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.

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

SUBMITTED MEASURED DATA – INDEX

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 three parallel power transistors.

MTS 4 - DQPSK (TETRA) Modulation Mode:	851 MHz	860 MHz	869 MHz	
Measured RF output	24.3	25.1	25.4	Watts, Average
DC Voltage, final RF amplifier stage/stages	28.0	28.0	28.0	Volts
DC Current, final RF amplifier stage/stages	8.3	8.3	8.0	Amperes
Input power for final RF amplifying device(s)	232	232	224	Watts
Primary Radio Input Supply Voltage	48.0	48.0	48.0	Volts AC
Minimum Measured RF output	3.9	4.0	3.9	Watts, Average
DC Voltage, final RF amplifier stage/stages	28.0	28.0	28.0	Volts
DC Current, final RF amplifier stage/stages	3.7	3.7	3.6	Amperes
Input power for final RF amplifying device(s)	104	104	101	Watts
Primary Radio Input Supply Voltage	48.0	48.0	48.0	Volts AC

MTS 4 - 64-QAM (TEDS) Modulation Mode:	851 MHz	860 MHz	869 MHz	
Measured RF output	9.7	10.0	9.9	Watts, Average
DC Voltage, final RF amplifier stage/stages	28.0	28.0	28.0	Volts
DC Current, final RF amplifier stage/stages	5.5	5.3	5.3	Amperes
Input power for final RF amplifying device(s)	154	148	148	Watts
Primary Radio Input Supply Voltage	48.0	48.0	48.0	Volts AC
Minimum Measured RF output	2.5	2.5	2.5	Watts, Average
DC Voltage, final RF amplifier stage/stages	28.0	28.0	28.0	Volts
Normal DC Current	3.2	3.2	3.2	Amperes
Input power for final RF amplifying device(s)	90	90	90	Watts
Primary Radio Input Supply Voltage	48.0	48.0	48.0	Volts AC

MTS 2 - DQPSK (TETRA) Modulation Mode:	851 MHz	860 MHz	869 MHz	
Measured RF output	25.6	25.0	26.1	Watts, Average
DC Voltage, final RF amplifier stage/stages	28.5	28.5	28.5	Volts
DC Current, final RF amplifier stage/stages	7.9	7.9	7.9	Amperes
Input power for final RF amplifying device(s)	225	225	225	Watts
Primary Radio Input Supply Voltage	48.0	48.0	48.0	Volts AC
Minimum Measured RF output	4.0	4.0	4.1	Watts, Average
DC Voltage, final RF amplifier stage/stages	28.5	28.5	28.5	Volts
DC Current, final RF amplifier stage/stages	3.6	3.6	3.5	Amperes
Input power for final RF amplifying device(s)	103	103	100	Watts
Primary Radio Input Supply Voltage	48.0	48.0	48.0	Volts AC

MTS 2 - 64-QAM (TEDS) Modulation Mode:	851 MHz	860 MHz	869 MHz	
Measured RF output	10.9	10.0	11.2	Watts, Average
DC Voltage, final RF amplifier stage/stages	28.5	28.5	28.5	Volts
DC Current, final RF amplifier stage/stages	5.2	5.2	5.2	Amperes
Input power for final RF amplifying device(s)	148	148	148	Watts
Primary Radio Input Supply Voltage	48.0	48.0	48.0	Volts AC
Minimum Measured RF output	2.8	2.5	3.0	Watts, Average
DC Voltage, final RF amplifier stage/stages	28.6	28.6	28.6	Volts
Normal DC Current	2.9	2.9	2.9	Amperes
Input power for final RF amplifying device(s)	83	83	83	Watts
Primary Radio Input Supply Voltage	48.0	48.0	48.0	Volts AC

Report on Test Measurements

Occupied Bandwidth –DQPSK (TETRA) Modulation and 64-QAM (TEDS) Modulation, 25 kHz Channel Spacing
The following exhibits show the occupied bandwidth performance for two linear digital modulations. The type of modulation used is determined by system configuration and is based upon channel usage as described in Exhibit B. The occupied bandwidth charts reference the following specification requirements and setup.

Specification Requirement IC RSS-119 per section 5.5.8 Table 3 and section 5.8.10 - Emission Limits – "Y-Mask":
Equipment with a 25 kHz channel spacing and an occupied bandwidth greater than 20 kHz shall have the power of any emission attenuated below the transmitter output power P (dBW) as specified in the following table:

Displacement Frequency, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth
12.375 < fd ≤ 13.975	whichever is the lesser attenuation: 30 + 16.67(fd–12.375) dB, or 55 + 10 log10(P) dB	100 Hz (Specified in Section 4.2.2)
fd > 13.975	whichever is the lesser attenuation: 57 dB, or 55 + 10 log10(P) dB	100 Hz (Specified in Section 4.2.2)

Modulation Type:	DQPSK Digital Modulation (TETRA)	64-QAM Digital Modulation (TEDS)
Emission Designator:	22K0D7D, 22K0D7E, 22K0D7W	22K0D7D
Channelization:	25 kHz	25 kHz
Power Setting:	25 Watts (Average)	10 Watts (Average)

Necessary Bandwidth Calculation:
TEDS: The necessary bandwidth of the modulation types are not directly calculable per the composite modulation formulas defined in TRC-43 section 8 or 47 CFR §2.202(g). QAM is not covered in TRC-43. An excerpt from 2.202: 64 QAM used to send 135 Mbps has the same necessary bandwidth as 64-PSK used to send 135 Mbps. TEDS is composed of eight QAM subcarriers spaced on 2.7 kHz center frequencies. The occupied bandwidth is represented by the lower half of the 1st subcarrier plus 7 times the subcarrier frequency spacing and the upper half of the 8th subcarrier. A band limiting filter is applied to each subcarrier, and the resulting spectrum is digitally mixed to be centered around DC at baseband, then up-converted and centered at the RF carrier frequency. The Occupied bandwidth of a subcarrier band limiting filter is computed to derive a value of K that is applied to the basic QAM described in 2.202.

	64-QAM	16-QAM	4-QAM
Gross Bit Rate	115,200	76,800	38,400
Bit Rate per subcarrier, R=	14,400	9,600	4,800

(8QAM subcarriers spaced on 2700 Hz center frequencies)

# of Symbols, S=	64	16	4
$B_n = 2RK/ \log_2(s)$			
$B = R/\log_2(s)$			
=	$14400 / \log_2(64)$	$9600 / \log_2(16)$	$4800 / \log_2(4)$
=	4800	4800	4800

K= 0.645
$B_n = 2*4800*0.65$
$B_n = 3096$

Occ BW = ½*B_n(subcarrier) + 7*subcarrier spacing + ½*B_n(subcarrier)
= ½*3096 + 7*2700 + ½*3096 Hz
= 21996 Hz
= (Rounded to) 22.0 kHz or 22K0

(Continued Next Page)

Report on Test Measurements

Occupied Bandwidth (Con't)

TETRA: The necessary bandwidth of the modulation signal is not directly calculable per the composite modulation formulas defined in TRC-43 section 8 or 47 CFR §2.202(g). TETRA modulation (π/4-DQPSK) is eight states with a raw bit rate of 36,000 bps.

π/4 differential phase shift keying is used to modulate a carrier with a digital bit stream
Data Rate: R = 36000 bps
Bits per Symbol: S=8
$B_n = 2BK$

$B = R / \log_2(s)$
$= 36000 / \log_2(8)$
$= 12000$

K= 0.915

$B_n = 2BK = 2 * 12000 * 0.915$
$B_n = 21960$ Hz
B_n = (Rounded to) 22.0 kHz or 22K0

Measurement Procedure and Instrument Settings:

Emission Measurement Analyzer Settings		Ref Settings		Measurement Settings
Horizontal:	12.5 kHz per Division	Resolution BW:	30 kHz	100 Hz
Vertical:	10 dB per Division	Video BW:	30 kHz	3 kHz
Sweep Time:	72 Seconds (<2 kHz/Sec)	Span:	125 kHz	125 kHz
Detector:	Peak			

Measured Occupied Bandwidth

Resolution BW:	300 Hz	Span:	75 kHz
Video BW:	10 kHz	Sweep Time	72 sec (1601 pts)
Detector:	Peak		

Test Procedure:

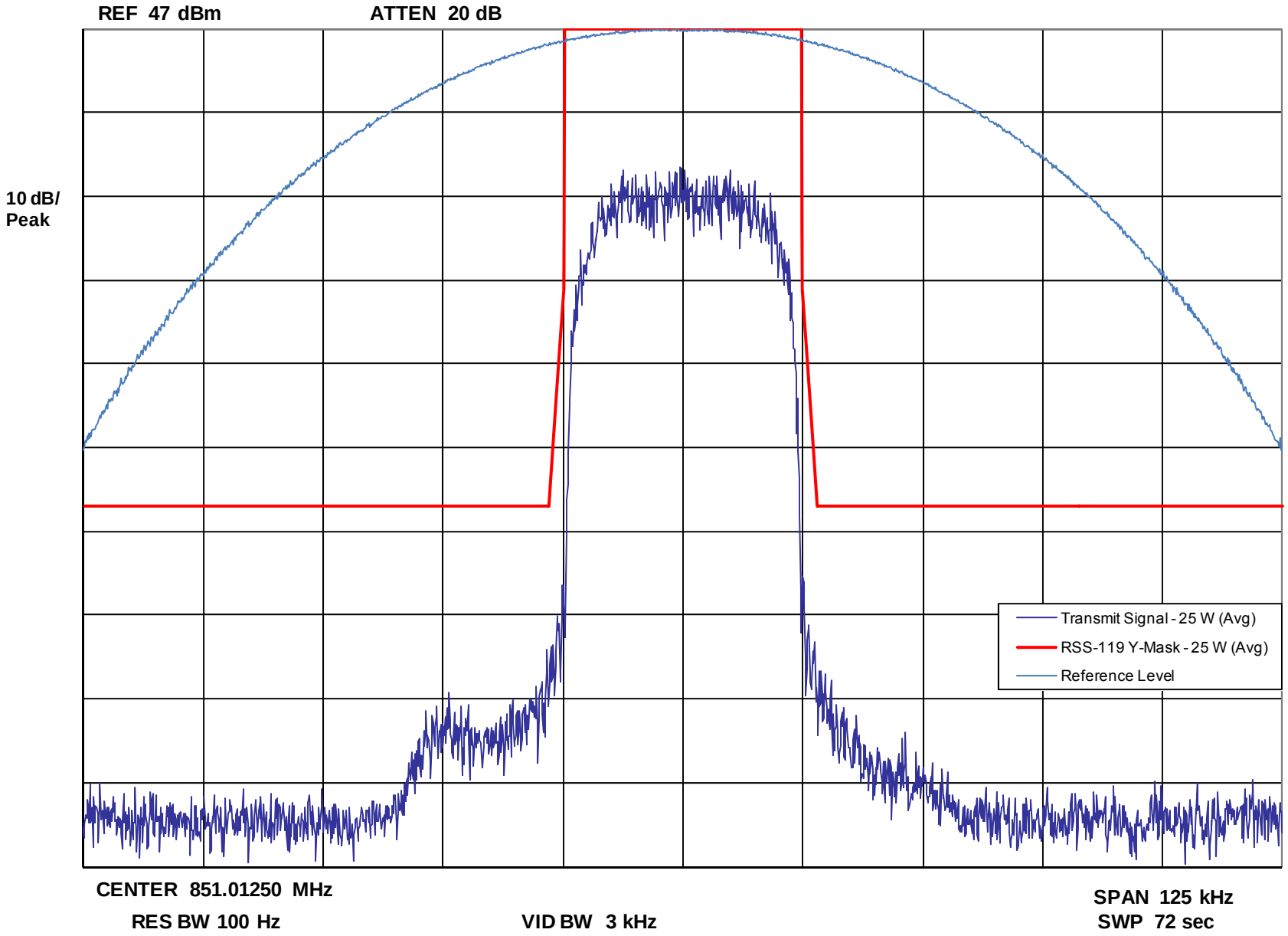
1) Adjust the spectrum analyzer per the values specified in the Emission Measurement Analyzer Settings and Ref Settings (above).
2) Modulate the transmitter with the appropriate modulation and signaling pattern, (pseudorandom data) and key the transmitter at the full power rating. Allow the analyzer to sweep fully and store the sweep.
3) Adjust the spectrum analyzer per the values specified in the Measurement Settings, allow the analyzer to sweep fully and store the sweep. Use the carrier power value from the previous step to generate the emission mask limit.
4) Plot the resulting analyzer traces 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 of the analyzer to record the occupied bandwidth value.

EXHIBIT	DESCRIPTION	Measured Occ BW
E1-2.1	Occupied Bandwidth, DQPSK Modulation, 25 kHz Channels, Low End of Band	21.07 kHz
E1-2.2	Occupied Bandwidth, DQPSK Modulation, 25 kHz Channels, Middle of Band	21.01 kHz
E1-2.3	Occupied Bandwidth, DQPSK Modulation, 25 kHz Channels, High End of Band	20.98 kHz
E1-2.4	Occupied Bandwidth, 64-QAM Modulation, 25 kHz Channels, Low End of Band	21.19 kHz
E1-2.5	Occupied Bandwidth, 64-QAM Modulation, 25 kHz Channels, Middle of Band	21.19 kHz
E1-2.6	Occupied Bandwidth, 64-QAM Modulation, 25 kHz Channels, High End of Band	21.15 kHz

Report on Test Measurements

Occupied Bandwidth – DQPSK Modulation – Emission Designator: 22K0D7D, 22K0D7E, 22K0D7W – Low End of Band

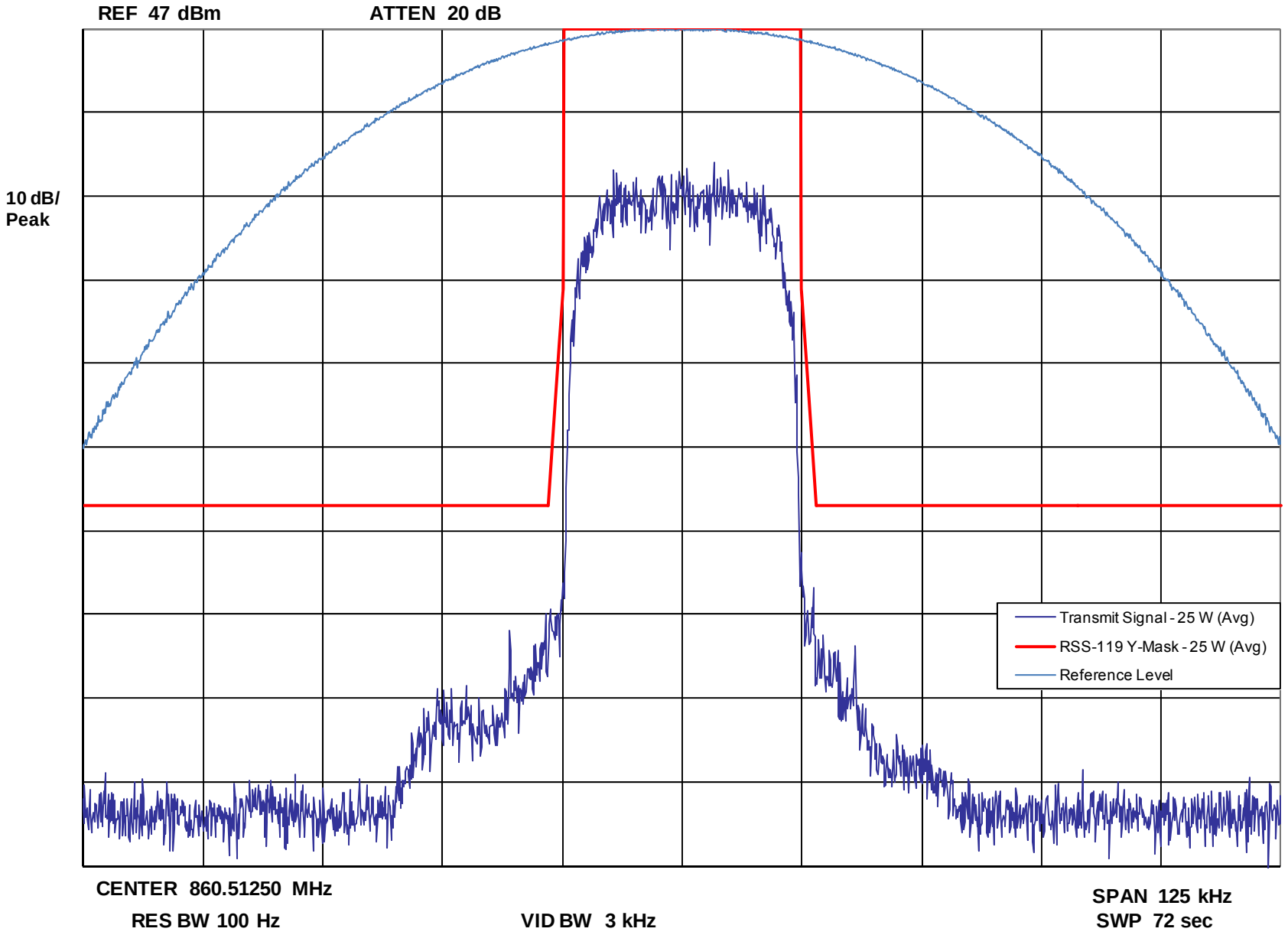
Occupied Bandwidth - DQPSK Modulation - 25 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – DQPSK Modulation – Emission Designator: 22K0D7D, 22K0D7E, 22K0D7W – Middle of Band

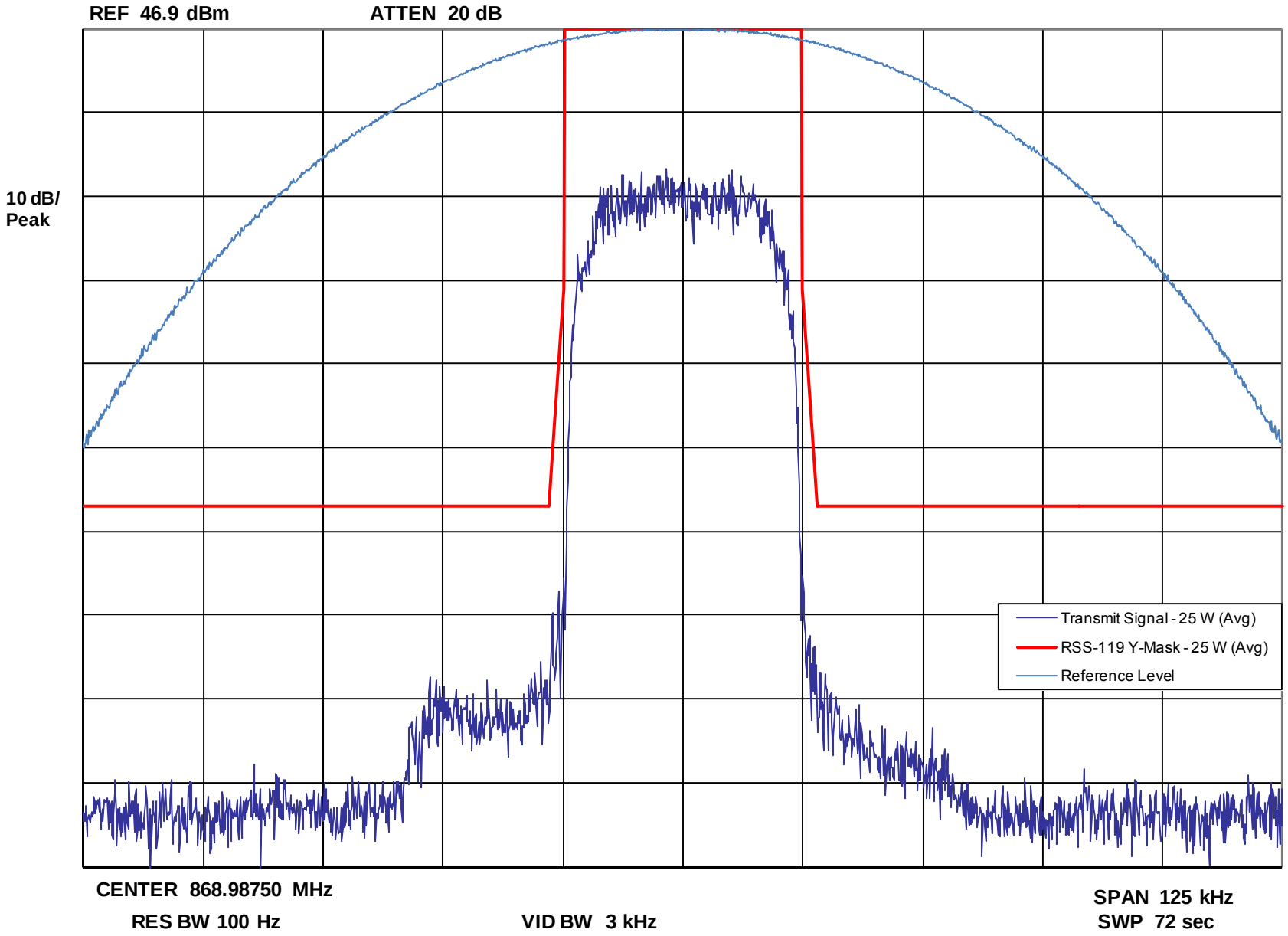
Occupied Bandwidth - DQPSK Modulation - 25 Watts (Average)



Report on Test Measurements

Occupied Bandwidth –DQPSK Modulation – Emission Designator: 22K0D7D, 22K0D7E, 22K0D7W – High End of Band

