Equipment :	Hydrogen iMaser 3000
Title:	**Test Report for T4S iMaser s/n 59**

	Name	Date	Signature
Prepared by	Blaser Georges	29.11.2010	
Approved by	Sylvère Froidevaux	29.11.2010	

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Table of Contents

1. Scope

This document summarizes the factory acceptance procedure of the Hydrogen Masers measuring results.

2. Applicable Documents

AD1: Contract N° 4501206806

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3. Test plan

PHASE NOISE

5MHz 1 and 2 iM58 vs 5MHz 1 and 2 iM61
10MHz 1 to 4 iM58 vs 10MHz 1 to 4 iM61
100MHz 1 and 2 iM58 vs 100MHz 1 and 2 iM61

OUTPUTS SIGNALS 5 MHZ

Output level 5MHz 1 and 2
Harmonics 5MHz 1 and 2
Spurious 5MHz 1 and 2
Isolation 5MHz 1 and 2

OUTPUTS SIGNALS 10 MHZ

Output level 10MHz 1 to4
Harmonics 10MHz1 to 4
Spurious 10MHz 1 to 4
Isolation 10MHz 1 to 4

OUTPUTS SIGNALS 100 MHZ

Output level 100MHz 1 and 2
Harmonics 100MHz 1 and 2
Spurious 100MHz 1 and 2
Isolation 100MHz 1 and 2

1PPS CLOCK

STABILITY TEST

Allan deviation
Daily drift
Temperature sensitivity
Magnetic test record

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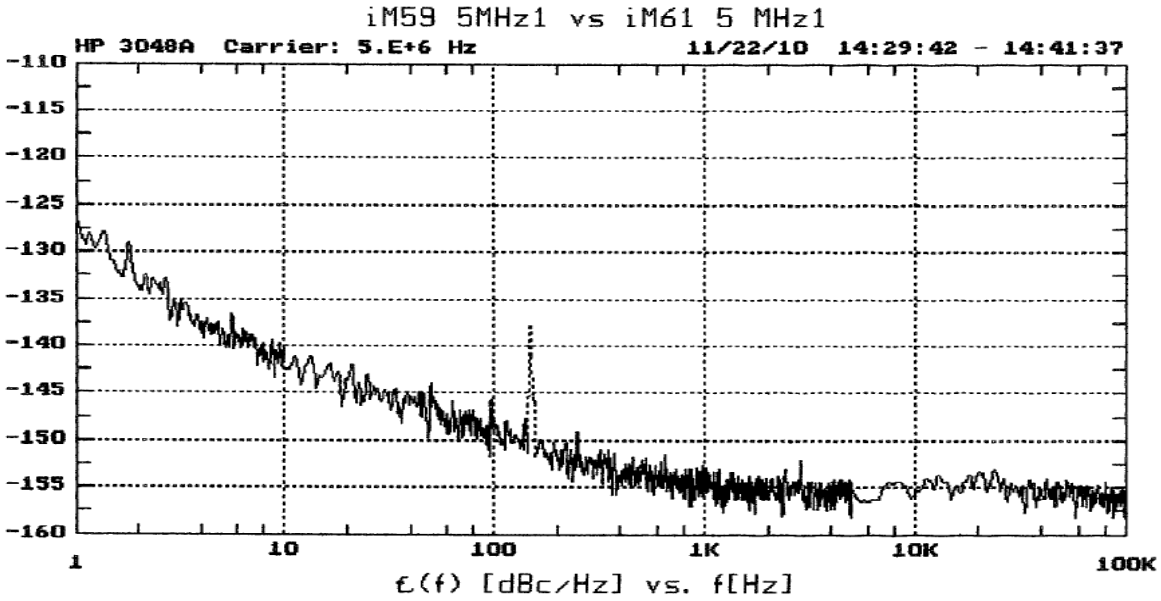
4. Test results

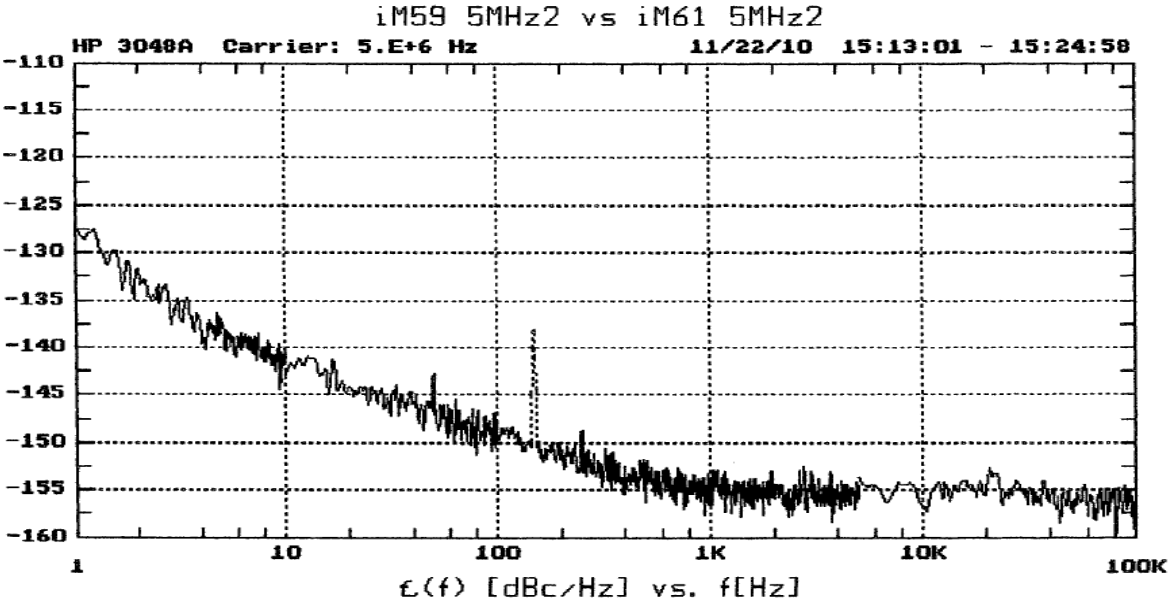
4.1. Phase noise

The phase results are raw data value, so 3dB may be subtract due to the use of same unit type OCXO

4.1.1. 5MHz1 iM59 vs 5MHz1 iM61



4.1.2. 5MHz2 iM59 vs 5MHz2 iM61



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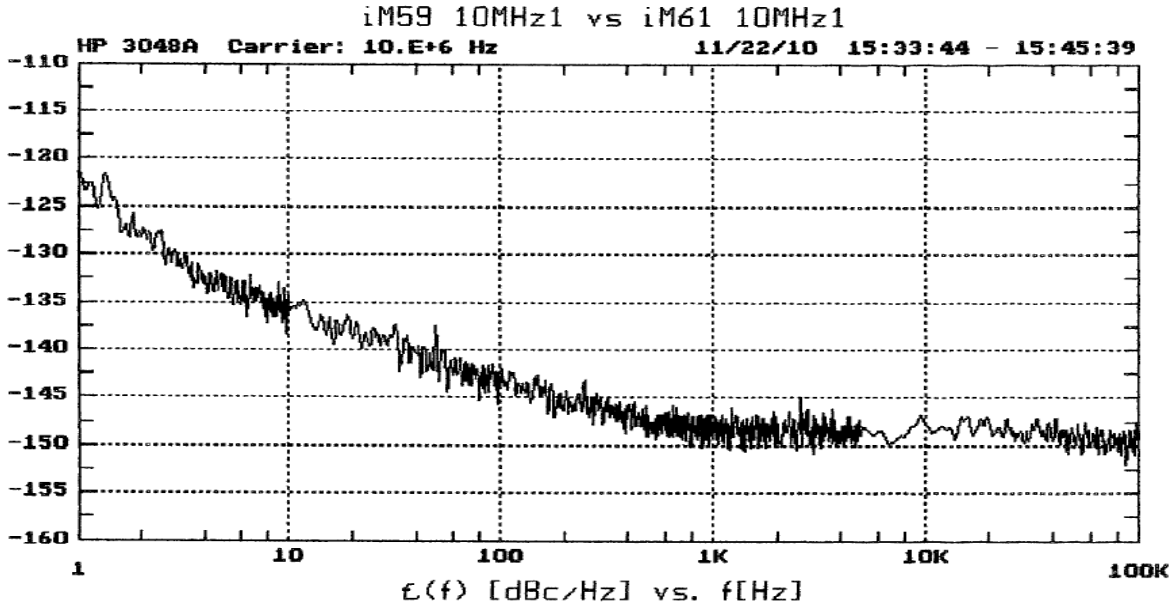
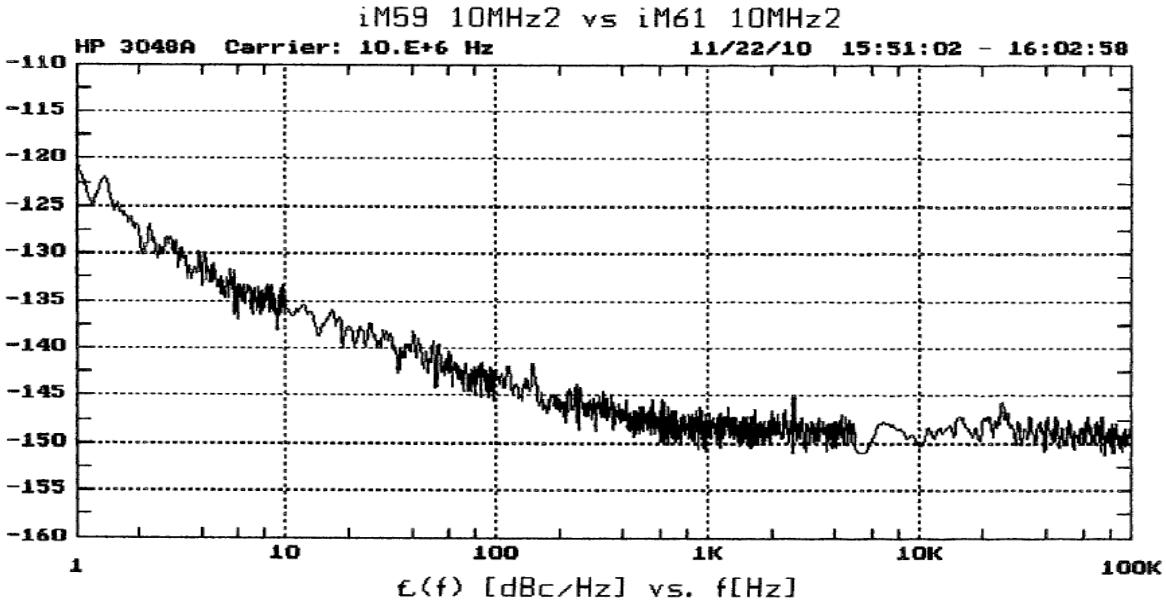
4.1.3. 10MHz1 iM59 vs 10MHz1 iM61



