

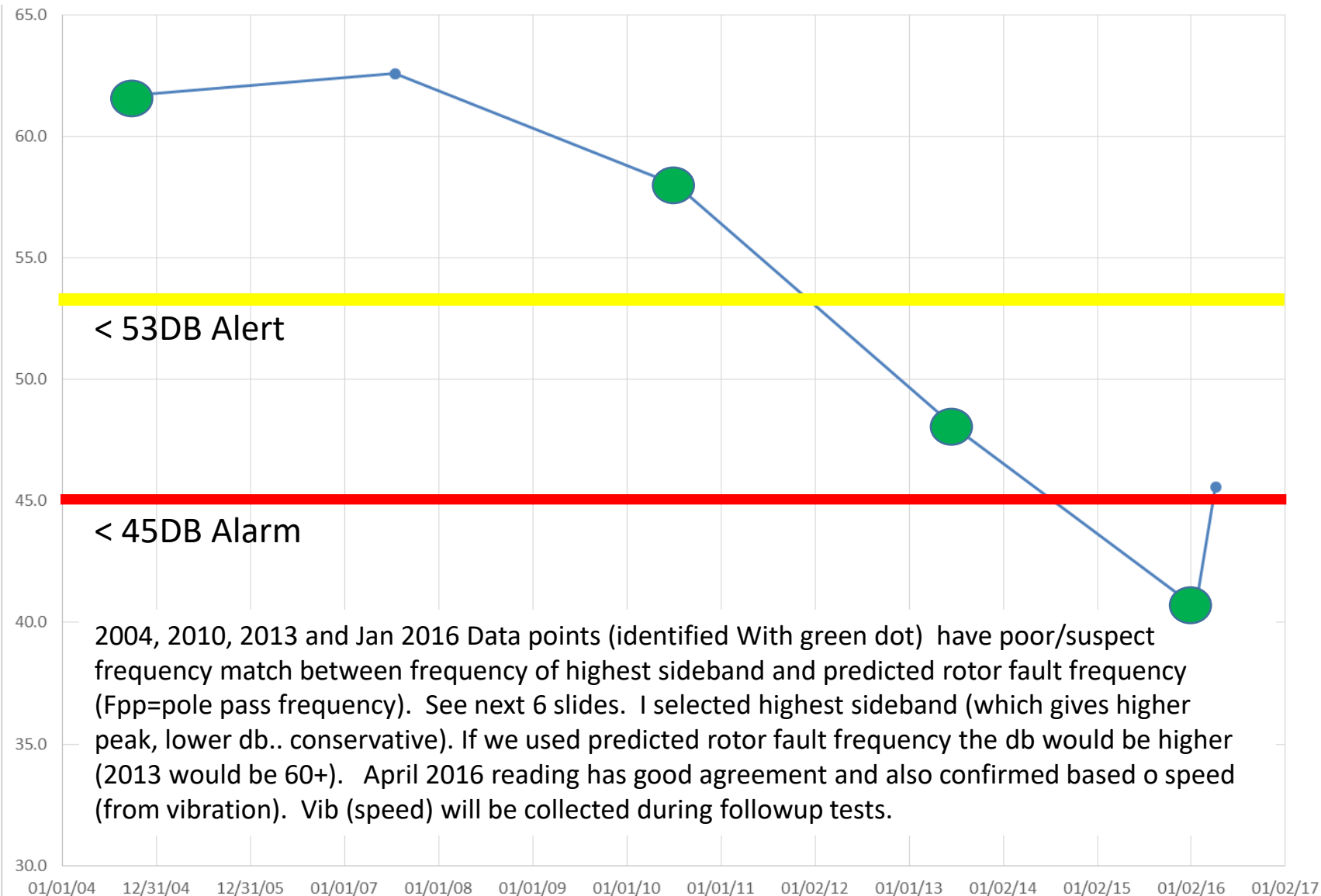
# Current Signature Trend 12C

DB

$20 \log (\text{Amps}_{60} / \text{Amps}_{\text{Sb}})$

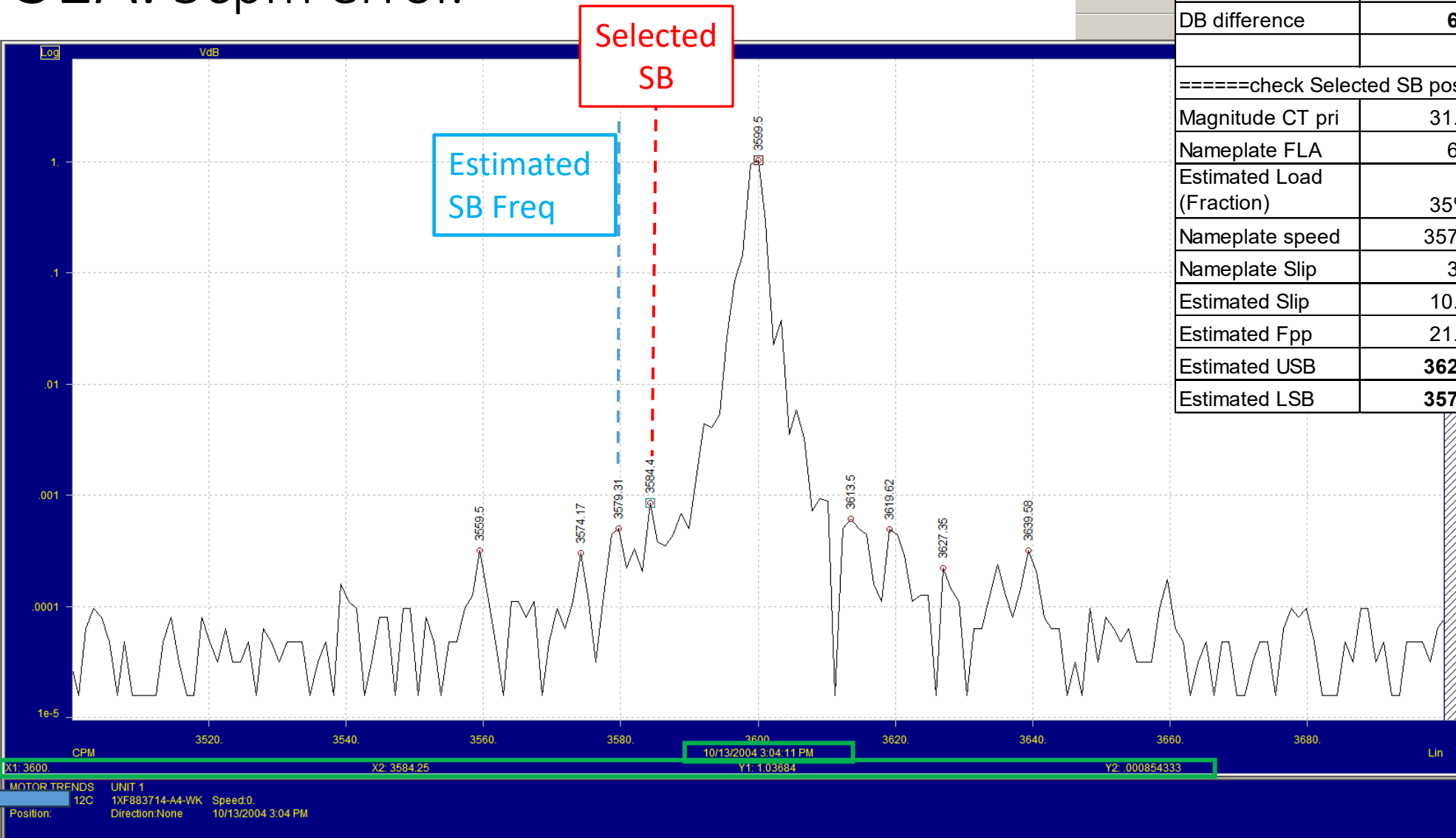
Essential Chiller 12C

Amps Sideband magnitude (DB below main peak)



# 12C 10/13/2004 62db or higher

## 31A. 5cpm error.

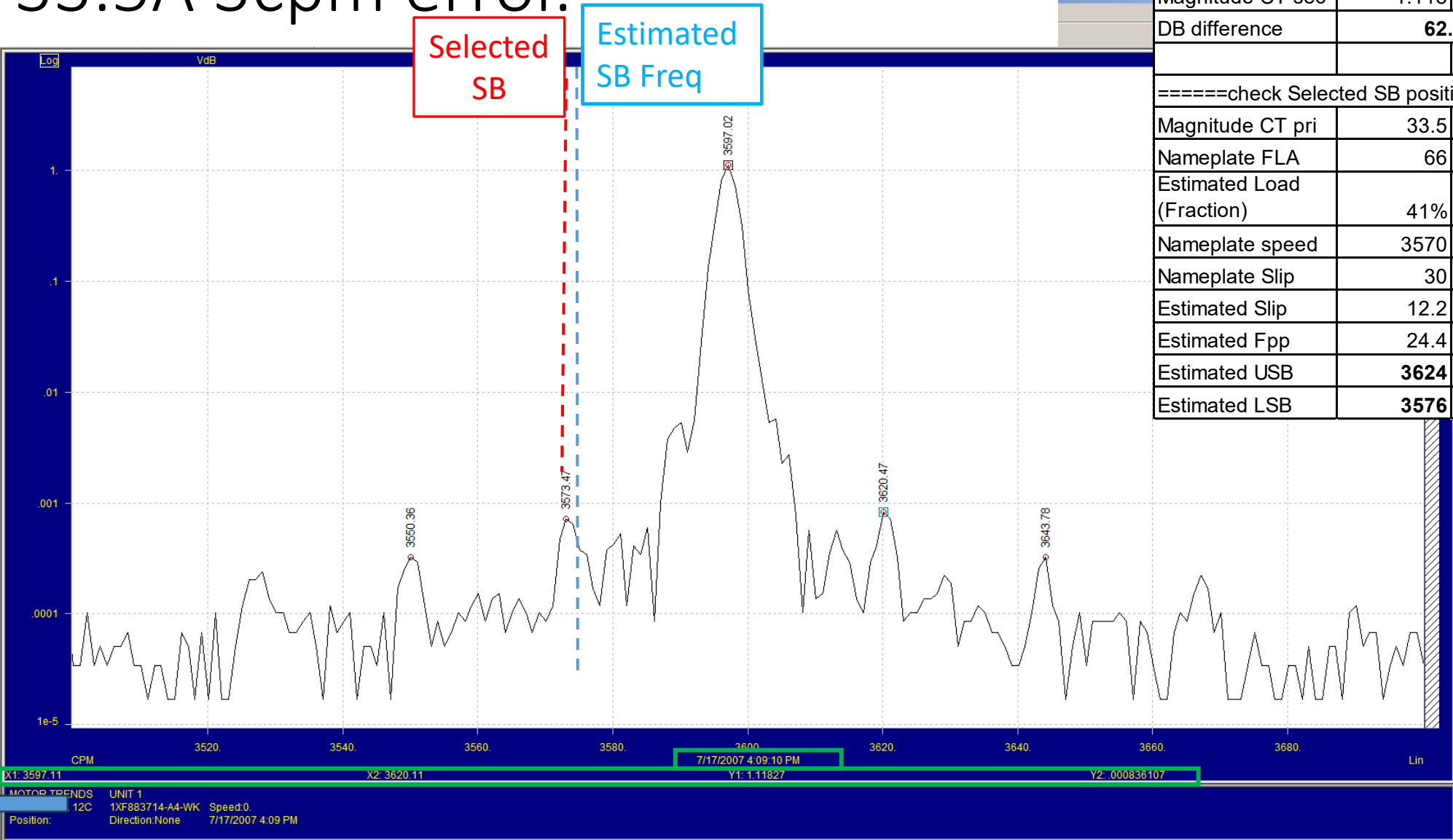


Test Date	10/13/04		
===Calc DB from observed/selected spectral data =====			
Parameter	Main Peak	Sideband	Comment / Formula
Freq (cpm)	3599.5	3584.4	From spectrum
Magnitude CT sec	1.037	0.00085	From spectrum
DB difference	61.7		DB = 20 LOG10 (Main / Sideband)
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	31.1		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	35%		$\sqrt{\text{Current}^2 - 22^2} / \sqrt{\text{FLA}^2 - 22^2}$ note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	10.6		NP Slip x Est Load (Fraction)
Estimated Fpp	21.2		Estimated Slip x poles (2)
Estimated USB	3621		3600 + Est Fpp
Estimated LSB	3579		3600 - Est Fpp