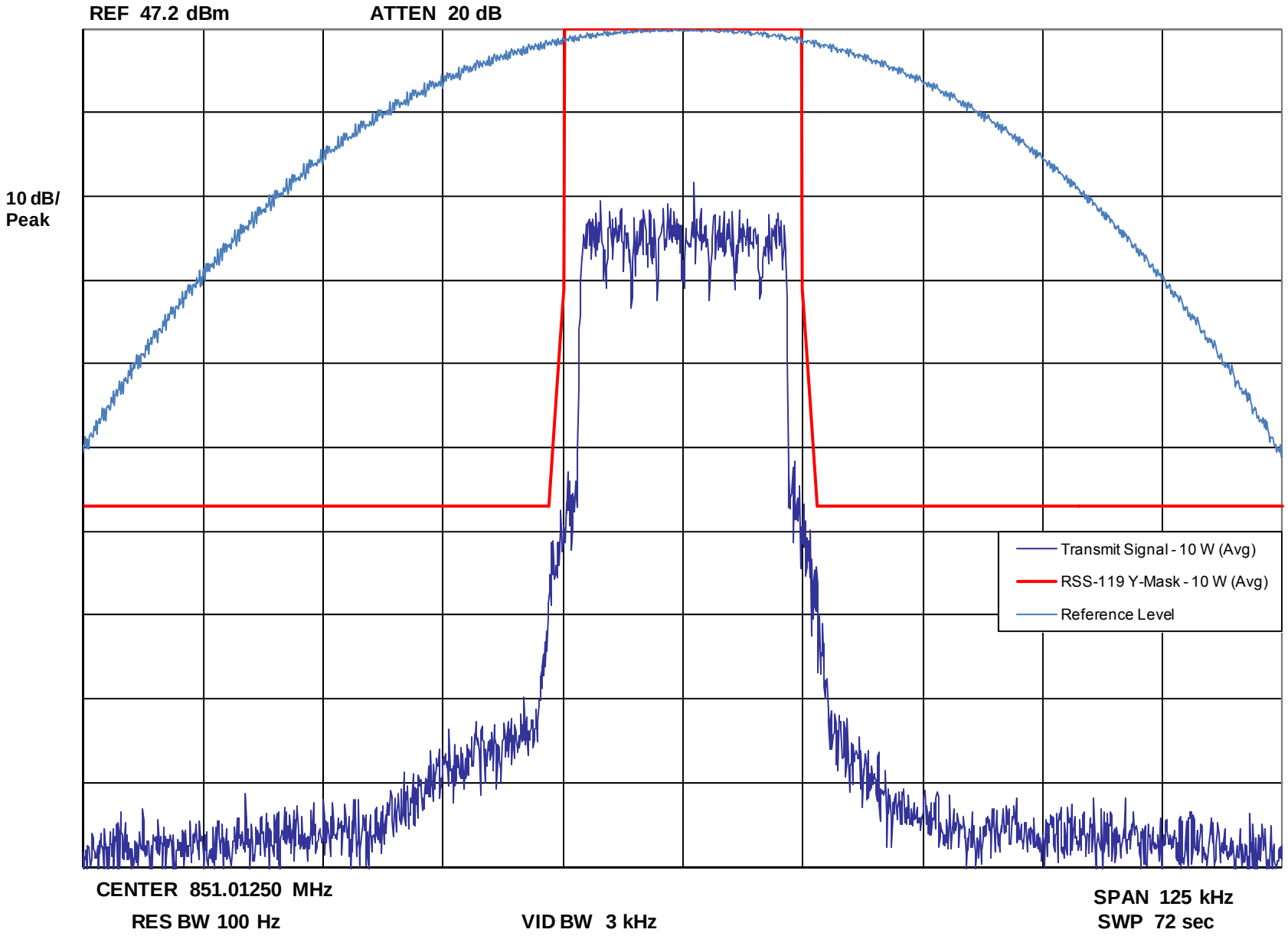
Occupied Bandwidth - DQPSK Modulation - 25 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – 64-QAM Modulation – Emission Designator: 22K0D7D – Low End of Band

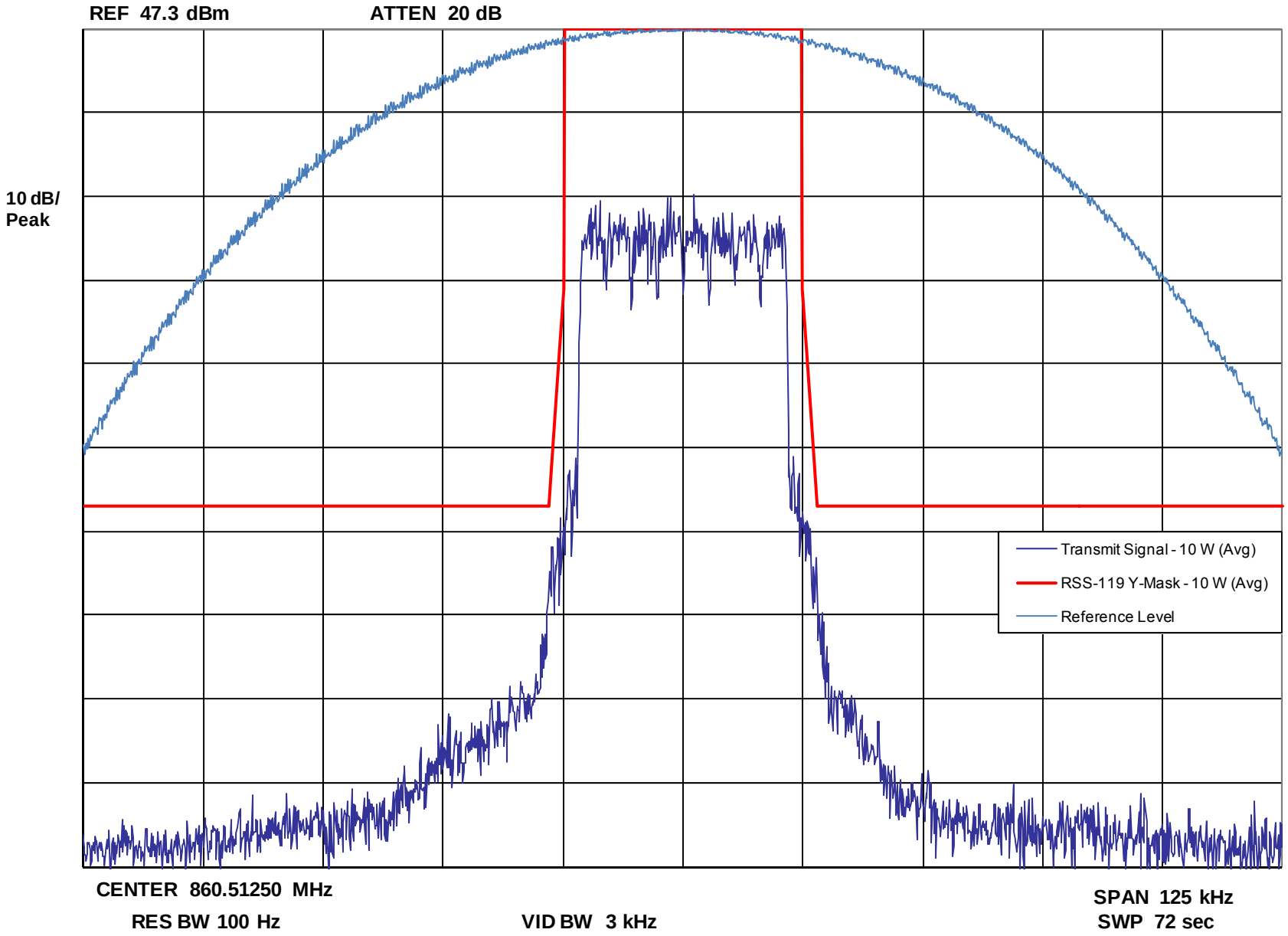
Occupied Bandwidth - 64-QAM Modulation - 10 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – 64-QAM Modulation – Emission Designator: 22K0D7D – Middle of Band

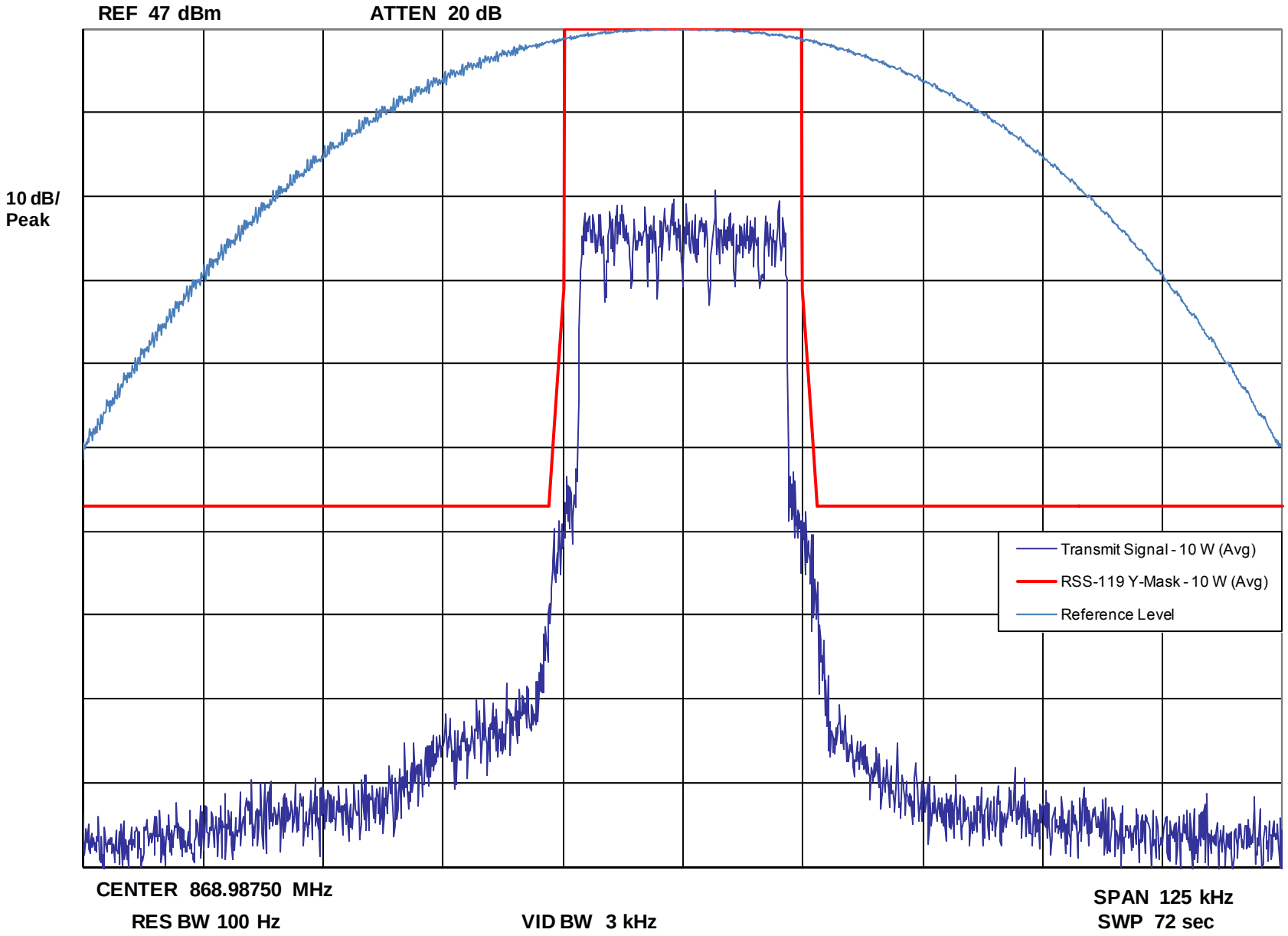
Occupied Bandwidth - 64-QAM Modulation - 10 Watts (Average)



Report on Test Measurements

Occupied Bandwidth – 64-QAM Modulation – Emission Designator: 22K0D7D – High End of Band

Occupied Bandwidth - 64-QAM Modulation - 10 Watts (Average)



Report on Test Measurements

Adjacent Channel Power –DQPSK (TETRA) Modulation and 64-QAM (TEDS) Modulation, 25 kHz Channels
The following exhibits show the adjacent channel power (ACP) performance for two linear digital modulations. The type of modulation used is determined by system configuration and is based upon channel usage as described in Exhibit B. The following ACP data references the following setup and specification requirements.

Specification Requirement 47 CFR §90.221 – Adjacent Channel Power Limits:
(a) For the frequency bands indicated below, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

(c)(1) Maximum adjacent power levels for frequencies in the 809-824 / 854-869 MHz band:

Frequency offset	Maximum ACP (dBc) for devices less than 15 Watts	Maximum ACP (dBc) for devices 15 Watts and above
25 kHz	−55 dBc	−55 dBc
50 kHz	−65 dBc	−65 dBc
75 kHz	−65 dBc	−70 dBc

(2) In any case, no requirement in excess of -36 dBm shall apply.

(d) On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least 43 + 10 log (P_{watts}) dB.

Modulation Types:	DQPSK Digital Modulation	64-QAM Digital Modulation
Emission Designator:	22K0D7D, 22K0D7E, 22K0D7W	22K0D7D
Channelization:	25 kHz	25 kHz
Power Setting:	25 Watts (Average)	10 Watts (Average)

Carrier Frequency: The unit was measured at a carrier frequency in the middle of the band, 860.5125 MHz. This is representative of performance over the full operating band.

Necessary Bandwidth Calculation: 47CFR90.221 sets forth an alternate method of establishing compliance with out of band emission (OOBE) limits. An Adjacent Channel Power mask and associated limits replace the standard OOBE mask sets. These are measured and recorded per 47CFR90.221.

Measurement Procedure and Instrument Settings:
Emission Measurement Analyzer Settings:

Horizontal:	20 kHz per Division	Resolution Bandwidth:	300 Hz
Vertical:	10 dB per Division	Video Bandwidth:	10 kHz
Sweep Time:	110 Seconds (<2000 Hz / Second)	Span:	200 kHz
Detector Mode:	RMS Power, 99%		

(continued next page)

Report on Test Measurements

Adjacent Channel Power (continued)

Test Procedure:

1) Adjust the spectrum analyzer per the values specified in the Measurement Procedure and Instrument Settings.

2) Modulate the transmitter with the appropriate signaling pattern (pseudorandom data) and key the transmitter at the desired power rating. Use the analyzer controls to set this signal to maximize dynamic range of the instrument and include noise floor into the plotted data. The spectrum analyzer then automatically presents the corrected (actual) power. Next, allow the analyzer to sweep fully and store the sweep; allow the analyzer to calculate channel power and ACP values.

3) Sweep the carrier and utilize the band power marker function of the spectrum analyzer to measure the power of the carrier in a 22 kHz bandwidth utilizing an 18 kHz filter criteria for ACP as stated in 90.221.

4) Use the carrier power value from the previous step to generate the ACP reference.

5) Store the resulting analyzer trace; add text and labeling as appropriate.

Test Results Summary:

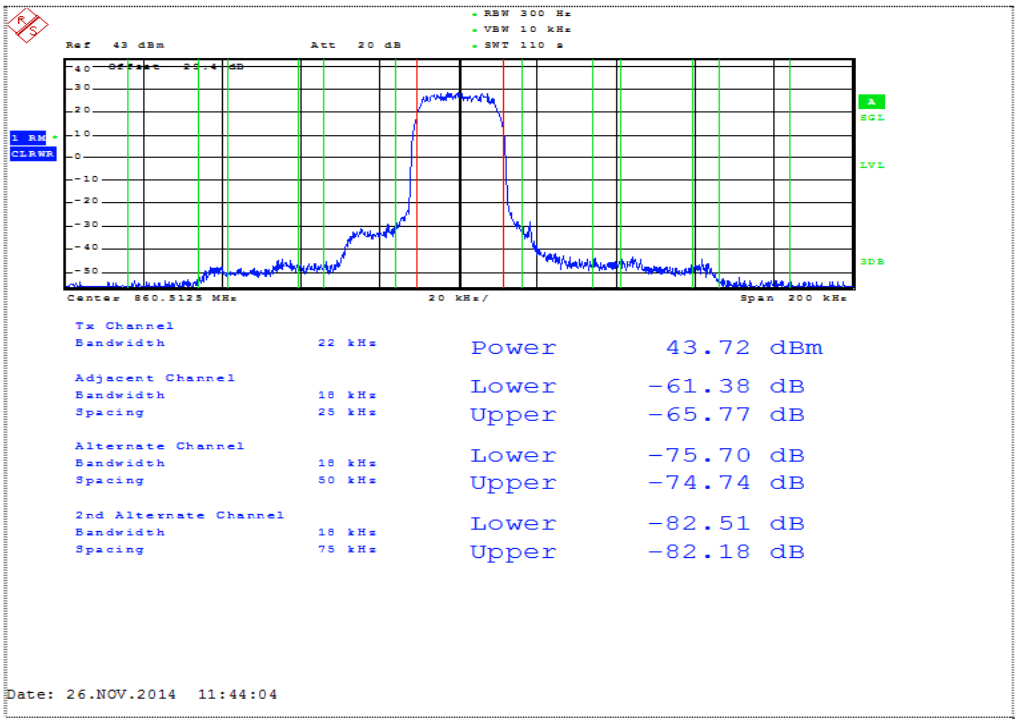
The adjacent channel power test results for the DQPSK and 64-QAM modulated transmitted signals are summarized below:

			(Spec -55 dBc)	(Spec -55 dBc)	(Spec -65 dBc)	(Spec -65 dBc)	(Spec -70 dBc)	(Spec -70 dBc)
Config	Modulation	Avg Power (Watts)	ACP @ -25 kHz (dBc)	ACP @ +25 kHz (dBc)	ACP @ -50 kHz (dBc)	ACP @ +50 kHz (dBc)	ACP @ -75 kHz (dBc)	ACP @ +75 kHz (dBc)
MTS4	DQPSK	25	-61.38	-65.77	-75.70	-74.74	-82.51	-82.18
		4	-68.19	-70.07	-80.54	-80.80	-82.22	-82.02
	64-QAM	10	-60.64	-64.09	-74.21	-74.36	-80.25	-80.60
		2.5	-65.20	-67.06	-79.26	-79.34	-81.31	-81.02
MTS2	DQPSK	25	-64.71	-67.68	-74.35	-73.53	-81.61	-81.43
		4	-70.27	-71.20	-80.49	-80.32	-81.62	-81.81
	64-QAM	10	-62.50	-64.22	-69.83	-69.39	-77.42	-77.31
		2.5	-68.05	-67.84	-78.85	-78.65	-80.08	-80.07
Note: The specification at +/- 75 kHz for power levels below 15 Watts is -65 dBc								

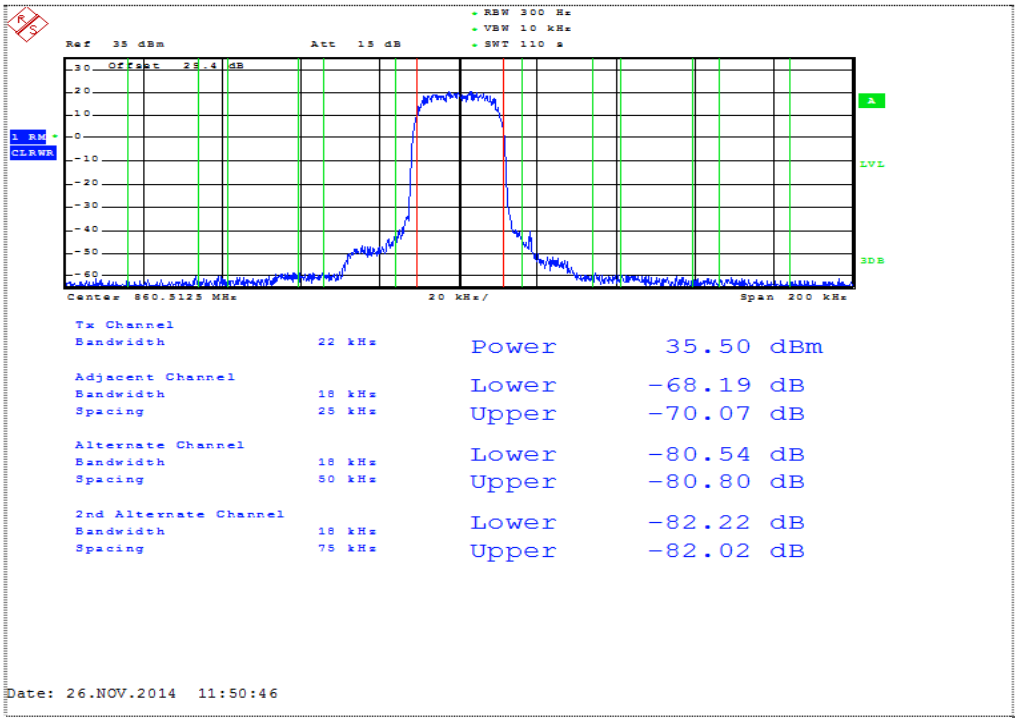
EXHIBIT	DESCRIPTION
E1-3.1	MTS 4, DQPSK Modulation, 25 kHz Channels, 25 Watts (Average), 4 Watts (Average)
E1-3.2	MTS 4, 64-QAM Modulation, 25 kHz Channels, 10 Watts (Average), 2.5 Watts (Average)
E1-3.3	MTS 2, DQPSK Modulation, 25 kHz Channels, 25 Watts (Average), 4 Watts (Average)
E1-3.4	MTS 2, 64-QAM Modulation, 25 kHz Channels, 10 Watts (Average), 2.5 Watts (Average)

Report on Test Measurements

Adjacent Channel Power – DQPSK (TETRA) Modulation 25 kHz Channels – MTS 4
The following shows the adjacent channel power (ACP) performance for DQPSK digital modulation. The charts show ACP performance at the high rated power and low rated power settings.



