

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

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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 Operation:

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>453</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>226</u>	Watts
Primary Supply Voltage	<u>48</u>	Volts DC

900 MHz Operation:

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>393</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 – 25 kHz Channel Spacing – 800 MHz Operation*

There is a single exhibit shown for 800 MHz operation. This mode can be used in a system configuration based upon channel usage as described in Exhibit B. The chart references the following setup and specification requirements.

Modulation Type: Quad-QAM, 64 kbps Random Data
 Emission Designator: 17K7D7W
 Channelization: 25 kHz
 Power Setting: 70 Watts (Average)

Specification Requirement § 90.210(g) Emission Limits: (Biennial Regulatory Review Report and Order, Adopted July 22, 2005, FCC 05-144, http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-05-144A1.doc):

Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth:

$$\text{At least } 116 \log (fd/6.1) \text{ dB, or } 50 + 10 \log (P) \text{ dB, or } 70 \text{ dB}$$

(whichever is the lesser attenuation);
- (2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth:

$$\text{At least } 43 + 10 \log (P) \text{ dB.}$$

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 is based upon a 99% power measurement of the transmitter spectrum, per 2.202 (a).

Measurement Procedure and Instrument Settings:Emission Measurement Analyzer Settings:

Horizontal:	12.5 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	10 kHz
Sweep Time:	72 Seconds (<2000 Hz / Second)	Span:	125 kHz
Detector Mode:	Peak		

Test Procedure:

- 1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
- 2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full 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) Use the band power marker function of the spectrum analyzer to measure the power of the carrier in a 25 kHz bandwidth.
- 4) Use the carrier power value from the previous step to generate the emission mask limit.
- 5) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.

EXHIBIT	DESCRIPTION	Power (Watts, Avg)	Emission Designator
E1-2.1	800 MHz Occupied Bandwidth	70 Watts	17K7D7W

Report on Test Measurements*Occupied Bandwidth – 25 kHz Channel Spacing – 900 MHz Operation*

There is a single exhibit shown for 900 MHz operation. This mode can be used in a system configuration based upon channel usage as described in Exhibit B. The chart references the following setup and specification requirements.

Modulation Type: Quad-QAM, 64 kbps Random Data
 Emission Designator: 17K7D7W
 Channelization: 25 kHz
 Power Setting: 52 Watts (Average)

§ 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 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.

- (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 is based upon a 99% power measurement of the transmitter spectrum, per 2.202 (a).

Measurement Procedure and Instrument Settings:Emission Measurement Analyzer Settings:

Horizontal:	12.5 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	10 kHz
Sweep Time:	72 Seconds (<2000 Hz / Second)	Span:	125 kHz
Detector Mode:	Peak		

Test Procedure:

- 1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings.
- 2) Modulate the transmitter with the appropriate signaling pattern, (pseudorandom data) and key the transmitter at the full 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) Use the band power marker function of the spectrum analyzer to measure the power of the carrier in a 25 kHz bandwidth.
- 4) Use the carrier power value from the previous step to generate the emission mask limit.
- 6) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.

EXHIBIT	DESCRIPTION	Power (Watts, Avg)	Emission Designator
E1-2.2	900 MHz Occupied Bandwidth	52 Watts	17K7D7W

Report on Test Measurements*Occupied Bandwidth – 50 kHz Channel Spacing – 940 - 941 MHz Part 24 Operation*

There is one exhibit shown for 900 MHz / Part 24 operation. This mode 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
Emission Designator: 17K7D7W
Channelization: 50 kHz channel plan
Power Setting: 52 Watts (Average)

§ 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 $116 \text{ Log}_{10} ((fd+10)/6.1)$ decibels;
or 50 plus $10 \text{ Log}_{10} (P)$ 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 $10 \text{ Log}_{10} (P)$ 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 is based upon a 99% power measurement of the transmitter spectrum, per 2.202 (a).

Report on Test Measurements*Occupied Bandwidth – 50 kHz Channel Spacing – 940 - 941 MHz Part 24 Operation (Continued)*Measurement Procedure and Instrument SettingsReference Calibration Analyzer Settings:

Horizontal:	12.5 kHz per Division	Resolution Bandwidth:	300 kHz
Vertical:	10 dB per Division	Video Bandwidth:	500 kHz
Sweep Time:	72 Seconds (<2000 Hz / Second)	Span:	150 kHz
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:	90 Seconds (<2000 Hz / Second)	Span:	150 kHz
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. 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.

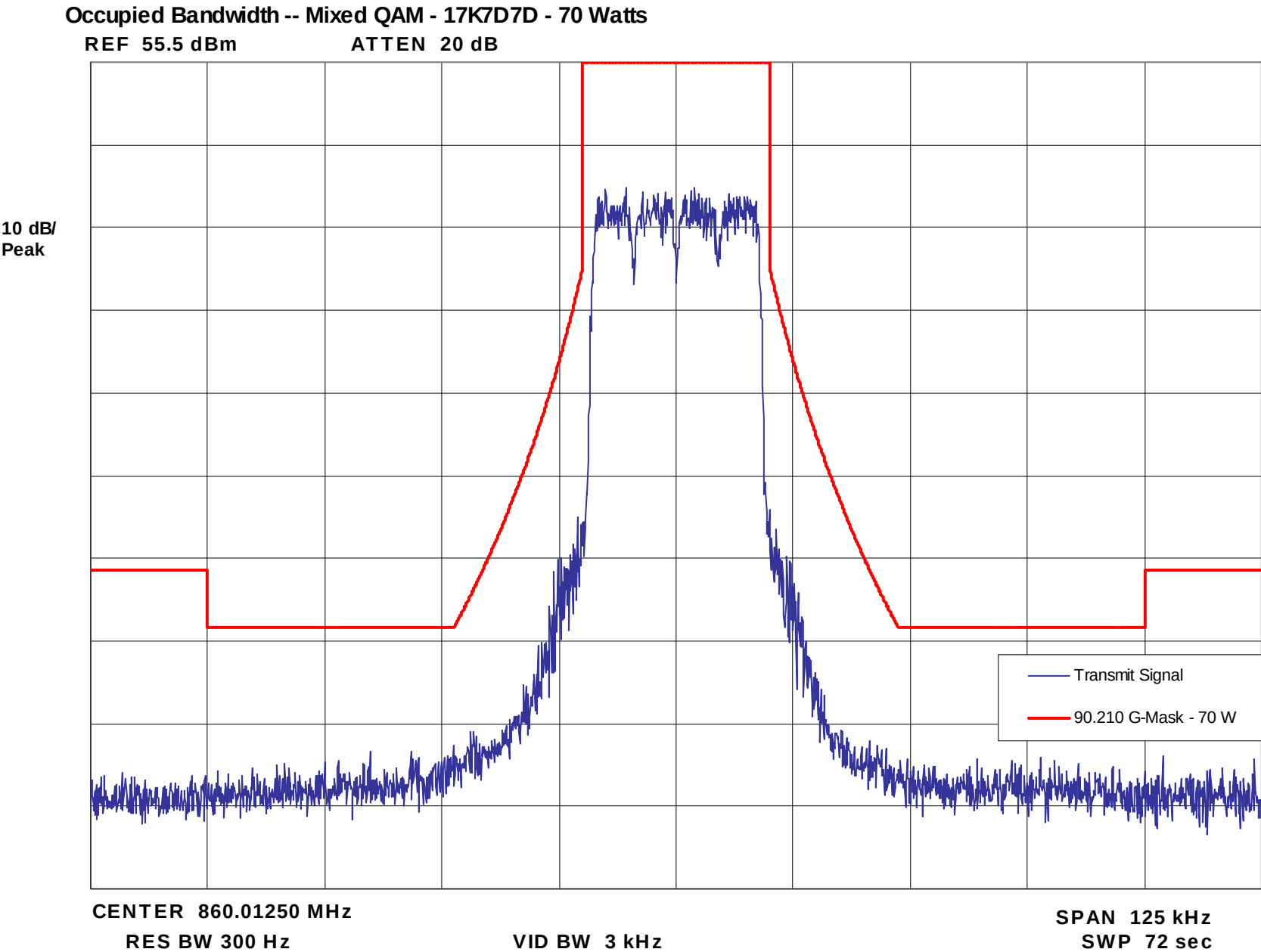
EXHIBIT	DESCRIPTION	Power (Watts, Avg)	Emission Designator
E1-2.3	940.5000 MHz – Part 24 Operation	52 Watts	17K7D7W

