amplifying device(s)	<u>303</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC
Minimum Measured RF output	<u>5</u>	Watts, Average
Normal DC Voltage	<u>28.3</u>	Volts
Normal DC Current	<u>4.9</u>	Amperes
Input power for final RF amplifying device(s)	<u>139</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC

Single Carrier Mode:

Measured RF output	<u>52</u>	Watts, Average
Normal DC Voltage	<u>28.3</u>	Volts
Normal DC Current	<u>12.0</u>	Amperes
Input power for final RF amplifying device(s)	<u>340</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC
Minimum Measured RF output	<u>5</u>	Watts, Average
Normal DC Voltage	<u>28.3</u>	Volts
Normal DC Current	<u>4.9</u>	Amperes
Input power for final RF amplifying device(s)	<u>139</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC

OCCUPIED BANDWIDTH – SINGLE CARRIER

Modulation Type: Quad-QAM – 64 kbps Random Data Per Channel – Single Carrier
 Emission Designator: 17K7D7W
 Channelization: 25 kHz per channel
 Power Setting: 52 Watts Average

SPECIFICATION REQUIREMENT:**§ 90.691 Emission Mask Requirements for EA-Based Systems:**

(a) Out of band emission requirements apply only to the 'outer' channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(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 $116 * \log_{10}(F/6.1)$ dB or 50 plus $10 \log_{10}(P)$ dB or 80 dB, 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 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block by greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P), in Watts, by at least 43 plus $10 \log_{10}(P)$ dB or 80 dB, 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.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

Necessary Bandwidth Calculation:

The necessary bandwidth of the modulation signal is not calculable per the formulas defined in 47 CFR 2.202 (b). Specifically, although the modulation for this emission is a composite modulation, the equations given in the composite tables in 2.202 are not applicable since none of them adequately approximate the form of digital modulation used. The necessary bandwidth of 17.7 kHz per carrier is based upon a 99% power measurement of the transmitter spectrum, per 2.202 (a).

Measurement Procedure and Instrument Settings:**Reference Calibration Analyzer Settings:**

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

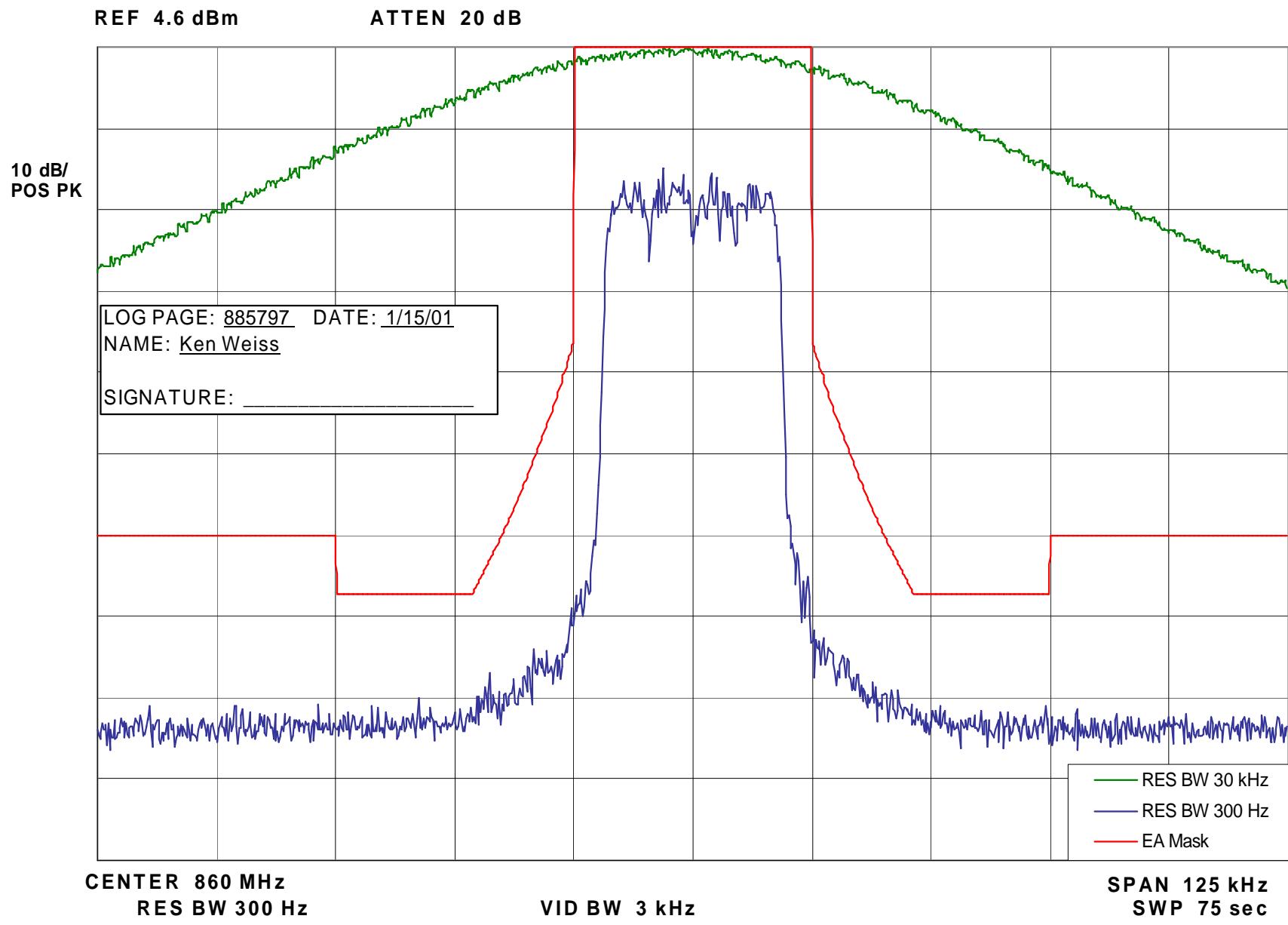
Emission Measurement Analyzer Settings:

Horizontal:	12.5 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	3 kHz
Sweep Time:	75 Seconds (<2000 Hz / Second)	Span:	125 kHz
Detector Mode:	Positive Peak		

Test 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 with a single carrier, at the full single carrier power rating (52 Watts). 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) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.

Occupied Bandwidth -- Single Carrier at 52 Watts (Avg)



OCCUPIED BANDWIDTH – DUAL CARRIER

Modulation Type: Quad-QAM – 64 kbps Random Data Per Channel – Dual Carrier
 Emission Designator: 42K7D7W
 Channelization: 25 kHz per channel
 Power Setting: 52 Watts Average

SPECIFICATION REQUIREMENT:**§ 90.691 Emission Mask Requirements for EA-Based Systems:**

(a) Out of band emission requirements apply only to the 'outer' channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

- (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 $116 * \log_{10}(F/6.1)$ dB or $50 + 10 \log_{10}(P)$ dB or 80 dB, 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 12.5 kHz.
- (2) For any frequency removed from the EA licensee's frequency block by greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P), in Watts, by at least $43 + 10 \log_{10}(P)$ dB or 80 dB, 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.
- (c) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

Necessary Bandwidth Calculation:

The necessary bandwidth of the modulation signal is not calculable per the formulas defined in 47 CFR 2.202 (b). Specifically, although the modulation for this emission is a composite modulation, the equations given in the composite tables in 2.202 are not applicable since none of them adequately approximate the form of digital modulation used. The necessary bandwidth of 17.7 kHz per carrier is based upon a 99% power measurement of the transmitter spectrum, per 2.202 (a). For the composite two carrier signal (1 additional channel), the resulting necessary bandwidth is $17.7 \text{ kHz} + 1 * 25 \text{ kHz} = 42.7 \text{ kHz}$.

Measurement Procedure and Instrument Settings:**Reference Calibration Analyzer Settings:**

Horizontal:	20 kHz per Division	Resolution Bandwidth:	300 kHz
Vertical:	10 dB per Division	Video Bandwidth:	300 kHz
Sweep Time:	150 Seconds (<2000 Hz / Second)	Span:	200 kHz
Detector Mode:	Positive Peak		