4.1.4. 10MHz2 iM59 vs 10MHz2 iM61



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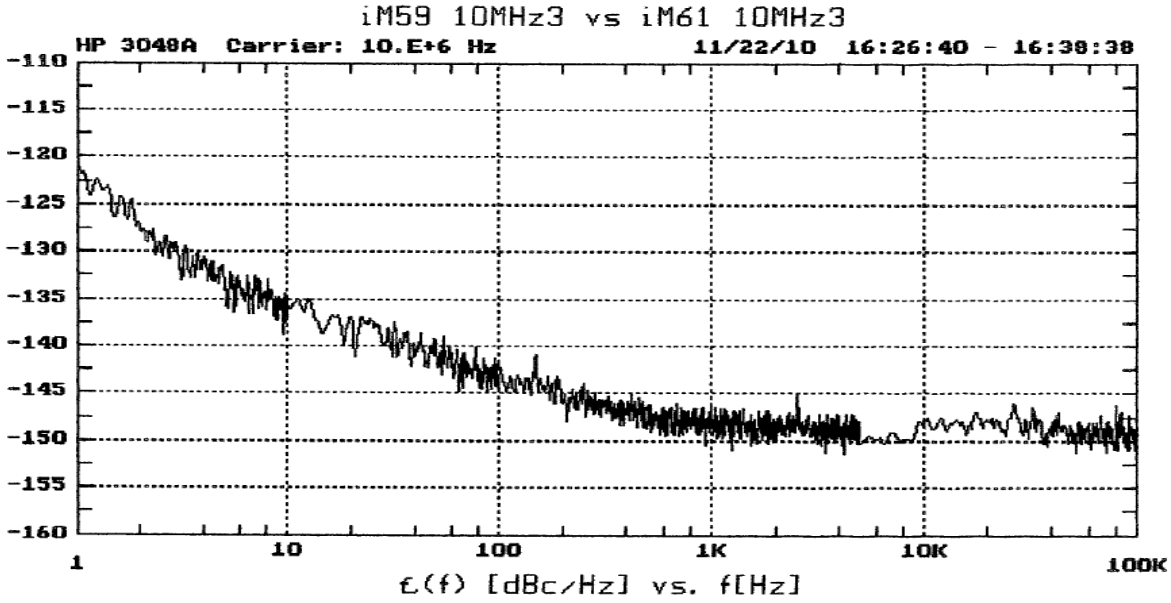
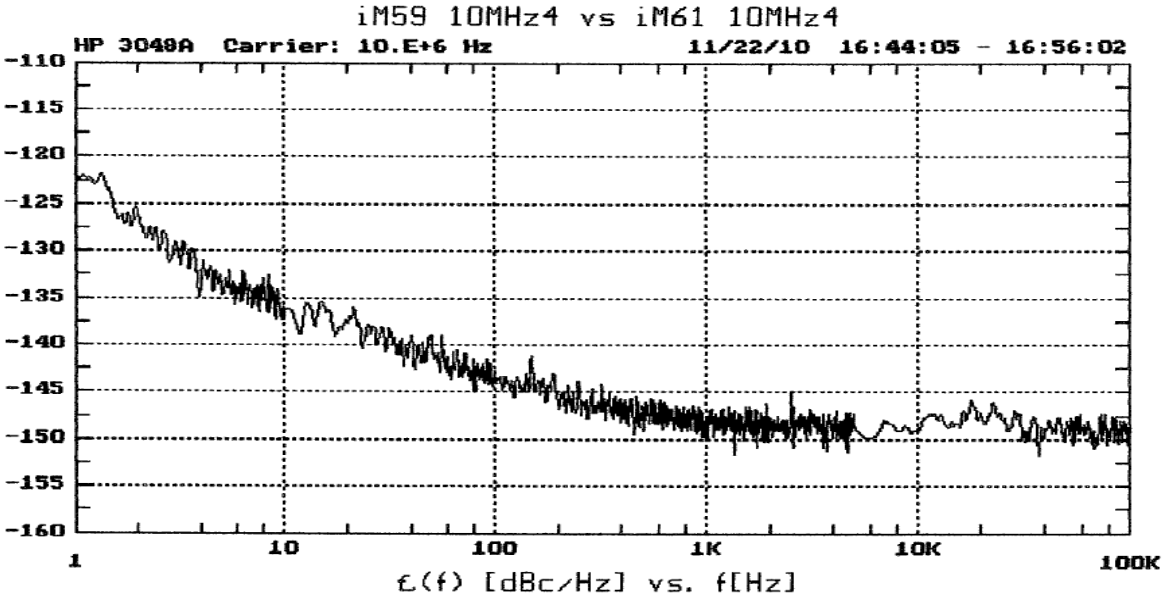
4.1.5. 10MHz3 iM59 vs 10MHz3 iM61



4.1.6. 10MHz4 iM59 vs 10MHz4 iM61



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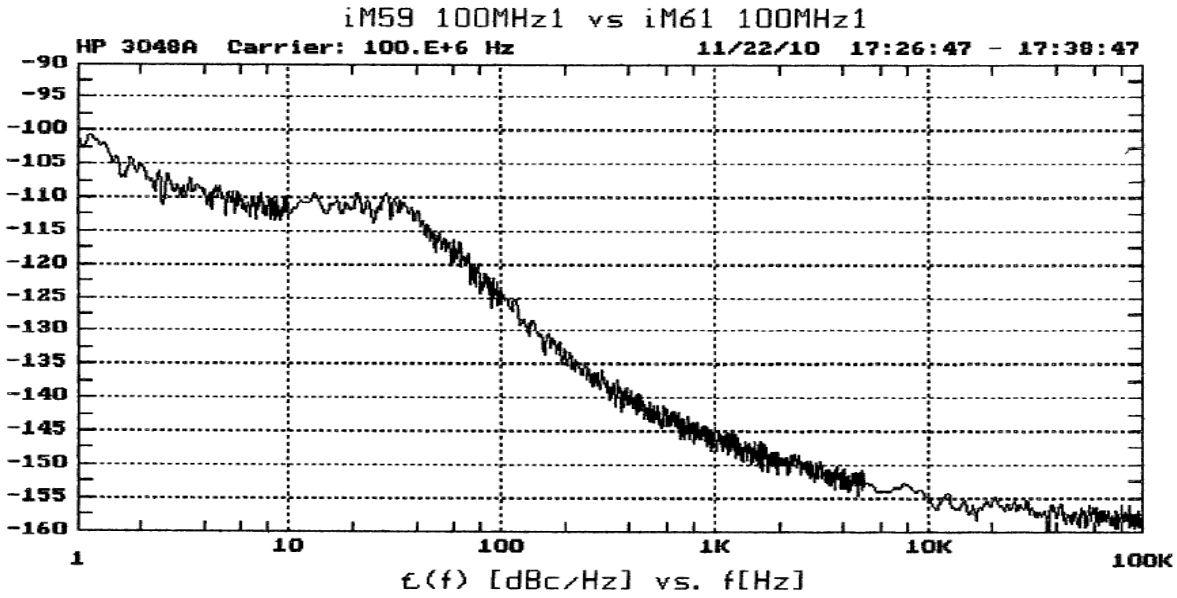
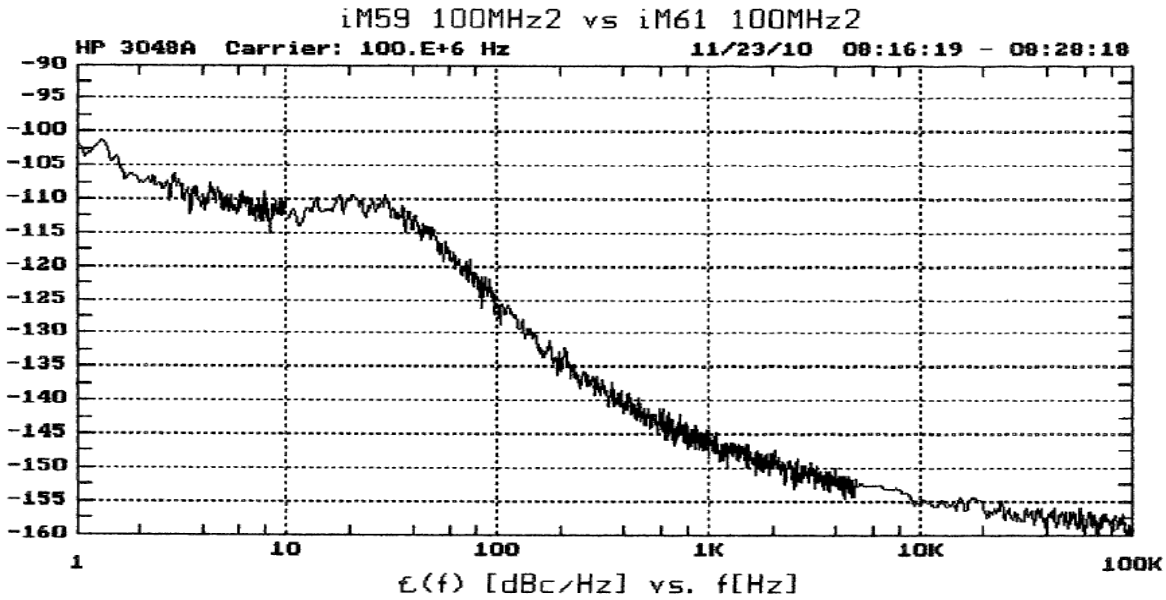
4.1.7. 100MHz1 iM59 vs 100MHz1 iM61