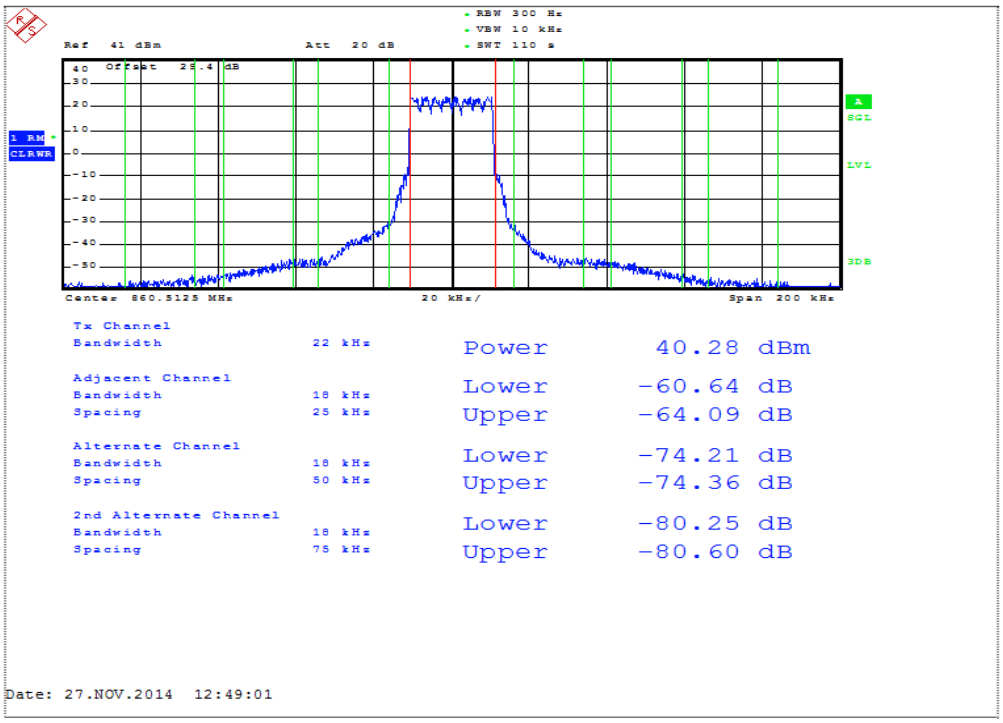
DQPSK, 860.5125 MHz, 25 Watts (Average) – MTS 4



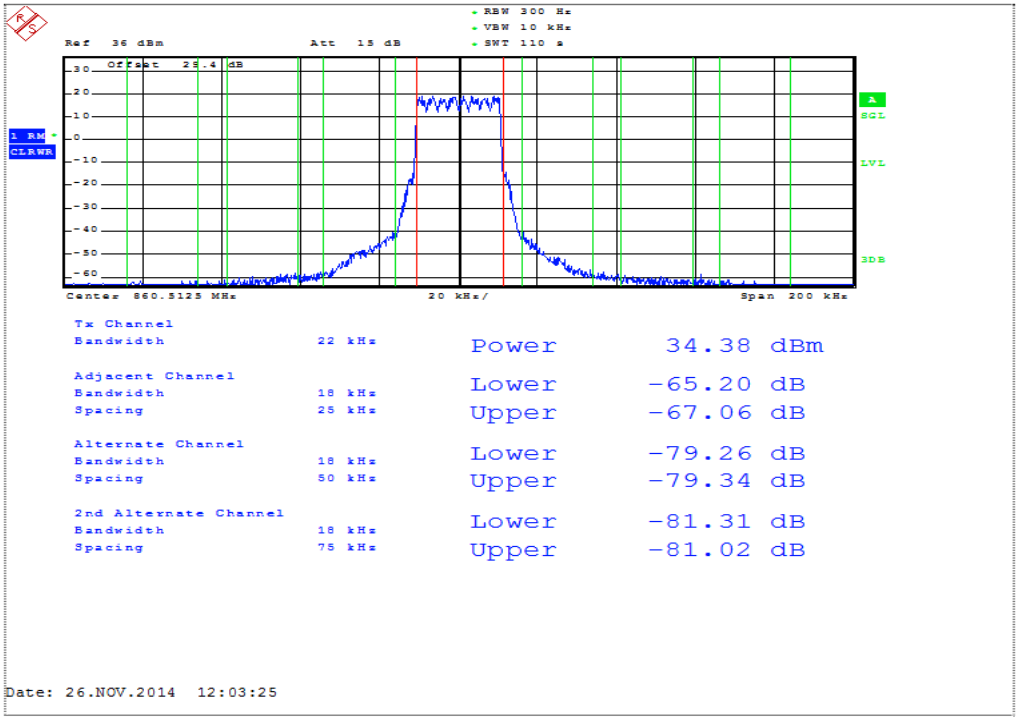
DQPSK, 860.5125 MHz, 4 Watts (Average) – MTS 4

Report on Test Measurements

Adjacent Channel Power –64-QAM (TEDS) Modulation 25 kHz Channels – MTS 4
The following shows the adjacent channel power (ACP) performance for 64-QAM digital modulation. The charts show ACP performance at the high rated power and low rated power settings.



64-QAM, 860.5125 MHz, 10 Watts (Average) – MTS 4

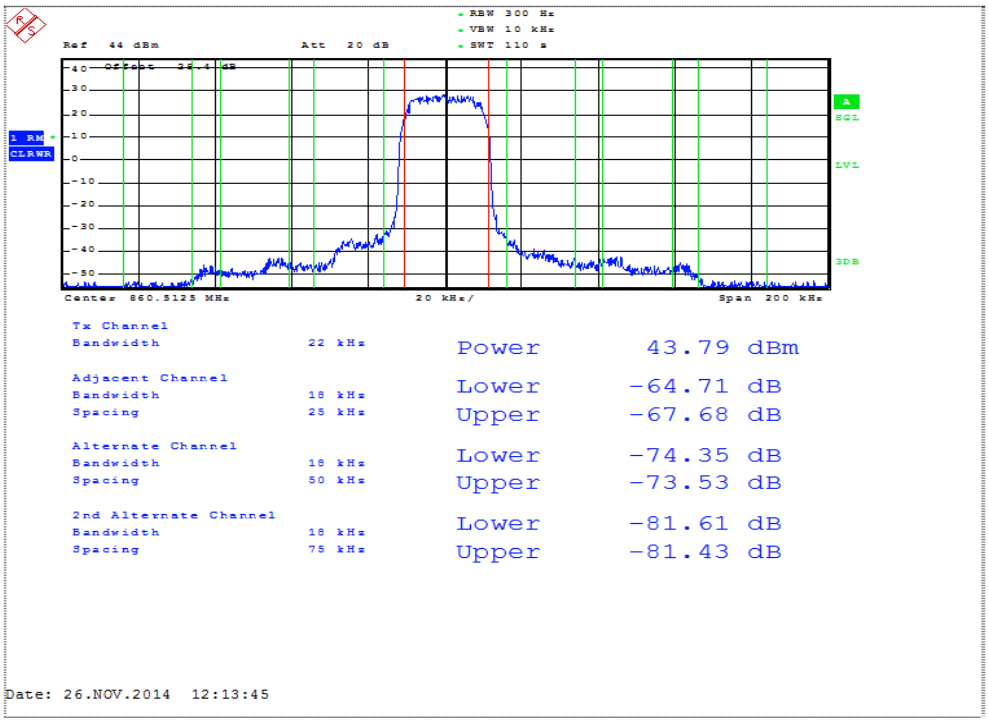


64-QAM, 860.5125 MHz, 2.5 Watts (Average) – MTS 4

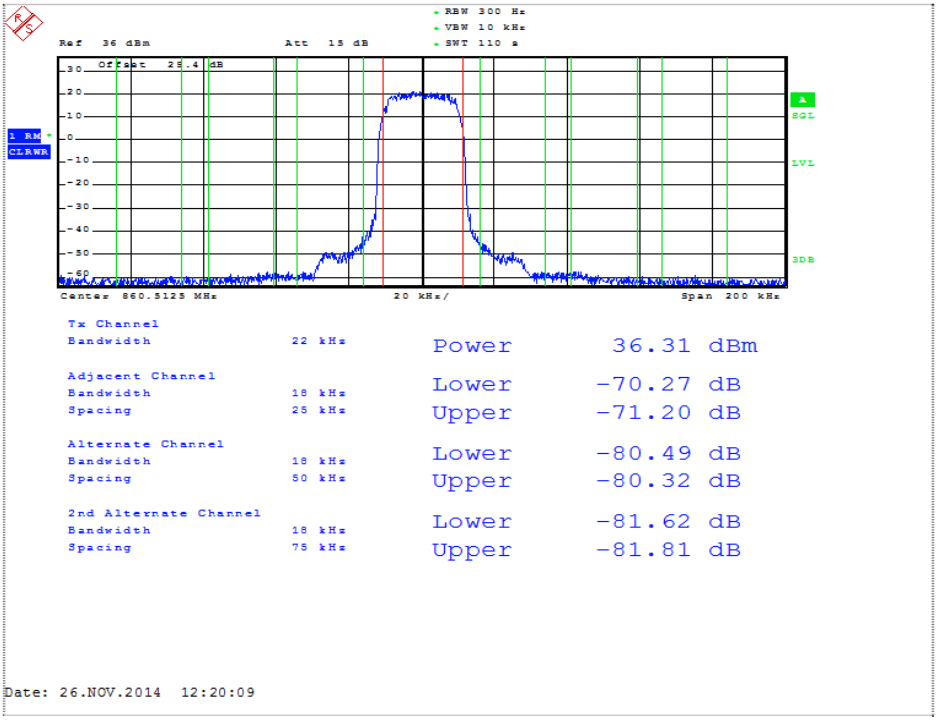
Report on Test Measurements

Adjacent Channel Power – DQPSK (TETRA) Modulation 25 kHz Channels – MTS 2

The following shows the adjacent channel power (ACP) performance for DQPSK digital modulation. The charts show ACP performance at the high rated power and low rated power settings.



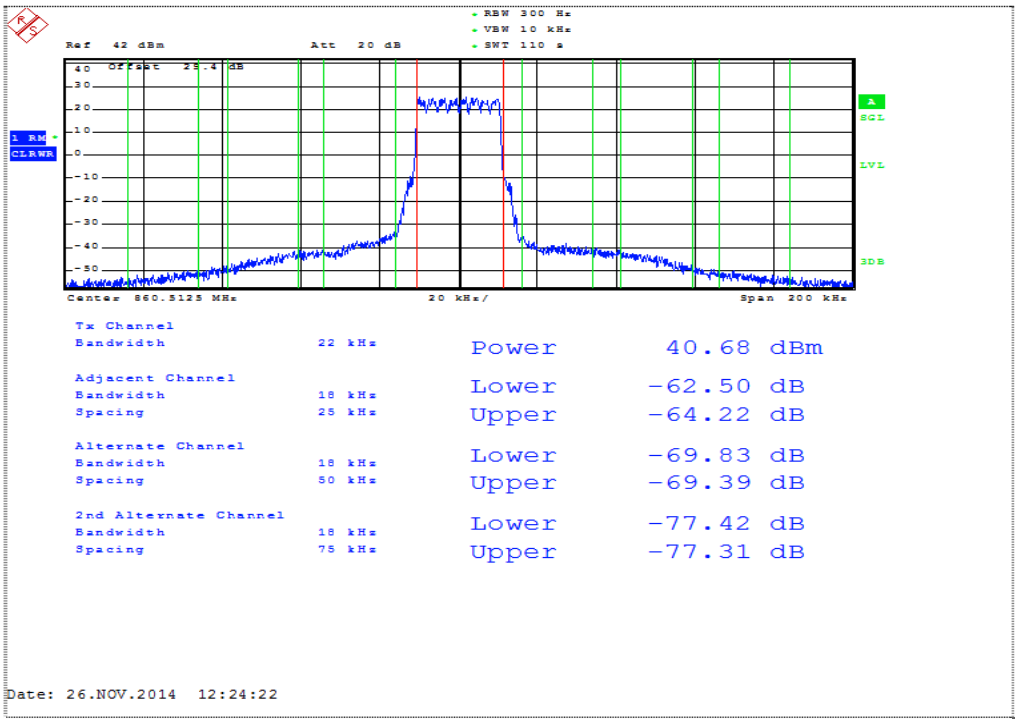
DQPSK, 860.5125 MHz, 25 Watts (Average) – MTS 2



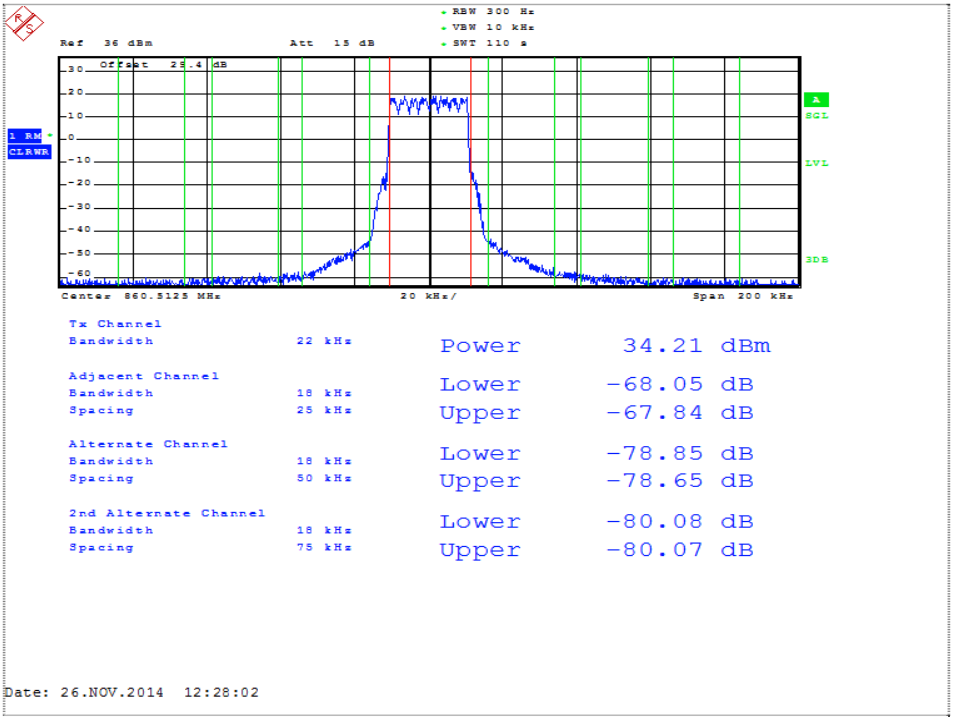
DQPSK, 860.5125 MHz, 4 Watts (Average) – MTS 2

Report on Test Measurements

Adjacent Channel Power –64-QAM (TEDS) Modulation 25 kHz Channels – MTS 2
The following shows the adjacent channel power (ACP) performance for 64-QAM digital modulation. The charts show ACP performance at the high rated power and low rated power settings.



64-QAM, 860.5125 MHz, 10 Watts (Average) – MTS 2



64-QAM, 860.5125 MHz, 2.5 Watts (Average) – MTS 2

Report on Test Measurements

Conducted Spurious Emissions – Harmonics and Emission Spectrum

Specification Requirement IC RSS-119 per section 5.5.8 Table 3 and section 5.8.10 - Emission Limits – "Y-Mask":
Equipment with a 25 kHz channel spacing and an occupied bandwidth greater than 20 kHz shall have the power of any emission attenuated below the transmitter output power P (dBW) as specified in the following table:

Displacement Frequency, fd (kHz)	*Minimum Attenuation (dB)*	*Resolution Bandwidth*
12.375 < fd ≤ 13.975	whichever is the lesser attenuation: 30 + 16.67(fd–12.375) dB, or 55 + 10 log10(P) dB	100 Hz (Specified in Section 4.2.2)
fd > 13.975	whichever is the lesser attenuation: 57 dB, or 55 + 10 log10(P) dB	100 Hz (Specified in Section 4.2.2)

Specification Requirement 47 CFR §90.221 – Adjacent Channel Power Limits:
(a) For the frequency bands indicated below, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

(c)(1) Maximum adjacent power levels for frequencies in the 809-824 / 854-869 MHz band:

Frequency offset	*Maximum ACP (dBc) for devices less than 15 Watts*	*Maximum ACP (dBc) for devices 15 Watts and above*
25 kHz	−55 dBc	−55 dBc
50 kHz	−65 dBc	−65 dBc
75 kHz	−65 dBc	−70 dBc

(2) In any case, no requirement in excess of -36 dBm shall apply.

(d) On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least 43 + 10 log (P_{watts}) dB.

For emissions beyond 50 kHz from the edge of the authorized bandwidth, the spectrum analyzer bandwidth shall be 100 kHz for frequencies below 1 GHz, and 1 MHz for frequencies above 1 GHz.

Modulation: DQPSK Modulation and 64-QAM Modulation as indicated

Carrier Frequencies: The unit was measured at carrier frequencies of 851.0125, 860.5125, and 868.9875 MHz for radiated emissions. These frequencies represent the low end, center, and high end of the 851-869 MHz band, and are representative of the full operating band.

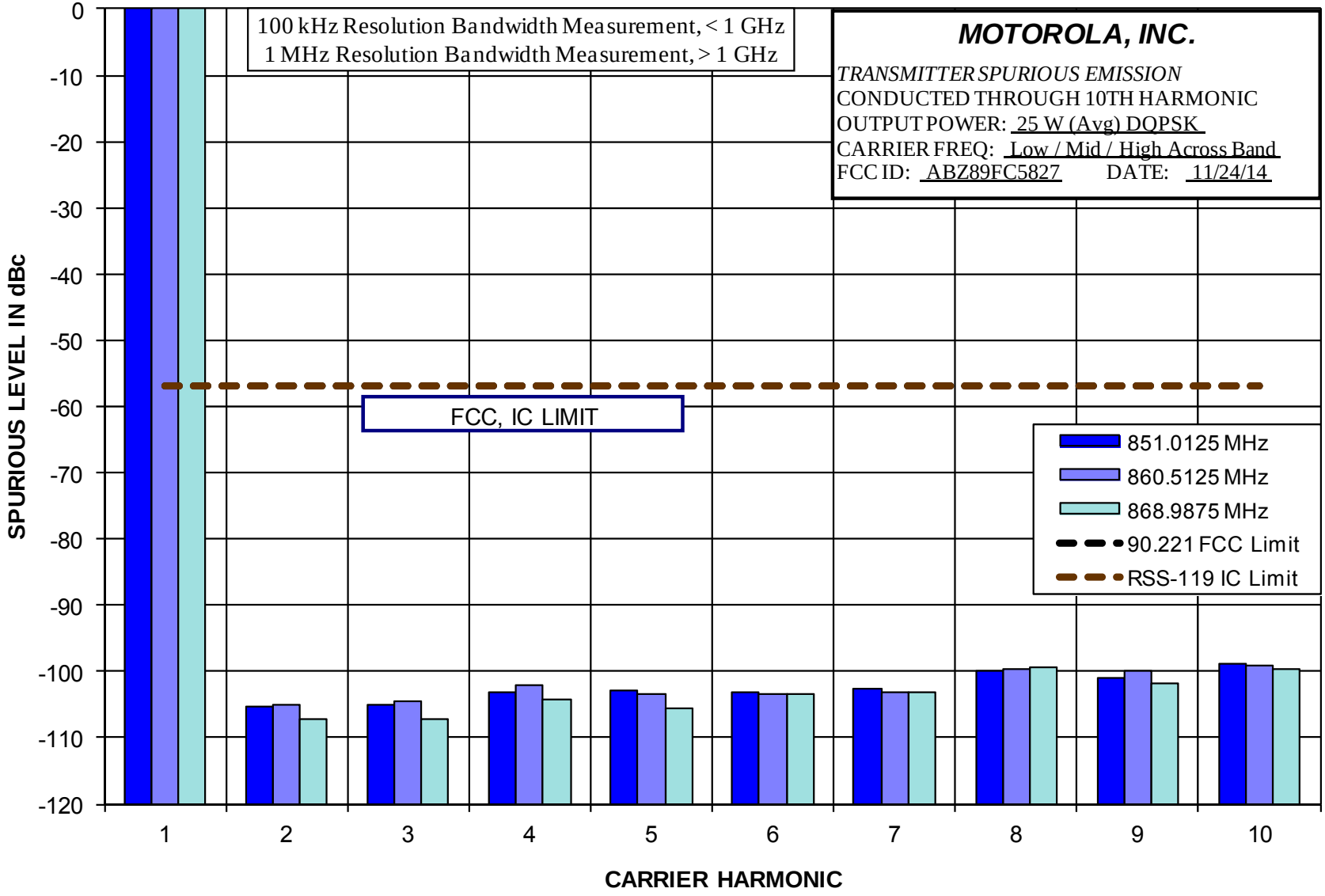
Specification: The limit functions above produce the following spurious emission limits away from carrier, either both specifications are noted on the following exhibits or the most stringent is shown:

DQPSK Modulation			*64-QAM Modulation*		
Power	*FCC*	*IC*	*Power*	*FCC*	*IC*
25 W	-57 dBc	-57 dBc	10 W	-53 dBc	-57 dBc
4 W	-49 dBc	-57 dBc	2.5 W	-47 dBc	-57 dBc

EXHIBIT	**DESCRIPTION**
E1-4.1	MTS 4 Conducted Spurious Harmonic Emissions, Power Output 25 Watts (Average), DQPSK
E1-4.2	MTS 4 Conducted Spurious Harmonic Emissions, Power Output 4 Watts (Average), DQPSK
E1-4.3	MTS 4 Conducted Spurious Harmonic Emissions, Power Output 10 Watts (Average), 64-QAM
E1-4.4	MTS 4 Conducted Spurious Harmonic Emissions, Power Output 2.5 Watts (Average), 64-QAM
E1-4.5	MTS 2 Conducted Spurious Harmonic Emissions, Power Output 25 Watts (Average), DQPSK
E1-4.6	MTS 2 Conducted Spurious Harmonic Emissions, Power Output 4 Watts (Average), DQPSK
E1-4.7	MTS 2 Conducted Spurious Harmonic Emissions, Power Output 10 Watts (Average), 64-QAM
E1-4.8	MTS 2 Conducted Spurious Harmonic Emissions, Power Output 2.5 Watts (Average), 64-QAM
E1-4.9, 10, 11	MTS 4 Conducted Spurious Emission Spectrum, 200 MHz Span, Power 25 Watts (Avg), DQPSK
E1-4.12, 13, 14	MTS 4 Conducted Spurious Emission Spectrum, 200 MHz Span, Power 10 Watts (Avg), 64-QAM
E1-4.15, 16, 17	MTS 2 Conducted Spurious Emission Spectrum, 200 MHz Span, Power 25 Watts (Avg), DQPSK
E1-4.18, 19, 20	MTS 2 Conducted Spurious Emission Spectrum, 200 MHz Span, Power 10 Watts (Avg), 64-QAM

