Report on Test Measurements

Measurements Report
The measurement report shows compliance information against the pertinent technical standards. Each parameter is measured generally at the low end, middle, and at the high end of the applicable frequency band. Each section of the report contains either verbiage or graphs which show compliance to applicable standards as required, explains testing method used, and indicates what the applicable specification is.

Information and performance relative to 25 kHz 'wideband' operation is included in the report. Although wideband operation in the 150-174 MHz and 421-512 MHz bands is no longer allowable for rule part 90 in the US, it is available for other FCC rule parts and in other countries, including Industry Canada.

The time division multiple access (TDMA) mode of operation provides two voice paths in a 12.5 kHz channel bandwidth and a data rate of 9600 bits per second or 12,000 bits per second in a channel bandwidth of 12.5 kHz. This is equivalent to one voice path per 6.25 kHz of channel bandwidth and 4800 bits per second or greater in a 6.25 kHz channel bandwidth. The GTR 8000 conforms to the spectrum efficiency requirements of FCC rule § 90.203 (j) (5).

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

Report on Test Measurements

Measurements Report

SUBMITTED MEASURED DATA – INDEX (Continued)

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 six parallel power transistors.

Linear Modulation Mode:

	406 MHz	420 MHz	430 MHz	
Measured RF output	**110**	**110**	**110**	Watts, Average
DC Voltage, final RF amplifier stage/stages	**24.3**	**24.3**	**24.3**	Volts
DC Current, final RF amplifier stage/stages	**10.9**	**10.9**	**11.2**	Amperes
Input power for final RF amplifying device(s)	**265**	**265**	**272**	Watts
Primary Radio Input Supply Voltage	**120**	**120**	**120**	Volts AC
Minimum Measured RF output	**2**	**2**	**2**	Watts, Average
Normal DC Voltage	**19.0**	**19.0**	**19.0**	Volts
Normal DC Current	**2.4**	**2.4**	**2.4**	Amperes
Input power for final RF amplifying device(s)	**46**	**46**	**46**	Watts
Primary Radio Input Supply Voltage	**120**	**120**	**120**	Volts AC

Frequency Modulation and Compatible 4-Level Frequency Modulation Mode:

	406 MHz	420 MHz	430 MHz	
Measured RF output	**110**	**110**	**110**	Watts, Average
DC Voltage, final RF amplifier stage/stages	**19.8**	**19.8**	**19.8**	Volts
DC Current, final RF amplifier stage/stages	**12.0**	**12.1**	**12.3**	Amperes
Input power for final RF amplifying device(s)	**238**	**240**	**244**	Watts
Primary Radio Input Supply Voltage	**120**	**120**	**120**	Volts AC
Minimum Measured RF output	**2**	**2**	**2**	Watts, Average
Normal DC Voltage	**19.0**	**19.0**	**19.0**	Volts
Normal DC Current	**2.4**	**2.4**	**2.4**	Amperes
Input power for final RF amplifying device(s)	**46**	**46**	**46**	Watts
Primary Radio Input Supply Voltage	**120**	**120**	**120**	Volts AC

Report on Test Measurements

Occupied Bandwidth – Linear Simulcast Modulation (LSM), 12.5 kHz Channel Spacing
Linear Simulcast Modulation can be used in a system configuration based upon channel usage as described in Exhibit B. The 'D1E' emission designator provides usage for telephony, the 'D1D' provides usage for data / telecommand, and the 'D1W' provides for usage as a combination. All are spectrally identical. The occupied bandwidth chart references the following setup and specification requirements.

Modulation Type:	Linear Simulcast Modulation, LSM
Emission Designator:	8K70D1E, 8K70D1D, 8K70D1W
Channelization:	12.5 kHz
Power Setting:	110 Watts, Average

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth (f_0) to 5.625 kHz removed from f_0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(f_d –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

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

Necessary Bandwidth Calculation: The necessary bandwidth of the modulation signal is not directly calculable per the composite modulation formulas defined in 47 CFR §2.202(g) / TRC-43 section 8. Quadrature Phase Shift Keying is used to modulate a carrier with a digital bit stream: Data Rate: R = 9600 bps; Bits per Symbol: S=4; B_n = 2BK; B = R/log_2(s) = 9600/log_2(4) = 4800; K= 0.9; B_n = 2*4800*0.9; B_n = 8700 Hz. The necessary bandwidth of 8.70 kHz is based on a 99% power measurement of the transmitter spectrum, per §2.202(a) / TRC-43 section 7(c).

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings				Measured Occupied Bandwidth	
Horizontal:	12.5 kHz per Division	Resolution BW:	100 Hz	Resolution BW:	150 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz	Span:	15 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	Number of Points:	1601
Detector:	Peak			Integration Time:	14.8 ms

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.
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.
6) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	DESCRIPTION	Meas Occ BW
E1-2.1	Occupied Bandwidth - Linear Simulcast Modulation (LSM), Low End of Band	8.82 kHz
E1-2.2	Occupied Bandwidth - Linear Simulcast Modulation (LSM), Middle of Band	8.97 kHz
E1-2.3	Occupied Bandwidth - Linear Simulcast Modulation (LSM), High End of Band	8.94 kHz

Report on Test Measurements

Occupied Bandwidth – Compatible 4-Level Frequency Modulation (C4FM), 12.5 kHz Channel Spacing
C4FM can be used in a system configuration based upon channel usage as described in Exhibit B. The 'F1E' emission designator provides usage for telephony, the 'F1D' provides usage for data / telecommand, and the 'F1W' provides for usage as a combination. All are spectrally identical. The occupied bandwidth chart references the following setup and specification requirements.

Modulation Type:	Compatible 4-Level Frequency Modulation, C4FM
Emission Designator:	8K10F1E, 8K10F1D, 8K10F1W
Channelization:	12.5 kHz
Power Setting:	110 Watts

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth (f_0) to 5.625 kHz removed from f_0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(f_d –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

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

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M= ½B	*Max Deviation, D*	*2M+2DK (K=1)*	*Nec BW*
1.2 kHz	2.85 kHz	8.10 kHz	8K10

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings				Measured Occupied Bandwidth	
Horizontal:	12.5 kHz per Division	Resolution BW:	100 Hz	Resolution BW:	150 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz	Span:	15 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	Number of Points:	1601
Detector:	Peak			Integration Time:	14.8 ms

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.
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.
6) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW**
E1-2.4	Occupied Bandwidth - Compatible 4-Level Frequency Mod (C4FM), Low End of Band	7.81 kHz
E1-2.5	Occupied Bandwidth - Compatible 4-Level Frequency Mod (C4FM), Middle of Band	7.82 kHz
E1-2.6	Occupied Bandwidth - Compatible 4-Level Frequency Mod (C4FM), High End of Band	7.86 kHz

Report on Test Measurements

Occupied Bandwidth –H-DQPSK, P25 Two Slot TDMA Digital Modulation, 12.5 kHz Channel Spacing
H-DQPSK modulation can be used in a system configuration based upon channel usage as described in Exhibit B. The 'D7E' emission designator provides usage for telephony, the 'D7D' provides usage for data / telecommand, and the 'D7W' provides for usage as a combination. All are spectrally identical. The occupied bandwidth chart references the following setup and specification requirements.

Modulation Type:	H-DQPSK, P25 Two Slot TDMA Digital Modulation
Emission Designator:	9K80D7E, 9K80D7D, 9K80D7W
Channelization:	12.5 kHz
Power Setting:	110 Watts, Average

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(2) On any frequency from the center of the authorized bandwidth (f_0) to 5.625 kHz removed from f_0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(f_d –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

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

Necessary Bandwidth Calculation: The necessary bandwidth of the modulation signal is not directly calculable per the composite modulation formulas defined in 47 CFR §2.202(g) / TRC-43 section 8. Quadrature Phase Shift Keying is used to modulate a carrier with a digital bit stream: Data Rate: R = 12000 bps; Bits per Symbol: S=4; B_n = 2BK; B = R/log_2(s) = 12000/log_2(4) = 6000; K= 0.81; B_n = 2*6000*0.81; B_n = 9800 Hz. The necessary bandwidth of 9.80 kHz is based on a 99% power measurement of the transmitter spectrum, per §2.202(a) / TRC-43 sec 7(c).

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings			
Horizontal:	12.5 kHz per Division	Resolution BW:	100 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz
Detector:	Peak		

Measured Occupied Bandwidth	
Resolution BW:	150 Hz
Span:	15 kHz
Number of Points:	1601
Integration Time:	14.8 ms

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.
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.
6) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	DESCRIPTION	Meas Occ BW
E1-2.7	Occupied Bandwidth - H-DQPSK P25 Two Slot TDMA Digital Mod, Low End of Band	9.75 kHz
E1-2.8	Occupied Bandwidth - H-DQPSK P25 Two Slot TDMA Digital Mod, Middle of Band	9.76 kHz
E1-2.9	Occupied Bandwidth - H-DQPSK P25 Two Slot TDMA Digital Mod, High End of Band	9.87 kHz

Report on Test Measurements

Occupied Bandwidth –3600 bps High Speed Trunking Control Data, 25 kHz Channel Spacing
There is one exhibit shown for 3600 bps high speed control data in 25 kHz channels. It can be used in a trunked system configuration based upon channel usage as described in Exhibit B. The occupied bandwidth chart references the following setup and specification requirements.

Modulation Type: Frequency Shift Keying Digital Modulation
Emission Designator: 16K0F1D
Channelization: 25 kHz
Power Setting: 110 Watts

Specification Requirement 47 CFR §90.210(c) and IC RSS-119 section 5.8.2 - Emission Limits – "C-Mask":
Emission *Mask C.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency from the center of the authorized bandwidth (f0) to 5.0 kHz removed from f0: Zero dB

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz but not more than 10 kHz: *At least 83 * $\log_{10}(f_d / 5)$ dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz but not more than 250 percent of the authorized bandwidth:
*At least 29 * $\log_{10}(f_d^2 / 11)$ dB or 50 dB, whichever is the lesser attenuation*

(4) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: *At least 43 plus 10 $\log_{10}(P)$ dB*

Necessary Bandwidth Calculation (Analog Emission):
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M= ½B	*Max Deviation, D*	*2M+2DK (K=1.2 typ)*	*Nec BW*
1.8 kHz	5.0 kHz	15.6 kHz	16K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings				Measured Occupied Bandwidth	
Horizontal:	12.5 kHz per Division	Resolution BW:	300 Hz	Resolution BW:	300 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz	Span:	30 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	Number of Points:	1601
Detector:	Peak			Integration Time:	7.4 ms

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 carrier power value from the previous step to generate the emission mask limit.
4) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
5) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW**
E1-2.10	Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels, Low End of Band	7.87 kHz
E1-2.11	Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels, Middle of Band	7.95 kHz
E1-2.12	Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels, High End of Band	7.91 kHz

Report on Test Measurements

Occupied Bandwidth –3600 bps High Speed Trunking Control Data, 12.5 kHz Channel Spacing
There is one exhibit shown for 3600 bps high speed control data in 12.5 kHz channels. It can be used in a trunked system configuration based upon channel usage as described in Exhibit B. The occupied bandwidth chart references the following setup and specification requirements.

Modulation Type: Frequency Shift Keying Digital Modulation
Emission Designator: 10K0F1D
Channelization: 12.5 kHz
Power Setting: 110 Watts

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth (f0) to 5.625 kHz removed from f0: Zero dB

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(f_d –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

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

Necessary Bandwidth Calculation (Analog Emission):
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M= ½B	*Max Deviation, D*	*2M+2DK (K=1.2 typ)*	*Nec BW*
1.8 kHz	2.5 kHz	9.6 kHz	10K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings				Measured Occupied Bandwidth	
Horizontal:	12.5 kHz per Division	Resolution BW:	100 Hz	Resolution BW:	150 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz	Span:	15 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	Number of Points:	1601
Detector:	Peak			Integration Time:	14.8 ms

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 carrier power value from the previous step to generate the emission mask limit.
4) Plot the resulting analyzer trace and the emission mask limit, add text and labeling as appropriate.
5) Adjust the signal analyzer resolution BW and span as indicated above, use the Occupied Bandwidth function to record the value.

EXHIBIT	**DESCRIPTION**	**Meas Occ BW**
E1-2.13	Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels, Low End of Band	5.49 kHz
E1-2.14	Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels, Middle of Band	5.28 kHz
E1-2.15	Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels, High End of Band	5.48 kHz

Report on Test Measurements

Occupied Bandwidth – Linear Simulcast Modulation (LSM) – Emission Designator: 8K70D1E, 8K70D1D, 8K70D1W – Low End of Band

Occupied Bandwidth -- Linear Simulcast Modulation - 110 Watts (Average)

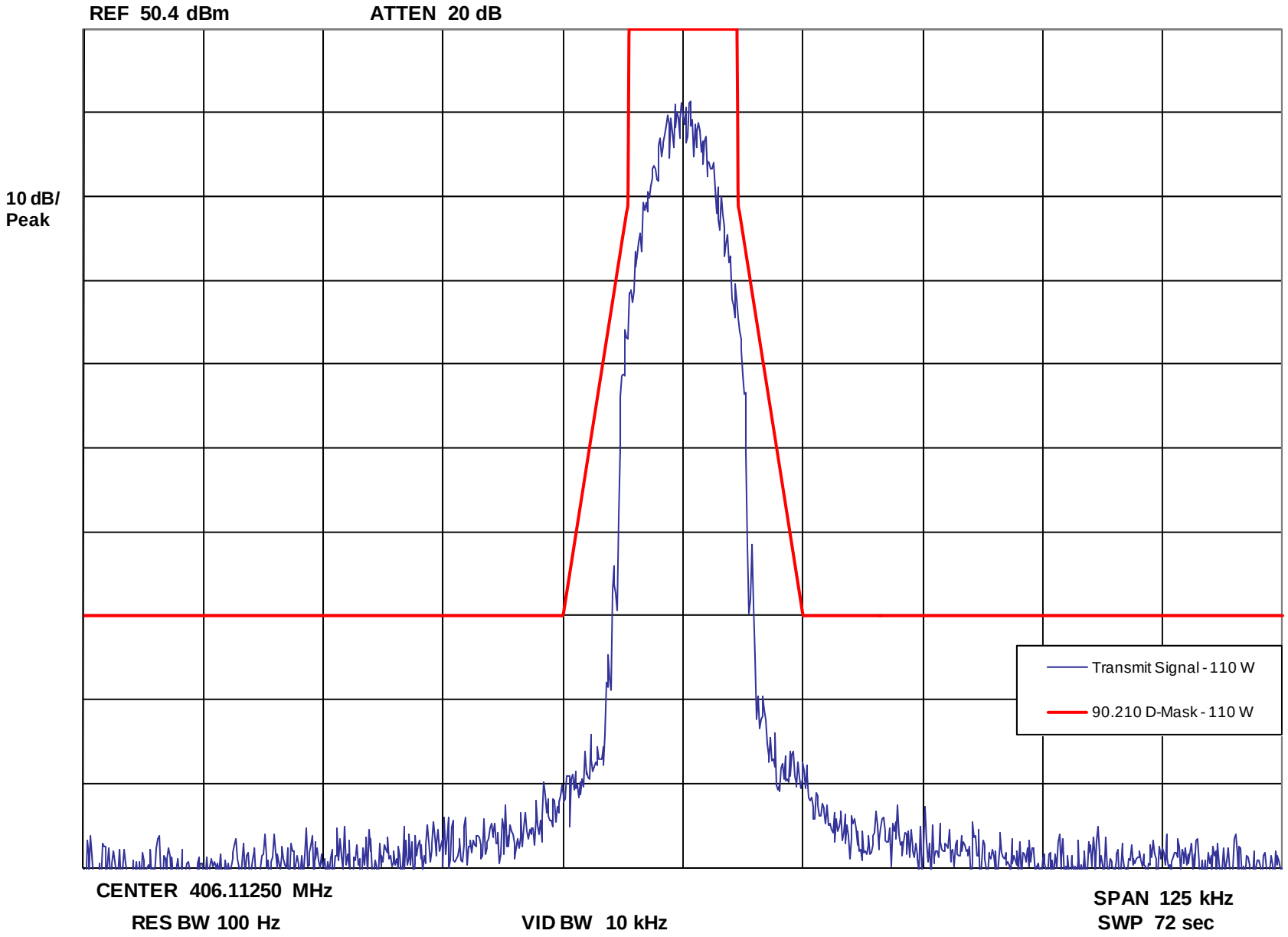


EXHIBIT E1-2.1

Report on Test Measurements

Occupied Bandwidth – Linear Simulcast Modulation (LSM) – Emission Designator: 8K70D1E, 8K70D1D, 8K70D1W – Middle of Band

Occupied Bandwidth -- Linear Simulcast Modulation - 110 Watts (Average)

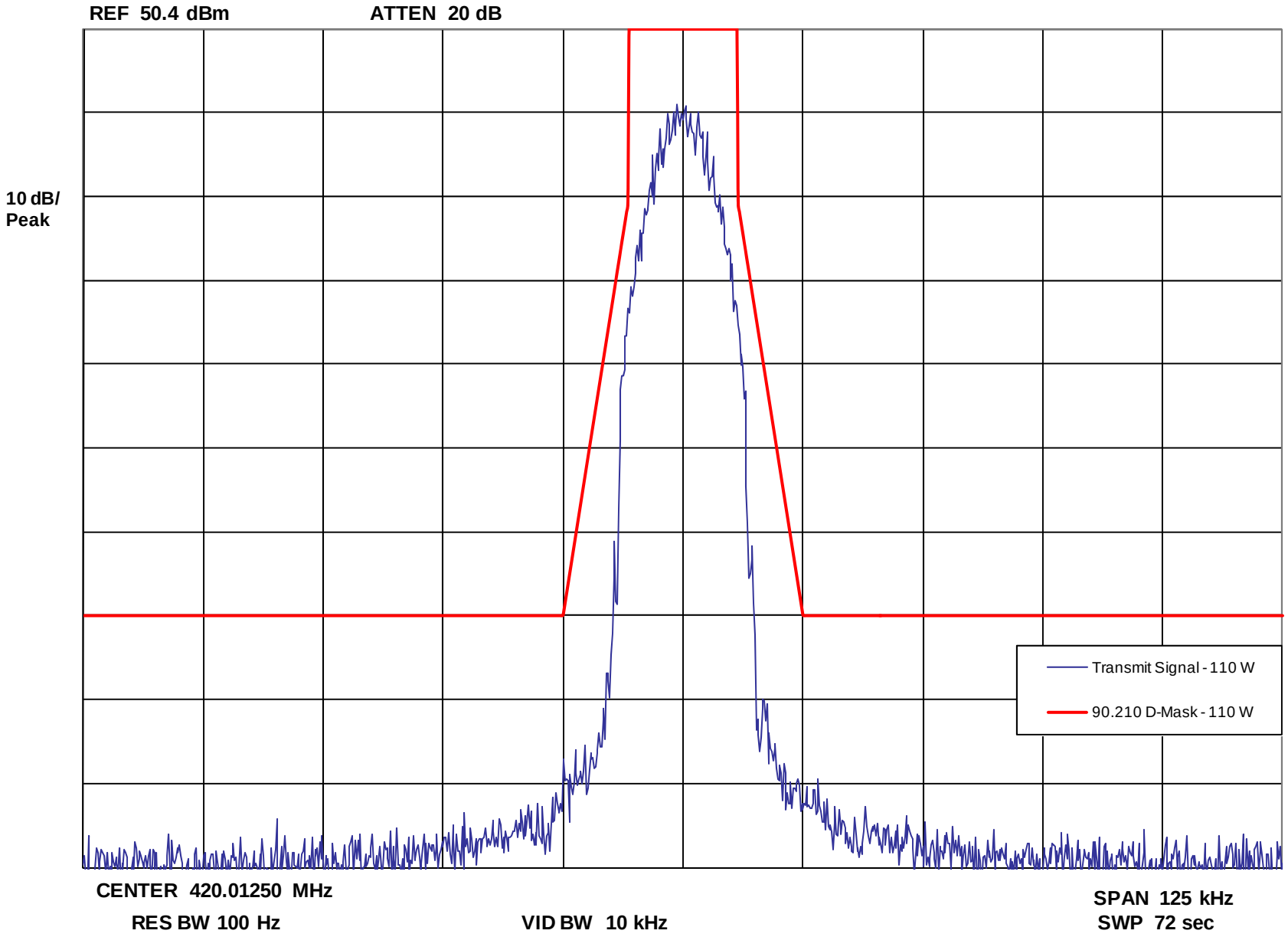


EXHIBIT E1-2.2

Report on Test Measurements

Occupied Bandwidth – Linear Simulcast Modulation (LSM) – Emission Designator: 8K70D1E, 8K70D1D, 8K70D1W – High End of Band

Occupied Bandwidth -- Linear Simulcast Modulation - 110 Watts (Average)

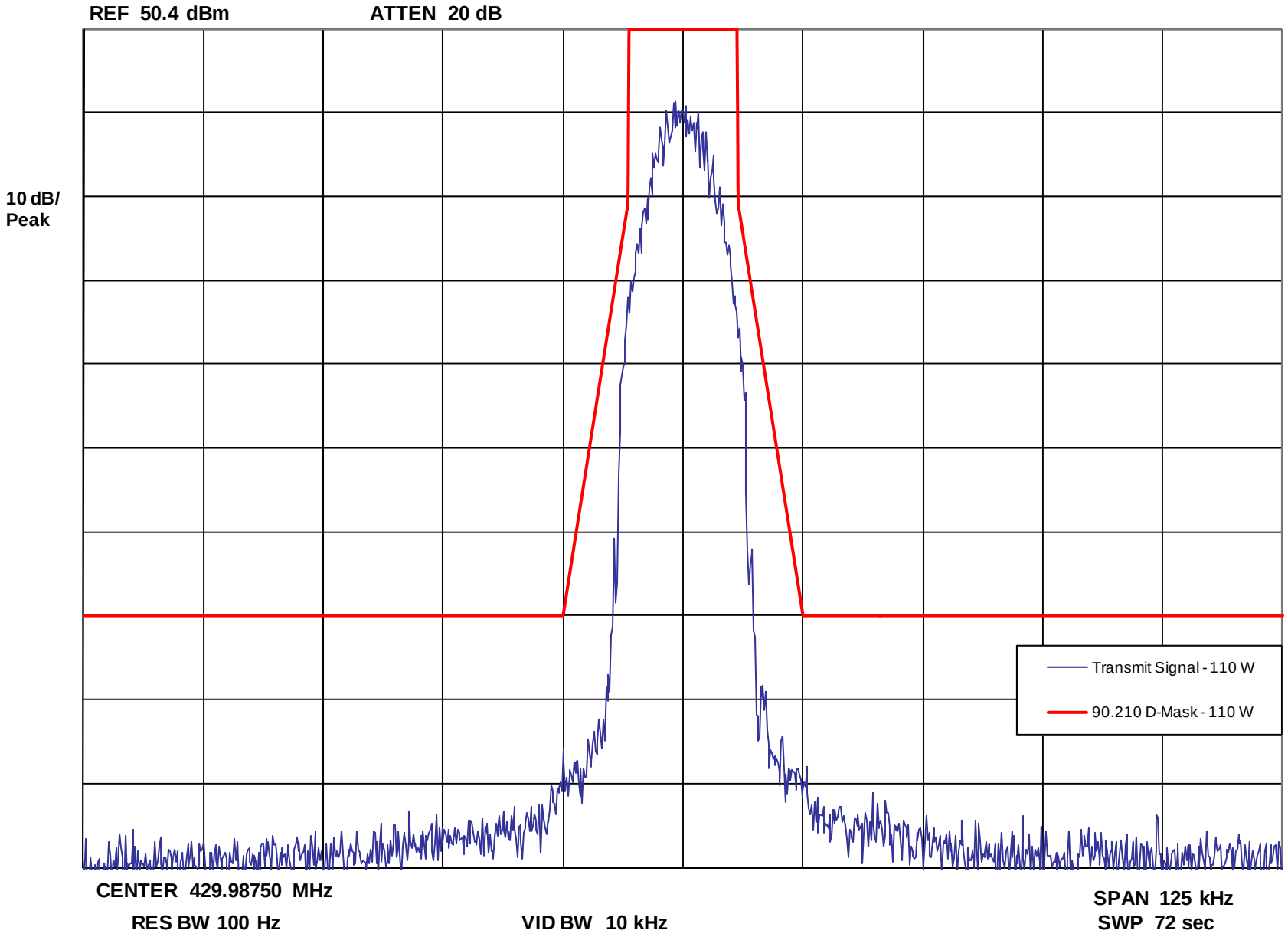
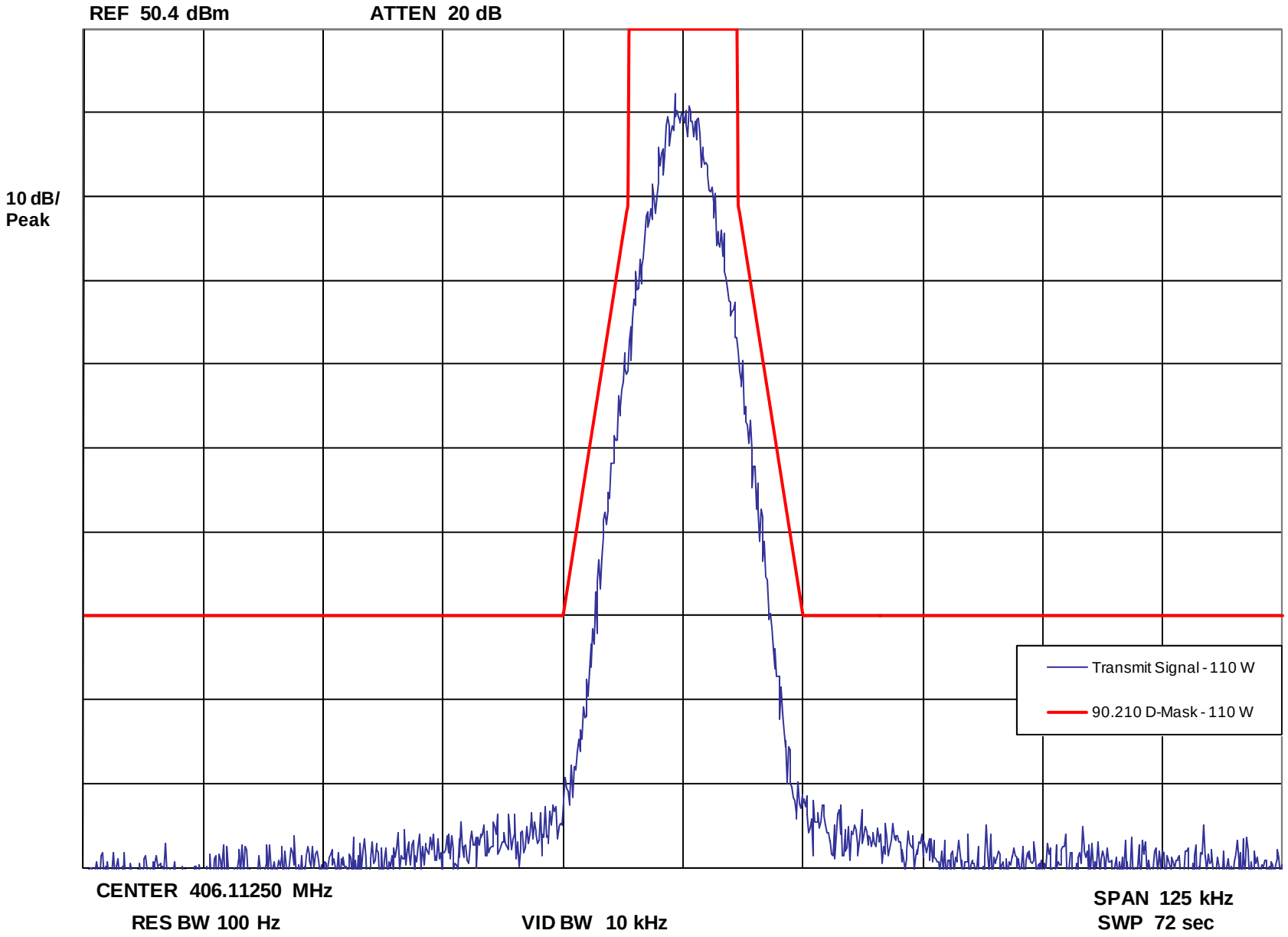


EXHIBIT E1-2.3

Report on Test Measurements

Occupied Bandwidth – Compatible 4-Level Frequency Modulation (C4FM) – Emission Designator: 8K10D1E, 8K10D1D, 8K10D1W, Low End of Band

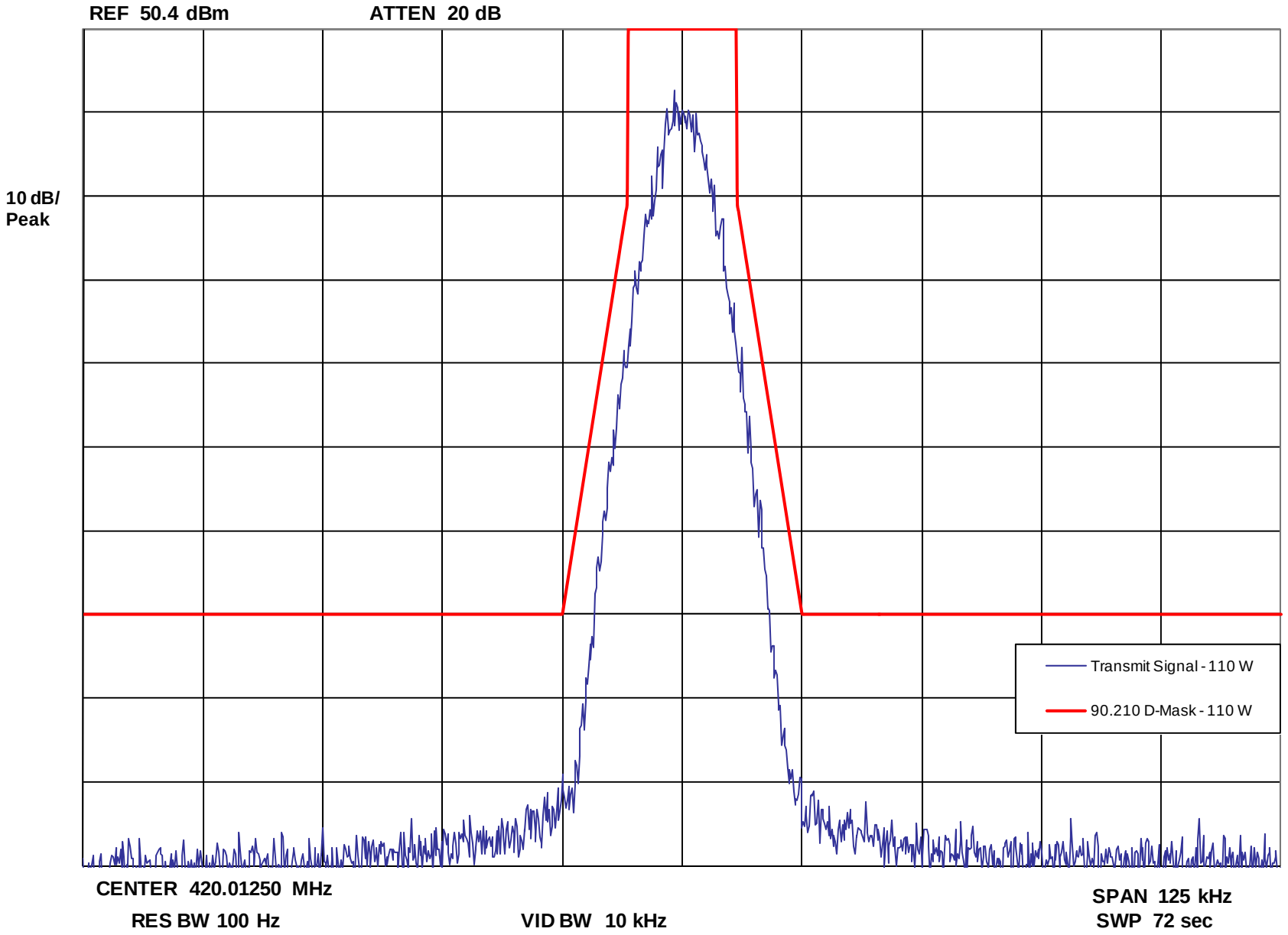
Occupied Bandwidth -- Compatible 4-Level Frequency Modulation - 110 Watts



Report on Test Measurements

Occupied Bandwidth – Compatible 4-Level Frequency Modulation (C4FM) – Emission Designator: 8K10D1E, 8K10D1D, 8K10D1W, Middle of Band

Occupied Bandwidth -- Compatible 4-Level Frequency Modulation - 110 Watts



Report on Test Measurements

Occupied Bandwidth – Compatible 4-Level Frequency Modulation (C4FM) – Emission Designator: 8K10D1E, 8K10D1D, 8K10D1W, High End of Band

Occupied Bandwidth -- Compatible 4-Level Frequency Modulation - 110 Watts

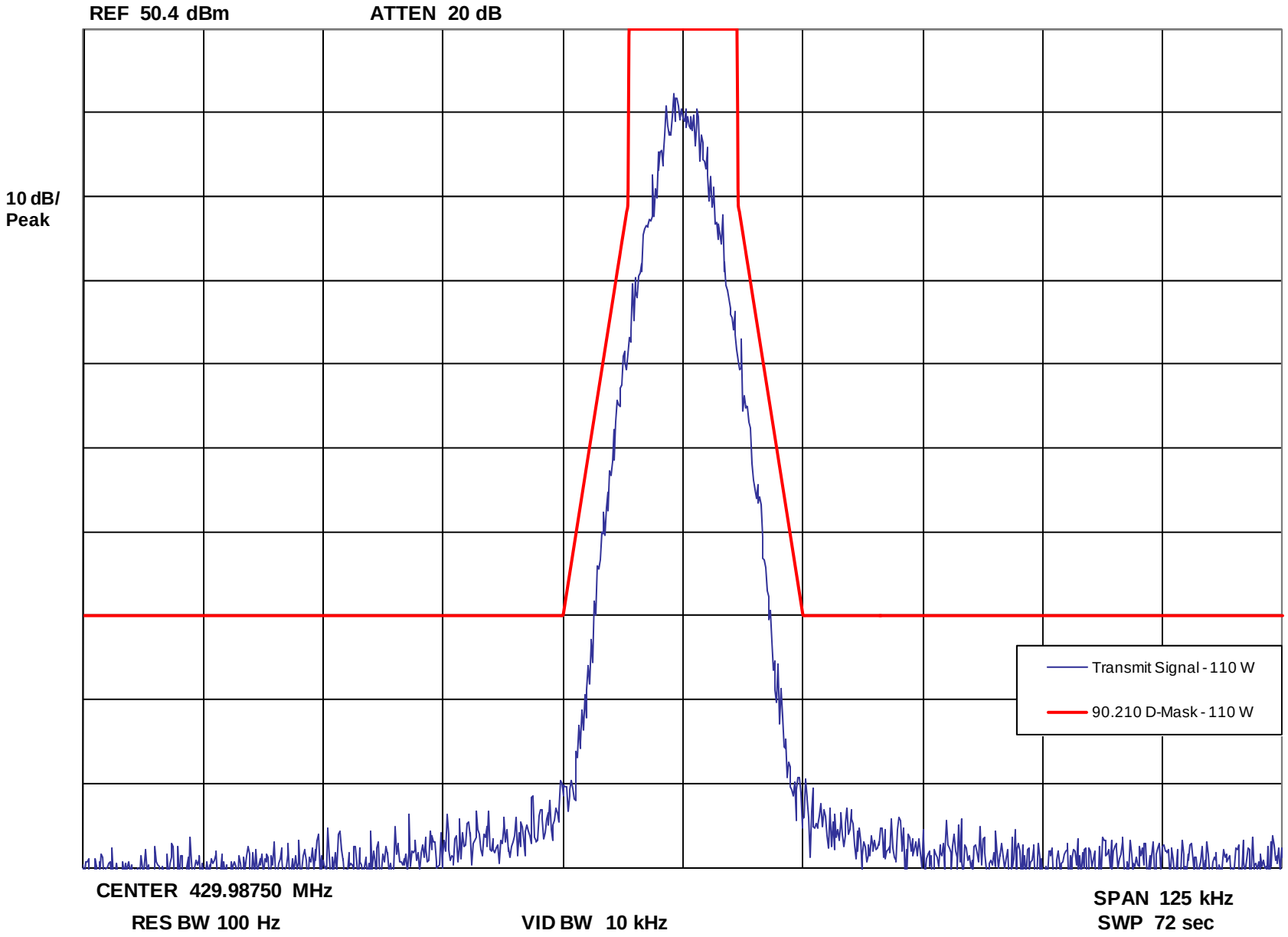
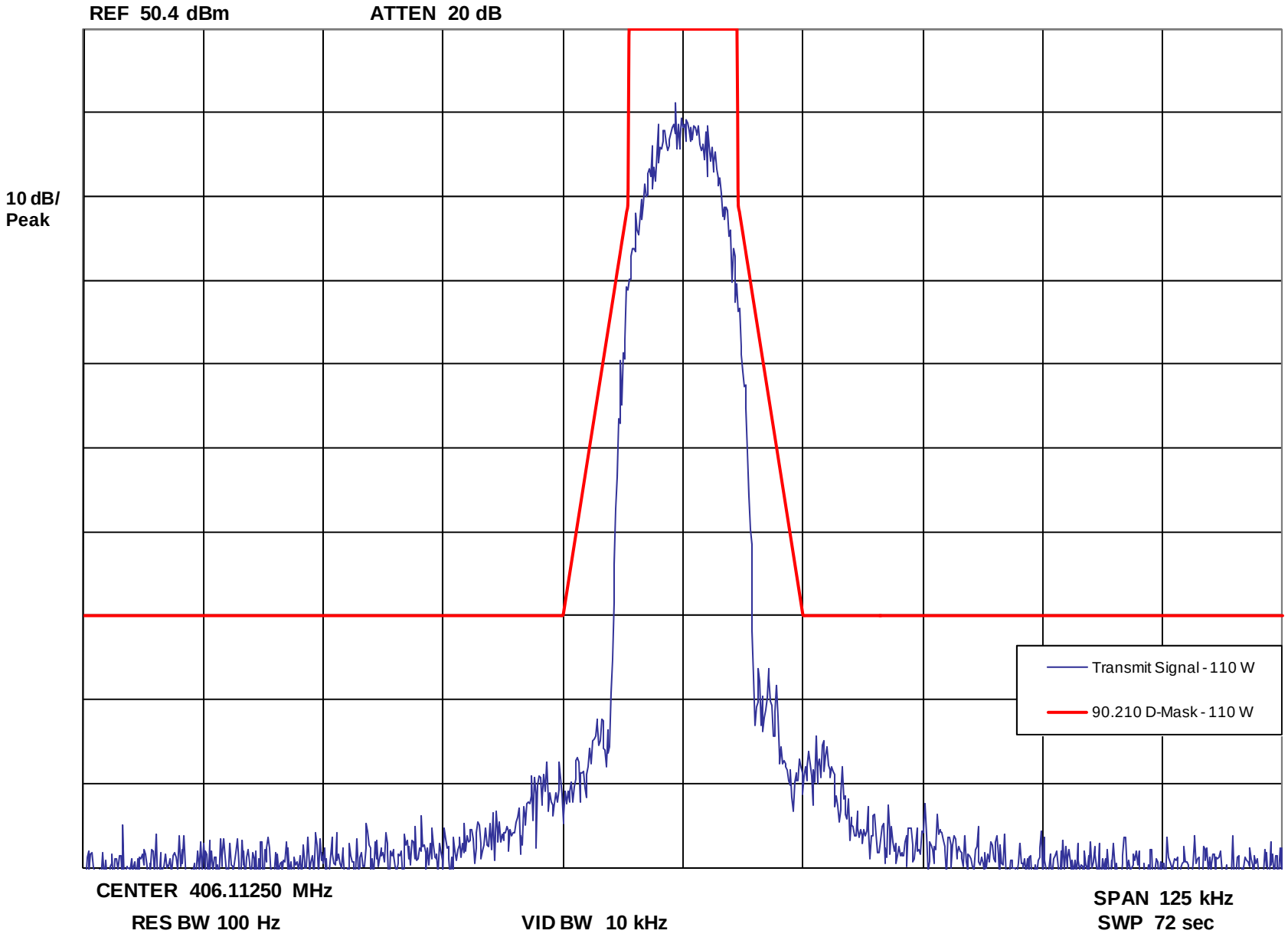


EXHIBIT E1-2.6

Report on Test Measurements

Occupied Bandwidth – H-DQPSK, P25 Two Slot TDMA Digital Modulation – Emission Designator: 9K80D7E, 9K80D7D, 9K80D7W, Low End of Band

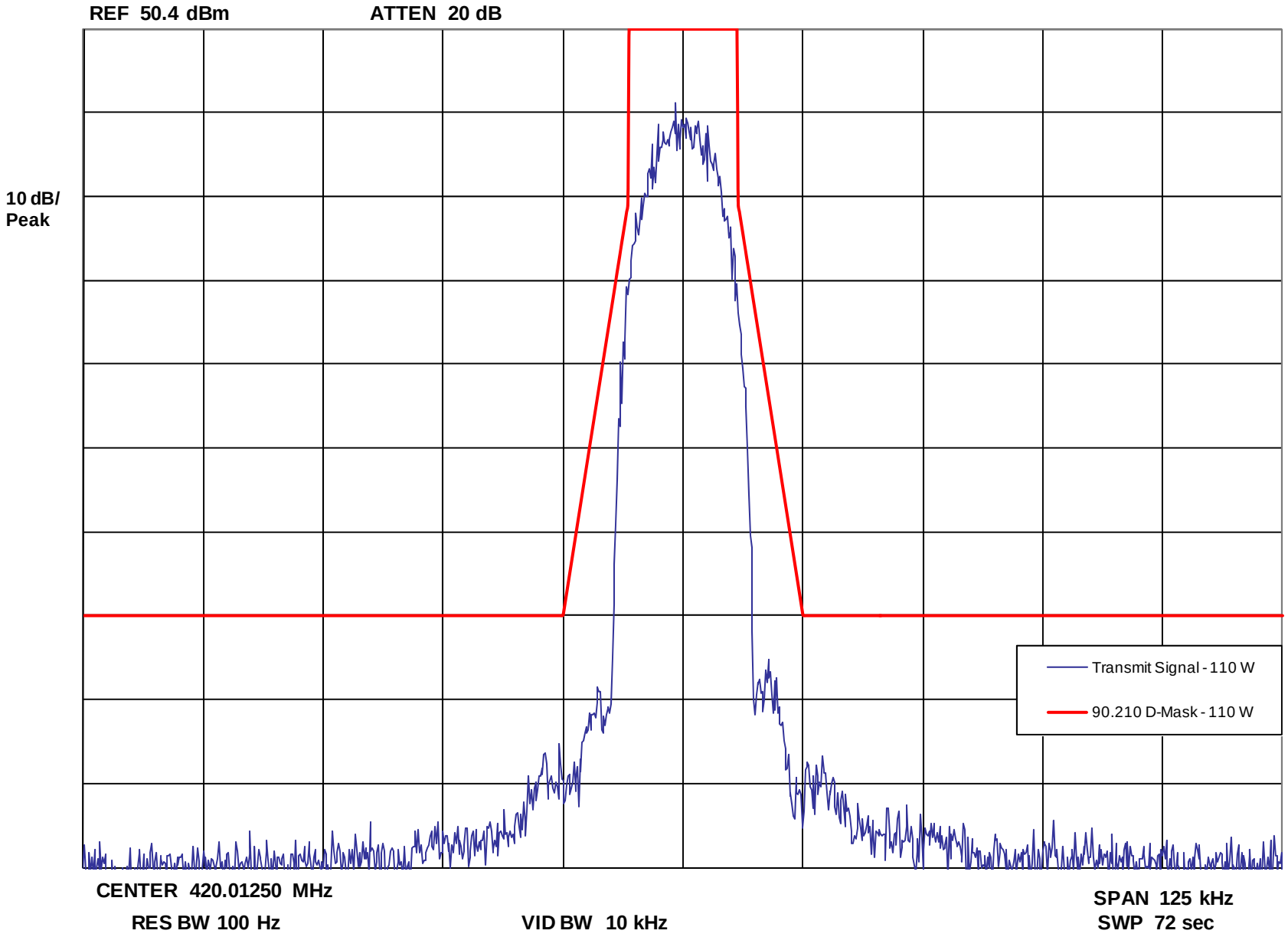
Occupied Bandwidth -- H-DQPSK P25 Two Slot TDMA Digital Modulation - 110 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – H-DQPSK, P25 Two Slot TDMA Digital Modulation – Emission Designator: 9K80D7E, 9K80D7D, 9K80D7W, Middle of Band

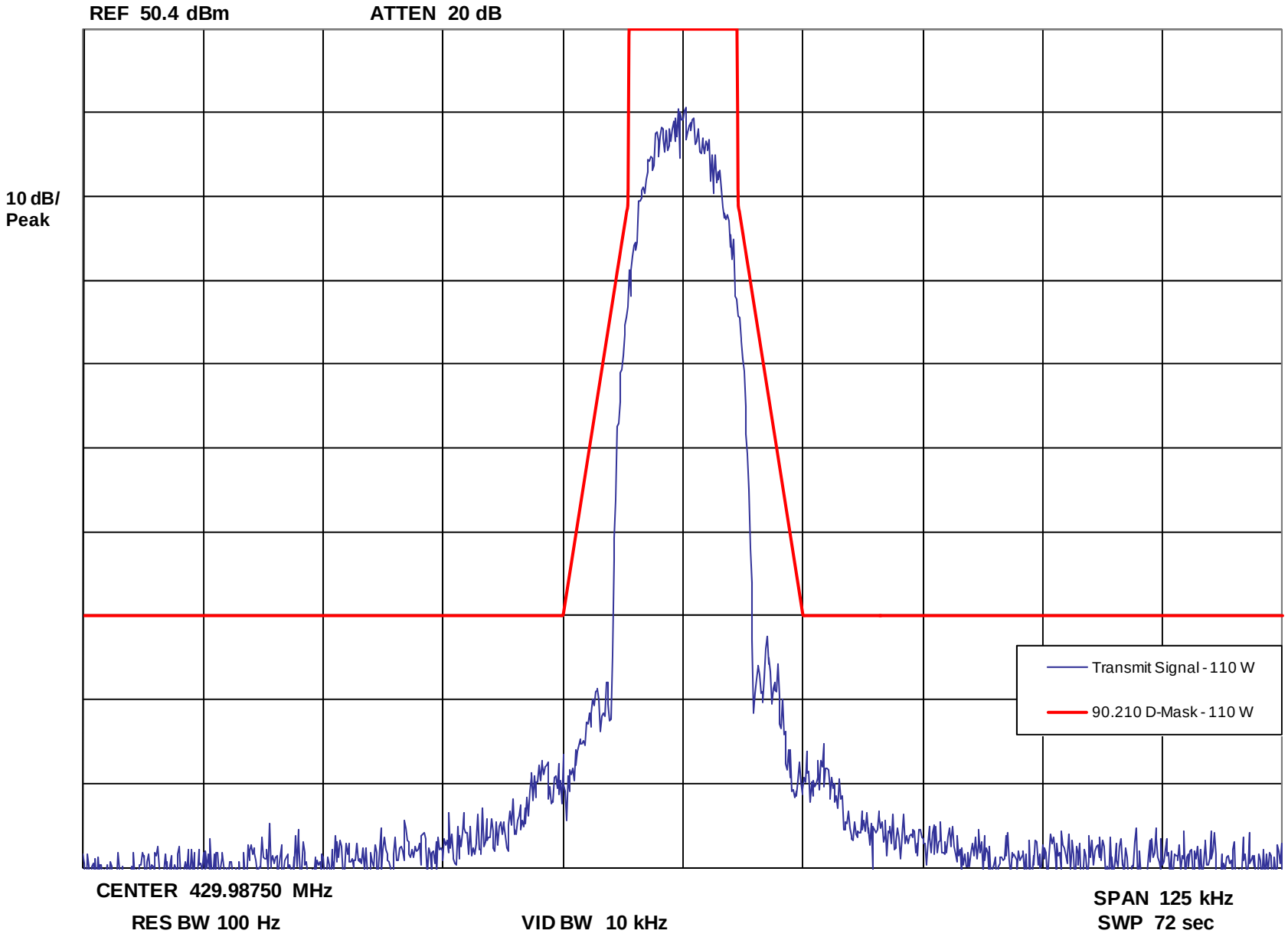
Occupied Bandwidth -- H-DQPSK P25 Two Slot TDMA Digital Modulation - 110 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – H-DQPSK, P25 Two Slot TDMA Digital Modulation – Emission Designator: 9K80D7E, 9K80D7D, 9K80D7W, High End of Band