4.1.8. 100MHz2 iM59 vs 100MHz2 iM61



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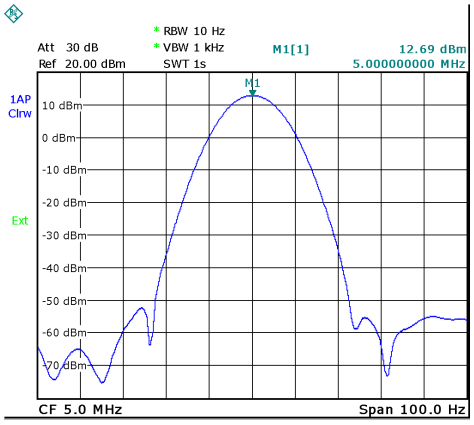
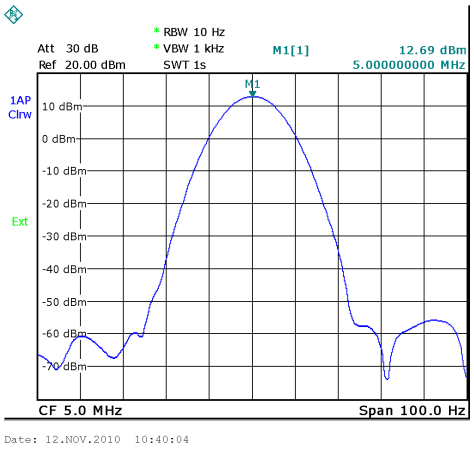
4.2. Outputs signals 5 MHz

4.2.1. Output level 5MHz 1



4.2.2. Output level 5MHz 2



4.2.3. Harmonics 5MHz1

1st Harmonic Frequency				Total Harmonic Distortion (THD)			
	5.00000000 MHz				0.09 %		-60.60 dB
No	Frequency	RBW	Power	No	Frequency	RBW	Power
1	5.00 MHz	10 Hz	12.82 dBm	6	30.00 MHz	100 Hz	-84.12 dBc
2	10.00 MHz	30 Hz	-60.96 dBc	7	35.00 MHz	100 Hz	-84.87 dBc
3	15.00 MHz	30 Hz	-78.35 dBc	8	40.00 MHz	100 Hz	-85.43 dBc
4	20.00 MHz	100 Hz	-83.98 dBc	9	45.00 MHz	100 Hz	-85.86 dBc
5	25.00 MHz	100 Hz	-83.60 dBc	10	50.00 MHz	100 Hz	-86.05 dBc

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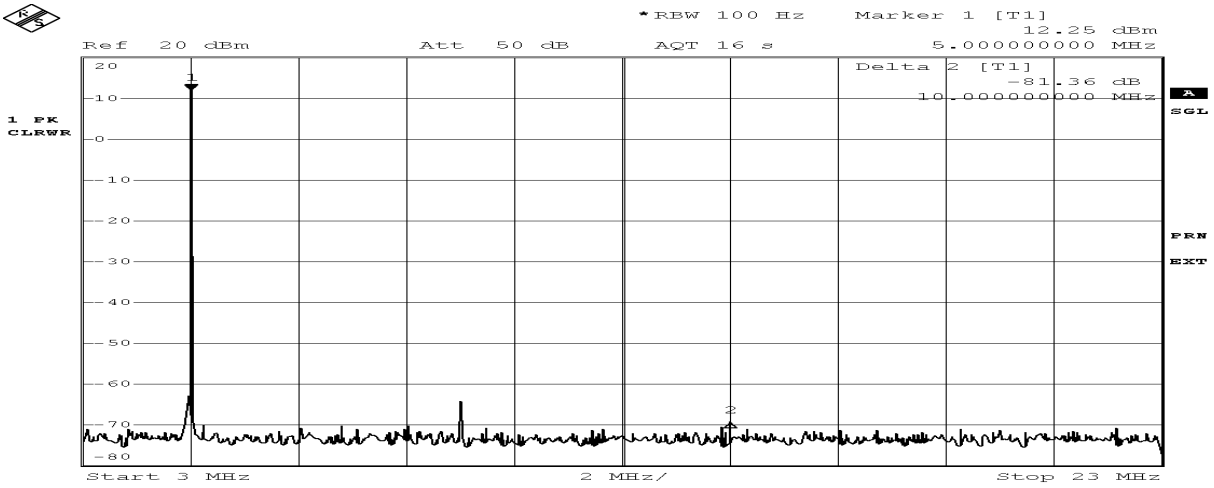
4.2.4. Harmonics 5MHz2

1st Harmonic Frequency				Total Harmonic Distortion (THD)			
	5.00000000 MHz				0.09 %		-60.74 dB
No	Frequency	RBW	Power	No	Frequency	RBW	Power
1	5.00 MHz	10 Hz	12.82 dBm	6	30.00 MHz	100 Hz	-84.51 dBc
2	10.00 MHz	30 Hz	-60.94 dBc	7	35.00 MHz	100 Hz	-84.94 dBc
3	15.00 MHz	30 Hz	-78.15 dBc	8	40.00 MHz	100 Hz	-85.41 dBc
4	20.00 MHz	100 Hz	-83.56 dBc	9	45.00 MHz	100 Hz	-85.86 dBc
5	25.00 MHz	100 Hz	-83.85 dBc	10	50.00 MHz	100 Hz	-86.36 dBc

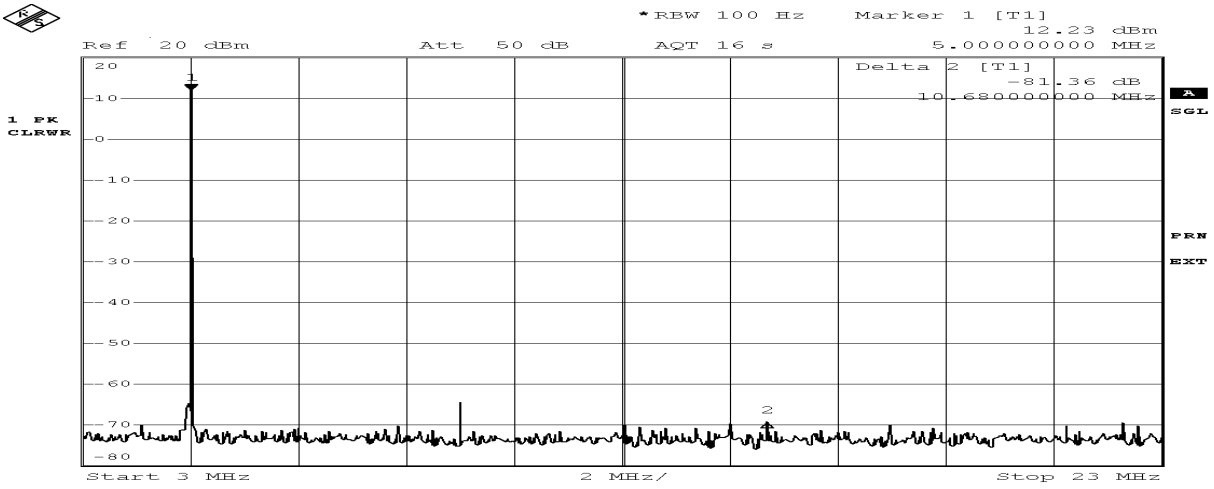
Date: 12.NOV.2010 15:35:12

4.2.5. Spurious 5MHz 1



Date: 12.NOV.2010 16:20:40

4.2.6. Spurious 5MHz 2



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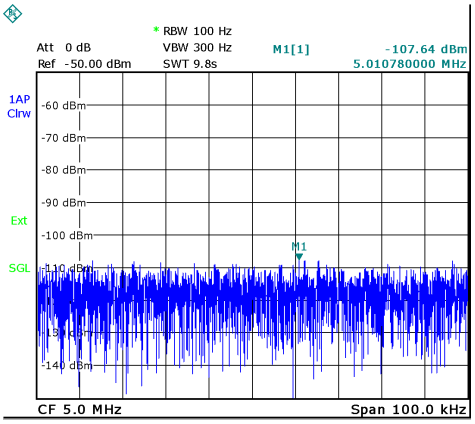
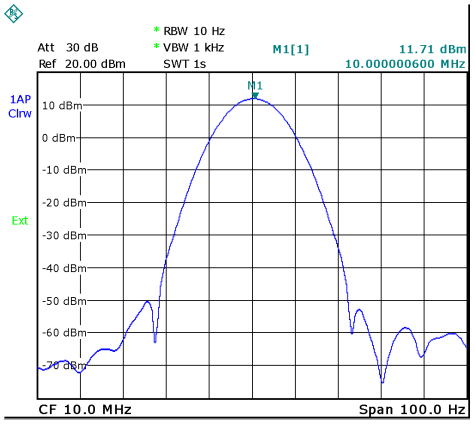
4.2.1. Isolation between 5MHz1 and 5MHz2