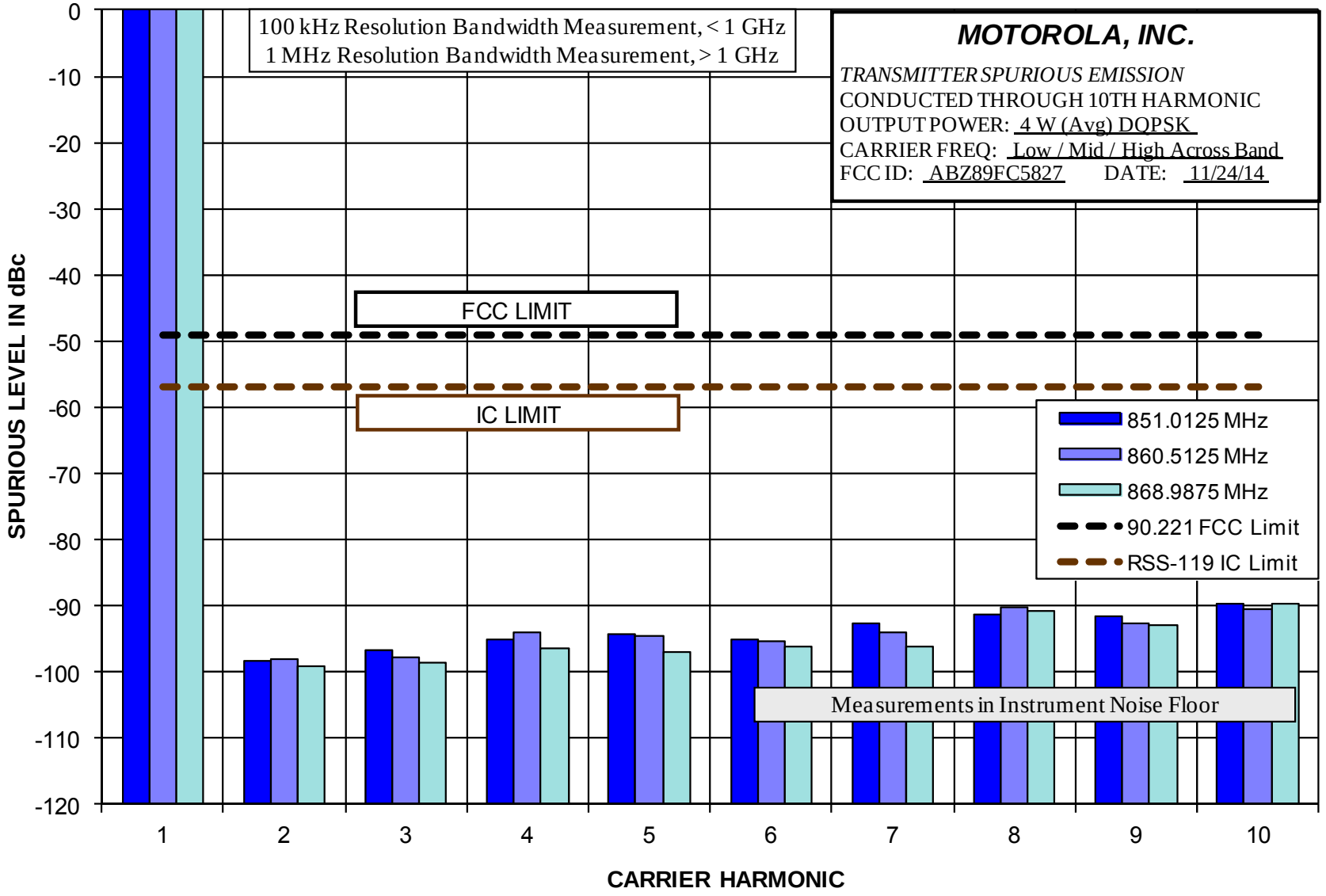
Report on Test Measurements

MTS 4 Conducted Spurious Harmonic Emissions – 25 Watts (Average), DQPSK



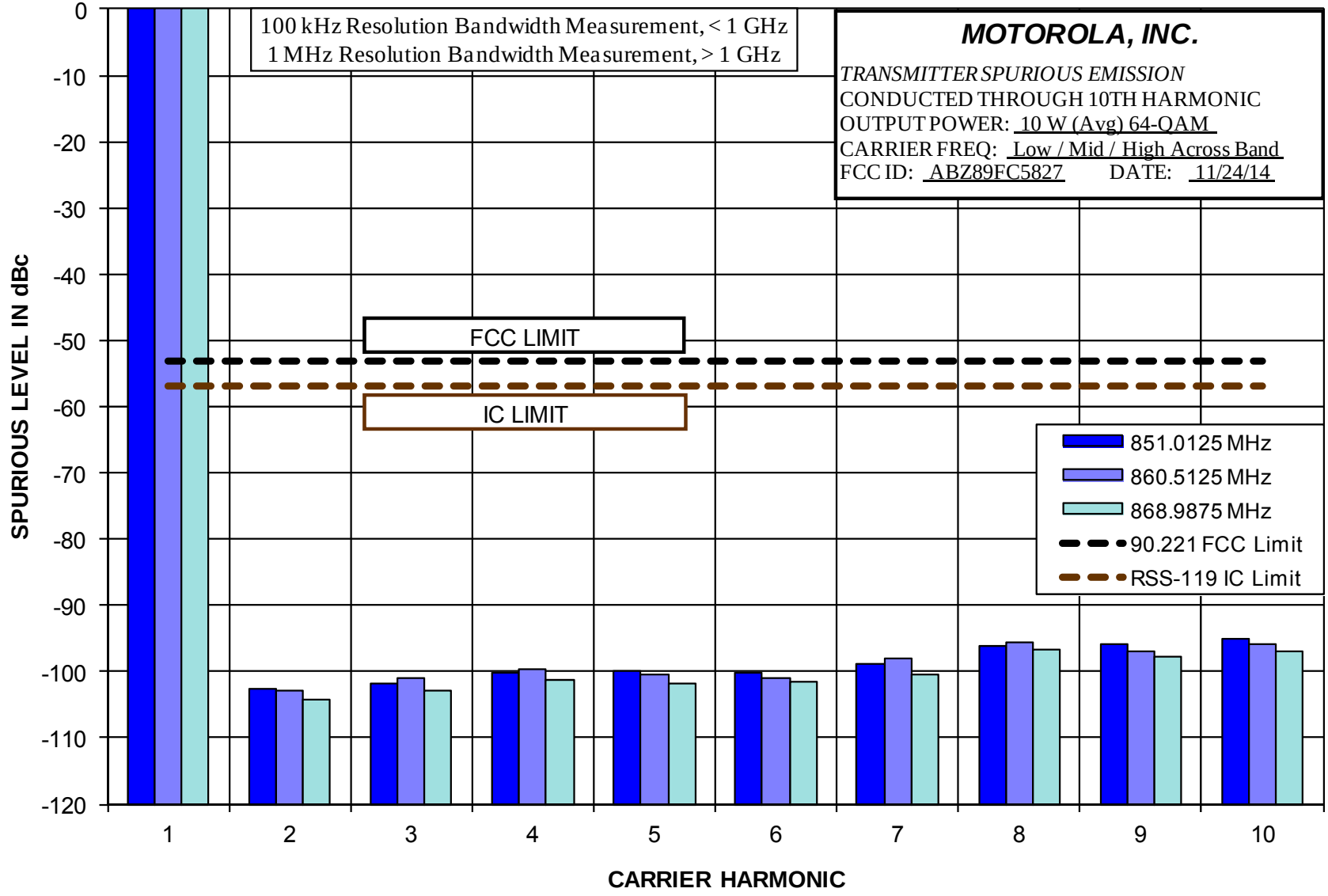
Report on Test Measurements

MTS 4 Conducted Spurious Harmonic Emissions – 4 Watts (Average), DQPSK



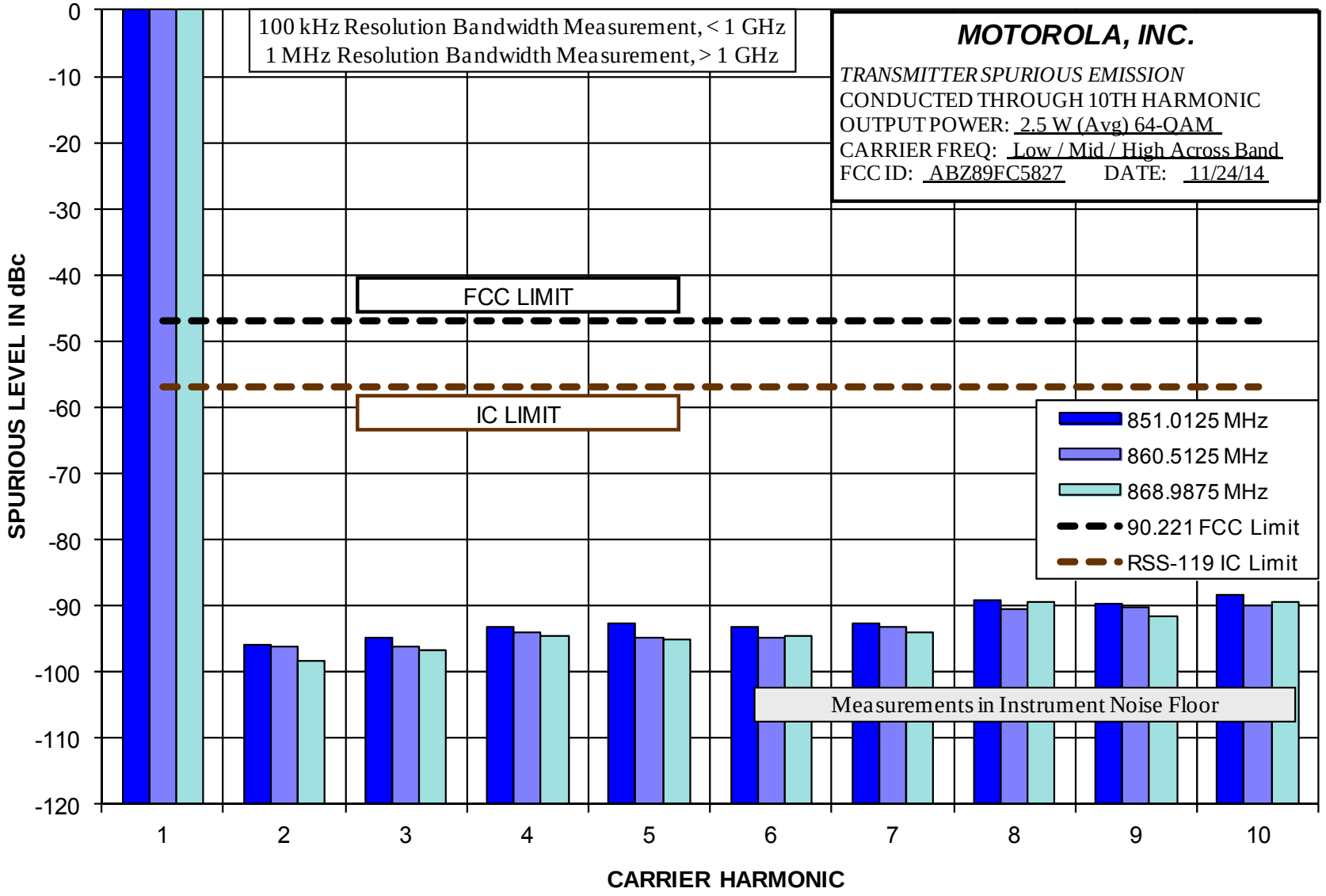
Report on Test Measurements

MTS 4 Conducted Spurious Harmonic Emissions – 10 Watts (Average), 64-QAM



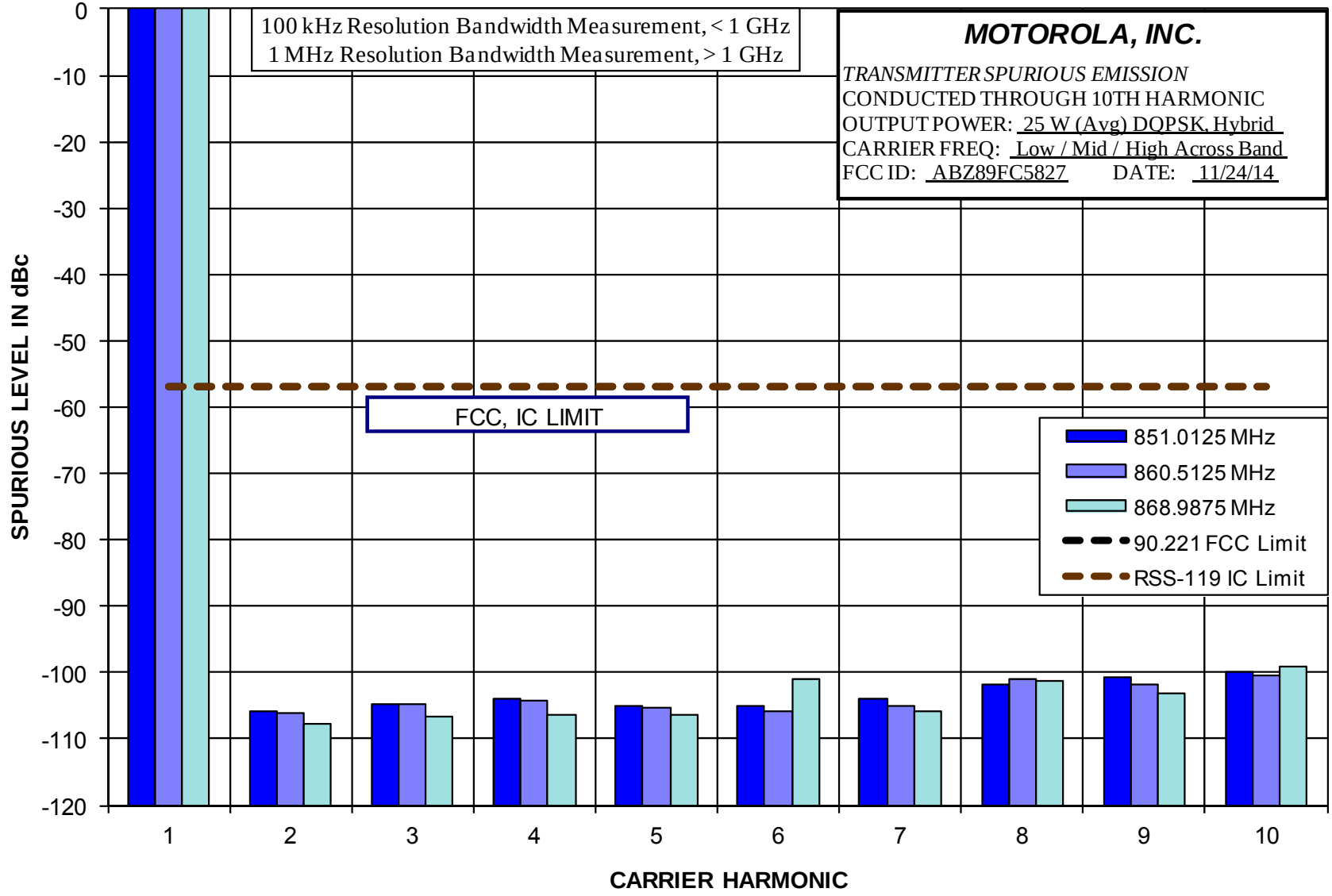
Report on Test Measurements

MTS 4 Conducted Spurious Harmonic Emissions – 2.5 Watts (Average), 64-QAM



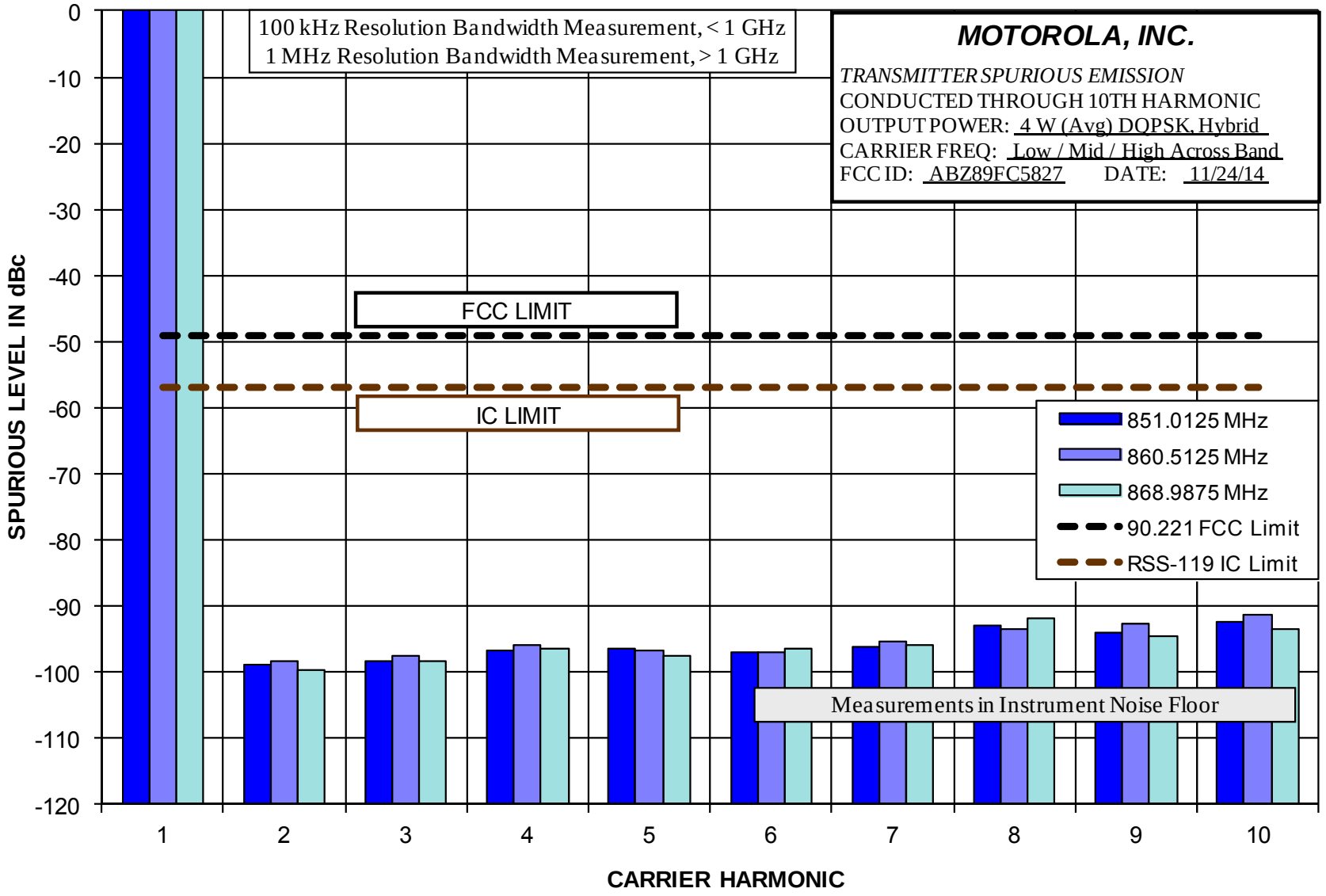
Report on Test Measurements

MTS 2 Conducted Spurious Harmonic Emissions – 25 Watts (Average), DQPSK



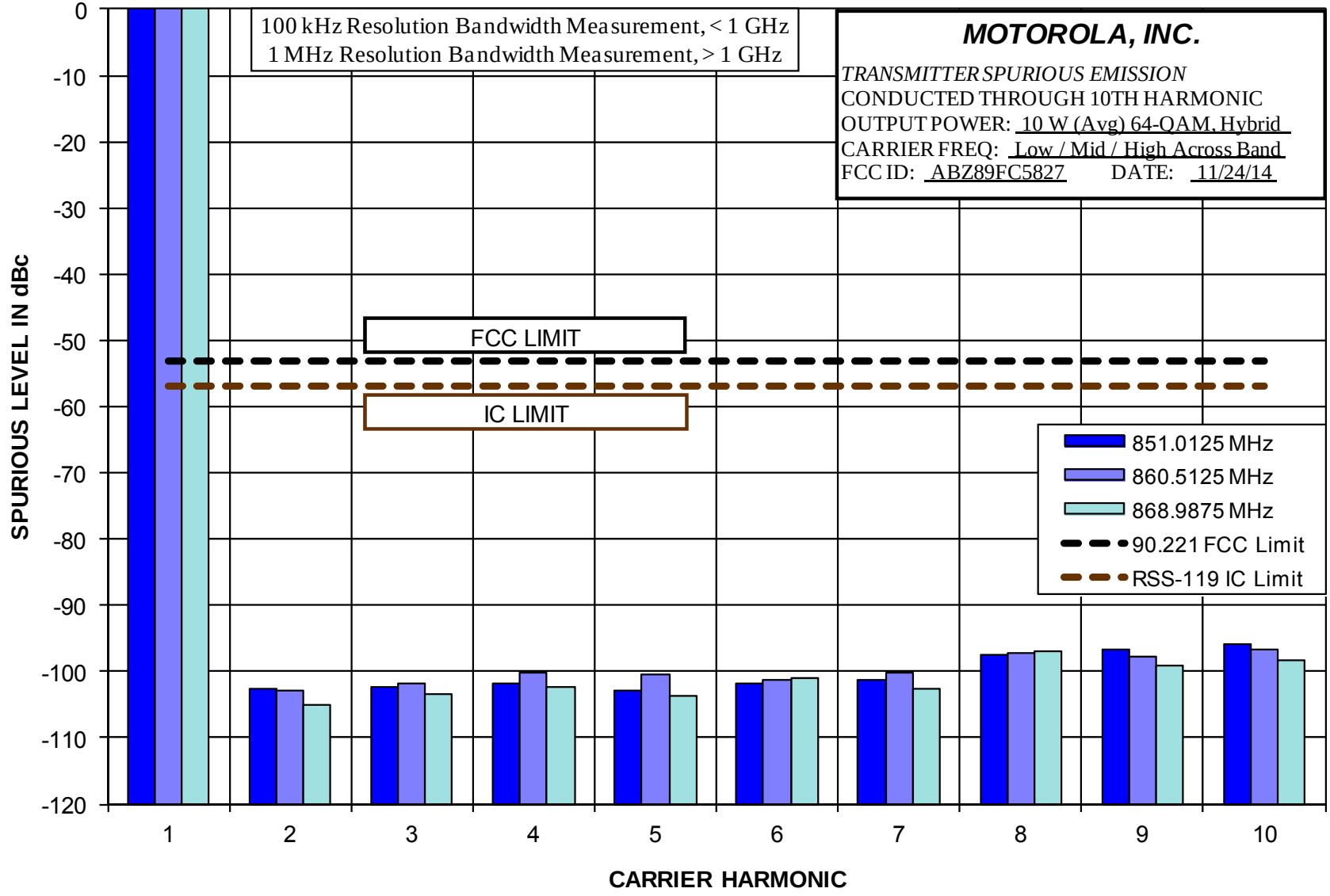
Report on Test Measurements

MTS 2 Conducted Spurious Harmonic Emissions – 4 Watts (Average), DQPSK



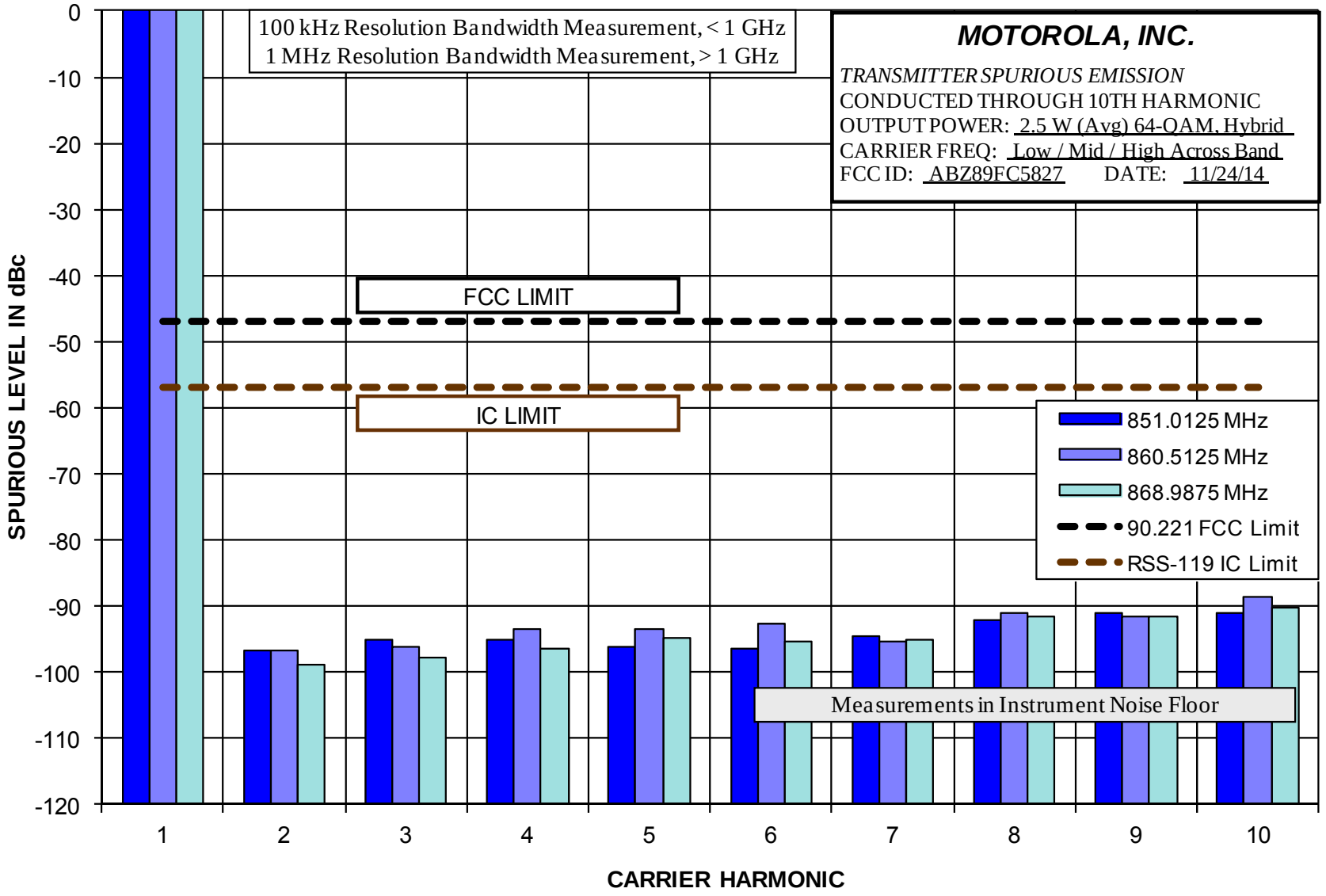