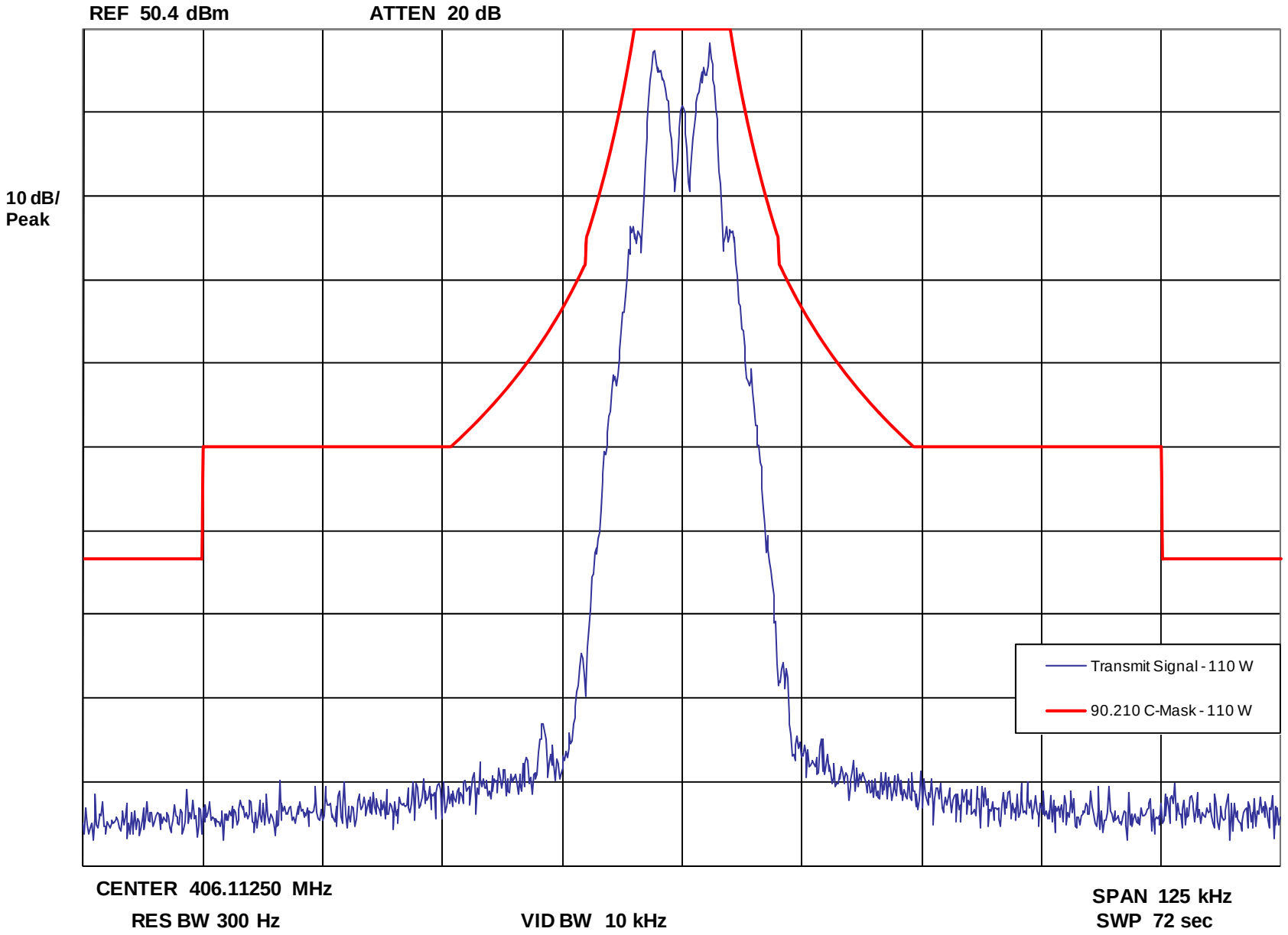
Occupied Bandwidth -- H-DQPSK P25 Two Slot TDMA Digital Modulation - 110 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels – Emission Designator: 16K0F1D, Low End of Band

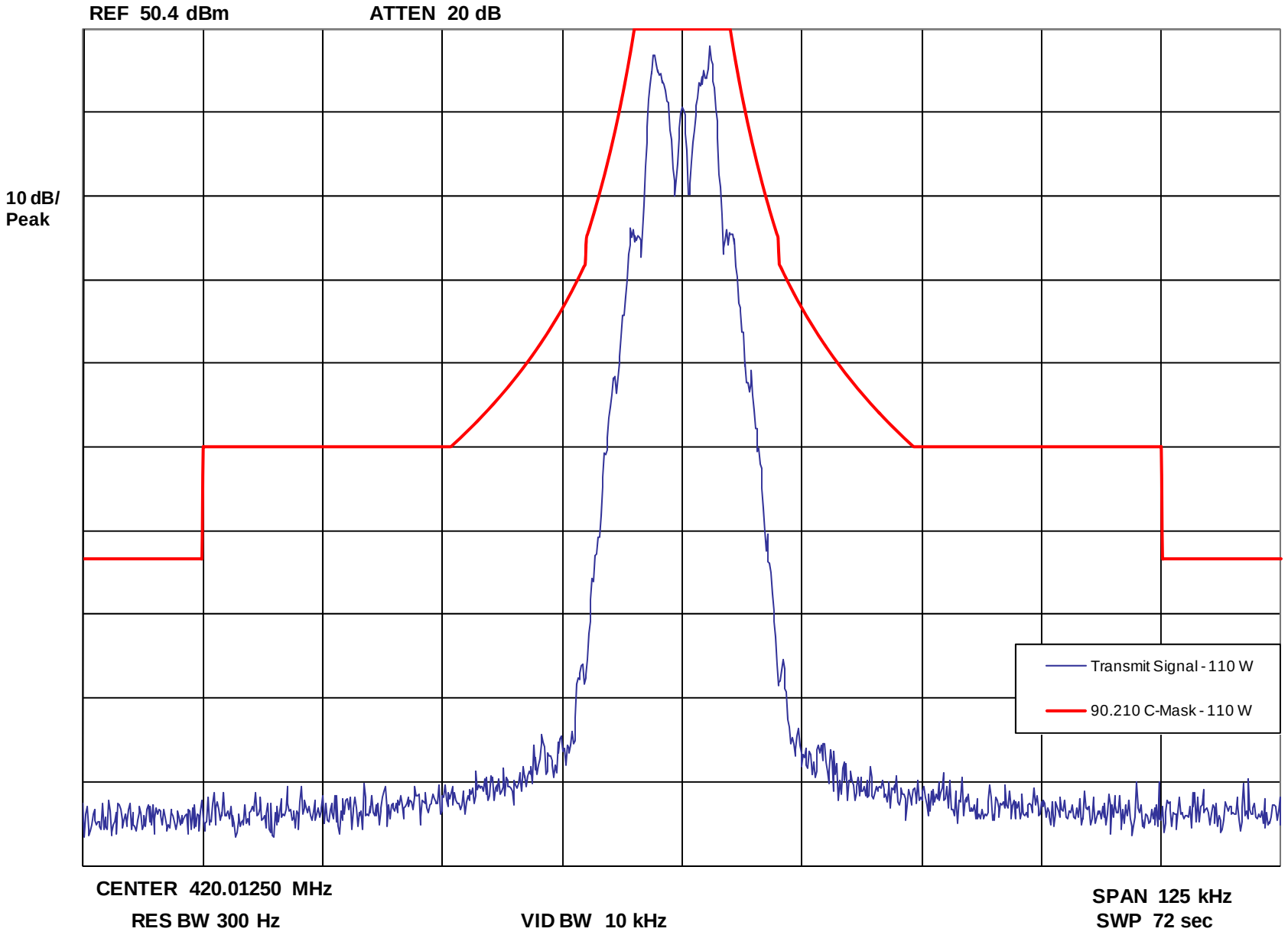
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 110 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels – Emission Designator: 16K0F1D, Middle of Band

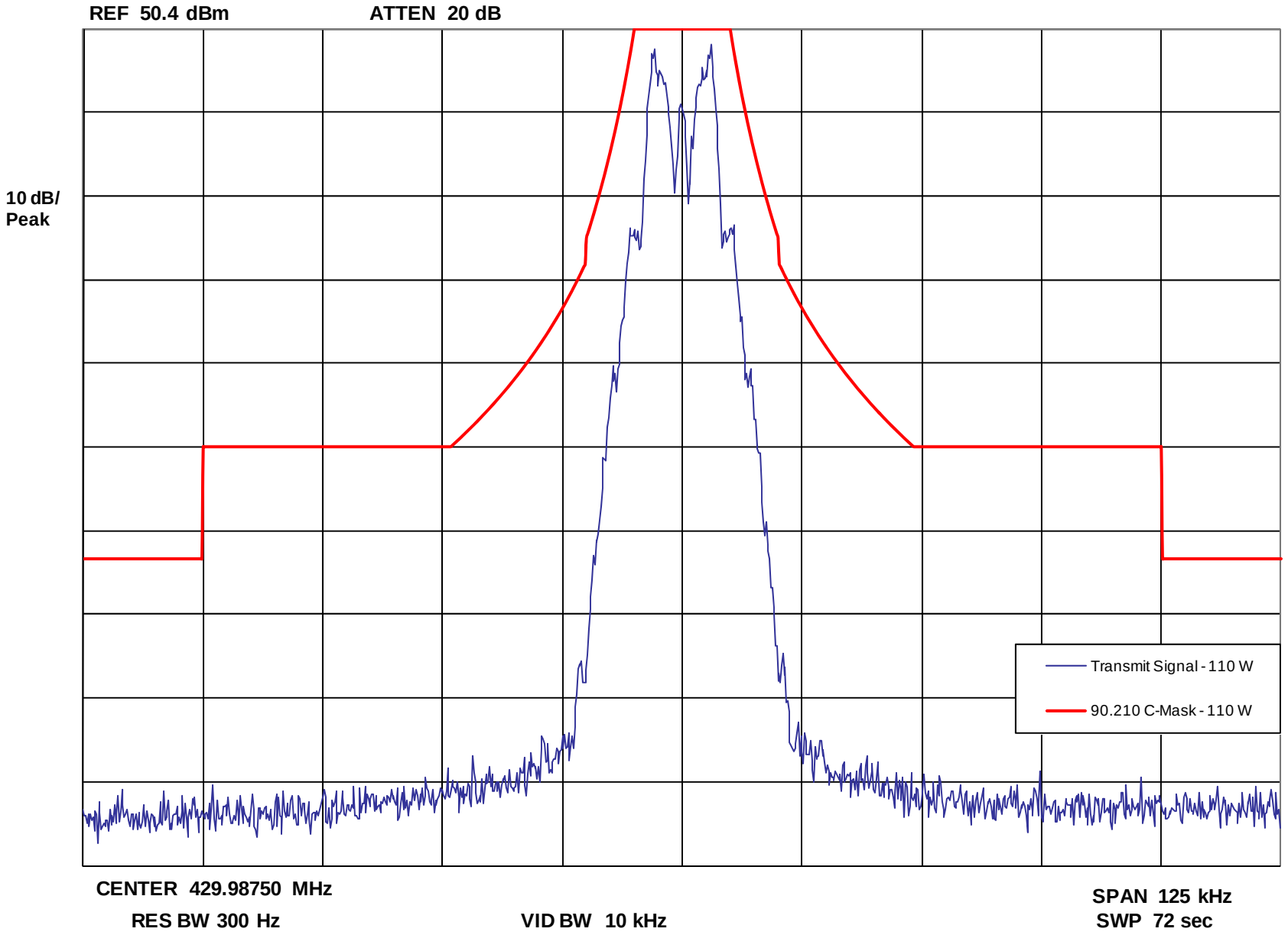
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 110 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 25 kHz Channels – Emission Designator: 16K0F1D, High End of Band

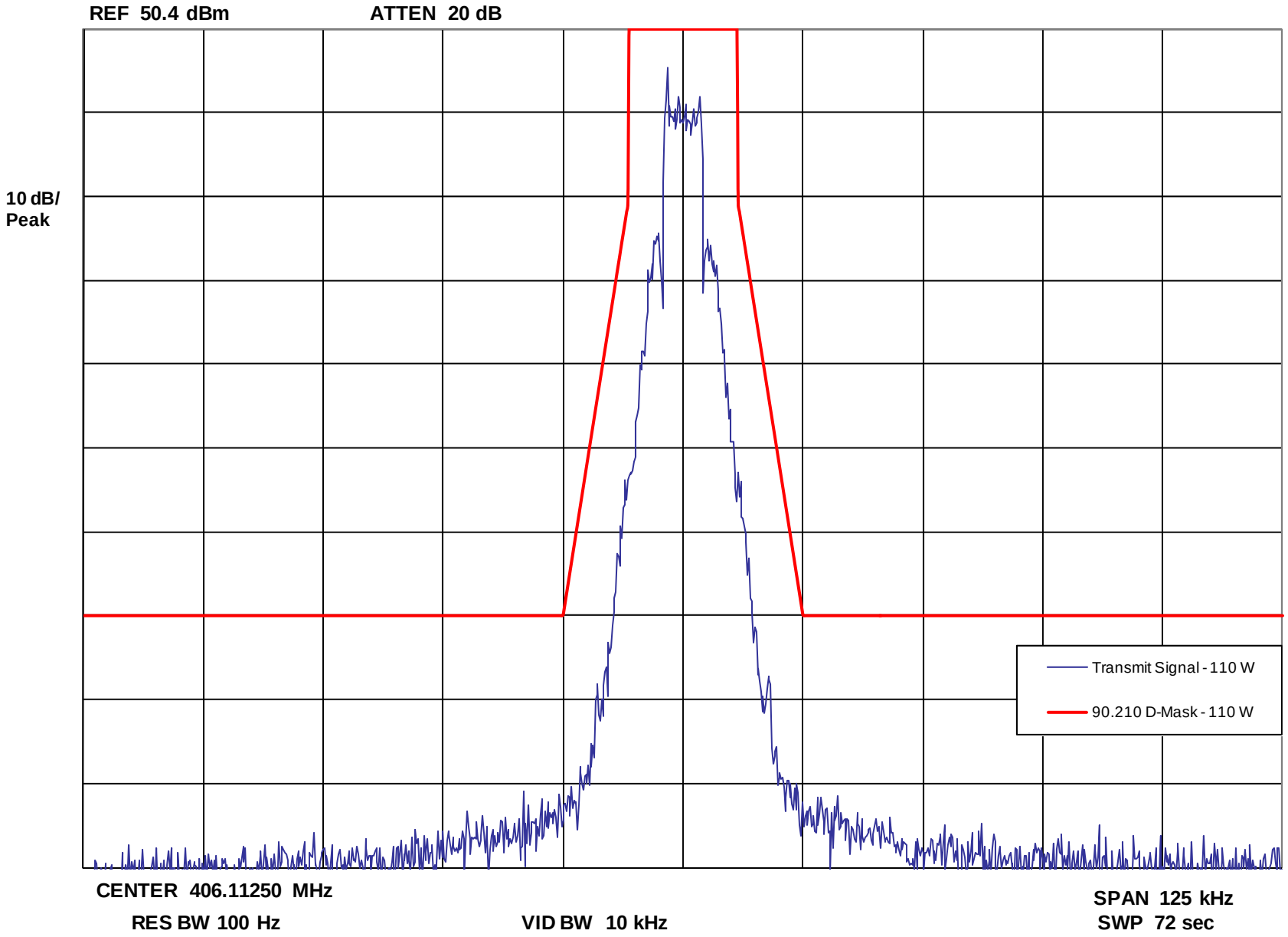
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 110 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels – Emission Designator: 10K0F1D, Low End of Band

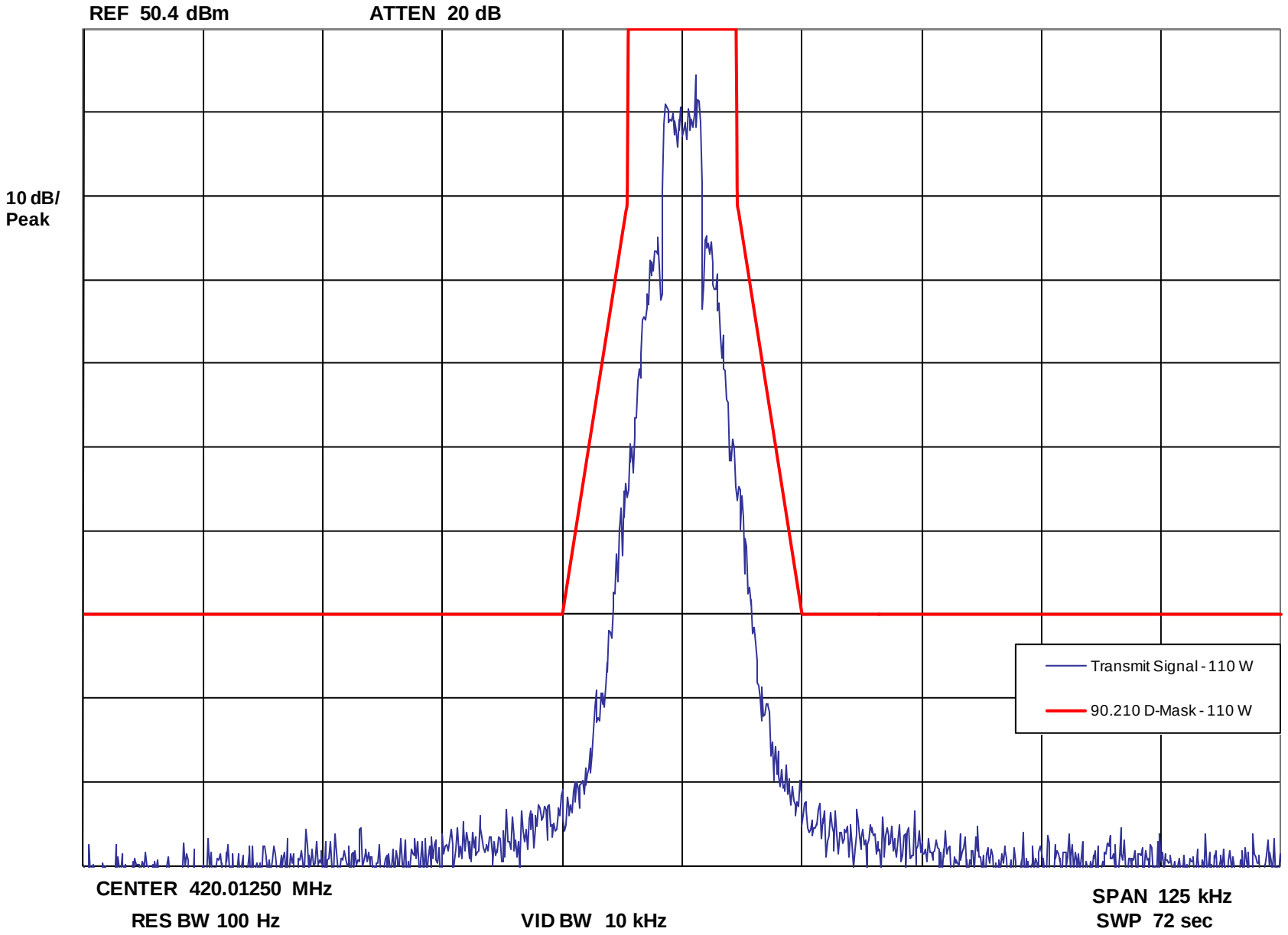
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 110 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels – Emission Designator: 10K0F1D, Middle of Band

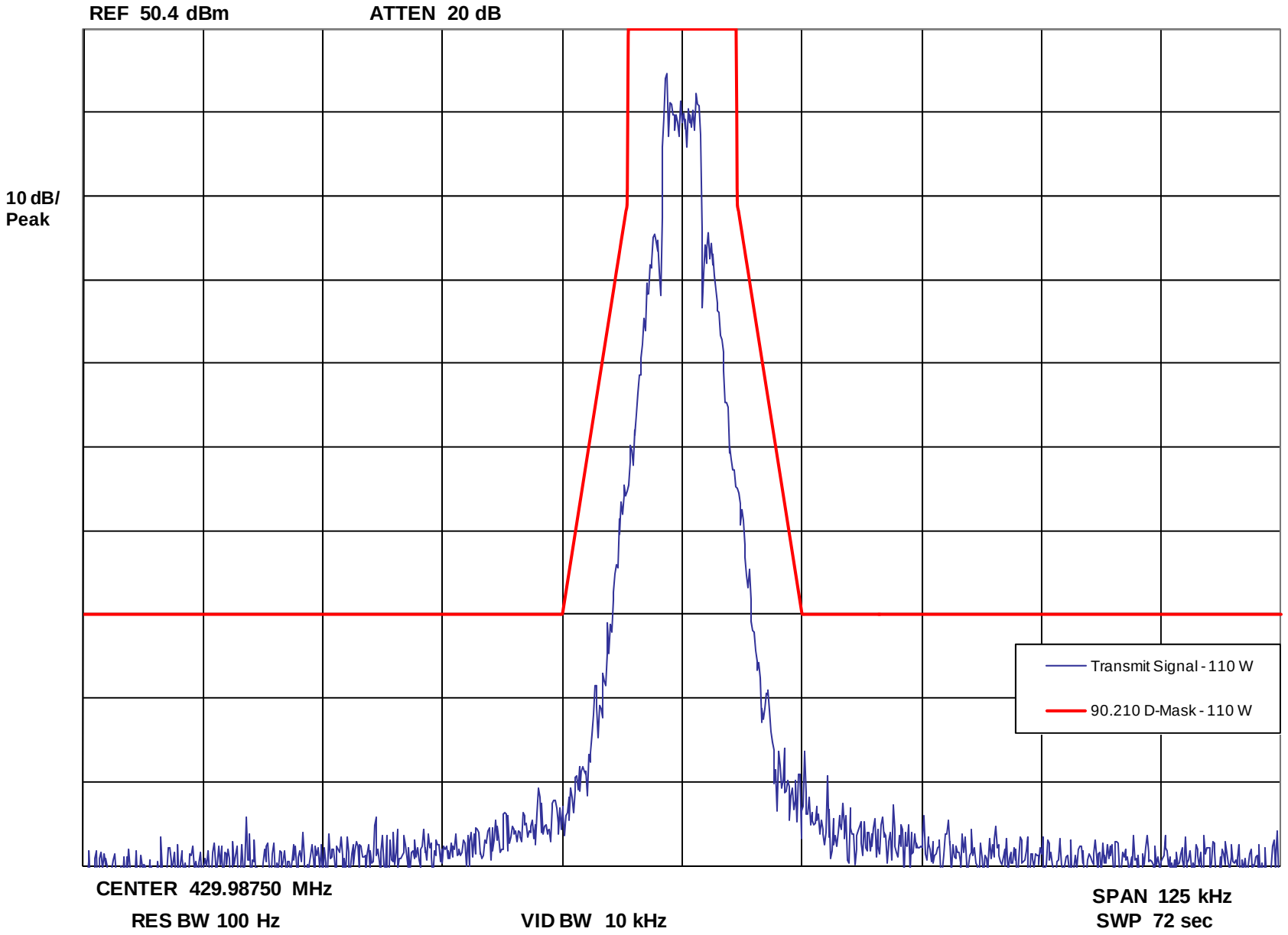
Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 110 Watts



Report on Test Measurements

Occupied Bandwidth – Trunking Control Data 3600 bps FSK Modulation, 12.5 kHz Channels – Emission Designator: 10K0F1D, High End of Band

Occupied Bandwidth -- Trunking Control Data - 3600 bps FSK Modulation - 110 Watts



Report on Test Measurements

Conducted Spurious Emissions – Harmonics and Emission Spectrum

Specification Requirement 47 CFR §90.210(b) and IC RSS-119 section 5.8.1 - Emission Limits – "B-Mask":
For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:

On any frequency removed from the assigned frequency by a displacement frequency (F_d in kHz) of:
c) >50 kHz *at least 43+10 * Log_{10} (P) dB.*

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D:* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

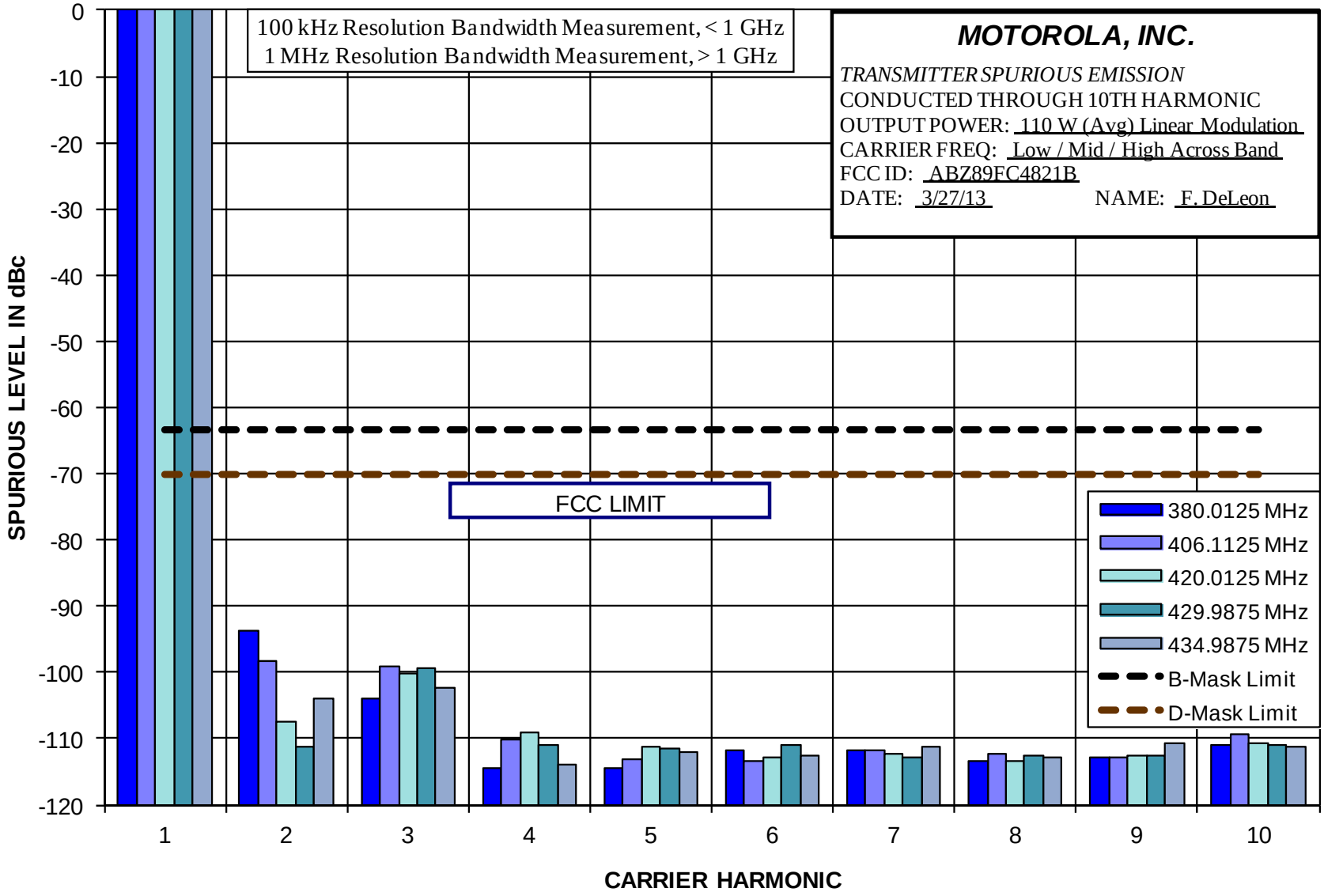
Modulation: Linear Simulcast Modulation (LSM), or Compatible 4-Level Frequency Modulation (C4FM) – Pseudorandom data, or Analog Frequency Modulation as indicated

Carrier Frequencies: Carrier frequencies of 380.0125, 406.1125, 420.0125, 429.9875, and 434.9875 MHz were measured for conducted carrier harmonics. These frequencies represent the low end, center, and high end of the 380-435 MHz band, and are representative of the full operating band. Carrier frequencies of 406.1125, 420.0125, 429.9875 MHz were measured for conducted spurious emission measurements (and only the worst case specification limit shown).

EXHIBIT	DESCRIPTION
E1-3.1	Conducted Spurious Harmonic Emissions, Power Output 110 Watts (Average), LSM The specification limit is -70.0 dBc
E1-3.2	Conducted Spurious Harmonic Emissions, Power Output 2 Watts (Average), LSM The specification limit is -53.0 dBc
E1-3.3	Conducted Spurious Harmonic Emissions, Power Output 110 Watts, C4FM The specification limit is -70.0 dBc
E1-3.4	Conducted Spurious Harmonic Emissions, Power Output 2 Watts, C4FM The specification limit is -53.0 dBc
E1-3.5	Conducted Spurious Harmonic Emissions, Power Output 110 Watts, Analog The specification limit is -70.0 dBc
E1-3.6	Conducted Spurious Harmonic Emissions, Power Output 2 Watts, Analog The specification limit is -53.0 dBc
E1-3.7, 8, 9	Conducted Spurious Emission Spectrum, 200 MHz Span, Power Output at 110 Watts, LSM The specification limit is -70.0 dBc
E1-3.10, 11, 12	Conducted Spurious Emission Spectrum, 200 MHz Span, Power Output at 110 Watts, C4FM The specification limit is -70.0 dBc
E1-3.13, 14, 15	Conducted Spurious Emission Spectrum, 200 MHz Span, Power Output at 110 Watts, Analog The specification limit is -70.0 dBc

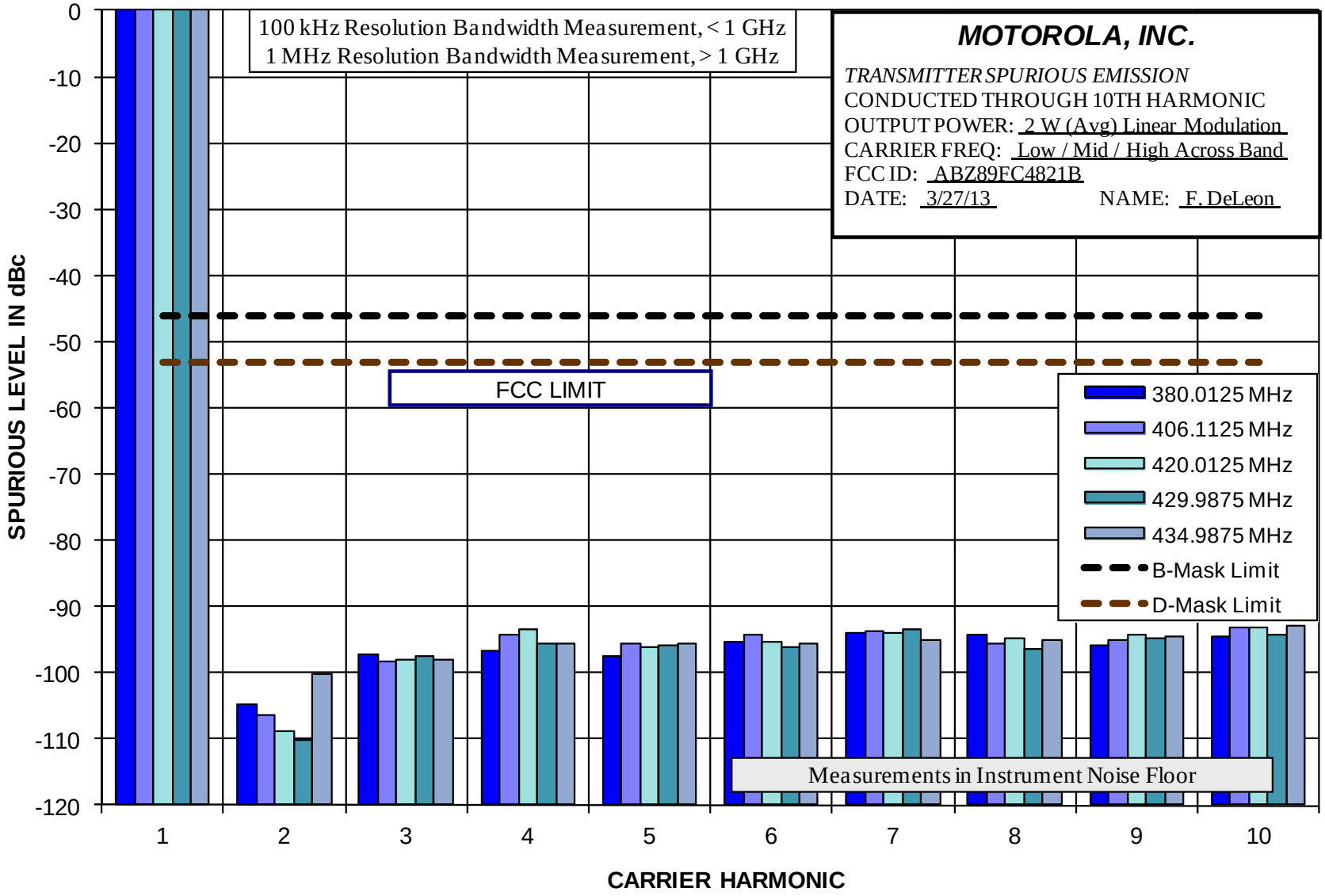
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 110 Watts (Average) LSM



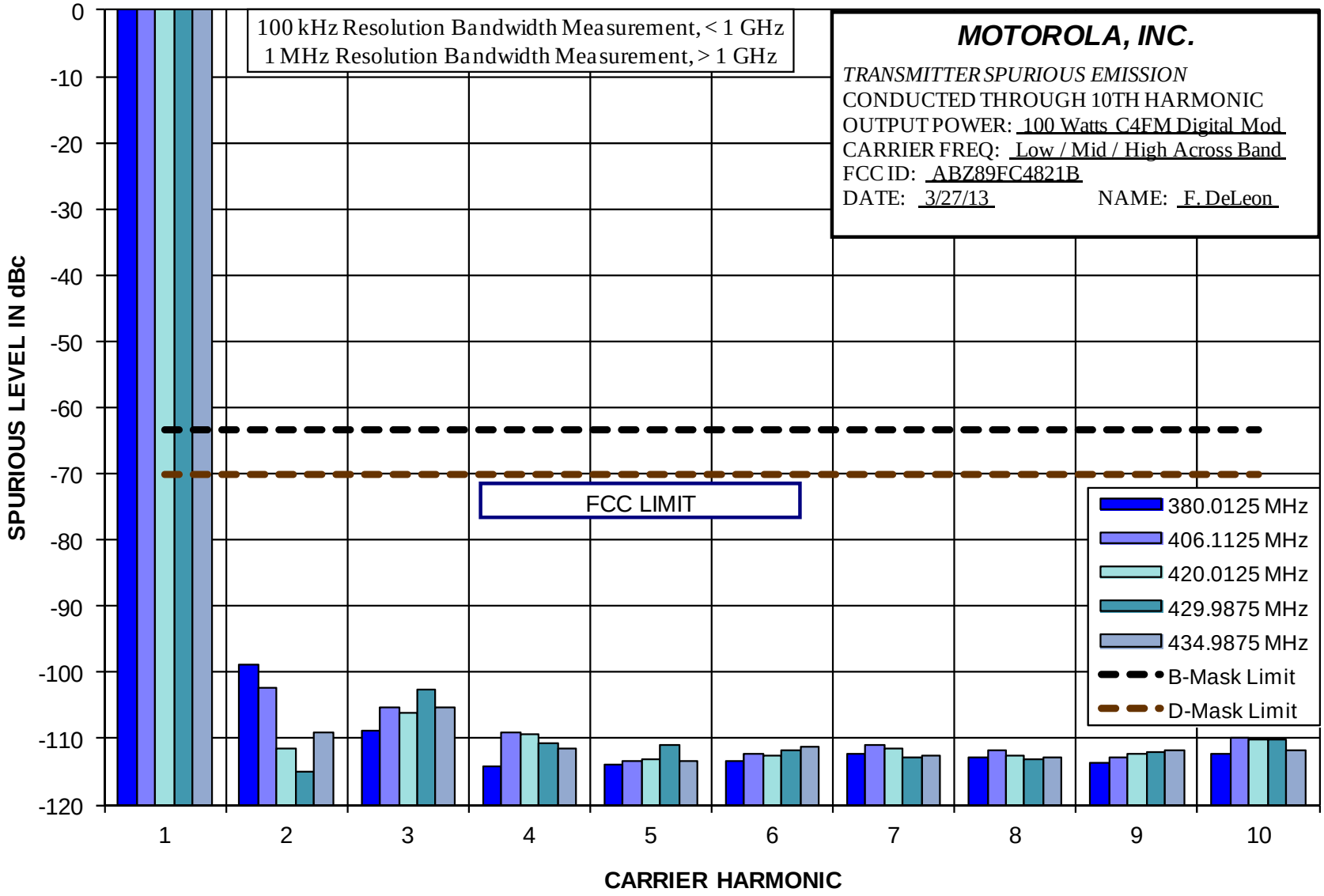
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 2 Watts (Average) LSM



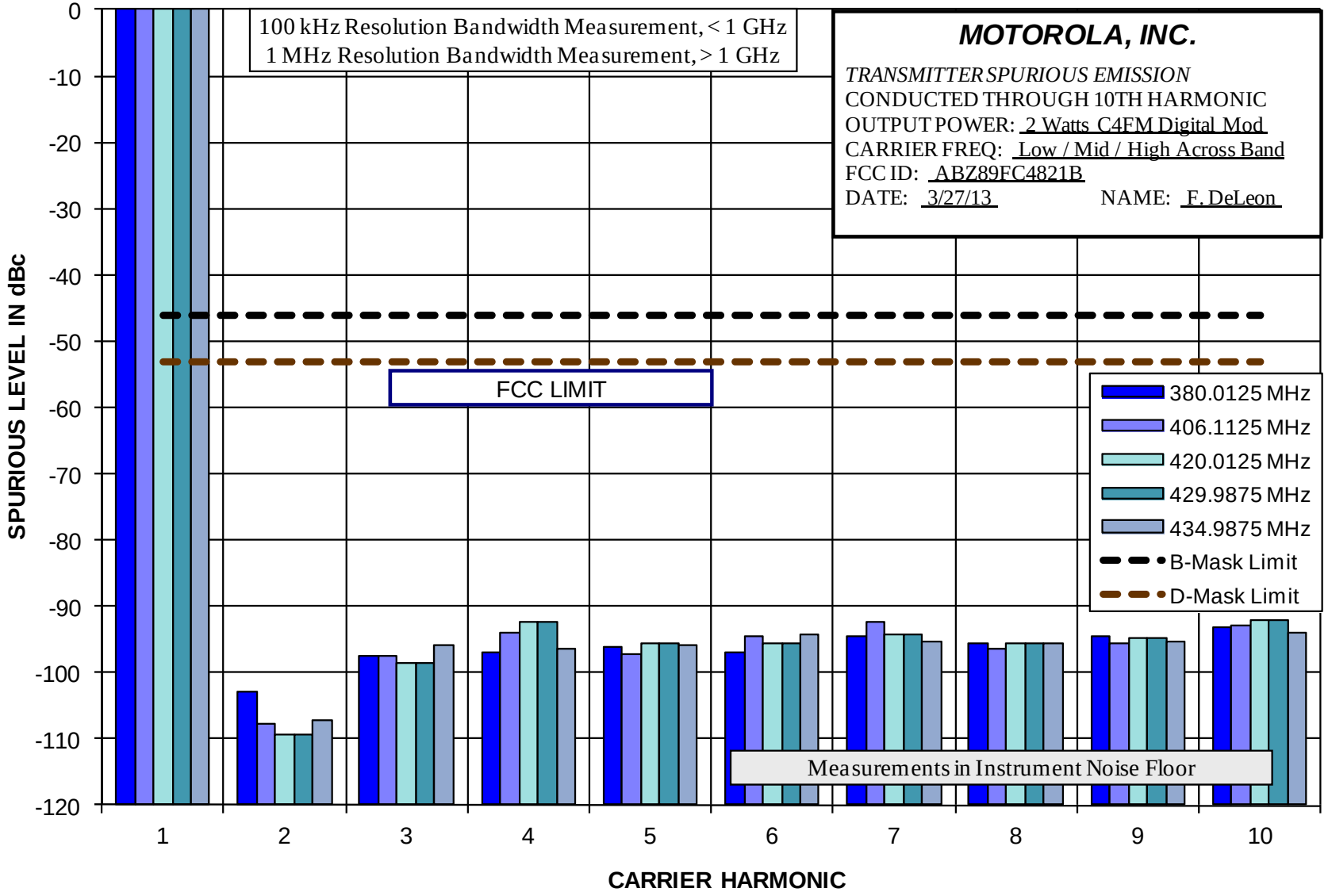
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 110 Watts – Compatible 4-Level Frequency Modulation (C4FM)



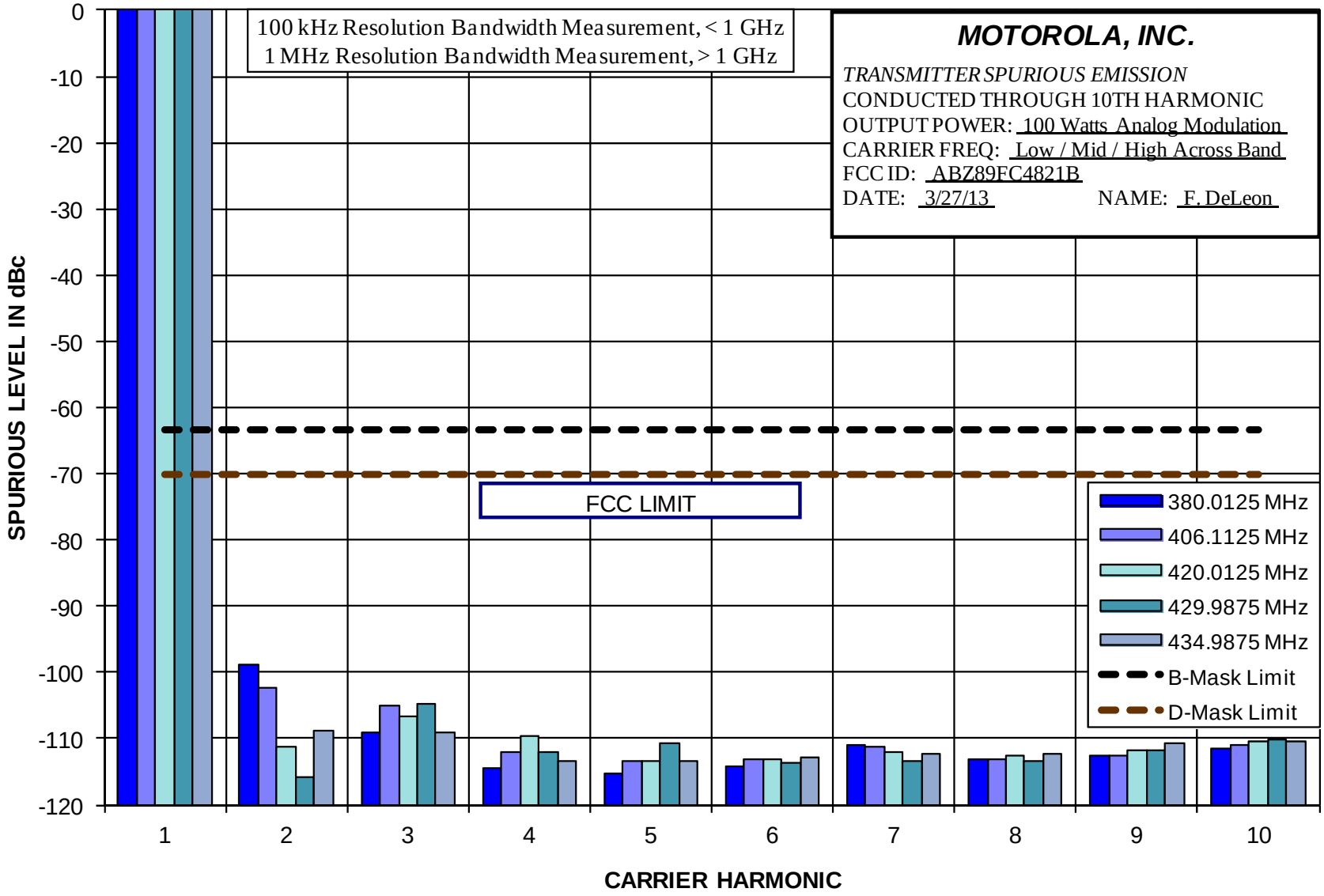
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 2 Watts – Compatible 4-Level Frequency Modulation (C4FM)



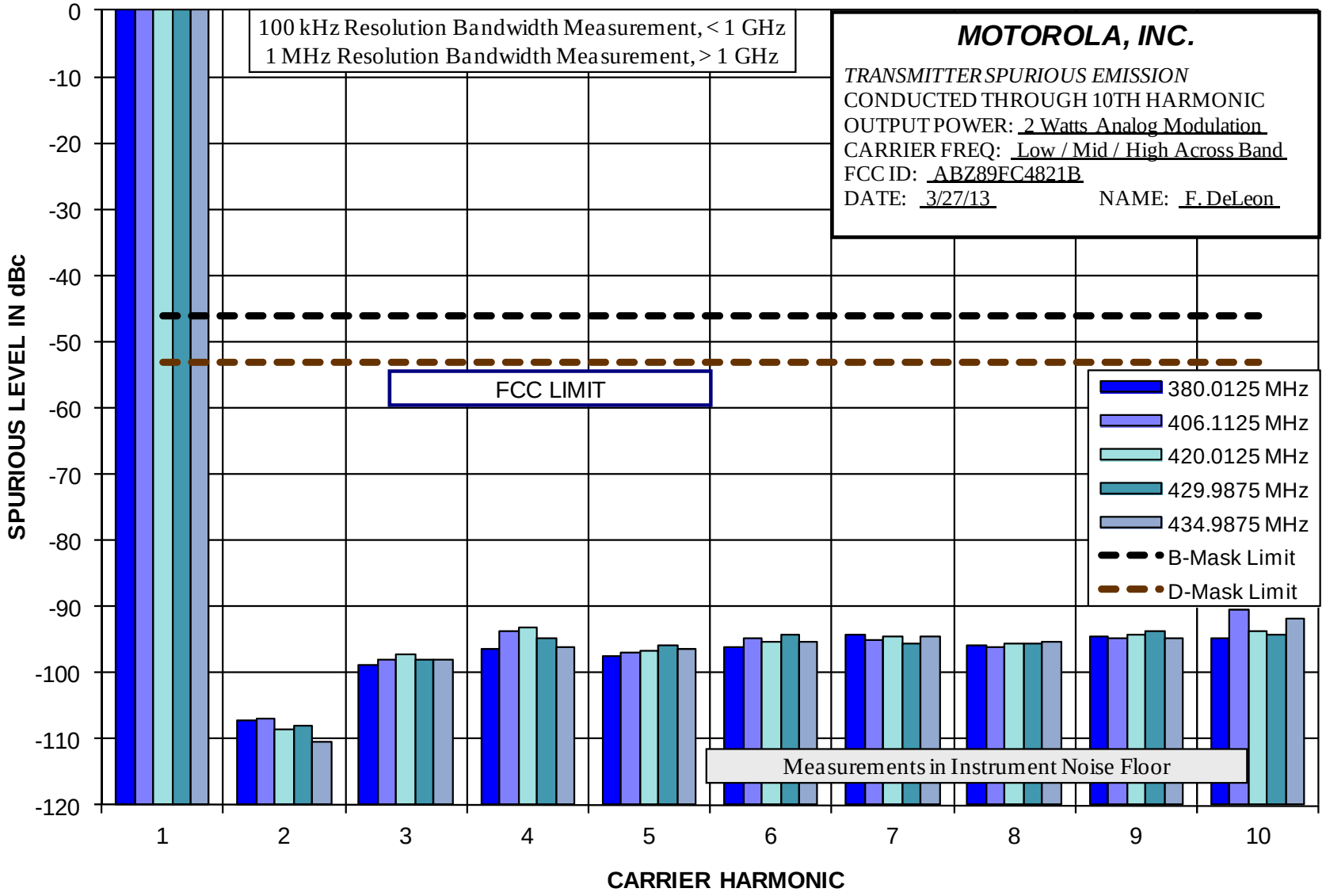
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 110 Watts Analog