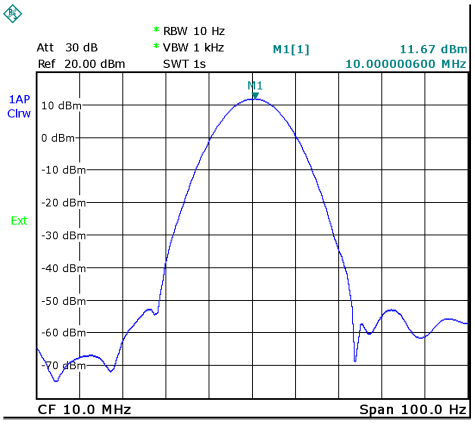


4.3. Outputs signals 10 MHz

4.3.1. Output level 10MHz 1



4.3.2. Output level 10MHz 2



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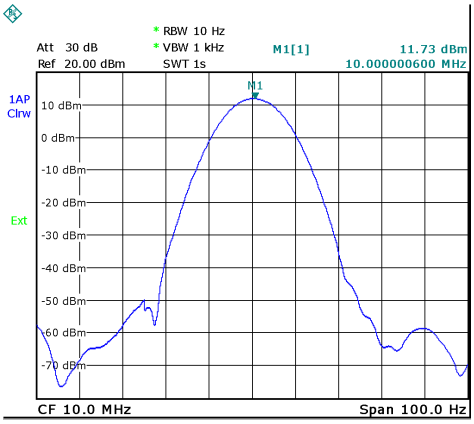
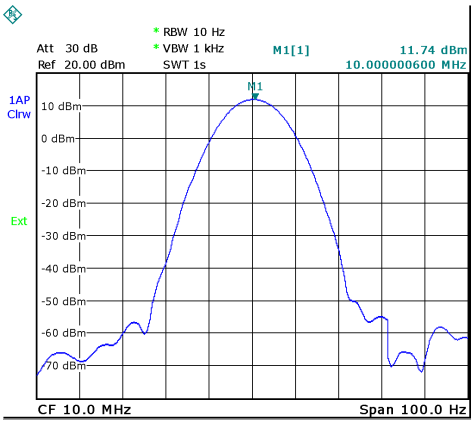
4.3.3. Output level 10MHz 3



4.3.4. Output level 10MHz 4



4.3.5. Harmonics 10MHz1

1st Harmonic Frequency				Total Harmonic Distortion (THD)			
	10.00000000 MHz				0.09 %		-61.28 dB
No	Frequency	RBW	Power	No	Frequency	RBW	Power
1	10.00 MHz	10 Hz	12.13 dBm	6	60.00 MHz	100 Hz	-77.51 dBc
2	20.00 MHz	30 Hz	-64.66 dBc	7	70.00 MHz	100 Hz	-87.58 dBc
3	30.00 MHz	30 Hz	-78.52 dBc	8	80.00 MHz	100 Hz	-85.59 dBc
4	40.00 MHz	100 Hz	-65.85 dBc	9	90.00 MHz	100 Hz	-86.04 dBc
5	50.00 MHz	100 Hz	-69.94 dBc	10	100.00 MHz	100 Hz	-86.58 dBc

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4.3.6. Harmonics 10MHz2

1st Harmonic Frequency				Total Harmonic Distortion (THD)			
			10.00000000 MHz			0.08 %	-61.56 dB
No	Frequency	RBW	Power	No	Frequency	RBW	Power
1	10.00 MHz	10 Hz	12.07 dBm	6	60.00 MHz	100 Hz	-77.33 dBc
2	20.00 MHz	30 Hz	-64.95 dBc	7	70.00 MHz	100 Hz	-84.39 dBc
3	30.00 MHz	30 Hz	-77.60 dBc	8	80.00 MHz	100 Hz	-85.36 dBc
4	40.00 MHz	100 Hz	-66.14 dBc	9	90.00 MHz	100 Hz	-86.02 dBc
5	50.00 MHz	100 Hz	-70.12 dBc	10	100.00 MHz	100 Hz	-85.99 dBc

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4.3.7. Harmonics 10MHz3

1st Harmonic Frequency				Total Harmonic Distortion (THD)			
			10.00000000 MHz			0.08 %	-61.48 dB
No	Frequency	RBW	Power	No	Frequency	RBW	Power
1	10.00 MHz	10 Hz	12.13 dBm	6	60.00 MHz	100 Hz	-76.23 dBc
2	20.00 MHz	30 Hz	-65.18 dBc	7	70.00 MHz	100 Hz	-87.45 dBc
3	30.00 MHz	30 Hz	-76.64 dBc	8	80.00 MHz	100 Hz	-86.20 dBc
4	40.00 MHz	100 Hz	-66.11 dBc	9	90.00 MHz	100 Hz	-86.14 dBc
5	50.00 MHz	100 Hz	-69.93 dBc	10	100.00 MHz	100 Hz	-86.36 dBc

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4.3.8. Harmonics 10MHz4

1st Harmonic Frequency				Total Harmonic Distortion (THD)			
			10.00000000 MHz			0.08 %	-61.70 dB
No	Frequency	RBW	Power	No	Frequency	RBW	Power
1	10.00 MHz	10 Hz	12.12 dBm	6	60.00 MHz	100 Hz	-76.69 dBc
2	20.00 MHz	30 Hz	-65.21 dBc	7	70.00 MHz	100 Hz	-86.68 dBc
3	30.00 MHz	30 Hz	-77.68 dBc	8	80.00 MHz	100 Hz	-84.90 dBc
4	40.00 MHz	100 Hz	-66.42 dBc	9	90.00 MHz	100 Hz	-86.06 dBc
5	50.00 MHz	100 Hz	-69.89 dBc	10	100.00 MHz	100 Hz	-86.43 dBc

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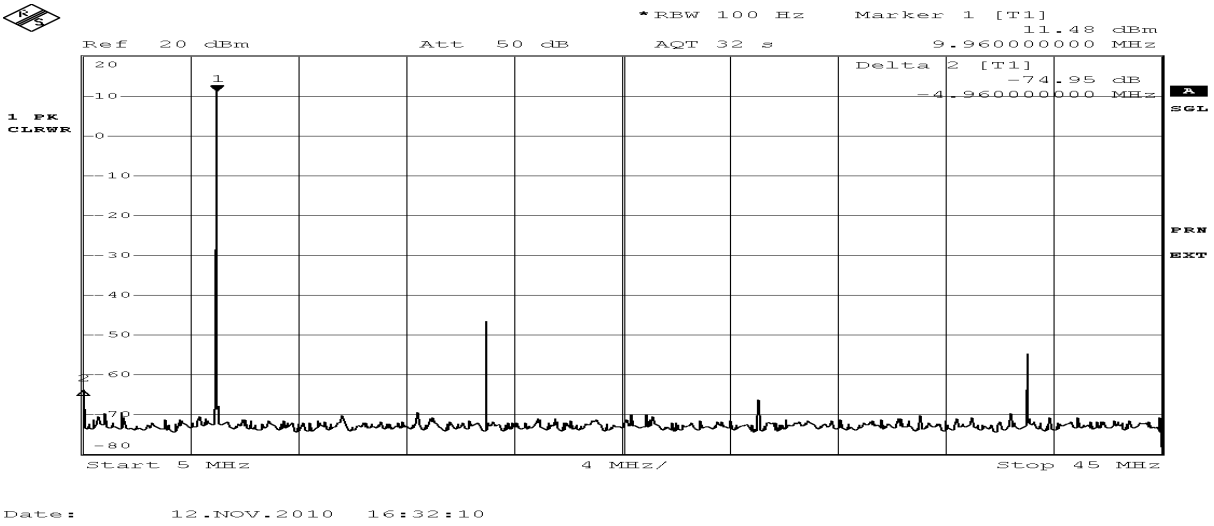
4.3.9. Spurious 10MHz 1



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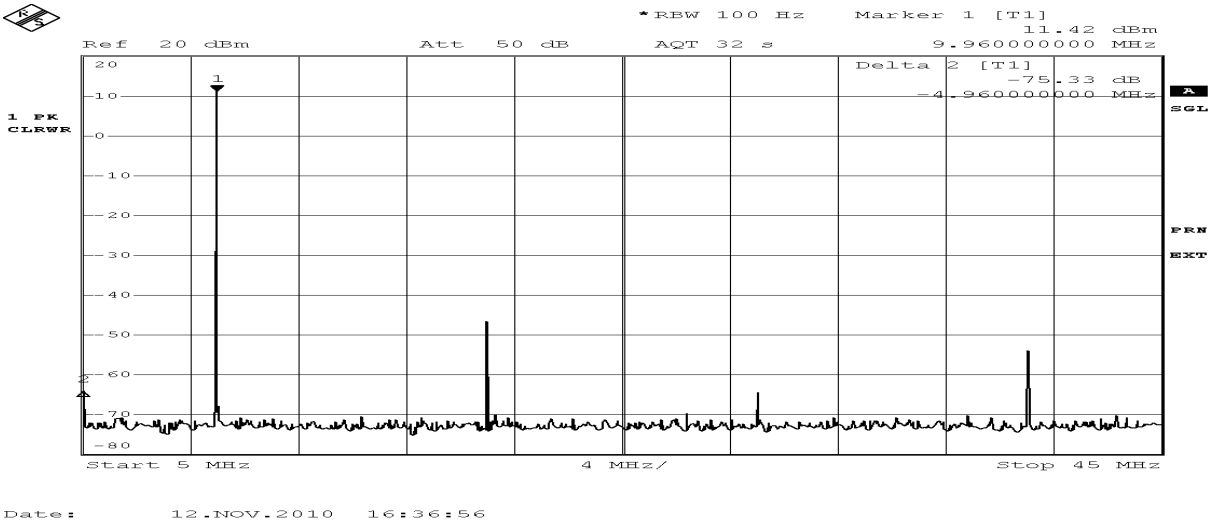
4.3.10. Spurious 10MHz 2