Press F1 for help

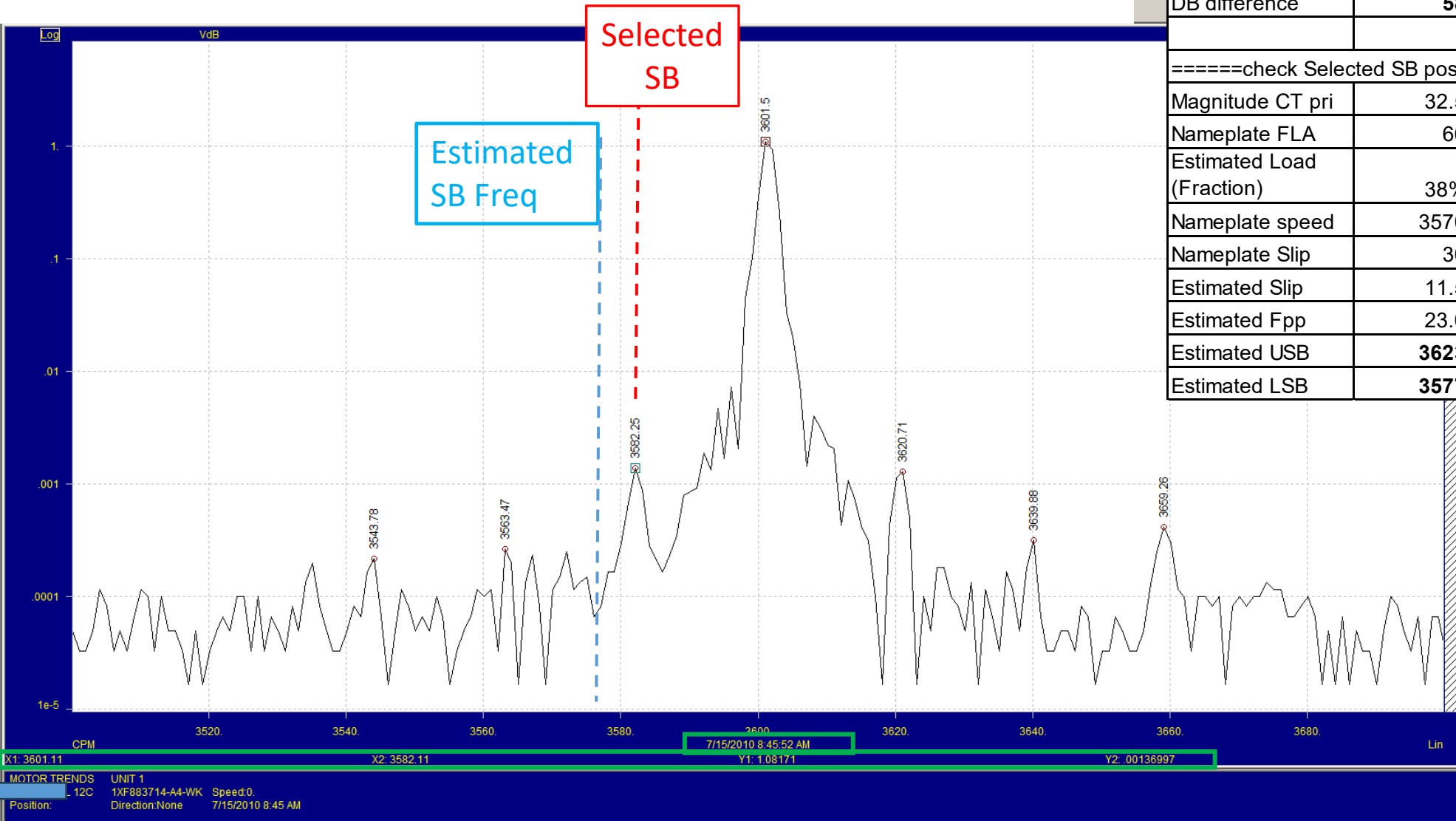


12C 7/17/2007 63db  
33.5A 3cpm error.



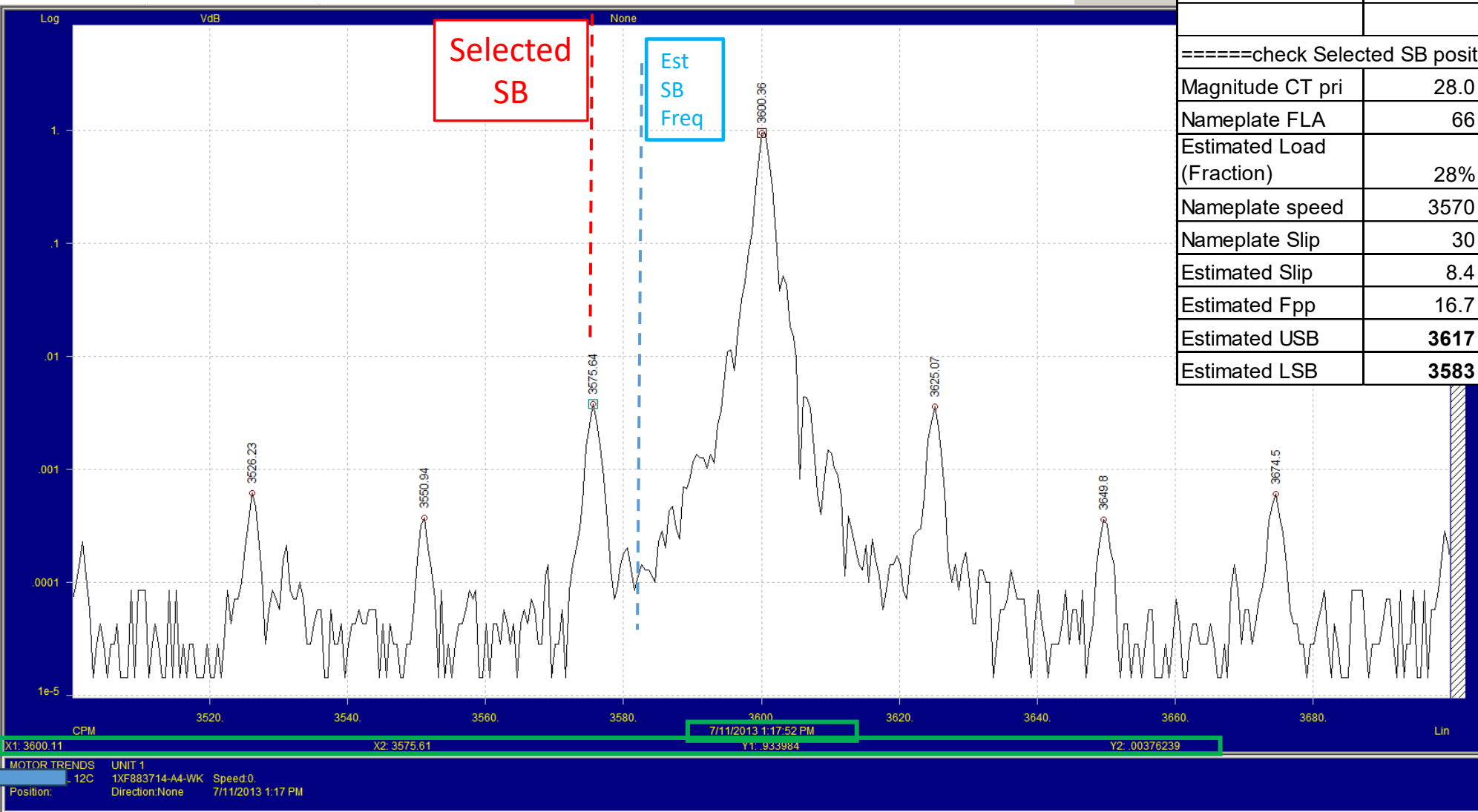
Test Date	07/17/07		
===Calc DB from observed/selected spectral data =====			
Parameter	Main Peak	Sideband	Comment / Formula
Freq (cpm)	3597	3573.5	From spectrum
Magnitude CT sec	1.118	0.00083	From spectrum
DB difference	62.6		DB = 20 LOG10 (Main / Sideband
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	33.5		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	41%		$\sqrt{\text{Current}^2 - 22^2} / \sqrt{\text{FLA}^2 - 22^2}$ note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	12.2		NP Slip x Est Load (Fraction)
Estimated Fpp	24.4		Estimated Slip x poles (2)
Estimated USB	3624		3600 + Est Fpp
Estimated LSB	3576		3600 - Est Fpp

12C 7/15/2010 58db or higher.  
32.5A 5cpm error.