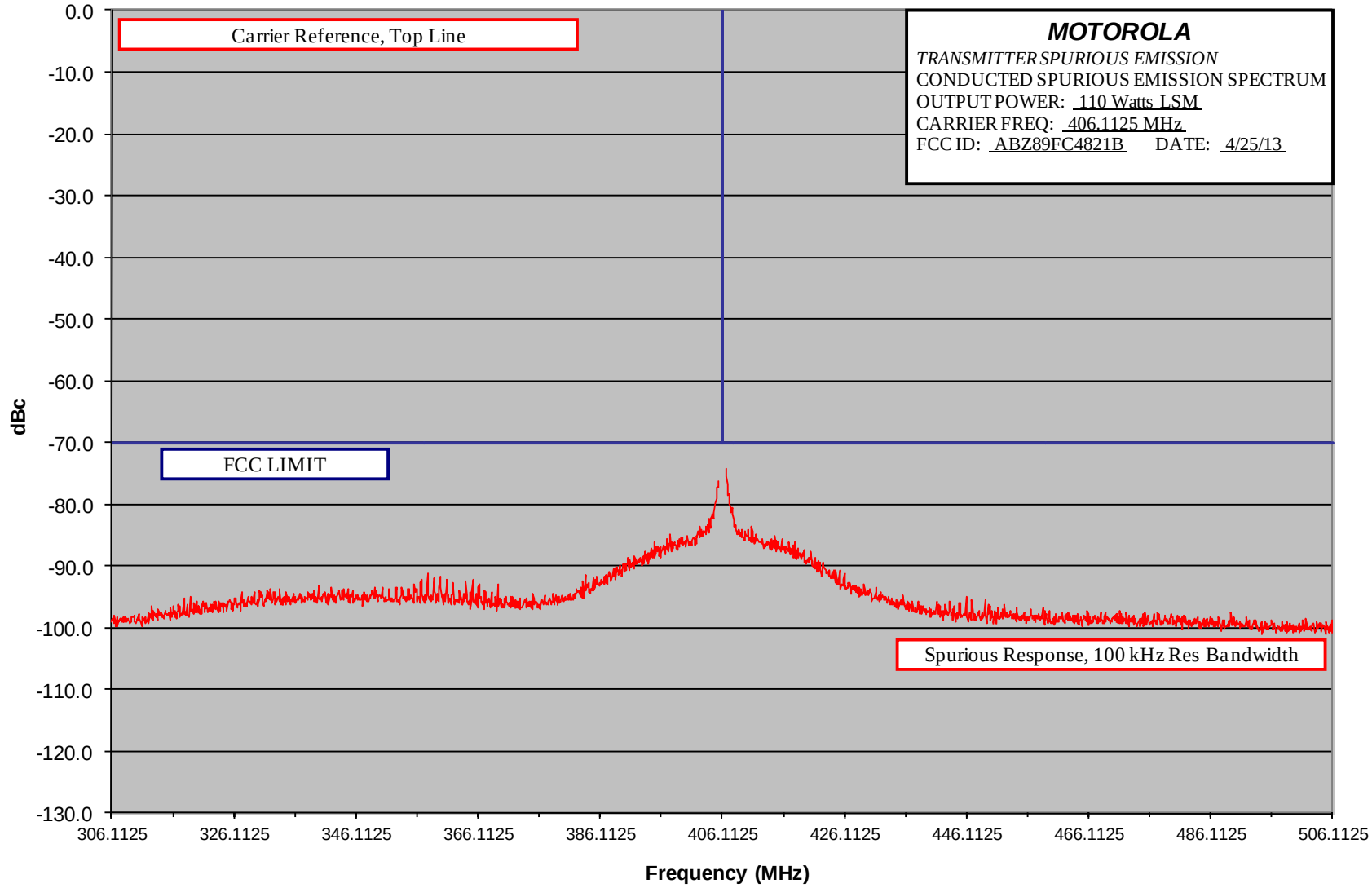
Report on Test Measurements

Conducted Spurious Harmonic Emissions – 2 Watts Analog



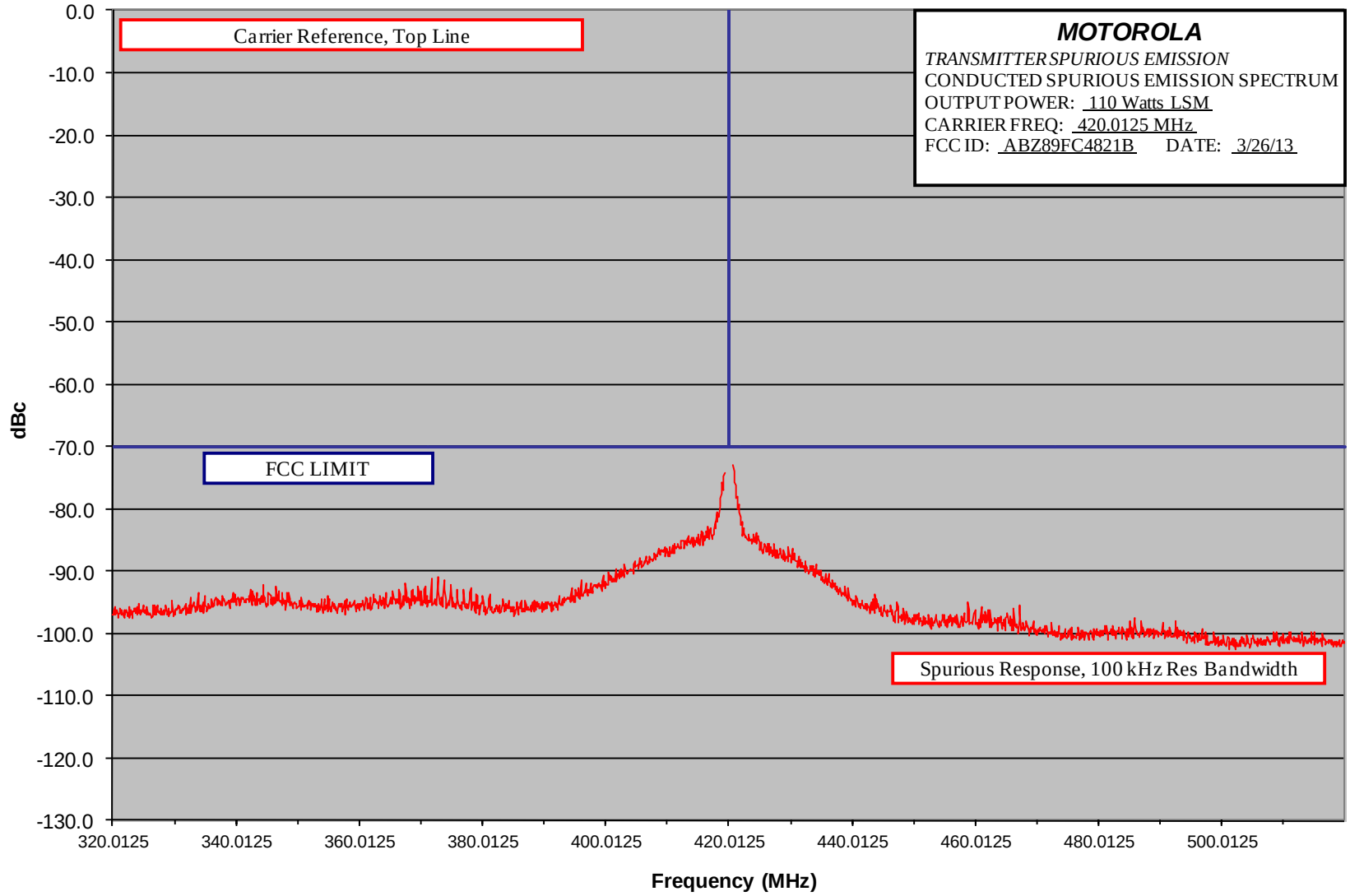
Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts (Average) LSM – 200 MHz Span – Low End of Band



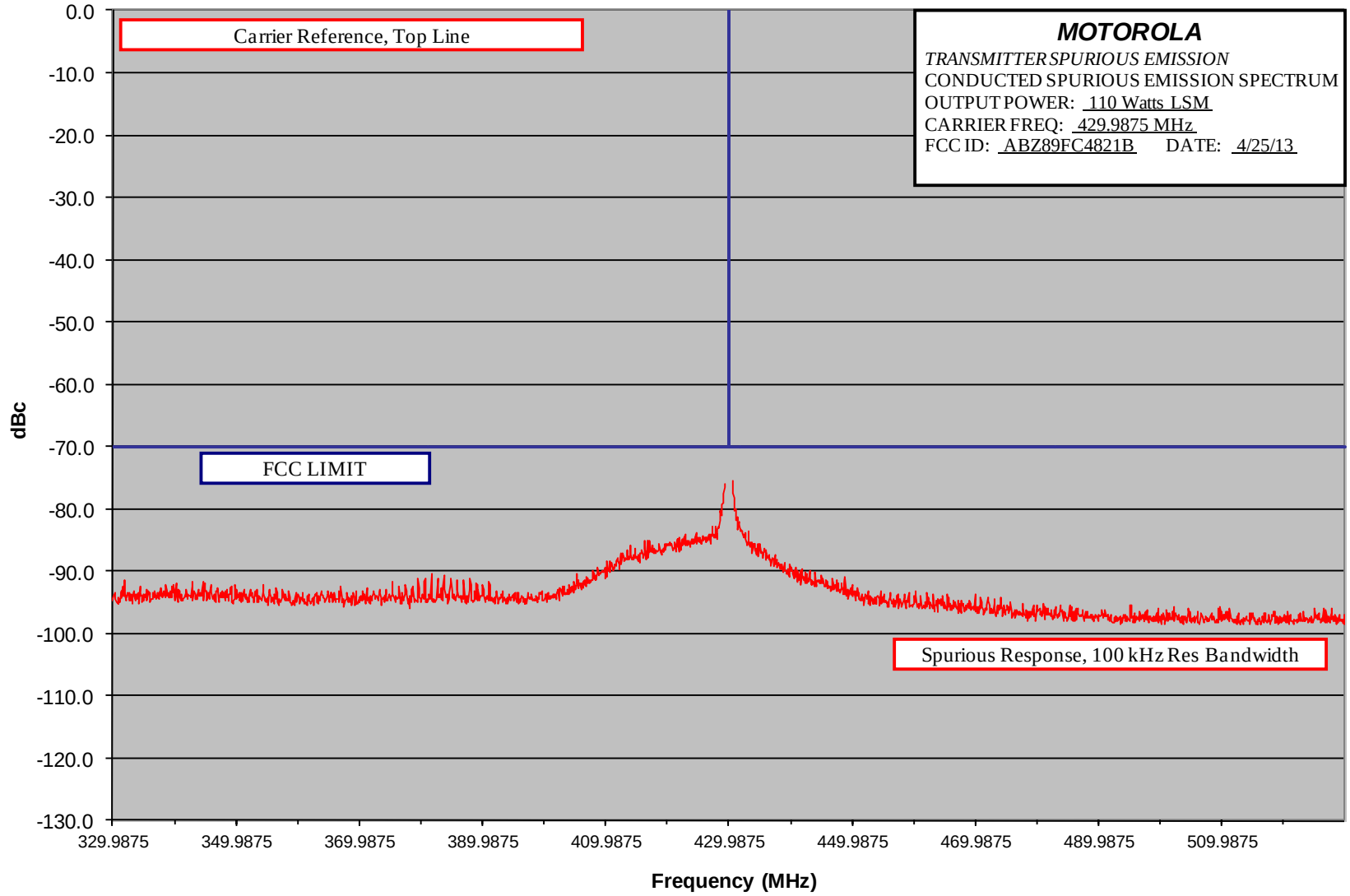
Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts (Average) LSM – 200 MHz Span – Middle of Band



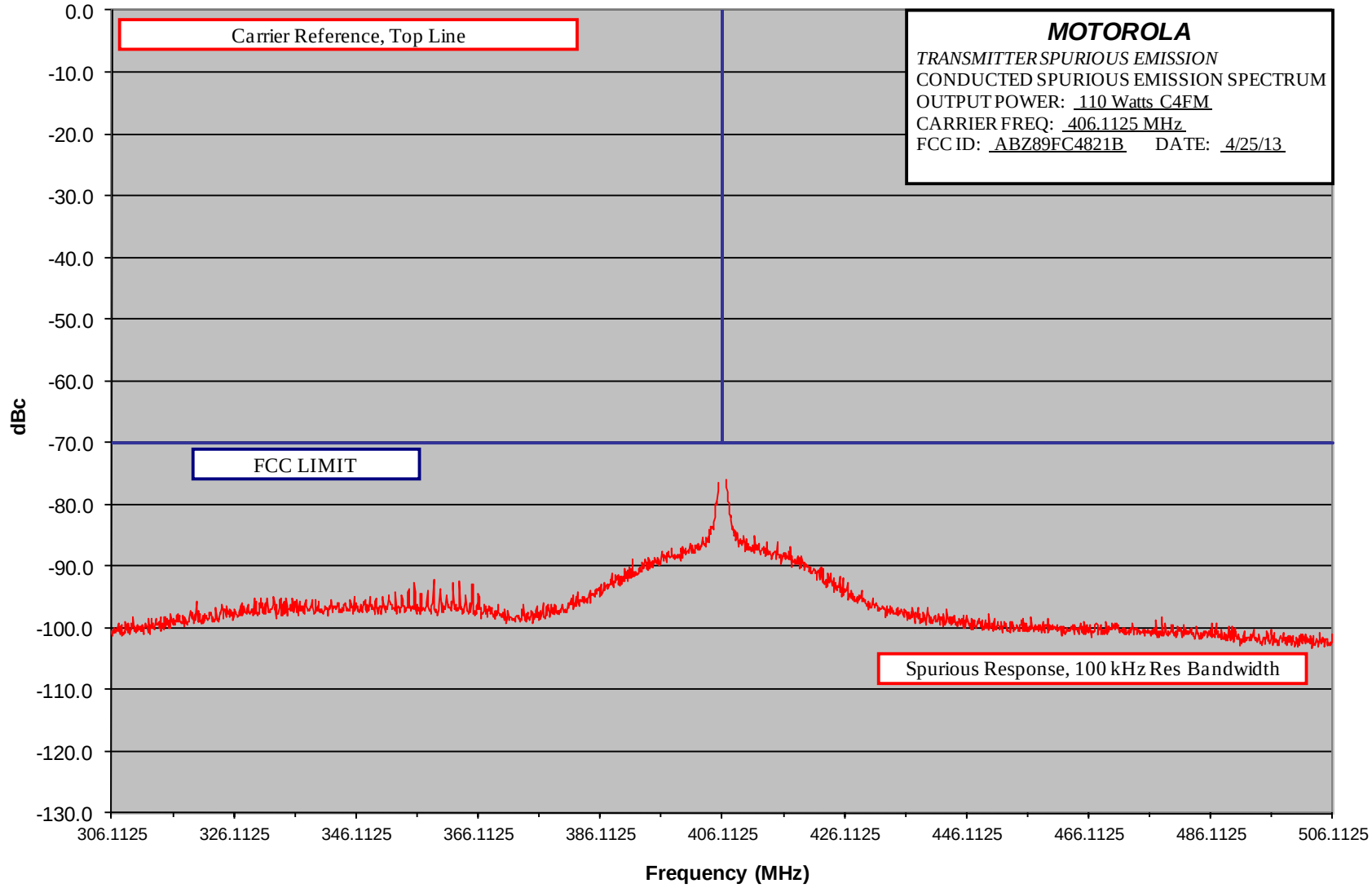
Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts (Average) LSM – 200 MHz Span – High End of Band



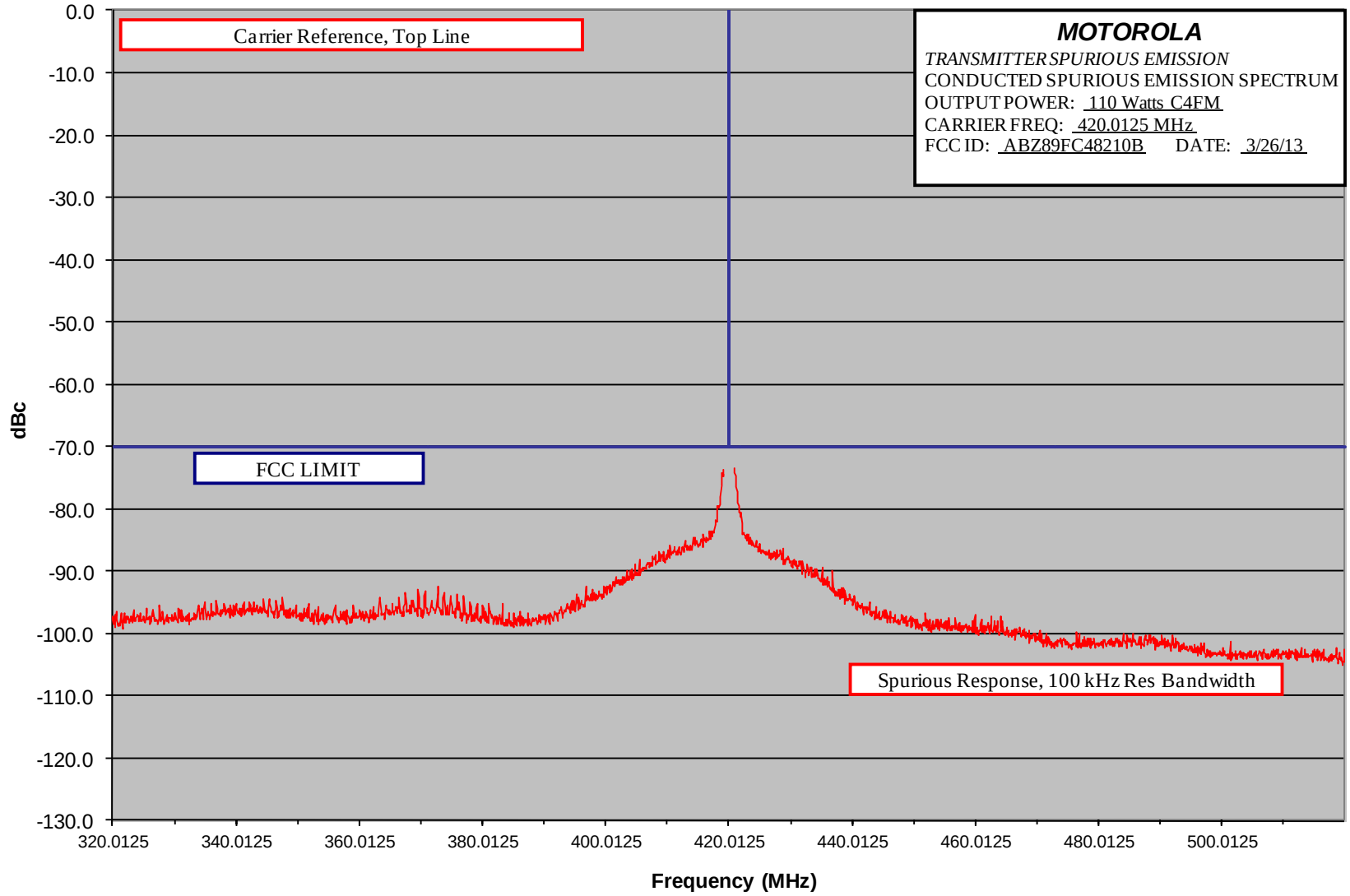
Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts C4FM – 200 MHz Span – Low End of Band



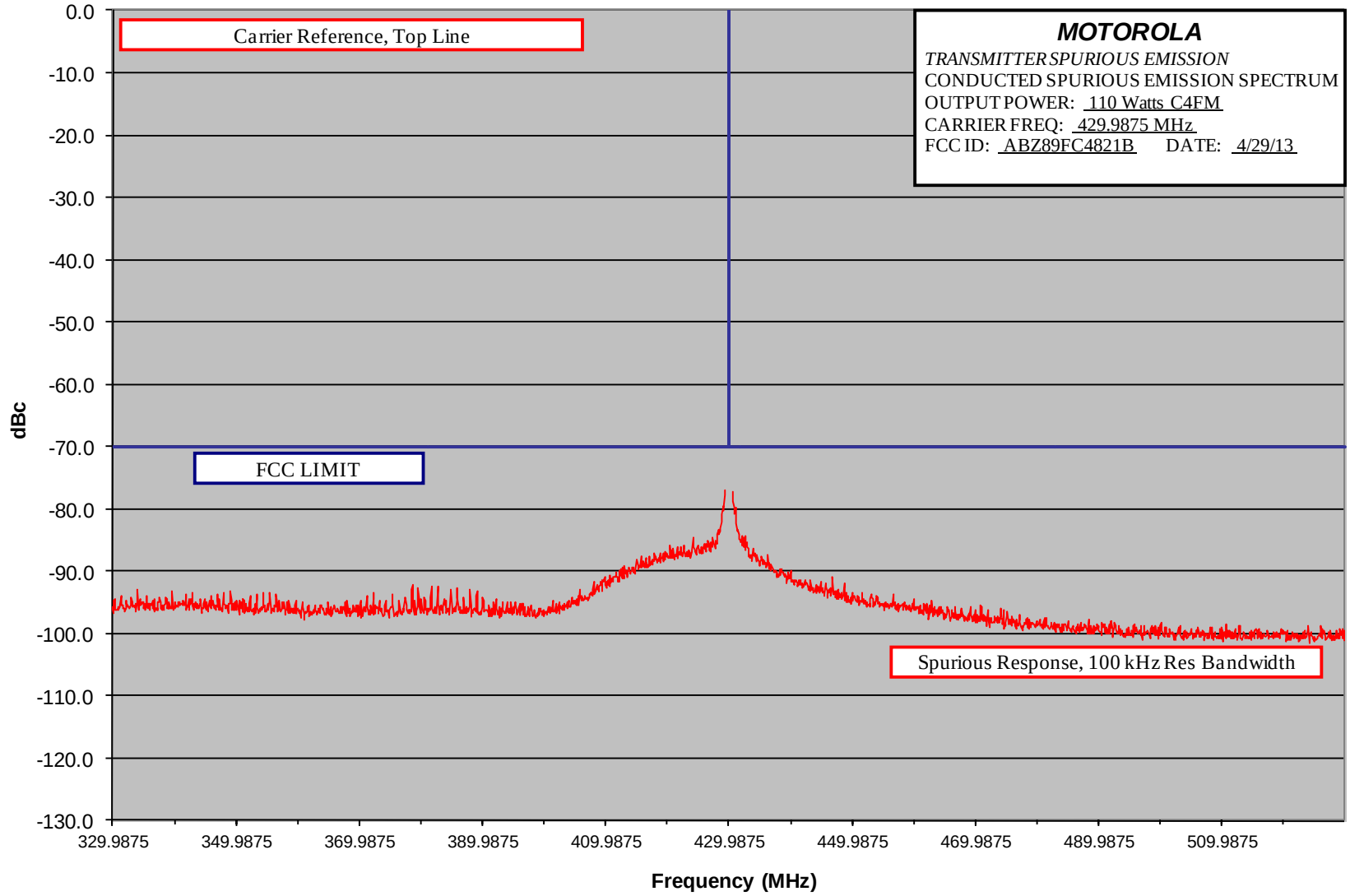
Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts C4FM – 200 MHz Span – Middle of Band



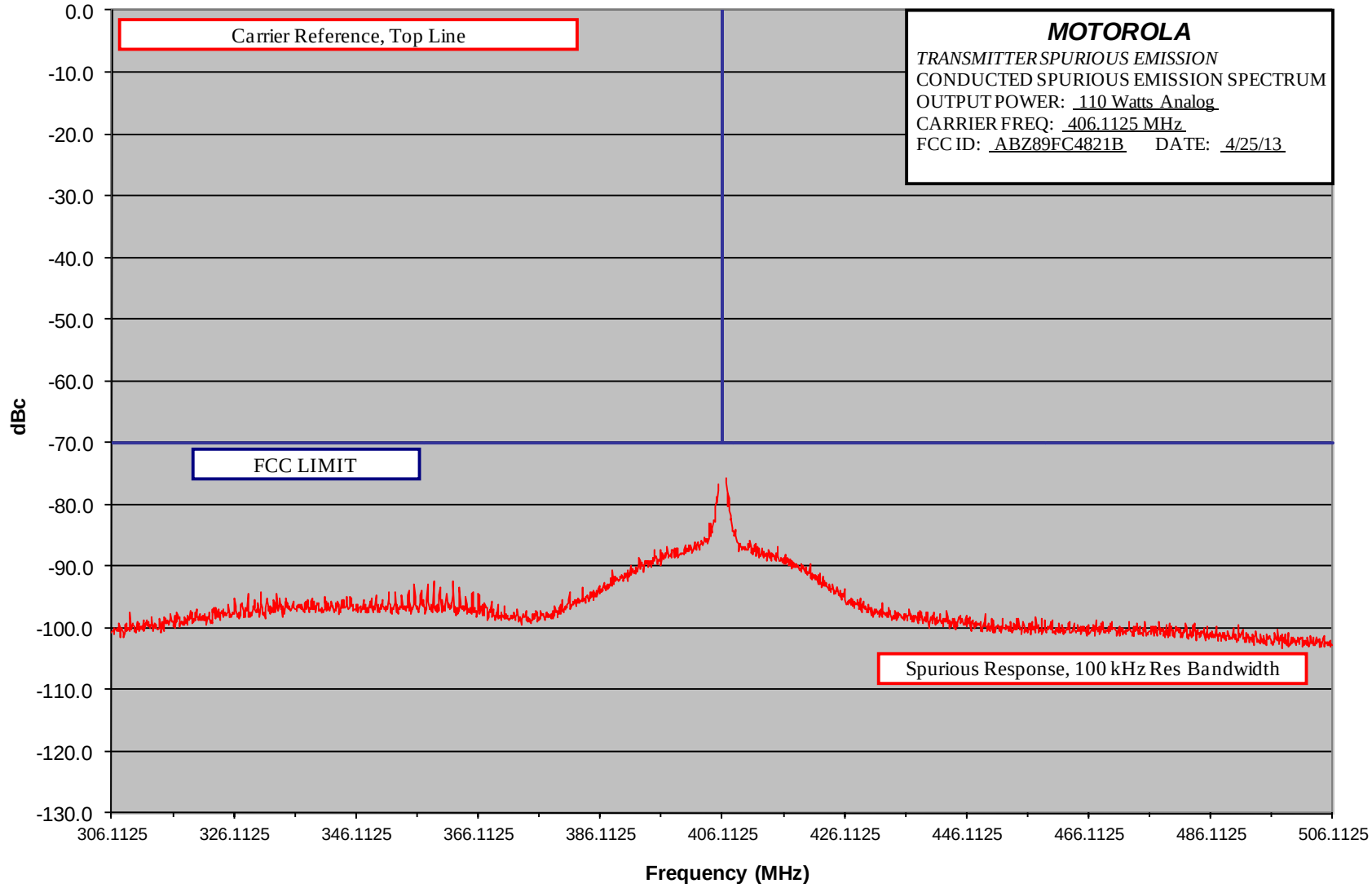
Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts C4FM – 200 MHz Span – High End of Band



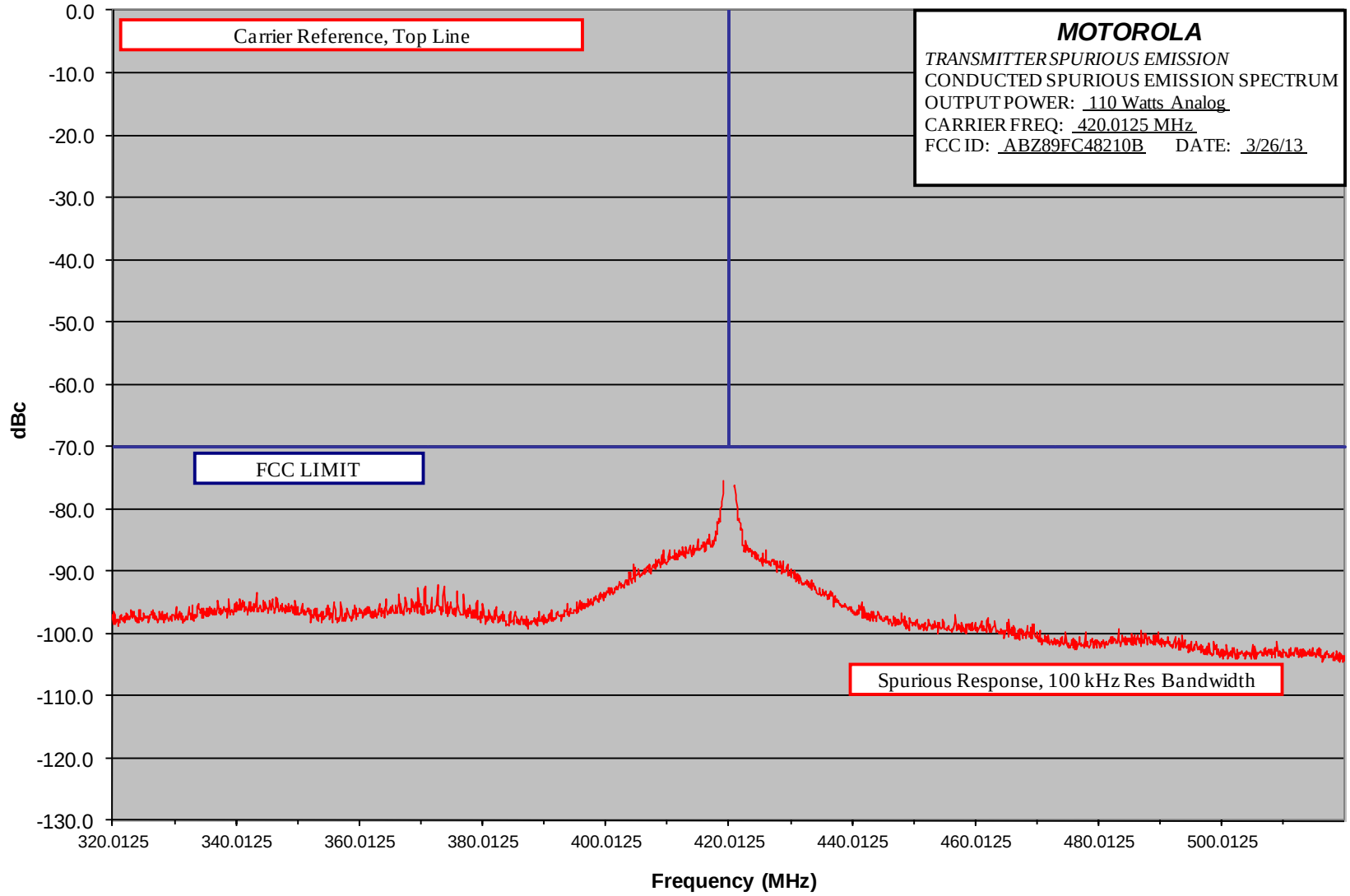
Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts Analog – 200 MHz Span – Low End of Band



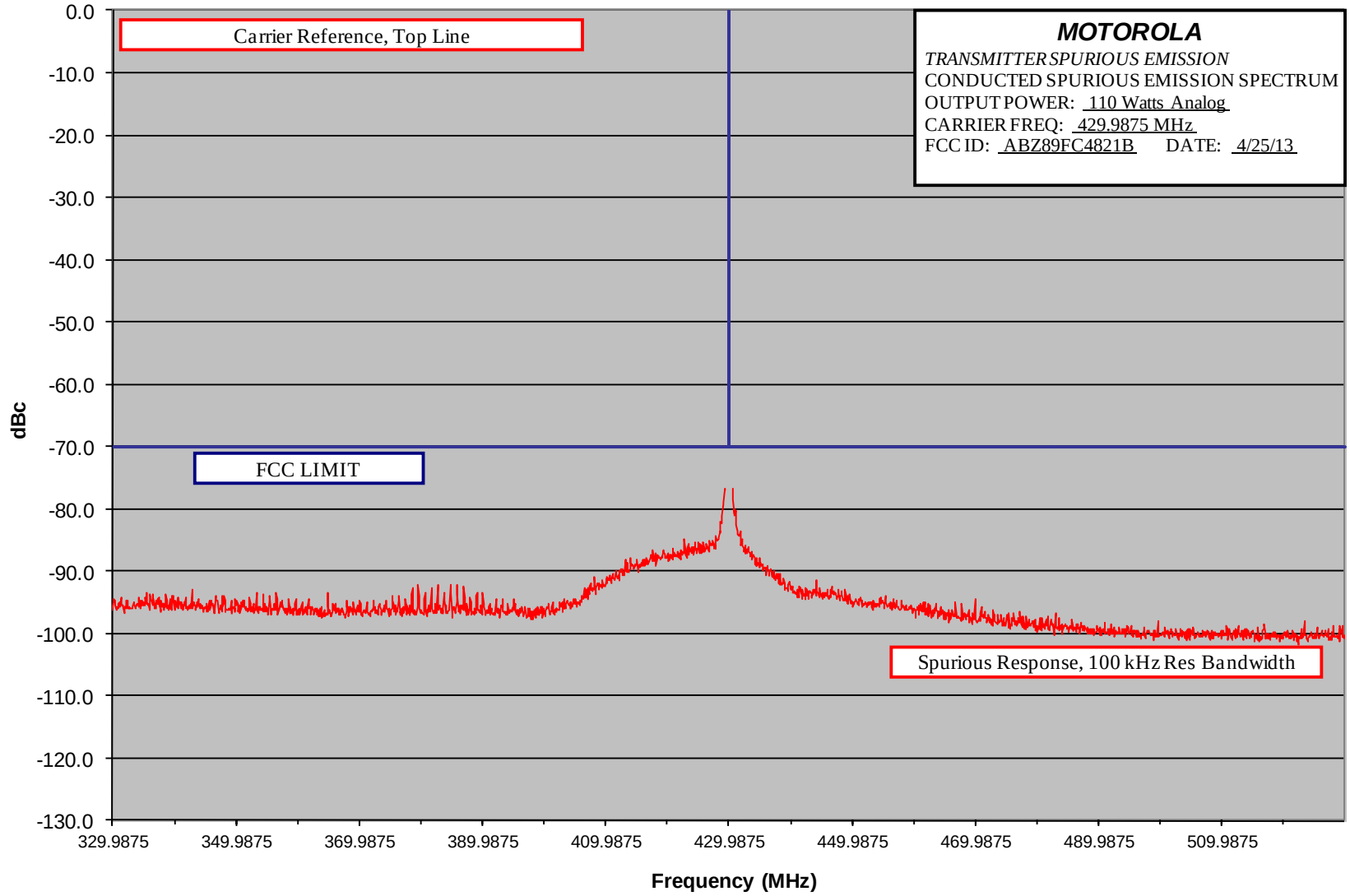
Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts Analog – 200 MHz Span – Middle of Band



Report on Test Measurements

Conducted Spurious Emission Spectrum – 110 Watts Analog – 200 MHz Span – High End of Band



Report on Test Measurements

Radiated Spurious Emissions, Harmonics

Specification Requirement 47 CFR §90.210(b) and IC RSS-119 section 5.8.1 - Emission Limits – "B-Mask":
For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:

On any frequency removed from the assigned frequency by a displacement frequency (F_d in kHz) of:
c) >50 kHz *at least 43+10 * Log_{10} (P) dB.*

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D:* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

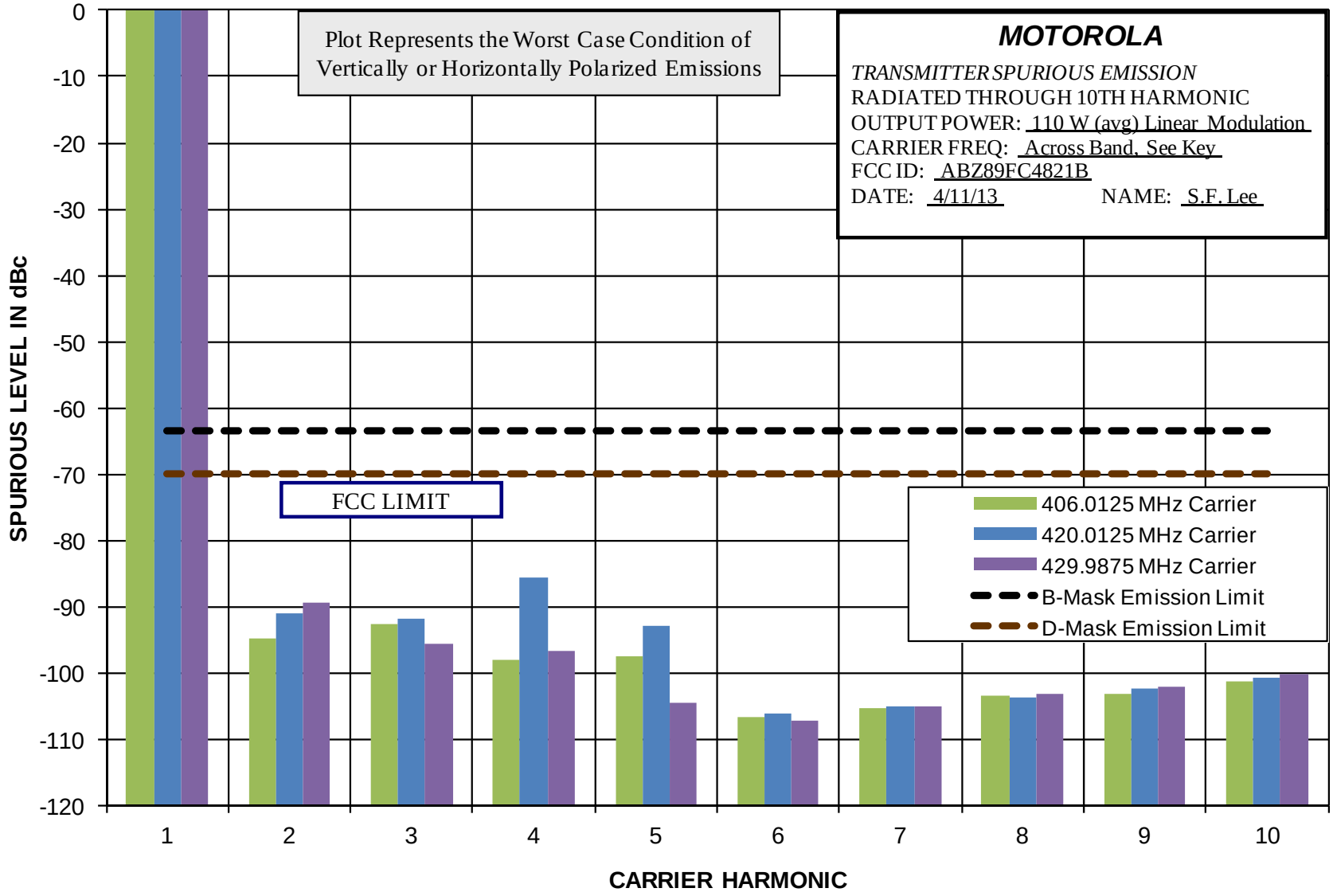
Modulation: Linear Simulcast Modulation (LSM), or Compatible 4-Level Frequency Modulation (C4FM) – Pseudorandom data, or Analog Frequency Modulation as indicated

Carrier Frequencies: Carrier frequencies of 406.1125, 420.0125, and 429.9875 MHz were measured for radiated carrier harmonics. These frequencies represent the low end, center, and high end of the Industry Canada band, and are representative of the full operating band.

EXHIBIT	DESCRIPTION
E1-4.1	Radiated Spurious Harmonic Emissions, Power Output 110 Watts (Average), LSM
	The specification limit is -70.0 dBc
E1-4.2	Radiated Spurious Harmonic Emissions, Power Output 2 Watts (Average), LSM
	The specification limit is -53.0 dBc
E1-4.3	Conducted Spurious Harmonic Emissions, Power Output 110 Watts, C4FM
	The specification limit is -70.0 dBc
E1-4.4	Conducted Spurious Harmonic Emissions, Power Output 2 Watts, C4FM
	The specification limit is -53.0 dBc
E1-4.5	Radiated Spurious Harmonic Emissions, Power Output 110 Watts, Analog
	The specification limit is -70.0 dBc
E1-4.6	Radiated Spurious Harmonic Emissions, Power Output 2 Watts, Analog
	The specification limit is -53.0 dBc

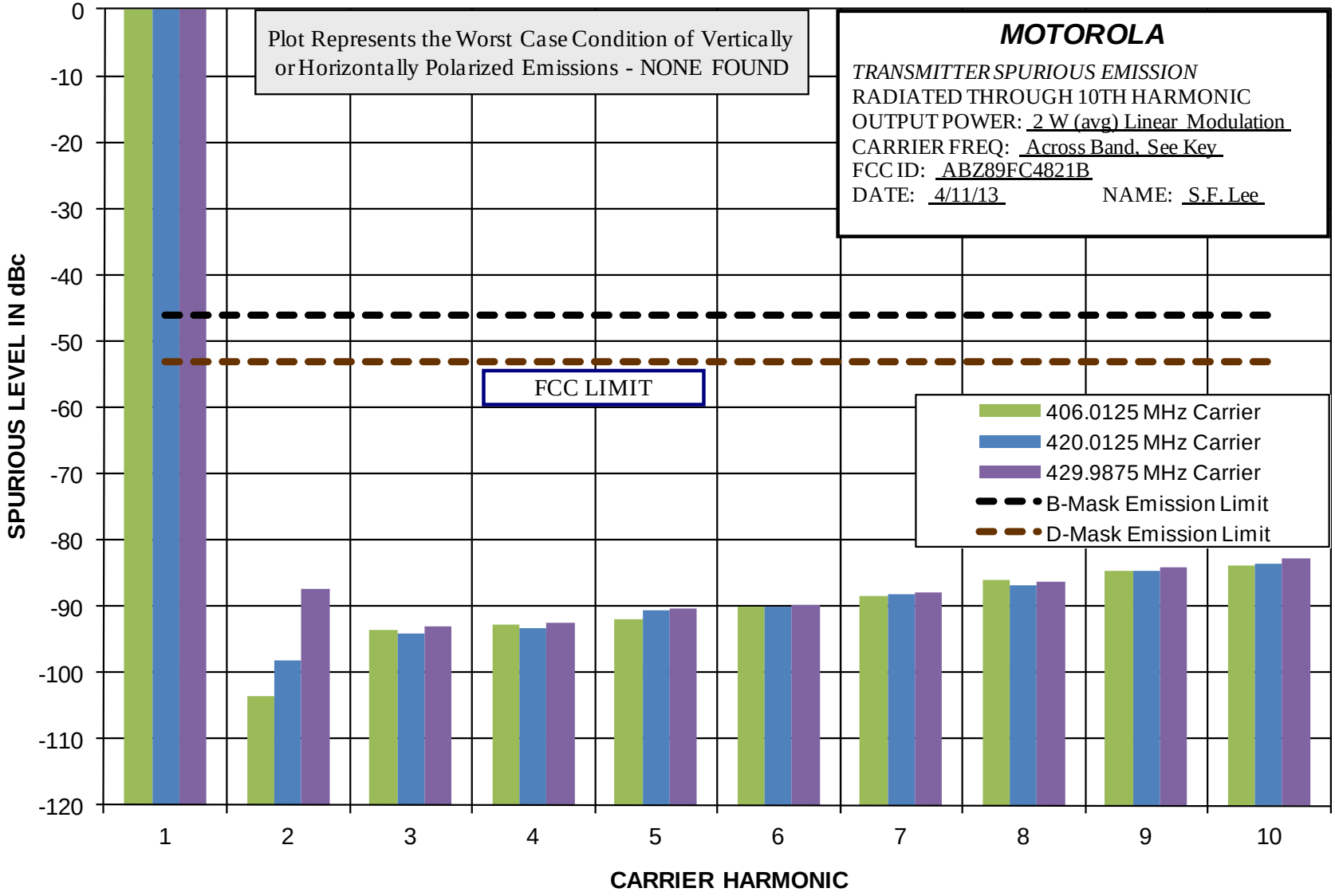
Report on Test Measurements

Radiated Spurious Harmonic Emissions — 110 Watts (Average) – Linear Simulcast Modulation (LSM)



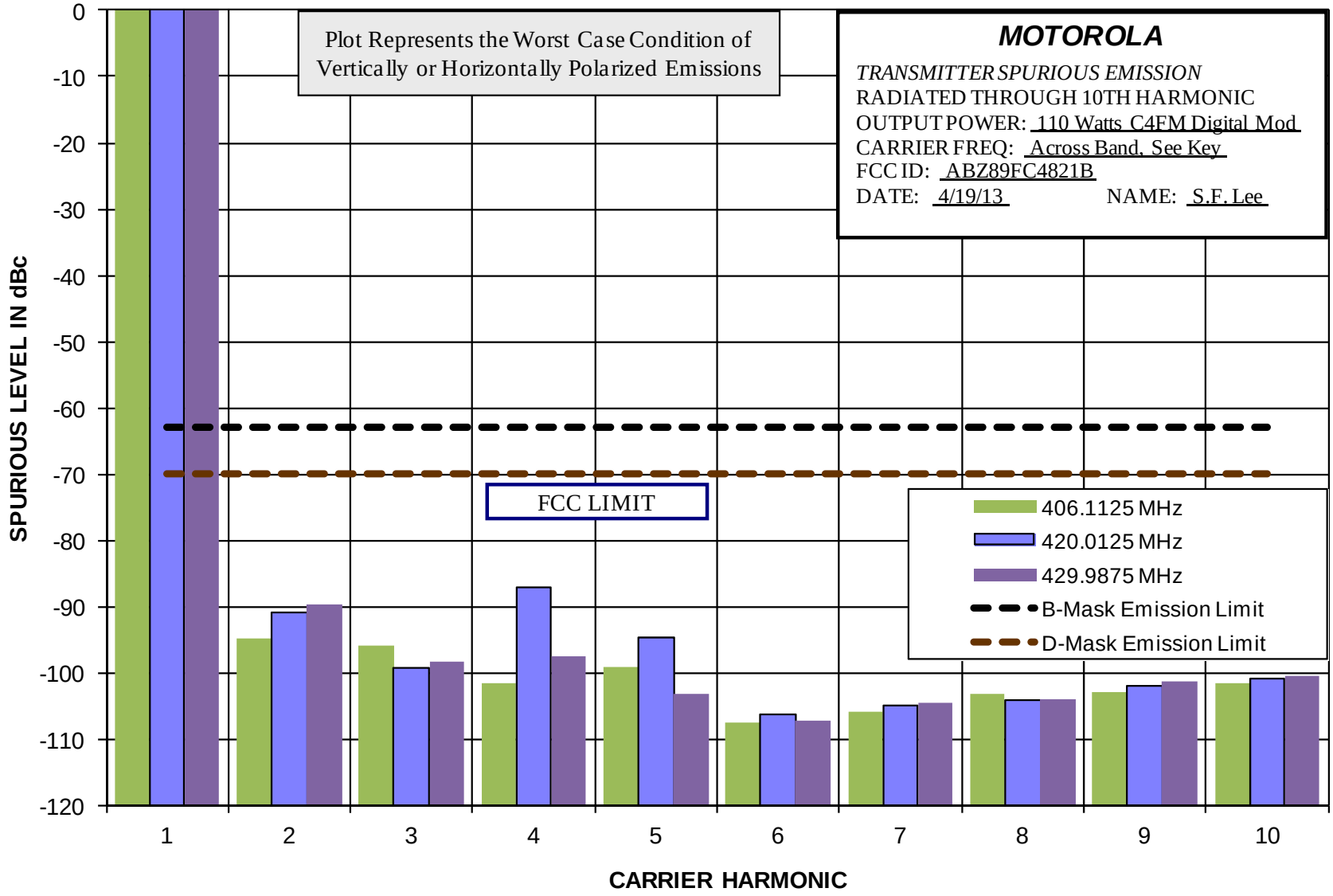
Report on Test Measurements

Radiated Spurious Harmonic Emissions – 2 Watts (Average) – Linear Simulcast Modulation (LSM)