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4.3.11. Spurious 10MHz 3

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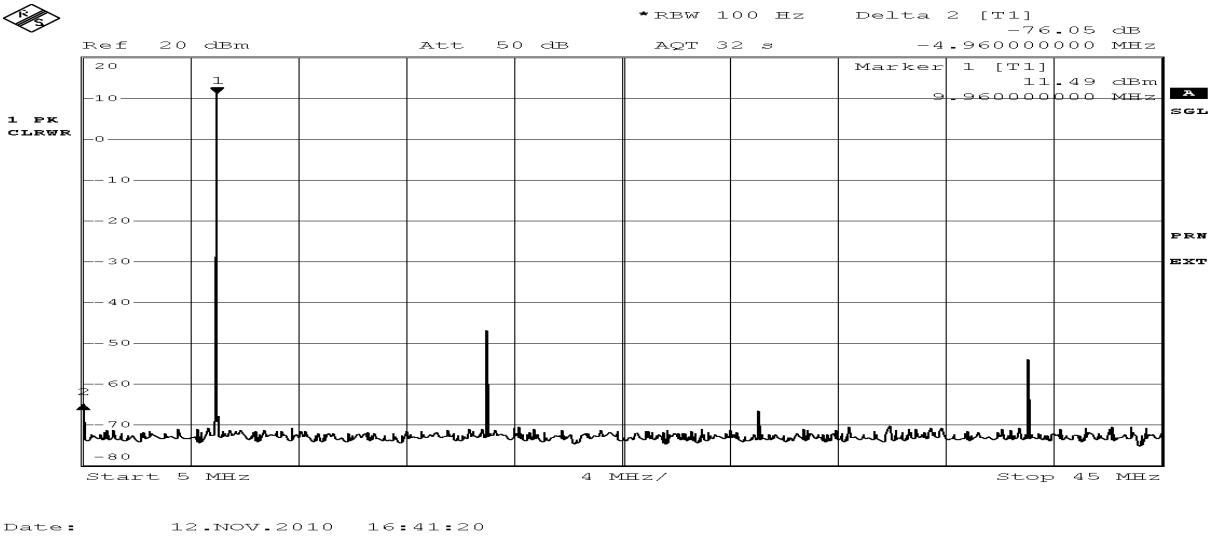
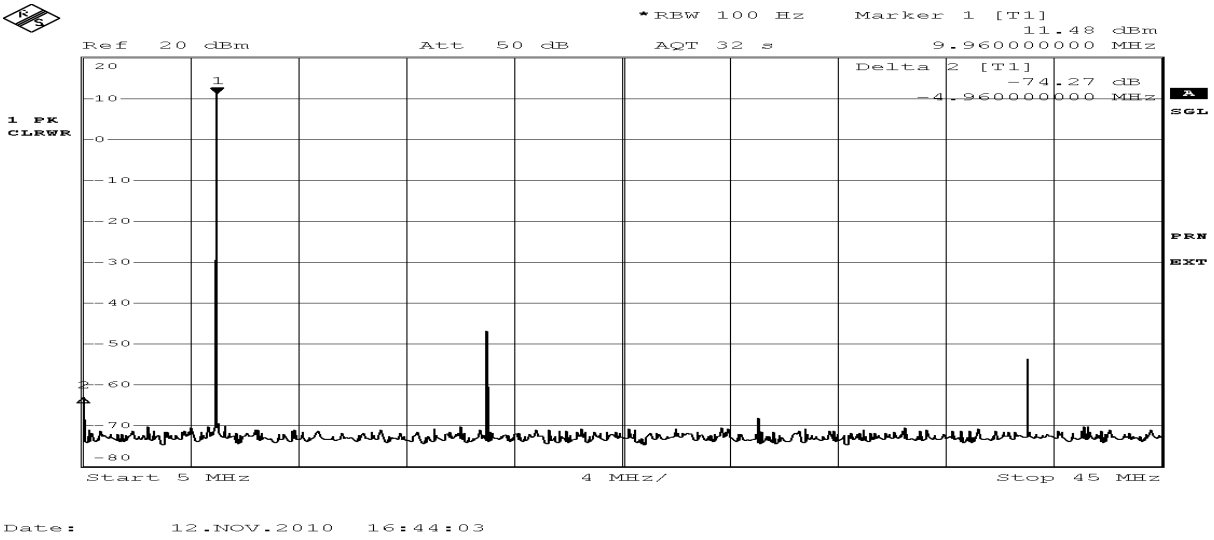
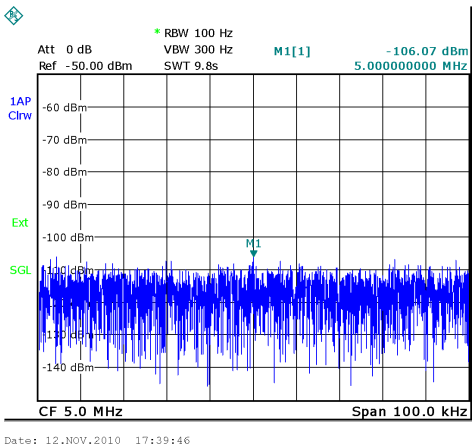
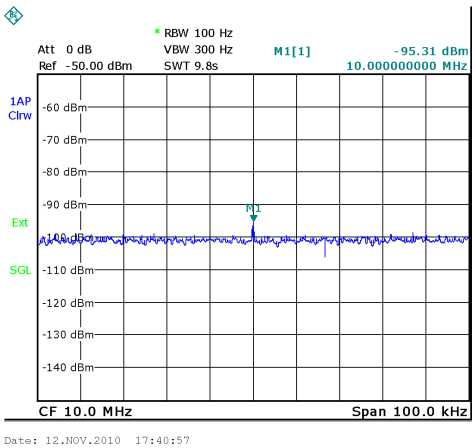


4.3.12. Spurious 10MHz 4



4.3.13. Isolation between 5MHz1 and 10MHz 1





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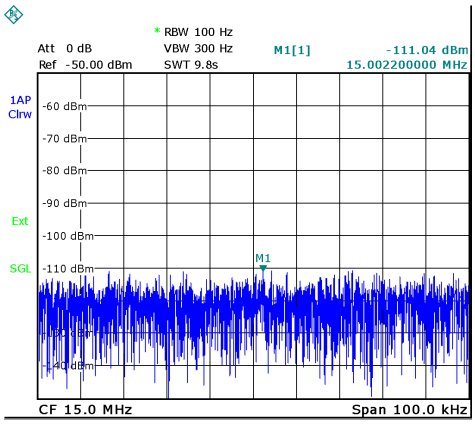

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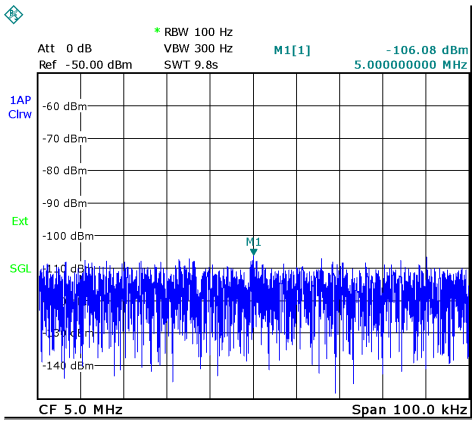
4.3.14. Isolation between 5MHz1 and 10MHz 2



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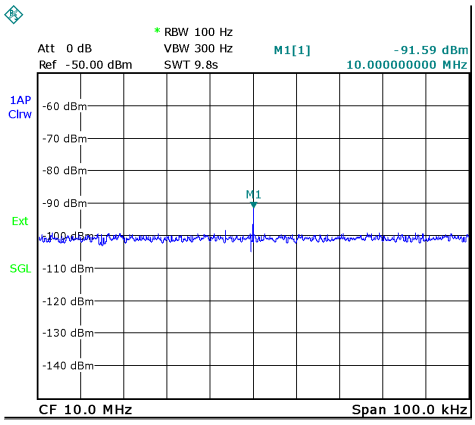

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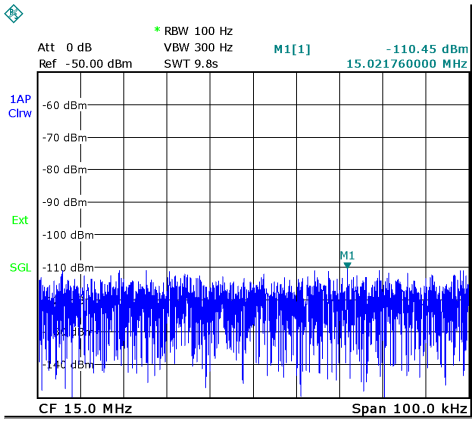

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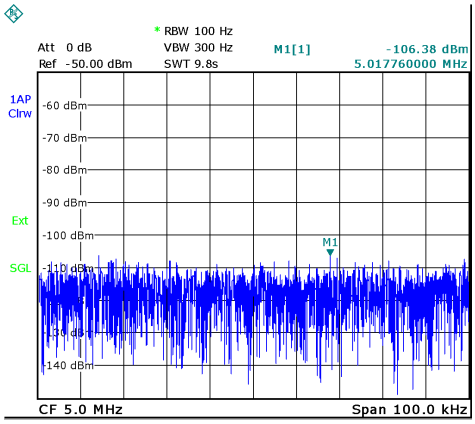
4.3.15. Isolation between 5MHz1 and 10MHz 3