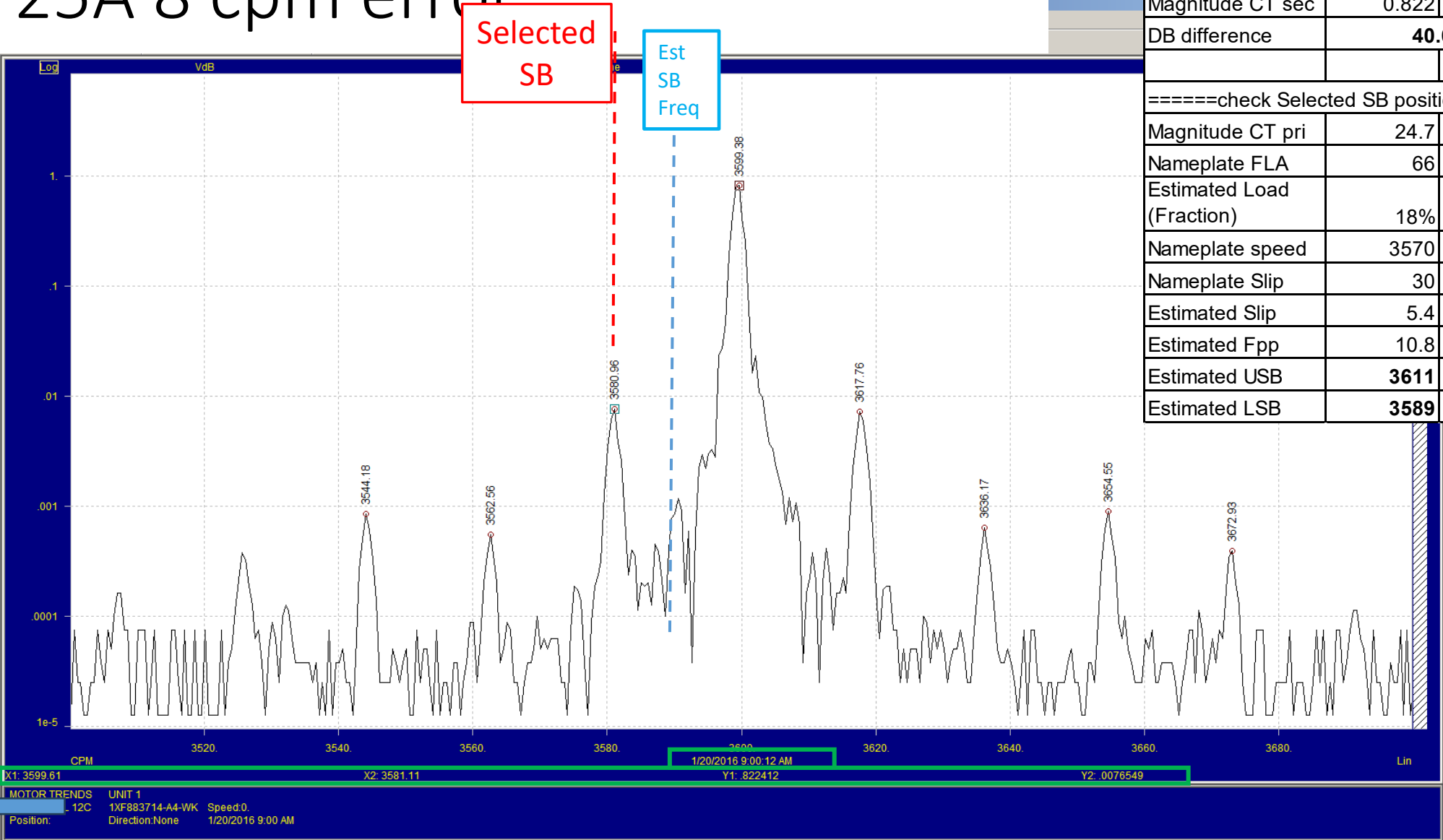
Test Date	07/15/10		
===Calc DB from observed/selected spectral data =====			
Parameter	Main Peak	Sideband	Comment / Formula
Freq (cpm)	3601.5	3582.3	From spectrum
Magnitude CT sec	1.082	0.00137	From spectrum
DB difference	58.0		DB = 20 LOG10 (Main / Sideband)
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	32.5		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	38%		$\text{sqrt}(\text{Current}^2 - 22^2) / \text{sqrt}(\text{FLA}^2 - 22^2)$ note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	11.5		NP Slip x Est Load (Fraction)
Estimated Fpp	23.0		Estimated Slip x poles (2)
Estimated USB	3623		3600 + Est Fpp
Estimated LSB	3577		3600 - Est Fpp

12C 7/11/13 47.9 db down  
28A. 7 cpm error.



Test Date	07/11/13		
===Calc DB from observed/selected spectral data =====			
Parameter	Main Peak	Sideband	Comment / Formula
Freq (cpm)	3600.4	3575.6	From spectrum
Magnitude CT sec	0.934	0.00376	From spectrum
DB difference	47.9		DB = 20 LOG10 (Main / Sideband)
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	28.0		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	28%		$\sqrt{\text{Current}^2 - 22^2} / \sqrt{\text{FLA}^2 - 22^2}$ note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	8.4		NP Slip x Est Load (Fraction)
Estimated Fpp	16.7		Estimated Slip x poles (2)
Estimated USB	3617		3600 + Est Fpp
Estimated LSB	3583		3600 - Est Fpp

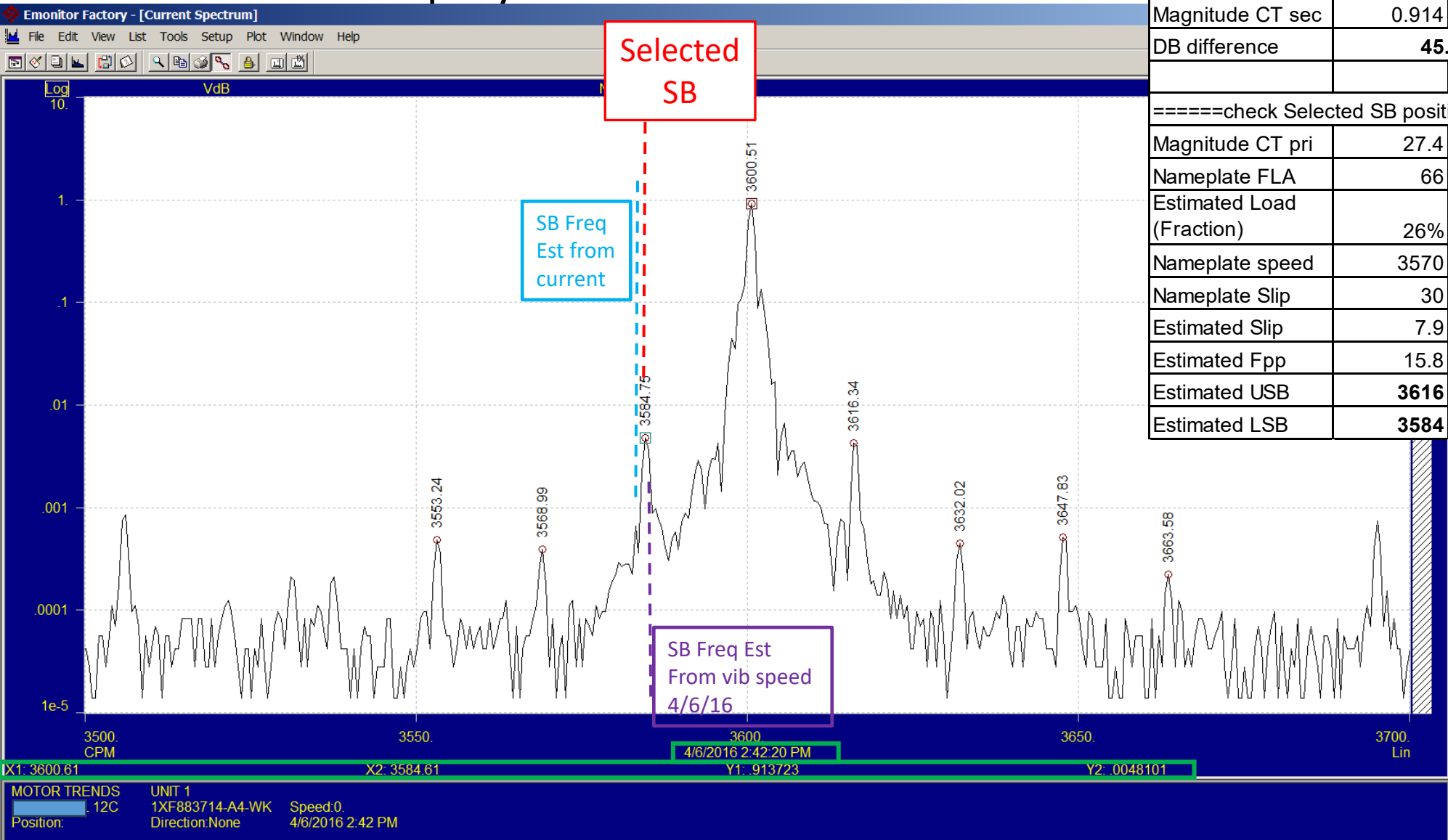
12C 1/20/16 40.6db  
25A 8 cpm error



Test Date	01/20/16		
===Calc DB from observed/selected spectral data =====			
Parameter	Main Peak	Sideband	Comment / Formula
Freq (cpm)	3599.38	3581.0	From spectrum
Magnitude CT sec	0.822	0.00765	From spectrum
DB difference	40.6		DB = 20 LOG10 (Main / Sideband
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	24.7		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	18%		$\sqrt{\text{Current}^2 - 22^2} / \sqrt{\text{FLA}^2 - 22^2}$ note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	5.4		NP Slip x Est Load (Fraction)
Estimated Fpp	10.8		Estimated Slip x poles (2)
Estimated USB	3611		3600 + Est Fpp
Estimated LSB	3589		3600 - Est Fpp

# 12C 4/6/16 45.6db.

## Confirmed freq by vib measurement



Test Date	04/06/16		
===Calc DB from observed/selected spectral data =====			
Parameter	Main Peak	Sideband	Comment / Formula
Freq (cpm)	3600.5	3584.8	From spectrum
Magnitude CT sec	0.914	0.00481	From spectrum
DB difference	45.6		DB = 20 LOG10 (Main / Sideband)
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	27.4		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	26%		$\sqrt{\text{Current}^2 - 22^2} / \sqrt{\text{FLA}^2 - 22^2}$ note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	7.9		NP Slip x Est Load (Fraction)
Estimated Fpp	15.8		Estimated Slip x poles (2)
Estimated USB	3616		3600 + Est Fpp
Estimated LSB	3584		3600 - Est Fpp

4/6/16 11:40AM Vib

- Panel meter current 31A
- 1X by vib is 3593 (slide 14), giving sideband prediction 3586

