

Report on Test Measurements*Measurements Report*

The measurement report shows compliance information against the pertinent technical standards. Each section of the report contains either verbiage or graphs which show compliance to applicable standards as required. Each section also explains testing method and indicates what the applicable specification is.

A list of test equipment for all sections, and certification signoff page are included at the end of the measurement report.

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

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E1-2.3 800 MHz – Three Transmit Carriers

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E1-2.5 800 MHz – Five Transmit Carriers

E1-2.6 800 MHz – Six Transmit Carriers

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E1-2.10 900 MHz – Four Transmit Carriers

E1-2.11 900 MHz – Five Transmit Carriers

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E1-3.3 800 MHz – Six Carrier Conducted Spurious Emissions, Harmonics, Power Output at 42 Watts

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SUBMITTED MEASURED DATA – INDEX (Continued)

EXHIBIT DESCRIPTION

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E1-3.9 900 MHz – One Carrier Conducted Spurious Emissions, Harmonics, Power Output at 52 Watts
E1-3.10 900 MHz – One Carrier Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
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E1-3.12 900 MHz – Six Carrier Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
E1-3.13 900 MHz – One Carrier – Conducted Close-In, 20 MHz Span, Power Output at 52 Watts
E1-3.14 900 MHz – One Carrier – Conducted Close-In, 200 MHz Span, Power Output at 52 Watts
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E1-4.4 800 MHz – Six Carrier Radiated Spurious Emissions, Harmonics, Power Output at 5 Watts
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Report on Test Measurements

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 eight parallel power transistors.

800 MHz Single Carrier Mode:

Measured RF output	<u>70</u>	Watts, Average
Normal DC Voltage	<u>28.3</u>	Volts
Normal DC Current	<u>16.0</u>	Amperes
Input power for final RF amplifying device(s)	<u>455</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>8.0</u>	Amperes
Input power for final RF amplifying device(s)	<u>227</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC

800 MHz Six Carrier Mode:

Measured RF output	<u>42</u>	Watts, Average
DC Voltage	<u>28.3</u>	Volts
DC Current	<u>12.9</u>	Amperes
Input power for final RF amplifying device(s)	<u>365</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>8.0</u>	Amperes
Input power for final RF amplifying device(s)	<u>227</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC

900 MHz Single Carrier Mode:

Measured RF output	<u>52</u>	Watts, Average
Normal DC Voltage	<u>28.3</u>	Volts
Normal DC Current	<u>13.9</u>	Amperes
Input power for final RF amplifying device(s)	<u>394</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>8.2</u>	Amperes
Input power for final RF amplifying device(s)	<u>232</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC

900 MHz Six Carrier Mode:

Measured RF output	<u>42</u>	Watts, Average
DC Voltage	<u>28.3</u>	Volts
DC Current	<u>12.8</u>	Amperes
Input power for final RF amplifying device(s)	<u>362</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>8.2</u>	Amperes
Input power for final RF amplifying device(s)	<u>232</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC

Report on Test Measurements

Occupied Bandwidth – Multi-Carrier Base Radio, 25 kHz Channel Spacing – 800 MHz Operation

There are six exhibits shown for 800 MHz operation. All can be used in a system configuration based upon channel usage as described in Exhibit B. All of the following charts reference the following setup and specification requirements.

Modulation Type: Quad-QAM, 64 kbps Random Data Per Channel
 Emission Designator: (See Exhibit Table Below)
 Channelization: 25 kHz per channel
 Power Setting: (See Exhibit Table Below)

§ 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 $116 + 10 \log_{10}(F/6.1)$ 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.

(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). For the composite two carrier signal (1 additional channel), the resulting necessary bandwidth is $17.7 \text{ kHz} + 1 \times 25 \text{ kHz} = 42.7 \text{ kHz}$. For the composite signal of n additional carriers, the resulting necessary bandwidth is $17.7 \text{ kHz} + n \times 25 \text{ kHz}$.

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: 500 kHz
Sweep Time:	as needed (<2000 Hz / Second)	Span: as needed per # carriers
Detector Mode:	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:	as needed (<2000 Hz / Second)	Span: as needed per # carriers
Detector Mode:	Peak	

Report on Test Measurements*Occupied Bandwidth – Multi-Carrier Base Radio, 25 kHz Channel Spacing – 800 MHz Operation (continued)*Test Procedure:

- 1) Adjust the spectrum analyzer per the values specified in the Reference Calibration Analyzer Settings section above.
- 2) Modulate the transmitter with the appropriate signaling pattern, (mixed QAM, pseudorandom data) and key the transmitter at the full power rating for the number of carriers to be measured. Use the analyzer controls to set this signal to the full-scale reference line. Allow the analyzer to sweep fully, store the sweep, and record the peak value.
- 3) Adjust the analyzer per the values specified in the Emission Measurement Analyzer Settings section above.
- 4) Allow the analyzer to sweep, and record the resultant emission levels.
- 5) Plot the resulting analyzer trace and the emission mask limit, add annotation text and labeling as appropriate.

EXHIBIT	DESCRIPTION	Power (Watts, Avg)	Emission Designator
E1-2.1	800 MHz – One Carrier	70 Watts	17K7D7W
E1-2.2	800 MHz – Two Carriers	52 Watts	42K7D7W
E1-2.3	800 MHz – Three Carriers	48 Watts	67K7D7W
E1-2.4	800 MHz – Four Carriers	42 Watts	92K7D7W
E1-2.5	800 MHz – Five Carriers	42 Watts	118KD7W
E1-2.6	800 MHz – Six Carriers	42 Watts	143KD7W

Report on Test Measurements***Occupied Bandwidth – Multi-Carrier Base Radio, 25 kHz Channel Spacing – 900 MHz Operation***

There are six exhibits shown for 900 MHz operation. All can be used in a system configuration based upon channel usage as described in Exhibit B. All of the following charts reference the following setup and specification requirements.

Modulation Type: Quad-QAM, 64 kbps Random Data Per Channel
Emission Designator: (See Exhibit Table Below)
Channelization: 25 kHz per channel
Power Setting: (See Exhibit Table Below)

§ 90.669 Emission Limits:

(a) On any frequency in an MTA licensee's spectrum block that is adjacent to a non-MTA frequency, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P) \text{ dB}$ or 80 dB, whichever is the lesser attenuation.

Note: The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

(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). For the composite two carrier signal (1 additional channel), the resulting necessary bandwidth is $17.7 \text{ kHz} + 1*25 \text{ kHz} = 42.7 \text{ kHz}$. For the composite signal of n additional carriers, the resulting necessary bandwidth is $17.7 \text{ kHz} + n*25 \text{ kHz}$.

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:	500 kHz
Sweep Time:	as needed (<2000 Hz / Second)	Span:	as needed per # carriers
Detector Mode:	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:	as needed (<2000 Hz / Second)	Span:	as needed per # carriers
Detector Mode:	Peak		

Report on Test Measurements*Occupied Bandwidth – Multi-Carrier Base Radio, 25 kHz Channel Spacing – 900 MHz Operation (continued)*Test Procedure:

- 1) Adjust the spectrum analyzer per the values specified in the Reference Calibration Analyzer Settings section above.
- 2) Modulate the transmitter with the appropriate signaling pattern, (mixed QAM, pseudorandom data) and key the transmitter at the full power rating for the number of carriers to be measured. Use the analyzer controls to set this signal to the full-scale reference line. Allow the analyzer to sweep fully, store the sweep, and record the peak value.
- 3) Adjust the analyzer per the values specified in the Emission Measurement Analyzer Settings section above.
- 4) Allow the analyzer to sweep, and record the resultant emission levels.
- 5) Plot the resulting analyzer trace and the emission mask limit, add annotation text and labeling as appropriate.

EXHIBIT	DESCRIPTION	Power (Watts, Avg)	Emission Designator
E1-2.7	900 MHz – One Carrier	52 Watts	17K7D7W
E1-2.8	900 MHz – Two Carriers	52 Watts	42K7D7W
E1-2.9	900 MHz – Three Carriers	48 Watts	67K7D7W
E1-2.10	900 MHz – Four Carriers	42 Watts	92K7D7W
E1-2.11	900 MHz – Five Carriers	42 Watts	118KD7W
E1-2.12	900 MHz – Six Carriers	42 Watts	143KD7W

Report on Test Measurements

Occupied Bandwidth – Multi-Carrier Base Radio, 25 kHz Channel Spacing – 940 - 941 MHz Operation

There are six exhibits shown for 900 MHz operation. All can be used in a system configuration based upon channel usage as described in Exhibit B. All of the following charts reference the following setup and specification requirements.

Modulation Type: Quad-QAM, 64 kbps Random Data Per Channel
 Emission Designator: (See Exhibit Table Below)
 Channelization: 25 kHz per channel
 Power Setting: (See Exhibit Table Below)

§ 24.133 Emission Limits:

(1) For transmitters authorized for a bandwidth greater than 10 kHz

(a) The power of any emission shall be attenuated below the transmitter power (P), as measured in accordance with § 24.132(f), in accordance with the following schedule:

(i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of up to and including 40 kHz:
at least 116 Log10 ((fd+10)/6.1) decibels;
or 50 plus 10 Log10 (P) decibels;
or 70 decibels;
(whichever is the lesser attenuation)

(ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 40 kHz:
at least 43 plus 10 Log10 (P) decibels;
or 80 decibels;
(whichever is the lesser attenuation)

(b) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

(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.

(d) The following minimum spectrum analyzer resolution bandwidth settings will be used: 300 Hz when showing compliance with paragraphs (a)(1)(i) and (a)(2)(i) of this section; and 30 kHz when showing compliance with paragraphs (a)(1)(ii) and (a)(2)(ii) of this section.

§ 24.132(f) All power levels specified in this section are expressed in terms of the maximum power, averaged over a 100 millisecond interval, when measured with instrumentation calibrated in terms of an rms-equivalent voltage with a resolution bandwidth equal to or greater than the authorized bandwidth.

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 $17.7 \text{ kHz} + 1*25 \text{ kHz} = 42.7 \text{ kHz}$. For the composite signal of n additional carriers, the resulting necessary bandwidth is $17.7 \text{ kHz} + n*25 \text{ kHz}$.

Report on Test Measurements*Occupied Bandwidth – Multi-Carrier Base Radio, 25 kHz Channel Spacing – 940 - 941 MHz Operation (Continued)****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:	500 kHz
Sweep Time:	as needed (<2000 Hz / Second)	Span:	as needed per # carriers
Detector Mode:	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:	as needed (<2000 Hz / Second)	Span:	as needed per # carriers
Detector Mode:	Peak		

Test Procedure:

- 1) Adjust the spectrum analyzer per the values specified in the Reference Calibration Analyzer Settings section above.
- 2) Modulate the transmitter with the appropriate signaling pattern, (mixed QAM, pseudorandom data) and key the transmitter at the full power rating for the number of carriers to be measured. Use the analyzer controls to set this signal to the full-scale reference line. Allow the analyzer to sweep fully, store the sweep, and record the peak value.
- 3) Adjust the analyzer per the values specified in the Emission Measurement Analyzer Settings section above.
- 4) Allow the analyzer to sweep, and record the resultant emission levels.
- 5) Plot the resulting analyzer trace and the emission mask limit, add annotation text and labeling as appropriate. For frequencies 40 kHz or more outside of the edge of authorized bandwidth, the data is adjusted using the factor $10 \cdot \log(30\text{kHz}/300\text{Hz})$ or 20 dB.

EXHIBIT	DESCRIPTION	Power (Watts, Avg)	Emission Designator
E1-2.13	940.5000 MHz – One Carrier	52 Watts	17K7D7W
E1-2.14	940.5000 MHz – Two Carriers	52 Watts	42K7D7W
E1-2.15	940.5000 MHz – Three Carriers	48 Watts	67K7D7W
E1-2.16	940.5000 MHz – Four Carriers	42 Watts	92K7D7W
E1-2.17	940.5000 MHz – Five Carriers	42 Watts	118KD7W
E1-2.18	940.5000 MHz – Six Carriers	42 Watts	143KD7W