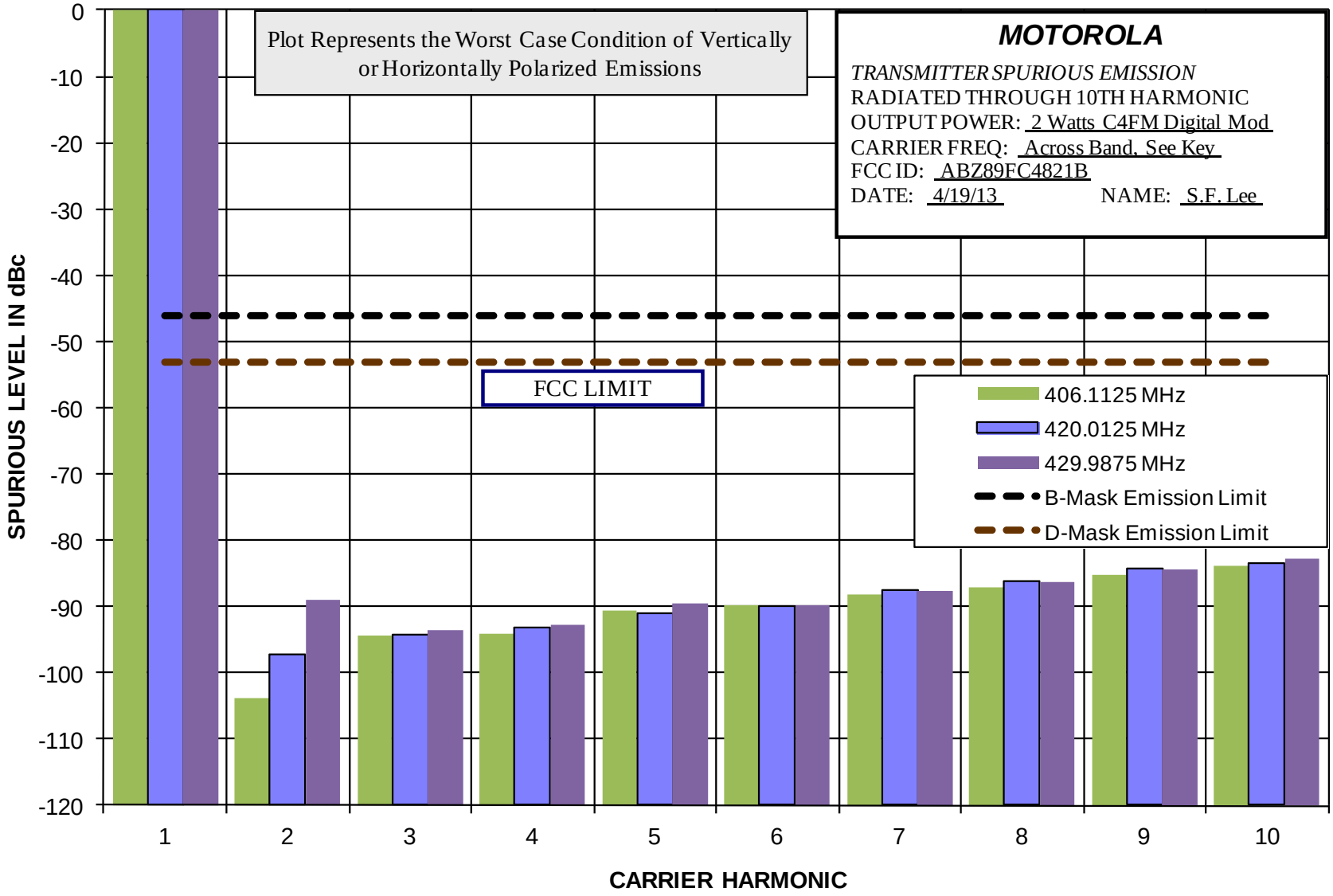
Report on Test Measurements

Radiated Spurious Harmonic Emissions — 110 Watts – Compatible 4-Level Frequency Modulation (C4FM)



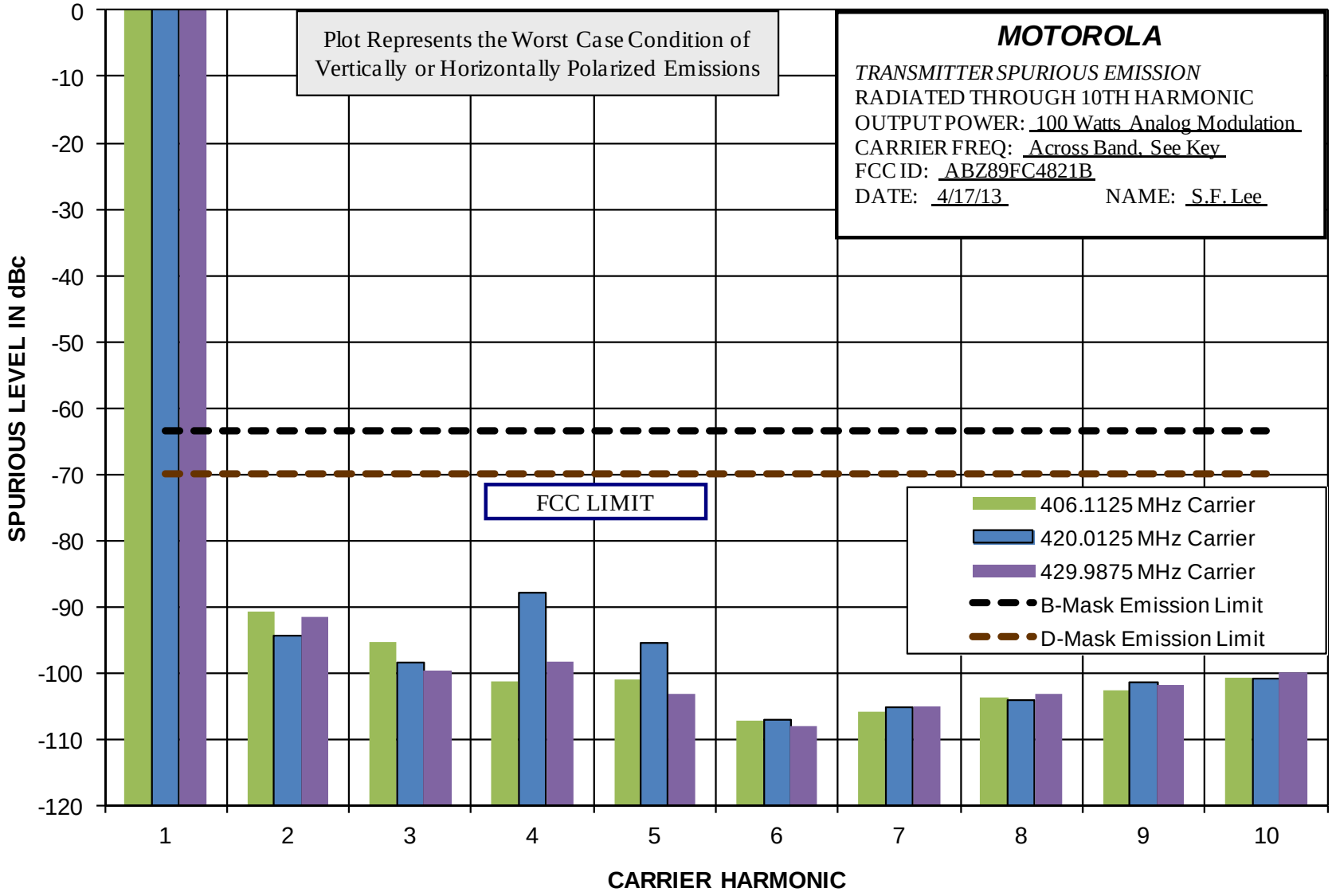
Report on Test Measurements

Radiated Spurious Harmonic Emissions – 2 Watts – Compatible 4-Level Frequency Modulation (C4FM)



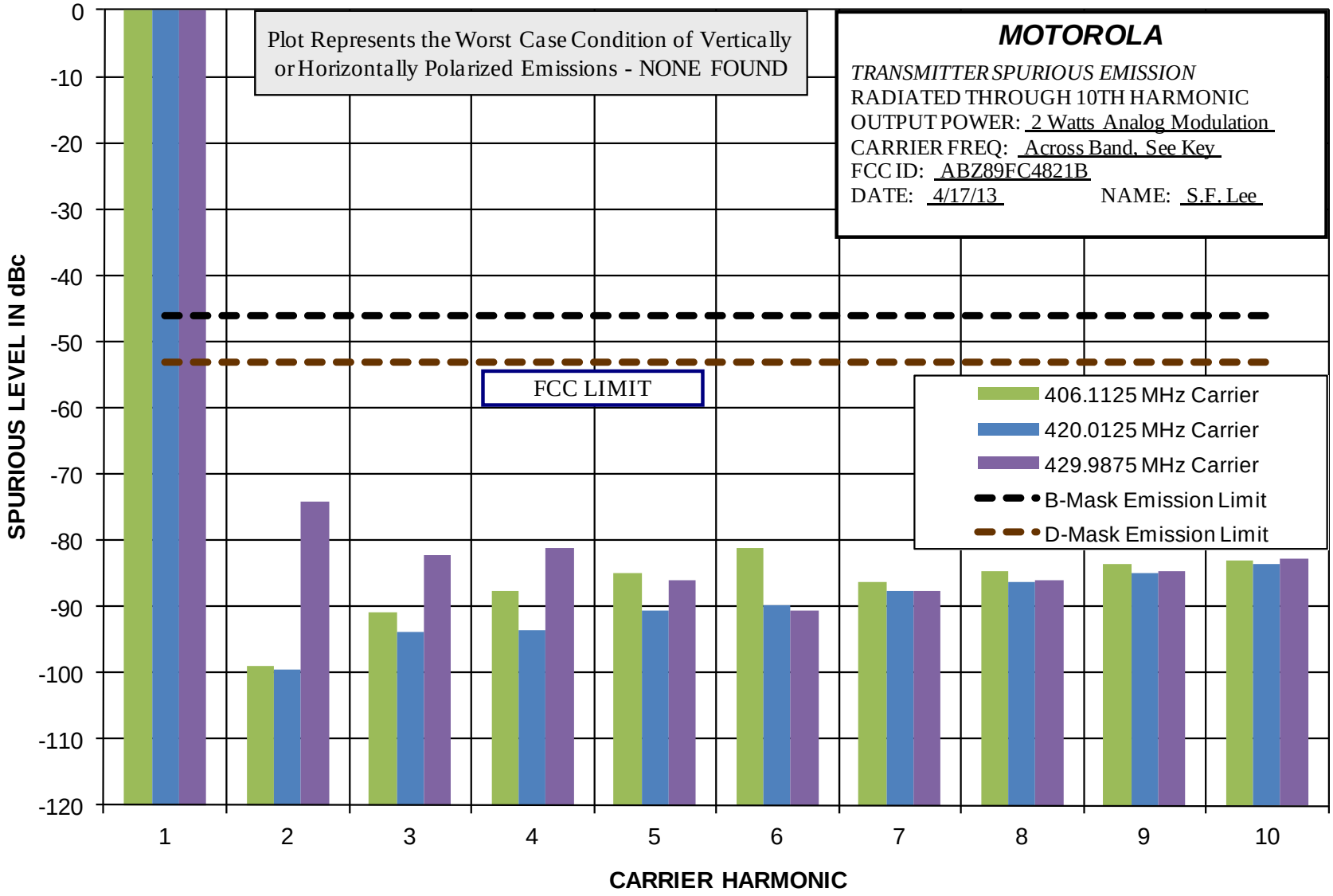
Report on Test Measurements

Radiated Spurious Harmonic Emissions – 110 Watts – Analog Frequency Modulation



Report on Test Measurements

Radiated Spurious Harmonic Emissions – 2 Watts – Analog Frequency Modulation



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 IC RSS-119 section 5.3:

Fixed and Base stations operating at 406.1-430 MHz and 450-470 MHz and 12.5 kHz channel bandwidth must have a frequency stability of better than +/- 1.5 PPM, and those operating at 25 kHz channel bandwidth must have a frequency stability of better than +/- 2.5 PPM.

Specification Requirement: Reference Part 90.213

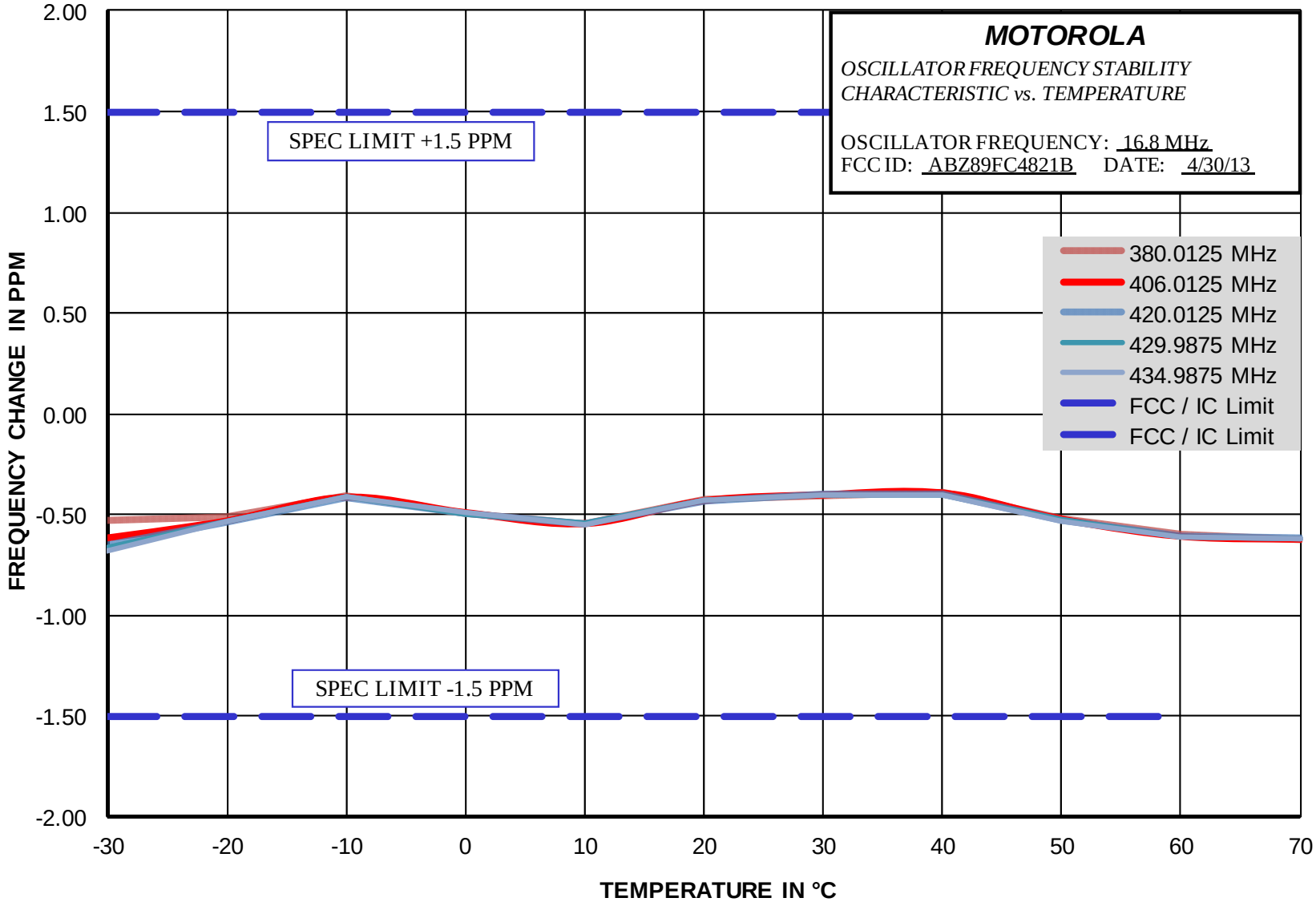
Fixed and Base stations operating at 421-512 MHz and 12.5 kHz channel bandwidth must have a frequency stability of better than +/- 1.5 PPM, and those operating at 25 kHz channel bandwidth must have a frequency stability of better than +/- 2.5 PPM.

Only the more stringent specification limit is shown on the frequency stability exhibits.
Performance was measured at carrier frequencies at the low end, middle, and high end of the operating band.

EXHIBIT	DESCRIPTION
E1-5.1	Frequency Stability Vs Temperature
E1-5.2	Frequency Stability Vs Voltage

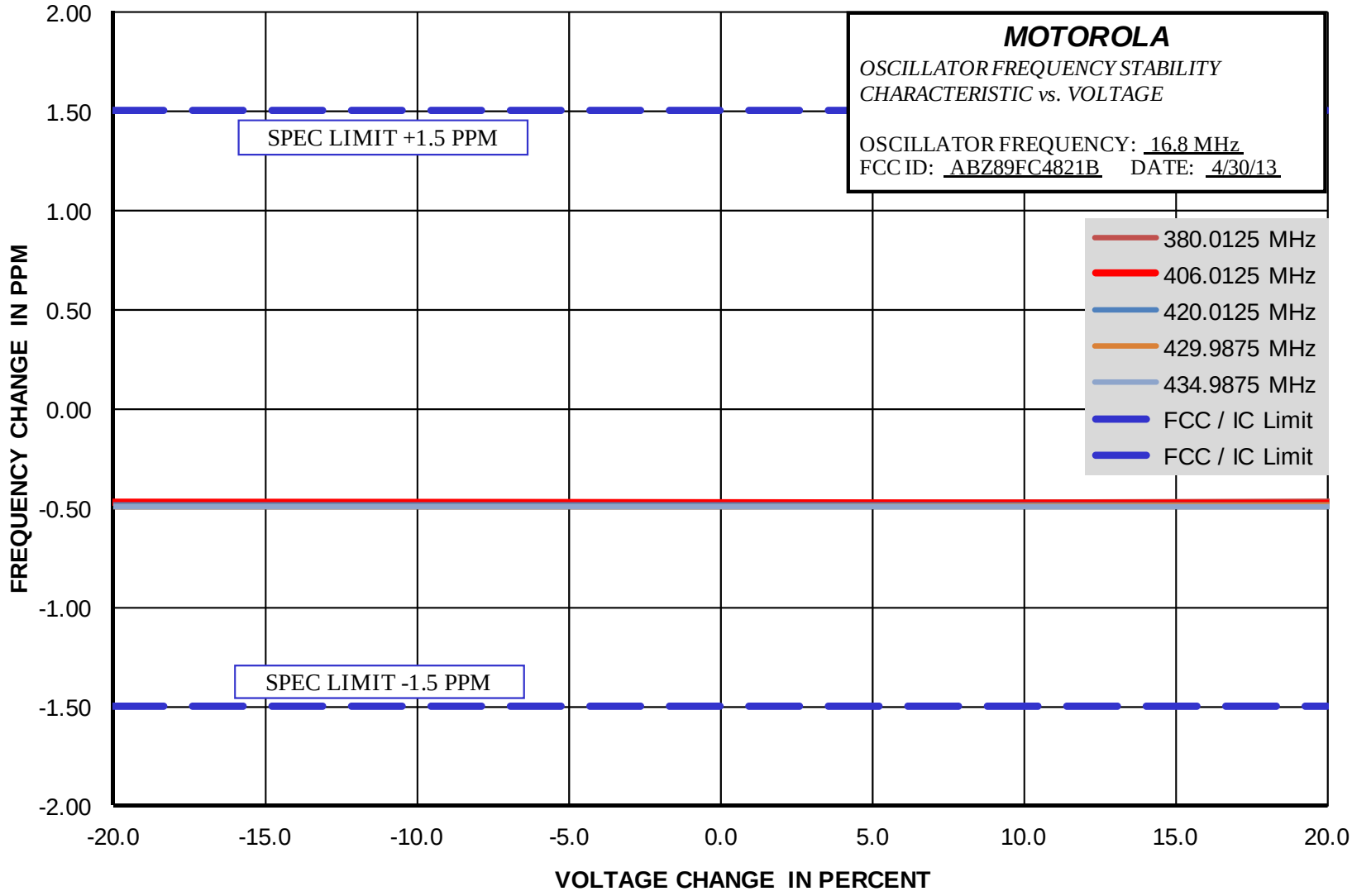
Report on Test Measurements

Frequency Stability Vs Temperature



Report on Test Measurements

Frequency Stability Vs Voltage



Report on Test Measurements

Frequency Transient Behavior

Specification Requirement 47 CFR §90.214 and IC RSS-119 section 5.9:

Transmitters designed to operate in the 406.1-512 MHz (421-512 MHz for FCC) frequency band must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated below:

Transient Frequency Behavior 25 kHz Channels

For time intervals:

a. t_1 =10 ms Maximum Frequency Difference ±25 kHz

b. t_2 = 25 ms Maximum Frequency Difference ±12.5 kHz

c. t_3 = 10 ms Maximum Frequency Difference ±25 kHz

Transient Frequency Behavior 12.5 kHz Channels

For time intervals:

a. t_1 =105 ms Maximum Frequency Difference ±12.5 kHz

b. t_2 = 25 ms Maximum Frequency Difference ±6.25 kHz

c. t_3 = 10 ms Maximum Frequency Difference ±12.5 kHz

Where t1 and t2 are times immediately following when the transmitter is turned on, and t3 is the time from when the transmitter is turned off.

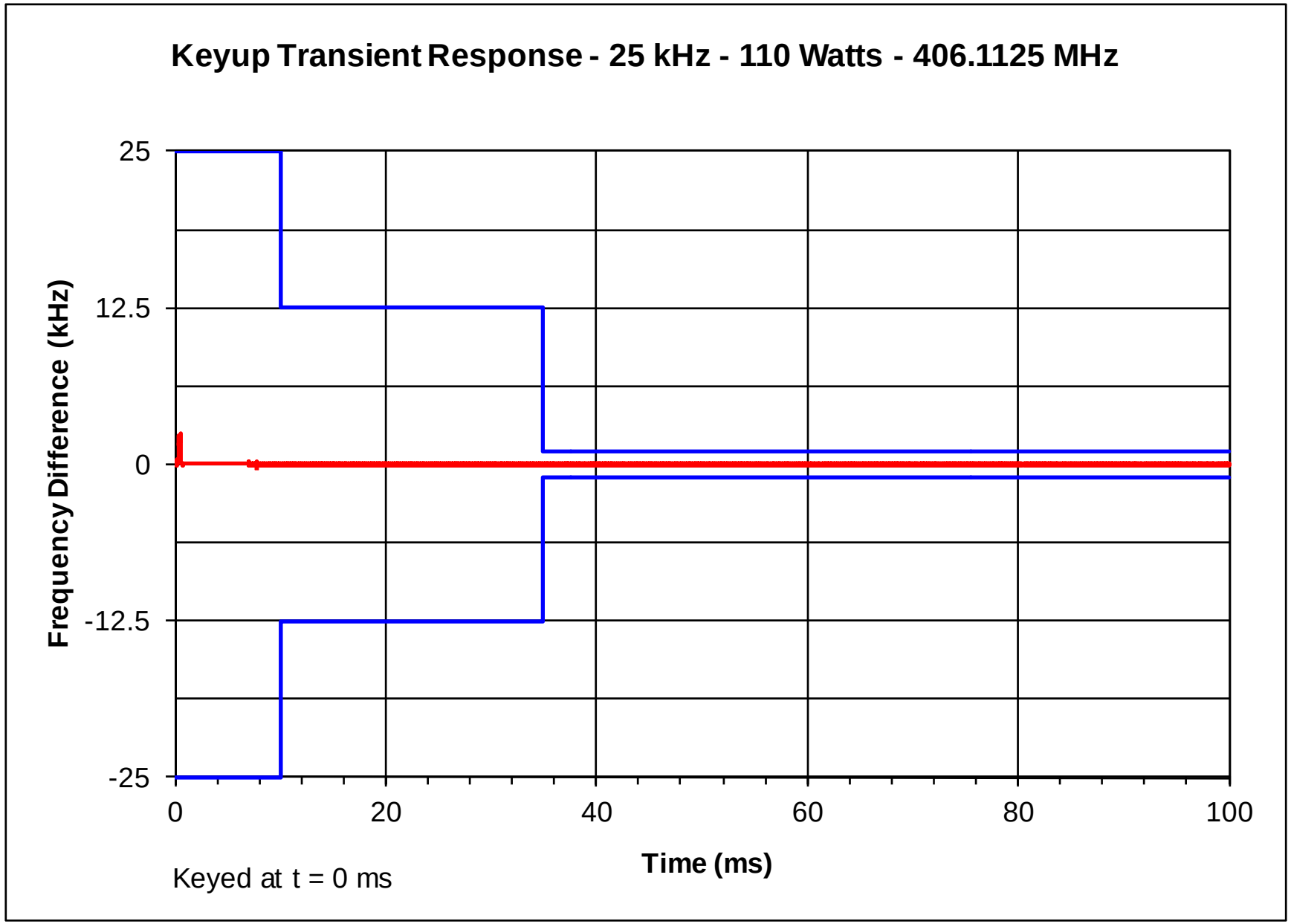
During the time from the end of $t_2$to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213 / RSS-119 section 5.3.

Modulation: Analog Mode Frequency Modulation
Carrier Frequencies: Performance was measured at carrier frequencies at the low end, middle, and high end of the operating band.

EXHIBIT	DESCRIPTION
E1-6.1, 2, 3	Frequency Transient Behavior, 25 kHz Channel Key-Up
E1-6.4, 5, 6	Frequency Transient Behavior, 25 kHz Channel De-Key
E1-6.7, 8, 9	Frequency Transient Behavior, 12.5 kHz Channel Key-Up
E1-6.10, 11, 12	Frequency Transient Behavior, 12.5 kHz Channel De-key