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5815

Report on Test Measurements

Occupied Bandwidth – 800 MHz



Report on Test Measurements

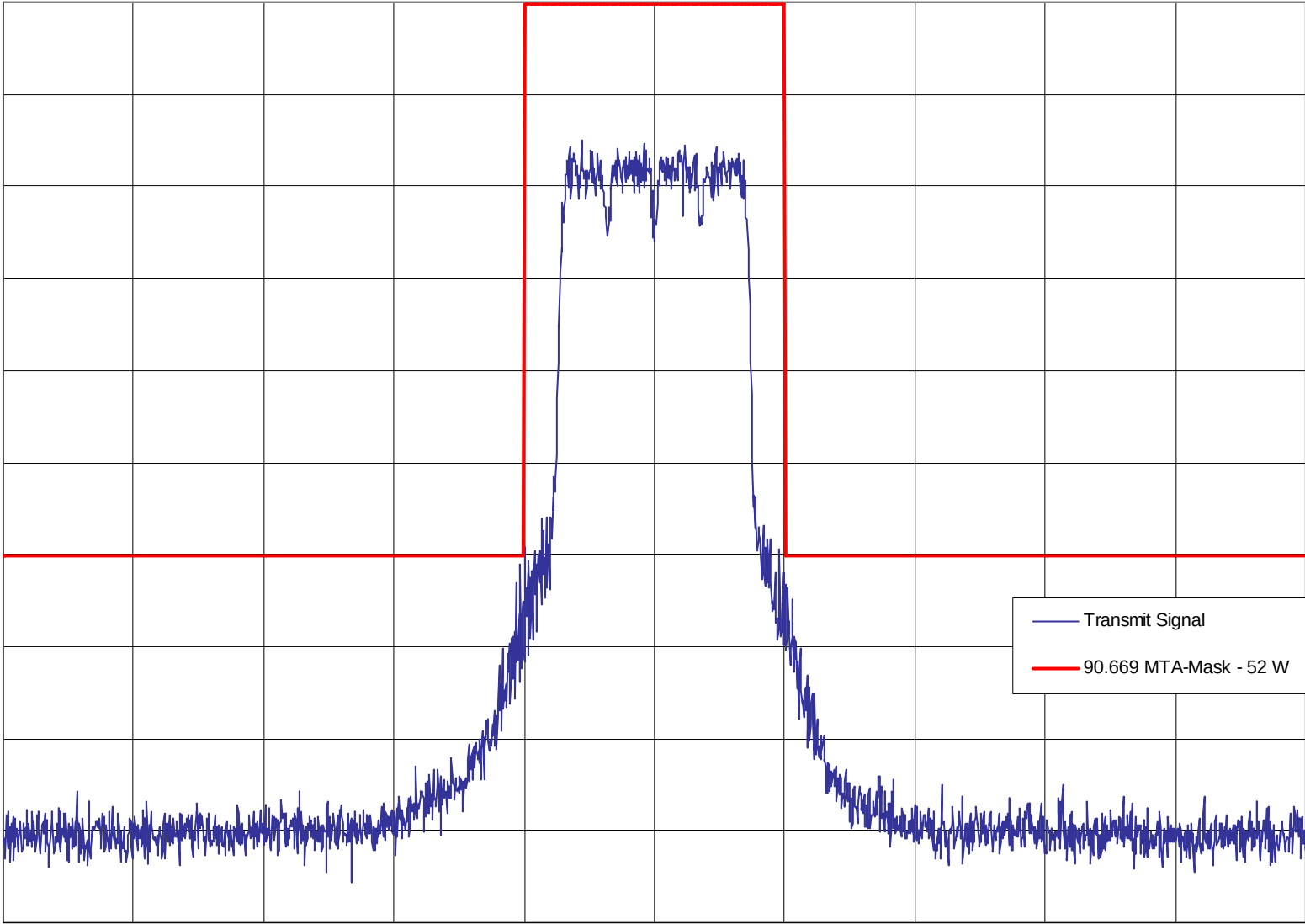
Occupied Bandwidth – 900 MHz

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

REF 54.2 dBm

ATTEN 20 dB

10 dB/
Peak



CENTER 938.0125000 MHz

RES BW 300 Hz

VID BW 3 kHz

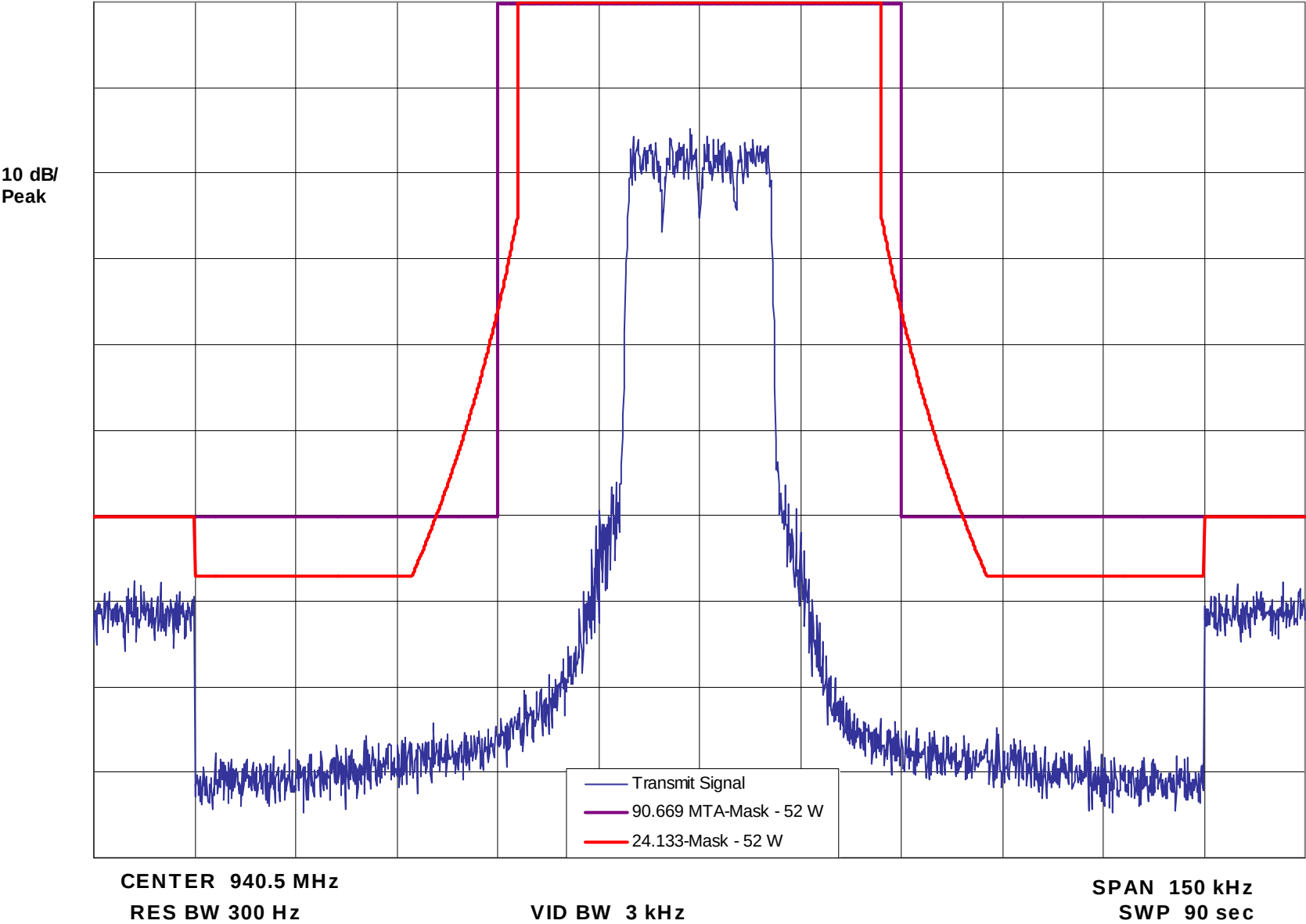
SPAN 125 kHz

SWP 72 sec

Report on Test Measurements

Occupied Bandwidth – 900 MHz Part 24 Operation

Occupied Bandwidth -- One Carrier - 16-QAM - 17K7D7W - 52 Watts
REF 54.2 dBm ATTEN 20 dB



Report on Test Measurements*Conducted Spurious Emissions, Harmonics and Close-In, 800 MHz Operation*Specification Requirement § 90.210(g) Emission Limits:

Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: *At least $43 + 10 \log (P)$ dB.*

Modulation: Quad-QAM, 64 kbps Random Data

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 – Conducted Spurious Emissions, Harmonics, Power Output at 70 Watts
The specification limit is -61.5 dBc |
| E1-3.2 | 800 MHz –Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts
The specification limit is -50.0 dBc |
| E1-3.3 | 800 MHz – Conducted Close-In, 20 MHz Span, Power Output at 70 Watts
The specification limit is -61.5 dBc |
| E1-3.4 | 800 MHz – Conducted Close-In, 200 MHz Span, Power Output at 70 Watts
The specification limit is -61.5 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.