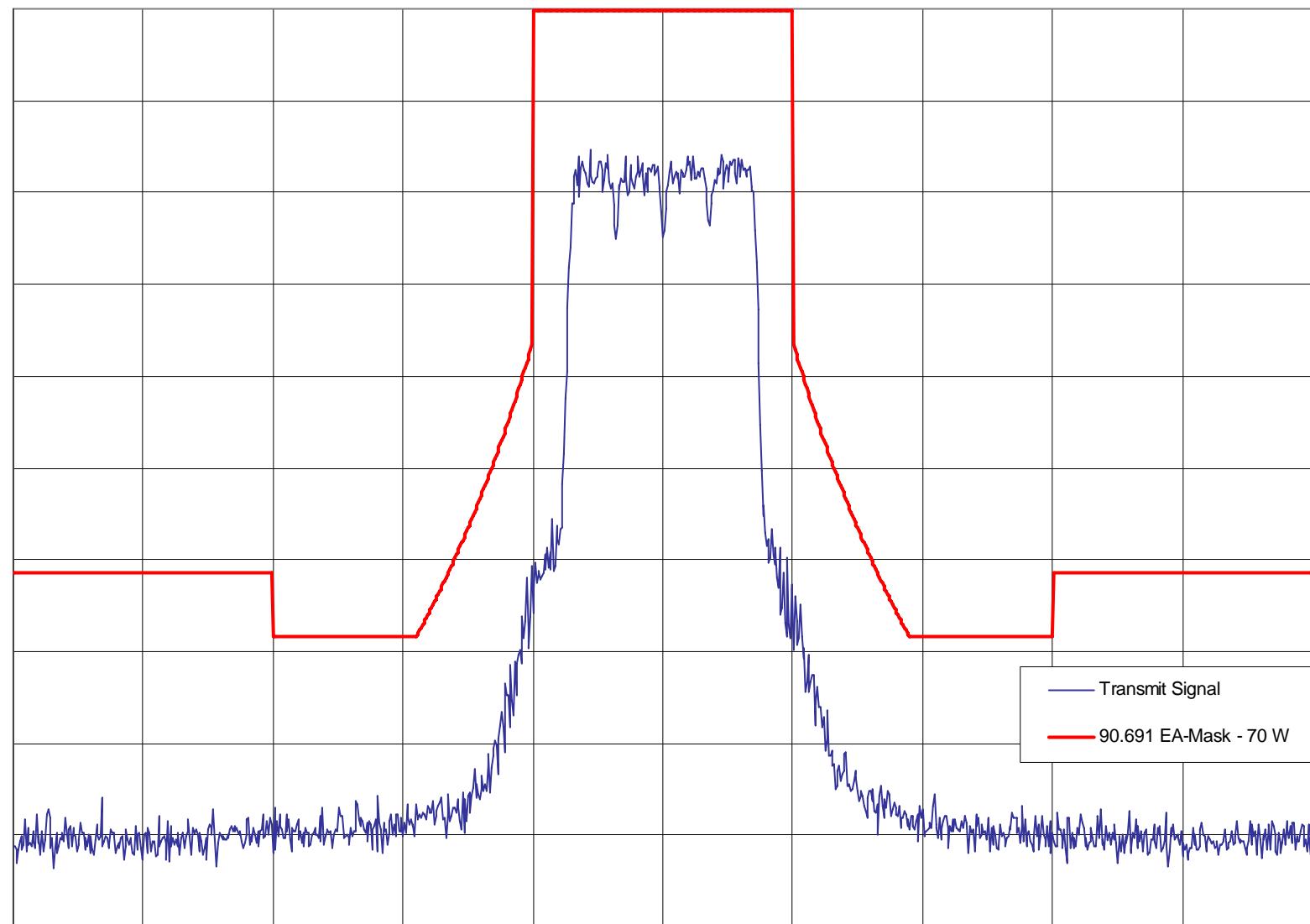
Report on Test Measurements

Occupied Bandwidth – 800 MHz – One Carrier

Occupied Bandwidth -- One Carrier - Mixed QAM - 17K7D7D - 70 Watts

REF 55.8 dBm

ATTEN 20 dB

10 dB/
Peak

CENTER 860.01250 MHz

RES BW 300 Hz

VID BW 3 kHz

SPAN 125 kHz

SWP 75 sec

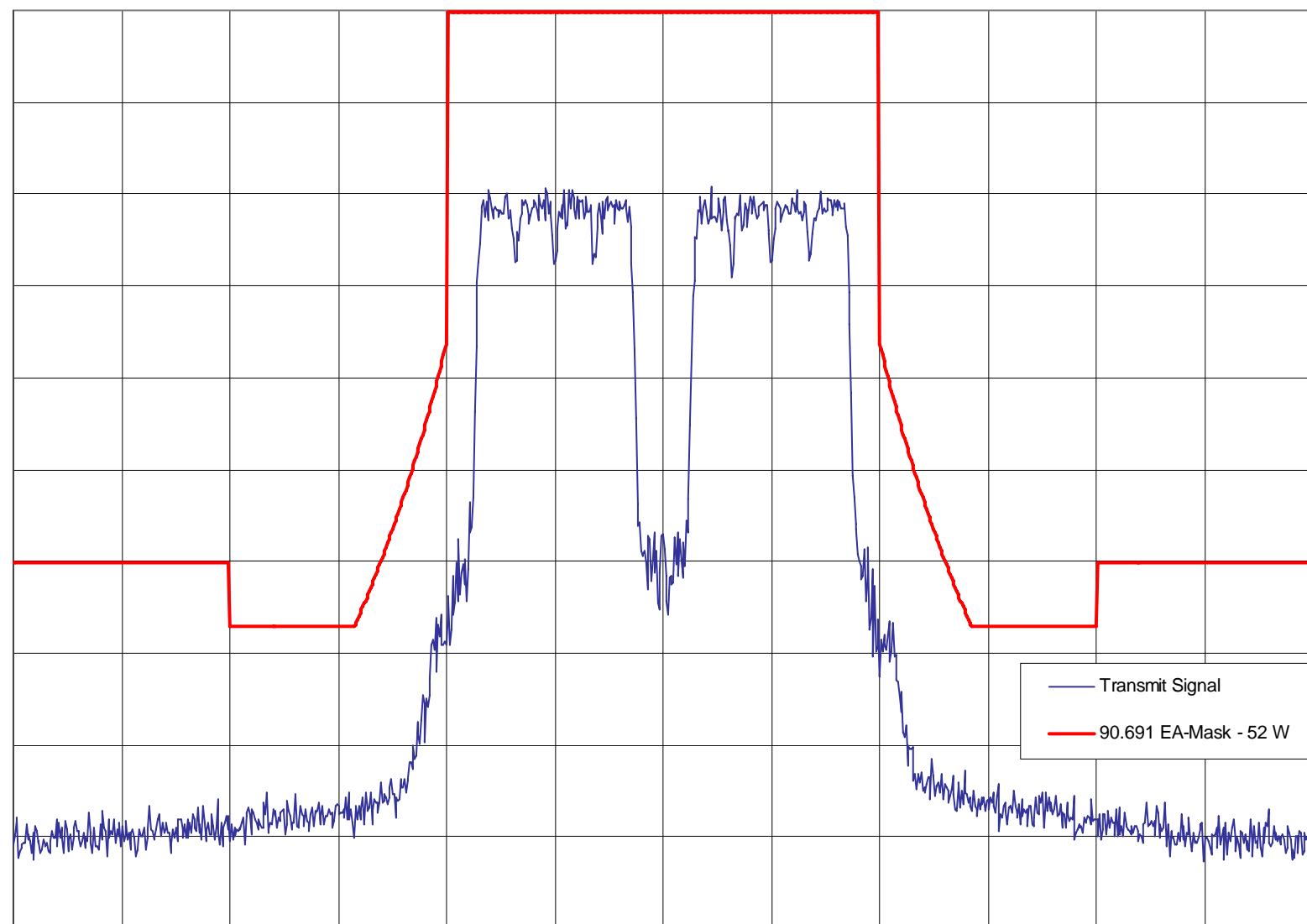
Report on Test Measurements

Occupied Bandwidth – 800 MHz – Two Carriers

Occupied Bandwidth -- Two Carriers - Mixed QAM - 42K7D7D - 52 Watts

REF 55.4 dBm

ATTEN 20 dB

10 dB/
Peak

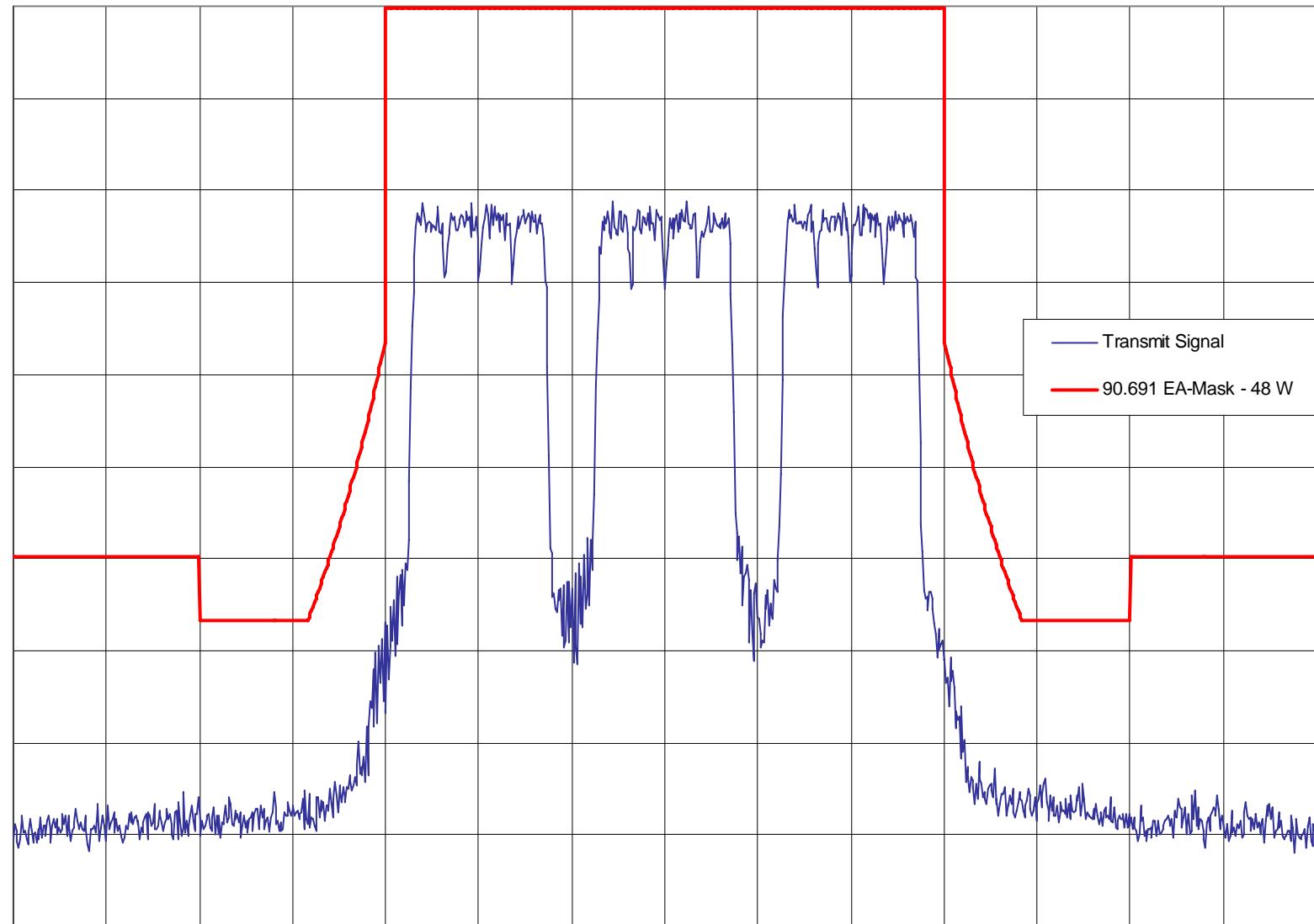
Report on Test Measurements

Occupied Bandwidth – 800 MHz – Three Carriers

Occupied Bandwidth -- Three Carriers - Mixed QAM - 67K7D7D - 48 Watts

REF 55.2 dBm

ATTEN 20 dB

10 dB/
Peak

CENTER 860.03750 MHz

RES BW 300 Hz

VID BW 300 kHz

SPAN 175 kHz

SWP 105 sec

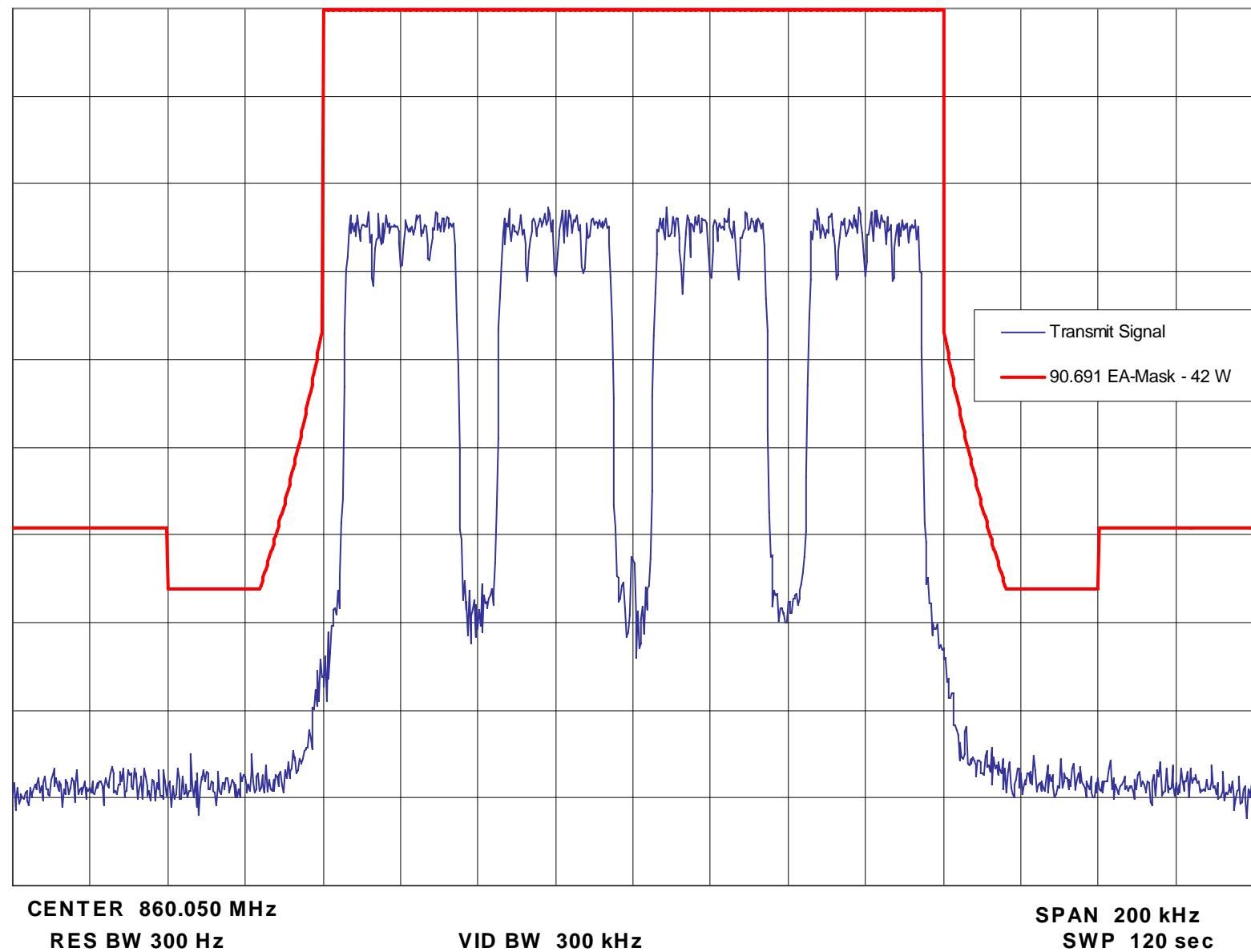
Report on Test Measurements

Occupied Bandwidth – 800 MHz – Four Carriers

Occupied Bandwidth -- Four Carriers - Mixed QAM - 92K7D7D - 42 Watts

REF 54.9 dBm

ATTEN 20 dB

10 dB/
Peak

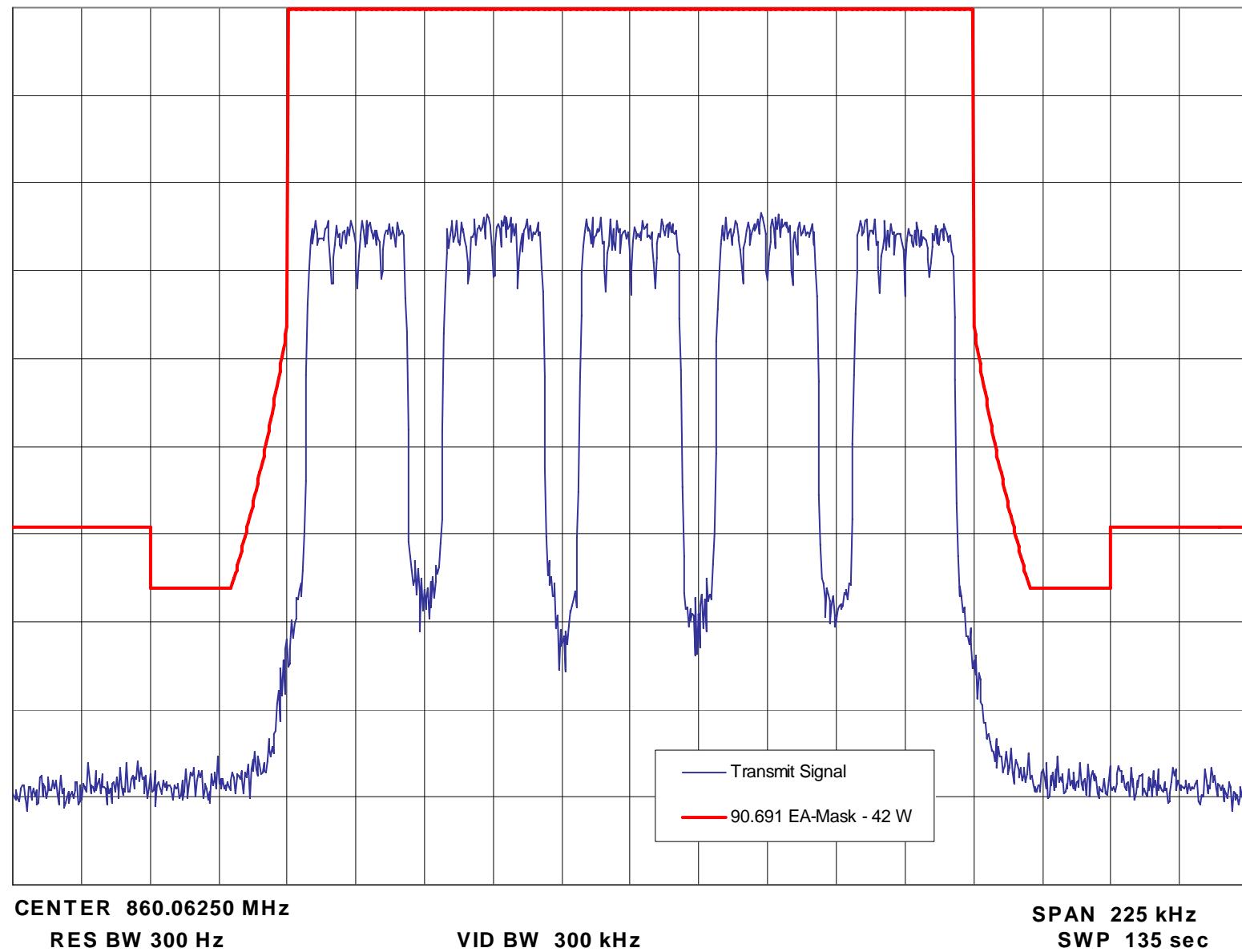
Report on Test Measurements

Occupied Bandwidth – 800 MHz – Five Carriers

Occupied Bandwidth -- Five Carriers - Mixed QAM - 118KD7D - 42 Watts

REF 54.7 dBm

ATTEN 20 dB

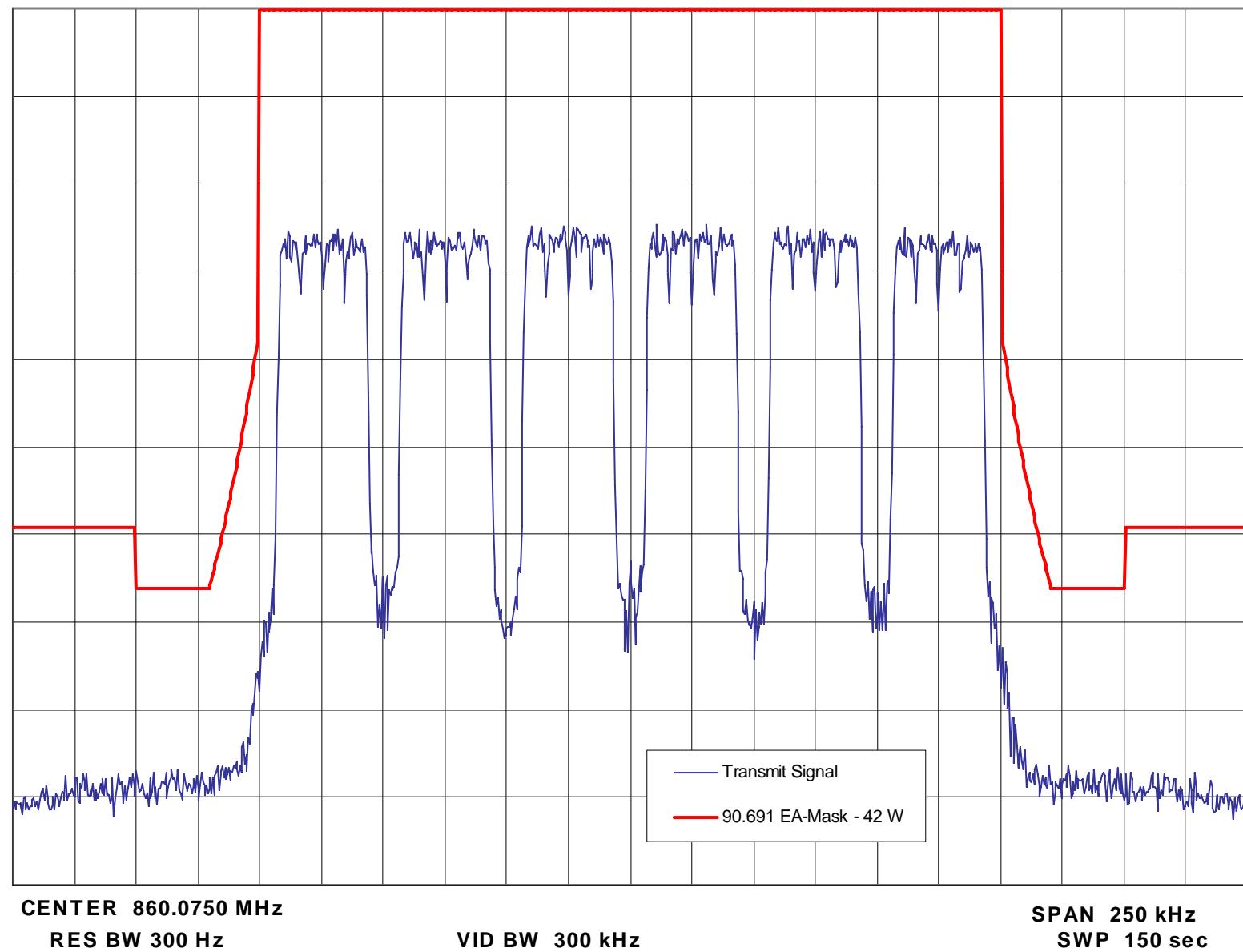
10 dB/
Peak

Report on Test Measurements

*Occupied Bandwidth – 800 MHz – Six Carriers***Occupied Bandwidth -- Six Carriers - Mixed QAM - 143KD7D - 42 Watts**

REF 55.2 dBm

ATTEN 20 dB

10 dB/
Peak

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements

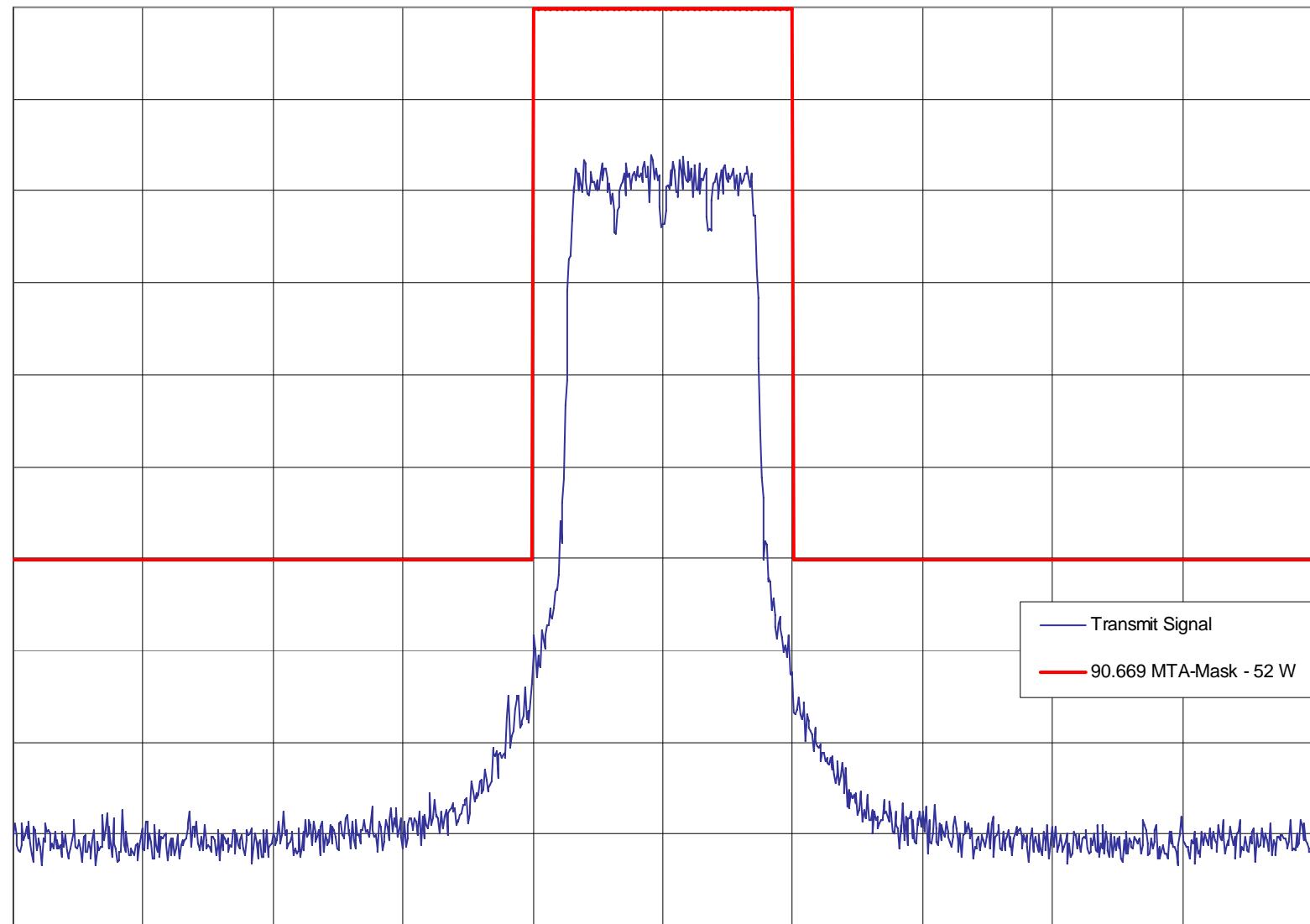
Occupied Bandwidth – 900 MHz – One Carrier