Report on Test Measurements

MTS 2 Conducted Spurious Harmonic Emissions – 10 Watts (Average), 64-QAM



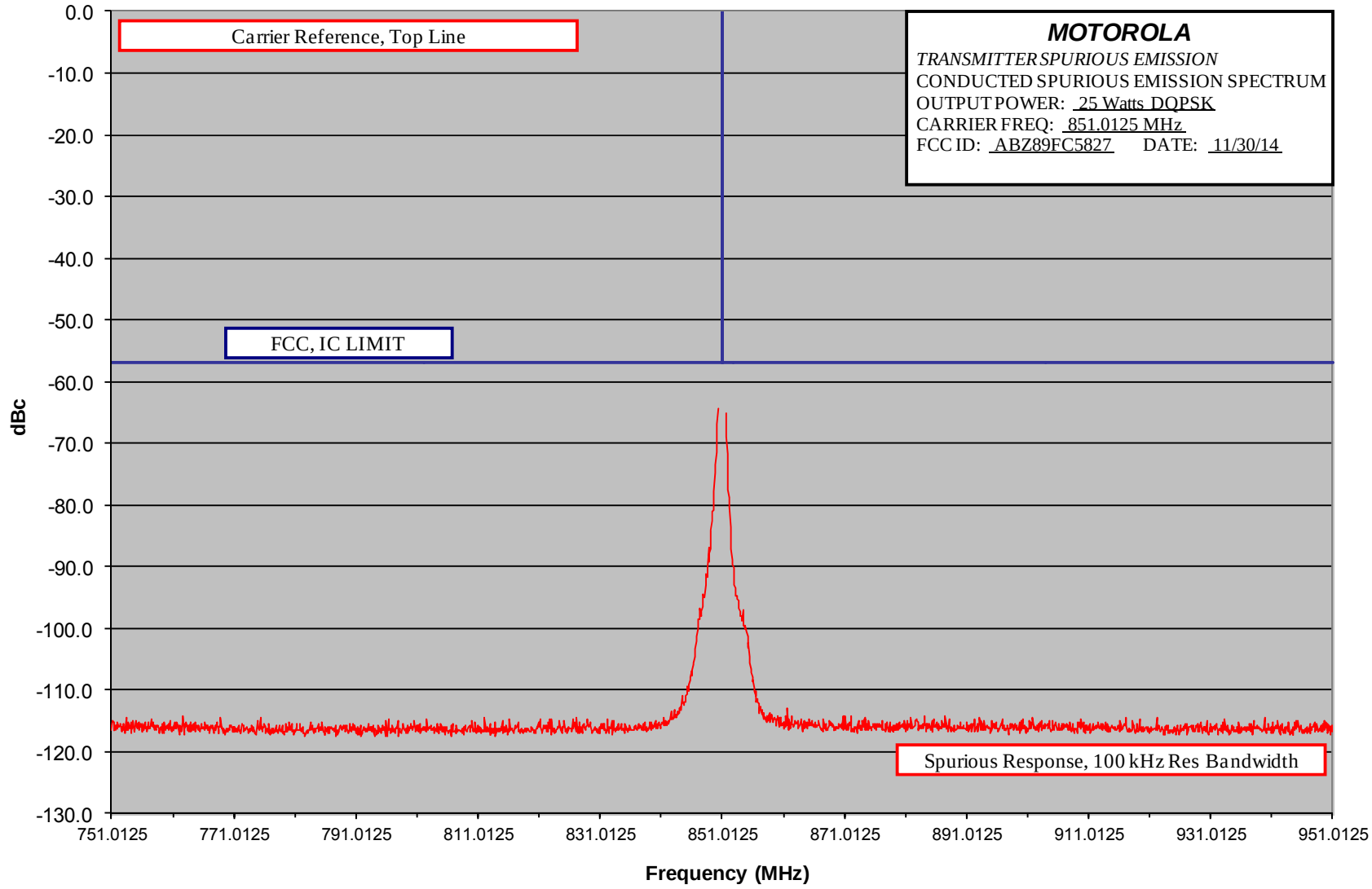
Report on Test Measurements

MTS 2 Conducted Spurious Harmonic Emissions – 2.5 Watts (Average), 64-QAM



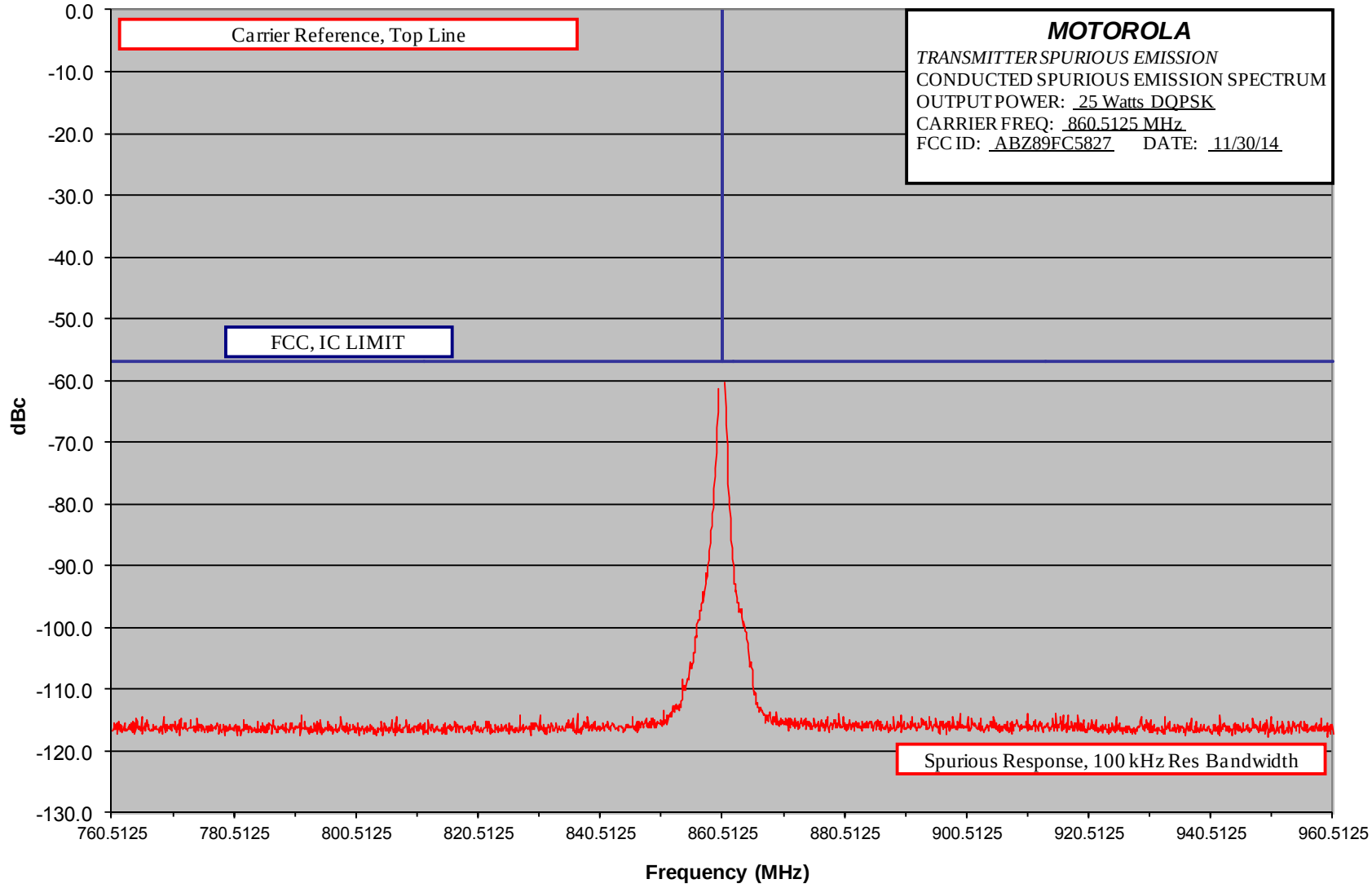
Report on Test Measurements

MTS 4 Conducted Spurious Emission Spectrum – 25 Watts DQPSK – 200 MHz Span – Low End of Band



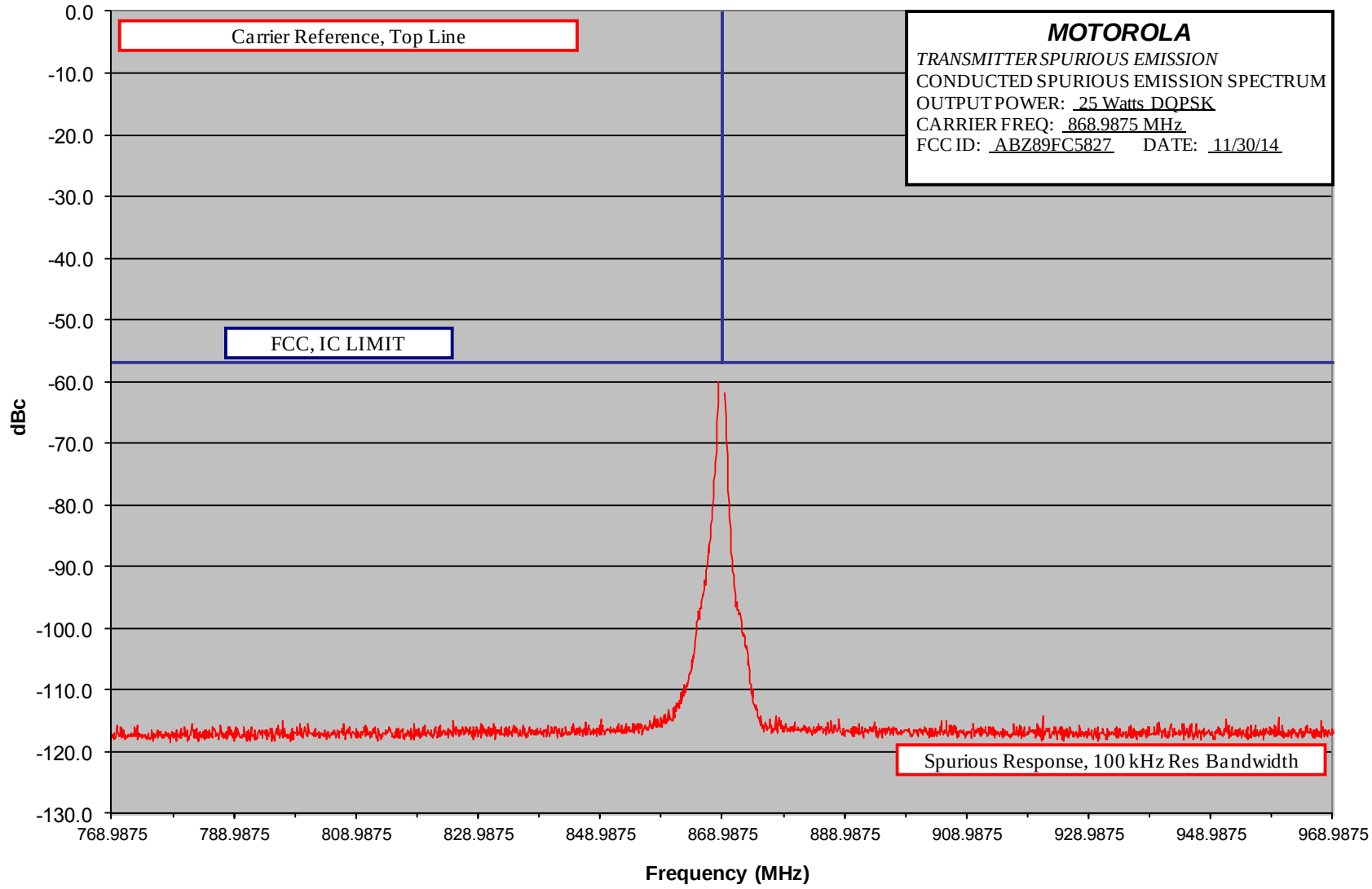
Report on Test Measurements

MTS 4 Conducted Spurious Emission Spectrum – 25 Watts DQPSK – 200 MHz Span – Middle of Band



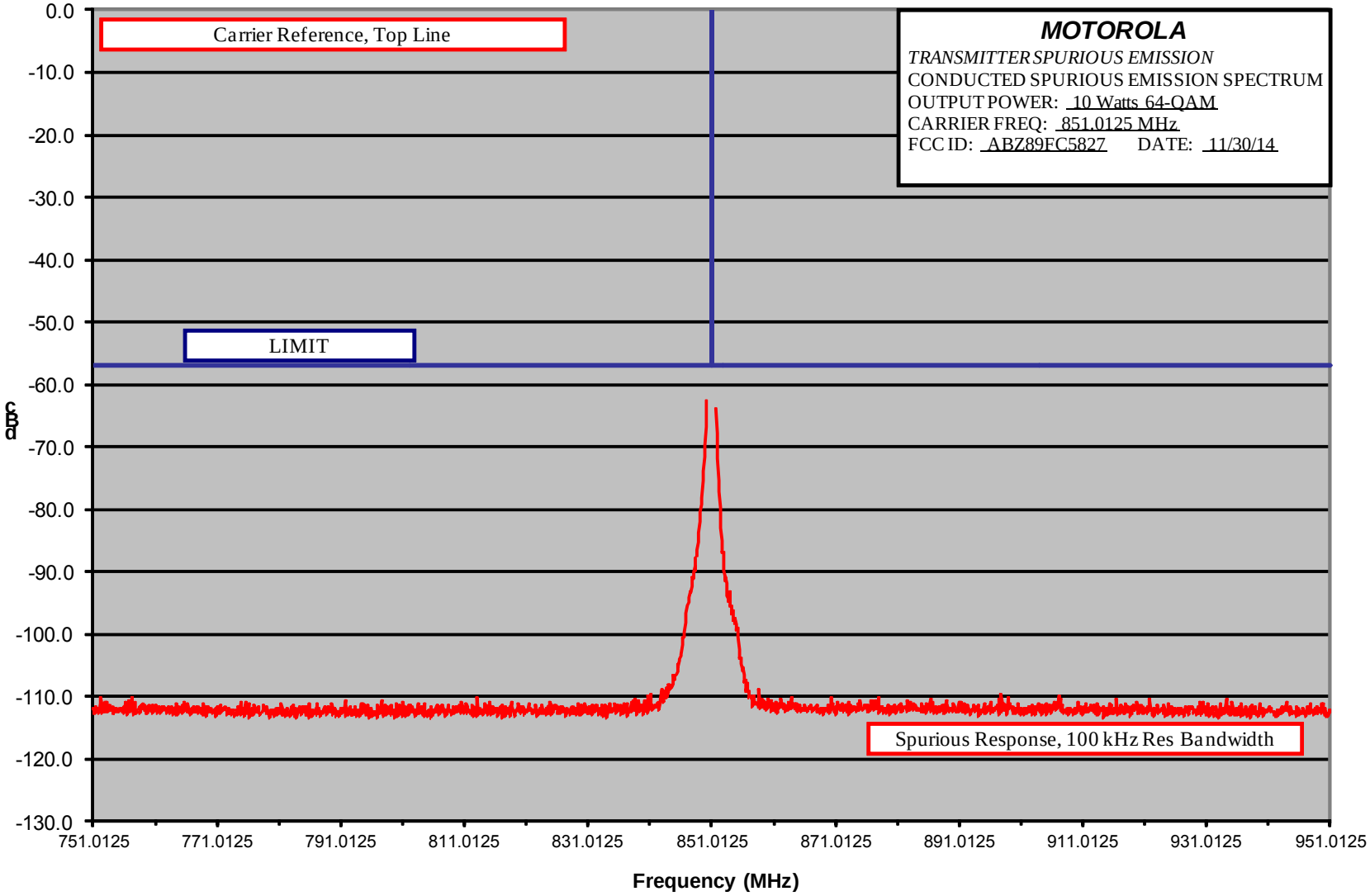
Report on Test Measurements

MTS 4 Conducted Spurious Emission Spectrum – 25 Watts DQPSK – 200 MHz Span – High End of Band



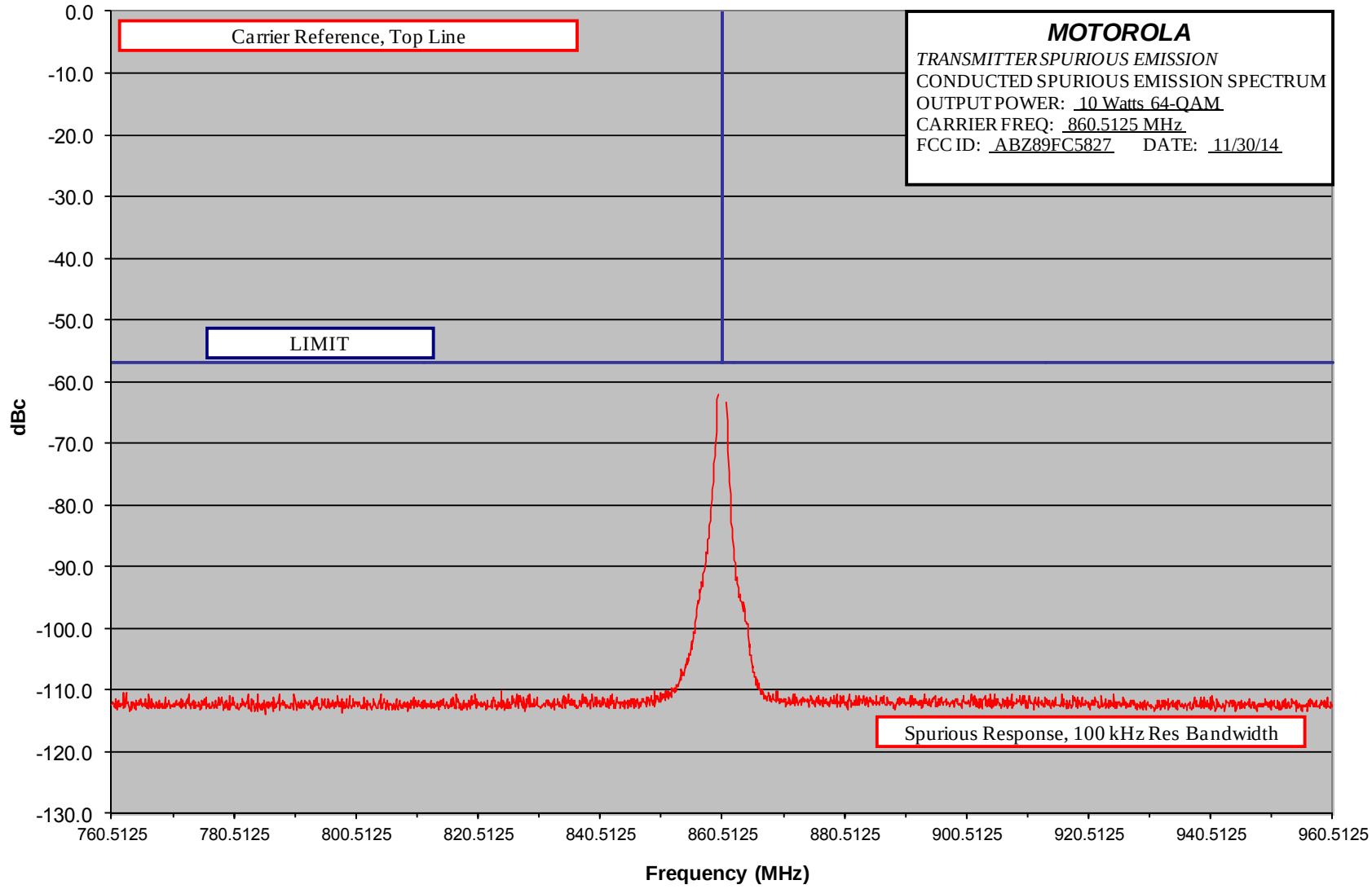
Report on Test Measurements

MTS 4 Conducted Spurious Emission Spectrum – 10 Watts 64-QAM – 200 MHz Span – Low End of Band