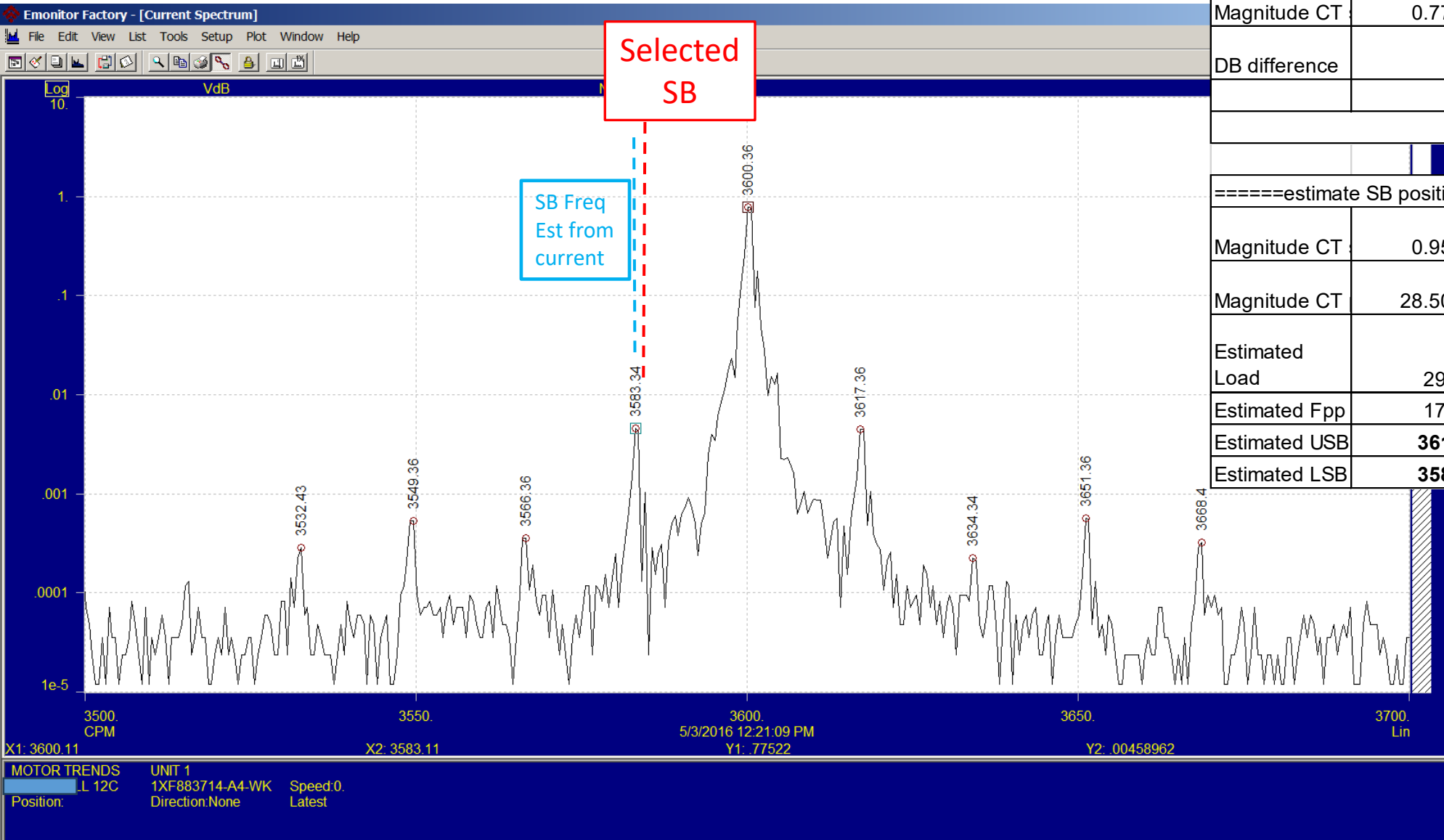
4/7/16 - Current meter  
Also oscillating with 4 second period when viewed one day later 4/7/16

Double click to display plot cursor options

Target: 4/6/2016 2:42 PM | emon | schimppw



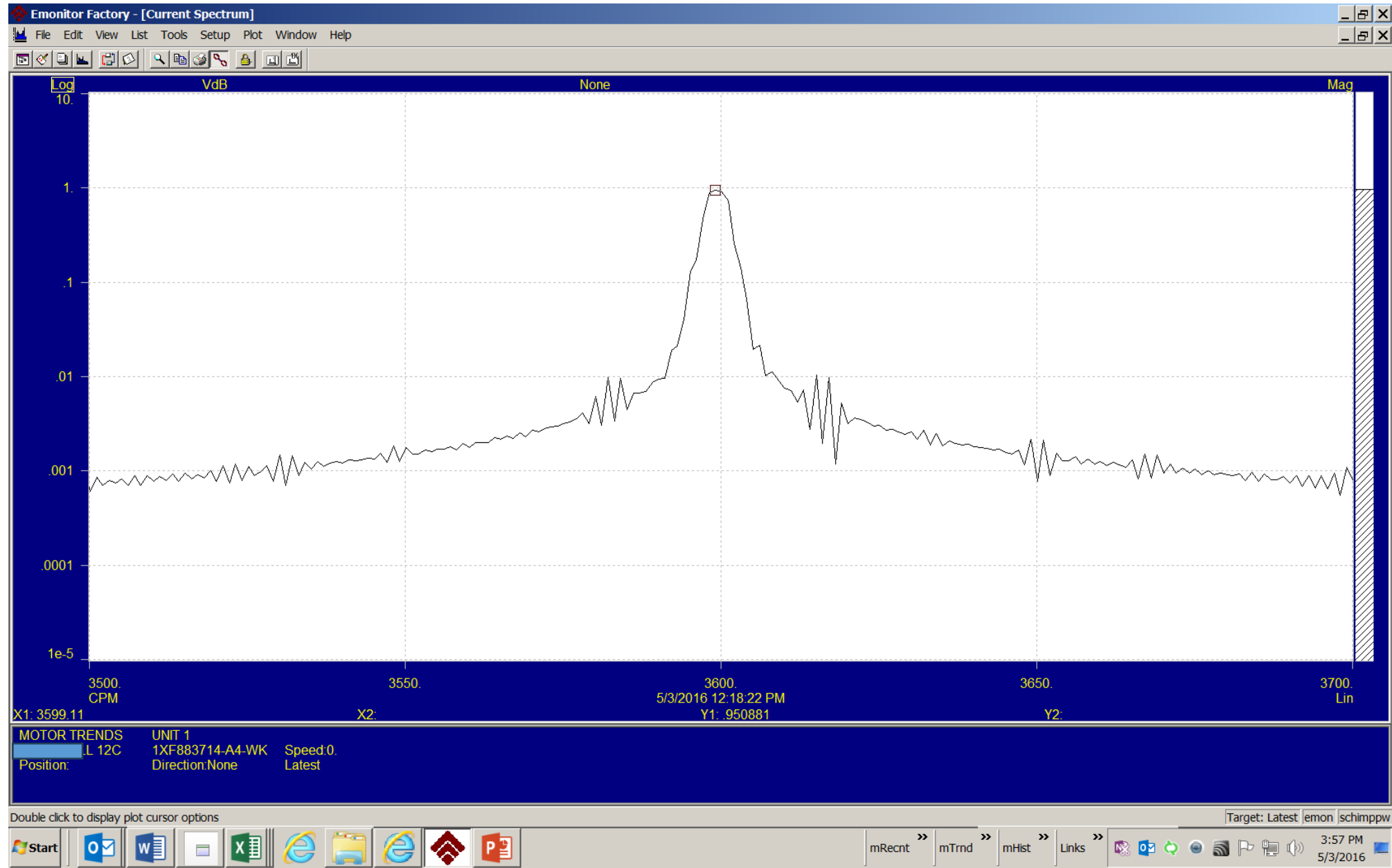
12C 5/3/16 44.6 DB



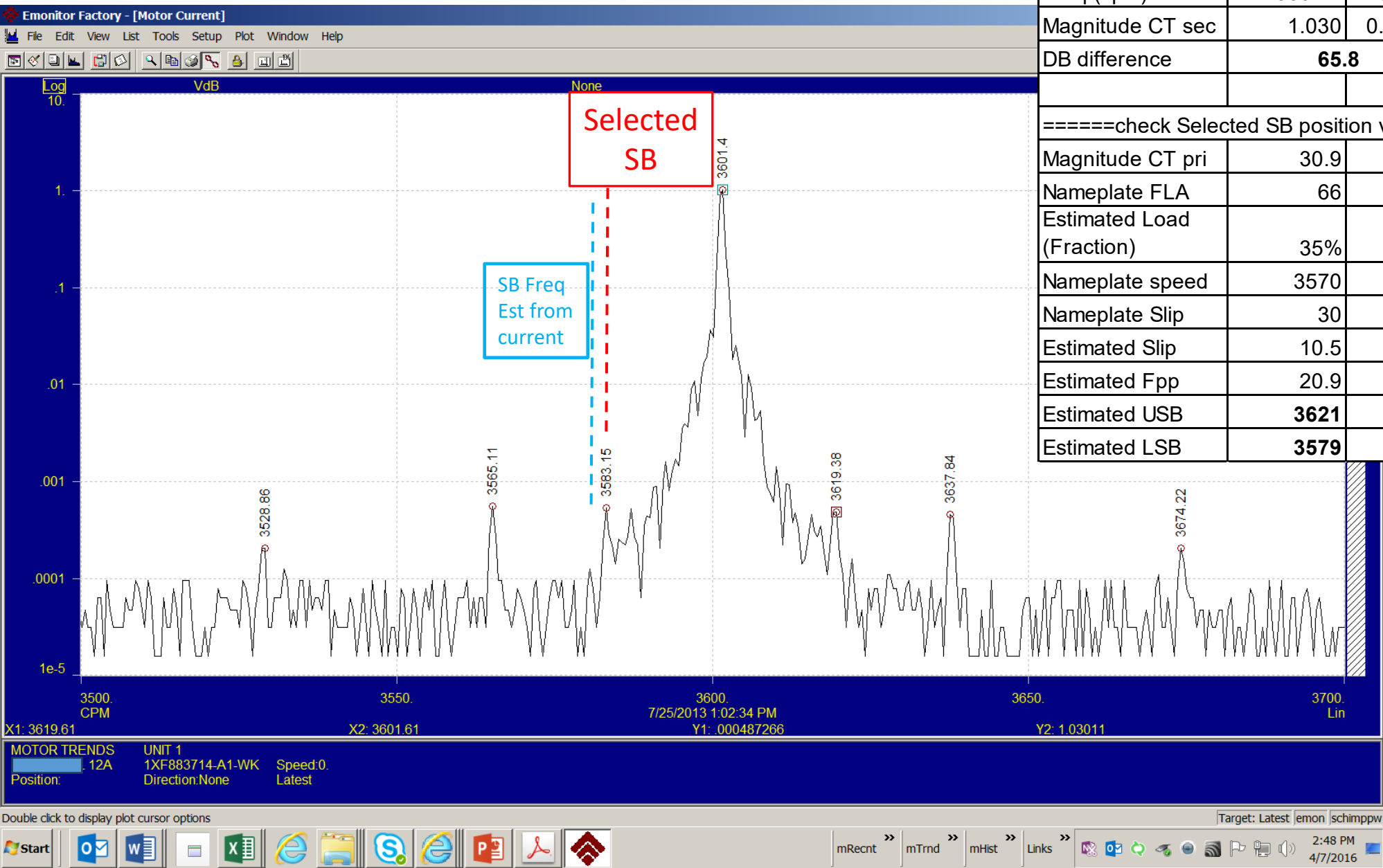
Test Date	05/03/16	
===Calc DB from observed/selected spectral data =====		
<u>Parameter</u>	<u>Main Peak</u>	<u>Sideband</u> <u>Comment / Formula</u>
Freq (cpm)	3600.1	3583.3      From Hanning spectrum
Magnitude CT	0.775	0.00459      From Hanning spectrum
DB difference	DB = 20 LOG10 (Main / Sideband)	
=====estimate SB position from Flattop Spectrum AMPs=====		
Magnitude CT	0.950	From flattop spectrum (next slide)
Magnitude CT	28.500	Use 30/1 CT ratio per 9EPKAA-01
Estimated Load	29%	$\sqrt{\text{Current}^2 - 22^2} / \sqrt{66^2 - 22^2}$ note 22 is no-load amps from EC5027 DS
Estimated Fpp	17.5	2*30*LoadFraction
Estimated USB	3617	3600 + Est Fpp
Estimated LSB	3583	3600 - Est Fpp