Occupied Bandwidth -- One Carrier - Mixed QAM - 17K7D7D - 52 Watts

REF 55.3 dBm

ATTEN 20 dB

10 dB/
Peak



CENTER 937.5000 MHz

RES BW 300 Hz

VID BW 3 kHz

SPAN 125 kHz

SWP 75 sec

EXHIBIT E1-2.7

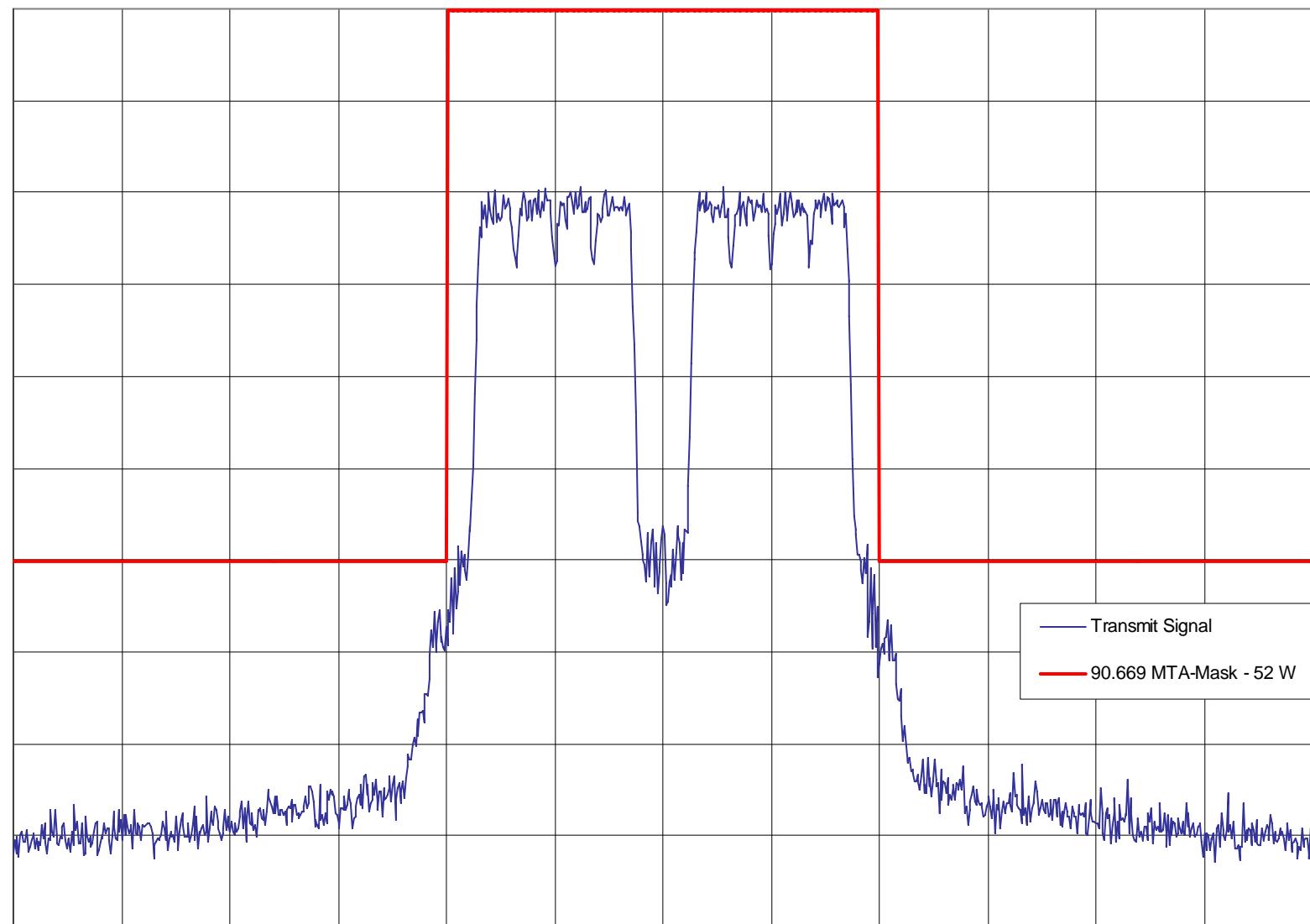
Report on Test Measurements

Occupied Bandwidth – 900 MHz – Two Carriers

Occupied Bandwidth -- Two Carriers - Mixed QAM - 42K7D7D - 52 Watts

REF 55.3 dBm

ATTEN 20 dB

10 dB/
Peak

CENTER 937.5125 MHz

RES BW 300 Hz

VID BW 3 kHz

SPAN 150 kHz

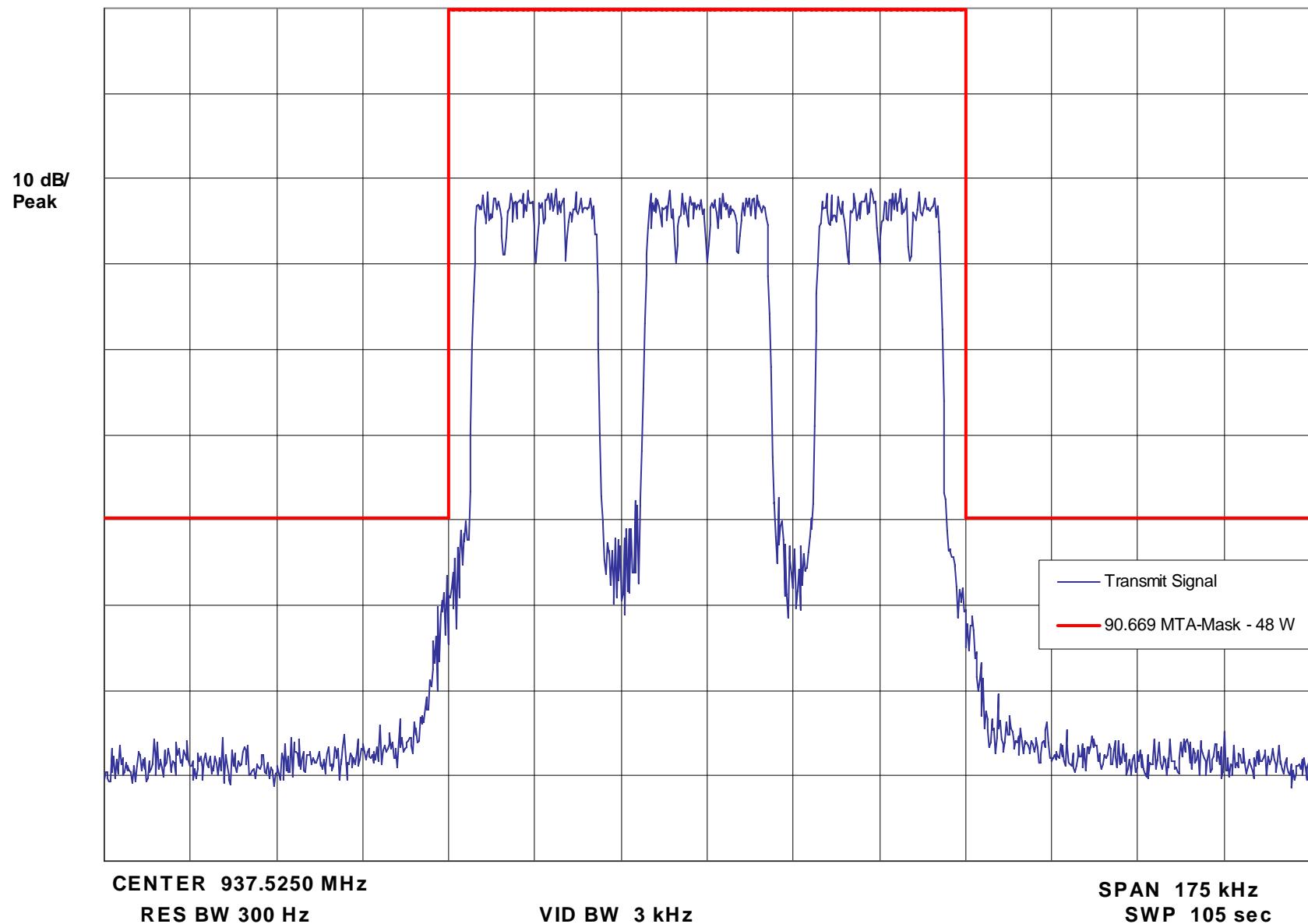
SWP 90 sec

Report on Test Measurements

Occupied Bandwidth – 900 MHz – Three Carriers

Occupied Bandwidth -- Three Carriers - Mixed QAM - 67K7D7D - 48 Watts

REF 55.1 dBm ATTEN 20 dB



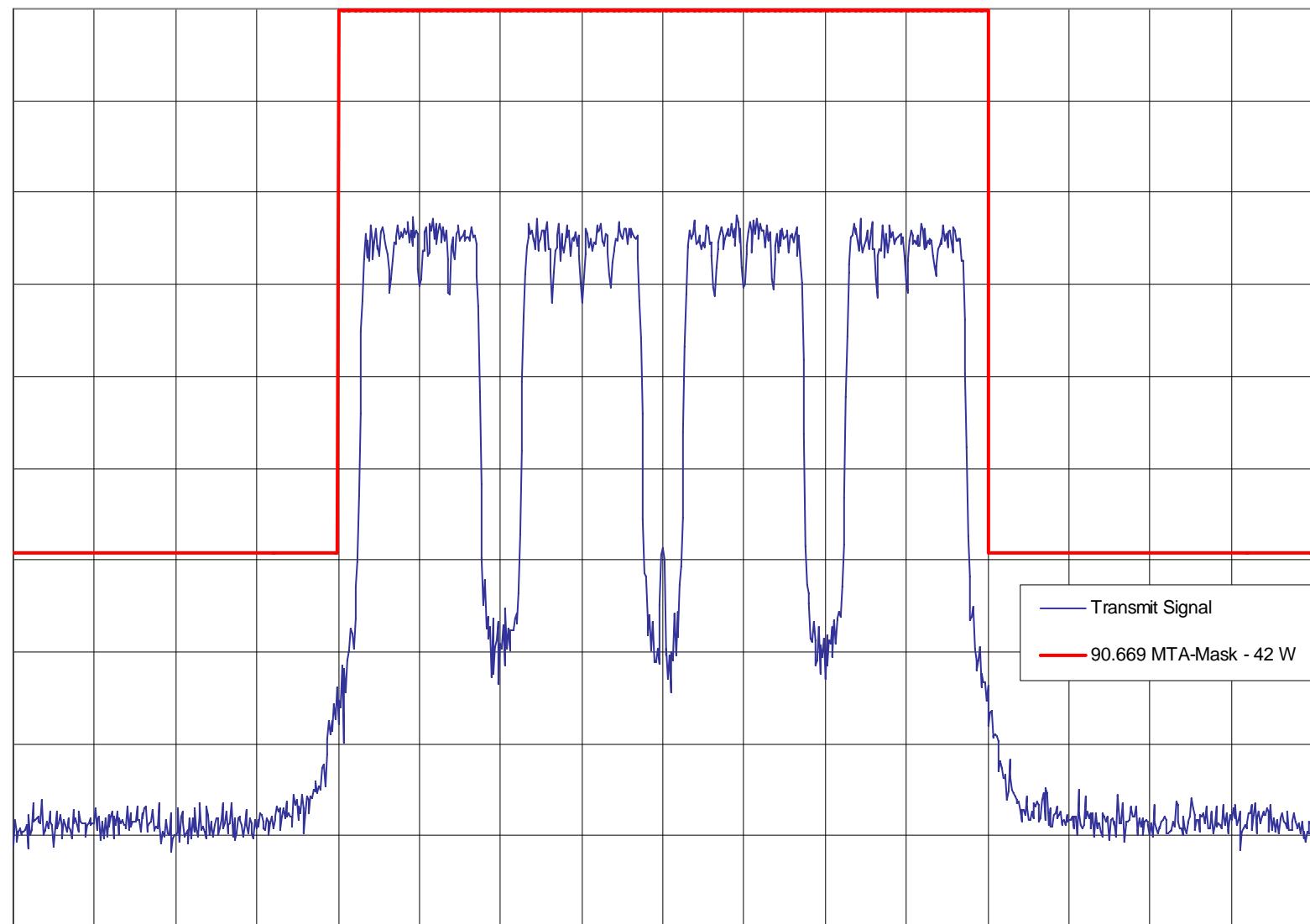
Report on Test Measurements

Occupied Bandwidth – 900 MHz – Four Carriers

Occupied Bandwidth -- Four Carriers - Mixed QAM - 92K7D7D - 42 Watts

REF 54.8 dBm

ATTEN 20 dB

10 dB/
Peak

CENTER 937.5375 MHz

RES BW 300 Hz

VID BW 3 kHz

SPAN 200 kHz

SWP 120 sec

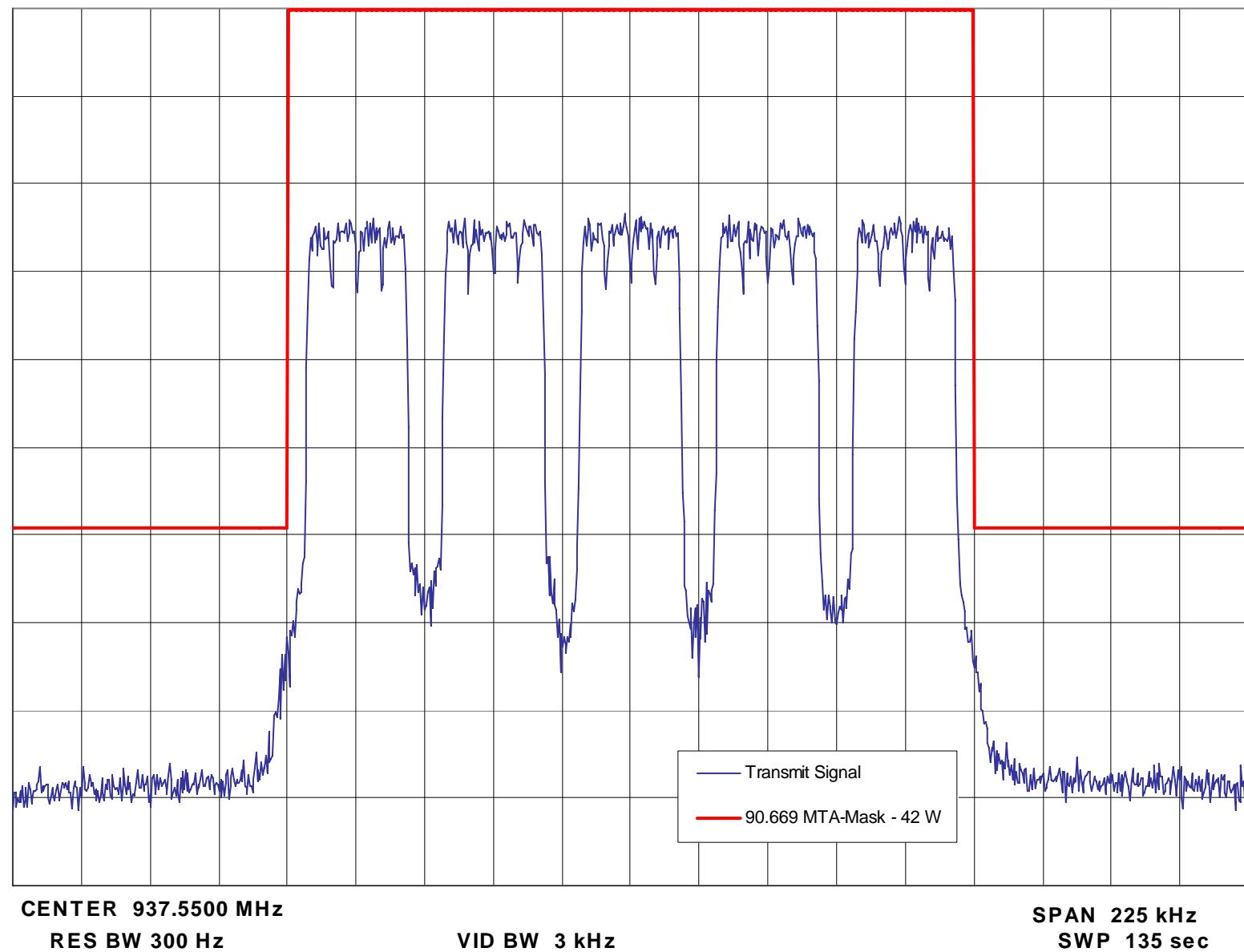
Report on Test Measurements

Occupied Bandwidth – 900 MHz – Five Carriers

Occupied Bandwidth -- Five Carriers - Mixed QAM - 118KD7D - 42 Watts

REF 54.8 dBm

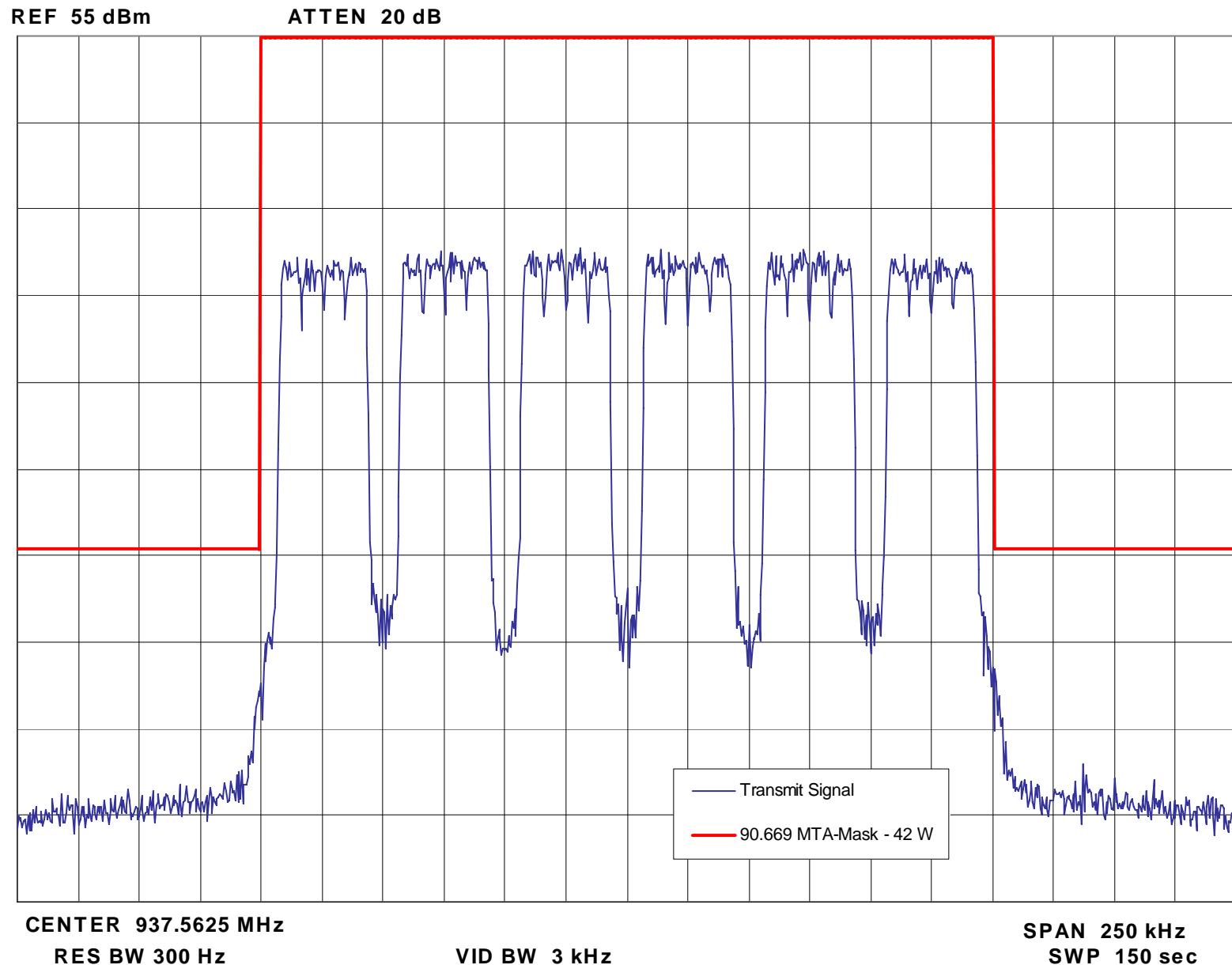
ATTEN 20 dB

10 dB/
Peak

Report on Test Measurements

Occupied Bandwidth – 900 MHz – Six Carriers

Occupied Bandwidth -- Six Carriers - Mixed QAM - 118KD7D - 42 Watts



APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements

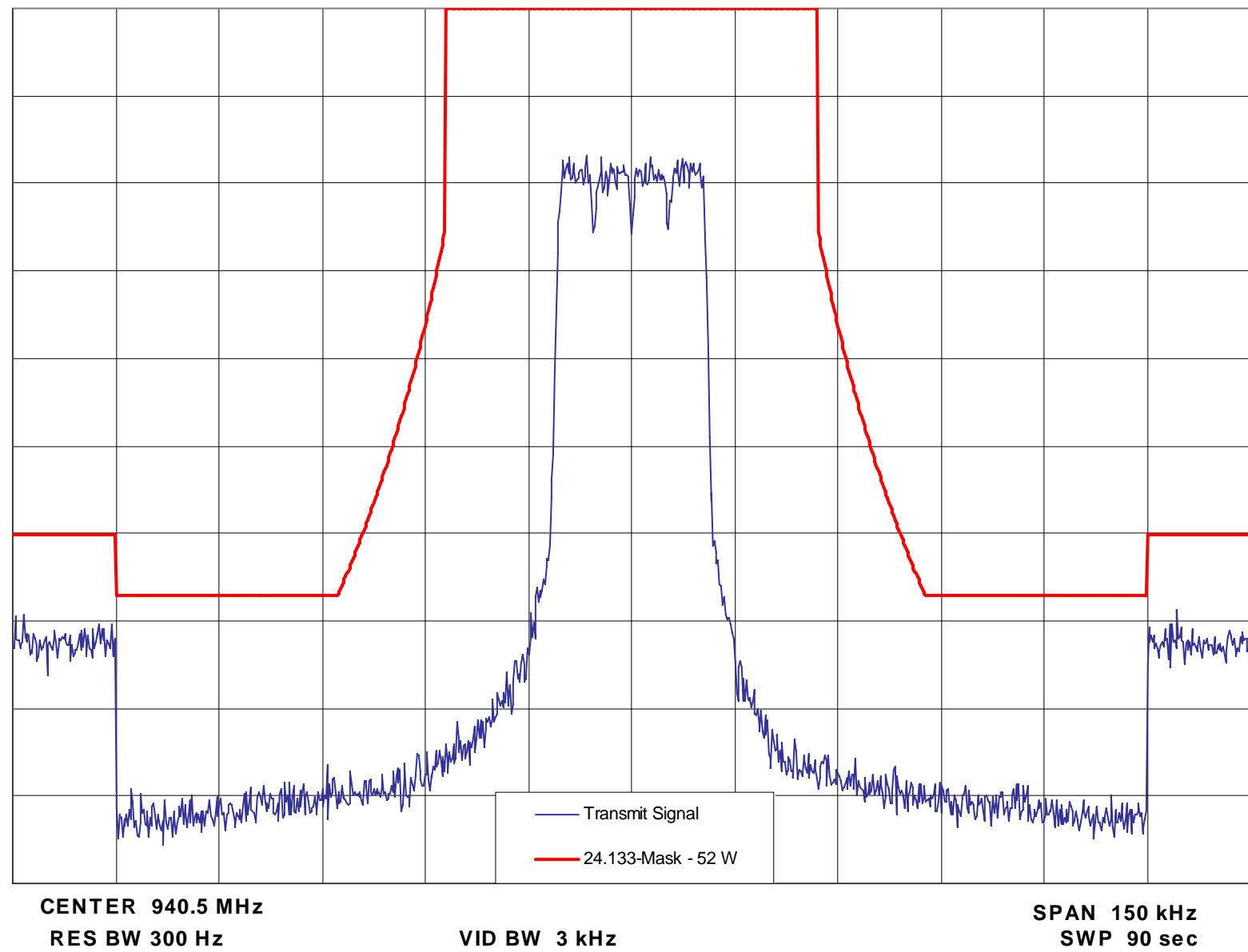
Occupied Bandwidth – 940-941 MHz Part 24 Operation – One Carrier