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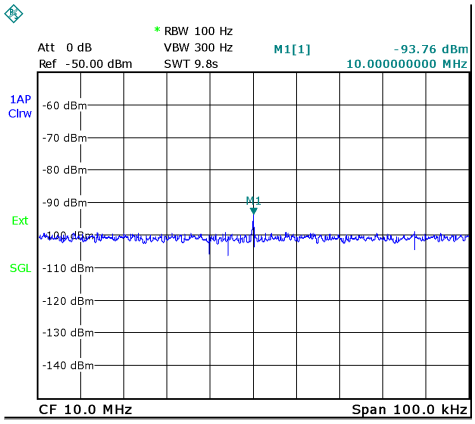

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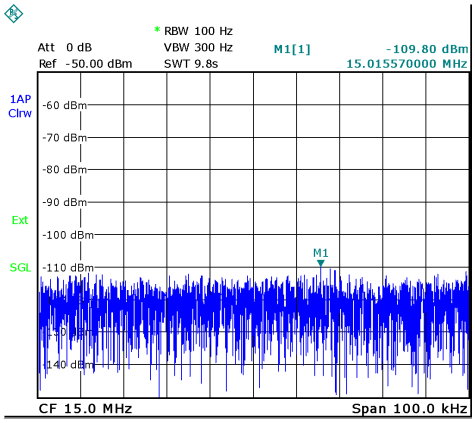

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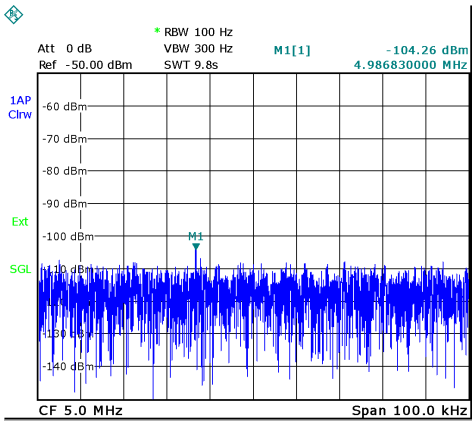
4.3.16. Isolation between 5MHz1 and 10MHz 4



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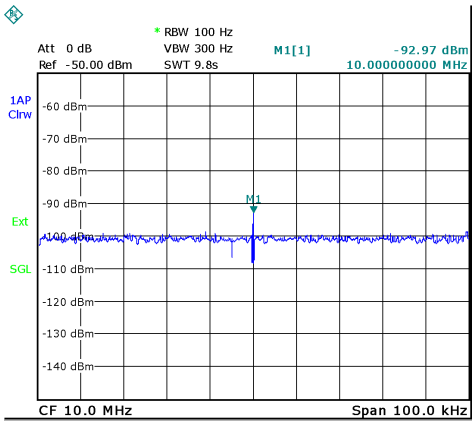

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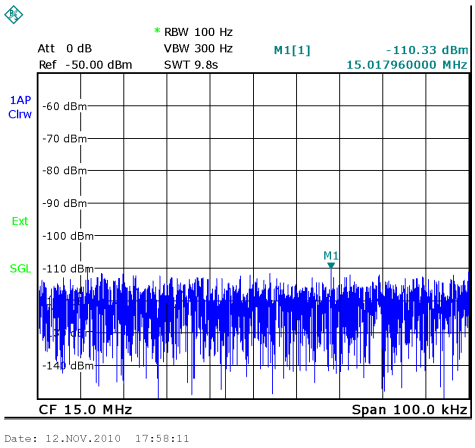

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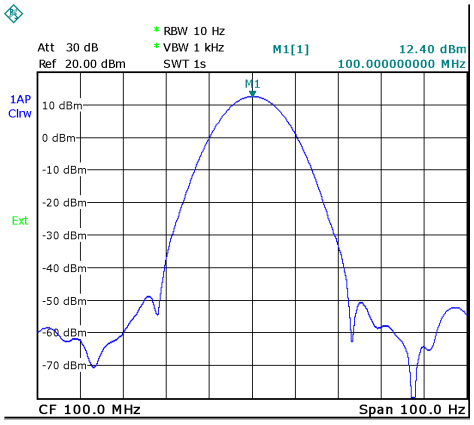
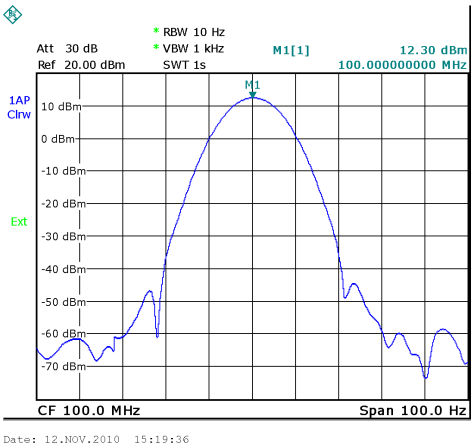
4.4. Outputs signals 100MHz

4.4.1. Output level 100MHz 1



4.4.2. Output level 100MHz 2



4.4.3. Harmonics 100MHz 1

1st Harmonic Frequency				Total Harmonic Distortion (THD)			
	100.00000000 MHz				0.16 %		-56.16 dB
No	Frequency	RBW	Power	No	Frequency	RBW	Power
1	100.00 MHz	10 Hz	12.62 dBm	6	600.00 MHz	100 Hz	-83.31 dBc
2	200.00 MHz	30 Hz	-56.26 dBc	7	700.00 MHz	100 Hz	-80.09 dBc
3	300.00 MHz	30 Hz	-82.21 dBc	8	800.00 MHz	100 Hz	-78.93 dBc
4	400.00 MHz	100 Hz	-95.59 dBc	9	900.00 MHz	100 Hz	-79.89 dBc
5	500.00 MHz	100 Hz	-82.11 dBc	10	1.00 GHz	100 Hz	-81.26 dBc

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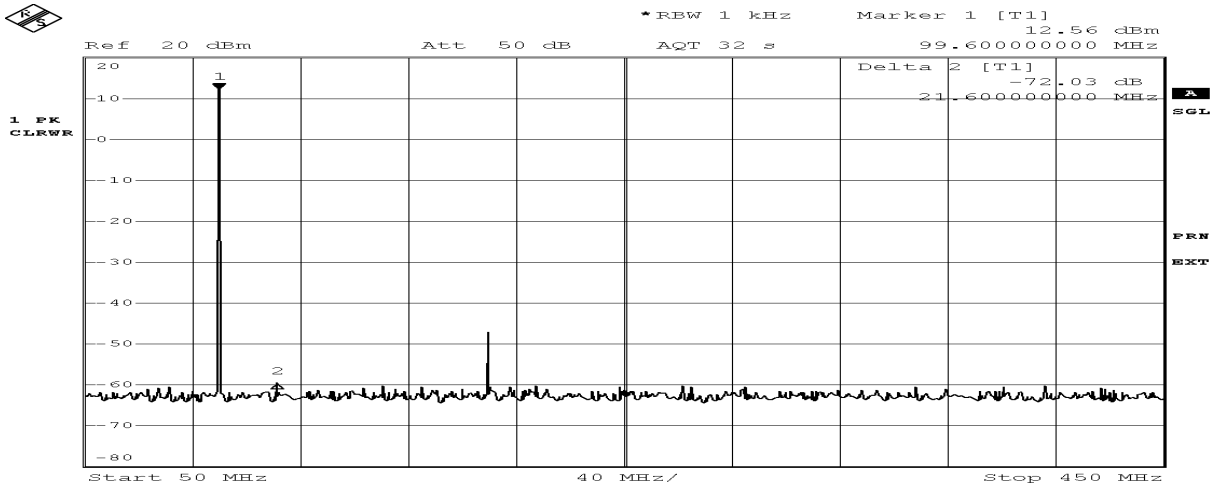
4.4.4. Harmonics 100MHz 2

1st Harmonic Frequency				Total Harmonic Distortion (THD)			
			100.00000000 MHz			0.17 %	-55.53 dB
No	Frequency	RBW	Power	No	Frequency	RBW	Power
1	100.00 MHz	10 Hz	12.53 dBm	6	600.00 MHz	100 Hz	-82.80 dBc
2	200.00 MHz	30 Hz	-55.64 dBc	7	700.00 MHz	100 Hz	-80.40 dBc
3	300.00 MHz	30 Hz	-78.59 dBc	8	800.00 MHz	100 Hz	-78.11 dBc
4	400.00 MHz	100 Hz	-93.77 dBc	9	900.00 MHz	100 Hz	-79.33 dBc
5	500.00 MHz	100 Hz	-81.86 dBc	10	1.00 GHz	100 Hz	-81.53 dBc