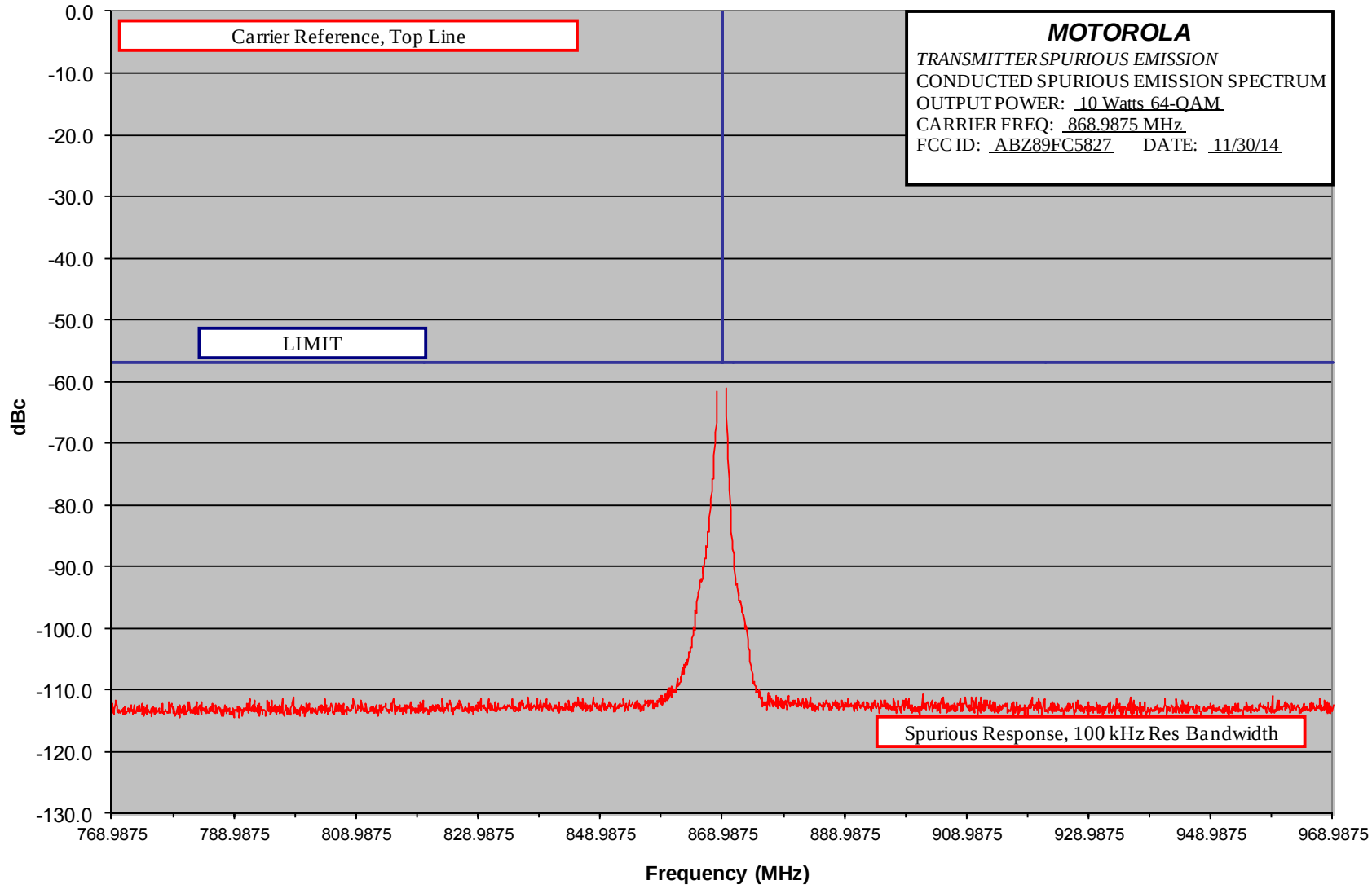
Report on Test Measurements

MTS 4 Conducted Spurious Emission Spectrum – 10 Watts 64-QAM – 200 MHz Span – Middle of Band



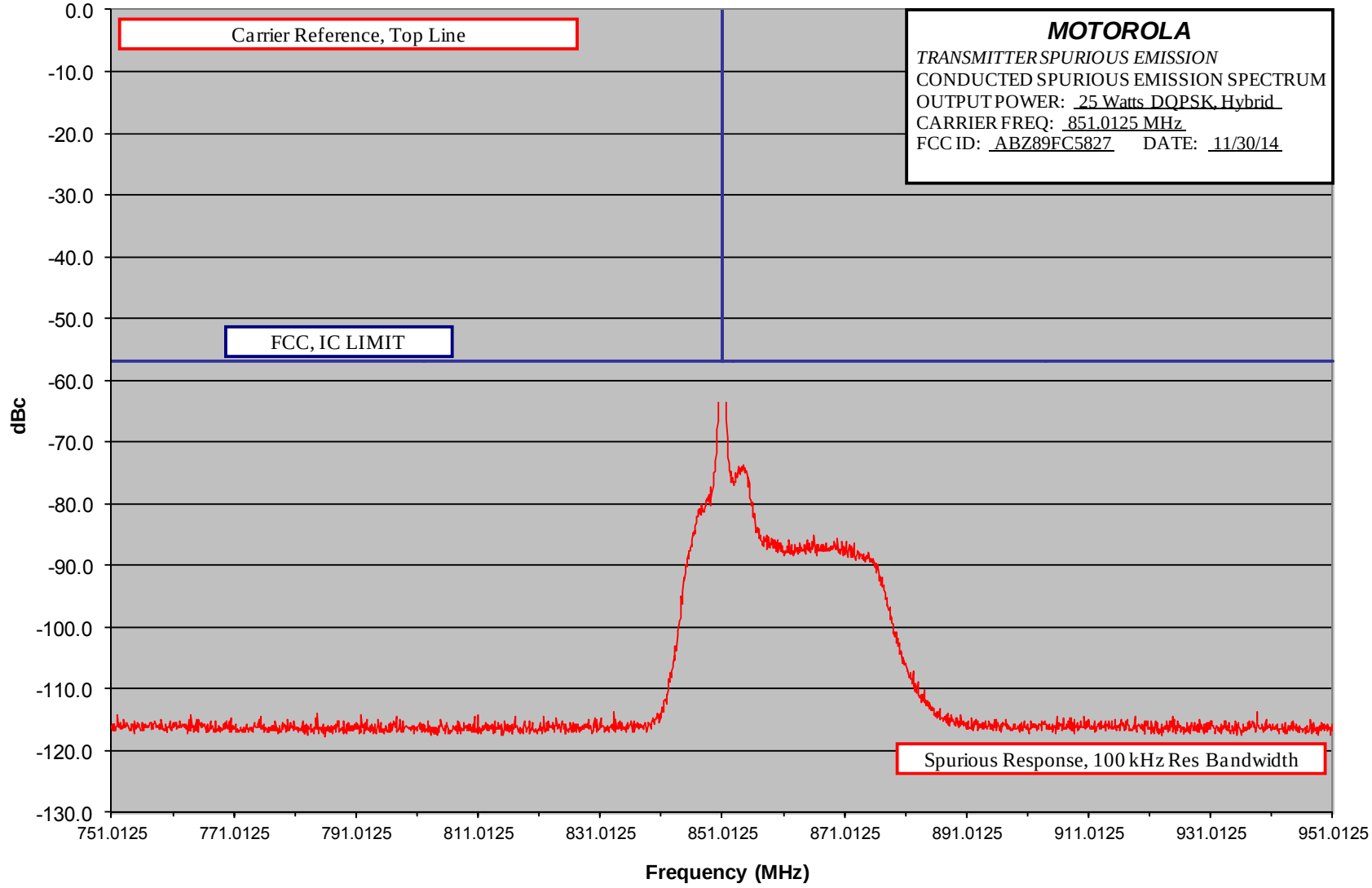
Report on Test Measurements

MTS 4 Conducted Spurious Emission Spectrum – 10 Watts 64-QAM – 200 MHz Span – High End of Band



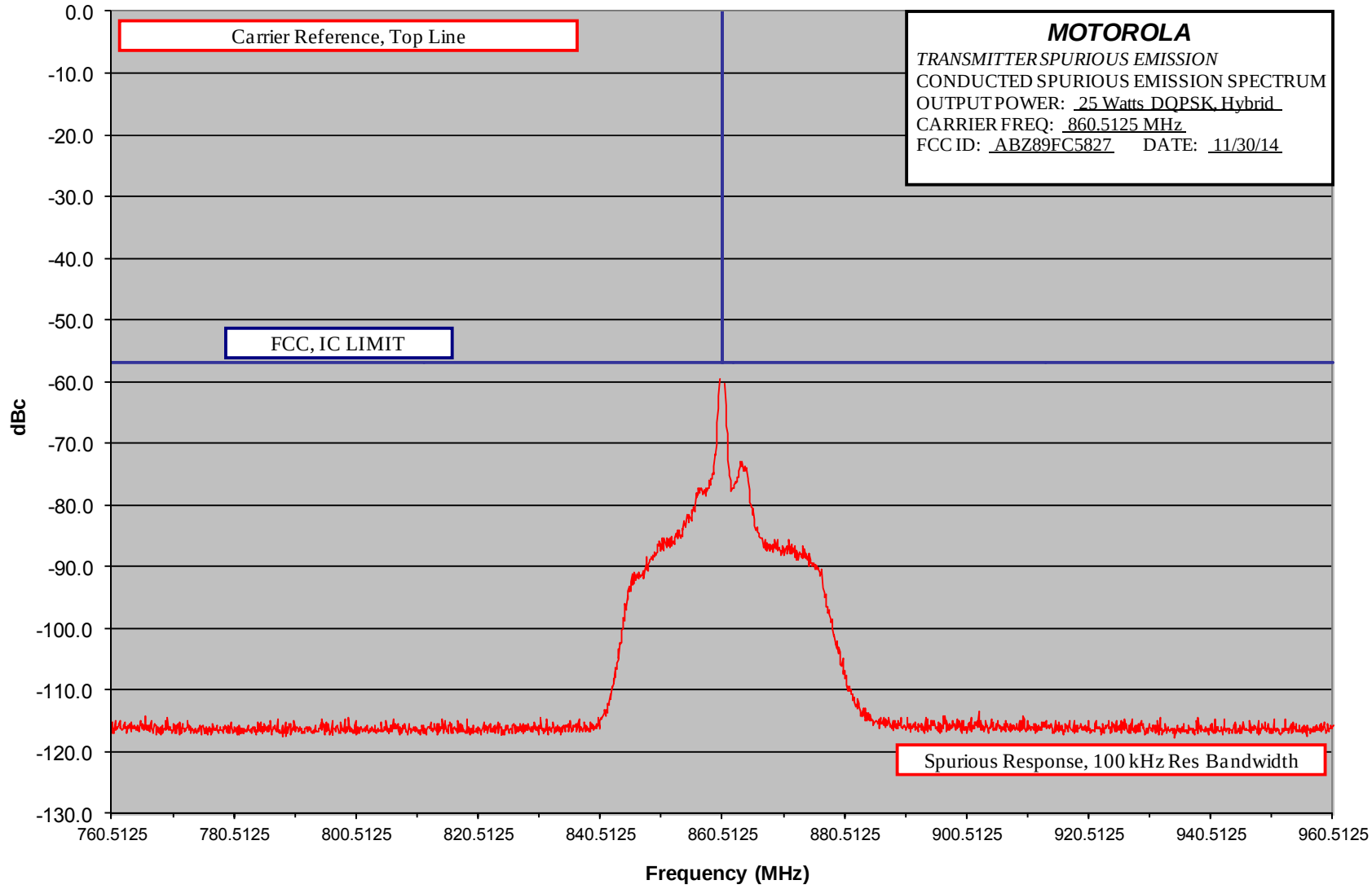
Report on Test Measurements

MTS 2 Conducted Spurious Emission Spectrum – 25 Watts DQPSK – 200 MHz Span – Low End of Band



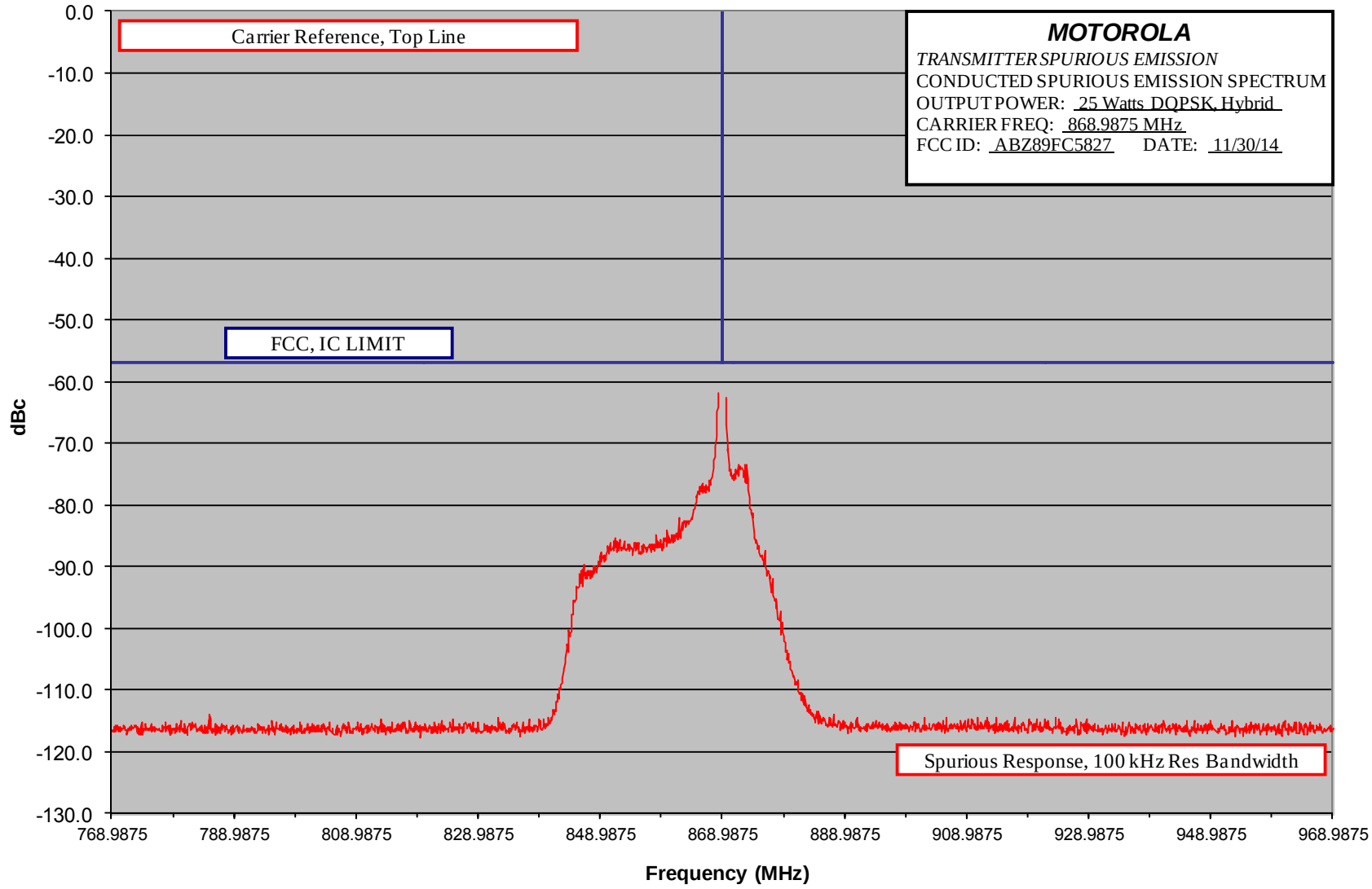
Report on Test Measurements

MTS 2 Conducted Spurious Emission Spectrum – 25 Watts DQPSK – 200 MHz Span – Middle of Band



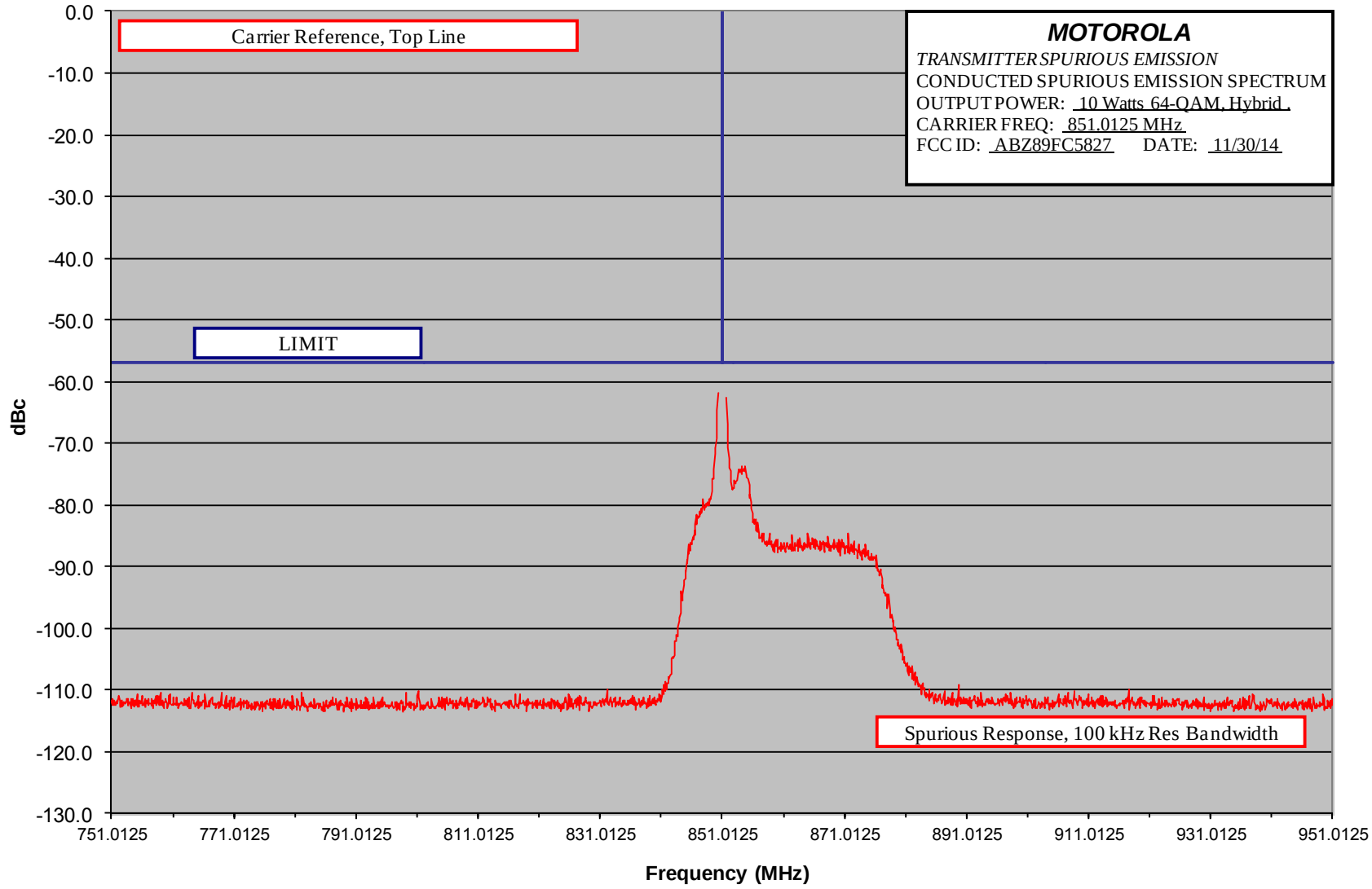
Report on Test Measurements

MTS 2 Conducted Spurious Emission Spectrum – 25 Watts DQPSK – 200 MHz Span – High End of Band