Occupied Bandwidth -- One Carrier - 16-QAM - 17K7D7W - 52 Watts

REF 55.7 dBm

ATTEN 20 dB

10 dB/
Peak

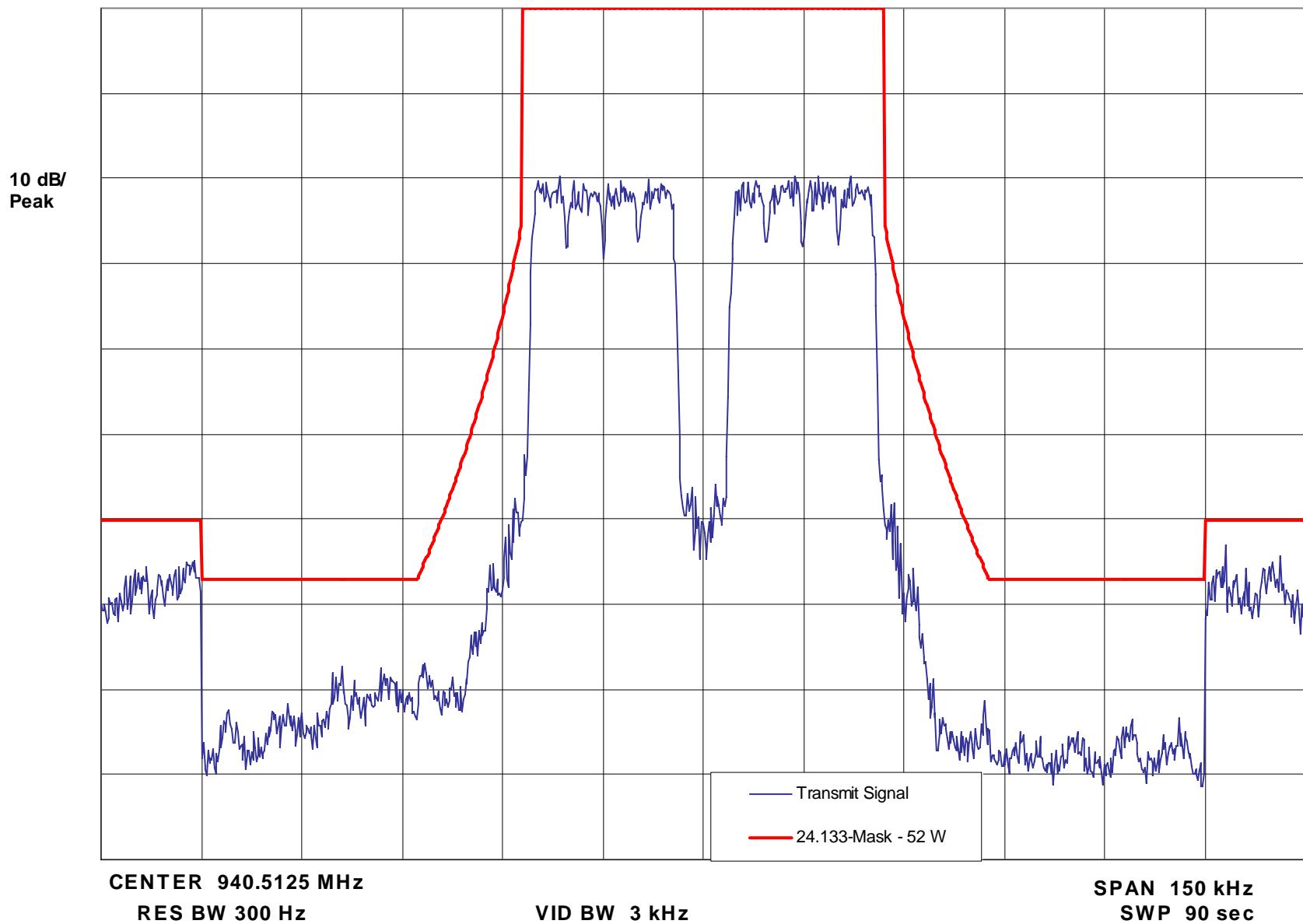


Report on Test Measurements

Occupied Bandwidth – 940-941 MHz Part 24 Operation – Two Carriers

Occupied Bandwidth -- Two Carriers - 16-QAM - 42K7D7W - 52 Watts

REF 56 dBm ATTEN 20 dB



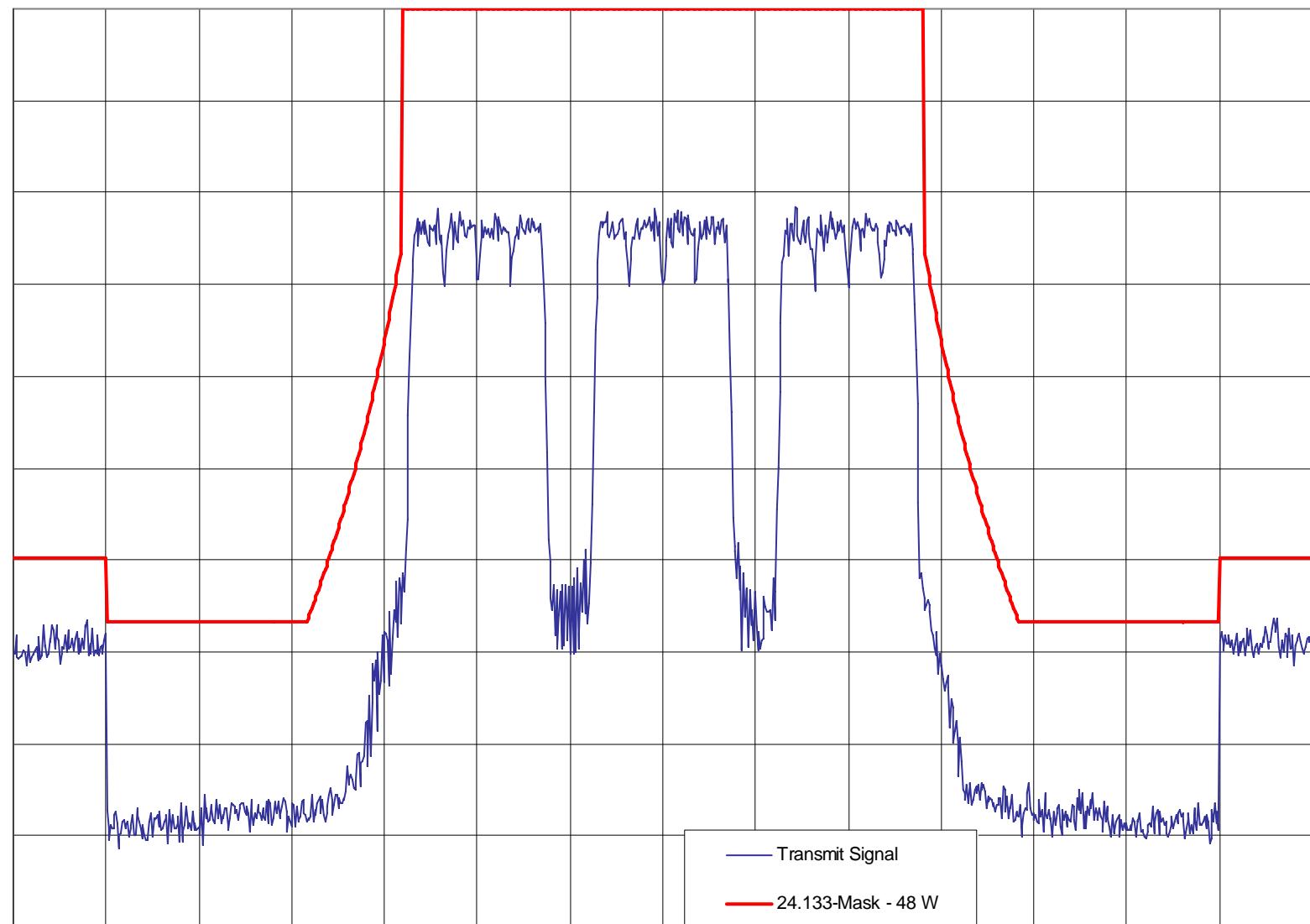
Report on Test Measurements

Occupied Bandwidth – 940-941 MHz Part 24 Operation – Three Carriers

Occupied Bandwidth -- Three Carriers - 16-QAM - 67K7D7W - 48 Watts

REF 55.8 dBm

ATTEN 20 dB

10 dB/
Peak

CENTER 940.525 MHz

RES BW 300 Hz

VID BW 3 kHz

SPAN 175 kHz

SWP 105 sec

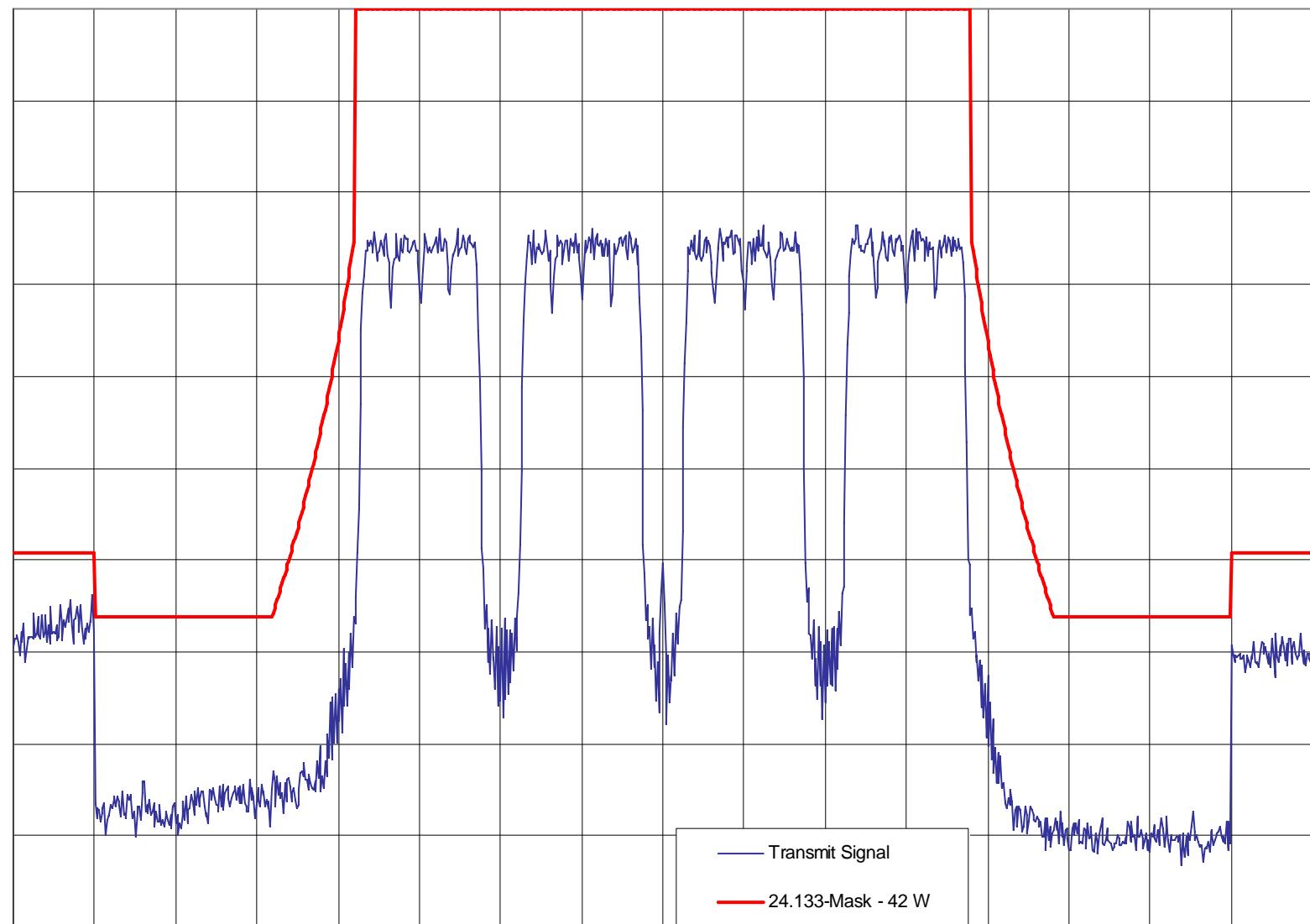
Report on Test Measurements

Occupied Bandwidth – 940-941 MHz Part 24 Operation – Four Carriers

Occupied Bandwidth -- Four Carriers - 16-QAM - 92K7D7W - 42 Watts

REF 55.6 dBm

ATTEN 20 dB

10 dB/
Peak

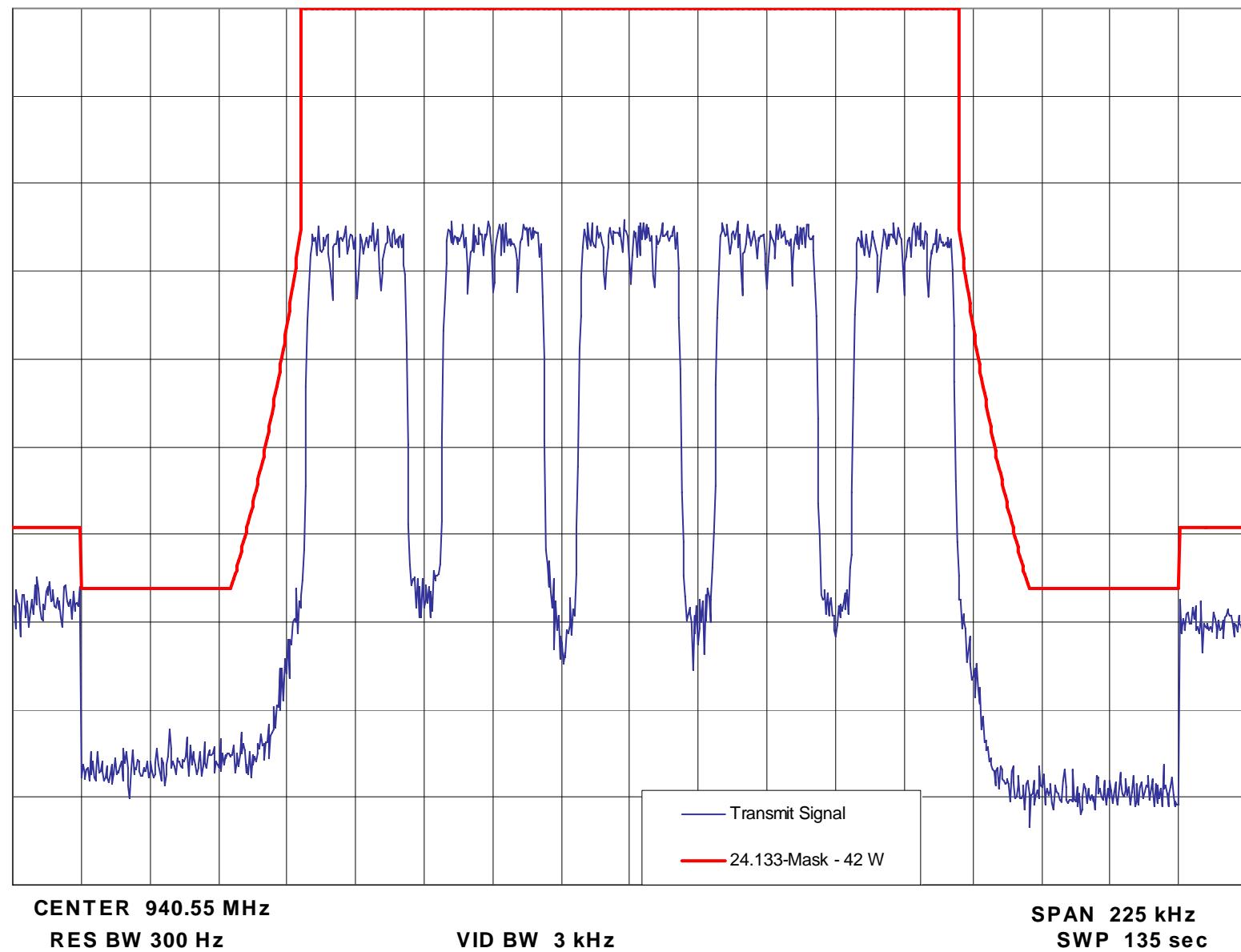
Report on Test Measurements

Occupied Bandwidth – 940-941 MHz Part 24 Operation – Five Carriers

Occupied Bandwidth -- Five Carriers - 16-QAM - 118KD7W - 42 Watts

REF 55.5 dBm

ATTEN 20 dB

10 dB/
Peak

Report on Test Measurements

Occupied Bandwidth – 940-941 MHz Part 24 Operation – Six Carriers

Occupied Bandwidth -- Six Carriers - 16-QAM - 143KD7W - 42 Watts

REF 55.6 dBm

ATTEN 20 dB

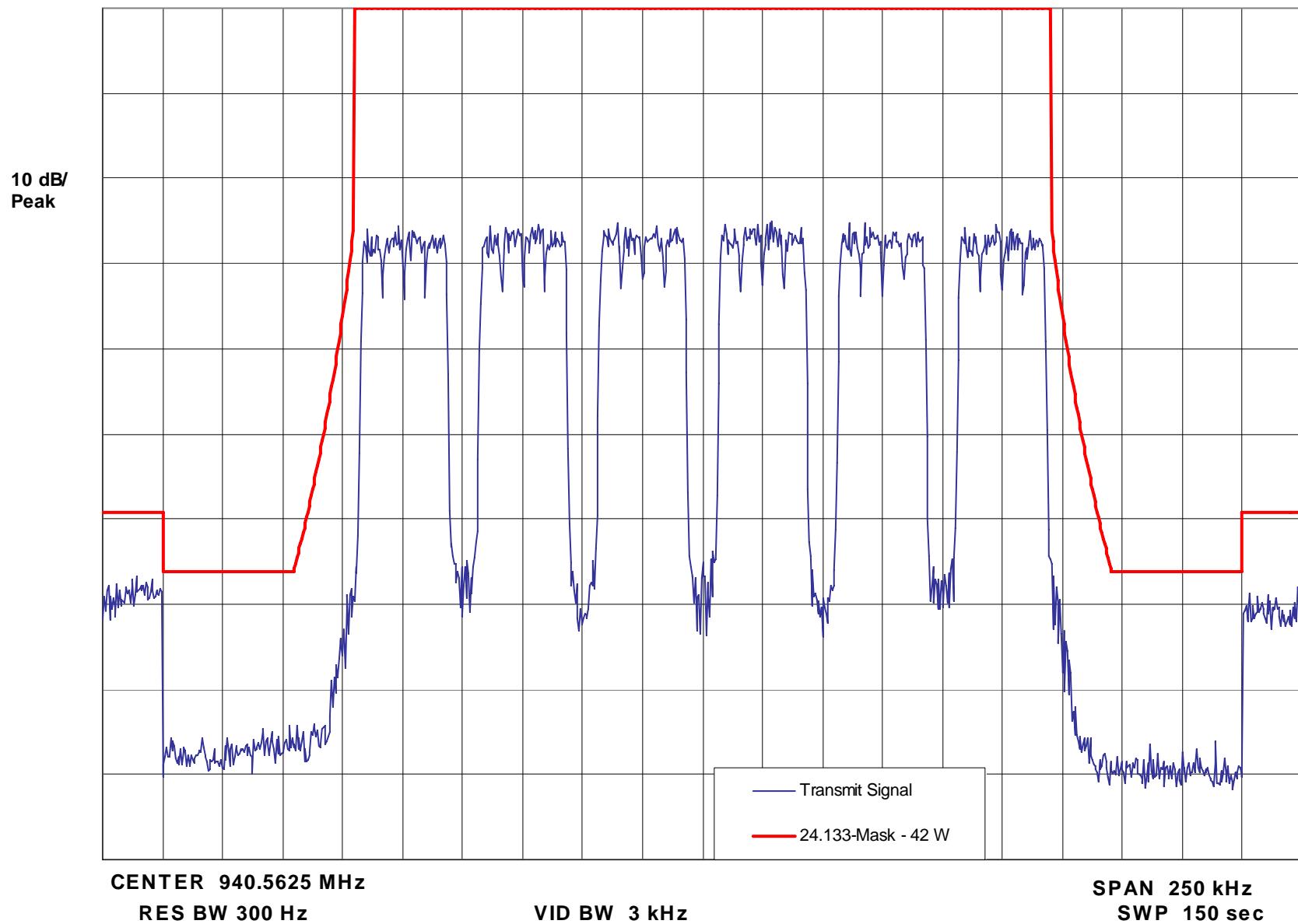


EXHIBIT E1-2.18

Report on Test Measurements*Conducted Spurious Emissions, Harmonics and Close-In, 800 MHz Operation***§ 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:

(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.

Modulation: Quad-QAM, 64 kbps Random Data Per Channel

Carrier Frequency: A carrier frequency of 860.0125 MHz was measured. This frequency is near the center of the operating band 851-870 MHz

EXHIBIT DESCRIPTION

E1-3.1 800 MHz – One Carrier Conducted Spurious Emissions, Harmonics, Power Output at 70 Watts
The specification limit is -61.5 dBc

E1-3.2 800 MHz – One Carrier Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
The specification limit is -50.0 dBc

E1-3.3 800 MHz – Six Carrier Conducted Spurious Emissions, Harmonics, Power Output at 42 Watts
The specification limit is -59.2 dBc

E1-3.4 800 MHz – Six Carrier Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
The specification limit is -50.0 dBc

E1-3.5 800 MHz – One Carrier – Conducted Close-In, 5 MHz Span, Power Output at 70 Watts
The specification limit is -61.5 dBc

E1-3.6 800 MHz – One Carrier – Conducted Close-In, 100 MHz Span, Power Output at 70 Watts
The specification limit is -61.5 dBc

E1-3.7 800 MHz – Six Carrier – Conducted Close-In, 5 MHz Span, Power Output at 42 Watts
The specification limit is -59.2 dBc

E1-3.8 800 MHz – Six Carrier – Conducted Close-In, 100 MHz Span, Power Output at 42 Watts
The specification limit is -59.2 dBc

Report on Test Measurements*Conducted Spurious Emissions, Harmonics and Close-In, 900 MHz Operation***§ 90.669 Emission Limits:**

(c) On any frequency in an MTA licensee's spectrum block that is adjacent to a non-MTA frequency, the power of any emission shall be attenuated below the transmitter power (P) by at least *43 plus 10 log₁₀(P) dB or 80 dB, whichever is the lesser attenuation.*

Note: The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

(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.

Part 24.133 Emission Limits

On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 40 kHz, the power of any emission shall be attenuated below the transmitter power (P), in Watts, by at least *43 plus 10 Log10 (P) decibels, or 80 decibels (whichever is the lesser attenuation).*

Modulation: Quad-QAM, 64 kbps Random Data Per Channel

Carrier Frequency: A carrier frequency of 937.5000 MHz was measured. This frequency is near the center of the operating band 935-941 MHz

EXHIBIT **DESCRIPTION**

E1-3.9 900 MHz – One Carrier Conducted Spurious Emissions, Harmonics, Power Output at 52 Watts
The specification limit is -60.2 dBc

E1-3.10 900 MHz – One Carrier Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
The specification limit is -50.0 dBc

E1-3.11 900 MHz – Six Carrier Conducted Spurious Emissions, Harmonics, Power Output at 42 Watts
The specification limit is -59.2 dBc

E1-3.12 900 MHz – Six Carrier Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
The specification limit is -50.0 dBc

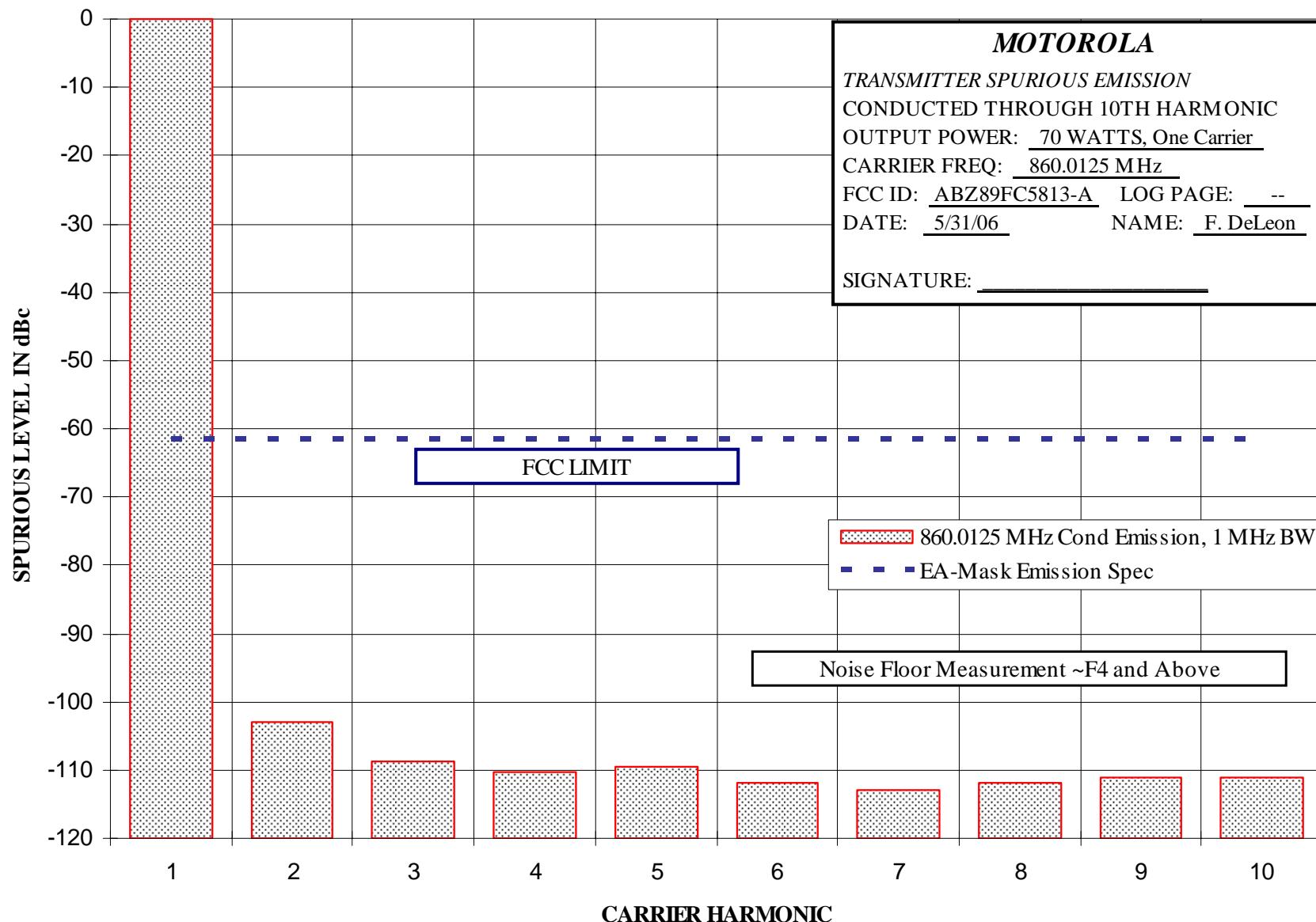
E1-3.13 900 MHz – One Carrier – Conducted Close-In, 5 MHz Span, Power Output at 52 Watts
The specification limit is -60.2 dBc

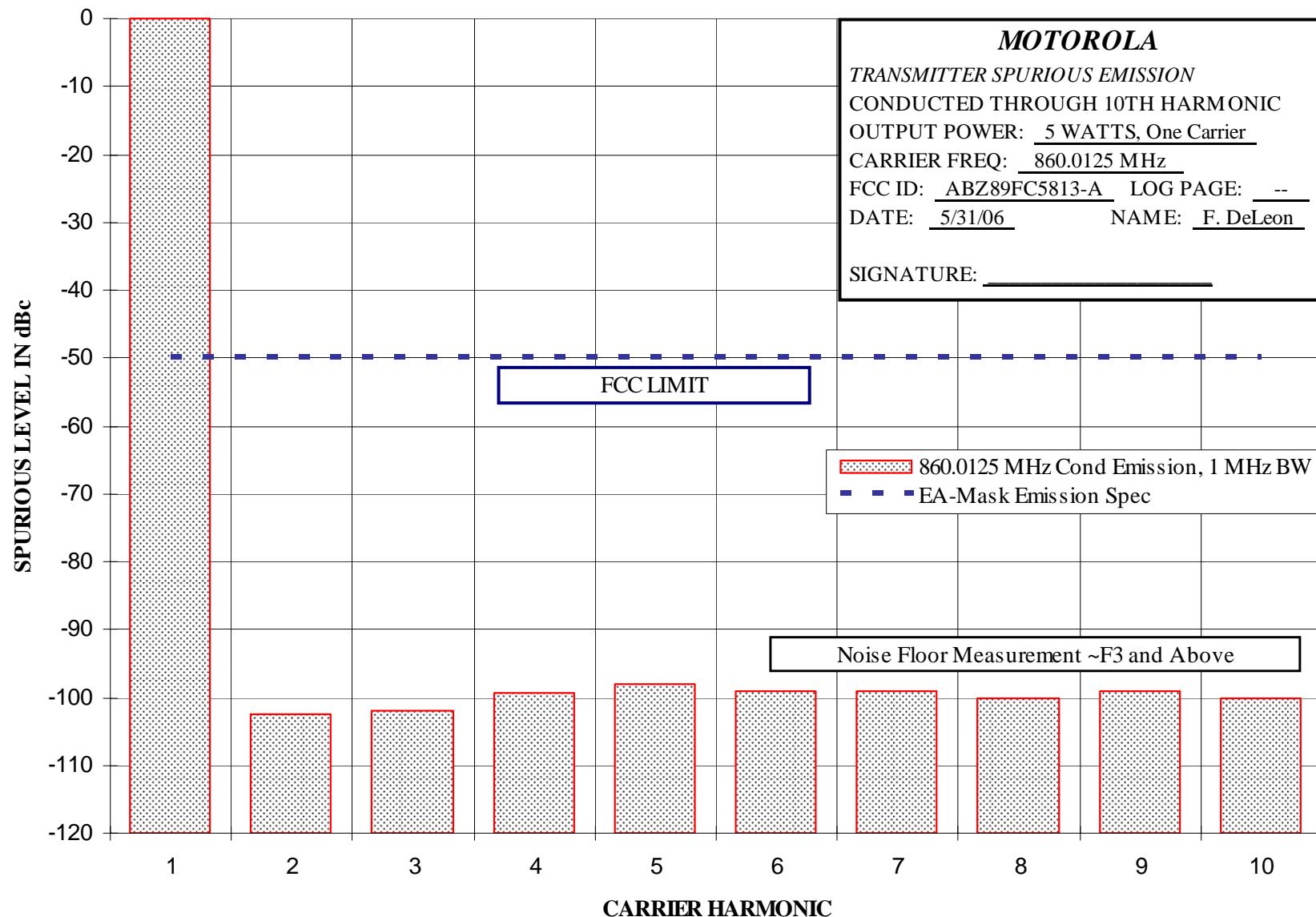
E1-3.14 900 MHz – One Carrier – Conducted Close-In, 100 MHz Span, Power Output at 52 Watts
The specification limit is -60.2 dBc

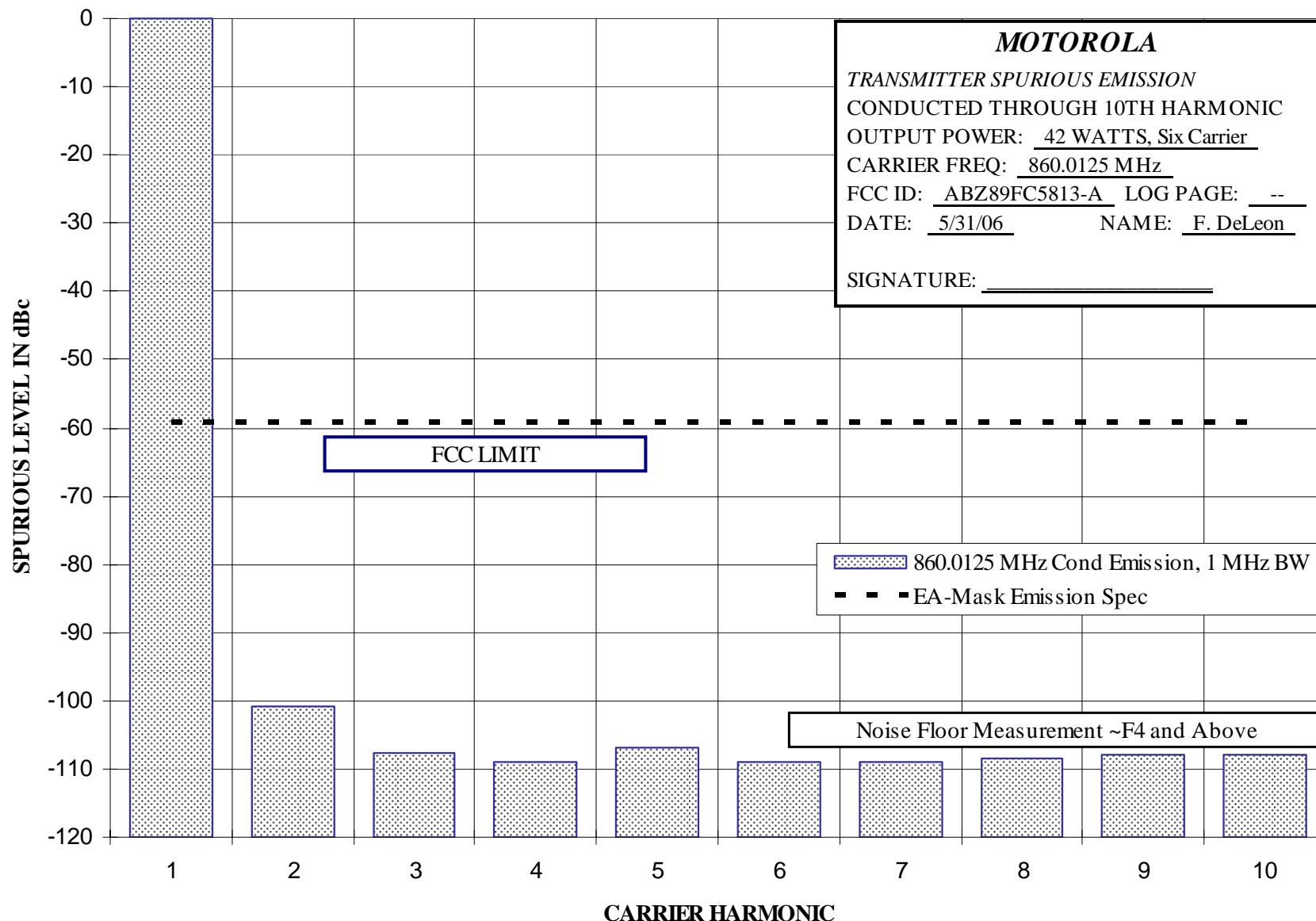
E1-3.15 900 MHz – Six Carrier – Conducted Close-In, 5 MHz Span, Power Output at 42 Watts
The specification limit is -59.2 dBc