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
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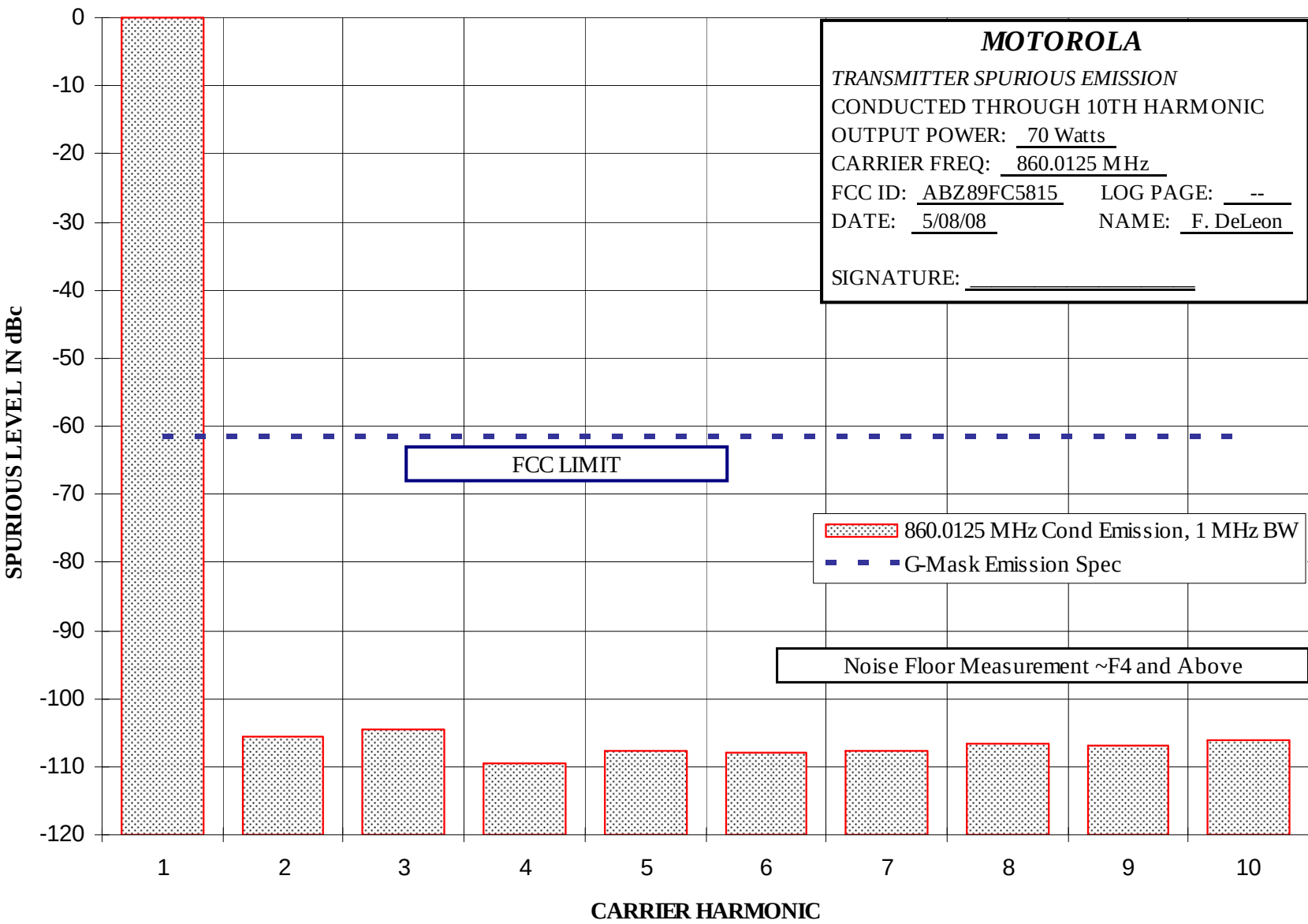
E1-3.5	900 MHz – Conducted Spurious Emissions, Harmonics, Power Output at 52 Watts The specification limit is -60.2 dBc
E1-3.6	900 MHz –Conducted Spurious Emissions, Harmonics, Power Output at 5 Watts The specification limit is -50.0 dBc
E1-3.7	900 MHz –Conducted Close-In, 20 MHz Span, Power Output at 52 Watts The specification limit is -60.2 dBc
E1-3.8	900 MHz – Conducted Close-In, 200 MHz Span, Power Output at 52 Watts The specification limit is -60.2 dBc

APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5815

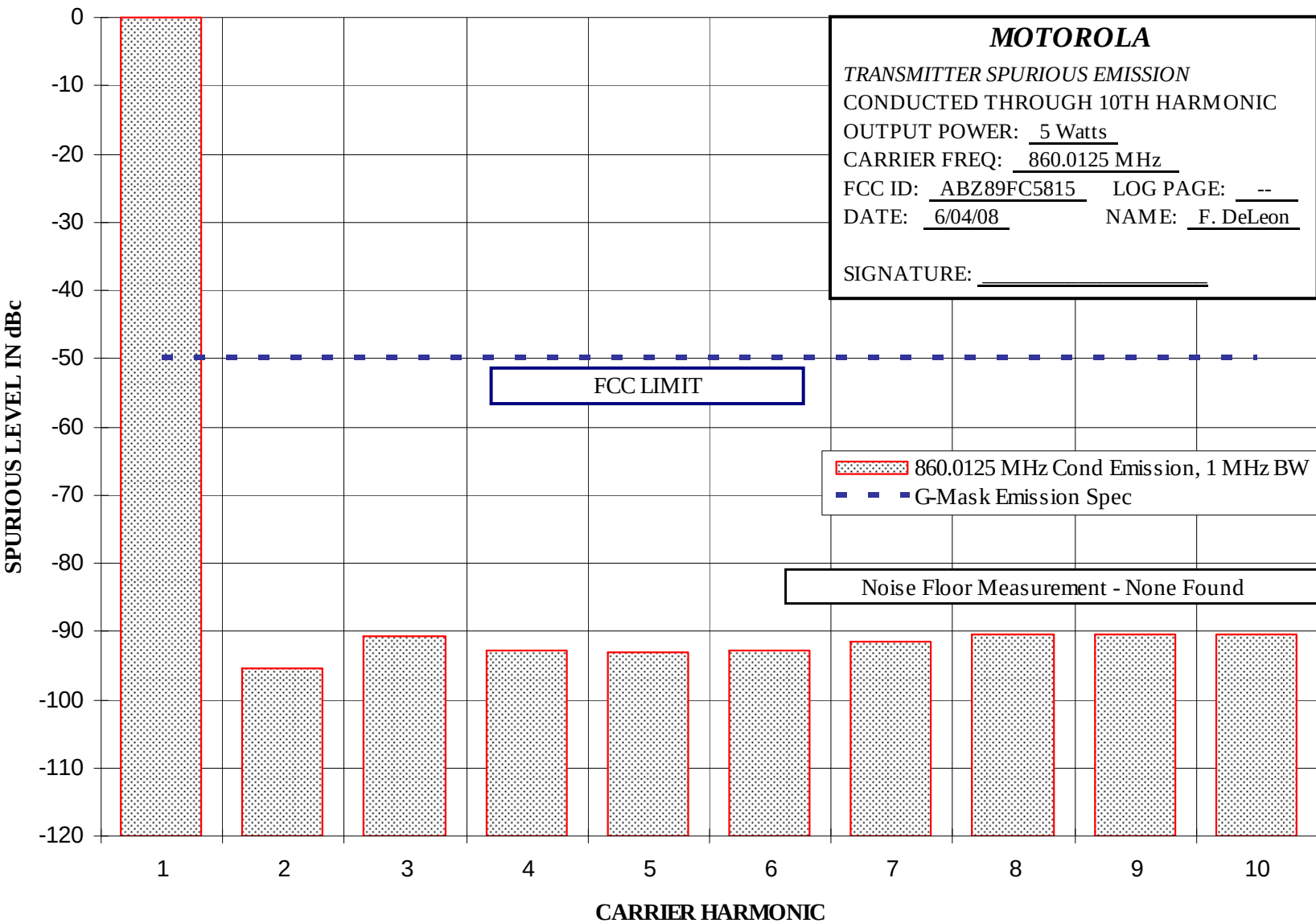
Report on Test Measurements

Conducted Emission – Harmonics -- 70 Watts – 800 MHz



Report on Test Measurements

Conducted Emission – Harmonics – 5 Watts – 800 MHz

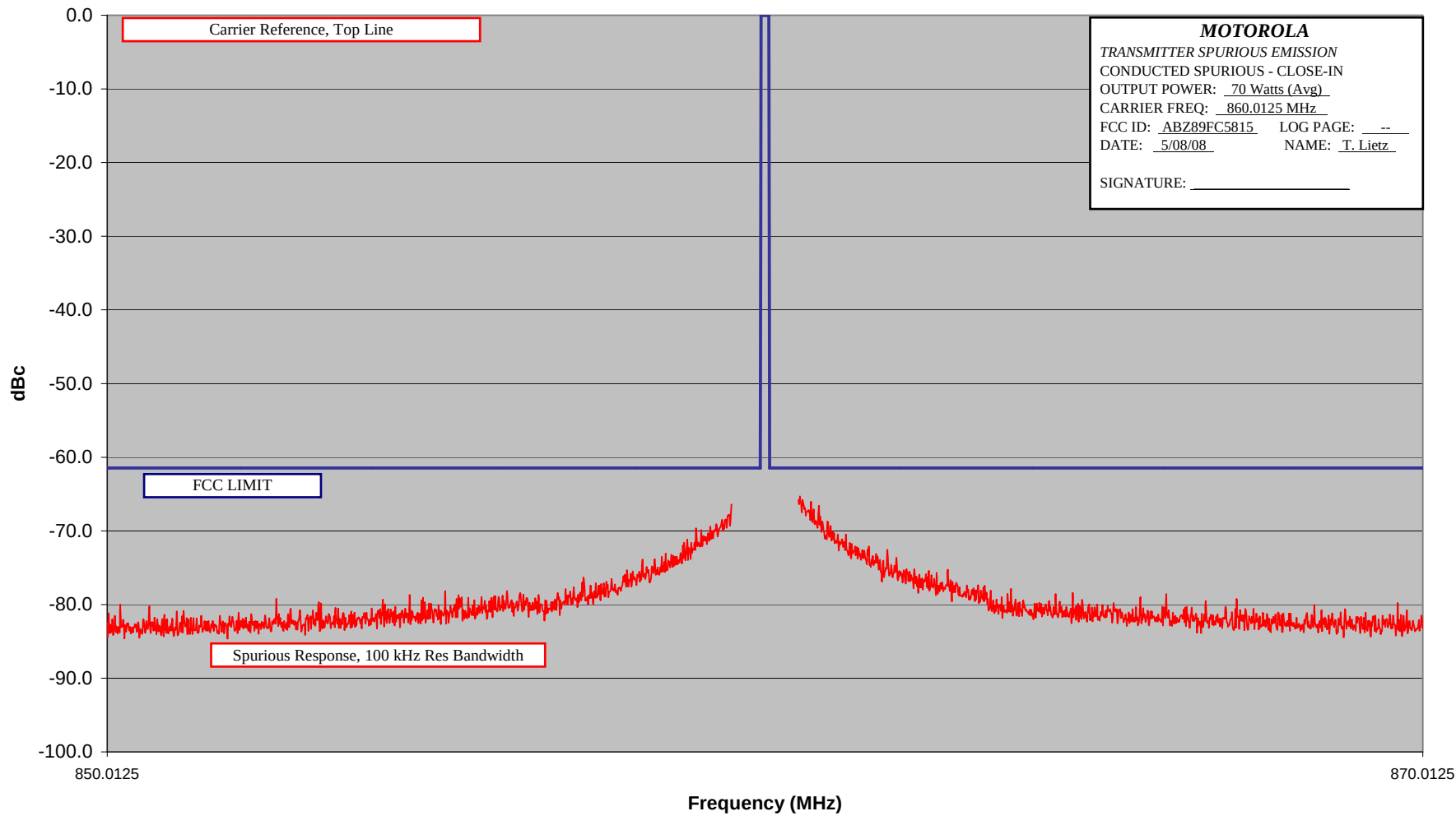


APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5815

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

MOTOROLA
TRANSMITTER SPURIOUS EMISSION
CONDUCTED SPURIOUS - CLOSE-IN
OUTPUT POWER: 70 Watts (Avg)
CARRIER FREQ: 860.0125 MHz
FCC ID: ABZ89FC5815 LOG PAGE: --
DATE: 5/08/08 NAME: T. Lietz
SIGNATURE: _____