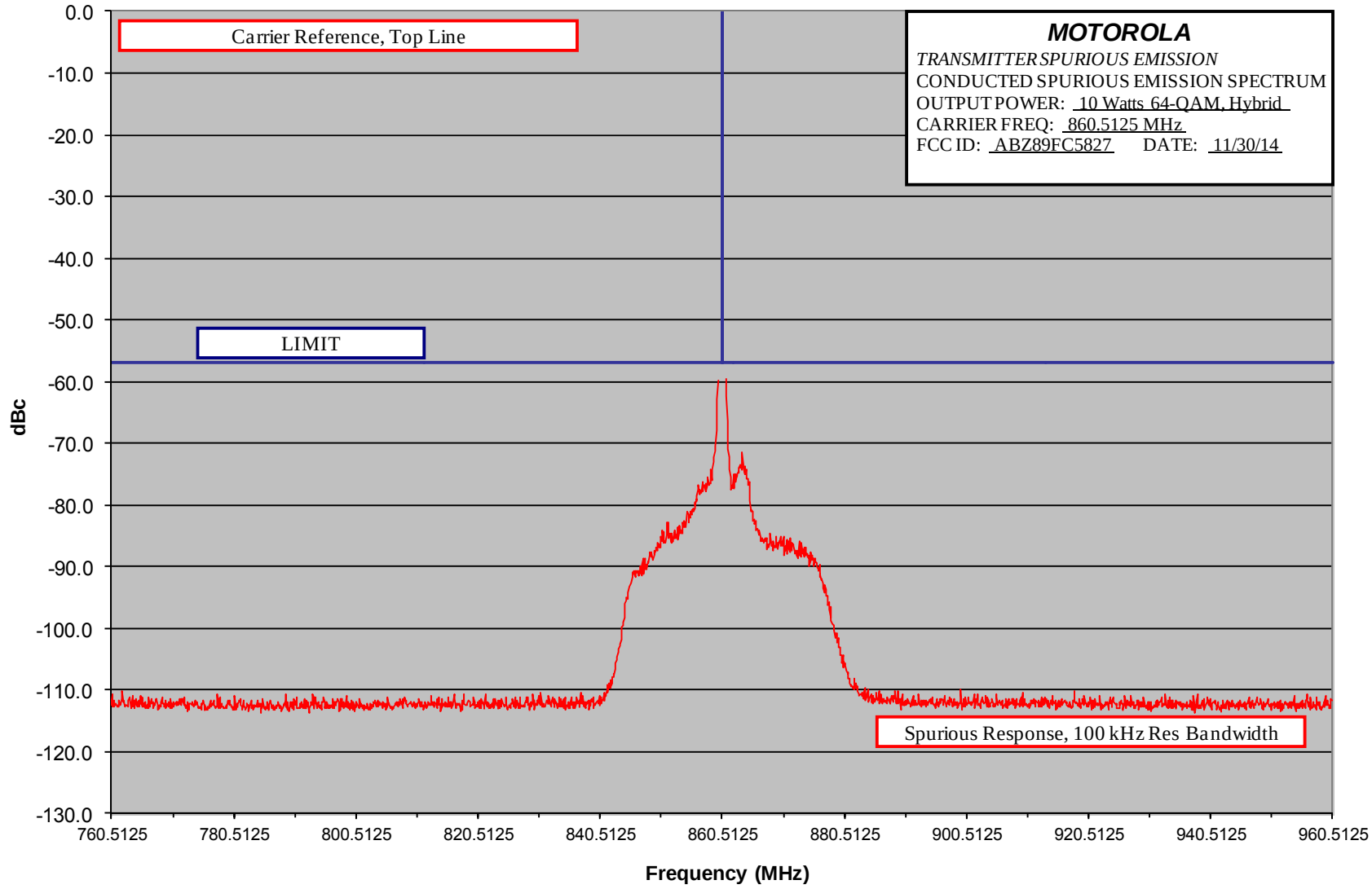
Report on Test Measurements

MTS 2 Conducted Spurious Emission Spectrum – 10 Watts 64-QAM – 200 MHz Span – Low End of Band



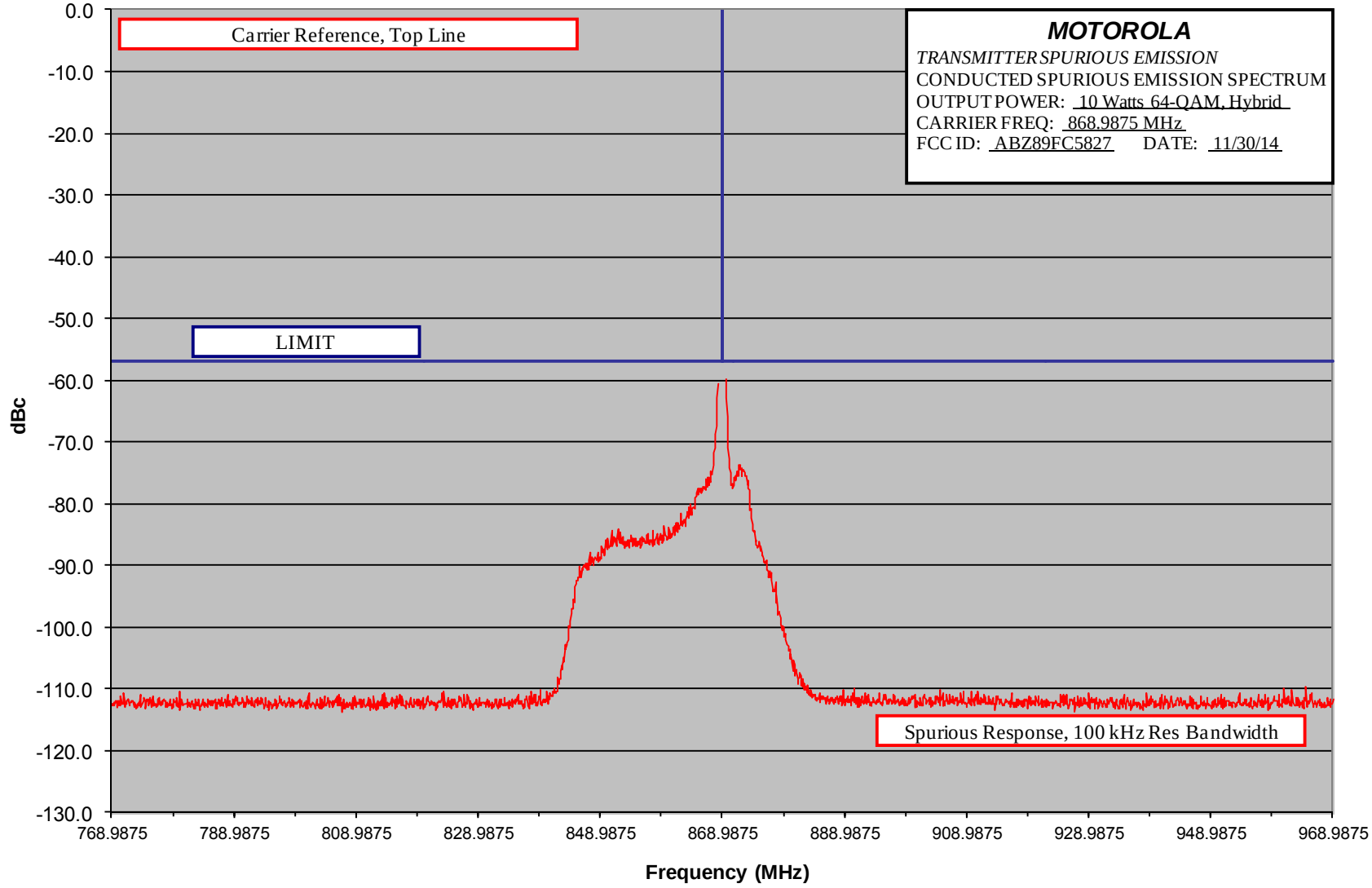
Report on Test Measurements

MTS 2 Conducted Spurious Emission Spectrum – 10 Watts 64-QAM – 200 MHz Span – Middle of Band



Report on Test Measurements

MTS 2 Conducted Spurious Emission Spectrum – 10 Watts 64-QAM – 200 MHz Span – High End of Band



Report on Test Measurements

Radiated Spurious Emissions, Harmonics

Specification Requirement IC RSS-119 per section 5.5.8 Table 3 and section 5.8.10 - Emission Limits – "Y-Mask":
Equipment with a 25 kHz channel spacing and an occupied bandwidth greater than 20 kHz shall have the power of any emission attenuated below the transmitter output power P (dBW) as specified in the following table:

Displacement Frequency, fd (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth
12.375 < fd ≤ 13.975	whichever is the lesser attenuation: 30 + 16.67(fd–12.375) dB, or 55 + 10 log10(P) dB	100 Hz (Specified in Section 4.2.2)
fd > 13.975	whichever is the lesser attenuation: 57 dB, or 55 + 10 log10(P) dB	100 Hz (Specified in Section 4.2.2)

Specification Requirement 47 CFR §90.221 – Adjacent Channel Power Limits:
(a) For the frequency bands indicated below, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

(c)(1) Maximum adjacent power levels for frequencies in the 809-824 / 854-869 MHz band:

Frequency offset	Maximum ACP (dBc) for devices less than 15 Watts	Maximum ACP (dBc) for devices 15 Watts and above
25 kHz	−55 dBc	−55 dBc
50 kHz	−65 dBc	−65 dBc
75 kHz	−65 dBc	−70 dBc

(2) In any case, no requirement in excess of -36 dBm shall apply.

(d) On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least 43 + 10 log (P_{watts}) dB.

For emissions beyond 50 kHz from the edge of the authorized bandwidth, the spectrum analyzer bandwidth shall be 100 kHz for frequencies below 1 GHz, and 1 MHz for frequencies above 1 GHz.

Modulation: DQPSK Modulation and 64-QAM Modulation as indicated

Carrier Frequencies: The unit was measured at carrier frequencies of 851.0125, 860.5125, and 868.9875 MHz for radiated emissions. These frequencies represent the low end, center, and high end of the 851-869 MHz band, and are representative of the full operating band.

Specification: The limit functions above produce the following spurious emission limits away from carrier, the report showing the most stringent specification is shown in the following exhibits:

DQPSK Modulation			*64-QAM Modulation*		
Power	*FCC*	*IC*	*Power*	*FCC*	*IC*
25 W	-57 dBc	-57 dBc	10 W	-53 dBc	-57 dBc
4 W	-49 dBc	-57 dBc	2.5 W	-47 dBc	-57 dBc

EXHIBIT	DESCRIPTION
E1-5.1	Radiated Spurious Harmonic Emissions, Power Output 25 Watts (Average), DQPSK The specification limit is -57.0 dBc (-13 dBm) for both FCC and Industry Canada
E1-5.2	Radiated Spurious Harmonic Emissions, Power Output 4 Watts (Average), DQPSK The specification limit is -49.0 dBc (-13 dBm) for FCC, -57 dBc (-21 dBm) for Industry Canada
E1-5.3	Radiated Spurious Harmonic Emissions, Power Output 10 Watts (Average), 64-QAM The specification limit is -53.0 dBc (-13 dBm) for FCC, -57 dBc (-17 dBm) for Industry Canada
E1-5.4	Radiated Spurious Harmonic Emissions, Power Output 2.5 Watts (Average), 64-QAM The specification limit is -47.0 dBc (-13 dBm) for FCC, -57 dBc (-23 dBm) for Industry Canada

Report on Test Measurements

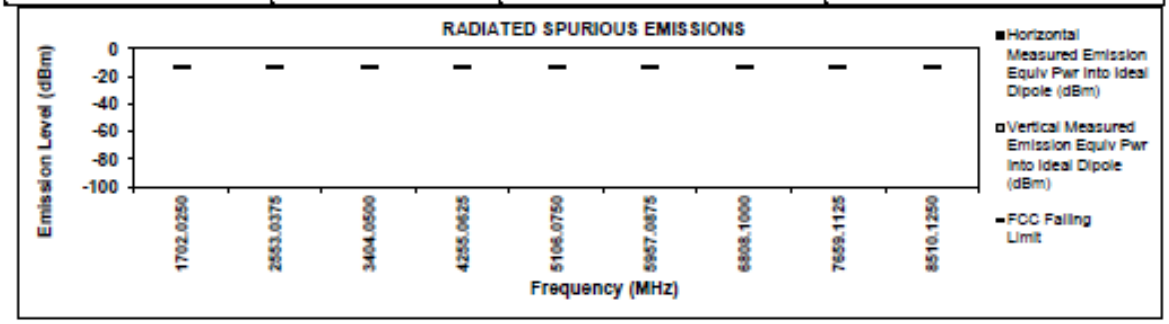
Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4
02255-EMC-00005
Tetra_25W (DQPSK)

851.0125 MHz | **25 kHz** | **25 Watt(s)/Max Power** | **S/N: 895GQG0099**

Frequency (MHz)	FCC Falling Limit	Horizontal Measured Emission Equiv Pwr into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr into Ideal Dipole (dBm)
1702.0250	-13	*	*
2553.0375	-13	**	**
3404.0500	-13	**	**
4255.0625	-13	**	**
5106.0750	-13	**	**
5957.0875	-13	**	**
6808.1000	-13	**	**
7659.1125	-13	**	**
8510.1250	-13	**	**



The data presented here was taken using the substitution method as found in the TIA/EIA-603 document.
Motorola Penang EMC Lab - Test Performed by: Faris
FCC Registration: ABZ89FC5827 Industry Canada: 109AK November 18, 2014
Remarks:** Indicates the spurious emission could not be detected due to noise limitations or ambients.
*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported

Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks:

Passed Results	Marginal Results	Failed Results

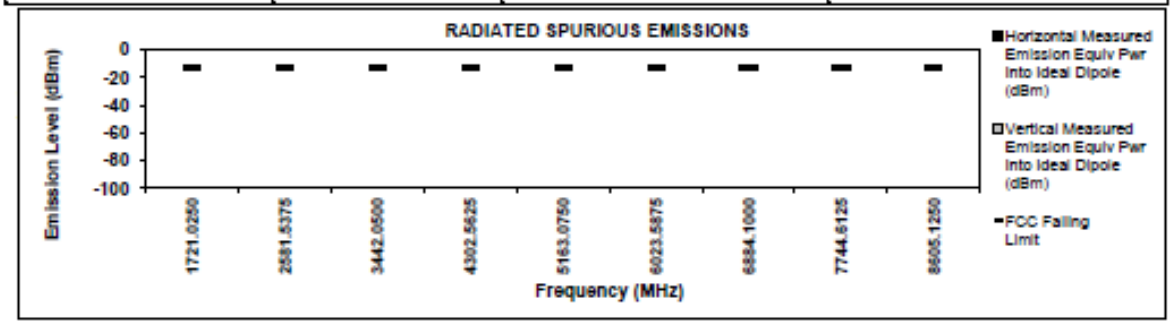
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **Tetra_25W (DQPSK)**
02255-EMC-00005
860.5125 MHz **25 kHz** **25 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	FCC Falling Limit	Horizontal Measured Emission Equiv Pwr into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr into Ideal Dipole (dBm)
1721.0250	-13	**	**
2581.5375	-13	**	**
3442.0500	-13	**	**
4302.5625	-13	**	**
5163.0750	-13	**	**
6023.5875	-13	**	**
6884.1000	-13	**	**
7744.6125	-13	**	**
8605.1250	-13	**	**



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Motorola Penang EMC Lab - Test Performed by: Faris
FCC Registration: ABZ89FC5827 Industry Canada: 109AK November 18, 2014
Remarks:** Indicates the spurious emission could not be detected due to noise limitations or ambients.
*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported

Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks:

Passed Results	Marginal Results	Failed Results

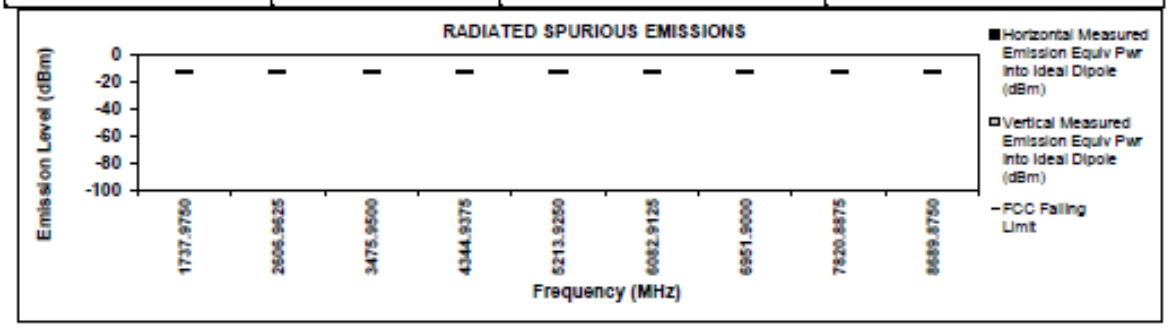
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **Tetra_25W (DQPSK)**
02255-EMC-00005
868.9875 MHz **25 kHz** **25 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	FCC Failing Limit	Horizontal Measured Emission Equiv Pwr into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr into Ideal Dipole (dBm)
1737.9750	-13	*	*
2606.9625	-13	**	**
3475.9500	-13	**	**
4344.9375	-13	**	**
5213.9250	-13	**	**
6082.9125	-13	**	**
6951.9000	-13	**	**
7820.8875	-13	**	**
8689.8750	-13	**	**



The data presented here was taken using the substitution method as found in the TIA/EIA-603 document.
Motorola Penang EMC Lab - Test Performed by: Faris
FCC Registration: ABZ89FC5827 Industry Canada: 109AK November 18, 2014
Remarks:** Indicates the spurious emission could not be detected due to noise limitations or ambients.
*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported

Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks:

Passed Results	Marginal Results	Failed Results

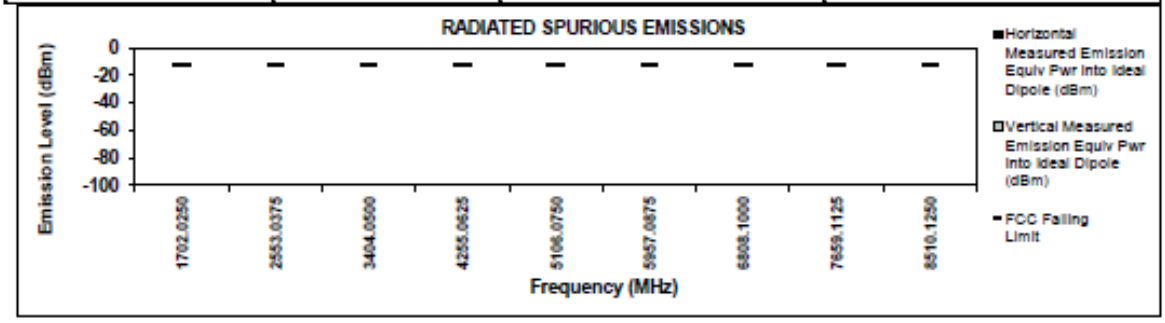
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **Tetra_4W (DQPSK)**
02255-EMC-00005
851.0125 MHz **25 kHz** **4 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1702.0250	-21	**	**
2553.0375	-21	**	**
3404.0500	-21	**	**
4255.0625	-21	**	**
5106.0750	-21	**	**
5957.0875	-21	**	**
6808.1000	-21	**	**
7659.1125	-21	**	**
8510.1250	-21	**	**



The data presented here was taken using the substitution method as found in the TIA/EIA-603 document.
Motorola Penang EMC Lab - Test Performed by: Faris
FCC Registration: ABZ89FC5827 Industry Canada: 109AK November 18, 2014
Remarks:** Indicates the spurious emission could not be detected due to noise limitations or ambients.
*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported
Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks: Passed Results | Marginal Results | Failed Results

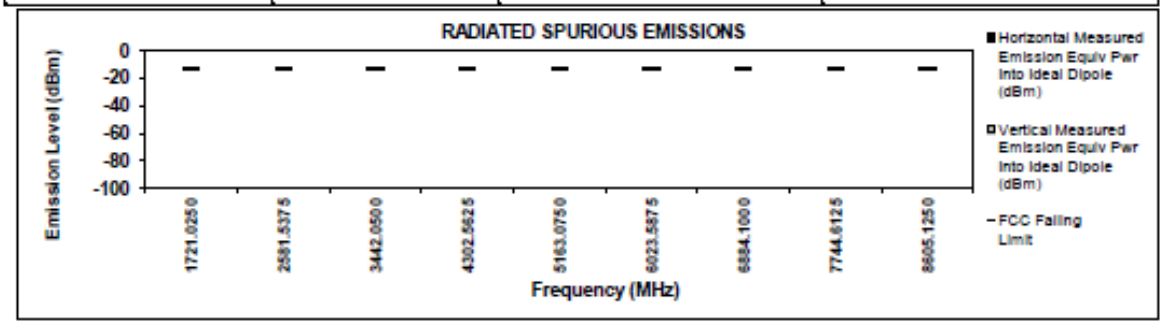
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **Tetra_4W (DQPSK)**
02255-EMC-00005
860.5125 MHz **25 kHz** **4 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1721.0250	-21	**	**
2581.5375	-21	**	**
3442.0500	-21	**	**
4302.5625	-21	**	**
5163.0750	-21	**	**
6023.5875	-21	**	**
6884.1000	-21	**	**
7744.6125	-21	**	**
8605.1250	-21	**	**



The data presented here was taken using the substitution method as found in the TIA/EIA-603 document.
Motorola Penang EMC Lab - Test Performed by: Faris
FCC Registration: ABZ89FC5827 Industry Canada: 109AK November 18, 2014
Remarks:** Indicates the spurious emission could not be detected due to noise limitations or ambients.
*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported

Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks:

Passed Results	Marginal Results	Failed Results

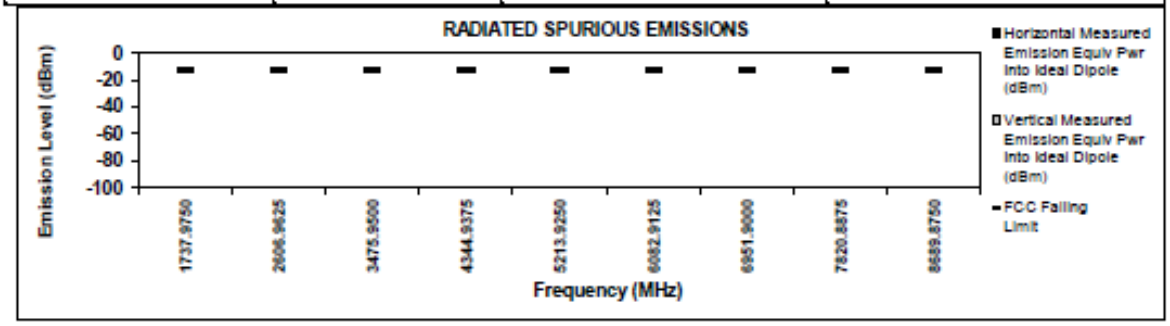
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **Tetra_4W (DQPSK)**
02255-EMC-00005
868.9875 MHz **25 kHz** **4 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1737.9750	-21	**	**
2606.9625	-21	**	**
3475.9500	-21	**	**
4344.9375	-21	**	**
5213.9250	-21	**	**
6082.9125	-21	**	**
6951.9000	-21	**	**
7820.8875	-21	**	**
8689.8750	-21	**	**