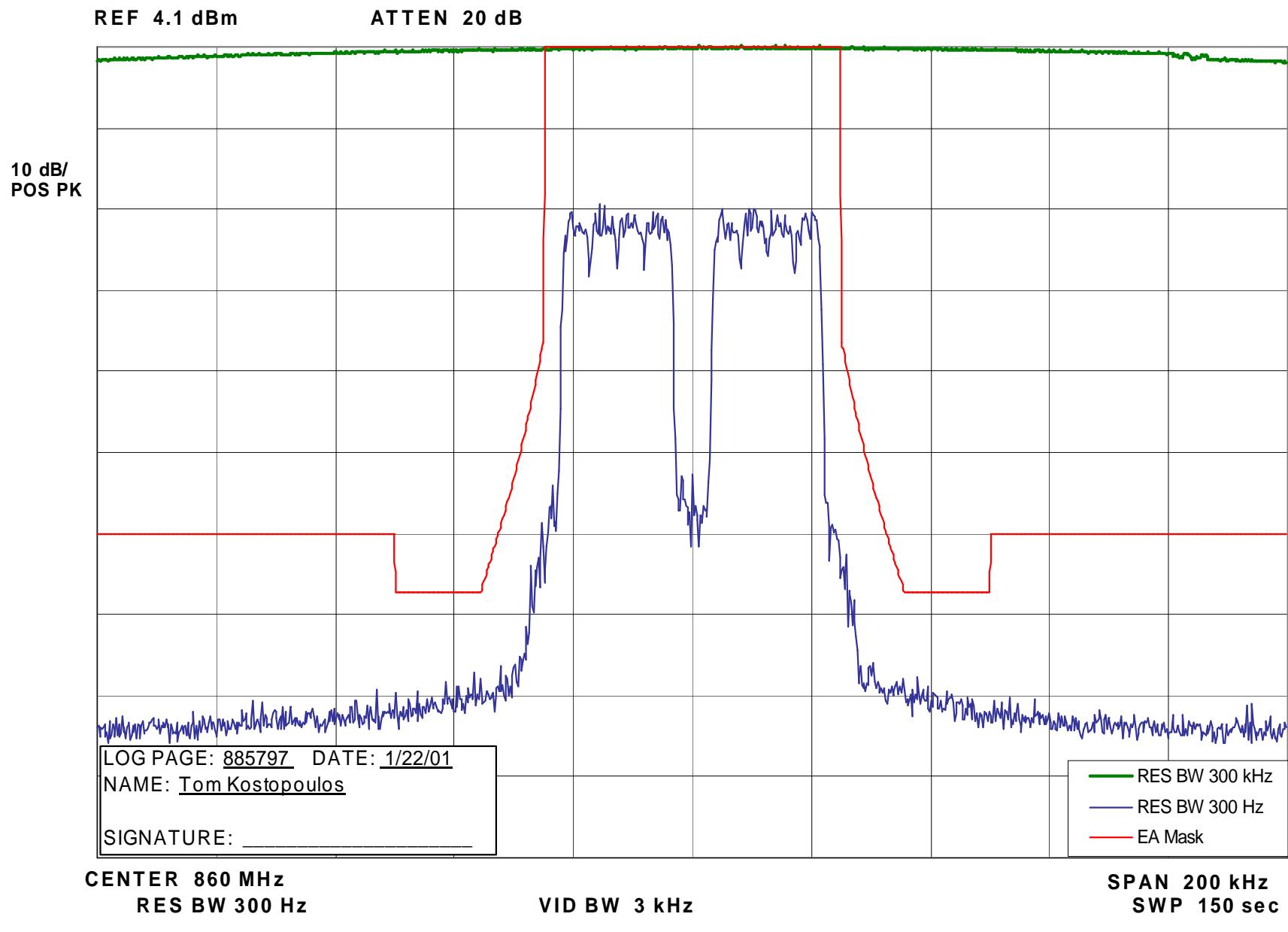
Emission Measurement Analyzer Settings:

Horizontal:	20 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	3 kHz
Sweep Time:	150 Seconds (<2000 Hz / Second)	Span:	200 kHz
Detector Mode:	Positive Peak		

Test 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 with two carriers, at the full two carrier power rating (52 Watts). 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) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.

Occupied Bandwidth -- Dual Carrier at 52 Watts Composite Signal



OCCUPIED BANDWIDTH – TRIPLE CARRIER

Modulation Type: Quad-QAM – 64 kbps Random Data Per Channel – Triple Carrier
 Emission Designator: 67K7D7W
 Channelization: 25 kHz per channel
 Power Setting: 48 Watts Average

SPECIFICATION REQUIREMENT:**§ 90.691 Emission Mask Requirements for EA-Based Systems:**

(a) Out of band emission requirements apply only to the 'outer' channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(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 $116 * \log_{10}(F/6.1)$ dB or $50 + 10 \log_{10}(P)$ dB or 80 dB, 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 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block by greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P), in Watts, by at least $43 + 10 \log_{10}(P)$ dB or 80 dB, 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.

(d) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

Necessary Bandwidth Calculation:

The necessary bandwidth of the modulation signal is not calculable per the formulas defined in 47 CFR 2.202 (b). Specifically, although the modulation for this emission is a composite modulation, the equations given in the composite tables in 2.202 are not applicable since none of them adequately approximate the form of digital modulation used. The necessary bandwidth of 17.7 kHz per carrier is based upon a 99% power measurement of the transmitter spectrum, per 2.202 (a). For the composite three carrier signal (2 additional channels), the resulting necessary bandwidth is $17.7 \text{ kHz} + 2 * 25 \text{ kHz} = 67.7 \text{ kHz}$.

Measurement Procedure and Instrument Settings:**Reference Calibration Analyzer Settings:**

Horizontal:	20 kHz per Division	Resolution Bandwidth:	300 kHz
Vertical:	10 dB per Division	Video Bandwidth:	300 kHz
Sweep Time:	150 Seconds (<2000 Hz / Second)	Span:	200 kHz
Detector Mode:	Positive Peak		

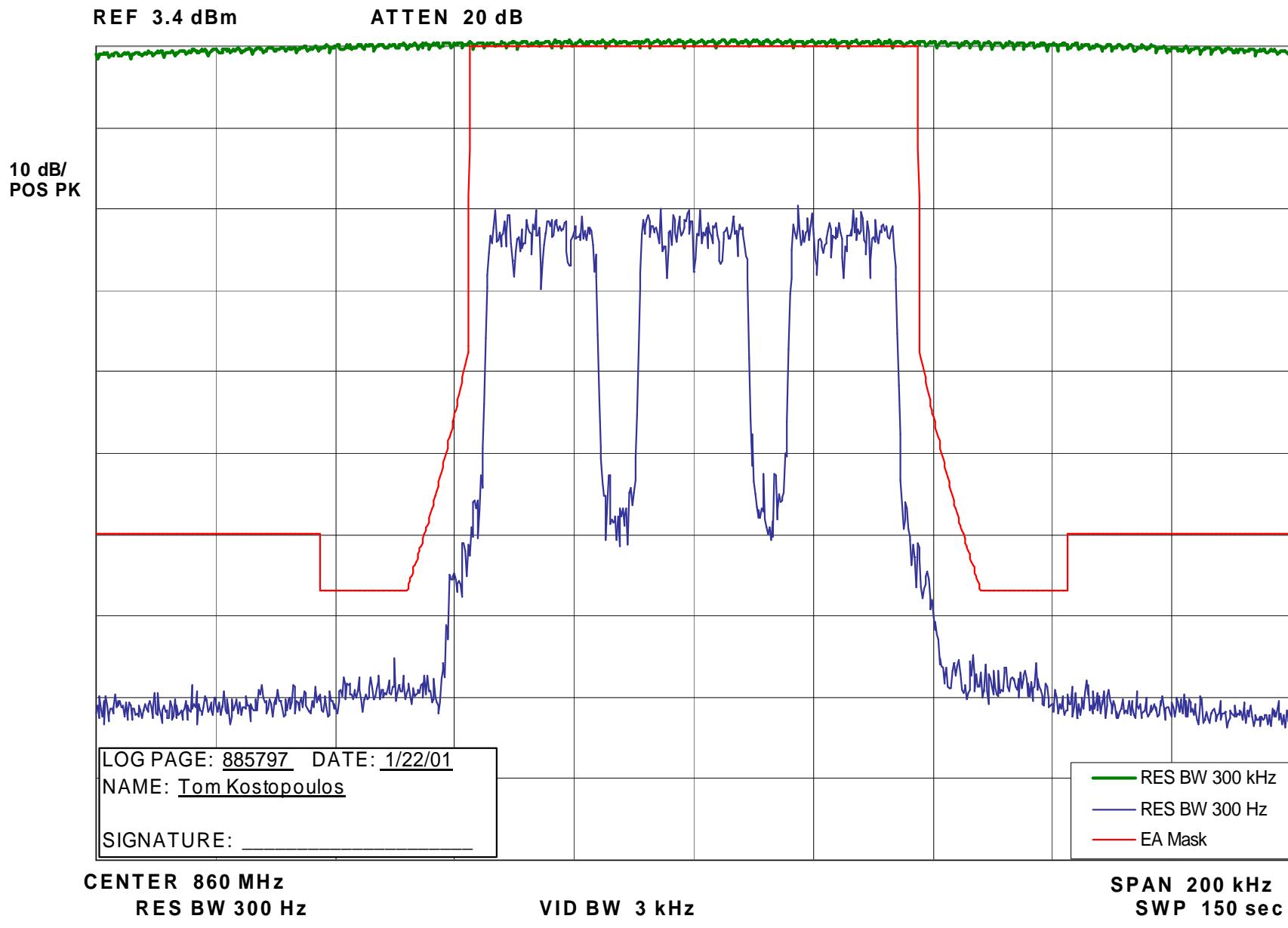
Emission Measurement Analyzer Settings:

Horizontal:	20 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	3 kHz
Sweep Time:	150 Seconds (<2000 Hz / Second)	Span:	200 kHz
Detector Mode:	Positive Peak		

Test 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 with three carriers, at the full three carrier power rating (48 Watts). 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) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.