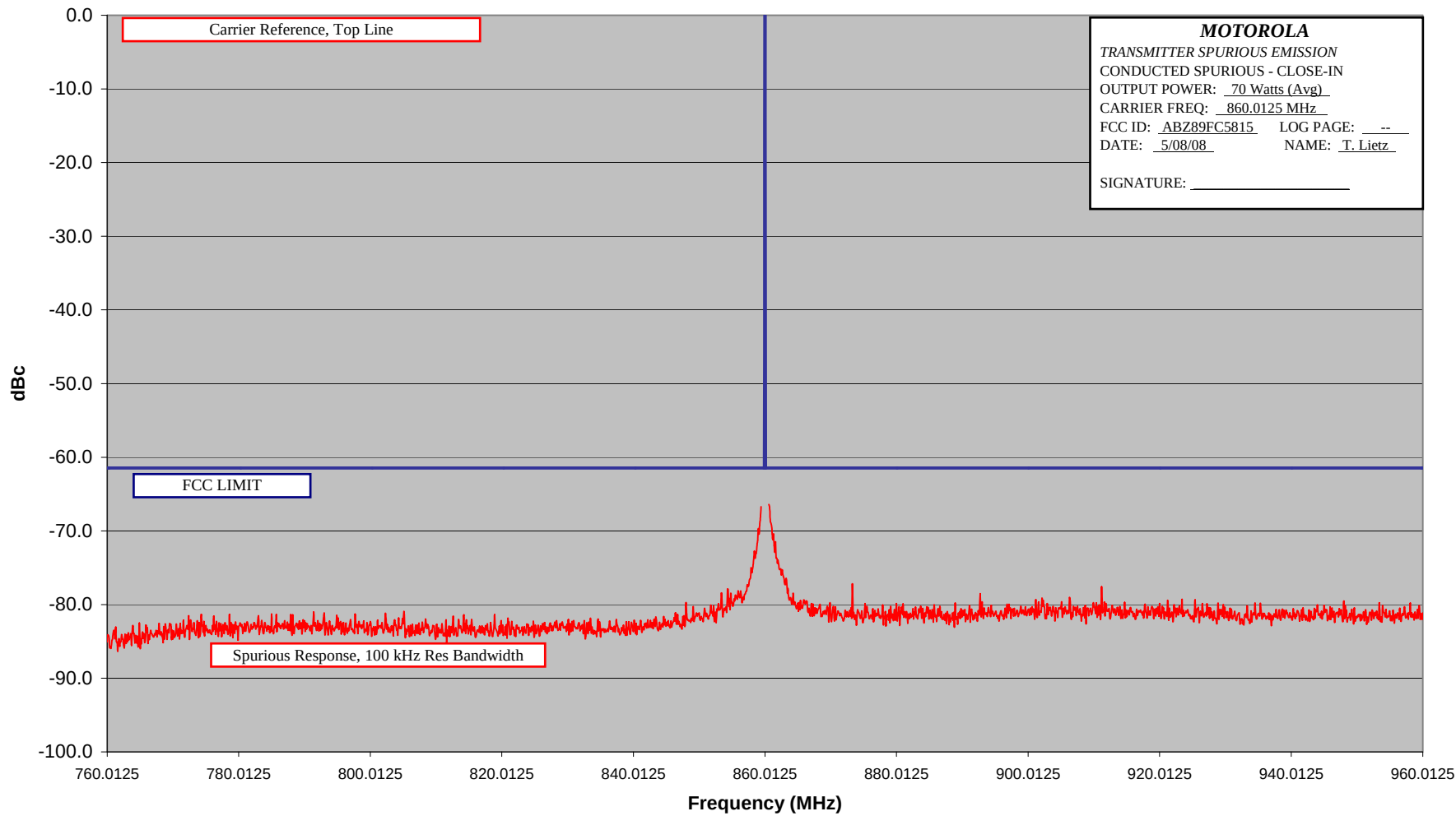


APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5815

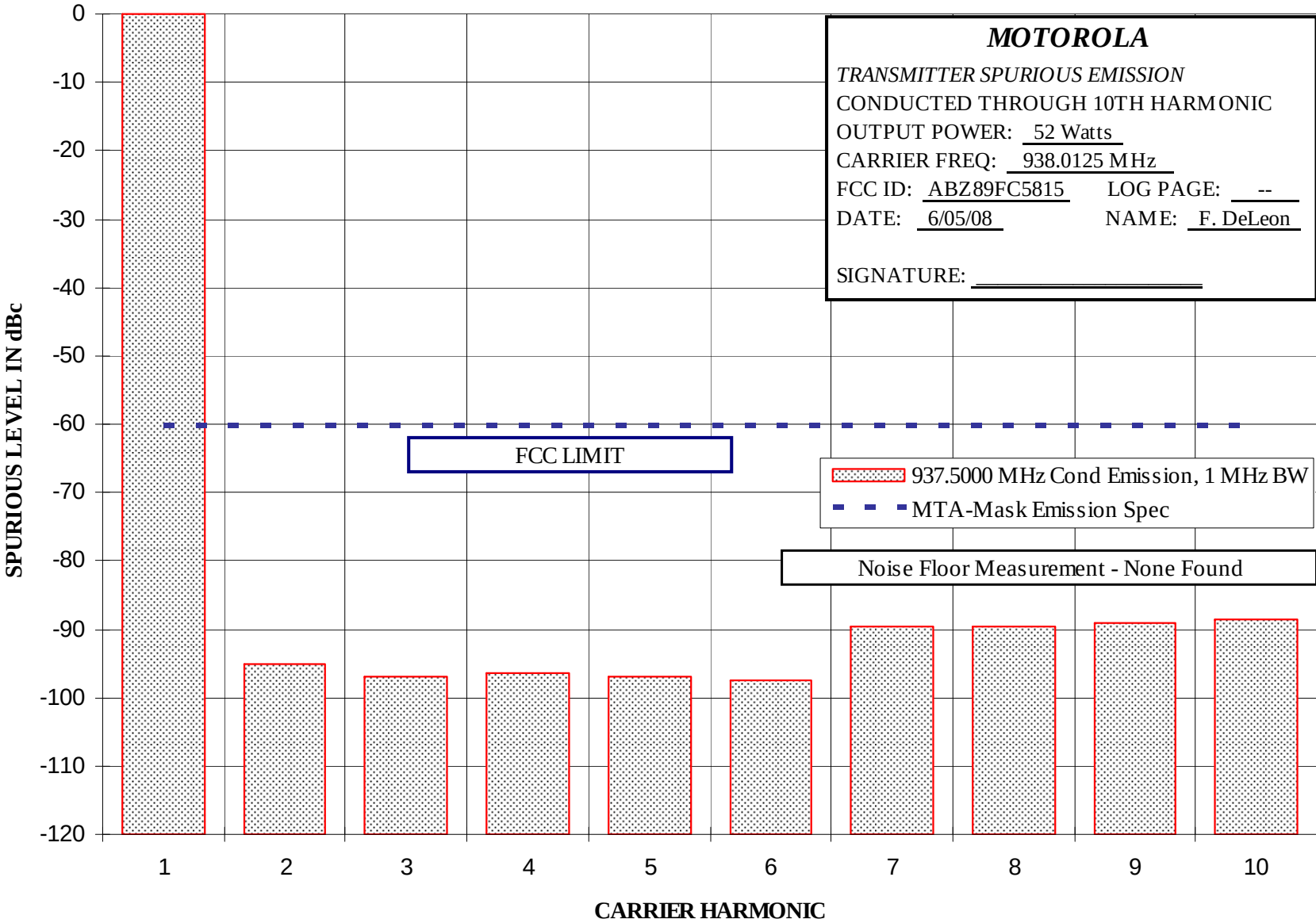
Report on Test Measurements
Conducted Emission – Close-In – 70 Watts – 800 MHz – 200 MHz Span

MOTOROLA
TRANSMITTER SPURIOUS EMISSION
CONDUCTED SPURIOUS - CLOSE-IN
OUTPUT POWER: 70 Watts (Avg)
CARRIER FREQ: 860.0125 MHz
FCC ID: ABZ89FC5815 LOG PAGE: --
DATE: 5/08/08 NAME: T. Lietz
SIGNATURE: _____