Date: 12.NOV.2010 15:48:33

4.4.5. Spurious 100MHz 1



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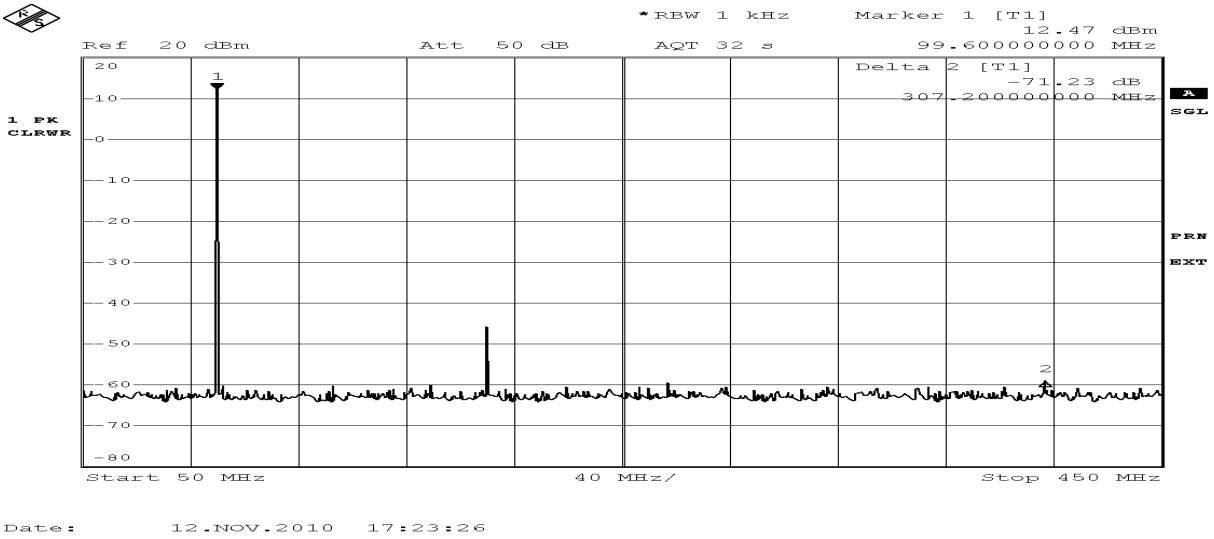
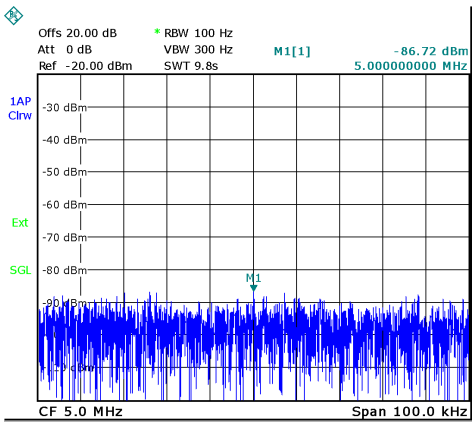
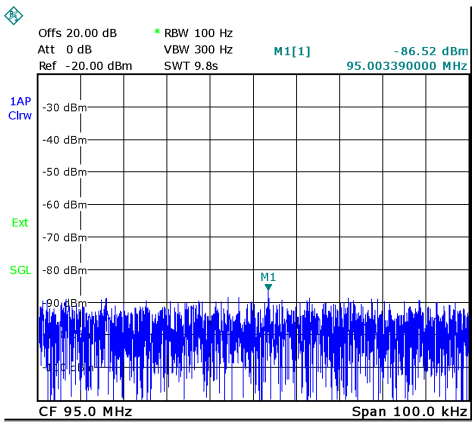
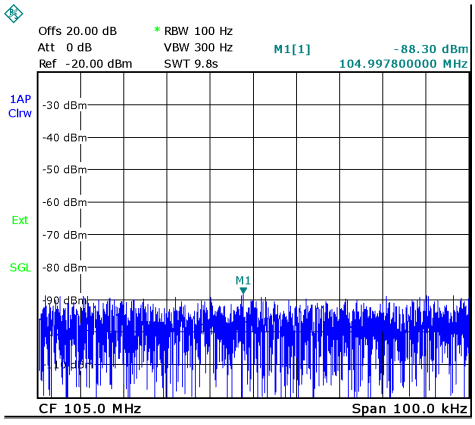
4.4.6. Spurious 100MHz 2



4.4.7. Isolation between 5MHz1 and 100MHz 1







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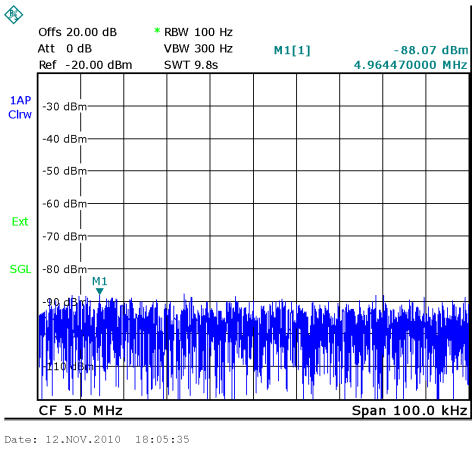
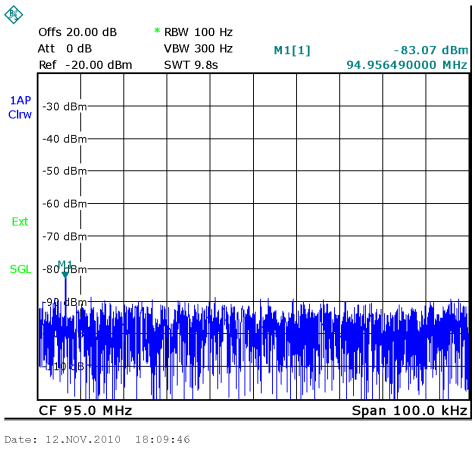
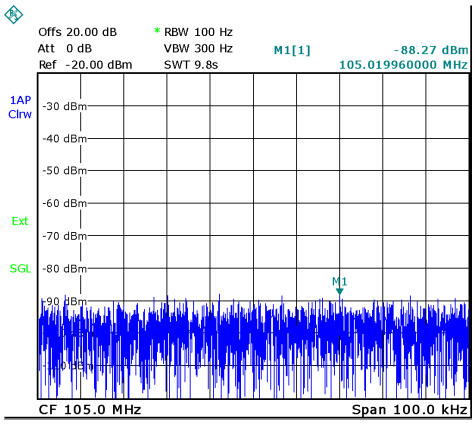
4.4.8. Isolation between 5MHz1 and 100MHz 2



Date: 12.NOV.2010 18:05:35



Date: 12.NOV.2010 18:09:46



Date: 12.NOV.2010 18:07:28

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4.5. 1PPS clock

Rem: Measured at 50 ohm

---

1 PPS output
Date:26.11.2010

Signal out

Level/50Ω [V]	duration [µs]	rise [ns]	fall [ns]
2.36	99.9	1.85	4.43

Clock test (passed/failed)

day	month	year	day/week	hour	minute	second	1/10 s
passed	passed	passed	passed	passed	passed	passed	passed

Delay adjustment (passed/failed)

100ms	10ms	1ms	100us	10us	1us	100ns	50ns
passed	passed	passed	passed	passed	passed	passed	passed

Reset level [V]	Delay [ns]
Level 1: 2V	29.6
Level 2: 3V	29.5
Level 3: 4V	29.4
Level 4: 5V	29.4

Jitter [ps]
65

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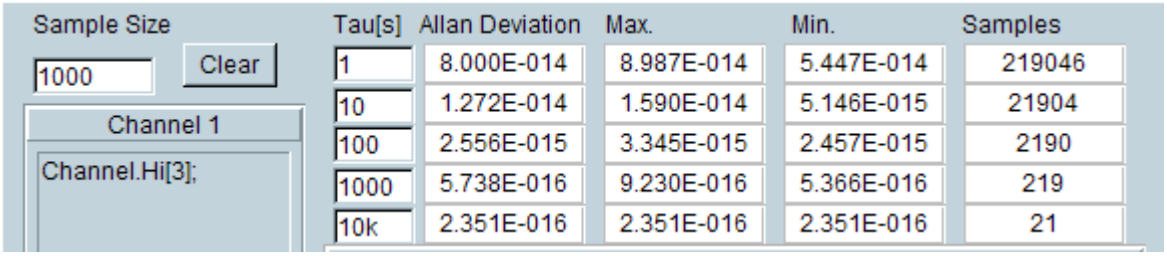
4.6. Stability test

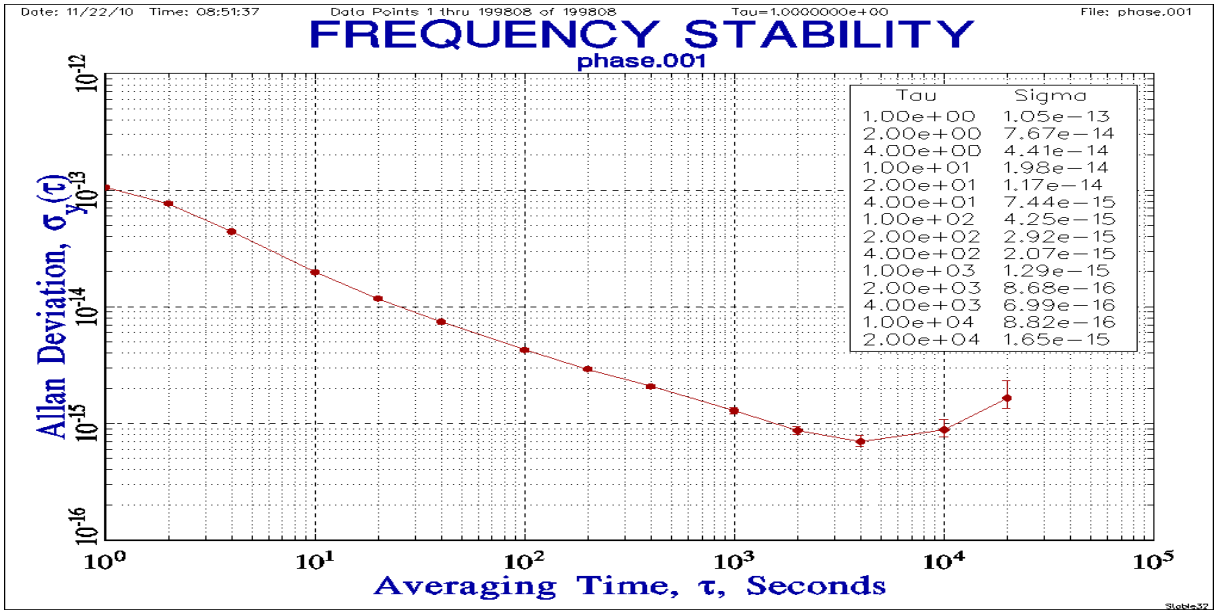
4.6.1. Allan deviation

Test with “3 corner hat” option (iM59 vs iM61 + iM53)