Occupied Bandwidth -- Triple Carrier at 48 Watts Composite Signal



OCCUPIED BANDWIDTH – QUAD CARRIER

Modulation Type: Quad-QAM – 64 kbps Random Data Per Channel – Quad Carrier
 Emission Designator: 92K7D7W
 Channelization: 25 kHz per channel
 Power Setting: 42 Watts Average

SPECIFICATION REQUIREMENT:**§ 90.691 Emission Mask Requirements for EA-Based Systems:**

(a) Out of band emission requirements apply only to the 'outer' channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(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 $116 * \log_{10}(F/6.1)$ dB or $50 + 10 \log_{10}(P)$ dB or 80 dB, 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 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block by greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P), in Watts, by at least $43 + 10 \log_{10}(P)$ dB or 80 dB, 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.

(e) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

Necessary Bandwidth Calculation:

The necessary bandwidth of the modulation signal is not calculable per the formulas defined in 47 CFR 2.202 (b). Specifically, although the modulation for this emission is a composite modulation, the equations given in the composite tables in 2.202 are not applicable since none of them adequately approximate the form of digital modulation used. The necessary bandwidth of 17.7 kHz per carrier is based upon a 99% power measurement of the transmitter spectrum, per 2.202 (a). For the composite four carrier signal (3 additional channels), the resulting necessary bandwidth is $17.7 \text{ kHz} + 3 * 25 \text{ kHz} = 92.7 \text{ kHz}$.

Measurement Procedure and Instrument Settings:**Reference Calibration Analyzer Settings:**

Horizontal:	20 kHz per Division	Resolution Bandwidth:	300 kHz
Vertical:	10 dB per Division	Video Bandwidth:	300 kHz
Sweep Time:	150 Seconds (<2000 Hz / Second)	Span:	200 kHz
Detector Mode:	Positive Peak		

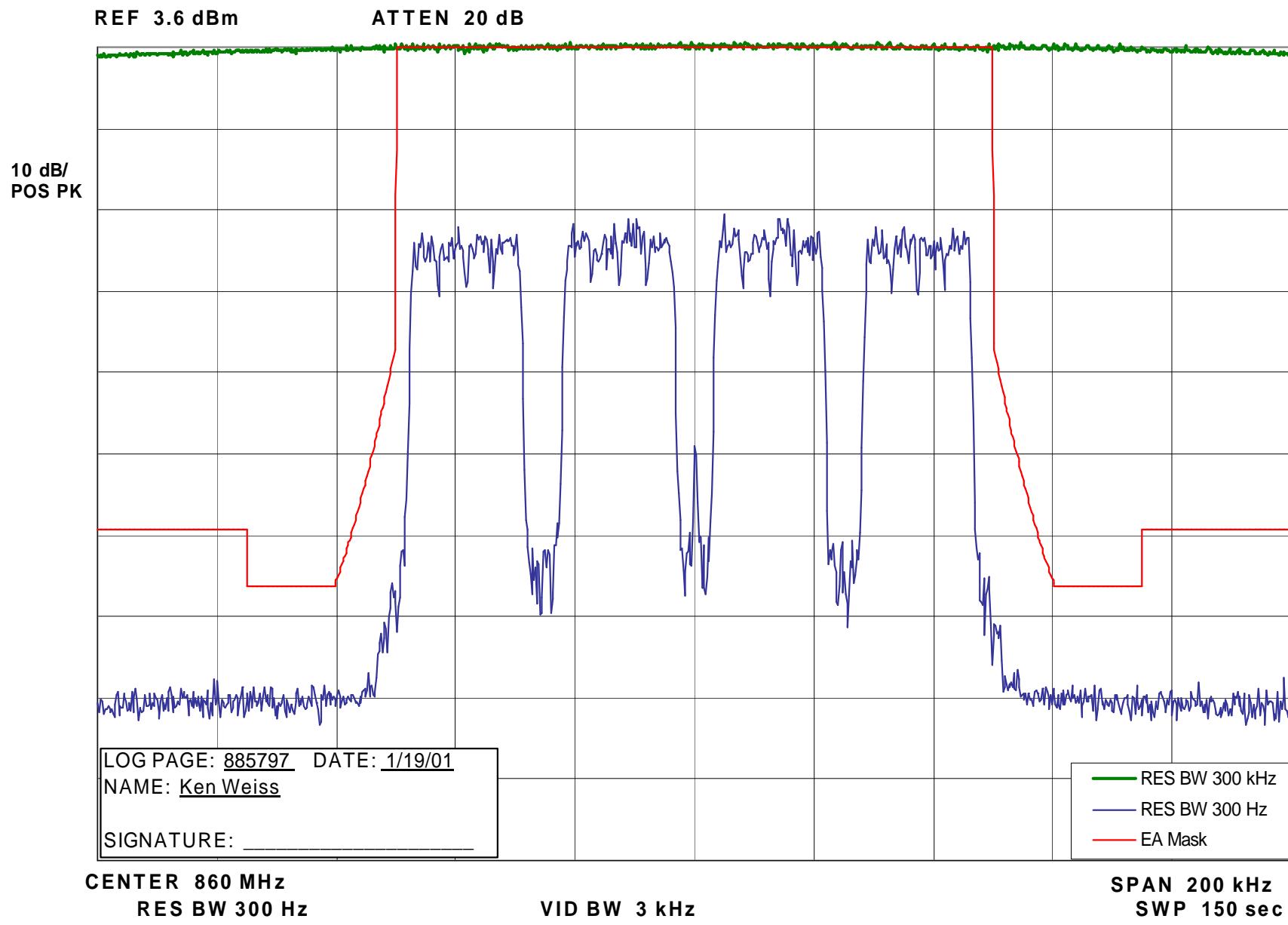
Emission Measurement Analyzer Settings:

Horizontal:	20 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	3 kHz
Sweep Time:	150 Seconds (<2000 Hz / Second)	Span:	200 kHz
Detector Mode:	Positive Peak		

Test 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 with four carriers, at the full Quad carrier power rating (42 Watts). 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) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.

Occupied Bandwidth -- Quad Carrier at 42 Watts Composite Signal



CONDUCTED SPURIOUS EMISSIONS**SPECIFICATION REQUIREMENT:****Reference: Part 90.691 (Emission Mask EA)**

On any frequency displacement of greater than 37.5 kHz removed from the authorized frequency block, the power of any emission shall be attenuated below the transmitter power (P), in Watts, by at least $43 + 10 \log_{10}(P)$ dB or 80 dB, whichever is the lesser attenuation.

Modulation: Psuedorandom data

Carrier Frequency: A Quad carrier centered around 860 MHz, or one single carrier frequency, at 860.0000 MHz, was measured. This frequency is near the center of the operating band 851-870 MHz.

SPURIOUS EMISSION PLOTS:**EXHIBIT DESCRIPTION**

11C-1 Quad Carrier - Conducted Spurious Emissions, Harmonics, Power Output at 42 Watts
The specification limit is -59.2 dB

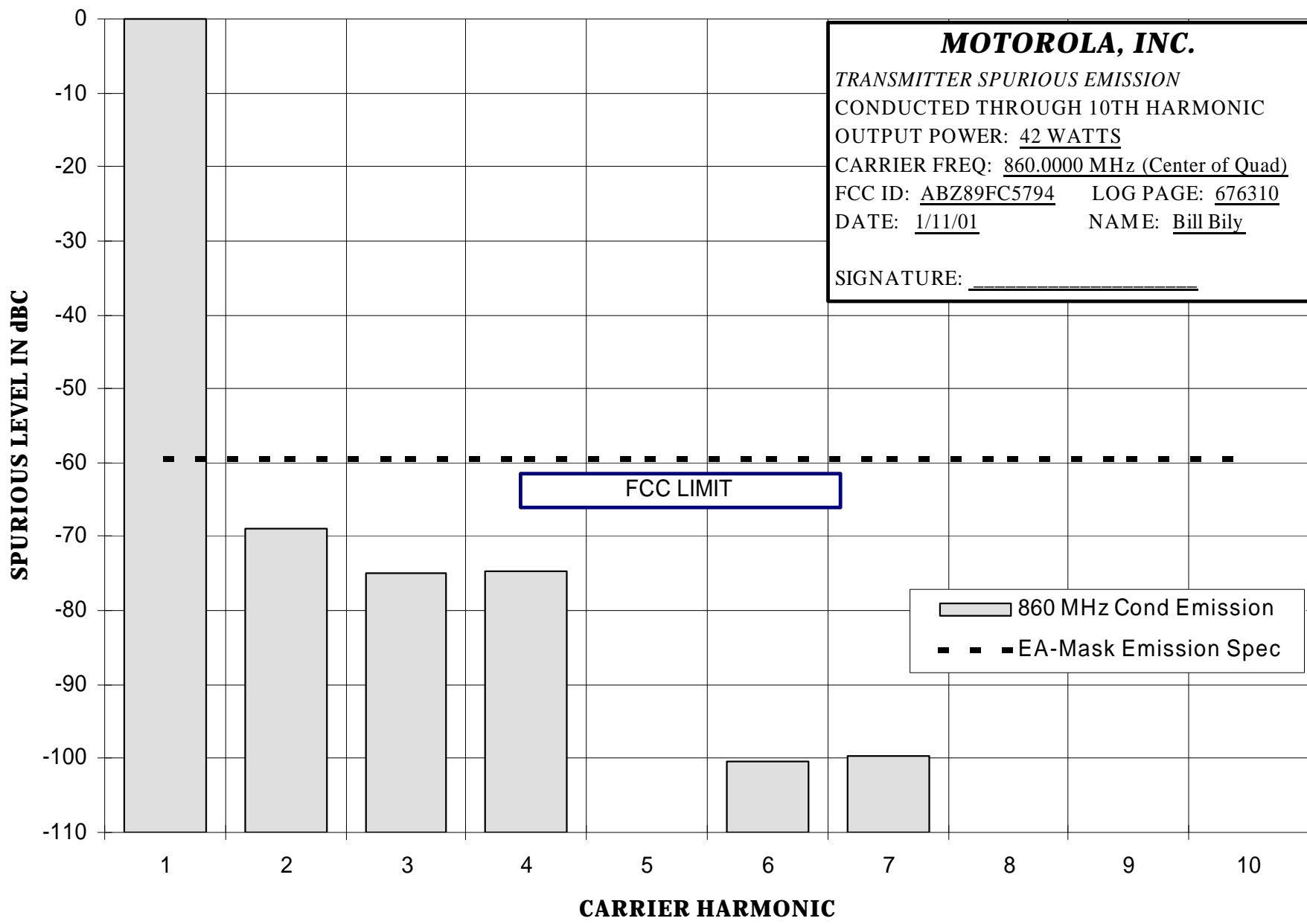
11C-2 Quad Carrier - Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
The specification limit is -50.0 dB