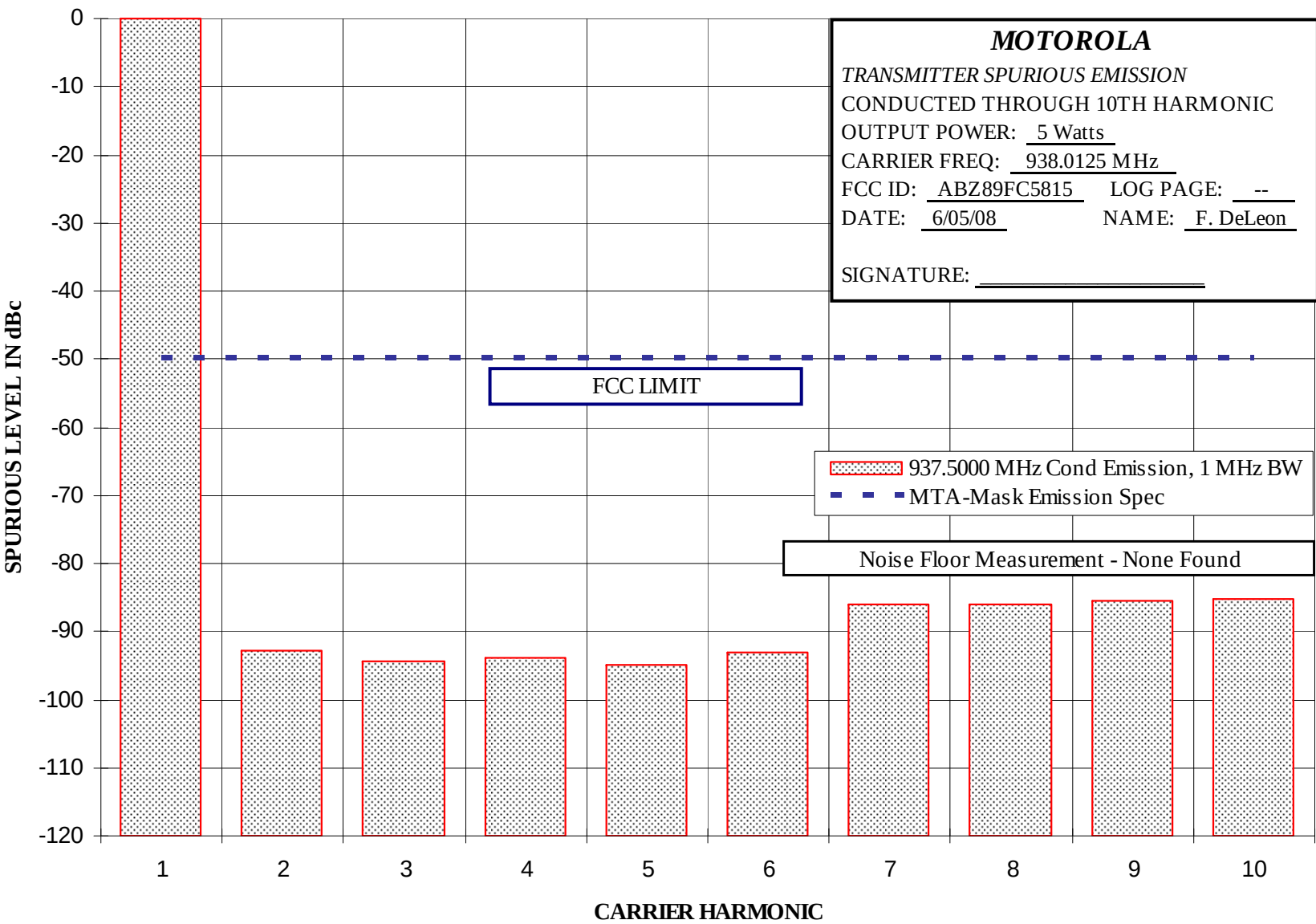
Report on Test Measurements

Conducted Emission – Harmonics – 52 Watts – 900 MHz



Report on Test Measurements

Conducted Emission – Harmonics – 5 Watts – 900 MHz

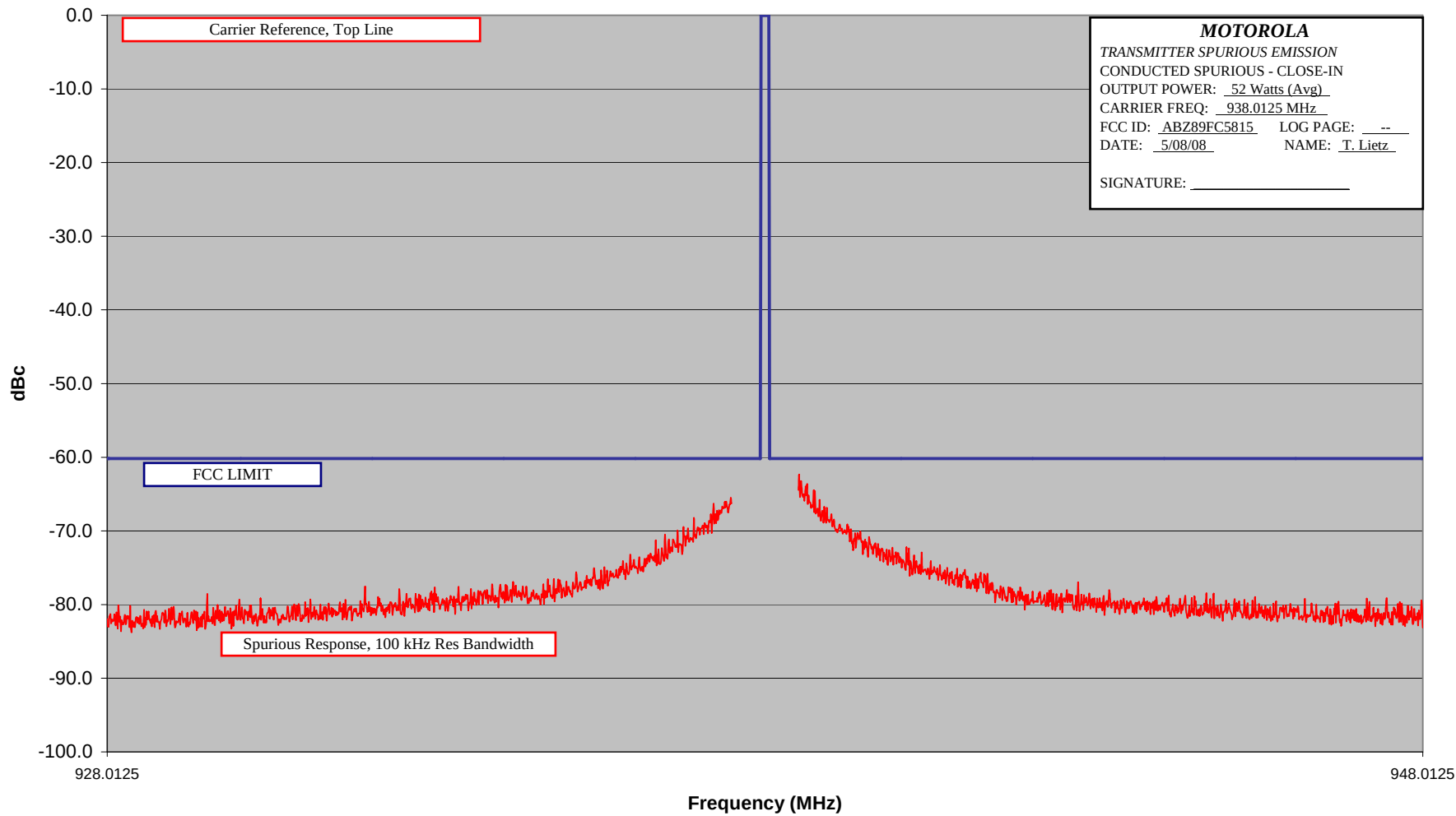


APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5815

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

MOTOROLA
 TRANSMITTER SPURIOUS EMISSION
 CONDUCTED SPURIOUS - CLOSE-IN
 OUTPUT POWER: 52 Watts (Avg)
 CARRIER FREQ: 938.0125 MHz
 FCC ID: ABZ89FC5815 LOG PAGE: --
 DATE: 5/08/08 NAME: T. Lietz
 SIGNATURE: _____