Tau[s]	Allan Deviation	Max.	Min.	Samples
1	8.000E-014	8.987E-014	5.447E-014	219046
10	1.272E-014	1.590E-014	5.146E-015	21904
100	2.556E-015	3.345E-015	2.457E-015	2190
1000	5.738E-016	9.230E-016	5.366E-016	219
10k	2.351E-016	2.351E-016	2.351E-016	21

iM59 vs iM61 (Raw data without drift removed)



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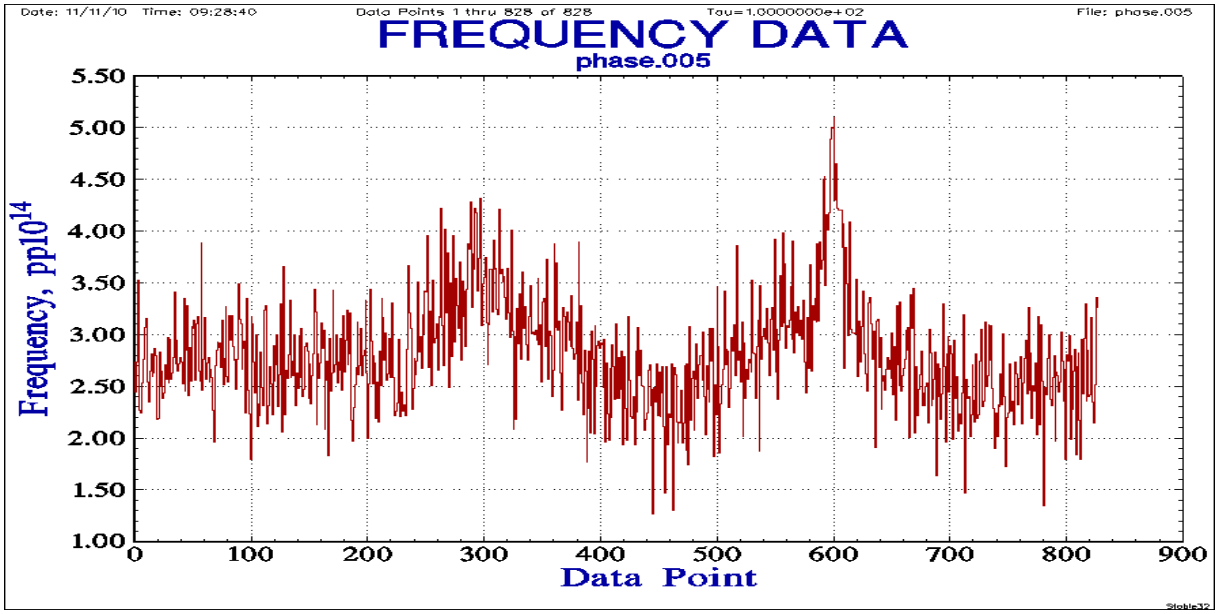
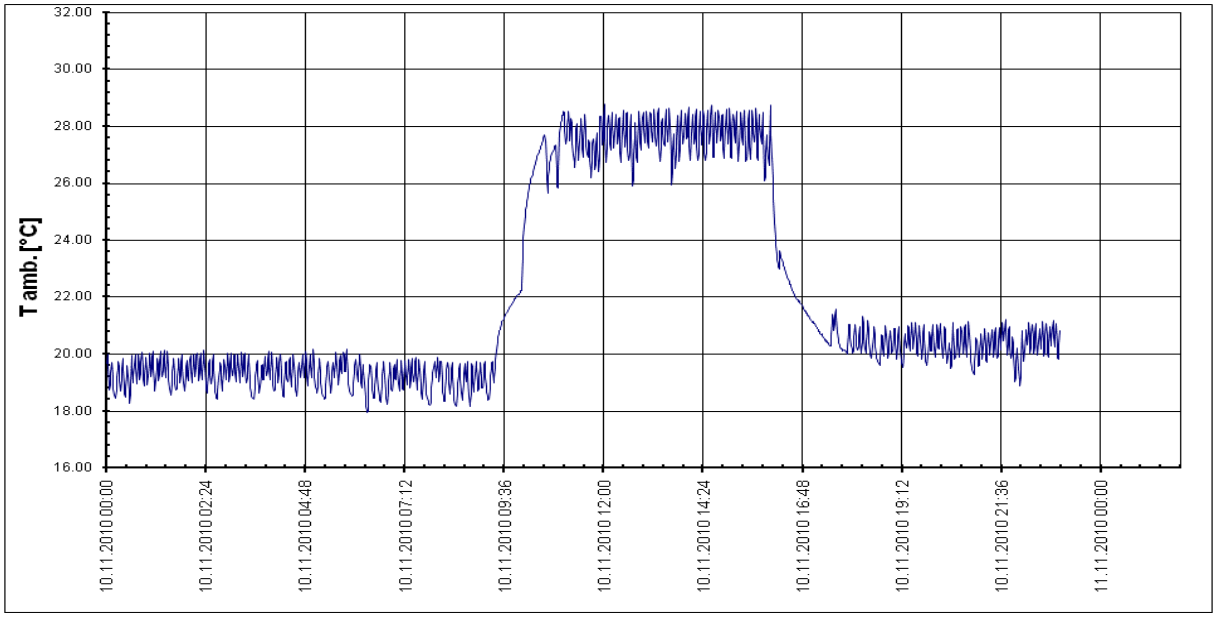
4.6.2. Temperature sensitivity

Temperature coefficient: $4 \cdot 10^{-15}$ / °C





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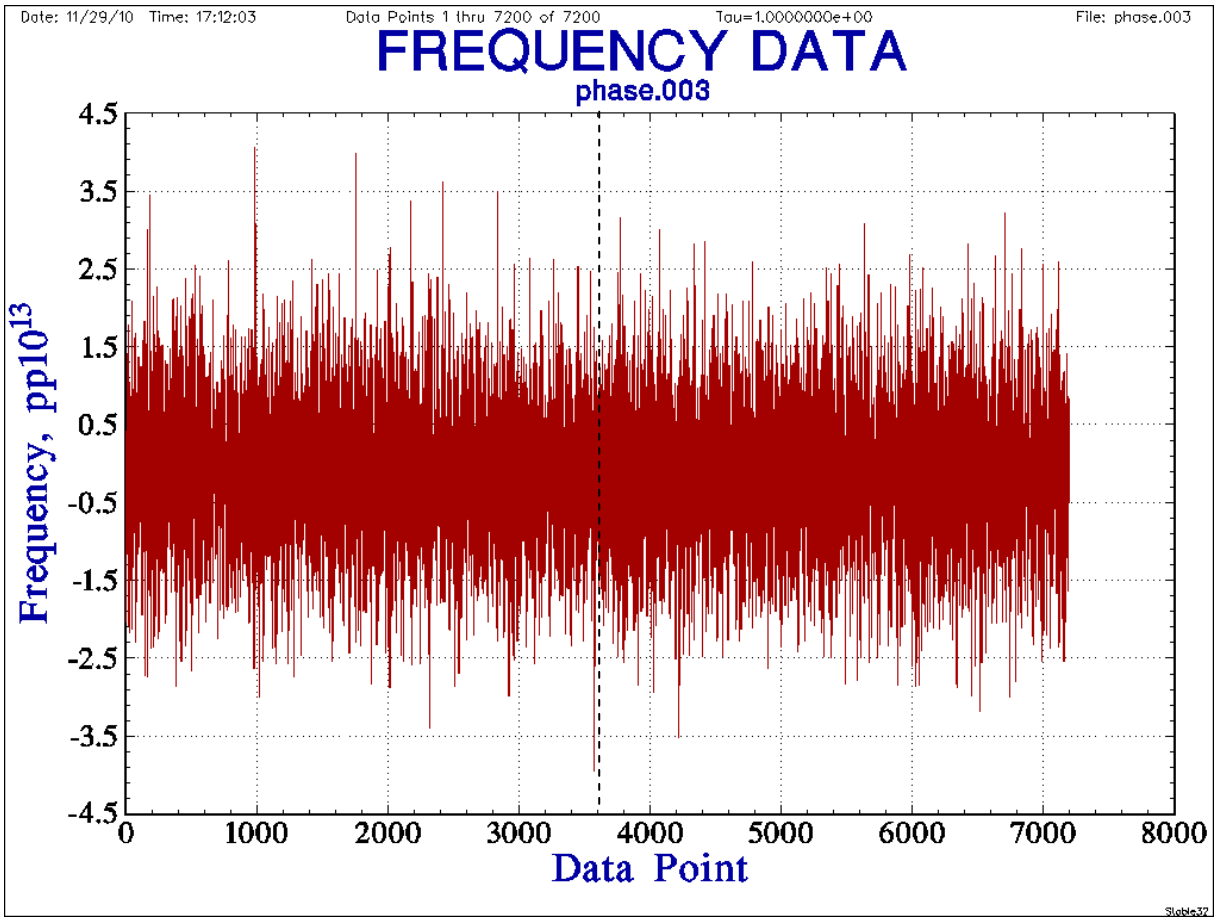
4.6.3. Magnetic test record At Spin Exchange

1.5E-14 / Gauss

4.6.4. AC Power Break

Note that the line indicate the moment of AC removal.



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5. Conclusion

All tests are successful, and all results are within specifications. The factory acceptance test is passed.

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