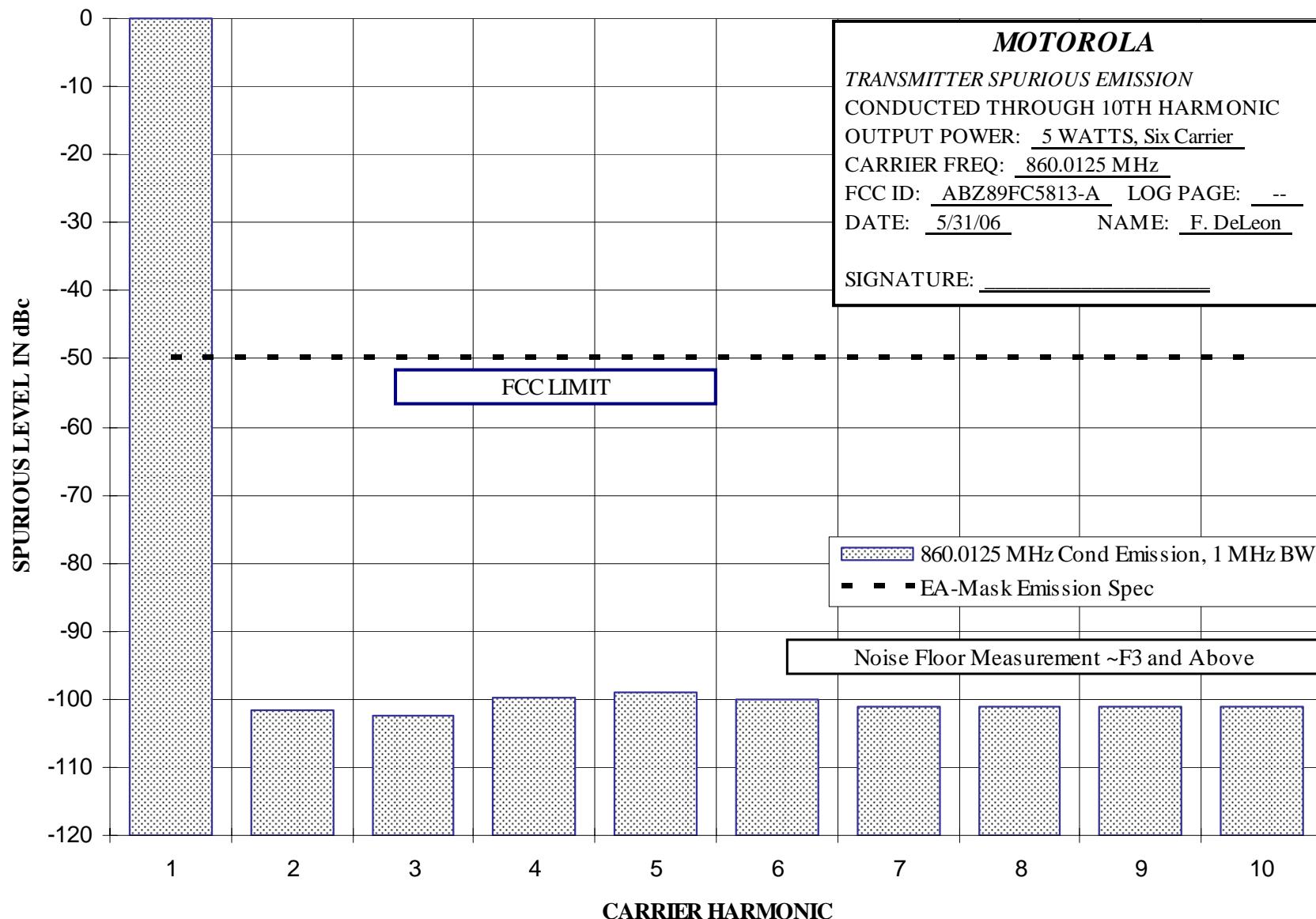
E1-3.16 900 MHz – Six Carrier – Conducted Close-In, 100 MHz Span, Power Output at 42 Watts
The specification limit is -59.2 dBc

Report on Test Measurements
Conducted Emission – Harmonics – One Carrier - 70 Watts – 800 MHz



Report on Test Measurements
Conducted Emission – Harmonics – One Carrier - 5 Watts – 800 MHz

Report on Test Measurements
Conducted Emission – Harmonics – Six Carrier - 42 Watts – 800 MHz

Report on Test Measurements
Conducted Emission – Harmonics – Six Carrier - 5 Watts – 800 MHz

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements
Conducted Emission – Close-In – One Carrier – 70 Watts – 800 MHz – 20 MHz Span

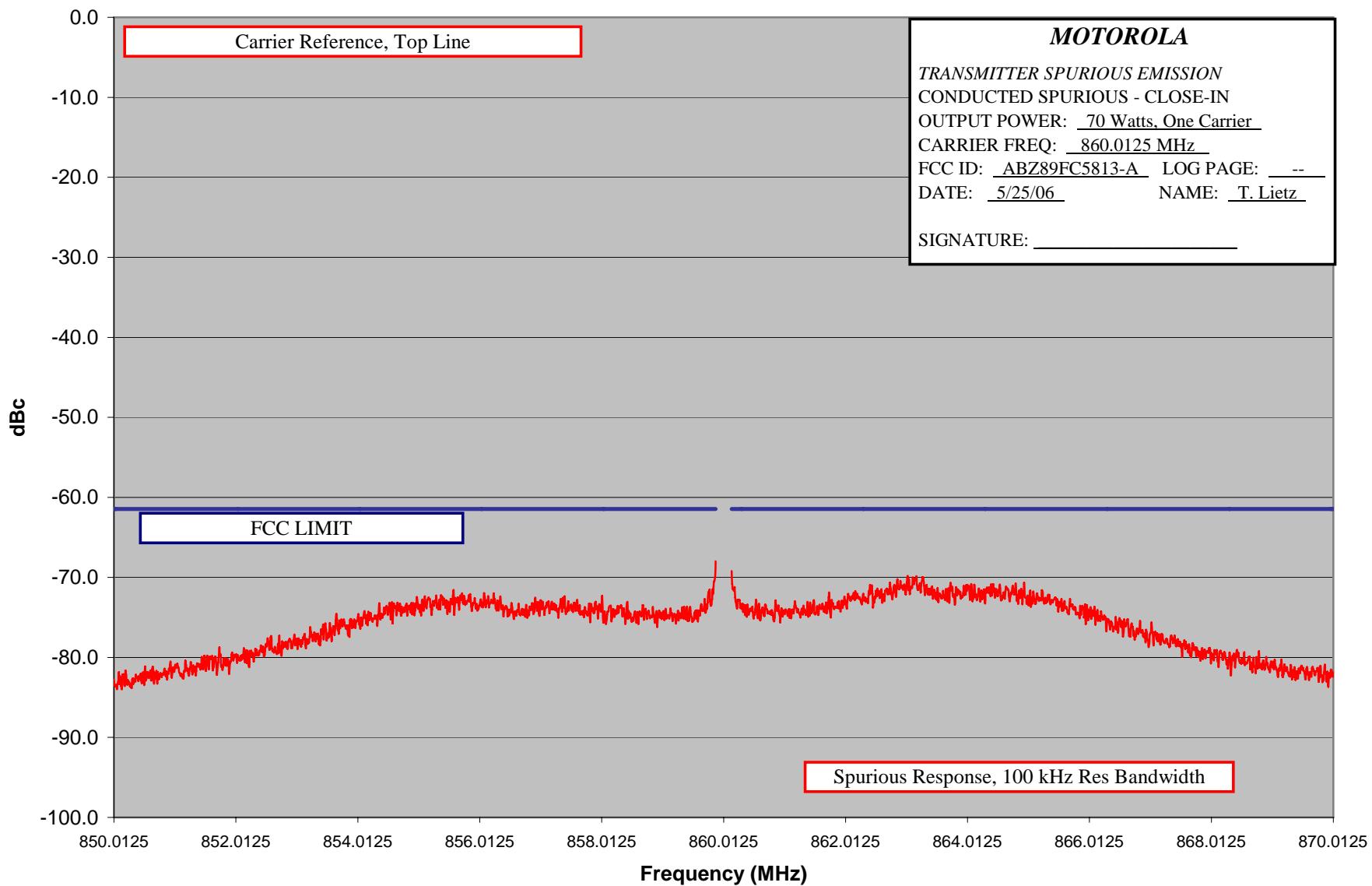


EXHIBIT E1-3.5

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements

Conducted Emission – Close-In – One Carrier – 70 Watts – 800 MHz – 200 MHz Span

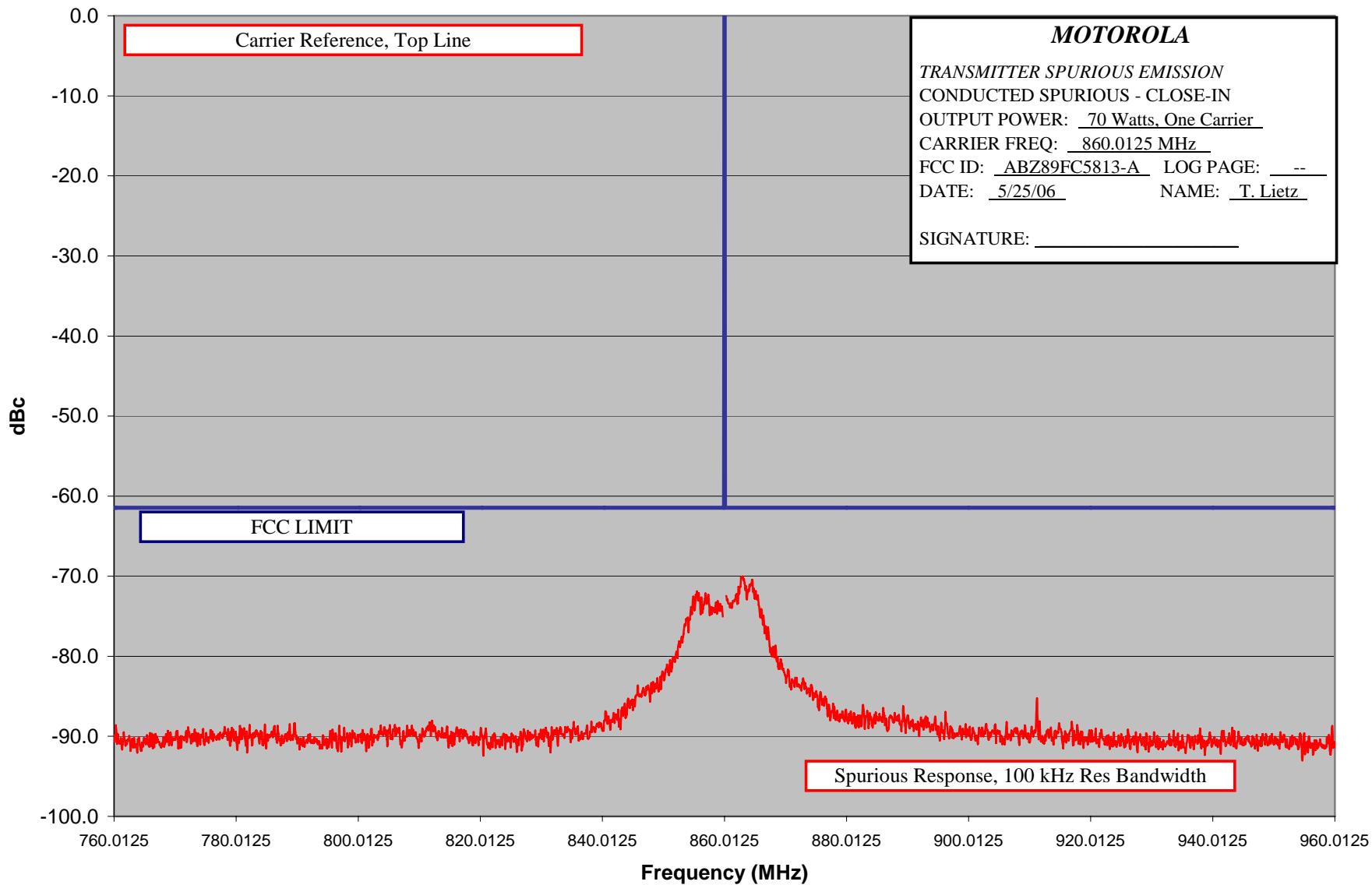


EXHIBIT E1-3.6

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements
Conducted Emission – Close-In – Six Carrier – 42 Watts – 800 MHz – 20 MHz Span

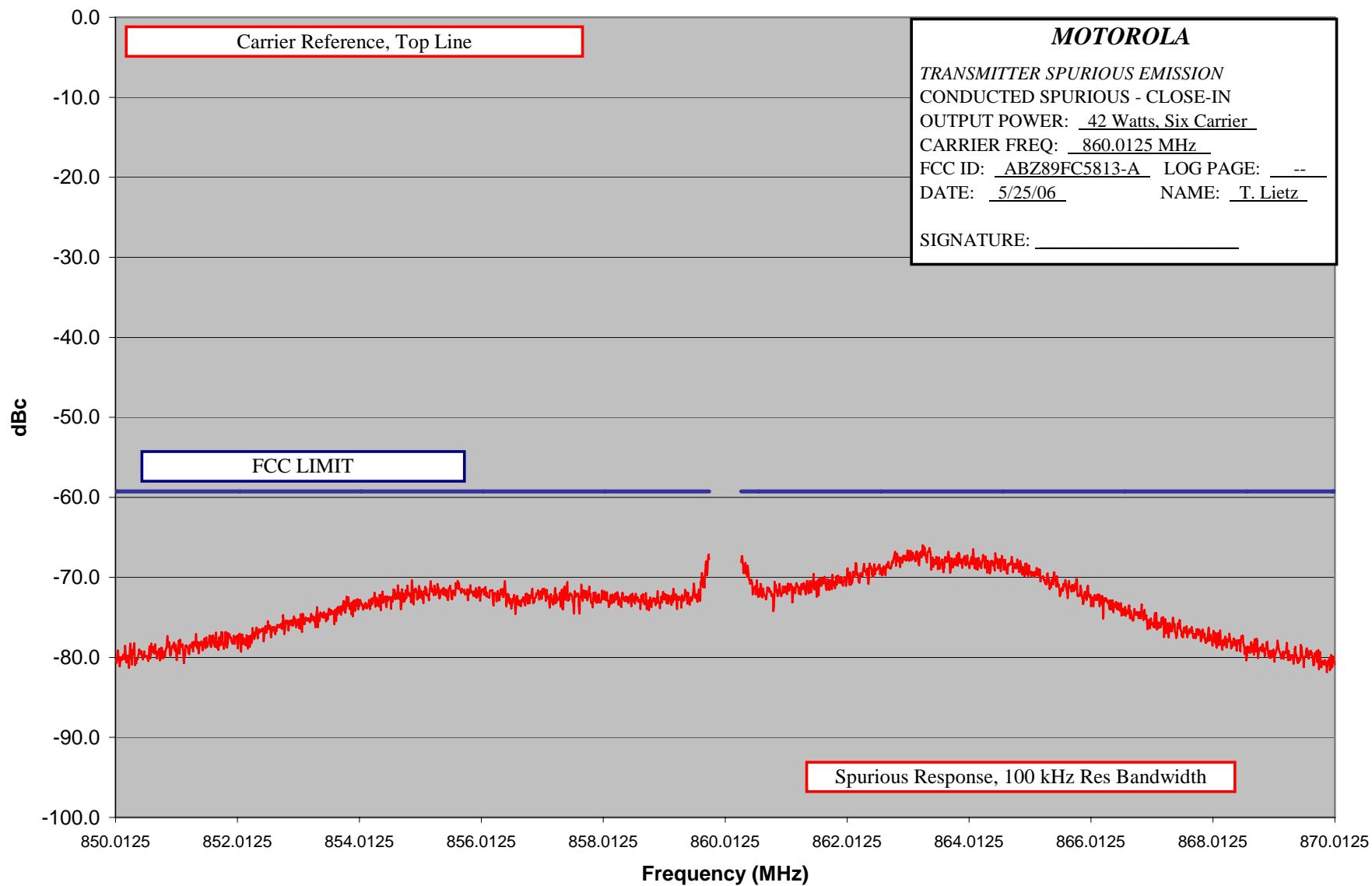


EXHIBIT E1-3.7

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements
Conducted Emission – Close-In – Six Carrier – 42 Watts – 800 MHz – 200 MHz Span