# 12C 5/3/16 Flattop CT sec current magnitude 0.95

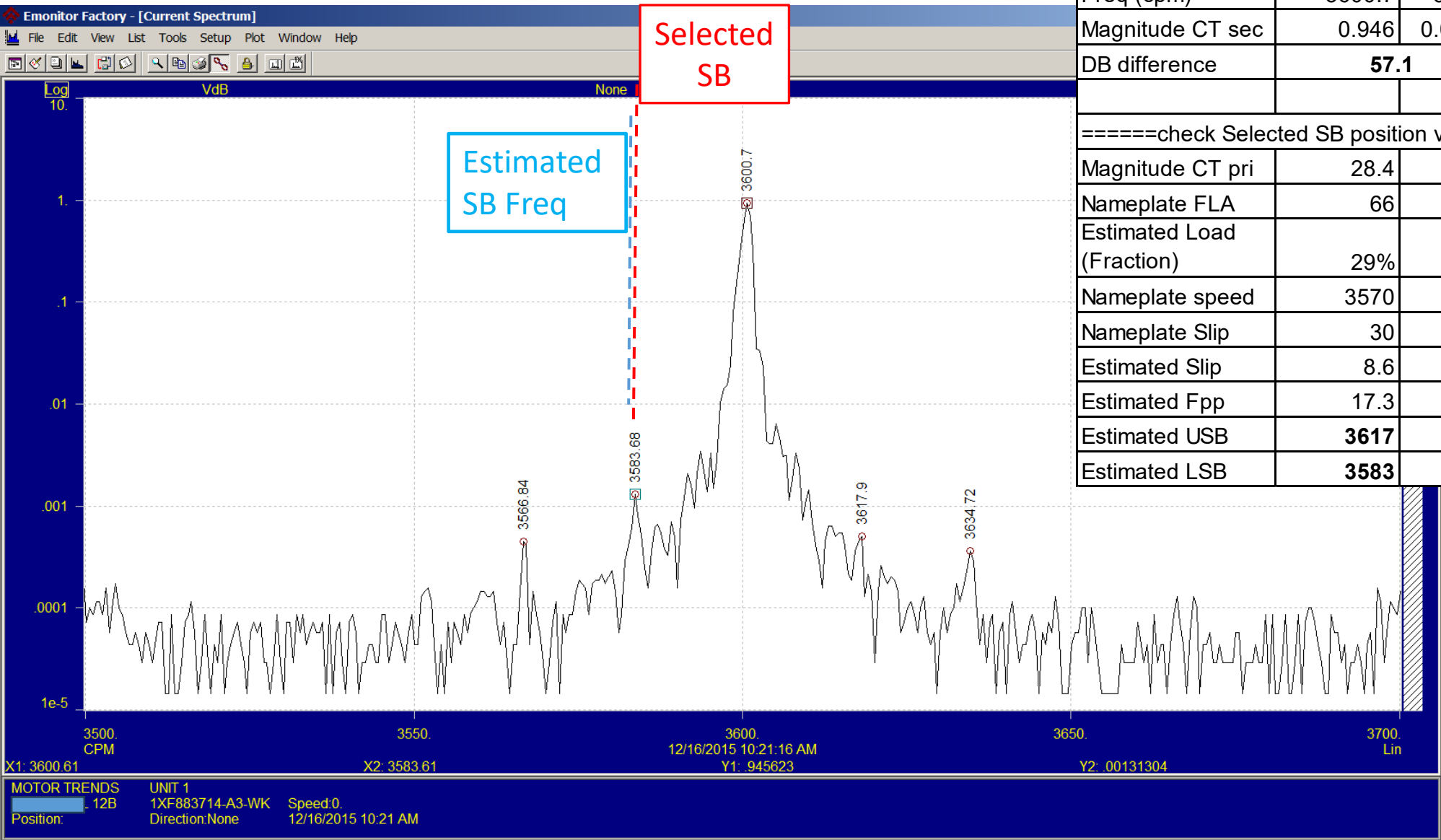


Sister: 12A (sister). 66db. 4cpm



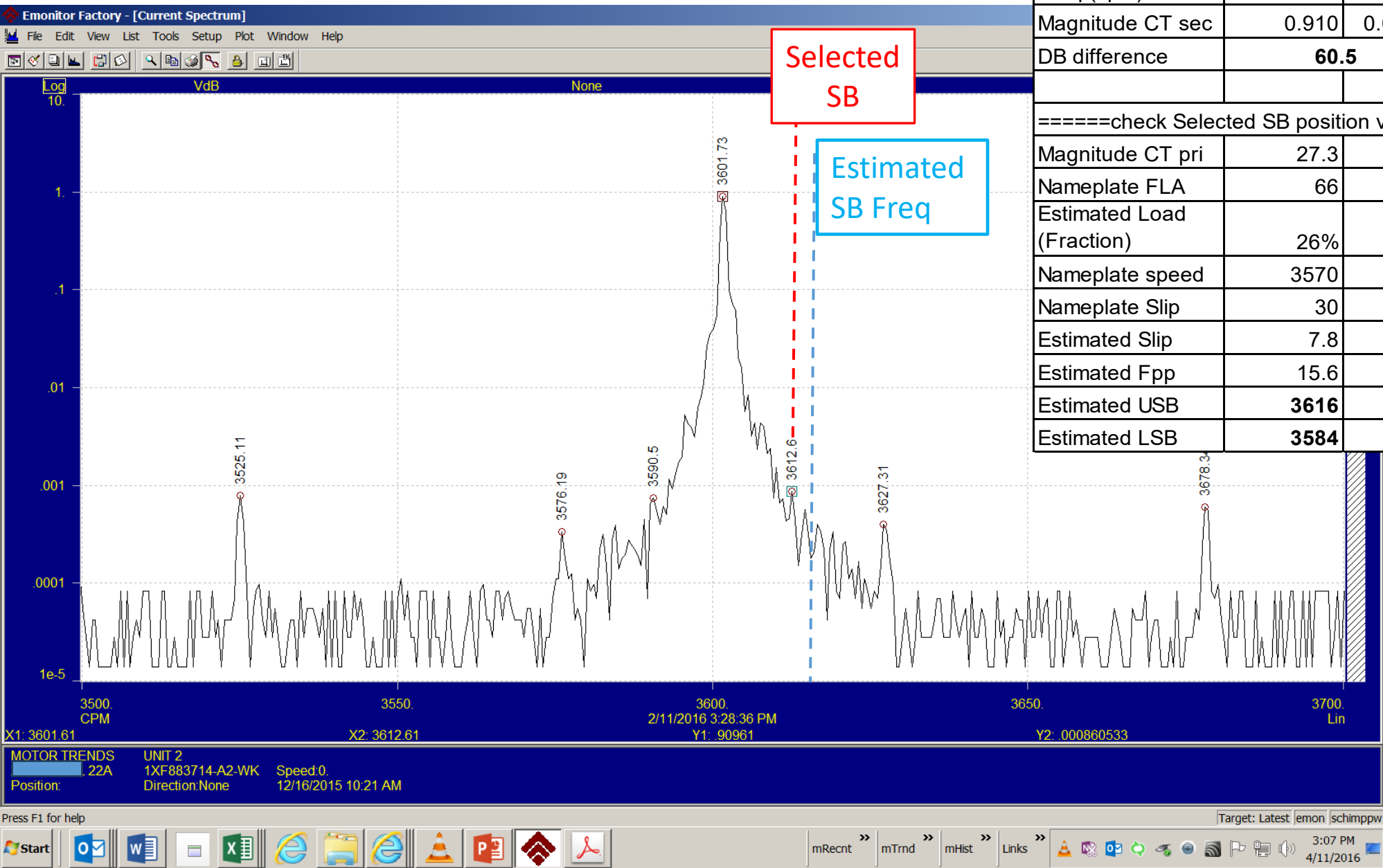
Test Date	07/25/13		
===Calc DB from observed/selected spectral data =====			
<u>Parameter</u>	<u>Main Peak</u>	<u>Sideband</u>	<u>Comment / Formula</u>
Freq (cpm)	3601.4	3583.1	From spectrum
Magnitude CT sec	1.030	0.00053	From spectrum
DB difference	<b>65.8</b>		DB = 20 LOG10 (Main / Sideband
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	30.9		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	35%		sqrt(Current^2 - 22^2) / sqrt(FLA^2 - 22^2) note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	10.5		NP Slip x Est Load (Fraction)
Estimated Fpp	20.9		Estimated Slip x poles (2)
Estimated USB	<b>3621</b>		3600 + Est Fpp
Estimated LSB	<b>3579</b>		3600 - Est Fpp

Sister: 12B 12B 57db. 0cpm error



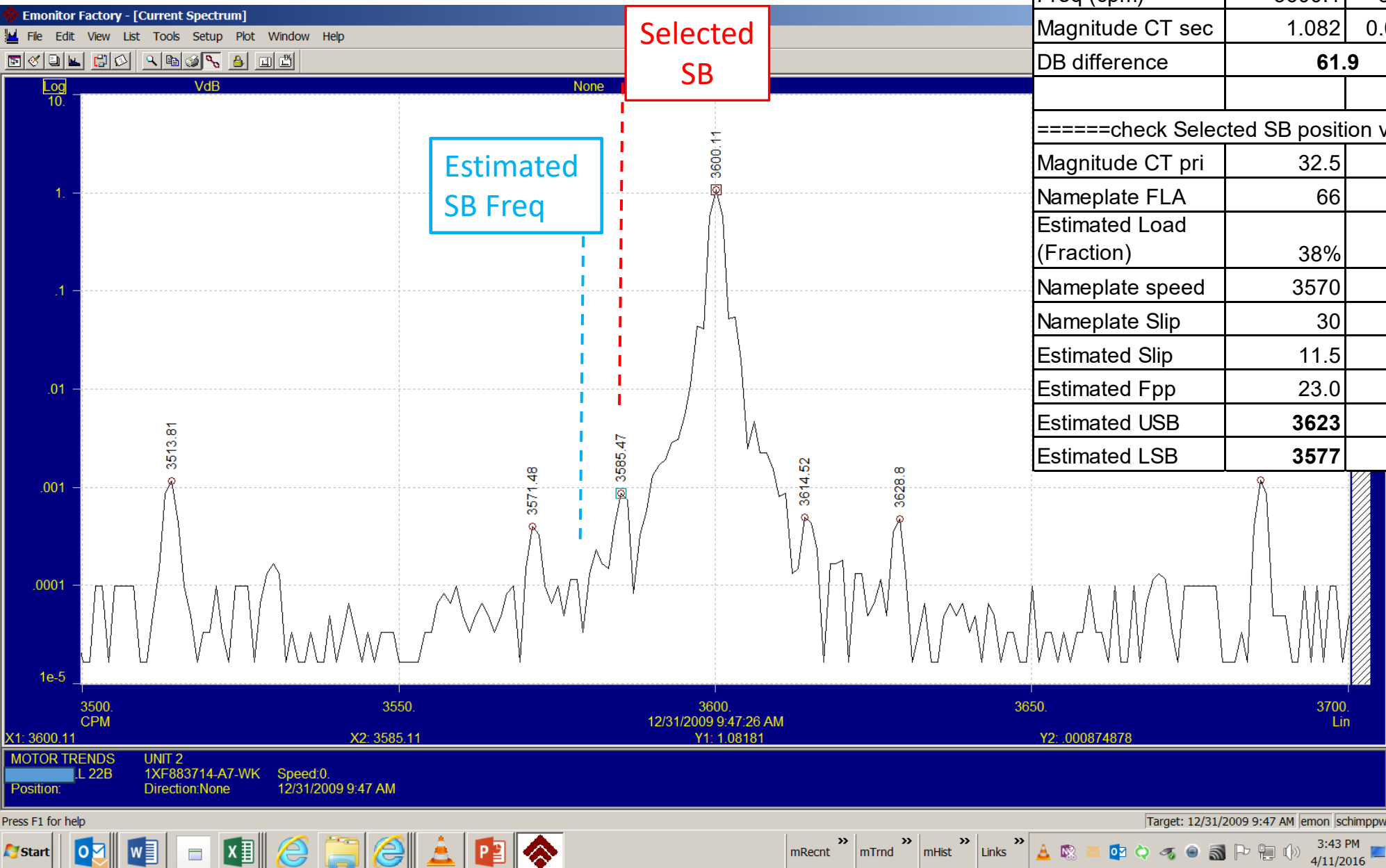
Test Date	12/16/15		
===Calc DB from observed/selected spectral data =====			
<u>Parameter</u>	<u>Main Peak</u>	<u>Sideband</u>	<u>Comment / Formula</u>
Freq (cpm)	3600.7	3583.7	From spectrum
Magnitude CT sec	0.946	0.00131	From spectrum
DB difference	<b>57.1</b>		DB = 20 LOG10 (Main / Sideband)
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	28.4		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	29%		sqrt(Current^2 - 22^2) / sqrt(FLA^2 - 22^2) note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	8.6		NP Slip x Est Load (Fraction)
Estimated Fpp	17.3		Estimated Slip x poles (2)
Estimated USB	<b>3617</b>		3600 + Est Fpp
Estimated LSB	<b>3583</b>		3600 - Est Fpp