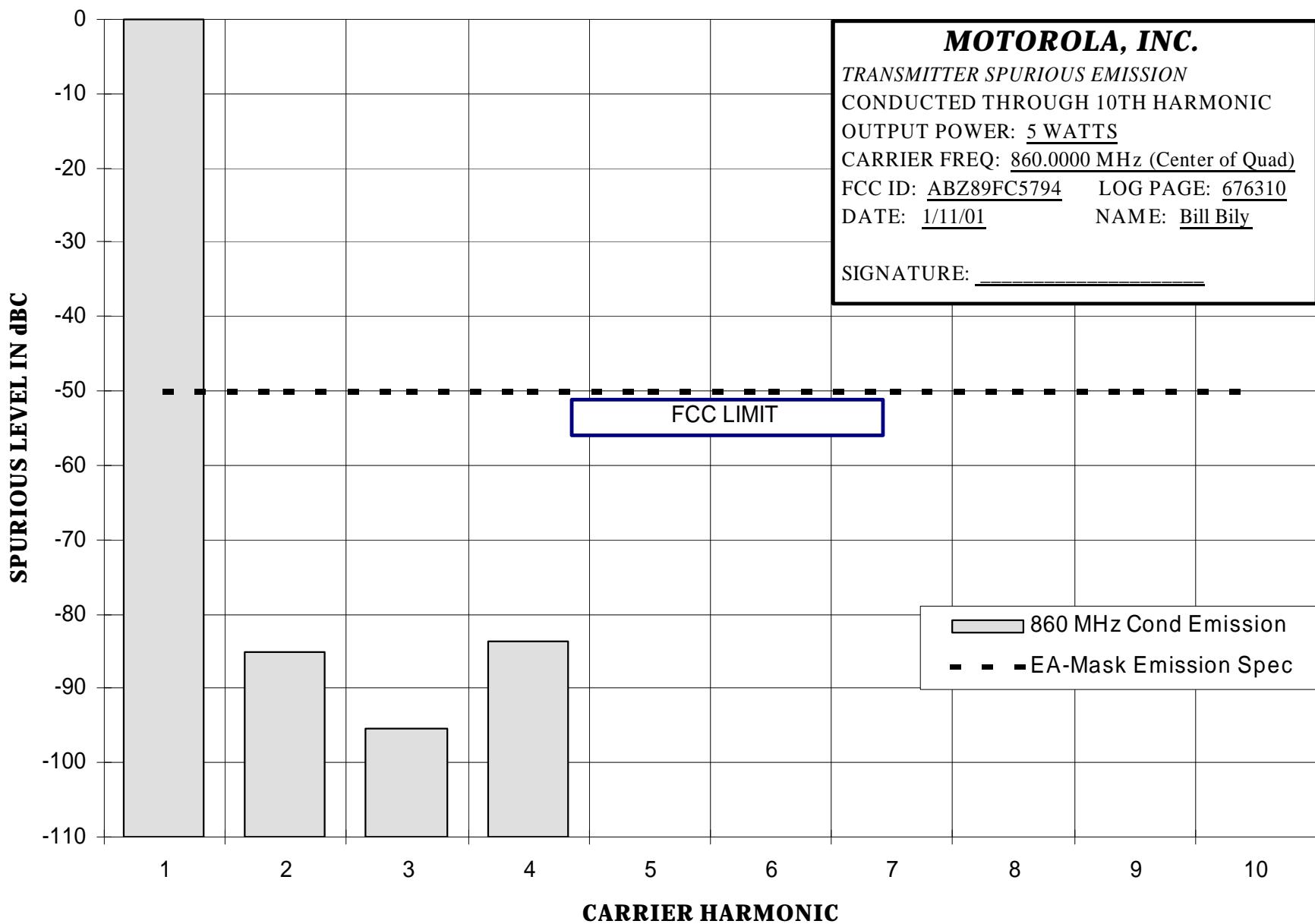
11C-3 Single Carrier - Conducted Spurious Emissions, Harmonics, Power Output at 52 Watts
The specification limit is -60.2 dB

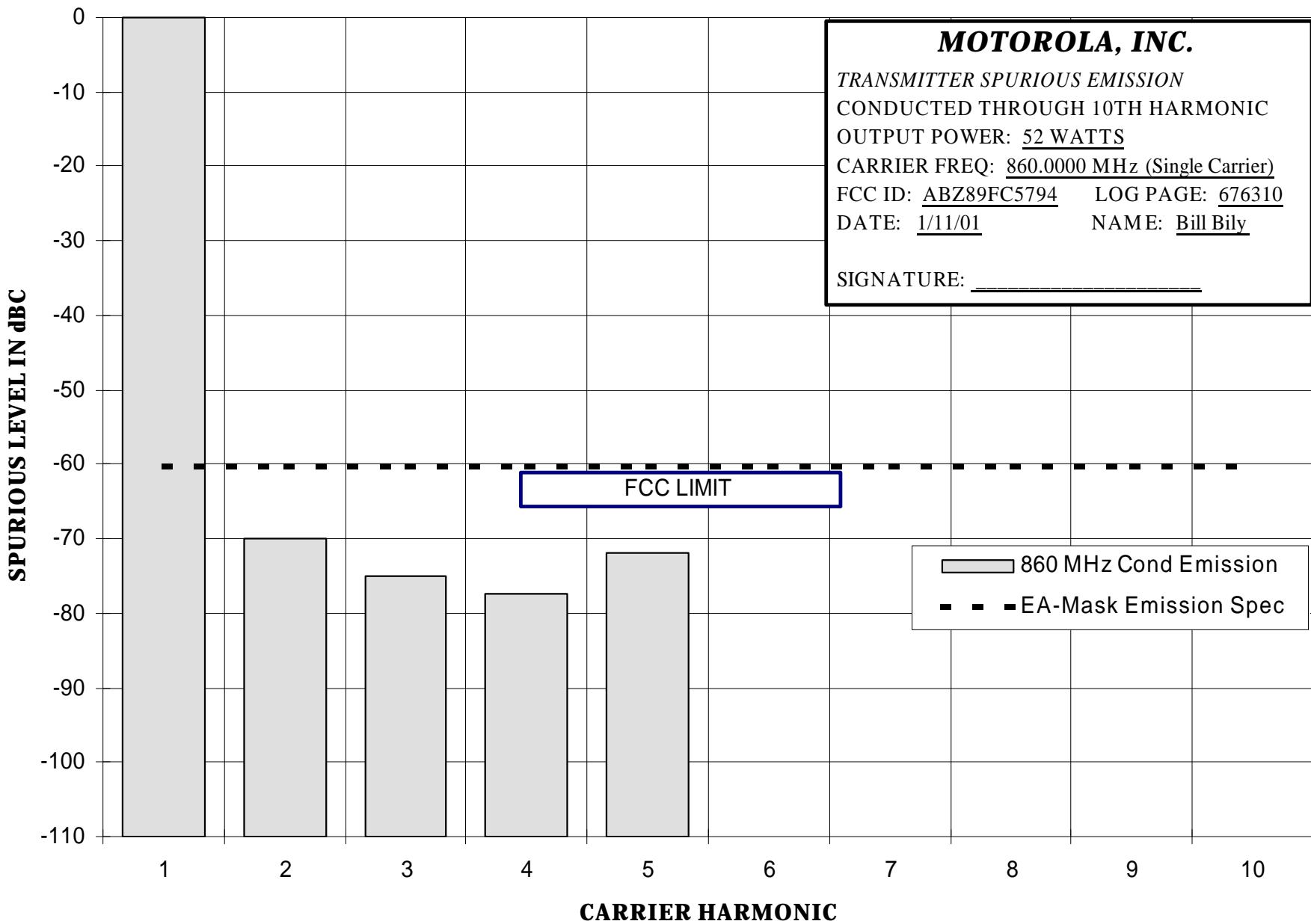
11C-4 Single Carrier - Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
The specification limit is -50.0 dB