The data presented here was taken using the substitution method as found in the TIA/EIA-603 document.
Motorola Penang EMC Lab - Test Performed by: Faris
FCC Registration: ABZ89FC5827 Industry Canada: 109AK November 18, 2014
Remarks:** Indicates the spurious emission could not be detected due to noise limitations or ambients.
*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported
Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks:

Passed Results	Marginal Results	Failed Results

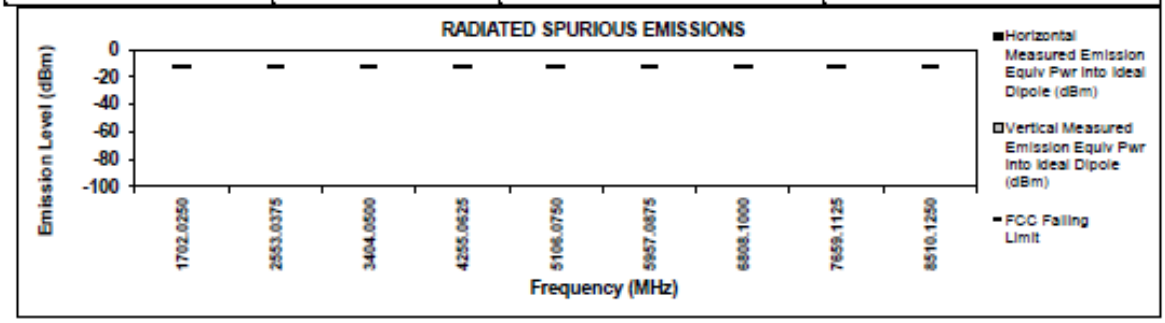
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **TEDS_10W QAM 64**
02255-EMC-00005
851.0125 MHz **25 kHz** **10 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1702.0250	-17	*	*
2553.0375	-17	*	*
3404.0500	-17	**	**
4255.0625	-17	**	**
5106.0750	-17	**	**
5957.0875	-17	**	**
6808.1000	-17	**	**
7659.1125	-17	**	**
8510.1250	-17	**	**



The data presented here was taken using the substitution method as found in the TIA/EIA-603 document.
Motorola Penang EMC Lab - Test Performed by: Faris
FCC Registration: ABZ89FC5827 Industry Canada: 109AK November 19, 2014
Remarks:** Indicates the spurious emission could not be detected due to noise limitations or ambients.
*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported

Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks:

Passed Results	Marginal Results	Failed Results

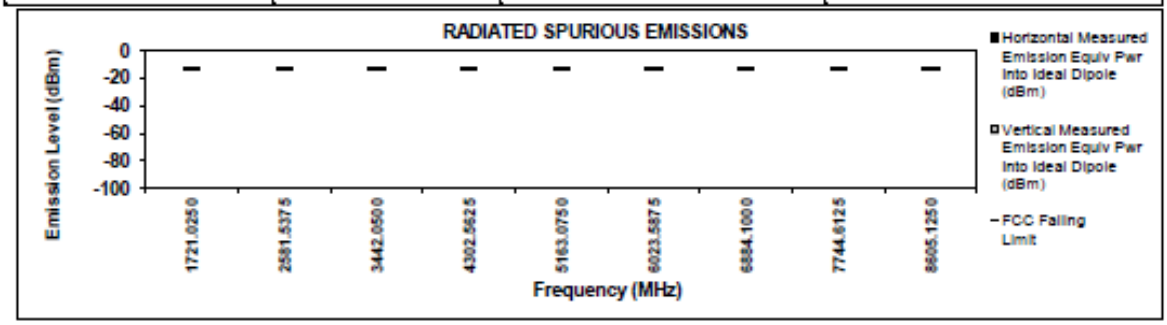
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **TEDS_10W QAM 64**
02255-EMC-00005
860.5125 MHz **25 kHz** **10 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1721.0250	-17	**	**
2581.5375	-17	**	**
3442.0500	-17	**	**
4302.5625	-17	**	**
5163.0750	-17	**	**
6023.5875	-17	**	**
6884.1000	-17	**	**
7744.6125	-17	**	**
8605.1250	-17	**	**



The data presented here was taken using the substitution method as found in the TIA/EIA-603 document.
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Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks: Passed Results | Marginal Results | Failed Results

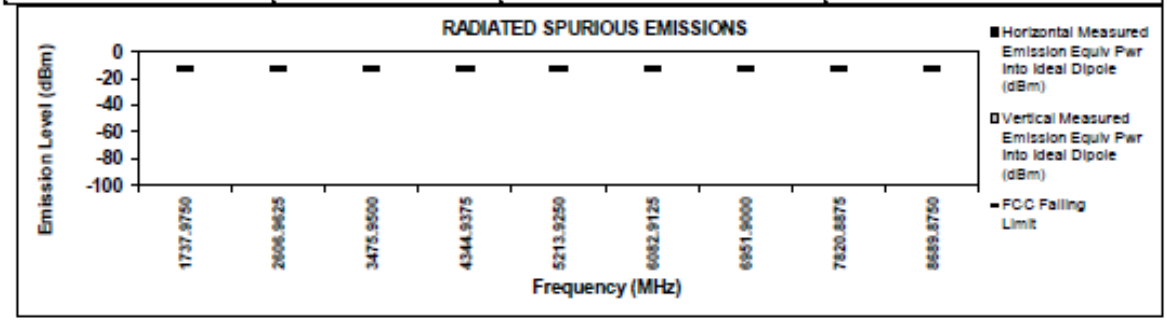
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **TEDS_10W QAM 64**
02255-EMC-00005
868.9875 MHz **25 kHz** **10 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1737.9750	-17	**	**
2606.9625	-17	**	**
3475.9500	-17	**	**
4344.9375	-17	**	**
5213.9250	-17	**	**
6082.9125	-17	**	**
6951.9000	-17	**	**
7820.8875	-17	**	**
8689.8750	-17	**	**



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Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks: Passed Results | Marginal Results | Failed Results

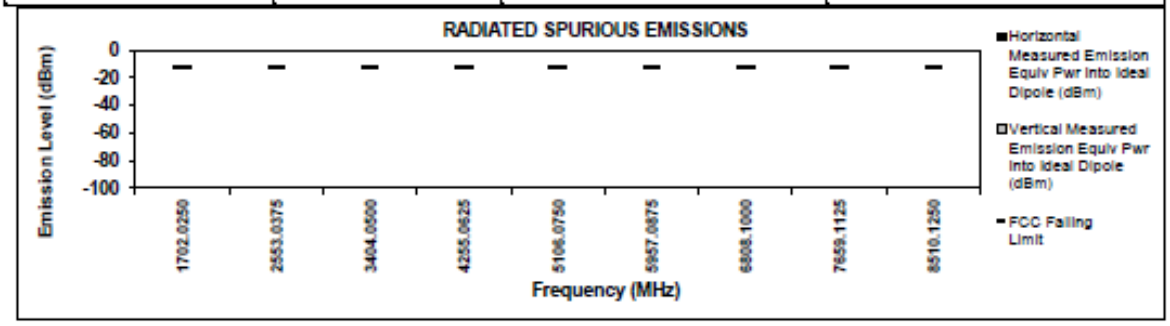
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **TEDS_2.5W QAM 64**
02255-EMC-00005
851.0125 MHz **25 kHz** **2.5 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1702.0250	-23	**	**
2553.0375	-23	**	**
3404.0500	-23	**	**
4255.0625	-23	**	**
5106.0750	-23	**	**
5957.0875	-23	**	**
6808.1000	-23	**	**
7659.1125	-23	**	**
8510.1250	-23	**	**



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*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported

Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks:

Passed Results	Marginal Results	Failed Results

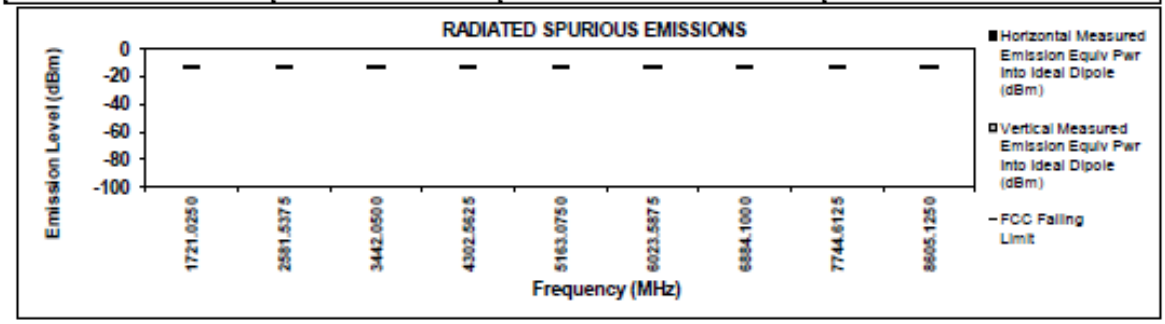
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **TEDS_2.5W QAM 64**
02255-EMC-00005
860.5125 MHz **25 kHz** **2.5 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1721.0250	-23	**	**
2581.5375	-23	**	**
3442.0500	-23	**	**
4302.5625	-23	**	**
5163.0750	-23	**	**
6023.5875	-23	**	**
6884.1000	-23	**	**
7744.6125	-23	**	**
8605.1250	-23	**	**



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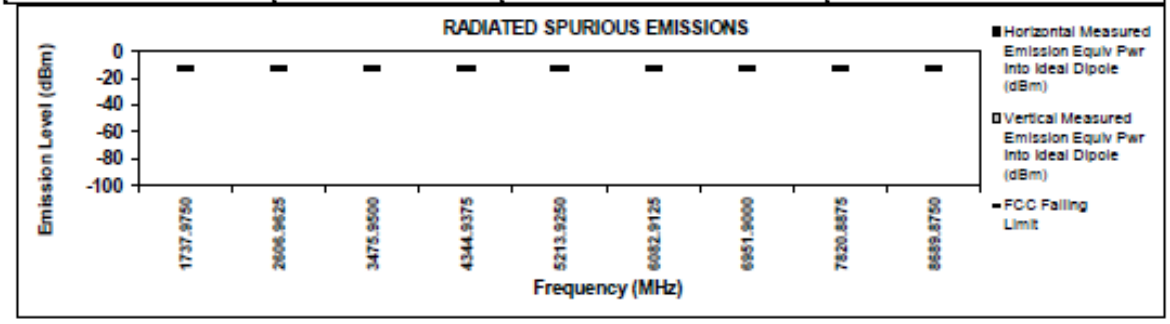
Report on Test Measurements

Radiated Spurious Emissions

TRANSMITTER RADIATED SPURIOUS EMISSIONS: MTS4 806-870MHZ

MODEL #: MTS4 **TEDS_2.5W QAM 64**
02255-EMC-00005
868.9875 MHz **25 kHz** **2.5 Watt(s)/Max Power** **S/N: 895GQG0099**

Frequency (MHz)	IC Failing Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
1737.9750	-23	**	**
2606.9625	-23	**	**
3475.9500	-23	**	**
4344.9375	-23	**	**
5213.9250	-23	**	**
6082.9125	-23	**	**
6951.9000	-23	**	**
7820.8875	-23	**	**
8689.8750	-23	**	**



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Temp (Deg): 22.5 Hum (%RH): 70.0

Remarks:

Passed Results	Marginal Results	Failed Results

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 RSS-119 Section 5.3

Fixed and Base stations operating at 851-866 MHz and 866-869 MHz must have a frequency stability of better than +/- 0.1 PPM for digital equipment with a channel spacing of 25 kHz and an occupied bandwidth greater than 20 kHz.

Specification Requirement: Reference Part 90.213

Fixed and Base stations operating at 851-854 must have a frequency stability of better than +/- 1.0 PPM.
Fixed and Base stations operating at 854-869 must have a frequency stability of better than +/- 1.5 PPM.

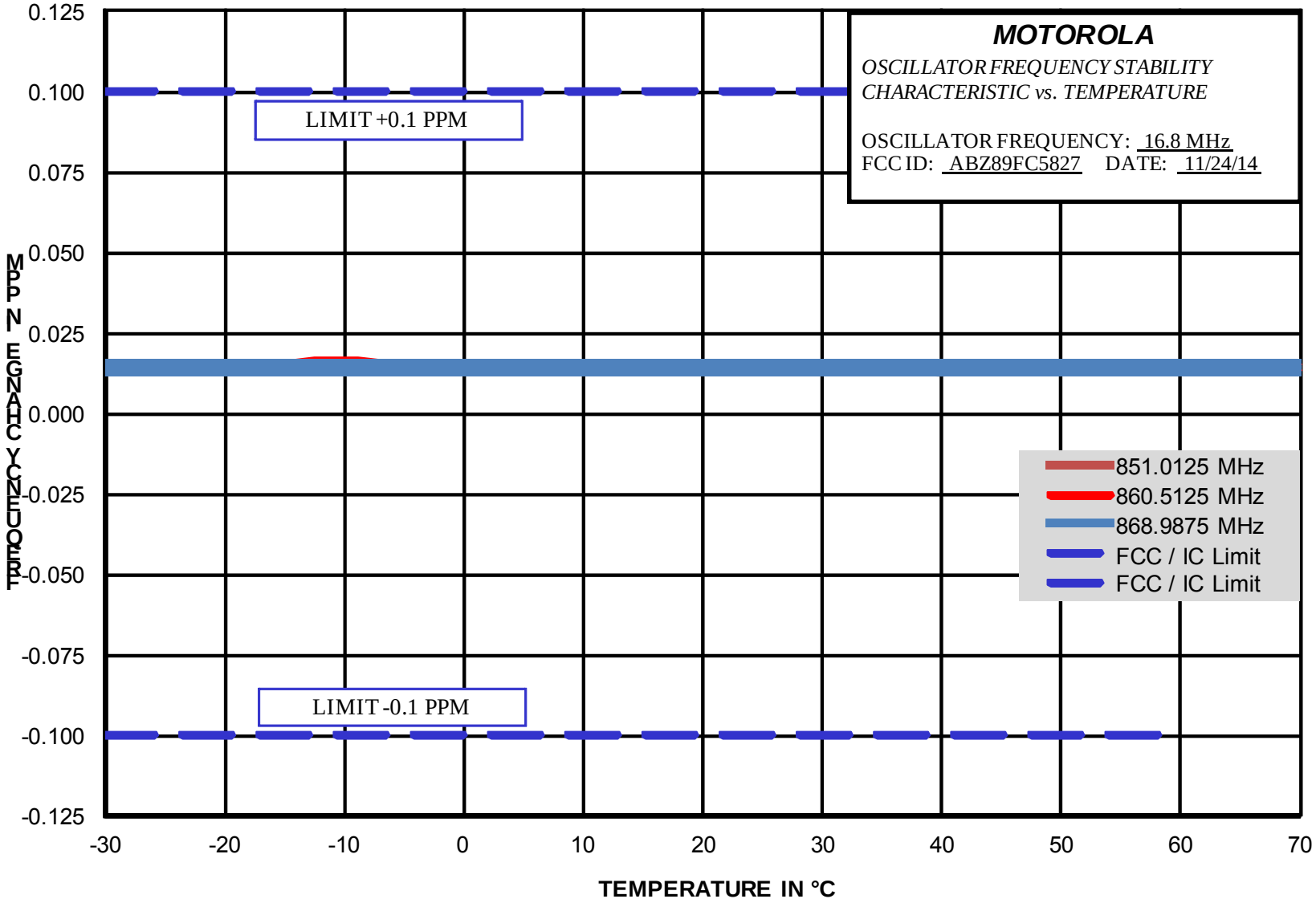
Only the more stringent specification limit is shown on the frequency stability exhibits.

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

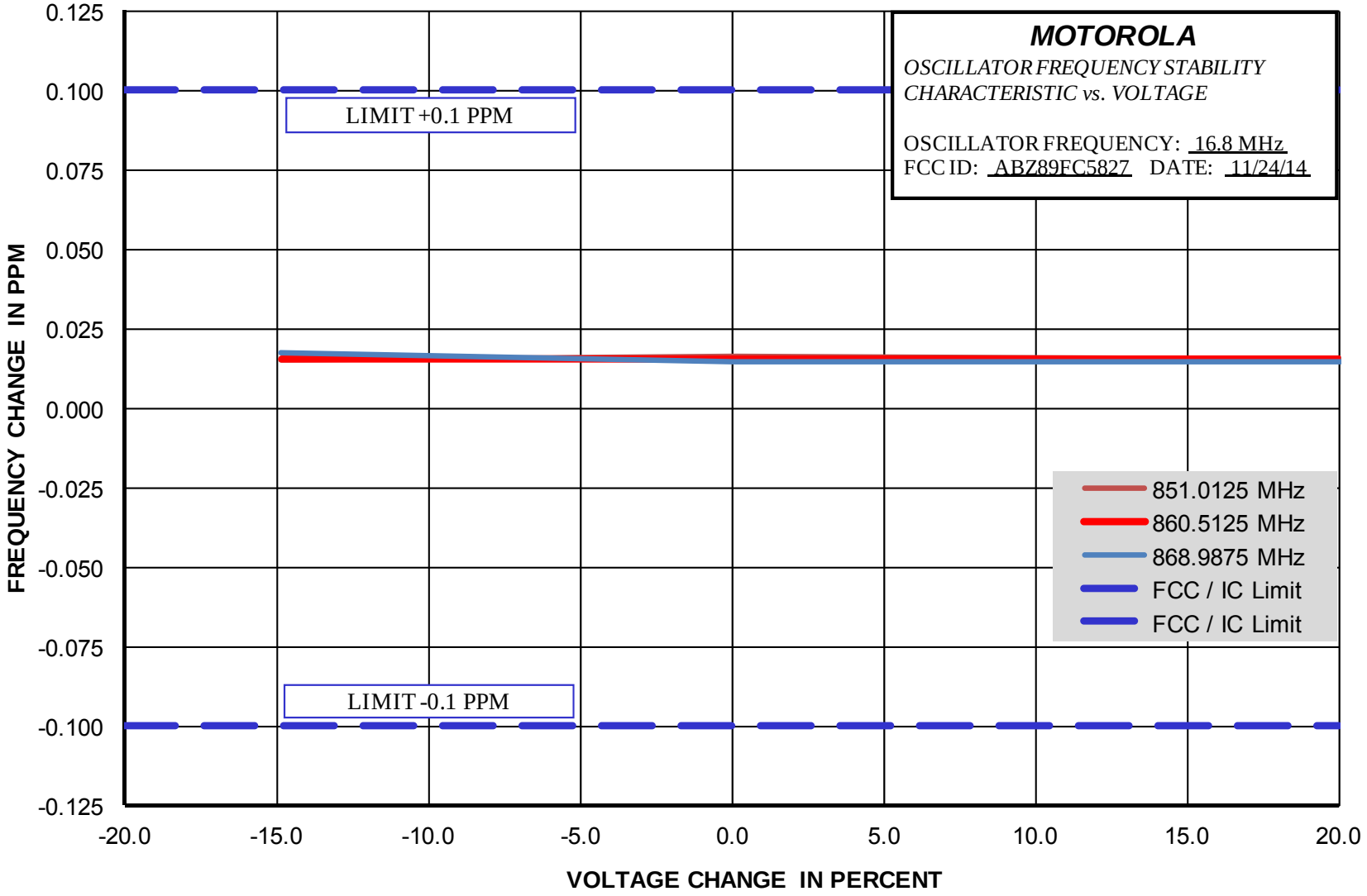
Report on Test Measurements

Frequency Stability Vs Temperature



Report on Test Measurements

Frequency Stability Vs Voltage



Report on Test Measurements

Test Equipment List

Radiated Emission

Model	Manufacturer	Description	Serial No.	Last Cal	Next Cal
SMP04	Rohde & Schwarz	Microwave Generator	100127	23-Jun-14	23-Jun-15
ESIB 40	Rohde & Schwarz	Spectrum Analyzer / ESI Test Rcvr	100264	17-Jun-14	17-Jun-15
CBL6112B	TESEQ	Bilog Antenna, 30 MHz-2 GHz	2863	17-Jul-14	17-Jul-15
CBL6112B	TESEQ	Bilog Antenna, 30 MHz-2 GHz	2964	18-Dec-13	18-Dec-14
SAS-571	A.H Systems	DRG Horn, 700 MHz-18 GHz	720	18-Dec-13	18-Dec-14
SAS-571	A.H Systems	DRG Horn, 700 MHz-18 GHz	1143	10-Jun-14	10-Jun-15
TM 320	Dickson	Temp / Humidity Monitor	12249298	8-Nov-13	8-Nov-14
NA	TDK	3m Semi-anechoic Chamber	888032	14-Mar	15-Mar
MBS-500	Chaintek	Bore sight Antenna mast	NA	no calibration required	
3000	Chaintek	Programming controller	MF780208272	no calibration required	
T-200-S	Chaintek	Turntable. Flush Mount 2M	NA	no calibration required	
PAM-0118	A.H Systems	Pre-amplifier	269	no calibration required	

RF Performance

6674A	Hewlett Packard	Power Supply	3126A-00133	7-Oct-14	7-Oct-15
85092C	Agilent	E-Cal Kit	US01400357	11-Jun-14	11-Jun-15
E5062A	Agilent	ENA Network Analyzer	MY44100902	10-Jun-14	10-Jun-15
E4445A	Agilent	Spectrum Analyzer	MY46181250	13-Oct-14	13-Oct-15
E4416A	Agilent	Power Meter	MY45102699	15-Apr-14	15-Apr-15
FSQ3	Rohde & Schwarz	Signal Analyzer	200144	16-Jun-14	16-Jun-15

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

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

NAME: **Ken Weiss**

SIGNATURE: Ken Weiss

DATE: **December 19, 2014**

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: **Bob Sarocka**

SIGNATURE: Bob Sarocka

DATE: 12/19/14

POSITION: **Engineering Section Manager**