# Sister 22A 60db 3cpm error



Test Date	02/11/16		
===Calc DB from observed/selected spectral data =====			
<u>Parameter</u>	<u>Main Peak</u>	<u>Sideband</u>	<u>Comment / Formula</u>
Freq (cpm)	3601.73	3612.6	From spectrum
Magnitude CT sec	0.910	0.00086	From spectrum
DB difference	60.5		DB = 20 LOG10 (Main / Sideband)
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	27.3		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	26%		sqrt(Current^2 - 22^2) / sqrt(FLA^2 - 22^2) note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	7.8		NP Slip x Est Load (Fraction)
Estimated Fpp	15.6		Estimated Slip x poles (2)
Estimated USB	3616		3600 + Est Fpp
Estimated LSB	3584		3600 - Est Fpp

# Sister 22B 62db. 8cpm error

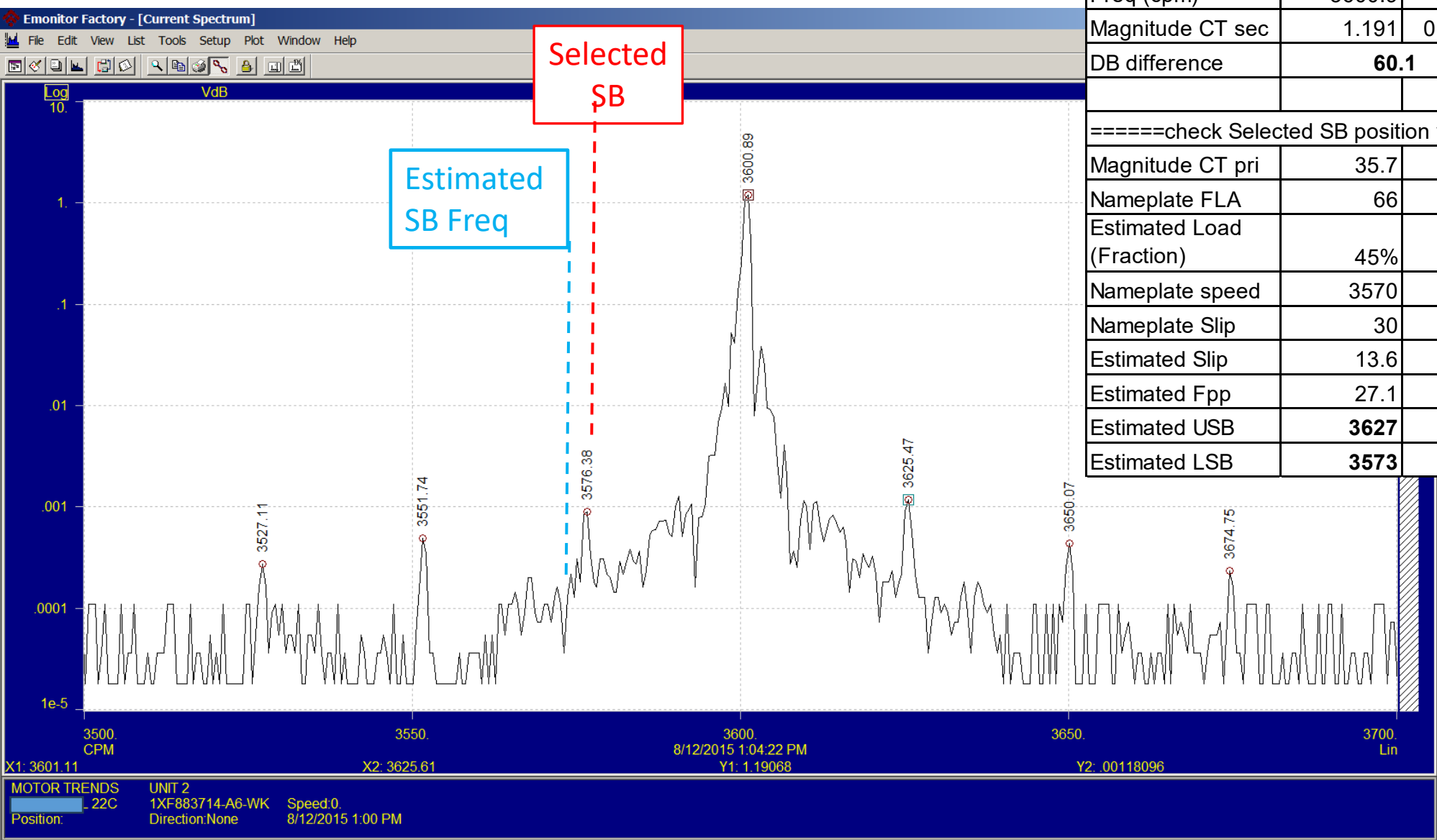


Test Date	12/31/09		
===Calc DB from observed/selected spectral data =====			
Parameter	Main Peak	Sideband	Comment / Formula
Freq (cpm)	3600.1	3585.5	From spectrum
Magnitude CT sec	1.082	0.00087	From spectrum
DB difference	61.9		DB = 20 LOG10 (Main / Sideband)
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	32.5		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	38%		$\sqrt{\text{Current}^2 - 22^2} / \sqrt{\text{FLA}^2 - 22^2}$ note 22 is no- load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	11.5		NP Slip x Est Load (Fraction)
Estimated Fpp	23.0		Estimated Slip x poles (2)
Estimated USB	3623		3600 + Est Fpp
Estimated LSB	3577		3600 - Est Fpp

2015 – bad data  
2012 – load too low  
to distinguish pole  
Pass sidebands

4/18/16 – No current  
Oscillation on mete  
(suggests healthy)

22C. 60db. 3cpm difference

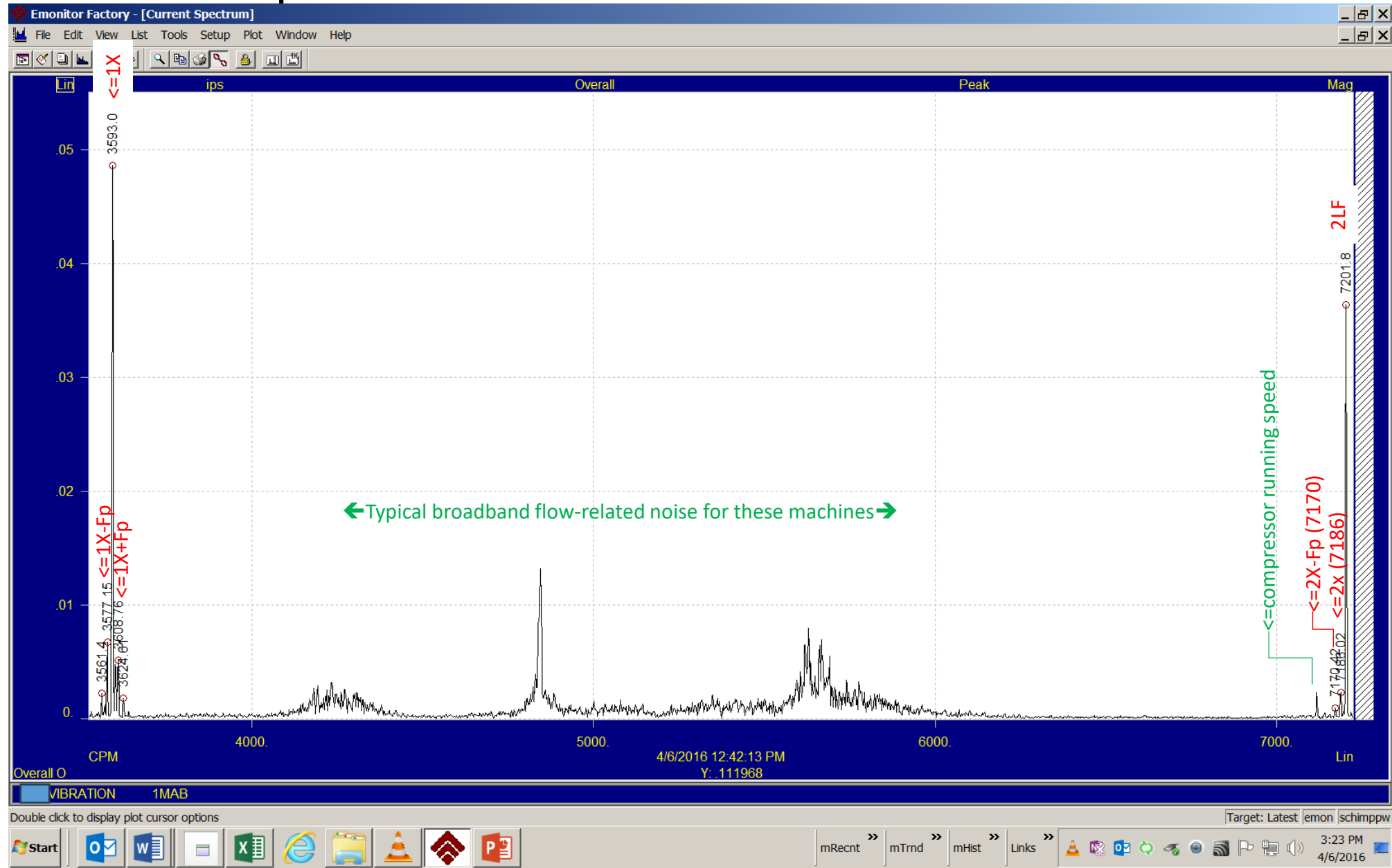


Test Date	08/12/15		
===Calc DB from observed/selected spectral data =====			
<u>Parameter</u>	<u>Main Peak</u>	<u>Sideband</u>	<u>Comment / Formula</u>
Freq (cpm)	3600.9	3625.5	From spectrum
Magnitude CT sec	1.191	0.00118	From spectrum
DB difference	60.1		DB = 20 LOG10 (Main / Sideband)
=====check Selected SB position vs posn est. from AMPs=====			
Magnitude CT pri	35.7		Use 30/1 CT ratio per 9EPKAA-01
Nameplate FLA	66		From nameplate
Estimated Load (Fraction)	45%		sqrt(Current^2 - 22^2) / sqrt(FLA^2 - 22^2) note 22 is no-load amps from EC5027 DS
Nameplate speed	3570		From nameplate
Nameplate Slip	30		3600 - NP speed
Estimated Slip	13.6		NP Slip x Est Load (Fraction)
Estimated Fpp	27.1		Estimated Slip x poles (2)
Estimated USB	3627		3600 + Est Fpp
Estimated LSB	3573		3600 - Est Fpp