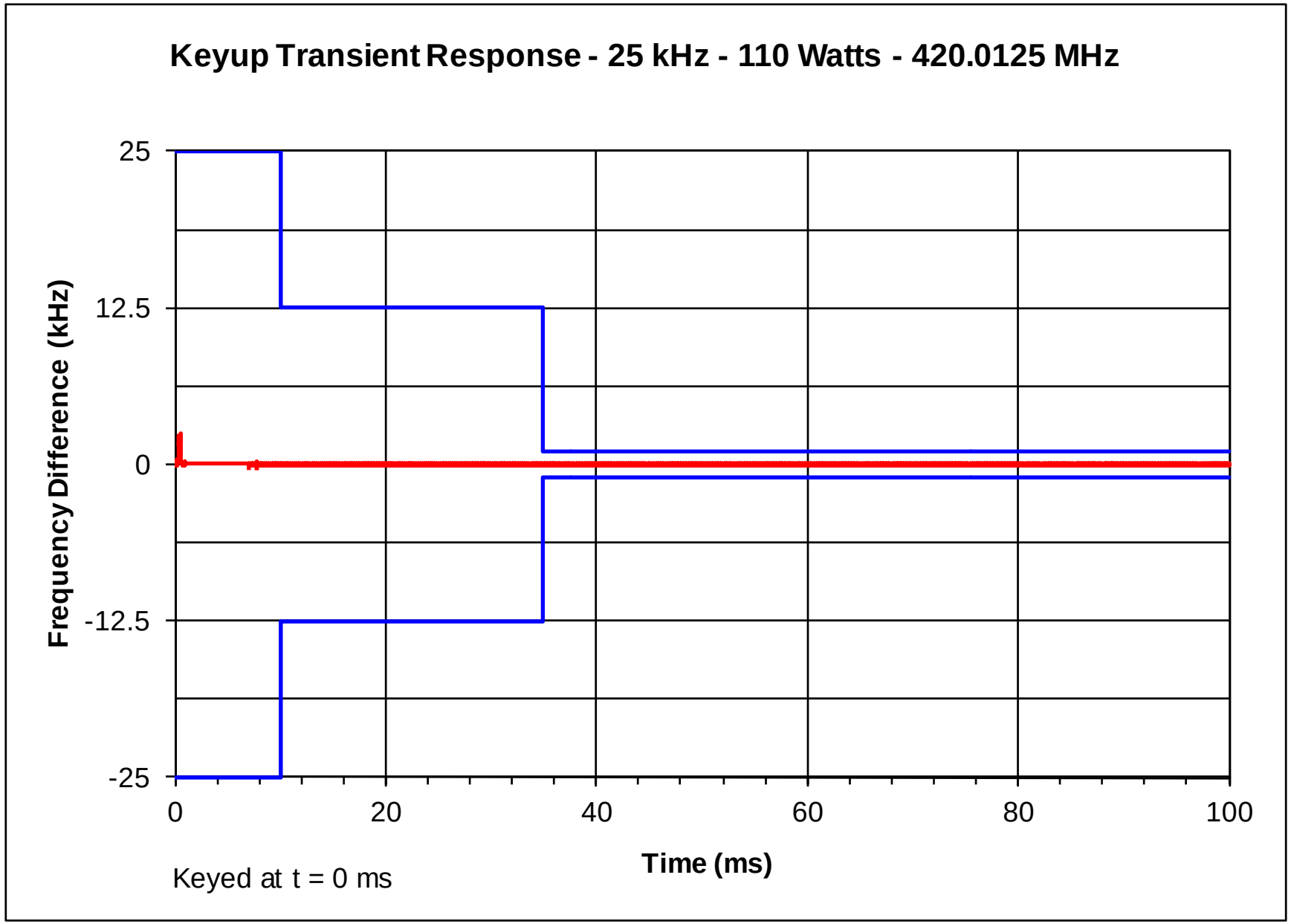
Report on Test Measurements

Frequency Transient – Key-up – 25 kHz Channels – Low End of Band



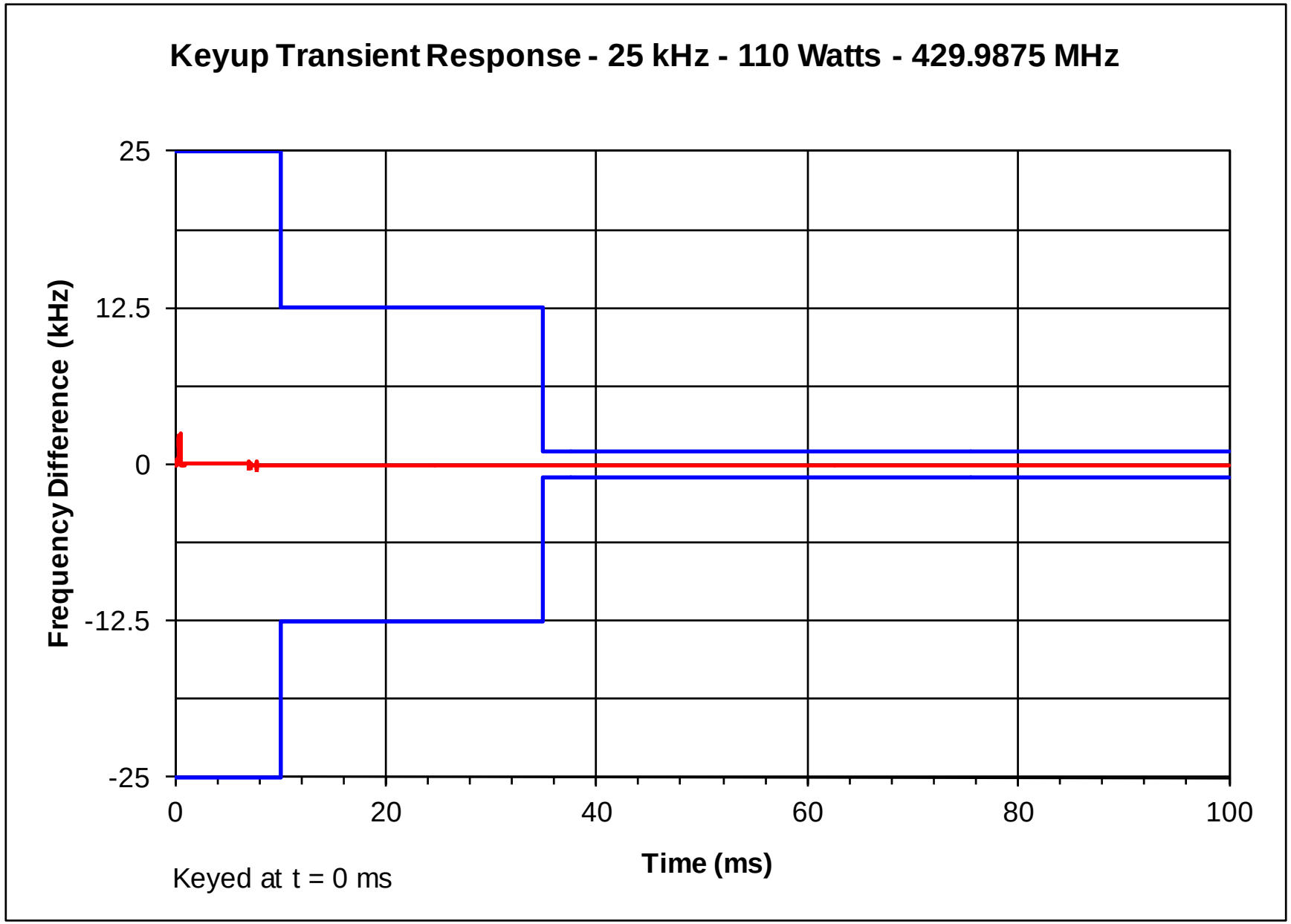
Report on Test Measurements

Frequency Transient – Key-up – 25 kHz Channels – Middle of Band



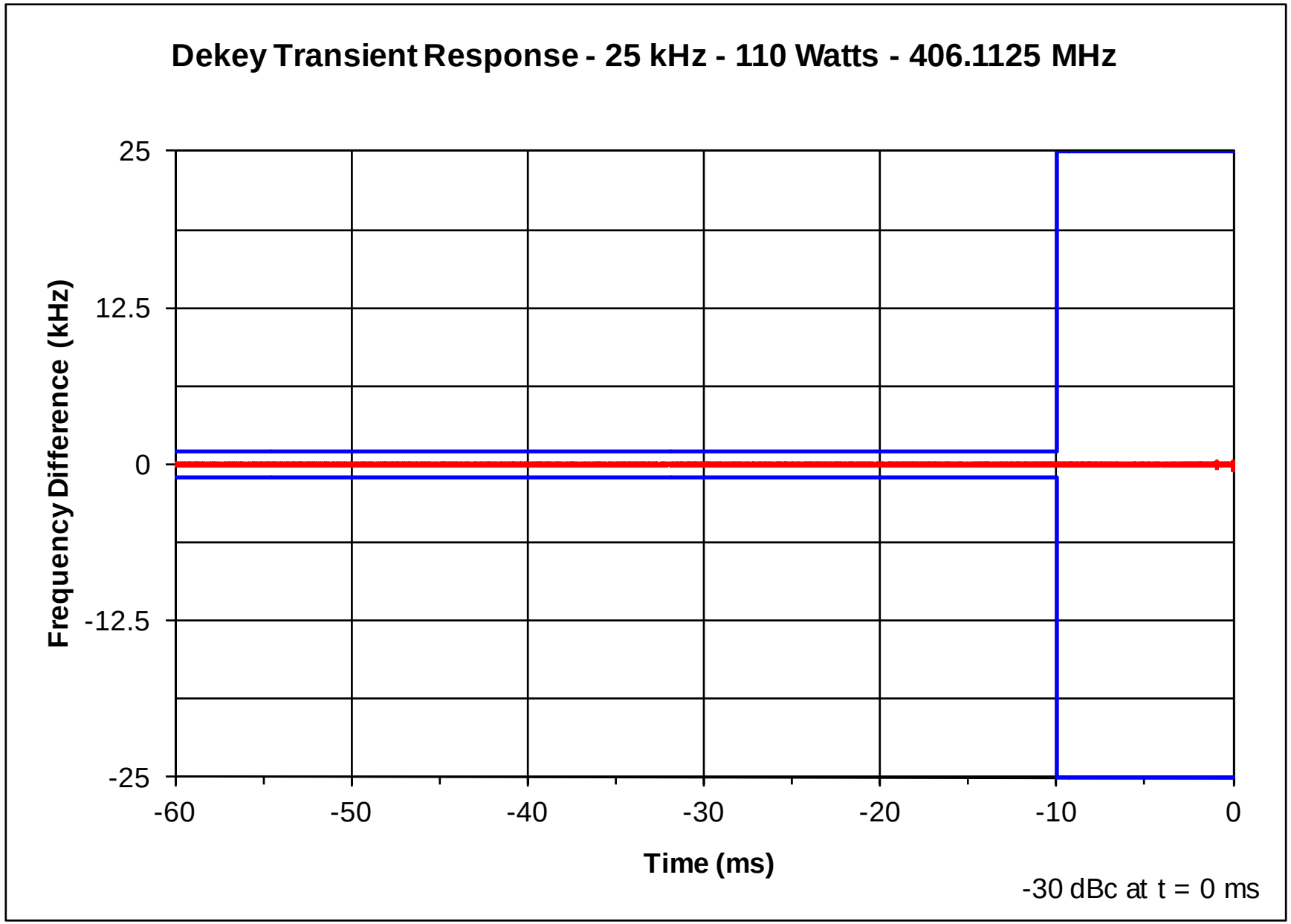
Report on Test Measurements

Frequency Transient – Key-up – 25 kHz Channels – High End of Band



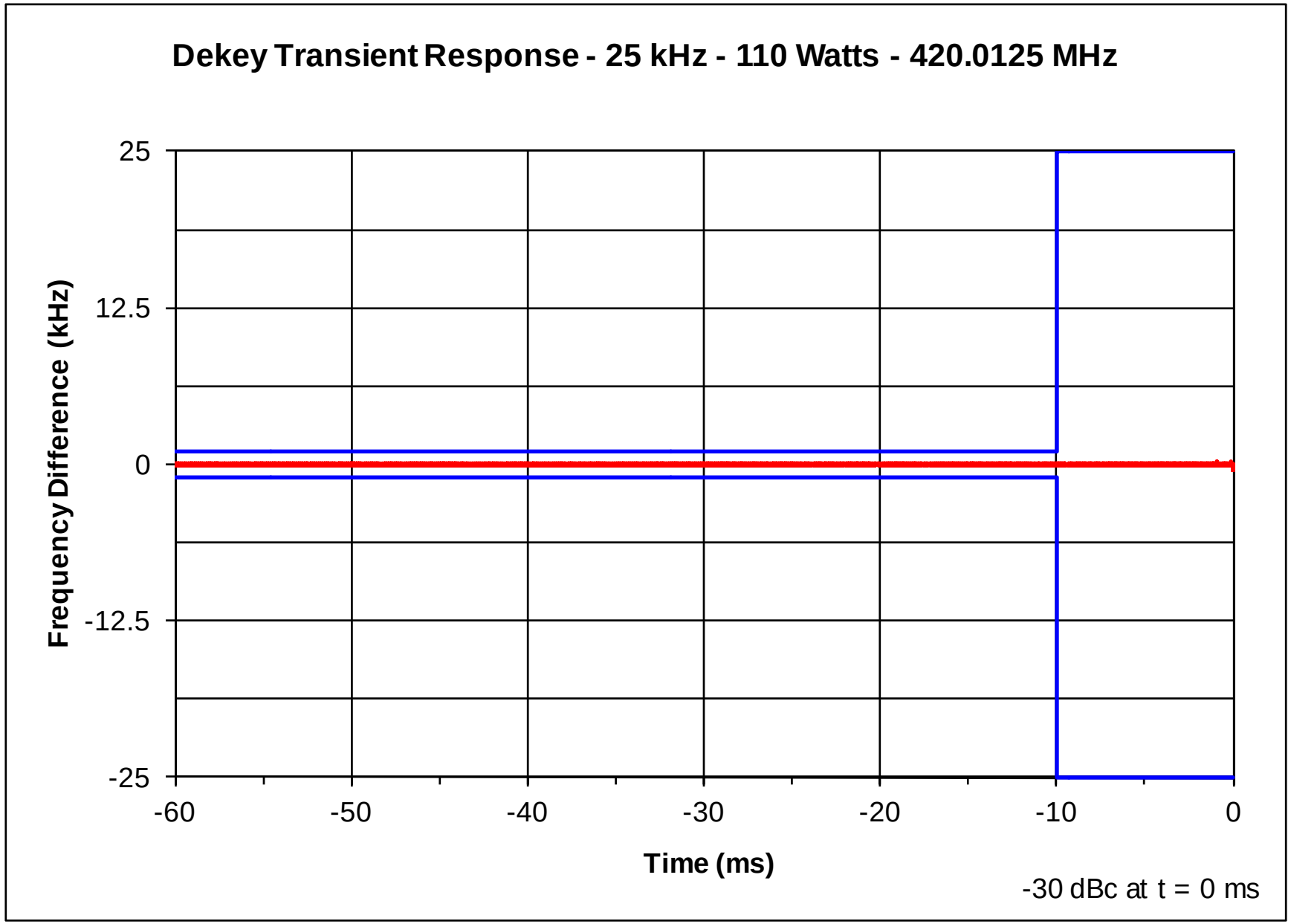
Report on Test Measurements

Frequency Transient – De-Key – 25 kHz Channels – Low End of Band



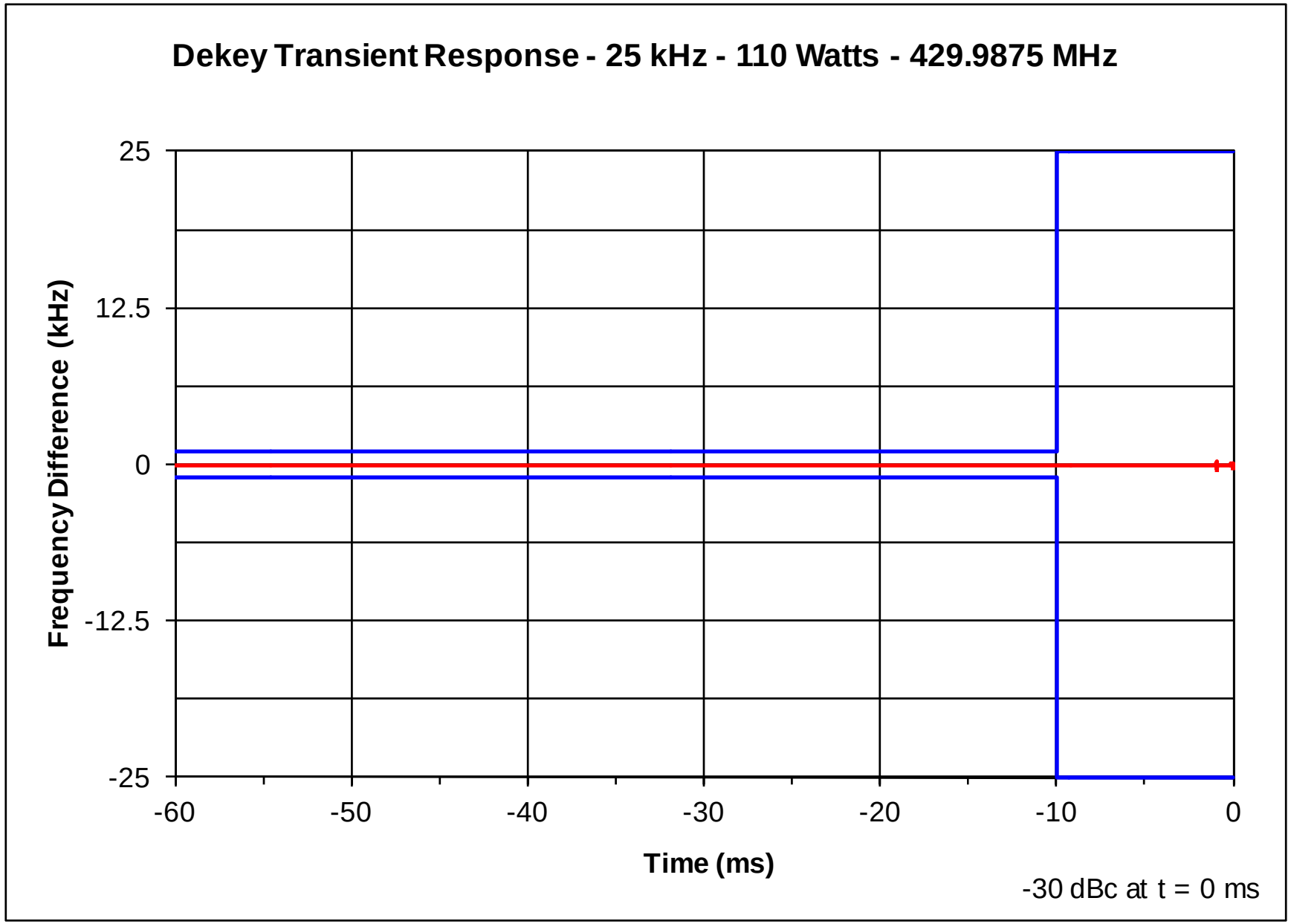
Report on Test Measurements

Frequency Transient – De-Key – 25 kHz Channels – Middle of Band



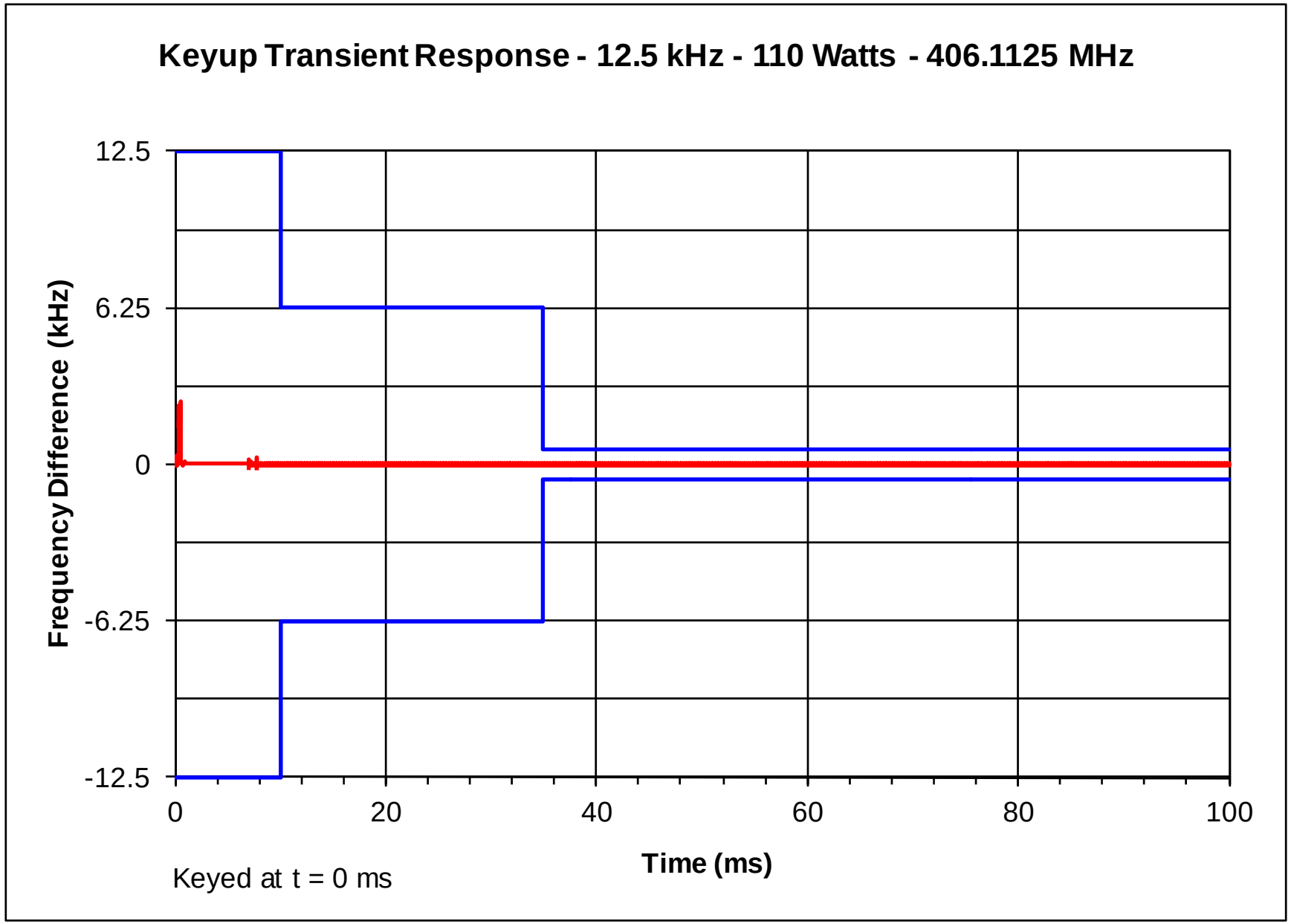
Report on Test Measurements

Frequency Transient – De-Key – 25 kHz Channels – High End of Band



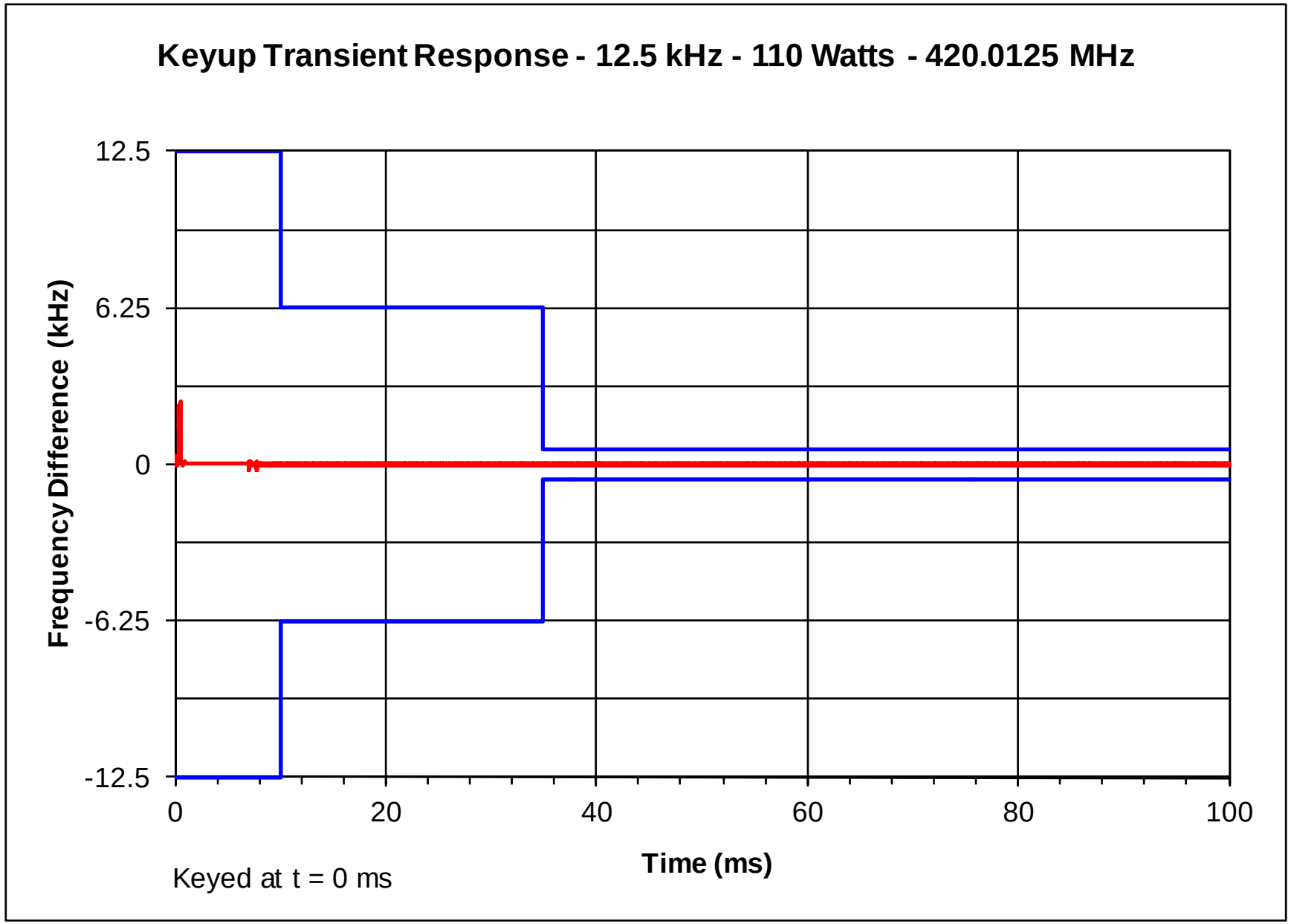
Report on Test Measurements

Frequency Transient – Key-up – 12.5 kHz Channels – Low End of Band



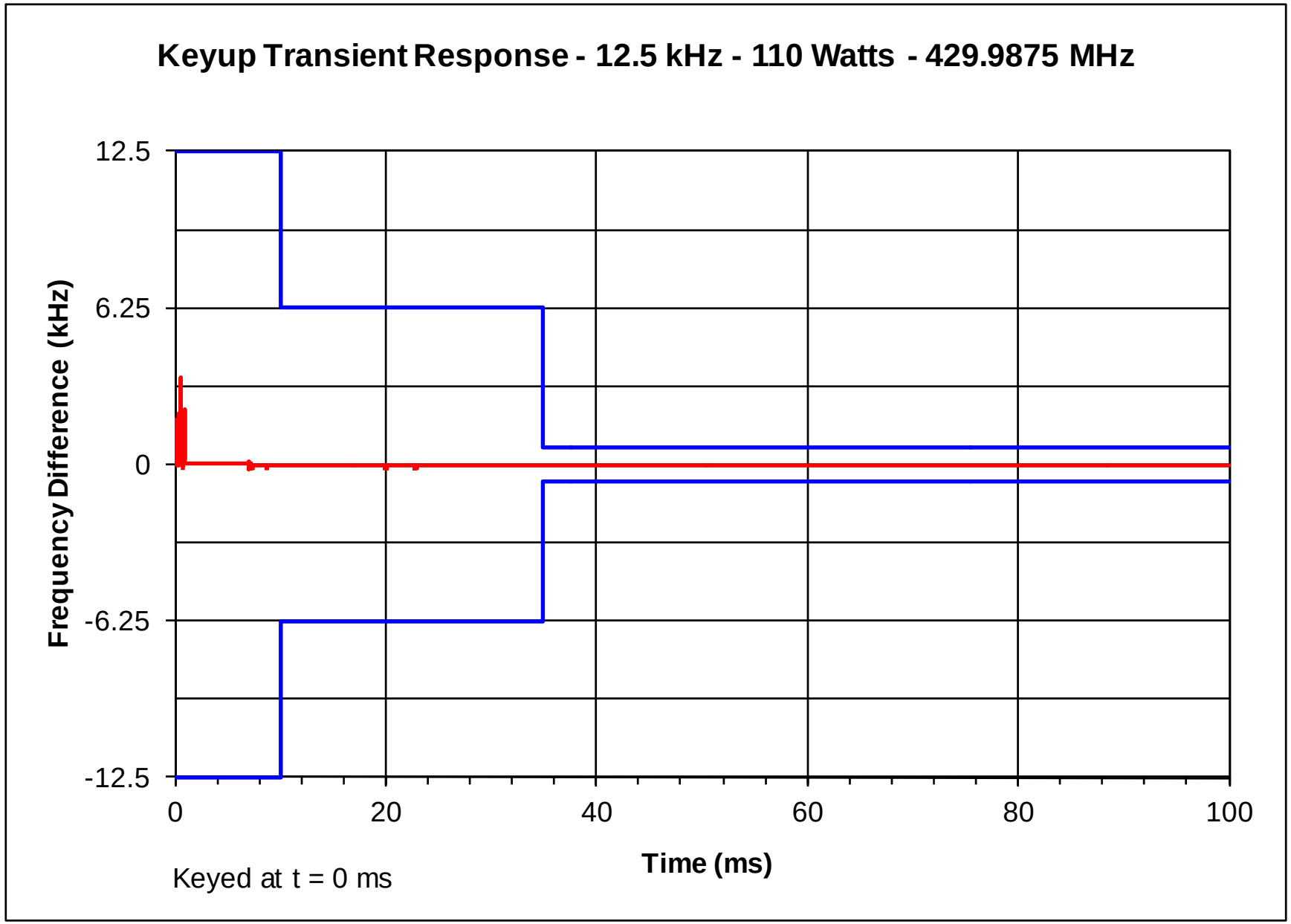
Report on Test Measurements

Frequency Transient – Key-up – 12.5 kHz Channels – Middle of Band



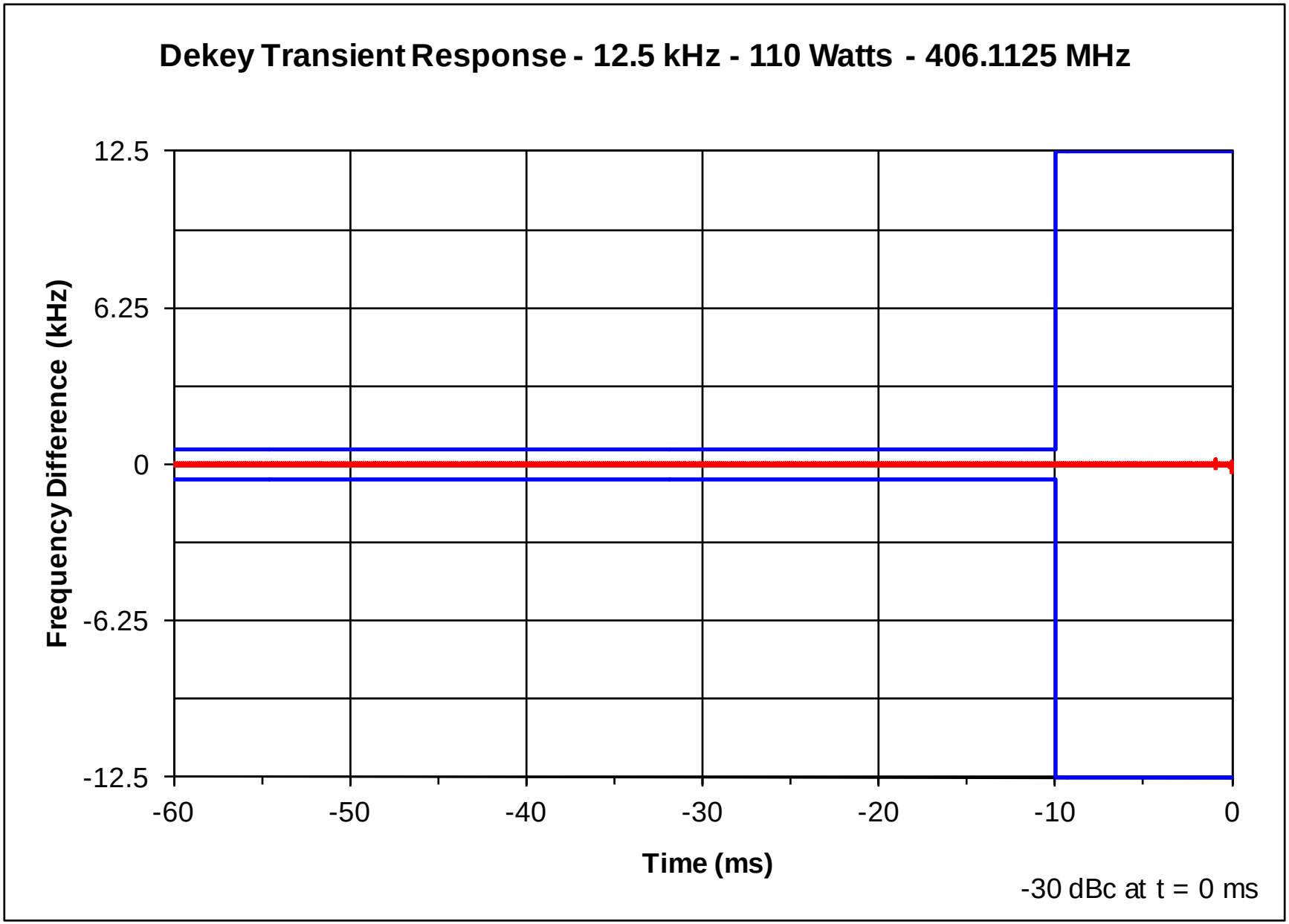
Report on Test Measurements

Frequency Transient – Key-up – 12.5 kHz Channels – High End of Band



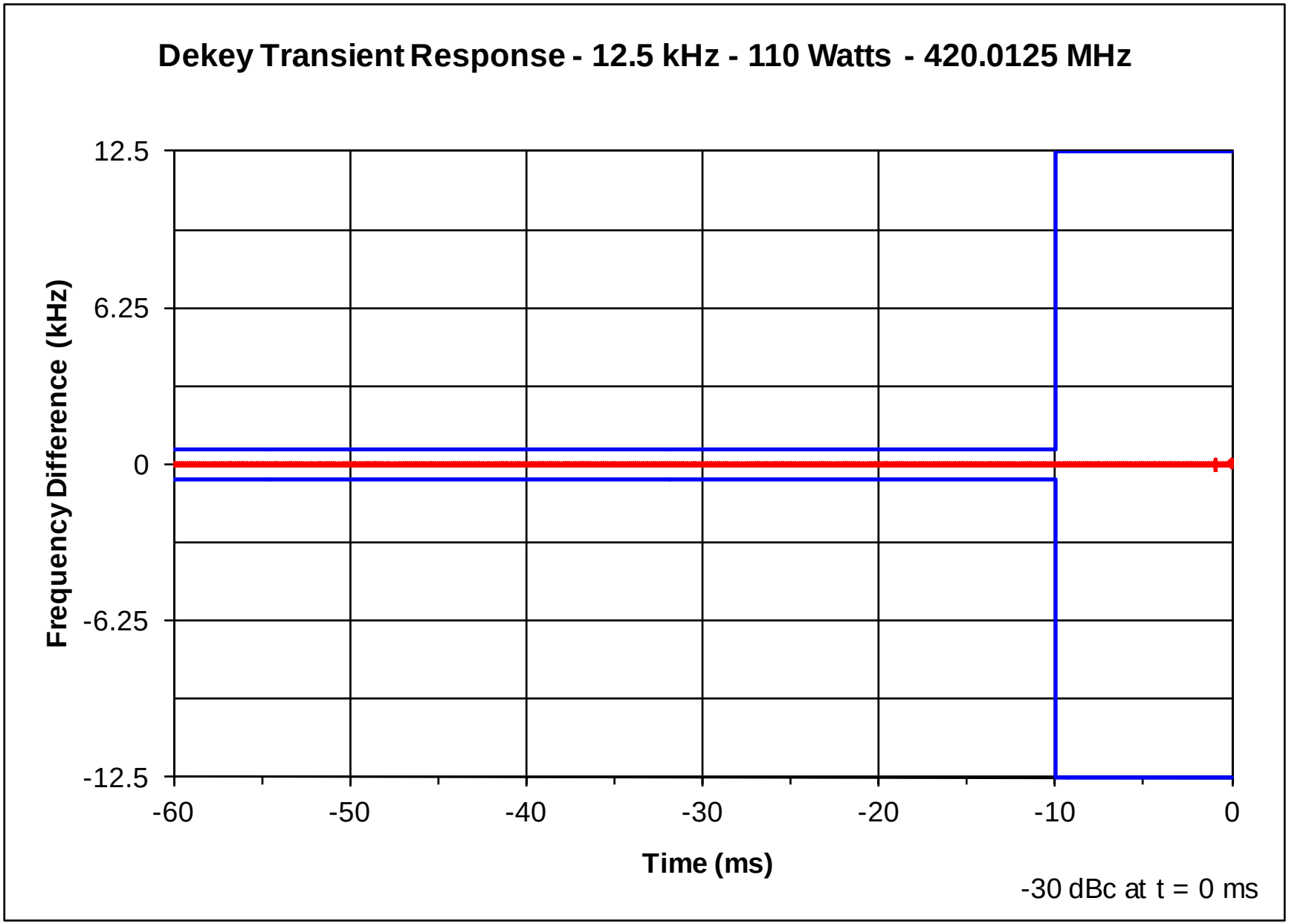
Report on Test Measurements

Frequency Transient – De-Key – 12.5 kHz Channels – Low End of Band



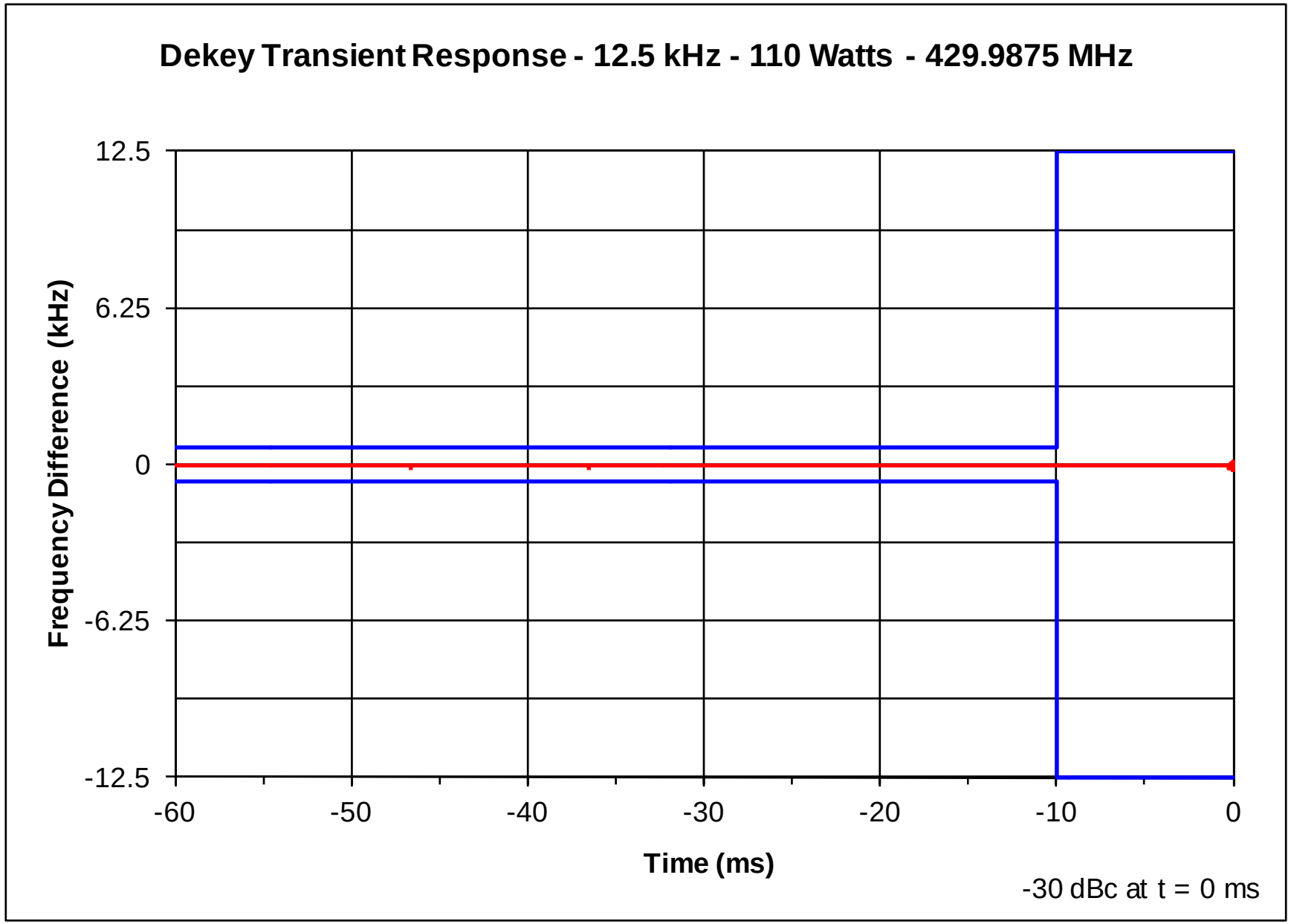
Report on Test Measurements

Frequency Transient – De-Key – 12.5 kHz Channels – Middle of Band



Report on Test Measurements

Frequency Transient – De-Key – 12.5 kHz Channels – High End of Band



Report on Test Measurements

Audio Frequency Response

Specification Requirement per TIA 603:
Audio Frequency Response, 25 kHz Channels*:* The audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level, with an additional 6 dB per octave attenuation allowed from 500 Hz to 300 Hz, and an additional 6 dB per octave attenuation is allowed from 2500 Hz to 3000 Hz in equipment operating in the 25 MHz to 869 MHz range.

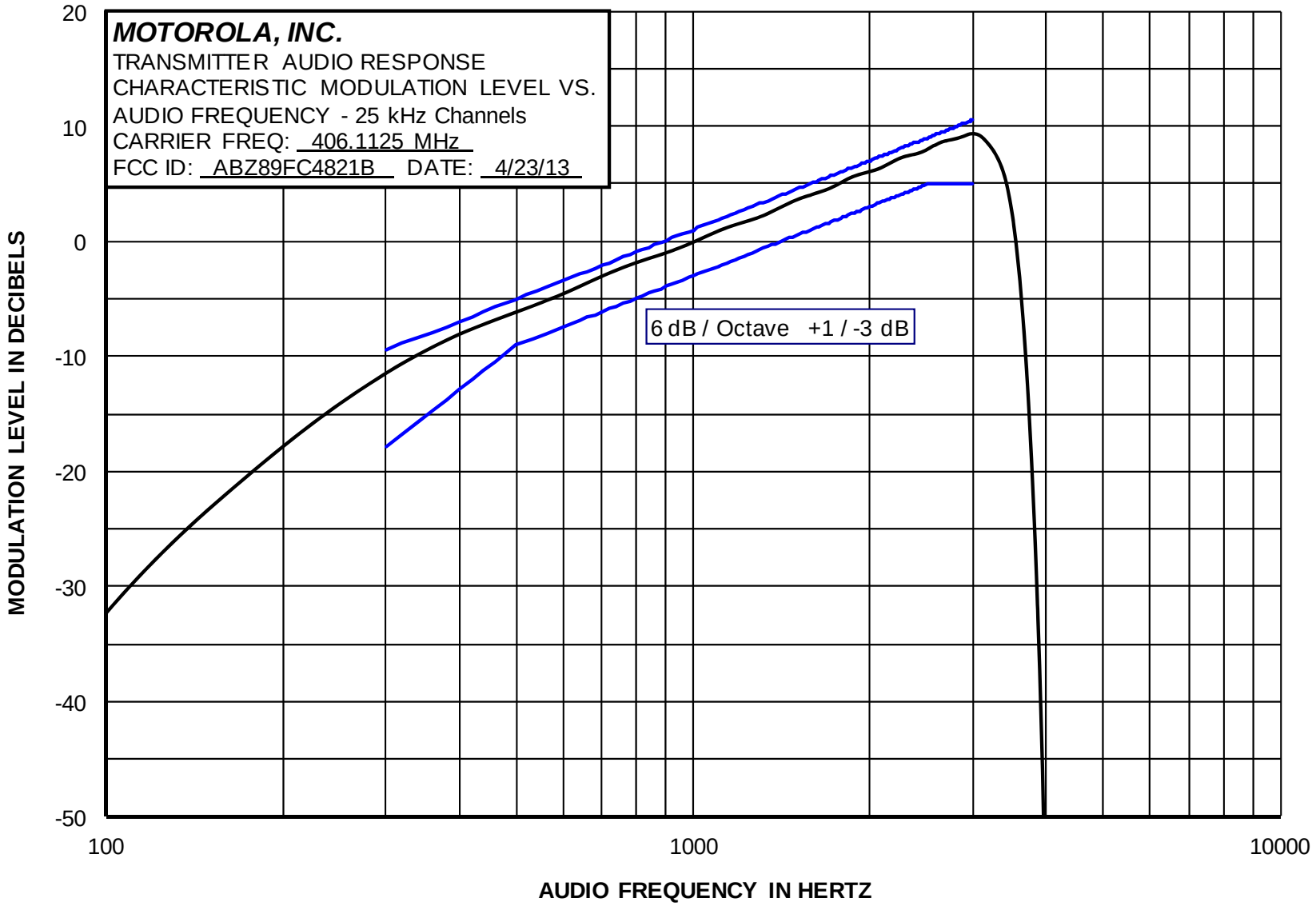
Audio Frequency Response, 12.5 kHz Channels*:* The audio frequency response from 300 Hz to 3000 Hz shall not vary more than +1 dB or -3 dB from a true 6 dB per octave pre-emphasis characteristic as referenced to the 1000 Hz level, with an additional 6 dB per octave attenuation allowed from 500 Hz to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

Modulation:	Audio Test Tone
Carrier Frequency:	Performance was measured at carrier frequencies at the low end, middle, and high end of the operating band.

EXHIBIT	DESCRIPTION
E1-7.1	Audio Frequency Response – Modulation Characteristics, 25 kHz Channels – Low End of Band
E1-7.2	Audio Frequency Response – Modulation Characteristics, 25 kHz Channels – Middle of Band
E1-7.3	Audio Frequency Response – Modulation Characteristics, 25 kHz Channels – High End of Band
E1-7.4	Audio Frequency Response – Modulation Characteristics, 12.5 kHz Channels– Low End of Band
E1-7.5	Audio Frequency Response – Modulation Characteristics, 12.5 kHz Channels– Middle of Band
E1-7.6	Audio Frequency Response – Modulation Characteristics, 12.5 kHz Channels– High End of Band
	The specification limit is shown on the response plots

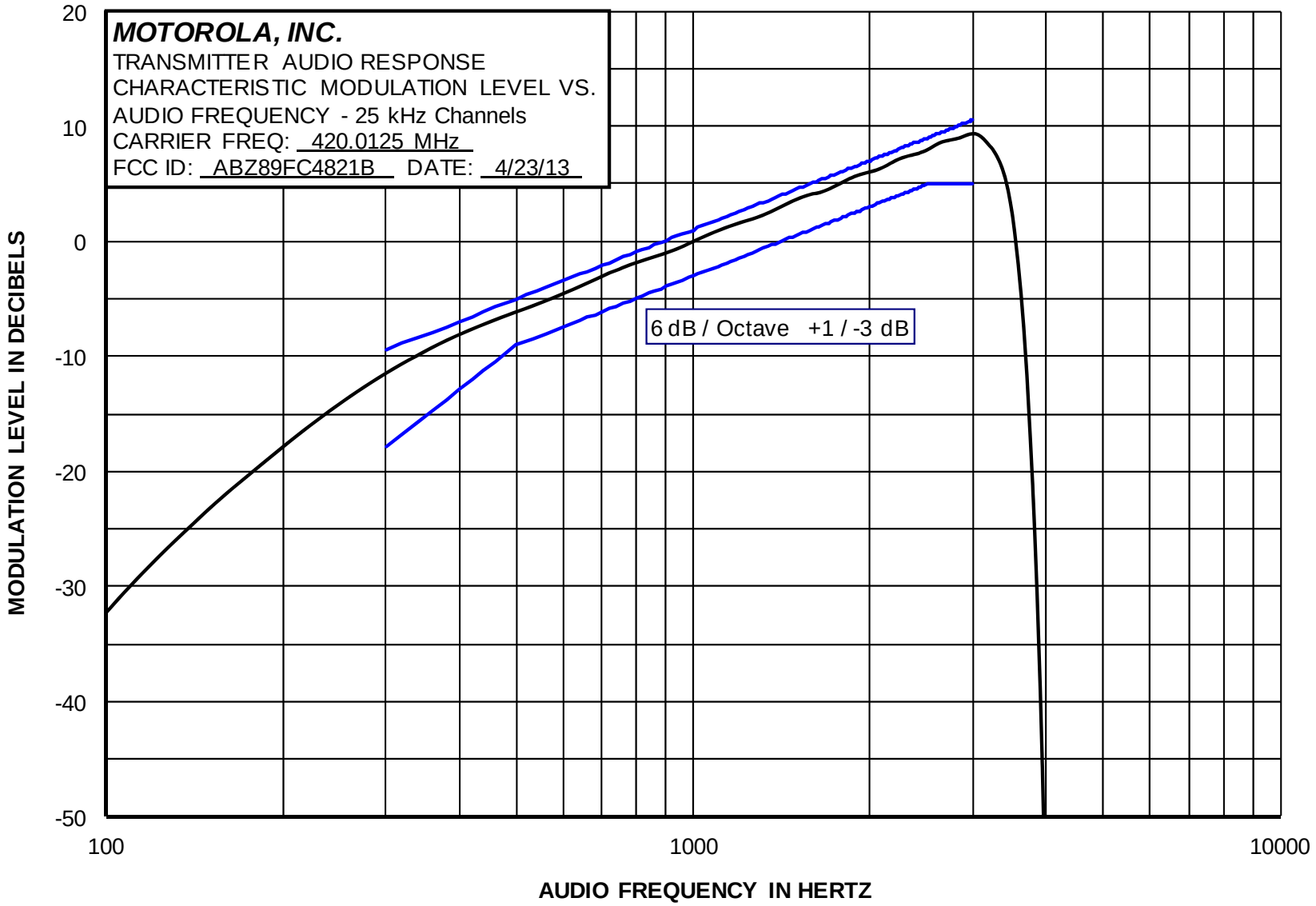
Report on Test Measurements

Audio Frequency Response – 25 kHz Channels – Low End of Band



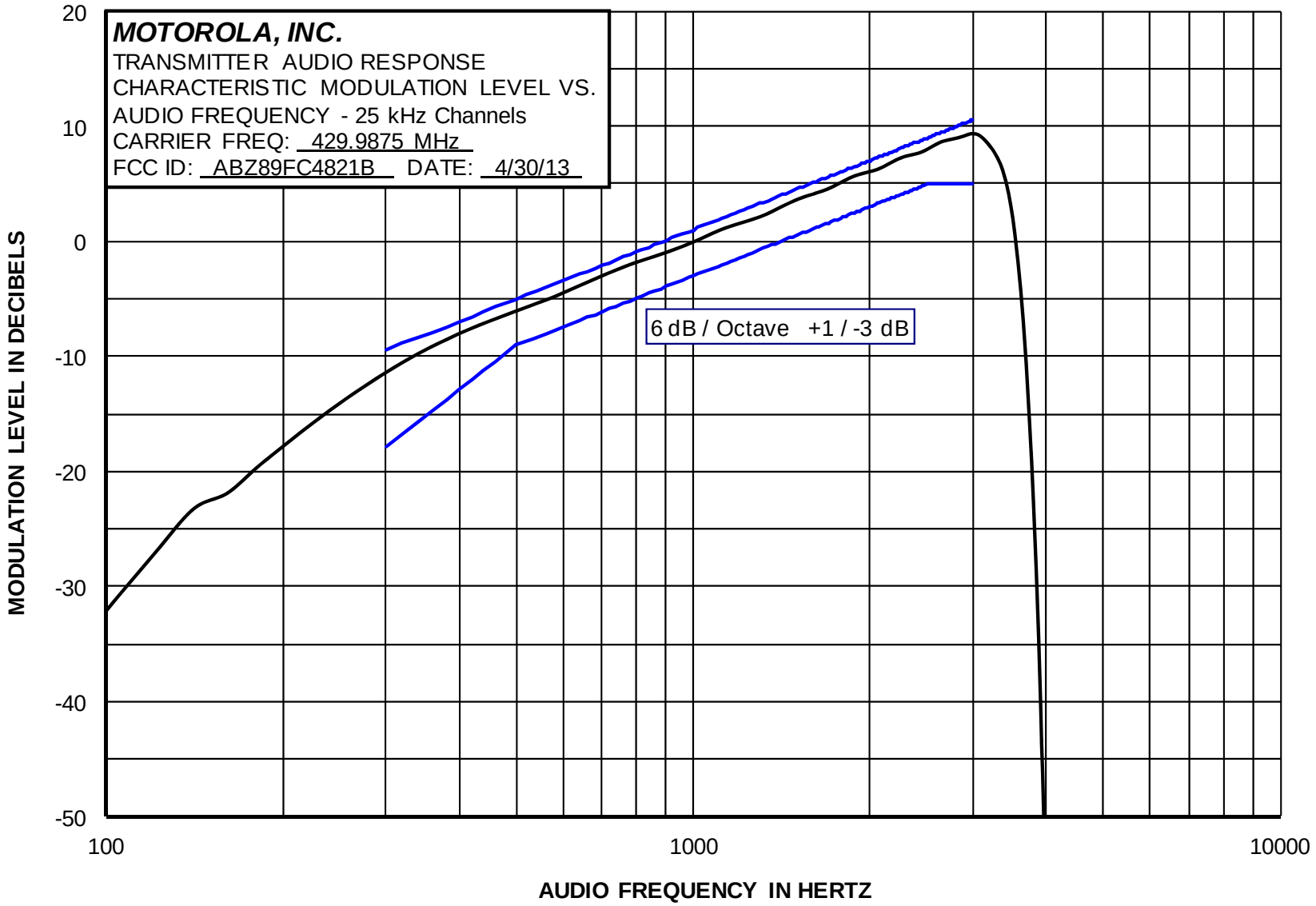
Report on Test Measurements

Audio Frequency Response – 25 kHz Channels – Middle of Band



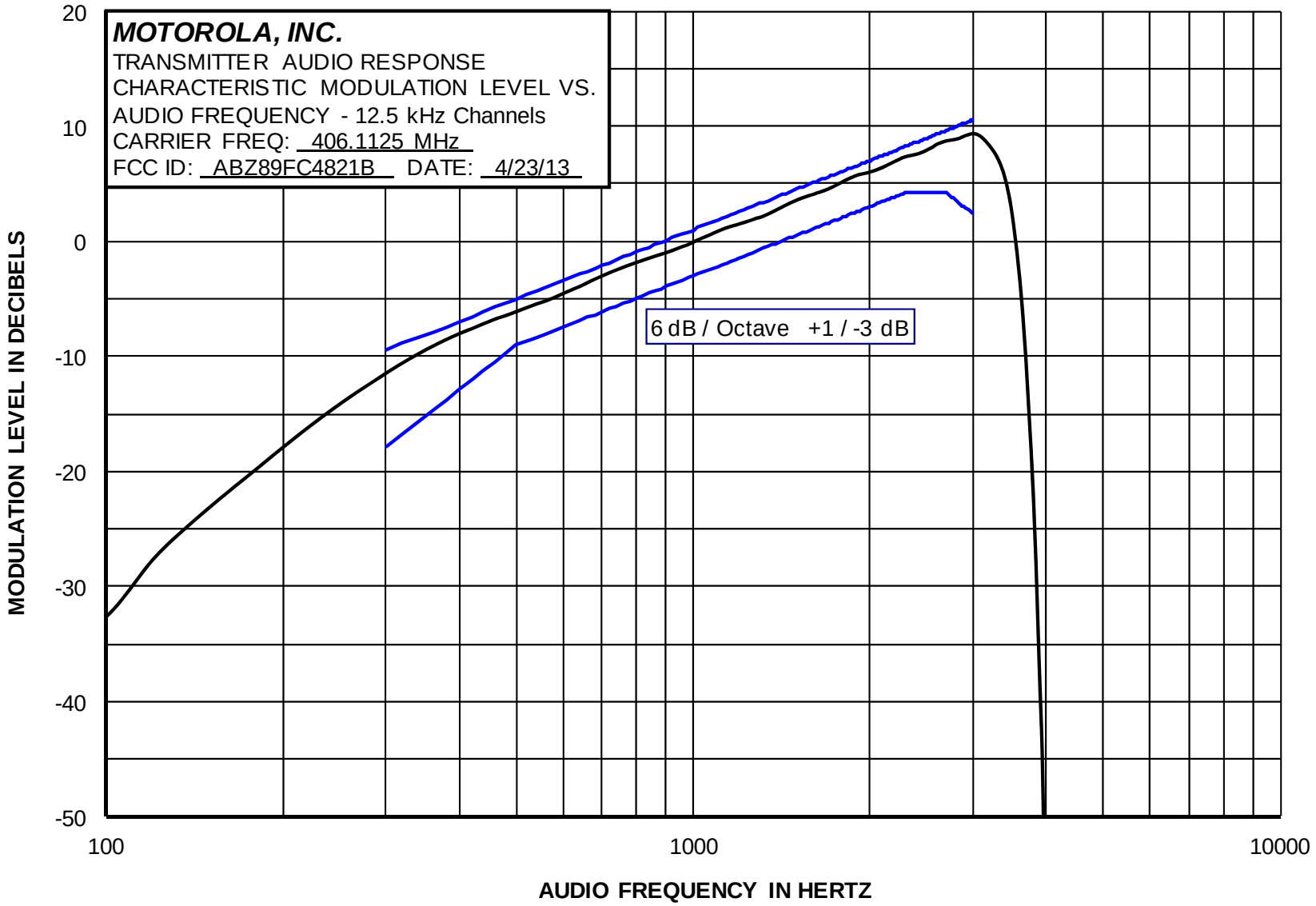
Report on Test Measurements

Audio Frequency Response – 25 kHz Channels – High End of Band



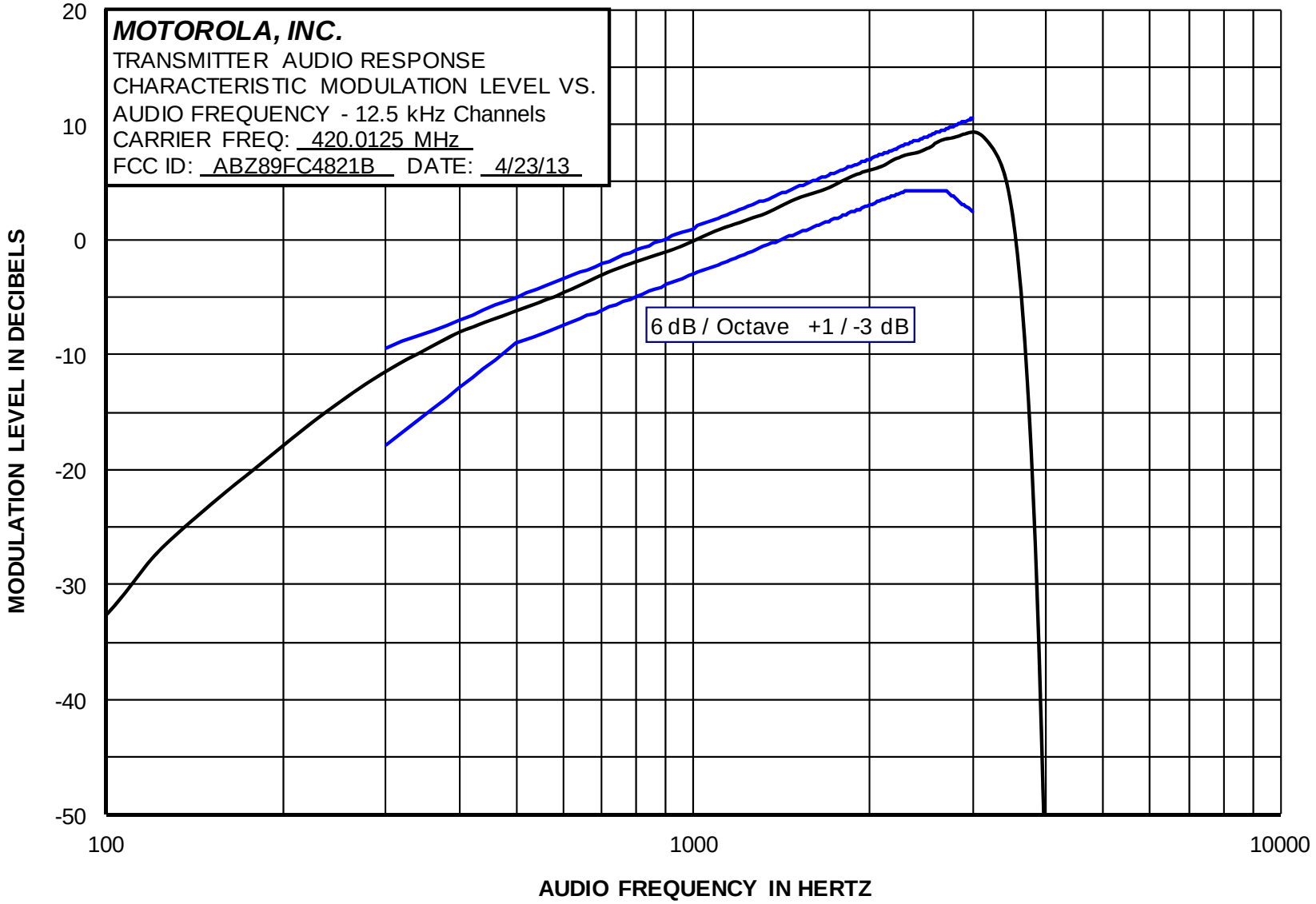
Report on Test Measurements

Audio Frequency Response – 12.5 kHz Channels – Low End of Band



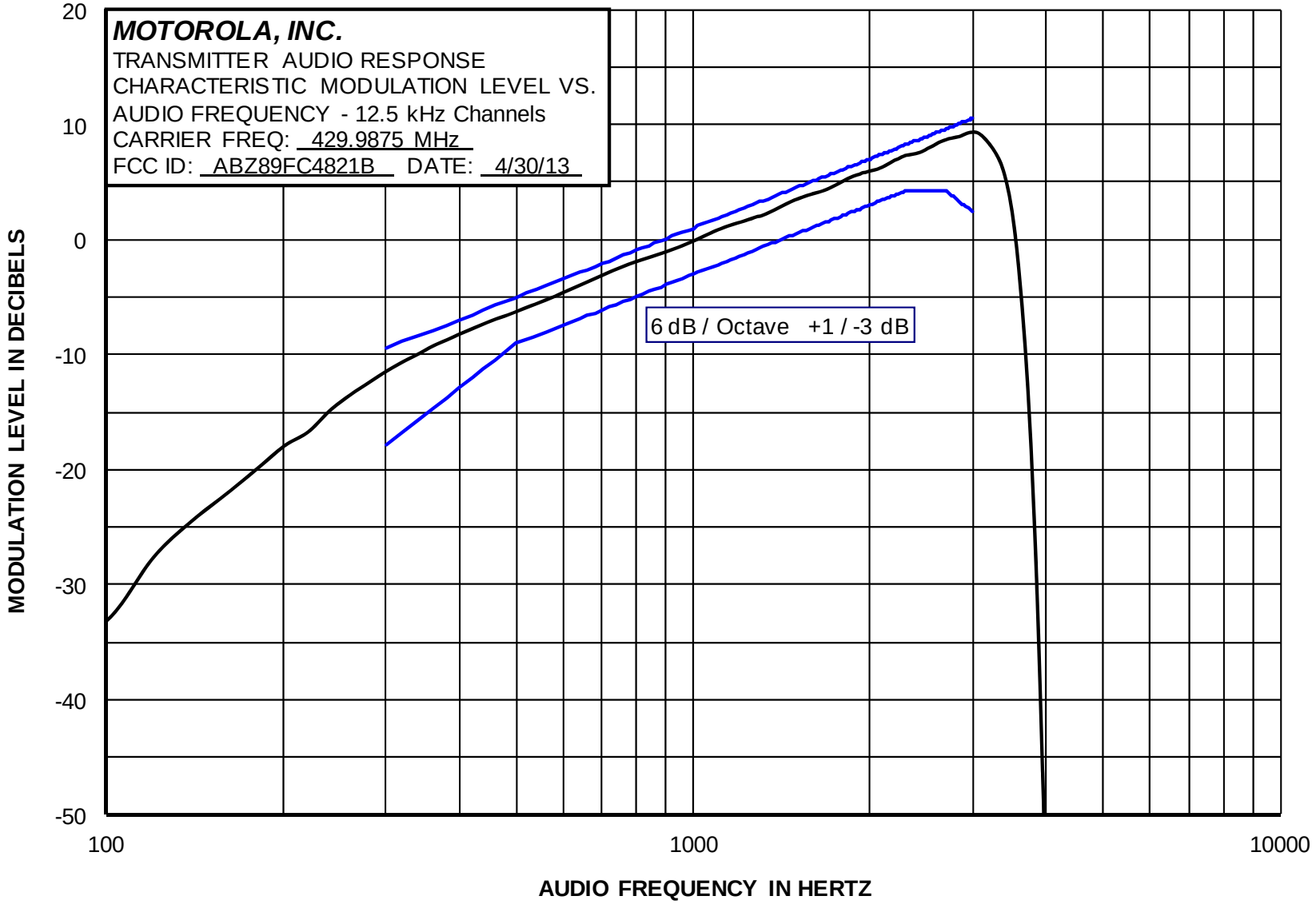
Report on Test Measurements

Audio Frequency Response – 12.5 kHz Channels – Middle of Band



Report on Test Measurements

Audio Frequency Response – 12.5 kHz Channels– High End of Band



Report on Test Measurements

Modulation Limiting

Specification Requirement per TIA 603:
Modulation Limiting, 25 kHz Channels*:* The maximum instantaneous peak and steady state deviations shall not exceed the rated system deviation of +/- 5 kHz at any audio frequency or change in level as specified in the method of measurement.

The minimum value of modulation limiting shall be at least 60% of the rated system deviation, or 3 kHz.

Modulation Limiting, 12.5 kHz Channels*:* The maximum instantaneous peak and steady state deviations shall not exceed the rated system deviation of +/- 2.5 kHz at any audio frequency or change in level as specified in the method of measurement.

The minimum value of modulation limiting shall be at least 60% of the rated system deviation, or 1.5 kHz.

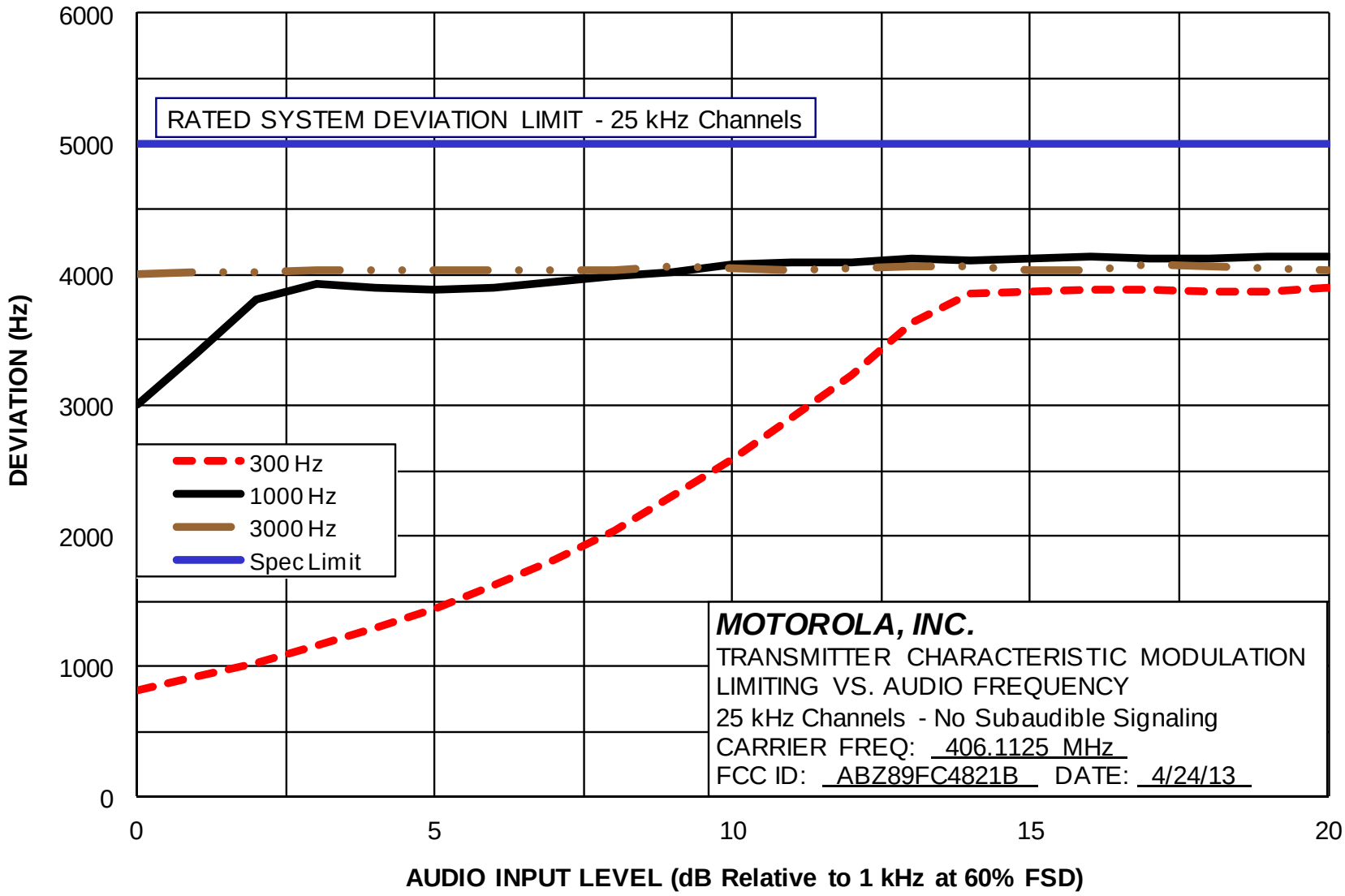
Modulation:	Audio Test Tone, Varying Frequency between 300 Hz and 3000 Hz
Carrier Frequency:	Performance was measured at carrier frequencies at the low end, middle, and high end of the operating band.