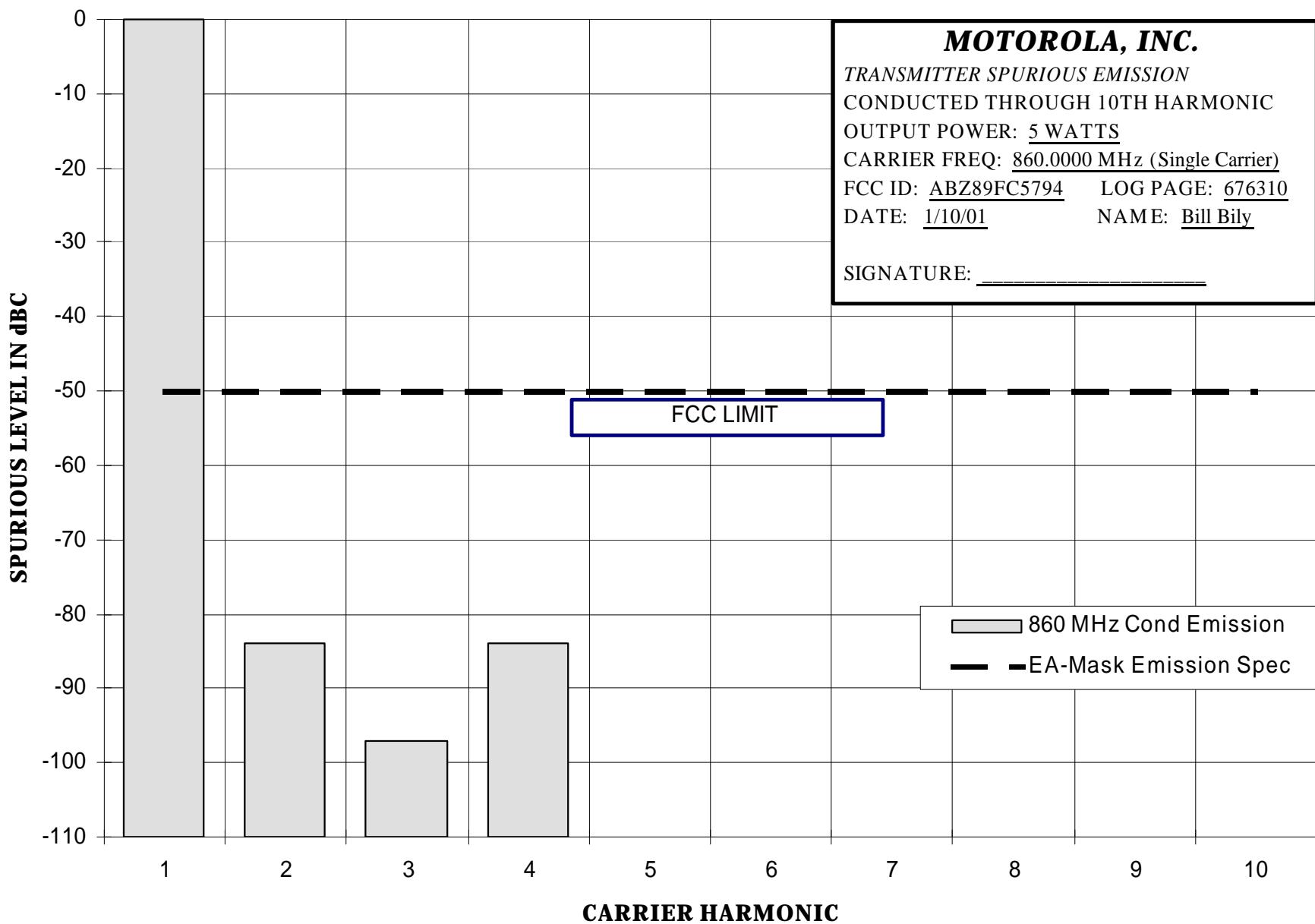
11C-5 Quad Carrier - Conducted Spurious Emissions, Close-In, Power Output at 42 Watts
The specification limit is -59.2 dB

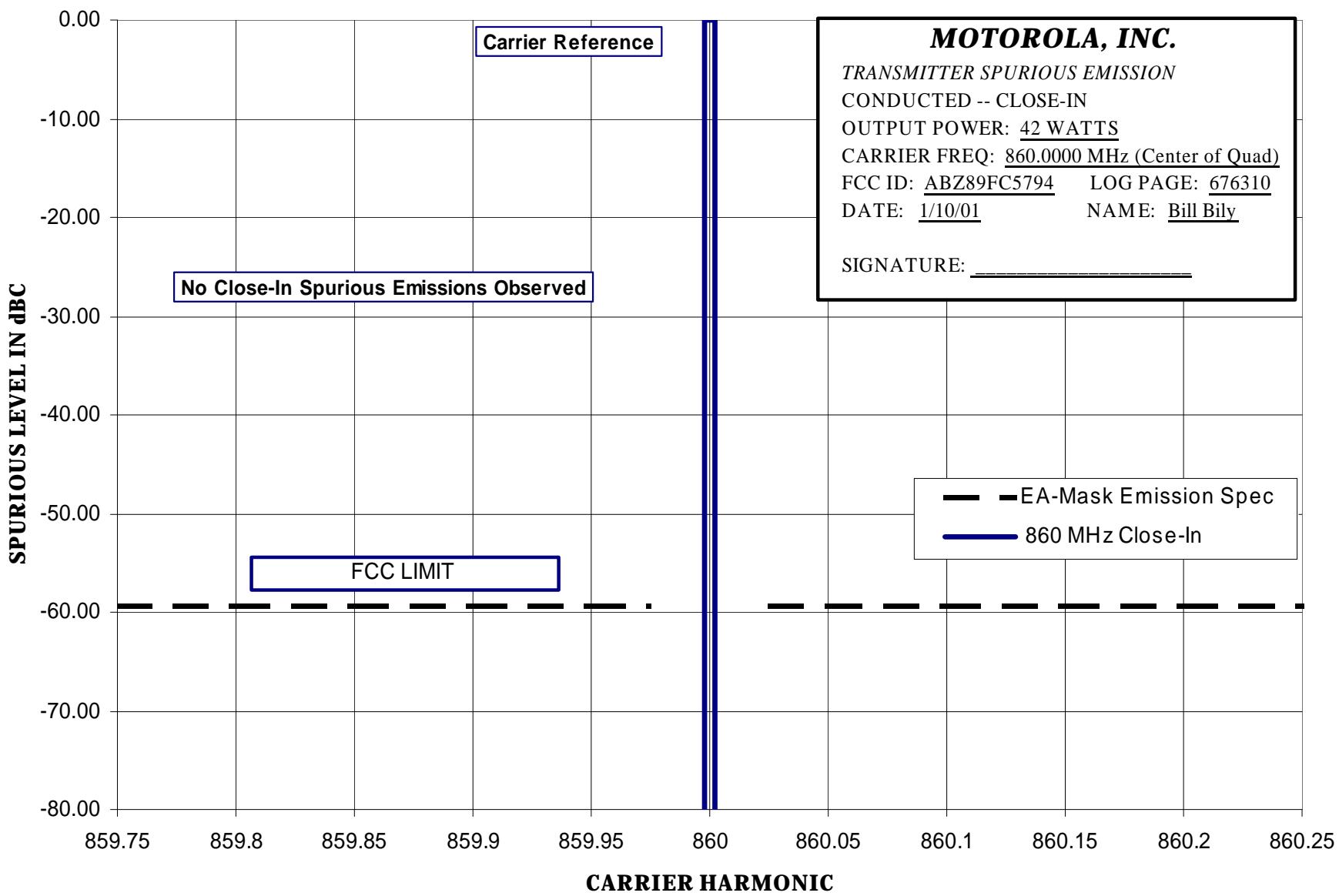
11C-6 Single Carrier - Conducted Spurious Emissions, Close-In, Power Output at 52 Watts
The specification limit is -60.2 dB