# Vibration Overalls - steady

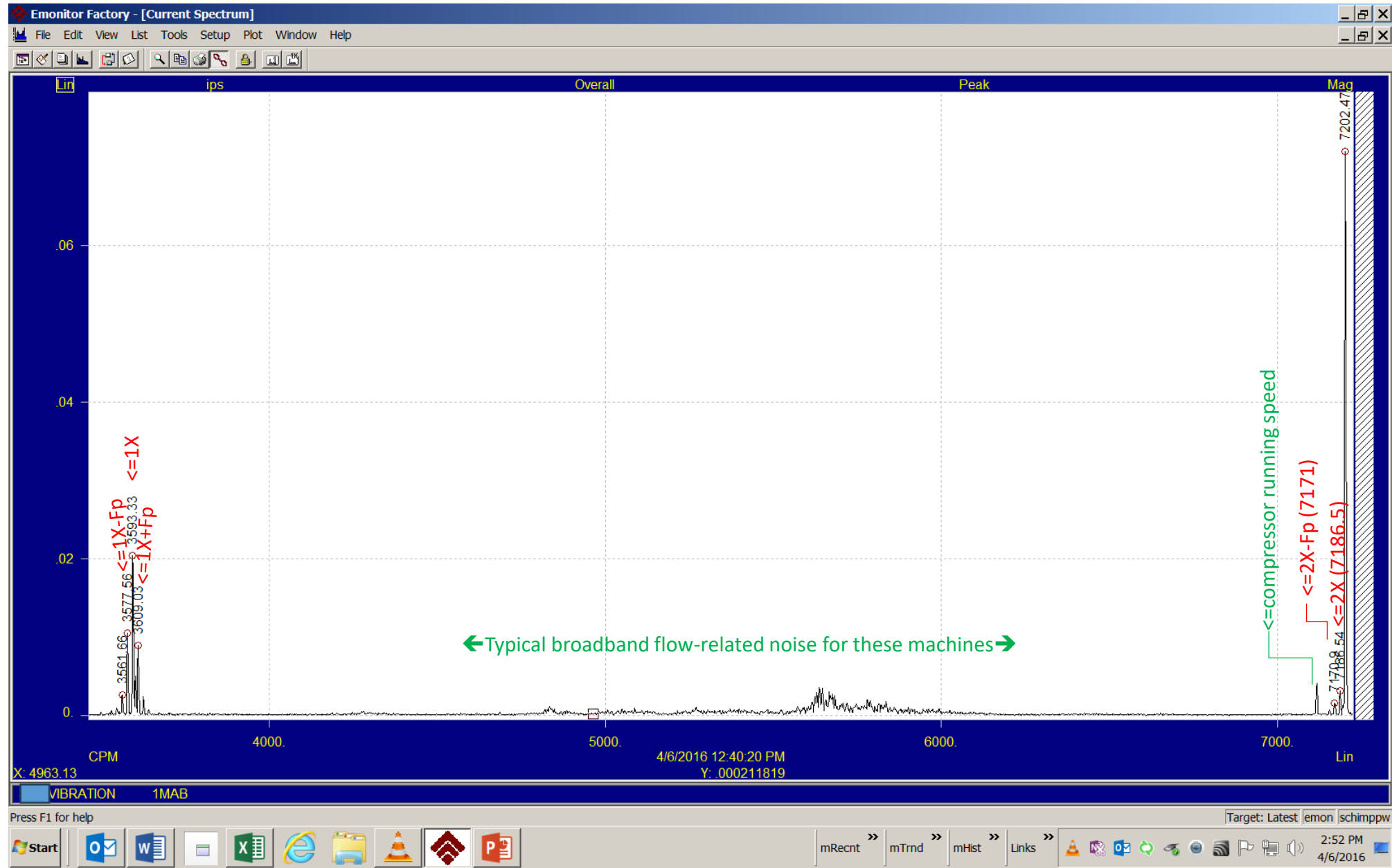
Date	Loc:	1A	1H	1V	2H	2V	3H	3V	4A	4H	4V
	Units:	ips	ips	ips	ips	ips	ips	ips	ips	ips	ips
	Alert:	0.1	0.18	0.14	0.16	0.12	0.12	0.08	0.14	0.1	0.1
	Alarm:	0.15	0.27	0.21	0.24	0.18	0.18	0.12	0.21	0.15	0.15
7/28/2004		0.06	0.15	0.09	0.09	0.12	0.13	0.06	0.15	0.09	0.09
10/18/2004		0.04	0.11	0.09	0.08	0.05	0.04	0.04	0.07	0.04	0.04
4/8/2005		0.11	0.14	0.09	0.09	0.05	0.08	0.05	0.10	0.05	0.06
9/19/2005		0.06	0.14	0.10	0.11	0.03	0.05	0.04	0.06	0.04	0.05
4/26/2006		0.05	0.12	0.07	0.10	0.09	0.08	0.05	0.08	0.05	0.05
2/1/2007		0.07	0.07	0.09	0.11	0.06	0.04	0.04	0.05	0.03	0.04
7/24/2007		0.05	0.11	0.08	0.12	0.08	0.16	0.07	0.16	0.07	0.06
1/7/2008		0.05	0.10	0.08	0.10	0.06	0.06	0.05	0.07	0.05	0.05
6/25/2008		0.06	0.10	0.09	0.11	0.08	0.05	0.05	0.06	0.05	0.05
12/8/2008		0.05	0.10	0.09	0.11	0.08	0.04	0.04	0.06	0.05	0.06
9/22/2009		0.05	0.11	0.09	0.10	0.05	0.04	0.04	0.06	0.05	0.05
4/26/2010		0.06	0.12	0.09	0.11	0.06	0.05	0.05	0.06	0.05	0.05
10/11/2010		0.05	0.11	0.08	0.11	0.05	0.05	0.05	0.06	0.05	0.06
1/3/2011		0.05	0.10	0.08	0.11	0.06	0.05	0.05	0.06	0.06	0.04
9/12/2011		0.05	0.10	0.08	0.11	0.08	0.05	0.05	0.06	0.04	0.05
5/8/2012		0.05	0.11	0.08	0.11	0.08	0.11	0.06	0.10	0.07	0.09
11/18/2012		0.05	0.09	0.08	0.10	0.06	0.05	0.05	0.06	0.06	0.04
1/27/2013		0.05	0.10	0.09	0.07	0.06	0.04	0.05	0.07	0.06	0.04
7/15/2013		0.05	0.10	0.08	0.07	0.06	0.04	0.05	0.07	0.05	0.05
2/25/2014		0.04	0.10	0.09	0.09	0.05	0.04	0.05	0.08	0.05	0.06
6/16/2014		0.04	0.09	0.07	0.08	0.06	0.05	0.04	0.06	0.04	0.04
10/22/2014		0.04	0.07	0.06	0.09	0.06	0.05	0.04	0.07	0.04	0.04
3/19/2015		0.04	0.09	0.07	0.09	0.04	0.05	0.04	0.07	0.04	0.04
6/15/2015		0.05	0.10	0.07	0.11	0.07	0.07	0.07	0.09	0.06	0.05
1/27/2016		0.05	0.08	0.09	0.12	0.08	0.06	0.04	0.06	0.06	0.04