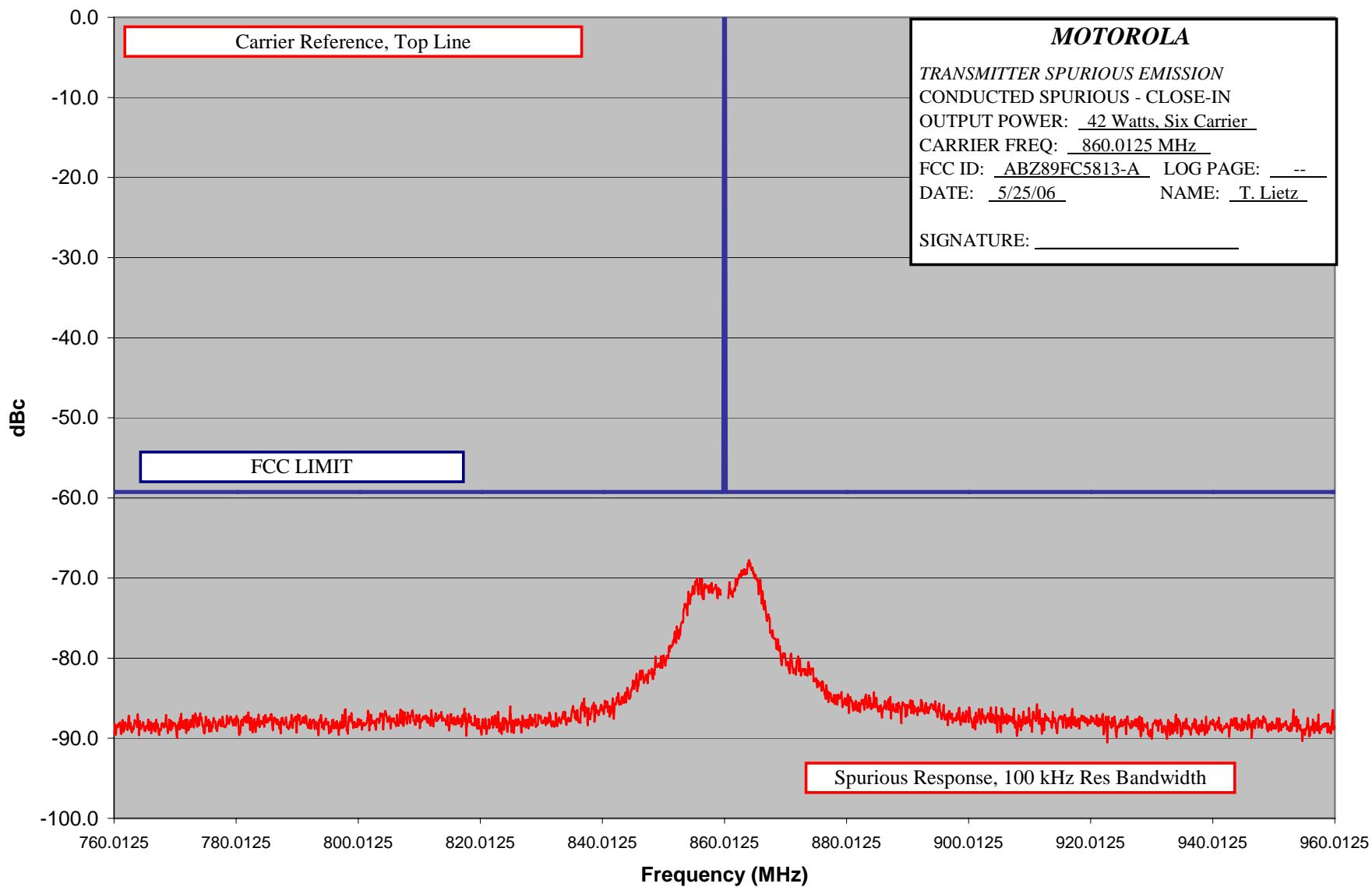


EXHIBIT E1-3.8

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements

Conducted Emission – Harmonics – One Carrier - 52 Watts – 900 MHz

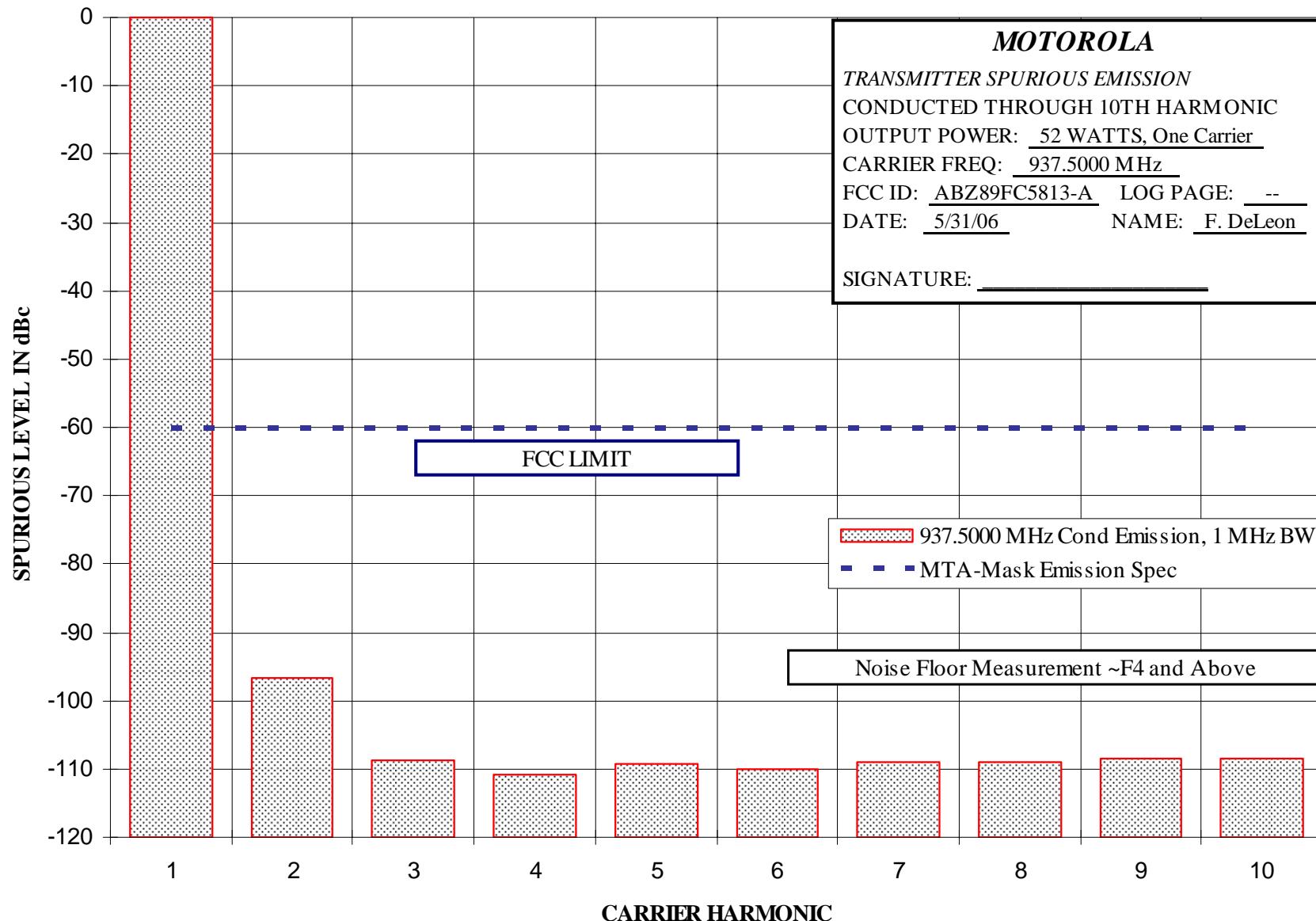
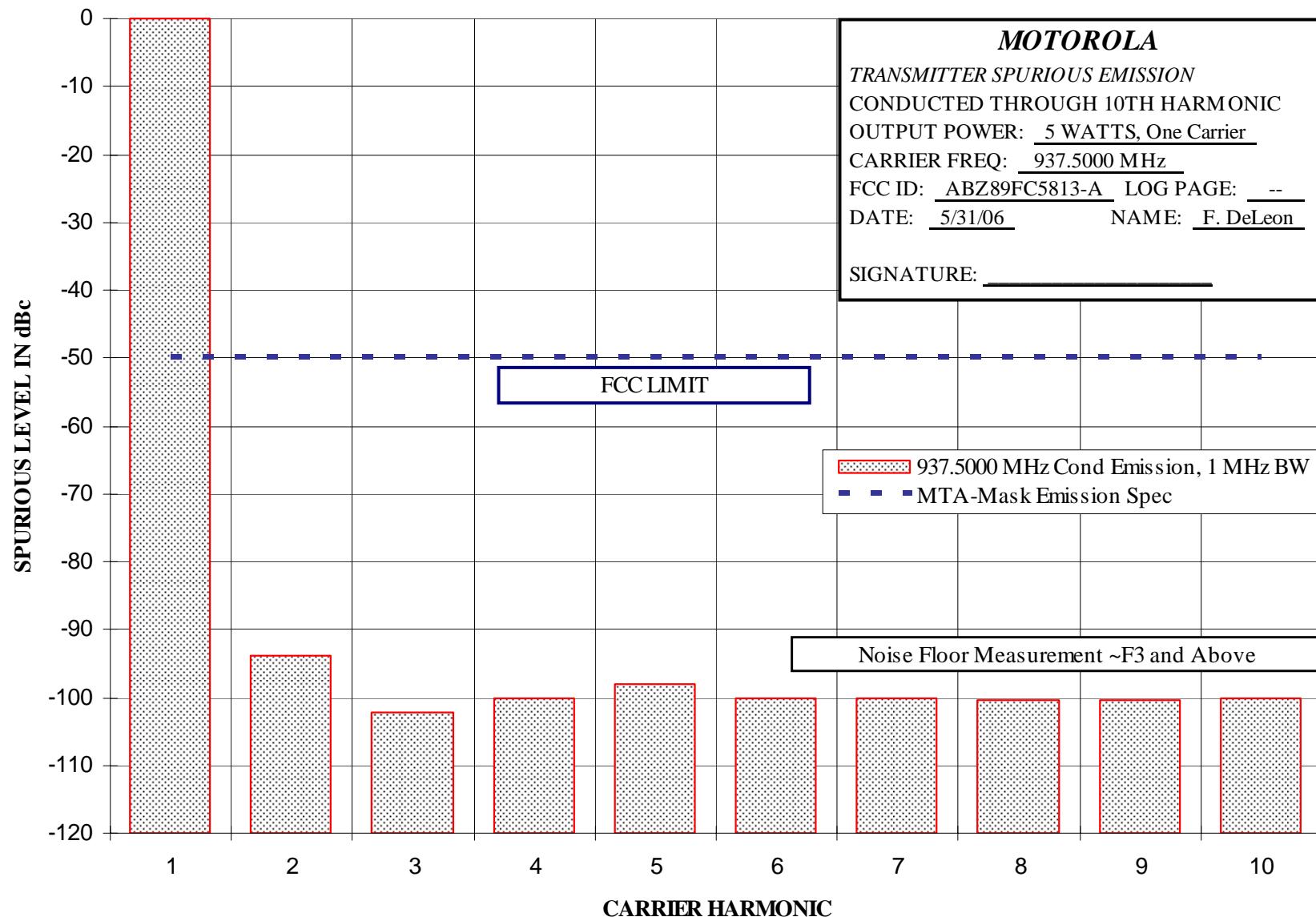
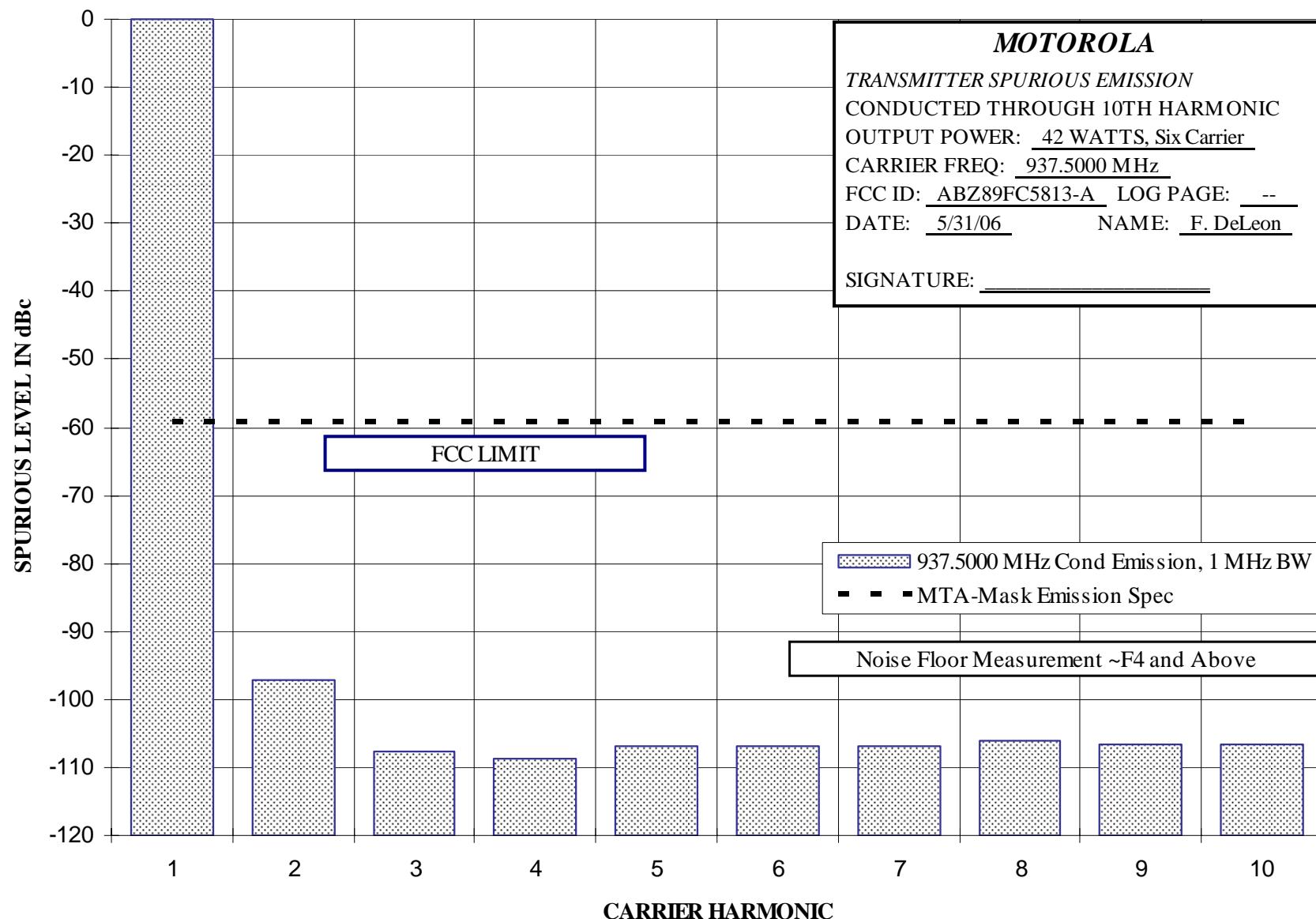
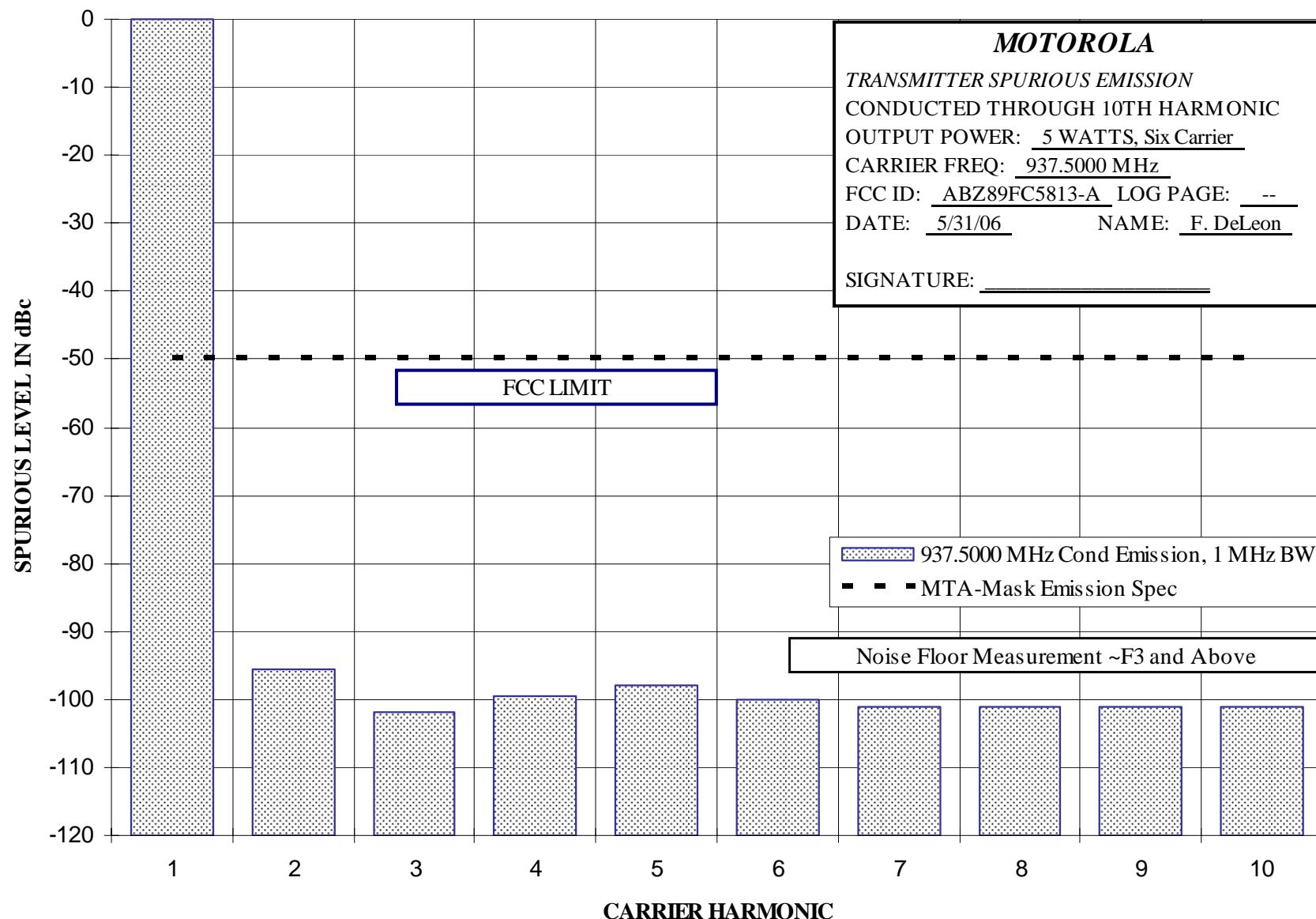


EXHIBIT E1-3.9

Report on Test Measurements
Conducted Emission – Harmonics – One Carrier - 5 Watts – 900 MHz

Report on Test Measurements
Conducted Emission – Harmonics – Six Carrier - 42 Watts – 900 MHz

Report on Test Measurements
Conducted Emission – Harmonics – Six Carrier - 5 Watts – 900 MHz

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements
Conducted Emission – Close-In – One Carrier – 52 Watts – 900 MHz – 20 MHz Span

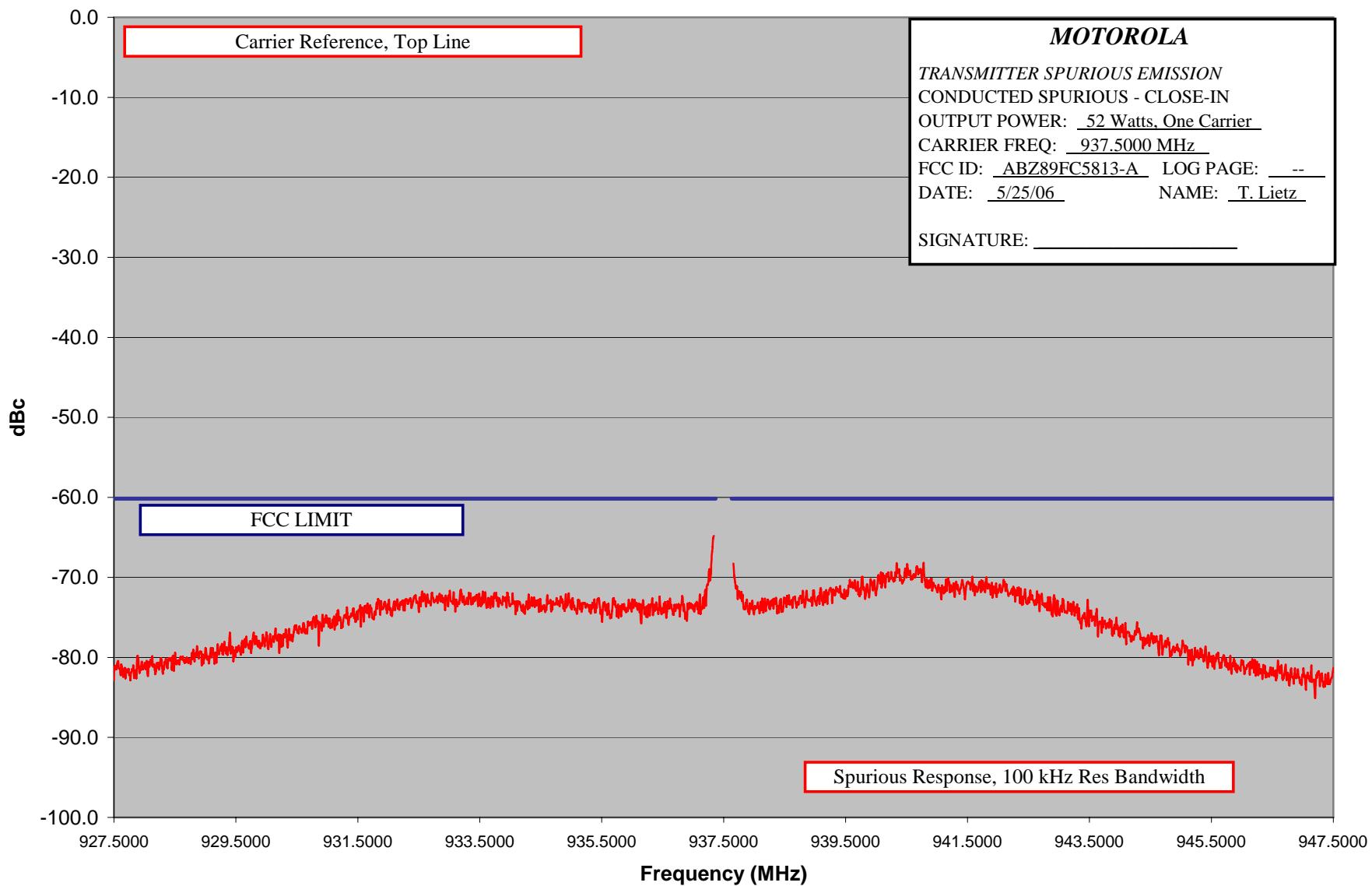


EXHIBIT E1-3.13

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements
Conducted Emission – Close-In – One Carrier – 52 Watts – 900 MHz – 200 MHz Span

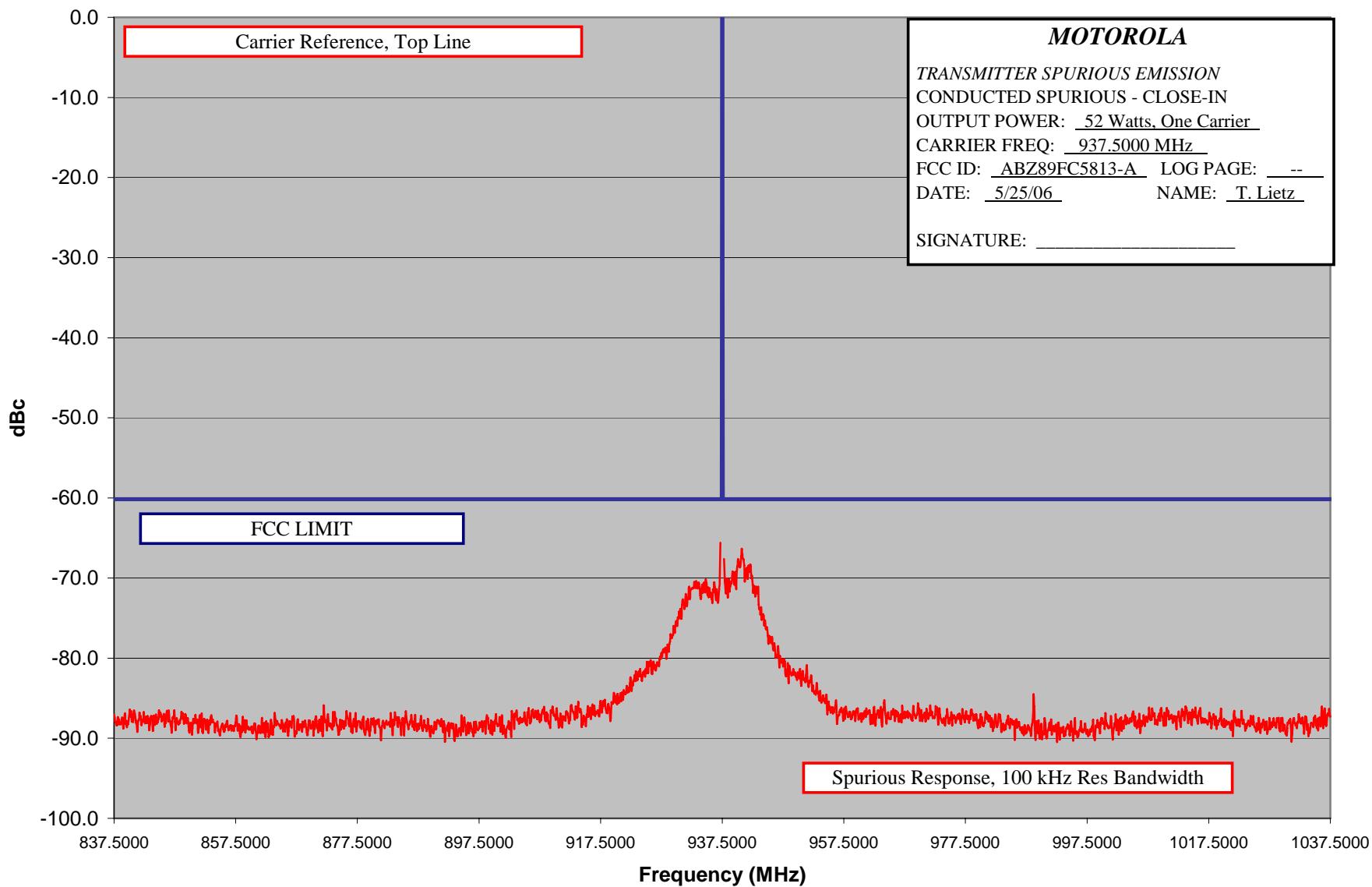


EXHIBIT E1-3.14

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements
Conducted Emission – Close-In – Six Carrier – 42 Watts – 900 MHz – 20 MHz Span

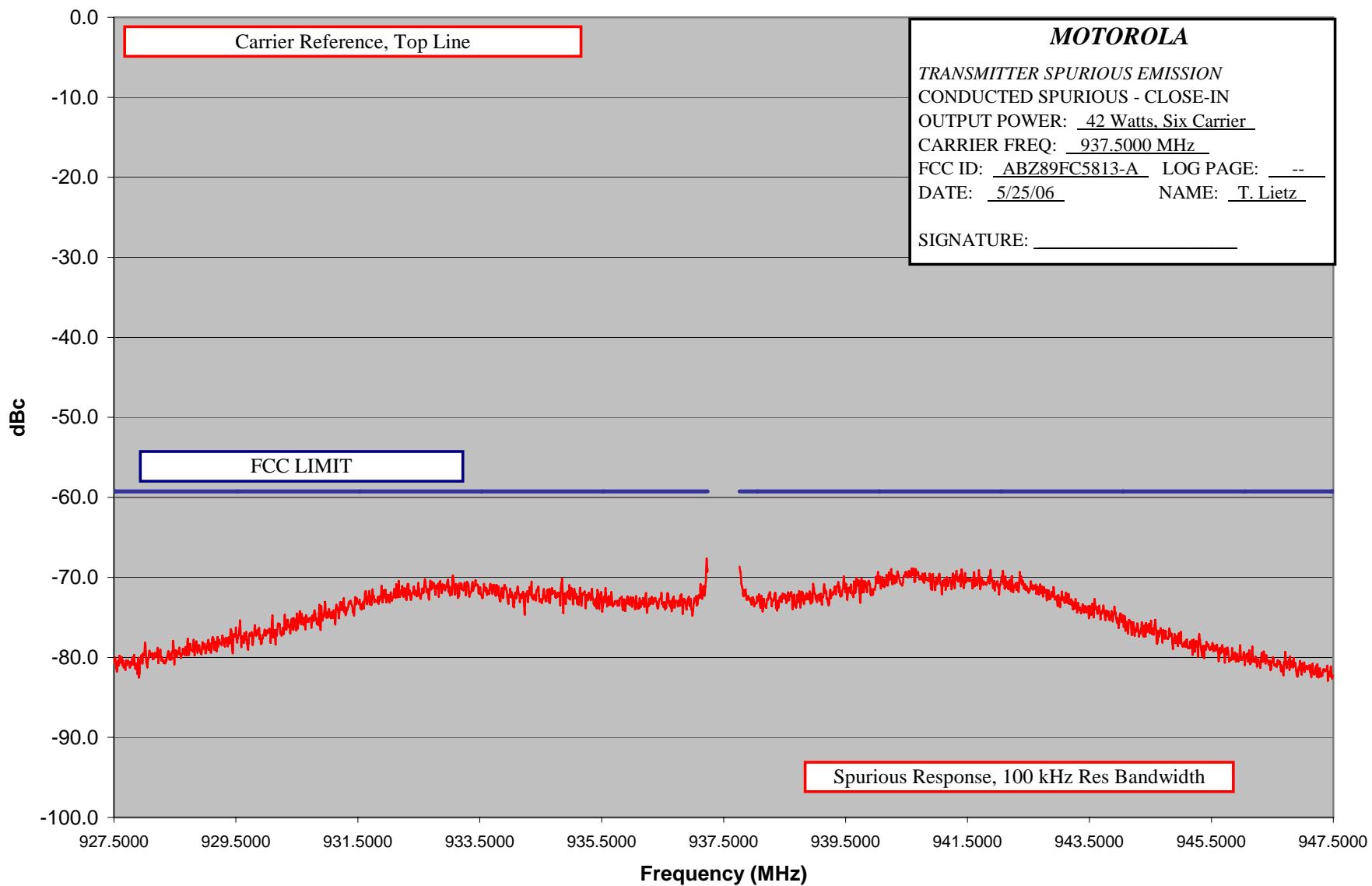


EXHIBIT E1-3.15

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements
Conducted Emission – Close-In – Six Carrier – 42 Watts – 900 MHz – 200 MHz Span

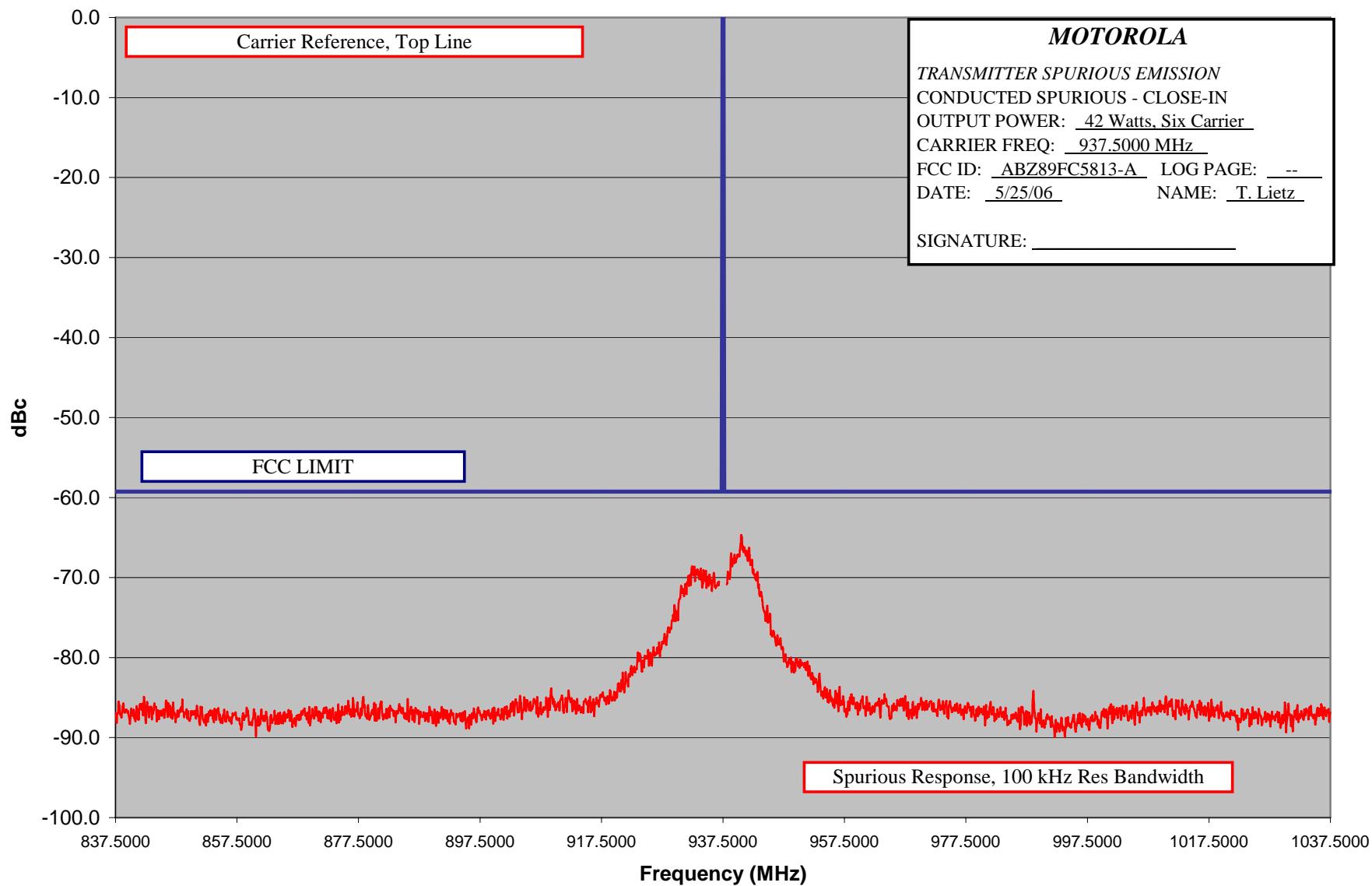


EXHIBIT E1-3.16

Report on Test Measurements*Radiated Spurious Emissions, Harmonics***§ 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:

(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 log₁₀(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.