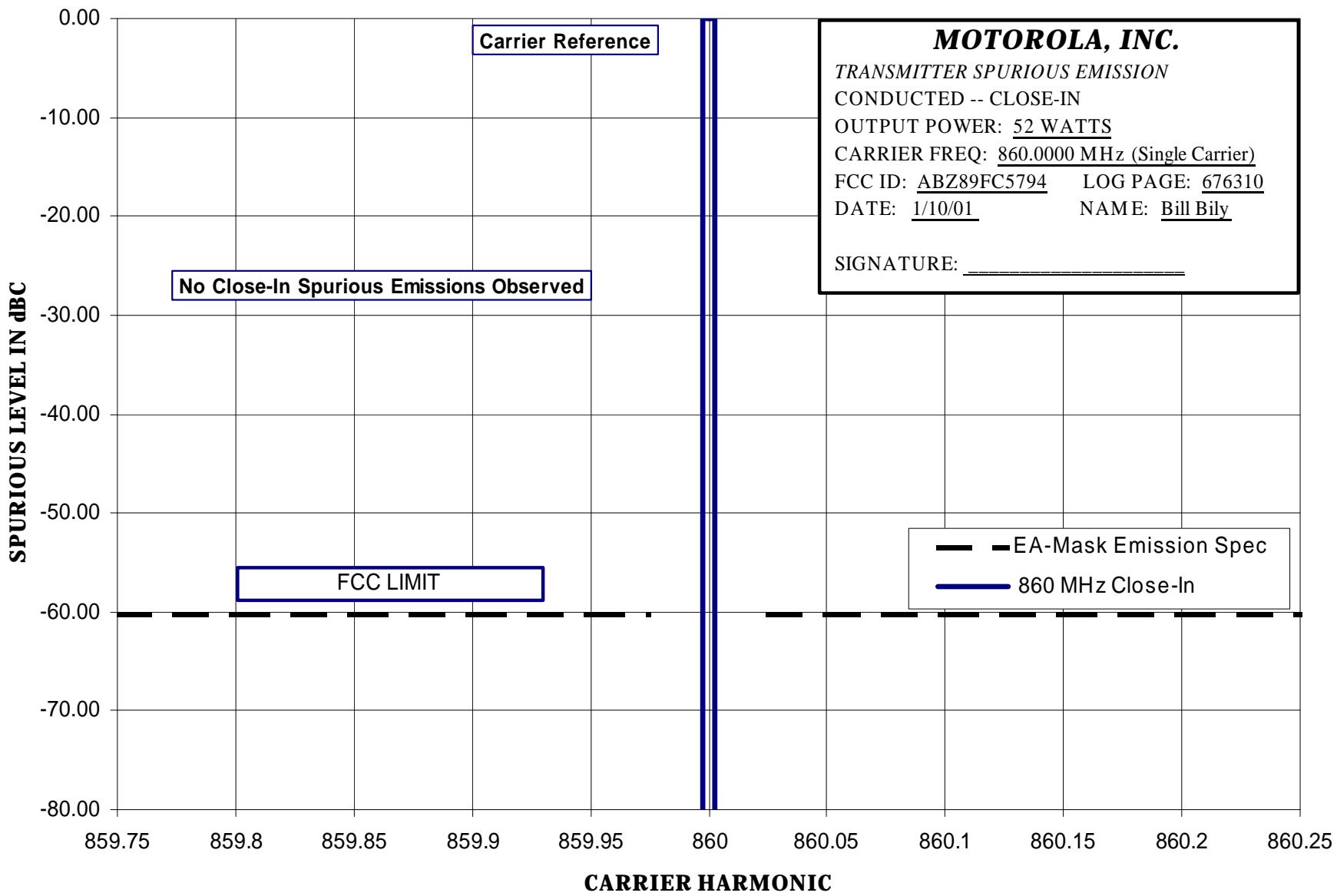












RADIATED SPURIOUS EMISSIONS**SPECIFICATION REQUIREMENT:****Reference: Part 90.691 (Emission Mask EA)**

On any frequency displacement of greater than 37.5 kHz removed from the authorized frequency block, the power of any emission shall be attenuated below the transmitter power (P), in Watts, by at least 43 plus $10 \log_{10}(P)$ dB or 80 dB, whichever is the lesser attenuation.

Modulation: Psuedorandom data

Carrier Frequency: A Quad carrier centered around 860 MHz, or one single carrier frequency, at 860.0000 MHz, was measured. This frequency is near the center of the operating band 851-870 MHz.

SPURIOUS EMISSION PLOTS:**EXHIBIT DESCRIPTION**

11D-1 Quad Carrier - Radiated Spurious Emissions, Power Output at 42 Watts

The specification limit is -59.2 dBc

11D-2 Quad Carrier - Radiated Spurious Emissions, Power Output at 5 Watts

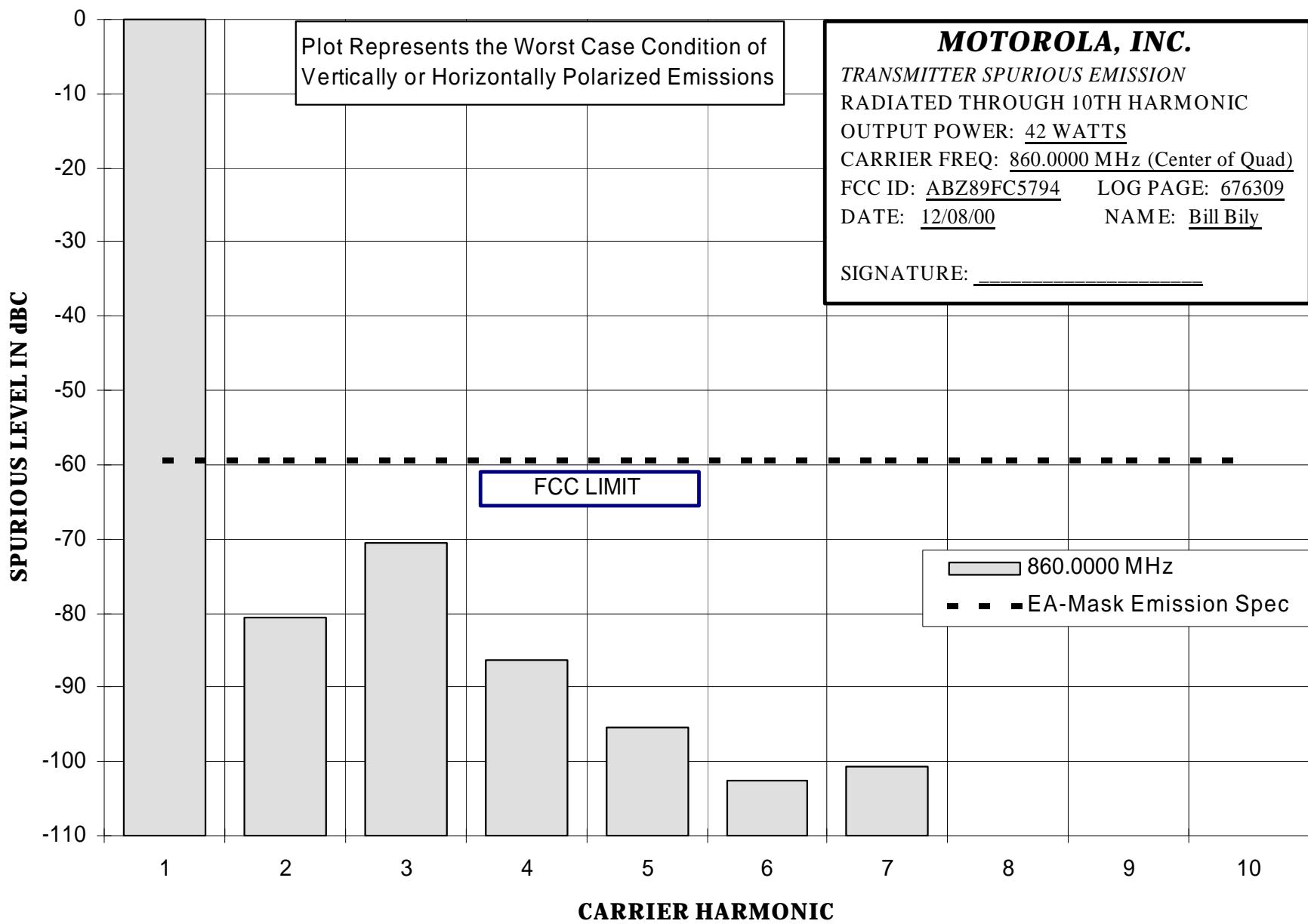
The specification limit is -50.0 dBc

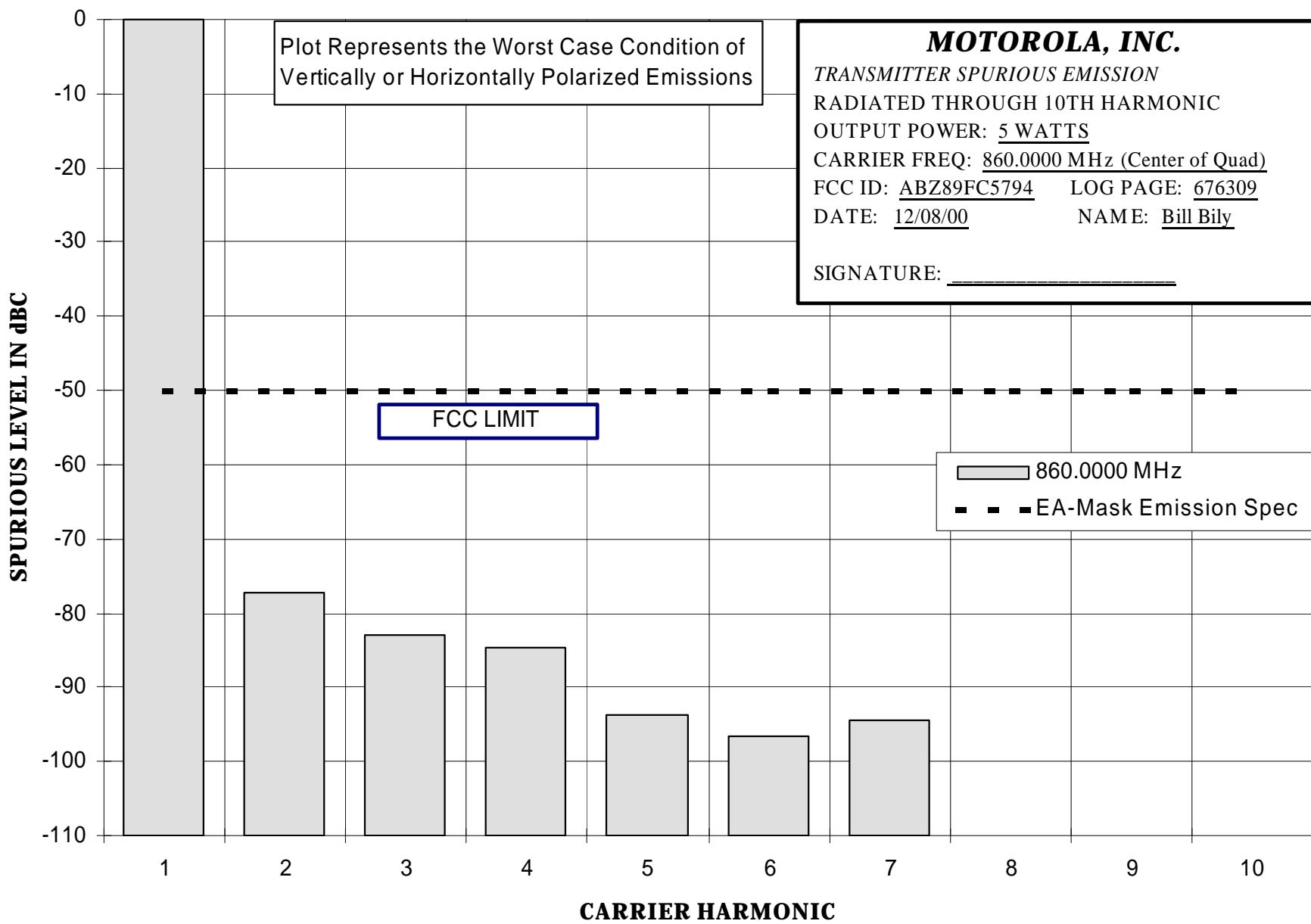
11D-3 Single Carrier - Radiated Spurious Emissions, Power Output at 52 Watts