Modulation Limiting Response Plots:

EXHIBIT	DESCRIPTION
E1-8.1	Modulation Limiting Response – Modulation Characteristics, 25 kHz Channels – Low End of Band
E1-8.2	Modulation Limiting Response – Modulation Characteristics, 25 kHz Channels – Middle of Band
E1-8.3	Modulation Limiting Response – Modulation Characteristics, 25 kHz Channels – High End of Band
E1-8.4	Modulation Limiting Response – Modulation Characteristics, 12.5 kHz Channels – Low End of Band
E1-8.5	Modulation Limiting Response – Modulation Characteristics, 12.5 kHz Channels – Middle of Band
E1-8.6	Modulation Limiting Response – Modulation Characteristics, 12.5 kHz Channels – High End of Band

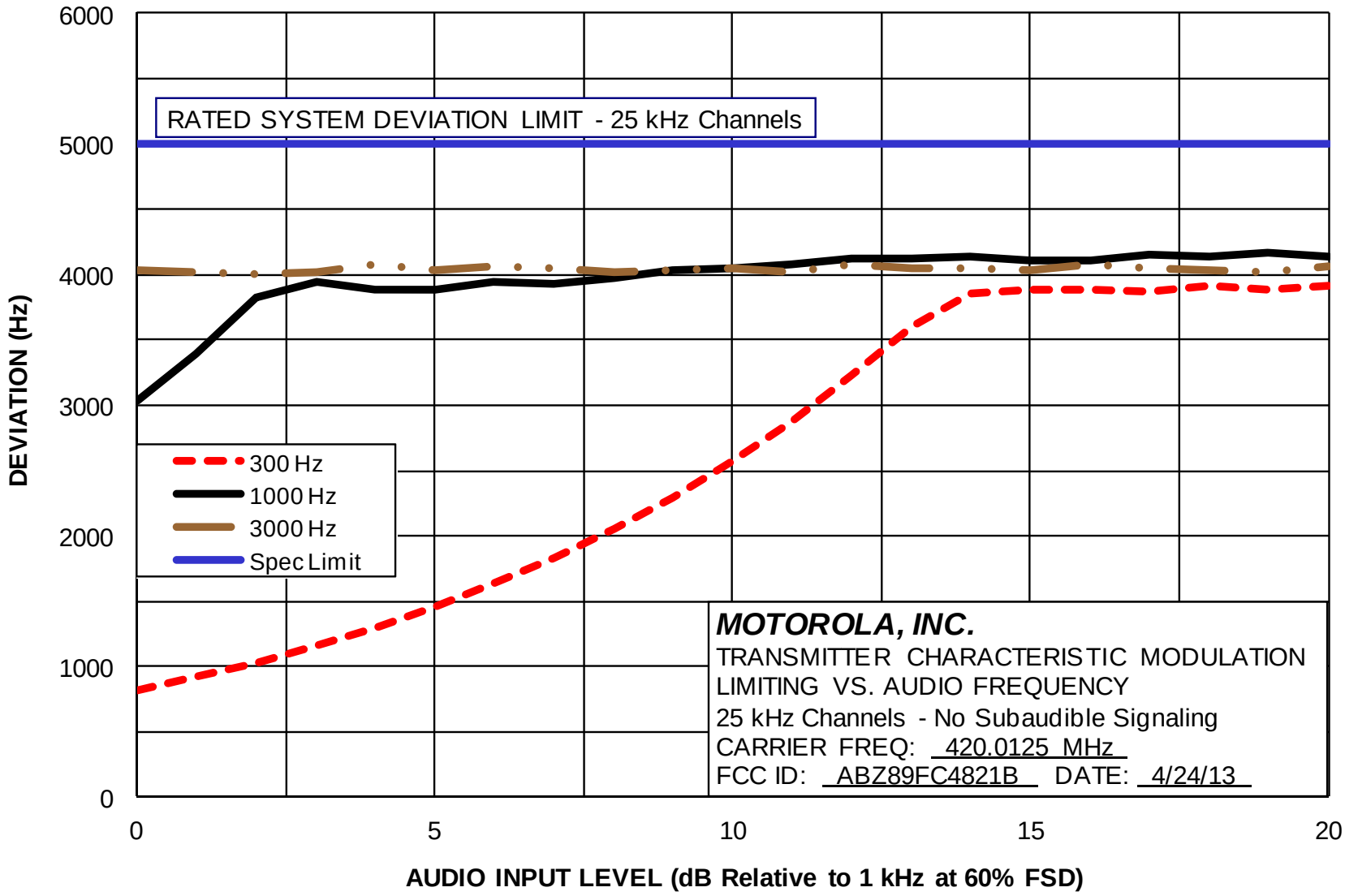
Report on Test Measurements

Modulation Limiting – 25 kHz Channels – Low End of Band



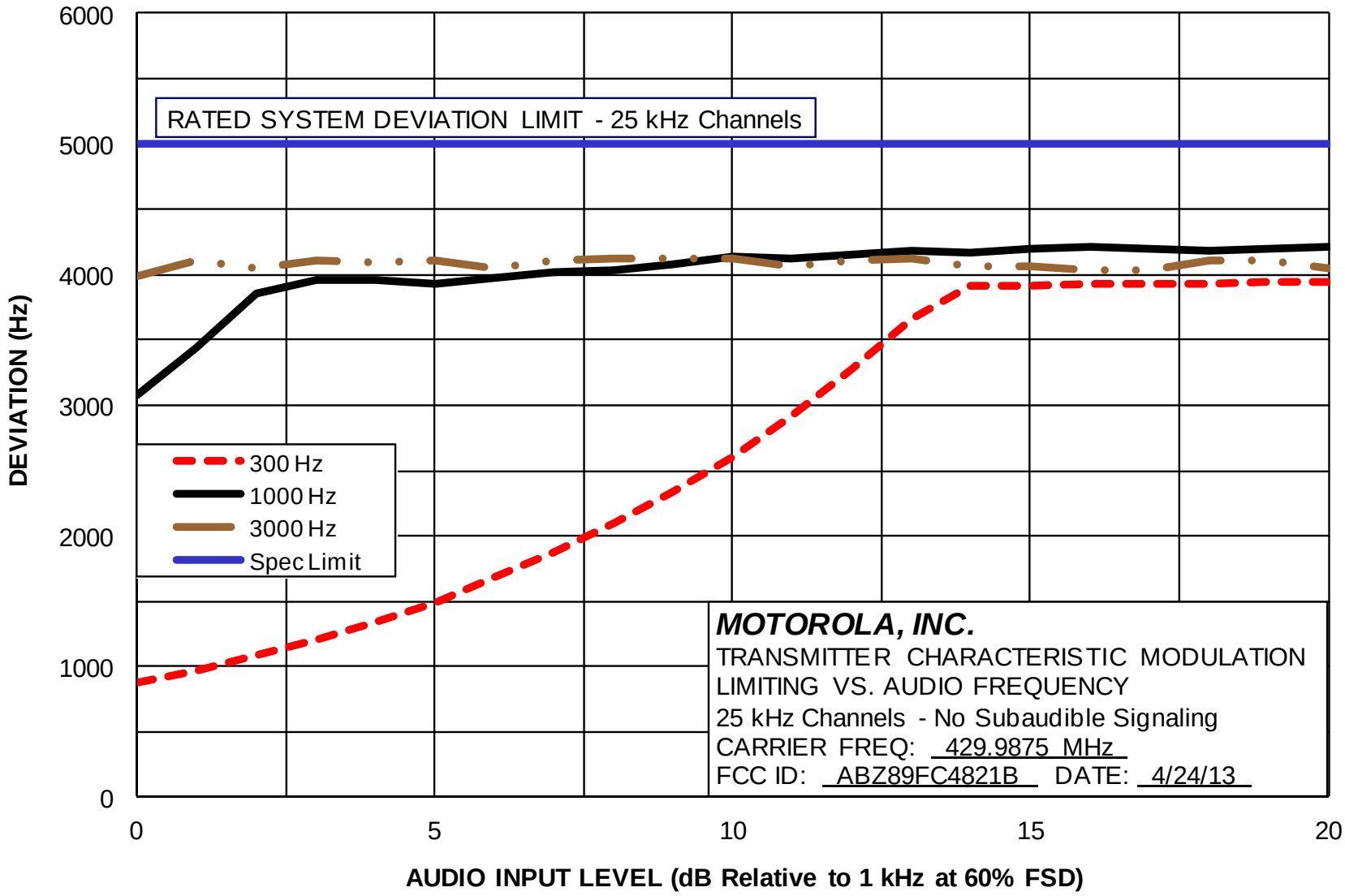
Report on Test Measurements

Modulation Limiting – 25 kHz Channels – Middle of Band



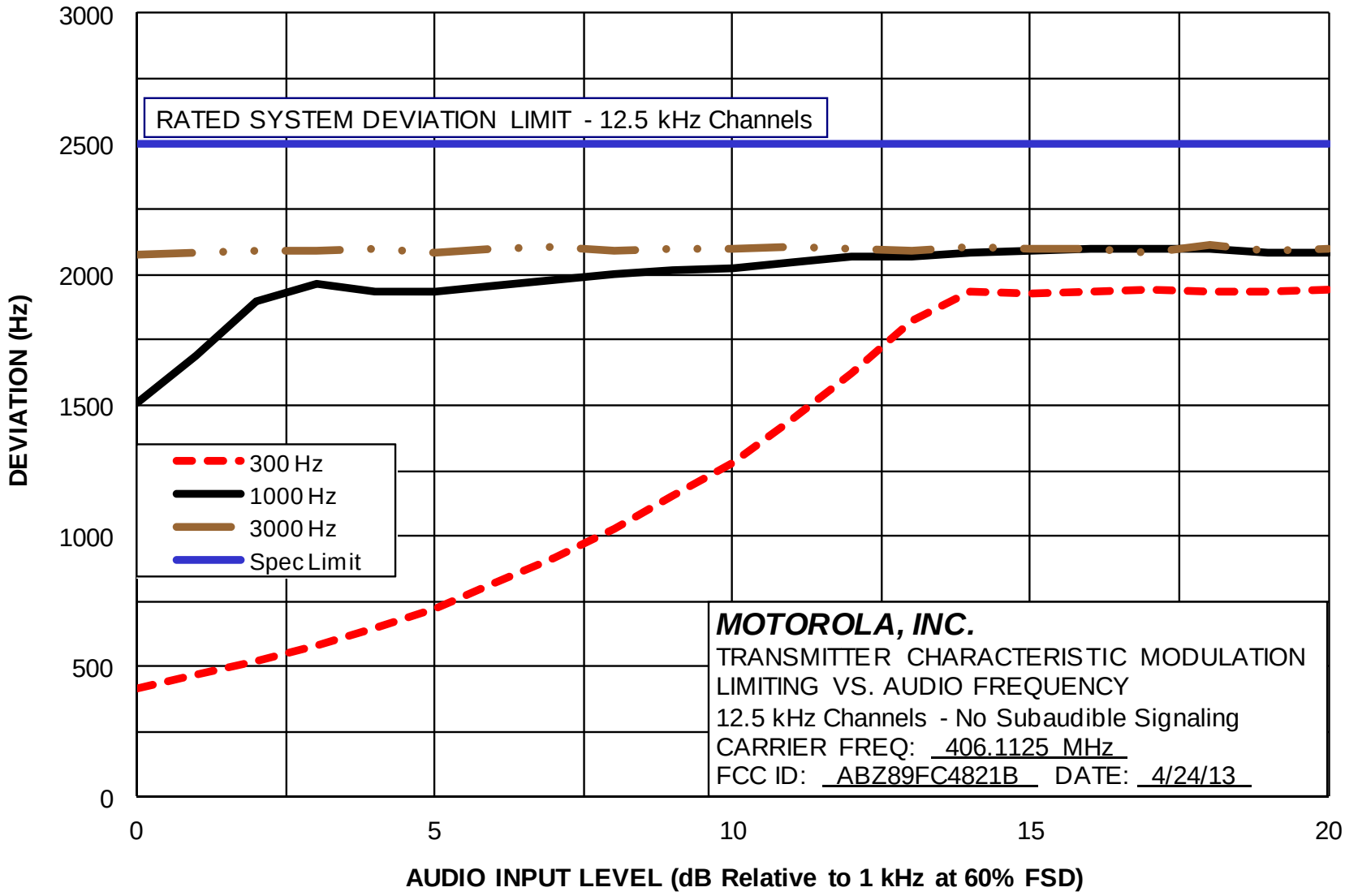
Report on Test Measurements

Modulation Limiting – 25 kHz Channels – High End of Band



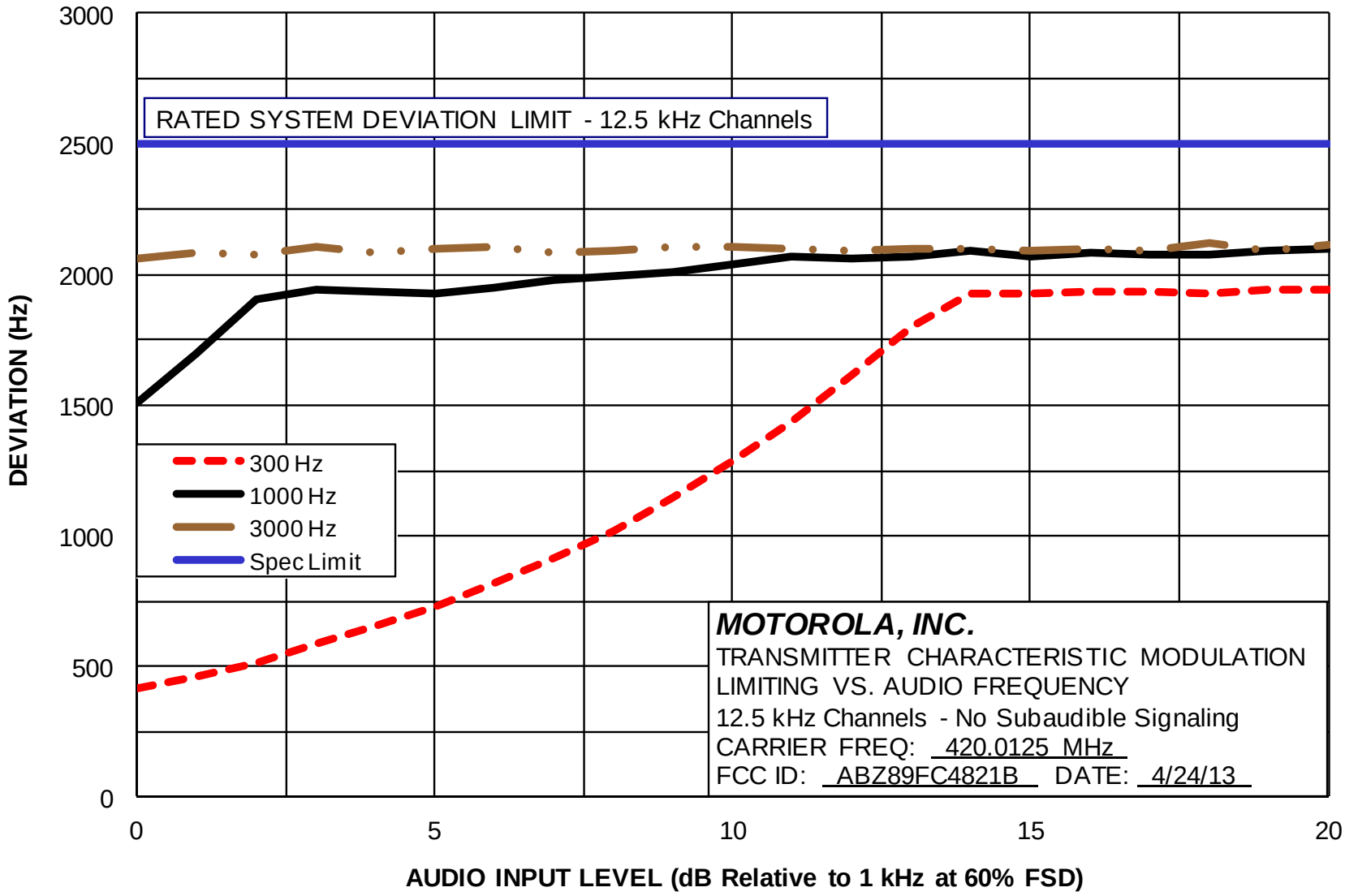
Report on Test Measurements

Modulation Limiting – 12.5 kHz Channels – Low End of Band



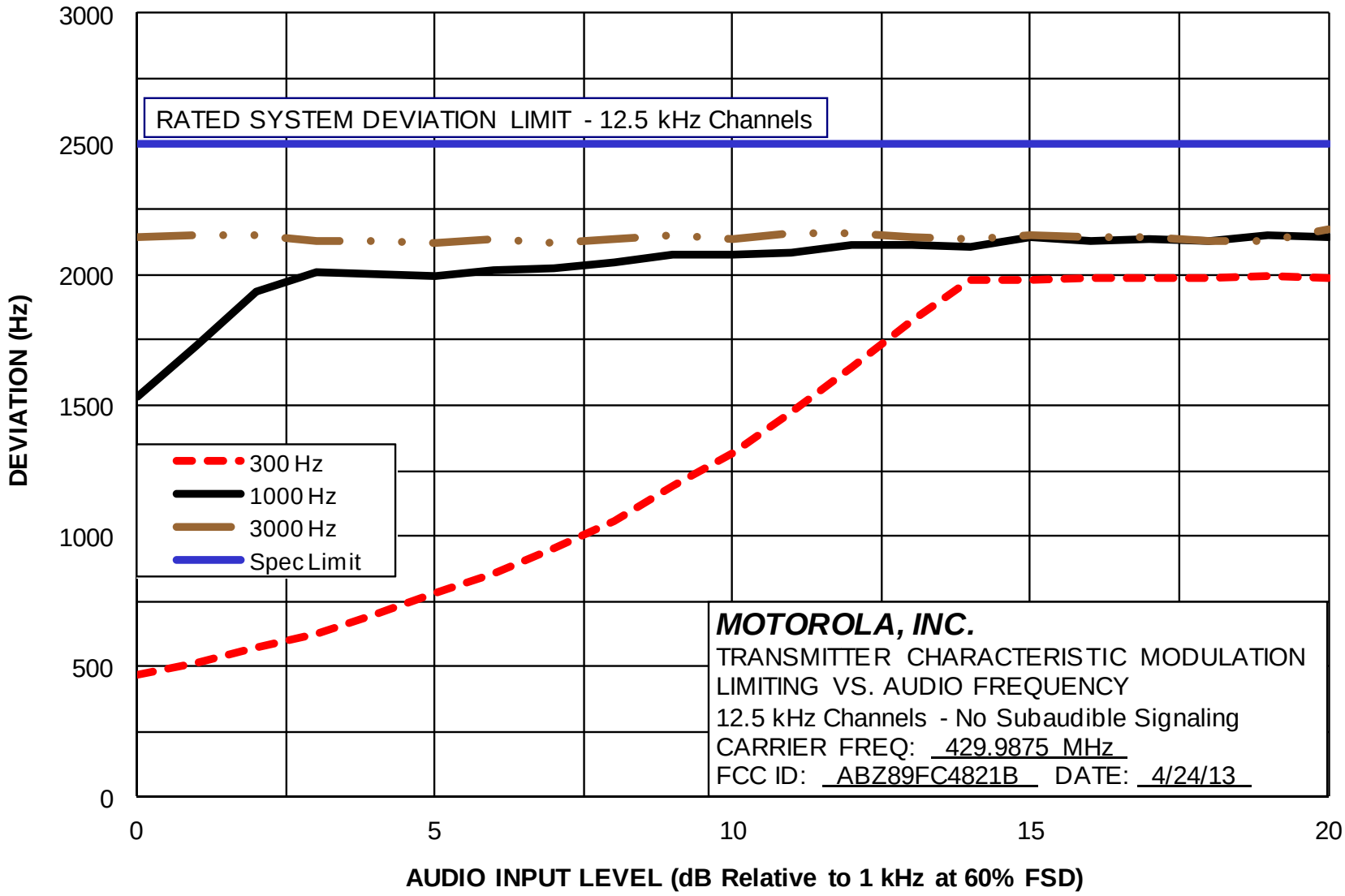
Report on Test Measurements

Modulation Limiting – 12.5 kHz Channels – Middle of Band



Report on Test Measurements

Modulation Limiting – 12.5 kHz Channels – High End of Band



Report on Test Measurements

Occupied Bandwidth – Analog Voice Frequency Modulation, 25 kHz Channel Spacing
The exhibits in this section show occupied bandwidth plots for analog voice modulation. Data is shown with the modulating audio tone itself, the tone plus Private Line (PL) sub-audible tone signaling, tone plus Digital Private Line (DPL) sub-audible signaling, 150 bps low speed data, and 300 bps low speed data. PL and DPL are used in "Conventional" systems, whereas 150 bps and 300 bps low speed data are used in "Trunking" systems.

The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type:	Analog Voice
Emission Designator:	16K0F3E
Channelization:	25 kHz
Deviation Limit:	±5.0 kHz Max
Power Setting:	110 Watts

Specification Requirement 47 CFR §90.210(b) and IC RSS-119 section 5.8.1 - Emission Limits – "B-Mask":
For transmitters equipped with an audio low pass filter and designed to operate with a 25 kHz channel spacing (authorized bandwidth 20 kHz), the power of any emission must be below the unmodulated carrier power (P) as follows:

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

a) >10 kHz up to and including 20 kHz — *At least 25 dB;*
b) >20 kHz up to and including 50 kHz — *At least 35 dB;*
c) >50 kHz — *at least 43+10 * Log_{10} (P) dB.*

Necessary Bandwidth Calculation:
The necessary bandwidth of the modulation per the formulas defined in 47 CFR §2.202(g) / TRC-43 section 8 is as follows:

Max Mod Freq, M	*Max Deviation, D*	*2*(M+D)*	*Nec BW*
3 kHz	5 kHz	16 kHz	16K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings				Measured Occupied Bandwidth	
Horizontal:	12.5 kHz per Division	Resolution BW:	300 Hz	Resolution BW:	300 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz	Span:	30 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	Number of Points:	1601
Detector:	Peak			Integration Time:	7.4 ms

Test Procedure:

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

EXHIBIT	**DESCRIPTION**	**Meas Occ BW Low, Mid, High**
E1-9.1, 2, 3	Carrier with 2500 Hz Audio Tone, 25 kHz Channels	14.85, 14.86, 14.85 kHz
E1-9.4, 5, 6	Carrier, 2500 Hz Audio, Private Line (PL), 25 kHz Channels	11.66, 11.59, 11.70 kHz
E1-9.7, 8, 9	Carrier, 2500 Hz Audio, Digital Private Line (DPL), 25 kHz Channels	11.87, 11.93, 11.89 kHz
E1-9.10, 11, 12	Carrier, 2500 Hz Audio, 150 bps Low Speed Data, 25 kHz Channels	11.81, 11.78, 11.81 kHz
E1-9.13, 14, 15	Carrier, 2500 Hz Audio, 300 bps Low Speed Data, 25 kHz Channels	11.66, 11.68, 11.59 kHz

Report on Test Measurements

Occupied Bandwidth – Analog Voice Frequency Modulation, 12.5 kHz Channel Spacing
The exhibits in this section show occupied bandwidth plots for analog voice modulation. Data is shown with the modulating audio tone itself, the tone plus Private Line (PL) sub-audible tone signaling, tone plus Digital Private Line (DPL) sub-audible signaling, 150 bps low speed data, and 300 bps low speed data. PL and DPL are used in "Conventional" systems, whereas 150 bps and 300 bps low speed data are used in "Trunking" systems.

The occupied bandwidth charts reference the following setup and specification requirements.

Modulation Type:	Analog Voice
Emission Designator:	11K0F3E
Channelization:	12.5 kHz
Deviation Limit:	±5.0 kHz Max
Power Setting:	110 Watts

Specification Requirement 47 CFR §90.210(d) and IC RSS-119 section 5.8.3 - Emission Limits – "D-Mask":
Emission *Mask D.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(2) On any frequency from the center of the authorized bandwidth (f_0) to 5.625 kHz removed from f_0: *Zero dB*

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: *At least 7.27 *(f_d –2.88 kHz) dB*

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: *At least 50 plus 10 log_{10}(P) dB or 70 dB, whichever is the lesser attenuation.*

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

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

Max Mod Freq, M	*Max Deviation, D*	*2*(M+D)*	*Nec BW*
3 kHz	2.5 kHz	11 kHz	11K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings			
Horizontal:	12.5 kHz per Division	Resolution BW:	100 Hz
Vertical:	10 dB per Division	Video BW:	10 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz
Detector:	Peak		

Measured Occupied Bandwidth	
Resolution BW:	150 Hz
Span:	15 kHz
Number of Points:	1601
Integration Time:	14.8 ms

(continued next page)

Report on Test Measurements

Occupied Bandwidth –12.5 kHz Channel Spacing (continued)

Test Procedure (Analog Voice):

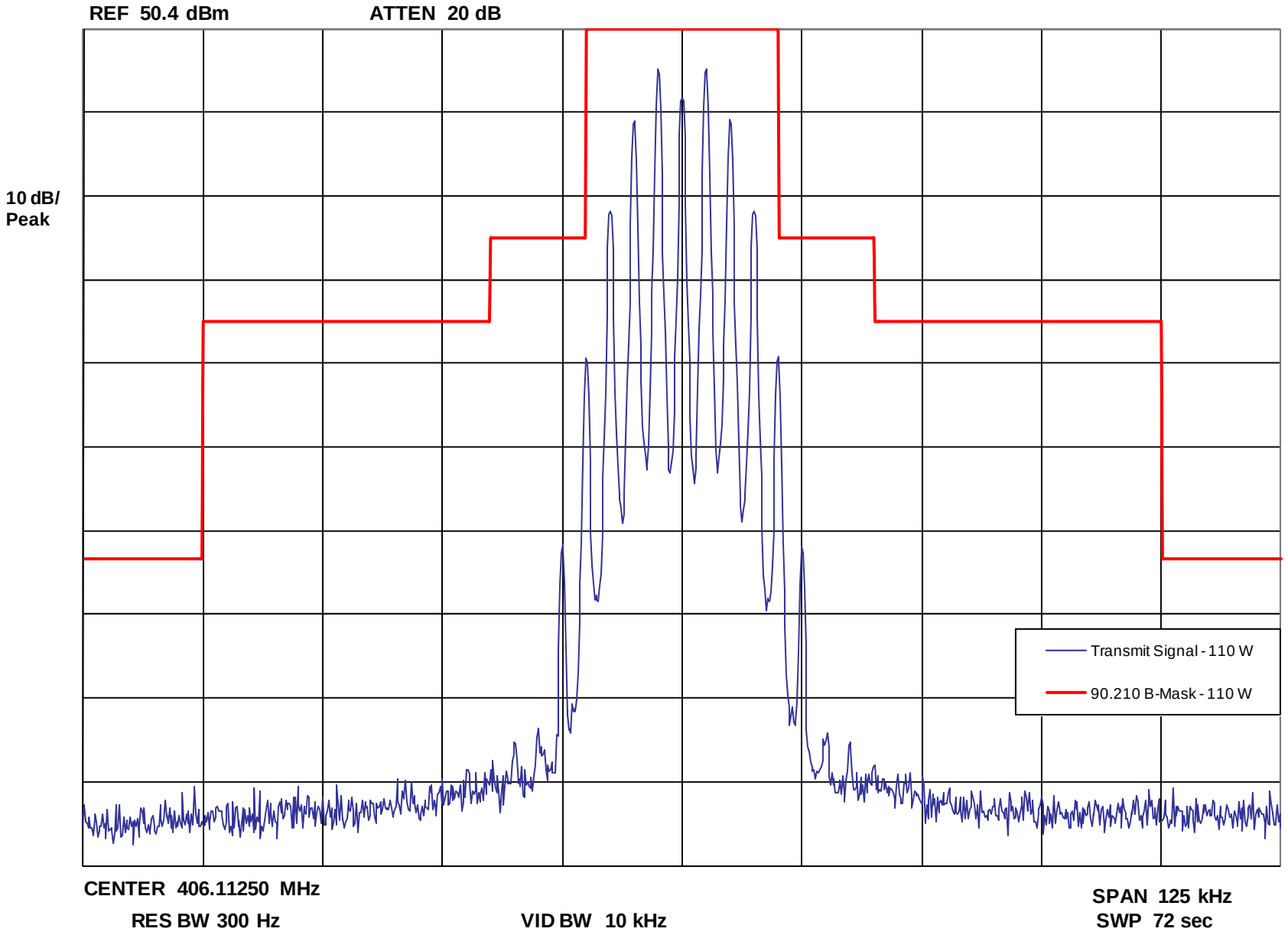
1) Key the station with no modulation to obtain the unmodulated carrier reference level on the analyzer. Use the analyzer controls to set this reference to a full-scale reference line. Store this analyzer trace in trace A.
2) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater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

EXHIBIT	DESCRIPTION	Meas Occ BW Low, Mid, High
E1-9.16, 17, 18	Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels	9.95, 9.95, 9.95 kHz
E1-9.19, 20, 21	Carrier, 2500 Hz Audio, Private Line (PL), 12.5 kHz Channels	6.06, 6.06, 6.05 kHz
E1-9.22, 23, 24	Carrier, 2500 Hz Audio, Digital Private Line (DPL), 12.5 kHz Channels	6.06, 6.05, 6.06 kHz
E1-9.25, 26, 27	Carrier, 2500 Hz Audio, 150 bps Low Speed Data, 12.5 kHz Channels	6.03, 6.02, 6.03 kHz
E1-9.28, 29, 30	Carrier, 2500 Hz Audio, 300 bps Low Speed Data, 12.5 kHz Channels	6.02, 6.02, 6.02 kHz

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

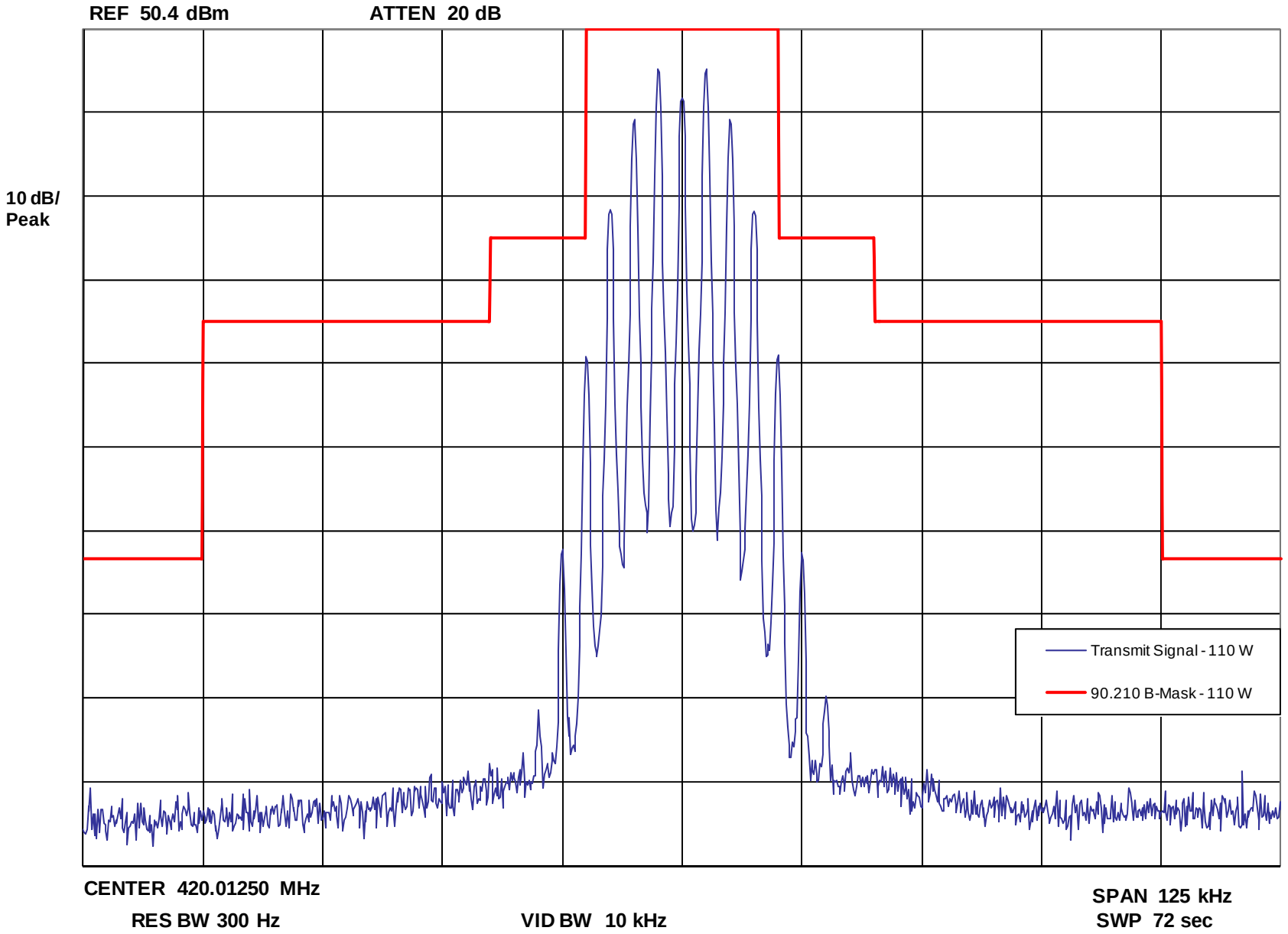
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

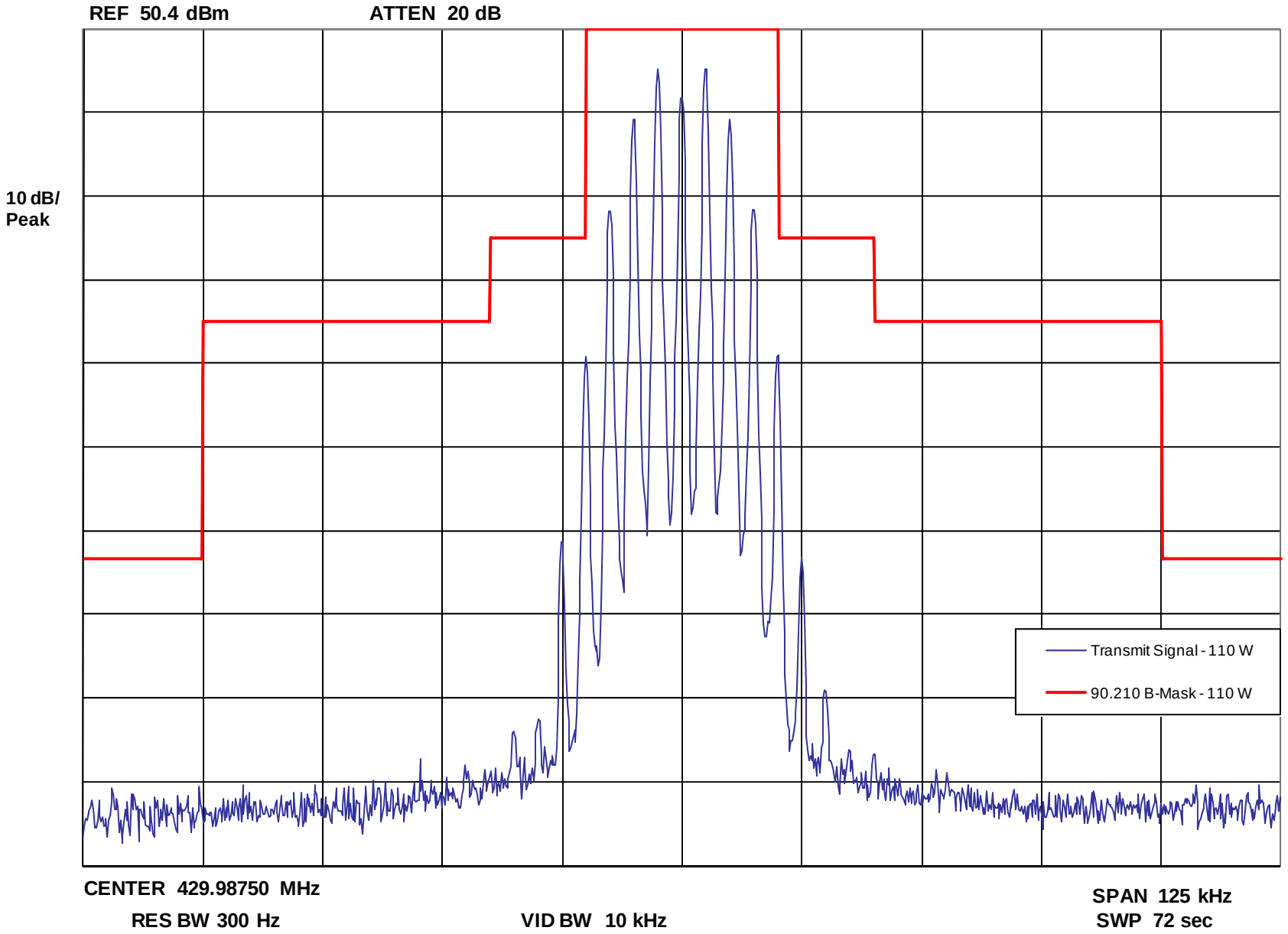
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

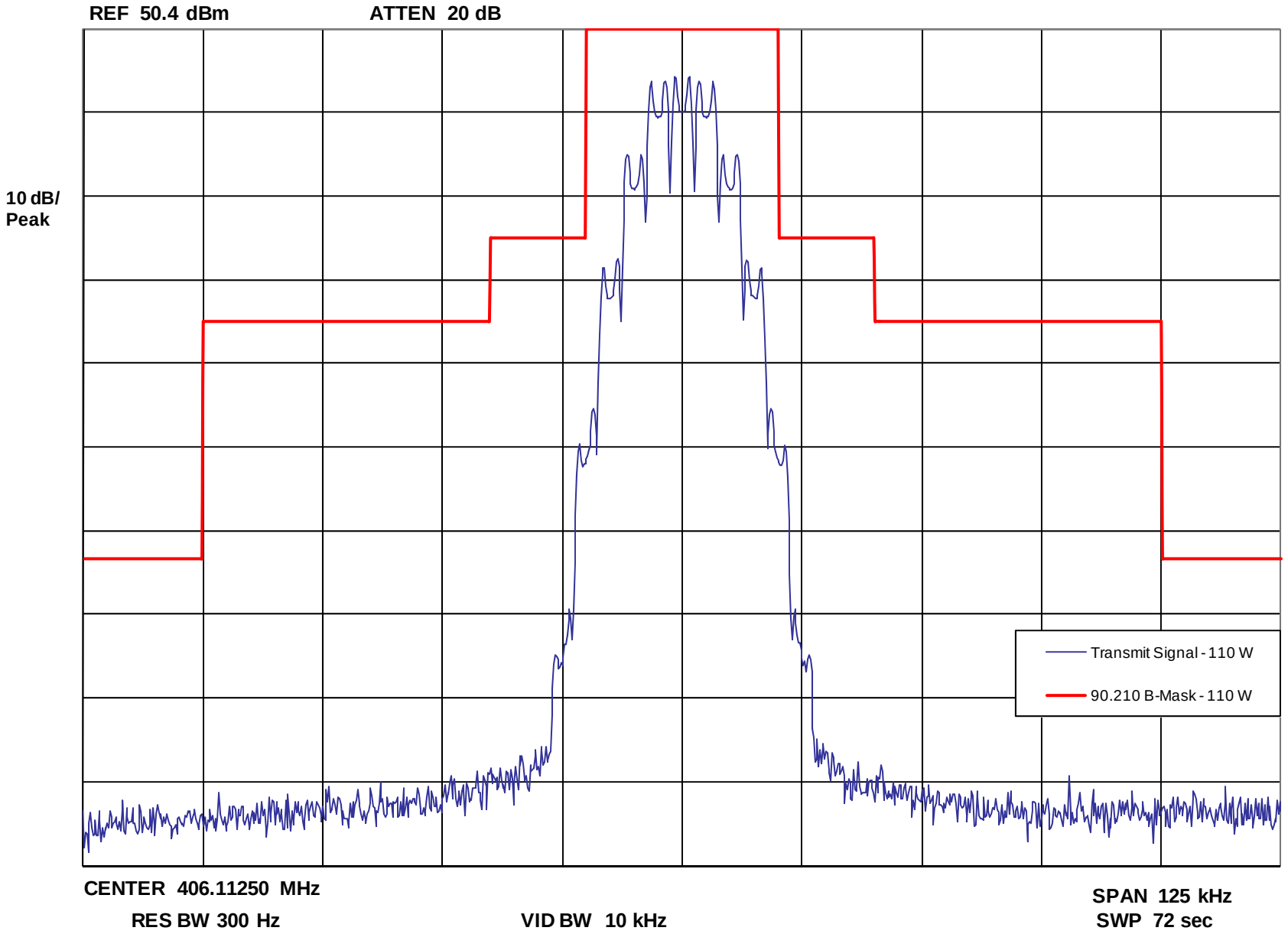
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

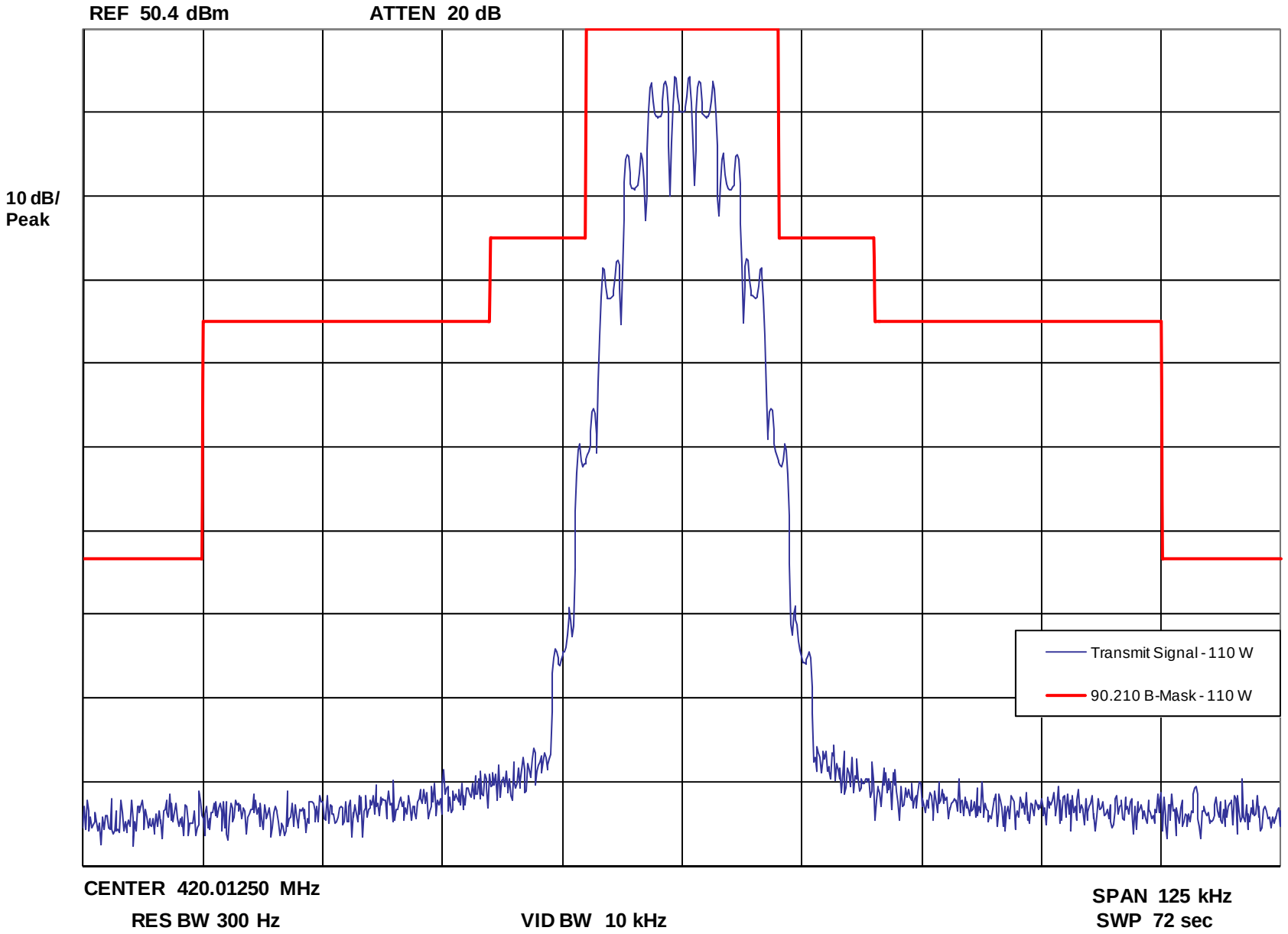
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

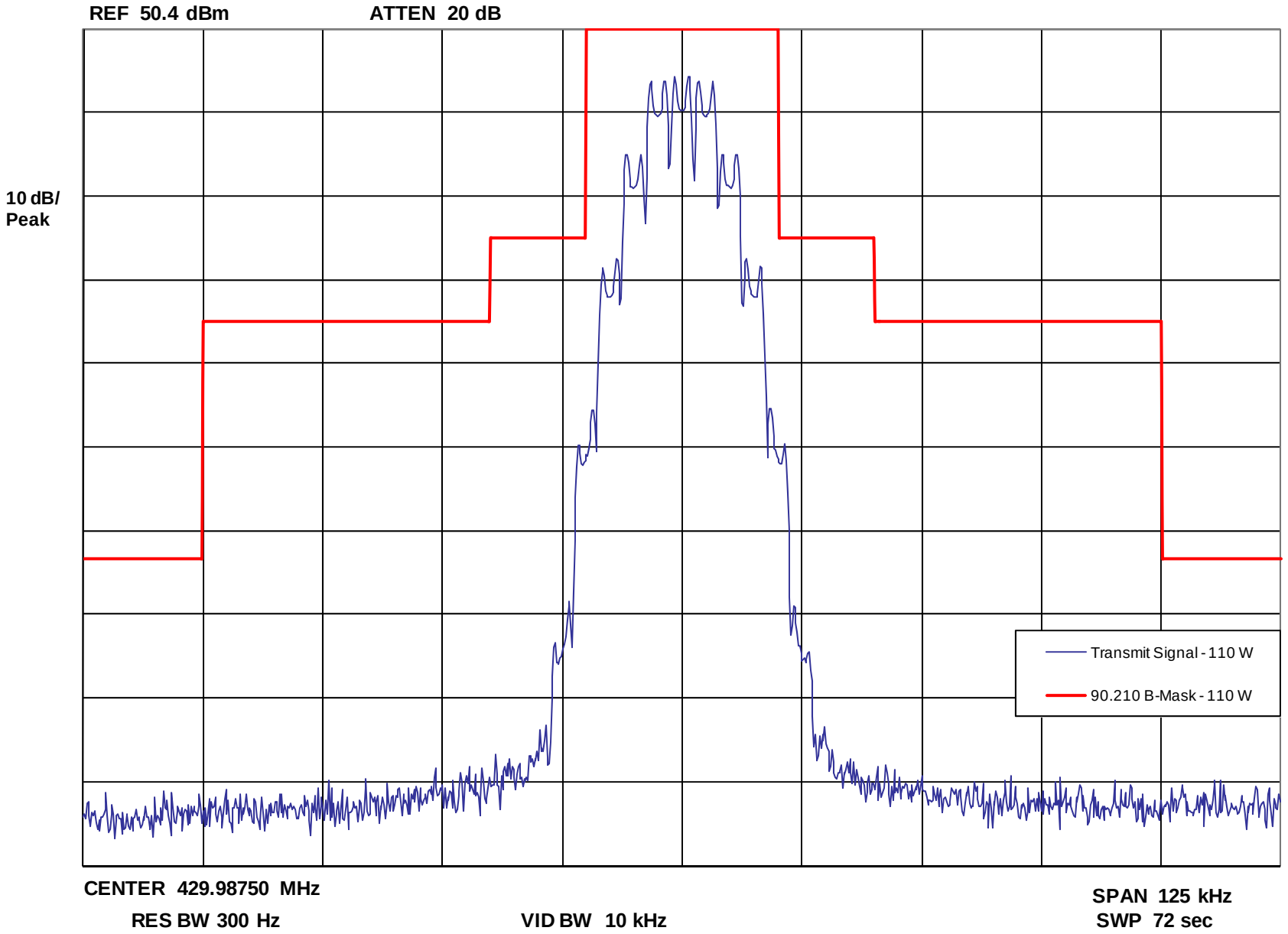
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