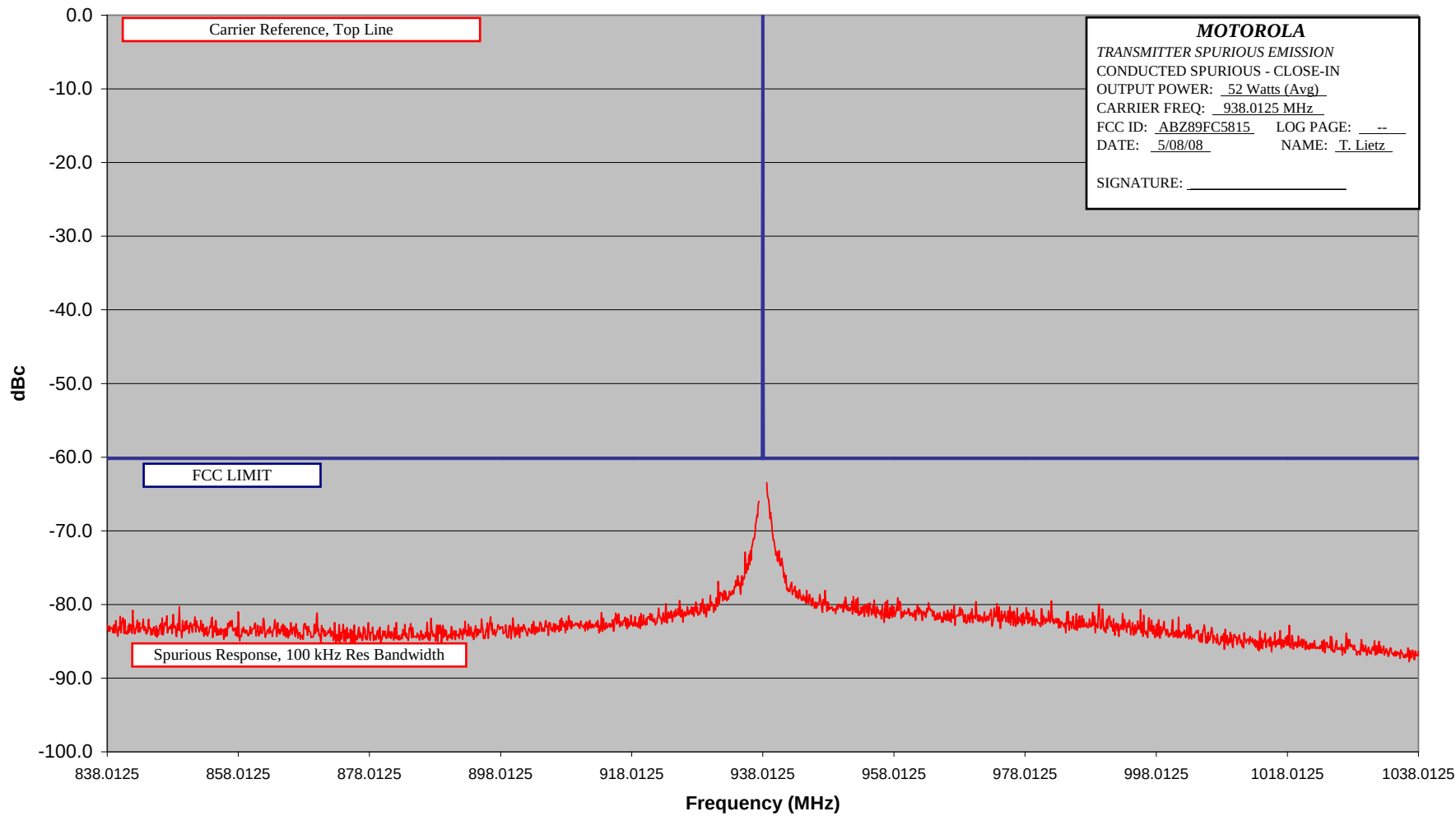
APPLICANT: MOTOROLA

EQUIPMENT TYPE: ABZ89FC5815

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

MOTOROLA
TRANSMITTER SPURIOUS EMISSION
CONDUCTED SPURIOUS - CLOSE-IN
OUTPUT POWER: 52 Watts (Avg)
CARRIER FREQ: 938.0125 MHz
FCC ID: ABZ89FC5815 LOG PAGE: --
DATE: 5/08/08 NAME: T. Lietz

SIGNATURE: _____



Report on Test Measurements

Radiated Spurious Emissions, Harmonics

Specification Requirement § 90.210(g) Emission Limits:

Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: *At least $43 + 10 \log (P)$ dB.*

Modulation: Quad-QAM, 64 kbps Random Data

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 – Radiated Spurious Emissions, Harmonics, Power Output at 70 Watts
The specification limit is -61.5 dBc |
| E1-4.2 | 800 MHz – 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 $10 \log_{10}(P)$ dB or 80 dB, whichever is the lesser attenuation.*

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

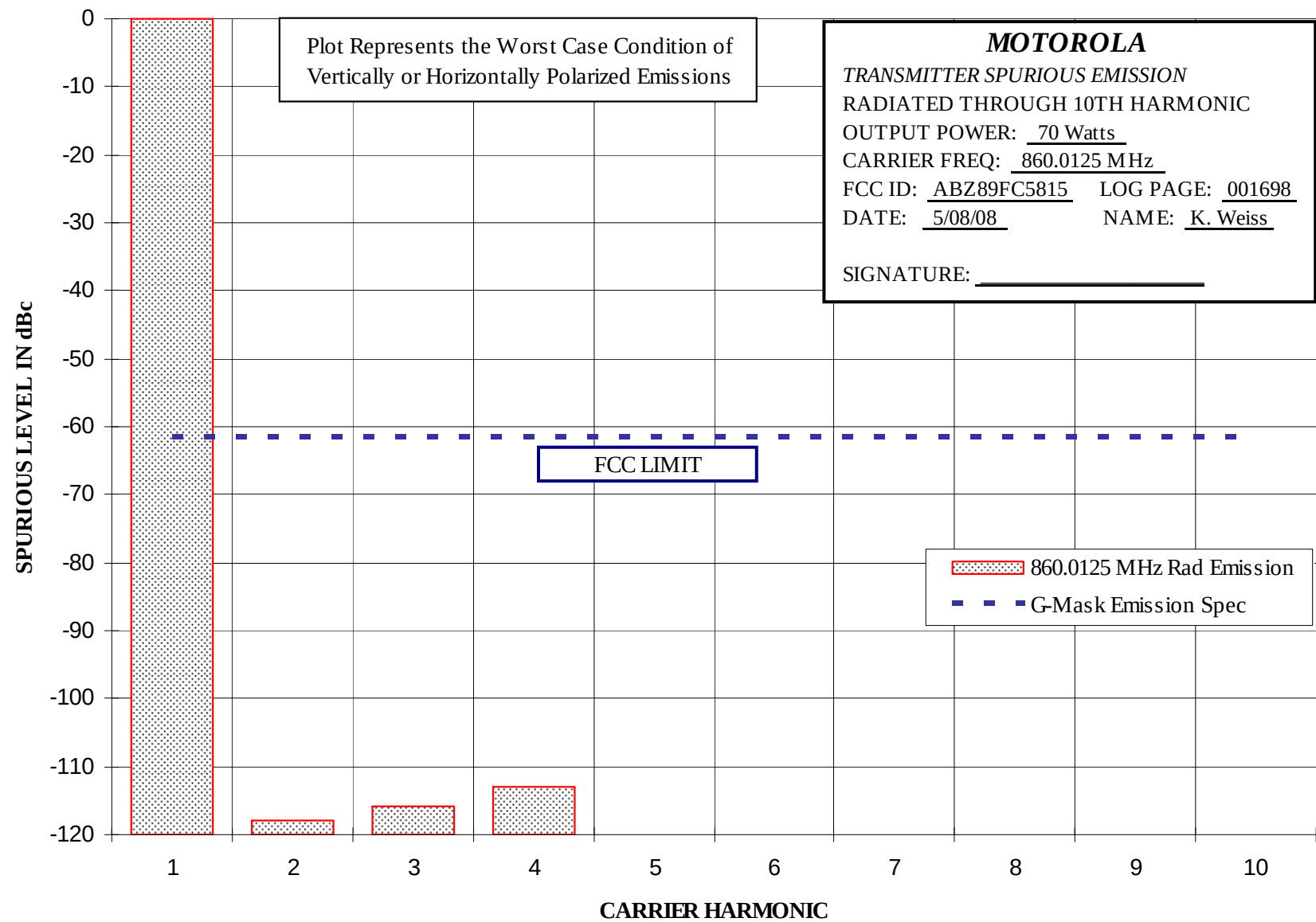
Carrier Frequency: A carrier frequency of 937.5000 MHz was measured. This frequency is near the center of the operating band 935-941 MHz

EXHIBIT DESCRIPTION

- | | |
|--------|--|
| E1-4.3 | 900 MHz – Radiated Spurious Emissions, Harmonics, Power Output at 52 Watts
The specification limit is -60.2 dBc |
| E1-4.4 | 900 MHz – Radiated Spurious Emissions, Harmonics, Power Output at 5 Watts
The specification limit is -50.0 dBc |