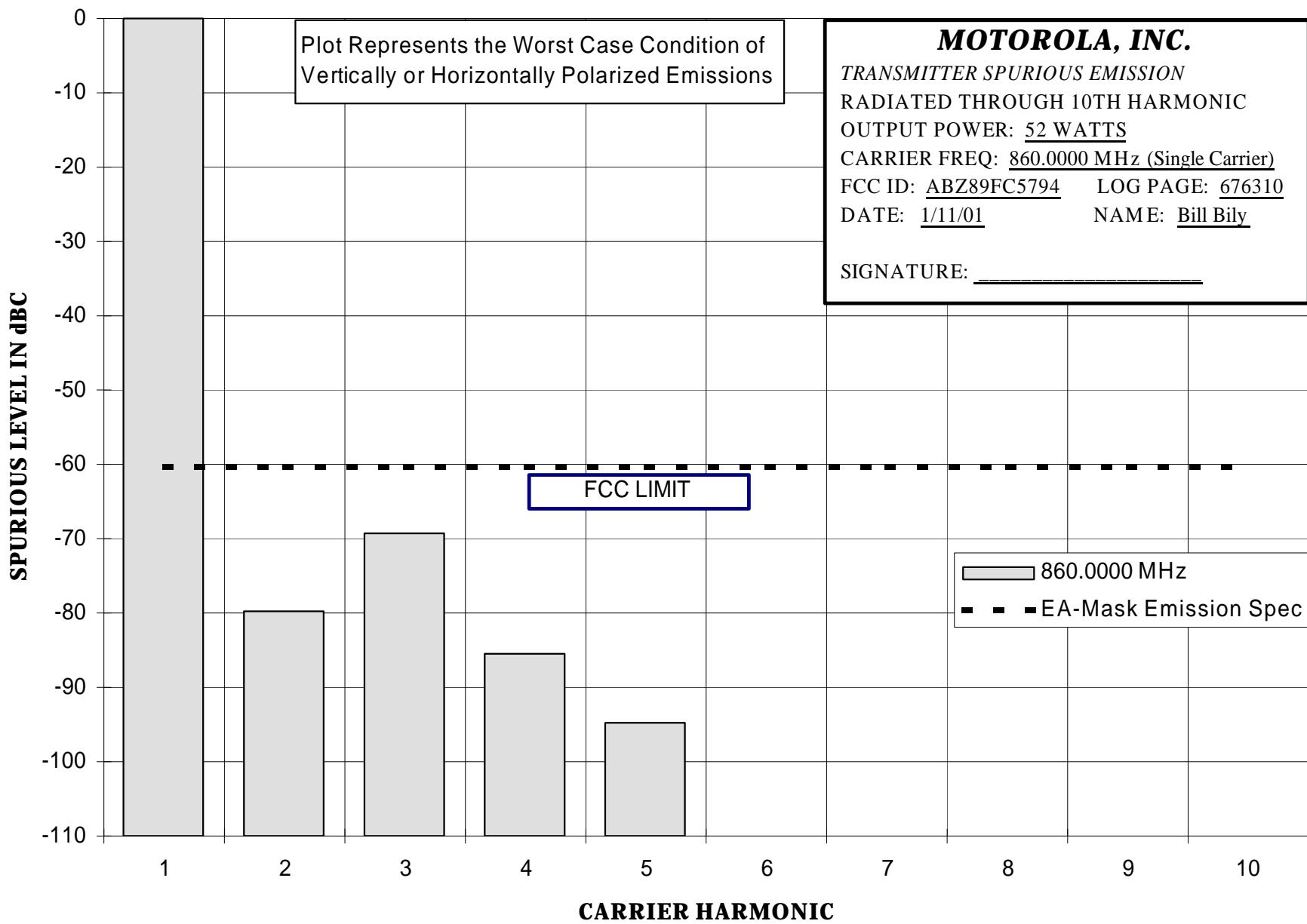
The specification limit is -60.2 dBc

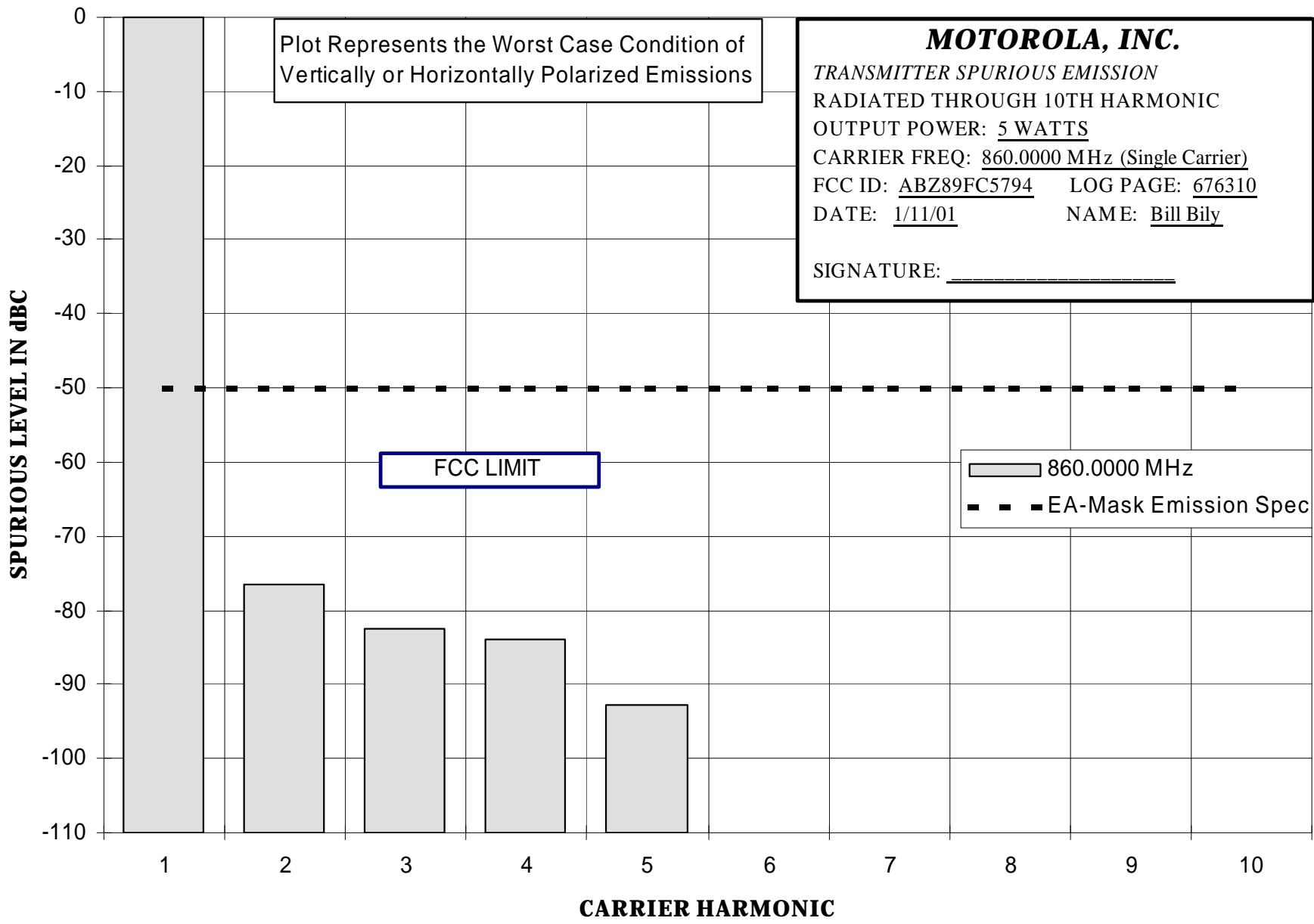
11D-4 Single Carrier - Radiated Spurious Emissions, Power Output at 5 Watts