Modulation: Quad-QAM, 64 kbps Random Data per Channel

Carrier Frequency: A carrier frequency of 860.0125 MHz was measured. This frequency is near the center of the operating band 851-870 MHz

EXHIBIT DESCRIPTION

E1-4.1	800 MHz – One Carrier Radiated Spurious Emissions, Harmonics, Power Output at 70 Watts The specification limit is -61.5 dBc
E1-4.2	800 MHz – One Carrier Radiated Spurious Emissions, Harmonics, Power Output at 5 Watts The specification limit is -50.0 dBc
E1-4.3	800 MHz – Six Carrier Radiated Spurious Emissions, Harmonics, Power Output at 42 Watts The specification limit is -59.2 dBc
E1-4.4	800 MHz – Six Carrier Radiated Spurious Emissions, Harmonics, Power Output at 5 Watts The specification limit is -50.0 dBc

§ 90.669 Emission Limits:

(e) On any frequency in an MTA licensee's spectrum block that is adjacent to a non-MTA frequency, the power of any emission shall be attenuated below the transmitter power (P) by at least *43 plus 10 log₁₀(P) dB or 80 dB, whichever is the lesser attenuation*.

Part 24.133 Emission Limits

On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 40 kHz, the power of any emission shall be attenuated below the transmitter power (P), in Watts, by at least *43 plus 10 Log10 (P) decibels, or 80 decibels (whichever is the lesser attenuation)*.

Modulation: Quad-QAM, 64 kbps Random Data Per Channel

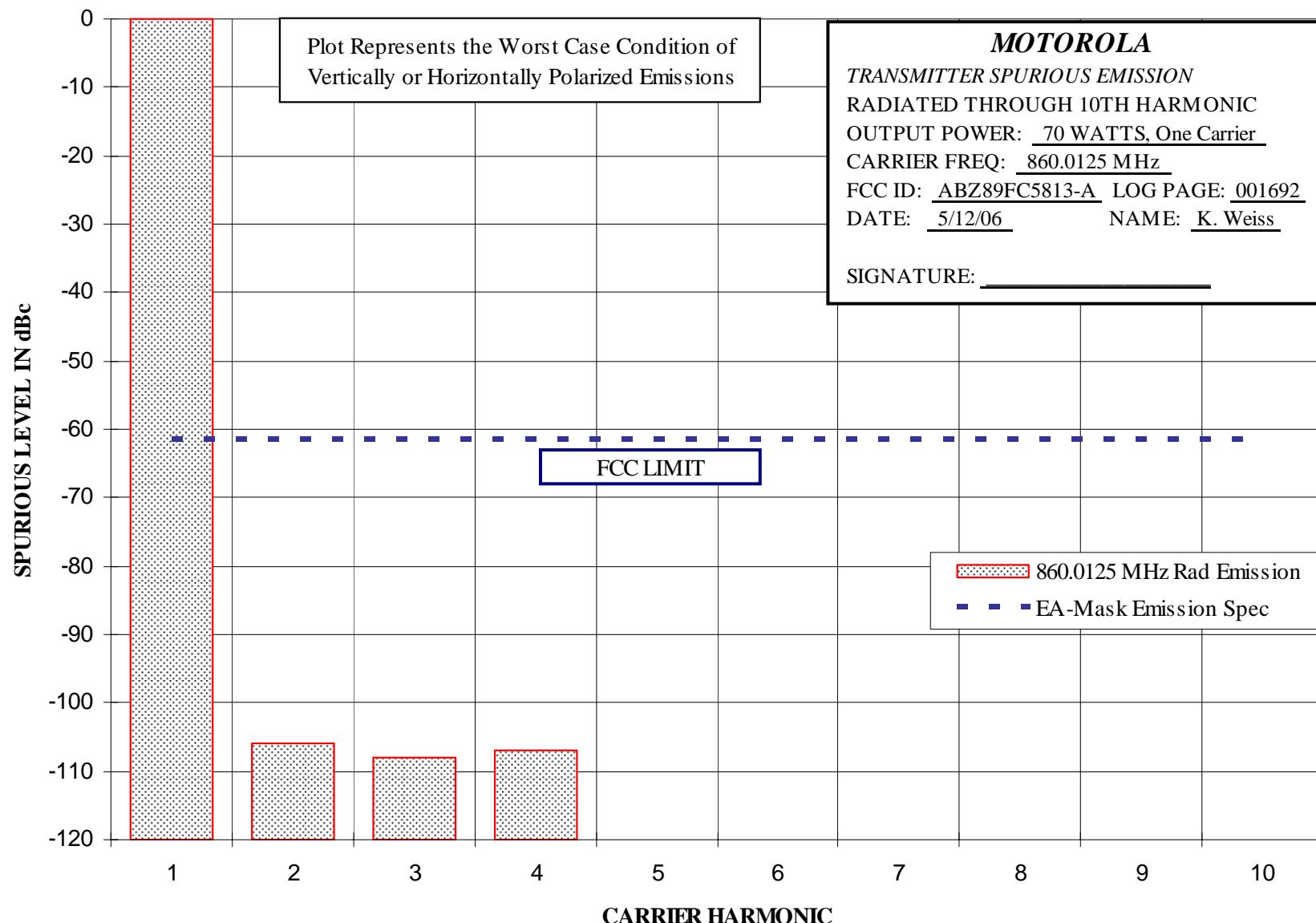
Carrier Frequency: A carrier frequency of 937.5000 MHz was measured. This frequency is near the center of the operating band 935-941 MHz

EXHIBIT DESCRIPTION

E1-4.5	900 MHz – One Carrier Radiated Spurious Emissions, Harmonics, Power Output at 52 Watts The specification limit is -60.2 dBc
E1-4.6	900 MHz – One Carrier Radiated Spurious Emissions, Harmonics, Power Output at 5 Watts The specification limit is -50.0 dBc
E1-4.7	900 MHz – Six Carrier Radiated Spurious Emissions, Harmonics, Power Output at 42 Watts The specification limit is -59.2 dBc
E1-4.8	900 MHz – Six Carrier Radiated Spurious Emissions, Harmonics, Power Output at 5 Watts The specification limit is -50.0 dBc

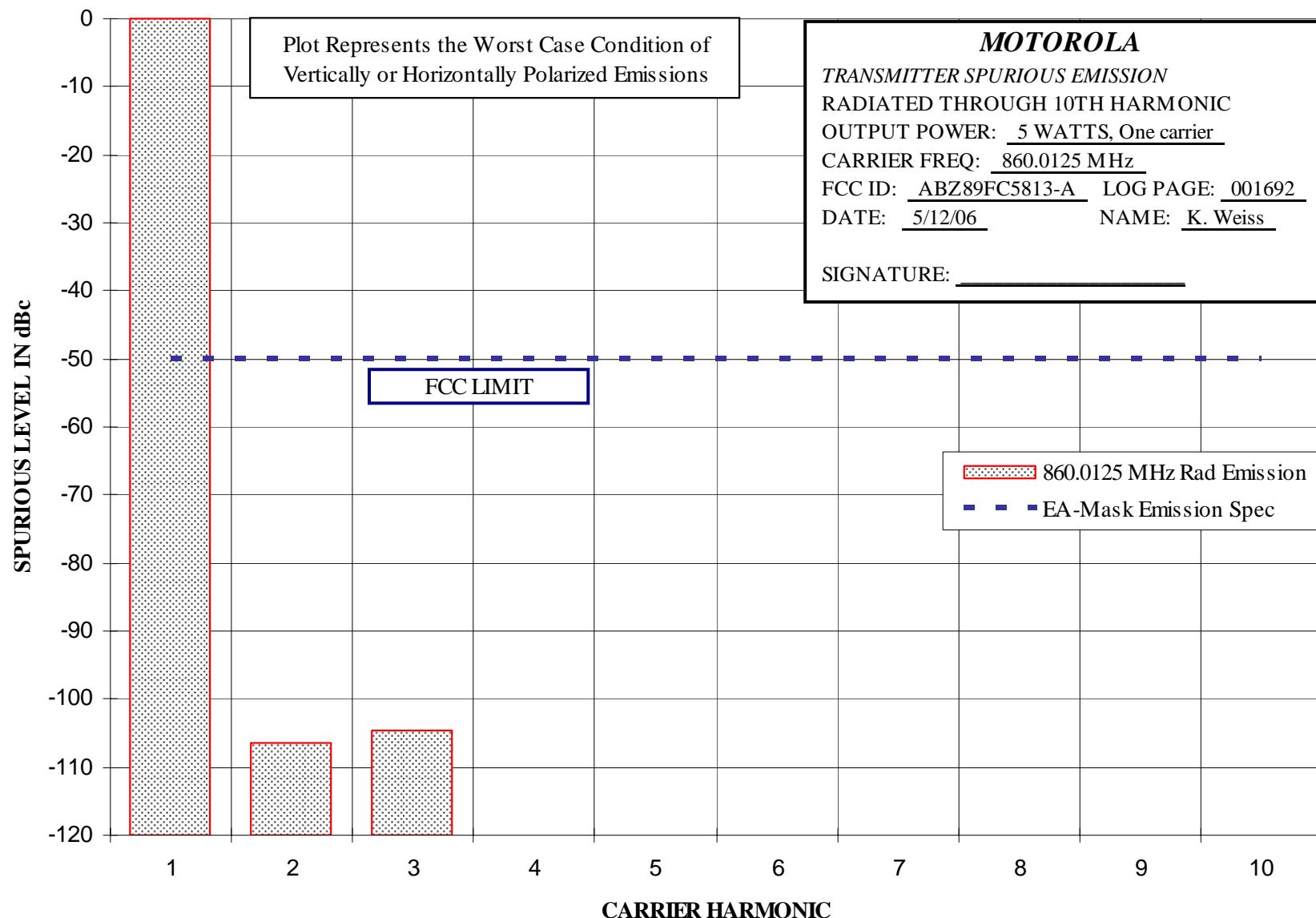
Report on Test Measurements

Radiated Emission – Harmonics – One Carrier - 70 Watts – 800 MHz



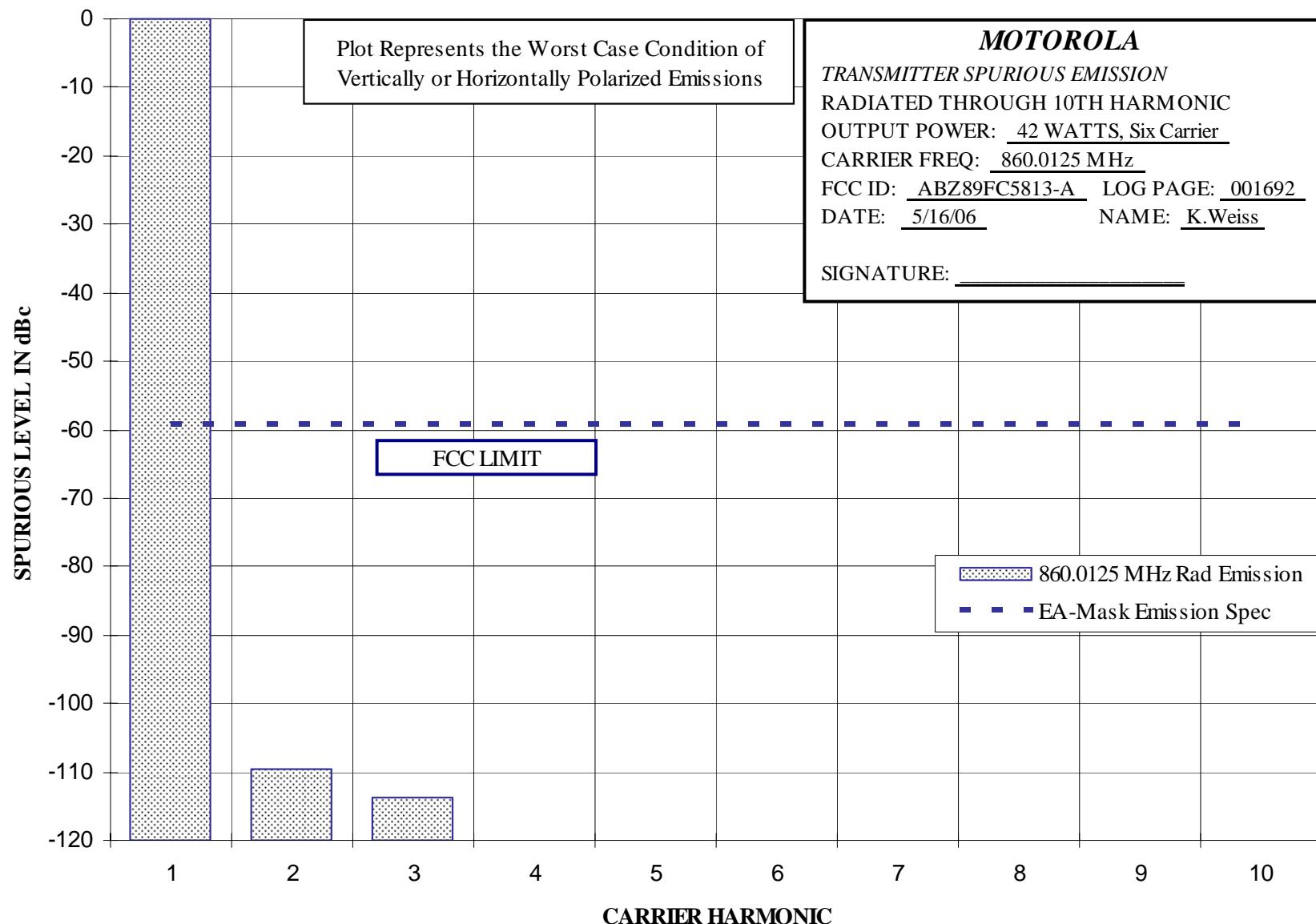
Report on Test Measurements

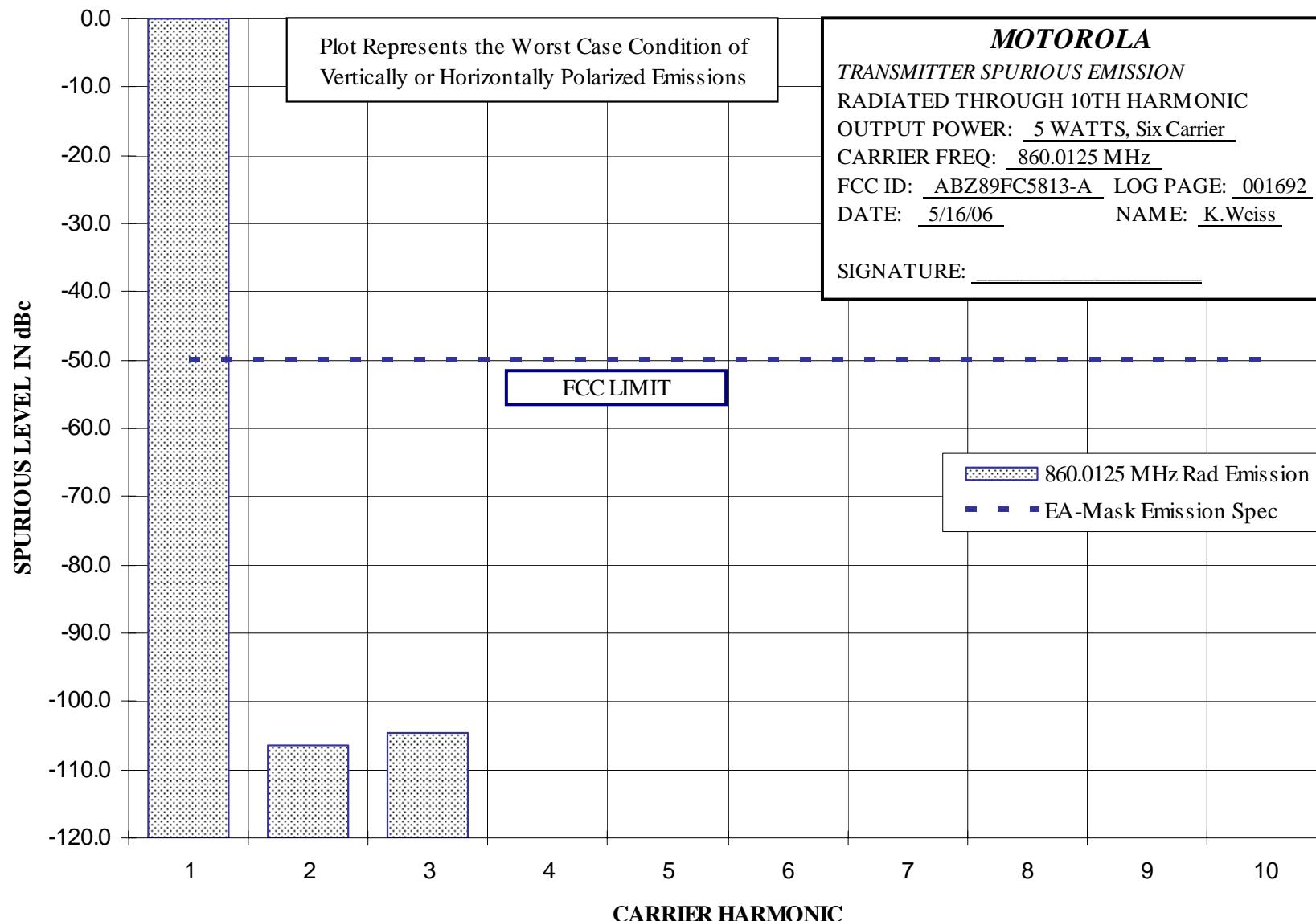
Radiated Emission – Harmonics – One Carrier - 5 Watts – 800 MHz



Report on Test Measurements

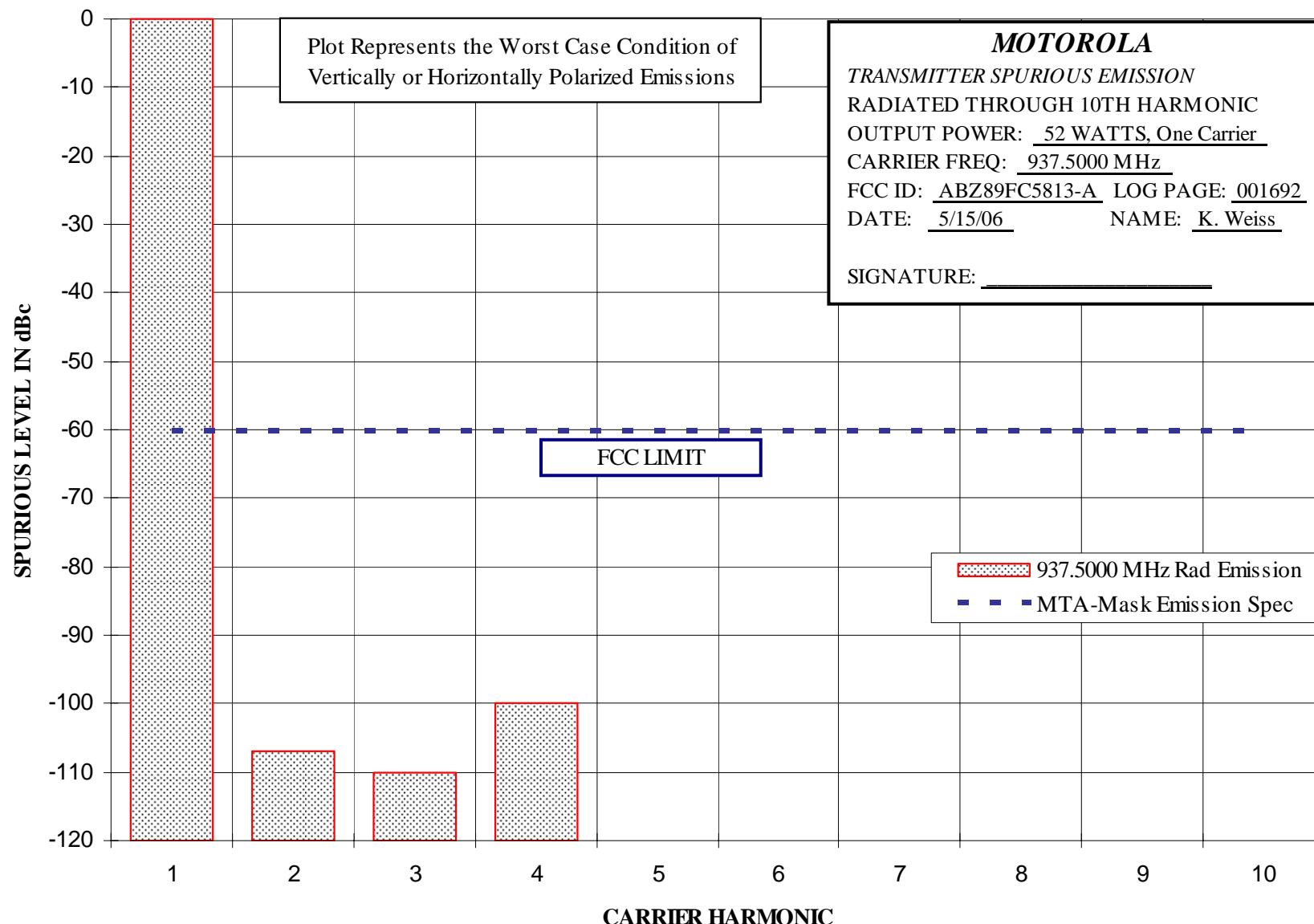
Radiated Emission – Harmonics – Six Carrier - 42 Watts – 800 MHz



Report on Test Measurements
Radiated Emission – Harmonics – Six Carrier - 5 Watts – 800 MHz