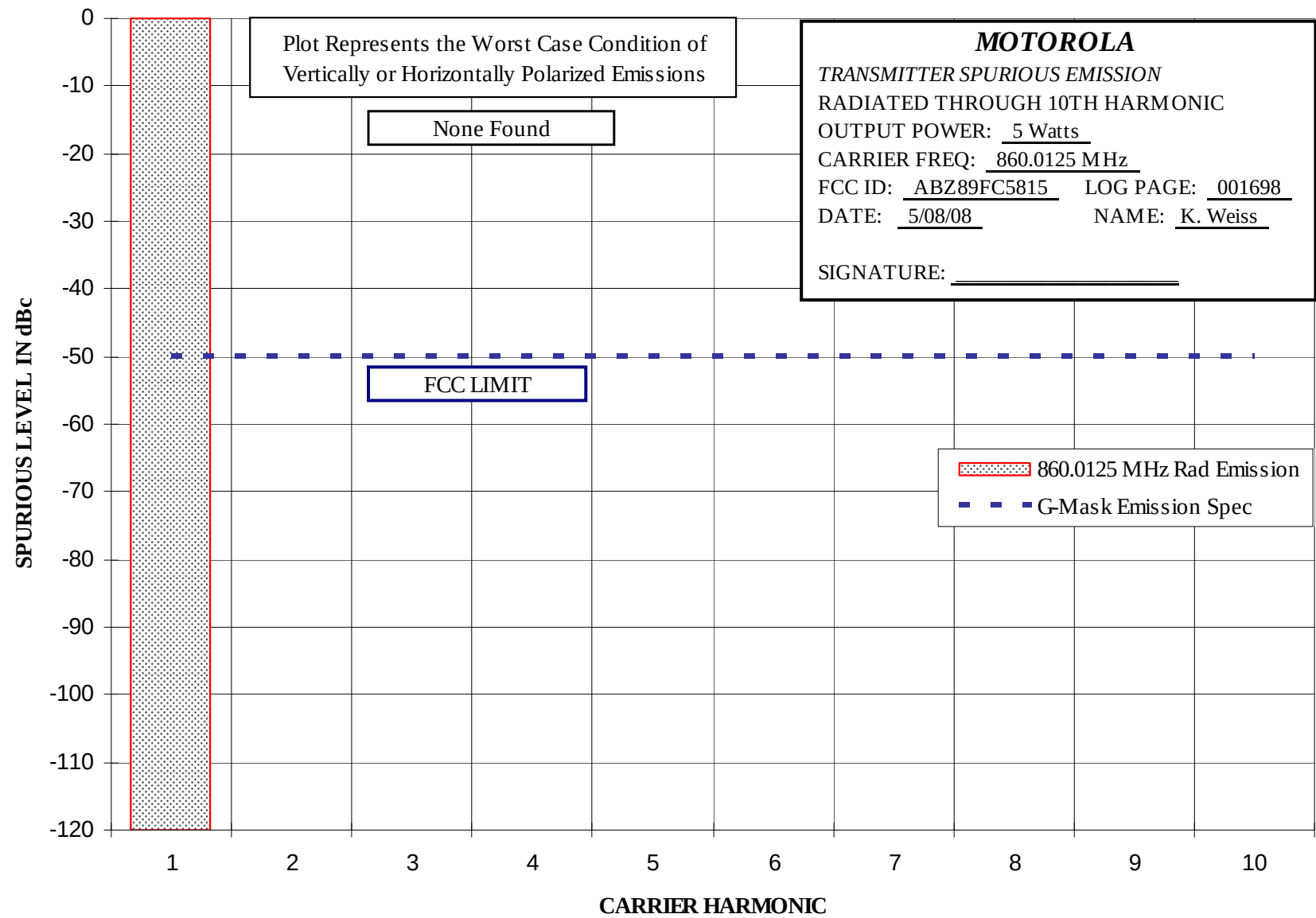
Report on Test Measurements

Radiated Emission – Harmonics – 70 Watts – 800 MHz



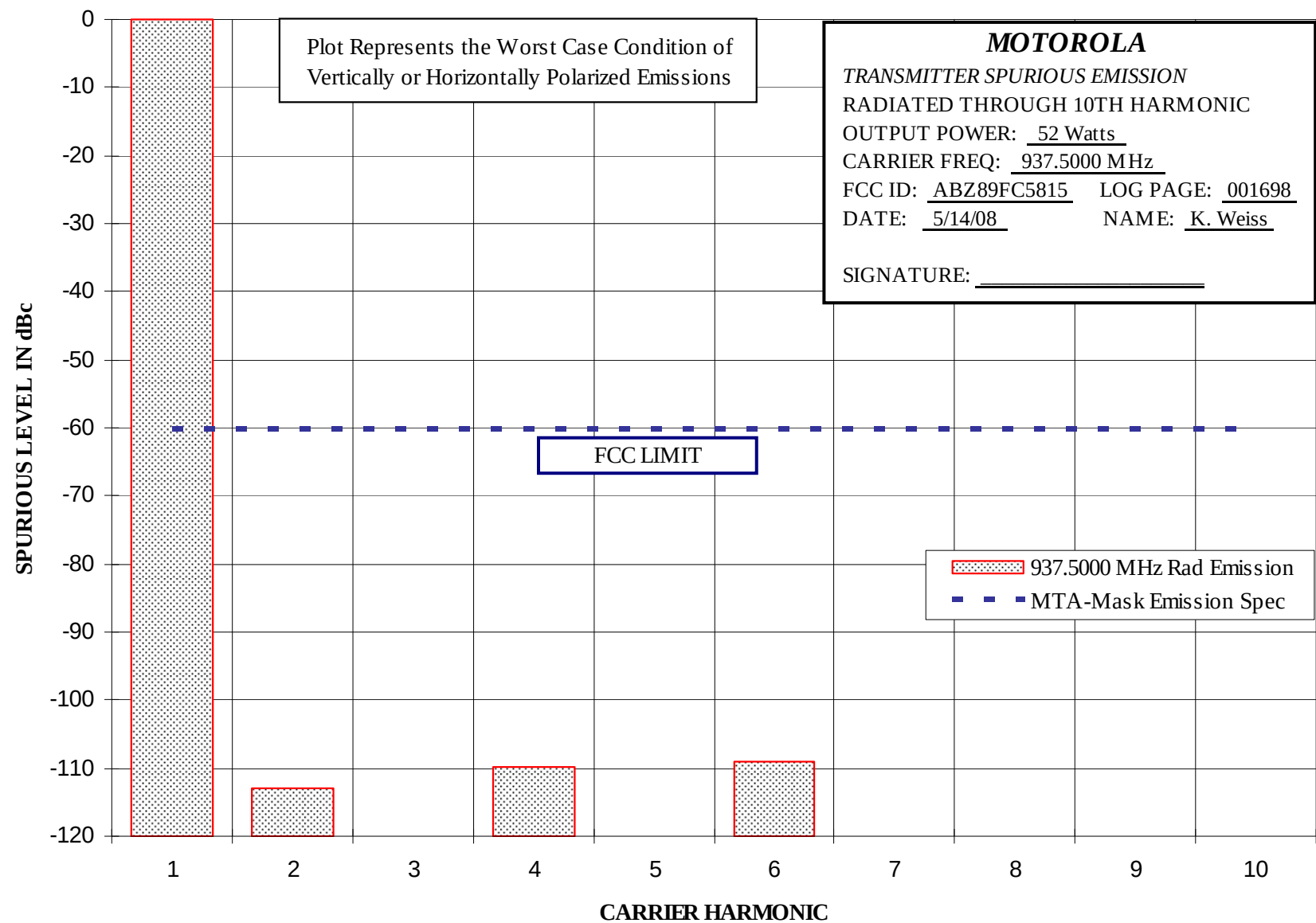
Report on Test Measurements

Radiated Emission – Harmonics – 5 Watts – 800 MHz



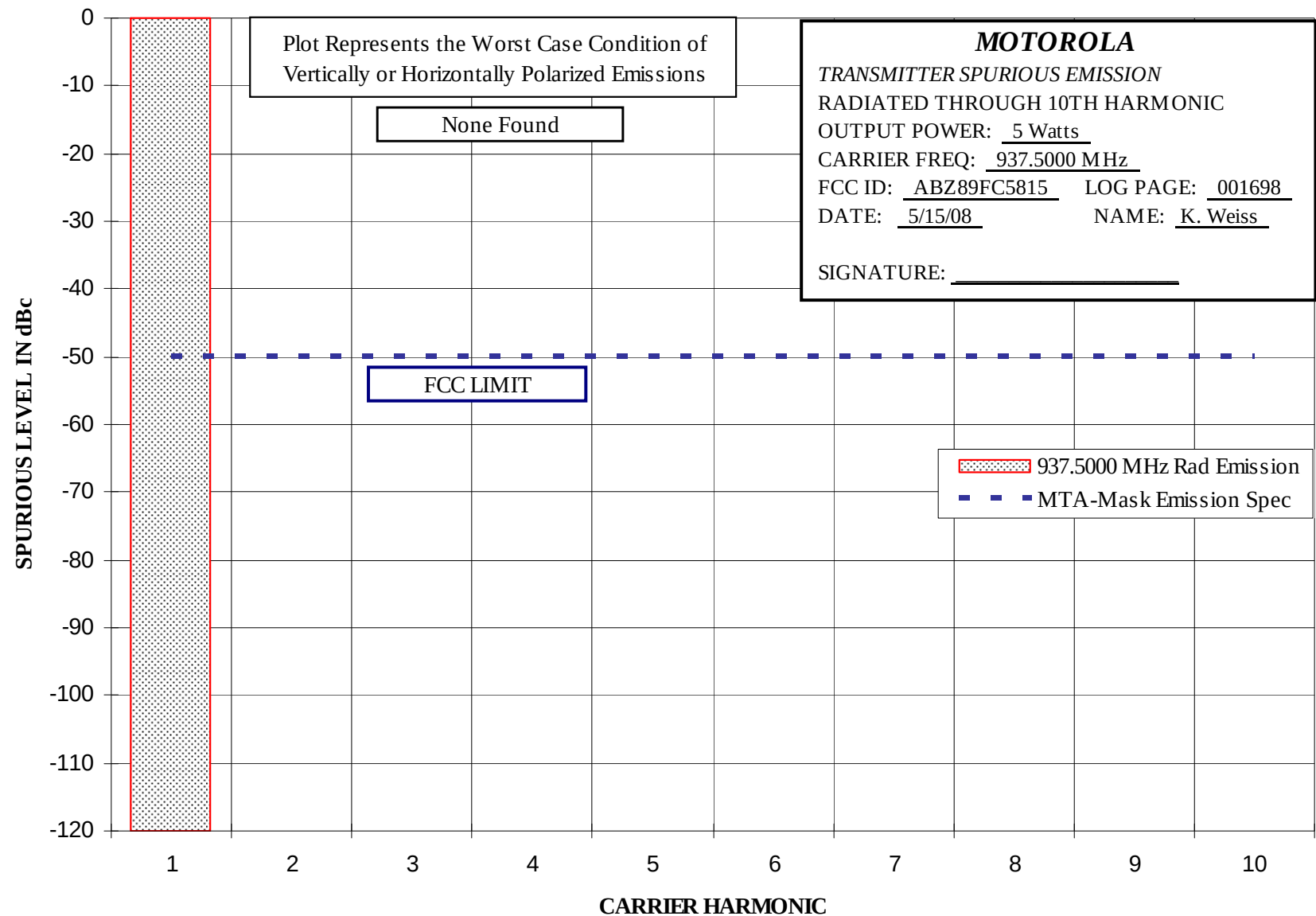
Report on Test Measurements

Radiated Emission – Harmonics – 52 Watts – 900 MHz



Report on Test Measurements

Radiated Emission – Harmonics – 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.