The specification limit is -50.0 dBc









OSCILLATOR FREQUENCY STABILITY**SPECIFICATION REQUIREMENT:****Reference: Part 90.213**

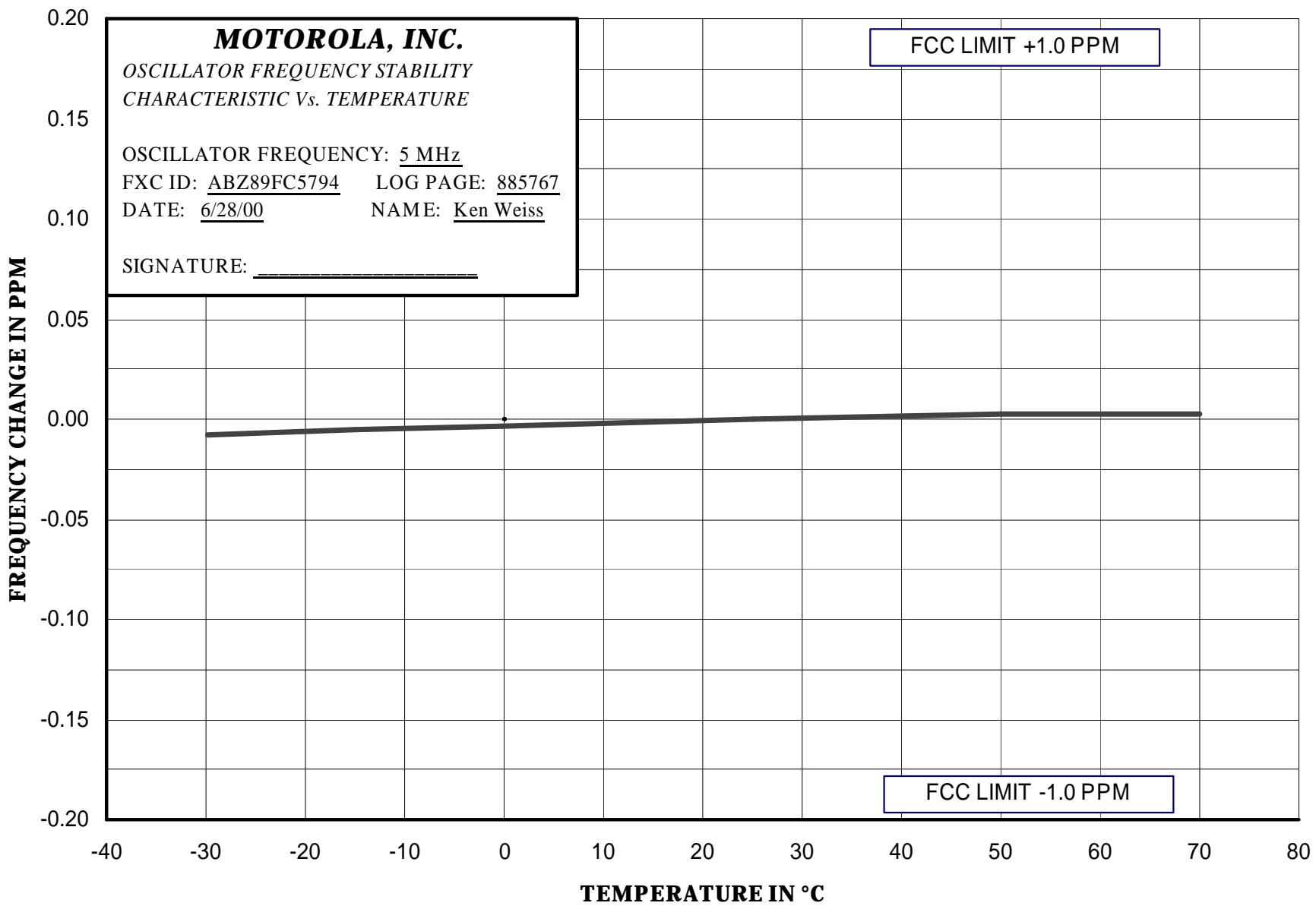
Fixed and Base stations, operating at 851-866 MHz, must have a frequency stability of better than 1.5 PPM.

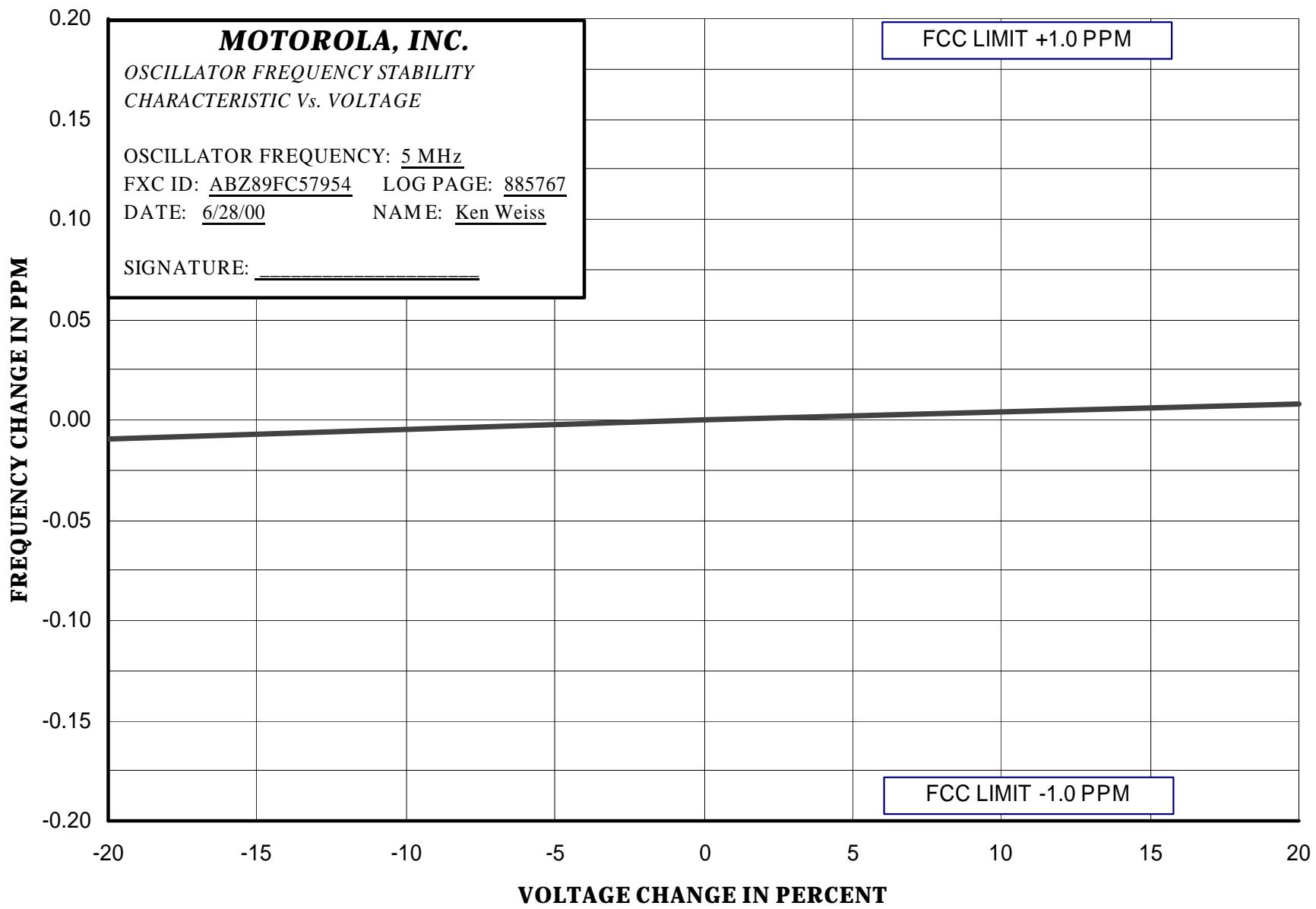
Fixed and Base stations, operating at 866-869 MHz, must have a frequency stability of better than 1.0 PPM.

Manufacturer data for the system site frequency standard was used in generation of the following frequency stability exhibits.

FREQUENCY STABILITY PLOTS:

<u>EXHIBIT</u>	<u>DESCRIPTION</u>
11E-1	Frequency Stability Vs Temperature
11E-2	Frequency Stability Vs Voltage





TEST EQUIPMENT LIST

MODEL	MANUFACTURER	DESCRIPTION	Serial No.	Last Cal	Next Cal
438A	Hewlett Packard	RF Power Meter	3513U06093	11/05/99	11/05/02
8481A	Hewlett Packard	RF Power Sensor	2702A78679	12/02/98	12/02/01
8568B	Hewlett Packard	Spectrum Analyzer	2841A04405	06/18/00	06/18/03
7475A	Hewlett Packard	Plotter	2807F99291	no calibration required	
6071A	Fluke	Signal Generator	3005007	no calibration required	
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	