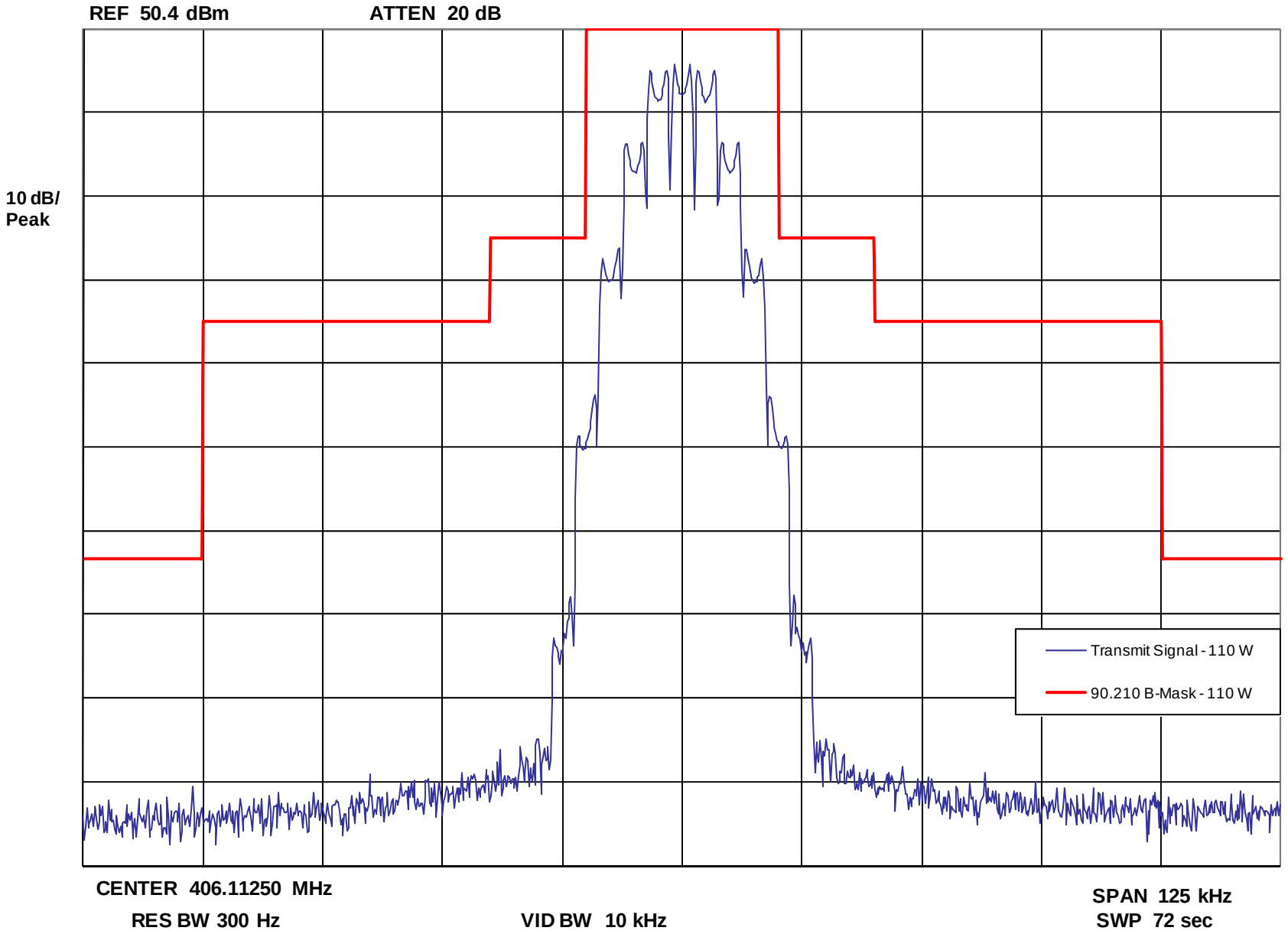
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and Digital Private Line (DPL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

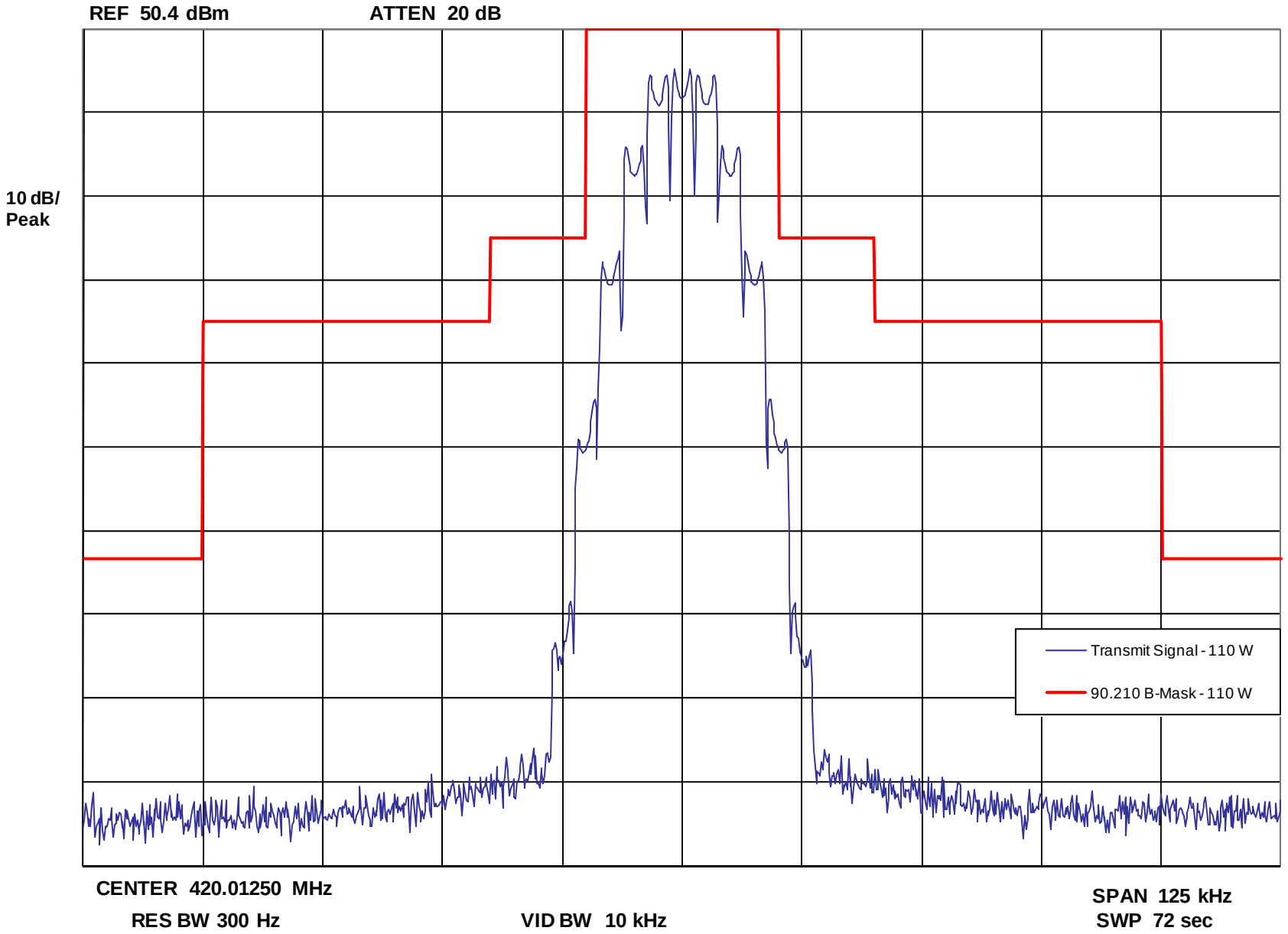
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and Digital Private Line (DPL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and Digital Private Line (DPL) Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL

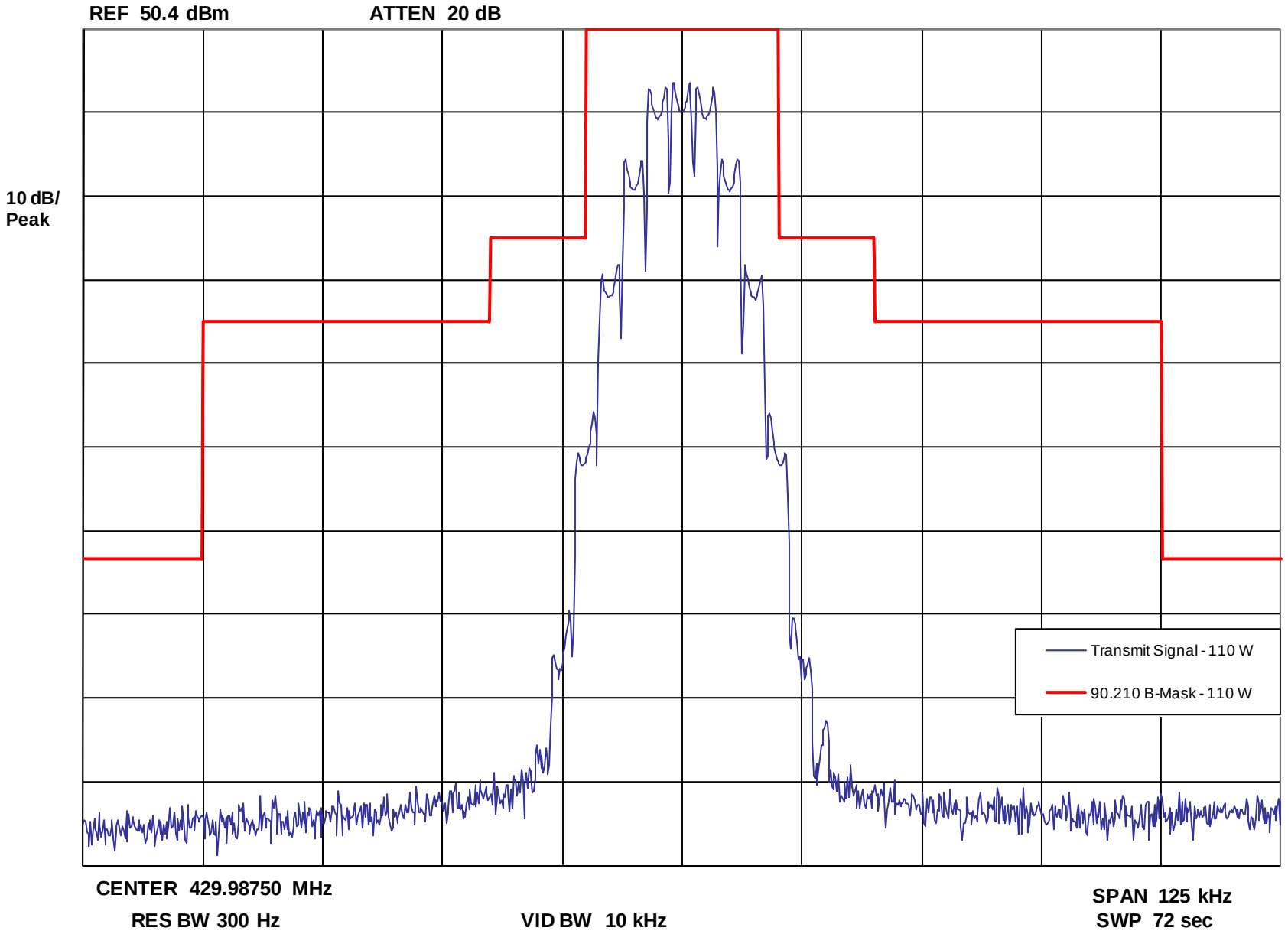
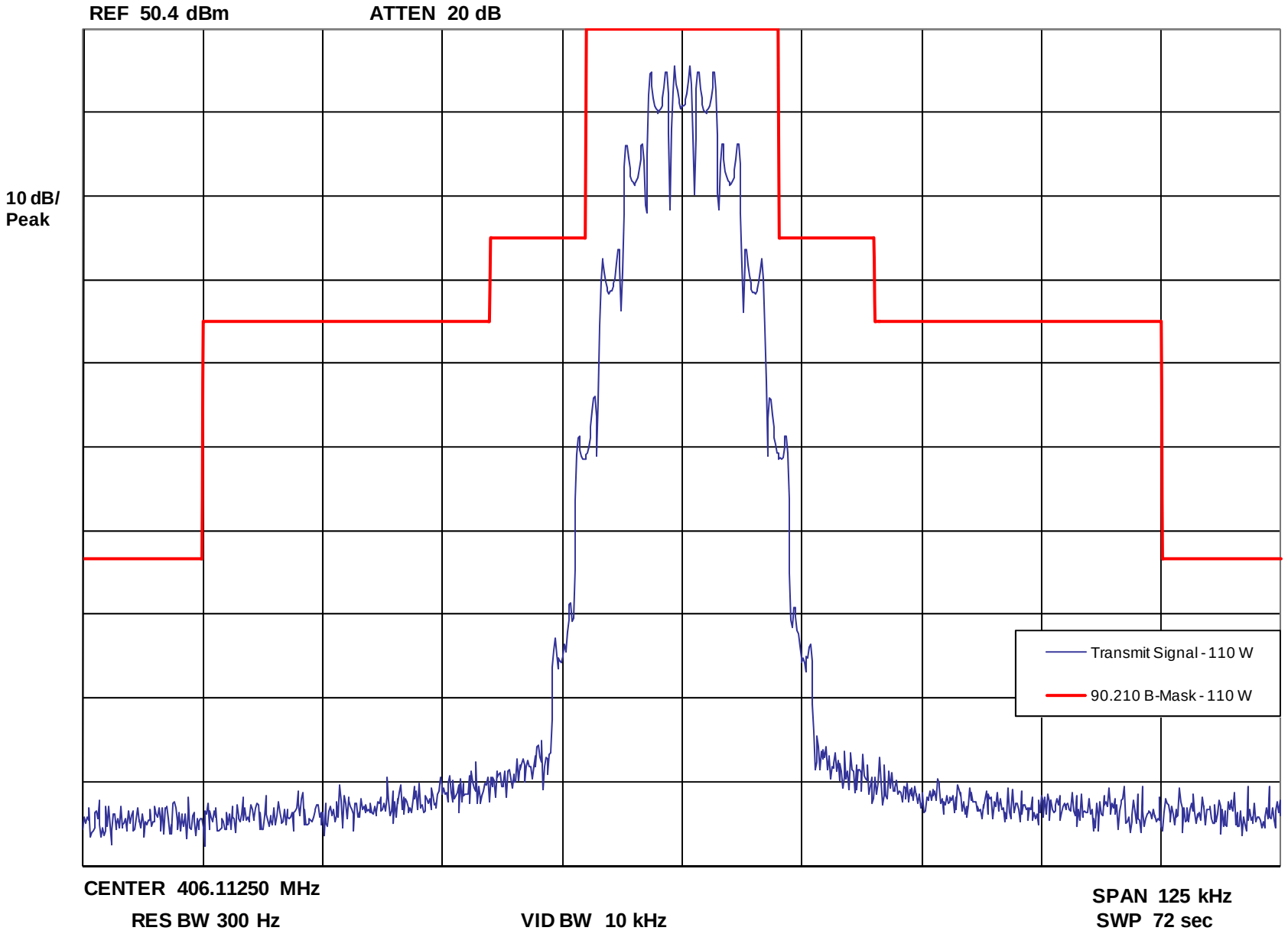


EXHIBIT E1-9.9

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 150 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

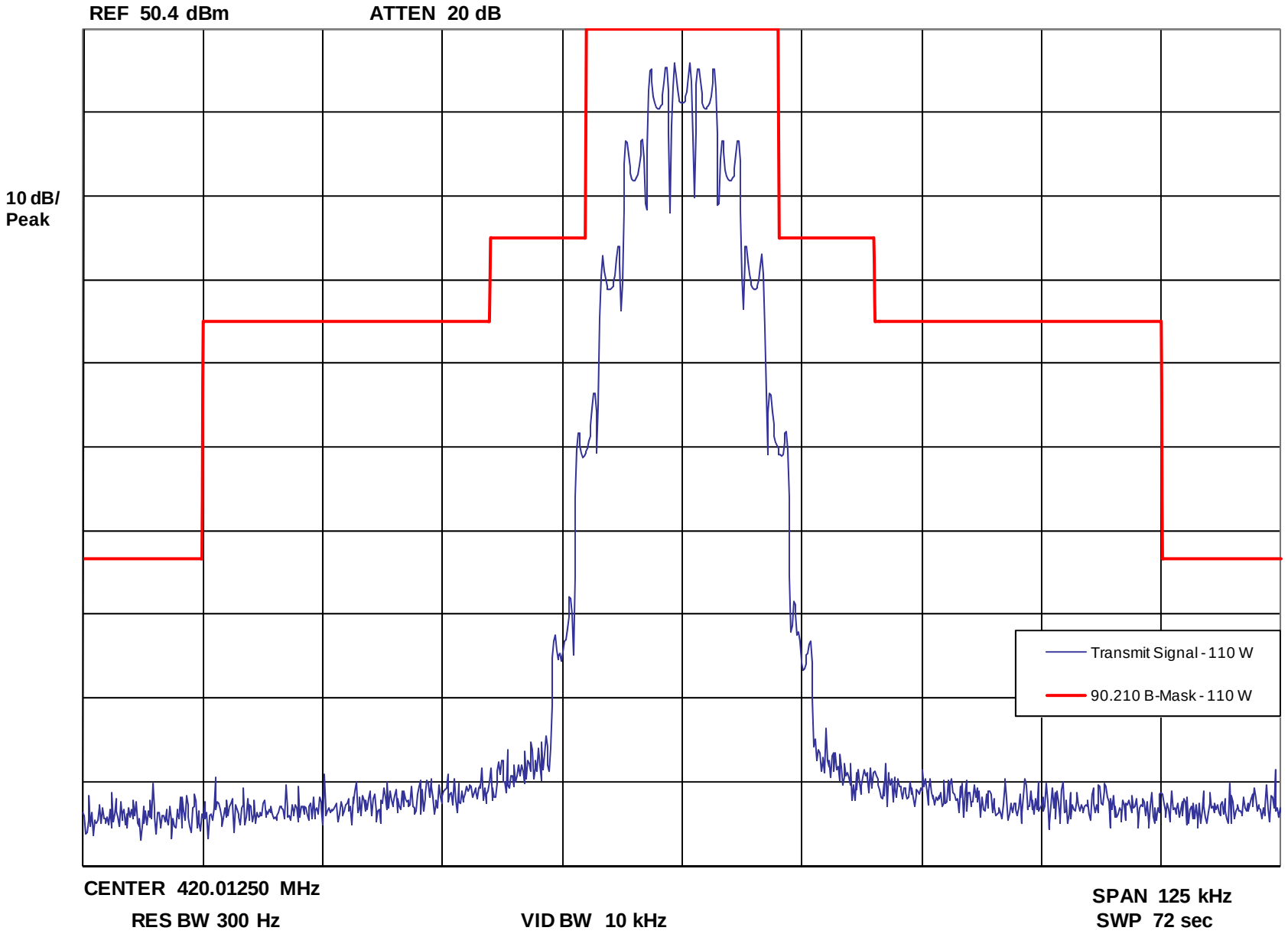
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 150 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

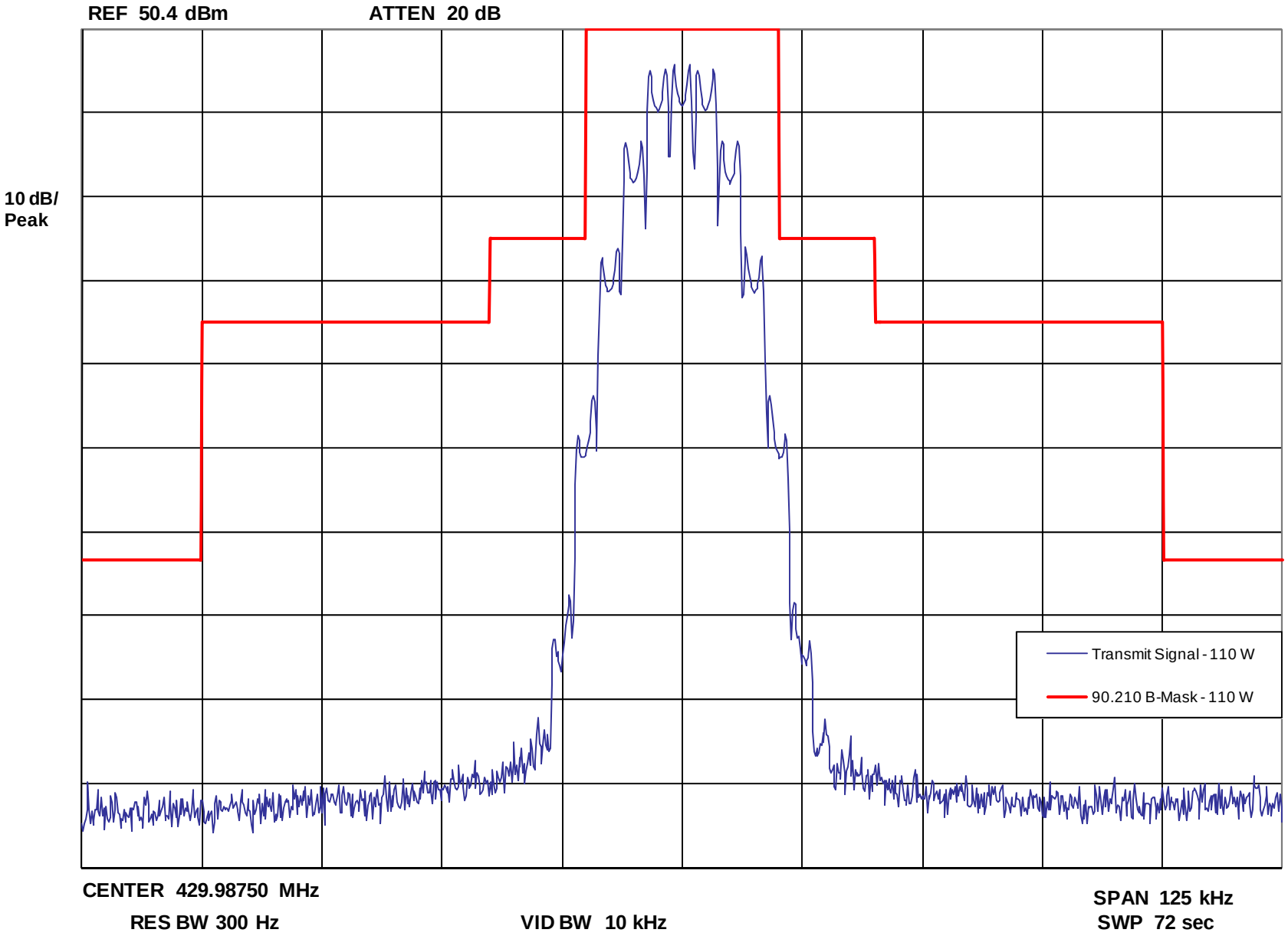
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 150 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

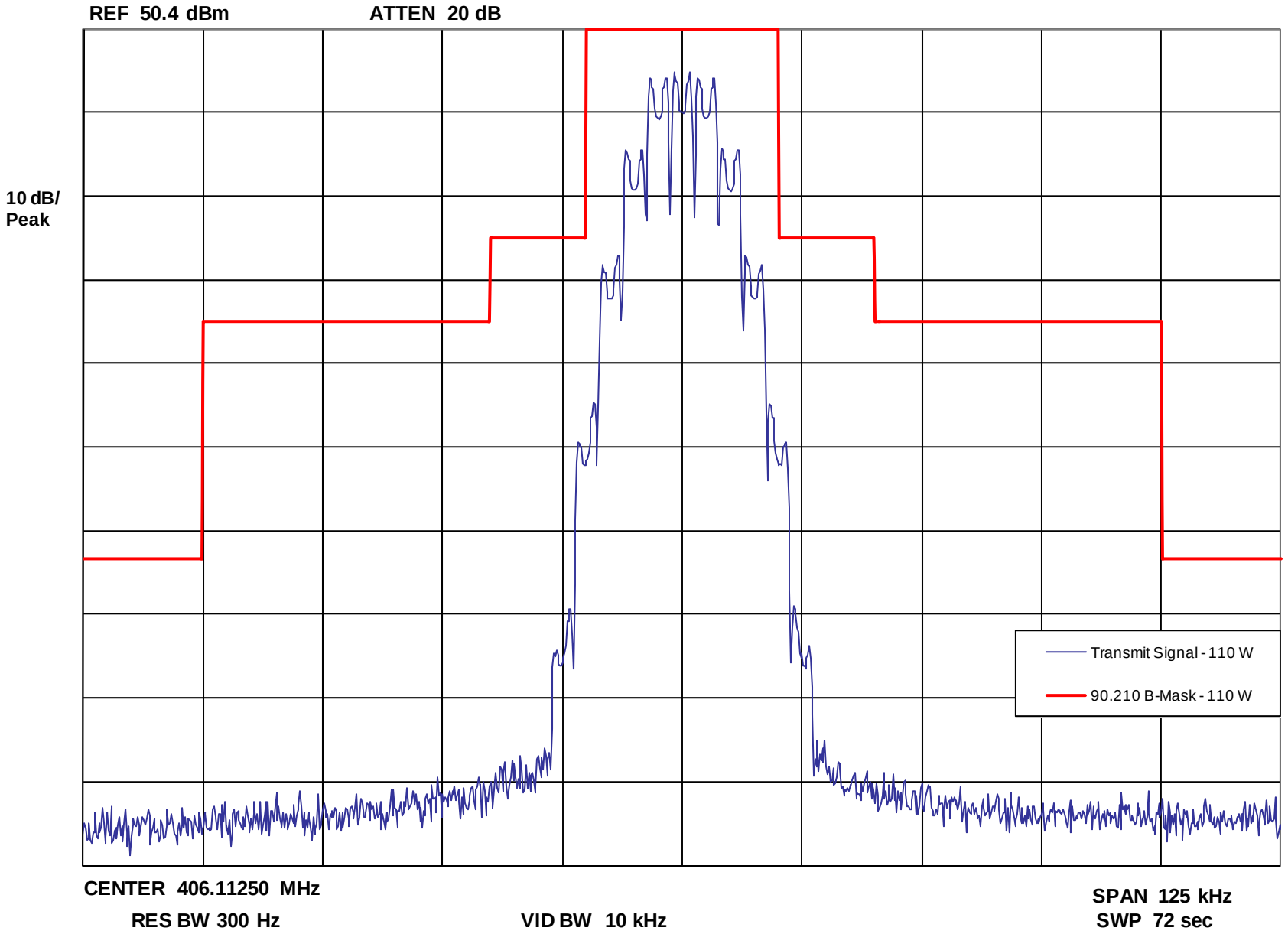
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 300 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Low End of Band

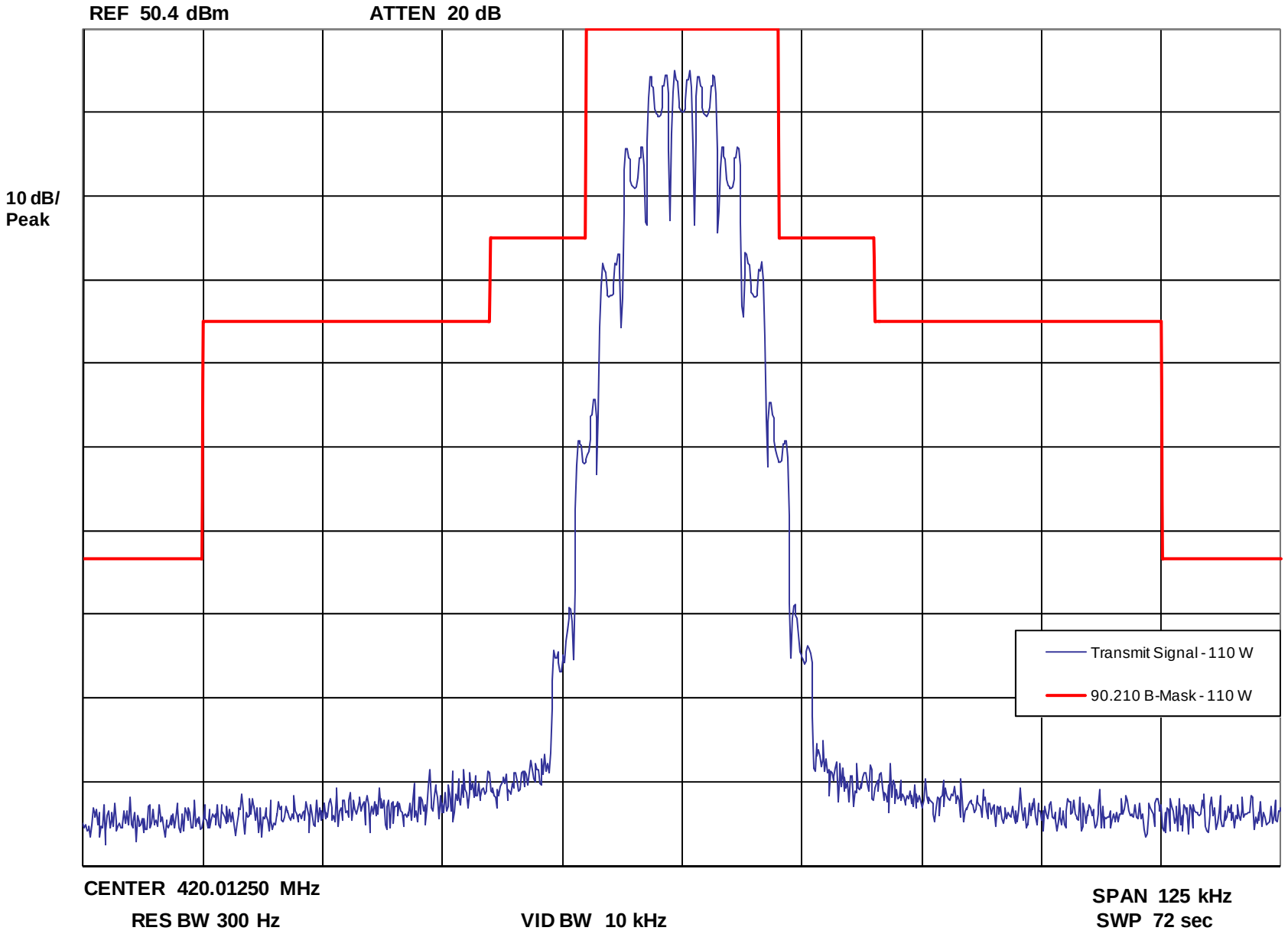
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 300 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – Middle of Band

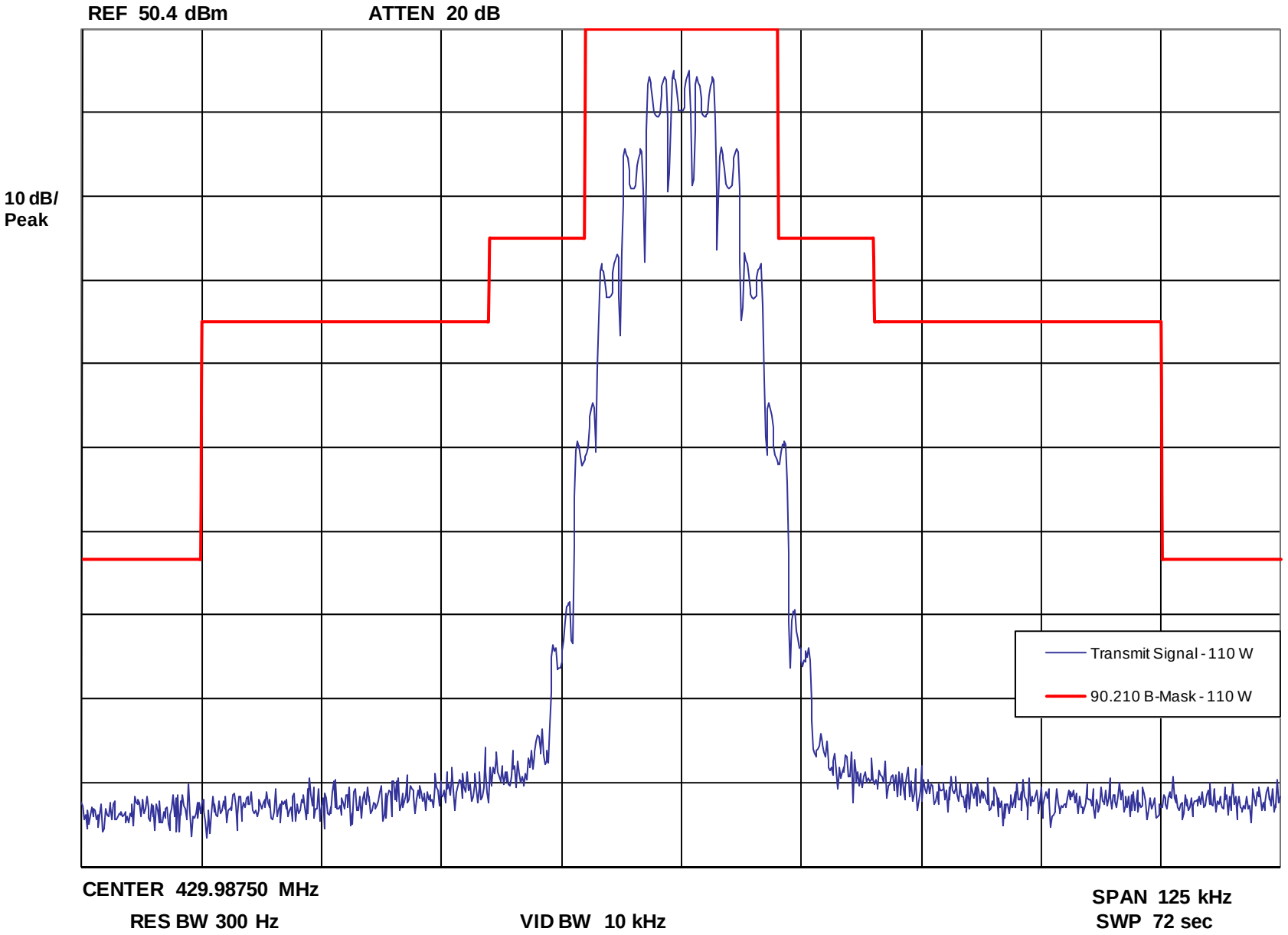
Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone and 300 bps Low Speed Data Signaling, 25 kHz Channels – Emission Designator: 16K0F3E – High End of Band

Occupied Bandwidth - 25 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio Tone

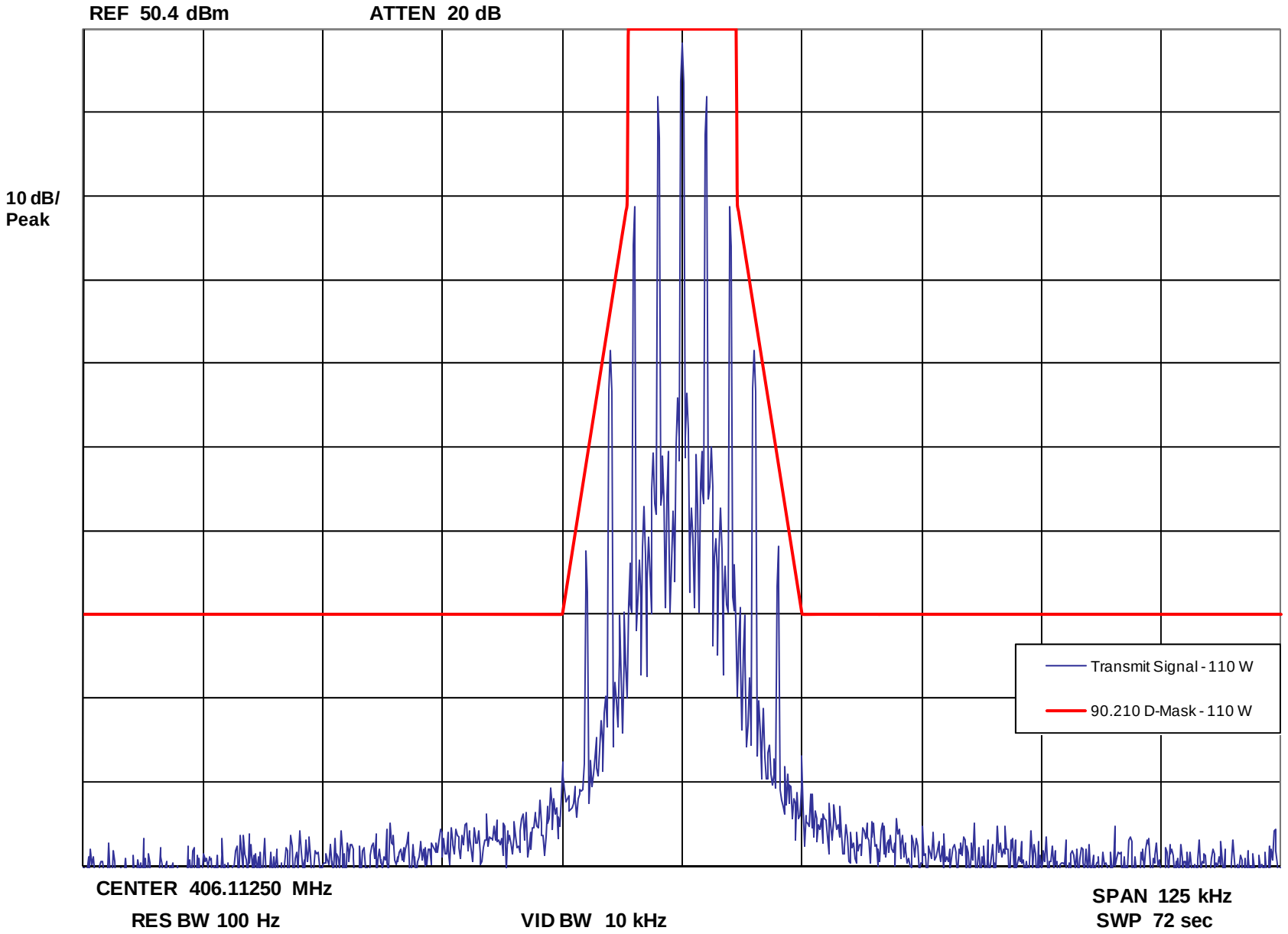
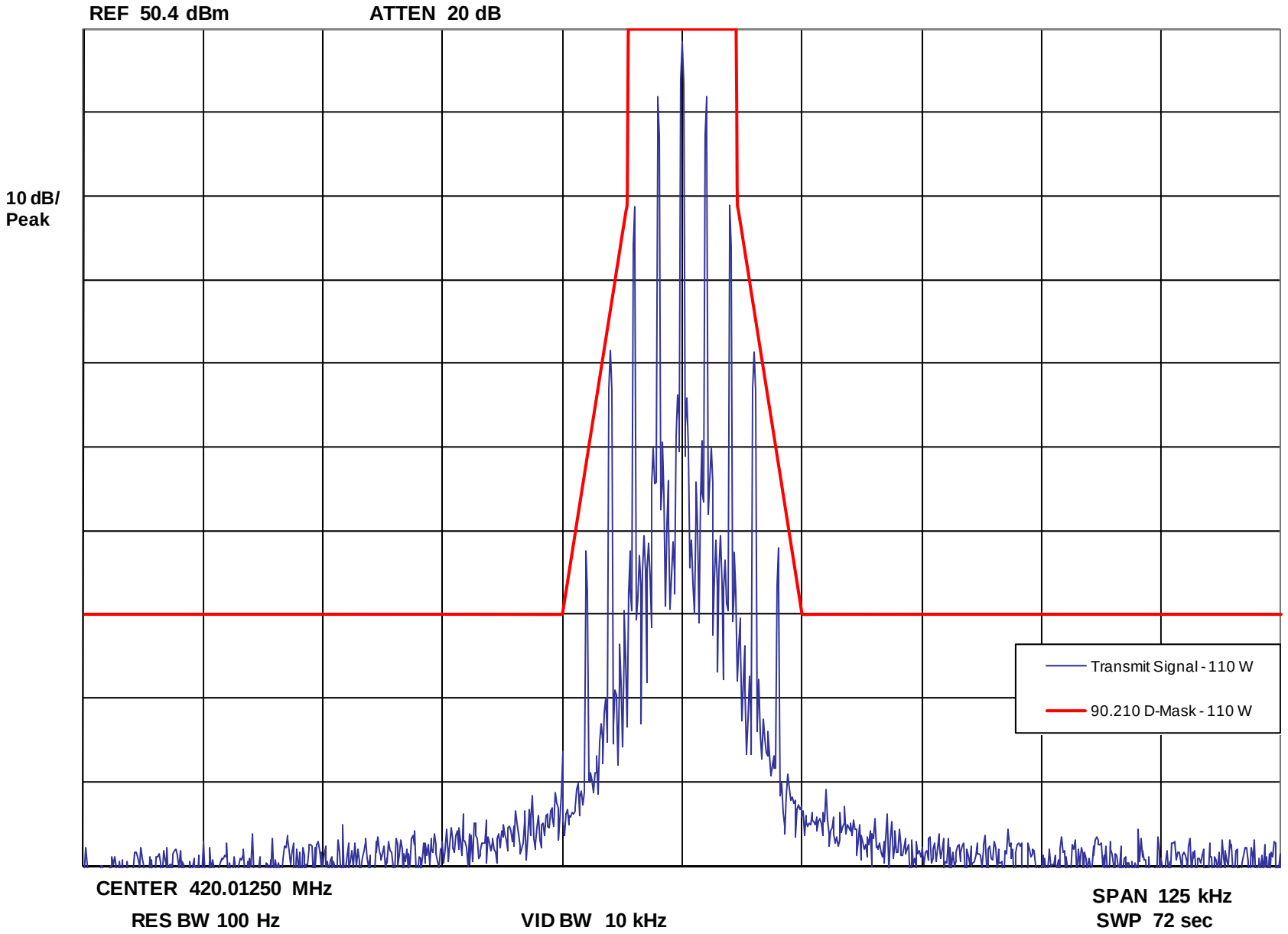


EXHIBIT E1-9.16

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

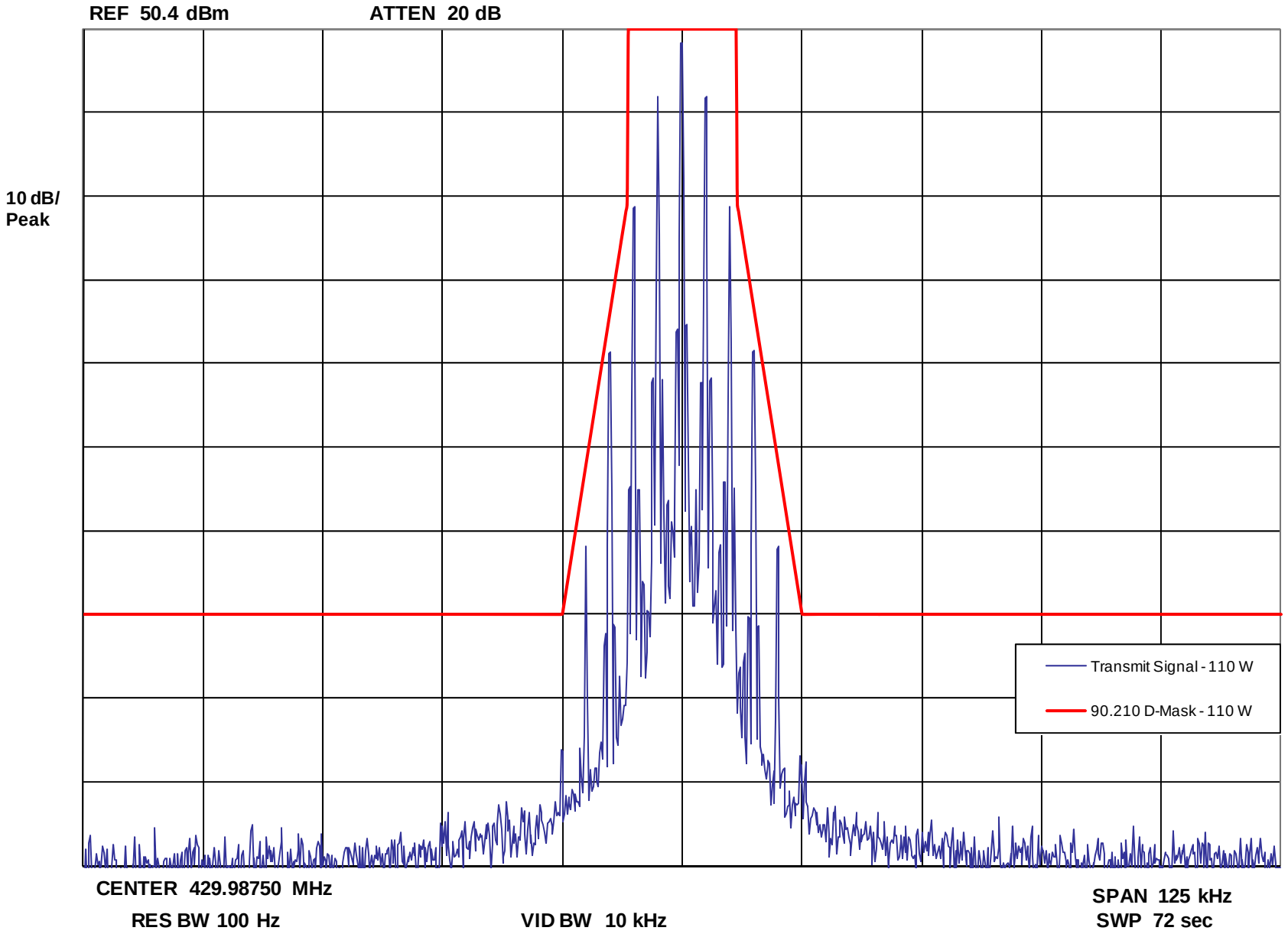
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio Tone