1V vibration – pole pass sidebands around 1x and 2x.  
5-10% of main peak

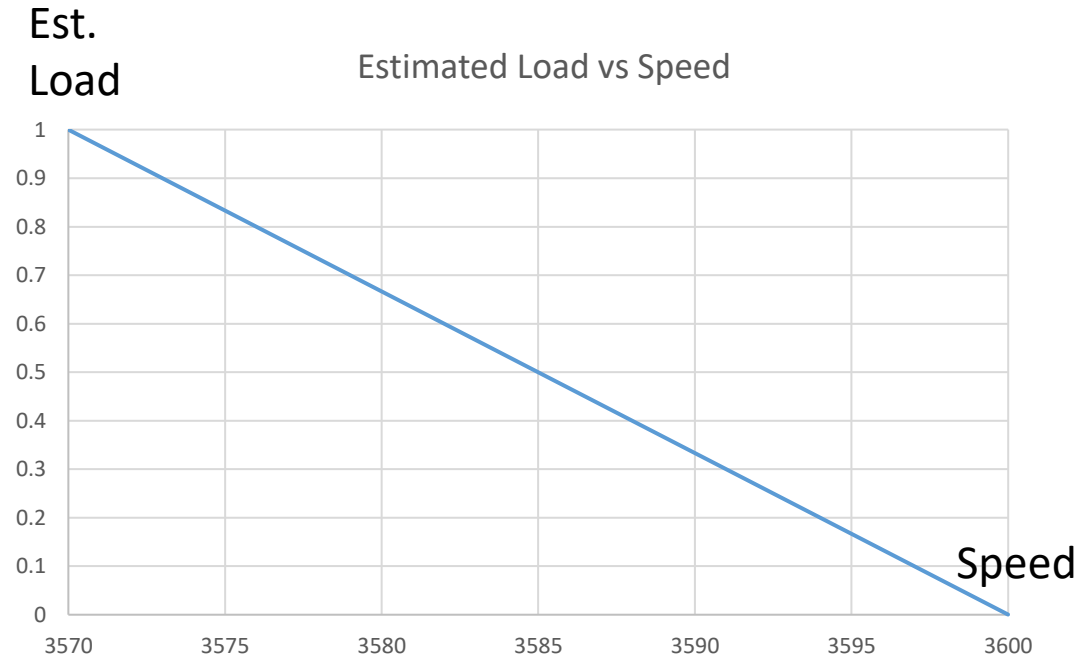
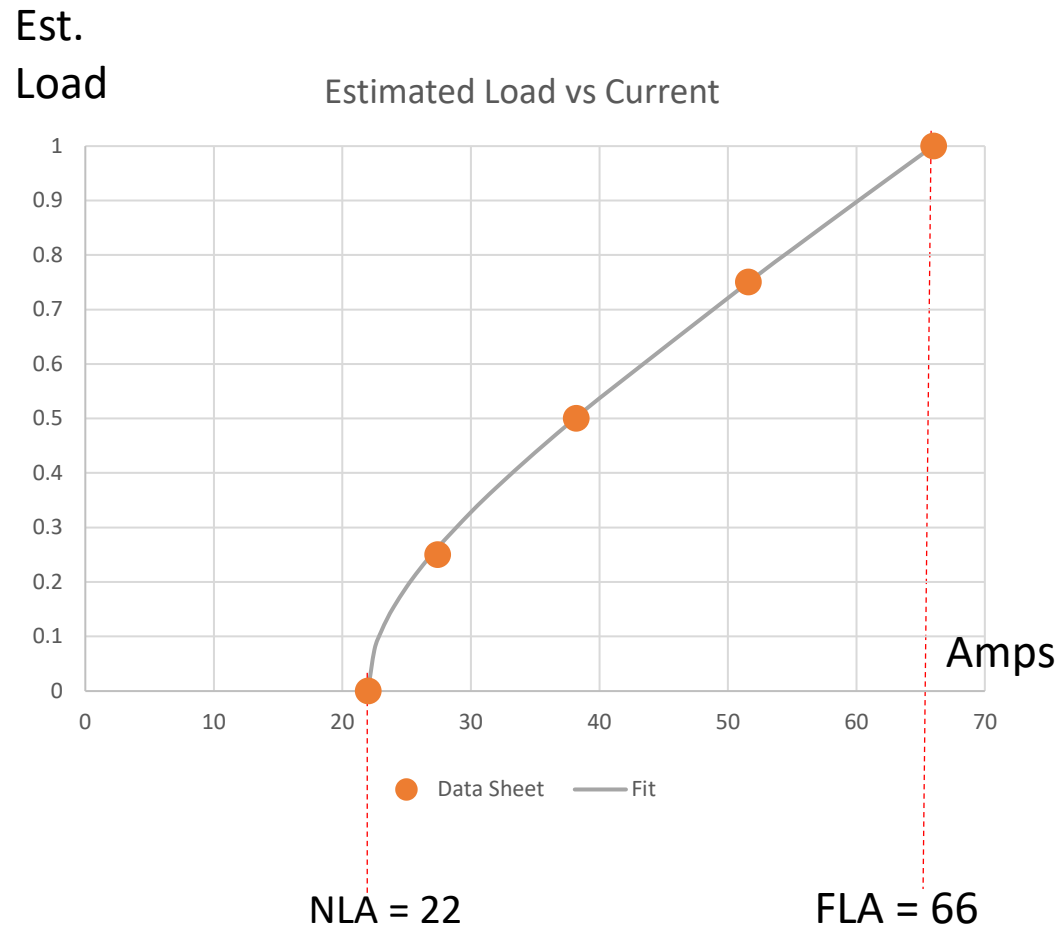




# 1H – pole pass sidebands around 1x and 2x.

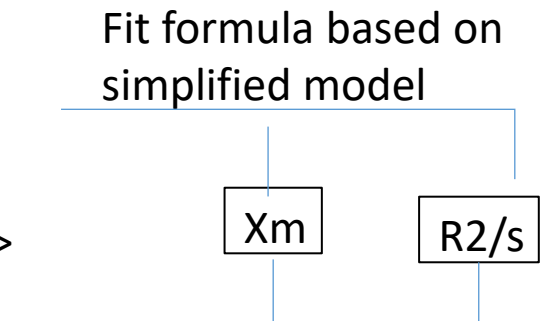


# Estimated Load (Fraction) vs Amps and vs speed



Data Sheet: From data sheet in EC 5029 (slide 19)

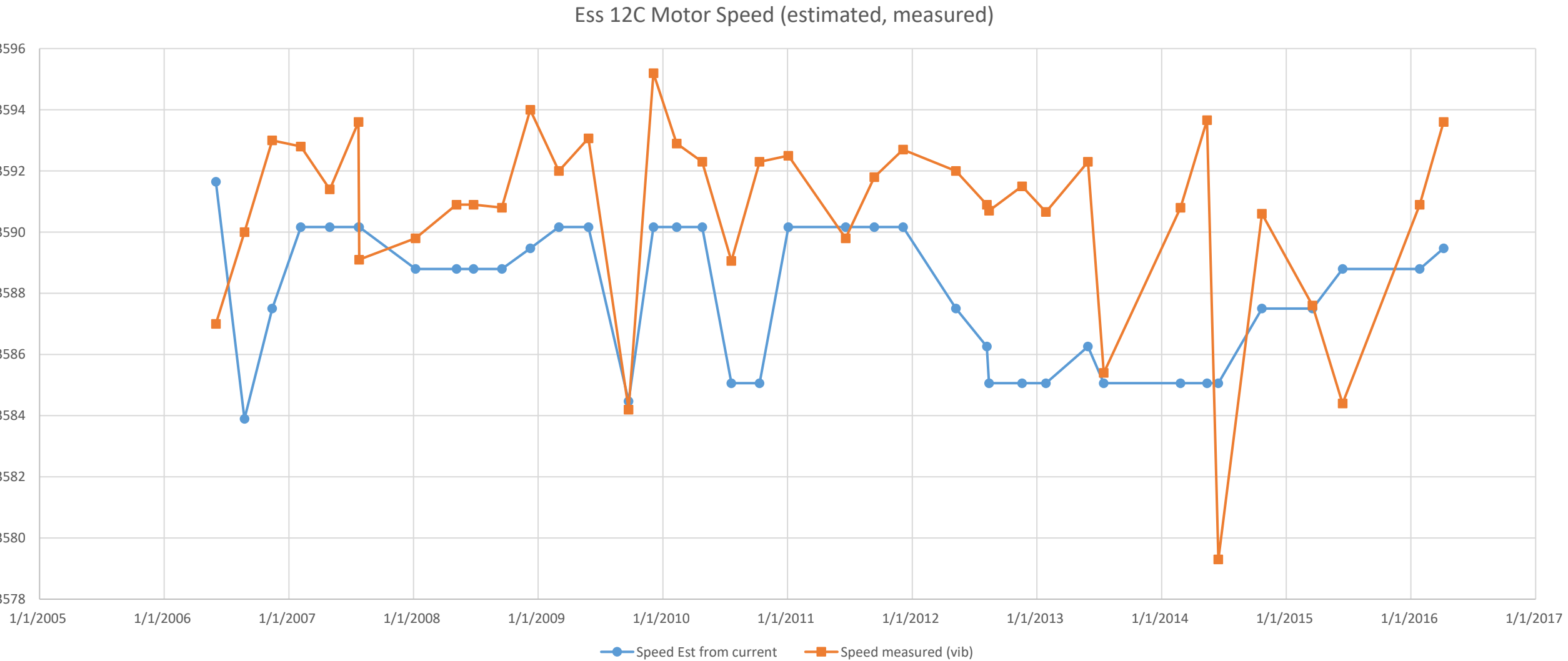
Fit:  $\text{Load} = \sqrt{\text{Amps}^2 - 22^2} / \sqrt{66^2 - 22^2}$  based on simplified model=>



12C Measured speed and estimated speed (est from panel current as collected during periodic vib measurements)

1 - Estimates of speed based on panel current generally do not match measured speed.  
(Presumably due to voltage above nameplate and variable)

2 – Neither estimated nor actual speed shows a decreasing long-term trend. Assuming long-term average of load does not change, this indicates that any rotor condition has not had effect on motor torque/speed characteristics.





Rotor photo (sister motors). Cast rotor construction, confirmed by OEM.  
Different failure mechanisms than fab rotor, and more difficult to repair











# Motor Data

Adobe Acrobat Pro


ow Help

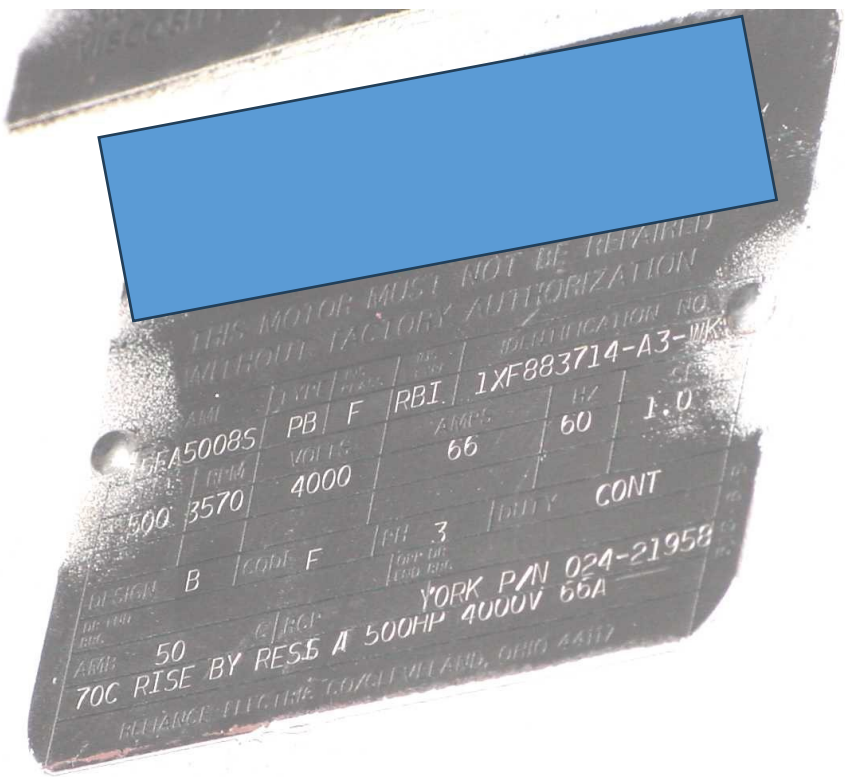


  150%   

REL. S.O.	FRAME	HP	TYPE	PHASE/ HERTZ	RPM	VOLTS
	E500BS	500	PB	3/60	3570	4000
AMPS	DUTY	AMB°C/ INSUL.	S.F.	NEMA DESIGN	CODE LETTER	ENCL.
66	CONT.	50/F*	1.0	B	F	DPP
E/S	ROTOR	TEST S.O.	TEST DATE	STATOR RES. @ 25°C OHMS (BETWEEN LINES)		
569299-SM	-	CALCULATED	N/A	.7613		
PERFORMANCE						
LOAD	HP	AMPERES	RPM	% POWER FACTOR	% EFFICIENCY	
NO LOAD	0	22.0	3599	6.83	0	
1/4	125	27.4	3593	54.8	89.5	
2/4	250	38.2	3586	75.2	93.6	
3/4	375	51.6	3578	82.8	94.5	
4/4	500	66.0	3570	85.8	94.6	
5/4	625	82.0	3561	87.0	94.3	

SAFETY REL





# DB

20 log (Amps60/AmpsSb)

Essential Chiller 12C Amps Sideband magnitude (DB below main peak)