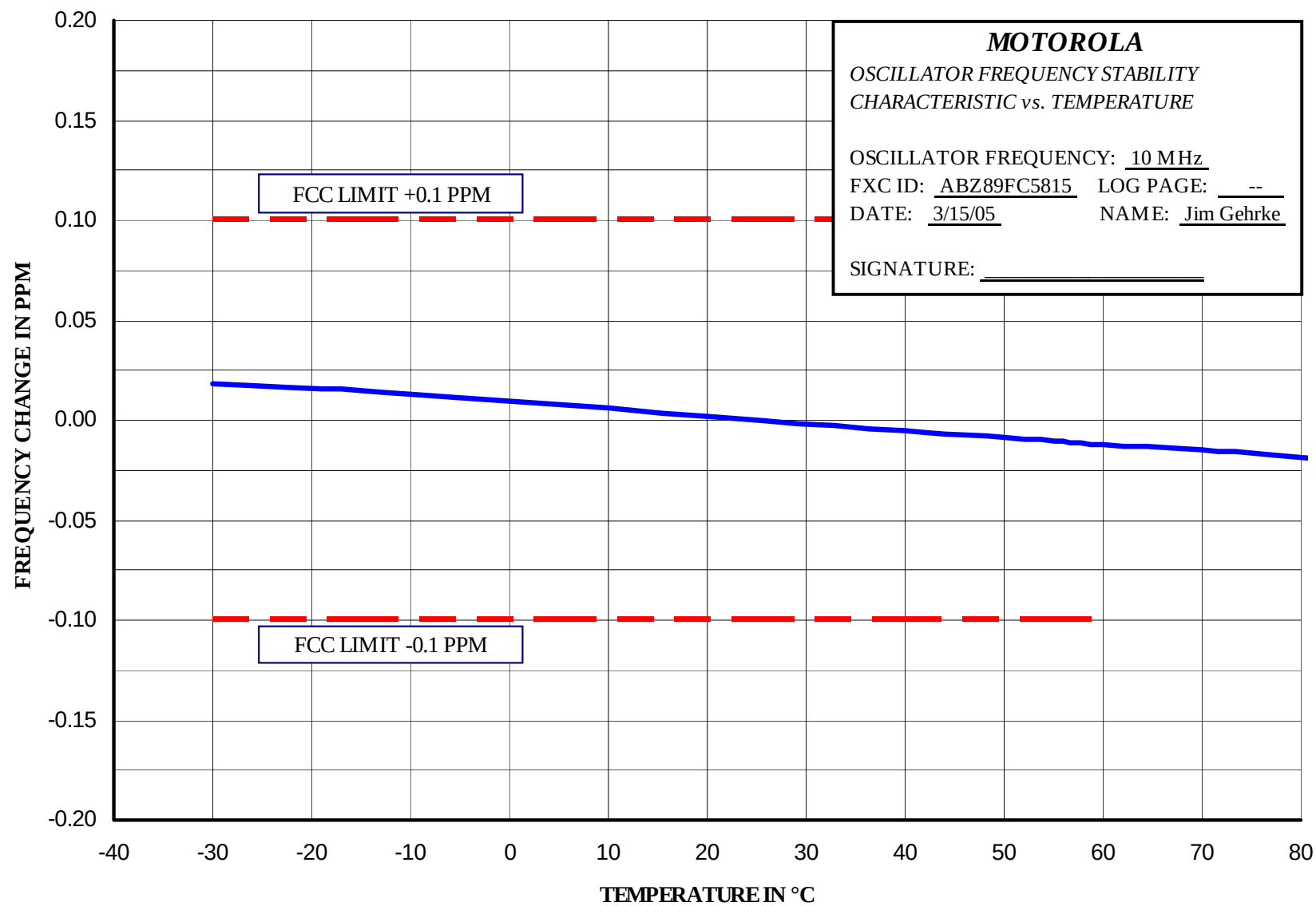
Fixed and Base stations, operating at 866-869 MHz, must have a frequency stability of better than +/- 1.0 PPM.

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

<u>EXHIBIT</u>	<u>DESCRIPTION</u>
E1-5.1	Frequency Stability Vs Temperature
E1-5.2	Frequency Stability Vs Voltage

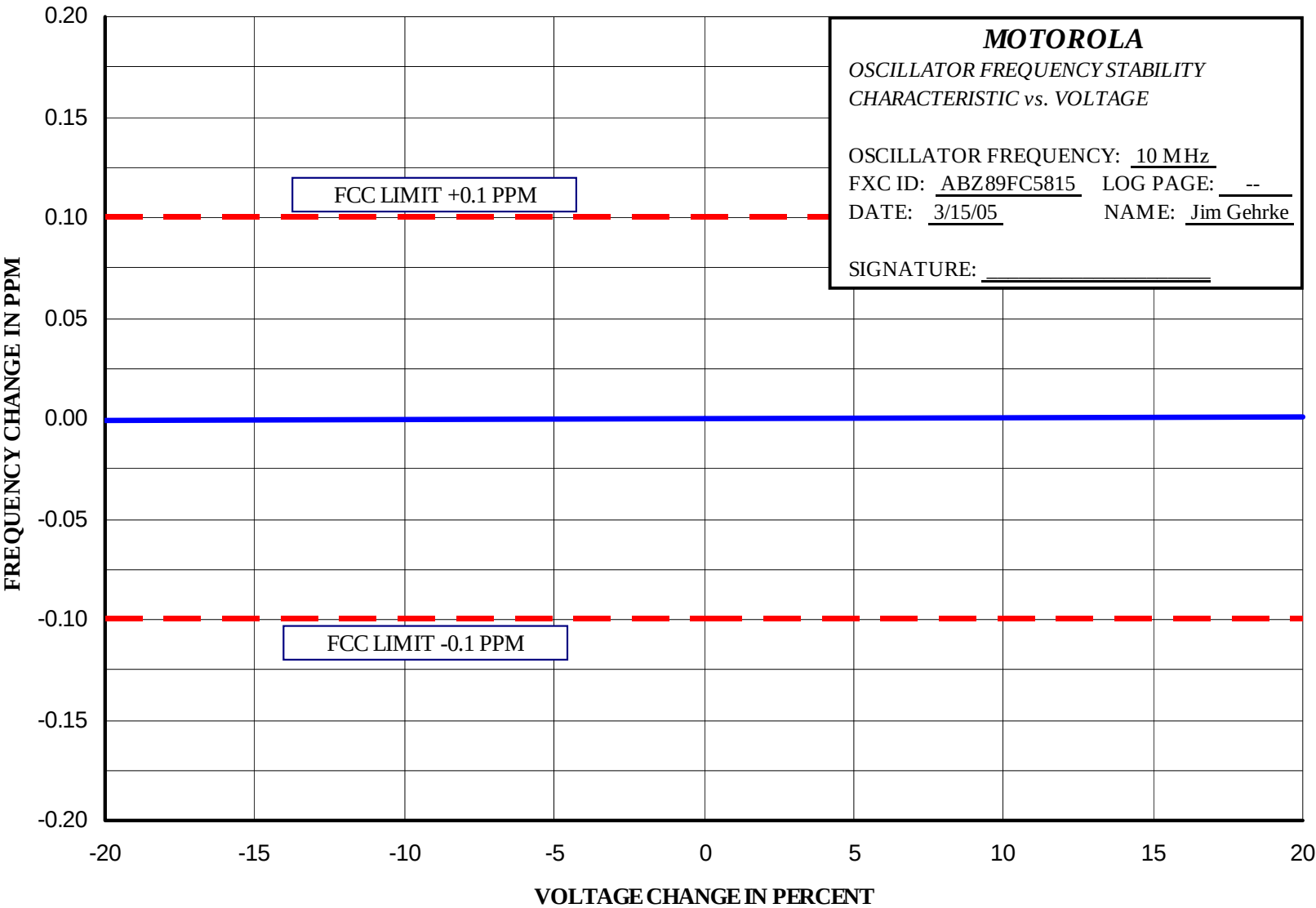
Report on Test Measurements

Frequency Stability Vs Temperature



Report on Test Measurements

Frequency Stability Vs Voltage



Report on Test Measurements

Test Equipment List

MODEL	MANUFACTURER	DESCRIPTION	Serial No.	Last Cal	Next Cal
438A	Hewlett Packard	RF Power Meter	3008A07428	10/25/07	10/25/10
8481A	Hewlett Packard	RF Power Sensor	2702A76706	05/09/07	05/09/10
E4443A	Agilent	Spectrum Analyzer	MY43360090	10/16/07	10/16/08
83712A	Hewlett Packard	Signal Generator	3429A00455	no calibration required	
8671B	Hewlett Packard	Signal Generator	2611A00159	10/24/07	10/24/10
85460A	Hewlett Packard	EMI Analyzer, Filter	3704A00467	07/21/07	07/21/10
85462A	Hewlett Packard	EMI Analyzer, RF/Display	3906A00500	07/21/07	07/21/10
8593E	Hewlett Packard	EMI Analyzer	3513A01649	06/08/07	06/08/10
89441A	Hewlett Packard	Vector Signal Analyzer	3416A00835	08/10/06	08/10/09
(Various)	Weinschel, Kathrein, Bird	RF Loads	Various	no calibration required	
TWPC-4510-1	Telewave	Cavity	5244	no calibration required	
3020A, etc.	Narda	Directional Coupler	Various	no calibration required	

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

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

NAME: Ken Weiss

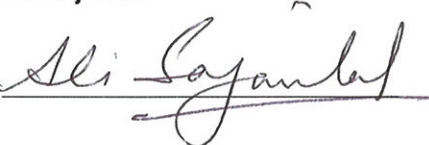
SIGNATURE: 

DATE: June 6, 2008

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 6, 2008

POSITION: Engineering Section Manager