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL

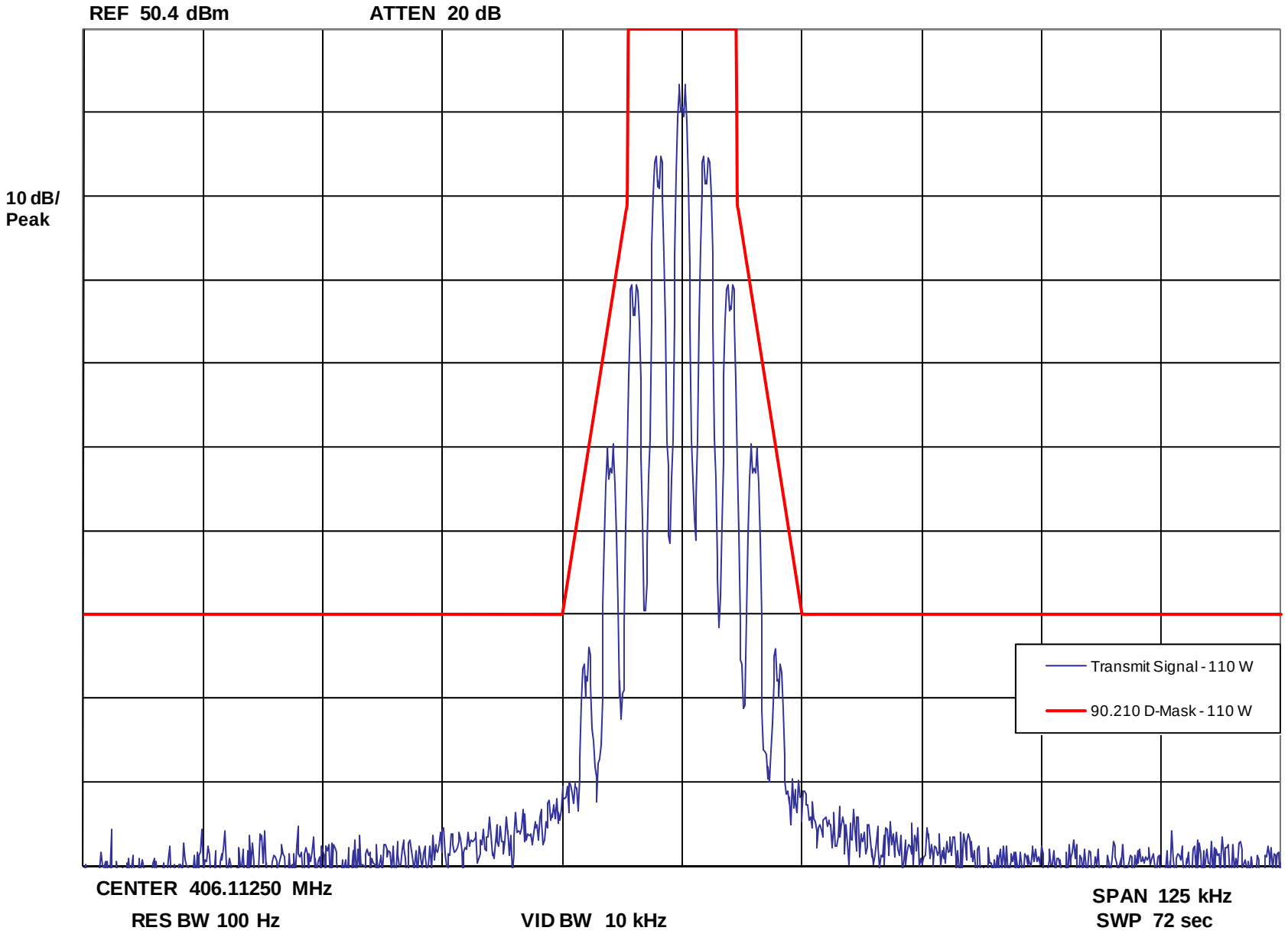


EXHIBIT E1-9.19

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL

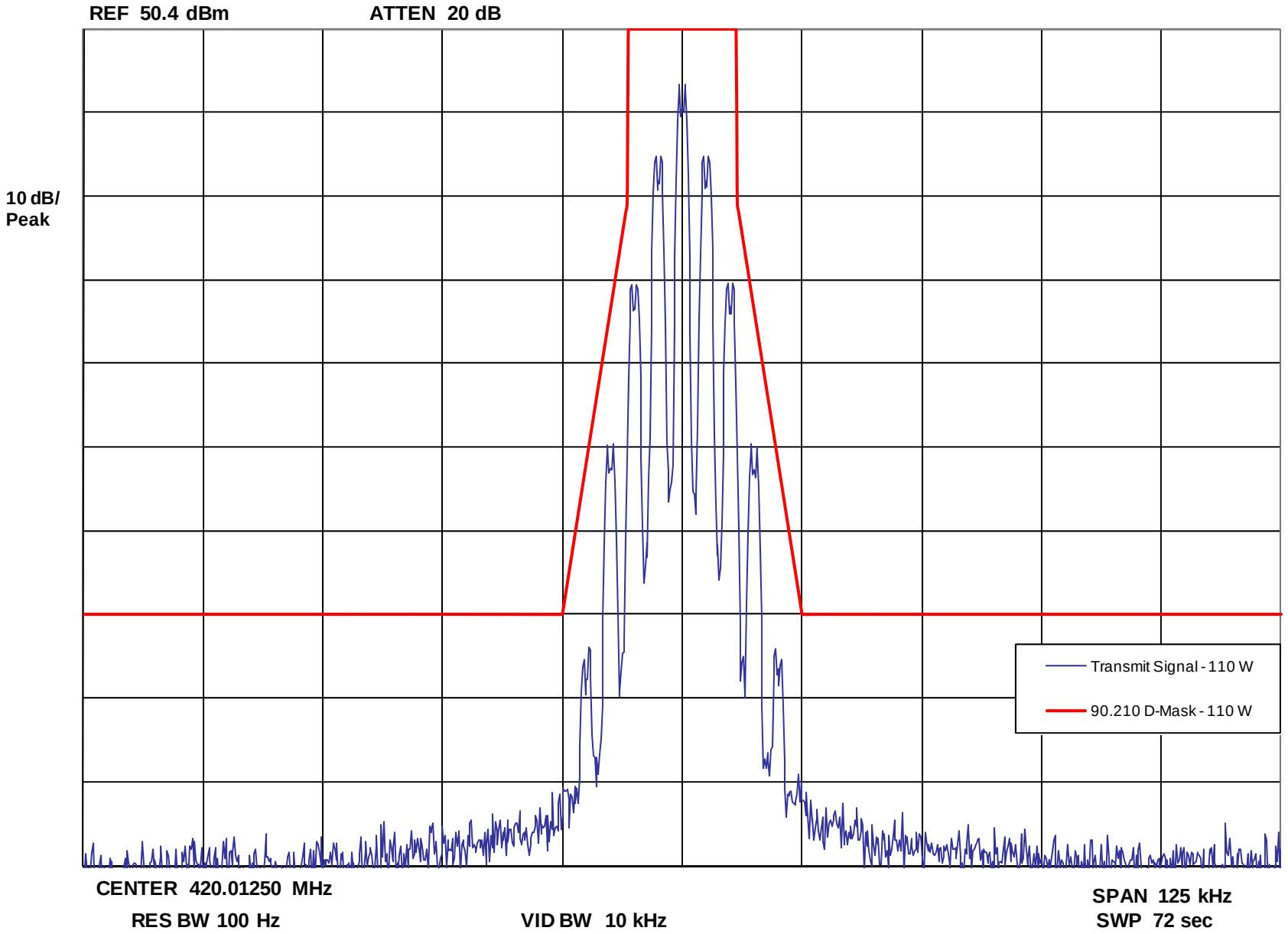


EXHIBIT E1-9.20

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Audio Tone and Private Line (PL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 123 Hz PL

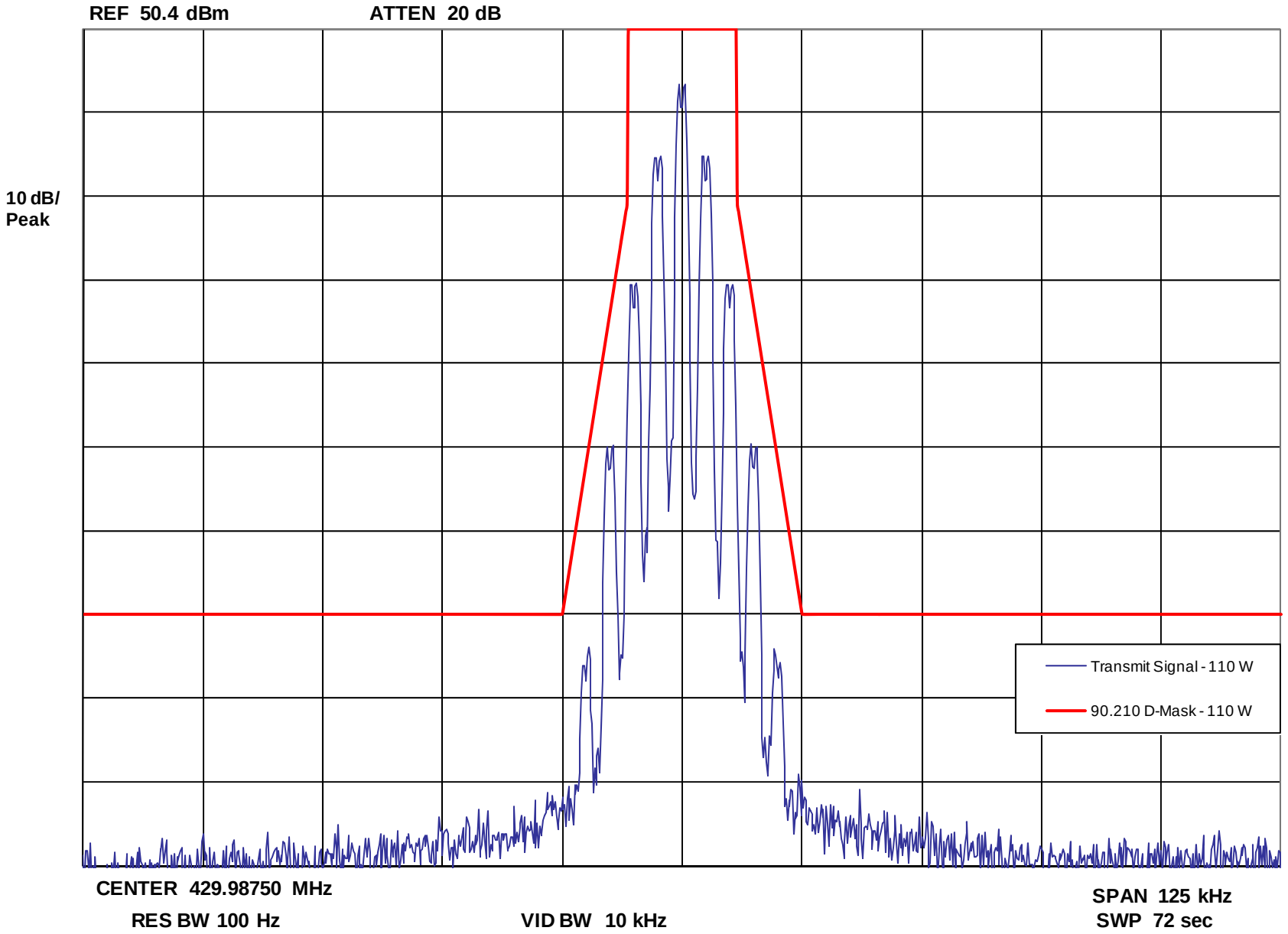


EXHIBIT E1-9.21

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, Digital Private Line (DPL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL

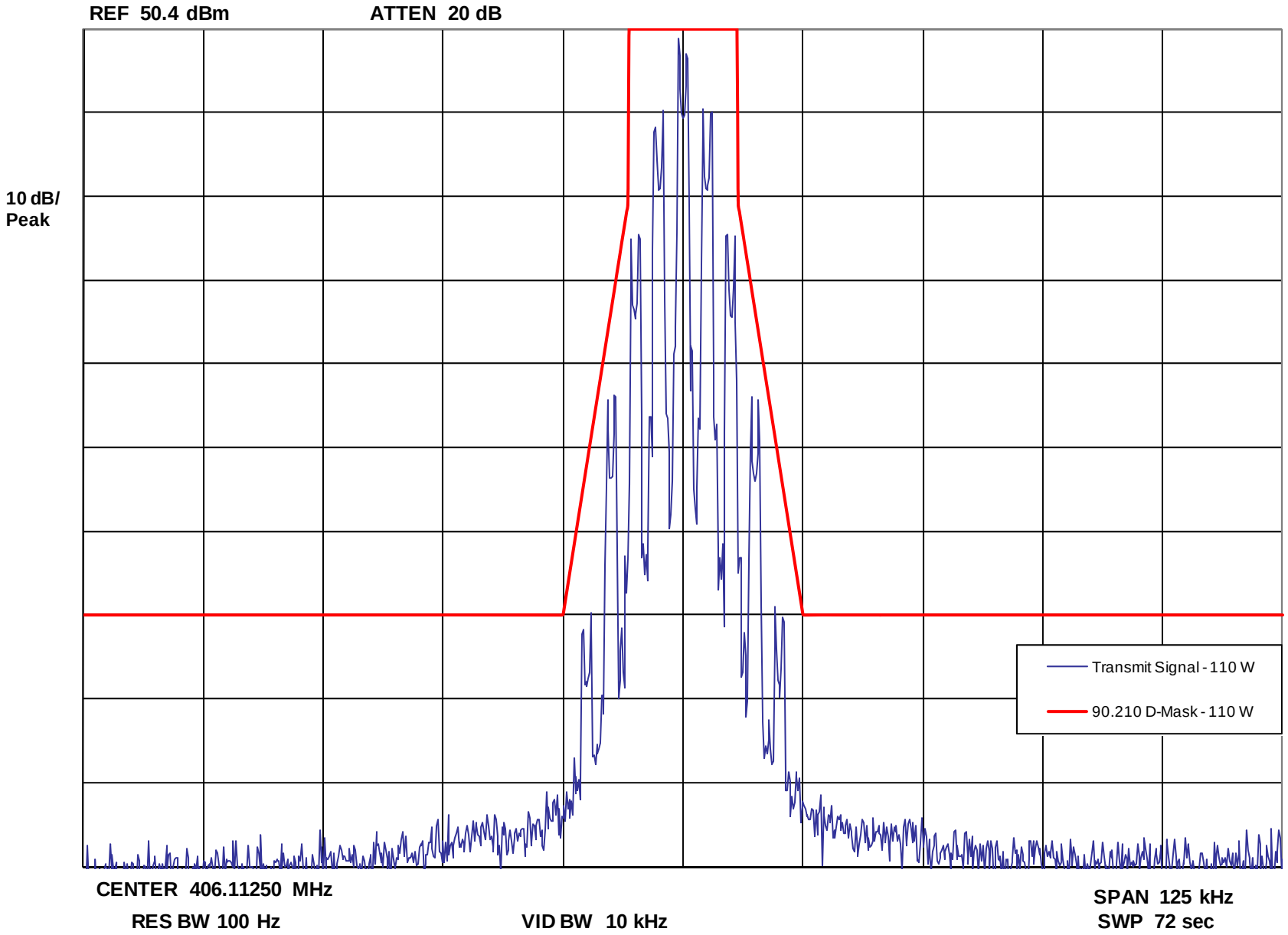


EXHIBIT E1-9.22

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, Digital Private Line (DPL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL

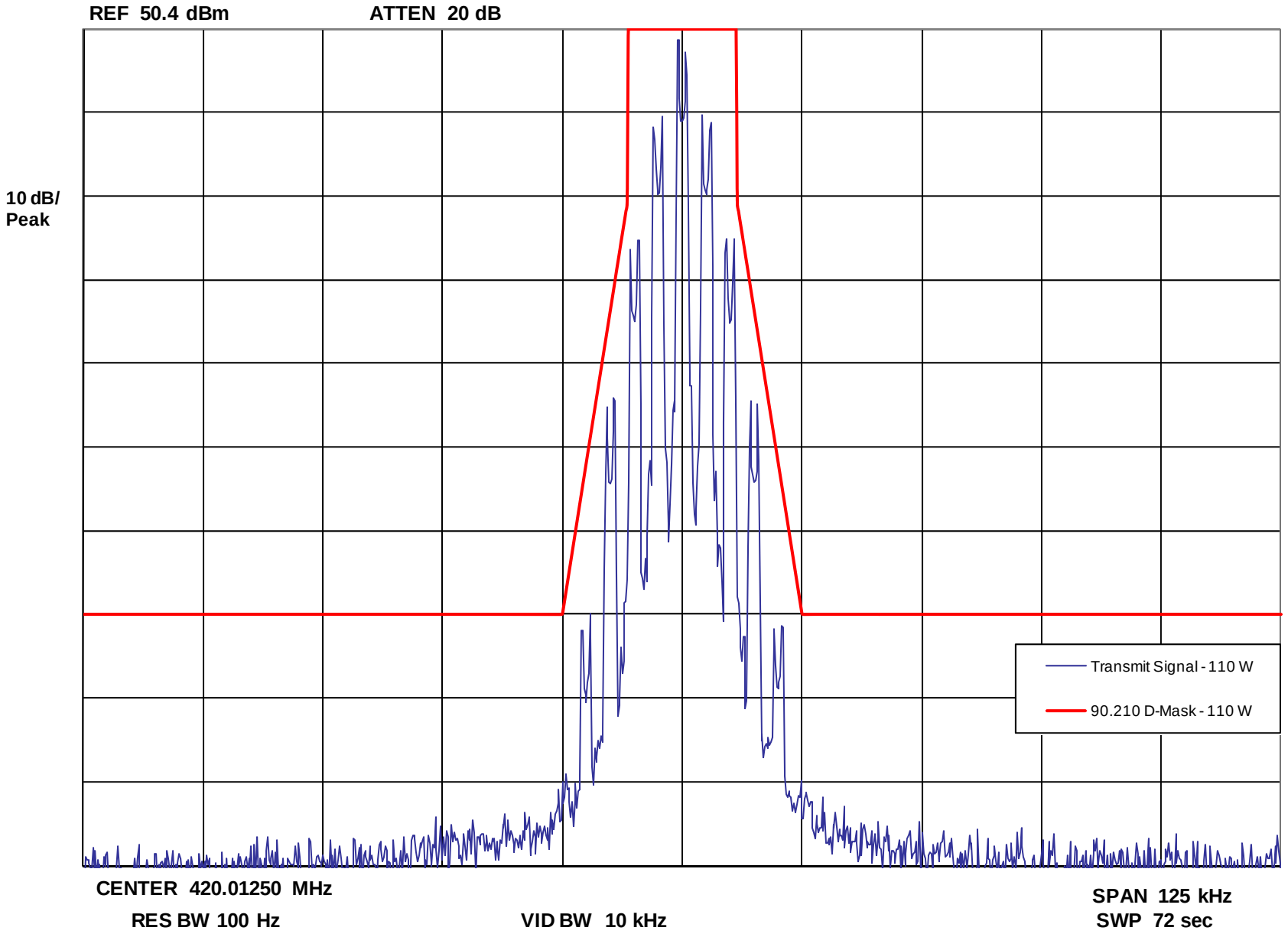
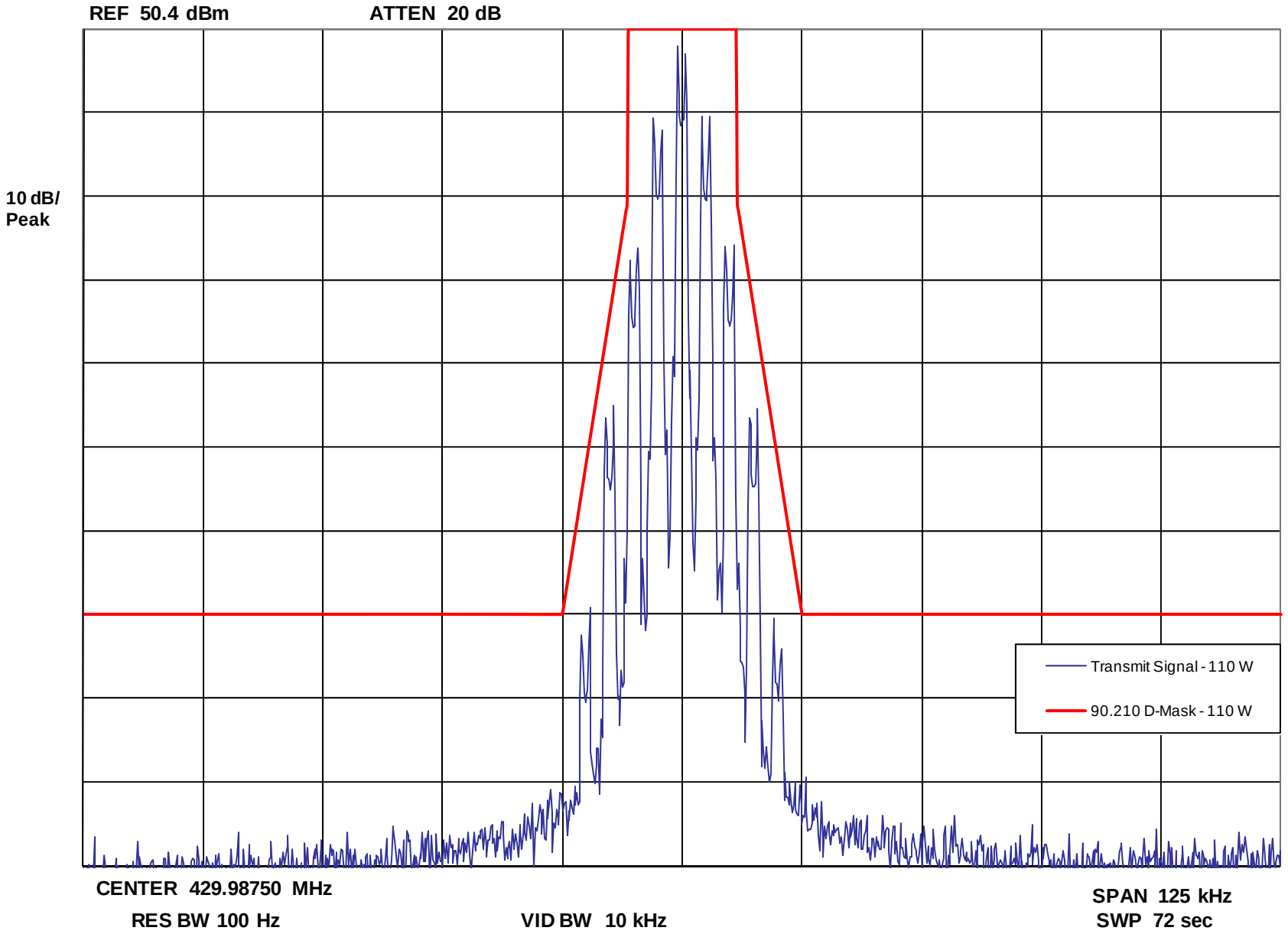


EXHIBIT E1-9.23

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, Digital Private Line (DPL) Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

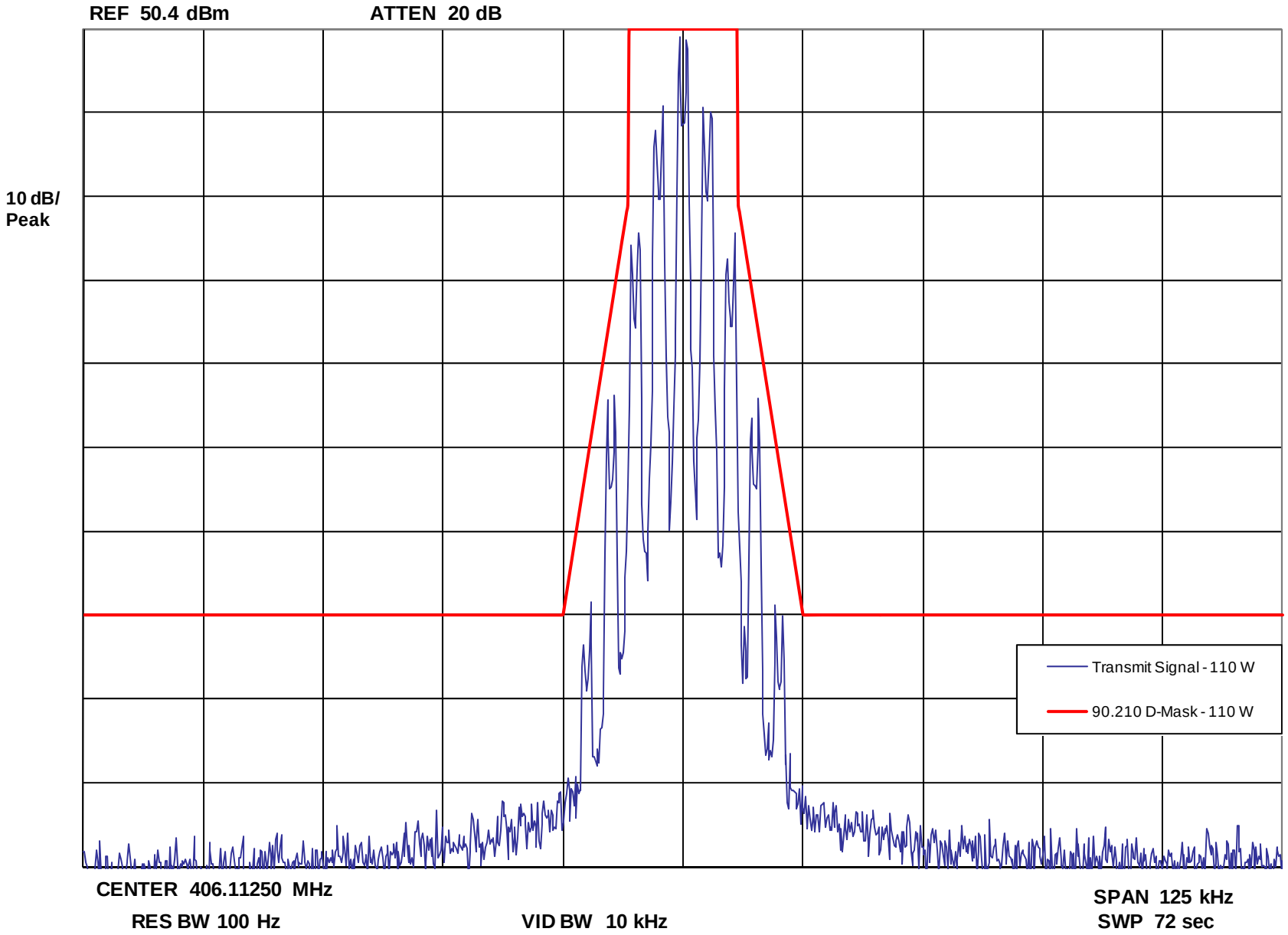
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 627 DPL



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 150 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

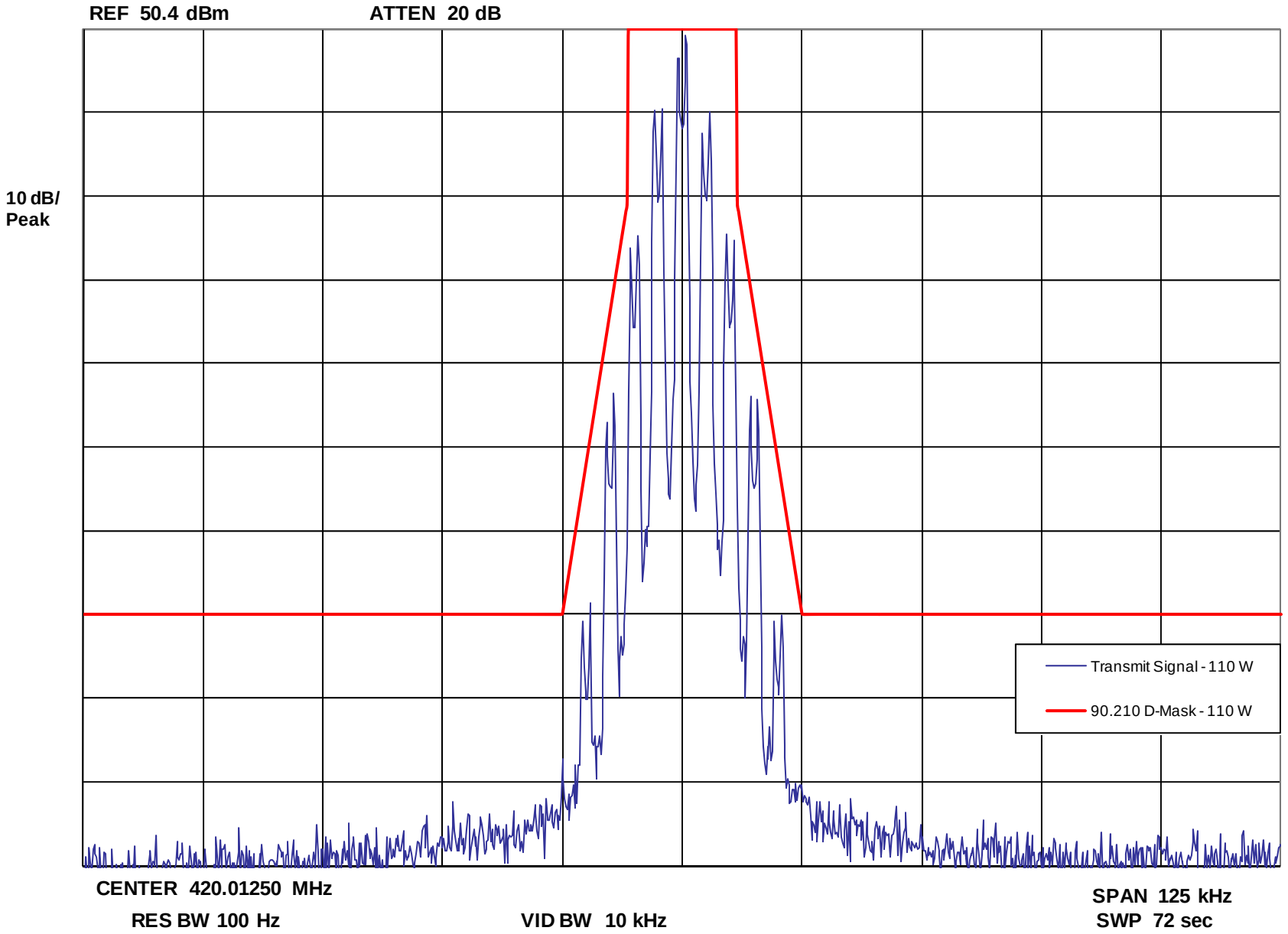
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 150 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

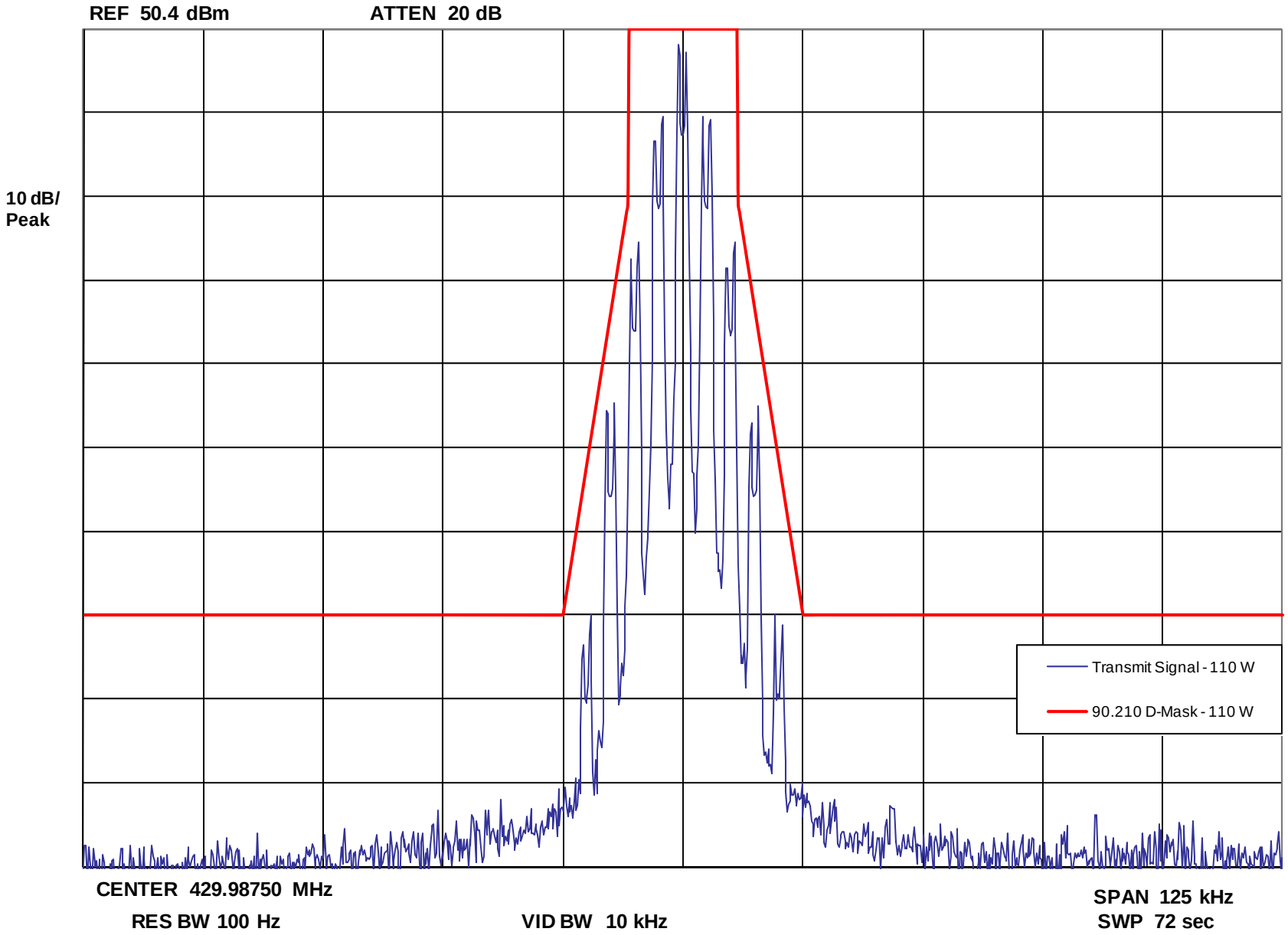
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 150 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 150 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 300 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Low End of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 300 bps

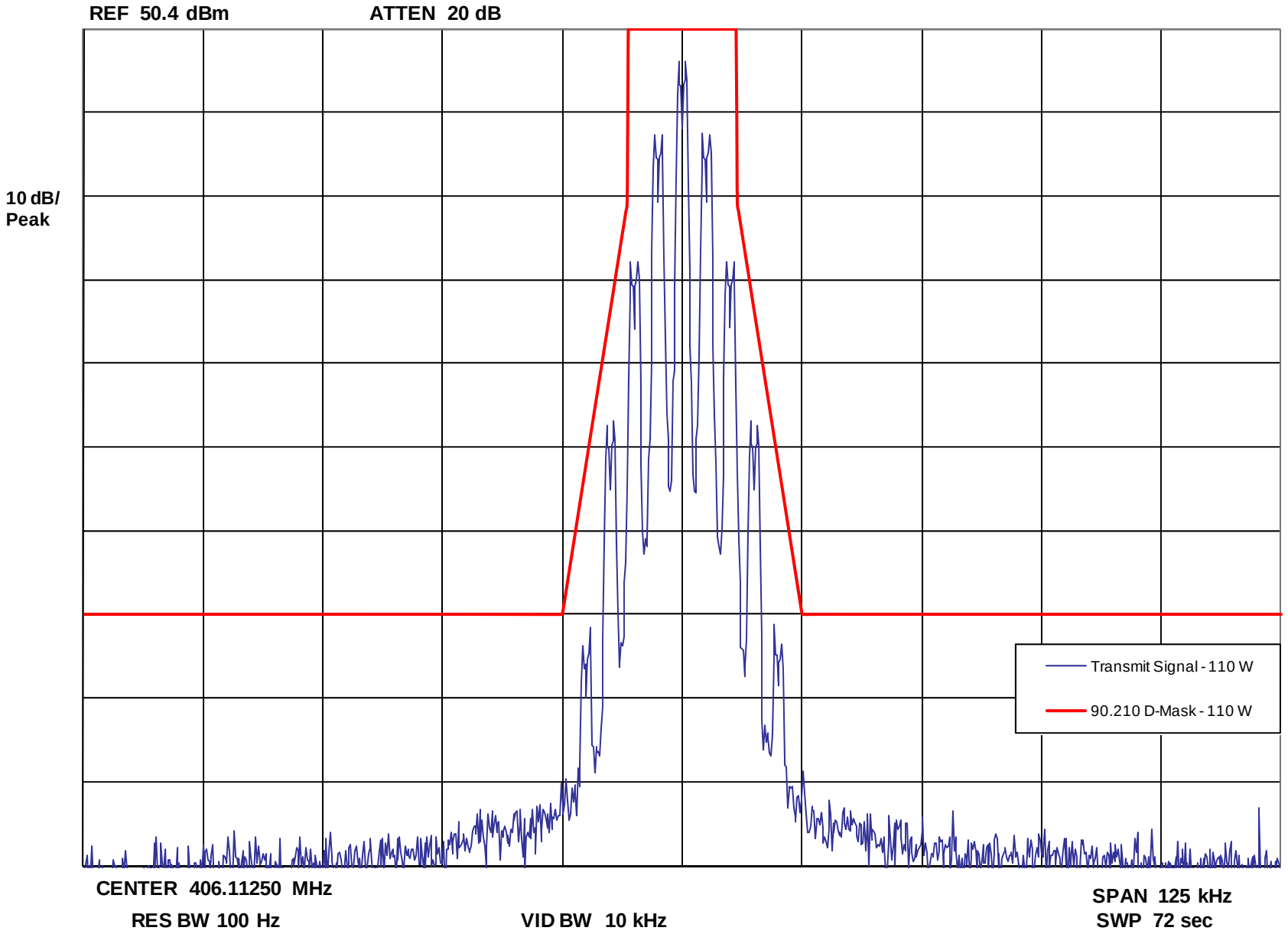
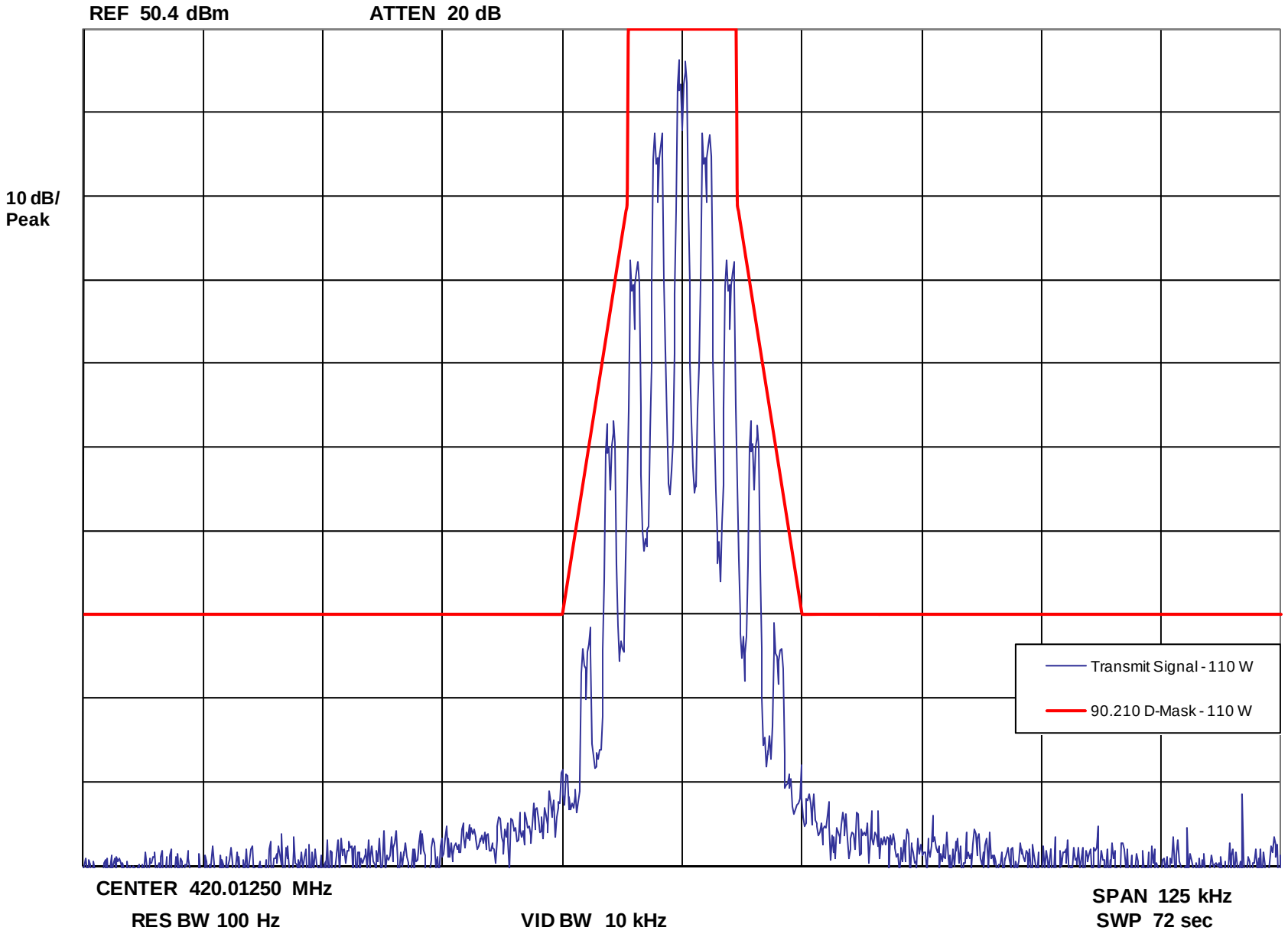


EXHIBIT E1-9.28

Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 300 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – Middle of Band

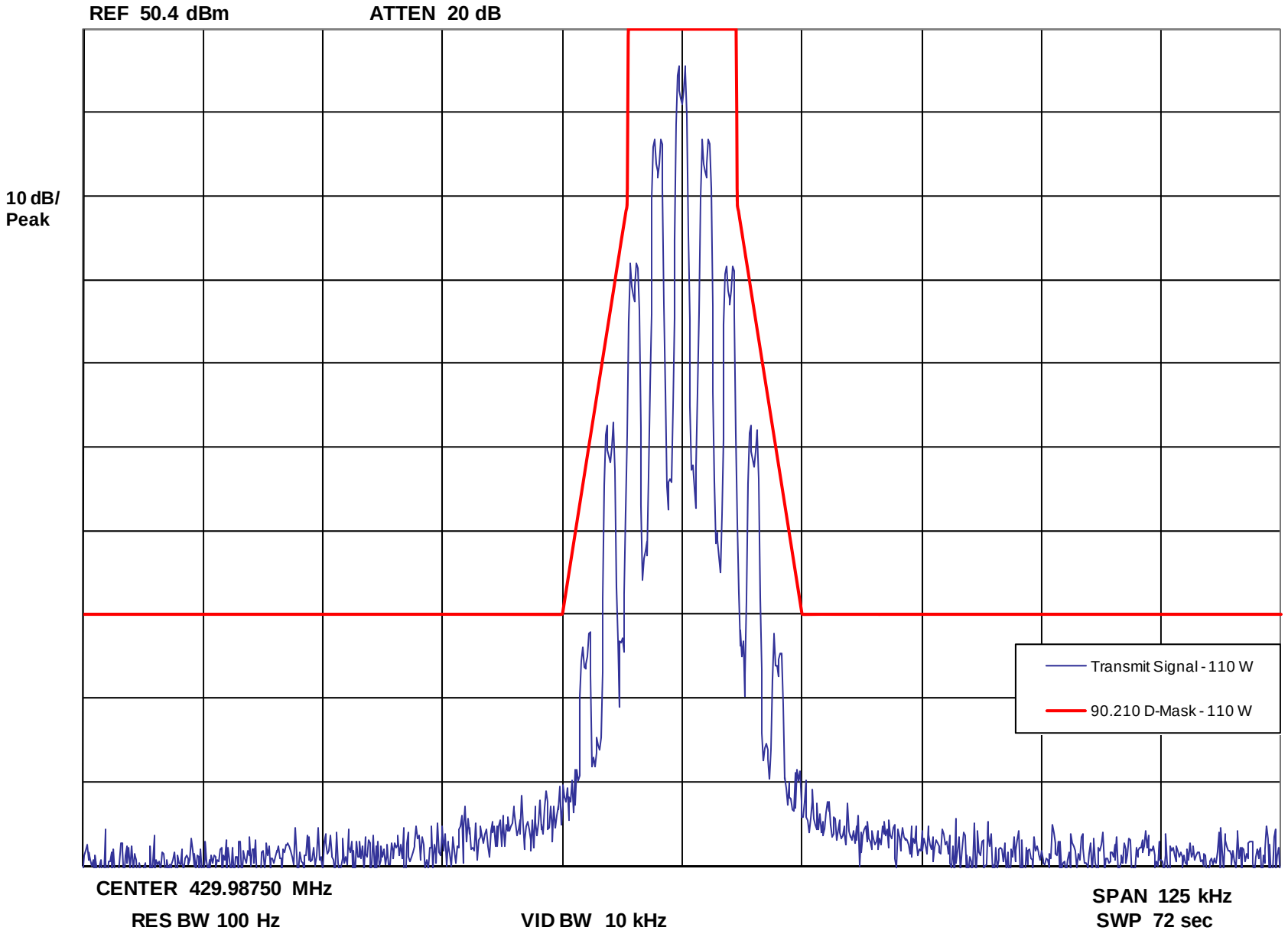
Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Occupied Bandwidth – Carrier with 2500 Hz Tone, 300 bps Low Speed Data Signaling, 12.5 kHz Channels – Emission Designator: 11K0F3E – High End of Band

Occupied Bandwidth - 12.5 kHz Channels - Carrier with 2500 Hz Audio and 300 bps



Report on Test Measurements

Test Equipment List

MODEL	MANUFACTURER	DESCRIPTION	Serial No.	Last Cal	Next Cal
8903B	Hewlett Packard	Audio Analyzer	3729A18082	7/16/11	7/16/14
E4438C	Agilent	Vector Signal Generator	MY45090123	7/12/12	7/12/13
E4438C	Agilent	Vector Signal Generator	MY49072394	2/24/12	2/24/14
E8663D	Agilent	Analog Signal Generator	MY50420108	10/24/11	10/24/13
8644B	Hewlett Packard	Signal Generator	3147A00102	7/12/12	7/12/15
E4438C	Agilent	Vector Signal Generator	MY45090361	4/12/12	4/12/14
3499C	Agilent	Switch/Control System	MY42000367	no calibration required	
E4416A	Agilent	Power Meter	GB41293746	8/12/12	8/12/13
53131A	Hewlett Packard	Universal Counter	3416A03458	1/12/13	1/12/14
N9030A	Agilent	PXA Signal Analyzer	MY49431362	9/24/12	9/24/13
8904A	Hewlett Packard	Multifunction Synthesizer	3518A07620	11/12/12	11/12/13
45	Fluke	Dual Display Multimeter	6349005	10/12/12	10/12/13
Notch Filter	Telewave	TWPC-3910-1	5547	no calibration required	
3020A	Narda	Directional Coupler	41902	no calibration required	
(Various)	Weinschel	RF Load	Various	no calibration required	
(Various)	Narda	RF Attenuators	Various	no calibration required	
E4440A	Agilent	Spectrum Analyzer	MY461185813	10/10/12	10/10/15
83712A	Hewlett Packard	Signal Generator	3429A00455	10/10/11	10/10/14
85460A	Hewlett Packard	EMI Analyzer, Filter	3704A00467	09/10/10	09/10/13
85462A	Hewlett Packard	EMI Analyzer, RF/Display	3906A00500	09/10/10	09/10/13
U8903A	Agilent	Audio Analyzer	MY50490005	12/09/10	12/09/13
438B	Hewlett Packard	RF Power Meter	3513U05927	05/18/11	05/18/14
8482A	Hewlett Packard	RF Power Sensor	2652A16686	10/04/12	10/04/13
N9030A	Agilent	PXA Signal Analyzer	MY49430626	10/10/12	10/10/13
89601	Agilent	Software for PXA	not applicable	not applicable	
(Various)	Weinschel, Kathrein, Bird	RF Loads	Various	no calibration required	
TWNC-1405-1	Telewave	Notch Cavity	923	no calibration required	
3020A, etc.	Narda	Directional Coupler	Various	no calibration required	

APPLICANT: MOTOROLA SOLUTIONS

EQUIPMENT TYPE: ABZ89FC4821B
109AB-4821B

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

__31__ years of Design and Development experience in the field of two-way radio communication.

NAME: Ken Weiss

SIGNATURE: 

DATE: May 31, 2013

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: Greg Alms

SIGNATURE: 

DATE: 5/31/13

POSITION: Engineering Section Manager