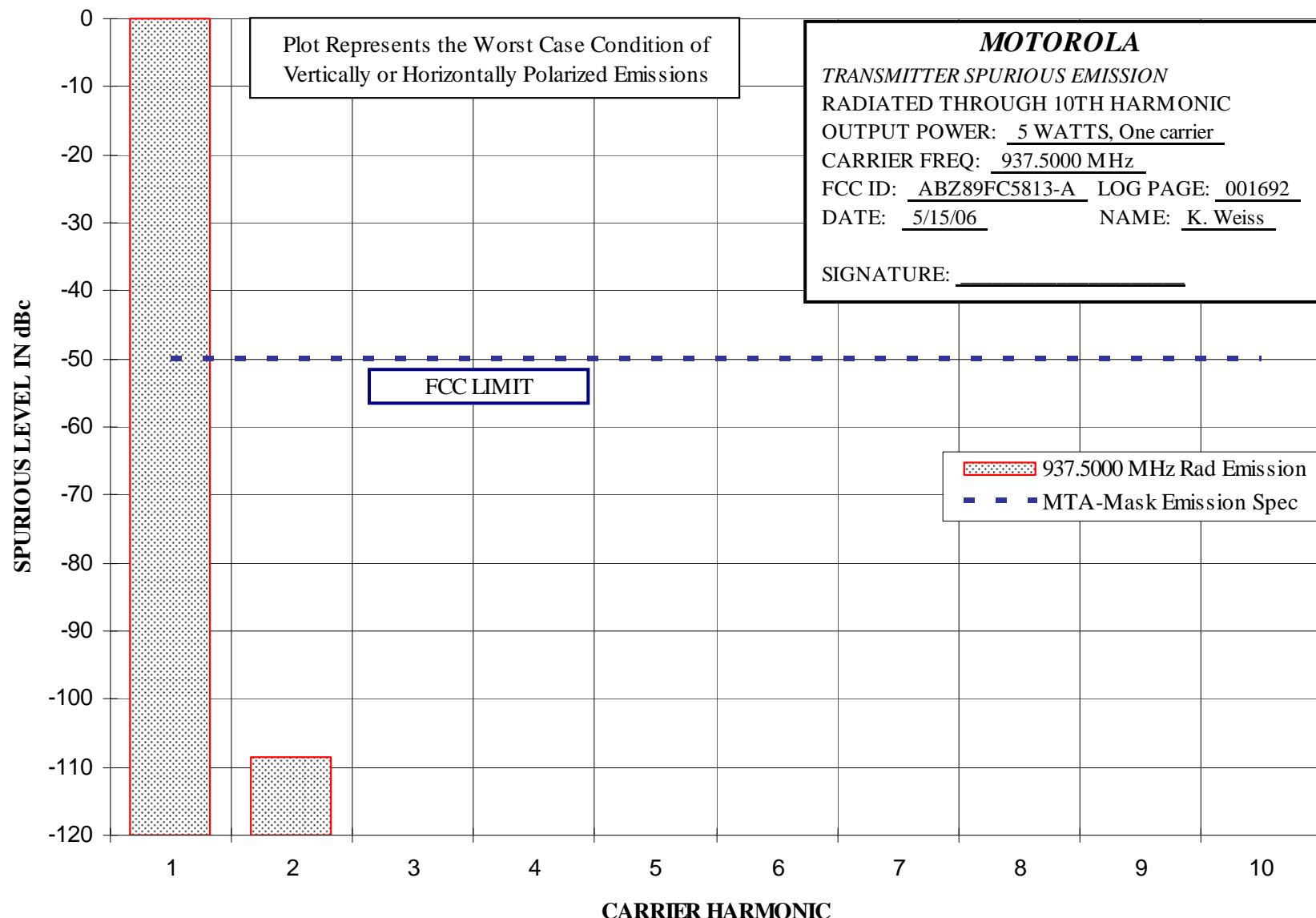
Report on Test Measurements

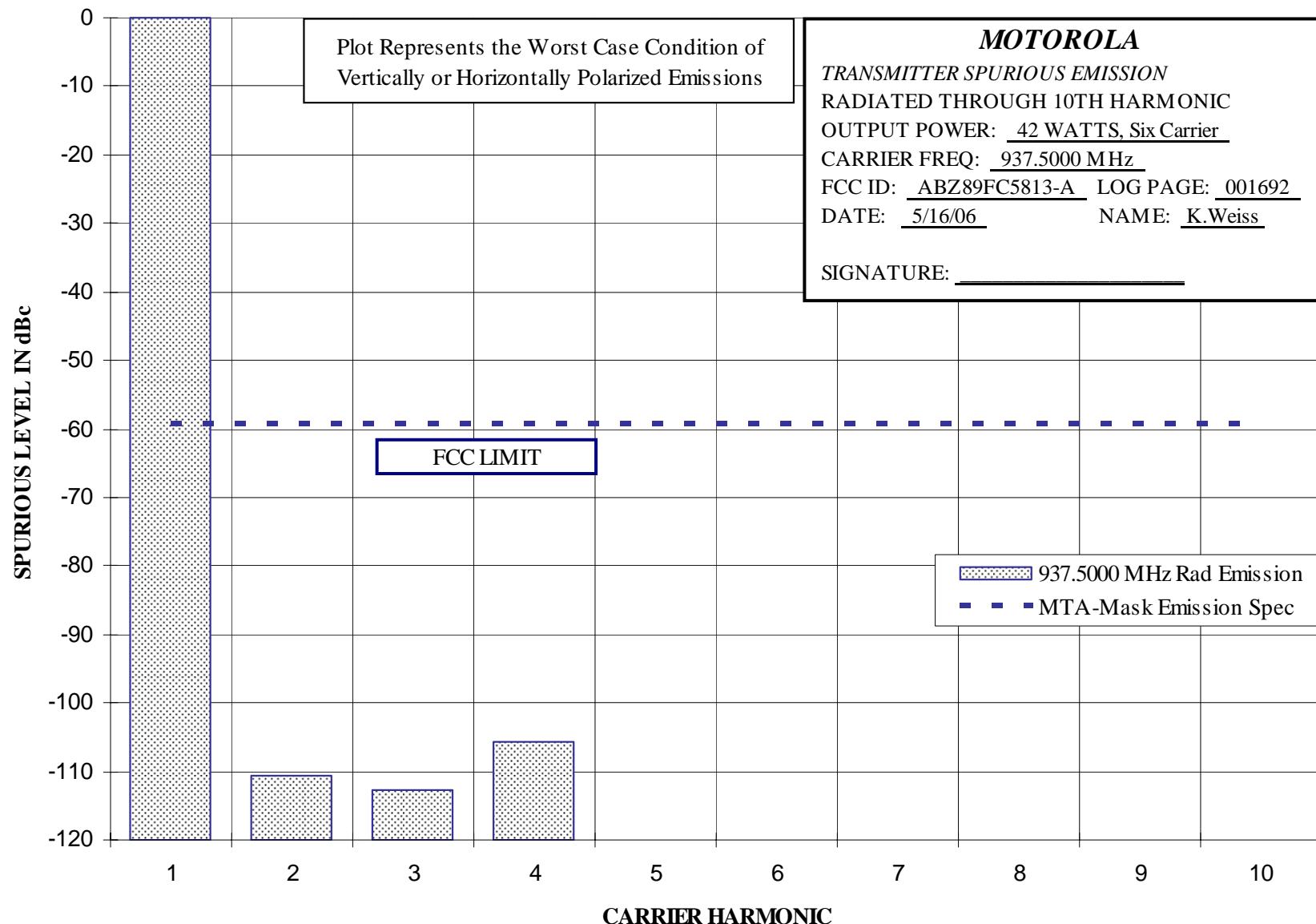
Radiated Emission – Harmonics – One Carrier - 52 Watts – 900 MHz



Report on Test Measurements

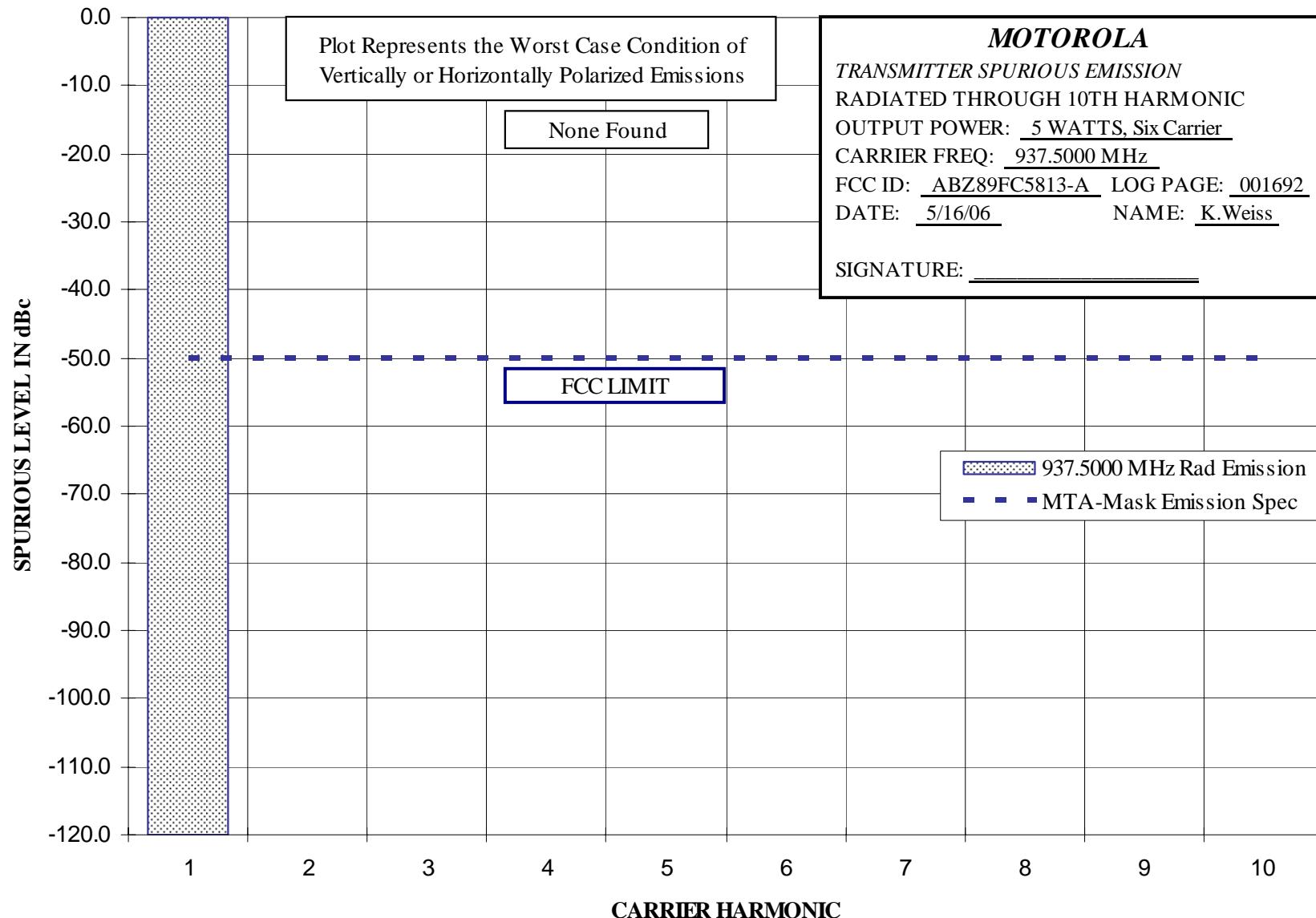
Radiated Emission – Harmonics – One Carrier - 5 Watts – 900 MHz



Report on Test Measurements
Radiated Emission – Harmonics – Six Carrier - 42 Watts – 900 MHz

Report on Test Measurements

Radiated Emission – Harmonics – Six Carrier - 5 Watts – 900 MHz



Report on Test Measurements***Oscillator Frequency Stability***

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

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.

Fixed and Base stations, operating at 935-940 MHz, must have a frequency stability of better than +/- 0.1 PPM.

Reference: Part 24.135

Fixed and Base stations, operating at 940-941 MHz, must have a frequency stability of better than +/- 1 PPM.

EXHIBIT DESCRIPTION

E1-5.1 Frequency Stability Vs Temperature

E1-5.2 Frequency Stability Vs Voltage

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements

Frequency Stability Vs Temperature

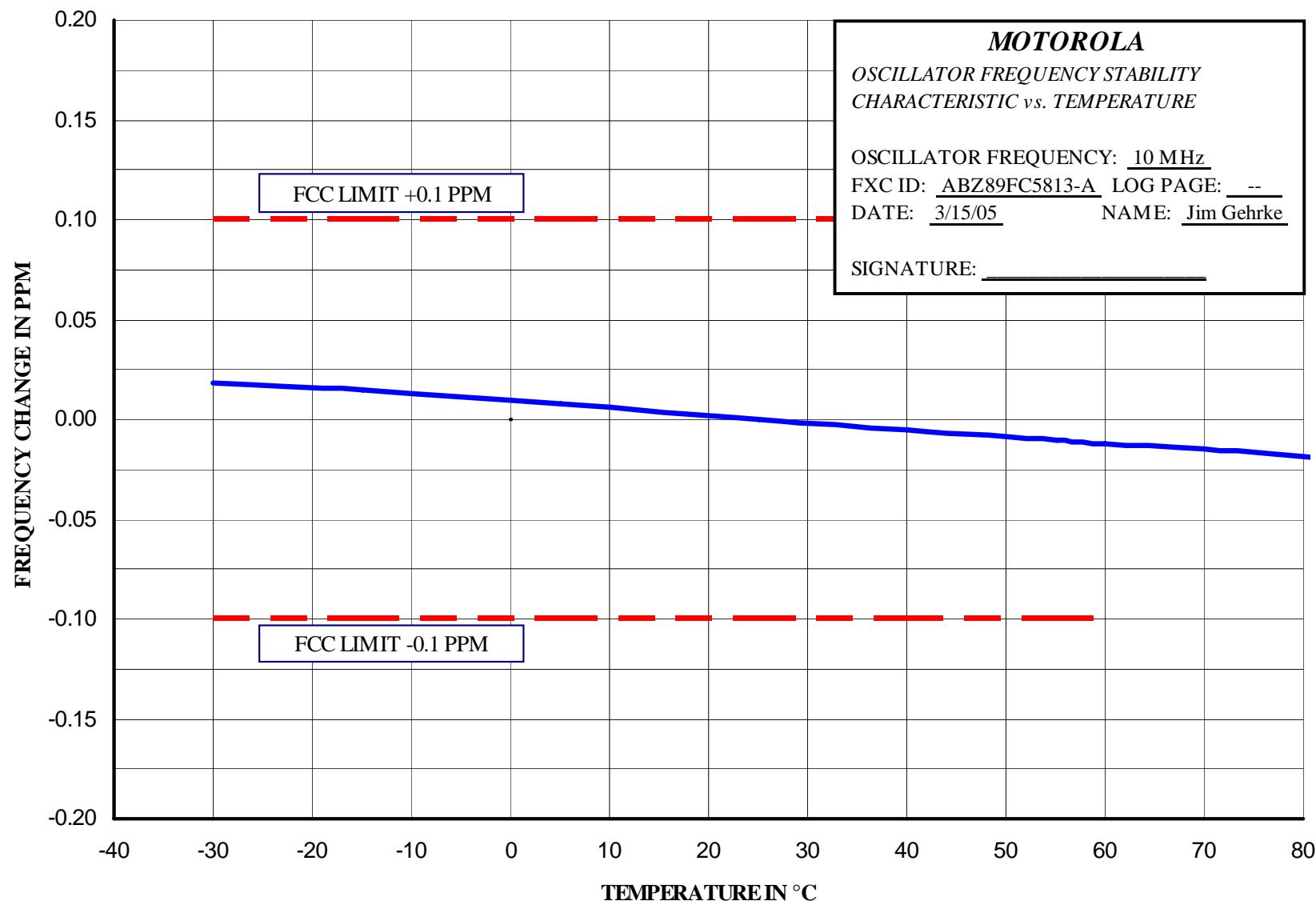
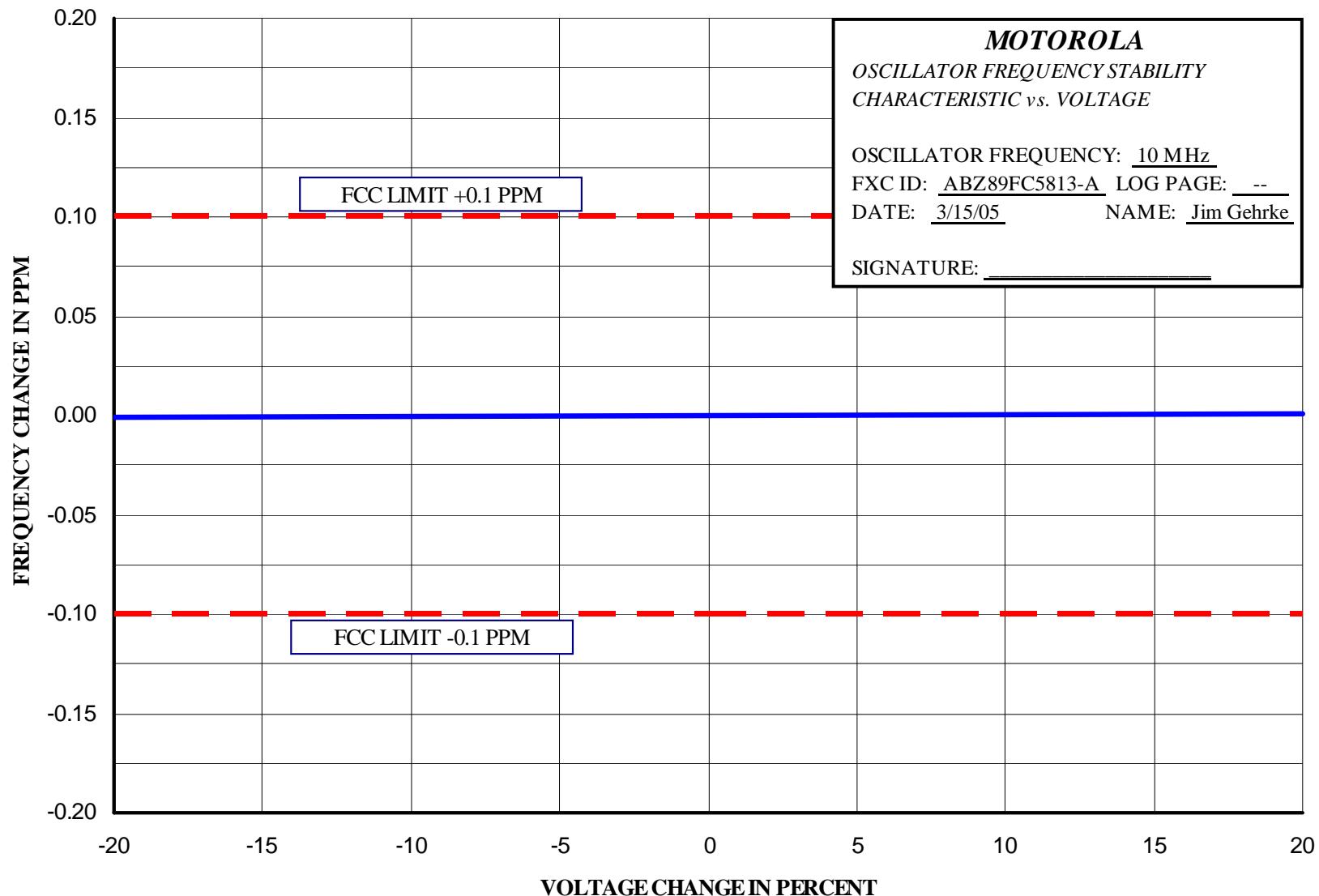


EXHIBIT E1-5.1

Report on Test Measurements

Frequency Stability Vs Voltage



Report on Test Measurements*Human Exposure Compliance Statement***SPECIFICATION REQUIREMENT:****§ 24.52 (RF Hazards)**

Motorola certifies that it has determined that the equipment for which authorization is being sought complies with IEEE C95.1-1991, "IEEE Standards for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz" as measured using methods specified in IEEE C95.3-1991, "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields -- RF and Microwave." This certification is based upon the installations being made in accordance with the instructions supplied with the equipment and in recognition that because of the characteristics of a particular site, a determination of compliance with respect to any particular site can be made only upon an analysis of the installation.

Report on Test Measurements

Human Exposure Manual Section

SPECIFICATION REQUIREMENT:**§ 24.52 (RF Hazards)**

This equipment is designed to generate and radiate radio frequency (RF) energy. It should be installed and maintained only by trained technicians. Licensees of the Federal Communications Commission (FCC) using this equipment are responsible for ensuring that its installation and operation comply with FCC regulations designed to limit human exposure to RF radiation in accordance with the American National Standards Institute IEEE Standard C95.1-1991, *IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*.

This standard establishes two sets of "maximum permitted exposure" limits, one for "controlled" environments and another that allows less exposure, for "uncontrolled" environments. These terms are defined by the standard:

Uncontrolled environment: Uncontrolled environments are locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces where there are no expectations that the exposure levels may exceed those shown [in a table of exposure limits].

Controlled environment: Controlled environments are locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage through areas where analysis shows the exposure levels may be above those shown in [the table of limit exposures for uncontrolled environments] but do not exceed the values in [the table of higher limit values for controlled environments].

The maximum permitted exposures prescribed by the standard are set in terms of different parameters of effects, depending on the frequency generated by the equipment in question. At the frequency range of this Personal Communication System equipment, 940-941 MHz, the maximum permitted exposure levels are set in terms of "power density", whose definition and relationship to electric field and magnetic field strengths are described by the standard as follows:

Power density (S): Power per unit area normal to the direction of propagation, usually expressed in units of watts per square meter (W/m^2) or, for convenience, units such as milliWatts per square centimeter (mW/cm^2). For plane waves, power density, electric field strength (E) and magnetic field strength (H) are related by the impedance of free space, i.e., 377 ohms. In particular,

Report on Test Measurements*Human Exposure Manual Section*

$$S = \frac{E^2}{377} = 377 \text{ } H^2$$

where E and H are expressed in units of V/m and A/m, respectively, and S in units of W/m².

Although many survey instruments indicate power density units, the actual quantities measured are E or E² or H or H².

Within this frequency range, the maximum permitted exposure limit for uncontrolled environments is a power density (mW/cm²) that equals f/1500, where "f" is the frequency expressed in MHz, and measurements are averaged over a period of 30 minutes. The maximum permitted exposure limit for controlled environments, also expressed in mW/cm², is f/300 where measurements are averaged over 6 minutes. Applying these principles to the minimum and maximum frequencies for which this equipment is intended to be used yields the following maximum permitted exposure levels:

	Uncontrolled Environment	Controlled Environment
	941 MHz	941 MHz
Limit	0.627 mW/cm ²	3.14 mW/cm ²

If it is intended that the equipment will operate at more than one frequency, compliance should be assured at the frequency which produces the lowest exposure limit (among the frequencies at which operation will occur).

Licensees must be able to certify to the FCC that their facilities meet the limits shown above. Some lower power PCS devices, 100 milliWatts or less, are excluded from demonstrating compliance, but this equipment operates at power levels orders of magnitude higher, and the exclusion is not applicable.

Whether a given installation meets the maximum permitted exposure limits depends, in part, upon antenna type, antenna placement and the output power to which this equipment is adjusted. The following example sets forth the distances from the antenna to which access should be prevented in order to comply with the "uncontrolled" and "controlled" environment exposure limits as set forth in the ANSI IEEE standards and computed above.

Report on Test Measurements

Human Exposure Manual Section

Example Calculations for iDEN 900 MHz Quad+2 Transmitter:

Calculating the minimum distance from the antenna necessary to meet the requirements of an uncontrolled environment, we assume the following:

Transmit frequency = 941 MHz

Base station cabinet output power, $P = +47.16 \text{ dBm}$ (52 Watts)

Antenna feeder cable loss, $CL = 1.0 \text{ dB}$

Antenna input power $Pin = P - CL = +47.16 - 1.0 = +46.16 \text{ dBm}$ (41.3 Watts)

Antenna gain, $G = 14.9 \text{ dBd}$, 17 dBi, sector antenna

Antenna height, $h = 2.44 \text{ m}$

Using the following relationship (cylindrical model used for near field calculation)¹:

$$S = \frac{P_{net}}{2\pi Rh} \quad \text{Omni-directional antenna}$$

Or

$$S = \left(\frac{180}{\theta_{BW}} \right) \frac{P_{net}}{\pi Rh} \quad \text{Sectorized antenna}$$

where S is the maximum permissible power density in W/m^2 and R is the safe distance from the sectorized antenna in meters, the minimum distance is calculated as follows:

$$R = \left(\frac{180}{\theta_{BW}} \right) \frac{P_{net}}{\pi h S} = \left(\frac{180}{105} \right) \frac{41.3}{\pi \times 2.44 \times 6.27} = 1.5 \text{ Meters (uncontrolled environment)}$$

$$R = \left(\frac{180}{\theta_{BW}} \right) \frac{P_{net}}{\pi h S} = \left(\frac{180}{105} \right) \frac{41.3}{\pi \times 2.44 \times 31.4} = 0.3 \text{ Meters (controlled environment)}$$

where $S = 6.27 \text{ W/m}^2$ and $S = 31.4 \text{ W/m}^2$ are obtained from table listed above by converting from mW/cm^2 to W/m^2 .

Note: The above result applies only in the direction of maximum radiation of the antenna. Actual installations may employ antennas that have defined radiation patterns and gains that differ from the example set forth above. The distances calculated can vary depending on the actual antenna pattern and gain.

¹ Federal Communications Commission Office of Engineering & Technology, OET Bulletin 65, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 97-01, page 32.

Report on Test Measurements*Human Exposure Manual Section*

While installation calculations such as the above are useful and essential in planning and design, validation that the operating facility using this equipment actually complies will require making power density measurements. For information on measuring RF fields for determining compliance with ANSI IEEE C95.1-1991, see *IEEE Recommended Practice for the Measure of Potentially Hazardous Electromagnetic Fields - RF and Microwave*, IEEE Std C95.3-1991. Copies of IEEE C95.1-1991 and IEEE C95.3-1991 may be purchased from The Institute of Electrical and Electronics Engineers, Inc., Attn: Publication Sales, 445 Hoes Lane, P.O Box 1331, Piscataway, NJ 08855-1331, (800) 678-IEEE or from ANSI, (212) 642-4900. Persons responsible for installation of this equipment are urged to consult these standards in determining whether a given installation complies with the applicable limits.

Whether a given installation meets ANSI standards for human exposure to radio frequency radiation may depend not only on this equipment but also on whether the "environments" being assessed are being affected by radio frequency fields from other equipment, the effects of which may add to the level of exposure. Accordingly, the overall exposure may be affected by radio frequency generating facilities that exist at the time the licensee's equipment is being installed or even by equipment installed later. Therefore, the effects of any such facilities must be considered in site selection and in determining whether a particular installation meets the FCC requirements.

Report on Test Measurements

Test Equipment List

MODEL	MANUFACTURER	DESCRIPTION	Serial No.	Last Cal	Next Cal
438A	Hewlett Packard	RF Power Meter	3008A07428	11/05/04	11/05/07
8481A	Hewlett Packard	RF Power Sensor	2702A76706	11/17/04	11/17/07
E4443A	Agilent	Spectrum Analyzer	MY43360090	12/27/03	12/27/06
E4443A	Agilent	Spectrum Analyzer	MY43360090	12/05/06	12/05/07
ESG-D2000A	Agilent	RF Signal Generator	US307040105	06/04/03	06/04/06
83712A	Hewlett Packard	Signal Generator	3429A00455	no calibration required	
8671B	Hewlett Packard	Signal Generator	2611A00159	11/08/04	11/08/07
85460A	Hewlett Packard	EMI Analyzer, Filter	3704A00467	11/17/03	11/17/06
85460A	Hewlett Packard	EMI Analyzer, Filter	3704A00467	11/03/06	11/03/09
85462A	Hewlett Packard	EMI Analyzer, RF/Display	3906A00500	11/17/03	11/17/06
85462A	Hewlett Packard	EMI Analyzer, RF/Display	3906A00500	11/03/06	11/03/09
8593E	Hewlett Packard	EMI Analyzer	3513A01649	05/19/04	05/19/07
(Various)	Weinschel, Kathrein, Bird	RF Loads	Various	no calibration required	
3020A, etc.	Narda	Directional Coupler	Various	no calibration required	

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5813-A

Report on Test Measurements

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

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

NAME: Ken Weiss

SIGNATURE: 

DATE: June 5, 2007

POSITION: Senior Staff 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: Ali Sajanlal

SIGNATURE: 

DATE: June 5, 2007

POSITION: Engineering Section Manager